the Mineralogical Record

Volume Twenty-five, Number Five
September–October 1994
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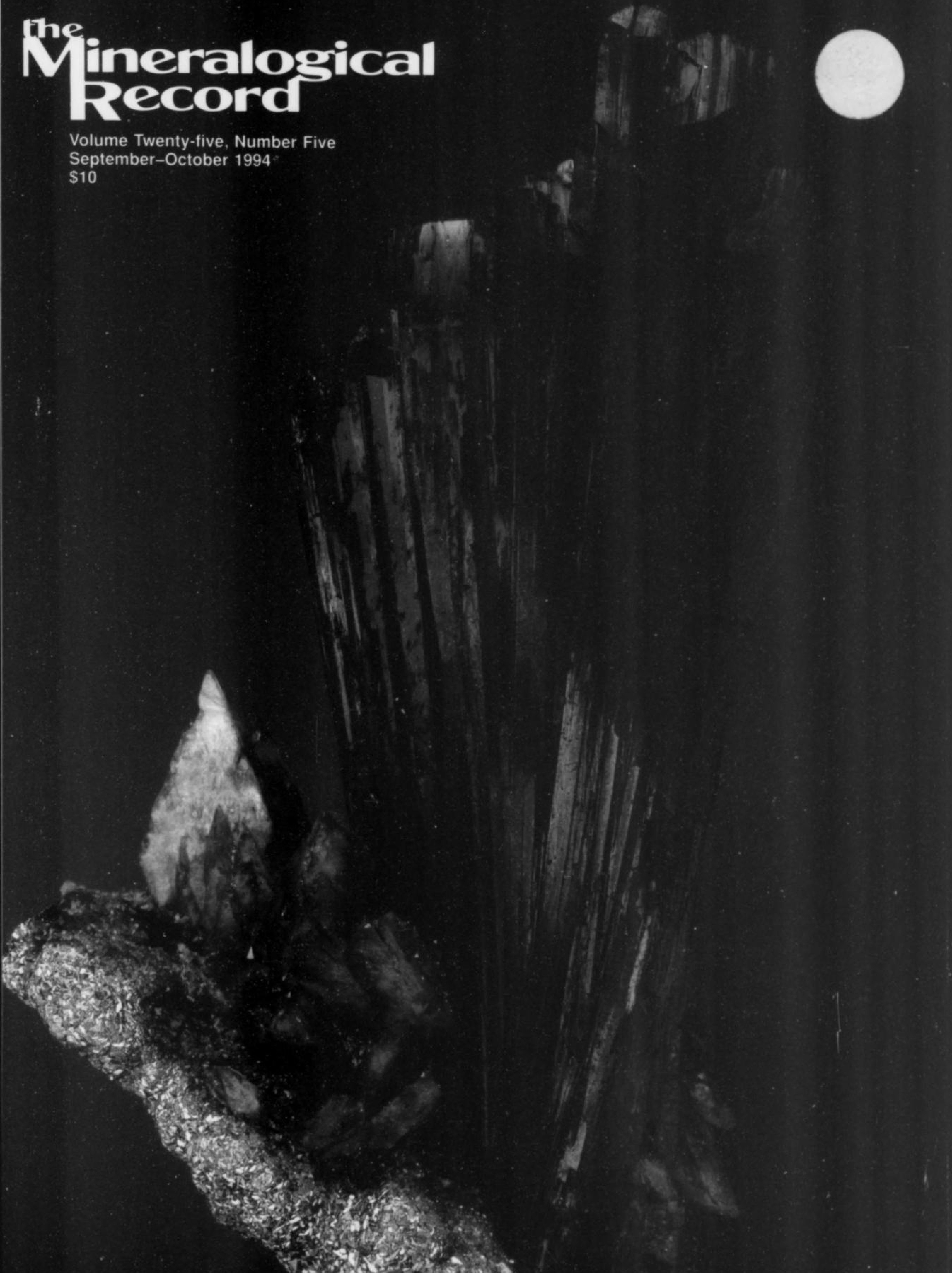

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*Continued on p. 399

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Articles

Columns

COVER: VIVIANITE with LUDLAMITE on pyrite, 10.7 cm tall, from Morococala, Bolivia. Cal Graeber Minerals specimen; photo by Jeffrey A. Scovil.

Guest Editorial:

Do Your Minerals Talk to You?

I never imagined that I would or could feel this way, but the realization has just settled in on me that mineral specimens I have always thought I coveted—the super flashy crystal specimens, *la crème de la crème*, those that often hide under dealers' beds or tables awaiting special customers—are now **boring** to me! Oh yes, I still enjoy looking at an extraordinary specimen like the Alma King, the Rose of Itatiaia, or the Van Allen Belt rose quartz. (How many remember it by that name? How many know what the Van Allen Belt is?) A truly exceptional mineral specimen will never fail to draw my eye, but only to appreciate it and, perhaps, to appraise it, no longer do I feel a desire to possess it.

Some of this may, in truth, mean that the process of my being weaned away from my former duties as curator of the Smithsonian is now complete, but I do not believe that this altogether accounts for my disenchantment. Certainly, while at the museum, I was able to focus totally on what I believed to be important for the national collection and this never required even a minor subversion of my personal collecting instincts. I was always able to recognize instantly a specimen's importance to the collection without having to submit the decision-making to some set of personal standards. Perhaps having to do this as a vocation rather than a hobby sated my desire for such museum-class specimens.

Since leaving the museum I have continued to buy specimens. Some of them are for other museums, some for private collectors, and some with no idea whatsoever of what their ultimate fate will be. Those in the latter category simply turn me on or, to use the phrase of Roz Pellman, they "talk to me." What they are not, however, are fancy aesthetic crystal groups of the competitive exhibit kind. At least part of this selection process, one might argue, has been dictated by cost. I absolutely do not have the resources to allow me to spend thousands of dollars on a single mineral specimen. This limitation, however, does not rule out lots of other very lovely groups of crystals of "common" minerals (did you know that the Ford/Dana *Textbook of Mineralogy* describes dioptase as rare?), but even these don't talk to me. The point is, I find such wonderful crystal groups **boring!** At a major show like Tucson I must *force* myself to look at such specimens in the special exhibit cases because, to me, they all look alike. Some are larger, some are smaller; some wider, some narrower; some brighter, some duller; but they really are all the same to me. I find them *voiceless*. In addition to being voiceless they have very little educational value.

So, you might ask, what kind of mineral specimens have "voices"? For me, crystals with inclusions have voices, twinned crystals have voices, strange and curious crystal growths have voices, pseudomorphs have voices; specimen suites from a particular locality have voices; and, of course, especially for me, single crystals have something in addition to and better than voices: they offer a tactile experience that I find irresistible. I have always been a specimen "handler." I know that this is considered a no-no when viewing another's collection and I strongly support the rule that one should never attempt to pick up a specimen without permission. But, given this cautionary note, I can't resist the urge, and single crystals are absolutely the most satisfying to fondle. Without venturing too near, I hope, to our crystal-crazed New Age cousins, I almost feel "at one" with a crystal when I can explore its forms with my fingers. In holding a crystal we not only note its overall shape, the nature of its edges, and many of the small-scale features of its faces, but we also can sense its density and we are made aware of the textures of its various surfaces. All of this provides the single crystal fancier an intimacy with crystals that few other collectors ever experience.

How many collectors of lovely crystal groups do you know who will sit and study them for long intervals (unless they are debating the risk of trimming or further cleaning), often learning something new and fascinating in the process? Those with collections of crystals having inclusions can pore over their little jewels for hours because there is so much to see if one has the patience to explore with a microscope. I contend that one can more effectively teach some mineralogy with one loose quartz crystal than with the biggest and flashiest quartz crystal group the world has ever seen.

Single crystals tend to be rare, at least the really good ones that are more or less complete all around. Of course many species are truly common—quartz, pyrite, beryl, topaz, garnets, tourmalines, etc.—but after these the challenge of finding good ones mounts. Which makes me wonder why I am sharing the joys of single crystal collecting with this audience. I should prefer not to encourage competitors for the fine crystals that I haven't yet discovered. But come ahead. If by writing about this aspect of the hobby I am able to make some converts, it will be more than worth the increased competition.

John Sampson White
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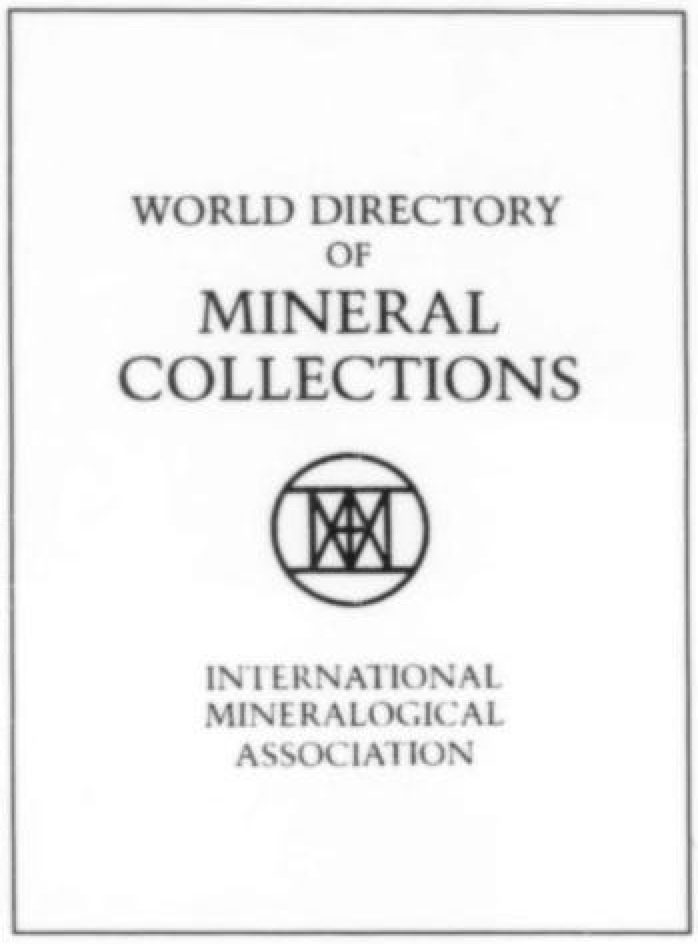
notes from the EDITOR



NEW MUSEUM DIRECTORY

I am pleased to announce the publication this month, by the Mineralogical Record, of the I.M.A.'s comprehensive *World Directory of Mineral Collections* (third edition), assembled under the direction of Ole Petersen. This is a standard reference which should have a place in the library of every mineralogist and mineral collector. It provides essential data on 444 mineral museums in the United States and 31 foreign countries, including their history, staffs, addresses, phone and FAX numbers, size and orientation of their mineral collections, services provided, hours, and so on.

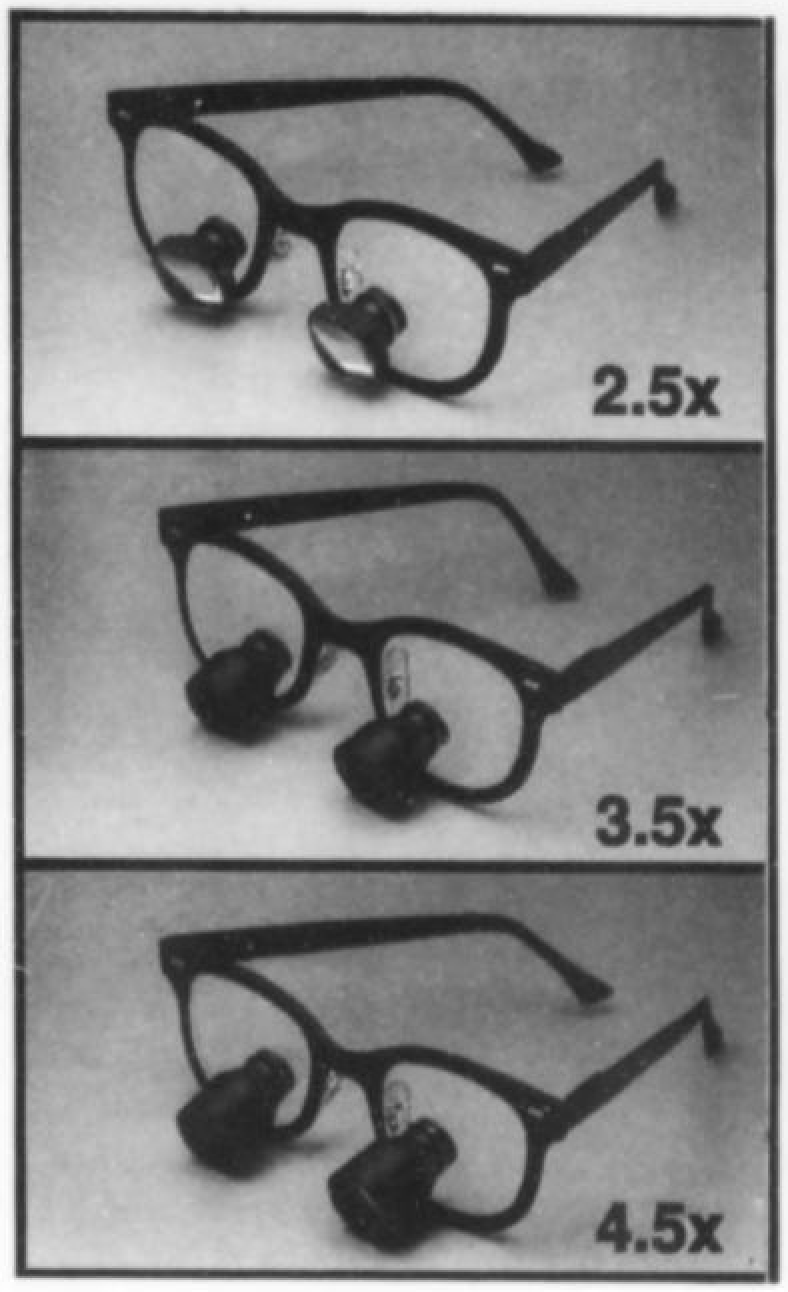
The directory is 293 pages, hardcover. Copies are available at $16.00 plus $2.00 postage from the Circulation Manager (Mineralogical Record, P.O. Box 35565, Tucson, AZ 85715). FAX/Credit Card orders may be submitted via our FAX number: (602) 544-0815. Only 1,000 copies have been printed; please order now and help support this invaluable publication.

THE ULTIMATE "HANDLENS"

A handlens is one of the mineral collector's most useful tools. Whether shopping for specimens at mineral shows or digging minerals in the field, a really close look can spot micromountable crystals, reveal damage, and aid in visual identification.

The only real drawbacks to the handlens are its short focal length (requiring a very short specimen-to-lens distance), its lack of stereoscopic imaging, and the fact that it leaves only one hand free for specimen manipulation. These shortcomings are merely an annoyance to mineralogists and collectors; but you can imagine how critically awkward they can be for other professions requiring magnification . . . e.g. microsurgery.

Surgeons are understandably less cost-conscious where the lives of their patients are at stake. Consequently, a (quite expensive) product has been developed for them which is also ideal for the well-funded mineralogist: custom-made glasses with a high-quality long-focal-



length "handlens" physically attached to each side. Result: no-hands use, at a comfortable working distance, in stereo!

These special glasses, which are also used by NASA astronauts, are produced by a company called *Designs for Vision, Inc.* (760 Koehler Avenue, Ronkonkoma, NY 11779; Tel. 1-800-345-4009). The glasses are referred to as "surgical telescopes," and come in a range of magnifications, from 2.5X to 8.0X. The higher magnifications require longer and more awkward barrels on the lenses; the 2.5 to 3.5X models would probably suffice for most mineralogical work.

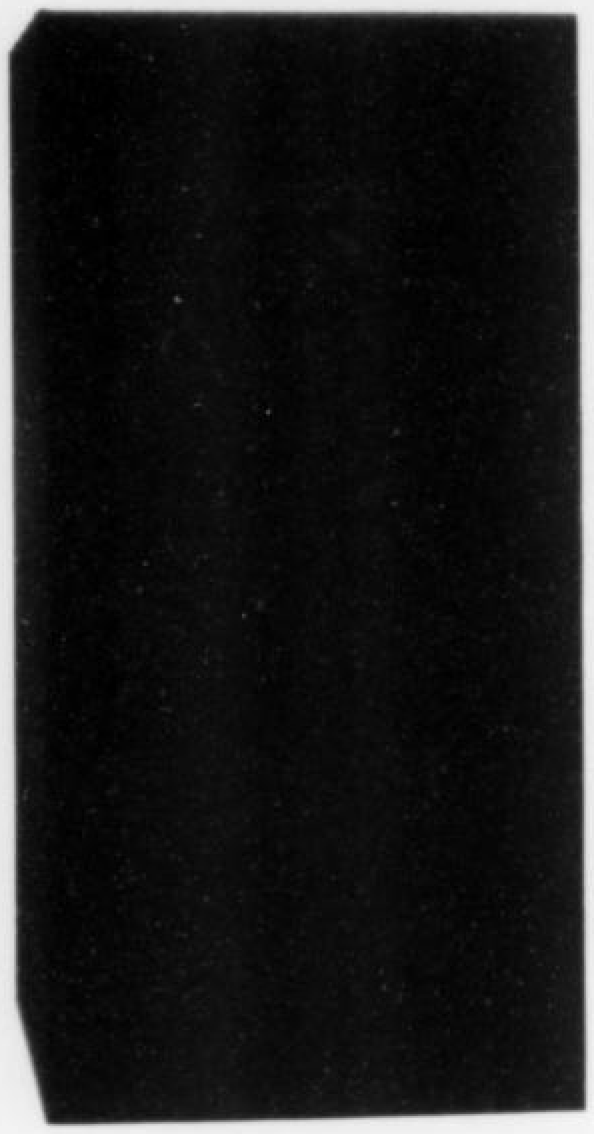
These are state-of-the-art optics of far higher quality than the average handlens, and the glasses to which they are attached are ground to your own prescription. Prices start at $695 for the 2.5X model and go up to $1,345 for the 8.0X. The buyer has a six-month grace period during which he can trade in the glasses for a different magnification (for a labor fee) or focal length (no charge).

SAFES FOR THE COLLECTOR

Home security is one of those problems that most mineral and book collectors never get around to doing anything about. Some people have an electronic security system installed in their homes, which is some protection against the casual burglar. But even if the system includes monitored smoke detectors it leaves specimens vulnerable to fire damage.

Other people seem to feel that insuring their collection for a certain dollar value is the responsible thing to do. Certainly this will help to protect your investment, up to a point. But most such insurance policies, when you can obtain them at all, base their premiums on a percentage of the appraised or insured value. It only takes a moment to figure out that, at 5% of the value as an annual premium, for example, you will have bought your entire collection over again yourself in 20 years, as if it had all been destroyed uninsured! Furthermore, many policies will carry an exclusion regarding claims for "nicks and chips," which are a major threat to specimen values. The high odds against total destruction (except perhaps in seismically active areas) and the high premiums for some people even at only 1% or 2%, make most collectors decide they'd rather shoulder the risks themselves.

The insurance problem is further complicated by the dynamic nature of one's inventory, the changing (and difficult to pin down)



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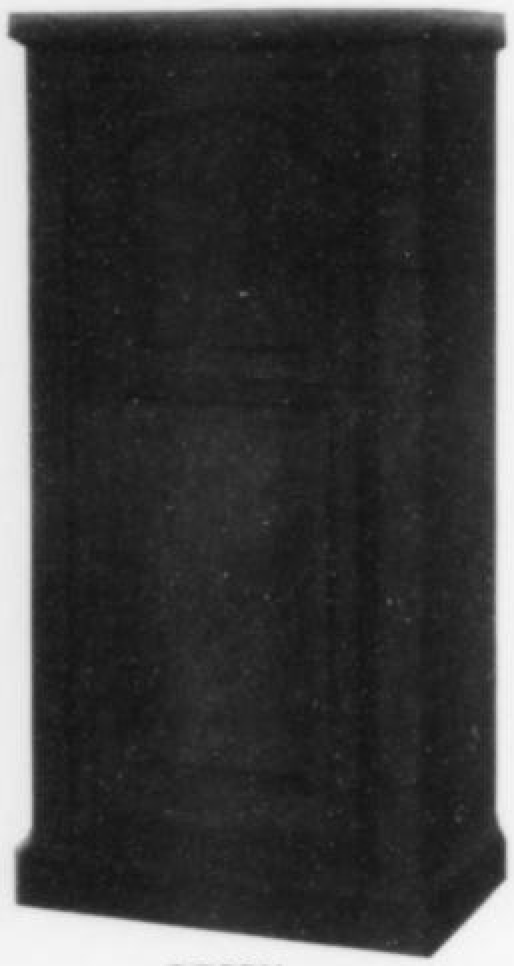

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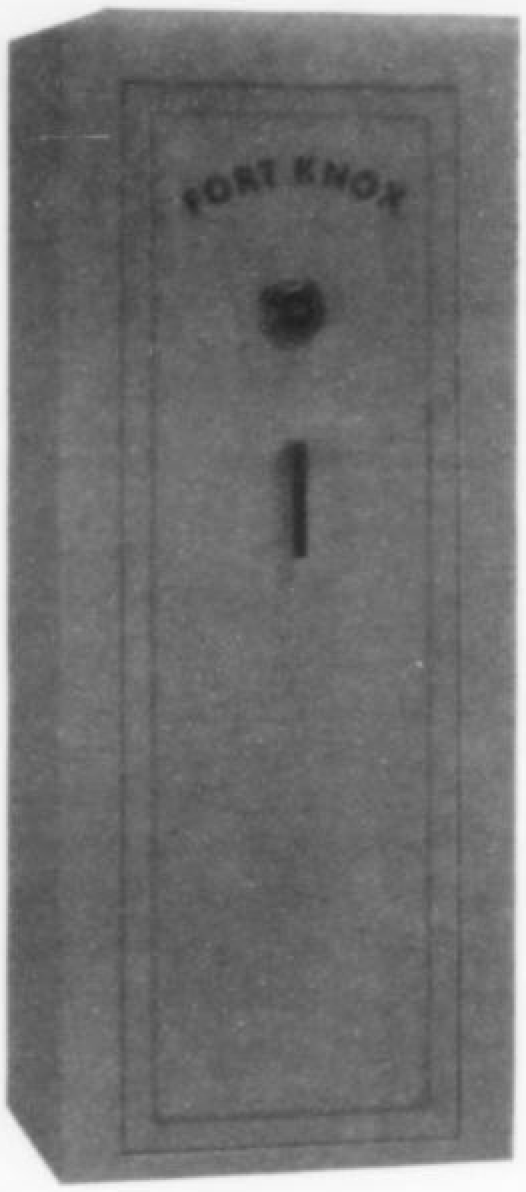
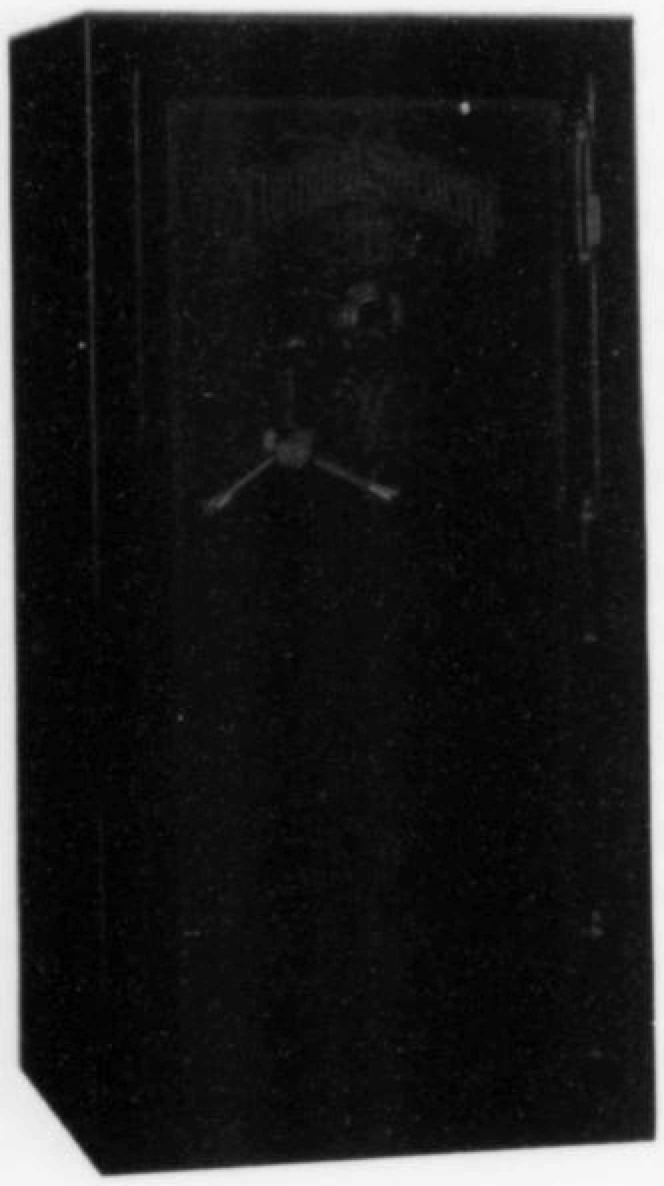
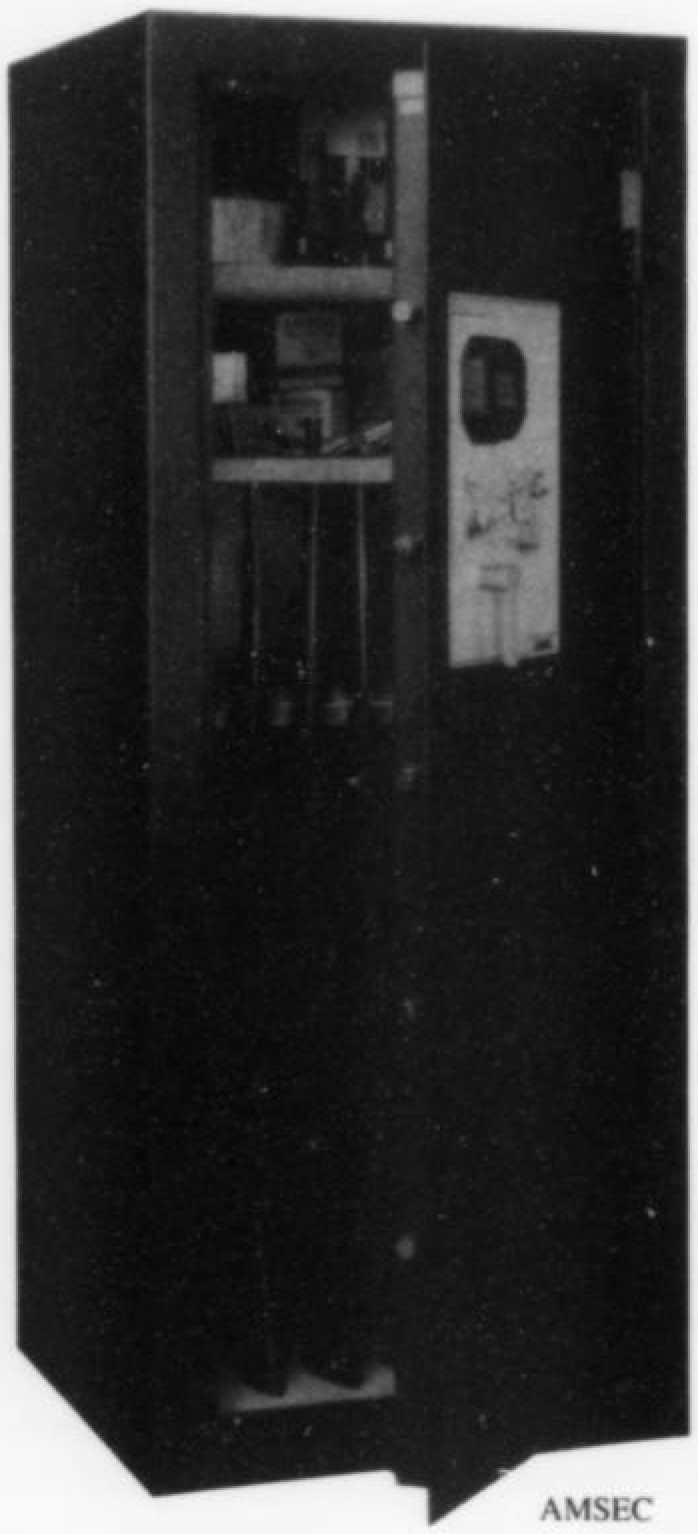
NATIONAL SECURITY



FORT KNOX



NATIONAL SECURITY



AMSEC

FORT KNOX

dollar value, and the irreplaceable nature of many prized specimens. Clearly it is far better to secure the specimens from loss or destruction than it is to simply insure their dollar value. To protect the specimens themselves is to better fulfill our duty as temporary custodians of natural treasures that will be passed down through countless future generations of appreciative owners and admirers.

Providing for the *physical* security of a collection, protecting it against fire, theft and vandalism, means utilizing a safe. (For a discussion of seismic mitigation techniques see Tony Kampf's article in the previous issue.) You can rent a safe deposit box at a bank, and many people do. But collectors *love* their specimens and want to have them nearby to admire and to show off to friends. Thus a home safe often provides the best of both worlds. Even in this area, there are numerous alternatives to consider. For example, I have seen small safes paneled to look like end-tables; but unless they are securely bolted to the floor, they may actually *increase* the danger to their contents. Any safe small enough for two strong men to pick up and haul away will be very tempting to burglars. They may well decide to steal it "on spec," to be opened later at their leisure, not even knowing whether it contains anything they want.

In my opinion, there are really only two types of safe that make sense for the collector: (1) small bolted-down or built-in safes secured into concrete, and (2) free-standing safes too large and heavy for two men to easily move, i.e. over 400 pounds or so. Of these two alternatives, the second has the simple advantage that it holds a lot more, although on the downside it does require somewhat more floor space. Someone who only collects cut stones or competition-quality thumbnails and miniatures may find that his whole collection will fit snugly in a small end-table-style safe. However, the collector who has a few dozen rare books and 15 or 20 flats of valuable minerals will need more room.

We are not the only group of collectors with this problem. People who own valuable guns know that their weapons are a magnet for burglars and are easily fenced. And, in America at least, a vast number of people own guns. Consequently, safe manufacturers have developed a product line just for them: the gun safe.

Gun safes are generally 60 to 70 inches tall so as to accommodate the longest rifles and shotguns. And yet their proportions are commonly rather narrow, giving them an elegant look. The first time I saw one of these, I immediately thought it was built to house a single 5-foot stack of large mineral flats. Fortunately, the manufacturers will generally fit out the interior with whatever arrangement of carpeted shelves you want, so there is no need to have a tall stack of flats resting on each other.

Many of these safes are attractively painted and lettered so as to look handsome and formidable in any office or den decor. Some models can be ordered with a beautiful handpainted mural on the door, or fluresecent lights inside. Prices typically range from $500 to $2,000, which is not really that much for a one-time expense when you consider how much a collection can be worth. For those who don't like the enameled steel look, some safe companies provide beautifully crafted exteriors of solid hardwood, giving a look of quality furniture. These, obviously, are bound to be more expensive, and can run to several thousand dollars.

The ultimate in safes, of course, is the built-in, walk-in, closet-size wall safe. But generally only the wealthiest collectors and dealers will need or want that much secured space. For the rest of us, a free-standing model will do nicely. Following is a list of some manufacturers who will be happy to provide more information on their products, prices, and local distributors.

AMSEC (American Security Products Co.)
11925 Pacific Avenue
Fontana, CA 92335
Call (714) 685-9680

Browning
One Browning Place
Morgan, UT 84050-9326
Call (800) 333-3288

The Decoy Safe Co.
(wood-clad gun safes)
323 N. Ivey Lane
Orlando, FL 32811
Call (800) 972-1850

Diebold, Inc.
P.O. Box 8230 (MS.T-79)
Canton, OH 44711
Call (800) 999-3600

Fort Knox Security Products
1051 N. Industrial Park Rd.
Orem, UT 84057
Call (800) 821-5216

Irwin's Gun Safes
9812 Cochiti S.E.
Albuquerque, NM 87123
Call (800) 735-5625

Liberty Safes
316 W. 700 S.
Provo, UT 84601
Call (800) 247-5625

National Security Safe Co.
380 E. 620 S.
American Fork, UT 84003
Call (800) 544-3829
(They also make vault doors)

Sportsman Steel Safe Co.
6309 Paramount Blvd.
Long Beach, CA 90805
Call (800) 266-7150

CALL FOR PAPERS

Joint FM-FMS-TGMS-MSA Mineralogical Symposium (17th), 1996 Fluorescence and Luminescence of Minerals

The 17th Tucson mineralogical symposium, to be sponsored jointly by the Friends of Mineralogy, Fluorescent Mineral Society, Tucson Gem and Mineral Society, and the Mineralogical Society of America, will be held in conjunction with the 42nd annual Tucson Gem and Mineral Show, on ***Saturday, February 10, 1996***. The theme of the symposium is ***Fluorescence and Luminescence of Minerals.*** Papers are invited on any mineralogic aspects of fluorescence and luminescence—description, occurrence, activators and crystal chemistry, applications, new means of stimulating or observing luminescence, etc. An audience of knowledgeable amateurs as well as professional mineralogists and gemologists is expected. The symposium theme commemorates the 25th anniversary of the founding of the Fluorescent Mineral Society, and the Tucson show will feature special exhibits and demonstrations of fluorescence and fluorescent minerals. The 1996 Tucson Show theme mineral will be ***Calcite***, and the fluorescence of calcite and other minerals will be the co-theme of the show.

If you wish to submit a paper, please contact Dr. Peter J. Modreski, Symposium Chairman (U.S. Geological Survey, Mail Stop 905, Box 25046 Federal Center, Denver, CO 80225-0046; telephone 303-236-5639; fax 303-236-5603) with your topic and a brief description of your proposed paper, by ***June 1, 1995***. Papers will be 15 or 20 minutes in length followed by a short period for questions and discussion. Upon acceptance of proposed topics, all authors will be required to submit a substantive 200–300 word abstract by ***September 1, 1995***. Abstracts will be published in the January-February issue of the *Mineralogical Record*, subject to the approval of the editor. Authors who so desire may also submit a more detailed paper after the symposium, to be printed in a special issue of the *Journal of the Fluorescent Mineral Society.*

PATIENCE REWARDED

Martin Ehrmann is remembered as one of America's foremost dealers in very high quality mineral specimens, and as a true gentleman of the Old School. His death in 1972 saddened all who knew him, and seemed to represent the end of a gracious era in the history of mineral dealing and collecting. At that time, the *Mineralogical Record* (then less than 3 years old) published a brief obituary and a promise that "a lengthier sketch of Martin's career [would] appear in a future issue."

Although I was not editor at the time, the onus of that unfulfilled pledge fell to me in 1976. I have always kept that promise in the back of my mind. At last someone—two someones—have taken on the formidable task of documenting Martin's legendary life and bringing the project to completion: Bill and Carol Smith. Their work is a feature article of this issue. So, to all of our readers who keep track of old promises, please note that after 22 years we have finally made good on this one. Our thanks to Bill and Carol for allowing us to reclaim that bit of editorial credibility and, moreover, for recording an important chapter in our mineralogical heritage that might otherwise have been lost.

SPECIAL ISSUE COMING!

The next issue will mark the completion of the 25th year of publication of the *Mineralogical Record.* As in the case of our 20th Anniversary Issue (vol. 21, no. 1), we will be commemorating this occasion with a special issue of a historical nature. And what an issue it will be, at over three times the size of a regular issue! Among other things, it will answer the question, "What has the editor been doing with his spare time for the last five years?" So be certain that your subscription is paid up, and look for something unusual in your mailbox two months from now.

The Orford Nickel Mine

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The Orford nickel mine has been a popular collecting site for chromian grossular, terminated millerite and large diopside crystals for well over a century. Specimens from this classic locality are found in many of the world's great collections. The deposit inspired the first attempt at mining and smelting nickel in Canada, and gave birth to one of the world's largest nickel companies.

LOCATION

The Orford nickel mine is situated in Lot 7,[1] Range XII, Orford Township (lot 7, rang XII, canton d'Orford), southeastern Québec, Canada (latitude: 45°25′00″; longitude: 72°07′20″; National Topographic System, Map 31 H/8, Mont Orford). It is about 800 meters east of Nickel Mine Bay (Baie Nickel Mine) on Brompton Lake (Lac Brompton), in the Municipality of the Parish of Saint-Denis-de-Brompton (Municipalité de paroisse de Saint-Denis-de-Brompton). The village of Saint-Denis-de-Brompton is 5.6 km northeast of the Orford nickel mine.

[1]St-Julien (1961) has pointed out that the mine is in Lot 7 and not Lot 6 as reported in all previous references.

Mineral specimens from the mine are often labeled as coming from Orford or Magog, Québec; these locality designations should be avoided. Orford is the modern, unofficial name of a village called Cherry River, which is located 12 km south-southwest of the mine. The town of Magog is 16 km to the south of the mine.

The mine can be reached from the junction (underpass) of Autoroute 10 and Highway 249 by proceeding 15.3 km north on Highway 249 towards Saint-Denis-de-Brompton, turning left (west) onto Chemin Bouffard, and following this road for 5.4 km to the end of the pavement. A gravel road bearing left around a pond for 500 meters leads to a house. The mine is located at the base of a rocky escarpment in a wooded area approximately 250 meters south of the house.

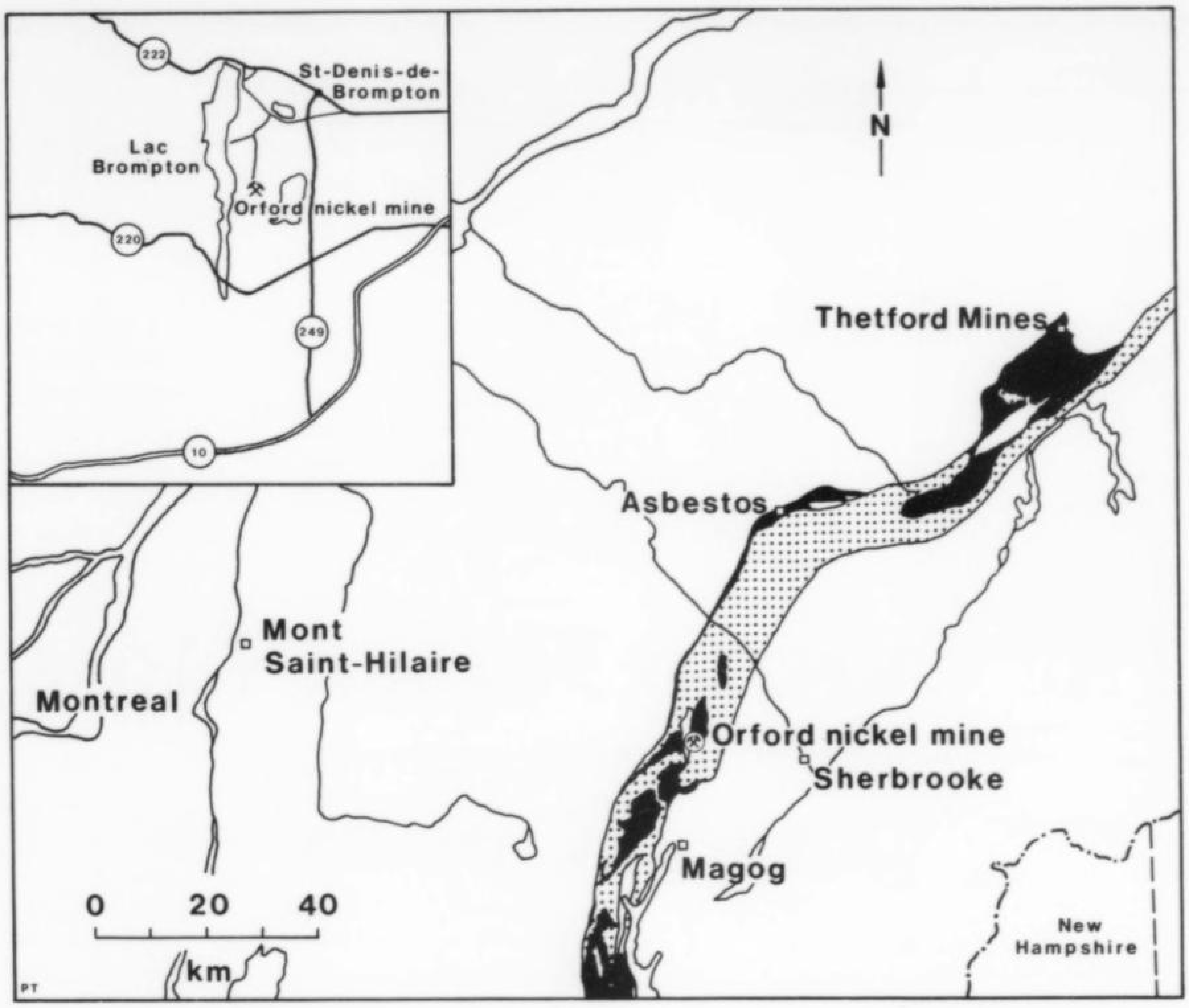


Figure 1. **Location map, showing ophiolitic ultramafic complexes (black) in the Saint-Daniel Mélange (stippled). Geology after Williams and St-Julien (1982).**

HISTORY

Mining and Smelting

The discovery of the Orford nickel deposit is not documented, but it seems likely that it was the result of prospecting for copper. Copper had been found in the Eastern Townships of Québec as early as 1841, and by the 1860's a major copper mining industry had developed, spurred by the demand for copper created by the American Civil War. In reporting on the Orford deposit in 1863, T. Sterry Hunt noted that "explorations were made at this place a year or two since, in the hope of obtaining copper, which was supposed to be indicated by the brilliant green of the garnet" (Hunt, 1863b). Hunt was the first to recognize the presence of the nickel sulfide, millerite at Orford (Chapman, 1888). A protégé of Professor Benjamin Silliman at Yale University, Hunt had been appointed chemist and mineralogist to the newly established Geological Survey of Canada in 1847, and has been called one of the great geochemists and mineralogists of all time (Boyle, 1971).

The Orford property came to be owned by Robert G. Leckie of Acton Vale, Québec. A graduate of the Glasgow Technical College in Scotland, Leckie became interested in mining soon after immigrating to Canada in 1856. In 1877, while attending a meeting of the American Institute of Mining Engineers in Boston, he met William E. C. Eustis, a Boston-based mining and metallurgical engineer. On hearing about the Orford property, Eustis decided to have a look at it. Accompanied by Robert M. Thompson, his Boston lawyer, he visited "the mine holed into the side of a hill" in September 1877 and, apparently impressed with what he saw, decided to purchase it (Thompson and Beasley, 1960).

Eustis then invited a Professor Whitby from Yale University to examine the deposit. "On the way to the mine, the professor was

Figure 2. **T. Sterry Hunt (1826–1892), chemist and mineralogist to the Geological Survey of Canada. Hunt recognized the presence of nickel in the Orford deposit, and carried out the first mineralogical work. Geological Survey of Canada photo (GSC 69324).**

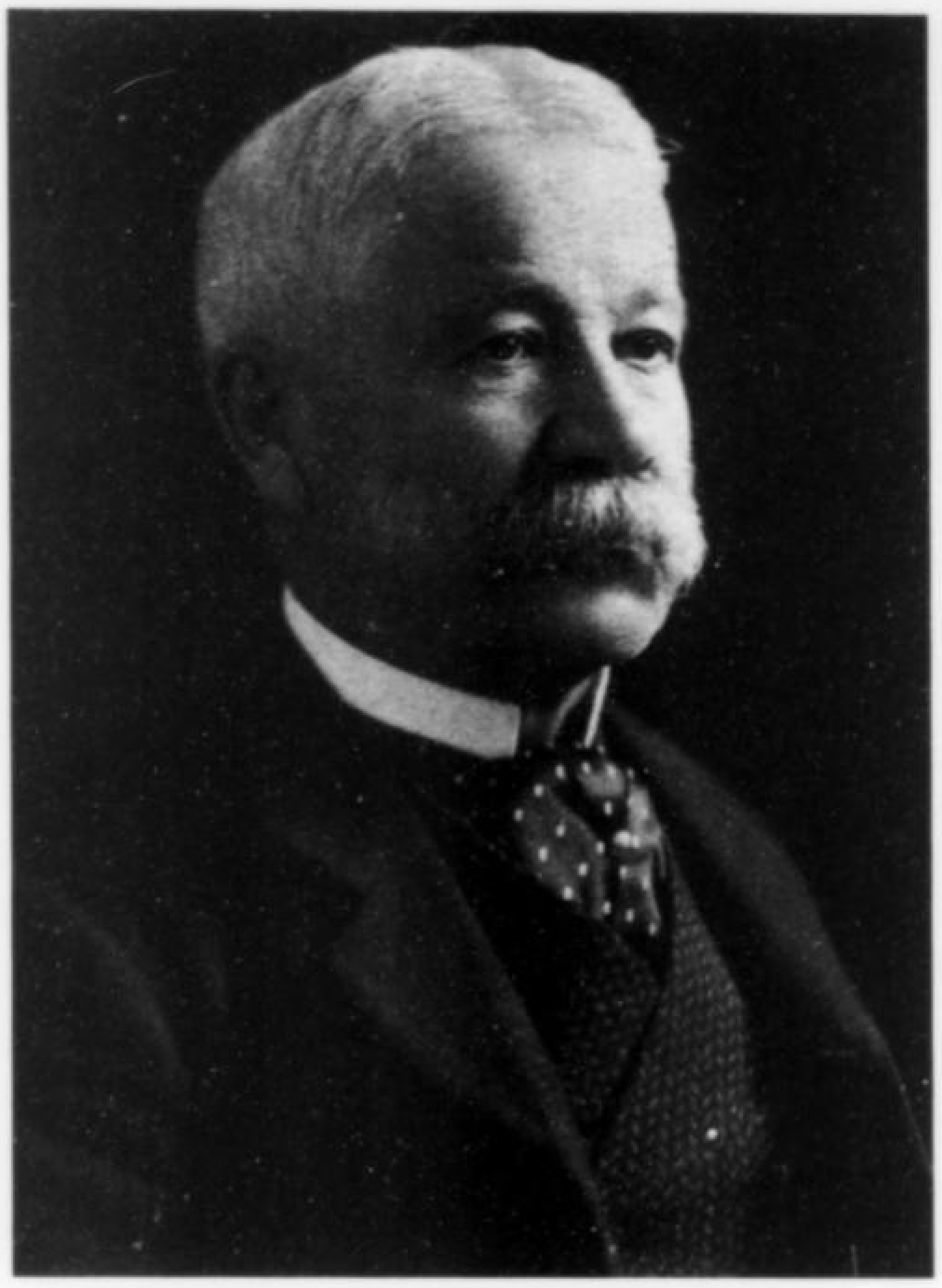


Figure 3. **Robert G. Leckie (1833–1913), mining engineer. Leckie sold the Orford nickel property to W. E. C. Eustis, and became the mine manager. National Archives of Canada photo (C140333).**

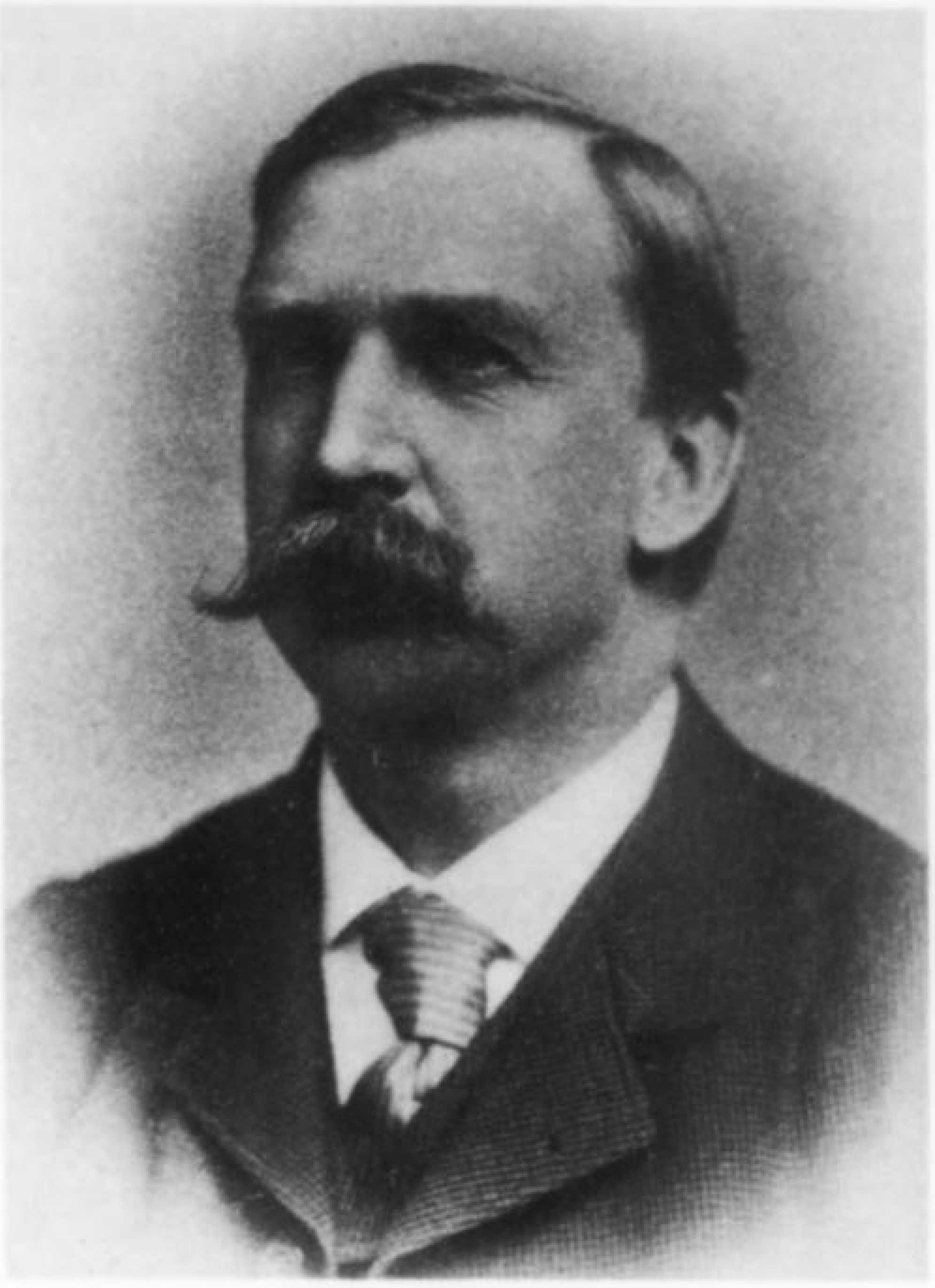


Figure 4. **William E. C. Eustis (1849–1932), mining and metallurgical engineer, and president of the Orford Nickel and Copper Company. Eustis purchased the Orford nickel property in 1877 and developed the mine. Harvard University Archives photo.**

thrown from his buggy. With ruffled feelings, he completed the journey, made a cursory inspection, testily gave his decision: 'scratch the ground again, and then send for me'; and left" (Thompson and Beasley, 1960).

Undeterred, Eustis proceeded to develop the mine, retaining Leckie as the mine manager. By November of 1877, 20 men were at work at the mine (Harrington, 1878). Two shafts were started about 55 meters apart, and by February 1878, the No. 1 shaft had been sunk to a depth of 12.5 meters, and the No. 2 shaft to a depth of 14 meters (Eustis, 1878; Eustis, 1879a).

With mining underway, Eustis turned his attention to the smelting of the ore. At a meeting of the American Institute of Mining Engineers in Philadelphia in February 1878, Eustis (1879a) reported that, contrary to his original "grave doubts about the practicability of treating the ore," he had obtained satisfactory results, first in crucible tests, and then in a small blast furnace at the Massachusetts Institute of Technology.

On March 9, 1878, the Orford Nickel and Copper Company was incorporated in the Province of Québec with a capitalization of $300,000. The articles of incorporation authorized the company to mine, manufacture and sell nickel, phosphate, copper and other minerals. The principal shareholders in the new company, which had its head office in Boston, were Eustis, who became president, and Thompson, who became general manager. Leckie, who also became a shareholder, was named managing director of the Orford mine.

The Orford property soon boasted "numerous substantial houses . . . a commodious store, powder-house . . . etc." (Willimot, 1882). Two furnaces were built to smelt the ore; one was a reverberatory furnace fired with gas generated from wood; the second was a small cupola operated with coke (Eustis, 1915).

Underground, the first shaft had reached a depth of approximately 30 meters, and a drift was driven to join up with the second shaft

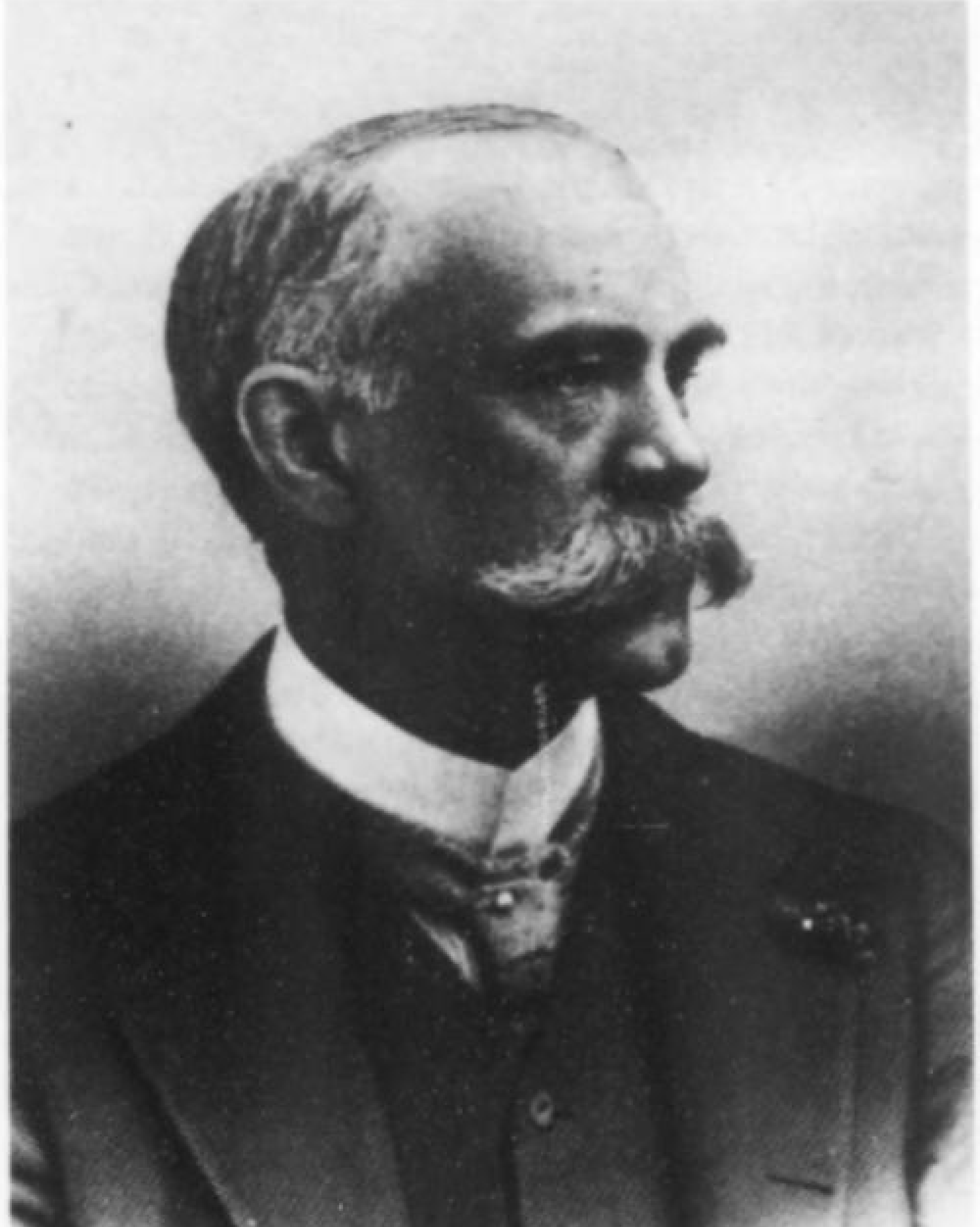


Figure 5. **Robert M. Thompson (1849–1930), general manager of the Orford Nickel and Copper Company. Thompson became the first chairman of the International Nickel Company in 1902. Photo courtesy of Inco Limited.**

which ultimately had a depth of some 45 meters. Ore was stoped out between the two shafts in order to provide feed for the smelting furnaces (Eustis, 1915).

To run the furnaces, Eustis obtained the services of a Scottish furnace man, James McArthur, who had been trained by Sir Henry Bessemer. Smelting the ore proved to be much more difficult than Eustis's tests had indicated. The story is told that "all that came out [of the furnace] was a pasty mass of slag, but no metal" and that "disgusted over the results, McArthur quit" (Thompson and Beasley, 1960).

Nevertheless, as attested to by the many tonnes of slag still to be found at the mine site, efforts to smelt the ore continued. Technical advice was provided by Henry M. Howe, who was later to become professor of metallurgy at Columbia University, and one of the most eminent American metallurgists of his time. Some success in smelting the nickel ore was achieved by adding pyritic copper ore as a flux (Howe, 1878). However, the resulting matte contained far more copper than nickel, and the large flux addition required was uneconomic.

In his Philadelphia paper, Eustis (1879a) had reported: "As to the per cent of nickel which [the] ore carries, and which will determine its money value, it is not easy at present [in February 1878] to speak with any certainty . . . [but] at the bottom of No. 1 shaft, pieces of ore taken to be average ones . . . show between three and four per cent nickel." This was optimistic. Hunt (1863b) had found that nickel was "sparingly disseminated" in the ore and "masses submitted to analysis did not yield more than one per cent of nickel," while the ore smelted in the test at the Massachusetts Institute of Technology had contained "not over one half of one per cent of nickel" (Eustis, 1879a). In the end, "the ore was found on the average low grade, and the gangue too refractory to make operations remunerative" (Leckie, 1900). After having invested a considerable sum of money, Eustis decided to suspend operations. Mining at Orford ceased in the spring of 1879.

When Charles W. Willimot of the Geological Survey of Canada visited the mine in August 1882, it was deserted except for a caretaker (Willimot, 1882). Willimot noted rather sardonically that "the general aspect on approaching the mine conveys some idea of the misdirected enterprise of the proprietors."

In the interim, Eustis and Thompson had leased a copper mine near Capelton, some 22 km to the southeast of the Orford nickel mine. This new venture, the Crown mine of the Orford Nickel and Copper Company, proved to be successful. In 1881 a smelter (later called the Orford Works) was built at Constable Hook (now Bayonne), New Jersey, to treat the pyritic copper ore from the Crown mine. Sulfuric acid was produced as a by-product and, in 1883, the Orford Nickel and Copper Company was renamed the Orford Copper and Sulphur Company. Four years later, in 1887, Eustis and Thompson ended their partnership, and the company was dissolved. Eustis retained the Crown mine in Quebec and formed a new company called Eustis Mining Company. Thompson took over the Orford Works, which he operated under the new name, the Orford Copper Company.

A year earlier, in 1886, the Canadian Copper Company had shipped some copper ore to the Orford Works from its major new discovery at Sudbury, Ontario. It was then discovered that the Sudbury ore also contained nickel. This eventually led to the development, at Constable Hook, of the Orford process for separating copper from nickel, and a contract for the Orford Works to refine the copper-nickel matte production of the Canadian Copper Company. In 1902, the Orford Copper Company merged with the Canadian Copper Company to form the International Nickel Company, with Thompson as the first chairman. Known today as Inco Limited, it is the Western world's largest producer of nickel. It can trace its beginnings to an unsuccessful nickel mine in Orford Township, Québec.

In a final chapter, some geophysical and diamond drill exploration was carried out on the Orford nickel property in the 1950's and 1960's. Nothing of economic significance was found.

Mineral Collecting

Although short-lived as a mining venture, the Orford nickel mine has a long history as a mineral locality. In 1862, even before mining began, a specimen of millerite was exhibited at the London International Exhibition as part of a collection of Canadian economic minerals gathered by the Geological Survey of Canada. The catalog accompanying the collection noted that the millerite was associated with "emerald-green . . . chrome garnet [grossular]" (Geological Survey of Canada, 1862). The green grossular attracted the attention of mineral collectors and museum curators. The earliest known specimens are in the Natural History Museum, London, and were presented by T. Sterry Hunt in 1862. Another specimen donated by Hunt in 1866 is in the Peabody Museum of Natural History collection at Yale University. Also in the Brush collection at Yale is a specimen of grossular which was presented by General Adams in 1867. Adams was at that time operating the copper mine at Capelton, Québec, which was later leased by Eustis and his partners in the Orford Nickel and Copper Company.

In 1878, after mining had begun, mineral specimens from the Orford nickel mine were exhibited at the Universal Exposition in Paris (Harrington, 1878). That same year, Eustis showed samples of millerite and grossular when he presented his paper on the mine to the American Institute of Mining Engineers in Philadelphia (Eustis, 1879a). This brought Eustis requests for specimens, and he obliged. In a letter to an A. Meany in Swansea, Wales, Eustis (1879b) wrote: "I have sent you today . . . a box of nickel specimens . . . I regret that I had none of our most interesting specimens in this office [in Boston]. The ore is regarded as such a curiosity by our mineralogists here that I cannot keep the specimens." One such specimen of grossular, donated by Eustis, is in the Peabody Museum collection at Yale. In Canada, Leckie was also providing specimens from the mine; two are preserved in the Redpath Museum at McGill University.

When Charles Willimot of the Geological Survey of Canada visited the Orford nickel mine in 1882 it was in the capacity of museum assistant. He was responsible for collecting rocks and minerals, and for preparing collections for the Geological Museum, the forerunner of the present Canadian Museum of Nature. A suite of specimens collected by Willimot at the Orford nickel mine and exhibited in the Geological Museum (Hoffmann, 1893) is now preserved in the Systematic Reference Series of the National Mineral Collection at the Geological Survey of Canada, Ottawa. One of the specimens collected by Willimot in 1882 is also in the Harvard Mineralogical Museum collection.

In 1890, R. W. Ells of the Geological Survey of Canada reported that "for the cabinet, magnificent specimens of chrome garnet [grossular], pyroxene [diopside] and calcite are here obtained, of which large quantities have been removed by collectors both from Canada and the United States" (Ells, 1890). Specimens from the mine had found their way into many important private collections in the United States, including those of *Clarence S. Bement* (1843–1923), now at the American Museum of Natural History; *Frederick A. Canfield* (1849–

Figure 9. **An early Orford micromount prepared by J. B. Brinton, Philadelphia. P. Tarassoff collection and photo.**

1926) and *Washington A. Roebling* (1837–1926), both at the National Museum of Natural History, Smithsonian Institution; and *A. F. Holden* (1866–1913), now at Harvard. The suite of Orford specimens in the Bement Collection was supplied in 1885 by a dealer named *Townsend*. Other mineral dealers who handled Orford specimens were *A. E. Foote & Company*, and *Lazard Cahn* (1865–1940). The collection of *Josiah D. Whitney* (1819–1896) at Harvard was the source of the Orford specimens used by Charles Palache and H. O. Wood in their classic crystallographic study of millerite (Palache and Wood, 1904).

Significant suites of Orford specimens are also in the Ferrier collections, now preserved in the Royal Ontario Museum and the Redpath Museum. These were acquired from *Walter F. Ferrier* (1865–1950), a geologist who assembled what was probably the most important private collection in Canada in the years up to 1913 (Stevenson, 1972). Ferrier corresponded with many contemporary mineralogists and mineral collectors, among whom were Palache and Roebling, and supplied them with specimens, mainly from Canadian localities. He was an active field collector, and it seems likely that he personally collected the "Ferrier" Orford specimens that now reside in a number of collections.

Orford specimens also appeared in important private collections in Europe, including those of *Carl Bosch* (1874–1940) in Germany, which is now at the Smithsonian, and *Charles Trechmann* (1851–1917) in England, which is now in the Natural History Museum, London. A specimen of grossular from the Trechmann collection and now in the Royal Ontario Museum was acquired by him from the London mineral dealer *Thomas D. Russell* in 1888.

In 1893, an Orford specimen was again exhibited at an international exposition. This time it was part of the Smithsonian's exhibit at the World Columbian Exposition held in Chicago. The specimen of grossular had been purchased from the Washington, D.C. mineral dealer *Edwin E. Howell* that same year.

***Figure 7.* Orford nickel mine specimen labels. Clockwise from upper left: A. F. Holden collection, Harvard Mineralogical Museum; W. F. Ferrier collection, Redpath Museum, McGill University; J. D. Whitney collection, Harvard; W. F. Ferrier collection, Redpath Museum; G. J. Brush collection, Peabody Museum of Natural History, Yale University; Redpath Museum collection—specimen donated by R. G. Leckie; Redpath Museum collection; J. D. Whitney collection, Harvard; C. S. Bement collection, American Museum of Natural History. Center, top: National Mineral Collection, Geological Survey of Canada. Center, bottom: Peabody Museum of Natural History collection—specimen donated in 1866 by T. Sterry Hunt, with his initials on the label. P. Tarassoff photo.**

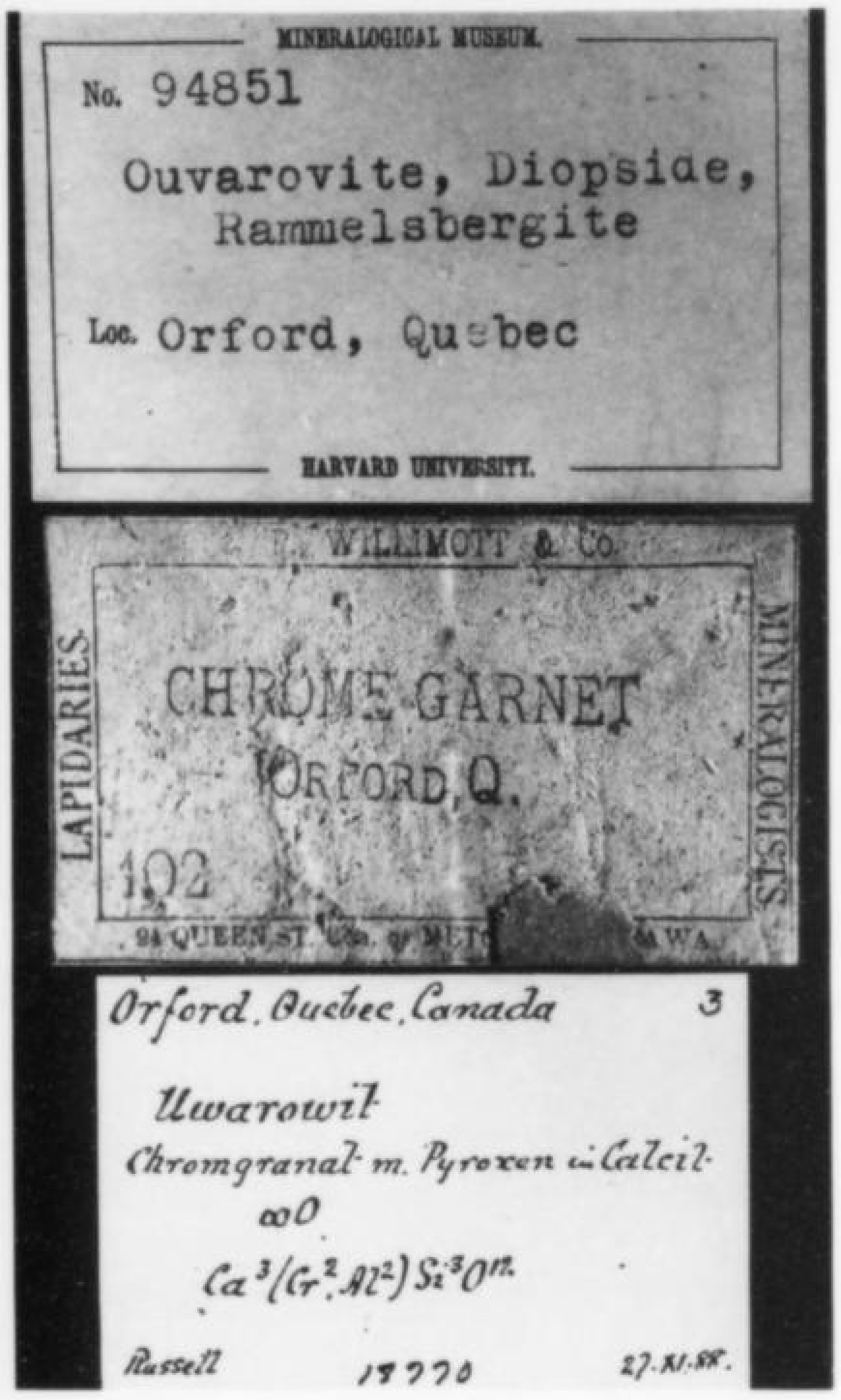


Figure 8. **Orford nickel mine specimen labels. Top: Harvard Mineralogical Museum collection—the rammelsbergite was later shown to be maucherite. Center: Miller Museum collection, Queen's University—label of 19th century Ottawa dealer, C. P. Willimott. Bottom: Royal Ontario Museum collection, ex-Trechmann collection, the Natural History Museum, London. P. Tarassoff photos.**

Some fifty years later, Dresser and Denis (1949) remarked that "the dump at the Orford nickel mine has long been a place of interest for mineralogists on account of the excellent specimens of the relatively rare mineral millerite, and also of uvarovite [grossular] and diopside, that may be collected there." Today, more than a century after mining ceased, the locality continues to be an active mineral collecting site, still producing specimens which are often superior to those in old collections.

GEOLOGY

Regional Geology

The Orford nickel deposit is associated with the same belt of northeasterly trending serpentinized ultramafic rocks which hosts the Ruberoid asbestos mine at Eden Mills, Vermont; the Jeffrey mine at Asbestos, Québec (Grice and Williams, 1979); and the asbestos mines at Black Lake and Thetford Mines, Québec. The belt also hosts many chromite and base-metal sulfide deposits which have been mined at various times.

The ultramafic rocks are part of the Saint-Daniel Mélange, one of three lithologic units which make up the Dunnage terrane in the southern Québec Appalachians (Tremblay and St-Julien, 1990; Cousineau and St-Julien, 1992). The Baie Verte-Brompton Line which forms the western boundary of Saint-Daniel Mélange marks the suture between rocks of North American continental affinity, and rocks of oceanic affinity which belong to the Dunnage terrane. The Saint-Daniel Mélange is an ophiolitic complex consisting of blocks and slices of sandstones, mafic and felsic volcanic rocks, granitoids and mafic to ultramafic rocks which are enclosed in a pebbly mudstone matrix; the ultramafic rocks consist of serpentinized harzburgite, dunite and peridotite (Slivitzky and St-Julien, 1987). All the rocks have been subjected to deformation and metamorphism. The Saint-Daniel Mélange is interpreted to represent vestiges of an oceanic domain of Cambrian age which was accreted at a subduction zone during the closure of the Iapetus (Proto-Atlantic) ocean during the Taconic Orogeny in Middle Ordovician time.

Tectonic deformation during the Acadian Orogeny in Devonian time resulted in major regional folding and faulting (Tremblay and St-Julien, 1990). Folding is complex due to superposition on earlier fold systems. The folds have steeply dipping limbs and steeply plunging axes (St-Julien, 1967).

Local Geology

The rocks in the area of the Orford nickel deposit consist of a complex assemblage of metasediments and metavolcanics which contain slices of serpentinized harzburgite, here referred to as serpentinite (Fortier, 1945; St-Julien, 1961; Slivitzky and St-Julien, 1987). This assemblage within the Saint-Daniel Mélange has been referred to as the Lac Montjoie serpentinite mélange (Williams and St-Julien, 1982). The serpentinite bodies are generally concordant with the beds of metasediments and metavolcanics which form part of a major drag fold that plunges about 50° to the northeast. The serpentinites contain veinlets of chrysotile asbestos and banded disseminations, massive lenses, veins, and pods of chromite (Fortier, 1945; Fortier, 1946).

The Orford Nickel Deposit

The Orford nickel deposit is located at the fault contact between a slice of serpentinite and black slates or phyllites of the pebbly mudstone matrix of the Saint-Daniel Mélange (Gauthier, 1985). Unfortunately, very little information about the geology of the deposit was recorded when it was being mined. The underground workings have long been inaccessible, but remnants of the deposit can be observed in the footwall serpentinite which forms a prominent escarpment.

Logan (1863) reported that "associated with the serpentine is a pale greenish pyroxene rock . . . large masses of calcareous spar [calcite], probably filling a vein, are here met with." In most of the subsequent literature the deposit has been described as a calcite vein. Recent studies suggest that the deposit was formed by metasomatic replacement, and that the "vein" exploited by the Orford nickel mine was probably a large lense of calcite within a skarn-like calc-silicate zone. Eustis (1879a) noted that "on surface other smaller veins and branches of spar [calcite] and garnet [grossular] are visible." The calc-silicate zone strikes north and dips about 70° to the west. It has a strike length of over 55 meters, and extends down-dip at least 45 meters. Its full width is unknown, but the "vein" itself was 3 meters wide (Eustis, 1879a).

The footwall serpentinite unit has been progressively carbonatized, grading from an essentially unaltered serpentinized harzburgite some 120 meters from the footwall, to tremolite and talc-tremolite marble on the footwall; carbonatization of the serpentinite is marked by a sharp increase in CaO and a decrease in MgO towards the footwall (Gauthier, 1986b; Trottier, 1985). Irregular patches of calcite in the serpentinite sometimes enclose relict massive chromite and serpentine (Fortier, 1946). In common with other serpentinites in the Saint-Daniel Mélange (Nickel, 1959), this serpentinite contains about 0.2% nickel (Gauthier, 1986b; Trottier, 1985); the concentration of nickel is essentially constant across the carbonatized zone.

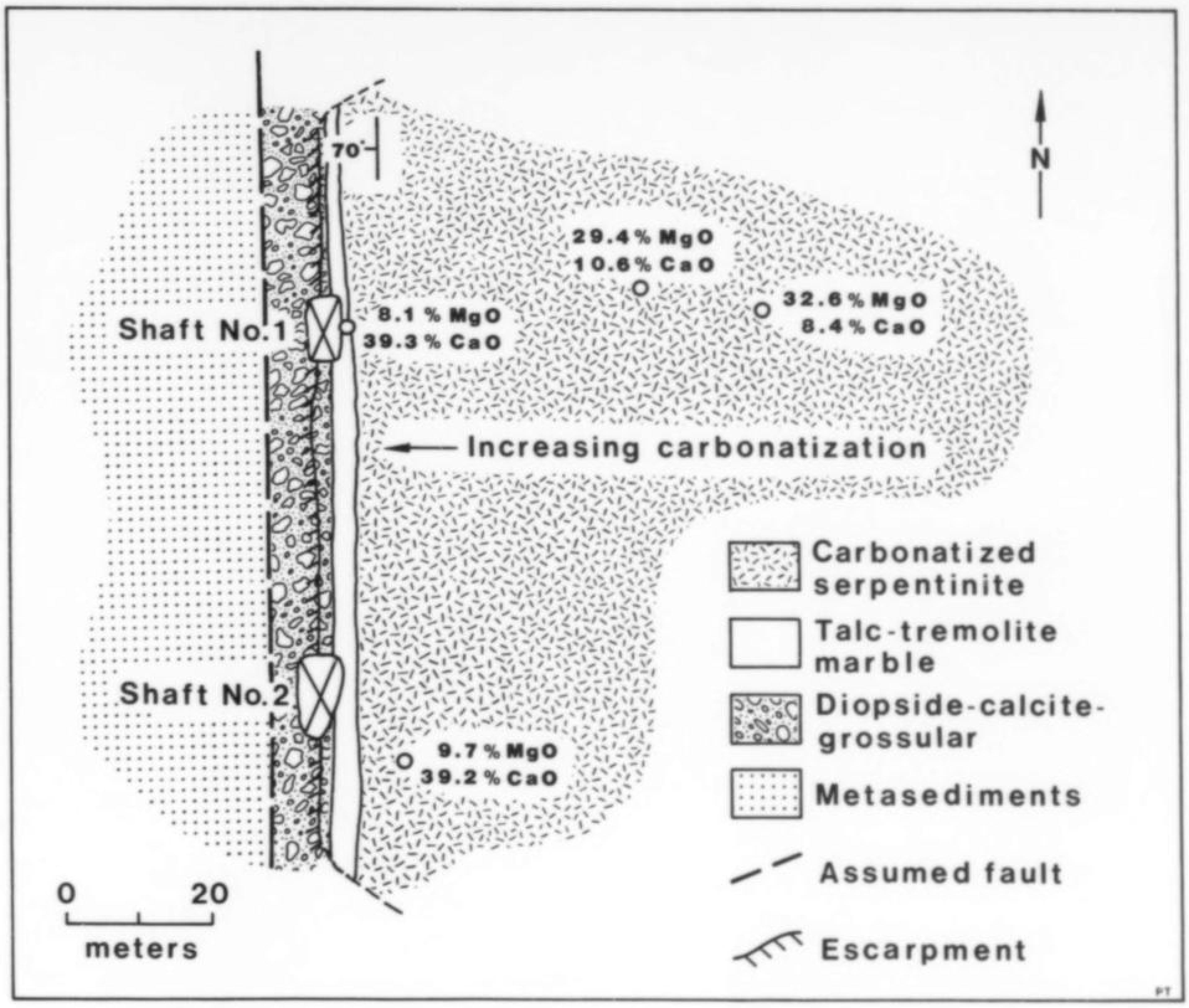


***Figure 9.* Geology of the Orford nickel deposit (modified after Gauthier, 1986b).**

Overlying the deposit on the hanging-wall side are phyllites or slates (St-Julien, 1961) which are identified with the pebbly mudstone matrix of the Saint-Daniel ophiolitic mélange (Slivitzky and St-Julien, 1987). The true nature of the hanging-wall itself, which is not exposed at the surface, is uncertain. It has been variously described as a magnesian limestone (Eustis, 1879a), a silicic tuff or schist (Fortier, 1945; Fortier, 1946) and an acid volcanic rock (St-Julien, 1961).

According to Eustis (1879a), the "No. 2 shaft . . . was started on the vein in decomposed spar [calcite] and pyroxene [diopside], carrying occasionally small masses of chrome-garnet [grossular]," and reached "good solid nickel ore" at a depth of 14 meters. Dump material suggests that the order of abundance of the minerals is diopside > calcite >> grossular >> chromite >> millerite.

Two generations of diopside can be recognized: (1) fine-grained rock-like masses, often intergrown with grossular, and containing calcite-filled cavities lined with crystals of diopside and grossular; (2) coarsely crystallized masses, frequently enclosing angular, granular masses of grossular. Both generations of diopside are often found together, with sharp contacts, in a breccia-like mélange. In addition to filling cavities, calcite occurs as very large, coarsely cleavable masses; in the overall paragenetic sequence it is the last mineral to have been deposited. Chromite occurs as relict masses and grains, and is usually enclosed by grossular. In thin section, chromite inclusions in the grossular show fuzzy and fringed edges suggestive of their having been partially dissolved (Fortier, 1946). Millerite, and the nickel arsenide maucherite, are closely associated with grossular and diopside in calcite-filled cavities; no paragenetic priority is apparent among the minerals in the cavities (Palache and Wood, 1904), suggesting they crystallized at, or about the same time.

Textural features of the mineral assemblages, and the carbonatization of the footwall serpentinite, are consistent with a hydrothermal origin for the Orford nickel deposit (Fortier, 1946; Gauthier, 1985; Gauthier, 1986a; Gauthier, 1986b; Gauthier *et al.*, 1989). Carbonatization of ultramafic rocks in ophiolitic complexes has been postulated to result from CO_2-Ca metasomatism by hydrothermal solutions circulating

***Figure 10.* One of the open shafts at the Orford nickel mine, circa 1964. Photo from Gregory (1967), reproduced with permission of *Rocks and Minerals*.**

***Figure 11.* Footwall at the site of the no. 2 (south) shaft in 1992. A. Tarassoff photo.**

along deep-seated suture zones during the late stages of their tectonic emplacement and serpentinization (Buisson and Leblanc, 1985). The end-product of this metasomatism is listwaenite, a carbonate-rich rock. As the hydrothermal system evolves, the listwaenite itself may undergo replacement. Several sulfide replacement deposits of this nature have been recognized in the Dunnage terrane of the Québec Appalachians (Gauthier *et al.*, 1989).

A tentative model is herein proposed for the genesis of the Orford nickel deposit. Following carbonatization of the serpentinite by CO_2-Ca metasomatism and the formation of listwaenite along the fault contact, continued hydrothermal activity, probably coeval with regional metamorphism, resulted in the replacement of the listwaenite by diopside and grossular. Chromite in the listwaenite, probably derived from the protolith serpentinite, provided nucleation sites for some of the grossular. Chromium mobilized by the partial dissolution of chromite was taken up by the grossular. Nickel, already present in the listwaenite and probably derived from the protolith serpentinite, was also mobilized, and with the addition of sulfur, arsenic and possibly more nickel, was reprecipitated as millerite and maucherite. The fine-grained diopside-grossular assemblage was subsequently brecciated by fault movement. Hydrothermal solutions then invaded the fractured zone, depositing diopside, grossular and calcite in openings.

MINERALOGY

The minerals occurring at the Orford nickel mine are listed in Table 1. Species marked with an asterisk were identified in the course of the present study and have not been previously reported from this locality. Mineral identifications were made by a combination of X-ray powder diffraction, and semiquantitative (EDS) and quantitative (WDS) electron microprobe analyses.

***Table 1.* Minerals of the Orford nickel mine.**

Sulfides	***Phosphates and Arsenates***
Arsenopyrite*	Annabergite*
Godlevskite*	Apatite group*
Maucherite	
Millerite	
Pentlandite*	***Silicates***
	Albite*
Oxides	Allanite-(Ce)*
Chromite	Andradite*
Magnetite*	Clinochlore*
	Diopside
Carbonates	Epidote
Calcite	Grossular
Dolomite	Microcline*
	Pecoraite*
	Prehnite*
	Tremolite

*Species whose occurrence at the Orford nickel mine is reported here for the first time.

The following mineral descriptions are based on an examination of specimens in private and institutional collections, and on the published literature.

Albite $NaAlSi_3O_8$

Albite occurs as colorless crystals to 1 mm, associated with microcrystals of green grossular on a distinctive matrix composed of jackstraw aggregates of yellow-green, striated, prismatic microcrystals of diopside. Microcline, another member of the feldspar group, is found in the same association. The albite crystals have a blocky habit, with an obvious triclinic symmetry. The crystal faces have a slightly frosted appearance.

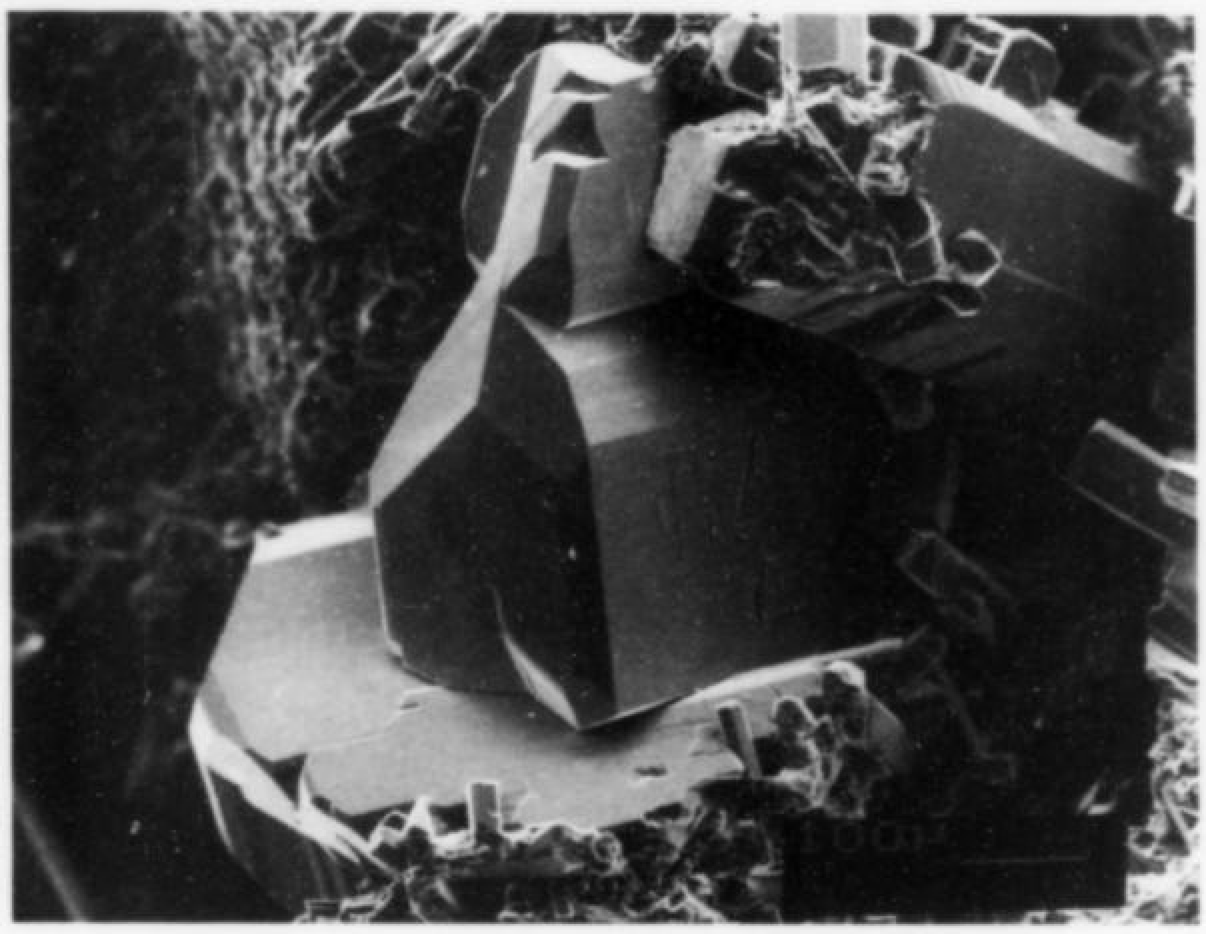


Figure 12. **Allanite-(Ce), twinned tabular crystals 0.7 mm across. S. Cares collection. SEM photo by T. T. Chen.**

Allanite-(Ce) $Ca(Ce,La)(Al,Fe,Cr)_3(SiO_4)_3(OH)$

Chromian allanite-(Ce) has been found as groups of intergrown, square, tabular, twinned crystals to about 0.7 mm, associated with microcrystals of diopside and grossular in cavities in a yellow-green fibrous diopside matrix. The morphology of the crystals suggests that the twin plane is (100). The crystals are transparent, dark brown and have a vitreous to adamantine luster.

Two crystals were examined with the electron microprobe. One showed three distinct zones due to a wide variation in Al, Cr and Fe in the Al site, and Ca and rare-earth elements (REE) in the REE site. The second crystal proved to be unzoned. Its analysis (Table 2) shows that allanite from the Orford nickel mine is unusual in having an exceptionally high chromium content.

Only a few crystals of allanite-(Ce) have been found to date.

Table 2. **Analysis* of allanite-(Ce) from the Orford nickel mine.**

Weight %		*Formula Content****	
SiO_2	30.90	Si^{4+}	3.008
Al_2O_3	13.05	Al^{3+}	1.497
CaO	10.55	Ca^{2+}	1.100
Cr_2O_3	7.11	Cr^{3+}	0.547
FeO	10.60	Fe^{2+}	0.863
MnO	0.25	Mn^{2+}	0.021
TiO_2	0.31	Ti^{4+}	0.023
La_2O_3	7.60	La^{3+}	0.273
Ce_2O_3	13.48	Ce^{3+}	0.480
Pr_2O_3	1.53	Pr^{3+}	0.054
Nd_2O_3	3.21	Nd^{3+}	0.112
Sm_2O_3	0.17	Sm^{3+}	0.006
H_2O**	1.54	H^+	1.000
Total	100.30	Cation Σ	8.984

* Microprobe analysis using Jeol 733 Superprobe with Tracor-Northern automation. Operating conditions: 15kV, 20 na, 30 μm defocussed beam. ** Determined by stoichiometry.
*** Formula content on basis of 13 anions.

Andradite $Ca_3Fe^{3+}_2(SiO_4)_3$

This member of the garnet group occurs as transparent, pale yellowish brown dodecahedrons to 1 mm associated with colorless diopside crystals in small cavities in fine-grained massive diopside and grossular.

A microprobe analysis gave CaO 33.91, MnO 0.34, Al_2O_3 2.29, V_2O_3 0.05, Fe_2O_3 28.14, SiO_2 36.59, total 101.32 weight %. No chromium was detected.

Andradite forms a series with grossular, and may be more common than the few known specimens would indicate.

Annabergite $Ni_3(AsO_4)_2 \cdot 8H_2O$

Annabergite is the principal component of pale bluish green encrustations occasionally found on and in weathered material in the mine dumps. Under the microscope, the encrustations are observed to be finely botryoidal. The weathered material may have come from the surface of the deposit and may predate mining.

Apatite group $A_5(XO_4)_3(F,Cl,OH)$

Apatite has been found as tiny, transparent, very pale yellow to colorless grains associated with pecoraite, millerite, grossular and diopside. The specific apatite species has not been determined.

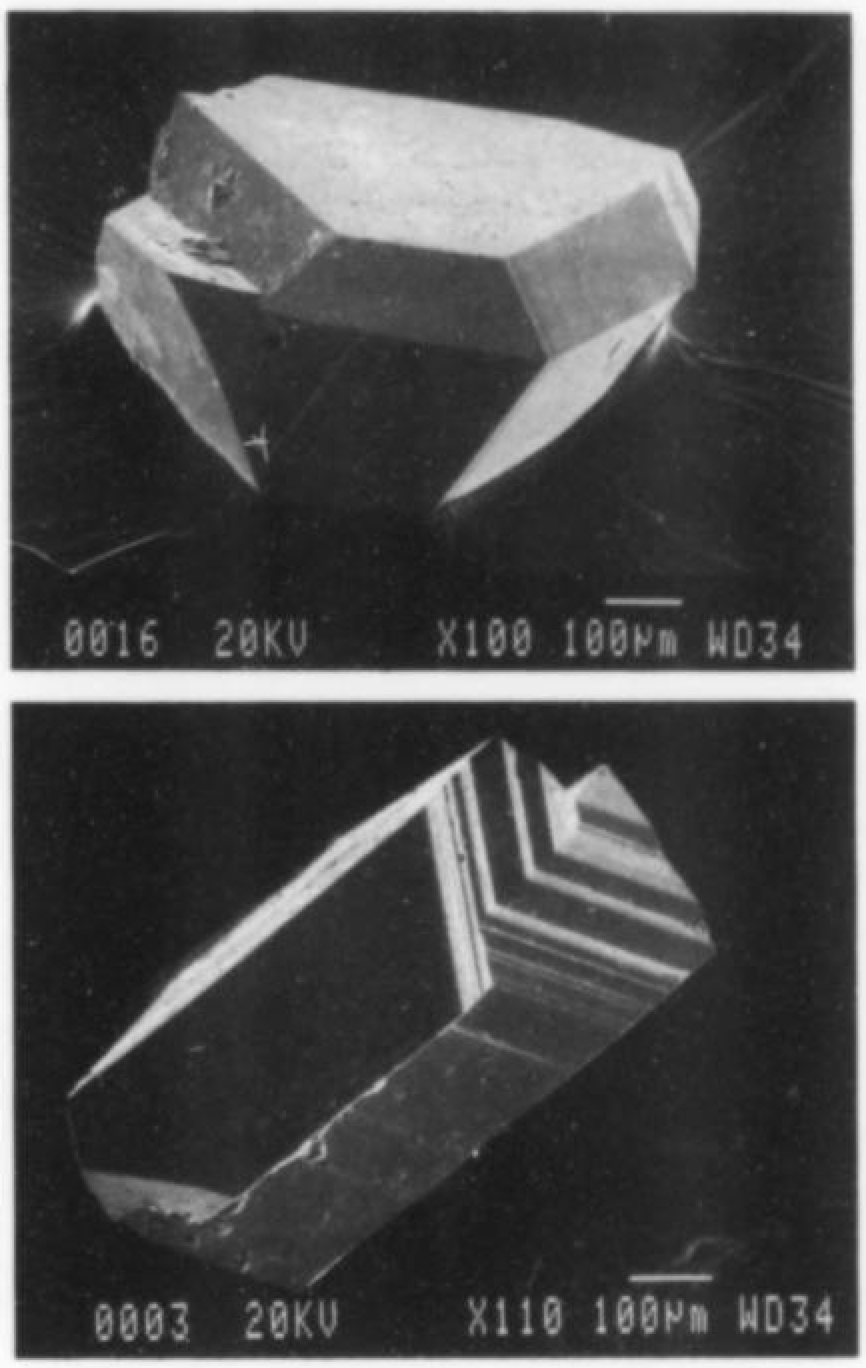


Figure 13. **Arsenopyrite, twinned crystal 0.7 mm across. W. A. Henderson collection. SEM photo by T. T. Chen.**

Arsenopyrite FeAsS

Arsenopyrite occurs as steel-gray, tabular, twinned crystals to 0.7 mm embedded in calcite and associated with grossular, diopside and millerite. Unequal development of the crystals has resulted in what appears to be one dominant {101} face. The crystals are apparently also twinned on (101). The prism faces are striated.

Like the other species which are found primarily as microcrystals embedded in calcite, arsenopyrite is exposed by etching the calcite with *dilute* hydrochloric or acetic acid. Only one specimen of arsenopyrite is currently known, but diligent search should uncover others.

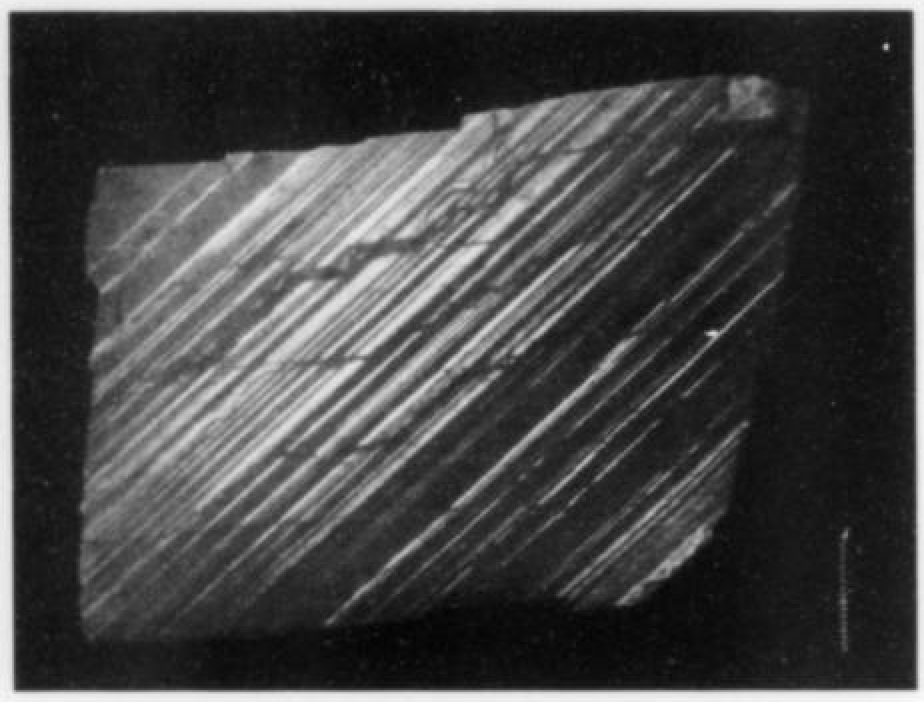


Figure 14. **Calcite showing a set of $\{01\bar{1}2\}$ twin striations on a parting surface developed along a second set of $\{01\bar{1}2\}$ twin planes. The parting surface is corrugated due to displacement along the first set of twin planes. W. A. Henderson collection and photo.**

Calcite $CaCO_3$

Coarsely cleavable massive calcite is very common in the mine dumps. Individual cleavage rhombohedrons measure up to 12 cm across. These cleavage fragments exhibit several interesting and uncommon features. They are polysynthetically twinned with the negative rhombohedron $(01\bar{1}2)$ as the twin plane (Palache and Wood, 1904). This pressure-induced twinning is evidenced by parallel striations on the $\{10\bar{1}1\}$ cleavage surfaces. All three equivalent sets of $\{01\bar{1}2\}$ twins may be observed in a single cleavage fragment, with two sets much more strongly developed than the third. Slip has occurred along the two sets, in what was apparently a second episode of plastic deformation; this causes displacement of the twin lamellae, and offsets where the twin striations cross. Parting is easily produced along the weakened twin planes, resulting in $\{10\bar{1}1\}$ cleavage rhombs bevelled by one or two $\{01\bar{1}2\}$ parting surfaces. The parting surfaces have pronounced parallel ridging and a dull luster. A further interesting feature of the calcite cleavage rhombs is that their surfaces are frequently twisted.

Crystals of calcite are uncommon. Small crystals, up to 3 mm in size, occur with grossular and diopside in the cavities in massive diopside. Larger crystals, up to 5 cm across, have been found in what appear to be solution cavities in massive calcite. The calcite crystals display scalenohedral, rhombohedral, and short prismatic habits, and tend to be rounded and etched. Several stages of deposition, each represented by a different crystal habit, may be observed on a single specimen.

The calcite is colorless to white, and transparent to opaque. It does not fluoresce in ultraviolet light.

Chromite $Fe^{2+}Cr_2O_4$

Chromite is relatively common in the Orford deposit. It occurs as inclusions in grossular crystals, as grains disseminated in granular grossular and diopside, and as small masses. Fortier (1946) reported finding chromite masses up to 30 cm across. Very rarely, chromite occurs as rough octahedral crystals to 0.7 mm. Both the massive chromite and the crystals are usually encrusted by grossular.

Microprobe analyses by Dunn (1978) of chromite inclusions in grossular have shown that their composition varies from $(Fe^{2+}_{0.57}Mg_{0.40}Mn_{0.02})(Cr_{1.57}Al_{0.37}Fe^{3+}_{0.06})O_4$ to $(Fe^{2+}_{0.53}Mg_{0.43}Mn_{0.02})(Cr_{1.72}Al_{0.23}Fe^{3+}_{0.06})O_4$. The magnesium content of 0.40 to 0.43 atoms per unit formula indicates a composition almost midway between chromite and magnesiochromite.

The chromite is black with a submetallic to metallic luster. Under the microscope it shows brownish red internal reflections.

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

This member of the chlorite group occurs as emerald-green foliated aggregates and thin tabular pseudohexagonal crystals to 1 cm embedded in calcite in pale yellowish green, fine-grained massive grossular and diopside. Godlevskite, maucherite, millerite and pentlandite occur in the same association.

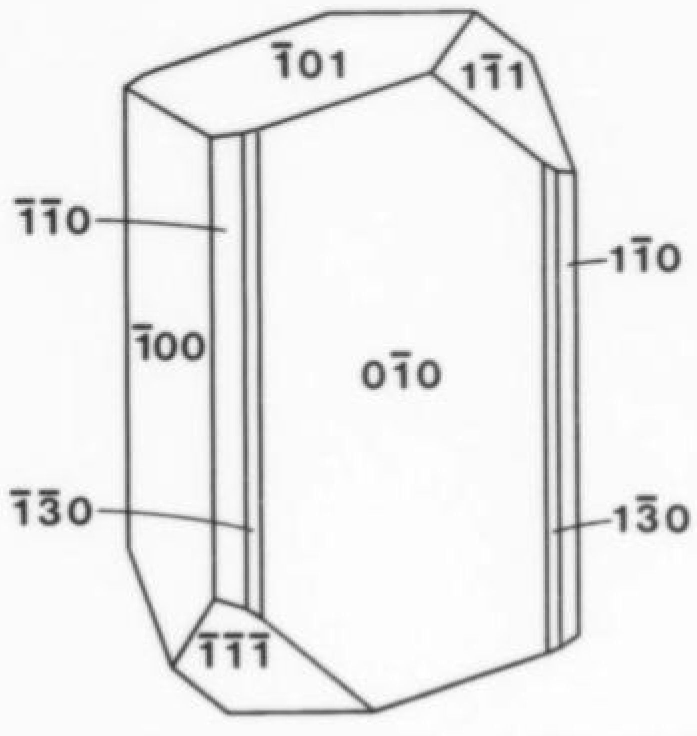


Figure 15. **Idealized drawing of diopside microcrystal from a calcite-filled cavity. SHAPE drawing by L. Horváth.**

Diopside $CaMgSi_2O_6$

Although an 1863 analysis indicated that the pyroxene from the Orford nickel deposit was diopside (Hunt, 1863a), the group name pyroxene continued to be used in the literature and on mineral collection labels until well into this century.

Much of the diopside is present as fine-grained masses and intergrown, subhedral prismatic to bladed crystals. Both types are often found in close association. Large masses of very coarsely crystallized subhedral crystals can be observed *in situ* in the footwall of the deposit. Columnar groups of subhedral prismatic crystals are also common in the mine dumps; groups up to 32 cm in length have been found. Elongated interstices between the crystals in the columnar

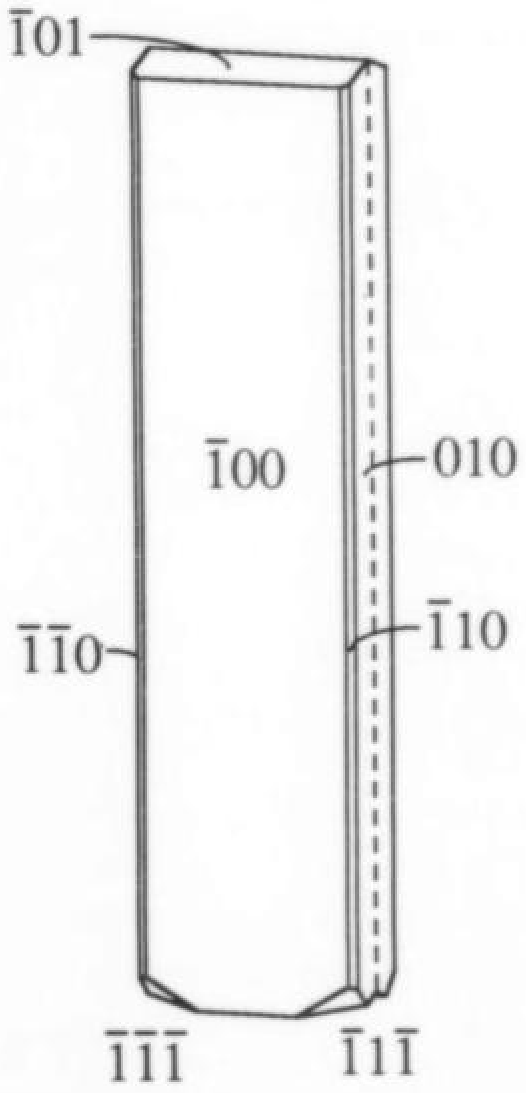


Figure 16. **Bladed diopside crystal tabular on (100) and twinned on (100). SHAPE drawing by R. P. Richards.**

groups are often lined with drusy grossular. Rarely, the crystals in the columnar groups are well formed and terminated.

Large cleavage masses of calcite in contact with very coarsely crystallized diopside are often penetrated by prismatic to bladed subhedral to euhedral diopside crystals to 8 cm in length. The crystals are sometimes curved and twisted; others appear to have broken *in situ*.

Sharp, equant to tabular diopside crystals to about 1 mm, and less often prismatic, bladed and tabular diopside crystals to about 1 cm in length, usually associated with grossular, are found in cavities in the fine-grained diopside. The cavities range in size from a few millimeters to a few centimeters, and are commonly filled with calcite. These afford excellent microcrystal specimens.

Some of the best diopside specimens from Orford are the large single crystals and parallel to sub-parallel crystal groups which have been recovered from the mine dumps in recent decades. A major find of exceptionally large crystals was made in 1968, and is widely represented in institutional and private collections. It appears that these crystals were originally embedded in calcite, and that they were released when the easily cleaved calcite was fragmented during mining or by weathering. The habit of most of the crystals is thin to thick bladed; a few are prismatic with an almost square cross-section. The bladed crystals are up to 14 cm long, and 2 cm by 3.5 cm in cross-section; a length of 6 cm and a cross-section of 0.5 cm by 1.5 cm is more typical. The crystals tend to be tapered, becoming wider and thinner towards the single termination. This and the numerous offsets on the crystal faces indicate that they are composite crystals. The crystals are also twinned, as described below. Doubly terminated crystals have been found, but are very rare.

In all crystal habits, the dominant forms are the pinacoids $a\{100\}$ and $b\{010\}$; these are combined in the same zone with narrow faces of the prisms $m\{110\}$ and $i\{130\}$ (Palache and Wood, 1904). All the faces in this zone $\{hk0\}$ are lustrous, and the $\{010\}$ faces are usually striated parallel to [001]. The terminating forms are the second-order pinacoid $p\{\bar{1}01\}$ and the fourth-order prism $u\{\bar{1}11\}$; these faces tend to be rough, with a dull luster. Also observed, as minute faces, are the basal pinacoid $c\{001\}$ and the prism $s\{111\}$. Crystals in the tabular habit are flattened on (010), (100), or rarely, on (001). Prismatic and bladed crystals are elongated parallel to [001]. The bladed crystals are tabular on (100), which is an uncommon habit for diopside.

Many of the diopside crystals at Orford are twinned, with (100) as the twin plane. The twins usually interpenetrate to some extent, and commonly the only surface expression of twinning is one or more "tabs" in the terminations, each of which shows a tiny $\{100\}$ face.

The color of fine-grained masses of diopside varies from yellowish white to pale yellow to pale yellow-green. Coarsely crystallized aggregates of diopside are grayish yellow to brownish gray with yellow green areas, and are subtranslucent to opaque. Microcrystals are generally various shades of pale yellow-green, and transparent; occasionally the crystals are colorless. Larger crystals grade to deep yellow-green. The color of the large bladed to prismatic crystals ranges from grayish yellow to a rich yellow-brown, with a vitreous luster. The crystals are megascopically translucent, but under the microscope they are observed to be transparent, with numerous internal "veils." Cabochons with a distinct cat's-eye have been cut from some of these larger diopside crystals.

Single crystals of white diopside labeled as having been found in the same township lot as the Orford nickel mine are in the Ferrier Collection at the Redpath Museum, McGill University. The crystals are doubly terminated, have an equant habit, and are 1.5 cm in size. These may be the same as those described in the catalog note accompanying a specimen of Orford millerite which was displayed at the 1862 London International Exhibition: "there is, on the [same lot], a pale green pyroxenic rock, in which occur druses, lined with large twin crystals of white pyroxene, and with cinnamon-colored garnets" (Geological Survey of Canada, 1862). No other morphologically similar diopside crystals have been observed in collections or on the mine dumps.

Green diopside from the Orford mine is sometimes referred to as "chrome" diopside. Electron microprobe analyses were carried out to determine whether the green color can in fact be attributed to chromium. The analyses (Table 3) confirm the presence of chromium in some samples, but show a much higher content of iron, another transition element which can act as a green chromophore. Vanadium, also known as a green chromophore, was sought but not detected. Only one sample (analysis 1) has a Cr_2O_3 content which overlaps the compositional range of the green chromian diopside from Outokumpu, Finland (Von Knorring *et al.*, 1986). No correlation between color and the chromium content of Orford diopside is evident. These results indicate that the use of the prefix "chromian" is not justified.

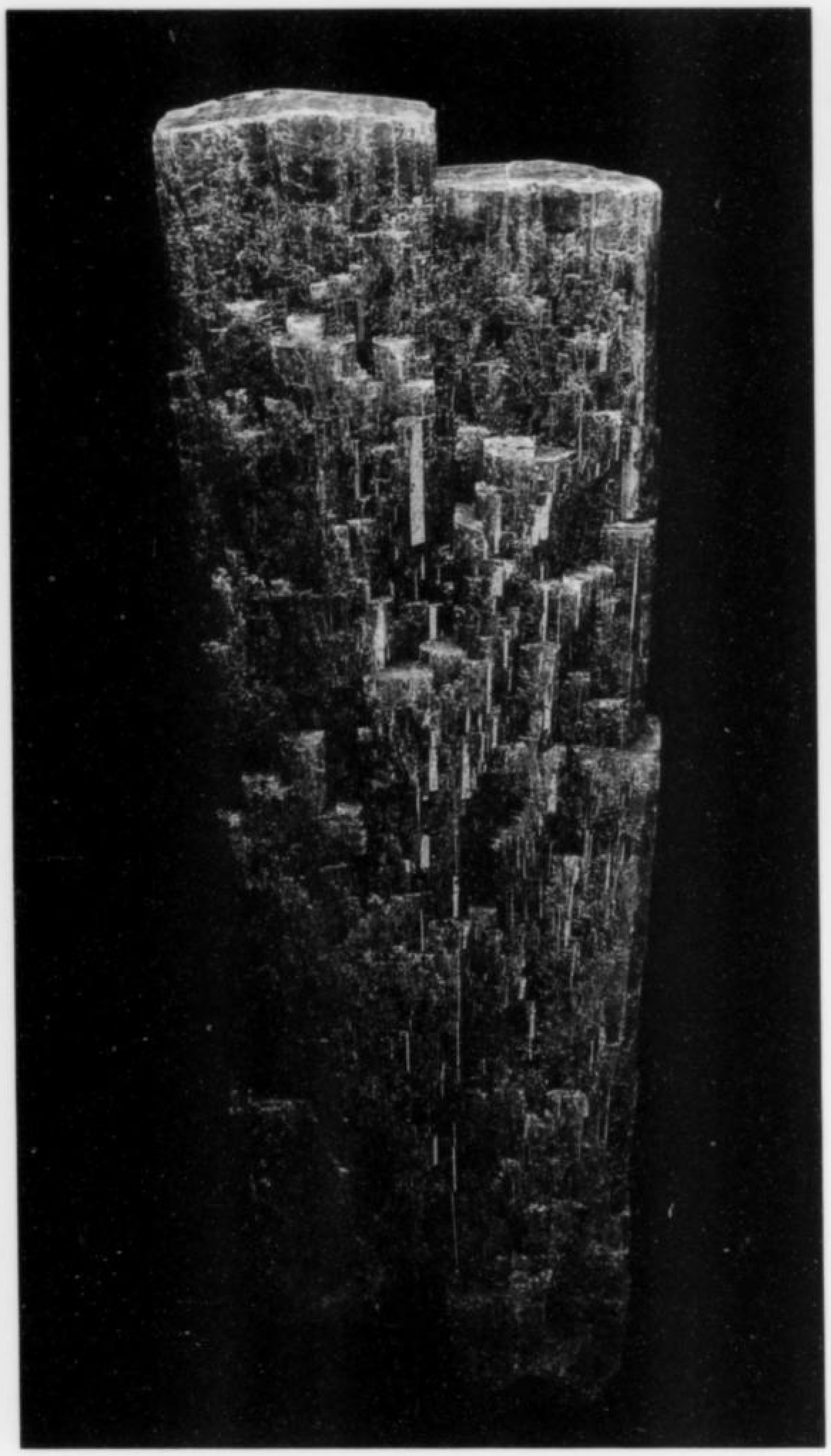
***Table 3*. Analysis* of diopside from the Orford nickel mine.**

	1	*2*	*3*	*4*	*5*	*6*
Color	*light yellow-green*	*yellow-green, light zone*	*yellow-green, dark zone*	*yellow-green*	*brown, light zone*	*brown, dark zone*
SiO_2	54.26	54.28	55.06	55.65	53.93	54.98
CaO	25.71	25.73	25.63	26.09	25.67	25.73
MgO	14.89	14.69	15.27	16.67	13.19	15.72
MnO	0.23	0.38	0.16	0.07	0.36	0.08
FeO**	4.54	5.32	4.35	2.80	7.61	3.79
Na_2O	0.19	0.07	0.10	0.00	0.05	0.11
Cr_2O_3	0.53	0.22	0.13	0.00	0.00	0.00
Al_2O_3	0.27	0.00	0.18	0.13	0.11	0.48
Total	100.62	100.69	100.88	101.41	100.92	100.89

* Microprobe analyses using Jeol 733 Superprobe with Tracor-Northern automation. Operating conditions: 15kV, 20 na, 30 µm defocussed beam.

** Total iron as FeO.

(1) Grain with very faint patchy zoning; from a small transparent crystal, associated with green grossular in a calcite-filled cavity in massive fine-grained diopside. (2) Zoned grain from a large bladed crystal. (3) Same grain as in (2). (4) Grain with very faint patchy zoning; from a columnar aggregate of subhedral crystals, brown with yellow green areas. (5) Grain with pronounced zoning; same specimen as in (4). (6) Same grain as in (5).



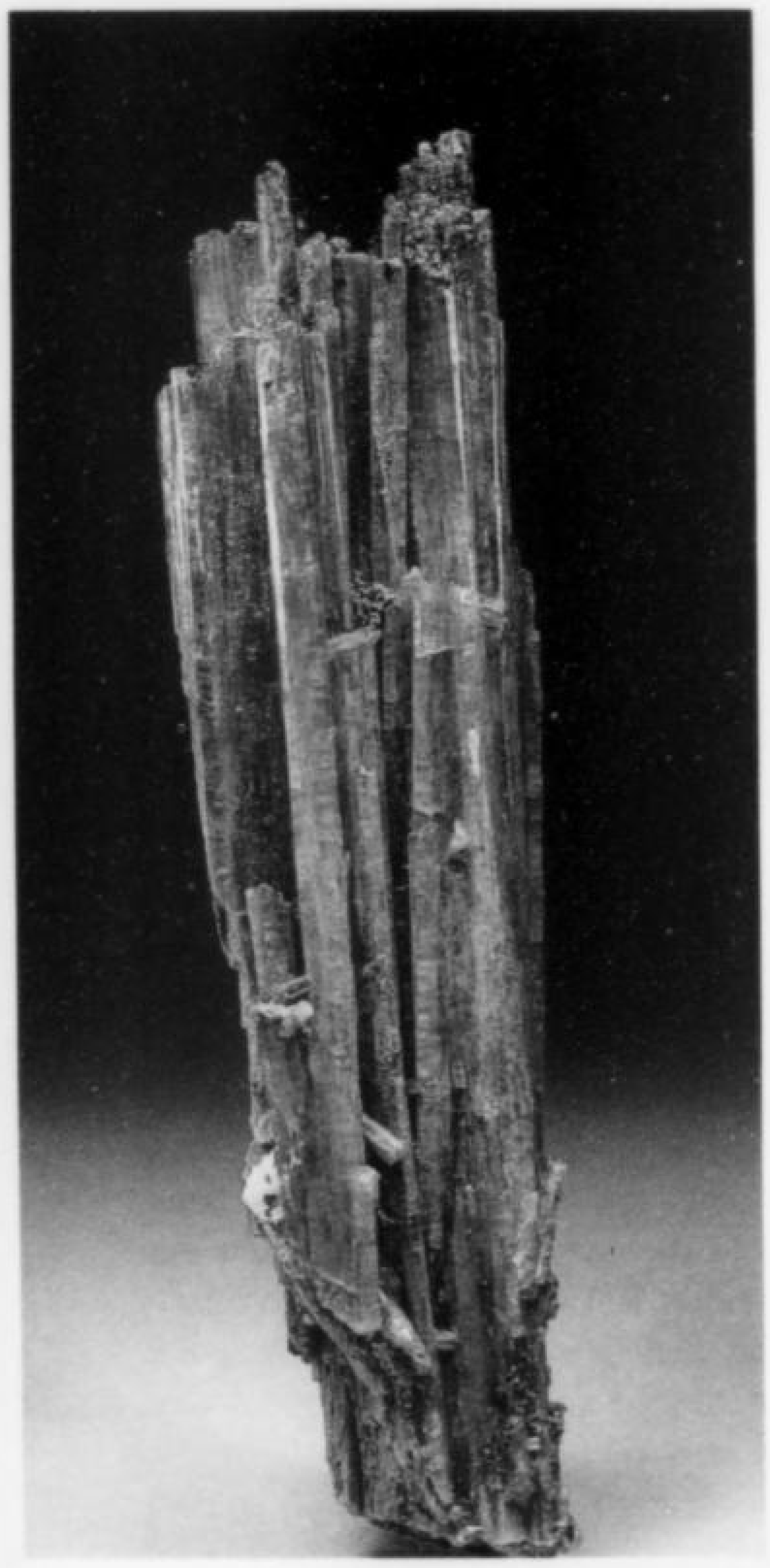


Figure 18. Diopside, columnar group of prismatic crystals 11 cm tall. M. Hébert collection. G. Robinson photo.

Figure 20. (Below) Diopside crystal croup, 6.5 cm tall. P. Tarassoff collection. G. Robinson photo.

Figure 17. Diopside, two diverging bladed crystals 13.8 cm tall, collected in 1968. Harvard Mineralogical Museum specimen 119207. (Shown actual size.)

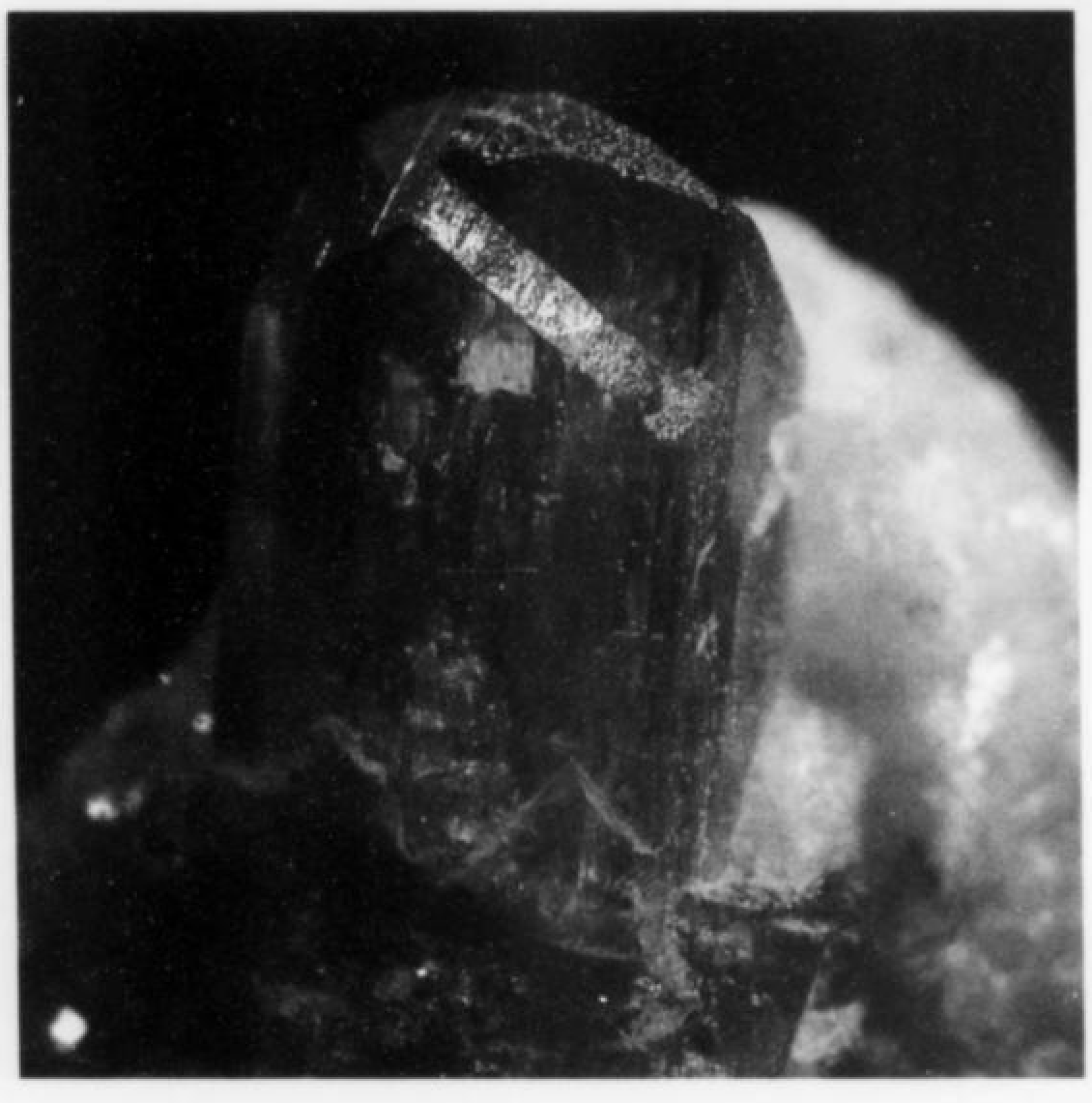


Figure 19. Diopside crystal, 2 mm tall. L. Horváth specimen and photo.

Figure 21. **Diopside, short prismatic crystal 2 mm in length. P. Tarassoff collection. L. Horváth photo.**

Figure 22. **Diopside, group of tabular crystals, 6 cm across. Canadian Museum of Nature specimen 53130. G. Robinson photo.**

Dolomite $CaMg(CO_3)_2$

Willimot (1882) reported that dolomite occurs with calcite in the interstices of aggregates of coarsely crystallized diopside. Its presence has not been confirmed.

Epidote $Ca_2(Fe^{3+},Al)_3(SiO_4)_3(OH)$

Hunt (1879) reported that small crystals of pale green epidote occurred in calcite with green grossular, chromite and millerite. No specimens of this description were observed in any of the collections examined in the course of the present study; the occurrence of epidote has therefore not been confirmed.

Figure 24. **Back-scattered electron image of polished section of godlevskite/pentlandite crystal showing intergrowth of godlevskite (light), pentlandite (dark) and maucherite (white). 100 μm scale bar. R. Gault photo.**

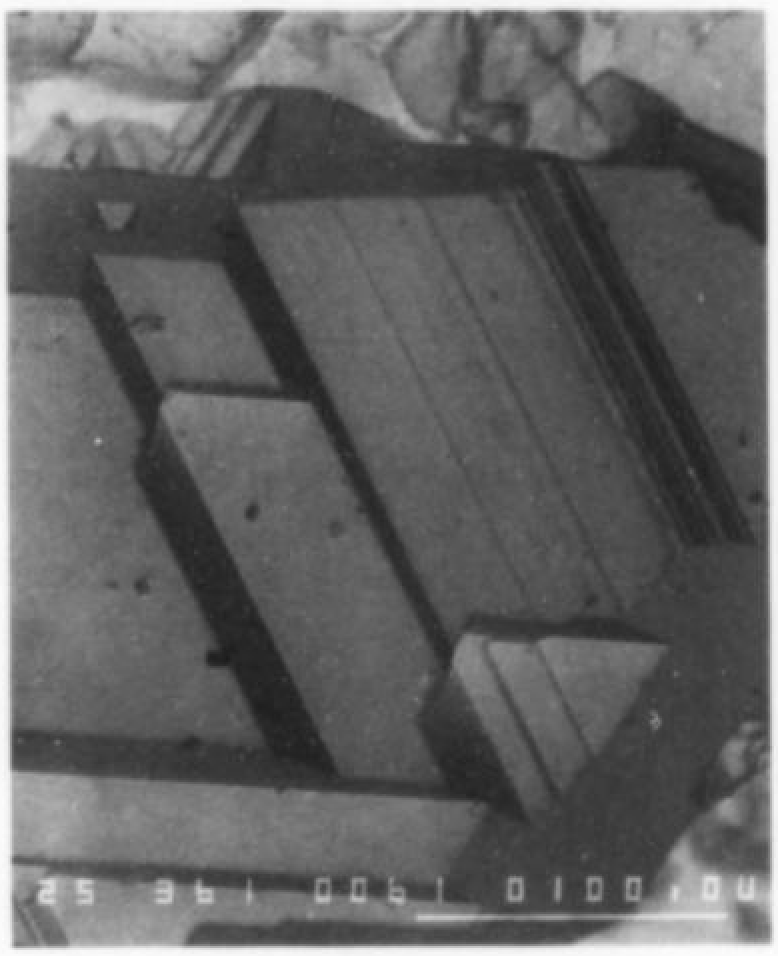


Figure 23. **Godlevskite/pentlandite crystal, field of view 0.25 mm. P. Tarassoff collection. SEM photo by R. Gault.**

Godlevskite $(Ni,Fe)_7S_6$

Godlevskite was originally described from the Noril'sk and Talnakh nickel deposits in Russia (Kulagov *et al.*, 1969), and was later found at the Texmont nickel mine near Timmins, Ontario (Naldrett *et al.*, 1972). At these localities godlevskite occurs as anhedral grains.

At the Orford nickel mine, godlevskite has been found intimately intergrown with pentlandite as euhedral crystals to 0.5 mm. The godlevskite/pentlandite crystals occur disseminated along with maucherite, millerite, clinochlore and chromite in a pale green, massive, fine-grained granular intergrowth of grossular and diopside impregnated with calcite. The sharpest crystals are found in small calcite-filled cavities.

The godlevskite/pentlandite crystals are equant and complex, with numerous stepped faces, some with distinctive triangular growth features. The crystals are bright, metallic, and bronze-yellow in color.

An electron microprobe analysis of the godlevskite gave Fe 3.71, Ni 64.01, Co 0.51, S 31.97, total 100.21 weight %.

Grossular $Ca_3Al_2(SiO_4)_3$

For many years the green garnet from the Orford nickel mine has been incorrectly called "uvarovite." In the earliest references it was referred to simply as "chrome garnet" (Hunt, 1863a; Willimot, 1882) based on Hunt's analysis which showed Al>Cr. However, citing Hunt's analysis, Palache and Wood (1904) called the garnet "ouvarovite, but with a very small proportion of chromium." The name "uvarovite" has been widely applied to Orford material in the literature (Fortier, 1946; Dresser and Denis, 1949; Sinkankas, 1964; Gregory, 1967; Traill, 1983) and on mineral collection labels. The correct identity of the green garnet was demonstrated by Dunn in 1978. Dunn's microprobe analyses of 14 specimens showed the garnet to be a chromian grossular with a compositional range from $(Ca_{5.89}Mn_{0.09})$-$(Al_{3.14}Cr_{0.41}Fe^{3+}_{0.37})Si_{6.06}O_{24}$ to $(Ca_{5.89}Mn_{0.11})(Al_{2.54}Cr_{1.25}Fe^{3+}_{0.21})Si_{6.00}O_{24}$.

The chromian grossular occurs as sharp crystals to 2 mm in druses on coarsely crystallized diopside, in druses lining cavities in fine-grained diopside, and as "floaters" embedded in calcite. Less commonly, grossular crystals encrust massive chromite. Grossular is also found disseminated in, and intergrown with fine-grained diopside, as fine-grained masses, and as granular intergrowths with calcite. The individual grains of grossular tend to retain a subhedral to euhedral crystal form.

The majority of the crystals are simple rhombic dodecahedrons {110}. On some crystals the dodecahedrons are modified by narrow faces of the {211} trapezohedron, sometimes in combination with small faces of the cube {100}, or a tetrahexahedron. This latter form has not been measured. Palache and Wood (1904) also observed the hexoctahedrons {358} and {459} as very narrow modifying faces; this was the first time that these forms had been reported for the garnet group. Most of the crystals have very smooth and lustrous faces.

The color of the crystals generally ranges through various shades of yellow-green to emerald-green; some appear almost black due to included chromite. Less commonly, the color is pale to dark yellow. The crystals are mostly transparent. Some crystals are color-zoned, with a green core and a yellow outer zone, or an opaque white to pale yellowish green core and a transparent emerald-green outer zone. Massive grossular is generally pale green to pale yellow-green, and translucent to opaque.

Rarely, the "hessonite" variety of grossular is found as druses of brownish orange crystals to 3 mm on fine-grained diopside and green grossular. Some of this material may be the same as the "cinnamon-colored garnets" referred to above in the description of diopside.

Magnetite $Fe^{2+}Fe^{3+}_2O_4$

Magnetite has been found as aggregates and disseminations of subhedral to euhedral crystals to 2 mm along the selvedges of small masses of calcite in fine-grained diopside. It is associated with clinochlore and pale green grossular. The smallest crystals are skeletal, while larger crystals generally have rounded faces and exhibit oscillatory growth. The dominant crystal form is the dodecahedron modified by small octahedral and, occasionally, cubic faces. Magnetite also occurs as extremely small, sharp octahedrons in the tremolite marble in the footwall of the deposit.

Magnetite is far less common at Orford than chromite, from which it can be readily distinguished by its strong magnetism.

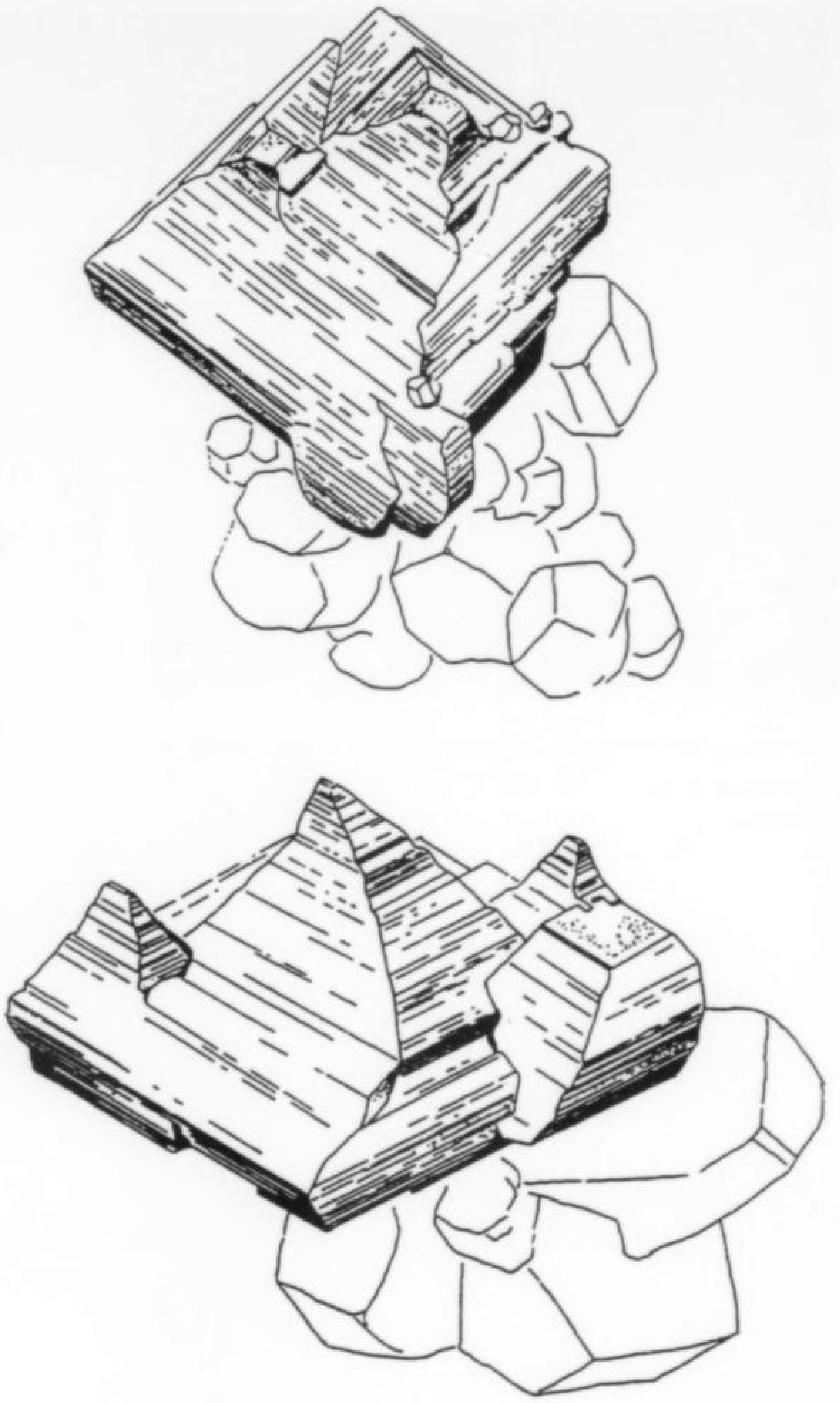


***Figure 25.* Maucherite crystals: (top) 1.0 mm across, S. Cares collection; (bottom) 0.4 mm across. W. A. Henderson collection. Drawing by G. Glenn.**

Maucherite $Ni_{11}As_8$

A metallic mineral provisionally identified as "rammelsbergite" by Palache and Wood (1904) was subsequently shown to be maucherite (Peacock, 1940). Had a paucity of material not prevented Palache and Wood from carrying out a definitive chemical analysis, the Orford nickel mine might have become the type locality for the mineral we now know as maucherite, which was not formally described until 1913 (Grunling, 1913). Dunn (1978) found that Orford maucherite is almost pure $Ni_{11}As_8$, with no iron substitution for nickel.

The maucherite occurs as single crystals and crystal clusters to 1 mm associated with green grossular, diopside and millerite in calcite; the crystals are revealed by etching the enclosing calcite. The dominant crystal forms are the tetragonal dipyramid {101} and the basal pinacoid {001} (Palache and Wood, 1904; Peacock, 1940). The dipyramid {102} is observed as narrow faces. Palache and Wood (1904) also reported the dipyramids {104}, {108} and {304} and the prism {110}, but there is some uncertainty about the goniometric measurements (Peacock, 1940). The maucherite crystals are heavily striated perpendicular to the *c* axis due to oscillatory growth between the dipyramidal forms and the pinacoid. Many of the crystals have multiple, stepped, pyramid-like terminations. The maucherite has a bronze-yellow color, often with an iridescent tarnish.

The Orford nickel mine is the only known occurrence of distinct crystals of maucherite in Canada.

Microcline $KAlSi_3O_8$

This member of the feldspar group occurs as thin, platy crystals to 2 mm across, associated with grossular and diopside. The microcline crystals have a corroded appearance, and are colorless to white, with a waxy luster. In the few known specimens, the associated diopside occurs as jackstraw aggregates of distinctive, yellow-green, short prismatic crystals.

A microprobe analysis of one microcline crystal gave K_2O 16.23, Na_2O 0.20, BaO 0.20, SrO 0.11, Al_2O_3 17.65, SiO_2 64.82, total 99.21 weight %.

Millerite NiS

The Orford nickel mine is noted for its terminated millerite crystals, which are illustrated in Goldschmidt's *Atlas der Krystallformen* (1920) and [labeled "Brompton Lake, Quebec"] in Dana's *System of Mineralogy* (Palache, *et al.*, 1944). The "beauty, perfection and unusual size" of the crystals led Palache and Wood (1904) to undertake a classic crystallographic study of Orford millerite.

A microprobe analysis of the millerite indicates substitution of iron (3.82 weight %) and cobalt (0.16 weight %) for nickel, and arsenic (0.16 weight %) for sulfur (Gauthier *et al.*, 1989). No copper was detected.

The millerite crystals occur either embedded in calcite or implanted on drusy grossular and diopside in calcite-filled cavities. Crystals in intimate contact with grossular and diopside are often "bent, twisted and contorted . . . as though, after formation, the crystals had been pressed down to fit all the irregularities of the uneven underlying surface" (Palache and Wood, 1904). Crystals projecting into calcite tend to be straighter and better formed. They occur as isolated crystals, as parallel to subparallel aggregates, as radiating clusters, and as randomly oriented, intergrown groups. Eustis (1879a) reported the occurrence of parallel crystals forming a flat plate. In one exceptional specimen in the Redpath Museum collection, millerite forms a crust of intergrown, flat-lying, microcrystals completely lining a 3 by 4-cm cavity. The habit of millerite crystals varies from stubby to long prismatic, to acicular. Most crystals are less than 1 cm in length and 1.5 mm in diameter. An unusual feature of some of the crystals is that they have a hollow tubular core.

The largest crystals are wholly enclosed in calcite. Willimot (1882) reported that such crystals often exceeded 8 *cm* in length. Hunt (1879) reported the occurrence of tabular crystals about 1 cm in width and 2.5 cm in length. None of the larger crystals appear to have been preserved. A crystal in the Whitney collection at Harvard, and illustrated by Palache and Wood (1904), has a length of 4 cm and a diameter of 2 mm.

Many of the millerite crystals have offsets due to pressure-induced twinning or gliding on $(01\bar{1}2)$. Repeated twinning along closely spaced glide planes causes the crystals to appear bent; in extreme cases, crystals exhibit V-bends. The occurrence of pressure-induced twinning in millerite was first recognized by Palache and Wood (1904) in their study of Orford millerite.

The millerite crystals exhibit a large number of forms. Palache and Wood (1904) measured nine forms, of which four were new for millerite. One or more faces of an additional 13 forms were observed but could not be identified with certainty. The dominant form is the trigonal prism $\{10\bar{1}0\}$ which is sometimes combined with the ditrigonal prisms $\{11\bar{2}0\}$ and, more rarely, $\{21\bar{3}0\}$ and $\{72\bar{9}0\}$. The prisms are striated parallel to [0001], often heavily due to oscillatory growth of the prism faces, and tend to have a rounded hexagonal to triangular cross-section. The most common termination is the positive rhombohedron $\{10\bar{1}1\}$, which is also a direction of perfect cleavage. Other terminating forms are the negative rhombohedrons $\{02\bar{2}1\}$ and $\{50\bar{5}2\}$, and the scalenohedrons $\{21\bar{3}1\}$ and $\{\bar{4}153\}$; these latter forms appear as very small faces. The prism faces of crystals freshly released from calcite have a bright metallic luster; their terminal faces tend to be duller and may be rough and pitted. The color of the millerite is brass-yellow and is quite distinctive from the bronze-yellow color of maucherite.

Millerite also occurs as grains disseminated in fine-grained massive grossular and diopside, and in the tremolite marble in the footwall.

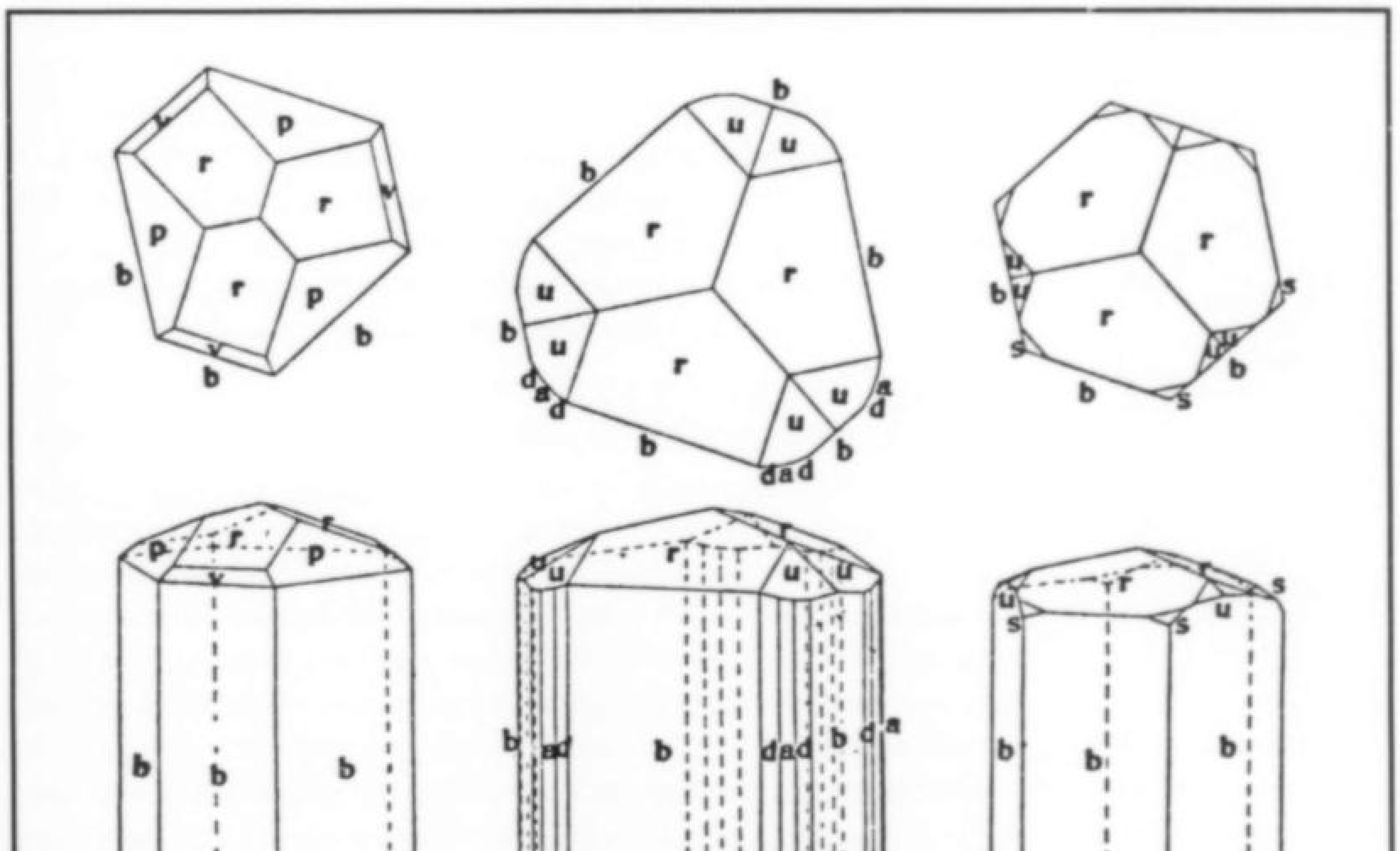


Figure 26. **Crystal drawings of millerite from the Orford nickel mine (from Palache and Wood, 1904).**

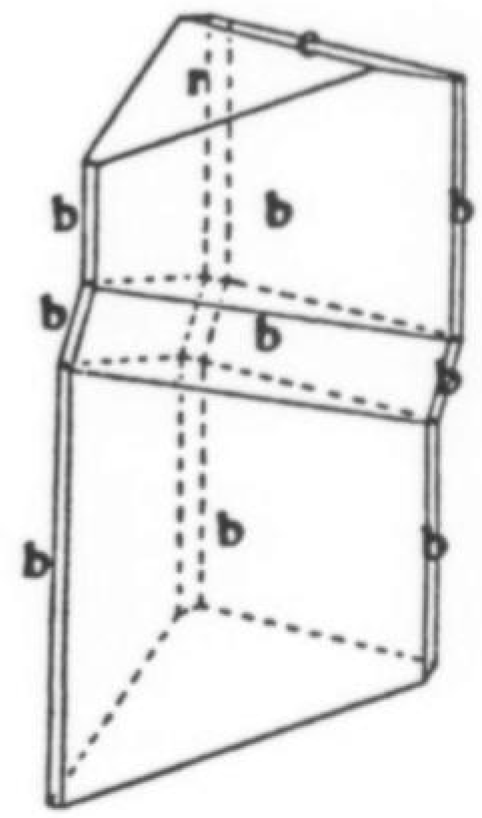


Figure 27. **Drawing of millerite crystal with offset caused by pressure twinning on $(01\bar{1}2)$ (from Palache and Wood, 1904).**

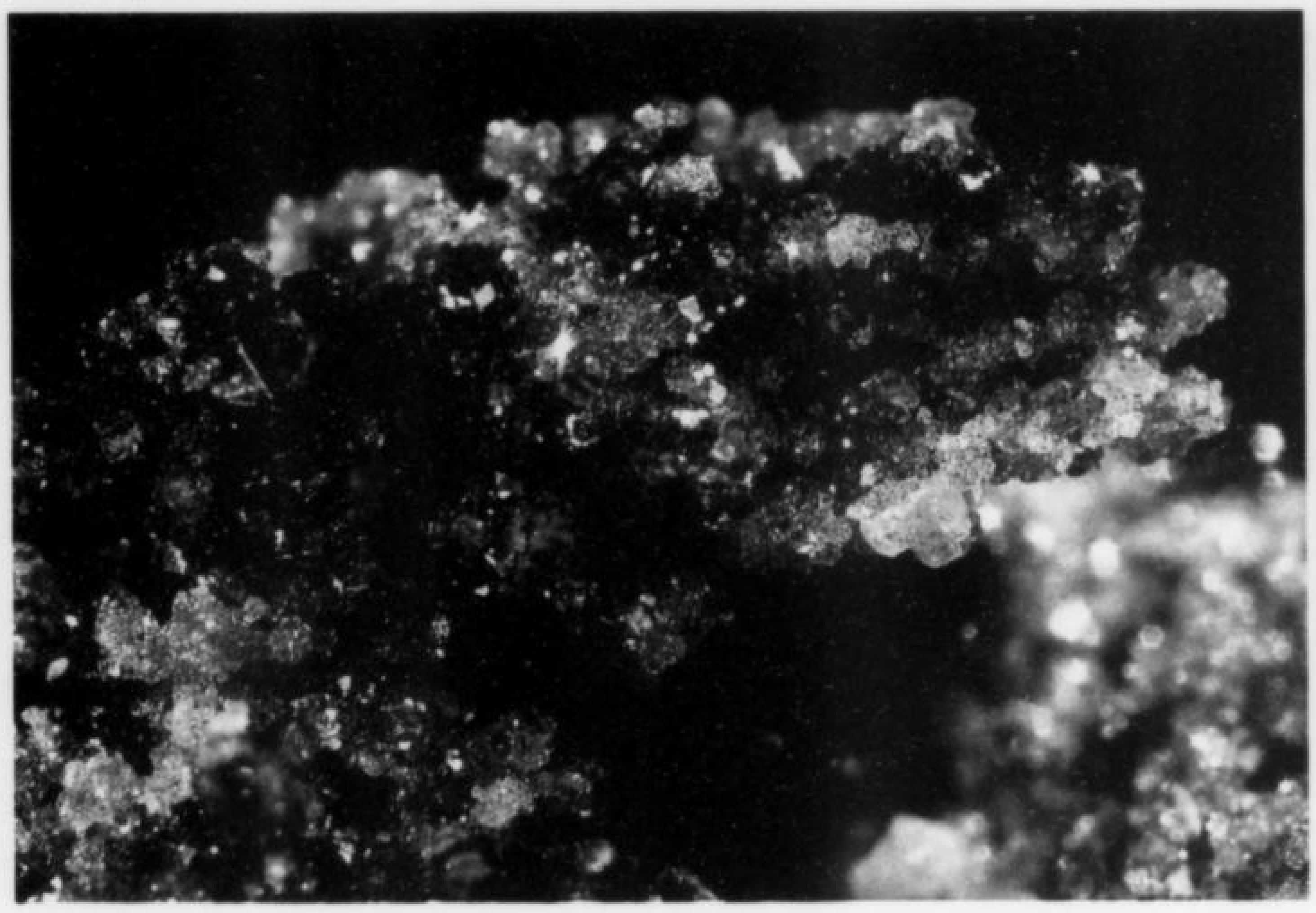


Figure 28. **Grossular, druse of 1 mm crystals. L. Horváth collection and photo.**

Figure 29. **Andradite, drusy crystals, field of view 6 mm. P. Tarassoff collection. L. Horváth photo.**

Figure 30. **Grossular in typical association with diopside; length of largest diopside crystal, 7 mm. P. Tarassoff collection. L. Horváth photo.**

The best clue to finding millerite crystals in the mine dumps is their association with green grossular embedded in calcite. Examination of freshly broken surfaces of the calcite will often reveal millerite if it is present. The best microcrystal specimens are obtained by etching the calcite in acid. Millerite has not been observed in direct association with coarsely crystallized diopside.

Pecoraite $Ni_3Si_2O_5(OH)_4$

Pecoraite, a nickel-bearing member of the kaolinite-serpentine group, occurs at Orford as grains, coatings, partial replacements and pseudomorphs after millerite crystals. Larger grains, to 2 mm, are cryptocrystalline. The partial replacements and pseudomorphs have a lamellar to splintery, somewhat fibrous structure. The color ranges from greenish yellow to yellow-green, with a waxy luster.

A quantitative microprobe analysis of a cryptocrystalline grain showed partial substitution of Ni by Mg, Fe, Co, Na, Mn and Ca, in descending order of atomic percentage. In total, approximately one in three of the Ni sites in the chemical formula is replaced by these elements. The mineral gives a very diffuse X-ray powder pattern similar to that reported for pecoraite in the Powder Diffraction File (22-754).

Pentlandite $(Fe,Ni)_9S_8$

As noted above, pentlandite occurs intimately intergrown with godlevskite. Maucherite was also observed as an intergrowth in one sample. The composite godlevskite/pentlandite crystals have sharp external faces. Although impossible to differentiate visually, the godlevskite and pentlandite are easily distinguishable through scanning electron microscopy using the backscatter image detector. No epitaxial relationship between the two species has been noted. A microprobe analysis of the pentlandite gave Fe 20.02, Ni 43.35, Co 4.84, S 31.65, total 99.86 weight %.

Pentlandite also occurs as anhedral, equant grains to 0.5 mm, associated with tiny chromite grains embedded in massive tremolite.

Prehnite $Ca_2Al_2Si_3O_{10}(OH)_2$

Prehnite has been found as reniform masses with a platy structure, as semi-parallel aggregates of subhedral blocky crystals to 1.5 cm on a matrix of platy prehnite, and as corroded, longitudinally striated, bladed crystals to 5 mm in length. The blocky crystals are etched and have a pale yellow-brown color. The bladed crystals are colorless. The platy masses have a yellowish white to pale tan color and a vitreous luster on fresh surfaces. The prehnite is associated with green grossular and diopside.

Prehnite crystals can easily be mistaken for etched calcite crystals, while the platy masses superficially resemble diopside. Prehnite has probably been previously overlooked for this reason.

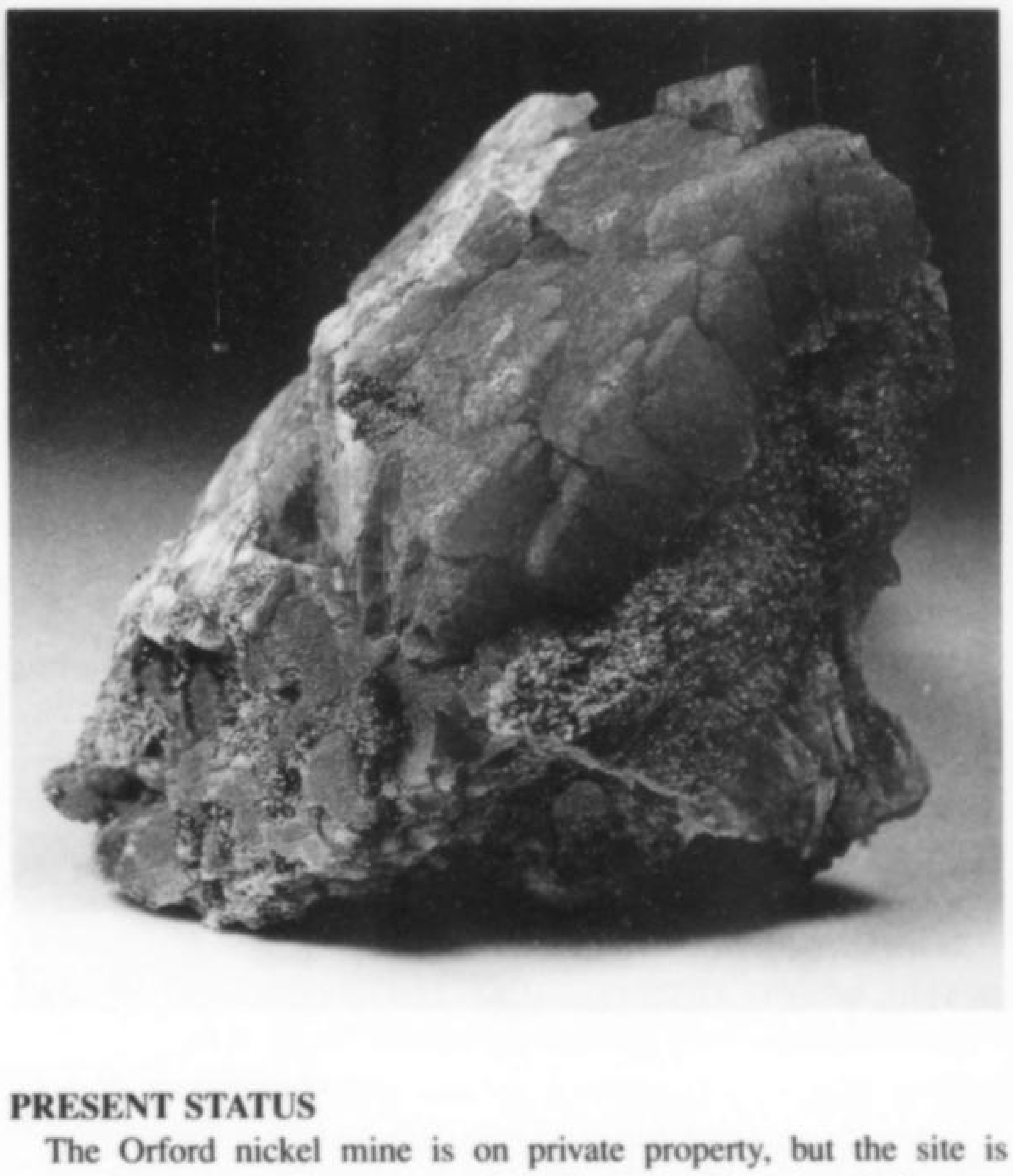
Pyrite FeS_2

A cautionary note is in order regarding the pyrite which is found in the vicinity of a foundation between the two mine shafts. This pyrite was used as a flux in smelting the ore and does not come from the Orford nickel mine.

Figure 31. **Millerite crystal, 5 mm. Canadian Museum of Nature specimen 50534; G. Robinson photo.**

Figure 32. **Millerite crystal, 1.2 mm. Canadian Museum of Nature specimen 55846; G. Robinson photo.**

Figure 33. **Prehnite, group of semi-parallel crystals with diopside and grossular, 6 cm. Canadian Museum of Nature specimen 55594, from the Pinch collection. G. Robinson photo.**



Tremolite $Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$

Tremolite occurs as patches of fine, silky white fibers on diopside (Sabina, 1966). It is also a component of the tremolite marble in the footwall in which it occurs as aggregates of colorless to very pale gray, fibrous microcrystals; these are revealed by etching the marble in acid.

Pale greenish gray, cryptocrystalline to very finely fibrous masses cut by cross-fiber asbestiform veinlets are occasionally found in the mine dumps. Both the matrix and the veinlets are tremolite. This material probably represents a replacement of the footwall serpentine.

Uncharacterized Species

Nickel Silicate

Dunn (1978) found "what may be a new nickel silicate mineral" as microscopic grains (3–4 μm in diameter) at the boundary between grains of chromian grossular and maucherite. Not enough of the mineral was available to permit its full characterization, and no information on its color or other physical properties was reported.

Unknown

This mineral occurs as coatings on diopside and grossular crystals, and as a filling in interstices between the crystals. It has a very fine, flaky structure. The color is pale greenish white to creamy white. An EDS analysis of a coating on diopside showed Ca, Mg, Si, and minor Fe spectral peaks; this may be from the substrate diopside. The mineral is amorphous.

PRESENT STATUS

The Orford nickel mine is on private property, but the site is currently open to collectors on a daily fee basis. The mine shafts were backfilled several years ago as a safety measure by the Québec government. Collecting can still be productive, and some excellent specimens have been found in recent years. Permission to collect should be obtained from the owner, whose residence is on the property.

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REFERENCES

BOYLE, R. W. (1971) Thomas Sterry Hunt (1826–1892)—Canada's First Geochemist. *Geological Association of Canada, Proceedings*, **23**, 15–18.

BUISSON, G., and LEBLANC, M. (1985) Gold in carbonatized ultramafic rocks from ophiolite complexes. *Economic Geology*, **80**, 2028–2029.

CHAPMAN, E. J. (1888) *The Minerals and Geology of Central Canada Comprising the Provinces of Ontario and Quebec*. Third edition. The Copp, Clark Company, Toronto, p. 74.

COUSINEAU, P. A., and ST-JULIEN, P. (1992) The Saint-Daniel Mélange: evolution of an accretionary complex in the Dunnage terrane of the Quebec Appalachians. *Tectonics*, **11**, 898–909.

DRESSER, J. A., and DENIS, T. C. (1949) Geology of Quebec. *Department of Mines, Quebec, Geological Report* **20**, III, p. 421.

DUNN, P. J. (1978) On the composition of some Canadian green garnets. *Canadian Mineralogist*, **16**, 205–206.

ELLS, R. W. (1890) Report on the Mineral Resources of the Province of Quebec. In: *Geological and Natural History Survey of Canada, Annual Report (new series)*, **IV**, 81K–82K.

EUSTIS, W. E. C. (1878) The nickel ores of Oxford [sic], Quebec, Canada. *Engineering and Mining Journal*, **25**, p. 187.

EUSTIS, W. E. C. (1879a) The nickel ores of Orford, Quebec, Canada. *Transactions of the American Institute of Mining Engineers*, **VI**, 209–214.

EUSTIS, W. E. C. (1879b) Unpublished letter to A. Meany, Swansea, Wales, from Boston, May 10, 1879. Eustis Mining Co. Collection, Historical Collections, Baker Library, Harvard University.

EUSTIS, W. E. C. (1915) Unpublished letter to David H. Browne, International Nickel Co., New York, from Boston, March 26, 1915. Inco Limited archives, Copper Cliff, Ontario.

FORTIER, Y. O. (1945) Orford map-area, Quebec (descriptive notes). *Geological Survey of Canada, Paper* **45-8**, 5 p. [with accompanying map 45-8A]

FORTIER, Y. O. (1946) Some observations on chromite. *American Journal of Science*, **244**, 649–657.

GAUTHIER, M., AUCLAIR, M., BARDOUX, M., BOISVERT, D., BRASSARD, B., CHARTRAND, F., DARIMONT, A., DUPUIS, L., DUROCHER, M., GARIEPY, C., GODUE, R., JEBRAK, M., and TROTTIER, J. (1989) Synthèse métallogénique de l'Estrie et de la Beauce. *Ministere de l'Energie et des Ressources, Québec, Rapport* **MB 89-20**, 633 p.

GAUTHIER, M. (1985) Synthèse métallogénique de l'Estrie et de la Beauce (secteur sud). *Ministère de l'Energie et des Ressources, Québec, Rapport* **MB 85-20**, 74 p.

GAUTHIER, M. (1986a) Synthèse métallogénique de l'Estrie et de la Beauce (secteur centre-ouest). *Ministère de l'Energie et des Ressources, Québec, Rapport* **MB 86-46**, 107 p.

GAUTHIER, M. (1986b) Synthèse métallogénique de l'Estrie et de la Beauce (secteur centre-ouest), annexe no. 1, fiches descriptives des gîtes métallifères repérés sur le terrain en 1985. *Ministère de l'Energie et des Ressources, Québec, Rapport* **MB 86-47**, 53–54.

GEOLOGICAL SURVEY OF CANADA (1862) *Descriptive Catalogue of a Collection of the Economic Minerals of Canada, and of its Crystalline Rocks. Sent to the London International Exhibition for 1862*. Printed by John Lovell, Montreal.

GOLDSCHMIDT, V. (1920) *Atlas der Krystallformen*, **VI**, Tafel 25.

GREGORY, G. E. (1967) Hunting for uvarovite garnets at the Orford nickel mines, Quebec, Canada. *Rocks and Minerals*, **42**, 278–279.

GRICE, J. D., and WILLIAMS, R. (1979) Famous mineral localities: the Jeffrey mine, Asbestos, Québec. *Mineralogical Record*, **10**, 69–80.

GRUNLING, F. (1913) Maucherit Ni_3As_2, ein neues Nickelmineral aus den Kobaltrücken des Mansfelder Kupferschiefers. *Centralblat für Mineralogie*, 225–226.

HARRINGTON, B. J. (1878) *Exposition Universelle de 1878 à Paris. Catalogue des minéraux, roches et fossiles du Canada; avec des notes descriptives et explicatives*. Commission géologique du Canada. Imprimerie de George E. Eyre et William Spottiswoode, Londres.

HOFFMANN, G. C. (1893) *Catalogue of Section One of the Museum of the Geological Survey embracing the Systematic Collection of Minerals and the Collections of Economic Minerals and Rocks and Specimens Illustrative of Structural Geology*. Geological Survey of Canada. Printed by S. E. Dawson, Ottawa.

HOWE, H. M. (1878) Unpublished letter to R. G. Leckie, Orford, from Boston (?), December 10, 1878. Inco Limited archives, Copper Cliff, Ontario.

HUNT, T. S. (1863a) Mineral species. In: *Geological Survey of Canada. Report of Progress from its Commencement to 1863* (short title *Geology of Canada*), Chapter XVII, 454–530.

HUNT, T. S. (1863b) Economic geology. In: *Geological Survey of Canada, Report of Progress from its Commencement to 1863* (short title *Geology of Canada*), Chapter XXI, p. 738.

HUNT, T. S. (1879) Discussion: The nickel ores of Orford, Quebec, Canada, by W. E. C. Eustis, *Transactions of the American Institute of Mining Engineers*, **VI**, 213–214.

KULAGOV, E. A., EVSTIGNEEVA, T. L., and YUSHKO-ZAKHAROVA, O. E. (1969) The new nickel sulfide godlevskite. *Geologiya Rudnikh Mestorozhdenyia.*, **11**, 115–121 [in Russian]. English abstract: *American Mineralogist*, **55**, 317–318.

LECKIE, R. G. (1900) The nickel question. In: Proceedings of Annual General Meeting of the Canadian Mining Institute, *Journal of the Canadian Mining Institute*, **III**, 224–226.

LOGAN, W. E. (1863) The Quebec Group. In: *Geological Survey of Canada, Report of Progress from its Commencement to 1863* (short title *Geology of Canada*), Chapter XI, 249–250.

NALDRETT, A. J., GASPARRINI, E., BUCHAN, R., and MUIR, J. E. (1972) Godlevskite (β-Ni_7S_6) from the Texmont mine, Ontario. *Canadian Mineralogist*, **11**, Part 4, 879–885.

NICKEL, E. H. (1959) The occurrence of native nickel-iron in the serpentine of the Eastern Townships of Quebec Province. *Canadian Mineralogist*, **6**, 307–319.

PALACHE, C., BERMAN, H., and FRONDEL, C. (1944) *Dana's System of Mineralogy*. Seventh Edition, John Wiley and Sons, New York, **I**, p. 240.

PALACHE, C., and WOOD, H. O. (1904) A crystallographic study of millerite. *American Journal of Science*, 4th series, **18**, 343–359.

PEACOCK, M. A. (1940) On maucherite (nickel-speiss, placodine, temiskamite). *Mineralogical Magazine*, **25**, 557–572.

SABINA, A. P. (1966) Rocks and minerals for the collector: Eastern Townships and Gaspé, Quebec; and parts of New Brunswick. *Geological Survey of Canada Paper* **66-51**, p. 15.

SINKANKAS, J. (1964) *Mineralogy for Amateurs*. D. Van Nostrand Company, Inc., New York, 585 p.

SLIVITZKY, A., and ST-JULIEN, P. (1987) Compilation géologique de la région de l'Estrie-Beauce. *Ministère de l'Energie et des Ressources, Québec, Rapport* **MM 85-04**, 40 p. [with accompanying map 2030].

STEVENSON, L. S. (1972) Walter F. Ferrier and the Ferrier mineral collections. *Mineralogical Record*, **3**, 232–234.

ST-JULIEN, P. (1961) Preliminary report on Lac Montjoie area, Sherbrooke, Richmond and Stanstead Counties. *Department of Natural Resources, Québec, Report* **PR-464**, 14 p. [with accompanying map 1402].

ST-JULIEN, P. (1967) Tectonics of part of the Appalachian region of southeastern Québec (southwest of the Chaudière River). *Royal Society of Canada Special Publication No.* **10**, 41–47.

THOMPSON, J. F., and BEASLEY, N. (1960) *For the Years to Come. A Story of International Nickel of Canada*. G. P. Putnam's Sons, New York, 374 p.

TRAILL, R. J. (1983) Catalogue of Canadian Minerals, Revised 1980. *Geological Survey of Canada, Paper* **80-18**, 432 p.

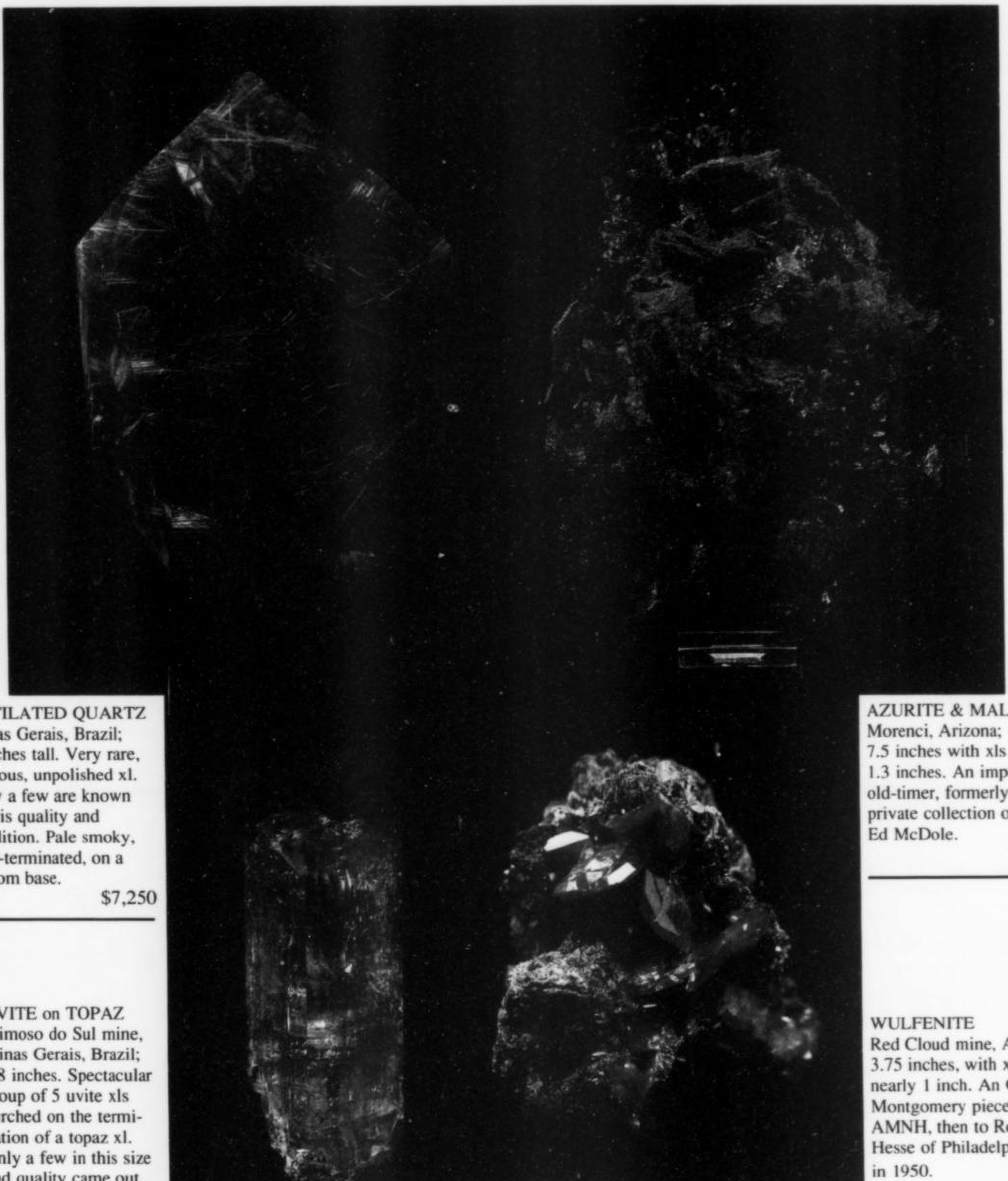
TREMBLAY, A., and ST-JULIEN, P. (1990) Structural style and evolution of a segment of the Dunnage Zone from the Quebec Appalachians and its tectonic implications. *Geological Society of America Bulletin*, **102**, 1218–1229.

TROTTIER, J. (1985) Unpublished field notes. Projet de l'Estrie et de la Beauce, Ministère de l'Energie et des Ressources, Québec.

VON KNORRING, O., CONDLIFFE, R., and TONG, Y. L. (1986) Some mineralogical and geological aspects of chromium-bearing skarn minerals from northern Karelia, Finland. *Bulletin of the Geological Survey of Finland*, **58**, 277–292.

WILLIAMS, H., and ST-JULIEN, P. (1982) The Baie Verte–Brompton Line: early Paleozoic continent-ocean interface in the Canadian Appalachians. In: Major structural zones and faults of the Northern Appalachians, edited by P. St-Julien and J. Béland, *Geological Association of Canada, Special Paper* **24**, 177–207.

WILLIMOT, C. W. (1882) Notes on some of the mines in the Province of Quebec. In: *Geological and Natural History Survey of Canada, Report of Progress for 1880–81–82*, p. 5GG.



RUTILATED QUARTZ
Minas Gerais, Brazil;
6 inches tall. Very rare, lustrous, unpolished xl. Only a few are known in this quality and condition. Pale smoky, well-terminated, on a custom base.
$7,250

AZURITE & MALACHITE
Morenci, Arizona;
7.5 inches with xls to 1.3 inches. An important old-timer, formerly in the private collection of Ed McDole.
$15,000

UVITE on TOPAZ
Mimoso do Sul mine, Minas Gerais, Brazil;
3.8 inches. Spectacular group of 5 uvite xls perched on the termination of a topaz xl. Only a few in this size and quality came out.
$7,500

WULFENITE
Red Cloud mine, Arizona;
3.75 inches, with xls to nearly 1 inch. An Over-Montgomery piece, sold to AMNH, then to Robert Hesse of Philadelphia in 1950.
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MARTIN LEO EHRMANN

(1904–1972)

Bill Smith and **Carol Smith**
1731 Daphne Street
Broomfield, Colorado 80020-1157

Martin Ehrmann rose from the status of poor immigrant to being America's premier dealer in museum-quality mineral specimens. His gentlemanly charm and ethics, Old World manners, and superb sense of taste were combined with an intrepid determination to root out the finest specimens wherever they could be found. Ehrmann's legacy lives on today in the form of thousands of exquisite specimens in museums and collections around the world, and countless friends who recall his gracious nature and legendary exploits.

Once in a while you just get lucky. Perhaps once a year, during the late 1950's and 1960's, while I (Bill) was studying the reference collection at the Smithsonian Institution's National Museum of Natural History (USNM), the Curator of Gems and Minerals, George Switzer, would announce the imminent arrival of Martin Ehrmann. We would gather in George's office as Martin marched in, carrying one or more parcels that contained some of the treasures he had acquired during his latest travels. Since he usually visited a number of countries and made many stops, we would be unsure if we were about to be exposed to the rubies, topazes and peridots of Burma, or a wonderful Central European classic from an historic museum located behind the Iron Curtain.

As we pressed around the table, Martin would unwrap the packages, invariably with a little chuckle of anticipation at what he was sure would be our surprise and delight. While we stared at the latest beauty from Tsumeb, or an incredible kunzite from Brazil, or a choice hessite from an often-renamed central European locality, Martin would step back, beaming with pleasure at our amazement. After a suitable period of appreciation, it would be time to discuss prices. Martin would then often ask the staff members, who through the years included George Switzer, Paul Desautels and John White, to write independent valuations of each piece. Martin would then disclose his prices, which would invariably be lower than any of the estimates.

After this, Martin would insist that all of us (including this mineralogical groupie) repair to lunch, so that he could regale us with


VAN PELT

Figure 1. **Martin L. Ehrmann.**

an account of his travels, and provide us with the stories behind his prizes. His favorite lunch spot in Washington was Hammel's, an old German-American restaurant on 10th Street, and, needless to say, he always insisted on being our host.

In this day of markets hungry for beautiful specimens, it is common for our suppliers to go to the ends of the earth in pursuit of mineralogical treasure; such mobility was rare in Martin's day, and not just because the market was so (apparently) small. Trans-oceanic air travel was virtually non-existent before World War II, and was tedious at best before the modern jet engine. Travel in most of Africa and Asia was even more rudimentary than it is today, and travel behind the Iron Curtain provided its own special distresses. Scientists and collectors have pursued specimens in foreign lands since the 16th century, but Martin may have been the first dealer to make a regular practice of truly worldwide searches for fine minerals. It is true that gem buyers from Idar-Oberstein had preceded Martin in Brazil and Asia, but their acquisitions were headed to the lapidary's workshop, and not to the mineral cabinet. It is also true that George Burnham made a six-month Atlantic-girdling mineralogical trek with Jack Jago Trelawney in 1950, but we believe this was, for Burnham, a one-time event. Only John Patrick's repeated Asia-and-Africa trips could be regarded as similar to Martin's, but these commenced in the early 1960's. And not only was Martin chronologically the first truly worldwide mineral dealer, he had also, for his time, the greatest number of the finest specimens. We have found nothing in Martin's early life to suggest that he would end as a gem and mineral dealer; as a young immigrant to our country, settling in the New York City area, he was faced with no job, but infinite possibilities. After a few years, Fortune pointed him down the path that made him the premier dealer of his day.

Early Years

Martin was born to Wolf and Rachel Ehrmann on August 9, 1904, in Rava Russkaya, a town then in the Russian Empire, and now in Belarus (it was incorporated into Poland from 1920 until the Nazi-Soviet division of 1939; until 1939 it was known by its Polish name, Rawa Russka, the name still used in the family). He was originally named Marcus Leo, but sometime after his arrival in the U.S. he Americanized his name to Martin (but some of the older family members continue to refer to him as "Marcus"). His oldest sister moved to Kiel, Germany in 1910, and the family followed, completing their emigration to Kiel by 1913 or 1914; Martin was one of the last to move. In 1921 Martin took a job working as a steward on a German ship; when the ship docked in New York, he decided to be a landlubber again. We have an image of a sixteen or seventeen-year-old Jewish boy, with his birthplace lost in the wreckage of war, and only familial ties to Germany, who is now 3,000 miles from Germany's hyperinflation. What this boy did was in perfect accord with the man we know in his later years: he set out in the New World to make a new life.

In the early and mid-1920's Martin took the young immigrant's usual succession of catch-as-catch-can jobs: he was a waiter at Thwaites' Restaurant on City Island; he sold shoes; he was a waiter at a New England resort. On May 8, 1928, he married Rita Zorn in Hoboken, New Jersey, where she had been born and raised; she was a distant cousin of Martin's, whom he had met at Sissing Lake Camp in the Adirondacks. They returned to Kiel for an extended honeymoon, so Martin must have been making a respectable income; when they returned, Martin was now (automatically) a U.S. citizen.

Fortune smiled on American mineralogy on that wedding day, for Martin's marriage is what led him to the world of gems and minerals. Rita worked as the American secretary for Dr. Ping Wen Kuo (his Chinese secretary was Dr. Eugene Shen). Dr. Kuo headed a corporation which imported gemstones carved in China. In 1928 Martin was hired as the company's only salesman, and since Dr. Kuo was a lover of the arts of China, Martin soon developed a permanent interest in Chinese jade; first came nephrite, then jadeite, and then all the other minerals followed.

First Dealings

In 1929, the year that his first son Sanford (Sandy) was born, Martin started his own business in his apartment at 610 Washington Avenue, Hoboken. (Their second son and only other child, Herbert, was born in 1932.) Martin began by selling carved snuff bottles and small jade discs for one or two dollars (Fred Pough specifically remembers white nephrite "mutton fat" jade discs at $2 each), and he sometimes sold more important jade carvings. Martin soon branched into other gems and then minerals; he joined the New York Mineralogical Club where he met Gilman Stanton, James Manchester, George English, Ernest Weidhaas (who later dressed as Santa Claus for the Ehrmann boys' holidays), and George Kunz, who also lived in Hoboken, and who may have served as Martin's mentor. He soon became well-known to the staff of the American Museum of Natural History (AMNH), and they recorded their first purchase from Martin on January 6, 1931: for $40 Martin sold them two chalcedony elephants, an agate tray and a turquoise lion, all from China. Martin wrote of those times:

> I was a struggling, hard-working young man who passionately enjoyed his newly acquired profession. I began to sell gemstones to the museums in New York City, Philadelphia, Baltimore and Washington, and to many museums and universities in the East. I later traveled to the Midwest visiting museums and universities there. I was able to sell fine mineral specimens and gemstones to these museums. Although restricted in their budgets during the Depression, they still had some money. When, at the end of the week, I had earned between $25 and $30, I felt very lucky. Slowly and systematically my list of regular customers increased.

During these pre-war years Martin developed close friendships with a number of jade lovers; the closest probably was with Herbert Whitlock at the AMNH. Whitlock's personal jade collection is now in the Wadsworth Athenaeum (in Hartford, Conn.); many of these pieces passed through Martin's hands. In 1949, at least eighteen years after they first met, Whitlock and Ehrmann coauthored *The Story of Jade*. This popular exposition might be found in your local library. Martin was almost certainly instrumental in building the Dr. I. Wyman Drummond jade collection, which was given to the AMNH in 1934, probably with Martin's encouragement. Martin never lost his love for jade; during a 1967 visit to his office in Beverly Hills one of us (Bill) saw a pile of Burmese jade boulders still awaiting sale. Though he was no Sinophile, Martin probably knew as much about jade as any American needed to know.

As was very common in the Great Depression, the Ehrmann family moved constantly from one flat to another, but always in the New York City area. A rough chronology is:

1931—610 Washington Avenue, Hoboken
1932—27 Central Avenue, Hartsdale
1932—3435 Olinville Avenue, Bronx
1933—700 W. 176th Street
1935—25 W. 68th Street
1938—25 Central Park (the Century Apartments)
1940—18 W. 70th Street

Martin had specimen labels printed using some of these addresses. In the later 1930's Martin sometimes operated from leased office and storage space. As early as 1933 he had a post office box at the Williamsburg Station. The size of the Calvert Collection, which he acquired, finally forced Martin to abandon permanently his home as business quarters. This led to his rental of space at Suite 2008, International Building, 630 Fifth Avenue, in Rockefeller Center.

First Major Transactions

Martin made his first major acquisition around 1932; this was the last (absolutely!) Kunz "Collection." After George F. Kunz died in 1932, Tiffany's wished to dispose of a large quantity of material that Kunz had accumulated so as to reclaim space in the basement of their store on Fifth Avenue. We have yet to determine how a small-time operator, as Martin was then, arranged for the necessary financing. All through Martin's life he had a remarkable talent for eliciting major financial support, into the hundreds of thousands, or perhaps millions of dollars, from a number of backers, mostly unknown to us, and often very publicity-shy. These backers were by no means all American, nor was Martin's marketing in any way limited to the United States. Martin's business dealings were in the style of the classical gem merchant: very personal, very dependent on trust, very secretive, very accepting of risk. The members of this fraternity do their best to discount national boundaries in their business, but this is not to say they are devoid of national feeling. Martin in particular, though he was a citizen of the world in his business, deemed it almost his patriotic duty to bring the best of the best (he only dealt in "the best") to the great American institutions.

By the time of the Kunz acquisition Martin had settled on Willy Pfoser as his cutter; he set Pfoser to work on kunzite, of which Kunz had left "several" boxes, with crystals varying from mediocre to fine. According to Louis Moyd, Willy was "a young and very capable lapidary," so Martin told Willy of spodumene's two perfect cleavages, and Willy educated himself by first cutting the less important pieces of kunzite.

Harvard University records show purchases from Ehrmann at least as early as 1931, for at this time Professor Palache purchased (using Holden Fund money) a magnificent kunzite from the Pala Chief mine. This 24-cm specimen came from the Kunz Collection, and is now in the Natural History Museum of Los Angeles County (NHMLAC). In 1933 Martin sold Kunz Collection specimens to the U.S. National Museum; these were purchased with Roebling Fund money and received numbers R6743 through R6783 (but many entries were multiple specimens). The Smithsonian specimens included diamonds from Texas, Indiana and Brazil, a kunzite from Pala, two faceted kunzites from North Carolina (!), two faceted vesuvianites from Italy, a Michigan copper, Siberian nephrite, numerous uraniferous specimens from Czechoslovakia and Germany, and a synthetic emerald from I. G. Farben.

As Martin increased his knowledge, expanded his stock, and strengthened his financial resources, he began to appear at a wide variety of mineralogical events. He attended meetings of the Philadelphia Mineralogical Society with some frequency, mixing with regulars like Harold Arndt, Charles Toothaker and Sam Gordon, and he was elected a member of the Society in 1934. Martin would sometimes set up an evening sale at the old Robert Morris Hotel near the Academy of Natural Sciences. In 1935 Paul Desautels first met Martin at one of the meetings, but Paul was too young (about 15 or 16) and too poor to buy anything from Martin. Arthur Boucot recalls other times seeing Martin at Sam Gordon's offices in the Academy.

By 1936 (if not earlier) Martin had developed both the skills and resources to obtain Tsumeb material, because that year the USNM obtained a malachite specimen (NMNH R7703) from him; this piece is still on display.

One of the ornaments of the gem collection in the American Museum of Natural History is the Edith Haggin de Long Star, a magnificent orchid-red star ruby of 100.32 carats, perhaps second only to the Rosser Reeves star ruby in the USNM. Martin sold this stone to Mrs. de Long, who then gave it to the Museum. In a letter from Roy Chapman Andrews, the director (and a friend of Martin's), to Mrs. de Long, Andrews apologized for not being able to accompany Ehrmann and Whitlock to the meeting that finalized the gift (Andrews had an ulcerated tooth). One of Herbert Ehrmann's most vivid childhood memories is of the night in November, 1937 when the $21,400 de Long Star ruby shared the Ehrmann apartment. This great gem was stolen on October 29, 1964, by the infamous Murph the Surf, and later ransomed, and so returned to the AMNH.

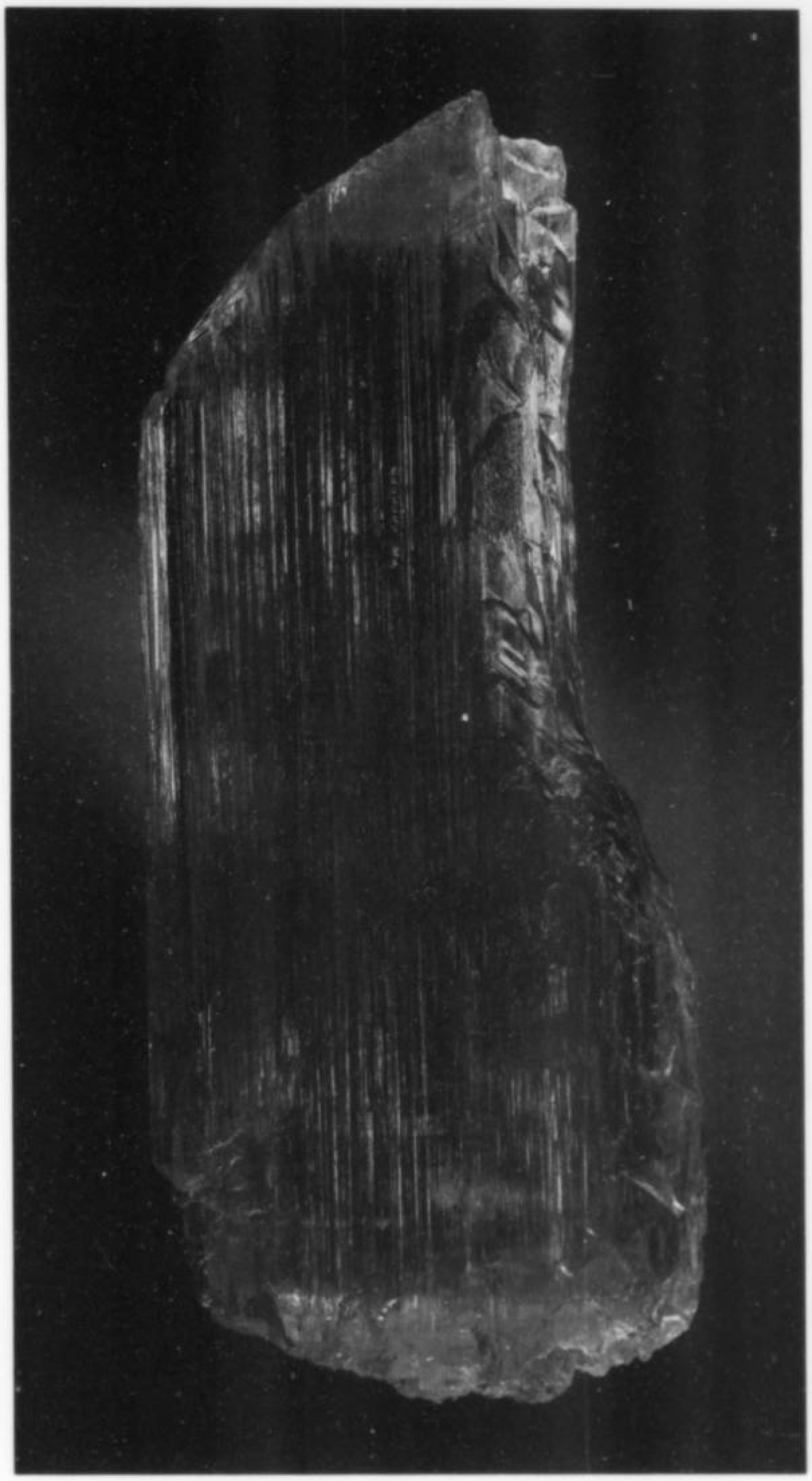

Figure 2. **Spodumene ("kunzite") crystal, 24 cm tall, from the Pala Chief mine, California. Originally in the collection of George F. Kunz, it was sold by Ehrmann to Harvard in 1933 and was later obtained by the Los Angeles County Museum of Natural History. Van Pelt photo.**

Apparently Martin did not confine his activities to the East Coast, since the Cranbrook Institute near Detroit has records that show a purchase from him of a 10-cm Urals Mountains aquamarine (CIS 344-11). This sale was made in 1937, so the piece was probably not from the Calvert Collection.

The Calvert Collection

The next big Ehrmann acquisition was the John Calvert Collection. In 1936 Martin became aware of this very large (100,000+ specimens) and great (he hoped!) collection; by no later than 1938 it was in his possession. Embrey and Symes (1987) have this to say about Mr. Calvert:

> Frederick Calvert (d. 1897), amongst other things a mining engineer, may (or may not) have accompanied [Henry] Heuland on collecting trips in Europe. Calvert traveled extensively, obsessed with the search for gold, and has been credited with finding the Belstone Consols copper mine, Devon. Said to have been known as 'Lying Jack,' almost nothing written by or about Calvert is free from doubt or exaggeration, starting with his year of birth (1811, or 1814, or even 1825) and the claim that he was acquainted with Philip Rashleigh (who died in 1811). Few specimens survive to support the claim that his mineral collection was superlative; it was sold off piecemeal, and the residue was eventually bought by the American dealer, Martin Ehrmann, in 1938.

Charles Sherborn (1940), in his account of the dispositions of various natural history collections, is even less complimentary:

> There were two John Calverts, one a silver miner of Vasi Rupi. The other was a mining engineer whose life was published in *The Mining Journal* about 1905. He was an unscrupulous blackguard. He seduced two of the Sowerby girls, one of whom I knew as an elderly woman who eked out a poor living in Drury Lane by selling shells. I found her later on in Chelsea and learned that "Jack" allowed her a small pension. He was in London in 1905 scheming to involve H. P. Woodward in some rotten mining plans but a cable to Westralia frustrated him. He was some connection to Lord Baltimore and is said to have had his collections. His collection was offered to the British Museum in 1938, and included the W. D. Saull Collection which he appropriated from the Metropolitan Institute . . . seven van loads. The bulk was stored for over twenty years in a house from which cobwebs and dirt had to be swept away (*Star,* 23 Aug. 1938), and was acquired later, I believe, by H. E. H. Smedley for Tottenham Castle Museum. A catalog of the collection in 1905 (?) is in the British Museum.

Calvert undoubtedly had an enormous quantity of other natural history specimens exclusive of his minerals, and it is perhaps these that ended up at Tottenham. Or Sherborn may simply have been unaware of the final sale to Ehrmann. The Calvert family may well have requested confidentiality in selling so important a collection to a buyer outside of England.

The story goes that John Calvert had two sons who were in financial difficulty. Having borrowed as much as they could using the collection as collateral, they were finally forced to sell. The "residue," as Embrey and Symes refer to it, was still very large; it was cased in many superb English cabinets well coated with London coal dust, and in 1936 these were housed in an ancient three-story brick building in east London, having been in storage for many years. Martin hired some students to wrap the specimens; when they were unpacked in New York, Louis Moyd reports they "were absolutely filthy with the settled out London dust and soot."

When the Calvert Collection arrived in October 1938, it was stored in the basement of Rockefeller Center (the location was memorable because it was next door to the Cutty Sark whiskey storeroom). It included a shell collection which was begun in the middle of the seventeenth century by Anne Arundel, wife of Cecil Calvert, second Lord Baltimore (and first governor of Maryland; Annapolis is in Anne Arundel County). All the minerals and shells had to be cleaned, sorted and (often) identified. These tasks fell to the great micromounter Neal Yedlin (later a well-known contributor to the *Mineralogical Record* and *Rocks and Minerals*) who was assisted by Martin's recently arrived 18-year-old nephew, Leo Bodenstein (Leo's pay, $10 per week—Neal took his pay in specimens, which Louis Perloff believes "was the core of Neal's very good collection").[1] Perloff recalls that Neal's skills at sight identification were much in demand, because "loose labels had been stacked during packing one behind the other in separate boxes apart from the specimens."

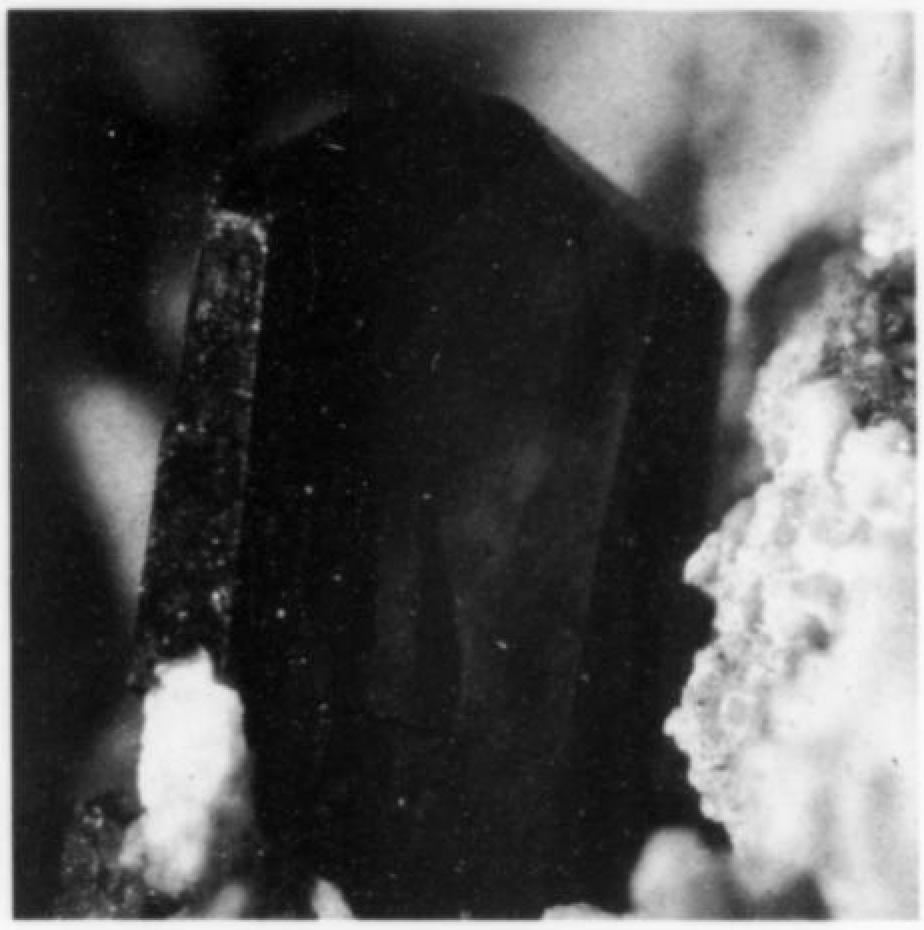

Figure 3. **Linarite crystal, about 1 mm, from Cornwall, England. Calvert collection, now in the Lou Moyd collection. Quintin Wight photo.**

In December of 1939 this work devolved on Louis Moyd; Moyd went on to eventually become a customer of Martin's when, in 1965, he became the first curator of minerals at Canada's National Museum of Natural Sciences (now the Canadian Museum of Nature). Evidently, working with Martin was considered quite a plum; Perloff says "I remember being somewhat envious when Neal told me he was going to help Martin with the Calvert Collection." Moyd remembers the specimens as a very mixed bag: "a mass of loose earthy hematite might be followed by a matrix specimen of excellent anatase." After receiving Neal's and Leo's, and later Louis', attentions the specimens were moved to Martin's showroom on the twentieth floor of the International Building (Suite 2008). Martin marketed the collection directly from his offices, by means of advertisements in the *American Mineralogist,* and by attending club meetings (New York, Boston, Philadelphia) and scientific conclaves (the Mineralogical Society of America annual meeting). Among the specimens from the Calvert Collection advertised in the *American Mineralogist* are:

Torbernite	.50 to $25	Chalcocite	$3 to $25
Liroconite	.50 to $20	Chalcosiderite	$2 to $100
Clinoclase	$1 to $50	Campylite [Mimetite]	$2.50 to $30
Childrenite	$1 to $40	Pyromorphite	$1 to $30
Cassiterite	$2 to $40	Fluorite	$1 to $30
Bournonite	$2 to $50		

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[1]This chronology is in conflict with Bentley (1979) which puts Yedlin in Maine in 1937, and Bentley's quotation of Louis Perloff "Neal Moved to Maine in the late 1930's." When questioned about the potential discrepancy, Perloff responded, "Neal Yedlin did indeed work with Martin Ehrmann on the Calvert collection. What I ought to have written about moving to Maine was that it was about the very late 1930's. It may even have been a year past the 1930's when Neal and his father moved to Halliwell, Maine. I know that he was living in Maine when he went into the Air Force in 1942, about the time I went into the Army."

These are November, 1938 prices and, though we were still in a terrible depression, fine minerals evidently commanded high prices even then. His Calvert Collection advertisement in October said: "Prices range from twenty-five cents to hundreds of dollars"; in the following month he also advertised "No matter whether you pay .25 or $2500.00, you know that you will get the best value." Nor were the advertised pieces the most valuable; one visitor to Martin's office saw a proustite group, "all with terminations, mounted on a block painted Chinese-red and covered with a Chinese, colored leather bag." This was almost certainly a Chañarcillo proustite; it was probably Martin's first Chilean proustite, though certainly not his last. For the account of another great Calvert piece, we excerpt from Switzer's Memorial to Martin in the *American Mineralogist:*

> I first met Martin the following year [1937] when I was a graduate student at Harvard, and at the time he was making piecemeal disposition of the Calvert Collection. I have a vivid memory of an encounter between Martin and Charles Palache at the 1938 GSA meeting in New York. There was great excitement on both sides when Martin handed Professor Palache a treasure he had found in the Calvert Collection, a finger-size crystal of jeremejevite, the first specimen of this rare aluminum borate ever to find its way to the United States. Martin had not recognized the crystal when he had unpacked it, and had placed it in a tray of beryl crystals, which it closely resembled, priced at two dollars each. It had been recognized by Frederick H. Pough, then Curator of the American Museum of Natural History, on a visit to Martin's shop shortly before the meeting. And Pough was only able to identify it because three years earlier he had seen a crystal in the Vesignie collection in Paris. When Palache was told what it was, no price mentioned, he snapped, 'I'll give you five hundred dollars for it,' and the sale was made.

The Moyds report that the Calvert Collection fossils were sold, as a single lot, to the Smithsonian, "except for a lovely suite of Paris Basin fossils that was discovered later among the minerals and shells." These were later purchased by Brooklyn College. The shells were sold individually for some time; later the unsold residue was purchased by Hugh K. Milliken, a well-to-do retired fabric designer.

Late Pre-War Years

Calvert Collection specimens were not the only minerals being sold by Martin in the pre-war years. In 1939 he advertized azurites and malachites from Tsumeb at $10–$15 (Arthur Boucot writes "I still have a little rosette of azurites that I bought for $5.00—real money for a thirteen year old"), dioptase from Guchab ($40), vanadinite from Morocco ($15), as well as Sicilian sulfur, Russian crocoite and Romanian stibnite. More interestingly, one writer refers to "Dr. H. von Karabacek" material in Martin's stock. We know that Professor Palache purchased for Harvard some of the finest, but by no means all, of the Karabacek Collection in 1935, and Martin seems to have obtained all or part of the remainder on one of his many European trips. Boucot also remarks that "he brought the Karabacek Collection from Prague," and that he was selling specimens from it on trips to Philadelphia. When Louis Moyd went to work for Martin in January, 1940 the Ehrmann office had a "Karabacek Collection" cabinet. Martin's May, 1939 full-page advertisement in the *American Mineralogist* was limited to Romanian sylvanites, Swedish and German cobaltites. Harz arsenics and dyscrasites, a phosphophyllite from Hagendorf, and a hessite from Colorado; except for the hessite, all of these are good candidates for Karabacek pieces.

We have plenty of evidence to show that Martin had the opportunity to visit Prague; he spent much time in Europe in the later 1930's. Gerd Wappler at Humboldt University, Berlin, observed that in 1936 Martin brought them material that he had obtained from the famous Roman dealer, Roberto Palumbo. Why was an ex-German Jew pursuing mineral business in Hitlerian Germany? Part of the answer is in Willie Sutton's response to "Why do you rob banks?" "Because that's where the money is." But there was a much stronger reason: Martin was attempting to extract his family, especially his six siblings, from what he perceived as impending tragedy. He made trips to Germany in 1936, 1937 and 1938 (the year of the Anschluss!) during which he rescued sisters Lena and Rosa, brothers Max and Benno, Lena's husband Ira, and Rosa's husband Bernard, Benno's wife Mia, and Max's wife Sophie, as well as numerous nieces and nephews. He also extracted his sister Frieda, but she had to go to Argentina because her husband was already legally blind, and so could not get a U.S. visa. In total, Rita and Martin helped rescue 16 members of the extended Ehrmann family. Sister Regina, however, was sure that "it couldn't happen to her" (a direct quote from both Sandy and Herb Ehrmann); she stayed, and it did.

The Ehrmann sons recall that they made at least five pre-war trips to Florida starting in 1936. These were winter vacations for the family, but some business was conducted; on at least one trip, Martin called on John D. Rockefeller Senior at his home in Ormond Beach. The sons also recall Merle and Bill Foshag (Dr. William Foshag of the Smithsonian) and their son Billy visiting them in New York in 1939, during the Foshags' trip to the World's Fair. In 1940 or 1941, Ehrmann, Foshag and young Billy Foshag made a visit to Mexico, with Martin's primary goal being to obtain fine Mexican opal. Martin and Billy returned to the U.S. together (Dr. Foshag continued his Mexican explorations under the Strategic Metals Program); Bill Junior still recalls Martin driving homeward hell-bent-for-leather in his "huge" Buick.

It was during this period that Martin's visits to Philadelphia resulted in the following charming, and very characteristic tale, as told by Louis Moyd:

> Our connections [his and Pauline's] with Martin began in the late 1930's, when he was a frequent visitor to the Museum of the Philadelphia Academy of Natural Sciences and the Philadelphia Mineralogical Society. I was then a volunteer research assistant to Samuel G. Gordon [and] Pauline was a graduate student in geology at Bryn Mawr College. In December 1939, I was unemployed. Pauline and I were both 23 and engaged. Martin had arranged for an exhibition and sale of specimens at a Philadelphia hotel on a weekend in mid-December. We couldn't afford to buy anything, but wanted to see the specimens. Martin took us up on our offer to help in the unpacking and sales. Our attachment was quite apparent, and Martin wanted to know why we didn't get married. On telling him I had no job or income, he said he thought I was employed by the Academy. Then he said "I'll give you a job, starting at the beginning of the new year." At the time, the annual joint meeting of the MSA, GSA, and Paleontological Society was held in the week between Christmas and New Years, and in 1939 it was to be in Minneapolis. Martin said he had not planned to exhibit there, but offered to cover our expenses and give us a small commission on sales, if we wanted to do this for him. We packed up the unsold material in Philadelphia and in New York Martin selected and packed additional specimens, plus a jeweler's "wallet" of cut stones. We were married in Yonkers (Pauline's home town) on the morning of December 23rd, picked up the specimens from the office in New York, and started driving toward Minneapolis in our unheated convertible LaSalle. There are many stories connected with this cold trip and the events at the meetings, but we'll tell only one here: On the trip, and in the hotel, we referred to the gem "wallet" as "the baby." One morning, going down in the elevator, Pauline,

noticing that I wasn't carrying anything, asked "Where's the baby?" My reply was, "it's O.K. I left it in the suitcase," which provoked some very peculiar stares from the other passengers.

Moyd continued to work for Martin until October, 1940, but then Martin had to reduce expenses. He had invested heavily in Brazilian rough, but the spread of the European War had shattered the gem market. Moyd returned for four weeks in February-March, 1941, to man the Ehrmann show rooms, while Martin and the family made their customary Florida vacation.

In 1940 Martin began his collaboration with Harry Berman at Harvard, on deuteron irradiation of diamonds; though Berman died during the war, Martin pursued their investigations in post-war days. One target of these bombardments had an interesting career of its own, as Clifford Frondel relates:

> Fred Pough gave you the correct information. I did indeed give the irradiated green diamond [set in an engagement ring] to my first wife, long since divorced and now deceased. The diamond was a colorless stone weighing about one carat and of good quality, although poorly cut. Irradiation in a deuteron beam in the Harvard cyclotron on February 5, 1941 produced a "nice green color" (as recorded in the cyclotron logbook) as a thin layer on the table (facing the beam) and somewhat less on the sides.
>
> The Harvard cyclotron began operation in October, 1939. The director of the cyclotron lab was a physicist interested in the irradiation of various synthetic and natural materials. In 1940, he contacted Harry Berman in the then Mineralogy Department at Harvard to provide a number of uncut diamonds. At the time I was an assistant in the Department and joined with Harry in this irradiation work. This continued into 1942, but I left Harvard early in 1942 to take a job with the War Department in Washington and lost close contact with Harry, who died in a plane accident in 1944. I hence know very little of the later work on the cyclotron. Martin Ehrmann, who was a close friend for many years, learned of the irradiation work on diamonds during a visit to Harvard in 1940. He supplied the cut stone that I irradiated. My memory is fuzzy, but I believe he got the stone from a diamond dealer named Baumann (?) who had a cutting plant on West 47th Street in New York City. When I got the green diamond back from my first wife I disposed of it to him, and he or his company may still have it. Martin rented time on the Harvard cyclotron and in January 1942 irradiated numerous large cut stones with results I do not recall.

World War II

Immediately after Pearl Harbor Martin volunteered for the U.S. Army, even though he was 37 years old and exempt from the draft. His adult life had bred in him a deep love for his adopted country, and his family's experiences had bred an equally great hatred for our enemies. One of his good mineral friends (and probably also a customer) was Brigadier General Julian Hatcher, who was stationed at Aberdeen Proving Ground in Maryland; Martin, with his family, had visited General Hatcher at APG in August, 1941, just four months before our entry into the war. One thing led to another, and Martin entered the Army as a Captain, posted to Aberdeen as the Intelligence Officer for the Bomb Disposal School. It is unclear what an Intelligence Officer would do for a bomb disposal school, but we suspect that, among other things, he performed "other duties as assigned." He was promoted to Major in May, 1943, and in January of 1944 was made Commanding Officer, Ordnance Bomb Disposal School; late that year he was promoted to Lieutenant Colonel. It is interesting to speculate on the combination of talents that Martin must have had that would equip him to head a school that taught a martial skill so exacting that the tiniest mistake would lead to instant obliteration.

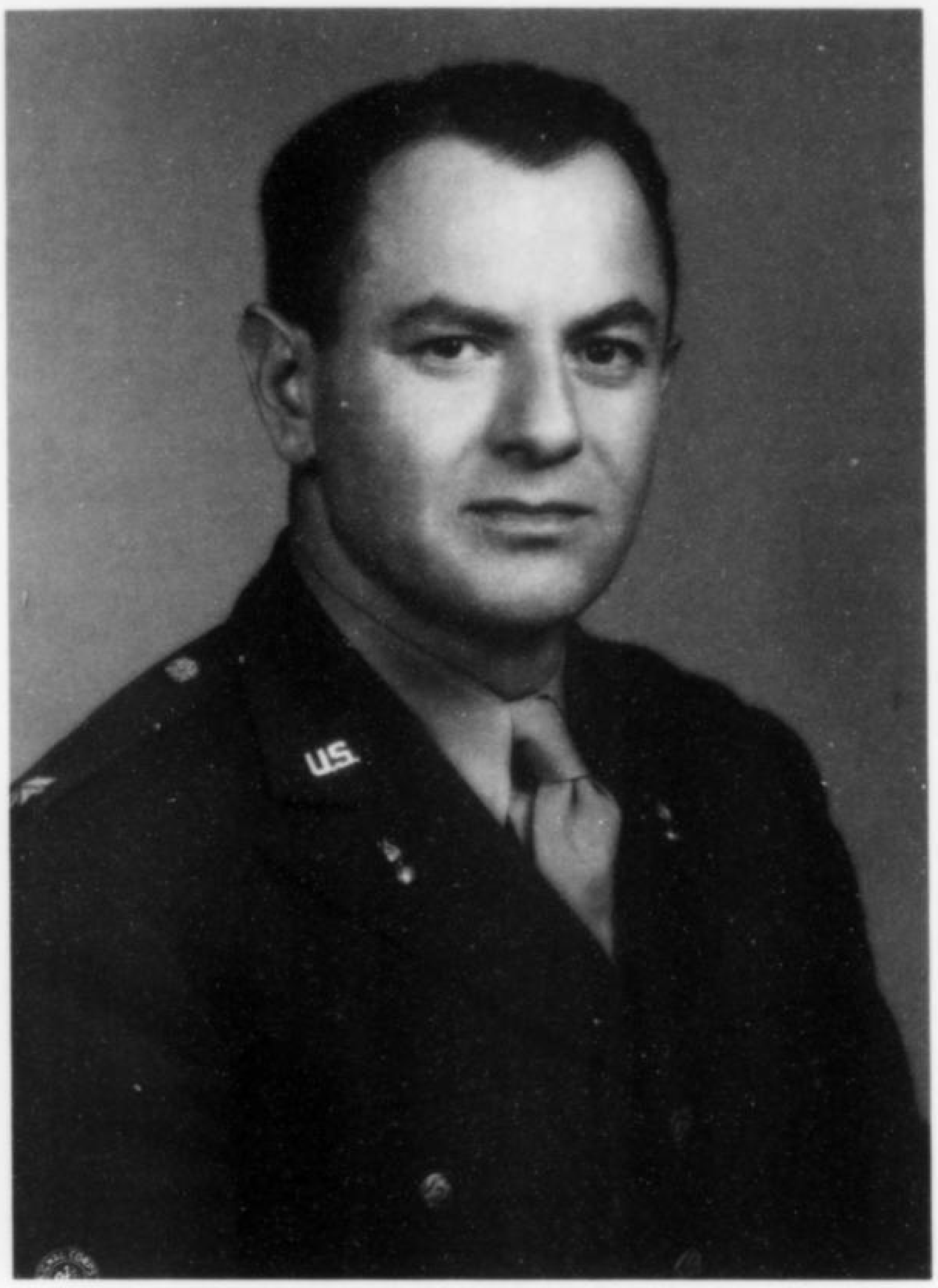


Figure 4. **Ehrmann during the war years.**

The anti-submarine warfare program and the developing Manhattan Project made insistent demands for piezoelectric and pyroelectric crystals, and there were many other claimants to such materials. For radio and radar oscillators, quartz crystals from Brazil were highly suitable and easily exploited, but for pressure gauges, tourmaline was the material of choice, and the best supplier of large, homogeneous tourmaline crystals was thought to be Madagascar. Martin was heavily involved in the attempt to recover Madagascar tourmalines for our war effort, and disparate accounts of his participation have been published. Secrecy and time have muddied these waters, and we shall never know the *exact* truth, but the one we accept as the closest is given in the following paragraphs, whose content was provided by Pierre Bariand. Those of you who saw the Ehrmann display at the 1992 Tucson Show may note that the account here differs materially from the text displayed at the Show; we stand by what is written here:

Before World War II the Director General of the Compagnie General de Madagascar was Bernard Amster; in this capacity he had had occasional dealings with Martin. The CGM was primarily concerned with agriculture (Madagascar was the largest rice producer in the French Empire), but the mineral resources of the island are significant. Since the minerals are sometimes beautiful, it was to be expected that they would attract Martin's interest. Since M. Amster was a Jew, the war was not kind to him, and even less so to others in his family, many of whom met their deaths in the extermination camps. After the fall of France in 1940, it was not long before Amster decided that if he were to die, it would be better to do so fighting, so he joined the Maquis. The Maquis was effectively divided into two segments: the Communist-controlled portion (after Hitler shattered the Nazi-Soviet Pact in June, 1941), called the FTPF, and the rightist FFI, under the loose direction of General de Gaulle in London. Though we might suspect that with Amster's background he might opt for the FFI,

Figure 5. **Ehrmann conferring with a tribal chief at Alto Ligonha, Mozambique.**

propinquity outweighed philosophy; since a communist (F.T.P.F.) unit was the closest, this is the one he joined (though he never had a party card). In spite of his non-proletarian background, Amster rose to the rank of Captain in this unit, a unit headed by a Colonel "Bernard," with headquarters in an abandoned chateau near Pressac (Vienne), about 20 km from Chabanais (Charente). From here they would torment the local German forces whose Kommandatur was in Limoges (Haute Vienne). After the U.S./U.K. forces landed in Normandy in June 1944, Col. "Bernard's" command attempted to control the entire Charente River region, with headquarters at the former Kommandatur in Angouleme. Needless to say, this effort led to severe fighting near the great U-Boat base at La Rochelle, and along the German lines of communication. At this time Gen. de Gaulle directed that all Resistance forces be absorbed into the French Army; these were now all subjected to military discipline. Readers with combat experience know that military units that fight continuously, without a break, will soon cease to exist. Thus it is not surprising that one day in August, 1944, Capt. Amster was in the local cinema in Angouleme, enjoying a respite in the fighting. What was surprising (at least to Capt. Amster) was that he was paged on the cinema's sound system, to present himself at the theater entrance. No combat officer enjoys surprises, so it was with some trepidation that Amster went to the entrance. To his utter astonishment, there stood Martin, in the full fig of Lt. Col., USA, holding a "machine gun" (perhaps a BAR, Browning Automatic Rifle) in his hands. Nor was Martin alone. According to Amster, he was backed by "about 500" U.S. troops, and several tanks. (This was almost certainly the Twelfth Army Group T-Force, one of the three heavily armed SHAEF[2] units tasked with technical intelligence collection.)

Martin wanted Captain Amster to return with him to England, and then to continue together to Madagascar, so they could liberate stockpiles of tourmaline on the island. Unfortunately, Amster was now under strict military discipline, and by the time papers flowed to and fro, so had time, and the opportunity to visit Madagascar was lost.

Amster is now a healthy 83, and recounts this tale with some amusement, according to Pierre.

Martin's military career did not cease immediately when the last shot was fired in Europe in May 1945. Because of his intelligence background, and his native fluency in German, he became part of Project PAPERCLIP. The mission of PAPERCLIP was to locate valuable German scientists and engineers, and to attempt their removal to the United States. The operation got its name from the technique used to identify significant items in the German dossiers. In a blow to the self-esteem of our readership, the term "valuable" was not applied to mineralogists and crystallographers, but to particle physicists and rocket engineers; America wanted Wernher von Braun, not Hugo Strunz. Martin had developed a strong technical background (irradiated diamonds, for example), and so, with complete fluency in German, he was made a principal interviewer. Martin's most consequential interviewee was Major General Walter Dornberger, who had been in charge of the German rocket effort (including the notorious V2), and who had been von Braun's boss. Dornberger was surprised to hear such perfect German flowing from an American colonel, so he asked Martin (in German), "Are you German?", to which Martin replied, "No, I am a Jew." The reddening of Dornberger's face terminated this exchange. The end of PAPERCLIP ended Martin's active duty, and just before his release he was awarded the Legion of Merit.

Peace, and the Move to California

In 1942, while Martin was in the Army, his family moved once again, to Graystone Avenue in Riverdale. Shortly after the war Martin had a house built on Delafield Avenue in Riverdale where the family continued to live when Martin began his West Coast sojourns. Martin did not revive his own mineral business when he donned "civvies" again, nor did he accept a suggestion proffered during his exit interview that he become the Dean of a small (unspecified) college. In 1946 he joined the William V. Schmidt company, whose owner was a Mr. "Packy" Paskow, and whose business was colored stones. In 1947 he moved to Lazare Kaplan and Company, whose business was only diamonds, purchased directly from sights. (Diamonds are marketed by the Diamond Trading Corp.—"DeBeers"—solely by "sights" held regularly in London. Attendance is by invitation only. Each invitee receives one or more candidate parcels; each parcel must be accepted or rejected as a lot.) Lazare Kaplan sent Martin, as their representative, to the West Coast, but he did not immediately uproot his family, and in March, 1950, he left Lazare Kaplan to set himself up as a diamond wholesaler.

[2]Supreme Headquarters, Allied Expeditionary Force, General Eisenhower's command in Western Europe.

Martin found the diamond business to be lucrative but boring. After handling Untersulzbachtal epidotes and Burmese star rubies, packets consisting of dozens or hundreds of wee diamonds just could not sufficiently occupy a man with Martin's capacity for life. Thus it was that he ceased, probably gradually, dealing in diamonds. Instead he established himself as an independent gem merchant. His primary business activity was dealing in fine colored gemstones. He loved his work, and gems provided him an excellent income. But much as Martin loved and respected a beautiful (natural!) sapphire, his deepest affection still lay in fine mineral specimens. For the rest of his life he successfully juggled these two vocations. When he returned from a trip his hand baggage might contain a gem such as a ruby, a mineral specimen such as Tsumeb azurite, or a "combination" like a gem tanzanite crystal.

Though Martin had his fair share of self-confidence, he did not suffer from hubris; he knew that unless he had the wisdom of Solomon and the financial resources of Bernard Baruch, it would be smarter, safer and more profitable to team up with someone rather than go it alone, so he first joined William Lowe and Company. After a short time he made his final and most important move: he associated himself with Vartanian & Sons, a firm headed by Nishan (Nish) Vartanian with his partner, Robert Sullivan. Vartanian & Sons were wholesalers of quality stones and jewelry, who purchased from and consigned to fine American jewelry firms. Their signature characteristic was that they were always a firm of opportunity. Though Martin usually operated out of separate quarters (the company offices were at 608 Fifth Avenue, New York; more than two decades later they moved to 680 Fifth Avenue), the association with the Vartanians lasted the rest of his life. The Vartanians provided much of the needed capital to Martin, because no matter how Martin's personal resources grew, he was always capable of finding deals that required even more money. Switzer recalls that many years ago he saw Martin with several letters of credit for $50,000 each. Dennis Sullivan (the son of Robert) says that the firm also paid all of Martin's expenses and that the remaining profits were split, but he does not know how; he also says that the Vartanians did not question Martin's transactions. Dennis recalls that Martin took the Vartanians and the Sullivans to the new gem hall at the Smithsonian in 1966, where Nish pointed to a large cat's eye from India and said "that's my stone—the Idol's Eye!" Nish had expected to get it, but the USNM had won that round.

In 1948 Rita and the family moved to the West Coast, where they remain today, and later that year or early in 1949 Martin established his business address at 448 S. Hill Street in downtown Los Angeles. He did not, however, sever all ties with the East Coast. As late as October, 1950 he still had a business office at 630 Fifth Avenue, and on January 1, 1950 he and his son Herb watched the Rose Bowl game at Switzer's Maryland home. It was about this time, the early part of the Korean War, that the U.S. Army proposed that Martin return to service. Martin declined, but made himself available as an advisor, and on one occasion he did arrive at Switzer's office in military uniform.

This is a good place to review Martin's West Coast business addresses. Following his occupancy at 448 S. Hill he moved, by 1958, to an address in the 1100 block of South Beverly Drive. This was followed, by 1962, with quarters at 369 S. Robertson Boulevard. His final move was to the well-known offices at 676 N. Lapeer Drive, accomplished by June, 1966.

After Martin arrived on the West Coast he resumed a collaboration on artificially colored diamonds that had been interrupted by the War and the death of Harry Berman. His new colleagues were Joseph E. Hamilton and Thomas M. Putnam, both of Crocker Laboratory, University of California, Berkeley. The instrument in use here was the 60-inch cyclotron, and the diamonds were bombarded with neutrons and alpha particles, as well as deuterons. The results were informally reported in an article in *Gems and Gemology* (Ehrmann, 1950), and more formally in the *American Mineralogist* (Hamilton *et al.*, 1952).

By the early 1950's Martin had commenced his visits to Tsumeb and elsewhere in South-West Africa (as it was then called). He was apparently the first dealer to appear regularly at this mining outpost, making at least one trip with the geologist, John Saul. Martin continued to visit Tsumeb at irregular intervals for the rest of his life. Bideaux recalls seeing, in the early 1950's, many fine pieces from South-West Africa that Martin had sent to the USNM. Bideaux also later acquired a Guchab dioptase that Martin had sold to Arthur Montgomery. Bill Pinch recalls a lunch with Martin and George Switzer in about 1959 or 1960, at which Martin produced a 2.6-carat faceted purple scorodite (now NMNH G3793). This stone was cut from a crystal taken from the back of a magnificent Tsumeb scorodite specimen that Martin had earlier exchanged to the museum. Many fine Tsumeb specimens handled by Martin are scattered at institutions throughout Europe and North America.

Burma

Martin made his first trip to Burma in 1955; he returned seven times, on trips following one another by as little as six months, until his last trip in 1962. These trips, including the European legs, usually lasted two or three months. He loved Burma, and his visits would have continued until his death, but General Ne Win seized the Burmese government on March 2, 1962, and the country was soon closed to all foreigners. Shortly after the military takeover, visas were limited to 24 hours. Furthermore, to assure the ruin of the gem trade, all mining was nationalized, and all gem dealings were to be handled by government officials.

Late in his life Martin began an autobiographical memoir of which he completed the first six chapters covering his Burmese adventures; this account deserves publication in its entirety. Martin summarized some of these experiences, and much of what he had learned, in a series of articles in *Gems and Gemology* (1957a) and another series in the *Lapidary Journal* (1957b). Arch Oboler also used the material that Martin gave him for an article in *Coronet* (Archer, 1961). In 1960 Martin invited his best friend, George Switzer, to accompany him on an extensive Burma trip, but Switzer felt that two months or more was too long to abandon the USNM, so Martin then invited another close friend, Victor Meen, of the Royal Ontario Museum. Vic accepted with alacrity, and the results of their extensive trip to Rangoon, Mogok, the jade mining industry near Mogaung, the amber mines of the Hukong Valley, and the cutting shops of Hong Kong are reported in the *Lapidary Journal* (Meen, 1962).

The primary purpose of the trips to Burma was to purchase rough and cut gems; this is what Martin's capitalization was intended for. Martin also intended to get all the mineral specimens he could lay his hands on, but this goal could not be allowed to dominate his trips. Thus Martin never visited the Bawdwin silver-lead mines developed by Herbert Hoover's group, nor the extensive tin mines. The goal of every Burmese trip was Mogok, with at least one journey to the Moguang jade mines and the Hukong amber mines. Martin began his Burma ventures by hiring, in Rangoon, a young native of Mogok, U Khin Maung, who was to serve as interpreter, guide, agent and driver. One of his outstanding qualities was ownership of a Jeep. When Martin was in Mogok he always stayed in the home of U Khin Maung's parents, which was shared also with other family members. Martin quickly learned all the Burmese courtesies, and adopted such local habits and customs as were necessary for convenient living, though without the ostentatious "going native" style popularized by the hippy revolution. Martin was an American, and never pretended to be other, but along with his beautiful Old World manners, he had a natural respect for, and an interest in, other cultures. To give the flavor of gem dealing in Burma, here is an excerpt from Martin's manuscript; it is the story behind the first significant delivery of Burmese peridots to the West:

Figure 6. **Ehrmann at ruby workings, Mogok, Burma, mid-1950's.**

The brokers had suddenly become aware of my existence. Sometimes they came in droves without announcing themselves. They stood in line awaiting their turn on the steps leading to my quarters. They were entirely unhurriedly at ease as though they had their whole lives before them and nothing else to do.

U Khin Maung brought the first broker in line to our living room. He carried a large heavy sackcloth which he emptied in front of me. I gazed bewildered at the pile of peridots in front of me, the first important lot of this gem stone that was shown me in Mogok. I estimated the lot to weigh at least seventy-five pounds. . . . There were many fine crystallized specimens of sizes I never believed existed. They had very sharp faces but were etched in forms of very tiny triangles throughout the whole crystals. I could just visualize the faces of our museum curators who had never dreamed that peridot crystals of this size existed.

Not all were crystals. Many were broken fragments but in large sizes, and clean and cuttable. I estimated that I could cut stones weighing from ten to about three hundred carats from this lot. The lot also contained many useless flawed pieces without any value. I wanted to buy this lot. The moment had come to start negotiations with the broker. During our examination I occasionally looked at the broker, who not for one second took his eyes off the lot. He had a nervous twitch which he tried to shake, but couldn't. I finally gave the sign to U Khin Maung that I wanted to buy the entire lot. When negotiations started, I noticed that all anxiety had left the broker and that he was completely at ease again.

Soon I found that he only wanted to sell about a third of the lot on instructions from the miner in Pyaung Gaung. . . . This town is located, unfortunately, in an insurgent area, only ten miles from Mogok, but no one in Mogok ever dared enter this area. My agent's persuasion was of no avail. The owner didn't need the money and wouldn't sell all until he needed more, which he wouldn't until after the Burmese New Year three months hence. He told us that the owner was quite positive that the price would not go down since all the miners and dealers were learning that prices continue rising, which also made for reluctance in selling. They all believed that it is the better part of wisdom to hold their gems until they needed the money. I just sat there watching the broker in disbelief. I finally made up my mind to enter the insurgent territory and negotiate with the owner for the entire lot. U Khin Maung was against it and so were the other dealers whom we consulted. I finally went to see the S.D.O., the Subdivisional Officer, and asked his advice. He too was against such a daring venture. The only one who didn't think it would be dangerous for me to go to Pyaung Gaung was the broker [for the peridot] who practically guaranteed my safety. The only drawback was the language barrier as no one in [Pyaung Gaung] spoke English. But I felt that I could negotiate by sign language and write figures on paper.

Reluctantly it was finally agreed that I leave by our jeep with the broker early next morning, not taking anything of value with me. If negotiation was successful, the broker would return with me and the peridots to Mogok, and he would be paid here.

We started off the following morning, as agreed, and after almost an hour we were about two miles from Pyaung Gaung. The broker asked me to stop there and wait in the jeep until he returned, as he wanted to talk to the chief of the insurgents [presumably the Shan National Army] and tell him the reason for my visit. If he [the insurgent chief] didn't agree, he [the broker] would come back and we would just return to Mogok. If he succeeded, he would bring horses so that we could ride in the two miles to the village and that I would be able to negotiate with the owner.

An hour later a horse and buggy arrived with the broker and the chief of the insurgents [who came with the broker] to either approve or disapprove my entering the village. [The chief] was a short man even by Burmese standards, about 50 years old, paunchy but very compact. He had black hair, very shiny from the hair tonic he had applied to part his hair in the middle. To my surprise he addressed me in poor but understandable English. He had a pleasant, high-pitched voice and a nice, easy manner. "Are you English?" were his first words. When I replied that I was an American, he smiled and seemed pleased. We talked about many things, including politics. He finally asked me if I was afraid of insurgents. I told him he was the first one I had ever met, and added if all insurgents were like him, there would be no need of fear. He then entered the jeep without saying anything further and we drove on to the village which we reached in ten minutes.

It was a settlement consisting of about 30 houses, some were thatched, others had corrugated tin roofs, all built on stilts. There was one big building in the village. This was where the chief of the insurgents lived, and all activities were apparently directed from this building. I was dropped off at one of the houses. The chief bade me an abrupt goodbye, wished me good luck, and left me standing in front of this house. Not knowing what to do, I waited at least ten minutes when finally the broker showed up with his horse and buggy and we climbed the stairs together. It was the owner of the peridots that greeted us when we took our shoes off before entering the living room. He welcomed me with dignity and politeness, all in Burmese which I didn't understand.

Again the sack of peridots were dumped on the floor and the owner, without sorting, divided one-third and said this is what he was going to sell today. The balance he wouldn't sell until he was in need of the money. In sign language I made him understand that I wished to buy the whole lot and would give him a very good price to make sure that even if he sold them at a later date he wouldn't take any losses. Again he indicated that he didn't need the money and therefore would only sell this third, and how much would I bid for it. I said that I never made bids, that he would have to give me a price and if I were satisfied, I would buy it. He wrote a price which seemed rather reasonable, but knowing the Burmese, I knew I couldn't just accept. I wrote the price of the lot and made it about a third of what he indicated. Smilingly he said, "Quare," the usual "We are far apart." I indicated I would buy it all for double the price that I had indicated. At first it seemed to interest him, but a few minutes later he again pointed to the third he had separated and wrote down a new figure. I raised my figure a little bit and finally we came to an agreement on this [portion of the] lot. But I wasn't ready yet to let the balance go. In sign language I tried to explain to him that if I buy the lot I would give him so much more than he actually expected, but that he didn't have to take the money right away. I could give the money to anyone he trusted in Mogok and he could draw from him as he liked, either in one month, two months or even wait until the Burmese New Year. He couldn't resist the temptation of this offer and he finally told me that I could buy the [whole] lot, the broker would take it with me, I could pay him, and he would arrange payments to him as needed. I could not have felt more elated if I had bought a million dollars worth of fine gems when I bought this lot of peridots which in value was nothing like any of the more precious stones like rubies or sapphires. It was a mere pittance but the fact that I was able to buy such an unusual fine lot of such an unusual fine gem pleased me immensely. After much more conversation but with complete dignity and politeness I left. The broker took the lot with him and put it in the jeep and asked me if he could drive with me back to Mogok.

The peridots Martin brought back were of matchless deep grass-green color, and of a more equant form than the Saint John's Island peridots, which are more often thin and tabular. Probably the largest cut stone from Martin's trip was acquired by the USNM in 1962; this 287-carat cushion-cut stone [NMNH G3705] is on display, and is figured in two of Paul Desautels' books (Desautels, 1970, 1972). John Sinkankas writes:

> I also remember seeing the splendid, crude, squarish and tabular prisms of peridot from the famous Burma deposit which he brought out for the first time. These were remarkable for their enormous size, hundreds of carats in some individuals, and their remarkable clarity and color.

In his *Lapidary Journal* article Martin describes his dealings with an aged opium smoker, who showed Martin a magnificent ruby that he refused to sell, but "maybe later." The conclusion to this tale may be in a story from Gus Meister:

> It was sometime after 1968 that I met Martin Ehrmann and Rita. When he found out that I, too, came from Kiel, had gone to school there same as he, we had a lot to talk about and he treated me like a long lost cousin. When Dr. [Werner] Lieber visited here a bit later, Martin invited me and my wife and the Liebers to a sumptuous dinner at a fancy place in the mid-Wilshire district. Later at his house in Beverly Hills he told me the story about this elderly Chinese gem dealer in Burma who owned a large, perfect ruby. They had done quite a bit of business over a period of time and were good friends. Martin had for some time tried to buy this gemstone, but the old gentleman would not part with it under any circumstances. Years went by and the business climate had deteriorated to the point where nothing much happened in the gem business. One fine day in the late 60's a young Chinese gentleman came into Martin's office and quietly laid a small package on his desk and then proceeded to introduce himself. He was the grandson of this elderly gentleman in Burma, and told Martin that the grandfather had died but had left specific instructions that Martin Ehrmann should have first call on this gemstone. He quoted a specific price (but I don't recall whether Martin actually mentioned it to me). As Martin told me, he promptly called the members of his syndicate and in no time had the money available to make the purchase. The young man had his money and had honored the wishes of his grandfather. Martin had the stone, so now what? The stone was of considerable size, about 2 x 4 cm, and flawless. The group studied the stone at length, wondering how to make the most of their investment, and finally decided to cut it into three or four smaller faceted stones. As Martin told it, they made money on the deal. What happened to the stones and who eventually owned them, I don't know.

This stone may be too small to be "The King of the Rubies," as Martin called it, that was purchased by his syndicate for $300,000. The rough finally yielded, after several cuttings, a magnificent 99.99-carat

***Figure 7.* Ehrmann haggling for gem crystals near Governador Valadares, Brazil, 1968. George Switzer photo.**

stone. On another of his trips, Martin purchased, with much negotiation, a piece of sapphire rough weighing 1,090 carats; from this piece several stones were cut from the 135-carat unflawed portion. The largest cut stone was 65 carats of a pure and intense velvety blue color, without a flaw.

Martin considered his Burmese collections to be his most important gemological contribution. Very large sums of money changed hands, and many wonderful stones and superb specimens came to the West. Martin also continued to fulfill what he saw as his patriotic duty. We believe that he was regularly debriefed upon return from his Burma visits by an agency of the U.S. Intelligence Community, probably the CIA, but perhaps Army Intelligence, or the DIA. His easy entree into a rather hermetic society, and especially his perennial visits to troubled border regions, could not be easily duplicated by your average Princeton graduate, and he was glad to provide this (unpaid) service.

Brazil

Burma was the target of Martin's most important travels of the late 1950's and early 1960's, but he certainly dropped his suitcase in many other countries during those years. Martin visited Brazil many times during the last two decades of his life (and probably earlier), and he scored some notable coups. For the story of one that may be familiar to many readers, we quote from Peter Bancroft (1984):

> Kunzite was not rediscovered in Brazil until 1961, when a large pegmatite was entered on the Frigorifico Anglo fazenda near São Jose da Safira, 60 kilometers northwest of Governador Valadares. The mine was named the Urupuca after the nearby river. At first a series of pockets was encountered which contained pink and green tourmaline, mica and quartz crystals. Next a zone rich in lepidolite was found, and finally pockets containing deep-colored lavender crystals of a type unknown to the miners. The area was quite remote and the huge quantities of lilac crystals found no buyers. Few dealers had heard of the discovery, and none could identify the new stones.
>
> Shortly after the discovery a buyer for Levon Nercessian, a gem dealer in Rio de Janeiro, encountered what was being offered as purple topaz at Galiléia. But because it was unlike any topaz he had seen and because he feared it was a synthetic stone, he had not acquired any. Nercessian's curiosity was aroused, and he set out for Galiléia. Although he could not identify the new stone, he liked the material and bought a large lot at a very low price. The samples he showed to a friend in Governador Valadares were identified as kunzite, and the rush to the Urupuca began. Many buyers still purchased the new stones as topaz, but knowledgeable ones, like American dealer Martin Ehrmann, knew it for kunzite. Ehrmann bought a large quantity of gem-quality crystals and used the better pieces to barter with museums throughout the world. A ton and then another ton of kunzite crystals were uncovered, making this strike the greatest of its kind in history. Prices escalated, fences were built around the mine, armed guards were posted, and cameras and visitors were prohibited. Wealthy Brazilian gem dealers bought huge flawless crystals weighing up to 3 kilograms and retired them to bank vaults as legacies for their children. . . .
>
> Paolo Nercessian, Levon's father, acquired the greatest crystal of all, a flawless gem of 31 by 15 by 19 centimeters. It was of the deepest violet and weighed 7.5 kilograms. This magnificent crystal was purchased by Ehrmann, who traded it to the Smithsonian Institution (NMNH 120372).

The comment that Ehrmann bartered these wonderful spodumenes

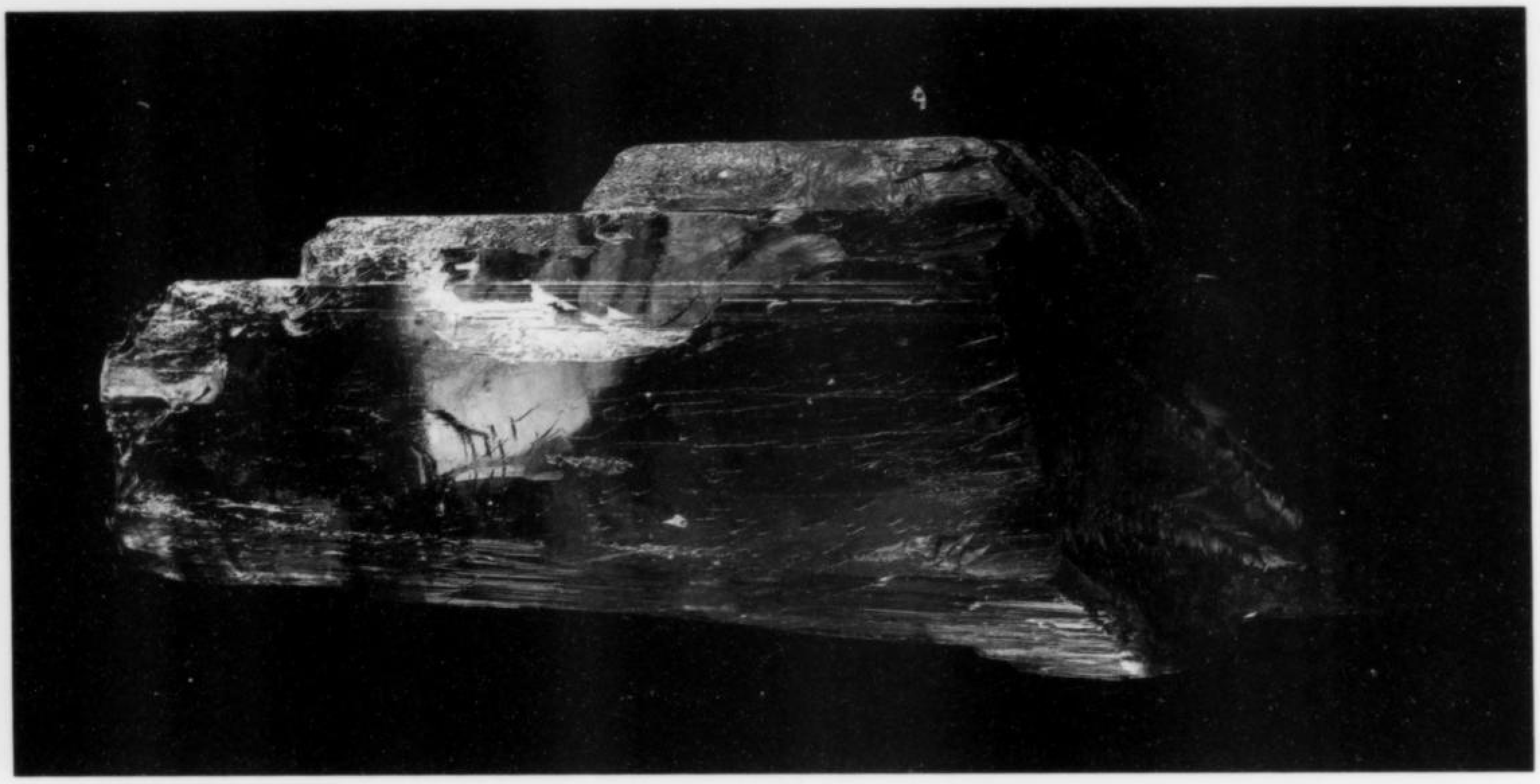


Figure 8. **Spodumene ("kunzite"), 27 cm, from Itambacuri, Brazil. Sorbonne specimen, acquired from Ehrmann in 1968. Nelly Bariand**

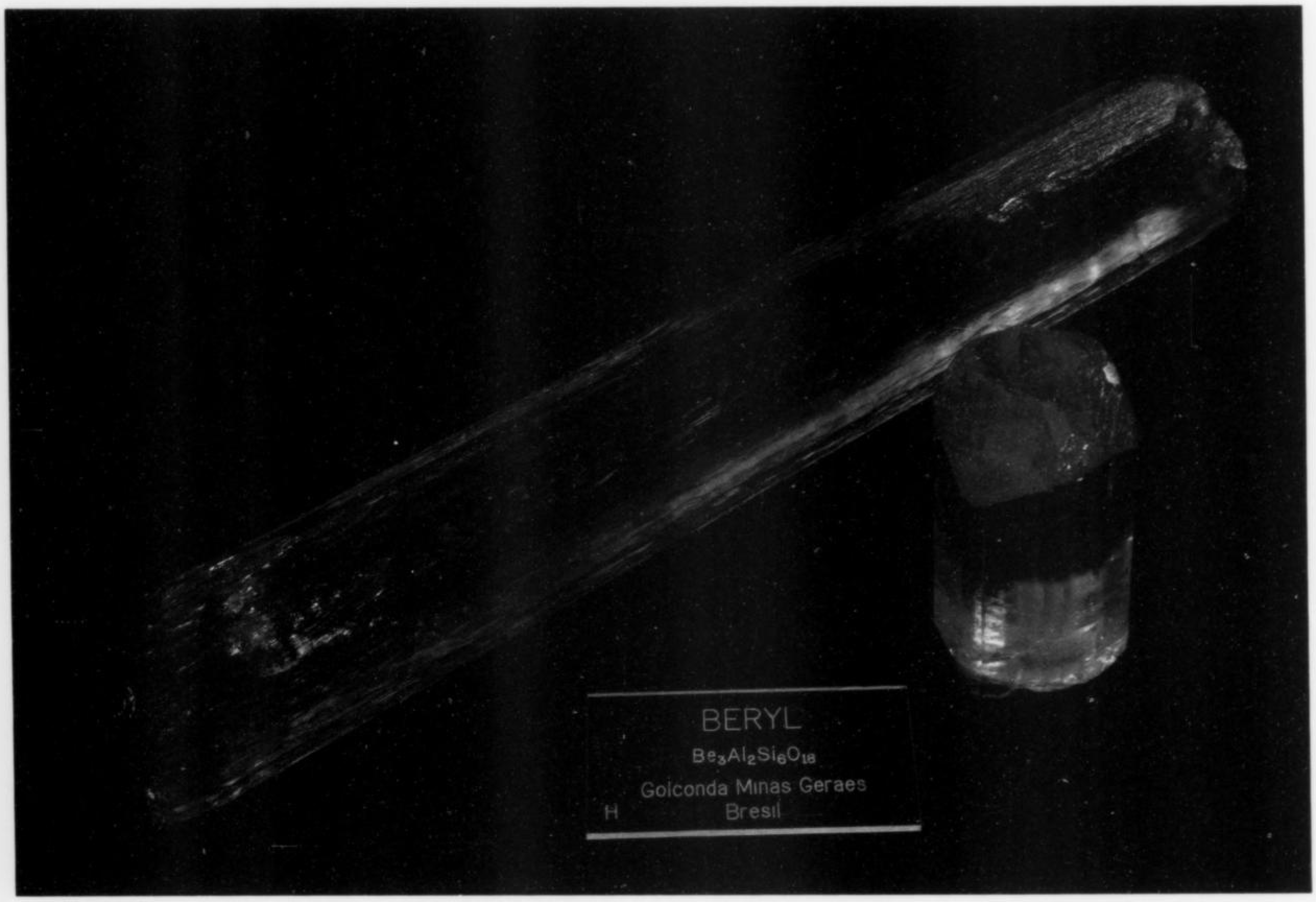
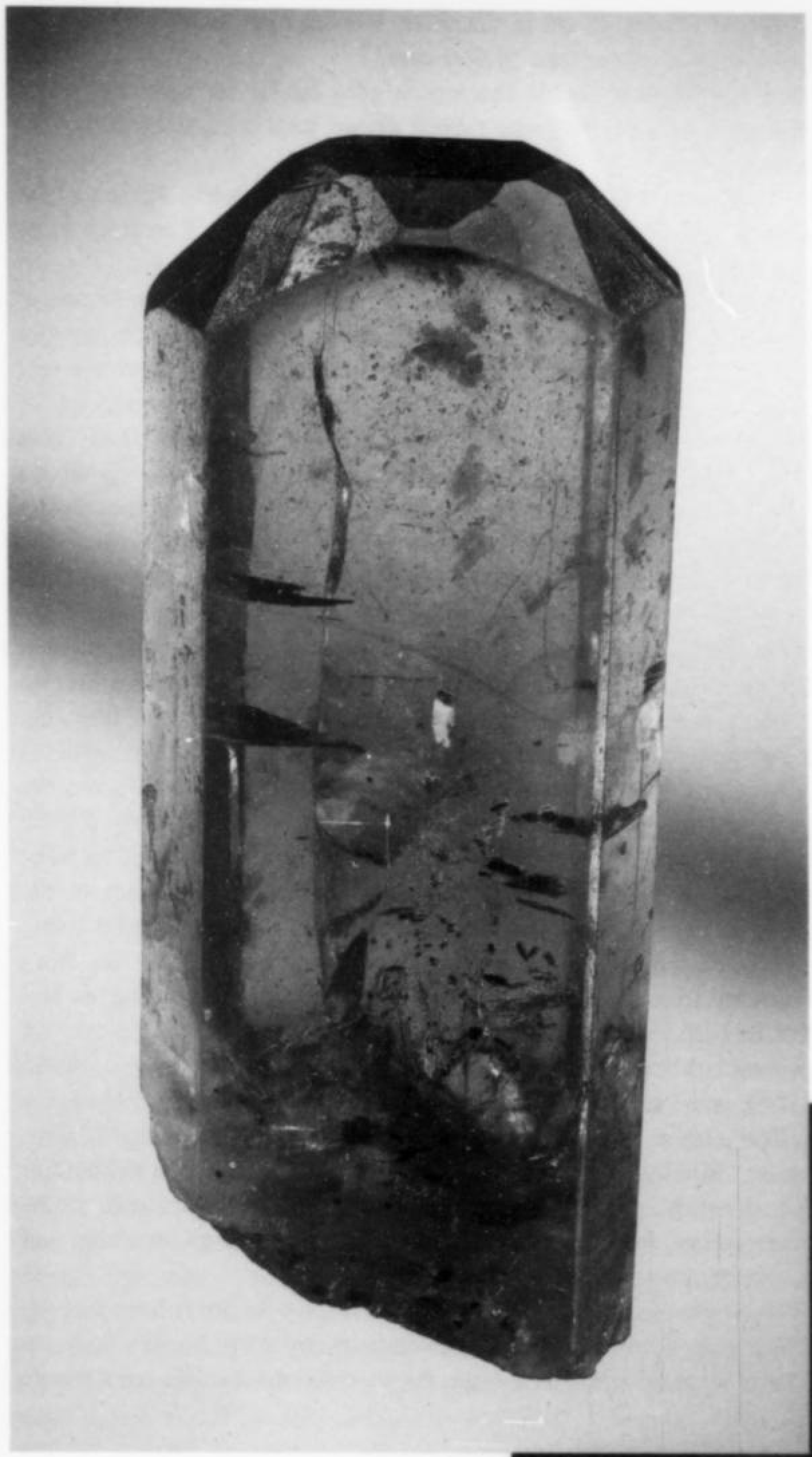


Figure 9. **Two beryls, the largest 33 cm long, from Minas Gerais, Brazil. Sorbonne specimen, acquired from Ehrmann in 1965. Nelly Bariand photo.**



throughout the world is confirmed by former Smithsonian curator John S. White. He noted that on the Mineral Museums Advisory Council (MMAC) trip through central Europe, following the 1991 Munich Show, he saw in most museums, including Freiberg, Dresden, Berlin and Prague, splendid Urupuca kunzites that the institutions had received in exchanges with Martin.

Jack Jago Trelawney adds:

> Ehrmann specialized in expensive and beautiful minerals and did a good job of tracking them down. Some of the best tanzanites and kunzites came from him. I bought one of his fine kunzites once. He appraised part of my collection in the 1960's but did not want any fee for the work. Instead he wanted me to buy a very good, large kunzite crystal from him, which I did not particularly want since it was too large for my collection. But in the circumstances I felt obligated to get it.

Gerhard Niedermayr, curator at the Vienna Museum of Natural History, tells of another of Martin's Brazilian adventures:

> Back in the 1960's, Martin came across a quartz dealer in the Governador Valadares region of Minas Gerais who had a batch of quartz crystals, some of which had another well-crystallized mineral growing on them. Martin did not know what the other mineral was, but to avoid alerting the locals to the possible importance of this mineral, he bought the whole lot of quartz crystals. He loaded these crystals on a lorry, drove to a secluded spot, separated and roughly trimmed the crystals with the unknown mineral, and drove to another quartz dealer where he sold the now barren crystals. [This was the first find of the remarkable Brazilian herderites.]

Figure 10. Beryl crystal, 14 cm tall, from Minas Gerais, Brazil. Los Angeles County Museum of Natural History specimen, via Ehrmann in 1959. Van Pelt photo.

Figure 11. Elbaite crystal group, 47 cm, from the Cruzeiro mine, Brazil. Los Angeles County Museum of Natural History specimen, acquired from Ehrmann's estate in 1972 by Mr. and Mrs. E. Hadley Stuart, Jr. and donated to the museum in 1974. Van Pelt photo.

Figure 12. **Ehrmann at home in his office, 1962.**

Again, from John Sinkankas:

> Martin was also the first, I believe, to import large quantities of the now well-known rutilated/hematitic quartz from Brazil, and Marge and I had the pleasure one day of going to the garage which Martin had rented to store the boxes of quartz, and go through them to extract choice pieces. One of the best, and here I speak of world-class specimens, I cut and polished to display a very large and perfect six-rayed rutile star.

By being in the right place at the right time, I (Bill) and my old friend Bob Highbarger bought 100 pounds of this material from Martin for one dollar a pound, on which we later turned a tidy profit.

In 1968 Martin and George Switzer of the Smithsonian made a tour of Colombia and Brazil. While on this trip Martin was instrumental in helping the USNM to acquire a fine Muzo emerald matrix specimen, currently on display. From Bogota they flew to Buenos Aires, so that Martin could visit his sister Frieda and her family; from there they went to Brazil, starting at Porte Alegre. They visited the Rio Grande do Sul amethyst mines, then went to Rio de Janeiro (to see Martin's friend and associate Levon Nercessian), to Belo Horizonte, by taxi to Ouro Preto, by small plane with Nercessian to Governador Valadares, and then to the Galileia mine near Conseilhera Pena. This trip was incorporated into an article by Switzer in the *National Geographic* (Switzer, 1971); the Society paid for Switzer's trip, and Martin arranged his schedule to accommodate Switzer's time.

The Crown Jewels of Iran

How would you like to stumble across a jewelry collection that contained (among others) the following pieces?

Darya-i Nur (Sea of Light), a flawless, pale pink diamond, between 175 and 195 carats (not measured because of the setting)

Taj-i Mah (Crown of the Moon), a colorless diamond, finest quality, 115.06 carats

Nur ul-Ain (Light of the Eye), a limpid, strong pink diamond, 60 carats

Nadir Throne: thousands of diamonds, with four emeralds, each more than 100 carats (one 225 carats)

Great Globe, 46 cm in diameter, 109 cm high, made of 34 kg. of gold, set with more than 51,000 gems

And for you belt buckle fanciers, a gold buckle set with a 17-carat diamond and 84 Burmese rubies whose total weight exceeds 400 carats.

The world is indebted to Martin for having these, and the rest of the Crown Jewels of Iran, exposed to the light of day. The story is as follows:

In 1968 the University of Toronto Press published *Crown Jewels of Iran* by V. B. Meen and A. D. Tushingham. This volume was heavily subsidized, and so was printed with magnificent color plates; the text was that of a first-class catalogue raisonné. The second paragraph of Meen's preface begins: "In the spring of 1964, I received my first direct information about the Crown Jewels of Iran from my friend Martin Ehrmann, a Los Angeles gem dealer. He had seen them during a brief stopover in Tehran between flights a few months earlier. His 'thumb-nail' description left me breathless. We decided then and there to try to make a joint study of the collection which could be published." Later in the preface he remarks, "during the months between Mr. Ehrmann's account and my arrival in Tehran I met no other gemmologist who knew anything of them." But later the problems arose: "It had also become abundantly clear, while I discussed the proposal with Bank officials, that a study of even the major items could not be carried out in the three or four weeks Martin Ehrmann and I had originally considered. It could take several months; but this possibility had to be balanced against the disruption to the Bank's operations and the length of time our own staff could spare. Eventually an arbitrary study period of three months was set, from February 1 to April 30, 1966. Unfortunately, Mr. Ehrmann did not feel that he could take so much time from his business, and withdrew." (A preliminary report, made while the study was still underway (Meen, 1966), provided the same reason for Martin's non-participation.)

The authors finish their acknowledgments with this graceful sentence: "Finally, to Martin Ehrmann of Los Angeles, gem dealer and friend, whose glowing account of the collection led directly to the project, our thanks are due for what has been an exciting and rewarding pursuit."

Heartfelt and sincere as these thanks are, we do not believe that the entire story behind the Crown Jewels is given in Dr. Meen's book. In Martin's autobiographical notes, he provided this outline for Chapter 18:

> I discovered this treasure of jewels in 1959 before it was displayed in the bank. Tried to get permission from the Shah to catalog it. Brought this news to the United States. Finally, after conferring with the Director and Board of Trustees of the Royal Ontario Museum, permission was granted. But somehow I was left out of it."

Considering that many, if not most, of Martin's overseas trips were measured in months, not weeks, it is implausible to believe that a three-month stay would automatically exclude Martin. And even if he could only stay two months, why did he not do so? Obviously, late in his life Martin felt that he had been deliberately excluded from the study, but inquiries in Ontario have failed to unearth support for the fact of his exclusion, nor has any plausible reason for such an exclusion been advanced. A. D. Tushingham (Meen's co-author) recalls only warm memories of Martin; if there was a problem between Martin and Vic, it escaped his notice. Whatever the facts may be, we do know that Martin was less happy with Dr. Meen in his later years than he was earlier.

Ehrmann Business Practices

According to George Switzer, Martin rotated first choice of his new material between the AMNH, Harvard, and the USNM. We believe

Figure 13. **Ehrmann with curator Werner Quellmalz in Dresden, 1967. John White photo.**

that this was a prewar custom, and that after he relocated to California Martin usually purchased each of his specimens with a specific customer in mind. His marketing was not as stringent as a DeBeers "sight," but the AMNH (for example) was not shown specimens headed for the Natural History Museum of Los Angeles County, nor vice versa. Furthermore, there were always certain very important private collectors who received Martin's personal attention, even though after the War he was primarily a wholesaler to non-institutional customers. We have seen that a fine Urupuca kunzite was sold to Jack Jago Trelawney, and John White has seen dozens of Ehrmann specimens in the Folch Girona Collection, including a lovely Sardinian phosgenite from Martin that is pictured in *Gem and Crystal Treasures* (Bancroft, 1973). Finally, it was not unknown for Martin to sell a specimen or two to a nearby minor collector just because he happened to be there at the right time. I (Bill) got a peridot crystal (29.2 carats, $25) in 1955, an Urupuca kunzite (330 grams, $165) in 1962, and a flawless tanzanite crystal (10.1 grams, $200) in 1968. It is obvious that even for those times, these prices were only nominal.

Martin made it his business to know where "the good stuff" was, as the following incident related by Gerhard Niedermayr illustrates:

One time, around 1966, when Martin was visiting Vienna, he went to see the collection of Karl Kontrus (1899–1975), at that time one of Austria's most diligent and thorough collectors. Martin brought with him some beautiful non-European minerals, but Kontrus said that he could not afford to buy them. Martin then proposed an exchange, but again Kontrus demurred, saying he had nothing suitable. Niedermayr continues:

> Martin then said, "how about a fine Chañarcillo proustite?" Kontrus argued that he had no suitable proustite, and none from Chañarcillo. But Martin, without ever having been before in the Kontrus house, walked into another room, directly to a showcase with closed and locked drawers beneath. He asked Kontrus to open the third drawer from the top on the right side of the cupboard. The drawer contained sulfides belonging to the fine systematic collection Kontrus had gathered throughout the years. In the very last corner of the drawer was a carton, with the best proustite specimen Kontrus had in his possession. Martin seized the box, opened it and smiled: "and what is that?" Kontrus was shocked because he never had shown this part of his collection to a dealer and only seldom to other visitors at all. But somebody must have seen this really remarkable specimen, and rumors about it, and knowledge of his secret place must have reached Martin, who always was alert to information about fine mineral specimens. Nevertheless, Martin failed to get the specimen he was so eagerly searching for.

Not only did he know where the privately held treasures were hidden, he also had a thorough knowledge of the institutional reserves, as shown by the next account, also from Niedermayr:

On Martin's last visit to Vienna, he came prepared to propose an exchange with the Naturhistorisches Museum. When meeting with the director of the mineralogical collection, and Niedermayr (then a young staff member), Martin proposed that the Museum offer some diamonds from South Africa, saying "you have plenty of those matrix specimens." Niedermayr had taken a liking to Martin (he was not unique in this respect), and he did not want to refuse Martin's proposal, but he felt that the Museum should not exchange any of its South African diamonds. So Dr. Niedermayr excused himself to the lavatory, rushed to the nearby study collection, relocated the diamonds, flushed the toilet, and returned. When the discussion resumed, Martin proposed inspecting their diamond holdings; this agreed to, he marched directly to the drawer containing the diamonds. When Niedermayr overtook him and opened the drawer, Martin was dumbfounded, and in Niedermayr's words, "annoyed that the former director, who had done several fine exchanges with him, obviously just before his retirement must have given away several matrix specimens, which Martin thought he would have the chance to get by exchange for himself." In spite of this subterfuge (motivated by a delicacy of feeling), Niedermayr always counted Martin as a friend as well as an important mineral dealer. These events, together with some others at that time, finally prompted the curators at the Vienna Museum to

Figure 14. **Epidote crystal group, 12 cm, from Knappenwand, Untersulzbachtal, Austria. Los Angeles County Museum of Natural History specimen, acquired from Ehrmann ca. 1964 by Ed and Betty Harrison and donated in 1988. Van Pelt photo.**

establish a policy to permit no one, not even another scientist, to see the drawers of the Vienna collection.

John Sinkankas has described Martin's memory this way: "In this respect he had a fabulous memory for recalling who had what, whether a private or institutional collector. On his frequent, prolonged buying trips abroad, this memory served him well because he could gamble on a large and expensive purchase of rough or a mineral specimen knowing quite well where it could be sold."

Hunting for great specimens requires a steely determination, as well as a capacious memory. Bob Jones recalls Marion Godshaw (a close friend of Martin's) telling of Martin's visit to the dioptase locality at Mindouli, in the then Moyen Congo. Before granting collecting permission and providing assistance, the local tribal chieftain required that the path to his residence be paved. Somehow Martin rustled up enough barrels of tar, or heavy fuel oil, to provide a suitable access.

It is part of our mineralogical folklore that Martin only knew, and was only interested in, gems and showy minerals. Arthur Montgomery said, "I liked Martin a lot, and I secured some of my finest specimens from him. But he did not know minerals really well. . . ." Jack Jago Trelawney comments, "He knew nothing at all about the technical aspects of mineralogy, but he knew what was beautiful and would sell well." Dick Bideaux was unable, in 1962, to persuade Martin to negotiate an exchange with the Sorbonne for one of their fine Allevard siderites, nor for a boleite from the Muséum National d'Histoire Naturelle, and George Switzer said "he didn't know one feldspar from another" (but then, who does?). Nevertheless, Martin dealt with many rare species, such as Bolivian phosphophyllite and argyrodite (John Barlow collection #1607, via Marion Godshaw and David Wilber), and he knew the correct prices too: there are records of his January, 1968 sale to the AMNH of an Andreasburg apophyllite (for $200) and a Walleroo atacamite ($750), both of which were from the Vaux Collection. Martin even pursued Franklin specimens, as Frondel tells us:

> My last memory of Martin concerns a trip he made to Harvard to obtain some large and fine specimens from Franklin, New Jersey. He did not say why he wanted them. Years later, after his

Figure 15. **Silver specimen, 16 cm, from Kongsberg, Norway. Los Angeles County Museum of Natural History, purchased from Ehrmann in 1966. Van Pelt photo.**

> death, I visited Moscow and the Mineral Museum of the Soviet Academy of Science [Fersman Museum]. There, lo and behold, were several of my fine Franklin specimens, mounted on pedestals. The curator told me that he got them from an American dealer, and traded fine blue topaz crystals for them.

But Bideaux suggests that this excursion into the exotic did not profit Martin. When an exchange shipment from the Fersman Museum was unpacked (at the USNM, perhaps because it came in under diplomatic seal), it was found to be very poor material, and not all what he had selected (and had been agreed upon). This is a demonstration that your average gem or mineral dealer is more to be trusted than the functionaries of a mighty bureaucracy.

Though mineral specimens received primacy from Martin, he frequently brought home unusual gem rough. Sinkankas reports: "Martin . . . did not hesitate to buy large and clean facet rough when he could see his way clear to having it cut commercially, or, in my case, when stones in the hundreds to the thousands of carats were wanted."

The Pawnshop Business

Martin was heavily involved in an arrangement with the USNM that was what is now called a "win-win" situation. The arrangement depended on the law that allows confiscation, by the U.S. Customs, of entire shipments containing dutiable property, on which any part of the duty has been evaded. The law at that time, the late 1950's, had a 10% duty on the value of cut diamonds entering the U.S. There was no duty on uncut diamonds (to encourage our own cutting industry), but in spite of this exception, many confiscated shipments contained uncut stones, proving that smugglers are no smarter, on the average, than shoplifters. These confiscations provided the basis for what Switzer called "the pawnshop business." What follows is a transcript of an interview with Switzer.

> We first got wind of it [the diamond confiscations] when one of our purchasing agents, Glen Shepard, found out that maybe we [the USNM] could get some of these confiscated diamonds from the GSA [General Services Administration, the Government's warehouse]. He [Shepard] had a friend over there, and they worked a deal, and they [the diamonds] began to come in, in rather large quantities, in some cases hundreds of thousands of [pre-1960!] dollars. We normally paid Martin in confiscated diamonds. One time [in 1958] Martin showed up with this nice canary diamond, which we acquired from him through a swap, and we named it the "Shepard Diamond" for Glen Shepard, and everyone looks at it and says "Oh, is this a famous diamond? Who is Shepard?" He was a purchasing agent [but a very *good* purchasing agent!] He was so proud that he redoubled his efforts to get [other property useful to the USNM]. Martin would come down when we would get a shipment; we would get the trashiest stuff sometimes, costume jewelry and all kinds of junk, and he would just take it all.

The Shepard Diamond [NMNH G3406] is currently on display; it is an intense fancy yellow, and weighs 18.3 carats.

Paul Desautels commented on these confiscations: "Many of the incredible mineral specimens I acquired from Martin Ehrmann were covered by exchanging junk jewelry from customs seizures, and Vartanian was the middle man for disposing of the stuff in the insatiable New York market." Armani Nercessian (Levon's sister) still has gold jewelry given to her by her father, Paulo, who purchased many of the confiscated pieces from Nish Vartanian, for use as family gifts.

It is difficult to see any losers in these arrangements, unless they are the smugglers; but this unusual bit of bureaucratic serendipity has now been terminated.

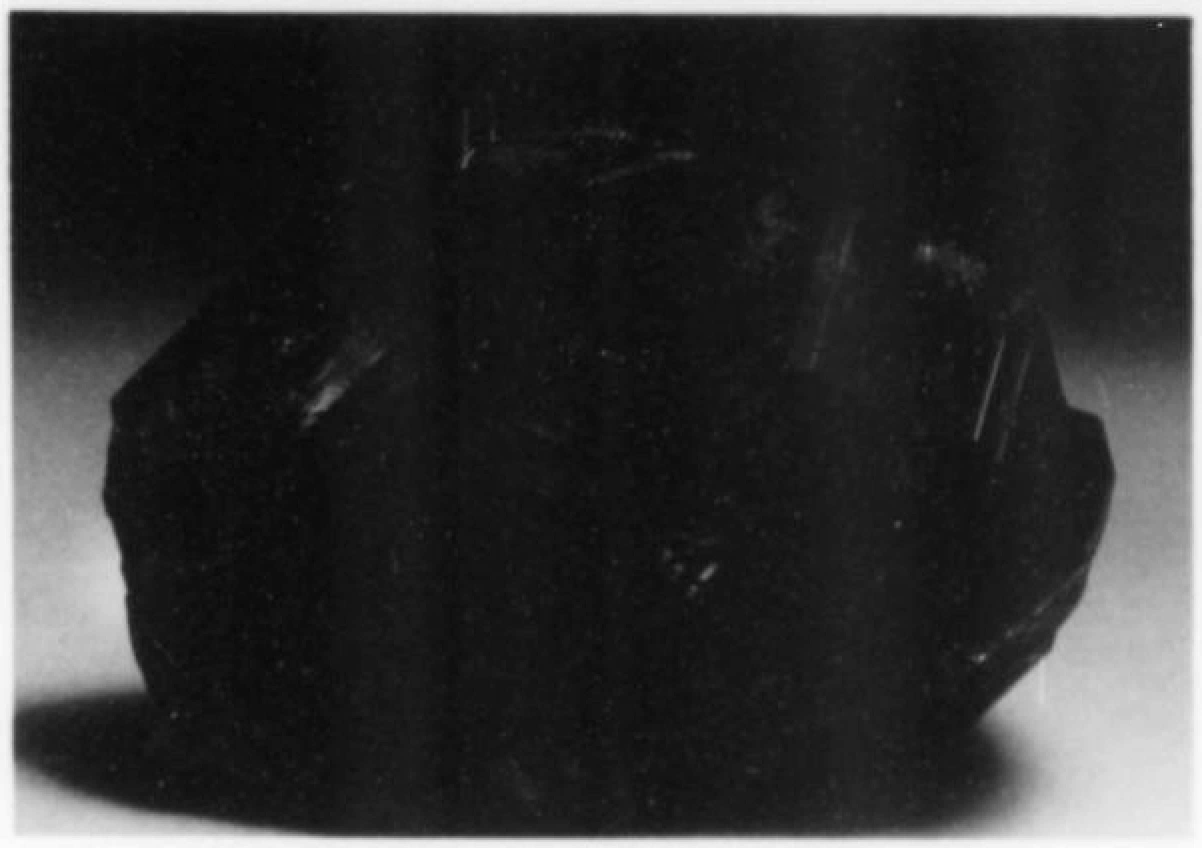


***Figure 16.* Zoisite ("tanzanite") crystal, 4 cm, from Arusha, Tanzania. Canadian Museum of Nature specimen, via Ehrmann. G. Robinson photo.**

Tanzanite

In July, 1967, an East African tailor-cum-prospector named Manuel d'Souza pegged some claims about 65 km southeast of Arusha, Tanzania, for what appeared to be bluish brown sapphires. In September of 1967 the firm of Gebruder Bank, Idar-Oberstein, got their first samples of an unknown gem from a "Mr. Wolff"; the stones were labeled as possibly iolite or dumortierite. Hermann Bank and Professor Waldemar Berdesinski of the University of Heidelberg identified them as zoisite. A trial lot was heated, which turned "the nicest blue." The Gebruder Bank firm got a new shipment of about a kilo in October. They then sold some cut stones to Edward Gübelin, and had sold their first stones in the U.S. by November, 1967. Hyman Saul, Assistant to the President of Saks Fifth Avenue, brought the new crystals to the New York offices of the Gemological Institute of America (GIA) in late 1967 or perhaps very early 1968, having seen them in the Nairobi offices of his son, John Saul, who was a shareholder in one of the three major tanzanite mines before they were nationalized. By this time, John had already sent blue zoisite to Gebruder Bank, and perhaps to others as well. Hyman showed them to G. Robert Crowningshield of the GIA, and the GIA had at least one crystal cut; later Hyman gave a number of crystals to the GIA staff.

Although John Saul already had a solid friendship with Martin, Hyman Saul first met him about the time he (Hyman) received the first sizable lot of tanzanite crystals. This meeting took place about 8:30 one morning in front of the main entrance to Saks. Martin had been waiting for Hyman, and the Saks doorman was obliged to make the introductions. Martin offered to buy the entire lot of crystals for $5,000, but Hyman declined the offer, electing instead to take them directly to Nish Vartanian. Vartanian & Sons offices were still at 608 Fifth Avenue, not far from Saks, and this visit is confirmed by Dennis Sullivan. According to Hyman and John, "a very fine early lot of zoisite" was ruined by improper controls of the heating procedure, although many of the early crystals required no heat treatment. Before the new gem became widely known, Nish would keep a very large and beautiful faceted tanzanite on his desk; Dennis says that when visiting traders saw this lovely sapphire-blue stone they would ask: "How much?" to which Nish would respond "$80 a carat." "Is it real?" the visitor would ask incredulously. "Yes, it's real." "Then I'll take it! It's mine!" "Congratulations, you've just purchased one of the finest zoisites I have." "A what?" And the game went on.

Hyman Saul very early on brought tanzanite crystals to the USNM; he believes he was the first to do so. George Switzer reports, however, that his first encounter with the new gem was when Campbell Bridges brought a half-inch, slightly waterworn, beautifully trichroic crystal to the USNM; Bridges had already shown the crystal to Crowingshield, who had verified it as zoisite. Paul Desautels said:

> I had already seen and identified a thumbnail-size piece brought to the Museum by a South African whose name escapes me at the moment (he later married a U.S. girl and moved to the States into the gem business). Then suddenly Martin showed up in my office with a large packet of incredible crystals and pieces. I leaned on him to have the biggest and best piece cut into a stone for the Museum. That's how the second largest (122.7 carats) cut gem came into the collection. It cost $60 per carat—maybe the best bargain I ever got. At the same time I acquired two super crystals from him, one of which was on display in the gem hall (maybe still is). That's all I got of that lot because I couldn't afford more. Later I got additional specimens from John Saul by trade.

The "South African" was the East African Campbell Bridges, who had just seen Switzer, and who indeed married a "tall blonde beauty from Illinois, who was my fiancee when we visited the Smithsonian," as Bridges told us recently. They continue to reside in Nairobi, not the United States. Fortuitously, Dick Bideaux was a witness to this exciting encounter.

The lot of crystals, including the two "supers," had come to Martin from John Saul (part directly, and part through Hyman); this lot was turned over to Paul by Dennis Sullivan, following Nish's instructions when he left for lunch. Paul's enthusiasm left a lasting impression on the young Dennis when the famous curator cried out "Look at this trichroism!"

The "second largest (122.7 carats)" gem (NMNH G4876) is shown in Paul's book (Desautels, 1970). Martin had this cut in Idar-Oberstein. Incidentally, Smithsonian records show that G4876 was received in an exchange with Walt Lidstrom; Jeffrey Post of the Smithsonian says that "Mr. Ehrmann had something we wanted, Mr. Ehrmann owed Mr. Lidstrom, and we had something Mr. Lidstrom wanted." One of the "two super crystals" is photographed from two different angles in John White's book (1991). This magnificent crystal (NMNH 145148) is also pictured (and very appropriately) in Bancroft's *The World's Finest Minerals and Crystals* (1973).

Unfortunately, although Martin later handled many more thousands of carats of tanzanite, we have been unable to determine precisely where he obtained the majority of his crystals. Dennis Sullivan, Hyman Saul and Hermann Bank disclaim any knowledge of his sources. John Saul says that after the one "incredible" packet, the only tanzanite that Martin got from him were some rejects that Martin recognized in Nairobi as having cat's eye potential; one 18.2-carat stone from this lot is now NMNH G4584. Campbell Bridges says "I vaguely recall that he obtained, at reasonable prices, a large quantity of rough tanzanite from either a German source connected with Ali Juyawati and/or the Wolffs." If this is the same person mentioned by Hermann Bank, it would seem useful to get to know Herr Wolff better.

Hyman Saul took some zoisite crystals and fragments to Walter Hoving, president of Tiffany and Company, who sent him to Henry B. Platt, a vice-president and their chief gem buyer. Platt studied the packet for several days, and then decided to move forward with the new gem, which he christened "tanzanite," because "zoisite" sounded too much like "suicide." It was Tiffany's assiduous marketing that popularized the new name, as opposed to "zoisite," or as in another proposal, "tanjeloffite" (Zara, 1970 or 1971). Tiffany's hired Campbell Bridges as consulting geologist; the firm got most of their tanzanite from Gebruder Bank. Tiffany's demand was so great, however, that they also bought some cut stones from Martin, through Vartanian & Sons.

The Famous Twenty-Five

The Sansom-Vaux family of Philadelphia was the greatest dynasty of mineral collectors in American history, probably surpassing even the Canfield-Dickerson family of New Jersey. Joseph Sansom (1767–1826) assembled one of the earliest collections in America; it was later given to Haverford College. His nephew, William Sansom Vaux (1811–1882), built a truly magnificent collection; "for a long time it was the finest collection of minerals in the United States, and it was only surpassed, later, by the Bement Collection" (Canfield, 1990). Watching this collection grow captured the imagination of William's nephew George, son of his brother George. (William's brother was actually the eighth Vaux to bear the name George, but late in his life he was often referred to as "Senior," and we shall do so here.) Unfortunately William died just as his nephew was entering Haverford College, so, quoting George Vaux III, "perhaps concerned as to whether his [George Jr.] youthful enthusiasms would continue, he adopted the device of leaving twenty-five specimens to his brother [George Senior]. I assume the selection was made by the two Georges." The remainder of this wonderful collection was left to the Philadelphia Academy of Natural Sciences. The consequences of this bequest were too painful to bear repetition here, but the fate of the 25 given to George Sr. was much happier.

George Jr.'s collection had been well-started before his uncle's death and, as it continued to grow, it remained housed in George Sr.'s residence on Arch Street, in Philadelphia, even after George Jr. moved in 1910 to Bryn Mawr. In 1912 George Sr. sold his Philadelphia home and moved to his "summer house" in Bryn Mawr, next door to which George Jr. had built his new home. George III suspects that George Sr.'s move was the occasion for all of George Jr.'s collection to move to a specially built wing of his new home, and also when the 25 specimens from William Vaux were installed there in their own case. This was a small, upright, glass-fronted cabinet with a wooden shutter. Juliet Reed recalls visits to the Vaux house in the mid-1950's, where "the proustites glowed in the setting sun." Many other important facts, as well as interesting details about George Vaux, Jr., can be found in Sam Gordon's memorial (Gordon, 1928); a more recent article on George Jr. was published in *Matrix* (Lininger, 1991).

After George Vaux, Jr. died in 1927, all of his collection was left to his sons, George III and Henry James, but the collection remained in George Jr.'s home in Bryn Mawr. When his widow died in 1958 the sons elected to sell their mother's home to Bryn Mawr College. They also decided to give their father's collection to the College, because it had "a bang-up geology department," and because the school agreed to yield the collection to the USNM (which had displayed a vivid interest in it), should the department ever be abolished. But the heart of George Vaux Jr.'s collection, the originally selected 25 from the William S. Vaux Collection, were again excluded from the gift, and remained in the possession of the brothers. We have nominated the cognomen the "Famous 25" for these ancient specimens.

George Vaux III had known Martin for many years. They had met in the 1930s while George III worked as a volunteer assistant to Sam Gordon (who had been originally hired by George Junior). In 1958, after the death of their father, the sons had had Martin appraise the collection that was to be given to Bryn Mawr, so it was natural that George III would turn to Martin for disposition of the Famous 25. Martin had certainly seen them in their setting in George Jr.'s home, and on one occasion he called on George III (and the Famous 25!) with George Switzer. George III says "My brother Henry and I decided that these ought to be in public collections of note, so we thought Martin was the most reliable party to carry this out."

In a letter from Martin to George, dated June 2, 1967, Martin confirmed his verbal offer to George of $18,000 for the "twenty-eight mineral specimens in which I am interested." Twenty-eight? No, 25 is correct; both the 1882 William Vaux will (of which we have a copy)

WEW

Figure 17. **Proustite crystal group (backlit to show transparency), 3.9 cm, from Chañarcillo, Chile. Smithsonian Institution specimen, via Ehrmann; #4 of the "Famous 25" originally from the William Vaux collection.**

and the 1958 gift to Bryn Mawr specify "twenty-five" as the excluded number. Mr. Vaux explains the three interlopers as follows: whenever the family departed the Vaux residence for extended periods, the Famous 25 were placed in a specially compartmented box, and this box was placed in a secure vault. Over the years three other specimens had sneaked into the box, probably because they wished to share in the reflected glory of the Famous 25. We also believe that several of the original 25 were replaced during the ensuing 85 years. Unfortunately, in his bid, Martin names (very cursorily) only 20 of these 28 specimens.

Martin's letter candidly described his motivation in purchasing the Famous 25: "I would very much like to have the prestige of handling these specimens; the monetary gain is of little importance to me at this point." (Martin was almost 63 years old "at this point.") Martin went on to say that the Famous 25 could be appraised "at about $9,000 for the cost of the specimens as of the date when you received them from your father." This presumably means 1927, when George Jr. died. George III says that the terms which were finally agreed to were essentially those spelled out in Martin's letter. Martin closed his letter with an emotional sentence: "I assure you again that I will consider it the crowning glory of my career to have the opportunity of handling your collection."

George III searched his family records for some time without success, attempting to find for us a specification of the Famous 25; finally he thought to look in the basement vault. There he found a small wooden cabinet with trays; this was the container in which the specimens were placed when they were to be stored in the vault. At the bottom of this antique, under the lowest tray, he found a variety of aged documents, including an envelope labeled "the 25"; in this envelope were several papers of which the most important is the list of twenty-five specimens chosen by George Sr. and George Jr., under the terms of William's will. This list is on legal-size paper, with the printed heading "Geo. Vaux, executor of Wm S. Vaux, dec'd." Here is the list, as hand-written:

(1)	Broad crystal [sic] of proustites	$150
(2)	Cross of proustites	$125
(3)	Large mass of proustite	$1100
(4)	Group of bright scalenohedrons [proustites]	275
(5)	Fine single crystal [proustite]	150
(6)	Group of dull crystals [proustites]	550
(7)	Group of yellow anatase Switz	100
(8)	Rutilated quartz	300
(9)	Large topaz	500
(10)	Gold group	200
(11)	" "	125
(12)	Yellow modified beryl	125
(13)	Epidote	100
(14)	Epidote	85
(15)	Emerald N.C.	450
(16)	Beryl xl on matrix	750
(17)	Rubellite	50
(18)	Topas [sic] in leather case	150
(19)	Andreasberg Apophyllite	100
(20)	Network Gold	50
(21)	Tysons Gold xx	50
(22)	Atacamite	75
(23)	Crystal Rutilated Quartz	150
(24)	Dioptase	200
(25)	Argentite	200
		$6110

The dollar figures assigned to each specimen are presumably estimates of their then-current (1882) values; they are certainly not, in every case, the cost to William Vaux. We believe this because the tray in which "the 25" envelope was contained also held an invoice for eight proustites, and it is virtually impossible to equate the dollar value of the six on William's list with any of the prices on the invoice. Also, we believe that the cost of specimens to William was not always known to other family members, as exemplified by this account from George III, about a specimen that we believe to be #16:

> Wm. S. Vaux was on one of his European trips and was visiting Russia. He was widely known all over as a collector, and he was sought out by some Russians who had this specimen for sale. The price they wanted was outrageous (at least for that time). I have forgotten the figure which my father used to quote in telling the story. Wm. Vaux refused. The men followed him all over Europe trying to entice him. They showed up on the pier as he was embarking on the ship to return, and at the gangplank he finally bought it, but would never disclose what he had paid.

Martin's letter to George III says of the 28 specimens: "the outstanding ones of greater value are the four proustites (the best ones of the eight), two golds [presumably #10 and #11], two epidote groups [#13 and #14, both from Untersulzbachtal], one emerald from North Carolina [#15], and perhaps the beryl if it isn't repaired too badly [#16, William's folly]." Among the "lower value group" Martin includes two extra epidotes, so his 28 include at least four pieces, including two proustites, that are not on the 1882 list; to make room for these four, at least one of the Famous 25 had to have drifted away. Speaking of the proustites, George III tells us that:

> Dr. L. J. R. Spencer, the celebrated keeper of Minerals at the British Museum [Natural History] came to see the collection while on a visit to this country. It was in the summer, and the 25 had been put away in their case in the vault. My father therefore had to get them out. Spencer nearly had a fit. "You don't actually handle those, do you?" he asked. The proustites, of course, were better than anything they had at the British Museum.

We have every reason to believe that Martin executed the heir's instruction to distribute the specimens to "public collections of note." In late 1967 and 1968 three great U.S. museums made purchases from Martin that consisted, wholly or in part, of the Famous 25 specimens; the institutions were the Smithsonian, the American Museum of Natural History, and the Natural History Museum of Los Angeles County. Noticeable absentees from this list are the Academy of Natural Sciences in Philadelphia, and Harvard University. There is no positive evidence to explain these omissions, but the course of custodianship at Philadelphia had been established long before the late 1960's, and Martin could not have failed to know of the Academy's dereliction. We speculate that at Harvard the only man really qualified to deal with specimen mineralogy, Clifford Frondel, was swamped by the efforts required to complete the third volume of *Dana's System*, 7th Edition (a one-man-show), while at the same time he was a Principal Investigator of the Apollo moon rocks, which had only recently arrived on Mother Earth.

Here is the list of acquisitions made by the three fortunate institutions. We have associated with many of these pieces specimen numbers assigned on the 1882 list, but these assignments are our attributions only.

USNM: November, 1967; (billed for $12,750 in December, 1967)
- Four Chañarcillo proustites, selected from #1–#6 (NMNH 121828–121831)
- Two Untersulzbachtal epidotes, #13, #14
- One North Carolina emerald (eight inches long), probably #15
- Two golds, presumably #10 and #11

AMNH: January 10, 1968 and August 8, 1968
- Chañarcillo proustite (AMNH 37096, $2,750)
- Andreasberg apophyllite, #19 ($200)
- Walleroo atacamite, #22 ($750)
- Golden Beryl, Mursinsk, #12 ($150)
- Chañarcillo proustite (AMNH 37556, $1,500)
- Hiddenite, NC, Emerald, probably post-1882 ($750)
- Beryl, Siberia, probably #16 ($1,500)

NHMLAC: early 1968
- One Chañarcillo proustite
- Two Russian blue topazes, one large, one small (#9, #18)
- One Russian platinum nugget
- One Russian dioptase (#24)
- One Swiss anatase (#7)
- One crystallized Oregon gold (probably #20 or #21)
- One Vermont rutilated quartz (#8)

One of these institutions got one of the two extra proustites, and NHMLAC got a "new" platinum nugget. In the "lower value group" Martin also mentioned the rubellite (#17), the apophyllite (#19), the anatase (#7), and the rutilated quartz, presumably #8. If we assume that NHMLAC's platinum nugget was in Martin's 28, the breakout of the Famous 25 is:

Famous 25 of 1882 + (two more proustites, two more epidotes, one platinum nugget, one NC emerald) – (one gold, one rutilated quartz, one argentite) = 28 specimens. (This is not the only possible solution to the Famous 25 problem; there is insufficient information to provide a unique solution.) The equation can be interpreted as follows: the two Georges got 25 specimens in 1882; George Jr. added six and removed three, so Martin got 28. The 24 specimens going to the three museums leave four of Martin's 28 unaccounted for: two new epidotes and one of the eight proustites, and the little rubellite from the original Famous 25. We have no idea where they went, nor do we know the destination of the missing gold, the extra rutilated quartz, nor the argentite that apparently departed earlier. In any event, 21 of the Famous 25 can be accounted for today.

In 1987 NHMLAC exchanged their enormous rutilated quartz from Waterbury, Vermont (whose exact mate is in a private Boston collection), for the Pala Chief kunzite at Harvard, described earlier in this article. Thus we have an Ehrmann (1931)-for-Ehrmann (1968) exchange, returning these very significant specimens to their homes in New England and California, 56 years after the first move. One of the USNM golds from the Famous 25 was later traded to Bill Larson; this California gold is now in the David Eidahl estate. One of the AMNH Chañarcillo proustites (AMNH 37096) was sold to the Perkins Sams collection via Paul Desautels; this disposition was made in late 1979 or early 1980, when the Museum was raising $185,000 by deaccessioning 16 minerals and one gem to help pay the half-million dollar cost of acquiring the Columbia University Collection. For this $2,750 specimen, now #4432 at the Houston Museum of Natural Science, Sams paid $30,000. Even though 12 years had passed, prices had not gone up eleven times over; Martin's original price to the AMNH was concessionary, in keeping with the spirit of George Vaux's release. (Unfortunately AMNH 37556, which remained at the AMNH, was later broken; fortunately, it was well repaired.)

The purchase and distribution of the Famous 25 was one of Martin's truly great transactions; eight Chañarcillo proustites is probably more than most dealers get to handle in their entire lives, let alone in one acquisition.

Last Years

As far as we can tell, the tanzanite transactions and the dispersal of the Famous 25 were the gemological and mineralogical highlights of Martin's last years, although he almost certainly continued to buy, sell and donate mineral specimens into his last few months. For example, in 1968 he acquired, apparently in competition with several others, the small but excellent mineral collection of Arch Oboler, the radio, movie and television writer/producer of such programs as *Inner Sanctum* and *The Shadow*. (We have already noted that Oboler had written a sketch of Martin.) Oboler had been building an extension onto his home, to house his growing mineral collection. Heavy rains flooded the excavation, and his daughter accidentally fell in and drowned. After that tragedy, Oboler lost interest in collecting minerals. Martin sold much of Oboler's collection to Walt Lidstrom, and also supplied Walt with many other specimens. It is plausible that Martin was responsible, at least in part, for Lidstrom's rapid ascent from an Oregon agate dealer to one of the pre-eminent dealers of classic mineral specimens in the 1960's.

In 1971, through his agent Levon Nercessian, Martin almost certainly acquired the bulk of the great elbaite find at the Cruzeiro mine in Minas Gerais. Among his papers was found photographs of a number of these specimens, including the original of the *Lapidary Journal* cover of January, 1972. As late as January, 1972, Martin was still crossing oceans in pursuit of specimens, because that is when

Figure 18. **Ehrmann at the Stewart lithia mine, California, with German mineralogist Hugo Strunz (left), collector Ed Swoboda, and Terry Szenics (right), 1971.**

Werner Lieber encountered him on a flight from Zagreb to Frankfurt. Martin was traveling first-class, whereas Lieber, "as a poor chemist," was in coach, so their only chance to talk was in the Frankfurt airport. Martin was returning from Tsumeb, and on his way to Idar-Oberstein; Lieber was returning to Heidelberg. We know of no later overseas trip by Martin.

Martin had always been a heavy smoker, and at least by early 1972 he had developed lung cancer. Probably at a point when he saw time running out, he began a set of autobiographical papers; he prepared an outline of "My Life with Gems and Minerals," proposing to include 21 chapters. Only the first six were completed, and these primarily dealt with Burma. The next 15 chapters were intended to cover such topics as the Kunz Collection, the deLong Star, the Calvert Collection, Minas Gerais, and strategic tourmalines. Of extreme interest, because we know little or nothing of his involvement in these topics, were the proposed chapters on Ceylon, the Dresden Green Vault and the Baldauf Collection, Mexican opals, Russia, the Deepdene Diamond (yellow, 104.88 carats), Bolivia and Colombia, and Australia. (Just think how long this article might have been, had the details of these topics been available!) Finally, there is the provocative outline for Chapter 18, "The Crown Jewels of Iran" that was discussed earlier.

It was characteristic of Martin's outgoing nature that in the six chapters he completed, he "wasted" much effort on describing the land, people, geology and history of Burma, instead of concentrating on what he, Martin Ehrmann, was doing. It is probably true that the unwritten chapters of his "autobiography" would have been equally generous to topics other than the author. Martin had little reason to think ill of himself, but he *loved* the world, and could never abandon his fascination with it.

Capt. Sinkankas tells us of Martin near the end.

> My last visit to Martin was in his apartment in Los Angeles where he entertained a group of friends only months before his death. The pallor of death was upon his face, but his eyes retained their sparkle, and his voice remained firm, and the bravery I mentioned before enabled him to carry on conversation and exchange anecdotes as if many years were left to him.

The last non-family member to see Martin was George Switzer. His illness came to its inevitable conclusion when Martin died on May 22, 1972.

Final Words

We hope that readers who knew Martin may be able to fit the preceding paragraphs into their private memories of him. But for those who never met him and have, until now, heard little or nothing about him, it may be useful to share our picture of Martin, with a few more illustrations of his character and personality. We do not offer this as a universal assessment, but simply as the view of Martin as seen by someone who knew him only in the last two decades of his life, modified by the testimony of many others.

Martin's generosity was so thorough-going that it was a constant source of concern to Rita, who kept his books. He never flaunted money, but he would not let money stand between friends and a convivial meal. He was famous for the open-door parties that he held in a rented suite at the annual Geological Society of America/Mineralogical Society of America meetings, where all mineral-lovers were welcome. Like many another impoverished graduate student, Art Boucot recalls that he "sometimes freeloaded at the elegant parties he threw during the annual meeting" of the MSA. Nor was Martin's generosity confined to the festive board. Louis Moyd recalls that "Martin was gregarious, considerate and endearing. He helped relatives, friends and acquaintances by recognizing their special needs and doing all within his means, and sometimes even beyond them. Through his wide acquaintanceship, he was able to find jobs for those who needed them (and this in Depression times). He brought people together who could be of help to each other in scientific or business matters," and further, "if a client had misinterpreted the terms of a

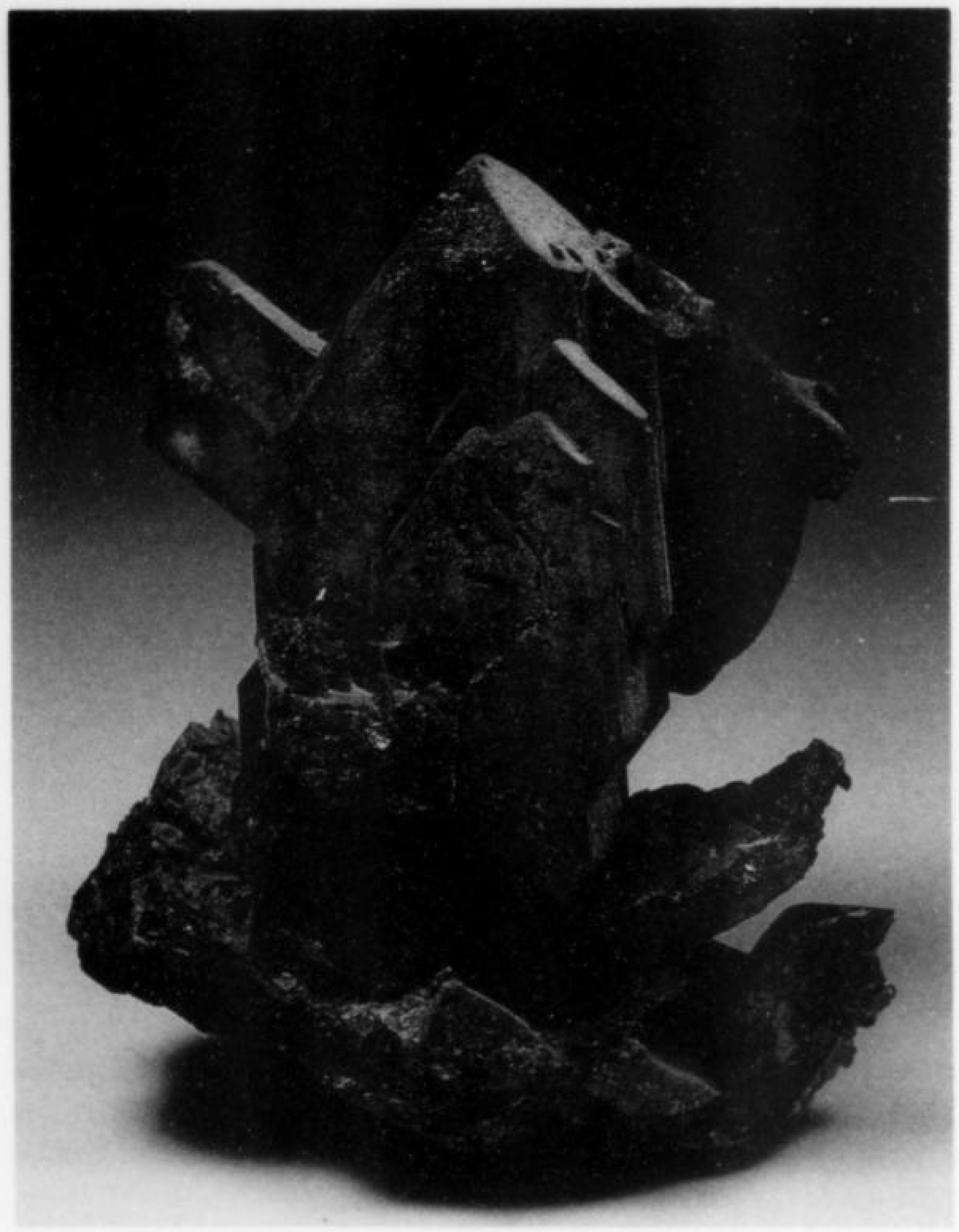


***Figure 19.* Malachite pseudomorph after azurite, 7 cm, from Tsumeb, Namibia. Canadian Museum of Nature specimen, via Ehrmann. G. Robinson photo.**

deal, and Martin would stand to lose by completing it, he would still go ahead."

Bob Cook provides this characteristic story: while Bob was a student at the Colorado School of Mines in Golden, he had become friendly with Gordon Nedblake, the owner of the Prospector's Store in nearby Idaho Springs. Bob's habit was to visit Nedblake every other Saturday; on one such visit in 1965 or 1966 Nedblake showed him two lots of rhodochrosite, one from the Sweet Home mine, the other from the Sunnyside mine. The quality of each lot was superb to the point of magnificence; Bob said that they would "knock your eyes out!" At last Bob had found specimens of the quality worth a call to Paul Desautels. Although Paul was extremely interested he was obligated to the Pasadena Show; so he proposed sending Martin to act as the Museum's factotum. Bob ferried Martin from Stapleton Airport to Nedblake's store, where Martin was shown both lots: around 20 Alma pieces including two "huge" ones, the other about 20 or 30 Sunnyside pieces. Martin quickly rejected Nedblake's price of $5,000 for the two largest Alma specimens (and he made no counter offer), but he immediately purchased all the Sunnyside specimens for $2,500. On the return drive to Stapleton, Martin displayed his pleasure with this transaction by peeling off five $50 bills, and giving them to Bob. (Later Nedblake displayed his pleasure by insisting that Bob accept another 10% of the sale price, so now everyone was pleased.)

But Martin was no plaster saint. Charlie Key relishes the memory of his first meeting with Martin, in Paul Desautels' office about 1968–1970, an encounter where John White was also present. Key and Rick Smith were alleged to have boasted that they were "the new Martin Ehrmanns," though they deny ever having said this. Charlie says, "I was in my usual open-collared shirt when Martin walked in, looked at me (for the first time), and said 'at last I have met my nemesis!', and he took a handful of my chest hair and twisted it." John White believes that the aspirations of Key and Smith (expressed through their activities) spurred Martin to new heights of mineral marketing.

The essential feature of Martin's character was that he was a lover. He did not merely deal in gems and minerals. They were not for him only a way to make a living, they were objects of affection, and he *loved* them. But even more than the beautiful stones, he loved people; not just "his kind" of people, but all worthy people. There were Burmese miners and Ceylonese traders that he regarded with fondness; he had permanent and deep friendships with Spaniards, Brazilians, South Africans, and Chinese; he was fascinated by the working miners in many lands, and he counted as friends many of the great professional mineralogists. But beyond the specimens, and even beyond people, Martin loved life. We know that if Martin had had the chance to visit, for instance, the Afghanistan that the collecting world now knows, he would have shared with us not only the treasures he found there, but also the history, the people and their manifold ways, the geography, the food, the geology, *everything*. He would not force these fascinations on you—he was not a bore—but if the conversational path led that way, you would have soon learned that there is a lot more to Afghanistan than tourmalines, camels, and Kalashnikovs.

Martin enjoyed sharing with others both his love for minerals and for life. We have seen him on extended trips with Vic Meen, and with George Switzer. During his 1962 visits with Martin in Paris, Dick Bideaux was invited to accompany Martin to Tsumeb. In 1966 Martin borrowed Leo Bodenstein's car in Munich and took Dennis Sullivan to Hannover, Dr. Schilly in Bonn, Dr. Niel in Cologne, Humboldt University, Berlin (where they had dinner with Dr. and Frau Strunz and their daughter and son), Leipzig, Dresden, Prague and Brno. In 1967 he conducted John White, then at the USNM, on a tour including London, Munich, Vienna, Budapest, Szeged, Spittal, Bologna, Zurich, East Berlin (including dinner with Hugo Strunz again), Dresden, Hagendorf and doubtless many other places. (Behind the Iron Curtain this trip was represented as a "lecture tour," and Martin's specimens, including benitoite and newly described tellurites and tellurates, were "samples" for the "lectures." Other "samples" included cigarettes, nylon stockings, etc.).

Martin's travels were a demonstration of his eclectic love of life. He was fully prepared to travel anywhere, by any means, and live under any conditions, to search out gems and minerals. He frequented locales whose sanitary facilities were non-existent, were not worthy of the name, were worse than useless, but no matter, he got on with the job. When he could live well, however, he did so. In Europe he stayed at the finer hotels; and why should he not, since he had spent so much time in hotel-less towns like Mogok? And speaking of hotels, Pierre Bariand says: "When Martin was in Paris he always stayed at the Hotel Lutetia. [Dick Bideaux met Martin here in 1962.] In later years, Martin's room was always flooded with roses, sent by a collector named Fraenkel; I saw dozens of very expensive dark red roses in the room around 1970 or 1971. Martin told me, 'If I was a girl, I could understand [the roses], but for an old man, it is very funny.'"

Sinkankas recalls other Ehrmann trademarks: "dressing impeccably, always traveling first-class, and eating at the best establishments, one of his favorites in Washington, DC being the kosher restaurant, Duke Ziebert's," and also, "no waiter or usher ever put him behind a pillar!"

These pictures of Martin are accurate; he was both adaptable and cosmopolitan, both democratic and possessed of Old-World manners, both personable and honest. In the pursuit of great specimens he was both unrelenting and thoughtful, both energetic and gentle. He was gregarious, egalitarian, and unprejudiced. (It is remarkable how generally free of prejudice the gem and mineral business seems to be; there must be an interesting essay here.)

He certainly was well-spoken; possibly this might sometimes have been called glibness. Perhaps also on the negative side, he was unreflective, and unscientific. He was sometimes cavalier with the

Figure 20. **Elbaite crystal group, 18 cm, from the Himalaya mine, California. Los Angeles County Museum of Natural History specimen, acquired from Ehrmann in 1968. Van Pelt photo.**

historical record and, to us, his biographers, he was careless of documentation. He is reported to have applied "Doctor" to his name while on some European travels. We suppose this scholarly distinction was adopted to render his "lecture tours" behind the Iron Curtain more plausible.

He was an honorable man, though his work led him to encounter those whom greed had corrupted. He lived by a maxim of Giorgio Strehler, the Milanese director: "it's better to be cheated than to cheat others." He intended to live life to the fullest, and he did. He intended to leave his family well provided for, and happy, and he did. He intended to bring pleasure, beauty, fun and profit to all he worked with, and he did. Finally, he intended to enrich the great U.S. mineral institutions, and he did that in spades! The USNM currently holds at least 499 minerals specimens, 25 gems, and one meteorite that came from Martin, mostly by exchange; NHMLAC purchased more than 500 specimens from Martin, and he donated some specimens to them also. A mineral museum can hardly be called "great" if it has no specimens acquired through Martin Ehrmann.

Let us end with a John Sinkankas quotation:

> While it is customary to eulogize someone after his death, we all knew while Martin was in his prime that here was one of the most remarkable of all collector-salesmen, a man who lived on his wits, displayed utmost bravery, followed up leads assiduously, and to top it all off, was scrupulously honest.

Acknowledgments

Many people have encouraged us to do a biography of Martin, but the main impetus for this article came, independently, from three successive curators at the U.S. National Museum: George Switzer, the late Paul Desautels, and John White. Without their strong and continuing support this account could not have been written. The current staff at the USNM has supported this impetus by providing much exact data on Martin's prolonged dealings with the Museum.

The Ehrmann family, directly through Martin's sons Sanford and Herbert, and indirectly from Rita and Martin's nephew Leo Bodenstein, were absolutely essential to much of this history.

Many others contributed to Martin's story; some contributions were very large, and others smaller, but all helped fill in a rapidly fading picture. We believe that the mineralogical and gemological communities owe a debt of gratitude to all those whose names follow: Bernard Amster; Peter Bancroft; Hermann Bank; Pierre Bariand of the Sorbonne; F. John Barlow; Joel Bartsch of the Houston Museum of Natural Science; Dick Bideaux; Arthur Boucot; Campbell Bridges; Roy Clarke, Russell Feather, Paul Pohwat, and Jeffrey Post of the USNM; Larry Conklin; Robert Cook; Carole deFord of the Cranbrook Institute; Dona Dirlam and Karen Stark of the GIA; William Foshag, Jr.; Carl Francis, Clifford Frondel and Bill Metropolis of Harvard; Si Frazier; Robert Gait and Joseph Mandarino of the Royal Ontario Museum; Kerith and Cal Graeber; Robert Jones; Anthony Kampf of the Natural History Museum of Los Angeles County; Charles Key; Bill Larson; Luis Leite; Werner Lieber; Gus Meister; Arthur Montgomery; Pauline and Louis Moyd; Armani Nercessian; Levon Nercessian; Gerhard Niedermayr of the Natural History Museum, Vienna; Louis Perloff; Joseph Peters and William Zeek of the American Museum of Natural History; William Pinch; Frederick Pough; Juliet Reed; Hyman Saul; John Saul; Eugene Schlepp; John Sinkankas; Dennis Sullivan; Jack Jago Trelawney; George Vaux, III; and David P. Wilber.

Wendell Wilson is the epitome of the supportive editor.

Although we have had the help of many people, the writers are solely responsible for all errors of fact, as well as for all eccentricities of opinion. We would be delighted to receive any corrections or additions to this account, and we shall insure that any such communications are, at the very least, preserved with our Ehrmann files.

References

ARCHER, N. (pseu. for Arch Oboler) (1961) He roams the gem trail. *Coronet*, March, 54–57.

BANCROFT, P. (1973) *The World's Finest Minerals and Crystals*. Viking Press, New York.

BANCROFT, P. (1984) *Gem & Crystal Treasures*. Western Enterprises, Fallbrook, CA and The Mineralogical Record, Tucson, AZ.

BENTLEY, R. (1979) Neal Yedlin—a memorial. *Mineralogical Record*, **10**, 231–237.

BODENSTEIN, L. (1991) *Und plötzlich musste ich english reden*. Schmidt u. Klaunig, Kiel.

CANFIELD, F. A. (1990) The final disposition of some American collections of minerals. *Mineralogical Record*, **21**, 41–46 (originally published in 1923).

DESAUTELS, P. E. (1970) *The Gem Kingdom*. Random House, New York.

DESAUTELS, P. E. (1972) *Gems in the Smithsonian*. Smithsonian Institution Press, Washington, DC.

EHRMANN, M. L. (1950) Bombarded diamonds. *Gems and Gemology*, **6**, 295–297, 318.

EHRMANN, M. L. (1953) Something about unusual gems. *Gems and Gemology*, **7**, 315–318.

EHRMANN, M. L. (1957a) Gem mining in Burma. *Gems and Gemology*, **9**, 3–31.

EHRMANN, M. L. (1957b) Burma, the mineral Utopia. *Lapidary Journal*, **75**, 306–318, 442–454, 544–554.

EHRMANN, M. L. (1958) A new look in jade. *Gems and Gemology*, **9**, 134–135, 158–159.

EMBREY, P. G., and SYMES, R. F. (1987) *Minerals of Cornwall and Devon*. British Museum (NH), London and the Mineralogical Record, Tucson.

GORDON, S. G. (1928) Memorial of George Vaux, Jr. *American Mineralogist*, **13**, 97–102.

HAMILTON, J. G., PUTNAM, T. M, and EHRMANN, M. L. (1952) Effect of heavy charged particle and fast neutron irradiation on diamonds. *American Mineralogist*, **37**, 941–949.

LININGER, J. L. (1991) Portrait gallery. *Matrix*, **2**, #1, 12–13.

MEEN, V. B. (1962) Gem hunting in Burma. *Lapidary Journal*, **62**, 636–653, 746–757, 816–835.

MEEN, V. B. (1966) The Royal Ontario Museum studies the Crown Jewels of Iran. *Lapidary Journal*, **66**, 529–535.

MEEN, V. B., and TUSHINGHAM, A. D. (1968) *Crown Jewels of Iran*. University of Toronto Press.

SHERBORN, C. D. (1940) *Where is the ___ Collection? An Account of the Various Natural History Collections which have come under the notice of the Compiler*. Cambridge University Press, p. 29.

SWITZER, G. (1971) Questing for gems. *National Geographic*, **140**, 835–863.

SWITZER, G. (1974) Memorial to Martin L. Ehrmann. *American Mineralogist*, **59**, 414–415.

WHITE, J. S. (1972) Martin L. Ehrmann Dies. *Mineralogical Record*, **3**, 100.

WHITE, J. S. (1991) *Smithsonian Treasury of Minerals and Gems*. Smithsonian Institution Press, Washington, DC.

WHITLOCK, H. P., and EHRMANN, M. L. (1949) *The Story of Jade*. Sheridan House, New York.

ZARA, L. (1970 or 1971) Tanjeloffite and blue zoisite. *Mineral Digest*, **2**, 20–33.

Minerals from the Topeka-Kentucky Giant and Indiana Veins, Ouray County, Colorado

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Porcelain-white milky quartz crystals with pale green botryoidal fluorite, and attractive anatase and brookite microcrystals, are found in this little-prospected area of the San Juan Mountains.

INTRODUCTION

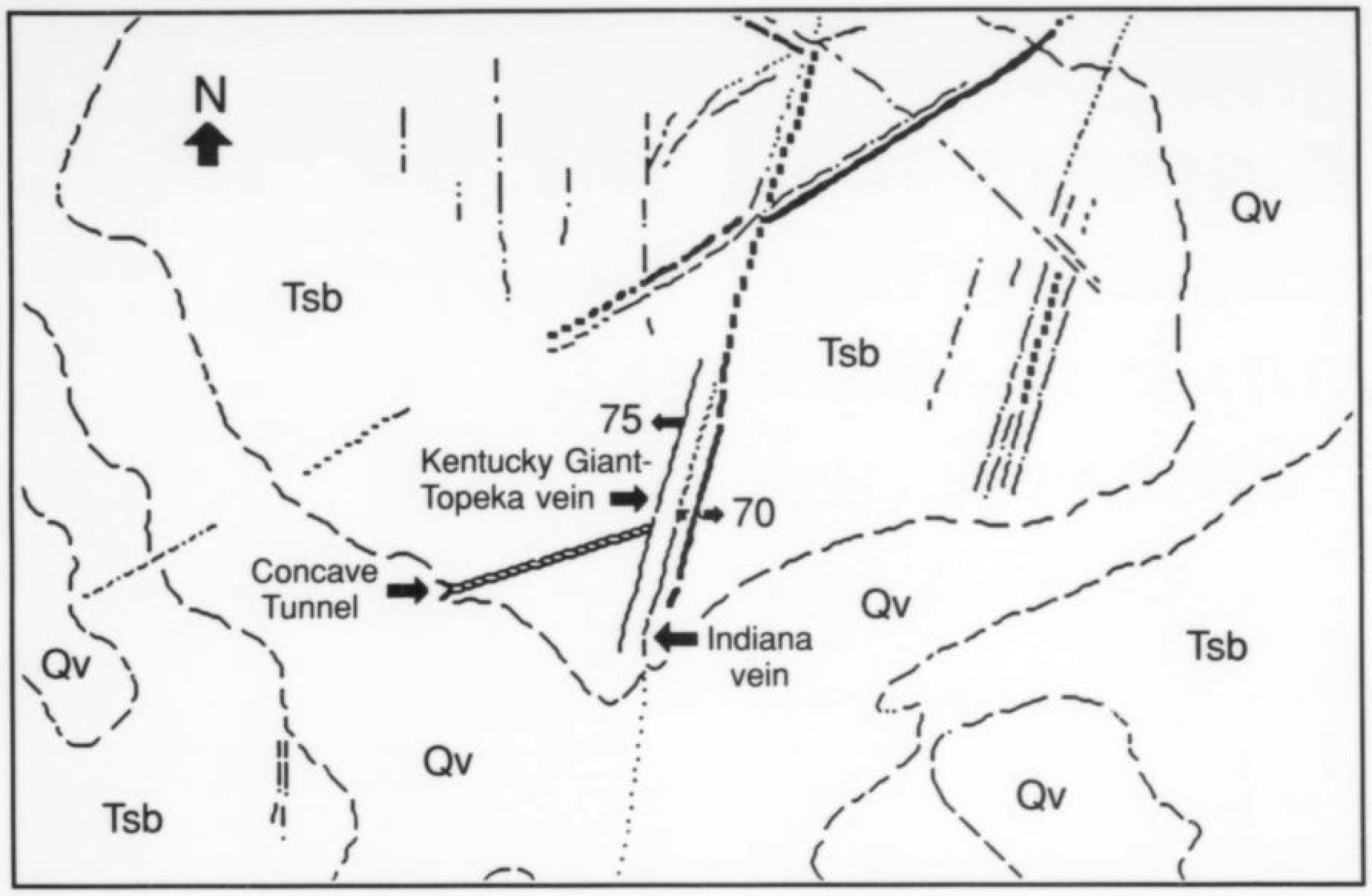
A series of mines along the southwest slope of Brown Mountain in Ouray County, Colorado, has recently yielded specimen-grade crystals of fluorite on milky quartz, and excellent microcrystals of anatase and brookite. These mines exploit two roughly parallel vein systems, the Topeka-Kentucky Giant on the west and the Indiana on the east. Specimens are found along a series of mines and dumps located on these veins, as well as at the Concave tunnel, a haulage tunnel intersecting the veins at a lower elevation. Because the access road to these mines dead ends at the Lost Day mine on the upper slope of Brown Mountain (as opposed to being a "through" route), there has been relatively little tourist traffic or prior collecting activity.

LOCATION and HISTORY

The mines are located north of Gray Copper Gulch, on the southwest flank of Brown Mountain, at elevations ranging from 10,385 to 11,056 feet. They appear on the U.S. Geological Survey *Ironton Quadrangle* $7^1/_2$ minute topographic map as a series of adits and prospects above the Silver Mountain mine, the latter also known as the Concave tunnel.

There is little recorded information on the history and production of this area. The veins were developed by a series of tunnels and shafts in the early 1880's, and some bodies of lead-zinc and "gray copper" (tetrahedrite-tennantite) ore were stoped from the upper workings in the early days of mining (Burbank and Luedke, 1969). The Concave tunnel was later driven as a haulage tunnel to intersect both veins at depth; this work was done prior to 1941. These mines are all patented claims and are therefore private property.

Several buildings and a trestle remain at the haulage level. The tunnel at this level is flooded and *extremely* dangerous, and under no circumstances should entry be attempted. Little is left at the upper workings other than dumps and some foundations. The Indiana vein was developed by a tunnel about 336 meters in length and 61 meters higher than the Concave tunnel. Tunnels at a higher level have recently been sealed under the Colorado Mined Land Reclamation program. Altogether more than a mile of development was done on these veins (Burbank and Luedke, 1969).



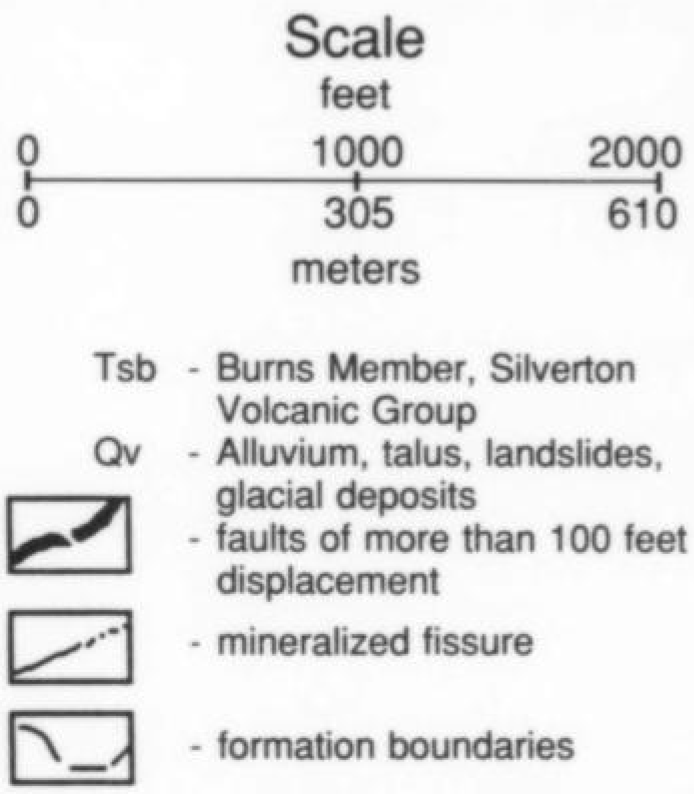


Figure 1. **Generalized geology of the area. Modified from Burbank (1941) and Burbank and Luedke (1964).**

GEOLOGY

The Indiana and Topeka-Kentucky Giant veins are located within the Silverton Caldera, in volcanic rocks of middle to late Tertiary age that comprise much of the San Juan region (Burbank and Luedke, 1969). Mineralization within the caldera was controlled by intense faulting and fracturing during subsidence. The Indiana and Topeka-Kentucky Giant veins lie within the Burns Member of the Silverton Volcanic Group. The Burns Member is characterized by medium to dark flow breccias, tuffs and flow-banded rocks of mainly rhyodacitic composition (Burbank and Luedke, 1964). The Indiana vein and the Topeka-Kentucky Giant vein are nearly parallel, striking approximately N 22° E. The Topeka-Kentucky Giant vein, on the west, dips steeply west at approximately 75°, while the Indiana vein on the east dips approximately 70° east (Burbank and Luedke, 1964 and 1969; Burbank, 1941). At the surface these veins are approximately 31 meters apart.

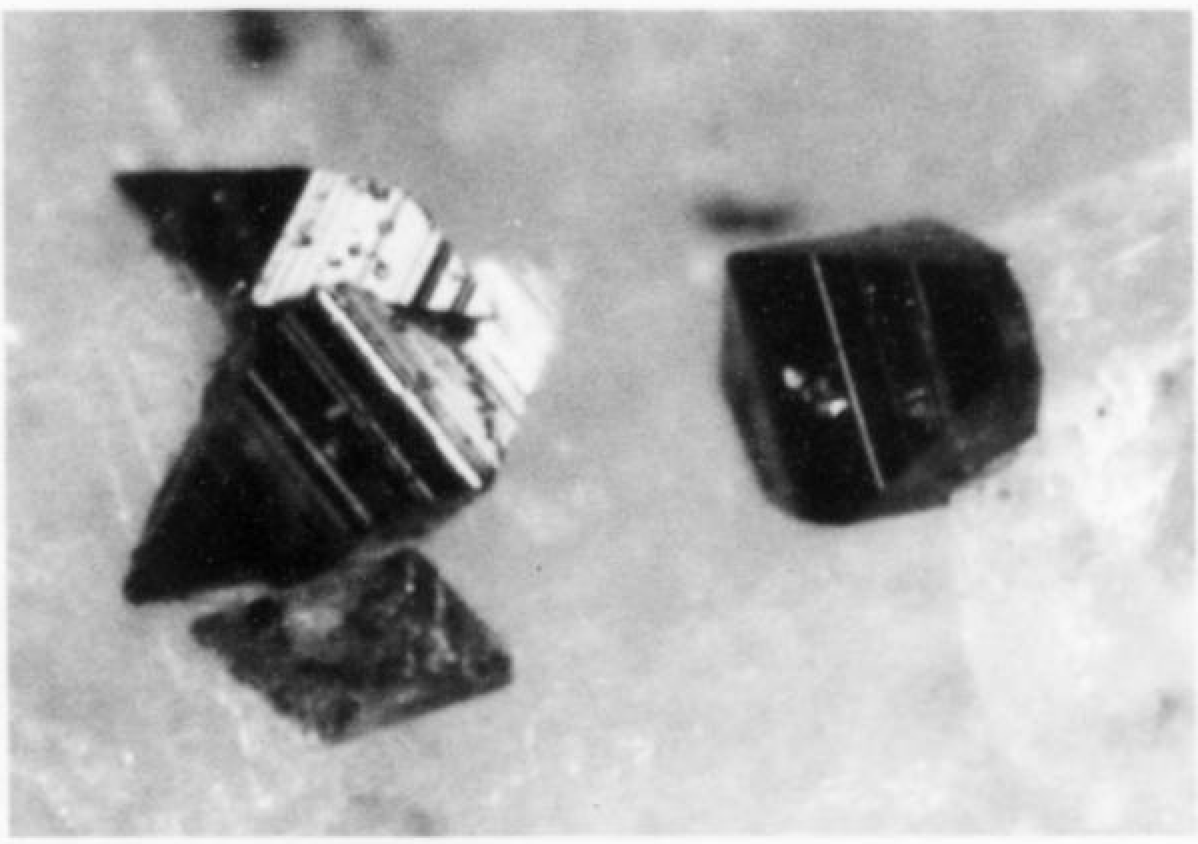


Figure 2. **Bipyramidal anatase crystals on barite; the largest crystal is 0.23 mm in length. (All photos by D. E. Kile; specimens from the collections of the authors.)**

MINERALOGY

Anatase TiO_2

Anatase is an uncommon species in Colorado. Three earlier reports of crystallized anatase describe dark blue pyramidal crystals to 1 cm in thin veins in dioritic rock from Gunnison County (Larsen and Hunter, 1914); microcrystals as much as 0.1 mm in size at the Ores and Metals mine in Ouray County (Rosemeyer *et al.*, 1988); and microcrystals to 0.7 mm, associated with brookite, from the Silver Link mine in Ouray County (Rosemeyer, 1993). Anatase from the Silver Link mine is similar in habit and association to that reported here.

Anatase at this locality occurs mostly at the Indiana vein, where it appears as minute, 0.05 to 0.2-mm crystals. They are heavily striated and predominantly of bipyramidal habit, showing occasional pinacoid faces. Crystals occur in shades of amber or blue and have a high luster; most are translucent to transparent. Crystals of different color can be in close proximity on the same specimen. The anatase formed concurrently with, to slightly after, the last quartz deposition, as evidenced by mostly surficial crystals and few subsurface crystals. A less common habit has been observed, showing prominent pinacoids, a nearly black color and submetallic luster. Anatase from this locality is usually associated with small quartz crystals (the transparent to translucent, prismatic habit, as opposed to the milky variety that is more tapered and stout), occasionally with brookite, and rarely with

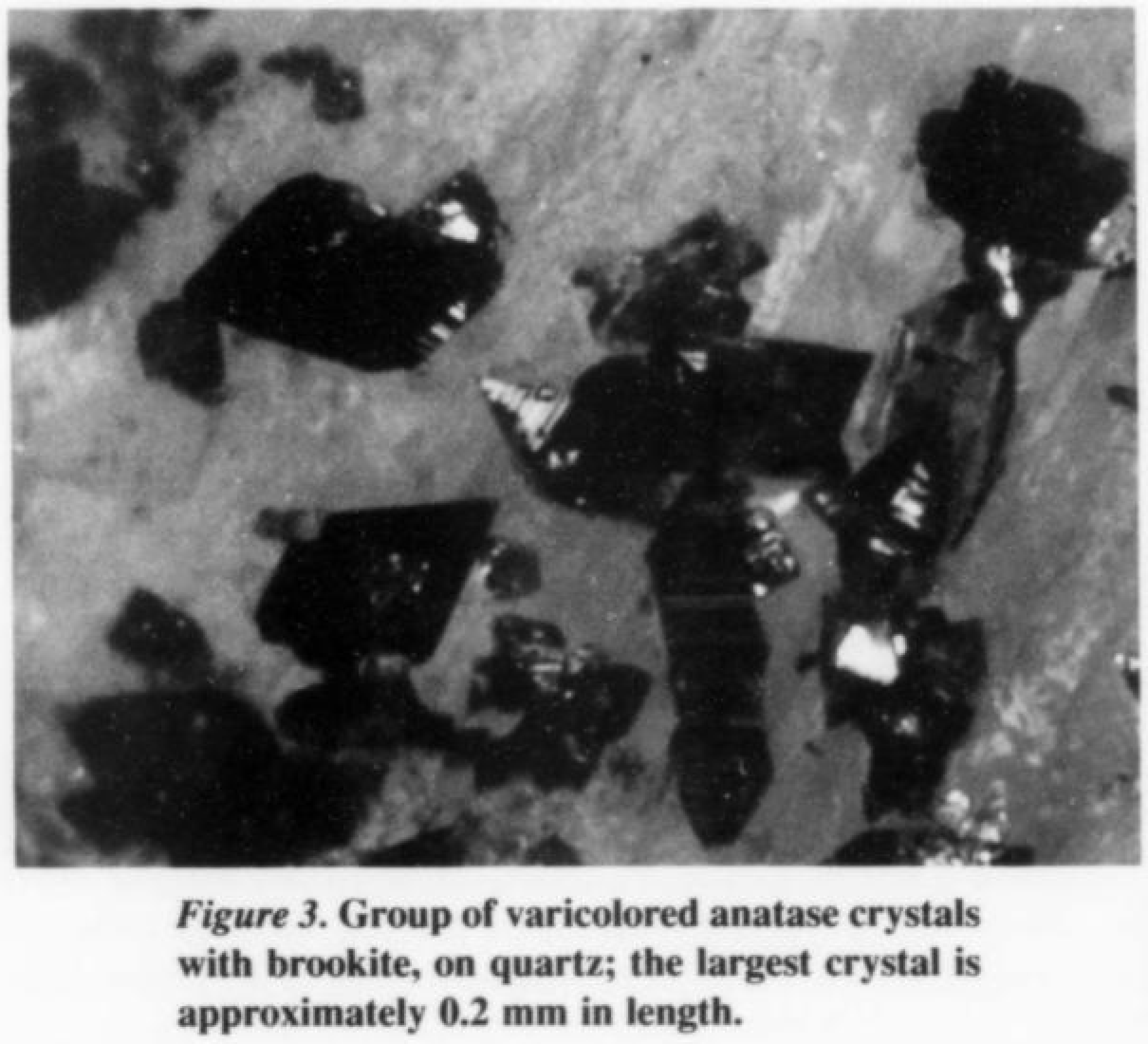


Figure 3. **Group of varicolored anatase crystals with brookite, on quartz; the largest crystal is approximately 0.2 mm in length.**

barite and pyrite. Identification of anatase was confirmed by X-ray diffraction (P. J. Modreski, written communication, 1993).

Barite $BaSO_4$

Barite occurs as thin, tabular, gray crystals, commonly with subparallel blades, as large as 2.5 cm across. They are typically zoned in alternating shades of gray, and have a bone-white rim. Massive white barite is frequently found, and is associated rarely with anatase.

Brookite TiO_2

Brookite is found as tabular, amber-colored crystals that range in size up to 0.26 mm. Some are distinctly color zoned. Identification was made by scanning electron microscope with energy-dispersive spectrometry (SEM-EDS) capability, which showed that only Ti and O were present (P. J. Modreski, written communication, 1993), and by optical methods. Deposition was contemporaneous with, to slightly after, the last stage of quartz crystallization. Brookite is uncommon in Colorado. It has only been reported from two places in the Iron Hill (Powderhorn) district in Gunnison County, where it occurs as crude, bluish-black crystallized aggregates associated with anatase near the Lot mine (Ray Ranstrom, personal communication, 1993) and as thin films (with anatase) in parts of the gabbro dike in the Iron Hill composite stock (Olson and Wallace, 1956), and has also been noted in a similar occurrence from the Silver Link mine in Ouray County (Rosemeyer, 1993). The locality near the Lot mine is likely the one referred to by Larsen and Hunter (1914), discussed under anatase above.

Fluorite CaF_2

Pale to medium green, botryoidal to hemispherical fluorite is, besides quartz, one of the more conspicuous minerals here. Two generations can be distinguished. The first occurs either as radiating aggregates composed of individual blades of fluorite, which form intergrown hemispheres typically no more than 7 mm across (or isolated hemispheres as much as 2.2 cm across), or as rough tetrahexahedrons as large as 1.5 cm. Early-generation fluorite is found on matrix fragments or on milky quartz crystals, where it commonly occurs coating one side of the specimen, a result of a directional fluid flow in the cavity that deposited fluorite on the side of the specimen facing the direction of flow. The quality of this fluorite is variable, ranging from dense, lustrous material to somewhat more porous with a chalky appearance when dry.

The later generation is characterized by colorless, transparent microcrystals as much as 2 mm in size. They occur on earlier-formed fluorite or quartz and show a distinct dodecahedral or dodecahedron/cube combination with sharp, lustrous crystal faces.

Goyazite $SrAl_3(PO_4)_2(OH)_5 \cdot H_2O$

Goyazite was observed on a single specimen as microscopic, pale, yellowish tan crystals as much as 1 mm in size, interstitial to small, prismatic quartz crystals. Identification was by optical and SEM-EDS methods. Goyazite has rarely been reported from Colorado; a similar occurrence was documented from the Sweet Home mine in Park County, where it occurs as orange crystals as much as 6 mm across, associated with fluorite, rhodochrosite, and apatite (Kosnar, 1979).

Gypsum $CaSO_4 \cdot 2H_2O$

Gypsum occurs as late-formed, microscopic, prismatic crystals to about 1 mm in length that form radiating aggregates coating fluorite or quartz; the aggregates are usually tightly intergrown, but occasionally free-standing prismatic crystals are found. Their identity was confirmed by optical methods.

Halotrichite $Fe^{2+}Al_2(SO_4)_4 \cdot 22H_2O$

Halotrichite was observed on a single specimen as radiating acicular tufts within a cavity in massive barite, associated with anatase. Individual needles are as large as 0.46 mm in length, and are transparent and colorless with a milky cast. It was identified by SEM-EDS and X-ray diffraction. This species has seldom been documented in Colorado, but is doubtlessly more prevalent than the few reports in the literature indicate.

Pyrite FeS_2

Pyrite is occasionally found as sharply formed, lustrous pyritohedrons as much as 5 mm across, in thumbnail to (rarely) miniature-size clusters. It is a ubiquitous constituent in wallrock and vein material, as disseminated anhedral grains and as small subhedral grains interstitial to quartz.

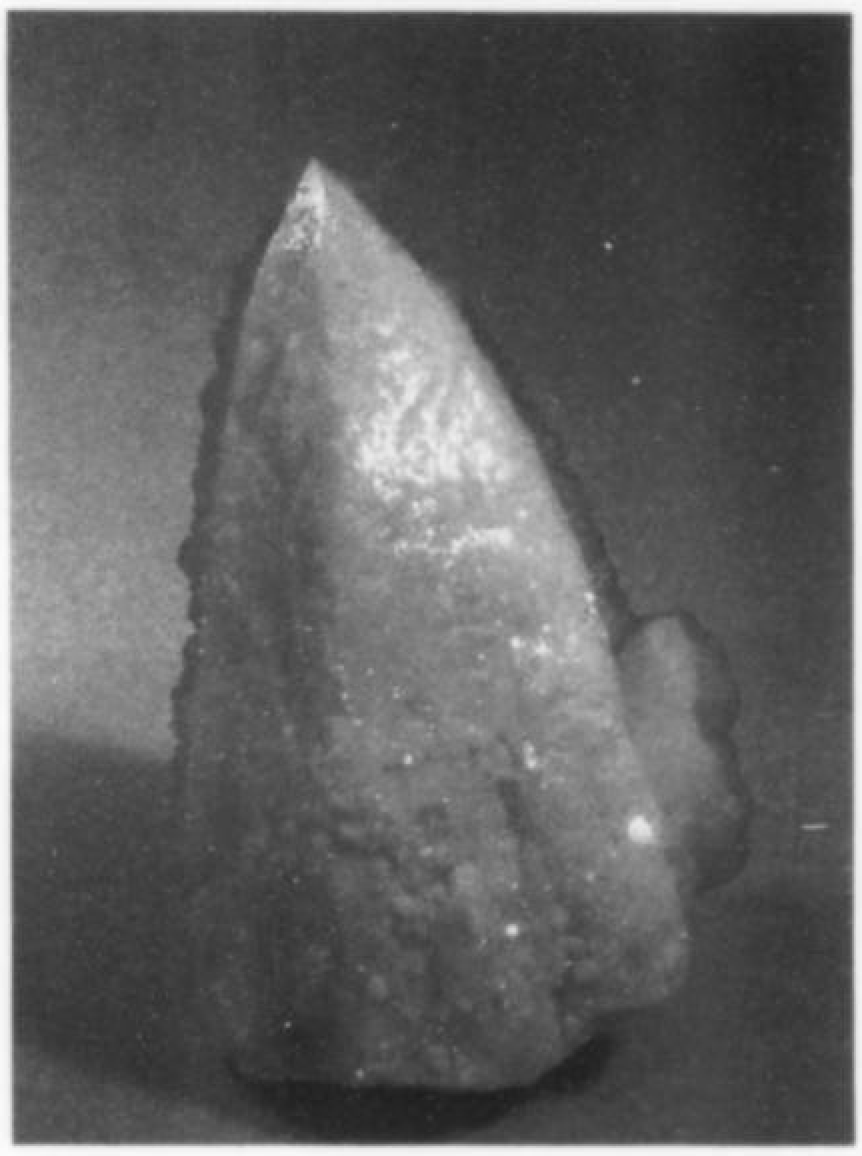


Figure 4. **Pale green, intergrown fluorite hemispheres coating one side of a 10-cm-high milky quartz crystal.**

Quartz SiO_2

Quartz is the most conspicuous mineral at this locality, although large, well-formed crystals are uncommon. Three habits are present:

(1) Medium to deep purple massive amethyst is sometimes seen underlying later-formed milky quartz. The amethyst is translucent and a few specimens have small transparent areas.

(2) The most noteworthy mineral at this locality is porcelain-white milky quartz that is associated with green fluorite. The quartz crystals are tapered, highly lustrous, and commonly have minute drusy quartz crystals near the base or along three adjacent prism faces. Except for the fluorite association, some of these crystals would be nearly identical to those reported from a prospect in the amphitheater east of Ouray (Stoufer and Rosemeyer, 1989; Kile *et al.*, 1991).

Individual milky quartz crystals have been found as much as 10 cm in length; smaller crystals (up to 3 cm) grouped in rounded clusters have also been recovered in cabinet-size specimens. The crystals are almost always partly to mostly covered with intergrown (and occasionally isolated) fluorite hemispheres that sometimes impart an attractive "halo" appearance to the specimen.

(3) Quartz also occurs as translucent prismatic crystals (with transparent tips) as large as 10 cm in length. Prominent scepters are occasionally found, the largest seen being 4.2 cm long. Delicate, acicular crystals are occasionally seen in cavities within massive quartz, associated with small botryoidal to hemispherical fluorite aggregates or crude fluorite tetrahexahedrons.

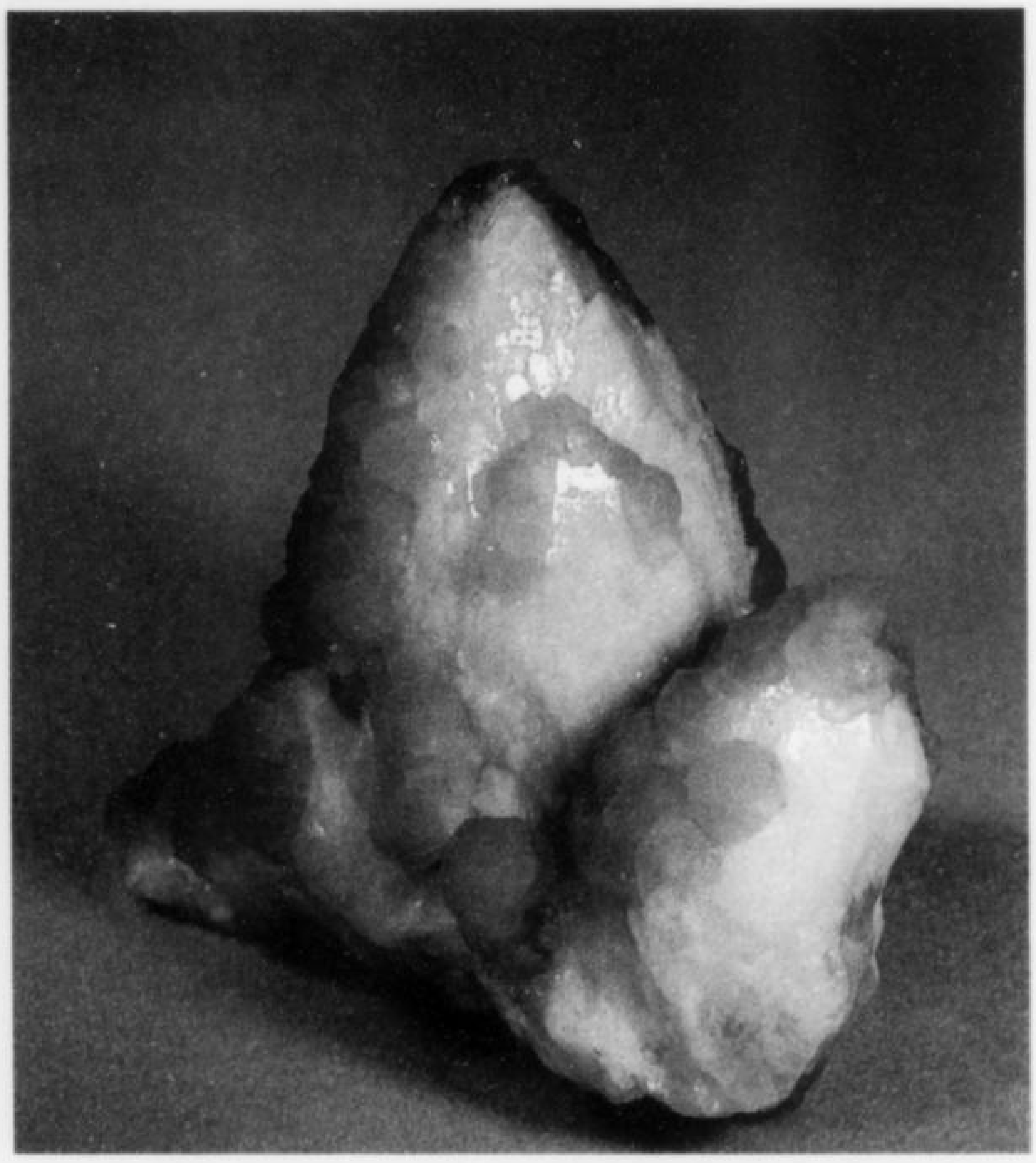


Figure 5. **Pale green intergrown fluorite hemispheres coating one side of a 6-cm-high milky quartz crystal.**

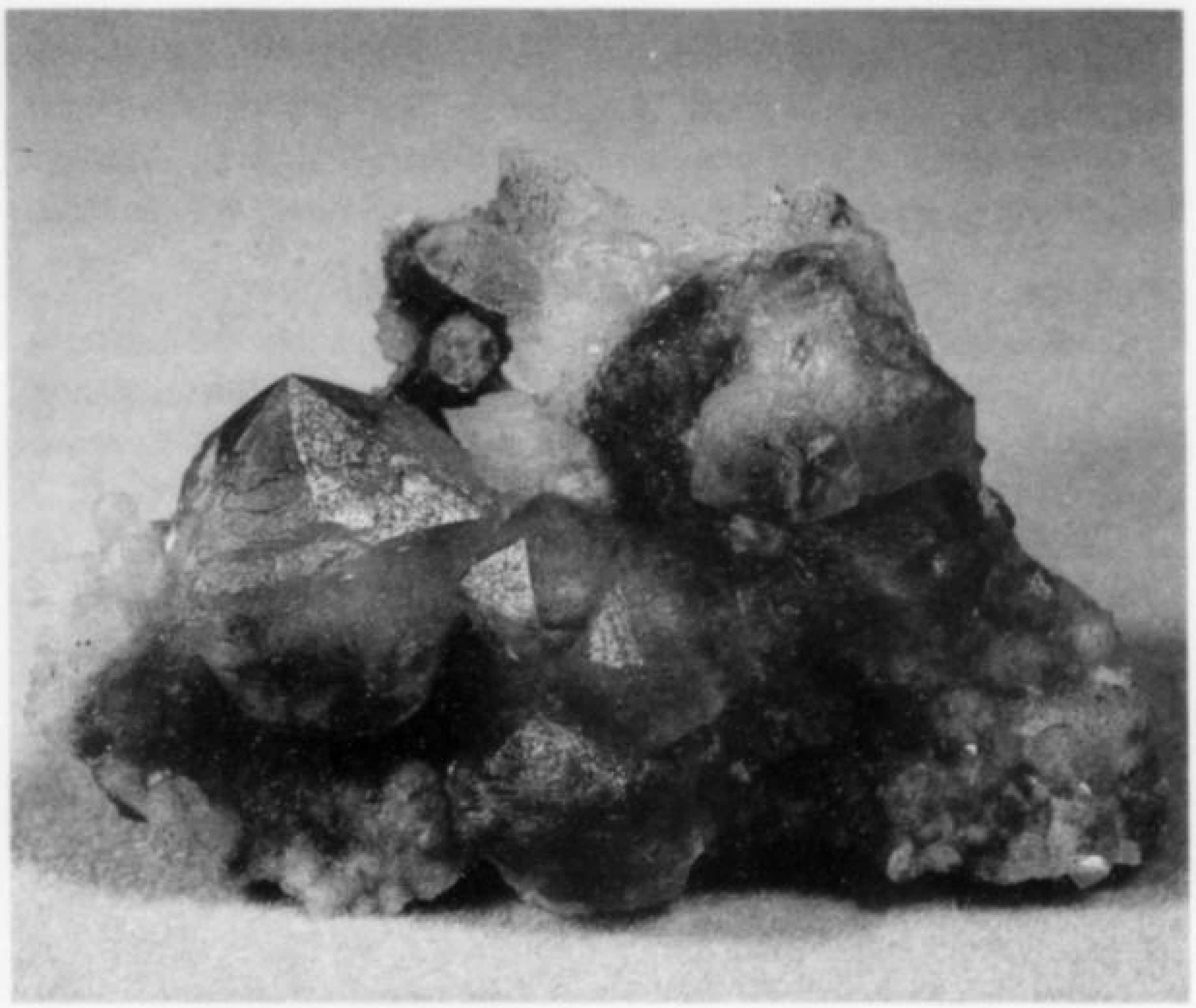


Figure 6. **Fluorite tetrahexahedrons to 1.3 cm on matrix fragment covered with drusy quartz. Overall specimen width, 4.0 cm.**

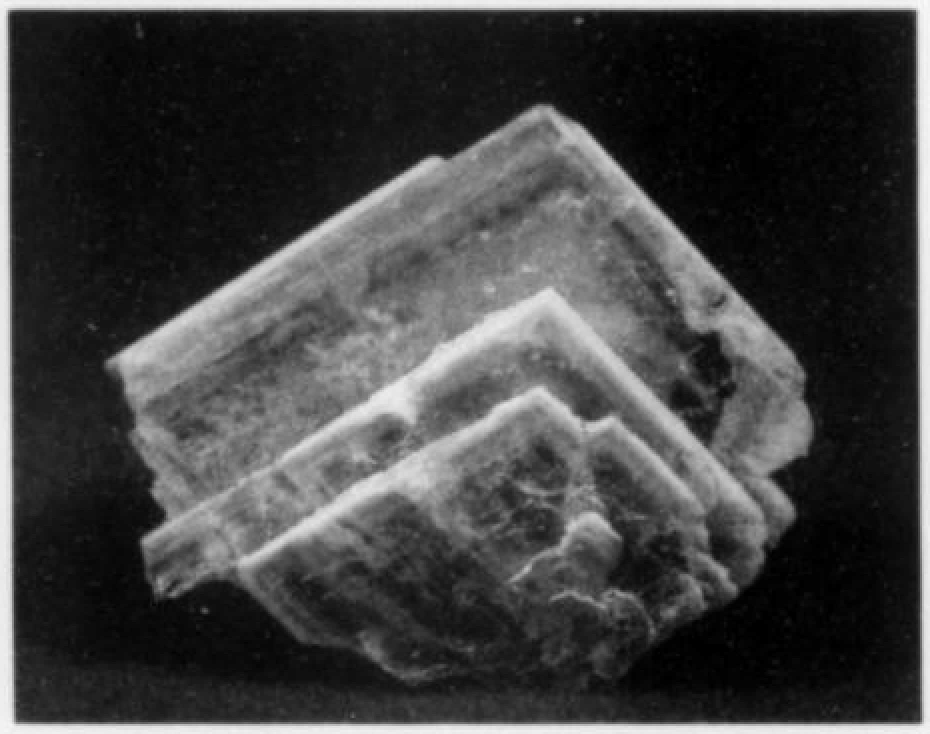


Figure 7. **Tabular barite crystal showing growth zoning; the specimen is 2.2 cm across.**

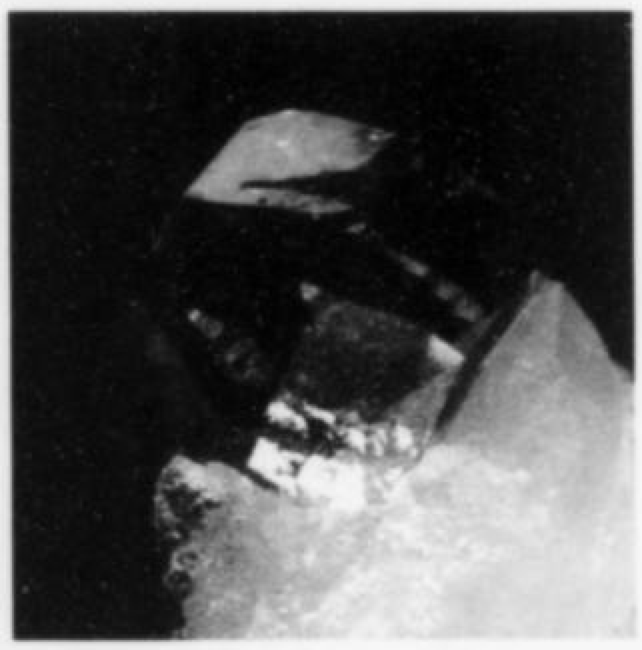


Figure 8. **Fluorite crystal, 2 mm in size, showing dodecahedron modified by the cube, on quartz.**

Figure 9. **Amber-colored brookite crystals to 0.15 mm across, with anatase.**

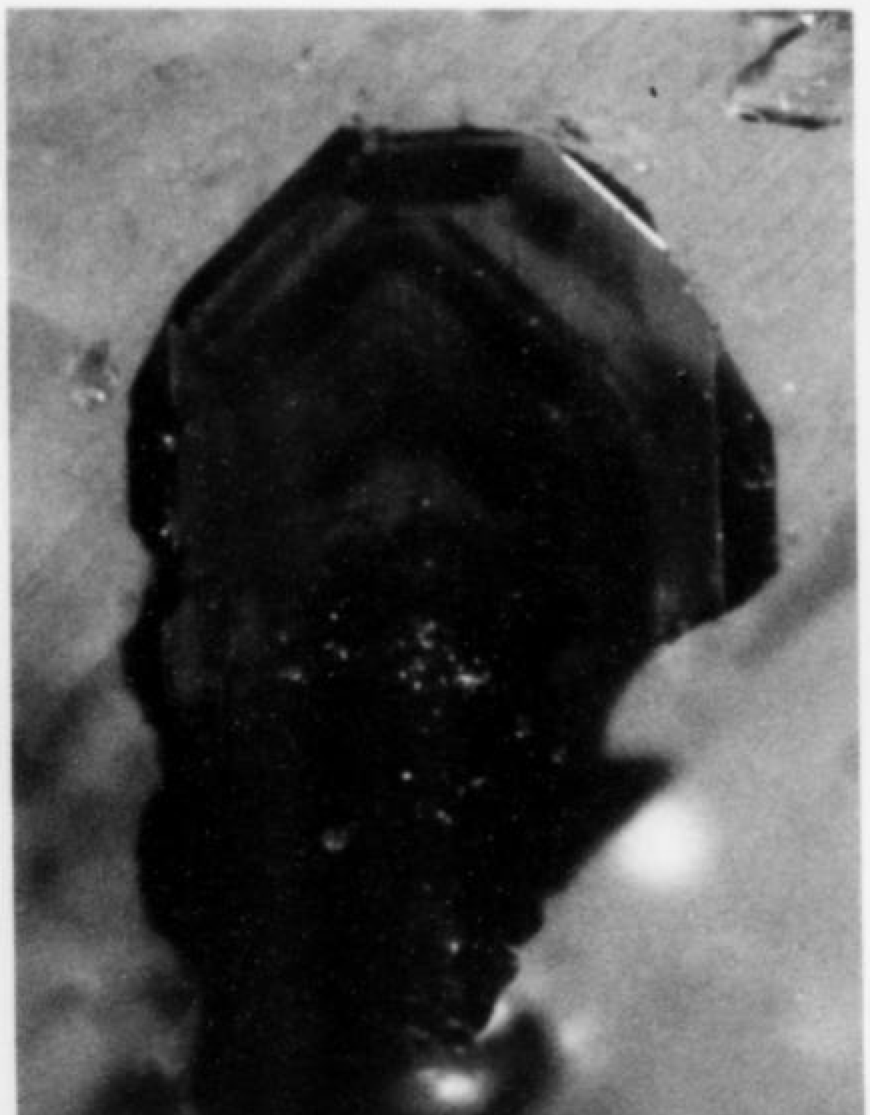


Figure 10. **Zoned, dark amber brookite on quartz; the brookite crystal is 0.26 mm across.**

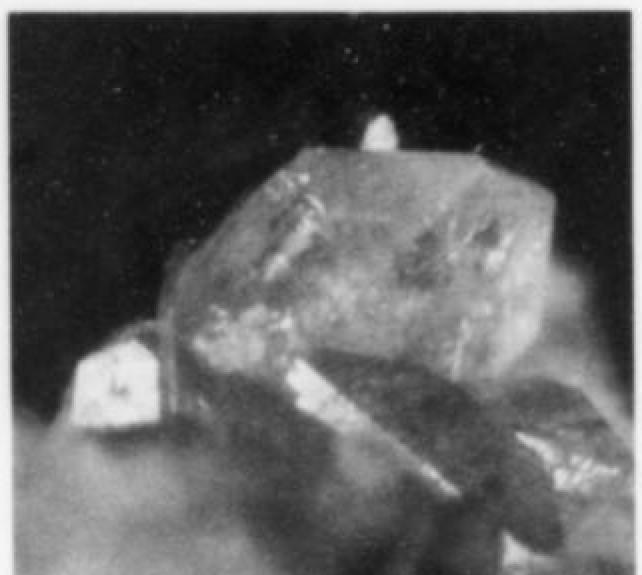


Figure 11. **Goyazite crystals to 0.33 mm across, on quartz.**

(continued overleaf)

(continued from page 374)

Other Minerals

Galena, chalcopyrite, and other unidentified sulfides or sulfosalts are occasionally noted as subhedral grains interstitial to quartz, and as small crystals, generally less than 2–3 mm, associated with small, translucent, prismatic quartz crystals. A hydrous iron sulfate (determined by SEM-EDS) was noted in minute amounts, on a single specimen, as orange-red prismatic microcrystals. Its X-ray diffraction pattern did not match any known species.

CONCLUSIONS

This locality has yielded an interesting suite of minerals and associations not previously reported from the San Juans. Although some areas have been carefully collected, the locality should continue to provide specimen-grade material, barring future restrictions to access. Cabinet-size specimens from this locality are quite rare, but thumbnail-size specimens are not uncommon.

Based on underground occurrences noted by local collectors (prior to tunnel closure) and a careful survey of dump material, it appears that anatase and brookite occur in both the Indiana and Topeka-Kentucky Giant veins, while fluorite and milky quartz occur only in the Topeka-Kentucky Giant vein. Transparent quartz crystals occur in both veins.

ACKNOWLEDGMENTS

The authors thank Eugene E. Foord (U.S. Geological Survey) for identification of halotrichite and goyazite and analysis of the unidentified hydrous iron sulfate, Peter J. Modreski (U.S. Geological Survey) for SEM and XRD analyses of anatase and brookite, and E. E. Foord, D. S. Collins (U.S. Geological Survey), and G. W. Robinson (Canadian Museum of Nature) for reviewing the manuscript .

REFERENCES

BURBANK, W. S. (1941) Structural control of ore deposition in the Red Mountain, Sneffels, and Telluride districts of the San Juan Mountains, Colorado. *Colorado Scientific Society Proceedings*, **14**, 141–261.

BURBANK, W. S., and LUEDKE, R. G. (1964) *Geology of the Ironton quadrangle, Colorado*. U.S. Geological Survey Map GQ-291.

BURBANK, W. S., and LUEDKE, R. G. (1969) Geology and ore deposits of the Eureka and adjoining districts, San Juan Mountains, Colorado. *U.S. Geological Survey Professional Paper* **535**, U.S. Government Printing Office, Washington, DC, 73 p.

KILE, D. E., MODRESKI, P. J., and KILE, D. L. (1991) Colorado quartz: occurrence and discovery. *Rocks and Minerals*, **66**, 374–406.

KOSNAR, R. A. (1979) The Sweet Home mine. *Mineralogical Record*, **10**, 333–338.

LARSEN, E. S., and HUNTER, J. F. (1914) Melilite and other minerals from Gunnison County, Colorado. *Washington Academy of Science Journal*, **4**, 473–479.

OLSON, J. C., and WALLACE, S. R. (1956) Thorium and rare-earth minerals in the Powderhorn district, Gunnison County, Colorado. *U.S. Geological Survey Bulletin* **1027-O**, 693–723.

ROSEMEYER, T., RAINES, E., and STOUFER, R. (1988) Anatase on quartz from Ouray, Colorado. *Mineralogical Record*, **19**, 103–104.

ROSEMEYER, T. (1993) Brookite, anatase and rutile from the Silver Link mine, Ouray County, Colorado. *Rocks and Minerals*, **68**, 327–330.

STOUFER, R., and ROSEMEYER, T. (1989) The Ohio mine, Ouray County, Colorado: A famous quartz locality rediscovered. *Rocks and Minerals*, **64**, 210–214.

What's New in Minerals?

Rochester Mineralogical Symposium 1994

by Jeffrey A. Scovil

The Rochester Mineralogical Symposium was held for the 21st year, April 14 through 17. This event has grown in stature through the years and is regarded as one of the best mineralogical symposia in the country. Although there are dealers, it is still, first and foremost, a symposium. All dealers must close their doors during the lectures and scheduled activities. Plenty of time is allowed for shopping breaks, and collectors can use their silver picks in the evenings when dealers doors stay open late.

There is a refreshing emphasis on minerals of the northeast and north-central United States. It is always good to see material from old localities where I used to collect while growing up in Connecticut. Northeast dealers were not the only ones there though. *Cal Graeber Minerals* (P.O. Box 2347, Fallbrook, CA 92088) had some of the superb **peridot** crystals that have been coming out of Pyaung Gaung, Myanmar (= Burma) recently. The crystal faces are rough, as though etched, but the interiors are extremely gemmy and of a fine green color. Some of these were available at the Tucson Show.

The Bennett mine in Buckfield, Maine (see the article in the May-June issue) produced some fine specimens last season. These included milky **quartz** crystals, **cassiterite**, **columbite**, **hydroxylherderite**, **pollucite** and **cookeite**. The most exciting crystals were the multicolored elbaites in shades of green and pink. Both Jim Mann (Box 597, Bethel, ME 04217) and Cal Graeber had some of these elbaites.

Leonard Himes of *Minerals America* had a pleasant surprise—a fine group of **emerald** crystals from North Carolina having several small rutiles attached and included. The whole specimen stands 4.8 cm high. Leonard also had several specimens from the Zomba-Malosa Complex, Chilwa Alkaline Province, Malawi (see the article in the January-February issue). The best known mineral from this locality is **aegerine**, which Leonard had in crystals up to 16 cm long, plus several **zircon** crystals, sometimes attached to the aegerines.

Pakistan continues to produce interesting new minerals, or just better ones than from other localities. Dudley Blauwet of *Mountain Minerals International* keeps on top of these things. He had some rather nice **zircon** from Bulbin, near Astar, Waziret district, Northern Areas. They are clean, reddish brown dipyramids in what appeared to be a very impure marble, in crystals up to 1.5 cm. Some of these have been available recently, but as loose crystals with no matrix.

Dassu, Baltistan, Northern Areas was represented by **stellerite** in white hemispheres to 2.5 cm in diameter. Most are loose groups, some with minor muscovite matrix. They are not as lustrous as the stellerites from Jalgaon, India, but quite interesting considering the pegmatite origin. Dudley also had some of the stellerites from Jalgaon, which have a beautiful luster and translucency, some with chalcedony and gyrolite on gray-blue drusy quartz.

A fairly new dealer in the business is *DeTrin-Rising Sun* (145-62 7th Ave., Whitestone, NY 11357) who specializes in the minerals of Russia and its former republics. I think that some of us are reaching a degree of saturation with minerals from those areas, because there has been so much available recently. Unfortunately, much of the material available these days is mediocre and/or damaged. Not so with the material of DeTrin, the owner of which seem to have a great eye for the best quality material. Most of their stock was the typical suite from Dalnegorsk, but of very fine quality. I look forward to what this dealer will bring forth in the future.

Jeffrey B. Fast (19 Oak Knoll Rd., E. Hampton, CT 06424) made available a fine selection of the new material from the Becker quarry, West Willington, Connecticut. The suite includes pale smoky, tessin-habit **quartz** to 7 cm long, pocket **almandine** crystals to 2.5 cm and white **magnesite** rhombs to 1 cm with minor drusy pyrite. One of the minerals I wanted to see was not in the room—the terminated pocket **kyanite**.

Some other local material was being handled by Lawrence D. Venezia (115 Coleridge St., E. Boston, MA 02128). Rare, but not particularly attractive, were masses of orange **donpeacorite** from Balmat, New York. From Pearl Lake, Lisbon, New Hampshire, Larry had some very clean **almandine** and **staurolite** in schist. The staurolites are up to 5 cm in length and many have small garnets sprinkled on them.

Topaz-Mineral Exploration's speciality (1605 Hillcrest, Grand Haven, MI 49417) is the minerals of Michigan's Upper Peninsula. Tom Bee, the owner, besides having an eye-opening display of minerals from that area, had many for sale. He had one of the finest assemblages of well-crystallized **copper** that I have seen in a while, plus fine **calcite** with copper inclusions, half-breeds, **datolite** and **epidote** on calcite. Many of these specimens have come out of old collections. There was a buying frenzy in his room; I almost had to fight someone to photograph a piece before it was bought. Luckily the fellow and I are still friends.

That fellow is Gary Richards, *Keeper of the Earth* (2511 N. Mason, Appleton, WI 54914). Gary is a very experienced dealer who spent a number of years helping Lance Hampel. On his own now, Gary is doing a fine job and also has a special fondness for minerals of the U.P. (Upper Peninsula), as they call it in those parts. Gary had recently bought an old collection that was heavy in pegmatite minerals, especially **tourmaline** and **beryl**. Localities included some of the common and expected—Afghanistan, Pakistan, Nigeria, California, Brazil—plus some that are not so common. These included Rabenstein, Bavaria; Namibia; Adun Chulon and Mursinka (both in Russia) and the old Gillette quarry, Haddam Neck, Connecticut. I was pleased to relieve Gary of the beryl from that last locality as well as the one from Mursinka.

Hans van Binsbergen of *Classic Minerals* (P.O. Box 1391, Exton, PA 19341) had been holding on to a batch of very high quality Lynch Station, Virginia **turquoise** that had been collected about five years ago. He offered for sale eight flats of bright blue, microcrystalline druses on quartz.

The new red **grossular** seen at the Tucson Show was well represented in the room of Beau Gordon (*Jendon Minerals*, P.O. Box 6214, Rome, GA 30162). They are from Sierra de La Cruz, Coahuila, Mexico and ranged from thumbnail to small cabinet size, all on matrix. Beau also had a nice selection of crudely crystallized **gold** from Mt. Kare, Papua, New Guinea. Most are slightly waterworn, small nuggets.

Mongort Minerals was a new name to me, and a pleasant surprise. Raymond Sprague and his partners have opened up the old Emmons quarry, Uncle Tom Mtn., Greenwood, Maine. They have leased the property since 1990 and have produced some interesting material. Included are blue/gray to pale purple **fluorapatite** on albite in thumbnail sizes; and milky white and zoned, multiple and parallel grown **quartz** crystals, sometimes sceptered, to 13 cm. They hit one pocket 4 meters across, mostly filled with **muscovite** in six-sided crystals with fibrous overgrowths, associated with **bertrandite** micro-

JAS

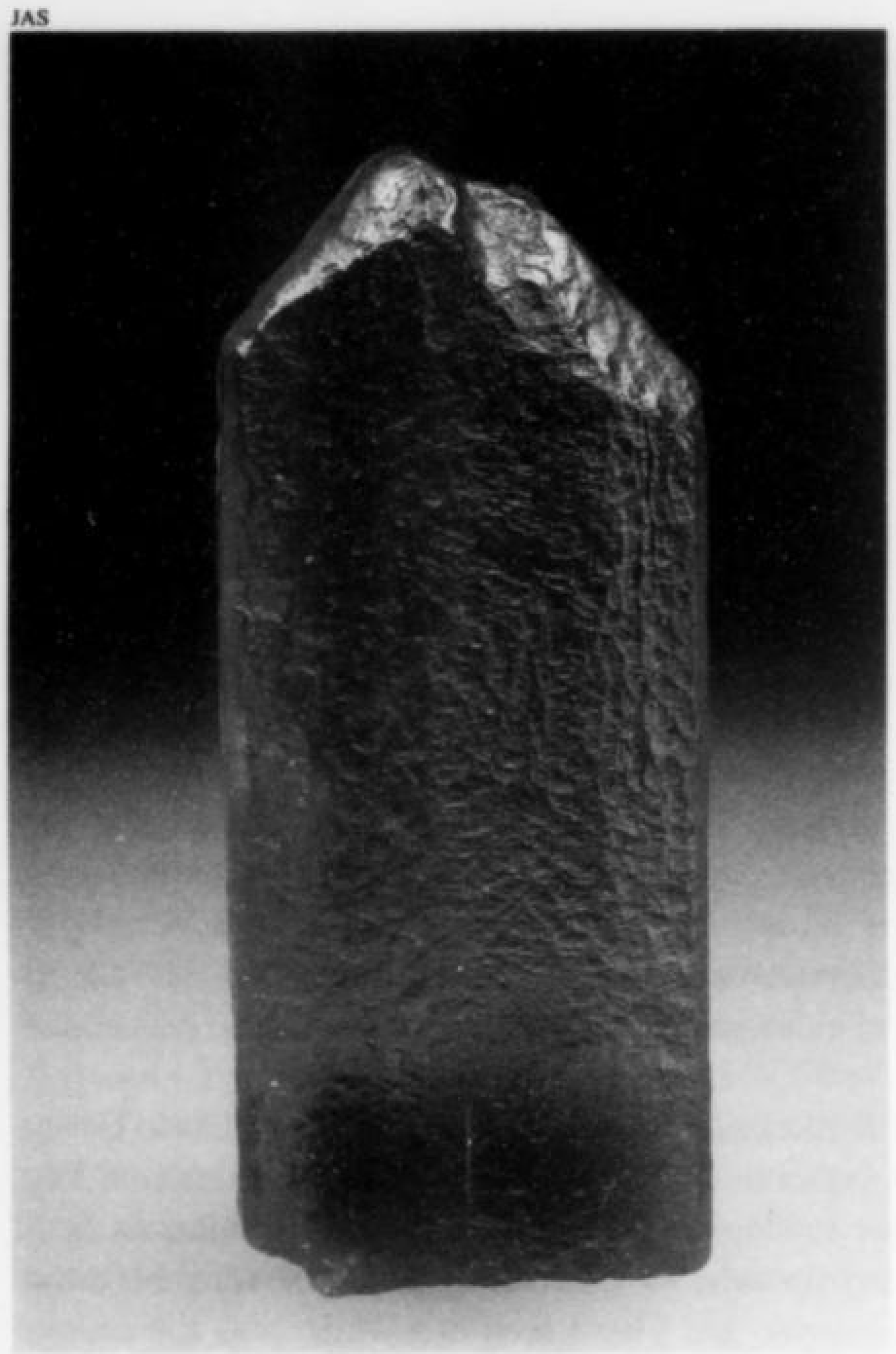


Figure 1. Olivene, var. peridot, from Pyaung Guang, Myanmar; 3.2 cm high. Cal Graeber Minerals specimen.

JAS

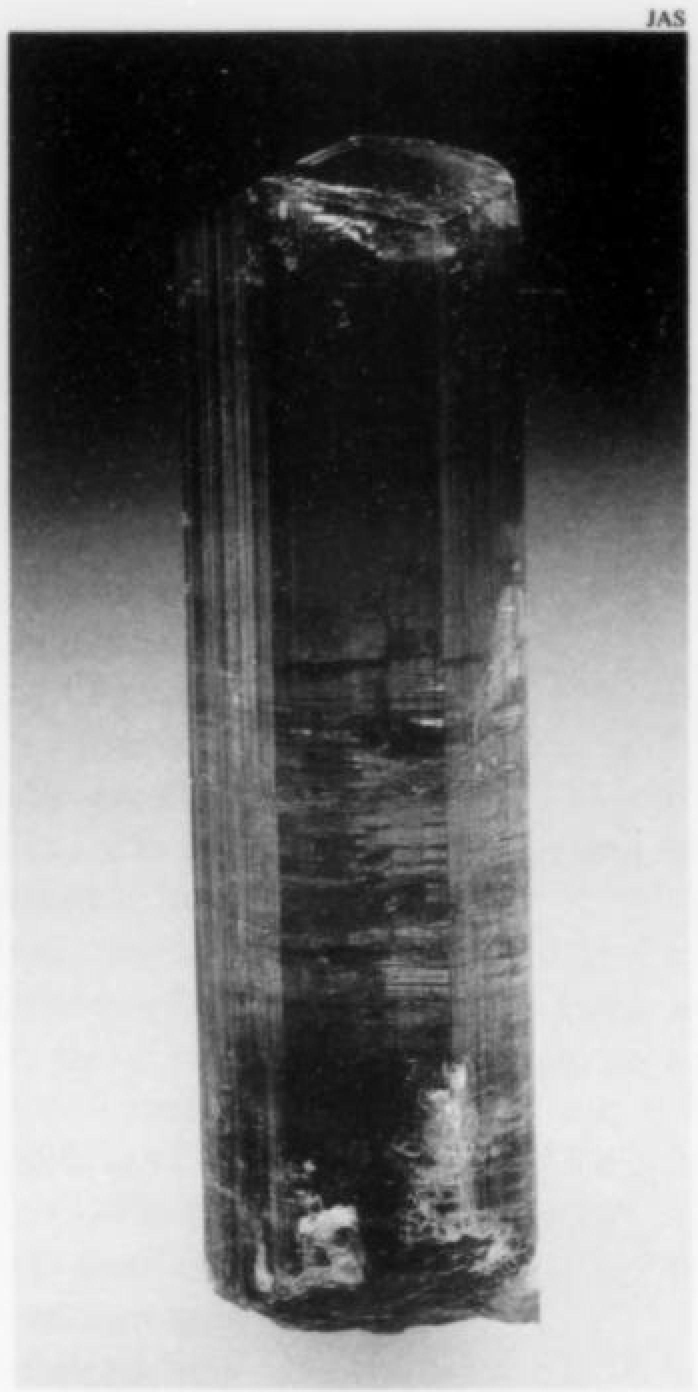


Figure 2. Elbaite from the Bennett mine, Buckfield, Maine; 5 cm long. Jim Mann specimen.

JAS

Figure 3. Dravite from Gujarkot, Bheri Zone, West Nepal; 2.7 cm long. Mountain Minerals International specimen.

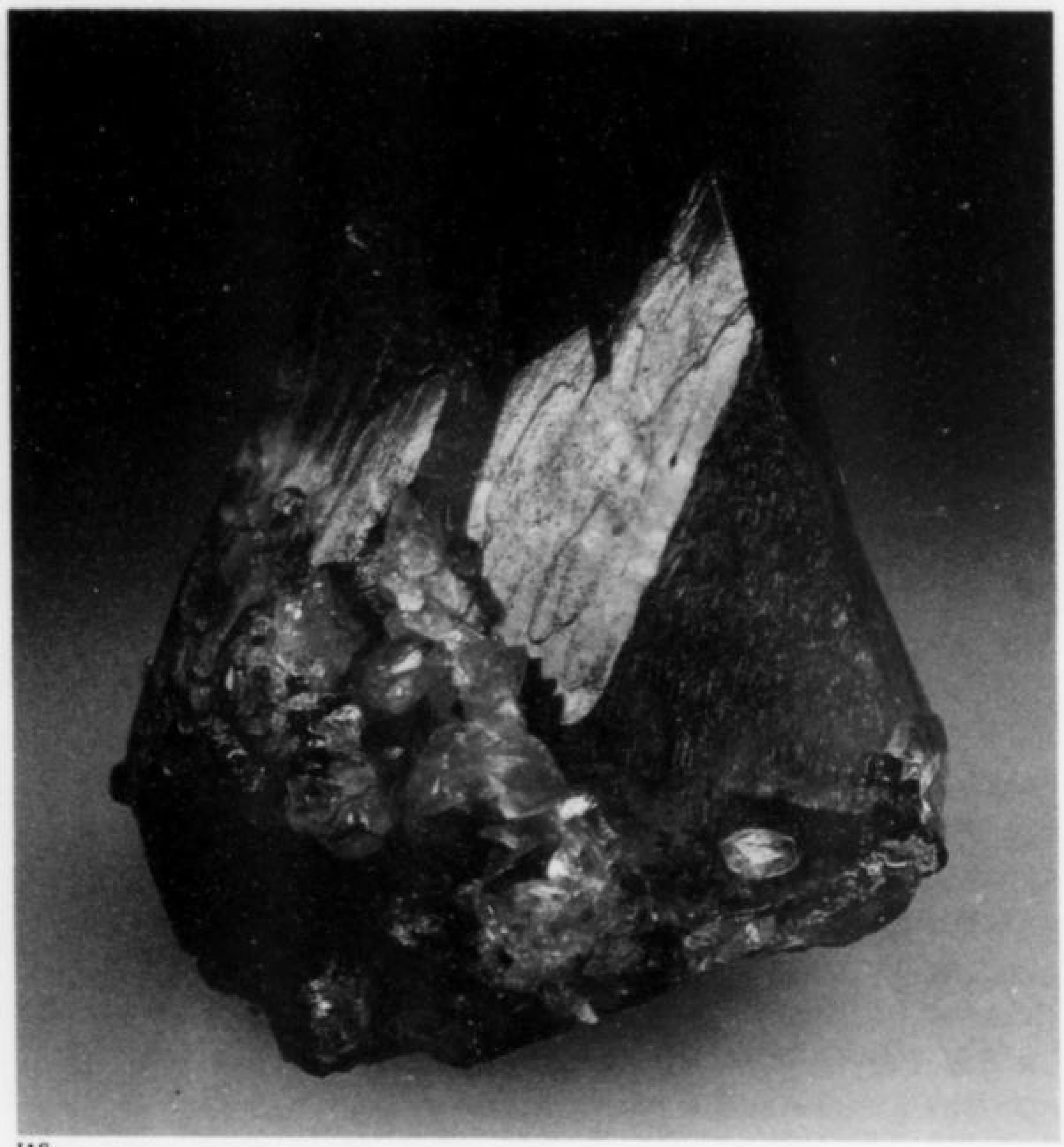


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Figure 4. Rhodochrosite from the Bennett mine, Buckfield, Maine; 2 cm high. Jim Mann specimen.

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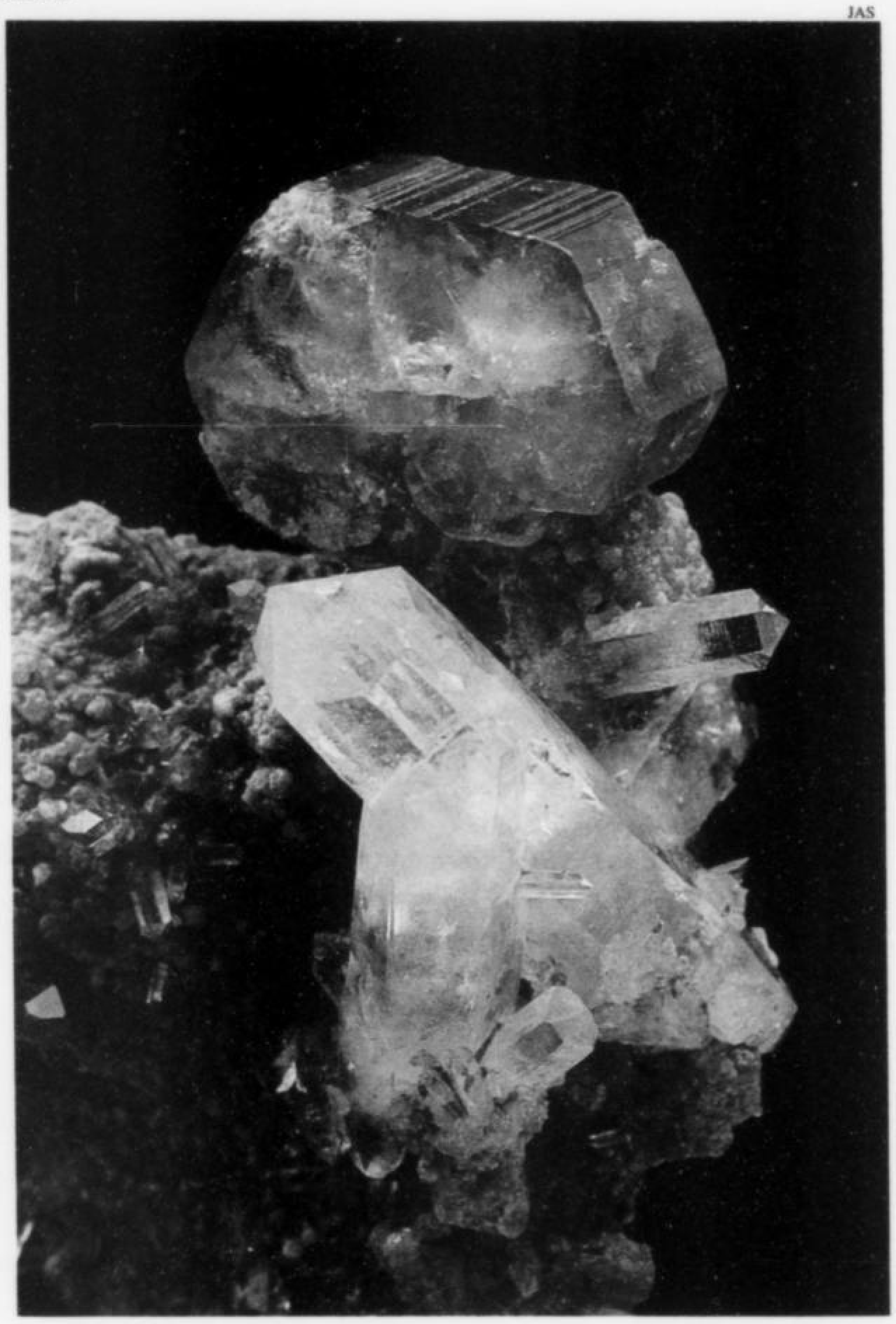

Figure 5. Fluorapatite on quartz from Mt. Rubellite, Hebron, Maine; the crystal is 1.3 cm wide. Jim Mann specimen.

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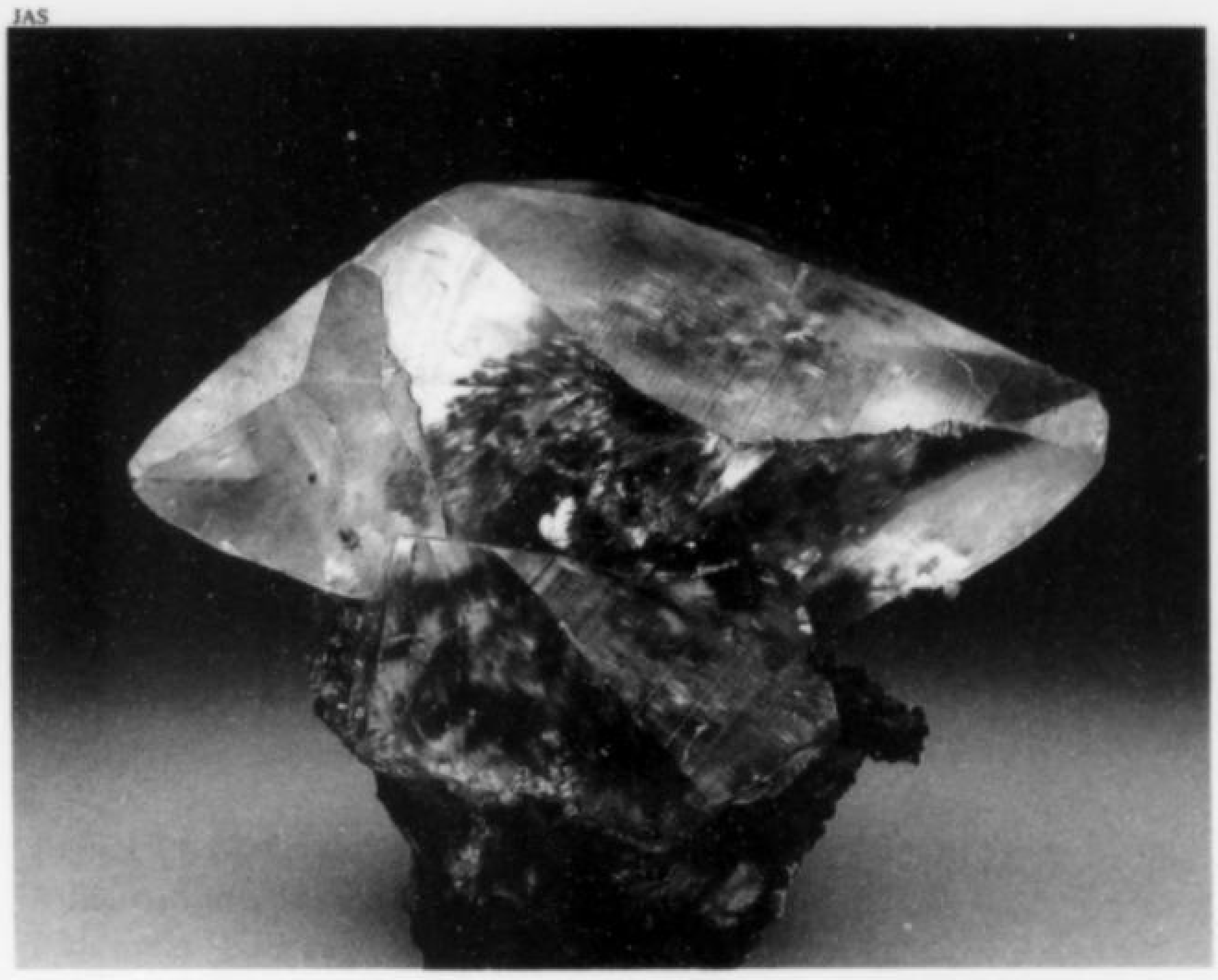

Figure 6. **Calcite and copper from the Quincy mine, Hancock, Michigan; 4.6 cm wide. Gary Richards collection.**

JAS

Figure 7. **Emerald and rutile from Hiddenite, North Carolina; 4.8 cm high. Minerals America specimen.**

JAS

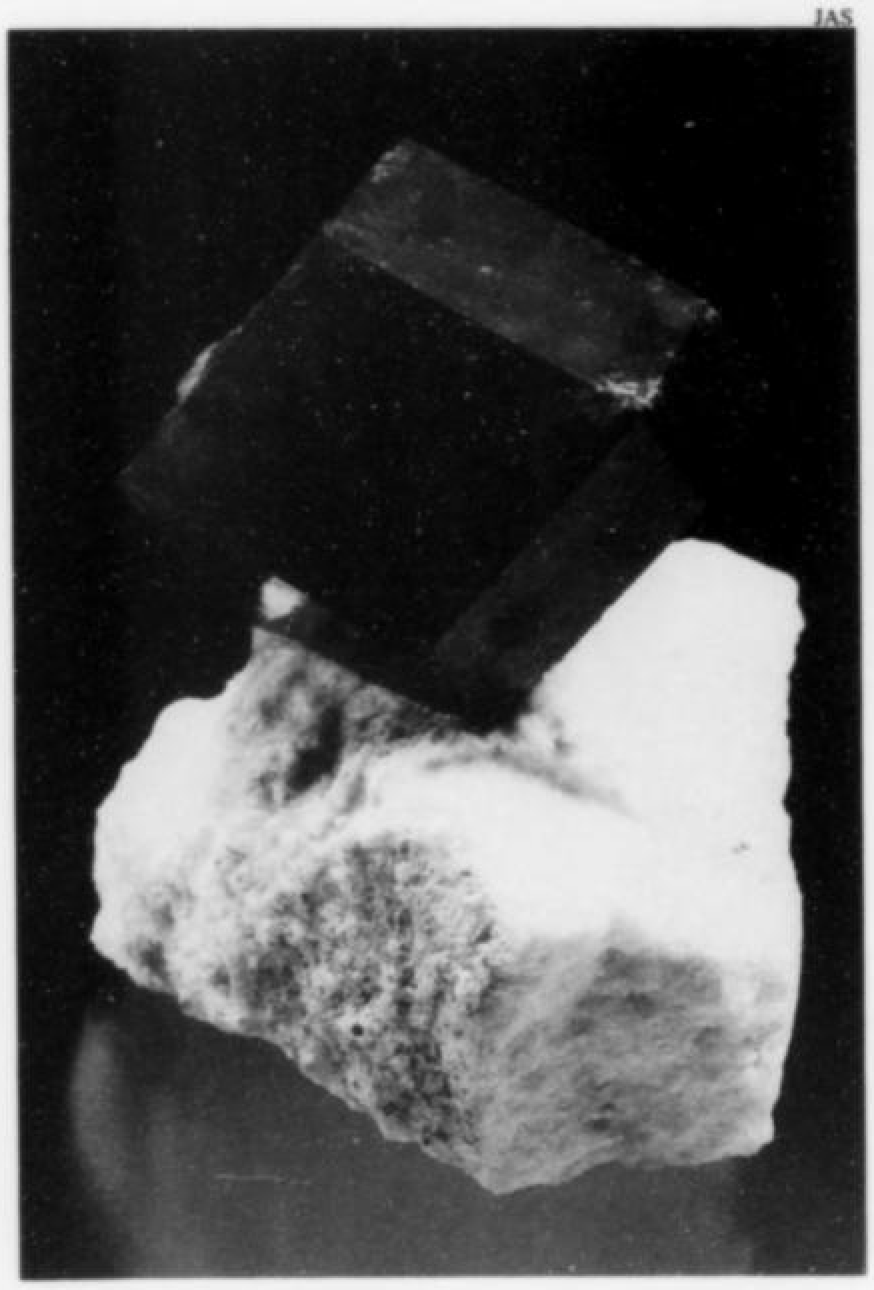

Figure 8. **Grossular from the Las Cruces Mountains, Coahuila, Mexico; 4.1 cm high. Cal Graeber Minerals specimen.**

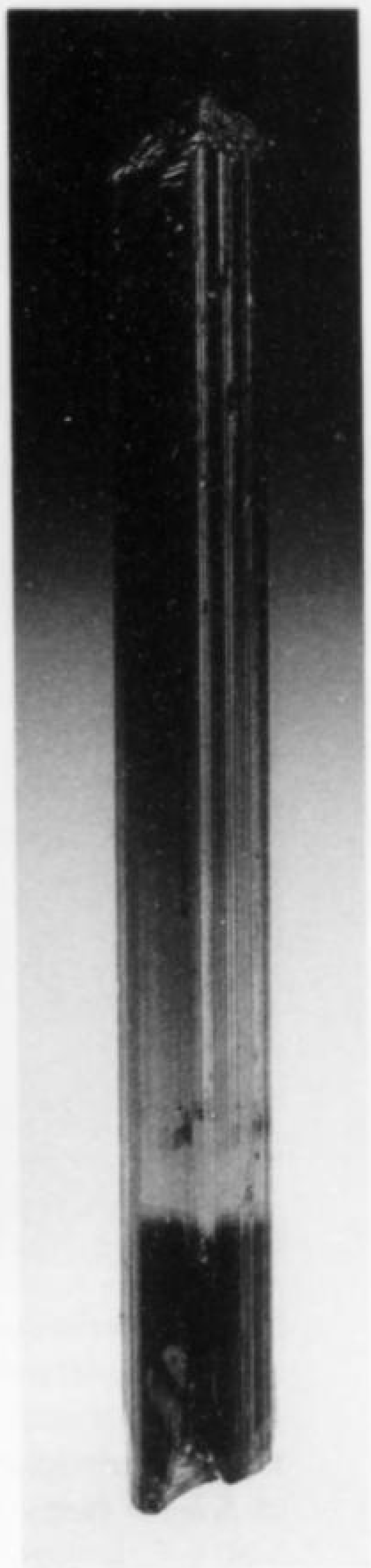

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Figure 9. **Dravite from the Mikhaylovskoye mine, Chita Oblast, Russia; 4.5 cm long. Dave Bunk Minerals specimen.**

JAS

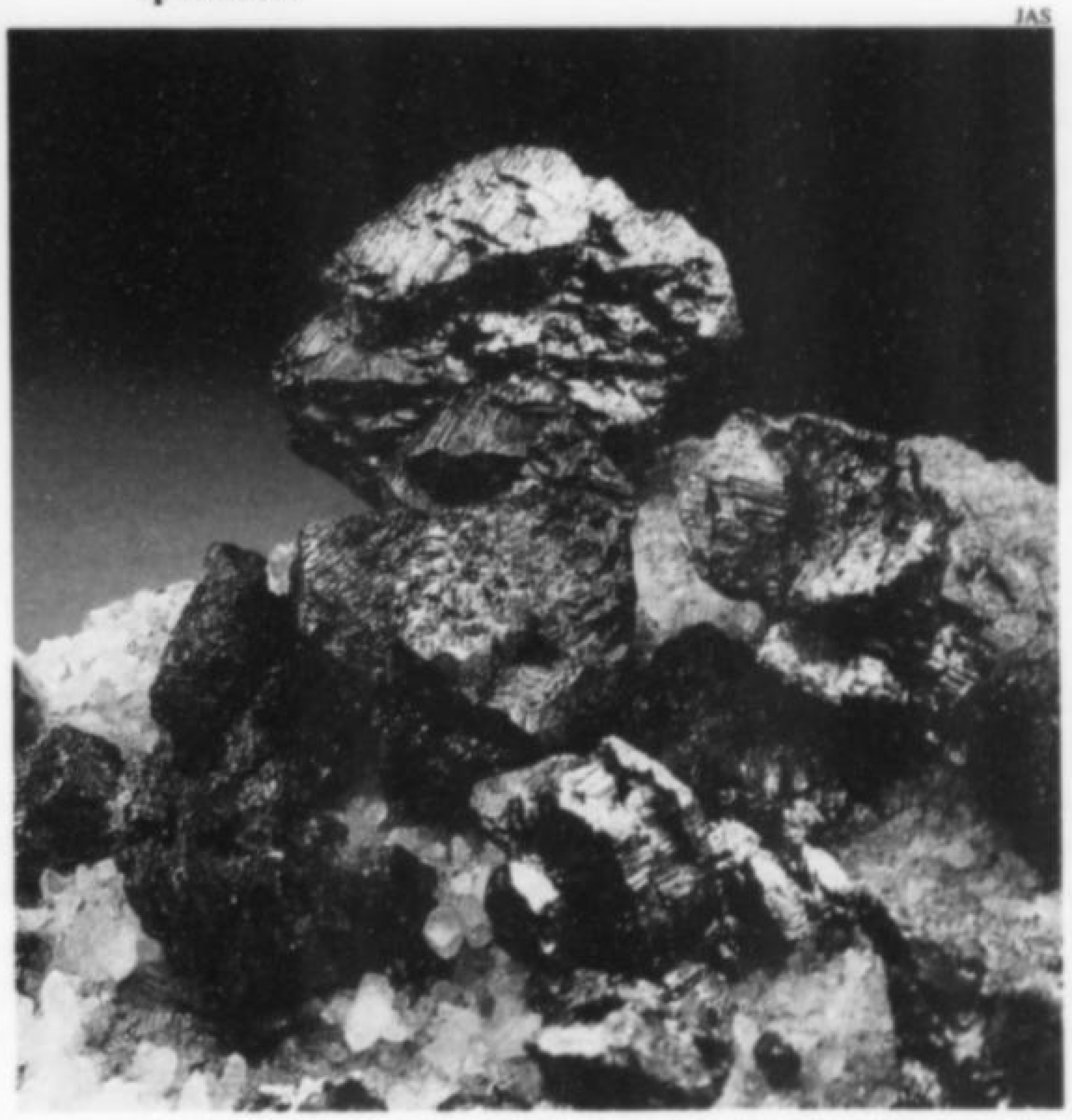


Figure 10. **Chalcocite from mine No. 57, Dzezkazgan, Kazakhstan; the crystal is 1.4 cm wide. Dave Bunk Minerals specimen.**

crystals. The quarry is also producing some nice green to pink **elbaite** crystals up to 10 cm long. Unfortunately, most of the elbaites are broken and repaired. Ray hopes that as they get deeper below the frost line, the elbaites will be in better shape.

Mongort also had minerals from other localities in Maine, such as **fluorapatite** from the Harvard quarry in Greenwood, and microcrystals and thumbnails of **perhamite** from the Ski Pike quarry, Cobble Hill, West Paris.

There were a number of Canadian dealers including *Collection Haineault* (2266 St-Alexandre, Longueuil, Québec J4J 3T9) who had some very good material from Mont Saint-Hilaire, Québec. Besides the fine **serandite** and **leifite**, Gilles Haineault offered a fine group of **carltonite** crystals as singles to 1 cm and large groups to 14 cm across. The crystals arc of the typical blocky habit, with blue cores and white exteriors. From the Jeffrey quarry, Asbestos, Québec there were some very nice, zoned, green to purple **vesuvianites**.

Jim Mann is a fellow who gets around; he bought some of the better **elbaites** from last summer's production at Mount Mica, Paris, Maine.

JAS

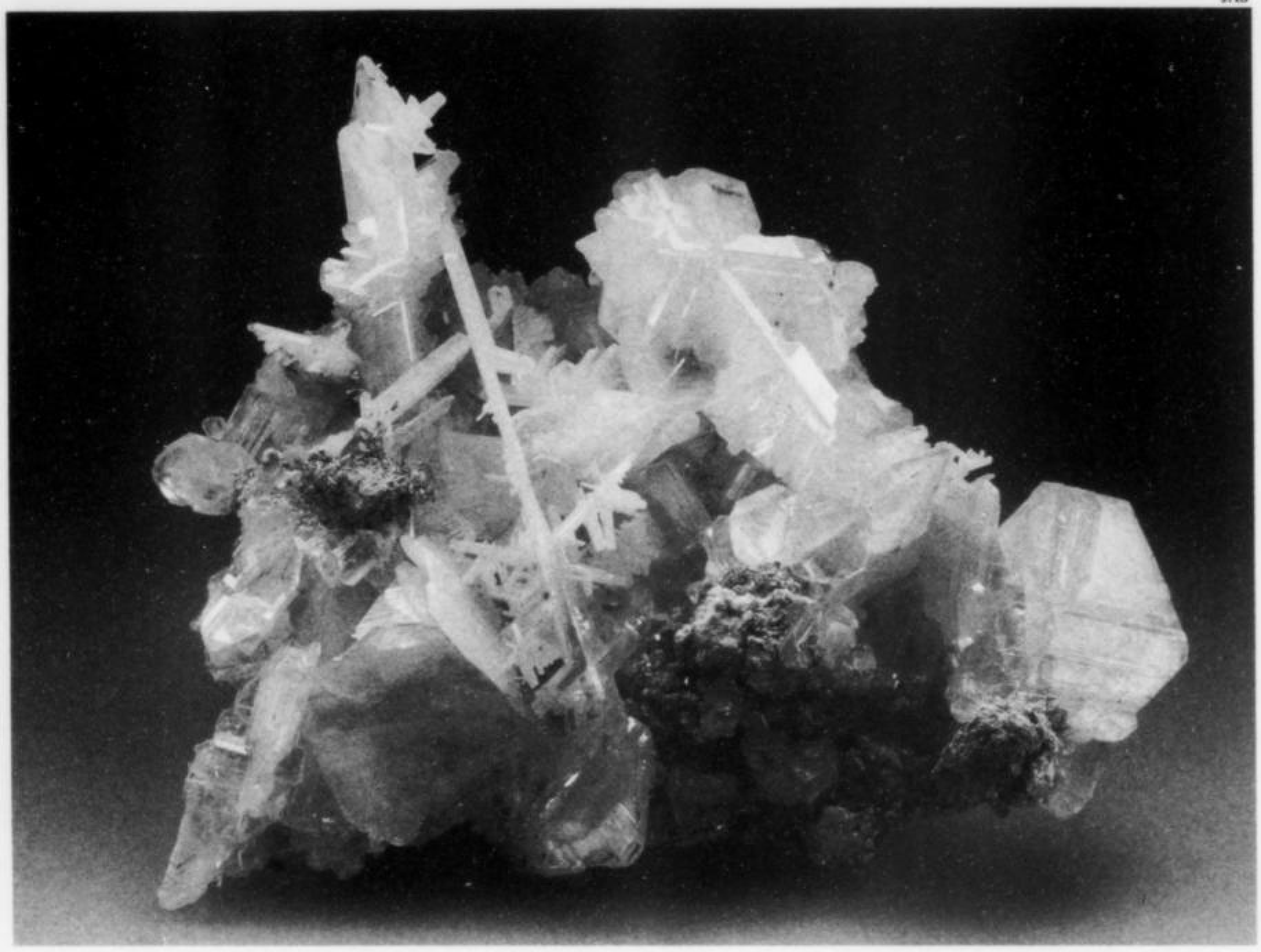
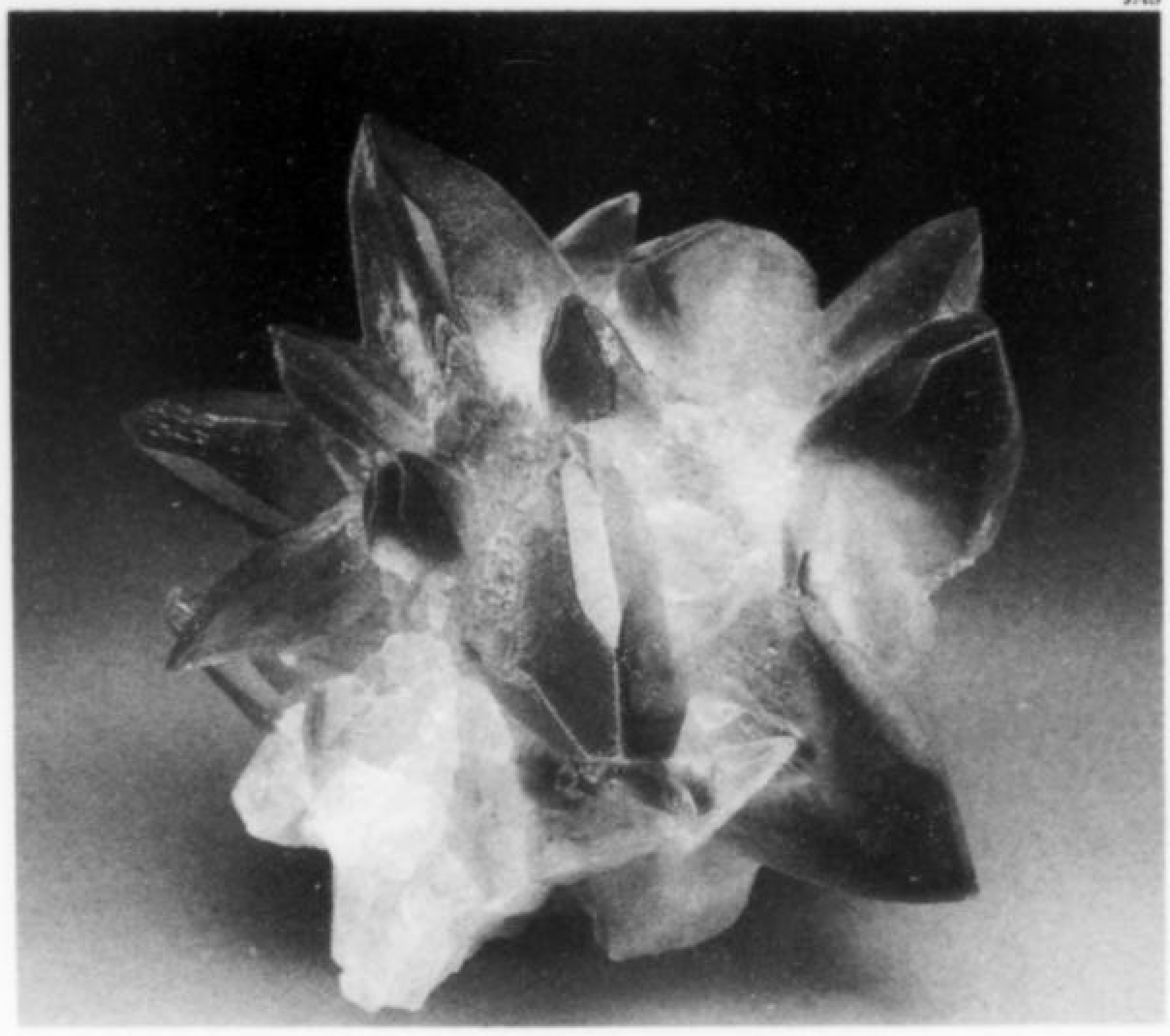


Figure 11. **Cerussite from the Bunker Hill mine, Kellogg, Idaho; 11.5 cm wide. John Cesar specimen.**

Figure 12. **Calcite from the Vulcan quarry, Racine, Wisconsin; 8.5 cm wide. Rock-N-Record specimen.**

JAS



As I mentioned earlier in the column, he also had some of the better material from the Bennett mine, Buckfield, Maine, the most notable being the elbaites. Also very interesting from the Bennett mine, was a **rhodochrosite** crystal 2 cm tall that some were claiming to be the best such crystal to come from a granite pegmatite (see photo). Although not as deep a purple as the **fluorapatites** of Mt. Apatite, those of Mt. Rubellite are quite fine. Jim showed me one, 1.3 cm across on a matrix of quartz prisms, that I would have been quite proud to own.

It seems that the specimens lately just keep getting better from the Bunker Hill mine, Kellogg, Idaho. John Cesar had for sale some **cerussite** from the recent efforts at that mine. The lustrous white crystals are nicely twinned, in groups up to 11.5 cm, that could almost be mistaken for Tsumeb.

The weather was typically cold and rainy, but since few of us left the confines of the hotel for the duration of the Symposium, it hardly mattered. There was of course, a fascinating group of speakers with topics that ranged from technical to entertaining to disturbing. The exhibits were inspiring and I vowed to get out and do more field collecting. The Symposium is not a big one for dealers or for new things, but it is an intense, enjoyable experience, all the more so because attendees are all serious collectors and students of mineralogy.

Cincinnati Show 1994

by Jeffrey A. Scovil

I had only about a week after Rochester, when I took off for the Cincinnati Gem, Mineral and Jewelry Show April 30 through May 1st. This was my first visit to the Cincinnati Show, and I found it to be a very pleasant event. The show is very well run, with a coordination of effort and organization that I have seldom seen. The quality of the dealers is very good, and the show is not allowed to get too big, so that the dealers do not have to compete for limited collector dollars.

The Cincinnati Show is not a place where dealers bring out all the new finds, but there were still fine things to see, and a few things that I missed at previous shows.

One of those items was the **dravite** from Gujarkot, Bheri Zone, West Nepal, carried by *Mountain Minerals International*. All of the samples are loose, brown, doubly terminated prisms, sometimes exhibiting parallel growth and fair transparency. The largest is about 5 cm long. Dudley also had several matrix spodumenes from Dara Pech, Kunar Province, Afghanistan. When fresh they can be a pale, ice-blue but fade to a very pale green. The two best specimens, with crystals up to 5.2 cm long, were bought by *M. Phantom Minerals* (P.O. Box 12011, Columbus, OH 43212).

The only truly new material (to me anyway), was carried by Kevin Ponzio of *Rock-N-Record* (P.O. Box 44, Plymouth, WI 53073) in the trading room. It seems that last year a drilling crew at the Vulcan quarry in Racine, Wisconsin, drilled into a clay zone. This large zone interrupted work and polluted the limestone being quarried. In the fall of 1993, members of the Racine Geological Society found that the "clay zone" was actually a series of crystallized vugs. Serious collecting ensued, and yielded quantities of **calcite** scalenohedra with phantoms outlined by pyrite microcrystals. Large plates of crystals to 5 cm in length were removed, along with cuboctahedral **pyrite** to 2.5 cm and botryoidal to tabular **marcasite**. The vugs also produced

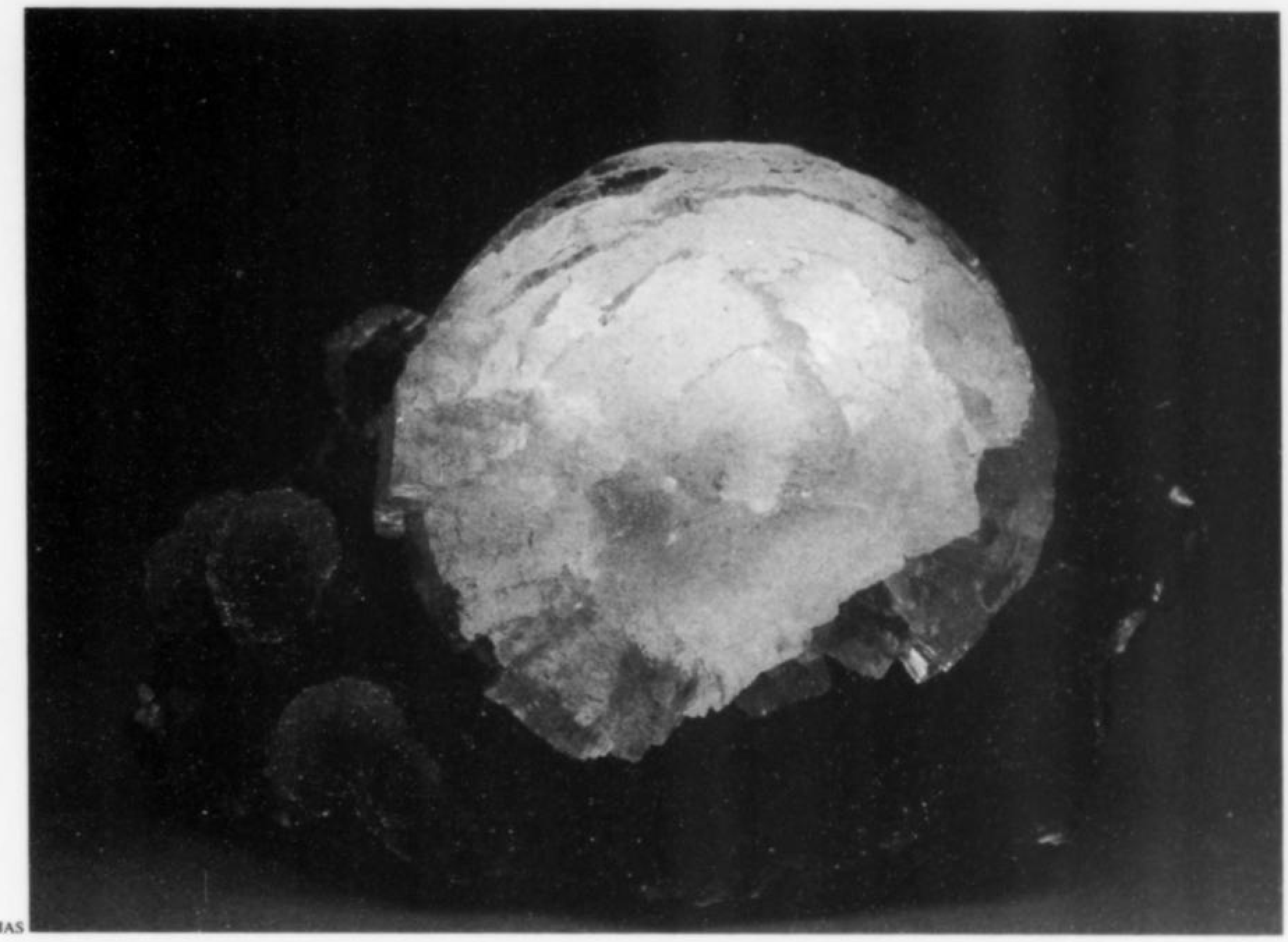


Figure 13. **Stellerite from Jalgaon, Maharashtra, India; 4.2 cm wide. Mountain Minerals International specimen.**

JAS

botryoidal **sphalerite**, bitumen globules, **gypsum** microcrystals and **strontianite** microcrystals. Kevin had a fine display of some of the better specimens from these vugs.

That about sums it up for an enjoyable symposium and show that I hope to return to again in the near future.

Costa Mesa Show 1994

by Jeffrey A. Scovil

[May 13–15, 1994]

Considering the state of southern California's economy (not to mention the rest of the country), plus all of the other problems there lately, I went to the West Coast Gem & Mineral Show with some trepidation. I should not have worried, though; I found that the general feeling among the dealers was that sales were up, and everyone seemed pretty happy. This was the third year for the show, and it looks as though it will become the major show of the West Coast.

Really new finds were scarce, as seems to be the case with most shows these days, but with a little looking, goodies were to be found. Brad and Star Van Scriver's room, as usual, was one that people could not wait to get into. From the same Russian locality that has been producing the fine orange scheelites, Brad had a number of very good **cassiterites**. They are loose, lustrous crystals to 4 cm long. In Brad's usual thorough manner, the locality was given as the Iliutin mine, Iliutin, Chukotka Region, Magada Oblast, East Siberia, Russia.

Something I had not seen before were the **chalcocites** from mine No. 57, 180-meter level, Block 31-50, East Dzezkazgan mining area, Dzezkazgan, Dzezkazgan Oblast, Kazakhstan. The rough, tabular crystals are up to 2 cm across on a matrix covered with small quartz crystals.

The same mine continues to outdo itself with the quality of its **bornite** crystals. Stan Esbenshade showed me a very sharp, dark, metallic blue dodecahedron about 2 cm across that he had bought from Brad. By the time I got to Van Scriver's room, few of these fine pieces were left, except for a 1-cm crystal on a calcite-coated matrix.

Another new find is the **dravite** from the Mikhaylovskoye mine, Malkhane pegmatite field, Oktyabrskaya vein, near Krasniy Chikoy, Chita Oblast, Russia. The crystals are gemmy, olive-green prisms to 4.5 cm in length. From the Akchiyspaskiy mine, East Dzezkazgan, Dzezkazgan Oblast, Kazakhastan, Brad had obtained some nice **native copper**. The crystals are spinel-twinned and dendritic in irregular groups to 5 cm.

Mine No. 31, 180-meter level, Dzezkazgan, continues to produce some fine **silver** specimens. Many are completely black because of alteration to **acanthite** which in some cases just coats the silver and, in others, completely replaces it.

The biggest excitement at the show was over the new **tourmaline** pocket found recently at the Himalaya mine, Mesa Grande, California. Kent Bricker of *The Collector* (912 S. Live Oak Park Rd., Fallbrook, CA 92028) told me there were actually a series of related pockets found within a 15-foot radius. They were worked out in the period just before and after the Tucson Show in mid-February. The colors are pink and green, but generally darker than is usually found at the mine. Many loose crystals were produced, the largest of which is doubly terminated and 23 cm long! Several nice matrix groups also came out, with elbaites on snowy white cleavlandite with pale smoky quartz. Most of the matrix groups have been repaired, with elbaites re-attached. As is typical at the Himalaya mine, crystals had broken off, and then healed, including the stubs left on the matrix. This makes it very difficult to reattach them without the repair showing.

Kent also had a nice selection of the superb **peridot** crystals that have come out of Pyaung Guang, Myanmar (formerly Burma) recently. All crystals are loose and etched-looking. So far there is no new information on the nature of the occurrence.

With its great wealth of pegmatites, Brazil has produced relatively little good quality **amazonite**. A step in the right direction are the specimens being produced by the Santa Maria do Itabira mine, Santa Maria do Itabira City, Minas Gerais, Brazil. *Valadares Minerals* (Rua Capote Valente, 513, AP 133 CEP 05409 Pinheiros, São Paulo, SP, Brazil) had some specimens from this locality for sale. The crystals are very etched, but a rich blue-green, with white cleavlandite, and are up to 6.5 cm in length.

While Mexico is no longer the fountain of incredible specimens that it once was, it still produces some good new finds. *Jendon Minerals* (P.O. Box 6214, Rome, GA 30162) just received a shipment of the new **grossular** from the Las Cruces Mountains, Coahuilla, Mexico. These

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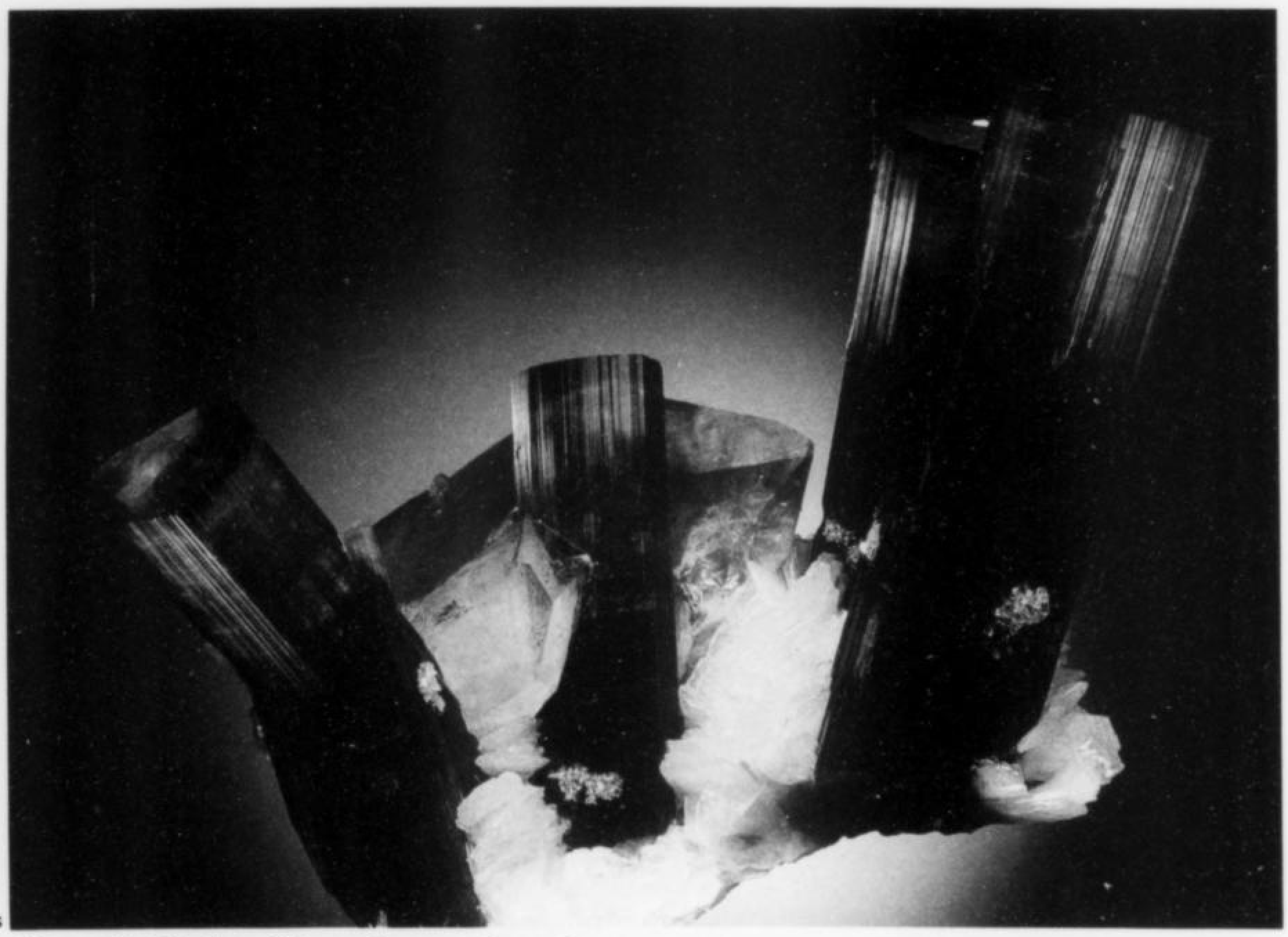

Figure 14. **Elbaite, albite and quartz from the Himalaya mine, Mesa Grande, California; 17.4 cm wide. The Collector specimen.**

JAS

Figure 15. **Beryl from the Violet claims, Wah Wah Mountains, Utah; 2.1 cm long. Rex Harris specimen.**

are the finest yet found, ranging in color from pale gray-green to pink to dark cinnamon-red, and up to 5.5 cm across. Some are associated with yellow-brown **vesuvianite**.

Fenn's Gems & Minerals (P.O. Box 16285, Las Cruces, NM 88004) specializes in Mexican minerals, and they had one new mineral for sale: "**moonstone**" from the Pili mine, Camargo, Chihuahua, Mexico. The crystals are quite green, occurring in groups of tabular to blocky crystals with dark green augite. Crystals exhibit a fine milky blue adularescence and are up to 3.5 cm long. All of the vugs seems to have been originally filled with calcite, which has been etched off.

Rex Harris (183 N. 300 West, Delta, UT 84624) continues to produce superlative specimens of **red beryl**. One piece he brought to me for photography is a doubly terminated crystal 2.1 cm long with another attached to its side. It may well be the finest thumbnail of the species in existence.

For the pseudomorph collector, *Rose's Rocks* (631 E. Puente, Covina, CA 91722) had found a single pocket of **quartz pseudomorphs after anhydrite**. The attractive, pale peach to tan pseudomorphs seem to be coated with a thin, bubbly layer of "hyalite" opal. The locality is the Agua Fria River, New River, Arizona.

By Sunday morning I had packed up my photo gear and looked forward to spending the day visiting and taking a few last notes. Leslie Kunzler, who works with Tony Jones of *California Rock & Mineral* (P.O. Box 318, Royal, AR 71968), asked me to look at a specimen they had recently acquired. I about died when she unwrapped a 10.7-cm **vivianite and ludlamite** on pyrite from Morococala, Bolivia. A single, twisted "gwindel" of vivianite rose off the matrix with a cluster of sub-parallel ludlamites at its base. I was kicking myself for not being able to photograph the piece, but did get a snap of it on top of a pile of boxes outside the hotel. Later that week while photographing for Cal and Kerith Graeber (P.O. Box 2347, Fallbrook, CA 92088) I was relieved to find that they had bought the specimen, and I was able to do it photographic justice (see cover of this issue). I have since been told that this piece, as fine as it is, it not the best of the vivianite/ludlamite combinations to come out recently.

That wraps up the Costa Mesa Show for this wandering photographer. See you at the next show.

Colorado Dealers

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Littleton, CO 80123
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Letters

OKLAHOMA QUARTZ

I am writing to report the recent rediscovery of a rare skeletal form of smoky quartz from McCurtain County, Oklahoma. Most crystals possess clear, colorless cores that apparently shattered during pocket decompression. All surfaces of the fragmented cores were subsequently overgrown with extremely lustrous smoky quartz in complex skeletal or hopper forms that occur as complete "floaters." Virtually all specimens include multiple growth planes of reddish beige clay as phantoms, and macroscopic fluid inclusions are visible in most crystals. These specimens rival any similar crystals from Brazil. Approximately 25 kg of crystals were recovered.

I have also found some unusual calcite specimens from the Arbuckle Mountains in southern Oklahoma. These display complex growth forms and fluorescence. In most cases, basal calcite scalenohedra were overgrown by twinned rhombic crystals. The bases of the scalenohedra fluoresce white in shortwave ultraviolet light and have a strong, persistent blue phosphorescence. Tips of scalenohedra project above the covering rhombs and fluoresce orange, and rhombic overgrowths a dull deep red. Most crystals contain planes of solid crystalline inclusions that define phantoms: fine-grained pyrite and sphalerite delineate some scalenohedra-rhomb contacts, and multiple planes of goethite plus pyrite define sparkling growth planes within rhombs. Finally,

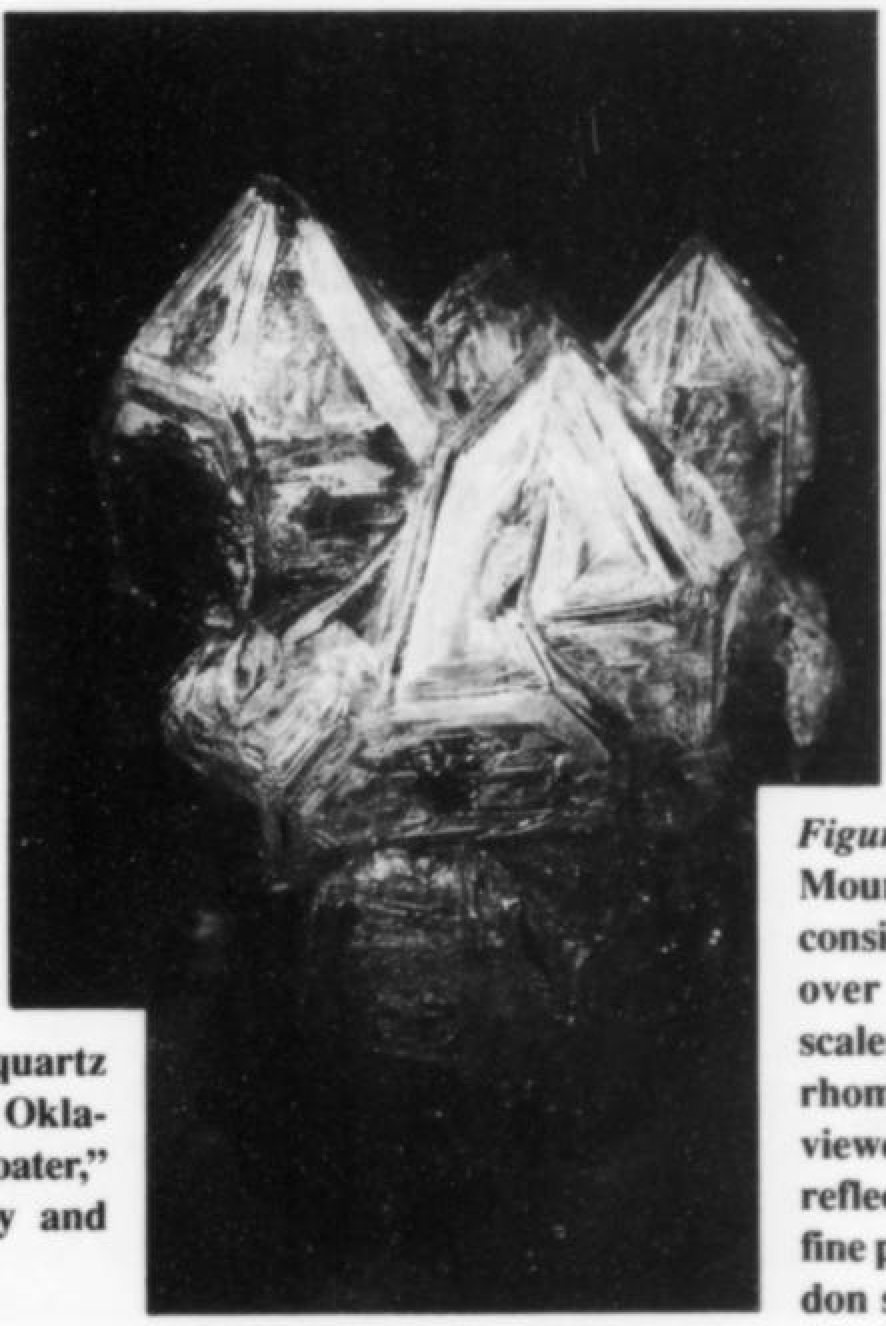

Figure 1. **Composite skeletal smoky quartz crystal (19 cm) from McCurtain County, Oklahoma, a completely doubly terminated "floater," with multiple planar phantoms of clay and hollow faces. David London specimen.**

Figure 2. **Calcite specimen from the Arbuckle Mountains, Oklahoma (largest crystal is 5 cm), consisting of twinned rhombohedrons that grew over basal scalenohedra (the tips of the scalenohedra project through reantrants in the rhombs on the left side of the specimen as viewed). Glints within the upper crystal are reflections off skeletal pyrite crystals that define phantoms within rhombohedra. David London specimen.**

some samples are encased in natural asphalt; in this association, the rhombic calcite overgrowths possess distinctive circular growth platforms (visible without magnification) that are believed to reflect crystal growth from a mixed brine-petroleum suspension. Most specimens consist of single rhombs (to 11 cm in dimension) or a few rhombic crystals, usually with scalenohedra projecting through to their surfaces. A few large crystal plates were collected.

David London
530 Garland Court
Norman, OK 73072

SECOND OCCURRENCE OF PAAKKONENITE

Paakkonenite (Sb_2AsS_2) was first described from the Seinajoki region in Finland in 1981. The quantity was very limited and only the Fersman Mineralogical Museum in Moscow is noted as having a specimen in hand. The mineral is not represented in the collection of the U.S. National Museum of Natural History (Smithsonian).

During recent casual microscopic examination of an ore sample from Pribram, Bohemia, Czech Republic, we noted a varied mineral assemblage. The sample consists primarily of siderite with sphalerite, then in order of descending quantity: stibarsen, arsenic, quartz, stibnite and rock fragments. The specimen was approximately 2.5 x 3.5 x 4.0 cm, and was obtained for our collection in 1986. The original information with the specimen indicates that it was mined prior to 1950, more likely prior to 1940. The assemblage in no way resembles the stibarsen samples we have seen coming from Pribram today.

A small fragment containing stibarsen (?) was sent to Jim Wilson of Weber State University in Ogden, Utah, for positive identification. The results show stibarsen and arsenic with possible antimony and paakkonenite.

Another sample was then sent to Cannon Microprobe of Seattle, Washington, for microprobe analysis. Photomicrographs show bundles of single straw-like prismatic crystals to 30 µm in the stibarsen. In polished section these are readily visible at 60X. To assure identification, a second X-ray and probe analysis were run by Cannon Microprobe. Both confirmed the original identification.

After the discovery of the paakkonenite in the Pribram sample, approximately 45 microprobe and/or X-ray analyses were run on 22 different samples of stibarsen from 11 worldwide localities, including two additional Pribram specimens. No additional occurrences of paakkonenite were identified.

This seems to be not only the second occurrence for this rare species but also seems to be only the second proven sample. A small quantity of this material is being offered for sale by Excalibur Mineral Company of Peekskill, New York. About two dozen specimens, from micromount-size to 1.5 cm, are available.

Forrest and Barbara Cureton
Tucson, Arizona

OVERSEAS SHIPPING

The cost of shipping mail-order specimens, books and magazines overseas can often be prohibitive for the potential buyer. However, I have a suggestion which will eliminate this problem, and increase business. The shipping costs, initially charged to the buyer, can be returned to him *at no cost to the seller.* This can be accomplished simply through the use of postage stamps which, in Europe, are worth more than their face value as philatelic collectibles even if cancelled! The $9.95 Eagle Express Mail stamp (which can be used for any class of shipping, not just Express Mail) is an excellent example of a stamp rare in Europe, because Express Mail per se is normally restricted to destinations within the U.S. The value is maximized if it is set in from the edge of the package face and carefully hand-cancelled lightly on a small corner.

As for myself, I would enjoy hearing from any readers who might be interested in what Finland has to offer mineralogically besides granite!

Ross Whipple
Rannankylä
44280 Sumiainen
Finland

URANINITE LOCALITY IDENTIFIED

In the figure caption and relevant text concerning the uraninite crystal from Topsham, Maine, shown on page 214, the locality given (Standpipe Hill) is incorrect, and the specimen shown (Canadian Museum of Nature specimen #56790) is not from any recent find. The specimen was probably collected over 20 years ago by Clifford Trebilcock, and sold to Charles Key, who sold it to William Pinch, whose collection was acquired by the Canadian Museum of Nature in 1990.

As aptly stated by Carl Francis in 1987, "the precise source of these [uraninite] specimens has been a closely held secret . . . which has led to speculation and erroneous locality attributions" (*Rocks and Minerals,* vol. 62, no. 6, p. 408). Standpipe Hill was one such attributed locality (*Rocks and Minerals,* vol. 56, no. 6, p. 248–249), and the one given on the label accompanying the illustrated crystal when it was cataloged.

Recently, a considerable number of crystals virtually identical to those collected by Mr. Trebilcock have been found at a small, unnamed, water-filled pit north of the main group of pits at the Consolidated quarries (*Rocks and Minerals,* vol. 69, no. 2, p. 118; *Mineralogical Record,* vol. 24, no. 5, p. 383). Known unofficially as the "Trebilcock locality," or the "Swamp No. 1 pit," the occurrence of this unnamed pit near the Consolidated group of quarries is in complete accordance with the locality data provided by Clifford Trebilcock himself (Francis, 1987), and is most likely the source of these remarkable uraninite crystals.

George W. Robinson
Canadian Museum of Nature

TROOST COLLECTION

Persons researching North American and European classic mineral localities are invited to consult me regarding specimens in the collection of Gerard Troost (formed ca. 1811–1850).

Museums wishing to receive a free paragenesis collection of geodes from Halls Gap, Kentucky, should contact me as well. The collection includes rare and peculiar habits of pyrite and galena, along with the most common minerals.

Alan Goldstein
Naturalist/Asst. Property Manager
Dept. of Natural Resources
Falls of the Ohio State Park
201 West Riverside Drive
Clarksville, IN 47129

ERRATA

In the article on the base-metal assemblage found at the Sterling Hill mine, New Jersey (vol. 25, no. 2, p. 95), in the Introduction it states that the Chalcopyrite room ranges in depth "from 770 to 870 feet." That should read "from 770 to *780* feet."

In the "What's new in minerals?" column (vol. 23, no. 5, p. 435), reference is made to "zirconolite-30Å" from Norway. The correct name is "zirconolite-3O," in reference to the *3*-layer *O*rthorhombic structure. Confusion between the number zero and the letter "O" led to the error.

In the Tucson Show report for 1994 (vol. 25, no. 3, p. 212), the locality given in the caption for the zircon specimen should be spelled "Kipawa" (not "Kipowa").

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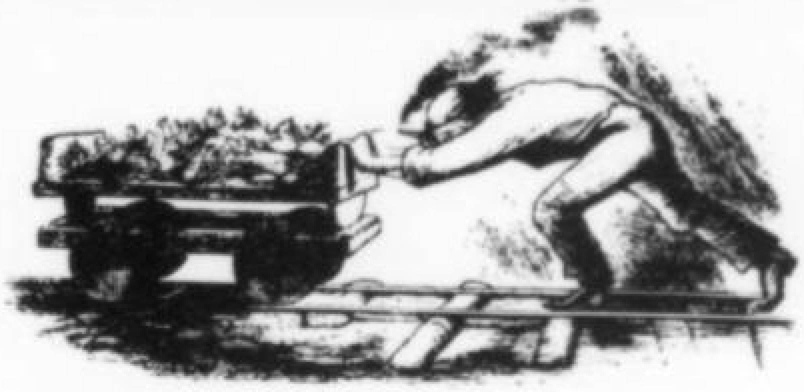

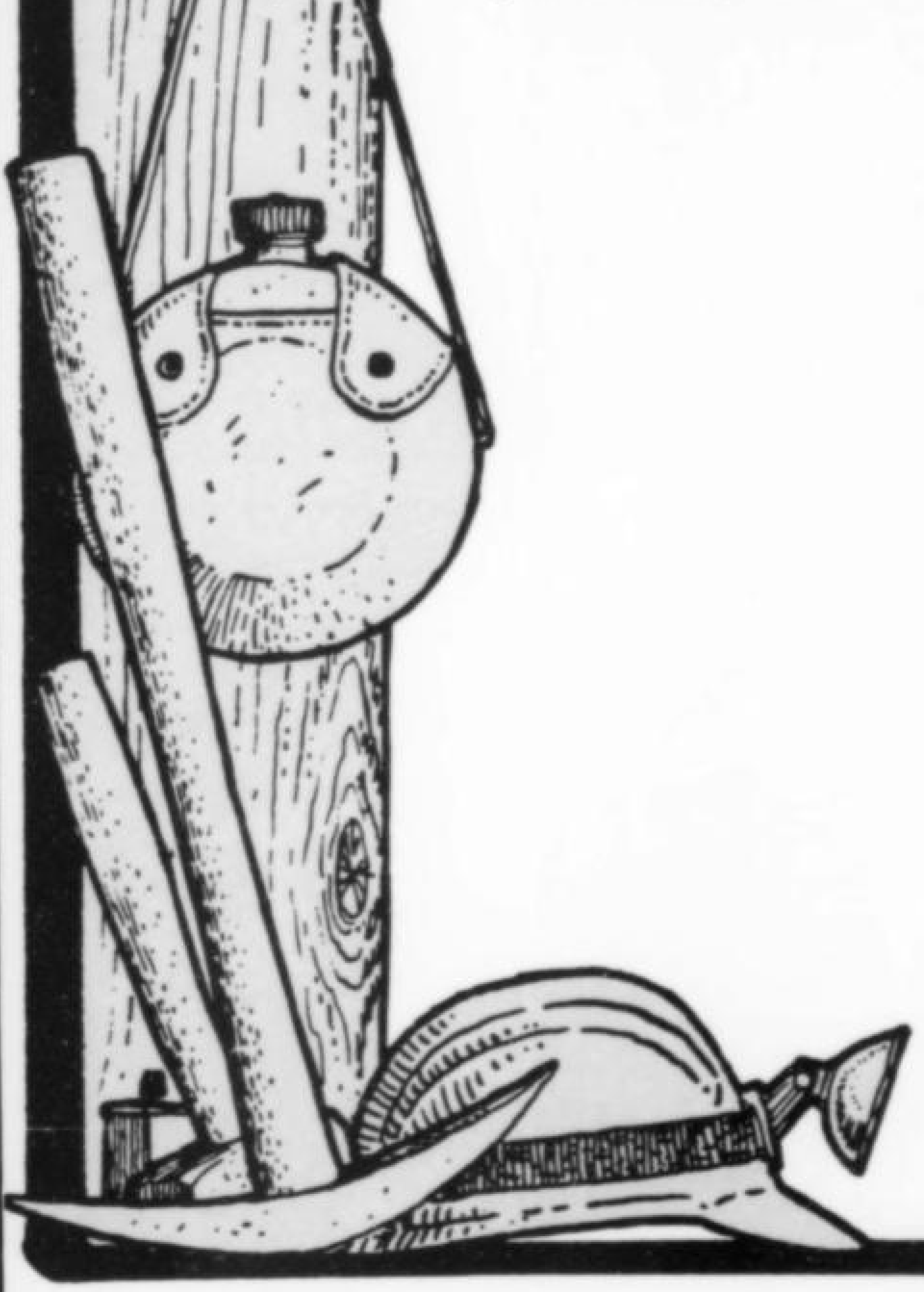

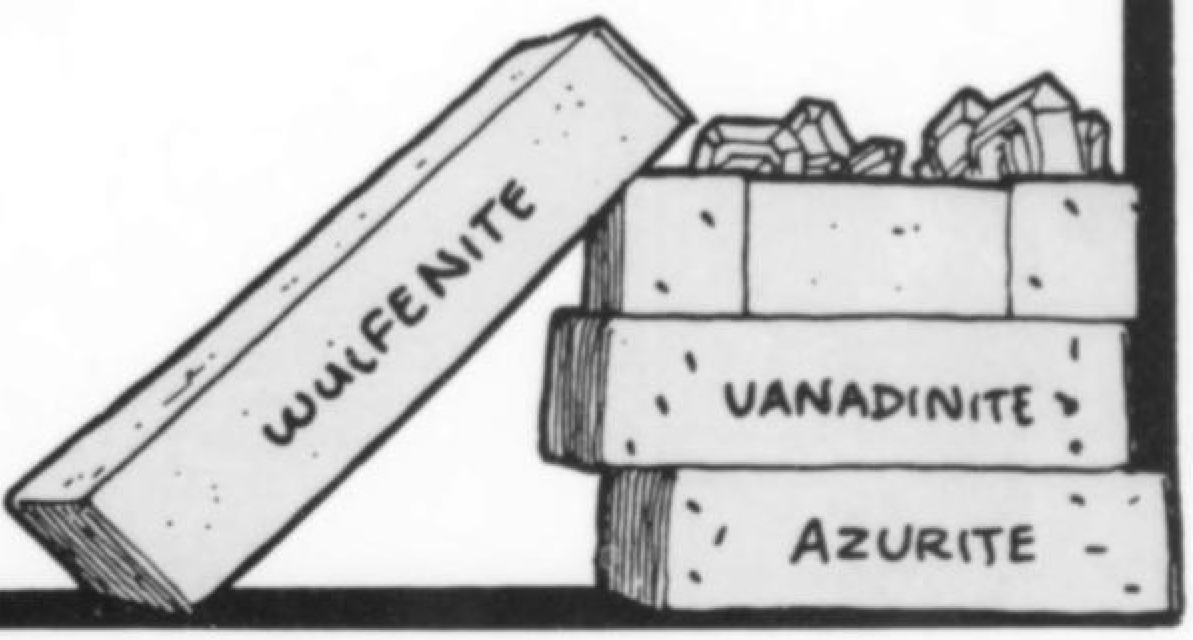

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