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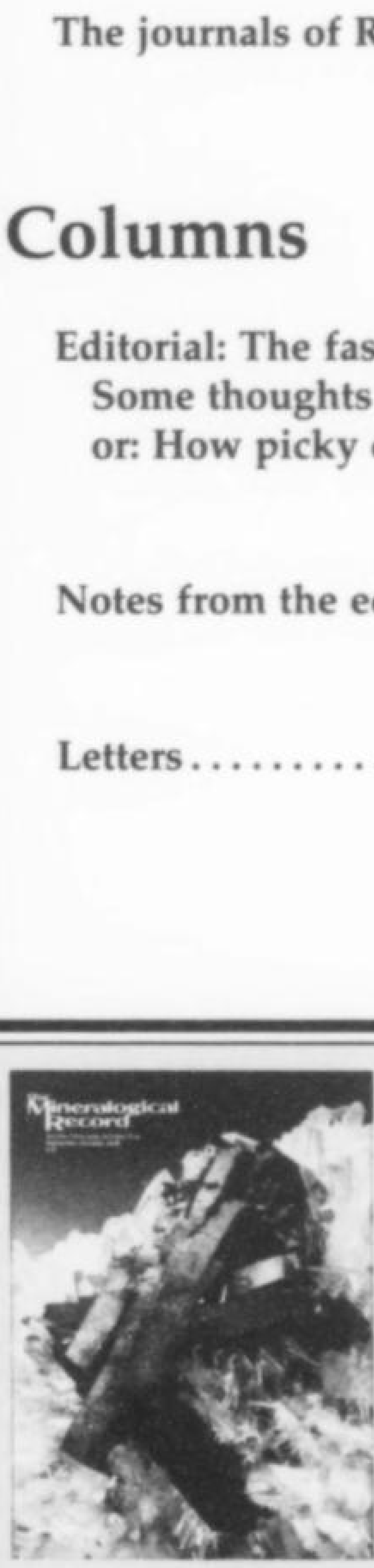

COVER: FERBERITE and quartz, 7 cm, from Mundo Nuevo, La Libertad, Peru. Marvin Rausch collection; photo by Jeff Scovil.

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Editorial

THE FASCINATION WITH PERFECTION

SOME THOUGHTS ON ELITE COLLECTING; OR: HOW PICKY CAN A COLLECTOR GET?*

Perfectionism makes me scream.
I love it.
It represents a futile dream.
I love it.
It makes you thin, it makes you lean,
it takes the hair right off your bean,
its the worst darn curse I've ever seen.
I love it.**

That little rhyme could have been written by many collectors today who have evolved painfully and joyously into compulsive, quality-seeking perfection fetishists. Common wisdom says that the perfectionist is doomed to a life of despair because nothing in this world is ever perfect. "Oh yeah?" says the mineral perfectionist; "What about microminerals, eh?" Point well taken.

A major aspect of elite collecting, then, is the search for macrospecimens possessing the kind of perfection usually seen only in microcrystals. Are micromounters therefore "elite" collectors? No, because perfection is too abundant in the microworld. Quality is available to everyone. Micromounters swim in it every time they break open a vuggy chunk of mineralized rock. Elite collecting involves an element of extreme rarity and exclusivity. Micromounters just have it too easy! The "elite" among micromounters are those with the most knowledge and experience, not the possessors of the greatest and rarest perfection.

"Perfection" generally refers to freedom from surface damage. Here we have some common terms to facilitate discussion:

Ding: A chipped or broken spot usually representing a point of impact. Old codgers in the business swear that this term was introduced into the language by Dave Wilber back in the late 1960's or early 1970's. (Some would call Dave "patient zero" when tracing back the perfectionist epidemic to its origin.) It is a wonderfully onomatopoetic word; you can almost hear the vibrant ring of a crystal being struck, rather like a tuning fork. The word has since found its way into common usage in the English language at large; for example, chips in auto paint resulting from the door of a car opening and impacting its neighbor are commonly called "door dings." Anyway, the ding is reviled by perfectionists as the mother of all flaws, an offense to the eye.

Wilber: A very small ding or chip, usually 0.5 mm or less. Formerly overlooked by most collectors, the tiny mini-ding or "wilber" was introduced into the collector consciousness by reference to guess who. Once inconsequential, damage on this fine scale is now the kiss of death for most otherwise perfect specimens. Often a single wilber in a prominent location will cut a specimen's value by 80%. (A close series of wilbers along a crystal edge is referred to as "chatter.")

Nano-wilber: Microscopic damage normally recognizable only under 10x magnification or greater. Nano-wilbers individually may not cause great concern, but in quantity can degrade the macro-appearance of a crystal. When arrayed along a sharp edge, the edge appears "rubbed." When present in quantity on a crystal face, the luster can be compromised on an almost insensible level. Nano-wilbers usually result from the simple wrapping and handling of specimens. Human skin, especially with a little microscopic grit lodged in the fingerprint, is like fine sandpaper. Human skin oil is mildly corrosive. Wrapping paper is also abrasive. A crystal truly and totally free of nano-wilbers has probably never been touched, by anyone or anything except water, since it was collected.

Clean: Surficially damage-free. When a perfection-seeker first sees a specimen, his eyes do a quick inventory of dings. If he finds none, out come the reading glasses or hand lens to check for wilbers. If no dings *or* wilbers are found, things are clearly getting serious. A potential candidate for acquisition (or at least coveting) is now in hand. Bright light is brought to bear, and a more rigorous microscopic study of every crystal edge, point and face is carried out. Should the crystal survive such scrutiny, it is awarded the designation "clean."

This is not the same as the gemological use of the word "clean" to mean *internally* flawless. Although internal quality is indeed of some interest to the elite collector, it is sensibly not a rigorous requirement. Still, gemologically (internally) "clean" as well as externally "clean" is definitely the ultimate.

Elite mineral collectors are far from alone in this preoccupation with perfection. Gemologists are even more demanding (for example, in the grading of diamonds for internal clarity). Elite coin collectors have their equivalents of wilbers, usually referred to as "bag marks" (tiny surface rubbings and micro-nicks resulting from

*Answer: Very VERY picky!
**With apologies to Graham Lee Heminger

freshly minted coins touching each other in a bag). Stamp collectors routinely work under magnification. If perfection can be had at all, people will seek after it. The scientist may not care, nor does the historian, but collectors are constantly involved in grading quality.

A well-formed, nearly euhedral crystal that is truly clean and free of even the tiniest surface damage is a magical thing to behold for the collector. It is as if the crystal is charged with some kind of energy, energy which would quickly drain off through chips and damages but which is trapped by perfection. Running a frantic eye over the edges and points repeatedly and finding no flaw seems to make the crystal crackle and spark with surface energy . . . a breathtakingly pleasurable experience for the mineralogical perfectionist.

Discrimination *can* be taken one step further: freedom from surface damage, by itself, is usually not sufficient to qualify a specimen as "*special*." There is also the aesthetic requirement, involving sculptural quality, color, and especially rarity. A "special" specimen stands out from thousands of similar, high-quality specimens by virtue of some unique feature. Maybe it is the way the crystals are piled upon each other, or some extraordinary inclusion, or the display of some usually recessive feature such as a particular crystal face, or perhaps a higher luster than seen before, or maybe an extraordinary association with another remarkable species, or perhaps just extra large size.

In other words, a "special" specimen has a uniqueness to it that goes beyond being simply "a very fine, clean example." Such a specimen is sure to surprise and impress people even though they may previously have seen *many* fine examples.

One might think that the elitist pursuit of flawless, "special" specimens requires hoards of money, but in fact it doesn't. What it requires is refined taste and a sharp eye. Qualifying specimens can be found for under $200 if the searcher is diligent, patient and unbiased against the more common occurrences. And even some interesting species rarities can be found in the lower price ranges. You, too, can become an "elite" collector, regardless of budget. Elitism is in one's standards, not one's pocketbook.

But perhaps a more important question is, *should* you become an elite perfectionist? The answer: not if you can help it. It is wasteful, frustrating, undeniably more costly on a comparative basis, and very competitive. Emphasis on perfection is counter-mineralogical in that perfection is an accident and not a species characteristic. Millions more specimens are available to us to find, buy, enjoy and learn from if we do *not* insist on absolute specimen perfection. If everyone demanded perfection the mineral market would crash and virtually all dealers would go out of business for lack of enough profitable stock. Field collectors would leave behind almost every specimen they dug up, creating a huge amount of unnecessary waste.

Consequently, perfectionism is an inclination we must fight, if we can. But we are only human. And perhaps it is a human weakness that we, as flawed creatures, have an irresistible attraction to items which possess what we ourselves can never have, and what the forces of entropy in nature seem bound to destroy: true perfection.

Perfection is one of the fascinations of mineral collecting, and most sensible collectors view it as an attainable "seasoning" in the mix of a good collection. Take it where you find it, but don't be overly demanding of it. That is the mature view which maximizes fun and involvement and learning while minimizing frustration, excessive cost and waste.

But for those who are hopelessly addicted, and who need their daily dose of perfection, there *is* a treatment: buy a microscope and become a micromounter. It may not be elite, but it is the true home of perfection.

notes from the EDITOR

TUCSON SHOW 2K WINNERS

It seems we neglected to mention some important winners from the 2000 Tucson Show; so here they are:

FM Award for Best Article of 1999:
Casey Jones, Jane Koepp Jones and Gene LaBerge ("The Flambeau Mine, Ladysmith, Wisconsin")
Desautels Trophy:
Irv Brown
Lidstrom Trophy:
Les Presmyk
Carnegie Mineralogical Award:
Franklin-Sterling Hill Mining Museum

TUCSON GEM & MINERAL SHOWS Y2K ECONOMIC IMPACT

The Metropolitan Tucson Convention and Visitors Bureau announced recently the results of a study of the economic impact of the various Tucson gem and mineral shows conducted at their request by FMR Associates, Inc. Some of the highlights are as follows:

- There were 24 show sites in 2000
- Total attendance was estimated at 50,370 people (19 show promoters, 3,700 dealers set up, and 46,650 buyers).
- Exhibitors (dealers) stayed in town an average of 15.6 days, and spent an average of $7838 locally on food, lodging, show space, transportation, etc.
- The buyers consisted of 11,000 local Tucson residents and 35,650 attendees from out-of-town. The out-of-town buyers stayed an average of 10.8 days and spent an average of $922 on local goods and services. They also spent an average of $1837 on retail show merchandise.
- The 19 show promoters stayed for 22 days and spent an average of $210,000 each setting up their shows.
- State and local governments collected $6 million in sales taxes on gross (reported) retail show-merchandise sales of $85.7 million. Wholesale sales, which are not taxed, are unknown but could easily be as high or higher.
- Therefore, total expenditures associated with the shows were $76.5 million for local goods and services, and $85.7 million on retail merchandise. If we assume that wholesale and unreported retail sales are around $88 million (pure speculation, but many shows are *exclusively* wholesale), then the total money changing hands during the Tucson Shows is around a quarter billion dollars!

By contrast, Tucson's month-long spring training baseball season (the Arizona Diamondbacks, Chicago White Sox and Colorado Rockies all play exhibition games for a month in the spring) brings in "only" $33 million to local businesses. The gem and mineral show has by far the largest economic impact on Tucson of any single event.

BACK ISSUES

Back issues of the *Mineralogical Record* are an indispensable reference for mineral collectors, which is why so many people work to build a complete set. However, if you have a special interest in specific localities, we are including here a cross-reference of available back issues according to the localities covered by major articles. These references are not "mere mentions" but complete articles full of interesting information. Just make a note of volume, number and price for each issue you want and call, fax or mail in your order to the Circulation Manager. Visa and Mastercard accepted. Circulation office tel.: 520-297-6709; FAX: 520-544-0815. Supplies are limited.

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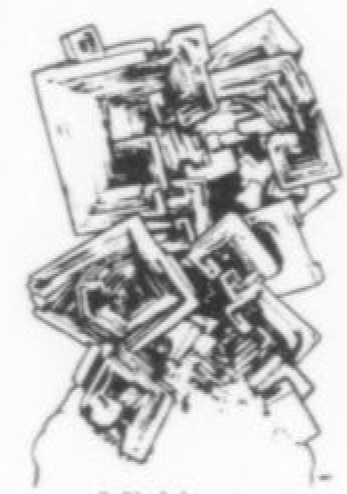

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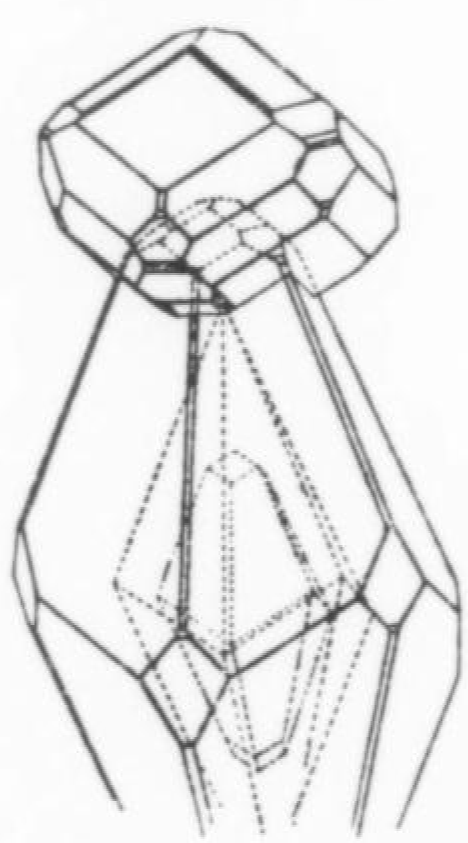

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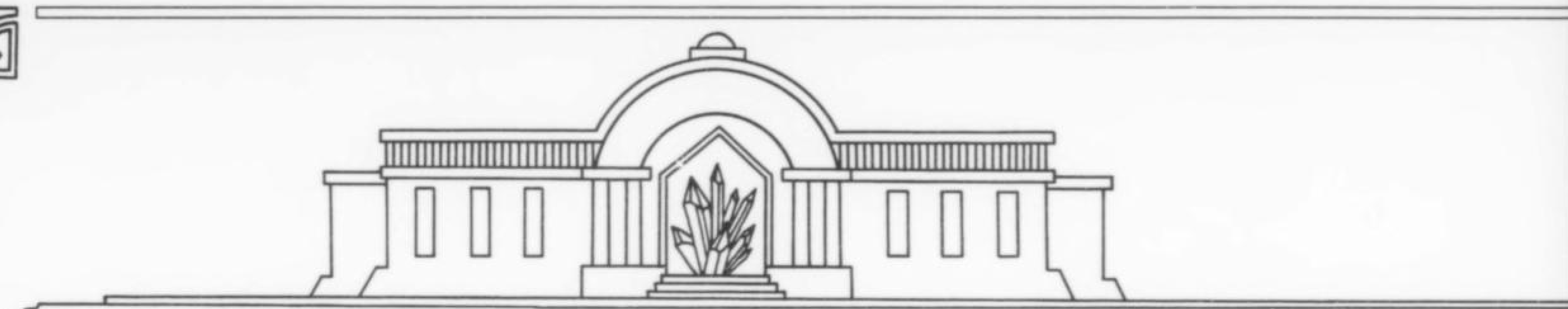

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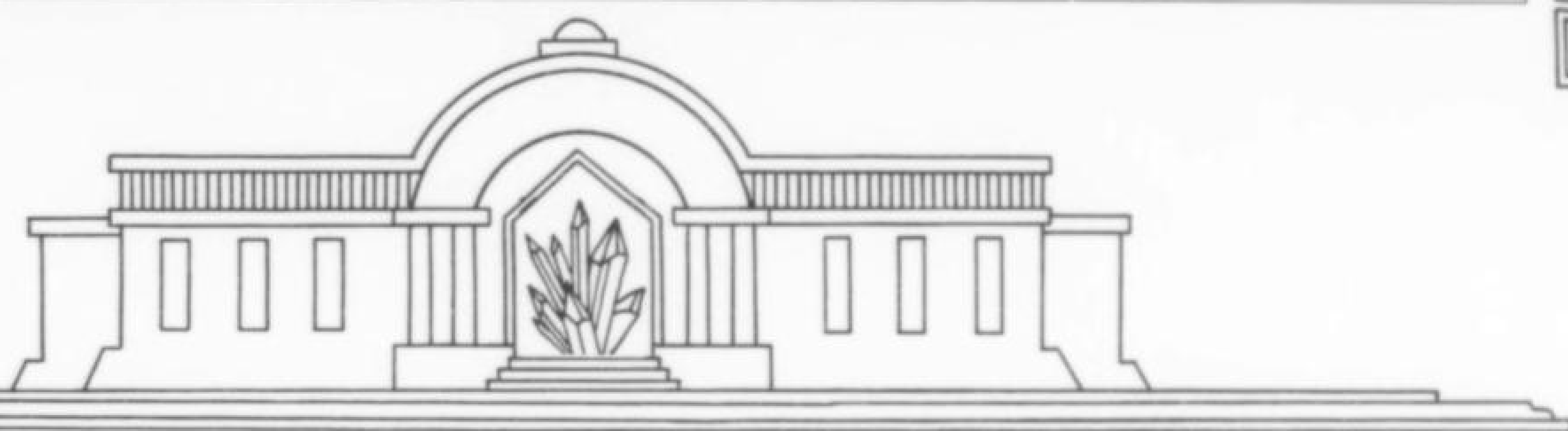

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Vol 1, No 1, Mineralogical Record, Spring 1970

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* Compiling and publishing information on mineral localities, and important mineral collections.
* Encouraging improved educational use of mineral specimens, collections, and localities.
* Support a semi-professional journal of high excellence and interest designed to appeal to mineral amateurs and professionals, through which *FM* activities may be circulated.
* Operating informally in behalf of minerals, mineral collecting, and descriptive mineralogy, with voluntary support by members.

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Collector Profile:

VLADIMIR ANDREEVICH PELEPENKO

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103009 Moscow, Russia

The mineral collection of Vladimir A. Pelepenko is among the most prominent personal collections in Russia. During the last few years it has been a rare day when numerous mineral hobbyists (sometimes up to 20 people a day) did not visit his apartment in Yekaterinburg, in the Ural Mountains, to see his collection, which has been built over a 30-year period. Geologists, lecturers, school teachers, famous collectors and novice hobbyists, actors, poets and politicians have been among those who have come to Vladimir Andreevich over the years.

The creator of this collection is an electrical engineer by profession, who graduated from the Urals Polytechnic Institute in 1962, then served three years in naval aviation. He first became acquainted with minerals in 1971 when Yurii Kozlov, a friend from his student days, presented Vladimir with a specimen of jasper and invited him along on a field trip to the old pits at Malyshevo. It was there that Pelepenko found an emerald crystal, giving birth to his passion for collecting. Field collecting trips to mineral localities became a regular event thereafter.

Gradually a group of Pelepenko's mineral collecting friends formed, all of them fascinated by mineralogy. Yurii Kobyashev, Vitalii Shabanov from Vladivostok, and many others came to be included. In 1973 Pelepenko made the acquaintance of Viktor I. Stepanov, one of the most prominent mineralogists in Russia, during a visit by Viktor to Sverdlovsk. Pelepenko and Stepanov have maintained their friendship, as well as business relations, over the years since then.

Pelepenko gathered specimens on his travels throughout the former Soviet Union, from the Kola Peninsula to the Far East, including several thousand kilometers travel through Kazakhstan. Most of his journeys were made in his own car, often going off-road.

Included in his collection are very good zircons in albite, from

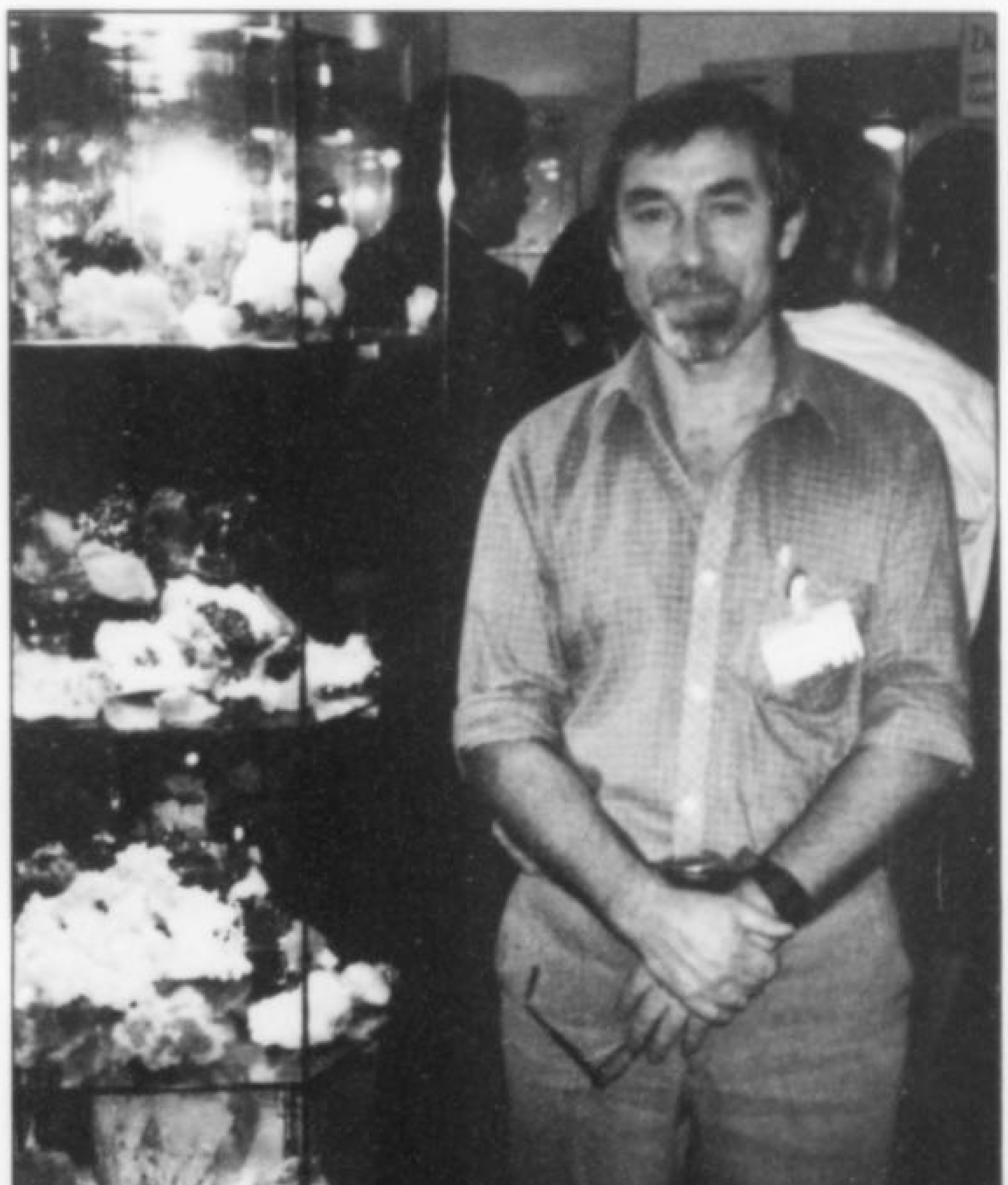
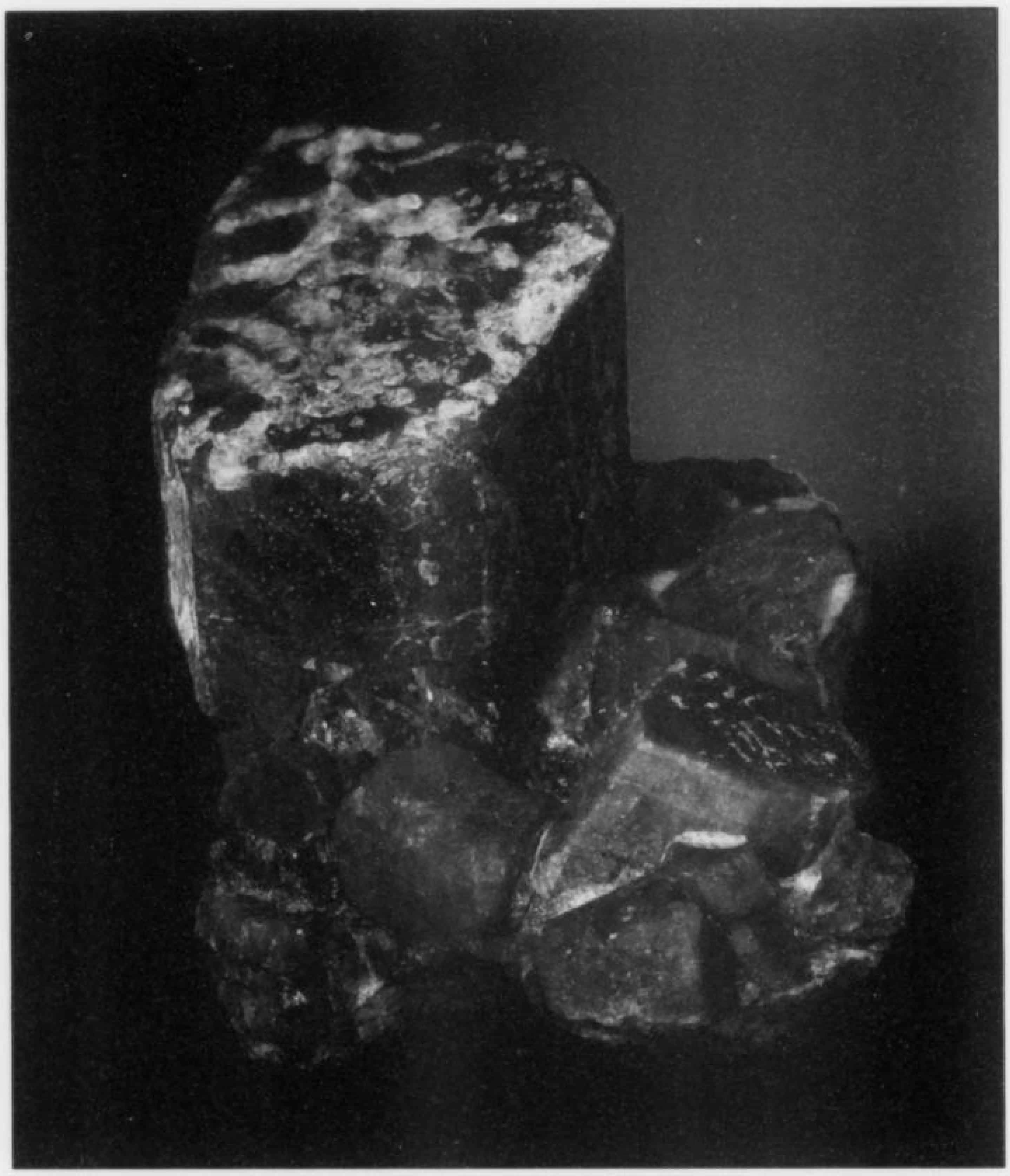


Figure 1. **Vladimir Pelepenko, standing beside one of his exhibit cases at the 1988 Munich Show. Wendell Wilson photo.**



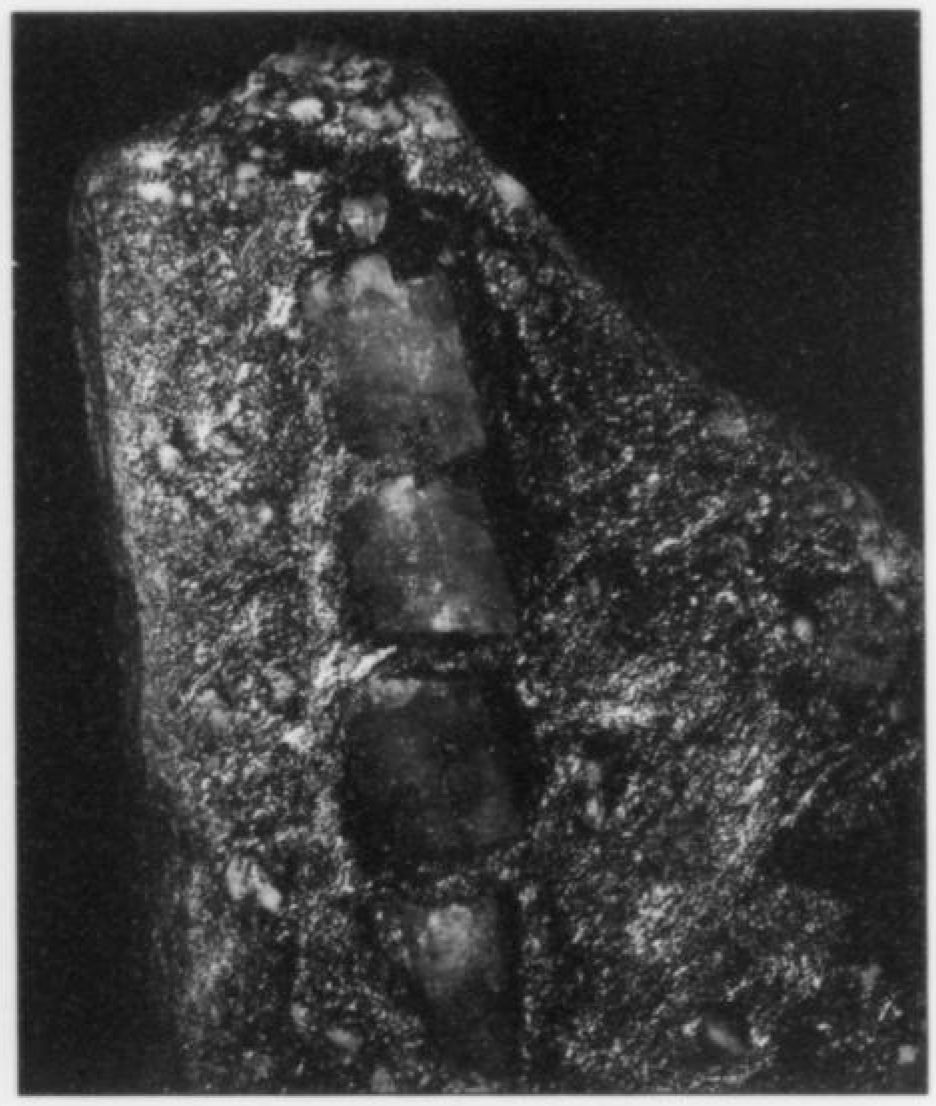
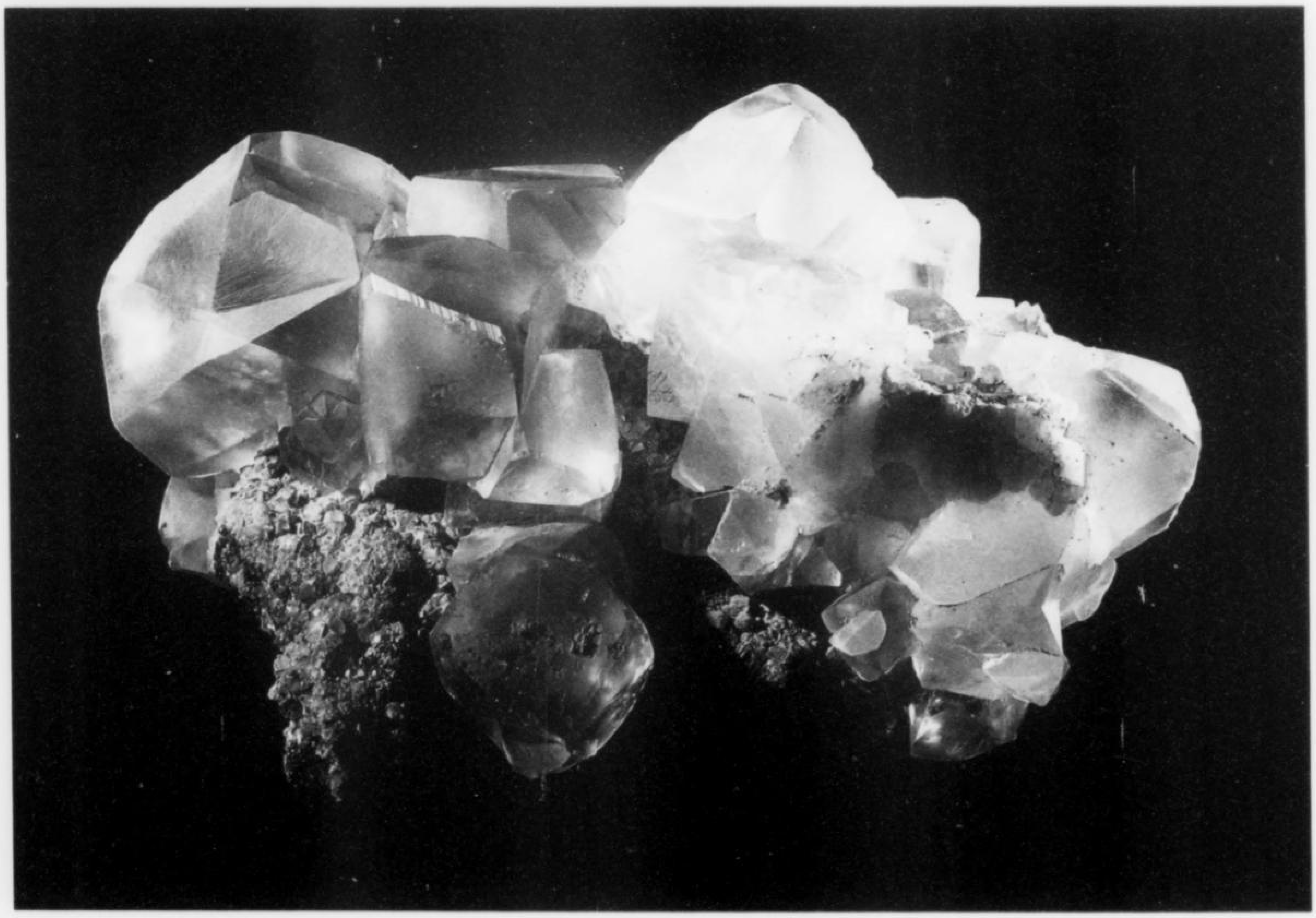


Figure 2. Green beryl in schist, 16 cm, from the Malyshevo pit, Middle Urals. Pelepenko collection; M. A. Bogomolov photo.

Figure 3. Amazonite crystal group, 6 cm, from Ploskaya, Keivy, Kola Peninsula. Pelepenko collection; M. A. Bogomolov photo.

Figure 4. Calcite crystal cluster, 18 cm, from Rudny, Kazakhstan. Pelepenko collection; M. A. Bogomolov photo.



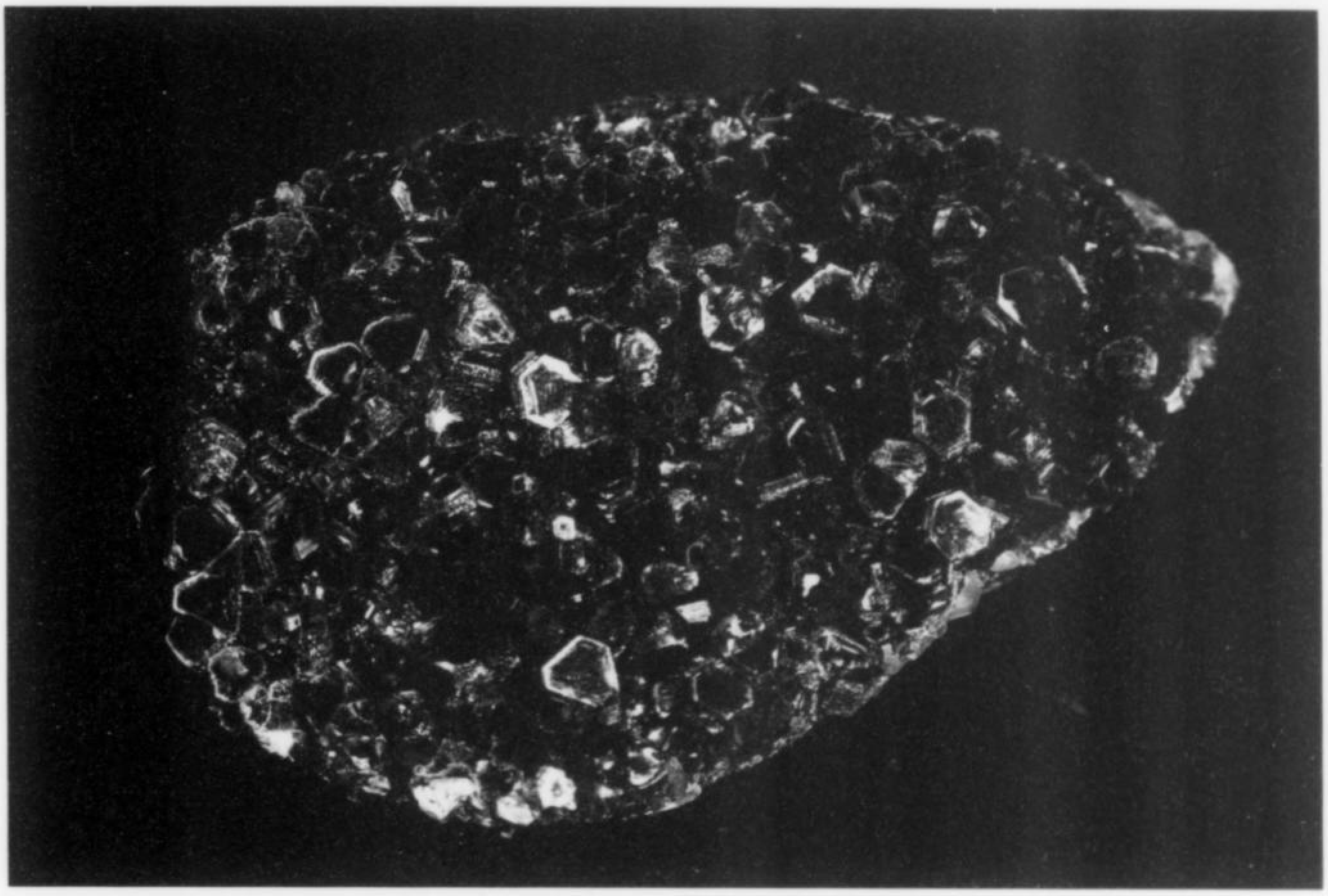


Figure 5. **Chromian amesite, 10 cm, from the Saranovskoye deposit, Middle Urals. Pelepenko collection; M. A. Bogomolov photo.**

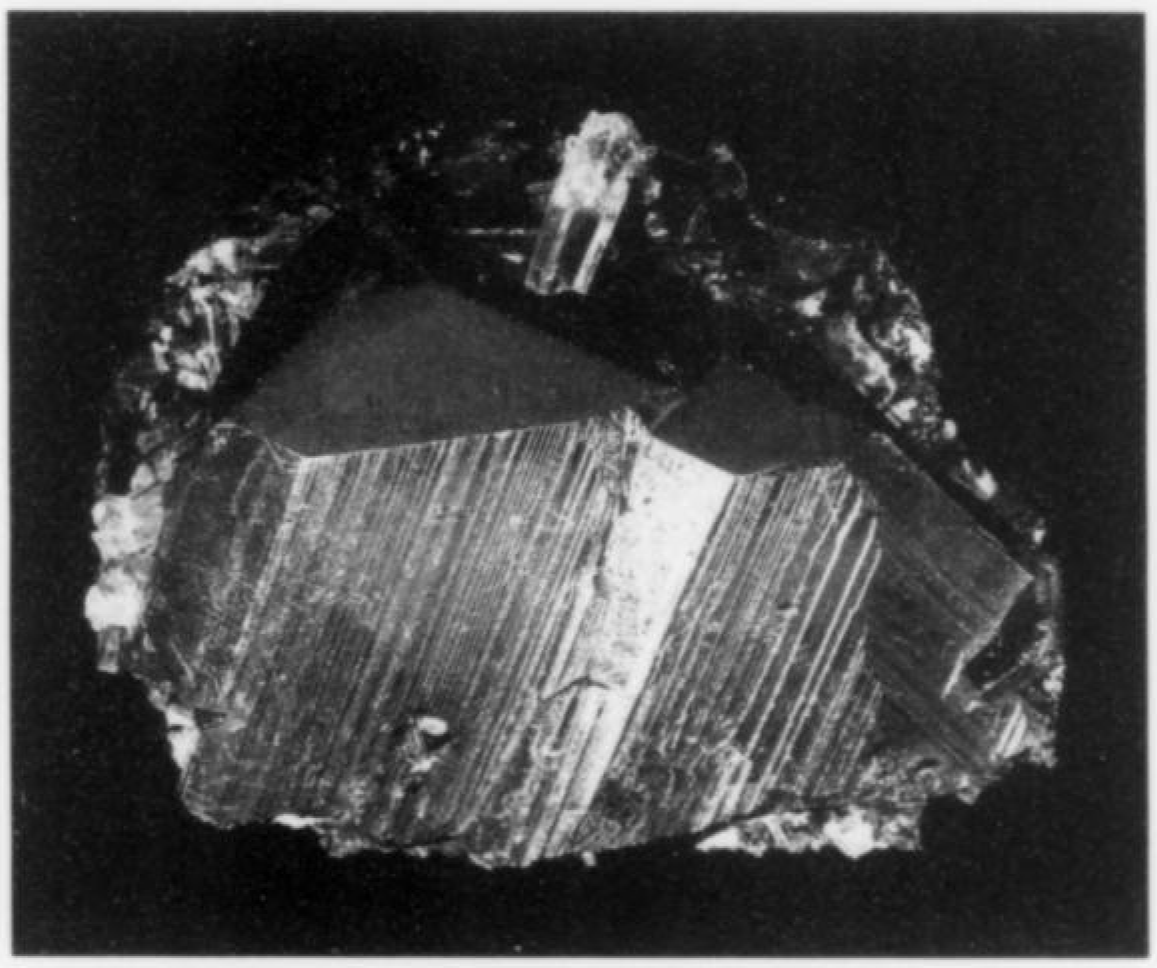


Figure 6. **Tennantite crystal with quartz and chalcopyrite, 7 cm, from Karabash, Urals. Pelepenko collection; M. A. Bogomolov photo.**

Figure 7. **Green beryl crystal, 8 cm, on muscovite and feldspar, from Mursinka, Urals. Pelepenko collection; M. A. Bogomolov photo.**

his first trip to the Kola Peninsula. He obtained specimens that had been stored away in cupboards, given to him by the wives of hospitable locals: "Take it away, Volodya, or it will end up covered by dust and stealing space from the glassware." Other specimens he obtained in exchange for car batteries and spare parts. He once had to return all the way to Yekaterinburg to retrieve a car part that was in short supply, which he then traded for a beautiful plate of dark blue fluorite crystals.

Pelepenko visited the Kazakhstan mines regularly every three months for many years. During one of these trips to Kara-Oba he personally collected some milk-white prismatic crystals up to 2 cm in length. The associated fluorite and wolframite he could easily identify, but he had to bring specimens of the white mineral to the Fersman Mineralogical Museum in Moscow for identification; it proved to be bertrandite, a species formerly unknown from the district. He returned several times to collect more specimens, one of which he presented to the Fersman Museum.

Specimens of sphalerite from Kara-Oba were at first difficult to obtain for his collection. When good specimens were finally discovered there, they were saved for Vladimir because by that time everybody knew about his passion for beautiful minerals. Before he could get them, however, there were long discussions,

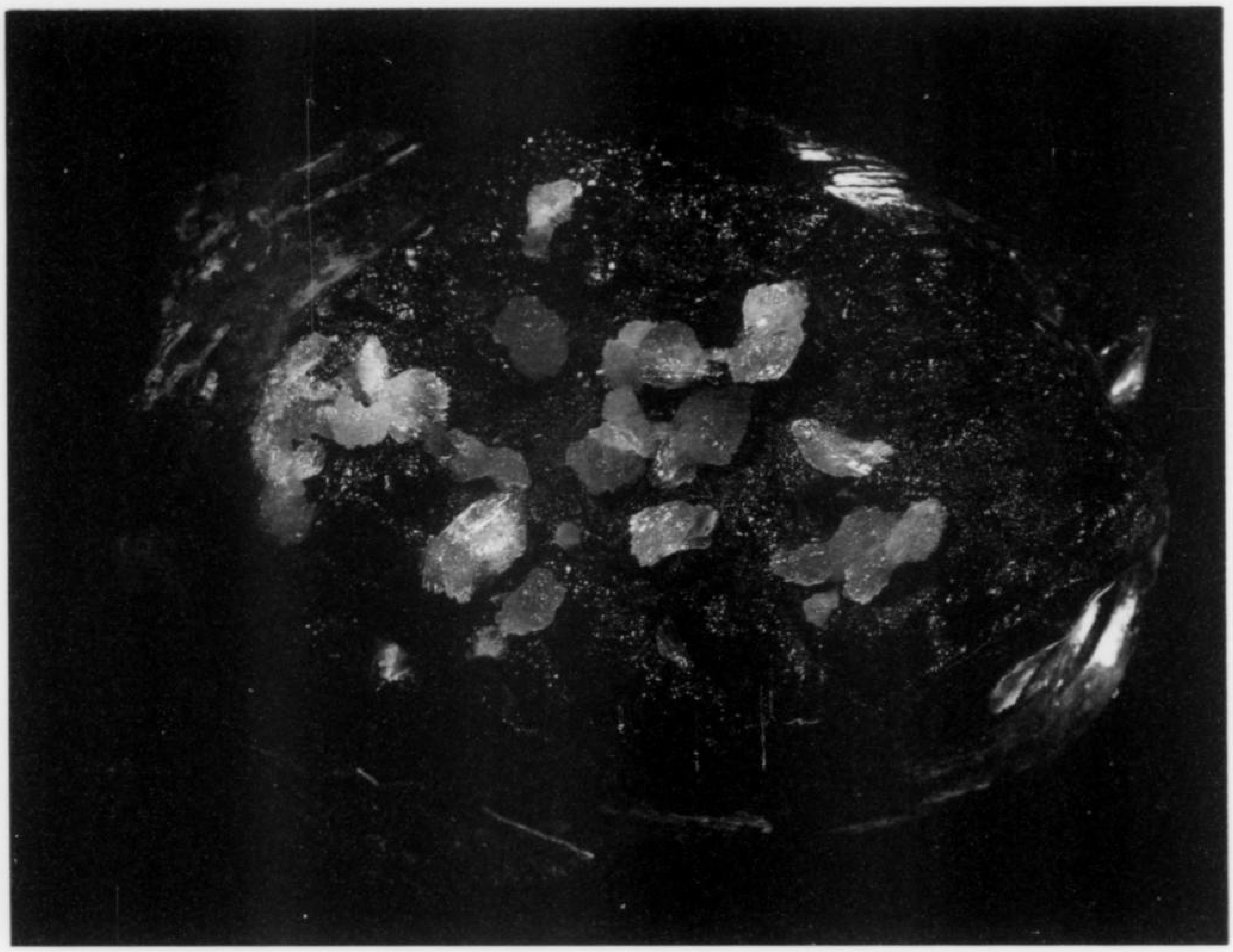


Figure 8. **Anapaite in a limonite shell fossil, 7 cm, from the Kerch Peninsula, Crimea, Ukraine. Pelepenko collection; M. A. Bogomolov photo.**

Figure 9. **Quartz crystals, 16 cm, from Perekatnoye, Aldan, Yakutia. Pelepenko collection; M. A. Bogomolov photo.**

card games, various promises, advances and just plain begging. But eventually fine specimens from Akchatau, Dzhezkazgan, Kadamdzhai, Gaurdak, the Khaidarken caves, Chauvai (in central Asia) and Kazakhstan began appearing in his collection. Included is a big cluster of smoky quartz crystals, 8 x 10 cm, from Akchatau which he obtained in trade for a desk set! This was the only item that interested the specimen's owner, though a pair of Zeiss binoculars, spare car parts, and a rifle were also offered.

By 1973 the Pelepenko collection, already numbering about 1,000 specimens, was considered to be the finest private collection of minerals in the Urals. In that same year Pelepenko was appointed Director of a facility which manufactured lenses for eyeglasses. Collecting continued to take up his holidays, including flights to Kazakhstan, and vacations traveling by car with his family. They crossed central Asia, through Kazakhstan, and visited the Pamir Mountains. They ascended into the mountains, along a serpentine road at 3,000 meters elevation, to the Dzhizhikurt deposit where he obtained two wonderful stibnite specimens. At the Kukhilal deposit near the Afghan border he collected specimens of ruby corundum and pink spinel.

In addition to being an engineer and mineral collector, Pelepenko is also an entrepreneur and founder of the first privately owned jewelry company in the Urals. The company extracts kyanite from the Borisovskiye Sopki, and topaz from the Fersman pit. Gemstone carvings for jewelry are produced following the traditions of Fabergé, in a workshop established by Pelepenko about ten years ago. At present he employs six young, gifted artisans as gemcutters; he has retained over 150 examples of their best work, and has displayed their pieces at various expositions including the Yekaterinburg Museum of the History of Gemstone-Carving and Jewelry.

In 1988 Pelepenko first became known to Western collectors as a result of a display of some of his best specimens at the Munich Show. The "Cold War" was ending, and the new policy of *glasnost*, or "openness," allowed him to travel to Western Europe and display

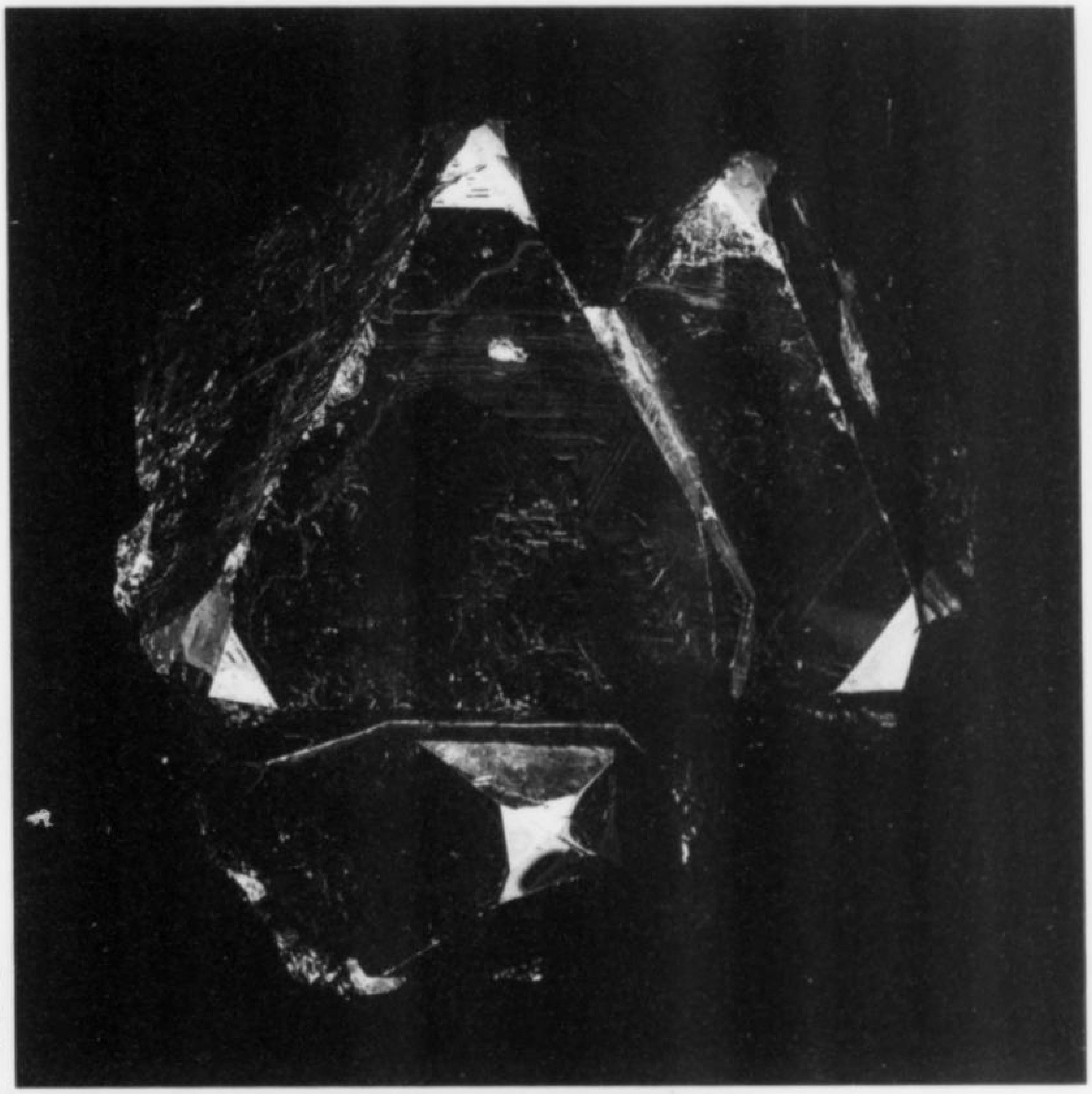
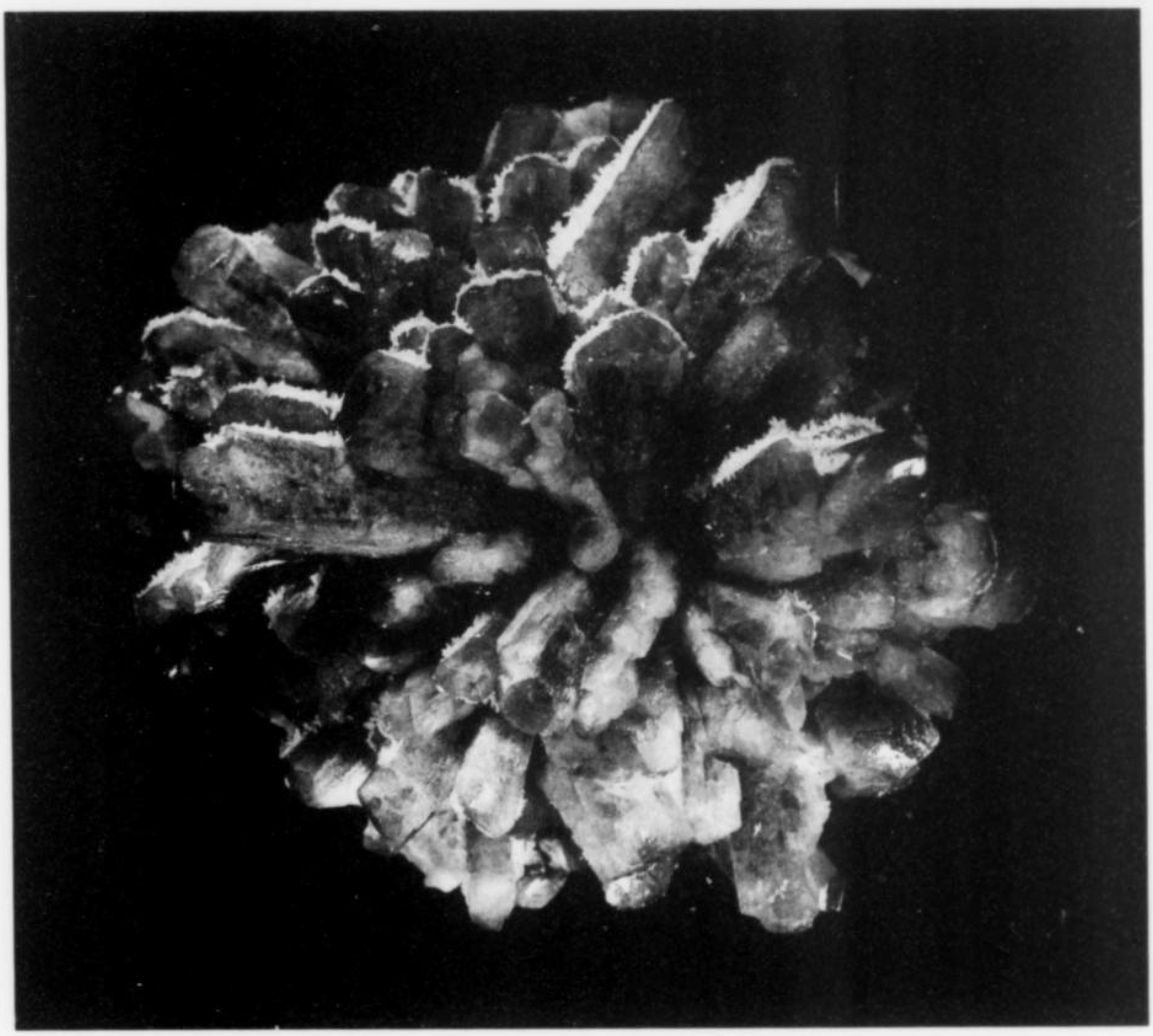


Figure 10. **Pyrite crystal cluster, 12 cm, from the Astafievskoye deposit, Yuzhnyi, South Urals. Pelepenko collection; M. A. Bogomolov photo.**

Figure 11. **Diopside crystal cluster, 10 cm, from the Bazhenovskoye deposit, Asbest, Middle Urals. Pelepenko collection; M. A. Bogomolov photo.**



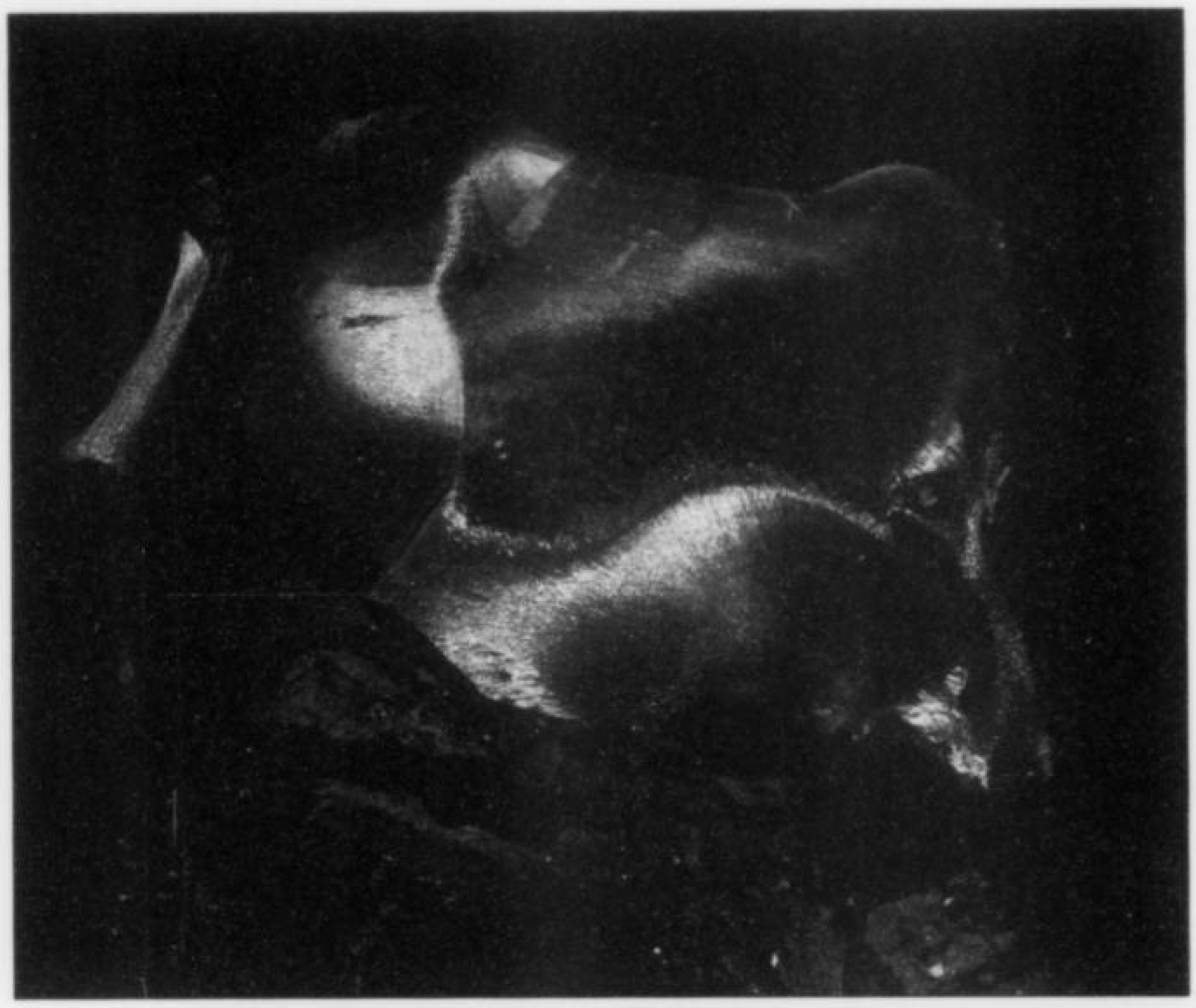


Figure 12. **Malachite, 15 cm, from Nizhnii Tagil, Middle Urals. Pelepenko collection; M. A. Bogomolov photo.**

Figure 13. **Cinnabar crystals to 1 cm, from Tschauvaj, Russia. Pelepenko collection; Wendell Wilson photo.**

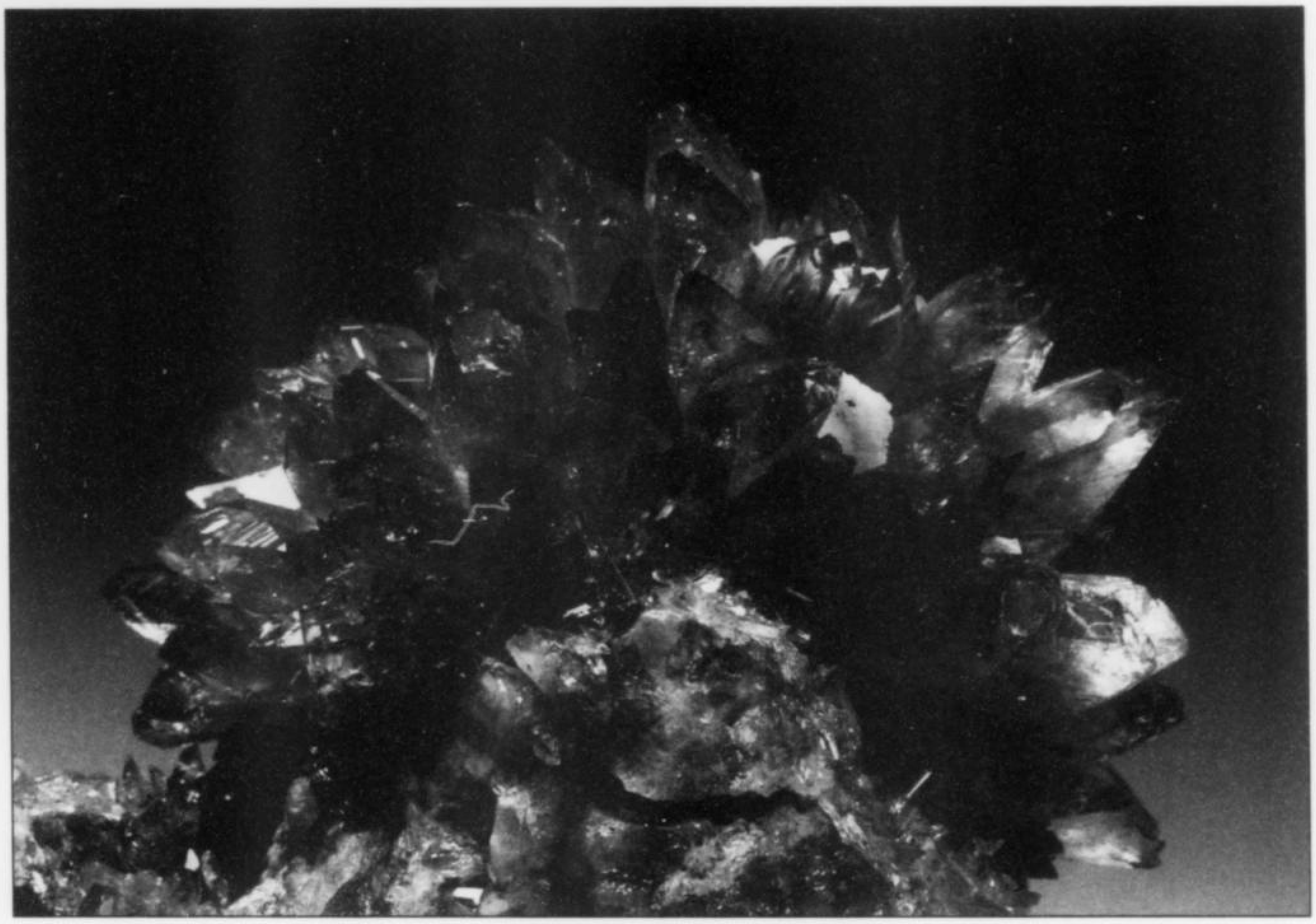


Figure 14. **Creedite crystal cluster, 6 cm, from Akchatau, Kazakhstan. Pelepenko collection; Wendell Wilson photo.**

his treasures. It was a historic and exciting event because at that time many Soviet minerals were relatively unknown in the West, save for some of the pre-Revolution classics. Minerals from operating mines at Dalnegorsk, from Dzhezkazgan in Kazakhstan and elsewhere were generally unfamiliar to most Western collectors. *Mineralogical Record* editor Wendell Wilson's report on the show described Pelepenko's exhibit as follows:

> The Pelepenko specimens were unfortunately not labeled, but most were from mines near Sverdlovsk. They revealed a highly refined aesthetic sensibility, and remarkably skillful field collecting . .. damage of any kind was almost non-existent. Most are small to large cabinet size, and are slightly reminiscent of the very best specimens from the Naica, Charcas and Santa Eulalia districts of Mexico. It was a stunning experience for knowledgeable Western collectors to survey so many superb specimens of so many different species, and yet, as to locality, recognize *none* by their habit. Some examples: no less than 16 specimens of lustrous pyrrhotite crystals, mostly 5 to *15 cm each,* as singles and groups associated with attractive quartz, sphalerite, galena

Figure 15. **Fluorite crystals to 7 cm on hübnerite, from Kara-Oba, Kazakhstan. Pelepenko collection; Wendell Wilson photo.**

Figure 16. **Scheelite crystals to 1.5 cm on pyrite, from Berezovsk, Russia. Pelepenko collection; Wendell Wilson photo.**

Figure 17. **Pyrrhotite crystals with quartz, 10 cm, from Dalnegorsk, Russia. Pelepenko collection; Wendell Wilson photo.**

and chalcopyrite. A colorless, water-clear crystal of euclase 2.3 cm across, nicely perched on matrix. Tetrahedrite crystals to 6 cm, with chalcopyrite. Lustrous arsenopyrite crystals to several centimeters, as singles and groups. A wide range of fine calcite specimens, perhaps three dozen pieces, some with very large crystals, and with colors ranging from white to yellow and bright pink. Sperrylite crystals (modified cubes) to 1.3 cm in matrix . . . I counted nearly a dozen more crystals in the 4–10 mm range in this one miniature. Single chalcopyrite crystals to 6 or 7 cm. A 5-cm group of beautiful purple-lavender creedite crystals. Fine and large galena, sphalerite, copper, pyrite and ilvaite. And a spectacular array of fluorites including water-clear and colorless cubes (to 5 cm on edge), transparent green cubes (to 10 cm on edge), colorless cube/dodecahedron crystals (to 3.5 cm), purple octahedral crystals (to 5 cm on edge) in fine groups, green octahedral crystals (to 5 cm on edge) with milky quartz, and blue cubes (to 5 cm, on a 15-cm matrix) associated with dozens of bright red cinnabar twins to 1 cm! All, as I said, are virtually undamaged. It was quite a sight.

At present the Pelepenko Collection numbers over 10,000 specimens, all of good quality. Approximately a quarter of the collection is made up of minerals from the Dalnegorsk deposit, which Pelepenko has visited many times. He has collected there underground and in the open pits, obtaining many fine specimens of water-clear fluorite, quartz in unusual habits, pyrrhotite in various habits, apophyllite, danburite and datolite. On one occasion he saw a specimen of fine white and pink calcite roses in the cabinet of a Dalnegorsk miner. All of the crystals had been striated with an ink pen for some unknown reason. Vladimir begged for the specimen, which was then given to him. He has since cleaned the ink off, and the beautiful specimen is now the pride of his collection.

In addition to fine crystal specimens, there are approximately 2,000 agates in his collection from Chukotka, the Schmidt Cape, the Leningradskii mine (60 km from Pevek), and Kazakhstan. These reflect Pelepenko's interest in lapidary materials.

Vladimir considers about 500 of his specimens to be unique in terms of their associations, twinning, inclusions or other features. And, of course, one should also mention the green minerals which are Pelepenko's special favorites: emeralds, chrysoberyl and malachite. Minerals from the Urals are also comprehensively represented, including ferroaxinite from Puiva, alexandrite and emeralds from the Malyshevo pits, uvarovite from the Saranovskoye deposit, and even the famous Urals malachite from Gumeshki and Vysokogorskoye.

Minerals from the Kola Peninsula make up another significant portion of the collection. These include eudialyite crystals to 2.5 cm. There are also fine specimens from the Dashkesan and Idzhevan deposits in the Caucasus.

In the near future, Vladimir plans to publish an illustrated catalog of his collection, and open a private museum in new quarters that are being provided for him by the government. The citizens of Yekaterinburg and visitors from elsewhere will then be able to freely admire his unique collection.

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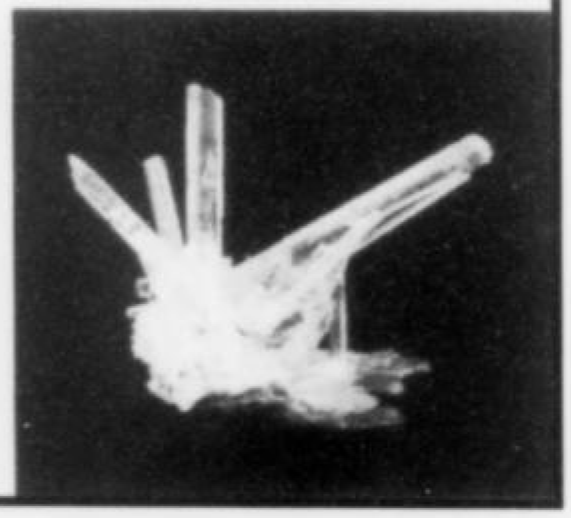

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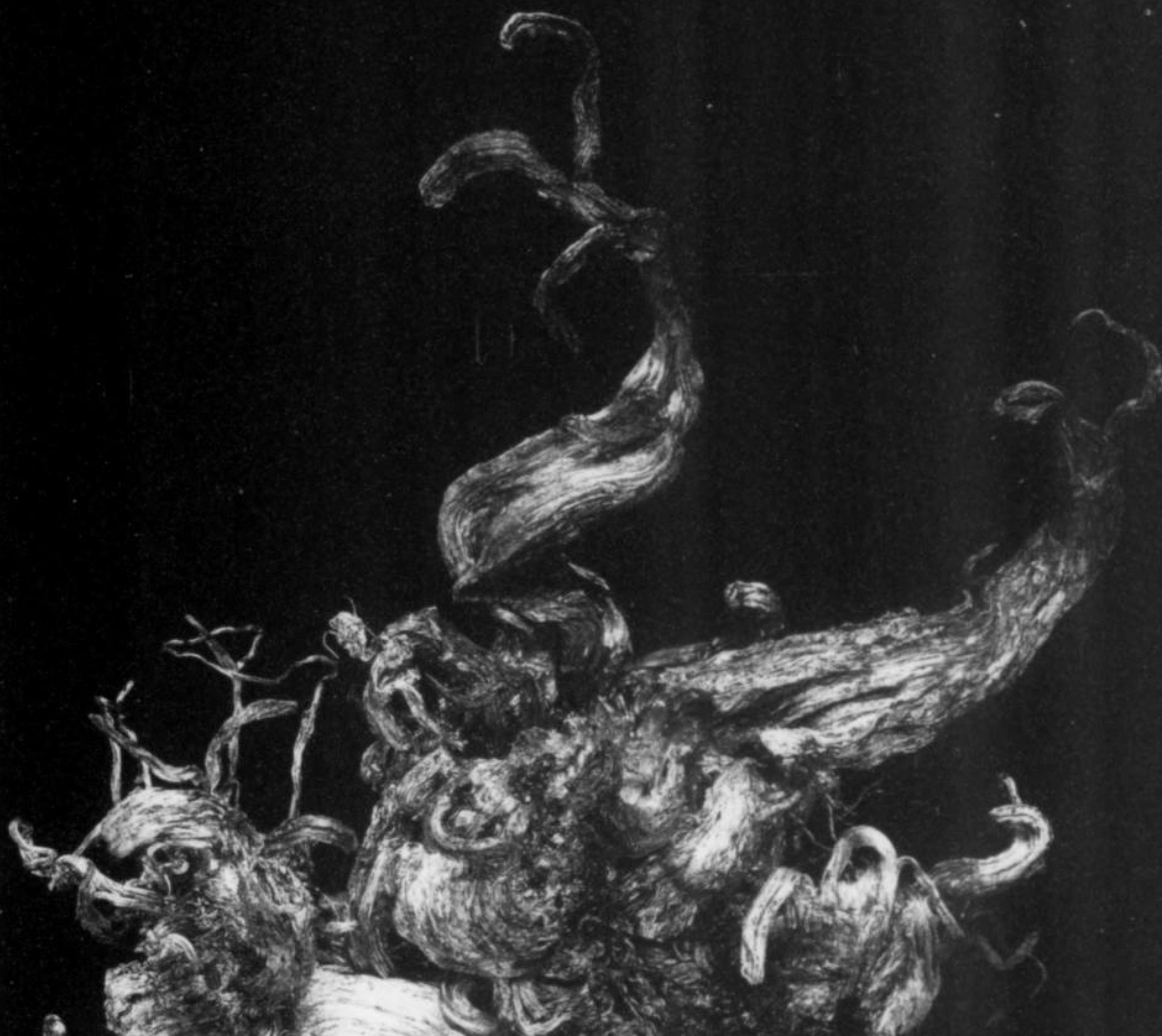

Silver, Mexico, 10 cm.

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Pink Fluorite with Pyrite, 12.3 cm, from Huanzala, Peru. Jeff Scovil photo.

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Minerals of the Millington Quarry, Somerset County, New Jersey

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High Bridge, New Jersey 08829

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42 Elm Street
New Providence, New Jersey 07974

Unlike the famous trap rock quarries at nearby Paterson, Prospect Park, Summit, and Bound Brook, New Jersey, the Millington quarry has only recently become a major producer of mineral specimens. Extremely fine examples of pectolite, natrolite, apophyllite, calcite, analcime and other species are being recovered.

INTRODUCTION

Like many neophyte mineral collectors from the New York metropolitan area, my* interest and collecting experience began with the minerals found in the basalt lava flows of northern New Jersey.

Since the late 1800's the trap rock quarries around Paterson (Peters *et al.*, 1980), Prospect Park, Summit, and Bound Brook (Sassen, 1978), New Jersey, have produced an abundance of beautiful zeolites and related mineral specimens which have found their way into collections around the world. Unfortunately, in the latter part of this century urban sprawl has closed most of the quarries and those still in operation are firmly off-limits to collectors.

In 1989, while visiting a small mineral show at Rutgers University in New Jersey, I noticed a small group of people gathered around an open van in the parking lot. My curiosity got the best of me and upon investigation I found an elderly gentleman with a variety of mineral specimens from the Millington quarry. I was somewhat surprised, because in over 25 years of collecting in New Jersey I was never aware of Millington producing specimens. This was of special interest to me because the Millington quarry is located near the town of Basking Ridge, in Somerset County, where I teach earth science.

I acquired a couple of especially nice pectolite specimens and on the drive home decided to send a letter to the quarry inquiring if arrangements could be made for my students to visit and collect minerals for their annual projects. I really didn't expect to receive an answer, much less be allowed to bring three to four hundred eighth graders and their parents into an operating quarry.

To my amazement, within a week I received a phone call from Mr. Robert Maragni, the Millington Plant Manager, to set up a meeting time to plan a student collecting trip. Each year since 1990, the Millington quarry has sponsored an "Annual Quarry Education Day" open to all students and parents of the William Annin Middle School. The staff members provide tours of the operation, offices and lab, serve refreshments, and allow students

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*First-person accounts in this article are by the senior author.

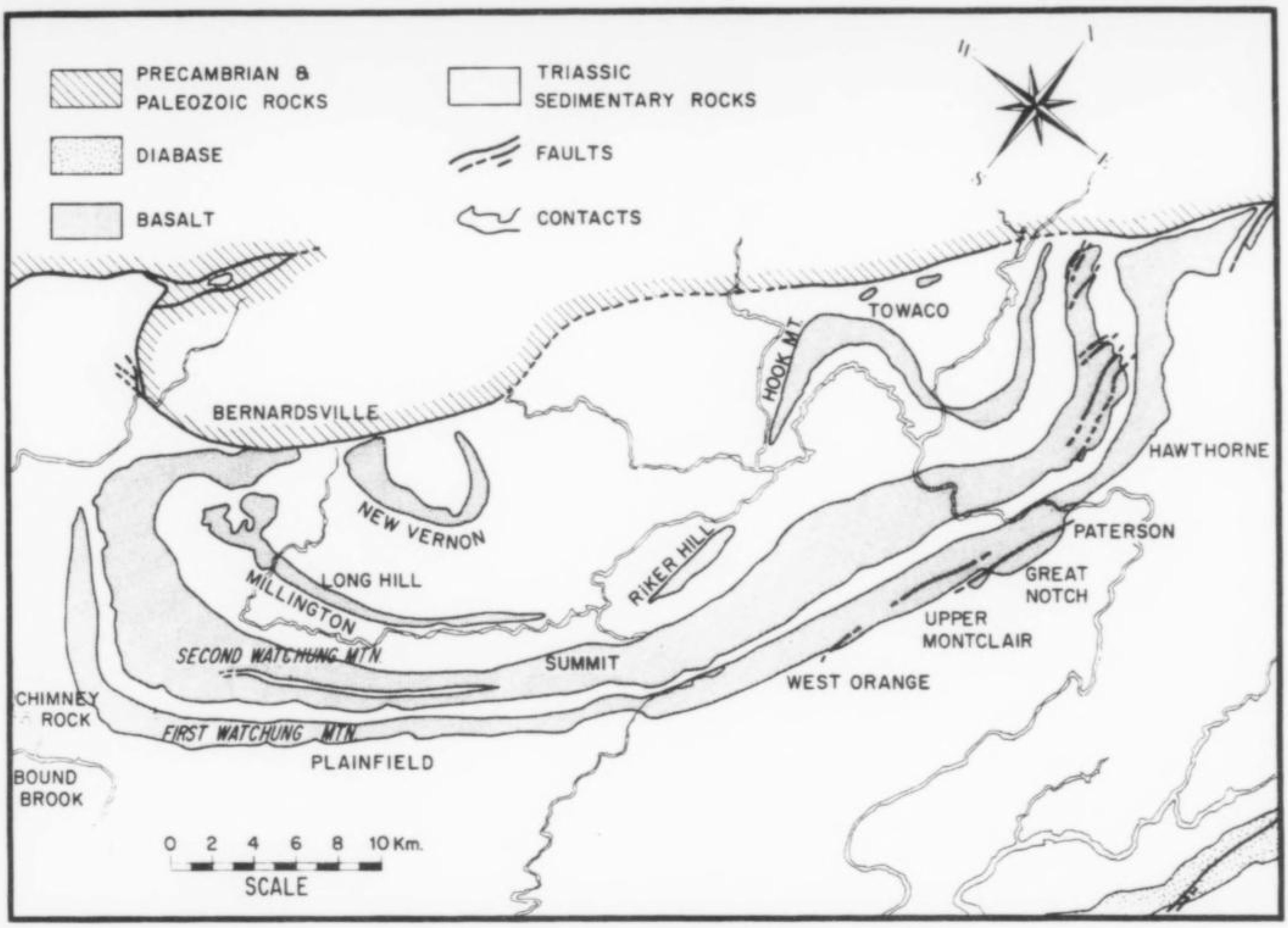


***Figure 1.* A map showing the location of Millington with respect to other quarries and the Triassic basalts of New Jersey. (After Mason, 1960.)**

to collect minerals in a safe location. The owner and staff of the Millington quarry set a rare and commendable example of mineral industry cooperation with local education and mineral clubs.

HISTORY

In the late 1800's America was experiencing great industrial growth. This was the age of industrialists like Andrew Carnegie, John D. Rockefeller and J. P. Morgan. Famous inventors like Alexander Graham Bell, Thomas Edison and others introduced technology which would change communication and expand horizons for generations to come. The gasoline automobile was also invented. These inventions opened a new market for crushed stone products. Railroads needed ballast and the automobile was beginning to create a need for better roads.

In 1895, Basking Ridge property owner F. W. Schmidt was operating a carriage business in Morristown. He realized the horse and buggy were soon to be replaced by the "horseless carriage." For Schmidt to remain successful, he would have to make some changes. Along with F. Nishwitz, who owned the Acme Harrow Company in Millington, and A. Lynch, Schmidt was keenly aware of the growing need for crushed stone products to build new macadam roads and as ballast beneath rail tracks. At the same time, Schmidt also knew the farm he owned was laden with rock. Using the resources at hand, the trio combined their vision and skills to launch the Millington quarry or what was then called The Morris County Crushed Stone Company.

The three men began quarrying operations adjacent to the Delaware, Lackawanna & Western Railroad (DL&W) to give the new company a ready customer and an efficient way to ship stone to construction sites.

By today's standards, the early methods of removing and crushing stone were quite primitive. Blast holes were drilled by hand or with steam-powered drills. Blasting was done with sticks of dynamite. Workers loaded the stone by hand into two-wheel horse-drawn carts. Horses or mules would pull the rock carts to a steam-powered crusher. The first crushing operation was located adjacent to the railroad right of way, so the crushed rock was near the rail loading dock. The original crusher, destroyed by fire in 1903, was replaced in 1904. The year was marked by further progress—the quarry got its first telephone; its first phone number was "4."

Moved by rail, stone was taken as close as possible to the customers' construction sites. The remainder of the trip was made by bottom-dump, horse-drawn wagons.

Around 1910, small railroad dump cars took the place of carts. The new cars ran on narrow-gauge track, but were still loaded by hand and pulled by horse. The demand for stone kept growing, and thoughts turned to modernizing the operation. The long, hard pull up the hill to the crusher was eased when quarry owners installed an inclined plane and a steam-powered skip hoist. Rail dump cars could now be emptied at the floor level of the quarry and steam could pull rock to the crusher. Soon the work of steam shovels took the place of hand-loading. By 1916, gasoline-powered locomotives did the work of horses. To residents of the area, the quarry was known simply as "The Stone Crusher." During the 1920's, the company also operated an Ameisite Company, which manufactured bituminous concrete-asphalt on site.

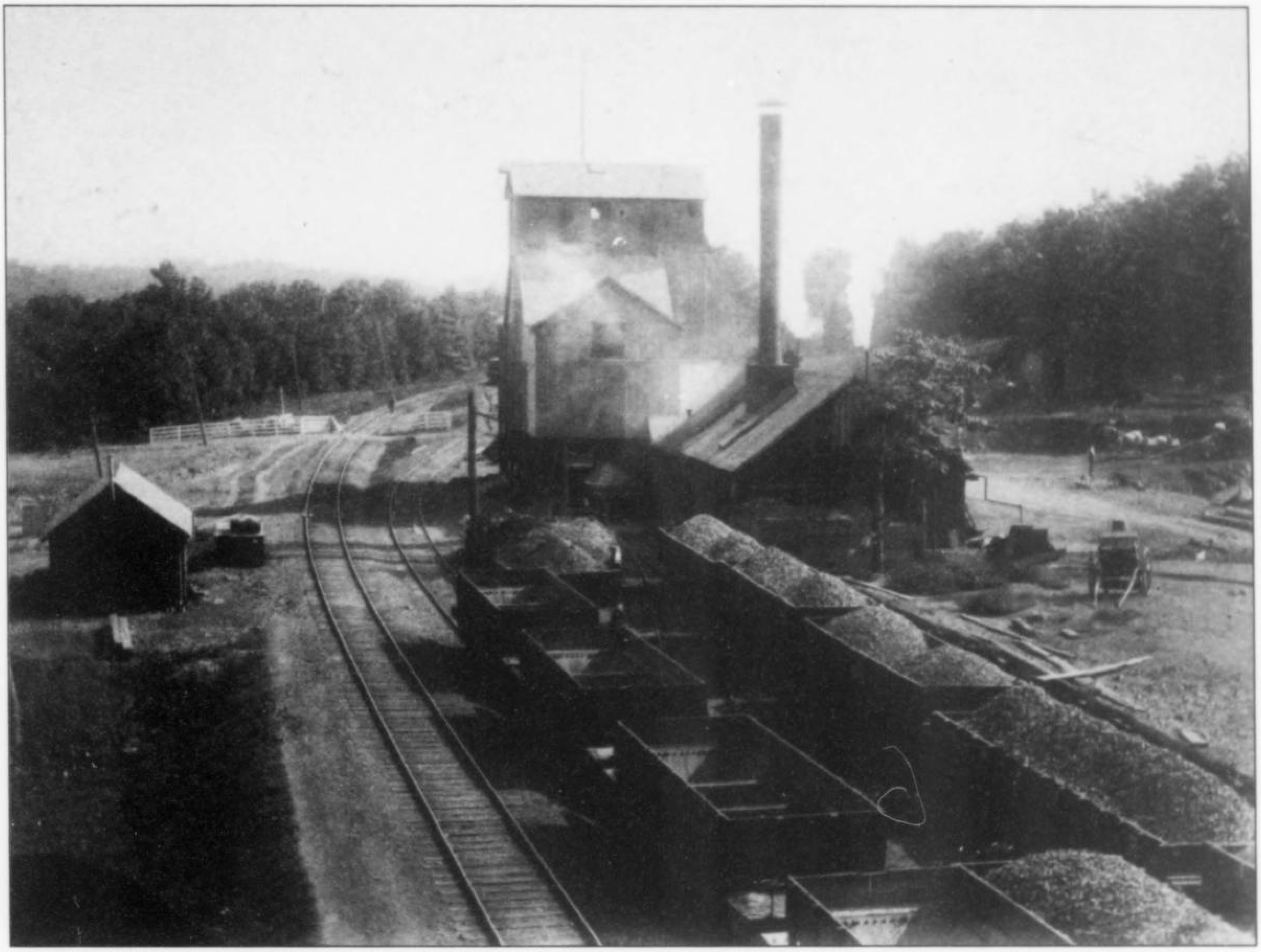


***Figure 2.* Millington quarry, steam-powered rock crusher, ca. 1890.**

In 1930, the North Jersey Quarry Company became the new owner, and continued operations until 1938, when the crushing plant was dismantled. There were plans for a new, modern, electric crushing plant, but because steel supplies and manpower were needed for the war effort in World War II, the project was put on hold. However, crushed stone brought from another location was sold from the site. In 1946, the project resumed and crushing was reinstituted in 1950–51. Although the plant was modernized it was not until 1953 that the last steam-powered crane was retired.

In 1956 the quarry was taken over by Houdaille Industries, Inc., a French company that operated several other quarries in New Jersey. They worked the Millington quarry until the early 1970's, and in 1978 sold it to the Mahan Family. The Mahans brought with them the experience of operating the nearby Dock Watch quarry and the Dallenbach Sand Company of Dayton, New Jersey.

In the early 1980's a new plant replaced the old one. It was set up near the center of the property and is still in operation today. In 1985 a new main office building was constructed on Stone House Road, along with a new sign, gate, and landscaping. A new operations building and scale house were constructed in 1989. A three-mile chain-link fence was placed around the perimeter of the 265-acre site. In 1995 the Mahans celebrated the Millington quarry's 100 years of operation with an open house that attracted over 3,500 visitors. In July of 1999, Tilcon Limited took over ownership of the quarry. At present the quarry produces over 3 million tons of crushed stone products annually.

GEOLOGY

During the early Triassic period North America separated from Africa and Europe creating a large rift valley running through what is now northern New Jersey. The western rift boundary is marked by the Ramapo Fault, which separates the Triassic deposits of the central New Jersey rift from the Precambrian gneiss to the west. To the east the rift is bordered by the Hudson River Valley and in the south by Cretaceous marl and sand deposits.

The subsiding New Jersey rift filled with shale, sandstone, and arkose, in places to a depth of 2,500 meters. Shallow water and tidal mud flats covered much of the rift floor, as evidenced by the preserved ripple marks, raindrop impressions, and dinosaur footprints found in the sedimentary rock today.

Subsequent tectonic activity forced magma into the Triassic sediments, forming extensive intrusive diabase sills, such as those exposed by later erosion at the Palisades Cliffs and Round Valley. Late in the Triassic period a series of dikes opened to the surface, creating three episodes of lava flows that are now called the First, Second, and Third Watchung Ridges. Each ridge is composed of two or more succeeding basalt lava flows resting on the Triassic sediments.

At sporadic locations in each of the Watchung Ridges the basalts exhibit classic "pillow lava" structure, indicating that the lava spilled into water. It is at these locations that the amygdaloid cavities are most prominent and produce the best mineral specimens.

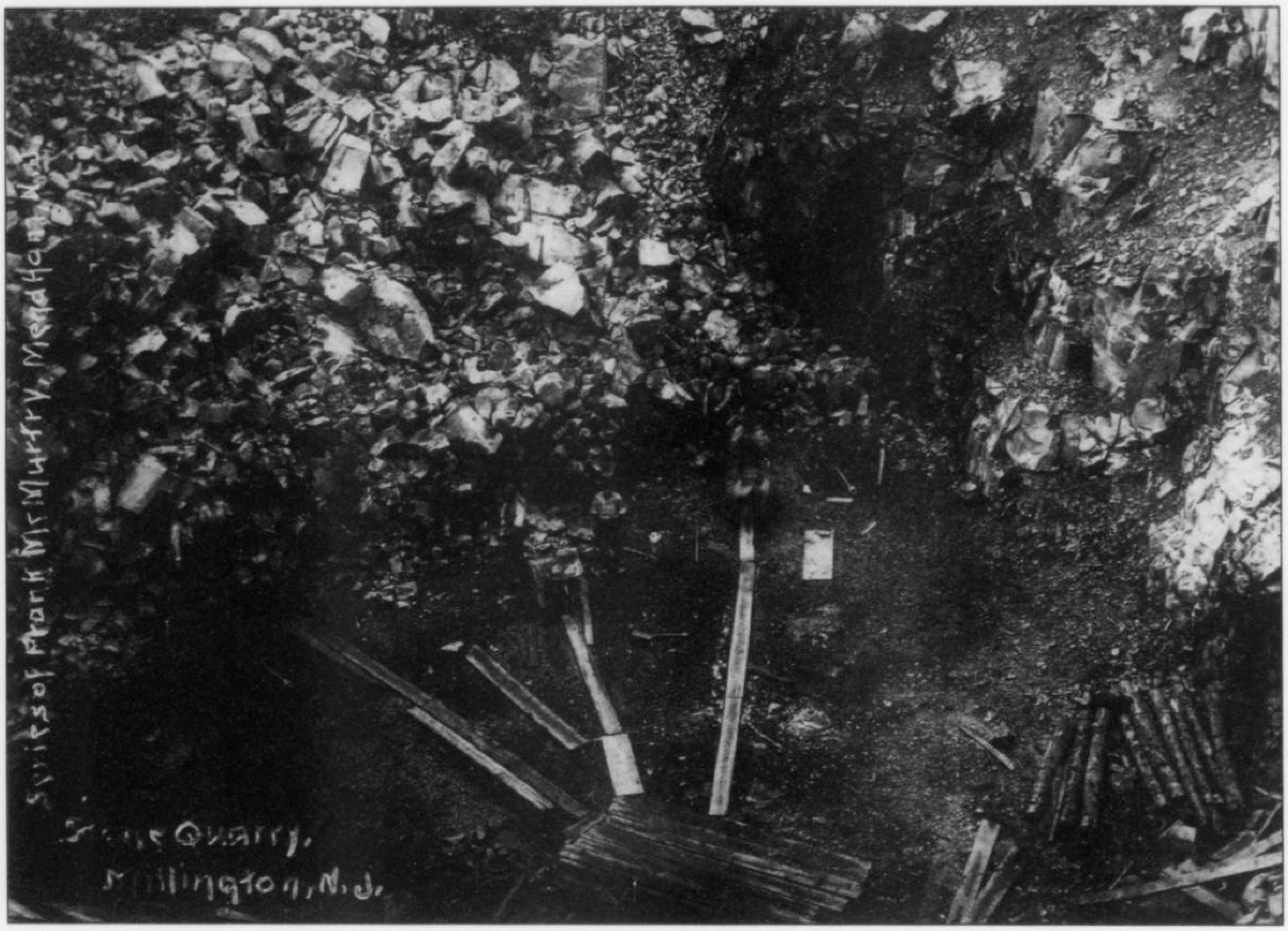


Figure 3. **Workers at the Millington quarry, ca. 1890. From an old postcard, courtesy of John Kolic.**

The Millington quarry is located in the southern end of the Third Watchung Ridge, locally called Long Hill. Although previous authors specify that the Third Ridge is composed of two lava flows, at Millington there are four flows exposed by the quarry operation. The first or bottom flow is approximately 30 meters thick and is the only flow to exhibit a poor "pillow formation." This first flow rests on a 50-cm-thick layer of hornfels created by contact metamorphism of the underlying shale. The upper 5 to 8 meters of this first flow is amygdaloidal and contains the majority of the best specimen-quality minerals. The second flow is also about 30 meters thick but contains few mineralized cavities. This is topped by two more smaller flows, each about 3 to 5 meters in thickness and lacking notable minerals.

MINERAL PARAGENESIS

Schaller (1932) and Mason (1960) have discussed in detail the sequence of mineral formation in the New Jersey basaltic lava flows. The following description of these periods of formation is based on their work and modified for the mineralization found at Millington.

Period 1, Solidification Period: The lava spilled onto the surface, in places such as Millington, into shallow tidal and salt water. As the upper surface of the lava solidified, gas bubbles rose up through the liquid rock and became trapped in the upper layer of the flow, forming the amygdaloid cavities.

Period 2, Saline Period: The saline minerals anhydrite and

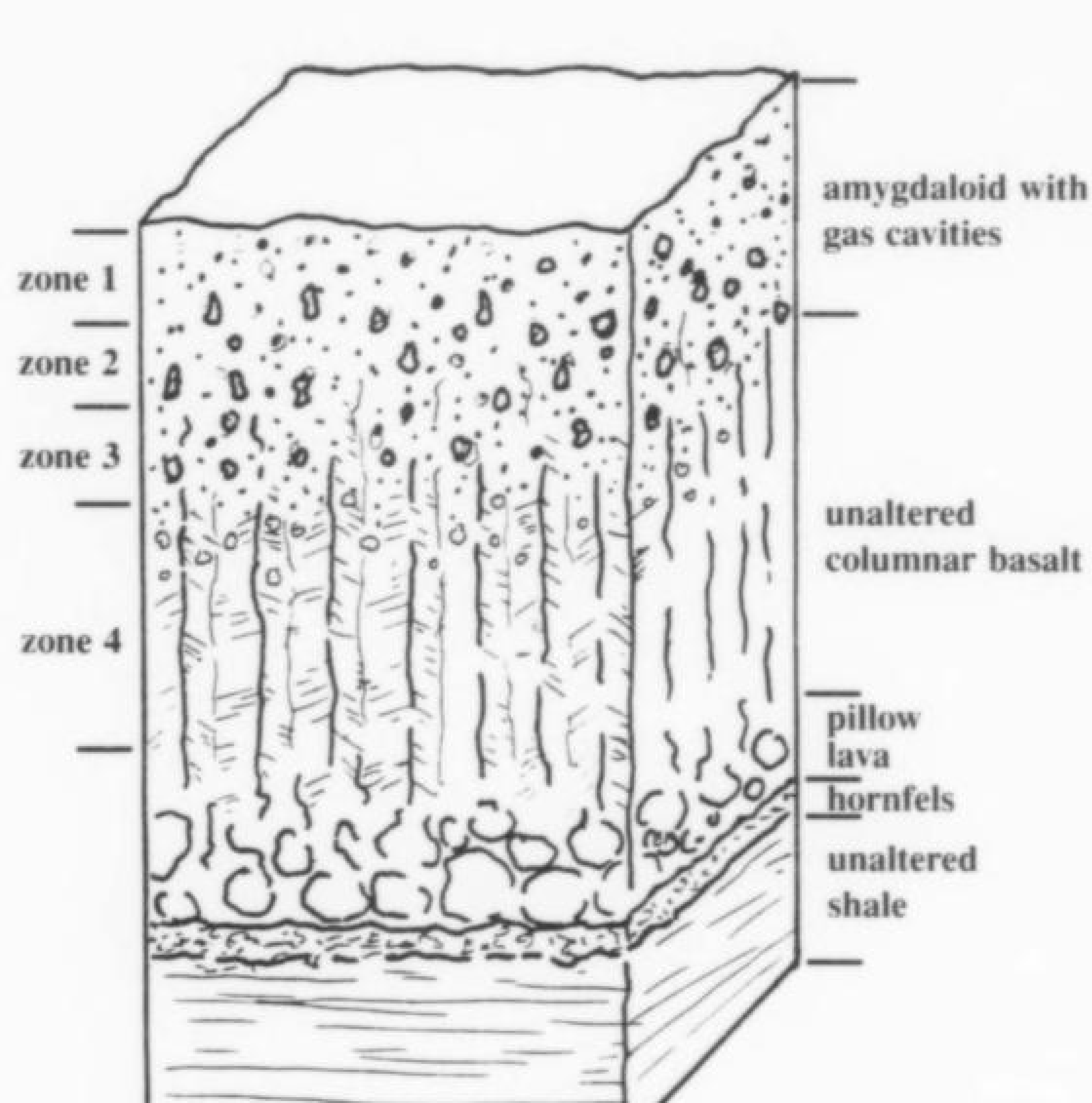


Figure 4. **Structure of the first lava flow in the Millington quarry.**

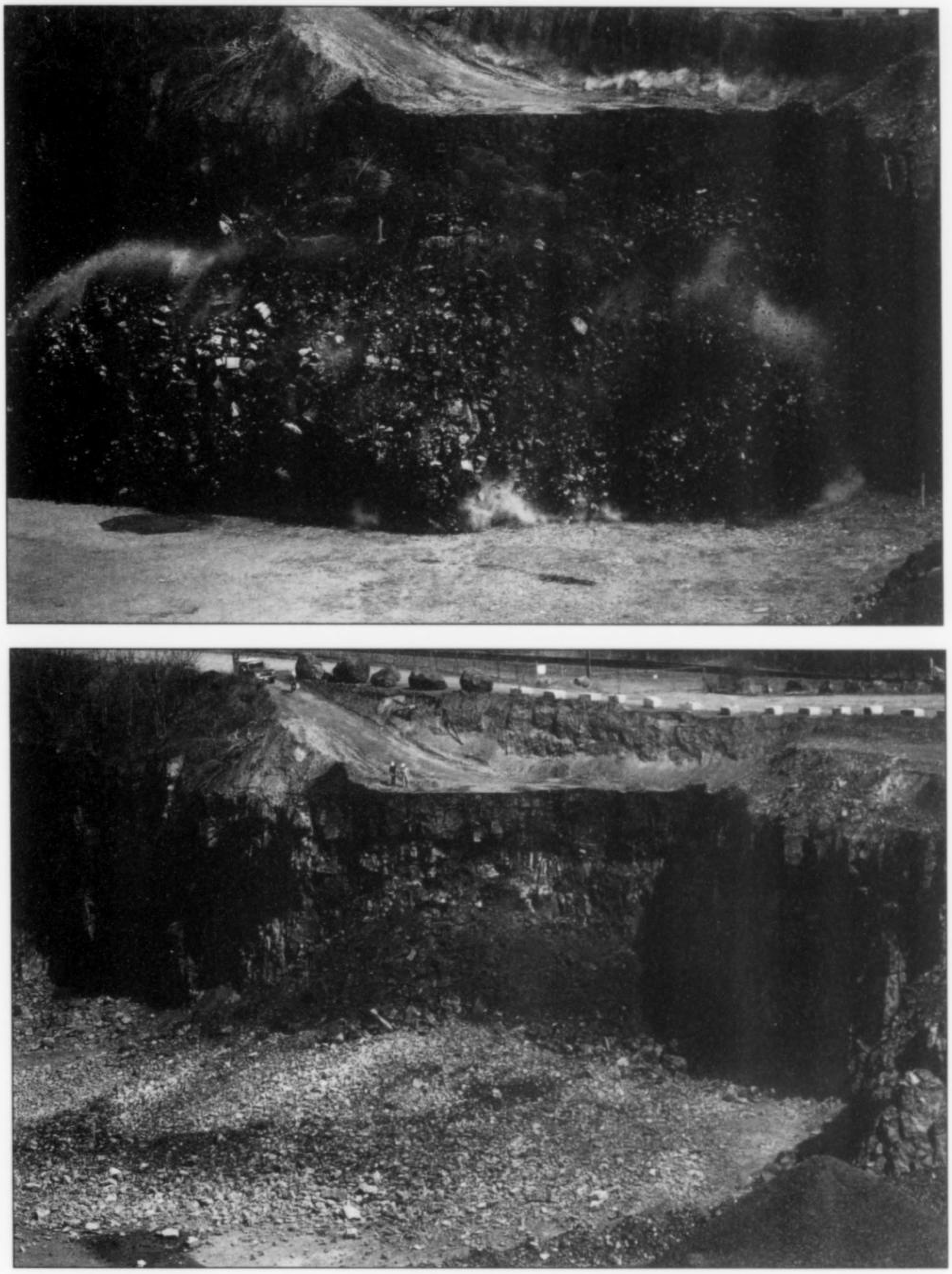


Figure 5. **Rock blast in the Millington quarry, 1995. Kent photos.**

(minor) glauberite began to form by replacing some of the basalt surrounding the gas cavities. At the end of this period additional groundwater entered some cavities, stabilizing the silica, and quartz began to form.

Period 3, Quartz Period: Abundant quartz crystallized in many cavities, especially in zone #4, the lower part of the amygdaloid. In places, the quartz forms a coating over the anhydrite and glauberite crystals.

Period 4, Prehnite Period: Additional groundwater solutions began to deposit prehnite in cavities where quartz had not already been deposited. Like the quartz, prehnite also formed over the saline minerals. The anhydrite and glauberite began to dissolve, leaving hollow cavities or molds in the quartz and prehnite. Datolite and pectolite then began to form.

Period 5, Zeolite Period: As the saline minerals dissolved, the cavity solutions increased in soda and lime, causing an abundance of zeolites to be deposited. During this period the majority of the natrolite, analcime, apophyllite, and datolite formed along with minor amounts of stilbite and heulandite. Small amounts of pectolite formed at the end of this period.

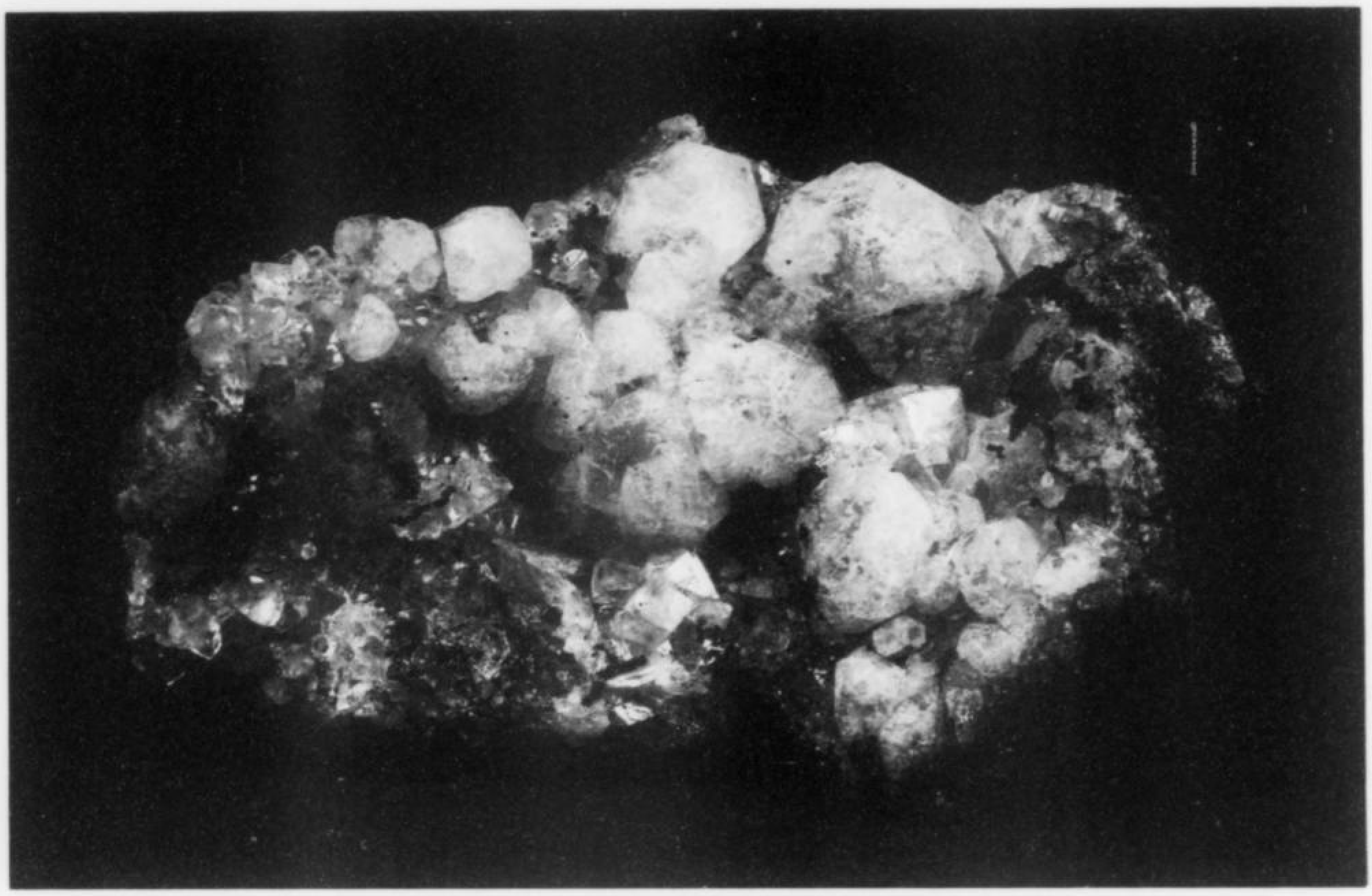


Figure 6. **Analcime with calcite, 12 cm, Millington quarry. Kent collection and photo.**

Period 6, Calcite Period: The majority of the calcite formed at this final stage, along with minor amounts of gypsum, pyrite, pyrrhotite, goethite, and hematite.

COLLECTING

During the 1994 Quarry Education Day field trip the students and I began to find fairly nice quality specimens for the first time, once again arousing my interest. I approached the quarry staff with a proposal for more extensive salvage of mineral specimens to establish a display collection in their office, for our school, and as a reference collection of unique Millington quarry specimens.

In 1995 the Millington quarry staff agreed to allow more extensive collecting of specimens on a weekly basis, with specific stipulations. I would be granted access during evenings or weekends during hours they were not operating. I was to wear the normal required safety equipment, have a cellular phone for any possible emergency, and I was not to collect alone. Bill Butkowski eagerly agreed to accompany me on my weekly trips to the quarry.

Since the Spring of 1996, Bill and I have tried to go to the quarry once a week, usually on a Friday night or Sunday afternoon, during the months of April through November. These are the months of heaviest demand for crushed basalt for construction and road building. Consequently, this is the period during which drilling and blasting take place. The company stockpiles enough stone product to carry them through the months of December to March. During these winter months they rebuild the jaw crusher, and perform maintenance on the secondary crushers, conveyor system, sorters and heavy equipment.

During the active months, blasting is done an average of twice a week. They drill and blast a section of basalt up to 10 meters deep, 5 meters back, and 15 meters along the working face of the rock wall. Our weekly visits usually allow us to check most or all of each blast before it is scooped up and hauled to the crusher.

Our collecting is primarily done in the fan-shaped broken rockfall from each blast site. We walk back and forth across the broken rock and boulders looking for exposed cavities. We need only a small hand sledge and average-size chisel to remove hand-sized specimens from the fractured basalt.

As mentioned, minerals of interest to collectors are only found in the amygdaloid of the lower or first basalt flow, and only sporadically. The amygdaloid seems to contain 3 to 5-meter-wide "pods" of mineral cavities with good-quality specimens dispersed about 15 to 20 meters apart. Each "pod" usually contains only one predominant mineral species. This dispersion of minerals means that quality specimens are found an average of one trip out of every three. Our best collecting to date was in August of 1997 when we removed about 6 flats of beautiful pectolite, yet we found nothing of interest two weeks before or two weeks after that day.

MINERALS

The basal pillow lava at the Millington quarry is poorly developed and the amygdaloid zone lacks the large open mineralized cavities found in the Paterson area north of the First Watchung Ridge. The mineral cavities at Millington generally range from 10 to 40 cm in diameter, and the minerals found there are the same as those from the well-known Paterson area, with a few noted exceptions.

Only in the last five years or so have local collectors become interested in the Millington quarry. The following discussion of its minerals is a compilation of confirmed species as of January 1, 1998. It is very likely that in the future more species will be identified.

Analcime $NaAlSi_2O_6 \cdot H_2O$

The zeolite minerals are among the best known and most abundant in other quarries in New Jersey basalt. There are ten zeolite minerals known from the Paterson area in the northern end of the First Watchung Ridge, but at Millington only six have been found, and only two of them are common. Of these, analcime is the most common.

The analcime crystals at the Millington quarry are all trapezohedral, usually 5–15 mm in diameter, and transparent. An occasional larger crystal up to 3 cm can be found, but such crystals tend to become cloudy white as they grow larger. Analcime is limited to zones 2 and 3 and has not proven to be very common (as originally observed by Cummings, 1985).

Anhydrite $CaSO_4$

Unaltered crystals of anhydrite are rare due to their solubility. Most of the original anhydrite has been dissolved or altered to gypsum. The only documented specimens of anhydrite from Millington are several small crystals (1–2 cm) embedded in clear massive cleavages of gypsum. When dissolved, anhydrite leaves behind elongated rectangular cavities or molds in the encrusting minerals. These molds are common in prehnite and datolite.

No actual glauberite has been found in Millington, and even the diamond-shaped molds left by its dissolution are very rare.

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

Babingtonite began to form in the later stage of the Quartz Period at Millington. It is found as small, black, wedge-shaped triclinic crystals on quartz and as quartz inclusions. The crystals are usually less than 4 mm long and are commonly associated with calcite, datolite or prehnite.

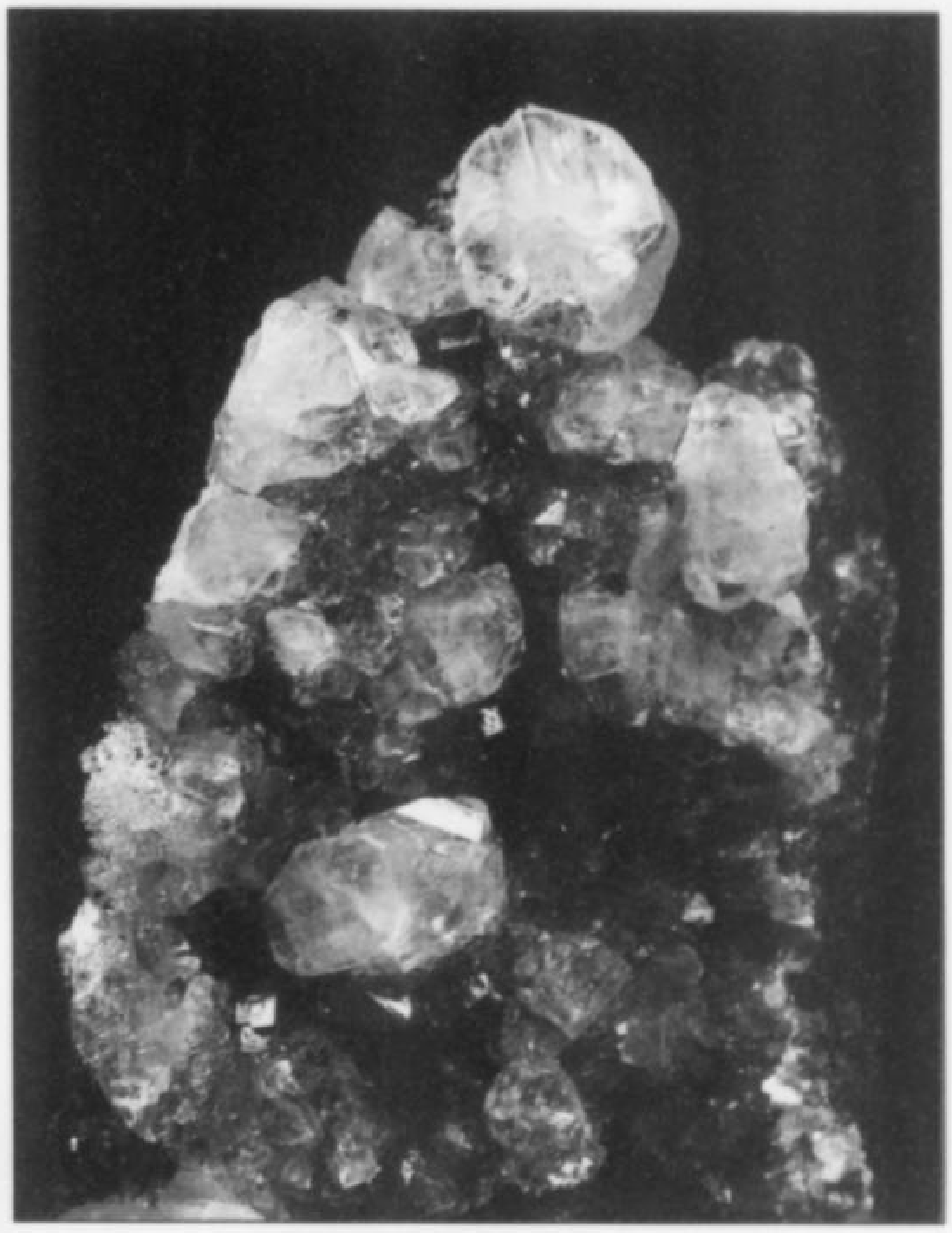


Figure 7. **Datolite crystal group, 10 cm, Millington quarry. Kent collection and photo.**

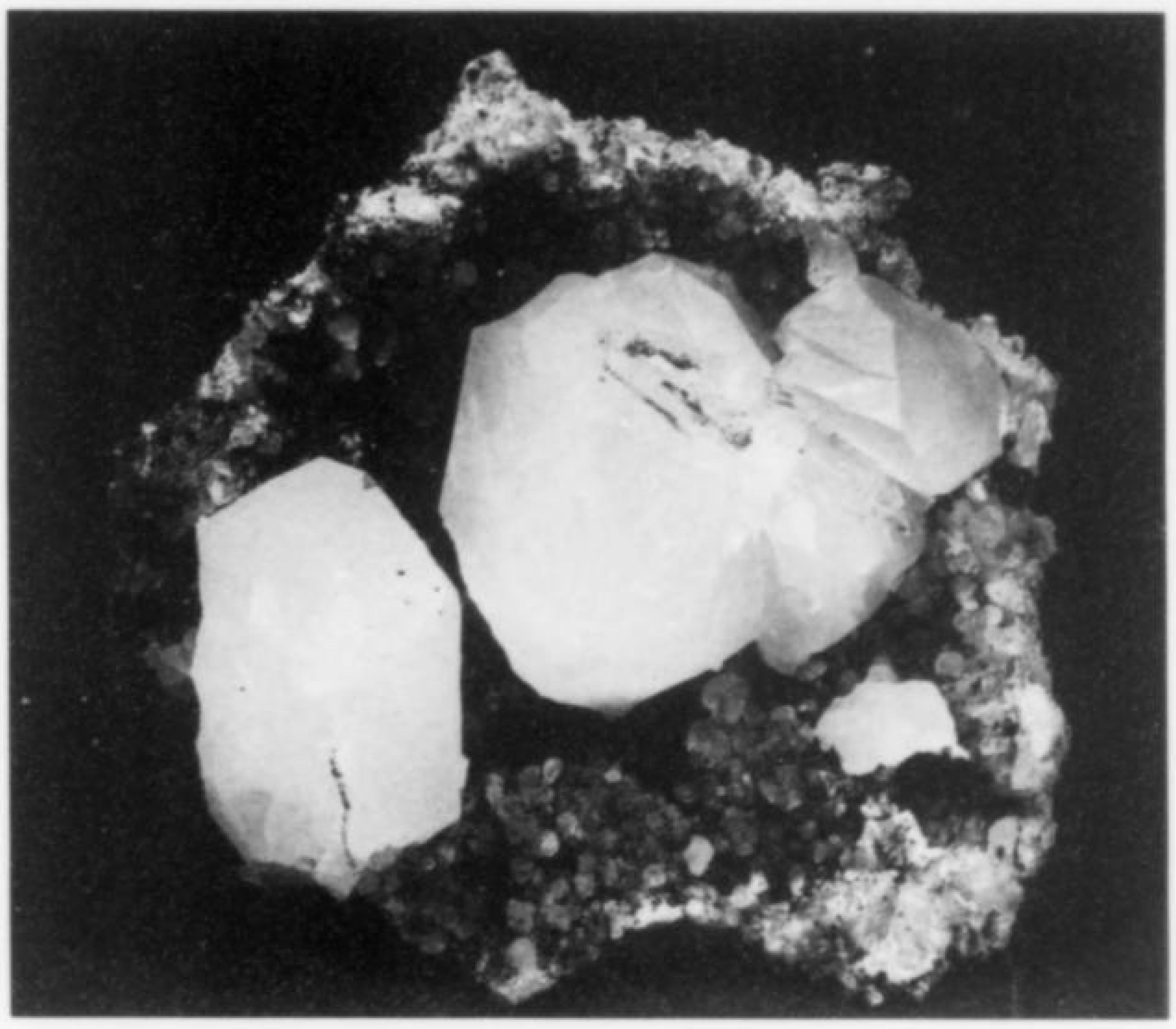


Figure 8. **Calcite crystal group, 8 cm, Millington quarry. Kent collection and photo.**

Calcite $CaCO_3$

Calcite is common throughout zones 1, 2, and 3. It exhibits more varied crystal morphology than any other mineral from Millington. The two most abundant forms are the rhombohedron and scalenohedron, each with numerous modifications. Crystal sizes range from microscopic up to 6 cm. It is often found lining cavities or as a secondary crystal growth, especially on prehnite or datolite. Millington calcite is becoming popular with fluorescent-mineral collectors due to its salmon-pink or green fluorescence under shortwave ultraviolet light.

Chabazite $CaAl_2Si_4O_{12}\cdot 6H_2O$

Only a few specimens of chabazite have been found, each a small white pseudorhombohedron measuring about 5 mm.

Clinochlore $(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$

Small amounts of clinochlore and pumpellyite are found, but most collectors refer to them collectively as "chlorite." Clinochlore is almost always found as greenish black velvety rosettes of crystals, each cluster no more than 2 mm across. Pumpellyite is found as blue-green fibrous coatings on calcite crystals or directly on the basalt lining of cavity walls.

Datolite $Ca_2B_2Si_2O_8(OH)_2$

The most abundant mineral species at Millington is datolite, especially in zones 3 and 4. It is usually found as drusy plates of small crystals 2 to 6 mm each, nearly white to pale green in color, and completely lining cavities. Most of the crystal plates are opaque but a few are gemmy, apple-green, monoclinic prisms from 1 to 2 cm each. Datolite commonly forms a base for secondary growth of other minerals such as pectolite, pyrite and pyrrhotite, making attractive specimens.

Fluorapophyllite $KCa_4Si_8O_{20}(F,OH)\cdot H_2O$

Fluorapophyllite is found in zone 3 cavities associated with pectolite and analcime. Analysis of several different specimens has shown that the crystals from Millington are fluorapophyllite. They take on the classic tetragonal prismatic habit, or a platy habit flattened parallel to the *c* face. Crystals range from 1 to 4 cm long and are colorless and transparent to white. Apophyllite is also common as a secondary crystallization on pectolite, usually with dipyramidal modifications.

Gypsum $CaSO_4\cdot 2H_2O$

Large crystals of transparent gypsum formed as a result of the dissolution of anhydrite. It is found as transparent plates, simple

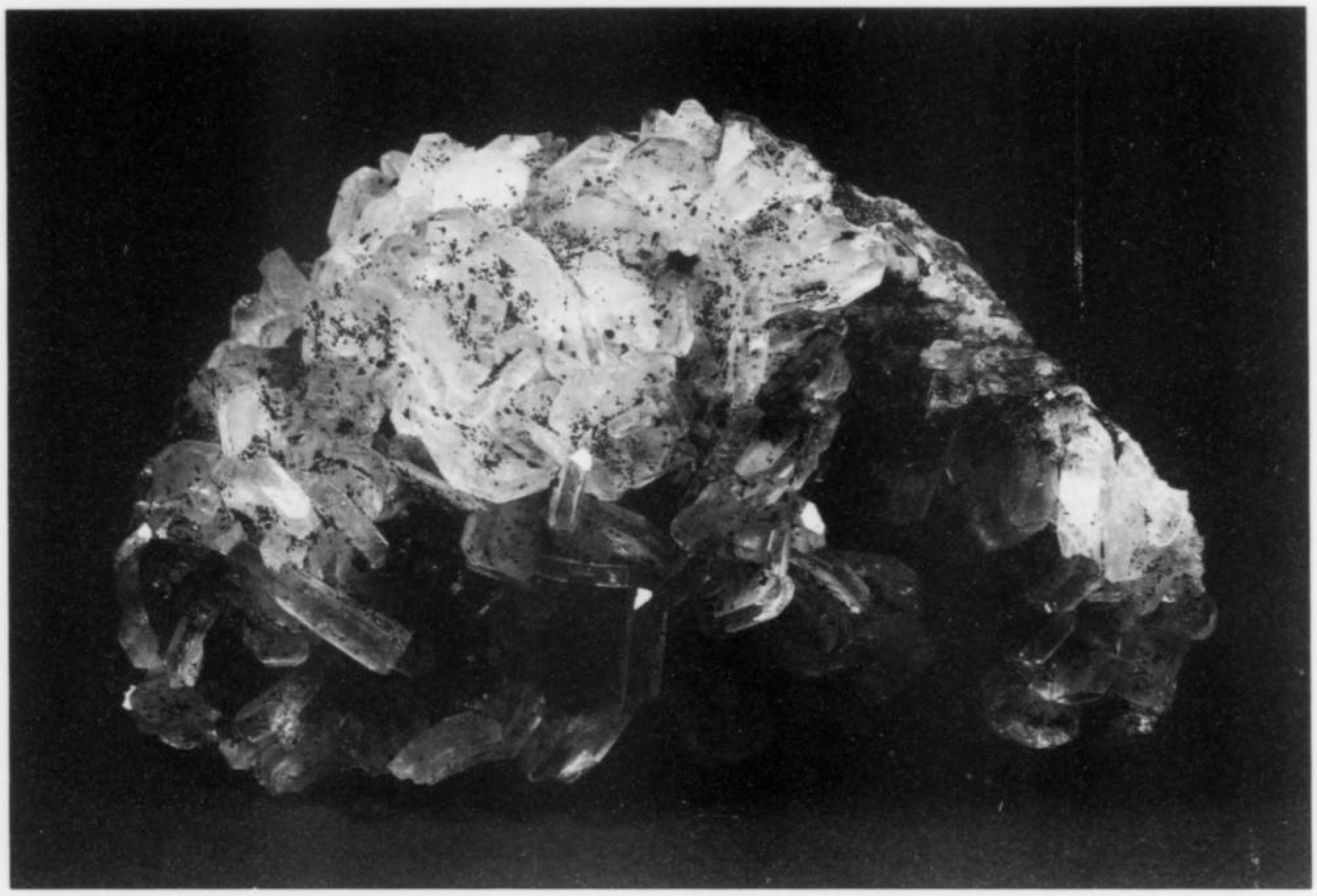


Figure 9. **Fluorapophyllite, 8 cm, with clinochlore, Millington quarry. Kent collection and photo.**

Figure 10. **Fluorapophyllite crystals to 3 cm, with clinochlore, Millington quarry. Kent collection and photo.**

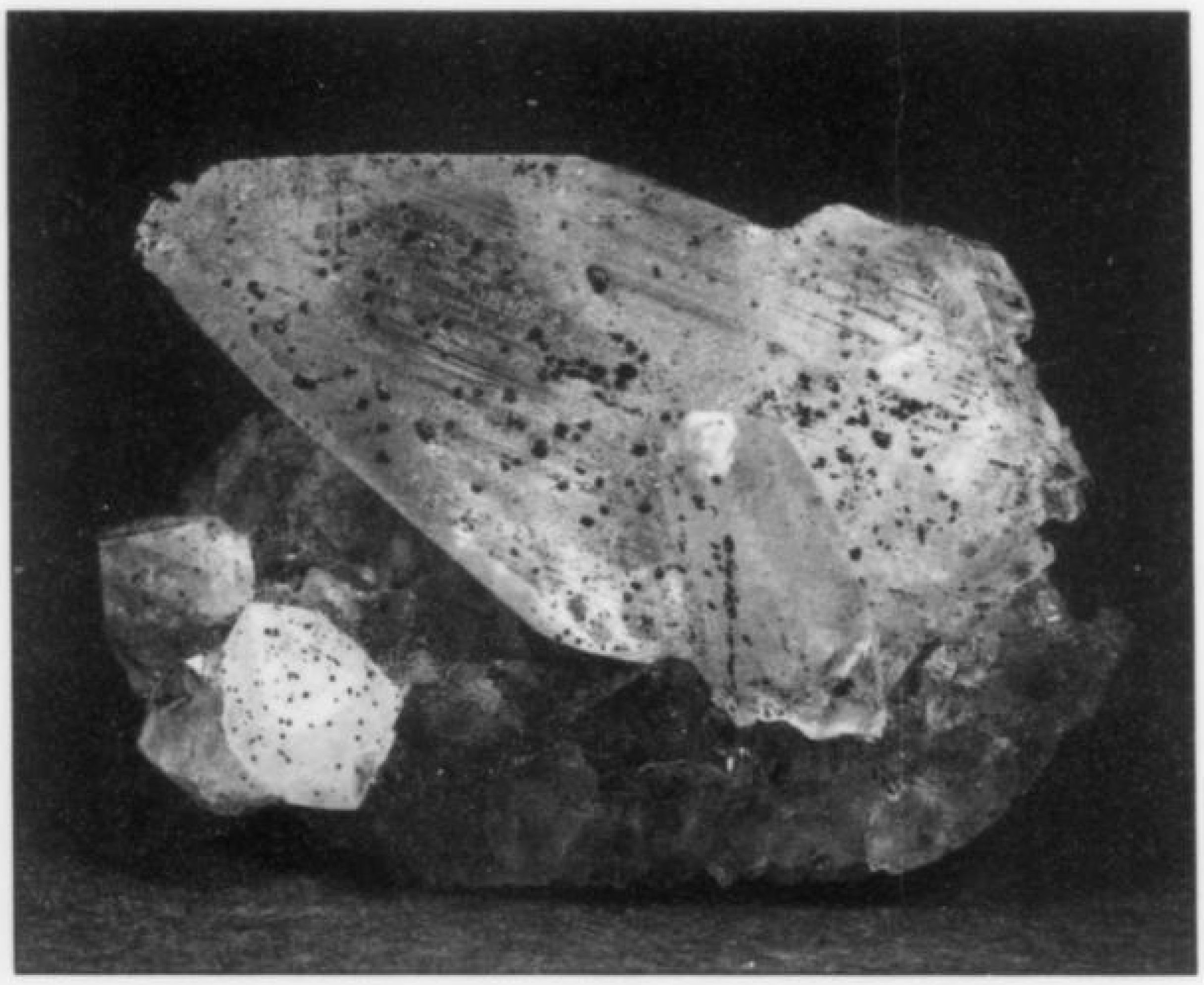


Figure 11. **Gypsum crystals, 4 cm, Millington quarry. Kent collection and photo.**

monoclinic prisms, and transparent masses nearly filling entire cavities. The individual crystals are up to 6 cm long and make especially nice specimens when coated with drusy pyrite or pyrrhotite.

Heulandite $(Na,Ca)_{2-3}Al_3(Al,Si)_2Si_{13}C_{36}\cdot 12H_2O$

Heulandite is relatively rare at Millington, as white or clear coffin-shaped crystals with pearly luster, in crystals only about 5 mm in length. A few small aggregates of crystals have been found, forming pale pink clusters about 1 cm in diameter, with up to 2 dozen individuals in a cluster.

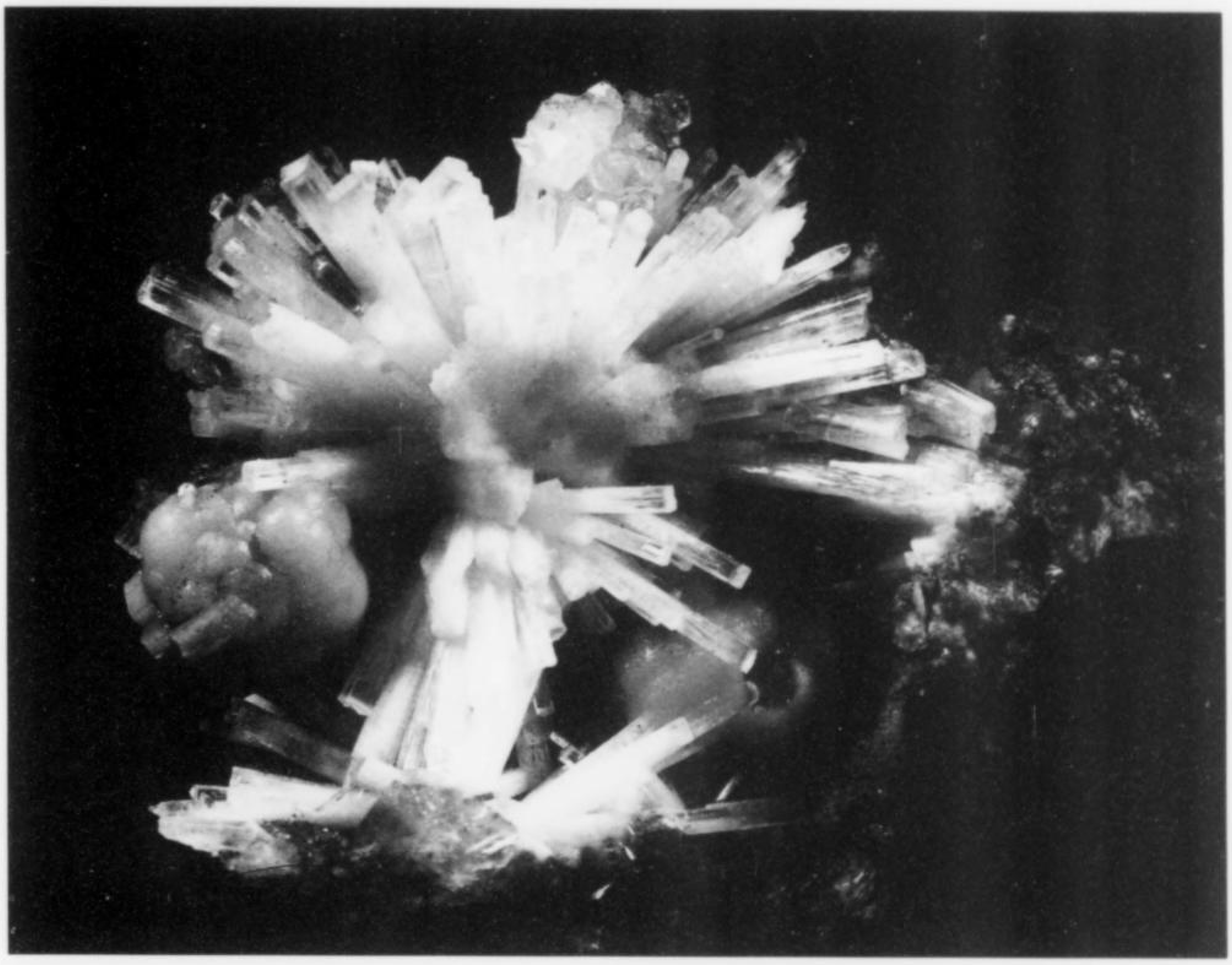


Figure 12. Natrolite crystal group, 8 cm, Millington quarry. Butkowski collection; Kent photo.

Figure 13. Goethite ring-shaped growth, 1.5 cm, Millington quarry. Butkowski collection; Kent photo.

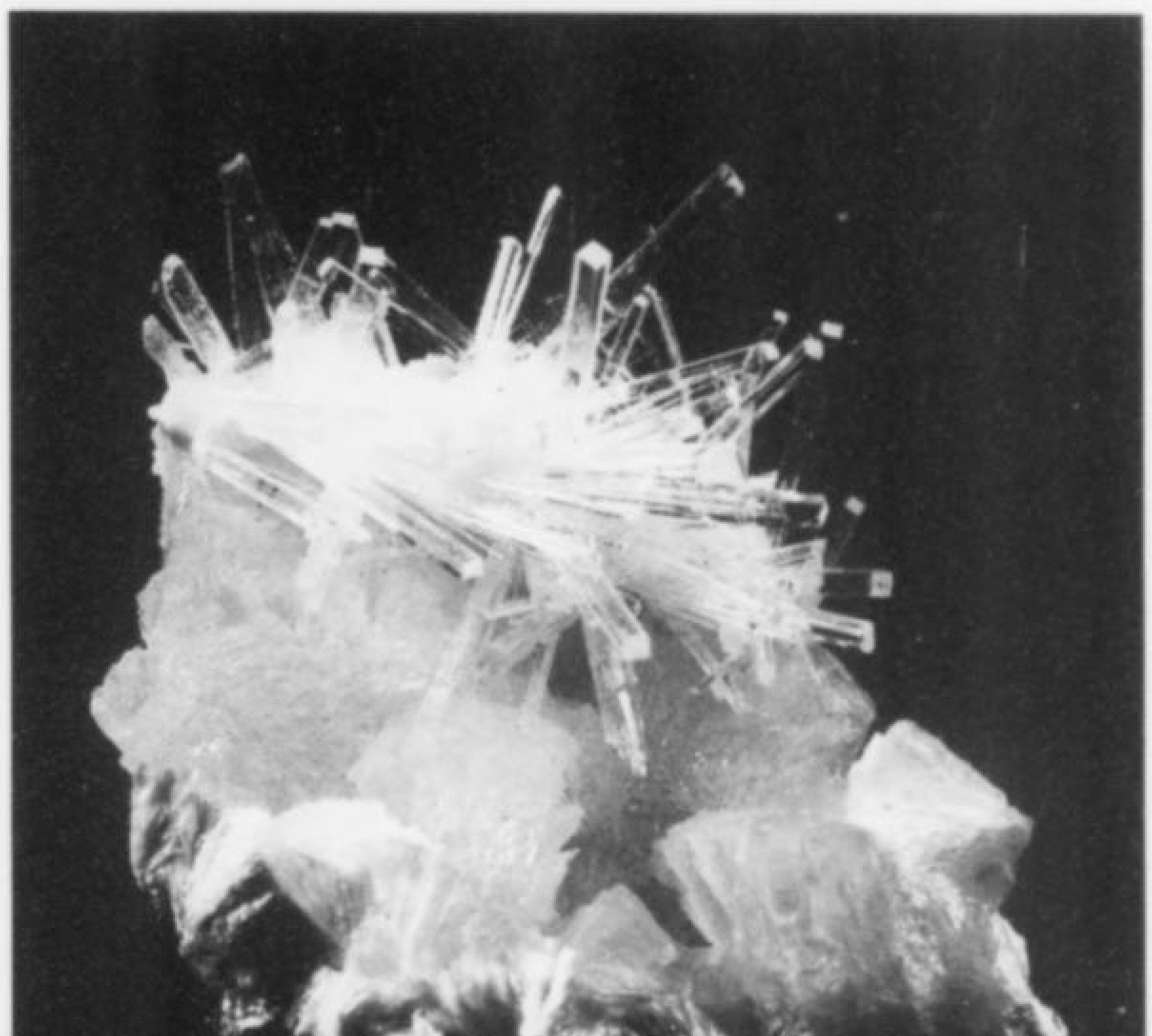


Figure 14. Natrolite crystals on pectolite, 6 cm, Millington quarry. Butkowski collection; Kent photo.

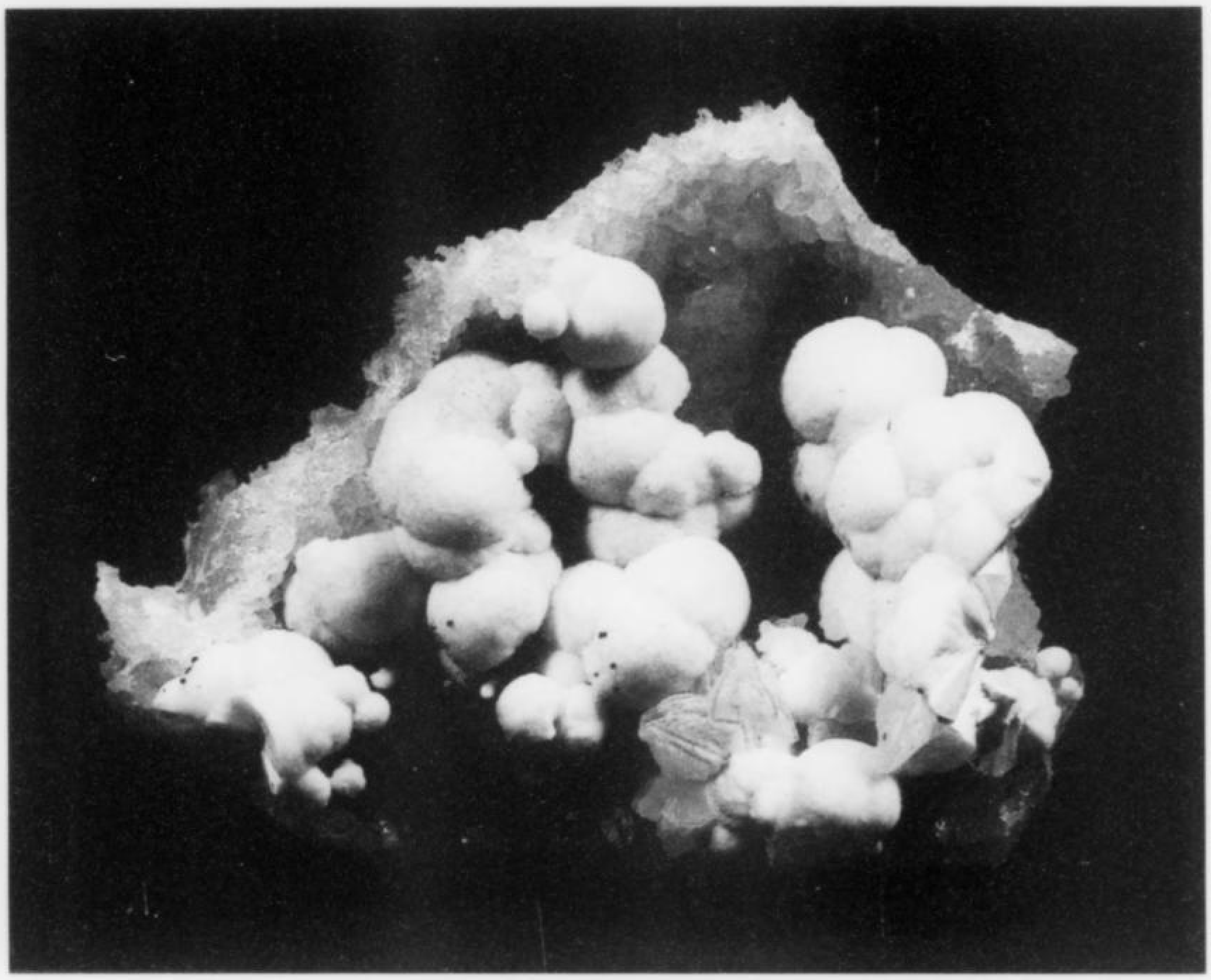


Figure 15. **White pectolite on prehnite, 6 cm, Millington quarry. Kent collection and photo.**

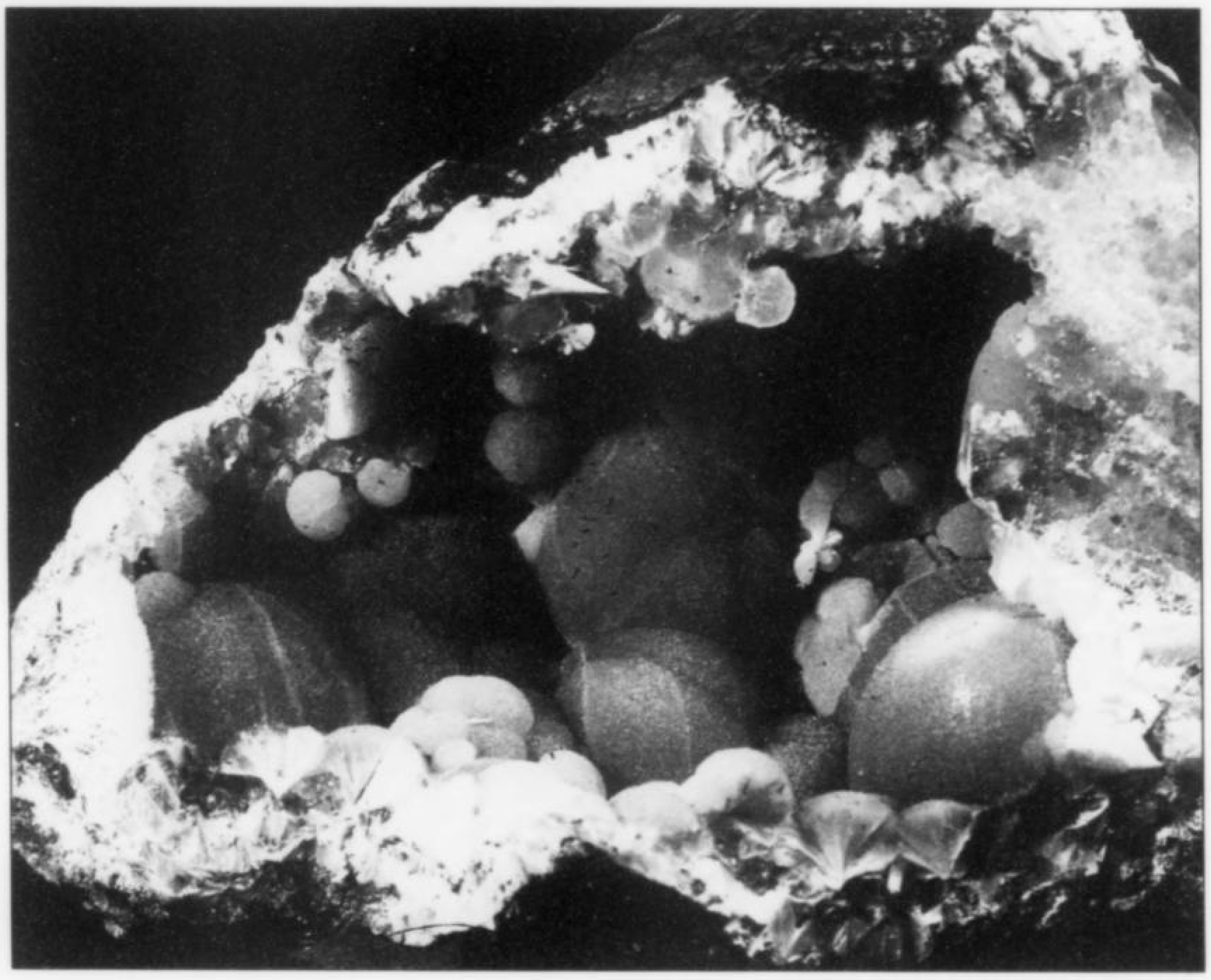


Figure 16. **Pink pectolite, 12 cm, Millington quarry. Kent collection and photo.**

Iron Oxides

Two iron oxides, goethite and hematite, formed during the Calcite Period. Goethite is common throughout Millington cavities, usually as small radiating rosettes of crystals from .5 to 2 mm across and less often as platy orthorhombic crystals. Goethite is a frequent inclusion in apophyllite, and as crystals on minerals formed during periods 4, 5, and 6. Hematite is found as tiny, platy red crystals in small vesicles and as a coating on other minerals, usually calcite.

Natrolite $Na_2Al_2Si_3O_{10}{\cdot}2H_2O$

Other than pectolite, natrolite is probably the most interesting mineral for collectors. It is considerably more common at Millington than any of the other New Jersey locations. It is found as random needles and somewhat radiating groups of long, clear individual crystals from 1 to 4 mm each in diameter and up to 4 cm long. All specimens collected so far are water-clear. It is also found rarely as tightly packed spheres like snowballs up to 4 cm across. These natrolite balls are occasionally hollow, with other minerals such as

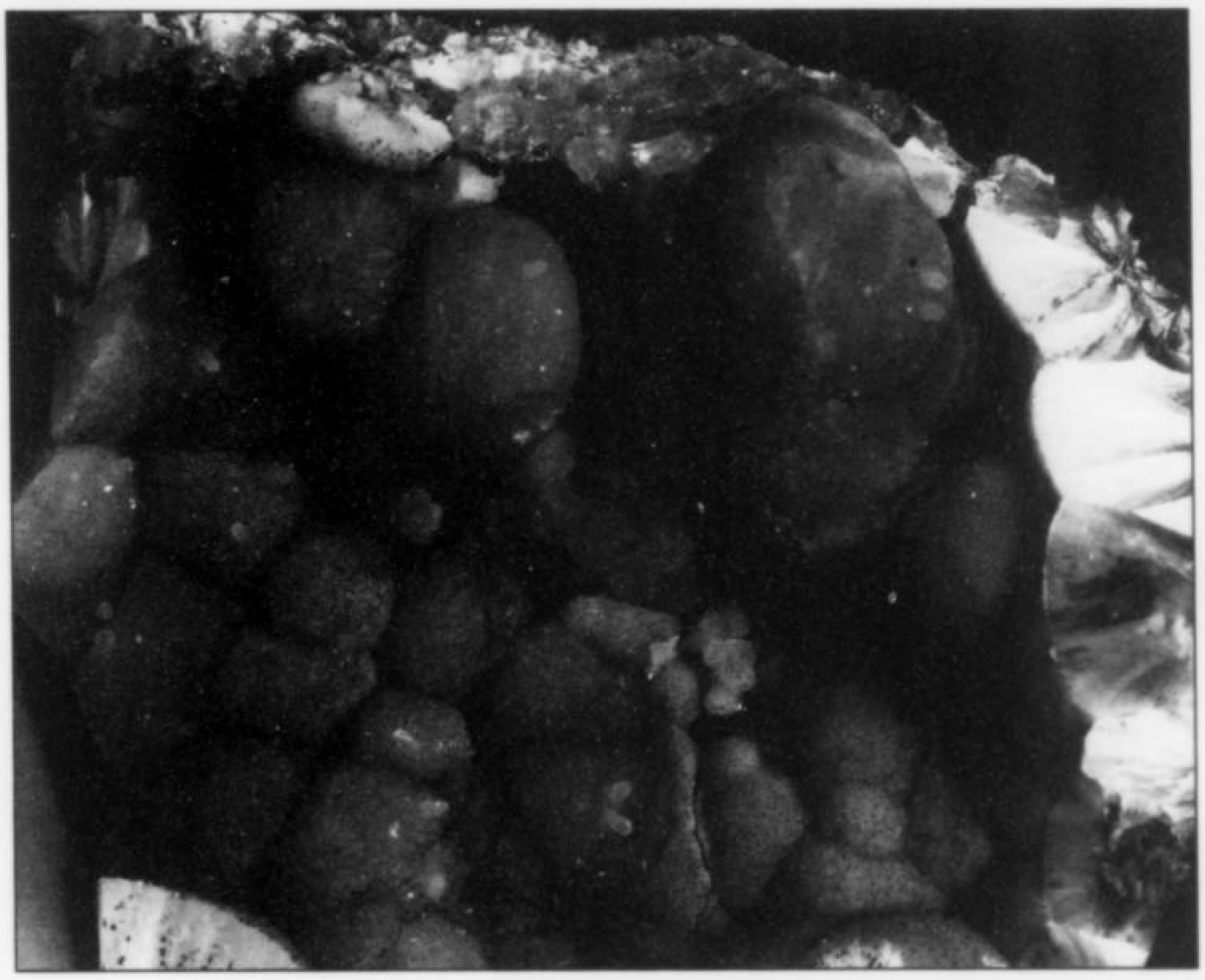


Figure 17. **Pink pectolite, 8 cm, Millington quarry. Kent collection and photo.**

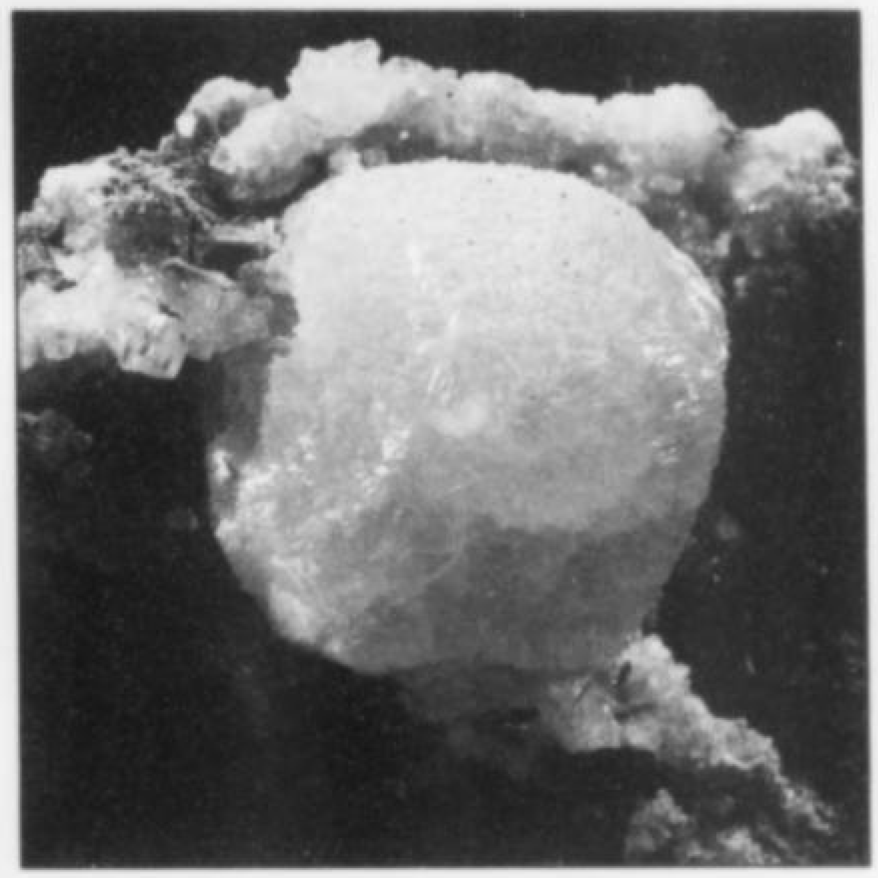
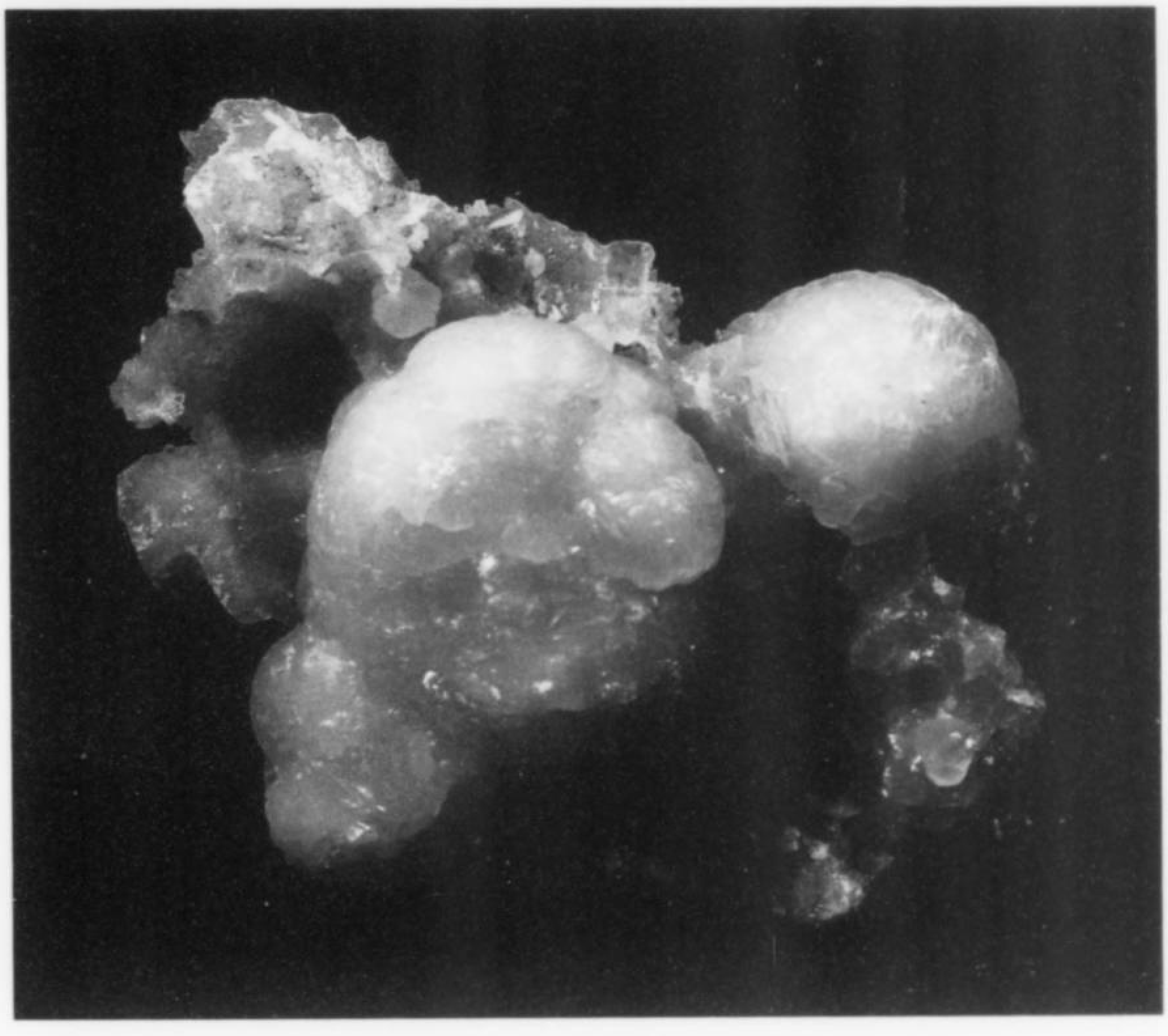


Figure 18. **Prehnite, 4 cm, on calcite, Millington quarry. Kent collection and photo.**

Figure 19. **Prehnite on datolite, 6 cm, Millington quarry. Kent collection and photo.**



analcime and calcite crystals on the inside (Cummings, 1985). Natrolite is found in the top of zone 3 and throughout zone 2. All specimens collected have shown the classic elongated orthorhombic prism with pyramid termination.

Pectolite $NaCa_2Si_3O_8(OH)$

Pectolite is probably the most significant of the Millington mineral specimens. Some of the world's best pectolite has come from New Jersey, and the best of those are from Millington.

Pectolite is triclinic in crystal form but is rarely found as individual crystals visible to the unaided eye. It is usually found as tightly packed, radiating white masses with an outward mammillary shape. Approximately 80% of the pectolite from Millington is the typical white color, often with a secondary growth of pale green prehnite or apophyllite crystals. The remainder of the pectolite specimens are pale pink to deep red in color, unlike those from any other location.

Analysis of red pectolite from Millington indicates that the samples are 1–2 weight % iron oxide, probably hematite, and this no doubt imparts the pink to red color. Analysis also indicates minor substitution of Mg and Al for Na and Ca.

The mammillary pectolite aggregates range in size from 1 to 6 cm across and usually form on datolite or directly on the basalt rock lining the cavity. It is found predominantly in zones 2 and 3.

Prehnite $Ca_2Al_2Si_3O_{10}(OH)_2$

Most collectors probably associate prehnite more than any other mineral with New Jersey basaltic lava flows. The quarries at Paterson and Prospect Park are famous for large, bright green plates and botryoidal "fingers" of prehnite. Although prehnite is fairly common at Millington, the specimens are small and difficult to collect. Pale green masses are found as thin coatings on basalt and don't separate easily from the rock. Occasionally we find a pocket with well-formed "floaters" of prehnite in the center of the opening, but these rarely exceed 6 cm in size. Small prehnite fingers project from the rock walls where it has coated crystals of anhydrite, which later dissolved, leaving hollow fingers.

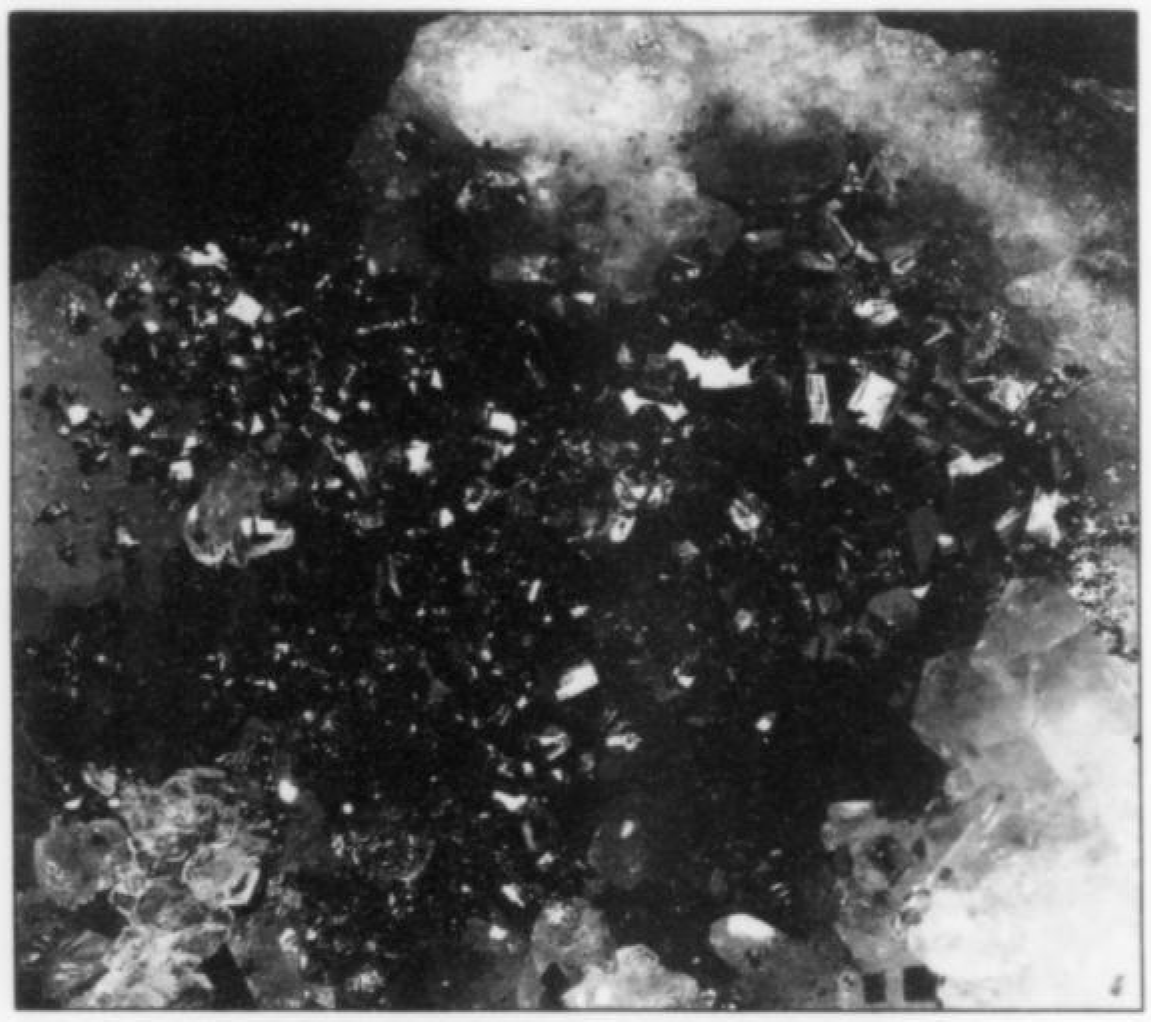


Figure 20. **Pyrite on datolite, 5 cm, Millington quarry. Kent collection and photo.**

Pyrite FeS_2, and **Pyrrhotite** $Fe_{1-x}S$

Two sulfides are common throughout the Millington quarry: pyrite and pyrrhotite, both forming during the Calcite Period.

Pyrite crystals are commonly found as small, 1 to 5-mm, well-formed cubes or pyritohedrons, usually as crystal groups on datolite, apophyllite and pectolite. Pyrrhotite has not previously been found in other New Jersey basalts, but is very common at Millington. It appears to have crystallized during two different periods, forming irregular masses in the basalt crust lining some cavities, and as a secondary crystal growth on or included in minerals from the Zeolite Period. It is easily recognized by its weak magnetism, silvery yellow color (often tarnished) and crude thick tabular hexagons up to 1 cm across. It is also found as spidery, irregular masses, oxidized and rusty.

Quartz SiO_2

Cavities completely lined with stubby quartz crystals are common throughout zones 3 and 4. The crystals are usually so densely packed that only the terminations of the individual crystals show in the open cavity center. The predominant color of Millington quartz is a pale smoky gray, although some crystals are clear, and rare crystals of gemmy, pale amethyst are found. Quartz crystals are all about 5 to 10 mm in diameter. It is also found as bluish white chalcedony masses that completely fill small 1–2 cm vesicles in the basalt.

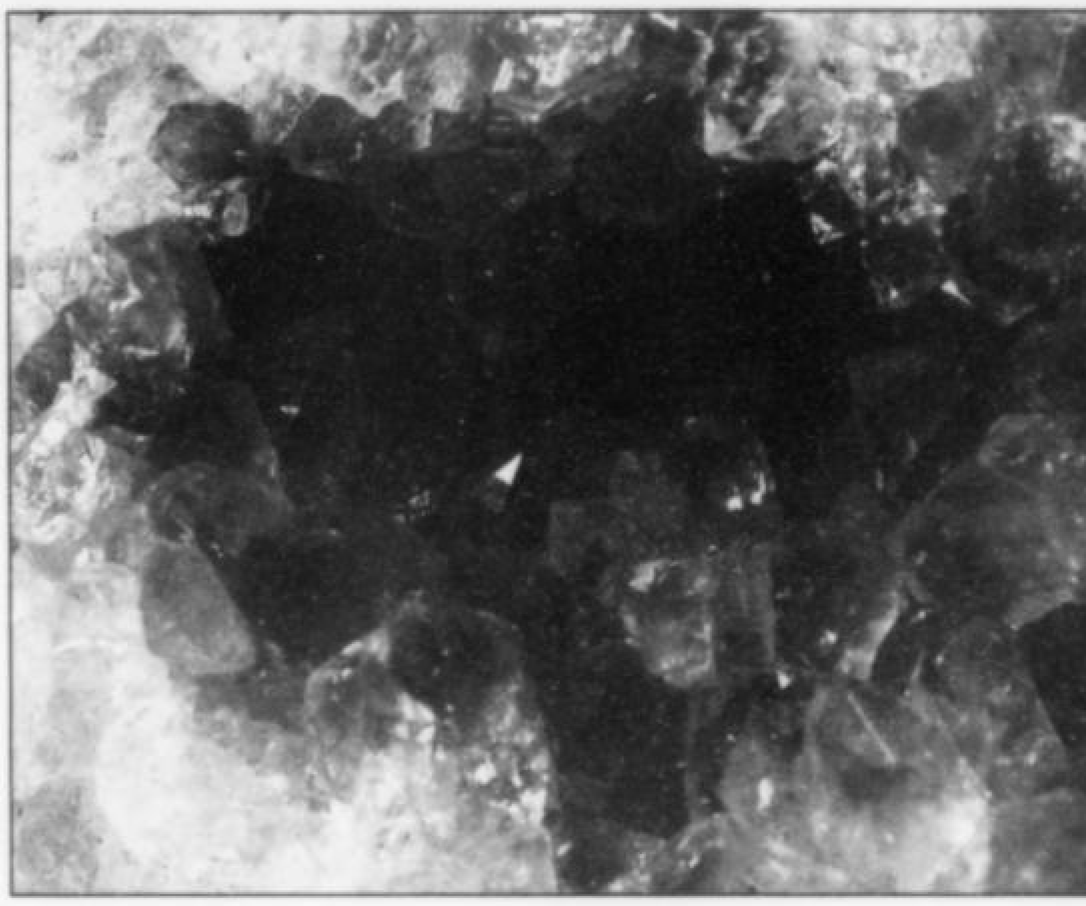


Figure 21. **Quartz (amethyst), 6 cm, Millington quarry. Mahan collection; Kent photo.**

Sphalerite ZnS, and **Galena** PbS

Sphalerite and galena have both been found as 1 to 4-mm crystals on prehnite. The sphalerite crystals are sharp red-brown to black and translucent. The galena crystals are sharp, simple cubes. One has a white coating that may be anglesite.

It is interesting to note that although Millington is rich in sulfides compared to other New Jersey localities, greenockite (CdS) is noticeably absent.

Stilbite $NaCa_2Al_5Si_{13}O_{36}\cdot14H_2O$

Stilbite is collected as small, round, radiating aggregates of tan colored crystals, usually attached directly to the basalt cavity walls. It is not common at Millington. Crystal clusters are no more than 2 cm across.

Thomsonite $NaCa_2Al_5Si_5O_{20}\cdot6H_2O$

Thomsonite was identified from the Millington quarry for the first time in 1997. It has been found as small spheres and "bowtie" crystal aggregates, white in color, and 5 to 10 mm long.

Other Species

There are several other mineral species found at Millington but they are of little interest to most collectors. These include microscopic black crystals of ilvaite associated with prehnite or datolite, and fibrous blue coatings of riebeckite on basalt surfaces (Bradley Platkin, personal communication).

There is one non-mineral of interest. From time to time we would find what appeared to be hydraulic fluid or dirty engine oil spilled on some specimens, and we assumed that it had leaked from some of the heavy equipment. Eventually we found several small quartz cavities intact which, when broken open, were completely filled with a thick, black, viscous hydrocarbon called bitumen. Bitumen is a generic name for natural petroleum-related mixtures. It has a faint oil odor and burns. It is an interesting substance, but not what you would want oozing onto the shelves of your mineral cabinet.

CONCLUSION

Despite the Millington quarry's 100-year history, it is only now becoming a major producer of specimen minerals. At present it is the best locality in the United States for specimens of pectolite and natrolite. Unfortunately, at the present rate of crushed stone

	Paragenesis Periods						Amygdaloid Zones	Abundance
	1	2	3	4	5	6		
Lava solidifies	X							
Augite	X							Common
Olivine	X							Common
Magnetite	X							Common
Anhydrite (casts)		X						Common
Glauberite (casts only)		X						Rare
Quartz			X				3, 4	Common
Babingtonite			X				3, 4	Uncommon
Datolite				X	X		3, 4	Common
Prehnite				X	X		3, 4	Common
Pectolite				X	X		3	Uncommon
Analcime					X		3	Abundant
Fluorapophyllite					X		2, 3	Common
Chabazite					X		2, 3	Localized
Natrolite					X		2, 3	Localized
Heulandite					X		2, 3	Rare
Stilbite					X		2, 3	Localized
Thomsonite					X		2, 3	Localized
Calcite				X	X	X	1–3	Ubiquitous
Pyrite						X	3, 4	Common
Pyrrhotite		X				X	3, 4	Common
Goethite					X	X	3	Localized
Hematite						X	3	Uncommon
Gypsum						X	3, 4	Localized
Sphalerite						X	3, 4	Rare
Galena						X	3, 4	Rare
Clinochlore						X	1, 2, 3, 4	Common
Opal						X	2	Uncommon
Bitumen						X		Common

***Figure 22.* Paragenesis, zonal location and abundance of minerals in the Millington quarry.**

production the basalt deposit will be exhausted and operations will cease around the year 2010. It is expected that in the last few years of operation the rock crusher and processing plant in the center of the quarry will be removed and the basalt "island" it sits on will be processed by a portable crusher. This last patch of basalt contains the largest mineralized section of the amygdaloid layer on the site; consequently, in its last years the Millington quarry should provide an abundance of quality specimens.

At the present time, the existence of mineral specimens in the Millington quarry has attracted a small number of illegal collectors. These trespassers have cut entrance holes in the perimeter fence, creating a safety problem, not to mention the danger of collecting at night in an active quarry. They put at risk the cooperative and educational projects of the quarry, as well as their own lives. The Millington quarry does not allow general collecting and hopes that this article will not influence collectors to inquire or trespass.

ACKNOWLEDGMENTS

We wish to thank the entire staff at the Millington quarry, especially Gary Mahan (Owner), Robert Maragni (Manager) and Linda Kimler (Public Relations), for their unprecedented cooperation with collectors and local Earth Science education. They made it possible for us to collect, preserve, and document the minerals unique to the Millington quarry. The new owners of the property, Tilcon Limited, have continued the education and mineral salvage programs initiated by the Mahans.

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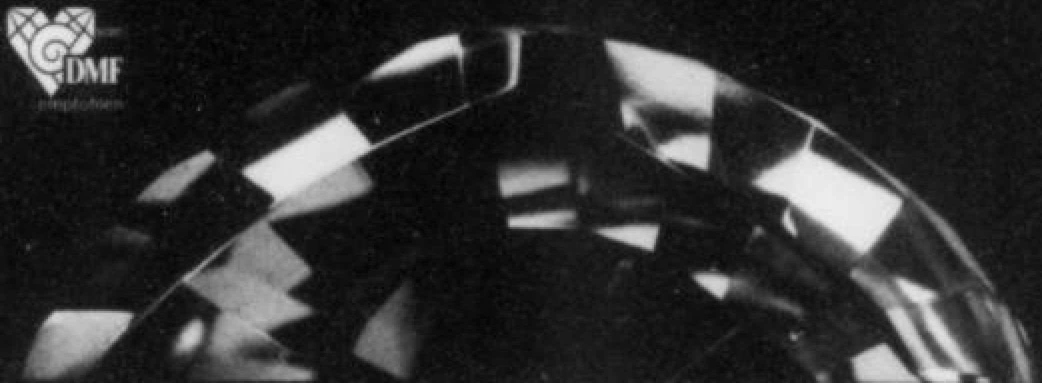

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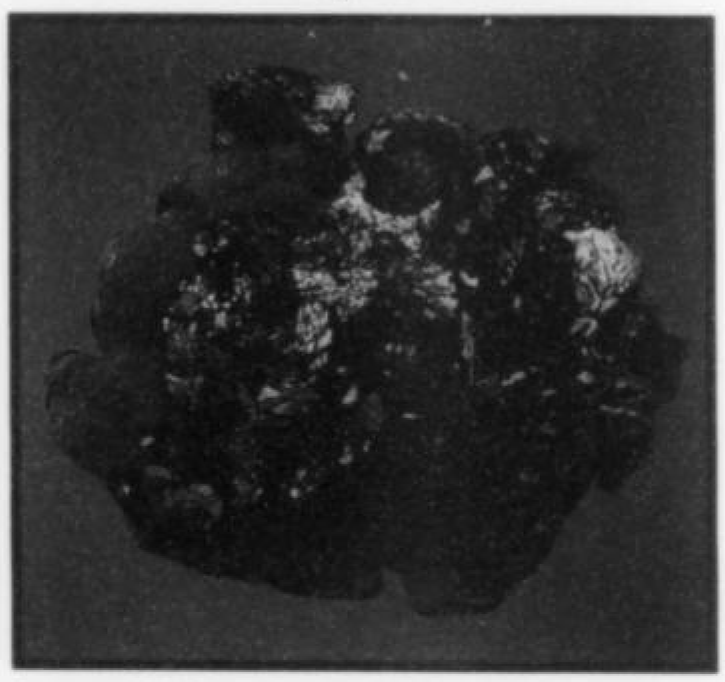

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MINERALOGY OF THE CALCITE-FLUORITE VEINS NEAR LONG LAKE, NEW YORK

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Interesting specimens of calcite, fluorite colored by dysprosium, chamosite, kainosite-(Y) and other minerals have been found in fresh roadcuts along New York State Route 30. The veins, exposed in 1995, have since been covered and are no longer accessible.

INTRODUCTION

Long Lake is located in Hamilton County, New York, a region of the state not well known for producing mineral specimens. Thus considerable interest attended the recent discovery of unusual calcite, fluorite and other minerals in veins cutting granitic gneiss exposed along State Route 30, 11.4 km north of Long Lake, at 44°02′42″ N latitude, 74°31′16″ W longitude.

These veins were exposed by blasting carried out in August of 1994 by the New York Department of Transportation as part of a road-widening project. The veins were visited by a few local collectors, but became more widely known by early 1995. Because of the orientation of the veins and their limited extent, accessible minerals were quickly removed by collectors. By May 1995, nearly all *in situ* minerals worthy of collecting had been removed to a depth of about 2 meters. By summer 1995, the area had been graded and seeded, the outcrop had been tarred, and specimens ceased to be available. For all practical purposes, collecting at this locality was limited to less than six months, during which many specimens of interest to both collectors and scientists were recovered.

GEOLOGY

The bedrock geology in the vicinity of the Long Lake calcite-fluorite veins is complex, consisting of a number of structurally deformed sedimentary and igneous rocks that have been metamorphosed to granulite facies. The calcite-fluorite vein occurrence itself is hosted by one such unit of granitic gneiss. The age of the veins is presently unknown, but is assumed to be post-metamorphic, based on field observations. Sm-Nd isotope studies currently underway may provide insight into the actual time of mineralization (Robert Darling, personal communication, 1997).

Two principal veins are located near the northern end of the outcrop on the west side of the road. These closely-spaced veins strike approximately 300° (magnetic), have near-vertical dips, and are exposed for approximately 20 meters along the steeply inclined outcrop. Slim Pond, approximately 3.5 km to the south, has a parallel strike, suggesting a possible fault set in that orientation. Brecciation prior to or during mineralization is evidenced by blocks of gneiss "floating" in the mineral assemblage. Later cross-cutting micro-faults and rare slickensided fluorite crystals indicate at least minor post-mineralization movement.

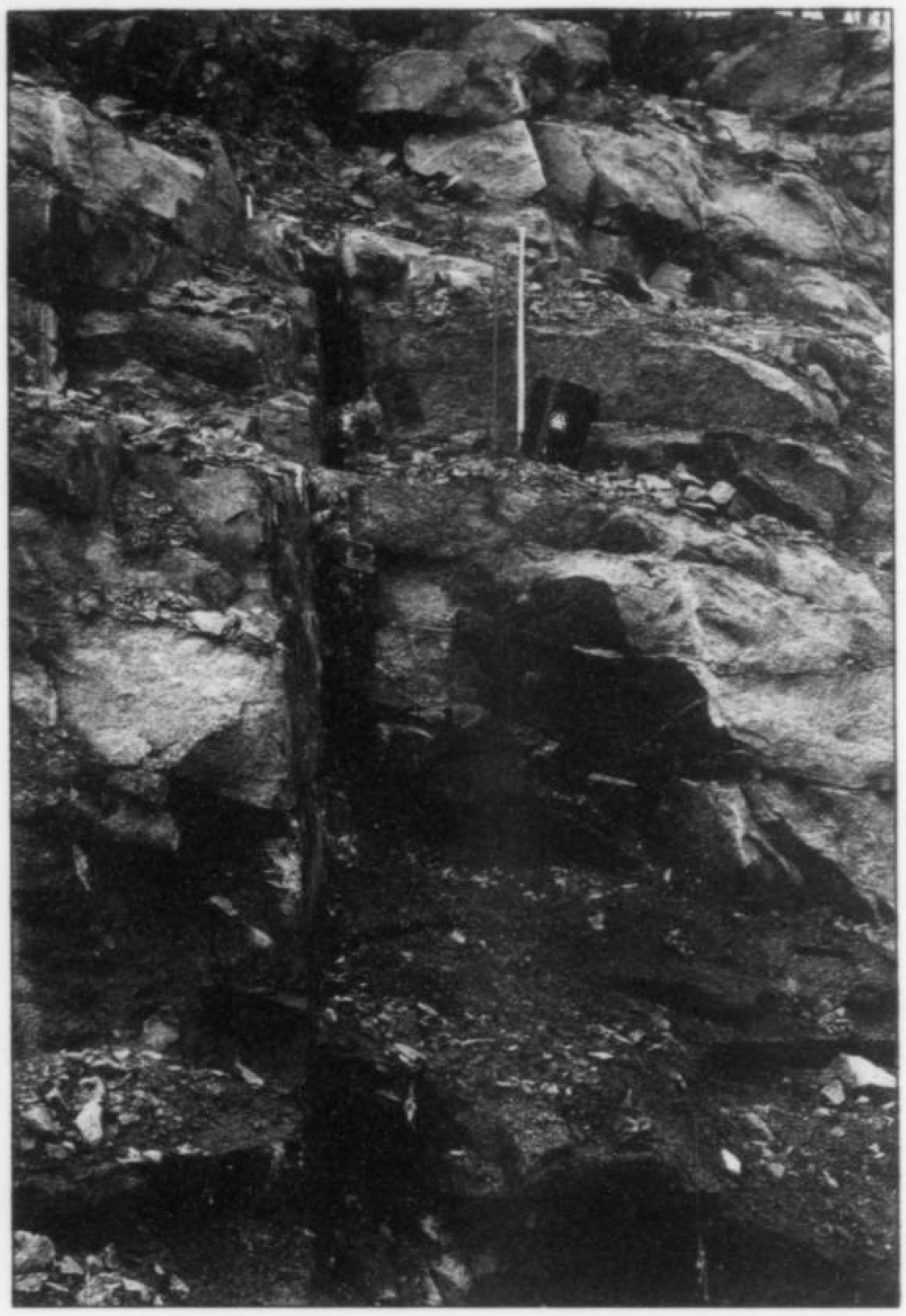

Figure 1. **The widest of the Long Lake veins, with a maximum width of about 10 cm (4 inches). The black bucket is 36 cm (14 inches) tall. Photo by Steve Condon.**

vein walls, leaving many cavities which were filled in by later-formed minerals. As a consequence, late-stage minerals can be found both on the vein walls and coating earlier-formed minerals. Thus the order of deposition of different minerals is not reliably reflected by their distance from the vein walls.

Calcite $CaCO_3$

Calcite occurs as crystals of two generations which bracketed the main period of fluorite deposition. Crystals of the two generations have quite different habits. Calcite-I, which was the first mineral to crystallize (with the exception of a thin layer of chamosite which often coats the vein walls), forms rhombohedral crystals, usually twinned on {0001}. These generally grew attached to the vein walls by one edge or corner of the triangle-shaped twin. This habit is similar to that of some calcite from the Rossie lead mines in St. Lawrence County, New York.

Calcite-II often forms crystalographically continuous overgrowths on calcite-I, but has a prismatic habit and is generally untwinned. The most common habit of calcite-II has short prisms with rounded pinacoidal terminations which are typically opaque white. When these occur as overgrowths on calcite I, they sometimes fail to obscure the apex of the first generation rhombohedron, which is visible as a small protrusion or as a darker spot in the middle of the rounded white termination.

A different, less common habit of calcite-II occurs as lustrous elongate prismatic crystals modified by a well-defined pinacoid and usually also the rare hexagonal dipyramid $\{7.7.\overline{14}.2\}$ They are transparent and colorless to very pale yellow, with horizontal striations on their prism faces. They easily might be mistaken for quartz crystals with unusual terminations. Careful goniometric study shows that the "prism" actually consists of faces of the true prism $\{10\bar{1}0\}$, which are strictly parallel to the *c*-axis, alternating with faces of a very steep positive rhombohedron such as $\{36.0.\overline{36}.1\}$, which are consistently inclined to the *c*-axis by 1 to 1.5°.

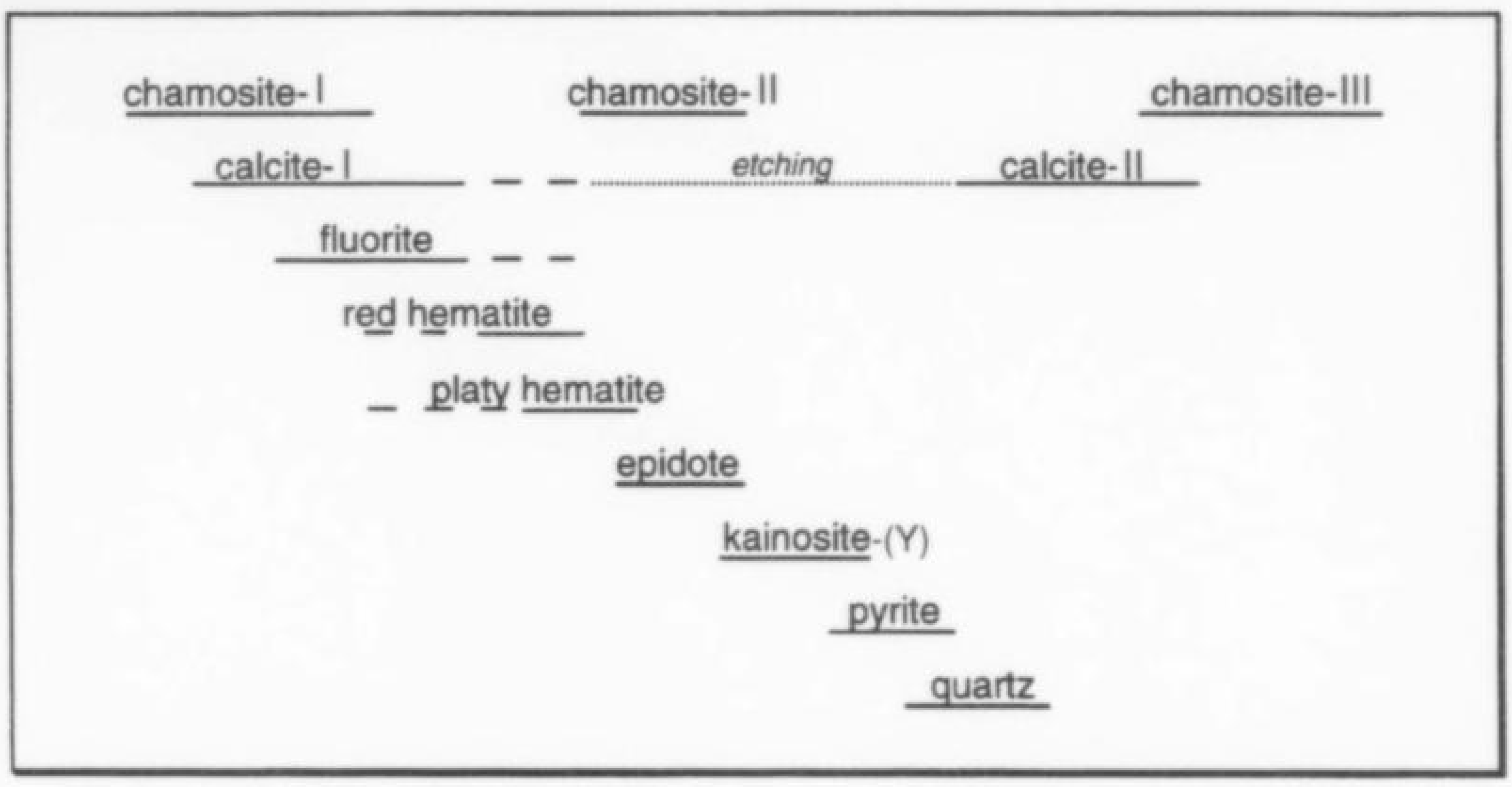

Figure 2. **Paragenesis of the mineral assemblage at Long Lake, NY.**

Similar veins exposed along the outcrop to the south and east are also mineralized, but are quite narrow (2 cm or less) and contain few pockets. While some specimens were retrieved from these smaller veins, most came from the two major veins described above.

MINERALOGY

The mineral assemblage of the Long Lake veins is a hydrothermal suite dominated by calcite and fluorite, but including chamosite, hematite, pyrite, quartz, cerian epidote and the rare mineral kainosite-(Y). The paragenetic sequence (Fig. 2) is complex, and clearly involves at least two stages of calcite deposition and several distinct stages of chamosite deposition.

Crystallization of fluorite and calcite incompletely covered the vein walls, leaving many cavities which were filled in by later-formed minerals.

The two habits of calcite-II probably represent successive, closely spaced crystal growth events. While most of the elongated crystals were found loose, and many stubby crystals lack any apparent later overgrowth, a number of specimens preserve elongate crystals which at least partly overgrew stubby ones. No change in the stubby calcite or precipitation of other minerals appears to have occurred before the growth of the more elongate crystals, and no examples of the stubby calcite overgrowing elongate calcite have been seen. Thus, the two habits appear to represent two episodes of growth which occurred in relatively quick succession.

Figure 3. **Quartz truncated by growing against fluorite, engulfing cerian epidote which grew on the surface of the fluorite. RPR specimen #3188a and photo. Quartz crystal is 1.4 mm wide.**

Figure 4. **Calcite-I. RPR specimen #3133a and photo. The long diagonal of the crystal group measures 4.5 cm.**

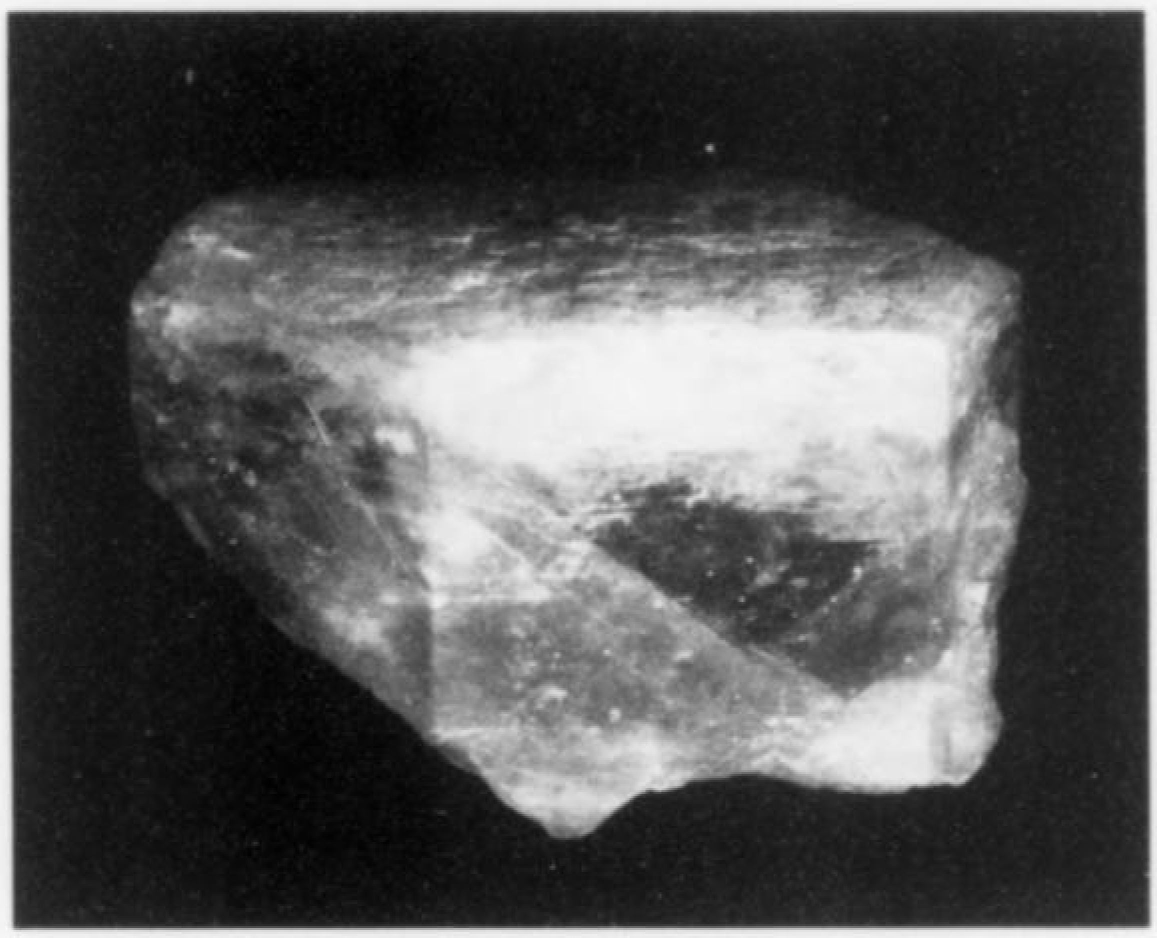

Figure 5. **Calcite-II, stubby habit. RPR specimen #3134a and photo. Crystal is 1.3 cm tall.**

Figure 7. **Typical fluorite with calcite. RPR specimen #3682 and photo. Specimen is 2.8 cm wide.**

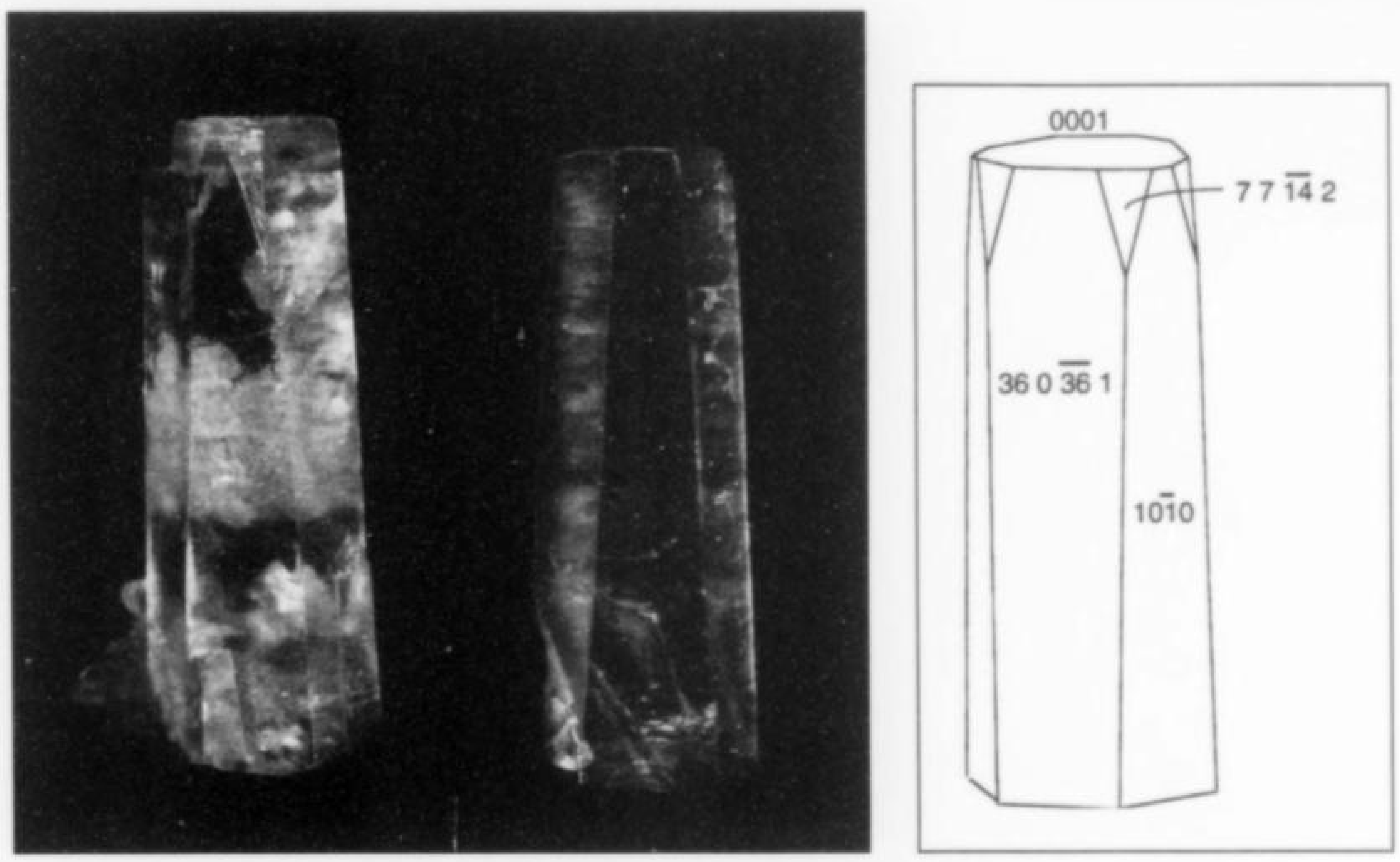

Figure 6. **Calcite-II, elongated habit. RPR specimen #3095, photo, and SHAPE drawing. Crystals are 2.5 cm tall.**

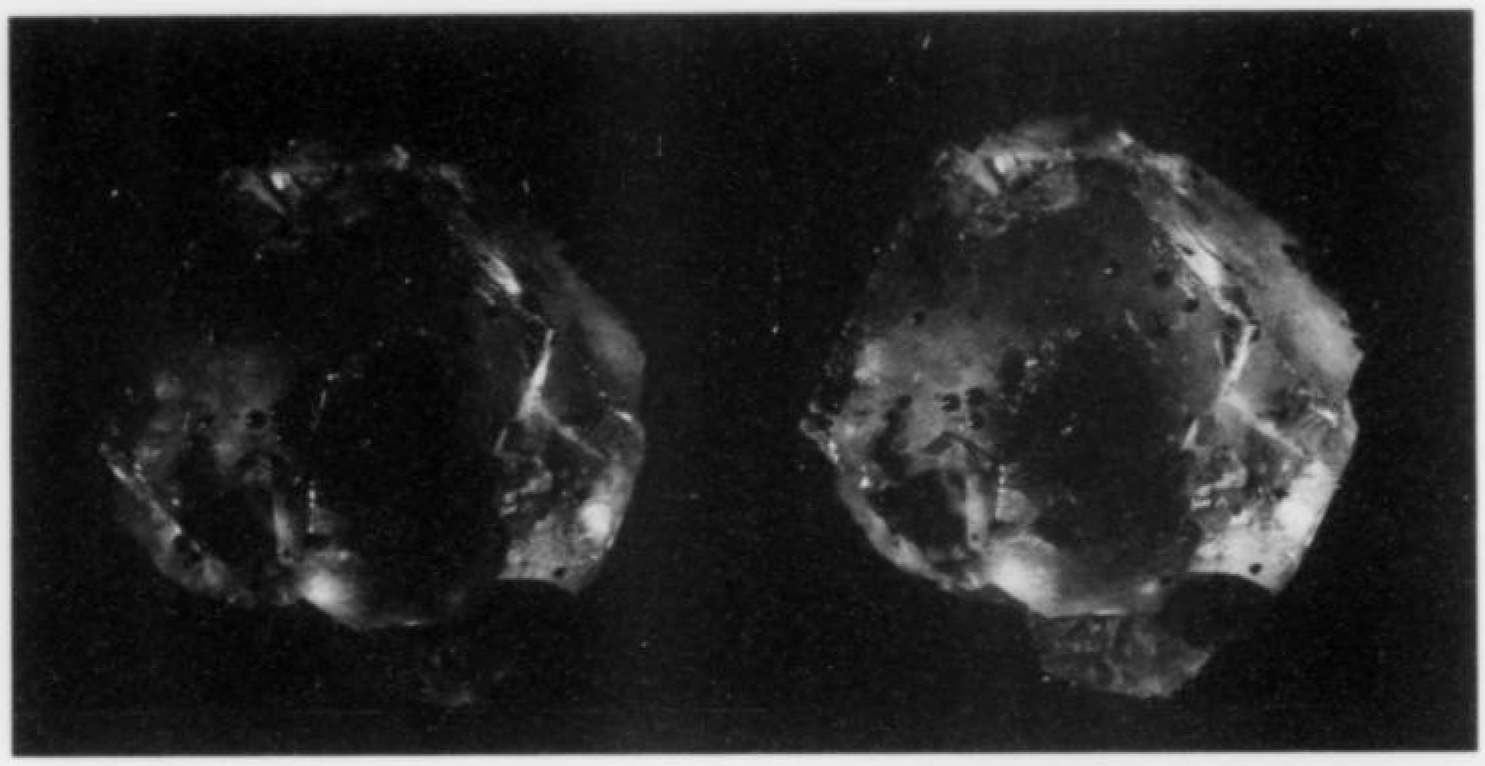

Figure 8. **Colorless fluorite crystal showing truncated corners and gray cube-shaped center (surface of crystal oiled to enhance transparency). RPR specimen #3676 and stereopair photo. Crystal is 1.2 cm wide.**

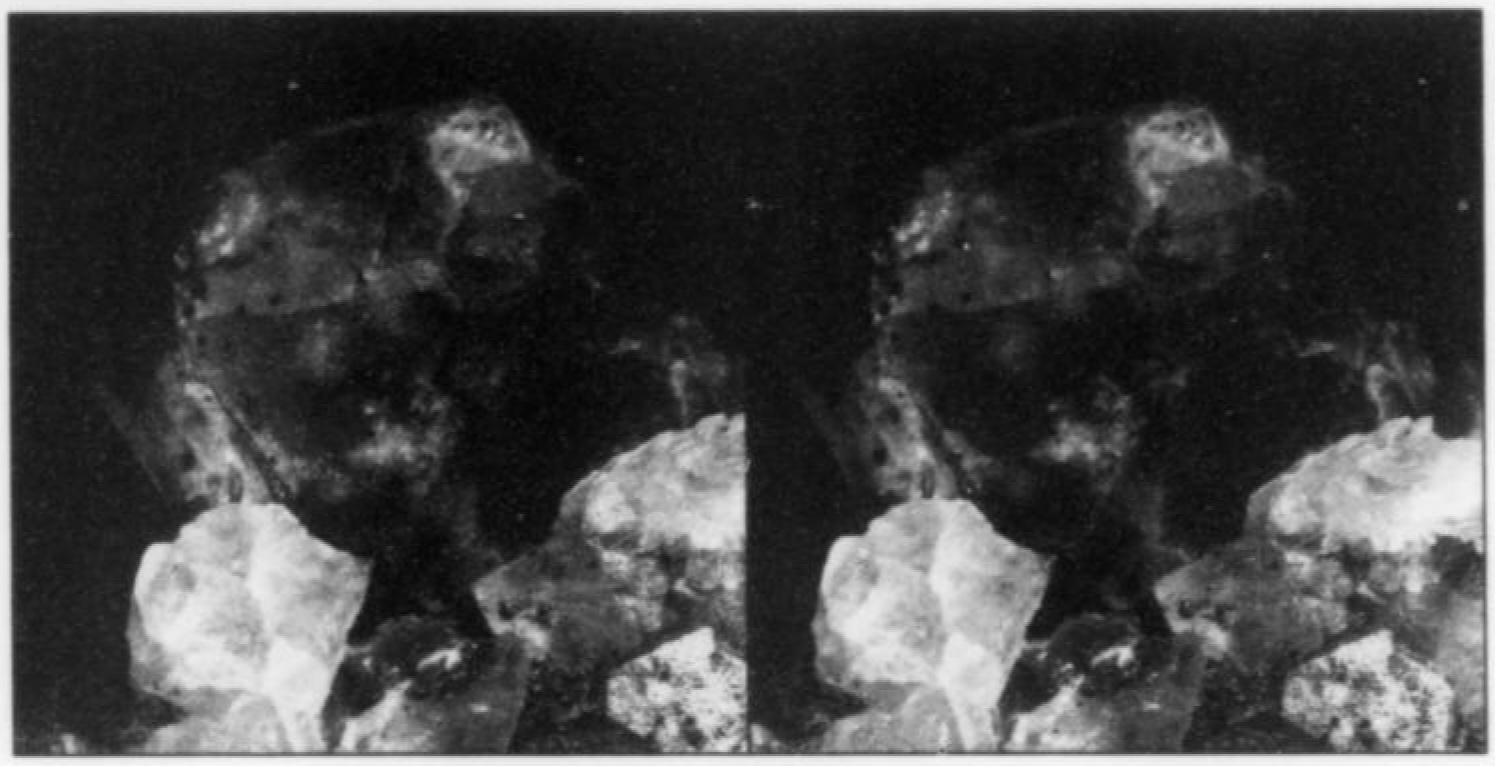

Figure 9. **Dark blue coloration under octahedral points. RPR specimen #3683 and stereopair photo. Main fluorite crystal measures 1.6 cm horizontally.**

Fluorite CaF_2

Fluorite occurs in approximately equal volume with calcite in the Long Lake veins, and has features which make it of interest to collectors and earth scientists alike.

The typical Long Lake fluorite crystal is between 1 and 2 cm in size, nearly colorless to blue-purple, and of octahedral habit but with irregular regions where the points of the octahedron should be. These irregular regions are composed of many small parallel "points" of octahedral habit on platforms of earlier cube faces. The overall morphology documents the incomplete transition from a cuboctahedral habit to an octahedral one.

Many crystals have dark olive-gray cube-shaped centers, which represent the initial morphology of the crystals. Occasionally, 1 to 2-mm gray cubic crystals, often overgrown with a thin rind of colorless fluorite, are found enclosed in calcite-I. These represent crystals which were arrested early in their growth when calcite crystallized around them. Other small crystals (<1 cm) which apparently began to form relatively late, show simple octahedral morphology and lack the dark cube-shaped central zone. Some are colorless or evenly colored throughout, but others have color bands delineating former cube faces on a cuboctahedral crystal, now thoroughly grown out into the pure octahedral form.

While the overall color of individual crystals ranges from nearly colorless to blue-purple, most crystals show the typical occluded core, and many show other color zonation as well. Most common is a thin, dark blue zonation in the position of the cube face overgrown by octahedral "points" (Fig. 9), with subtle variations of color intensity best seen in sections of crystals (Fig. 10). These more subtle color variations include concentric patterns which probably represent changes in trace element composition on faces of a given form over time (growth zonation), and radially arranged patterns which indicate differential trace element incorporation into faces of different forms (cube and octahedron) growing at the

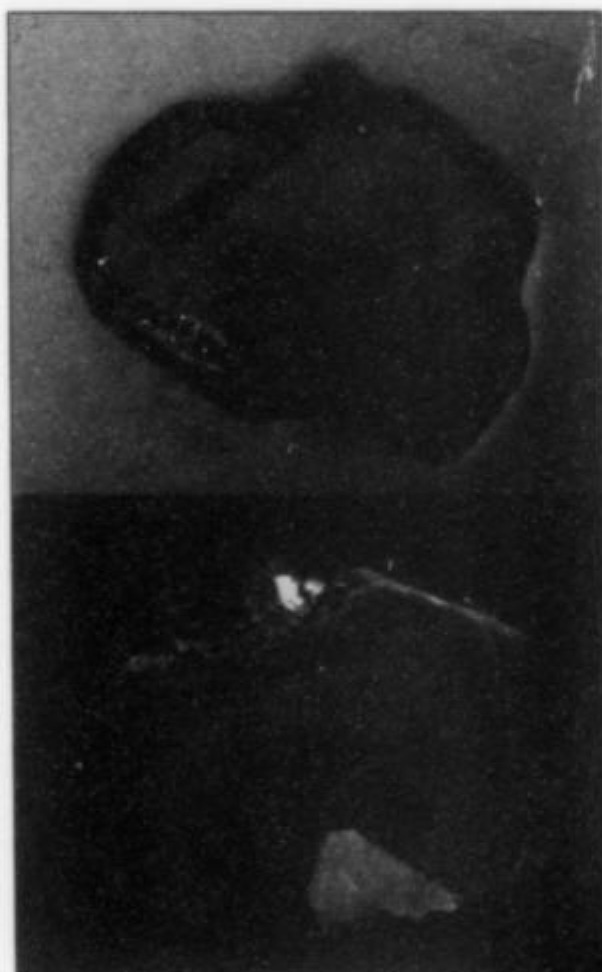

Figure 10. **Fluorite crystal section showing sectoral and growth zonation. RPR specimen #3677 and photo. Section is 2 cm in maximum dimension.**

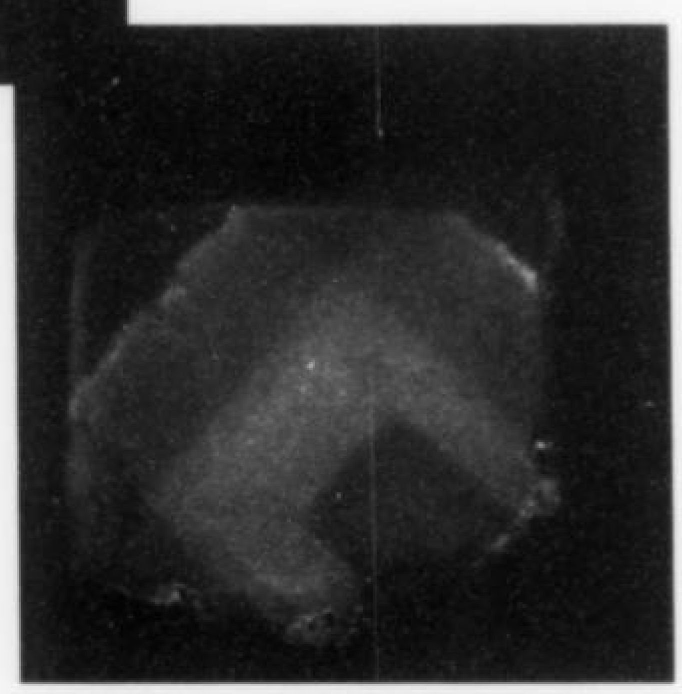

Figure 11. **Cathodoluminescence in fluorite. Crystal section, 8 mm on edge, RPR specimen #3678. Photos RPR.**

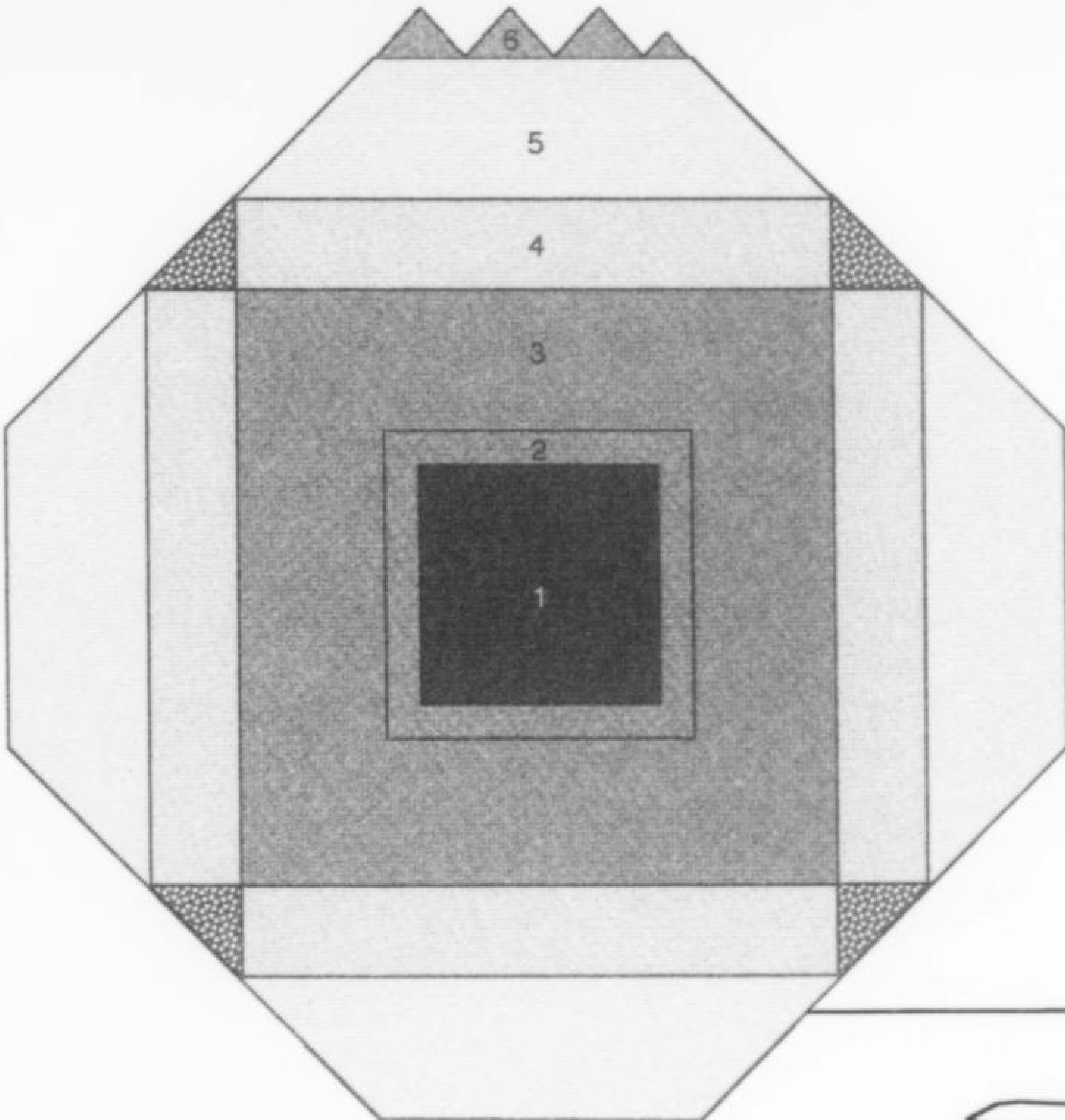

Figure 12. **Sectoral and growth zonation in Long Lake fluorite as revealed by cathodoluminescence.** ***Zones 1 and 2,*** **dark cubic center;** ***zone 3,*** **lighter region representing growth on cube faces;** ***zone 4,*** **growth on both cube (light) and octahedral (stippled) faces;** ***zone 5,*** **growth on cube faces only, but bounded by octahedral faces which become larger over time;** ***zone 6,*** **irregular toothed growth of octahedral faces on remaining portions of cube faces.**

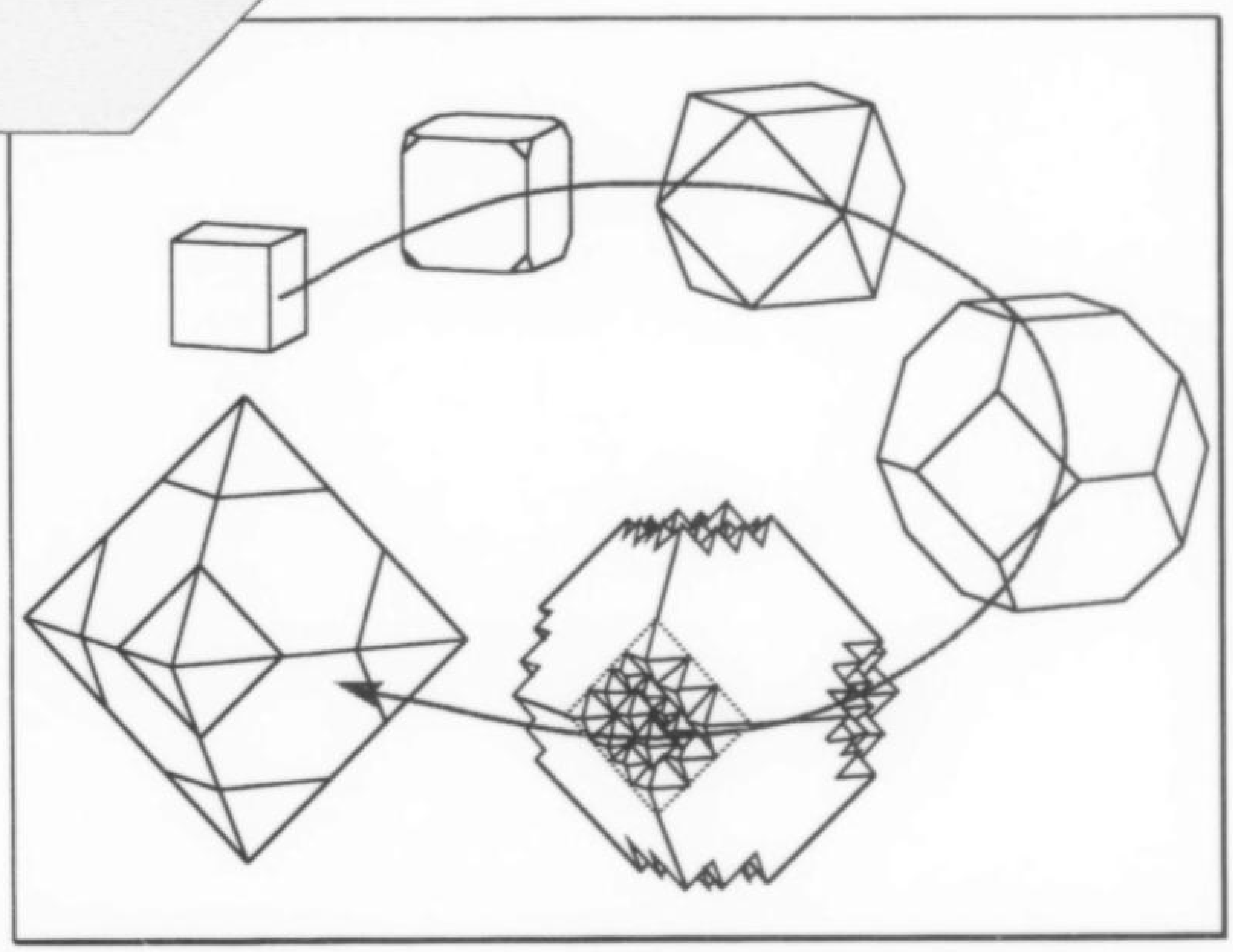

Figure 13. **Morphological development of typical Long Lake fluorite, from an initial cubic habit through cuboctahedral intermediates to the final typical toothed habit. Completion of the simple octahedron by filling out of the toothed region is seen in some specimens.**

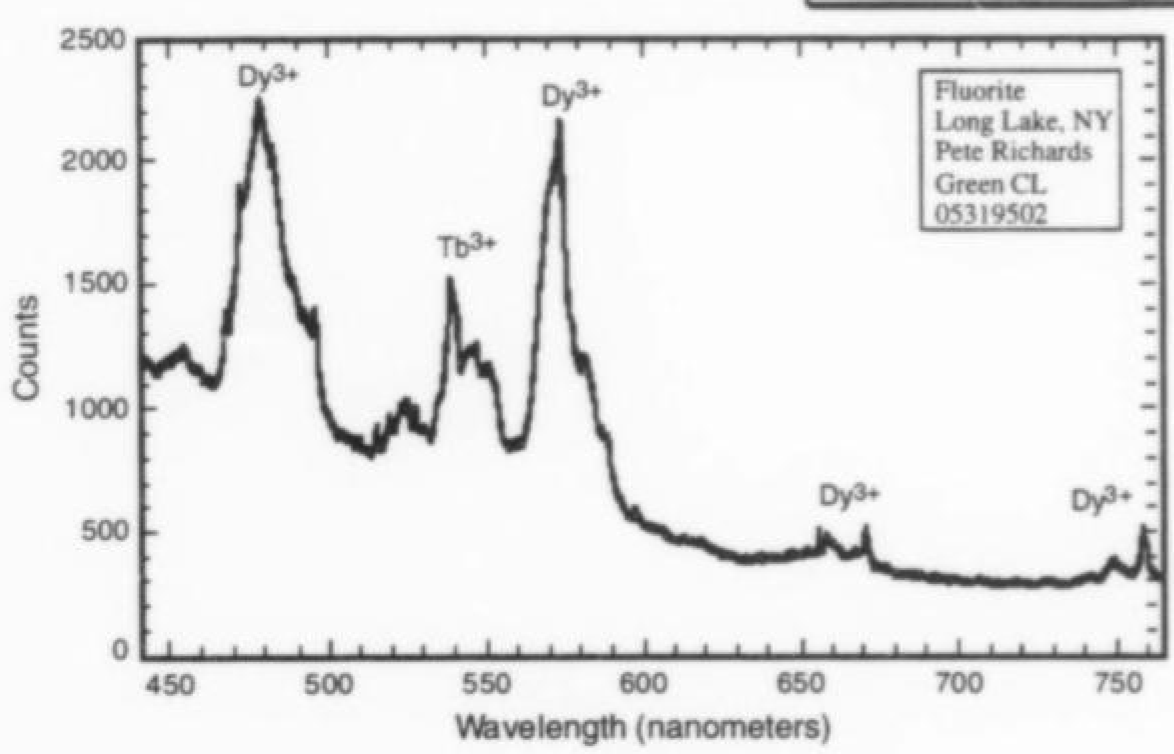

Figure 14. **Luminescence spectrum of Long Lake fluorite.**

same time (sectoral zonation). (For a discussion of these types of zonation, see Rakovan and Waychunas, 1996.)

Synchrotron X-ray fluorescence studies show that the fluorites are sector zoned with respect to the trace elements Sr, Y and the rare earth elements. The sectors under the octahedral faces are enriched in these elements relative to the cube sectors (Rakovan, 1998). Segregation of these elements between the cube and octahedral sectors may be due to different growth rates on the cube and octahedron faces or differences in their atomic structures.

The apparent colors of typical crystals vary with the source of light. In daylight and standard fluorescent light they appear blue to blue-gray, but in incandescent light they take on a warmer color, reaching a magenta-blue in halogen light. Very rarely, pale green and aqua colors of fluorite have been seen, but these specimens were not found in place, and may have come from a different vein. No euhedral crystals with these colors were recovered, and consequently their habit and position in the paragenetic sequence is unknown.

When crystal sections of typical fluorite are examined by cathodoluminescence an even stronger and more striking color zonation in various shades of blue, green and purple is revealed (Figs. 11 and 12). The calcite-I on which the fluorite grew shows a strong orange-red luminescence. The pattern of banding in the fluorite revealed by cathodoluminescence reinforces the above interpretation of the morphological development of these crystals, summarized in Figure 13.

Analyses of the luminescence spectrum of fluorite were made by John Hanchar of Rensselaer Polytechnic Institute, using a Patco ELM-3 luminoscope (12 kV, 0.7 mA, ~15mTorr vacuum, working range 440–770 nm with 8 nm/step, 40 steps total, calibration with a Hg-Ar lamp). The results (J. Hanchar, personal communication, 1995), reproduced in Figure 14, indicate that the major element responsible for the luminescence is the rare earth element *dysprosium,* with possible contributions from *terbium.* Dysprosium was also identified as a constituent in kainosite-(Y) (see below). Since the intensity of the peaks in luminescence spectra bears no simple relationship to concentration, the concentration of dysprosium in the fluorite cannot be inferred from these observations. Wavelength-dispersive electron microprobe analyses of typical fluorite did not detect any elements other than Ca and F (method detection limit for REE ~200–600 ppm; ~100 ppm for most other elements).

Typically, larger fluorite crystals are attached to the edges of calcite-I crystals, which in turn are attached to the vein walls or their initial chamosite coating. While some fluorite is attached directly to the vein walls, most of the crystals formed on earlier minerals. The geometry of many specimens indicates that the rhombohedral crystals of calcite-I tended to grow with their *c* axes parallel or sub-parallel to the vein walls. This is the configuration which would allow the crystals to most rapidly reach the interior of the vein where saturated fluids would facilitate further growth. Crystals which started growth in less favorable orientations either grew more slowly, or may even have dissolved again. This model is consistent with the concept of geometric competition (Grigor'ev, 1965). The maze of calcite crystals encrusting the vein walls when fluorite deposition started may have decreased fluid flow through the vein margins, initially allowing fluorite to grow faster in open spaces more interior to the veins. Later, conditions favoring nucleation at many sites produced numerous smaller crystals.

Chamosite $(Fe^{2+},Mg,Fe^{3+})_5Al(Si_3Al)O_{10}(OH,O)_8$

Three generations of chamosite are present in the Long Lake veins. The earliest consists of a thin, dark green coating on the vein walls. The middle generation occurs as dark green hemispheres of

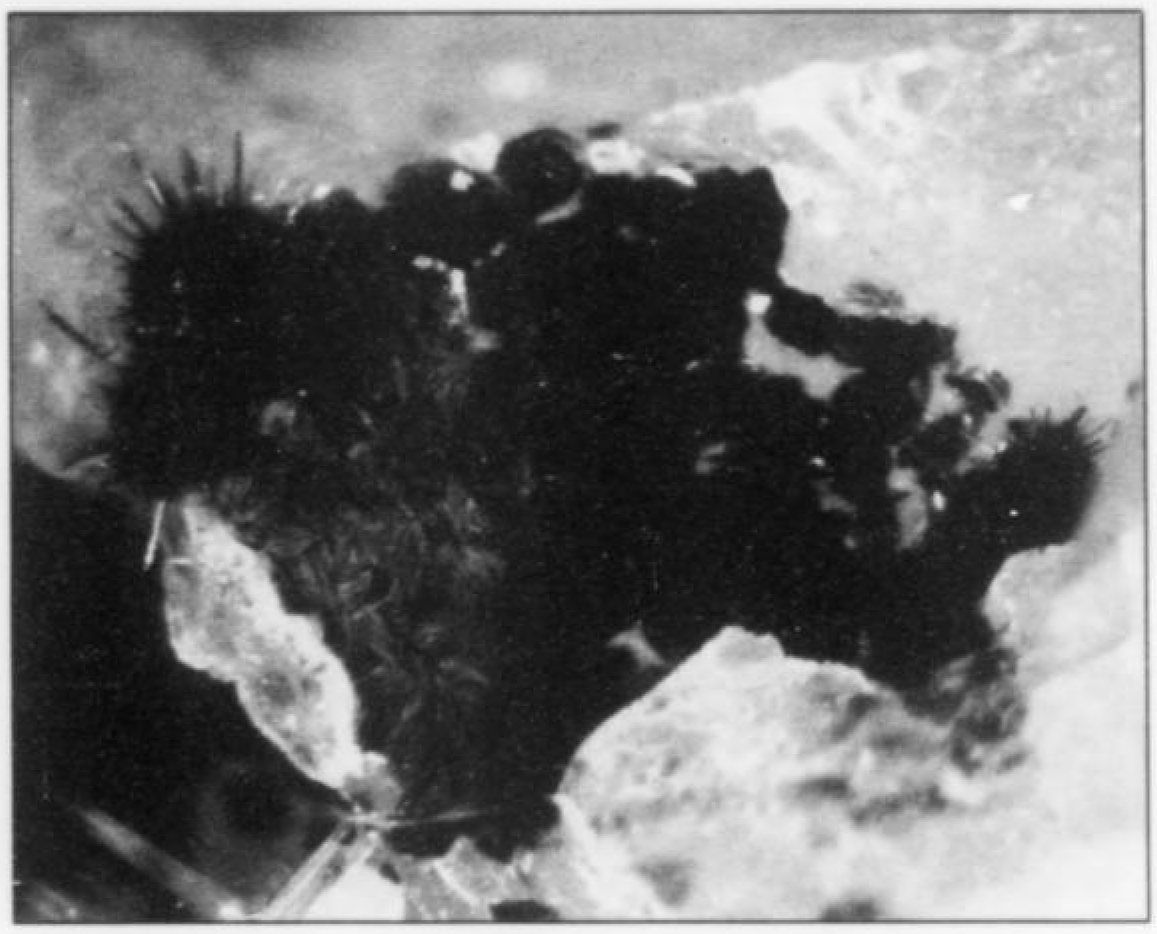

Figure 15. **Chamosite-II (green) and cerian epidote (brown). RPR specimen #3548 and photo. Region covered by chamosite is about 2 mm wide.**

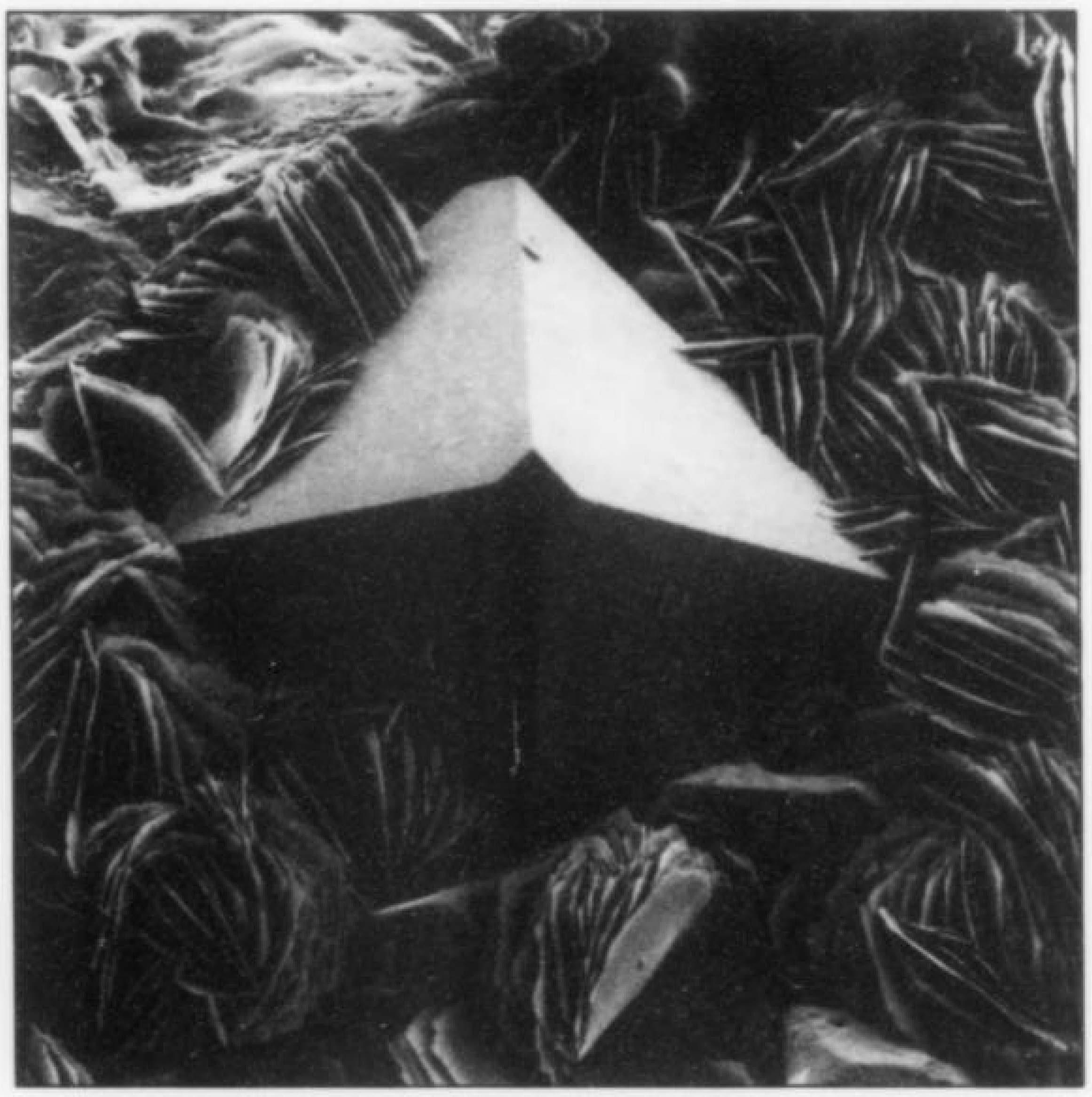

Figure 16. **Chamosite-II, aggregates of platy crystals. Also shown are a fluorite crystal and several small irregular calcite crystals. SEM image by GWR. Chamosite groups are about 100 microns (0.1 mm) across.**

well-formed platy crystals, often perched on calcite-I, and sometimes associated with cerian epidote. Some of this chamosite makes small but attractive specimens. The latest generation is a yellowish to olive-green late-stage void filling or coating on minerals exposed in open pockets. In some cases, this chamosite occurs as golden colored platy crystals and flakes.

Electron microprobe analyses of chamosite of the second and third (golden phase) generations yielded the following empirical formulae (Fe^{2+}, Fe^{3+} and OH determined by stoichiometry):

Chamosite-II $(Fe_{3.74}Mg_{1.19}Al_{.06}Mn_{.04}Ca_{.01})Al(Si_{2.86}Al_{1.14})O_{10}(OH)_8$

Chamosite-III $(Fe_{3.61}Mg_{1.16}Ca_{.20}Mn_{.02}K_{.02})(Al_{.93}$-$Fe_{.07})(Si_{3.16}Al_{.84})O_{10}(OH)_8$

The major differences between these two are that chamosite-III has more calcium, is relatively Si-rich (at the expense of Al), and probably contains some Fe^{3+}.

Epidote $(Ca,Ce)_2(Al,Fe)_3(SiO_4)_3(OH)$

A rare-earth-bearing epidote-group mineral occurs abundantly as microscopic hemispherical aggregates of bladed olive-brown crystals attached primarily to calcite-I and fluorite. Crystals which are undamaged can form attractive microspecimens, but most crystals which occur in open pockets are damaged.

Electron microprobe analysis of one sample yielded the following formula (Fe^{2+}, Fe^{3+} and OH determined stoichiometrically):

$(Ca_{1.24}Ce_{.40}La_{.18}Nd_{.15})(Al_{1.65}Fe^{2+}_{.83}Fe^{3+}_{.47}Mg_{.01})(Si_{1.03}O_4)_3(OH)$

This indicates that allanite-(Ce) may be present too.

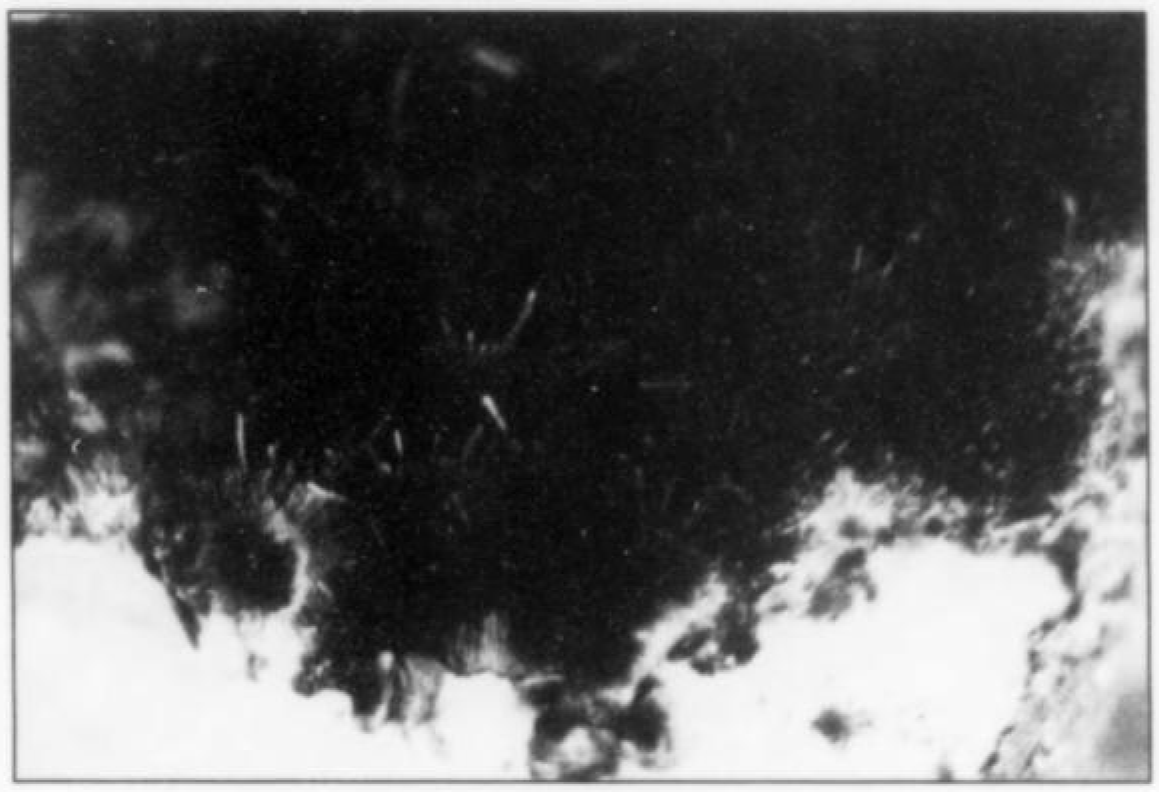

Figure 17. **Cerian epidote clusters. RPR specimen #3679 and photo. Field of view is 3 mm wide.**

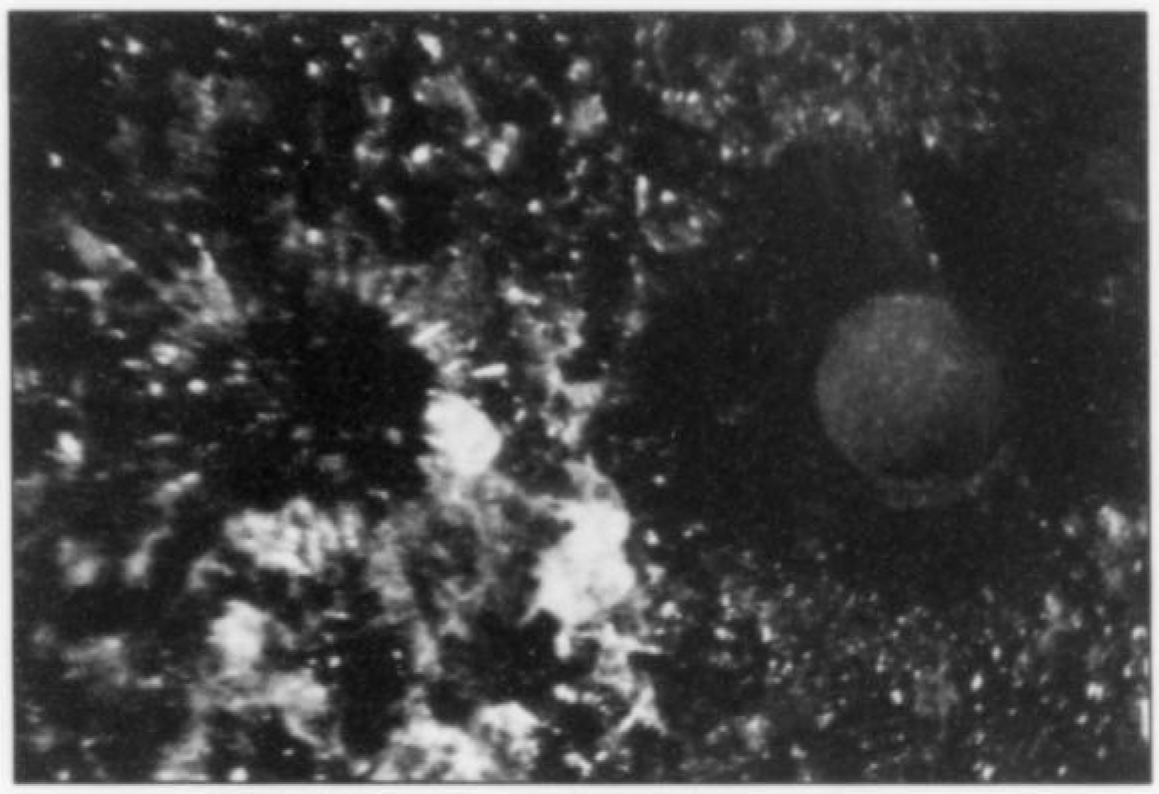

Figure 18. **Earthy hematite on fluorite, revealed by removal of cerian epidote. Note nearby intact epidote cluster. RPR specimen #3680 and photo. Field of view is 3 mm.**

Hematite Fe_2O_3

Hematite occurs as red earthy material, often found in the centers of hemispherical clusters of cerian epidote attached to fluorite, and sometimes as coatings on internal fractures in calcite-I. Less commonly, hematite is found as metallic black platy crystals (<1 mm) that show ruby-red highlights produced by internal reflections. X-ray powder diffraction analysis shows that these crystals are indeed hematite and not lepidocrocite. The crystals are usually isolated or in small, randomly oriented groups, attached to calcite-I and associated with fluorite. Rarely, they occur as delicate hemispherical aggregates, which are hollow and lined

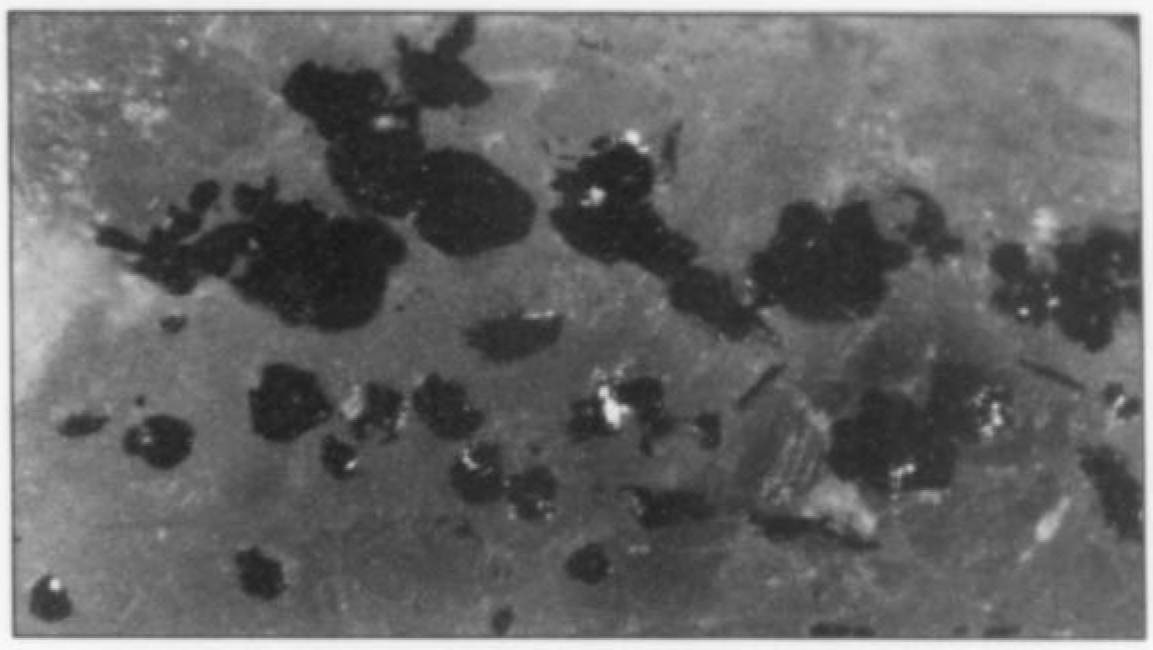

Figure 19. **Metallic black hematite showing ruby-red highlights. RPR photo. Field of view is 3 mm.**

with red hematite. Platy hematite occurs overgrown by fluorite attached to calcite-I, enclosed in fluorite, and encrusting fluorite, indicating that the fluorite and hematite were deposited synchronously. Based on the specimens available, calcite-II is later than hematite, without overlap.

Kainosite-(Y) $Ca_2(Y,Ce)_2Si_4O_{12}(CO_3)\cdot H_2O$

Kainosite-(Y) is a relatively rare mineral, and Long Lake is the second known occurrence of kainosite-(Y) in New York State. Kainosite-(Y) was previously found in cavities in pegmatite veins excavated from the Delaware Aqueduct, shaft 23, Bronxville, NY, and studied by Fred Pough (Louis Moyd, personal communication,

Figure 20. **Kainosite-(Y) crystal on certain epidote. RPR specimen #3681a and photo. Field of view is 1.8 cm wide.**

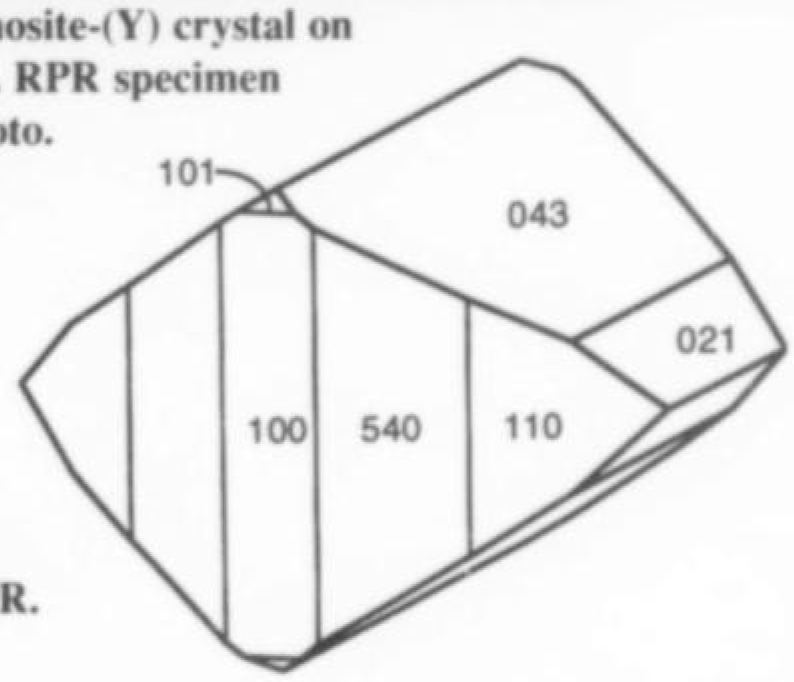

Figure 21. **Kainosite-(Y) habit. SHAPE drawing by RPR.**

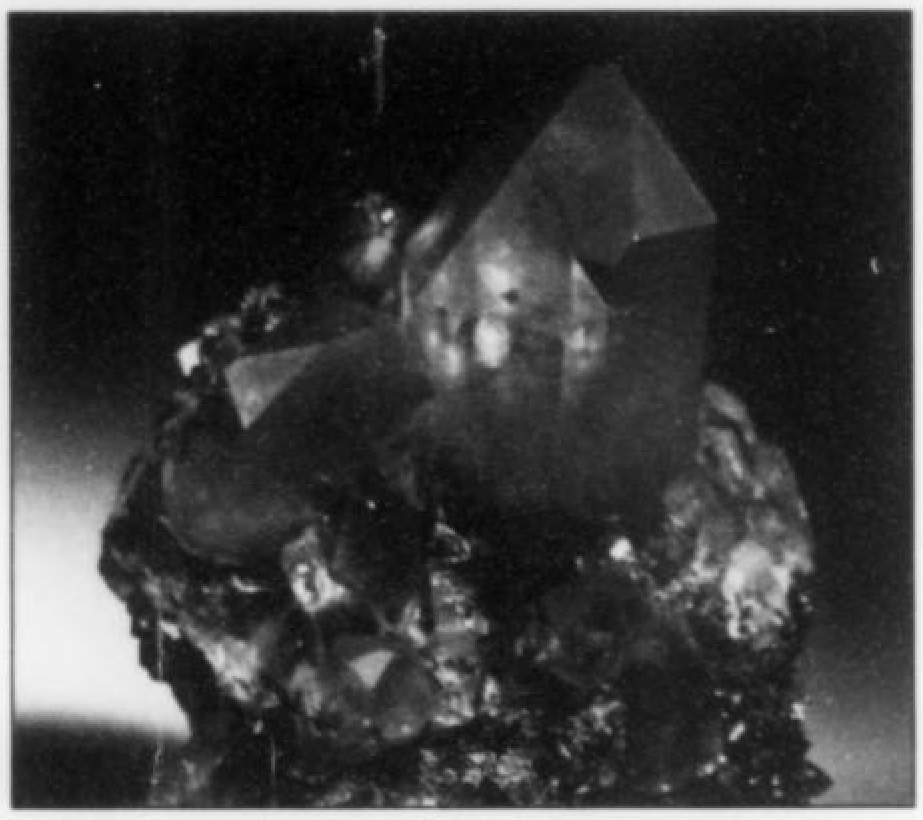

***Figure 22.* Quartz crystal of typical habit, showing characteristic orange-brown coating. RPR specimen #3184 and photo. The large crystal is 1.5 cm tall.**

***Figure 23.* Quartz crystal, contact Dauphiné twin. RPR specimen #3186 and photo. Twinned crystal is 5 mm tall.**

1996). At Long Lake, kainosite-(Y) occurs as well-formed flesh-colored, translucent to opaque prismatic crystals which reach several millimeters in size (Figs. 20 and 21). The habit is somewhat variable because different {h01} prisms develop to varying degrees on different crystals, even on the same specimen. The lack of material well-suited for goniometry has hindered a full exploration of kainosite-(Y) morphology, but the drawing illustrates the typical habit.

Deciphering the position of kainosite-(Y) in the paragenetic sequence at Long Lake is difficult, in part because of the scarcity of material, and in part because other minerals do not seem to overgrow kainosite-(Y). Kainosite-(Y) is associated with, but earlier than, chamosite-III coating fluorite and breccia blocks. It is found on cerian epidote in similar settings, and is mostly later than the epidote. It occurs with quartz, cerian epidote, and fluorite in crystal aggregates unattached to the vein walls, in which fluorite forms the core, incompletely overgrown by epidote, followed by growth of isolated groups of kainosite-(Y) crystals and finally quartz. It also occurs in small voids in calcite I which appear to be miniature gash veins formed by tectonic shearing, where it is associated with chamosite-II, which may either pre-date or post-date it.

Kainosite-(Y) crystals are commonly etched, but examples showing no evidence of etching are also found, sometimes within millimeters of etched crystals. Crystals occurring in small pockets in calcite-I are almost always free of etching. These observations indicate that the etching is probably a result of late-stage weathering, and not geochemical changes during deposition of the vein assemblage.

Electron microprobe analysis of the kainosite-(Y) yields the empirical formula (CO_3 and H_2O determined stoichiometrically): $Ca_{2.05}$-$(Y_{1.41}Dy_{.11}Gd_{.10}Er_{.07}Nd_{.06}Yb_{.06}Sm_{.05}Ho_{.03}Ce_{.01}Lu_{.01})Si_{4.05}O_{12}(CO_3)\cdot H_2O$, which is quite comparable to the ideal formula. As has been observed in kainosite-(Y) from other localities (Adams *et al.*, 1964; Heinrich *et al.*, 1962), the heavy rare earths predominate over the light rare earths, with dysprosium being most abundant.

Pyrite FeS_2

Pyrite occurs infrequently as small (<1 mm) cubes modified by the pyritohedron {012}, usually attached to fluorite or to microminerals which overgrow fluorite. The pyrite has a dark brown color indicative of replacement by goethite.

Quartz SiO_2

Quartz occurs as prismatic crystals, which are usually small (<2 mm), but sometimes exceed 1 cm in length. The morphology of these crystals is typical of quartz from hydrothermal veins, with moderately developed prisms, and faces of the positive rhombohedron $r\{10\bar{1}1\}$ usually somewhat larger than those of the negative rhombohedron z $\{01\bar{1}1\}$. Faces of the trigonal dipyramid $s\{11\bar{2}1\}$ are often present, but faces of trigonal trapezohedra such as $x\{51\bar{6}1\}$ have not been observed.

Long Lake quartz often has an orange-brown surface coating which is presumed to be an iron oxide/hydroxide. Dauphiné twinning is commonly revealed by different luster on the $r\{10\bar{1}1\}$ and $z\{01\bar{1}1\}$ portions of faces of the termination. Rarely, one rhombohedron is more strongly coated with iron oxide/hydroxide than the other (compare Henderson, 1984). One example of what appears to be a contact Dauphiné twin has been found (Fig. 23).

Isotopic analysis of the oxygen in Long Lake quartz gave a $\delta^{18}O$ value of 16.77‰ relative to Standard Mean Ocean Water.

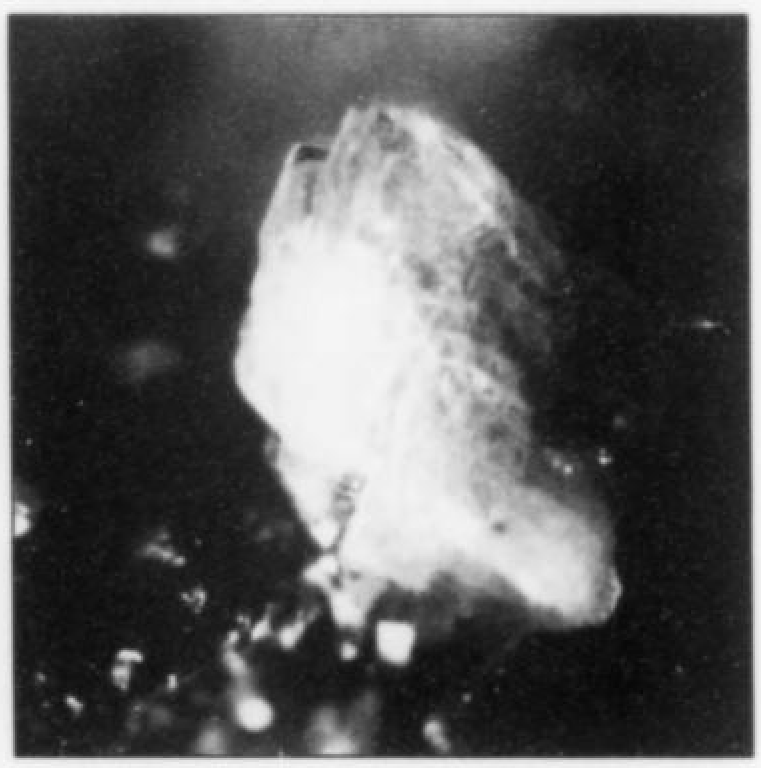

***Figure 24.* Titanite crystal group, about 1 mm. RPR specimen #3917 and photo.**

Titanite $CaTiSiO_5$

Titanite occurs rarely as small, pink, spear-shaped crystals which form sub-parallel clusters reaching 1 mm in size. The majority of the specimens were part of a single sample of calcite-filled vein, and were discovered accidentally when the calcite was dissolved away in a search for fluorite. We believe this sample may

Table 1. **$\delta^{13}C$, $\delta^{18}O$ (‰ PDB) and trace element contents (ppm) for selected calcites.**

Source	*Fe*	*Mn*	*Sr*	*Mg*	$\delta^{18}O$	$\delta^{13}C$
Calcite I, Long Lake	386	2707	291	0	−14.62	−0.81
Calcite II, Long Lake	266	2398	0	0	−7.20	−11.27
No. Burgess, ONT	694	1712	185	320	−12.96	−3.56
Mineral Point, NY	2050	2968	200	2329	−12.48	−2.66
Buckingham, QUÉ	331	279	295	0	−14.53	−1.72
Rossie, NY	543	1542	297	272	−11.96	−1.45

have come from a narrow vein located about 30 meters south of the two veins which produced the majority of the specimens described in this paper. One specimen was also found among the materials from the major veins.

The titanite crystal groups occur on chamosite-II and are closely associated with cerian epidote, kainosite-(Y) and quartz. On the sample which produced the majority of the specimens, titanite is definitely later in the paragenesis than chamosite, probably later than cerian epidote, definitely earlier than quartz, and of uncertain relationship to kainosite-(Y). Because of the small number of specimens recovered, and uncertainties about the outcrop location of the major sample and the paragenetic position of this species, titanite is not included in the paragenesis diagram in Figure 2.

DISCUSSION

Hydrothermal veins similar to those at Long Lake are rare, but not unknown in other Grenvillian rocks. The calcite-galena veins near Rossie, St. Lawrence County, New York, often carry small amounts of blue-green octahedral fluorite crystals; the Coal Hill vein, southwest of Rossie, hosts minor amounts of cerian epidote and synchysite-(Ce); and cerian epidote has been identified in similar veins near Mineral Point, north of Rossie (Robinson *et al.*, in press). Cerian epidote is also commonly associated with calcite crystals from the Madawaska (Faraday) mine near Bancroft, Ontario. Kainosite-(Y) associated with fluorite, calcite, chamosite, quartz and other minerals has been described from the Bicroft mine near Bancroft, Ontario (Pouliot *et al.*, 1964). Graham and Ellsworth (1930) described kainosite-(Y) from a brecciated calcite-apatite vein in North Burgess township, Lanark County, Ontario. Cavities in brecciated blocks of feldspar from the New York feldspar quarry near Buckingham, Québec, have been found to contain microscopic crystals of both cerian epidote and kainosite-(Y) associated with calcite, fluorite, pyrite and quartz (Canadian Museum of Nature, Mineral Occurrence Collection). Finally, Hogarth (1972) reported kainosite-(Y) from the nearby Evans Lou pegmatite.

Geochemical data for most of these occurrences are scant to non-existent, and little can be said with certainty about their origins. Table 1 gives electron microprobe trace element analyses and stable isotope analyses of calcites from some of these occurrences. Except for calcite-II, the trace element contents and ^{13}C–^{18}O signatures of the other calcites are overall quite similar. The variable Mg content is probably related to the host rock, since the Long Lake and Buckingham occurrences are hosted by granitic rocks, and the other occurrences by Grenville marble or rocks in close proximity to Grenville marble. The unique trace element and isotopic composition of calcite-II, its association with etched crystals of calcite-I, and its late position in the paragenetic sequence suggest that it probably formed by near-surface groundwater dissolution and re-precipitation of calcite-I.

Fluid inclusion studies of fluorite from Long Lake (Bird and Darling, 1996) reveal primary three-phase fluid inclusions consisting of vapor, brine, and a single halite crystal. Freezing experiments indicate that the liquid from which the fluorite crystallized was a calcium-rich brine containing ~25 weight % $CaCl_2$ and 10 weight % NaCl. (For comparison, Atlantic Ocean water contains 3.5% total dissolved salts by weight.) This brine is the most saline yet documented from New York State (Robert Darling, personal communication, 1996). Heating the inclusions yields liquid-vapor homogenization temperatures of ~133°C, and a final halite dissolution temperature of ~172°C (Bird and Darling, 1996).

Like the Long Lake veins, the calcite-galena veins near Rossie, New York also strike west-northwest with near-vertical dips, and are hosted by Grenville-age granitic gneisses. Interestingly, studies of primary fluid inclusions in sphalerite, fluorite and calcite from the Rossie veins also yield results very similar to those reported above (Ayuso *et al.*, 1987). These investigators found that primary fluid inclusions in the Rossie vein minerals also consist of three-phase inclusions with a single daughter crystal of halite, and homogenization temperatures of 104° to 152°C (sphalerite), 90° to 130°C (calcite) and 110° to 150°C (fluorite). Likewise, freezing and halite solution runs showed the total salinity of the brine to be in the range 26 to 31 equivalent weight % NaCl, with other salts such as KCl, $MgCl_2$ or $CaCl_2$ likely present. Plots of lead isotope ratios by the same authors yielded a secondary isochron, which was interpreted as lacking age significance as a result of the mixing of solutions which evolved from distinctly different, long-lived environments.

Thus, the Long Lake and Rossie veins appear to be similar both structurally and mineralogically. The trace element and ^{13}C - ^{18}O compositions of calcite from each occurrence also are similar, as are the fluid inclusion data obtained from their principal minerals. It has long been known that the age of the Rossie veins is post-Ordovician (Smyth, 1903; Buddington, 1934; Brown, 1983), and recently, a K-Ar date obtained from adularia from Rossie indicates its age is 186.3 ± Ma, concurrent with Appalachian tectonism (Robinson *et al.*, in press). Whether the veins at Long Lake are also Appalachian in age may be answered by Sm-Nd isotope studies presently underway (Robert Darling, personal communication, 1997).

ACKNOWLEDGEMENTS

Steve Condon told RPR about the Long Lake site (GWR discovered it independently), and contributed many specimens for study. Dr. John Hanchar measured luminescence spectra of fluorite and provided data for inclusion in this paper. The Oberlin College Geology Department provided access to thin-section-making equipment and a luminoscope for examining fluorite sections. Dr. Ken Krieger of the Water Quality Laboratory of Heidelberg College offered use of a Wild stereomicroscope with iris diaphragm, with which photographs of several of the smaller minerals were obtained. Dr. Bill Cook used his unique X-ray technique to identify some of the forms of kainosite. Dr. Robert Darling provided fluid inclusion data and is attempting to date the minerals. Jerry Van

Velthuizen identified the hematite. This work was supported, in part, by the Canadian Museum of Nature, RAC Research Grant EPN100 to GWR.

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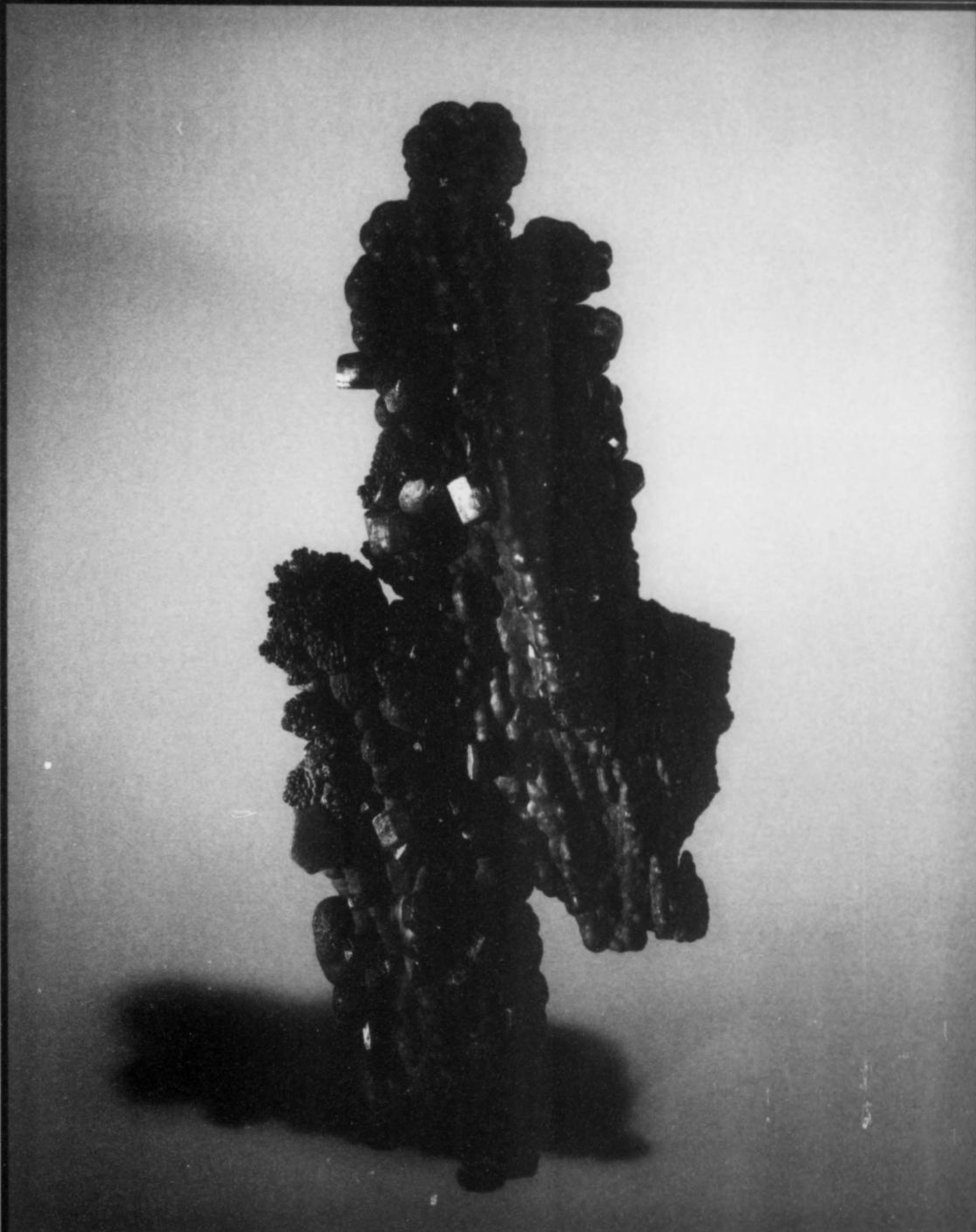
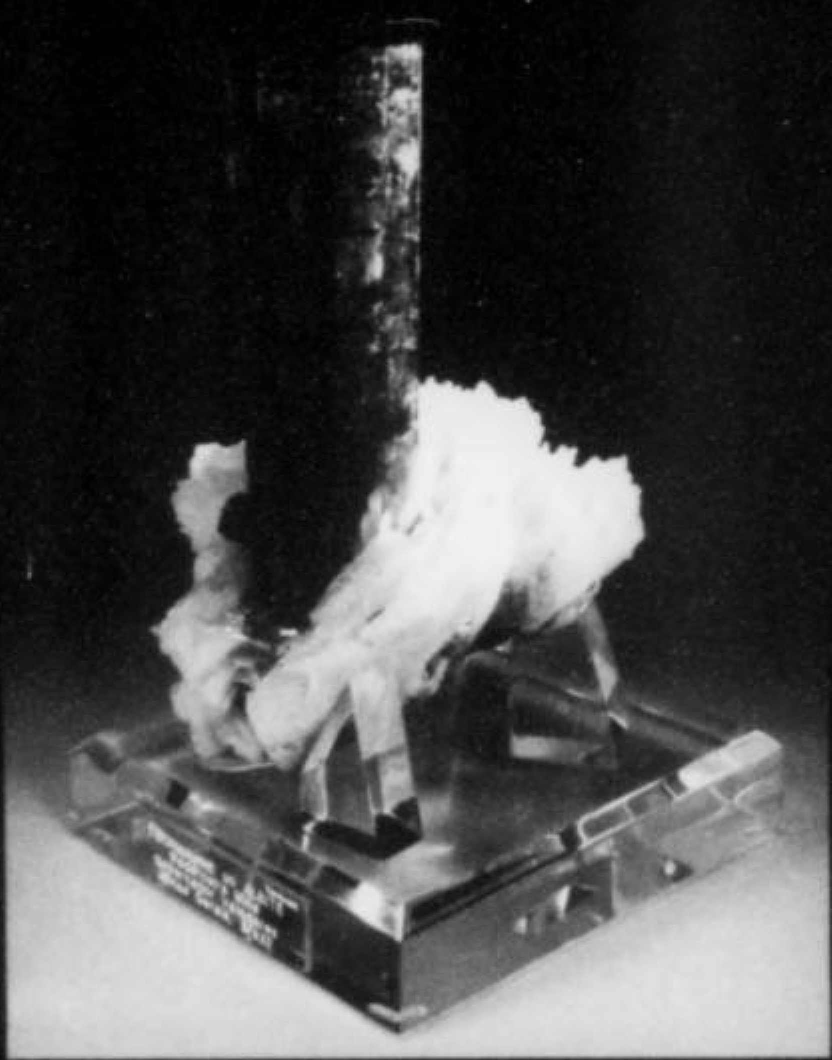


Vanadinite on Hollandite, 6 inches, Taouz, Morocco. Obtained (in Morocco) by C. & S. Smale, August 1994

Clara and Steve Smale
COLLECTORS

PHOTO BY STEVE SMALE



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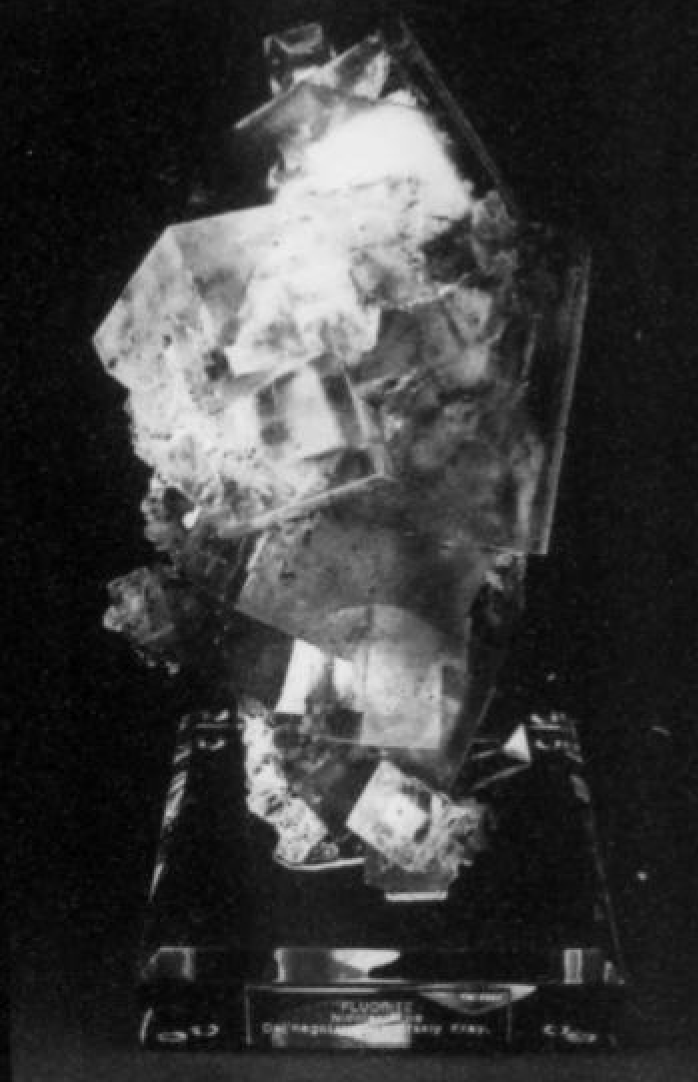

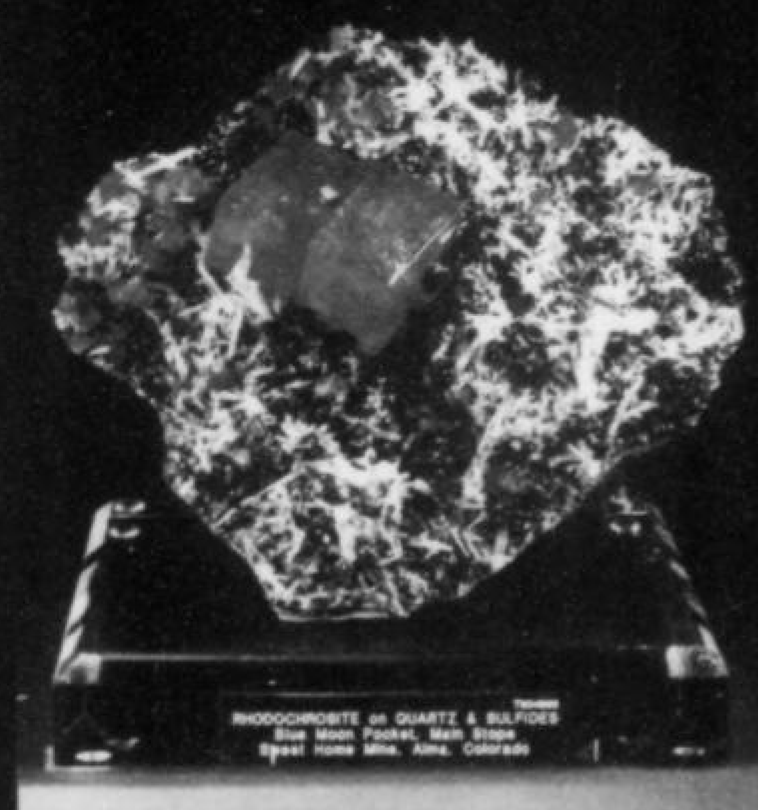

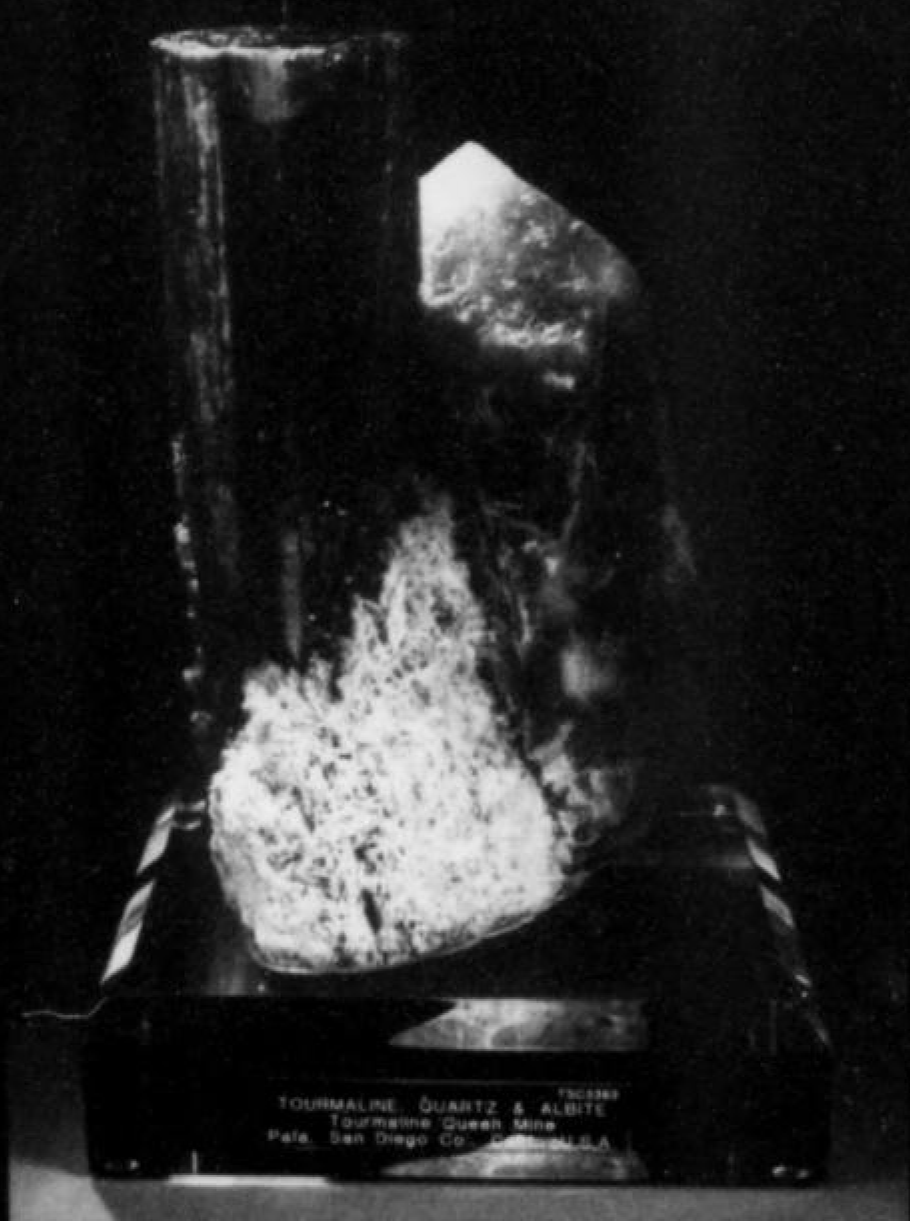

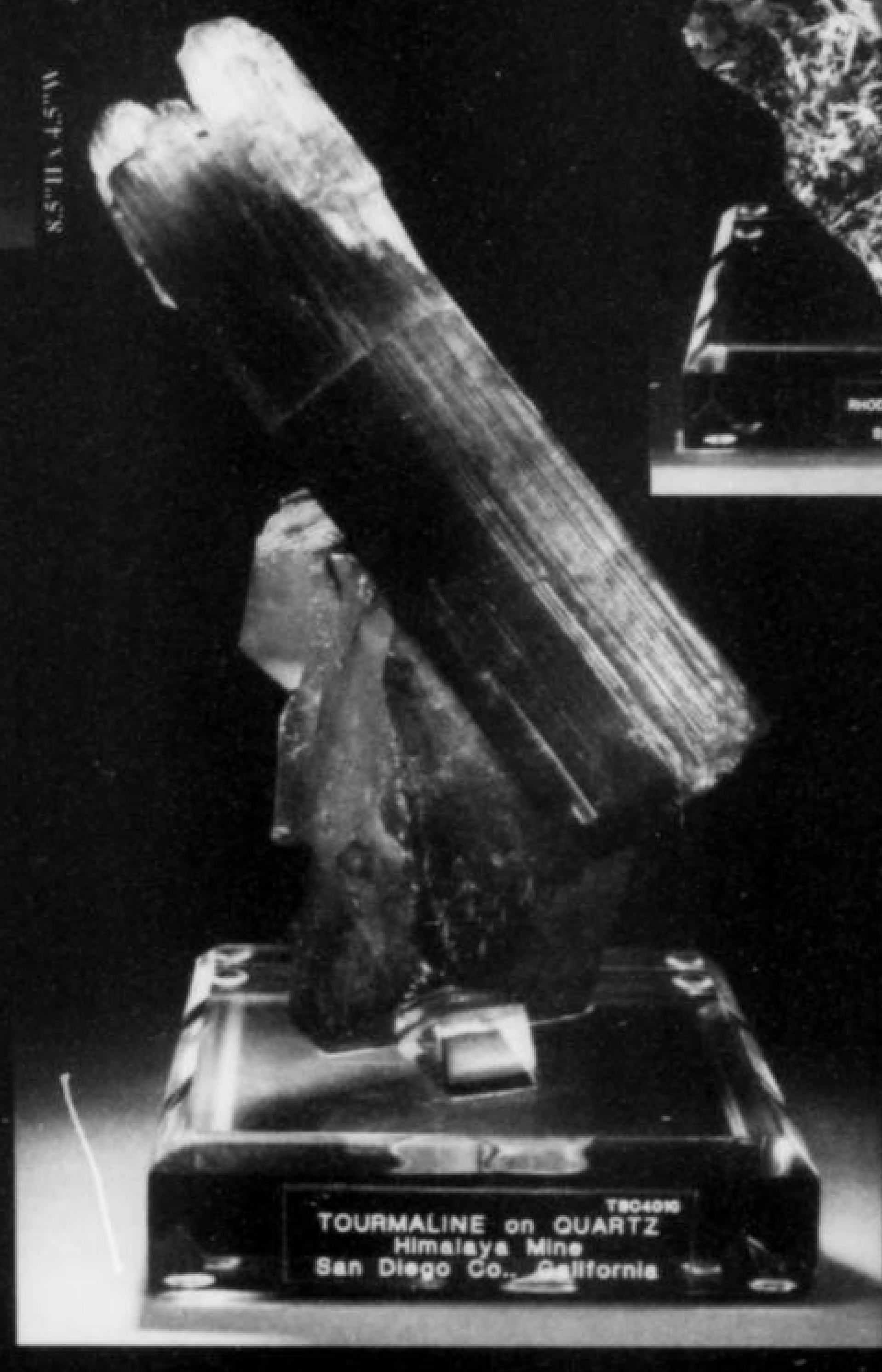

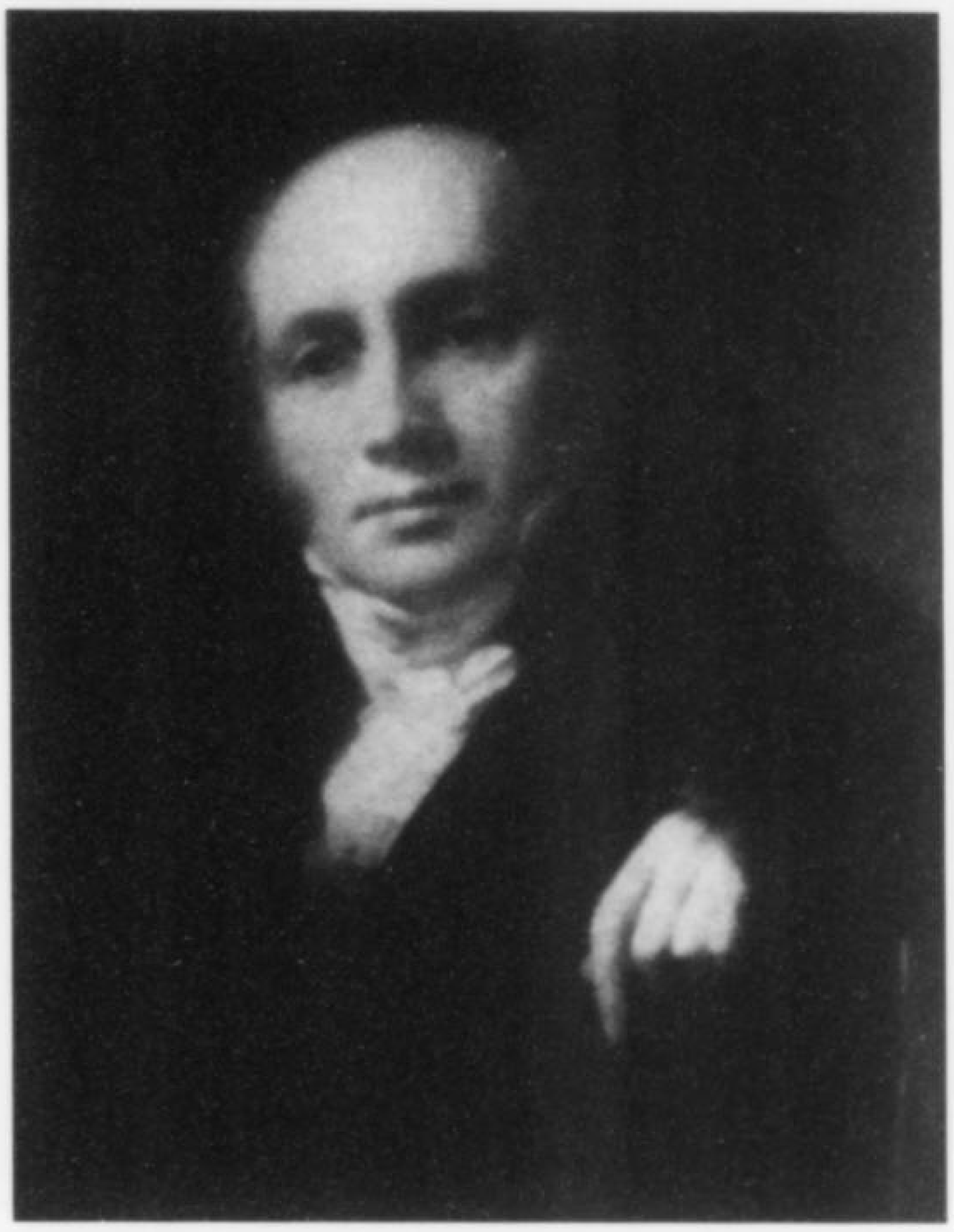

The Journals of Robert Ferguson (1767–1840)

Brian and Mary Lloyd
Gregory, Bottley & Lloyd
13 Seagrave Road
London SW6 1RP, England

Well known by mineralogists in the early part of the 19th century, Robert Ferguson's mineral collection disappeared from public knowledge until being sold by his descendants in 1997. His journal of travels and acquisitions between 1786 and 1810 makes interesting reading.

INTRODUCTION

One of the greatest excitements that mineral collectors and dealers can experience is the "discovery" of a long-lost (or at least long out of sight) mineral collection. So it was when the descendants of Robert Ferguson (1767–1840) in Scotland decided to sell their ancestor's extensive and fascinating collection in late 1997.

Ferguson was born into a wealthy family and was given an allowance sufficient to permit him unlimited travel through Europe. He spent those early years enjoying the life of a young *bon vivant*, meeting other mineralogists and collectors, and making regular purchases of specimens to build his collection. Surely those must have been his happiest years, for after the death of his father in 1810, Robert Ferguson settled down to the management of the

Figure 1. (top) **Portrait of Robert Ferguson by Sir Henry Raeburn.**

Figure 2. **A small leather bag, tied with string and sealed with red sealing wax, containing native mercury and some rock, presumably cinnabar, from Spain; photographed with a small, late 18th-century glass bottle (1.2 inches high) containing scales of platinum. This is the platinum from Pinto purchased from Baron Block in 1801 at a cost of 2 Ecus. Photo by Mick Cooper.**

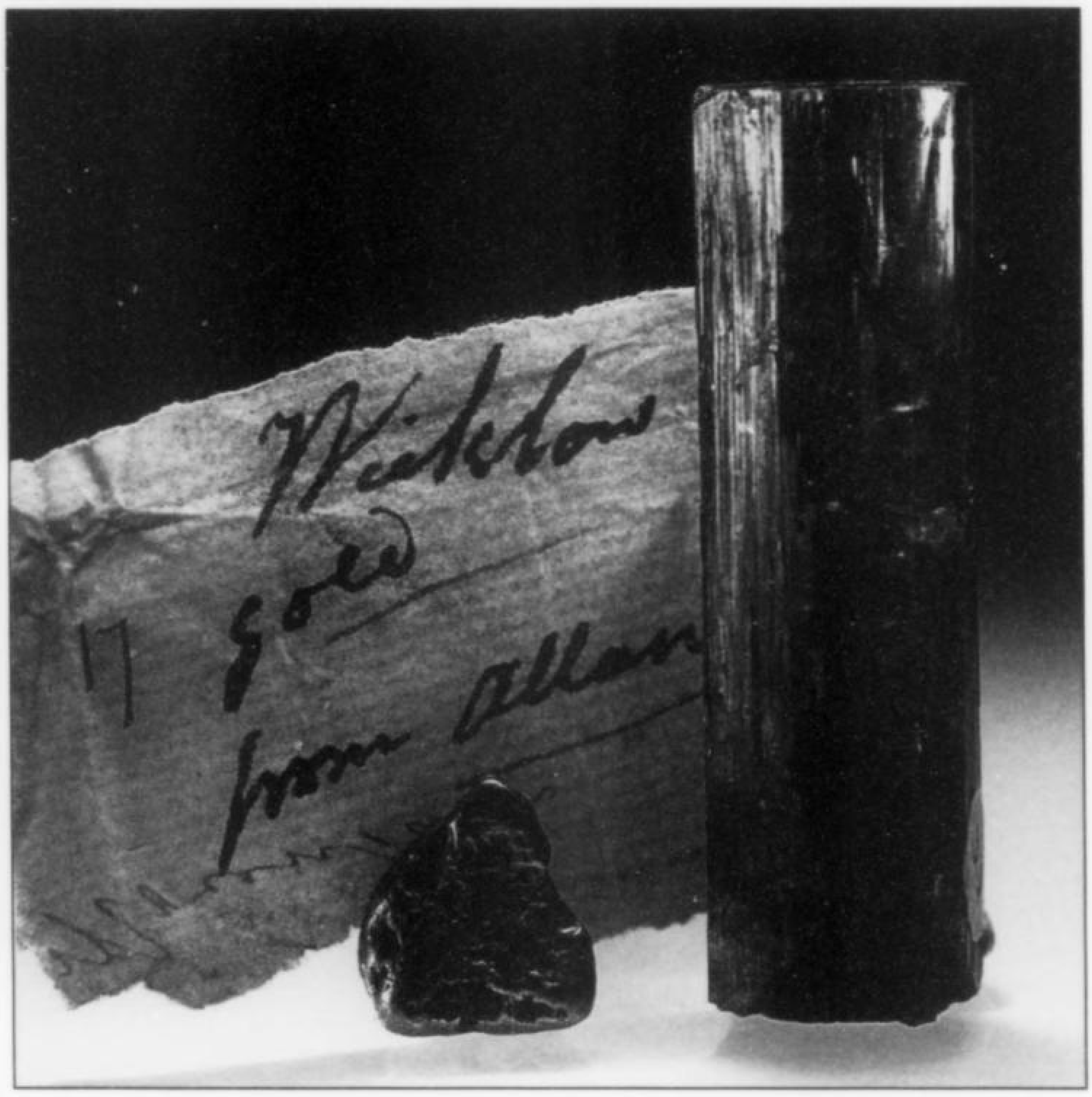

Figure 3. **A gemmy, transparent to translucent terminated aquamarine crystal, 2 x 0.5 inches, with manuscript labels "Morne Mountains, Co. Down." It is possible that all aquamarine crystals from the Mourne Mountains in Ireland were found and sold by the mineral dealer Patrick Doran who had worked as a quarryman in the Mourne Mountains in his youth. He was probably born in 1781, and died in 1881. Photographed with a nugget of native gold from County Wicklow, Ireland, and associated manuscript label indicating it was probably acquired from the mineral collector Thomas Allan (1806–1863). Photo by Mick Cooper.**

family estates in Scotland and represented his district as a Member of Parliament. He ceased adding to his mineral collection, which slowly became a dust-covered relic.

Shortly after Ferguson's death in 1840, Alexander Rose, a wood turner, mineral dealer and lecturer in mineralogy at Queen's College in Edinburgh, compiled a report on the mineral collection, presumably for the Ferguson family, highlighting its major strengths and pointing out that the specimens were crowded and covered with dust, an indication that Ferguson had rather lost interest in his collection toward the end of his life. Some specimens were disposed of over the next few years, a few going to Sir Arthur Russell. A remarkably fine lanarkite from Scotland is now in the Russell collection at the Natural History Museum in London, together with three Scottish minerals illustrated or mentioned in James Sowerby's *British Mineralogy* of 1804–1817: a millerite (plate 158) from Lord Elgin's lime quarry at Broomhall in Fifeshire, a water-worn blue topaz, mentioned but not illustrated (plate 163) and an etched beryl (plate 421). Murray's *Statistical Account of Scotland* (1845) merely notes that Ferguson's collection of minerals "for richness and extent is surpassed by few private collections of this sort in the Kingdom"; after that the collection seems to disappear from public knowledge until around 1997 when the remainder was sold.

Robert Ferguson's present-day descendants sold the extant remains of the collection to Brian Lloyd (of the firm Gregory, Bottley & Lloyd, London), in late 1997. A portion was subsequently resold to various collectors and dealers including Herbert Obodda, Rob Lavinsky (The Arkenstone) and John Vaevert (Trinity Minerals).

Minerals). There is still much remaining to be sorted and cataloged prior to eventual sale, including several hundred interesting European minerals, all the lapidary items and all of the fossils. There is also a large quantity of low-quality, mostly unlabeled minerals and rocks.

ROBERT FERGUSON

Ferguson was a complex individual, much prone to falling in love with unsuitable women. His early journal indicates his problems with the opposite sex, and it could well be that he was actively encouraged by his father to leave Scotland for Europe at the age of 26 in 1793. He met and fell in love with the married Countess Henrietta Schall of Gausig (a small town about 30 miles to the east of Dresden in Saxony), by whom he had a child, and eventually was cited co-respondent in the famous divorce case brought by Lord Elgin against his wife Mary, for which the court ordered Ferguson to pay the staggeringly high sum, for the time, of £10,000 damages to Lord Elgin. He subsequently married the now divorced Lady Elgin in 1808.

From 1786 to 1810 he wrote 30 journals detailing his early life and travels in central Europe, his expanding mineralogical interests and acquaintances, his love life and his rather curious political views. He was strangely complimentary about Napoleon at a time when England was at war with France.

Figure 4. **Yellow fluorite cubes with globular aggregates of barite scattered with small chalcopyrite crystals, 2 x 2 inches; from Gersdorf, Saxony, Germany. Photo by Mick Cooper.**

Figure 5. **A group of lustrous, transparent, colorless quartz crystals, the largest 3 x 1 inches, from St. Gotthard, Switzerland. Purchased with other Swiss minerals from the dealer Burrell of Berne in September 1795. Photo by Mick Cooper.**

Figure 6. **A cavity in matrix (4.2 x 3.5 inches) lined with drusy calcite and bright yellow crystals of sulfur, from Conil, Cadiz, Spain; with manuscript label "Souffre natif de Conille en Espagne." It is interesting to compare this with the very fine Spanish sulfur illustrated in Sowerby's *Exotic Mineralogy* with accompanying text stating that the "mine at Conilla near Cadiz was opened many years ago by the King of Spain for the express purpose of extracting a few of its magnificent treasures, with some of which the late Mr. Forster was indulged (i.e. the mineral dealer Jacob Forster 1739–1806). The mine was immediately closed again, and I am told the works destroyed by the French while they blockaded Cadiz towards the end of the last war." Photo by Mick Cooper.**

He made large purchases of minerals during his travels and, possibly for customs purposes, had copious and comprehensive lists of these in French. Most specimens are numbered and described, with purchase prices. Unfortunately, on his return to Scotland he seems to have re-numbered the collection, making it difficult to tie in many of the specimens with the lists. His largest purchase was of a collection formed by Baron Peter Block (1764–1818), the German Privy Councillor and inspector of the Green Vaults in Dresden. This was acquired in 1801 for £500 and was packed into 5 cases for shipment to Scotland. Various other purchases made between 1796 and his departure from Paris in 1803 were packed into a further 12 cases for shipment, at a declared value of £815. Again, a master packing list for these survives, with individual case values, together with other very detailed documentation.

On Ferguson's return to England in 1803 he became well known in mineralogical circles and became a prominent founding member of the Geological Society, being appointed a trustee in April 1810 and the council vice-president at the first meeting in June 1810 (along with the Count de Bournon, Sir John Aubyn and others). He was described as "a patron of science, and on all occasions a most liberal contributor to the wants of the society." Thomas Allan (1777–1833) proposed that a newly described mineral recently brought back from Greenland by Karl Gieseke (1761–1833) should be named *fergusonite* in his honor, and Jameson dedicated his *System of Mineralogy* of 1820 to "Robert Ferguson of Raith in Testimony of his distinguished talents as a mineralogist by his Faithful and Sincere Friend the Author." James Sowerby's *Exotic Mineralogy* of 1811–1820 is similarly dedicated:

> To Robert Ferguson F.R.S., a gentleman known as possessing a Cabinet of rare Foreign Minerals, and who generously volunteered his aid in this undertaking, I do myself the honor to dedicate this Volume. That it may be as equal to his expectations in my part as the subjects are important, is the great desire of his humble servant, James Sowerby.

Ferguson was elected a Fellow of the Royal Society in 1805, and was asked by Parliament to report on Charles Greville's collection with, amongst others, William Babington (1757–1833), Charles Hackett (1765–1847) and William Wollaston (1766–1828), the collection subsequently being purchased for the British Museum.

THE COLLECTION

There remained around 4,500 specimens in the collection by the time of its recent sale, of which only 2% can be judged excellent by modern collecting criteria, 35% good and 25% poor, with a further 18% polished, some of which are remarkably fine, and 20% fossils.

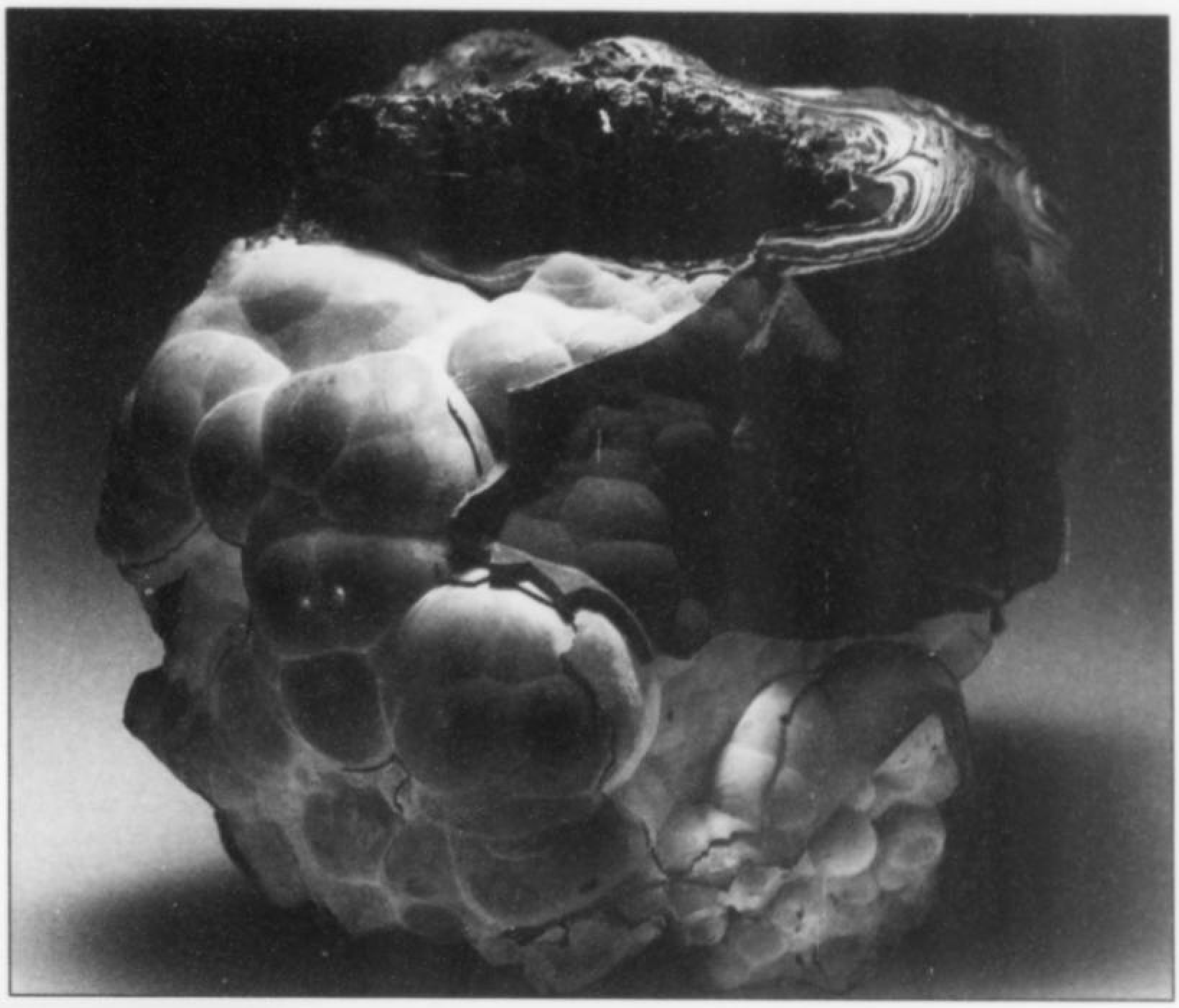

Figure 7. **Botryoidal lamellar malachite from Siberia, 4.5 x 3.5 inches, probably part of the collection purchased from Mr. Globig in Vienna early in 1803. Photo by Mick Cooper.**

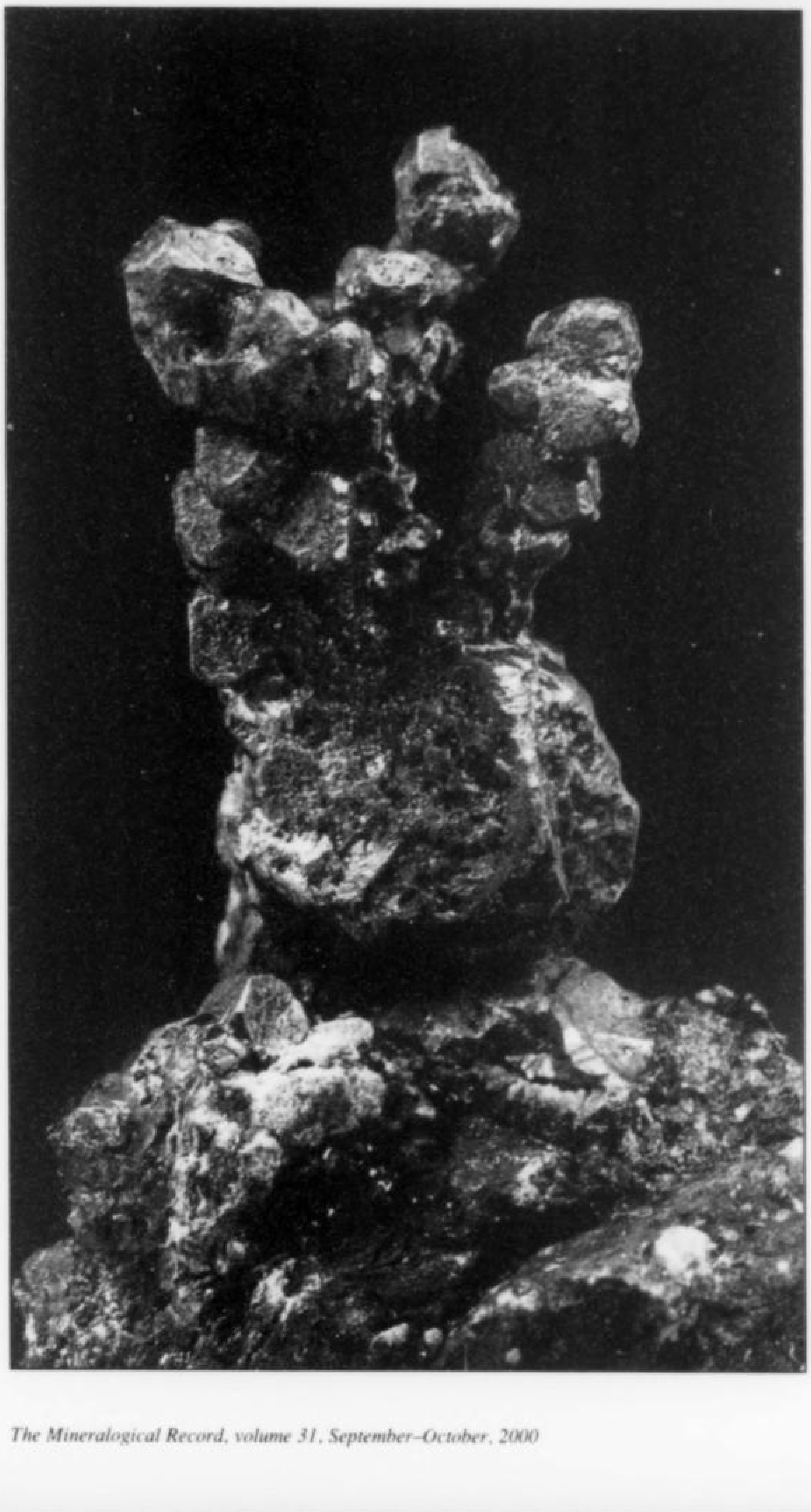

Figure 8. **Acanthite-after-argentite crystal group, about 1 inch, from Freiberg, Saxony. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

Highlights include: a 1.55-kg meteorite from Aigle in France, almost certainly obtained directly from Jean-Baptiste Biot, who had written his famous report on the first recorded fall of a meteorite in 1806; suites of silvers, calcites, cassiterites and fluorites etc. from Bohemia and Germany, and of Russian minerals, though he never visited Russia. A large proportion of these was bought directly from Baron Block. British specimens were not too well represented and were probably purchased after his return to England in 1804. He must have bought a group of fine Cornish minerals in one lot (their labels are distinctly different from the rest of the labels), and another similar group of Leadhills specimens. There is a gold nugget from County Wicklow, and an excellent Mourne Mountains aquamarine.

Ferguson owned various minerals purchased from Henry Heuland (1778–1856), with catalog numbers, presumably from one or more of Heuland's auction sales which took place in London in the first half of the 19th century, though it has not been possible to trace *which* sale in the extensive holdings of Heuland catalogues in the Natural History Museum Library in London. The labels are in manuscript in Heuland's hand, so perhaps these were private purchases. The most interesting of these is a large apophyllite from Poona in India, with a manuscript label which reads:

> Mr Heuland presents his respectful compliments to Mr Ferguson and has the honor to send the specimen of Apophyllite from Poona, East Indies, which Mr. H. mentioned already to Mr Ferguson, whose kind acceptance of the same will make Mr. H. truly happy. 15th July 1828.

Whether this is a gift from Heuland or the hopeful plea for a sale is not known!

He was particularly fond of polished specimens, and these range from larger German agates down to small Indian mocha stones, a fine polished "Iceland spar" rhomb from Iceland and a quite extraordinary collection of the finest polished agates, each mounted in a gilded card mount, a style typically used towards the end of the 18th century for mounting casts of Greek and Roman intaglios. There is also an orbicular granite illustrated as plate 2 in Sowerby's

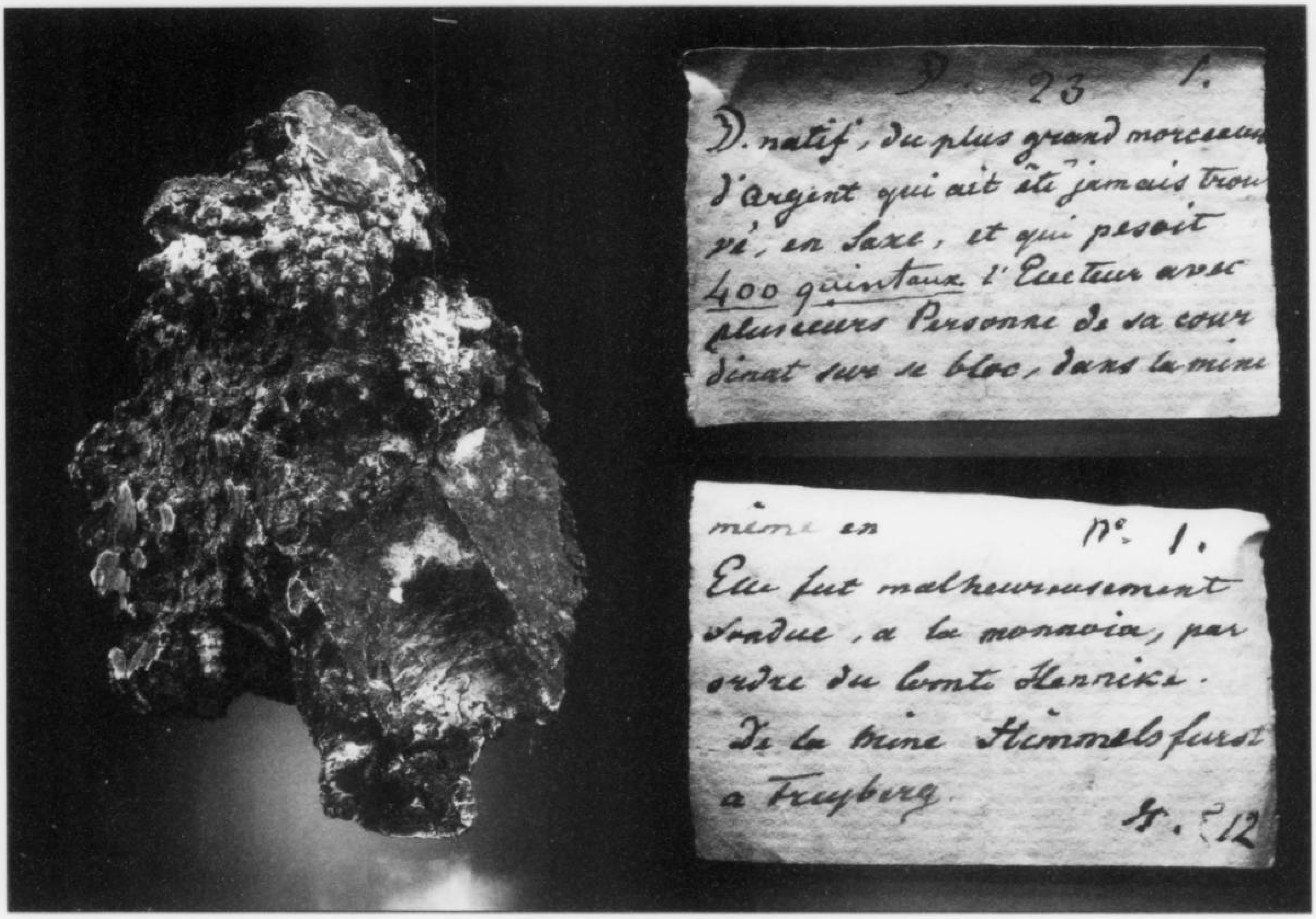

Figure 9. **Silver, 1.5 inches, with accompanying label, from the Himmelsfürst mine, Freiberg, Saxony. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

Exotic Mineralogy of 1811, though the text makes no mention of Ferguson.

It is quite difficult to reconcile the various currencies used at the time with modern values, but 1 German ducat (0.111 ounces of gold) was equal to 3 Ecus, an Ecu being a French silver coin. One pound sterling equalled 6 Ecus. Taking an ounce of gold in the late eighteenth century as having the buying power of maybe $600 (£360) now leads to a current value of 1 Ecu at around $22 (£13), and a pound sterling at $132 (£78). Ferguson listed almost all of the prices he paid in Ecus, with a few in German ducats, with totals in pounds sterling. So the £10,000 damages paid to Lord Elgin equates to a fine of around 1.25 million dollars! The most he spent on a single mineral was 90 Ecus ($2000 now), with the majority of his purchases being under 20 Ecus per specimen. The various cases he sent back for which there are extant lists totalled £1275, or currently $168,000 (£100,000), to which must be added all purchases made in England or not listed.

JOURNAL ENTRIES

In the following account, everything in italics has been taken verbatim from his journals.

1767

Robert Ferguson born September 8th—the eldest son of William and Jane Ferguson of Raith House, Kirkaldy, Scotland.

1786

The Scottish mathematician and geologist John Playfair (1748–1818)—*a very able man*—was appointed tutor to Robert and his younger brother Ronald. There was an undescribed *youthful indiscretion*, in which Playfair did not intervene, which greatly annoyed their father, and there were differences of opinion about their education. *Mr Playfair had acted very unguardedly and was not so compliant as he ought to have been.*

1788

April

Playfair was dismissed by William Ferguson, and the brothers were no longer allowed to contact him, thus losing *a valued friend.*

November

Left home to study Civil Law and Literature at Glasgow—*resolving to earn a good opinion of my father and society.* In the care of a Dr Millar.

1789

Left Glasgow early in May, returning in November to join a class in anatomy.

1790

First trials in civil law in May, and then to Edinburgh in August to study Scottish law.

1791

May–June

Trials before becoming an advocate. Tried to find employment at the bar (Parliament House) and was given one or two cases, but is not perceived to be making a serious career as a lawyer.

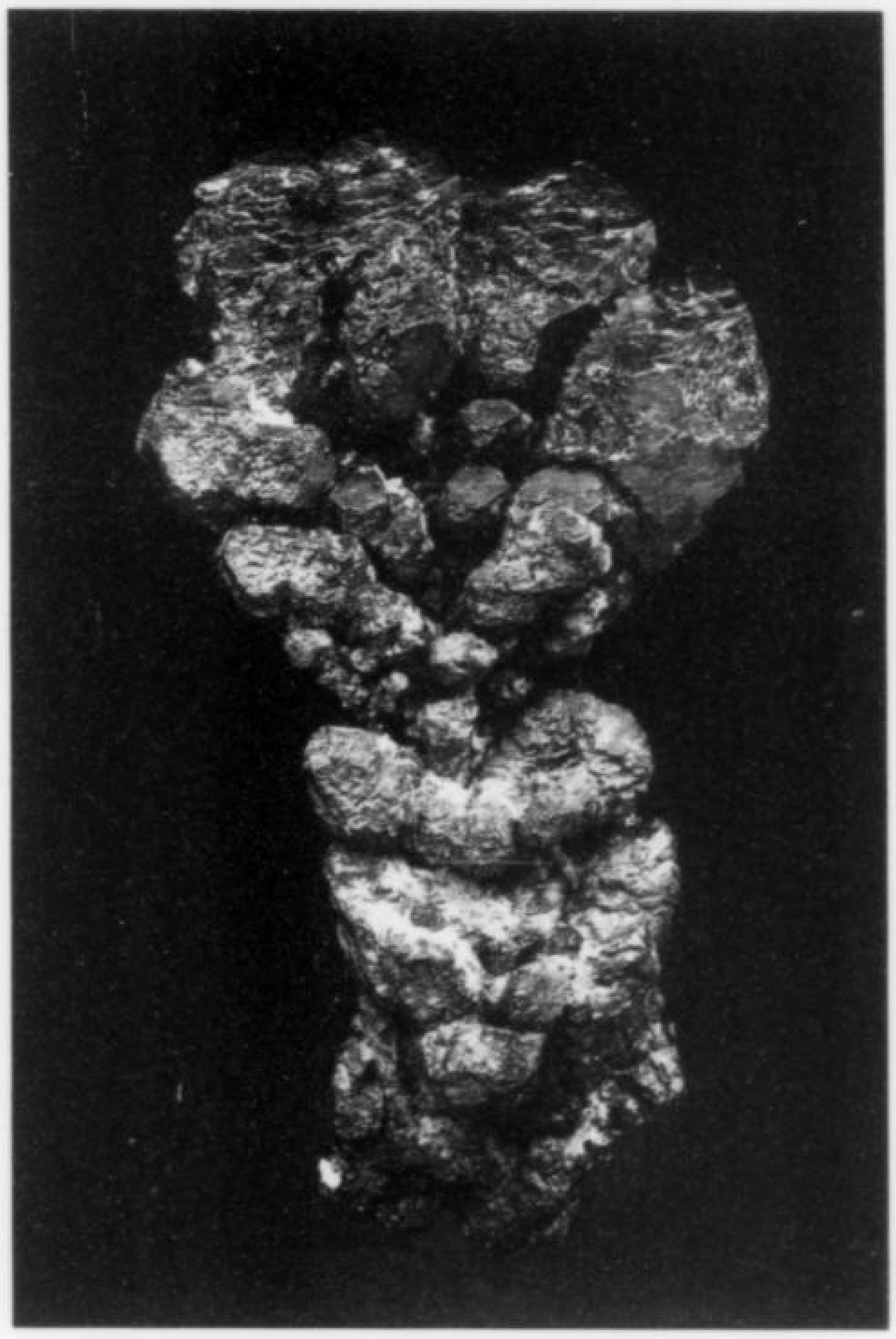

Figure 10. **Acanthite-after-argentite crystal group, 2.6 inches, from the Himmelsfürst mine, Freiberg, Saxony. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

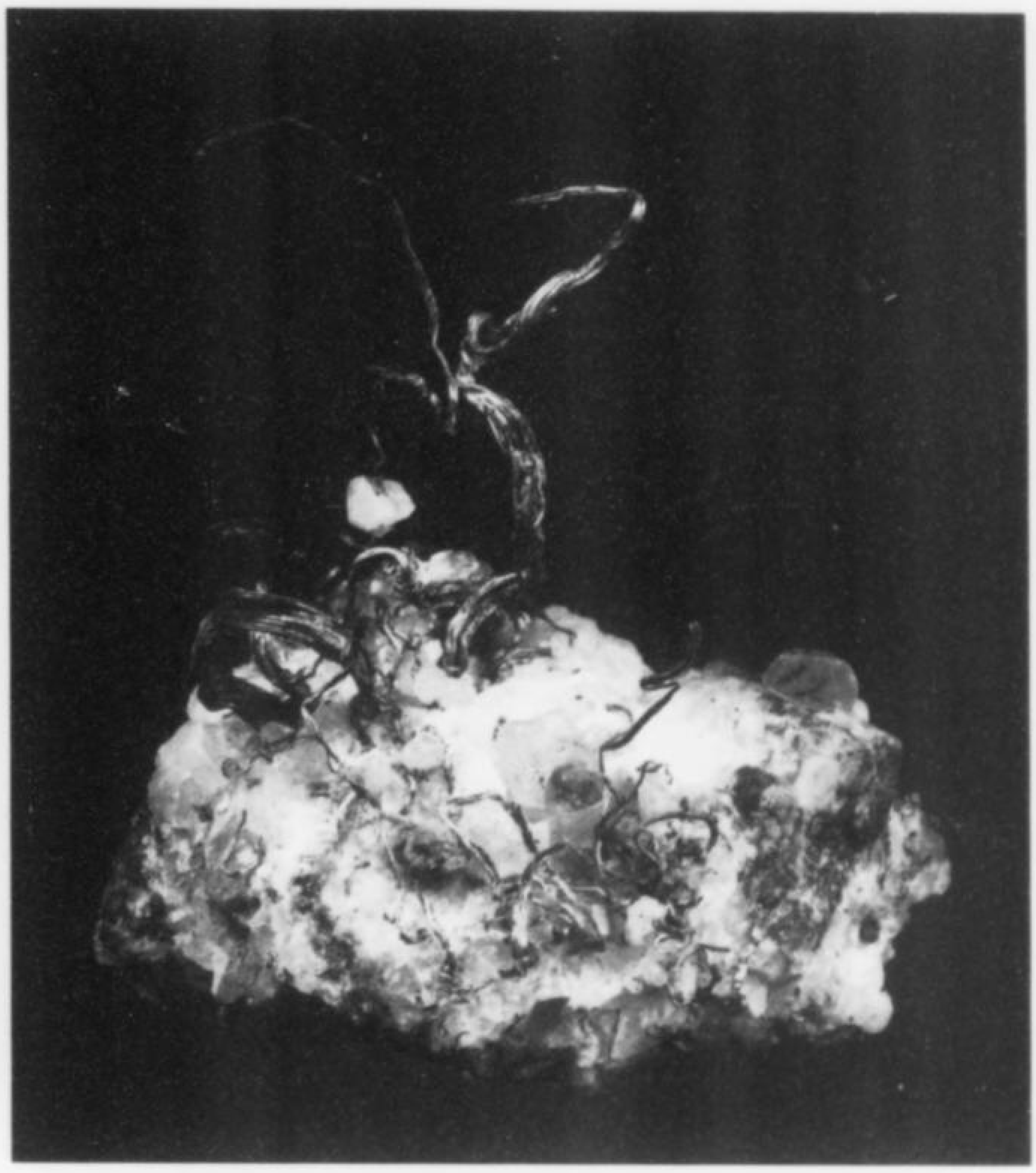

Figure 11. **Wire silver, 2.6 inches, from the Himmelsfürst mine, Freiberg, Saxony. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

1792

Spent the year mostly at home in Scotland recovering from an unfortunate illness, and making local visits.

1793

April

Toured the south of England including Stonehenge, Plymouth, Bath and Windsor where he spoke to King George III on the terrace at Windsor castle. He heard Fox and Pitt debate the Reform bill in the House of Commons, and met the playwright Sheridan.

September 1st

He took Sir Robert Keith's advice before deciding to set out for the Continent.

October 4th

Arrived in Brussels where he met Lord Elgin and visited a Mr. Biggin and gave him a copy of Hutton's *Theory of the Earth*.

October 14th

This being a flat country, no rocks and no mineralizing. Dr. Hutton in his Theory of the Earth mentions the only stone found here in great plenty, and which he thinks curious, is the sand hardened and apparently vitrified into various forms and lying in strata among the loose sand, not unlike the strata of flint in the chalk, only the same species with what is around it. Coal in great quantity about Namur with much sulphur in it. Mr. Biggin tells me there are a great many minerals thereabout, and been little explained.

October 18th

Aix La Chapelle—*Some copper mines between Liege and Aix La Chapelle.*

October 23rd

Osnabrück—*the ridge of the hills here seem to be composed of limestone and some coarse sandstone, evident marks of being once intimately connected with the sea. Several marine objects on the stones.*

October 26th

Hanover—*enquired if I could see any cabinets or collections of minerals from the Harz. Called at an apothecaries, but he was out. Perhaps this evening may hear where I may procure a few specimens. Find I can get none here. Heard of a Jew who sold them, but an Englishman had lately got all he had. Perhaps at Brunswick I may get some.*

October 28th

Helmstadt—*in Brunswick I saw the cabinet which I should imagine as valuable and extensive a cabinet as any in Europe. It would take a week to see everything and have time to admire all the works of nature and art here collected. The different branches are arranged in different galleries. There is a gallery of minerals and fossils, another of natural history, for anatomy, for antiques and coins. In short the various articles there collected are wonderful. Beautiful specimens of the different ores of Germany.* He went back to his inn where he disposed of some specimens of the country he had acquired on the way which now seemed to him *a despicable collection.*

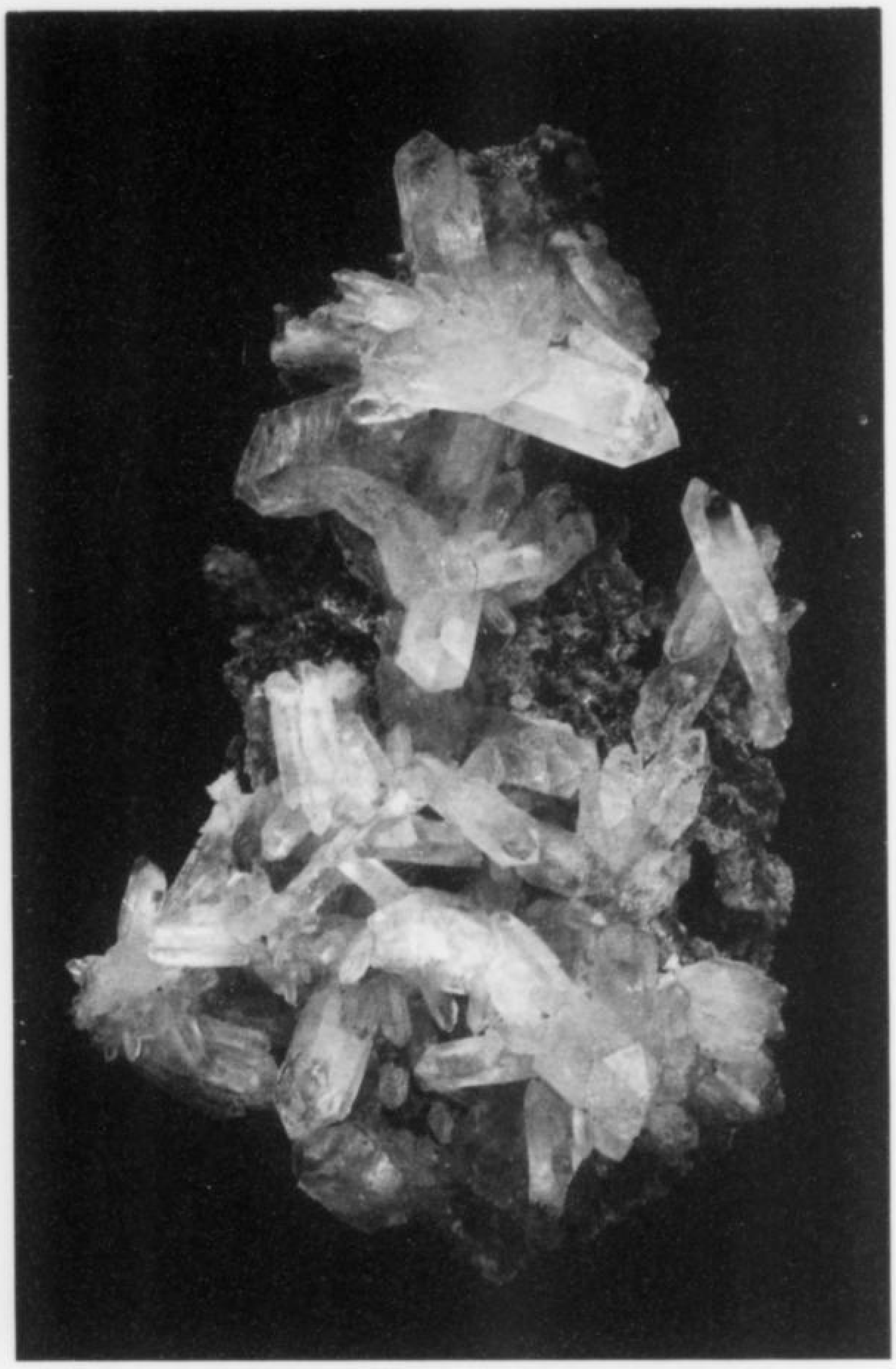

Figure 12. **Quartz crystals on matrix, 4.7 inches, from Chemnitz, Hungary. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

November 1st

Comments on his expenses and notes that the new road to Berlin is being made with a beautiful granite, so picks up several specimens for his collection.

November 11th

Dresden. *Find I have much to see here. Galleries of paintings, cabinets, mineralogy etc., etc.*

November 16th

Obtains unlimited entry to the gallery of paintings and a list of curiosities to see—noting mineralogy in particular.

December 18th

In the Spring I might go to Freiberg and visit the mines, then on to Leipsig and Vienna.

1794

January 27th

Dresden—He bought some fossils and sees a great part of the mineral collection of Baron Joseph von Racknitz (1744–1818).

January 30th

Yesterday was with Racknitz again at 10 o'clock and seen more of his cabinet which is really excellent, extensive and well arranged . . . Having begun my acquaintance with Dr. Titius—a little of a pedant—but through him I can see the Elector's cabinet and his own private cabinets. Two very complete ones he has to dispose of, one for £300 sterling, and the other for £600 sterling.

Carl Titius (1744–1813) was the physician and inspector of the Royal Saxon Natural History gallery in Dresden, as well as the owner of a large mineral collection, with catalogs published in Saxony in 1821 and Leipzig in 1805.

February 22nd

Bought a horse for £40.

May 9th

Freiberg—*Yesterday morning had a pleasant ride to this place. The country near this is becoming very bare and open indeed. Baron Racknitz was kind enough to give me a few lines to Mr. Heimitz, the chief man here, who very civilly soon came and paid us a visit, and arranged our plans for this forenoon. In the evening called on Mr. Werner, the professor of the mines and of mineralogy here with whom we stayed a long while.*

This morning and forenoon I was well employed and well amused in visiting one of the mines and afterwards the furnaces and the manner of amalgamating the silver.

The mines of Freiberg belong to many different proprietors, but they are all under fixed laws and regulations. The Elector has the property of a few, and draws a duty from all the rest, but I understand he draws little from them, laying out all there, paying the establishments, different professors and officers, and contented with the population that they give rise to. These mines have been worked for about 600 years. Now about 6000 miners employed in them. Silver is the only object, which they separate from the other metals and matter by furnace or by the process of amalgamation.

We went this morning to visit one of these mines, to that called the KinPrince belonging to the elector. Went to the bottom and was most pleased with it, and with the idea it has given me of mining. It is not very deep, about 1000 feet. The rock through which the vein passes is a kind of hard schistus, and is the rock of all the mountains here. This mine tolerably rich, no native silver here, but mixed with lead and copper. The vein is this ore with a great quantity of Terra Ponderosa. Hardly any quartz.

Left this scene and next saw the beating down of the ore to powder and the separating the useless from the valuable parts, before it is sent to the furnace or to the amalgamation. The ore is first gently roasted with salt before the amalgamating process.

Amalgamation—curious we only saw the machinery and not the process. The ore to be amalgamated is put into barrels and there is first put in half that quantity of water (to 20 of powder ore, 10 of water, 10 of quicksilver), which is at it were churned like our churning barrels for some time an hour. After that half the quantity of quicksilver as there is ore is poured in, and the churning goes on for 16 hours. The silver and quicksilver are now sieved and the useless parts are left behind. The silver and quicksilver are separated afterwards by means of heat. Very little quicksilver lost in this process.

After our dinner went and saw the magazine found here. No great things, but for the public everything for sale. Therefore bought some pretty enough specimens of native silver etc., very dear, and Mr Heimitz asked us to spend the evening with him. We shall therefore go soon there.

1795

January–February

In Munich, much with Henrietta, Countess Schall.

March 13th

Munich—*For some time past circumstances regarding the health of my Henrietta has interested me much. My dear friend is* with

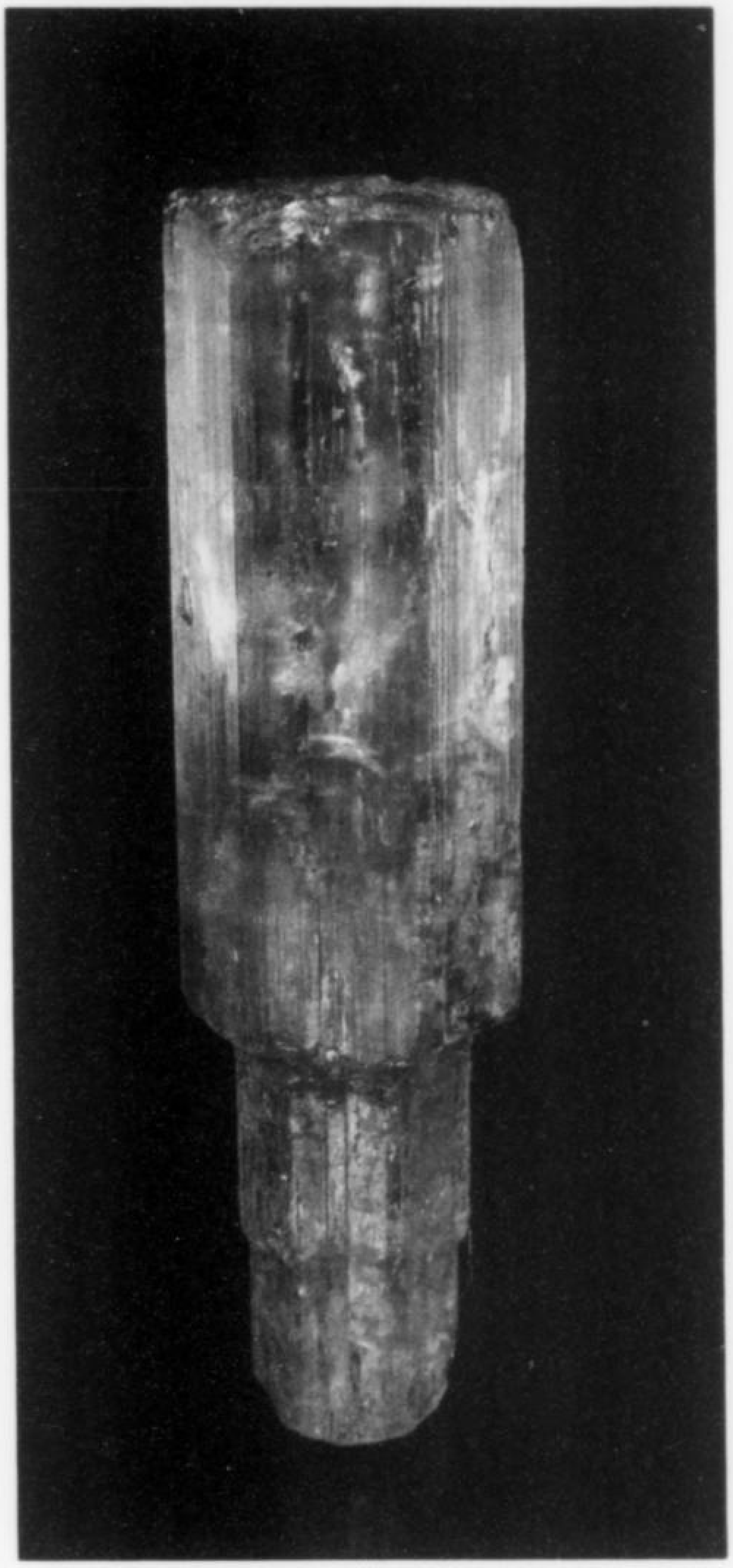

Figure 13. **Beryl scepter, 2.7 cm, from Mursinka in the Ural Mountains, Russia. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

child. *She has at last told me so. We are completely happy. My first anxiety was naturally how the Husband was to know it. She told me I might be at my ease in that respect, that 6 weeks ago she had some presentiment and told him her health was a little disordered, and perhaps that was the cause.*

May 9th

Munich—*Yesterday went with my friend to the Treasure here. To compare it with the treasure at Dresden it is nothing. There is a blue diamond very valuable, and a singular pearl, the half black.*

May 13th

Departed for Salzburg with Countess Schall. *We must when at Salzburg wait on the Prince Evegne there in order to have permission to see the gold mines that belong to him. This obliges me to take my uniform. He is the first ecclesiastical prince in Germany.*

May 18th

Traunstein, where he described getting salt by evaporation. *The weak waters are made to pass, drop by drop, through an immense building filled with brush wood. The same waters pass generally 8 times through this and after this operation the water which remains is much stronger and much water is evaporated. It is then sent to the boilers. These salt works belong to the Elector or Board of Finance and make one of the chief articles of the revenue. The tax on grain is the other. It is not easy to judge of the real revenue of these works, but by questions one may judge Switzerland is supplied by contract from these works, and almost all Swabia. At Traunstein there are 4 great boilers. 3 work always. About a million barrels are made each year.*

They also visited the underground salt mines in the area and on May 21st were on the road to the gold mines of the Bishop of Salzburg. At Hoff, 2 hours from the mines, they were obliged to stay the night, where they were grossly overcharged for a few trout and eggs, and had to sleep on straw. *The people [are] extremely impertinent. Left early to get to Beck in time to see the works there. Here the amalgamation of gold ore takes place and nothing very curious. The richest ore is sent directly to Lenten to the furnace, the poorest kept here. The operation is nearly the same [as] I saw at Freyberg. By means of mercury the gold is separated, all on a small scale. Abandoned the idea of visiting the mines. Saw the plan of the workings which satisfied me. The workings are ancient and date their origin from the Romans. These mines after all the expense*

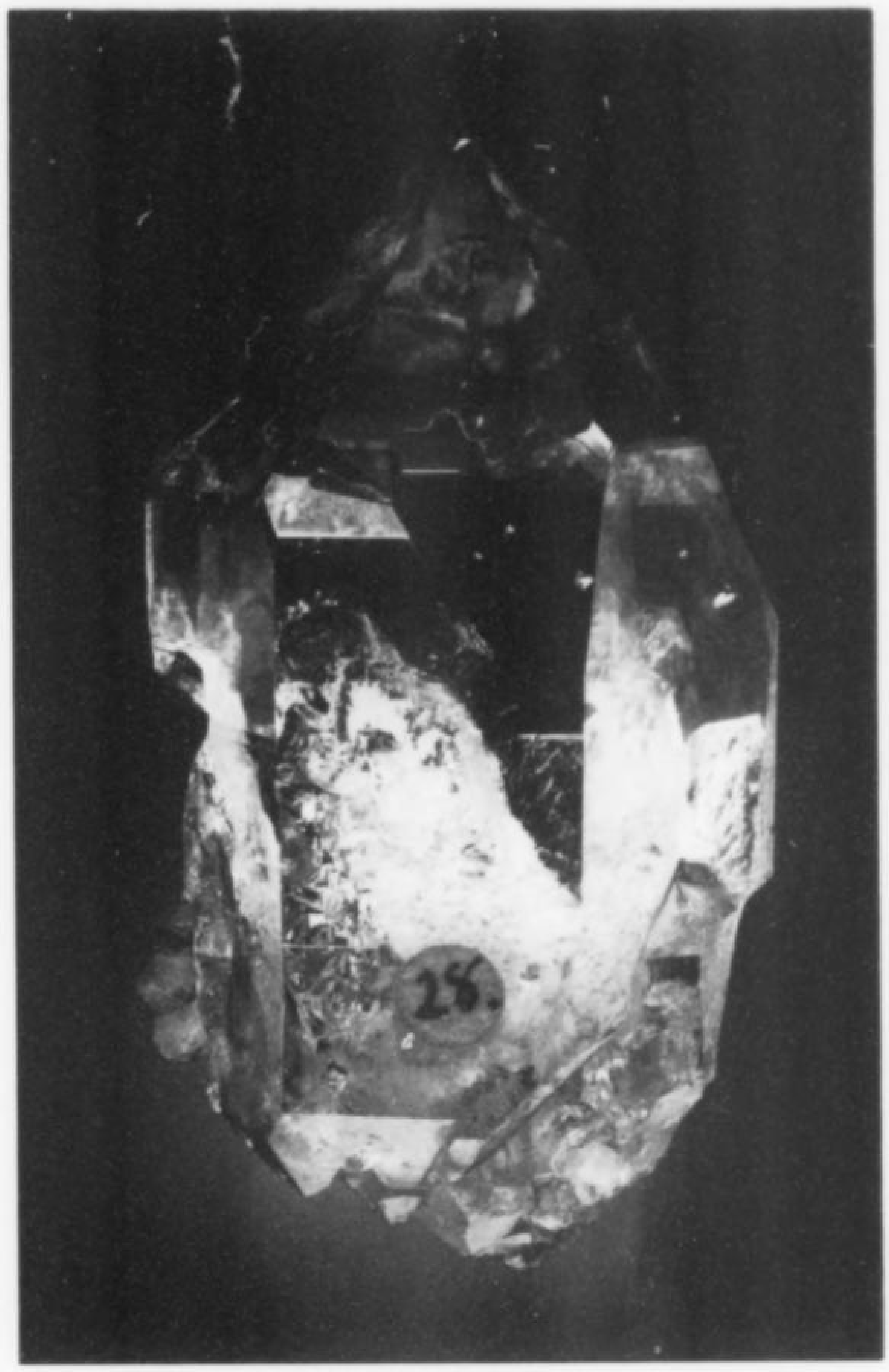

Figure 14. **Pale smoky quartz crystal, 2.9 inches, from the St. Gotthard area, Switzerland. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

give very little to the Archbishop. By the 27th they were back in Salzburg where he—*bought some fossils and a considerable collection from the salt mines*—and then returned to Munich by early June.

June 12th

Not well for these two to three days with a violent heat outside. Obliged to stay in from this day. Called a physician and am to be purged. A load of bile in my body which must be sent off. Got money this morning and for £150 received only value £135. A handsome loss drawing on England.

By June 23rd the Countess Schall had departed, and he left for Augsburg where—*found out a dealer in fossils. Bought some things and tomorrow morning will probably buy an* ***oeuil de chat*** (quartz cat's eye) *for my dear Henrietta who likes them*—then on to Zurich by the end of the month.

July 9th

Zurich—An acquaintance helped him procure a collection of dried Alpine plants which he intended to send on to Henrietta, but—*in respect of mineralogy there is little to be got here, and no merchants in that line. However, there are at Berne, and he is to call on me tomorrow to go to a physical society. Curiosity made me say I would be glad to go.*

Towards the end of the month—*was an hour with Lavater. He was kind enough to say he liked my acquaintance and said that he found the English in general the most painful visitors he had, as having little to say. He looked on me as an exception. Talking of mineralogy, he said his brother-in-law had an excellent collection of things, and chiefly of crystals. That if I would come to him at 9 o'clock he would present him to me. Have likewise a cabinet of mineralogy to see tomorrow* [at] *chez Mr. Ramm.*

July 28th

Glavis and the Elm Valley—*In this valley is the famous quarry of slate for tables etc. The landlord at Glavis had several, but not very good. Very heavy and equally dear.*

September 5th

Berne—*made acquaintance with a great dealer in minerals here, who has a splendid shop and everything Switzerland produces in that branch and many other things. He will I am sure have my money. Indeed I have begun in buying 3* ***oeuil de chat*** (quartz cat's eyes) *for my Henrietta.*

September 8th

Have as I expected paid a dear visit to this Mr. Burrel who is here. I shall pay him tomorrow £17. However for that I have got a good many excellent specimens of the minerals of the St. Gotthard and likewise some good ***yeux de chat*** *for Henrietta.*

September 10th

The dog the mineralogist has got £20 from me, including ***les yeux de chats*** *for my Henrietta, but the specimens are excellent. I have got a complete collection of all the St. Gotthard. They are packed up and one of these days go to Dresden directed to my friend, to be put with the other things.*

29th September

Lausanne—*called on Mr. Struve, the professor of Chemistry here, who has a collection of minerals. Went to him to execute a commission for Mr. Wilkinson. Shall return to him tomorrow at 4.*

Got a small specimen of what Mr. Wilkinson wished. Seems a kind of coal. Saw his collection—not very good, but for lecturing upon.

Then Bex, Vevey, Fribourg and Berne.

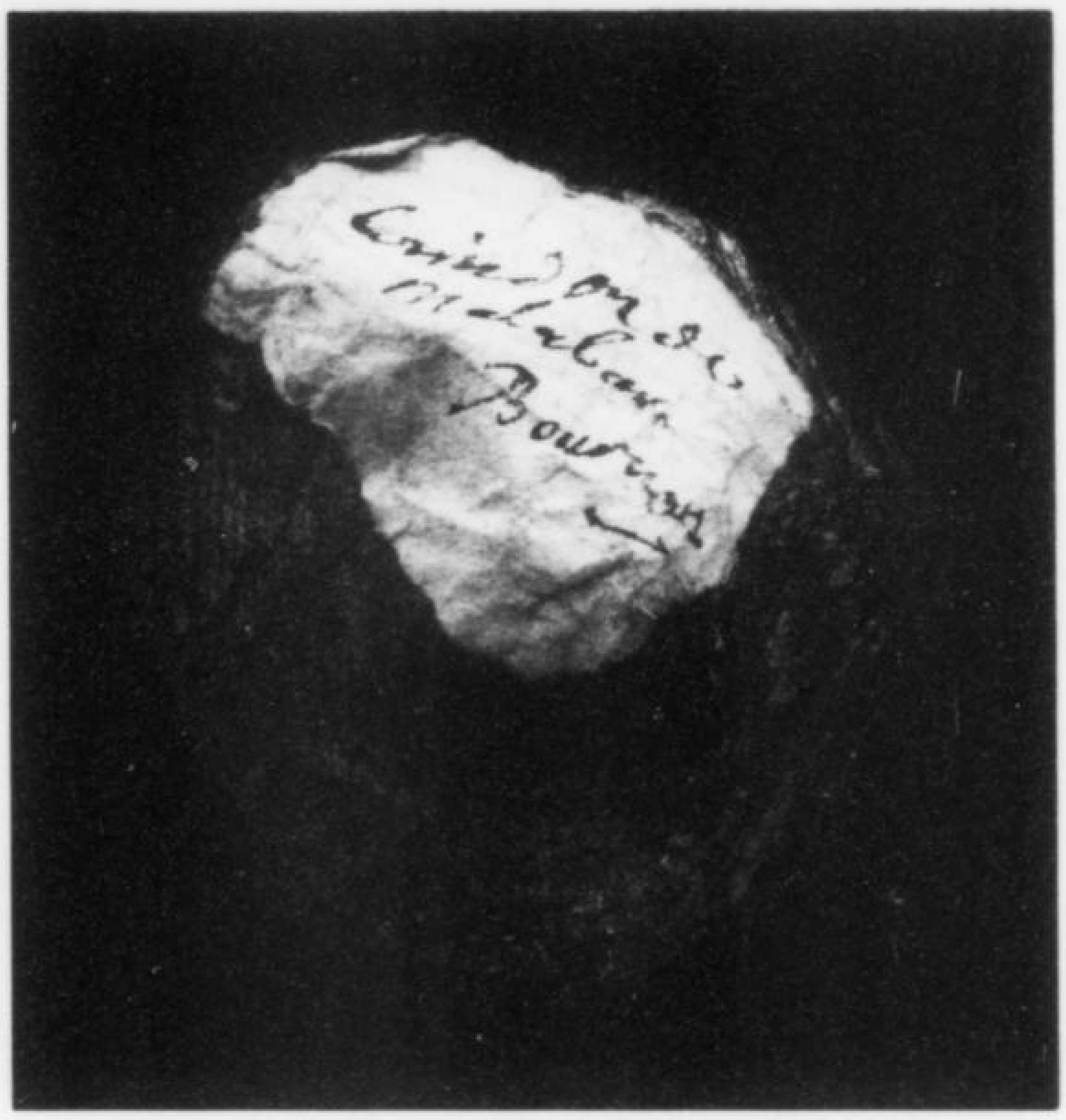

Figure 15. **Corundum crystal, 1.6 inches, locality unknown. Ex Count Bournon Collection and Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

6th October

Berne—*I have a note of introduction when at Innsbruck to a gentleman there who has a good cabinet of fossils.*

Went to Mr. [Jakob] *Wyttenbach* [1748–1830], *a clergyman here who is completely dedicated to Natural History, an interesting cabinet of mineralogy and a vast collection of dried plants, his strongest passion. I stayed a long while with him, and not being so ignorant of the minerals we remained long there. Then he showed me his Herbaire, and I wish strongly to have a good collection for my Henrietta.*

October 18th

In Nuremberg.

November

Freyberg—*visited very often the gallery and the cabinet of natural history—added very considerably to my collection of fossils.*

November 3rd

Henrietta's son is born, and Robert Ferguson gets venereal disease. *I have a slight clap. Curse her, damn her—dirty impertinent swindler. She robs me of £20 and poxes me.* His doctor prescribes copious quantities of tisane to drink, and injects him. He is anxious about his brother Ronald, who was in the army, and rails against the infamous imbecility of the British Prime Minister Pitt in his various military expeditions.

December 1st

In Verona, departed on December 5th for Augsburg and Innsbruck. *Have sent (to Henrietta) a box of fossils I bought here to be put with the rest. Some capital specimens of marine objects found near Altdorf.*

December 6th

Departed Nuremberg, arrived Augsburg 9th, then Verona December 18th.

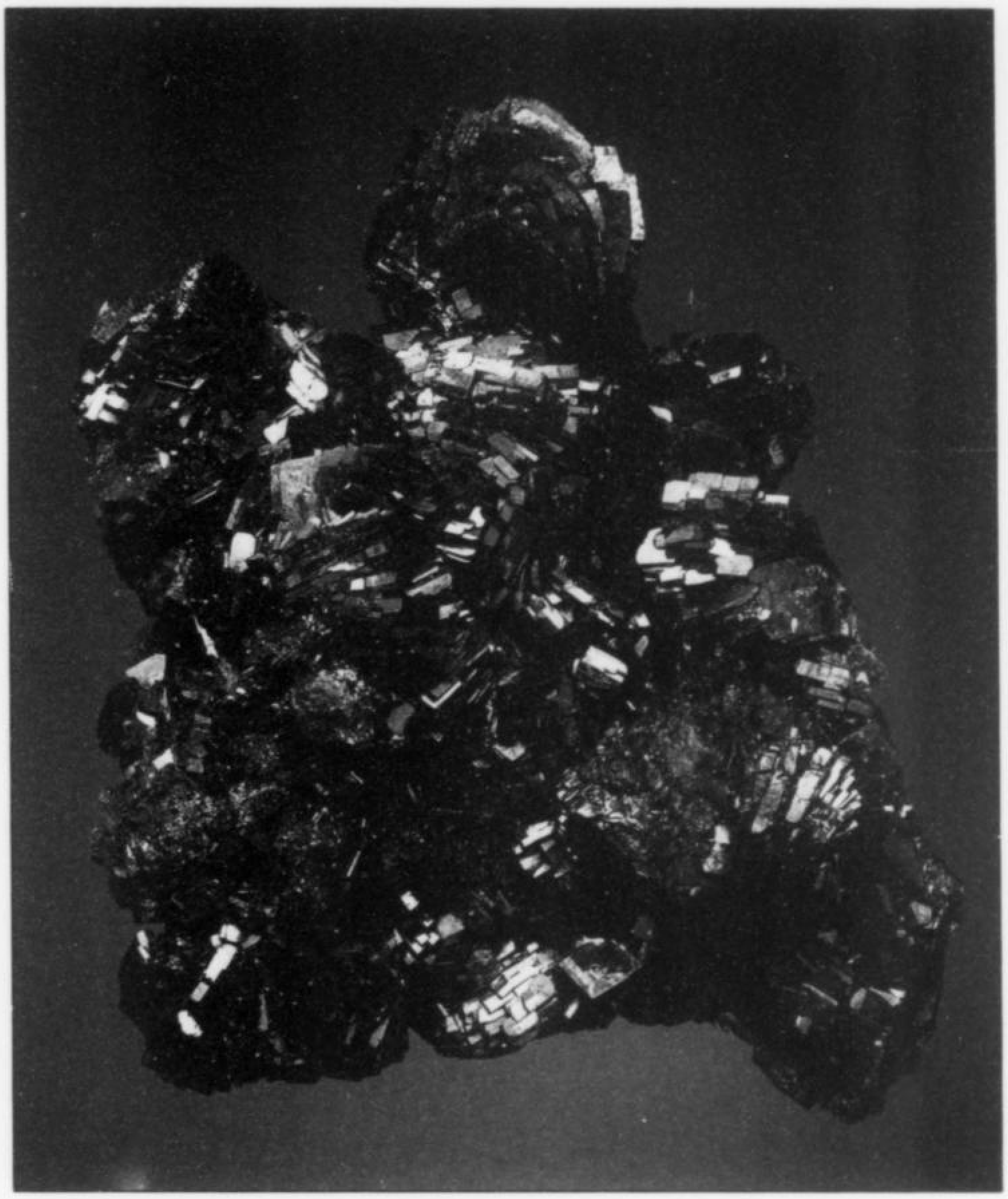

Figure 16. **Azurite crystal cluster, 4.7 inches, from Chessy, France. Ex Ferguson Collection, now in the H. Obodda collection; photo by Jeff Scovil.**

1796

January 1st

Departed for Venice, arriving 3rd. Visited the usual sights, saw the Doge's procession, visited the opera etc.

March 18th

Met Henrietta in Verona, and left separately on the 22nd for Florence as they did not want to be seen with each other, though once there they seemed to do everything together. He visited the Pietre Dure workshops, and was presented at Court. The political situation worsens with Lombardy being taken by the French. In May in Pisa he commissioned several vases from Michali's shop, including copies of the Borghesi and Medici vases.

June 23rd

Very uneasy at the unexpected progress of the French. Napoleon was in Bologna with 20,000 men and it is likely that the English would be ordered to leave. They decided to stay quietly in Florence rather than to reach Rome, and while there he purchased a suite of stones from Arno, antique worked stones, lapis lazuli, Egyptian and other agates and some Elba specimens—in all about 70 specimens which cost £20.

June 30th

Bonaparte arrived last night here—passed our windows—saw him afterwards very distinctly at the opera, and this morning went to see him at the Palace Pitti. He is rather a little man, well built, longish face, a serious look and talks little.

September 20th

Henrietta begins to think she is with child . . . We talk nothing but politics.

1797

The political situation was still very uncertain, but by January 1797 they were in Rome, then Albano by mid-February. There was difficulty leaving Italy as there was an embargo on ships at Ancona.

Henrietta stayed in Rome, while Robert Ferguson, carrying an introduction from Sir R. Murray to Sir William Hamilton [1755–1797], traveled to Naples, returning on March 21st. There were several Vesuvius specimens in the collection, presumably acquired during this visit.

May 4th—Rome

Their son, named Henry Robert, is born.

May 21st

Bought a chimney-piece for the library for £50.

June 5th

He met Henrietta briefly in Florence, before departing for Genoa, Turin, Berne and Augsburg, arriving Leipsig on July 16th where he acquired some agate boxes at a fair. Before leaving for England he wrote to his father explaining his affair with Henrietta.

July 23rd—Hamburg

Hoped to get a passage to England on a neutral ship, finally leaving on July 30th, and spent two weeks on board due to bad weather. Arrived London on September 19th.

September 31st
Arrived Raith.

October 4
Have been living pretty quietly here—have arranged a little of my cabinet, which is not at all bad. It amuses me a little.

November 29th
Our political state is serious enough at present . . . enormous taxes, disgust, civil confusion, bankruptcy—perhaps revolution awaits us.

1799

February 19th
He dallied with Madame de Tisizkiewicz in Warsaw who *I love like a rare woman. She has only one eye, the other glass. She has been and is beautiful. She has played her pranks in her day* ***avec eclat***.

On a visit from Warsaw in the spring of 1799 he visited Freiberg and Dresden where he purchased for £40 specimens from Saxon mines—pyrargyrite, cobalt, agates and siliceous stones, a large unworked ruin agate and a large *flos ferri* from Carinthia.

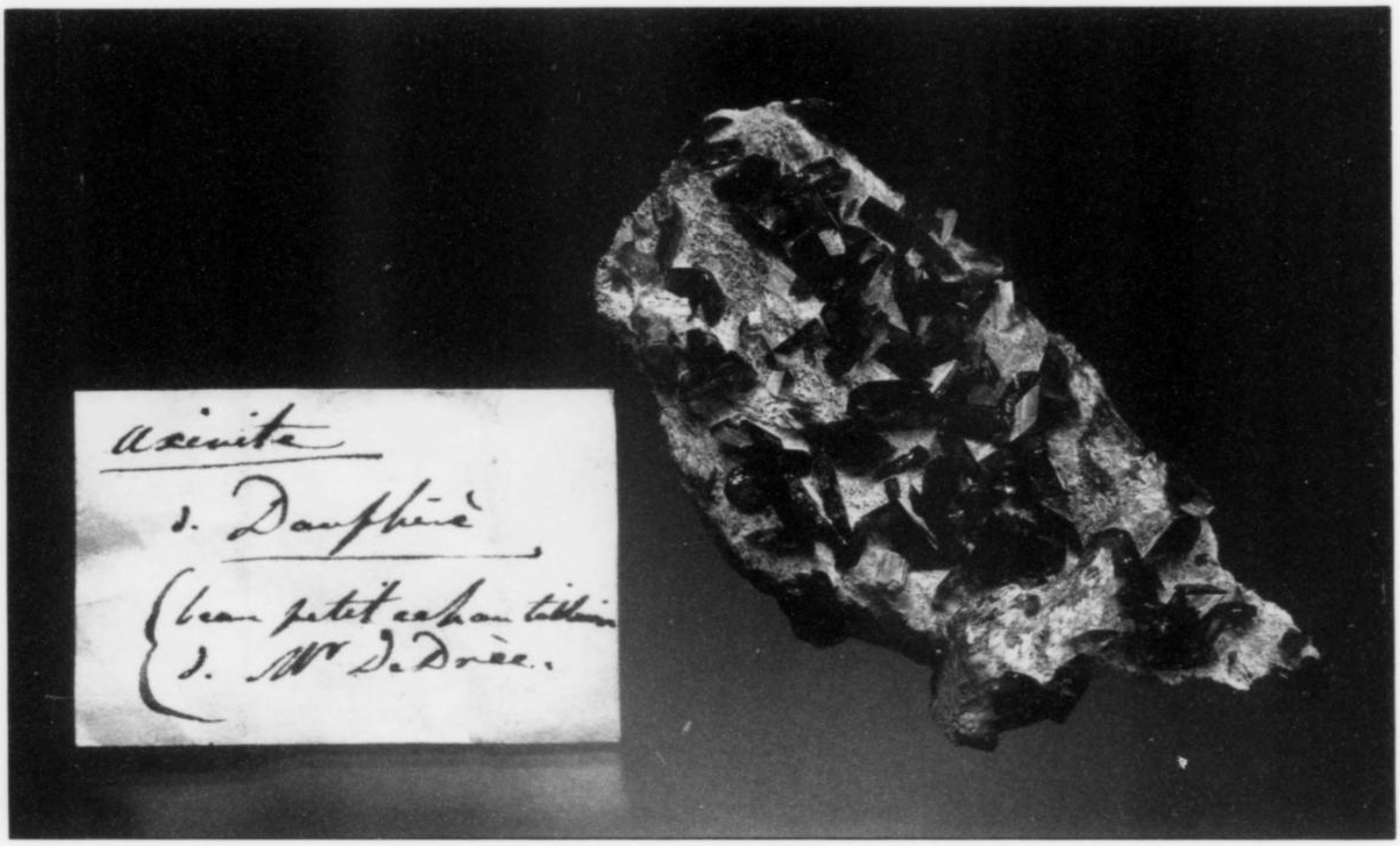

Figure 17. **Ferroaxinite crystals on matrix, 4 inches, from Dauphine, France. Ex Ferguson Collection (purchased from the Marquis de Drèe with three others in Paris in 1803 for £3), now in the H. Obodda collection; photo by Jeff Scovil.**

1798
March and April
Visited Edinburgh etc., and paid his last visit to Raith for some time, leaving on May 1st. He sealed his papers and journals to date in a trunk and *May look at them again in the future. If I am not to open again the trunk they are in, directions are found upon it that they may be committed to the flames.*

May 12th
London, left for Hamburg via Yarmouth on June 27th, arriving July 5th.

August 1st—Magdeburg
My mind revolts at acting as a citizen in support of the present administration and present system of governing. I hate kings and aristocracy and am convinced the world would be much happier without them.

He was again with Henrietta before departing for Warsaw on September 17th, where he stayed for some months making short visits to nearby places.

In the winter of 1799 in Warsaw he purchased many specimens from the copper, lead and iron mines of Siberia including a large native copper at 10 ducats, agates, a mammoth tusk from Siberia at 10 ducats and a superb malachite from Waletiki at 30 ducats, all valued at £40.

November
Freyberg—*visited very often the gallery and the cabinet of natural history—added very considerably to my collection of fossils.*

1800
April
Gausig—*However much I should like to continue uninterrupted the quiet life here, enjoying all the beauties of the season in so quiet and retired a spot, and all the amusements of an excellent library where I indulge my taste of rambling through different subjects—belles lettres, antiquity, mineralogy etc. etc., and a little music.*

Frederick Bulow gave him about 70 minerals including Saxon specimens and others from the North. Valued at £30, they were sent by Bulow to Gausig.

June

Gausig—where he listed various books he liked—*Rousseau, Buffon, Bonnet, Abbé Rogier, Journal de Physique, Journal de la Chemie, Werner, Cronstedt . . . were I sure of remaining uninterrupted for a long period I should establish a more regular course of study than I do at present, when I am conscious of flying too rapidly from one subject to another. Mineralogy, Chemistry and all the branches of Natural Philosophy are chiefly what I like most to dwell upon, but I have likewise around me Rousseau, Tristram Shandy, Voltaire, Pallas etc.*

October

Warmburn, Saxony—*I bought 6 very handsome chrysoprases for a trifle—gave £3-10-0 when they are worth £15 or £20.*

December

Gausig—*My sedentary occupations are the study of Natural Philosophy and especially at present mineralogy which united with chemistry and geology becomes most interesting to the mind.*

1801

January

Dresden—*The morning I occupied very much in visiting different cabinets of mineralogy, my favorite pursuit—and which I prosecute as not only a very interesting study when combined with chemistry, geology and physics—but a true and sure resource for me either when disposed from choice or necessity to live alone, or when I may be an older man.*

The cabinet of Mr. Le Baron Block particularly pleased me from the complete arrangement and suite of specimens which he has got together—as I knew it was to be sold—and got infinitely below its real value—I thought I could not do better than make a so valuable acquisition—especially as in our country we are so far behind in that science which is so much and so universally cultivated at present, as we really do not possess a collection perfect in all its detail. The specimens are not large, but large enough to give most completely the characters.

I was likewise encouraged in making an offer, as I know I was to treat with an honourable man that would not by any means after the bargain was struck diminish the value of the collection. At least I have every reason to believe so, and we must often have some confidence in this world, without that transactions would be greatly diminished.

I am to have it for less than £500.	
Terms are for all:	*2500 Ecus*
in a few weeks to pay:	*500 Ecus*
On receiving the cabinet in the month of June, perhaps at my return from Vienna:	*1000 Ecus*
& the rest a year from that date with 5% interest:	*1000 Ecus*
	2500 Ecus

I had ordered a small collection from Dr. Titius which I must now likewise take and pay for, but I know I can get the double of what I am to pay for it when I am in Britain. I dare say to my father will not blame me for this extraordinary expense. I shall write him again soon (having wrote him a long letter from Dresden) and shall tell him of my purchase. Shall put down the price £600—as then I shall be able to pay for Block's and the small collection of Titius likewise. The half to be paid in the spring when I receive the cabinet with the catalogue, and the other half in a year.

I shall then possess a most complete and distinguished cabinet of mineralogy, and with what I already possess added to it, and what I shall now and then continue to pick up, I believe I shall have a very valuable collection, well worth £12 or £14 hundred pounds.

Figure 18. **Red elbaite, called "sibirite," from the Ural Mountains, 2.2 inches. Purchased by Ferguson for £6. Mick Cooper photo.**

The catalogue of the Block collection runs to 114 large pages, presumably in Block's handwriting, and lists, in varying degrees of detail, the collection as sent back to Scotland in five large wood cases. In all just over 5000 specimens were purchased at a listed price of 4100 Ecus (£685), for which we know he paid Baron Block 2500 Ecus (£500), indicating a discount of some 40%.

Case 1, containing 1213 quartz minerals "of the second class after Haüy" valued at 872 Ecus, has the most detailed list, with prices paid for each item plus names and full locality details.

There were 113 opals at 173 Ecus
414 quartz crystals and amethyst at 317 Ecus

193 agates at 77 Ecus
90 jaspers at 20 Ecus
199 chalcedonies at 164 Ecus
204 misc. quartz at 121 Ecus

Notable Hungarian opals are mentioned at 6 to 18 Ecus each, rock crystal with "metallic fluid inclusions" from Schemnitz at 15 Ecus, a Saxon amethyst with liquid inclusions at 15 Ecus and various chalcedonies at 6 to 9 Ecus each.

Case 2 contained a further 874 minerals "of the second class excepting quartz," and various unclassified minerals, all listed on 37 pages with many deletions and corrections. The majority are under 10 Ecus, but a superb large prism of amazonite is mentioned at 90 Ecus, a beautiful Saxon topaz at 30 Ecus, a garnet from the Caspian Sea at 12 Ecus and crystals of Lapis from Siberia, *very rare and not known by mineralogists*, at 15 Ecus. Unclassified minerals included 28 *Yeux de Chats* (presumably of the type much appreciated by Henrietta), suites of aventurines, obsidian etc. and a *beautiful small specimen, exceptionally rare and very expensive*, of Siberian rubellite at 60 Ecus.

Case 3 contained minerals "of the first class after Haüy." Four hundred and thirty fossils are neatly and comprehensively listed in two different hands, with the subsequent minerals, in Block's handwriting, starting well documented and tailing off in detail and neatness as perhaps boredom sets in. There are 379 carbonates, 326 apatites and fluorites and 200 barites and witherites. All of these are inexpensive, apart from two Bleiberg *Lumachella* stones at 7 and 15 Ecus.

Case 5 and 6 contained 1674 metallic minerals listed on 19 pages. There are few descriptions, but good locality details. Surprisingly, at a time when Siberian platinum nuggets must have been readily available, only two platinum specimens are listed (from Choco and Pinto), both being small grains in glass bottles. There were 67 golds, one from Transylvania at 20 Ecus, 199 silvers (a beautiful Mexican silver was 9 Ecus and one from Freiberg 20 Ecus), 317 iron minerals, suites of 78 cassiterites from Saxony and Bohemia and 35 arsenics, noting that *numbers 30 to 35 are very dangerous and must be handled with circumspection*. Among the remaining metal ores are listed 331 copper, 198 lead and 59 mercury.

Spring—Vienna

Purchases included quartz, agates, Hungarian opals, minerals from the gold mines of Schemnitz and Kremnitz, gold in fossil wood, wulfenites from Bleiberg and a beautiful gemmy salt (value 12 Ecus) from Wielesk which was given to him by a courier named Duff. In all about 200 specimens valued at £54.

June

Wrote my father the other day. By a letter from him the beginning of last month in answer to having told him having bought Block's collection of fossils, he seems not to have liked this extraordinary expense. Taking in all things, and my reduced allowance just at the time of a man's life when he would like to spend what money he well could, either on useful or unuseful objects—it was not the kind of answer I expected—but no help—my allowance will hardly do just now.

On a visit to Carlsbad, Joachimsthal, Annaberg and Freiberg in June and July he purchased from various dealers the large pisolite from Carlsbad which was much admired by Baron Racknitz, at 5 ducats (30 Ecus), stalactites and fossil wood, feldspar crystals which he found in the fields near Carlsbad, quartz, silvers etc. In all about 71 items valued at £22.

July 19th

Carlsbad—*I am just setting off for Dresden. I take the road by the mountains which is execrable but it will interest me, and my little carriage will I hope do its duty. Trickler from Dresden, a good and respectable man, and a mineralogist like myself, is to accompany me. 10 days ago I offered to give him a place in my carriage, which seemed to give him much pleasure, and thus being able to visit Joachimstahl, Annaberg, etc. and return to Dresden by Freyberg.*

The waters (at Carlsbad) I am persuaded have been salutary to me since leaving Dresden. I have been quite free of all spasms and indigestions.

I continue to make small additions to my cabinet, though my finances are low, and bought here a specimen of the deposit of Carlsbad water and a large specimen of Pysolite, which caused much envy from Racknitz. I believe it is one of the finest pieces that has been procured, and becomes daily more rare as the place where they found the pysolite is now built upon and filled up. In passing by Joachimstahl, Annaberg and Freyberg I shall probably procure some specimens for myself as well as for Col. Bigge. Charles Bigge (1773–1849), was an English mineral collector whose collection was donated to the Hancock Museum in Newcastle in 1830.

On my return to Dresden my cabinet, in making out a hurried catalogue, will occupy me not a little.

At Dresden in the summer he purchased a few minerals including a large calcite from the Harz Mountains, and mostly cheaper specimens under 3 or 4 Ecus; also a beautiful specimen of realgar at 30 Ecus, spending £24 for about 60 specimens.

July 25th

Dresden—*We packed up some specimens, but not so great a choice as I should have expected.*

The profit, clear of all expenses, of the mines of Saxony are no great things, but the hands they employ and the population they create in a part of the country that otherwise would have remained forests are their chief advantage certainly to the country.

At Freyberg we went through very distinctly all the operation of the amalgamation, and saw it completely, so I ought now to understand that detail as it is the third time I have seen it now.

Got acquainted with Werner, saw a little of his collection of ***Pierres Fines*** *but in a hurry as he was preparing to go to Carlsbad. Got acquainted with a Dr. Mitchell, a very good mineralogist who has been some time at Freyberg studying under Werner. He has translated the catalogue of the Leskean Museum made by Karsten, which collection of minerals is now in Dublin. He is an Irishman I believe. I likewise found there a young man from near Edinburgh, a Mr. Jamieson, son of a Leith merchant who is studying with great application mineralogy likewise under Werner. He is protected by Dr. Walker and perhaps has some hopes of filling one day his chair. He will be an agreeable acquaintance for me in my mineralogical department when at home. He has already wrote a small treatise on some of the Western Islands but I have not yet seen it.*

After tomorrow I suppose my friend [Henrietta] *will be here. We shall probably stay here a week and then go to Gausig. I mean to occupy myself a good deal with a hurried catalogue of my collection. Must draw at present a considerable sum to pay at least most of the advances she has made for me in my payments to Block.*

September 24th

Gausig—*about a week after our arrival from Carlsbad we came here for a fortnight, then back to Dresden. For about a fortnight during my stay (in Dresden) worked hard with Block and got with difficulty through one of my 5 armoires, and from the time I find it* *is necessary to make out the even hurried catalogue I must renounce all attempts to proceed in it till my return from Vienna in the spring, or Block must go on by degrees with it in winter, and then I shall have it all packed up and sent down the Elbe. To arrange it at home will be a great source of amusement and occupation to get the better or at least counterbalance a little* beaucoup d'ennuie, *however I fear a thousand interruptions will even prevent its being well arranged, and if I have not a good place allotted for it, better to leave till a future period the unpacking of the cases, but all this will depend on future circumstances.*

From Dresden we returned again here, with Bigge who has finished his tour to Venice, and according to promise comes to spend a few days in Lusatia before going home. He is an excellent worthy fellow, and I hope to spend many a day with him. He is likewise now a keen mineralogist. I set him a 'going.

On a visit to Leipzig in October Ferguson purchased 11 minerals including a large diverging, fibrous malachite from the Harz at 6 Ecus, the lot valued at £5.

October

Gausig—*I have not forgot exercise. I am a keener sportsman than I was, and my walks are generally stronger than when at home. Add to all these various varieties of amusement and resource, my taste and now information in mineralogy which probably I should never have indulged had I only travelled after the common routine of things. Certainly I look forward that my taste for that part of Natural History will be a vast resource and fund of occupation for me, not only so long as I can continue active, but when I cease to be so. For the pursuit of mineralogy, which properly embraces chemistry and geology, interests the man that must remain at home as well as the most active traveller.*

1802

May

Ferguson spent May mainly in Vienna, with a short trip to Prague where he purchased 17 minerals for £8 including 3 cobalt specimens, one at 12 Ecus, a proustite from Joachimsthal, garnets, mica and a sphene from Bohemia.

Purchases from Stephani in Vienna included two Transylvanian golds at 45 Ecus and 18 Ecus, plus five further golds. A large mass of iron meteorite found by Pallas in Siberia had found its way into the Imperial cabinet in Saint Petersburg, from there to Prince Poniatowski who sold it to the Viennese banker Mr. Van der Null, who then exchanged it with Stephani, who in turn sold it to Ferguson for 48 Ecus. Various silvers and agates including a beautiful silver from Potosí cost 30 Ecus, and a malachite with black dendrites the same price. In all he spent £80 with Stephani.

Vienna—*My mineralogy nearly in status quo. Some few augmentations. Some handsome specimens of gold. A veritable specimen of the mass of native iron found in Siberia by Pallas. Several very handsome snuff boxes added to my collection—mostly presents from my friend.*

Also when in Vienna Ferguson recorded that Baron Block had purchased for him from the Swedish dealer Nepperschmidt about 74 mostly Swedish and Norwegian minerals at 86 Ecus (£14).

June 19th

Gausig—*We return to Dresden in a week for 10 days. I am sorry at any kind of interruption here, but it is likewise necessary for me to be there to get a little more of my cabinet of mineralogy packed up.*

Block has been lazy and has made little progress with the catalogue. However, I shall be able to have another box packed up and to send off with these two boxes the other boxes containing all the additions I have made.

My collection will undergo a complete new arrangement now since I possess Haüy's work. He opens up a new field of the most interesting and new views for mineralogy. I study a little of him everyday and endeavour to make myself well acquainted with his theory on the crystallisation, though I fear the geometrical part is too deep for me. I shall have a very complete and valuable collection when all together and when a little arranged. It will be a great resource for me when at home, as it is most likely that I shall always endeavour to keep free of all public occupations and preserve my liberty and independence, be master of my own time and pursuits.

August 12th

Gausig—*The fortnight we stopped in Dresden I was most completely occupied in packing up my cabinet and succeeded in getting it all packed up and sent to Mr. Von der Brehling to send down the Elbe. It is a great business off my hands. God knows when I may get it all unpacked and put in order at Raith.*

Frickler came with us to spend a month. His society is most agreeable and instructive. We made a great collection of the variety of granites etc. here and we went over together again all the principles of music and its composition.

Returning to Vienna in the winter of 1802, Ferguson acquired 21 specimens including a rough piece of lapis lazuli at 20 Ecus. This, together with 12 specimens purchased at a sale for 14 Ecus and part of a crystal model set total 86 Ecus (£14).

1803

In February and March 1803 he made considerable purchases. From Mr. Globig he bought a fine collection of 34 Siberian minerals totalling 600 Ecus (£100). The group includes beryls in rock at 65 Ecus, topaz at 60 Ecus, copper, a malachite at 28 Ecus, and three pieces of crocoite at 120 Ecus. He spent 405 Ecus (£91) on 105 minerals (with various dealers, de Penisch, Rodmond, Louvoy and Geisler) including Saxon silver at 15 Ecus and a Greenland cryolite at 24 Ecus. From Mon. Le Conseiller d'Uffel his acquisitions include two Kongsberg silvers at 25 Ecus each, Freyberg silver at 20 Ecus, a suite of Dauphiné quartz and a very large pyrargyrite at 90 Ecus. These totalled 741 Ecus (£100) for 100 minerals, the bill to be paid in *agricultural items*, though there is no indication as to what these were.

Finally, on a visit to Hanau in April he purchased about 30 specimens for £11 including a collection of agates, Luneburg boracite, Bohemian garnets at 1 Ecu for 1 pound weight and a steatite after quartz at 9 Ecus, found near Bareuth, described as *very rare and singular.*

May 22nd

Paris—*Since my arrival here have been most singularly active, have seen as much of Paris and as much of the society as many that have been here many months. At present we are at last at war. I have still some faint hopes that it will be terminated in negotiation and amicably settled.*

Despite the unsettled political situation he managed to spend £30 on 12 groups of minerals including a suite of Montmartre specimens at £5, Fontainbleau sand-calcite crystals at £10, agate and other boxes, Swiss adularia and kyanite.

May 24th

A strange, unpleasant and unexpected situation we Britons are all in here, obliged to declare ourselves prisoners of war on our parole. This violent act of the government is said as reprisals for the ships taken by England before the declaration of war.

General Junot ordered the British, with some exceptions, to go to Fontainbleau, but as Ferguson had many friends in Paris, *I don't doubt but I shall have permission to stay in Paris.*

October 29th

The Countess Schall had to return to Germany, and he tried to get permission to leave Paris for 6 months in Germany to be with her. Most of his friends had departed, and he bemoaned the fact that he had been left in the lurch in Paris. However—*hope still remains. My request is in a fair way of being again presented favourably to Berthier* [Alexandre Berthier, Prince of Neuchatel, was Napoleon's chief of staff and had served with Lafayette in the American Revolutionary war] *and I should think that in the course of a week I should know something decided about my fate. If my request is granted I shall rejoice to get away for several months (even remaining a prisoner) in such a critical period as this. If not, I shall endeavour to occupy myself with advantage, follow the course of chemistry of Vauquelin, the lectures of the worthy Sage, and the course of Charles' experimental philosophy.* Nicolas-Louis Vauquelin (1763–1829) was the French chemist and discoverer of Beryllium and Chromium. Balthazar Sage (1740–1824) was the founder of the Royal School of Mines in Paris. Jacques Charles was the French physicist who had experimented with gas balloons. *The spectacle now and then of my resources at home, music etc., and the museum furnish amply my means. In a moment I may be sent to some garrison town, there to spend a sad dull existence.*

November 5th

After all my hopes and assurances that I have had to have permission to go to Germany on my parole, I am now told that my request is refused. All my friends gone, imagining I was to follow them soon.

November 13th

Lady Elgin arrived last night from Pau.

December 3rd

A general measure against the English prisoners has taken place, and orders issued for all here to be sent away without any one exception to Verdun.

He tried to stay, citing the chief members of the Institute as his supporters, and by December 13th was granted an extension to his stay in Paris.

Now I am more at my ease. The prolongations granted are very few indeed. I find myself therefore particularly distinguished, and the more so, as a man of letters. My attestation in my favour was signed by Bertholet, Fouserery, Vauquelin, Haüy, La Céféde, Sage, Devon. I might have had many more, but such names were quite enough. Going on very comfortably here, occupied and interested with the hours at Vauquelins, Charles and Sage etc.

1804

January 25th

Ferguson was granted another 2 months in Paris, and it was during this time that he formed a passionate relationship with Lady Elgin.

The president of the Royal Society in London, Sir Joseph Banks (1743–1820), who had circumnavigated the world with Captain Cook, wrote to the French astronomer Jean-Baptiste Delambre on January 30th: "There is among the English detained in France a young gentleman, Mr. Robert Ferguson, whose pursuits are very much directed to scientific objects. He is not yet a fellow of the Royal Society, but will certainly be chosen into that body as soon as he can return home. If his liberty could be obtained, it would be considered here as a great favour to scientific men, and a great compliment to the Royal Society."

May 1st

I am now on my road to Gausig. Left Paris early this morning. I have got at last my passport for Germany by an application of the 1st Class of the Institute to government, owing to a letter wrote to them by Sir Joseph Banks in my favour. I go towards her [Countess Schall] *with the most heart felt satisfaction. My parting with* [Lady Elgin] *was become absolutely necessary for the present. I cannot enter with any detail of my last four or five months at Paris. My feeling for* [Lady Elgin] *was the leading feature of my actions. I followed courses of Vauquelin, Charles and Sage. I have got acquainted with the most celebrated men of science in Paris. My activity to combine all my pursuits and keep up the various different sets of acquaintances and be so much of the day with* [Lady Elgin] *required an activity which belongs to me in a very great degree.*

I am perhaps the only one who could have produced a passport like mine in these times.

He travelled to Gausig via Karlsruhe, Frankfort and Dresden, arriving at Gausig on May 19th, leaving on August 12th. He sailed from Tonningen to Hull on September 20th and arrived at Raith on October 13th.

1805

March 31st

It is now four months since I opened this book. I shall not attempt to go over all the details of my life here since then. In general it has been as I expected. I have gone through a good deal of duty, seen most of my acquaintances, balanced acts, and am now no longer a late returned stranger. I have arranged my cabinet which may now remain as it is without exciting in me much more interest for many a day.

He then travelled to London, returning to Raith in August. In London he went to Court, joined the right clubs and met as many influential people as he could. *Hitherto I have been dwelling on the great circles of the London world. Other branches of the society I did not neglect either. I cultivated the acquaintance and friendship of Sir Joseph Banks, and became a fellow of the Royal Society. Am acquainted with the most celebrated men of letters in London and have the means of cultivating their society when more convenient. I know Hatchett very well, am a proprietor of the Royal Institution, Davy, Chenevix, Sir Charles Blogden etc. etc. I have seen most of the best cabinets, intimate with Charles Greville, Bournon, Philips, Mr. Knight, Mr. Hope, Sir Harry Englefield etc. for the fine arts.*

1807

December 22nd

Lord Elgin divorced his wife and was awarded damages of £10,000 by the jury from Robert Ferguson.

1808

April 20th

Robert Ferguson and Lady Elgin married at Blexholm Church.

1808

I attended regularly the Geological Society then in its infancy, the Royal Society etc. Intimate with Humphrey Davy, Wollaston etc.

He was vice-president of the Geological Society, and an active member of the council from 1810. He ceased writing his journals towards the end of 1810. On October 31st of that year his father died and he inherited the family estates. The remainder of his life was spent running these estates in Scotland, in politics—he was the Member of Parliament for Kirkaldy for many years—and in scientific pursuits, though there are almost no records of any further additions to his collection.

Table 1. **Purchases between 1796 and 1803 sent back to Scotland.***

1795

Berne—£20

A complete collection of St. Gotthard minerals, bought from the mineral dealer Burrel.

1796

Florence—£20

A suite of stones from Arno. Antique worked stones. Lapis Lazuli. Egyptian and other agates, Elba minerals. In all about 70 specimens.

1799

Freiberg and Dresden—£50

Mainly specimens from Saxon mines. Pyrargyrite, cobalt, agates and siliceous stones. A large unworked ruin agate. Large flos ferri from Carinthia. Agate boxes bought at a fair in Leipzig. Many specimens given to Ferguson

Warsaw—£40

Many specimens from the copper, lead and iron mines of Siberia. A large native copper of 10 ducats. Agates. A mammoth tusk at 10 ducats and a superb malachite from Waletiki at 30 ducats.

1800

Given by Frederick Bulow—£30

These were sent by Bulow to Gausig (where Ferguson spent most of 1800), and included *Saxon specimens and others from the North.* In all about 70 specimens.

1801

Dresden—£500

The large collection of around 5000 specimens purchased from Baron Block, plus some minerals from Titius.

Vienna—£54

Quartz, agates, opals from Hungary. Minerals from the gold mines of Schemnitz and Kremnitz. Gold in fossil wood. Wulfenites from Bleiberg. A beautiful gemmy salt (value 12 Ecus.) from Wielesk, given to him by a courier named Duff. In all about 200 specimens.

Carlsbad and at Joachimstahl, Annaberg and Freiberg—£22

Purchases from various dealers including a large pisolite from Carlsbad at 5 ducats (30 Ecus.), stalactites and fossil wood. Feldspar crystals which he found in the fields near Carlsbad. Quartz, silvers etc. In all about 71 items.

Also a collection in a wood box of 400 Freiberg minerals after an arrangement of Werner.

Dresden—£24

5 minerals including a large Calcite from the Harz Mountains—£3.

Mostly cheaper specimens each under 3 or 4 Ecus., but number 56 is a *beautiful specimen of realgar* at 30 Ecus. About £21 for 60 specimens.

Leipzig—£5

11 minerals for 32 Ecus. including a large diverging, fibrous malachite from the Harz at 6 Ecus.

1802

Prague—£8

17 minerals including 3 cobalt specimens, one at 12 Ecus, a proustite from Joachimstahl, garnets, mica and a sphene from Bohemia.

Vienna—£67

24 minerals purchased for £53 from Stephani in Vienna included two Transylvanian golds at 45 and 18 Ecus plus 5 further golds. The large iron meteorite from Siberia at 48 Ecus. Various silvers and agates including a beautiful silver from Potosí at 30 Ecus and a malachite with black dendrites also at 30 Ecus.

Minerals purchased for Ferguson by Baron Block from the Swedish dealer Nepperschmidt—about 74 mostly Swedish and Norwegian minerals—totaled 86 Ecus (£14).

Vienna—£14

21 specimens for 72 Ecus. including a rough piece of lapis lazuli at 20 Ecus.

12 specimens purchased at a sale in Vienna cost 14 Ecus. Another purchase was part of a crystal model set, though no price is mentioned.

1803

Dresden—£291

Purchases from Mon. Le Conseiller d'Uffel included 2 Kongsberg silvers at 25 Ecus each. Freiberg silver at 20 Ecus, and a very large pyrargyrite at 90 Ecus. These totaled 741 Ecus (£100) and the bill was to be paid in "agricultural items," though there is no indication as to what these were. Also a suite of Dauphiné quartz. In all 100 minerals for £100.

Also purchased in Dresden from various dealers including de Penisch, Rodmond, Louvoy and Geisler were 105 specimens totaling 405 Ecus = £91. These included Saxon silver at 15 Ecus and a Greenland cryolite at 24 Ecus.

A fine group of 34 Siberian minerals purchased from Mr. Globig totaling 600 Ecus (£100), included beryls in rock at 65 Ecus, topaz at 60 Ecus, copper, a malachite at 28 Ecus, and three pieces of crocoite at 120 Ecus.

Hanau—£11

About 30 specimens including a collection of agates. Luneburg boracite. Bohemian garnets at 1 Ecu for 1 pound weight and a steatite after quartz at 9 Ecus, found near Bareuth, described as *very rare and singular.*

Paris—£30

12 groups of minerals including a suite of Montmartre specimens at £5. Fontainbleau sandstones at £10. Agate and other boxes. Swiss adularia and kyanite.

*Other purchases included wood crystal models after Haüy (some of which had been sent with some bronzes with Lord Elgin's possessions) and a small box containing porcelain models after Haüy, also some *rare and expensive* minerals and larger minerals, totaling £82, as well as collections of rocks and granites self-collected around Gausig. There were various bronzes and books, an instrument invented by Regnier to test the strength of man and animals, another to test the quality of gunpowder, and the lock of a gun, with a protective device against rain and accidental firing, also by Regnier.

1840

December 3rd

Robert Ferguson died at his home in Portman Square, London, on December 3rd 1840. His obituary in *The Globe* reads:

> It is with feelings of strong regret that we have to record the death of Mr. Ferguson, MP for Kirkaldy, another of those steady friends of liberty who, like the late Lord Holland, directing his political course by the principles of Mr. Fox, has pursued it with undeviating consistency during a long public life and parliamentary career.
>
> The death of such a man as Mr. Ferguson is truly a national loss for Scotland. For although he was not a speaker in the House of Commons, he was—what can at any time be ill-spared, and at present will be greatly missed—a long-tried and highly estimated example of undeviating consistency, blended with indefatigable industry in his attention to his parliamentary duties, the effect of which was extensively beneficial in its influence on those just entering the arena of public life.
>
> In private society Mr Ferguson's death will have caused a vacancy which will be long before it can be adequately supplied. Many will long look to the now empty place he was wont to occupy, and will remember how it was once filled. To kind, unaffected, but polished manners, Mr F. united a heart which could respond to every generous emotion, reciprocate every warm affection, while it could sympathise with the distresses of his poorer fellow-men, and prompted him to relieve their distresses and assist their exertions.
>
> Mr. Ferguson possessed a highly cultivated taste in the arts, and science was proud to recognise him a not unworthy son.
>
> By those who were his more intimate friends and associates his memory will be cherished in connection with the recollection of many acts of kindness. To his tenantry he was attached by the strongest ties of grateful esteem.
>
> This generous, open-hearted, and highly honourable man has descended to the tomb; to which he will be attended by the tears and blessings of his family, and his numerous tenantry and dependants.

***Table 2.* Ferguson specimens in the Russell Collection at the Natural History Museum in London.**

Millerite—plate 158 in Sowerby's *British Mineralogy*—given to Russell by Viscount Novar

Galena from Dufton—an Allan specimen of before 1816. Russell refers to the Ferguson Collection catalog, this specimen (with red circular label) being number 9

Chalcopyrite (2 specimens)

Pyromorphite

Beryl—plate 421 in Sowerby's *British Mineralogy* (the smaller specimen)

Garnet

Topaz—mentioned in Sowerby's *British Mineralogy*, plate 163

Analcime

Prehnite

Caledonite—on display in main collection

Leadhillite—on display, noted as being from Viscount Novar

Lanarkite

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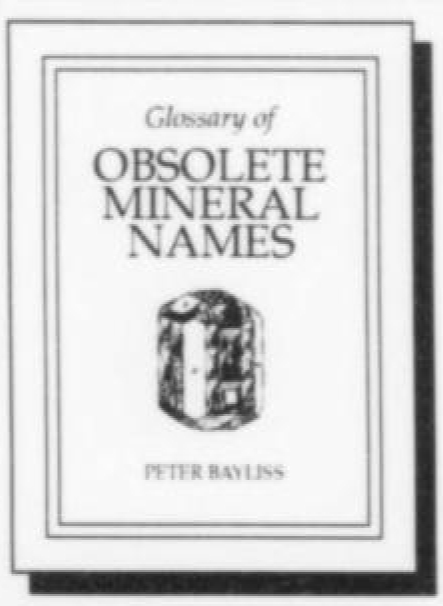

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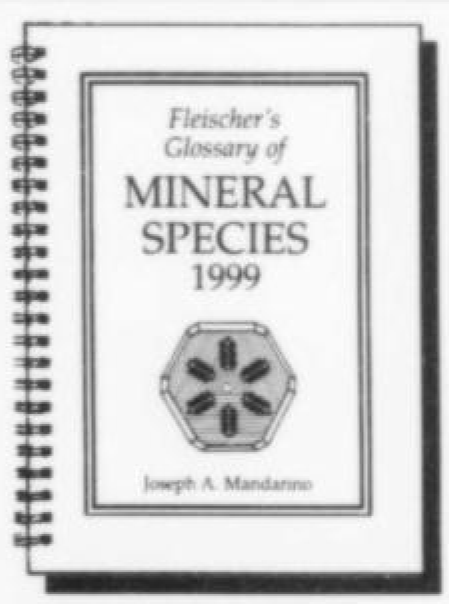

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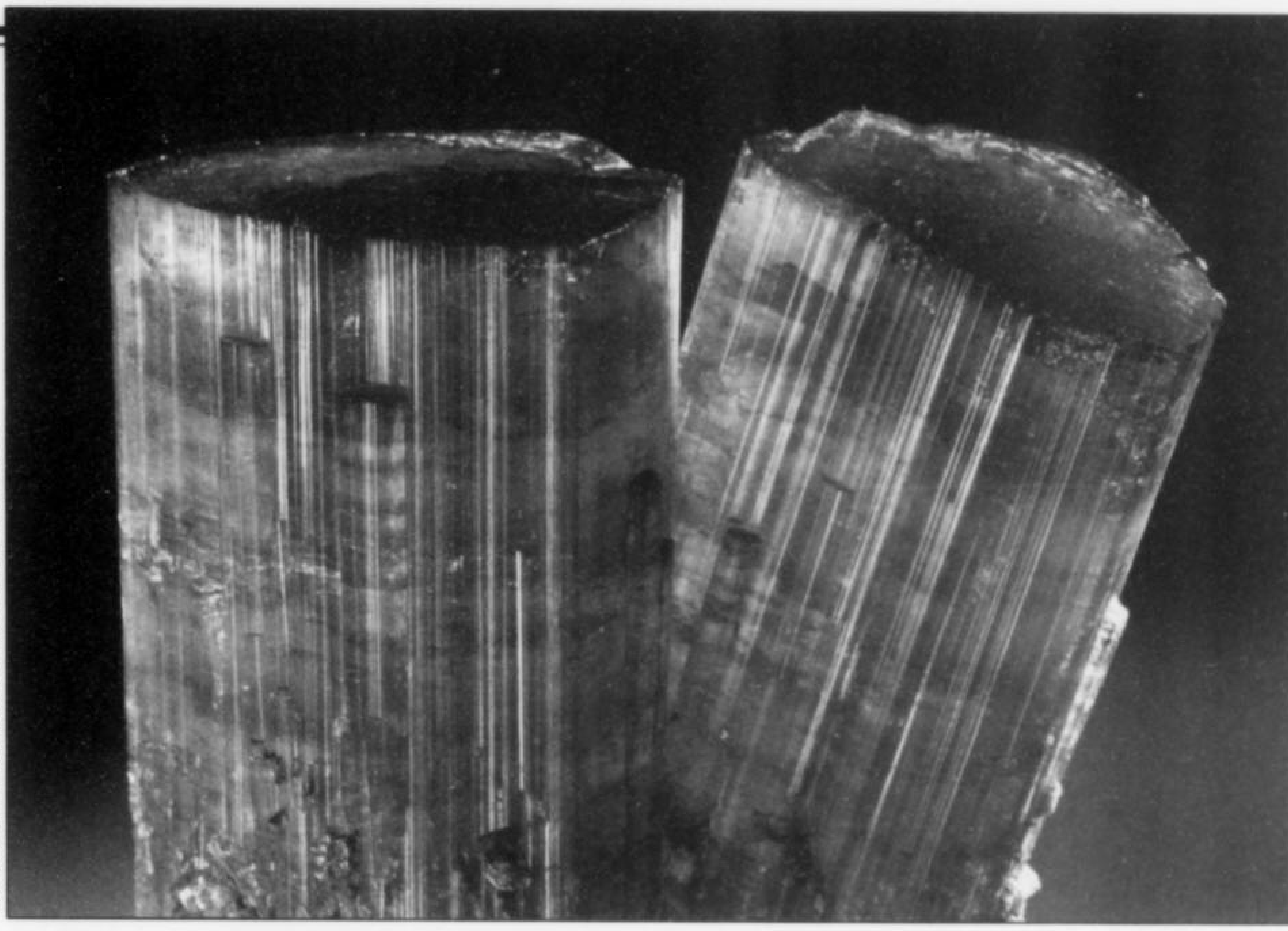

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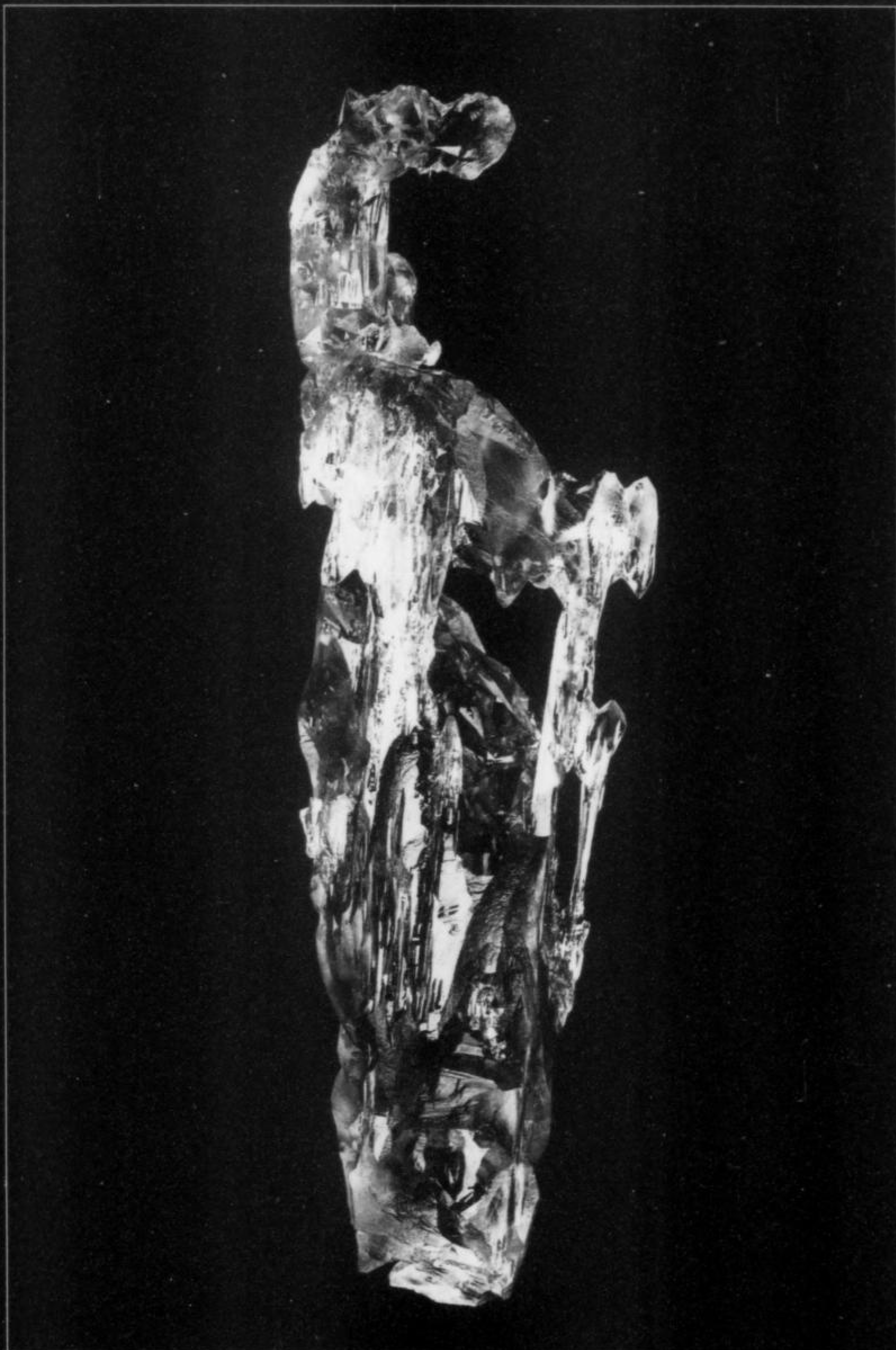

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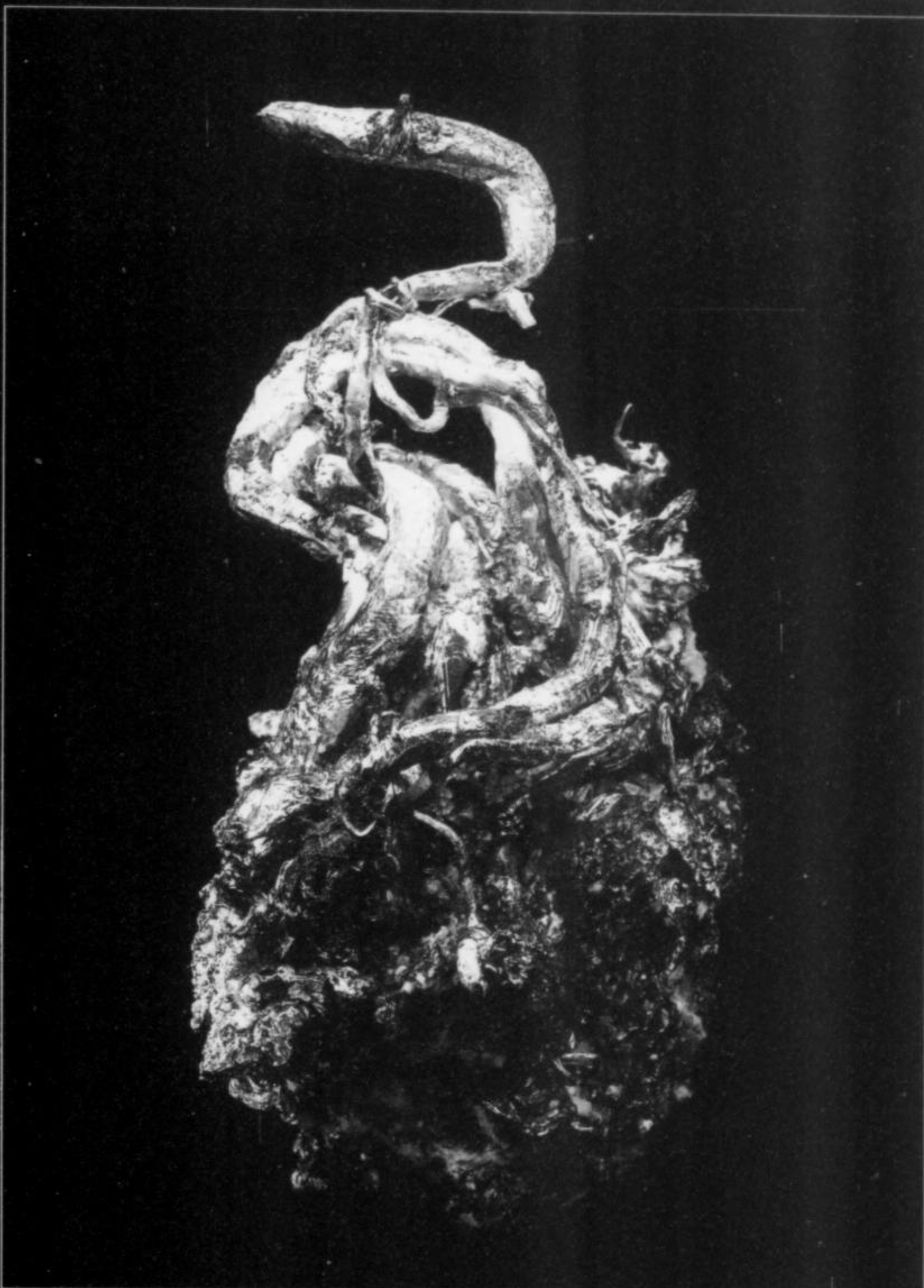

JEFF SCOVIL

Silver, 15 cm, Kongsberg, Norway. Acq. 1999

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Letters

GALLERY REVIEWS

Just got the new MR—I was thrilled with John White's Guest Editorial ["Curators in Glass Cages"] and even more so with his "Gallery Reviews" ["Factors in Assessing a Museum Gallery"], and the letters regarding the British Museum's new exhibition—good for you!

This letter is prompted not only for kudos, but also to add a bit of information regarding the last paragraph in "Gallery Reviews" ["Finally, and I have yet to find this in any museum, is there a contact phone number or address provided within the gallery which one may use if one would like to make an inquiry about something seen there, unseen there, or would simply like more information about minerals?"].

The *old* mineral hall in the British Museum, all the way at the end near the entrance to the Meteorite Hall, has a bell with the words, "Enquiries, Please Ring." After ringing and waiting a while, one is soon greeted by a member of the curatorial staff who will be of tremendous help. As one of them told me, "Of course, that's what we're here for!" They are willing to open the cabinets under those tall vitrine-like desks; it is wonderful to see that storage. First they unlock the doors, revealing three deep drawers, fitting tightly to keep out dust; and when they pull these out, there is a glass cover that slides back. Only then can they lift out the specimen. Talk about 19th-century workmanship and thoroughness!

About ten years ago, while on a business trip, I visited the British Museum to look up their specimens of susannite. I had recently purchased a fine thumbnail-size specimen myself, from Tiger, Arizona, and wanted to compare it to the museum's specimens from Leadhills. Unfortunately, however, there was not a single susannite on exhibit: *all* had been replaced by labels reading "Temporarily Removed"! So I rang the bell, and a very nice gentleman appeared. He confirmed what I told him about the susannites being off exhibit (though he had not previously been aware of it). As it was already late afternoon, he asked if I could come back the following afternoon. When I returned the next day and rang the bell, he came out and took me to an office where he had a microscope on the table, and next to it every Leadhills susannite in the museum's collection! I was invited to study them at my leisure. I do not have to tell you how impressed and grateful I was.

So, you see, there is at least *one* place where you can get answers. The inquiry desk of just about any museum, by the way, will give you departmental phone numbers or call a curator for you. The number need not be mounted on the exhibit hall for every Tom, Dick, and Harry who has a stupid question (usually along the lines of "What is it worth?"). If someone is truly curious he will find a way to get some answers.

Kay Robertson
Los Angeles, CA

OF RARE MINERALS AND MUSEUM LABELS

I am really impressed! The cover of the May-June 1999 issue showed a picture of two intergrown minerals (andyrobertsite and calcioandyrobertsite) in the *only known specimen*.

I collect stamps as well as minerals, and my exhibition collection consists of 20 stamps, each of which is known in quantities of 10 or less examples. So when I read about collectors gathering five or ten flats of some so-called "rare" mineral, I say "ho hum." But a mineral known from only a single specimen is special. Hurrah for genuine rarity!

In reading the Freilich Issue [vol. 31, no. 1] I was reminded of the difference between museum exhibits of paintings and minerals. Art museums supply labeling as to the name of the artist, the date, sometimes the medium used, and frequently also some additional interpretation and background. Mineral museum labels typically carry only species and locality, sometimes also with a note on the composition. Why do exhibits of scientific specimens provide less information than exhibits of artworks? Something is wrong.

Henry Fisher
Columbus, OH

Regarding the andyrobertsite specimen, I have now seen another identified andyrobertsite. It is just a tiny, pale blue fleck on matrix, but it appears not to be from the original specimen pictured. Rob Lavinsky (The Arkenstone) had it at the Tuscon show. Ed.

ANDYROBERTSITE AGAIN

What a pleasant surprise to see my former specimen (the andyrobertsite) on the May-June 1999 cover! What first caught my attention and interest in this piece was the electric blue color. Having shown it to a number of advanced collectors and also a professional mineralogist, all of them bewildered as to its identity, I determined to do something about it. Well, it sat undone for about five years, but when I finally came across the specimen again I sent it to Excalibur Mineral Company for a rough analysis.

Several people have enquired if there are any more pieces available, but to my knowledge it was the only specimen of its kind in the Richard Baughart collection. Five or six small, 1 to 2-mm fragments were sent to Excalibur originally, and these were subsequently sold to various collectors after andyrobertsite was confirmed but before calcioandyrobertsite was known to be present as well. Two pieces of official type material were deposited at the Royal Ontario Museum and the Smithsonian Institution. Those are the only disbursements that I am aware of, all of them taken from the one original specimen. I hope this information is useful to species collectors.

It is truly a delight to see new mineral species coming to light which are well-crystallized and beautifully colored.

Stephen M. Kuitems
Bernardsville, NJ

FREILICH ISSUE

We just wanted to congratulate you on the very nice Freilich Issue [vol. 31, no. 1], again one of the great issues of the last few years. The photographs are superb and the introduction about Joe Freilich and his collection is very interesting.

Paul & Regina Tambuyser
The Netherlands

Really liked the Freilich Issue (change of pace). But my vote for recent best specimen in MR is Wayne Thompson's aquamarine (vol. 31, no. 2, p. 188), which must have been conceived in heaven!

Peter Bancroft
Fallbrook, CA

Continued on page 449

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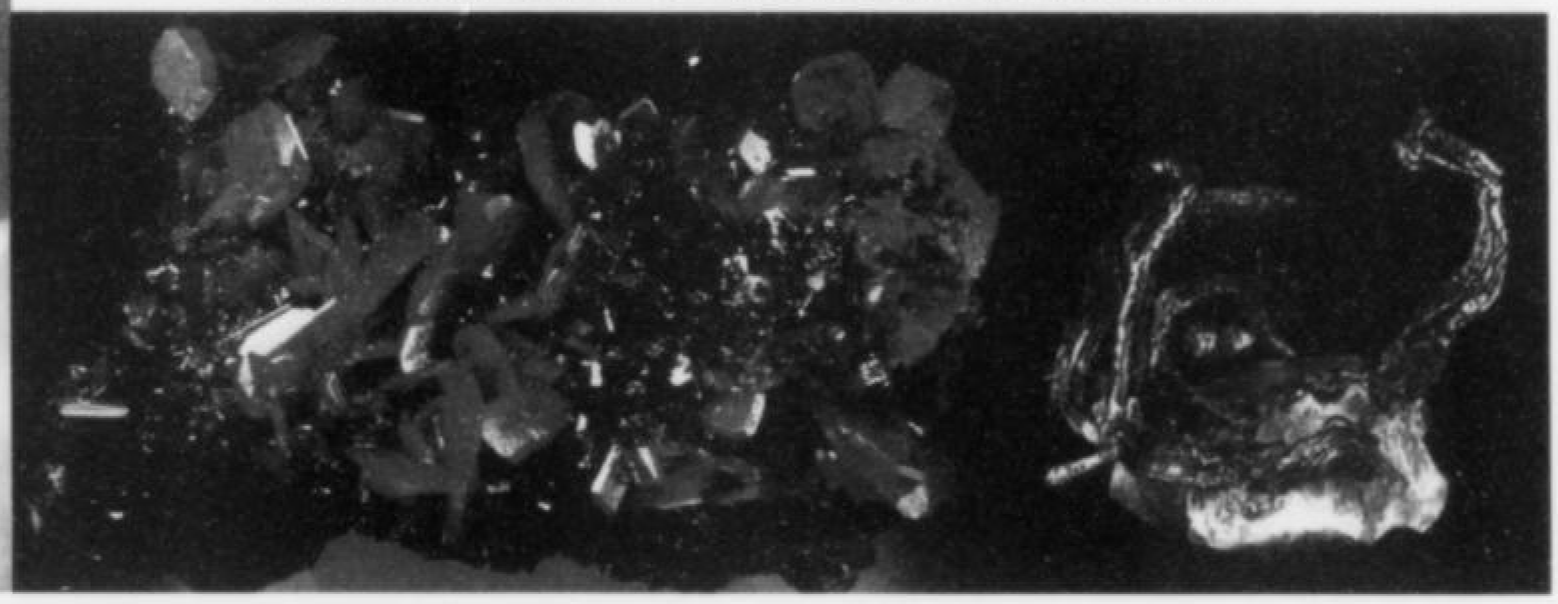

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I have enjoyed the *Mineralogical Record* for years. It has helped set a standard for information and collecting. The exposure that it gives to us armchair collectors is great. I get to see minerals from collections that I would, under normal circumstances, not have access to.

Danny F. Jones

It was great reading about Dave Wilber in the Freilich Issue. He was, and still is, my idol in the mineral world. I first became aware of Dave when he judged the mineral displays at the Del Mar fairgrounds around 1963. He criticized my display because I misspelled sulpher (oops!). I wondered who this nitpicky person was. When I saw his display at the Pasadena Show some time later, I realized that he was, and still is, an expert on minerals and what distinguishes the elite from the norm.

I recall a lecture he gave about his collection many years ago. Dave stated that "these minerals belong to everybody, I'm just the curator." Thanks Dave; so what did you do with my phosphophyllite?

Al Ordway
Hesperia, CA

I received my January-February 2000 issue today. Bravo! Simply Bravo!

Ben Speed
Parker, CO

Thank you so much for the wonderful issue featuring the Joe Freilich collection. Both the superb specimen photos and the account of the passionate enthusiasm in building a premier collection in record time inspires us all, and will inspire new collectors, who will readily understand the beauty and importance of extremely fine minerals. This issue will help set a standard of excellence in modern collecting.

The Freilich Issue was a welcome variation in the *Mineralogical Record*'s usual format, reminiscent of the catalog supplements published some years ago for the Carnegie and Houston museums. In fact, we would enjoy seeing such catalogs of other super-fine private collections in the future. Perhaps the next one could focus on a European collection, so that we can see what aspects of collecting are considered of utmost importance in other countries.

This was a wonderful visual feast comparable to any $70 "coffee-table" book. Again, Bravo for a landmark issue.

Keith & Mauna Proctor
Colorado Springs, CO

Anyone looking at the [Freilich Issue] would certainly enjoy the pictures tremendously for the quality of the minerals, the photography, and the printing. A few might puzzle at the introductory articles [and be] concerned about the possible motivations and exchange of considerations behind the appearance of this expensively illustrated catalogue of a recently assembled mineral collection whose future disposition is unclear. . . . Promoting a mineral collection is distinct from promoting mineralogy.

J. Alex Speer
Mineralogical Society of America

Some people seem concerned about the nature of the "arrangement" involved in publishing the Freilich Issue. Mr. Freilich paid the portion of the cost of the issue which was in excess of the cost of a regular issue. We thought this was a good deal for subscribers. No other "considerations" were involved, and as of today (April 22) the collection has not been put up for sale, nor does Joe say he has any plans at present to sell it.

As to promoting a collection vs. promoting mineralogy: "promotion" of the collection is a natural side-effect in that anything published about is also thereby "promoted." This is unavoidable. It is certainly possible to "promote" a collection and also, through it, to promote mineralogy and inspire a love of minerals. Ed.

As a spokesman for the underdog, I must say that the Jan.-Feb. issue was another major insult to the grass roots group of collectors. As much as I love MR, you crossed the line bowing down to money rather than the hobby itself.

The first turn-off was your attempt to place Mr. Freilich in the same category as Bement, Canfield and Roebling. What this issue represents is a guy who hires a well-known connoisseur to go out and buy the best specimens on the market. That isn't collecting, it's acquiring! Just having money does not make a person one of the great mineral collectors. Why did MR choose to be the vehicle for this guy to show off his newly acquired minerals?

That brings me to the March-April issue. It reminds me of the old *Mineral Collector* magazine, where Mr. Chamberlain finally had to step in and put an end to the bickering among advertisers. I pay my subscription to learn about new minerals and localities, not who has the most money and certainly not what people's opinions are. Worse yet, John White even added an article on how you too can critique a museum gallery. Sure, he's qualified to do so, but for MR to publish it just proves my point: MR is becoming too posh. You need to find a balance, and not leave the rest of the collecting community out of the picture.

J. Roger Mitchell
Media, PA

Joe Freilich and Dave Wilber haven't been at it for several decades like Roebling et al. ultimately were (and in that sense don't compare), and the collection is admittedly not as well rounded as decades of acquisition could make it in the future. But their work at elite collection-building is part of the same tradition as the earlier great collectors. They simply wanted to share their enjoyment of those minerals with our readers, and were willing (as with the earlier Carnegie Museum and Houston Museum catalogs) to pay the extra printing expense of doing so. It was a gift to readers, costing much more to produce than subscriptions could pay for. It was not intended as a sociopolitical statement. The assumption was that all collectors might enjoy looking at some nice specimens. Ed.

TAJIKISTAN HELIODOR

I feel it is time to rein in some of the reckless and irresponsible speculation about the nature of the color of the wonderful heliodor beryls from Tajikistan. Many collectors (myself included) were skeptical when we first saw these lovely, intensely yellow crystals. But I, at least, am no longer uneasy about them. Unfortunately, there are still some highly regarded collector/dealers who are claiming, without evidence, that the crystals have been treated.

I have been interested in these crystals ever since I first saw them over three years ago. I have been in communication with two of the major sellers, who claim to be quite close to the source of the crystals, though they have not actually visited the highly inaccessible locality itself. They are convinced that the color is natural, and that the Tajikistani miners do not have access to irradiation equipment.

The worst of the negative theories is that these are actually Pakistani aquamarines that have been treated, a claim which makes no sense at all. The character of these crystals (color aside) is quite different from most Pakistani beryl; it has a distinctive appearance. Besides, who would take fine aquamarine and purposely turn it yellow?

The self-styled experts who are cynically denigrating these fine specimens in the absence of proof should back off. Their slander is adversely affecting the market for these legitimate specimens, and that is most unfair. Until they can support their claims, they should keep their opinions to themselves.

John S. White
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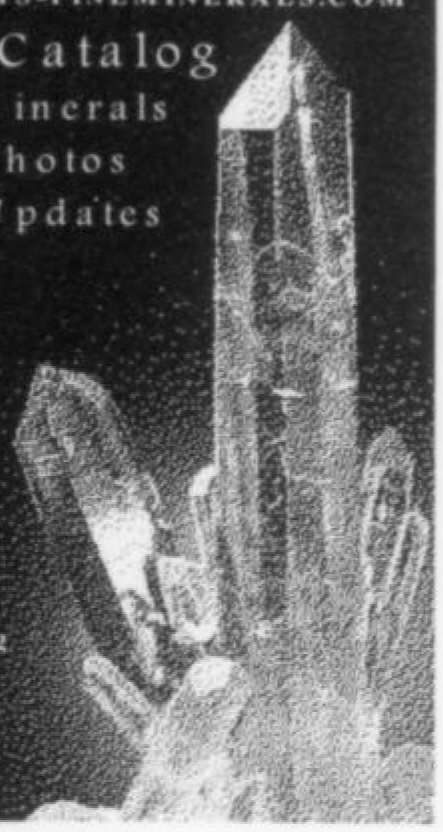

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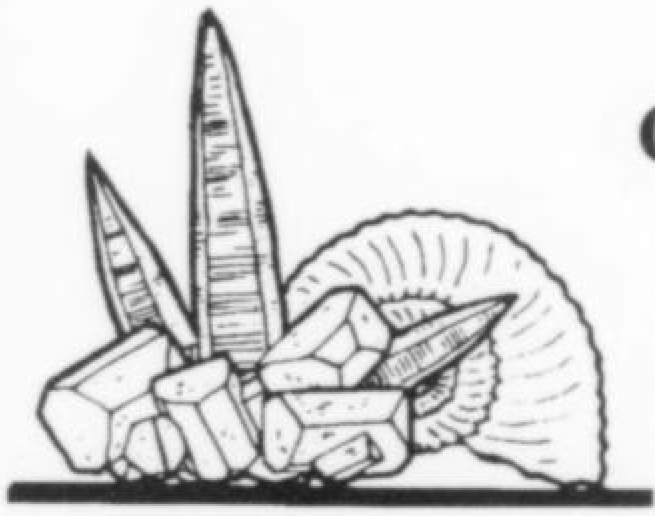

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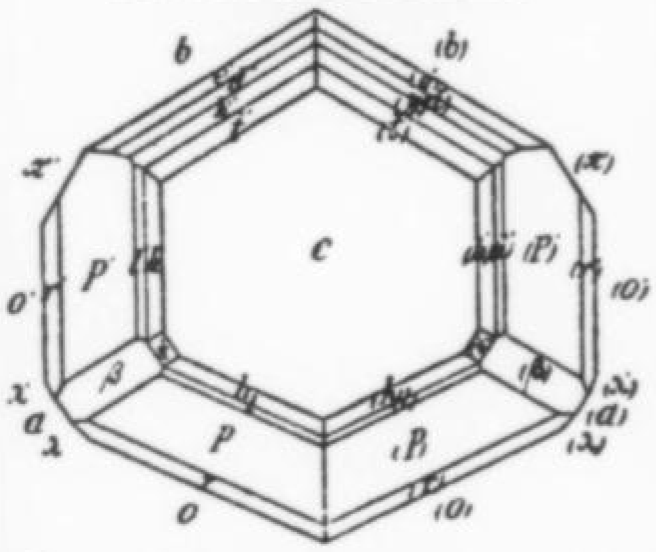

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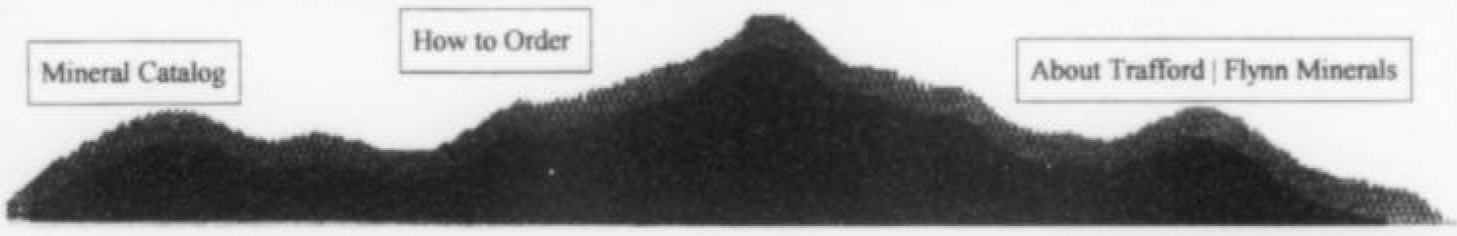

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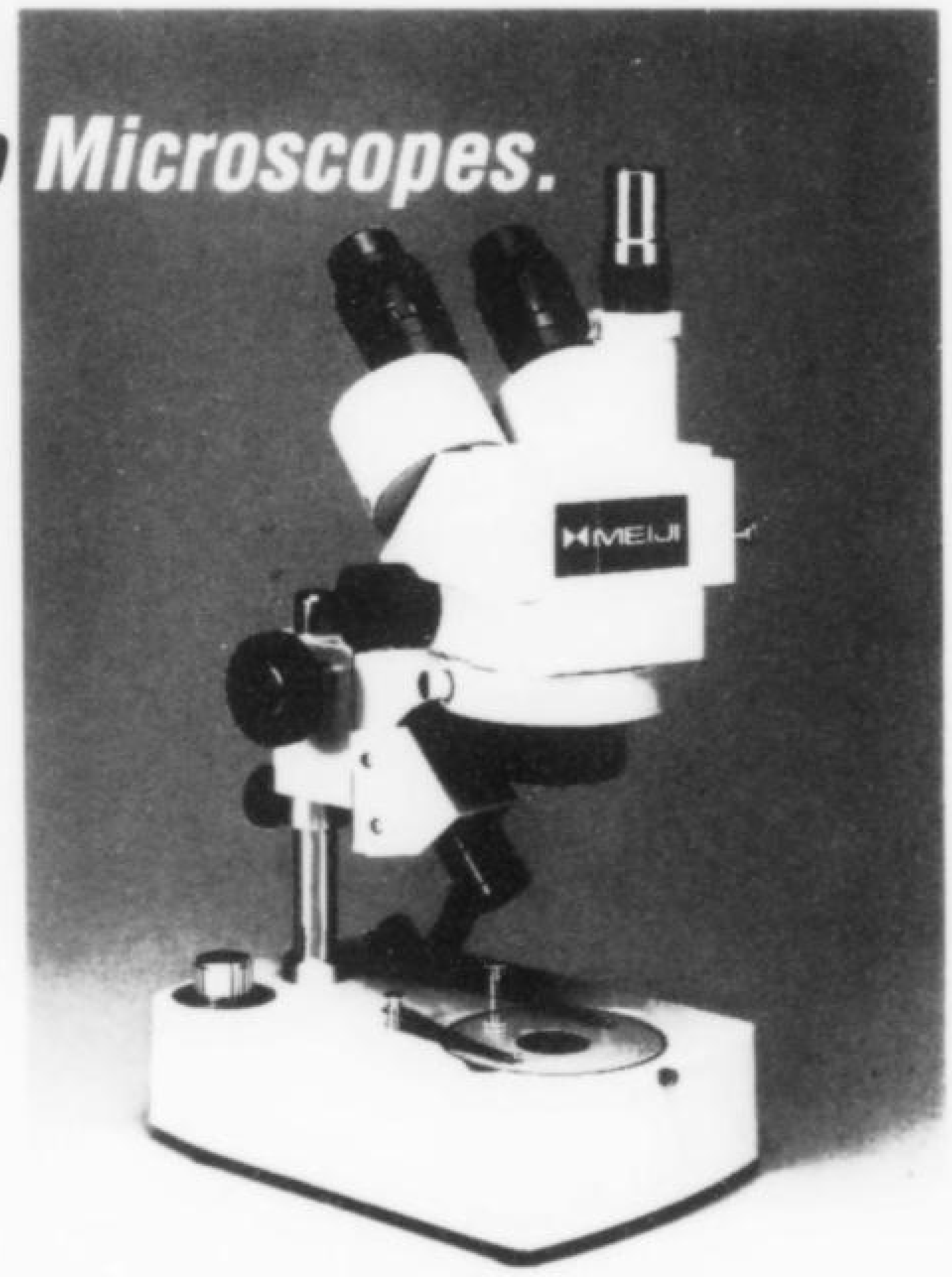

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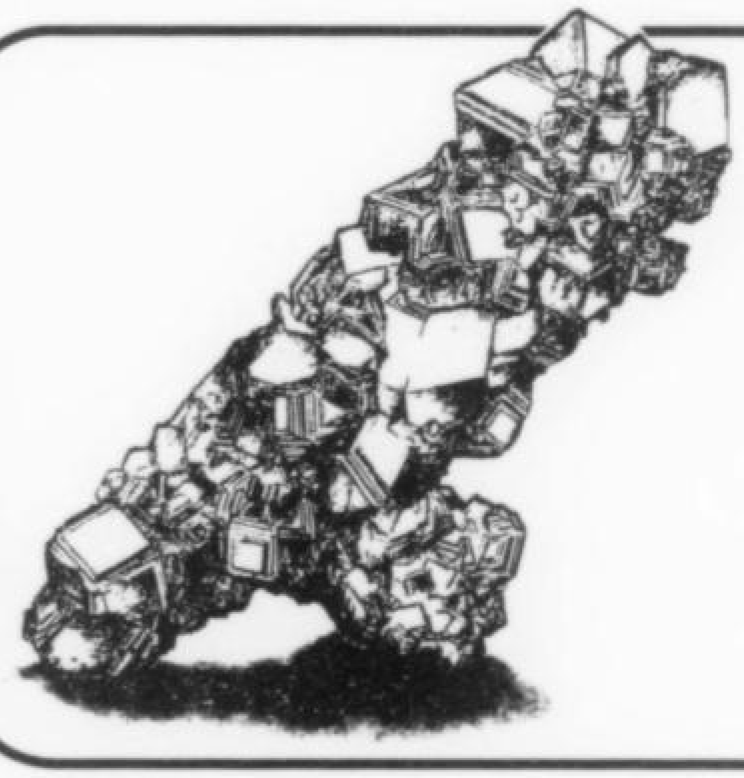

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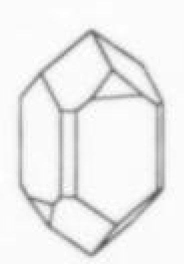

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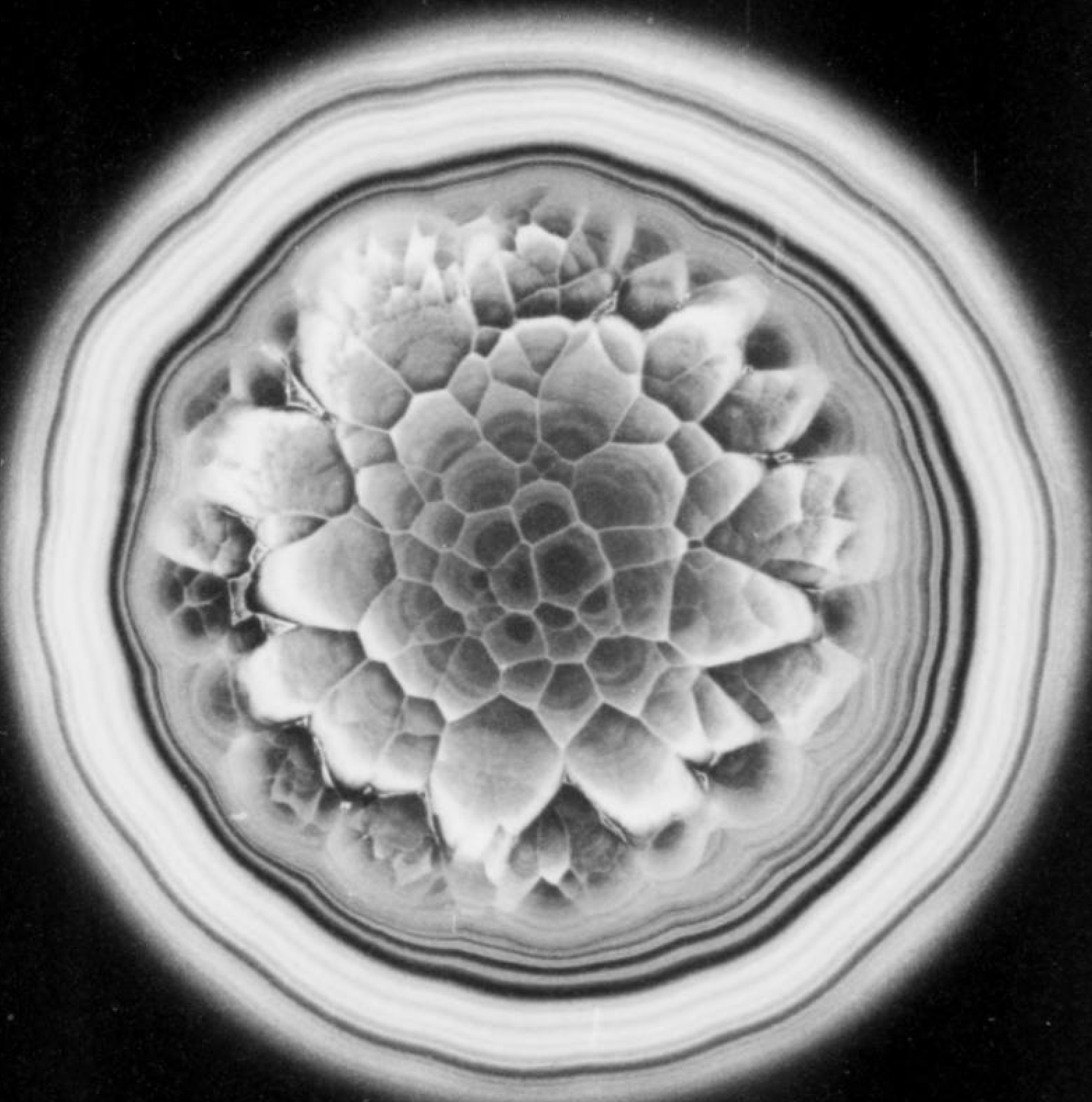

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