the Mineralogical Record

Volume Twenty-one, Number Five
September–October 1990
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the Mineralogical Record ®

September–October 1990
Volume Twenty-one, Number Five

Articles

Columns

COVER: ADAMITE group, 7 cm tall, from the Ojuela mine, Mapimi, Durango, Mexico. Collected in 1981 and now in the Carnegie Museum of Natural History, Pittsburgh (see special supplement in this issue). Photo by Harold and Erica Van Pelt.

notes from the EDITOR

CARNEGIE MUSEUM CATALOG

We are pleased to include in this issue a bonus for our subscribers: a copy of the new catalog of the Carnegie Museum of Natural History in Pittsburgh. The Carnegie has one of the most rapidly growing exhibit collections in the country, thanks to the backing of The Hillman Foundation, Inc. Because of all the relatively recent growth, most people are not familiar with the museum's new stature and with its beautiful new exhibit hall, the Hillman Hall of Minerals & Gems, celebrating its tenth anniversary this year. The enclosed catalog should remedy that situation, and inspire many to pay a visit to this outstanding facility.

I want to thank the Hillman Foundation and its president, Ronald W. Wertz, for graciously underwriting the cost of producing the catalog and including it in this issue. Collection Manager Richard A. Souza was also essential to its production. It was a pleasure to work with these two gentlemen who, when given options, always chose the path of highest quality, and who were unstintingly helpful and hospitable throughout the long process of planning, writing, photographing and designing the catalog. Their commitment to quality is as evident in the catalog as it is in the Carnegie Museum itself. These days, with many museums stagnant or on the wane (see Museum Notes column in this issue, regarding the British Museum) it's nice to see a mineral museum which is clearly on the rise.

ANTIQUARIAN REPRINT SERIES

The 20 specially reprinted copies of Schmiedel's rare colored mineralogy, which we offered in the January-February issue (in exchange for a $200 donation to the Record Library) were all claimed in short order, and a number of additional people who would have wanted one were disappointed. Since the original has been given back to its owner, Herb Obodda, and because we don't want to subject the 237-year-old book to the stress of another round of color photocopying, we must unfortunately decline further requests for additional copies. I want to express our thanks once again to Herb for graciously making that extremely rare and valuable original available to us for the purpose of reproduction.

I promised that if the Schmiedel reprint edition was well-received, we would reprint another rare colored mineralogy, and so we have. The chosen work this time is even older: Johann Ernst Hebenstreit's *Museum Richterianum* (1743), a massive documentation of the personal collection of Johann Christoph Richter, which ranks as the earliest color-plate book devoted primarily to mineralogy. It contains hand-colored engravings of 114 of Richter's specimens (which are, by and large, of considerably higher quality than those pictured by Schmiedel). And it's rare . . . only four surviving copies in colored state. The author and his work are described in the accompanying article in this issue.

Richard Bideaux has graciously given permission for the Mineralogical Record to publish a facsimile reprint of his hand-colored copy, which also contains the frequently missing portrait engraving of Richter. As with the earlier reprint of Schmiedel, we have reproduced all the color plates directly from the originals using a Canon Laser Color Copier. The plate depicting gold specimens, however, has been highlighted by hand using metallic gold paint, as in the original. And it is a much larger book than Schmiedel: nearly 500 pages, and twice the page size (about 10½ x 16½ inches), including one especially large plate, a folded engraving measuring about 16½ x 18 inches, showing Richter's collection room. For this project we have also commissioned an English translation of the Latin preface, compiled a list of translated figure captions to go with each plate, and added a table of contents (in English) which, strangely enough, was not included by Hebenstreit. These additions make the book more easily usable by modern readers, and might actually qualify it as a "second edition."

Figure 1.* Detail from the engraved portrait of Johann Christoph Richter, showing his hand resting on a copy of his collection catalog, *Museum Richterianum.

We have printed 30 numbered copies on 24-pound 100% cotton paper, and have had them nicely hardbound with stamping in black and gold. Our cost on the reprints is about $120 per copy, and so we are asking for a donation to the Record Library of $250 (the difference being tax-deductible in the U.S., as a gift). Copy no. 1 will go into the Record Library. Our 24-hour answering service will take telephone reservations, but we must subsequently receive your check by mail before shipment. Call 602-299-5274. Order from the Editor, Mineralogical Record, 4631 Paseo Tubutama, Tucson, Arizona 85715.

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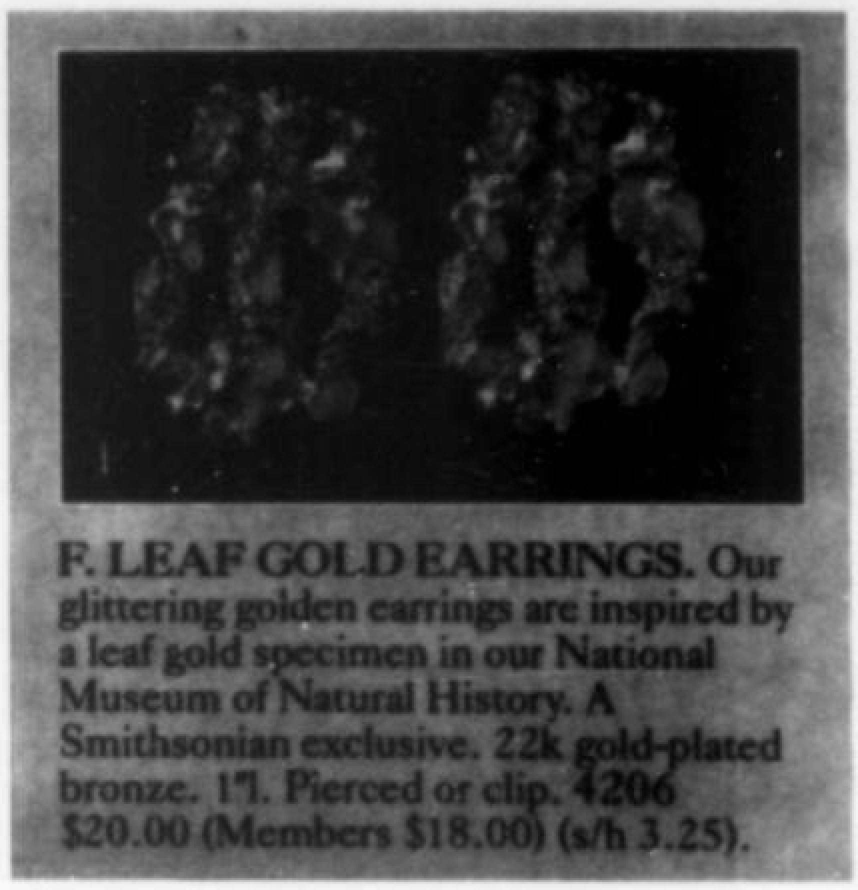

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SPECIMEN REPRODUCTIONS

Readers who own a copy of vol. 11, no. 2, know the beautiful "seaweed" gold specimen pictured on the cover. It's about 18 cm tall, and came from the Eureka mine, Tuolumne County, California. The specimen, now in the Smithsonian, has been reproduced as a set of gold-plated earrings, available for $23.25 postpaid through the Smithsonian's Summer 1990 Catalogue. Order from The Smithsonian Institution, Dept. 0006, Washington, DC 20073-0006, or call 703-455-1700 to place a credit card order.

CHECK YOUR FILES

We need, for the Record Library, a copy of the **1986** Munich Show catalog, and also catalogs from 1982 and earlier. These are probably of little use now to the average collector, but we'd like to keep them for archival purposes. If you come across one in going through your old files, please don't throw it away—send it to us.

CLUB ANNIVERSARY

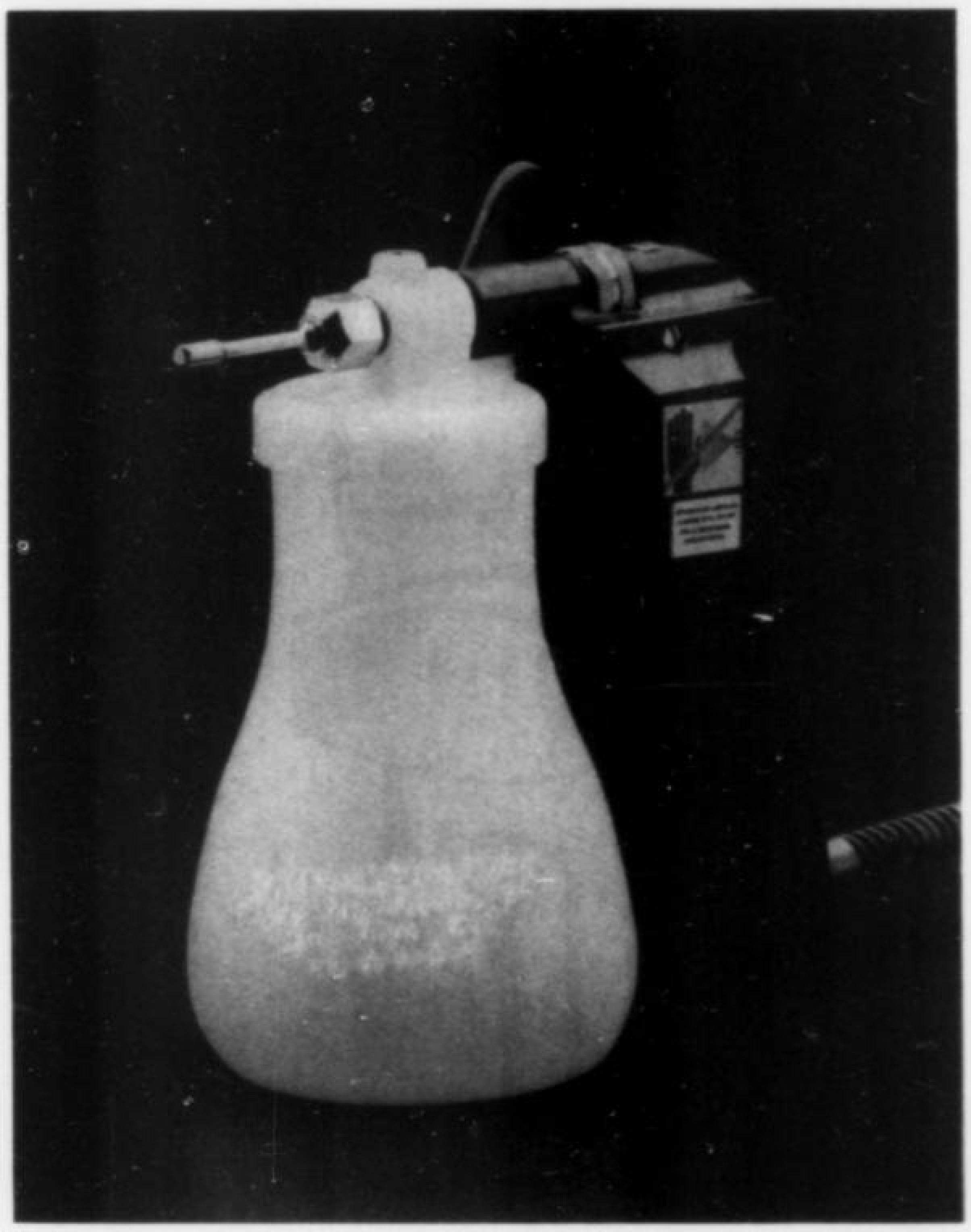
We won't usually cover club news, but a 50th anniversary is something special. Our congratulations to the Connecticut Valley Mineral Club on their 50th year. The club currently boasts nearly 200 members. The Springfield (Mass.) Museum of Natural History serves as club headquarters, where monthly meetings are held. Persons interested in joining are invited to contact the museum.

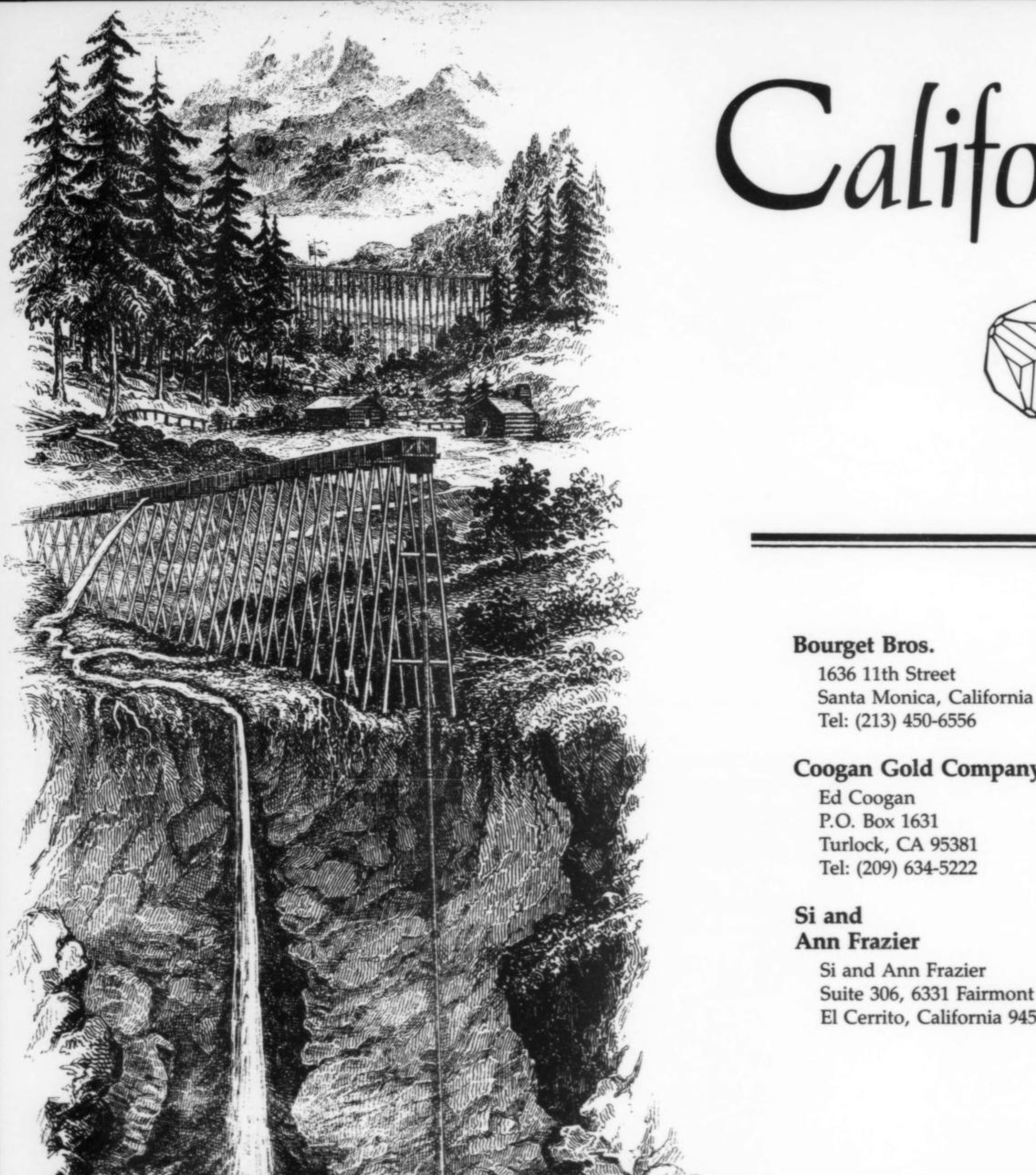
MINERAL FASHIONS

For those who like to *wear* their mineral art, Hermès, the Parisian purveyor of silks, has produced an attractive silk print cloth covered with eighteenth-century-style colored illustrations of mineral specimens. There is nothing antiquated about the prices, though: a pair of shorts in the material is $875, and a scarf blouse will cost you from $995 to $1,295.

NOTICE

Died, Wayne W. Holt, 57. Mr. Holt, of Henrietta, New York, was a micromounter, member of many mineralogical societies, and a charter subscriber to the *Mineralogical Record*.





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HEBENSTREIT'S
MVSEVM RICHTERIANVM
1743

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Johann Christoph Richter accumulated one of the larger mineralogy collections of the eighteenth century. The massive, systematically arranged catalog of his collection (with its hand-colored engravings of 114 of his best specimens), is a landmark in the history of mineral literature, ranking as the first colorplate book devoted primarily to mineralogy.

Many wealthy personages of the eighteenth century built "cabinets of curiosities," natural history collections of wide and general scope. Royalty liked to have samples of the kingdom's mineral wealth at hand, with which to impress visitors; and aristocrats of a scholarly bent simply enjoyed collecting for its own sake. Some of these collectors issued catalogs of their collections, sometimes written for them by hired scholars and illustrated by hired engravers and colorists. They felt, it seems, a sort of *noblesse oblige* to science, as well as a desire to show off their treasures. Johann Christoph Richter (1689–1751) was one of these gentlemen, a wealthy banker and member of the legislature in Leipzig. He engaged Johann Ernst Hebenstreit to write a systematic catalog of his collection, and C. F. Boetius to illustrate the book with engravings. The resultant work was entitled *Museum Richterianum,* "The Richter Museum."

RICHTER

In his youth, Richter studied literature and philosophy, and developed a budding interest in law. But his father had other ideas, encouraging him instead to follow in the family footsteps and make a career in business. The elder Richter was a successful banker as well as a dealer in glass-making sand and coloring agents, especially cobalt for the manufacture of cobalt-blue glass. Seized with curiosity about the origins of the commodities he traded, the father took his son on travels to see the mines, living among the miners and going underground to see the ores in place. It was on these excursions that the young Richter began to build his mineral collection, at first simply as an aid to memory, but soon with a growing passion for the beautiful minerals themselves. In his preface he writes:

> The collection . . . grew from day to day, to such an extent that it became necessary to sort the specimens into categories and arrange them on shelves and in display cabinets. As the number of shelves kept growing, my love for these things grew also, so that after a while, whatever time I had left over from the management of my personal or business affairs, I dedicated to their study and care. I cannot disavow . . . the incredible satisfaction, the bliss, which swept over me at the contemplation of the divine perfection of these works of nature—an emotion that I can blame for nothing more grave than refreshing and invigorating the mind, and driving away other troublesome preoccupations.[1]

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[1] Quoted from a complete translation of Richter's Latin preface prepared for the Mineralogical Record by Sophia S. Morgan and published in full in the Record's facsimile reprint of *Museum Richterianum.*

***Figure 1.* Engraved portrait of Richter.**

Those lines could have been written, word for word, by many modern collectors as well.

Richter's friend and mentor in mineralogy was Johann Zacharias Platner, a Professor of Medicine in Leipzig. Platner visited Richter often in his mineral room, where they whiled away the hours in convivial mineralogical discussion and instruction, greatly strengthening Richter's interests in natural history. Platner offered advice on the preparation of Richter's museum, helped categorize the new specimens as they came in, drew the first rough outlines of the massive catalog that would eventually be published, and schooled Richter regarding the best books to read about mineralogy. Richter's library eventually grew to 3,000 volumes; of course, only a relatively small number could have been on mineralogy per se.

HEBENSTREIT

Johann Ernst Hebenstreit was born into a poor family in Neustadt, Germany, in 1702. As a youth he developed an interest in science, especially botany, but also other branches of natural history including mineralogy. He studied at Jena, then entered the University of Leipzig in 1723, eventually becoming a professor of medicine there in 1730. Two years later he traveled to North Africa on a scientific expedition, collecting a great many natural history specimens and curiosities for his patron, August I; but he afterwards returned to the university where he continued to write and publish scientific books and papers until his death there in 1757.

Hebenstreit's doctoral dissertation was on the classification of sea shells (1728), and upon his appointment as professor he published a treatise on minerals of pharmaceutical value (1730). His natural history publications dealt with such subjects as fish anatomy, insects, and medicinal plants, as well as mineralogy, e.g. his *Historiae naturalis fossilium caput de terris* . . . (1745).[2] However, most of his published works are on medical subjects, particularly his anatomical investigations on cadavers.

In 1743, Hebenstreit's *Museum Richterianum* appeared; as a systematic mineralogy it was amazingly detailed and orderly for its time. However, despite all the work that Hebenstreit put into the book, it appears likely that Richter did not actually pay him for his efforts. Richter writes:

> The illustrious Johann Ernst Hebenstreit, distinguished Doctor of Anatomy and Surgery, contributed a great deal of labor and study to the Museum, and was never remiss in doing even the least of all the tasks that could have been expected of such a friend. For the sake of the extraordinary knowledge to be derived from these things . . . he not only helped me with everything that needed to be classified, but prepared the greater part of the Catalog and added to it his own interpretations on these subjects.[1]

In other words, he did it for the fun of it. It is possible he received some sort of royalty on sales, but since publication was financed by Richter, and many copies were probably given away by him, an author's royalty is unlikely.

Before preparing the catalog, Richter and Hebenstreit did a literature search of other such collection catalogs, not

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[2] The term "fossil" in those days was used to mean any natural object that had been dug up out of the earth, especially minerals. For paleontological specimens Hebenstreit used the terms *lapides idiomorphi, lapidem figuratorum,* or *gebildeten Steinen,* literally "picture rocks" or "rocks bearing images."

only to see how others had approached the task, but also to establish solid precedents for their own work. Hebenstreit lists what they found in his introduction:

> Other collectors, who have spent their lives acquiring and arranging their valuable collections and bringing forth museums, as soon as they had achieved their purpose they have, without reservation, placed catalogs of their inventories before the eyes of the learned: Olaus Worm,[3] Basilius Besler, Athanasius Kircher, Georg Everhard Rumph, Eleazar Albinus, Franciscus Calceolarius, Manfredus Septalius, Johann Jacob Scheuchzer, Johann Crafto Hiegell, Jacobus Petiver, Eduard Luidius, Fridricus Ruisch, Albertus Seba,[4] and among the living scholars Johann Heinrich Lincke, Jacob Theodor Klein, and Johann Philipp Brennius. From each a part of the Lesson of Nature, which he loved the most, was assembled in his collection, justifying its publication.

THE BOOK

The book begins with Richter's dedication to Saxon Prince Friedrich Christian, then Richter's preface discussing the development of his collection and of the collection catalog. Following this is a detailed discussion (presumably by Hebenstreit) of the development of natural history collecting and systematic mineralogy or mineral classification, drawing on the authorities and works then available (Pliny, Dioscorides, Aldrovandus, Henkel, Agricola, Gesner, Woodward, Linnaeus, Theophrastus, Caesalpinus, Mercati, etc.)

Minerals and ores are then methodically discussed in chemical order, with chapters on gold, silver, copper, tin, lead, iron, antimony, mercury, cobalt and bismuth ores, each broken down into the different species or varieties deemed significant. Other chapters cover sulfides, bitumens, salts, clays, "earths," quartz, fluorite, the gem minerals, and a variety of other species. These are accompanied by engraved and hand-colored illustrations of 114 mineral specimens from Richter's collection. In each chapter, following a discussion of the systematics (with careful reference to their earlier authors), Richter's specimens are listed and described, giving habits, mineral associations and localities for each.

Following the mineralogy chapters, which form the largest portion of the book, are discussions and specimen lists of the other objects Richter collected, including samples of various types of marble, fossils, and preserved biological specimens of animals, fish, insects, etc. Finally there is a dissertation on the gem cameos of antiquity by Johann Friedrich Christ (1700–1756), illustrated by three full-page plates showing many examples from Richter's collection.

MVSEVM
RICHTERIANVM
CONTINENS
FOSSILIA ANIMALIA
VEGETABILIA MAR.
ILLVSTRATA
ICONIBVS ET COMMENTARIIS
D. IO. ERNESTI HEBENSTREITII
ANAT. ET CHIRVRG. P. P. O.
ACCEDIT
DE GEMMIS SCALPTIS
ANTIQVIS
LIBER SINGVLARIS.

LIPSIAE
EXCVDI CVRAVIT CASPARVS FRITSCH
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***Figure 2.* Title page.**

Also included among the plates are a full-page portrait of Richter himself; a larger fold-out engraving showing the interior of the museum, with its odd pyramidal glass cases (perhaps inspired by very similar cases in the Brandenburg *Kunstkammer* in Berlin), cabinets of drawers, books, and an extensive collection of Old Masters paintings almost seamlessly covering the walls; and interesting half-page engravings beginning each major section, showing miners, cherubs, angels and so on engaged in mining and specimen collecting.

THE COLLECTION

Richter's collection consisted of 2,309 mineral specimens and 291 gemstones; in addition there were 215 samples of marble and alabaster, 794 fossils and 2,022 biological items for a grand total of 5,631 specimens. Among the minerals, he seems to have had a particular interest in the metallics. He owned 514 specimens of silver and silver-containing minerals, and 137 specimens of gold and gold-containing minerals. Those are impressive totals for a systematic collection even today, and they span a wide range of localities.

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[3] Entitled *Museum Wormianum* (1655), probably the inspiration for the title of Richter's catalog.

[4] A copy of Seba's much more ambitious collection catalog, referred to here by Hebenstreit, sold at auction in London last April for $240,000. (*Locupletissimi Rerum Naturalium Thesauri accurata Descriptio,* 1734–1765, large folio, 4 vols., Amsterdam; 449 hand-colored plates, only 9 of which show minerals and fossils) (personal communication, Thomas Lamb, Christie's).

Figure 3. **Gold from Brazil.**

Figure 4. **Silver from the "East Indies" (the silver paint oxidized black).**

Figure 5. **Silver from Norway, probably Kongsberg.**

His native golds, for example, came from Norway, Brazil, Guinea, India and China as well as the nearer localities in Transylvania, Bohemia, Silesia and Hungary. For silver minerals the famous Saxon Erzgebirge was a favorite collecting area.

In terms of specimen quality Richter's collection ranged from quite good to what we might term "study-grade" today. Judging by the plates, he had a great many crystal specimens but was indifferent to damage. One thing that is generally most striking to modern eyes viewing early eighteenth-century mineral collections is the relatively middling specimen quality, even in collections built by the wealthiest aristocrats. A collector of our century, with only modest income and a humble place in society, can easily assemble a mineral collection in a few years which would have dazzled the crowned heads of Europe in Richter's time. Today we can surpass virtually every extant systematic collection of the eighteenth century (in terms of quality, and without regard to specific localities) if we so wish. The value of old collections such as Richter's is the insight they give into the localities which were then producing. Most of those occurrences, especially the metal mines, are long extinct, and the samples taken from them are an important clue to their understanding by modern mineralogists. An extensive catalog such as Richter's tells a great deal about those old localities, and can be used to build up a fairly detailed picture of their mineralogy.

Following Richter's death in 1751, the museum was sold. Around 1780 the cabinet is known to have been in the possession of a Leipzig industrialist named Frege, and a few individual pieces became part of the Johann Heinrich Linck collection. The Richter collection as a unit is lost sight of by 1799, and ultimately appears to have been dispersed.

BIBLIOLOGY

Museum Richterianum[5] was published in Leipzig in 1743 by Caspar Fritsch, in parallel columns of Latin and German. As such, it provides a virtual "Rosetta stone" for students of early mineralogical nomenclature. It was issued in both colored and uncolored states; apparently only four copies in colored state have survived. These are in the DeGolyer Library at the University of Oklahoma, Norman; the Boston Public Library; the library of the Academy of Natural Science in Philadelphia; and the Richard Bideaux library in Tucson. The Philadelphia copy is unique in that it contains *two* prints of each plate, one colored and one uncolored, bound face-to-face. A side-by-side comparison of the Philadelphia copy's colored plates with color photocopies of the Bideaux copy confirms that they are more or less identically colored. Both even show the careful use of metallic gold and silver paints for highlighting. And Richter refers to the "costly illustrations," a phrase not applicable to uncolored printed engravings. The colored plates are therefore certainly "official" products of the publisher. Nine uncolored copies are known in other American libraries, and the British Museum Library has three uncolored copies. (There are probably a few more in mainland European libraries as well.)

It is impossible to say what one of the known hand-colored copies might sell for today at auction, but $5,000 to $10,000 might be a reasonable guess. An uncolored copy might bring $2,000 to $3,000.

A CONCLUSION

Today it doesn't take a nobleman's income to build a fine mineral collection, but publishing a color-plate book about one's own specimens has become exceedingly unusual. One can't help wondering what information about today's great private collections will have survived 250

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[5] *Mvsevm Richterianvm; continens fossilia animalia vegetabilia mar.* Illvstrata iconibvs et commentariis d. Io. Ernesti Hebenstreitii, anat. et chirvrg. p.p.o., accedit *De gemmis scalptis antiqvis* liber singvlaris. Lipsiae [Leipzig], excvdi cvravit Casparvs Fritsch, MDCCXLIII [1743]. Includes *Mvsei Richteriani dactyliotheca, gemmas scalptas opere antiqvo* plerasqve complexa interprete Ioh. Frider. Christio [1700–1756]. Folio, pp. [56], 384, [18], 34, with folding engraved frontispiece, engraved portrait, and 17 engraved plates of specimens, 14 of which (minerals and fossils) are hand-colored and 3 (cameos) uncolored, 41 cm, title page in red and black, title vignette and allegorical chapter heading engravings. Colophon: Lipsiae, excvdebat Christoph. Breitkopf MDCCXXXXIII [1743].

Figure 6. **Erythrite from the Rappolt mine, Schneeberg, Saxony.**

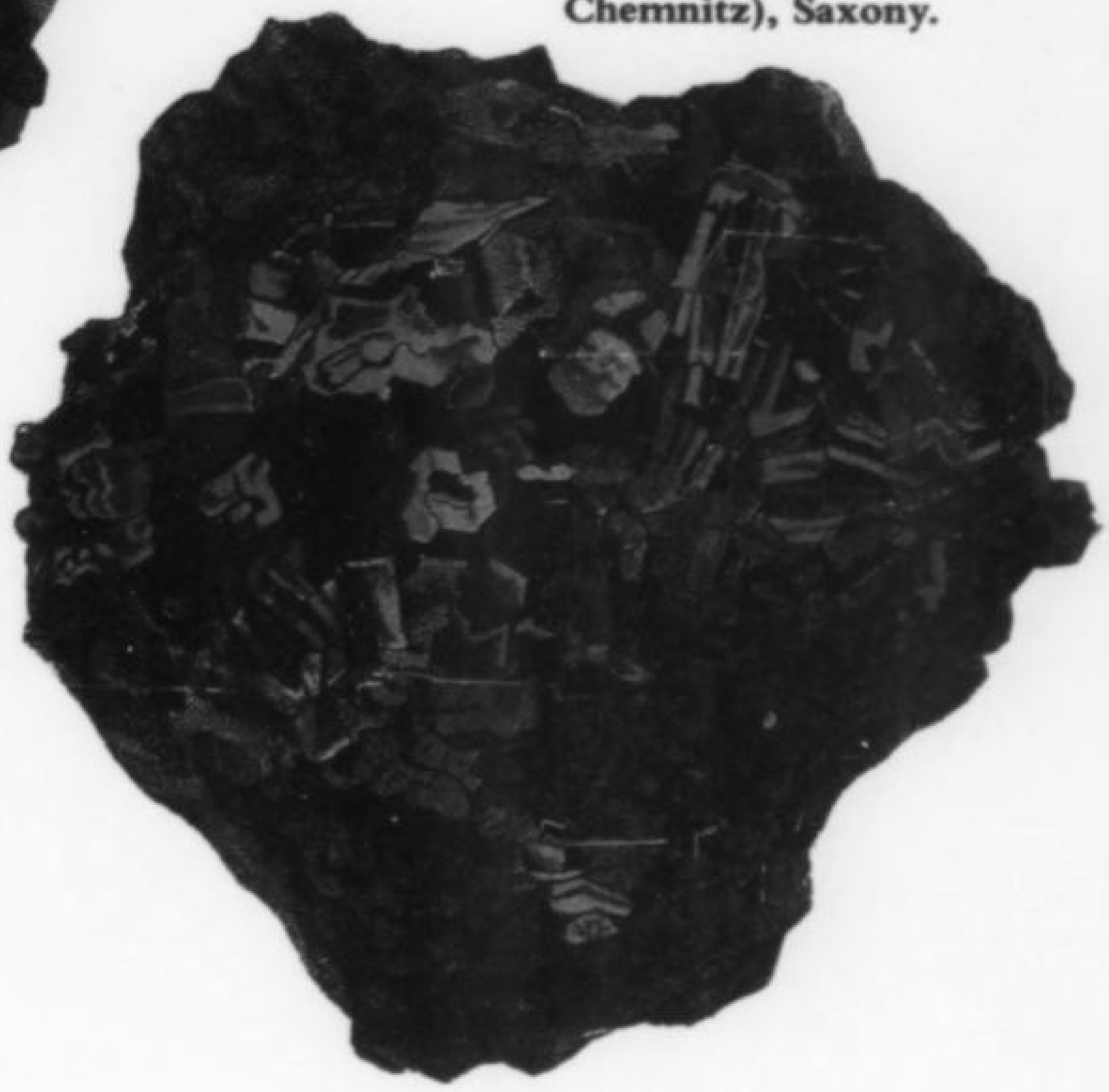

Figure 7. **Pyromorphite from Zschoppau (near Chemnitz), Saxony.**

Figure 8. **Bismuthinite from the Anna and Daniel mine, Schneeberg, Saxony.**

Figure 9. **Wire silver from Schneeberg, Saxony.**

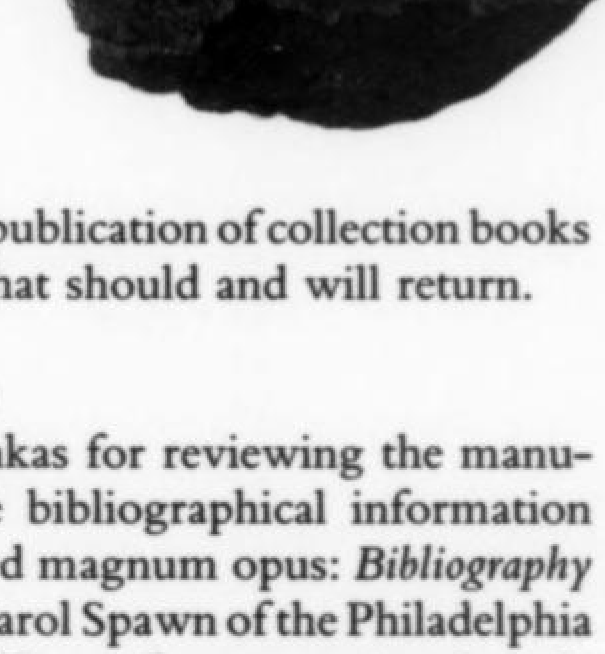

Figure 10. **Cassiterite from Schlaggenwald, Bohemia.**

years from now. Perhaps the publication of collection books such as Richter's is a trend that should and will return.

ACKNOWLEDGMENTS

My thanks to John Sinkankas for reviewing the manuscript and confirming some bibliographical information with his soon-to-be-published magnum opus: *Bibliography of Gemology.* Thanks also to Carol Spawn of the Philadelphia Academy of Natural Science library for comparing the colored plates of two copies, at my request, and confirming that they are identical. Other helpful librarians too numerous to mention kindly provided information on the copies of *Museum Richterianum* in their holdings. Si Frazier and Curtis Schuh reviewed the manuscript. Finally, my sincere thanks to Richard Bideaux for allowing his rare hand-colored copy of *Museum Richterianum* to be studied and reproduced.

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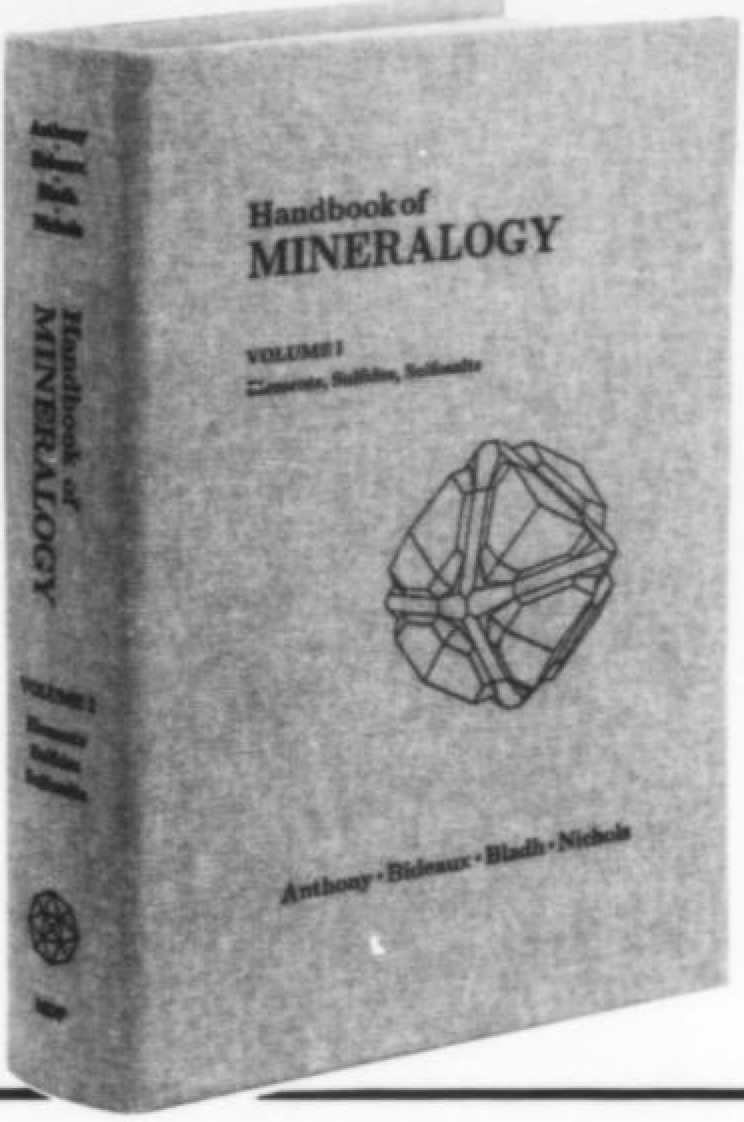
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VOLUME I
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THE INTERNATIONAL HANDBOOK

APATITE AND MUSCOVITE FROM THE ZÉ PINTO PROSPECT, MINAS GERAIS, BRAZIL

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Fine specimens of dark green apatite and extraordinary groups of muscovite crystals have recently been found at a new location in Minas Gerais, where over a ton of crystal specimens were recovered from a single pocket.

INTRODUCTION

Muscovite and apatite occurrences are not especially uncommon in Brazil, but high-quality specimens are always noteworthy. In 1989 some of the finest muscovite crystals ever found were discovered in large quantity, along with fine dark green apatite crystals, at a pegmatite in eastern Minas Gerais. Over 1 metric ton of muscovite crystal specimens and more than 100 kilograms of apatite crystals were recovered from a single large pocket. Much of this material was sold by several Brazilian mineral dealers at the 1990 Tucson Show.

The locality is known as the Zé Pinto prospect (or alternately as the Fazenda Santa Elisa prospect). It is currently under lease by José Pinto, a miner and gem dealer from Governador Valadares. Mining there is continuing.

LOCATION

The Zé Pinto prospect lies in Minas Gerais near the boundary with Espirito Santo, 43 kilometers east-northeast of Conselheiro Pena, in the township of the same name. This is 95 km east-southeast of Governador Valadares, in the Rio Doce Basin. Map coordinates are x = 282.0, y = 7894.2, on the Conselheiro Pena map (SE-24-Y-C-II, 1/100,000, IBGE, 1979).

Access is from Conselheiro Pena along the Cuparaque road for 65.7 km, passing Vila Penha do Norte and Goiabeira, to Aldeia. (Some dealers have used the name "Aldeia do Eme mine," apparently because Aldeia is the nearest village.) From this village a service road leads southeastward to the farm buildings at 4.6 km and terminates 600 meters farther along, at an elevation of 300 meters. From there it is a 15-minute hike up a steep trail to the mine.

***Figure 1*. Location map.**

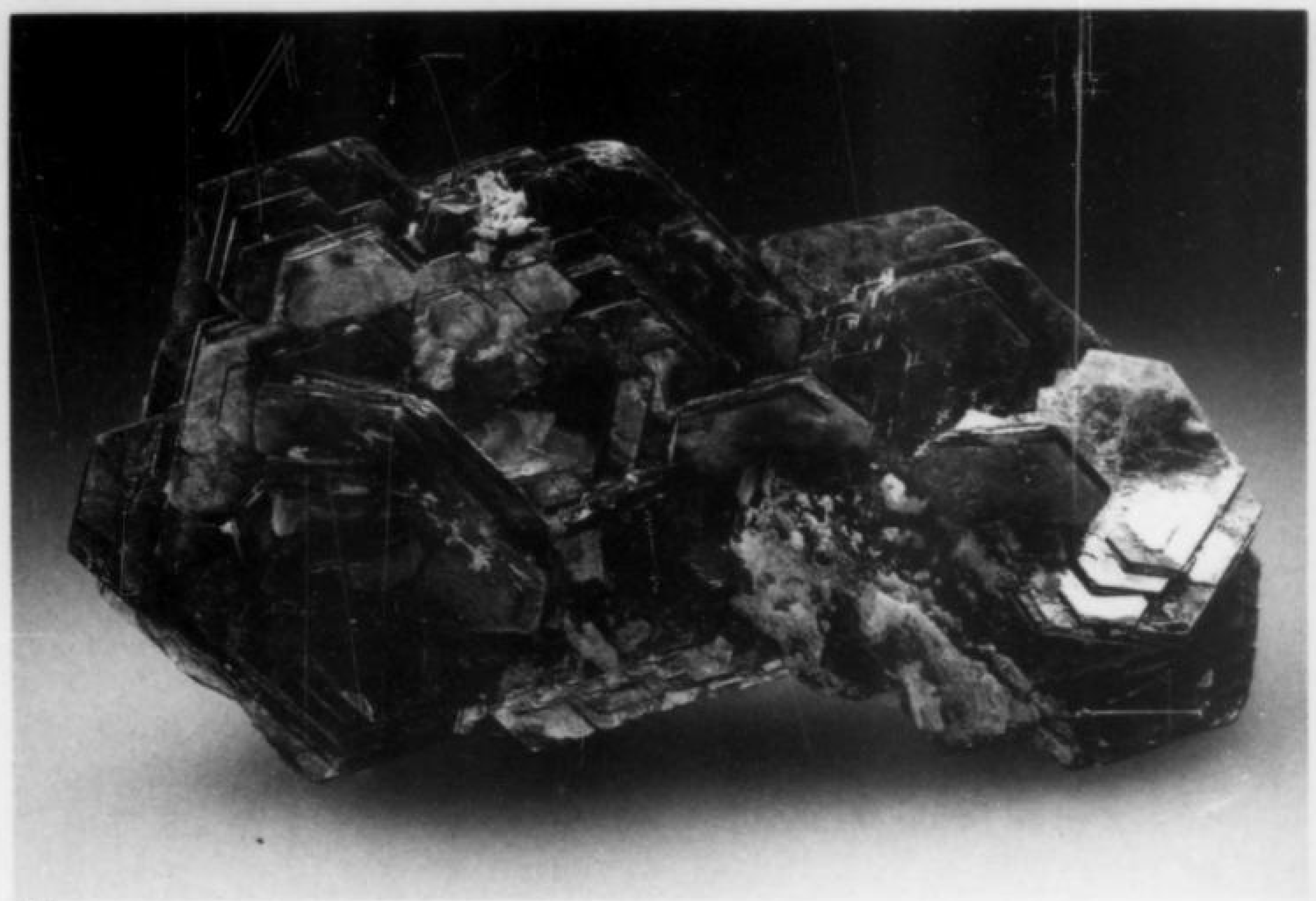
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Figure 2. **Muscovite group, 9 cm across. Carlos Barbosa specimen.**

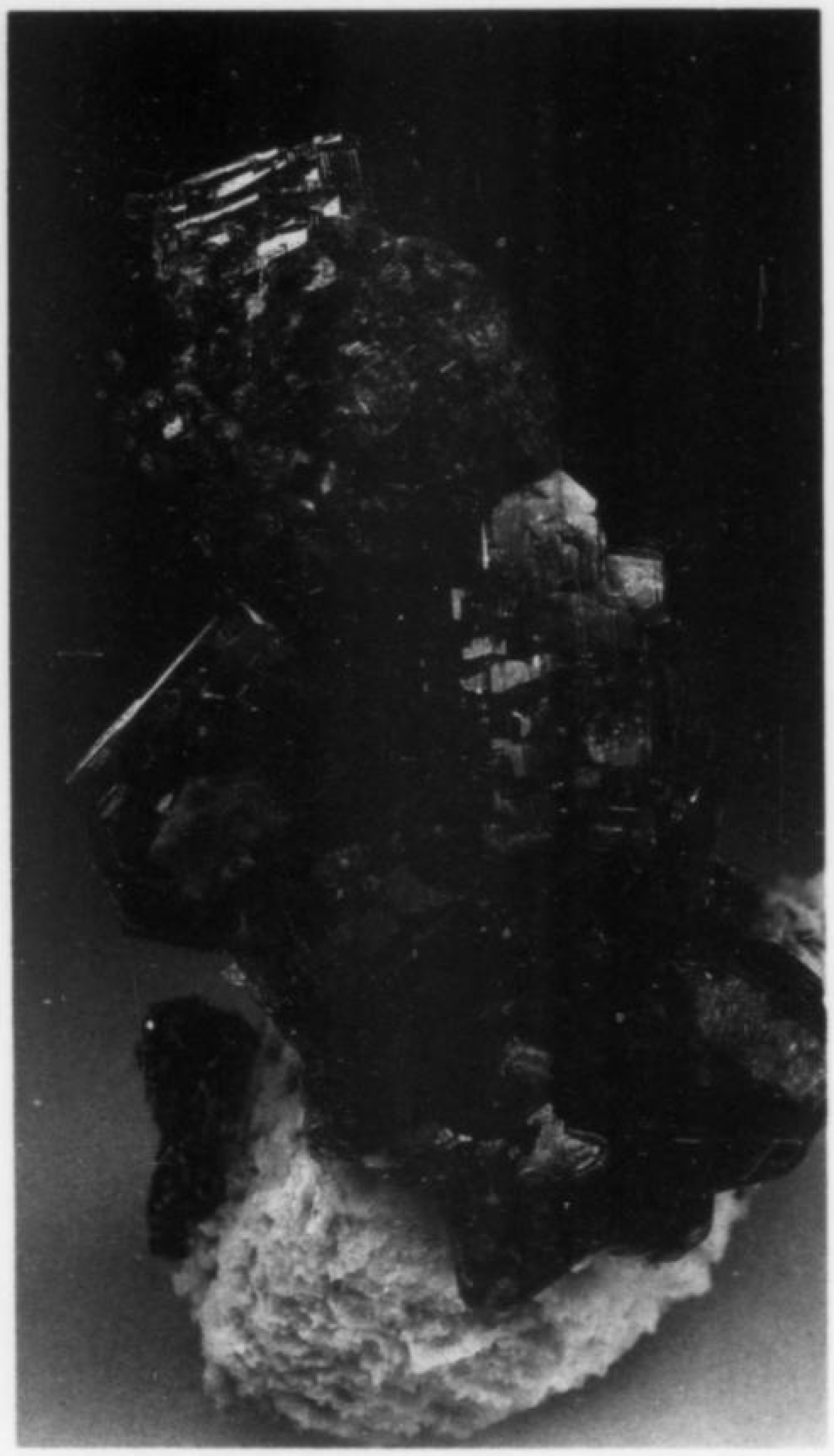

Figure 4. **Muscovite crystal, 2 cm, backlit to reveal strong reddish color, with complex parallel-growth apatite crystals. Valadares Minerals specimen.**

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Figure 3. **Muscovite group with smoky quartz; the large muscovite crystal is about 6 cm across. Carlos Barbosa specimen.**

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Figure 5. **Muscovite crystal group, 6 cm across. Don Olson specimen.**

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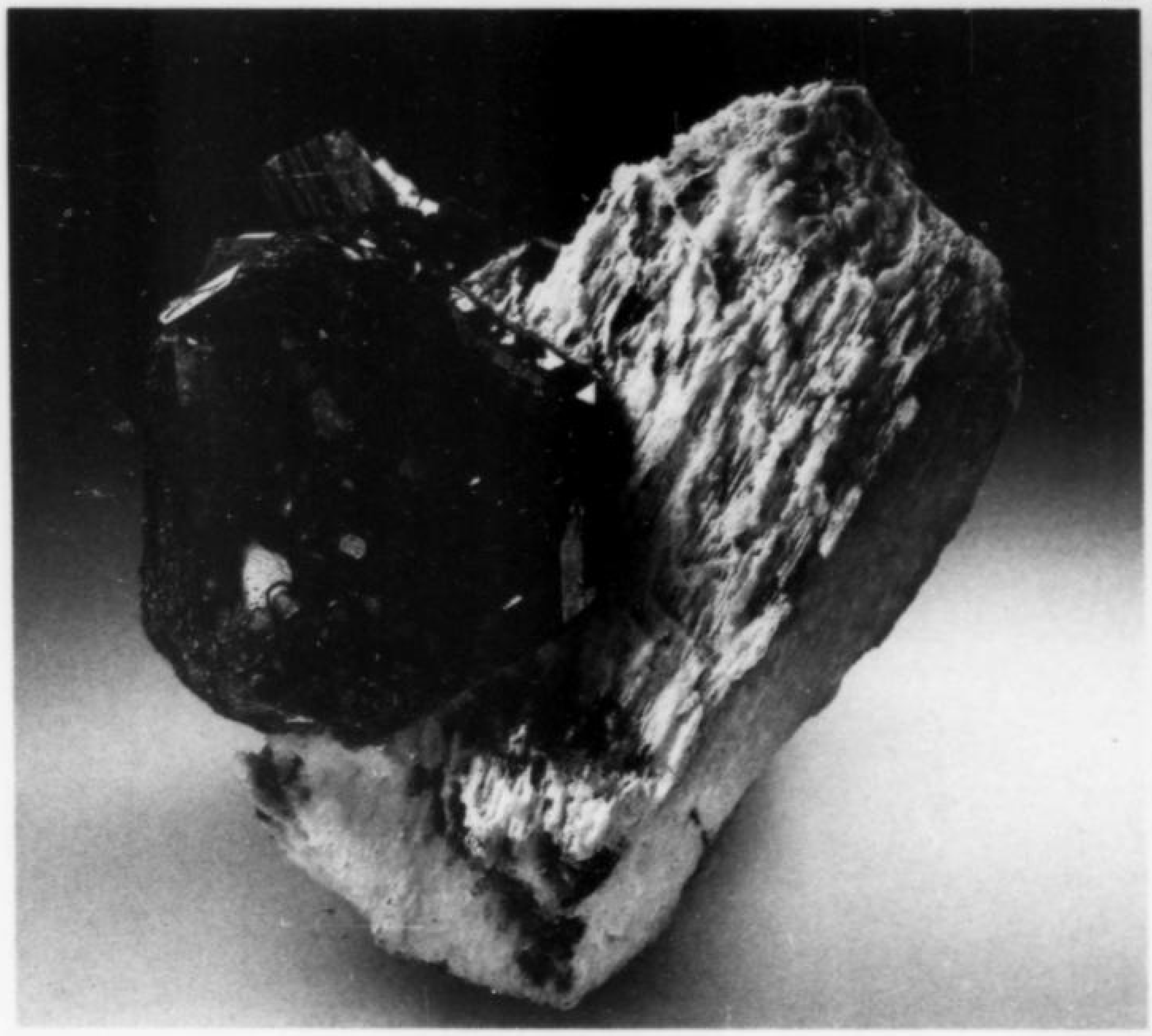

Figure 6. **Large apatite crystal, 4.2 cm, on spongy K-feldspar with muscovite. Valadares Minerals specimen.**

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Figure 7. **Apatite crystals to 2.7 cm, on feldspar. Don Olson specimen.**

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Figure 8. **Large apatite crystals to 6.5 cm. Valadares Minerals specimen.**

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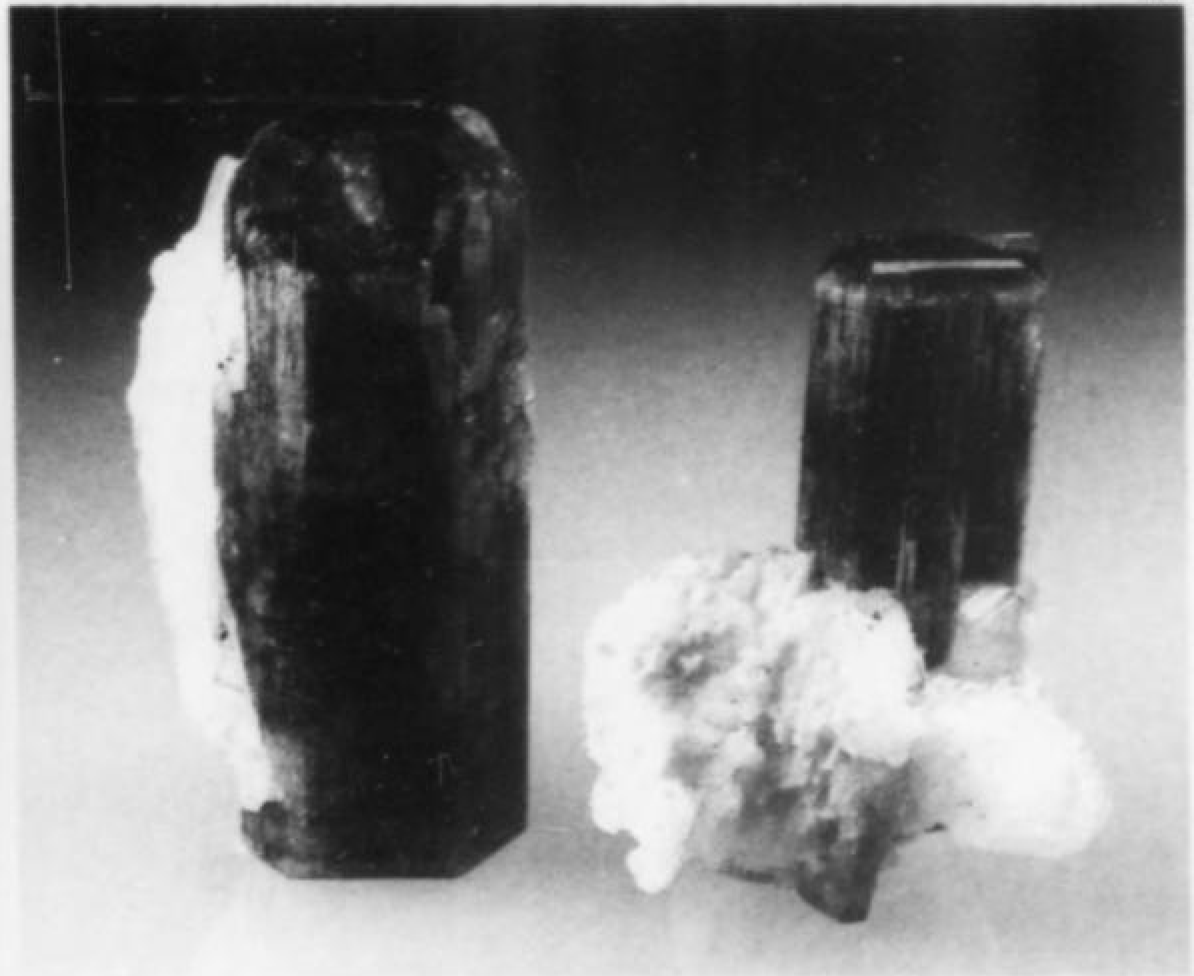

Figure 9. **Apatite crystals to 2.3 cm with blue overgrowth zones, on white feldspar. Carlos Barbosa specimen.**

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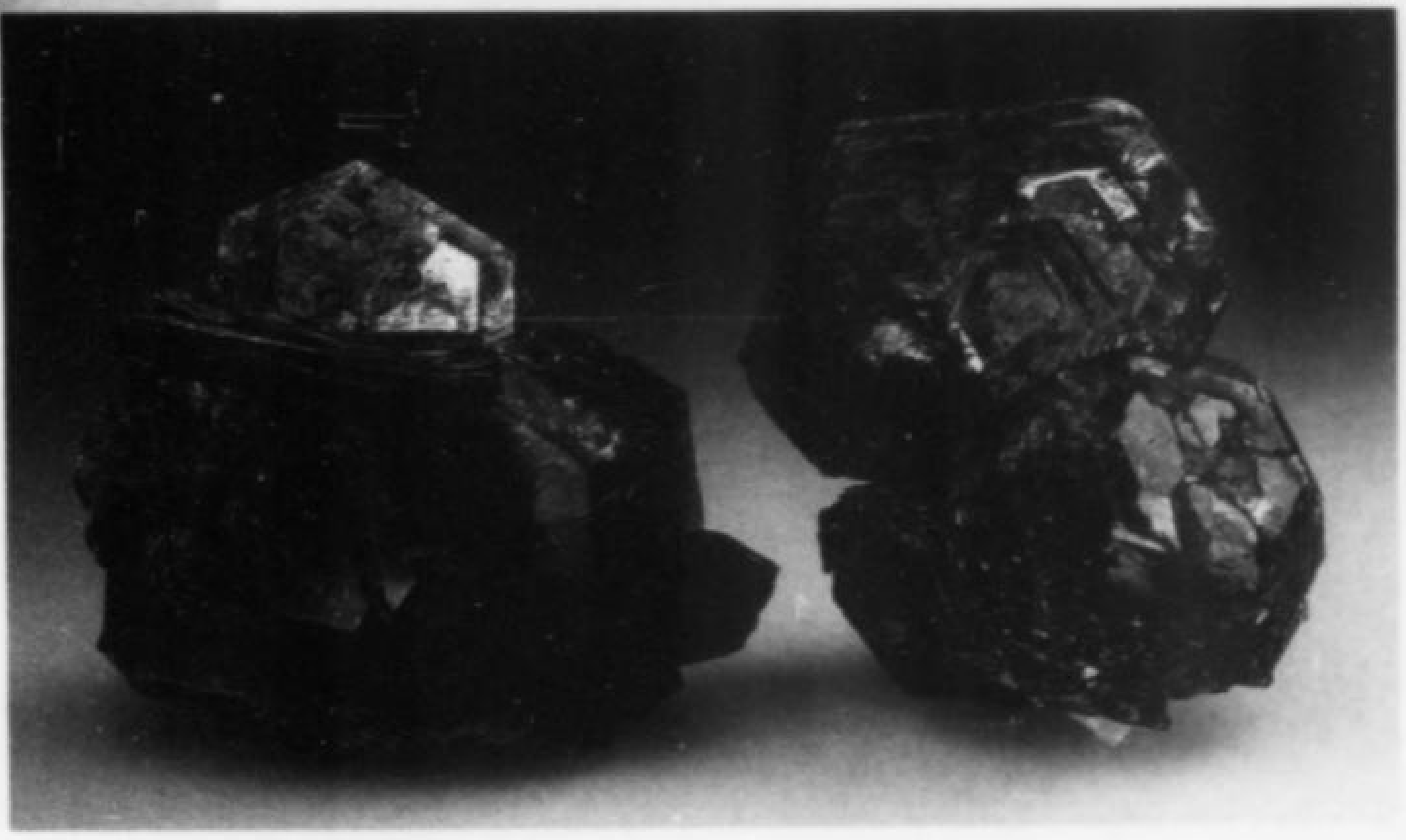

Figure 10. **Muscovite crystals to 4.2 cm on apatite. Valadares Minerals specimen.**

GEOLOGY

Terrain in the area of the deposit consists of low grass-covered hills broken by beautiful, barren "sugar loafs," with small patches of forest in the gulches. Extensive cattle farming and agriculture are restricted to the valleys.

Geologically the local rocks are Middle Precambrian members of the Brazilian basement complex, 2,500 to 1,800 million years old. Almost all outcrops are phacoidal gneiss.

The pegmatite crops out in a gulch on the western slope of a low hill overlooking the Santa Elisa farm buildings. Following removal of overburden, a wide adit 20 meters in length (as of October 1989) was driven, along which irregular stopes and small pits have been developed.

The pegmatite body strikes N40°E with a 30° NW dip. It is zoned, with a core of giant crystals surrounded by finer grained material containing schorl. Vugs, usually lenticular or flattened in shape and up to 2 meters in length, occur scattered through the core zone. These vugs are apparently controlled by fractures striking parallel to the pegmatite body but dipping 50° NW.

The vugs are typically lined with quartz crystals stained by iron and manganese oxides, mildly altered K-feldspar, and late muscovite and apatite crystals. Clay fills the remaining open spaces in the vugs, and must be removed from specimens.

MUSCOVITE

Muscovite occurs as whitish, silvery, pale amber to rose colored twinned plates up to 10 cm across. The crystals are roughly hexagonal and show some rosette-like development on the *c* faces. They occur singly and in interlocking groups to perhaps 20 cm. One thousand kilograms of crystals were recovered from a single pocket, the same pocket which yielded the best apatite crystals.

The rose-brown color shown in the more transparent areas of the crystals (and by transmitted light) suggested to some that it may be zinnwaldite, the lithium-iron analog of muscovite. However, electron microprobe analyses (Peter Modreski, personal communication) show that the Zé Pinto mica is muscovite with a low iron content (1.28 to 1.57 weight %, assuming all is present as FeO), only a slight deficiency in aluminum (for which iron and lithium substitute in zinnwaldite), and a low fluorine content of 0.18 to 0.29 weight % (compared to as much as 8.67 weight % ideally in zinnwaldite). Modreski thereby estimates lithium content as only 0.4 weight %, and offers no explanation for the reddish color. Manganese content was found to be very low (0.01 to 0.02 weight % MnO). Independent analyses by Cannon Microprobe in Seattle have confirmed these findings (Bart Cannon, personal communication).

APATITE

Early-formed apatite occurs as rounded, waxy, olive-green masses to 20 cm replacing garnet in the pegmatite; some rare, rounded dodecahedral pseudomorphs have been found.

Second-stage apatite is extremely well crystallized, and has made the locality immediately famous among mineral collectors. Zé Pinto apatites are reminiscent of crystals from Panasqueira, Portugal, though somewhat more opaque and elongated. The common forms are the first-order prism and basal pinacoid {0001}. In some cases the prism edges are bevelled by a second-order prism, and the pinacoid edges by one or two first-order and sometimes also by a second-order bipyramid. Some bipyramid faces are slightly hoppered.

Generally the prisms are up to 4 cm in length and 1 to 3 cm in diameter; larger crystals are rare. They occur singly and in intergrown groups without any preferred orientation. Surfaces may be smooth, or a complex mass of parallel terminations and faces. Color is bottle-green to dark green or black, and also pale blue to blue-green in thin late-stage overgrowths. Most crystals are somewhat translucent to opaque, and only rarely transparent on thin edges; all are internally fractured, and no faceting-grade material has been found. Secondary healing of fractures and overgrowth of fracture surfaces, two-phase inclusions, and flakes of a metallic mineral have been observed in crystals. Zoning is also common, and luster is typically brilliant, although the prism faces can be somewhat striated.

Apatite crystals occur in groups with muscovite and white feldspar, sometimes also with smoky quartz crystals. Powdery albite and tiny quartz crystals stud the surfaces of some apatites.

Over 100 kilograms of apatite crystals were recovered from the same large pocket which yielded the muscovite specimens. Hundreds of fine specimens have reached the mineral market, especially at the 1990 Tucson Show.

OTHER MINERALS

Quartz crystals, especially smoky quartz, have been collected in large specimens up to 50 cm across, with good, slightly tapered prismatic crystals to 20 cm. Some are doubly terminated. Some specimens have been tectonically fractured and rehealed to produce curved laths.

K-feldspar, probably microcline, occurs as white crystals 1 to 10 cm in size, although a few exceptional crystals were seen to reach a meter in length. The faces tend to be corroded and spongy, and are commonly stained by iron hydroxides.

Schorl occurs as crystals to 30 cm but always highly fractured and of no interest to collectors. An interesting myrmekitic intergrowth of quartz and schorl can be found on the dumps.

Garnet is common as opaque, rounded nodules to 10 cm, sometimes replaced by apatite, and enclosed in K-feldspar. The garnet, where freshest, is reddish brown in color, with $n = 1.828$, and is highly fractured.

Beryl was found in the residual soil before mining began.

Pyrite in friable masses is common.

Nontronite and secondary uranium minerals are uncommon.

Panning of the vug-filling clay-rich material yields granular iron hydroxides and manganese oxides, flakes of muscovite, fragments of tourmaline, magnetite, pyrite, and many small crystals of apatite, garnet and **zircon.** Discoidal apatite crystals, from a fraction of a millimeter to 2 mm, colorless and transparent, in single or twinned crystals and groups, are highly suitable for micromounting, as are the tiny zircon crystals. The zircons tend to be dull in luster, tan and opaque, and elongate prismatic with two acute pyramid termination forms; it is sometimes twinned.

ACKNOWLEDGMENTS

Our thanks to José Pinto for his friendly reception on the occasion of our visit to the prospect. Thanks also to Dr. Peter Modreski and Bart Cannon for analytical data; to Carlos Barbosa, Don Olson and Edson Endrigo for the loan of specimens to photograph; and to Dr. Wendell E. Wilson for the specimen photography.

CRYSTALLIZED ROSE QUARTZ FROM ALTO DA PITORA, MINAS GERAIS, BRAZIL

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Fine specimens of crystallized rose quartz have come previously from two principal locations in Brazil: the Sapucaia mine near Governador Valadares and the Taquaral district, both in Minas Gerais. Now a third important locality in eastern Minas Gerais has been discovered.

INTRODUCTION

A new occurrence for fine, crystallized rose quartz was discovered in eastern Minas Gerais, Brazil, in early 1989. According to Carlos Vasconcelos, a gem dealer from Governador Valadares, at least 1 metric ton of rose quartz crystals were recovered there during 1989, 100 kg of which is graded as superior in quality and color. The prospect is currently under lease by José Pinto, a miner and gem dealer from Governador Valadares; mining there is continuing.

LOCATION

The locality, known as Lavra (= "mine") da Pitora, is situated on the northern slope of the Serra da Piorra range, 8 kilometers east-northeast of the town of Galiléia, in the township of the same name. This is 53 km east-southeast of Governador Valadares, in the Rio Doce Valley. The Urucum pegmatite (Cassedanne, 1986), famous for lilac spodumene and pink beryl, is 4 km south-southeast, and the phosphate-rich Énio pegmatite (Cassedanne and Cassedanne, 1981), is 2 km north-northeast. Map coordinates are x = 240 and y = 7900 on the Itabirinha de Mantena map (SE-24-Y-A-V, 1/100,000, IBGE, 1979).

Access from Governador Valadares is by a partially paved road to Mantena, taking the fork toward Conselheiro Pena at the village of São Vitor (32.5 km). After proceeding 28.5 km along the road to Conselheiro Pena, a small but good road branches off to the left and runs to the villages of Laranjeiras and São Geraldo do Baixio. At

***Figure 1.* Location map.**

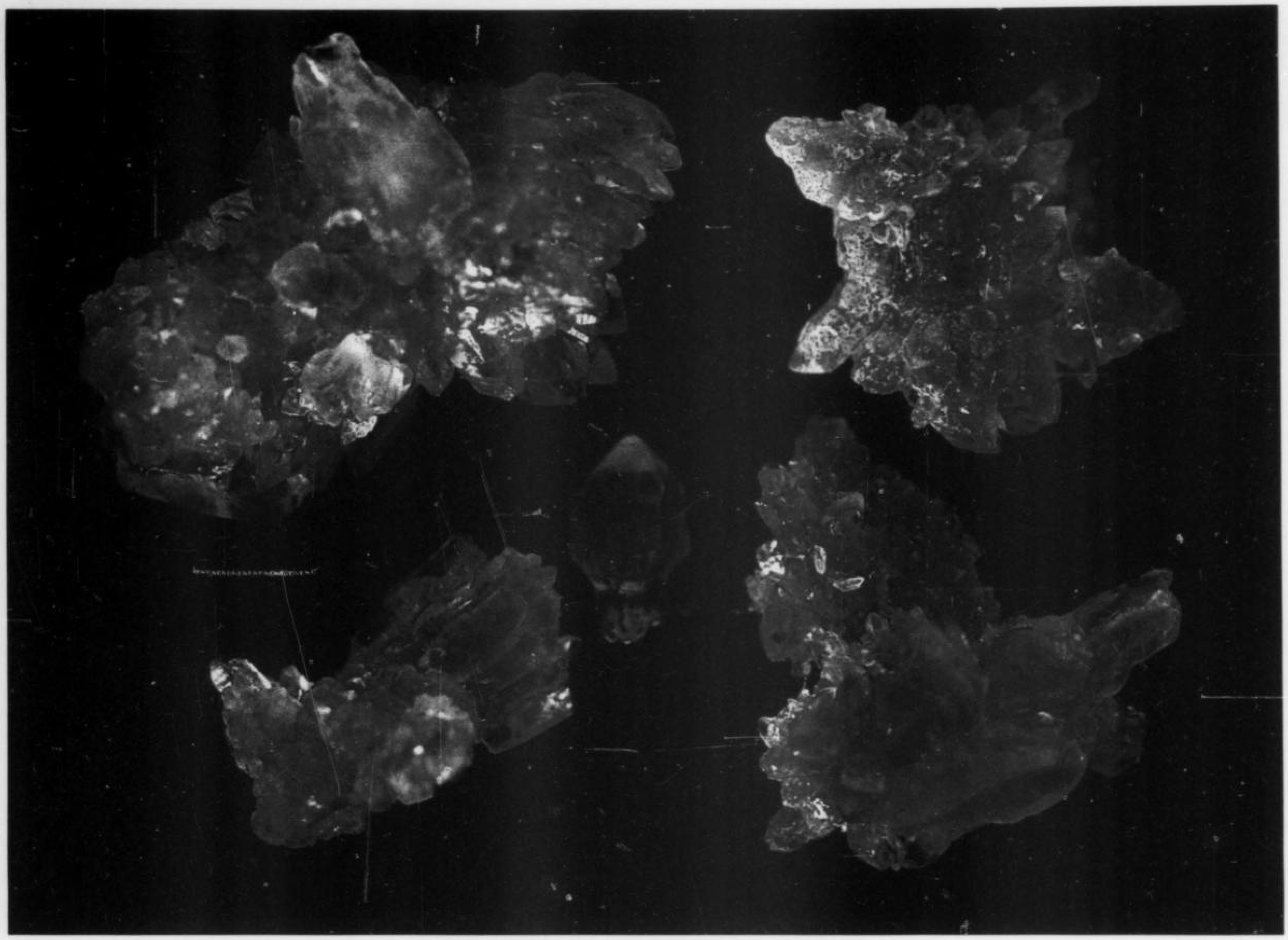

Figure 2. **Rose quartz specimens to 6 cm, from Alto da Pitora. Note single scepter crystal at center. Cassedanne photo and specimens.**

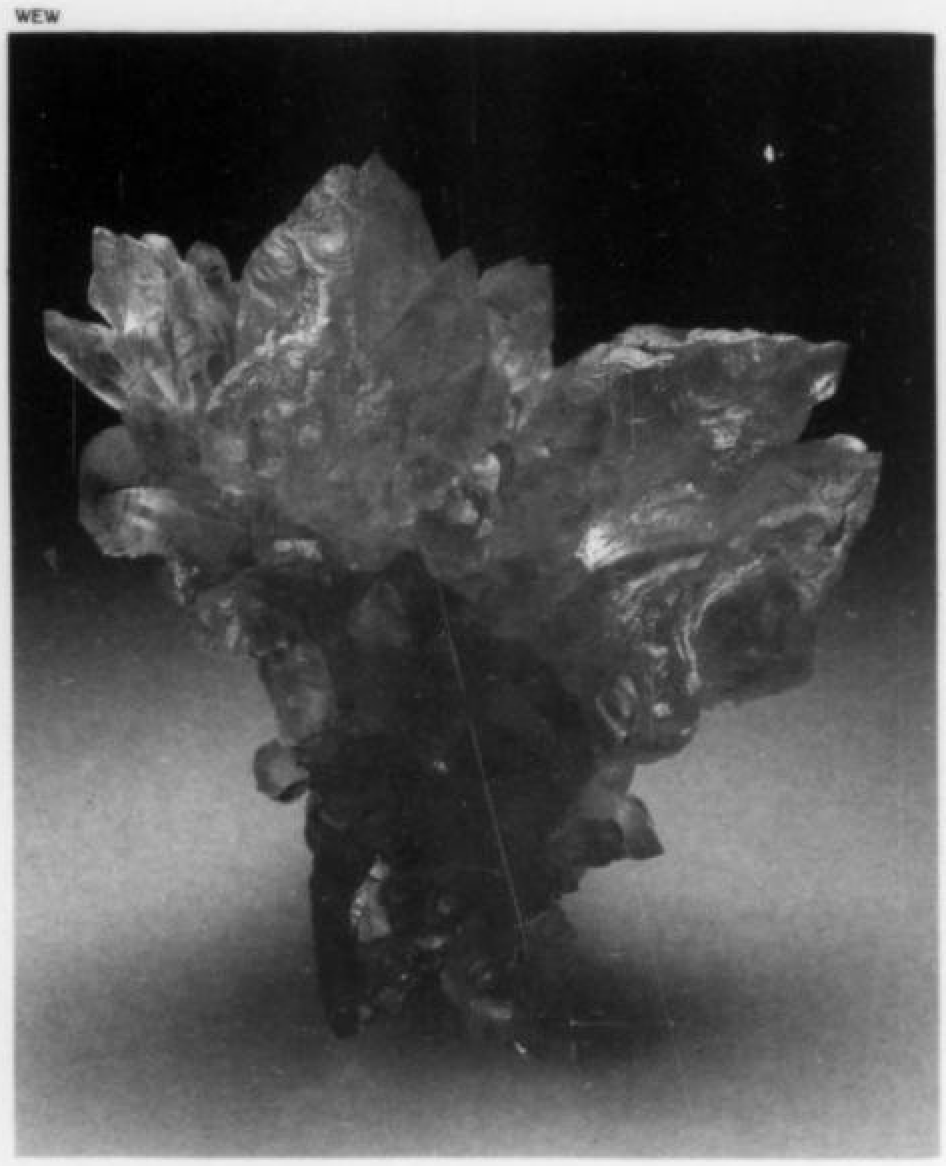

Figure 3. **Small spray of rose quartz crystals; 5.7 cm across. Mike Ridding specimen.**

Figure 4. **Rose quartz crown surrounding a pale smoky quartz crystal; 13 cm across. C. Vasconcelos specimen.**

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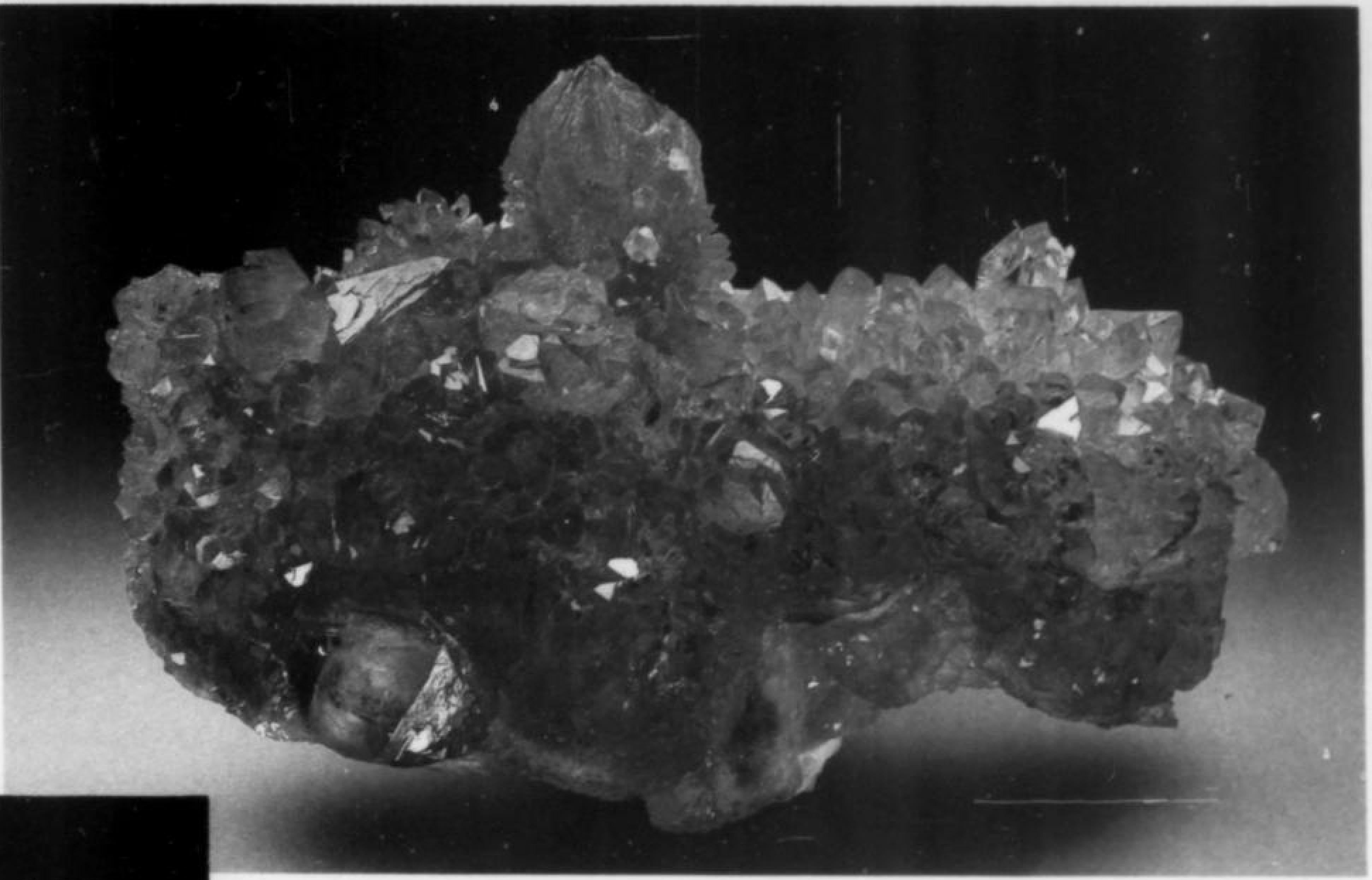

Figure 6. **Rose quartz overgrown around colorless to pale smoky quartz crystals; 14.8 cm. Mike Ridding specimen. Note black particulate inclusions at lower right, possibly tantalite or cassiterite.**

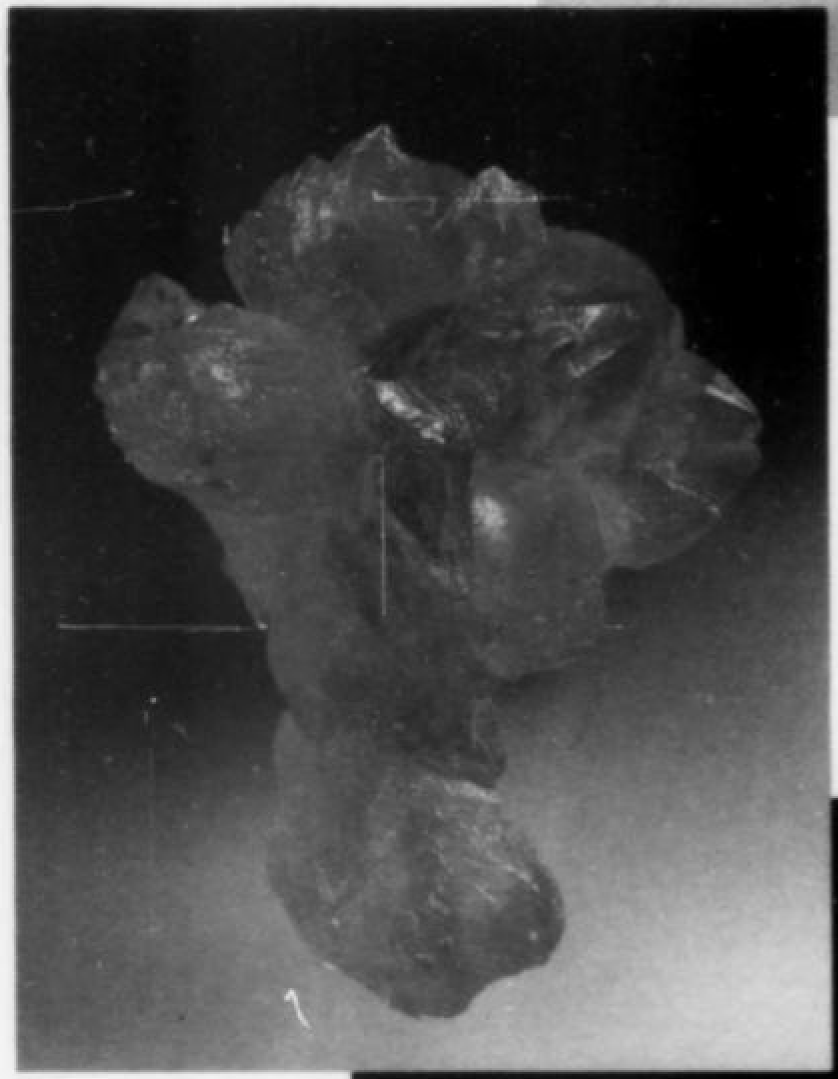

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Figure 5. **Small rose quartz group, 4.2 cm. C. Vasconcelos specimen.**

Figure 7. **Crown of rose quartz crystals partially surrounding a pale smoky quartz crystal; 11.2 cm. Roberts Minerals specimen.**

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10.5 km along this road a jeep trail forks to the right, leading to the Fazenda Laranjeiras farm buildings and from there toward the Sierra da Piorra at 2 km. From this point vehicles can proceed no further; a straight but steep footpath requiring a half-hour hard climb leads to the mine. Alternate access from the south is only possible with four-wheel-drive vehicles, making a rough climb over a bad jeep trail running upstream along Urucum Creek. The hiking necessary from this direction is tiresome.

GEOLOGY

Geologically the region is Lower Precambrian in age, with intrusions of Upper Precambrian granite. The topography consists of gently undulating mica-schist hills dominated by granitic inselbergs, "sugar loafs," and elongated ranges such as the Serra da Piorra (see Cassedanne and Cassedanne, 1981, for more details). Vegetation is mainly thick, high grass in the lowlands and clear, dry forest in the higher elevations. Deep weathering has made rock outcrops rare.

The deposit once produced gem-grade tourmaline from an extensive eluvium, but crystallized rose quartz production began only in the first days of 1989. The pegmatite has been worked by means of 20 or so adits along its length, some connecting with short cross-cuts, reaching up to 80 meters in length. These adits and irregular stopes and pits, frequently interconnected, exploit the pegmatite over a horizontal distance of about 300 meters, and to a depth of about 60 meters (elevation 440 to 500 meters).

The pegmatite body strikes northeast-southwest and dips nearly vertically. It varies in width from 1.5 to 5 meters, and is zoned. The outer zone is medium-grained, surrounding a tabular central zone composed of large K-feldspar crystals, spodumene laths to several tens of centimeters, and gray to milky quartz. Parallel fracture sets dipping gently northeast and 20° southeast cut the pegmatite body and contain small, elongate vugs. These vugs contain milky quartz crystals, hydrothermally altered K-feldspar, late albite and minor muscovite upon which are perched rose quartz crystals and groups. Iron and manganese oxides are widespread.

CRYSTALLIZED ROSE QUARTZ

Rose quartz occurs in radiating clusters, in groups of parallel to subparallel prisms, and as isolated, single crystals. Some groups form crowns or radiating bunches and rings surrounding colorless or pale smoky to citrine quartz crystals. The habit is similar to that found at the other Brazilian occurrences in the Taquaral district (Cassedanne and Cassedanne, 1973, 1980) and the Sapucaia pegmatite (Cassedanne, in press; Cassedanne and Roditi, in press). The crowns consist of small, doubly terminated crystals, in some cases with *c* axes oriented parallel to that of the core crystal, which is commonly a large milky or gray crystal of quartz.

Rose quartz crystals are also found on plates of milky quartz having etched faces; more rarely on K-feldspar; and exceptionally on muscovite as flat-lying or perpendicular crystals, flat rosettes and clusters.

Irregular and repeated variations in prism diameters have resulted in stepped growth features and small but perfect scepter crystals. Crystals having a single hexagonal base typically have multiple parallel terminations, or what appear to be curved faces. Variations in the intensity of the rose color are common, from nearly colorless to an intense pink.

A few translucent rose quartz crystals have been found to contain very thin, randomly oriented, sometimes curved rutile needles. Here and there clusters of small sericite flakes and albite plates occur scattered on rose quartz, along with tiny white quartz crystals and occasional films of chalcedonic quartz. The lack of associated phosphates and tourmaline is typical of the Pitora specimens, which are also frequently free of matrix.

Crystal groups of varying size have been recovered, commonly 5 to 10 cm across with individual rose quartz crystals to 2 or 3 cm across at maximum; most crystals are smaller. Large matrix specimens, consisting of rose quartz bunches on altered white feldspar, to about 30 cm have been recovered. The luster of the rose quartz varies from bright to frosty.

OTHER MINERALS

Skeletal **quartz** crystals to 30 cm, groups of flattened and doubly terminated quartz crystals, and single doubly terminated quartz crystals have been recovered. Some show growth anomalies, and nearly all are translucent to milky. Dark smoky and citrine quartz (some containing two-phase inclusions) are uncommon.

White K-feldspar (probably **microcline**) occurs in large singles and groups to several centimeters in size. Many of these are chalky on the surface and easily fractured due to hydrothermal alteration.

Albite (*cleavelandite*) has been found in fine groups of translucent to milky blades. Groups measuring several tens of centimeters have been recovered, sometimes coated by small muscovite platelets and rare pyrite crystals.

Hyaline **opal** with a vivid green fluorescence occurs on milky quartz.

Less common species found associated in the vugs include **amblygonite, beryl,** rare **lepidolite, cassiterite, tantalite** and **schorl.** Small black inclusions in some rose quartz groups are probably one of these latter three species.

ACKNOWLEDGMENTS

Our thanks to José Pinto for his friendly reception on the occasion of our visit to the prospect. Thanks also to Carlos Vasconcelos for information and for the loan of specimens photographed; to Ken Roberts and Mike Ridding for the loan of specimens; and to Dr. Wendell E. Wilson for the photography of the specimens shown here.

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ZANAZZIITE
A NEW MINERAL FROM MINAS GERAIS, BRAZIL

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ABSTRACT

Zanazziite is a new magnesium beryllium phosphate closely related to roscherite. It occurs as barrel-shaped crystals and crystal rosettes up to 4 mm, with colorless quartz, rose quartz crystals, and eosphorite in pockets in the Lavra da Ilha pegmatite, near Taquaral, in northeastern Minas Gerais, Brazil. Specimens, labeled "roscherite," are widely distributed. The mineral is named for Dr. Pier F. Zanazzi of the Universita degli Studi di Perugia, in recognition of his studies of the crystal structures and crystal chemistry of minerals.

Analysis gave P_2O_5 39.27, SiO_2 0.36, Al_2O_3 1.54, Fe_2O_3 0.76, CaO 10.65, MgO 11.66, FeO 9.63, MnO 1.77, BeO 9.81, H_2O 13.32, total 98.77 with BeO by atomic-absorption spectrophotometry; H_2O by H analyzer; FeO by titration; and other elements, including total Fe, by microprobe. Crystals show considerable zoning with respect to FeO and MgO. Formula:

$(Ca_{1.97}Mn_{.03})(Mg_{.61}Fe_{.40})_{\Sigma=1.01}(Mg_{2.38}Fe_{1.08}{}^{+2}Mn_{.23}Al_{.31}Fe^{+3}_{.1})_4$
$Be_4(P_{5.73}Be_{0.06}Si_{0.06})_{\Sigma=5.85}O_{24}(OH)_{3.4}\cdot 6.6\ H_2O$

or, ideally: $Ca_2Me^{+2}Me_4^{+2}Be_4(PO_4)_6(OH)_4\cdot 6H_2O$, where Me^{+2} indicates Mg, Fe, and Mn, with Mg > Fe. Monoclinic space group C2/c. a = 15.874(4)Å, b = 11.854(3)Å, c = 6.605(1)Å, β = 95°21(2)′, V = 1237Å^3, Z = 2. Strongest X-ray diffraction lines, in Å, with intensities and indices: 9.50 (90) (110), 5.91 (100) (020), 3.16 (70) (330), 3.05 (50) (510), 2.766 (50) (240), 2.682 (40b) (600), 2.208 (40), 1.642 (50b). Crystals are prismatic to bladed, generally rough to barrel-shaped, with the forms {100}, {110} and {001}.

Zanazziite is pale to dark olive-green, with a vitreous to slightly pearly luster. Cleavages are on {100} good, and {010} distinct. The mineral is nonfluorescent. Density = 2.76 measured, 2.77 calculated; Mohs hardness is about 5. Optically biaxial +, α = 1.606, β = 1.610, γ = 1.620, $2V_z$ = 72° (65° calc) X = b, Z:[100] = 3° in obtuse β; cleavage fragments give an almost perfectly centered BXA figure. $1 - K_p/K_c = 0.0067$.

INTRODUCTION

A mineral identified as roscherite on the basis of X-ray diffraction data was reported from the Lavra da Ilha pegmatite in Minas Gerais, Brazil, by Cassedanne and Cassedanne (1973). A crystal of this mineral was used by Fanfani *et al.* (1975) for a crystal structure determination. Although roscherite is a Mn/Fe mineral (Lindberg, 1958), Fanfani *et al.* (1975) concluded that the Lavra da Ilha mineral contains mostly Mg with less Fe and just a little Mn, as well as substantial Al. They obtained the most satisfactory structural refinement with a Mg:Fe ratio of 7:3. Our investigations, described in this paper, show that the Lavra da Ilha mineral is an essentially Al-free Mg mineral related to roscherite, and is thus a new species. It is named zanazziite, after Dr. Pier F. Zanazzi of the Universita degli Studi di Perugia, in recognition of his substantial studies of the structural crystallography and crystal chemistry of many minerals, including this one. The name and description have been approved by the Commission on New Minerals and Mineral Names of the International Mineralogical Association. The holotype specimen, #R17847, is preserved at the Smithsonian Institution. This specimen also provided the crystal on which Fanfani *et al.* (1975) made their structure determination. Numerous specimens of zanazziite have been collected and are widely distributed in public and private mineral collections throughout the world.

OCCURRENCE

The Lavra da Ilha pegmatite and its minerals have been described by Cassedanne and Cassedanne (1973). The pegmatite outcrops in the bed of the Jequitinhonha River, in Itinga municipio, near Taquaral, in northeastern Minas Gerais, Brazil. The pegmatite appears structurally simple, with a wall zone rich in feldspar and muscovite, and a quartz core. Near the core margin are small pockets and fissures which contain quartz crystals and a number of phosphate minerals.

The quartz crystals are large and colorless but cloudy, with faces commonly covered with a thin, milk-white to rose-colored film of drusy quartz. It is usually upon this film and on rose quartz crystals that zanazziite has grown in pale to dark olive-green, translucent crystals which tend to resemble pyromorphite in habit, although showing inclined terminal faces as a consequence of being monoclinic. Individual crystals of zanazziite are barrel-shaped, up to 4 mm long and 1 to 2 mm in diameter. Multiple crystals vary from simple groups of subparallel individuals to divergent sprays resulting in hemispherical forms. The faces making up the sides of the "barrels" are glassy and curved; the ends are dark green, frosted in appearance, and consist of a complex mosaic of terminal faces. Zanazziite also occurs in bladed crystals of similar morphology, but these are less common.

In addition to the large, cloudy quartz crystals, other minerals earlier than zanazziite in the pockets are albite, muscovite, rose quartz in crystals, and wardite. Eosphorite is roughly contemporaneous with zanazziite; even after careful study, the temporal relationship remains obscure. Eosphorite occurs in crystals, usually similar to those of zanazziite in size, but sometimes much larger. They are elongate, transparent and golden brown in color, and occur in individual crystals, sprays, and druses. Other late minerals include apatite crystals in small radial clusters, pyrite, which forms minute druses on zanazziite and tiny isolated crystals and crystal groups on eosphorite, albite, and Mn oxides in thin films and smudges.

***Figure 1.* SEM photograph of zanazziite crystals, showing the common pseudohexagonal morphology. The largest crystal is about 0.4 mm in length. NMNH #R17847.**

CHEMISTRY

Zanazziite, NMNH specimen #R17847, was analyzed with an ARL-SEMQ microprobe, operating at 15Kv and 0.15 μA, with an electron beam approximately 1 micron in diameter. Corrections were made using a modified version of the Magic IV program. The standards were Durango apatite for P, Rockport fayalite for Mn, and Kakanui hornblende for all others. Background corrections were included. Beryllium was determined on a separate sample of 84.93 mg by atomic-absorption spectrophotometry. Water was determined using an H analyzer on duplicate samples of about 25 mg. A microprobe analysis was made on a different (cotype) specimen, NMNH #154805, supplemented with an FeO determination by titration. Spectroscopic analysis and a general microprobe scan showed that no elements other than the ones reported were present in other than trace amounts.

***Table 1.* Chemical analyses of zanazziite and roscherite.**

Oxide	Zanazziite NMNH #R17847	Zanazziite NMNH #123018	Zanazziite NMNH #154805	Roscherite NMNH #C6719
P_2O_5	39.27	38.36	38.30	39.09
SiO_2	0.36	—	0.22	0.01
Al_2O_3	1.54	1.03	1.45	0.47
Fe_2O_3	0.76	—	0.8**	—
CaO	10.65	10.11	10.05	10.63
MgO	11.66	9.85	8.80	6.99
FeO	9.63	8.91*	9.40**	20.52*
MnO	1.77	2.26	3.66	1.32
BeO	9.81	—	—	—
H_2O	13.32	—	—	—
Total	98.77			

— Indicates not determined.
* Total Fe.
** By titration.

The analytical results are presented in Table 1. The analysis of the type specimen represents the average of a total of 25 spot analyses made on four grains. Fe is divided between ferrous and ferric states based on Fe^{+2}:Fe^{+3} ratio of 14:1 determined by titrimetric analysis. The second analysis in Table 1 is of another (cotype) specimen of zanazziite in the Smithsonian collection (NMNH #123018). Although there are differences between the analyses of this specimen and of the holotype (NMNH #R17847), these differences are not greater than the variations within the holotype sample itself.

ZONING

Four traverses with the microprobe were made over a single zanazziite crystal mounted in section parallel to the long direction (*c* axis). These were run across the crystal in two directions at four different locations as shown in Figure 3. The *c* axis is parallel to scans 1 and 2. As is the case with associated eosphorite (White, this issue, p. 418–422), zanazziite is dramatically and complexly zoned, and a number of interesting observations can be made from the results of the analyses:

(1) The first part of the crystal that grew, near the start of scans 1, 2, and 3, contains the least iron. The analyzed crystal contained approximately 4% iron oxide upon initial crystallization. (All Fe is calculated as FeO.)

(2) The FeO content quickly climbed to about 10%, from which level it varied somewhat, reaching a maximum of about 13.5% and dropping to nearly 4%. MgO varies between 8 and 12%. Magnesium and iron show a strongly but not perfectly inverse relationship. This pattern is supportive of the model that the two elements substitute extensively for each other but do have some preference for different sites in the structure.

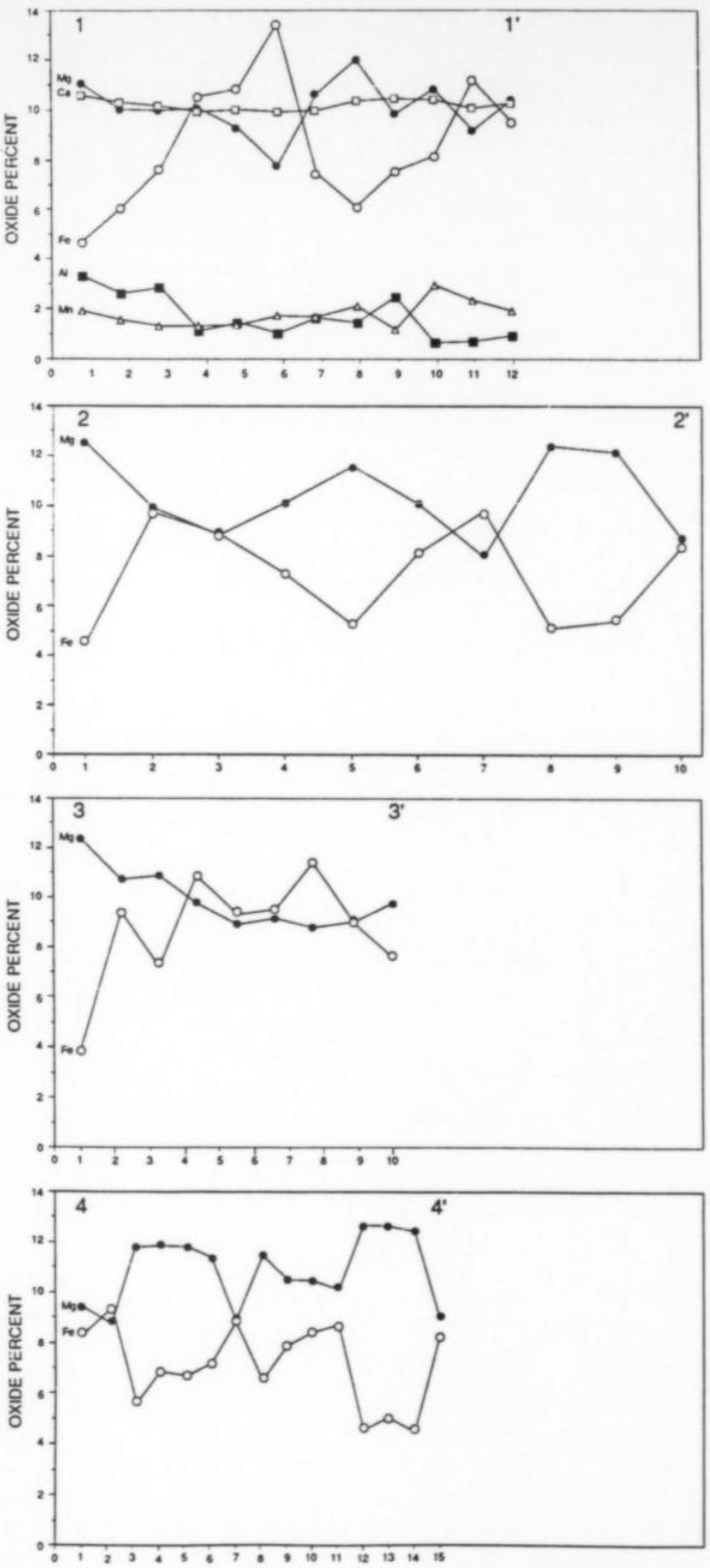
(3) There is very little variation in the other metals in zanazziite. Al_2O_3 is slightly enriched at the outset of growth, where the iron is at its least, beginning at about 3.3% and falling to a rather consistent 1.5 to 2% from there on. CaO and MnO are remarkably consistent at about 10% and 1.75%, respectively. Al, Ca and Mn analyses were included in all of the traverses but the results were so similar that they are shown in Fig. 2 for 1-1′ only.

FORMULA

Deriving the formula of zanazziite was a complex task. For their structural analysis, Fanfani *et al.* (1975) had only partial chemical data, which suggested that the mineral has significant Al. They thus interpreted their electron density information to derive the formula:

$$Ca_2(Al_{1.33}\square_{.67})(Mg,Fe)_4Be_4(PO_4)_6(OH)_6\cdot 4H_2O$$

with Mg:Fe = 7.3 and Al randomly occupying ⅔ of a site of rank 2, called M(2) in this paper. The □ indicates that ⅓ of the M(2) site is vacant. In a later paper on a triclinic roscherite, Fanfani *et al.* (1977)



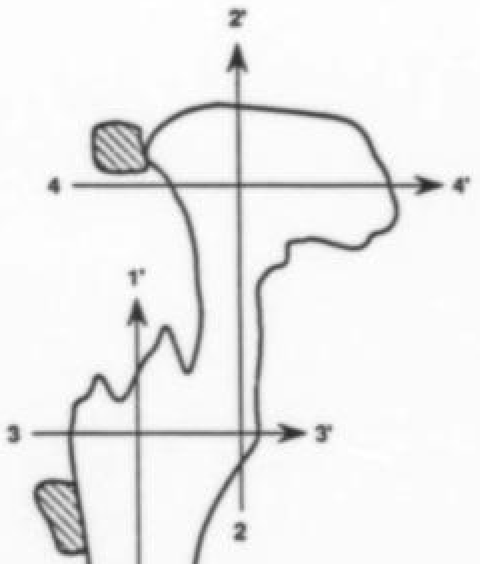


Figure 2. **Graph showing results of microprobe scans for Ca, Mg, Fe, Mn and Al across a zanazziite crystal, NMNH #R17847.**

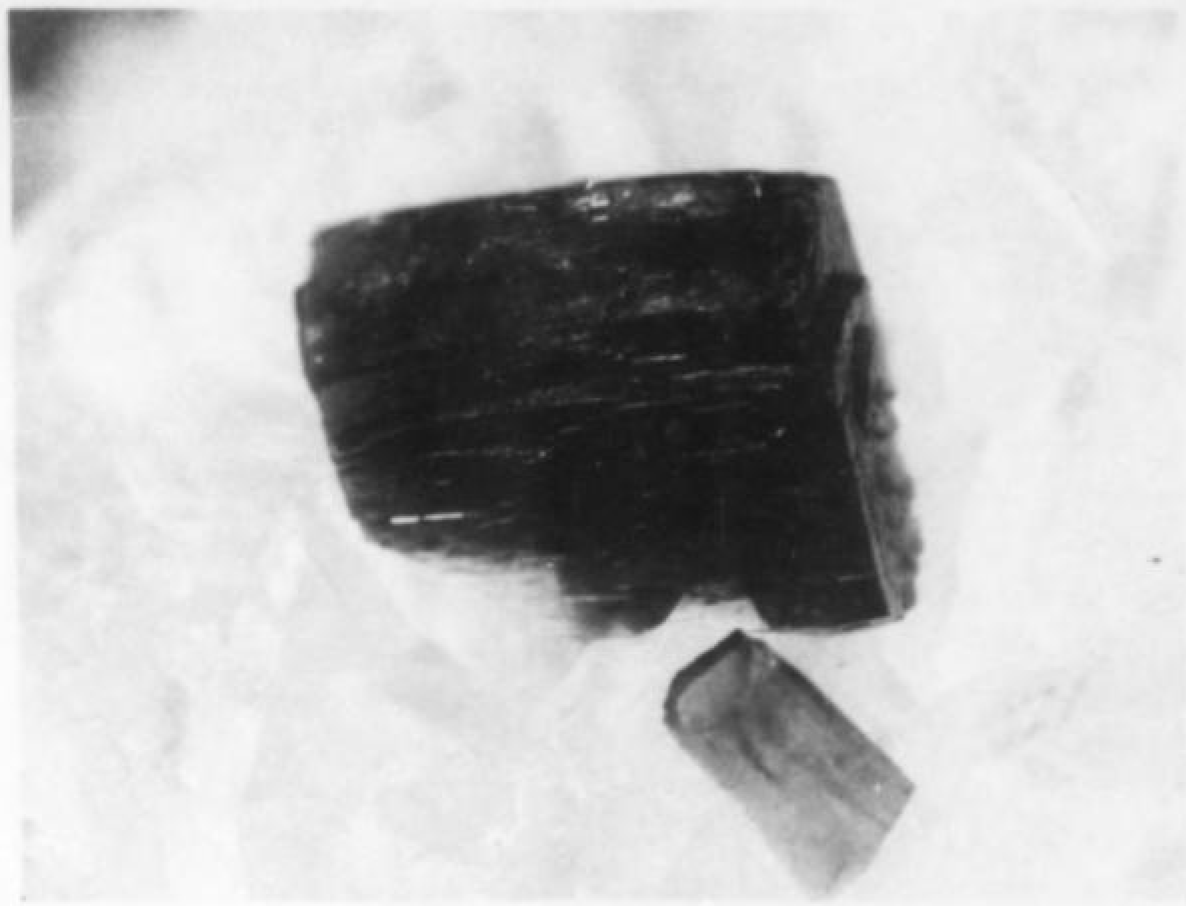


Figure 3. **Zanazziite crystal, 4 mm, on rose quartz, from Brazil. USNM #154810. Dan Behnke photo.**

Figure 4. **Zanazziite crystal aggregate, 2.8 mm across, from Brazil. USNM #155707. Dan Behnke photo.**

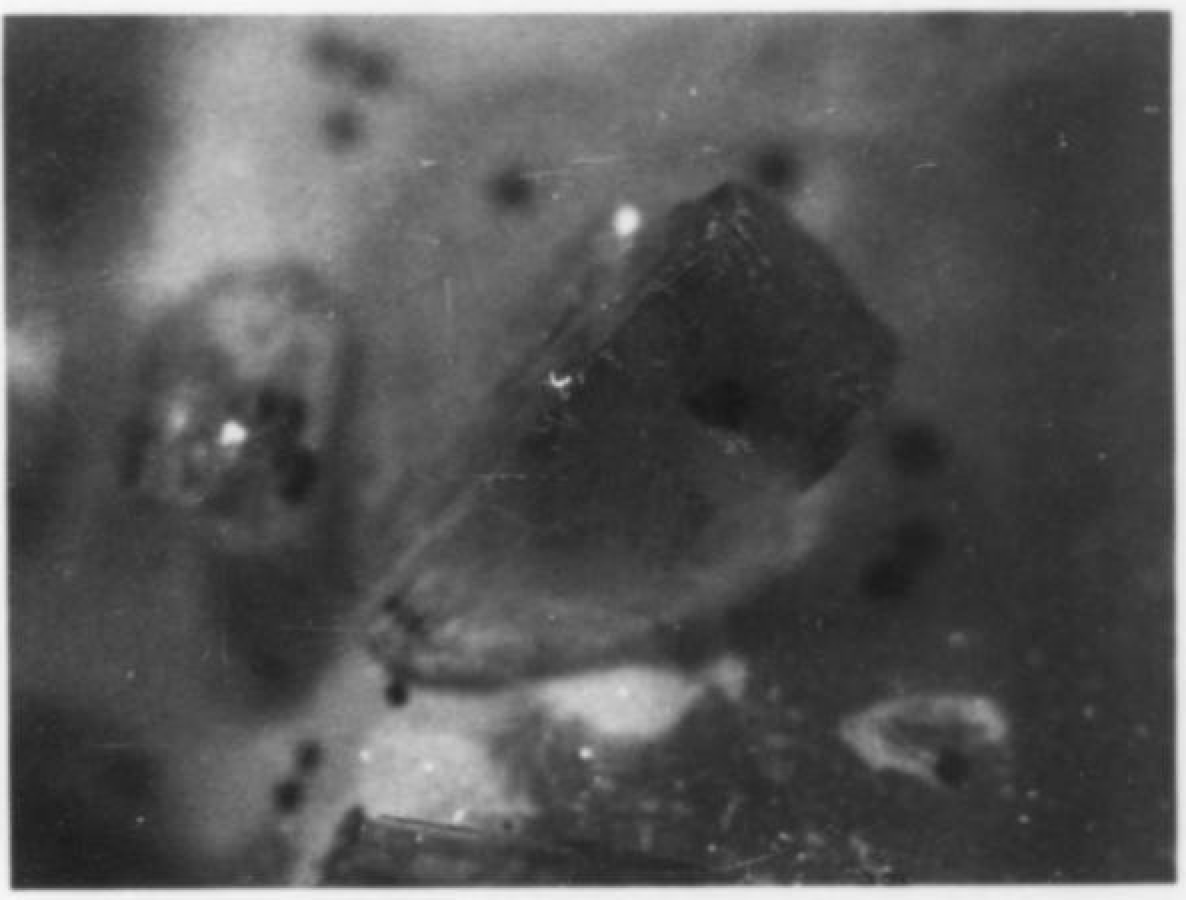


Figure 5. **Zanazziite crystal, 1.4 mm, from Brazil. NMNH #155707. Photo by Dan Behnke.**

concluded that roscherite might also contain only divalent cations (indicated by Me^{+2}) in M(2) and proposed a possible roscherite-type formula:

$Ca_2(Me_1^{+2}\square_1)Me_4^{+2}Be_4(PO_4)_6(OH)_4 \cdot 6H_2O$

In fact, zanazziite contains little Al^{+3} and the Fe is almost entirely divalent Fe^{+2}, as shown by the chemical analysis. In a structure analysis, the actual atoms cannot be resolved. The X-rays are scattered by the electrons of the atoms, and the structure analysis derived from the X-ray scattering or diffraction data provides an estimate of the number of electrons associated with each atomic site. The formula proposed by Fanfani *et al*. (1975) is equivalent to 17.3 electrons in M(2) and 64.8 electrons in the general Mg-Fe site or M(1). If we assume that M(1) is fully occupied by four atoms, we can derive the formula for NMNH #R17847, based on 34 oxygen atoms on the structure:

$(Ca_{1.97}Mn_{.03})(Mg_{.61}Fe_{.40})_{\Sigma=1.01}(Mg_{2.38}Fe_{1.08}^{+2}Mn_{.23}Al_{.31}Fe_{.1}^{+3})_4$
$Be_4(P_{5.73}Be_{0.06}Si_{0.06})_{\Sigma=5.85}O_{24}(OH)_{3.4} \cdot 6.6H_2O$

This provides a number of electrons in M(1) and M(2) close to that determined by Fanfani *et al*. (1975) and the number of H ions to match the chemical analysis for H as well as providing charge balance. The sum of the analysis is a bit low, and there are some minor problems with the derived formula, notably with the tetrahedral site occupied by P. There are some vacancies indicated in the site, since the atoms should add to six, and the substitution of Be and Si for P is very unusual. The vacancies could be eliminated by putting some Al in the site, but although Al substitutes commonly for Si in silicates, it is not known to substitute for P in phosphates.

There is also some uncertainty about the distribution of the various cations between the M(1) and M(2) sites. The M(2) site is highly distorted, with two Me-O distances about 2.27 Å, two about 2.53 Å, and the two Me-OH bonds 1.73 Å. This would suggest that only very small or highly distorted atoms could fit in the site. However in triclinic roscherite, the M(2) site is split in two, with one half being largely occupied and the other vacant. The splitting of the M(2) site causes the change to triclinic symmetry. In the triclinic roscherite, the occupied site has distances of 2.20, 2.48, and 2.00 Å, much less distorted, and suitable for Fe^{+2}, which is compatible with somewhat distorted octahedral sites of about this size. The distances observed in monoclinic roscherite may be an average for the occupied and unoccupied sites. Such an average would give a "fuzzy" picture of that part of the structure, which would appear as a high temperature factor for the OH involved in the site. This is in fact what Fanfani *et al*. (1975) observed. It is on this basis that Fe^{+2} rather than Mn is assigned to the site, with the proportions of Fe^{+2} and Mg^{+2} calculated to match the electron density observed by Fanfani *et al*. (1975). The placement of Al^{+3} and Fe^{+3} is also uncertain, but since they are smaller than Mg^{+2}, it seems reasonable to place them in M(1), the smaller of the two sites.

Despite these minor problems, the formula fits the chemical data and the structure well. The ideal formula for zanazziite is:

$$\mathbf{Ca^2Me^{+2}Me_4^{+2}Be_4(PO_4)_6(OH)_4 \cdot 6H_2O}$$

where Me^{+2} indicates divalent Mg, Fe, and Mn; with Mg > Fe or Mn. This is the formula suggested by Fanfani *et al*. (1977) as possible for a roscherite-type mineral. Some variation in the number of atoms in M(2) and therefore in the $OH:H_2O$ ratio is likely. This may also help account for the high temperature factor reported by Fanfani *et al*. (1975) for OH adjacent to the M(2) site.

Ironically, the relationship of this species to roscherite is a little uncertain because no authentic roscherite specimen has been studied in such chemical and structural detail as zanazziite. Zanazziite may be the magnesium analog of roscherite, which is rich in manganese or iron, or it may differ in the occupancy of M(2), the amount of Fe^{+3}, or the amount of OH and H_2O. The X-ray powder diffraction patterns of zanazziite and roscherite are very similar. The roscherite group minerals require further study.

ROSCHERITE AT THE TYPE LOCALITY

Not all of the specimens from Lavra da Ilha that give roscherite-type X-ray diffraction patterns are zanazziite. A remarkable spray of pale green crystals which approach 2 cm in length is in the Smithsonian collection. It was hoped that the specimen would be zanazziite because the great size of the mass of crystals would make it very easy to separate absolutely clean samples for analysis and measurement of physical properties. Unfortunately, in spite of its pale color, this sample (NMNH #C6719) is an Fe-dominant triclinic roscherite (see Fanfani *et al*., 1977). The microprobe analysis is given in Table 1. The crystals are complexly and irregularly zoned. Some sectors contain as much as 8% MgO and approach the zanazziite composition field. The minerals associated with this roscherite are earlier-crystallized albite and muscovite, along with later eosphorite and another generation of albite in very small and sharply developed crystals scattered sparsely over the roscherite.

***Table 2*. X-ray powder diffraction data for zanazziite; Gandolfi camera, CuK_α radiation.**

d	I	hkl
9.50	90	110
5.91	100	020
4.82	20	310
4.43	10	021
3.35	20	$13\bar{1}$
3.16	70	330
3.05	50	510
2.945	20b	040
2.852	10	$33\bar{1}$
2.766	50	240
2.682	40b	600
2.208	40	$15\bar{1}$, 710
2.159	20	350, $\bar{7}11$
2.031	20	351, $\bar{2}23$
1.974	20	800, 060
1.917	20	
1.769	20	
1.746	10	
1.692	10	
1.642	50b	
1.517	10	
1.490	10	
1.461	10	
1.430	10	

CRYSTALLOGRAPHY

Fanfani *et al*. (1975) determined the space group and unit cell of zanazziite as well as its crystal structure. Their results are summarized here. Zanazziite is monoclinic, space group C2/c. a = 15.874(4)Å, b = 11.854(3)Å, c = 6.605(1)Å, β = 95°21(2)′, V = 1237Å³, Z = 2.

X-ray powder diffraction data for zanazziite are given in Table 2; they are very close to the data given for roscherite by Lindberg (1958) and published on Powder Diffraction File Card 11-355. Least-squares refinement of these data gives the lattice parameters a = 15.850(13)Å, b = 11.850(6)Å, c = 6.652(7)Å, β = 95°55(4)′, in fairly good agreement with the parameters determined by Fanfani *et al*. (1975).

Single crystals of zanazziite are too uneven to permit satisfactory measurement of the interfacial angles and morphological relationships; however, morphologies appear similar to those reported by Lindberg (1958) for roscherite. Crystals of zanazziite are most commonly barrel-shaped and have major {100} and {110}. Faces of {001} are irregular and rounded. Less common bladed crystals have major {100}, minor {110}, and irregular, rounded {001}.

PHYSICAL PROPERTIES

Zanazziite is pale to dark olive-green, with a white streak. Its luster is vitreous but may be slightly pearly on cleavage surfaces. Its cleavage is {100} good, {010} distinct, in the orientation of Lindberg (1958) for roscherite. Zanazziite is nonfluorescent in longwave or shortwave ultraviolet light. Its measured density is 2.76 g/cm^3, calculated 2.77 g/cm^3. The Mohs hardness is about 5, judging from its resistance to scratching and breakage by a steel needle.

Optically, zanazziite is biaxial positive, $\alpha = 1.606$, $\beta = 1.610$, $\gamma = 1.620$, all ± 0.002, as measured with the Becke line method in Na light using a spindle stage. $2V_z = 72°$ (65° calc.), $X = b$, Z:[100] = 3° in obtuse β. Cleavage fragments give an almost perfectly centered BXA figure. Calculation of the specific refractive energies, with the analysis recalculated to 100%, using the Gladstone-Dale constants of Mandarino (1976), indicates good internal agreement of the data; $1 - K_p/K_c = 0.0067$.

ACKNOWLEDGMENTS

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ZONED EOSPHORITE FROM LAVRA DA ILHA TAQUARAL DISTRICT MINAS GERAIS, BRAZIL

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INTRODUCTION

Studies of compositional zoning within individual crystals became feasible, and even simple, when the electron microprobe first came into use. Prior to its appearance, detailed analysis of specific areas within microscopic crystals was virtually impossible. Nearly all published analyses of minerals were simply averages of the compositions of the various zones comprising their crystals. The microprobe made possible analyses of tiny spots down to 5 microns in diameter within crystals that are themselves very tiny. Furthermore, one could now traverse across a minute crystal with the probe's electron beam and continuously record changes in its composition. No longer was it necessary for mineralogists to settle for analyses equalling "average" compositions.

The earliest studies of compositional zoning in single crystals were performed on the rock-forming minerals, the silicates that comprise the most essential components of crustal rocks, because it was the petrologists who first recognized the potential of the microprobe for providing answers to geochemical riddles. Pyroxenes, feldspars and certain oxides were intimately probed, revealing fascinating patterns of compositional variations. In many cases important data resulted, which helped to shed light on the crystallization histories of the rocks that contain these minerals, and to elucidate the conditions under which they formed.

The fact that most natural crystals are zoned became apparent as these studies progressed. In nature, unlike the controlled environment of a laboratory, the conditions under which crystals form are rarely stable or uniform. Complex combinations of changes in solution chemistry, temperature, pressure, and pH all may contribute, individually or in unison, to assure that there are variations in crystals as they grow. No longer is it customary to regard the composition of a mineral as a fixed ratio of its component elements. We have begun to think of them more in terms of a record of compositional variation. When the variations in a crystal's chemistry have been analyzed in detail we may find that the crystal is one mineral in one microportion but a different one elsewhere, a fact that complicates the challenge of assigning an appropriate name. Seldom does the chemistry vary enough to encompass more than two species, but it is known to do so as with the plagioclase feldspars, a solid solution series wherein several of the six species comprising the series may be found occupying successive zones in one crystal. In such cases the compositional variation is usually one-directional, but examples of oscillating zoning with alternating calcium-rich and sodium-rich zones have been observed. Plagioclase was a favorable material for pre-electron microprobe studies of zoning because its crystals are relatively large and the differences in composition could be easily matched to readily determined optical properties.

Analyses of zoned crystals of late-stage pegmatitic pocket minerals are few, but this is an area of research that is bound to attract more attention. One reason for this is that changes in the growth conditions, especially temperature, pressure and the chemistry of the solutions, are often abrupt and extreme and the crystals in this environment readily respond to these changes.

LAVRA DA ILHA PEGMATITE

Specimens of beautiful eosphorite crystals perched on rose quartz and drusy white quartz have been known to occur at the Lavra da Ilha pegmatite since 1969 (Lucio, 1971). The diggings at the pegmatite are on an island in the middle of the Jequitinhonha River, about 3 km north of Taquaral, Minas Gerais, Brazil. There have been a number of published references to the minerals of this pegmatite. One of the earliest and best of these (Cassedanne and Cassedanne, 1973) provides an excellent description of the locality and the various species identified there up to that time. The associated minerals (besides quartz) that the Cassedannes mentioned include "roscherite," wardite, amblygonite, sphalerite, rockbridgeite, montgomerite, apatite and vivianite. What was then called "roscherite" has subsequently been recognized as a magnesium-dominant analog and has therefore been named zanazziite (Leavens *et al.*, this issue).

Subsequent examination of other specimens from Lavra da Ilha by this author and others has extended the number of associated species to include the Fe-dominant triclinic roscherite (Leavens *et al.*, 1990); both whiteite-(Ca) and whiteite-(Mn) (Moore and Ito, 1978)—this is the type locality for the pair; muscovite, which is quite common and may be found in crystals up to about 4 cm; albite, which is scarce; microcline, which is extensively etched; elbaite, which is notable for its extreme scarcity; and pyrite which occurs as exceedingly small, microscopic crystals on eosphorite, zanazziite and albite. Only three out of more than 100 specimens from the locality in the Smithsonian's collection contain elbaite. On two it is found as microscopic, hairlike, blue-gray inclusions in a large transparent quartz crystal fragment. The other is but a small section of very dark crystal embedded in whiteite. The only other evidence for tourmaline at this site appeared on the cover of the *Mineralogical Record,* volume 12, no. 6 (1981),

Figure 1. **Eosphorite from Lavra da Ilha, near Taquaral, Minas Gerais, Brazil. Thin section of divergent group of crystals in polarized light. Longest dimension from point to base is 19 mm. Smithsonian specimen, NMNH #155306. V. E. Krantz, photographer.**

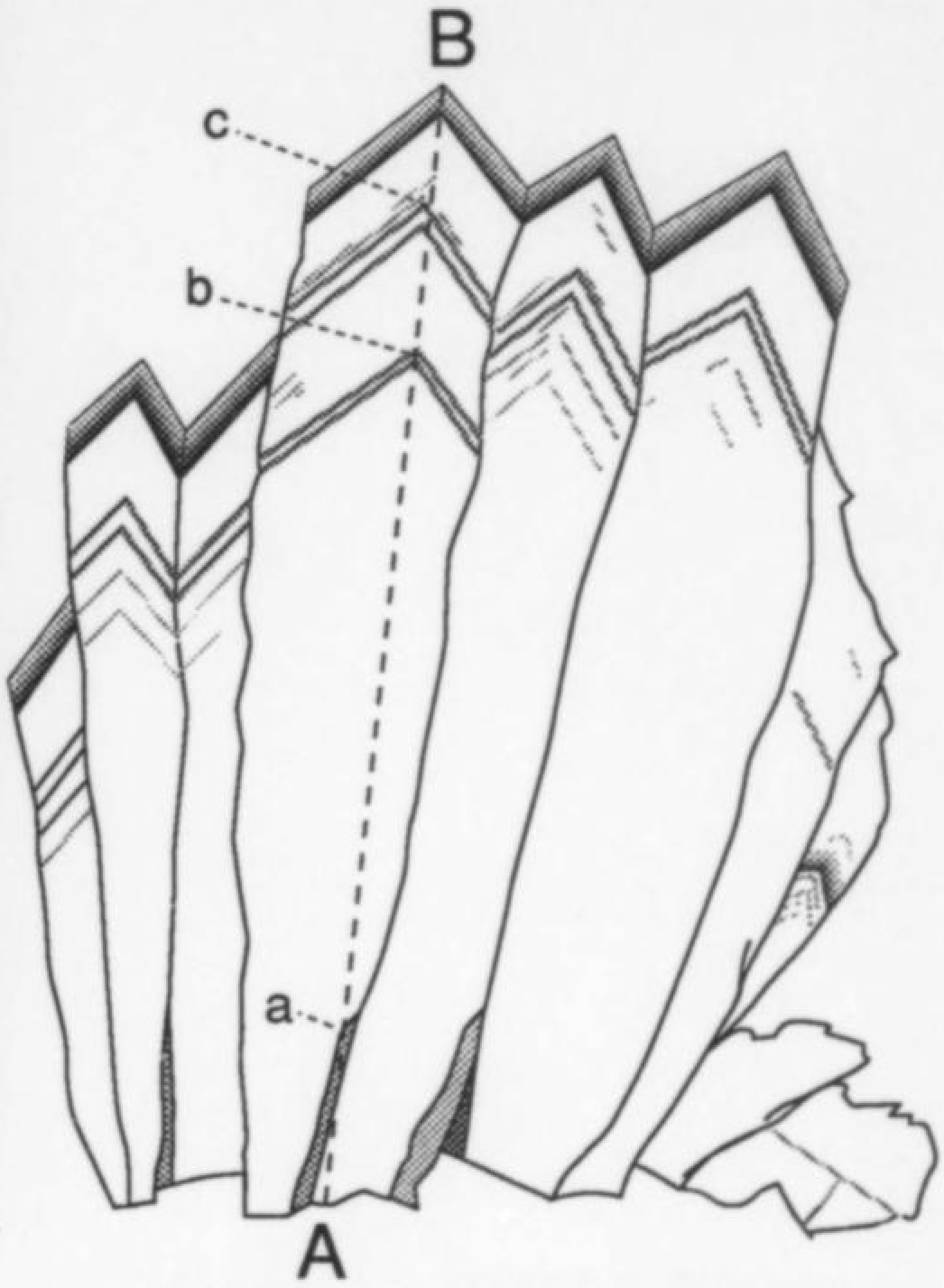

Figure 2. **Eosphorite, a sketch of thin-sectioned specimen #155306. Microprobe analysis followed traverse from A to B. Points *a*, *b* and *c* coincide with abrupt compositional changes revealed by sharp peaks in Figure 4.**

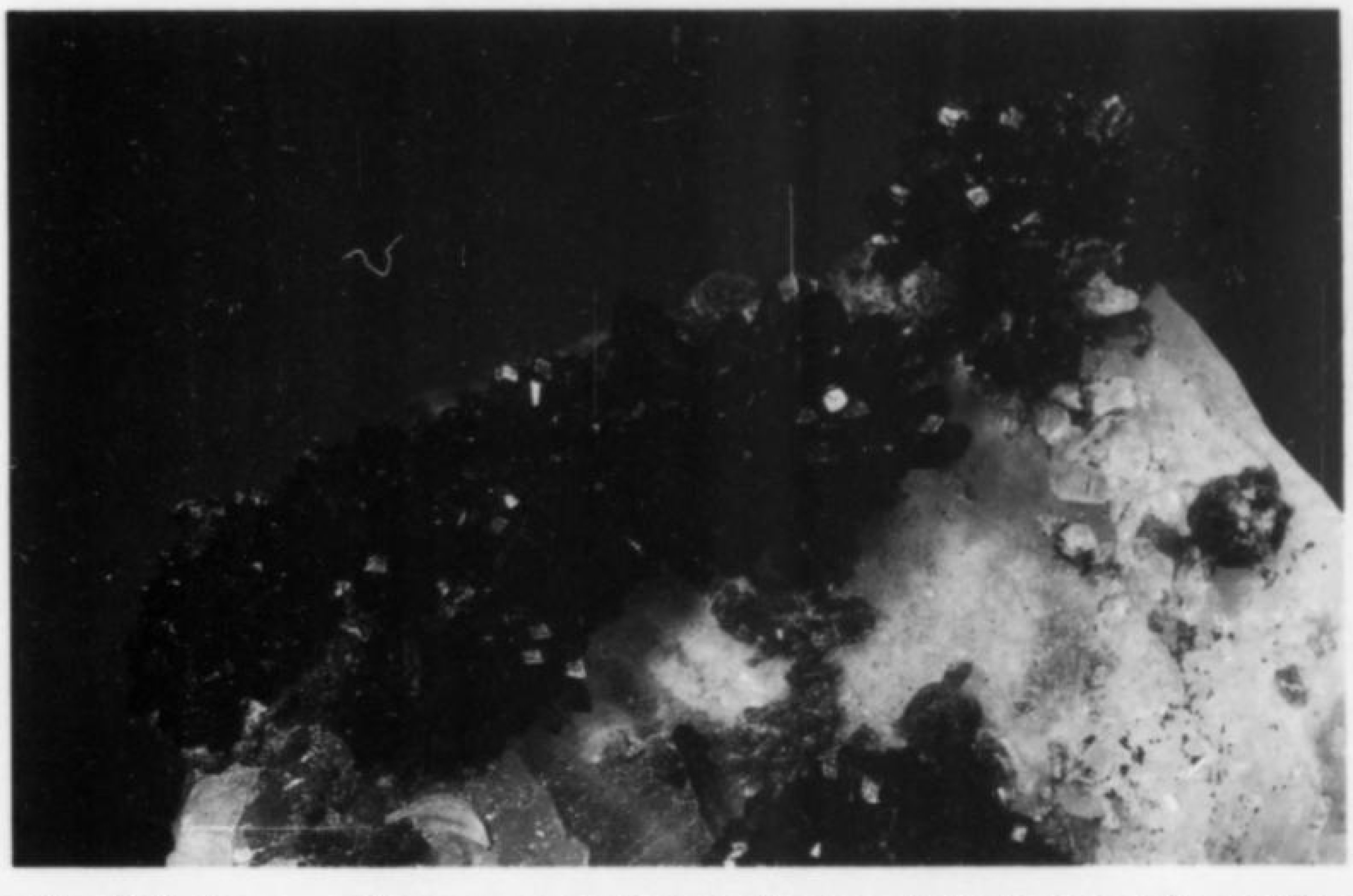

Figure 3. **Radial clusters of eosphorite with minor zanazziite on quartz, from Lavra da Ilha, near Taquaral, Minas Gerais, Brazil. A very typical habit for eosphorite at this locality. Specimen is 6 cm across. Smithsonian specimen, NMNH #123017. Breck P. Kent, photographer.**

in the form of a lovely photo (by Harold and Erica Van Pelt) of a group of rose quartz crystals said to be from Lavra da Ilha. Surprisingly, there are several sharp, black-looking crystals attached to the specimen and these most likely are tourmaline.

The quartz upon which most eosphorite and the other phosphates have grown warrants comment. It is observed in at least four distinctly different forms at this mine. What are unquestionably the earliest are normal, colorless to pale smoky crystals and shattered crystal pieces. These are always at least partially encrusted with wavy patterns of drusy white to pink quartz or thicker undulations of a porcelaneous-looking chalcedonic white to tan quartz. Often one will find thin plates of drusy quartz that have broken loose from quartz crystals, revealing impressions of the crystals upon which they formed. In some cases the undersides contain eosphorite and zanazziite crystals, indicating that they were broken away from their substrate before phosphate crystallization ceased. The rose quartz from Lavra da Ilha is rivalled in excellence only by a limited number of large and spectacular specimens from the famous Sapucaia del Norte pegmatite, near the village of Sapucaia, in the municipo of Galileia, Minas Gerais, and by some recently discovered specimens from Alto da Pitora near Governador Valadares, Minas Gerais (see Cassedanne and Alves elsewhere in this issue). The Lavra da Ilha groups are always small but they often have

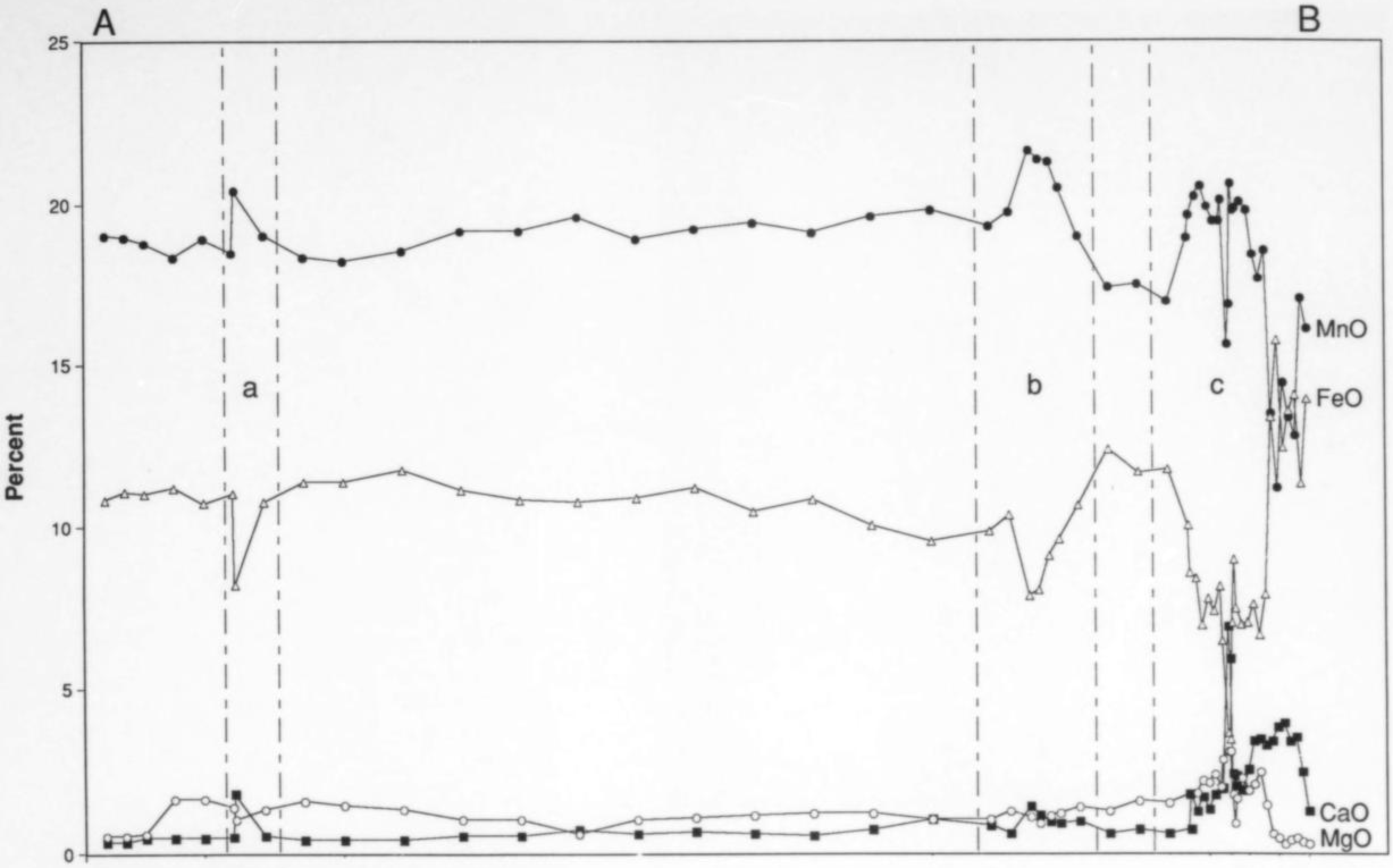

***Figure 4.* Graph showing pattern of zoning in eosphorite (NMNH #155306) as revealed by microprobe analysis. A continuous traverse was run from A to B. Points *a, b* and *c* are abrupt compositional changes that can be correlated with visible features in #1. The change at point *a* occurred when a portion of another crystal was encountered at the edge of the main crystal. Points *b* and *c* result from zoning which is readily apparent in #1.**

an intensity of color that is unequaled. Much of the rose quartz from this occurrence spreads out in blossom fashion from underlying colorless or slightly smoky crystals. Parallel and subparallel arrangements of crystals are also often seen. Crystal groups typically have eosphorite and zanazziite profusely or sparsely sprinkled over them, and fine sharp crystals of wardite are also relatively abundant.

There is still another pegmatite within the Taquaral district, in the municipo of Itinga, that produces lovely rose quartz crystal specimens resembling those of Lavra da Ilha (Cassedanne and Cassedanne, 1980). This is a newer mine, or prospect, known as Laranjeira or pegmatito do Ademar ("Ademar's pegmatite"). Its specimens are readily distinguishable from those of Lavra da Ilha because crystallized phosphates are never associated with them (Cassedanne and Cassedanne, 1980). These authors make the important distinction that crystallized wardite, while it does occur at this newer locality, is always found in vugs in hydrothermally altered potassium feldspar, not in direct association with rose quartz.

EOSPHORITE

In spite of the diversity of species found at Lavra da Ilha, eosphorite $(Mn,Al(PO_4)(OH)_2 \cdot H_2O)$ is by far the most abundant phosphate mineral. Eosphorite specimens from this locality are unquestionably the most dramatic and aesthetically pleasing ever found. An excellent photograph of eosphorite from Lavra da Ilha is shown on the cover of the *Mineralogical Record,* volume 7, no. 2 (1978) (photographer Olaf Medenbach). Individual crystals seldom exceed 2 cm; most are about 1 cm or less in length. The habit displayed in this photograph is very typical of much of the eosphorite. Eosphorite here has a tendency to form radial groupings in which the individual crystals are very distinct, as shown here, but it also forms denser groups that develop a spheroidal habit (Fig. 3). Equally common, however, are single blade-shaped crystals or several such crystals growing together in a subparallel manner (Fig. 1). When this habit predominates, the crystals tend to be spread randomly and point in all directions over their quartz matrix.

A portion of one of the dense clusters was selected for thin-sectioning and chemical analysis. It was analyzed with an ARL-SEMQ microprobe, operating at 15 Kv and 0.15 μA, with an electron beam approximately one micron in diameter. Standards employed were Kakanui hornblende for Fe, Mg and Ca, and Rockport fayalite for Mn. Corrections were made using a modified version of the Magic IV program. Aluminum and phosphorus were also determined but are not included in the discussion because their amounts did not vary meaningfully throughout the traverse. Figure 1 is a photograph of the sample taken with polarized light. The fan-like divergence of the crystals is immediately obvious, but just as obvious is the zoning that is particularly pronounced toward the ends of the crystals. These zones are so sharply defined that they suggest abrupt changes in the composition of the crystals, changes that could readily be detected through microprobe analysis. An analysis was performed along the traverse indicated by the dashed line A-B in Figure 2, and the results are presented in Figure 4. The graph shows that the crystal is mostly eosphorite with Mn:Fe about 2:1 except for two intervals where the Mn:Fe ratio jumps noticeably, one where it dips to about 4:3, another where it jumps to about 6:1 with a strong increase in Ca (which was otherwise at a constant concentration). Finally, near the end of the crystal's growth there are strong fluctuations in the composition with Mn and Fe exchanging dominance twice over a short interval, and ending with a composition very close to Mn:Fe = 1:1. This is ac-

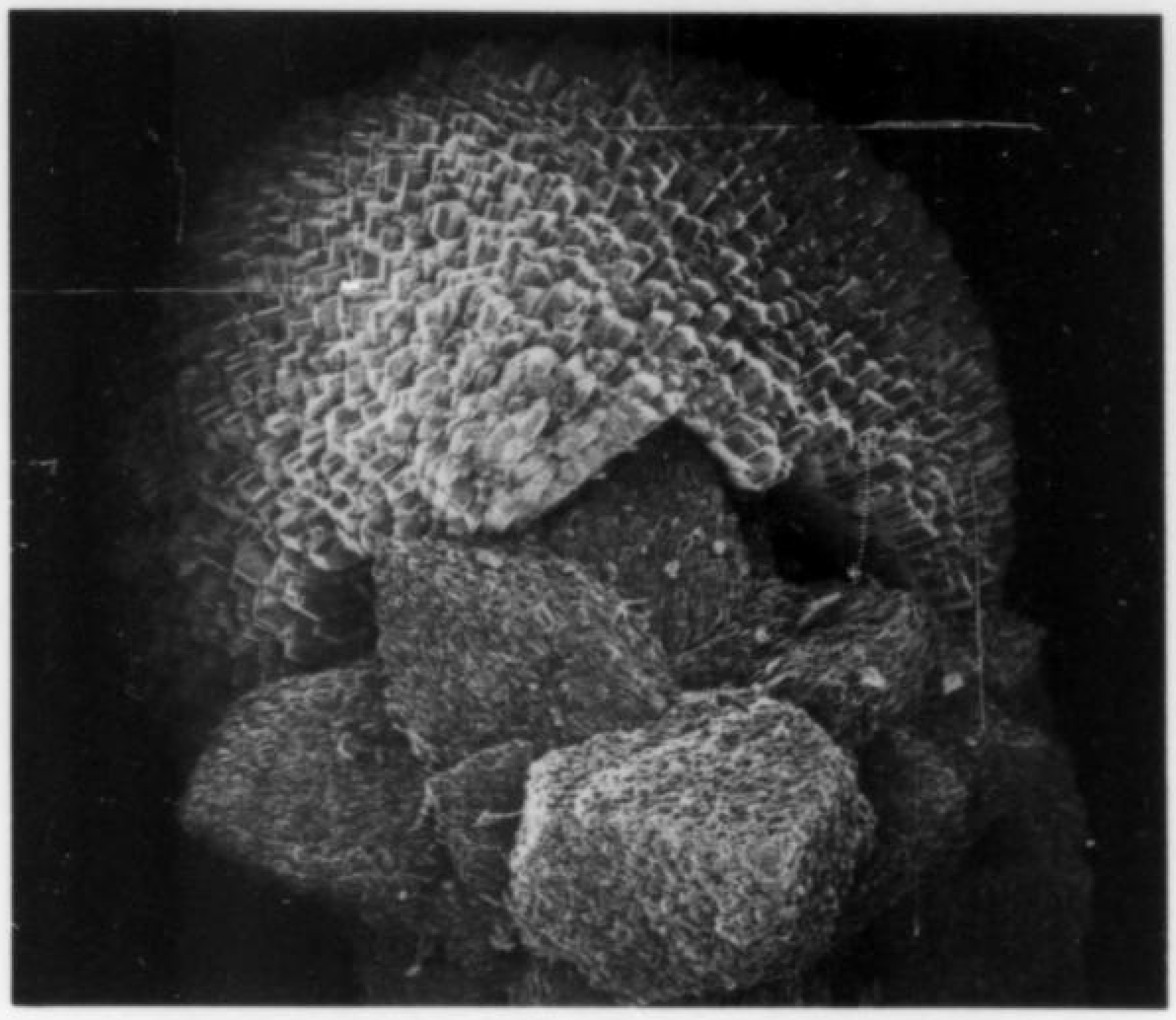

Figure 5. **Eosphorite sphere on quartz, from Lavra da Ilha, near Taquaral, Minas Gerais, Brazil. SEM photograph; sphere is 1 mm in diameter. Smithsonian specimen, NMNH #122712.**

companied by a roughly twofold increase in calcium. Two thin zones in this region contain more iron than manganese and are actually childrenite, the iron analog of eosphorite.

Zoning of this general pattern is not unrecognized in eosphorite. Hurlbut (1950) studied eight eosphorites from pegmatites in New England and concluded that an increase in the ratio of iron to manganese from base to tip was typical of these. Furthermore, even though his work was based mostly on the determination of indices of refraction supported by very few chemical analyses, he was able to demonstrate that the iron-to-manganese ratio was relatively constant within the crystals but there was a sharp increase in the iron content toward the cessation of crystal growth, much like the Lavra da Ilha eosphorite.

Apart from the late-stage chemical gyrations as revealed by the prominent zoning of the Lavra da Ilha crystals, there is other evidence to suggest an unstable environment near the conclusion of the crystals' growth. The edge of the crystals, the portion that appears feathery in the photograph (Fig. 1), shows undulatory extinction under the microscope while the rest of the crystal does not. This may mean that its growth was influenced by significant changes in the conditions of formation.

SEQUENCE OF CRYSTALLIZATION

Eosphorite is clearly later than whiteite-(Mn) on many specimens, although with some the mutual relationship is less certain. In their description of whiteite, Moore and Ito (1978), having demonstrated that calcium-rich and calcium-poor whiteite both occur at Lavra da Ilha (given as Lavra Taquaral by the authors), wrote . . .

> It is tempting to suggest that the Ca-poor variant formed earlier and recovered the Mn^{+2} cations in solution. At a later stage, when nearly all Mn^{+2} was removed from the fluid, the Ca^{+2}-rich phase crystallized. This is consistent with the observation that the Ca-poor variant occurs as large crystals and its growth probably spanned a longer period of time.

This argument is weakened by the prolific crystallization of eosphorite, a manganese mineral, following whiteite-(Mn). Eosphorite is also found on the type specimen of whiteite-(Ca), which Moore and Ito feel is later than whiteite-(Mn). Rather than proposing that the solutions were depleted in manganese through the crystallization of whiteite-(Mn), this author believes that the pegmatite suffered something like a pocket rupture with accompanying thermal shock, as described by Jahns (1982), which dramatically altered the chemistry of the ambient solutions. Evidence of even earlier violence abounds in the form of shattered quartz crystal "floaters" which were subsequently coated with chalcedony and/or drusy quartz, often rose colored, and then encrusted with later phases, especially whiteite, eosphorite and zanazziite on all surfaces. The chalcedony was deposited in strange swirling growths, resembling forms often associated with thermal springs precipitation.

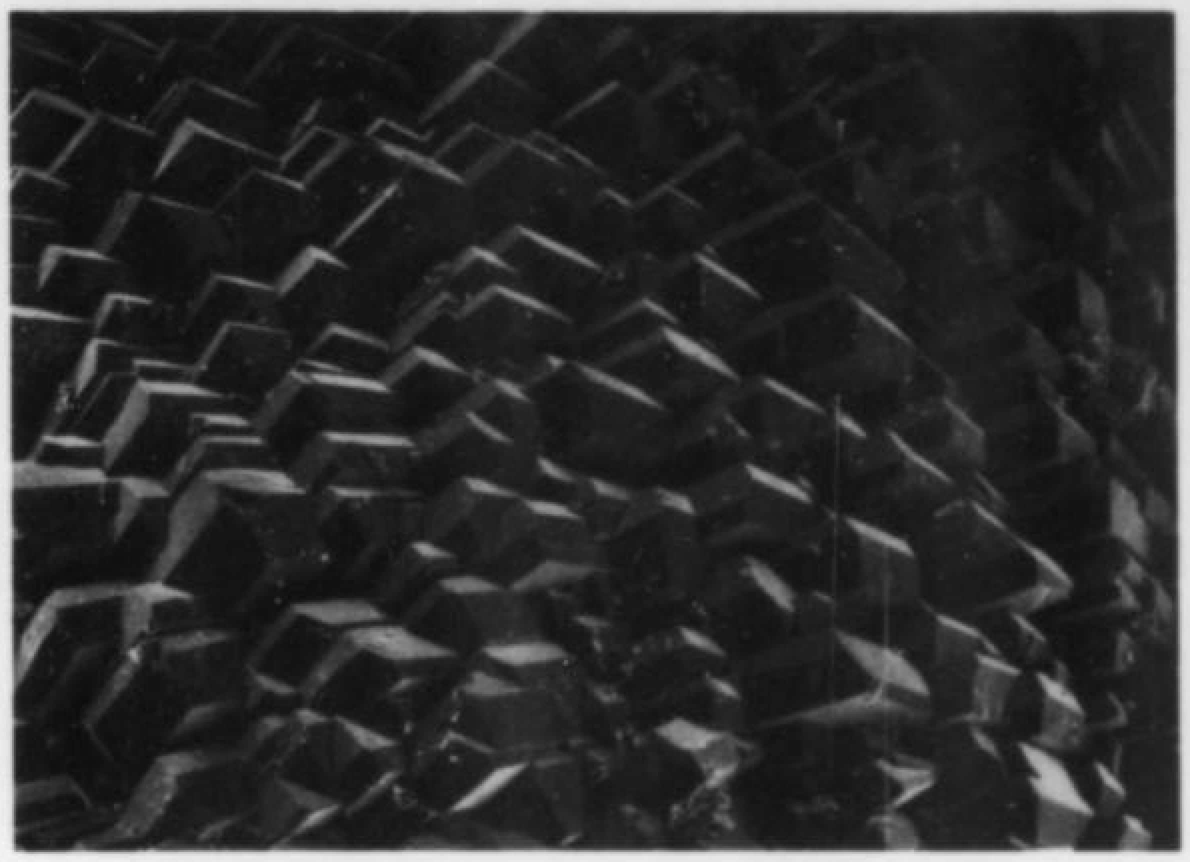

Figure 6. **Eosphorite from Lavra da Ilha, near Taquaral, Minas Gerais, Brazil. SEM photograph, same as #5 but enlarged five times. Smithsonian specimen, NMNH #122712.**

To use the words of Moore and Ito (1978), "it is tempting to suggest" that there may have been at least two pocket ruptures at this pegmatite. The first would have occurred when little more than albite, microcline, muscovite, quartz and perhaps amblygonite crystals existed in the pocket(s). This event shattered the pocket, freeing quartz crystals from their matrix and breaking many of them. It ushered in fluids rich in manganese, iron, magnesium, calcium and beryllium. The fluids may have attacked early phases, especially albite and amblygonite, thereby liberating sodium and aluminum, providing metals needed for the subsequent minerals to form. A later rupture event must have occurred, interrupting the growth of eosphorite and causing sharp changes in its composition. It also produced changes in subsequent whiteite crystals which became calcium-rich.

This simplistic scenario is largely speculative and is based solely on a few analyses plus observations of more than 100 specimens from the Smithsonian's collection.

NOMENCLATURE

There appears to have evolved, particularly in Europe, an unfortunate tendency to label these specimens "childro-eosphorite," presumably because they contain a substantial amount of iron and thus are a mix of the eosphorite and childrenite endmembers. The author is of the opinion that this practice should be discouraged. If one feels the need to modify the name in order to indicate that the mineral is iron-rich, the term "ferroan eosphorite" would be preferred because its meaning is more obvious, and it avoids introducing a new mineral name for what is not a new species, just as ferroan rhodochrosite is preferred over sidero-rhodochrosite.

ACKNOWLEDGMENTS

This paper has benefited from data obtained from and suggestions and comments made by Pete J. Dunn, Michael Wise, Richard V. Gaines, and J. A. Nelen. The illustrations shown as Figures 5 and 6 were computer-enhanced by George L. Venable.

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AN UNCOMMON MARGARITE/CORUNDUM ASSEMBLAGE FROM STERLING HILL, NEW JERSEY

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INTRODUCTION

The occurrence of corundum in the Franklin Marble formation was first noticed at Franklin, in Sussex County, New Jersey, by Vanuxem and Keating (1822) and from Newton, in Sussex County, by Fowler (1832, 1836). It was also reported from two localities in Orange County, New York: near Amity (Shepard, 1832), and in Warwick (Fowler, 1829). During the late 1800's additional occurrences were found, notably in that portion of the Franklin Marble cropping out along the Wallkill Valley between the mine workings at Franklin and at Sterling Hill, a distance of approximately 3 miles. Most of the corundum occurrences in Sussex County were noted by Charles Palache in Spencer *et al.* (1908), and in Palache's U.S.G.S. Professional Paper 180 (1935) on the mineralogy of Franklin and Sterling Hill.

The initial occurrence of corundum at Sterling Hill was recorded by Palache in 1906 in his personal field notebooks, which are preserved in the Harvard Mineralogical Museum: "red corundum occurred in various pockets along to the west of the vein at Sterling, within 50 feet [of the orebody]." This information apparently had been gained from J. J. McGovern (died 1915), a well-known early collector of Franklin minerals. A corundum specimen labeled "west of the vein at Sterling Hill" in Palache's handwriting was acquired during the 1920's and presumably represents a later discovery.

In 1952 and a few years thereafter, several notable finds were made of corundum pockets in the Franklin Marble adjacent to the orebody at Sterling Hill. The initial occurrence was adjacent to the 430 level, near the West Shaft, to the west of the orebody at Sterling Hill. This occurrence was a small one, approximately a cubic meter in size, and formed an isolated pod.

Some years later, the assemblage described here was found in pods in the Franklin Marble, 28 meters above the 340 level. This, too, was partially preserved, in part by miners and in part by geologists and mine management. This second occurrence was in a "room" cut in the Franklin Marble, 12 meters from the orebody on the 340 level at Sterling Hill, in Ogdensburg, New Jersey. The "room" was excavated to serve as a charging station where transformers recharged the batteries of small locomotives which were used to haul ore trains. The discovery of the suite of minerals described here was fortuitous. At least three pods were found, possibly more, and all were in the footwall under the orebody. These occurrences paralleled the plunge of the ore and it is highly likely that others existed between these or above or below them, but were not encountered.

Because the specific occurrences were accessed through the Sterling mine, most specimens have been labeled as coming from Sterling Hill. Although, strictly speaking, this is true, we wish to emphasize that the minerals did not come from, and were not in direct contact with, the famous zinc orebody there. They were hosted by the Franklin Marble, which envelops the orebodies at both Franklin and Sterling Hill. There were local reports of differences in the mineral content of these two occurrences, most notably in the relative abundance of arsenopyrite and corundum, but we have no firsthand information about such differences.

This paper documents the dozen or so minerals that characterize the assemblage from the 1950's occurrence, and includes unusual species such as goldmanite, thortveitite and chromian gahnite. All minerals were verified using X-ray powder diffraction and microprobe analyses, except where otherwise noted. Specimens are presently available in the mineral marketplace. We have not examined the geologic relations personally; the above locality information is in large part as obtained from miners and geologists who did observe the *in situ* occurrence, and to whom we are grateful.

MINERAL DESCRIPTIONS

The host mineral in this coarse-grained assemblage is white calcite, but the relative amount of the other minerals varies from specimen to specimen; calcite, however, is always present. Next in abundance is red corundum, platy crystals of phlogopite, and blue-green margarite. These are described below, together with the rare and unusual minerals.

Anorthite $CaAl_2Si_2O_8$

Snow-white plagioclase occurs in relative abundance with margarite and corundum. It has not been studied in detail. The optical properties indicate that it is very close in composition to the Ca-rich end-member, anorthite.

Arsenopyrite FeAsS

Superb arsenopyrite crystals to several millimeters are found in insoluble residues which remain after dissolution of the calcite matrix in dilute acetic or hydrochloric acids. Most of these resemble other arsenopyrite crystals from Sterling Hill, as illustrated by Dunn (1979).

Clinochlore $Mg_5Al(Si_3Al)O_{10}(OH)_8$

Clinochlore was found as pale brown, soft aggregates among the insoluble residues.

Corundum Al_2O_3

Corundum occurs as subhedral to euhedral, almost barrel-shaped crystals. The crystals have curved faces but are discernibly dipyramidal in habit, with a prominent {0001} pinacoid. Crystal size varies; most are near 1 cm and the crystals are roughly equant in habit. Anhedral crystals are also found. The color is dull red to pinkish red, and the luster of the crystals is dull in general. Parting lamellae are evident, parallel to {0001}.

Gahnite $ZnAl_2O_4$, **Hercynite** $FeAl_2O_4$

Very small (0.5 mm) violet-red octahedra were isolated from this assemblage by the late Lawson H. Bauer, who recognized the uniqueness of their composition, containing both Cr and Zn, in a deposit containing only traces of chromium. For a while, they were locally thought to be grimaldiite (Frondel, 1972), but our subsequent investigation has shown that they are zoned spinel-group minerals, consisting of a core of chromian-zincian hercynite of composition $(Fe_{0.43}Zn_{0.39}Mg_{0.18})(Al_{1.60}Cr_{0.38}Fe^{+3}_{0.02})O_4$, surrounded by an outer zone of chromian-ferroan gahnite of composition $(Zn_{0.55}Fe_{0.35}Mg_{0.10})(Al_{1.61}Cr_{0.36}Fe^{+3}_{0.03})O_4$.

Goldmanite $Ca_3(V,Cr,Al)_2(SiO_4)_3$

Goldmanite was found as very small (0.5 mm) dodecahedral crystals in insoluble residues. It was originally thought to be uvarovite (Frondel, 1972), but our subsequent study has shown these crystals to be vanadium-dominant and thus goldmanite. These goldmanite crystals are associated with vanadian grossular and vary from a goldmanite of composition $Ca_3(V_{1.6}Cr_{0.2}Al_{0.2})(SiO_4)_3$, to a vanadian grossular of composition $Ca_3(Al_{1.4}V_{0.5}Cr_{0.1})(SiO_4)_3$.

Graphite C

Graphite crystals are numerous in the assemblage, forming minute 0.5–1.0 mm, sharp, platy crystals, tabular on {0001}. An anecdote from Sterling Hill's history is linked to these crystals: the late Lawson Bauer, chief chemist of the New Jersey Zinc Company, entertained visitors by immersing these graphite crystals in a special solution; they absorbed the solution and, upon heating, greatly exfoliated, creating long wormlike forms.

Margarite $CaAl_2(Al_2Si_2)O_{10}(OH)_2$

Margarite occurs as platy aggregates resembling mica. Its appearance led to early and erroneous reports of kyanite and "mariposite" in some local lists of minerals, but these minerals are not known from these deposits. The most visible characteristics of this margarite are its blue-green color and its decidedly pearly luster, not unlike that of talc. The margarite lamellae attain sizes of 2–3 cm, are commonly warped, and irregularly distributed within the matrix. Because of its significance, it was studied in detail. A chemical analysis of this margarite was made in 1964 by the late Dr. Jun Ito and given by Cook (1973), but this, as published, was given partly in error; the correct analysis by Ito is given in Table 1, together with other data obtained on this material. This analysis, calculated on the basis of 12 oxygens, yields: $(Ca_{0.83}Na_{0.16}K_{0.004})(Al_{1.84}Li_{0.06}Fe^{+3}_{0.02}Cu_{0.02}Mg_{0.01}Ti_{0.01}Cr_{0.004}V_{0.004})(Si_{1.96}Al_{2.04})(O_{9.54}(OH)_{0.46}))(OH)_2$. This is in good agreement with the usual composition of margarite, although the contents of Na, Fe^{+3} and Mg are lower than are ordinarily found, and there are noteworthy contents of Cr, V, Ti and Cu. Margarite is commonly associated elsewhere with corundum, notably in emery deposits. It often occurs as an alteration product of corundum, but this is not the case at Sterling Hill, where the two minerals are separately crystallized.

Rutile TiO_2

Lustrous rutile crystals occur up to a centimeter in length, but most are much smaller. They are generally prismatic in habit, but some are equant. Most are dark red in color (black megascopically). Rutile is locally abundant in this assemblage, and fine specimens have been preserved.

Thortveitite $(Sc,Y)_2Si_2O_7$

Thortveitite was found as tiny 20-micron crystals with lath-like habit, within the gahnite/hercynite crystals described above. Microprobe analysis found it to be nearly pure scandium silicate, with small amounts of yttrium, as is common for this mineral. Frondel (1970) reported the major hosts for scandium in the orebodies, and the thortveitite noted here suggests that spinel may host Sc in the Franklin marble.

Titanite $CaTiSiO_5$

Titanite was found as small brown crystals in insoluble residues.

Zircon $ZrSiO_4$

Zircon was found as rounded, prismatic, 1-mm crystals, in insoluble residues.

DISCUSSION

The margarite-corundum pods along the footwall of the western leg of the orebody at Sterling Hill may represent the recrystallization of a once-continuous, highly aluminous bed in the original limestone, close to and conformable with the orebody, and later broken into boudinage structure by the intense dynamothermal metamorphism that has affected the region. This structure is typical of the thin sandstone/quartzite and gneissic beds that occur locally in the Franklin Marble as noted by Hague *et al.* (1956). There is, however, no field evidence that the corundum pods occurring elsewhere in the Franklin Marble are of this origin.

A related occurrence, in part chemically and mineralogically different, was found in 1982 by collectors in the Franklin quarry (a.k.a. the Farber quarry) on Cork Hill Road in Franklin, a bit north of Sterling Hill. This occurrence, on the upper bench on the west side of the quarry, was of simpler mineralogy, having no corundum and none of the rarest minerals. Phlogopite, margarite and calcite are the dominant minerals; dolomite, rutile, clinochlore, muscovite and titanite are also found. Material from this 1982 occurrence has been preserved by Richard Bostwick and others, and studied by Yau *et al.* (1984) who interpreted it as a retrograde assemblage; the parent rock is assumed to have been composed of feldspars and/or scapolite.

In his notebooks of 1906 Palache states, in reference to the corundum pockets at Sterling Hill, that "this line of pockets ran all the way

Table 1. **Analytical and physical data for Sterling Hill margarite.**

SiO_2	29.70	Optically negative, 2V = moderate,
Al_2O_3	49.96	$\alpha = 1.625\ (\pm\ 0.004)$
Fe_2O_3	0.25	$\beta = 1.640\ (\pm\ 0.001)$
Cr_2O_3	0.07	$\gamma = 1.641\ (\pm\ 0.001)$
V_2O_5	0.10	Pleochroism is indiscernible.
TiO_2	0.25	Orientation: $X \approx c$, $Z = b$
CaO	11.68	D (meas) = 3.03;
MgO	0.12	D (calc) = 3.07 g/cm³.
CuO	0.53	
Li_2O	0.21	
Na_2O	1.24	
K_2O	0.05	
H_2O^+	5.60	
H_2O^-	0.23	
Total	100.0*	

*recalculated to 100.0 weight percent after deduction of 3.00 wt. % corundum insoluble residue.

Includes traces of Ga, Mn, Ba, Sr, Y, Yb, Ni, Mo, Ag, Cd, and Sb.

between Franklin and Sterling Hill." Elsewhere in his notes he states, in abbreviated style, that "Corundum [is] found in limestone [the Franklin Marble] in hanging wall from Trotter mine [in the western leg of the orebody at Franklin] south as far as Ogdensburg." These statements appear to be legends that he gained from the local mineral collectors, and do not appear in his treatise (Palache, 1935) where it is said only that "An irregular chain of pockets containing corundum is said to have extended from Sterling Hill to Franklin." Present day field work indicates that the corundum pockets were few and far between. At the best known locality, at the former site of the iron furnace at the foot of Franklin Pond, translucent corundum crystals of a fine red color were associated with rutile and spinel but, unlike the Sterling Hill occurrence, both margarite and anorthite were lacking. This also appears to be true of most other corundum occurrences in the Franklin marble in Sussex County, New Jersey, listed by Palache (1935) and in Orange County, New York, listed by Whitlock (1903) and by Shepard (1832).

In addition to margarite, another member of the brittle mica group, clintonite, $Ca(Mg,Al)_3(Al_3Si)O_{10}(OH)_2$, occurs in the Franklin Marble (without associated corundum) at Amity, Orange County, New York, northeast of Franklin, New Jersey (see Kearns, 1978). It is the type locality for clintonite (Finch, 1829); the complex synonymy of the name clintonite, which includes seybertite, is given by E. S. Dana (1896). Here clintonite occurred as reddish brown scales and aggregates of coarse lamellae and plates up to 25 cm across, associated with spinel, dolomite, clinochlore, talc, chondrodite, and vesuvianite, with corundum lacking. Clintonite was reported by Struwe (1958) from Franklin, associated with spinel, pargasite, norbergite and graphite.

The Franklin Marble, especially in its northward extension into Orange County, New York, contains (in addition to the corundum, margarite and clintonite occurrences) a wide variety of accessory minerals. In part these are more or less uniformly dispersed through the marble, in particular: graphite, chondrodite, spinel and, less abundantly, uvite. Other occurrences consist of local concentrations or pockets characterized by abundant spinel (at least one locality has octahedra up to 10 cm on edge), clinopyroxenes including fassaite, tremolite, calcic hornblende, and edenite (type locality is near Edenville), vesuvianite, scapolite, grossular, feldspars, chlorites, titanite, warwickite (type locality is at Warwick), and talc (as an alteration product). These occurrences first drew attention in the early 19th century and gave rise to a considerable body of literature, summarized by Whitlock (1903). This general assemblage, including clintonite, is viewed by Knopf (1953) and Knopf and Lee (1957) as representing limestones that have been metasomatically altered and recrystallized at elevated temperatures.

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FLUOCERITE-(CE) AND OTHER MINERALS FROM THE LITTLE PATSY QUARRY

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INTRODUCTION

Fluocerite-(Ce), a cerium fluoride, has been found in newly quarried exposures in the Little Patsy quarry, South Platte district, Jefferson County, Colorado. Crystalline masses of fluocerite up to 5 cm in diameter have been found associated with purple fluorite along the contact of the albite replacement unit with the quartz core.

LOCATION and GEOLOGY

The Little Patsy quarry is in a pegmatite located in the NW ¼ of the SE ¼ of section 28, T7S, R70W. The Little Patsy pegmatite is one of many rare earth-containing pegmatites located 2 to 3 miles northeast of the town of Buffalo Creek, within the Pikes Peak National Forest. The pegmatite is a vertical, pipe-like body with a circular cross section approximately 55 meters in diameter. It is completely enclosed within the Pikes Peak Granite. Four zones are exposed in the pegmatite: a wall zone, an outer intermediate zone, an inner intermediate zone and a core. The quartz-microcline-biotite wall zone is texturally composed of graphic granite and micropegmatite with scattered blades of biotite. The outer intermediate zone contains biotite books up to 60 cm in length within microcline. The inner intermediate zone is composed of microcline with scattered 5 to 15-cm cavities containing euhedral crystals of hematite-coated quartz and microcline. The quartz core contains quartz crystal pockets, localized along fractures and possibly primary spherical pockets. Isolated masses of purplish gray fluorite containing no rare earth elements are present along the northern core margin. An irregular and discontinuous albite replacement unit is present along the margins of the quartz core (Simmons and Heinrich, 1980).

Fergusonite, thorite, yttrotantalite and small masses of cyrtolite have been found within the giant biotite books (Haynes, 1965; Simmons and Heinrich, 1980). Yttrofluorite occurs replacing some of the core-margin fluorite (Haynes, 1965). Samarskite with a predominance of heavy rare earth elements and yttrium has also been found (Brewster and Simmons, 1986).

During 1987–88, renewed mining of the quartz core in the Little Patsy pegmatite exposed more of the albite replacement units on the southern and northern sides of the lower, main quarry. Along the southern wall of the main quarry, the fine-grained albite replacement unit is present between the quartz core and the quartz-microcline-biotite zone. Within the albite unit are scattered fist-sized nodules of cyrtolite. Adjacent to and within some of the cyrtolite masses are clusters of 2 to 5-cm crystals of black, lustrous columbite. Hematite has replaced some of the biotite that represents isolated, unreplaced fragments of the quartz-microcline-biotite zone.

FLUOCERITE-(Ce) OCCURRENCE

Along the northern wall of the main quarry, the albite replacement unit is exposed between the quartz core and the microcline zone. Within the albite replacement unit, along its contact with the quartz core, are 1 to 5-cm nodules of coarsely crystalline, straw-yellow fluocerite-(Ce). Occasionally the fluocerite is physically in contact with 1 to 5 cm masses of fine-grained, crumbly purple fluorite. The nodules exhibit well developed cleavage and separate easily into smaller masses. Some of the nodules contain black, metamict grains which energy dispersive X-ray analysis has shown to contain thorium and silica; the grains may be a thorium silicate, perhaps thorite. Some of the fluocerite-(Ce) nodules exhibit what Haynes (1965) called step-sided, "pyramidal roots" extending into the albite. Although the significance of this morphology has been vigorously debated (Simmons and Heinrich, 1980), the authors here regard the morphology as euhedral crystal faces modified by interference during growth. Bastnaesite appears as a thin red-brown layer coating the exteriors of the fluocerite nodules and fracture surfaces.

MINERALOGY

The average density of the fluocerite-(Ce) is 5.90 g/cm^3. This was measured on a triple beam balance using four visibly pure, coarsely crystalline yellow masses varying in weight from 10 to 32 grams. Energy dispersive X-ray analysis confirms that the mineral is fluocerite-(Ce). Semiquantitative analyses by Dr. Peter Modreski (using KEVEX EDX-XRF) indicates that the fluocerite contains more than twice as much cerium as lanthanum, with additional amounts of Pr, Nd, Sm and Th. X-ray diffraction analysis indicates that minor amounts of bastnaesite and fluorite are intimately mixed with the fluocerite-(Ce). In thin section the fluocerite-(Ce) is colorless with fairly abundant inclusions of other unidentified minerals. Under crossed nicols the fluocerite-(Ce) is of low, first order birefringence.

Table 1. **Comparison of bastnaesite and fluocerite X-ray patterns from the Joint Committee on powder diffraction (JCPDS) with fluocerite from the Little Patsy quarry, White Cloud quarry (Heinrich and Gross, 1960), and the lithium pegmatite at Høydalen, Tørdal Kirke, Norway (Sverdrup, Saebö and Bryn, 1965).**

JCPDS 11-340 bastnaesite		**JCPDS 2-529, syn fluocerite**		**Little Patsy Colorado fluorcerite-(Ce)**		**White Cloud Colorado fluorcerite**		**Høydalen, Norway fluocerite**	
d(Å)	I/I_o	d(Å)	I/I_o	d(Å)	I/I_o	d(Å)	I/I_o	d(Å)	I/I_o
4.879	.4			4.889	.11				
		3.63	.7	3.651	.46	3.64	m	3.66	w
3.564	.7	3.54	.6	3.567	.52	3.55	m	3.59	m
		3.186	1.0	3.204	1.0	3.19	vs	3.19	vs
				3.148	.28*			3.16	m
2.879	1.0			2.878	.13			2.87	w
2.61	.01								
				2.731	.07*			2.73	w
		2.53	.3	2.553	.1	2.54	vw	2.55	w
2.445	.09			2.444	.03				
				2.357	.03				
2.273	.03								
2.238	.03								
				2.221	.04				
2.057	.4	2.050	.8	2.055	.46	2.05	s	2.05	m
2.016	.4	1.995	.8	2.011	.49	2.00	vs	2.00	m
				1.929	.11*			1.91	m
1.898	.4			1.894	.05				
		1.81	.2	1.825	.07	1.815	vw		
1.783	.09	1.78	.7	1.797	.32	1.782	m	1.79	m
		1.72	.5	1.729	.21	1.723	w	1.73	w
1.674	.21			1.671	.04				
				1.644	.11*			1.64	m
1.629	.1	1.61	.2	1.624	.08				
		1.59	.1	1.600	.05				
1.573	.15			1.573	.04				
1.481	.09			1.482	.02				
1.439	.11	1.43	.4	1.437	.15	1.427	w	1.43	w
				1.364	.1				
		1.36	.4	1.361	.11	1.36	w	1.36	w

*D-values due to minor admixed fluorite.

Bastnaesite in thin section is red-brown and coats the exterior and some fractures of the fluocerite-(Ce). Under crossed nicols, the bastnaesite exhibits relatively high birefringence.

Table 2. **Semiquantitative analysis of Little Patsy fluocerite by KEVEX EDX-XRF.**

Sample / Element	Approximate weight ratio A	Approximate weight ratio B	Normalized weight ratio A	Normalized weight ratio B
La	0.24	0.24	16.5	16.8
Ce	0.53	0.53	37.4	37.2
Pr	0.05	0.05	3.5	3.6
Nd	0.11	0.11	7.8	7.8
Sm	0.03	0.03	1.9	1.8
Y	0.01	0.01	0.7	0.7
Th	0.03	0.03	2.2	2.0
Sn (?)	—	0.003	—	0.2
sum	1.0	1.003	70.0	69.9

The X-ray diffraction analysis was accomplished using a Siemens D 500 diffractometer with a Peltier solid state detector using CuK$_\alpha$ radiation with a monochromator, alpha wavelength = 1.54056. Elemental analysis was carried out by energy dispersive X-ray analysis using a Tracor Northern TN2000 analytical focusing system and a JEOL 35cf scanning electron microscope. Representative samples and one large matrix specimen have been donated to the Denver Museum of Natural History.

ACKNOWLEDGMENTS

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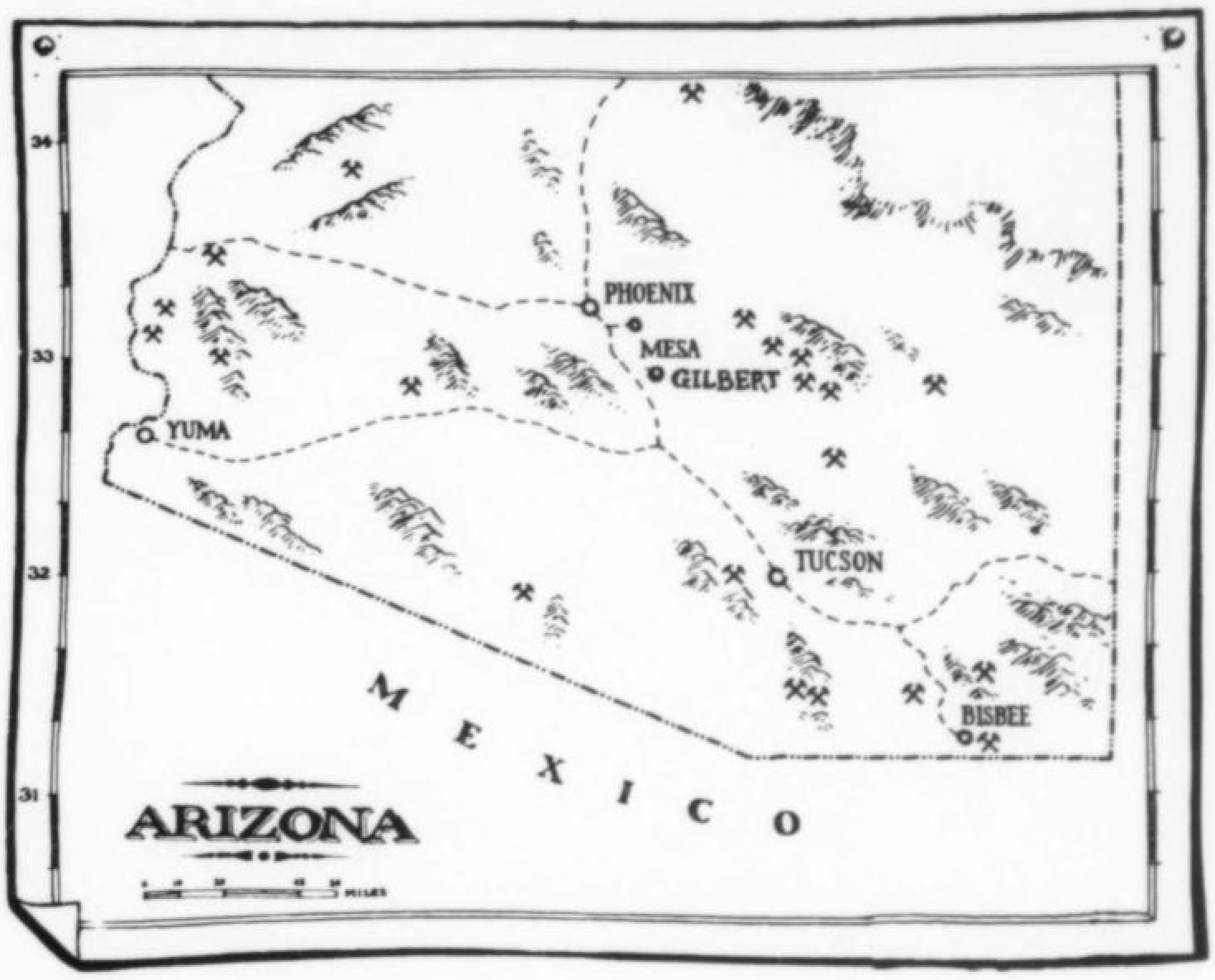

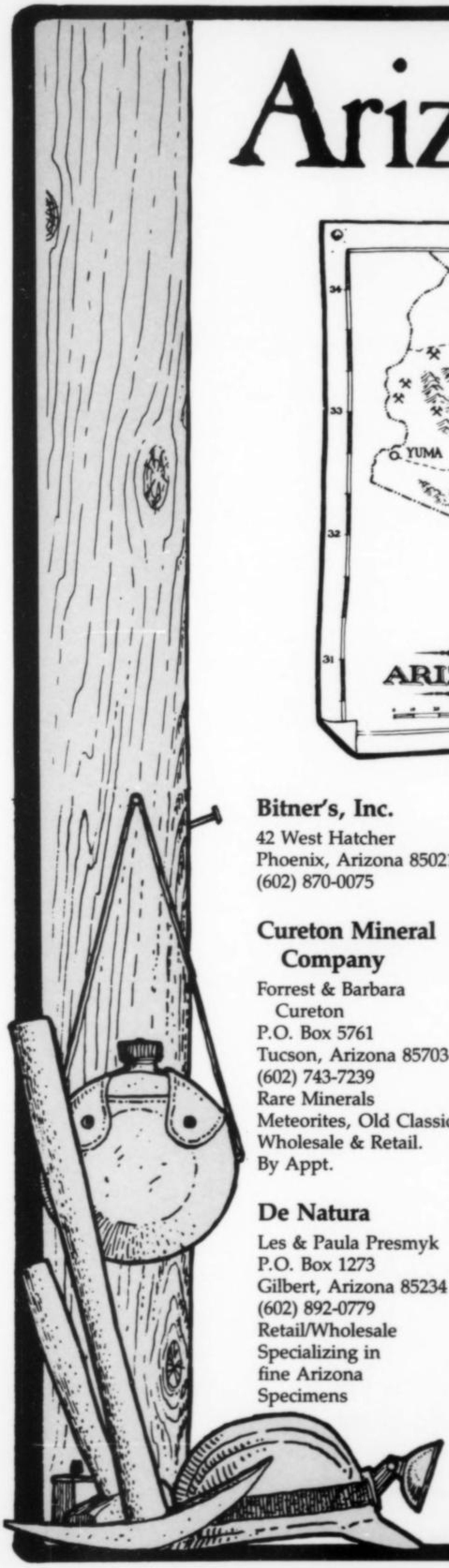

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Minerals of
THE CARNEGIE MUSEUM
of Natural History

Gold, 13.5 cm tall, from California. Acquired in 1981 from the A. C. Burrage collection, Harvard Mineralogical Museum.

THE HILLMAN HALL OF MINERALS & GEMS

The Carnegie
Museum of Natural History
Pittsburgh

by
Richard A. Souza
Collection Manager, Section of Minerals, Carnegie Museum of Natural History
Wendell E. Wilson
Editor, Mineralogical Record magazine
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Editor, Carnegie Magazine
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Harold and Erica Van Pelt

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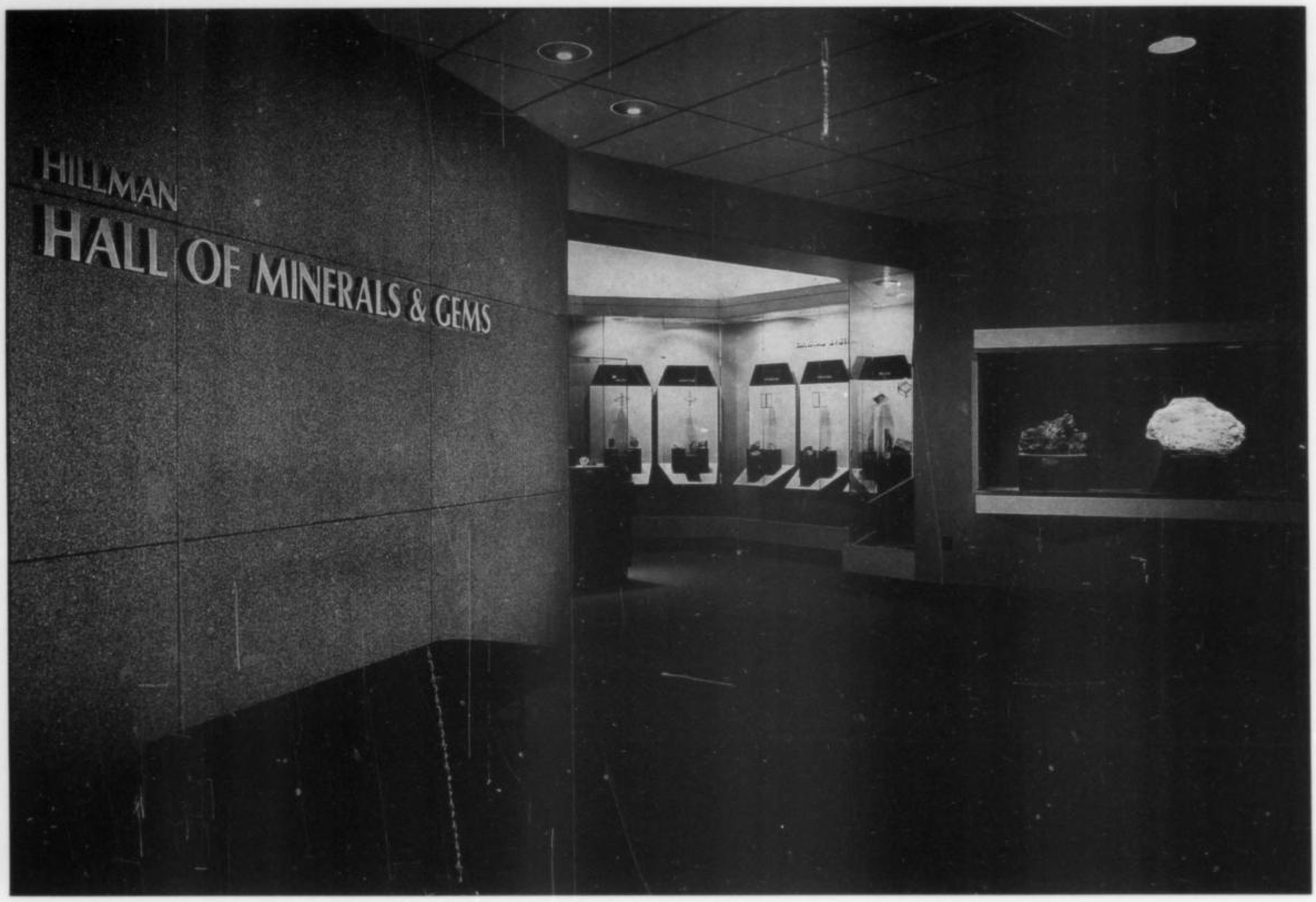


Entrance to Hillman Hall.

INTRODUCTION

The Hillman Hall of Minerals & Gems was innovative and dramatic when it opened in 1980 and it is even more so now. With continuous upgrading of the collections and refinement of the gallery, it has become one of the premier mineral halls in the country. If Andrew Carnegie were alive today, he surely would be pleased because the hall has the dramatic impact upon the public mind that he wanted the natural history museum to convey. Without pretense, the hall states "Minerals should be enjoyed for their sheer beauty as well as their educational value." The Hillman Hall of Minerals & Gems is a jewel box of lush colors, wondrous forms and striking contrasts. It was good fortune that both Andrew Carnegie and Henry L. Hillman, the latter having inspired the effort which led to the resurrection of the museum's mineral exhibit, appreciated the importance of minerals. Carnegie, at the beginning of the twentieth century, and Hillman, approximately 70 years later, have been the principal players in the evolution of this exciting facility; consequently it is altogether appropriate that the museum carry the name of one and the gallery the name of the other.

The wonders of nature are bountiful and every branch of natural science can show countless objects which illustrate this fact. Objects from the mineral world (having mostly come from underground) tend to be less familiar and thus more mysterious to the average museum visitor than objects from many of the other natural sciences. We should therefore acknowledge the wisdom of an exhibition in which the beauty and diversity of minerals is emphasized. Too often museums present minerals in strictly pedantic or instructional exhibits which display hundreds of potentially exciting specimens to poor advantage. Most people who love minerals were first captivated by their form and color, and studied their more technical aspects later. Similarly, those museum visitors who are first captivated by the visual appeal of mineral specimens may then study the educational exhibits,

COVER: Aquamarine beryl group on matrix, 11 cm, from Nager, Aliabad, Hunza, Pakistan; acquired in 1990.

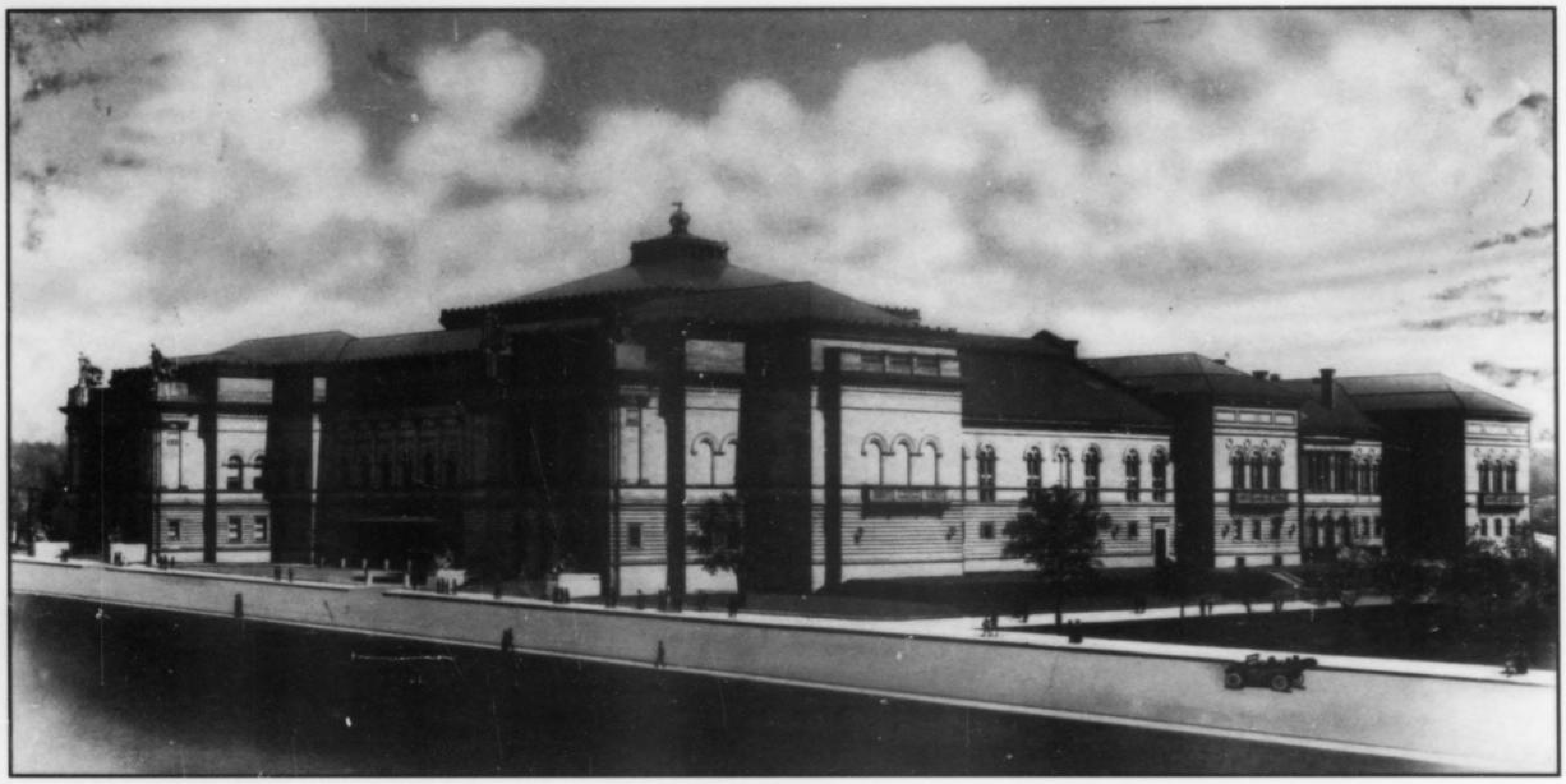
Calcite, 6.7 cm, from Egremont, Cumbria, England; acquired in 1904 as part of the Jefferis collection.

and on their own seek out the detailed scientific information in textbooks and field guides.

Natural history museums have always struggled to find a balance between presenting science and creating exhibits that are esthetic. Rather than making a primary commitment to the sheer beauty of minerals, they have tended to allow a certain traditionalism to dilute the exhibition effort and the acquisitions program as well. This dilution comes from trying to expand the collections in inappropriate directions that neither the size nor the regionality of the museum can justify. For example, one often finds such museums purchasing exhibit specimens strictly for classroom instruction, or tiny reference samples of rare and exotic mineral species for "research" that will likely never be done there. Both practices make little sense; a museum such as The Carnegie Museum of Natural History should concentrate on improving the quality of its exhibit collection, by adding striking specimens and by improving upon their presentation. This is just what The Carnegie Museum of Natural History is doing. One goal of the museum's mineral section is obtaining the best available specimens from Pennsylvania, and this is as it should be, for no other major natural history museum in the State of Pennsylvania is currently doing so. The main thrust of the mineral section's continuing effort, however, is the acquisition of ever more perfect specimens for exhibit, a goal easily appreciated by and beneficial to the general museum-going public.

This outstanding gallery reflects great credit not only on The Carnegie, but on the commitment of Henry L. Hillman who decided in 1969 to take a leading role in supporting the creation of a mineral hall. He and The Hillman Foundation, Inc. have not wavered in their generous and participatory support ever since. The Carnegie Museum of Natural History, Henry Hillman and The Hillman Foundation are to be congratulated for working together so effectively toward a common goal which benefits all who visit the museum.

J.S.W.

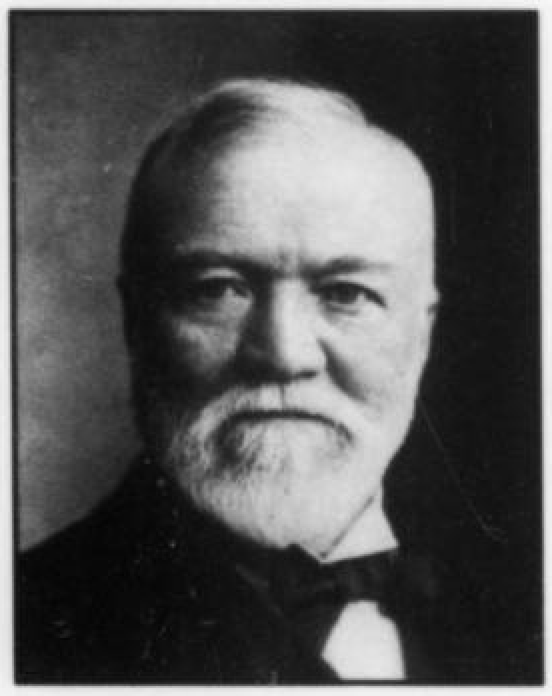


The Museum in 1907.

HISTORY

Carnegie Institute

In Pittsburgh, Pennsylvania, where Andrew Carnegie's family settled in 1848, Carnegie found a proletarian city that represented his background and his philosophy. There he rose from telegraph messenger through the ranks of the Pennsylvania Railroad and eventually became the independent owner of bridge-building and rail-making steel companies. "Dear old smoky Pittsburgh," he called it when he enlarged his magnificent library and "Institute" in 1907. "It was here that fortune came to me, and it is as a Pittsburgher I have labored for Pittsburgh. This Institute is built with Pittsburgh money for Pittsburgh."



Andrew Carnegie (1835–1919)

In Pittsburgh in the 1890's, local collectors and natural history scientists were loosely united in "The Academy of Art and Science," and Carnegie intended that this society should meet in his new Institute. When Andrew Carnegie created his "Carnegie Institute" in 1896 he planned a "Department of the Museum" which was eventually to become The Carnegie Museum of Natural History. Botanists, entomologists, ornithologists, anthropologists, paleontologists, geologists and mineralogists found the new Carnegie Museum to be a home for their professional meetings and scientific research. As Carnegie stated at the formal rededication of the enlarged Institute in 1907, "If a man would learn of the treasures of art, he must come here and study; if he would gain knowledge, he must come to the library and read; if he would know of the great masterpieces of the world in sculpture or architecture, or of nature's secrets in the minerals he refines, or of natural history, he must spend his time in the museum . . ."

At the start of the twentieth century, Pittsburgh was clearly a sophisticated center of research in the extractive industries. The importance of mining, coal, iron ore and natural gas to the local economy made Pittsburgh a natural home for mineralogy. Pittsburgh's historic role as an iron and steel center is impressive. During World War II the city of Pittsburgh produced more steel than Germany and Japan combined. Commercial aluminum (Alcoa) was created here, and the Gulf Corporation developed here. In Pittsburgh the United States Bureau of Mines established one of its vital centers, serving West Virginia and Pennsylvania, and in Pittsburgh the United Mine Workers made their home. In this context, the modern development of the Hillman Hall of Minerals & Gems is understandable and appropriate.

The Mineral Section

One of the first developments in mineralogy at the museum was an exhibit produced by Professor Gustave Guttenberg, a curator at the Academy of Art and Science, who loaned his entire personal mineral collection of 550 pieces to the academy. After his death in 1896 the collection was purchased by the museum and it became the core of the permanent mineralogical collection.

As early as 1897 the museum accessioned its first world-class mineral specimen—a pseudomorph of hemimorphite after calcite, (page 7). This Joplin, Missouri, specimen was a gift of A. L. Means.

During its first years the mineral collection expanded principally through gifts. The museum acquired ores and metals representing the industries of the Pittsburgh region—the ores and manufactured products of tin, lead, copper, antimony and bismuth. Local examples of steel products, specimens of oil-bearing rock and crude petroleum, and of coal, coke and graphite also were included.

Carnegie himself added to the growing collection with several gifts, the most important in 1904 when he purchased the extraordinary mineral collection of William W. Jefferis of West Chester, Pennsylvania.

Jefferis had started collecting in 1837 and for sixty years had devoted himself to developing what was regarded at the time as one of the finest private collections in the country. As the friend and constant correspondent of noted mineralogists such as George J. Brush, James D. Dana, Isaac Lea, and Benjamin Silliman, Jefferis furnished specimens for illustrations in many mineralogical publications and textbooks, in particular James D. Dana's famous *System of Mineralogy*.

Jefferis's large general collection contained countless calcite, fluorite, and barite specimens from classic English localities, as well as particularly fine suites from other European locales, and from New York and Pennsylvania. After 1900 important collectors and institutions maneuvered to obtain his collection before it was put on the market. But Carnegie was not to be denied, and in 1904 he purchased the collection for the Carnegie Museum for approximately $20,000. The records show that another institution offered more at the last moment, but Jefferis, whose vocation had been banking, honored his previous agreement with Carnegie. Two boxcars were needed to transport the approximately 12,000 specimens by railroad to Pittsburgh. With the acquisition of the Jefferis Collection the museum attained stature as a mineral museum and repository. In 1906, shortly after he expressed in a letter to George F. Kunz his pleasure and gratification that the Carnegie Museum of Natural History had acquired his life's work, Jefferis died.

During the first part of the twentieth century, the museum's mineral collection grew largely through donations, with some purchases. Between 1900 and 1905 Douglas Stewart (the presiding caretaker of the mineral collection from 1901 to 1926) acquired a donation of 2,600 gem specimens from the leader of the United Mine Workers, John L. Lewis, and also purchased over 1,000 mineral specimens from the noted mineralogist and dealer George L. English. Between 1906 and 1908, the prominent Pittsburgh collector Norman Spang donated approximately 100 specimens, one being a 75-pound, perfectly terminated quartz crystal from Switzerland. By 1907 Stewart had installed exhibit and storage cases allowing 4,500 specimens to be exhibited in a Hall of Mineralogy and 9,000 to 10,000 specimens to be stored systematically for reference. And in 1919 the pioneer of petrographic microscopy in the United States, Dr. M. E. Wadsworth, Dean of the School of Mines at the University of Pittsburgh, gave his collection of rocks to the museum.

Douglas Stewart's sole position at the museum for many years was as the Custodian of Mineralogy and, in 1923, he also became Director of the Carnegie Museum, a position he held until his death in 1926. With the death of Stewart the mineralogical collection for decades fell to the responsibility and interest of several professional and amateur mineralogists. For years, in a pattern unfortunately familiar to many natural history museums, no need was felt for a separate curator of mineralogy as long as the mineral collection could be administratively grouped with related areas such as Geology and Paleontology.

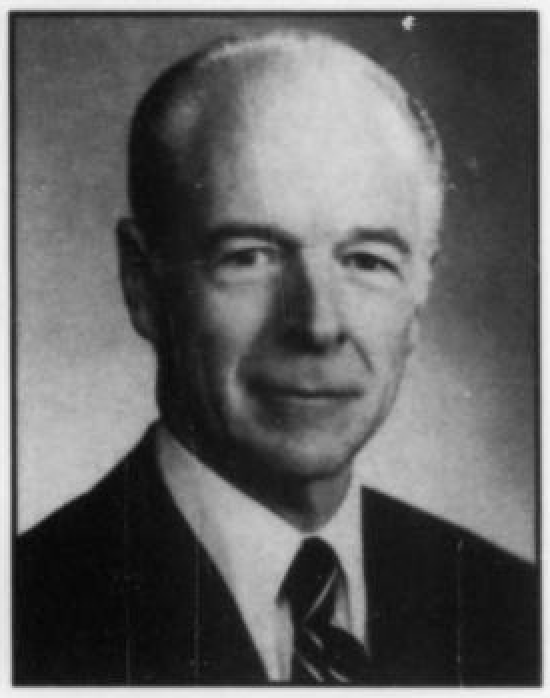
In 1927, Geology Professors Charles R. Fettke of the Carnegie Institute of Technology and Henry Leighton of the University of Pittsburgh were appointed Honorary Curators; in 1937 Invertebrate Paleontologist Dr. I. P. Tolmachoff was named Acting Curator of Mineralogy and then Curator of Geology and Mineralogy in 1943; David M. Seaman, an assistant to Tolmachoff, succeeded him from 1945 to 1949 and Invertebrate Paleontologist E. R. Eller followed Seaman until 1969. During these four decades, the collection developed only slowly, with the addition of specimens acquired through field collecting, trading, and purchase.

Although upgrading the exhibit specimens and the exhibit gallery space (Mineral Exhibition Hall) had been the primary focus during Seaman's tenure in the 1940's, under his successor the exhibit hall was dismantled in the early 1950's, and most of the specimens were placed in storage. A decade later, under the same curator, the collection's emphasis shifted back to the acquisition of exhibit-quality specimens as well as gem materials. Some specimens were placed on public exhibit. In the latter part of the 1960's, geologist Delbert L. Oswald, working as a Research Associate under Eller's guidance, assisted in the development of a small exhibit of minerals. Also, it was during this time that the museum administration began discussions about establishing a major mineral exhibit.

Genesis of Hillman Hall

In 1969 the President of The Carnegie, James M. Walton, spoke with one of Pittsburgh's most prominent businessmen, Henry L. Hillman, about the early stages of a capital campaign fund. Their discussion centered on the steps to be taken to upgrade the existing exhibits and the program areas where new exhibits could be introduced to enhance the Carnegie Museum of Natural History.

Mr. Hillman, a trustee of the museum, is a lifelong Pittsburgher. As a college student he earned a degree in geology from Princeton, and at the time of his discussion with Walton was serving as the executive officer in the family business started by his father. He recalls that he had gone to see a commercial display of minerals that was being presented at a Pittsburgh department store. He was impressed by the number of people who were attracted to and fascinated by the mineral specimens. With this experience in mind he expressed to Walton an interest in supporting a new mineral exhibit designed to present "minerals in the manner of sculpture and shown for their beauty as well as physical properties and economic uses."



Henry L. Hillman

For the entire next decade, the generosity of Henry L. Hillman and The Hillman Foundation, Inc. made it possible for The Carnegie Museum of Natural History to acquire exhibit-quality specimens for the new hall. Delbert Oswald, working in the mineral section at that time, became Associate Curator and devoted full attention to enhancing the mineral exhibit collection and developing the hall. In the early 1970's, during the first few years of this effort, the noted mineralogist Dr. Frederick H. Pough was retained as a consultant to assist Oswald.

The mineral section of the museum became increasingly active, and gradually took on a new autonomy within the museum. Not only did The Hillman Foundation provide funds through a capital fund grant for the renovation of space allocated to the new mineral hall, it also provided funds for a specimen acquisition program. A masterpiece pegmatite assemblage from the Little Three mine in California (page 24) and a 70-gram platinum nugget from the Soviet Union were purchased at this time, as was what is very likely the world's largest single crystal of rutile, a 24 pound mirror-faced specimen from Graves Mountain, Georgia. Supported by The Hillman Foundation, the museum acquired a 19-piece gold collection from the Harvard Mineralogical Museum and the Dr. Frederick H. Pough gem collection of nearly 800 specimens. The Pough Gem Collection represents over thirty years of personal selection and is 50% comprised of rare and highly unusual gem species. Over half of the gems currently on display in the mineral and gem hall are from the Pough Collection.

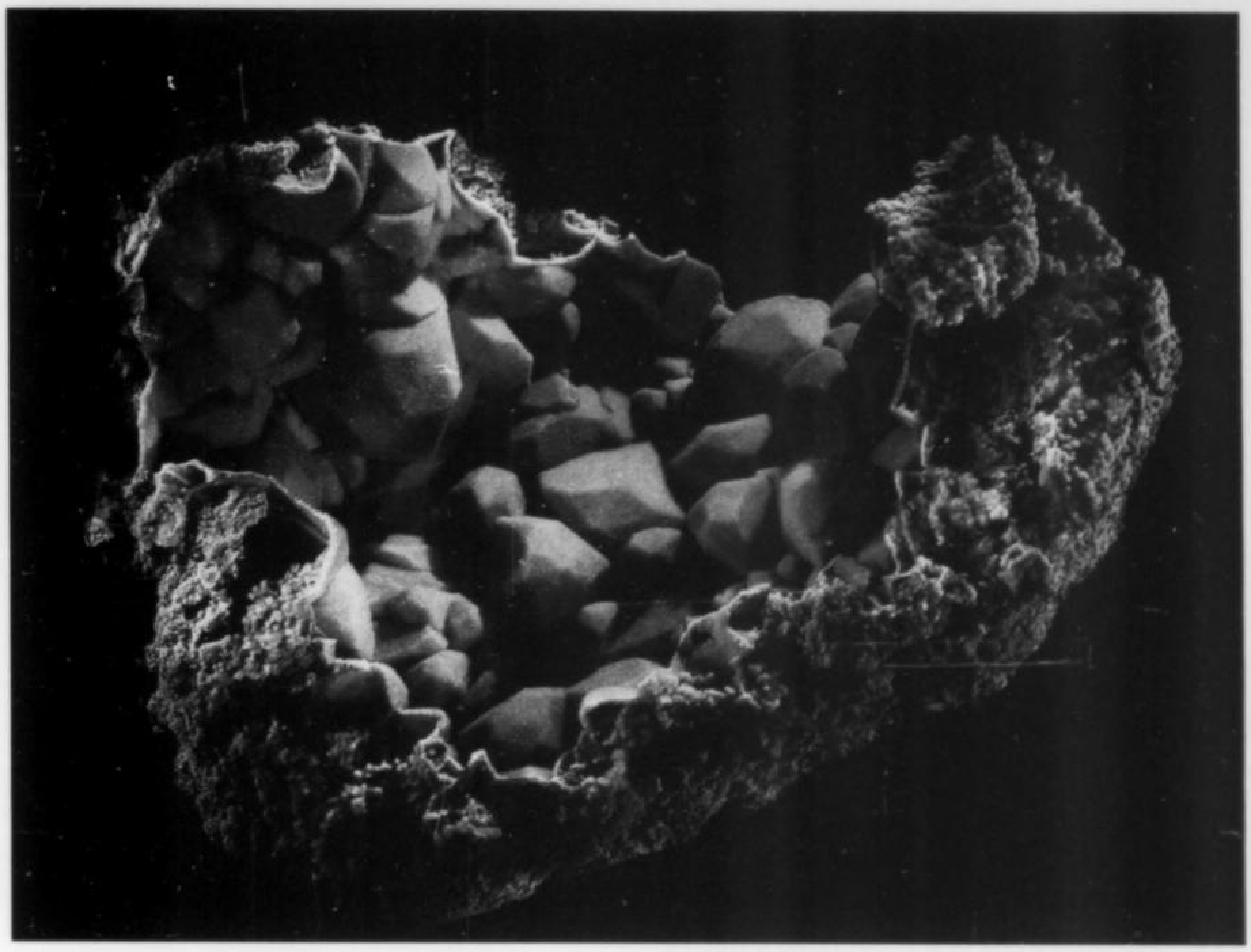
Along with the increase in purchased accessions, the mineral section witnessed an increase in donor interest, which brought in many new specimens suitable for exhibition in the mineral and gem hall. The J. Allen Thiel and J. P. Gills Rough and Cut gem collections were donated, as were the collection's finest Brazilian aquamarine crystal (page 22) and its finest bejewelled aquamarine and diamond brooch (page 32).

After eleven years of specimen acquisition, planning and construction, the Hillman Hall of Minerals & Gems opened in September of 1980. The concept of presenting mineral specimens as sculptures was adhered to, and the beautifully designed exhibit hall provides a basic understanding and appreciation of minerals—scientifically, educationally and aesthetically.

Oswald retired from the museum shortly thereafter and for several years the mineral section and its exhibit hall were directly under the auspices of Dr. Mary R. Dawson, Vertebrate Paleontologist and Chief Curator of Earth Sciences. In 1982, Geologist Richard A. Souza was hired to oversee the mineral section's exhibit and education programs and the management of some 23,000 specimens. During the eight years that followed, Collection Manager Souza worked closely with Ronald W. Wertz, President of The Hillman Foundation, in developing one of the most active and successful specimen acquisition programs of any major natural history museum in North America. The goal of the program was to acquire some of the world's finest specimens of a number of species while simultaneously filling in species and locality voids with the best available specimens and significantly upgrading the other species on exhibit.

In 1987, The Hillman Foundation worked with The Carnegie Museum of Natural History to establish The Carnegie Mineralogical Award. This national award is given annually at the Tucson Gem and Mineral Show to an honored recipient in recognition of outstanding contributions which have promoted mineralogical preservation, conservation and education—the ideals embodied in The Carnegie's Hillman Hall of Minerals & Gems.

Numerous support grants worked to vitalize the mineral section's programs. In 1988 The Carnegie's President, Dr. Robert C. Wilburn, and the Trustees launched the Second Century Fund campaign with a goal of $125 million. As part of its contribution to this fund, The Hillman Foundation established an endowment for the Hillman Hall of Minerals & Gems to provide for continuing improvement of and operating support for the mineral program. This contribution also provided funding for a mineral conservation and preservation laboratory and a permanent curatorial position. R.J.G., R.A.S.



Hemimorphite pseudomorphs after calcite, 54 cm (21 inches!), colored yellow by the cadmium sulfide mineral greenockite. This Joplin, Missouri specimen, donated in 1897 by A. L. Means, is the finest such pseudomorph in the world.

HILLMAN HALL

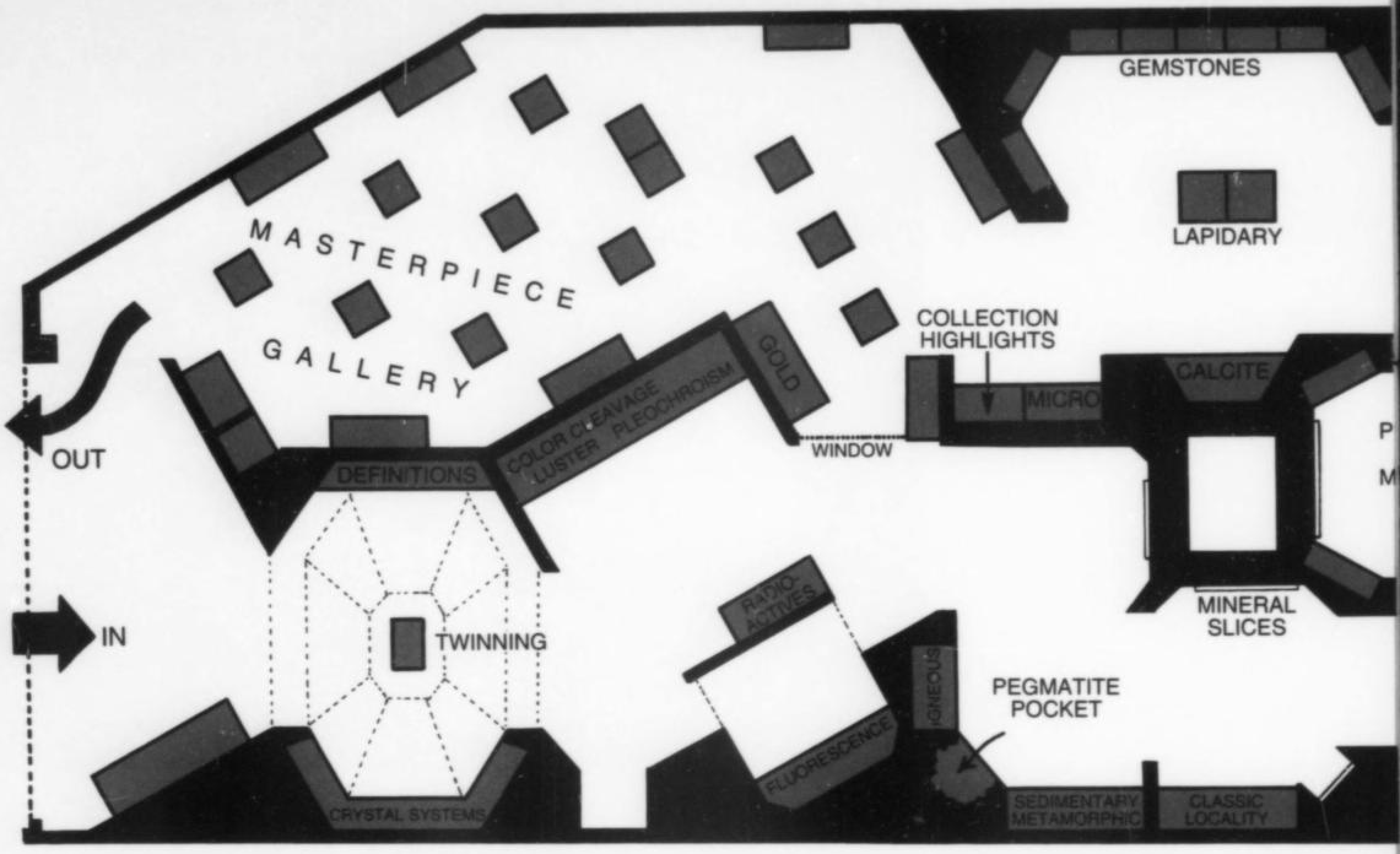
In 1980, Hillman Hall of Minerals & Gems introduced the spectacular beauty of the mineral world to the public in a dramatic permanent exhibition.

By emphasizing mineral specimens as natural works of art that stimulate the mind, the hall captures its audience with crystals, reflections, colors and angles. Once the visitor's curiosity is aroused the hall then explains such mysteries as internal order and structure of crystals, physical properties, mineral classification, and mineral formation. In this hall the crystalline world is appreciated for both its aesthetic and scientific value by laymen, students and professionals.

Prior to his retirement in 1988, Clifford J. Morrow, Jr., Chairman of Exhibit Design and Production at The Carnegie Museum of Natural History, created in Hillman Hall a design so effective that many consider it a model by which to measure other natural history mineral halls. A testament to the hall's recognition and success was its selection in 1985 to be showcased in the widely acclaimed public television series *Planet Earth*. During the hall's first decade, exhibit staff from many natural history museums throughout the world made Hillman Hall of Minerals & Gems a necessary stop on their itinerary as they prepared to design new mineral halls for their own museums.

In 1971 Delbert Oswald, Associate Curator in the mineral section, was assigned the initial task of selecting the approximately 1,100 mineral and gem specimens to be displayed. Dr. Mary R. Dawson, Chief Curator of Earth Sciences, worked closely with designer Morrow and Associate Curator Oswald in preparing the educational text and label copy. An interesting aspect of the written text in Hillman Hall is that the amount of educational copy decreases as the visitor travels through the hall from the first exhibit of the crystal systems, to the systematic collection and into the final gallery displaying the "masterpiece" specimens. This decrease in information is balanced by an increase in the focus on the physical beauty of the specimens.

"Hillman Hall of Minerals & Gems," in brushed chrome letters on a dark igneous rockwall, greets visitors as they enter the carpeted hall. The visitor is introduced immediately to crystallography and the complex laws governing the regular geometric arrangement of atoms forming mineral crystals. It is here one learns of the internal order of crystals, their external morphology, and how crystals are classified into six major systems, one with two subdivisions. Along with mineral representatives of each system, and as part of the demonstration, are beautiful glass crystal models created by Dr. F. Krantz of Bonn, Germany. The museum's 25-piece glass model collection (seven of which are displayed) is reputed to be the last such collection made by Dr. Krantz.



Floorplan of Hillman Hall.

The educational theme continues with the physical and optical properties of minerals as each succeeding exhibit builds upon the previous exhibit's information, like the increasing complexity of internally ordered patterns that characterize crystals. Properties of crystal habit, fracture and cleavage, color and luster, double refraction and pleochroism are carefully described and demonstrated using specimens from the collection. The specimen used for the interactive pleochroism display is an exceptional purplish pink spodumene crystal from Afghanistan (acquired in 1971) measuring 10 by 13.5 cm. Across from these cases are interactive exhibits describing and demonstrating the unusual properties of radioactivity, fluorescence and phosphorescence.

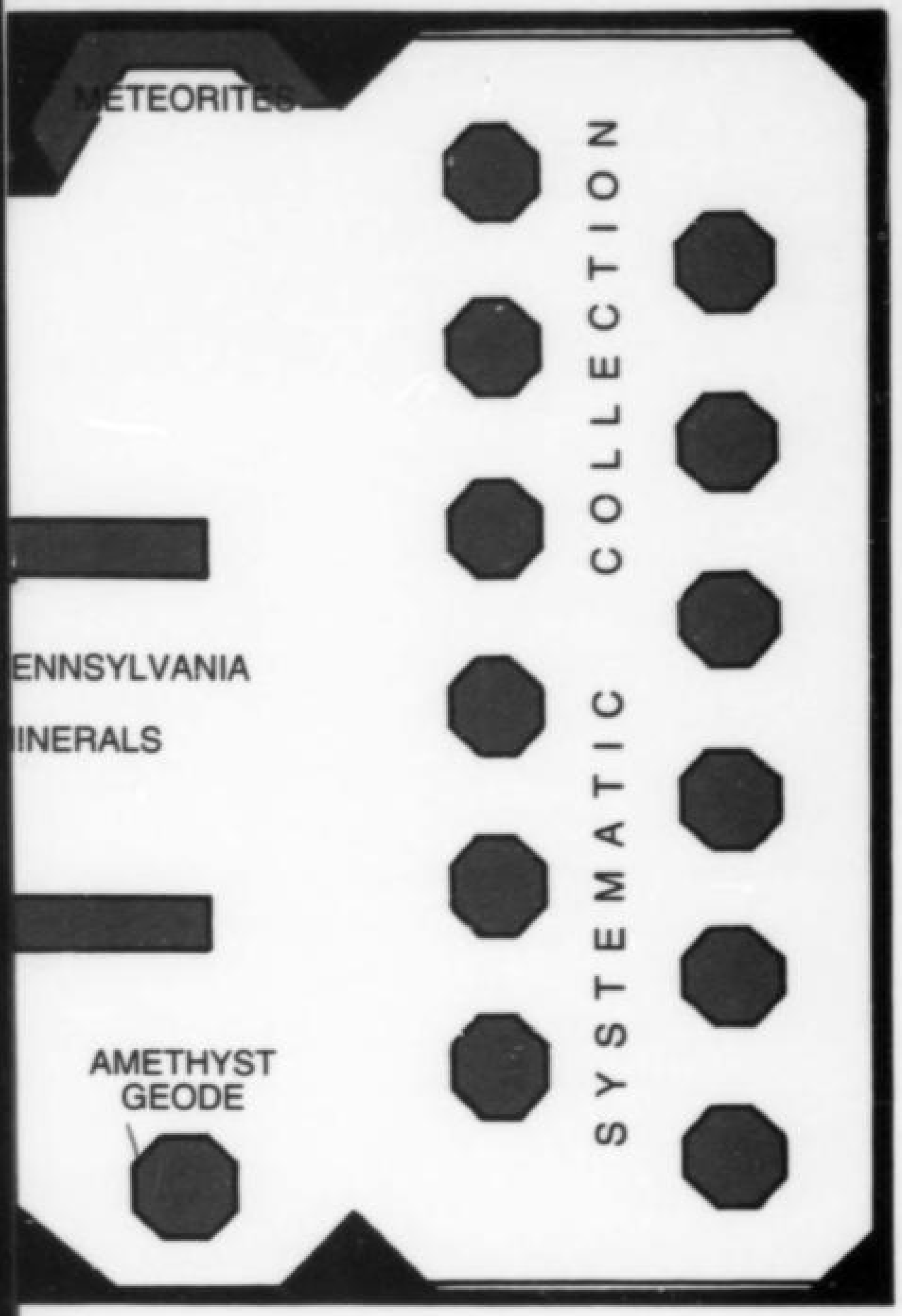
Along the way to the exhibit on the formation of minerals and rock types the visitor passes a dark windowed wall which allows a tantalizing glimpse of the hall's Masterpiece Gallery where some of nature's most beautiful specimens lie in quiet splendor.

The highlight of the mineral formation and rock types (igneous, metamorphic and sedimentary) area is the recreation of a sparkling lepidolite and muscovite-coated pegmatite pocket from the Stewart mine in California. The design and construction of this pocket have often been described by individuals familiar with the California pegmatite region as the finest museum representation of such an occurrence. To recreate this pocket, Patrick Martin, Chief Preparator of the Exhibits staff, traveled to the Stewart mine and placed latex forms directly on the rockface wall, thus making molds which he then used at the museum to reconstruct the pocket. The center of the exhibit shows a portion of the pegmatite pocket with beautiful red tourmaline, pink beryl and purple spodumene crystals.

At this juncture in the tour there is a striking reprieve from the science of minerals with a display of colorful mineral slices. Illuminated with backlighting, the slices offer beautiful visual examples of internal color zonations. One of the most interesting pieces is a large (23.5-cm) polished slice of liddicoatite from Madagascar (acquired in 1971), showing not only the pink to green to brown color zonations (indicative of trace element changes), but the trigonal to pseudohexagonal growth form changes as well.

Opposite this exhibit is the Classic Locality exhibit featuring the famous Ouray-Silverton-Telluride "triangle" located in the western San Juan Mountains of Colorado. Photographic views of the Sunnyside-American Tunnel, Camp Bird and Idarado mines are shown with representative specimens arrayed in the foreground. One 12-cm Sunnyside specimen (acquired in 1986) is a group of brightly colored pinkish red rhodochrosite rhombohedrons on matrix.

Moving from the mines of Colorado the visitor next encounters the wealth of Pennsylvania mineralogy in the Pennsylvania exhibit alcove. Here many




The systematic collection exhibit cases.

exhibited specimens came from the William W. Jefferis Collection of approximately 12,000 pieces acquired by Andrew Carnegie in 1904. Jefferis (page 30) of West Chester, Pennsylvania pursued mineral specimens for more than sixty years with many coming from the Keystone State region. One of the exhibited specimens, a large brucite composed of waxy, light green, rosette masses was taken from Wood's Chrome mine in Lancaster County, a famous early producer of exceptional brucite specimens. In 1857, Jefferis purchased from the mine's owner an unusually large quantity of this mineral which he then used for many of his trading ventures, particularly with European collectors. As stated by one of Jefferis' biographers, this mineral brought "hogheads" of English fluorites, calcites and barites to his collection. Also on display are some of Jefferis' fine Chester County minerals such as chalcopyrite, wavellite, quartz and garnet. One Pennsylvanian specimen of interest is a fantastic Chester County rutile sixling (page 30) measuring 6.5 cm. Acquired by the museum in 1987, the piece was originally part of the private collection of noted mineralogist E. Mitchell Gunnell.

At the halfway mark in the hall is the visually stunning presentation of the systematic collection, arranged according to crystallo-chemical classification. Here designer Morrow created a dramatic environment of glass octagons, housing the mineral class divisions, with mirrored wall backgrounds to apparently reflect an infinite and pleasantly disorienting succession of showcases. In the systematic collection the specimen acquisition program has made its strongest improvements in recent years. Many of the newer acquisitions shown and described on these pages were obtained with the generous support of The Hillman Foundation.

In the systematic display, which contains approximately 415 specimens, there have been over 250 changes since 1982, changes which significantly upgraded the exhibited specimens or filled in various species and locality voids. The specimens range in size from miniature to museum-size, with the majority being cabinet-size. In recent years attention has been placed on acquiring specimens of the sulfosalt, sulfide and phosphate classes, as well as secondary lead minerals including wulfenite, pyromorphite and mimetite. Locality interest has focused on regions of the world that may help fill out the geographic representations within the collection.

Successful acquisition of individual specimens and suites from the centuries-old mining regions of Bolivia, Chile, Romania, Germany and Czechoslovakia, as well as from regions of current exploration such as India, Namibia and Morocco have contributed to the overall development of specimen quality and species quantity. Marvelous silvers, proustites, acanthites, stibnites and anglesites have been recently acquired. Additionally, fluorites, rhodochrosites, pyromorphites and vivianites, topazes and apophyllites have all been significantly upgraded. Also newly acquired species of molybdates and tungstates such as wulfenites, scheelites and powellites have been added to the collection. Many of these specimens have come from the personal collections of highly regarded mineralogists and collectors such as Richard V. Gaines, William B. Sanborn, Richard A. Bideaux, Thomas McKee and E. Mitchell Gunnell. Other acquired specimens once belonged to well known collectors and scientists including Peter Bancroft, Werner Lieber, Stanley Alexander, Lazard Cahn, John Sinkankas, Joseph Urban and Frederick H. Pough.

After passing a small meteorite "touch" exhibit the visitor enters the area which features gem materials. Of the approximately 300 gem pieces on display the majority are from the 800 piece gem collection of Dr. Frederick H. Pough acquired by the museum in 1976. Donations primarily comprise the remainder of the exhibit. One interesting aspect of this exhibit is the exhibit of uncommonly cut stones, a 50-piece display of rarely-faceted minerals. Included are a 7-carat Bolivian phosphophyllite, an 8.3-carat blue-green, triangular step cut euclase from Brazil and a yellowish brown, brilliant round cut Spanish sphalerite of 22.4-carats. The gem collection displays only one jewelry piece, a 117.5-carat medium blue rectangular step cut aquamarine set in a diamond (count 175) and platinum-iridium filigree brooch (page 32) of Edwardian style. This exceptional piece, the collection's finest jewelry specimen, was donated in 1982 and is appropriately displayed in the rough-and-cut gem case in front of a 1,742-carat medium-blue, etched crystal of Brazilian beryl (page 22).

Just before entering the Masterpiece Gallery the visitor is immediately attracted to a large 45-cm twinned calcite from Joplin, Missouri. The specimen as displayed continuously fluoresces a deep red, and thus introduces the visitor to The Calcite Case highlighting the multitude of crystal forms and color varieties that may be found within a single species.

In the adjacent Collection Highlights Case, special changing exhibits are featured. The displayed topics have ranged from Recent Acquisitions to Pennsylvania Meteorites to The Birthstones. This particular case, changed every 6 to 12 months, symbolizes the dynamic approach of Hillman Hall—everchanging exhibits that present the finest quality pieces for exhibit.

Within the serenity of the Masterpiece Gallery the visitor is left alone to view some of nature's finest creations in glowing glass cubicles. The gallery was designed to present aesthetically outstanding mineral specimens designated as "world-class" representatives of their particular species (i.e., specimens classified among the very finest in the world).

The first case contains a 19-piece gold collection (approximately 180 troy ounces total) of leaves, nuggets, and well-crystallized specimens purchased from the Harvard Mineralogical Museum in 1981 (pages 11 and 12). The suite contains several pieces that once belonged to the famous A. C. Burrage and G. de la Bouglise Collections, built during the nineteenth century.

After the gold collection the Masterpiece Gallery presents 50 other specimens, the majority of museum size, and many world-class. Acquired in 1980, a large (31-cm) double geode of deep green dioptase from the Reneville district of Zaire captivates visitors before they come to the brilliant yellow-orange tabular crystals of the San Francisco mine wulfenite (page 29). This large (18-cm), fragile, rosette-covered specimen with orange mimetite balls was acquired in 1988.

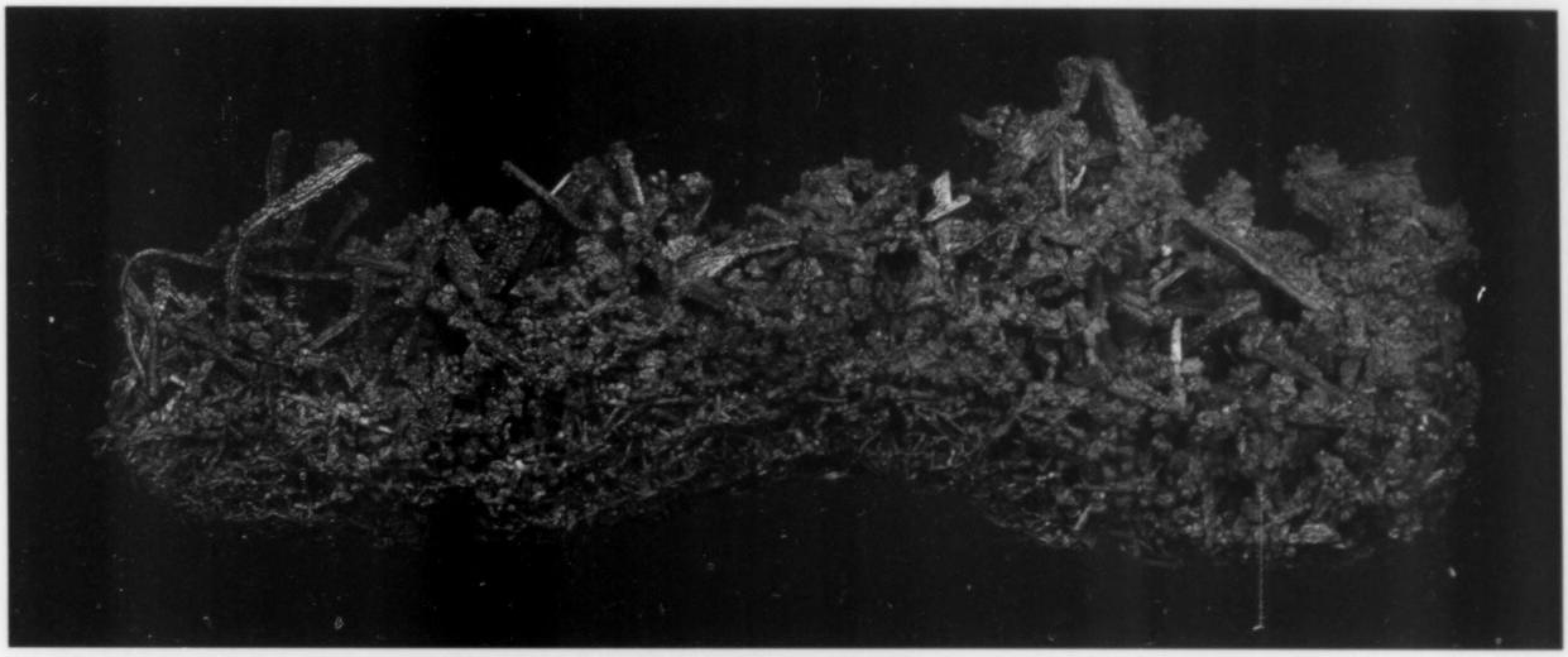
While following this line of vision, visitors are immediately attracted to the bright and spectacular yellow pseudomorph specimen of hemimorphite after calcite (page 7). This extraordinarily large (54-cm) specimen is the finest in the world of its kind and very likely the finest in the museum's mineral collection. Visitors are now in the center of the gallery. One may notice first the world-class honey-colored powellite in white apophyllite from India (page 29), and next the deep-golden topaz crystal on smoky quartz from Brazil (page 24). The large (19-cm) Zaire plancheite (page 20) of multi-hued blues, and the classic Little Three mine pegmatite assemblage with two large blue topaz crystals (page 24) are nearby.

Finally, stunning specimens of twinned and gwindeled Swiss quartz, Japanese stibnite, Brazilian tourmaline and Virginian apophyllite (page 20) are placed alongside numerous specimens from Namibia, Morocco and the United States. Like the systematic collection this is a dynamic region of the hall, where the displayed specimens periodically are replaced or upgraded.

The Masterpiece Gallery is the final statement on The Carnegie Museum of Natural History's continuous effort at preserving and conserving our mineral heritage, while also educating and delighting the public.

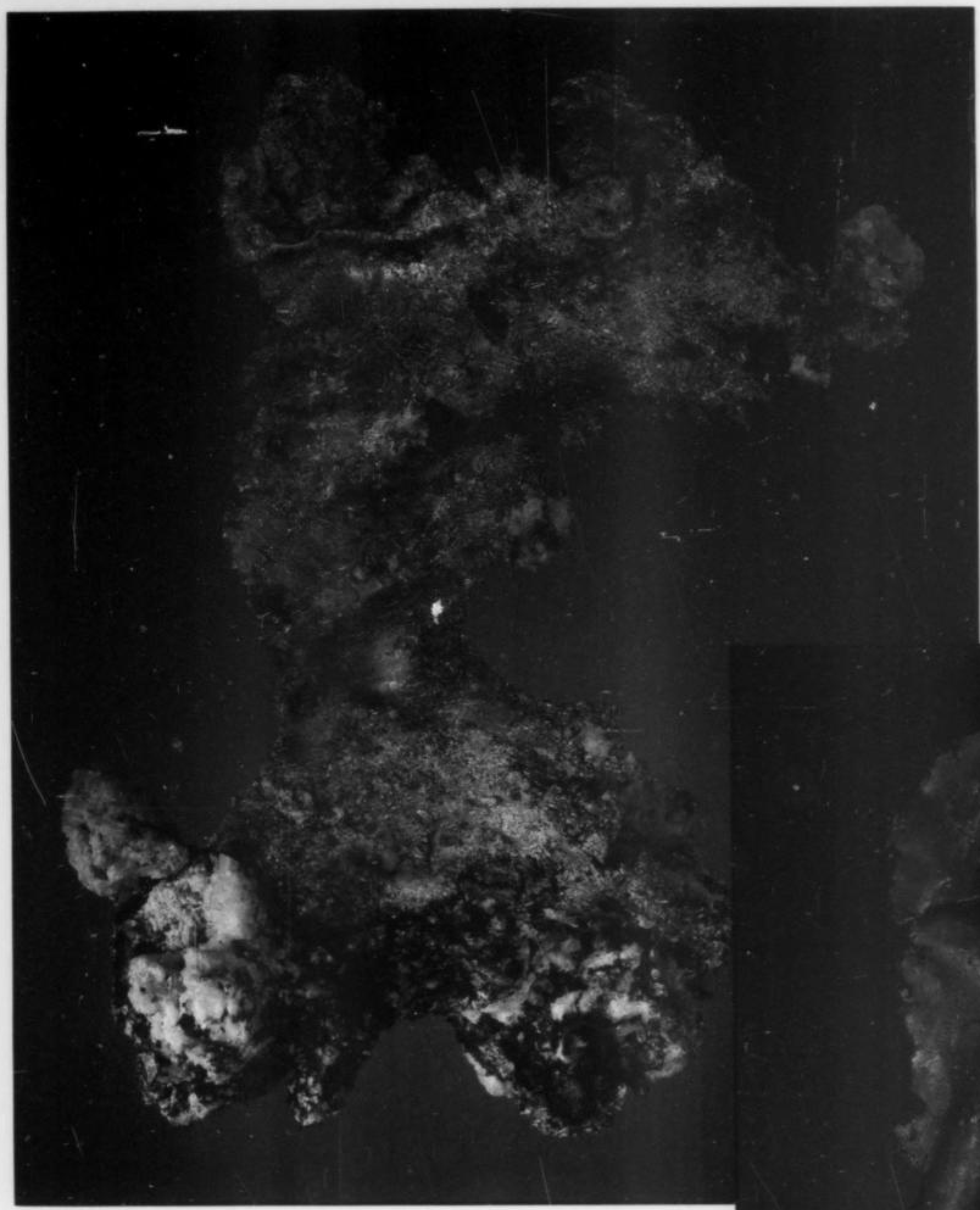
R.A.S.

HIGHLIGHTS of the COLLECTION



GOLD

Gold nuggets and gold dust are typically rounded and stream-worn, but gold specimens broken from fresh rock sometimes show beautiful crystal habits. The two specimens shown on this page, measuring 11 cm *(above)* and 7.5 cm *(at left)*, are from Breckenridge, Summit County, Colorado. Gold was discovered in the Breckenridge area in 1859, and during the 1880's a number of fine leaf-gold and wire-gold specimens such as those pictured here were recovered. Unfortunately only a few have survived to the present day. Other fine pieces are owned by the Denver Museum of Natural History and the Harvard Mineralogical Museum; both specimens shown here were acquired from Harvard in 1981.

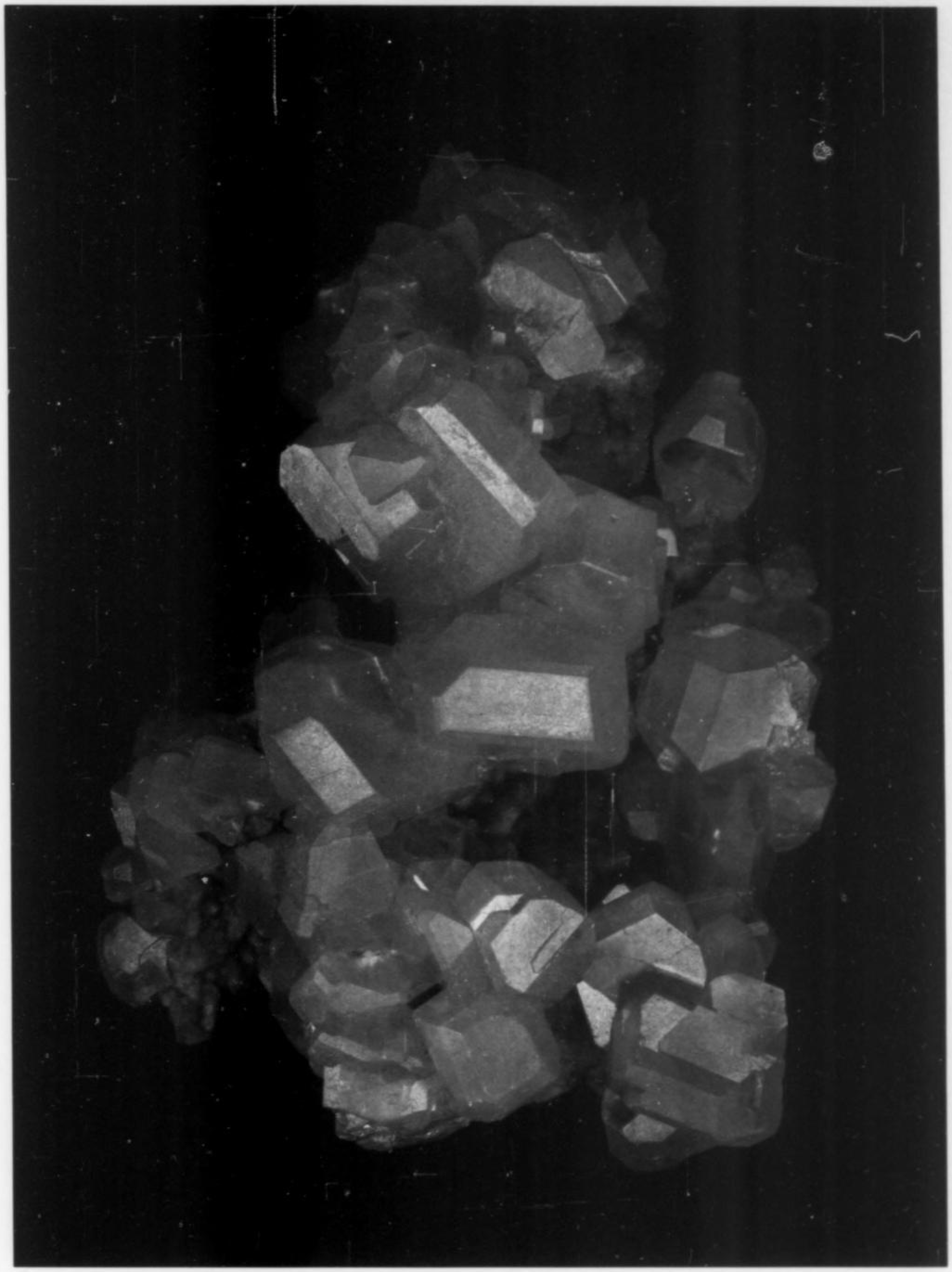


GOLD

Shown at left is a superb leaf-gold specimen with white quartz, 7 cm tall, from Rosia Montana, Transylvania, Romania. Rosia Montana, formerly known as Verespatak, is one of Old Europe's most famous gold mining areas. Herodotus, writing in the 5th century B.C., mentions gold jewelry being worn by natives of Transylvania living near the Aries River, which drains the Rosia Montana area and carries waterworn gold down from the deposits. Mining of the Rosia Montana veins has yielded many of Europe's finest gold specimens.

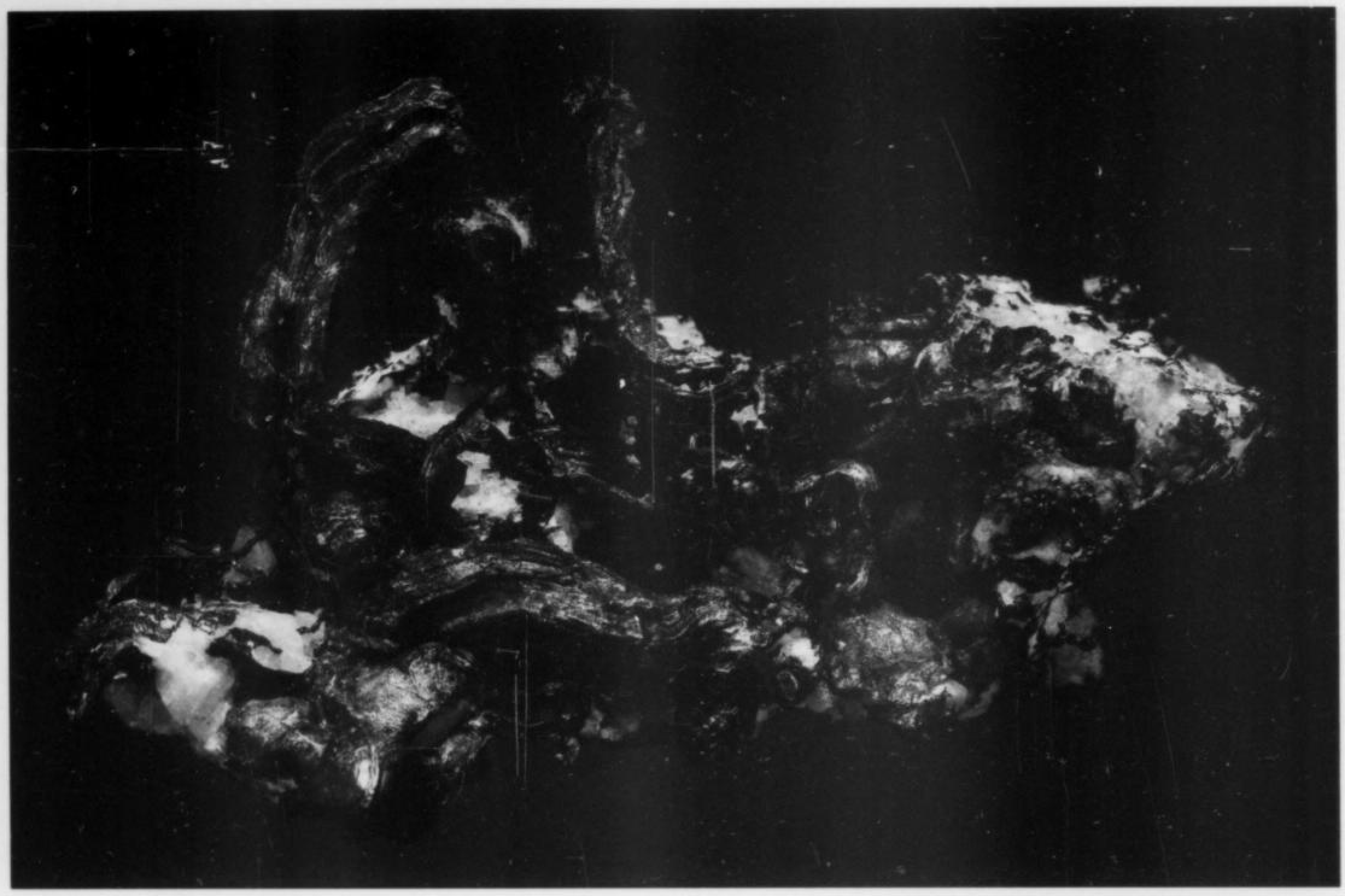
GOLD

California has produced most of the world's best gold specimens. The magnificent 12.5-cm leaf-gold shown at right was found in an unknown mine somewhere in the rich Tuolumne County gold belts, discovered in 1848. Wayne C. Leicht, California gold specialist and historian, ranks this as one of the best gold specimens from Tuolumne County. Other fine examples are in the Smithsonian, the Leicht collection, and the Harvard Mineralogical Museum (from which the specimen shown here was acquired in 1981).

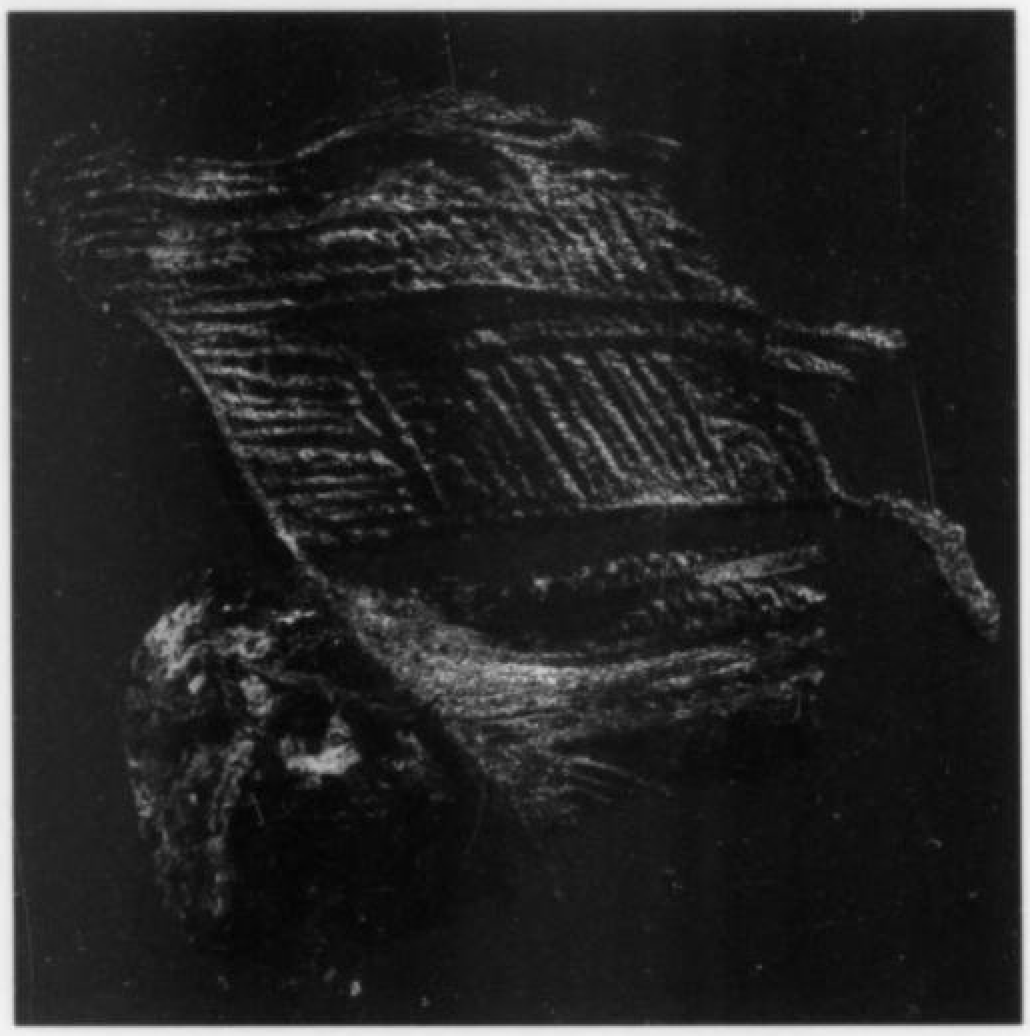


SULFUR

Sulfur occurs in fine, large crystals at only a few places in the world. The most famous localities are on the Italian island of Sicily. The extraordinary group pictured above came from the centuries-old sulfur mines at Cianciana, Agrigento Province. It was acquired in 1988, from the collection of a prominent American mineral dealer, Lazard Cahn (1865–1940). The Sicilian mines have been closed for many years, and are no longer yielding fine exhibit-quality specimens.



SILVER



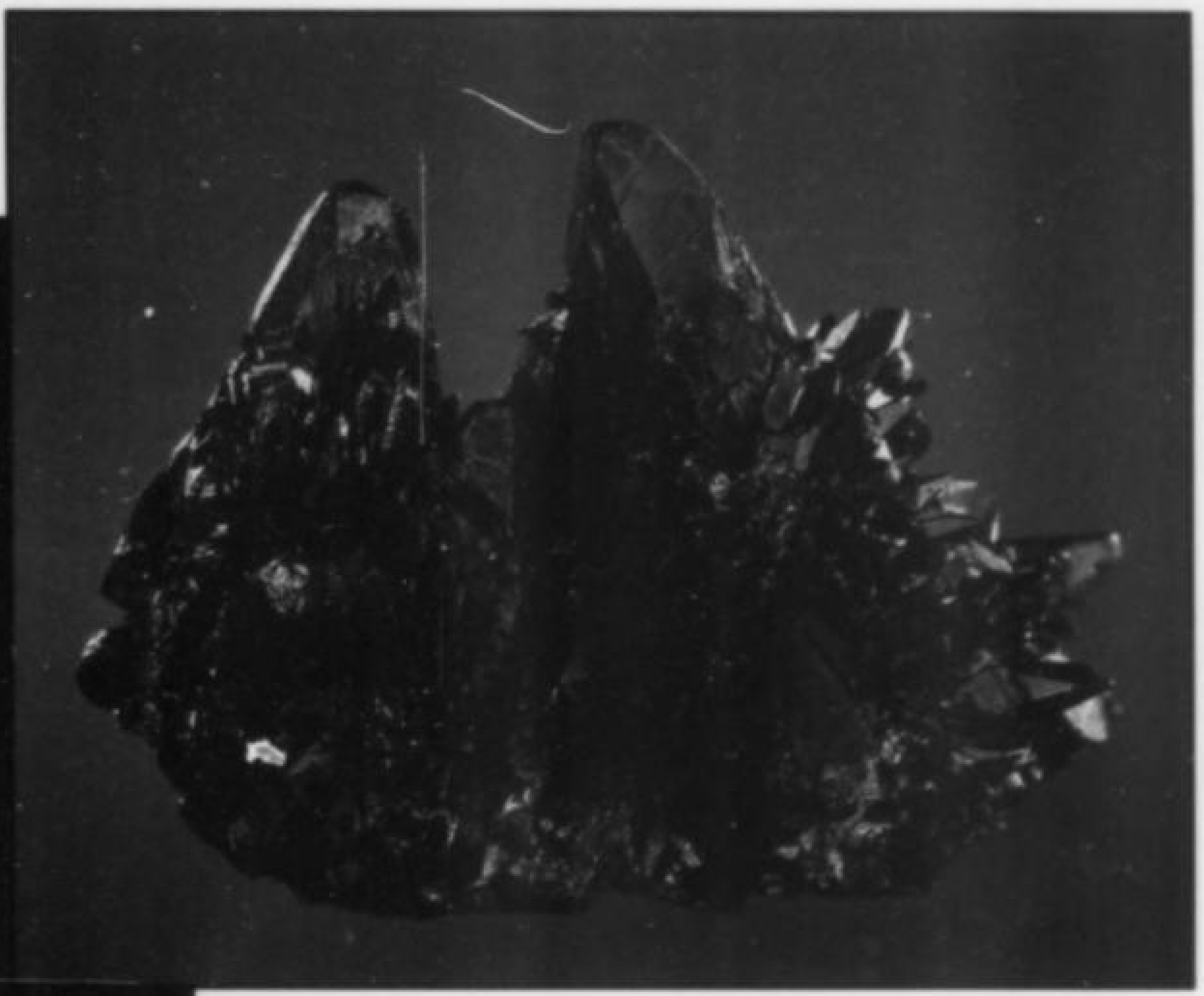
Native silver has been found at many places around the world. The specimen above, 14 cm long, came from the most famous silver district of all: Kongsberg, Norway. The Kongsberg mines, discovered in 1623, have yielded what are by far the world's finest specimens of wire silver.

Another famous silver-mining area, actually more famous for the silver-containing mineral proustite (see facing page), is Chañarcillo, Chile, source of the remarkable 8-cm flag-shaped crystal group shown at right. It was part of the collection of a German, professor von Konen, in 1885, and was acquired by The Carnegie in 1983. The Chañarcillo deposits were discovered by a mule-driver in 1832.

The silver at left is from the Batopilas district, Chihuahua, Mexico, known since 1632 for beautiful specimens of intergrown needle-shaped crystals. To commemorate a visit by the Bishop of Durango around 1730, one mine owner is said to have paved the sidewalk, from the church to the house where the Bishop was to stay, with thousands of 66-pound ingots of Batopilas silver. Even today rich pockets of crystalline silver are occasionally encountered in some of the old mines.

ACANTHITE

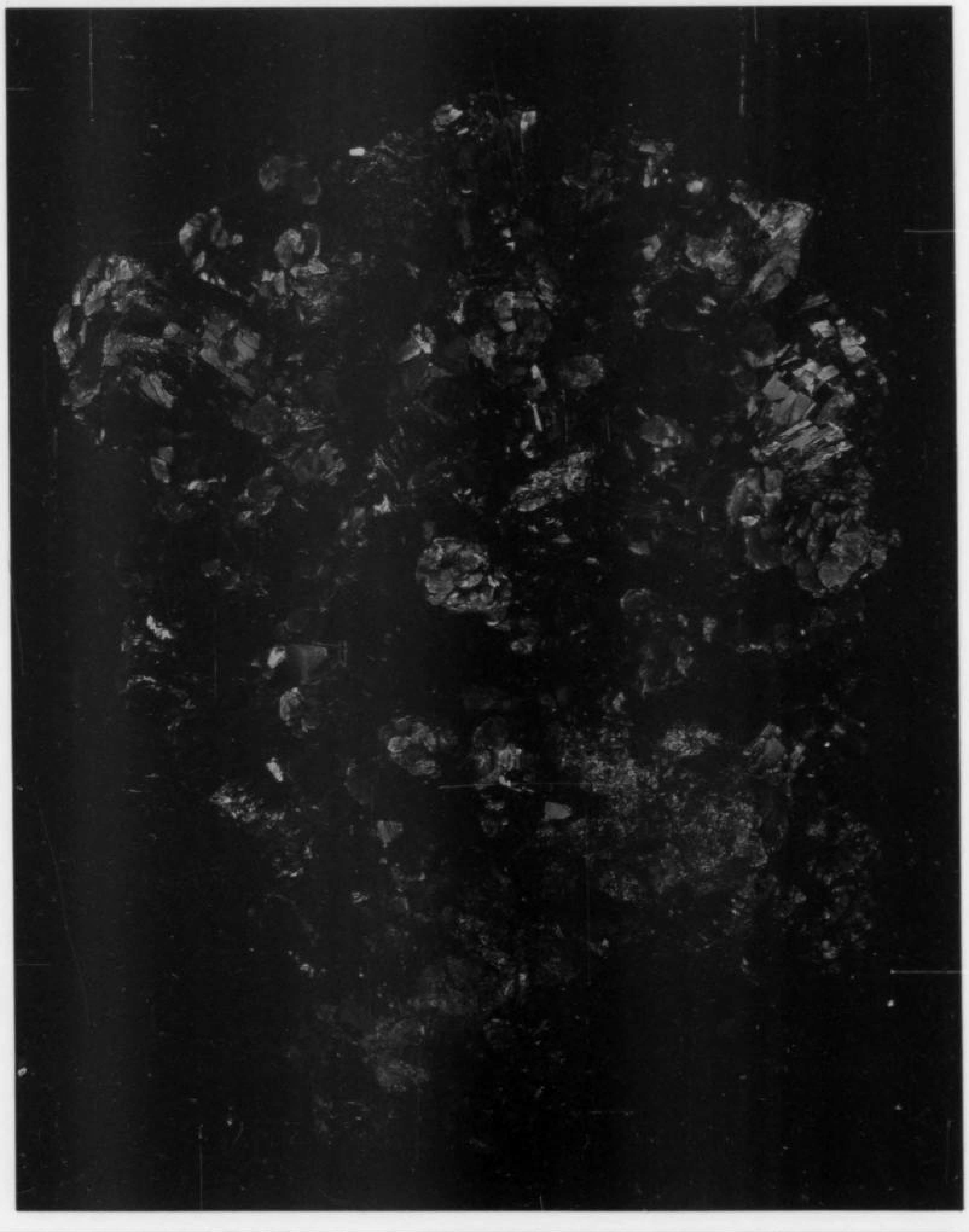
Acanthite, the basic sulfide of silver, is not uncommon as an ore mineral but is rare in fine crystals. The 6.2-cm group of cubic crystals shown at left (acquired in 1987) is probably the finest known Bolivian acanthite. It came from the mines at Colquechaca, Potosi, where mining dates back at least to the 15th century. Guanajuato, Mexico, has produced similar specimens, one of which is also in the Carnegie Collection.



PROUSTITE

Ruby-red proustite, a silver-arsenic sulfide, is among the minerals most treasured by collectors and museums. The 5-cm specimen above (from the Dolores mine, Chañarcillo, Chile) and the beautiful 6.5-cm specimen at left (from Niederschlema, Saxony) show why this is true. The Saxon mines have been known at least since the tenth century, though all have long since been exhausted and closed.

STEPHANITE



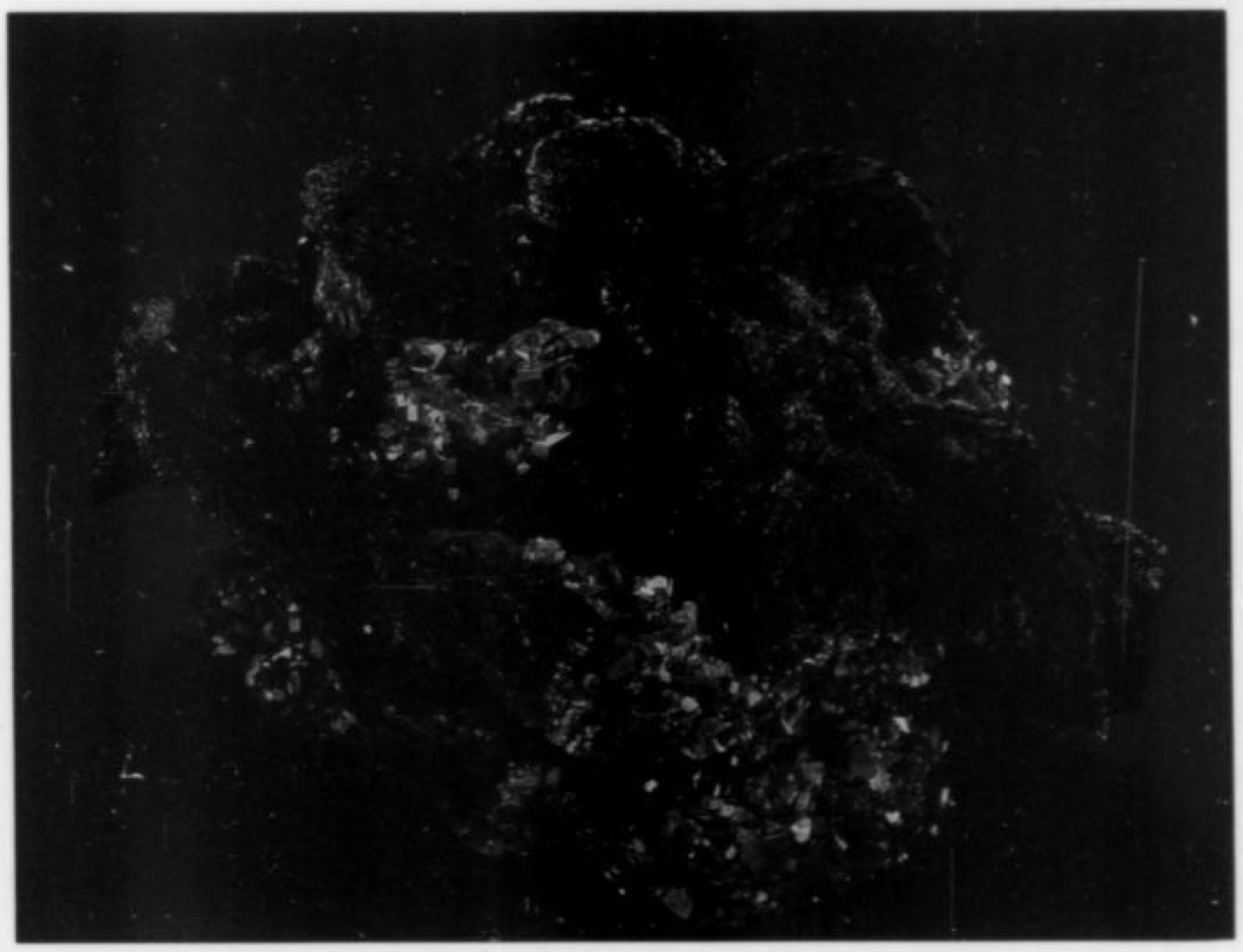
Stephanite, a silver-antimony sulfide, is uncommon in good crystals, but some fine specimens have been recovered in Mexico, South America and Eastern Europe. The example shown above, 5 cm across, was found in the Veta Grande mine, Zacatecas, Mexico, in the late 1980's. The Veta Grande ("Great Vein") was first shown by local Indians to a Spanish captain named Juan de Tolosa in 1546; as a result, Tolosa became one of the richest men in Mexico.

PYRARGYRITE

Pyrargyrite, which, like stephanite, is a silver-antimony sulfide, occurs in many of the same deposits. The superb 11-cm specimen shown at right came from the Valenciana mine in the Veta Madre ("Mother Vein"), Guanajuato, Mexico. The Veta Madre has yielded copious quantities of silver since its discovery in 1558. The Carnegie specimen was first acquired by the British Museum of Natural History around 1870, and later by The Carnegie in 1978.

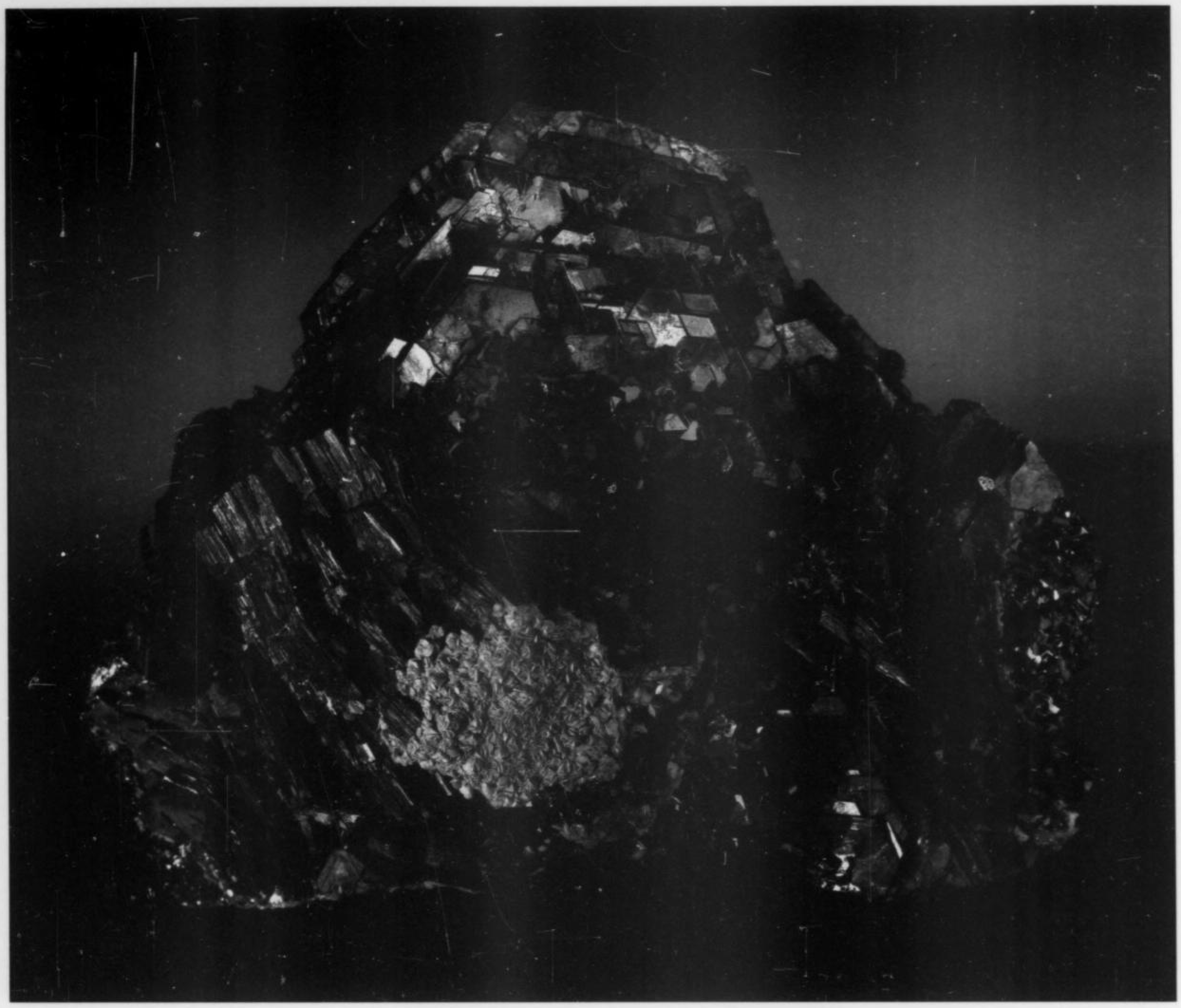
DYSCRASITE

Dyscrasite, a compound of silver and antimony, is quite rare in good crystals. A few years ago collectors began finding calcite-covered specimens in an old mine in Pribram, Czechoslovakia. They dissolved off the calcite in acid to reveal some of the world's finest crystal groups of dyscrasite. The Carnegie's specimen, pictured at right, measures 12.5 cm and is one of the largest recovered; it may well be the finest known example of the species. The Pribram deposits, discovered in the thirteenth century, have yielded a wide variety of fine minerals, and it is ironic that some of their finest (such as the dyscrasite) came out only after the mines had been closed.



WURTZITE

Wurtzite, a zinc sulfide, is almost never found in sizeable or even recognizable crystals. Thus the extraordinary 10-cm crystal group on galena shown at left is all the more surprising. It was found in the Animas vein, Chocaya district, Potosi Department, Bolivia, and subsequently entered the collection of Dr. Frederico Ahlfeld, one of Bolivia's most famous mineralogists and coauthor of the definitive work on Bolivian mineralogy. It is the finest known example of the species.

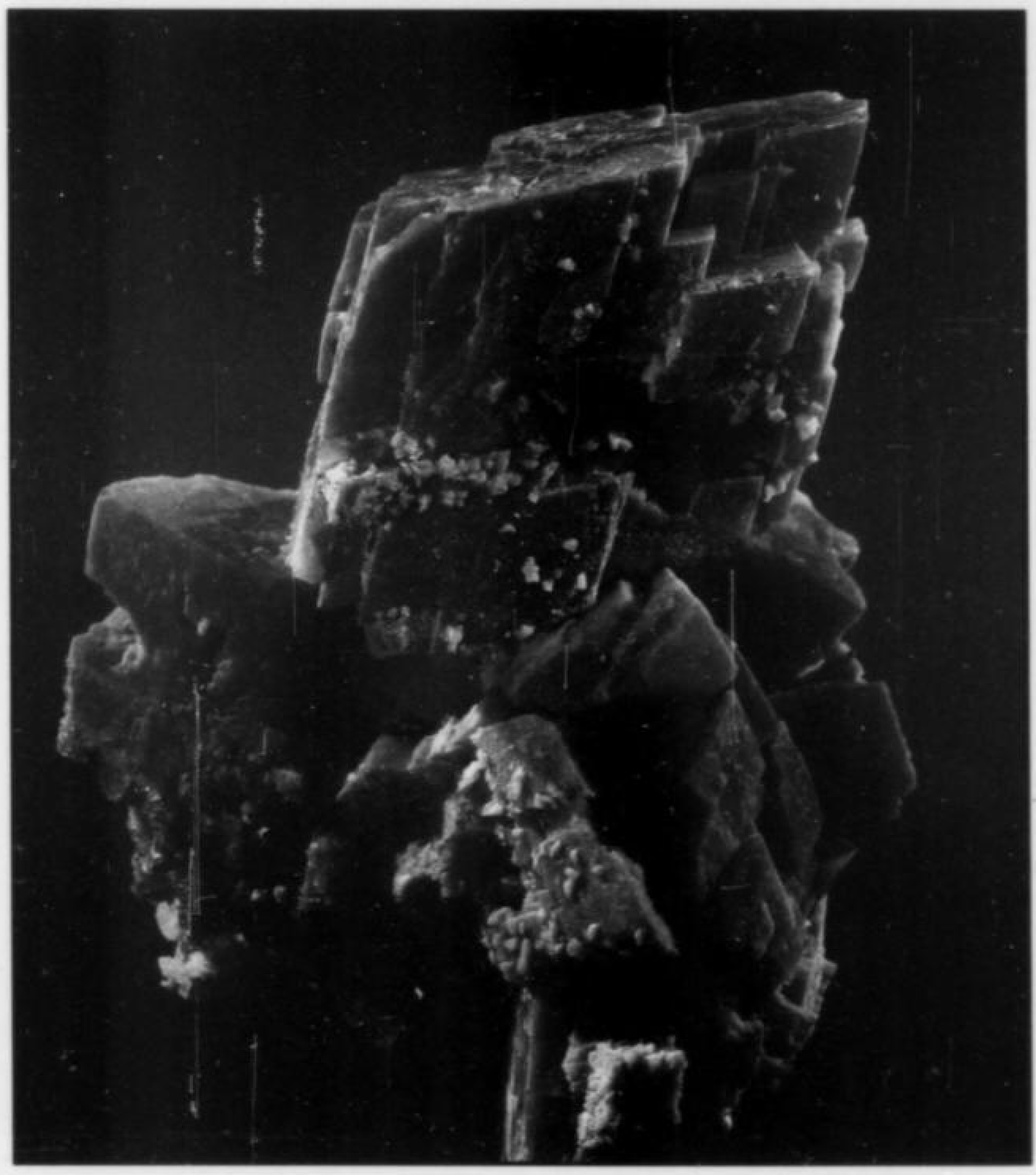


PYRRHOTITE

Pyrrhotite, an iron sulfide, is known in large showy crystals from only a few localities. The specimen shown above, 13.5 cm across, is from Trepca, Yugoslavia, and was acquired in 1987.

FLUORITE

Fluorite, calcium fluoride, occurs in fine crystals and bright colors at many localities worldwide. Large octahedral crystals are somewhat rare, however; the specimen at right, 9.5 cm across, is considered the finest from New Mexico's best locality, the Pine Canyon deposit in Grant County.



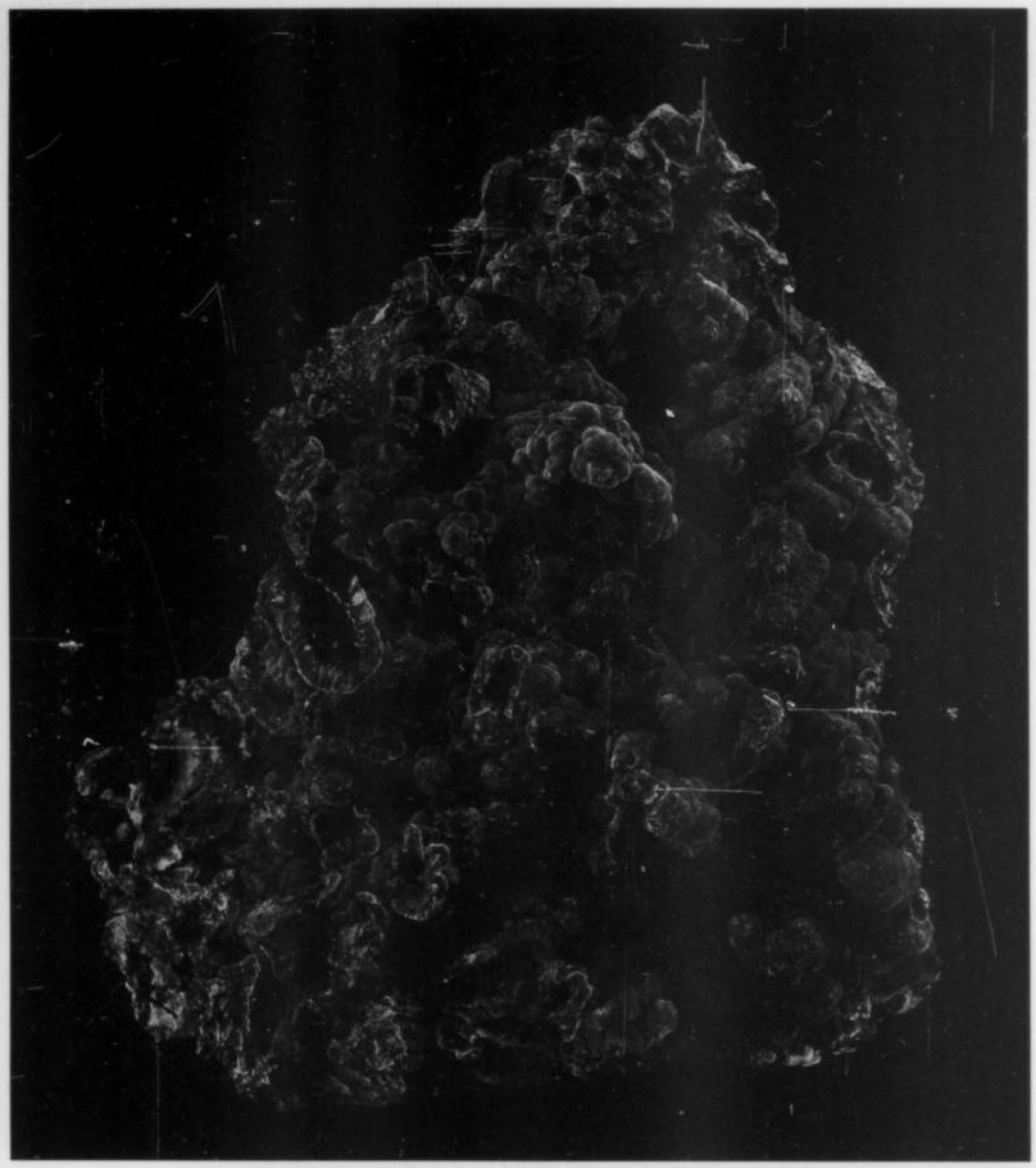
CERUSSITE

Cerussite, lead carbonate, seems to have reached its ultimate development in the unique deposit at Tsumeb, Namibia. The largest and best-formed examples, like the 14.5-cm group shown above, have been found there amid a wide range of other rare and beautiful minerals.

RHODOCHROSITE

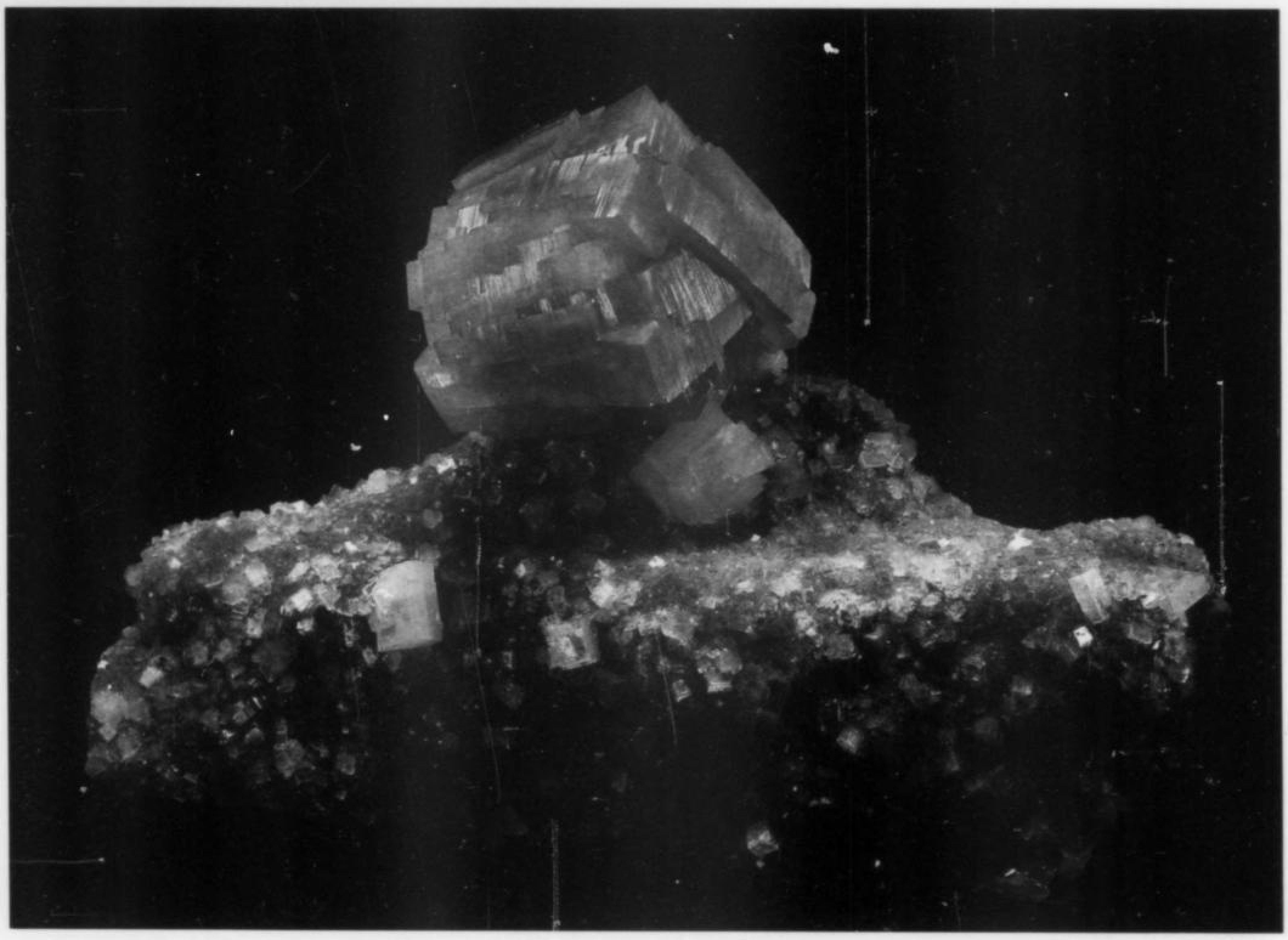
Rhodochrosite, a pink to red manganese carbonate, occurs in fine crystals at a number of Colorado localities. The specimen at left, 8.9 cm, came from the American Tunnel near Gladstone, in the Silverton district, San Juan County. It was acquired in 1983 from the William Sanborn collection.

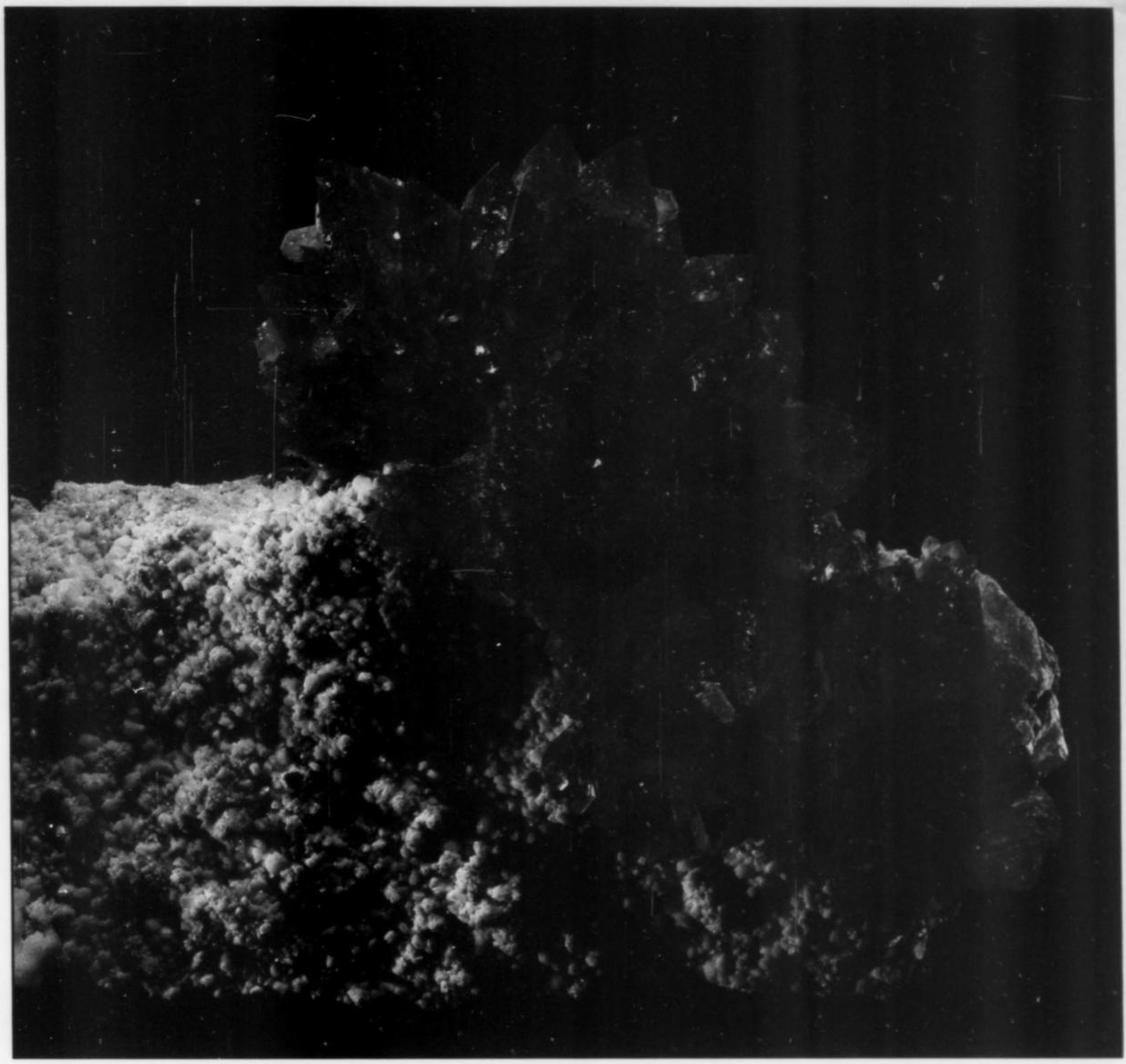
The American Tunnel originally provided access to the Sunnyside mine, discovered in 1872. It has yielded many fine specimens, especially rhodochrosite with octahedral green fluorite.



PLANCHEITE

Plancheite, a rare copper silicate, is usually found in small tufts and thin veins. The remarkable 19-cm specimen of velvety blue plancheite shown at left is from the M'sesa mine, Shaba province, Zaire. According to Dr. George Robinson, Curator at the Canadian Museum of Nature, it is very probably the finest known example of the species. The M'sesa mine is in the center of the "Shaba crescent," an area heavily mineralized in uranium, copper and other metals. Copper minerals have been mined in the crescent since ancient times, and smelted in crude ovens to yield metallic copper.





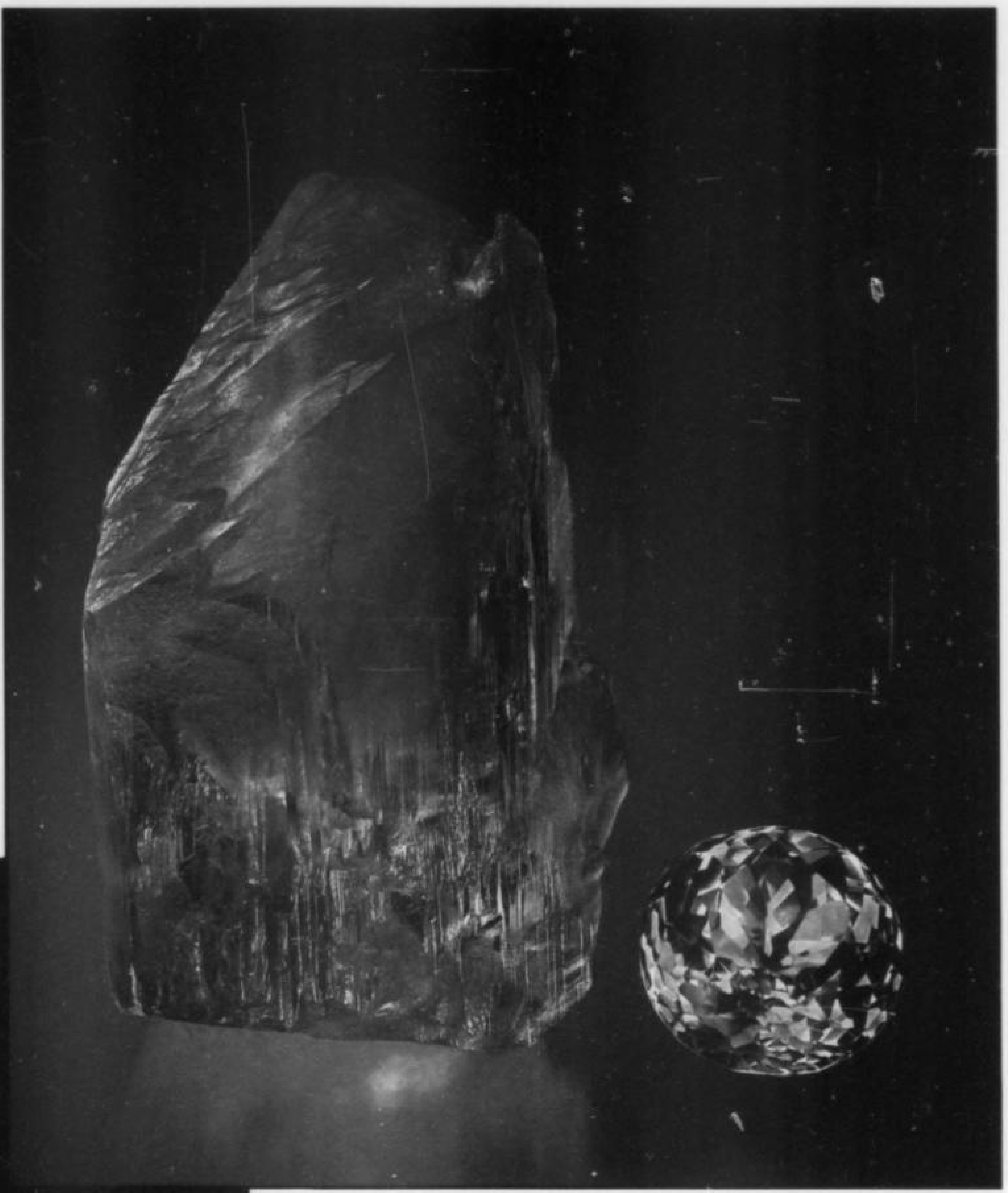
APOPHYLLITE

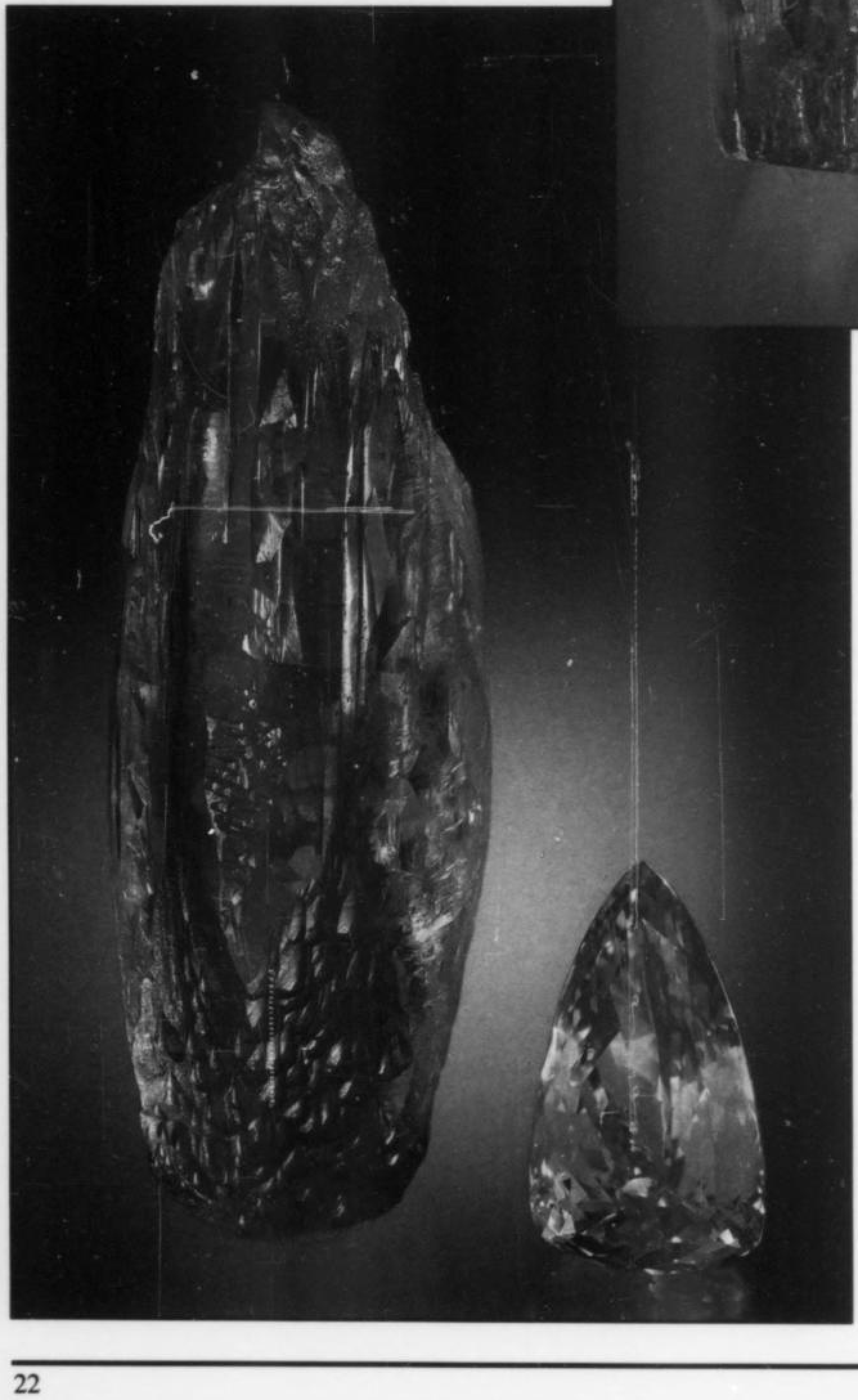
Apophyllite, a potassium-calcium silicate, occurs in good crystals worldwide, but two occurrences stand out as the best. The specimen shown on the facing page *(bottom)* is from a discovery made at the Fairfax quarry, Centreville, Virginia. There, in 1953 and 1967, an interconnected pair of lava tubes was opened which yielded huge subparallel crystals and rosettes on a matrix of green prehnite. The Carnegie specimen from this find measures 24.1 cm across, and was acquired in 1985 from the Lewis Land collection.

The other occurrence generally considered best for the species is the #2 quarry, Pashan Hills, Poona, India. Extraordinary specimens of beautiful green apophyllite on heulandite have been mined there for many years. (Most other Indian apophyllite is colorless.) The example shown above, 15.5 cm across, was acquired in 1984 from the Peter Bancroft collection. Unfortunately, the quarry had to be closed in 1989 because the town of Poona had grown around it, and blasting was endangering the adjacent residences. The Carnegie specimen is among the finest ever found there.

SPODUMENE

Spodumene is a lithium-aluminum silicate, and the lilac-colored variety known as kunzite is among the prettiest of gemstones. Shown at right is a 7.3-cm crystal from the Pala Chief mine, San Diego County, California, and a 52.5-carat faceted stone from Brazil. The crystal was acquired in 1985 from the Julian Armstrong collection, and the cut stone in 1976 as part of the Frederick Pough gem collection. The San Diego County pegmatite deposits, like those in Brazil, are famous for producing beautiful gem specimens of spodumene, tourmaline, topaz, garnet and other species.





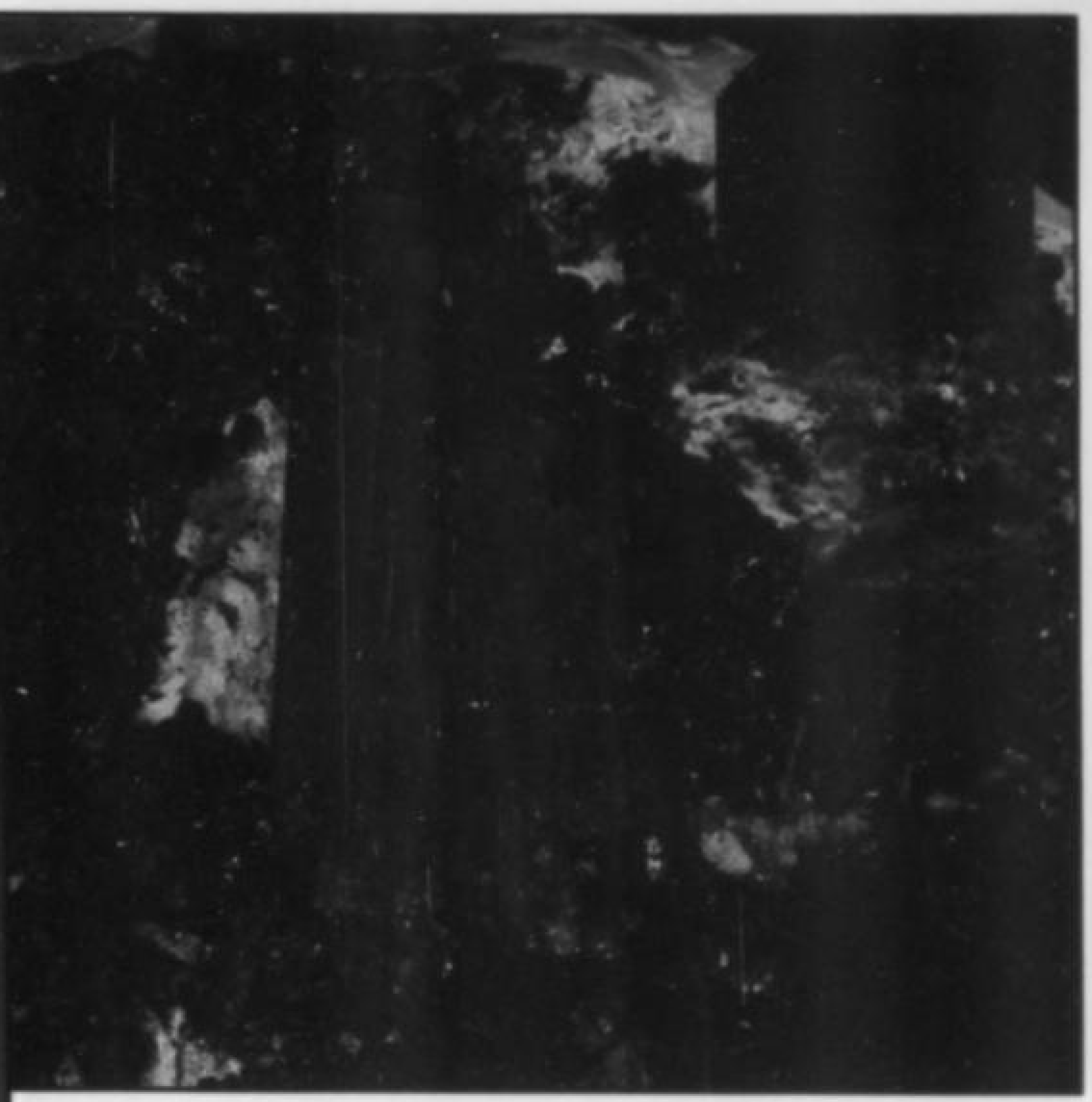
BERYL

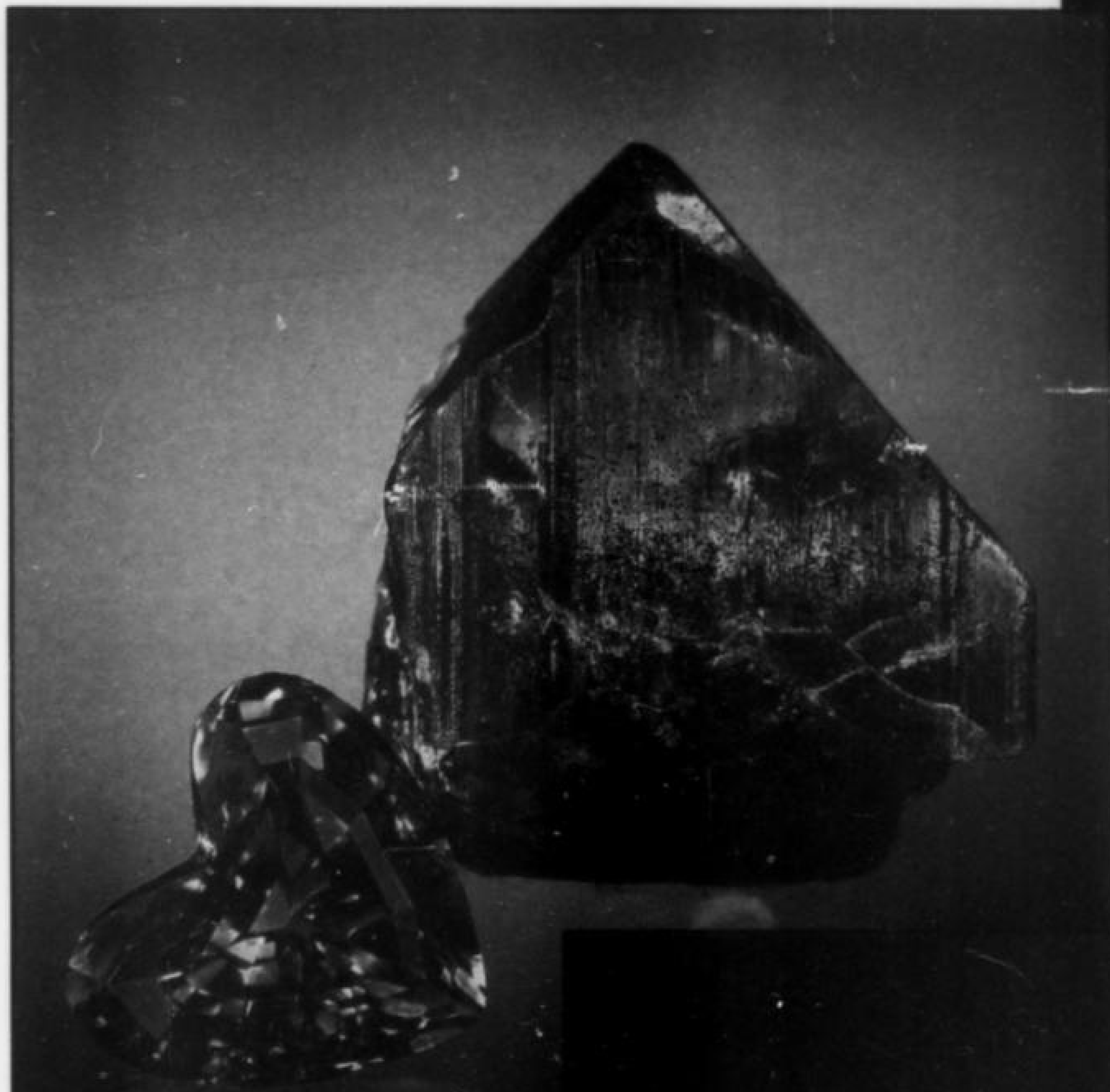
Beryl, a beryllium-aluminum silicate, occurs in a range of beautiful colors, each color having its own varietal gem name. Chromium-green is called *emerald* (see facing page), yellow is *heliodor*, pink is *morganite*, colorless is *goshenite*, and blue is *aquamarine*. The aquamarine crystal shown at left measures 13 cm and comes from Brazil; the cut stone weighs 137.3 carats. They were received as donations in 1978 and 1980.

Beryl most commonly occurs in deposits called pegmatites, created from the residual liquids of large, slowly solidifying bodies of molten rock. Late-stage pegmatite formation is often characterized by a corrosive period in which some crystals are partially dissolved. This results in irregular but attractive crystal surfaces like those on the crystal at left.

BERYL

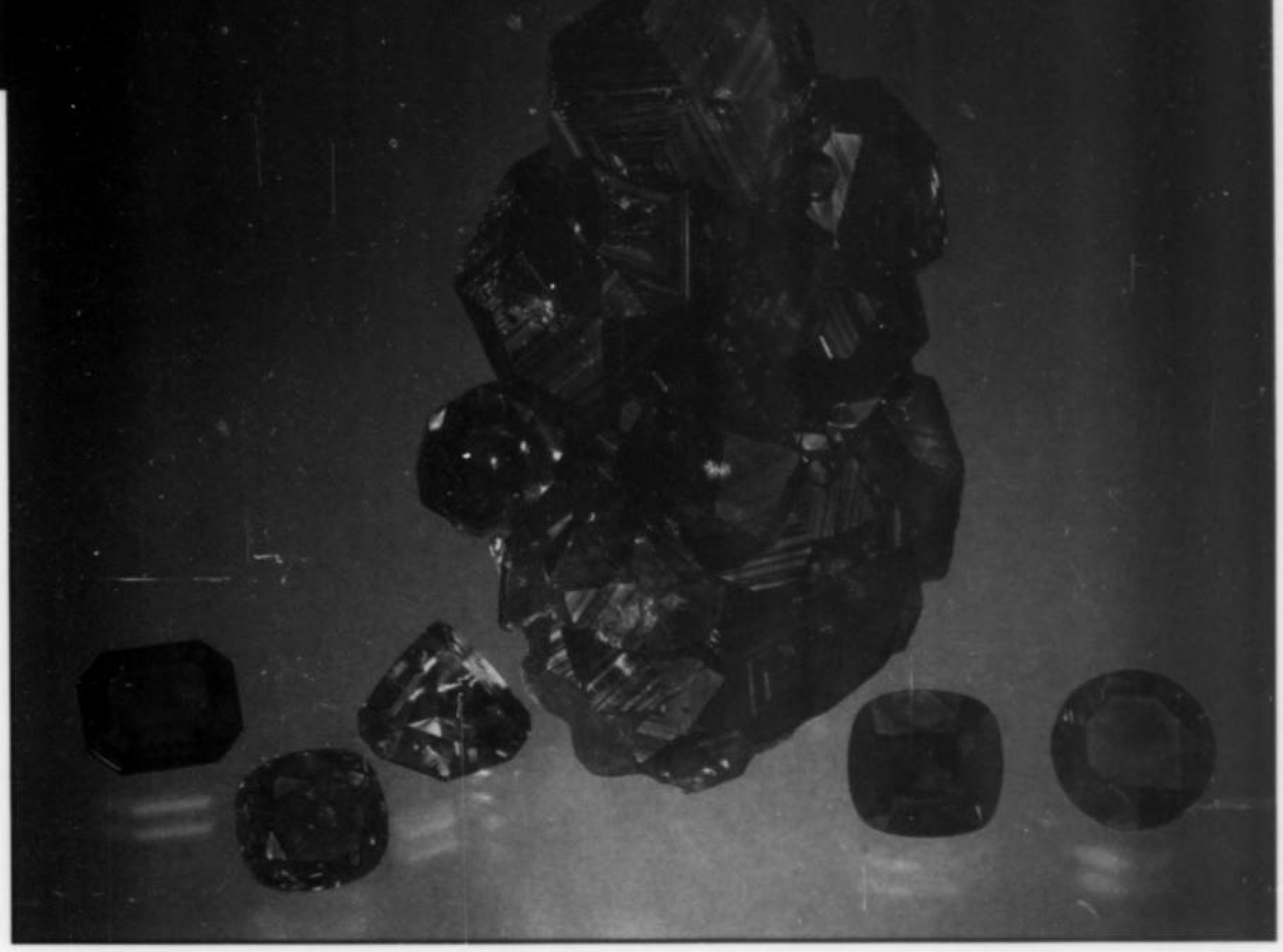
Emerald, chromium-green beryl, is one of the most valuable of gemstones. The principal deposits are in Colombia and, to a lesser extent, in the Soviet Union and elsewhere. The specimen shown at right, with crystals to 3 cm, is from Boyaca in the famous Muzo district, Colombia. The cut stone, 1.30 carats, is from Takowaja, in the Ural Mountains, Russia.





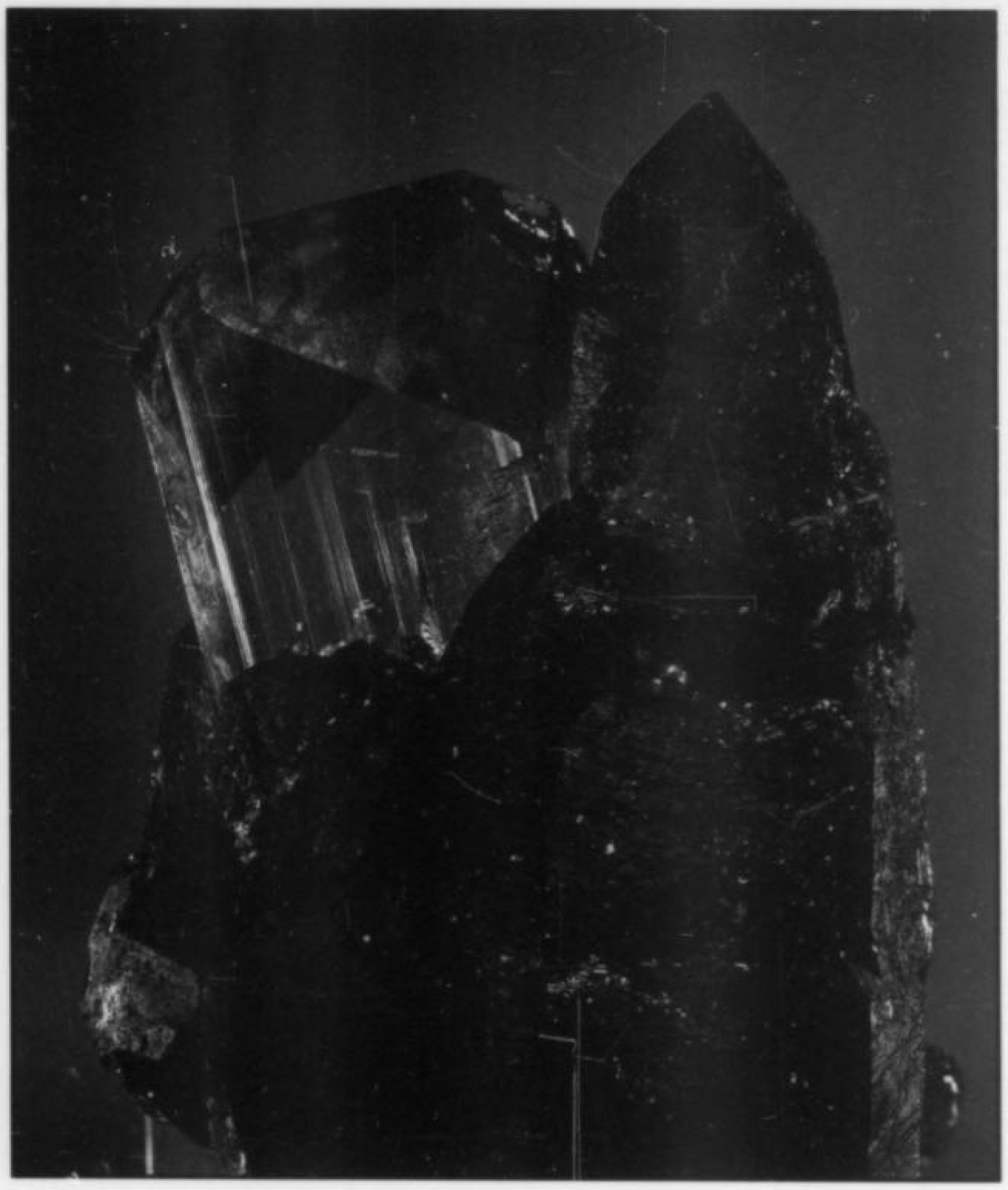
FORSTERITE

Forsterite, a green magnesium silicate, is given the gem name *peridot* when clear and facetable. The large crystal at left, 4 cm, comes from the premier locality, a small island in the Red Sea known as St. John's Island or Zeberget Island. The occurrence, known to the ancient Egyptians, has yielded the largest sharp crystals. The cut stone, from the same locality, weighs 16.6 carats (Pough gem collection).



GARNET

The garnet group of silicate minerals consists of several different species, some of which are shown at right. The crystal group, 5.6 cm, is grossular from the Jeffrey mine, Asbestos, Quebec. The cut stones are (from left to right): deep red pyrope (gem variety *rhodolite*), 5.3 carats; green andradite (gem variety *demantoid*), 5.3 carats; orange spessartine, 5.75 carats; red-orange grossular (gem variety *hessonite*), 5.3 carats; deep red pyrope (gem variety *rhodolite*), 5.7 carats.



TOURMALINE

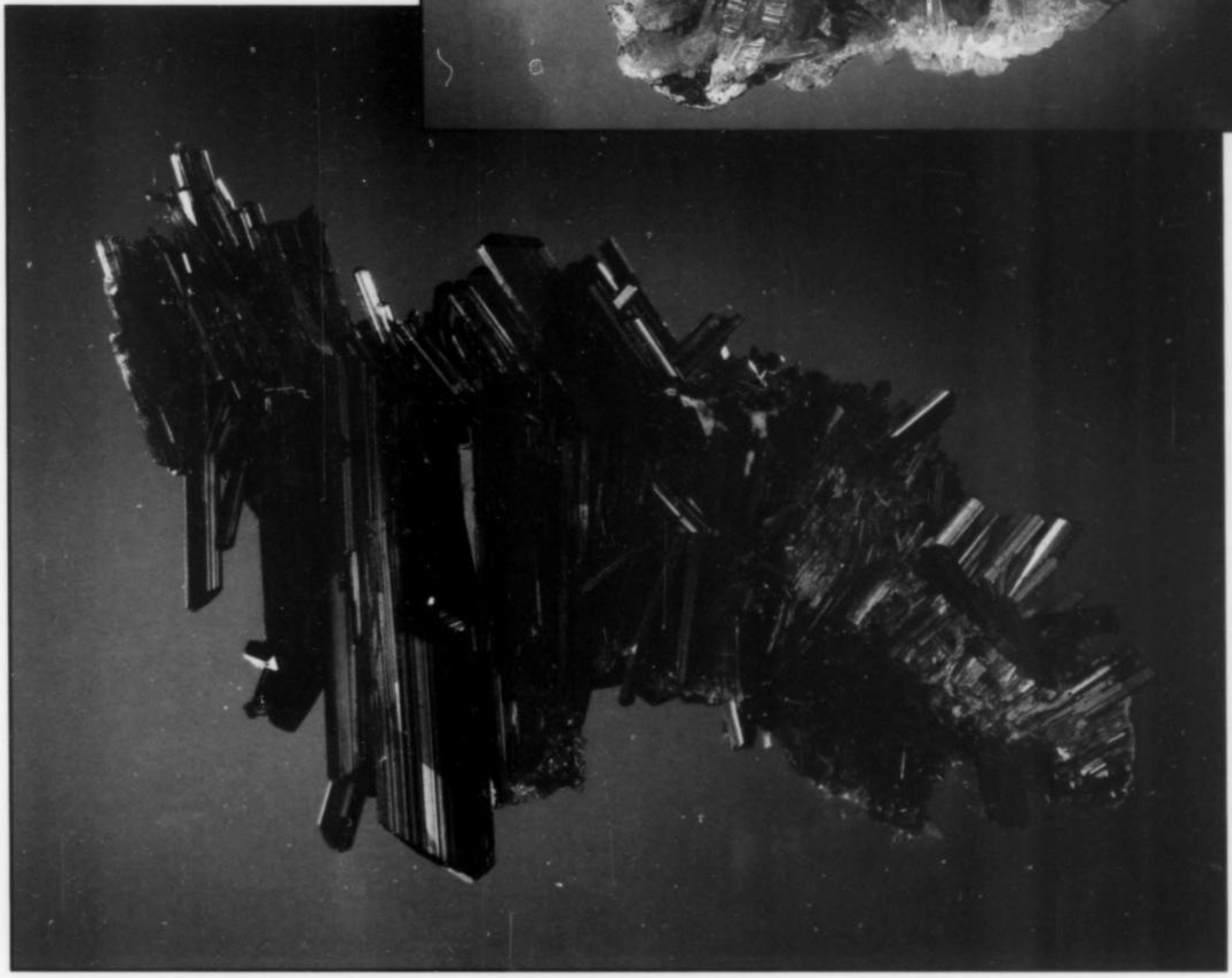
The tourmaline group of borosilicate minerals, like the garnets, contains a host of species and colors. Shown above is an extraordinary specimen of black tourmaline (schorl) with blue topaz and smoky gray-brown quartz on white albite, 26 cm across, from the Little Three mine in San Diego County, California. The Little Three pegmatite, discovered in 1903, was purchased in 1951 by Louis B. Spaulding Sr. and Jr. In a major pocket discovered in 1976, Louis Jr. collected the pictured specimen, which is considered by Dr. Anthony Kampf (Curator, Natural History Museum of Los Angeles County) to be the finest cabinet specimen ever found at the mine.

TOPAZ

Topaz, an aluminum silicate, comes from many pegmatite occurrences in Brazil, and elsewhere around the world. The gemmy yellow crystal at left, intergrown with a smoky quartz crystal 13.5 cm wide, comes from a pegmatite near Mimosa, Espirito Santo, Brazil. Although not unusual for size, its extraordinary color makes it stand out among topaz specimens. It was acquired by the museum in 1986.

QUARTZ

Quartz is pure silicon dioxide, one of the most common minerals in the earth's crust. When transparent and colored by impurities it is given varietal gem names; violet or purple quartz, colored by iron, is known as amethyst. The beautiful specimen shown at right, 11 cm across, is from a famous but very remote locality called the Las Vigas mine, located in the mountains near Veracruz, Mexico.

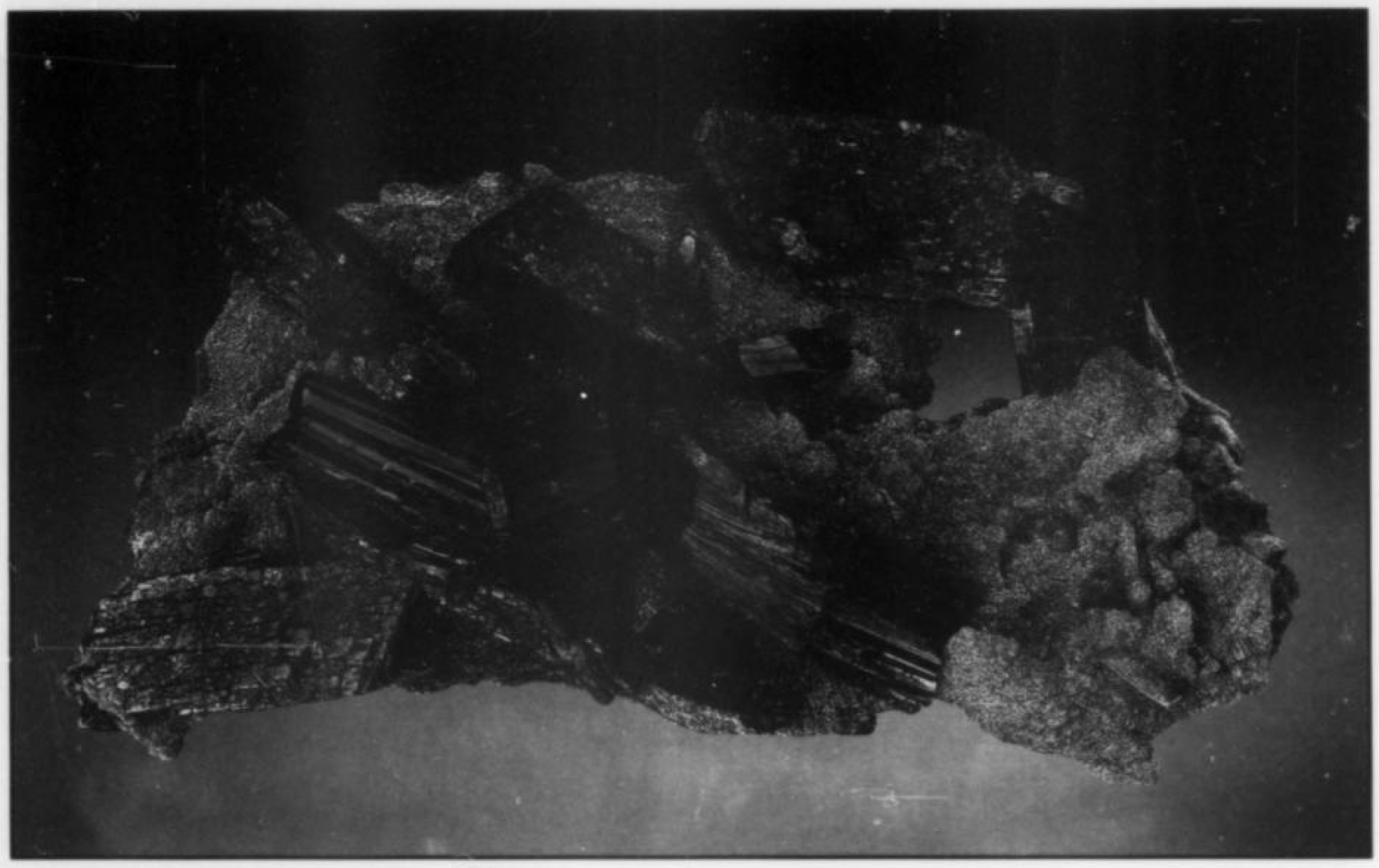


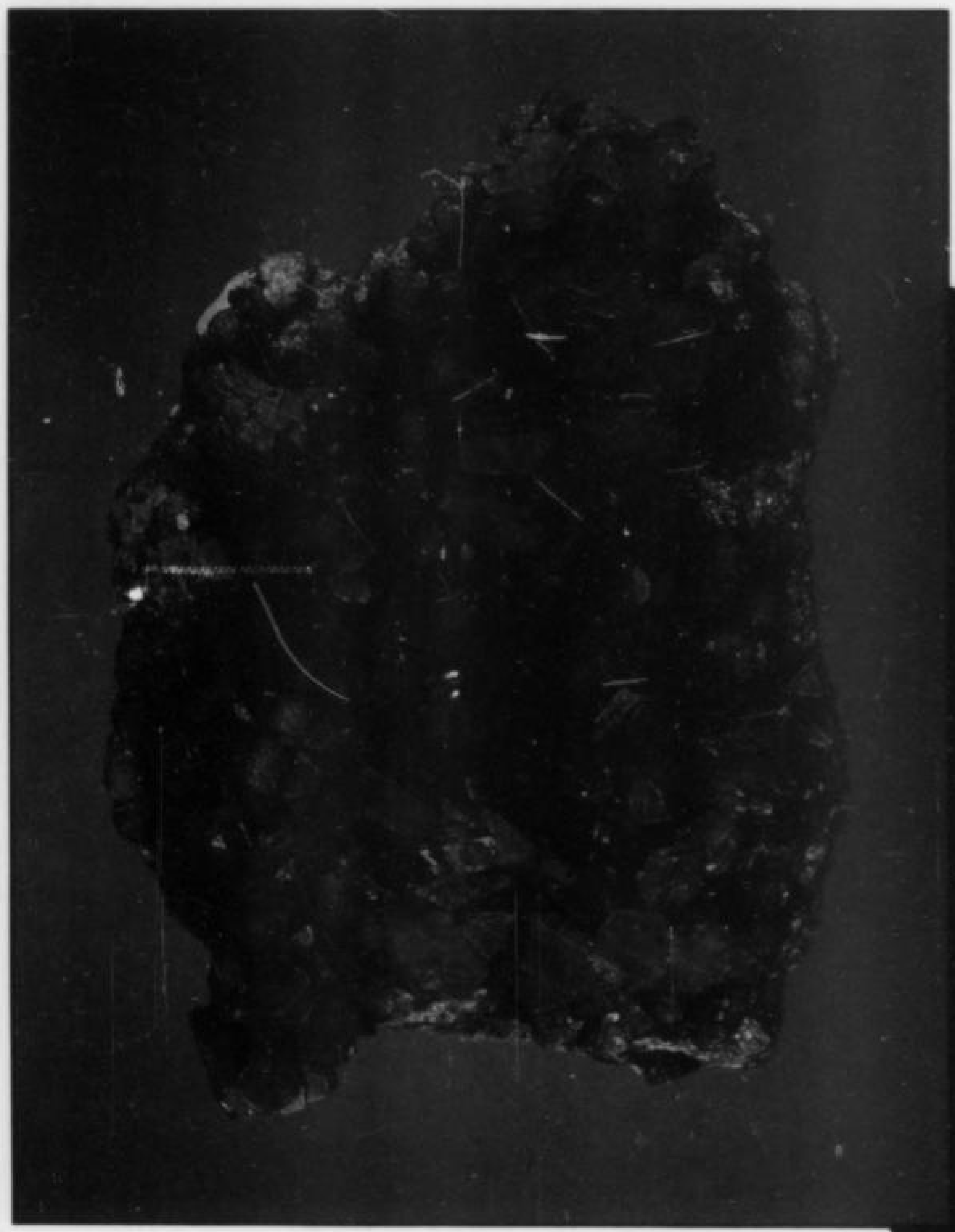
EPIDOTE

There are several outstanding localities for fine and large crystals of epidote (a calcium-aluminum-iron silicate), but the specimens most admired by collectors have come from a cleft in the Austrian Alps called Knappenwand, in the Untersulzbach Valley. One of these, 9 cm long, is shown above; it has the large, flat, gemmy crystals which are so characteristic of this old locality, first discovered by a local shoemaker and mineral collector in 1865. In recent years the Vienna Natural History Museum has been sponsoring new excavations there, and many fine specimens have been recovered. The one pictured above, however, is an old-time piece.

VIVIANITE

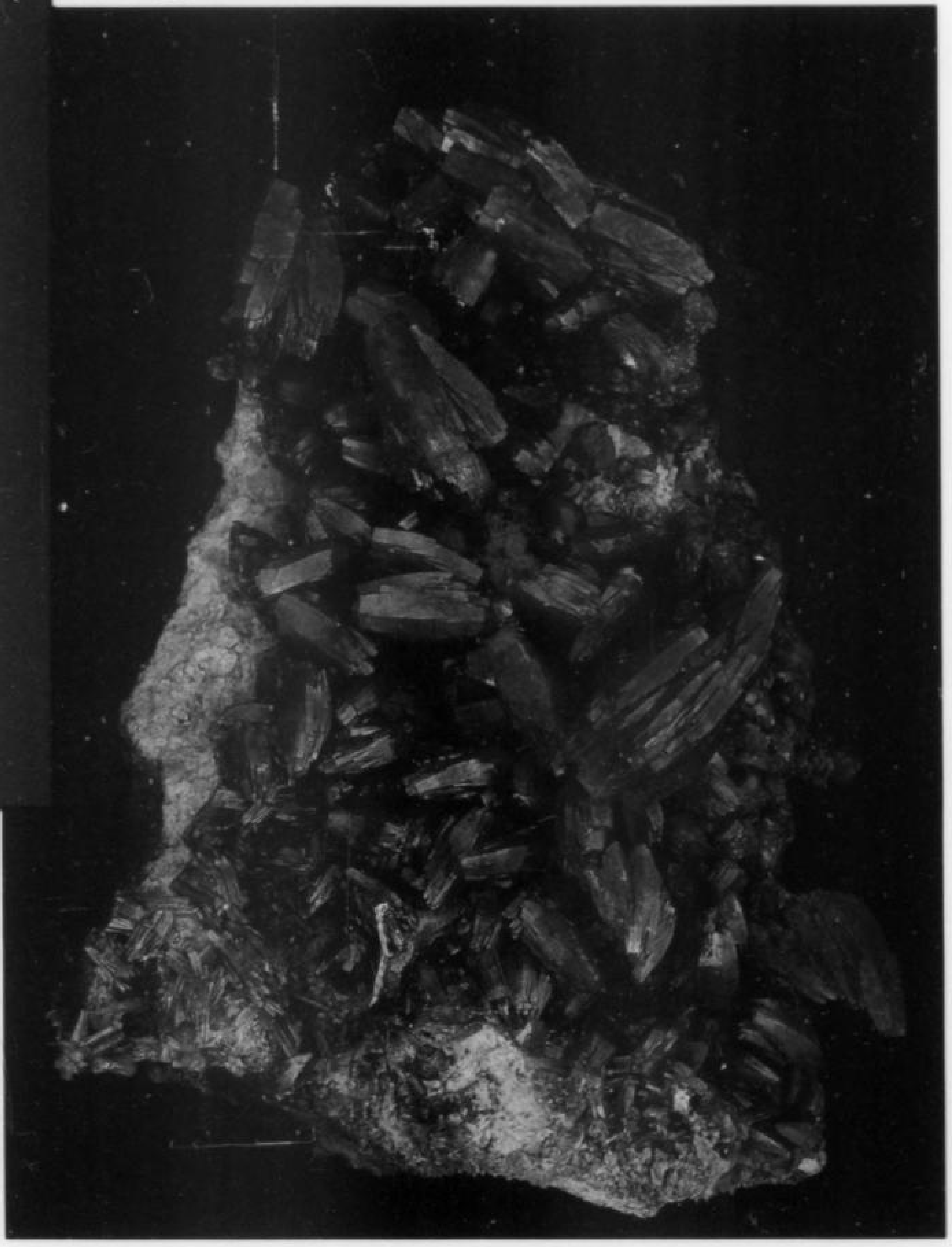
Vivianite, an attractive iron phosphate mineral, reaches its finest development at Morococala, Oruro Department, Bolivia. In 1983 a major discovery of vivianite took place in a tin mine there, yielding many of the world's best specimens of the species. The specimen pictured at right, 17 cm across, is one of those, acquired by the museum in 1989. The matrix is iridescent pyrite.





PYROMORPHITE

Many superb specimens of green and yellow pyromorphite, like the 12-cm specimen shown below, were discovered in 1980 in a large pocket in the Bunker Hill mine near Kellogg, Idaho.



LUDLAMITE

Gemmy green ludlamite, an iron-magnesium-manganese phosphate, comes from several localities worldwide, the most important American occurrence being the Blackbird mine in Lemhi County, Idaho. The superb Blackbird specimen shown above is 7 cm in size; it was acquired in 1988 from the Thomas N. McKee collection.

ADAMITE

Probably the most coveted specimens of adamite, a zinc arsenate, are the violet crystals and groups found at the Ojuela mine, Mapimi, Mexico in 1981. Only a small number of specimens were recovered but, like the remarkable, 7-cm, purple and pale green specimen shown at right, all are superb and commanded high prices. The Ojuela deposit, discovered in 1598, has yielded thousands of fine specimens of yellow adamite, paradamite, hemimorphite, legrandite and other species but purple adamite remains one of its most sought-after treasures.

VAUXITE

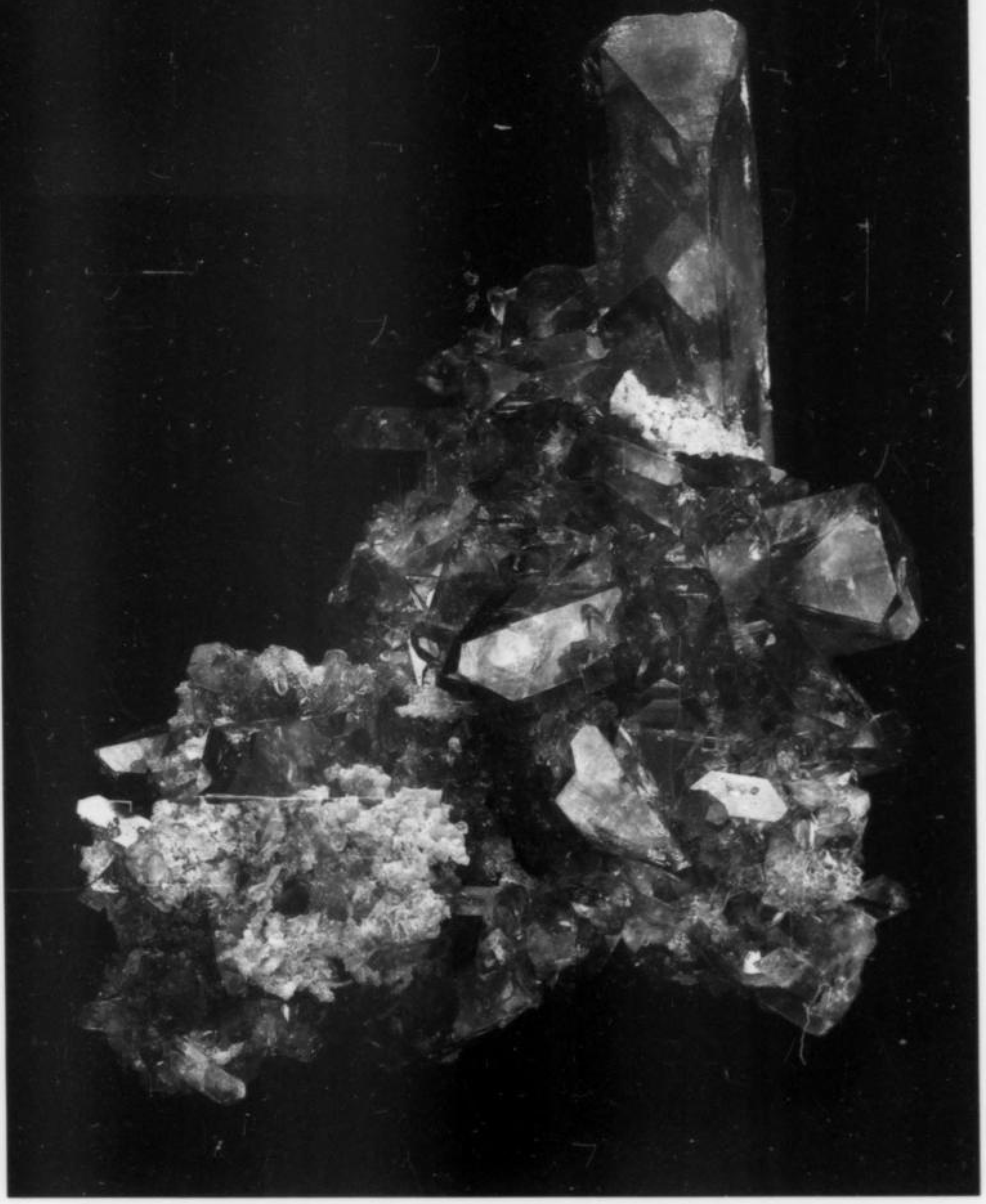
Vauxite, an iron-aluminum phosphate from Bolivia, was known only as relatively small and unexciting specimens until 1980, when a new occurrence was discovered at the Miraflores mine, Huanuni. Plates of deep blue microcrystals up to 22.5 cm across were recovered; the largest and best is shown at left.

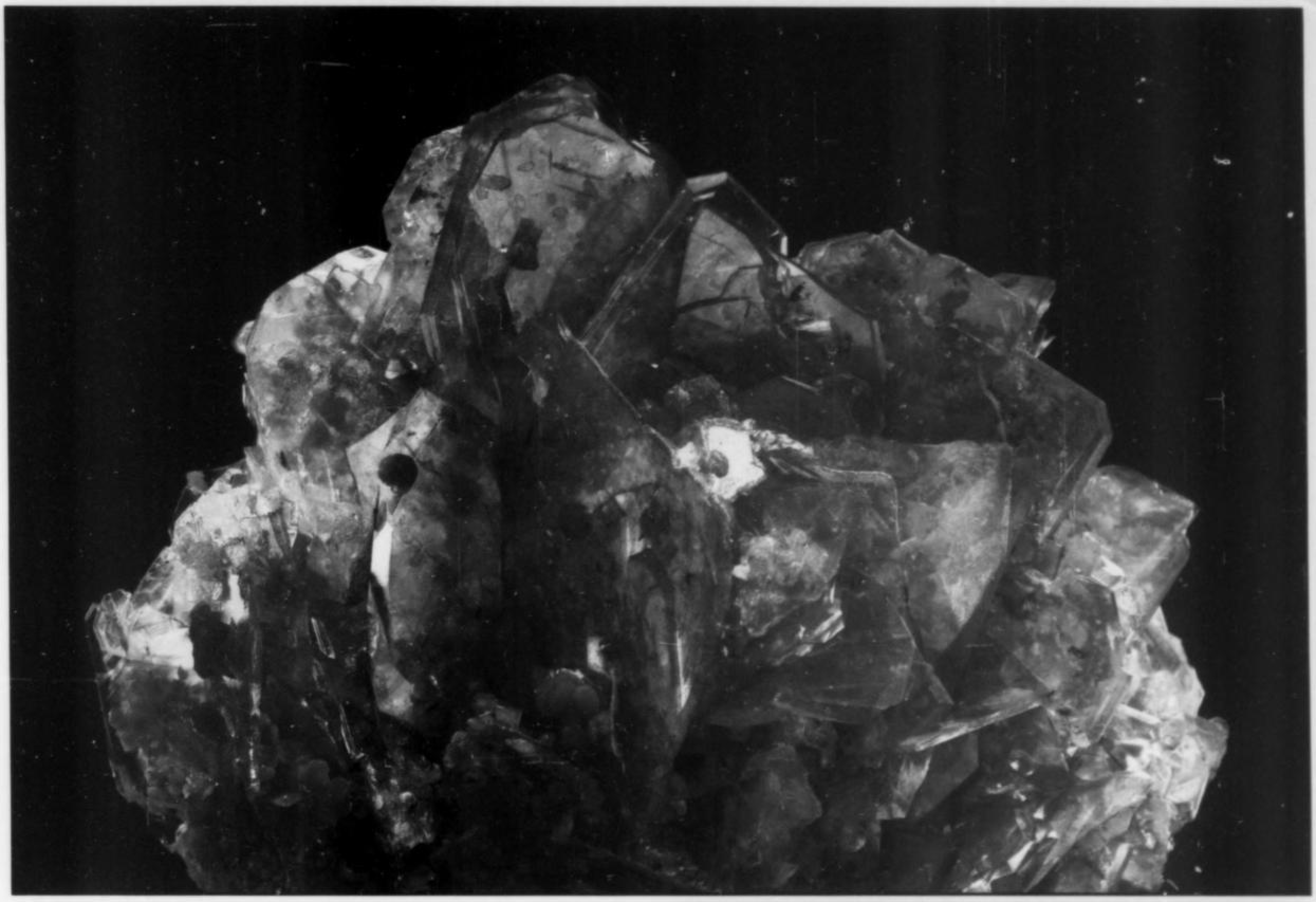
BARITE

Barite, barium sulfate, is a common mineral but superb specimens are relatively rare. The example shown at left is from the classic British locality at Frizington in Cumbria; it measures 12.5 cm, and was acquired in 1989 from the Thomas N. McKee collection. English barites were most plentiful in the nineteenth century, when the mines were in operation. Virtually all the best specimens in collections today date from that period.

BARITE

The beautiful yellow barite shown at right measures 17.5 cm tall. It was collected in 1986 at the Pohla mine near Crottendorf, East Germany, in the Saxon Erzgebirge. The mine, which is about 3 miles from the Czechoslovak border, has been operating only since about 1980, principally for uranium ore. Since 1984, however, it has become famous among mineral collectors for the superb golden barite found there. The Carnegie specimen is among the best recovered.



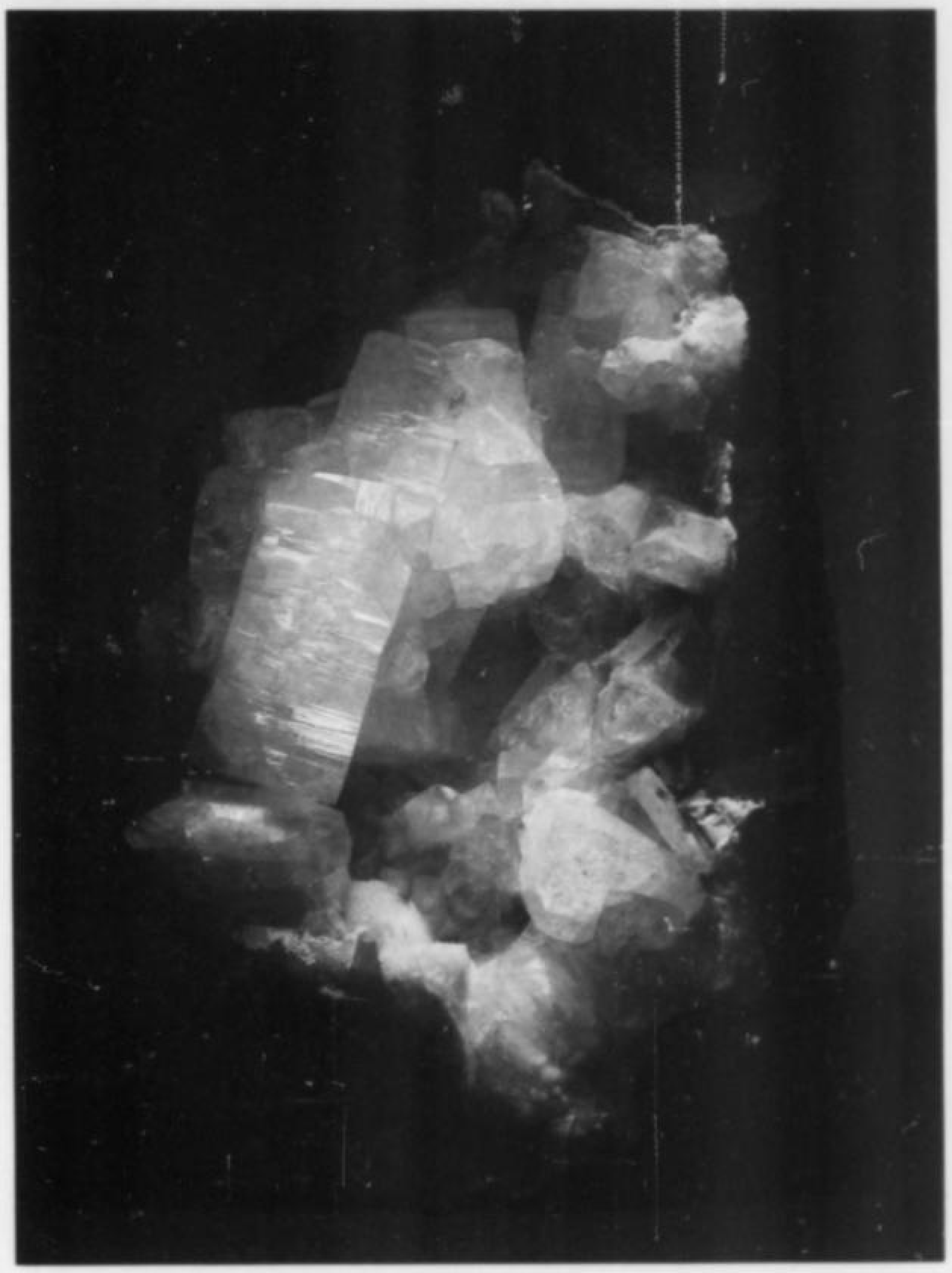


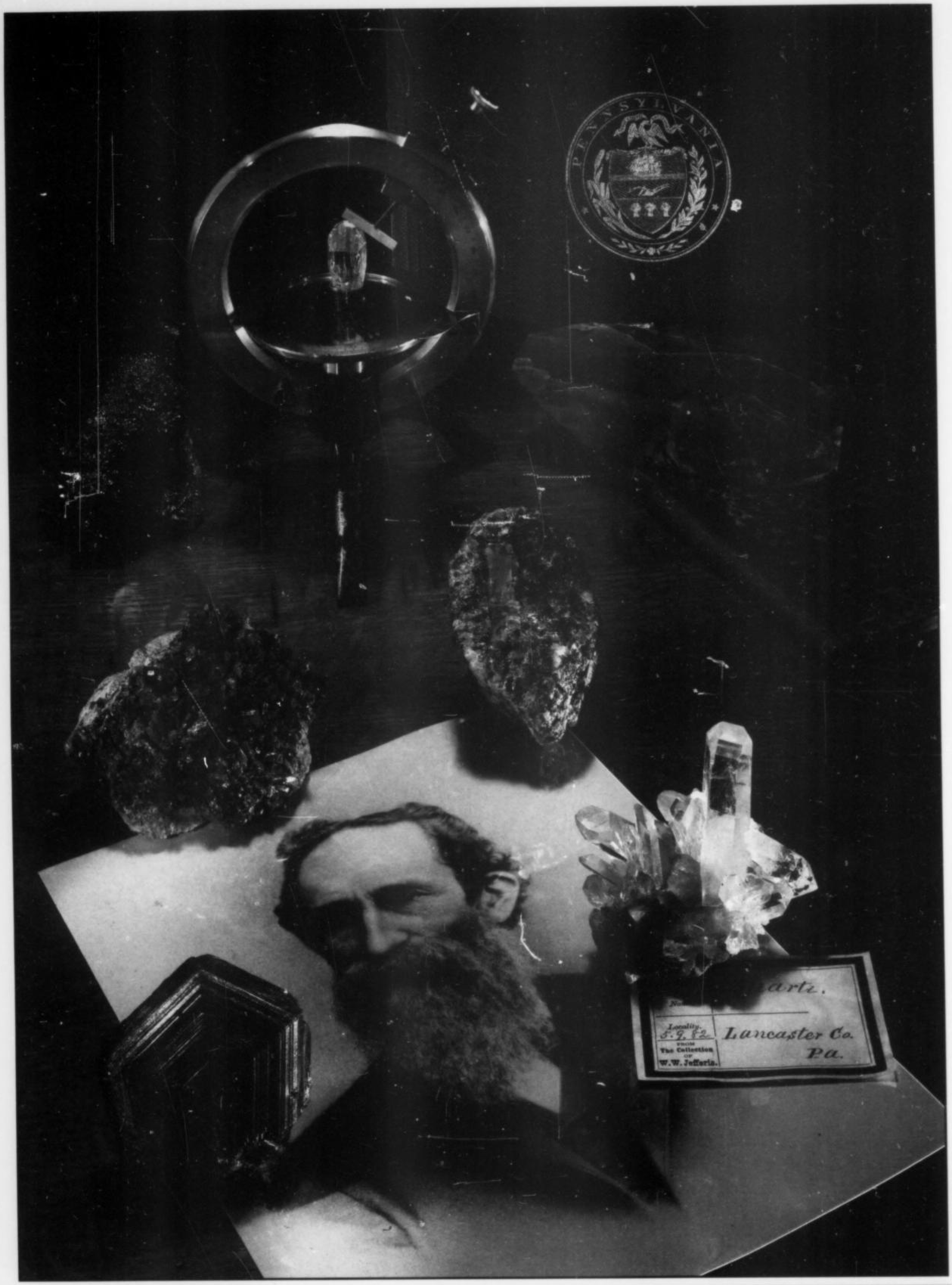
WULFENITE

Wulfenite, lead molybdate, is one of the most popular mineral species, occurring as it does in many localities and in almost as many colors and habits. Mexico and Arizona have the largest number of important localities. Among the Mexican occurrences, one that stands out for sheer beauty and size of its specimens is the San Francisco mine near Magdalena in Sonora. There, in 1971, an enormous walk-in series of wulfenite pockets was discovered which eventually yielded over 100,000 specimens. The finest are considered to be those from one particular zone which produced large, thin, gemmy yellow crystals with red mimetite. The specimen shown above, 18 cm in size, is probably the largest and best preserved from that zone. It was acquired by the museum in 1988 from the Joseph Urban collection.

POWELLITE

Powellite, a yellow to orange calcium molybdate, reaches its best development in India. After an extensive search, the sole Indian locality was found to be the Aurora quarry on Pandulena Hill near Nasik in Maharashtra state. Rustam Kothavala, who discovered the occurrence and sold the few rare specimens that were recovered, ranks The Carnegie's 24-cm matrix specimen, shown at right, as among the very best. The white crystals are apophyllite.

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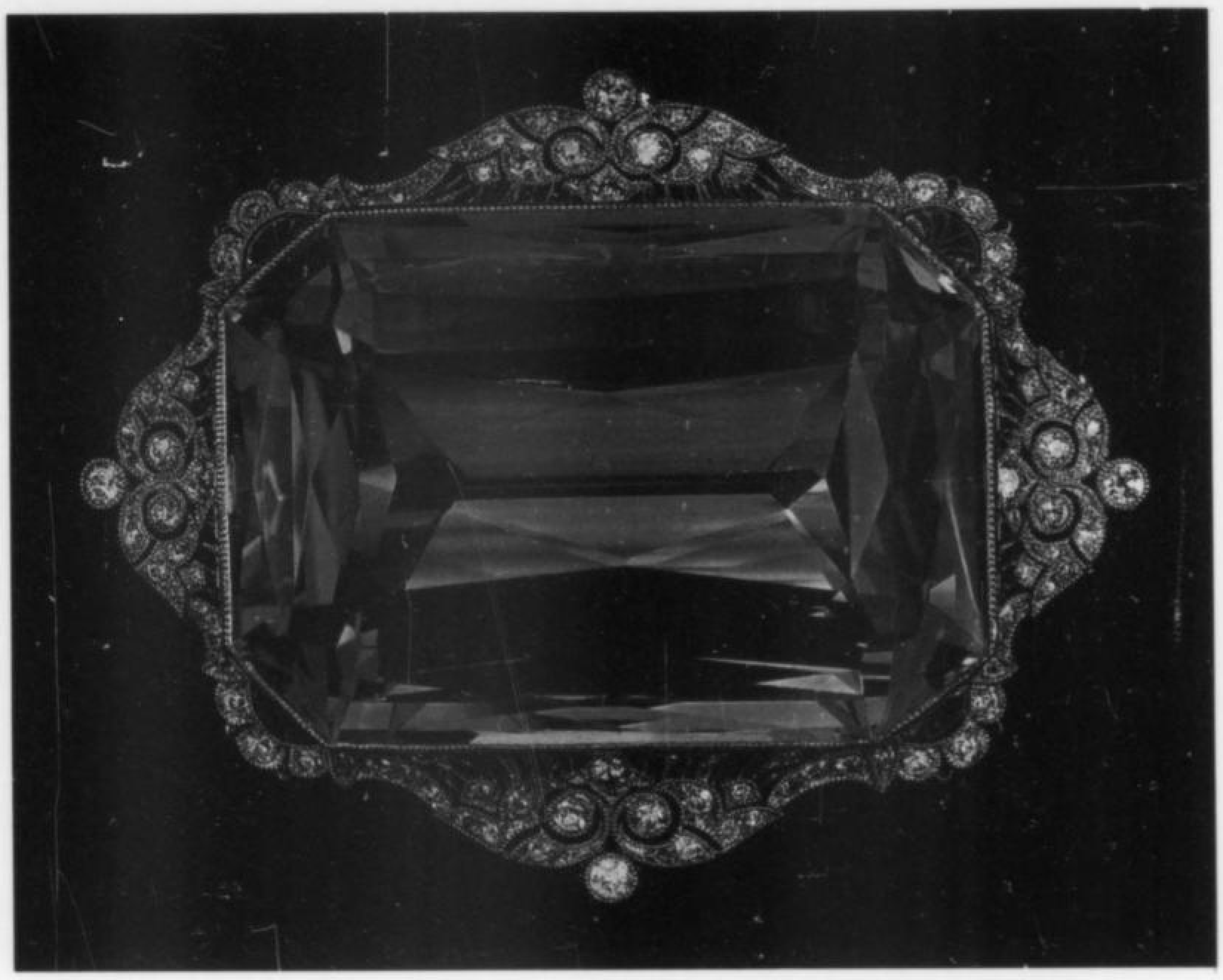
THE PENNSYLVANIA COLLECTION

Being situated in Pennsylvania, the Carnegie Museum has naturally striven to acquire important examples of the state's mineral occurrences. Several are shown in the photo at left, with an antique brass goniometer (used for measuring interfacial angles on large crystals) and a photo (courtesy of the Chester County Historical Society, West Chester, Pennsylvania) of William Jefferis, of West Chester, Pennsylvania, whose extensive collection was purchased by Andrew Carnegie in 1904. Clockwise from lower left: a superb black-brown rutile twin, 6.5 cm, from Sadsbury Township in Chester County; green pyromorphite, 7 cm, from the famous Wheatley mine near Phoenixville; black iridescent hematite, 5 cm, from Mud Lake, Lancaster County; green antigorite, 11 cm, from the town of Texas in Lancaster County; aquamarine beryl crystal in matrix, 8 cm, from Chester County; and clear quartz, 6.5 cm, from Lancaster County, shown with its Jefferis collection label (Jefferis acquired it in 1882).

The calcite specimen shown above is from the Thomasville stone and lime quarry, Thomasville, York County, Pennsylvania. It measures 13 cm and includes a 10-cm twinned crystal with a honey-colored iridescent luster. It was acquired by donation in 1988.

W.E.W.



Aquamarine beryl, 111.17 carats, with 175 small diamonds in a 19th-century platinum brooch. Acquired by donation in 1982.

THE FUTURE

The Hillman Hall of Minerals & Gems is one of the most popular exhibition galleries in The Carnegie Museum of Natural History and we are continually seeking to improve it and its programs. Over the past decade many of the original exhibit specimens have been replaced with higher quality and more impressive examples of their species. We are especially proud of the Masterpiece Gallery with its one-of-a-kind specimens representing the epitome of nature's mineral beauty. It is the natural history museum's intention to continue to upgrade the collection that supports the Hillman Hall and its progress.

Conservation and preservation of collections are serious concerns for natural history museums. Recently a team of internationally recognized conservators visited The Carnegie Museum of Natural History, assessed its mineral and gem collection, and reviewed its curatorial practices. Their recommendations are now being implemented to safeguard the mineral and gem specimens for posterity. In addition, renovations to our curatorial facilities are planned to provide for better care and storage of the exhibit and reference collections and for their study.

The Carnegie Museum of Natural History's public education programs have included classes on minerals and gems that are extremely popular. These classes have been conducted in cooperation with mineral section Research Associates and the Gemological Institute of America, and have prominently featured the Hillman Hall collection. Recent instruction and interest in minerals, gem grading, birthstones and antique jewelry have resulted in numerous specimen exhibits, some traveling, of rare pieces from the museum's collection. In the future these exciting classes will be expanded to involve more people.

In a world of rapid environmental degradation, museums have an obligation to preserve our natural heritage for future generations. As with all things natural, minerals are fragile and finite in number and distribution. They too are a diminishing resource. Through the Hillman Hall of Minerals & Gems and its associated collections and programs The Carnegie Museum of Natural History is fulfilling its commitment to the future.

J.E.K.

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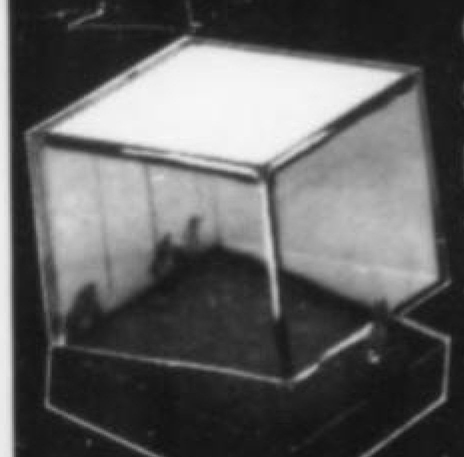

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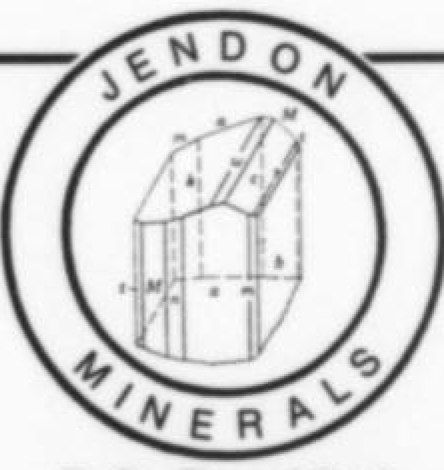

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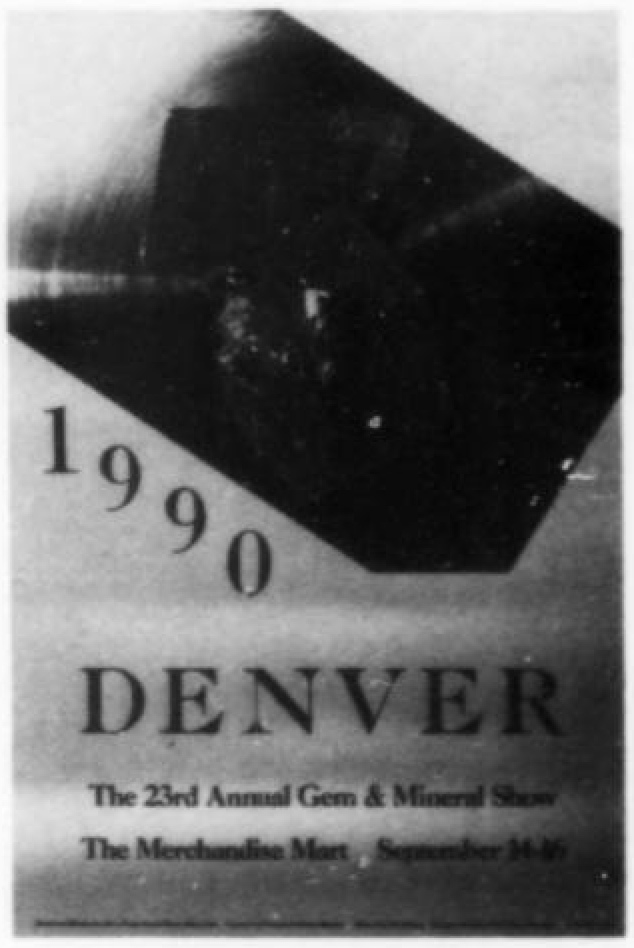

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Many minerals occur only as microcrystals and require the use of a stereomicroscope for best observation. Photographic reproduction of the view through a stereomicroscope can be very useful in illustrating books, articles and lectures. In some ways, however, stereophotomacrography can produce an effect which is actually superior to direct viewing through the microscope.

INTRODUCTION

Compared with stereophotography in the close-up range, involving thumbnail to cabinet-size specimens, stereophotography of microminerals requires some special equipment for specimen handling and also appropriate photographic equipment capable of achieving higher magnifications.

Articles on mineral photography and stereophotography using single-lens systems[1] at low magnifications have appeared recently in the *Mineralogical Record* (Wilson, 1987; Wilson and Chamberlain, 1987) with full bibliographies. Those articles should be studied as a prerequisite to the following discussion.

Application of the "rotation method" for stereophotography of hand-size specimens presents no mechanical difficulties; the moving of specimens and associated backgrounds, reflectors and lighting equipment can be done by hand, and the tolerances for error are ample. At a field of view suitable for microminerals, however, the tolerances are quite small and mechanical aids are necessary. Two kinds of adjustment are most critical: (1) rotation of the specimen with sufficient precision to keep it from also moving forward or backward out of the zone of sharp focus, or left or right in the viewfinder, and (2) focusing of the optical system to center on the axis of rotation of the specimen-holding system.

The "rotation center" may be thought of as a vertical cylindrical space with a diameter equaling the depth of field. (The axis of rotation must generally be centered in the viewfinder.) In the case of a field of view measuring 1.2 x 1.8 mm, which equals about 20X enlargement with 35mm format, the depth of field is less than 0.05 mm (Flügge, 1965), so it is obvious that precision will be essential in high-magnification stereophotomacrography.

SPECIMEN-HANDLING EQUIPMENT

The mechanical solution to specimen manipulation in the micromineral range was found following some experimentation with various photographic, mechanical, and laboratory devices designed for other purposes.

Beginning with a thick piece of plywood as a base, a high-quality panorama head (like that on most tripods) is mounted with a screw. To this is attached a two-track translating device[2] which can be obtained through photo supply houses; the tracks are crossed at 90° to each other, allowing precise left-right and forward-backward positioning of the specimen. Atop this is mounted a small scissor-arms lifting platform[2] of the kind typically used in chemistry laboratories; this allows precise vertical positioning (see Fig. 1, which shows the total assembly).

Mechanical devices designed for the positioning of components in optical systems (available, for example, from Spindler & Hoyer, Göttingen) provide even higher precision at correspondingly higher prices.

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[1] The distinction between macro and micro is one of equipment rather than magnification. Photomacrography uses a single lens–system imaging arrangement, like that described here, whereas photomicrography uses a double lens–system arrangement corresponding to the objective and occular in a microscope.

[2] Ed. note: The catalog of Edmund Scientific (101 E. Gloucester Pike, Barrington, New Jersey 08007-1380) lists these items.

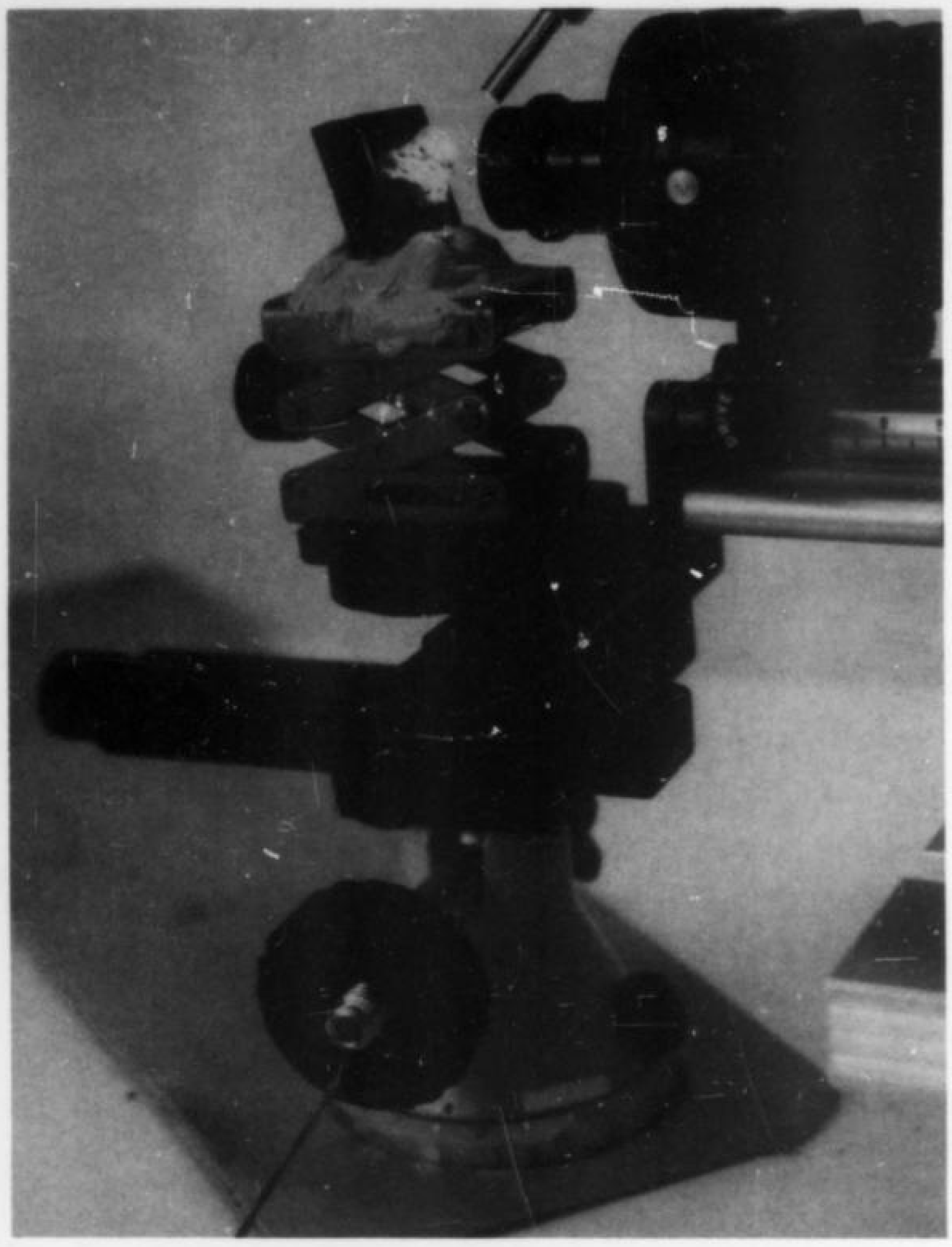

***Figure 1.* Specimen-holder assembly, consisting of a panorama head (bottom), a two-track translating device (center) and a scissor-arms lifting platform (top) on which the specimen is mounted.**

PHOTOGRAPHIC EQUIPMENT

Standard stereomicroscopes can, of course, be fitted with camera adapters and used for photography. However, for high-quality photography there are specially designed microscopes (such as the M400 series "Photomakroskopes" from Leitz-Wild). As an alternative to a new microscope, special photographic lenses and oculars can be used with a standard stereomicroscope. Such equipment works very well, and is very expensive.

A more cost-effective approach for people already equipped for 35 mm photomacrography is based on the use of bellows and special lenses. Macro lenses provide the highest picture quality for this type of work, but are more awkward and cumbersome to use than microscopes because of the long extensions necessary and the darkness of the viewscreen image even at maximum aperture. I have been using this kind of equipment for many years (see Betz, 1974, 1977), working vertically on a repro stand using Zeiss-Luminar lenses. (Leitz-Photar lenses are very similar.) But for stereophotography it became necessary to rearrange the system from vertical to horizontal. This allows longer extensions, in some cases using two bellows coupled together, sometimes with the addition of a homemade extension tube between them. The whole photo assembly is then mounted on a two-track table as shown in Figure 2, which permits precise left-right and forward-backward positioning by turning the large black knobs. Thus it serves as an optical bench, allowing forward-backward adjustment of focus and left-right adjustment for centering the field of view on the rotation axis.

The same type of table is also useful for lower-magnification photography as shown in Figure 3.

To cover the whole range of practical magnification, a number of different lenses are necessary. Close-up or macro lenses such as the Micro-Nikkor 55 mm lens shown in Figure 3 are useful for magnifications of 1X to about 10X (with bellows). For higher magnifications at equal extensions, wider angle lenses are needed. I use two lenses, 63 mm and 25 mm, in addition to the 55 mm Micro-Nikkor; together these three allow me to cover most of the practical range in magnifications. The 25-mm lens is good for 6X to 25X (at a maximum extension of 50 cm), with optimum results at about 10X. A 16-mm lens could reach from 10X to 40X, with optimum results at about 16X.

ADJUSTING THE SYSTEM

After the equipment is assembled and positioned approximately, it is first necessary to center the optic axis of the camera system on the rotation axis of the specimen-handling system. This is done by mounting a needle vertically on the specimen platform using silicone putty. The needle is adjusted precisely to the rotation axis, using the two track knobs under the specimen platform. Then the optical system is adjusted to center on the needle. Minor corrections and refinements in the optical bench are made while looking through the viewfinder and rotating the specimen base (plywood platform) back and forth through an angle of about 90°, until the needle remains perfectly centered and focused during rotation. Once these adjustments have been made, the camera system is no longer moved. The rotation axis is incapable of movement, and so the system remains locked with the optic axis intersecting the rotation axis at the center of the zone of sharp focus. All subsequent rotation, focusing, and specimen positioning are done with the specimen-holding assembly, adjustment of which in any direction will not affect the optical/rotational alignment.

TAKING STEREO PHOTOGRAPHS

The first step is naturally the selection of a specimen to photograph, and examination of it under the stereomicroscope to determine the best viewing angle, orientation and magnification. All dust must be carefully removed. I use a fine spray of water with a little detergent. Some crystals can be cleaned of dust by dabbing with a small point of silicone putty. Steady hands are essential.

The specimen is then mounted on the specimen platform using silicone putty, adjusted mechanically to bring it into focus, and illuminated by fiber-optic light pipes. Careful refinement of the lighting angles often improves the picture. Alignment of the optic and rotation axes can be rechecked by watching through the viewfinder while rotating the specimen 30°–60°—it should remain centered and focused.

Now the two photographs that will comprise the stereopair may be taken. Exposure times are determined as usual. Aperture settings should be as large as the specimen depth will permit; smaller aperture settings will provide unnecessary additional depth of focus accompanied by a decrease in overall sharpness.

After the first-position photograph has been taken, the specimen must be rotated 5°–6° for the second-position photograph. If the angle of rotation is less, the stereoscopic effect will be insufficient and the specimen will appear too flat when the stereo pair is viewed. If the rotation exceeds 5° by very much the stereo effect will be exaggerated, producing distortion and "hyperstereoscopy." A rotational scale is therefore necessary in order to keep the rotation angle precise. A circle is inscribed on the mat (see Fig. 2) and marked off in degrees, and a wire pointer is attached to the panorama head.

The translation method of producing stereo-pair photos is an alternative to the rotation method detailed above, and is widely described in stereo textbooks (e.g., Waack, 1985). This involves a slight left or right movement of the specimen or the camera system, instead of a rotation of the specimen. However, because the optic axis in each photo of the pair does not intersect the specimen in the same place, the two photos are not precisely congruent and will have zones at the left and right margins that lack a counterpart in the other photo (hence

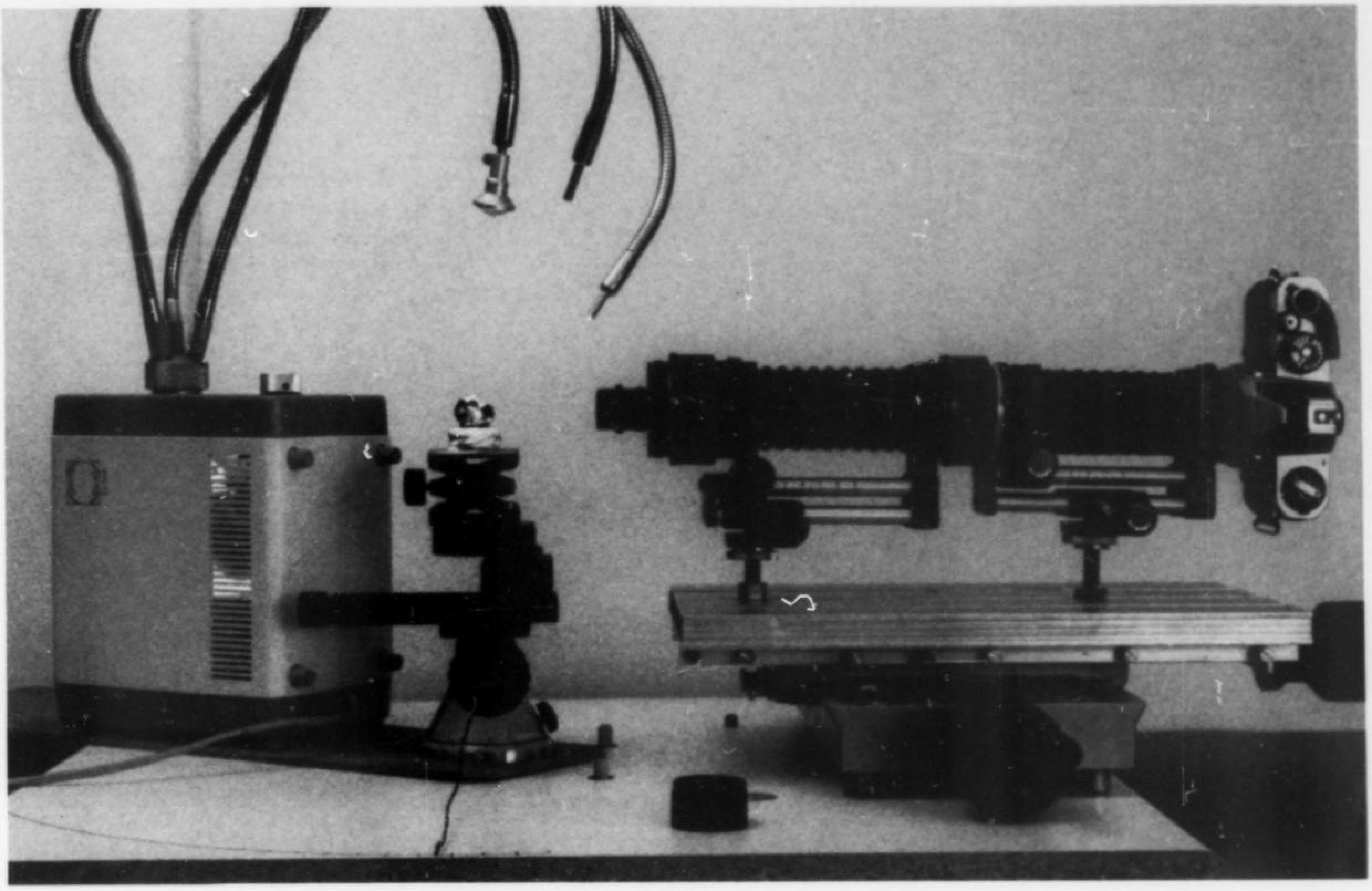

Figure 2. **The complete system for taking stereo photographs of microminerals: fiber-optic light system (left), specimen-holder assembly (center) and camera system consisting of a lens, two coupled bellows and a camera mounted on a two-track adjustable table.**

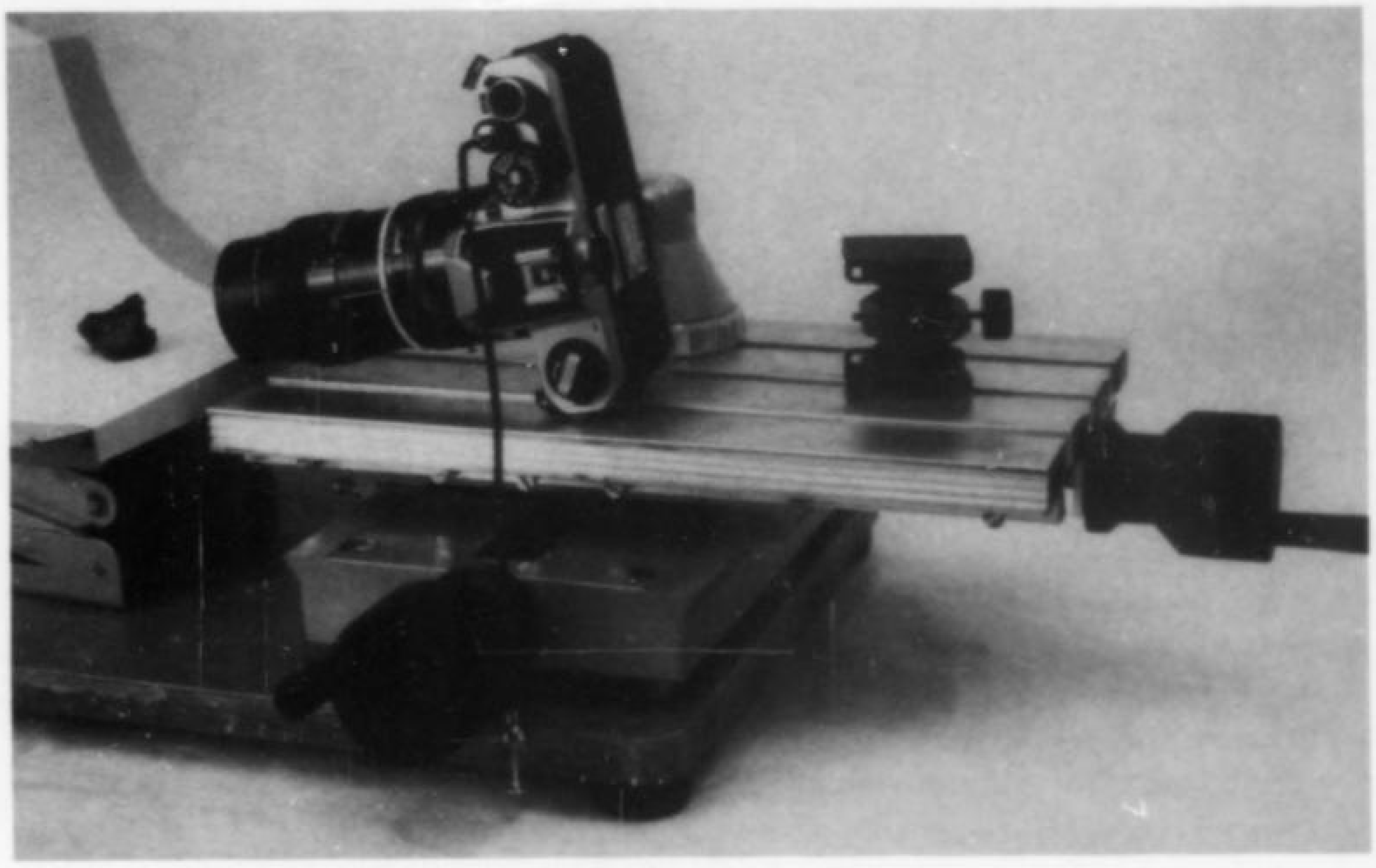

Figure 3. **Close-up stereophotography system using the two-track table as a camera mount, without bellows.**

no stereo effect there). Aside from the lack of precise overlap, the translation method for micromineral photography is also made difficult by the extremely small distances that must be translated accurately, typically a few hundredths of a millimeter. The translation method works just as well in producing a stereo effect, but because of these two problems the rotation method is the preferred one.

LIGHTING

A critical aspect of lighting in stereophotography is that the lights be rotated along with the specimen. This is accomplished by placing the fiber-optic light source directly on the plywood panel to which the specimen-holding apparatus is attached, as in Figure 2.

An equally critical aspect, however, is the avoidance of any obvious differences in lighting between the two photos of the stereo pair. It is possible, for example, to rotate the specimen and lights 5° and thereby bring the view into alignment with a bright reflection which is not visible in the other photo. Although technically correct in theory, these unilateral reflections (present in one photo but not the other) are very disconcerting to the eye when the stereo pair is viewed. Consequently they should be avoided. Soft, diffused lighting can help to prevent unilateral reflections, but in most cases a reorientation of the lights or the specimen will solve the problem.

VIEWING STEREOPHOTOS

Only a few remarks need to be made here beyond the advice given by Wilson and Chamberlain (1987). The best way to view stereo slide

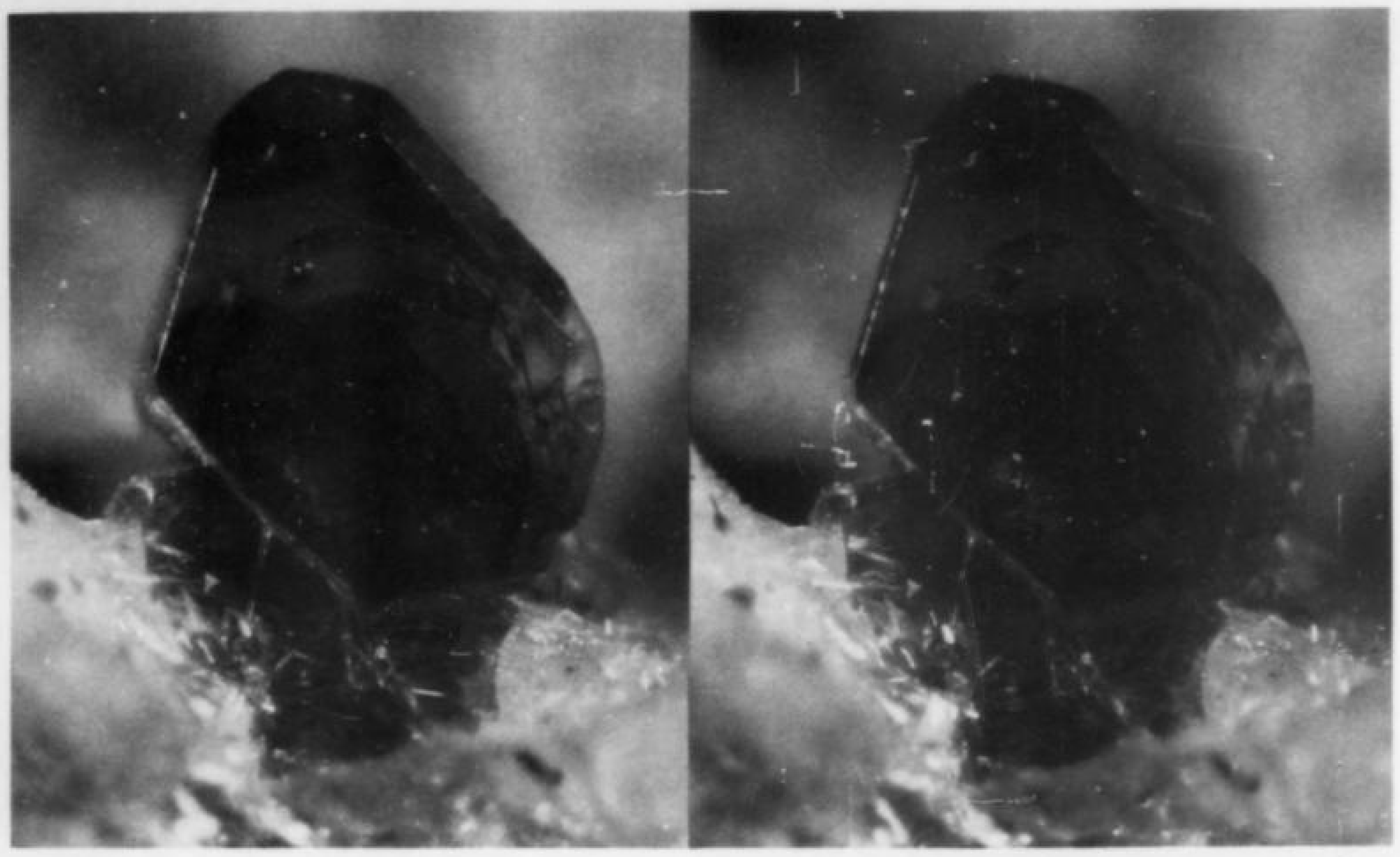

Figure 4. **Tabular roedderite crystal, ca. 1 mm, viewed down the *c* axis. (All photos by the author; all specimens from the collection of A. and E. Rondorf.)**

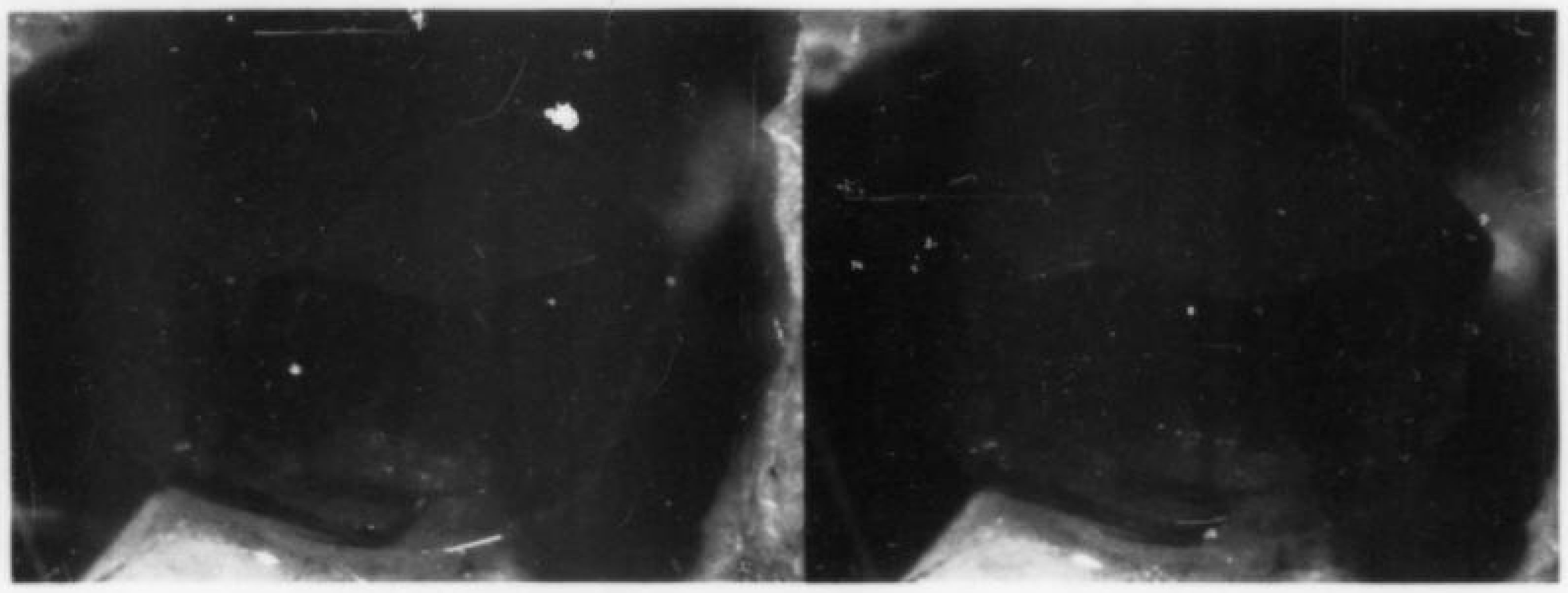

Figure 5. **Short, prismatic/pyramidal roedderite crystal, ca. 1.6 mm.**

pairs is with a pair of connected slide viewers. The distance between the two viewers should be adjustable, from 5.5 to 7.2 cm, to allow for differences among users.

The classic "Brewster-type" viewers (like the Stereopticon viewers distributed with the November-December 1987 issue of the *Mineralogical Record*) are sufficient for most mineralogical purposes, but they do limit the size of photos that can be used. Corresponding points in the two photos cannot be farther apart than the pupils of the viewer's eyes without requiring the viewer to look cock-eyed in order to resolve the pair (a virtually impossible feat for most people).

For viewing larger reproductions a reflecting stereoscope may be used which increases the effective interocular distance of the user. These are available from VCH-Verlagsgesellschaft, Weinheim, West Germany. It can be used with stereo print pairs of any size and also with projected slides.

The KMQ-System should also be mentioned (Koschnitzke *et al.*, 1986). Print pairs are viewed vertically (one above the other instead of side by side) using a prism-stereoscope or a stereovisor reflecting stereoscope. The KMQ-System works with almost any size prints, with projected images, and also with video images, but is unsuitable for pictures smaller than about 13 x 18 cm. With this system a single stereo-pair could occupy a full page in the *Mineralogical Record*.[3]

The above alternatives notwithstanding, the standard stereoscope is still the best method of viewing most stereo photos; the other stereoscopes would be most appropriate for viewing calendar-size or poster-size stereo pairs.

ROEDDERITE

In order to demonstrate stereophotomicrography, a series of stereo pairs is reproduced here depicting roedderite $(Na,K)_2(Mg,Fe^{+2})_5Si_{12}O_{30}$, crystals from Bellerberg, Eifel, West Germany. The Bellerberg quarry is the type locality for eifelite (Abraham *et al.*, 1983) and the first known terrestrial occurrence of roedderite (Hentschel *et al.*, 1980; Hentschel, 1987). Roedderite was originally described from the Indarch meteorite and named for Edwin Roedder of the U.S. Geological Survey (Fuchs *et al.*, 1966); it crystallizes in the hexagonal system.

Both of these rare species, members of the osumilite group, are remarkable for their low alumina content relative to other silicates. At Bellerberg they occur in small cavities in silicic xenoliths in a volcanic basalt. Yellow roedderite has been found in several of these xenoliths. The crystals of other colors shown here are all from one remarkable xenolith found in 1980 by Heinz Doll, a member of the quarry staff. Most of the original specimen, about 40 cm across, was donated by Mr. Doll to the Ruhr University in Bochum for further research. A small piece of it is in the collection of Alice and Eugene Rondorf of Neuwied; the photographs shown here are based on crystals in their collection. Chemical investigation of some of the colorless roedderite crystals led to the discovery of eifelite, which forms a series with roedderite.

Mineralogical Record readers interested in learning more about the Bellerberg quarry and the rest of the surrounding Eifel district should consult Hentschel (1977) and Esser (1979).

ACKNOWLEDGMENTS

I would like to thank Alice and Eugene Rondorf for providing specimens for photography, and Eric Offermann for introducing me to mineral stereophotography many years ago and for providing many helpful discussions and suggestions. Dr. Steven C. Chamberlain and Dr. Wendell E. Wilson reviewed the manuscript and provided helpful suggestions.

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[3] Ed. note: A wide variety of stereo equipment, supplies and books is available in the U.S. from Reel 3-D Enterprises, Inc., P.O. Box 2368, Culver City, CA 90231; write for their free catalog.

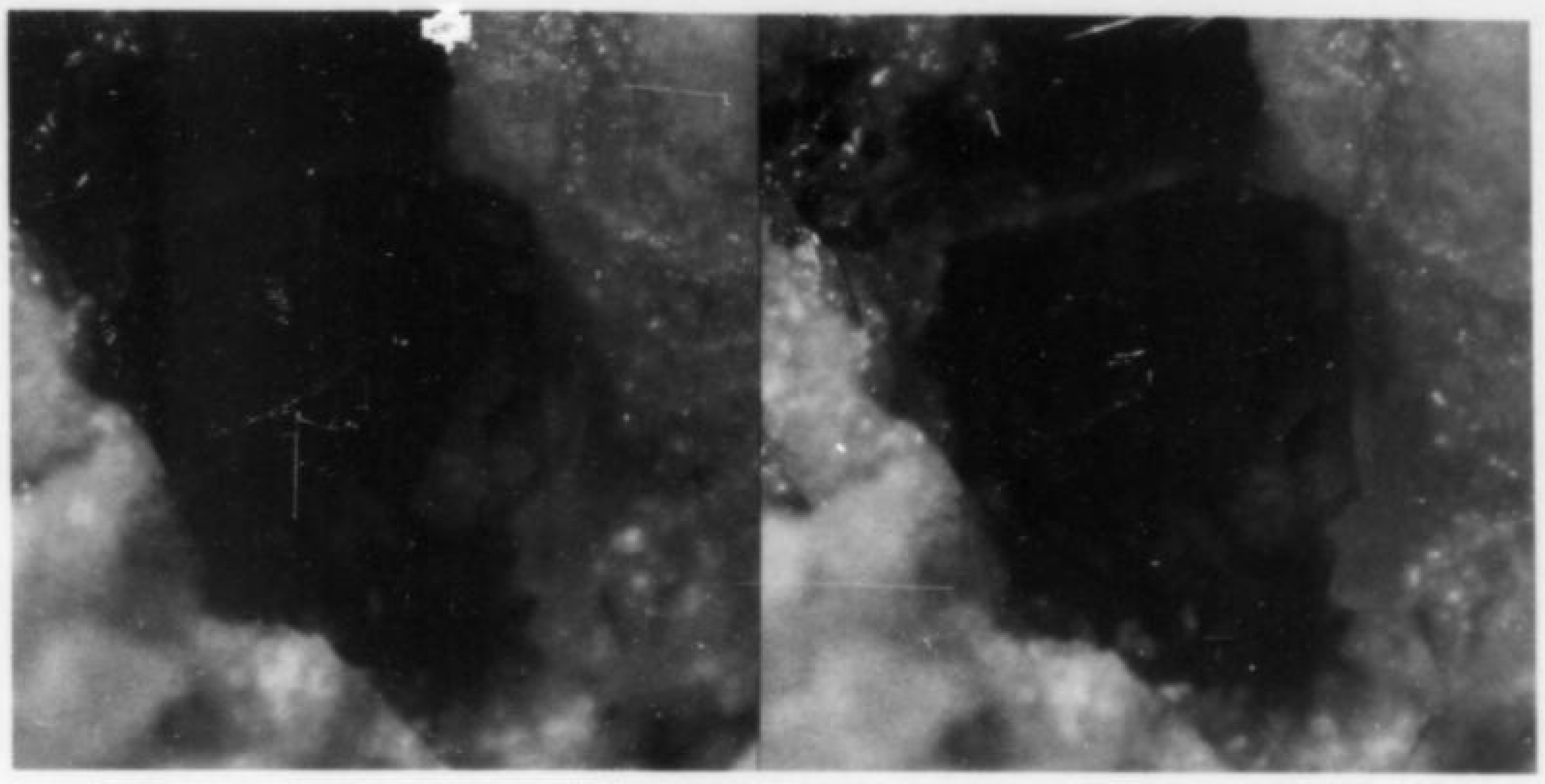

Figure 6. **A 0.6-mm roedderite crystal showing a hauyne-like habit.**

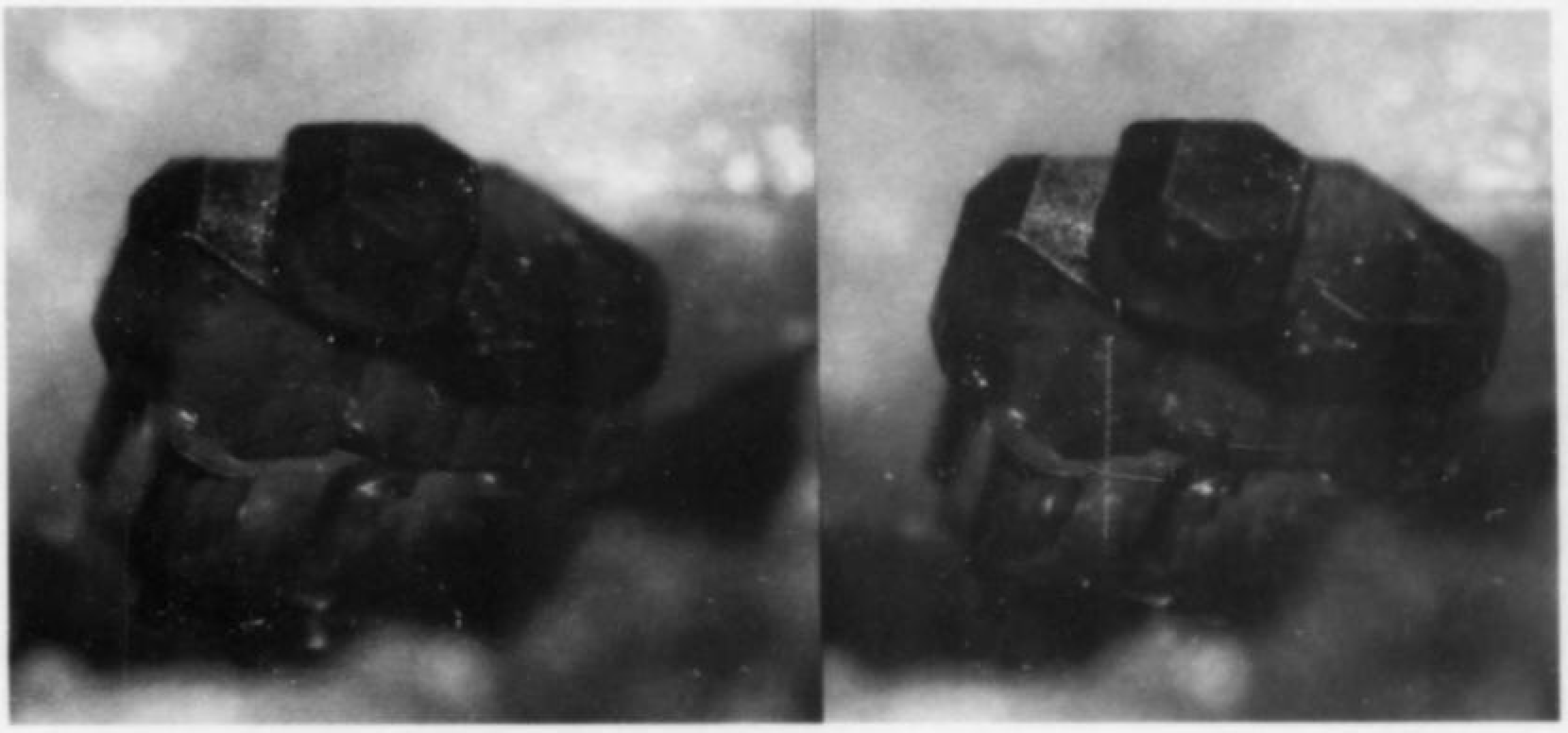

Figure 7. **Short, prismatic roedderite crystals in a 1.6-mm group.**

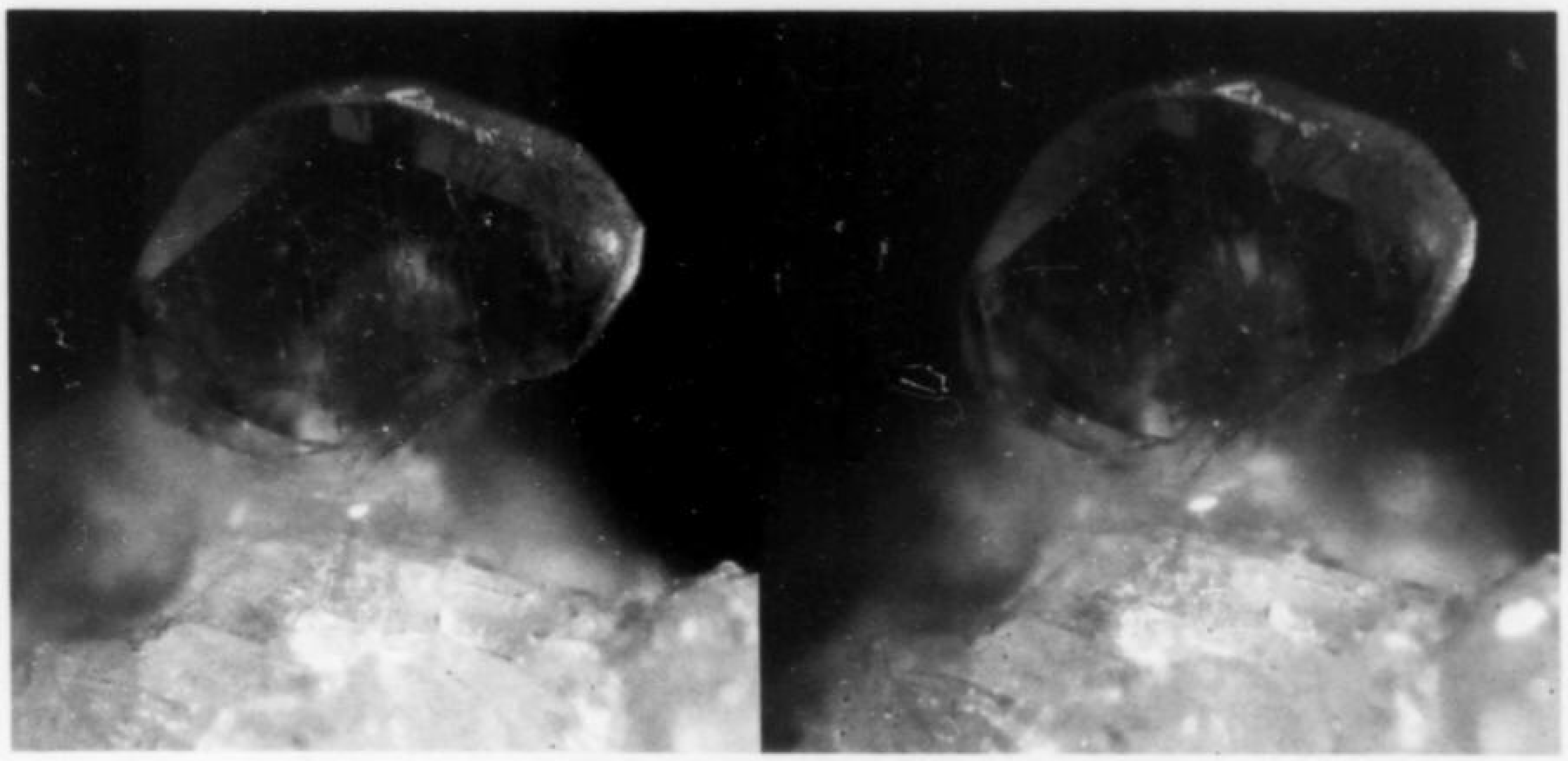

Figure 8. **Tabular roedderite crystal, ca. 0.6 mm.**

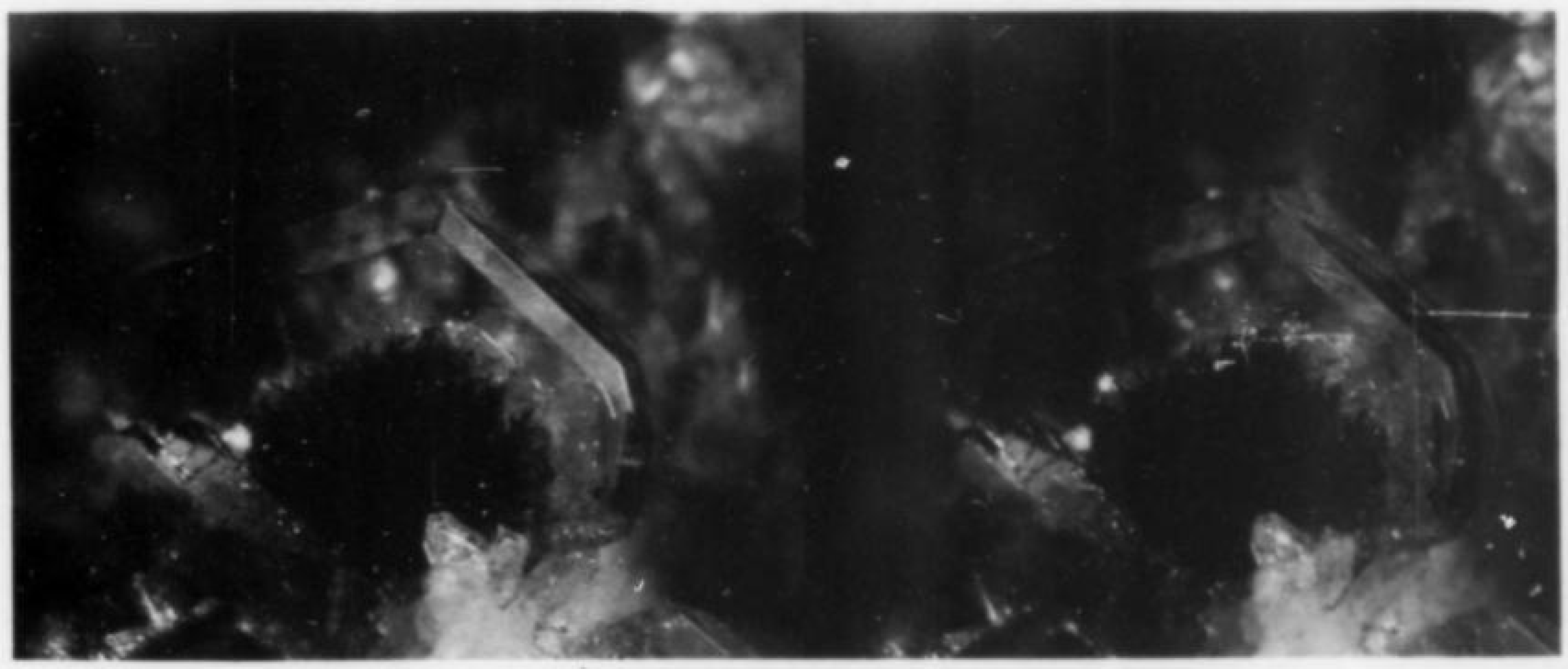

Figure 9. **Tabular roedderite crystal, ca. 2 mm, with inclusions.**

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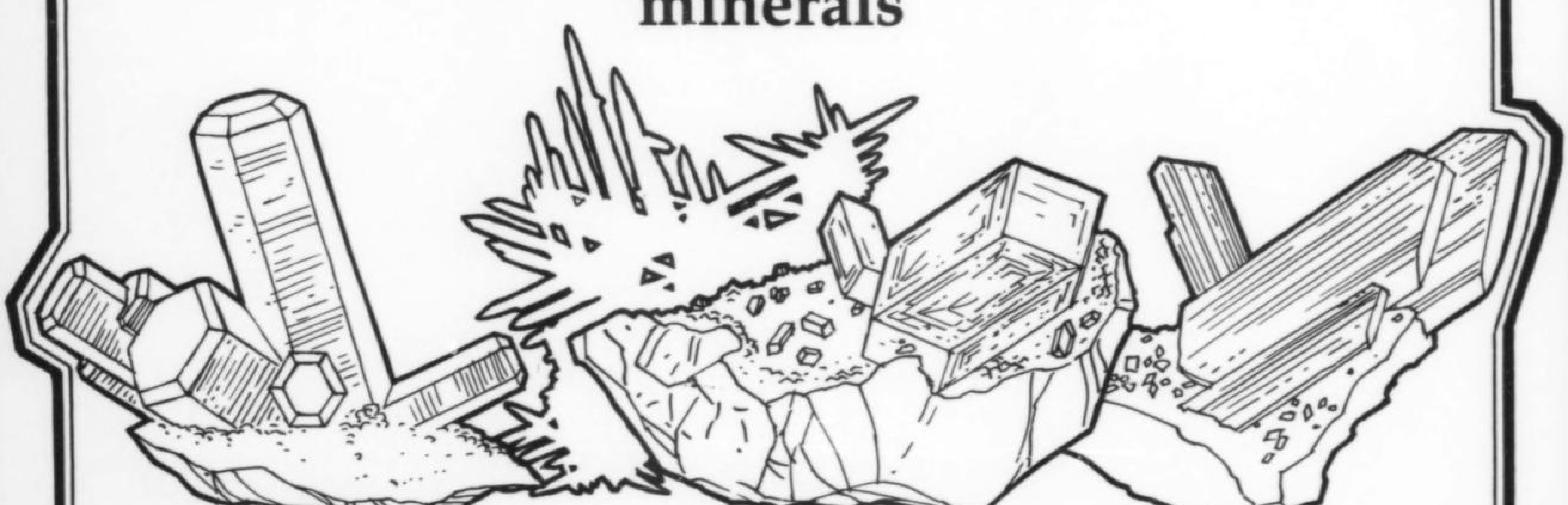

What's New in Minerals?

SEVENTEENTH ANNUAL ROCHESTER ACADEMY OF SCIENCE MINERALOGICAL SYMPOSIUM

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The following report is a summary of the *What's New in Minerals* program presented at the seventeenth Annual Rochester Mineralogical Symposium last April. In general, only discoveries made since the previous year's symposium are discussed. For the sake of a complete summary, even those occurrences which have already been described in earlier issues of the *Mineralogical Record* are recapped here. As in past years, the information is presented geographically, with emphasis placed on truly new finds rather than continuing supplies of previously known materials. Addresses are given for most of the dealers who are not advertisers in the *Mineralogical Record*.

We are indebted to numerous collectors, curators and mineral dealers who have shared information with us for this report; without their support and knowledge it would have been an impossible task. A number of the occurrences were first described in Lanny Ream's *Mineral News,* where further details may be found.

Part I: United States

ALASKA

Theo Manos (P.O. Box 180358, Dallas, TX 75218) has acquired a large number of gold nuggets with quartz from the Manley Hot Springs area near the Arctic Circle. The nuggets range up to over a kilogram in weight.

ARIZONA

George Godas (6304 S. Clark Dr., Tempe, AZ 85283) collected several flats of small descloizite crystals associated with vanadinite, calcite and wulfenite from the Dripping Springs Mountains. Along with Mark Hay, he also collected some exceptional vanadinite specimens from the Western Union mine in the Cerbat Mountains, just north of Kingman. Many of these crystals are between 3 and 4 cm, and form doubly terminated individuals with steep dipyramids that taper to a point. They range in color from straw-yellow to blood-red. Mark Hay and Dick Morris (*Arizona Minerals,* 2410 E. Caballero, Mesa, AZ 85203) also have collected transparent, colorless crystals of calcite, similar in habit and appearance to those from Cumbria, England, from an undisclosed location in Mohave County.

A continual supplier of good Arizona minerals, John Mediz (*Copper City Rock Shop,* 566 Ash St., Hwy. 60-70, Globe, AZ 85501) offered a number of new specimens at the Tucson show. Among others were velvety malachite from the Mary shaft, Courtland, Cochise County; etched-to-lustrous crystals of dark brown andradite from the Dripping Springs Mountains, near Hayden; yellow wulfenite with mimetite somewhat similar to the San Francisco mine material, but from the Toughnut mine, near Tombstone; and small pale blue hemimorphite specimens from the 79 mine, Gila County.

Etched blue-green octahedrons of fluorite with purple overgrowths have been found at the Hesson mine in the Buckskin Mountains, La Paz County. Some specimens resemble those from Grant County, New Mexico, and are available from *David Shannon Minerals.*

Richard Dale (P.O. Box 2522, Globe, AZ 85501), owner for the last three years of the famous Apache mine near Globe, recently uncovered a large mineralized area which yielded some very bright orange-red, sharp single crystals of vanadinite to 6 mm attractively sprinkled on matrix. A large number of more typical, densely coated specimens were also recovered.

ARKANSAS

Probably the best wavellite to ever be collected at the County pit at Mauldin Mountain, north of Mount Ida, was available from *Starfire Mines* (Star Route 1, Box 306, Mt. Ida, AR 71957) at the Denver show last September. The material was similar to previous finds but an order of magnitude better, with individual crystallized green balls, over a centimeter in diameter, richly scattered on pieces of quartz/argillite matrix up to half a meter across. Some of the smaller pieces are very aesthetic, and are probably among the better specimens of wavellite ever found.

CALIFORNIA

The Michigan Bluff district and Eagle's Nest mine in Placer County continue to produce very fine specimens of crystallized gold. Wayne and Dona Leicht (*Kristalle*) had an excellent selection of specimens available at this year's Tucson show, and Coogan Gold Company had a good selection of stream-worn pebbles of quartz and gold up to 12 cm from Mariposa County at the Denver show last September.

Recent activity at a chromium prospect near Jacksonville, Tuolumne County, has produced a small number of good uvarovite specimens. These consist of lustrous drusy green crystals up to about 5 mm coating fracture surfaces on chromite ore. Specimens are available from *Galas Minerals.*

Thenardite pseudomorphs after mirabilite have been found at Boron as skeletal prismatic crystals in parallel growths up to about 10 cm. Some have minor inclusions of realgar. Specimens are available from *Seibel Minerals* (P.O. Box 95, Tehachapi, CA 93561).

Groups of lustrous, prismatic stibnite crystals up to 8 cm have been found at the McLoughlin mine, Lake County. Bruce and Jo Runner had specimens available at the Tucson show.

Some interesting 2-mm tabular crystals of dachiardite with serrated edges were collected from the Opal Hill quarry in Riverside County last year by Jim McGlasson and Steve Pullman. Dachiardite was considered a rare zeolite about a decade ago, but it has shown up in numerous occurrences since then.

Gems of Pala, Inc. (P.O. Box 382, Pala, CA 92059) has been mining the famous Stewart mine for the last several years. The primary production has focused on massive lepidolite with fans of pink elbaite, a material which has found use in a variety of polished objects including jewelry boxes, miniature obelisks, pyramids, etc. Over the last year, however, several gem pockets were also discovered. These yielded pale crystals of morganite up to 10 cm across, though the better ones were in the 5–7 cm range. Elsewhere in the pegmatite district, Ken Gochenour, of Tufton, has opened up a new pegmatite near the Blue Chihuahua mine, where he has found a doubly terminated hydroxylherderite crystal 7 cm long, in addition to numerous smoky quartz

***Figure 1*. Vanadinite specimen, 8 cm, from the Western Union mine. Mohave County, Arizona. George Godas specimen.**

and muscovite crystals. He has named the quarry the Marion Godshaw Memorial (MGM) quarry in honor of his late friend. Ken has also recently found some excellent spessartine crystals in the 2–4 cm range on Little Cahuilla Mountain in Riverside County.

While probably considered by many to now be in the "continuing supply" category, *Pala International* has continued to produce exceptional bicolored elbaite specimens from the Himalaya mine at Mesa Grande, as was evident from their fabulous case of matrix specimens displayed at the Tucson show last February. Remember what it was like trying to get a good California tourmaline a few years ago? We should not take these great specimens for granted!

Lastly, there has apparently been yet another significant find of morganite crystals on albite from the White Queen mine; interested persons should contact Bill Todzia (*Rincon Minerals*).

COLORADO

Probably the most exciting find made in Colorado over the past year was by Bryan Lees and Dennis Wilson at the blue barite locality near Stoneham. Using heavy machinery, one major pocket and a series of smaller ones were uncovered over the last two weeks of July, 1989. The largest pocket consisted of a flat, 15–20 cm wide opening that extended over 3 meters into the enclosing limestone, and yielded hundreds of beautiful blue barite specimens with crystals up to 10 cm long in plates up to nearly 30 x 40 cm. Many of these are associated with pale yellow calcite and are extremely aesthetic. Specimens are available from *Collector's Edge*.

Other interesting Colorado minerals noted at the Denver show included silver and acanthite from the Homestake mine near Creede, which is old material recently acquired by Don Knowles (*Golden Minerals*); parallel growths of large smoky quartz crystals with iron oxide inclusions associated with gray-green fluorite crystals from Crystal Park, El Paso County; and more very fine amazonite and smoky quartz groups from the Crystal Peak area in Teller County, which were available from *Willis' Earth Treasures*.

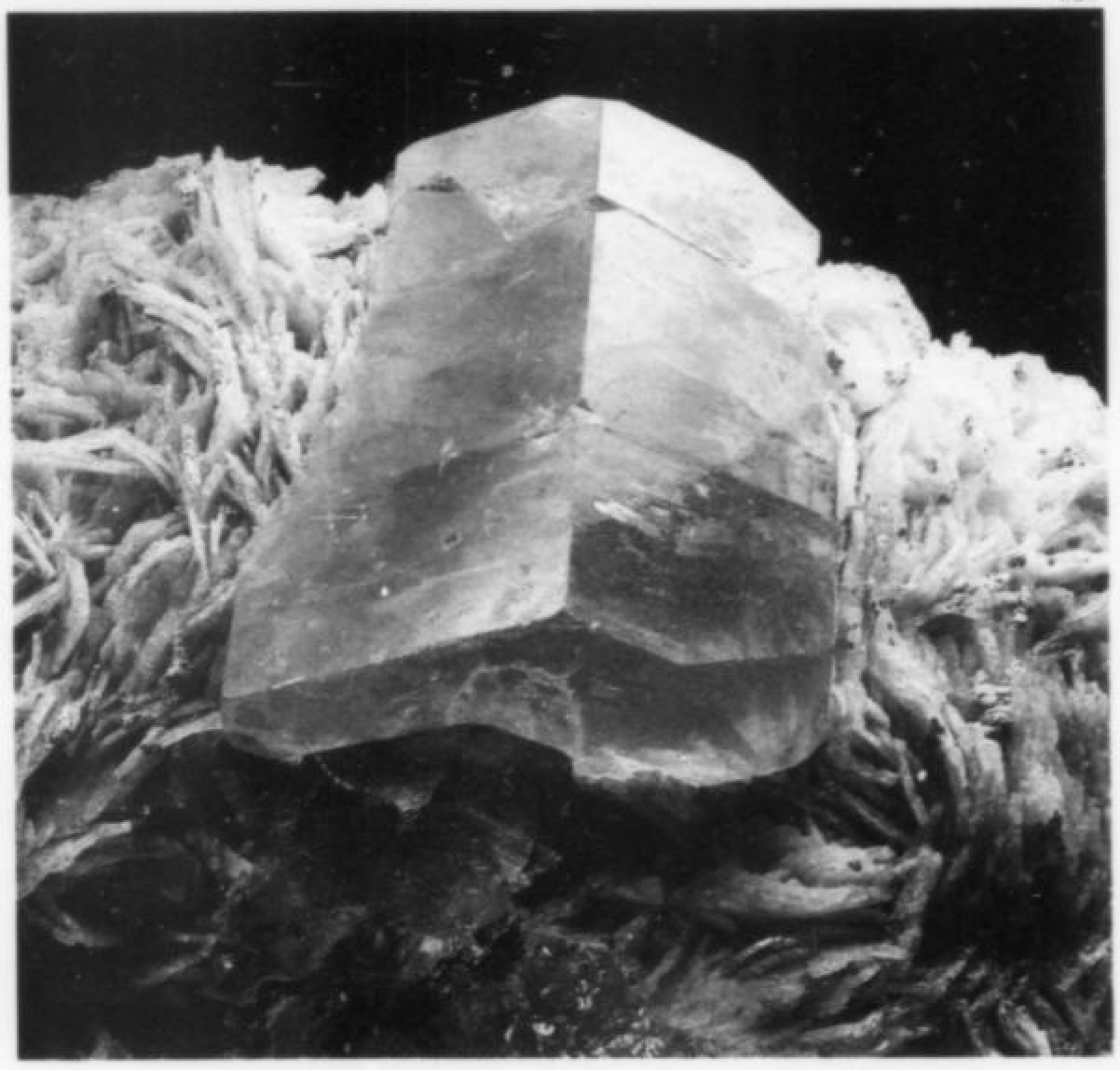

***Figure 2*. Beryl crystal, 7.7 cm, on albite, from the White Queen mine, San Diego County, California. Bill Todzia (*Rincon Minerals*) specimen.**

GEORGIA

The staurolite crystals from Fannin County typically enjoy little notoriety among collectors, but sometimes provide a glimmer of joy. Jesus Gonzolo (Arquitectura 15 BTS, 28005 Madrid, Spain) sought a particular twin that is only dreamed of in books—a combined Maltese and St. Andrews twinned staurolite—and actually found one while on a recent visit to Georgia! After having looked through a barrel containing literally thousands of staurolite crystals, his search was rewarded with a perfect 2-cm twin combination.

IDAHO

Dark yellow radiating tufts of carpholite have been identified from the Sawtooth Mountains. Some of these are paler yellow to white, and appear to be potassium-dominant, rather than manganese-dominant. This is apparently the first reported discovery of carpholite in the United States (*Mineral News*, May 1989, p. 9).

John Seibel (*Seibel's Minerals*) had an interesting lot of barite crystals from Borah Peak, Custer County, for sale at the Denver show. These consist of rather thick, tabular, pale yellow crystals in groups up to about 30 cm across.

ILLINOIS

John and Pat Carlon (1110 E. Emerson, Bloomington, IL 61701) have obtained some very good blue-gray celestine crystals on purple fluorite crystals in clusters to 20 cm from the Anabel Lee mine in the Cave-in-Rock district. The crystals, which are up to 5 cm, were discovered in September, 1989. Also found were some unusual, color-zoned fluorite cubes to several centimeters associated with crystals of gray calcite. The transparent fluorite crystals show brown internal zones which fluoresce a bright yellow to orange-pink color in ultraviolet light. Chalcopyrite crystals are sometimes present at the interface between the clear and brown zones. The specimens are virtually indistinguishable from similar ones previously found at the Minerva mine.

LOUISIANA

A deposit of gem-quality fire opal has recently been discovered in Sabine Parish, near Toledo Bend Reservoir. The opal occurs as a cement in a gray to white orthoquartzite sandstone. Dr. William Simmons (Department of Earth Sciences, University of New Orleans, Lakefront, New Orleans, LA 70148) had specimens and cabochons available this year at the Rochester Symposium.

MAINE

There have been a number of exciting finds made in Maine over the past year. Recent work by Ron and Denis Holden, Leonard Beliveau, and Mark, Gary and Brian Laverdiere at the Bennett quarry near Buckfield, has produced what are perhaps the finest morganite specimens ever found in the New England states. The finest is a 7-cm doubly terminated pink crystal with albite, and the largest was a 30-cm orange hued crystal with milky quartz. The larger crystal, which was sacrificed for gem rough, has yielded a number of light pink stones ranging up to 184.2 carats. The find has received a great deal of notoriety in Maine newspapers and was heralded as a multimillion dollar discovery, but expectations of that magnitude have certainly not been realized. (Unfortunately, much of the better facet rough tends to lose some of its color when broken into the smaller pieces required for inclusion-free gems.) Other species collected include blue fluorapatite, cassiterite, columbite, hydroxylherderite, cookeite, manganotantalite, bicolored elbaite and quartz. Work will progress into the 1990 season in search of more gem rough.

Jim Mann (*Mt. Mann Minerals*, P.O. Box 597, Bethel, ME 04217) has been working the Mt. Rubellite pegmatite near Hebron, with occasional success ever since August, 1985. In the fall of that year, Jim made the first really significant find at Mt. Rubellite since 1934, with his discovery of purple fluorapatite crystals up to 2.5 cm. Last fall, Jim had a repeat performance. What started out to be a week's worth of exploration and development work ended up as 34 days of quite productive mining. Among the more noteworthy finds were two isolated pockets of quartz containing excellent smoky crystals and several fine scepters, a 30 x 30 x 50-cm pocket and a 25-cm pocket that yielded some of the best fluorapatite crystal groups found to date, and a number of very good cookeite specimens, some of which are pseudomorphs after tourmaline. As winter set in a few small pieces of green elbaite were found, providing a glint of optimism for more good things to come in 1990.

Elsewhere in the state, Phil McCrillis (*Plumbago Mining Corp.*, Box 449, Casco Bank Bldg., Rumford, ME 04276) has been busy mining more amethyst from the new locality at Sweden, reported here last year, and subsequently in the *Lapidary Journal* (vol. **43**, no. 8, p. 44–46). A number of good matrix specimens up to 20 x 30 cm were available from Phil at the Tucson show.

Some rather sharp muscovite pseudomorphs after tourmaline have been collected from a pegmatite on the east slope of Noyes Mountain near Greenwood. These occur in various stages of replacement from partial to nearly complete, and are available from *David Shannon Minerals*.

New also this year, for the state of Maine, is its first mineral symposium, which is being jointly sponsored by the Harvard University Mineralogical Museum Association and the Maine Geological Survey. The time is April 21–22, 1990, and the place, Jewett Hall, University of Maine at Augusta. For more details contact Woodrow Thompson, Maine Geological Survey, State House Station #22, Augusta, ME 04333.

MARYLAND

Good specimens of strontianite and calcite have been collected from a road cut on Highway 40/48 approximately one half mile west of the entrance to Rocky Gap State Park.

MISSOURI

Joe Kielbaso (*Gemini Minerals*, P.O. Box 52, Tipp City, OH 45371) frequents the mining districts of Missouri in search of their wonderful minerals. Recently he and several others have obtained some excellent, tabular, spinel-law twinned galena crystals from the Sweetwater mine, near Sweetwater, Reynolds County. The crystals form bright metallic twins up to 3 x 5 cm by 8 mm in groups with chalcopyrite and calcite.

MONTANA

Albert and Betty Volker (1806 S. 10th West, Missoula, MT 59801) are actively working their 4V's claim near Lolo, approximately 50 miles southwest of Missoula, as demonstrated by the fine lot of smoky quartz crystals they had at the Tucson show. The crystals are typically lustrous and occur in all color gradations from pale smoky to nearly opaque black. Sizes range from 1 to 30 centimeters. They appear to occur in miarolitic cavities in decomposed granite, and a few are associated with minor albite and microcline.

Duane Johnson (P.O. Box 761, Butte, MT 59703) has made what has proven to be one of several finds of kipushite for the year. The

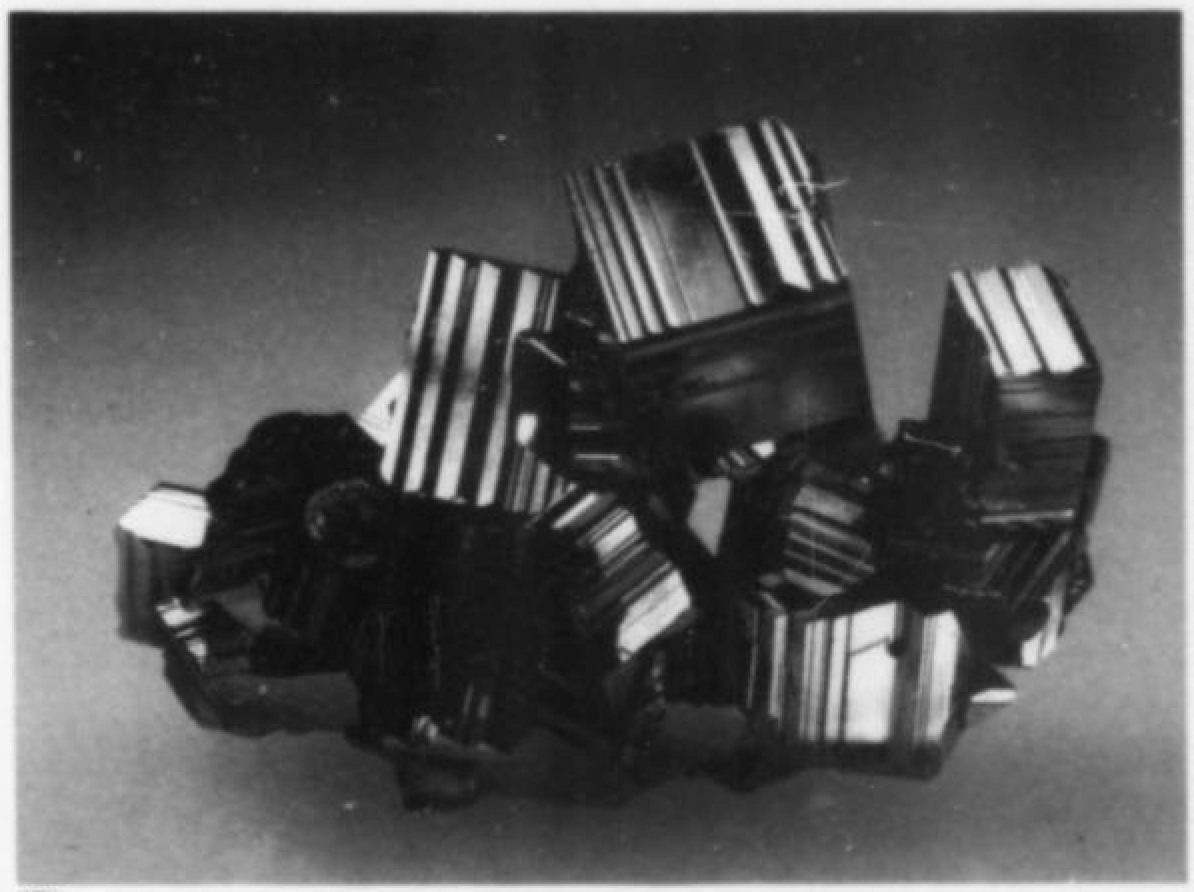

***Figure 3*. Pyrite group, 4.5 cm, from the Daly-Judge mine, Park City, Utah. Chuck Turley specimen.**

Black Pine mine at Philipsburg has produced bluish green, micro-rosettes of kipushite on quartz crystals. Some of this material has probably been offered in the past as philipsburgite, which is also relatively abundant at the locality, considering these minerals are isostructural, but with different arsenic and phosphorus contents.

The Butte Mineral and Gem Club had an impressive display of amethyst crystals collected from Crystal Park. The club staked claims there in 1969 to insure the area would remain open to collectors. Good crystals of amethyst to approximately 5 x 8 cm and scepters to 5 cm were on display. The sceptered crystals are particularly attractive, with transparent, pale amethystine tips on smoky quartz shafts.

NEVADA

There has been a great deal of interest generated in the exploration of numerous epithermal gold deposits in Nevada over the past few years. Among other interesting finds, Lane Griffin has reported blue-green aggregates of vivianite crystals up to 4 cm from the Fortitude pit near Battle Mountain. Richard Thomssen of Carson City found green kipushite microcrystals associated with zincian libethenite at the Snowstorm mine, in Lander County. Jim McGlasson (*The Collector's Stope*) has also made a number of other interesting finds in Lander County. These include micro blue litidionite pseudomorphs after libethenite with chrysocolla from the Pyro pit at the Snowstorm mine; massive neyite in pyrite and arsenopyrite from Whiskey Canyon, Lewis district; owyheeite with freibergite and various sulfosalts in quartz at the Eagle vein, Lewis district; and some sharp, white orthoclase crystals up to 2 cm from the McCoy mine. Jim, along with Steve Pullman of Reno, has also collected blood-red carminite covered with transparent gypsum at the San Rafael mine in Nye County.

In Churchill County, bright blue-green microcrystals of clinotyrolite have been found at the Lovelock mine, Cottonwood Canyon, and small dendritic crystals of cinnabar in white calcite at the Relief Canyon mine. Specimens of each were available from *David Shannon Minerals* at the Denver show. Lastly, there have been more new discoveries made at the Chalk Mountain mine, including fine vanadinite and mimetite specimens in addition to 1.9-cm leadhillite crystals.

NEW HAMPSHIRE

Continued work at the Palermo mine near North Groton by Bob Whitmore and others has rewarded collectors with a unique opportunity to see a classic locality revitalized. In addition to salvaging a portion of history and numerous mining artifacts, last year's collecting also afforded some excellent chalk-white apatite crystals and some of the best quartz specimens known from the locality.

NEW MEXICO

Despite being idle, the Harding pegmatite near Taos still continues to increase its species count. Ray DeMark of Albuquerque reports that while thorite and bityite have been found in recent years, pucherite crystals have also recently been identified. The drusy orange crystals occur as thin coatings on quartz and albite pegmatite.

Lance Hampel (*Precious Earth Co.*) recently acquired several flats of rather aesthetic chalcedony specimens from a roadcut occurrence on Apache Creek Road, near Quemado, Catron County. The botryoidal gray-white chalcedony appears to have formed in openings in an altered volcanic rock, forming natural *objets d'art* in large cabinet-sized specimens. Many of the pieces show multiple layers of chalcedony and drusy quartz with pale yellow, microcrystalline encrustations. When X-rayed, these yield powder patterns best explained as a mixture of heulandite and quartz. SEM examination of the same material, however, shows the additional presence of a Ca-Al silicate that may be prehnite.

NORTH CAROLINA

While not as abundant or easily found as in the past, small crystals of corundum may still be collected in the Statesville area, Iredell County.

OREGON

Two new zeolite species, tschernichite and boggsite, named for Rudy Tschernich and Russell and Robert Boggs, have been collected from Goble, Oregon. Both minerals occur in small vesicles in a dark basalt: the tschernichite as sharp pseudo-tetragonal dipyramids averaging 4–5 mm, and the boggsite as 1–2 mm hemispheres of radiating white to colorless crystals.

TEXAS

Good crystals of blue celestine several centimeters in length and geodes of pale yellow calcite up to 18 cm have been found in the Glen Rose formation around Bull Creek in northern Austin, and in central Texas.

UTAH

A large find of azurite has been made at the Nevada Lode claim near La Sal, San Juan County. These were mined by Bob Lane, Graham Sutton, Wayne Richards and Fred Lane. The specimens consist of lustrous bright blue spherical aggregates of crystals up to 8 cm, though most are 2–4 cm. Many are on a matrix of rather porous green malachite and make very attractive specimens, some of which are nearly 25 cm across. They are clearly the best that the locality has produced to date. Many dealers at the Tucson show had specimens for sale, though probably the best were available from Bob Lane (P.O. Box 26154, Phoenix, AZ 85068) and Les and Paula Presmyk (*De Natura*).

At the Denver show Bryan Lees (*Collector's Edge*) had some unusual white stalactitic calcite on coal from an unnamed coal adit in Huntington Canyon, Emery County. These were collected in early September and average 6–7 cm in length. A few are associated with minor amounts of amber.

Also at the Denver show there was a large number of interesting Utah minerals available from Phil Richardson of Salt Lake City. Among these were calcite as white rhombohedral overgrowths on scalenohedrons and coralloid groups to 20 cm resembling those from Santa Eulalia, Chihuahua, Mexico, but from Long Trail Gulch, Lion Hill, in Tooele County; pale green dodecahedral crystals of grossular up to 2 cm in a white tactite matrix from Wah Wah Mountain, Beaver County; good aurichalcite, hemimorphite and smithsonite from Dry Canyon, Ophir Hill district, Tooele County, which were also available from *Hollowell Minerals* (P.O. Box 1149, Fresno, CA 93715); 1–3 cm tetrahedrite crystals with pyrite from the Daly-Judge mine, Park City district, Summit County (also available from Bryan Lees); cubic crystals of pyrite to 4 cm from Bullion Canyon, Dugway Mountains, Tooele County; yellow-green botryoidal masses of faustite from the 5190 level of the Bingham open pit copper mine in Salt Lake County; parapierrotite from a small prospect near Lookout Pass, Tooele County; and gray cubic crystals of sulvanite to nearly a centimeter from Thorpe Hill, Tooele County.

Good specimens of rich, yellow coconinoite microcrystals on sandstone have been found in the White Canyon mining district of San Juan County. Specimens are currently available from both David Shannon and Patrick Haynes (*Virgin Mining Company*, P.O. Box 1531, Cortez, CO 81321).

Mike Bergmann (617 N. State St., Suite 152, Chicago, IL 60610) and Robert Johansing (517 W. 3rd St., Leadville, CO 80461) have obtained more of the lovely, pale blue-green, cuboctahedral fluorite specimens from the Deer Trail mine near Marysvale, Piute County. The crystals, which average 1–2 cm, occur attractively scattered on a light colored quartzite matrix.

VERMONT

Ken Hollmann (Box 134, Center Rutland, VT 05736) reports a find of large quartz crystals (up to 30 cm) from a highway construction project near Manchester. The crystals occur in pockets near a quartzite-dolostone contact and are sometimes associated with minor stalactitic goethite. Unfortunately, many are badly damaged, as they were improperly collected by the local residents and construction workers rather than responsible collectors or museum personnel.

VIRGINIA

Si and Ann Frazier came up with some unusual quartz crystals from near Saltville, Smyth County. The 1–2 cm clear crystals not only show reverse scepter habit, but also have small "off center" crystals growing from the edges of the main crystal.

WASHINGTON

The Spruce claim in King County is now a well-established locality for fine quartz and pyrite specimens. This year was no exception, as more excellent specimens were produced. New this year, however, were some large barite crystals. These typically form multiple, parallel growths of opaque, white, diamond-shaped, tabular crystals in groups and aggregates up to 20 cm. Specimens were available at the Tucson show from the claim's owner, Bob Jackson (P.O. Box 2652, Renton, WA 96056). In addition to the Spruce claim material, similar minerals have also been found in nearby areas. Bart Marckette (*High Mountain Minerals,* Portland, OR), who has a lease on the Pedro claim, has collected fine, large pyrite-quartz combinations similar to the Spruce claim specimens, in addition to fine chalcopyrite, galena and scheelite crystals.

WYOMING

Mel and Grace Dyck (*Dyck's Minerals,* 1559 N. 18th St., Laramie, WY 82070) are continuing to provide new and interesting selections of Wyoming minerals. The following items, among others, were available from them at the Denver show last September: calcite crystals with sand inclusions, in groups up to 10 cm, similar to the Rattlesnake Butte locality in South Dakota, but from Goshen Hole, Platte County, Wyoming; opaque white dolomite pseudomorphs after pseudohexagonal aragonite twins up to 4 cm across from near Lovell, Big Horn County; a gray carbonate-apatite mineral forming pseudomorphs after spherical aggregates of pyrite up to 3 cm from near Shell, Big Horn County; gray-green botryoidal fluorite occurring as hydrothermal fracture-fillings in brecciated granite from near the Colorado border in Jackson County; chlorite pseudomorphs after dodecahedral crystals of garnet up to 8 cm from Oldman Ranch, Encampment, Carbon County, that resemble those from Salida, Colorado; tabular blue barite crystals in groups up to 7 cm from Shirley Basin, Carbon County; and chalky white calcite pseudomorphs after shortite from Green River.

Part II: Canada

Before beginning our coverage of new mineral finds for Canada, we would like to announce a new book that has recently been published concerning Canadian minerals: *Famous Mineral Localities of Canada,* by Joel D. Grice, Curator of Minerals at the Canadian Museum of Nature. This 190-page book is available in both French and English hardcover editions and covers 19 selected mineral occurrences in detail, teaching basic mineralogical concepts along the way in a very readable, painless manner. Color photographs by Jack Schekkerman are used throughout to illustrate specimens. The book is currently available from *Southern Nevada Mineral Co.* (5000 E. Bonanza #8479, Las Vegas, NV 89110) and the boutique at the Canadian Museum of Nature (P.O. Box 3443 Station 'D', Ottawa, Ontario, Canada K1P 6P4). The cover price is $35.00.

BRITISH COLUMBIA

Rod Tyson (*Tyson's Minerals*) and Frank Melanson (*Hawthorneden*) provided a very impressive display of fine gold specimens from the Bralorne mine near Goldbridge, at the Tucson show. The display consisted of 15 pieces of rich, spongy gold in quartz that had been selectively etched to expose the gold. The specimens range in size from about 3 x 4 cm to 12 x 20 cm. Having been held since the mine closed in 1971, these pieces were recently sold by Bralorne Resources to Rod and Frank, so that they might be preserved as specimens rather than be sent to the smelter, and thus lost forever. All too frequently the other road has been chosen. We must applaud Bralorne's efforts to preserve these important specimens as part of our mineral heritage.

Paulingite continues to be discovered in more and more localities. Chase Creek, Falkland, British Columbia has recently yielded 2-mm clear dodecahedra implanted on 1–2 mm stubby erionite prisms. These minerals occur in rather flat, elongate cavities in a felsitic rock. Specimens are available from Neil Hubbard (122 Cordery Rd., Evington, Leicester, England LE5 6DF).

MANITOBA

Recent collecting at the Red River floodway near Winnipeg has produced what may be some of the best gypsum specimens ever found in Canada. These occur as pale yellow, transparent crystals, which are often twinned, radiating outward from a central "rose" in groups up to nearly 20 cm across, though most are less than half that size. Specimens are available from *Tyson's Minerals*.

NOVA SCOTIA

While once famous for its gold mines, Nova Scotia has not produced good quality specimens of gold for many years. However, last year Coxheath Gold Holdings Limited obtained some very good specimens as a result of exploration and development work at the Tangier mine, east of Halifax. The gold occurs as rich masses several centimeters across in quartz veins in the Meguma metasediments. A number of the best high-grade specimens recovered so far (which average 5–10 cm) have been set aside by Coxheath's president, Michael Riddell, to be sold as specimens so that they might be preserved and enjoyed by future generations. The best of these have already found their way into the collection of the Nova Scotia Museum in Halifax. Hats off to Coxheath!

In spite of years of heavy collecting, the basalt cliffs around the Minas Basin in the Bay of Fundy still continue to produce good specimens of zeolites and agate. Excellent specimens of laumontite with stilbite may be collected at Halls Harbour, and if wrapped in wet paper and later stored in a jar of water, should remain stable as laumontite indefinitely.

NORTHWEST TERRITORIES

Over the past few years the Nanisivik mine at Nanisivik, N.W.T., has become a fairly well known producer of high quality specimens of pyrite with unusual crystal habits. Last year, however, smoky quartz crystals were collected that are probably the best the mine has ever produced, and among the best ever found in Canada. These are typically dark smoky to clear and transparent, and could easily be mistaken for Herkimer diamonds, if it weren't for the lustrous pyrite pseudomorphs after marcasite and dolomite with which they are associated. Most of the crystals are 3 to 6 cm in length, but some may reach proportions several times that size. A few large rhombs (5 to 10 cm) of pink dolomite were also recovered. Some of these have fairly transparent cores that should yield some unusual gemstones.

ONTARIO

Several new discoveries in the Bancroft area were evident at the Bancroft Gemboree last July. These included lustrous, black, doubly terminated amphibole crystals and titanite crystals from Tory Hill; chocolate-brown zircon crystals (reportedly to 10 cm) from a roadcut near Wilberforce; gray-blue, tapered, hexagonal crystals of corundum from near Harcourt; and large terminated crystals of scapolite from a roadcut near Baptiste Lake. These and other interesting specimens were available in the swappers' area at the show.

The annual CCFMS field trip to western Ontario yielded a number of interesting finds last August. Among the highlights were amethyst and fluorite crystals from the Beaver mine near Stanley, and good specimens of hematite, goethite, calcite, quartz and manganite crystals from several of the open pit iron mines near Atikokan.

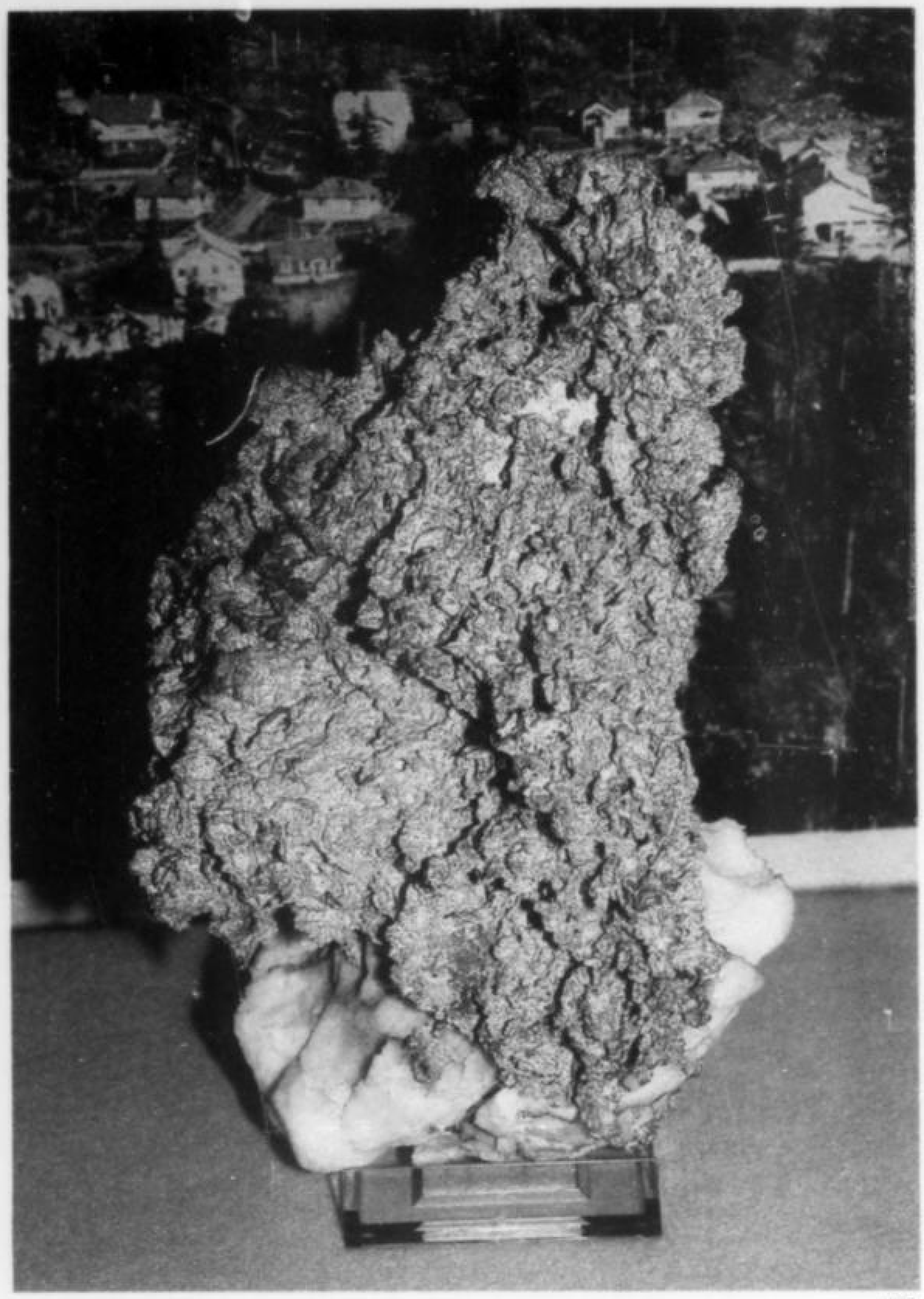

Figure 4. **Gold on quartz, about 12 cm, from the Bralorne mine near Goldbridge, British Columbia. Rod Tyson and Frank Melanson specimen.**

QUEBEC

As always, the Poudrette quarry at Mont Saint-Hilaire continues to yield its mineralogical treasures. During the summer of 1989, a series of large pockets was exposed from which came superb specimens of leifite and elpidite. The leifite pocket, which occurred in a pegmatite vein, produced superb crystals of that species up to 2 cm, associated with dark reddish brown rhodochrosite, gray-green elpidite and pink albite, which occurred as overgrowths on large, twinned microcline crystals. Nearby pockets provided large, densely intergrown, radiating masses of elpidite needles up to 20 cm long in specimens nearly half a meter across, and plentiful zircon and siderite specimens. Later in the year, what are probably the best crystallized elpidite specimens known were collected from another large pegmatite cavity. These are extremely well-formed, greenish gray, lustrous prisms with sharp terminations. Most are in the 1 to 3 cm range, though a few exceptional pieces approach 10 cm in length and 1 cm across. A single pocket uncovered in September contained a small number of very fine, sharp crystals of genthelvite, up to about a centimeter in size. Probably the largest and finest pectolite crystals found to date were also recovered in September from pockets in marble xenoliths. Perhaps the finest of these is a 4.5-cm, glassy, doubly terminated crystal collected by Gilles Haineault. Another pocket excavated by Gilles yielded more large, transparent fragments of sodalite from which a number of exquisite gemstones have been faceted by Art Grant. These are particularly interesting, as they not only represent the finest and largest faceted sodalites in the world, but they are also characterized by a dramatic photoreversible color change. In ordinary light they appear pale yellow to colorless, but when exposed to ultraviolet irradiation, they become a bright raspberry-pink color which slowly fades, with exposure to light, back to pale yellow. Excellent specimens of all these and other Mont Saint-Hilaire minerals are available from Gilles Haineault (*Collection Haineault,* 2266 St.-Alexandre, Longueuil, Quebec, Canada J4J 3T9).

More sodalite syenite xenoliths were also exposed in September. These produced fine crystals of ussingite, vuonnemite, griceite, etc., and provided many new minerals for the ever-growing species list for Mont Saint-Hilaire: namely tugtupite, erdite, searlesite, alabandite, natrite, sazhinite-(Ce), native lead, halite and makatite. Furthermore, while not newly collected minerals, continuing research at Carleton University and the Canadian Museum of Nature has verified the presence of yet another four species: sugilite, daqingshanite-(Ce), penkvilksite, and the new species perraultite. The latter three were formerly UK-44, UK-41 and UK-17, respectively.

While the Jeffrey mine at Asbestos has been relatively quiet over the past year, there have been a number of interesting specimens collected in the similar deposits to the north, near Thetford Mines. Among these are grossular crystals similar to those from Asbestos, but generally of smaller size and paler color, pale yellow prehnite crystals to 3 cm, and small crystals of apophyllite, stilbite and calcite. Also good specimens of clinochlore and muscovite may be collected from the Broughton Soapstone quarry, approximately 25 km to the northeast.

Continuing development and cooperation with Unocal Limited has enabled the Canadian Museum of Nature to obtain more new and interesting specimens from the Kipawa alkaline syenite complex. Very good specimens of vlasovite, zircon, miserite and other species were collected by museum staff and visiting scientists Harry Micheelsen (University of Copenhagen, Denmark) and Bill Birch (Museum of Victoria, Australia).

Lastly, rich, black masses of aurostibite have recently been obtained at the Tonawanda mine, Cadillac Township, Abitibi district. Specimens of this rare mineral are available from Bernard Borduas (1698 Duchesne, Val D'Or, Quebec J9P 6G8).

YUKON

Rod Tyson recently obtained a good lot of new gormanite-souzalite specimens from the Big Fish River, near the Yukon—Northwest Territories border. These are quite different in appearance from most of the earlier-collected material from the nearby Rapid Creek occurrence, as they are comprised of more individual, acicular crystals thickly covering the ironstone matrix.

Part III: Other World Occurrences

AFGHANISTAN

Some very good crystals of andradite from Afghanistan have appeared on the market over the past year. These are typically dark greenish brown dodecahedrons up to 3 cm associated with green epidote, clinochlore, diopside and calcite that form matrix specimens up to about 15 cm. *International Gems and Minerals Corporation* (P.O. Box 4731, Metuchen, NJ 08840) had a good selection of these available at last year's Denver show. While the locality for these was given as Nuristan, Afghanistan, it should be noted that we have seen very similar specimens labeled as coming from Parachinar, Tribal Area, Pakistan, which is very near the Afghanistan border, so the precise locality, if there is only one, is still in question. The problem has been discussed in further detail by Moore (*Mineralogical Record,* vol. 20, p. 484–485).

More good lazurite crystals have been found in the Kokcha River area, Farmggu, Badakshan. The ultramarine-blue cubo-dodecahedra which occur up to 3 cm in size in massive white marble make extraordinary specimens.

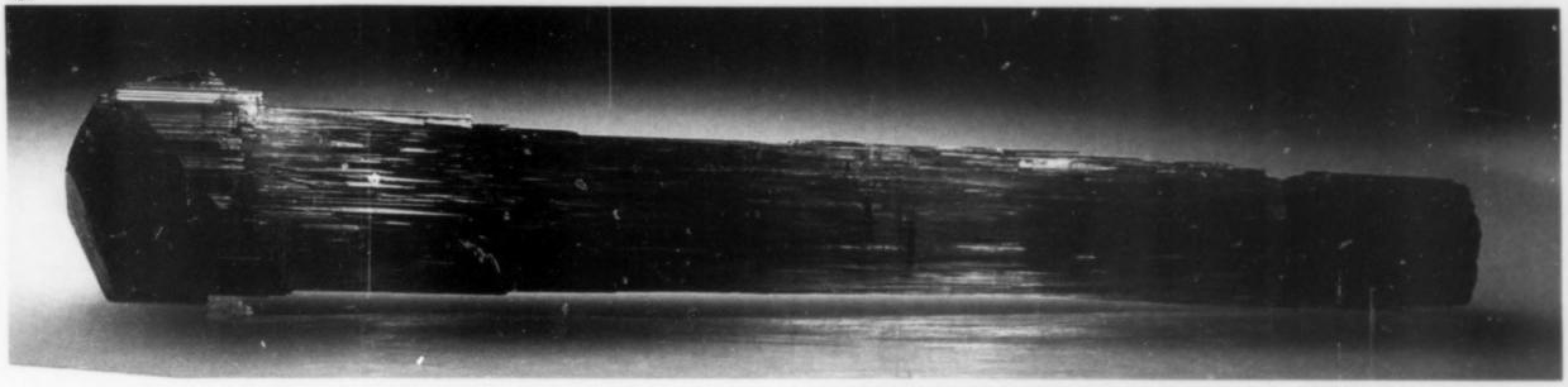
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Figure 5. **Elbaite crystal, color-zoned and sceptered, 15 cm long, from Barra de Salinas, Minas Gerais, Brazil. Ken Roberts specimen.**

Hamidullah Khan of Peshawar Cantt, Pakistan, noticed some very interesting graphite crystals in association with the well-known ruby crystals from Gugali. The graphite occurs as hexagonal platy crystals to several millimeters disseminated in the marble host rock at the locality, and may be revealed by light etching in dilute acetic or hydrochloric acid.

AUSTRALIA

Colorful, blue-green, curved crystals of pseudomalachite up to about 6 mm, on chrysocolla, have been found at the Mt. Glorious mine in Queensland. From the Northern Territory, zircon as sharp, 2-cm, gemmy red-brown crystals has been found at Mud Tank, and sharp, 2-cm, greenish brown titanite crystals have been coming out of the Harts Range. Small, 2–4 cm, doubly terminated smoky quartz crystals occur in geodes near Moralla, Victoria, and 3-mm white balls of gonnardite on basalt have been collected from near Bundoora. Rich, yellow-green crusts of kambaldaite in specimens up to 10 cm have been found at Kambalda, Western Australia, and similarly appearing specimens of a presumably new species, gartrellite, and chenevixite have been found at Ashburton Downs. Pale blue patches of hentschelite occur with native copper, cuprite and malachite at the Spring Creek mine, near Wilmington, South Australia. All these and other interesting Australian minerals were available from *Ausrox* at the Tucson show.

Also seen at Tucson were some new pyromorphite crystals from Rum Jungle, Northern Territory; millerite resembling the old Gap mine, Pennsylvania, material from the Agnew mine, near Leinster, Western Australia; and aurichalcite with hemimorphite from the Evelyn mine, Pine Creek, Northern Territory.

BRAZIL

There have been a large number of incredible finds made in the gem pegmatites of Brazil over the past year. Pierre Laville (*Telequartz Exportadora Ltda.*, Rua Pedro Alves 126, 20220 Rio de Janeiro, Brazil) obtained a remarkable crystal of lettuce-green, gem-quality spodumene from a recent find at Resplendor, in Minas Gerais. This crystal is approximately 10 x 25 cm and appears to be a naturally rehealed shard of an even larger crystal that was probably broken during a late stage explosive event common to the genesis of many gem pegmatite pockets. Pierre reports that there were indeed larger crystals in the find (some up to nearly a meter long), but as usual, the smaller ones were cleaner and more perfect. Many of the crystals are color-zoned with distinct green, lavender and blue regions. In all, about 700 kg of material was removed from the pocket, most of which will inevitably be cut into gemstones.

Pierre also was able to acquire some exceptionally high-quality rose quartz crystals from a new find at the Pitora mine, near Galiléia, approximately 20 km from Sapucaia, Minas Gerais. These are very similar to the older specimens formerly found at Ilha da Lavra, Taquaral, and at the Sapucaia mine. A few specimens were reportedly associated with columbite. The extremely high luster and rich color of these rose quartz crystals makes them some of the best ever. *Hawthorneden, the Rocksmiths, Wright's Rock Shop* and numerous others also have specimens available.

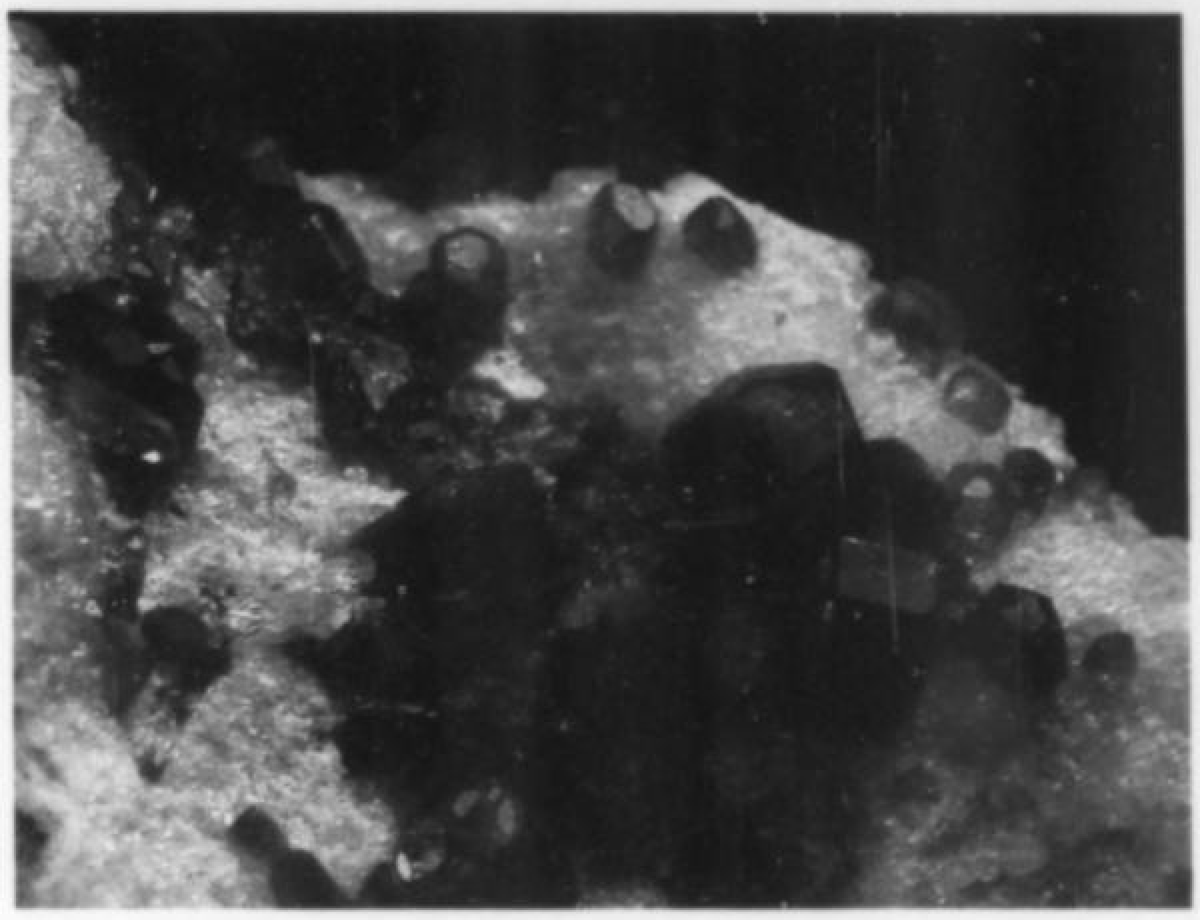


Figure 6. **Blue fluorapatite crystals to 1 mm from Rio Grande do Norte, Brazil. Canadian Museum of Nature specimen #54823; photo by George Robinson.**

Another new find in Minas Gerais consists of large (2–5 cm), sharp, gray-blue to green fluorapatite crystals and pseudohexagonal rosettes of muscovite from a locality called the Zé Pinto prospect (described as lavra Aldeia do Eme on some labels and as the José Pinto mine on others) near Conselheiro Pena. By the time of the Tucson show, specimens of these had been widely distributed among the dealers. The muscovite crystals are about as good as one could imagine for the species, and the fluorapatite crystals, while opaque, are extremely sharp and contrast nicely against their typical matrix of etched microcline.

Good specimens of parallel-growth smoky quartz crystals have been coming out of lavra Pedra Alta, Baxio, Minas Gerais, and pale smoky quartz gwindels have been found in Ibitiara, in Bahia. Specimens of each are available from *the Rocksmiths*. Alvaro Lucio (Caixa Potal 1286, 30000 Belo Horizonte, Minas Gerais, Brazil) has found good Dauphiné-twinned quartz crystals from Gouveia, Minas Gerais. These occur as transparent, colorless crystals 1 x 5 cm with their "s" and "x" faces repeated 60° apart rather than the normal 120° apart.

Ken Roberts (*Roberts Minerals*) had an incredible lot of sixteen elbaite scepters at the Tucson show. These remarkable specimens were found at Barra de Salinas, Minas Gerais, and consist of gemmy, multicolored, sceptered crystals with bright green tips and pink shafts, ranging in length from 5 to 15 cm. In addition to these, Luiz Menezes had a good selection of dark green-to-black crystals of elbaite from Barra de Salinas available at the Denver show. These averaged 2 x 6 cm and at first glance could easily be mistaken for schorl. The terminations are wonderfully complex, consisting of numerous trigonal pyramids with and without a basal pedion.

There has been a significant find of chrysoberyl at Pancas, near Colatina, Espirito Santo. A number of crystals over 10 cm have been recovered, including a giant (approximately 18 x 25 cm) twinned crystal displayed by Roger Titeux at the Tucson show. This specimen is truly superb, if not the world's finest. Many of the smaller crystals are untwinned, which is relatively uncommon for chrysoberyl. Most of the lot was purchased by Jacinto Neto in Teofilo Otoni, but specimens have recently been available from Pierre Laville, Carlos Barbosa (Rua Cel. Roberto Soares Ferreira 586, Bairro Vila Bretas, Governador Valaderas—CEP 35030, Minas Gerais, Brazil) and others. Also new from Espirito Santo (and also of significant size!) was a 20 x 20 x 40 cm topaz crystal in the possession of Rubens de Vasconcelos (P.O. Box 112, 35.100 Governador Valaderes, Minas Gerais, Brazil). The large, translucent, pale blue-gray to brown crystal is of a simple prismatic habit with a basal pinacoid and small pyramids, and was found at Mimeso do Sul.

A small pegmatite near Campina Grande in Paraiba State has recently yielded some small but vividly colored crystals of gem elbaite. The colors are truly fantastic—turquoise blue, tanzanite-like purple-blue, bright red and emerald green—but the pockets and crystals are small and probably will be of limited production. Because of their size and color, most are being cut into gems which are selling for unprecedented prices ($1000 to $4000 per carat!).

New from Rio Grande do Norte are two recent finds made by Dr. Reinhard Wegner of the City University of Campina Grande, Paraiba. Both finds are from the Capoeira (Boqueirãozinho) pegmatite located approximately 3 km east of Parelhas. The first of these consists of centimeter-sized lustrous, bright blue, tabular fluorapatite crystals on quartz, which are available from *Hawthorneden*. The second find, while perhaps not as visually attractive as the first, is certainly of greater mineralogic significance, namely crystals of the rare phosphate mineral triploidite. These form radiating masses of divergent, columnar, cinnamon-red crystal sprays to 8 cm in lithiophilite and albite. These specimens are among the best for the species ever found anywhere, and are available from Sharon Cisneros (*Mineralogical Research Co.*).

Some interesting black tourmaline crystals have been found near Malacacheta, Minas Gerais, some of which were being marketed as ferridravite at the Tucson show. Subsequent microprobe analyses at the Canadian Museum of Nature, however, suggest they are in the schorl-dravite series. The one crystal analyzed gave Fe:Mg = 1.2, proving that one, at least, to be schorl. The crystals themselves resemble uvite from Pierrepont, New York, and are available from Carlos Barbosa and *Hawthorneden*. *Hawthorneden* also had a good selection of novacekite thumbnails from Brumado, Bahia, at the Tucson show.

The Rocksmiths have obtained some bicolored elbaite crystals that will be of interest to micromounters. These are typically less than a centimeter in length and have bright red tips on otherwise pale green prisms. The locality for these is lavra do Pederneira, Santa Maria do Suassui, Minas Gerais.

Michel Jactat (53 Rue Eugene Delacroix, 49000 Angers, France) obtained some excellent crystals of schorl from the Conselheira Pena mine, near Governador Valadares, Minas Gerais. The brilliant, lustrous crystals are deeply striated and have terminations consisting of basal pedions as well as small pyramid faces. Single crystals to 3 x 10 cm were found, in addition to jackstraw clusters.

Luiz Menezes has obtained more of the beautiful golden rutile "stars" from Ibitiara, near Diamantina, Minas Gerais. The six-rayed clusters result from epitactic orientation on black, hexagonal hematite crystals, and occur in a clay layer at a surface exposure on an unnamed hill. Also worth noting were some very attractive flower-like radial clusters of amethyst from Planalto, in Rio Grande do Sul, also available from Luiz.

Lastly, Carlos Barbosa has obtained more interesting specimens from Linopolis, in Minas Gerais. Among these are wodginite in lustrous black crystals up to 1 cm; dark blue-green acicular crystal sprays of souzalite up to 3 mm on albite, muscovite and a massive white mineral that resembles augelite; and large (7 x 12 cm) rusty-brown ernstite pseudomorphs after eosphorite. Carlos was also able to provide more detailed locality information on some of the minerals we have reported on in previous years: the fluorite crystals with complex phantom zones within clear cubes associated with anatase pseudomorphs after brookite were revealed to be from Mantena, Galileia county, Minas Gerais; the bundles of fibrous apatite crystals (to 3 mm in 1 cm clusters) are from that locality; and the exceptional moraesite crystals from Galileia were revealed to be from the Pomarole mine, Linopolis, Galileia county, Minas Gerais. The increased use of county names by many dealers, while better than former labels which might only indicate a state, such as Minas Gerais or Bahia, is beginning to create confusion among collectors. Detailed locality information should always be provided whenever possible.

BULGARIA

Ernesto and Jeannine Ossola brought an impressive lot of specimens from the 19th of September mine near Madan, to the Tucson show this year. Specimens from this locality somewhat resemble those from both Kapnic, Rumania, and Trepča, Yugoslavia, and occur in a myriad of sizes, shapes and combinations of species and crystal habits. The main species represented in these specimens are quartz, calcite, galena, chalcopyrite, pyrite, sphalerite, dolomite and rhodochrosite. Some of the galenas are particularly lustrous and make highly desirable specimens.

CHILE

A recently obtained, massive, bright blue mineral from the Emma Luise gold mine near Huanaco, Taltal Province, was recently submitted to the Canadian Museum of Nature for identification by Rene Vandervelde (*Korite Minerals Ltd.*, 532-38A Ave. S.E., Calgary, Alberta, Canada T2G 1X4). Combined X-ray diffraction and qualitative EDS microprobe analysis established its identity as the rare species ceruleite.

CHINA

The past year has probably seen more varied and high-quality specimens of Chinese minerals on the market than have been available for decades. This is largely through the efforts of Doug Parsons, who has been traveling extensively throughout that country, actively acquiring minerals. Perhaps the most spectacular of these is a large lot of what have to be the world's best realgar specimens. These come from the Hunan Realgar mine near Shimen, Hunan Province, and occur as sharp, terminated, transparent red crystals up to 8 cm long in groups approaching 30 cm across with gray scalenohedral calcite crystals. These should obviously be kept in the dark to prevent their alteration, in spite of the overwhelming temptation to display them in a brightly lit showcase! They are truly magnificent specimens. Other new items of interest that Doug has imported include lustrous crystals of stibnite from the Xikuangshan antimony mine near Lengshuijiang, Shaoyang County, Hunan Province, including one large matrix specimen approximately 25 x 65 cm; topaz and elbaite crystals from southwestern Yunan Province, near the Burma border; centimeter-sized bournonite and stannite crystals, arsenopyrite crystals, galenobismutite (?), and excellent crystals of hübnerite to 7 x 10 cm from Chenzhou, Hunan Province; scheelite crystals from Hemgyang, Hunan

Province; bright green, gem-quality diopside crystals similar to those from De Kalb, New York, from the Kunlun Mountains, in southwestern Xinjiang Uygur Autonomous Region near the Kashmir/Pakistan border (see *Mineralogical Record,* vol. 20, p. 392 and 399); more fine fluorite, quartz and calcite specimens from Leiyang, Hunan Province, and a number of other minerals.

Gerald Clark (*International Mineral Exchange*) recently obtained an outstanding morganite crystal on a matrix of quartz and feldspar from Hunan Province. The transparent morganite is typically tabular with first-order pyramids and second-order prisms. It measures 4 x 9 x 9 cm.

COLOMBIA

Some exceptional gem-quality emerald crystals were found a year ago at the Muzo mine. Two of these were recently on loan to the Natural History Museum of Los Angeles County and are pictured in the *Mineralogical Record* (vol. 20, p. 392). Also of interest from the Muzo mine are the large, fine crystals of parisite that have been recovered over the last few years. However, one crystal which Michel Jouty (Les Plans, 74400 Chamonix, France) had at the Tucson show this year exhibited a cleavage surface with two small, unusual, brassy crystals. The unknown crystals appear to be twinned and show surface markings much the same as can be seen on some crystals of perovskite.

FRANCE

Alain Carion was able to collect some very fine bastnaesite and allanite crystals from the Trimouns quarry, Arriege Dept., approximately 20 km from Andorre. The quarry is a large open-pit talc mine at 2700 meters elevation in the French Pyrenees, and can only be collected in the summer months. The bastnaesite and allanite occur in pockets in a white dolomite unit, sometimes in association with small talc crystals. The bastnaesite forms rich orange-brown, tabular, hexagonal crystals up to about 2.5 cm in diameter; the allanite is typically greenish brown in color and forms prismatic crystals of equal size. To our knowledge neither have been analyzed.

Bernard Brunet (10 Rue Gracieuse, 75005 Paris, France) and Eric Asselborn (*The Pavillion,* Attignat 01340, Montrevel en Bresse, France) have obtained some very large stolzite crystals from Sainte Lucie en Saint Leger de Peyre, Lozere. The single crystals approach 3 cm across, and clusters of smaller crystals exceed that dimension. The habits range from simple tabular crystals with a "corrugated" prism zone to pyramidal individuals with multiple growth terminations suggestive of the wulfenite from Bleiberg, Austria. The locality is reputed to have produced the largest stolzite crystals known. Eric also found a quantity of snow-white barite in radial clusters to 5 cm, sometimes grouped in a fine-grained dolomitic rock from Saint Laurent le Ninier, Gard.

Jaochim Karl (*Mineralien & Fossilien Galerie,* Fahrgasse 88, D-6000, Frankfurt, West Germany) had a fine selection of two recently collected French classics at last year's Denver Show: superb pink fluorite crystals on leucocratic granite from Mont Blanc, near Chamonix, and some very fine, sharp crystals of axinite from the famous locality at Le Bourg-d'Oisans, Isere.

INDIA

Residential expansion of the city of Pune (Poona) has forced the closure of one of the major specimen producing quarries in Pashan. Operations at this now classic mineral locality famous for its green apophyllite and mesolite specimens ceased on September 30, 1989. While there are still fine specimens on the current market, it looks like they may regrettably be the last. Rustam Kothavala (511 Van Buren Ave., Oakland, CA 94610) had an excellent selection of these at the Tucson show. There were additional fine Indian zeolites at a number of other dealers' booths, too. One of the more remarkable of these was the 10-cm, doubly terminated crystals of heulandite from the Sayad Pimpri quarry at Nasik, in the possession of Manju Mahal (35 Nargis Dutt Rd., Bandra West, Bombay 400 050, India).

Montreal collector Dr. Donald Doell recently obtained an interesting suite of pegmatite minerals reportedly from the Hyderabad area. Among these are gem-quality yellow-green beryl crystals to 7.5 cm, aquamarine crystals to 2 cm, twinned yellow-green chrysoberyl crystals to 5 cm, and small (1–3 cm) etched amethyst crystals with inclusions of goethite and hematite. Many of these have slightly rounded edges, suggesting they may be coming from either a placer or near-surface occurrence, but little is presently known about their specific origins.

INDONESIA

Crystals of beta-quartz up to 2.5 cm in diameter occur in weathered dacite near the village of Cremas, West Java (*Mineral News,* **5**, no. 11, p 4–5).

ITALY

Frank Melanson (*Hawthorneden*) recently obtained a small lot of honey-yellow calcite hemispheres on a dark basalt matrix from Mina Montalto di Castro, Toscana. The unusual shape and contrast with the matrix makes these rather different specimens for such a common species.

Doug Parsons had a single spectacular specimen from Italy at the Tucson show. This consists of a perfect 2-cm pink fluorite octahedron on a lustrous, 10-cm, terminated, light smoky quartz crystal from Monte Bianco, in the Aosta Valley region of northern Italy. The specimen was apparently collected four years ago and is as good as the more familiar Swiss material.

Michel Jouty recently acquired some interesting, lustrous black crystals of davidite up to 7 mm from Cervandonne. Michel explained that Cervandonne is a mountain on the border between Italy and Switzerland, well known for its cafarsite crystals. However, there is an interesting variation. The southern slope of Cervandonne is in Italy, and the cafarsite there is typically dark golden brown to black with an earthy luster. The northern slope, which lies in Switzerland, produces lustrous black crystals. Jouty also had tan, etched gasparite-(Ce) crystals (2–3 mm) on banded gneiss and 1–2 mm crystals of cervandonnite-(Ce) on microcline, both from the Italian Cervandonne.

MADAGASCAR

There have been a number of gem-quality yellow orthoclase crystals seen on the market over the last year from Itrongay, Tulear, Madagascar. Probably the best of these is a sharp, transparent blocky crystal approximately 6 x 8 cm now in the collection of the Natural History Museum of Los Angeles County. About 50 of these crystals were obtained by Paul Obeniche (1 Rue Paul Cezanne, 75008 Paris, France), along with several kilograms of facetable crystal fragments. The largest crystal recovered so far weighs 870 grams. While being marketed as orthoclase, the doubly terminated crystals show triclinic symmetry, suggesting they are probably microcline, though verification by X-ray studies to determine the degree of triclinicity have not been done so far as we know. Specimens of these crystals are also available from Gilbert Gauthier (7 Ave. Alexandra III, Maisons-Laffitte, 78600 France).

There appears to be more fine quartz specimens from Tambobolehibe on the market, too. The crystals are typically waterclear and occur in clusters of all sizes. *Hawthorneden* and a number of other dealers had specimens of these at Tucson.

MALAWI

The number of quartz localities on the globe seems limitless. Recently, some interesting thumbnail-sized single crystals showing a pinch and swell "reverse scepter" growth phenomenon with amethyst tips have been found about 80 km west of Mchinji. The crystals have inclusions of what appear to be brown goethite crystals and black hematite spherules.

MEXICO

It has been a relatively quiet year for new finds from Mexico, though Jack Young (*Lyko Minerals,* 5226 Doniphan Dr., El Paso, TX

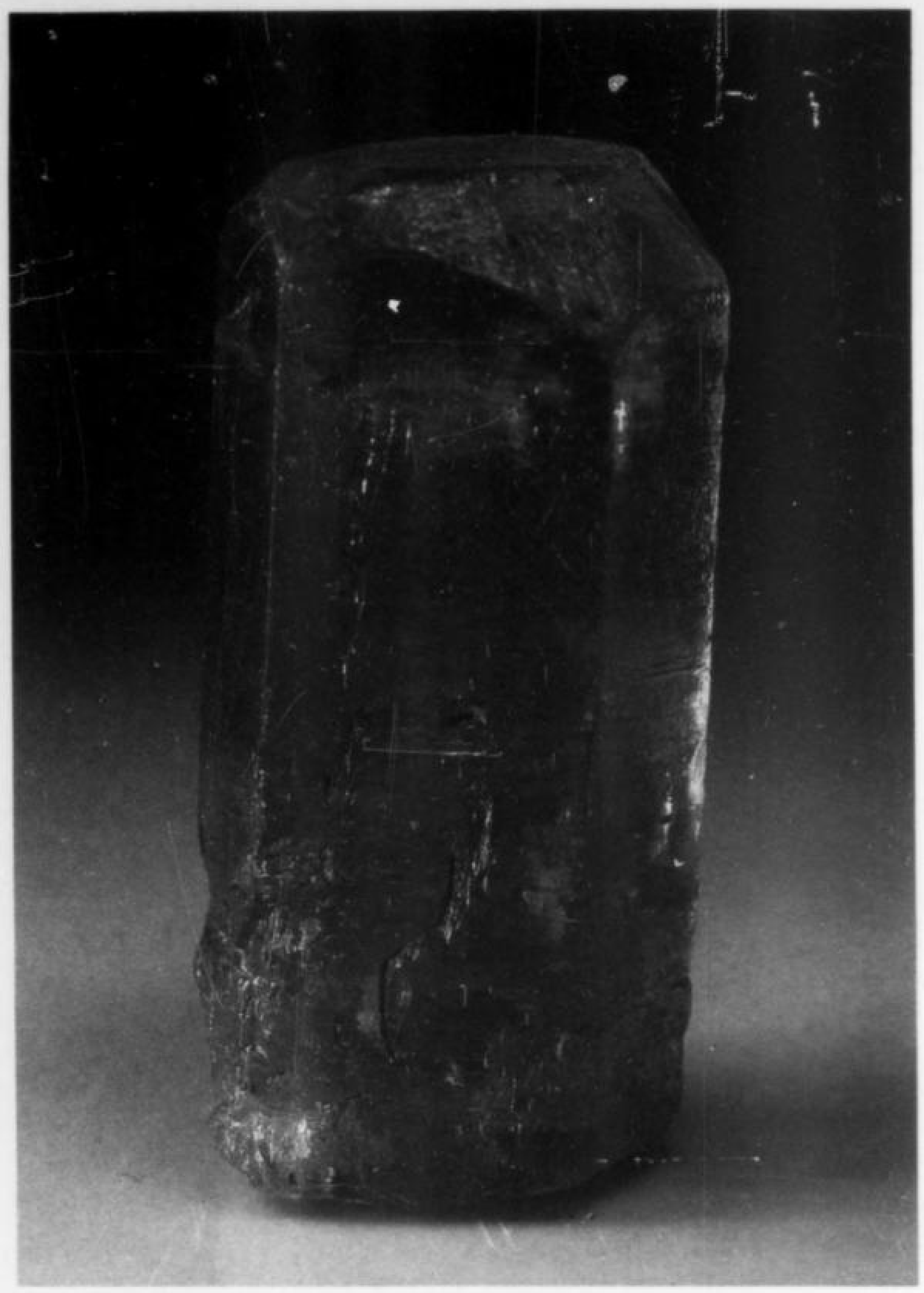


Figure 7. **Beryl crystal, 7 cm, from Hyderabad, India. Don Doell collection; photo by George Robinson.**

79932) managed to receive a small lot of some new epidote crystals from Guerrero during the Tucson show. These consist of lustrous, dark green, fairly thick, prismatic (twinned?) crystals up to 7 cm in groups up to about 8 x 8 cm.

Also at the Tucson show, Gene and Jackie Schlepp (*Western Minerals*) had a new lot of colorless, transparent creedite crystals from Mina Navidad, Rodeo, Durango; and Brad Van Scriver (12700 N. Bandanna Way, Tucson, AZ 85737) offered an excellent lot of "old time" orange wulfenite from Sierra de Los Lamentos, Chihuahua, which had been in storage for over 20 years. Additional new finds worth noting include rhodochrosite with hematite and fluorite from Santa Eulalia, Chihuahua, and blue hemimorphite from the Santo Nino mine, Guadalupe, Durango, which were available from Dalton and Consie Prince (*Collector's Choice*), and apophyllite from the El Potosí mine, Santa Eulalia, Chihuahua, available from *Precious Earth Company* and others.

MOROCCO

Enrique Llorens Pozo (Joaquin Costa 58, 4.°, 08001 Barcelona, Spain) had a number of large new barite specimens from the Fez region available at last year's Denver show. The crystals form rather thick, tabular, colorless overgrowths on an earlier generation of etched pale yellow barite.

Horst Burkard (Dornheckenstrasse 20, D-5300 Bonn 3, West Germany) recently obtained a fine selection of azurite and malachite crystal groups from the Bou Beker mine near Touissit.

NAMIBIA

The past year has seen a few very fine lots of specimens from Tsumeb. Over a two-week period last April more excellent dioptase specimens were recovered from the 32 level. These are probably the best that have been on the market for a number of years, and remind one of the "good old days" when such material with 1–2 cm emerald-green crystals on white calcite matrix was more abundant. In early September, some excellent, blocky lustrous azurite crystals to 4 cm were found, as were a few thin, tabular, clear to pale blue anglesites. Specimens of these minerals are available from *Pala International*, Don and Gloria Olson, and Miriam and Julius Zweibel (*Mineral Kingdom*). The Zweibels also were fortunate to obtain an incredible specimen of the rare species queitite, with centimeter-sized greenish yellow crystals, which is now in the Harvard Mineralogical Museum, along with an equally impressive specimen of the rare mineral thometzekite.

Other finds from Namibia include barite in yellow-brown opaque crystals to 10 cm from Brucheros, north of Keetmanshoop, available from Don and Gloria Olson; black, tabular tourmaline crystals from Damaraland available from *Hawthorneden*; and a new lot of very fine descloizite specimens from Berg Aukas, available from Mike Haritos (*S.T.D. Mineral Co.*, 22 Spring Hill Rd., Hyde Park, MA 02136).

NEPAL

Crystals of dark green epidote have been found in the Manang district in the Kali Gandaki Valley. The specimens somewhat resemble those from Baja California, but with generally larger crystals. A small number of specimens are available from *Mountain Minerals International* who also have 1–3 cm doubly terminated schorl crystals from Ganesh.

NIGERIA

There has been an increasing number of gem pegmatite minerals appearing on the market over the last few years from the Jos region of Nigeria. Perhaps the most impressive of these noted at this year's Tucson show was a superb, 3 x 11-cm, gem-quality, pink and green bicolored crystal of elbaite displayed by Alexander Blythe. The color and crystal habit reminded one vaguely of the Newry, Maine, material, only an order of magnitude better.

PAPUA NEW GUINEA

Slightly waterworn nuggets showing good octahedral gold crystals up to 6 mm have been found in Papua New Guinea. A few specimens with irregular cubic crystals have also been recovered. Good specimens were available from Bill Forrest (P.O. Box 25001, Fresno, CA 93729-5001) at the Tucson show.

PERU

Approximately 100 specimens of dark pink, bladed rhodonite crystals were found last summer at the Chiurucu mine, Huanucu Dept. These ranged in size from 2 cm to large plates of crystals approximately 15 cm across. While perhaps not as large as those from Franklin, or as red as those from Broken Hill, they are, nevertheless, extremely fine and equally desirable (see *Mineralogical Record,* vol. 20, p. 481 for details). Approximately 250 specimens of pink to red rhodochrosite were also found last summer at the Santa Rita mine, Lima Dept. Many show pseudomorphs after calcite. The individual crystals are generally small (3–5 mm), however the overall composition of the specimens makes them quite attractive. Lastly there was a lot of about 60 specimens of chalcopyrite found at the Huaron mine, Pasco Dept. These have crystals up to about 1.5 cm aesthetically perched on light brown calcite crystals. All these and other minerals were available from Dennis and Dan Belsher (*Worldwide Resources*) at the Denver show.

Rock Currier (*Jewel Tunnel Imports*) reports that he sent some supposed bournonite from the Pachapaqui mine, Pachapapaqui, Ancash Department, to Dr. William Wise of the University of California, who determined the material to be arsenic dominant, and therefore seligmannite. While it is presently unclear just how much of the "bournonite" from this locality is actually seligmannite, future analyses will tell more.

WEW

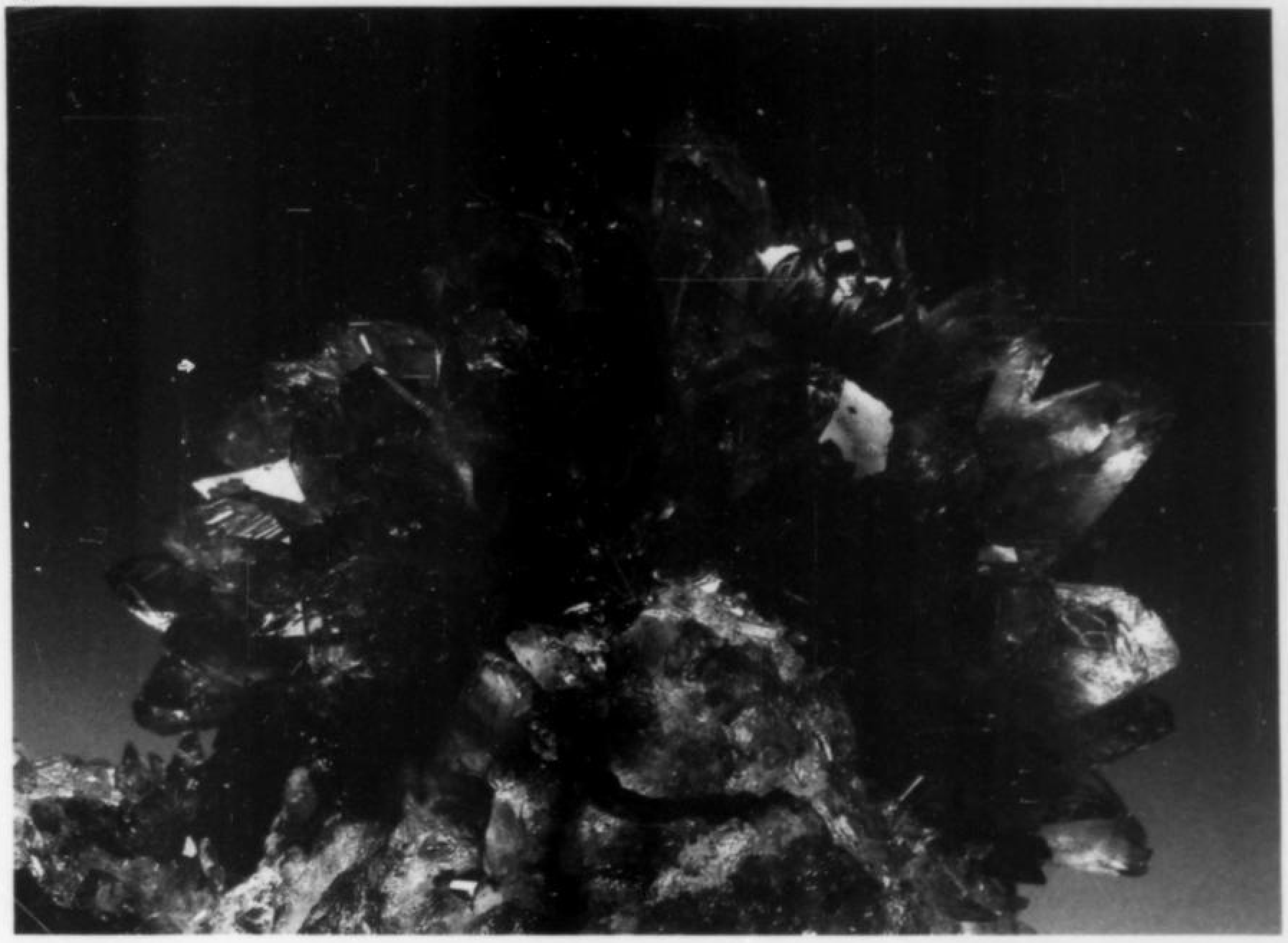


Figure 8. **Creedite crystal group, 6 cm across, on matrix, from Aktschatau, central Kazakstan, USSR. Vladimir Pelepenko collection.**

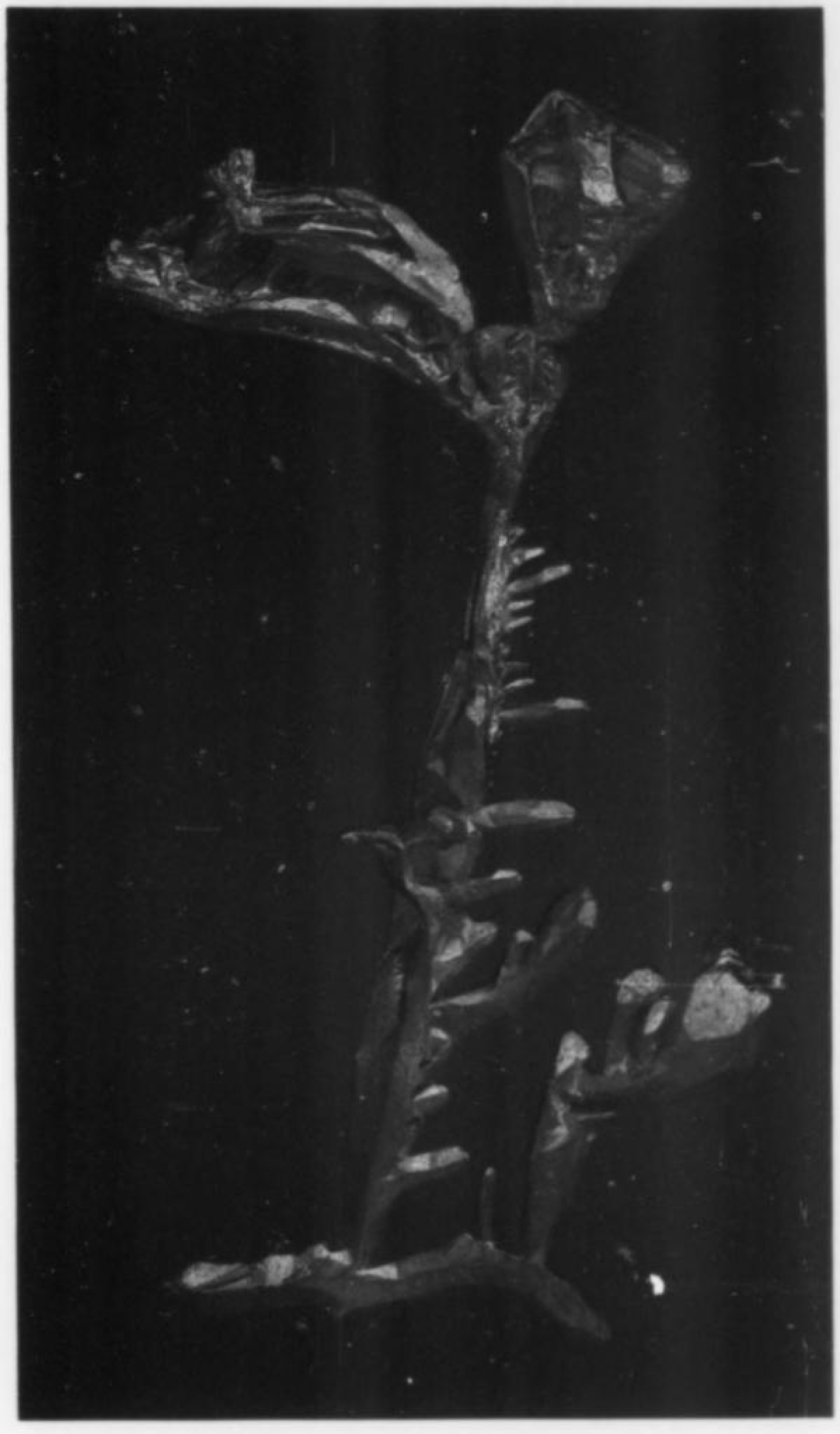


Figure 9. **Gold specimens, 3.7 cm (top) and 4.5 cm, from the Santa Elena placer field, Venezuela. Dennis and Dan Belsher specimens; photos by Harold and Erica Van Pelt.**

Neil Hubbard spotted an unusual mineral on some of the fine-grained crystallized rhodonite from Huanzala. The bright sulfur-yellow 1–2 mm tetrahedra have proven to be helvite. Clear to very pale yellow spessartine and chalcopyrite microcrystals have also been noted. *Golden Minerals* had some of this material available over the past year.

POLAND

Alain Carion had an interesting selection of new Polish specimens available at both the Denver and Tucson shows. These included 1.5-cm octahedrons of galena in calcite from Ulgusz; 5-mm octahedrons and cuboctahedrons of hauerite in a clay matrix from Jeziorak; and some attractive gray banded flint nodules from Tarnobrzeg.

SENEGAL

There were a number of rather large (up to 25 cm) specimens of good-quality yellow-green senegalite crystals from Faleme, seen at the Tucson show last February. These were available from Ernesto Ossola and others.

SPAIN

There were a few rather unusual blue quartz crystals from Orihuela, Murcia, brought to the Denver show by Enrique Kucera (Comte d'Urgell 171, 08036 Barcelona, Spain) last September. These form small, sharp bipyramidal crystals to about 1 cm with hematite on a volcanic (?) rock matrix. The color appears to be due to inclusions of an unspecified mineral. Colorful, iridescent, botryoidal specimens of turgite from Melaga were also available.

SWITZERLAND

Michel Jouty frequently comes up with new and exciting rarities. Recently he acquired some blocky to stubby 3 x 8-mm colorless crystals of the rare species armenite from the Simplon Pass. Until recently there was but one known specimen of this rare mineral, the type specimen from Norway. A few years ago large fibrous masses of the mineral were found in a roadcut near St. Remigny, Quebec, and subsequently a few microcrystals were found by Bart Cannon near North Bend, Washington. The latest crystals from the Simplon Pass, however, are clearly the best found to date.

TANZANIA

Larry Conklin recently obtained a very fine single crystal of amethyst from the gem mines near Moro Goro. Unfortunately, most of these tend not to survive as specimens, due to their gem value. Let's hope Larry can save a few more.

UNITED KINGDOM

Neil Hubbard has come up with many exciting new microminerals during the past year from all across the U.K. We'll first take a look at those from England. In Cornwall, small, feathery, white clusters of dundasite have been found at the Trevinnick mine, St. Kew. These occur on a limonite-coated cerussite matrix. Nadorite crystals to 1 mm on jamesonite have been found at Port Quin, St. Endellion. The tan colored crystals form rosettes thickly coating the matrix. Parnauite has been discovered at two new localities: as medium apple-green, crudely crystallized aggregates to 2 mm in a sericitic, quartz matrix at Wheal Unity, St. Day, and from the Penberthy Crofts mine near St. Hilary, where it resembles bright green malachite in a limonitic matrix. The Clitters mine at Gunnislake has a real rarity, the beryllium phosphate roscherite! This tends to form "fuzzy" looking botryoids up to 3 mm on a matrix of iron-stained quartz.

Elsewhere, in Cumbria, the Pink quarry at Shap Fell has produced some brilliant, dark brown, bladed crystals of brookite (to 3 mm) and muscovite in miarolitic cavities in granite; and in Derbyshire, small (less than 1 mm), clear crystals of weddellite associated with 1–2 mm needles of white ettringite have been found on clear fluorite cubes at the Fall Gate quarry, near Ashover. In Devon, grass-green diopside crystals to 2 mm have been found with light brown andradite dodecahedra and clear vesuvianite crystals in thin veins at the limestone quarry at Meldon. Also, some very attractive diopside microcrystals have been found in an albitite vein at Thurstaston, Wirral, Merseyside. These occur as dark, emerald-green crystals with orange-brown limonite selectively coating their termination faces. Associated minerals include clear albite crystals, acicular fluorapatite, tan, rod-like zircon, and orange-yellow, wedge-shaped titanite crystals. Lastly, clear-to-amber vanadinite microcrystals have been found on gray-white calcite scalenohedra from the Judkins quarry, Nuneaton, Warwickshire.

In Wales, the type locality for anglesite, Parys Mountain, Anglesey, has recently produced some very unusual crystals of that species, composed of pyramidal forms only, thus appearing quite different from the more familiar bladed habits. Sharp epidote microcrystals have been found from Marloes Bay, Haverforswest, Dyfed, and sharp microcrystals of linarite may be found in the Old Workings, Dylife mine, Dylife, Powys. Millerite crystals in thick needles to 3 mm occur in divergent, radial sprays on galena and siderite in shale at Coed Ely Colliery, Llantrisant, Midglamorgan. Nearby, at Gelli Colliery, octahedral siegenite has been found on white dolomite crystals. Witherite, in symmetrical, tabular, pseudohexagonal twinned crystals (2–3 mm) are being found at the Pen-Y-Clun mine, Llanidloes, Dyfed.

The Hendre-Felen mine at Ystradmeurig, Dyfed has recently produced good crystals of ullmannite up to 4 mm that resemble striated, white pyrite cubes. Beautiful, blue-green, 1–2 mm crystals of wroewolfeite are coming from the Eaglebook mine, Nantymoch, Dyfed, and pseudo-octahedral wulfenite crystals (1–2 mm) are being found with green pyromorphite and white cerussite twins at the Bwlchglas mine, Talybont, Dyfed. However, for sheer alphabetical *tour de force*, no locality beats the Llwyn Llwyd mine, Ysbyty Ystwyth, Dyfed, which is currently producing aurichalcite-like blue coatings of schulenbergite on limonite and quartz.

Last year, while visiting relatives in Scotland, Canadian micromounter Quintin Wight also paid a visit to Leadhills and Strontian, and was pleasantly surprised to learn that there is still plenty of good material to be had. At Leadhills, a large dump of material from the Susanna vein yielded drusy quartz, pyromorphite in all colors from green to red, fine sphalerite crystals, cerussite, galena, pyrite, malachite, and other minerals. At Strontian, much to his surprise, he found a working mine! It appears that the Whitesmith mine is currently being reworked for barite for use as drilling mud, and though the operation has filled in the open cut at the Bellsgrove mine, it did so by bulldozing the old mine dumps, which has provided a wealth of large, brecciated blocks full of excellent brewsterite and harmotome crystals. There are also good calcite, barite, galena and pyrite specimens to be collected, but these are somewhat overshadowed by the sharp, 2-cm twinned crystals of harmotome that are readily available.

U.S.S.R.

Since the premiere of the Pelepenko collection at the Munich show over a year ago, there has been in increasing number of fine Russian minerals both on exhibit and for sale at the world's major mineral shows. This was never so evident as at the Denver show, last September, where specimens from both the Pelepenko collection and the Fersman Museum were on display, and at the Tucson show last February, where the Fersman Museum once again provided a beautiful display. It was also sobering to learn that many of these "classics" were actually contemporary ones, including 1.5-cm sperrylite crystals in matrix from Talnach, Norilsk, Siberia, 4-cm platinum nuggets from Siberia, 20-cm plates of purple creedite crystals from Kazakhstan, and 8 x 20-cm gem heliodore crystals from Volodarsk, Ukraine, among others. Drs. Alexander Godovikov and Leo Bulgak, who brought the Fersman displays to the United States, reported that the sperrylite crystals from the Norilsk deposit have been found in multiple growths to 4 cm (!), but these larger aggregates are less sharp. A few very good crystals to 2.5 cm have been found, however, and many under 2 cm are known that exhibit sharp development. The brilliant, blackish silvery, modified cubic crystals occur embedded in massive sulfides similar to the Sudbury, Ontario, material, and are unquestionably among the world's finest.

There were excellent specimens of vivianite and anapaite from Kertch, Ukraine, available from a number of dealers at Tucson, and Bryan Lees and Doug Parsons each had an excellent selection of Russian minerals at both the Denver and Tucson shows. At Tucson, Herb Obodda had a superb specimen of betekhtinite with 3-cm gray prismatic crystals richly dispersed on a 10 x 20-cm matrix from Dzeskazgan, central Kazakstan. One new item available from both Bryan Lees and the Tideswell Dale Rock Shop (Commercial Road, Tideswell, Derbyshire, England) was rather large dendritic crystals of sal ammoniac from Kadamdzhaj, in middle Asia. These apparently formed as the result of a 75-year-long mine fire in an abandoned coal mine, and while they may be argued to be of post-mining origin, they are nonetheless as good as the species gets, forming snowflake-like dendritic white crystal aggregates to 5 cm in length.

Additional recent finds include transparent, pale pink octahedral spinel crystals to 5 mm in white marble from Pereval, Lake Baikal area; 2–3 mm green bazzite crystals in purple fluorite from Kent, Kazakhstan; gemmy salmon-pink cleavages of the boron feldspar reedmergnerite from Dara-Pierz, Tadzhikistan; clear, 1-cm terminated crystals of sulfoborite from Lake Inder, Kazakhstan; and 3–4 cm crystals of amesite in 1–2 cm wide seams in chromite from Sarany, Urals. Lastly, Gilbert Gauthier discovered an interesting mineral in

(continued on p. 501)

MUSEUM NOTES

by **Stan Dyl**

I am greatly pleased at the response to requests for news items for Museum Notes. We want this column to be a clearing house for any and all information about museum activity that is newsworthy to the mineralogical community at large. This issue's column, for example, runs the gamut from announcing the construction of new exhibits at several museums, to a warning of the dismantling of perhaps the world's most venerable and comprehensive systematic mineral displays.

VIENNA MUSEUM OF NATURAL HISTORY

Shortly before Christmas (1989) a theft took place in one of the exhibition halls of the Natural History Museum of Vienna (see vol. 20, no. 5, p. 347). Stolen were nine very fine specimens of apatite, including the best from the famous Knappenwand locality, Untersulzbachtal, Austria. Also taken were two other apatites, from Knappenwand (4.5 cm and 8 cm); three examples (5 x 7 cm, 6 x 7 x 8 cm, 4 x 6.5 cm) from Stillulppgrund, Zillertal; one from Epprechtstein, Fichtelgebirge (2.7 x 2.7 x 4.2 cm); and two from Panasqueira, Portugal (4 x 6 x 6.5 cm and 3 x 3.5 x 6 cm). A fuller description of each piece is available. If you are offered something suspicious, contact the museum's mineralogy department (tel: 0222-93-45-41) or give me a call.

CANADIAN MUSEUM OF NATURE

The *PDAC Digest* (Prospectors and Developers Association of Canada) records in their Autumn 1989 issue that a wing in the Canadian Museum of Nature (formerly the National Museum of Natural Science, National Museums of Canada), the proposed new mineral gallery, will be named after Viola MacMillan. The gallery will house among its exhibits salient portions of the recently acquired William Pinch Collection. Ms. MacMillan, who served as President of PDAC for over 20 years, is a key contributor to the Museum's fund-raising effort. Her gift of $1.25 million to support the purchase of the Pinch Collection is the largest single private gift in the Mineral Department's history.

NATURAL HISTORY MUSEUM OF LOS ANGELES COUNTY

A news release from UVP, Inc., a manufacturer of ultraviolet lamps since 1932, disclosed that the 11-year-old fluorescent mineral display at the Los Angeles County Natural History Museum has recently undergone a dramatic metamorphosis. Once containing just nine massive mineral specimens, the new exhibit "shines" with 29 well-crystallized specimens which glow under new shortwave and longwave UVP ultraviolet lamps.

Dr. Anthony R. Kampf, Curator of gems and minerals, was approached by Thomas S. Warren, founder of UVP, Inc., and Rodney Burroughs, President of the Fluorescent Mineral Society, with ideas for upgrading what was an aging, run-of-the-mill display. According to Dr. Kampf, "Virtually every major natural history museum has a respectable fluorescent mineral exhibit. Mr. Warren and Dr. Burroughs were concerned that a major natural history museum in the second largest U.S. city didn't measure up."

No effort was spared to make the new fluorescent exhibit conform to exacting, world-class standards. For example, Dr. Kampf personally examined 20,000 of the Museum's 33,000 specimens under a ultraviolet light, before making the final selection. The specimens chosen are unusually brilliant under shortwave and longwave ultraviolet light, and distinctive in shape and color. In order to complete the project on schedule, Dr. Kampf served as fund-raiser, exhibit designer and carpenter. Pleased with the results, he concludes: "Our new UV lamps, which make the specimens visible up to 20 feet away, afford us a very attractive display. Best of all . . . our foot traffic in that portion of the gallery has increased 'several hundred percent,' and the Fluorescent Mineral Society is extremely pleased with the new exhibit."

BRITISH MUSEUM (NATURAL HISTORY)

There is growing international concern about the future of the Mineral Gallery at the British Museum (Natural History). It seems that plans are underway to *replace* the Gallery with a zoological exhibit, and to *relocate* part of the mineral exhibits into the Geological Museum next door. It is felt that the sad result will be the loss of the systematic display, and a reduction of the available floor space for mineral displays to a fraction of that in current use.

Many students of mineralogy and connoisseurs of fine specimens consider the British Museum (Natural History) mineral gallery as the finest systematic mineral display in the world. The gallery comprises some 1200 square meters of display space, with about 10,000 specimens and 1500 species on permanent display. The exhibit is comprehensive and easily lends itself to usage as a teaching and identification aide to amateur and professional alike.

The Russell Society, an organization of amateur and professional mineralogists in the United Kingdom, is coordinating national and international opposition to the relocation plan. Society Vice President Roy Starkey observes that: "It is . . . neither in the interest of the museum, the international scientific community nor visiting members of the public, that access to one of the world's finest public reference collections be lost."

Dr. Richard S. W. Braithwaite, Lecturer at the University of Manchester Institute of Science and Technology, is equally upset by the pending disastrous changes. In a letter to BM(NH) Director Dr. Neil Chambers, Dr. Braithwaite writes: "I am horrified by the possibility that this action (dismantling the Mineral Gallery) might take place, and am convinced of the importance of reversing any such decision. The museum is after all a *national* museum of the highest reputation, and the state should pay, and those in charge should fight for it."

Those anxious to express their opposition to the BM(NH) Mineral Gallery relocation should write to:

Dr. Neil Chalmers, Director
British Museum (Natural History)
Cromwell Road
London, SW7 5BD
United Kingdom

Roy Starkey's final appeal is well worth repeating: "It may well be that the battle to save the Mineral Gallery is already lost, but your

***Figure 1.* Calcite specimen, 35 cm, from the Gordonsville zinc mine near Carthage, Tennessee. Donated by the friends of Duke Burton to the Royal Ontario Museum. Photo by Brian Boyle.**

help and support will be invaluable in helping to ensure that adequate priority is given to providing a suitable alternative home for the worlds' finest systematic display." We surely hope so.

ROYAL ONTARIO MUSEUM

Dr. Robert I. Gait, Curator of Mineralogy at the Royal Ontario Museum, Toronto, announced the acquisition of the "Duke Burton Calcite," from the Gordonsville mine, near Carthage, Tennessee. The late Duke Burton was a friend of the Royal Ontario Museum and a member of most of the mineralogical clubs in the Toronto area. Last year Duke died after a tragic accident and his friends decided that a fine mineral specimen would be a suitable tribute to his memory. The beautiful calcite (illustrated here) was purchased with funds donated to the Royal Ontario Museum by Duke Burton's friends.

COLORADO SCHOOL OF MINES

CSM Curator Virginia Mast reports two exciting projects their Museum is undertaking. First is a new series of exhibits highlighting earth environments, with a focus on caves and cave formation. The centerpiece will be an authentic replica of the Clear Creek Cave. Clear Creek Cave is unusual in that it is a *fault* cavern formed in Precambrian gneiss. According to Virginia, a number of fine, genuine helectites will be worked into the replica, resulting in what will surely be a spectacular display. Minerals found at Clear Creek Cave include the ubiquitous calcite, as well as aragonite and hydromagnesite.

CSM Museum staff are also planning a large outreach program in cooperation with the Colorado Alliance for Science. The project seeks to enhance Colorado primary and secondary earth science curricula using the CSM's rich collections as a base. The program will be specifically tailored to the needs of state school districts. Features include field trips, study guides, lesson plans—all related to local geology. Program activities will in turn show how regional geology affects the nearby economic and social history. The goal: to aid Colorado students in understanding the significant impact that geology has on their lives.

SMITHSONIAN INSTITUTION

The U.S. National Museum of Natural History, Smithsonian Institution, reports that an almost flawless 54-kilogram (120-pound) specimen of transparent smoky-citrine quartz, consisting of two prismatic crystals, has been donated by the Independent Jewelers Organization. John S. White, Curator-in-Charge of the Smithsonian gem and mineral collection, emphatically states that "there is no other citrine grouping of comparable quality and size in any museum in the world. Of extraordinary size, the two crystals are so perfectly transparent that it is possible to read newsprint through them."

This unbelievable specimen was recently discovered in a mine in Minas Gerais, Brazil, and purchased by IJO. The two crystals are

Figure 2. **Spectacular 54-kg specimen of transparent smoky and citrine quartz from Minas Gerais, Brazil. Donated to the Smithsonian Institution by the Independent Jewelers Organization.**

joined together at the base. The longest crystal is 66 cm tall and 18 cm in diameter. The citrine was placed on permanent display near the entrance of the Mineral Hall on February 27.

IJO also presented the Smithsonian with a monetary gift for the planned new Geology, Gems and Mineral Hall. A fund-raising campaign for the new hall is presently underway. The Smithsonian collection, arguably the finest in the world, is currently displayed in cases that were installed in the late 1950's. The collection has grown substantially since that time, and is certainly worthy of the dramatic new exhibit technology currently available.

The Smithsonian's new hall will make it possible for the first time to display many recently acquired specimens of spectacular size and beauty. Use of state-of-the-art video and interactive computer-controlled exhibits will give the visitor a new appreciation of gems and minerals, coupled with an increased understanding of the scientific principles of mineralogy and geology.

OFFICIAL MMAC STATEMENT

The Mineral Museums Advisory Council, an organization of North American mineral museum curators and others with related interests, has become increasingly disturbed in recent years by the loss to science of many irreplaceable mineralogical specimens. Of concern are the practice of segmenting specimens of very rare minerals into a size that makes them virtually worthless for scientific study, and the dispersal of these fragments through sale principally to the non-scientific collector community. These practices are particularly unfortunate where they involve type specimens or specimens upon which significant scientific research has been performed.

We see the most practical remedy for this situation to rest in the hands of the scientific community. To this end we urge that mineralogists who perform research on rare and scientifically significant specimens observe the following three practices:

1. Deposit type (as required by the IMA Commission on New Minerals and Mineral Names) and described rare material in an appropriate institution.
2. Indicate in their papers the disposition of this material.
3. Refuse to sell this material under any circumstances.

MUSEUM SYMPOSIUM

Coming in 1991 (September 9–15, in Dresden, East Germany) is the 16th International *Symposium on Museums and Collections in the History of Mineralogy, Geology and Paleontology*. The INHIGEO Symposium, as it is called, is sponsored by the International Union of Geological Sciences and the International Union of the History and Philosophy of Sciences. The 1991 event will be locally organized by the East German Society of Geological Sciences (*Gesellschaft für Wissenschaften*). The Symposium is a vehicle for contributions "to an analysis of the functions and the significance of museums and collections in the history of the geological sciences in order to determine their present-day part in scientific and social life. Emphasis will be placed on research and educational work in museums and collections in the past and in the present. Materials and works from public and private museums, collections, and archives will also be appreciated as historical evidence of the geological sciences' cultural history." A 3-day lecture program will be included.

Optional excursions on the 13th and 14th will take participants to the State Museum of Mineralogy and Geology in Dresden, The Freiberg Mining Academy and nearby historical mining installations, the Erzgebirge Mountains (Annaberg, the Schneeberg Museum of Mining and Folk Art, etc.), and geological exposures in the area surrounding Dresden. Before the Symposium begins, visits can be arranged to the Museum of Natural Sciences at Humboldt University, and following the Symposium the Freiberg Mining Academy will host a colloquium on the history of ideas concerning the paragenesis of minerals, to mark the 200th birthday of August Breithaupt (1791–1873).

Accommodations will be provided in some of Dresden's top-ranking hotels, at rates of DM 160 to DM 300 per night. Registration fees are DM 400 for conference members, DM 200 for accompanying persons, and DM 100 for students. The four optional excursions require additional fees. For registration or for more information write to: Gesellschaft für Geologische Wissenschaften der DDR (GGW), Sekretariat, INHIGEO, Invalidenstrasse 43, Berlin DDR-1040.

* * *

This space is for you, Museum Professional. Let us know what's happening out there. Send bulletins, announcements, bylines, news releases, photographs, etc. to:

Stanley J. Dyl II, Curator
Seaman Mineral Museum
Michigan Technological University
1400 Townsend Drive
Houghton, Michigan 49931

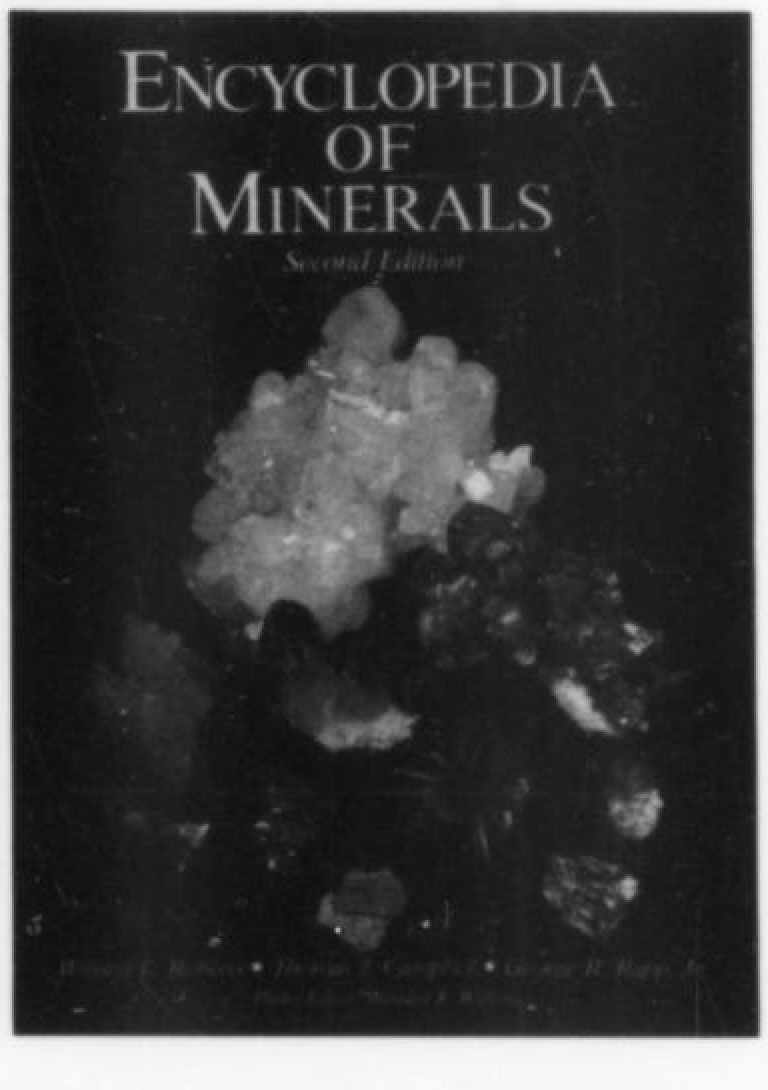
Book Reviews

Mineralien und Fundstellen, Bundesrepublik Deutschland

[Minerals and Localities of West Germany] by R. Bode and A. Wittern. Published (1989) by Doris Bode Verlag, Dürnberg 2, D-4358 Haltern 4, West Germany. Hardcover, 20 x 28 cm, 303 pages, ISBN 3-925094-24-5, price DM 89, postpaid.

This beautifully illustrated book is amazingly good value for the price. It is divided into two parts: the first describes 30 of the most important West German mining areas, covering roughly 500 specific localities, with notes on geological history and lists of species. The second part lists 970 mineral species in chemical order, with notes on their compositions and properties, illustrated by 400 photographs including much superb color specimen photography. References are given to major papers, mostly in German journals such as *Lapis, Emser Hefte* and *Der Aufschluss*. There is a useful (though not very large) bibliography, and indexes by locality and by species. The standard of photography is so high that I still wonder how the book can have been produced so economically. Do not be put off by the German text—it is easy to follow what is being said. This book will be the standard German mineralogy for many years to come.

Michael O'Donoghue



Encyclopedia of Minerals

by W. L. Roberts, T. J. Campbell, and G. R. Rapp, Jr.; W. E. Wilson, photo editor. Second Edition (1990), published by Van Nostrand Reinhold, New York, 979 p., 240 color photographs, 104 black and white photographs, cloth, $99.95. ISBN 0-442-27681-8.

Two editions of *Encyclopedia of Minerals* are now available to the community of amateur and professional mineralogists. They differ, particularly in illustrations, and this warrants some comparison between the two.

An outline of *Encyclopedia of Minerals* (1990), ed. 2 (hereafter abbreviated EM2) and a comparison with *Encyclopedia of Minerals* (1974), ed. 1 by W. L. Roberts, G. R. Rapp, Jr. and J. Weber (abbreviated EM1) is in order. For example, total pages of text for EM2 (EM1) are 979 (693), the number of listings being 3200 (2200) mineral names. About 10% of the entries are those of mixtures, varieties, etc. and each takes up only one line. That is, a little over 3¹/₂ species appear per page in each edition. Species are arranged alphabetically so there is no need for an index. The topics under each species are essentially the same in both editions: name, formula, crystal system, class, space group, formula units in cell, cell parameters, three strongest X-ray diffraction lines, optical characters, hardness, density, cleavage, fracture, color and luster, mode of occurrence, and selected references (best reference in English). For EM2, color photos, mostly of large specimens, make up the central portion of the book and consist of 240 new photos comprising 48 pages of plates. The range of specimens per plate is 3 to 6, the average being 5. In addition, I read on the dust jacket that 104 black-and-white photographs and 45 crystal drawings occur scattered throughout the book. Plates and other photographs would represent about 350 species of minerals. This contrasts with EM1, which has 128 pages of plates, 8 such sequences of 16 plates distributed alphabetically and periodically throughout the book. There are 6 to 8 color photographs per plate. In both editions of EM, the species in the plates are arranged alphabetically. A total of over 900 color photomicrographs representing over 525 species constitutes the plates for EM1.

So what can be said about EM2 (EM1)? So far as I am concerned, aside from the plates, not very much. The tendency toward large specimens (I call them 'cabinet material') is clearly seen in EM2. The fine prints and plates constitute by far the strongest feature of the two editions. EM1 has certain benefits because more material, including many prints of rare species not found as larger specimens, is presented. This was the labor of that Magister Ludi, Dr. Julius Weber.

But what purpose do such encyclopedias serve? One would hope, to paraphrase J. S. Bach, "to enrich the soul and offer recreation for the mind." Key information retrieval via good references should be the key goal of any encyclopedia. Here EM1 and EM2 fail miserably, right at the most vital level—that of information retrieval. For the amateur, most valuable sources are often left out and the many that remain are of marginal worth. And the professional has better references at hand, what with all the new mineral index programs and their comprehensive databases; the annual index of *Mineralogical Abstracts* is a boon for such information retrieval.

Among the many examples of bloopers is *mitridatite*, a common albeit unattractive late-stage weathering product in pegmatites, gossans, soils and sediments. The formula entered in both EM1 and EM2 is $Ca_3Fe_4^{+3}(OH)_6(H_2O)_3(PO_4)_4$. I was involved in solution of its enormous (75 atoms in the asymmetric unit) crystal structure which appeared in two separate journals in 1977. The refinement converged nicely to $R = 0.06$ and every atom (except protons) could be found. With due attention to structure and bonding, the formula became $Ca_6(H_2O)_6[Fe_9^{+3}O_6(PO_4)_9]\cdot 3H_2O$, a hydrated - aquated - calcium - ferric - oxyphosphate, and this incredible sheet in brackets subsequently has been found in other structures as well. I went to the 'bible' of mineral data retrieval, the *Mineralogical Abstracts* (MA), and found its entry within minutes: MA 78-257 (1978). There the structurally determined formula was presented, and for the first time a close agreement between density and specific gravity appeared in abstract form. Oddly, MA, with its easy-to-use annual index of minerals and localities, was cited as one of the references in the introduction of EM2. Somehow, this one was missed. Another example is steenstrupine, with its elaborate formula and large unit cell based on a structure study first done in 1983. Big formula and big cell appear in EM2, but the only reference given is in 1966! (Yet in EM1, that same sole reference is given but a crazy formula and crazier cell parameters appear!) One can go on and on. Just contrast the excellent prints in both editions with the uncritical to inept use and citations of appropriate references!

I don't know who will buy *Encyclopedia of Minerals*, editions 1 and 2, or for what reason. The prints and plates are superb, EM1 has more coverage, EM2 is a bit more florid. But *Glossary of Mineral Species* by Dr. Michael Fleischer has a reference for each species with a minimum of fanfare. Besides, it is cheap. As for EM1 and EM2, *Caveat emptor.*

Paul B. Moore

Zeolites of Victoria

by W. D. Birch (editor). Published (1989) as Special Publication No. 2 by the Mineralogical Society of Victoria, P.O. Box 146, Collins Street, Melbourne, Victoria 3000, Australia. Softcover, 17.5 x 24.5 cm, 110 pages, ISBN 0-9594573-1-3, $22 Australian postpaid (surface mail).

The Australian state of Victoria contains abundant zeolite localities, given expert treatment in this excellent society publication. An interesting historical survey, accompanied by many historical photographs, is followed by brief geological discussions, geographical notes, and detailed species descriptions for each of the several zeolite regions. Thirty-seven color photographs, 140 black-and-white specimen photos, over 140 new chemical analyses and tables of previously unpublished X-ray diffraction data are included.

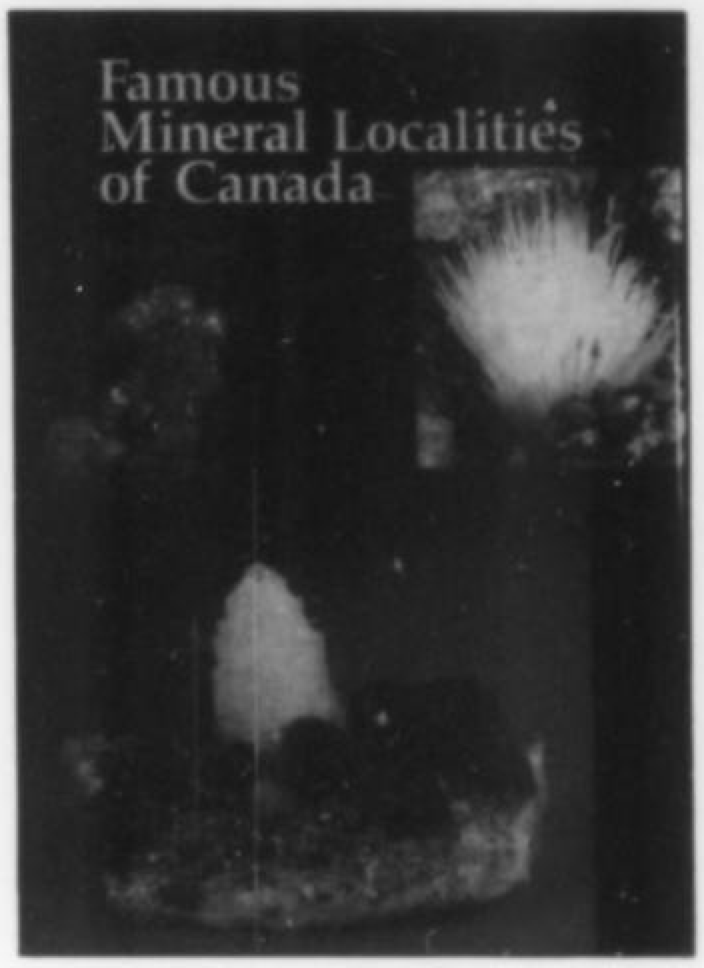
W.E.W.

The Henkel Glossary of Fluorescent Minerals

by Gerhard Henkel. Published (1989) by the Fluorescent Mineral Society, P.O. Box 2694, Sepulveda, California 91343. Softcover, spiral-bound ("wire-o"), 15 x 23 cm, 91 pages, $14.50 postpaid in the U.S., $16.00 airmail postpaid outside the U.S. and Canada.

This comprehensive pocket-guide, edited by Earl Verbeek and Peter Modreski of the U.S.G.S., lists all of the mineral species known to fluoresce under ultraviolet light. Each entry includes chemical formula, reported colors of fluorescence under both shortwave and longwave radiation (with a note on which response is stronger), and a couple of digits indicating the number of corresponding entries and localities in Dr. Henkel's unpublished master list. The master list itself is 500 pages long, containing nearly 10,000 entries; the society has plans to publish it in its entirety, with annotations, but it will be far from pocket-size! The *Henkel Glossary* is an excellent reference by itself, and probably as much as the average collector will ever need. Hardcore fluorescence enthusiasts will want a copy for quick reference, despite having to set aside shelf space for the future master list.

W.E.W.



Famous Mineral Localities of Canada

by Joel D. Grice (1989). Published by Fitzhenry & Whiteside, 195 Allstate Parkway, Markham, Ontario L3R 4T8 and co-published by the Canadian National Museum of Natural Sciences (now the Canadian Museum of Nature), Ottawa. Hardcover, 19 x 26 cm, 190 p., ISBN 0-88902-898-2, $35 Canadian.

The title of this book will be misleading to *Mineralogical Record* readers; it is not a real reference on, or treatment of, the famous mineral localities of Canada. The "many entertaining digressions" referred to on the dust jacket flap seem to account for most of the book, and the actual descriptions of the famous mineral localities themselves range from fragmentary to virtually nonexistent. The chapter on the famous Francon quarry, for example, has less than a third of a page of pertinent text, which tells almost nothing about Francon; the rest of the text in that chapter is a digression on triboluminescence, with a mention that weloganite from Francon exhibits this property. The chapter on the Rock Candy mine fares no better; it is actually just an extended general digression on color, luster, cleavage, hardness and density. The chapter purporting to be on the famous Yukon phosphate occurrences is devoted largely to a discussion of how minerals are named, with only a brief account of the discovery of the Yukon deposits.

Other chapters offer a bit more. The section on the Wawa iron deposit manages nearly a page of pertinent text before wandering into a general discussion of iron mining and smelting. The Sudbury and Cobalt chapters have some interesting history. And the page of text on Labrador's labradorite occurrence is interesting.

Following the main body of text is an appendix of "technical" terms, most of which are already very familiar, even to most amateurs. A list of the chemical symbols and elements is followed by a 35-page appendix (some useful data here) listing the known mineral species from each locality, along with chemical formulae and a few words of physical description. The table for each locality contains references to entries in the six-page bibliography at the end (although the bibliographic entries fail to give page numbers for the references).

This book may well be interesting and educational for a Canadian reader (or museum visitor) being introduced to mineralogy for the first time. The author knows his subject material, and writes in an interesting, readable style. But it will be of little use or value to amateur collectors, much less advanced collectors, who will already have better and more thorough basic references at hand, such as Sinkankas's *Mineralogy for Amateurs*. There is a fair amount of specimen photography, much of it in color, and some interesting views of the localities, but not sufficient to warrant adding this book to any serious mineralogical library.

W.E.W.

Klöck, ein Südosteirisches Basaltvorkommen und Seine Minerale

[Klöck, a Southeastern Styria, Austria, Basalt Quarry and its Minerals] by J. Taucher, W. Postl, B. Moser, D. Jakely and P. Golob. Published (1989) by the authors, Kaiser-Franz-Josef Kai 52, A-8010 Graz, Austria. Hardcover, 22 x 30 cm, 160 pages, ISBN 3-900917-01-9, price 1080 Austrian Schillings.

This book justifies its expense by the large number (400!) of excellent colored and black-and-white photographs and the extensive bibliography which are included. The minerals are listed and described in chemical order, along with many beautifully drafted crystal drawings. Historical and geological discussions are included as well.

Michael O'Donoghue

The Origin of Agates, Thundereggs and Other Nodular Structures

by Benjamin M. Shaub, published (1989) by the Agate Publishing Company, and obtainable from the author, 159 Elm Street, Northampton, MA 01060. Hardcover, 21 x 26 cm, 105 pages, ISBN 0-9623605-0-3, price $19.95 postpaid.

The subtitle of this book is: "A new syngenetic theory for the origin of the siliceous and carbonaceous nodules vs. the 200-year-old epigenetic infilled cavity theory for the origin of these nodules." Shaub's theory first took form during his college years in the 1920's, and he has since then developed it, solely through theorization.

In short, he suggests that gelatinous, colloidal silica agglutinated into spherical or irregular masses in magmas before their solidification into rock; he opposes the theory that voids in solidified rock were later infilled by silica precipitating from water passing through the rocks.

Whatever the merits of this theory may be, Shaub does not substantiate his "proof" with any experimental research, nor with any reference to such research in the professional literature. His bibliography cites mainly his own articles in *Lapidary Journal* (1979–1981), and antiquated general references. Fifteen color photos of agate structures are included.

W.E.W.

Die Minerale Salzburgs

[The Minerals of Salzburg province, Austria] by Albert Strasser. Published (1989) by the author, Hubert-Sattler-Gasse 13, A-5020 Salzburg, Austria. Hardcover, 18 x 25 cm, 348 pages, ISBN 3-900885-001, price approximately 575 Austrian schillings.

This is a full-scale regional mineralogy of one of Europe's most important mineralized areas. The book opens with minerals listed and described in chemical order, with references to an excellent bibliography. Black and white photographs and crystal drawings accompany the text, which also includes chemical analyses and phase data in some cases. The second main section of the book covers the Salzburg area geographically, giving a good deal of geological detail on major occurrences. It would be difficult to find a more thorough treatment of an area. A short section containing good-quality color photographs precedes the bibliography and two indexes are devoted to species and localities.

Michael O'Donoghue

Mineralfundstellen im Land Salzburg

[Mineral Localities in Salzburg province, Austria] by Rupert Hochleitner. Published (1989) by Christian Weise Verlag, Oberanger 6, D-8000 München 2, West Germany. Hardcover, 15 x 21 cm, 128 pages, ISBN 3-921656-14-1, price DM 34.80.

It is surprising to see two books published almost simultaneously on the same subject, more or less (see preceding book review). But this abundance is just another indication of the exceptionally high Germanic enthusiasm and appetite for mineralogical literature, far greater per capita than in the United States and practically anywhere else.

Hochleitner's book is a shorter, smaller-format complement on Salzburg mineralogy arranged geographically by valleys, beginning with Gasteiner Tal and progressing through Rauriser Tal, Fuscher Tal, Kapruner Tal, Mühlbachtal, Stubachtal, Felbertal, Hollersbachtal, Habachtal, Untersulzbachtal, Obersulzbachtal, Krimmler Achental, Golling and Leogang . . . many fine localities indeed.

The information given for occurrences in each valley is geared for the field collector, giving maps and precise directions, along with attractive color photos of the spectacular scenery and the beautiful minerals, 81 color photos in all. Minerals are listed for each occurrence, but with very little description of habits. The geology of each valley is briefly summarized, and information on the local accommodations available for visitors is mentioned.

This is a collector's field guide and not a thorough scholarly treatment. It is readable and easy to use, even for people not fluent in German. The detailed maps, photos and mineral lists will be intelligible to all collectors. This book should be considered essential for anyone actually planning to visit the area, but is of less value as a shelf reference because of the lack of individual species descriptions and professional literature citations. A two-page bibliography (entries are not cited in the text) refers almost exclusively to the popular literature, primarily articles in *Lapis* magazine.

W.E.W.

Letters

LECHNER COLLECTION

In 1955 Schortmann Brothers received and commenced the distribution of a fine European collection they had purchased from Dr. Adolf Lechner of Vienna, Austria. The outstanding material in this collection was sold, first to major institutions (Harvard and the USNM), then to private collectors.

I am attempting to mount a display at the forthcoming Tucson Show about the Schortmann Brothers and the Lechner Collection, analogous to my Roebling Collection display at the last Pasadena and Tucson Shows. I would be most grateful for any information, or leads to information, about Herr Lechner, his life, and his collection, and the circumstances of its disposal. My address is:

Bill Smith
1731 Daphne Street
Broomfield, CO 80020-1157
(303) 466-8723
(please call collect)

BAUMHAUERITE-2a

This note is to update your readers on the baumhauerite-like mineral from Quiruvilca, Peru, previously reported by Robinson and Harris in the *Mineralogical Record* (vol. 18, 199–201). As a result of TEM studies undertaken by one of us (AP), the mineral has been positively identified as the new species baumhauerite-2a (Pring *et al.*, *American Mineralogist*, in press). The electron diffraction pattern of this material shows streaking along a*, indicating a disordered intergrowth of baumhauerite and baumhauerite-2a, but with a dominant 44.5 x 8.4 x 7.9 Å cell, proving baumhauerite-2a to be the major phase present. While the minor thallium reported by Robinson and Harris may play the same structural role as silver present in the type material from Lengenbach, it is possible that in both cases supercell formation is due to ordering of lead and arsenic.

Allan Pring
South Australian Museum, Adelaide
George W. Robinson
Canadian Museum of Nature, Ottawa

MAGAZINES WANTED

I am a teacher and sponsor of the Earth Science Club in an inner-city Los Angeles high school. We are trying to build up our library, and would like to obtain back issues of *Mineralogical Record* and *Rocks & Minerals*. I realize these are choice publications which people zealously guard, but we are asking readers who might be short on storage space to donate copies. Each issue is eagerly awaited and read by many students. I know this is asking a lot, but it would be of great benefit to us, and is also tax-deductible.

Walter S. Bowser
Huntington Park High School
Earth Science Club
6020 Miles Avenue
Huntington Park, CA 90255

AMETHYST OCCURRENCES

I very much enjoyed reading the article "Amethyst occurrences of the eastern United States" (vol. 21, p. 203).

Three towns listed in the table as being in Coös County, New Hampshire, are actually in other counties. These are: Waterville Township (Grafton County), Surry Township (Cheshire County), and Westmoreland Township (Cheshire County).

In the text under the heading of New Hampshire an amethyst find is listed as having been mined in the winter of 1987/1988, in Stark. This occurrence was an open pocket (the cap of which had been torn away by glaciation). Peter Samuelson did not begin cleaning it out until the spring of 1988; I know this because I helped him.

Carlton L. Holt
Milan, NH

GOLDSCHMIDT and GOLDSCHMIDT

Reading your "Goldschmidt & Goldschmidt" note (vol. 21, no. 3, p. 186) reminded me that when I was doing research on Goldschmidt [the crystallographer] for my book *Letters to George F. Kunz* (1986), I discovered, with deep digging, that his middle name was Mordecai—no wonder he didn't use his middle initial to distinguish himself from Victor Moritz Goldschmidt.

Lawrence H. Conklin
New York, NY

ESPERITE TYPE LOCALITY

The March-April issue of *Mineralogical Record* arrived today and, as usual, it received top priority. While reading the article on the El Dragón mine I came across an error on p. 142, where Paterson, New Jersey, is given as the type locality for esperite. The correct type locality is Franklin, New Jersey, formerly the only known occurrence.

Carl Kanoff
Candor, NY

Daniel Hall, Joe Venuto, John C. Ebner and Wilfred Welsh wrote to point out the same error. Ed.

COMPUTER PROGRAM

Can anyone recommend a software database for mineral identification, suitable for high school students, that can be used on a Macintosh system?

Donn Cook
1530 W. Hemlock Way
Santa Ana, CA 92704

IMITERITE FROM TUOLUMNE COUNTY

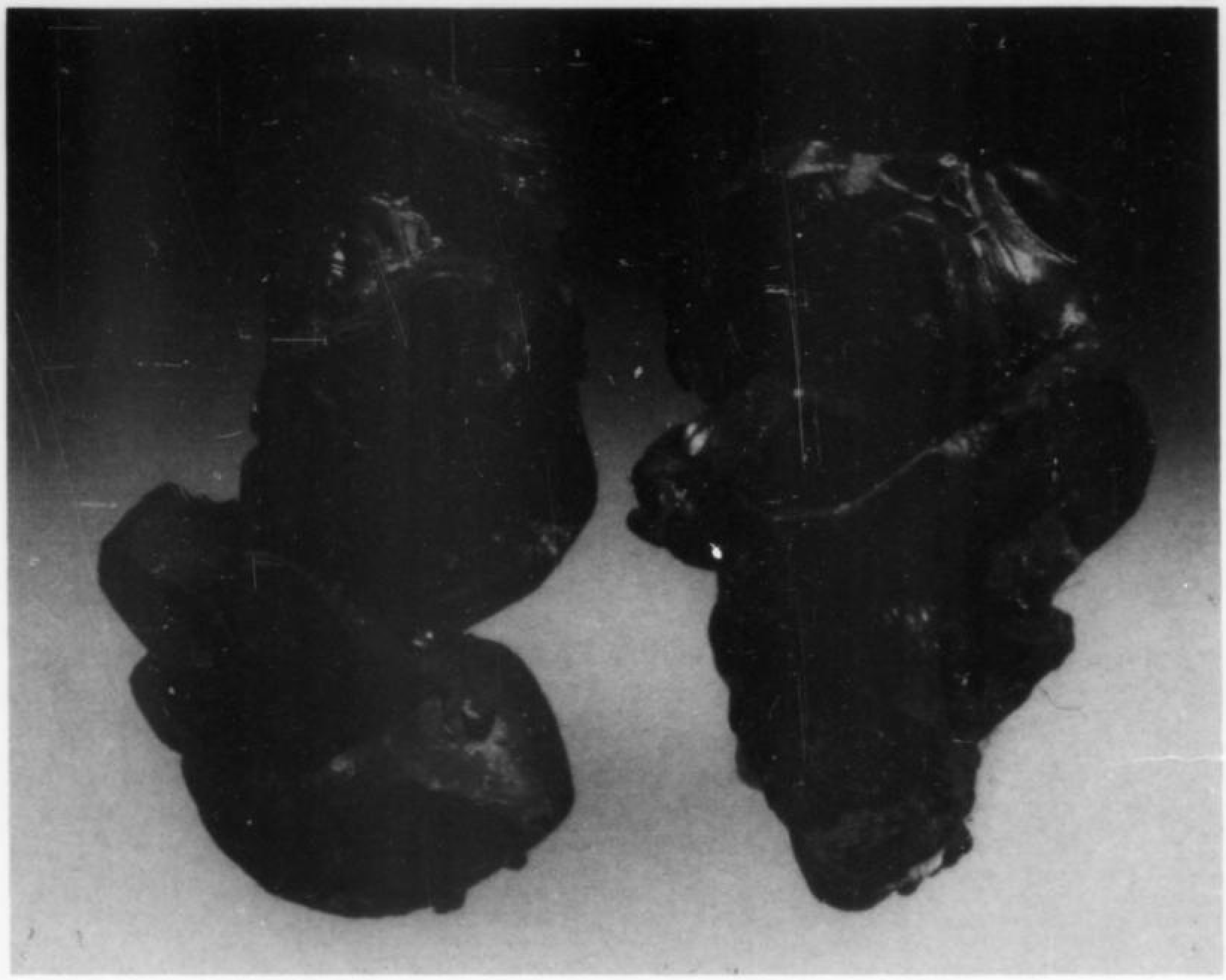
During the autumn of 1989, Cureton Mineral Company acquired a large portion of the Marion Godshaw collection. Included among these specimens were two 8-mm crystal groups labeled "Petzite—Golden Rule mine, Tuolumne County, California," an occurrence mentioned in Pemberton's *Minerals of California* (1983). The original label, retained by Godshaw, is from the Mineralogical Museum of the University of Bonn, West Germany.

The crystals are quite sharp, with a thin, gray coating. They do not look like petzite, but more like distorted acanthite. For positive identification the specimens were sent to Cannon Microprobe in Seattle, Washington, where they were analyzed using an ARL SEMQ electron microprobe.

The crystals indeed proved to be distorted acanthite, but with scattered microcrystal inclusions of *imiterite* (Ag_2HgS_2), covered by a thin overall coating of stromeyerite. This appears to be only the second known world occurrence of imiterite (the first being the Imiter mine, Morocco). Michael Fleischer of the Smithsonian Institution (personal communication, 1990) concurs that he is aware of no other occurrences.

One of the crystal groups is now in the collection of the California State Mining and Mineral Museum in Mariposa.

Forrest Cureton
Tucson, AZ



WEW

***Figure 1.* Acanthite crystals, 1.3 cm, with inclusions of imiterite and a thin coating of stromeyerite, from the Golden Rule mine, Tuolumne County, California.**

ANNIVERSARY ISSUE

I have just received the Twentieth Anniversary Issue and I must congratulate you. It is very different from the usual issues, but very fine even though.

The article on connoisseurship had some interesting points. Actually achieving the impossible—"connoisseur Nirvana" (total knowledge and sensitivity)—might not be such a great thing anyway. There would be nothing left to strive for! What makes mineralogy enjoyable is precisely that there is always *more: more* minerals, *more* localities, *more* people, *more* knowledge, *more* experiences. What makes it all fun is not what we have *already* seen and done, but what we *will* see and do in the future. The process, the quest for these experiences, may be the essence of the hobby. So, three cheers for the place where we all must start (i.e., in ignorance), and the Noble Eightfold Path we walk!

Claus Hedegaard
Faarvang, Denmark

You've hit the nail on the head. May the blessings of The Enlightened One (Buddha? Dana? Washington Roebling?) be upon you. Ed.

Congratulations to the *Mineralogical Record* for twenty years of publication!

I appreciate your acknowledgment and further encouragement (in the editorial, "Twenty years of abundance") of cooperation between collectors, dealers and scholars on one hand, and mining companies on the other. Not only is the concept itself a good one, but I also like the approach which you take to it. As much as many of us hate to admit it, the mining companies really are in charge when it comes to collecting their rocks on their property.

Edwin L. Clopton
Coralville, IA 52241

Just received the Twentieth Anniversary Issue, which I find quite interesting . . . an excellent issue which has the potential of becoming a classic.

Regarding the "What's new in minerals?" note on the black mineral (called "ilmenite") with rutile from Ibitiara, Brazil: We have [in the Smithsonian collection] more than a dozen specimens of this material, *all* of which are labeled hematite and always have been. We have two that are analyzed (one of which is from Luiz Menezes), and have been confirmed as hematite containing only 3–4% titania. They are not ilmenite.

John Sampson White
Smithsonian Institution
Washington, DC

Charles Pearson and I would like to correct a few errors which crept into our recently published article "Clarence S. Bement: The Consummate Collector" (vol. 21, p. 47–62).

We particularly regret misspelling the surname and maiden name of Marion Moore Bement (incorrectly cited as Marion Bement LeGoff on pages 48, 50 and 51). The superb German erythrite photograph (Fig. 10, p. 53) should have been credited to Jackie Beckett and Kerry Perkins. Larry Conklin pointed out that the biographical sketch of Bement listed in the references on page 62 was improperly cited. It should have been cited as follows:

KUNZ, G. F. (1923?) Biographical sketch of Clarence S. Bement. AMNH files, Item 365, folder #7. *Matrix,* **1**, no. 3, 42–43.

Robert Middleton, currently a mineralogical consultant at the Academy of Natural Sciences in Philadelphia, called recently to indicate that the ANSP had received an inquiry regarding a letter in their archives (cited as BEMENT, C. S., 1881). Bob's inability to locate the letter was understandable as it was written July 28, 1888!

Mr. Pearson and I would like to hear from other *Mineralogical Record* readers should they spot other factual errors incorporated into the Bement article. Clarence Bement is a pivotal figure in the history of the AMNH's mineral collection and we certainly wish to have our facts straight!

I would like to take this opportunity to praise Mr. Richard Hauck of Bloomfield, New Jersey. He provided me with a reproduction of the original copy of Canfield's *The Final Disposition of Some American Collections of Minerals,* which I subsequently passed on to the *Mineralogical Record,* where it was reprinted.

Joseph J. Peters
Charles L. Pearson

I wish to correct the record regarding some species names mentioned in my recent article on Washington Roebling (vol. 21, no. 1).

On page 20, guitermanite is referred to as "now discredited." Actually, although Fleischer considers the name now to be invalid (and does not include it in his *Glossary of Mineral Species*), it has not been formally discredited according to IMA procedure.

On page 23, "jerseyite" is referred to as "now discredited"; but, in fact, the name "jerseyite" has never been officially given to a new species.

On page 25, I stated incorrectly that the mcgovernite structure was determined by Foit (1966); the structure has yet to be solved.

Finally, Gage's letter of 1926, quoted on page 25, reports the occurrence of alamosite at Franklin, but it should be mentioned that this identification was never confirmed.

Arthur Roe
Tucson, AZ

What's New (continued from p. 492)

an old specimen from the nineteenth-century collection of Louis Saemen, labeled "rhodochrome" (a variety of clinochlore) from Bissersk, Urals. The mineral, which occurs as 5-mm black inclusions in the compact purple chlorite, has proven to be redledgeite.

VENEZUELA

Dennis and Dan Belsher (*Eldorado Enterprises*) make regular trips into the Venezuelan jungle to visit the Santa Elena gold placers (see *Mineralogical Record,* vol. 18, no. 6, p. 89–90) during the rainy season (March-May). The placer deposits are mostly eluvial, so the gold specimens vary from stream-rounded to perfectly sharp. This year they returned with about a kilogram of fine gold specimens, including some remarkable *branching* specimens unlike any seen previously.

ZAIRE

Gilbert Gauthier frequently has the best and most unusual specimens from this country's famous Shaba Province. At Tucson, Gilbert had many unusual uranium and copper species such as ludjibaite, francoisite-(Nd), etc., but two items are particularly noteworthy: roubaultite and kipushite, both in crystals. The roubaultite is particularly exciting, as there are perhaps less than ten known specimens to represent the species. The new crystals are also from a new locality, the KOV mine near Kolwezi, and form 3-mm terminated, olive-green individuals on a limonitic matrix. The kipushite, which is associated with hemimorphite and pseudomalachite, comes from the Kipushi mine. The discovery was made by Dr. Joseph Lhoest, using an old map delineating the most promising portions of the mine. Several dozen specimens with crystals up to 3 mm were recovered. Gilbert has also played an active role in some recent discoveries made at the Mashamba West mine, where robin's-egg-blue spheres of shattuckite up to 5 mm have been found on earthy chrysocolla coatings on 4-cm calcite crystals. Other finds include superb duhamelite and vesignieite crystals from Mashamba, and excellent specimens of soddyite, cuprosklodowskite, schoepite, rutherfordine and other rare species from Musonoi.

ZIMBABWE

Rüdiger Hesse recently obtained an excellent lot of blue euclase crystals from the Lost Hope mine, Miami pegmatite fields, Karoi district, which he had for sale at the Tucson show. These were mined in 1977, but withheld from the market until now. There were about 50 pieces in all, with sharp, blue, blocky crystals in groups up to about 12 x 12 cm. The occurrence has been described in detail by Hochleitner in *Lapis* (vol. 14, no. 10, p. 24–27).

Part IV: Extraterrestrial Occurrence

MARS

Recent infrared spectrographic studies by Roger Clark and Gregg Swayze (U.S.G.S., Denver), Robert Singer (University of Arizona, Tucson) and Jim Pollack (NASA, Ames Research Center) suggest that scapolite is an abundant mineral on Mars. Perhaps the most similar terrestrial scapolite known is the yellow fluorescent material from Grenville, Quebec. On Mars, scapolite is presumed to be relatively abundant at locations such as Eden and Hellas, with lesser amounts occurring at Oxia Palus, Syrtis Major and Hellespontica, and with little to none detectable at Margaritifer or Erythraeum. It is assumed that the average grain size is in the order of 50 to 100 μm, which certainly precludes the availability of cabinet specimens.

While it has been suspected for some time now that pyroxene occurs on Mars (see *Advances in Space Research,* vol. 5, p. 59–69), no hydrous or carbonate-bearing species has been identified until now. Martian scapolites appear to vary in their bicarbonate and bisulfate content, which provides some interesting implications supporting the possible previous existence of a denser Martian atmosphere and flowing water on its surface. Those interested in Martian mineralogy should see the *Journal of Geophysical Research* special issue on Mars. Anyone up for a field trip?

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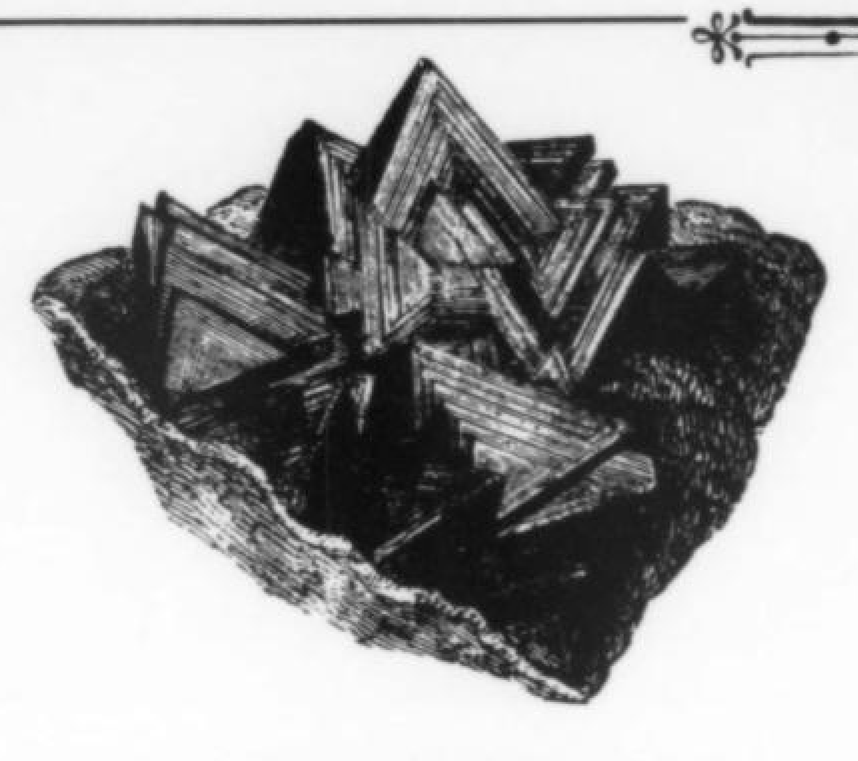

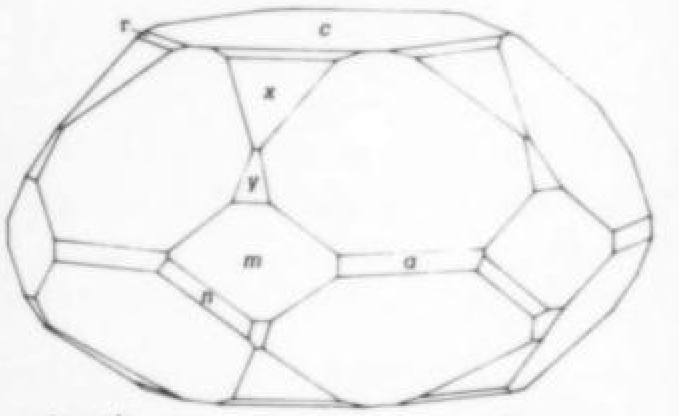
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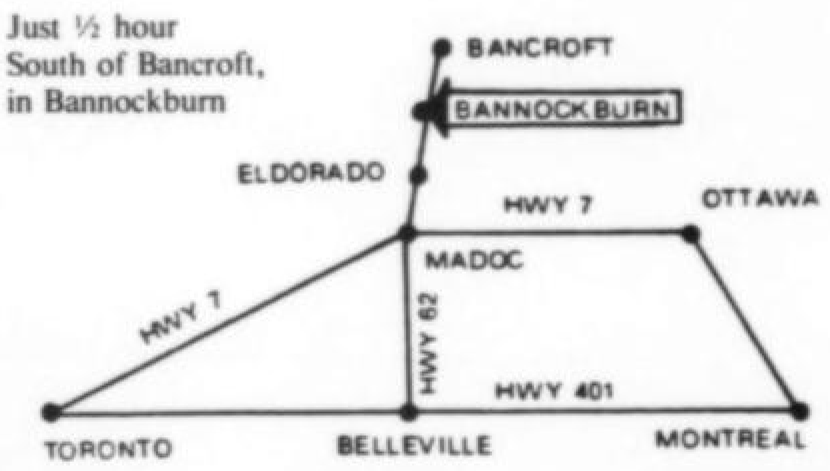
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