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WULFENITE—from level 4 of the 79 mine, Gila County, Arizona. The specimen was collected in 1971 by Thomas J. Trebisky and is now in his personal collection. The crystal is about 1 cm on a side. This photograph, by Tom Trebisky, won the slide competition at the Tucson Show in February, 1974.

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editorial matter

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Editorial

UNAPPRECIATED GIFTS- PART 2

In the last issue I argued that collectors should resist the impulse to give to colleges and universities high quality mineral collections of great intrinsic value. Now, I would like to discuss some alternatives to consider. An obvious repository for important collections are the various public and private natural history museums. One can assume that the really significant specimens in his or her collection would be more appreciated and better cared for at institutions whose primary purpose is the appreciation and care of natural history collections. Institutions of this type are staffed with people who are curators; that is, professional specimen appreciators. These are people who are in part employed specifically to manage the collections. They can ill-afford to ignore this responsibility. Such institutions tend to have Boards of Directors to whom the curators must answer if they fail in their charge. They also have an obligation to the public that is equally impossible to disregard.

Naturally, since my experiences through the years have been with the Smithsonian I know what the Institution can and will do with collections. While the Smithsonian is certainly one logical place for collections to be given, I do not believe that all collections and everything mineralogically significant should end up in this one museum.

A less obvious course of action is putting the collection on the market so that it can be sold. The mineral business depends upon the recirculation of old material, particularly since new new material of high quality is more competitively sought by an increasing number of mineral dealers. Contemporary collectors should have the opportunity to acquire classic old mineral specimens that are referred to in the literature but no longer collectable in the field. Such material reenters the market only in this way or when museums and collectors release some of their duplicate specimens through exchanges. Of course, there are many affluent collectors who simply cannot afford to sell their collections because the money raised would create tax problems for them. They have little choice but to donate their collections to nonprofit museums, so that they may claim the value of the collection as a tax deduction.

Several variations and combinations of methods of disposing of one's collection can be arranged. A scheme that seems quite reasonable is to select a certain number of the most unique and irreplaceable specimens for donating to a museum, and releasing the remainder to the mineral market. Some museums, particularly those with major reference collections might also have an interest in good study grade material representing localities not well covered in their collections. Naturally most museums would welcome the entire collections as this would provide much back-up or duplicate material that could be used for exchanges. However, few collectors can afford to just give away their collections. Their financial problem is just the opposite of that of the affluent. Besides, this practice, if adopted too extensively, would result in too few specimens finding their way into the dealers' shops so they can be acquired by active collectors.

A major personal collection was recently dispersed in an interesting manner. Some 500 specimens were donated to a museum, the curator having been allowed to select the pieces he felt were most important for his museum. Then, several young but very knowledgeable collectors were allowed to select specimens for their own collections. Much of the remainder entered the study collection of a university, while some of it was sold for charitable purposes. For those collectors whose economic situation permits it, this is a wonderful way to guarantee that their minerals will be appreciated or, at least, well utilized.

Regardless of what means of disposal is intended, I urge all collectors to make plans for the orderly disposal of their collections in their wills. Every so often minerals fall into the control of heirs who are not interested in them and do not know how to dispose of them properly. This leads to many problems that could easily have been avoided. The late Ed McDole used to threaten that when he felt the end was near he would dig a big hole, throw his minerals in, pour concrete over them, and then jump into the concrete. We don't endorse this procedure but we do recommend either of the following two basic courses, Either give the collection outright to some institution or some individual, or sell it. The collector may wish to designate several dealers who are to be invited to offer bids. This allows for a quick and efficient sale and serves to expedite dispersal to those who are building collections. The natural competitiveness of the dealers will help to assure that a fair price is offered.

This seems all too obvious yet I am sure we all know of instances where the matter was mishandled, resulting in problems and embarrassment for the heirs, the potential recipients, and the mineral dealers called in to make bids on the collections. When these problems can be so simply avoided, why not do so?

John S. White, Jr.

NEW MICROMOUNT LIST AVAILABLE

Mineralogical Research Company, 14770 Whipple Court, San Jose, California 95127, has announced their completely revised and enlarged listings of micromounts, boxes, and corks. Anyone wishing a copy is asked to send 10¢ in postage to cover the cost of mailing the lists.

FLORISSANT GEMS & MINERALS CLOSES SHOP TO PUBLIC

Florissant Gems & Minerals, of Florissant, Colorado, has announced that they are closing their shop to the public effective September 2. However, the shop will be open by appointment (only). They report they will still offer digging but this will be only through appointment also.

FM friends of mineralogy

PROGRESS ON LOCALITY-NAME PROJECT

by Barbara Frank Muntyan

Excellent progress is being made on FM's Locality-Name Register project. All Regional Coordinators were contacted in early June, and in nearly every Region there are now FM members gathering data, sifting through it, and forwarding this information to the General Chairman. We still plan to use December 1, 1974, as the cut-off point for receipt of new information, and by that time we should indeed have plenty of data to work with.

Even more exciting is the progress made in forming the panel of experts who will evaluate and correct information submitted by FM members. Paul Desautels contacted almost a dozen prominent museum curators, mineralogists, and collectors to enlist their help, and their response has been wonderful. Individuals who have consented to serve as members of this panel include: Peter Embrey of the British Museum; Akira Kato of the National Museum of Science in Tokyo; H. A. Stalder of the Natural History Museum in Bern, Switzerland; Louis Moyd of the National Natural Science Museum of Canada; Joaquin Folch-Girona of Barcelona; Werner Lieber of Germany, and Richard Gaines of the U.S. We hope to add several others to this panel before their review work begins.

The response of these foreign experts was swift and enthusiastic. Peter Embrey writes, "I shall be happy to check and edit... the British localities for this awesome project." Louis Moyd, in accepting to serve on the panel, says that "it's a very worthy cause," and Akira Kato writes that he heard of the project "with great pleasure...." and that he will be happy to help with it. Joaquin Folch says that he "appreciates this work which, no doubt, will be of great help to people interested in mineralogy."

We hope to send the basic data to panel members by the middle of December. They will evaluate and return this corrected information as soon as possible, and then it can be edited and prepared for publication.

We are still in the planning stages regarding format for this Register, and we would very much like to hear from FM members concerning their suggestions and preferences. We will certainly have an alphabetical listing of mineral species, and under each mineral heading list all the prominent collecting localities. We are also thinking of having a second section to this Register, listing all prominent collecting localities alphabetically; under each locality heading we would list all known minerals found there. This would approximate a bilingual dictionary where one finds, let's say, a French-to-English section and an English-to-French section. This format might provide a useful aid to collectors or museums who would like to acquire a suite of species from a given locality but who might not be aware of all the important minerals which occur there.

Does this idea have appeal? Let's hear from you, FM Members, If you don't speak up, your publication won't be what you want or need.

We have had also a very good suggestion from one of the panel members. Werner Lieber suggested that we include any previous names for each locality. This would be especially valuable for identifying collecting sites in former colonial areas, such as the erstwhile Belgian Congo, or in middle European countries where there have been significant name and boundary changes, It would even be useful for identifying collecting localities in this country, where a change in mine ownership has also sometimes meant a change in mine name. How many times have innocent collectors and exhibitors mistakenly thought that the old name and the new names represented two distinct, but nearby, occurrences?

This brings me to an important last point about the future of the Locality-Name Register. The edition that will be published during this coming year will be, we hope, only a first edition. It may be a modest beginning, but we must start somewhere. In future editions, we hope to be able to expand the format and include more information about each locality, particularly geologic data, precise geographic determinents, and similar technical information. As we receive suggestions for changes and additions from FM members and others, these also will be incorporated into an expanded format. We would like to see this publication be of service not only to the amateur collector, but also to the many professionals involved in education and public displays. It is an ambitious project, but one which is receiving outstanding support.

There is still a lot of planning and a lot of work left to be done before the Locality-Name Register becomes a reality. Any suggestions — and any help — will be received most gratefully. This is one project that can't get off the ground without a lot of participation by FM members.

Send your comments and locality data to: Barbara Frank Muntyan, 16978 Wapiti Court, Boulder, Colorado 80301.

PHOTO CONTEST – 1975

The *Mineralogical Record* will sponsor its 5th slide contest in conjunction with the 1975 Tucson Gem and Mineral Show, Tucson, Arizona. Anyone (except professional photographers) may enter one or two 35 mm color transparencies and compete for the $25 cash prize and the pleasure of seeing your photograph used on the cover of a future issue of the *Record*. Last year's winning photograph is the cover of this issue.

HOW TO ENTER - mail your two transparencies, carefully packed and adequately identified to: Richard A. Bideaux, 1706 West Grant Road, Tucson, Arizona 85705. Enter mineral name and locality on the slide frame.

IMPORTANT - all slides will be returned, but **only** if return postage and addressed envelopes are provided with each entry.

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melanophlogite

A New and Interesting Find

by Sergio Gallo
Via Ventimiglia 188,
10127—Torino, Italy

Melanophlogite, a cubic form of silica, has been found in late 1971 at a locality named Fortullino, 2 km south of Quercianella (Livorno), Tuscany, Italy. It is the fourth occurrence of this rare and little known mineral after those of Sicily (Racalmuto, Agrigento, 1876), Chvaletice, Bohemia (1964), and Mount Hamilton, California (1972).

Von Lasaulx (1876) first described and named the mineral. The name describes the fact that the mineral from Sicily turns black when heated. The samples from Sicily revealed the presence of organic matter, sulfur and water, and a content of SiO_2 near 88%. A recent study by Skinner and Appleman (1963) of samples from this locality confirmed the cubic structure, space group $P4_232$, with a cell edge $a = 13.41$ Å. The cell content is 48 units of SiO_2, calculated density 1.99 g/cc. The chemical analysis revealed at least 6% of $[C + H + S]$.

The melanophlogite from the occurrence at Chvaletice, Bohemia, was found during the mining period 1964-65 in a metamorphosed sedimentary pyrite-rhodochrosite deposit of Algonkian age as colourless cubes on lussatite. Lubor Žák, who studied this mineral, offers the following information. The superstructural unit cell has space group $P4_2/nbc$, $a = 26.82$, $c = 13.37$ Å. It breaks down on heating at 1050° C to a cubic cell with space group $P4_232$, and $a = 13.4$ Å. The unit cell content is $46\ SiO_2 \bullet C_{2.2}H_{17.3}O_{5.4}S_{0.1}$. The sulfur content is much lower than in the Sicilian melanophlogite. The clathrate structure, suggested by Kamb (1965) for the Sicilian melanophlogite, can also be applied for the Chvaletice mineral.

The newer Italian occurrence of melanophlogite was in late 1971, not far from Livorno (Tuscany). There the lodes of magnesite in the main serpentinite rocks provide low

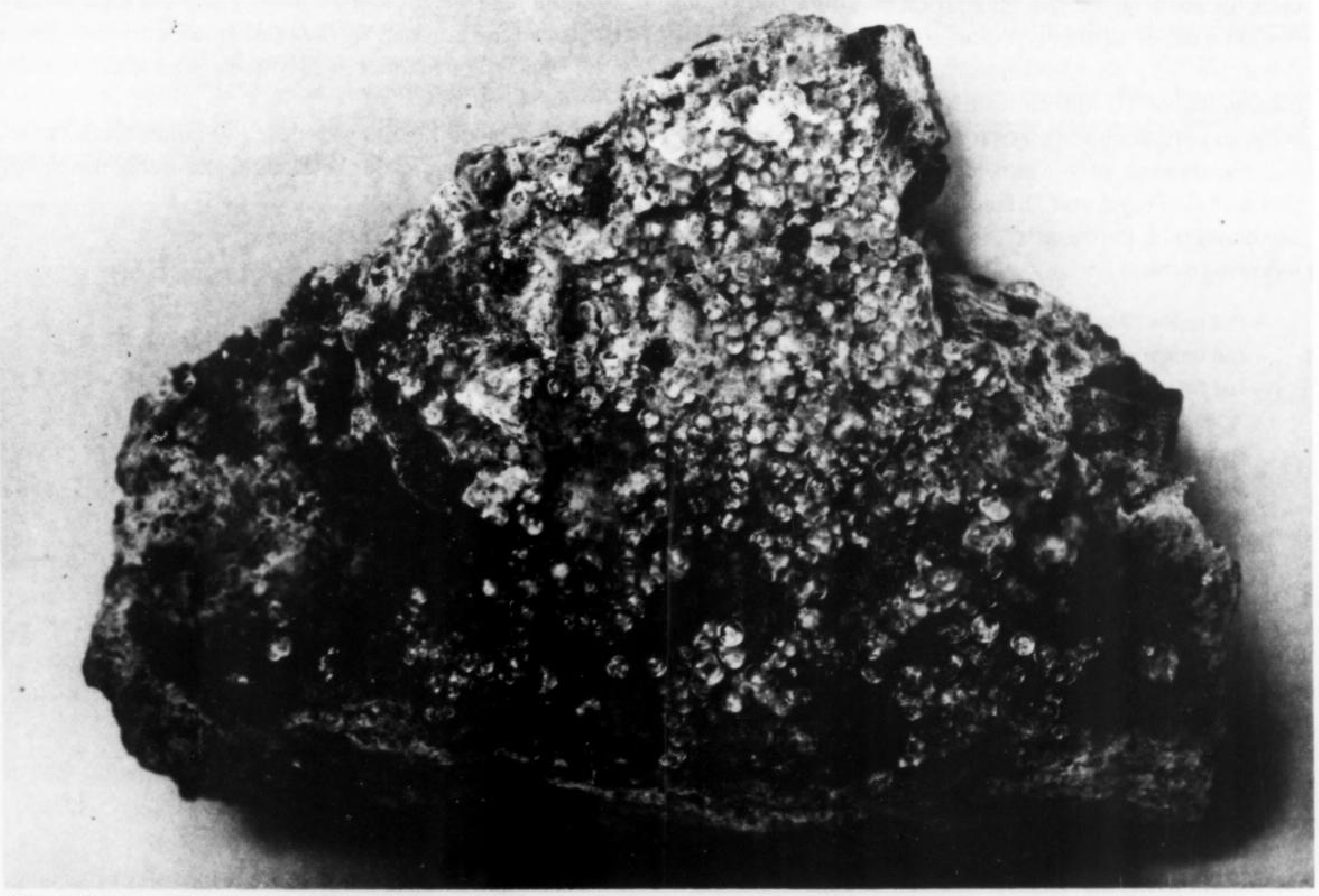

Fig. 1. **Melanophlogite, Fortullino, Italy. (1.2x)**

***Fig. 2.* Melanophlogite, Fortullino, Italy. (6.25x)**

quantities of iron sulfides and many small veins of dolomite. In the vugs of this mineral of hydrothermal origin the crystals of melanophlogite are found. The crystals occur, on very rare occasions, as single undistorted individual cubes 1-3 mm on an edge; more commonly they occur as complex intergrown round aggregates, water clear and transparent, of 2-5 mm in diameter. The studies of Grassellini, Troysi and Orlandi (1972), of the "Istituto di Mineralogia e Petrografia" of Pisa University, yield the following data:

- the index of refraction is 1.450
- the density is 2.106 ±0.005 g/cc
- the SiO_2 content is 88.20%
- the gases developed from the mineral during the vacuum heating to 900° C, analyzed with mass spectrometer, are H_2O, CO_2, and low molecular weight hydrocarbons
- x-ray diffraction photographs, by the Buerger precession method, show that the crystals are cubic, space group *Pm*3*n*, with a cell edge of $a = 13.393 \pm 0.005$ Å. The same space group was suggested by Kamb (1965) for the Sicilian melanophlogite.
- the clathrate structure, suggested by Kamb for melanophlogite, can also be applied for the Fortullino mineral
- the unit cell content is $Si_{44.73}O_{86.92}(OH)_{5.08}$
- the sulfur content, high in the Sicilian melanophlogite (2.3%), low in the Bohemian sample, is very low in this last find (<0.1%) and probably unimportant for the stabilization of the structure
- the high weight loss on heating and the high density show the presence in the open framework cavities of a quite high number of guest molecules without chemical bonds
- the mineral doesn't show the typical jet-black colour after heating, as do the Sicilian and Bohemian specimens

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PENNSYLVANIA MINERALS: I. VIOLARITE FROM THE GAP NICKEL MINE

by J. A. Speer and E. C. Martin
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Blacksburg, Virginia 24061

Violarite is a member of the linnaeite mineral series whose end members include the minerals linnaeite (Co_3S_4), polydymite (Ni_3S_4), and greigite (Fe_3S_4). The compound Cu_3S_4 has not yet been found to occur naturally. Intermediate compositions include the minerals carrollite ($CuCo_2S_4$), siegenite ($(Co,Ni)_3S_4$), and violarite (Ni_2FeS_4). The relationships between composition and nomenclature are shown graphically in figure 2 with the use of the M_3S_4 compositional triangles. The shaded areas represent the compositional extent of the natural linnaeite minerals (Vokes, 1967: Vaughan *et al.*, 1971).

The Gap nickel mine is located on Mine Ridge, southeast of Lancaster in Bart Township, Lancaster County, Pennsylvania. The mine was opened in 1732 and worked for copper. In 1852 the presence of nickel was discovered in the ores and the Gap mine became primarily a nickel producer. Between 1863 and 1888, the Gap mine was the only producer of nickel in North America. In 1877, annual production was estimated at 7,200 short tons of ore, showing from 1.10 to 2.26 percent copper and 1.53 to 4.23 percent combined nickel and cobalt. With the importation of nickel ore from New Caledonia and the mining of the Sudbury nickel ores in 1887; operations at the Gap mine became uneconomical and ended in 1893.

In the Gap ores, the predominant sulfide is pyrrhotite; chalcopyrite, millerite and pentlandite are subordinate. In specimens examined containing violarite, millerite is absent. The violarite occurs as polycrystalline veins following boundaries between other ore minerals. Small amounts of pentlandite commonly occur at the contact of the violarite and pyrrhotite. The violarite displays the characteristic, well developed cracks (fig. 1). An isotropic, grey mineral, which appears to be magnetite, fills many of these cracks. In reflected light, violarite is isotropic and is cream-colored with a slight violet tint.

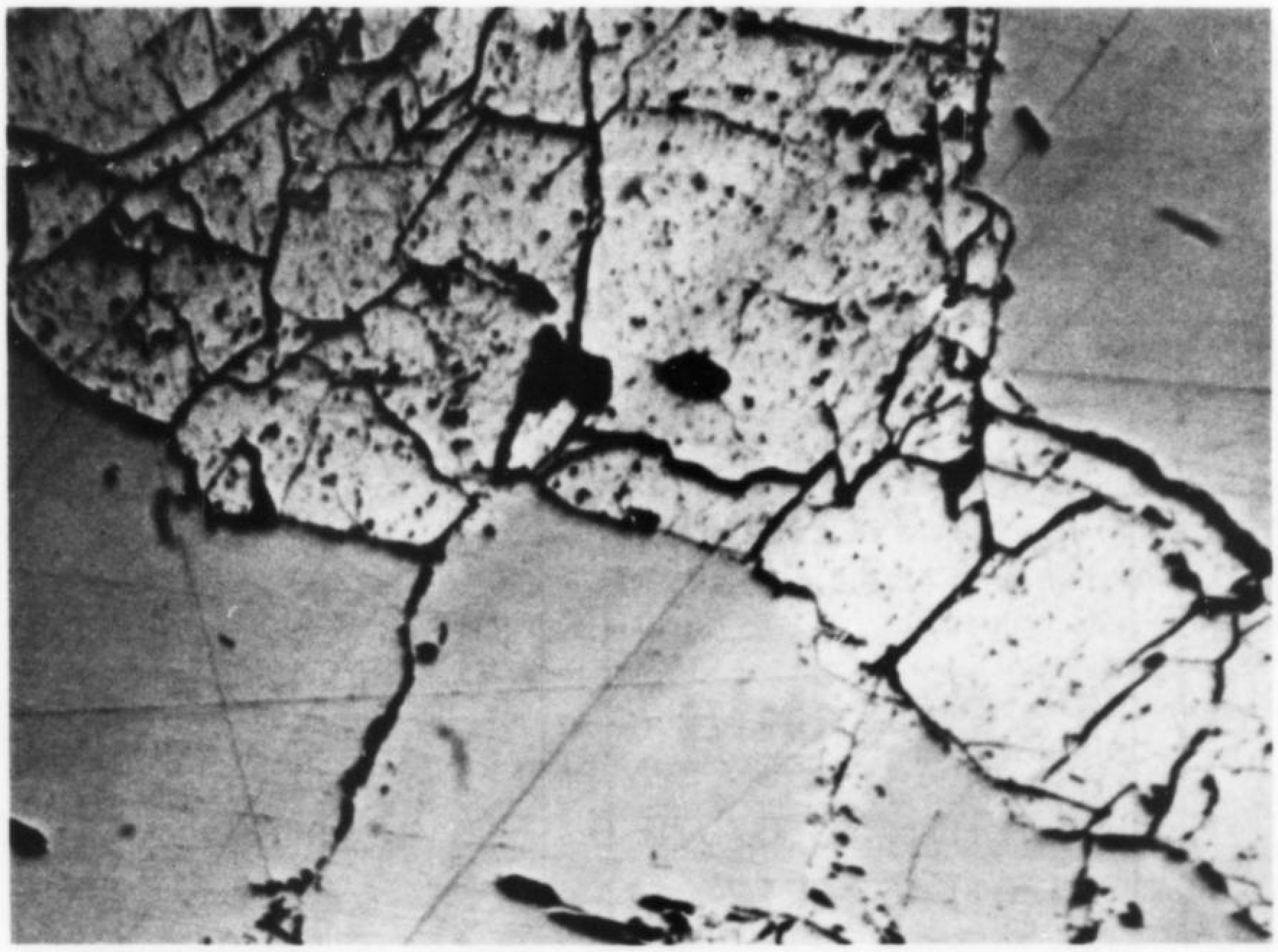

***Fig. 1.* Violarite (light grey), showing the characteristic cracking pattern, surrounded by pyrrhotite (dark grey) with small amounts of pentlandite (medium grey) developed at the violarite-pyrrhotite contact and along cracks in pyrrhotite. Field width is 0.75 mm.**

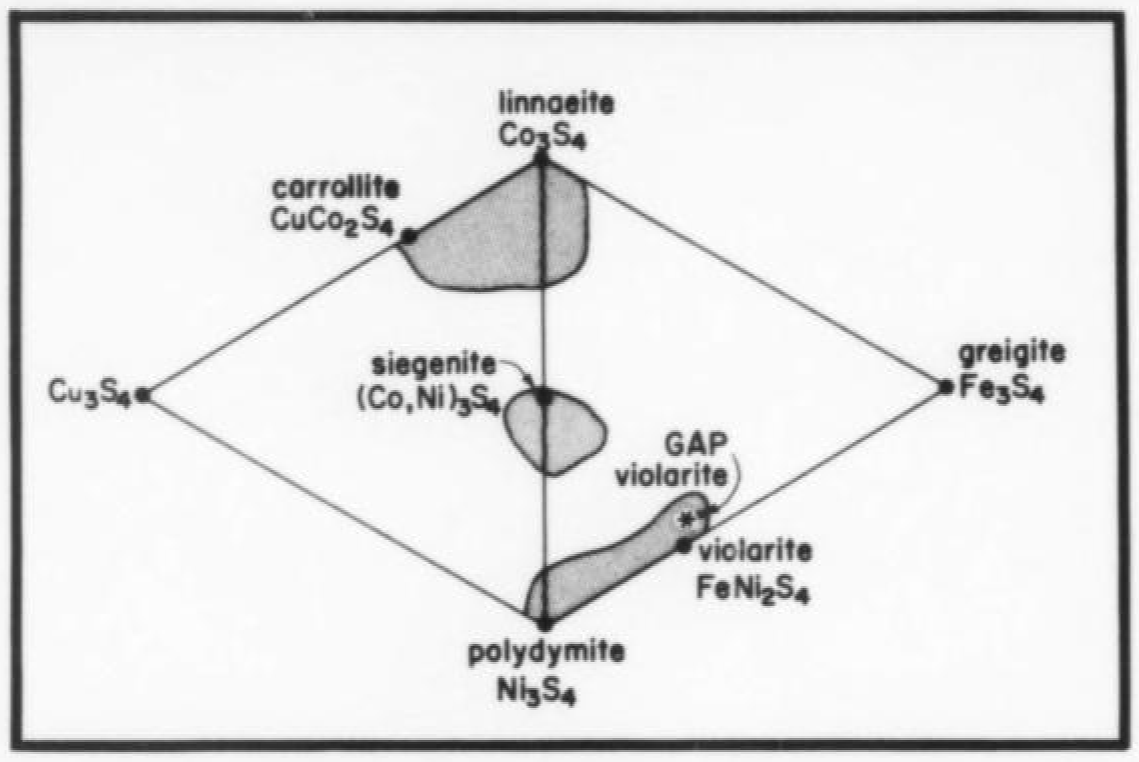

Fig. 2. **Relation between the linnaeite series minerals and composition in the Cu-Co-Ni and Co-Ni-Fe triangles. Shaded areas represent compositional range of natural linnaeites.**

Violarite, a nickel iron sulfide, Ni_2FeS_4, is confirmed in the ores of the Gap nickel mine, Lancaster County, Pennsylvania. A. F. Buddington (1924) first called attention to a secondary nickel mineral in the Gap nickel ores, which he called "nickel mineral X". M. N. Short and E. V. Shannon (1930) felt the two minerals were identical. They did not, however, confirm the occurrence of violarite. More recently, A. Heyl (1973) pointed to the possibility of violarite's occurrence at the Gap nickel mine on the basis of the reported mineralogy. This prompted our search for the mineral in specimens of the senior author's collection.

An electron microprobe analysis of the Gap violarite is listed in Table 1 along with analyses for stoichiometric Ni_2FeS_4 and a Sudbury violarite for comparison (Short and Shannon, 1930). The ratio of nickel to iron is approximately 2:1, which is the ratio for stoichiometric violarite. This violarite contains 2.56% cobalt and is the first cobalt bearing mineral to be recognized at Gap.

X-ray data were obtained on a Gandolfi camera of 114.6 mm. diameter with chromium radiation (Table 2). The unit cell constant, $a = 9.46$ A, was determined from the observed 20 values on the indexed powder photograph using the Nelson-Riley extrapolation method.

Table 1. Analysis of violarite

	Ni_2FeS_4	Gap, Pa.	Sudbury, Canada
Cu	-	-	1.12
Ni	38.94	35.31	38.68
Fe	18.52	19.35	17.01
Co	-	2.56	1.05
S	42.54	41.84	41.68
Insol.	-	-	0.40
	100.00	99.06	99.94

Table 2. X-ray powder diffraction data for violarite, Gap nickel mine, Pennsylvania

Camera diameter: 114.6 mm., Cr radiation

hk*l*	d(meas.), Å	d (A.S.T.M.), Å
111	5.44	5.47
220	3.34	3.35
311	2.85	2.85
400	2.37	2.36
422	1.93	1.931
511,333	-	1.820
440	1.67	1.674

ACKNOWLEDGEMENTS

The authors would like to thank the Molecular Structures Laboratory at Virginia Polytechnic Institute and State University for the use of the microprobe and x-ray facilities.

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AN AMERICAN MINERALOGIST PART VI

by Arthur Montgomery
Lafayette College, Easton, Pennsylvania 18042

CRYSTALLOGRAPHIC STUDY IN EUROPE

In May, 1926, Gordon was granted a six months' leave with pay by the Academy in order to go to Europe and study under Professor Victor Goldschmidt at Heidelberg, Germany. This man was the most noted morphological crystallographer of his time and Gordon, with his intense interest in measuring and drawing crystals, wanted to perfect his techniques under Goldschmidt's guidance and enroll in a formal course under him. Wherry had done the same thing some years earlier and Gordon was again following the example of his teacher and friend. Goldschmidt must have found his young American student an apt crystallographer. In 1928 the two of them were to collaborate in a monograph, printed as Special Publication No. 2 of the Philadelphia Academy, entitled *Crystallographic tables for the determination of minerals*. The tables, chiefly a compilation by Gordon of crystallographic data on crystallized minerals found in Goldschmidt's monumental *Atlas of Crystal Forms* (Heidelberg, 1913-1923), represented an important contribution to geometrical crystallography. They comprised a 70-page volume, covering 759 minerals, with the crystallographic elements and key axial-ratio data for these arranged in such a way as to greatly simplify mineral identification by means of crystallographic measurements alone. It is unfortunate that this compendium finds so little use today in mineralogy, being superseded by the far simpler and more accurate determinative data based on x-ray crystal-diffraction techniques.

During this European trip, apparently the first "salary-and-expenses paid" vacation the young curator had ever had, he was able to visit and effect mineral exchanges with mineralogical museums in Germany, Switzerland, Hungary, Denmark and England. He spent four of the six months at Heidelberg University.

In 1928 a festschrift volume honoring Professor Goldschmidt was published by Heidelberg University. In it Gordon contributed a paper with three beautiful crystal drawings illustrating the varied complex habits of calcite from the iron mines of French Creek, Pennsylvania (Festschrift v. Victor Goldschmidt, Heidelberg, 1928, p. 108-116). The three drawings are reproduced (Figs. 31, 32,33) together with the angle table.

DEATH OF GEORGE VAUX, JR.

Gordon returned from Europe in February of 1927. In October of that year he was to learn of the sudden death, at the age of sixty-three, of his patron and friend, George Vaux, Jr. He read his *Memorial to George Vaux, Jr.* in late December at the annual meeting of the Mineralogical Society of America held at Cleveland. It was published in the following year in *The American Mineralogist* (Vol. 13, 1928, p. 97-102). Certain paragraphs of particular pertinence are excerpted here:

MEMORIAL OF GEORGE VAUX, JR.

".....Mr. Vaux, Jr., was elected a member of the Academy of Natural Sciences on October 25, 1892. In 1894 he was elected Treasurer, and in 1911, Solicitor of the Academy, serving also as a member of the Council, and of the Board of Trustees......."

"He was deeply interested in the development of the Department of Mineralogy of the Academy, and frequently contributed the means by which its work and researches were carried on. His cooperation made possible the expeditions sent to the Andes of Ecuador, Peru, Bolivia, and Chile in 1921; to Greenland in 1923; and to Bolivia and Chile in 1925. These trips were very successful not only in the number of fine specimens obtained, but in scientific results as well, which included the discovery of eight new minerals."

"It was fitting, therefore, that the beautiful blue, hydrous iron and aluminum phosphate from the tin mines of Llallagua, Bolivia, should be named Vauxite in his honor. Related minerals received the names paravauxite and metavauxite......"

"To most mineralogists, George Vaux, Jr., was best known through the magnificent collection of minerals he had assembled. Due to his enthusiasm he had accumulated approximately 10,000 specimens, including 850 species.

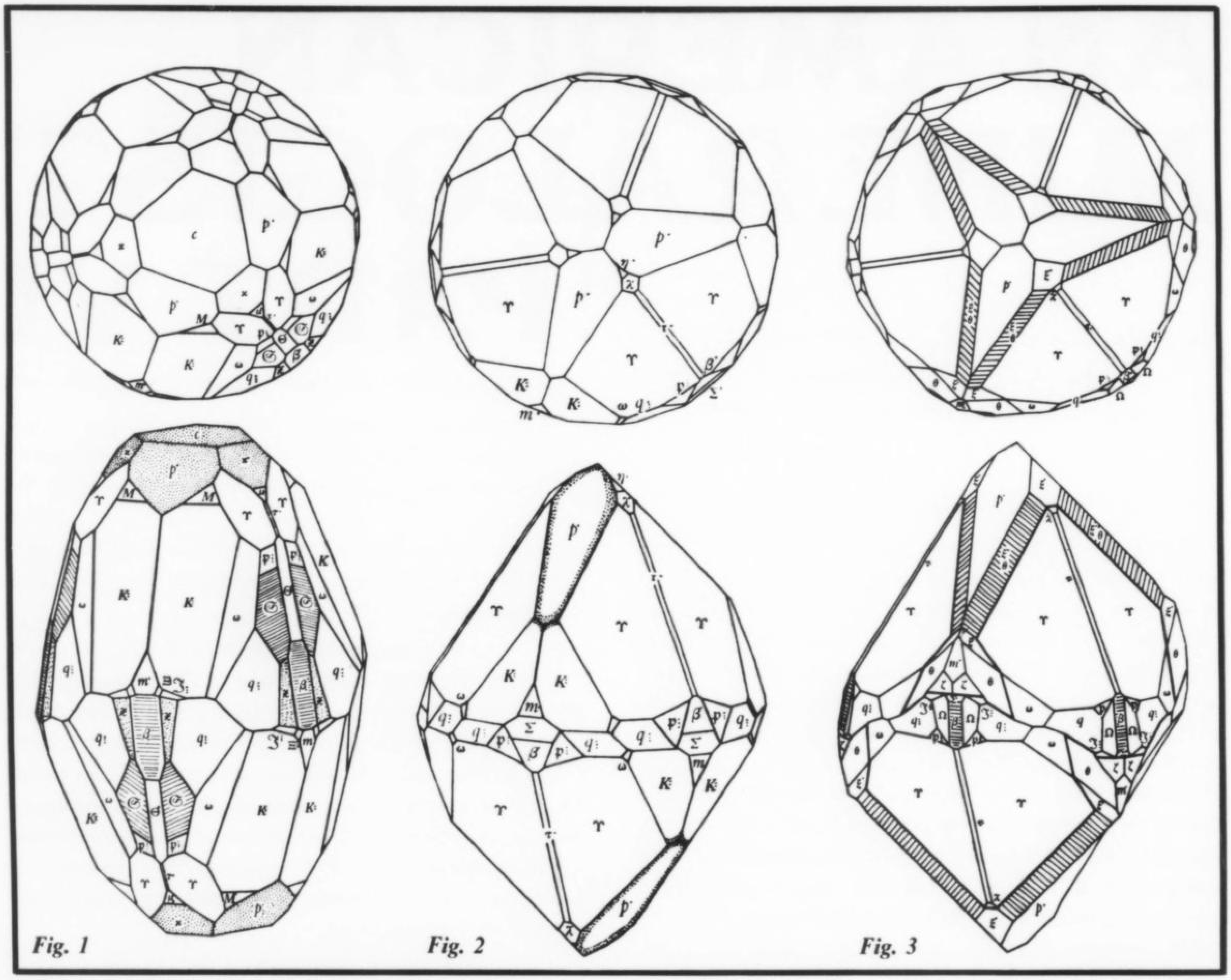

Fig. 1 Fig. 2 Fig. 3

Fig. 1. **Calcite crystal, Gordon's Type** *2*, **from French Creek mines, Pa.** *From Festschrift v. Victor Goldschmidt, Heidelberg, 1928, p. 111. Fig. 2.* **Calcite crystal, Gordon's Type** *4*, **from French Creek mines, Pa.** *From Festschrift v. Victor Goldschmidt, Heidelberg, 1928, p. 112. Fig. 3.* **Calcite crystal, Gordon's Type** *5*, **from French Creek mines, Pa.** *From Festschrift v. Victor Goldschmidt, Heidelberg, 1928, p. 113.*

He regarded the science of mineralogy as 'The most delightful of pastimes....one of the most fascinating subjects to which one can devote himself'. It was a surprise to him that more persons were not interested in this science."

"Mr. Vaux, Jr., began collecting while still a young boy. He became acquainted with the collection of his uncle, William S. Vaux, at that time the finest mineral collection in America; and had the pleasure of associating with the naturalists who met at their house on Saturday afternoons. It is of interest to note that it was his grand-uncle, Joseph Sansom (1767-1826) who brought together one of the first mineral collections in America, which was later given to Haverford College. When George was 19 years old his uncle, William Vaux, died, and the collection was bequeathed to the Academy, with a fund of $10,000 to maintain it. The family was given the privilege of retaining twenty-five specimens."

"The collection of George Vaux, Jr., grew rapidly in the course of years, as he realized that the opportunity of acquiring good specimens was limited and it was his endeavor to obtain the best specimens available."

"In 1910 he built a beautiful Colonial house at Bryn Mawr, and shortly after, a large fire-proof extension, for his mineral collection."

"In the center of the room is the treasured desk about which the friends of his uncle, William S. Vaux, gathered to examine minerals in the days of his youth. To the right, on a cabinet, stands a small upright case with a glass front concealed by a wooden shutter. This contains the twenty-five specimens, including the marvelous proustites, which were collected by his uncle. Abutting the windows are twelve drawer-cabinets, and four vertical cases with glass fronts which contain the larger and showier minerals. Most of the specimens are in cardboard trays in drawers. Each is carefully labeled and tastefully arranged; individual crystals being mounted on stands to display them to best advantage."

Table I.
Results of Goniometric Measurements of Calcite from the French Creek Iron Mines.

No.	Letter	Symbol		Faces measured	Signal	Type 2		Faces measured	Signal	Type 4		Faces measured	Signal	Type 5		Calculated angles	
		Gd.	Bravais, G_1			φ	ρ			φ	ρ			φ	ρ	φ	ρ
1	*c*	0	0001	3	P	00 00	00 00									00 00	00 00
2	*a*	∞0	$11\bar{2}0$	2	P	00 01	90 00									00 00	90 00
3	*b*	∞	$10\bar{1}0$	3	P	30 02	89 54	1	P	29 59	89 58					30 00	90 00
4	ζ	$\frac{1}{3}\infty$	$31\bar{4}0$									9	P	15 32 ±39	89 55 ±93	16 06	90 00
5	ω	$\frac{16}{5}0$	$16.16.\overline{32}.9$	15	G	00 16 ±17	71 58 ±7	2	P	00 11 ±11	72 17 ±17	6	P	00 19 ±23	72 02 ±34	00 00	71 46
6	*p*·	+1	$10\bar{1}1$	8	G	30 00 ±1	44 36	6	G	30 00 ±1	44 36	18	G	29 54 ±4	44 36	30 00	44 36
7	*m*·	+4	$40\bar{4}1$	5		30 01	75 46	2	F	29 53 ±3	75 42 ±1	3	G	29 40 ±15	75 42 ±5	30 00	75 47
8	*e*:	$+1\frac{1}{2}$	$41\bar{5}6$	2	P	17 32	36 25									19 06	37 00
9	*M*	$+\frac{16}{5}\frac{4}{5}$	$8.4.\overline{12}.5$	5	F	10 46	64 28									10 53	64 24
10	*K*:	+41	$21\bar{3}1$	17	G	10 55 ±3	68 56 ±13	12	G	10 53 ±5	68 56 ±6					10 53	69 02
11	Ξ:	+64	$14.2.\overline{16}.3$	2	P	22 57	79 00									23 25	78 37
12	𝔍:	+10.4	$62\bar{8}1$	15	F	16 06	81 58									16 06	82 00
13	η·	$-\frac{4}{5}$	$\bar{4}045$					6	G	29 59 ±3	38 15 ±2					30 00	38 17
14	x·	−1	$\bar{1}011$	4	F	29 52	44 36									30 00	44 36
15	λ·	$-\frac{8}{7}$	$\bar{8}087$					6	F	29 37 ±36	48 13 ±56	5	F	29 52 ±9	48 22 ±2	30 00	48 25
16	μ·	$-\frac{6}{5}$	$\bar{6}065$	1	F	29 59	49 39									30 00	49 48
17	ξ·	$-\frac{4}{3}$	$\bar{4}043$									12	P	29 34 ±18	52 55 ±45	30 00	52 45
18	τ·	$-\frac{13}{8}$	$\overline{13}.0.13.8$	1	P	29 46	57 54	6	F	29 59 ±1	58 01 ±1	14	F	29 47 ±24	58° 02 ±7	30 00	58 02
19	Φ·	−2	$\bar{2}021$	2	F	30 05	63 08	3	F	29 57 ±2	63 09 ±8					30 00	63 07
20	Θ·	−4	$\bar{4}041$	1	G	29 58	75 08									30 00	75 47
21	β·	−6	$\bar{6}.0.61$	5	G	30 00 ±1	80 38 ±16	5	F	29 56 ±6	80 01 ±39	5	F	29 59 ±3	80 21 ±20	30 00	80 24
22	ι·	−10	$\overline{10}.0.10.1$	2	P	30 02	84 10									30 00	84 12
23	Σ·	−11	$\overline{11}.0.11.1$	4	P	30 02 ±2	84 39 ±21	2	G	29 56 ±2	84 34 ±3	3	F	29 05 ±13	84 35 ±15	30 00	84 44
24	*γ	$-\frac{21}{8}\frac{5}{8}$	$\overline{31}.\overline{16}.47.8$	2	F	10 46 ±6	59 22 ±2	12	F	10 41 ±16	59 27 ±5	16	F	10 32 ±21	59 28 ±18	10 40	59 33
25	θ	−41	$\bar{2}131$									6	P	10 58 ±17	69 14 ±22	10 53	69 02
26	𝔭:	−52	$\bar{3}141$	15	G	16 08 ±3	74 24 ±16	5	G	16 07 ±6	74 16 ±3	10	G	16 17 ±39	74 16 ±12	16 06	74 18
27	*𝔖	$-\frac{11}{2}\frac{5}{2}$	$\bar{7}.\bar{6}.13.2$	6	F	17 04 ±8	75 38 ±10									17 47	76 06
28	q:	−82	$\bar{4}\bar{2}61$	18	G	10 46 ±9	79 07 ±10	3	G	10 53 ±2	78 12 ±1	13	G	10 50 ±32	79 09 ±12	10 53	79 09
29	𝔛:	−84	$\overline{16}.\bar{4}.20.3$	4	F	20 00 ±29	80 00 ±33									19 06	80 35
30	*Ω	−75										6	F	24 35 ±24	80 21 ±15	24 30	80 27

* New forms. Signal: G good, F fair, P poor. Maximum variation from average angle indicated by ±.

Fig. 4.* George Vaux, Jr., 1863-1927. *Photo, Courtesy of George Vaux, II.

Fig. 5.* Sam Gordon, George Vaux, Jr., and George Vaux, II, at French Creek mine about 1918. *Photo, courtesy of F. Harold Evans.

"Perhaps the most characteristic feature of the collection was the development of suites, it having been his endeavor to obtain as complete a series of fine specimens of each mineral as possible. Mineralogists will readily recollect the impressions received upon seeing the drawers of Joplin golden calcite, Tsumeb azurite, and Verespatak gold, specimens of unrivaled perfection, beauty of color, and variety of form......"

The loss of his principal backer must have been a grievous blow to Gordon. Yet the family continued, at least for a while, to support his work and expeditions. Mrs. Vaux appears to have had an extremely friendly relationship with her husband's protégé. The young curator well knew that without the friendship and influence of George Vaux, much of what he had tried to accomplish at the Academy might have been in vain. He never failed to acknowledge, then or later, the extent of his debt to this private collector whose reassuring presence in the background, continuing financial aid, and powerful position at the Academy were indispensable in keeping him on the job there for so long.

One of the sons, George Vaux, II, had an early serious interest in minerals. He worked under Gordon as a student assistant at the Academy for several periods before and after his father's death. He and his brother, Henry, actually planned to accompany Gordon in 1932 on a second Greenland expedition which, unfortunately, never materialized. It was he who performed a great service to mineralogy when in the nineteen-fifties he installed his father's minerals in the Geology Department at Bryn Mawr College, where the beautiful and esthetically-arranged displays now safely preserve and put to excellent educational use one of the finest of American collections.

A Typical Sulfosalt Environment: The Mineralogy of the Julcani District, Peru

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Photos by Julius Weber
(except where noted)

Sulfosalts have traditionally been defined as a family of minerals having the general formula $A_mB_nX_p$, where A is a metal most commonly copper, silver or lead; B is a semimetal generally arsenic, antimony, or bismuth; and X is usually sulfur; m, n and p are whole numbers. Chemical compositions of most sulfosalts can be written as the combination of whole number multiples of simple sulfides, such as $9PbS \bullet 4Sb_2S_3$ ($Pb_9Sb_8S_{21}$) for semseyite, or $2PbS \bullet Cu_2S \bullet Sb_2S_3$ ($2PbCuSbS_3$) for bournonite. With information gained from recent crystal structure analysis, Takeuchi and Sadanaga (1969) suggest a more detailed definition which includes the semimetals being coordinated to three sulfur atoms to form a low pyramid, with the semimetal at the apex, and sulfurs at the base. Nowacki (1970) suggests a definition which includes BX_3 trigonal pyramids as above, and also BX_4 tetrahedra. This latter definition is the broadest of all, and includes species such as enargite, luzonite, and arsenopyrite within the family. Without intending to decide upon one definition being more correct than the other, Nowacki's usage will be employed in this paper.

Fig. 1. **Location map, Julcani district, Peru.**

Sulfosalts are found mainly in sulfide ore deposits, and they have been identified in many different types of these deposits. Generally no more than two or three species are present, and these are not in abundance. Porphyry copper deposits frequently contain enargite and/or tennantite-tetrahedrite, with silver sulfosalts in marginal zones. Enargite has been reported from Mississippi Valley type deposits, but it has probably been frequently overlooked. A wider variety of species and sulfosalts in greater abundance are found in ores typified by those at Cobalt, Ontario, Canada. It is within the so-called "epithermal" deposits found in recent mountain belts that the greatest variety and abundance of sulfosalts are found. This type of mineralization is found in veins with a close volcanic affiliation and is thought to have formed at shallow depths and low temperatures. It is the mineralogy of a deposit of this type which forms the subsequent discussion of this paper. It should be noted here however, that a group of these "epithermal" deposits, among them Cripple Creek, Colorado, and Goldfield, Nevada, are unusually rich in tellurium and gold.

It is pertinent to mention another sulfosalt environment of special mineralogical interest. The Lengenbach quarry, Binnetal, Switzerland, has produced a variety of mainly arsenic bearing lead sulfosalts from metamorphosed limestones, whereas lead sulfosalts from a similar environment at Madoc, Ontario, Canada, are rich in both arsenic and antimony. A bismuth rich sulfosalt assemblage at Gladhammer, Kalmar, Sweden, appears also to be similar to these two occurrences. As these deposits are not of eco-

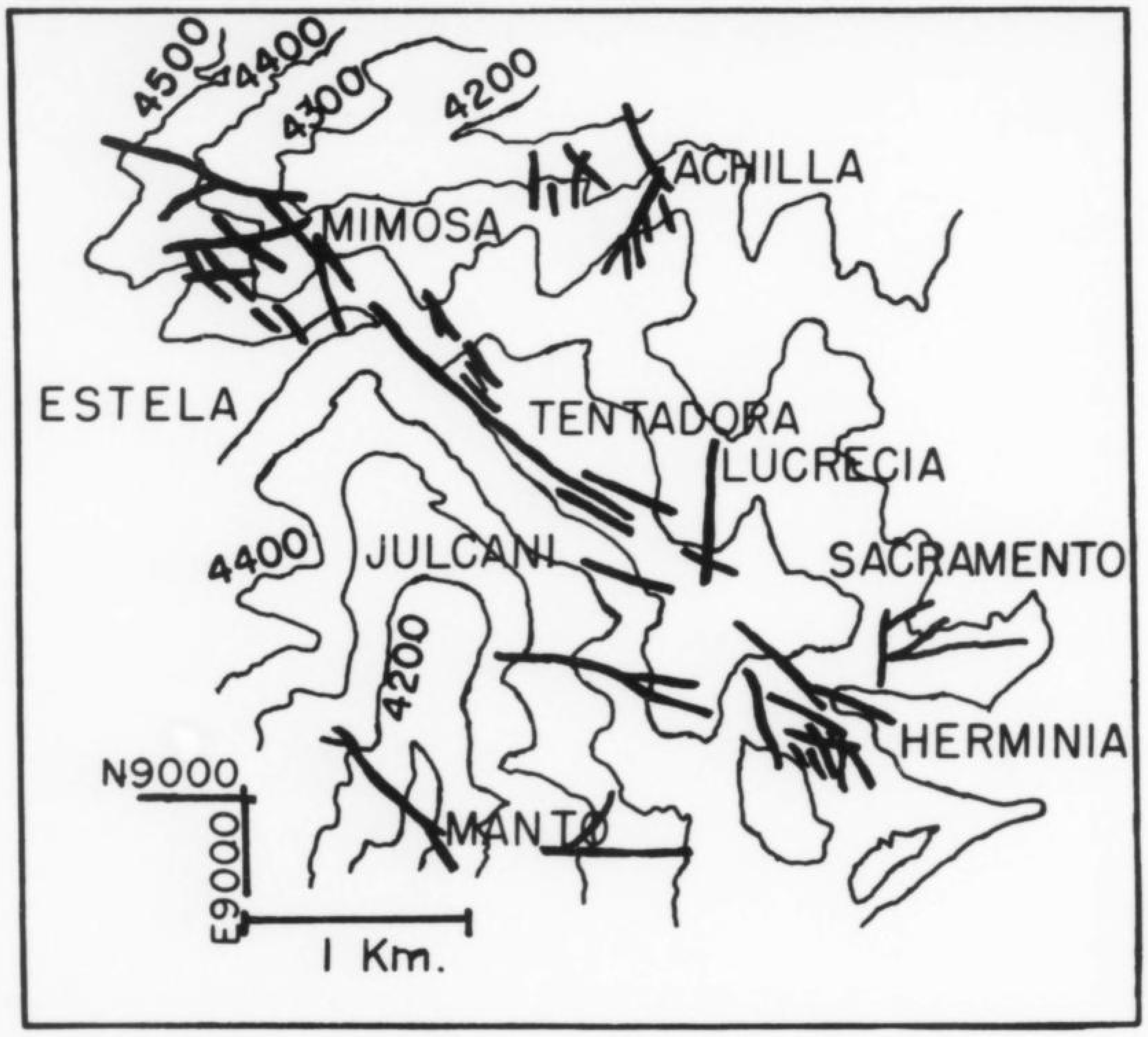

Fig. 2. **Locations of mines in the Julcani district, Peru. Topographic features indicated in meters above sea level.**

Fig. 3. **Julcani mining camp seen from the southwest. Dacite flows comprise the rough surfaces in view. Small mine dumps near the summit in the center are prospects on the outcrops of the Rosario and Carmencita veins of the Lucrecia area. Tentadora is immediately to the left. (*photo by the author*)**

nomic interest, their investigation has been the result of persistent work by mineralogists.

The Julcani mining district, Peru, has been selected as an example of an assemblage of sulfosalts because of certain features which it has that are typical of many so-called "epithermal" deposits. This interesting area has never received an adequate mineralogical description, and furthermore, the writer has had extensive field experience in the region. The Julcani district is located 200 miles to the southeast of Lima, Peru, as indicated in figure 1, at an elevation of 14,000 feet. Some evidence suggests initial gold mining in the area by the Incas, and since Spanish Colonial times it has had a series of mining operations and abandonments. Presently a modern flotation plant is in operation, with the recovery of silver, copper, bismuth, antimony, lead, zinc, tungsten and gold. Most of the production comes from complex sulfosalt ores, these ores being found in veins in dacite flows. The mines in the district are indicated in figure 2, and a view of the Julcani mining camp is given in figure 3.

Table 1 lists the vein filling minerals which have been identified by X-ray diffraction techniques from collections made by the author. Also reported are those identified by microscopic and microchemical techniques by Lacy (1946). The discrepancies between the species found by the writer and those reported by Lacy are probably due to two causes. Firstly, microscopic and microchemical identifications of many sulfosalts have been shown to be unreliable. Secondly, areas of the mine open for sampling in 1946 were generally not open to the writer in the late 1960's, and vice versa. Two phases remain unidentified in the collections on hand. Stannite and freieslebenite have been reported from Julcani, but the stannite is actually tetrahedrite, and the so-called freieslebenite remains unidentified.

A discussion of pertinent features of the more important or interesting minerals from the district follows.

Sulfides:

Pyrite is found throughout the district in great abundance and is invariably the earliest sulfide. It occurs as disseminations in the altered wall rock away from the veins, as the vein coatings closest to the walls, and sparsely with the later sulfides. It is found in large amounts in Tentadora, crystallizing as pyritohedra and octahedra, but elsewhere occurs strictly as pyritohedra.

Marcasite has been identified in polished sections in intimate intergrowth with pyrite. It is found in the southern part of Herminia as a marginal halo, with pyrite, galena, sphalerite and carbonates as the latest stage of mineralization.

Galena and *sphalerite* are widely distributed throughout the district in minor to abundant amounts. They are found in the intermediate to late stages of mineralization.

Orpiment and *realgar*, as recorded in old reports, occurred commonly in the Sacramento mine. They are now found on the extreme margins of the southern part of the district in veins of massive grey quartz.

Table 1

List of vein filling species reported from the Julcani district, Peru.

Species	*Composition*
Native Elements	
gold	Au
Sulfides	
argentite*	Ag_2S
bismuthinite	Bi_2S_3
bornite	Cu_5FeS_4
chalcopyrite	$CuFeS_2$
galena	PbS
marcasite	FeS_2
orpiment	As_2S_3
pyrite	FeS_2
realgar	AsS
sphalerite	ZnS
stibnite	Sb_2S_3
Sulfosalts	
andorite	$PbAgSb_3S_6$
aramayoite	$Ag(Sb,Bi)S_2$
arsenopyrite	FeAsS
boulangerite	$Pb_5Sb_4S_1$ to $Pb_2Sb_2S_5$
bournonite	$PbCuSbS_3$
enargite-famatinite	$Cu_3(As,Sb)S_4$
galenobismutite*	$PbBi_2S_4$
jamesonite*	$Pb_4FeSb_6S_{14}$
luzonite	Cu_3AsS_4
matildite*	$AgBiS_2$
miargyrite*	$AgSbS_2$
polybasite*	$(Ag,Cu)_{16}Sb_2S_{11}$
proustite-pyrargyrite	$Ag_3(As,Sb)S_3$
semseyite	$Pb_9Sb_8S_{21}$
tennantite-tetrahedrite	$Cu_{12}(As,Sb)_4S_{13}$
zinkenite*	$Pb_6Sb_{14}S_{27}$
Others	
apatite	$Ca_5(PO_4)_3(OH)$
barite	$BaSO_4$
calcite	$CaCO_3$
hematite	Fe_2O_3
kaolinite	$A1_2(Si_2O_5)(OH)_4$
quartz	SiO_2
siderite	$FeCO_3$
wolframite	$(Fe,Mn)WO_4$

*reported by Lacy (1946) but not found in the present study

Stibnite is found in minor amounts in the Sacramento mine occurring only with pyrite. It has been reported present in rich stopes in the upper workings of Herminia, but could have easily been confused with the bismuthinite which does occur there.

Bismuthinite is widely distributed throughout the district, and in places is quite abundant. Julcani was producing 5% of the world supply of bismuth in the 1960's. Bismuthinite is most commonly found in intimate mixture with tennantite-tetrahedrite. It appears as fibrous masses which have been mistaken for jamesonite. It is an interesting fact

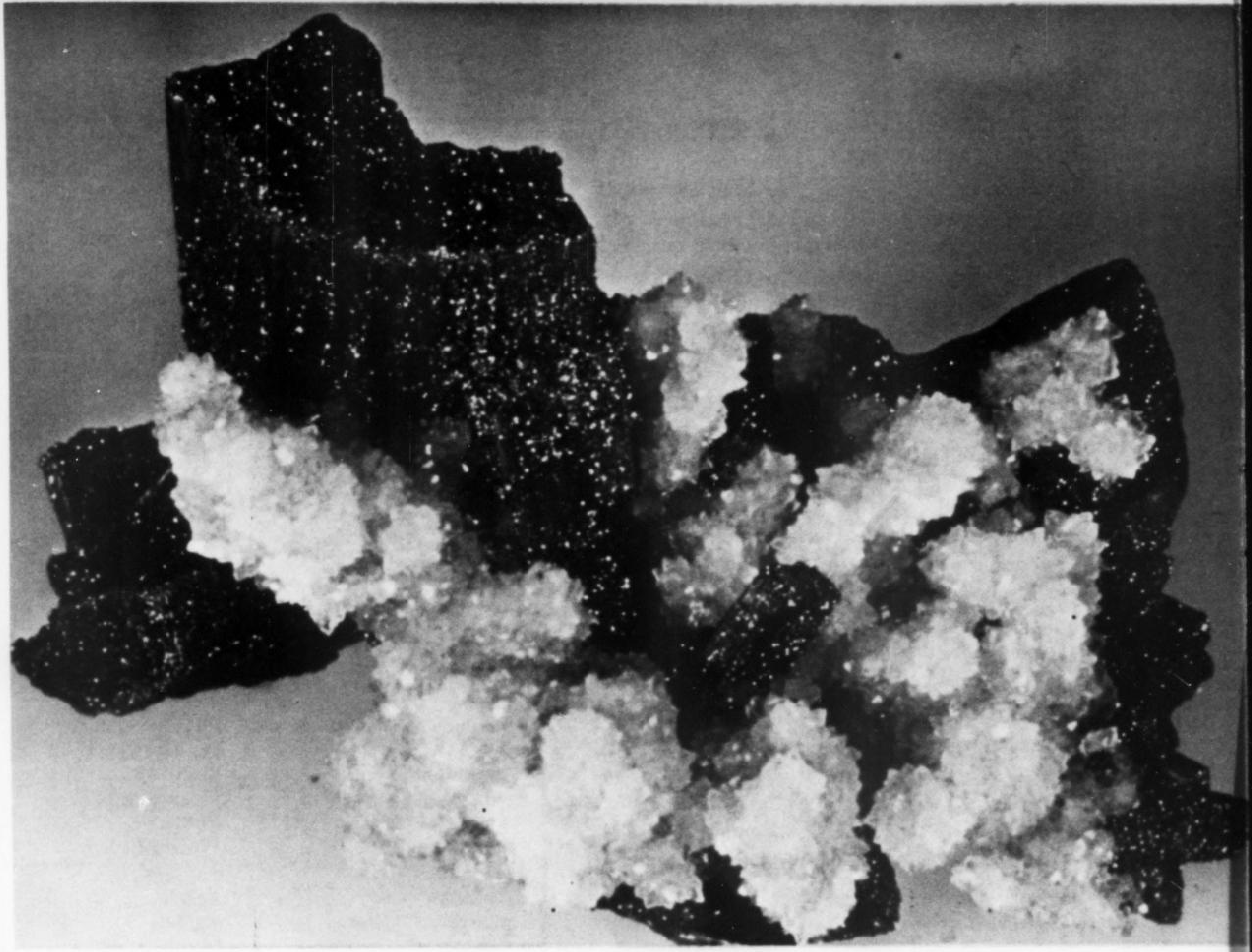

***Fig. 4.* 1 x 2/3 x 1 inch enargite crystal, {001} prism, striated parallel to prism direction, multiple twins on (320), resting on drusy quartz and coated with drusy pyrite. 500 level, Docenita vein, Herminia.**

that in this deposit, where virtually all of the copper and silver and much of the lead are present as arsenic and antimony sulfosalt minerals, the majority of the bismuth is present as this simple sulfide.

Sulfosalts

Enargite occurs in great abundance in the northwestern part of Herminia at depth. Figure 4 shows a typical assemblage, although it is also found with wolframite. Another typical association is with barite, the enargite frequently being coated with tennantite-tetrahedrite. A large vein opening of this material, 30 feet long, 20 feet high, and 5 feet wide, was encountered in the Docenita vein during mining in 1968. Small amounts of enargite are also found in Lucrecia, Tentadora, and in the San Demetrio vein of Mimosa. Arsenic/antimony compositional variations have been investigated by Feiss (1970).

Luzonite has been identified by x-ray diffraction and in polished sections of ore. It is found in small amounts in intimate intergrowth with enargite, and such an occurrence suggests a temperature of formation between 300 ° and 320 °C (Skinner, 1960).

Tennantite-tetrahedrite is the most valuable ore mineral in the district, contributing the majority of the silver and copper values. It is found in major amounts in every mine except Tentadora. It is commonly found coating enargite, or alternatively, it is found with bournonite and galena, or with bismuthinite. The arsenic to antimony ratio has been shown to have significant variations (Feiss, 1970), and zoning of trace elements within single crystals is suspected. Crystals up to 1-1/2 inches across have been found.

Bournonite is a common mineral in restricted areas of Herminia, and is found associated with tennantite-tetrahedrite, and in the Mercedes vein with galena.

Semseyite is found in abundance in a narrow halo in Herminia, to the southeast of rich silver-bismuth mineralization. It is found as radiating masses of prismatic crystals (figure 6), and is frequently overgrown with galena, sphalerite and/or siderite.

Boulangerite is found commonly in massive form in the northwestern margins of Mimosa, associated with minor sphalerite, barite and quartz. It is of particular interest that semseyite and boulangerite, both very close in chemical composition, are found in the southeast and northwest marginal positions of the district, some three miles apart. This suggests a similarity in evolution of the mineralizing solutions in these areas.

Arsenopyrite is found only in the Estela mine, and comprises a part of the earliest and intermediate stages of mineralization, seen in figure 7.

Andorite and *aramayoite* have been found in trace amounts in the central part of Herminia.

Several additional sulfosalt minerals occur in the district; they appear to be new species, and their descriptions are as yet incomplete.

Other Minerals

Wolframite is invariably found with quartz and pyrite as part of the earliest mineralization in Tentadora, with enargite in Herminia and San Demetrio, and with arsenopyrite in Estela.

Barite is a common and abundant gangue mineral in Herminia and is found throughout the paragenetic sequence. Blades up to 10 inches long have been found in the Docenita vein, associated with enargite. It is found in most mines, although it is rare in Estela and Mimosa, where it is evidently deposited but later subjected to hydrothermal leaching, as will be discussed presently. In a preliminary study of the variation of strontium content in barite, Hanor (1966) found strong changes, with a maximum of 8.8% strontium in barite from the central part of Herminia.

Siderite-calcite is found in abundance in limited areas throughout the district, invariably among the latest assemblage, which includes galena, sphalerite, pyrite and occasional marcasite. These carbonates are commonly compositionally zoned, as evidenced in figure 8. This figure also shows the molds of large bladed, probably orthorhombic, crystals believed to have been barite. A veneer of sphalerite separates the carbonates from the molds.

Apatite is found as a minor accessory mineral in Estela, as small white hexagonal prisms on arsenopyrite crystals.

The sum total of the assembled mineralogy of the Julcani district is one example of a common sulfosalt environment. Space precludes a more detailed description of the distribution of species or a discussion of the origin of the

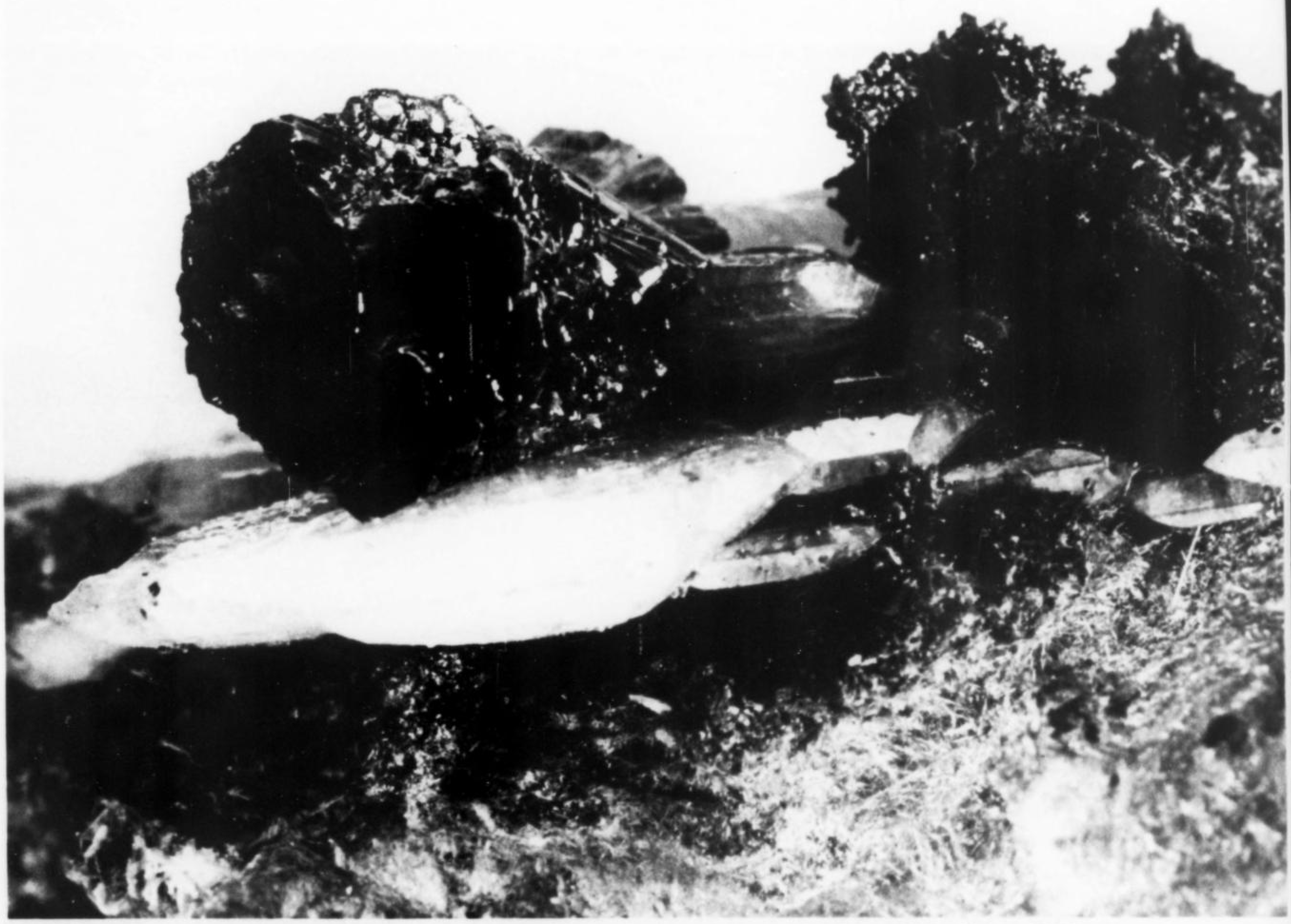

***Fig. 5.* Complex intergrowth of bournonite crystals (upper left), with pyrite (upper right), bismuthinite (lower third), tennantite-tetrahedrite (not visible), and barite. Herminia. Portion viewed is 1 inch across.**

Fig. 6. **Radiating masses of Semseyite,** ***40x.*** **Herminia.**

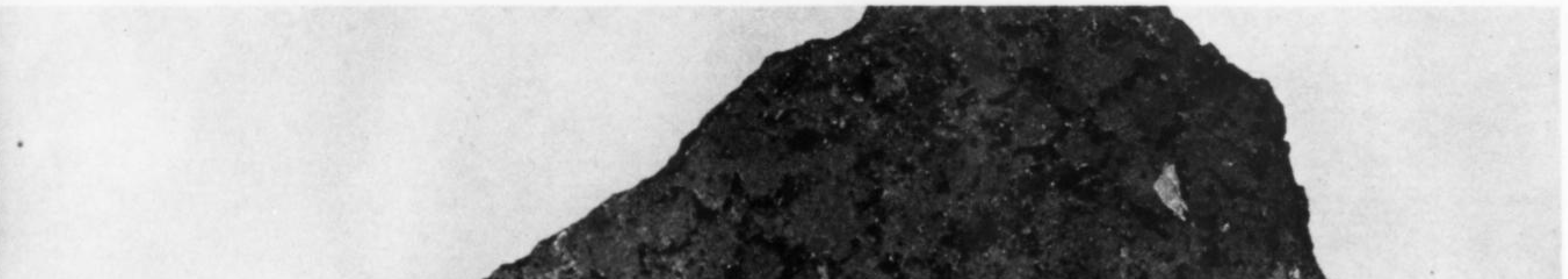

Fig. 7. **Earliest stage of mineralization comprising pyrite, arsenopyrite, tennantite-tetrahedrite, chalcopyrite, wolframite (black blades) and kaolinite (white), and intermediate stage consisting of pyrite, arsenopyrite, tennantite-tetrahedrite, and chalcopyrite. 440 level, Estela.**

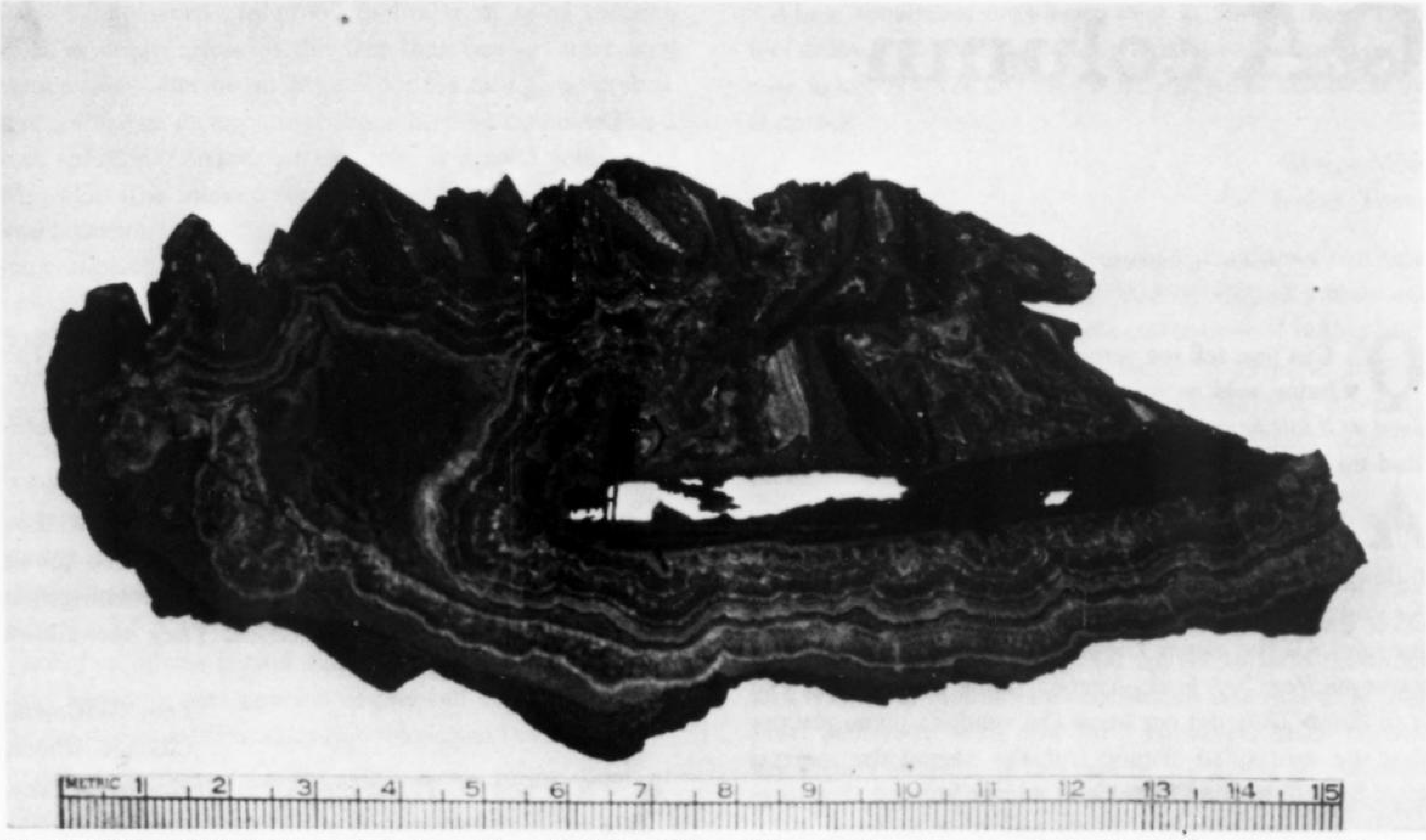

Fig. 8. **Molds of bladed crystals followed by sphalerite, followed by zoned carbonates. Barite is believed to have filled the molds. 460 level, Mimosa.**

deposit. The presence of this type of sulfosalt deposit is restricted to recent mountain belts. Igneous activity is a necessary element for the formation of these deposits, but if is probable that the sulfosalt abundance may be more a character of the geochemical cycling of arsenic, antimony, and bismuth in the continental crust. Much remains to be learned of these deposits.

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QA column

Q. Can you tell me something about a white mineral being sold as w____ by many dealers? ***(name not used as it has never been submitted to the IMA. Ed)*** **I can find no reference to the name in any of the literature.**

A. We are indebted to Trudy Houser of Cincinnati, Ohio, for pursuing this matter and providing the following comments: "Recently I visited a rock shop in Keokuk, Iowa, where I found more of the so-called w____ for sale. All the owner knew about this mineral was that a woman from Ash Fork, Arizona, came through and sold it to them. They did not know the vendor's name, except that she was called Winnie and she named the mineral after herself, as they found it in a large vein on their property. A friend bought a whole tray of it in April, 1974, in Arizona. I bought one specimen in 1972 in a rock show in New Hampshire. A dealer from Colorado Springs sold it in the wholesale section in Lincoln, Nebraska. This mineral is not credited, but soon it will show up everywhere. Can or should anything be done about it?"

I should hope that collectors can effectively kill the use of this name by spreading the word that it is invalid. Please, woman from Ash Ford, stop arbitrarily applying your name to mineral specimens. The mineral, by the way, is ARAGONITE.

Q. Where is Tong Wha, Korea? In a news item and in advertisements in the *Record* this location is mentioned. When I was visiting Korea in 1972, I asked Koreans involved in mining and in mineral collecting where this location was. They said they never heard of it.

Mitchell A. Bogen
New York, New York

A. The following information has been supplied by Patricia Barker, who visited Korea in the late 1960's: "Tong Wha isn't a locality at all. Apparently it is a name dreamed up by a certain mineral dealer to go with their Korean minerals. Whether they are doing this deliberately or unknowingly I couldn't say, but it *has* been called to their attention. The beautiful scheelites, wolframites and cassiterites coming out of the Republic of Korea in the past two or three years come from the Tae wha mine, a few miles north of Chungju in Chungchongpukdo (North Chungchong province). Some years ago very fine specimens of wolframite (huge crystals), scheelite (enormous orange-colored crystals that fluoresce vividly), and molybdenite (probably the finest crystals ever found anywhere) came from the Wolak mine, near the small city of Danyang, also in Chungchongpukdo province. The scheelite from Tae wha is recognizable, from that of the Wolak mine, by being deeply iron-stained and often fluorescing only on corners or edges."

Q. Can you please explain how the so-called "box quartz" pieces formed? These are the well-known polyhedra of quartz that are hollow and lined with quartz crystals pointing toward the interior. They are known from several localities.

Troy Grabowski
Chicago, Illinois

A. The late W. T. Schaller, U. S. Geological Survey, wrote an explanation of box quartz that we believe has never been published.

"These specimens (from Crawford's Place, 5 miles east of Statesville, Iredell County, North Carolina) are neither crystals of quartz nor a form of pseudomorphous silica after crystals of pre-existing calcite. It will be noted that all of them are extremely *asymmetric*. Even the small flat piece which apparently resembles a "nail head" (with three flat rhombohedra) termination of calcite on top with a large flat face (apparently the basal pinacoid) on the other side, is very asymmetric. The angle from the large flat face to each of the three faces on the other side should be the same if it were a crystal. These angles measure 14°, 29°, and 48° respectively.

All of the faces of the specimens are covered with the same kind of triangular markings, such as occur commonly in the basal pinacoid of calcite, and it is evident that each surface of the specimens was at one time in close contact with a basal pinacoid of calcite. Hence these "box quartzes" represent the filling in of the empty spaces between aggregates of pre-existing platy crystals of calcite (platy after the basal pinacoid)...After the empty spaces between the platy crystals of calcite were filled (if not completely filled, a geode type of structure developed), the calcite was dissolved away and the "box quartzes" resulted.

They therefore are not a replacement of calcite, but simply a filling in of the spaces between platy crystals of calcite, now removed."

Q. "Solid solution" seems a contradiction in terms. How can a substance be both at the same time? What exactly does the term mean?

Marian B. Casperson
Micco, Florida

A. The word "solution" in the term *solid solution* simply refers to the fact that two or more substances may intermix in any proportion in a given crystalline solid, just as any proportions may be combined in a true solution. Olivine, for example, is a solid solution of Mg_2SiO_4 (the mineral forsterite) and Fe_2SiO_4 (the mineral fayalite). Olivine crystals may be found of widely varying compositions. Some may be dominantly forsterite with only minor fayalite, others may be just the opposite, and some may reveal nearly equal amounts of each. If one were able to actually see the atoms in a fayalite crystal, we would see an orderly arrangement of iron, silicon and oxygen atoms extending in three dimensions. Every atom would have a specific place in the pattern, and the three different types would be present in the ratio of two irons to one silicon to four oxygens. However, if some forsterite were present in solid solution, we would see periodic substitution of a magnesium atom for an iron atom. In the case of an olivine crystal that is nine parts fayalite and one part forsterite, the position of one out of every ten iron atoms will have been taken by a magnesium atom.

All proportions, from the one extreme to the other, are theoretically possible; thus, olivine is a true *solid solution*.

Q. I would like to know if it's typical for calcite, var. manganocalcite, to lose its color. I have three specimens, two from the Idarado mine at Telluride, Colorado, and one from San Juan County, Colorado (near Durango), each purchased at a different time. One of these from Telluride still has a very faint ting of pink left, but the other two are totally devoid of any color. These specimens have been kept in dark mineral cabinet drawers and none have been subjected to bright showcase lights. Is there any means by which the color can be restored?

Marge Mills
Irving, Texas

A. In reply, George R. Rossman (California Institute of Technology) writes: "Asking around, I have not been able to discover a documentable case of fading Idarado manganocalcite....I am unable to respond to Ms. Mills' question directly, or to suggest ways to intensify color in these samples short of fundamentally altering them."

Perhaps some of our readers have some ideas to offer.

Q. I am chiefly a micromounter. Recently, I obtained a dundasite specimen (Tasmania) which has about a dozen individual crystals that appear to have the color and texture of monoclinic crocoite on one side of it. The label declared: "with crocoite". However, these crystals are clearly rhombs. Is this one of the habits of crocoite?

Leonard Schiff
Brox, New York

A. Sorry, I can find no examples of such crystals on numerous crocoite specimens examined and I haven't been able to locate any other collectors who have them either. It appears that you will have to sacrifice one crystal for x-ray identification at your favorite local institution. Please let us know the results.

MINERAL COLLEC

from the Capelinha-Malacacheta

by Jacques P. a

The Rio Doce Valley and the Governador Valadares-Teófilo Otoni area are world famous for their beautiful gems and fine, mostly well-crystallized mineral samples such as: beryl, tourmaline, topaz, spodumene, amblygonite, brazilianite, and garnet, derived from numerous pegmatite bodies.

However, other minerals mined from different deposits in the same area are poorly, if at all, known. Examples include fine titanite crystals, gem diopside, large kyanite crystals, excellent twinned staurolite, and sometimes the rare euclase.

Our purpose is to describe some of these occurrences with their geographic location and the roads which reach them for the mineral collector who wishes to make a trip to this area. The mineralogy, geology and size of obtainable specimens coming from the various occurrences will also be summarized.

The area may be reached from Diamantina, Governador Valadares or Teófilo Otoni. These three towns lie on main highways and have airports. Capelinha, one of the great mineralogical centers, may be reached from Diamantina in 3 hours (134 km) using a good unpaved road toward Araçuai for 47 km, then by way of Merces de Diamantina and Itamarandiba. Leaving Teófilo Otoni, another unpaved road passes through Pote and Malacacheta (91 km) before reaching Capelinha in 5 hours (167 km).

Numerous jeep roads cross the area, however they are intransitable during the rainy season which corresponds to the northern hemisphere winter. The best season to travel without rain on the dirt roads is July to September. Inhabitants are always hospitable, especially the workers of the little prospects (= garimperos). Vegetation is mainly thick, high grass with scarcely any forest.

The metamorphic region is undulating with local granitic inselbergs and is mainly composed of mica schists and gneiss belonging to the Algonkian, on which Cretaceous sandstone lies in disconformity, forming large plateaus (= chapadas). Deep weathering and thick vegetation make outcrops rare.

TITANITE FROM CAMPO DO BOA (CAPELINHA COUNTY).

This prospect, which belongs to Manoel Pimentel Figereido, is located to the NNW of Capelinha. Access is by way of the Minas Novas road for 7 km, then by the São Caetano

CTING LOCALITIES

a Area (State of Minas Gerais, Brazil)

P. and Jeannine O. Cassedanne +

road running NW across a plateau for 14.7 km. From there a narrow jeep road leads, in 4 km, to the prospect, crossing the Boa Creek (= Riacho do Boa). This is a tributary of the Rio Santa Catarina which flows into the Rio Araçuai.

This region is made up of low grade metamorphic mica schists and phyllites with layers of quartzite. A series of quartz lenses running N70°E is being worked along more than 1 km within a deeply weathered wallrock having a slightly northern dip. In 1966, a parallel vein with a 30° northern dip and good titanite crystals was accidentally found. It is irregular with a average width of a few decimeters and is very drusy. The little exploration adits are now caved in.

The vein is a skarn or an epidotite with banding parallel to the wall rock, having a medium to fine crystal size and a yellow-green to deep green color. It is essentially made up of feldspar, quartz, epidote, green hornblende, titanite and a little magnetite. The druses are very abundant and parallel to the banding and are coated by crystals of titanite, frequently well formed, and/or epidote. The larger cavities, up to 1 decimeter, are more rounded and are coated with albite crystals sometimes associated with the previous minerals. They also may include transparent or chloritic quartz crystals. In the wallrock, large quartz crystals with green-blue or black tourmaline needles may be found.

In the cavities, titanite crystals are irregularly grown (Fig. 1, 2 & 3). They are frequently various centimeters in length, with some rare specimens up to 1 decimeter (we examined a single perfect crystal of 12 x 4 x 5 cm in M. P. Figuereido's house). They are always yellowish green with a resinous luster. The crystals, of which some faces are corroded or striated, are locally transparent, but commonly have cracks and fissures. This fact explains the rarity of cut gems of good quality of medium to large size (up to 10 carats).

The average specific gravity is 3.52 and the hardness is 5 — 5.5. The crystals do not fluoresce in ultra-violet light. The high index of refraction and the good color explains why, in spite of its low hardness, the titanite of Campo do Boa is actively sought after by the lapidaries.

+ National Research Council (C. N. Pq.) & Federal University of Rio de Janeiro.

Most of the crystals examined have the following faces:

Faces (V. Goldschmidt-1922)	hkl	Characteristics
p = a	{100}	Well developed, always corroded
n	{111}	Well developed, smooth
x	{102}	Well developed, corroded
b	{010}	Elongated and striated
k	{114}	Very small and smooth
c	{001}	Moderately developed and smooth

Single crystals are rarely encountered. Generally they show two types of twins up to 5 cm in length:

- a common contact twin along the (100) plane — Fig. 4,

- a penetration cruciform twin, the plane of twinning being parallel to (010), and a twofold contact and penetration twin (Fig. 5) of the preceeding types (J. P. & J. O. Cassedanne, 1971). A good photograph of this latter is given by R. Metz (1967 p. 200 fig. 103) for a Swiss specimen identical to those from Campo do Boa.

Albite crystal groups reaching up 25 cm in length are also very good and highly prized by mineral collectors. They are well faceted and sometimes skeletal (Fig. 6 & 7). Epidote is locally abundant in clusters of fibrous crystals reaching up to 30 cm in length. Last of all, quartz from the satellite veins sporadically appears in very large and good samples (Fig. 8).

Mr. George Ferreira Coelho (Rua das Flores) would be an excellent guide to the occurrences in the vicinity of Capelinha.

EUCLASE FROM SANTA DO ENCOBERTO (SÃO SEBASTIÃO DO MARANHÃO COUNTY).

This occurrence is located 10 km from Sao Sebastião do Maranhão and approximately 500 m to the NW of the Santana do Encoberto farmhouse (= fazenda). Access from Diamantina is by way of Itamarandiba (134 km) and Socorro (172 km) or from Governador Valadares.

The deposit is a heterogeneous pegmatite vein striking N40° E with a 70° S dip and interbedded in mica schists. The vein is enriched in black tourmaline near the contact. The width of the pegmatite is 10 — 12 m with a micaceous zone near the quartz core where the euclase is located in a very small lense. Thus it occurs in the same position as beryl in the other regional pegmatites.

A series of adits, of approximately 500 m length running along the pegmatite and having a 60 m difference in level, have been sporadically worked for mica for the past 35 years. Today the exploration is restricted to a large chamber of 12 x 4 m situated 250 m from the entrance. It is the only level where the euclase is occurring (J. Cassedanne, 1969).

Essentially the paragenesis includes: albite (cleavelandite in druses coated with small microcline crystals); mica; vermiculite; milky faceted quartz with specimens reaching 0.4 m along the core of the pegmatite; hexagonal, fluorescent, yellowish calcite crystals; platy white or pink apatite (up to 1 cm); euclase; coarse pyrrhotite and pyrite; spessartine and rare secondary minerals derived from spots of uraninite; with much limonite and altered feldspar near the surface. Tantalite or cassiterite were never found.

***Fig. 1.* Titanite crystals upon matrix.**

Euclase regularly has grown in the druses of the mica and/or albite. It is always in transparent or milky crystals of generally centimeter size, however, it reaches up to 8 cm in length. The crystals are doubly terminated.

Specimens include single crystals (Fig. 9) and groups upon the matrix (Fig. 10) reaching several kg in weight. Unfortunately the color is unattractive in comparison to the blue enclase of Equador (Rio Grande do Norte) or Dom Bosco (Minas Gerais) (J. Cassedanne, 1970). Specimens may be bought in mineral dealer shops of Teofilo Otoni and Governador Valadares and sometimes at the Fazenda of Santa do Encoberto.

The pre-1968 dumps are being reworked today in order to find euclase lost before the discovery of the mineral.

KYANITE FROM QUILOMBO (CAPELINHA COUNTY)

The trip is made in one hour first by way of the Capelinha-Araçuai road for 3.5 km then by way of the winding Setubinha-Minas Novas jeep road on the top of a plateau near the 1,200 meters elevation for 30 km. It crosses the Rio Fanado 8 km from Capelinha. The workings called

Fig. 2. **Titanite crystals upon a matrix, the left crystal is 3 cm in length.**

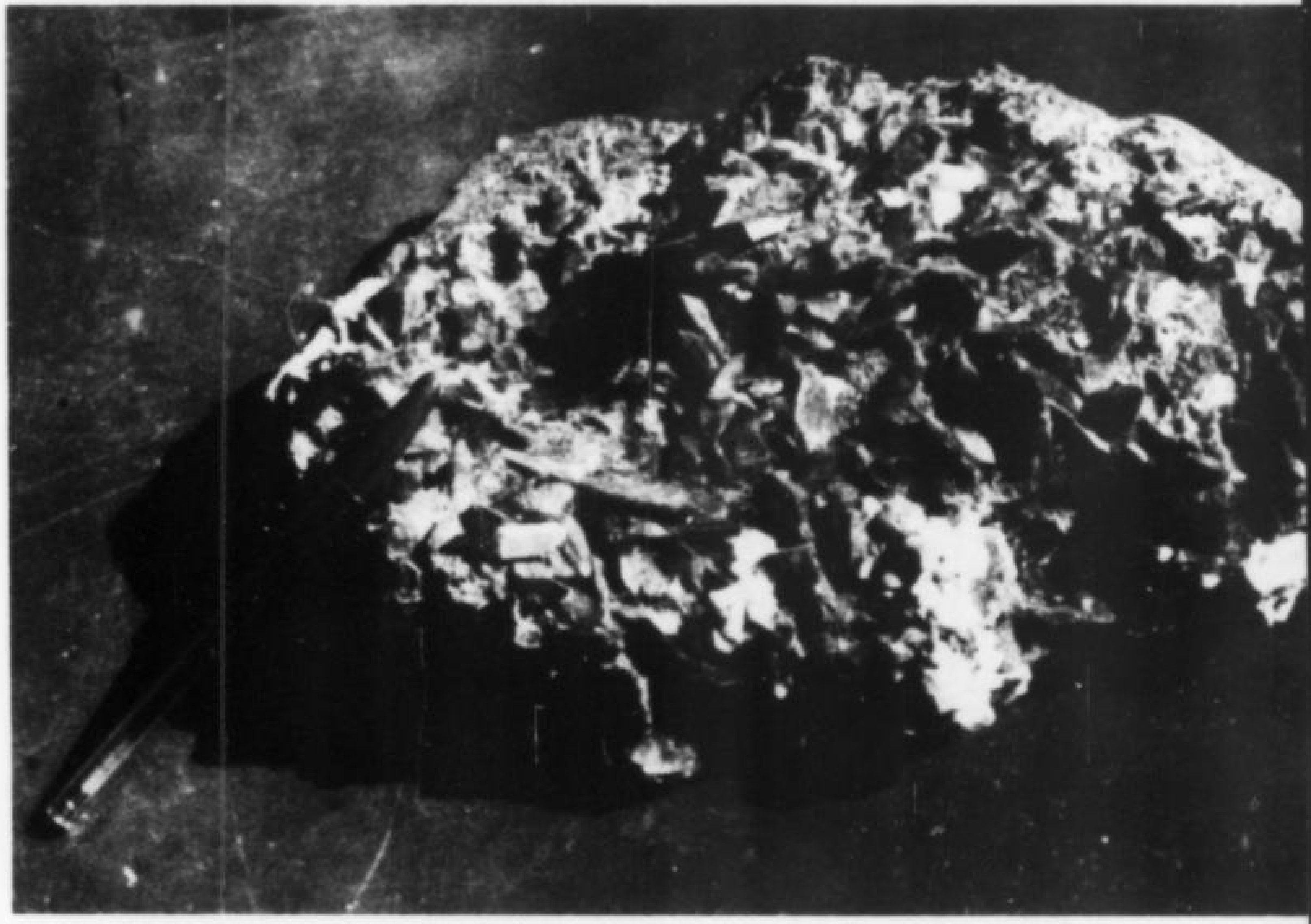

Fig. 3. **Large platy sample coated with titanite crystals** ***(by courtesy of Mr. M. P. Figuereido, 1969).***

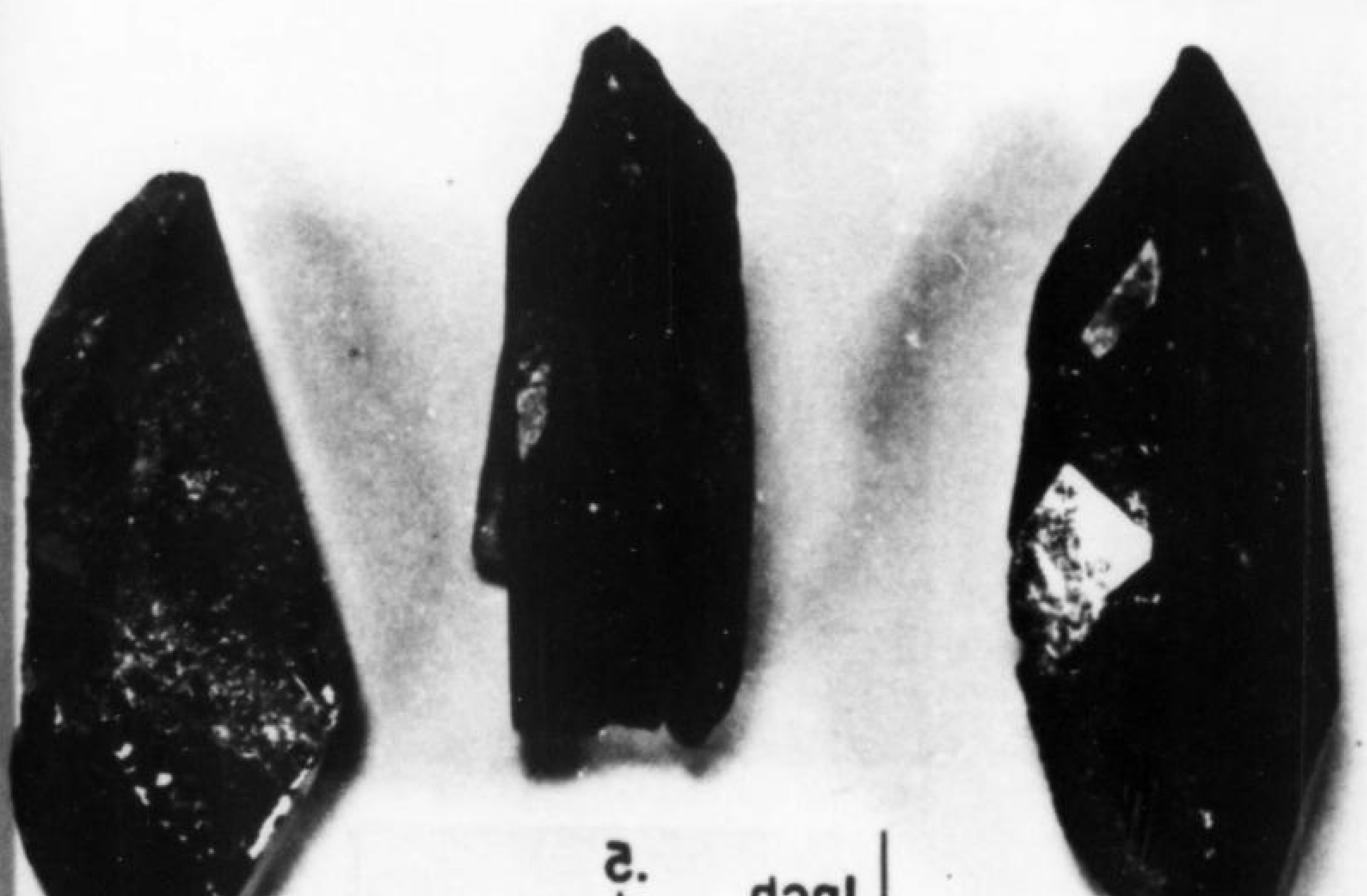

Fig. 4. **Titanite crystals single and twinned.**

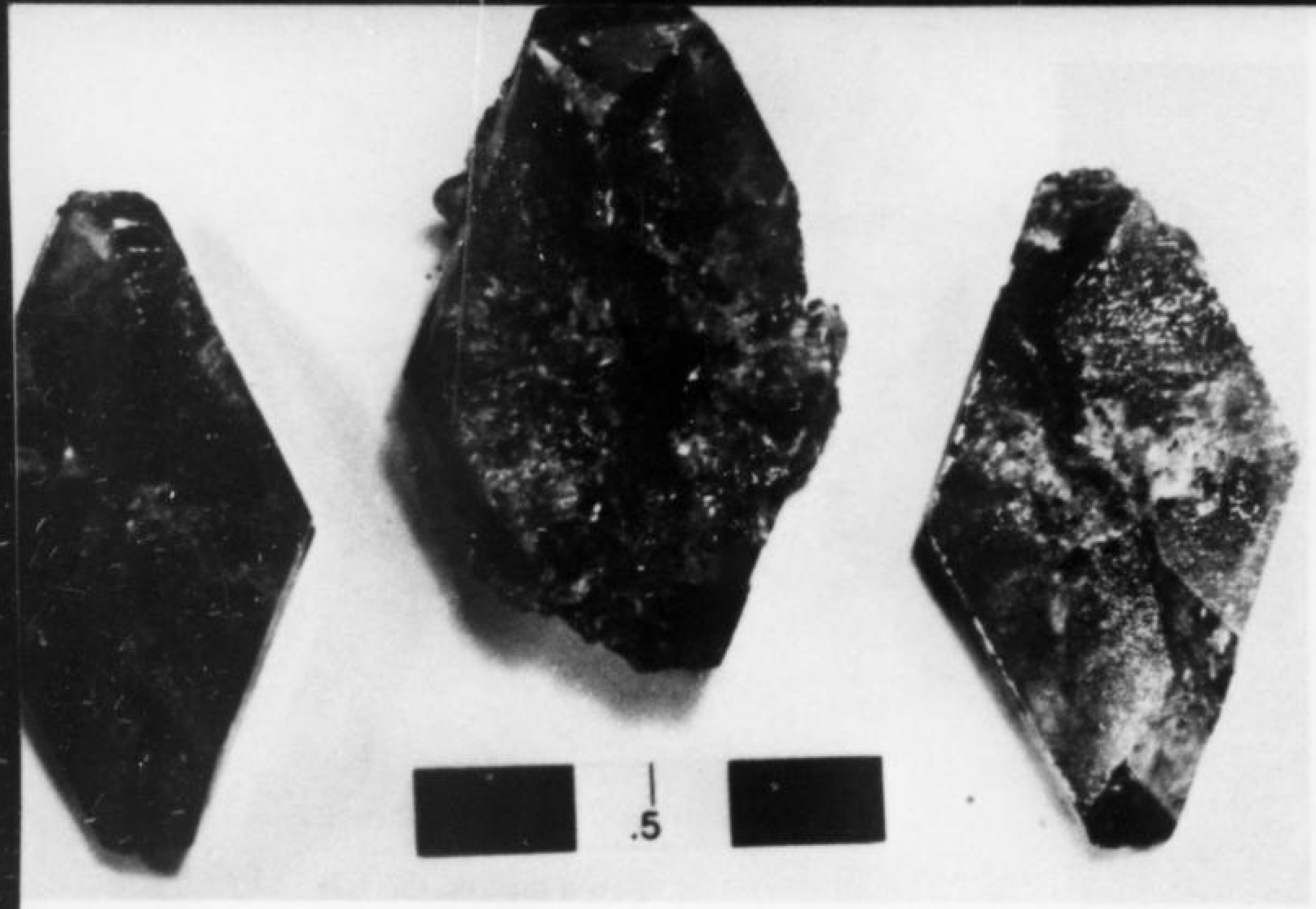

Fig. 5

Fig. 6

Fig. 5. **Twinned titanite crystals. *Fig. 6.* Albite group from a vug. *Fig. 7.* Close-up of an albite aggregate. The larger crystal is 2 cm in width. *Fig. 8.* A good quartz specimen from a parallel vein (*by courtesy of a garimpero*).**

Fig. 7

Fig. 8

Alagadiço are located ENE from Capelinha two hundred meters from the road, on the edge of the plateau.

The occurrence, near the contact of the basement with the Cretaceous sandstone, is formed by large boulders of milky quartz and kyanite embedded in the soil and resulting from the weathering of the underlaying mica schists. A rich kyanitic eluvium overlies the soil where the kyanite crystals are found. These are generally ferruginous and coated by manganese oxides giving typical specimens.

In the quartz boulders which surpass 1 m^3, kyanite occurs in large clusters and single crystals of a bluish white color reaching 30 cm in length.

The occurrence is handworked by garimperos. Collecting is easy but very irregular and sometimes worthless.

KYANITE FROM FAZENDA TABATINGA (SÃO JOSÉ DO JACURI COUNTY)

The prospect which belongs to Cesar Carvalho, is located to the NNE of São José do Jacuri hamlet. It is reached from the south by way of the Governador Valadares to São João Evangelista unpaved and winding road, for 142 km, then by the Santa Maria do Suaçui road for 16 km and finally by a very bad jeep road that leads in 19 km to São José. In the dry season the trip is made in 6 hours. From the north, access is also possible in 234 km from Teofilo Otoni by way of Malacacheta (138 km).

In this region, all roads are precarious and very often intransitable during the rainy season.

From São José do Jacuri a four-wheel vehicle road leads in 23 km to a fork at the Tabatinga Fazenda. To the left, it is possible to reach the Barro Preto prospect in 6 km at the top of a steep mountain. To the right, the Sete Voltas prospect is reached by way of a 6.5 km very bad road and a 20 minute walk going up a steep footpath. One hour and 45 minutes are necessary from any of these prospects to São José.

Barro Preto — In the bottom of a broad valley, graphitic kyanite schists are irregularly cut by quartz veins along a 500 m length, having a north-south direction. Small pits have been excavated in the larger veins. The soil is capped by eluvium of small blue and black colored kyanite crystals.

In the graphitic schists, the kyanite is always iron-grey to black and includes carbonaceous material. Crystals reach up to 20 cm in length and are very rare specimens.

On the contrary, in the quartz veins, kyanite is very pure, occurring in veinlets, clusters or unoriented crystal groups. They may be up to 50 cm in length in the vugs. Some samples are translucent to transparent with a green core and a blue periphery and are suitable for lapidary purposes (Fig. 11).

Fig. 9

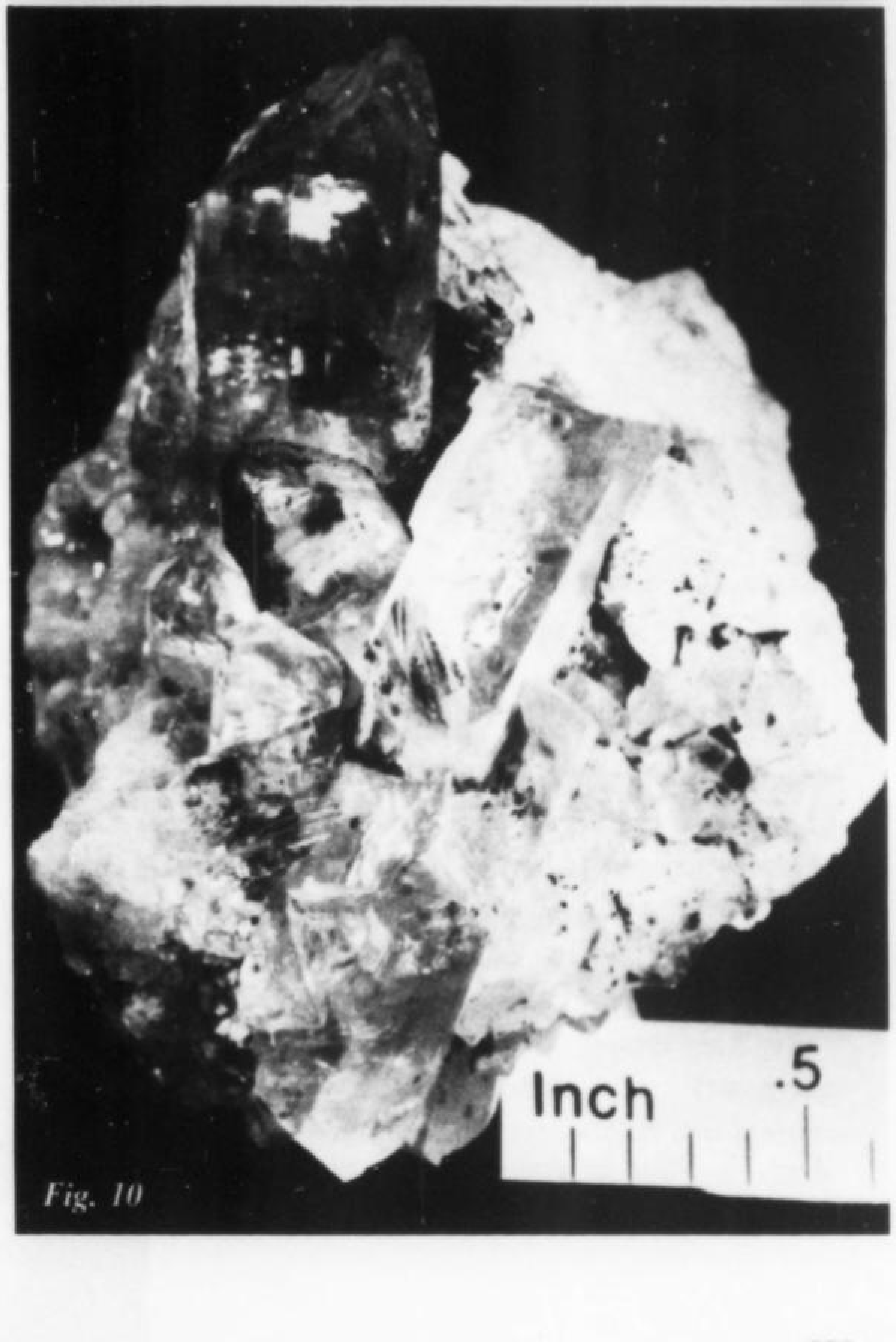

Fig. 10

Fig. 9. **Transparent euclase crystal.** ***Fig. 10.*** **Euclase crystals upon a matrix.**

The workings are today stopped and partially flooded, but large excellent samples may yet be recovered from the dumps.

Sete Voltas — This prospect, to the SW of the preceeding one, is on a 2 m wide quartz vein running NNE-SSW with a 70 °W dip. Large crystals of blue kyanite are irregularly scattered in the quartz.

The Sete Voltas and Barro Preto prospects are situated in the contact-metamorphic zone of an intrusive granite which penetrates a metamorphic complex.

STAUROLITE FROM FAZENDA GRAMIAIS (RUBILITA COUNTY).

The prospect lies to the NW of the little Rubilita hamlet. It may be reached from Salinas in the north in 33 km by way of a good unpaved road or by the south from Araçuai by way of Coronal Murta in 80 km on a precarious and winding jeep road in approximately three hours.

From Rubilita a four-wheel vehicle road, passable only in the dry periods, crosses the Rio Salinas and runs to Aparecida, for 6.5 km, then turns in the direction of Cachoeira and reaches the Fazenda Gramiais in 11 km. This farm is located on the left side of the Côrrego do Mangue which is crossed before arriving at the farm. A 15 minute walk on a footpath leads to the prospect. It looks down on the west of a little creek, which is a northern tributary of the Côrrego do Mangue, which in turn flows into the Rio Salinas.

The occurrence is a 2 m thick biotite schist layer with staurolite, running EW and dipping 50 °S (Fig. 12). This layer is embedded in the same biotite schist, however, without staurolite.

Many crystals are scattered upon the soil, but they are very fractured. A little hardworked pit produced approximately 800 kg of selected crystals before stopping for lack of market.

In the biotite schist, crystals of staurolite are irregularly scattered, and sometimes associated with little needles of grey and bluish kyanite.

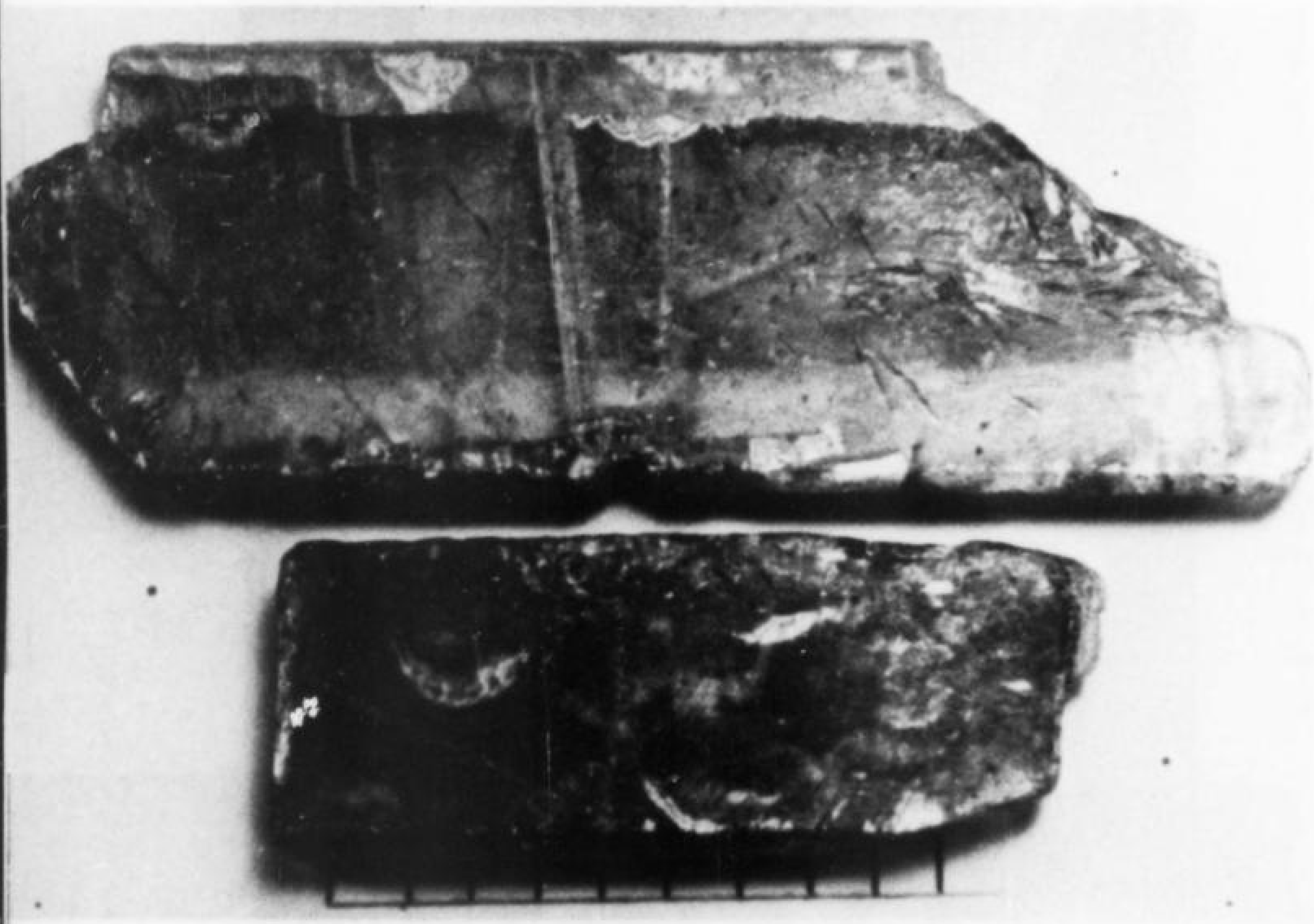

***Fig. 11.* Pieces of gem kyanite. Barro Preto prospect.**

***Fig. 12.* View of the staurolite biotite schist occurrence. Nylon tip pencil is 13 cm in length.**

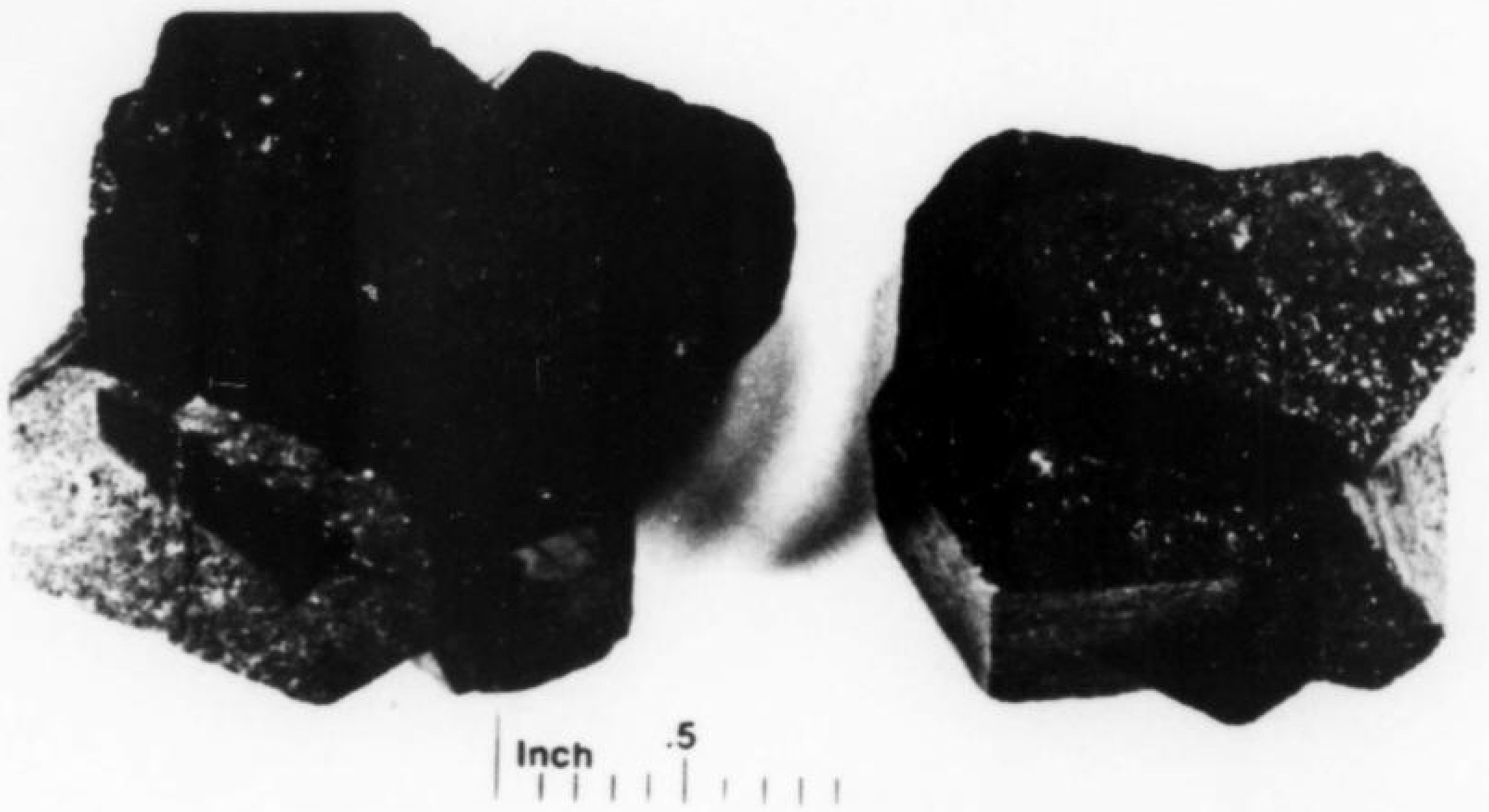

Fig. 13. **Twinned staurolite crystals.**

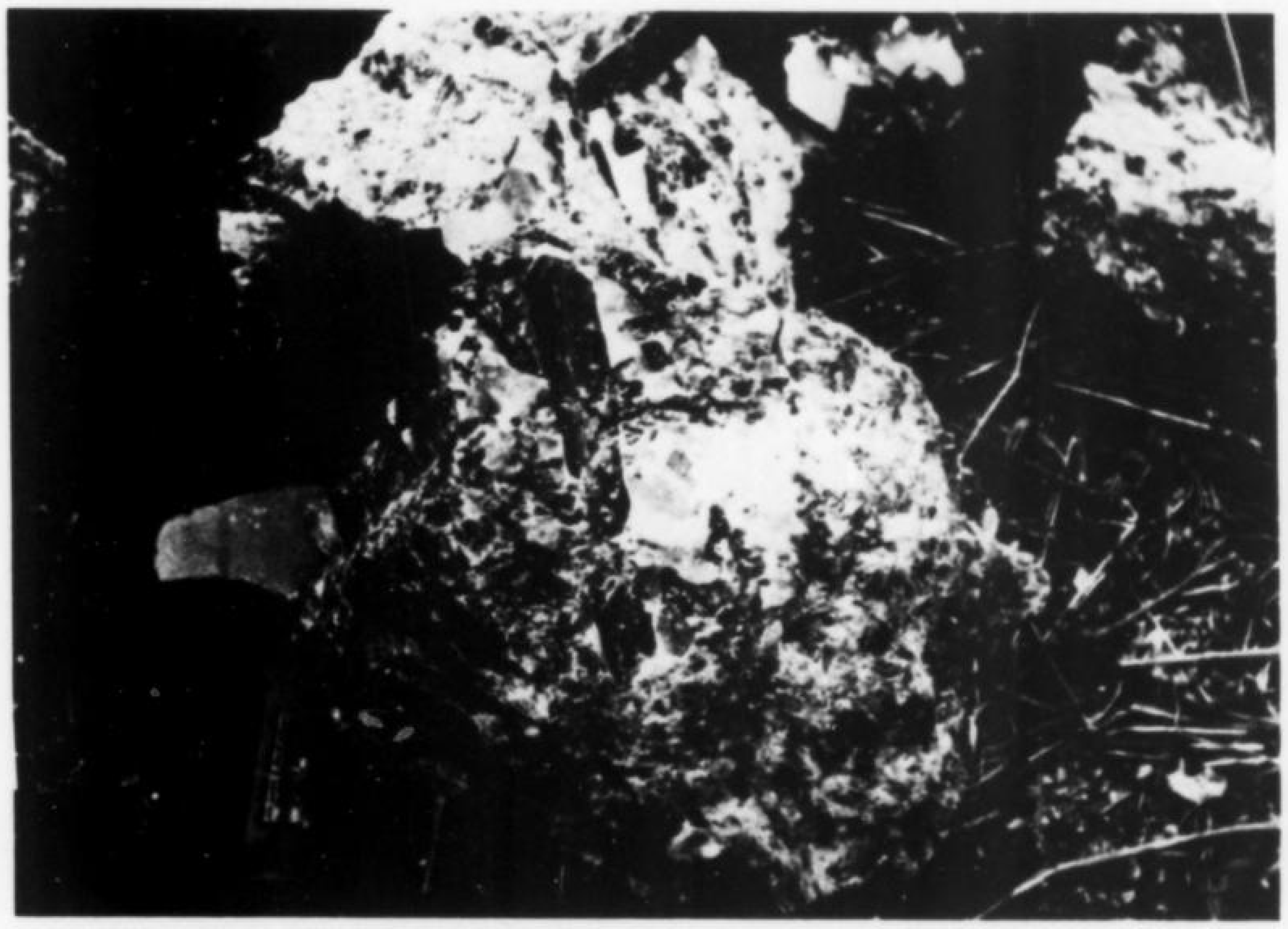

Fig. 14. **Large fractured diopside crystal from the dumps.**

The staurolite crystals are very good, resinous brown, always with sharp edges (Fig. 13) and with a length reaching up to 8 cm. They are single, twinned or in aggregates. Single crystals have a lozenge section or 6 vertical faces having only the forms $m\{110\}$, $b\{100\}$ and $c\{001\}$. Twinning is always at 60 ° following the (232) plane. They are either a complete twin or made up of a whole crystal and half of another. Aggregates result from the assemblage of various twins. It is also possible to observe double twinning with two half skew symmetric crystals. Ninety degree twinning was never observed in the collected material.

Mr. José Miranda in Rubilita possesses a stock of good crystals to sell.

DIOPSIDE FROM SETUBA (MALACACHETA COUNTY).

This prospect is located in the Benedito Honório Fazenda, to the NW of Malacacheta. It lies in the bed of a small creek, the Côrrego Setuba, where some pits were opened. Access is easy for 15 km by car from Malacacheta by way of the Setubinha unpaved road which climbs a high mountain. From the place where one must leave the car, a footpath climbs up the Côrrego Setuba and reaches, after a 20 minute walk, the prospect in a small forest. Local jeep roads are precarious and intransitable during the rainy periods.

The occurrence is interbedded in highly weathered schists cut by numerous quartz veins. It is a pyroxenite lens running EW, 8 m in width and outcropping approximately on a 25 m length. The northern wallrock dips 60 °N.

In the outcrop the pyroxenite is compact or leached into a spongy quartz mass with limonite boxworks. In depth, it is massive with large grey or greenish diopside crystals reaching up to 30 cm by 8 cm, however, always fractured and worthless. It passes irregularly to large dark spots having lenses and veins of shining green diopside associated with transparent or milky quartz and some sulfides (pyrite, pyrrhotite and chalcopyrite). The green diopside is generally in elongated crystals to 20 centimeters in length, and a few centimeters wide. They are rarely short. The color is deep green with small gem fragments

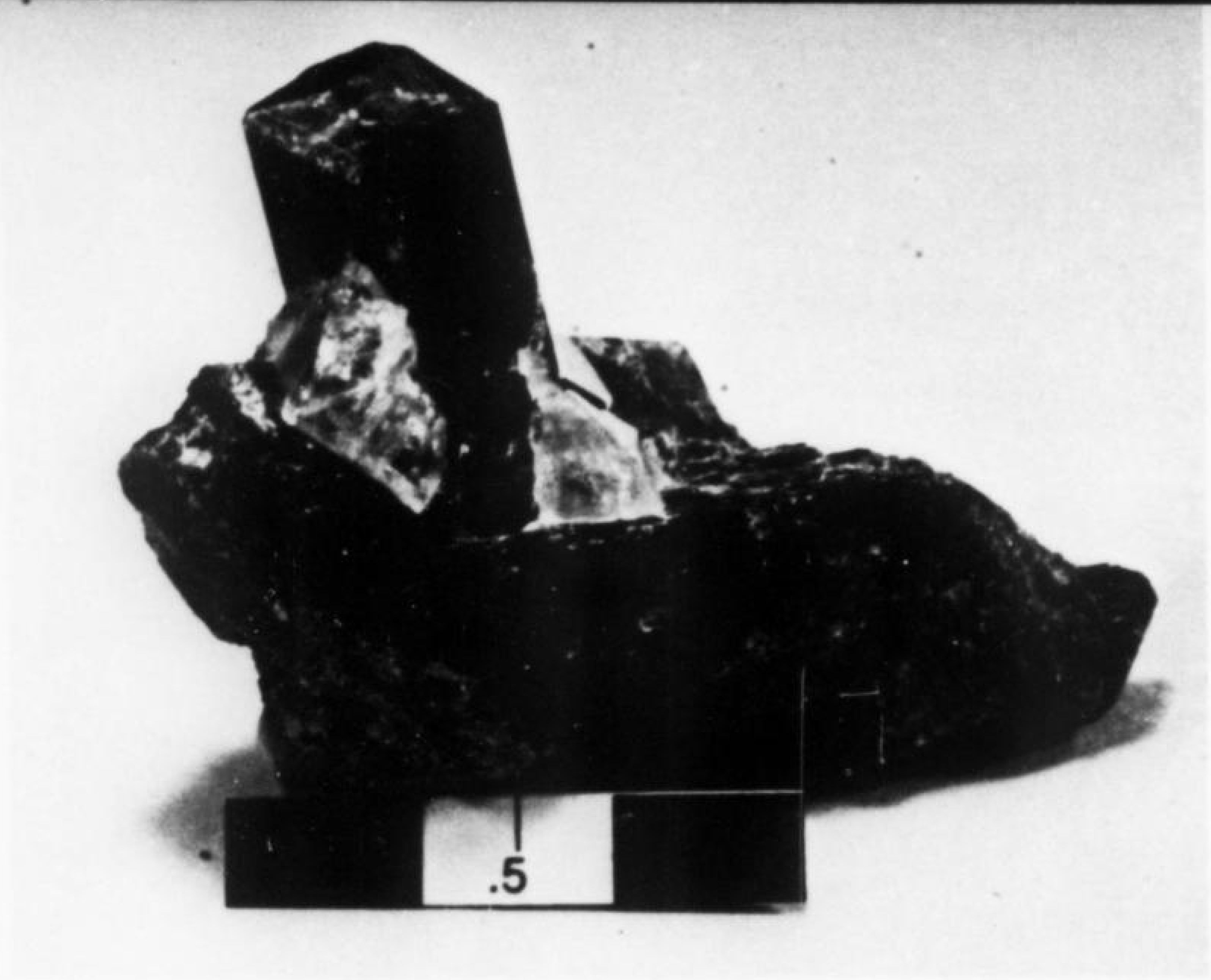

***Fig. 15.* Terminated crystal of diopside upon quartz. Scale is 3 cm in length.**

irregularly scattered in the translucent to transparent mass. Crystals are single, unoriented in the quartz (Fig. 14), in parallel groups or more rarely in clusters.

The faces are always shining, sometimes with growth figures. Fracture is more dull, granular or nearly platy. A marked parting is always present forming a large angle with the vertical axis: 74° (*c/a* or 001∧100). Faces parallel to this parting terminate many crystals. The pieces suitable for lapping are in tablets between the parting planes which are more yellowish and dull.

The color is generally bottle green or darker with sometimes a touch of yellow. The latter color is nearer to that of olivine or tourmaline than emerald. The cut gems are always little and generally smaller than 10 carats and are locally known as "esmeraldita".

The properties of the gem diopside are:

Specific gravity: 3.33 Hardness 5.5

Biaxal positive with $n\alpha = 1.674$ $n\gamma = 1.705$, birefringence: 0.031

No fluorescence in U.V. light and no reaction to the Chelsea filter.

An X-ray fluorescence analysis demonstrated the abundance of iron and the presence of 0.3% Cr.

Finally an x-ray diffraction study shows:

1. The importance of: first and third order reflections corresponding to the clinopinacoidal {010} form, with respective intensities of 15 and 100; third order reflection corresponding to the orthopinacoidal {100} form, intensity 55.

2. The importance of the second order reflection, the basal parting plane {001}, intensity 85.

In summary, the diopside from Malacacheta is ferruginous and contains a little chromium. It produces small colored gems and good, but not abundant, collection specimens (Fig. 15). The workings are stopped today but many good samples are easily recoverable from the dumps.

ACKNOWLEDGMENTS — Many thanks to our colleague Dr. J. D. Cadman who kindly revised the English manuscript.

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When not noted the scale of the photographs is one inch long. Specimens, with exception of 3 and 8, and all photos by J. P. Cassedanne.

What's New in Minerals?

John S. White, Jr.

THE GREAT SMOKIES

In late Winter or early Spring the first of the new smoky quartz specimens made an appearance. Very quickly the word spread that the Hot Springs area of Arkansas has produced a large number of very fine, sharp, dark-smoky quartz crystals in groups and as individuals. Quite remarkable for an area that is renowned for its abundant colorless and minor milky quartz. Why, suddenly, do we have a flood of smokys? Naturally, suspicions immediately arise in the minds of most collectors and the question is asked "Have they been irradiated?" I've had the same suspicions and have inquired of many people as to whether or not the color is natural. Sadly, no definitive answer is forthcoming. Several mineral dealers state without hesitation that the crystals are treated. One said it is all done in New Jersey in a cyclotron large enough to drive a truck-full of crystals into. Other dealers feel that the color is probably natural. One informant told me that an initial pocket of some 500 specimens of natural smoky quartz was found. Just after this material from a different source, in much greater numbers, was mined and sent to New Jersey for irradiation. I am told that the two batches are distinctly different in appearance but I have seen none of the first type for comparison. To the credit of all of those I know who are selling this material in this country, they are not reluctant to admit to their customers that the color might be artificially induced. I qualified that statement because it has been reported that some *European* dealers are selling these Arkansas specimens as having come from Switzerland. How they could be thus misrepresented is a mystery because the Arkansas smoky quartz does not resemble any Swiss specimens that I have seen.

The best description of the new material is that it closely resembles a sealpoint Siamese cat. The tips are dark, almost black, and they grade into light smoky toward the base. The matrix is quartz and most is colorless, milky or very pale smoky. The crystals tend to show pronounced zoning parallel to rhombohedral faces. They come in a wide range of sizes and, as mentioned above, excellent individual crystals are available. Very large groups are reported but I haven't seen any larger than about 6 x 5 x 5 inches. The habits are essentially what we've come to associate with Hot Springs quartz crystals.

The locality, by the way, is given as Mt. Ida which, if true, is in the middle of a National Forest in the Ouachita Mountains and it would seem that mining there might be illegal.

The nature of these phenomenal specimens has led to other questions, some of which are hard to answer. For example, does the color fade? So far, I don't know. A collector told me recently that his specimen has faded but without some qualitative measure I would be reluctant to make a judgement. Another question being asked is "Since they may be artificially colored, should I buy a specimen for my collection?" Well, the obvious answer is that each collector will have to decide individually. There is no avoiding the fact that these are beautiful specimens, regardless of their history. Should the color fade, they would still be attractive. Which brings up an interesting point. If this is natural smoky quartz, why have the specimens been selling for less than we have been accustomed to paying for the colorless ones? Let's face it, the prices on these specimens have been as attractive as the specimens themselves. Another question—"where is all of this material coming from?" There has not, in recent years, been a great surplus of colorless quartz. Now we not only have thousands of outstanding quartz specimens, but they are smoky besides! There is one other feature that one sees often with this material. There are strange little damage pits irregularly positioned on the crystals, perhaps one or two to a specimen. We are all familiar with damaged quartz crystals but the damage is usually found along edges and at the points of the terminations. These pits are *within* faces, not along their edges. It is what one might expect if crystals were loaded without padding into a large basket for carrying into a chamber to be exposed to radiation. Intriguing. Wonder if we'll ever know for sure.

NEW RAY COPPERS

A short note from Wendell E. Wilson...

Possibly the finest copper specimens ever found in Arizona have come recently from the famous Ray mine, Pinal County. Although the discoverers remain anonymous, some details have filtered out. Sometime around March, 1974, the specimens were encountered suspended in clay in a pocket "about the size of an icebox". The pocket was in solid rock and there were no indications of copper elsewhere in the immediate area. The best specimens have single crystals of copper 5 inches to 5-1/2 inches long and 1 inch wide. A few are in large, spectacular groups, an occasional specimen is on a breccia fragment matrix, and there are many free, single, "floater" crystals. Thin layers

Fig. 1

W.E.W.

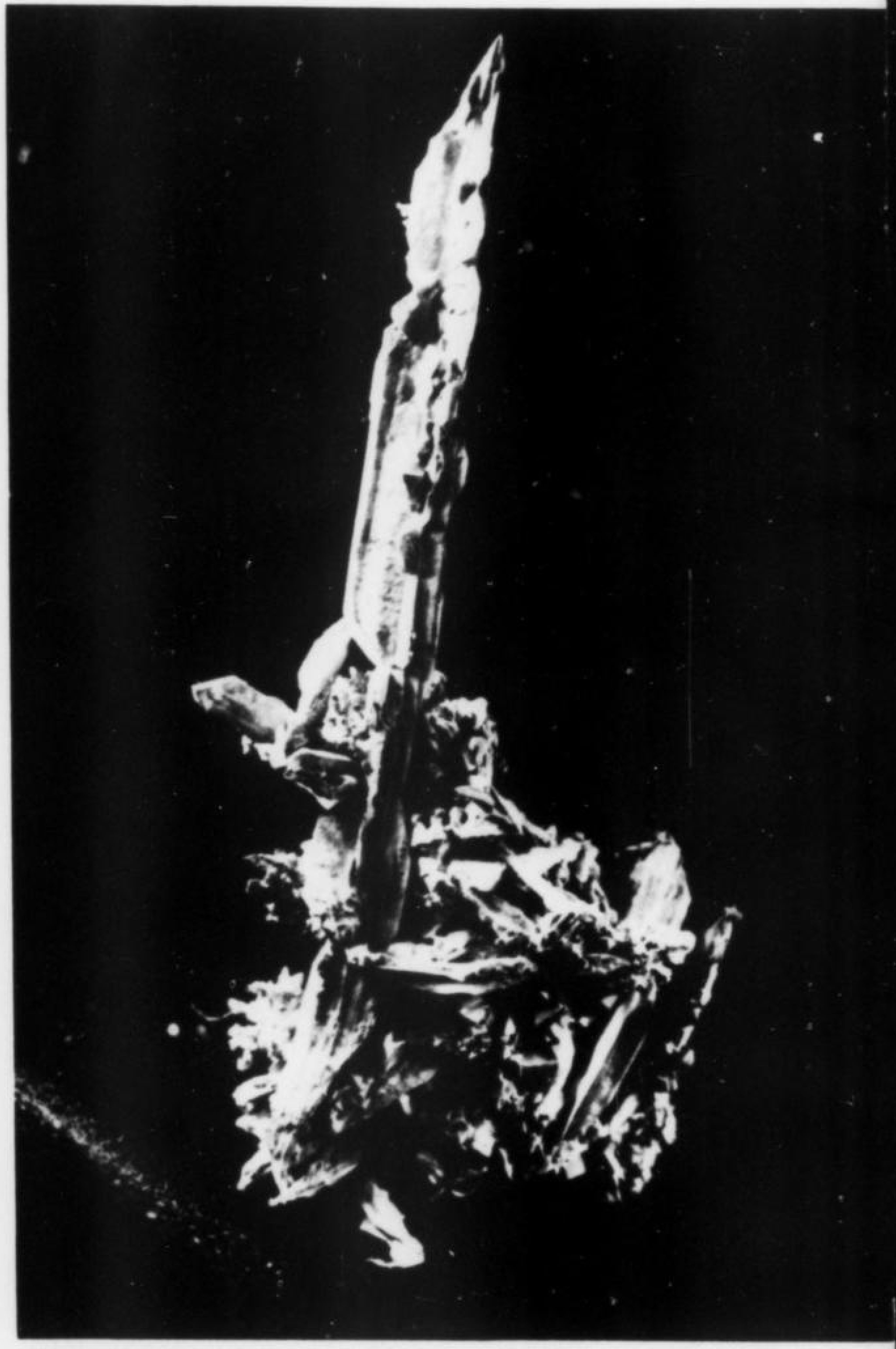

Fig. 4.

W.E.W.

W.E.W.

Fig. 2

W.E.W.

Fig. 3.

Figs. 1 and 2. **Single crystal of copper from the Ray mine, Pinal Co., Arizona, donated to the Smithsonian by Wayne Thompson.** ***Fig. 3.*** **Single crystal of copper, Ray mine. Wilson collection. Length: 1-1/2 inches.** ***Fig. 4.*** **Group of copper crystals from the Ray mine. John Tetrick collection. The large crystal is 3 inches long.**

of dark red cuprite and pale green malachite partially coat some specimens. The grapevine has it that Robert Jones (Scottsdale) and Wayne Thompson (Paradise Valley) have obtained some of the best cabinet pieces; Wayne Thompson and Mrs. Brooks Davis (Tucson) have specimens for sale at this writing, although there is no assurance that they will by press time.

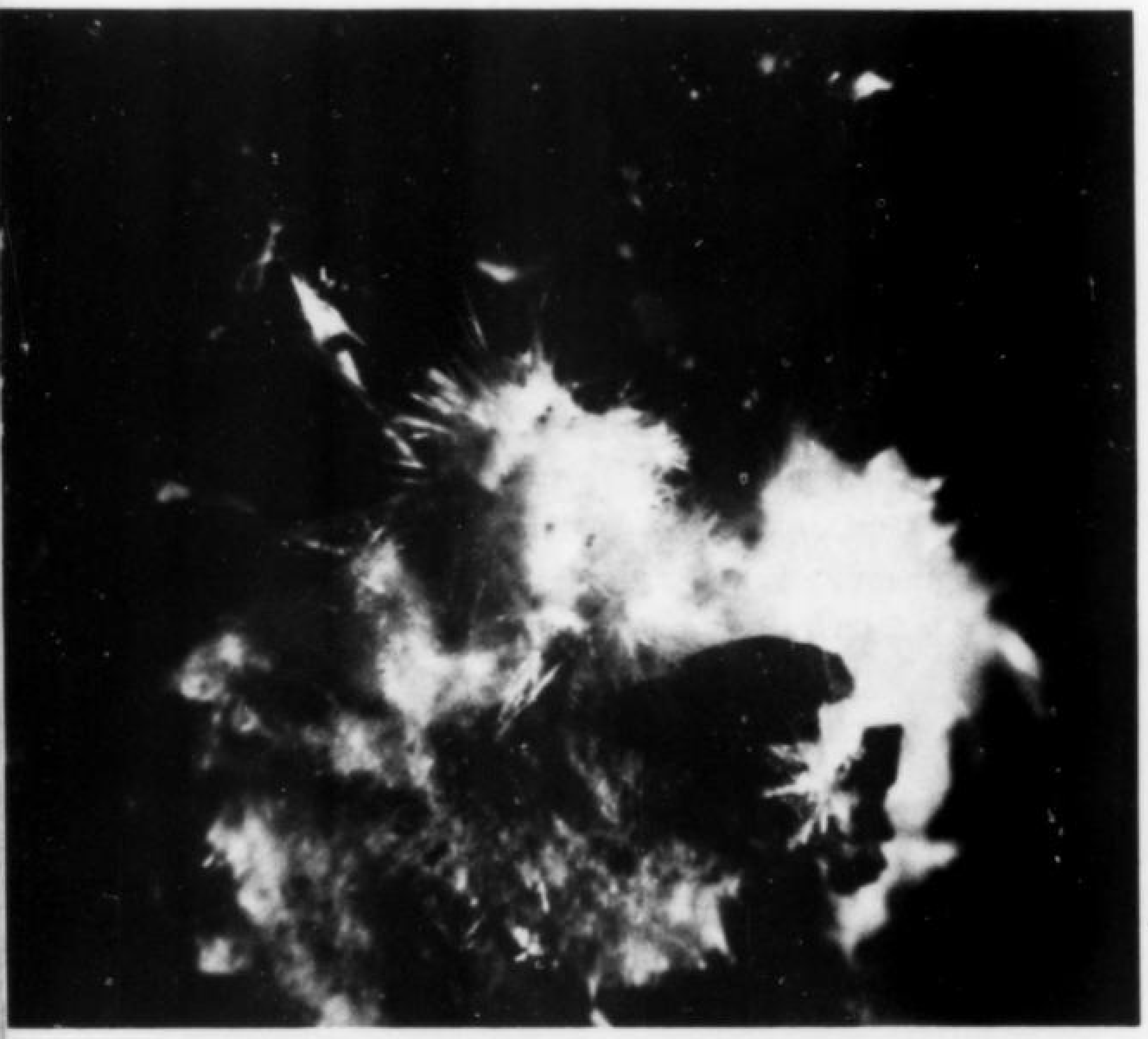

***Fig. 5.* Dundasite—Juanita tunnel, New Mexico.**

DUNDASITE FROM NEW MEXICO

The following note is from the Marble family of Holden, Massachusetts—Roger, Peg and Bill...

A new occurrence of dundasite, believed to be the first reported in the United States, is at the Juanita tunnel of the South Juanita mine. The Juanita tunnel, south of Kelly Gulch at the former town of Kelly, New Mexico, is within a 1/2 mile of the mainhead of the Kelly mine of Smithsonite fame. The nearest town of any size is Magdalena in Socorro County.

The original material, found by Bill Marble, was obtained some distance inside the tunnel but may also be found on the dump outside the tunnel. Dundasite occurs here in silky, very small (maximum 2 mm) spherical aggregates of radiating acicular crystals (see photo by Julius Weber). The color is usually snow-white but some dundasite has been found tinted a very light blue. The dundasite occurs in cavities on and in brown cellular limonite in association with allophane and azurite.

The x-ray powder diffraction data on the New Mexico dundasite agree fairly well with the type material from Tasmania, JCPDS Card 21-936.

THE ONGANJA MINE

Some follow-up notes have been received about the minerals of the Onganja mine (see volume 5, #2, p. 78).

From Richard A Kosnar...

There were some of the finest crystals of primary malachite found there, only a few, but superb. I kept a suite of things for my own collection, but I sold the best malachite. I have a fine calcite with chalcotrichite (bright) inclusions on copper crystals. Also a pale green apatite on calcite crystals with copper inclusions. A number of fine associations were found but never saw the light of day.

From Franz Lammer (Austria)...

From the Onganja mine, South West Africa, I have a further associated mineral. The sample is about 6 x 12 cm and consists mainly of a reddish dolomite. The face-side is covered with small black-blue plates of covellite and very small crystals of red dolomite and imbedded are many apatites, the largest 1 to 1.5 cm, of a light green color. From this occurrence has also come numerous native copper specimens. A large part is corroded and of dark color, but there are all types of copper crystals, wire and moss, and of a fresh copper color. Some comes out of massive cuprite and some is included in calcite. The number of native copper crystals is more than ten thousand.

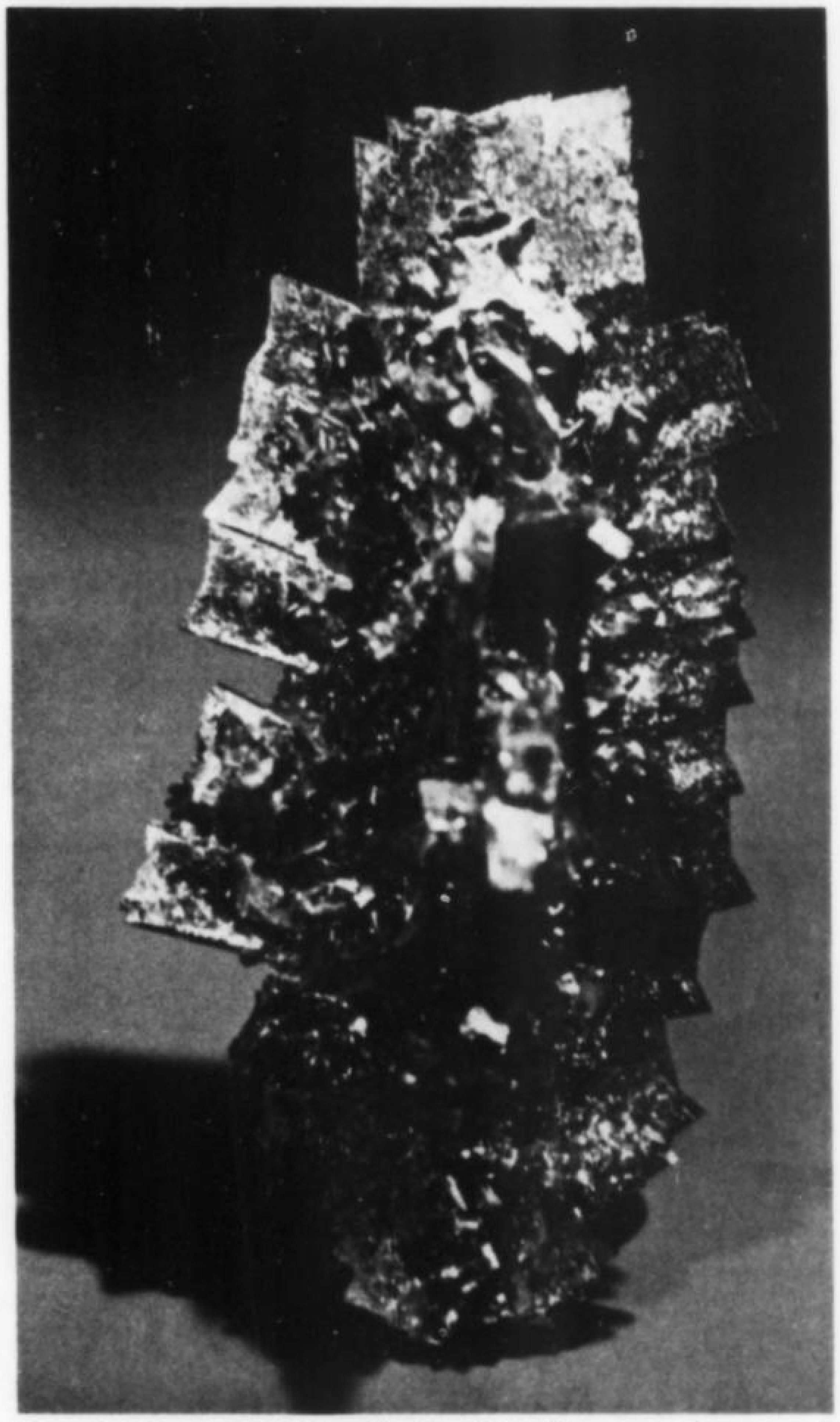

Fig. 6.* Marcasite—Czechoslovakia. The crystal group is 9 cm long by 4.5 cm wide.*Smithsonian specimen.

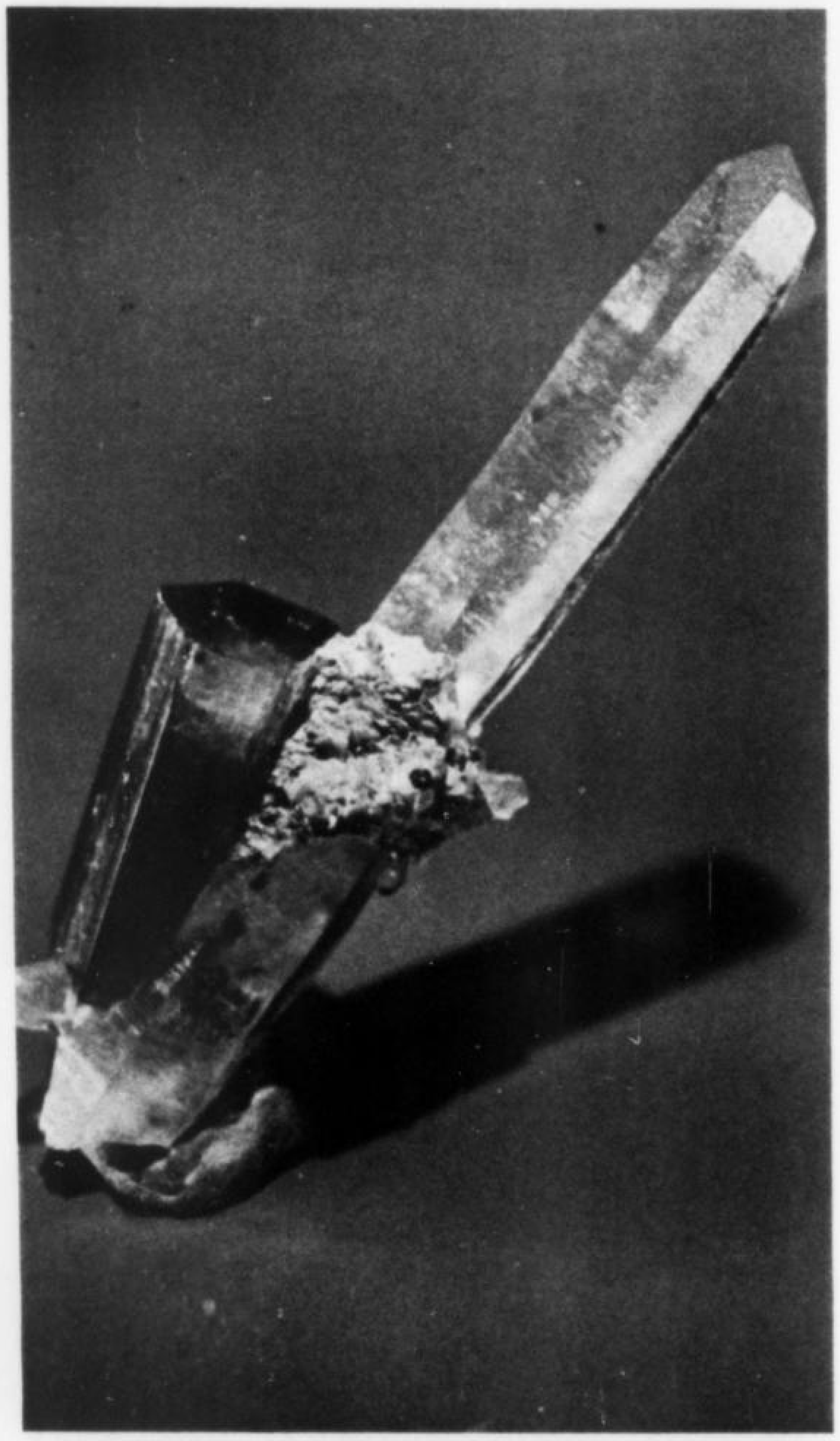

Fig. 7. **Apatite with quartz from Panasqueira, Portugal. The apatite is lavender and the quartz crystal is 10 cm long.** ***Smithsonian specimen.***

CZECHOSLOVAKIAN MARCASITE

A limited (?) number of very fine marcasites from Vintirov, Bohemia, Czechoslovakia, has recently appeared in this country. They occur in lovely sculptural groups such as the one illustrated in the accompanying photograph. This specimen is 9 cm high by 4.5 cm wide.

Vintirov is a relatively new brown coal open pit operation in northwestern Bohemia, in the Oligocene-Miocene sediments of the North Bohemian brown coal basin.

BOURNONITE, NOT SELIGMANNITE

From Pete Dunn comes the following note...

Fine bournonite specimens, both micromount and cabinet size, have been recovered in recent years from Noche Buena, Zacatecas, Mexico.

This occurrence of purported bournonite, $PbCuSbS_3$, usually intimately associated with arsenopyrite and pyrite, led to the suspicion that the crystals might instead be seligmannite ($PbCuAsS_3$), the arsenic analogue of bournonite. Seligmannite is by far the less common of the two species and is found as crystal specimens at few localities; the most notable being the Binnetal, Valais, Switzerland.

Crystals of bournonite in the Smithsonian collections, two from Noche Buena and one from the Zancudo mine, near Medellin, Antioquia, Colombia (NMNH53234), all associated with arsenopyrite, were x-rayed and their densities determined. They were submitted to electron microprobe partial analysis (for arsenic and antimony content).

All three specimens had densities from 5.72 to 5.77 and an antimony content near 23%. This antimony content is consistent with that noted in prior bournonite analyses. The associated arsenopyrite was also x-rayed to ascertain that it was not gudmundite, the antimony analogue of arsenopyrite. It is arsenopyrite.

Hence the Noche Buena crystals are indeed bournonite, even though they are found intimately associated with an arsenic mineral.

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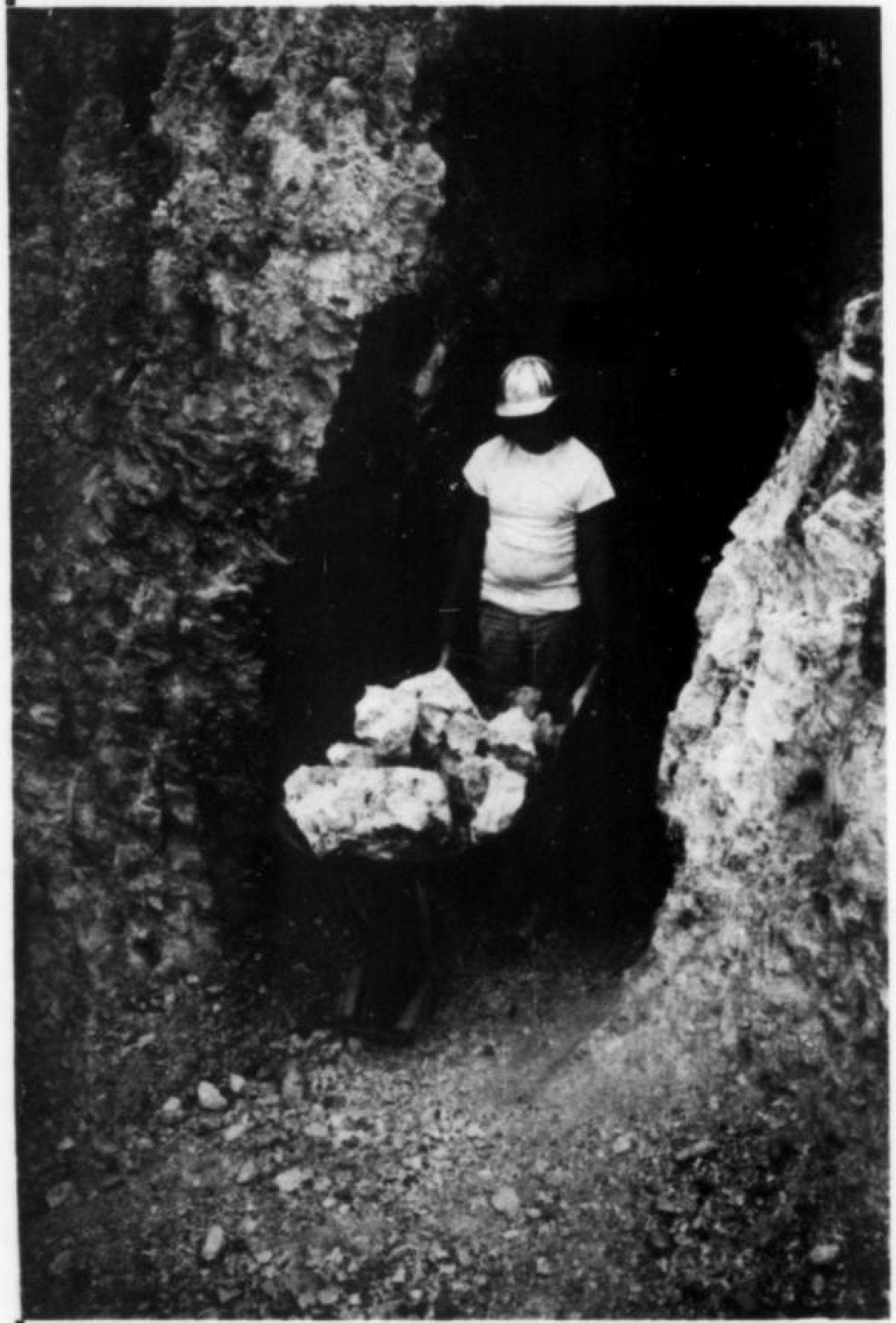

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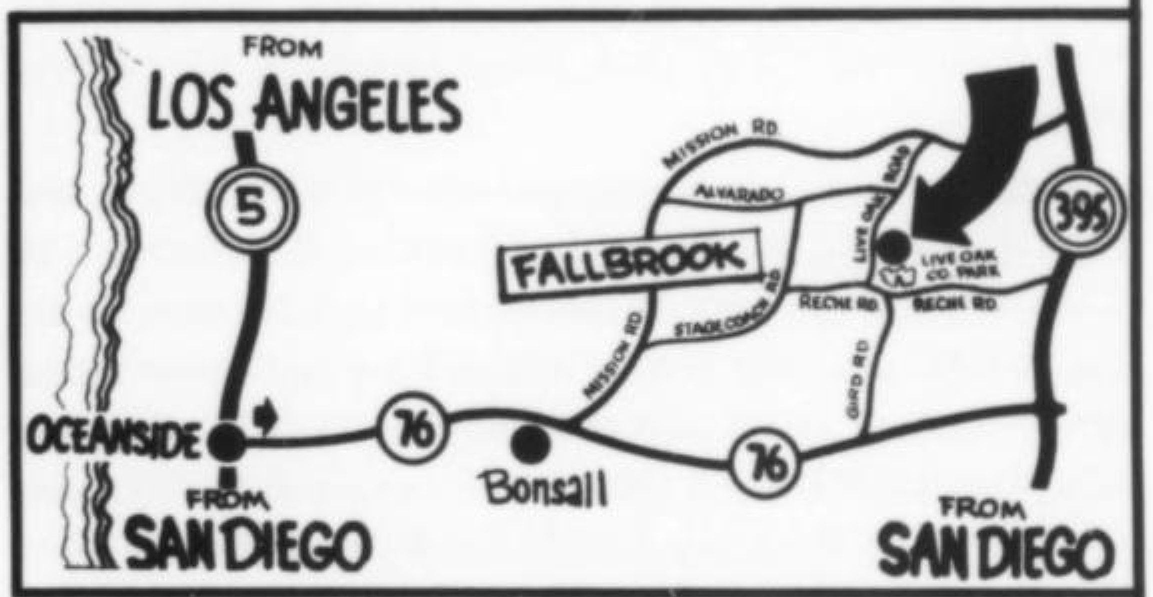

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Yedlin on Micromounting

The art of micromounting grows and grows, and is taking hold throughout the nation, in Canada, in Germany, England, Switzerland and elsewhere. Following the lead of the Baltimore Mineral Society's micromount symposium, begun some 16 years ago, the Pacific Micromount Society, the Canadian Micro Mineral Association, and the Micro Mineralogists of the District of Columbia carried on with annual sessions. Many smaller groups, no less enthusiastic and knowledgeable, have come into being. Today the directors of the country's convention shows have set aside a portion of their programs for the exclusive use of the collectors of the small but perfect minerals. Exhibits and competitions are included, as well as demonstrations and lectures.

The Earth Science Club of northern Illinois, under the leadership of Horace Greene, an old Baltimorean, produced a slide program for the Midwest Federation of Mineralogical and Geological Societies. This consists of color slides and narration, available for use by member clubs, showing history, techniques, and superb specimens of finished micromounts. We've seen the result—quite fabulous—and its presentation should grace the programs of every organization whose members are truly interested in minerals. The Eastern Federation had such a show, created by the Baltimore Society, and we urge all other federations to create their own, using, as a basis, the existing programs.

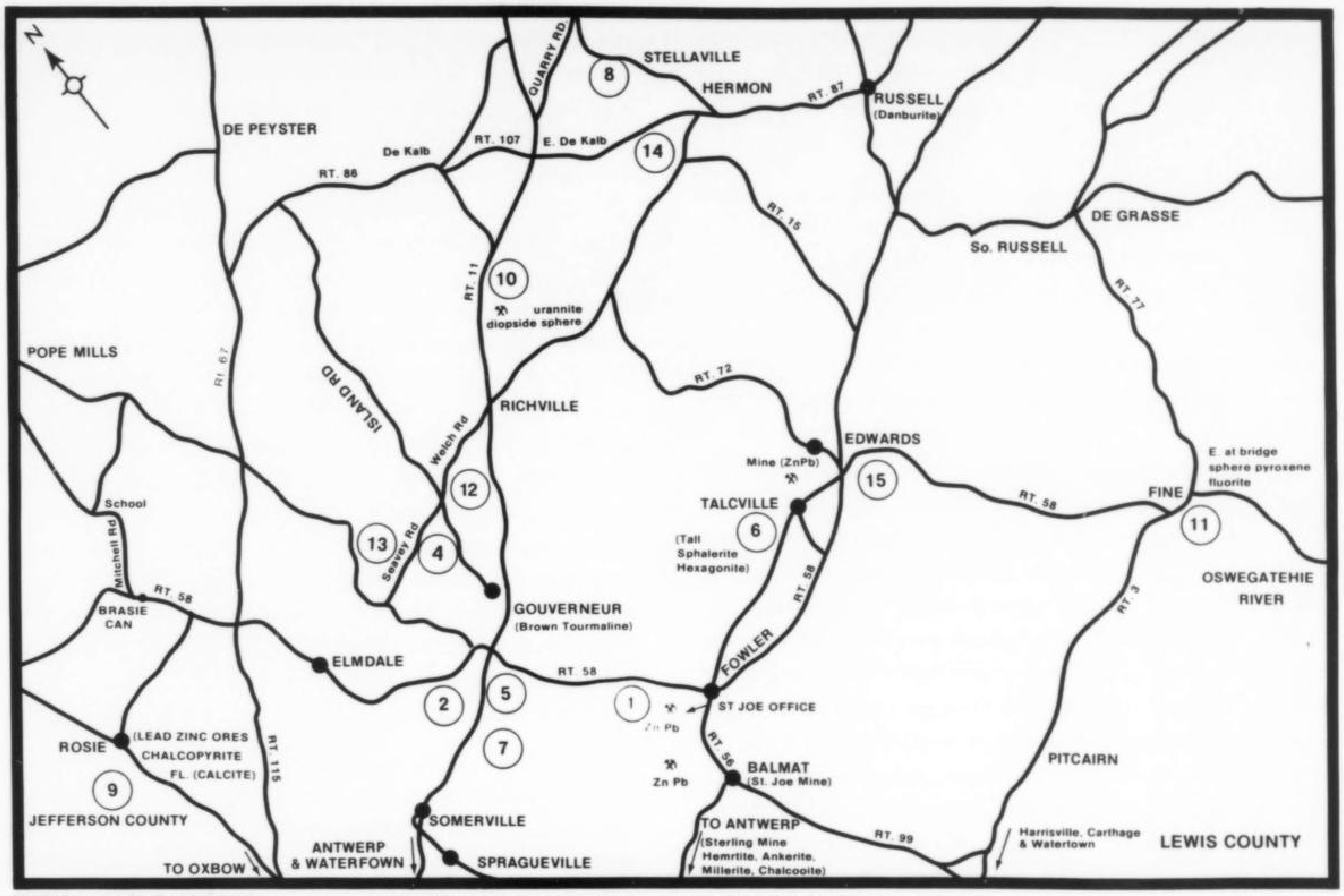
We'd been going over some old records of localities, and turned up a map put out by the Chamber of Commerce of Gouverneur, New York, in the heart of St. Lawrence County. This area is historically famous for fine minerals, and no museum of note lacks specimens from it. In 1937 we attended a meeting of the State Geological Society, accompanied by Dr. F. H. Pough, Dr. F. D. Zeman and Dr. Winifred Goldring, state paleontologist. Our meanderings first took us to the Barton garnet mine at North Creek, New York, where sections of rough almandine up to 3 feet in diameter pock-marked the quarry walls. The material is used as an abrasive, even though synthetics abound, for the fragmentation of the garnet is such that it abrades with constant sharp edges, and since sharp edges usually are harder than flat surfaces of the same material, why the desirability is evident. For the record we did not collect micromounts at that time. Our beginnings were in 1946, when we acquired a folding microscope from Hugh Ford in New York.

From North Creek we drove northwestward to St. Lawrence University in Canton, the association meeting place, and thence throughout the area, collecting at many places indicated on the map herewith, quite easily and successfully.

Now that was 37 years ago but recent reports indicate that St. Lawrence County is yet prolific, with recent road cuts and old workings. This merits a mineralogical collecting vacation there, for the minerals are there and the literature abounds in references. Several collectors in recent years have attacked the old locality descriptions as a research project. They've gone to the tax office, taken the names of old landowners as a starter, together with the dates the material was described, and worked forward from the records to present ownership. The danburites from Russell were so refound. The researching of all this material would make a fine master's project, updating the literature and exposing present day collectors to the sites of great finds of the past.

A note from Russ MacFall, author and recent micromount collector who discusses the American Federation show at Lincoln, Nebraska, and says, in part: "Micromounting was well represented.......with three symposiums, and they were all well attended and professionally led. It is growing in this part of the country, thanks to your articles (sic) and a greater interest in minerals in an area that is not well endowed with mineral collecting localities!"

Dr. David H. Garske, 1604 38th Street, Rapid City, South Dakota 57001, has sent several lists of minerals for sale, including micromounts. Too few dealers take the time and trouble to prepare and offer this type of specimen for sale, and the addition of one who will is most welcome. Most dealers can supply hand and cabinet types with little difficulty, but to furnish good micromount material requires an awareness of crystal form and perfection, associations, esthetics, training and skill. Garske has these. He has a doctorate in mineralogy, has collected since childhood, and is prepared to share his aptitudes with others. A glance at one list before us: Twenty-six South Dakota phosphates, including collinsite, hureaulite, jahnsite, robertsite, segelerite, leucophosphite, kryzhanovskite, wolfeite and others. Most are in minute crystals; some are not. His descriptions advise. We suggest you send for his lists, including, as a courtesy, 2 stamps for postage.



MAP BY HELENE HOWARD

SOUTHWESTERN ST. LAWRENCE COUNTY, NEW YORK MINERAL LOCALITIES

Issued by Gouverneur, New York, Chamber of Commerce. Map by Helene Howard, (amended).

Key to Map of Southwestern St. Lawrence County, New York

1. Route 58 roadcut at Popple Hill—(quartz, biotite, oligoclase).

2. Old Camp Boughner 1 mile out on Clinton Road—(garnet, serpentine, oligoclase).

3. Along Somerville to Spragueville Road—(hematite, dendrites, crystal growth).

4. Rock Island Road out—(barite, calcite).

5. Road cut on route 58 at Matoon Creek—(plastically deformed marble with clusters of black dike blocks).

6. Along Talcville Road, route 97—(talc, phlogopite, "hexagonite", zinc and lead ores).

7. William S. Sullivan marble. Quarry Road off route 11 just before leaving Gouverneur toward Somerville—(white and colored marbles, brown tourmaline).

8. Both sides of road just before Stellaville—(pyrite, muscovite, plagioclase).

9. Lead mines just before Rossie on route 30, Rossie-Oxbow Road—(galena, sphalerite, chalcopyrite, calcite, etc.).

10. McLear Quarry on Kents Corners Road. East of route 11, and visible from 11. DeKalb Junction. Turn East at creamery—(uraninite, actinolite, diopside, quartz, titanite).

11. Fine, New York. Bridge at Oswagatchie River. Intersection of Routes 3 and 58 at roadcuts—(titanite, fluorite, pyroxene, zircon, apatite, calcite and feldspars).

12. Jones farm on Welch Road. Turn right 4 miles north of Rock Island Road. Ask permission—(tremolite, scapolite, brown tourmaline).

13. Sullivan dolomite quarry. Turn west from Rock Island Road on Seavey Road.

14. Open pit 2-3/4 miles down Ore Bed Road on left—(pyrite, melanterite, etc.).

15. Road cut on new Route 58 just east of Edwards—(diopside and calcite crystals, phlogopite, graphite).

Additionally there are minerals available at the dumps of Edwards, Balmat and Fowler mines. Permission required. Russell is famous for danburite, and the Sterling mine, at Antwerp, has produced ankerite, hematite, chalcodite and some of the finest millerite specimens extant. Northeasterly, at Pierrepont (not shown, but see road maps and published literature) is world famous schorl.

The Rochester Mineral Company, Box 1675, Duxbury, Massachusetts 02332, has also sent a price list. If you are interested in Canadian specimens, from Mont St. Hilaire, Bancroft, Beaver Lake and the like, the list includes many such, in all sizes and quantities.

We have heretofore presented the dilemma of offering for identification a single minute crystal and making the following decision: To sacrifice the crystal and so be aware of what we once *had*, or, not to consume the specimen and not know what we *have*. To this Scylla and Charybdis of the mineral world there can be added a third horrible situation: To consume your only specimen and *not* know what you *had*. (As our devout grandmother used to say, "God forbid". To which we add, "Amen".)

Some notes: Pete Dunn, of the Smithsonian, in May, 1974: "The material from Rhode Island we've been calling danalite is, in fact, genthelvite. Danalite has a preponderance of iron over zinc in its chemical formula; genthelvite has zinc over iron".

White crusts and fibres associated with herderite from Newry, Maine, have been determined to be, in many cases, uralolite.

We hereby complement Gilbert G. George, of Providence, Rhode Island. After the Boston Mineral Society's show at Bridgewater College in Massachusetts, we dropped by Harvard's earth sciences department at Cambridge to see the hundreds of old mineral labels preserved there. Gracing Dr. Clifford Frondel's desk were some of the most beautiful exhibit specimens of serandite and catapleiite ever, a gift to the university by George. In previous issues of the *Mineralogical Record* we'd written that Gil was an ardent collector, haunting roadcuts, and coming up with Swiss Alpine type material. We know, too, of his interest in the Mont St. Hilaire minerals; micromounts and hand specimens, but were totally unaware of the superb specimens he'd gathered there. The donation to Harvard of the superb minerals is indicative of, and a tribute to, his generosity.

Just got a catalogue of cabinets for micromounts and small specimens from Craftmaster, Route 1, Box 311 Q, Olympia, Washington 98502. These are sturdy, good looking and inexpensive, and come in all shapes, sizes and combinations. There is a 10 drawer job for $38.50, F.O.B., that we couldn't build at the price. Such equipment has long been needed. Send a couple of stamps for the literature.

David E. Jensen has retired as head of the mineralogical section of Ward's Natural Science Establishment at Rochester, New York. This after 44 years, during which he supplied specimens, information and service to collectors and educational institutions. As a "sideline" he devoted himself to mineralogical clubs and mineralogical people, wrote books, and took time to participate in the affairs of the Eastern Federation of Mineralogical and Lapidary Societies, now finishing his term as president. Dave indicates that he will continue his interest in minerals and collectors, will continue acquiring rare books on gems and minerals, and will attend shows, club meetings and field trips. Gratefully, Dave Jensen, we'll see you around.

We've just been privileged to address the members of the Capital District Mineral Club at Schenectedy, New York. Elmer Rowley was our host and he spared no pains in keeping us entertained. We spent a day at Union College, where he is curator of minerals, and where we saw the Otto Pfordte (Rutherford, New Jersey) collection which the college acquired about 1910, and the assemblage of Charles Wheatley who, in 1840, was owner and operator of the fabulous Wheatley mines at Phoenixville, Pennsylvania. Specimens of pyromorphite, wulfenite, cerussite and anglesite abound, the likes of we'd never seen before, even at the Philadelphia Academy of Natural Sciences. Wheatley was a general collector as well, and many old specimens are displayed in a number of hall cases at the college. From here we drove to Albany and visited the New York State collection of minerals at the state education building. It is, of course, rich in local specimens, with a goodly representation from other localities. The industrial materials to be found in New York are well represented. A new educational complex is in the offing, where the collections will be housed, for presently so poor are the lighting facilities that the admonishment "Take a flashlight" is indeed justified.

From there to Rowley's personal collection at Glens Falls, superbly displayed, and including many from the Adirondack area, original finds of this collector, who spent his life searching and finding new localities and unusual minerals in upper New York.

Bruce Wadleigh, 50 Winslow Avenue, Norwood, Massachusetts 02062, was the finder of the large milarites from Moat Mountain, North Conway, New Hampshire, a couple of years ago. These were acquired by the Smithsonian and are, perhaps, the largest found in the United States.

Some of the New England dealers who collect at Moat Mountain come up with this mineral on occasion. We've obtained a micro specimen, with smoky quartz on microcline, from Bob Eastman, Ossippee, New Hampshire. John Oliver, Intervale, same state, has found this mineral. So has Bryan Chakoumakos, Box 204, Farmington, Maine 04938. All of them have hydroxyl-herderite on quartz from the Bennett Mine, Buckfield, Maine. No lists, but in your New England meanderings this year be certain to search out these men. You'll be well rewarded. An inquiry, enclosing a self-addressed, stamped envelope, would do a lot of good.

Buy and take with you on all your field trips a good mineral book. Dust off and cover your microscope for the periods it's not in use. Label and/or number both the box and cover of your finished mount.

Neal Yedlin
129 Englewood Drive
New Haven, Connecticut 06515

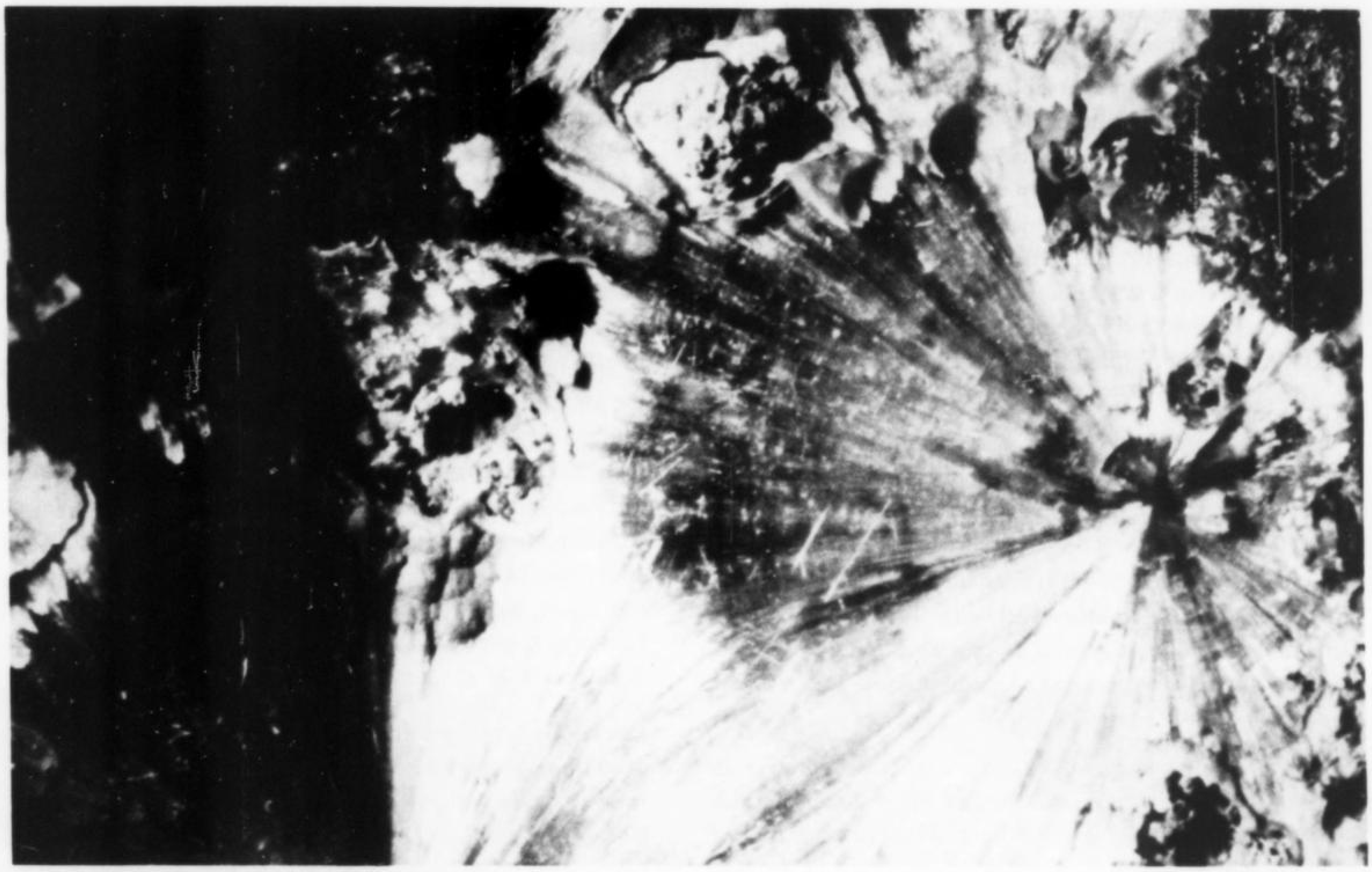


Fig. 1. **Bright yellow cacoxenite fibers. 10x**

IRON PHOSPHATE MINERAL LOCALITY
at Indian Mountain, Alabama

by Henry Barwood **Rt. 3, Box 144, Auburn, Alabama 36830**

Alabama's finest collecting locality, where noteworthy specimens of crystallized iron phosphates may be obtained, is an abandoned iron mine on the south slope of Indian Mountain in extreme southeastern Cherokee County. The mine is located in sec. 1, T 12 S, R 11 E and may be reached by taking the old access road north from the defunct railroad station of Bluffton. There are many old iron mines in this district and several other mines also contain phosphate minerals; however, none are quite so prolific as Indian Mountain.

The most widely recognized name for this location is Indian Mountain, but the locality has been and is now also known as Rock Run, Bluffton, and Tecumseh Furnace, Alabama; Etna and Cedartown, Georgia. Note that phosphate mineral localities do exist at Rock Run and Cedartown; however they are distinctly different in both mineralogy and appearance from material found at Indian Mountain. Equally confusing are the many iron and aluminum phosphates reported by collectors from this mine, often without any test other than visual examination. The quantity and extent of distribution of material collected over the years is staggering and any estimate of the amount of specimen material removed from Indian Mountain would run into tonnage.

History

Other than a few documented descriptions, little is known about the early development of the locality as a collecting site, and very little is known about the material collected or the disposition of the specimens obtained. Indian Mountain has been known as a source of micromount specimens for about fifteen years (Hurst, 1957) and what is possibly this same locality has been known as an occurance of dufrenite (?) since 1939 or earlier (Frondel, 1949).

The mine at Indian Mountain is by no means recent. The opening was described under the name "High Bluff Limonite Bank" some seventy years ago (McCalley, 1897). In his report on the region, McCalley mentions that the ores of this district were noted for extremely high silica and phosphorus content.

In the late nineteen thirties the area was prospected for strategic minerals. A number of small maganese prospects were opened and several of the old iron mines, including the one at Indian Mountain, were mined on a small scale (Pierce, 1943). A prospect near the iron mine, known as the Gorman prospect, was worked for manganese ore and was later used as a stockpiling area for the iron ores. This old stockpiling area is still very rich in material containing crystallized iron phosphates.

Geology

Indian Mountain, where it extends into Georgia, has recently been shown to be a synclinorium composed of Devonian Frog Mountain sandstone and younger formations (Cressler, 1970). The main part of Indian Mountain, located in Cherokee County, Alabama, has long been considered to be of Cambrian and older formations, but in light of recent investigations is probably much younger. None of the outcrops examined in the mining area appear to be fossiliferous.

Most of the iron ores occur in, or as float from, sandstone (in part quartzite) bodies which have undergone extensive brecciation and replacement. The breccias appear to be chemical and not tectonic in origin. Some of the ore bodies resemble gossan and several of the mines expose quartzite containing disseminated pyrite. It is possible that the ores are residual concentrations as well as oxidation products of the sulfide minerals.

The actual source of the phosphorus giving rise to the crystalline phosphates is not known, but is probably a simple recrystallization and enrichment of an already phosphorus rich ore. The richest areas of crystallization occur in the iron ores near the surface and no crystals occur at very great depths. The iron ore minerals are massive to crystalline goethite and undetermined iron and manganese oxides. Rarely, barite and hyalite opal are found growing on and enclosing the phosphate minerals.

Minerals

Specimens from Indian Mountain were examined with the x-ray diffractometer and, in certain cases, by thin section with the petrographic microscope. Wet chemical tests were performed only for rockbridgeite to determine the Fe/Mn ratio. Diffractometer patterns were compared with literature values (Frondel, 1949; Moore 1970; Fischer 1966; Mitchell, 1969) and with known samples, and represent close, but not exact, matches of peaks and intensities. Impurities, preferred orientation, and alteration (oxidation) probably account for the slight irregularities.

Rockbridgeite: This mineral occurs abundantly at Indian Mountain as brown to black radially fibrous crusts and spheres and rarely as distinct simple prismatic crystals. The crusts are up to 12 mm thick and the spheres sometime reach 3 cm in diameter. Rockbridgeite is the earliest phosphate mineral formed at Indian Mountain and grows on and in brecciated ferruginous quartzite of light to dark brown color (the matrix of all the species occuring here). Rockbridgeite is commonly altered (in order of occurrence)

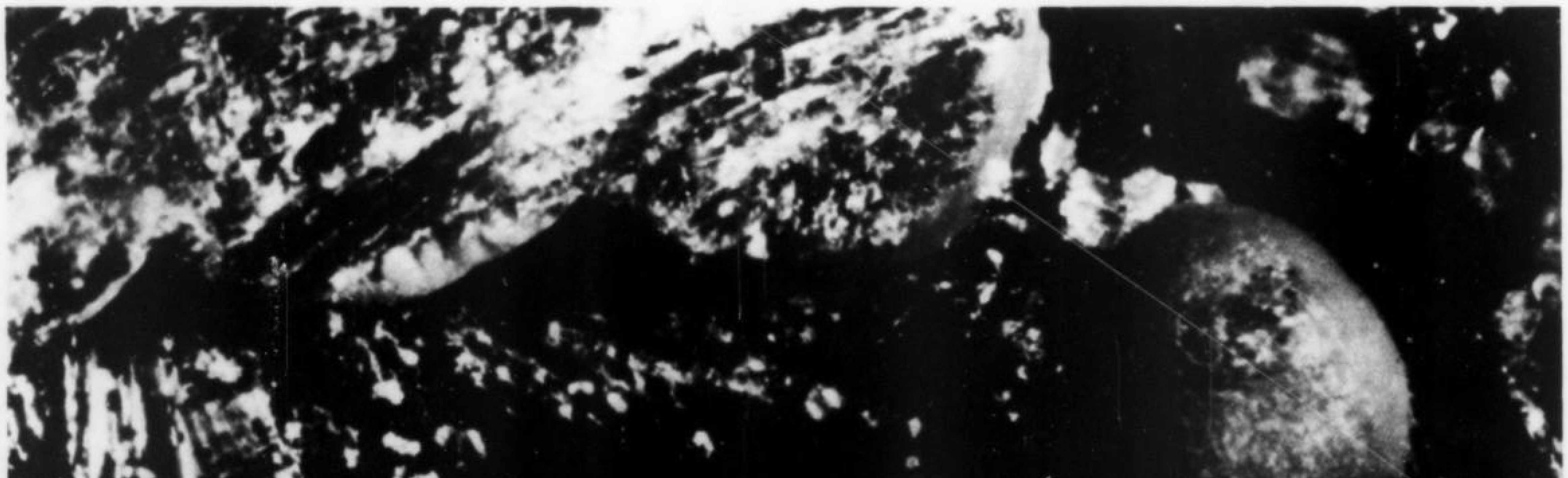


***Fig. 2.* Red prisms of beraunite associated with laubmannite. 10x**

to laubmannite, beraunite, strengite, and cacoxenite. Chemical tests on pure material gave only a trace of manganese.

Laubmannite: Locally abundant bright green radially fibrous crusts and spheres proved to be laubmannite on comparison of diffractometer patterns with patterns of known material from Shady, Polk Co., Arkansas, supplied by A. L. Kidwell. The spheres are generally small, reaching a maximum diameter of 10 mm and are intimately associated with beraunite and occasionally strengite. Tiny green acicular crystals are sometimes seen growing on altered rockbridgeite. These crystals and thin green coatings on the ores were not examined and may represent some other species.

Beraunite: Sparingly, vein fillings and isolated pockets of bright to brick red beraunite are found. Good prismatic crystals are uncommon but do occur in sizes up to 10 mm. The red color and strong pleochroism indicate that the beraunite is the oxidized variety *eleonorite*.

Strengite: Excellent strengite specimens occur abundantly at Indian Mountain as bright pink to purple simple prisms and crystalline globular aggregates. Crystals to 10 mm occur as isolated individuals, but most are 2 - 6 mm and coat surfaces of breccia up to 8 x 10 cm. Generally the more purple crystals are associated with sooty manganese oxides. Much corroded and poorly crystallized strengite has been misidentified as phosphosiderite.

Cacoxenite: Fibrous yellow to golden aggregates of cacoxenite crystals are common at Indian Mountain, but are fragile and easily destroyed while collecting or by weathering. Some of the early specimens were beautiful bursts of free-standing fibers up to 8 mm in diameter. Very rarely the crystals are short prismatic and exhibit terminations.

Acknowledgements

My thanks go to Dr. A. L. Kidwell for samples of laubmannite, Dr. Benjamin Hajek for the loan of the x-ray diffractometer, and to Mr. John S. White Jr. for his editorial advice.

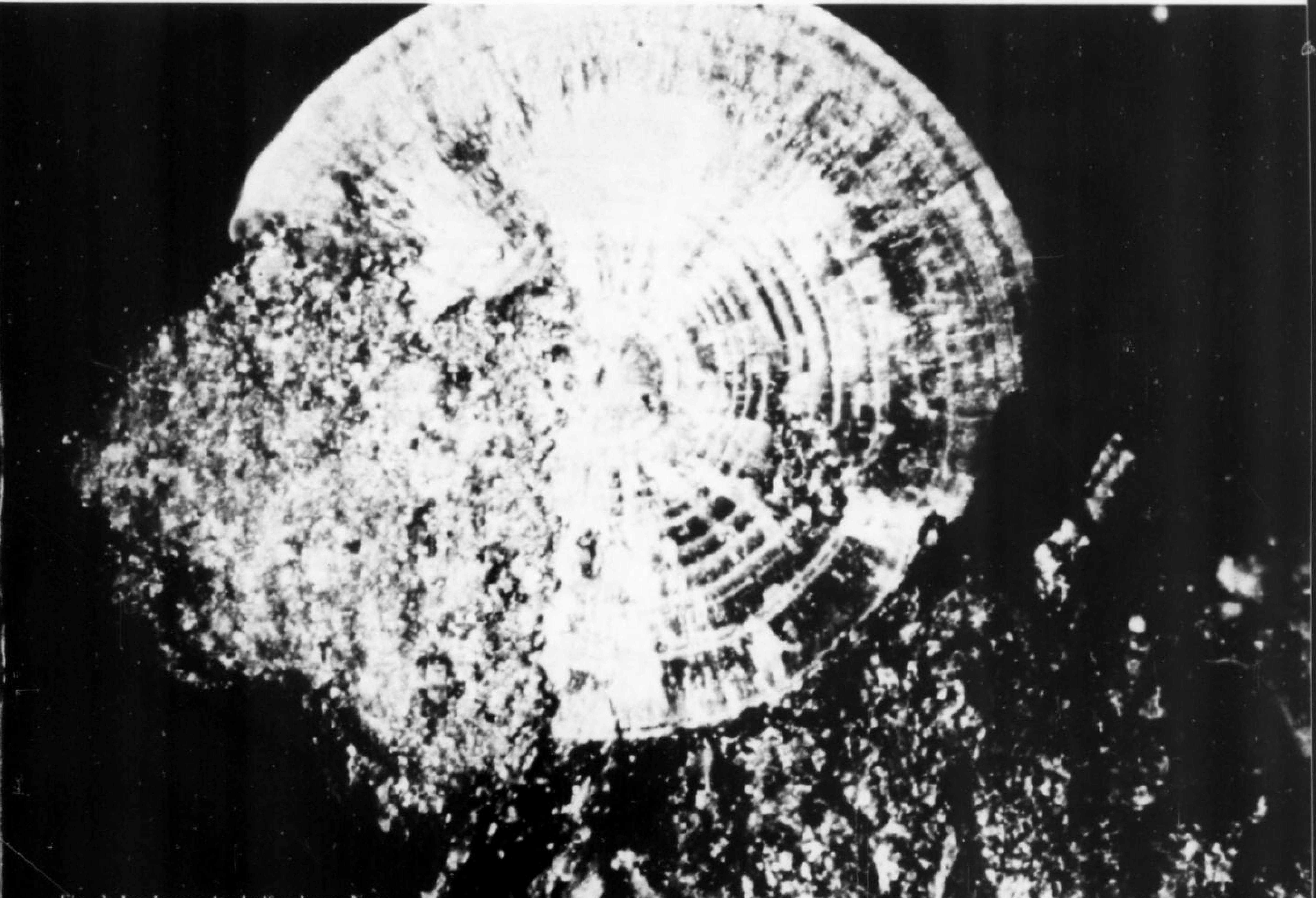


Fig. 3. Laubmannite half sphere. Note concentric banding. 10x

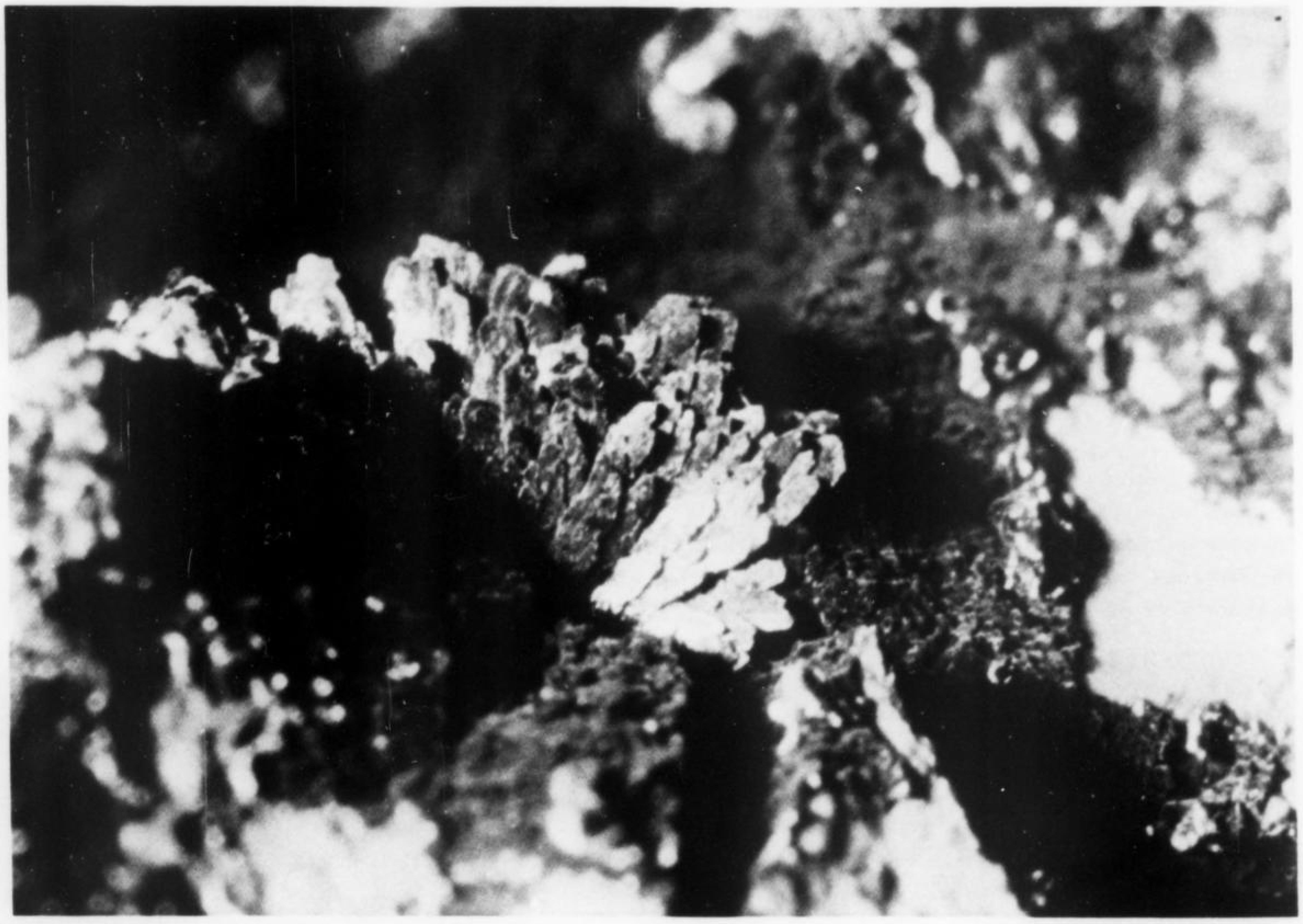


***Fig. 4.* Dark brown crystals of rockbridgeite. 10x**

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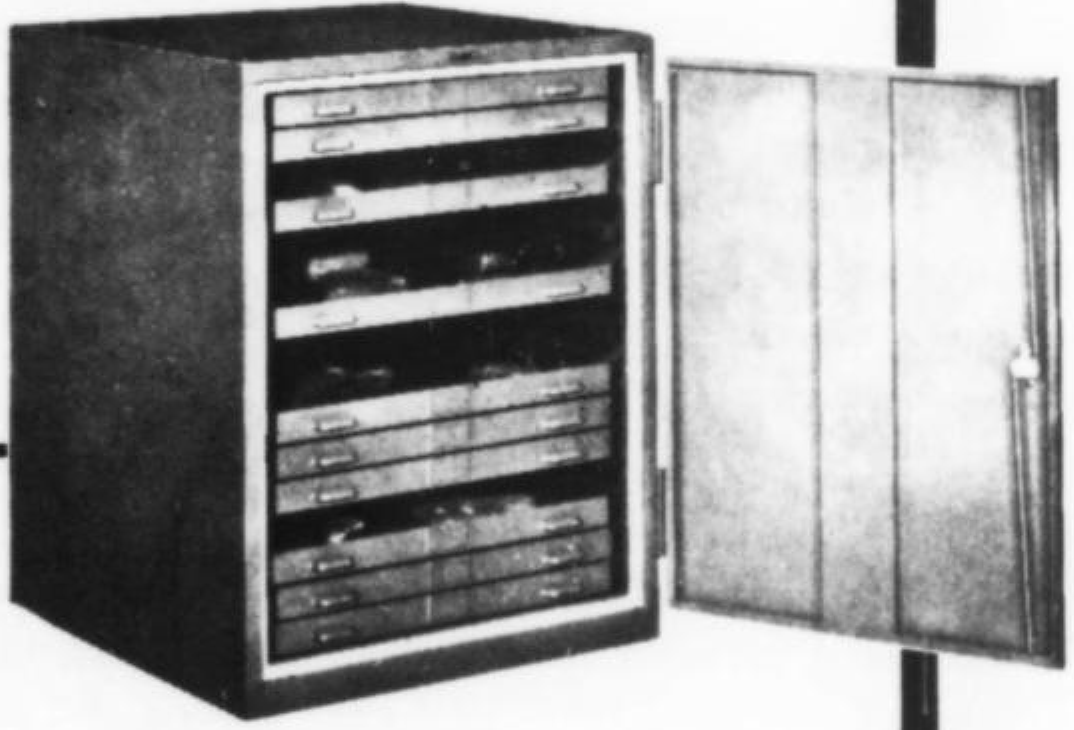

To the Editor

AGREEMENT

Dear Sir:

I would like to say that I am in agreement with Mr. Freedman's letter in volume five/number two issue. I am also in agreement with Mr. Dunn's comments in the same issue. I think you have a very good publication but it could be better. Let's have more on minerals and less on photography and vaguely related mineralogical items.

I would like to see more articles concerning rare species i.e. descriptions, occurrences etc. More articles about some of the famous mines and their minerals would be interesting also.

Harry Wagoner
Earlham, Iowa

COLLECTING UNDERGROUND

Dear Sir:

I was pleased to read Wendell Wilson's useful article on collecting underground, which contained many worthwhile suggestions. However, I would like to point out that rather than downgrading the utility of carbide lights, these are, in spite of their shortcomings, not only useful but sometimes of vital importance, especially where one is exploring old mines which have not been worked in recent years.

Anyone who lives in mining regions will recall the distressing regularity with which one reads of people exploring old mine workings who are overcome by bad air or lack of oxygen and asphyxiated. In many old mines or portions of mines there is no air circulation and what little oxygen originally present is gradually consumed through oxidation of old timbers; of pyritic ore; or sometimes displaced by the emanation of carbon dioxide or other gases from the rock itself. This condition leaves no telltale odor or other indication which can be observed, except in the way it affects the burning of an open light.

Trying to light matches will detect lack of oxygen, but this method to be effective must be repeated at very frequent intervals, which at times is an impossibility. Nothing can substitute for a continuously burning carbide light as a warning against lack of air, and the momentary feeling of panic which one experiences when one first realizes that the light will not burn must be experienced to be appreciated, especially as there is usually no other clue or warning that this condition exists.

On one occasion, in an old lead mine in Oaxaca, Mexico, I had a frightening lesson about this, which brought the point home to me. We were proceeding down a long incline along the vein, when suddenly the lead carbide light went out, whereas the ones to the rear continued to burn. When it proved impossible to relight, the lead man quickly retreated up the incline, and only then could his lamp be restarted. We experimented, and discovered that a heavy layer of carbon dioxide filled the lower workings, caused by emanations from nearby springs I suspect, and that the line of demarcation was so sharp that a difference of 3 feet vertically made the difference between a brightly burning light and this same light extinguished. If we had had only electric lights, it is certain that all in the party would have proceeded down the drift until the front man collapsed from lack of air, and with subsequent efforts by the others to help him, all would have quickly succumbed.

Another unique feature of carbide lights is their application for marking mine walls with arrows or sample numbers or other useful information, merely by writing with the flame against the rock leaving a trail of soot in its wake. They are also great for lighting cigars. I heartily agree that there is no substitute for a good electric lamp to illuminate specimen hunting activities, but every entry into abandoned mines or even abandoned portions of active mines, should be accompanied by at least one carbide light for the sake of safety if for no other reason.

Richard V. Gaines
Pottstown, Pennsylvania

MORE ON "BAD TASTE"?

Dear Sir:

We all thought F. L. Smith advertisement in the *Record* was hilarious and the best—almost the only—bit of fun for ages. If your average readers are so stuffily starch-shirted they can't see the joke then it's high time they climbed into a cabinet, closed the doors, and threw away the key!

Peter G. Embrey
British Museum (Natural History)
London

LITERARY SECRETIONS YET!

Dear Sir:

...I am afraid that "articles" like "An American in Altdorf" are not very suitable for a publication like the *Mineralogical Record* is. If collectors like Mr. Halpern want to report about how they spent their holidays, I think they should bring together funds to raise a new periodical, entirely devoted to their literary secretions, or try to have them published in the local weekly advertiser or such. The columns of the *Record* are far too good for this.

Lourens Wals
Turnhout, Belgium

I am afraid that reader Wals missed the point of this little vignette. We see it as a very cleverly written story that forcefully reveals the pressures that operate on collectors when they are involved in mineral exchanges. Ed.

ON UNAPPRECIATED GIFTS

Dear Sir:

Your latest editorial (Vol. 5, No. 4) on the sad fate of display-quality mineral collections at colleges and universities seems to me too one-sided and does an injustice in not allowing for those schools where care, appreciation and proper educational use are given to their minerals. It is true that many deplorable situations exist, much as you describe them; but other cases are known to me where good appreciation and care have been exercised, which makes the picture less dark. Our Lafayette College collection belongs in this latter category.

When someone considers giving a first-class collection to a school, it is imperative that the potential donor make sure that good care, genuine appreciation and proper educational use of the specimens will be forthcoming. Some real interest in minerals obviously has to be there already at the school. An endowment, sufficient to insure at least minimal upkeep, display and future enlargement, should if at all possible accompany the gift; and this is one of the best ways to encourage active use of the collection on into the future. Very seldom has this practice been followed, in my opinion, except in the cases of donations of very great collections. Where the right conditions exist at a school, or can be inspired to appear, I believe no finer thing can be done with a first-class collection than to so donate it to a receptive school and wisely encourage the educational and scientific use of its minerals. And by such means the doner's name and key role in building the collection remain in close association with its minerals.

We can only improve the sad state of affairs which commonly does exist, by each one of us who cares, doing our small part to see to it that minerals come to mean more, educationally, scientifically, aesthetically, and noncommercially, to people everywhere. Those with responsibility for good collections at colleges and universities, who have failed to exercise it, especially need such educating. A first step toward improving the present situation would be to make a survey of the status of mineral collections at all educational institutions in the country. Friends of Mineralogy and/or IMA should consider undertaking such a project. Then we will know more about the true situation and be in a better position to seek for ways and means to improve it. Amateurs and professionals could best work together on such a survey, which would be of vital importance to mineralogy. In that sense alone, your editorial, in calling attention to the dire plight of collections at many colleges and universities, takes on positive and constructive meaning.

Arthur Montgomery
Lafayette College
Easton, Pa.

from *Rocks and Minerals*, June 1974

"I entered one pit with other collectors who were already hammering away at the freshly blasted material, although crowded, room was found for my participation in the action with my 3-pound sledge hammer. I began carefully hammering at a 400 lb. boulder of feldspar and quartz and was immediately joined by one gentleman who aided me, and in about 15 minutes two other collectors came over and short work was made of the boulder."

*Believe it or not this is **not** the script for a training film illustrating dangerous collecting practices.*

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I certify that the statements made by me above are correct and complete.

JOHN S. WHITE, JR.
Publisher

What do I have for *You*?

Maybe nothing.

That is not so likely, but realistically it could happen. Because I am not a street-level dealer where one wanders in to get out of the rain or pass an idle quarter-hour peering at odd and curious items. I am a mineralogist by choice and profession, and have been so for nearly twenty years, so my stock, beautifully displayed, consists chiefly of first-class mineral specimens.

I can state without any modesty that through my hands have passed some of the best and finest material offered in this country, and probably abroad as well. Many "Larry Conklin specimens" grace some of the outstanding collections and museums; many, when they appear on the market again, bring double and triple the prices I charged years ago, and many I would gladly buy back (if I could) at double and triple those figures.

However, I also buy collections and estate accumulations. When I do, I have to buy not merely the super-specimens I am so proud of, but also relatively minor crystals and specimens. The latter I usually get rid of as quickly as I can. So it *can* happen that even the ordinary collector can find in my cabinets and showcases unusual items that are wanted and not easy to find elsewhere.

Therefore, whether you are an advanced collector or an investment buyer, a more-or-less beginner, or one who seeks the beautiful for a special decorative purpose, I may have what *you* are looking for — and at a comparatively modest price, too!

I like to give personal attention to every caller, so telephone me if you want something special. Or simply drop by and have a look around. If fine minerals excite you, I can promise you a pleasant visit.

* * *

Mineralogist

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