the
Mineralogical
Record

Volume Eighteen, Number Three
May–June 1987 $7.50


No. 167
COLLECTION.
WELLS, FARGO AND CO
Value, $ 25,585.4
Received of

The Mineralogical Record Inc.
is a non-profit organization
The Mineralogical Record
magazine is published by the
Mineralogical Record Inc.,
7413 N. Mowry Place
Tucson, Arizona 85741

Editor & Publisher
Wendell E. Wilson
Associate Editors
Pete J. Dunn
Washington, DC
Peter G. Embrey
British Museum (N.H.)
London, England
Richard C. Erd
U.S. Geological Survey
Menlo Park, CA
Donald R. Peacor
University of Michigan
Ann Arbor, MI
George W. Robinson
Natl. Museums of Canada
Ottawa, Ontario
Abraham Rosenzweig
Tampa, FL
Richard W. Thomssen
Carson City, NV
Associate Photographers
Nelly Bariand
Sorbonne
Paris, France
Werner Lieber
Heidelberg, W. Germany
Olaf Medenbach
Ruhr Universitat Bochum
Bochum, W. Germany
Eric Offermann
Arlesheim, Switzerland
Harold and Erica Van Pelt
Los Angeles, CA
Julius Weber
Mamaroneck, NY
Circulation Manager
Mary Lynn Michela
(Subscriptions, back issues,
reprints)
P.O. Box 35565
Tucson, Arizona 85740
602-297-6709
Editing, advertising
Wendell E. Wilson
4631 Paseo Tubutama
Tucson, AZ 85715
602-299-5274
Promotions and Book Sales
Gale Thomssen
P.O. Box 1656
Carson City, NV 89702
Design
Wendell E. Wilson
Subscriptions
- **Individuals (U.S.):** $27 for one year, $52 for two years, $750 lifetime. (First-class mailing available; write to circulation manager for rates.)
- **Individuals (outside the U.S.):** $30 for 1 year, $58 for two years, $850 lifetime. (Airmail mailing available; write to circulation manager for rates.)
- **Libraries, Companies and institutions (worldwide):** $45 for one year. (First-class or Airmail mailing available; write to circulation manager for rates.)

Special second class postage
(USPS-887-700)
Paid at Tucson, Arizona, and
additional offices. POSTMASTER:
send address changes to:
7413 N. Mowry Place
Tucson, AZ 85741

* Continued on page 255

the Mineralogical Record

May-June 1987
Volume Eighteen, Number Three

Articles

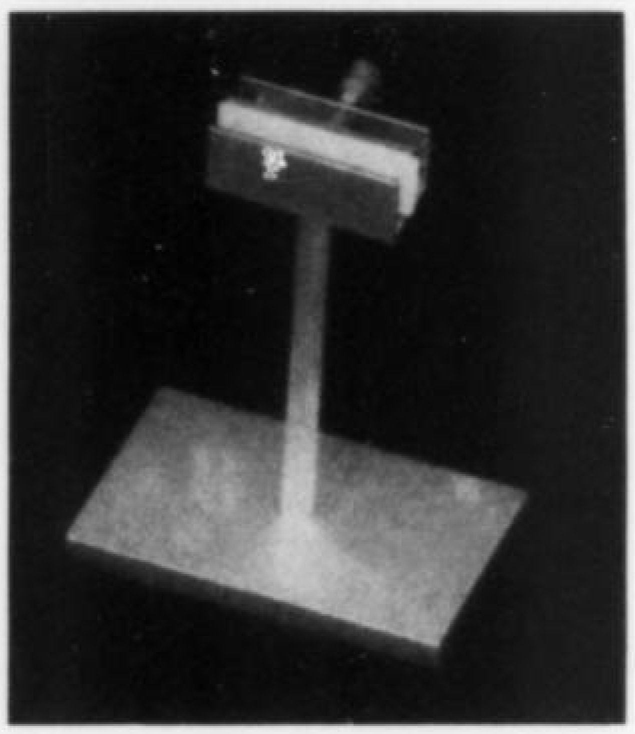
Departments

COVER: CUPRITE crystal, 2.6 cm (1 inch) on antlerite crystals from the Southwest mine, Bisbee, Arizona. For more information on this recent discovery see *What's New in Minerals?* in this issue. Collection of R. W. Graeme IV and D. Graeme; photo by Wendell E. Wilson.

notes from the EDITOR

SLAB HOLDER

Polished slabs seem, at first thought, to be obviously the province of lapidaries rather than mineral collectors. However, a moment's reflection will show that quite a few different species are best displayed as slabs in the mineral collector's cabinet. Examples include variscite and associated minerals from Fairfield, Utah; zoned liddicoatite tourmaline from Madagascar; meteorites of all kinds; banded malachite from Bisbee or Zaire or Siberia; banded rhodochrosite from Catamarca, Argentina; ruby in green zoisite from Tanzania; petrified wood; "blue john" fluorite from England; and perhaps even a nice agate slab or fossil.



Devices contrived for holding these slabs upright in the display case have been many, but a particularly practical and attractive one has recently been introduced by *The Lustigs* (P.O. Box 2051, San Leandro, CA 94577). The Lustigs are normally a wholesale-only dealership but have agreed to sell some of these stands retail to readers of this column, on an introductory basis. The stands consist of a heavy rectangular base, a stem and a small rectangular screw-clamp, all in 24-karat gold-plated brass. Three sizes are available: small (1½ x 2½ x 3½ inches, $31 postpaid), medium (2 x 3 x 4½ inches, $35 postpaid), and large (2½ x 3½ x 5 inches, $41 postpaid). All orders must be prepaid. Dealers should request the Lustigs' color brochure and price list showing ten different designs of gold-plated brass specimen stands in a range of sizes. For pure elegance and beauty, not to mention practicality (they don't tarnish), these are the best decorator specimen stands on the market.

CALL FOR PAPERS:
FM-TGMS SYMPOSIUM, FEBRUARY 1988

The ninth Friends of Mineralogy–Tucson Gem and Mineral Society Symposium will be held February 14, 1988, in conjunction with the Tucson Gem and Mineral Show. The topic of the symposium will be beryl, the featured mineral of the show. Papers concerning all aspects of the descriptive mineralogy and paragenesis of beryl are invited.

Presentations will be 15 or 20 minutes in length followed by a period of questions. An audience of knowledgeable amateurs as well as professional geologists and mineralogists is expected.

All authors will be required to submit a 200-word abstract by September 1, 1987; the abstract should have a heading with the title, the author's name and address. Upon acceptance of the paper the author will be required to submit an extended abstract of from 1000 to 2000 words in length plus figures. Extended abstracts will consist of camera-ready text and illustrations.

Papers by students are encouraged and will be considered for the "Best Student Paper" award from Friends of Mineralogy. The award is intended to cover all or part of the expenses incurred by the student while traveling to the symposium.

Please submit abstracts to:

FM-TGMS Symposium
Attn: Henry Truebe, Chairman
c/o St Joe American Corporation
2002 North Forbes Blvd.
Tucson, AZ 85745

CALL FOR PAPERS:
FM COLORADO CHAPTER SYMPOSIUM, AUGUST 1988

The Colorado Chapter of the Friends of Mineralogy will hold a symposium on the "Mineralogy of Precious Metal Deposits" in August, 1988, at the Colorado School of Mines campus in Golden. Papers concerning the mineralogy of precious metal deposits, particularly those in Colorado, are invited. Historical reviews of precious metal districts will also be considered.

Presentations should be about 20 minutes in length. Authors must supply a 6 to 8-page extended abstract, camera-ready, including illustrations, prior to the symposium. A title and brief abstract must be submitted by October 1, 1987; final selection of papers will be made by December of 1987.

For more information or to submit titles and abstracts contact either of the symposium chairmen:

James A. McGlasson
7387 S. Flower St.
Littleton, CO 80123
(303) 972-0376

James F. Hurlbut
622 Gardenia Ct.
Golden, CO 80401
(303) 279-7796

NOTICES

Died, Emory Mitchell Gunnell, 83, of a stroke, in Denver. Mitch Gunnell began collecting minerals in 1919, and continued until shortly before his death late last year. His collection, numbering about 4,000 specimens at maximum, was among the finest private collections in the country, and exceeded in quality the collections of many museums as well. And yet during his lifetime virtually no one was ever allowed to view it in its entirety. Irascible and somewhat reclusive, especially in his later years, Mitch Gunnell collected solely for himself and is not known to have ever exhibited his specimens publicly. About ten years ago he began selling portions and sub-collections here and there; Wayne Leicht (*Kristalle*) is currently assisting in the liquidation of the collection.

Gunnell was born in 1903 and earned his Bachelor's Degree in Geology in 1928 at Knox College in Galesburg, Illinois. In 1931 he obtained his Master of Science Degree at Washington University in St. Louis, writing his thesis on mineral fluorescence. During the late 1930s he wrote several articles on fluorescence for *The Mineralogist* magazine. In 1938 he married Kathryn Kidder and they honeymooned in the Southwest, traveling through Arizona, New Mexico and Colorado. They moved to Colorado permanently in 1940.

Properties he had inherited provided sufficient income so that Gunnell could work pretty much where and when he wished. He taught geology in Illinois, and worked as assistant curator at the Buffalo Museum of Science for a time; from 1940–1944 he worked at Pohndorff's Mineral Store in Denver. Upon leaving Pohndorff's he decided to go into the mineral business for himself, and dealt on a part-time basis until 1976. His specialty was single-crystal study sets (see vol. 6, no. 5, p. 226–229), which he sold to collectors and universities across the country. For the most part, however, he worked on building his own collection, the full magnitude of which has only now come to light.

Died, Betty Roberts, 45, of cancer. Betty Roberts was well known to mineral collectors as the co-owner (with husband Ken Roberts) of *Roberts Minerals* in Twain Harte, California. She and Ken first met when she was 14 years old, and they soon developed a shared interest in rockhounding. In 1968 they met mineral dealer Walt Lidstrom (who died in 1976) at a show and were introduced to the collecting of beautiful, well-crystallized minerals – they purchased a $35 Veracruz amethyst after much careful consideration. Ken went full-time into the mineral business in 1974 and three years later Betty left her job as a hospital administrator to work with Ken.

Betty's favorite project at the Tucson Show in recent years was assembling specimens from one major pocket or discovery into one showcase which she titled "a family reunion." Collectors, dealers and curators from across the country were happy to loan specimens, and showgoers were treated to fabulous exhibits of Red Cloud mine wulfenite, N'Chwaning mine rhodochrosite, French pyromorphite, Tsumeb dioptase, and several other discoveries over the years.

Betty loved the beauty of minerals. She was an experienced field collector, and a superb judge of specimen esthetics. She was also an authority on mining antiques, particularly miners' candlesticks; the collection which she and Ken built ranks among the top two or three in the country. More than these things, however, she loved people. Always smiling and happy to greet people, always ready to encourage and to cheer up anyone who might need it, always willing to help out struggling young collectors, Betty was among the most beloved members of the mineral community.

(Note: A fund to help out with Betty's hospital expenses has been established. Contributions should be sent to Gale Thomssen, P.O. Box 1656, Carson City, NV 89702.)

Photo by Kent England

Died, Howard Belsky, 28, of cancer. Howard Belsky, owner of *Howard's Minerals* in Brooklyn, New York, began dealing in rare mineral species in 1972. He traveled extensively, particularly in Europe, and was a regular at the annual Tucson Show, selling through his room at the Desert Inn. Howard's interest in minerals surfaced at age 5 and eventually led him to obtain a Master's Degree in geochemistry at Stoneybrook (New York). He was meticulous in his species identifications, and commonly employed sophisticated instrumentation usually unavailable to dealers.

ERRATA

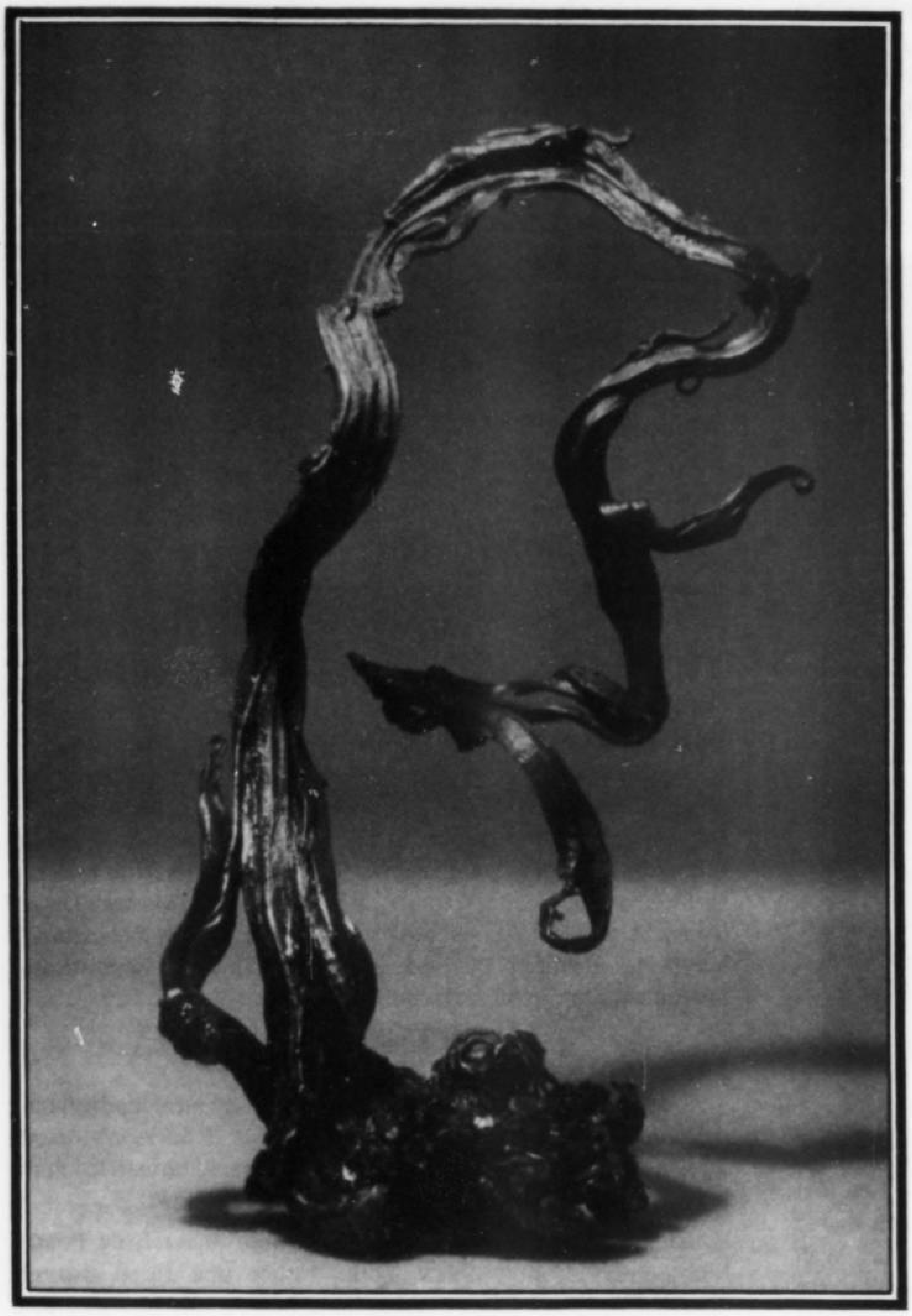
Following the proofing stage, five lines of text were inadvertently deleted by our graphics company from Bill Henderson's *Microminerals* column in the last issue. The lines should be inserted in the break between pages 141 and 142, and are as follows:

liquid inclusions as negative crystals within quartz from Fonda, Montgomery County, New York. Notice that these also are bounded by plane faces making up a habit much like that of a distorted quartz crystal. In three of the cavities are visible round bubbles filled with vapor. These form after the cavities are closed

We apologize for the omission. Ed.

1 K	2 E	3 G	4 E	L	■	5 A	6 R	7 S	8 E	9 N	10 O	L	■	11 C	■	12 B
13 A	D	A	M	■	14 M	■	15 A	E	R	U	G	■	16 X	O	N	O
17 S	E	N	E	18 G	A	19 L	■	20 R	O	E	D	21 D	E	R	■	L
22 O	N	O	R	A	T	O	■	A	■	23 V	E	E	N	■	24 B	E
L	■	25 M	A	I	T	L	A	N	26 D	■	27 N	E	O	T	O	■
■	■	28 A	L	T	A	■	■	29 D	I	A	S	■	T	■	30 R	31 A
32 G	33 O	L	D	■	34 G	A	35 S	■	O	■	36 B	37 L	I	X	■	L
38 U	V	■	■	■	A	■	I	■	39 P	40 A	U	L	M	■	■	E
41 G	E	42 R	43 S	44 T	M	45 A	N	46 N	■	47 K	R	O	E	48 H	49 N	K
50 I	R	A	R	S	■	51 T	H	O	52 R	■	53 G	Y	■	E	■	S
A	■	S	■	U	■	■	54 A	B	E	L	■	55 D	56 A	L	57 Y	■
■	■	58 P	U	M	P	E	L	L	Y	■	■	■	59 U	V	A	N

Solution to last issue's crossword puzzle



BASSETITE

and other uranium minerals from Arcu su Linnarbu, Capoterra, Cagliari, Sardinia

R. Vochten
Laboratorium voor Chemische en Fysische Mineralogie
Universiteit Antwerpen
Middelheimlaan 1, 2020 Antwerp, Belgium

G. Brizzi
Amici Mineralogisti Fiorentini
Via Lorenzo il Magnifico 16
50129 Firenze, Italy

INTRODUCTION

The prospecting area of Arcu Su Linnarbu is located in the Monte Arcosu, near the village Capoterra in the province Cagliari, more precisely south-southeast of the Punta Su Aingiu Mannu (Fig. 1). The locality can best be reached from Capoterra by the unpaved road leading to Sant Andrea, from where the prospecting area can be reached by crossing the San Antonio channel (Fig. 2). The Monte Arcosu granites are bounded by metamorphic rocks with a northeast-southwest contact. The granites are medium-grained and are pinkish in color, due to the presence of a considerable amount of potassium feldspar. The metamorphic rocks consist of two distinct types, a sericite-muscovite schist and a cornubianitic, slightly micaceous, quartzite.

The uranium mineralization occurs in this contact zone and consists predominantly of secondary uranium minerals. At Arcu Su Linnarbu all prospecting research was carried out in an outcrop of cornubianitic quartzite.

In late 1950 the Somiren Company began exploring for uranium. The last mining activity took place between 1980 and 1983. The mining operations included open pit and underground workings.

MINERALS

A number of secondary uranium minerals (uranyl phosphates) have been described from this locality by Garavelli *et al.* (1959), Ippolito *et al.* (1956), Pietracaprina (1963) and Ravagnani (1974). The following descriptions cover only those minerals which are likely to be of interest to mineral collectors, with special emphasis on bassetite since it has not been previously reported.

Autunite $Ca(UO_2)_2(PO_4)_2 \cdot 10\text{–}12H_2O$

Meta-autunite $Ca(UO_2)_2(PO_4)_2 \cdot 2\text{–}6H_2O$

Meta-autunite is by far the most abundant of the two, but some highly transparent crystals have been identified as autunite (Fig. 3). The crystals are tabular, about 1 mm in size, and show a very strong fluorescence in ultraviolet light.

Bassetite $Fe(UO_2)_2(PO_4)_2 \cdot 8H_2O$

During our search in 1982 in the outcrop of the strongly diaclased cornubiantic quartzites, many specimens of the rare mineral bassetite were recovered. Bassetite belongs to the same series of uranyl-phosphates as do many of the other species at the locality. The mineral is named after the type locality at Wheal Basset, Redruth, Cornwall, England.

The crystals of bassetite found at Arcu Su Linnarbu are small, tabular, to about 1 mm in size, with a square or rectangular outline indicating pseudo-tetragonal symmetry (Fig. 4). They are sometimes gathered in parallel aggregates or in fan-like groups with a yellow-brown color. The crystals are commonly opaque, or at times, semi-transparent with a vitreous to pearly luster. Most of the crystals are associated with meta-autunite and minor torbernite.

Bassetite is not fluorescent in ultraviolet light, although some crystals show a pale yellow-green fluorescence due to an intergrowth with meta-autunite.

The identification of the mineral was accomplished as follows.

The chemical composition of the samples found in Arcu Su Linnarbu in weight percent was determined as: FeO, 7.78, UO_3, 62.71; P_2O_5, 15.43; H_2O, 14.20, which corresponds with the chemical formula $Fe(UO_2)_2(PO_4)_2 \cdot 8H_2O$. The specific gravity measured in toluene is 3.63 g/cm^{-3} which is identical with the density calculated for a unit cell with $Z = 2$.

Thermogravimetric and differential scanning calorimetric measurements were also performed, from which it was concluded that the mineral shows the same dehydration pattern as was earlier found on synthetic material (Vochten *et al.*, 1984). The dehydration can be represented as:

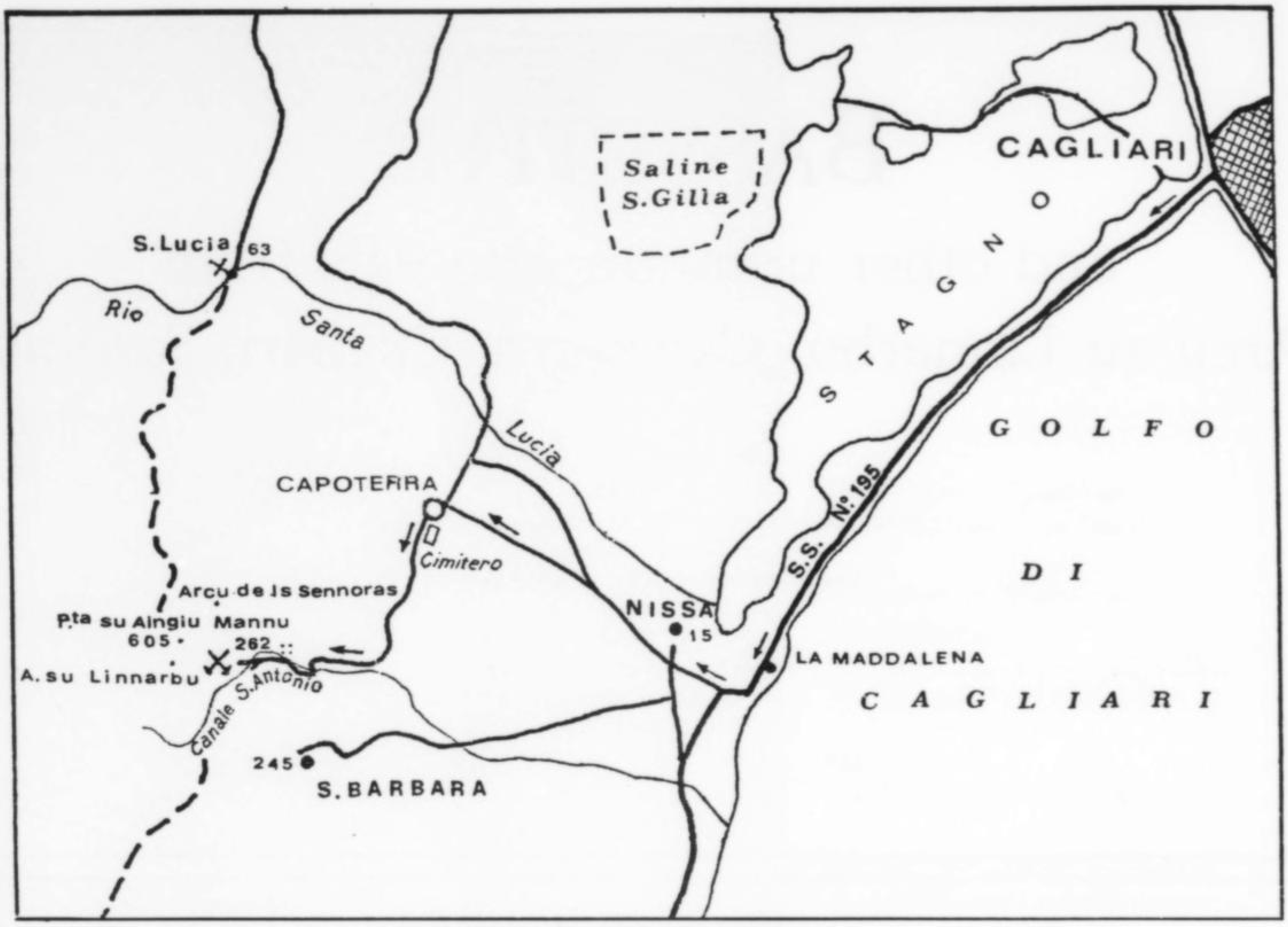


Figure 2. **Location map of the uranium prospecting area of Arcu Su Linnarbu, Capoterra, Cagliari, Sardinia. Scale: 1:100,000.**

$$\begin{tikzcd}
Fe(UO_2)_2(PO_4)_2\cdot 8H_2O \arrow[d, "25\text{–}160°C"] \\
Fe(UO_2)_2(PO_4)_2\cdot 2H_2O \arrow[d, "160\text{–}235°C"] \\
Fe(UO_2)_2(PO_4)_2\cdot H_2O \arrow[d, "235\text{–}400°C"] \\
\text{Decomposition}
\end{tikzcd}$$

Finally, X-ray diffraction data were recorded using a Gandolfi camera and CuKα radiation. In Table 1 the obtained values for d_{hkl} are summarized together with those obtained by Frondel (1954) for bassetite of the type locality. These results show unequivocally the presence of the mineral bassetite, in the Arcu Su Linnarbau assemblage, which, until now, has not been reported from this area.

Parsonsite $Pb_2(UO_2)(PO_4)_2\cdot 2H_2O$

This quite rare mineral has been reported as thin crusts composed of radial fibrous aggregates. The color is usually pale citron-yellow, varying (in this deposit) to brownish yellow, probably due to absorption of iron oxides. Due to inclusions the crystals are sometimes not transparent. Parsonsite does not fluoresce in ultraviolet light.

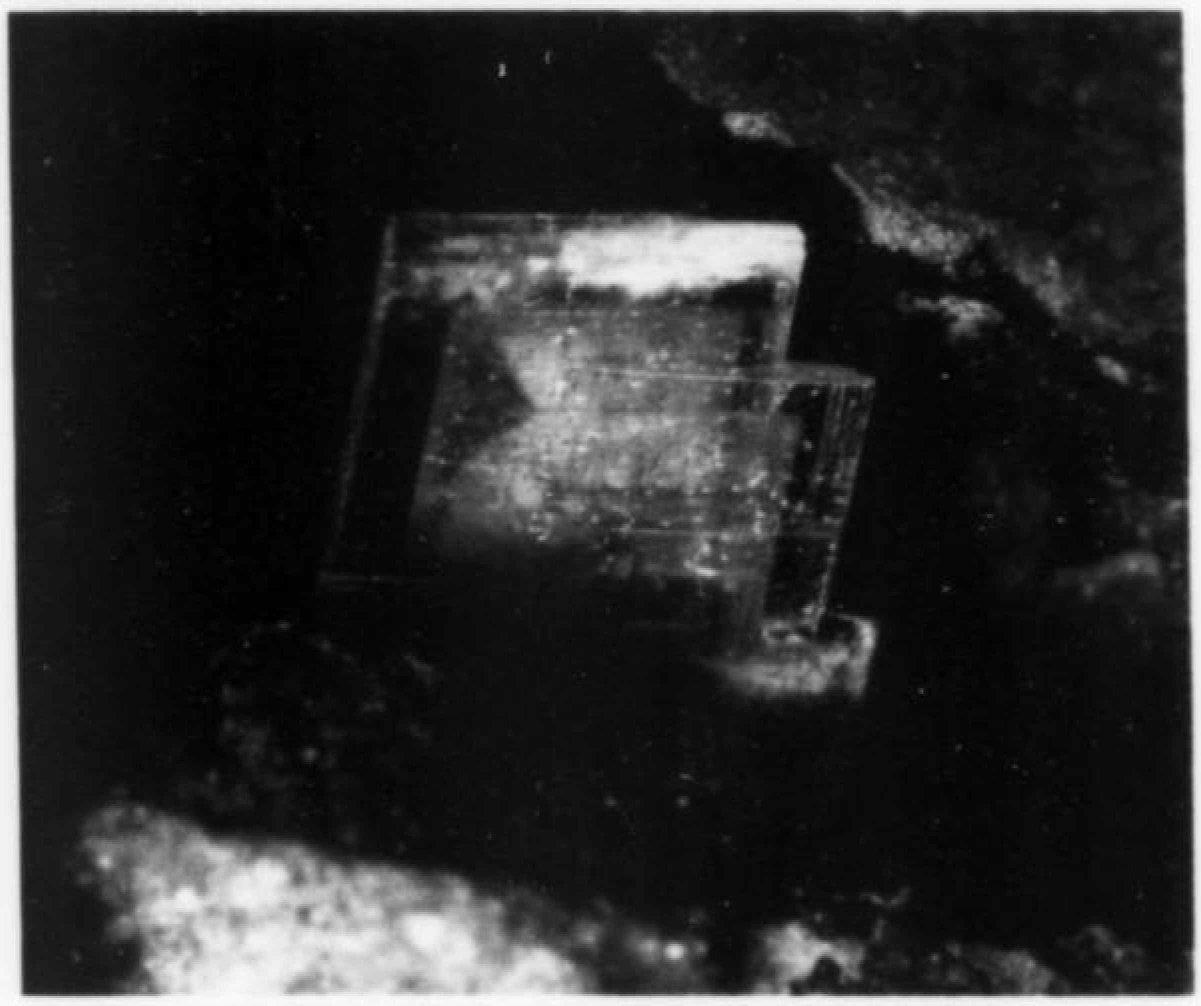


Figure 3. **Transparent, 3-mm tabular crystals of meta-autunite from Arcu Su Linnarbu, Capoterra, Cagliari, Sardinia (photo by G. Brizzi).**

Phosphuranylite $Ca(UO_2)_3(PO_4)_2(OH)_4\cdot 6H_2O$

Phosphuranylite is found sparingly as minute, tiny tabular crystals with a yellow color. The mineral is not fluorescent and is sometimes associated with saléeite and sabugalite, which are common at the deposit.

Table 1. **X-ray powder diffraction data of bassetite from Cornwall (Frondel 1954) and Arcu Su Linnarbu, Capoterra, Cagliari, Sardinia**

Cornwall		Arcu Su Linnarbu	
d_{hkl}	I/I_o	d_{hkl}	I/I_o
8.59	60	8.61	70
4.89	100	4.87	100
4.24	30	4.35	40
3.46	100	3.42	90
3.10	10	3.04	10
2.96	30	– –	– –
2.85	20	2.80	25
2.55	50	2.60	40
2.46	20	2.44	20
2.34	50	2.36	40
2.13	10	2.10	5
2.07	50	1.98	40
1.921	50	1.904	40
1.830	20	1.838	20
1.783	50	1.791	30
1.627	10	1.642	5
1.557	10	1.566	5

114.6 mm Gandolfi camera, CuKα radiation

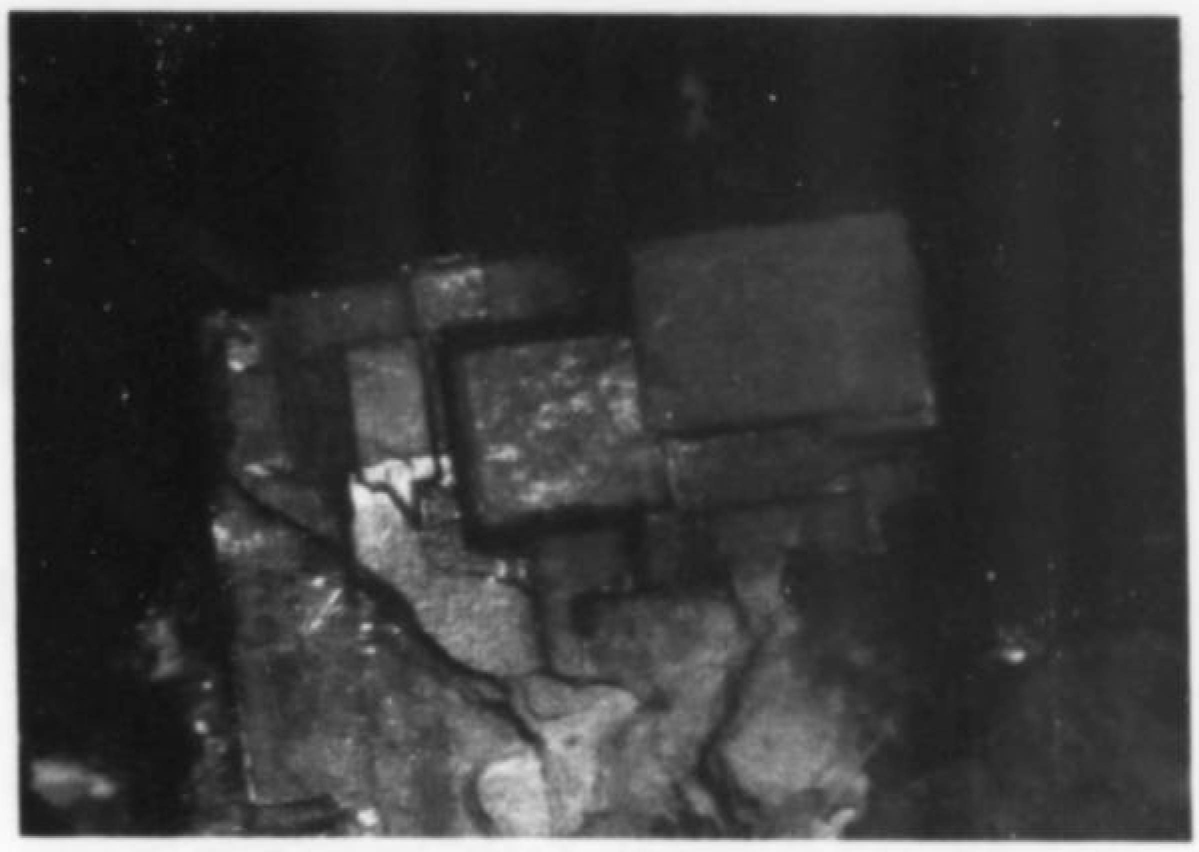


Figure 4. **Tabular, 3-mm crystals of bassetite from Arcu Su Linnarbu, Capoterra, Cagliari, Sardinia (photo by G. Brizzi).**

Sabugalite $HAl(UO_2)_4(PO_4)_4 \cdot 16H_2O$

Sabugalite occurs frequently throughout the deposit as tabular crystals up to 1 mm. The color ranges from bright yellow to lemon-yellow and it fluoresces yellow-green in longwave ultraviolet light.

Saléeite $Mg(UO_2)_2(PO_4)_2 \cdot 10H_2O$

Saléeite is common at this deposit and occurs as rectangular plates to about 1 mm flattened on {011}. The color varies from

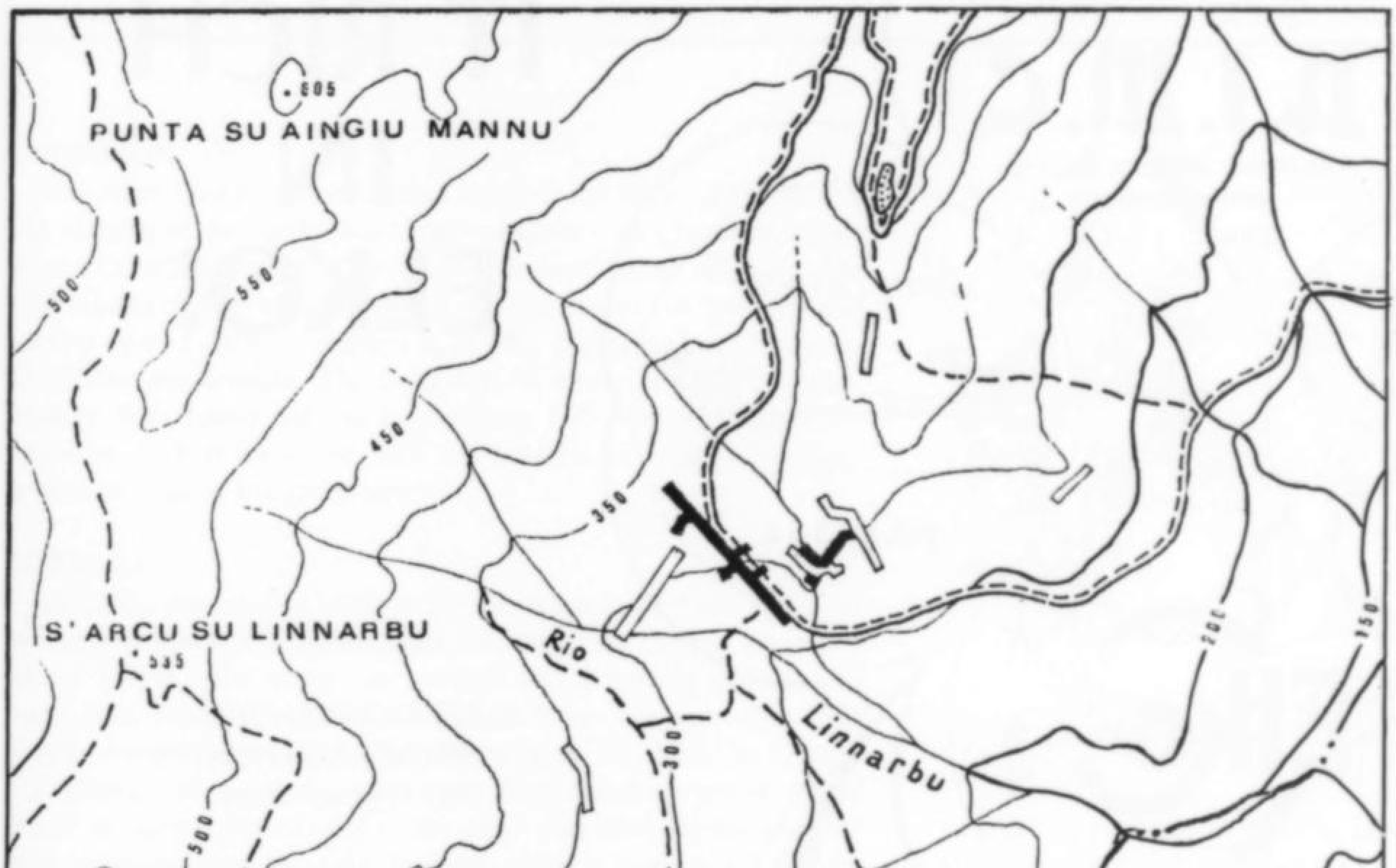


Figure 1. **Topographic and location map of the Arcu Su Linnarbu region with indication of the radioactive zones.**

yellow to olive-green, and the crystals are mostly transparent. It is also found as opaque, earthy masses with a pale yellow color. The crystals are strongly fluorescent in ultraviolet light.

Torbernite $Cu(UO_2)_2(PO_4)_2 \cdot 8\text{–}12H_2O$

Metatorbernite $Cu(UO_2)_2(PO_4)_2 \cdot 8H_2O$

Both torbernite and metatorbernite are present in the deposit. Torbernite occurs as thin, rectangular, transparent green plates to a few millimeters in size. Metatorbernite occurs as green opaque crystals. Neither mineral is fluorescent.

The above mentioned minerals are the main phases in the assemblage. The following minerals are also present but rarely found: uranophane $Ca(UO_2)_2Si_2O_7 \cdot 5H_2O$, carnotite $K_2(UO_2)_2(VO_4)_2 \cdot 3H_2O$, uraninite UO_2, and gummite (a mixture).

ACKNOWLEDGMENTS

The authors want to thank Mr. R. Meli for designing the maps and also the members of the Amici Mineralogici Fiorentini Club for their help during the field research in Sardinia in 1982.

REFERENCES

FRONDEL, C. (1954) Bassetite and Uranospathite. *Mineralogical Magazine,* **30**, 343–353.

GARAVELLI, C. L., MAZZI, F., and RINALDI, F. (1959) Minerali secondari di Uranio nella zona di San Leone (Cagliari). *C.N.R.N., St. Ric. Div. Geomin, Roma,* **II**, 275–298.

IPPOLITO, F., BAGGIO, P., LORENZONI, S., MITTEMPERGHER, M., and SILVESTRO, F. (1956) Studi sulla mineralizzazione di Uranio in Italia. *L'Industria Mineraria, Roma,* **VII**, Nr. 9, 627–634.

PIETRACAPRINA, A. (1963) I minerali d'Uranio in Sardegna. *Studi Sassaresi, Sassari,* sez. III, XI, fasc. 3, 587–650.

RAVAGNANI, D. (1974) *I giacimenti uraniferi italiani e i loro minerali.* Gruppo Mineralogico Lombardo, Milano.

VOCHTEN, R., DE GRAVE, E., and PELSMAEKERS, J. (1984) Mineralogical study of bassetite in relation to its oxidation. *American Mineralogist,* **69**, 967–978.

the Alice Glory Hole

Clear Creek County, Colorado

Timothy A. Hanson
1925 Juan Tabo, Suite B-261
Albuquerque, New Mexico 87112

W. B. (Rusty) Craft
P.O. Box 1269
Winnemucca, Nevada 89445

The Alice Glory Hole has for many years produced fine miniatures and cabinet specimens of pyrite and chalcopyrite. Recently, a spectacular occurrence of fine gold crystals was discovered there as well.

LOCATION

The Alice Glory Hole is located in the front range of the Rocky Mountains, in the north-central part of Clear Creek County, about 48 km (30 miles) west of Denver. It is situated in the Alice-Yankee Hill mining district at an elevation of 3170 meters (10,300 feet) 800 meters west of Alice, in Section 3, R74W, T3S, Empire, Colorado, 15-minute quadrangle. The mine can be easily reached by automobile from Idaho Springs by traveling I-70 west for 4 km (2½ miles) to the Fall River exit, then north 14 km (8½ miles) to Alice, and then west to the glory hole.

HISTORY

In 1883, the surface portion of the Alice stockwork was first worked by placer mining methods. Although the deposit was not a placer in the strict sense, the acreage was originally patented as such. The placer operations were short-lived, but rich. The 1883 yearly report submitted to the Director of the Mint in Denver (Burchard, 1884) stated a yellow dirt from the Alice placer would wash "an inch string of gold to the pan." Considerable native silver was recovered with the gold, and one piece as large as a hen's egg was recovered from the sluices.

Placer mining disclosed a mineralized porphyry bedrock of commercial grade. In 1886, a 10-stamp mill was erected which treated 15 to 30 tons of oxidized ore daily. This mill operated at a profit for three seasons, recovering free gold by amalgamation. Milling ceased when the sulfide mineralization increased at a shallow depth. An adit was then driven to tap the orebody at depth, and a jig mill built to treat the sulfides. This enterprise failed and, in the years that followed, other ventures trying to treat the unoxidized ore by concentration met with indifferent success.

From the early teens to thirties, the Alice property was idle. The increased price of gold in 1933 rekindled interest in the lower part of the supergene sulfide zone, which had been previously uneconomical to process. In March, 1936, the American Smelting and Refining Company assumed controlling interest in the operation. In June, 1936, operations were suspended while the milling capacity was increased from 70 to 200 tons per day. Milling was resumed in October, 1936. Two years later, mining and milling were suspended due to unfavorable economic conditions (Guiteras, 1939). The mine has been idle since that time. Total gold production for the Alice district is estimated to be more than 23,000 ounces.

Figure 1. **Pyrite and gold from the Alice Glory Hole. Illustration by Ann Grych.**

GEOLOGY

A Precambrian complex comprises the main rock mass of the Alice-Yankee Hill mining district. The chief rock of the district is schist of the Idaho Springs formation. It has a general northwesterly trend and a northeasterly dip, and occupies nearly all the area between Alice and Yankee Hill. On the east side of Yankee Hill, a

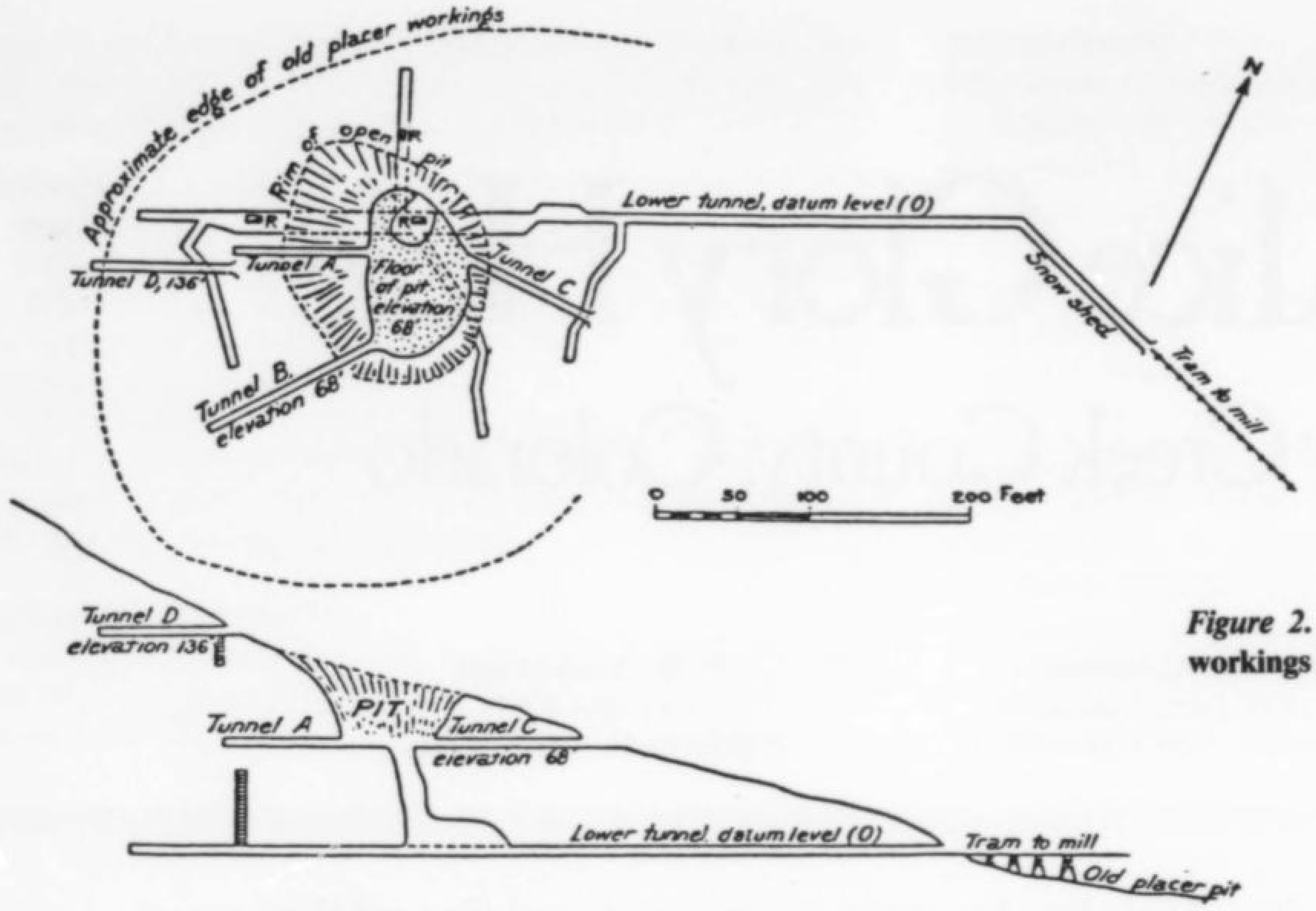


Figure 2. **Generalized map of the Alice mine workings circa 1916 (Bastin and Hill, 1917).**

north-south body of granite gneiss 400 to 800 meters wide crops out. It fingers into schist to the north, but joins larger masses of granite gneiss to the south and northeast. The Alice district is on a narrow northerly tongue of medium-grained Boulder Creek granite, one of several which interfinger with schist and granite gneiss and merge southward into a small stock. About 1200 meters southwest of the town of Alice, a porphyry stock containing the Alice orebody is exposed. All the Alice mine workings are contained within it (Lovering and Goddard, 1950).

Bastin and Hill wrote the best detailed description of the Alice property (1917); their work is summarized here.

The porphyry is of two varieties. The coarser and more abundant variety is a typical quartz monzonite porphyry, so crowded with feldspar phenocrysts as to appear granitic in texture to the naked eye. The rock is gray with a locally pink cast. It is intruded by dikes of a pale gray to nearly white alaskite porphyry which shows a sparse scattering of quartz phenocrysts in an aphanitic groundmass. It is probable that it came from the same magmatic source as the monzonite porphyry but at a slightly later time.

The important mineralization has been accomplished through the removal in solution of certain constituents of the porphyries and the deposition in their places of metallic sulfides (metasomatic replacement) which was initiated along a network of irregular fractures. Both porphyries are mineralized, the quartz monzonite more extensively than the alaskite. This was probably due to the coarser texture being more favorable to metasomatic replacement and its more extensive fracturing. The alteration of the porphyry is most intense along the crevices which formed the main channels of circulation and decreases gradually away from these channels, so that a rock composed wholly of sulfides and secondary silicate minerals grades gradually into little-altered porphyry.

Maximum alteration took place where two or more fractures intersected. Here "nests" of ore minerals up to 13 cm across were developed. Less commonly cavities occur at the intersections and are partly filled with ore minerals, some cavities reach 30 cm in diameter. Most vugs were probably formed by the solvent action of solutions, but others represent open spaces formed by movement between the porphyry fragments and are only partly filled with ore.

The metallic constituents of the nests and vugs of ore are predominant pyrite and subordinate chalcopyrite. Quartz and siderite are the principal gangue minerals. Intimately associated with the chalcopyrite in some places are sulfides of bismuth, some very rich in silver.

MINE WORKINGS

The Alice orebody has been developed by an open pit and irregular underground workings. Most of the underground workings are inaccessible, especially below the pit floor since they are flooded or caved. The glory hole is accessible by foot from the eastern edge of the pit. Extreme caution should be used around the pit due to the danger of falling rock.

MINERALS

Those minerals occurring at Alice in specimens of interest to collectors are discussed below:

Barite $BaSO_4$

Barite is rare, but when found it occurs with iron oxide-coated siderite and underlying quartz. It forms stacked platelets along the c-axis to 3 cm, with the individual crystals rarely exceeding 7 mm. The crystals are semitransparent to white with a faint pink cast.

Bismuth Sulfosalts

More work needs to be done identifying the bismuth sulfosalts occurring at Alice. Preliminary results from backscattered electron images (BSE), microprobe analysis, and powder diffraction data indicate that benjaminite, emplectite, heyrovskyite and matildite are present. Other bismuth sulfosalts are also present but have not been positively identified. Identification of the minerals has been hampered due to their intimately intergrown character.

Chalcopyrite $CuFeS_2$

Chalcopyrite is one of the most abundant sulfide minerals at Alice, rivaled only by pyrite. It forms euhedral crystals commonly to 5 cm in the sulfide nests. Larger masses occur as fillings. Associated primary minerals include the bismuth sulfosalts, gold, pyrite and quartz. Secondary minerals include bornite, chalcanthite, chalcocite, covellite and siderite. Bornite and covellite frequently form colorful coatings on faces and fractures of chalcopyrite.

Figure 3. **Tetrahexahedral gold crystal on pyrite. Gold measures 2 mm. Steve Hanson and Tim Hanson photograph.**

Gold Au

The occurrence of finely crystallized gold on pyrite, chalcopyrite, bismuth sulfosalts or quartz is rare. The crystal habits that have been observed most commonly are the tetrahexahedron and modified octahedrons. The most spectacular specimen we have seen consists of three tetrahexahedrons ranging in size from 2 to 3 mm on a pyrite cube smaller than 1.5 cm. Blob, crystalline wire, leaf and sponge gold have also been recovered. The highest concentration of gold appears to be with the bismuth sulfosalts while the largest and best crystals appear on pyrite.

Pyrite FeS_2

Pyrite is the most renowned of the minerals collected at Alice. Euhedral crystals commonly occur nestled in quartz, as floaters, in clay in vugs, or as a chalcopyrite-pyrite-siderite conglomerate. Excellent examples of "stepped" and "eyed" crystals are obtainable (see figures). An individual crystal of the stepped variety in excess of 9 cm across was recovered, but most crystals rarely exceed 4 cm. Pyrite at Alice has a distinctive silver color, rather than brassy or yellow.

Quartz SiO_2

Quartz is the most abundant mineral in the mine. Vugs and open fractures in the orebody are commonly lined with euhedral quartz crystals to 4 cm in size. Inclusions of chalcopyrite and pyrite are fairly common. Sceptered crystals are scarce and very rarely found on matrix. Some scepters have an amethystine tint.

Figure 4. **Wire gold 2.5 mm long. Tim Hanson photograph.**

Siderite $FeCO_3$

Siderite is the second most abundant gangue mineral in the glory hole. It is commonly found with chalcopyrite, pyrite and quartz. When found it always possesses an iron oxide coating. Crystals average 2 cm and very rarely exceed 4 cm. Intergrown crystals form rhombohedrons displaying slightly to extremely curved faces. Individuals usually cluster randomly but occasionally do form rosettes.

ACKNOWLEDGMENTS

We thank the following people for the time, effort and information they supplied, without which this paper would not have been written: Bruce Strope, for his work on microprobe analysis and SEM and BSE photographs; Ann Grych, for her illustrations; and Steve Hanson, for helping out with the mineral photography. Jim Mabon and Bob North supplied powder X-ray diffraction information on the bismuth sulfosalts. The Al Mosch family supplied historical data.

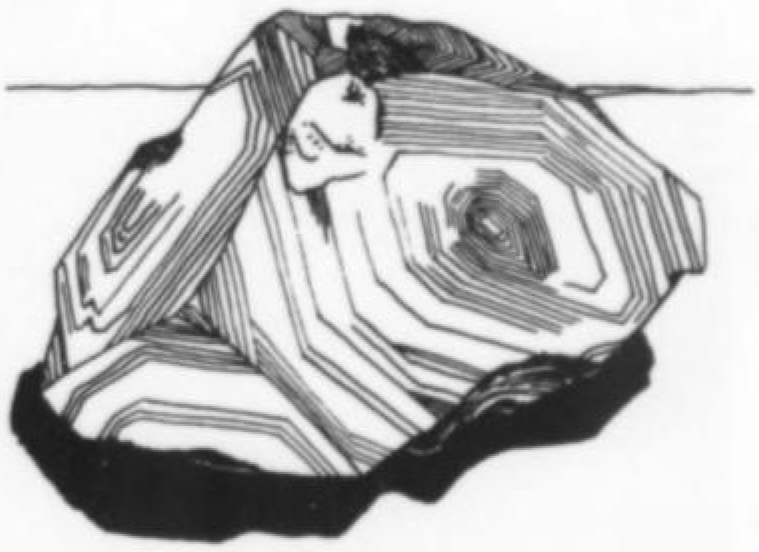


Figure 5. **"Eyed" pyrite crystal, artist's rendition. Ann Grych illustration.**

REFERENCES

BASTIN, E. S., and HILL, J. M. (1917) Economic geology of Gilpin County and adjacent parts of Clear Creek and Boulder Counties, Colorado. *U.S. Geological Survey Professional Paper* **94**, 98, 120, 319, 323–326.

BURCHARD, H. D. (1884) *Report of the Director of the Mint Upon the Production of Precious Metals in the United States During the Calendar Year 1883,* 280, Washington, DC.

GUITERAS, J. R. (1939) Mining and milling methods and costs at the Alice Unit of the American Smelting and Refining Company, Alice, Colorado, *USBM Information Circular* **7058**.

LOVERING, T. S., and GODDARD, E. N. (1950) Geology and ore deposits of the Front Range, Colorado. *U.S. Geological Survey Professional Paper* **223**, 164–165.

Colorado Dealers

* *by appointment only, except as noted*

M. P. Abel Minerals
P.O. Box 440356
Aurora, CO 80044
303-695-7600
Superb Worldwide Specimens

Collector's Edge
Bryan & Kathryn Lees
402 Gladiola Street
Golden, CO 80401
303-278-9724
We Buy Collections

Collector's Stope
Jim & Patti McGlasson
7387 S. Flower Street
Littleton, CO 80123
303-972-0376
Fine Minerals, Species, Micromounts

Crystal-Linn International
Martin Zinn
P.O. Box 2433
Evergreen, CO 80439
303-670-1960
Fine Minerals, Tourmaline

Eldorado Enterprises
Don Belsher
P.O. Box 219
Eldorado Springs, CO 80025
303-494-7785
Fine Minerals

Geology Museum & Shop
Colorado School of Mines
Golden, GO 80401
303-273-3823
Mon-Sat 9-4, Sun 1-4

Golden Minerals
Don E. Knowles
13030 West 6th Place
Golden, CO 80401
303-233-4188
Largest Stock in Colorado

L & T Creations
Tag & Lee McKinney
6780 S. Logan
Littleton, CO 80122
303-794-7803
Colorado-Utah Minerals

Mineral Treasures
Dee Belsher
P.O. Box 1204
Broomfield, CO 80020
303-466-4128
Old Collections

*

Colorado Mineral & Fossil Show
September 16-19, 1987
Holiday Inn-North

Two Great Shows to See!

Mountain Minerals International
George & Cindy Witters, Dudley Blauwet
P.O. Box 302
Louisville, CO 80027
303-665-7366
Specializing in Asian Minerals

Resource Enterprises
R. Theodore Hurr
P.O. Box 115
Wheat Ridge, CO 80033
303-421-3893

Tavernier
3355 S. Wadsworth, G123
Lakewood, CO 80227
303-985-9646
Fine Minerals & Gems

Williams Minerals
Keith & Brenda Williams
P.O. Box 1599
Idaho Springs, CO 80452
303-567-4647
Colorado Minerals & Mineral Mounts

Worldwide Resources
Dennis O. Belsher
P.O. Box 636
Golden, CO 80402
303-494-7785
South American Minerals

Columbine Mineral Shop
Benjy & Liz Kuehling
633 Main Street
Ouray, CO 81427
303-325-4345
Open 7 days, May 1-Oct. 31
9 a.m. to 9 p.m.
Off-season by Appointment
Fine Minerals for Collectors

Mike Madson Minerals
3201 Snowberry Court
Grand Junction, CO 81506
303-243-2234
Wholesale Minerals

The Rock Hut
Gus Seppi, Jim & Irene Witner
706 Harrison Avenue
Leadville, CO 80461
303-486-2313
Specimens, Unique Gifts, Jewelry

THE MUSEUM

OF THE GEOLOGICAL SURVEY OF SOUTH AFRICA

Ann de Grys, Martin Kohler and **Linda Minnaar**
Geological Survey
Private Bag X112
Pretoria 0001, South Africa

•

The mineral wealth of the Republic of South Africa and neighboring Namibia are on exhibit at the Museum of the Geological Survey in Pretoria. Visitors are welcome.

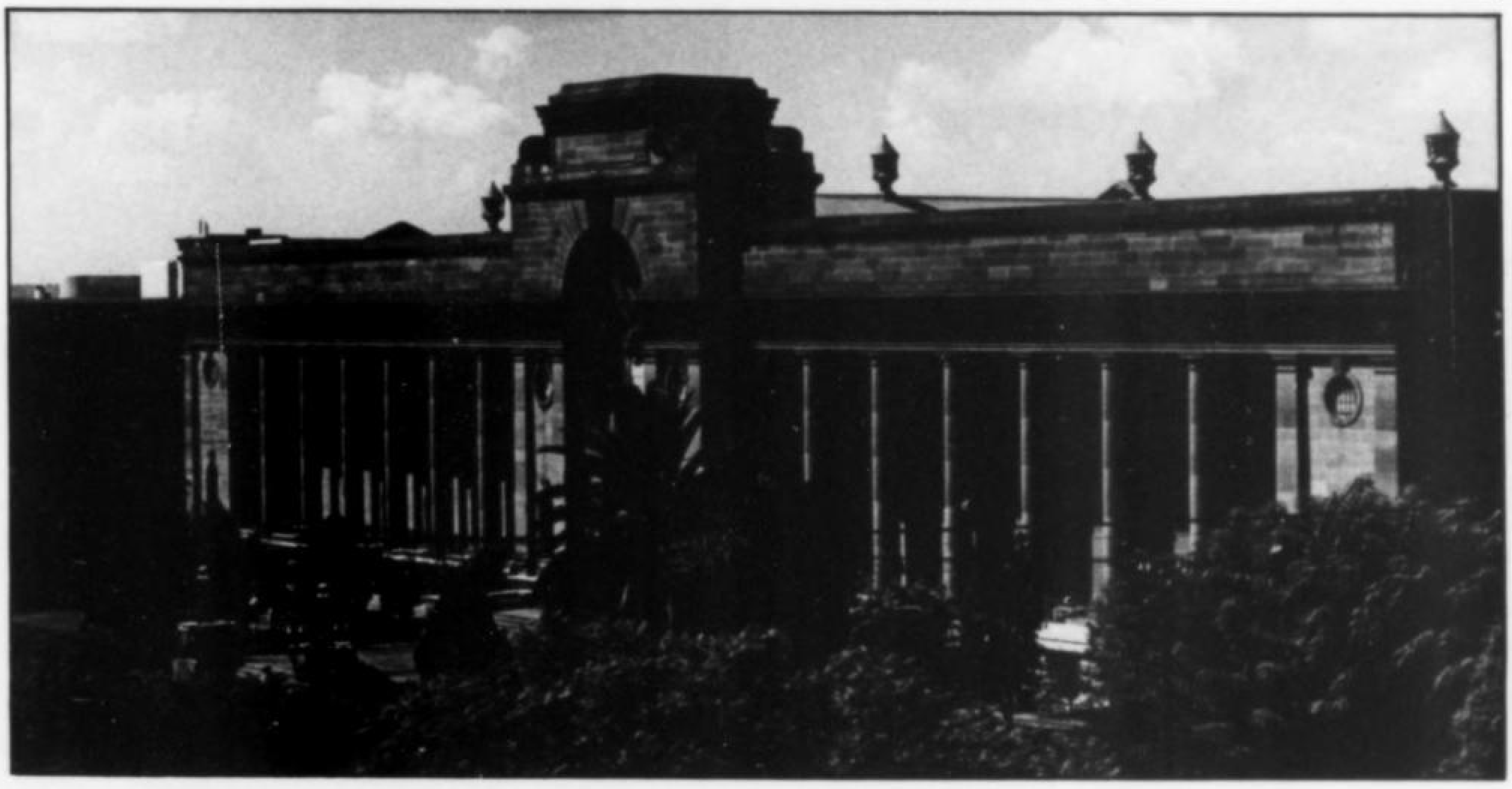


***Figure 1. (above)* A view of the Transvaal Museum in which the Museum of the Geological Survey is located.**

HISTORY

The mineral collection of the Geological Survey of South Africa was started by Dr. G. A. F. Molengraaff, a Dutch geologist, in 1897. Molengraaff had worked for a time in the East Indies before accepting an appointment as State Geologist under President Kruger of the Zuid-Afrikaansche Republiek (Transvaal) in the 1890s. His plan was to build a representative collection of rocks and minerals from southern African locations and also from other parts of the world.

The need for a reference collection grew as gold and other minerals began to be discovered in the Transvaal. During the 1860s and 70s gold had been found near Francistown in what is now Botswana and northeastern Transvaal. Then, in 1886, an outcrop of gold was discovered in Johannesburg, in the heart of what was eventually to prove the richest goldfield in the world. Excited prospectors came to the museum to see typical ore samples and compare their own specimens. There was also a laboratory where assays could be obtained.

The Geological Survey of South Africa was formed in 1912 by a

***Figure 2.* Sturmanite, length of longest crystal, about 15 cm. Locality, N'Chwaning mine, near Kuruman, South Africa. (All photographs taken by M. Köhler and L. Minnaar.)**

***Figure 3.* Boltwoodite from Arandis, Namibia. Length of specimen, 11 cm.**

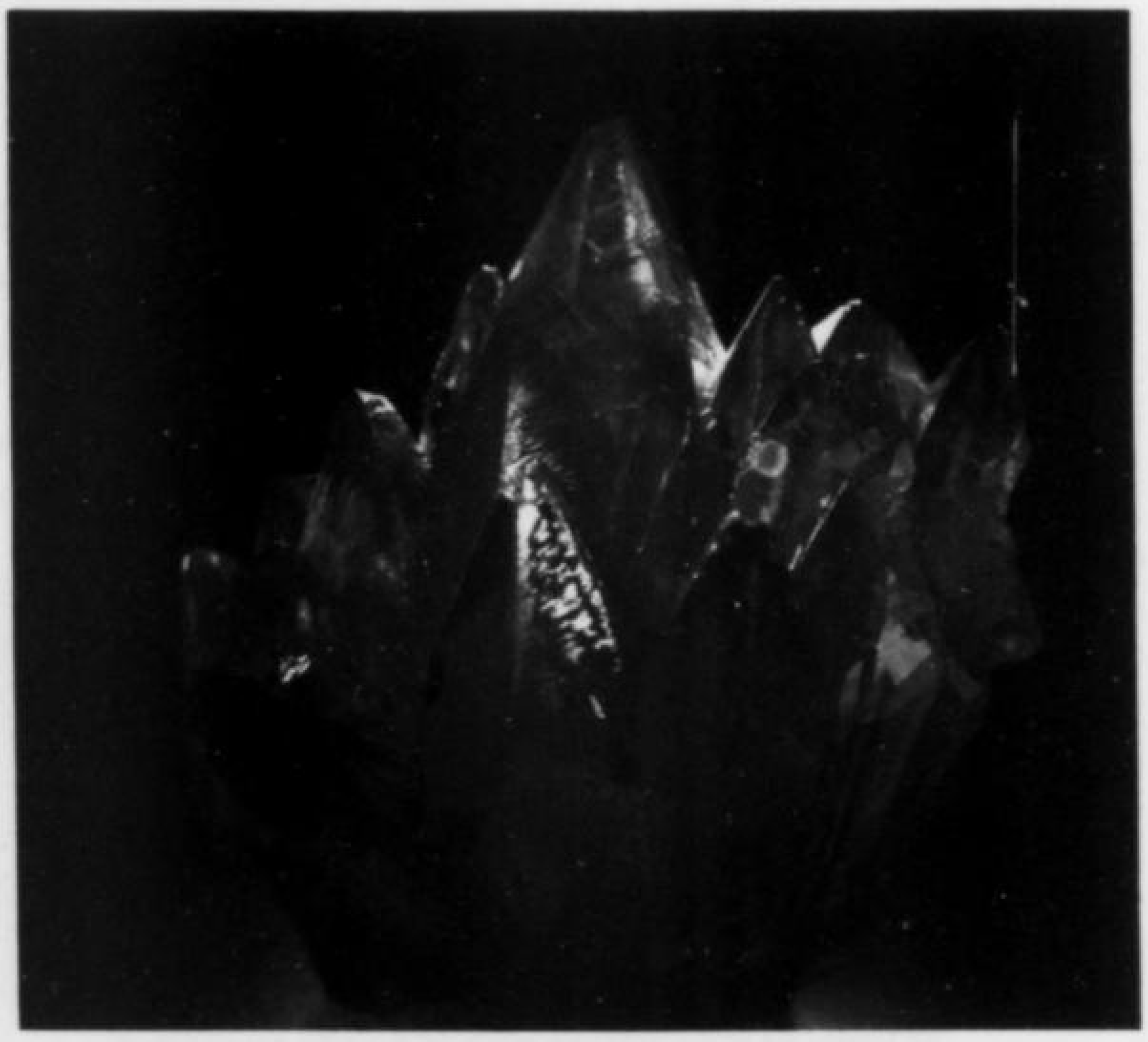


***Figure 4.* Rhodochrosite group, about 3 cm tall, from the N'Chwaning mine near Kuruman, South Africa.**

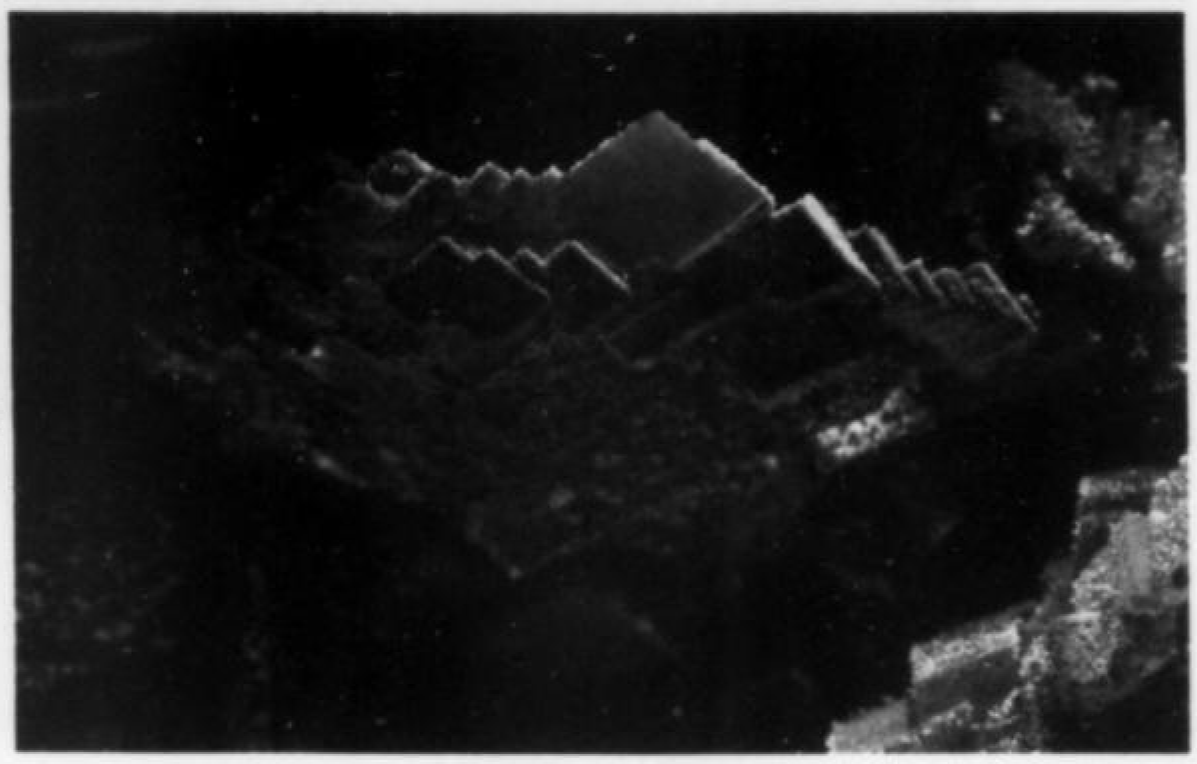


***Figure 5.* Calcite crystal group, about 1 cm across, from Tsumeb, Namibia.**

merger of the geological surveys of the Boer republics (Transvaal and Orange Free State) with the surveys of the British colonies of Natal and the Cape of Good Hope. Exploration continued apace during the 1920s and 30s, and rich deposits of platinum, chromium, vanadium, fluorite, tin, manganese, iron, antimony, lithium, asbestos, mica and coal were located before the outbreak of World War II.

During the early years of the survey, geologists brought back many samples from the field, and these formed the basis of the museum's collection of local minerals. Foreign specimens were acquired by purchase, and an important early addition to the museum's collection was a suite of minerals supplied by the German firm of KS Mineralien Niederlage zu Freiberg around 1904. Among these were many specimens from classic European localities.

For many years, when the collection was being extensively util-

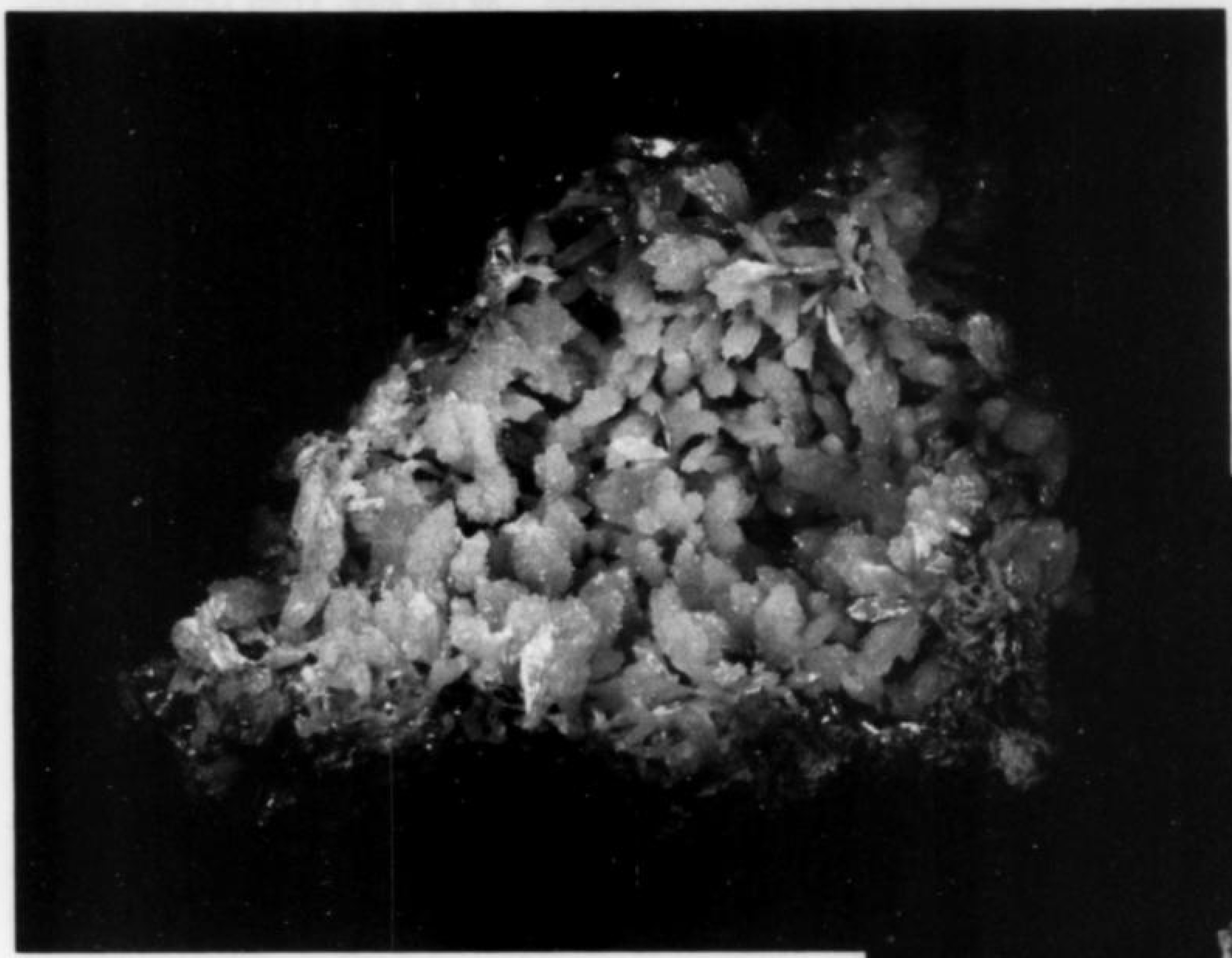


Figure 6. Smithsonite, length of specimen 8 cm. Location, Tsumeb, Namibia.

Figure 7. Mimetite, length of specimen 7 cm. Locality, Tsumeb, Namibia.

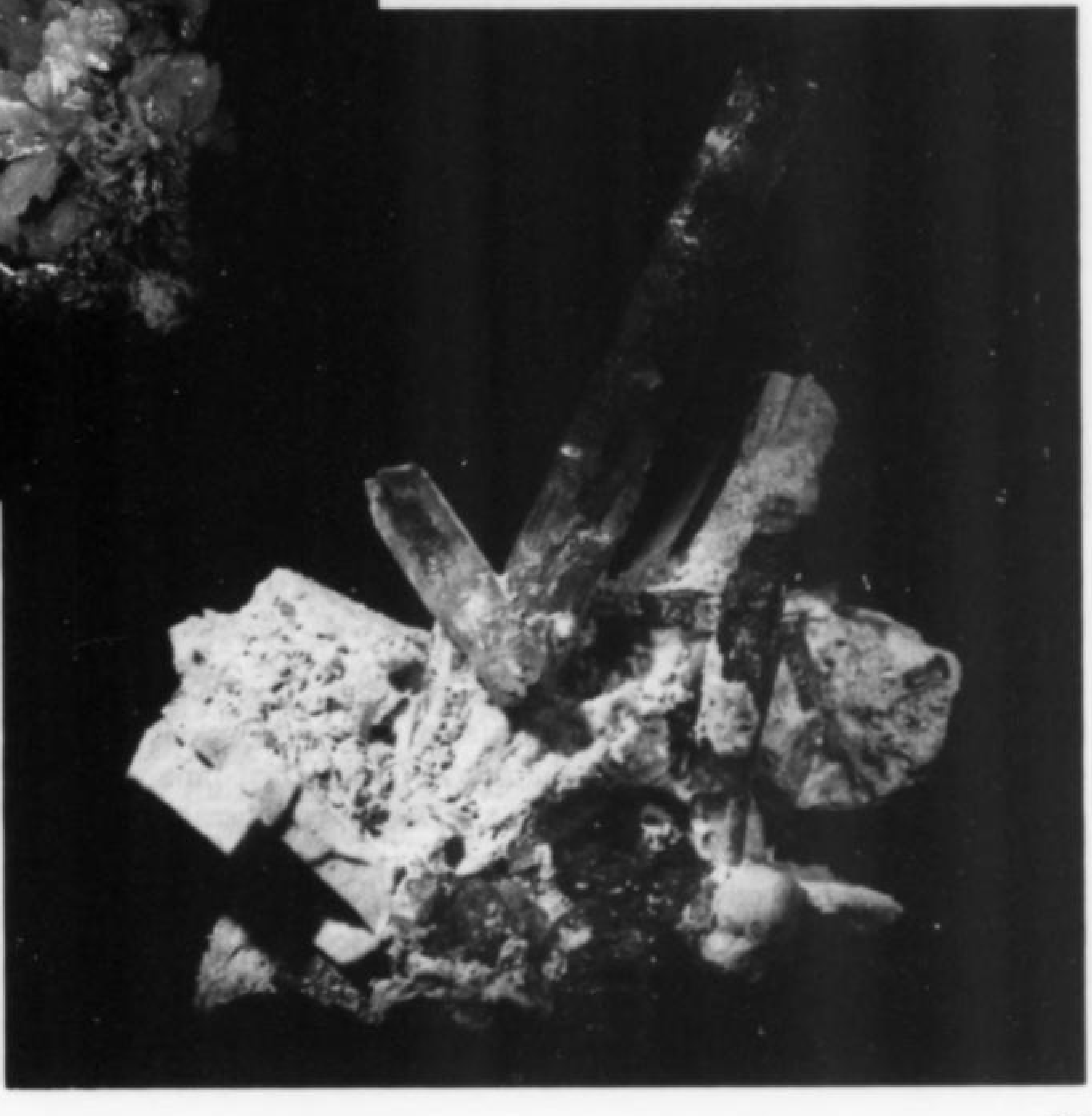
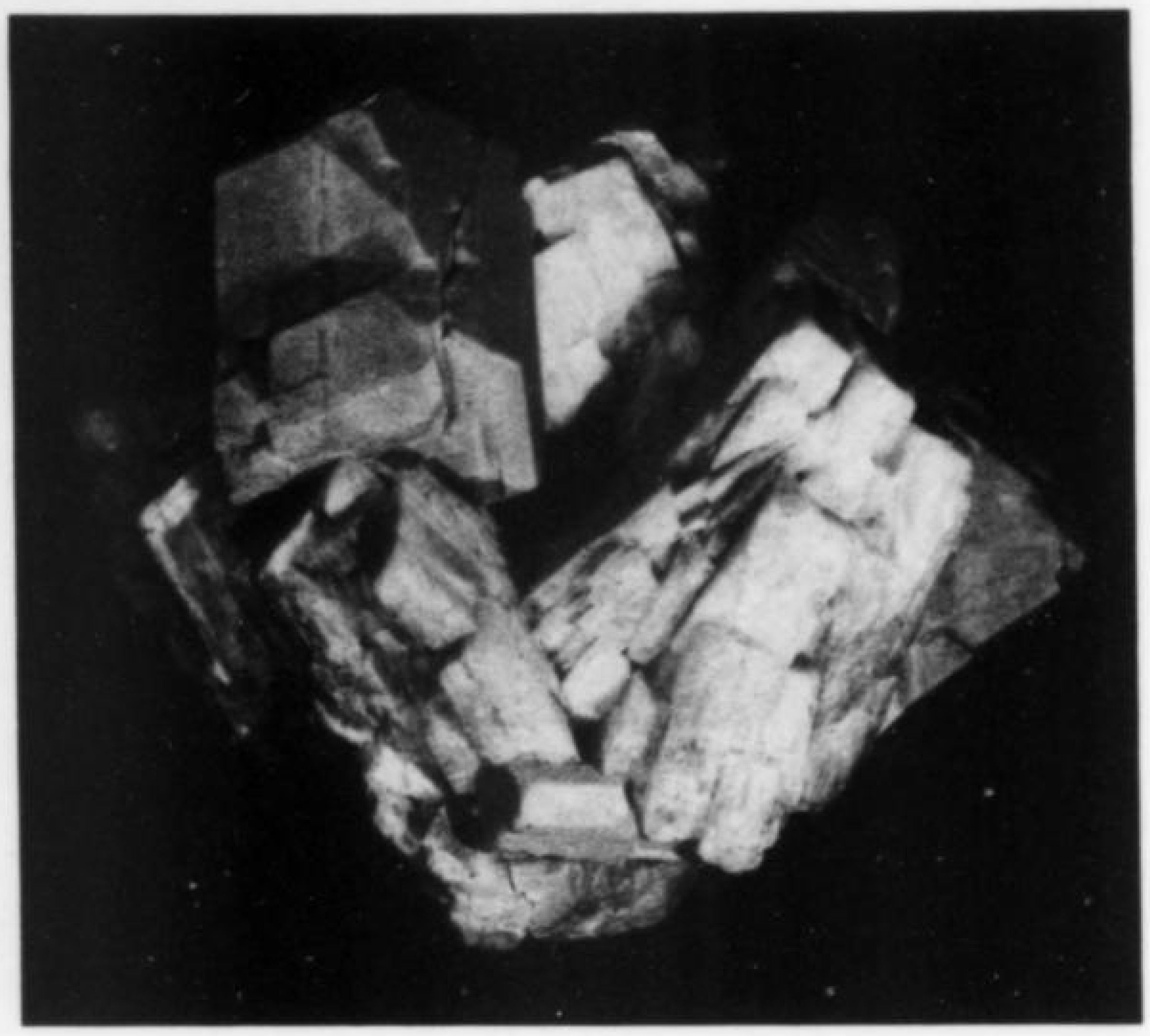


Figure 8. Jeremejevite, length of largest crystal 3.7 cm. Swakopmund, Namibia.

Figure 9. **Gray corundum crystal, 59 cm long. From Letaba district, Transvaal.**

Figure 10. **Orthoclase crystal, length 4 cm. Locality, Messum, Namibia.**



ized by mining men, other visitors were admitted only by appointment. But in 1920 the museum was transferred to more spacious quarters, and was then opened to the public for the first time. Many people came to see the collections, and the museum became popular as a venue for school outings.

The museum is now relatively well satisfied with its collection of representative ore samples from local deposits. Consequently there has been a gradual shift in policy to focus on the acquisition of display-quality mineral specimens. Most of these are now obtained by purchase from dealers.

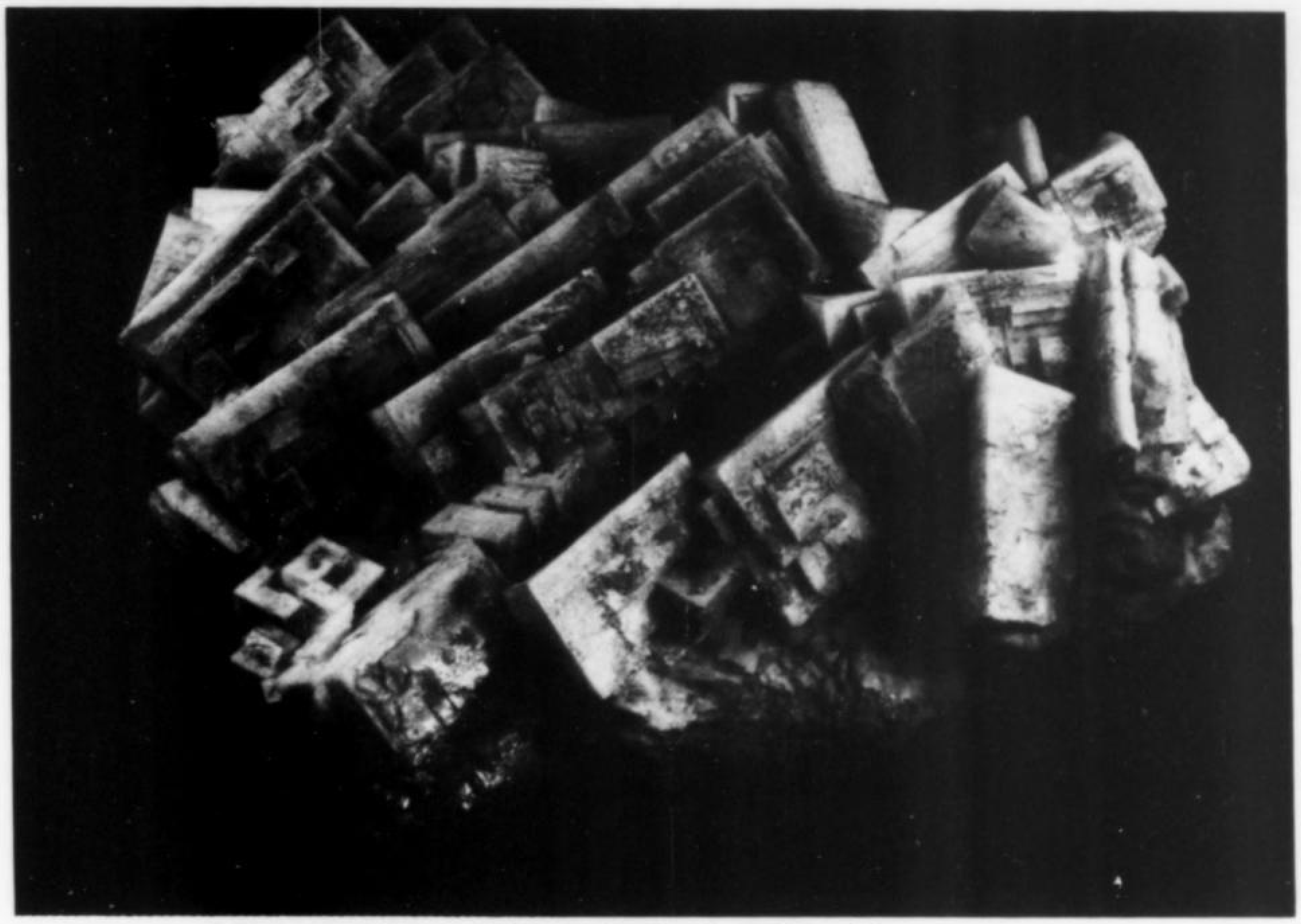


Figure 11. **Halite, length of specimen 25 cm. Locality, Mkarikari, Botswana.**

SPECIMENS ON DISPLAY

The Museum of the Geological Survey is currently housed in a building which also accommodates the Transvaal Natural History Museum. In the geological section there are three galleries. The first contains the systematic mineralogy collection, gemstones and meteorites. The second is devoted to economic minerals, and the third to South African fossils and stratigraphy.

Prominent among the meteorites are two large pieces (200 and 410 kg) of the Gibeon, Namibia, nickel-iron meteorite. Nearby is a fragment of lunar rock donated by NASA.

Diamonds are big business in South Africa, and the museum's diamond exhibit is understandably among the most popular with visitors. On exhibit are uncut diamond crystals, loose and imbedded in kimberlite and conglomerate. Models of famous diamonds include the Cullinan (largest diamond ever found), shown in its original form, as cleaved sections and as faceted stones. The Cullinan, found at the Premier mine in 1905, yielded many priceless gems, the largest of which was donated by the South African government to Edward VII of Great Britain.

Other noteworthy gemstones in the collection include emerald crystals in schist (from Gravelotte, Transvaal), lovely blue jeremejevite crystals (from near Swakopmund, Namibia), cuprite (from Onganja, Namibia), blocky blue topaz crystals (from Klein Spitzkopje, Namibia), purple sugilite (from Wessels mine, northwestern Cape Province), and gemmy green elbaite (from Brazil).

In the systematic exhibit minerals are arranged according to the system of Strunz. Significant specimens include an octahedral fluorite crystal measuring 21 cm on edge (from the Zaaiplaats tin mine, Transvaal), a magnificent 70-cm group of pink rhodochrosite crystals on manganese oxide matrix (from Hotazel, northwest Cape Province), amethyst crystal geodes (from Namibia), and large quartz and calcite crystals (from the Nababeep West mine, northwest Cape Province). There is, of course, a collection of Tsumeb minerals including ten azurite pseudomorphs collected in the 1930s, a large (40 x 50 cm) group of white calcite crystals sprinkled with small, green dioptase crystals, a large specimen of acicular malachite, and a 14 x 26-cm geode lined with mimetite crystals. Many other Tsumeb species are on exhibit including smithsonite, cerussite, cuprian adamite and sulfide minerals, to mention only a few.

In the economic gallery are displayed a wide range of South African ore samples representing the most important deposits of gold, uranium, platinum, chromium, mica, asbestos, gypsum, tin and antimony. The gold exhibit is in two parts, dealing separately with the Barberton and Witwatersrand goldfields. Visible gold in veins and flecks in rock are shown, but most of the gold recovered in South African mines is too finely divided to be visible (averaging 6 to 10 grams per ton of rock). Platinum is also only rarely visible in its ores, but the museum does have specimens showing tiny platinum specks and crystals of sperrylite ($PtAs_2$) from the Merensky Reef of the Bushveld Complex. A large sperrylite crystal, formerly a part of the collection, was stolen from its cabinet in 1970.

Perhaps among the least attractive mineral specimens in the museum is the largest known corundum crystal. Gray and crudely formed, it weighs in at 151 kg (333 pounds!). It was found in northeastern Transvaal sometime before 1918. This enormous and markedly unesthetic crystal is nevertheless remarkable and interesting in its own way, and serves to demonstrate that the purpose of the Museum of the Geological Survey is not only to show beautiful specimens but to give an insight into the exceptional mineral wealth of South Africa.

The museum is open to all visitors; roughly 100,000 people pass through the galleries each year. Hours are 9 to 5 Mondays through Saturdays and 11 to 5 on Sundays. The museum is located on Paul Kruger Street at the corner of Visagie Street. Curator of Minerals is Ann de Grys. ⊠

California Dealers

Bourget Bros.
1636 11th Street
Santa Monica, California 90404
Tel: (213) 450-6556

California Rock and Mineral Co.
P.O. Box 86
Brea, California 92622
Tel: (714) 990-5073

Frazier's Minerals and Lapidary
Si and Ann Frazier
Suite 306, 631 Fairmount Ave.
El Cerrito, California 94530
Tel: (415) 848-9541

Galas Minerals
Chris and Agatha Galas
1419 N. Commons Road
Turlock, California 95380
Tel: (209) 632-6222

Cal Graeber
P.O. Box 47
Fallbrook, California 92028
Tel: (619) 723-9292

Hamel Minerals
6451 West 84th Place
Los Angeles, California 90045
Tel: (213) 645-1175

Ikon Mining & Exploration
Jim Walker & Mary Fong/Walker
2030 Shipway Avenue
Long Beach, California 90815
Tel: (213) 430-0080

Jewel Tunnel Imports
Rock H. Currier
1212 S. Mayflower Avenue
Arcadia, California 91006
Tel: (818) 357-6338
Wholesale Only

Kassionas
John and Dolores Kassionas
P.O. Box 578
Alviso, California 95002
Tel: (408) 263-7784

Kristalle
332 Forest Avenue, #8
Laguna Beach, California 92651
Tel: (714) 494-7695

A. L. McGuinness
Al McGuinness
4305 Camden Avenue
San Mateo, California 94403
Tel: (415) 345-2068

James Minette
25918 Cherryhill
Boron, California 93516
Tel: (619) 762-5308

Oxcart Minerals
Hollis & Priscilla Oxley
989 Leo Drive
San Jose, California 95129
Tel: (408) 255-1495

Nature's Treasures
P.O. Box 10136
Torrance, California 90505
Tel: (213) 373-3601

Pala International & The Collector
912 So. Live Oak Park Road
Fallbrook, California 92028
Tel: (619) 728-9121
US Wats 1-(800)-854-1598

Pathfinder Minerals
Mary Jean & Larry Cull
41942 Via San Gabriel
Fremont, California 94538
Tel: (415) 657-5174

Mark and Jeanette Rogers
P.O. Box 1093
Yucaipa, California 92399
Tel: (714) 797-8034

Schneider's
13021 Poway Road
Poway, California 92064
Tel: (619) 748-3719

Seibel Minerals
20308 Sears Drive
P.O. Box 95
Tehachapi, California 93561
Tel: (805) 822-5437

Silverhorn
Mike Ridding
1155 Coast Village Road
Montecito, California 93108
Tel: (805) 969-0442

Weber's Minerals
605 San Dieguito Drive
Encinitas, California 92024
Tel: (619) 436-4350

Whatever you're looking for in the way of fine display specimens, rare species material, moderately priced specimens for beginning and intermediate collectors, bulk material for research and study, wholesale or retail, you'll find it in California. Plan to stop in when you're in our area. Many of us do shows, so it's always best to call first.

Garnet Hill
White Pine County
NEVADA

Curtis L. Hollabaugh and Victoria L. Purcell
Department of Geology
West Georgia College
Carrollton, Georgia 30117

Garnet Hill has been a popular source of attractive, sometimes gemmy, garnets for over 80 years. Well-formed crystals of almandine-spessartine can still be collected at the locality.

INTRODUCTION

Beautiful, trapezohedral almandine-spessartine garnets, some of gem quality, occur in vesicles in rhyolite at Garnet Hill in east-central Nevada. The occurrence is located in Sections 1 and 2, northern third of Section 12 and the NE¼ of the NE¼ of Section 11, T16N, R62E, in White Pine County, Nevada. This area is shown on the Ruth 7½-minute quadrangle. The collecting area is easily accessible from U.S. Highway 50, 6.5 km (4 miles) northwest of Ely. The land is administered by the Bureau of Land Management and is open year round for collectors. Although the locality has been collected for over 80 years, with hard work a dedicated collector can still obtain some fine specimens.

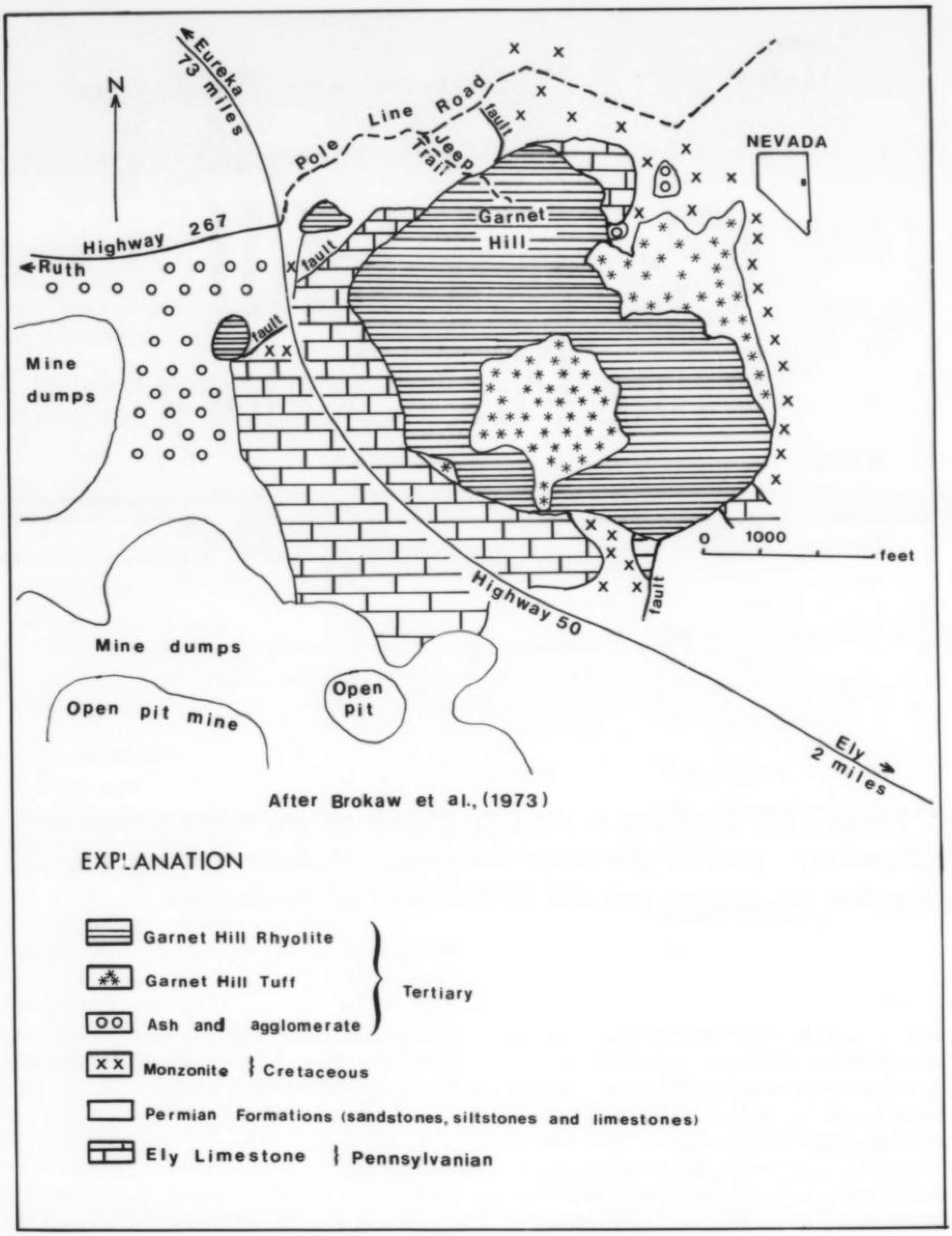
The garnet fields at Garnet Hill are accessible by dirt roads running north from U.S. Highway 50; a four-wheel-drive vehicle may be necessary to reach the top of the hill where the best collecting is (NE¼ of SW¼ of NW¼ of Section 1). The rhyolite mass is roughly circular, approximately 2 km across. Other collecting sites scattered across the flow are accessible by jeep trails. Elevations at Garnet Hill vary from 2068 meters (6720 feet) along Highway 50 to 2277 meters (7400 feet) at the hilltop. The climate is semiarid with summer temperatures in the 90s (F). Rock outcrops comprise less than 20% of the area.

The Ely area is best known for the large Ruth porphyry copper deposit located in the Robinson district south of Garnet Hill. Copper, zinc and molybdenum were first mined there in 1915. The Robinson district, located west of Ely, is a west-trending mineralized zone 13 km long and 300 to 460 meters wide. From 1915 to 1961, 19.1 million tons of 1.66% copper ore was removed from underground mines. Open-pit mining from 1968 to 1975 yielded 31.5 million tons of 0.72% copper ore. The mine has been closed since June, 1980 (Westra, 1982).

GEOLOGY

Geology in the neighborhood of the Robinson district is very complex. A miogeosynclinal sedimentary sequence ranging in age from Devonian to Permian was folded into a northwest-trending anticline. The best known of these sedimentary rocks are the Pennsylvanian Ely limestone and the Permian Kaibab limestone. Sandstones and shales also form part of the sequence. The anticline is locally overturned with its upper limb cut by at least six bedding plane thrust faults. The entire district is fragmented by early mid-Tertiary normal faults. During Early Cretaceous times the anticline was intruded by monzonite and quartz monzonite porphyry stocks, dikes and sills. The rocks are light-gray to light-brownish-gray.

Minerals present include potassium feldspar (phenocrysts 1 to 2.5 cm long), plagioclase, hornblende and quartz; accessory minerals are augite, biotite, magnetite, titanite, apatite and zircon. Alteration and mineralization affected both the sedimentary and the igneous rocks. The Ely limestone shows the most intense hydrothermal alteration. The limestone was recrystallized and transformed by the addition of silicates, oxides and sulfides. The first minerals to form were tremolite needles followed by garnet, diopside, idocrase, chlorite and epidote. Later hematite, magnetite, pyrite and chalcopyrite were added to the limestone immediately adjacent to



After Brokaw et al., (1973)

Figure 1. **Generalized geologic map of the Garnet Hill area.**

the monzonite. The monzonites were also partly altered; hornblende was altered to biotite and plagioclase altered to clays. Some of the clays were altered to sericite, and secondary quartz was added to the monzonites. Primary ore mineralization consists of pyrite, chalcopyrite, minor molybdenite and traces of bornite. Above the water table these minerals were leached of their copper. The copper was redeposited as chalcocite below the water table (Ridge, 1972; Brokaw *et al.,* 1973; Westra, 1982).

The rhyolite at Garnet Hill is flow banded, gray and pink in color with rare phenocrysts of smoky quartz, potassium feldspar, plagioclase, biotite and secondary calcite and stilbite. Lithophysae (hollow, bubble-like structures composed of concentric shells of finely crystalline quartz and feldspar) and vesicles (small cavities formed by the expansion of a bubble of gas during solidification of the rock) are commonly lined with drusy quartz and occasional singles or groups of almandine-spessartine garnet.

The Garnet Hill rhyolite is the youngest igneous rock in the Ely district and is probably Pliocene in age (Pabst, 1938). The rhyolite is underlain by a crystal-lithic tuff with lenses of green and black obsidian. The tuff is well exposed at the south-central and northeast front or edge of the rhyolite flow. Other rock units in contact with the rhyolite are a bed of ash and agglomerate exposed at the base of the crystal-lithic tuff and monzonite porphyry dikes and sills to the north, east and southeast of the flow. The Elijah mine is located in this monzonite and many pits dug in the south and east portions of the rhyolite were dug in search of copper mineralization in the underlying monzonite. The southern contact is with the Paleozoic Ely limestone. The limestone forms cliffs along Highway 50 that block any view of the rhyolite. Other Paleozoic units surrounding the Garnet Hill rhyolite are the Riepe Spring limestone, the Rib Hill sandstone and the Arcturus formation (Brokaw *et al.,* 1973).

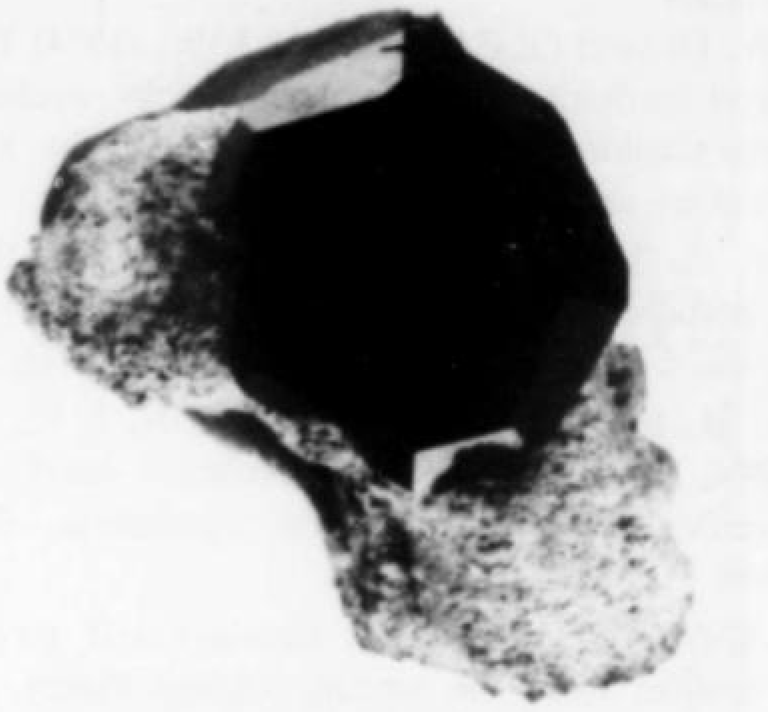


Figure 2. **Garnet crystal on rhyolite matrix; the crystal is approximately 1.5 cm across and deep red in color. All specimens from the collection of Curtis Hollabaugh. All photographs by J. Waters.**

Figure 3. **Garnet crystals in lithophysae; the largest crystal is approximately 8 mm across and deep red in color.**

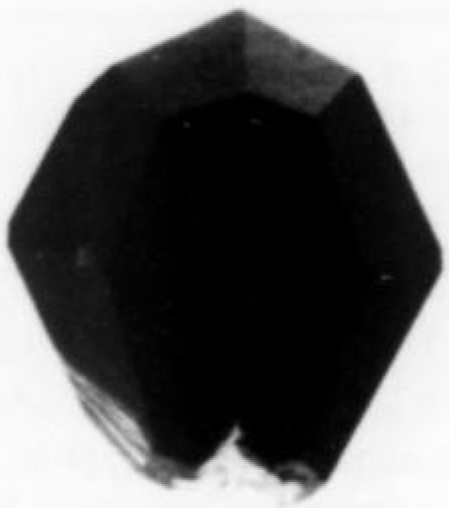


Figure 4. **Garnet crystal measuring 12 by 14 mm, and deep red in color.**

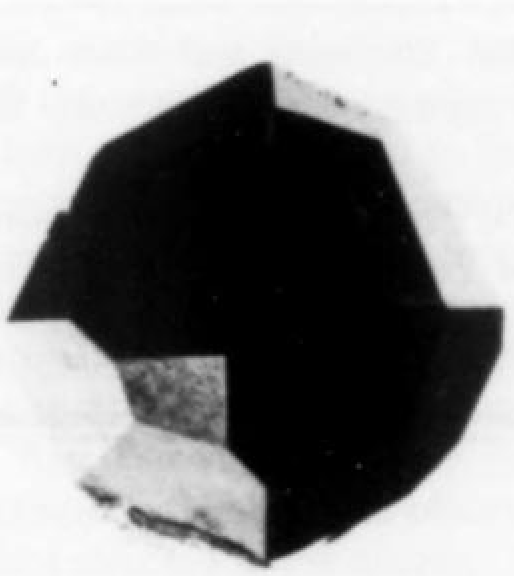


Figure 5. **Garnet crystal measuring 13 mm, and deep red in color.**

On the geologic map of the Ruth Quadrangle, Brokaw *et al.* (1973) have designated a unit of "younger rhyolite." We have separated this unit into the Garnet Hill rhyolite and the underlying crystal-lithic tuff for three reasons. First, the tuff and rhyolite appear to represent separate eruptions from the same magma chamber. The underlying crystal-lithic tuff represents the initial stage of emplacement. Explosive eruptions laid down this unit as pyroclastic breccia and tuff. Following this the Garnet Hill rhyolite was formed as a flow or dome. Second, the tuff and rhyolite are easily distinguished in the field as distinct, mappable units. And third (of most concern to mineral collectors), the rhyolite contains all the vesicles and lithophysae containing garnets.

Chemically the Garnet Hill rhyolite is an alkali rhyolite with an average of 74.38% SiO_2, 0.05% TiO_2, 13.23% Al_2O_3, 1.65% Fe_2O_3, 0.06% MnO, 0.15% MgO, 1.08% CaO, 3.56% Na_2O and 4.77% K_2O (average of four atomic absorption analyses done by Richard Sanders).

MINERALOGY

The garnet crystals form trapezohedrons averaging 4 mm across, although crystals as large as 15 mm have been collected by the authors. Most garnets occur as single crystals attached to rhyolite. The garnets usually occur in lithophysae or vesicles lined with drusy quartz, but may also be found as phenocrysts in the rhyolite. Many of the garnets seem to be concentrated along fracture zones or along the flow banding. Complete garnet euhedrons are very rare. Most show only about half the number of faces for a complete trapezohedron. The point of attachment is usually uneven with irregular patches of garnet projecting into the rhyolite and included quartz extending into the garnet. Only the portions of the largest garnets farthest from matrix are free of inclusions and imperfections.

Chemical analyses done by atomic absorption yields the formula:

$$(Fe_{1.96}Mn_{.793}Al_{.105}Na_{.071}Ca_{.052}Mg_{.023}K_{.002})$$
$$(Al_{1.99}Ti_{.009})(Si_{2.943}Al_{0.057})0_{12}.$$

Recalculation shows this to be an almandine (67.6%)-spessartine (27.3%)-grossular (4.3%)-pyrope (0.8%) garnet. The results are in close agreement with the analysis of Pabst (1938).

The garnets are believed to have been deposited by vapor phase crystallization from gases released during cooling of the lava flow. Local fracture zones may have served as passageways for some of these gasses since the garnets seem to be concentrated along these zones.

Garnets occurring as phenocrysts crystallized in the magma chamber and were brought up with the magma as it erupted. Garnets from the Antarctic Peninsula Volcanic Group (Hamer and Moyes, 1982), Canterbury, New Zealand (Wood, 1974), and Central Victoria, Australia (Green and Ringwood, 1968; Birch and Gleadow, 1974) were formed this way. These garnets differ from the vapor phase garnets in composition: almandine-pyrope with only 1.20 to 2.21% MnO versus the almandine-spessartine vapor-phase garnets with 11.35% MnO.

SIMILAR OCCURRENCES

Two other well known collecting sites similar to Garnet Hill are Ruby Mountain, Colorado, and Garnet Basin, Thomas Range, Juab County, Utah. Ruby Mountain in Chaffee County, Colorado (NW¼, Section 13, T15S, R28W) is very similar to Garnet Hill. The rhyolite is pink and gray, flow banded, and contains rare phenocrysts of quartz, potassium feldspar, plagioclase, hematite, calcite, muscovite and topaz. Lithophysae and vesicles lined with drusy quartz rarely contain garnets and topaz. The garnets are a red-orange color, ranging from 0.5–2 mm in size. Our collecting at Ruby Mountain has rarely produced garnets of the size or quantity found at Garnet Hill; however, the combination of superb topaz and garnet crystals makes the Ruby Mountain specimens ideal for micromounts. Chemical analysis of the garnets indicates they are spessartine-almandine with up to 29.48% MnO (Van Alstine, 1969).

The Thomas Range, especially its southernmost extent, Topaz Mountain, are world famous for the topaz, bixbyite, pseudobrookite, red beryl, hematite and garnets that occur there. The best garnet specimens have been collected at Garnet Basin in the southwestern part of the range. Most garnets, alone or in combination with other minerals, are less than 1 cm in diameter, but some crystals to 2.5 cm have been found. The collecting and the geology of the area have been described by Holfert (1977) and Ream (1979).

Garnets occurring as a product of vapor-phase crystallization and/or magmatic crystallization occur throughout many rhyolites in the western United States. Such localities include Silver Cliff, Colorado; Tomichi Dome, Colorado; Black Range, New Mexico; Grants Ridge, New Mexico; Sheep Creek Range, Nevada; Lincoln County, Nevada; Burro Creek, Arizona; Wah Wah Mountains, Utah and Eureka, Nevada (Christiansen, 1981; Burt *et al.*, 1982).

ACKNOWLEDGMENTS

VLP wishes to acknowledge an undergraduate research grant from the Geological Society of America. Timothy M. Chowns helped in geologic mapping of the area. Johnny A. Waters took all photographs. Richard P. Sanders aided in atomic absorption analysis. Bruce W. Hurley first introduced CLH to Garnet Hill. Students aiding in mapping and sample collection were Randy Kath, Steve Warner, Barry Robertson, Steve Fuller, Bill Verner, Jeff Brady, Jim Bowman, Steve Foster, Janet Burgess, Denise Walker and Pat Rogers. Bonita Stewart typed the manuscript.

REFERENCES

BIRCH, W. D., and GLEADOW, A. J. W. (1974) The genesis of garnet and cordierite in acid volcanic rocks: evidence from the Cerberean Cauldron, Central Victoria, Australia. *Contributions to Mineralogy and Petrology,* **45**, 1–13.

BROKAW, A. L., BAUER, H. L., and BREITRICK, R. A. (1973) Geologic Map of the Ruth Quadrangle, White Pine County, Nevada. *U.S. Geological Survey Map GQ 1085.*

BURT, D. M., SHERIDAN, M. F., BIKUN, J. V., and CHRISTIANSEN, E. H. (1982) Topaz rhyolites – distribution, origin, and significance for exploration. *Economic Geology,* **77**, 1818–1836.

CHRISTIANSEN, E. H. (1981) Geology and geochemistry of topaz rhyolites from the western United States. Unpublished Doctoral Thesis, Arizona State University.

GREEN, T. H., and RINGWOOD, A. E. (1968) Origin of garnet phenocrysts in calc-alkaline rocks. *Contributions to Mineralogy and Petrology,* **18**, 163–174.

HAMER, R. D., and MOYES, A. B. (1982) Composition and origin of garnet from the Antarctic Peninsula Volcanic Group of Trinity Peninsula. *Journal of the Geological Society of London,* **139**, 713–720.

HOLFERT, J. (1977) *A Field Guide to Topaz and Associated Minerals of Topaz Mountain, Utah.* The Diamond Gallery, Provo, Utah, 41 p.

PABST, A. (1938) Garnets from vesicles in rhyolite near Ely, Nevada. *American Mineralogist,* **23**, 101–103.

REAM, L. A. (1979) The Thomas Range, Wah Wah Mountains, and vicinity, Western Utah. *Mineralogical Record,* **10**, 261–278.

RIDGE, J. D. (1972) Annotated bibliographies of mineral deposits in the Western Hemisphere. *Geological Society of America Memoir* **131**.

VAN ALSTINE, R. E. (1969) Geology and mineral deposits of the Poncha Springs NE Quadrangle, Chaffee County, Colorado. *Geological Survey Professional Paper* **626**.

WESTRA, G. (1982) Alteration and mineralization in the Ruth porphyry copper deposit near Ely, Nevada. *Economic Geology,* **77**, 950–970.

WOOD, C. P. (1974) Petrogenesis of garnet-bearing rhyolites from Canterbury, New Zealand. *New Zealand Journal of Geology and Geophysics,* **17**, 759–789.

A BAUMHAUERITE-LIKE MINERAL FROM QUIRUVILCA, PERU

George W. Robinson
National Museum of Natural Sciences
Mineral Sciences Division
Ottawa, Ontario K1A 0M8

Donald C. Harris
Geological Survey of Canada
601 Booth Street
Ottawa, Ontario K1A 0E8

Over the last decade the La Libertad mine at Quiruvilca, Peru, has been a major producer of fine mineral specimens. Magnificent groups of well-crystallized orpiment and pyrite have been relatively common on both the North American and European markets. Another species for which the locality has achieved considerable fame, though occurring in far less abundance, is the rare sulfosalt, hutchinsonite. Superb crystals over a centimeter long have been found associated with orpiment, and are clearly the world's best (Dunn, 1977; White and Nelen, 1985). In at least one lot of hutchinsonite that appeared on the market about two years ago, there is a powdery, maroon-colored coating on some of the specimens. These specimens are distinctive, because the orpiment crystals are smaller than most, occurring as divergent sprays or drusy coatings of 1 to 5-mm crystals associated with barite, enargite and hutchinsonite. The purplish red coating was originally thought to be a new species, and specimens were submitted to us for identification.

Microscopic examination shows the unknown to be composed of a mat of tiny acicular crystals that appear deep red in transmitted light, but are far too small to be identified visually. The associated species, however, are easily recognized, and appear to have crystallized in the following paragenetic sequence: pyrite, quartz, sphalerite, unknown + hutchinsonite + enargite, barite and orpiment. Galena and seligmannite have also been observed in polished sections as early-formed minerals in the matrix.

When viewed with the scanning electron microscope, the true nature of the mineral is quickly seen as an aggregate of complexly intertwined, curved, fibrous crystals somewhat reminiscent of the fibrous rutile recently reported from Franklin, New Jersey (Germine, 1985). Simultaneous qualitative energy-dispersive X-ray analysis indicated the mineral to be a lead-arsenic sulfosalt, and polished sections were prepared for quantitative analysis with a CAMEBAX microprobe operated at 20 Kv. The X-ray lines and standards used were $Pb_{M\alpha}$ (syn. PbS), $Tl_{L\alpha}$ (syn. $TlSbS_2$), $Ag_{L\alpha}$ (Ag metal), $Hg_{L\alpha}$ (natural HgS), $As_{L\alpha}$ (syn. $FeAs_2$), $Sb_{L\alpha}$ and $S_{K\alpha}$ (syn. $Cu_{11}FeSb_4S_{13}$). Because of the fine-grained and fibrous nature of the material, difficulties were encountered in preparing a polished section having areas of the mineral of suitable size for accurate analysis. The small grain size probably accounts for the low totals, considering that no other elements were detected. The relatively high sulfur content is probably due to unavoidable analytical errors. The results are presented in Table 1.

Obtaining a good X-ray powder diffraction pattern was not easy, due to admixed impurities (which had to be tediously removed by hand-picking under the microscope) and to the inherent tendency of the mineral to diffract X-rays relatively poorly. Whether this situation is due to the fibrous nature of the sample, poorly crystallized grains or some other factors remains uncertain. Films were

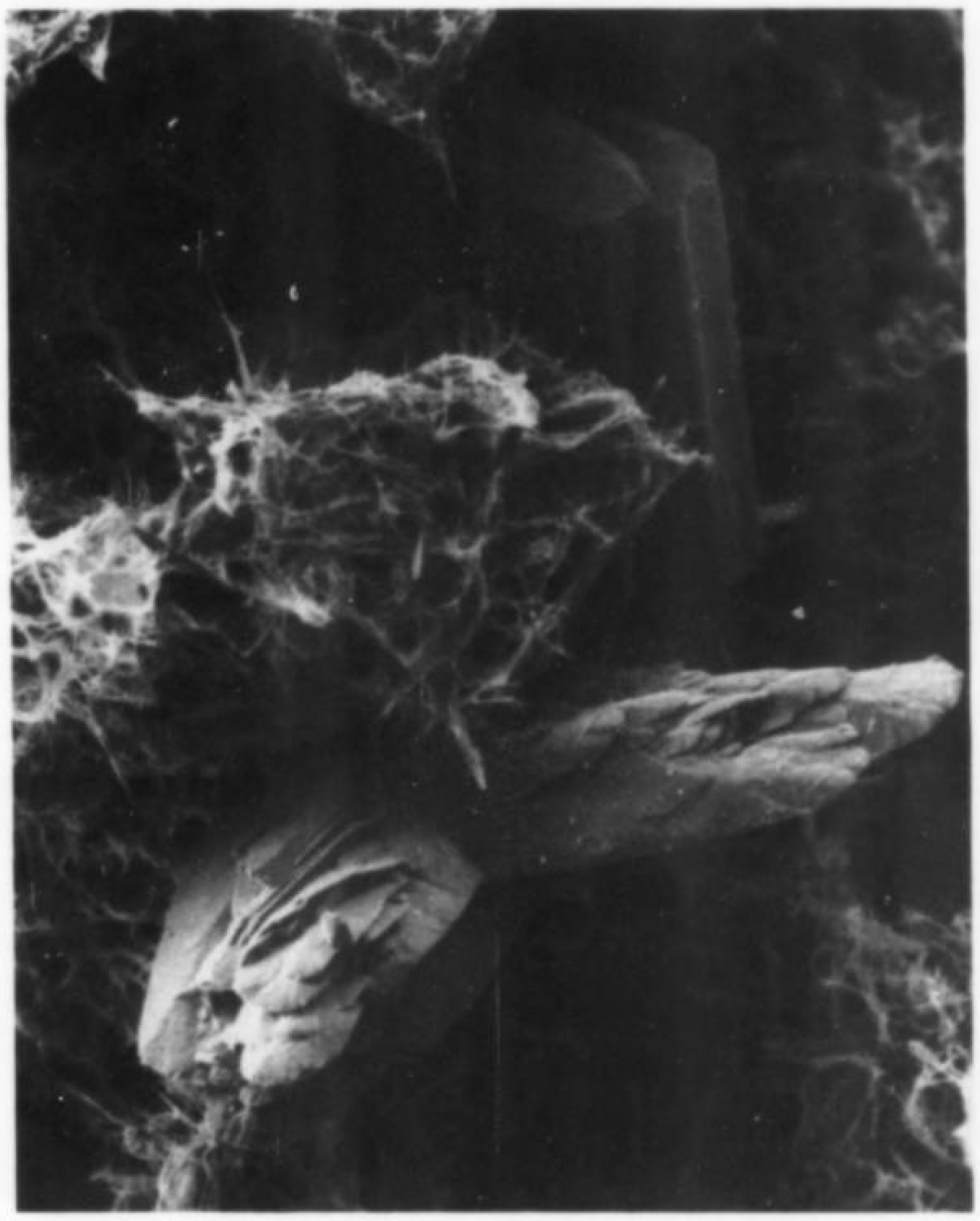


Figure 1. **Orpiment, enargite and baumhauerite-like mineral from the La Libertad mine, Quiruvilca, Peru. Field of view is approximately 0.8 x 1.0 mm. (Canadian) National Museum of Natural Sciences specimen, catalog number 52373; SEM photograph by G. Robinson.**

Figure 2. **Orpiment, enargite and baumhauerite-like mineral from the La Libertad mine, Quiruvilca, Peru. Field of view is approximately 0.5 x 0.7 mm. National Museum of Natural Sciences specimen, catalog number 52373; SEM photograph by G. Robinson.**

prepared using a 114.6-mm powder camera with both Gandolfi and Straumanis mounts. The resulting films typically show rather broad, diffuse lines, with a few reflections appearing on some films but not on others. Thus, the X-ray data presented in Table 2 are a composite average of data from several films.

Based on the X-ray data, likely species (all of which bear reasonable similarities to the unknown) include owyheeite, baumhauerite, sartorite, liveingite, veenite, boulangerite, robinsonite, lorandite, heteromorphite and launayite, among others. Fortunately, most of these can be quickly dismissed on the basis of chemical dissimilarities. The two species most similar in composition to the unknown are baumhauerite ($Pb_3As_4S_9$) and liveingite ($Pb_9As_{13}S_{28}$). Using an average of the two analyses reported in Table 1, the calculated empirical formulas based on 4 and 13 (As + Sb) atoms, respectively, are $(Pb_{2.73}Tl_{0.12}Ag_{0.03}Hg_{0.02})_{\Sigma 2.90}(As_{3.43}Sb_{0.57})_{\Sigma 4.00}S_{9.76}$ and $(Pb_{8.87}Tl_{0.38}Ag_{0.10}Hg_{0.06})_{\Sigma 9.41}(As_{11.14}Sb_{1.86})_{\Sigma 13.00}S_{31.72}$.

Because both the calculated formula and X-ray powder data of the unknown match baumhauerite more closely than liveingite (JCPDS standards 12-281 and 31-678), we conclude it to be a baumhauerite-like mineral, if not in fact baumhauerite itself. Burkart-Baumann *et al.* (1966) described an X-ray amorphous phase with a baumhauerite composition in a gratonite sample from Cerro de Pasco, Peru. It may be that our material is a similar phase, but with better developed crystallinity approaching the baumhauerite structure. It is regrettable that larger crystals have not been found that would permit single crystal X-ray studies or measurements of density, hardness or optical properties. Electron diffraction or TEM studies may provide additional information to better characterize this mineral.

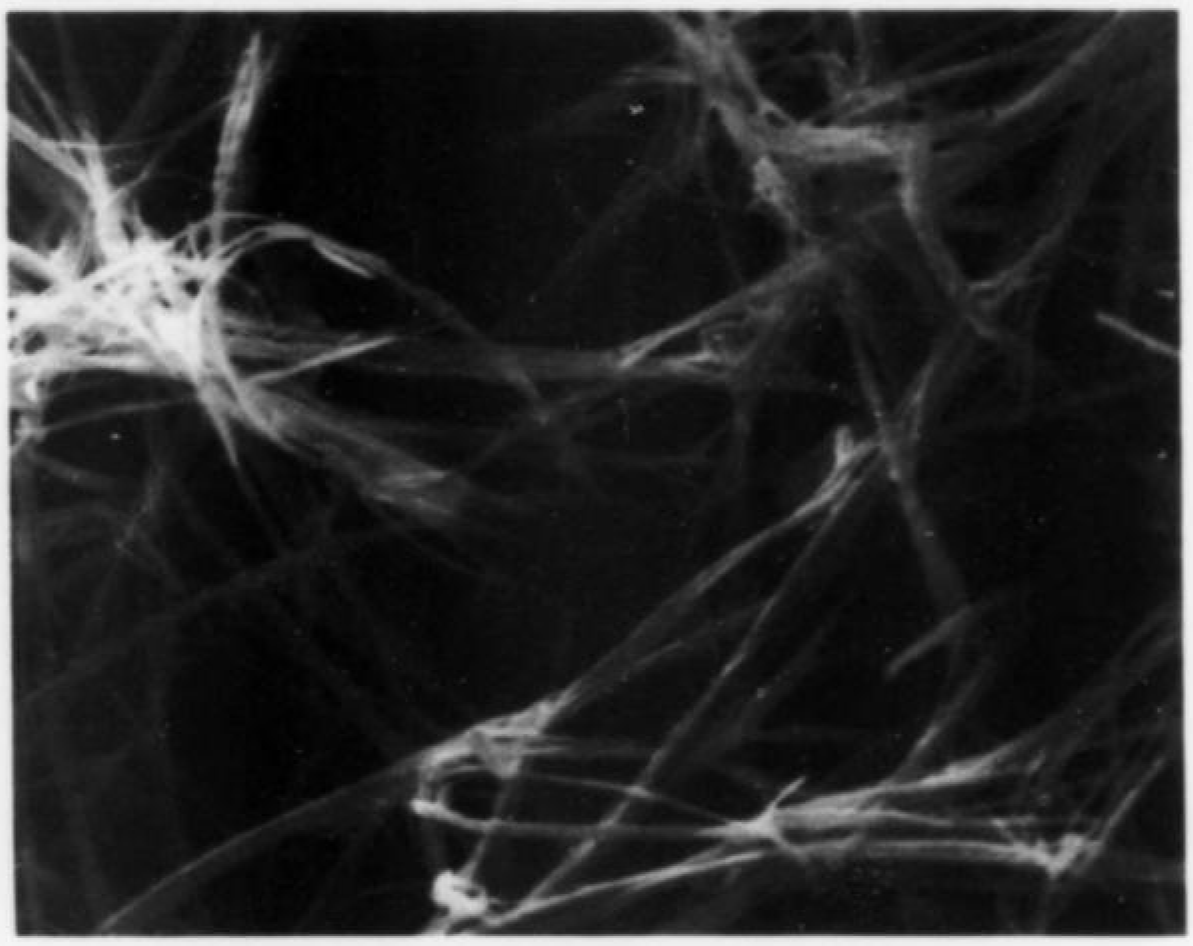


Figure 3. **Baumhauerite-like mineral from the La Libertad mine, Quiruvilca, Peru. Field of view is approximately 60 x 75 microns. National Museum of Natural Sciences specimen, catalog number 52373; SEM photograph by G. Robinson.**

Table 1. **Microprobe analyses of baumhauerite-like mineral from the La Libertad Mine, Quiruvilca, Peru.**

	Ideal $Pb_3As_4S_9$	Analysis 1	Analysis 2
Pb	51.38	44.3	44.4
Tl	–	2.0	1.7
Ag	–	0.2	0.3
Hg	–	0.4	0.2
As	24.77	20.7	19.6
Sb	–	5.5	5.4
S	23.85	24.8	24.3
	100.00	97.9	95.9

Table 2. **X-ray powder diffraction pattern of baumhauerite-like mineral from the La Libertad Mine, Quiruvilca, Peru.**

d	I/I_o	d	I/I_o
11.13	mw	3.05	vw
7.72	vw	3.01	w
7.22	vw	2.93	w
6.10	w	2.87	vw
5.74	w	2.76	vs
5.45	vw	2.72	vw
5.12	vw	2.64	ms
4.83	vw	2.31	ms
4.45	vw	2.27	w
4.13	vs	2.22	w
3.95	mw	2.10	ms
3.83	mw	2.06	w
3.74	w	2.02	w
3.66	m	1.96	vw
3.57	w	1.91	w
3.47	vs	1.83	w
3.37	w	1.79	w
3.23	w	1.63	vw
3.14	w	1.55	vw

ACKNOWLEDGMENTS

We would like to thank William Pinch and Vandall King for bringing this mineral to our attention. Forrest and Barbara Cureton generously made samples available for study, and Jerry van Velthuizen prepared the X-ray films. We are also indebted to the editorial staff of the *Mineralogical Record* for their helpful suggestions.

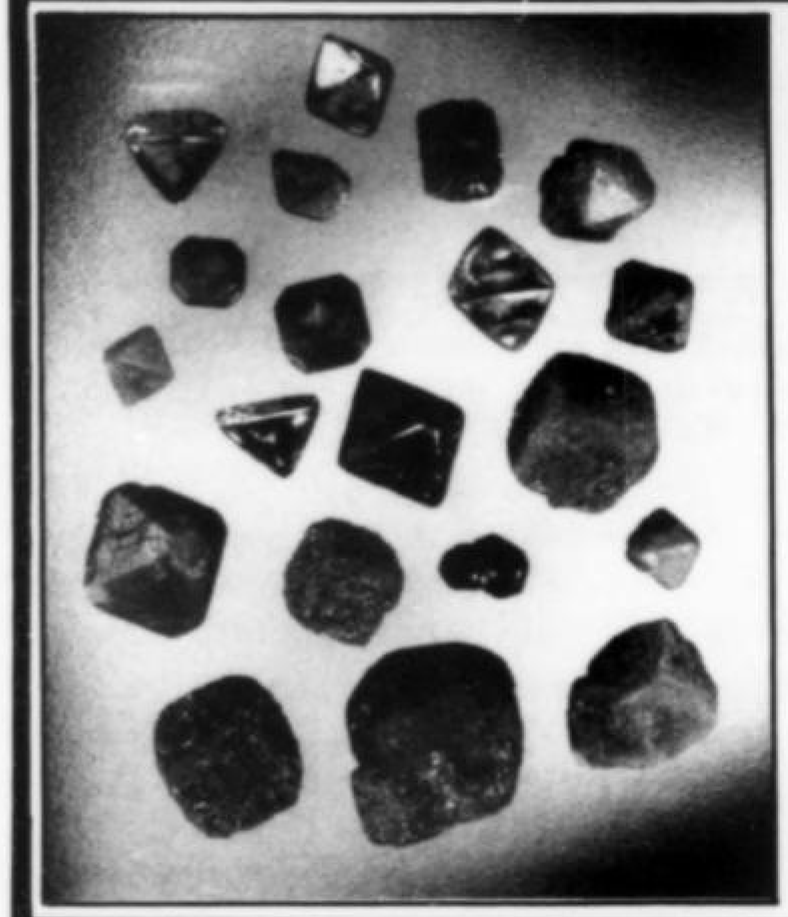
REFERENCES

BURKART-BAUMANN, I., OTTEMANN, J., and AMSTUTZ, G. C. (1966) Neue Beobachtungen an den röntgen-amorphen Sulfiden von Cerro de Pasco, Peru. *Neues Jahrbuch für Mineralogie,* Monatshefte **12**, 353–361.

DUNN, P. J. (1977) Hutchinsonite from Quiruvilca, Peru. *Mineralogical Record,* **8**, 394.

GERMINE, M. (1985) Fibrous rutile from Franklin, New Jersey. *Mineralogical Record,* **16**, 483–484.

WHITE, J. S., and NELEN, J. A. (1985) Hutchinsonite from Quiruvilca, Peru. *Mineralogical Record,* **16**, 459–460.



DIAMONDS

fine selected specimens

Cubes, Octahedrons, Twins

Interesting surface features

GEMAURA

JACK & ELAINE GREENSPAN

P.O. BOX 4162 • W. SEDONA, AZ 86340
602-282-7828

FINE MINERALS
AND
GEMSTONES

Direct from Brazil

OCEANSIDE GEM IMPORTS, INC.

P.O. Box 222
Oceanside, N.Y. 11572

Phone (516) 678-3473
Hours by Appointment

NEW DEALER

Tierra Minerals

Specializing in Mexican Material

Wholesale—Two Showrooms

1112 Del Rio Street
El Paso, Texas 79915
(915) 592-0902

CALL or WRITE

3651 E. Marginal Way S.
Seattle, Washington 98134
(206) 623-6876

J. Carl Faddis — Isidoro "Shorty" Bonilla — Alphonso Arriaga

THE FINE MINERALS

LESNICKS

WHOLESALE IN TUCSON ONLY
BOX 31074, TUCSON, AZ 85751

RETAIL SHOWS

Mar. 7-8	Delaware Club Show Brandywine Caterers Claymont, DE
Mar. 14-15	Albuquerque Show Old Airport Terminal 2920 Support (NM)
Mar. 21-22	Montgomery Cty. Frgrds., Gaithersburg, MD
Mar. 27-29	San Diego Show (CA) Scottish Rite Temple 1893 Camino Del Rio So.

602-749-3435

Are you secure enough to pay less??
Then we want to see you at
The Rochester Symposium (April 9-12), Cincinnati (April 25-26),
Oklahoma City AFMS (June 11-14), Dearborn, Mich. MSG (June 25-28)

Mountain Minerals International

Just back from Asia . . .
Check us out!
Sorry — no lists

P.O. Box 302 • Louisville, CO 80027 • (303) 665-7366

MONAZITE AND CALCIOANCYLITE FROM THE FOOTE MINE, NORTH CAROLINA

John Sampson White
and **Joseph E. Nelen**
Department of Mineral Sciences
Smithsonian Institution
Washington, DC 20560

Mr. Emory McDanal of Clover, South Carolina, is an avid collector of minerals from the Foote Mineral Company spodumene mine, Cleveland County, North Carolina. The diverse and interesting suite of minerals (numbering nearly 100 species) found in this unusual lithium pegmatite have been described in various published articles and the paragenesis is described in an article by one of us (White, 1981). Recently McDanal sent to the Smithsonian for identification a small specimen (NMNH #162757) from the mine, consisting of quartz and holmquistite. Scattered over a fracture surface which transects the foliation are about 15 tiny gray crystals having a blocky shape and a frosty luster. The largest of these is only about 0.1 mm. Some are partially coated by druses of even smaller crystals of pyrite. There are also larger pyrite crystals, up to 1.5 mm, which are in the form of sharp and brilliant cubes modified by octahedral faces; these appear to be of the same generation as those partially coating the gray crystals.

More recently McDanal supplied a second specimen of the gray crystals which is similar in most aspects to the first except that a small portion of one end of the fracture surface also contains an orange crystalline crust upon which the gray crystals appear to have grown. This mineral has not yet been identified; its powder pattern does not match that of any known mineral.

It became evident at the outset that the gray crystals were going to prove challenging to identify. The X-ray diffraction pattern was, after much study, finally determined to represent a mixture of two phases, one of which closely resembles monazite. The second phase took longer to identify.

Another crystal was mounted for analysis on the microprobe. The initial results were confounding. Portions of the crystal appeared to have the composition of calcian monazite in which cerium is the dominant rare earth and phosphorus is present in appropriate amounts. The other portions of the crystal were found to contain similar amounts of calcium and rare earths but no phosphorus. In fact, no other metals that could have formed anionic complexes were found. In time the authors finally concluded that the mineral is most probably a carbonate which in turn suggested the mineral calcioancylite. A check of the powder pattern provided confirmation.

CHEMICAL ANALYSIS

A spectral microprobe scan of a crystal revealed calcium, various rare earths, and phosphorus as the major components. Quantitative analyses were performed on all elements detected in the scan. The electron microprobe employed is an ARL-SEMQ with six fixed (Si, Al, Fe, Mg, Ca, K) and three scanning spectrometers. Operating conditions included 15kV accelerating voltage and a focused beam. Lα intensities for the rare earth elements and Kα intensities for all other elements were measured by repeating counting for 10-second intervals. Standards used were pure synthetic rare-earth phosphates for La, Ce, Pr, Nd, Sm and P; sodalite for Cl; Durango (Mexico) apatite for F; and Kakanui hornblende for the remaining elements. All results were corrected for matrix effects using a modified version of MAGIC IV. Pr, Nd and Sm were also corrected for the effects of overlapping Lβ lines. Both phases were analyzed at ten different points, the results averaged and presented in Table 1. There is no discernible inhomogeneity within each phase and, in fact, the variations in the results do not exceed the normal ±2% statistical variation of the amounts present.

A portion of the crystal, approximately 50% by area, gave an analysis for a calcian monazite containing Ce, Nd, La, Pr and Sm

Table 1. **Microprobe analyses of monazite and calcioancylite.**

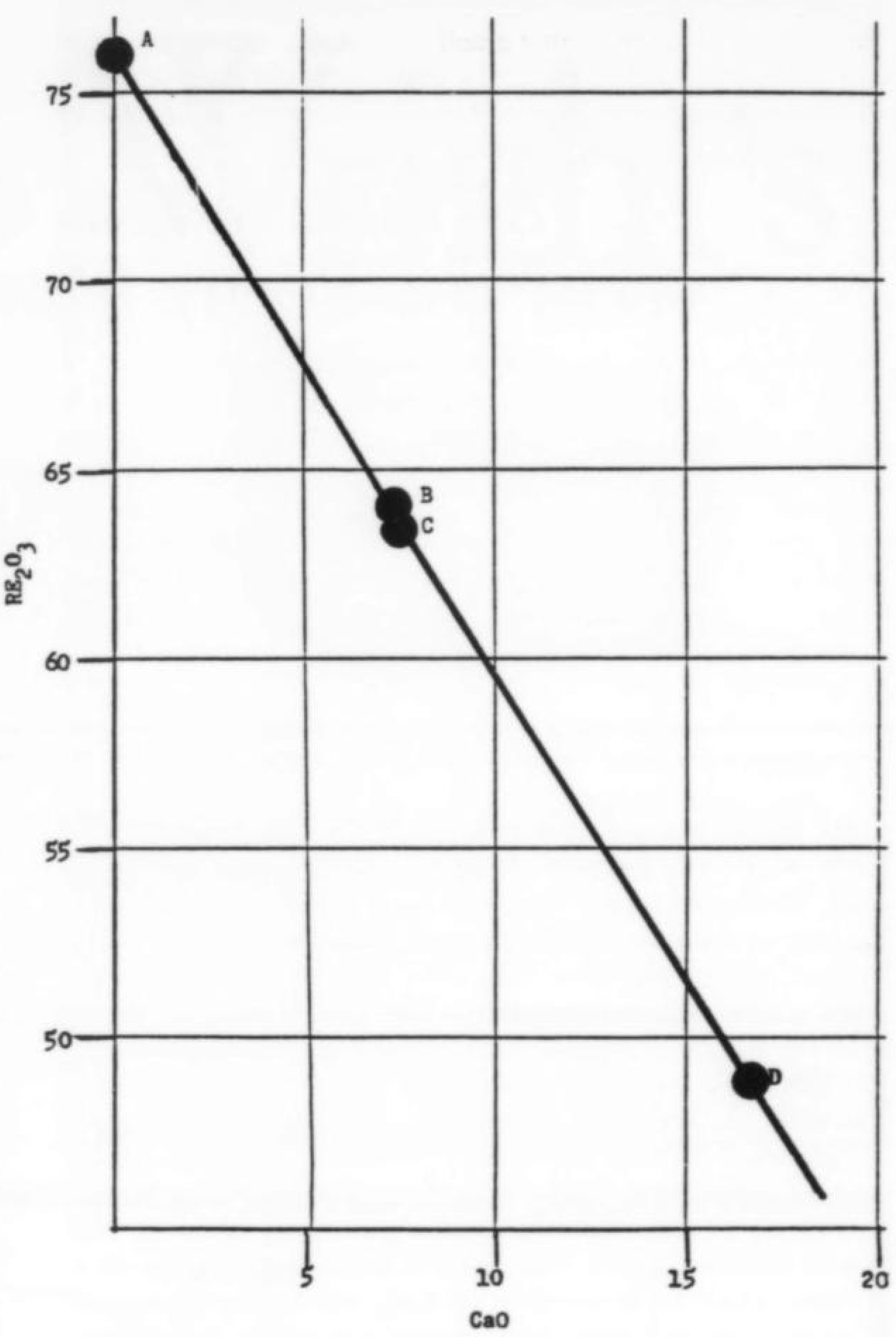
	Monazite				Calcioancylite			
	Foote mine #162575		Theoretical (Ce:La = 1:1)		Foote mine #162575		Theo-retical*	Theo-retical**
Ce_2O_3	25.95	53.55	34.99	69.73	29.31	63.29	64.00	48.94
La_2O_3	10.53		34.74		20.37			
Nd_2O_3	12.71				10.30			
Pr_2O_3	3.00				2.76			
Sm_2O_3	1.36				0.55			
Fe_2O_3	0.96				0.40			
CaO	8.26				7.37		7.29	16.74
CO_2					n.d.		22.9	26.26
P_2O_5	26.39		30.27		0.17			
SiO_2	1.45				1.22			
H_2O					n.d.		5.8	8.06
F	0.77				0.61			
Cl	0.72				0.70			
Total	92.10		100.00		73.76		100.00	100.00

*$RE_{1.5}(Ca)_{0.5}(CO_3)_2(OH)_{1.5}\cdot 0.5H_2O$
**$CaCe(CO_3)_2(OH)\cdot H_2O$

in order of decreasing amount (see Table 1). The amount of calcium commonly found in monazite is no more than a few tenths of a percent of the oxide. The nature of the calcium substitution in the Foote mine sample, greater than 8% CaO, is uncertain. That calcium is indeed substituting for rare earths seems evident because the combined rare earths total is proportionately low. Silicon may substitute for phosphorus and the charge balance could be maintained by replacing part of the trivalent cerium with tetravalent cerium. The latter oxidation state of cerium may be much more common in minerals than is generally realized, even though most mineral analyses report cerium as trivalent. If more tetravalent cerium is present than is needed to balance the silicon for phosphorus substitution, it would serve to satisfy the charge requirements of a calcium/rare earths substitution as well. The authors are reluctant to propose that some of the calcium may be due to admixed fluorite or apatite. There are no diffraction lines for either of these phases in the powder pattern. The authors cannot account for the low summation (92.10%) shown in the analysis.

The analysis of the calcioancylite, which comprises the balance of the analyzed crystal section, also posed a problem. In this mineral, calcium oxide (at 7.4%) is about 10% lower than expected for the calcium end-member, while the combined rare-earth oxide content is high by approximately the same amount. The answer to this apparent anomaly was found in the studies by Sawyer *et al.* (1973) and Dal Negro *et al.* (1975) in which are described the hydroxycarbonates of the lanthanide elements. Although the ideal formulas of ancylite and calcioancylite show a 1:1 ratio of alkaline earths to rare earths, these authors demonstrated that both calcium-rich and strontium-rich ancylites can exhibit substitution of rare earths (predominantly La and Ce) for the divalent metal (Ca or Sr), even to the total exclusion of the latter. Charge balance is maintained by an adjustment in the ratio of hydroxyl to water. Dal Negro *et al.* (1975) proposed the general formula, $(RE)_x(Ca,Sr)_{2-x}(CO_3)_2(OH)_x{\cdot}(2\text{-}x)H_2O$, for carbonates of the ancylite type, of which there are two: ancylite (Sr > Ca) and calcioancylite (Ca > Sr). Dal Negro *et al.* reported ancylite from Mont St-Hilaire, Quebec, with an excess of combined rare earths over a 1:1 ratio of rare earths to Sr/Ca, and they expressed the composition of this material as: $(La,Ce)_{1.38}(Sr,Ca)_{.62}(CO_2)_2(OH)_{1.38}{\cdot}0.6H_2O$. Sawyer *et al.* (1973) synthesized an ancylite-structure compound in which there are no divalent metals, thus having the composition $(RE(OH)CO_3$, derived from the formula above where $x = 2$.

If one were to make $x = 1.5$ and allow only calcium to be present as the divalent metal, the amounts of RE_2O_3 and CaO theoretically derived (64 and 7.3%, respectively) are essentially identical to the amounts for the same oxides obtained through chemical analysis of the Foote mine sample (63.29 and 7.37%, respectively). This would appear to indicate that the composition of the Foote mine sample can be rather precisely defined by the formula wherein $x = 1.5$. In Figure 2 are given percentages of RE_2O_3 and CaO for the two theoretical end-member compositions, the theoretical composition with $x = 1.5$, and the composition of the Foote mine sample. When



	A. RE(OH) CO_3 (theoret.)	B. $(RE)_{1.5}Ca_{0.5}(CO_2)_2$ $(OH)_{1.5}{\cdot}0.5H_2O$ (theoret.)	C. Foote Mine Sample (#162567)	D. $RE(Ca)(CO_3)_2$ $(OH)(H_2O$ (theoret.)
RE_2O_3*	76%	64%	63.29%	48.94%
CaO	–	7.3%	7.37%	16.74%

*For the purpose of these calculations the authors arbitrarily used only the atomic weight of cerium.

***Figure 2.* A tabular and graphic representation of three theoretical rare earth to calcium ratios compared to the Foote mine calcioancylite.**

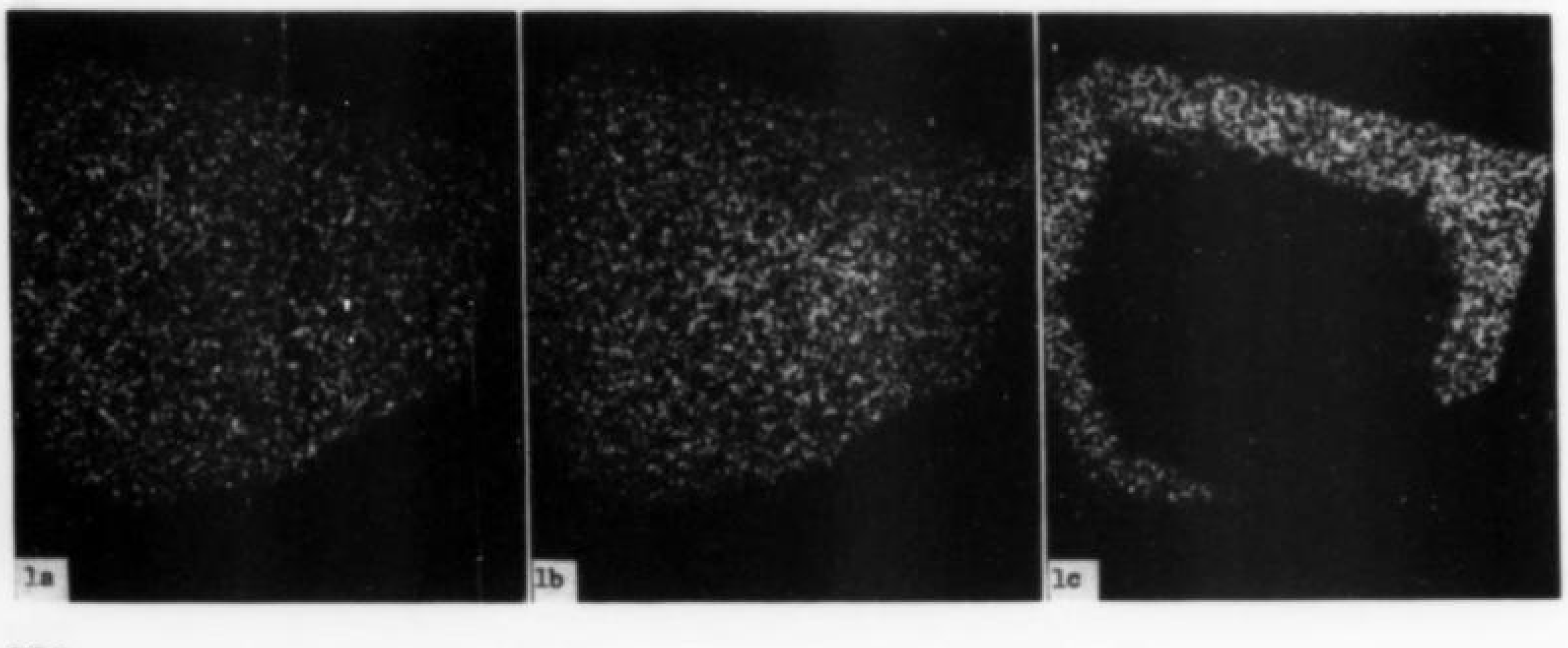


***Figure 1.* X-ray beam scanning photographs of the calcioancylite and monazite sample.**

these figures are plotted on a graph they form a straight line.

With respect to the rare earths in the calcioancylite, cerium is dominant, followed in order by decreasing amounts of La, Nd, Pr and Sm (see analysis, Table 1).

The near perfect 3:1 ratio of RE_2O_3 to CaO suggests a structural control and it is certainly possible that there is ordering of these metals, an ordering that would be precluded if the space group *Pmcn* is correct.

The species status of this particular compositional variation of calcioancylite is also uncertain. This mineral could conceivably be a new species, but it is not the purpose of this paper to propose it as such. At the very least it may be regarded as a cerium-rich or lanthanum-rich calcioancylite.

Figure 1 consists of X-ray beam scanning photographs taken of the sample with the spectrometer set for Ce, La and P, respectively. It is obvious that the rare earths are nearly uniformly distributed but that La is more concentrated near the center. Phosphorus, on the other hand, is confined to the outermost zone, which defines the monazite overgrowth on calcioancylite.

EPITAXY?

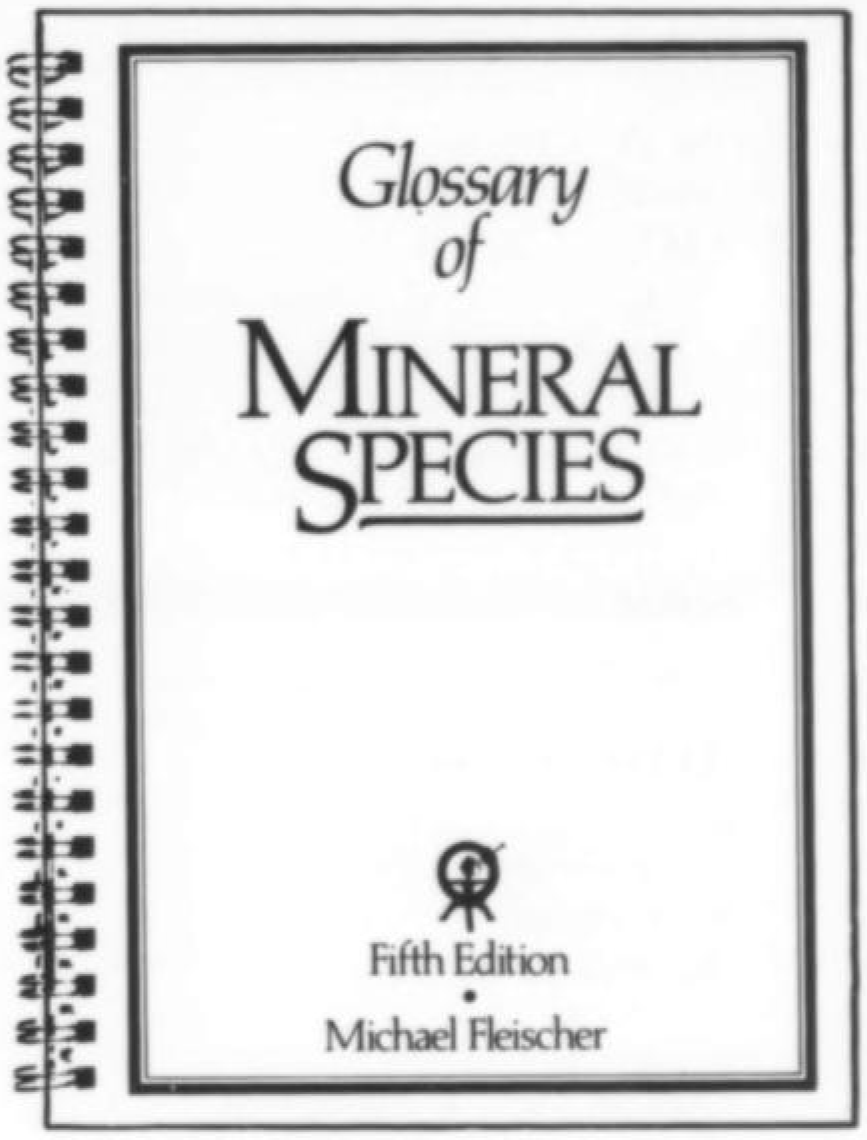
The question of a possible epitaxial relationship between the two phases was also investigated. For this determination, single-crystal X-ray photographs were taken of the "crystal." Zero-level pictures were obtained for calcioancylite only. No single-crystal pattern for monazite could be generated. The most obvious explanation for this is that calcioancylite is a discrete crystal and that monazite is fine-grained polycrystalline. To test this theory the "crystal" was mounted in a Debye-Scherrer camera and rotated in the X-ray beam. The pattern that was produced consisted of a very spotty calcioancylite (which is to be expected when a single crystal is rotated about one axis) superimposed upon a monazite pattern consisting of solid arcs, as would result from a polycrystalline sample or a powdered sample. This evidence supports the single crystal work and indicates that the monazite is indeed in a polycrystalline form and therefore only a coating on the calcioancylite, not an epitaxial overgrowth.

REFERENCES

DAL NEGRO, A., ROSSI, G., and TAZZOLI, V. (1975) The crystal structure of ancylite, $(RE)_x(Ca,Sr)_{2-x}(CO_3)_2(OH)_x(2\text{-}x)H_2O$. *American Mineralogist,* **60**, 280–284.

SAWYER, J., CARO, P., and EYRING, L. (1973) Hydroxycarbonates of the lanthanide elements. *Revue de Chemie minerale,* **10**, 93–104.

WHITE, J. S. (1981) Mineralogy of the Foote mine, Kings Mountain, North Carolina. *Carolina Geological Society Field Trip Guidebook 1981,* 39–48.



Illinois-Wisconsin

mineral dealers

MAKE CONTACT!

. . . with a great source for fine mineral specimens from Midwestern and Worldwide sources. We have everything from top-quality display pieces to affordable beginner specimens, thumbnails to cabinets. Give us a call! Many of us have lists, others are open by appointment or attend shows where you can see our stock. You'll enjoy seeing our material, and we'll enjoy meeting another collector!

Mike Bergmann

919 Northwoods Dr.
Deerfield, Illinois 60015
(312) 945-0772
Fine Mineral Specimens

David M. Crawford

1808 Harlem Blvd.
Rockford, Illinois 61103
(815) 962-5286
Quality Mineral Specimens

Dave's "Down to Earth" Rock Shop

1312 Chicago Ave.
Evanston, Illinois 60201
(312) 866-7374
Fine Minerals & Fossils

Earth Resources

F. John Barlow
P.O. Box 576
Appleton, Wisconsin 54912
(414) 739-1313

Grayson Lapidary, Inc.

Roy Grayson
5135 Washington
Hillside, Illinois 60162
(312) 449-1399
Wholesale & Retail, Appt. only

Donald K. Olson Gemstones & Minerals

P.O. Box 766
Cedarburg, Wisconsin 53012
(414) 377-5844
See us at Major Shows

Mineral Miner

Henry Schmidt
177 Blackhawk Rd.
Highland Park, Illinois 60035
(312) 433-2413
Worldwide Minerals, Appt. only

The Outcrop

Pete & Nancy Olson
P.O. Box 2171
Springfield, Illinois 62705
(217) 787-6149
By Appt.; List Available

Reo N. Pickens

610 N. Martin Ave.
Waukegan, Illinois 60085
(312) 623-2823

Precious Earth Co.

Lance T. Hampel
in The Gold Mine Shops
W156 N9666 Pilgrim Rd.
Germantown, Wisconsin 53022
(414) 255-4540
Fine Minerals; Open Daily

AN UNUSUAL QUARTZ CRYSTAL FROM ZAIRE

John Sampson White
Department of Mineral Sciences
Smithsonian Institution
Washington, DC 20560

An unusual quartz crystal from Midingi, Shaba, Zaire, was purchased from the French mineral dealer Gilbert Gauthier at the 1986 Tucson Gem and Mineral Show in Tucson, Arizona, by Mary T. Winters, and subsequently donated to the Smithsonian Institution for the national mineral collection. Mrs. Winters is a volunteer worker in the Division of Mineralogy, Smithsonian Institution, and is a collector of quartz crystals containing inclusions of other mineral species. The crystal described herein is but one of a lot of small Midingi crystals she acquired at the show, most of which contain inclusions of heterogenite and/or malachite, chrysocolla and copper (Gauthier, personal communication). According to Gauthier, Midingi was a very small open pit mine operated during World War II for copper and cobalt. He collected these crystals himself sometime between 1953 and 1957 while living in Shinkolobwe.

The crystal which is the subject of this note is about 2 cm in length and 1 cm in diameter. While it is essentially colorless to pale smoky, it appears colored because it contains phantoms of a white to cream color and it is deeply etched, especially on the prism faces. Of the 50 or so crystals in the lot, this is the only one that is so heavily etched, and is the only one containing phantoms. All surfaces of the crystal appear to have experienced considerable etching. On the prism faces this is revealed in the form of deep incisions, which are in the same plane as the *a* axes, and roughly rectangular pits whose longer dimensions are also in this orientation. One end of the crystal is completely enclosed by a variety of rhombohedral forms and these, too, are rough due to etching which has produced incisions and pits on their surfaces. The opposite end, assumed to have been broken from matrix, also shows evidence of etching. These are very unusual features, each different from the other, on both ends of the crystal and these are what caught the eye of Mrs. Winters and lead to this note.

THE FACE-ENCLOSED TERMINATION

Apart from the etching, the general morphology can be described as very typical of quartz wherein the dominant form is presumed to be the positive rhombohedron $\{10\bar{1}1\}$, and the other rhombohedron $\{01\bar{1}1\}$ is developed to a lesser degree. What are remarkable are the faces modifying the edges where the dominant rhombohedron faces meet. The author has never observed this form development on any of thousands of quartz crystals previously examined. This crystal has a pair of linear faces occupying what would have been the edges at the junctures of the rhombohedron faces (Figs. 1 and 2). The asymmetry of the edges where these faces converge at the apex of the crystal suggests that one set is left-handed and the other right-handed. As these are equivalent forms, their junctures would be symmetrical if they were equally devel-

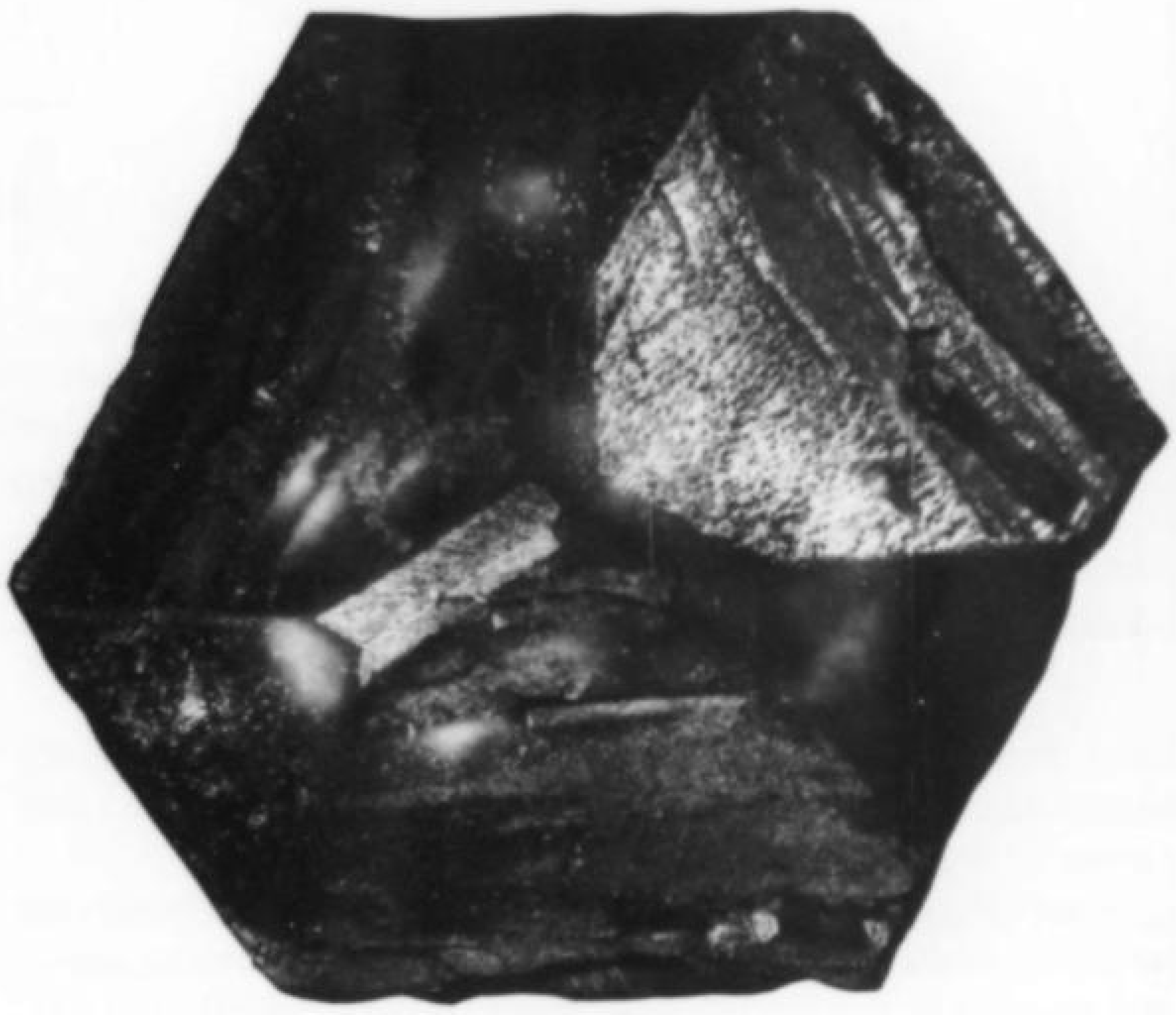


***Figure 1.* Photograph of the terminated end of the Midingi crystal showing the chevron patterns on the pairs of modifying faces. Photo by Victor E. Krantz, Smithsonian Institution.**

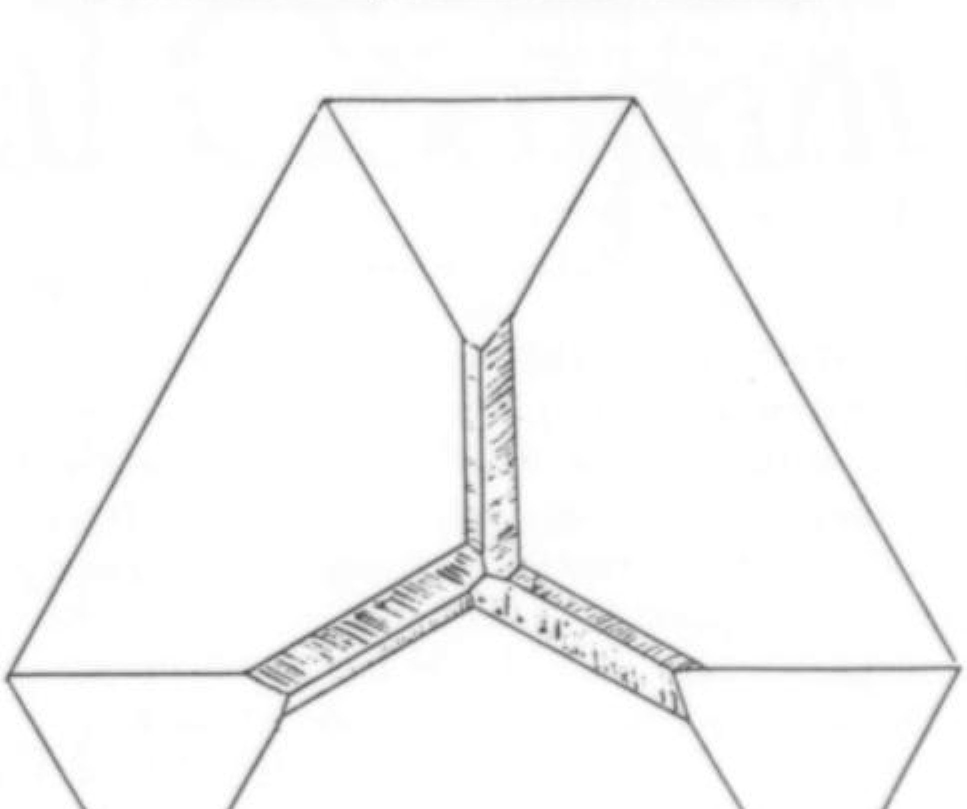


***Figure 2.* Idealized drawing illustrating the morphology of the Midingi crystal.**

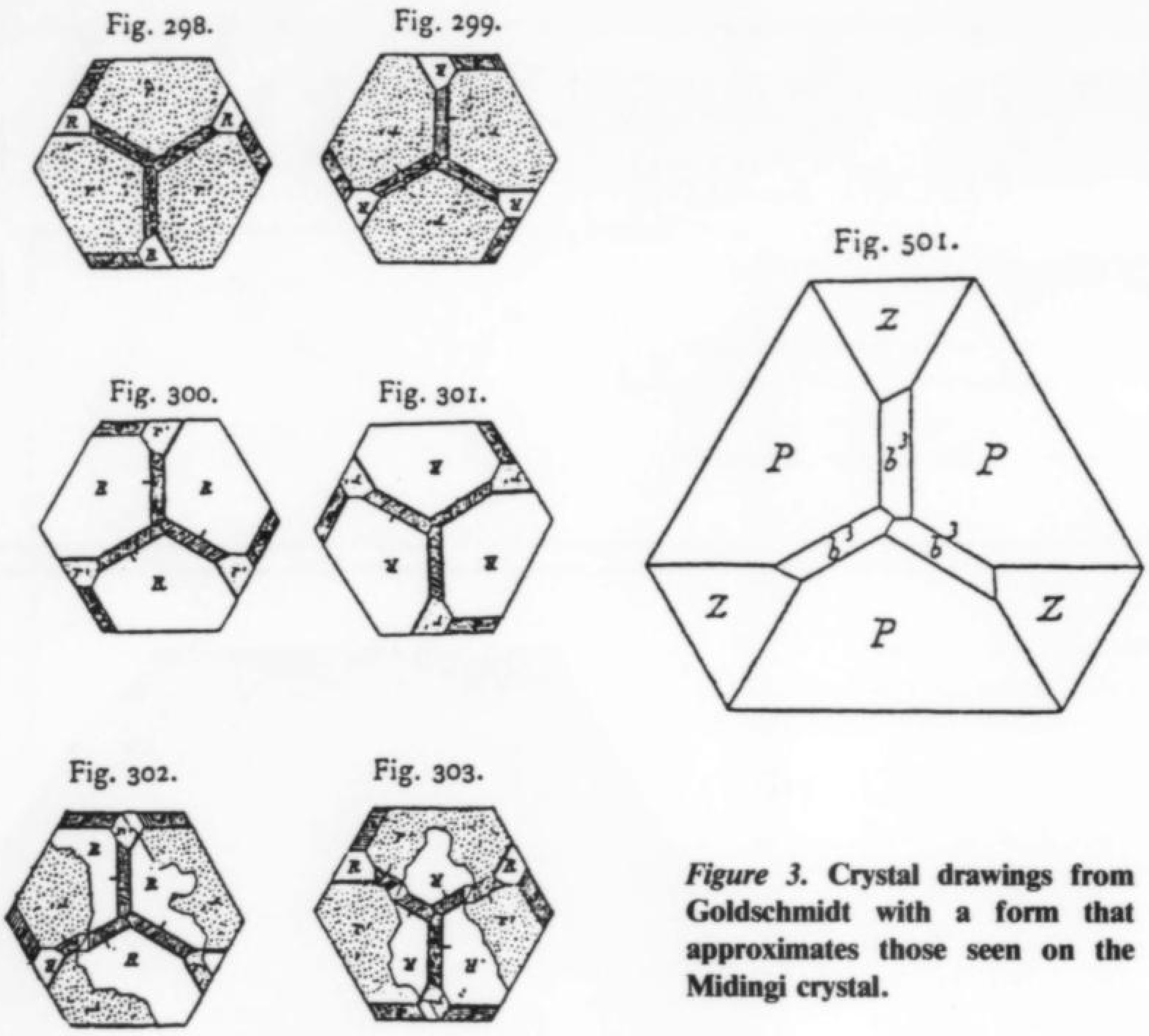


Figure 3. **Crystal drawings from Goldschmidt with a form that approximates those seen on the Midingi crystal.**

oped. However, since one of them is uniformly overdeveloped, the edges where they join are skewed first one way and then the other (center of Fig. 2).

In an effort to find published descriptions of these forms, the author consulted Goldschmidt's *Atlas der Kristallformen* (1922) and was able to find several illustrations (Figures 298–303 and 501, reproduced here as Figure 3) which show a single form in the approximate position of the pairs of faces on the Midingi crystal. The crystals illustrated in Figures 298–303 are from Strzegom, Wroclaw, Poland (Striegau, Schliesen, at the time of publication), and that of Figure 501 is from Amelose, near Biedenkopf, Hessen, Germany. It was not possible to find an illustration of the pairs of faces observed on the crystal from Midingi. Indices given for the form b^3 in Figure 501 are: $\{21\bar{3}4\}$. The author has not attempted to perform goniometry on the Zaire crystal, but would consider making it available to anyone interested in doing so.

The surfaces of these exotic faces are not smooth but have on them fine parallel striations which give the overall image of a chevron pattern for each pair. It is likely that these have been etched and, in fact, it may be that these faces were entirely produced through etching. Three smaller crystals in the lot obtained by Mrs. Winters, although not as extensively etched, also have these forms. Samples of smoky quartz from "Striegau" in the collection of the U.S. National Museum show the b^3 faces, and do not appear etched. They are, therefore, most likely primary faces.

THE BASE

It was this end of the crystal which first was brought to my attention. It is deeply etched and, as a result, there is a prominent hexagonal, raised section in the center of the base (Fig. 4). This section consists of a ridge with six sides and septa that converge toward the center from the corners producing a star. Unlike the surrounding quartz, which is transparent, the walls of the star appear milky, suggesting that they may be related to the phantoms elsewhere in the crystal. Since the phantoms appear to be clay-coated, the basal etch section may be impregnated with clay which increased its resistance to etching. As can be seen in the photograph

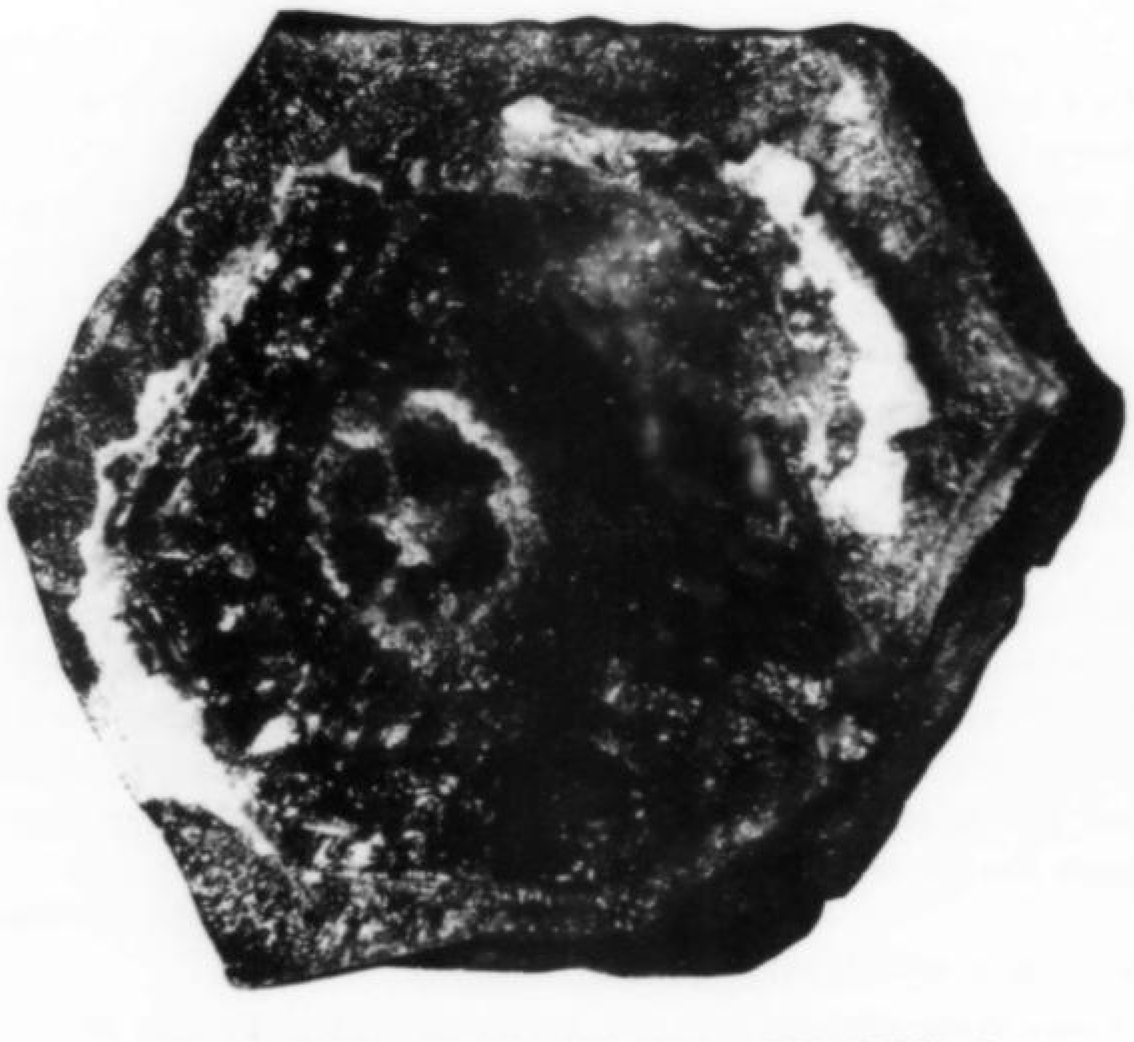


Figure 4. **Photograph of the base of the Midingi crystal with the various zones clearly shown. Photo by Victor E. Krantz, Smithsonian Institution.**

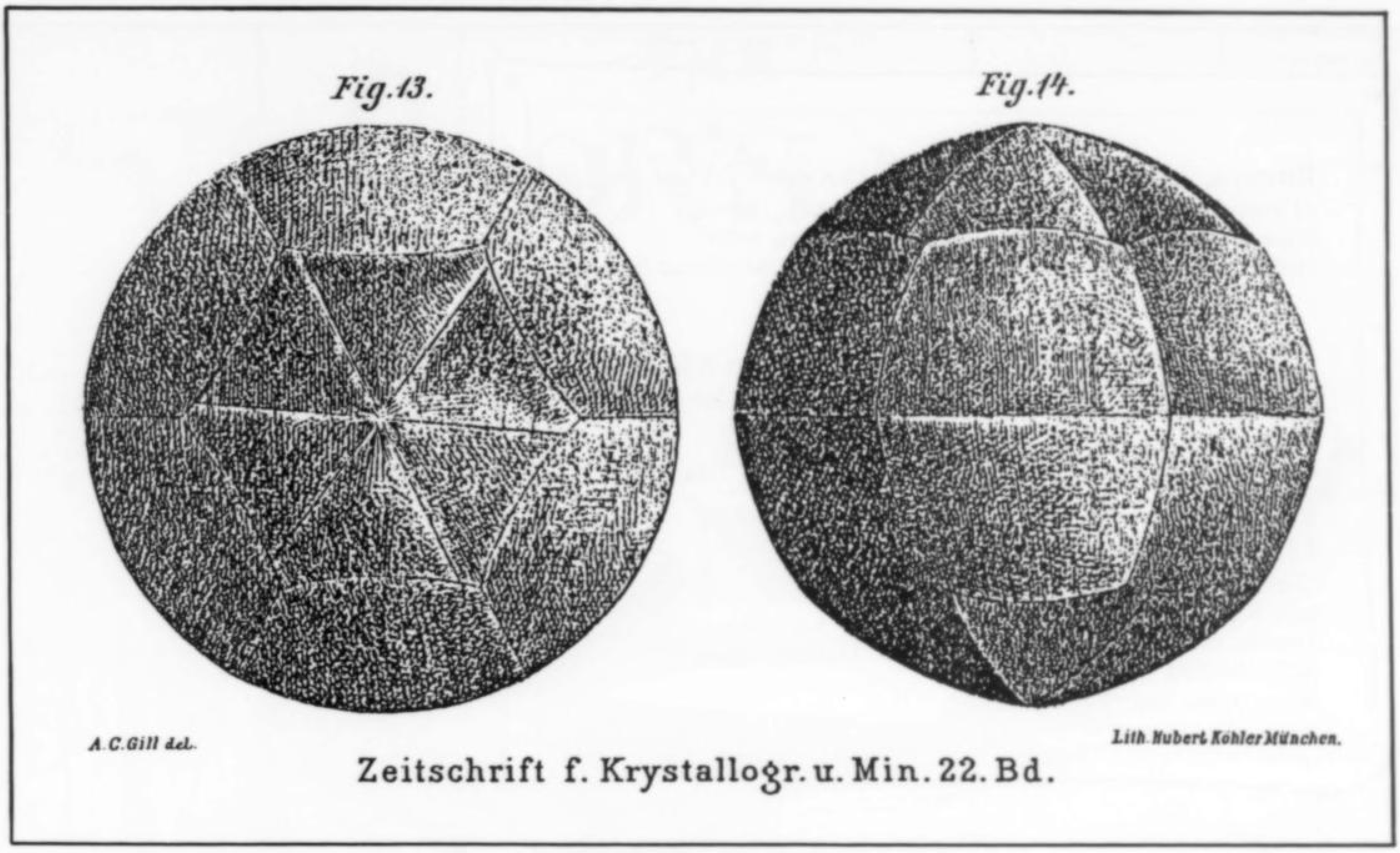


Figure 5. **A quartz sphere that has been etched in hydrofluoric acid by Gill (1893) to produce star configuration at either end.**

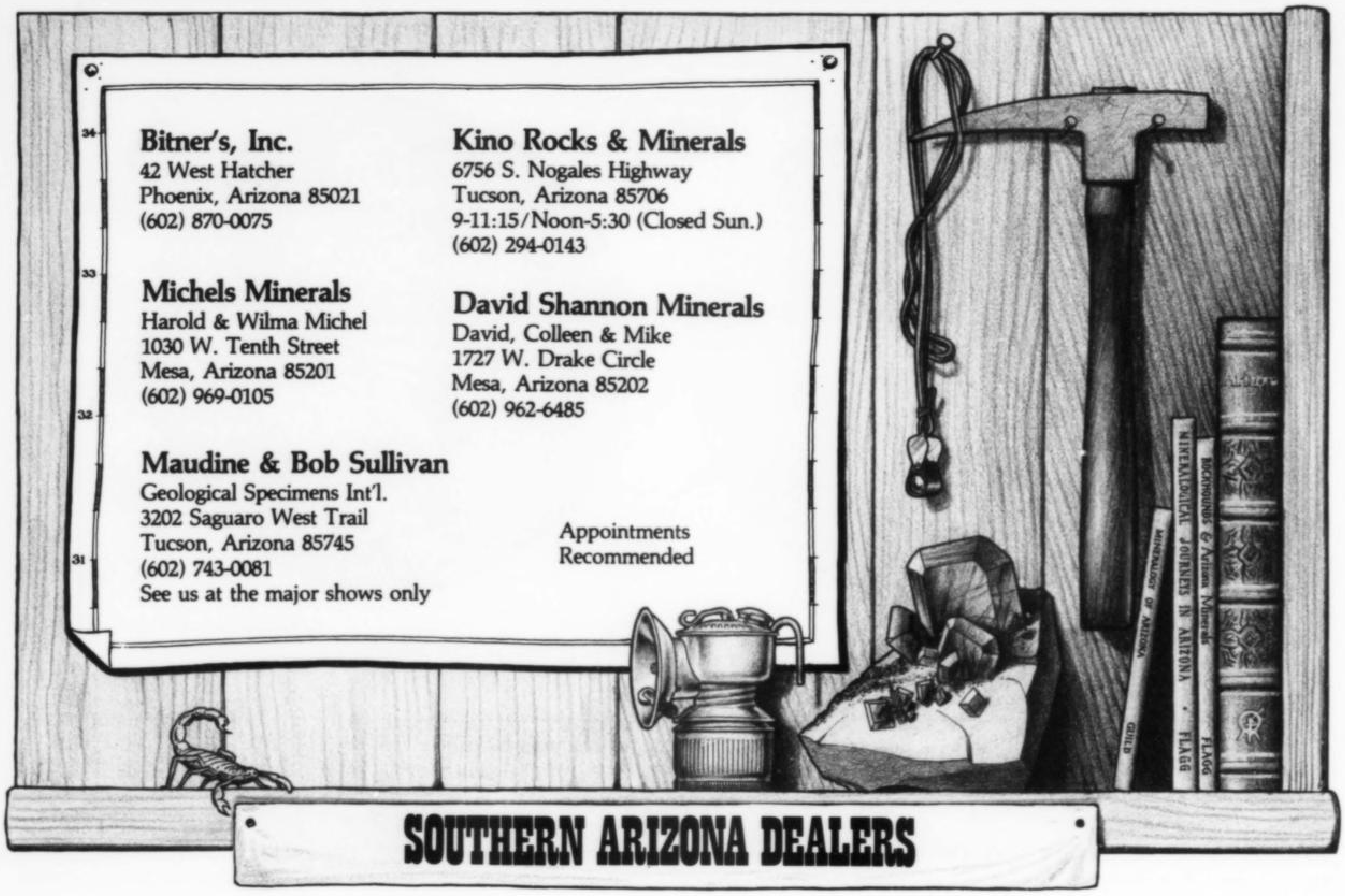
the figure stands out in strong relief. Other zones defined by thin films of clay (?) on several successive sets of crystal faces are clearly visible on the bottom surface. It is perfectly possible that this star may be due to etching alone. Gill (1893) experimented with etching quartz crystal spheres in hydrofluoric acid. In some cases he produced stars centered about the *c* axis that are similar to the star at the base of the Midingi crystal (Fig. 5). Whatever the reason for the star, this observation adds yet another page to the remarkably complex story of the fascinating world of the crystals of quartz.

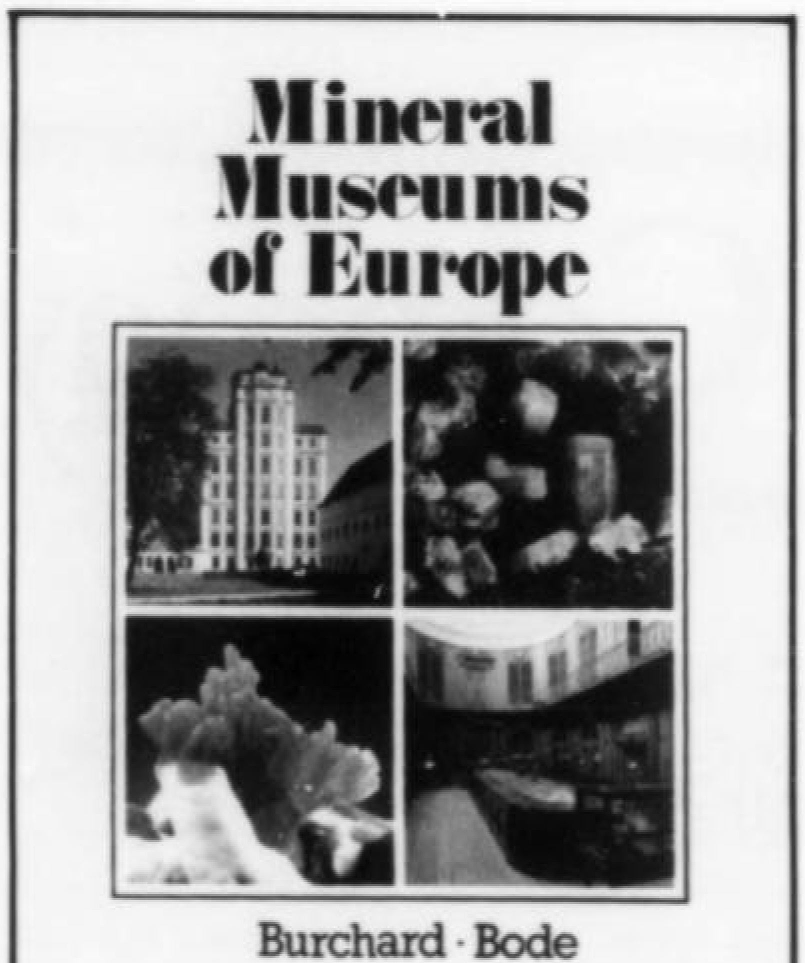
I am very grateful to Mary Winters for allowing me to examine this fascinating crystal and for donating it to the U.S. National Museum (NMNH #164181).

REFERENCES

GILL, A. C. (1893) Beitrage zur kenntniss des quarzes. *Zeitschrift für Krystallographie und Mineralogie,* **22**, 97–128.

GOLDSCHMIDT, V. (1922) *Atlas der Krystallformen.* Vol. **7**, Carl Winters Universitätsbuchhandlung, Heidelberg.


34
33
32
31
MINERALOGY OF ARIZONA
GUILD
MINERALOGICAL JOURNEYS IN ARIZONA
FLAGG
ROCKHOUNDS & Arizona Minerals
FLAGG



MINERALS OF THE UNITED STATES

Update and Additions

Arthur E. Smith Jr.
9118 Concho Street
Houston, Texas 77036

The first Collector's Library listing of mineralogical literature on American localities appeared in the January-February 1979 issue of the *Mineralogical Record.* Since that time numerous additional articles and books of merit have been published. These are included here as additions to the original listings. The only repetition is the latest State Mineralogy where no new mineralogy has been published. Many of the publications in the original article are still available but at different prices. A few that were out of print at that time have been reprinted and many others have now gone out of print. If you are interested in any of these I suggest that you write the state agency or book publisher at the address given for a list of available publications and prices. A number of state mineralogy publications are also available directly from the Mineralogical Record Book Department; check their ad on page 239 of this issue.

Two new categories that should be useful have been added. They are *Locality Index,* where available, and *Maps.* Only statewide maps are listed, including geology, mineral occurrences, mining districts, active mines and mineral resources. If an attempt was made to list all the area maps in these categories, the list would be too voluminous for this publication.

A particularly useful reference book that covers many localities throughout the United States is: *Ore Deposits of the United States; 1933–1967* (1968), John Ridge, Editor, 2 volumes, 1880 p. Order from the Society of Mining Engineers, Caller no. D, Littleton, CO 80127. The cost is only $38.50 ppd. and it is a real bargain.

The American Association of Petroleum Geologists (AAPG) publishes a series of regional geological highway maps that are somewhat generalized but useful for reference and preliminary research for known or potential mineral collecting sites. They may be ordered from the AAPG Bookstore, P.O. Box 979, Tulsa, OK 74101. Postage and handling is $1.50 for orders up to $10.00, $3.00 up to $20.00 and $4.50 up to $50.00. The catalog number and the area is included under each state.

Most of the information in this listing was obtained during the fall of 1985 and is subject to change. Remember to add sales tax if you order within your own state. The abbreviations used are "ppd" (postage paid) and "+ p&h" (plus postage and handling).

I would like to thank all those who responded to the request in the original article for additional material and corrections with particular thanks to R. C. Smith II, who gave much information on Pennsylvania.

ALABAMA

State Mineralogy

Mineralogy of Alabama (1982) R. B. Cook & W. R. Smith, Alabama Geol. Survey Bull. B120, 285 p.,illus., *$8.75 + p&h.

Area Mineralogy—Mica

Mica in Alabama (1984) R. S. Epperson & K. F. Rheams, Alabama Geol. Survey Atlas Ser. AS18, 53 p., *$6.50 + p&h.

—Phosphates

Phosphate Minerals of Alabama (1983) H. L. Barwood, *Rocks and Minerals,* **58**, 56–63.

New Minerals from Indian Mountain, Alabama and Cedartown, Georgia (1982) H. L. Barwood & L. W. Zelazny, *Rocks and Minerals,* **58**, 152–154.

—Piedmont

Gibbsite in Saprolites of the Alabama Piedmont, East Central Alabama (1984) Alabama Geol. Survey Cir. C121, 107 p., *$5.00 + p&h.

Alabama Gold (1980) T. A. Simpson & T. L. Neatherly, Alabama Geol. Survey Cir. C104, 169 p., illus., *$3.75 + p&h.

Mineral Resources—Piedmont

Mineral Resources of the Alabama Piedmont (1984) K. H. Rheams, Alabama Geol. Survey Spec. Map SM200, 19 p., map, *$2.25 + p&h.

Maps—Geologic

Geologic Map of Alabama (1926) Alabama Geol. Survey Spec. Rept. SR14, map only. Ozalid, *$4.25 + p&h.

—Geologic Highway

Southeastern (1975) AAPG Geol. Highway Map Ser., cat. no. 669, $4.50 + p&h.

—Minerals

Minerals Map of Alabama (revised, 1984) Alabama Geol. Survey Spec. Map SM193, *$2.00 + p&h.

—Active Mines and Quarries

Directory of Active Mines and Quarries in Alabama (1975) Alabama Geol. Survey Spec. Map SM176, *$1.75 + p&h.

*Check to: Map Fund, mail to: Geological Survey of Alabama, Publications and Sales Office, P.O. Box 1424, University Station, Tuscaloosa, AL 35486. P&h add $.75 for first publication and $.25 for each additional.

ALASKA

State Mineralogy—none

Area Mineraology—Central Alaska Range

Mineral Occurrences in the Upper Wood River, Edgar Creek and West Fork Glacier Areas, Central Alaska Range (1976) K. W. Sherwood *et al.,*Alaska Geol. Spec. Rept. SR 14, *$1.00 ppd.

Collecting Guides

Guide Book for Rockhounds (1970) Chugach Gem and Mineral Society, Anchorage, Alaska, n.p., out of print.

Maps—Geologic Highway

Alaska and Hawaii (1974) AAPG Geol. Highway Map Ser., cat. no. 668, $4.50 + p&h.

—Mining Districts & Mineral Deposits

Mining Districts and Mineral Deposits of Alaska (1977) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, (1:2,500,000), 2 sheets, 33 x 47", $40.00 ppd.

—Minerals

Map Showing Occurrences of Lead Minerals in Alaska (1984) E. H. Cobb, U.S. Geol. Survey Mineral Inv. Res. Map MR-91, (1:2,500,000), **$2.40 ppd.

Map Showing Occurrences of Copper Minerals in Alaska (1984) E. H. Cobb, U.S. Geol. Survey Mineral Inv. Res. Map MR-90, (1:2,500,000), **$2.40 ppd.

Map Showing Occurrences of Tin Minerals in Alaska (1984) E. L. Cruz & E. H. Cobb, U.S. Geol. Survey Mineral Inv. Res. Map MR-89, (1:2,500,000), **$2.20 ppd.

*Alaska Div. of Geol. & Geoph. Surveys, 794 University Ave., Fairbanks, AK 99701.

**U.S. Geol. Survey, Map Distribution Branch, Box 25286, Federal Center, Denver, CO 80225.

ARIZONA

State Mineralogy

Mineralogy of Arizona (1977) J. W. Anthony *et al.,* The University of Arizona Press, 1615 East Speedway, Tucson, AZ 85719, $15.95 paper, ppd., $28.50 cloth, ppd.

Checklist of Arizona Minerals (1982) R. W. Grant, Mineralogical Soc. Arizona Spec. Pub. Ser. No. 1, 78 p., illus. $4.00 ppd. Mineralogical Soc. Ariz., P.O. Box 902, Phoenix, AZ 85001.

Area Mineralogy—Bisbee

Bisbee! (1981) R. W. Graeme, *Mineralogical Record,* **12**, n. 5.

—Hillside Mine

Paulkerrite, A New Titanium Phosphate from Arizona (1984) D. R. Peacor *et al., Mineralogical Record,* **15**, 303–306.

—Tiger

Mammothite, A New Mineral from Tiger, Arizona (1985) D. R. Peacor *et al., Mineralogical Record,* **16**, 117–120.

The Mammoth–St. Anthony Mine, Tiger, Arizona (1982) W. D. Panczner, *Rocks and Minerals,* **57**, 5–10.

See also: R. A. Bideaux (1980) *Mineralogical Record,* **11**, n. 3, Arizona I

—Hamburg & Red Cloud Mines

Arizona I (1980) *Mineralogical Record,* **11**, n. 3.

—Defiance, C & B, Grey Horse,
Grand Reef, Tombstone and Mineral Park

Arizona II (1980) *Mineralogical Record,* **11**, n. 4.

—Magma, Vekol, Old Yuma, Hilltop,
Silver Bill, Camp Verde, Horseshoe Dam

Arizona IV (1983) *Mineralogical Record,* **14**, n. 2.

—Glove, New Corneia, Ray, Mistake Mines

Arizona V (1983) *Mineralogical Record,* **14**, n. 5.

—Holmes Claim

Vanadinite from the J. C. Holmes claim, Santa Cruz County, Arizona (1986) G. Novak & W. W. Besse, *Mineralogical Record,* **17**, 111–115.

Collecting Guide

Mineral and Gem Localities in Arizona (1977) Lee Hammons, Arizona Maps and Books, Sedona, Arizona, 112 p., illus., out of print.

Maps—Geologic

Geologic Map of Arizona (1969) Arizona Bur. Geol. Map 13, (1:500,000), *$9.55 ppd.

—Geologic Highway

Southern Rockies (1967) AAPG Geol. Highway Map Ser., cat. no. 662, $4.50 + p&h.

—Metallic Minerals

Map of Known Metallic Mineral Occurrences in Arizona (1965) Arizona Bur. Geol. Map 5, (1:1,000,000), *$1.80 ppd.

—Mining Districts

Mining Districts and Mineral Deposits of Arizona (1977) C. A.

Mardirosian, Mineral Research Company, North Gate Lane, #707, Bldg. C, Laredo, TX 78041, 35 x 49", $35.00 ppd.

Mineral Resources

Metallic Mineral Districts and Production in Arizona (1983) Arizona Bur. Geol. Bull. 194, *$9.25 ppd.

*Arizona Bureau of Geology and Mineral Technology, Publication Sales Office, 845 North Park Avenue, Tucson, AZ 85719.

ARKANSAS

State Mineralogy

Mineral Species of Arkansas (in preparation) J. M. Howard & Charles Milton, Arkansas Geol. Comm.

The Minerals and Rocks of Arkansas (1886) Grant and Faires, Philadelphia, 32 p., out of print.

Area Mineralogy – Antimony Deposits

Antimony District of Southwest Arkansas (1979) J. M. Howard, Arkansas Geol. Comm. Inf. Circ. 24, 29 p., illus. *$3.50 ppd.

– Granite Mountain

Eggletonite, the Na Analogue of Ganophyllite (1984) D. R. Peacor *et al., Mineralogical Magazine,* **48**, 93–96.

– Kellogg Silver mine, Barite,
and Iron Phosphates

Symposium on the Geology of the Ouachita Mountains, Volume II (1977) C. G. Stone *et al.,* Arkansas Geol. Comm. Misc. Pub. MP-14, 74 p., illus., *$5.50 ppd.

– Phosphate Minerals

Phosphate Minerals of Arkansas (1981) A. L. Kidwell, *Rocks and Minerals,* **56**, 189–195.

Aluminum Phosphate Minerals from Mauldin Mountain, Montgomery County, Arkansas (1985) A. E. Smith, Jr., *Mineralogical Record,* **16**, 291–295.

– Potash Sulphur Springs

Schoderite, A New Locality and Redescription (1979) Adolph Pabst, *American Mineralogist,* **64**, 713–720.

Miserite, A Review of World Occurrences with a Note on Intergrown Wollastonite (1984) Charles Milton, in *Contributions to the Geology of Arkansas, Volume II,* Arkansas Geol. Comm. Misc. Pub. 18-B, 97–114, *$8.50 ppd.

Collecting Guides

Field Guide to the Magnet Cove Area and Selected Operations and Mineral Collecting Localities in Central Arkansas (1982) C. J. Stone *et al.,* Arkansas Geol. Comm. Guidebook GB-82-1, 31 p., illus., *$4.00 ppd.

Rock and Mineral Collecting Localities (Arkansas) (1982) J. M. Howard, Arkansas Geol. Comm. Misc. Pub. MP-19, 7 p., maps, *free.

Spring Field Trip to Arkansas, April, 1982 (1982) Mineral Section Houston Gem and Mineral Society, 30 p., illus., $3.50 ppd. from: Art Smith, 9110 Concho, Houston, TX 77036.

Maps – Geologic

Geologic Map of Arkansas (1976) Arkansas Geol. Comm., (1:500,000), 53 x 34", *$8.05 folded or *$8.80 rolled, ppd.

– Geologic Highway

Midcontinent (1966) AAPG Geol. Highway Map Ser., cat. no. 661, $4.50 + p&h.

*Arkansas Geological Commission, Vardelle Parham Geology Center, 3815 West Roosevelt Road, Little Rock, AR 72204.

CALIFORNIA

State Mineralogy

Minerals of California (1983) H. E. Pemberton, Van Nostrand Reinhold, New York, 591 p., illus., $29.95 + p&h. Order from: Order Processing, 7625 Empire Dr., Florence, KY 41041.

History of crystallized gold in California (1987) W. C. Leicht, *Mineralogical Record,* **18**, 33–40.

Area Mineralogy – Blue Bell Claims

The Blue Bell Claims, San Bernardino County, California (1984) M. F. Maynard *et al.,* San Bernardino County Museum, Dept. of Earth Sciences, 2024 Orange Tree Lane, Redlands, CA 92373, 61 p., illus., $7.30 ppd.

– Coyote Peak

Taeniolite, an Uncommon Lithium-Mica from Coyote Peak, Humbolt County, California (1983) R. C. Erd *et al., Mineralogical Record,* **14**, 39–40.

Orickite and Coyoteite, Two New Sulfide Minerals from Coyote Peak, Humbolt County, California (1983) R. C. Erd & G. C. Czamanske, *American Mineralogist,* **68**, 245–254.

– Darwin

The Mines and Minerals of Darwin, California (1984) C. S. Stolburg, *Mineralogical Record,* **15**, 5–18.

– Death Valley

New Data on Hungchaoite, the Second World Occurrence, Death Valley Region, California (1979) R. C. Erd *et al., American Mineralogist,* **64**, 369–375.

– Dogtooth Peak

Dogtooth Peak Pegmatites, Fresno County, California (1979) M. L. Jacobson, *Rocks and Minerals,* **54**, 92–96.

– Gold

Gold! (1982) *Mineralogical Record,* **13**, n. 6.

– Himalaya Mine

Recent Work at the Himalaya Mine (1985) C. R. Marcusson, *Mineralogical Record,* **16**, 419–424.

– Jensen Quarry

The Jensen Quarry, Riverside County, California (1984) F. Devito & A. Ordway, Jr., *Mineralogical Record,* **15**, 273–290.

– Kalkar Quarry

Mineralogy of the Kalkar quarry, Santa Cruz, California (1986) G. E. Dunning & J. F. Cooper Jr., *Mineralogical Record,* **17**, 315–326.

– Mt. Thompson Mine

Mt. Thompson Mine, Plumes County, Northern California (1980) M. I. Jacobson, *Rocks and Minerals,* **55**, 48–51.

– New Melones Lake

Ferroaxinite from New Melones Lake, Calaveras County, California (1982) Demetrius Pohl *et al., Mineralogical Record,* **13**, 293–302.

– Red Mountain

Mcguinnessite, A New Carbonate from California (1981) R. C. Erd *et al., Mineralogical Record,* **12**, 143–147.

– San Benito County

Stroniojoaquinite and Bario-orthojoaquinite, Two New Members of the Joaquinite Group (1982) W. S. Wise, *American Mineralogist,* **67**, 809–816.

– San Bernardino County

New Occurrence of Faujasite in Southern California (1982) W. S. Wise, *American Mineralogist,* **67**, 794–798.

– Stewart Pegmatite

Occurrence and Alteration of Phosphate Minerals at the Stewart Pegmatite, Pala District, San Diego County, California (1985) J. E. Shigley & G. E. Brown, Jr., *American Mineralogist,* **70**, 395–408.

—Tuolumne County

Gold occurrences in Tuolumne County, California (1987) G. M. Allgood, R. W. Allgood & J. Pradenas, *Mineralogical Record,* **18**, 41–45, 62–64.

Maps—Economic Minerals

Economic Mineral Map—Lead and Zinc (1959) J. G. Goodwin, California Div. Mines Misc. Maps, (1:1,000,000), *$1.25 ppd.

—Geologic

Geologic Map of California (1977) C. W. Jennings, California Div. Mines Geol. Data Map 2, (1:750,000), *$8.00 ppd.

—Geologic Highway

Pacific Southwest (1973) AAPG Geol. Highway Map Ser., cat. no. 663, $4.50 + p&h.

—Mining Districts & Mineral Deposits

Mining Districts and Mineral Deposits of California (1974) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, 2 sheets, 39½ x 48", (1:1,000,000), $60.00 ppd.

*California Division of Mines and Geology, P.O. Box 2980, Sacramento, CA 95812.

COLORADO

State Mineralogy

Minerals of Colorado, a 100-year Record (1961) E. B. Eckel, U.S. Geol. Survey Bull. 1114, 399 p., illus., map in pocket, reprinted without map, **$5.00 ppd.

Area Mineralogy—Aspen

Geology of the Aspen 15-minute Quadrangle, Pitkin and Gunnison Counties, Colorado (1979) Bruce Bryant, U.S. Geol. Survey Prof. Paper 1073, 145 p., illus., **$7.00 ppd.

—Breckenridge

Famous mineral localities: Breckenridge, Colorado (1987) E. Raines & A. E. Smith, *Mineralogical Record,* **18**, 51–64.

—Creede

Ktenasite from Creede, Colorado (1979) Edward Olsen, *American Mineralogist,* **64**, 446–448.

—Clear Creek District

A Lithium-bearing Pegmatite in the Clear Creek District, Clear Creek County, Colorado (1982) M. I. Jacobson, *Rocks and Minerals,* **57**, 241–244.

—Crystal Mountain District

Kings Kenyon Lithium Pegmatites (1985) M. I. Jacobson, *Rocks and Minerals,* **60**, 129–221.

—Gilman District

Ore Deposits of the Gilman District, Eagle County, Colorado (1978) T. S. Lovering *et al.,* U.S. Geol. Survey Prof. Paper 1017, 90 p., illus., **$9.00 ppd.

Gilman, Colorado (1980) W. J. Warren & R. B. Cook, *Rocks and Minerals,* **55**, 145–152.

—Great American Rift

Mines and Minerals of the Great American Rift (1983) R. W. Holmes & M. B. Kennedy, Van Nostrand Reinhold, New York, 332 p., illus., $34.50 + p&h, Order Processing, 7625 Empire Dr., Florence, KY 41042.

—Italian Mountain

Minerals of the Italian Mountain Area, Colorado (1984) H. A. Trube, *Mineralogical Record,* **15**, 67–88.

—Leadville, Rico, Pikes Peak,
Cripple Creek

Colorado III (1985) *Mineralogical Record,* **16**, n. 3.

—Mt. Antero, Lakewood, Diamonds, Amethyst

Colorado Minerals (1984) *Rocks and Minerals,* **59**, n.1.

—Muddy Creek

Water-clear Barite from Muddy Creek, Colorado (1981) *Mineralogical Record,* **12**, 79–80.

—Nathrop

Gold in Rhyolite at Nathrop, Colorado (1979) D. E. Seaman, *Rocks and Minerals,* **54**, 108–109.

—Pikes Peak, San Juans,
Home Sweet Home Mine

Colorado II (1979) *Mineralogical Record,* **10**, n.12, also **11**, n.1.

—San Juan Mountains

Across the San Juan Mountains (1983) T. A. Rickard, *Mineralogical Record,* **14**, 191–194, 243–249.

—Skarn Deposits

PreCambrian Tungsten and Copper-zinc Skarn Deposits of South-Central Colorado (1981) E. W. Heinrich, Colorado Geol. Survey Res. Ser. 21, 115 p., illus., *$10.00 ppd.

—South Platte District

Rare-Earth Pegmatites of the South Platte District, Colorado (1980) W. B. Simmons, Jr. & E. W. Heinrich, Colorado Geol. Survey Res. Ser. 11, 131 p., illus., *$10.00 ppd.

—State Line Diatremes

Diamond Collecting in Northern Colorado (1982) D. S. Collins, *Mineralogical Record,* **13**, 205–208.

—Stoneham

The Stoneham barite locality, Colorado (1986) N. L. Bennett, *Mineralogical Record,* **17**, 255–258.

—Turret District

Epidote from the Calumet Iron Mine in the Turret District, Salida, Colorado (1983) R. S. Minch, *Rocks and Minerals,* **58**, 153–155.

Locality Index

Colorado Locality Index (1979) B. L. Muntyan, *Mineralogical Record,* **10**, 323–328.

Maps—Geologic

Geologic Map of Colorado (1979) Ogden Tweto, U.S. Geological Survey, Colorado Geological Survey Misc. 16, (1:500,000), *$8.00 ppd, add $.50 for rolled copy.

—Geologic Highway

Southern Rockies (1967) AAPG Geol. Highway Map Ser., cat. no. 662, $4.50 + p&h.

—Mineral

Mining Districts and Mineral Deposits of Colorado (1976) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, 33 x 49", (1:1,000,000), $35.00 ppd.

Reported Occurrences of Selected Minerals in Colorado (1971) U.S. Geol. Survey Minerals Inv. Res. Map MR-57.

*Colorado Geol. Survey, Publications Dept., 1313 Sherman St., Room 715, Denver, CO 80203.

**U.S.G.S. Books and Open-File Reports, Federal Center, Bldg. 41, Box 25425, Denver, CO 80225.

CONNECTICUT

State Mineralogy

Connecticut Minerals (1951) J. A. Sohon, Connecticut Geol. & Nat. Hist. Survey Bull. 77, 128 p., *$3.00 + p&h.

Area Mineralogy—Litchfield County

Nickel Deposits of Litchfield County, Connecticut (1979) W. Brunet, *Rocks and Minerals*, **54**, 55–59.

—Thomaston Dam

The Thomaston Dam Site, Thomaston, Connecticut (1985) C. G. Segeler & Joseph Molon, *Rocks and Minerals*, **60**, 119–124.

—Trap Rocks

Minerals of the Trap Rock Ridges of the Connecticut Valley (1980) W. M. Brunet, *Rocks and Minerals*, **55**, 232–235.

Collecting Guides

Mineral Collector's Field Guide: The Northeast (1979) Bill Shelton & Bud Webster, Mineralogy, Wallingford, Conn., 137 p., illus., out of print.

Mineral Collector's Field Guide: Connecticut (1978) Bud Webster, Wallingford, Conn., 40 p., illus., out of print.

Maps—Geologic

Preliminary Bedrock Geologic Map of Connecticut (1982) Connecticut Geol. & Nat. Hist. Survey, (1:250,000), *$2.00 + p&h.

—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

—Minerals

Mineral Deposits and Occurrences in Connecticut (1957) N. C. Pearre, U.S. Geol. Survey Map MR-7, *blue line copies $1.50 + p&h.

*Dept. Env. Prot., Nat. Res. Center, Pub. and Sales, 165 Capitol Ave., Room 555, Hartford, CT 06106. Add $1.00 per order p&h.

DELAWARE

State Mineralogy

Delaware, Its Rocks, Minerals and Fossils (1980) D. C. Windish & T. E. Pickett, Delaware Geol. Survey & Div. Econ. Dev., 18 p., *free.

Area Mineralogy—Chromite Deposits

See Pennsylvania—*Area Mineralogy*—Chromite Deposits.

Maps—Geologic

Generalized Geologic Map of Delaware (revised, 1976) Delaware Geol. Survey Spec. Pub. 10, (1:576,000), *free.

—Geologic Highway

Mid-Atlantic (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

*Delaware Geol. Survey, University of Delaware, Newark, DE 19716.

FLORIDA

State Mineralogy

Rocks and Minerals of Florida, A Guide (1961) E. W. Bishop & L. L. Dee, Florida Bur. Geol. Spec. Pub. SP8, 40 p., illus., map, *$2.00 ppd.

Maps—Geologic

Geologic Map of Florida (1964) R. O. Vernon & H. S. Puri, Florida Bur. Geol. Map Ser. MS18, (30 mi. = 1"), 19" x 25", *$2.00 ppd.

—Geologic Highway

Southeastern U.S. (1975) AAPG Geol. Highway Map Ser., cat. no. 669, $4.50 + p&h.

*Florida Bureau of Geology, 903 West Tennessee, Tallahassee, FL 32304.

GEORGIA

State Mineralogy

Minerals of Georgia: Their Properties and Occurrences (1978) R. B. Cook, Georgia Geol. Survey Bull. B-92, 189 p., $5.00 + p&h.

Notes on Some Occurrences in Georgia and Virginia (1979) H. L. Barwood & Benjamin Hajek, *Mineralogical Record*, **10**, 48–49.

Unusual Minerals in Georgia (1979) V. J. Hurst & J. W. Strum, *Rocks and Minerals*, **54**, 161–165.

Notable gold occurrences of Georgia & Alabama (1987) R. B. Cook, *Mineralogical Record*, **18**, 65–74.

Area Mineralogy—Cedartown

New Minerals from Indian Mountain, Alabama and Cedartown, Georgia (1982) H. L. Barwood & L. W. Zelazny, *Rocks and Minerals*, **57**, 152–154.

—Fayette County

Occurrence of Sillmanite in Fayette County, Georgia (1982) Georgia Geol. Survey Rept. 4, 7 p., *$2.50 + p&h.

—Graves Mountain

Famous Mineral Localities: The Mineralogy of Graves Mountain, Lincoln County, Georgia (1985) *Mineralogical Record*, **16**, 443–458.

—Gold

General Information on Gold in Georgia (1980) W. C. Rozov, Georgia Geol. Survey Misc. Pub., 18 p., free + p&h.

Maps—Geologic

Geologic Map of Georgia (1976) Georgia Geol. Survey, (1:500,000), *$3.00 + p&h.

—Geologic Highway

Southeastern (1975) AAPG Geol. Highway Map Ser., cat. no. 669, $4.50 + p&h.

—Mineral Resources

Mineral Resources Map of Georgia (1969) Georgia Geol. Survey, (1:500,000), 42 x 36", *$5.00 + p&h, (1:2,000,000), 11 x 17", *$.10 + p&h.

*Georgia Geological Survey, 19 Martin Luther King, Jr. Dr., SW, Room 400, Atlanta, GA 30334, p&h charges: $1.00 on orders up to $5.00, $1.50 on order $5.00 to $10.00, $2.00 on orders $10.00 to $20.00, $2.50 on orders $20.00 to $30.00.

HAWAII

State Mineralogy—none

Area Mineralogy—Puu o Ehu Quarry

Puu o Ehu Quarry, Hawaii (1984) J. S. White, *Mineralogical Record*, **15**, 95–97.

IDAHO

State Mineralogy

The Minerals of Idaho (1926) E. V. Shannon, U.S. Nat. Museum Bull. 131, 483 p., illus., out of print.

Area Mineralogy—Coeur d'Alene

Pyromorphite from the Coeur d'Alene District, Idaho (1982) J. A. Crowley & N. A. Radford, *Mineralogical Record,* **13**, 273–285.

Society of Economic Geologists' Coeur d'Alene Field Conference, Idaho—1977 (1982) R. R. Reid & G. A. Williams, 139 p., *$15.40 + p&h.

The Bunker Hill Mine, Kellogg, Shoshone County, Idaho (1981) N. A. Radford & J. A. Crowley, *Mineralogical Record,* **12**, 339–347.

Mineral Resources

Gold Camps and Silver Cities (1983) 2nd edition, M. W. Wells, Idaho Geol. Survey Bull. 22, 165 p., illus., *$13.20 + p&h.

Maps—Geologic

Geologic Map of Idaho (1978) John G. Bond, Idaho Geol. Survey, (1:500,000), 44 x 66", *$11.00 + p&h.

—Geologic Highway

Northern Rockies (1972) AAPG Geol. Highway Map Ser., cat. no. 665, $4.50 + p&h.

—Mining Districts

Mining Districts of the State of Idaho (1941) C. P. Ross, Idaho Geol. Survey, (1:500,000), 49 x 66", *$.83 + p&h.

Mining Districts and Mineral Deposits of Idaho (1976) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, (1:1,000,000), 33 x 49", $35.00 ppd.

—Gold Occurrences

Gold Occurrences in Idaho (1978) M. P. Gaston & Bill Bonnichsen, (1:1,000,000), 24 x 35", *$1.00 + p&h.

*Idaho Geological Survey, Morrill Hall, Room 332, University of Idaho, Moscow, ID 83843, p&h add $1.00 per order.

ILLINOIS

State Mineralogy

Guide to Rocks and Minerals of Illinois (1959) Illinois State Geol. Survey Ed. Ser. 5, 50 p., illus., *$1.00 + p&h.

Area Mineralogy—Fluorite

Fluorite and Associated Minerals from Southern Illinois (1982) C. A. Francis, *Rocks and Minerals,* **57**, 63–71.

Fluorspar Mining District, Cave-in-Rock and Shaunee National Forest Guidebook (1979) C. I. Schubert & E. D. Cashnatt, Illinois State Museum Guidebook Series No. 3, 42 p., out of print.

Maps—Geologic

Geologic Map of Illinois (1967) Illinois State Geol. Survey, (1:500,000), *$3.00 + p&h.

—Geologic Highway

Great Lakes (1978) AAPG Geol. Highway Map Ser., cat. no. 671, $4.50 + p&h.

*Illinois State Geol. Survey, Nat. Res. Building, 615 East Peabody Drive, Champaign, IL 61820, p&h add $.70 on orders up to $3.00, $.95 up to $6.00, $1.20 up to $9.00.

INDIANA

State Mineralogy

Minerals of Indiana (1961) R. C. Erd & S. S. Greenberg, Indiana Geol. Survey Bull. 18, 73 p., illus., *$1.25 + p&h.

Area Mineralogy—Geodes

Indiana Geodes: Some of Nature's Mysteries (1975) R. D. Rarick, *Outdoor Indiana,* **40**, n. 2, 23–29, reprint, *free + p&h.

—Bethel Church

Hawleyite and Phosphate Minerals from Bethel Church, Indiana (1984) R. M. Coveney *et al., Mineralogical Record,* **15**, 351–357.

—Rensselaer

Epitaxial Marcasite on Pyrite from Rensselaer, Indiana (1978) K. J. Brock & L. D. Slater, *American Mineralogist,* **63**, 2110–2112.

Minerals of the Rensselaer Stone Co. Quarry, Pleasant Ridge, Indiana (1986) K. J. Brock, *Rocks and Minerals,* **61**, 111-115.

—Salem

Celestite from Salem, Indiana (1983) L. D. Wells *et al., Mineralogical Record,* **14**, 7–12.

Locality Index

Indiana minerals: a locality index (1986) T. E. Huizing & R. E. Russell, *Rocks and Minerals,* **61**. 136–151.

Maps—Geologic

Geologic Map of Indiana (1956) Indiana Geological Survey, (1:1,000,000), *$.50 + p&h.

—Geologic Highway

Greak Lakes (1978) AAPG Geol. Highway Map Ser., cat. no. 671, $4.50 + p&h.

*Publications Section, Indiana Geological Survey, 611 North Walnut Grove, Bloomington, IN 47405. Add $.50 per publication p&h.

IOWA

Mineral Resources

Minerals of Iowa (1974) P. J. Horick, Iowa Geol. Survey Ed. Series ES-2, 88 p., illus., *$2.10 ppd.

Maps—Geologic

Geological Map of Iowa, Showing the Indurated Rocks Exposed or immediately beneath the Glacial Deposits (n.d.), Iowa Geol. Survey Map M-9, *$1.30 ppd.

—Geologic Highway

Northern Plains Area (1984) AAPG Geol. Highway Map Ser., cat. no. 672, $4.50 + p&h.

—Mineral Resources

Mineral Resources Map of Iowa (1970) F. H. Dorheim, Iowa Geol. Survey Map M-11, (1:500,000), *$.80 ppd.

*Iowa Geological Survey, 123 N. Capitol St., Iowa City, IA 52242.

KANSAS

State Mineralogy

Kansas Rocks and Minerals (1957) L. L. Tolsted & A. Swineford, Kansas Geol. Survey Ed. Series 2, 64 p., *$1.00 + p&h.

Area Mineralogy—Red Beds

Copper Sulfides in the Lower Permian Red Beds of South Central Kansas (1981) Kansas Geol. Survey Bull. 223, Part 1, Stratigraphy and Host Rock Lithology, 86 p., Part 2, Ore Mineralogy, 15 p., *$7.50 or $5.00 each part + p&h.

Maps—Geologic

Geologic Map of Kansas (1964) Kansas Geol. Survey (1:500,000), *$7.50 + p&h, (1984) 8½ x 11", *free + p&h.

—Geologic Highway

Mid-Continent (1966) AAPG Geol. Highway Map Ser., cat. no. 661, $4.50 + p&h.

*Publications Sales, Kansas Geological Survey, 1930 Constant Ave., Campus West, The University of Kansas, Lawrence, KS 66046, p&h is $2.00 for orders up to $25 and $3.00 for orders over $25.

KENTUCKY

State Mineralogy

Kentucky's Rocks and Minerals (1964) W. L. Helton, Kentucky Geol. Survey Spec. Pub., ser. X, SP9, 55 p., *$1.00 + p&h.

Area Mineralogy—Barite

Barite Deposits of Kentucky (1982) W. H. Anderson *et al.*, Kentucky Geol. Survey Bull., ser. XI, B1, 56 p., *$5.00 + p&h.

—Central, Geodes, Hall's Gap

Kentucky! (1981) *Rocks and Minerals,* **56**, n. 3.

Maps—Geologic

Geologic Map of Kentucky (1981) R. C. McDowell *et al.*, Kentucky Geol. Survey, (1:250,000), 3 sheets, *$15.40 + p&h.

Generalized Geologic Map of Kentucky (1979) Kentucky Geol. Survey, (1:1,000,000), *$1.00 + p&h, page size, *$.10 + p&h.

—Geologic Highway

Mid-Atlantic (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

—Mineral Resources

Mineral Resources and Mineral Industries Map of Kentucky (1962) Kentucky Geol. Survey, (1" = 8 mi.), *$2.00 = p&h, (1" = 20 mi.), *$.25 + p&h.

*Kentucky Geol. Survey, 311 Breckinridge Hall, Univ. of Kentucky, Lexington, KY 40506, p&h minimum $.75 or 15% of total order.

LOUISIANA

State Mineralogy—none

Area Mineralogy—Salt Domes

The Nature and Evolution of Salt Domes and Their Caprock (1980) J. D. Martinez, Louisiana Geol. Survey Pamphlet 6, 16 p., *$3.00 ppd.

Maps—Geologic

Geologic Map of Louisiana (1984) J. I. Snead & R. P. McCulloh, Louisiana Geol. Survey, (1:500,000), 21 x 42", *$7.00 folded and $9.00 rolled ppd.

—Geologic Highway

Southeastern U.S. (1975) AAPG Geol. Highway Map Ser., cat. no. 669, $4.50 + p&h.

—Mineral Resources

Map of Louisiana, Showing Oil, Gas and Sulfur Fields, Salt Domes, etc. (1938) J. H. McGuirt & M. B. Stevenson, (1:500,000), out of print.

*Louisiana Geological Survey, University Station, Box G, Baton Rouge, LA 70893.

MAINE

State Mineralogy

Maine Mines and Minerals, Philip Morrill, v. 1, *Western Maine* (1958) 80 p., maps, v. 2, *Eastern Maine* (1959) 80 p., maps, $9.00 per set, ppd. From Mineralogical Record Book Dept., P.O. Box 1656, Carson City, NV 89702 or Winthrops Gem & Mineral Shop, Box 218, East Winthrop, ME 04343.

Area Mineralogy—Pegmatites

Maine Tourmaline (1985) C. A. Francis, *Mineralogical Record,* **16**, 365–388.

Collecting Guides

See Connecticut: *Mineral Collector's Field Guide, Northeast.*

Gems and Minerals: A Guide to Rockhounding in Maine (1983) Jane Perham & Laura Sawyer, Delorme Pub., P.O. Box 298, Freeport, ME 04032, 48 p., illus., very generalized, $2.95 ppd.

Maps—Geologic

Bedrock Geologic Map of Maine (1984) P. H. Osberg *et al.*, Maine Geol. Survey Open-File Rept. 84-1, 13 p. and map, (1:500,000), *$2.50 ppd.

Generalized Geologic Map of Maine (1972) A. M. Hussey, Maine Geol. Survey, 8½ x 11", *$.25 ppd.

—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

*Check to: Treasurer State of Maine, order from: Maine Geol. Survey, Dept. of Conservation, State House, Station 22, Augusta, ME 04333.

MARYLAND

State Mineralogy

Minerals of Maryland (1940) C. W. Ostrander & W. E. Price, Jr., Maryland Nat. History Soc., Baltimore, MD, 92 p., illus., out of print.

Area Mineralogy—Chromite Deposits

See Pennsylvania—*Area Mineralogy*—Chromite Deposits.

Gold in Maryland (1983) K. R. Kuff, Maryland Geol. Survey Pamphlet, *free.

Collecting Guide

Minerals of the Washington, D.C. Area (1980) L. R. Bernstein, Maryland Geol. Survey Ed. Ser. No. 5, 148 p., illus., *$4.00 ppd.

Maps—Geologic

Geologic Map of Maryland (1968) Maryland Geol. Survey, (1:250,000), 54 x 43", *$3.00 ppd.

—Geologic Highway

Mid-Atlantic (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

*Maryland Geol. Survey, The Rotunda, 711 West 40th St., Suite 440, Baltimore, MD 21211.

MASSACHUSETTS

State Mineralogy

Massachusetts Minerals and Fossil Localities (1978) Peter Gleba, Krueger Enterprises, Inc., 24 Blackstone Street, Cambridge, MA 02139, 117 p., maps, $8.75 ppd.

Area Mineralogy—Chester Emery Mines

The Chester Emery Mines (1978) G. F. Links, *Mineralogical Record,* **9**, 235–242.

Collecting guide

See Connecticut: *Mineral Collector's Field Guide, Northeast.*

Maps—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

MICHIGAN

State Mineralogy

Mineralogy of Michigan (1976) E. W. Heinrich, Michigan Geol. Survey Bull. 6, 225 p., illus., *$3.00 ppd.

Area Mineralogy—Iron Ranges, Copper Country, Grand Rapids, Maybee

Michigan! (1983) *Rocks and Minerals,* **58**, n. 3.

—Copper Country

Native silver occurrences in the copper mines of Upper Michigan (1986) D. K. Olson, *Mineralogical Record,* **17**, 37–48.

—Gold Belt

The Michigan gold belt (1986) D. W. Maguire, *Mineralogical Record,* **17**, 117–121.

Locality Index

Michigan Mineralogy: A Locality Index (1983) Tom Morris, Jr., *Rocks and Minerals,* **58**, 107–112.

Maps—Geologic

Bedrock of Michigan (1977) R. W. Kelley, Michigan Geol. Survey Geologic Map GM2, 11 x 15", *$.10 ppd.

—Geologic Highway

Great Lakes (1978) AAPG Geol. Highway Map Ser., cat. no. 671, $4.50 + p&h.

*Information Serv. Center, Michigan Dept. Nat. Resources, Box 30028, Lansing, MI 48909.

MINNESOTA

State Mineralogy—none

Area Mineralogy—Iron Ranges & Royalton

Minnesota! (1982) *Rocks and Minerals,* **57**, n. 3.

—Deer Lake Complex

Geology of the Deer Lake Complex, Itasca County, Minnesota (1978) J. L. Berkley *et al.,* Minnesota Geol. Survey Rept. Inv. 70-A, B, *$4.50 + p&h.

Collecting Guide

Guide to Mineral Collecting in Minnesota (1979) 2nd revised, G. R. Rapp, Jr. & D. T. Wallace, Minnesota Geol. Survey Ed. Ser. 2, 45 p., *$1.00 + p&h.

Maps—Geologic

Geologic Map of Minnesota, Bed Rock Outcrops (1982) G. B. Morey, Minnesota Geol. Survey State Map Ser. 10, (1:3,168,000), *$1.00 + p&h.

—Geologic Highway

Northern Plains (1984) AAPG Geol. Highway Map Ser., cat. no. 672, $4.50 + p&h.

*Minnesota Geol. Survey, 2642 University Ave., St. Paul, MN 55114, p&h add $1.00 per order.

MISSISSIPPI

State Mineralogy—none

Maps—Economic Minerals

Economic Minerals Map of Mississippi (1983) D. C. Booth, Mississippi Bur. Econ. Geol., (1:500,000), *$5.25 ppd.

—Geologic

Geologic Map of Mississippi (1968) A. R. Bicker, Jr., Mississippi Bur. Econ. Geol., (1:500,000), 38 x 48", *$5.25 ppd, (1"=30 miles), 8½ x 11", *1 copy free, additional $.25 ppd.

—Geologic Highway

Southeastern (1975) AAPG Geol. Highway Map Ser., cat. no. 669, $4.50 + p&h.

*Mississippi Bureau of Geology, Box 5348, Jackson, MS 39216.

MISSOURI

State Mineralogy—none

Area Mineralogy—Bixby

Siegenite from the Buick Mine, Bixby, Missouri (1984) Mark LeFont, *Mineralogical Record,* **15**, 37–39.

—Route I-44

Guide to Mineral Resources along I-44 Rolla to St. Louis, Missouri (1978) A. W. Hebrank, Missouri Dept. Nat. Resources Misc. Pub. 36, 20 p., *$1.00 ppd.

Maps—Geologic

Geologic Map of Missouri (1979) K. H. Anderson, Missouri Dept. Nat. Resources, 1"=8 miles, *$2.00 ppd.

—Geologic Highway

Mid-Continent (1966) AAPG Geol. Highway Map Ser., cat. no. 661, $4.50 + p&h.

—Mineral Resources

Mineral Resources Map of Missouri (1965) Missouri Dept. Nat. Resources, 1"=8 miles, out of print.

*Maps and Publications, Missouri Department of Natural Resources, P.O. Box 250, Rolla, MO 65401.

MONTANA

State Mineralogy—none

***Area Mineralogy*—Barite**

Barite Occurrences in Montana (1982) Montana Bur. Mines Open File Rept. MBMG95, 10 p., *$2.00 ppd.

—Butte

The Minerals of Montana Tech: A History of the Mineral Museum (1983) R. B. Berg & L. G. Zeihen, Annual Rept. Montana Bur. Mines AR4, *$3.00 ppd.

—Lead-Zinc-Silver

Lead-Zinc-Silver Deposits in Carbonate Host Rocks in Montana: Mississippi Valley-Type ? (1982) Montana Bur. Mines Open File Rept. MBMG104, 10 p., illus., *$2.00 ppd.

—Stillwater Complex

Guidebook of the Stillwater Complex, Montana (1985) G. K. Czamanske & M. L. Zientek, Montana Bur. Mines Spec. Pub. SP92, 328 p., *$28.00 ppd.

—Lewis and Clark County

Metallic Mineral Deposits of Lewis and Clark County, Montana (1983) Montana Bur. Mines Memoir M52, 73 p., illus., *$8.00 ppd.

—Lolo Pass

Quartz Crystals from the Granite Creek–Lolo Pass Area, Montana (1982) M. O. Tweten, *Mineralogical Record,* **13**, 214–217.

—Talc and Chlorite

Talc and Chlorite Deposits in Montana (1979) Montana Bur. Mines Memoir M45, 66 p., illus., *$6.00 ppd.

—Yogo Gulch

The Great American Sapphire (1985) S. J. Voynick, Mountain Press, P.O. Box 2399, Missoula, MT 59806, 256 p., illus., $10.95 ppd, paper cover, $16.95 ppd, cloth cover.

***Maps*—Geologic**

Geologic Map of Montana (1955) C. P. Ross *et al.,* U.S. Geol. Survey, 2 sheets, (1:500,000), *$3.50 + p&h.

—Geologic Highway

Northern Rockies (1972) AAPG Geol. Highway Map Ser., cat. no. 665, $4.50 + p&h.

—Mining Districts

Mining Districts and Mineral Deposits of Montana (1976) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, 41 x 47", (1:1,000,000), $35.00 ppd.

—Metallic Mineral Deposits

Western Montana Metallic Mineral Deposits Map (1978) Montana Bur. Mines Open File Rept. MBMG 29, *$4.75 ppd.

*Montana Bur. Mines & Geol., Montana Tech, Main Hall, Room 200, Butte, MT 59701, p&h to be invoiced on U.S. Geol. Survey publications only.

NEBRASKA

State Mineralogy

Gemstones and Minerals of Nebraska: A Handbook for Students and Collectors (1971) R. K. Pabian, Nebraska Geol. Survey Ed. Cir. EC-2, 80 p., illus., *$1.00 ppd.

Area Mineralogy

Nebraska! (1980) *Rocks and Minerals,* **55**, n. 3.

Nebraska's Gold Fields (n.d.) Jay Fussell & Allan Griesemer, Nebrasks Geol. Survey Geo-Resources GR-2, *free.

***Maps*—Geologic**

Nebraska (1969) Nebraska Geol. Survey Geol. Maps & Charts, GMC-1, (1:1,000,000), *$.75 ppd, GMC-2, 11 x 17", *free.

—Geologic Highway

Northern Plains (1984) AAPG Geol. Highway Map Ser., cat. no. 672, $4.50 + p&h.

—Mineral Resources

Mineral Resource Map of Nebraska (1980) Nebraska Geol. Survey Resource Map RM-6, (1:1,000,000), *$1.50 ppd.

*Checks to: University of Nebraska, send to: Conservation and Survey Division, The University of Nebraska, 113 Nebraska Hall, Lincoln, NB 68588. Add $.50 to orders under $1.00.

NEVADA

***State Mineralogy*—none**

***Area Mineralogy*—Northern Mines**

Mines of Tuscarora, Cortez and Other Northern Nevada Districts (1910) W. H. Emmons, Reprint of U.S. Geol. Survey Bull. 408, 220 p., maps, **$14.95 + p&h.

—Southern Mines

Mines of the Goldfield, Bullfrog and Other Southern Nevada Districts (1907) F. L. Ransome, Reprint of U.S. Geol. Survey Bull. 303 with additions, 144 p., map, illus., **$14.95 + p&h.

—Eastern Mines

Mines of Cherry Creek and Other Eastern Nevada Districts (1916) J. M. Hill, Reprint of U.S. Geol. Survey Bull. 648, 214 p., maps, **$14.95 + p&h.

—Western Mines

Mines of Battle Mountain, Reese River, Aurora and Other Western Nevada Districts (1915) J. M. Hill, Reprint of U.S. Geol. Survey Bull. 594, 200 p., maps, $14.95 + p&h.

—Southwestern Mines

Mines of the Silver Pea Range, Kawich Range and Other Southwestern Districts (1907) S. H. Ball, Reprint of U.S. Geol. Survey Bull. 308, 218 p., map, **$14.95 + p&h.

—Barite

Barite in Nevada (1984) K. G. Papke, Nevada Bur. Mines & Geol. Bull. B98, *$11.00 ppd.

—Comstock, Getchell Mine, Steamboat Springs,
Northumberland Mine, Majuba Hill,
Julie Claim, White Caps Mine

Nevada Issue (1985) *Mineralogical Record,* **15**, n. 1.

—Chalk Mountain

Endlichite and Descloizite from the Chalk Mountain Mine, Churchill County, Nevada (1982) Martin Jensen, *Mineralogical Record,* **13**, 219–221.

—Fluorite

Fluorspar in Nevada (1979) K. G. Papke, Nevada Bur. Mines & Geol. Bull. B93, 77 p., map, *$6.60 ppd.

—Luning

Magnesioaxinite from Luning, Nevada (1980) P. J. Dunn *et al., Mineralogical Record,* **11**, 13–15.

Collecting Guide

Guidebook to Mineral Deposits of the Central Great Basin (1978) 5th Quadrennial Symp. IAGOD, Nev. Bur. Mines & Geol. Rept. R32, 75 p., *$3.85 ppd.

Mineral Resources

Mining Districts and Mineral Resources of Nevada (1923) R. C. Church, reprinted by Nevada Publications, 295 p., map, **$14.95 + p&h.

Maps—Geologic Highway

Pacific Southwest (1968) AAPG Geol. Highway Map Ser., cat. no. 663, $4.50 + p&h.

—Mining Districts

Metal Mining Districts of Nevada (1976) J. H. Schilling, Nevada Bur. Mines & Geol. Map M37, *$3.30 ppd.

Mining Districts and Mineral Deposits of California (1974) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, 35 x 49", $35.00 ppd.

—Active Mines

Active Mines and Oil Fields of Nevada (1983) Jones & K. G. Papke, Nevada Bur. Mines & Geol. Map M84, *$4.40 ppd.

—Lead Occurrences

Lead Mines and Occurrences in Nevada (1984) Nevada Bur. Mines & Geol. Map M78, *$5.00 ppd.

*Nevada Bureau of Mines & Geology, University of Nevada, Reno, NV 89557.

**Nevada Publications, 4135 Badger Circle, Reno, NV 89509, p&h add $1.50 for first book and $.50 for each additional.

NEW HAMPSHIRE

State Mineralogy

The Geology of New Hampshire: Volume 3, Minerals and Mines (1956) T. R. Myers & G. W. Stewart, New Hampshire State Planning and Dev. Com. GEO-3, 108 p., map in pocket, *$3.00 ppd.

Area Mineralogy—Government Pit

Microminerals (1983) Bill Henderson, *Mineralogical Record,* **14**, 47–48.

—Chandler Pegmatite

Recent Activity at the Chandler Mine, Raymond, New Hampshire (1985) Frank Lavoie, *Rocks and Minerals,* **60**, 262, 270–273.

Minerals of the Chandler Mine, A Zoned Lithium Rich Pegmatite (1985) C. A. Francis, *Rocks and Minerals,* **60**, 263–264.

—Palermo Pegmatite

Phosphate Minerals of the Palermo No. 1 Pegmatite (1981) C. G. Segeler *et al., Rocks and Minerals,* **56**, 196–214.

Collecting Guides

See Connecticut: Mineral Collector's Field Guide: Northeast.

Maps—Geologic

Geologic Map of New Hampshire (1955) M. P. Billings, New Hampshire Dept. Resources GEO-44, (1:250,000), *$3.00 ppd.

—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

—Mineral Deposits

Mineral Deposits and Occurrences in New Hampshire Exclusive of Clay, Sand and Gravel, and Peat (1957) N. C. Pearre & J. A. Calkins, U.S. Geol. Survey Mineral Resources Map, MR-6.

*Checks to: State of New Hampshire, New Hampshire Dept. of Resources & Dev., P.O. Box 856, Concord, NH 03301.

NEW JERSEY

State Mineralogy

Minerals of New Jersey (1959) A. S. Wilkerson, New Jersey Geol. Survey Rept. No. 1, 51 p., map, out of print.

Area Mineralogy—Bemco Mine

Metamict Minerals at the Bemco Mine near Cranberry Lake, New Jersey (1980) A. H. Yassiliou, *Mineralogical Record,* **11**, 39.

—Bridgeville

Ferroaxinite from Bridgeville, New Jersey (1984) Warren Cummings, *Mineralogical Record,* **14**, 43–44.

—Franklin–Sterling Hill

Contributions to the Mineralogy of Franklin and Sterling Hill, New Jersey (1979) P. J. Dunn, *Mineralogical Record,* **10**, 160–165.

Allacite & Pyrobelonite (1983) P. J. Dunn, *Mineralogical Record,* **14**, 203–204 & 251–252.

Alleghanyite (1984) O. V. Peterson *et al., Mineralogical Record,* **15**, 299–302.

Alleghanyite, Manganhumite, Sonolite, Leucophoenicite & Jerrygibbsite (1985) P. J. Dunn, *American Mineralogist,* **70**, 379–387.

Arsenate Minerals: An Overview (1982) F. J. Parker & Jack Troy, *Mineralogical Record,* **13**, 35–38.

Hauckite (1980) P. J. Dunn *et al., American Mineralogist,* **65**, 192–195.

Hodgkinsonite (1982) P. J. Dunn & R. C. Bostwick, *Mineralogical Record,* **13**, 229–232.

Jarosewichite (1982) P. J. Dunn *et al., American Mineralogist,* **67**, 1043–1047.

Johanbaumite (1980) P. J. Dunn *et al., American Mineralogist,* **65**, 1143–1145.

Kolicite (1979) P. J. Dunn *et al., American Mineralogist,* **64**, 708–712.

Kraisslite (1978) P. B. Moore & Jun Ito, *American Mineralogist,* **63**, 938–940.

Lawsonbauerite, Torreyite (1979) P. J. Dunn *et al.,* American Mineralogist, **64**, 949–952.

Marsturite (1978) D. R. Peacor & P. J. Dunn, *American Mineralogist,* **63**, 1187–1189.

Minehillite (1984) P. J. Dunn *et al., American Mineralogist,* **69**, 1150–1155.

Ogdensburgite, Sjögrenite, Holdenite (1981) P. J. Dunn, *Mineralogical Record,* **12**, 369–375.

Retzian-(Nd) (1982) P. J. Dunn & B. D. Sterman, *American Mineralogist,* **67**, 841–845.

Sterlinghillite (1981) P. J. Dunn, *American Mineralogist,* **66**, 182–184.

Minerals of the Buckwheat Dolomite, Franklin, New Jersey (1983) T. A. Peters *et al., Mineralogical Record,* **14**, 183–184.

—Mullica Hill

Mullica Hill, New Jersey (1980) W. A. Henderson, *Mineralogical Record,* **11**, 309–311.

—Trap Rocks

Mineralization at the Milligton Quarry, New Jersey (1985) Warren Cummings, *Rocks and Minerals,* **60**, 213–218.

Triassic Traprock Minerals of New Jersey (1984) J. J. Peters, *Rocks and Minerals,* **59**, 157–183.

Famous Mineral Localities: Paterson, New Jersey (1978) T. A. Peters & J. J. Peters with Julius Weber, *Mineralogical Record,* **9**, 157–166, 171–179.

Minerals of Laurel Hill, Secaucus, New Jersey (1981) N. W. Facciolla, 50 Maple Street, Teaneck, NJ 07666, $4.50 ppd.

Petersite, a REE and Phosphate Analog of Mixite (1982) D. R. Peacor & P. J. Dunn, *American Mineralogist,* **67**, 1039–1042.

Collecting Guides

See Connecticut: *Mineral Collector's Field Guide, Northeast.*

Quest for New Jersey's Minerals (1978) Robert Speiser, 13 Beam Place, Haledon, NJ 07508, 27 p., illus., out of print.

Maps—Geologic

Geologic Map of New Jersey (1950) New Jersey Geol. Survey, (1:250,000), 28 x 51", *$8.00 ppd.

Geologic Map of New Jersey (1984) New Jersey Geol. Survey, (1:1,000,000), 8½ x 11", *$.50 ppd.

—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

*Checks to Treasurer, State of NJ, mail to Maps and Publications Sales Office, Bur. of Collections, CN-402, Trenton, NJ 08625.

NEW MEXICO

State Mineralogy

Minerals of New Mexico (revised, 1959) S. A. Northrop, Univ. New Mexico Press, Albuquerque, NM 87131, 665 p., hardcover, out of print.

Area Mineralogy—Fluorite

Fluorspar in New Mexico (1978) W. N. McAnulty, New Mexico Bur. Mines Memoir 34, 61 p., *$8.00 + p&h.

—Grants District

Geology and Mineral Technology of the Grants Uranium Region, 1979 (1980) C. A. Rautman, New Mexico Bur. Mines Memoir 38, 400 p., *$18.00 + p&h.

—Great American Rift

Mines and Minerals of the Great American Rift (1983) R. W. Holmes & M. B. Kennedy, Van Nostrand Reinhold, Order Processing, 7625 Empire Drive, Florence, KY 41042, hardcover, $34.50 + p&h.

—Point of Rocks Quarry

Minerals of Point of Rocks (1984) R. S. DeMark, *Mineralogical Record,* **15**, 149–156.

—Red Cloud Mines

The Red Cloud Mines, Gallinas Mountains, New Mexico (1980) R. S. DeMark, *Mineralogical Record,* **11**, 69–72.

Collecting Guide

New Mexico Rocks & Minerals, The Collecting guide (1981) Sunstone Press, P.O. Box 2321, Santa Fe, NM 87501, 70 p., illus., $10.20 ppd.

Mineral Resources

Silver and Gold Occurrences in New Mexico (1984) R. M. North & V. T. McLemore, New Mexico Bur. Mines Open File Rept. 191, *$7.10 + p&h.

Maps—Geologic

Geologic Map of New Mexico (1965) C. H. Dane & G. O. Bachman, U.S. Geol. Survey (1:500,000), 2 sheets, *$6.60 + p&h.

—Geologic Highway

Geologic Highway Map of New Mexico, New Mexico Geological Soc., Campus Station, Socorro, NM 87801, (1:1,000,000), $3.50 ppd.

Southern Rocky Mountains (1967) AAPG Geol. Highway Map Ser., cat. no. 662, $4.50 + p&h.

—Active Mines

Active Mines and Processing Plants in New Mexico (1982) J. M. Barker & M. J. Logsdon, New Mexico Bur. Mines Resource Map RM-14, (1:3,500,000), 8½ x 11", *$.50 + p&h.

—Mining Districts & Mineral Deposits

Mining Districts and Mineral Deposits of New Mexico (1977) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, $35.00 ppd.

*Publications Room, New Mexico Bureau of Mines & Mineral Resources, Socorro, NM 87801. P&h: on orders less than $5, there is no charge; $5–$25, add $1.50; over $25, add $1.50 for each $25.

NEW YORK

State Mineralogy

Minerals of New York (1978) D. E. Jensen, Ward's Nat. Science Est., P.O. Box 1712, Rochester, NY 14603, 220 p., illus., cat. no. 32E4001, soft cover, $9.14 ppd, cat. no. 32E400, hard cover, $14.89 ppd.

Area Mineralogy—Ticonderoga

Bastnaesite near Ticonderoga, New York (1983) C. G. Doll, *Mineralogical Record,* **14**, 239–241.

Graphite from the Lead Hill Mine, Ticonderoga, New York (1983) R. J. Lauf & A. E. Pasto, *Mineralogical Record,* **14**, 25–30.

—Harriman State Park

Rare Element Mineral Occurrences in the Greater New York Area (1981) John Gillespie, *Rocks and Minerals,* **56**, 70–72.

—Hickory Hill

Pseudo-skeletal Quartz Crystals from Hickory Hill, Montgomery County, Near Fonda, New York (1981) R. I. Gait, *Rocks and Minerals,* **56**, 153–155.

—Syracuse

A New Pyrite Locality Near Syracuse, New York (1983) W. P. Dossert & S. C. Chamberlain, *Rocks and Minerals,* **58**, 49–55.

—Adirondacks

Plagioclase Feldspars from the Adirondacks of Eastern New York State (1984) E. B. Rowley, *Rocks and Minerals,* **59**, 120–124.

—Antwerp

The Sterling Mine, Antwerp, New York (1984) G. W. Robinson & S. C. Chamberlain, *Mineralogical Record,* **15**, 199–216.

—Beaver Creek

Mineralization, Mining and Mineral Resources in the Beaver Creek Area of the Grenville Lowlands in St. Lawrence County, New York (1983) C. E. Brown, U.S. Geol. Survey Prof. Paper 1279, 21 p., illus., $5.00 ppd. from U.S.G.S. Books and Open-File Reports, Federal Center, Bldg. 41, Box 25425, Denver, CO 80225.

Collecting Guide

See Connecticut—*Mineral Collector's Field Guide, Northeast.*

Maps—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

Checks to New York State Library, mail to New York State Museum, 3140 Cultural Education Center, Albany, NY 12230.

NORTH CAROLINA

State Mineralogy

Mineral Localities of North Carolina (1958, revised 1971) J. F. Conley *et al.*, North Carolina Div. Mineral Res. Inf. Cir. 16, 128 p., illus., maps, out of print.

Area Mineralogy—Bald Knob

The Bald Knob Manganese Deposit (1985) W. B. Simmons, Jr., *Rocks and Minerals,* **60**, 130–135.

Manganese Minerals of Bald Knob, North Carolina (1981) W. B. Simmons, Jr., *Mineralogical Record,* **12**, 167–171.

—Kings Mountain

The Foote Quarry, Kings Mountain North Carolina Revisited, 1984 (1985) Jack Hanahan, *Rocks and Minerals,* **60**, 76–83.

The Foote Minerals (1978) Laura Marble & Jack Hanahan, Jr., *Rocks and Minerals,* **53**, 158–173.

—Pegmatites, Ruby Mines, Gold, Diamonds, Zeolites, Collecting Localities

North Carolina (1985) *Rocks and Minerals,* **60**, n. 2.

—Shelby Area

Cassiterite Occurrences in the Shelby Area, North and South Carolina (1985) J. P. D'Agostino & J. W. Whitlow, U.S. Geol. Survey Bull. 1569, 14 p., **$1.00 ppd.

Collecting Guides

Mineral Collecting Sites in North Carolina (1978) W. F. Wilson & B. J. McKenzie, North Carolina Geol. Survey Inf. Cir. 24, 120 p., illus., maps, *$5.00 ppd.

Mineral Resources

North Carolina Geology and Mineral Resources: A Foundation for Progress (revised, 1980) W. F. Wilson *et al.*, North Carolina Geol. Survey Ed. Ser. 4, *$2.00 ppd.

Maps—Geologic

Geologic Map of North Carolina (1958) North Carolina Geol. Bull. 71, (1:500,000), *$5.00 ppd, (1" = 30 mi.), *free.

—Geologic Highway

Mid-Atlantic Region (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

*North Carolina Geological Survey Section, P.O. Box 27687, Raleigh, NC 27611.

**U.S.G.S. Books and Open-File Reports, Federal Center, Bldg. 41, Box 25425, Denver, CO 80225.

NORTH DAKOTA

State Mineralogy—none

Area Mineralogy—Williston Basin

Potash Salts in the Williston Basin, U.S.A. (1979) S. B. Anderson & R. P. Swinehart, North Dakota Geol. Survey Rept. Inv. RI-69, 93 p., *$2.00 ppd.

Little-Known MidPaleozoic Salts of Northwestern North Dakota (1984) David Fischer & S. B. Anderson, North Dakota Geol. Survey Rept. Inv. RI-83, 18 p., *$2.00 ppd.

Maps—Geologic

Geologic Map of North Dakota (1980) Lee Clayton *et al.*, U.S. Geol. Survey, (1:500,000), 40 x 50", $$4.00 ppd. Map Distribution, U.S. Geol. Survey, Box 25286, Federal Center, Denver, CO 80225.

Bedrock Geologic Map of North Dakota (1982) J. P. Bluemle, North Dakota Geol. Survey Misc. Map 21, (1:1,000,000), 27 x 30", *$1.00 ppd.

—Geologic Highway

Geologic Highway Map of North Dakota (1976) John Bluemle, North Dakota Geol. Survey Misc. Map 19, (1:1,000,000), *$1.00 ppd.

Northern Plains (1984) AAPG Geol. Highway Map Ser., cat. no. 672, $4.50 + p&h.

*North Dakota Geological Survey, University Station, Grand Forks, ND 58202.

OHIO

State Mineralogy—none

Area Mineralogy—Duff's Quarry

Trapezohedral Pyrite in Ohio (1976) H. H. Fisher, *Rocks and Minerals,* **51**, 293.

Pyrite Crystals from Duff's Quarry, Huntsville, Ohio, U.S.A. (1980) R. I. Gait, *Mineralogical Record,* **11**, 97–99.

Maps—Geologic

Geologic Map of Ohio (1947) J. A. Bownocker, Ohio Geol. Survey, (1" = 1 mi.), *$2.75 ppd.

—Geologic Highway

Great Lakes Area (1978) AAPG Geol. Highway Map Ser., cat. no. 671, $4.50 + p&h.

*Ohio Division of Geological Survey, Fountain Square Bldg. B, Columbus, OH 43224.

OKLAHOMA

State Mineralogy

Minerals of Oklahoma (1963) E. L. Gilmore, The Author, 77 p., map, out of print.

Common Minerals, Rocks and Fossils of Oklahoma (1960) W. E. Ham & N. M. Curtis, Jr., Oklahoma Geol. Survey Guidebook 10, 28 p., illus., *$2.00 ppd.

Area Mineralogy—Copper in Red Beds

Copper Deposits in Sheep Pen Sandstone (Triassic) in Cimarron County, Oklahoma and Adjacent Parts of Colorado and New Mexico (1983) R. O. Fay, Oklahoma Geol. Survey Cir. 86, 24 p., illus., *$8.00 paper, $12.00 cloth, ppd.

Copper in the Flowerpot Shale (Permian) of the Creta Area, Jackson County, Oklahoma (1966) W. E. Ham & K. S. Johnson, Oklahoma Geol. Survey Cir. 64, 32 p., illus., *$1.00 ppd.

—Paoli Area

Brochantite and other minerals from the Paoli, Oklahoma, area (1986) J. Lobell, *Mineralogical Record,* **17**, 371–374.

Collecting Guide

Gem Trails of Oklahoma (n.d.) Colonel Brigham Young, Alamo Flower Shop, Oklahoma City, 69 p., illus., out of print.

Mineral Resources

Geology and Earth Resources of Oklahoma: An Atlas of Maps and Cross Sections (1972) K. S. Johnson *et al.*, Oklahoma Geol. Survey Ed. Pub. 1, 15 p., illus., *$2.00 ppd.

Maps—Geologic

Geologic Map of Oklahoma (1954) H. D. Miser, Oklahoma Geol. Survey, (1:500,000), 2 sheets, *$8.80 ppd.

—Geologic Highway

Mid-Continent (1966) AAPG Geol. Highway Map Ser., cat. no. 661, $4.50 + p&h.

—Mineral

Mineral Map of Oklahoma (1970) K. S. Johnson, Oklahoma Geol. Survey Map GM-15, (1:750,000), *$1.50 ppd.

*Oklahoma Geological Survey, The University of Oklahoma, 830 Van Vleet Oval, Room 163, Norman, OK 73019.

OREGON

State Mineralogy

A Description of Some Oregon Rocks and Minerals (1950) H. M. Dole, Oregon Dept. Geol. & Min. Ind. Misc. Paper 1, 41 p., *$1.00 ppd.

Area Mineralogy—Ritter

Paulingite: Variations in Composition (1982) R. W. Tschernich & W. S. Wise, *American Mineralogist*, **67**, 799–803.

Mineral Resources—Nickel

Investigations of Nickel in Oregon (1978) Oregon Dept. Geol. & Mineral Ind. Misc. Paper 20, *$5.00 ppd.

Maps—Geologic

Geologic Map of Oregon: West of 121st Meridian (1961) U.S. Geol. Survey Map I-325, *$6.10 ppd; *East of 121st Meridian* (1977) U.S. Geol. Survey Map I-902, *$6.10 ppd.

—Geologic Highway

Pacific Northwest (1973) AAPG Geol. Highway Map Ser., cat. no. 667, $4.50 + p&h.

—Mineral Resources

Mineral Resources Map of Oregon (1984) Oregon Dept. Geol. & Min. Ind. Geol. Map Ser. GMS-36, *$8.00 ppd.

—Mining Districts

Mining Districts and Mineral Deposits of Oregon (1976) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, (1:1,000,000), 29 x 49", $35.00 ppd.

*State of Oregon Dept. of Geol. & Min. Ind., 910 State Office Building, 1400 SW Fifth Ave., Portland, OR 97201.

PENNSYLVANIA

State Mineralogy

Mineralogy of Pennsylvania, 1966–1975 (1978) R. C. Smith II, Friends of Mineralogy, Pennsylvania Chapter Spec. Pub. no. 1, 304 p., hard cover, $15.50 ppd from Bryon Brookmyer, Box 19, Sunset Ave., Blue Ball, PA 17506.

Second Preliminary Report on the Mineralogy of Pennsylvania (1876) F. A. Genth, Pennsylvania Geol. Survey, 2nd ser., Rept. B2, out of print.

Area Mineralogy—Cedar Hill Quarry

Desautelsite, A New Mineral of the Pyroaurite Group (1979) P. J. Dunn *et al.*, *American Mineralogist*, **64**, 127–130.

—Campbell's Quarry

Campbell's Quarry—A Complex Mineral Locality in Gettysburg, Pennsylvania (1978) Donald Hoff, *Rocks and Minerals*, **53**, 247–253.

—Cornwall

Geology and Origin of Triassic Magnetite Deposit and Diabase at Cornwall, Pennsylvania (1973) D. M. Lapham & Carlyle Gray, Pennsylvania Geol. Survey, 4th ser., Mineral Resource Rept. 56, 343 p., illus., maps, *$11.65 ppd.

—Delaware County Pegmatites

Classic Pegmatite Occurrences in Delaware County, Pennsylvania (1984) J. J. Peters, *Rocks and Minerals*, **59**, 109–119.

—East Salem

Celestite, East Salem, Pennsylvania (1983) J. L. Jones, *Rocks and Minerals*, **58**, 265–266.

—Eastern

Mineralogy Associated with Burning Anthracite Deposits of Eastern Pennsylvania (1980) D. M. Lapham *et al.*, Pennsylvania Geol. Survey, 4th ser., Mineral Resource Rept. M78, 82 p., *$3.15 ppd.

—Kine's Quarry, Kibblehouse Quarry, New Enterprise Quarry, Adams County, Cornwall-Type Iron Mines

Pennsylvania (1978) *Rocks and Minerals*, **53**, n. 3.

—Metal Mines

Metal Mines and Occurrences in Pennsylvania (1973, 2nd printing) A. W. Rose, Pennsylvania Geol. Survey, 4th ser., Mineral Resource Rept. 50, part 3, 14 p., map, *$3.05 ppd.

—Lead and Zinc

Zinc and Lead Occurrences in Pennsylvania (1977) R. C. Smith, II, Pennsylvania Geol. Survey, 4th ser., Mineral Resource Rept. 72, 318 p., illus., maps, *$14.10 ppd.

—Iron Mines, Dillsburg

The Iron Mines of Dillsburg, Pennsylvania (1980) J. L. Jones and Jan Goodman, *Rocks and Minerals*, **55**, 153–157.

—Montgomery County

Historical Sketches of Copper and Lead Mining in Montgomery County, Pennsylvania (1980) F. H. Evans, Pennsylvania Chapter Friends of Mineralogy, 36 p., $4.50 ppd. Order from Bryon Brookmyer, Box 19, Sunset Ave., Blue Ball, PA 17506.

—Phoenixville

Highlights of the Life of Charles M. Wheatley (1985) F. H. Evans & A. V. Heyl, Mineralogical Society of Pennsylvania, 48 p., illus., $4.50 ppd. Order from Mineralogical Soc. of PA, c/o Dr. Arnold Fainberg, 598 N. Prince Frederick St., King of Prussia, PA 19406.

—Uranium Minerals

Uranium in Carbon, Lycoming, Sullivan, and Columbia Counties, Pennsylvania (1978) W. D. Sevon *et al.*, Field Conf. of Pennsylvania Geologists, Guidebook, 43rd Conf., 99 p., out of print.

Geology and Mineralogy of Copper-Uranium Occurrences in the Picture Rocks and Sonestown Quadrangles, Lycoming and Sullivan Counties, Pennsylvania (1985) R. C. Smith, II & D. T. Hoff, Pennsylvania Geol. Survey, 4th ser., Min. Res. Rept. 80, *$18.35 ppd.

—Winfield

Faylor-Middlecreek Quarry, Winfield, Pennsylvania (1979) S. C. Chamberlain & W. P. Dossert, *Rocks and Minerals*, **54**, 104–107.

—State Line District

Chromium Minerals at the Line Pit, State Line Chromite District, Pennsylvania and Maryland (1981) E. E. Foord *et al.*, *Mineralogical Record*, **12**, 149–155.

Chromium Deposits of Maryland and Eastern Pennsylvania (1980) W. H. Hartford, *Rocks and Minerals,* **55**, 52–59.

Chromite and Other Mineral Deposits in Serpentine Rocks of the Piedmont Upland, Maryland, Pennsylvania and Delaware (1960) N. C. Pearre & A. V. Heyl, Jr., U.S. Geol. Survey Bull. 1082-k, p. 707–833, maps, out of print.

Mineral Resources

Directory of the Mineral Industry in Pennsylvania (1985) S. W. Berkheiser, *et al.,* Pennsyvlania Geol. Survey, 4th ser., Inf. Cir. 54, 165 p., *$5.75 ppd.

Maps—Geologic

Geologic Map of Pennsylvania (1980) T. M. Berg *et al.,* Pennsylvania Geol. Survey, 4th ser., Map 1, 42 x 58" (1:250,000), *$11.55 ppd.

—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

*Check to: Commonwealth of Pennsylvania, Dept. of General Services, State Book Store, P.O. Box 1365, Harrisburg, PA 17105.

RHODE ISLAND

State Mineralogy

Minerals of Rhode Island (1972) C. E. Miller, Dept. of Geol., University of Rhode Island, Kingston, RI 02881, 83 p., illus., maps, out of print.

Area Mineralogy

Amethyst sceptered quartz from Ashaway Village, Hopkinton, Rhode Island (1986) W. C. Metropolis, J. Rakovan & S. Avella, *Rocks and Minerals,* **61**, 247–250.

Minerals of Poker Hill, Cumberland, Providence County, Rhode Island (1986) J. Cahoon & P. Young, *Rocks and Minerals,* **61**, 281–284.

Maps—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

SOUTH CAROLINA

State Mineralogy

Catalog of Mineral Localities of South Carolina (1908) E. Sloan, South Carolina Geol. Survey Bull. 2, 505 p., out of print.

Area Mineralogy—Kings Creek

The Kings Creek, South Carolina, Barite Pits (1979) Roger Barnett & Jerry Howe, *Rocks and Minerals,* **54**, 173–175.

—Liberty Hill

Smoky Quartz in the Liberty Hill Pegmatite (1978) Dick Dayvault, *Rocks and Minerals,* **53**, 208–213.

Maps—Geologic

Geologic Map of the Crystalline Rocks of South Carolina (1965) W. C. Overstreet & Henry Bell, III, South Carolina Geol. Survey, (1:250,000), 39 x 56", *$4.50 ppd.

—Geologic Highway

Mid-Atlantic (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

*South Carolina Geological Survey, Harbison Forest Road, Columbia, SC 29210.

SOUTH DAKOTA

State Mineralogy

Minerals and Rocks of South Dakota (1973) B. C. Petsch & D. J. McGregor, South Dakota Geol. Survey Ed. Ser. 5, 32 p., *$2.05 ppd.

Mineralogy of the Black Hills (1965) W. L. Roberts & George Rapp, Jr., South Dakota School of Mines and Tech. Bull. 18, 268 p., illus., $7.00 soft cover, $10.00 hard cover, ppd from: South Dakota School of Mines, Museum of Geology, 500 E. St. Joseph, Rapid City, SD 57701.

Area Mineralogy—Black Hills Pegmatites

Red Montgomeryite and Associated Minerals from the Tip Top Pegmatite (1983) P. J. Dunn *et al., Mineralogical Record,* **14**, 195–197.

Fluorapatite from King Lithia Mine, Pennington County, South Dakota (1984) M. L. Wilson *et al., Mineralogical Record,* **15**, 361–366.

Wodginite and Associated Oxide Minerals from the Peerless Pegmatite, Pennington County, South Dakota (1985) P. Cerny *et al., American Mineralogist,* **70**, 1044–1049.

Phosphate minerals from the Tip Top mine, Black Hills, South Dakota (1986) T. J. Campbell & W. L. Roberts, *Mineralogical Record,* **17**, 237–254.

—Black Hills

Mineral Localities in the Black Hills of South Dakota (1985) T. J. Campbell & W. L. Roberts, *Rocks and Minerals,* **60**, 109–118.

Type locality minerals of the Black Hills (1986) K. L. Triscori & T. J. Campbell, *Mineralogical Record,* **17**, 297–302.

—Elk Creek

Famous mineral localities: Elk Creek, South Dakota (1987) T. J. Campbell, D. R. Campbell & W. L. Roberts, *Mineralogical Record,* **18**, 125–130.

Maps—Geologic

Geologic Map of South Dakota (1964) South Dakota Geol. Survey Ed. Ser. Map 1, 8½ x 11", *$1.10 ppd.

Geologic Map of the Black Hills (1972) Bruno Petsch, South Dakota Geol. Survey Ed. Ser. Map 5, 11 x 17", *$1.45 ppd.

—Geologic Highway

Northern Plains (1984) AAPG Geol. Highway Map Ser., cat. no. 672, $4.50 + p&h.

*South Dakota Geological Survey, Science Center, University of South Dakota, Vermillion, SD 57069.

TENNESSEE

State Mineralogy

Rocks and Minerals of Tennessee: A Guide to Identification, Occurrence, Production and Uses (1957) R. J. Floyd, Tenn. Div. Geol. Inf. Cir. 5, 36 p., out of print.

Area Mineralogy—Fluorite

Fluorspar in Tennessee (1983) S. W. Maher & B. C. Spencer, Tenn. Div. Geol. Rept. Inv. 42, 30 p., *$5.00 + p&h.

—Elmwood

The Elmwood and Gordonsville Zinc Mines near Carthage, Tennessee (1978) L. E. Kearns & F. H. Campbell III, *Mineralogical Record,* **9**, 213–218.

—Zinc Deposits

Tennessee Zinc Deposits Field Trip Guide Book (1983) Gray *et al.*, Guidebook No. 9, Dept. Geol. Sciences, Virginian Polytechnic Inst. & State Univ., Blacksburg, VA 24061, $12.00 ppd.

Maps—Geologic

State Geologic Map (1966) Tenn. Geol. Div., (1:250,000), 4 sheets, *$2.50 each sheet + p&h, (1970) 8½ x 11", *free first copy, additional are $.20 + p&h.

—Geologic Highway

Mid-Atlantic (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

—Mineral Resources

Minerals Resources and Mineral Industries of Tennessee (1959) W. D. Hardeman & R. A. Miller, Tenn. Div. Geol., (1:500,000), 42 x 66", $2.00 + p&h.

*Tennessee Division of Geology, Publications Sales Office, 701 Broadway, Nashville, TN 37219, p&h add $.70 for first pub. and $.25 for each additional; maps add $1.00 for each 3 and $1.50 for from 4 to 10.

TEXAS

State Mineralogy

Texas Rocks and Minerals: An Amateur's Guide (1964) R. M. Girard, Texas Bur. Econ. Geol. Guidebook 6, 109 p., illus., *$2.50 + p&h.

Texas Gemstones (1961) E. A. King, Texas Bur. Econ. Geol. Rept. Inv. 42, 45 p., illus., *$1.50 + p&h.

Area Mineralogy—Plata Verde Mine

Geology of the Plata Verde Mine, Hudspeth County, Texas (1982) J. G. Price, Texas Bur. Econ. Geol. Mineral Res. Cir. 70, 34 p., map, illus., *$2.00 + p&h.

—Salt Domes

Pyrrhotite Nodules from Gulf Coast Salt Domes (1980) A. E. Smith, Jr., *Mineralogical Record,* **11**, 100–101.

—Trans-Pecos

Developmemt of the Mercury Mining Industry: Trans-Pecos, Texas (1980) R. D. Sharpe, Texas Bur. Econ. Geol. Mineral Res. Cir. MRC64, 32 p., illus., *$2.00 + p&h.

Annotated Bibliography of Mineral Deposits in Trans-Pecos Texas (1983) J. G. Price *et al.,* Texas Bur. Econ. Geol. Mineral Res. Cir. MRC73, 110 p., illus., *$5.00 + p&h.

Maps—Geologic

Geologic Map of Texas (1932) Texas Bur. Econ. Geol. Misc. Maps MM14, (1:2,000,000), out of print.

—Geologic Highway

Texas (1973) AAPG Geol. Highway Map Ser., cat. no. 666, $4.50 + p&h.

—Mineral Resources

Mineral Resources Map of Texas (1979) L. E. Garner *et al.,* Texas Bur. Econ. Geol., *$2.50 + p&h.

*Texas Bureau of Economic Geology, University of Texas, Box X, University Station, Austin, TX 78712, p&h add $.75 for orders up to $3.00, $1.25 up to $5.00, $1.75 up to $10.00, $2.25 up to $20.00.

UTAH

State Mineralogy

Minerals and Mineral Localities of Utah (1981) K. C. Bullock, Utah Geol. & Mineral Survey Bull. 117, 177 p., *$10.00 + p&h.

Area Mineralogy—Big Cottonwood District

Geology, Ore Deposits and History of the Big Cottonwood Mining District, Salt Lake County, Utah (1979) L. P. James, Utah Geol. & Mineral Survey Bull. 114, *$10.00 + p&h.

—Fluorite, Spor Mt.

Geology of the Fluorite Occurrences, Spor Mountain, Utah (1981) K. C. Bullock, Utah Geol. & Mineral Survey Spec. Studies 53, 31 p., *$3.00 + p&h.

—Green River Formation

Abelsonite, Nickel Porphyrin, A New Mineral from the Green River Formation, Utah (1978) Charles Milton, *American Mineralogist,* **63**, 930–937.

—Rocky Range

Geology, Ore Deposits and Mineralogy of the Rocky Range, near Milford, Beaver County, Utah (1982) J. A. Whelan, Utah Geol. & Mineral Survey Spec. Studies 57, 35 p., *$7.50 + p&h.

—Southwestern

Guidebook to Mineral Deposits of Southwestern Utah (1978) I.A.G.O.D. Meeting, Field Excursion C-2, 75 p., *$1.00 + p&h.

—Thomas Range

The Thomas Range, Wah Wah Mountains and Vicinity, Western Utah (1979) L. R. Ream, *Mineralogical Record,* **10**, 261–278.

Collecting Guides

A Field guide to Topaz and Associated Minerals of Topaz Mountain, Utah (1978, revised edition) John Holfert, Bountiful, Utah, 67 p., illus., out of print.

Rockhound Guide to Mineral and Fossil Localities in Utah (1979, revised) C. H. Stowe, Utah Geol. & Mineral Survey Cir. 63, 79 p., illus., *$5.00 + p&h.

Maps—Geologic

Geologic Map of Utah (1981) L. F. Hintz, Utah Geol. & Mineral Survey Map A-1, (1:500,000), 2 sheets, sent rolled only, *$15.00 + $4.50 for tube, ppd (1979) Misc. Pub. A-2, 8½ x 11", *$1.00 + p&h.

—Geologic Highway

Southern Rockies (1967) AAPG Geol. Highway Map Ser., cat. no. 662, $4.50 + p&h.

—Mining Districts and Minerals

Utah Mining District Areas and Principal Metal Occurrences (1983) H. H. Doelling & T. E. Tooker, Utah Geol. & Mineral Survey Map 70, (1:750,000), *$5.00 + p&h.

Non-Metalic Mineral Resources of Utah (1983) Utah Geol. & Mineral Survey Map 71, (1:750,000), *$5.00 + p&h.

Mining Districts and Mineral Deposits of Utah (1974) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, (1:1,000,000), 36 x 49", $35.00 ppd.

*Utah Geol. & Mineral Survey, 606 Black Hawk Way, Salt Lake City, UT 84108. P&h add: $2.00 for orders less than $10, $4.00 for orders $10–$25, $8.00 for orders $25–$50, $12.00 for orders $50–$100.

VERMONT

State Mineralogy

Vermont Mines and Mineral Localities (1964) Philip Morrill & Robert Chaffee, Dartmouth College Museum, 54 p., out of print, contact for possible reprinting, Dondero's Rock & Mineral Shop, Box 641, North Conway, NH 03860.

Collecting Guides

See Connecticut—*Mineral Collectors Field Guide: Northeast.*

Maps—Geologic

Centennial Geologic Map of Vermont (1961) Vermont Geological Survey, (1:250,000), *$6.00 ppd.

—Geologic Highway

Northeastern (1976) AAPG Geol. Highway Map Ser., cat. no. 670, $4.50 + p&h.

*Vermont Department of Libraries, Geological Publications, c/o State Office Building P.O., Montpelier, VT 05602.

VIRGINIA

State Mineralogy

Minerals of Virginia (1970) R. V. Dietrich, Virginia Polytechnic Inst. Reserach Div. Bull. 47, 325 p., illus., $4.00 ppd from: Publication Distribution Office, 111 Lansdown St., Blacksburg, VA 24061 or from Virginia Div. Min. Res., *$4.00 + p&h.

Area Mineralogy—Amherst County

Minerals of a Weathered Allanite Pegmatite, Amherst County, Virginia (1980) R. S. Mitchell & G. E. Redline, *Rocks and Minerals,* **55**, 245–249.

—Blue Ridge & Red Brush Mine

Contributors to Virginia Geology—IV (1980) Virginia Div. Mineral Res. Pub. 27, 63 p., illus., *$6.00 + p&h.

—Bull Run Quarry

Bull Run Quarry, Loudoun County, Virginia (1979) H. R. Freeland, *Rocks and Minerals,* **54**, 48–54.

—Gold

Gold in Virginia (1980) P. C. Sweet, Virginia Div. Mineral Res. Pub. 19, 77 p., illus., maps, *$5.50 + p&h.

Mineralogy and Chemistry of Gold, Halifax County (1985) *Virginia Minerals,* **31**, n. 3, *$1.00 + p&h.

—Kelly Bank Mine

Turquoise from Virginia's Kelly Bank Mine (1978) R. S. Mitchell & H. R. Freeland, *Rocks and Minerals,* **53**, 214–218.

—Quartz Crystals

Quartz Crystals (1983) *Virginia Minerals,* **29**, n. 1, *$1.00 + p&h.

—Vesuvius

Phosphate Minerals in the Vesuvius, Virginia Area (1982) H. L. Barwood & L. W. Zelazny, *Rocks and Minerals,* **57**, 20–22.

—Willis Mountain

Geologic Investigations in the Willis Mountain and Andersonville Quadrangles, Virginia (1981) Virginia Div. Mineral Res. Pub. 29, 83 p., illus., *$14.00 + p&h.

—Wise County & Lone Jack Quarry

Virginia Minerals and Fossils (1985) *Rocks and Minerals,* **60**, n. 4, *$3.50 + p&h.

Locality Index

Virginia Mineral Locality Index (1985) D. A. Penick, Jr., *Rocks and Minerals,* **60**, 164–170, *$3.50 + p&h.

Collecting Guides

See Maryland—Collecting Guide—*Minerals of the Washington, D.C. Area,* *$4.00 + p&h.

Mineral and Fossil Collecting Sites (1985) *Virginia Minerals,* **31**, n. 3, *$1.00 + p&h.

Mineral Resources

Minerals for Virginia (1985) H. W. Webb, Virginia Div. Mineral Resources Pub. 61, 26 p., illus., *$3.00 + p&h.

Selected Virginia Mineral Resource Information (1984) P. C. Sweet & W. D. Rowe Jr., Virginia Div. Mineral Res. Pub. 51, 28 p., with maps and tables, *$4.00 + p&h.

Virginia Gold—Resource Data (1983) P. C. Sweet & David Trimble, Virginia Div. Mineral Res. Pub. 45, 196 p., *$10.00 + p&h.

Maps—Geologic

Geologic Map of Virginia (1963) Virginia Div. Mineral Res., (1:500,000), 33 x 59", black and white ozalid copy, *$4.00+ p&h, (1964) 8½ x 11", color, 1"=45 mi., $.15 + p&h.

—Geologic Highway

Mid-Atlantic (1979) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

Map of Mineral Industries and Resources of Virginia (1983) Palmer Sweet, (1:500,000), 30 x 78", color, *$8.00 + p&h.

*Virginia Division of Mineral Resources, Box 3667, Charlottesville, VA 22903, p&h is 0 under $1.50, $1.25 for orders $1.51 to $10.00, $1.50 for orders $10.01 to $20.00, $2.00 for orders $20.01 to $50.00 and $3.00 for orders over $50.00.

WASHINGTON

State Mineralogy

Minerals of Washington (1975) Bart Cannon, Cordilleran Press, 1041 NE 100 St., Seattle, WA 98125, 184 p., illus., $6.75 ppd.

Area Mineralogy—King County

Quartz and Pyrite from King County, Washington (1978) John Medici *et al., Mineralogical Record,* **9**, 349–359.

—Rock Island Dam

Paulingite: Variations in Composition (1982) R. W. Tschernich & W. S. Wise, *American Mineralogist,* **67**, 799–803.

—Washington Pass

Okanoganite, A New Rare-Earth Borofluorosilicate from the Golden Horn Batholith, Okanogan County, Washington (1980) R. C. Boggs, *American Mineralogist,* **65**, 1138–1142.

Mineral Collecting at Washington Pass, Okanogan Co., WA (1985) Randy Becker, *Mineral News,* **1**, n. 3, 2–3, n. 4, 3–4, n. 5, 3–4, n. 6, 1–3.

Collecting Guides

Gems and Minerals of Washington (revised, 1984) L. R. Ream, Jackson Mountain Press, Renton, WA 216 p., illus., **$8.95 ppd.

The Rockhounds Guide to Washington, 4 (1986) Bob Jackson, Jackson Mountain Press, Renton, WA, 50 p., **in press.

Maps—Geologic

Geologic Map of Washington (1961) M. T. Huntting *et al.*, Washington Div. Mines & Geol., 2 sheets, (1:500,000), out of print.

—Geologic Highway

Pacific Northwest (1973) AAPG Geol. Highway Map Ser., cat. no. 667, $4.50 + p&h.

—Mineral Resources

Mineral Resources Map of Washington (1978) W. S. Moen, Washington Div. Mines & Geol. GM-22, 4 maps and text, (1:1,000,000), out of print.

—Mining Districts & Mineral Deposits

Mining Districts and Mineral Deposits of Washington (1978) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, 33 x 43", $35.00 ppd.

*State of Washington Dept. of Nat. Resources, Div. of Geol. & Earth Res., Olympia, WA 98504, p&h add $1.00 per order.

**Jackson Mountain Press, P.O. Box 2652, Renton, WA 98056.

WEST VIRGINIA

State Mineralogy

Minerals of West Virginia (1964) J. H. C. Martens, West Virginia Geol. & Econ. Survey Ed. Ser. ED-8, 41 p., illus., out of print.

Maps—Geologic

Geologic Map of West Virginia (1968) West Virginia Geol. Survey, (1:250,000), 2 sheets, 42 x 58", *$6.50 folded, $7.50 rolled, ppd.

—Geologic Highway

Mid-Atlantic (1970) AAPG Geol. Highway Map Ser., cat. no. 664, $4.50 + p&h.

—Mineral Resources

Mineral Resources and Mineral Industries of West Virginia (1958) West Virginia Geol. Survey, (1:500,000), 34 x 39", out of print.

*West Virginia Geological & Economic Survey, Box 879, Morgantown, WV 26507.

WISCONSIN

State Mineralogy

Story of the Rocks and Minerals of Wisconsin (1906) P. V. Lawson, Appleton, WI, 202 p., out of print.

Area Mineralogy—Jackson

Wavellite in Jackson County, Wisconsin (1984) A. Falster, *Rocks and Minerals,* **53**, 125–126.

—Molybdenite

Molybdenite in Wisconsin (1983) J. K. Greenberg, Wisconsin Geol. Survey Misc. Paper 83-2, 36 p., *$2.85 ppd.

—Stettin Pluton

Minerals of the Stettin Pluton, Marathon County, Wisconsin (1986) A. Falster, *Rocks and Minerals,* **61**, 74–78.

—Sulfides

The Massive Sulfide Occurrences in Wisconsin (1979) Wisconsin Geol. Survey Misc. Papers 79-2, 20 p., out of print.

—Upper Mississippi Valley

Upper Mississippi Valley Base-Metal Districts (1978) M. G. Mudrey, Wisconsin Geol. Survey Guide Book Ser. 1, 39 p., *$3.35 ppd.

Maps—Geologic

Bedrock Geology Map of Wisconsin (1982) M. G. Mudrey *et al.*, Geol. Survey State Map Ser. 18, (1:1,000,000), *$22.75 plastic, ppd, *$8.50 paper, ppd, (1981) 8½ x 11", (1:2,730,000), *$.25 ppd.

—Geologic Highway

Great Lakes (1978) AAPG Geol. Highway Map Ser., cat. no. 671, $4.50 + p&h.

*Wisconsin Geological and Natural History Survey, Map and Publications Sales Office, University of Wisconsin—Extension, 3817 Mineral Point Rd., Madison, WI 53705.

WYOMING

State Mineralogy

Minerals and Rocks of Wyoming (1986) W. D. Hausel, Wyoming Geol. Survey Bull. 66, 117 p., illus., *$6.00 ppd.

Area Mineralogy—Diamonds, gold, jade

Wyoming Issue (1983) *Rocks and Minerals,* **58**, n. 5.

Collecting Guide

Hints for Rock Hunting and Prospecting in Wyoming (n.d.) W. D. Wausel, Wyoming Geol. Survey Pamphlet, *$.25 ppd.

Mineral Resources

Economic Mineral Deposits of Wyoming—A Review (1982) W. D. Hausel, Wyoming Geol. Survey Reprint 41, *$4.00 ppd.

Ore Deposits of Wyoming (1982) W. D. Hausel, Wyoming Geol. Survey Prelim. Rept. 19, *$6.00 ppd.

Gold Districts of Wyoming (1980) Wyoming Geol. Survey Rept. Inc. RI23, *$5.00 ppd.

The Geology, Diamond Testing Procedures, and Economic Potential of the Colorado-Wyoming Kimberlite Province: A Review (1985) W. D. Hausel *et al.*, Wyoming Geol. Survey Rept. Inv. RI-31, *$4.00 ppd.

Tour Guide to the Geology and Mining History of the South Pass Gold Mining District, Fremont County, Wyoming (1984) Wyoming Geol. Survey Public Inf. Cir. PIC-23, *$4.50 ppd.

Maps—Geologic

Geologic Map of Wyoming (1985) J. D. Love & A. C. Christiansen, Wyoming Geological Survey, (1:500,000), *$10.50 ppd, rolled only.

—Geologic Highway

Northern Rockies (1972) AAPG Geol. Highway Map Ser., cat. no. 665, $4.50 + p&h.

—Mines and Minerals

Metallic and Industrial Minerals Map of Wyoming (1985) R. E. Harris *et al.*, Wyoming Geol. Survey Map Series MS-14, *$12.00, folded, $13.50 rolled, ppd.

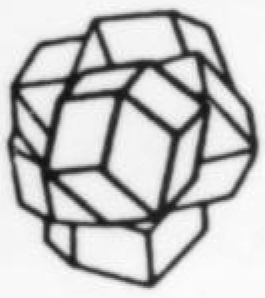
Wyoming Mines and Minerals (1979) W. D. Hausel *et al.*, Wyoming Geol. Survey Map Series MS-5, (1:500,000), *$7.00 folded, $8.50 rolled, ppd.

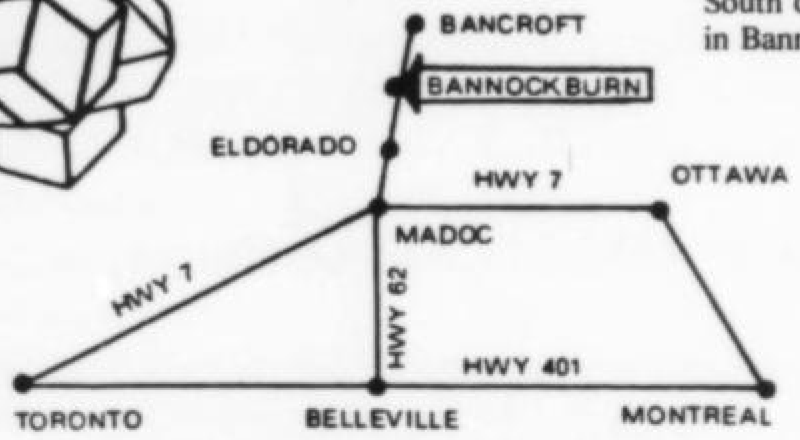
Mining Districts and Mineral Deposits of Wyoming (1976) C. A. Mardirosian, Mineral Research Company, Northgate Lane, Suite 707, Bldg. C, Laredo, TX 78041, $35.00 ppd.

Uranium Mines and Uranium and Thorium Occurrences in Wyoming (1985) Wyoming Geol. Survey Open File Rept. 85-6, (1:5,000,000), *$7.00 ppd.

*Wyoming Geological Survey, Box 3008, University Station, University of Wyoming, Laramie, WY 82071. ⊠

HAWTHORNEDEN





Just ½ hour
South of Bancroft,
in Bannockburn

FINE MINERAL SPECIMENS
Micromount to Cabinet Size

WANTED TO PURCHASE – OLD COLLECTIONS

Open Mid-May to September
(Otherwise By Chance or By Appointment)

Wendy & Frank Melanson (613) 473-4325
Mailing Address: R. R. #1, Eldorado, Ontario, K0K 1Y0

Italian miner. *Harper's*

Sam Weller Minerals
Mineral Dealer & Mine Agent

Specialists in 19th & 20th Century Cornish & British specimens, and also worldwide minerals. Write for free list and visit us when in Britain.

"Chy-an-Stennack"
Lower Boscaswell,
Pendeen, Nr. Penzance, Cornwall,
Great Britain. Telephone:
Penzance (0736) 788286

WALSTROM
MINERAL ENTERPRISES
Worldwide mineral specimens.
Micros to cabinet. Rare species.
LIST AVAILABLE
P. O. Box 583, Carson City, NV 89702

TOPAZ-MINERAL EXPLORATION
DEPT. M
1605 HILLCREST
GRAND HAVEN, MI. 49417
WORLD-WIDE MINERALS
PSEUDOMORPHS
LIST

NICK CARRUTH
Specializing in British Minerals
Cornish Classics and Hope's Nose Golds in stock
OLDTIME BRITISH ALWAYS WANTED
→ Periodic List ←
Copse Cottage, Delaware Road
Drakewalls, Cornwall PL18
England (0822) 832530

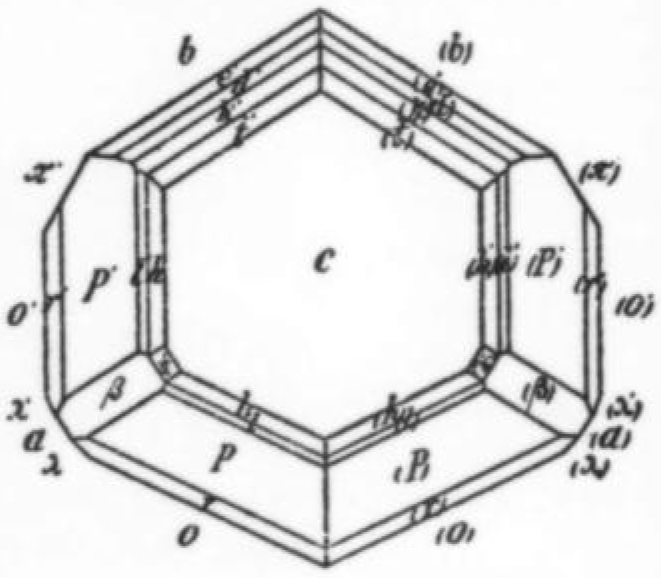
Fine
Mineral Specimens

Specializing in
Great Classics,
Afghan & Pakistani
Pegmatite Minerals.

lists issued.

H. Obodda
Box 51
Short Hills, N.J. 07078
(201) 467-0212

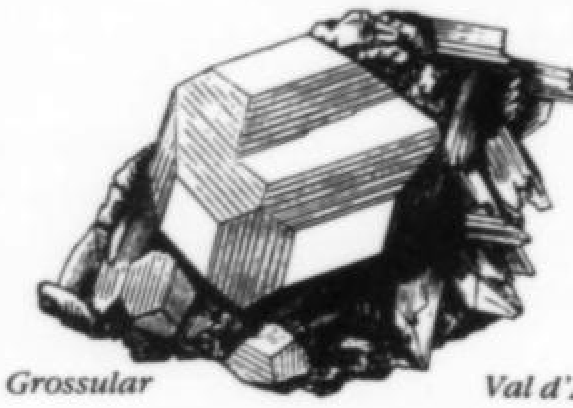
Rare Species?
Common
Minerals?



Our customers say: "Quality material, accurate labels, excellent wrapping." Find out why! $1 brings 20 pages of listings. $2 puts you on our mailing list for a year

Minerals Unlimited
P.O. BOX 877-MR
RIDGECREST, CALIF. 93555

G. Carlo Fioravanti
mineralogist



Grossular *Val d'Ala*

19/20 Via Pie di Marmo
Rome, Italy

Located between Piazza
Venezia and the Pantheon

Mon. 5-8 pm; Thurs. & Fri.,
11-1 pm, 5-8 pm; Sat. 11-1 pm

Phone: 06-6786067

A Photographer's Guide

to taking Mineral Specimen Photographs for the Mineralogical Record

Wendell E. Wilson
Editor, the *Mineralogical Record*
4631 Paseo Tubutama
Tucson, Arizona 85715

***Top-quality mineral photography combines the strict discipline of scientific illustration with the creative esthetics of fine art. This guide provides basic, practical information regarding philosophy, style, technique and quality factors desired in photography for publication in the* Mineralogical Record.**

The photographic work involved many troubles. The translucency or transparency, the soft open or dense texture of minerals is certainly not easy to simulate in a photograph. In multiple aggregates of crystals, to catch just the right angle of illumination that will bring forward the edges, faces and intersections is a task of puzzling calculation, and demands a slight degree at least of technical information in mineralogy. In a measure the photographer's equipment will make these distinctions, but beside that, the discerning eye and the responsive technique of the artist must also be called into requisition. However, the attempt to introduce color into figures [of minerals] has, as we all know, been tried with results that make "the judicious grieve."

Louis Gratacap (1912)

INTRODUCTION

We are living in fortunate times; the technologies of photography and printing have developed to an exactitude only dreamed of by mineralogists of previous generations. The early volumes of the *American Mineralogist* (founded in 1916) have often been compared to the *Mineralogical Record,* and whereas the text of those early articles is excellent, the lack of specimen photos seems a glaring defect to modern eyes. Even the proverbial thousand words cannot adequately substitute for a high-quality color mineral photograph. Mineral specimens must be *seen* in order to be fully appreciated.

Over the years, entire collections, entire museums, have been lost or destroyed and no record remains of their specimens. No one knows, for example, what the original mineral collection of James Smithson looked like; it was destroyed by a major fire in the Smithsonian Institution in 1876. It seems almost ridiculous to suggest that images on fragile paper will outlast solid rock and mineral samples, but history has sometimes proven that to be the case. Louis Gratacap (1912) in his *Popular Guide to Minerals, with Chapters on the Bement Collection of Minerals . . .* was equally aware of this when he wrote:

> The preparation of such illustrated catalogues gives a public permanency to the specimens. It is quite certain that had the Shepard Collection of Minerals, destroyed by fire, been given a literary and figured record, Mineralogy would have been benefitted, and something more tangible than shadowy memories of its salient features would have replaced such dim and purely personal chronicles.

Gratacap recognized that every specimen illustrated in the literature becomes part of an invaluable, perhaps immortal collection of mineralogical information.

The *Mineralogical Record* is perhaps the single most important published collection of mineral specimen* illustrations in the history of scientific literature. Within its volumes are recorded photographic images of thousands of specimens, many of those in full color. Naturally we are proud of this accomplishment, but quantity alone is not sufficient. It is the overall quality of each photo which determines, to a great extent, the scientific value and also the esthetic satisfaction provided. Our wish is, therefore, to maximize photo quality, and so this guide has been prepared to aid photographers in producing images of the best possible quality for publication in the *Mineralogical Record.* It is aimed primarily at photographers who already have some experience and wish to refine their skills but, for those just beginning, an Annotated Bibliography is included to provide additional background and guidance.

PHILOSOPHY

Scientific illustration is an artform dating back to the Middle Ages. From early woodcuts to hand-colored engravings, chromolithographs, and finally to modern offset photolithography, the purpose has remained the same: to depict, with as much technical verisimilitude as possible, natural history specimens.

The restriction that binds scientific illustrators (the "Prime Directive," as it were) is the overriding priority given to maximum, undistorted realism. This restriction limits artistic creativity but by no means eliminates it. A wide range of choices are still left to the illustrator, and through these choices art emerges. For example, the choice of specimens to depict coincides to some extent with the concept of "found art." The orientation of the specimen, the nature of the background, the complex details of lighting all may vary widely without compromising the Prime Directive.

It is an obvious fact that each specimen contains far more "data" than can be depicted in any single illustration, no matter how expertly done. Consequently each illustration represents a collection of trade-offs, compromises and selections abstracted, as it were, from the bank of data that is the specimen. Because of this, creativity becomes a factor, and the illustration process manifests a flexibility which has scientific advantages as well. Illustrations can be tailored to the studies they support, giving emphasis to appropriate aspects covered in text.

Before getting down to a detailed discussion of the components of quality, however, it should be made clear that not *all* mineral photography needs to conform to the requirements of scientific illustration. We intend no criticism of work done from purely artistic considerations, regardless of how much distortion of mineralogical reality might be involved. Art is its own justification. It must be accepted on its own terms, and there are publications in which it is appropriate. A scientific journal, however, must place reality first and limit artistic expression to a tasteful, conservative, non-distracting level. The suggestions given here are geared to that goal.

COMPONENTS of QUALITY

Many factors affect photo quality. Variables such as resolution and color fidelity should always be maximized, and trade-offs balanced on the basis of mineralogical considerations alone. Other factors, such as specimen selection, orientation, focus and magnification, permit some consideration of esthetics. And there are aspects, such as background and lighting, in which artistry is the major ingredient (once a few basic requirements have been met).

Specimen Selection

It is obviously important to select a specimen which prominently and simultaneously exhibits as many important mineralogical features as possible. Because features such as clarity, perfection of crystallization, obvious twinning, abundance of forms, intensity of color, well-formed associated species, freedom from damage, and so on, are esthetically pleasing as well as mineralogically revealing, such specimens often turn out to be what are also considered the most beautiful and (micromounts aside) the most valuable. It is comforting to know that there may well be an important intellectual basis for what we consider "beautiful." It also obviates some potential arguments over specimen choice between researchers and esthetically oriented photographers.

In some cases the choice of specimens is very limited, and one must simply shrug and do the best one can. If information content is too low, however (as with photos of earthy specimens), the editor may well reject it for publication. It is necessary that the photographer be able to block out from his mind what he knows about the specimen, and see only what the photo actually tells, if he is to evaluate it objectively.

Given the good fortune to be able to select from some reasonably attractive specimens. the photographer must keep in mind what distinguishes the photogenic from the non-photogenic. This is simply a matter of how well the features of the specimen coincide with the technical limitations of photography. Imagine, for example, two specimens of vanadinite on matrix. One consists of a flat plate of matrix with all the crystals on one side. The other piece of matrix is roughly spherical with identical crystals distributed over it on all sides. Mineralogically and even esthetically the two specimens might be considered equal, but the flat specimen will yield a vastly superior photograph.

A good procedure for assessing photogenic quality is to hold the specimen in your hand and close one eye; do not be tempted to slowly turn the specimen as you look at it, but rather hold it in a fixed position. If it loses much of its charm under those circumstances, a photo will probably prove disappointing. It is an unfortunate fact that some of the finest, most exciting specimens will fail this test, and there is nothing that can be done about it.

A photogenic specimen is therefore one which presents its best features to one single view. In addition, it should not be excessively deep relative to width and height. Specimens may pass the hand-held test and yet cause a problem if they demand depth of field which the camera cannot provide. Imagine again, if you will, two vanadinite specimens. One is the flat plate mentioned above, crystals on one side. The other is identical except for being "bent" into a 90° angle, like a half-open book. In each case all crystals are visible from a single viewpoint, but the photographer may find that he cannot keep them all in focus on the "bent" specimen. A specimen, in order to remain all in focus, must "fit" within a certain planar space. The smaller the specimen, the thinner the space becomes relative to width and height. With practice a photographer develops an intuitive sliding scale in his mind which helps him make a quick evaluation of specimens of different sizes and proportions.

Another thing a camera cannot do is see around corners. If the best angle of view on a superb crystal is blocked by part of the matrix or other crystals, no amount of manipulation under the lens will help. Unless the owner is cooperative enough to actually trim the specimen, it is best to move on to another one.

A wide range of other seemingly minor flaws in a specimen can prove fatal to a photograph. Sometimes they do not become evident until one is actually viewing them through the viewfinder or on the finished slide. They are unpredictable, and a photographer should not take such failures too personally.

The bottom line in specimen selection, however, is that no

---

*As distinct from idealized crystal drawings.

amount of technical expertise can fully compensate for a bad specimen. Sows' ears are not made into silk purses by crafty mineral photographers. So it pays to select very carefully.

Orientation and Magnification

Once a specimen has been selected, the precise view to show must be chosen. This is not as straightforward as it sounds. The possibilities with respect to orientation and magnification are infinite.

The photographer should turn the specimen through all possible positions, examining it for composition relative to which direction is up, which side faces the lens, the play of shadows, the concealment or display of important crystals, and so on. All the while he must be imagining a rectangular photo border superimposed across the specimen and varying in size (i.e., magnification) from showing the entire piece to showing only tiny portions. When the whole specimen is shown it should not be surrounded by an excessive amount of empty background.

A preference has developed among mineral collectors (stemming from the study of formal crystal drawings) for seeing certain species oriented with the *c* crystallographic axis vertical or near vertical. There is no real esthetic or technical value to this, but failure to comply can sometimes have a jarring effect. Therefore, some knowledge of crystallography is of definite benefit to the photographer.

Another preference people seem to have, this one primarily esthetic, is that a long crystal appears more "comfortable" if oriented from lower left to upper right, rather than from upper left to lower right. I have no explanation for this.

Most specimen photos will have a center of interest, the best crystal perhaps. The center of interest is usually most comfortably located somewhat above center and either on the vertical midline or just to the right of it. General rules for composition have been formulated (see, for example, Poore, 1967), but a sufficiently skilled photographer can often break the rules and make it work anyway.

After an approximate view has been chosen it must be delicately refined through the lens until the photographer is satisfied. Even tiny adjustments at this stage can have profound effects on the visibility of individual crystals, crystal faces, surface features, and internal characteristics.

Resolution

Resolution or sharpness can be maximized by (a) using the best quality macro lens, (b) using a midrange f/stop, (c) eliminating sources of vibration, (d) using the "slowest" film available, and (e) using a large-format camera.

A test card can be purchased in any camera store and used to determine the sharpness capability of your system. It is amazing what changing lenses can do . . . most cameras do not capture sharpness up to the limit of the film. The lens I use for 35-mm work is a 55-mm Micro-NIKKOR (on a Nikon F3 body). This is a macro lens, made especially for close-up photography. For 4x5 work I have found Rodenstock lenses to be very sharp; Harold and Erica Van Pelt use Schneider lenses.

The sharpness of a lens can be compromised by the use of filters and tele-extenders, hence these should be avoided.

Sharpness tends to suffer slightly at small f/stops due to edge diffraction around the diaphragm blades. The best results will probably be obtained around f/11 for a 55 mm lens; some lenses will still be satisfactory at f/22 and even f/32, particularly if they are of longer focal length.

Vibration can be a vexing problem, especially if one lives in a multi-story wood-frame house near a busy street or freeway. The best situation would be a cast concrete floor, located far from heavy traffic. A heavy tripod helps, and the tripod can also be hung with weights to damp out vibrations. The table used should be firm and heavy; it can be bolted to the wall to increase rigidity. I like to prop the neck of the tripod against the table, with a gob of clay stuck in between, to join the two systems into one; if the table and tripod vibrate *together* the film will not show it. If a long lens is used, a little clay or a triangular wooden wedge can be stuck under it to steady it. Many cameras have a mirror lock which allows the mirror to be manually raised and held rather than quickly flopping up and down automatically. With exposure times of 1 second or more, however, the mirror vibration has a negligible effect. It has also been suggested that a wire cable release can transmit vibration, so I use a rubber bulb release.

As to film type, the general rule is, the slower the sharper. Since mineral specimens are very patient and will wait through even the longest exposures, slow films are the obvious choice. I use Ektachrome 50 Professional film for 35-mm color, Ektachrome Tungsten 6118 for 4x5 color, Plus-X 125 (or slower) for 35-mm B&W, and Polaroid Type 55 for 4x5 B&W. The Polaroid produces its own 4x5 contact print plus a 4x5 negative and is very sharp, much sharper than 35-mm B&W. For the highest resolution and archival quality, some photographers prefer Kodachrome Professional Film Type A (35-mm color). Color negative film and color prints are almost never used for publication purposes.

While we are talking about film it should also be emphasized that photoprocessing is important to monitor. Pick the best, most expensive lab in town to do your work. If in doubt, call several professional photography studios and ask who they recommend. This is most critical with 35-mm B&W work; the difference between a good lab and a bad one can mean life or death for a photo. Scratches, lint, poor print focus and poor contrast should not be tolerated. Have unsatisfactory prints redone. If nothing else, run your own test by submitting identically exposed rolls to several labs and comparing the results. Be sure the enlargements are "custom" printed (that is, the focus is manually readjusted for each print rather than all run off at one setting). If nothing else, mail your film to a good out-of-town lab for processing.

Large-format photography, in which film size is larger than 35 mm, yields proportionally sharper results. The difference is usually *not* noticeable when photos are printed half-page in size or smaller, so for most purposes 35-mm cameras are fine. But for full-page reproduction the extra sharpness becomes obvious. This is why nearly all of our cover photos are shot on 4x5-inch film. It is a big step up in quality *and* in expense, not to mention major sacrifices in convenience. Few mineral photographers need to go this far, but practically all of the "masters" use large format at least some of the time.

Focus

When important areas of a specimen are out of focus, information is lost and esthetics can suffer. In rare cases a reduced depth of field can be used to throw a crystal into sharp relief where it is backed by potentially busy and distracting material. But generally speaking the goal is usually to get as much of the specimen into focus as is practical.

Trade-offs come into play here. Re-orienting the specimen may bring more of it into the zone of sharp focus, but at the expense of composition or ideal angle. Reducing the f/stop will widen the zone, but at the expense of a little overall sharpness. Choices must sometimes be made among the various crystals present, not all of which can be brought into focus simultaneously.

Because most focusing is done at full aperture for best vision, it is easy to overlook fingerprints, dust specks, lint and cotton fibers which will snap into sharp focus when the lens is stopped down. A careful check for these little gremlins should always be made.

With 35-mm cameras the planar zone of sharp focus is always parallel to the film plane, but with large-format photography the zone can be tilted relative to the film plane. This comes in useful when the ideal angle on a particular crystal is in conflict with the ideal angle for getting the rest of the specimen into focus. It is also handy for shots involving an arrangement of several specimens.

Tonal Qualities

Achieving a good range and distribution of tones (gradations of light and dark) is among the more difficult and subtle goals of mineral photography. Common faults committed by the novice include "burn-outs" and "black-outs."

Burn-outs are reflections from crystal faces that are so intense as to appear a featureless white on the slide or print. Very small burn-outs are less noticeable, but lights should be positioned to avoid creating large ones. For non-opaque minerals, each crystal face, as seen by the camera, has two possible components: the internal view *through* the face, and the surface features of the face. Reflections should be placed with care, deciding in each important case whether it is better to see the inside or the surface of the crystal at that place. Each reflection can also be moderated in its intensity to provide a little of each, to one degree or another. But at its brightest it should still show clearly the surface features of the crystal face; more light will obliterate these needlessly.

Black-outs occur where portions of the specimen are unnecessarily placed in total darkness. Usually this is the result of an overenthusiastic quest for drama in the photo. The play of dark and light across a specimen is useful for giving a sense of depth, but it is rarely necessary to darken areas all the way to black. Less severe lighting will show more data and is still capable of demonstrating proper depth.

Another purpose of lighting with reflections is to define crystal shapes for the viewer. Ideally, at each place where two faces meet, there will be a difference in how they are lit so that the edge is then clearly seen. The key here is *subtlety.* Reflections should be kept to the minimum necessary for defining shapes and showing a sampling of surface features; otherwise the internal aspects will be obscured for no good reason.

One reason why beginners have trouble with tonal range is that they trust their eyes. The human eye is a miracle of bioengineering and is sensitive to a greater range of tones than film can capture. What looks well defined through the viewfinder can easily end up as a burn-out or a black-out on film. The photographer must learn to recognize the limits of the film and work within them. He must restrain his impulse toward dramatic extremes, and make careful use of fill-in lighting.

Color Fidelity

Color fidelity is usually not a problem so long as the lights are of the correct "temperature" or color. As mentioned earlier, lens filters should be avoided because they reduce sharpness. If filters become absolutely necessary for some reason they should be placed on the *lights* and not over the lens.

Alas, some minerals do not register correctly on color film. Minor corrections can be made by the printer, but with unreliable results. Well known problem minerals include emerald, alexandrite (red to green chrysoberyl), dioptase, scorodite, blue fluorite, green fluorite and green andradite. The main difficulty, whatever the cause, seems to lie mostly with the blue-greens. Using a different film type, filters or light temperature generally is of little help.

Adding artificial color to specimens is a ticklish business. Methods include colored lights, colored reflectors and colored background swatches seen through transparent crystals. It can sometimes be argued that the attempt is merely to "trick" the film into producing a better approximation of the color our eyes see. More often the result is actually an enhancement or an exaggeration of the true color, something not acceptable in a scientific illustration. There are technical problems as well. Colored reflectors are really only appropriate for use with *opaque* minerals such as gold, where no distinction can be seen between surface color and internal color. A colored reflection looks strange on a transparent crystal because only the interior, not the surface, should have color. Only with opaque minerals does surface-reflected light actually change color. In any case, doctoring up the color should be undertaken judiciously if at all, and if the editor finds the effect obvious the photo will be rejected.

Another subject of recurring debate is the degree to which true internal colors should be brought forth by backlighting. Minerals such as cinnabar and proustite may appear almost black under ordinary room light but can be made to glow like the Black Prince's Ruby if sufficient watts are pumped in from behind. Purists complain that such a photo is misleading. On the other hand, the color revealed is a bona fide physical characteristic of the specimen. There is good logic on both sides of this argument; our policy is that backlighting *in moderation* is allowed.

Lighting

Lighting is among the most important and most difficult aspects of mineral photography. As mentioned above, the light itself must be the correct temperature (3200°K) to match with color film.* Reflections from individual faces must be carefully chosen and moderated so as to fully define the crystals. The concept of definition also applies to the specimen as a whole, relative to the photo background. Where the border of the specimen is dark the background should be light, and vice versa. This makes the specimen stand out instead of awkwardly blending into the background.

Because we are accustomed in life to light sources being located above, the brightest light on a specimen should appear to come from above, say 10 o'clock to 2 o'clock. Less intense "fill-in" light can come from all other directions. Light coming on a specimen from straight ahead, near the camera lens, will make the specimen appear flat. In most cases a mix of darker and lighter areas sufficient to show depth and shape will require lighting at a high angle to the lens axis, typically 60° to 70°. Some backlighting (at 100° to 180°) may help to show internal colors and features but should be used only in moderation. Of course, for really showing depth the specialized techniques of stereo-photography can produce startling results; a short article on this approach is scheduled for a future issue.

Diffusing material placed over the light sources will help to spread out the lighting angle, eliminate sharp shadows, burn-outs and black-outs, and create a softer, more appealing effect. Acetate sheets suitable for the purpose can be purchased in pads in most large art and drafting supply stores.

If light from the bulbs is allowed to strike the lens directly, a phenomenon called "flare" may result. This is a milky tone overlying the photo, and is often most intense near the center. Lens

---

*A good choice is the Tensor Super Swivel #6500 lamp (about $40) made by Tensor Lighting Company of Chelsea, Massachusetts. We have tested these and found the light to be within 2° of 3200°K. These are not available directly from Tensor, but can be ordered through any lighting store in Europe and the U.S. Not available in Canada, however. If you have difficulty, call Tensor (617-889-1184) and they will tell you of the nearest distributor.

hoods are supposed to prevent this but are less effective in close-up photography. To avoid flare, cut a square baffle out of black construction paper and tape it over the light so that it casts its shadow on the camera lens but not on the specimen. This becomes progressively more difficult to accomplish with greater angles of backlighting, so extra care must be taken.

Fill-in light and reflections can usually be supplied with reflectors made from aluminum foil (frosty side out). White cards can also be employed. The angle these reflectors make with the primary light source can be adjusted to moderate brightness. In generally bright situations extraneous fill-in light can be eliminated by the use of black "reflectors" or cards.

Because of the subtleties involved, the use of electronic flash for lighting rarely produces publishable results. Nevertheless, a *few* photographers have spent years developing specialized techniques which seem to work fairly well for them. The ultimate in delicacy and refinement, however, can only be achieved with normal lighting which can be minutely adjusted while the photographer studies the scene through the viewfinder.

A few photographers have also spent much time perfecting techniques for the use of natural daylight. This is very difficult because direct sun is so harsh and indirect daylight, even on an overcast day, can be too blue. But the careful use of diffusers and reflectors can produce good results, particularly with bright minerals plagued by excessive contrast.

Background

The choice of background is largely a matter of esthetic taste, although there are indeed a few ways in which it can impinge on scientific veracity. Placing a colored background behind a transparent crystal, for instance, can seriously mask the mineral's true color. In the same way a brightly lit colored background can produce what amounts to colored fill-in lighting detrimental to an accurate depiction of the specimen. And, as mentioned above, the background must not closely match the color or tone of the specimen; if it does, visual confusion may result.

One school of thought, particularly popular among Europeans, favors close-ups taken to show only a portion of the specimen. In this way the natural matrix of the specimen can be made to form the backdrop of selected crystals, and artificial backgrounds can be partially or entirely eliminated. Many Americans, on the other hand, prefer to see specimens shown in their entirety. The decision is up to the photographer, although the editor may occasionally wish to crop a photo down somewhat. In the case of photomicrography, most micromounts permit the use of natural matrix as a background.

All the other aspects of background choice involve personal taste, but some very definite tastes have evolved among mineral collectors. Backgrounds should not distract from specimens. Shadows should be soft and fuzzy rather than sharp. A feeling of depth should accompany the background. And, of course, no clay or other specimen supports should be visible, no loose dirt, smudges or scratches should show, and no margins or fold lines in the background material should be evident.

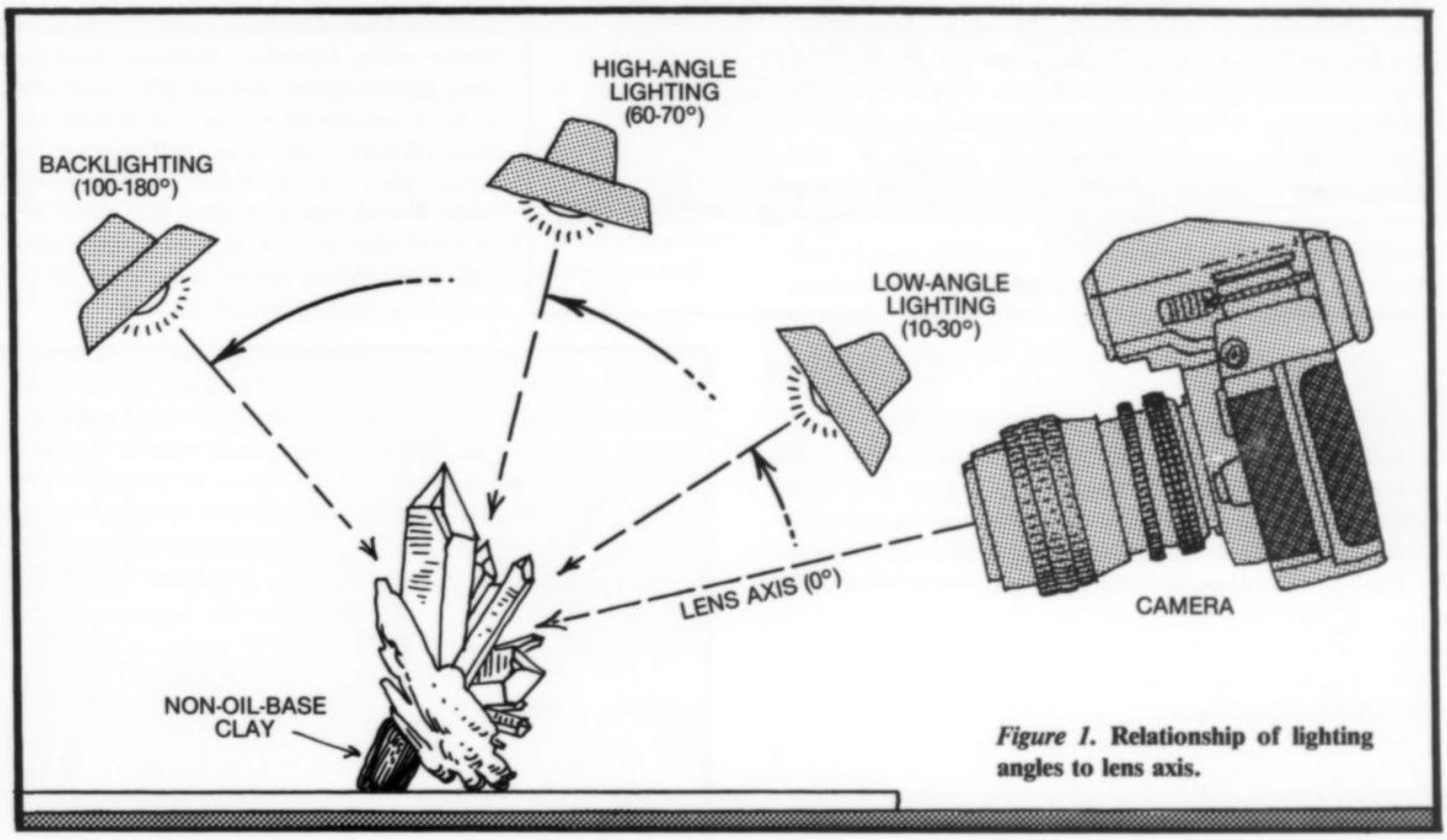


Figure 1. **Relationship of lighting angles to lens axis.**

Textured backgrounds should generally be avoided. Even the finest textures (velvet, silk, construction paper) become starkly obvious on film. Smooth, mat-finish colored papers (available in large art supply stores) are a good choice. So is glass or Plexiglas. Some photographers place the specimen on a sheet of clear glass, with a colored background paper laid out several centimeters below the glass. This causes the specimen's shadow on the paper to fall outside the field of view, giving the impression of levitation. The specimen's reflection in the glass will show unless the camera shoots from directly overhead. I prefer to use a sheet of white, translucent Plexiglas. It will not show scratches, and it causes shadows to appear as a blurry puddle.

Bright colors (particularly reds) are generally thought to be distracting, as are two-toned backgrounds. If a colored background is used it should be held entirely or partially in dimmer light so as to appear muted. A delicate pool or zone of brighter color is sometimes effective but only the best photographers are able to make this technique succeed. White, grays and black are the safest

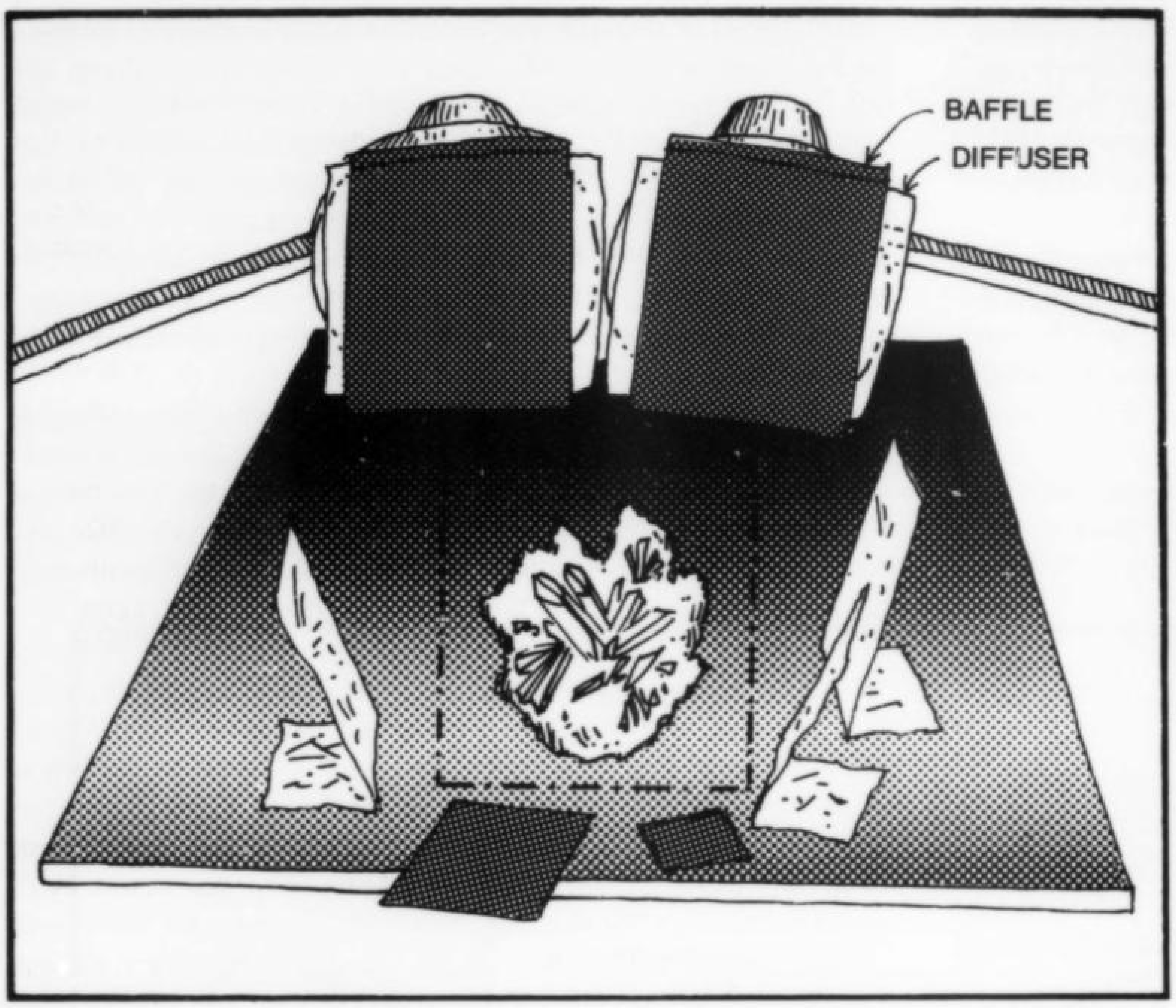


Figure 2. **Simple lighting arrangement used by the author. Baffles are cut from black construction paper; so are black "reflector" squares in front of specimen to partially block fill-in light reflected from underlying panel. Panel is translucent white Plexiglas. Reflectors are made from aluminum foil, and are individually placed so as to provide fill-in light and to reflect light from selected crystal faces. Diffusers are frosty acetate plastic sheets. Lights are Tensor #6500 Super Swivel lamps. Dashed line *(left)* shows cropped field of view as seen by the camera. Side view *(below)* shows how baffle prevents lamp from shining directly on lens.**

choices. White also serves to provide some natural fill-in light by reflection.

Specimens look best if they appear to stand out from a background area which has some depth. The only way to achieve this is to have a gradation of tone in the background, usually from lighter at the bottom to darker at the top or lighter near the middle to darker around the edges. This is all accomplished with diffusers, baffles and hoods, in ways that each photographer develops on his own.

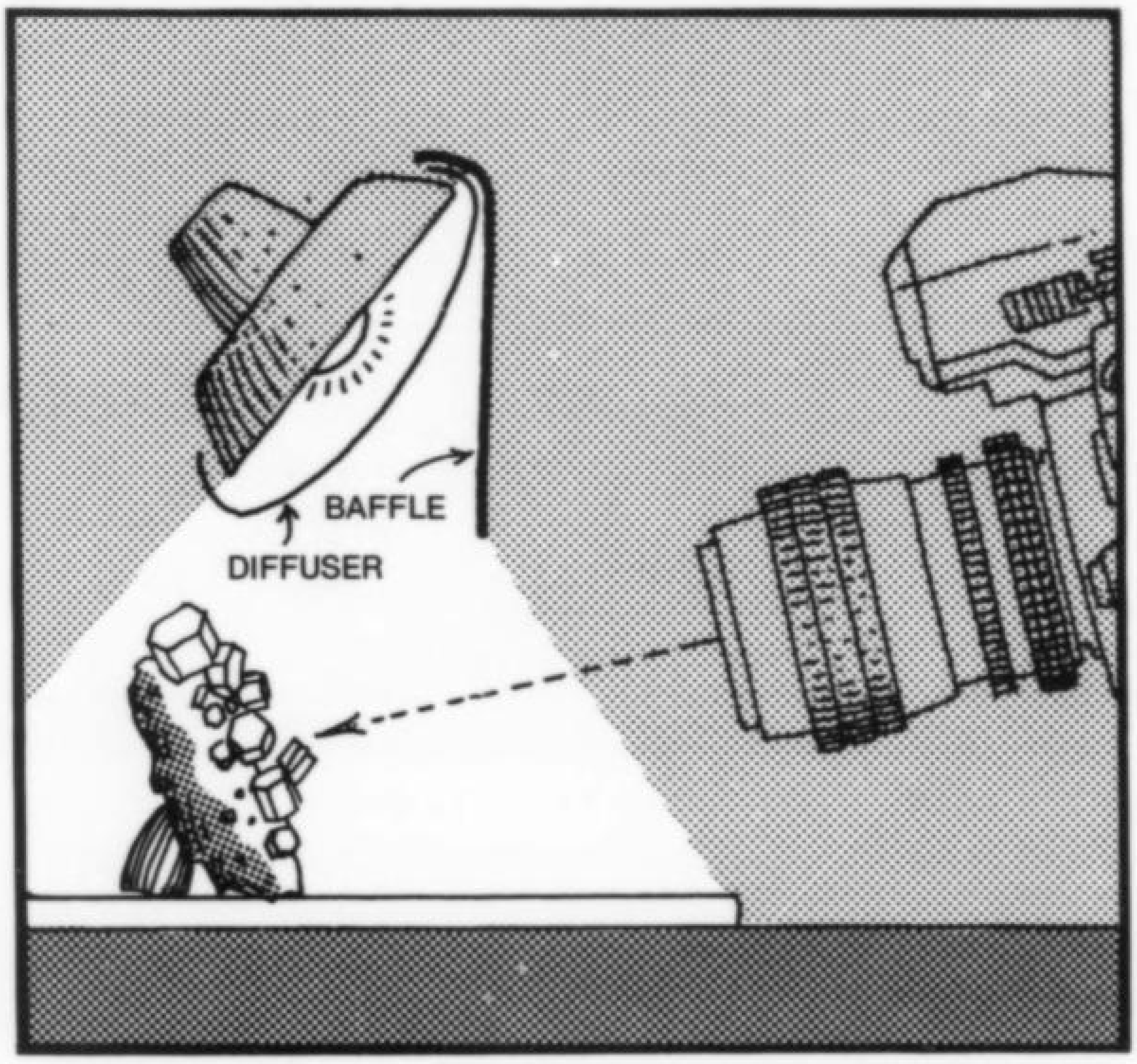
PHOTOMICROGRAPHY

The photographic techniques and skills peculiar to working through the light microscope or the scanning electron microscope are beyond the scope of this guide (and of this author's expertise). However, most of the criteria used to judge other photos apply here as well. Only the technical limitations differ, the major effects of which are to render a whole new class of specimens photogenic, and to eliminate most background options. With the use of bellows and a standard 35-mm camera and lens, fields of view down to 2 or 3 mm across can be achieved without recourse to other devices. From there down, however, specialized and expensive microscopes are required.

RECORDING AND STORAGE

Just as any fine mineral collection should have a collection catalog or ledger recording all the pertinent information about each piece, so should a mineral photo collection. Full details about specimen size, locality and ownership should be carefully recorded at the time the photo is made (not later from memory). The simplest procedure is to number the specimens consecutively, or to begin renumbering each year and include a year prefix (e.g., slide 84-135 would be the 135th specimen photographed in 1984). Numerous exposures of the same subject may be worth saving, and each need only be marked with the assigned catalog number.

To avoid any possible ambiguity in the photo records it is advisable to include a quick thumbnail sketch of each specimen next to its catalog number. This also facilitates the occasional search for particular subjects that have been photographed. As a safety precaution it is wise to photocopy the ledger every couple of years and store the copy in a safe place. One might also wish to copy full information onto one slide of each specimen and file these in a chronological catalog.



As to the preservation of the photographs themselves, it should be remembered that heat, moisture and light will all speed deterioration. If no special precautions are taken, most Ektachrome transparencies will begin to lose color fidelity in about 25 years, and Kodachrome transparencies will show deterioration in about 60 years. This can be prevented by storage in air-tight, light-tight containers placed in a freezer. Frozen film will probably survive for many centuries unchanged. Just be certain to let the containers warm up to room-temperature before removing photos for use, or condensation will take place on the cold film.

Finally, unless you plan to have your photo collection buried with you when you die, you should give some thought to its eventual disposition. Be certain your instructions are clear and that your ledger goes with the photographs. Otherwise all your years of work may eventually be thrown in the trash can by an unknowing descendant.

CONCLUSIONS

Learning to take publishing-quality mineral photographs is a difficult task. Many years and thousands of photos can go into refining one's technique, but the rewards can be significant. Mineral photographers who become known for doing good work will usually be welcomed by collectors and sometimes even by museums. They get to handle and examine beautiful specimens that other people are allowed to see only through the showcase glass, if at all. And they build what amounts to a personal collection of specimen images which can be enjoyed over and over. The researcher who does his own photographic work extends his expertise in a way that improves the value and accuracy of his published studies. In the long run, however, it is the readers and the science of mineralogy which profit most.

ACKNOWLEDGMENTS

My thanks to the editorial and photographic boards of the *Mineralogical Record* and also to Dr. Carl Francis, Terry Huizing, Dr. Anthony Kampf and Clive Russ for reviewing the manuscript and providing helpful suggestions.

ANNOTATED BIBLIOGRAPHY

Many helpful books and booklets have been written for the beginner wishing to learn photography and close-up photography. Any large photographic supply store will probably have a selection of the latest titles on hand. The following are also recommended, most of which deal with the personal techniques of various experienced mineral photographers.

BETZ, V. (1977) The Photographic Record; more German minerals. *Mineralogical Record,* **8**, 304–307. Notes on technique, with many fine examples, by one of Europe's best mineral photographers.

CHAMBERLAIN, S. C. (1978) The Photographic Record; the Waddell Collection. *Mineralogical Record,* **9**, 91–94. Good discussion of factors to be considered in black and white mineral photography, with examples.

GRATACAP, L. P. (1912) *Popular Guide to Minerals, with Chapters on the Bement Collection of Minerals in the American Museum of Natural History, and the Development of Mineralogy.* Van Nostrand, New York, 260–264. Gratacap is perhaps the earliest commentator on the specific difficulties of mineral specimen photography.

HEDGECOE, J. (1978) *The Photographer's Handbook.* Knopf, New York, 352. Includes a good discussion of the basics of close-up photography, plus a review of many other aspects of photography. A well illustrated and thorough general text.

OFFERMANN, E. (1975) *in* The Photographic Record; photographing Swiss micromounts. *Mineralogical Record,* **6**, 302–309. Discussion by *Mineralogical Record* Associate Photographer Eric Offermann dealing with his techniques for photographing micromounts using bellows and daylight. Many fine examples.

PINCH, W. W., and HURTGEN, T. P. (1975) Photographing minerals, *in 9th Here's How* Kodak "idea book" AE-95. Touches on a number of problems and topics pertinent to mineral photography.

POORE, H. R. (1967) *Pictorial Composition and the Critical Judgment of Pictures.* Sterling Publishing Company, New York. Republished (1976) by Dover Publications under the title *Composition in Art.* The rules of composition which apply to fine art generally apply to mineral photography as well. This work gives a good review of the basics.

SCHALLER, W. T. (1953) A photographic technique for showing some mineral relations. *U.S. Geological Survey Bulletin* **992**, 83–94 plus 14 plates. A primitive approach to setting reflections.

SCOVIL, J. A. (1984) Mineral photography: basics and a different approach. *Rocks & Minerals,* **59**, 272–277. See also his following installment: Mineral photography: equipment and vibration. *Rocks & Minerals,* **61**, 70–73.

WILSON, W. E. (1974) The Photographic Record; lighting techniques. *Mineralogical Record,* **3**, 167–170. Here is given a detailed explanation, with several examples, of how to position and illuminate mineral specimens. Common mistakes are discussed.

Some notes on photography excerpted from our Author's Guide (vol. 17, no. 6, p. 393–400)

Like Oscar Wilde, we at the *Mineralogical Record* and our faithful readers have the simplest of tastes: we are easily satisfied with the best. Normally, this is not a problem for authors, except when it comes to specimen photos. Not only must the specimen itself be of top quality, but the technical and esthetic aspects of the photo must also meet a high standard.

We demand top quality specimens for illustrations because (1) such pieces best show mineralogical features such as habit, forms, associations, colors, etc., (2) they represent a standard of quality for the locality against which collectors and curators can compare their own specimens, and (3) they provide maximum esthetic pleasure for the reader. A European subscriber once complained to me that the *Record* works too hard to show the best; instead, he said, we should show specimens of the quality which collectors can reasonably expect to be able to dig up at the locality or purchase from dealers for a nominal sum. Otherwise, the reader will become discouraged. My response is that the purpose of the *Mineralogical Record* is not to foster satisfaction with one's personal collection, but to provide *information.* Once one knows what the best looks like it is a simple matter to visualize the mediocre; the reverse, however, is not possible. And in any case personal satisfaction must come from within; the joy of gaining new knowledge is all that we can expect to offer the reader.

Therefore, the first task is simply to locate the best, or at least particularly fine, specimens.

Those authors wishing to provide at least some of the necessary specimen photography themselves should canvas the private and public collections available to them, then borrow the specimens or visit the owner for a photo session. For cover photos, we must have 4 x 5-inch large-format transparencies because cover-size enlargements require the extra detail afforded by large-format photography. For the article itself, however, any size down to 35-mm color slides (not negatives) will do fine for color work (send originals, not duplicates), and 5 x 7 or 8 x 10 black and white (B&W) glossy prints will suffice for the rest. Polaroid 4 x 5 prints and other odd sizes of B&W are permissible as well. We can convert color transparencies to B&W prints but the result will not be as sharp as if the photo had been shot originally on B&W film. Remember that color printing is very expensive, so we will probably want to publish *only* the colorful specimens in color.


Don Pearce

Michigan Copper Country Minerals!
Copper, Silver & Associated Species

No Lists • Send phone no.
and we'll contact you
with information

P.O. Box 198
Mohawk, Michigan 49950
Tel: (906) 289-4860


David & Celia Lare

Jeffrey Mining Co. Inc.

Specializing in Quartz and Other fine minerals. See us at Spruce Pine, NC, and Quarryville, PA, Shows!

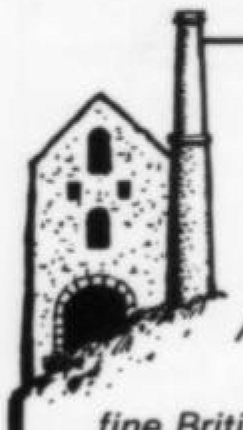
P.O. Box 11506
Memphis, TN 38111
(901) 358-1600

BOB & VERA TURNER

Natural Connection

WHOLESALE **Mexican** MINERALS

BY APPOINTMENT ONLY
520 MARTHMONT WAY
EL PASO, TEXAS 79912
(915) 581-1926


ARNOLD FISHER MINERALS

fine British & Worldwide Specimens
Mineral Photographs - Devon Gold

Trewellard Cottage, Lower Trewellard
Penzance, Cornwall TR19 7SU, England
Tel: 0736-788305

Simon Harrison Minerals Fine Minerals

15 Queenwood Avenue
Fairfield Park
Bath, Avon
BA1 6EU ENGLAND
Tel: 0225-312-835

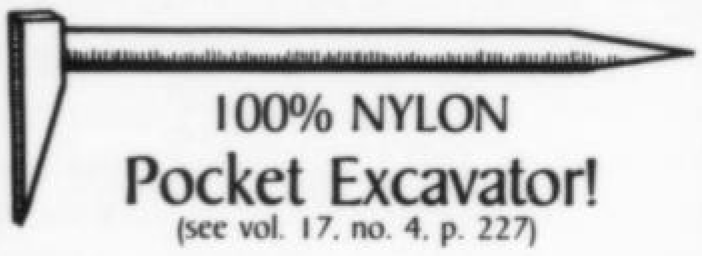
Sierra Vista
MINERALS


fine minerals

FREE ILLUSTRATED LIST

BUYING MINERALS

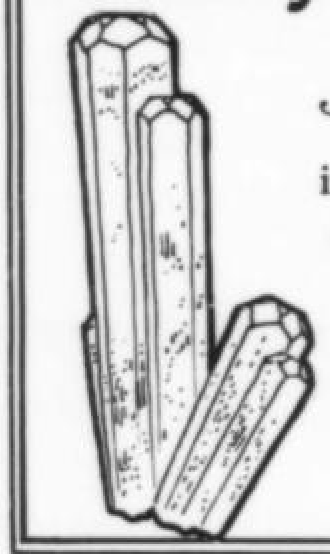
2375 E. Tropicana, #186
Las Vegas, NV 89119
Tel: (702) 798-7271


100% NYLON
Pocket Excavator!
(see vol. 17, no. 4, p. 227)

18"—$21.00, 36"—$32.00 postpaid

LARRY VENEZIA
115 Coleridge St.
East Boston, Mass. 02128
(617) 567-2113

Geary Murdock


Specializing
in Idaho Aquamarine,
and Fine Worldwide
Mineral Specimens

628 Whittier Street
Idaho Falls, Idaho
83401

Donald A. Zowader
Write for list.


MOUNTAIN GEMS AND MINERALS

97 Lamington Rd.
Somerville, New Jersey 08876
201-526-1183

48th
CALIFORNIA FEDERATION SHOW!

"Mother Lode Treasures"

June 26-28, 1987
Stanislaus Co. Fairgr., Turlock, Cal.
Dealers • Exhibits • Demos

MICROMOUNTS, THUMBNAILS,
MINIATURES & CABINETS

Specializing in Arsenates,
Benitoite & Associated Minerals.
Micromount List, $2, refundable.

Bruce & Jo Runner

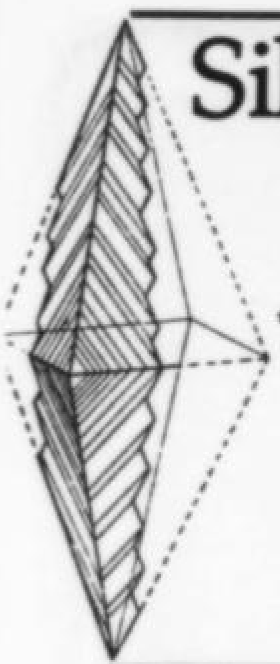
13526 South Ave., Delhi, CA 95315
Showroom by Appt. (209) 634-6470

2 ZEISS POL WL MICROSCOPES

1—Complete with monocular and binocular heads, 4 axis universal stage with all accessories and complete set up for macro photography. $12,500.00

1—Complete with binocular head, transmitted and reflected light accessories including bright field-dark field objectives and reflected POL objectives. $12,000.00

Tel: (415) 222-3735
John Patrick



Silver Scepter
minerals

◆

* WE BUY COLLECTIONS *
Fine Minerals
Oriental Carpets
Shown by Appointment
P.O. Box 1382
Richland, WA 99352
(509) 627-4163

Opal Fields

Specializing in
Opal • Opal Specimens
Fine Mineral Specimens

5618 Odana Rd., The Atrium, suite 103
Madison, Wisc. 53719
Tel: (608) 273-0399

Colorado
Gem and
Mineral
Company

Specializing in
Pegmatite Specimens
Jack Lowell
(602) 966-6626
Post Office Box 424,
Tempe, Arizona
85281

* **VIDEO MINERALS** *

A New Concept

Now be able to view beautiful
specimens in your own home.
Quality minerals $25–$1000.
Send for list and color videotape
(Beta or VHS); $25 deposit required,
refundable with return
of tape or towards purchase.
ART GRAEBER • P.O. Box 252
Yucaipa, CA 92399 • 714-797-2591, eves.

(see review, vol. 18, no. 2, p. 115)

AUSTRALIAN
MINERALS
Micros to Museum
Quality, Type Localities
& Rare Specimens from
Australia. Send Want
List or request our Price
List.
Cyril Kovac (Gemcraft P.L.)
1st Floor, 293 Wattletree Rd.
East Malvern, Melbourne,
Victoria 3145 Australia
Tel: (03) 509-1666

LUIZ MENEZES

We have fine Jacupiranga mine specimens, Brazilian minerals, excellent crystal specimens, and rutilated quartz.

Visit our showroom in São Paolo (by Appt.).

RUA ENG. AGENOR MACHADO,
108 CEP 04710 - S. PAULO - S.P. -
BRASIL. TELEPHONE (011) 521-0538

BOOKS OUT—OF PRINT

Send $1.00 for latest catalog listing 100's on minerals, mining, geology, fossils, gems.

Tel.: 619-488-6904
PERI LITHON BOOKS
P.O. Box 9996
5372 Van Nuys Court
San Diego, Calif. 92109

713-862-5858

Collector's Choice

See us at
the 1987
Tucson
Show!

Dalton & Consie Prince

5021-A Augusta, Houston, Texas 77007

THE INTERNATIONAL HANDBOOK

ENGLISH · ITALIAN
GERMAN · RUSSIAN
FRENCH · CHINESE
SPANISH · DUTCH
JAPANESE · SWEDISH
NORWEGIAN · PORTUGESE

GARNET BOOKS
P.O. BOX 294
HAGAMAN, NEW YORK
12086

$7.50 Postage Paid
DEALER INQUIRIES WELCOME

A Multi-Lingual Reference Directory For Mineral Collectors Covering Mineral Names...General Classifications... and Related Terminologies....... in 12 Languages

MICROS *Only*

finest worldwide microminerals
SATISFACTION GUARANTEED
FREE general & advanced collector lists

SIMKEV MINERALS
942 Chevrolet,
Oshawa, Ontario, L1G 4H8, Canada

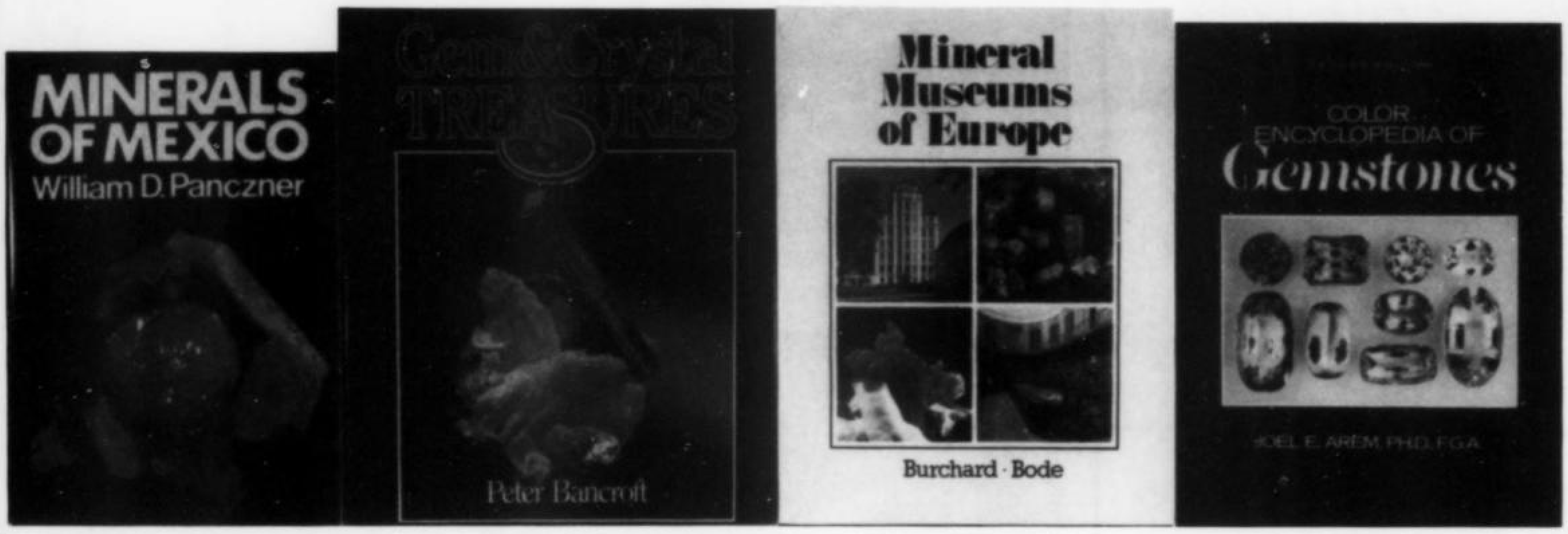
THE CRYSTAL STORE
Elizabeth Main
—
Coleman's McEarl Points

92½ East 7 Street
NYC 10009 212 529-7575

SIERRA CONTACT
MINERALS

Just Acquired! Ray Thompson Collection,
(Denver), Winner 1979 Lidstrom & McDole Trophies
Fine mineral specimens from worldwide locations.
Thumbnails to Large Museum Pieces
Zuber Hydraulic Rock Splitters

STEVE ROSE • HARVEY GORDON
1002 S. WELLS AVE., RENO, NEVADA 89502
TEL: 702-329-8765 (O); 702-329-4866 (H)



Species Mineralogy

NEW!

Glossary of Mineral Species 1987!
☐ Comprehensive catalog of the names and compositions of all known species.
$14.50 postpaid (S)

Mineral Names: What Do They Mean?
☐ R. S. Mitchell's unique compendium of the origins of mineral names.
$20 postpaid (H)

Collector's Book of Fluorescent Minerals
☐ The definitive study of mineral fluorescence, by M. Robbins.
$50 postpaid (H)

The Tourmaline Group
☐ Dietrick's modern classic on tourmaline, an important work. **$38 postpaid** (H)

Field Guide to Rocks & Minerals
☐ Great for beginners, one of our favorites. **$14 postpaid** (S)
$20 postpaid (H)

The Sulfosalts
☐ Fine, well-illustrated review of the sulfosalt group.
In Italian **$25 postpaid** (H)

The Radioactive Minerals
☐ Fine, well-illustrated review of the radioactive minerals.
In Italian **$25 postpaid** (H)

The Phosphates
☐ Fine, well-illustrated review of the phosphate-group minerals.
In Italian **$29 postpaid** (H)

Foreign Mineralogies

Minerals of Mexico
☐ Over 600 species from over 4,500 localities, plus fascinating history & color photos; 480 pages! Not a "coffee table" book but a catalog of occurrences by species.
$48 postpaid (H)

Mineralogy of Great Britain & Ireland
☐ Reprint of the 1858 classic by Greg & Lettsom; 550 pages! **$49 postpaid** (H)

Minerals of Tasmania
☐ Basic reference to the minerals and localities of Tasmania. **$7 postpaid** (S)

Catalogue of South Australian Minerals
☐ Describes over 400 species; 169 color photos, maps. **$21 postpaid** (S)

Mineralogy of Llallagua, Bolivia
☐ Reprint of Bandy's 1944 classic monograph on Llallagua.
$5 postpaid (S)

Minerals of Western Australia
☐ Reprint of the 1948–1951 classic by E. S. Simpson, three volumes, hardbound.
$106 postpaid (foreign add $3) (H)

Rocks & Minerals of Ontario (1978)
☐ Hewitt **$6 postpaid** (S)

Collectibles

Encyclopedia of Antique Scientific Instruments
☐ Over 700 entries, 150 illustrated instruments; a valuable reference on the history of science. **$17 postpaid** (H)

Billings Microscope Collection
☐ 244-page compendium on an important collection; 475 photos. **$20 postpaid** (S)

Illustrated Mining Histories

The Monster Mine, Burra Burra
☐ One of Australia's truly great mines; a well-illustrated history.
$40 postpaid (H)

De Re Metallica
☐ Reprint of the 1912 English edition of Agricola's 1556 classic on mining.
$18.50 postpaid (S)

Empire of Silver
☐ Illustrated mining history: San Juan Mountains of Colorado.
$42 postpaid (H)

The Cliff: America's First Great Copper Mine
☐ Illustrated mining history: the Cliff mine and others, Upper Michigan.
$23 postpaid (H)

Pikes Peak Gold
☐ Illustrated mining history: Cripple Creek, Colorado. **$9 postpaid** (S)

The Last Gold Rush
☐ Illustrated mining history: Cripple Creek and Victor, Colorado. **$14 postpaid** (S)

Mining History in South Australia
☐ Illustrated mining history: South Australia. **$23 postpaid** (H)

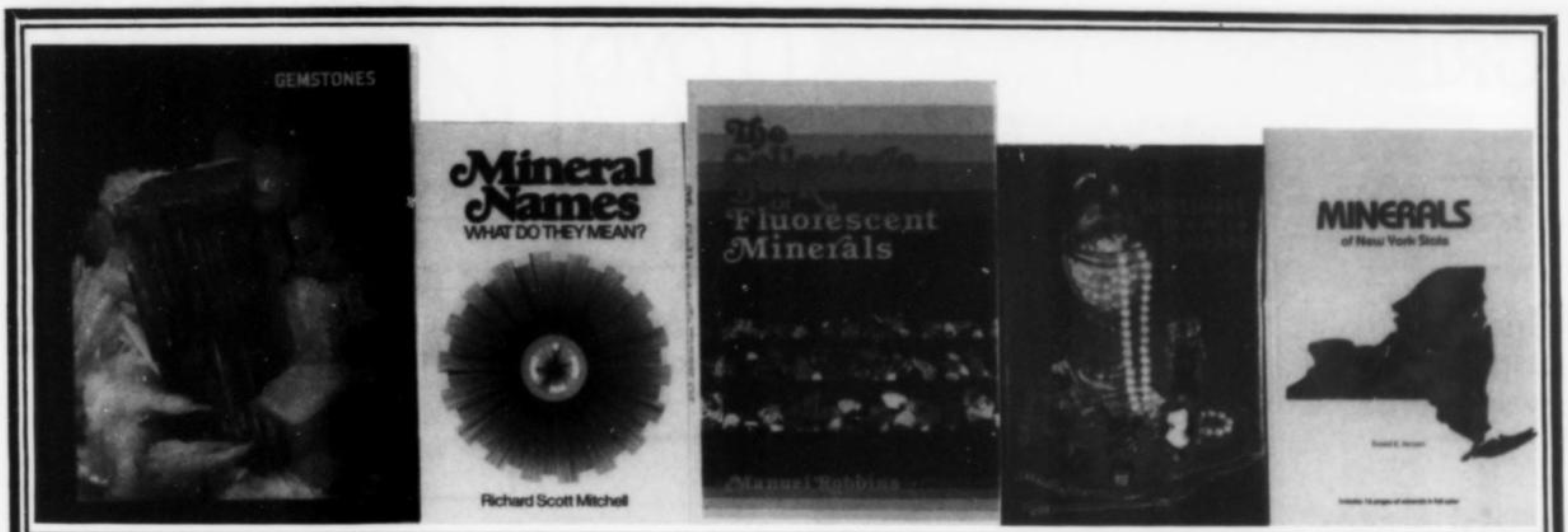
Mining Town
☐ Illustrated mining history: Coeur d'Alene, Idaho. **$28 postpaid** (H)

Gold Camps & Silver Cities
☐ Illustrated mining history: the famous mining districts of Idaho.
$16 postpaid (S)

Prepaid orders only except by previous arrangement. Allow 4-6 weeks for delivery. SORRY—credit cards not accepted. Return any book for refund if not completely satisfied.

Mineralogical Record Book Dept.

P.O. BOX 1656, CARSON CITY, NEVADA 89702
TEL.: 702-883-2598



"Coffee Table" Books

Mineral Museums of Europe
☐ Unique and interesting review of 80 Western European mineral museums.
$53 postpaid (H)
Leatherbound: $175 postpaid (H)

The Magic of Minerals
☐ Gorgeous 'coffee table' book, Olaf Medenbach photography. 110 oversize color photos. **$49 postpaid** (H)

Gem & Crystal Treasures
☐ Fascinating background on 100 famous localities, over 300 color photos.
$65 postpaid (H)
Leather Edition
$230 postpaid (foreign add $35) (H)

Color Encyclopedia of Gemstones
☐ Concise and accurate data plus over 300 color photos by Joel Arem.
$53 postpaid (H)

Brazil, Paradise of Gemstones
☐ Superb color photography of many fine Brazilian crystal specimens by the Van Pelts. **$25 postpaid** (H)

Gemstones
☐ Time-Life's excellent review of the major gem minerals, well illustrated.
$15 postpaid (H)

Noble Metals
☐ Time-Life's excellent review of gold, silver and platinum, well illustrated.
$15 postpaid (H)

The Jade Kingdom
☐ Paul Desautels' long-awaited work on Jade.
$38 postpaid (H)

State Mineralogies

Mineralogy of Alabama (1982)
☐ Cook & Smith **$20 postpaid** (S)

Mineralogy of Arizona (1977)
☐ Anthony *et al.* **$17 postpaid** (S)

Mineralogy of the Black Hills
☐ (1965) Roberts & Rapp **$18 postpaid** (H)

Mineralogy of the Black Hills
☐ (1965) Roberts & Rapp **$12 postpaid** (S)

Minerals of California (1983)
☐ Pemberton **$36 postpaid** (H)

Minerals of Georgia (1978)
☐ Cook **$12 postpaid** (S)

Minerals of Maine (1958–59)
☐ Merrill **$9 postpaid** (S)

Mineralogy of Michigan (1976)
☐ Heinrich **$9 postpaid** (S)

Minerals of New York State (1978)
☐ Jensen **$10 postpaid** (S)
$15 postpaid (H)

Mineral Sites in North Carolina
☐ (1978) Wilson **$12 postpaid** (S)

Minerals of Utah (1981)
☐ Bullock **$20 postpaid** (S)

Minerals of Virginia (1970)
☐ Dietrich **$10 postpaid** (S)

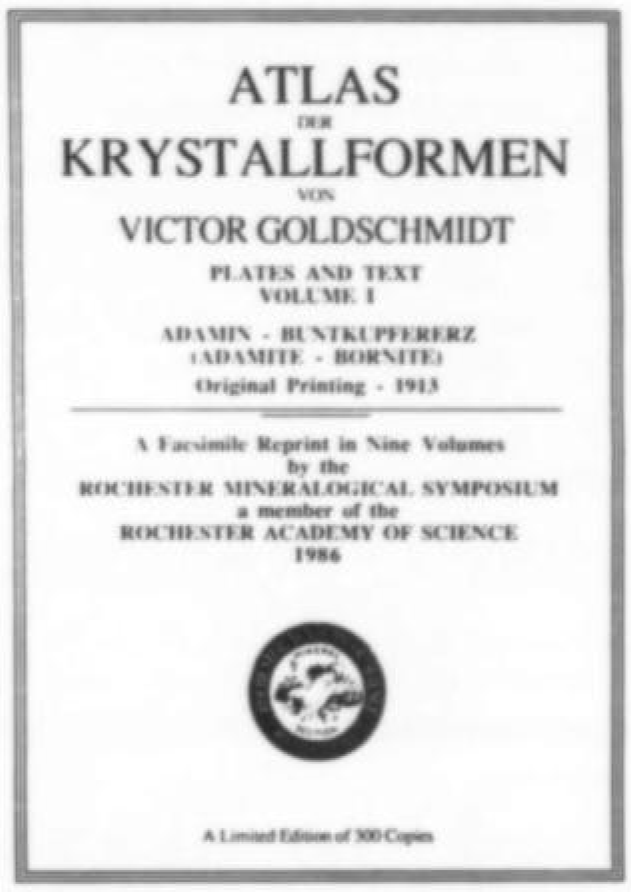
Minerals of Washington (1975)
☐ Cannon **$7 postpaid** (S)

Minerals of Washington (1985)
☐ Ream (New Edition) **$9 postpaid** (S)

Minerals of Washington, DC (1980)
☐ Bernstein **$9 postpaid** (S)

Return any book for a full refund if not completely satisfied.

All Foreign Orders Add $1 per Book except as noted
H = Hardcover; S = Softcover



ATLAS
DER
KRYSTALLFORMEN
VON
VICTOR GOLDSCHMIDT
PLATES AND TEXT
VOLUME I
ADAMIN - BUNTKUPFERERZ
(ADAMITE - BORNITE)
Original Printing - 1913

A Facsimile Reprint in Nine Volumes
by the
ROCHESTER MINERALOGICAL SYMPOSIUM
a member of the
ROCHESTER ACADEMY OF SCIENCE
1986

A Limited Edition of 300 Copies

Goldschmidt's Atlas!
Limited edition reprint.
☐ All nine volumes: **$350 postpaid** (S)

Limited Quantity!

Indexes

Index to the Mineralogical Record
☐ A 14-year cumulative index for vol. 1–14. Extremely handy.
$21 postpaid (S)

Prepaid orders only except by previous arrangement. Allow 4-6 weeks for delivery. SORRY—credit cards not accepted. Return any book for refund if not completely satisfied.

Mineralogical Record Book Dept.

P.O. BOX 1656, CARSON CITY, NEVADA 89702
TEL.: 702-883-2598

GREGORY, BOTTLEY & LLOYD

MINERALOGISTS & GEOLOGISTS - ESTABLISHED 1850

8-12 RICKETT STREET, LONDON SW6 1RU

TELEPHONE 01-381 5522: TELEGRAMS METEORITES LONDON SW6

Brian Lloyd looks forward to seeing you when you are next in London. We are open weekdays 9:30 to 5 pm — evenings and weekends by appointment.

Wanted to Buy or Exchange

METEORITES

Correspondence Invited

Jim DuPont

391 Valley Rd., Watchung, NJ 07060

A. L. McGuinness

WHOLESALE MINERAL SPECIMENS

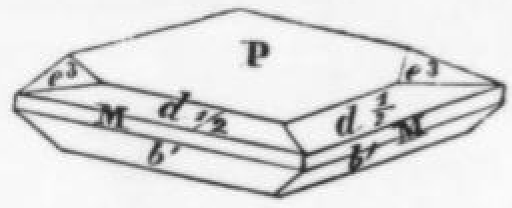
DEALER INQUIRIES INVITED

By Appointment Only — Lists $1.00

4305 Camden Ave., San Mateo, CA 94403

Tel: (415) 345-2068

kristalldruse



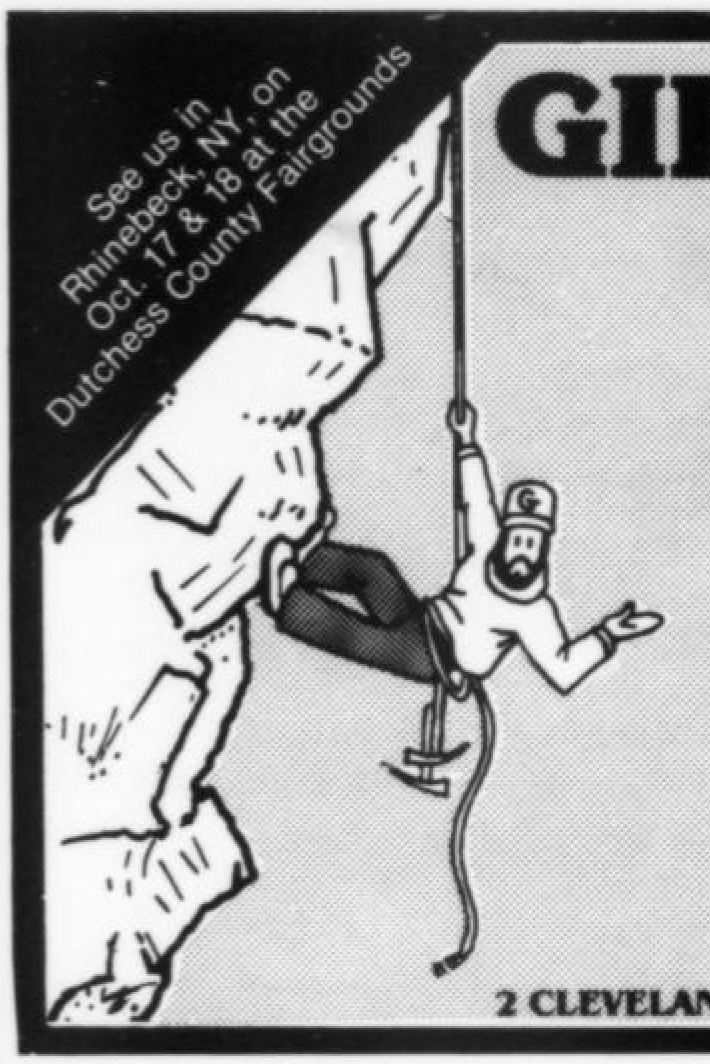
Kristalldruse is the largest mineral shop in Munich.

We specialize in:

- European Classics
- Rare Species Worldwide
- Localities such as Laurium, Hagendorf and Eifel
- Alpine Minerals
- Books on Mineralogy, Geology, Paleontology & Gemology (write for list of 350 titles)
- We also buy rare and newly described species, and top quality display specimens

Send us your want list or visit us when you're in Munich.
Mon.-Fri. 9-6, Sat. 9-1 p.m.
Downtown Munich near the Stadtmuseum, 2 minutes from the Marienplatz in the Dultstrasse

OBERANGER 6, D-8000 MÜNCHEN 2
Tel. 089-260-4018



See us in Rhinebeck, NY, on Oct. 17 & 18 at the Dutchess County Fairgrounds

GIRDAUSKAS MINERALS

- **Rare Species and Native Elements**
- **Unusual Specimens and Localities**
- **Locality Species (Franklin, Tsumeb, Laurium, Bisbee, Langban, Foote, Mapimi, etc.)**
- **Micros to Cabinet**
- **Books and Magazine Back Issues**
- **We Buy Your Surplus and Unwanted Items**

SEND US YOUR WANT LISTS!

WRITE FOR LISTING!

2 CLEVELAND DRIVE, POUGHKEEPSIE, N.Y. 12601, U.S.A.

We Have Moved!

40,000 pounds & two trailers of:

RARE SPECIES and loveable uglies—New discoveries and type locality specimens from worldwide sources, micromounts to cabinet sizes.

ATTRACTIVE moderately priced specimens in all sizes. Also bulk materials for institutions and dealers. Specialty: Franklin and Sterling Hill specimens.

$1 brings you our periodic lists for at least a year. NOTE NEW ADDRESS!

Please state your interests. Dealer inquiries invited. Satisfaction guaranteed.

Excalibur Mineral Co.

14 Leigh Court
Randolph, NJ 07869

What's New in Minerals?

by Wendell E. Wilson

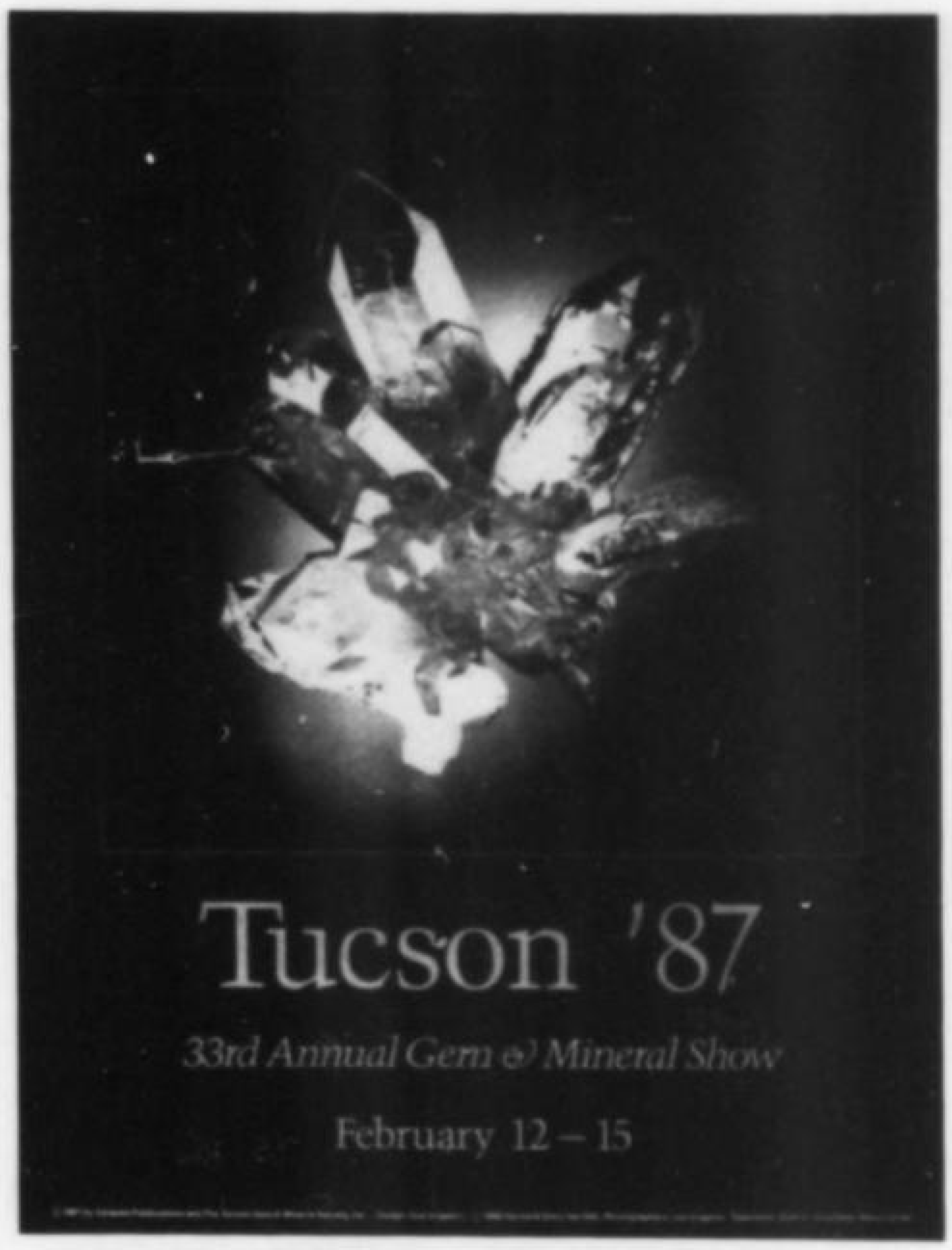


Figure 1. **Tucson Show poster for 1987; photo by the Van Pelts; published by Sanpete Publications, Tucson, and the TGMS.**

Tucson Show 1987

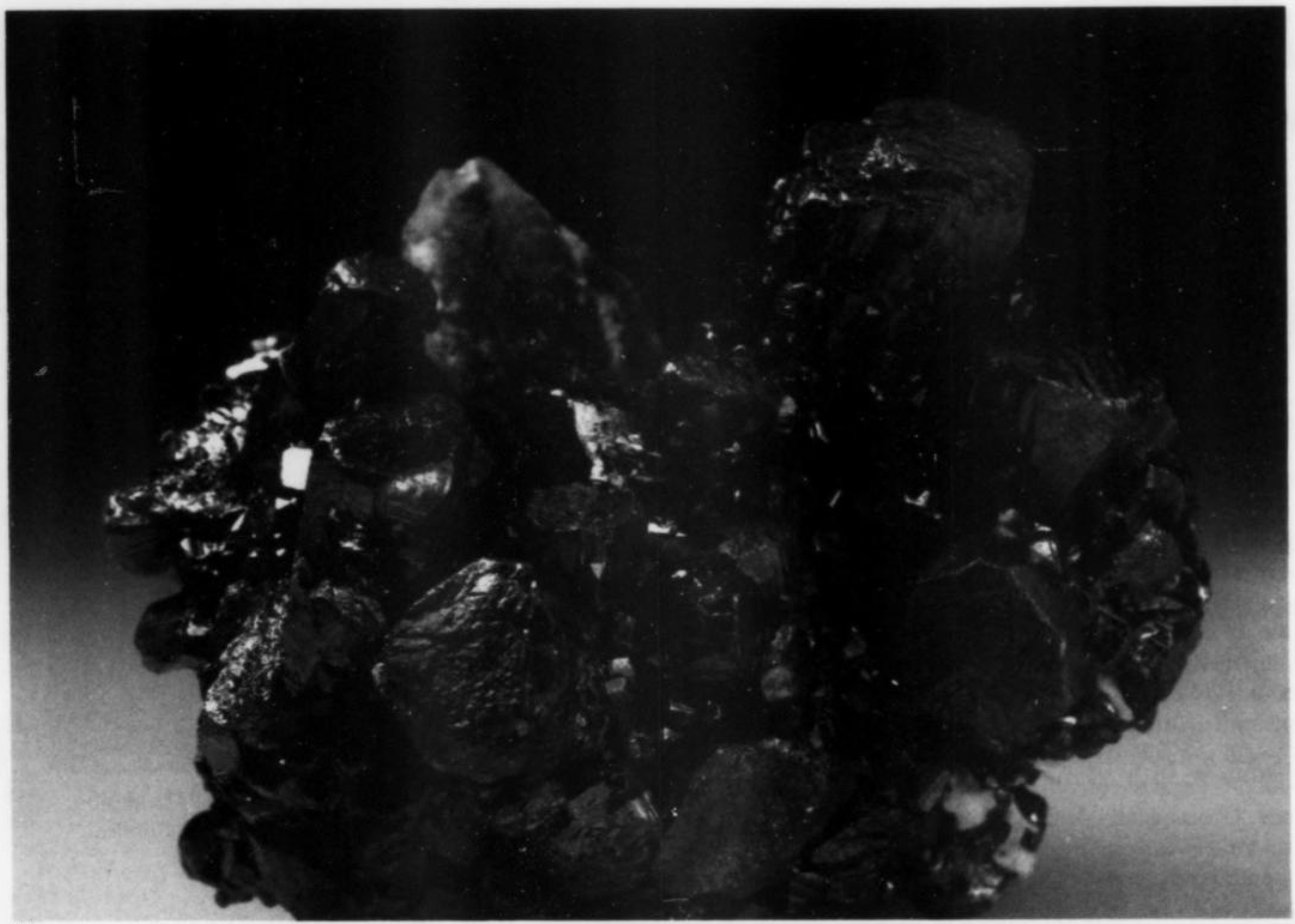
For those who are newcomers to these pages I should perhaps give some background. The "Tucson Show" is actually a conglomeration of shows which take place in early February. The Tucson Community Center houses the "Main Show," the original Tucson Gem and Mineral Show which has been produced for some 33 years by the Tucson Gem and Mineral Society. In the early 1970s the show began to really catch on, so much so that the community center could not begin to contain all the dealers who wished to have selling space. Consequently dealers "overflowed," so to speak, into the various motels surrounding the community center, and their numbers continue to increase. This year more than 1000 dealers were formally open for business at one location or another. This number alone would qualify Tucson as the World's Largest Mineral Event. But the TGMS show at the community center has continued to be pre-eminent in the superb displays it attracts from top museums and private collectors around the country and the world. Hence the Tucson Show's top prize for "best rocks in the show," the McDole Trophy, is the most prestigious mineral collecting award in the country and perhaps the world.

Drawing by H. Martin; ©1987 The New Yorker Magazine, Inc.

"Miss Eisenhart, considering the weather, I've decided to take the afternoon and February off."

What has caused the Tucson Show to ramify into such a sprawling phenomenon? Aside from excellent management, most people would agree that the critical factor is Tucson's balmy winter climate. When the snow and ice are building up on doorsteps across America and Europe, the thought of warm sun, swimming pools and palm trees is enough to prod almost anyone into an eventual "business trip" to Tucson for the show. Many people now come for two weeks, three weeks, or even an entire month. The more people who come, the more of an important event the show becomes, and therefore an ever larger number of people come, bringing money, and attracting still more dealers. It is a great convenience to have so many people agree on which show is *the one* not to miss, because everyone can now count on seeing everyone else at a single place and time. The stimulus to business and collecting has been immeasurable.

Now that the 1987 Tucson Show is over, people are still wondering exactly what it was that made this the most successful show in history. Was it the "crystal power" movement sweeping the country lately? Was it the excitement/entertainment value of the continuing saga of Roy Whetstine's star sapphire (which he claims to have bought at last year's show for $10, and subsequently had appraised for millions, despite widespread skepticism)? Was it the smooth and friendly management of the main show at the Community Center? Was it good advertising?



WEW

Figure 2. **Proustite crystal group, 6 cm across, from the Hartenstein mine, near Aue, Erzgebirge, East Germany. Ben de Wit specimen.**

WEW

Figure 3. **Chalcopyrite twinned crystal on matrix, 2.6 cm tall, from the Pachapaqui mine, Ancash Province, Peru. Graeber and Himes specimen, now in the Tom Gressman collection.**

WEW

Figure 4. **Vivianite crystal, 3 cm, on quartz crystal matrix, from Trepča, Yugoslavia. Ben de Wit specimen.**

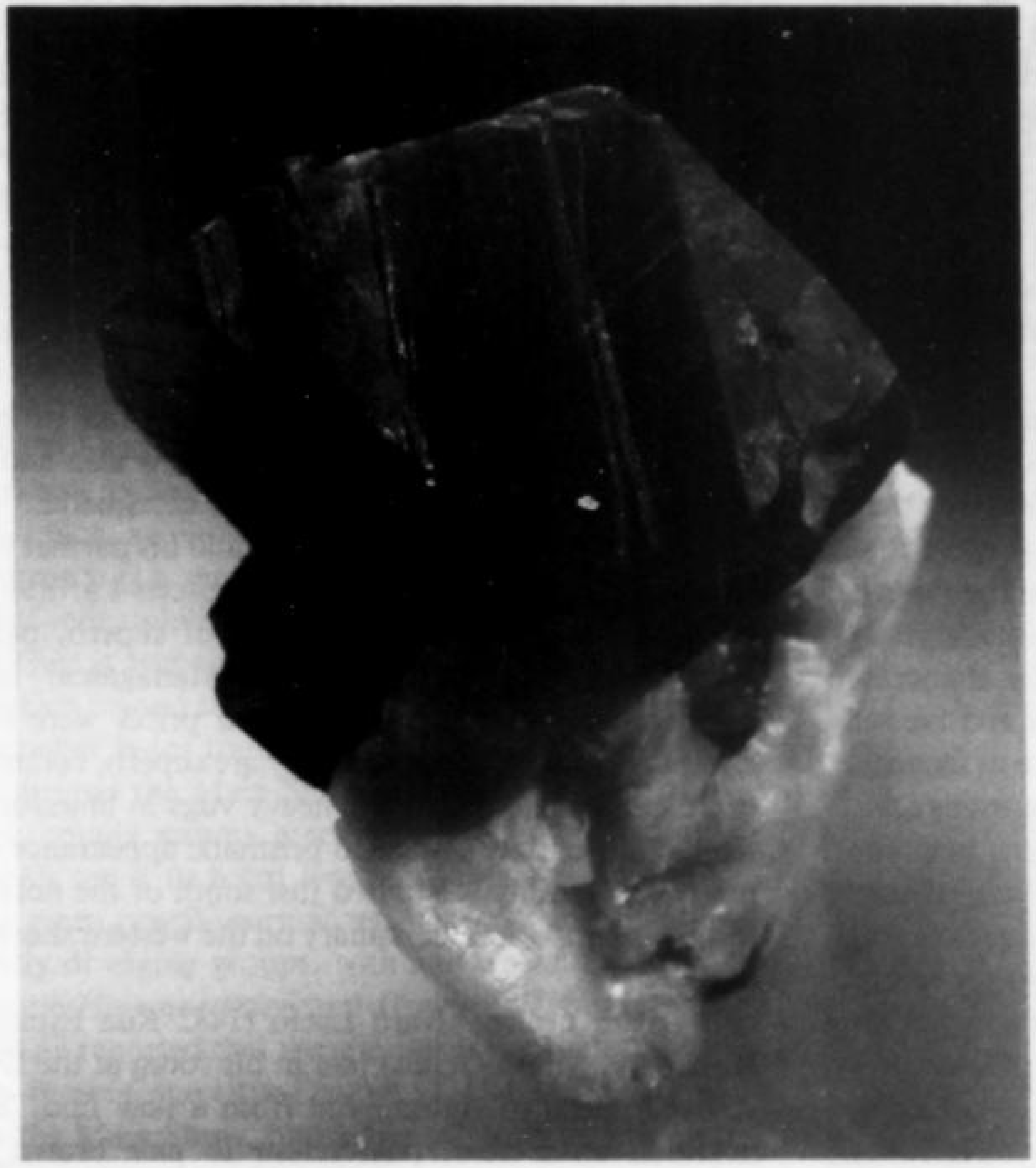

WEW

Figure 5. **Ruby crystal, 2.4 cm, from the Haramosh Valley, Pakistan. Simon Harrison specimen.**

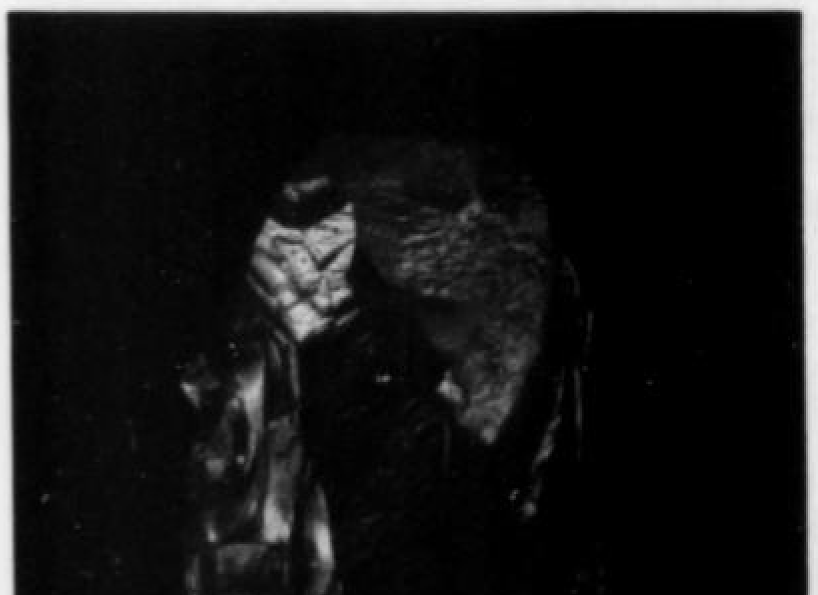

WEW

Figure 6. **Beryl crystal, 13 cm, from Wolodarsk-Wolynsky, Wolyn, Ukraine, Soviet Union. F. John Barlow specimen.**


WEW

Figure 7. **Proustite crystal, 3.6 cm, from Chañarcillo, Chile. Simon Harrison specimen, now in the Terry Wallace collection.**


WEW

Figure 8. **Cinnabar twinned crystal, 2.5 cm, on matrix, from the Snow drift near Paradise Valley, Humboldt County, Nevada. Bruce Bennett specimen.**

Was it the bullish stock market? Was it *Reaganomics??* No one really knows. But attendance at the main show was up by more than a quarter, to more than 26,000 people. At one point, Rock Currier (*Jewel Tunnel Imports*) had ten assistants writing invoices as fast as they could and they were still unable to keep up with the crush of customers. Another dealer told me that, by 2 p.m. of the first day at the main show, he had already taken in $25,000. Others, almost to a man, reported runaway sales far exceeding any previous year. Even the Show Poster (a quartz photo by the Van Pelts) sold out. Said one dealer: "You'd have to be carrying dirt balls to do badly at this show."

One man's good fortune stands out among the rest, however. Readers may recall (from the notice published in this column in vol. 14, no. 6, p. 390) that back in 1983 Keith Proctor suffered the theft of 23 superb specimens, mostly gem crystals, valued at more than $300,000. A satchell, which he had momentarily set on the floor in a dealer's booth at the Houston Show, was snatched while his back was turned. It was assumed by most people that the chance of recovery was nil; the crystals would most likely be cut and faceted immediately and would thus become impossible to trace or identify. But for once the odds-makers proved wrong. On Saturday, two sharp-eyed French collectors were browsing in the Arena hall, and were offered some crystals for sale which they immediately recognized as among the stolen pieces. With admirable presence of mind, they made deposits and put business cards down on several specimens to reserve them, then found a telephone and called the FBI. In a short time the specimens were seized and the dealer was being questioned; he claimed to have bought them as a lot for $2500, and said he would assist in tracking down the seller/thief. Miraculously, 80% of the stolen specimens were recovered on the spot. Keith became the object of much warm congratulations throughout the remainder of the show, and he added the specimens to his already spectacular exhibit case. As of this writing, the thief is still presumably at large but the FBI now has a fresh trail to follow and it would not be surprising to hear of an arrest in the next few weeks.

Mineral specimen dealers were set up in the usual motels again this year: primarily the Desert Inn and the Travelodge, also the La Quinta, a few at the Sheraton, and the occasional lost soul at one of the otherwise all-lapidary motels or non-selling motels. Business in the motels was good and it began early; heavy selling took place Thursday through Saturday a week before the main show at the Tucson Community Center. Even Elizabeth Taylor and George Hamilton, in town for a month filming a movie at Old Tucson, were seen browsing through the motels.

Keith Williams (P.O. Box 1599, Idaho Springs, CO 80452) at the Travelodge had several old collections for sale. Particularly noteworthy were several fine Los Lamentos **wulfenites**. Keith also had about 75 specimens of **freibergite** from the Eagle mine, Gilman, Colorado. The freibergite occurs as sooty gray single and composite crystals, 5–12 mm, on specimens of thumbnail to cabinet size.*

Rod Tyson (*Tyson's Minerals,* Travelodge) had many fine Canadian specimens including Mont St-Hilaire pieces, pyrite from Nanisivik, and so on. His **manganite** from the Caland pit, Atikokan, Ontario, is extremely fine and modestly priced, and is available in thumbnail to small cabinet sizes.

It was a pleasure to see Anna and Andrew Chrapowicki at the Desert Inn this year (2-4/6/62 Lechner Street, A-1030 Vienna, Austria). This was their first visit to the United States, although I remembered hearing from other dealers about a little Polish woman in Vienna who specialized in Russian minerals. Anna speaks halting but intelligible English, and brought along many fine and interesting Russian specimens including some nice zircons.

Speaking of Russian specimens, John Barlow (*Earth Resources*) recently acquired some superb greenish yellow **beryl** crystals from a pegmatite at Wolodarsk-Wolynsky, Wolyn, Ukraine. Five of these were for sale in Anna Chrapowicki's room, and John had others in his pocket. The crystals are typical of what has been coming out of that area for several years now. The late Curt Van Scriver brought out an especially fine lot of beer can-size crystals about five years ago, one of which is now in the Harvard collection. The color is always a rich greenish yellow (sometimes called "heliodor"), and crystals are always heavily corroded, with intricately pitted, frosty, spiky terminations and with rectangular etch pits covering the prism faces. Crystal interiors are typically very gemmy. Size ranges from 2 or 3 cm to 15 or 20 cm. Crystal pockets in the region are reported to reach *20 meters* in size, and are commonly filled with fine, loose muscovite and clay containing loose crystals of beryl, lepidolite, protolithionite, quartz and topaz. Barlow also had some very nice **diamonds** in matrix from near Yakutsk, Siberia.

Paul Obeniche in the Desert Inn and his partner Gilbert Gauthier (7, avenue Alexander III, 78600 Maisons-Laffitte, France) at the Main Show had literally hundreds of superb, pale blue **celestite** specimens from the Sakoany mine, Madagascar. Sizes range from small cabinet to museum size, and prices were reasonable. The celestite crystals from this locality are superb, commonly reaching 8 or 10 cm in size, and lining heavy vugs in limestone. Habit varies from a moderately elongated prismatic appearance to steep bipyramids. The locality is situated just south of the northern seaport of Majunga, opposite Boanamary on the western shore of Bombetoka bay.

Brazilian dealer Alvaro Lucio (1482 Rua Espirito Santo, Belo Horizonte, Minas Gerais) had in his room at the Desert Inn about 200 specimens of **fluorapatite** from a new find. The crystals are lustrous, water-clear, pale yellow to pale brown and somewhat modified. No matrix is evident, and the crystals occur as parallel to jumbled intergrown groups from thumbnail to small cabinet size. These were all collected recently from a pegmatite on the fazenda ("farm") Campolina, Medina "County," Minas Gerais. Several other dealers also had a small selection of these specimens. Alvaro also had good, sharp **muscovite** crystals to nearly 3 cm, in massed groups on large (to over 30 cm), clear quartz crystals from near Conselheiro Pena in Minas Gerais. These were available in cabinet sizes only and make fine display pieces.

Another Brazilian dealer at the Desert Inn, Carlos Barbosa (Rua Cel Roberto Ferreira 586, Governador Valadares, M.G.), had some fine, small crystals and groups of deep red **uvite** from Brumado in Bahia. The crystals, some to more than 1 cm, are shortened on the *c* axis so that some almost look like garnets.

Geary Murdoch had a large selection of well-formed single crystals of **labradorite** at his booth in the mezzanine room of the Desert Inn. The sharpest crystals measure about 2 cm or so, but crude singles and twins to 8 cm were also available. The crystals are translucent with transparent patches, gray to grayish yellow and pale yellow in color, and make fine additions to single-crystal and systematic collections. The locality is in Clark County, Idaho.

Bob Turner (*Natural Connection*) in the Travelodge had a large quantity of very beautiful **amethyst on galena** from a recent strike at Naica, Chihuahua. A wide variety of habits and combinations, some with bright blackish sphalerite, were available and sold very well.

Simon Harrison, in the Desert Inn, had a small selection of superb miniatures and thumbnails including a Chañarcillo **proustite**, Hope's Nose **gold**, Pakistan **ruby** crystal on matrix, and a fine Cornish **liroconite**.

Bruce Cairncross had a room at the Desert Inn on behalf of South African dealer Rob Smith, who was badly injured in an auto accident just before the show. Readers of last year's report will remember that Rob was the source of some fine **ajoite-in-quartz** crystals from the Messina mine, Transvaal, and Bruce brought many more this year from a large recent strike. Included in the lot were a few with **papagoite** inclusions and epidote crystals.

Terry Coldham (G.P.O. Box 4524, Sydney, Australia 2074) had some highly unusual specimens of **fluorite on stibnite** from Chiang Mai province, Thailand. The gray to colorless fluorite completely coats long (to about 10 cm), slender stibnites in large groups, so that the dark core is just discernible. On other specimens the stibnite protrudes uncoated from fluorite. The groups were collected from natural caverns encountered in a fluorite quarry. So far about 300 kg of cabinet specimens have been recovered. Terry left some of his stock with *Southern Nevada Mineral Company* (5000 E. Bonanza, Box 8479, Las Vegas, NV 89110), through which specimens can now be purchased.

Just to prove that collectors can still get lucky from time to time, Bruce Bennett (10399 Shady Brook, Boise, ID 83704) brought to the show a remarkable twinned **cinnabar** crystal exactly an inch long, on matrix, which he self-collected at a "new" locality in Nevada. The occurrence is a small prospect called the Snow drift, located about a half-mile uphill from the Cahill mine near Paradise Valley, Nevada. This is *not* the same as the Pershing County, Nevada, locality which caused such a stir a few years ago as a result of very similar cinnabar twins found there.

Several dealers around the Main Show had a few specimens of lustrous, beautiful, totally gemmy green **vivianite** from Huanuni, Bolivia. The crystals are 5 to 8 cm long and about 5 mm wide, closely resembling green pencil-tourmalines. They occur as parallel growths and slightly diverging groups, with and without matrix. I saw specimens in the *Hawthorneden* and *Graeber/Himes* booths, among others, and all reported that the specimens originated with a Swiss dealer, Jean-Pierre Cand (Rue Daubin 32, CH-1203 Geneve).

Ben de Wit, at the Main Show, had his usual array of fine East German and Polish specimens. Most striking was a unique specimen of rich, red **proustite** crystals on matrix from the Hartenstein mine, Aue, Erzgebirge, East Germany. It is so fresh looking that I suspect it has been recently collected or recently acid-etched out of enclosing calcite. Also in Ben's cases were several fine miniatures of gemmy green **vivianite** on quartz matrix from Trepĉa, Yugoslavia. The vivianite crystals are 3 to 4 cm in size.

Bob Sullivan, at the Main Show, had some large and fine specimens of smoky **quartz** from Conselheiro Pena, Minas Gerais, Brazil. The cabinet-size pieces show stepped parallel growth and variegated, patchy or cloudy patterns of smoky color. Bob also had some remarkably sharp and lustrous, gemmy **gypsum** crystals in vugs from an alabaster quarry near Zaragoza, Spain. The crystals look like fine anglesites or euclases, and reach more than 6 cm in size.

Cal Graeber and Leonard Himes, at the Main Show, had a large quantity of very fine and reasonably priced specimens from the Pachapaqui mine, Ancash province, Peru. Excellent specimens of **chalcopyrite, pyrite, sphalerite, quartz,** pink manganoan **calcite** and **kutnahorite** in various combinations and habits could be purchased for $30 to $100.

Wayne and Dona Leicht (*Kristalle*), at the Main Show, practically filled their booth with fine specimens from the **collection of E. M. Gunnell** (see death notice, p. 178). Superb cabinet pieces, fine thumbnails and miniatures, and rare, systematic material abounded. I could go on at great length about the old classics and exquisite display pieces of tourmaline, torbernite, beryl, manganite, pyromorphite, cinnabar, microcline, silver and gold; but suffice to say that Gunnell was a long-time collector with the most refined tastes, and his collection showed it. And there is more to come; as of this writing, Wayne still has more of the collection to pick up, including most of the finest Colorado pieces! As for **gold,** the California gold mines, especially Michigan Bluff, continue to produce, and the Leichts had many specimens at historically low prices, especially in the thumbnail size range.

Miriam and Julius Zweibel (*Mineral Kingdom*) had some very fine **scorodite** specimens from Tsumeb. The pseudo-octohedrons appeared to vary in color depending on the lighting, from a teal-blue to blue-green and a sort of pale seafoam-blue . . . the colors are difficult to describe. Crystals to 1.5 cm were available in groups of thumbnail to miniature size. Also in the Zweibels' stock were some nice **mimetite** specimens from the increasingly famous Kombat mine in Namibia.

Sharon Cisneros (*Mineralogical Research Co.*) had a number of gold nuggets from some unusual places including the classic crocoite locality of Beresovsk in the Ural Mountains, Soviet Union. She also had Brazilian rutile and senaite (see vol. 17, no. 3, p. 193), and of course a large number of rare species including several that were first described just last year.

Displays at the Main Show were extraordinary as usual, and I won't attempt to recount them all, just a few that seem to stick in the memory.

Kent England

Figure 9. **Colorless quartz crystal, 17,600 pounds (7990 kg), locality unspecified, displayed at the show by Zee Haag. (Too bad he couldn't have gotten it out on matrix.)**

Showgoers were greeted first by Zee Haag's incredible 17,600 pound, doubly terminated quartz crystal, nearly the size of a Volkswagon. Zee won't say where it's from, but apparently it's a pegmatite being mined for industrial quartz, and the huge crystals are usually broken up with sledge hammers by the miners. Zee is salvaging a few intact to see if there is a market for them. Although it is against show rules for exhibit specimens to carry prices, the big quartz was parked in the front lot of the Desert Inn during the week before the show, and I did spot a tiny price sticker; it said "2½¢/carat." Gee, that sounds reasonable; now let's see, there are 5 carats to the gram, 454 grams to the pound . . . .

If a special award for "Most Exciting Specimen at the Show" were given, Douglas and Richard Graeme's Bisbee cuprite would have won by acclamation. It was just a small specimen in the center of their display case of (mostly self-collected) Bisbee specimens. But it was the talk of the show, and people were constantly dragging their friends bodily up to the showcase glass and saying, "What do you think of *that*?!" In fact, a wide range of experienced and sophisticated collectors and curators all agreed that it could be considered the world's finest cuprite specimen. Just turn back to the cover of this issue and you will see it.

The story behind this remarkable specimen was told to me by the collectors' father, Richard Graeme III, author of the Bisbee Issue (vol. 12, no. 5) and certainly the leading authority on Bisbee mineralogy, while I set the specimen up for photography. His sons were collecting underground on the fifth level of the Southwest mine last year, and came across a cuprite boulder measuring over a meter across, which had fallen out of a large clay-filled fault zone. At one side of the boulder they found a malachite-atacamite nodule which they broke off and opened. At the center of the nodule was a vug (perhaps 10 cm in size) lined with large, gemmy, cubic cuprite crystals. A miniature-sized piece of matrix fell loose from the side of the vug, and is the one shown on the cover, with a 1-inch faceting-grade cuprite crystals on green tufts of atacamite. Other crystals inside the vug reach twice that size but are contacted on more sides due to the relatively small size of the vug. Thus far at least 20 different species have come from this find, including claringbullite (the world's finest), paratacamite and spangolite. (Identifications were made by Sidney A. Williams.) The Graemes have, of course, removed all traces of mineralization from the area (they are thorough), so there is little point in attempting further work at that particular site. But it is remarkable that a deposit which has remained a world-class mineral occurrence for more than a century, and which is considered to be more or less mined out, should at this late date produce the world's best anything! Never say die.

Most of the best museums in the country were represented by displays this year, as usual, and some focused on quartz (the show's featured mineral). These cases are always spectacular, but the piece I was most impressed by was just a small one, a *group* of several esthetically intergrown red beryl crystals, about 2.5 cm tall, without matrix, from the Wah Wah Mountains, Utah (Los Angeles County Museum of Natural History collection). Harvard's case of rare and superb Arizona specimens was also very impressive, as was the Pinch Mineralogical Museum's large exhibit of Cornish minerals.

Among the private cases, those of Tom McKee, Keith Proctor, Rick and Cholly Rolater, James Bleess (thumbnails), and of course the Graemes stood out in particular. In the Arena area (generally reserved for lapidaries and equipment dealers) the Amsterdam Sauer company exhibited a huge twinned chrysoberyl crystal (122,400 carats or 54 pounds) from Jaqueto, Bahia, Brazil; this is the same one pictured in the book *Brazil, Paradise of Gemstones,* and it is quite an experience to see in person. Those who keep track of such things should mark this one down as "world's biggest."

AWARDS

The Lidstrom and the McDole trophies were both won this year by Tom McKee, who dutifully slugged down his initiatory shot glass of black rum from the late Ed McDole's original bottle and thus became officially an "Old Bounder" with Ed. In fact, he won the Mcdole with two superb cases of specimens including what I dispassionately consider to be the World's Finest aurichalcite, which incidentally I collected myself at the 79 mine during my college days in Arizona. There is not sufficient space in this particular column to picture it, but I'll show a photo of it soon, probably in the next issue.

The Friends of Mineralogy Award for the best article to appear in the *Mineralogical Record* during the previous year was won by Tom Campbell and Willard Roberts for their study of the Tip Top mine in the Black Hills. A close second, according to the judges, was Ole Johnsen's article on Kongsberg in the Silver Issue.

AUCTION VOLUNTEERS 1987 TUCSON SHOW

Rex Bannister
Joel Bartsch
Bill Basbagill
Dan Behnke
Esther Behnke
Ron Bentley
Bill Besse
Julian Blakely
Ruth Blakely
Bryan Brookmyer
Russ Bucciene
John Carlon
Pat Carlon
Kim Cathcart
Janet Clifford
Paul Clifford
Anne Cook
Bill Cook
Christi Cramer
Dave Crawford
Michael Davis
Jean DeMouthe
Paul Desautels
Stanley Dyl
Francis Edwards
Howard Ehrle
Kent England
Jesse Fisher
Mary Fong-Walker
Vi Frazier
Ken Gochenour
John Gorham
Mike Gray
Pat Gray
Tom Gressman
Darlene Hampel
Lance Hampel
Gary Hansen
Simon Harrison
Doug Hooker
Terry Huizing
Dick Hull
Bob Jackson
Bob Jones
Anthony Kampf
Joe Kielbaso
Mark Kielbaso
Kathy Kilduff
Joan Kureczka
Ross Lillie
Gloria Ludlum
Sandy Ludlum
Carolyn Manchester
Russ Manchester
Peter Megaw
Barbara Muntyan
Ted Parkevich
Christine Pfaff
Neil Prenn
Ed Raines
Lee Riechel
Vera Rogers
Maureen Ryan
Gary Schalla
Ernie Schlichter
Henry Schmidt
Jerry Simpson
Don Smarjesse
Ron Sohn
Marshall Sussman
Les Tolonen
Gene Tribbey
Jim Walker
Jonathan Weiss
Bruce Wetteroth
Carolyn Wilson
Doris Wright
Gene Wright

SHOW TABLE VOLUNTEERS WORLDWIDE

Pat Barker
Ron Bentley
Pat Carlon
Kim Cathcart
Patrick Collins
Jean DeMouthe
Tana Daugharthy
Joan Davy
Kevin Davy
Ronald DeBlois
Richard Erd
Russell Feather
Piers Foa
Ann Frazier
Si Frazier
Dea Gable
Mary Lynn Goebel
David Harrison
Simon Harrison
Claus Hedegaard
Marie Huizing
John Jaszczak
Anthony Kampf
Tsukasa Kikuchi
W. J. R. Kwak
Anne-Marie Laurion
Walter Lombardo
Jim McGlasson
Jean McKenna
Wolfgang Mueller
Adriana Pagano
Renato Pagano
Cynthia Peat
Paul Pohwat
Steve Pullman
Ed Raines
Marie Risch
Walt Risch
Steve Scott
Art Smith
Jesus Talaban
Marion Talaban
Richard Thomssen
Paul Van Hee
Charles Weber
Marcelle Weber
Christian Weise
Bruce Wetteroth
David Wilber
Horst Windisch
Martin Zinn III

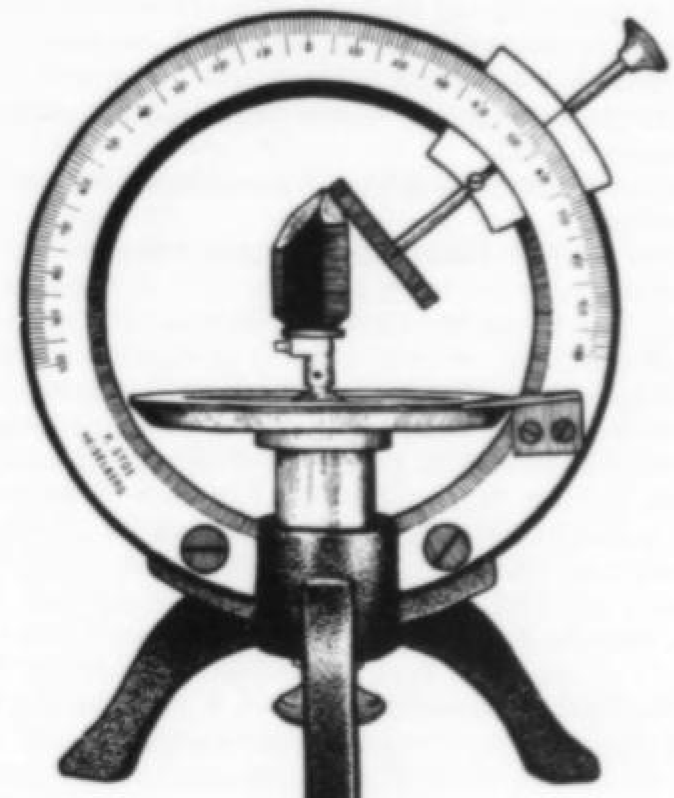
THANKS

Once again we had a very successful fund-raising auction at the show this year, thanks to several hundred generous donors and no less than 78 volunteer workers. Before and during the show our intrepid collecting team canvassed the mineral, gem, fossil, book and equipment dealers throughout the various motels and the community center, asking if they would like to help support the magazine by donating something. In all they garnered 1242 items, which were then passed on to our processing teams for labeling, and then to either the silent auction team (which keeps silent auctions going throughout the four days of the show), or the Saturday night auction team, which gets the 50 or 60 best and most interesting items.

I'd like in particular to thank our entertaining auctioneer, Gary Hansen, auction co-managers Don Olson and Wendell E. Wilson *Sr.* (my father), collecting team captain Gloria Ludlum, processing

(continued on page 249)

Annual list of donors to the MINERALOGICAL RECORD



Presented here is a listing of everyone, according to our records, who donated to the auction this year, made a cash donation, or donated library materials during the previous 12 months or so (except for a few people who wished to remain anonymous). If you made a donation and are *not* listed here, or if you need a letter itemizing your donation(s) for tax purposes, please write to the editor.

I know all the readers of the *Mineralogical Record* will join me in saying thanks to these generous people who help to keep our magazine going year after year. W.E.W.

A & A Gems & Minerals, Al & Adeline Deale, Monroe, WA
Ken Adams, Miami, FL
The Adit, Robert A. Jenkins, Isidora Goyenechea, Santiago, Chile
Adris Oriental Gems & Arts Corp., Anil, Samrat, Ketan & Varsha Dholakia, New York, NY
African Gems & Minerals, Rob Smith, Johannesburg, South Africa
Agate/Amethyst World Inc., Fred & Mary Miller, Van Nuys, CA
Enrique Aliste, Temple City, CA
Amazon Imports, Joe DeCristoforo, Williston Park, NY
Aries, Port Charlotte, FL
Ari Imports, Ltd., Rhoda G. Kurs, Chicago, IL
Arkansas Mineral Properties, Stephens, AR
Ana Arruda, Lisboa, Portugal
Artcraft Imports, Sandra Hoover & Martha Thomas, Arlington, TX
Art Source International, Paul F. Mahoney, Boulder, CO
Assex Trading Inc., Paulo Freire, Washington, DC
Aurora Mineral Corp., Harvey Siegel & Michael Siegel, Freeport, NY
Fred Bailey, Nanisivik, N.W.T., Canada
Bailey Minerals, Jesus & Marion Talaban, Madrid, Spain
Baltimore Mineralogical Society, Baltimore, MD
Barbera Company, Edward & Joen Barbera, Alameda, CA
Pierre Bariand, Massy, France
Barlow's, Bruce & Debbie Barlow, Phoenix, AZ
Russell E. Behnke, Meriden, CT
Belgo-Diam, Eric Fintzi, Los Angeles, CA
Ben-Gems Inc., Todd Benowitz, Chicago, IL
Bennett B-W Walls, Aris Mallas, Rotan, TX
Bennett Lapidary Arts, W. Scott Bennett, Montrose, CO
Benthos Projects, Scott Vergiels, Temperance, MI
Beth Gordon's Minerals, Weldon Gordon, Saugus, CA
Black Bear Corporation, Lee Hammons, Young, AZ
Black Hawk Fossils, Ltd., Ed & Dan Ulmer, Black Hawk, SD
Black Hills Institute of Geological Research, Inc., Hill City, SD
Bleily's Gems, Bob, Micki & Rob Bleily, Parma, ID
Blue Stone, Gerry Sullivan, Belen, NM
Bob Riddle Minerals, Bob & Vicki Riddle, Lowst Grove, AR
Glenn & Kathleen Bolick, Hickory, NC
Bones & Stones, Dave Plooster, Black Hawk, SD
The Boston Miners, Leo C. Vaught & Donald G. Wyman, Winchester, MA
Brazamco, Ron & Patricia Mills, Tucson, AZ
Horst Burkard, Bonn, West Germany
Thomas Buza, Tucson, AZ
Bruce Cairncross, Johannesburg, South Africa
California Mineral Company, Hans G. Thern, Danville, CA
California Rock & Mineral, Tony Jones, Brea, CA
Canyon Rock & Gift Shop, S. T. & June Rich, Cody, WY
Alain Carion, Paris, France
Ronald R. Carman, Humble, TX
Carousel Gems & Minerals, Betty & Al Tlush, Belen, NM
Castex Casting Crafts, David R. Kiel, Hayward, CA
Caveman Lapidary, Dan & Hope Rigel, Oregon
Ceylon Sapphires Intl., David Chambers, Chatsworth, CA
Chacon's Custom Cabbing, Fred & Josie Chacon, El Paso, TX
Chambers Minerals, Don Chambers, Henderson, NV
Clare D. Chandler, Red Bluff, CA
S. Chatta, Lubumbashi, Zaire
J. Chaver, Madrid, Spain
China Imports, Arlington, VA
Coleman's Quartz Mines, Ron Coleman, Jessieville, AR
Collection Haineault, Giles & Claude Haineault, Longueuil, Quebec, Canada
Collection Minerive, Pelusin, France
The Collector, Roxanne Kremer & Aras, Rosemead, CA
Collector's Choice, Dalton & Consie Prince, Houston, TX
The Collector's Stope, Jim & Pattie McGlasson, Littleton, CO
Colorado Gem and Mineral Company, Jack Lowell, Tempe, AZ
Columbine Mineral Shop, Benjy & Liz Kuehling, Ouray, CO
Lawrence H. Conklin, New Caanan, CT
Contempo Lapidary, Ernie Wilson, Sun Valley, CA
Copper King Turquoise, Odis & Judy Flowers, Bisbee, AZ
Couture & Co., David N. Couture, Atwater, CA
Craftstones, Herbert E. Walters, Ramona, CA

David M. Crawford, Rockford, IL
Creation Fossils, Richard Kirchhevel, Roundup, MT
Crista-Galli, Salt Lake City, UT
Crown Gems Company, Loreen Haas, Sherman Oaks,CA
Crystal Cavern Minerals, Tom Palmer, El Paso, TX
Crystal Clear Creations, James Thiel & Thomas Palmer, Ann Arbor, MI
Crystal Continuum, Dale Young, Sedona, AZ
Crystal Deva Designs, Paul & Bente, Santa Fe, NM
Crystal Fountain, Gary & Elizabeth Fleck, Royal, AR
Crystal-Linn International, Martin Zinn, Evergreen, CO
Crystal Ventures, Thomas Warton, San Francisco, CA
Cureton Mineral Co., Forrest & Barbara Cureton, Tucson, AZ
Dahnke Intermark, John & Helen Dahnke, Loma Linda, CA
Dalinka Designs, Susan Dalinka, Spring Valley, CA
Dave Johnson Lapidary, Dave Johnson, Tucson, AZ
Dave's Down to Earth Rock Shop, David, Sandra, June & Lincoln Douglass, Evanston, IL
David Gem & Jewelry, Quintin Poon, Los Angeles, CA
David Shannon Minerals, David, Colleen & Mike Shannon, Mesa, AZ
Daybright Gems, Stan & Dodie Day, Lewiston, ID
Olive & Frank Delaney, Tucson, AZ
Gil de Moura, Garden Grove, CA
De Natura, Les & Paula Presmyk, Mesa, AZ
Dennis Brand International, Jennifer Brand, Van Nuys, CA
Den's Petrified Critters, Dennis Kingery & Monty Knutson, Rock Springs, WY
De Re Mineralogica, Christiane & Pierre Rayssiguier, St. Nom La Breteche, France
Ben de Wit, Fallbrook, CA
Diamond Pacific, Sandra A. Depue, Barstow, CA
Diversified Minerals, David J. Lewis, Salt Lake City, UT
Dolly's Jewelry, Dolly Reuna, Tucson, AZ
Duncan's Minerals, Don & Betty Duncan, Yuma, AZ
Dyck's Minerals, Mel & Grace Dyck, Laramie, WY
Earth Enterprises, Dom Smarjesse, Novi, MI
Earth Resources, F. John Barlow, Appleton, WI
Earth's Gems, John Lovelace, Brentwood, TN
Earthsong, David & Nancy Allred, Jacksonville, OR
Ed Brandt Stone Co., Nampa, ID
Frances L. Edwards, Phoenix, AZ
Bud & Linda Ehrle, Miles City, MT
Mercedes Eisel, Omaha, NE
El Paso Rock Shop, Mario Vizcarra, El Paso, TX
Emeralds, Sam K. Redman, Mitchellville, IA
Em's Gems, Em & Ogle Love, Tucson, AZ
Enchanted Mesa Minerals, Jerry Ostrom, Belen, NM
Stan Esbenshade, Tucson, AZ
Facetron, Norma & Betty Jarvi, Anaheim, CA
Peter M. Faust, Ontario, CA
Fenn's Minerals, Colonia Juarez, Chihuahua, Mexico
I sassi di Alfredo Ferri, Dr. Alfredo Ferri, Milano, Italy
1515 Minerals, Accrington, AL
Filer's, Russell & Alexandra T. Filer, Yucaipa, CA
Finders Keepers, Raymond Fasy, Jenkintown, PA
Gary Fleck, Albuquerque, NM
The Foothills, Harvey & Lois Patterson, Yuma, AZ
49er Minerals, Jim & Joyce Vacek, Scottsdale, AZ
Frank Lau Jewelry, Inc., Joanna Lau, Seattle, WA
Si & Ann Frazier, Berkeley, CA
Will & Jean Frech, Fresno, CA
Freedom Valley Gems, Ali-M. Baigzad, San Jose, CA
Galas Minerals, Chris A. Galas, Turlock, CA
Galerie Fossil, Dietmar Seeh, Tuttingen, West Germany
G & M Minerals & Fossils, Piero Gandiglio & Giuseppe Montrucchio, Cuorgne, Italy
Garvin's Book & Rock Shop, Jack Garvin, Burbank, CA
R. Gatz, Safford, AZ
Gilbert J. Gauthier, Maisons-Lafitte, France
Gem & Lapidary Wholesalers, Lynn McCullough, Flora, MS
Gem & Mineral Mining (PTY) Ltd., Larry Introna, Cape Town, South Africa
Gem City, Richard L. Heino & John M. Arnold, Laramie, WY
Gemcraft Pty. Ltd., Cyril Kovac, East Malvern, Victoria, Australia
Gemini Minerals, Joe Kielbaso, Tipp City, OH
The Gemological Division, Ray Grimsinger, San Diego, CA
Gemological Institute of America, Santa Monica, CA
Gemological Society of Great Britain, England
Gems of Pala Inc., John Duboe, Pala, CA
Geodon Gems, Aurora, IL
Geological Specimens International, Robert & Maudine Sullivan, Tucson, AZ
Gesswein, Daniel R. DaCosta, Bridgeport, CA
Gibson's Gem & Mineral, Clayton Gibson, Tucson, AZ
Gochenour's, Ken & Dana Gochenour, Tustin, CA
George Godas, Tempe, AZ
Marion Godshaw, Santa Monica, CA
Golden Minerals, Golden, CO
Alan Goldstein, Louisville, KY
Goldstein Imports, Inc., New York, NY
Graeber Minerals, Cal & Kerith Graeber, Fallbrook, CA
Art Grant, Hannibal, NY
Graystone Enterprises, Michael Gray, Venice, CA
Grenville Minerals, Darryl B. MacFarlane & Bradley S. Wilson, Kingston, Ontario, Canada
The Gypsum Rose, Marge & Deidre Scanlon, Central City, CO
Hahn Natural History Books, Donald E. Hahn, Cottonwood, AZ
Hamel Mining and Minerals, Jean H. Hamel, Los Angeles, CA
Hanneman Lapidary Specialties, W. William Hanneman, Castro Valley, CA
Hardies, Ken & Alice Hardies, Quartzite, AZ
Bob Harris, Delta, UT
Joan & Bryant Harris, Missoula, MT
Harrison Enterprises, Prescott, AZ
Bill Hawes Jr., Tempe, AZ
Hawthorneden, Frank & Wendy Melanson, Eldorado, Ontario, Canada
Hesperian Press, Peter Bridge, Victoria Park, W.A., Australia
Hinshaw Rock 'N Gems, Merrill, Janis, Matt & Teresa Hinshaw, French Lick, IN
Hodson's of Scottsdale, G. Keith Hodson, Scottsdale, AZ
Ken Hogan, Teaneck, NJ
Hollowell Minerals, Fresno, CA
Richard Walker Holmes (estate of), Denver, CO
Carlton L. Holt, Milan, NH
The House of Gems, Sid Peters, Windhoek, South-west Africa
House of Mr. Del, St. Louis, MO
R. H. Hronik, Falls Church, VA
Kenneth Huang, New York, NY
Neil Hubbard, Leicester, England
David Hudson, Idar-Oberstein, West Germany
The Irish Rovers, Gerry & John Shannon, Lakewood, CO
Ivory Artisan, Philip Saada, South Ocean, NJ
Ivory Jack's Trading Company, Kurt & Francine Tripp, Bothell, WA
Jackson Mountain Press, Bob Jackson, Renton, WA
J. & M. Gems, Luckey Lakshmanan, Saxonburg, PA
J. & M. Lapidary, St. Johns, AZ
Ganzalo Jara, Bogota, Columbia
John Jaszczak, Columbus, OH
Jewel Tunnel Imports, Rock H. Currier, Arcadia, CA
Jim's Gems, Jim & Petty Belcher, Wichita Falls, TX
Jim's Gems, Wayne, NJ
Jonathan Starr Ltd., Jonathan Star, Tucson, AZ
Hilary Jones-Wujcik, Tucson, AZ
Jon Jax, Marte Gunning, Hawaiian Gardens, CA
Michel Jouty, Chamonix, France
Jule-Art, Arthur & Julia Shuck, Cape Coral, FL
Julie's Rock Shop, El Paso, TX
Justina's Gems, Robert Wright, Fallbrook, CA
Dr. Anthony Kampf, Los Angeles, CA
Karakurum Enterprises, Farzand Ali Bhola, Simi Valley, CA
John & Dolores Kassionas, Alviso, CA
Henry F. Kennedy, Freehold, NJ
Keweenaw Gem & Gift, Inc., Cindy & Ken Flood, Houghton, MI
Dr. Albert Kidwell, Houston, TX
Mark & Joe Kielbaso, Tipp City, OH
Kohl's Enterprises, Roy & Susan Kohl, Eureka, CA
Korite Minerals Ltd., Pierre Pare, Calgary, Alberta, Canada
Kripps for Gems Inc., Prem J. Kirplani, Silver Spring, MD
Lake Superior Agate Inc., Scott Walter, Minneapolis, MN
La Milagrosa, Jeanne & Federico McAninch, Tucson, AZ
La Mina de Rocas, C. E. Odinot, Dallas, TX
La Minera, Pio Mariani, Roma, Italy
L & T Creations, Lee A. & D. Taggart McKinney, Littleton, CO
Bob Lane, Phoenix, AZ
Raymond Lasmanis & Cheryl Stewart, Olympia, WA
Roger E. J. Leemans, Brussels, Belgium
Luis Leite, Alamda, Portugal
The Lesnicks, Stan & Beth Lesnick, Tucson, AZ
James & Rita Lewis, Hanksville, UT
Little 3 Mine, Louis Spaulding, Ramona, CA
LJP, Larry & Carmen Piekenbrock, Boulder, CO
Mrs. Betty Llewellyn, Dallas, TX
L M Enterprises, Hopkins, MN
Lortone, Inc., Don M. Guthrie, Seattle, WA
Love is in the Earth, McDonald E. Bernardes, Belo Horizonte, Minas, Brazil
Lovelace, Bev & Ernie Holloway, Wichita Falls, TX
L.P. Gems, Inc., Leonard Przeclawski, Winter Park, FL
Lyko Mineral & Gem, Inc., Jack Young, El Paso, TX
Majestic Gems & Carvings, Paul & Bobbi Downing, Tallahassee, FL
M & R Gems, El Paso, TX
Marilyn's Rockpile, Marilyn Dodge, Providence, RI
Marocks, Claude Ben David, Montreal, Quebec, Canada
McGregor Minerals, Hot Springs, AR
Tom McKee and Gary Coleman, Scottsdale, AZ
Jean McKenna, Cranston, RI
McKinneys, Maurice & Gola McKinney, Cambria, CA
Dehne McLaughlin, N.T., Australia
McLaughlin's of Tucson, Ann & Nubbs McLaughlin, Tucson, AZ
M C M Gems, Jerry & Peg Manning, Gov. Valadares, Minas Gerais, Brazil
McNeil's Arts & Minerals, Jimmy & Hisami McNeil, Memphis, TN
John Medici, Dublin, OH
Richard Meede, Tempe, AZ
Peter Megaw, Tucson, AZ
George F. Melloy, Bethlehem, PA
Melted Crayon Paintings, Arlene Echelberger, Chico, CA
Luiz Menezes, São Paulo, Brazil
Middle Tennessee Minerals, Robert Halfacre, Elmwood, TN
Mike Madson Minerals, Mike Madson, Grand Junction, CO
Milliren's Rocks & Gifts, Dennis & Cathy Milliren, Overland Park, KS
"Mine Anne" Minerals, Anna & Andrew Chrapowicki, Vienna, Austria
Mineral Exquisit, Uli Burchard, Haindlfing, Freising, West Germany
Mineralien und Fossilien Galerie, Frankfurt, West Germany
Mineralientage München, Johannes Keilmann, Oberhaching, West Germany
Mineral Kingdom, Julius & Miriam Zweibel, Pompano Beach, FL
Mineralogical Airborne Research, Kim & Diane Cathcart and Neal Carson, Las Vegas, NV
Mineralogical Research Company, Eugene & Sharon Cisneros, San Jose, CA
Minerals America, C. Leonard & Roberta G. Himes, Orlando, FL
Mineral Treasures, Dee Belsher, Broomfield, CO
Montana Gemological, Randy & Katie Gnelting, Columbus, MT
Leonard Morgan, Haddenfield, NJ
Mountain Gems & Minerals, Donald A. Zowader, Somerville, NJ
Mountain Minerals International, Louisville, CO
M. Phantom Minerals, Neal & Christine Pfaff, Columbus, OH
Geary J. Murdock, Idaho Falls, ID
Mary M. Murphy, Forest Hills, NY
Pat Murphy, Loxton, South Australia
Thomas Gary Nagin, Royal, AK
Namibia Minerals, Suurbekom, South Africa
Nature Arts Company, Sherwin N. Berger, Phoenix, AZ
Natural Connection, Bob Turner, El Paso, TX
Osorio M. Q. Neto, Belo Horizonte, Minas Gerais, Brazil
North American Minerals, Les Tolonen, Cincinnati, OH
North Star Minerals, Ross C. Lillie, Mt. Clemens, MI
H. Obodda, Short Hills, NJ
Oceanside Gem Imports, Inc., Milton & Hilde Sklar, Oceanside, NY
Eric Offermann, Lettenweg, Switzerland
Donald K. Olson & Gloria Ludlum, Cedarburg, WI
One Track Mines, Larry Gray, Boise, ID
Onyx Imports, Bill Davenport, Smyrna, TN
Opal Jay-R Mine, Mike Anderson & Cheri Saunders, Huachuca City, AZ
Opex Minerals, Paul Cory & Dag Johnson, Santa Barbara, CA
Oplex International, Don & Karen Thompson, San Diego, CA
Originals by C. Sues, Carol Sues, Phoenix, AZ
Jacilyn Orsero, France
Jean Orsero, La Rochello, France
The Outcrop, Pete & Nancy Olson, Springfield, IL
Overland Gems Inc., Pete Flusser, Los Angeles, CA
Oxcart Minerals, Hollis & Priscilla Oxley, San Jose, CA
Dr. Adolf Pabst, Berkeley, CA
Padre Mining, E. H. McMacken, Ramona, CA
Dr. Renato & Adriana Pagano, Monfalcone, Italy

Pala International, Bill Larson & Lou Schwartz, Fallbrook, CA
Ted Parkevich, Whitehall, OH
Pathfinder Minerals, Mary Jean & Larry Cull, Fremont, CA
Don Pearce, Mohawk, MI
Pearl Pond-Acres of Gold, J. R. Harris, North Baltimore, OH
G. W. Pedlow, Lock Haven, PA
Penney's Gemstones, David & Lana Penney, Pima, AZ
Pequa Minerals, Ltd., Josef Vajdak, New York, NY
Perje-Pedras do Brasil Ltda., Paulo C. Lima, Sao Paulo, Brazil
Pickens Minerals, Reo Pickens, Waukegan, IL
Potomoc Museum Group, Doug Sievers, Silver Spring, MD
Fred Pough, Reno, NV
Harris Precht, Hamilton, OH
Precious Earth, Lance Hampel, Germantown, WI
Primitive Playmates, Kitty Starbuch, Vicksbury, MI
Professional Trading Inc., M. Saleem Khahani, Succasunna, NJ
Rain Star Jewelry Mfg., Gary & Loraine Peters, Albuquerque, NM
The Rancher, Rex Harris, Delta, UT
R.E.B. Associates, Ron Bentley, Enfield, CT
Red Metal Minerals, Richard Whiteman, Hancock, MI
Regal Reflections, Inc., Bob & Sherry Walker, The Woodlands, TX
R.E. Gems, R. E. Green, East Jordan, MI
Richard's Gallery, E. D. Richards, Memphis, TN
Rincon Mineral Co., Tucson, AZ
Leon Ritzler, Hillsdale, NJ
Mark & Jeanette Rogers, Yucaipa, CA
Roberts Minerals, Ken Roberts, Twain Harte, CA
The Rock Farm, Gene & Alice Law, San Marcos, CA
The Rock-hut, Gus Seppi, Jim & Irene Witmer, Leadville, CO
The Rock Hut, Jack & Noreen Murdock, Winnemucca, NV
The Rocksmiths, Eldon, Jean & Jaye Smith, Tombstone, AZ
Rockyland Enterprises, Sergio Avila, El Paso, TX
Cass M. Rollins, Tucson, AZ
Roper's Rock Ranch, Aubrey, Willa, Adam & Barbie Roper, Huntsville, TX
Brad & Linda Ross, St. Clairsville, OH
Joseph C. Rota, Carlin, NV
Randolph S. Rothschild, Baltimore, MD
Royal Case & Display, Alderwood Manor, WA
Bruce & Jo Runner, Delhi, CA
Rick & Deanna Russell, Cincinnati, OH
Russell's Rock & Jewelry, J. F. & S. A. Russell, North Liberty, IN
Russell-Zuhl Inc., New York, NY
Rustam, Rusty Kothavala, Oakland, CA
Saint-Roy, Paris, France
S. & L. Tims Lapidary, Stan, Lucile, Bob & Mimi Tims, Tucson, AZ
S & P Gems, Phil & Shirley Oakley, Salem, OR
Santiam Lapidary, Cascadia, OR
Schneider's Rock & Minerals, William Schneider, Poway, CA
Thomas M. Schneider, San Diego, CA
Schooler's Minerals & Fossils, John & Earlene Schooler, Blue Springs, MO
F. W. & Milly Schupp, Tucson, AZ
Ruth Schwartz, New York, NY
Curt G. Segeler, Brooklyn, NY
Seibel Minerals, John Seibel, Tehachapi, CA
Sesco, Reno, NV
R. B. Shah, Bharat Shah, Pittsburgh, PA
Shale's, Lee & Benji Shale, Los Angeles, CA
Roland E. Sherman, Pomona, CA
Shoba Inc., Abedin T.J., Monrovia, CA
The Showcase, Ernie Schlichter, Sudbury, MA
Shows of Integrity, Edward J. Tripp, Blue Ridge, TX
Curtis P. Schuh, Tucson, AZ
Sierra Contact Minerals, Inc., Harvey M. Gordon & Stephen W. Rose, Reno, NV
The Silver Flower Studio, Hagen W. Smitmans, Huachuca City, AZ
Silverhorn, Michael Ridding, Santa Barbara, CA
Silver Scepter Minerals, Spokane, WA
Kenneth & Meredith Silvy, Bath, NY
D. R. Simmons, Queensland, Australia
Simon Harrison, Fairfield Park, Bath, Avon, England
Arthur E. Smith, Jr., Houston, TX
Mary Smith, Tucson, AZ
Southern Nevada Mineral Co., Walter Lombardo, Las Vegas, NV
Southwestern Minerals, Gary & Priscilla Young, Albuquerque, NM
Southwest Products, Walt Miller, Yuma, AZ
Spectrum Enterprises, Gordon Mustain, Tucson, AZ
Mike, Sandra, Tom & Cherie Sprunger, Leamington, UT
Srilanka Gemstones International, Raju R. & Renuka R. Rasiah, Tarzana, CA
Stanford's, Bill & Dorothy Stanford, Riverdale, CA
Starr Gems, Inc., Tucson, AZ
J. E. Stevens, Washington, UT
St. Johns Rock Shop, Frank E. Wilbur, St. Johns, AZ
L. B. Stone, Los Angeles, CA
Stonewerks, Lynn & Richard Atkinson, Seminole, FL
Jack Streeter, San Diego, CA
Stringer's Gem Shop, W. A. & Anna Stringer, Nampa, ID
Dorothy M. Stripp, South Orange, NJ
Sugilite Source, David D. Cordry, Phoenix, AZ
Marshall Sussman, Evanston, IL
Edward R. Swoboda, Los Angeles, CA
Tatus Minerals, Art & Sally Tatum, El Paso, TX
Tepe Gemstone Supply, Inc., Earlene Tallman, Marsing, ID
Terra Azul Minerals, Layton Talbott, Miami, AZ
Texas Mineral Supply, Don & Joann Langston, Ft. Worth, TX
The Bug House, Loy & Althea Crapo, Delta, UT
Thaimas Gems & Jewelry, Temple City, CA
Thomas Range Gem & Mineral Co., John Holfert & Steve Allred, Bountiful, UT
L. Lyons Thompson
Wayne Thompson, Phoenix, AZ
Gale and Richard Thomssen, Carson City, NV
Tideline, Inglewood, CA
Tierra Minerals, Carl Faddis, Alfonso Arriaga, El Paso, TX
Tiger-Eye Manufacturing (PTY) Ltd., Hannes Kleynhans, Hermanus, South Africa
Tim Roark Imports, Ben Kho, Atlanta, GA
Tom Wolfe Minerals, Tom Wolfe, Fountain Valley, CA
Too Few & Precious, Mike & Nora Shirey, Chino, CA
Fred V. Torres, Whittier, CA
TransGem Corporation, Jonathan Parentice, Scottsdale, AZ
Tucson Gem & Mineral Society, Bruce Maier, President, Tucson, AZ
Turmale & Herschede, Inc., Mark Herschede Jr., Cincinnati, OH
Tynsky's Fossil Shop, James & Karen Tynsky, Kemmerer, WY
Tysons' Minerals, Rod & Helen Tyson, Edmonton, Alberta, Canada
Ultima Gems Inc., Clint Fruitman, Tucson, AZ
Ultra Tec, Joseph I. Rubin, Santa Ana, CA
Uncle Tom's Rock Shop, Tom & Linda Stockwell, Owatonna, MN
Uniquely K Custom Gems, Stephen Kotlowski
Universal Gems & Minerals Inc., Joe Diamond, El Paso, TX
Uranerz U.S.A., Inc., Larry E. Lehto, Denver, CO
Harold & Erica Van Pelt, Los Angeles, CA
Van Scriver's Mineral Company, Brad van Scriver, Tucson, AZ
J. D. Warinsky, Teaneck, NJ
Washington Gem & Mineral Co., Gary Kaufman, Washington, DC
Charles & Marcelle Weber, Guilford, CT
Weber's Minerals, Ed & Naomi Weber, Encinitas, CA
Western Enterprises, Peter Bancroft, Fallbrook, CA
Western Minerals, Eugene & Jackie Schlepp, Tucson, AZ
Westwood Lapidary, St. Louis Park, MN
Bruce Wetteroth, Berkeley Heights, NJ
Wheeler Manufacturing, R. B. Wheeler
Whole Earth Minerals, Steven Pullman, Reno, NV
Wholesale Paleo, Jeff Aubry, Crawfordsville, IN
Williams Minerals, Keith A. & Brenda J. Williams, Idaho Springs, CO
Willis' Earth Treasures, Dick & Joyce Willis, Stewartsville, NY
Wire Art Jewelry, Brian & Jolem Punches, Santa Maria, CA
Thomas C. Witherspoon, Crawfordsville, IN
World Gems, Jim Clanin, Pala, CA
World Mineral Industries Inc., John Sheppard, Victoria, B.C., Canada
Worldwide Resources, Dennis & Daniel Belsher, Golden, CO
Dolores & Tony Worth, El Paso, TX
Joe Worthington, Evergreen, CO
Wright's Rock Shop, Chris Wright, Hot Springs, AR
Yellow Hair Trading & Mining Inc., W. H. Preston, Globe, AZ
Victor Yount, Warrenton, VA
Jack Zektzer, Seattle, WA

(continued from page 246)

teams captains Sandy Ludlum and Bruce Wetteroth, and silent auction captains Ruth and Julian Blakely. The complete list of our auction staff is shown on page 246.

For next year we could use still more volunteers, and would be happy to hear from anyone who might like to contribute at least a couple of hours during or before the show. Write or call us before arriving in Tucson, or simply present yourself at our room in the Desert Inn or at the Silent Auction room at the community center. We'll put you to work, credit you with one year toward your five-year gold pin, and invite you to join us at the Volunteers' Pizza Party Saturday night late following the auction! You'll be part of a good crew and will be working for a good cause.

Thanks to Promotions Manager Gale Thomssen, we also have quite a large staff manning subscription tables at virtually all major shows throughout the world (!). These fine people, including those who helped us at this year's Tucson Show are listed on page 246, with our sincere thanks.

While I am thanking people I should mention our sharp-eyed volunteer proofreader, Steven Morehead, who has saved your editor from the typo gremlins more than once. And our corporate directors, associate editors and associate photographers all serve as unpaid volunteers, not to mention our *authors* (without which a magazine is in deep trouble)! To all these people, my thanks.

(Donors of auction specimens are listed separately beginning on page 247.)

Finally I'd like to thank TGMS Show Chairman Terry Wallace and the rest of the Tucson Gem and Mineral Society for their continued cooperation over many years. It has always been one of our greatest pleasures to be associated with this great show. Thanks also to the many other shows and show committees around the world who have provided us with table space during the last year. As long as we have such support from shows, volunteers, donors, authors, mineralogists, photographers, collectors and subscribers, the *Mineralogical Record* will continue to flourish.

W.E.W.

Letters

REGARDING USHKOVITE AND LAUEITE

A search for ushkovite from the Palermo quarry and Hagendorf-süd was prompted by the short article by Dr. Pete J. Dunn which appeared in the November-December (1985) issue of *Mineralogical Record.* Many who read the article must have been as surprised as I was by the results obtained on examining three specimens of what looked like laueite: one from the Palermo quarry; one from Hagendorf-süd and one from the Sandamab quarry in Namibia. Dunn reported that all three were clearly specimens of the relatively new mineral, ushkovite, which is the magnesium analog of laueite. (There may be a series between them as indicated by the available analyses.) In any event, I decided to look for a specimen of ushkovite among numerous samples of laueite that I had collected over the years at both the Palermo quarry and at Hagendorf-süd in northeastern Bavaria. Incidentally, Dunn made it clear that laueite could also be found at both of these localities.

Dunn's analysis of the Palermo ushkovite showed 0.0% Mn; therefore a positive test for that element would be a promising indication, though not necessarily proof, of the presence of laueite. I felt that a strong positive test for Mn could probably be obtained from a laueite specimen. Only a tiny bit is needed for the microchemical test for Mn. The mineral is dissolved in a drop of 6N nitric acid, then a drop of silver nitrate solution is added together with a slight excess of strong oxidizing agent such as sodium bismuthate. The mixture is briefly boiled. A clear purple solution results when Mn is present, the depth of color giving a clue to the amount of Mn. A test for Mg may be made by first adding sodium sulfide to precipitate the Mn. Then the test for Mg using Titan Yellow can be run (as recommended by the 1964 Commission of Analytic Reactions of the International Union of Pure and Applied Chemistry).

I made such tests on 18 samples from the Palermo quarry and on four from Hagendorf-süd. Each time, I obtained a strong test for Mn. Since these tests were only qualitative, I decided to cross-check my findings by determining the refractive indices and optic angles. This was done on four Palermo specimens and two from Hagendorf-süd. The results, shown in the Table below, suggest that I failed to find any ushkovite since the values agree much better with the published values for laueite.

I then wrote to Dr. Anthony Kampf, who had written his thesis on the Palermo phosphates. He replied that he had not examined the laueites in detail. I also wrote to Dr. Arno Mücke, University of Gottingen, who is widely known for his work on the Hagendorf minerals. His reply (my translation) of February 6, 1986, was as follows:

> I know of no phosphate minerals from Hagendorf with an Mg content high enough that one would designate Mg as anything except a trace element in amounts which, according to my experiences, are never more than 1 weight percent MgO.
>
> The mineral—ushkovite—will remain a Hagendorf puzzle for me. Pete Dunn has either encountered an isolated paragenesis for the Hagendorf pegmatite (which would also be unlikely) or else he had a sample which did not come from Hagendorf at all and was therefore mislabeled.
>
> A possibility exists that the material came from Hagendorf-nord rather than Hagendorf-süd. I know little about the phosphates from Hagendorf-nord. But even this possibility would be surprising for me; the two pegmatites lie in the same formation and are only a couple of hundred yards apart.
>
> Your refractive index determinations for laueite, which yielded lower values than those given by Fleischer *et al.* (1984) do not surprise me. At Hagendorf, particularly for laueite (and strunzite as well as keckite), there is a high replacement of Al for Fe. The minerals are then less intensely colored than pure laueite.

Table 1. **Optical Data (obtained in white light).**

Specimen	n_α	n_β	n_γ	2V Meas.	2V Calc.
Palermo	1.596	1.657	1.681	68°	62°
Palermo	1.602	1.658	1.682	65°	64°
Palermo	1.603	1.659	1.683	66°	63°
Palermo	1.595	1.657	1.683	65°	64°
Hagendorf*	1.580	1.652	1.678	56°	60°
Hagendorf*	1.587	1.655	1.680	57°	60°
Laueite (Fleischer)	<1.612	1.658	1.682	50°	70°**
Laueite (Kostov)	1.591	–	1.688	–	–
Ushkovite (Chesnokov)	1.584	1.637	1.670	50°	74°**

*A. Mücke comments that Al replaces Fe in Hagendorf laueites, lowering the refractive indices.

**The difference between measured and calculated appears high.

Dunn's unexpected results on three randomly chosen samples contrast sharply with my findings. Magnesium minerals such as ushkovite are most uncommon in pegmatites. Nevertheless, Mg-containing minerals do occur occasionally in pegmatites although they are then highly localized. Dunn's three analyses show that Mg minerals might indeed occur there. However, it would be desirable, in my opinion, to take a second look at the specimens which had been analyzed solely by microprobe and utilize some other test procedure for confirmation.

This seeming contradiction may disappear when more information becomes available on the paragenesis of the various occurrences. It has been noted that at the Palermo quarry some widespread minerals such as whitlockite, for example, may contain significant amounts of Mg. Jahnsite is fairly abundant and certainly contains Mg. Possibly ushkovite should be looked for in such Mg-rich areas.

Vandall King (*Ward's Natural Science Establishment,* Rochester, New York) reminded me that the Chandler Mills pegmatite on the Sugar River, Newport, New Hampshire, might be a good place to look for ushkovite. The magnesium-rich triphylite from there was described by Chapman (1943), who included a chemical analysis from Justa M. Lindgren. He reported that the triphylite was unusually low in Mn (MnO = 3.11%) and high in Mg (MgO = 7.38%). If one assumes that the Mg:Mn ratio remains the same in the changes which formed "laueite" then it appears likely that ushkovite would be the mineral that would be found there.

My many visits to the Chandler Mills (and the adjacent George Smith) mines yielded fine crystals of triphylite, beryl, brazilianite and hurlbutite but no laueite, although it is known to occur there. I would indeed appreciate a specimen of such material for study and I hope that some reader will be in a position to provide it.

Curt G. Segeler
284 East 16th Street
Brooklyn, NY 11226

REFERENCES

CHAPMAN, C. A. (1943) Large magnesia-rich triphylite crystals in pegmatite. *American Mineralogist,* **28**, 90–98.

CHESNOKOV, B. V., VILISOV, V. A., CHEREPIVSKAYA, G. E., AND GORSKAYA, M. G. (1983) Ushkovite, $MgFe_2^{+3}(PO_4)_2(OH)_2 \cdot 8H_2O$, a new mineral. *Zapiski Vsesoyuznogo Mineralogicheskogo Obshchestva,* **112**, 42–46 (in Russian). Abstract in *American Mineralogist,* **69**, 212–213.

DUNN, P. J. (1985) New occurrences for ushkovite and comments on laueite. *Mineralogical Record,* **16**, 463–464.

FLEISCHER, M., WILCOX, R. E., and MATZKO, J. J. (1984) Microscopic determination of the nonopaque minerals. *U.S. Geological Survey Bulletin* **1627**, p. 260.

KOSTOV, I. (1968) *Mineralogy.* Oliver and Boyd, London, p. 457.

I wish to comment on a recent article on ushkovite and laueite by Dunn (1985), and point out that the laueite clan of minerals has previously been studied in considerable chemical and crystallographic detail. Dunn analyzed on electron microprobe crystals from specimens ". . . chosen by random selection . . . ." The three samples were from the Palermo mine, New Hampshire, Sandamab, Namibia; and Hagendorf, Bavaria. Although all specimens were initially presumed to be laueite, Dunn stated: "The samples studied all proved to be ushkovite, close to the end member, and not laueite."

Unfortunately, the article lacks scholarship. The only citation is the article on ushkovite (in Russian, but evidently read from an abstract in *American Mineralogist*). There is also a short remark on stewartite. Four other more detailed studies already exist on the laueite-stewartite problem, involving their crystal structures.

Crystal structure analysis is the brilliant jewel of our science. Since I have been involved with the solution of over 120 diverse structure types, I can testify that this elaborate "glass bead game" still far exceeds other techniques in its dependability and information content. The chemical analyses (wet chemical to probe, many done by outstanding investigators) for about 60% of these compounds turned out to be *wrong* in some way—usually a missing element, or incorrect valence state or states and also water content and the structural role of that water. Therefore, I have come to cast a jaundiced eye at any single analysis in the absence of some other technique.

Moore (1965) and Plieth *et al.* (1961) independently published the crystal structure of laueite on crystals from Palermo and Hagendorf respectively. Bauer (1969) published the structure of pseudolaueite (from Hagendorf) and structurally showed how it was related to laueite. Finally, Moore and Araki (1974) published the crystal structure of stewartite (from Hagendorf) in brutal detail. In all four studies, the associated thermal vibration parameters corresponded to a manganese atom or a very close neighbor. Since X-ray scattering is approximately proportional to atomic number (atomic number of Mg = 12, of Mn = 25), it is sensitive to significant differences in atomic number from crystal to crystal, and the presence of a "light" Mg atom instead of "heavy" Mn would have resulted either in a very high temperature factor or a failed crystal structure determination. The Mn-O bond distance averages were the acid test: Mn-O = 2.12 for laueite, 2.20 for pseudolaueite and 2.18 Å for stewartite [typical Mn^{+2}-O octahedral average is 2.20 Å]. Baur (1969) sagaciously pointed out that the low average distance for Mn-O in laueite, even though the thermal parameter suggested Mn, was in fact indicative of *ca.* ½ Mn^{+2} + ½ Mn^{+3} at the site, and that Jahn-Teller static distortion of the polyhedron offered a satisfactory explanation for the unusual shape of MnO_6 (individual Mn-O distances from 2.08 to 2.19 Å) in laueite. May I remark that Mn^{+3}-O_6 distorted octahedra lead to typically very intensely colored crystals and the crystals are very pleochroic, from pink to deep reddish black. This may explain in part the range of colors so often found in these Mn-Fe phosphate minerals.

Dunn writes the laueite formula as $MnFe_2^{+3}(PO_4)_2(OH)_2 \cdot 8H_2O$. This is unfortunate in light of modern structural knowledge, for one might as well write $H_{18}MnFe_2P_2O_{18}$ and convey about the same information! His formula says to a chemist that the compound is a hydrate and/or that the water is zeolitic. Water in structures has many faces. Here, there are two. One is hydrogen-bonded water only, or zeolitic water. The other is *aquated* water, that is, water acting as a ligand and chemically bound to a metal. The formula $Mn(H_2O)_4]Fe_2^{+3}(OH)_2(h_2O)_2(PO_4)_2] \cdot 2H_2O$ applies to all three minerals (laueite, pseudolaueite and stewartite) on the basis of their structures. It states that four water molecules are bonded to manganese, two to iron(s) and two zeolitic waters remain (these last probably explain why laueite and stewartite often turn turbid under a microscope with Tensor lamp).

Dunn selected three samples at random purported to be laueite and got the Mg-rich member every time. Four other investigators independently selected samples and got Mn members every time! It may be true that ushkovite occurs at Palermo, Sandamab and Hagendorf but the tone of Dunn's note, the absence of any statistical study of samples and the apparent lack of awareness of an already existing literature leave a distorted impression in the mind of the reader.

Paul B. Moore
Professor, Chemical Crystallography
University of Chicago

REFERENCES

BAUR, W. H. (1969) A comparison of the crystal structures of pseudolaueite and laueite. *American Mineralogist,* **54**, 1312–1323.

DUNN, P. J. (1985) New occurrences for ushkovite and comments on laueite. *Mineralogical Record,* **16**, 463–464.

MOORE, P. B. (1965) The crystal structure of laueite, $Mn^{+2}Fe_2^{+3}(OH)_2(PO_4)_2(H_2O)_6 \cdot 2H_2O$. *American Mineralogist,* **50**, 1884–1892.

MOORE, P. B., and ARAKI, T. (1974) Stewartite, $Mn^{+2}Fe_2^{+3}(OH)_2(H_2O)_6[PO_4]_2 \cdot 2H_2O$; its atomic arrangement. *American Mineralogist,* **59**, 1272–1276.

PLIETH, K., RUBAN, G., and SMOLCZYK, H.-G. (1961) Zur Kristallstruktur des Laueits, $Fe_2Mn[PO_4/OH]_2 \cdot 8H_2O$. *Acta Crystallographic,* **19**, 485.

It is certainly true that structural formulas convey more information; however, it has been the Mineralogical Record*'s policy to use Fleischer's* Glossary of Mineral Species *as the standard reference for formulas, and author Dunn was complying with this convention.*

Ed.

Author's Response:

The (unrelated?) letters from Mr. Segeler and Dr. Moore concerning my short paper on ushkovite require some responses, both to answer their points, and provide insights.

Mr. Segeler's letter:

Because I encouraged Mr. Segeler to provide his information on these species, I am please that he has done so. Having examined his data, observations, and arguments, however, I wish to call attention to some problems with his interpretations. He states that his results "suggest that I (Segeler) have failed to find any ushkovite since the values agree much better with the published data for laueite." There are two problems here:

(a) CHEMICAL TESTS

The mid-member of the laueite-ushkovite series (if indeed these is a solid solution series as Mr. Segeler suggests), would contain 6.83 wt. % MnO and 3.88 wt. % MgO, assuming these were the sole substituents. Using the given qualitative chemical test for Mn, one could probably obtain a subjectively "strong" reaction for Mn from a manganoan ushkovite. It therefore follows that Mr. Segeler's samples are not clearly shown to be laueite or ushkovite; one can say only that they contain some detectable but undetermined amount of Mn. Without some calibration standards for the chemical tests, and careful analytical procedures, Mr. Segeler's assertion is unsupported.

(b) OPTICAL DATA

In order to make *useful* optical comparisons in a relation such as ushkovite-laueite, one must have data sets for both species in which the chemical and optical data have been performed on the same material. These data exist for ushkovite, but not for laueite. The optical data given for laueite are for samples for which the chemical composition is apparently unknown. Hence, because we do not know the composition (and therefore the species designation) of either Mr. Segeler's six samples or those for which optical data are cited from the literature (also unanalyzed quantitatively), Mr. Segeler's statement that "the results . . . suggest that I failed to find any laueite" is not supported. I do not question the accuracy or precision of Mr. Segeler's data (as a collector, he is known for his skill in optical mineralogy). I question the *usefulness* of these data for establishing species. Because the ambiguous chemical and optical data are the basis for his letter, his conclusion is unsupported. His material may be laueite, but it is not *shown* to be.

I agree with Mr. Segeler's comment that it would be desirable to "utilize some other test procedure for confirmation" of samples which had been analyzed solely by microprobe. That is why I did so, employing X-ray diffraction methods, and stated so in my text. The combination of the two procedures employed (microprobe analysis and X-ray diffraction) provided definitive proof of ushkovite. It may be that laueite is much more common than ushkovite and my sampling was fortuitous and gave a wrong impression of relative abundance, but that remains unproven.

Dr. Moore's letter

Dr. Moore raises some matters which are answered below, but I consider much of his letter to be non-germane grandstanding and arm-waving.

The matter of "scholarship" in my ushkovite note is addressed on the basis of few citations (literature references) of structural studies on laueite. Inasmuch as the limited number of citations was very deliberate, I welcome the opportunity to address my decision.

One of the plagues of editors is the practice of "reference-padding": the deliberate listing of references of limited or no utility for the purposes of: (a) demonstrating that the writer has read the pertinent literature (or is at least aware of it); (b) mentioning other colleagues' work so they will not be slighted, and may even be pleased or flattered.

Clearly, I could have mentioned Dr. Moore's name more often, but it would not have improved the paper. Additionally, such reference-padding costs money, and the practice is deplorable. So, I don't do it.

My note on ushkovite is just that . . . a note . . . to inform the mineralogical community of the existence of this mineral at additional localities. Because I saw some opportunity for structure studies of ushkovite, I had interested a structural crystallographer in the matter, supplied him with ushkovite crystals, and told him I would not address the structural aspects of the problem. This was another reason for not mentioning the laueite studies of Moore and others.

Dr. Moore indicates that some chemical analyses in the literature are incorrect; it's useful to note that some structure studies are also incorrect. I agree with his comment that a single analysis should be met with a jaundiced eye; that's why I used X-ray diffraction as another confirmatory techinque and stated so in my text.

The ushkovite paper of Chesnokov *et al.* (1983) was consulted in the original journal. If it had not been, there are editorial conventions for stating otherwise and they would have been employed, as I have done where appropriate. There is clearly no basis for Moore's irresponsible assertion in this regard. The *additional* citation of the abstract in the New Mineral Names section in the *American Mineralogist* is a courtesy to the collector community, which seldom has access to the Soviet literature.

These letters and my responses will be read by some in the community of professional mineralogists, so I wish to make a few brief comments to that audience as well:

I am pleased that Dr. Moore has not disagreed with my data or my interpretations. Secondly, one might note that all of the extant structural studies of "laueite" were performed on crystals not chemically analyzed in any other way.

Pete J. Dunn
Smithsonian Institution
(Feb. 2, 1987)

FAKE EMERALD MATRIXES

Regarding your statement on faked emeralds (vol. 17, p. 147), I recently took a close look at two so-called matrix emerald specimens. One contains two complete emerald crystals partially imbedded in fine-textured calcite on coarse vein calcite. The other contains one emerald crystal perched on fine-grained calcite on an abraded calcite *cobble.*

The first specimen looked suspicious because the two emerald crystals are of distinctly different shades, even though separated by only about 1.2 cm of calcite matrix. After soaking for about five hours in soapy water, the glue holding the emerald crystals became tacky; the fine-grained calcite began to look artificial as well, and proved to be pulverized calcite with a glue binder mixed in.

Richard Tripp
Golden, Colorado

REGARDING CANAPHITE

Since there was some doubt about the provenance of the canaphite specimen described in the *Mineralogical Record* (vol. 16, p. 467–468), we felt that your readers might be interested in the story of its discovery.

Collecting zeolites was not too difficult in 1966 at the Great Notch quarry on Route 46 in New Jersey and we often visited the locality. (Note that this is not Haledon as suggested in the article). On one occasion, Sidney Steriss was collecting at a spot a few feet below the highest point in the quarry when his chisel broke into a small pocket. From it he collected about half a dozen or so stilbite groups on which were clusters of tiny, clear, flattened, prismatic crystals.

A year later Sid gave the specimen described in the article to his close friend, the late Neal Yedlin. As was his custom, Neal photographed the specimen and gave Sid a copy of the slide correctly labeled as to locality and date.

In an effort to identify this unknown, Sidney sent a specimen to John White at the Smithsonian Institution who furnished some data but did not characterize the specimen. Instead, he passed it along to Mary Mrose at the USGS. She informed Sid that it was a phosphate. The specimen was then sent to Dr. Paul Moore in Chicago because of his interest in phosphates. It is not known what became of that specimen.

Somewhat later another specimen was given to Dr. Philip Goodell, then at City College, New York. He moved to Texas shortly after and that specimen was apparently lost.

In 1984, Sidney was looking for micros which might be of interest to his friend, Joe Arons of New York. He gave Joe a sample of this still unknown mineral. A year later, Joe read the description of canaphite in the *Mineralogical Record* and thought that his micro looked like the SEM picture in the canaphite article.

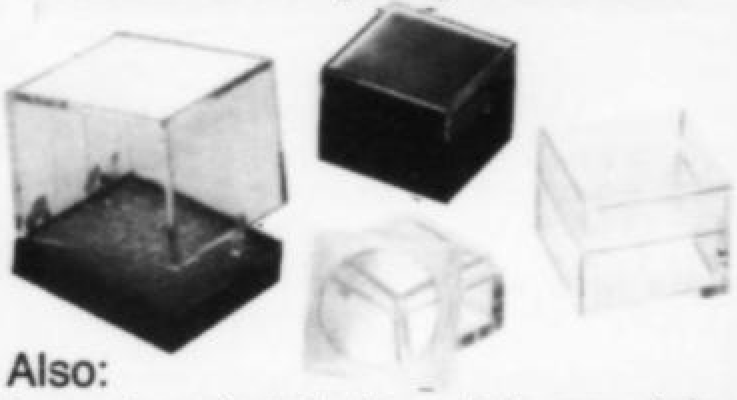
In order to obtain confirmation, he gave the specimen to Curt Segeler who determined its refractive indices and qualitative composition. The data match the published data for canaphite. We concluded that Sidney Steriss's find of 1966 is no longer an unknown.

Sidney Steriss
Joseph Arons
Curt Segeler

EXCHANGES

For some years now I have collected a wide range of crystalline minerals from many working and abandoned Cornish mines and quarries. I now wish to expand my collection to include specimens from other classic world locations. I am primarily interested in crystallized apatite, beryl, tourmaline, topaz and fluorite specimens, and would like to exchange good quality Cornish and Cumbrian minerals for them.

Jane Roberts
Trevisco, Barton
Central Treviscoe
St. Austell, Cornwall PL26 7QP
England



MONTEREGIAN MINERALS
MICROMINERALS AND RARE SPECIES

Specializing in Mt. St-Hilaire and
other Canadian localities. List available.

P.O. Box 2096, Dorval, Quebec
H9S 3K7 CANADA

Durangite

Thomas Range, Utah;
Micro to Museum Size.
See M.R. vol. 17, no. 5, p. 342.
Pfeifer and Richerson, c/o 2093 E.
Delmont Dr., Salt Lake City, UT 84117

For Sale: Vol. 1-15
Mineralogical Record
Mint Cond. except vol. 2-3 have
small hole in upper left corner
Price $1500 postpaid
John E. Hufford, 5550 Woolworth Ave.
Omaha, Nebraska 68106

RARE & EUROPEAN MICROMOUNTS
(Laurion, Cornwall, USSR Kola, etc.)
free list available.

M. Hettinga, Lootsstraat 20III
1053 NX Amsterdam-Holland

Russell E. Behnke

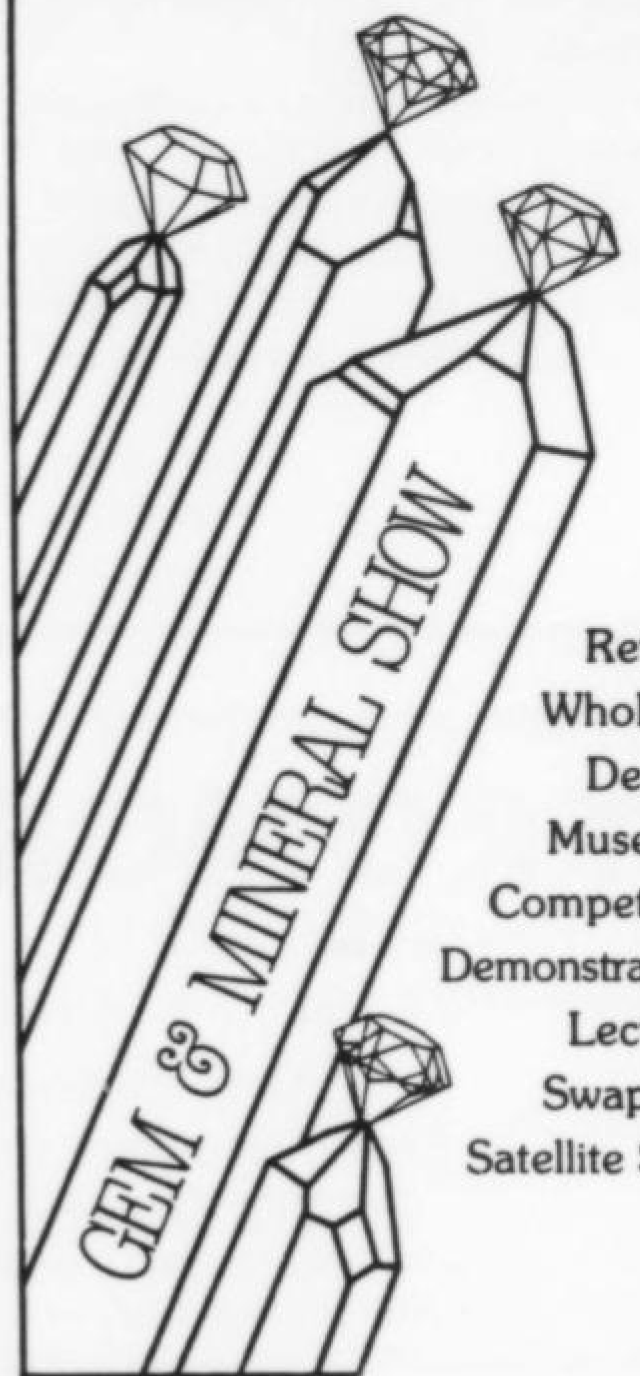
Do you want to discover great minerals from century-old classic locations or own exquisite crystals from the gem mines of Brazil or the unexplored deposits of China?

If so, I can help. I specialize in select miniatures and cabinet specimens, competitively priced from $250 to $3500 and up. For our mutual protection I sell at retail only those special pieces I believe will always be among the most highly prized. If you care about value as well as quality, I would like to hear from you. Please call or write today. I would like to surprise you (ever so nicely) with what I can do for you!

•

161 Sherman Avenue
Meriden, Connecticut 06450
203-235-5467

20th DENVER



Retail &
Wholesale
Dealers,
Museums,
Competition,
Demonstrations,
Lectures,
Swapping,
Satellite Show

THE PREMIERE
OF
THE SEASON'S NEWEST
MINERAL, FOSSIL,
& GEM FINDS

DENVER
GEM & MINERAL
SHOW

September 18 – 20, 1987

Merchandise Mart
451 E. 58th Avenue
I-25 & Exit 215

Stock up for the fall shows and the holidays while you enjoy a visit to scenic Colorado.

For information:

Denver Council
P.O. Box 621444
Littleton, CO 80162
(303) 978-9926

Carousel
GEMS AND MINERALS

1202 Perion Drive
Belen, New Mexico 87002
505-864-2145
★ SEND SASE FOR LIST ★

Fine Rare Books
Geology, Mineralogy, Paleontology,
Mining, Gemology, and Jewelry
Send $1.00 for Catalog
THE GEMMARY, INC.
P.O. Box 816, Redondo Beach, Ca. 90277

MINERAL DECOR *for Zeolites!*

OUR 10TH YEAR IN BUSINESS!

• Top-quality wholesale specimens • Affordable prices • Micromount to Cabinet sizes

72 Casa Grande, Little Gibbs Road (behind hanging gardens) Bombay 400 006 India (Tel: 8229474)

THE OUTCROP
"MINERALS FOR THE COLLECTOR"
Send stamp for current list.
Satisfaction guaranteed.

PETE & NANCY OLSON
(217) 787-6149
P.O. BOX 2171
SPRINGFIELD, IL 62705

SHOWS

June 11-14: Oklahoma City, OK (AFMS & RMFMS)
June 13-14: New Haven, CT
June 20-21: Topsfield, MA
June 20-21: Arlington, TX
June 25-28: Westminster, CO (Denver Area)
June 25-28: Dearborn, MI
July 11-12: Culver City, CA
July 18-19: Colorado Spr., CO
July 25-26: Long Beach, CA
July 31-Aug. 2: Greenville, SC (EFMLS)

the Rocksmiths

Eldon, Jean & Jaye Smith
Box 157 • Tombstone, Arizona
85638

the Mineralogical Record

Show Schedule

Dates subject to change and error. Confirm before travelling.

Las Vegas	May 15-17
Elko (NV) Mining Expo	June 11-13
New England Micromounters	
Cal. Fed. Show Turlock	June 26-28
Reno, Nevada	Aug. 1-2
Denver	Sept. 18-20
The Hague, Netherlands	Sept. 26-27
Torino, Italy	Oct. 3-5
Maastricht, Netherlands	Oct. 11
Munich, W. Germany	Oct. 30-31 & Nov. 1
Amsterdam, Netherlands	Nov. 29

MAGAZINES! *See Us There!* BOOKS!

Affiliated with the Friends of Mineralogy, an independent, non-profit organization devoted to furthering amateur and professional interests in mineralogy. For membership information contact Don Zowader, 97 Leamington Rd., Somerville, NJ 08876.

Contributed Manuscripts
Contributed manuscripts are welcome. Acceptance is subject to the approval of the editor.

Suggestions for authors
See vol. 17, no. 6, p. 400 or write for a copy.

Author's Guide to Writing Locality Articles: See vol. 17, no. 6, p. 393–400 or write for a copy.

Replacement copies
Availability of replacement copies usually extends for several months following publication, but is not guaranteed. Requests for replacements should be made as soon as possible.

Back Issues
Write to the Circulation Manager for a list of issues still in print. For **out-of-print issues** contact *Mineralogical Research Co.,* 15840 E. Alta Vista Way, San Jose, CA 95127. A list of other dealers in back issues is available on request.

The Mineralogical Record accepts specimens on loan for photography and study, but can accept no responsibility for loss or damage.

Design
Wendell E. Wilson

Graphic Production
Capitol Communications
Crofton, MD

Printing
Waverly Press, Easton, MD

Color Separations
Effective Graphics,
Compton, CA

Book sales
P.O. Box 1656
Carson City, NV 89702
702-883-2598

Advertising Information
All advertising in the Mineralogical Record must be paid in advance of the closing date. Discounts apply when more than two ads are paid for at a time. Telephone orders not accepted. Write to the editor for rates.

Closing dates:

Jan.-Feb. issue	Oct. 15
March-April issue	Dec. 15
May-June issue	Feb. 15
July-Aug. issue	April 15
Sept.-Oct. issue	June 15
Nov.-Dec. issue	Aug. 15

An additional 30 days past the closing date are allowed in which advertisers may make changes (excluding size changes) in ads already paid for.

*Take advantage of our free typesetting and layout service!

*Write for our free 24-page brochure on how to advertise minerals!

Editing, advertising
Wendell E. Wilson
Mineralogical Record
4631 Paseo Tubutama
Tucson, AZ 85715
602-299-5274

Foreign Payments
Remittance may be made in local currency, at *prevailing exchange rates,* without surcharge, to the following people:

Australia
Piers Foa, Kovac's G. & M.
291-293 Wattletree Rd.
East Malvern, Victoria 3145

Belgium:
Paul Van Hee
Marialei 43
B-2120 Schoten

Canada:
Mrs. J. W. Peat
36 Deepwood Crescent
Don Mills, Ontario M3C 1N8
Books & Back Issues Only:
Patrick W. Collins
Madawaska House
Calabogie, Ontario K0J 1H0

France:
ADIDOM
32, rue Servan
75011 - Paris

Great Britain
Simon Harrison
15 Queenwood Avenue
Fairfield Park
Bath, Avon BA1 6EU

Italy:
Renato Pagano
Via S. Anna 1/B
I-34074 Monfalcone

Japan:
Tsukasa Kikuchi
P.O. Box 18, Hongo
Tokyo 113-91

Netherlands:
W. J. R. Kwak
Kabeljauwallee 23
6865 BL Doorwerth (Gld)

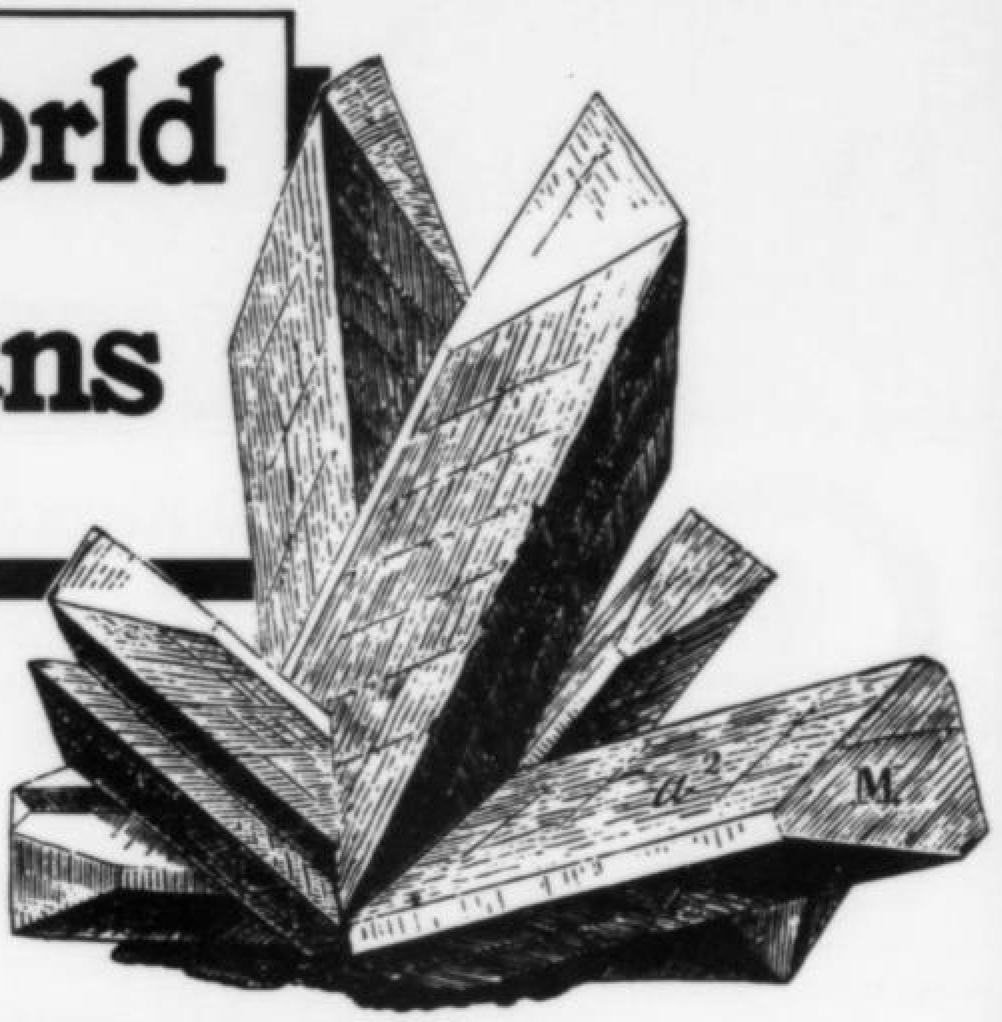
Scandinavia
Claus Hedegaard
Storgade 71
DK-8882 Faarvang, Denmark

South Africa:
Horst Windisch
30 Van Wouw Street
Groenkloof, Pretoria

Spain & Portugal:
Bailey Minerals
Paseo de la Castellana, 171
28046 Madrid, Spain

West Germany:
Christian Weise Verlag
Oberanger 6
D-8000 München 2

Searching the World
to bring you the finest in
Mineral Specimens
at competitive prices



* FIRST QUALITY MINERALS
for collection & display

* RARE SPECIES
for systematic collection, reference, research

MINERAL LISTS: Send for our bimonthly **mineral lists** of thumbnail, miniature, and cabinet specimens. First quality mineral specimens for collection and display, plus rare species for systematic collection, reference, and research. Send large SASE for lists. Non-USA, send two International Reply Coupons.

MICROMOUNT & SPECIMEN BOXES: **Boxes:** A separate listing is available detailing prices and sizes of mircomount. Perky Boxes, plastic magnifier boxes, white cotton-lined specimen boxes, display stands, etc. Send large SASE for lists. Non-USA, send two International Reply Coupons.

MICROSCOPES & OPTICAL GOODS: Send for our separate price list with information covering **stereo microscopes** and accessories for gem and mineral use. Send large SASE for lists. Non-USA, send two International Reply Coupons.

LOOK FOR OUR BOOTH AT MAJOR WESTERN U.S.A. SHOWS

MINERALOGICAL RESEARCH CO.
A DIVISION OF THE NAZCA CORPORATION
15840 E. ALTA VISTA WAY, SAN JOSE, CALIFORNIA 95127 U.S.A.
PHONE: 408-923-6800

Now dealing in out-of-print copies of the
Mineralogical Record
★ Send us your want list
★ Let us know if you have copies to sell
★ Ask for listing of copies in stock

ADVERTISERS INDEX