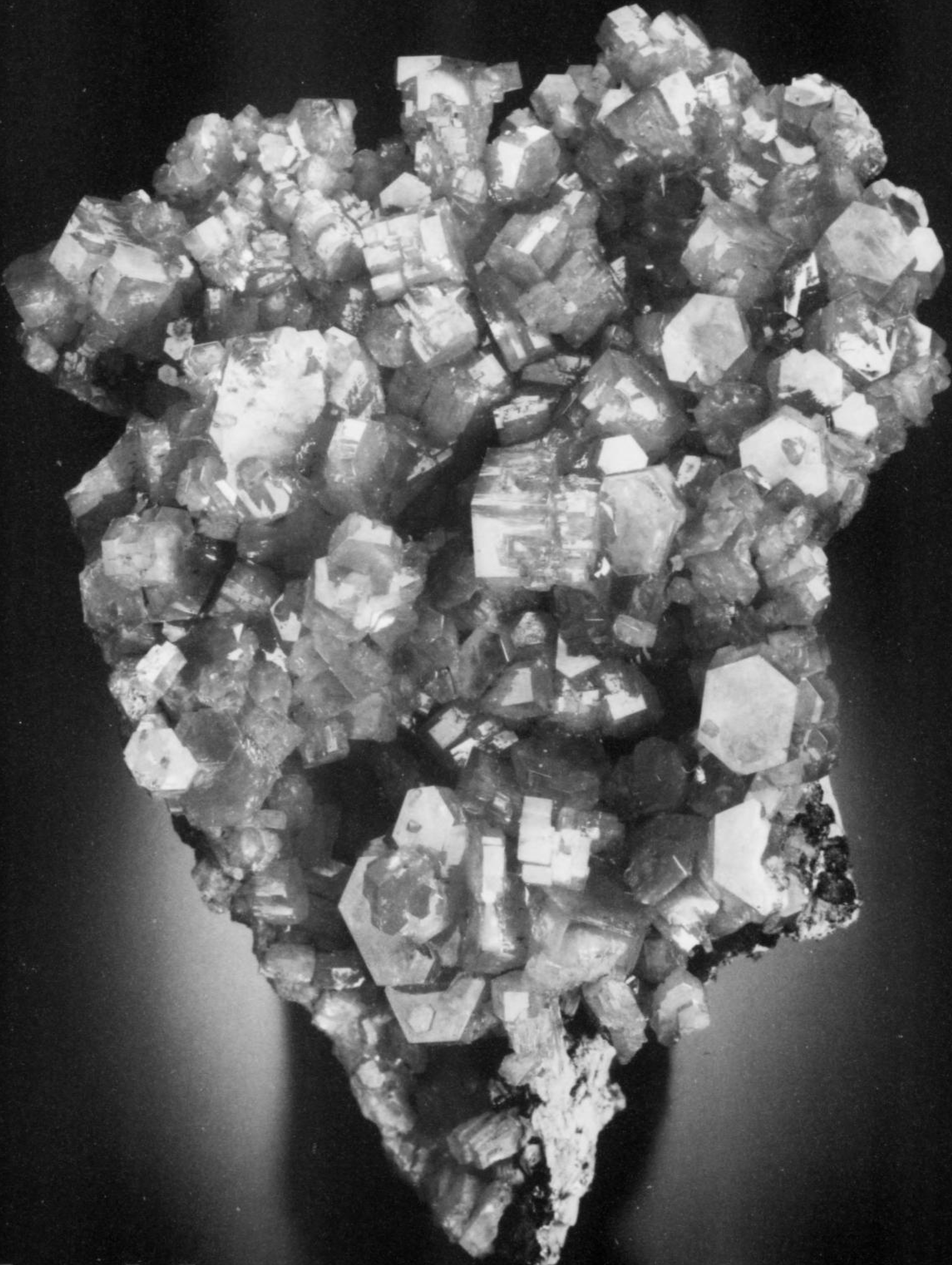

THE MINERALOGICAL RECORD

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*Continued on p. 285

THE MINERALOGICAL RECORD

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Columns

What's new in minerals

COVER: MIMETITE crystal cluster, 7.3 cm, from near Bapu, Guangdong Province, China. Rob Lavinsky specimen, now in the Tom Hall collection; photo by Jeff Scovil.

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EDITORIAL:

RECORD-KEEPING FOR MINERAL COLLECTORS

The arrival of a big mineral event like the Tucson Show, where a collector may acquire a substantial number of specimens in a brief, hectic time, always raises the issue of record-keeping. Many find this chore too bothersome to deal with at all, while others have had their own system for many years. For those in need of a good method, and for those willing to consider some changes in the way they do things, here are a few suggestions.

First of all, it is important to recognize the value and usefulness of good record-keeping, especially with regard to prices paid, to whom, and when. Most collectors today have a certain amount of accessioning and de-accessioning going on as a routine part of their collecting process. As you upgrade with better pieces you let go the ones that have been replaced and are no longer needed. You may sell them to or through a dealer, or to a friend, or you may donate them to some museum or society collection. Before you set an approximate selling price, though, you will want to check to see what your original purchase price was. It is all too easy to forget what you paid for something, especially after several years!

If you then sell your specimens at a profit, you may incur a tax liability on the gain. Your original purchase price is called your "basis" in that specimen, and you will not be taxed (at least in the U.S.) on the full sum received in the sale, only on what is in excess of your basis. But you may be required to show a receipt to prove what your basis was; if you cannot produce proof of a purchase price, it is possible that you may then be taxed on the *entire* amount received for the specimen, rather than just on your profit. Likewise, there may be tax or insurance benefits to be had if you can document a loss when specimens are sold, or if specimens are lost, stolen or destroyed. So obviously it pays to ask for and save receipts for specimens, and to file them in an easily accessible way.

If you donate specimens to a non-profit organization you may be eligible for a tax benefit, and it may be useful in determining the amount of your allowable deduction if you can document the original purchase price. If you sell your specimens at a substantial loss it may also be possible to receive a tax break of some sort, depending on your circumstances.* So, once again, it can pay to keep careful records.

When you sell or donate your specimens, the recipients will usually be more interested if you can produce reliable documentation of the locality. As every mineral collector knows, a specimen without a locality may be virtually worthless (unless it is sufficiently distinctive in terms of locality, or contains faceting-grade material or smeltable precious metals). That means always saving the original label(s) that come with a specimen when you acquire it. Although a label by itself is not irrefutable proof of the locality, it is at least a document attested to by the person, company or museum cited thereon, for whatever that is worth. It is also recommended that you have a special label of your own made, at least for specimens which you self-collected and which have therefore had no previous owner. Ideally you should provide a personal collection label for *every* specimen that you part with, so that the history of those specimens can be preserved for future owners.

Additional documentation beyond a specimen label and receipt may be advantageous to keep as well. For example, it's becoming increasingly difficult to sight-identify many collectible species because some former species are now group names, and determining the exact species within the group may require an analysis. In other cases, where a very rare species is involved which is similar in appearance to a more common (and less valuable) species, analytical confirmation is extremely valuable. Dealers occasionally have such analyses done and will supply copies of the paperwork upon request. This kind of documentation is great to have because then the subsequent owner has more to rely on than just your word.

Other kinds of valuable documentation include letters and e-mails giving background about the specimen. You may possess written correspondence from the former owner or field-collector who found the specimen, and that is of interest as well, especially if the letter is from a particularly prominent curator, collector or dealer.

For your own enjoyment you may also wish to keep some personal notes about how, when or from whom specimens were acquired. One of the great pleasures in collecting is that "every specimen has a story," and eventually even you may begin to forget the details.

So, having decided that it is a good thing to keep documentation with your specimens, where do you keep it? In a shoe-box? A drawer? An empty flat? A file cabinet? On your computer?

Computers are wonderful tools, but are not ideal for the storage of original documents such as labels and receipts. Yes, you can scan them in, but your future buyers will certainly prefer to be given the *original* documents rather than computer-stored copies. So, although it is indeed possible to do absolutely everything on computer as long as it is regularly backed up on CD's, a physical system will be appealing to a great many collectors. Some people have employed the traditional card-catalog system, and others use the ledger system, but neither allows convenient storage and retrieval of associated documents, labels, etc. And, although file cards for disbursed specimens can be taken out of the file, entries written into a ledger are there forever, and labels glued into a catalog are messy to remove.

What is needed is a kind of file card system adapted to the storage of associated documents. Receipts and other paperwork are often larger than standard file-card size, so a larger size would be more practical. Once you have enlarged upon the standard 3 x 5-inch file card, the next logical size is standard 8.5 x 11-inch sheets—which you might as well have three-hole-punched for keeping in loose-leaf binders. These sheets, one to be used for each specimen, can be made from card stock so that they are nice and stiff, and they can be printed on one side with a form to fill out (locality, source, price, field-collecting details, former owners, etc. etc.). Attached directly to the back of this sheet can be a large glassine or white-paper envelope, open at the top, in which can be kept the receipt, specimen labels, correspondence and other documents.

One kind of information that I like to write down is "who wants

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*NOTE: The author is not a professional tax preparer or tax consultant. Rules may vary depending on the circumstances. Be sure to consult a professional before making any decisions involving tax liabilities or expected benefits.

this piece." How often has some friend or acquaintance said to you: "If you ever sell that piece I'd love to have it!" If you then make a note in your catalog sheet for that specimen, he will be impressed and you will never forget who is a ready customer for it, should the time come when you are finally ready to sell. Nor will it slip your mind years later that you had promised a certain specimen to a good friend, who will be crushed if he finds that you have forgotten your promise and sold the piece to someone else.

A difficult problem in almost every cataloguing system is how to readily connect the catalog data to the actual specimen. If you only have one specimen of any given species, your problems are minimal, but if you have a big collection or a collection containing many different specimens of certain species, then you may well have problems matching them up with their documentation. Museums and some collectors still use the traditional system of painting or gluing a catalog number or tiny label onto the back of each specimen. This method, though currently out of fashion, has its advantages. Many years ago I used to glue a small 1x1-cm label to the back of each of my specimens; these labels gave only the year acquired, my catalog number, and my name. It is still a treat to come across one of my old specimens in a dealer's stocks and to see the year that I originally acquired it, even if my personal standard-size label that had accompanied it is long gone. However, affixing numbers or labels can be difficult with small specimens such as thumbnails and micromounts, and can be quite tedious when a large number of specimens of the same material are acquired all at once. Most people today seem to find it too messy and bothersome to affix anything directly to their specimens.

Still, *something* must be done; it is a less messy alternative to file some sort of actual image of the specimen itself with its file data. For example, you can make a thumbnail sketch in a 2x2-inch square on your file sheet, as I used to do years ago. But, for collectors who aren't very good at sketching, there may be some question as to whether the little drawing represents a particular specimen (when in fact it more resembles Chairman Mao wearing a fruit-basket for a hat). And, although *you* may recognize your own drawing for what it represents, your heirs may not.

Clearly the best kind of image would be a photograph but, here again, this takes perhaps even more skill than making a quick, recognizable sketch, and it can take a significant amount of time to set up your tripod and lights every time you want to record an acquisition. Then you have to wait for film to be developed, unless you use a digital camera. (If you buy from an internet dealer, your purchase will most likely be inspired by the dealer's digital photo of the specimen shown on his website; you can copy or print this image for your files.)

Fortunately modern technology provides a quick fix in the form of the digital scanner. Word is beginning to leak out that digital flatbed scanners do a pretty fair job of photographing minerals. Okay, you won't win any prizes for subtle lighting techniques, but the optics provide more depth of field than you would imagine, and the results are often surprisingly satisfactory—even, in some cases, good enough for publication! The technique is simple: You very carefully lay the specimen face-down on the scanner glass, place a sheet of white or black paper over it for a background (leaving the scanner cover open), and scan it like a document. If you are worried about scratching the scanner glass, just lay down a square of window glass first, and lay the specimen on that. Admittedly, this only works for specimens that will not be damaged by lying face-down for a minute or two, but it is very quick, easy and efficient.* In fact, you can just as easily cover the scanner glass with a dozen or more specimens and scan them all in one pass. Personal flatbed scanners are available at office-supply stores for $80 to $250 (here in the *Mineralogical Record* office we use a professional-model Epson 1640XL, which is probably more than most people need).

I use the Adobe Photoshop software when scanning. It allows you to crop the image the way you want, adjust the details of color hue, intensity and contrast on-screen, then print a copy in any size. The print can be on regular paper or on glossy photo paper. Just clip out your little print and paste it onto your recording sheet. Now you can instantly recognize which specimen the records apply to! (To see how it works, see the photos on pages 221 and 280, Fig. 17.)

Once this system is set up it is very easy and quick to record new specimens as they come in. You take a blank three-hole-punched recording sheet with an envelope already glued to the back. Write in the data on the form, and stuff the labels and receipt into the envelope. Then carefully lay the specimen on the scanner, scan it, print it, clip out the print and paste it onto the sheet. Now file the sheet (alphabetically by species or locality) in your loose-leaf binders. When you sell or give away a specimen, add your personal collection label to the label(s) and documents in the envelope and pass them on to the new owner, while retaining the file sheet itself with its photo, purchase receipt, and a copy of your sales or donation receipt for future tax documentation. Voila! All is taken care of.

This system may be a bit too involved for dealers who buy and sell substantial numbers of specimens; they need to have a fairly streamlined operation to avoid bogging down in sheer quantity of stock. Nevertheless, most dealers prepare their own labels, and if they will just staple pre-existing labels to the back (as many dealers already do), and issue a receipt upon request, important documentation will be preserved for their customers.

If other collectors have suggestions for systems or techniques that have worked well over the years, let us know and we will pass those hints on to our readers.

Some Photoshop Hints

Adobe Photoshop is perhaps the most commonly used software for handling digital photo images. Here are some hints for using it in combination with an Epson scanner to produce mineral specimen snapshots.

[1] On the Adobe Photoshop menu, click "File," then "Import," then choose your scanner from the drop-down menu.

[2] For an Epson scanner, select for "Flatbed" and "24-bit color (std)." Then choose the resolution you want, knowing that greater resolution equals larger file size and requires more memory space. If you plan to reproduce your specimen actual size, a resolution of 300 dpi is fine; but if you want to have a print that is blown up to twice natural size, better select 600, and so on for whatever enlargement you want. For micromounts you may want to select a very high resolution, e.g. 3200, to allow for enough enlargement.

[3] Now click "Preview" to get a quick image of the entire flatbed glass area, including your subject. On the Preview screen, place the plus-shaped cursor at the upper-left of the area immediately around the subject, then left-click-and-hold on the mouse while you drag downward to the right. This will open a small square area around the specimen to scan, rather than scanning the entire flatbed.

[4] Now, under "Adjust," click the little button with a wrench and screwdriver icon on it, and then adjust the sliders that appear for exposure and contrast until the specimen looks right. Then click "Okay." Now click the little button at extreme lower-left labeled "Auto" and wait a few moments while the focus is adjusted. Now click "Scan."

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*Some dealers are also beginning to use this technique for e-mailing potential customers a quick image of a specimen they might like.

[5] When the scan is completed, exit from the scanner program, and your specimen image will be before you on the Photoshop screen. To crop the image down, select the dashed-square icon at top left on the vertical toolbar, and the left-click-and-drag as before to select the area you want to keep. Now click "Image" on the top horizontal toolbar, and then click "crop" on the drop-down menu.

[6] The same drop-down menu (under "Image") contains two other very useful buttons for "Rotate canvas" and for "Adjust." Under "Adjust," the "Brightness/Contrast" option is very useful.

[7] When you have adjusted the look of the image the way you want, click "File" in the top menu, then "Save as" to give the picture a name and decide where to save it in your folders. This will save it automatically in the .psd (= "Photo Shop Document") format. This format is not convenient for e-mailing, however, so if you wish to e-mail an image click on "Save for Web" instead. This will convert the image to .jpg format, which can be easily e-mailed as an attachment. You may then want to reduce the size of the image so that it will be small enough to show up on the screen uncropped: click on "Image Size," then set the image width at 300 to 500, and click "Apply." If it looks good, click "Okay," give the image a title, and click "Save."

[8] To print the image, click "File," then "Print Options." This will show you how big your image will look actual-size on the sheet of paper. Change the percentage figure up or down to enlarge or reduce as desired, then click "Print," then select the print quality you want, then click "Okay," and your printer will print the image in full-color. If you select "High" for print quality, and use glossy photo paper in a photo-quality printer, your print will look like a high-quality glossy print from any developer.

Of course, vastly more can be done with the extremely versatile Photoshop software, including even the delicate "repair" of dings on a crystal. But the above instructions should be enough to get you started. If you have any problems, consult the nearest 16-year-old.

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February 2004 will mark the 50th Tucson Gem & Mineral Show. The Tucson Show has had a effect on all our lives—imagine how different, and how much less exciting, life would have been without it!

To celebrate this momentous event Bob Jones and the *Mineralogical Record* have prepared a **50-year History of the Tucson Show**, and its satellite shows, to be published as a thick (probably around 150 pages), beautiful, high-quality, heavily illustrated, full-color souvenir book by the Mineralogical Record. The events, displays, mineral discoveries, and stories associated with each of the 50 years will be summarized, and the birth of the various satellite shows described. Photos will be drawn from the TGMS archives and many other sources. The history of important awards and all of the recipients will also be documented.

This book is going to be a real labor of love, entirely underwritten by donations. Not large donations from just a few folks, but instead many $200 donations from individuals who have a soft spot in their heart for the Tucson Show and for all the great memories they have of it. Each donor's name will be listed on the special dedication page at the front of the book. All donations will be spent on production, and the more donations we receive, the higher the production quality will be. The book will carry no advertising, and will not be supported by subscription funds from the *Mineralogical Record*. That's why it needs your support.

Author Bob Jones and the editors of the *Mineralogical Record* would like to invite you to help make this wonderful book a reality by donating $200 (tax-deductible) toward its production expenses. Your name will then be permanently associated with this milestone publication. If you like, you may make your donation "in memory of" someone, perhaps a special friend, now gone, who contributed to your enjoyment of the mineral world (your listing on the page would then read something like "James Smith, in memory of John Doe"). You and your spouse may, if you wish, be listed as a couple.

People to whom the Tucson Show has been important are excited about this project. They want to have their name on the dedication page; even the editors themselves will be contributing. This book will be like the "yearbook" of our lives in the mineral world, and people will surely have fun collecting signatures in their copy.

Every subscriber to the *Mineralogical Record* will receive a free copy of the softcover edition of the 50-year commemorative book, mailed along with the regular January-February issue of the magazine. If we receive enough donations we will also produce a limited hardcover edition, and all contributors of at least $200 will receive a copy free of charge.

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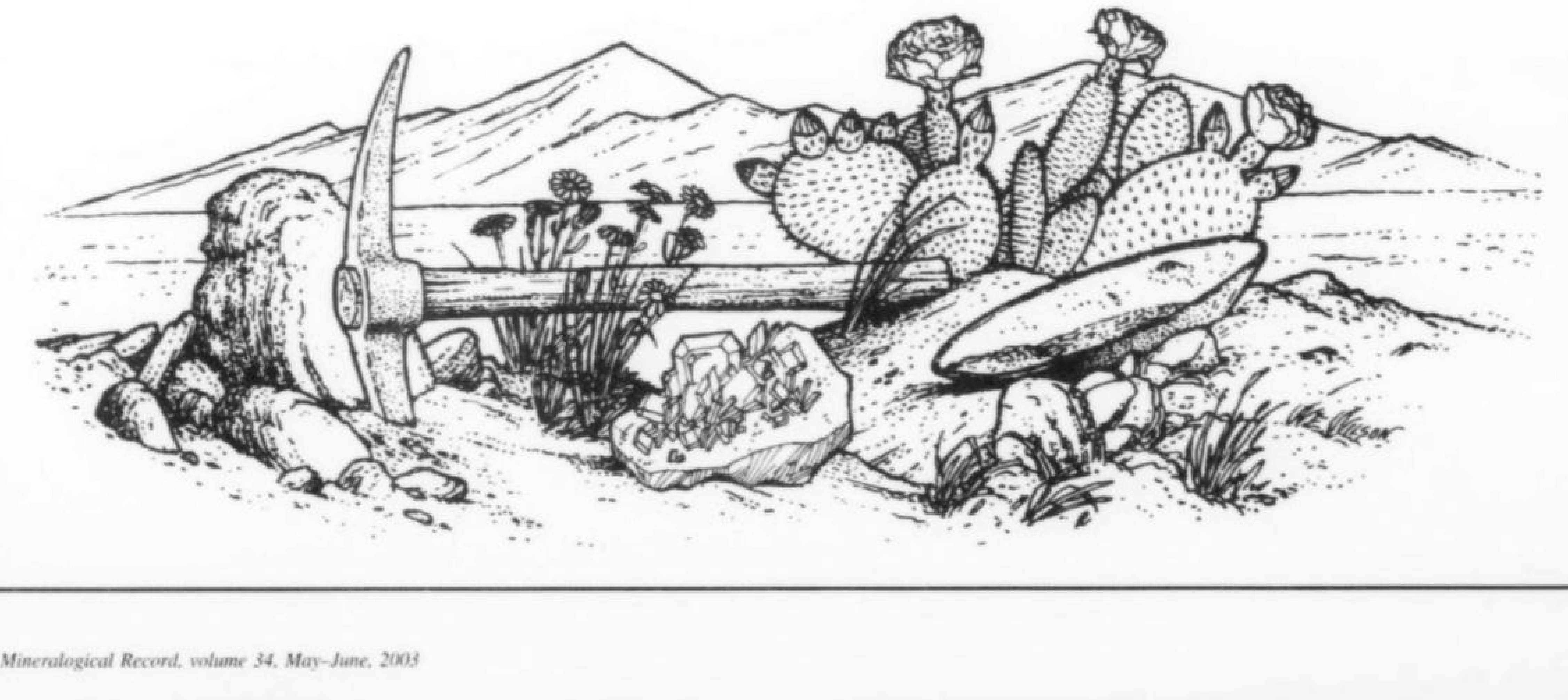

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Who We Are:

Vol 1, No 1, Mineralogical Record, Spring 1970

The *Friends of Mineralogy* was founded in Tucson, Arizona, on February 13, 1970. Its objectives were to promote better mineral appreciation, education and preservation. The chief aims and activities of *FM* include:

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

The Mineralogical Record has agreed to an affiliation with the Friends of Mineralogy whereby it will publish its written material and news of its activities. The *Friends of Mineralogy* will support the *Mineralogical Record*, since the aims of both are similarly educational and directed toward better coordination of the interest and efforts of amateurs and professionals.

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THE BISHOP COPPER PROSPECT

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For many years turquoise crystals were known from only one locality in the world: the Bishop copper prospect near Lynch Station, Virginia. At least 26 other locations worldwide have now been documented as producing crystals of turquoise, but the specimens recovered from the Bishop prospect are still generally considered the best and most attractive specimens known.

INTRODUCTION

Although the existence of the Bishop prospect is common knowledge among mineral collectors, little information has been published about the geology and mineralogy of the site commonly known as the Lynch Station, Virginia turquoise crystal occurrence. Many collections contain specimens of turquoise crystals on either a mica schist or a white quartz breccia recovered from the dumps of this small mine. Local collectors reworked the mine dumps many times in search of additional crystallized turquoise specimens and, despite its being frequently declared an extinct locality, they have often been successful.

The Bishop copper prospect is located about 1 mile west of Lynch Station in Campbell County, Virginia, on the southern bank of Bishop Creek. It is not indicated on the Lynch Station 15-minute quadrangle, but Espenshade (1954) identifies it as a short unnamed inclined adit accompanied by a small dump about 325 meters southwest of the Bishop manganese mine. The locality was early on referred to as a "copper prospect" and there is really no indication that it was developed as part of the manganese operations nearby. We will therefore refer to it specifically as the Bishop copper prospect, because it is mineralogically, geologically and spatially distinct from the nearby Bishop manganese mine. The dumps do not contain significant manganese mineralization and it can only be assumed that there was originally some surface mineralization which caused the miners to investigate for copper.

HISTORY

The Bishop copper prospect is located in the James River-Roanoke River manganese and iron mining district. Mining for iron ore began during the Revolutionary War period and extended into the 1880's. Manganese mining began in 1868 and continued intermittently until 1945. The Bishop manganese mine site was originally opened for manganese ore and had a recorded production of 13 tons of ore in 1885 and 700 tons in 1893 (Watson, 1907). Mining had apparently ceased at the locality by 1910 when the first specimens of crystallized turquoise were reported (Sterrett, 1910).

The district was explored for manganese ores by the Otter River

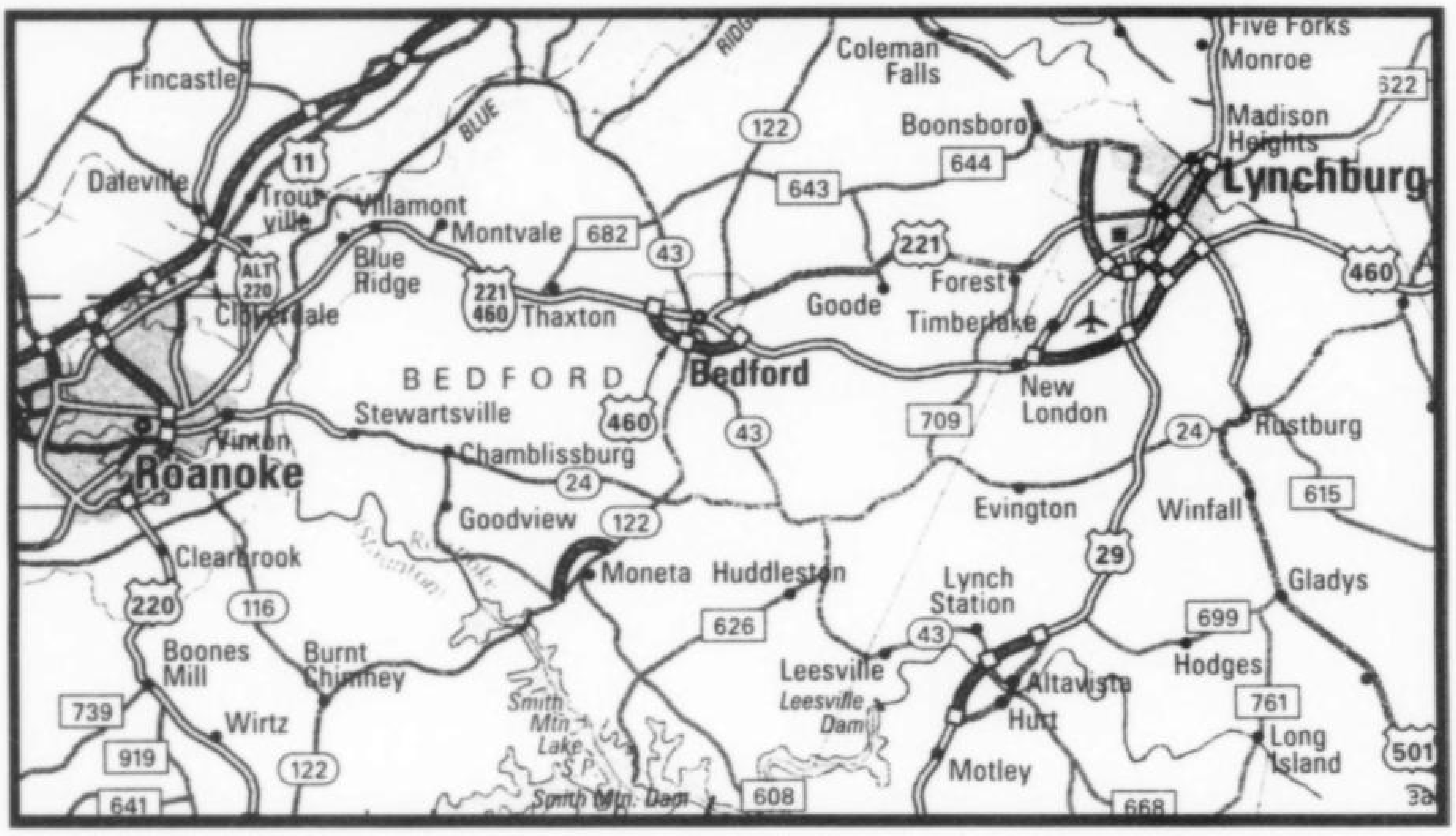

Figure 1. **Location map. Lynch Station is about 20 miles south of Lynchburg, just off Highway 29 on Highway 43.**

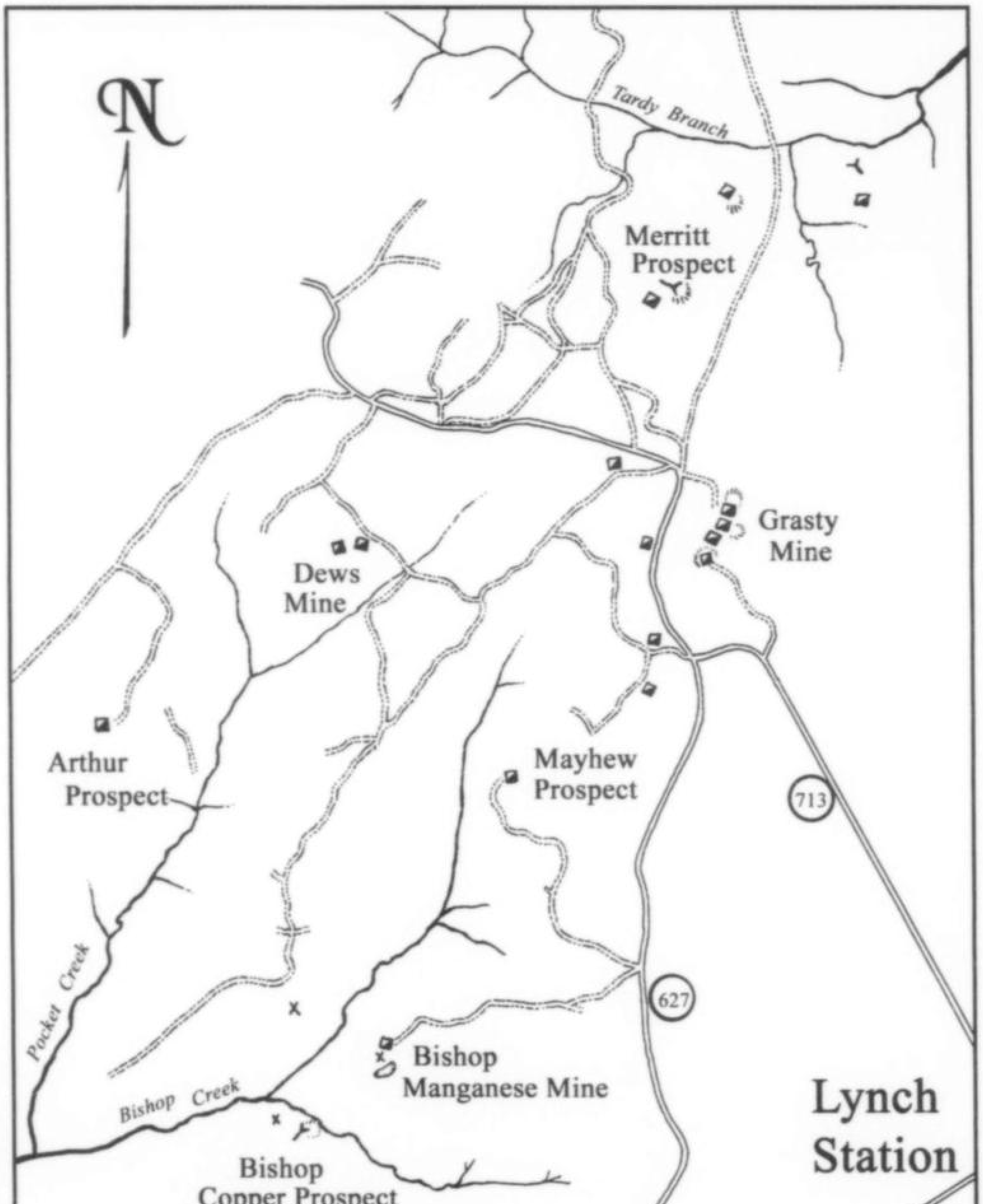

Figure 2. **Mines and prospects in the southern portion of the James River–Roanoke River manganese district, west of Lynch Station (after Espenshade, 1954).**

Figure 3. **The vertical shaft at the Bishop manganese mine, about 570 meters northeast of the Bishop copper prospect where the turquoise crystals occur. Joe Dague photo.**

Mining Company in 1937–1943 and the Bishop copper prospect was examined at that time, but not worked (Espenshade 1954). The area comprising the adjoining Grasty, Mayhew, Bishop manganese, Merritt, Dews and Arthur properties was extensively prospected by the company via 17,000 feet of trenches and 14 shafts, and was subsequently mapped by the U. S. Geological Survey in 1940. A production of less than 200 tons of manganese ore from all the mines in this group was reported during this interval. The Grasty property, located about 2 miles northeast of the Bishop mine, contained blocks of marble with disseminated pyrite and chalcopyrite, and barite was noted in several places. Other than the disseminated chalcopyrite in the marble, no copper mineralization, or turquoise, was noted during the prospecting. No mining or prospecting other than for mineral specimens has taken place since 1943.

GEOLOGY

The Bishop copper prospect, the Bishop manganese mine and other nearby occurrences of iron and manganese ores are located in the Mount Athos Formation, which contains beds of quartzite, conglomerate, calcareous quartzite, marble, siliceous mica schist and ferruginous mica schist (Espenshade 1954). The iron and manganese oxide ores are mostly restricted to the weathered outcrops of the white marble unit and this marble is also known to contain veins of sulfides (pyrite, chalcopyrite, sphalerite and bornite) and areas of barite. The underlying Archer Creek Formation contains a blue marble and a siliceous graphitic schist. The immediate area of the Bishop copper prospect is mapped as a muscovite schist unit, whereas the nearby Bishop manganese mine exploits a quartzite and an included white marble unit of the Mount Athos Formation. The shaft sunk in search of copper was located a few hundred feet west of the quartzite outcrop that was the primary manganese source at the Bishop manganese mine and was within the larger muscovite schist member of the Mount Athos Formation. Judging by the known specimens in collections, this inclined shaft must have penetrated schist and also a brecciated zone of white quartz; breccia specimens are commonly cemented by turquoise, with crystals and crystal druses lining the open spaces.

TURQUOISE

The first recorded observation of turquoise crystals at the Bishop copper prospect is a reference to a note to be published by W. T. Schaller (Sterrett 1910):

> A specimen of well-crystallized turquoise from Campbell County, Va., was sent in to this office for identification by Mr. J. H. Watkins. The matrix of the specimen consists of irregular fragments of glassy quartz which are in part cemented together by thin veins of turquoise. On one side of the specimen the turquoise forms a drusy, botryoidal layer, cavernous in texture and including many small irregular fragments of the glassy quartz. The turquoise, with its many included quartz fragments, polishes well and makes a very handsome ornamental stone. The botryoidal coating consists of minute crystals, rhombic in shape but triclinic in symmetry, analogous to the crystals of chalcosiderite, with which turquoise is shown to be isomorphous. The analysis of the mineral, shown below, leads to the formula $CuO.3Al_2O_3.2P_2O_5.PH_2O$.

Figure 4. **The dump attached to the short incline at the Bishop copper prospect, looking north toward the creek (the opening to the incline is right behind the photographer). Lance Kearns photo.**

Analysis of turquoise specimen from Campbell County, Va.

P_2O_5	34.13
Al_2O_3	36.50
Fe_2O_3	.21
CuO	9.00
H_2O	20.12
Total	99.96

Other analyses of turquoise yield formulas which are in close agreement with the one given above.

Joel H. Watkins, the discoverer mentioned above, was at the time employed in southern Virginia as a geologist for the Southern Railroad. The company had asked him to inspect a property which they had heard might be a source of manganese ore.

Schaller published a series of descriptions of the crystallographic, optical, physical and chemical properties of the turquoise, but did not elaborate on either the source of the specimen nor the geology of the occurrence (Schaller, 1912a, b, c). There is nothing in these papers to suggest that Schaller visited the locality, or that he had first-hand knowledge of the Bishop copper prospect. Subsequent descriptions also gave the locality only as "a copper prospect near Lynch's Station, in Campbell County, Va," but did mention minor kaolinite and sericite in the quartz vein containing the turquoise crystals (Pogue 1915). Bland (1963) later mentioned ilmenite in association as well, and noted that the turquoise crystals are sometimes found in rosettes.

The locality appears to have been inactive from then until 1941 when collectors rediscovered it and recovered additional specimens (Trapp 1968; R. V. Gaines, personal communication). The site was not identified as the Bishop copper prospect at that time, and apparently had not been visited since being abandoned in 1910. The initial rediscovery was by Richard V. Gaines (a cousin of Joel H. Watkins) and Cedric Gleason; Gaines was at that time serving in the Army and stationed at Fort Belvoir. They located the site by finding the old overgrown dumps and the buried, but still visible, rails sticking out of the old mine portal. Gleason found the best piece that day, a particularly large and attractive specimen of crystallized turquoise on quartz measuring about 12 cm. The specimen remained in Gleason's collection until his death, at which time it became part of William Baltzley's collection (the specimen is presently in the collection of Mrs. Joan Baltzley). Trapp states in his article:

> When in 1909 the inclined shaft of the manganese [sic] mine had been sunk to a depth of approximately 60 feet, the shaft hit a quartz vein. It was in this quartz vein that the "blue stuff" was found and the miners thought they had hit copper ore. An attempt was made to smelt the "blue stuff" with the hope that copper would result; but this was a vain hope, the only product being roasted crystal turquoise and the destruction of the finest specimens. Attempts at further mining were abandoned at this time.
>
> It was just after this discovery that Mr. J. H. Watkins came across two miners at the Bishop mine and asked them for a specimen of the "blue stuff." Fortunately they gave him a fine one. About a year later, in 1911, Watkins asked Dr. W. T.

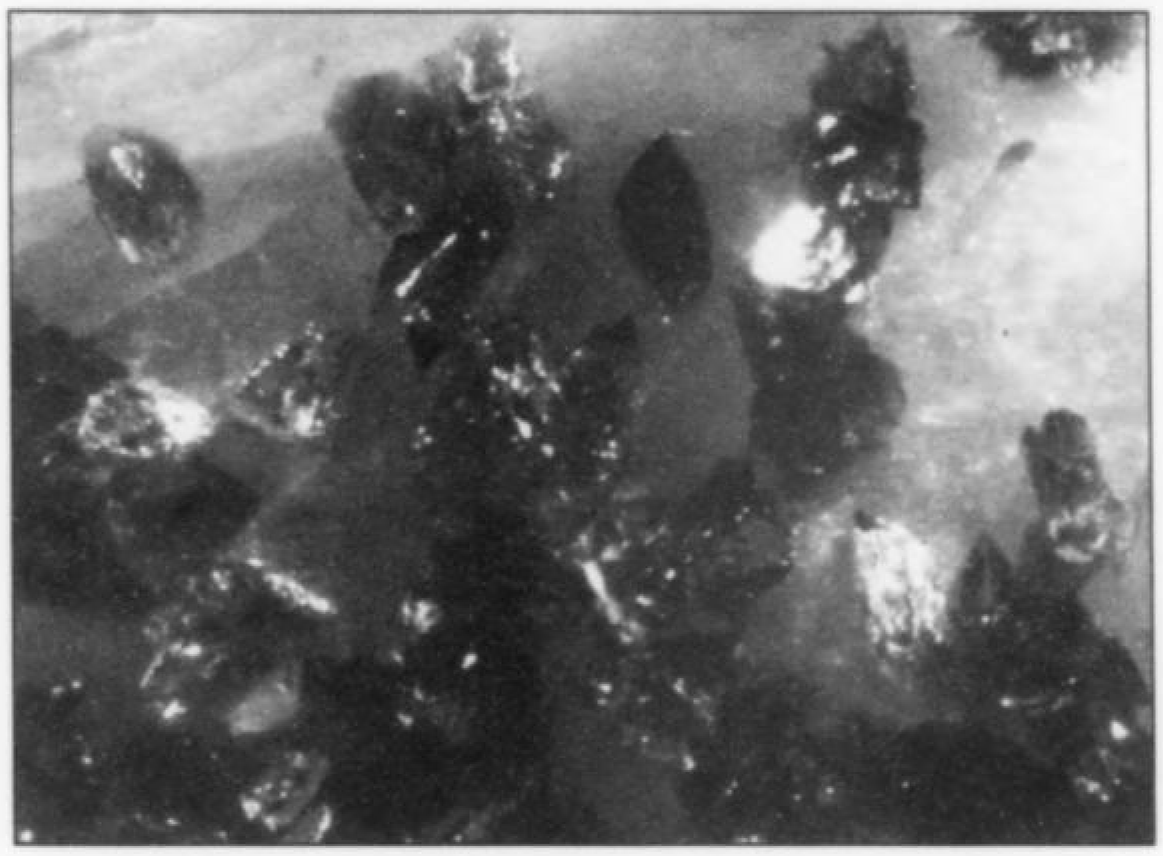

Figure 5. **Turquoise crystals to 0.5 mm scattered on white quartz, from the Bishop copper prospect. Allan Young collection; Wendell Wilson photo.**

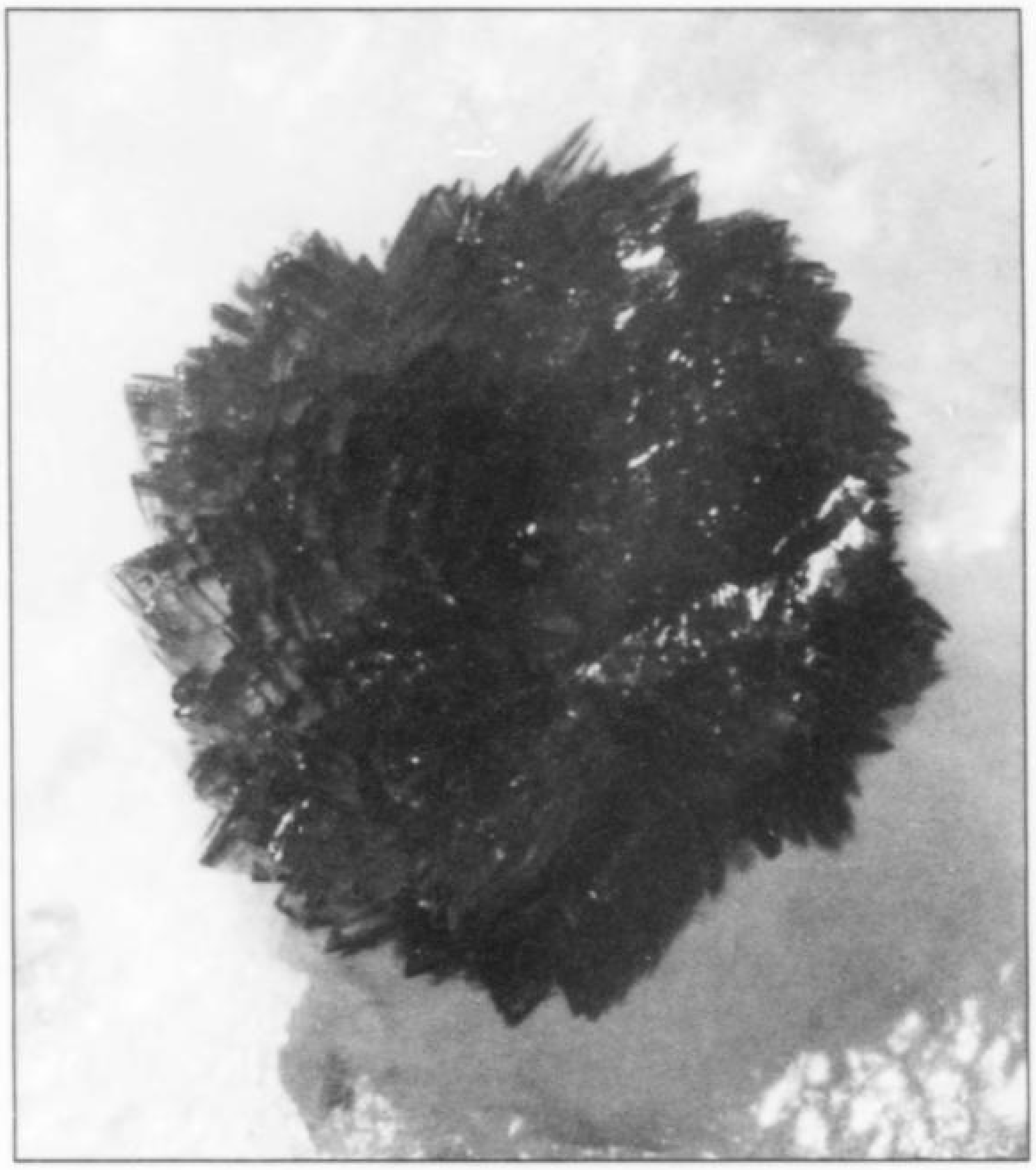

Figure 6. **Spherical cluster of turquoise crystals, 1.8 mm across, from the Bishop copper prospect. Dan Behnke specimen and photo.**

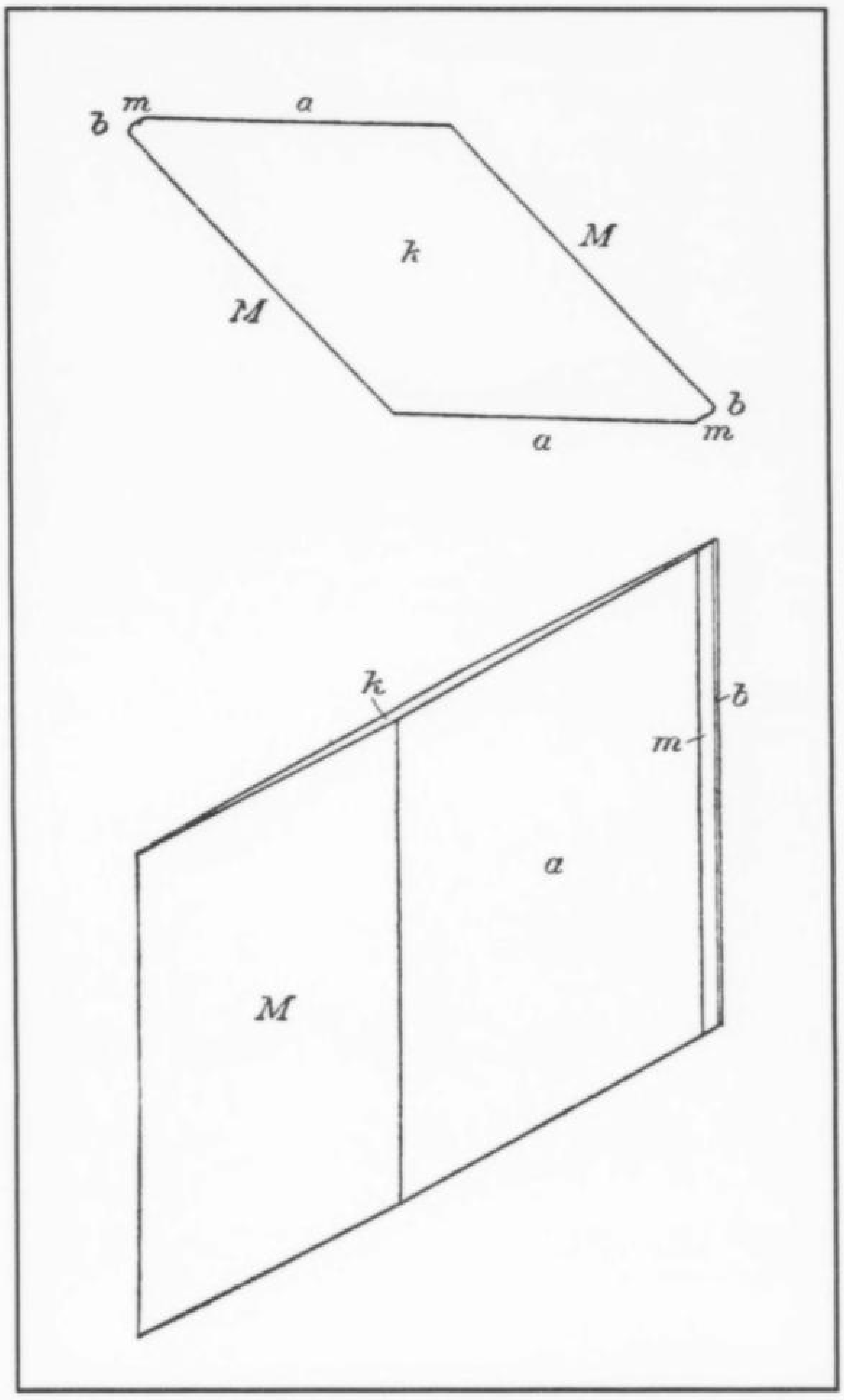

Figure 7. **Crystal drawings of Lynch Station turquoise by Schaller (1912); the forms shown are $b\{010\}$, $a\{100\}$, $m\{110\}$, $M\{1\bar{1}0\}$ and $k\{0\bar{1}1\}$.**

> Schaller, crystallographer of the U.S. Geological Survey, to identify the specimen. It was determined to be turquoise. Later Dr. Schaller transferred the specimen to the Smithsonian Institution where it is on exhibition. Dr. Schaller credited the donation to Mr. Watkins.

The source of this information was apparently a personal communication and represents the only documented information about the position of the turquoise in the mine shaft. This article was also the first to specifically identify the Bishop mine area as the source of the turquoise crystals.

After the rediscovery, other collectors were quick to locate and visit the area (Robinson, 1942). Robinson was accompanied to the site by Dr. E. E. Fairbanks, who commented on the occurrence of a greenish variety of turquoise with a higher iron content. The article noted that "not long ago the old mine was reopened but not a single turquoise specimen was encountered." This comment, by Robinson, probably refers to the prospecting carried out by the Otter Creek Mining Company where shaft No. 8 was sunk at the Bishop manganese mine (Epenshade 1954). This shaft is located about 300 meters northeast of the copper prospect that actually produced the turquoise crystals, so it is not surprising that none was found there.

The Bishop mine was opened to collectors in the early 1960's and a considerable number of specimens were recovered at that time (Dietrich, 1970). At least one collector cleaned out a portion of the old shaft and found specimens. It is not known if the specimens recovered from the old shaft were in-place or simply debris from the former mining operation. An anonymous collector wrote in 1963 about having visited the site on three occasions, digging down about 3 feet and recovering about 50 specimens showing good turquoise crystals each time. At that time a Mrs. Travis, sister of the property owner, gave permission to collect. The collector recommended that the owner charge a one-dollar fee for collecting, and this idea was adopted. Later that same year Louis

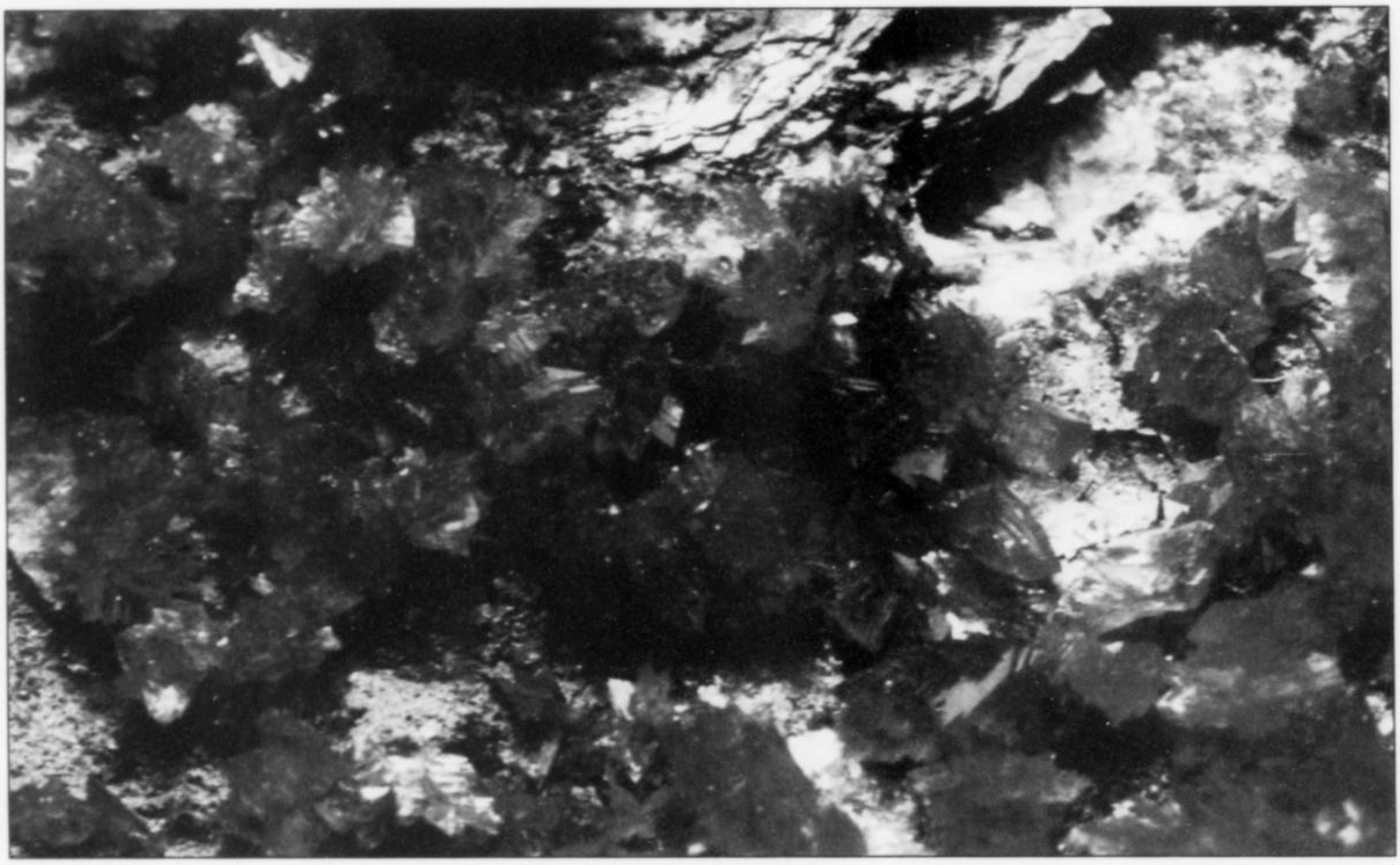

Figure 8. **Turquoise crystals to 0.5 mm, in clusters on gray mica schist, from the Bishop copper prospect. Smithsonian specimen (R15322); Wendell Wilson photo.**

Bland (1963) (perhaps himself the anonymous collector mentioned above) wrote about visiting the locality, paying the fee at the Whiterock service station (which served as the Bishop prospect information center at that time), and finding many beautiful specimens. He wrote:

> In order to obtain good material, one must dig through a mixture of dirt, roots and logs dashed with an occasional candy wrapper left by previous litterbugs. At the three-foot level, one runs into a layer of brown to black mica. Directly below this layer, a layer of schist and quartz fragments is encountered. When this final layer is hit, it is necessary to wash every piece [to check for turquoise crystals] and keep an eye on the schist fragments too.

As Bland said, most of the specimens from this period are on a mica schist, but a few are on gray to white quartz. The author spent an entertaining day digging in the dumps during a Virginia field trip in 1967 and managed to recover a few small specimens by screening and washing "dirt" from the dumps. Around that same time, June Culp Zeitner (1968) wrote:

> Although worked for many years by eager collectors, the old dumps still produce numerous fine specimens. Only recently Don Woolford, Peter McCrery and several other members of the Richmond [Virginia] Gem and Mineral Society recovered some large and exceptional pieces after some hard digging.

One of the more bizarre theories proposed for the origin of these crystals is that they had crystallized on the dump as a post-mining product. One local collector insisted that a barrel of dump material placed under his downspout continued to produce specimens for years and was self-renewing. Turquoise crystals were reported as being found inside a root of a relatively young tree (Anonymous, 1963) and, according to Mrs. Catherine Shaw, one of the owners of the property, a large mass of turquoise crystals was recovered from inside a tree trunk near the mine. A biogenic origin for some of the crystals cannot be ruled out; however, no specimens representing these finds are known to exist today. The absence of modern-day sources of phosphorus or copper, other than the turquoise itself, is a strong argument against rapid crystallization of turquoise on the dumps or in tree roots.

Schaller prepared line drawings of the crystals and recorded the interfacial angles and axial ratios for a triclinic unit cell, identifying by goniometry the forms *b*{010}, *a*{100}, *m*{110}, $M\{1\bar{1}0\}$ and $k\{0\bar{1}1\}$. Forms *a* and *M* are dominant and are striated vertically; the dome k (the only terminal face identified) can be smooth or striated, although Schaller suspected that the smooth example he studied may actually have been a cleavage face. In 1947 Graham determined a unit cell by X-ray (Weissenberg photo) techniques, and changed Schaller's original setting to Peacock's normal setting for triclinic crystals. The crystal structure of turquoise was eventually solved using a Bishop mine specimen (Cid-Dresdner, 1964). Only recently has the turquoise group been sorted out and the minerals planerite and aheylite described and grouped with turquoise and chalcosiderite (Foord and Taggart, 1986, 1998).

The Bishop area contains little of interest to mineral collectors except for the turquoise crystals. There are minor occurrences of manganese oxides, and a number of other minerals have been reported from petrographic examination of the enclosing rocks, but these are of no interest as specimens. No records were made of the nature or position of the quartz veins that contained the turquoise

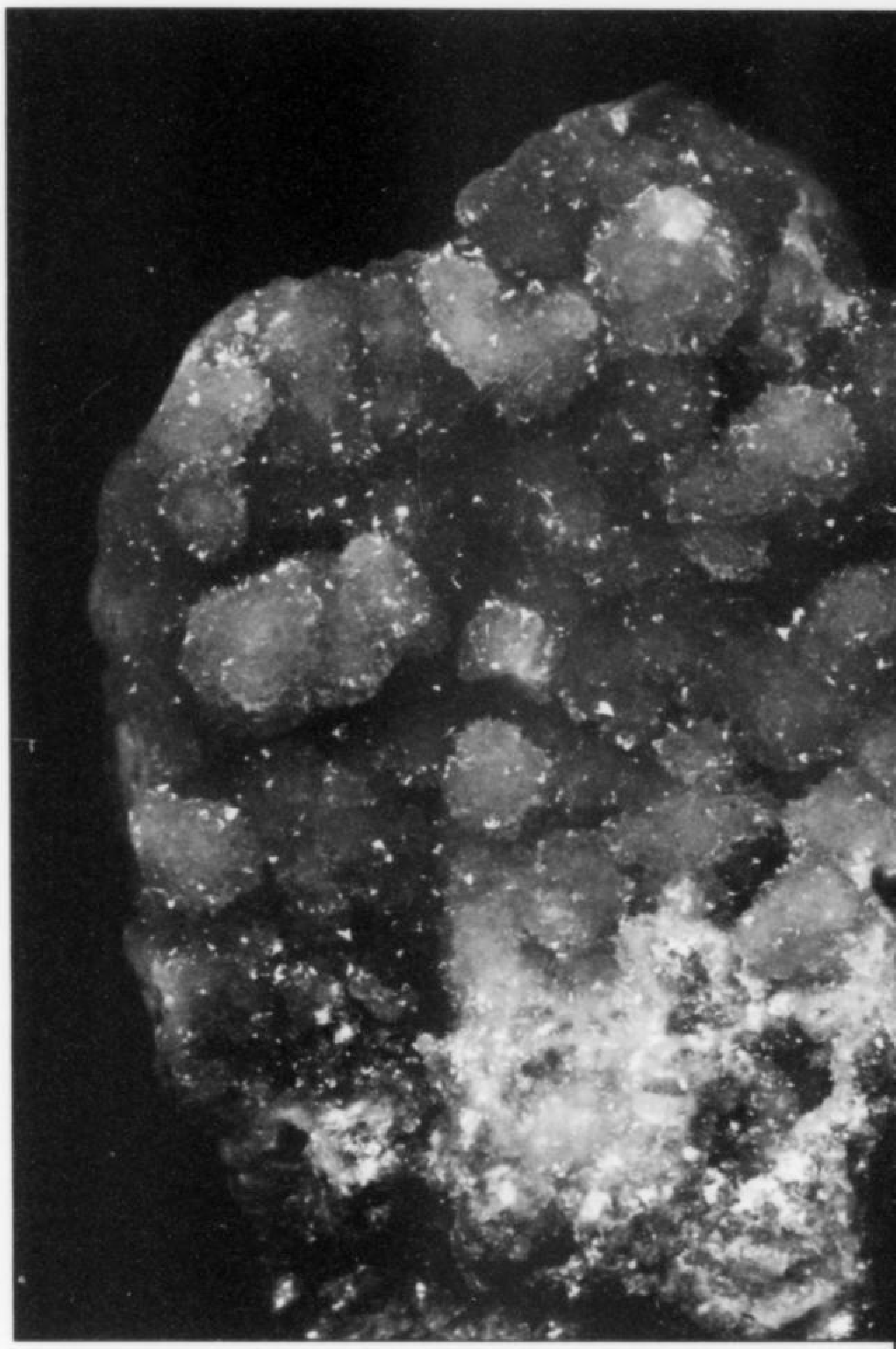

Figure 9. **Rich crust of turquoise crystals, 3.1 cm tall, from the Bishop copper prospect. Bob and Susan Weaver collection; scanner photo by Wendell Wilson.**

Figure 10. **Pocket of turquoise crystals in white quartz breccia, 2 cm across. Rob Lavinsky specimen; scanner photo by Wendell Wilson.**

crystals at the time of mining. We will probably never know the precise disposition of the turquoise crystal-bearing veins within the workings or the degree to which turquoise was disseminated into the surrounding schist. The paucity of information about the paragenesis of the turquoise crystals is unfortunate.

The copper prospect and the Bishop manganese mine are currently owned by the family of Ms. Catherine Shaw-Gallant, under a family-owned corporation. The turquoise crystal locality appears to have retreated into obscurity sometime after the 1970's and is presently overgrown.

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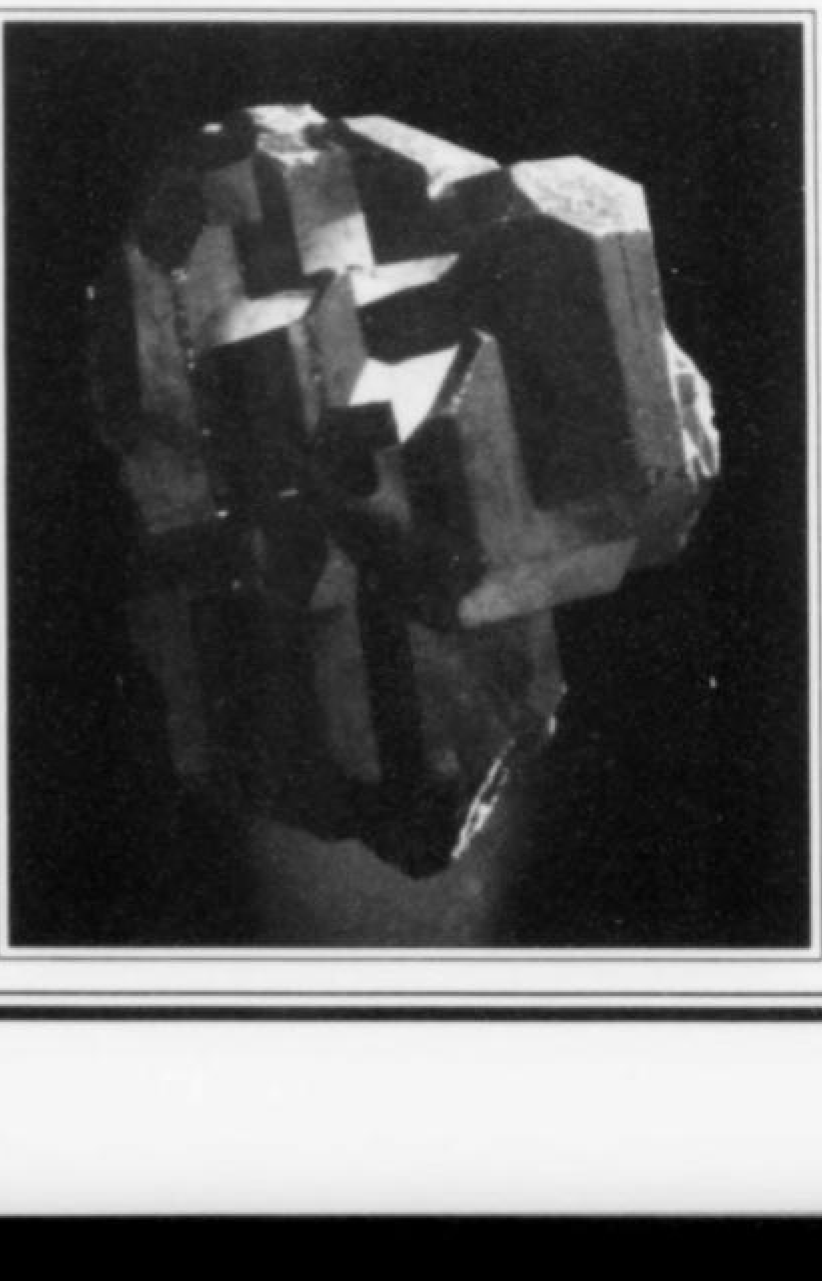

Cuprite, 2.7 cm. Queensland, Australia

Jeff Scovil photo

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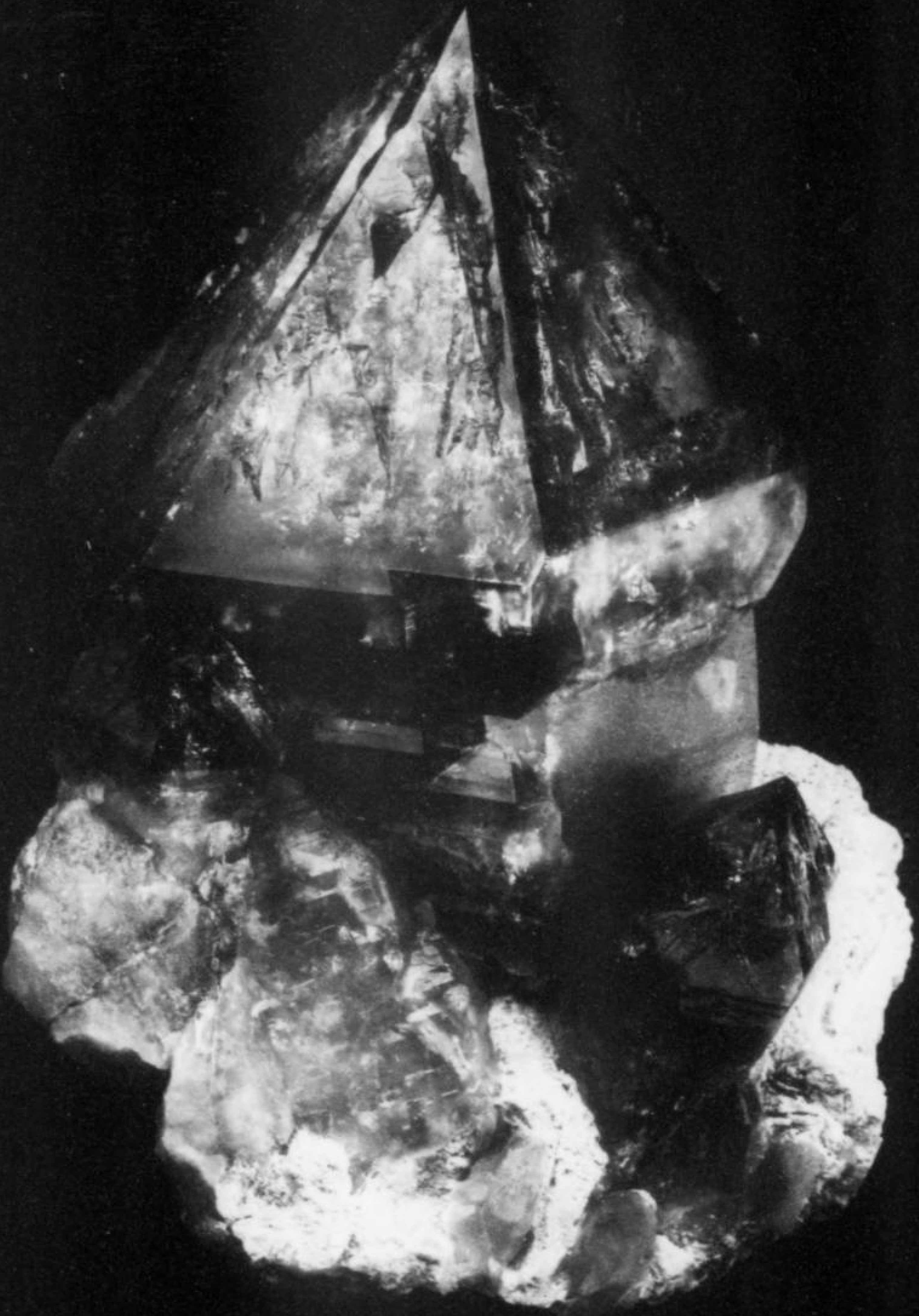
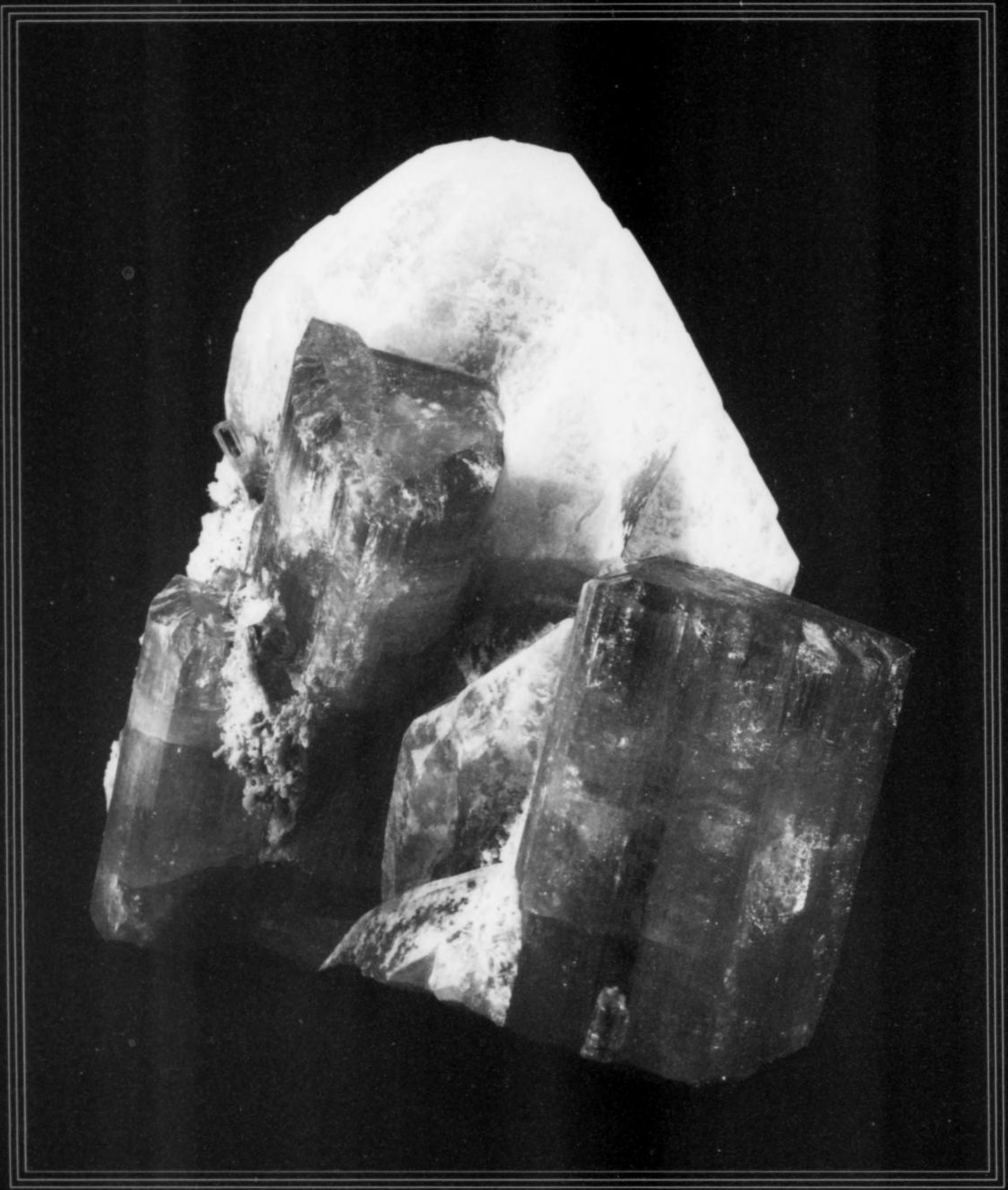


Amethyst Scepter, 17 cm, from Onyang, Kyong-Sang-Mande, Korea. Jeff Scovil photo.



TOURMALINE on Quartz, 12 cm, from near Paprok, Afghanistan.
Found in late 1997 and obtained from Wayne Thompson, Dec. 20, 1997.

Clara and Steve Smale
COLLECTORS

PHOTO BY STEVE SMALE

"The Father of Bolivian Geology"

Friedrich (Federico) Ahlfeld

(1892–1982)

Stewart D. Redwood
Casilla 13385,
La Paz, Bolivia

Bolivia is fortunate to have had the lifetime services of the renowned and distinguished geologist Friedrich (Federico) Ahlfeld, respected as "The Father of Bolivian Geology." In a career of over fifty years in mining geology in his adopted country of Bolivia, he published numerous works on the geology and mineral deposits of Bolivia, many of which are to this day standard references.

INTRODUCTION

Federico Ahlfeld is well-known internationally as "The Father of Bolivian Geology," primarily for his voluminous bibliography of published works on the geology and mineralogy of that country (compiled here for the first time). In addition to his definitive books and articles, he also made the first geological and mineral deposit maps of Bolivia. The mineral *ahlfeldite,* a hydrated nickel selenite discovered at the Pacajake mine in Bolivia, was named in his honor in 1935.

Federico Ahlfeld was a mineralogist, economic geologist and regional geologist with specialities in ore deposits, ore genesis and metallogenic belts; in particular, he was considered a world expert on tin and tungsten. He worked in Bolivia during the heyday of the great tin, tungsten, antimony and silver mines, and made valuable studies of many of these famous deposits including Uncia-Llallagua, Pulacayo, the Cerro Rico of Potosí, Colquechaca, Carguaicollo, Chicote Grande and many smaller deposits. He also studied the mines and minerals of Peru and Argentina, as well as tin and tungsten deposits in Russia, China and Europe.

EARLY WORK

Friedrich Ahlfeld was born on 6 October 1892 in Marburg, Germany, the son of Friedrich Ahlfeld and Elizabeth Vollmer. He studied Mining Engineering at the Mining School of Clausthal from 1910 to 1914, and after serving in World War I he completed his degree in 1919, specializing in Geology and Mineral Deposits. In 1921 he was awarded his doctorate from Clausthal for his thesis on the minerals of the Hesse-Nassau Province in Germany. During the next two years Ahlfeld visited Italy, Austria, Yugoslavia and Romania as a consultant.

Traveling via Venezuela, Ahlfeld first arrived in Bolivia in 1924 at the age of 32. He had been hired as a geologist for Mauricio Hochschild & Compania, La Paz, for whom his first study was of the old silver mines of Carangas in the Western Cordillera. He also visited Peru during this period and published studies of the antimony deposits of Acora (Puno) in 1926. After spending a year consulting in Germany, he participated in the German Andean Expedition to the Cordillera Real of Bolivia in 1927–1928 with the renowned geographer Dr. Carl Troll. In 1929 he traveled to Africa,

Figure 1. **Friedrich Ahlfeld as a young man. Photo courtesy of Manfred Ahlfeld.**

visiting Southern Rhodesia (Zimbabwe), Congo and Tanzania, and attended the International Geological Congress in Pretoria. He returned to Marburg between 1929 and 1932 to study Mineralogy and was appointed Dozent (Professor) of Mineralogy, Petrography and Economic Geology there in 1931, a post he held until 1934.

Returning periodically to Bolivia, he visited the Colquijirca silver mine in Peru in 1931 and climbed El Misti Volcano overlooking Arequipa. In 1932 and 1933 he was an Adviser of the Russian Government in Tashkent, and published papers on the mineralogy and mineral deposits of Turkestan (Turkmenistan) and Kazakhstan. He returned to Bolivia as Chief Geologist of the Bolivian Government in La Paz from 1935 to 1936. This was followed in 1937 by a position as a Geologist at Nanking (Nanjing) for the Chinese Government, where he supervised exploration for tin deposits in Hunan.

RETURN TO BOLIVIA

In 1938 Friedrich Ahlfeld was appointed Chief Geologist in charge of the Geology Section of the new Directorate General of Mines and Petroleum, the precursor to the Geological Survey of Bolivia, a position he held until 1946. During this period he pioneered geological studies in the remote tropical lowlands of the Precambrian shield of eastern Bolivia. He discovered the iron ore deposit of Mutún at Puerto Suarez on the Brazilian frontier in 1939. In 1943 he made a geological survey of the route of the proposed railway from Santa Cruz to Puerto Suarez.

Between 1946 and 1948 he was Chief and Researcher of the Department of Metallurgy in the new Institute of Geology and Mining of the National University of Tucumán in the city of Jujuy, and at the same time was Professor at the School of Mines there. Jujuy is on the southern continuation of the Bolivian Tin Belt in northwestern Argentina.

Ahlfeld surveyed the mineral deposits of the region and published a book on the mineralogy of Argentina.

Following this he worked for Hochschilds' tin mining company in Bolivia, Empresa Minera Unificada del Cerro de Potosí, from 1949 to 1950, and then for Patiño Mines and Enterprises in 1951 to 1952. Upon the nationalization of the Bolivian mining industry in that year, Ahlfeld went to Bilbao in Spain as a consultant for the José Lippeheide mining company in the Basque province between 1953 and 1954. He published his monograph on the mineral deposits of Bolivia in Bilbao in 1954, and in the same year he published a paper about the tungsten deposits of Spain. In 1955 he returned to Bolivia as a consultant geologist to various organizations including the United Nations (1956–1960) and the German Geological Mission in Bolivia (1959 to 1963). He made his last visit to Germany in 1960, and traveled to Switzerland in 1961. He was Professor of Geology and Mineralogy at the University of San Andres in La Paz from 1956 to 1960, Honorary Professor of the Tomás Frias University in Potosí, Honorary Professor of the Bolivian Technological Institute in La Paz (1963), and was Chief of the Bolivian Geological Survey, GEOBOL. In 1963 he mapped the Ayopaya province for the German Mission at the age of 71, quite a remarkable feat even for a much younger man in this very steep and remote sub-tropical region.

MINERALOGICAL CONTRIBUTIONS

Ahlfeld was foremost a mineralogist and made many important contributions to mineralogy, especially of tin and tungsten and their low-temperature minerals, and of sulfosalts—the typical minerals of the Bolivian Tin Belt. He discovered the new mineral ramdohrite at the Chocaya mine in southern Bolivia in 1930, and angelellite in Argentina, and described several other new mineral species whose names are now obsolete. He pioneered studies relating the crystal habit of cassiterite to temperature of deposition. Ahlfeld also studied the metallogenic belts of Bolivia, notably the Tin Belt. Ahlfeld's regional studies served as a basis for oil exploration and led to the discovery of new oil fields in the vicinity of Santa Cruz in the 1950's. There was probably no part of the vast and varied land of Bolivia, nor any Bolivian mine, that he did not visit, from the high Andes to the jungles.

Ahlfeld's interests included mountaineering, archaeology, ethnography and photography. His mountaineering skills were of great help in fieldwork in the high Andes. He participated in numerous mountaineering expeditions and is credited with the discovery of many new peaks and routes. He was a founding member of the Club Andino Boliviano and one of its early presidents. He also studied the provenance of semiprecious stones and rocks from the important pre-Incan Tiwanaku site in Bolivia. He identified the sodalite used in jewelry at Tiwanaku as being from Cerro Sapo in the Ayopaya alkaline province, a deposit which he himself had discovered. He also discovered a pre-Incan semi-precious mine at Turco, Bolivia.

Ahlfeld's greatest legacy is his prodigious list of publications which have greatly enriched the Bolivian geological and mineralogical literature. He published 142 works on Bolivia between 1925 and 1975. These include several on geography, mountaineering, archaeology and ethnography. In addition there are some 36 publications on other countries including Argentina (11), Russia (7), Peru (5), Africa (3), Germany (3), Italy (3), China (2), Venezuela (1) and Spain (1), plus eight on general mineralogy, making a total of 186 publications. He was sole author of all but 24 of these papers, and senior author of almost all of the rest. Most of his works were published in German and Spanish, which is why he is poorly known to English-speaking geologists and mineralogists. His main English publications were six papers in Economic Geology between 1930 and 1948, mainly on the Bolivian tin and tungsten deposits, and an important paper on the metallogenic belts of Bolivia in *Mineralium Deposita* in 1967.

Ahlfeld's principal books, all in Spanish or German, were *The Minerals of Bolivia* (all titles given here in English) with Jorje Muñoz-Reyes, now in its sixth edition and still in print after 65 years. It was first published in Spanish in La Paz in 1937, with a German edition in Berlin the following year, new Spanish editions in 1943 and 1955, and a student edition in La Paz in 1967; it was recently updated by Salomón Rivas in Santa Cruz in 1998. The 1955 edition listed 242 mineral species in Bolivia (a number which had more than doubled to 515 by 1998). *The Mineral Deposits of Bolivia* was published in Berlin in 1939 with Jorje Muñoz-Reyes, with Spanish versions in La Paz in 1941, 1954 and 1964, the latter with Albrecht Schneider-Scherbina. He published the first Map of the Mineral Deposits of Bolivia in La Paz in 1946. *The Geology of Bolivia* with Professor Leonardo Branisa was published in Argentina in 1946 and in La Paz in 1960, with a popular edition published in La Paz in 1972. *The Physical Geography of Bolivia* was published in La Paz in 1969 and reprinted in 1973. Ahlfeld also published a monograph on *The Tungsten Deposits of Bolivia* (La Paz, 1942) and a monograph on *Tin and Tungsten* (Stuttgart, 1958).

Federico Ahlfeld also made important contributions to the Argentinian geological and mineralogical literature. *The Minerals of Argentina* was published with Victorio Angelelli in Jujuy in 1948. This was the precursor to the classic treatise on the mineral deposits of Argentina published by Angelelli in 1950 and 1984.

AHLFELD'S MINERAL COLLECTIONS

Ahlfeld built several important mineral collections. An early collection was purchased in 1932 jointly by Harvard University (Cambridge, Massachusetts) and the U.S. National Museum's Smithsonian Institute (Washington). The idea of a joint purchase was put forward by Charles Palache, Harvard's curator, and accepted by William Foshag, USNM curator. Foshag selected one third of the collection for the USNM, amounting to 319 specimens, and the rest was retained by Harvard. All paperwork from Ahlfeld was retained by Palache (Paul W. Powhat, Smithsonian Museum, personal communication). It is reported that Ahlfeld later donated important collections of minerals and fossils to the Tiahuanaco Archaeological Museum in La Paz and the Bolivian Directorate of Mines and Petroleum in La Paz, and that his library was donated in 1980 to the Geological Institute of the University of San Andres in La Paz (Danieli, 1986). His son Manfred retains an important selection of specimens from the collection in Mexico, while the rest has been dispersed by dealers. Ahlfeld sold many pieces himself before he died, to dealers including Jack Young and Charles Key. His widow sold the rest, mainly to Terry Szenics, who in turn sold the best pieces to the Azurite Corporation (Alfredo Petrov, personal communication).

HONORS

Ahlfeld was elected to the Society of Economic Geologists of the USA in 1930. He held the office of Regional Vice-President for South America in 1941 and again in 1953. He was also a Member of the Society of American Mineralogists; a Member of the Mineralogische Gesellschaft of Berlin; and a Member of the National Academy of Sciences of Bolivia. He was awarded the Service Cross of Germany; the Condor of the Andes (1960)—the highest civilian decoration of Bolivia; and the Mining Merit Medal by the Ministry of Mines and Metallurgy of Bolivia in 1976.

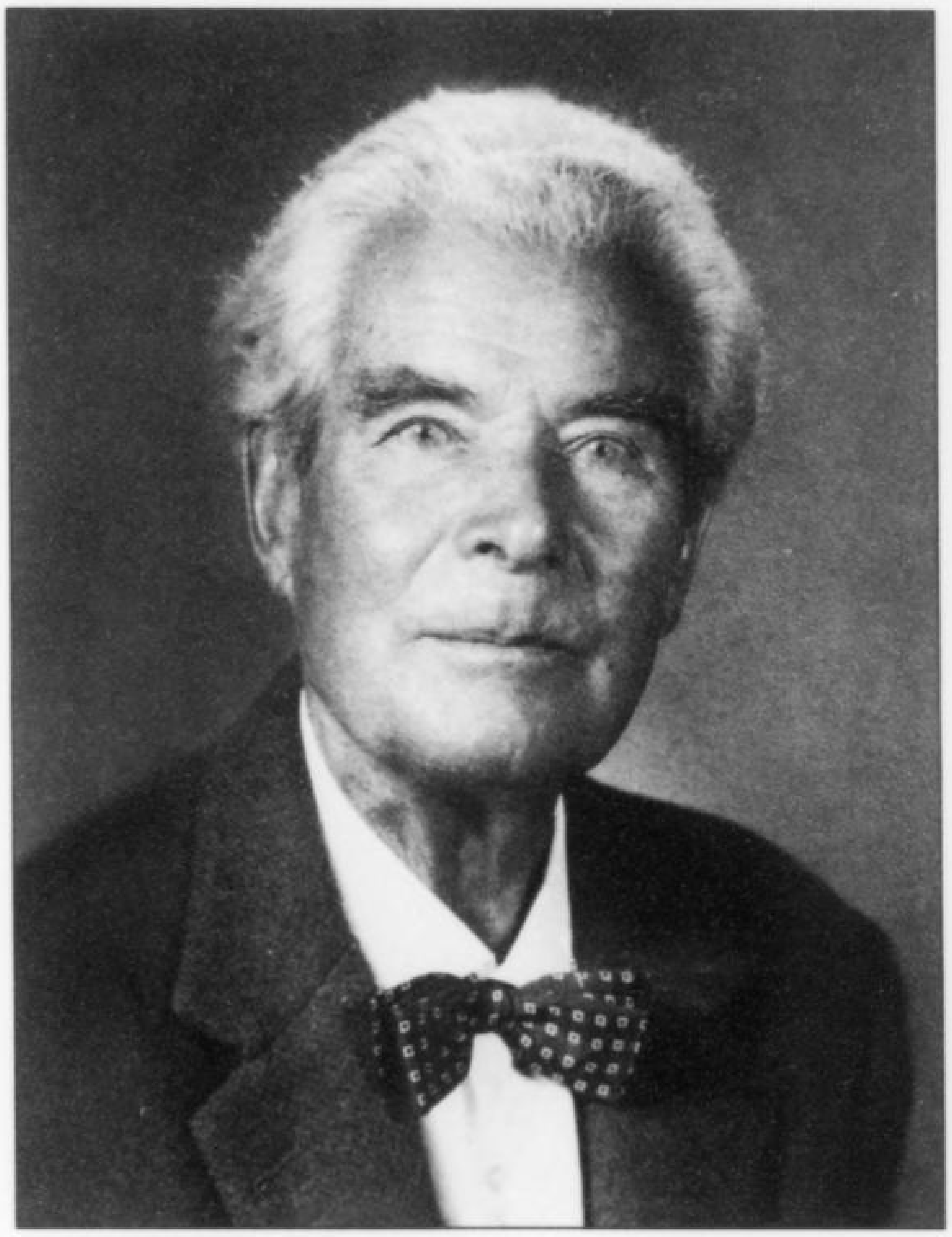


Figure 2. **Friedrich Ahlfeld. Photo courtesy of Manfred Ahlfeld.**

The square at the entrance to the Bolivian Geological Survey (SERGEOMIN, formerly GEOBOL) in La Paz is named Ahlfeld Plaza in his honor, and features a bust of him. He is also commemorated in the naming of the Federico Ahlfeld Falls on the Pauserna River on the Huanchaca Plateau in the Noel Kempff National Park in eastern Bolivia. This remote region was discovered by the legendary British explorer Colonel Percy Harrison Fawcett in 1908–1909, whose lectures in London are said to have inspired *The Lost World* of Sir Arthur Conan Doyle, published in 1912 (Fawcett, 1953).

Ahlfeld became a Bolivian citizen in 1938. He and his family acquired a house in Cochabamba in 1947 and moved there permanently in 1964; he was later made an Honorary Citizen of that city of eternal spring. He was also made an Honorary Citizen of the Province of Ayopaya. His friend, Dr. Fritz Berndt (after whom *berndtite* is named), is still alive and living in Ahlfeld's former home in Cochabamba; Berndt, who described Ahlfeld as a person of strong self-discipline who worked at keeping himself in good physical shape, recalls visiting mines with him when Ahlfeld was in his seventies. It is said that "even in his eighties he was still a forceful personality, disguising his age with a youthful agility and full mental ability" (Neate, 1987). His health started to fail in 1975 and he died in Cochabamba in his ninetieth year on 9 January 1982. He was survived by his wife, Isegret Goltz, and son, Manfred Ahlfeld.

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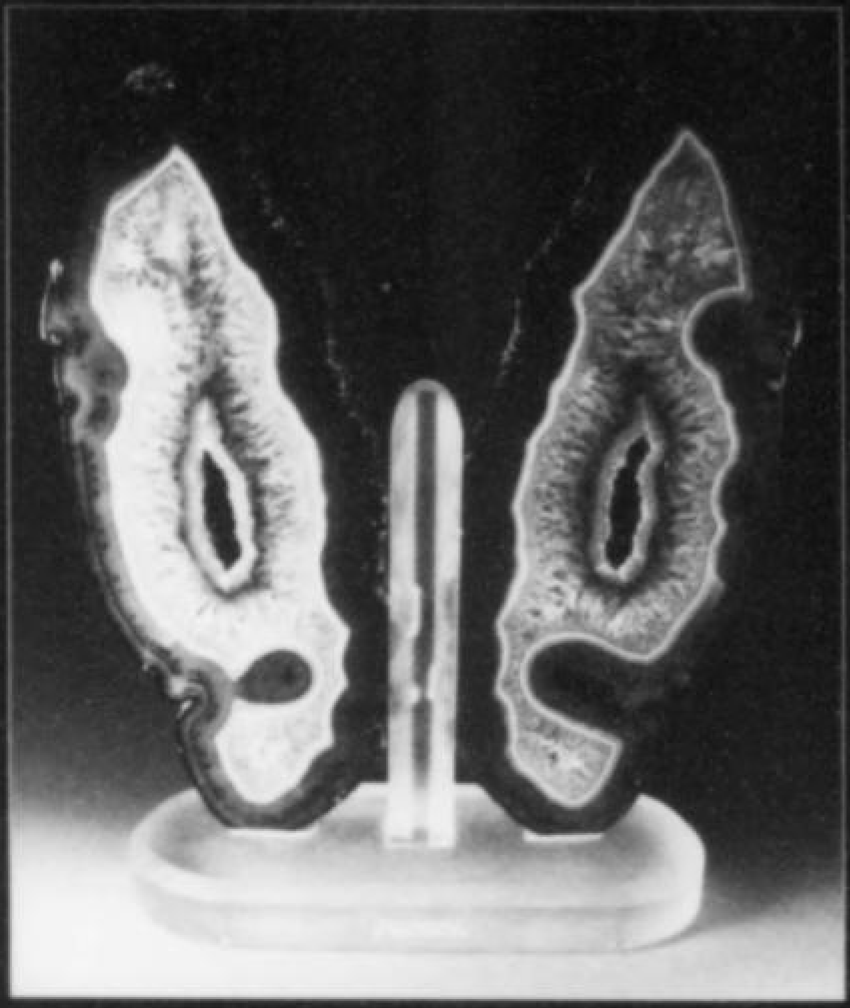

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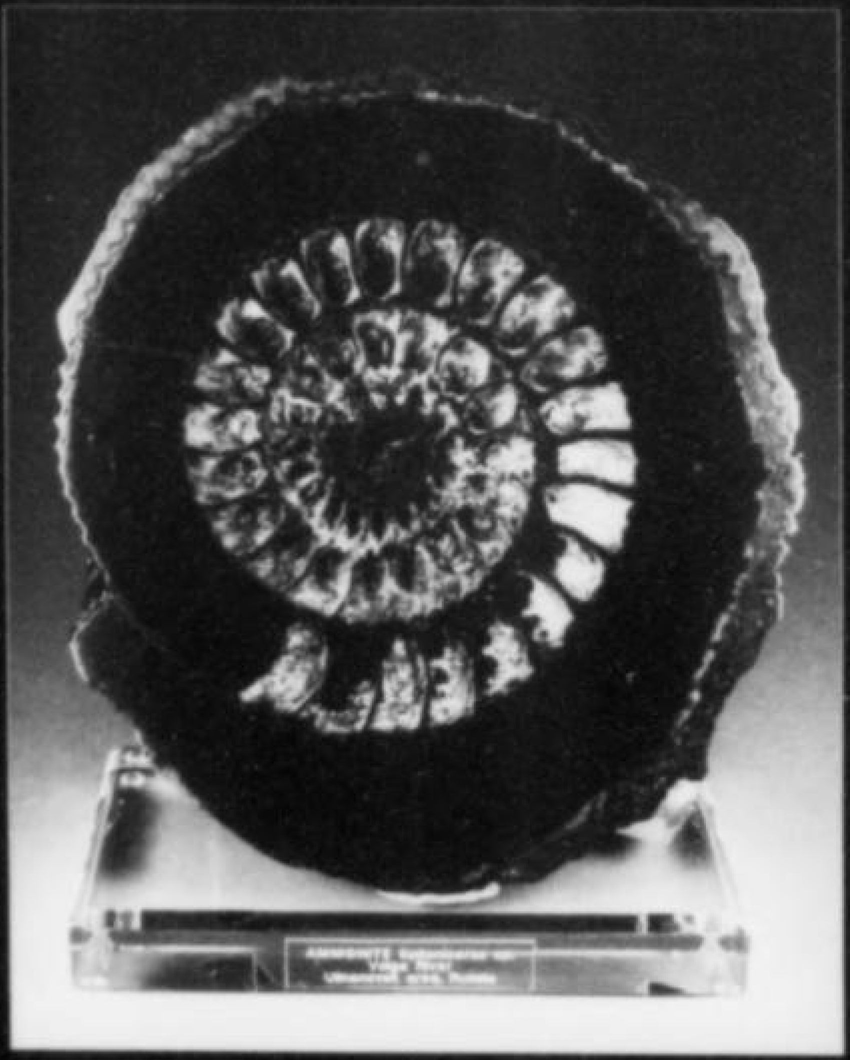

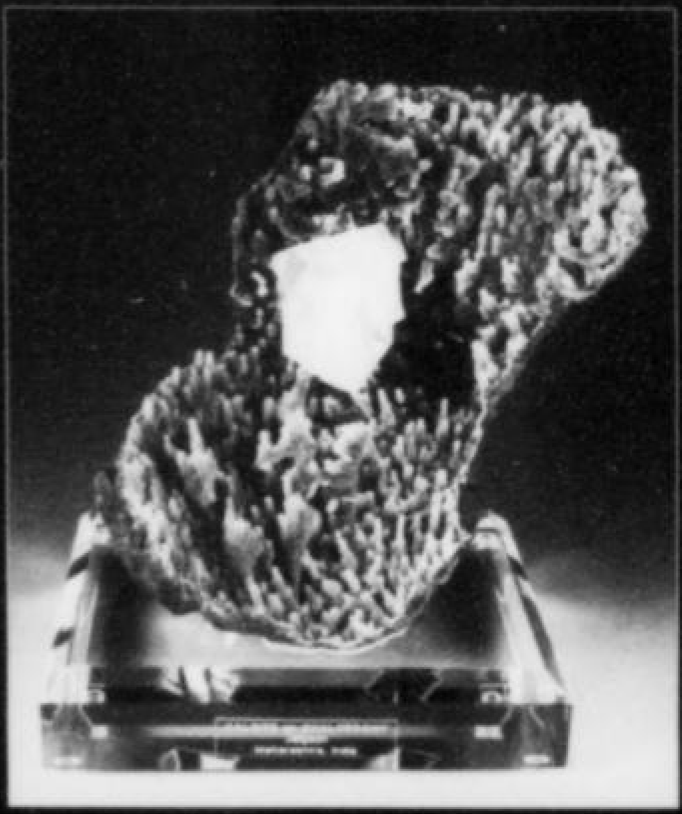

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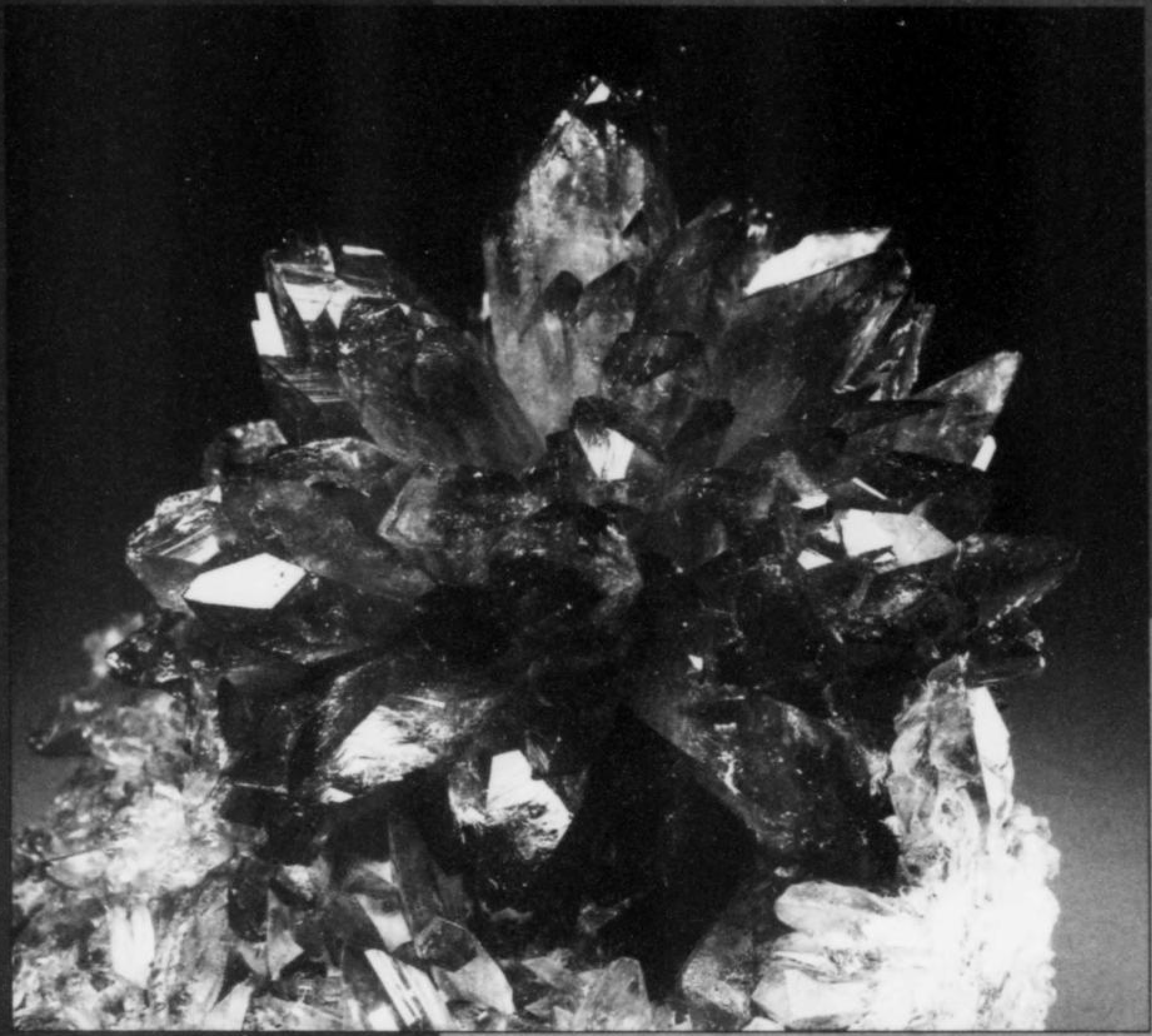

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GOLDQUARRYITE

A New Cd-Bearing Phosphate Mineral from the Gold Quarry Mine, Eureka County, Nevada

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ABSTRACT

Goldquarryite, idealized formula $CuCd_2Al_3(PO_4)_4F_2(H_2O)_{10}$-$(H_2O)_2$, structure-derived formula $(Cu_{0.70}\square_{0.30})_{\Sigma 1.00}(Cd_{1.68}Ca_{0.32})_{\Sigma 2.00}$-$Al_3(PO_4)_4F_2(H_2O)_{10}[(H_2O)_{1.60}F_{0.40}]_{\Sigma 2.00}$, is triclinic, space group $P\bar{1}$, with unit-cell parameters derived from crystal structure: a = 6.787(1), b = 9.082(2), c = 10.113(2) Å, α = 101.40(1)°, β = 104.27(1)°, γ = 102.51(1)°, V = 568.7(3) Å^3, $a{:}b{:}c$ = 0.7473:1:1.1135, Z = 1. The strongest seven reflections in the X-ray powder-diffraction pattern are [d(Å)(I)(hkl)]: 9.433(100)(001); 4.726(30)(002); 3.700(30)($0\bar{2}2$); 3.173(30b)($\overline{12}2$, $\overline{11}3$, 120, 003); 3.010(30)($\bar{1}22$, $\bar{2}12$); 2.896(30)($\overline{21}1$); 2.820(50)(022). The mineral occurs on a single specimen collected from the 5,425-foot bench, Gold Quarry mine, Eureka County, Nevada, as isolated clusters of radiating sprays of crystals and as compact parallel crystal aggregates, which are both found on and between breccia fragments. Sprays and aggregates never exceed 3 mm in longest dimension and typically average about 0.5 mm in size. Goldquarryite is a late-stage supergene mineral associated with opal, carbonate-fluorapatite and hewettite, on a host rock composed principally of brecciated and hydrothermally rounded jasperoid fragments which have been lightly cemented by late-stage silicification. Individual euhedral crystals are acicular to bladed, elongate [100], with a length-to-width ratio of approximately 20:1; the maximum size is 1.5 mm but most crystals do not exceed 0.4 mm in length. Forms are {010}, {001} major and {100} very minor. The mineral is pleochroic; translucent (masses) to transparent (crystals); very pale blue to blue-gray (crystals) or blue (masses); with a white streak and a vitreous to glassy luster. Goldquarryite is brittle, lacks cleavage, has an irregular fracture, and is nonfluorescent; hardness (Mohs') is estimated at 3–4; measured density is 2.78(1) g/cm^3 (sink-float techniques using methylene iodide-acetone mixtures), calculated density is 2.81 g/cm^3 (for formula and unit-cell parameters derived from crystal structure). Optically, it is biaxial positive, α = 1.570, β = 1.573, γ = 1.578; $2V$ (meas.) = ~ 30°, $2V$ (calc.) = 76°; dispersion $r < v$, strong. Average electron-microprobe analysis: K_2O = 0.17, CuO = 5.33, CaO = 1.25, NiO = 0.23, ZnO = 0.05, CdO = 26.24, Al_2O_3 = 15.22, V_2O_3 = 0.05, P_2O_5 = 28.04, F = 3.63, H_2O (calculated assuming stoichiometry) = [22.19], –O = F = –1.53, total = 100.87 weight %, corresponding to $[(Cu_{0.66}Ni_{0.03}Zn_{0.01})_{\Sigma 0.70}\square_{0.30}]_{\Sigma 1.00}(Cd_{2.00}Ca_{0.22}K_{0.04})_{\Sigma 2.26}(Al_{2.92}V_{0.01})_{\Sigma 2.93}(PO_4)_{3.88}F_{1.87}\cdot H_2O_{12.06}$, based on 29.45 (O + F) anions. H_2O was confirmed by both infrared spectroscopy and crystal-structure analysis. The mineral name is for the locality.

INTRODUCTION

During a thorough investigation of the mineralogy of the Gold Quarry mine, Eureka County, Nevada, Jensen *et al.* (1995) reported two undefined phosphate phases which they designated as "Unknown #1" and "Unknown #2". The latter phase, "Unknown #2", has now been formally characterized and the description of this new mineral is the subject of this paper.

The mineral is named goldquarryite after the type (and only known) locality, the Gold Quarry mine, Eureka County, Nevada. The mineral and mineral name have been approved by the Commission on New Minerals and Mineral Names, I.M.A. (2001-58). The holotype specimen (6 x 3.5 x 3 cm), one single-crystal mount and a few micron-sized fragments in a gelatin capsule are housed

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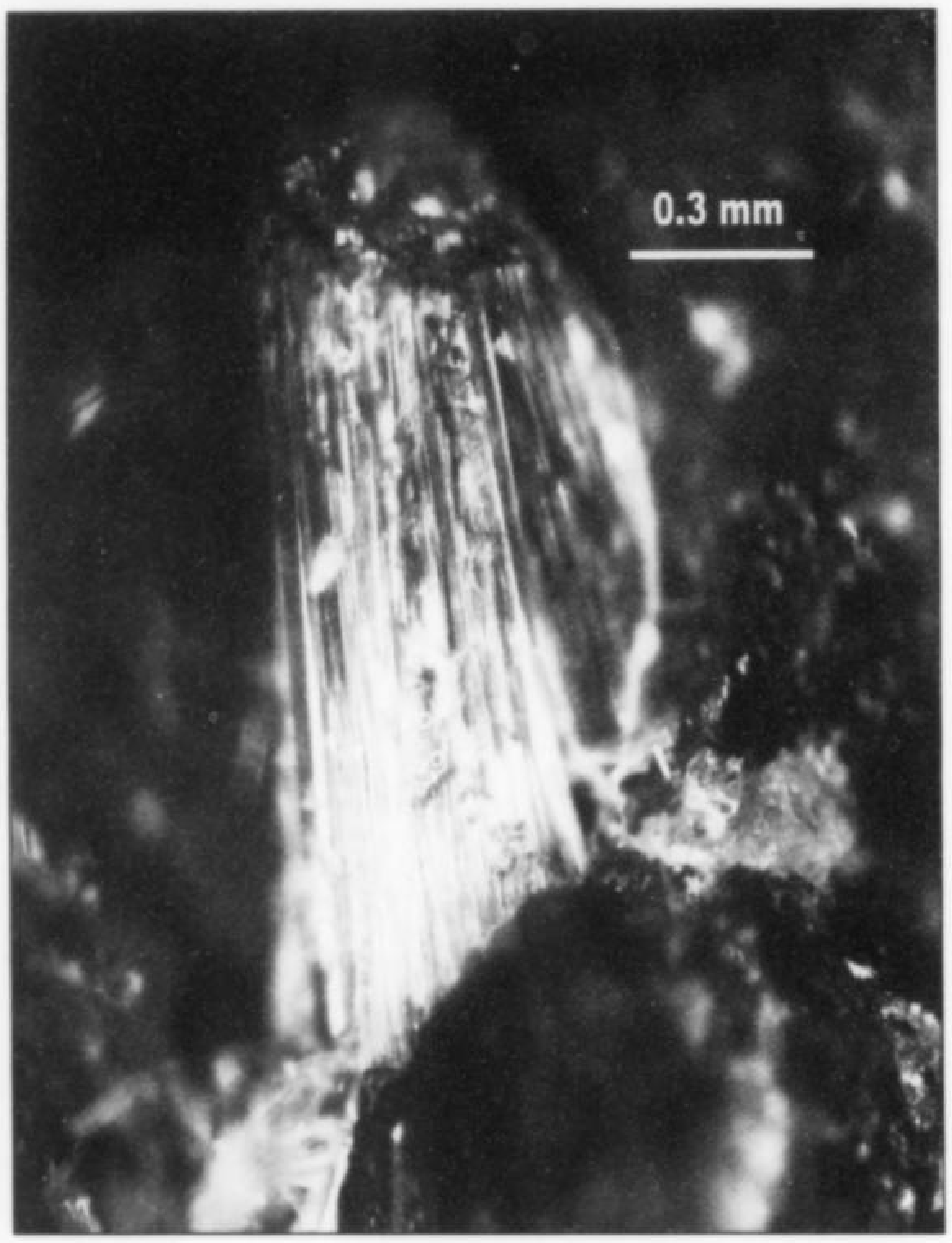

Figure 1. **Compact parallel aggregates of goldquarryite. Scale bar: 0.3 mm.**

in the Systematic Reference Series of the National Mineral Collection of Canada at the Geological Survey of Canada, Ottawa, under catalog number 68084.

OCCURRENCE AND ASSOCIATED MINERALS

The new species was found at the Gold Quarry mine, 11 km northwest of Carlin, Eureka County, Nevada. The mine is a large open-pit Carlin-type gold deposit presently operated by the Newmont Gold Company. Jensen *et al.* (1995) discuss the mineralogy, history and geology of this interesting deposit. Only one specimen containing goldquarryite, about 8 x 8 cm in size (since split for mineralogical study), was preserved from a freshly blasted muck pile exposed on the 5,425-foot bench at mine coordinates 16500N, 19500E. The piece, collected in February 1992, consists of brecciated and hydrothermally-rounded jasperoid fragments lightly cemented by late-stage silicification. Supergene minerals on the surface of the jasperoid breccia include a uniformly thin, colorless, botryoidal opal crust and a later coating (and local microcrystals) of pale yellow, impure carbonate-fluorapatite. Hewettite, in radiating sprays (to 10 mm) of lustrous maroon-red fibrous crystals, and goldquarryite were the last minerals to form, and occur as isolated clusters on and between breccia fragments; the two species do not occur in immediate association and their paragenetic relationship is not known. The largest crystal cluster of goldquarryite is a radiating spray 3 mm across consisting of stoutly acicular aqua-blue crystals up to 1.5 mm in length. Perhaps a total mass of 100 mg of this new species is present on the entire specimen. Goldquarryite is a late-stage supergene mineral, but the source of the cadmium is unknown at this time. However, greenockite, CdS, also occurs in this deposit.

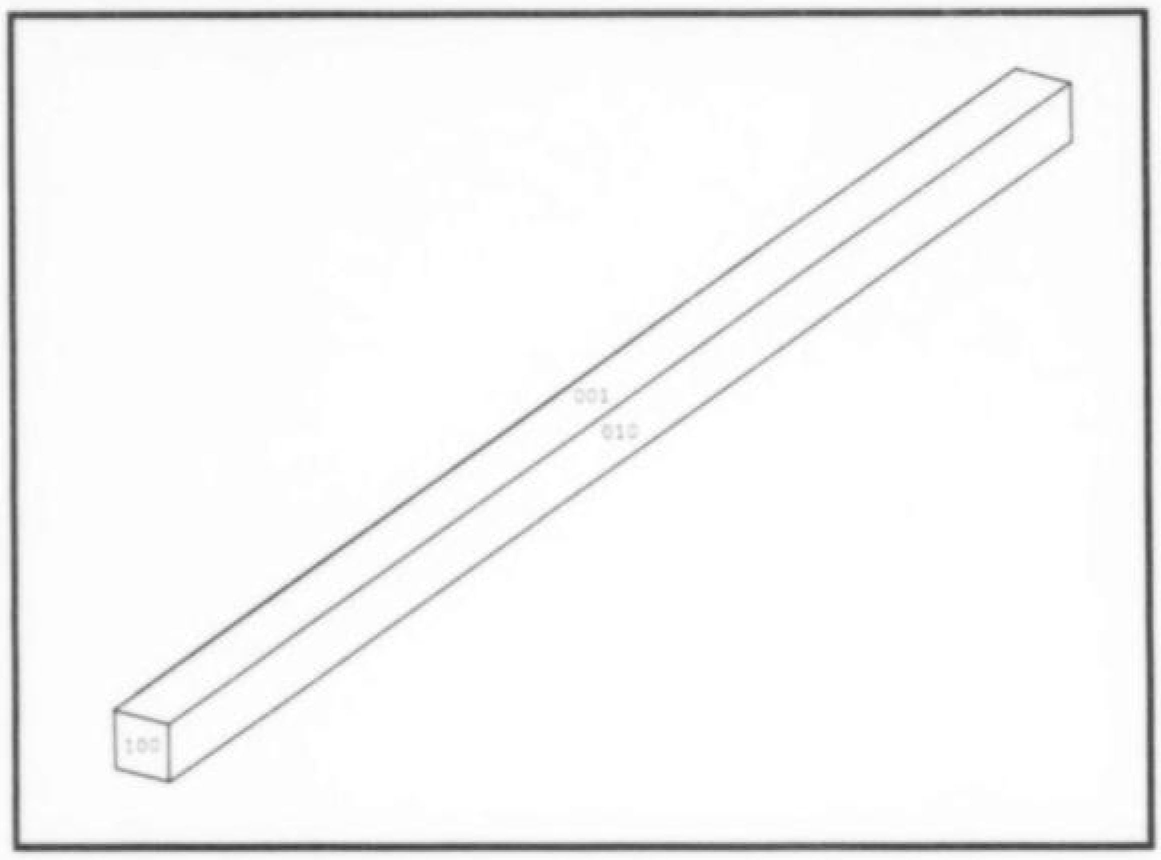

Figure 2. **Goldquarryite, idealized crystal drawing.**

PHYSICAL AND OPTICAL PROPERTIES

Goldquarryite occurs as isolated clusters of radiating crystals and as compact parallel aggregates of crystals, on and between breccia fragments. The largest known cluster on the type specimen (Fig. 1) is approximately 3 mm in longest dimension, but most clusters average about 0.5 mm in size. The maximum crystal size is about 1.5 mm in length with a diameter of 0.1 mm. Most crystals, however, do not exceed 0.4 mm in length, are euhedral, elongate along [100], and have a length-to-width ratio of about 20:1. Crystals may be acicular or prismatic elongated flattened blades with dominant {010} and {001} and very minor {100} forms. The mineral is multiply twinned with {001} as the twin plane; single-crystal precession studies show twinning by 180° rotation about c^*. Crystals are very pale blue to blue-gray, masses are blue, and the streak is white. The luster is vitreous to glassy, and crystals are transparent, whereas aggregates are translucent. Goldquarryite is brittle, with an irregular fracture, no observable cleavage, and no fluorescence under either longwave or shortwave ultraviolet light. The hardness (Mohs') is estimated to be 3–4. The measured density, by sink-float techniques using methylene iodide-acetone mixtures, is 2.78(1) g/cm^3. The calculated density, on the basis of both the chemical formula and unit-cell parameters derived from the crystal structure, is 2.81 g/cm^3.

The mineral is biaxial positive with $\alpha = 1.570$, $\beta = 1.573$, $\gamma = 1.578$; $2V$ (measured) = ~ 30°, $2V$ (calculated) = 76°. The dispersion is $r < v$, strong. Crystals are pleochroic, deep blue parallel to the elongation and very pale blue normal to the elongation.

X-RAY STUDIES

Two crystals of goldquarryite, one mounted with a^* and the other mounted with b^* parallel to the dial axis, were examined by single-crystal precession methods with Zr-filtered Mo X-radiation. The crystal mounted about b^* is twinned by 180° rotation about c^*. The following levels were photographed: $hk0 \rightarrow hk2$, $h0l \rightarrow h2l$, and $0kl \rightarrow 2kl$. The mineral is triclinic with space-group choices $P1$(1) or $P\bar{1}$ (2) (diffraction aspect P^*). The crystal-structure determination (Cooper and Hawthorne, manuscript in preparation) indicates that $P\bar{1}$ is the correct space group. The refined unit-cell parameters from powder data: $a = 6.777(3)$, $b = 9.081(4)$, $c = 10.104(5)$ Å, $\alpha = 101.40(4)°$, $\beta = 104.24(4)°$, $\gamma = 102.56(4)°$, $V = 567.1(4)$ Å^3, $a{:}b{:}c = 0.7463{:}1{:}1.1127$, Z = 1, are based on 29 reflections with d values between 4.726 and 1.577 Å for which unambiguous indexing was possible, based on visual inspection of single-crystal precession films. A fully indexed powder pattern is

Table 1. **X-ray powder-diffraction data for goldquarryite.**

	$I_{obs.}$	dÅ$_{meas.}$	dÅ$_{calc.}$	*hkl*
	100	9.433	9.442	001
	10	8.567	8.546	010
	20	7.406	7.386	$0\bar{1}1$
	20	6.326	6.306	100
	20	6.204	6.176	$\bar{1}01$
	10	5.644	5.635	011
	10	5.277	5.263	$\bar{1}11$
	10	4.828	4.810	$1\bar{1}1$
*	30	4.726	4.721	002
	3	4.489	4.485	$\bar{1}02$
*	20	4.281	4.273	020
*	10	4.119	4.112	$\bar{1}20$
	25	3.875	3.887	$\bar{1}12$
			3.854	$1\bar{2}1$
*	30	3.700	3.693	$0\bar{2}2$
	15b	3.544	3.554	021
			3.526	$1\bar{1}2$
*	10	3.311	3.306	$\bar{2}01$
	3	3.270	3.270	$\bar{2}10$
	30b	3.173	3.179	$\bar{1}\bar{2}2$
			3.162	$\bar{1}\bar{1}3$
			3.151	120
			3.147	003
	3	3.095	3.088	$\bar{2}02$
	30	3.010	3.015	$\bar{1}22$
			3.002	$\bar{2}12$
*	25	2.940	2.933	$0\bar{2}3$
*	30	2.896	2.894	$\bar{2}\bar{1}1$
*	50	2.820	2.818	022
	15	2.753	2.755	$\bar{1}\bar{2}3$
			2.751	$2\bar{2}1$
*	15	2.722	2.721	210
	3	2.673	2.672	$1\bar{1}3$
*	5	2.635	2.632	$\bar{2}22$
*	15	2.574	2.573	$1\bar{2}3$
*	5	2.527	2.528	103
*	5	2.491	2.489	$\bar{2}30$
	15	2.462	2.469	$\bar{1}04$
			2.456	$2\bar{1}2$
	3	2.431	2.432	$\bar{1}23$
*	10	2.395	2.393	$\bar{2}21$
	10	2.349	2.349	$\bar{1}32$
			2.347	$0\bar{2}4$
*	10	2.314	2.313	$\bar{1}\bar{2}4$
	3	2.284	2.281	122
*	20	2.250	2.250	$\bar{2}\bar{2}3$
*	15	2.213	2.214	$0\bar{4}1$
*	5	2.172	2.175	$0\bar{4}2$
	10	2.140	2.141	$\bar{2}14$
			2.138	$\bar{3}20$
			2.136	040
	15	2.102	2.102	300
			2.101	$1\bar{2}4$
*	20	2.059	2.059	$\bar{3}03$
*	15	2.034	2.034	$2\bar{4}1$
	5	2.017	2.016	$\bar{1}\bar{1}5$
			2.012	$\bar{1}33$
*	5	1.996	1.997	$\bar{1}24$
	10b	1.975	1.985	$\bar{2}41$
			1.981	$\bar{1}05$
			1.968	$1\bar{3}4$
*	20	1.932	1.932	301
*	5	1.890	1.890	$\bar{1}42$
	10	1.871	1.876	$\bar{3}04$
			1.869	230
	10	1.845	1.846	$0\bar{4}4$
			1.839	114
	3	1.834	1.831	$3\bar{2}2$
	3	1.811	1.809	$\bar{2}\bar{3}4$
	3	1.788	1.794	$\bar{1}\bar{3}5$
			1.786	$\bar{3}\bar{2}3$
*	10	1.769	1.769	$\bar{1}\bar{4}4$
	15	1.732	1.735	302
			1.732	141
	3	1.707	1.706	320
*	5	1.693	1.692	$\bar{1}51$
*	15	1.675	1.675	105
	20b	1.653	1.657	$\bar{4}22$
			1.653	$\bar{4}02$
			1.648	$\bar{1}06$
*	5	1.635	1.635	$\bar{4}20$
	3	1.618	1.614	$\bar{1}\bar{4}5$
*	15	1.598	1.599	$\bar{4}31$
*	25	1.577	1.577	$1\bar{4}5$

114.6 mm Debye-Scherrer powder camera, Cu radiation, Ni-filter (λCu*K*α 1.54178 Å; intensities estimated visually, b = broad line; not corrected for shrinkage and no internal standard; * = reflections used for unit-cell refinement; indexed with a = 6.777, b = 9.081, c = 10.104 Å, α = 101.40°, β = 104.24°, γ = 102.56°.

presented in Table 1. Cell parameters derived from the crystal-structure determination are: a = 6.787(1), b = 9.082(2), c = 10.113(2) Å, α = 101.40(1)°, β = 104.27(1)°, γ = 102.51(1)°, V = 568.7(3) Å^3, and $a{:}b{:}c$ = 0.7473:1:1.1135. Full details of the structure will be published elsewhere. The powder-diffraction data are unique and bear no resemblance to any other inorganic phase listed in the Powder Diffraction File. Goldquarryite is the first Cd-bearing phosphate phase to be found in Nature.

CHEMISTRY

Goldquarryite crystals were analyzed with a JEOL 733 electron microprobe using Tracor Northern 5500 and 5600 automation, utilizing an operating voltage of 15 kV, a beam current of 20 nA, and a beam diameter of 40 µm. Data reduction was done with a PAP routine in XMAQNT (personal communication C. Davidson, CSIRO) and a potential Cd/K peak overlap was corrected. The following standards were used: sanidine (K *K*α), cuprite (Cu *K*α), diopside (Ca *K*α), nichromite (Ni *K*α), zincite (Zn *K*α), synthetic $Cd_5(PO_4)_3(OH)$ (Cd *L*α), gehlenite (Al *K*α), synthetic VP_2O_7 (V *K*α), apatite (P *K*α) and phlogopite (F *K*α). A 100s energy-dispersion scan showed no elements other than those reported. Mg, Mn, Fe, Ga, Bi, Cl, Si, Sr, Sn and As were sought but not detected. The valency states for all elements and the number of O and F atoms were determined by crystal-structure analysis prior to the

Table 2. **Compositional data for goldquarryite.**

	Weight %	*Range*
K_2O	0.17	0.12 – 0.22
CuO	5.33	5.10 – 5.63
CaO	1.25	1.14 – 1.34
NiO	0.23	0.19 – 0.24
ZnO	0.05	0.00 – 0.23
CdO	26.24	25.65 – 26.60
Al_2O_3	15.22	15.01 – 15.58
V_2O_3	0.05	0.00 – 0.11
P_2O_5	28.04	27.70 – 28.18
F	3.63	3.46 – 3.77
H_2O[1]	[22.19][1]	
–O = F	–1.53	
Total	[100.87]	

[1] Determined by stoichiometry with H_2O calculated assuming 2F atoms.

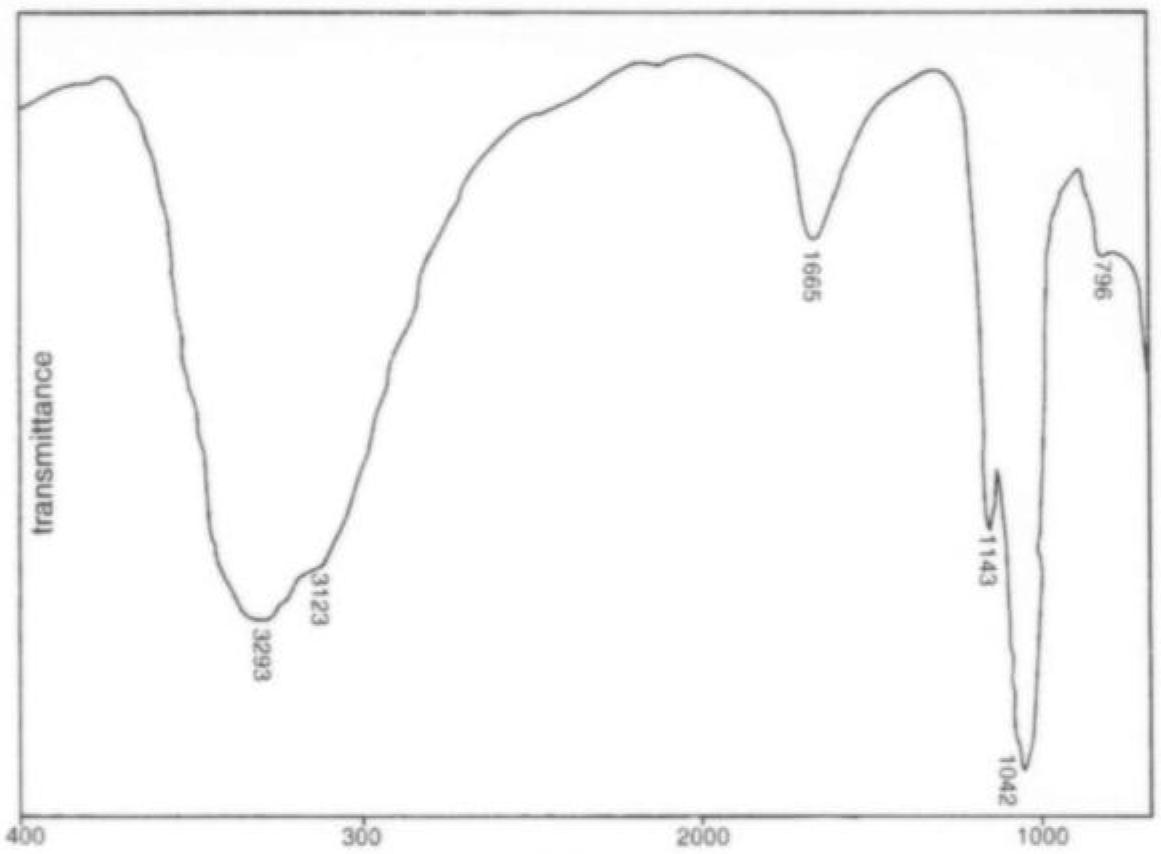

Figure 3. Infrared-absorption spectrum for goldquarryite.

final interpretation of the electron-microprobe results. The paucity of pure, uncontaminated material prevented the quantitative determination of H_2O by classical methods. However, its presence as molecular H_2O was confirmed both by crystal-structure analysis and powder infrared-absorption spectroscopy; the formula was normalized on 29.45 O+F anions. The average of five determinations and ranges are given in Table 2 and the empirical formula for goldquarryite is $[(Cu_{0.66}Ni_{0.03}Zn_{0.01})_{\Sigma 0.70}\square_{0.30}]_{\Sigma 1.00}(Cd_{2.00}Ca_{0.22}K_{0.04})_{\Sigma 2.26}(Al_{2.92}V_{0.01})_{\Sigma 2.93}(PO_4)_{3.88}F_{1.87}\cdot(H_2O)_{12.06}$. The crystal-structure-derived formula, $(Cu_{0.70}\square_{0.30}]_{\Sigma 1.00}(Cd_{1.68}Ca_{0.32})_{\Sigma 2.00}Al_3(PO_4)_4F_2(H_2O)_{10}[(H_2O)_{1.60}F_{0.40}]_{\Sigma 2.00}$, requires CuO = 5.79, CdO = 22.43, CaO = 1.87, Al_2O_3 = 15.91, P_2O_5 = 29.52, F = 4.74, H_2O = 21.73, sum = 101.99, less O = F = –1.99, total = 100.00 weight %. The idealized formula is $CuCd_2Al_3(PO_4)_4F_2(H_2O)_{10}(H_2O)_2$.

The *Kp* value is 0.204 and is derived from the average index of refraction ($\bar{n}$) 1.574 and the calculated density of 2.81 g/cm^3. The *Kc* value is 0.202 and is based on the crystal-structure-derived formula given above. The compatibility index (1-*Kp/Kc*) is –0.012, which, according to Mandarino (1981), is "superior."

INFRARED-ABSORPTION SPECTROSCOPY

The equipment and procedures for acquiring the infrared-absorption spectrum for goldquarryite were reported by Roberts *et al.* (1994) and are not repeated here. The sample was analyzed using a Bomem Michelson MB-100 FTIR spectrometer equipped with a wide-band mercury-cadmium telluride detector. The transmittance spectrum (Fig. 3) clearly shows absorption bands for structural H_2O. A strong-intensity band, centered at 3293 cm^{-1} with a shoulder at 3123 cm^{-1}, is due to O-H stretching, and a medium-intensity band, centered at 1665 cm^{-1}, is due to H-O-H bending in the H_2O group. In addition, the very strong band at 1042 cm^{-1} is the ν_3 fundamental stretching band for phosphate, as is the medium-strong band at 1143 cm^{-1}.

ACKNOWLEDGMENTS

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Peruvian Minerals:
an Update

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The Peru Issue, published in 1997, surveyed the history, productivity and mineralogy of the most important Peruvian mines and mining districts. Since that time, famous localities such as Pasto Bueno, Pachapaqui, Uchucchacua, and Huanzala, as well as lesser-known mining areas, have yielded a wide range of new collector-quality mineral specimens. In addition, some significant new occurrences have been discovered. We provide here a specimen-recovery update for 1997–2002.

Introduction

Peru is a distant country for most mineral collectors, but it has nevertheless been one of the most interesting mineralogically, especially in recent years. An excellent survey of important Peruvian mines and minerals by Crowley *et al.* (1997) clearly demonstrated the mineralogical richness of this country. Happily, fine mineral specimens have continued to be found in Peru since that time; our purpose here is to survey the productivity of the most important sites in recent years and describe some of the more interesting discoveries made between 1996 and 2002 (see also our five articles in the German magazine *Mineralien Welt*, 1999–2002). The order of the localities is the same as that followed by Crowley *et al.* (1997).

Quiruvilca

The Quiruvilca district, in the Department of La Libertad in northern Peru, is especially famous for its orpiment crystal specimens, often with fine black hutchinsonite crystals. However, the locality has produced few interesting minerals recently. The newer specimens of arsenopyrite, enargite, and cogwheel-twinned bournonite do not reach the quality attained earlier.

Gebhard and Schlüter (1998) determined that some unusual crystals on older specimens from Quiruvilca, previously thought to be enargite, are in fact the world's finest crystals of luzonite and famatinite. Luzonite forms tetragonal bipyramidal crystals to 1 cm covered by small tetrahedrite crystals; it has also been identified as tabular reddish violet metallic crystals to 4 cm with cores of

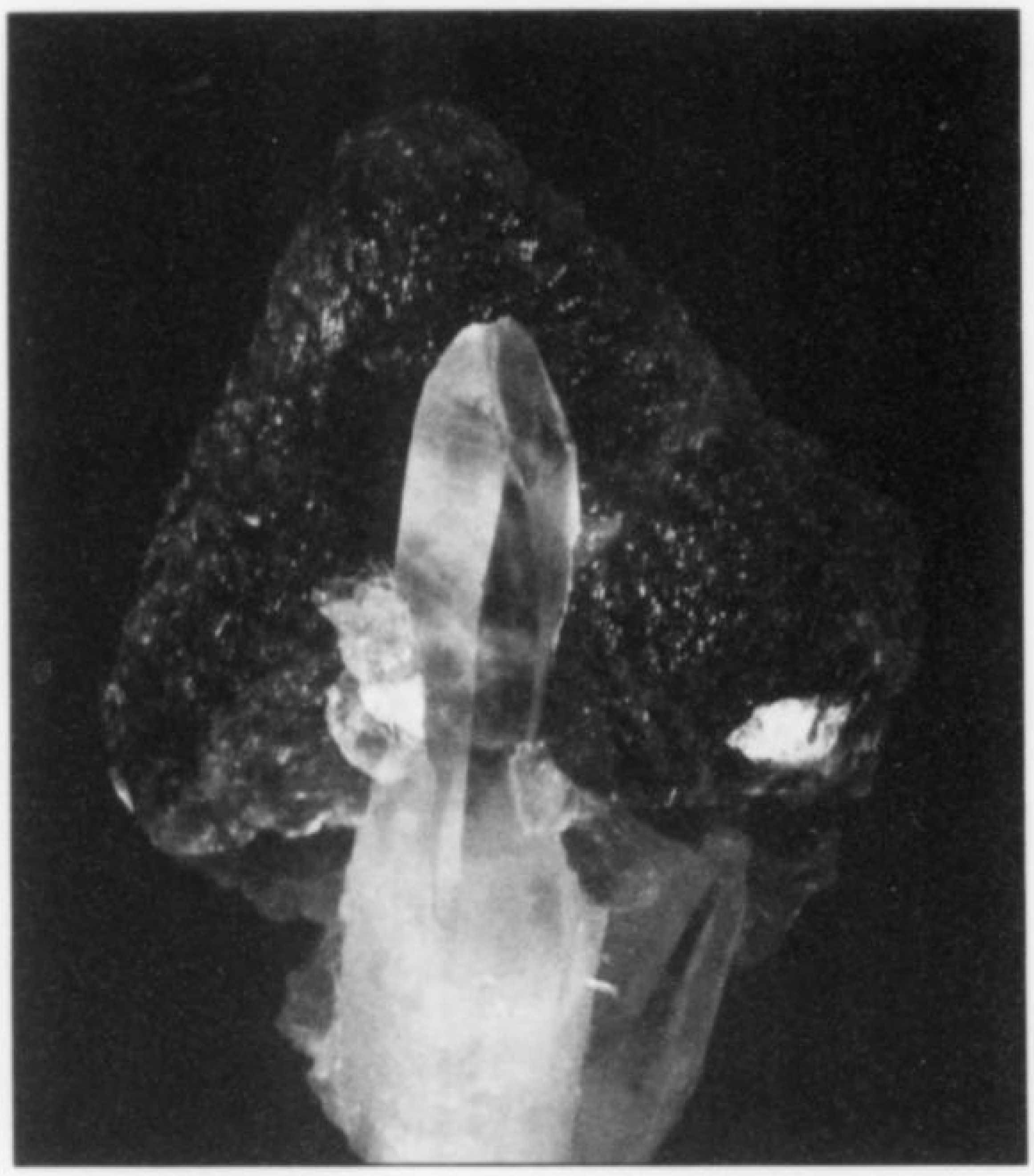


Figure 1. **Fluorite on quartz, 8 cm, from Pasto Bueno; collection and photo J. Hyrsl.**

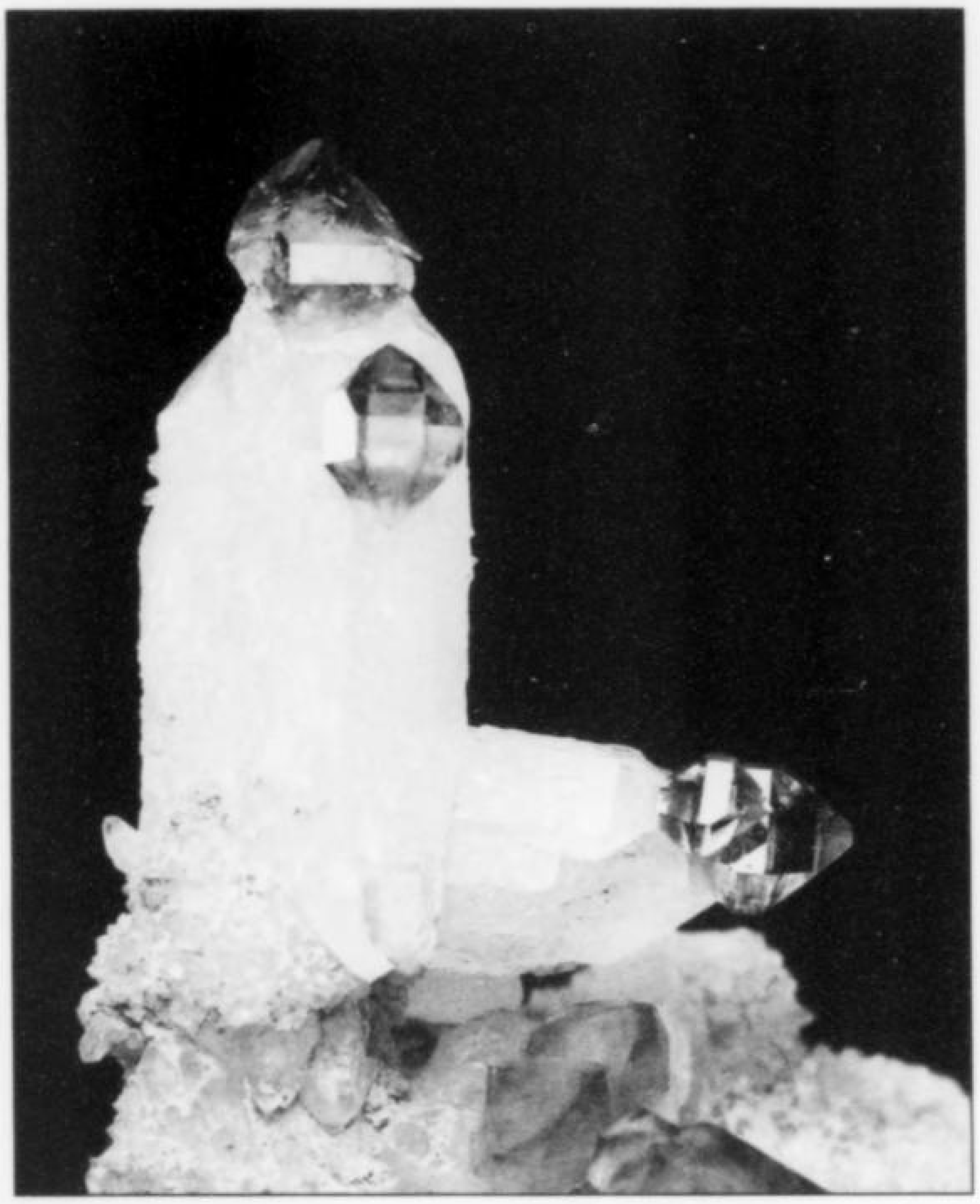


Figure 2. **Quartz Japan-law twin with amethyst reverse-scepters, 3 cm, from Mundo Nuevo; collection and photo J. Hyrsl.**

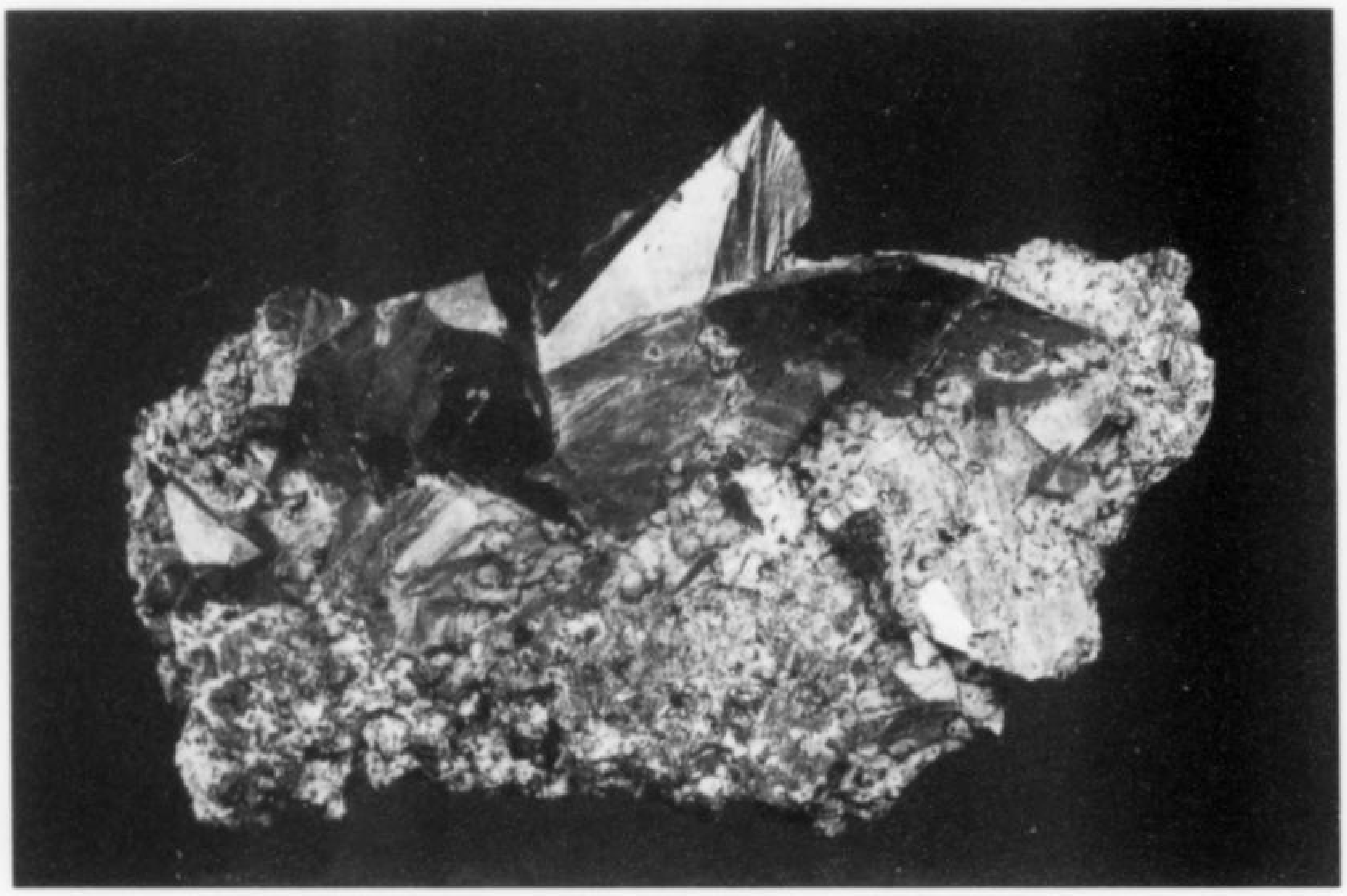


Figure 3. **Tetrahedrite, 12 cm, from Mundo Nuevo; collection and photo J. Hyrsl.**

enargite. Famatinite forms red-violet crystals to 3 cm, completely covered by small tetrahedrite crystals. Interestingly, luzonite, famatinite and enargite all grow on pyrite crystals, but never occur together on the same specimen. Gebhard has also reported bismuthinite.

Pasto Bueno and Mundo Nuevo

The Pasto Bueno tungsten district in Ancash Department is still one of the most prolific Peruvian localities. It has long been famous for hübnerite, but the most recently found hübnerite crystals have been, in general, smaller than those of the past: they range up to 5 cm, usually as loose singles broken off from quartz druses. Doubly terminated hübnerite crystals from Pasto Bueno are very rare. In 1999 there was a find of beautiful matrix specimens with transparent, bright red, platy hübnerite crystals to 2 cm growing on quartz, with colorless fluorite cubes, tetrahedrite, and transparent orange sphalerite crystals to 1 cm resembling scheelite. In 2001, black hübnerite crystals on quartz were found, the largest measuring 6 x 12 cm. Nice orange scheelite pseudo-octahedrons to 1 cm on druses of smoky quartz with greenish muscovite were relatively common a few years ago. Complex, brownish yellow sphalerite crystals to 2 cm, found in January 2003, were mislabeled as "scheelite" in Peru. The difference in fluorescence is diagnostic; the sphalerite shows only weak orange fluorescence on the surface, whereas scheelite typically fluoresces a bright blue-white.

Older specimens of rhodochrosite from Pasto Bueno are among the world's best, but large rhodochrosite crystals have not been

Figure 4. **Quartz Japan-law twins, 7 cm, from Mundo Nuevo; collection and photo J. Hyrsl.**

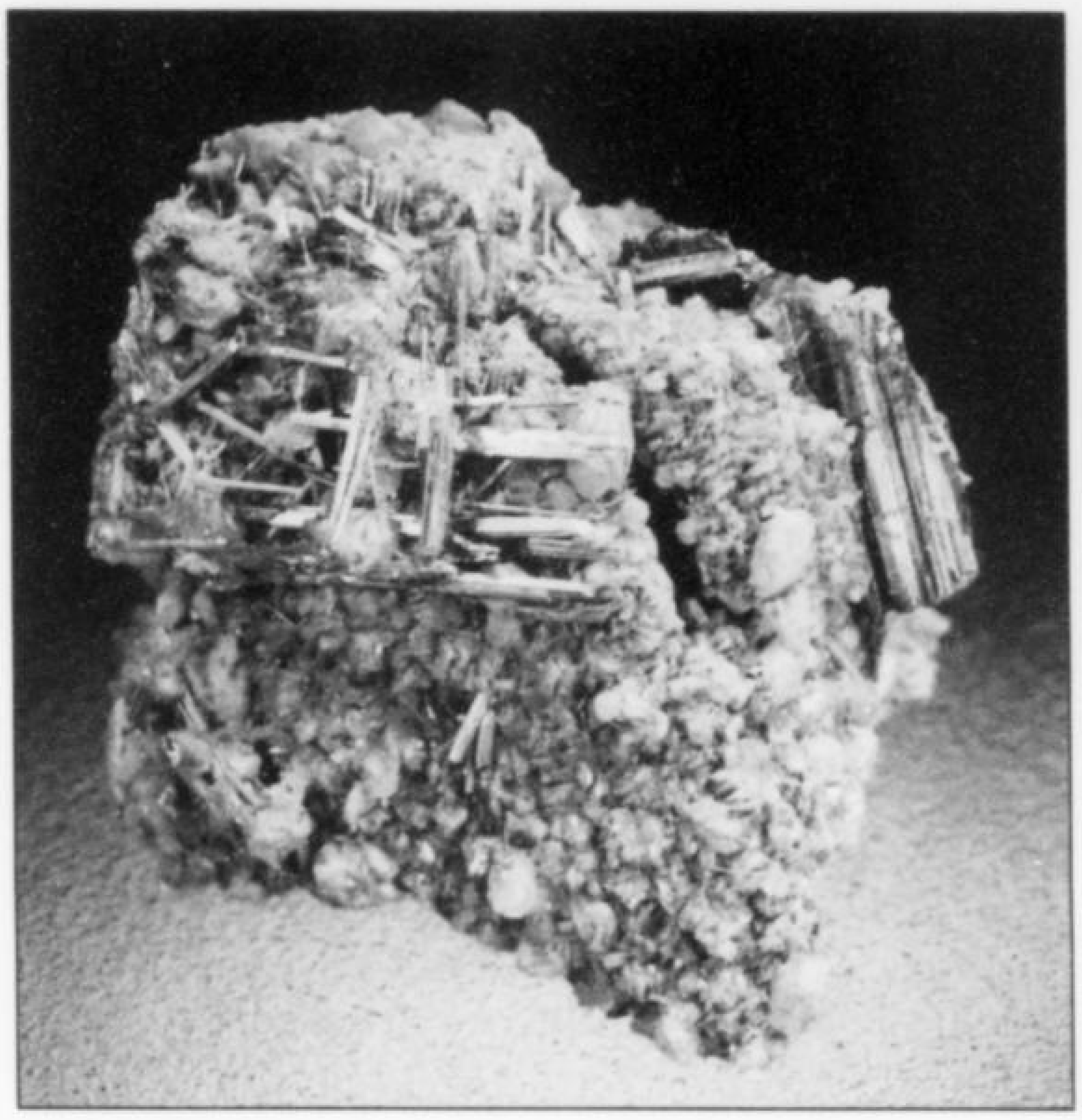


Figure 5. **Meneghinite crystals on matrix, 3.5 cm, from Pucarrajo; collection and photo J. Hyrsl.**

found recently—only simple, pink rhombohedrons to 1 cm growing on drusy quartz. Many larger quartz crystals from Pasto Bueno have arsenopyrite, pyrite or chlorite inclusions, and flattened Japan-law twins of quartz measuring 1 or 2 cm have sometimes been collected. Pasto Bueno is also the source of the best recent fluorite specimens from Peru, in pale green to violet crystals reaching almost 10 cm. Nice emerald-green fluorite octahedrons on large quartz crystals (up to 12 x 30 cm!) appeared at the end of 2002. A specimen with pale yellow to colorless crystals of euclase to 1 cm on pink mica and fluorite is in the collection of Art Soregaroli.

The Mundo Nuevo mine near Pasto Bueno yielded several finds of excellent Japan-law twinned quartz in 1998 and 1999. The specimens are very distinctive, in that the milky quartz crystals are long-prismatic and not flattened. In some cases the crystals are doubly terminated, and there are even multiple Japan-law twins, with two crystals growing in parallel from the longer central crystal; large specimens commonly contain several Japan-law twins.

Large tennantite (X-ray verified) crystals to 5 cm were found in 2002, some of them partially covered by green scorodite. Tennantite occurs together with striated pyrite cubes up to 7 cm. Both grow on quartz, and some pyrite crystals are "pierced" by a long quartz crystal. Excellent hübnerite specimens of the same type as illustrated (Fig. 30) in Crowley *et al.* (1997) were found in 2002. They are dark red and up to 4 cm long, growing on quartz crystal druses.

A roadcut near Mundo Nuevo yielded interesting specimens at the end of 2002. They are druses of small quartz crystals up to about 2 cm long, with small doubly terminated amethyst crystals up to 5 mm growing on the points.

Raura

The Raura district, northeast of Lima in Lima Department, is known for producing Peru's best stibnite. Good groups of very lustrous stibnite crystals to 3 cm long and 4 mm wide, terminated by a low pyramid, were found in 1999, but unfortunately almost all of them were damaged during collecting. Loose, colorless to violet hexagonal crystals to 7 cm were offered as apatite in Lima in 1997, but X-ray analysis has shown them to be aragonite. We purchased a very unusual specimen in December 2002: a matrix encrustation of transparent, violet aragonite crystals up to 3 cm. Each crystal has a hexagonal cross-section, but the termination is "tooth-like," with three individual small crystal points.

Pachapaqui

The Pachapaqui ore district continues to be a source of good bournonite specimens, and of needle-like, slightly bulging arsenopyrite crystals to 1.5 cm long. Bournonite is quite common, and cogwheel-shaped crystals to 3 cm, etched from quartz using hydrofluoric acid, were found in 2001 and 2002. Pink manganoan calcite in crystals and stalactitic aggregates is still found at Pachapaqui, and scepter crystals of quartz are common. Matrix encrustations of colorless fluorite cubes up to 1 cm appeared in 2002. The rhodonite from this locality is much inferior to the rhodonite of Chiurucu, but occasionally it harbors small yellow tetrahedrons of helvite to 2 mm (large ones exist but are extremely rare).

In 1997 the Arabia mine in the Pachapaqui district produced some nice druses of yellow manganaxinite crystals to 5 mm growing on massive rhodonite. Pale yellow dodecahedrons of spessartine to about 1 mm and black veins of alabandite are commonly found on these specimens.

Fine tetrahedrite specimens, with very lustrous, simple tetrahedral crystals to 2 cm associated with sphalerite, were found in August 2001. In the same year, some very interesting specimens were unearthed, showing small tetrahedrite crystals in parallel growth, having formed epitactically on chalcopyrite crystals to about 3 cm; but all of the chalcopyrite had been replaced by pyrite, so that these specimens represent an epitaxy over what is now a pseudomorph. Crowley *et al.* (1997) mention similar specimens, but incorrectly regard them to be pyrite pseudomorphs after

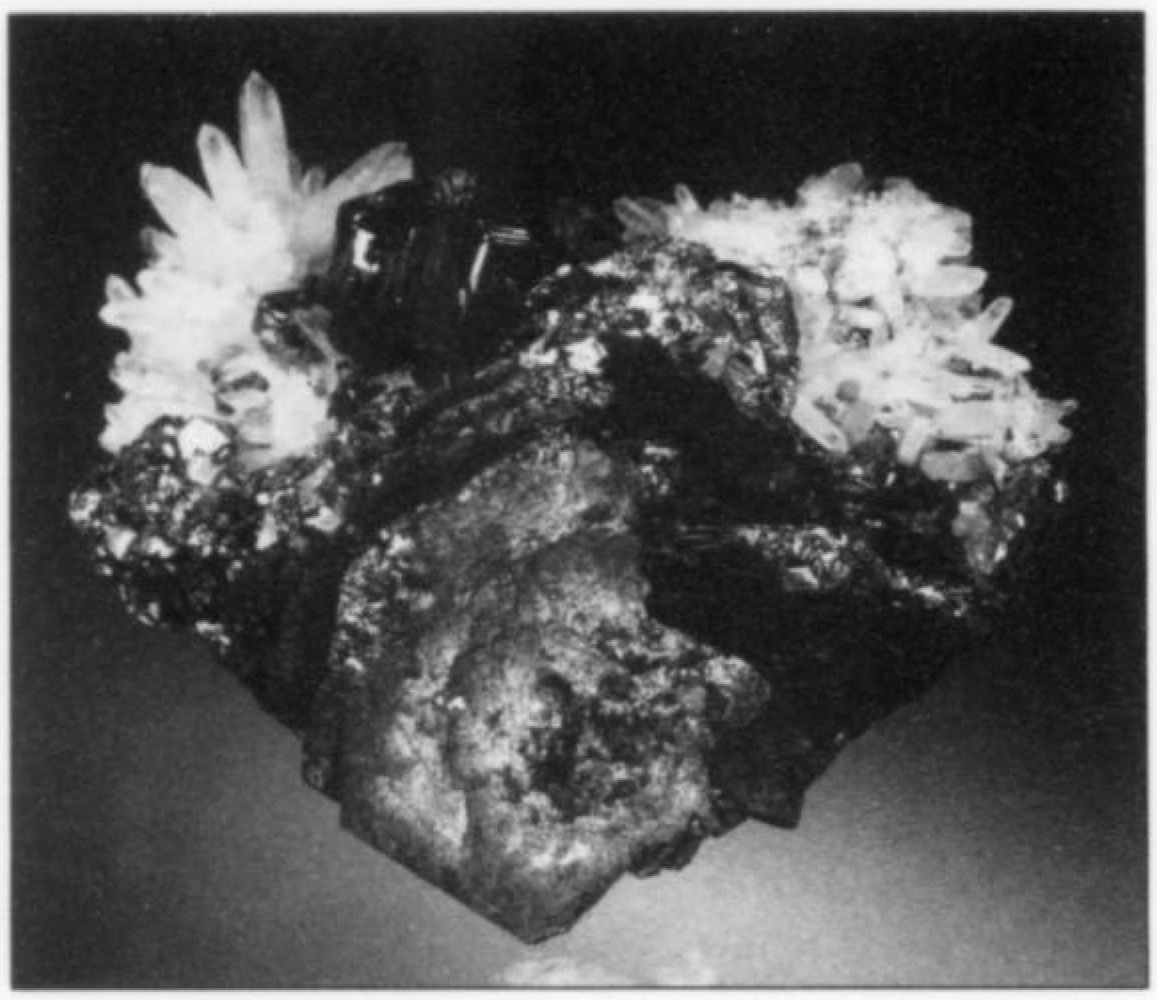


Figure 6. **Pyrrhotite crystals with quartz and sphalerite, 10 cm, from Pucarrajo; collection and photo J. Hyrsl.**

tetrahedrite: we found small grains of relict chalcopyrite occasionally present in the cores of these crystals.

Pucarrajo

The small Pucarrajo mine was assigned to the Pachapaqui district by Crowley *et al.* (1997), but is actually in a pass halfway between Pachapaqui and Huanzala, and is owned by a different company. During the past few years it has produced many excellent specimens, although these are often mixed in with the more common Huanzala material. In 2000, the Pucarrajo mine yielded what are probably Peru's best pyrrhotite specimens, with sharp, platy pyrrhotite crystals to 5 cm associated with chalcopyrite and black sphalerite crystals on quartz. The pyrrhotite is fresh, and small pyrite cubes line the edges of the pyrrhotite crystals. Clusters of nice chalcopyrite crystals to 4 cm were also found in 2000, including some unusual flattened twins resembling Stars of David. Arsenopyrite is common as silvery white, blocky crystals to about 2 cm, usually with lustrous black sphalerite. Orange scheelite bipyramids to 8 mm associated with arsenopyrite were found in 2001. In a very few specimens, meneghinite occurs in striated crystals to 1.2 cm—probably the world's best for the species. The most recent unusual find from Pucarrajo, coming at the end of 2002, was boulangerite as long needles up to about 3 cm, forming a felt-like vein on calcite. Its identity was confirmed by X-ray diffraction analysis.

Huanzala

The Huanzala mine in Huanuco Department is famous for producing the best pyrite specimens in the world. Pyrite is still found here in large quantity, but no huge crystals have been seen recently; some highly lustrous octahedral pyrite crystals to about 3 cm, with white barite, are very similar to older specimens from Quiruvilca. Nice pyrite pseudomorphs after hexagonal pyrrhotite plates with black sphalerite have also been found very recently. A very few specimens with black, tapered crystals of cronstedtite to 1.5 cm on pyrite crystals have also been found.

Newly collected "tetrahedrite" specimens were found by X-ray analysis to be tennantite; the crystals are simple tetrahedrons with slightly curved faces to about 1.5 cm. In 2001, very nice, lustrous tennantite (X-ray verified) was found growing on pyrite; unlike the similar, and more common, tetrahedrites from Casapalca, these crystals are simple tetrahedrons to about 3 cm.

In 1998 there was an extraordinary find of wurtzite in the Huanzala mine. The dark brown crystals, with diameters to 1 cm, show a typical hexagonal-pyramidal shape, and grow in clusters with nice white tabular barite and lustrous galena, the last species sometimes spinel-law twinned. Excellent boulangerite specimens with acicular crystals up to 4 cm long were found a few years ago. A gemmy crystal of sellaite 2.1 cm long from the Huanzala mine was described by Moore (1998). There have been no new finds of the famous pink octahedral fluorite from Huanzala, but specimens of small purple fluorite crystals are common; sometimes they completely cover matrixes to over 10 x 20 cm.

An extremely unusual Huanzala mine specimen owned by Art Soregaroli was pictured on page 130 of the March–April 1998

Figure 7. **Wurtzite with white barite, 11 cm, from Huanzala; collection and photo J. Hyrsl.**

Figure 8. **The authors at Uchucchacua, 2000.**

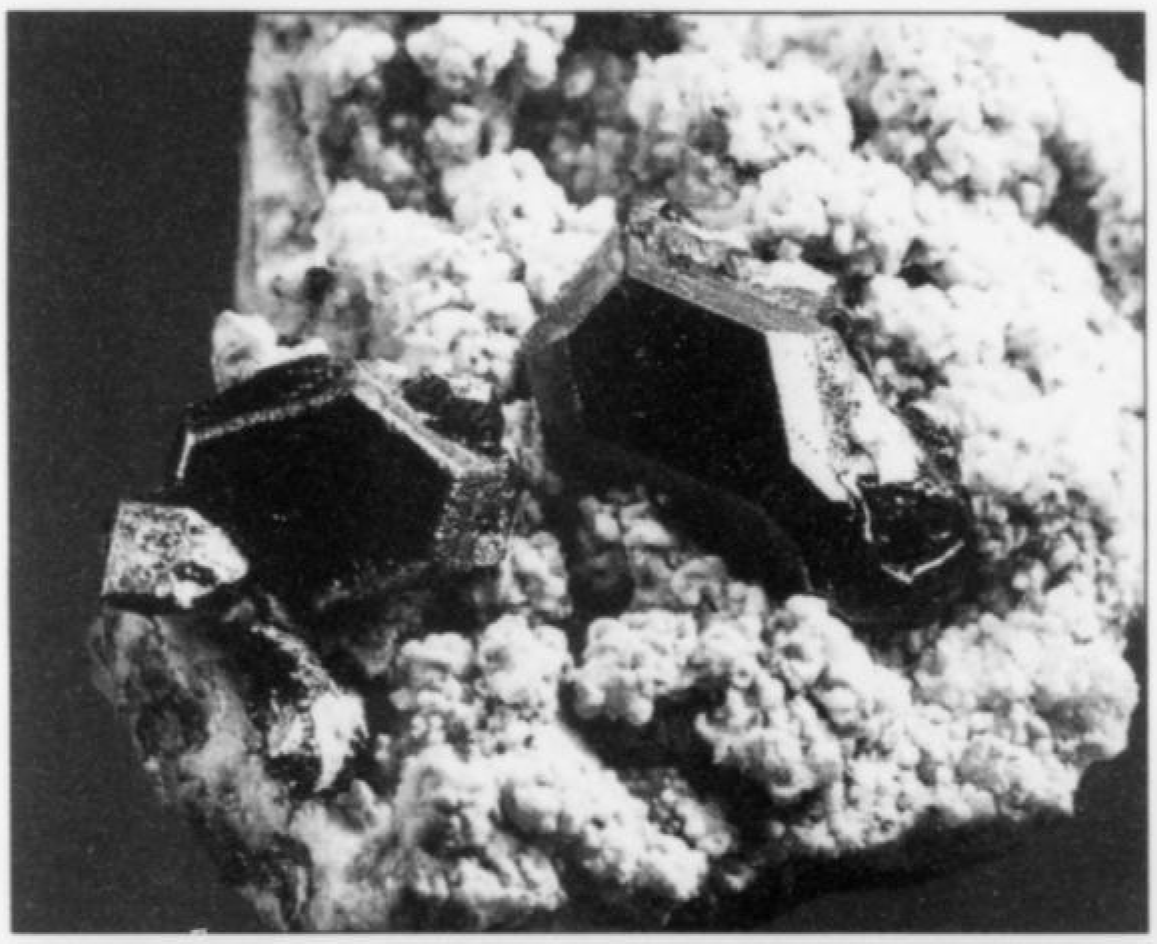


Figure 9. **Acanthite on rhodochrosite, 4.5 cm, from Uchucchacua; collection and photo J. Hyrsl.**

issue of *Mineralogical Record*. A gemmy 2.1-cm sellaite crystal on a matrix of quartz, jalpaite, pyrite crystals and chalcopyrite crystals is accompanied by, and partially encloses, native copper wires (identification by E. E. Foord).

Chiurucu

The small Chiurucu mine (not prospect; see Crowley *et al.*, 1997), is famous for having produced some of the world's best rhodonite specimens in 1989 and 1990, and several very nice specimens were found again in the summer and autumn of 1998. They are comparable in size to the best of the older specimens, but their color is generally paler. The mine was reopened in 2001, and there is a good possibility that further finds will be made there.

A quarry near Chiurucu produced a large quantity of beautiful quartz specimens in 2002. The crystals are up to about 15 cm long and 4 cm wide, and all are heavily striated perpendicular to the *c*-axis. Many of them contain eye-visible inclusions of galena and sphalerite, sometimes in the form of phantoms.

Uchucchacua

Uchucchacua in Lima Department is the fifth largest silver mine in the world, producing 221 tons of silver in 1999. The mine is famous for excellent rhodochrosite in dark red, translucent to

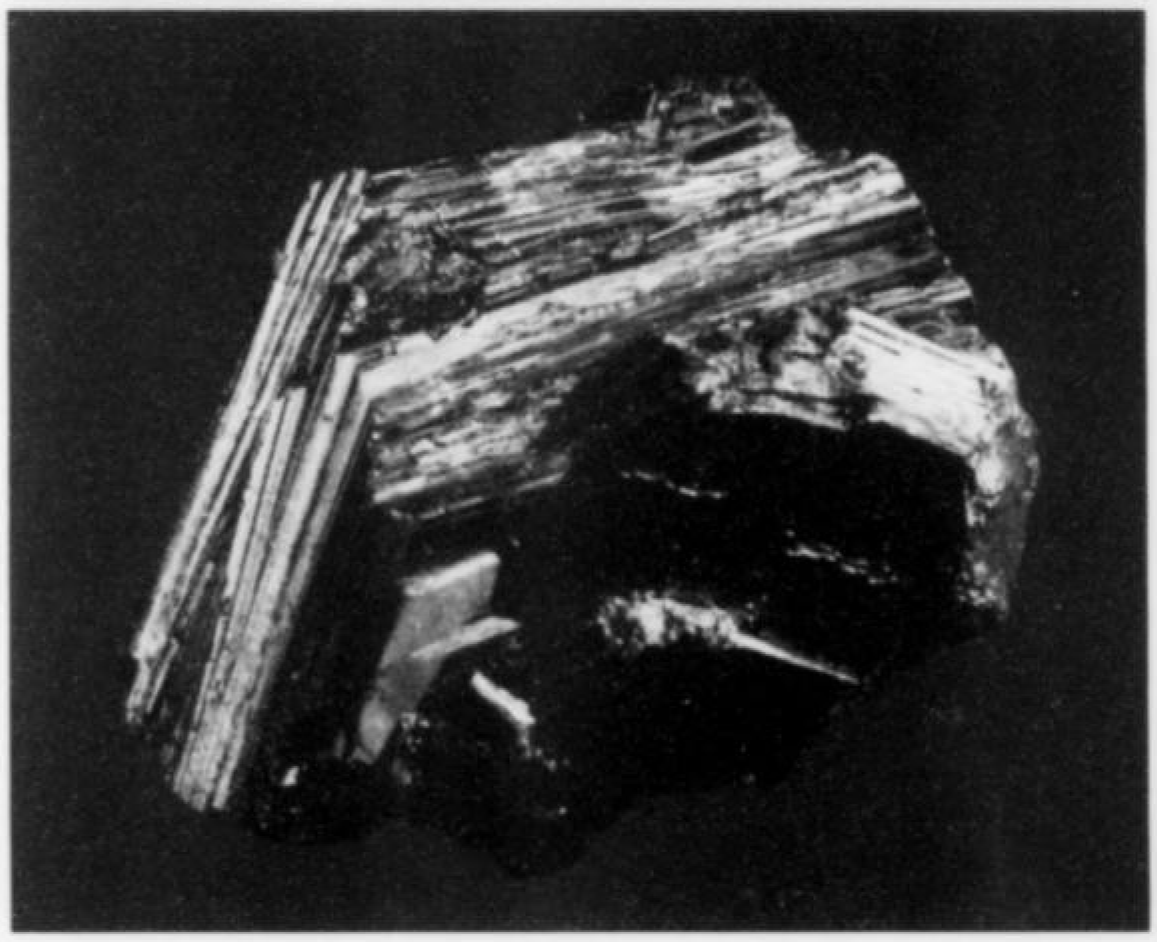


Figure 10. **Arsenpolybasite crystals, 3.2 cm, from Uchucchacua; collection and photo J. Hyrsl.**

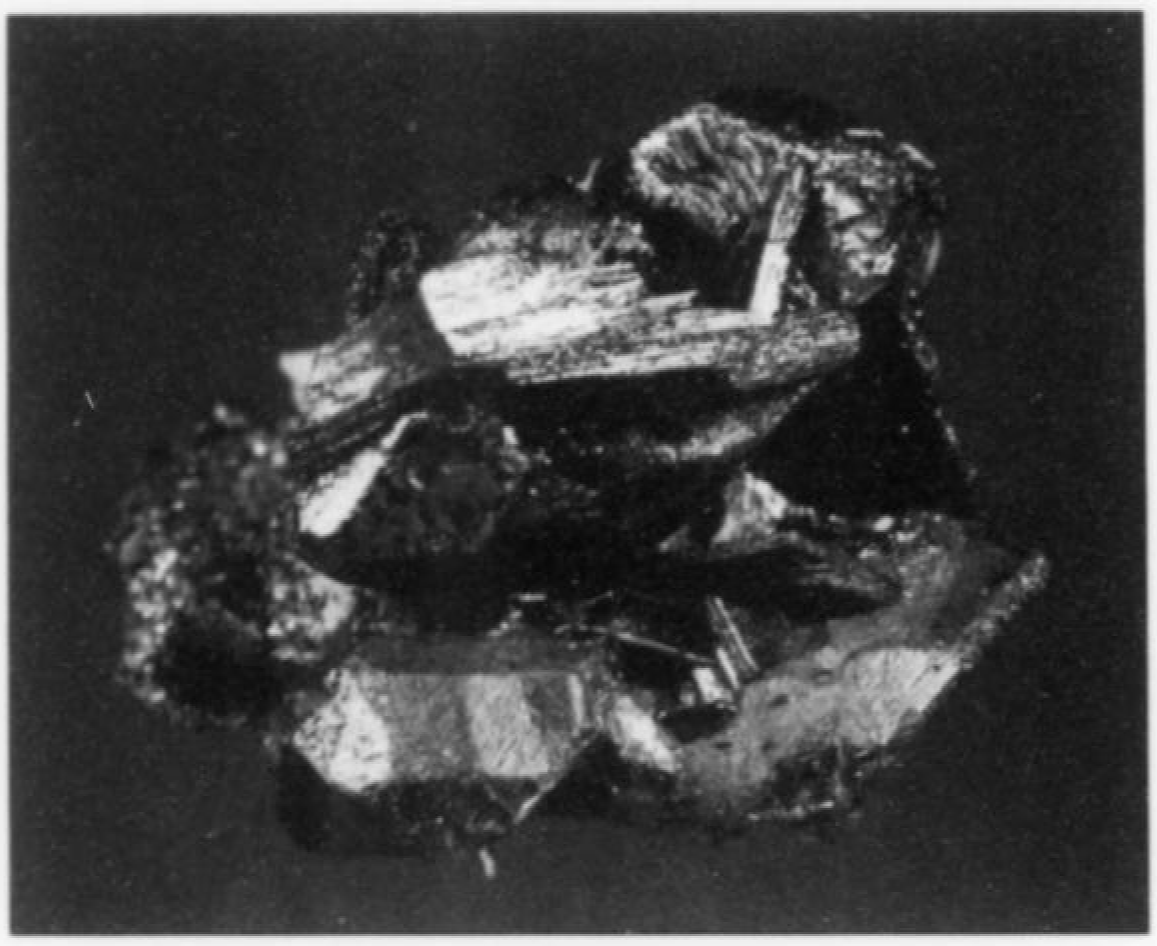


Figure 11. **Blocky acanthite crystals with platy arsenpolybasite crystals, 6 cm, from Uchucchacua; collection and photo J. Hyrsl.**

gemmy crystals showing complex combinations of scalenohedral and rhombohedral forms. The rhodochrosite crystals grow on a very hard gray to black skarn matrix, with black amorphous neotocite and in some cases with small, colorless quartz or fluorite crystals. The average size of the rhodochrosite crystals is about 1 cm, but exceptionally they reach 4 cm; the authors saw one 8-cm rhombohedron which is very dark (almost black) and damaged. A very strange rhodochrosite specimen, purchased in Lima in 1998, shows transparent scepter-shaped scalenohedral crystals to 1 cm growing on thin, opaque prisms of an earlier generation of rhodochrosite.

Uchucchacua is also famous for its silver minerals. Proustite, for example, is still quite commonly found there. Acanthite (paramorphic after argentite) has been known for some time in crystals to about 1 cm, but in 2000 the mine produced a few sharp, lustrous acanthite crystals to 3 cm, some of them on a matrix of pale-colored rhodochrosite. This acanthite is accompanied by arsenpolybasite (identified by X-ray and chemical analyses) in massive form and as lustrous hexagonal crystals to almost 5 cm. Some arsenpolybasite crystals grow also on large masses of proustite. Splendid white native silver wires to at least 20 cm long were found in the Uchucchacua mine in the spring of 2001, but no silver specimens have been found at Uchucchacua since then. The silver wires are generally very thin and highly lustrous, but beware: some of the wires have been glued onto matrix by the locals.

A beautiful fluorite specimen was found at Uchucchacua in 2001: a group of colorless cubes to 3 cm with small, red proustite crystal inclusions.

Milpo and Atacocha

The Milpo and Atacocha mines in the Atacocha district, Pasco Department, are mentioned only briefly by Crowley *et al.* (1997), without providing descriptions of any minerals except for the orpiment from Atacocha, of which no recently mined specimens are known. However, these two mines have been among the most specimen-prolific mines in Peru during recent years. Most of the Peruvian dealers who go to the area buy specimens from both the Milpo and Atacocha mines at the same time, and thus are often unsure which mine a given specimen came from, although it seems that during 2000 and 2001 the Milpo mine produced the more interesting material, particularly kutnohorite, amethyst and bournonite.

Highly lustrous bournonite crystals to 1 cm are common from Milpo and Atacocha, and resemble the better-known pieces from

Figure 12. **The Milpo mine in 2001; photo J. Hyrsl.**

Figure 13. **The Alimon mine in 2001; photo J. Hyrsl.**

Quiruvilca and Pachapaqui. Usually they are tabular single crystals, but striated cogwheel-type twins have also been found. Tetrahedrite from Milpo generally occurs in small crystals; good specimens are very rare, but can be very aesthetic. The best contain highly lustrous black tetrahedrite crystals to 3 cm, each a parallel-growth aggregate of smaller crystals. Massive galena is very common, but we have seen no interesting galena crystals except for a few flattened crystals epitactically oriented on striated pyrite cubes. Pyrite specimens from Milpo have been common for several years; the largest good specimen we observed weighs about 25 kg. The pyrite crystals are almost always simple cubes to 5 cm; bigger crystals are very rare.

Fluorite from these mines can be violet, colorless or bluish, and is commonly transparent. The crystals, averaging 1 or 2 cm on edge, are combinations of cube and dodecahedron forms; a few specimens with larger, octahedral fluorite crystals sprinkled with pyrite crystals were also found. Yellow blocky barite crystals up to 1.5 cm, sometimes growing on quartz crystals, were found in Atacocha in 2002.

Quartz is the most common species from Milpo and Atacocha, and is easily distinguishable from the quartz found at other Peruvian mines. Quartz crystals on many of these specimens have a slightly barrel-shaped form; small scepter crystals have also been observed. Crystals of pseudo-pyramidal habit—i.e. two rhombohedrons, without prism faces simulating a hexagonal bipyramid—reach up to about 3 cm, and groups of these crystals reach more than 20 cm across; they are very lustrous, and some have reddish phantoms. Amethyst, which is very rare in most other Peruvian mines, is quite common at Milpo. Pale-colored amethyst forms crystals to 1 cm in druses, rarely over rhombohedrons of calcite. Some amethyst crystals have a slightly rounded, pyramidal shape, and reach 3 x 5 cm. A few pieces collected in August 2001 show a very strange habit: pale-colored crystals to 3 cm wide and 5 cm long, the crystals have hollowed-out terminations resembling volcanic craters, complete with small peaks in their centers. Orange botryoidal aggregates of chalcedony up to about 5 mm in diameter are one of the most interesting recent finds from Milpo, and are probably unique for Peru. They were observed on a very few pieces of crystallized quartz, and were called rhodochrosite by local dealers. But colorless to brownish chalcedony is common as a coating or botryoidal encrustation on many quartz crystals.

Calcite is common in both the Milpo and Atacocha mines, as white, yellowish or reddish crystals occurring in several generations and reaching several centimeters in length. Crystals of earlier generations are opaque, while later crystals are translucent to transparent. A few specimens of calcite twins encrusted by rhodochrosite were found in the Atacocha mine in 2001. Pink crusts covering calcite and kutnohorite from both mines were identified by X-ray analysis as rhodochrosite. These rhodochrosite crusts range from extremely thin to about 3 mm thick. The Atacocha mine has also produced rod-like rhodochrosite formations on matrix. Pale single rhodochrosite rhombohedrons up to about 8 cm covered by calcite or quartz appeared in 2002. The Milpo mine also has produced several lots of nice siderite specimens. Some siderite crystals are lens-shaped, while others are pale brown rhombohedrons to about 1 cm.

The biggest surprise during a study of recent specimens was the X-ray analytical determination of kutnohorite from the Milpo mine. The kutnohorite crystals are simple, white to beige rhombohedrons growing on quartz and pyrite; in some cases they are covered by a crust of younger, pink rhodochrosite or by calcite crystals. Reaching sizes of more than 10 cm, these are probably the largest and most aesthetic crystals of kutnohorite in the world! They are easily distinguishable from similar-looking calcite crystals by their much weaker solubility in dilute hydrochloric acid.

Alimon and Huaron

Alimon is mentioned as one of the Huaron group of mines in Crowley *et al.* (1997), but is in fact an independent mine on the other side of a mountain. It has a different owner than the Huaron mines and, according to the miners, it was producing much more ore than Huaron during our visit in August 2001. Huaron has thus

Figure 14. **Chalcopyrite crystal, 3 cm, on matrix, from Alimon; collection and photo J. Hyrsl.**

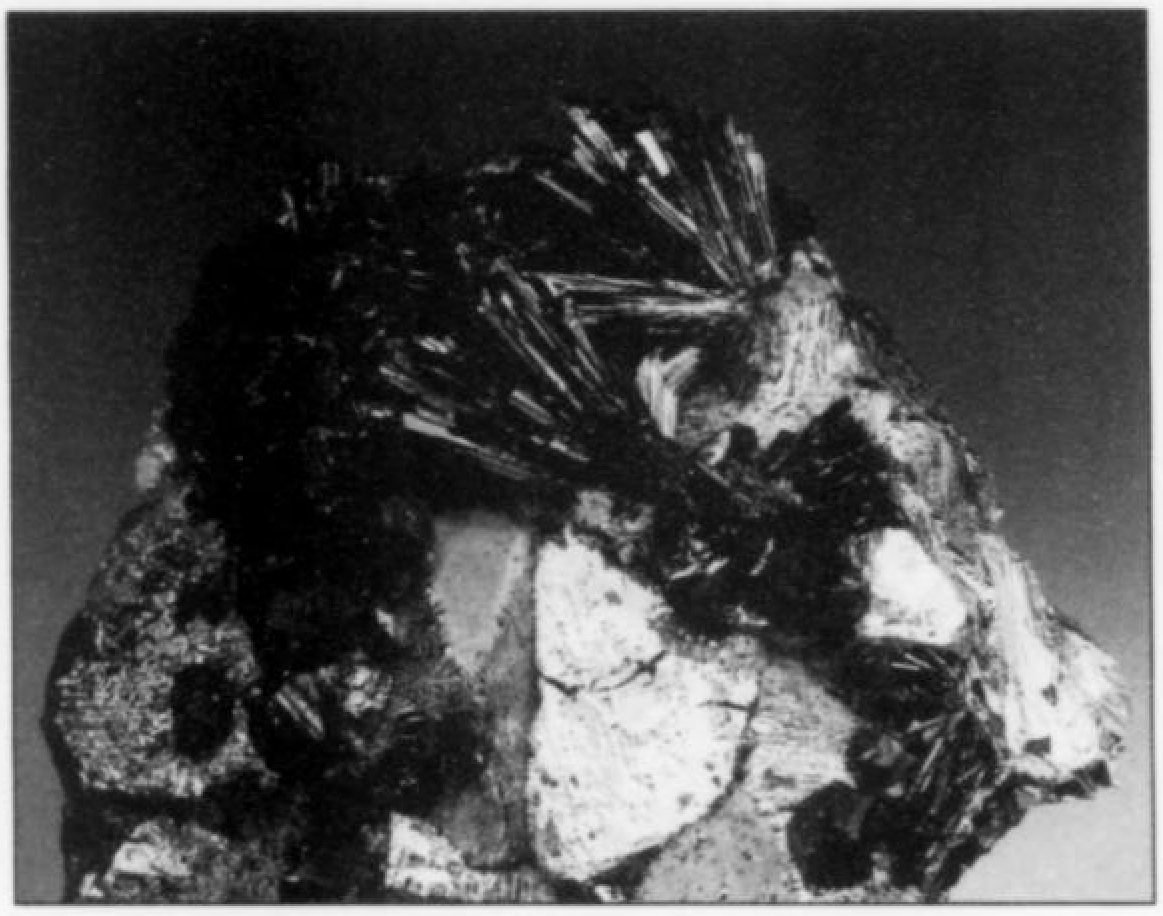


Figure 15. **Huebnerite crystals on pyrite matrix, 6 cm, from Morococha; collection and photo J. Hyrsl.**

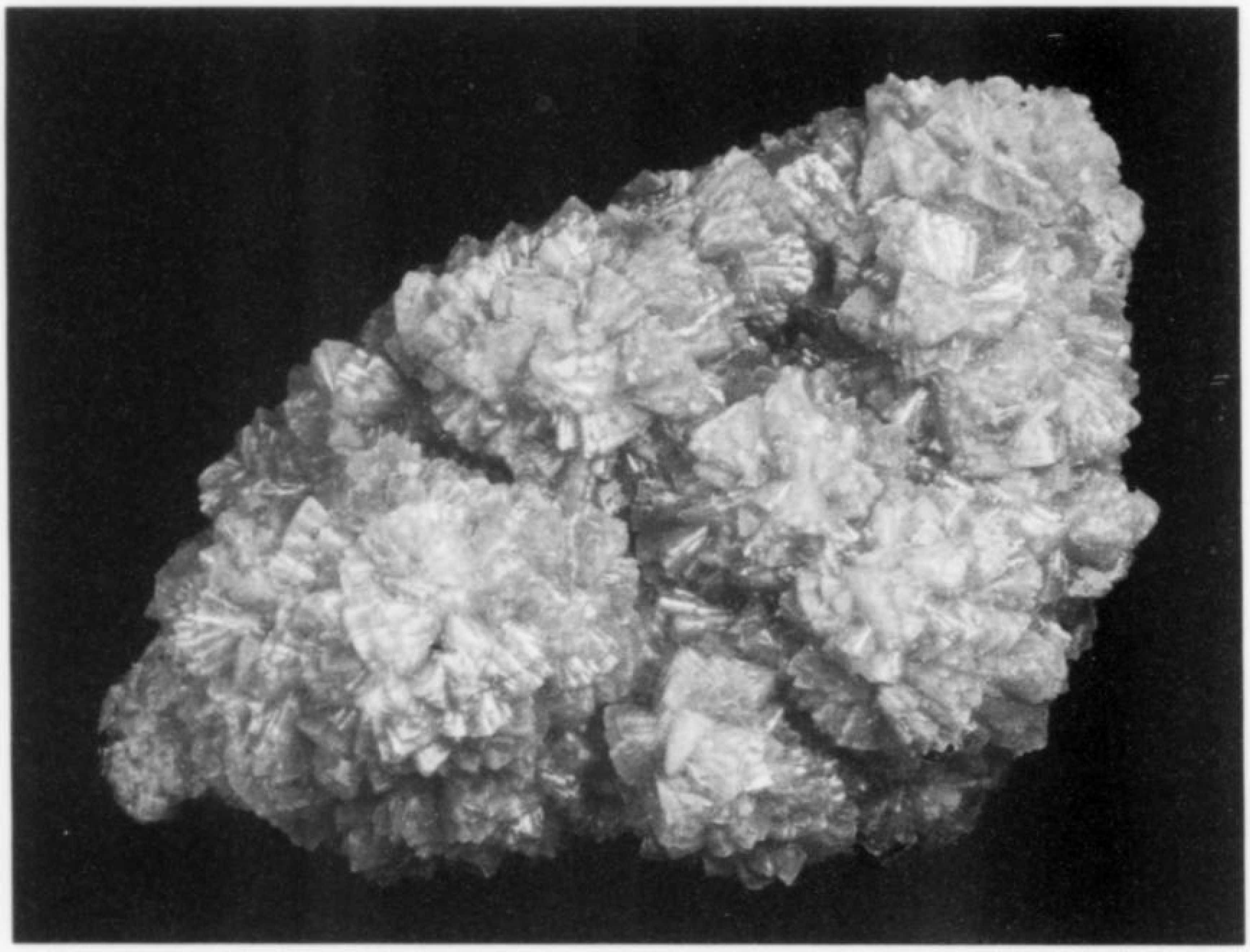


Figure 16. **Rhodochrosite, 8.5 cm, from Manuelita; collection and photo J. Hyrsl.**

far produced only small numbers of specimens, most notably clusters of small chalcopyrite crystals on massive calcite and rhodochrosite, and occasional groups of small rhodochrosite crystals. But in 2002, Huaron produced a large number of specimens of beautiful thick quartz crystals up to 2 cm long growing on small rhodochrosite aggregates. In some cases the quartz is accompanied by tetrahedrite crystals to 1 cm or by sphalerite crystals completely covered by a chalcopyrite crust. At the end of 2002 there was a very unusual find of rhodochrosite pseudomorphs after barite (?), some of which are perimorphs (hollow molds); these reach about 6 cm. Growing on them are hemispheres of black sphalerite, and sometimes even red pyrargyrite crystals to 2 mm.

The Alimon mine is still producing very aesthetic specimens of pyrite, sphalerite and chalcopyrite growing amid beds of needle quartz crystals (very rarely Japan-law twinned). Surprisingly, there was a find in 2000 of colorless fluorite octahedrons; the biggest single crystal is 19 cm on edge and weighs 3.5 kg! In 2001, the Alimon mine yielded small druses of tiny stibnite needles growing on quartz.

Carhuacayan

This mine, closed at the time of visits by Crowley *et al.* (1997), is producing again. Specimens of sphalerite, pyrite, galena and bournonite seen in Lima in 2002 are very similar to old ones from the locality.

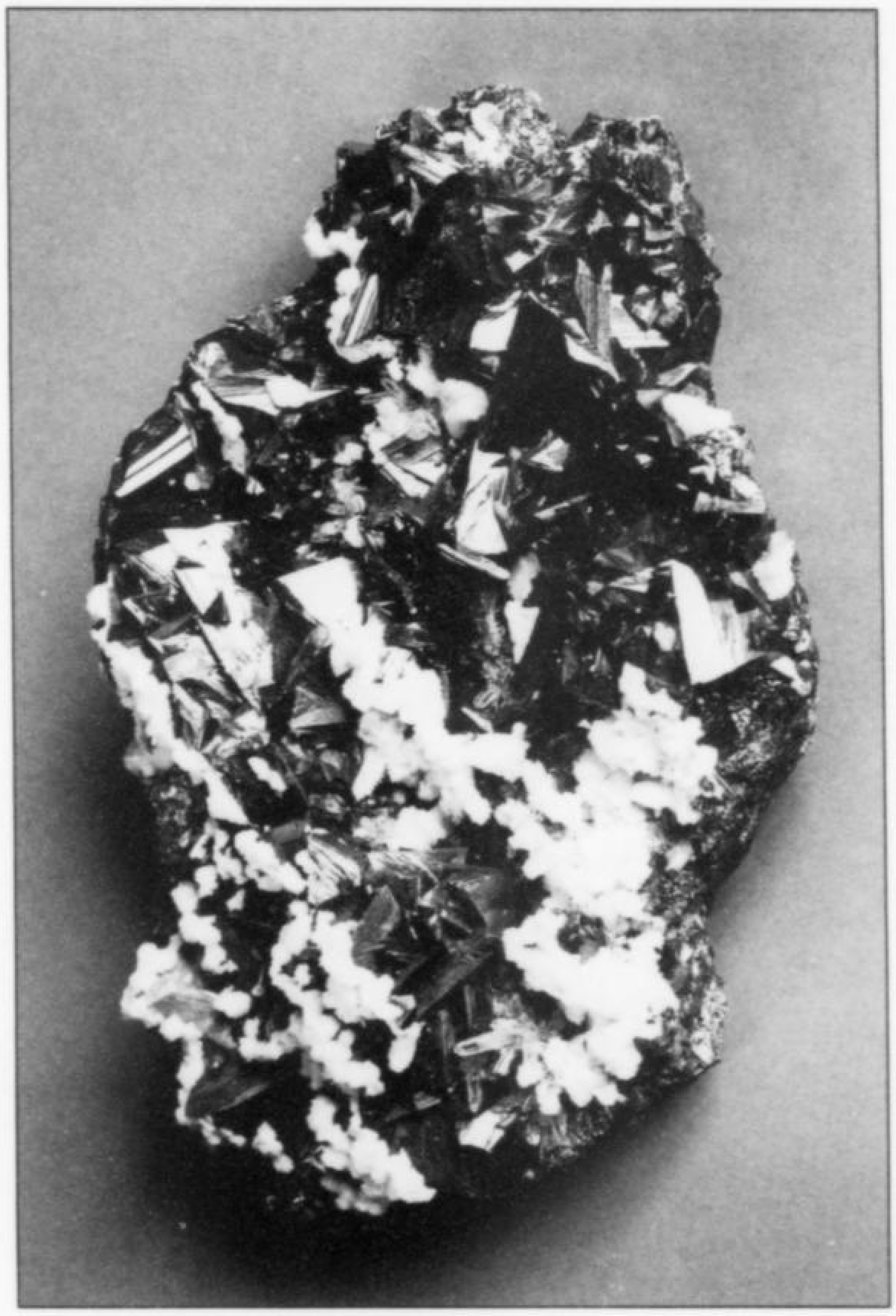


Figure 17. **Tetrahedrite crystals with calcite, 17 cm, from Casapalca; collection and photo J. Hyrsl.**

Morococha and Manuelita

In 1998 the Morococha mines produced a few very dark green, almost black, vivianite crystals to 2 cm, some with small black sphalerite crystals, on massive pyrite. In 2001 some unusual quartz crystals to 20 cm long with parquet surfaces were found. A limited number of unusual hübnerite specimens came from Morococha in May 2002: groups of black platy crystals up to 1.5 cm long, 3 mm wide, but only about 1 mm thick. They show red only when very strongly backlit. The hübnerite crystals grow on groups of large pyrite crystals, with nearly black sphalerite crystals to 5 mm. In January 2003 there was a unique find of a few gemmy gypsum crystals up to about 10 cm long, which contain inclusions of pale pink rhodochrosite and sphalerite. Nice pink rhodochrosite rhombohedrons up to 7 mm on black sphalerite were found sparsely.

The Manuelita mine, about 2 km from Morococha, along the road to La Oroya, has been producing beautiful rhodochrosite crystal specimens for several years. They look distinctly different from rhodochrosite from other Peruvian sources: simple, pink-red rhombohedrons to 1 cm in groups to 20 cm. Some of the rhombohedrons reach 3 cm, but these larger ones are very pale-colored and not attractive. Massive banded rhodochrosite from veins in the Manuelita mine is often tumble-polished, and the finished stones strongly resemble the famous rhodochrosite from Mina Capillitas in Argentina.

Casapalca

The most recent major find of excellent tetrahedrite crystals at Casapalca was made during the summer of 1998, and production of specimens continued sporadically until summer 1999. Thousands of specimens were extracted, but only a minute percentage of them were recovered undamaged.

The products of this large find can be divided into three major types. In the most common type, simple tetrahedrons of tetrahedrite to 3 cm, exceptionally to 7 cm, rest on drusy quartz. These crystals are very often found covered by white calcite, which Peruvian dealers dissolve away with hydrochloric acid; these acid-treated specimens unfortunately have much lower luster than the rare untreated ones. The second specimen type, much rarer and more beautiful, consists of tetrahedrite crystals associated with highly lustrous black sphalerite crystals. The latter species is often pseudo-octahedral in form, and grows in parallel groups; the tetrahedrite crystals show combinations of the positive and negative tetrahedrons with the negative faces selectively coated by a very thin crust of chalcopyrite. The third and rarest assemblage consists of gray tetrahedrite crystals with dark brown, extremely lustrous sphalerite crystals, both covered by bournonite crystals to 5 mm. The bournonites are very complex and rounded, not the more common cogwheel twins. Some of the tetrahedrites have been naturally corroded, and are irregularly pitted, the holes overgrown by very small calcite scalenohedrons.

Figure 18. **Freibergite with barite, 8 cm, from San Genaro; collection and photo J. Hyrsl.**

A few huge tetrahedrite crystals to 13 cm on edge have been found at Casapalca; these grow on pyrite and do not have a high luster. Some nice specimens of gray chalcopyrite crystals to 3 cm with coatings of tetrahedrite, growing on quartz and calcite crystals, were also recovered. A few druses of cogwheel bournonite crystals to 1 cm on quartz appeared again in 2002.

Casapalca has also yielded some interesting specimens of quartz, brown gypsum, and calcite (including pink scalenohedrons of manganoan calcite). Very unusual specimens of arborescent native copper, probably also from Casapalca, appeared in 2001; some have associated white gypsum crystals.

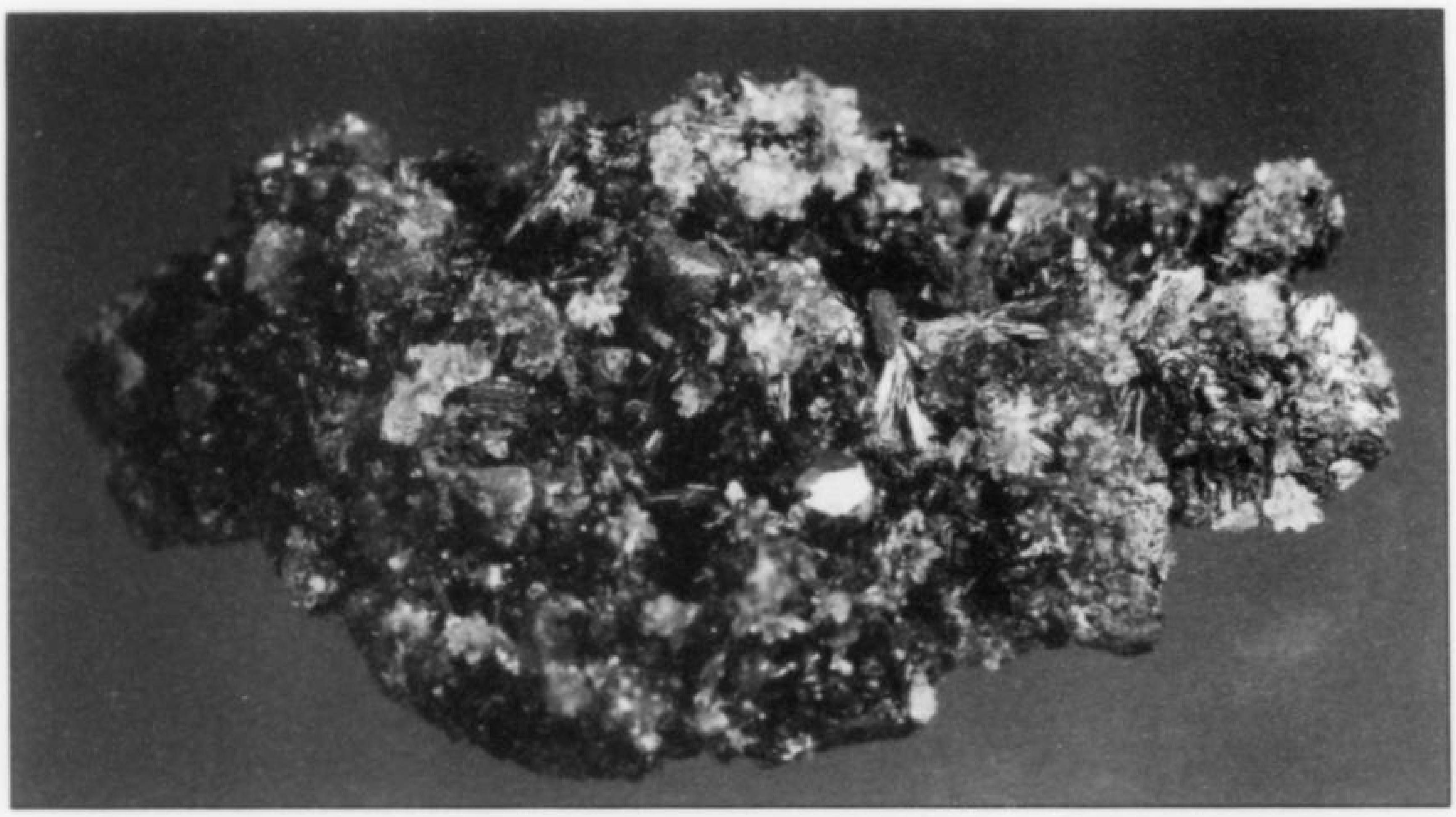


Figure 19. **Krupkaite, 4.5 cm, from Julcani; collection and photo J. Hyrsl.**

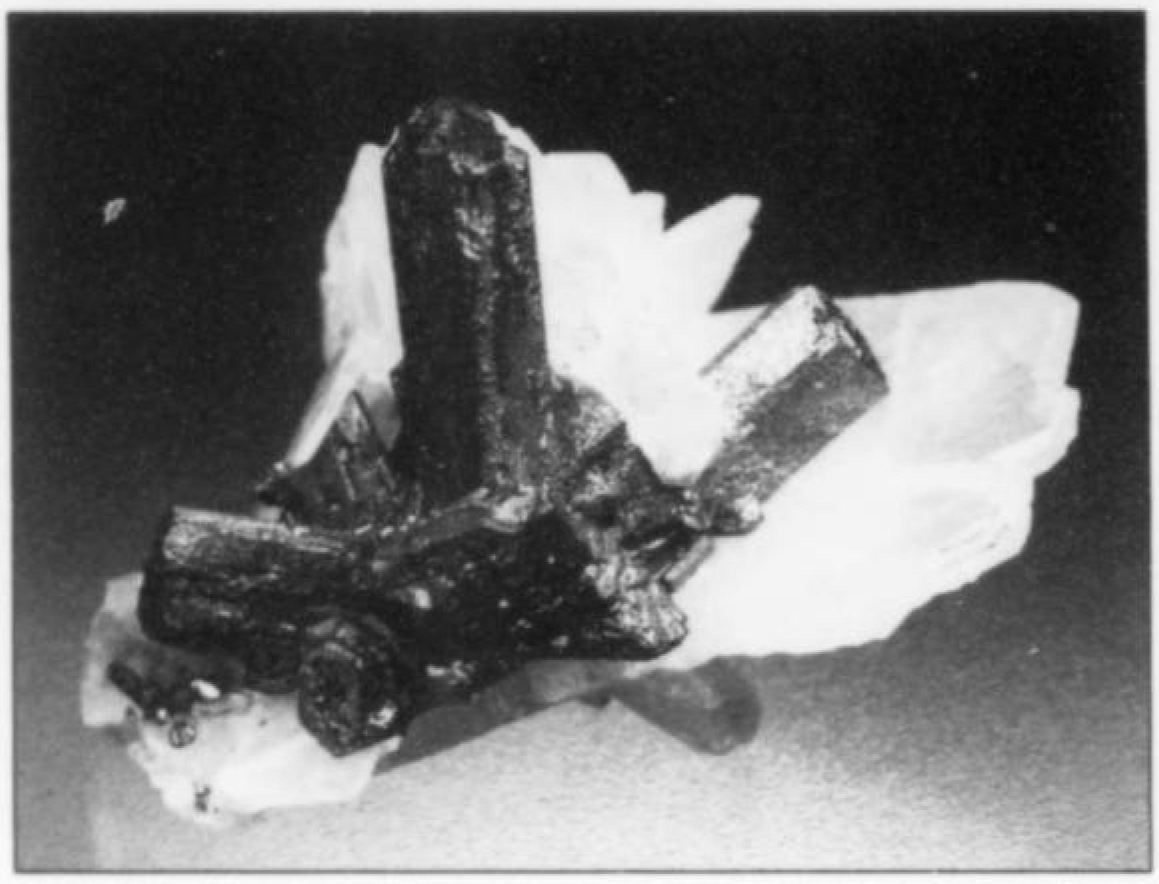
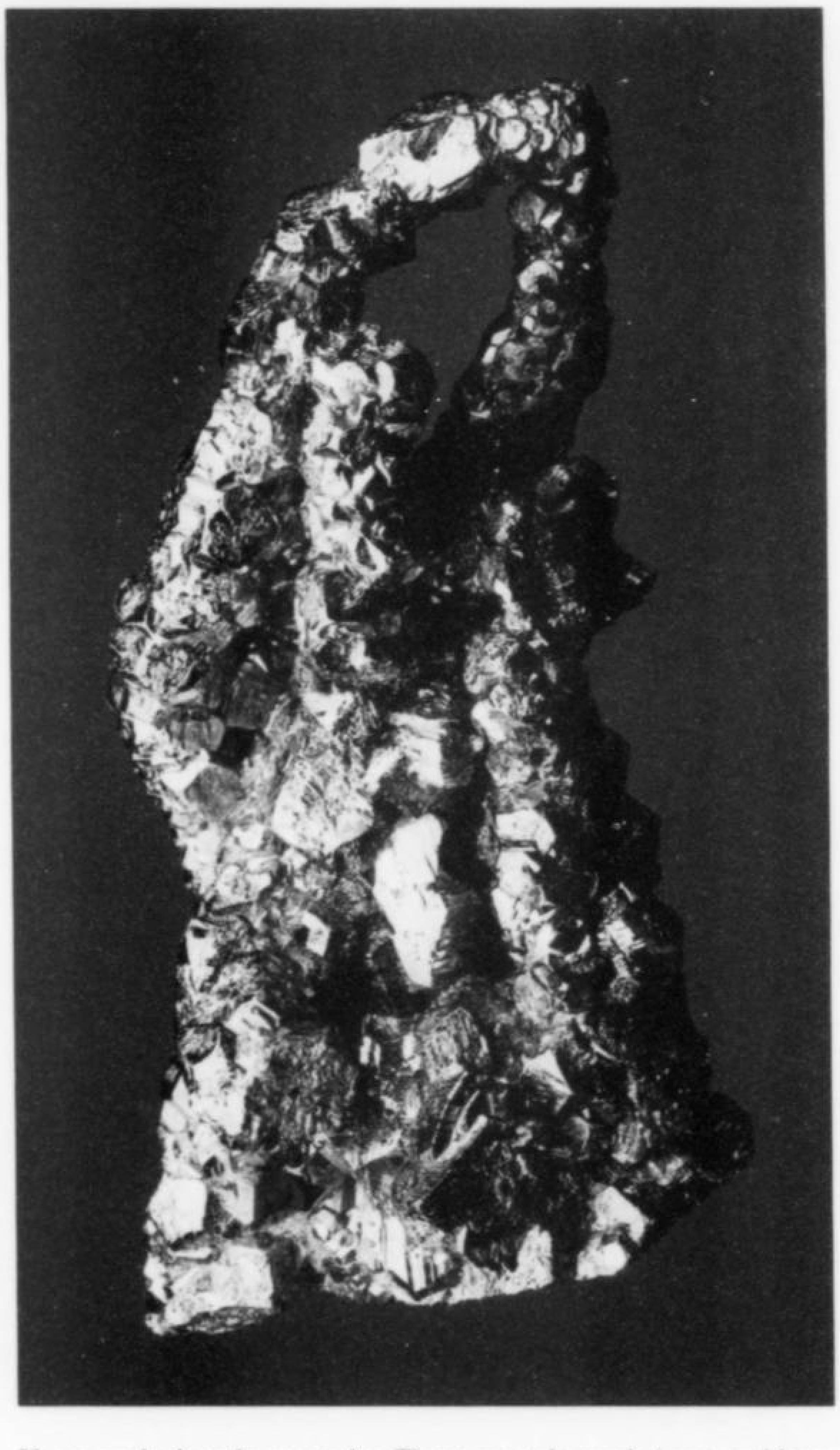


Figure 20. **Enargite crystals on barite, 6 cm, from Julcani; collection and photo J. Hyrsl.**

Figure 21. **Pyrite stalactites, 7 cm, from Julcani; collection and photo J. Hyrsl.**



San Genaro

The San Genaro mine in the Castrovirreyna district, Huancavelica Department, is still the most prolific locality in Peru for silver minerals. It yields primarily small specimens of crystallized pyrargyrite, with rarer miargyrite (in nearly black, lens-shaped crystals), polybasite (in hexagonal plates), stephanite and freibergite (both in complex, gray, highly lustrous crystals). The best freibergite (X-ray verified) occurs as very complex, rounded crystals to 1.5 cm, on barite with pyrargyrite and rarely with bournonite crystals; these specimens were found in 2001. Interesting columnar crystals of realgar to 1.5 cm, strongly resembling recently found crystals from Baia Sprie, Romania, were found in 2001; the realgar has formed on tetrahedrite and sphalerite.

The new, very rare species baumstarkite, $AgSbS_2$, a polymorph of miargyrite, was described recently from San Genaro by Effenberger *et al.* (2002); for a long time this material was thought to be aramayoite. Baumstarkite forms black crystals to about 3 mm (commonly twinned) on miargyrite, as well as cleavages resembling wolframite. There have probably been no new finds of the species, but it can be seen on older specimens.

Nice clusters of columnar to rounded 1.5-cm pyrargyrite crystals have been found sporadically at the San Genaro mine. Surprisingly, some "pyrargyrite" specimens found in 1999 were determined by X-ray analysis to be proustite. These crystals reach 1 cm, and have flatter, shinier surfaces than the pyrargyrite from other recent finds. Native silver from San Genaro is usually found as small wires, but in the summer of 2000 some herringbone-style aggregates resembling those from Batopilas, Mexico were discovered. A fantastic silver specimen of this type, about 15 cm tall, was exhibited in February 2001 at the Tucson Show.

Julcani

The Julcani mine continues to be a very prolific locality. Very good crystals of enargite to 7 cm, similar to old specimens from Quiruvilca, were found in 1999; they occur on platy white barite crystals which reach more than 10 cm. Very rarely, the enargite forms star-shaped twins. A very interesting find in the summer of 1999 produced many sharp pseudomorphs of tennantite after enargite to more than 7 cm long. The larger crystals may be hollow, or may contain relict enargite in their centers. A few groups of pseudomorphic crystals to 1.5 cm are covered by fine-grained pyrite; these are composed of an intermediate member of the tetrahedrite-tennantite series. Complex, rounded, highly lustrous gray crystals to 1.5 cm have been identified as tetrahedrite.

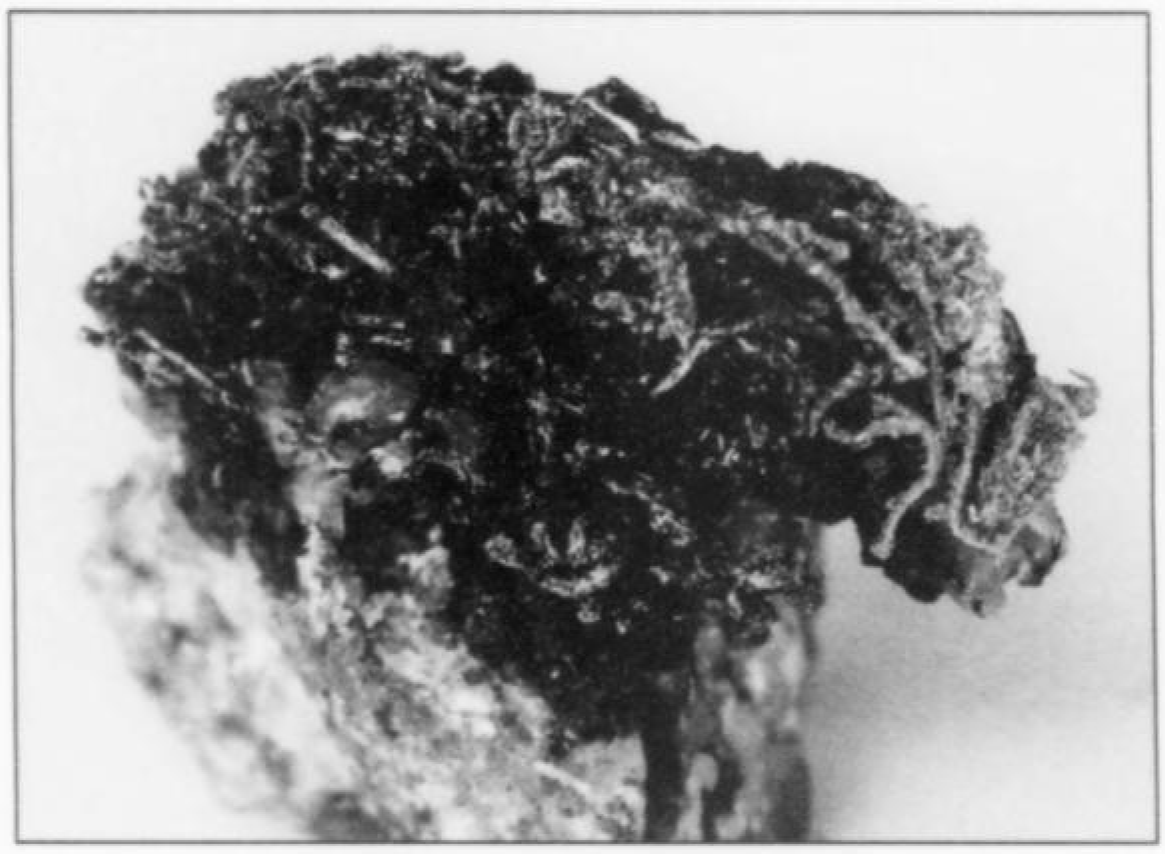


Figure 22. **Wire gold on matrix, 2.5 cm, from Pampa San Jose; collection and photo J. Hyrsl.**

Julcani has also recently produced nice stalactites of pyrite and of marcasite, and some bournonite crystals as well. Nice pyrite octahedrons up to about 5 cm on matrix appeared in 2002. Very rare, complex intergrowths of acicular bismuth sulfosalt crystals on barite are known from the past, and a few excellent specimens of krupkaite (verified by X-ray and microprobe analysis), with needles to 4 mm, were found in 1999. Very similar specimens found at earlier times at Julcani have been identified as bismuthinite and/or boulangerite.

In December 2002 specimens of black wolframite crystals up to about 1 cm appeared, accompanied by clusters of tiny gold crystals; these clusters reach about 3 mm. They were originally covered by calcite which was etched off.

Pampa San Jose

Although Peru is among the world's leading gold producing countries, collector-quality Peruvian gold specimens are almost unknown. However, in 2000 a few attractive specimens of wire gold appeared, purportedly from Pampa San Jose, Carolita, Huancay. The specimens consist of massive vein quartz and abundant limonite, with gold wires to about 1 cm.

Laguna da Salinas

This salt deposit near Arequipa, currently being exploited, has produced some interesting borates, including spherical aggregates of inyoite crystals to 15 cm and crystallized ulexite.

Figure 23. **Fluorapatite crystal, 7 cm, from Espinal, Ica; collection and photo J. Hyrsl.**

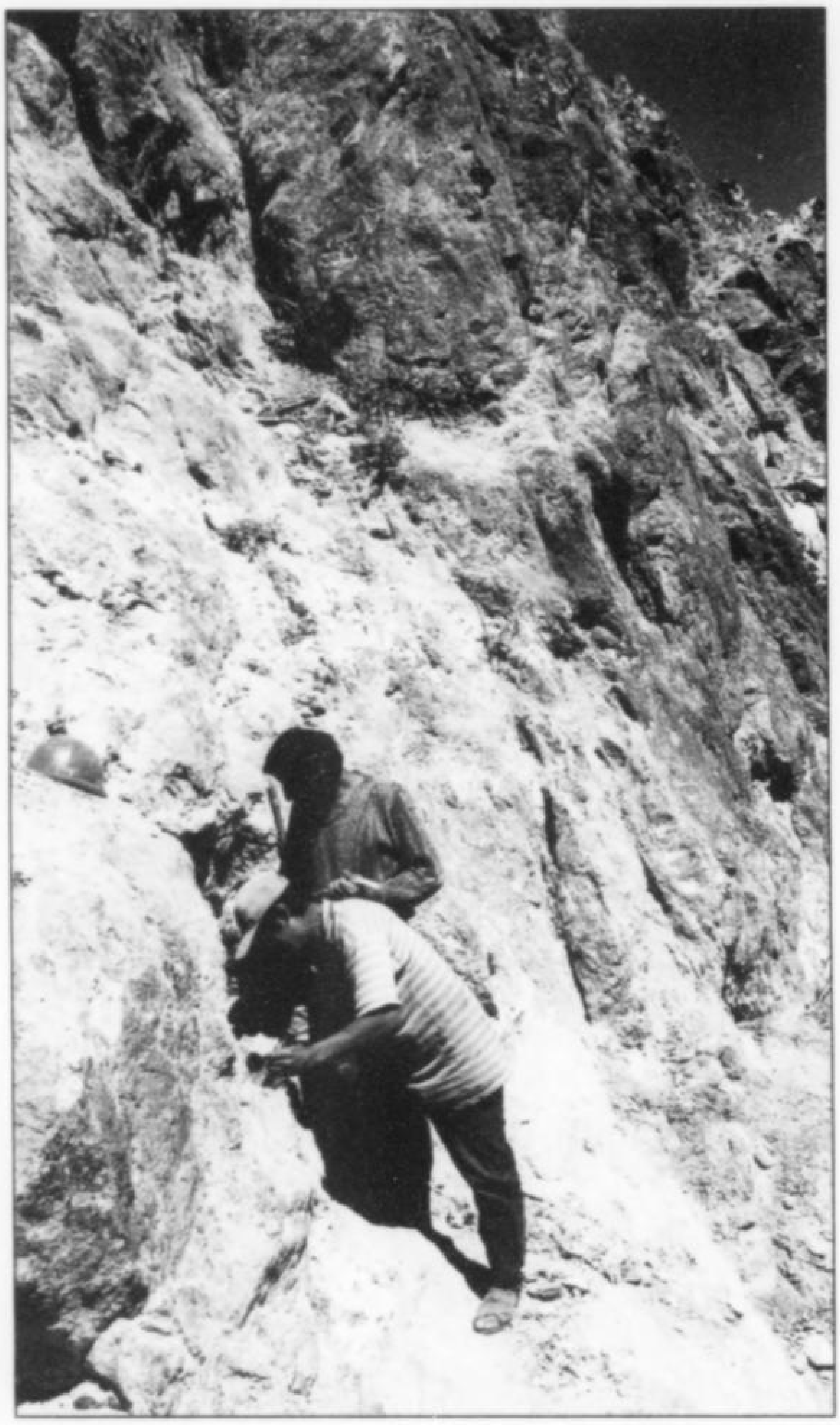
Ica region

Good mineral specimens from southern Peru were almost unknown in the past, but this changed with some significant discoveries in the late 1990's. Nice brown ferro-axinite in sharp crystals and groups to about 7 cm was found in Molletambo, 40 km east-southeast of Ica. Rarely the ferro-axinite is accompanied by prehnite and black tourmaline. Gray apatite crystals to 7 cm have been found at the nearby locality of Espinal (Moore, 1998); some good epidote specimens appear to have come from the same source. A much less important epidote locality is the Paracas quarry near Huaytara, on the border of Ica and Huancavelica departments. Although the epidote crystals from this occurrence are not nearly as fine as those from Pampa Blanca, they are made more interesting by their association with ferro-axinite.

The region between Pisco and Ica apparently contains more localities for interesting vein quartz. Several habits of quartz from this area have appeared in Lima during the past few years. In February 1999 the authors saw terminated quartz crystals to about 30 cm long, reportedly from an unnamed prospect near Pisco; they resemble specimens from Pampa Blanca. Lustrous black schorl crystals to 2 cm on feldspar matrix were mentioned by Moore (1998); their locality was given as Chacoya, Castrovirreyna Province, Huancavelica Department (east of Pisco). An unknown locality in the Ica region produced beautiful orange calcite scalenohedrons to several centimeters long. This calcite is transparent, but has an opaque crust; some crystals with artificially polished surfaces have been sold.

Pampa Blanca and Ullpac

The first Japan-law twinned quartz specimens from southern Peru appeared on the market around 1997. Secretive local suppliers have given various locality names, but the source is the Rosario Mabel



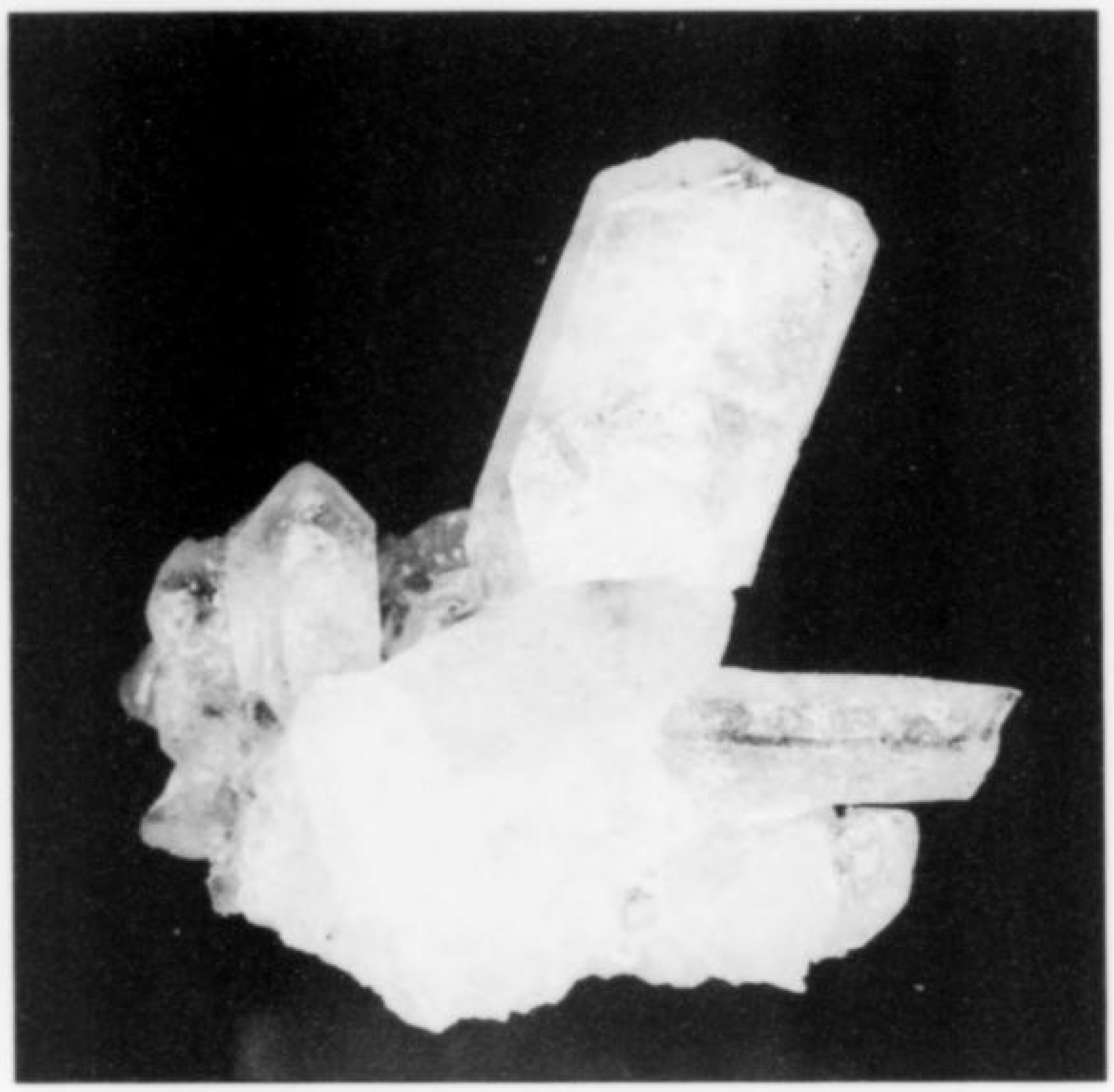


Figure 25. **Quartz "closed square" twin, 4 cm, from Ullpac; collection and photo J. Hyrsl.**

Figure 24. **Collecting at Pampa Blanca, 2000; photo J. Hyrsl.**

claim near Pampa Blanca in Castrovirreyna Province, Huancavelica Department. Between 1995 and 1998 this claim also produced huge quantities of fine epidote specimens. In 1999 the claim was sold to a new owner, G. Russo, who renamed it "Flor de Peru II." The occurrence is at a contact between granite and carbonate rocks, where abundant andradite garnet, rarely in crystals to 2 cm, has been found with epidote. The epidote characteristically forms sprays of thin

Figure 26. **Salt mining in Las Salinas; photo J. Hyrsl.**

Figure 27. **Gypsum crystal cluster, 6.5 cm, from Las Salinas; collection and photo J. Hyrsl.**

needles up to about 10 cm long; thick terminated crystals are quite rare. Japan-law twinned quartz here is rarer than at Ullpac Mountain (also written as Ollupac; see below); the crystals are similar in habit to the Ullpac specimens, but are transparent and thus much more attractive. The biggest specimen to reach the Lima market in 2001 weighs about 200 kg and contains at least 10 Japan-law twins, each twin about 10 cm across. A huge 49-cm twin was found at Pampa Blanca in 2002. Rarely, calcite crystals occur on the quartz twins.

Probably the world's most productive locality for Japan-law twinned quartz at present is the "Flor de Peru I" claim at Ullpac Mountain, situated about 3 km north of Pampa Blanca; this abandoned copper (?) mine (which was called the Tentadora mine when it was active) began to produce specimens in 1999. The crystals come from simple quartz veins and are rarely accompanied by epidote, green platy vesuvianite, small scheelite crystals and pale amethyst. Quartz here forms crystals to about 20 cm long. Japan-law twins are very common, averaging about 5 cm, occasionally reaching 10 cm. The twins are almost always flattened, and range in shape from the typical "V" through heart-shaped to very rare "closed squares." The twins are usually accompanied by untwinned quartz crystals, but one part of the vein produced a limited number of groups to more than 30 cm in size, composed entirely of large Japan-law twins. Unfortunately, Ullpac quartz twins are usually rendered milky by a thin crust of younger, white quartz. Very rarely the twins show green chlorite phantoms or are terminated by amethyst scepters.

Las Salinas

The Las Salinas halite mine near Otume village south of Pisco (not to be confused with Laguna de Salinas near Arequipa) has produced very aesthetic clusters of golden gypsum crystals during the last two years. The crystals reach about 7 cm and are commonly twinned on {100}. The only associated mineral is halite in colorless cubes to about 5 cm. The most recently found gypsum specimens are among the most beautiful known.

Lily mine

Secondary minerals are rare in Peru, and thus the discovery of very beautifully crystallized secondary copper minerals in 1998 was very surprising. The locality is the Lily mine, about 40 km east of Pisco and about 200 km south of Lima. Originally the material was called brochantite, but X-ray analysis has shown it to consist primarily of atacamite. The most beautiful specimens show bright green, flattened prismatic crystals to several millimeters completely enclosed in younger gypsum crystals; an example is shown on the cover of the May–June 2000 issue of the *Mineralogical Record*. Much rarer are blocky, almost pseudocubic, greenish black crystals of paratacamite from the Lily mine. These can reach 1.5 cm and are surely among the world's finest examples of the species. Also, malachite forms bright green radial crystal aggregates, in some cases covered by younger quartz or gypsum; the aggregates can resemble paratacamite. Gypsum crystals from the Lily mine commonly show inclusions of pale blue, amorphous chrysocolla. Nice

Figure 28. **Paratacamite with malachite, 7 cm, from Lily; collection and photo J. Hyrsl.**

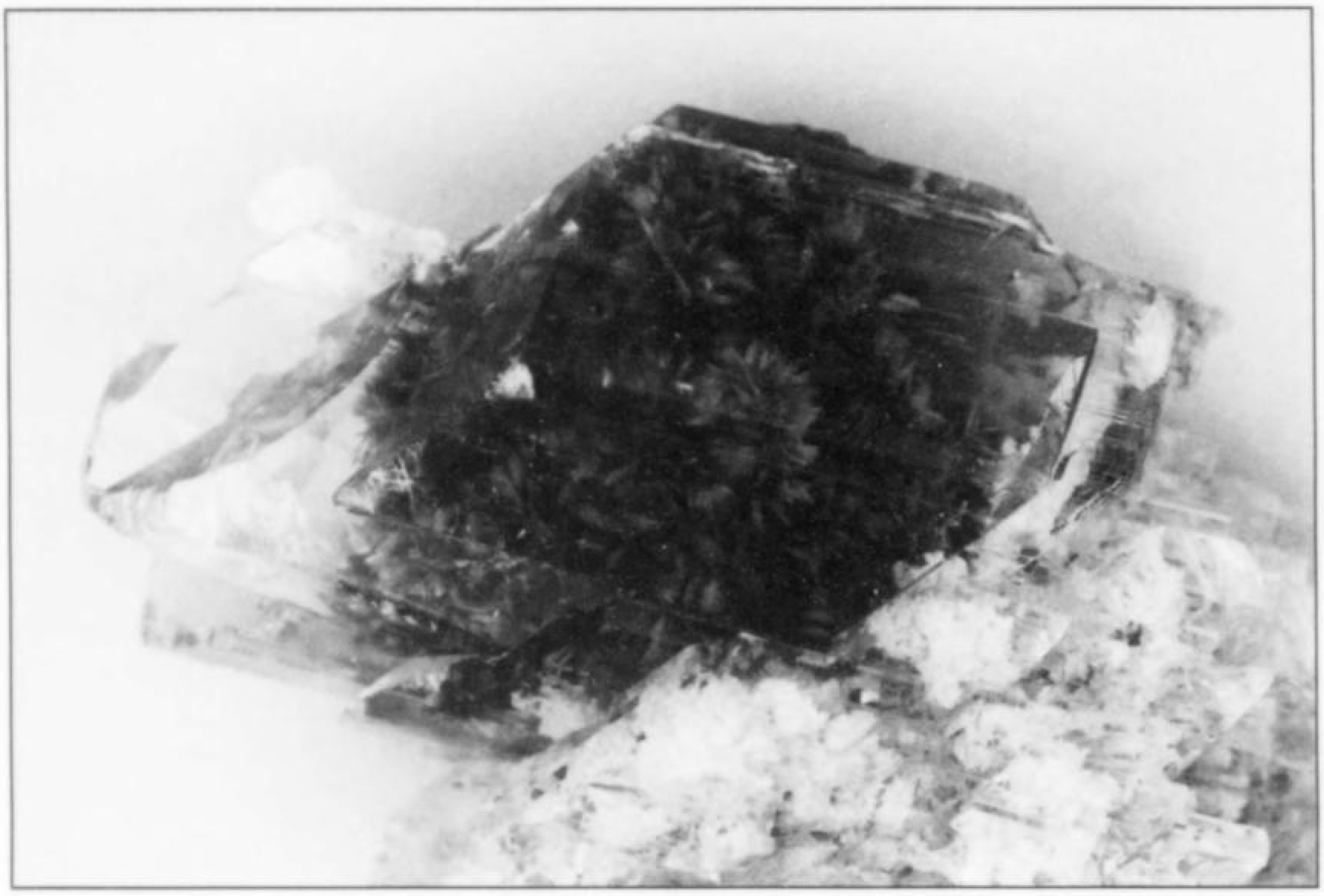


Figure 29. **Malachite in gypsum, 3 cm, from Lily; collection and photo J. Hyrsl.**

blue-green lapidary material, referred to as "gem silica," consists of chalcedony stained by chrysocolla inclusions (Hyrsl, 2001).

Acari

The Acari mine exploits what is probably a porphyry-copper orebody near Nazca in Arequipa Department. For at least two decades it has produced large quantities of lapidary-grade chrysocolla (called "turquesa" in Peru), as well as transparent blue opal (described in the trade as "Andean opal") which is colored by chrysocolla inclusions. Mixtures of opal, chalcedony and chrysocolla in varying proportions, with varying refractive indices and densities, have been described by Hyrsl (2001). The same locality is also producing pink opal which contains a significant amount of palygorskite.

Unknown localities

In 2001, some very interesting amethyst specimens were found at a locality first given as near Cuzco, later given as near Nazca, not far from Ica. The best specimens show amethyst scepter crystals to about 7 cm.

An unknown locality in central Peru produced a few specimens of *faden* quartz in 2001. The slightly twisted crystals are about 5 cm long and of mediocre quality.

In 1998 a few very large, transparent, orange scheelite crystals appeared at the Tucson Show, and later they were cut into huge faceted stones to 266.68 carats. The loose crystals closely resemble those from China. We were told in Lima that they come from the Turmalina mine in Piura Department in far northern Peru, but this attribution needs confirmation.

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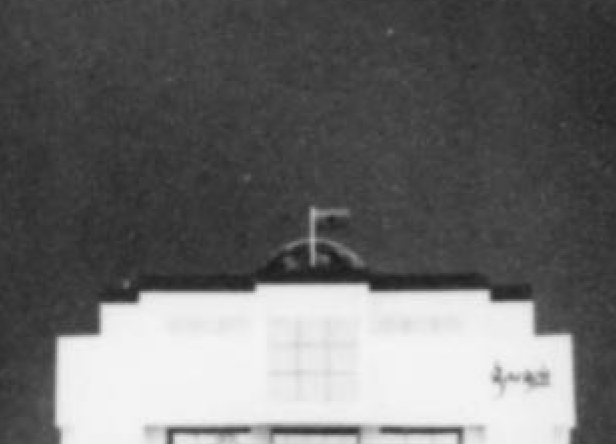

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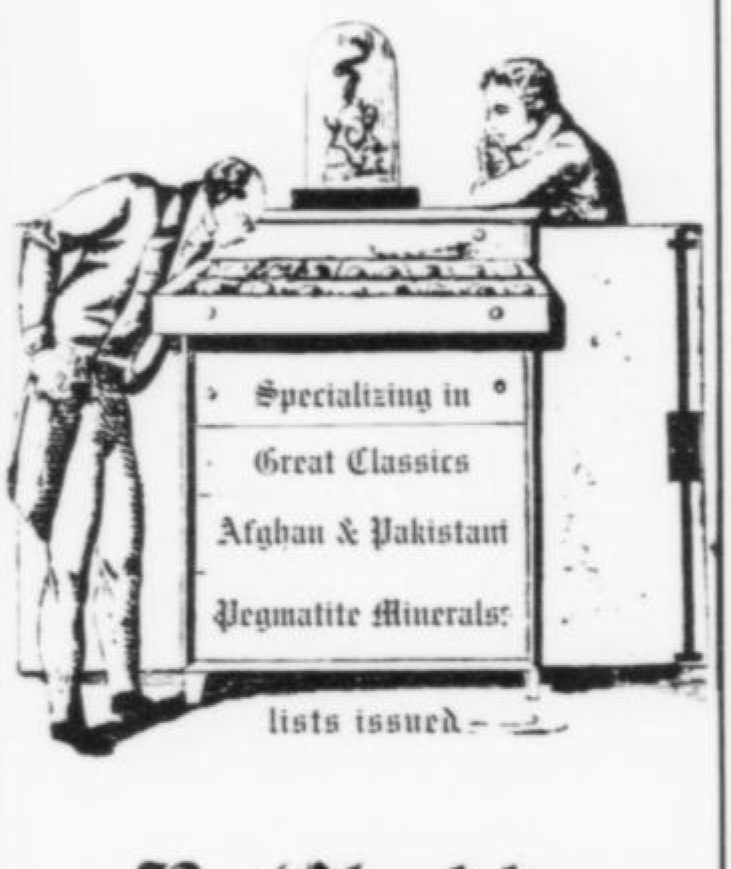

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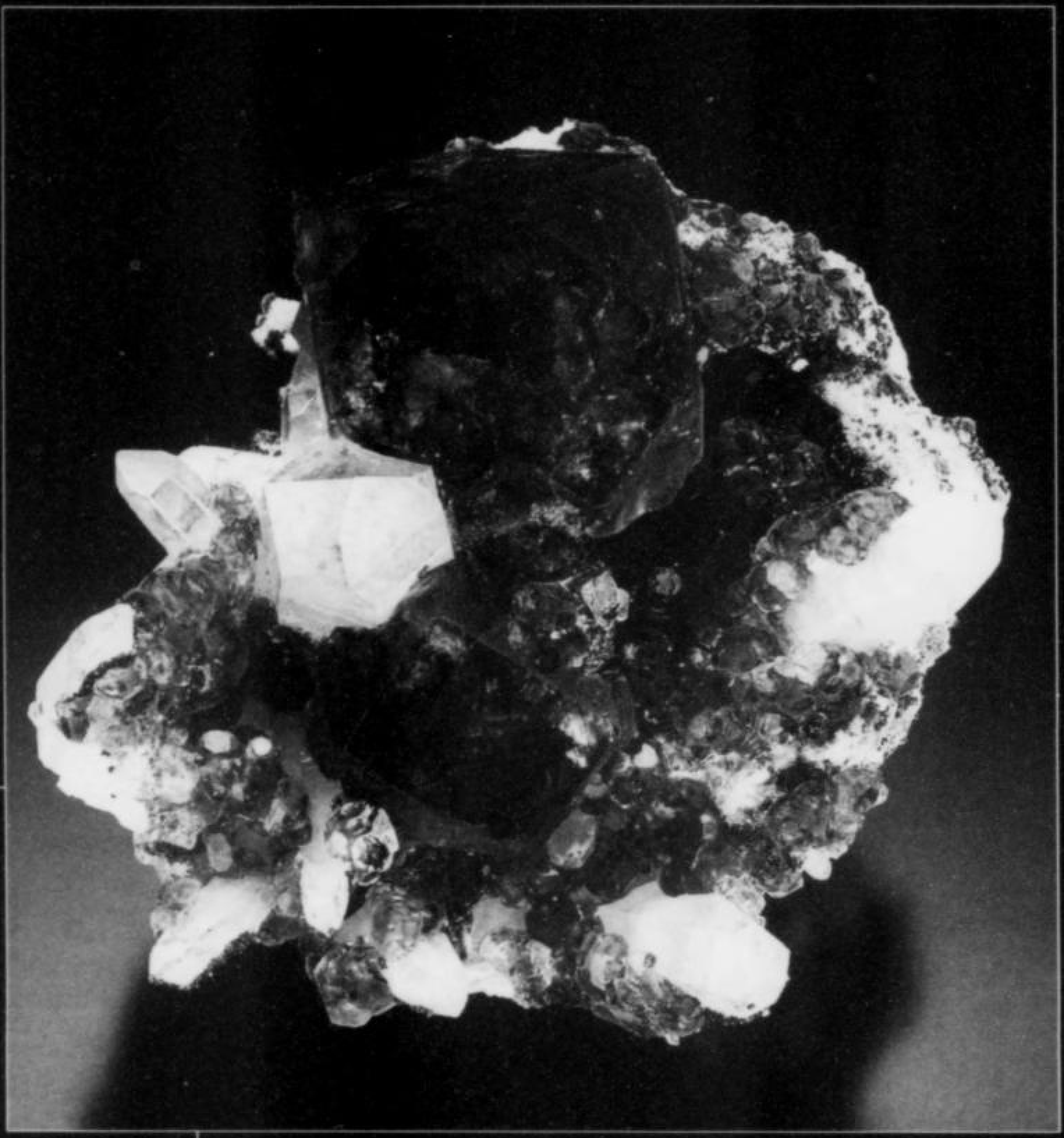

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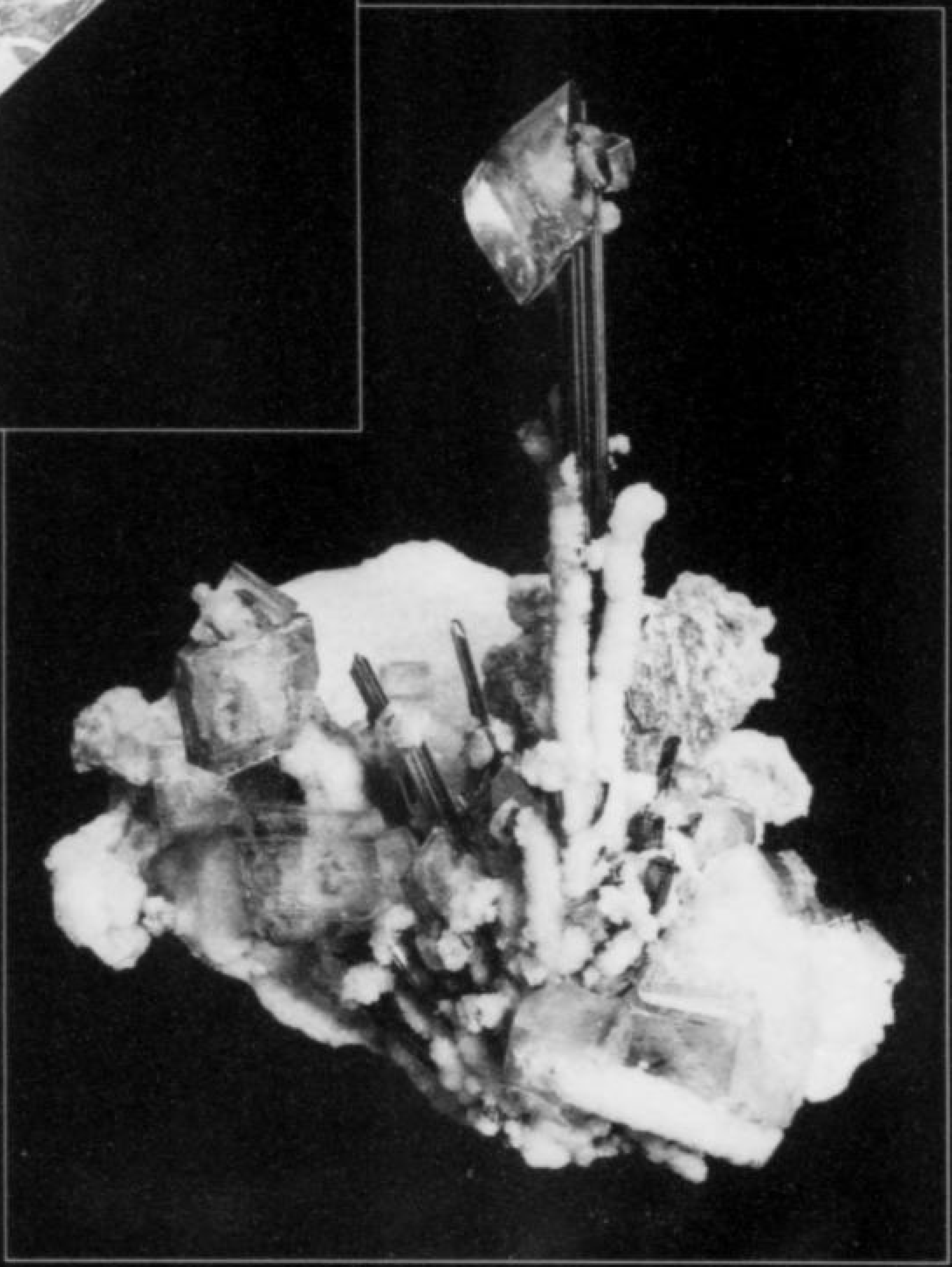

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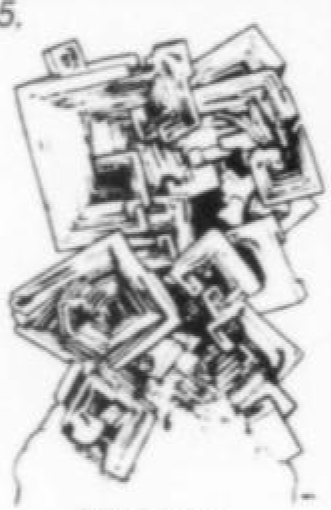

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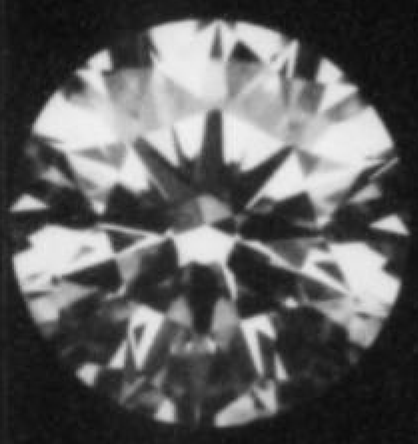

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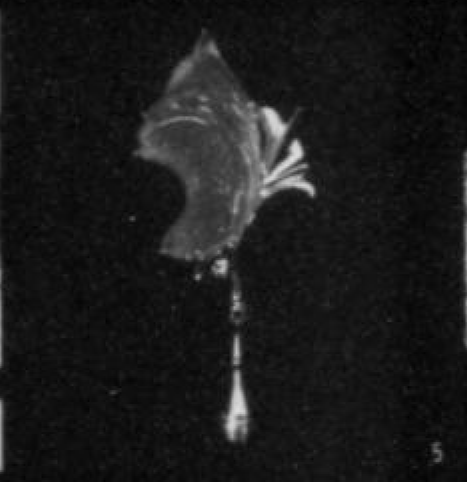

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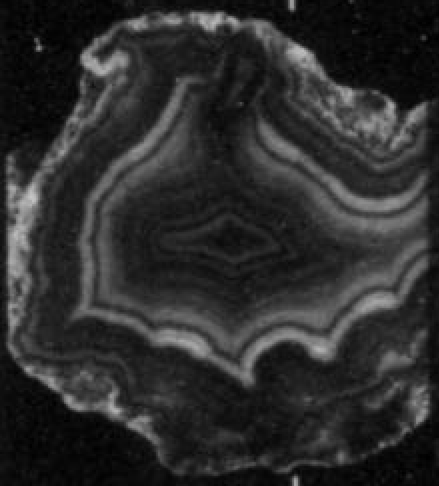

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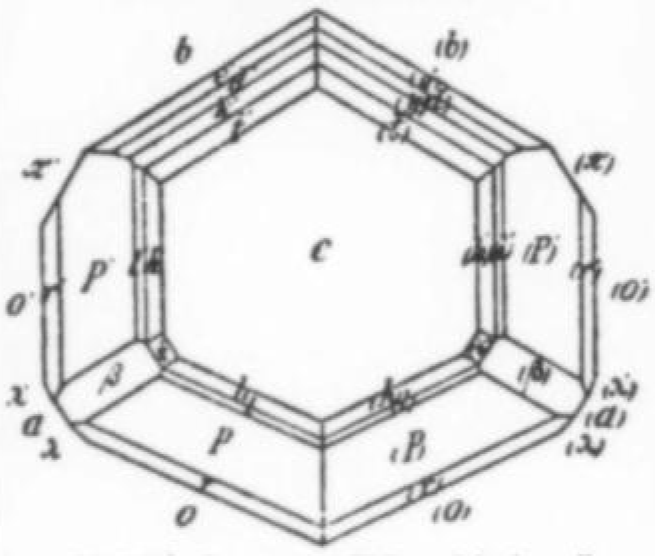

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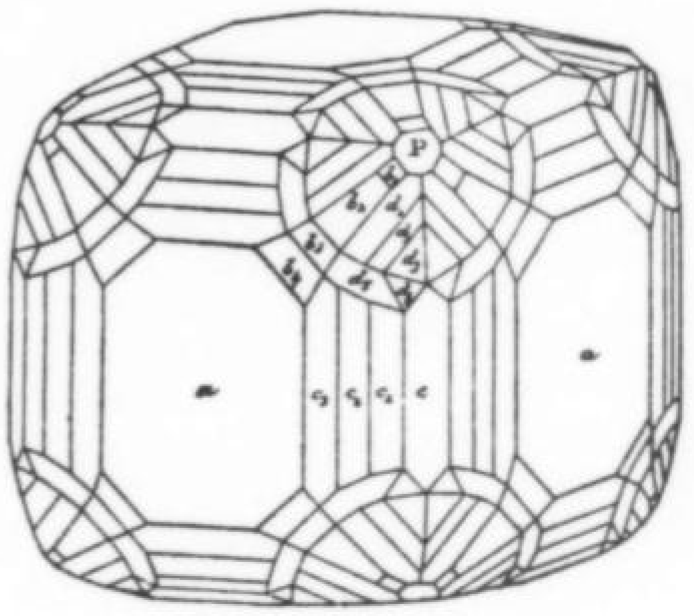

J. A. Mandarino
Chairman Emeritus of the Commission on
New Minerals and Mineral Names
of the International Mineralogical Association
and
Curator Emeritus
Department of Mineralogy
Royal Ontario Museum
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Kanonerovite Monoclinic

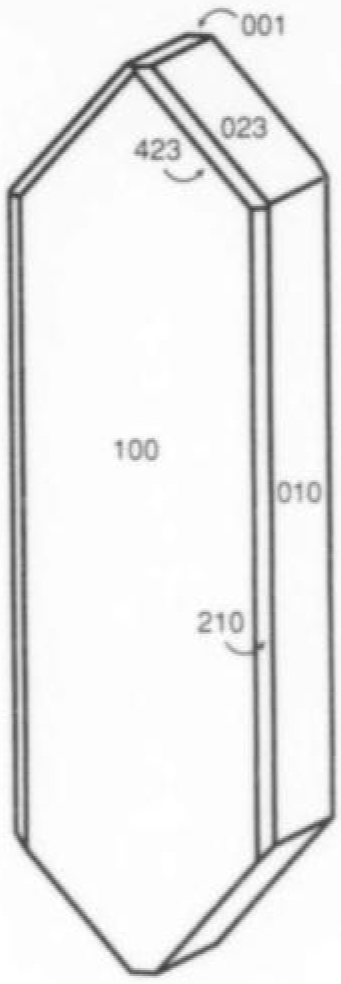
$MnNa_3P_3O_{10}\cdot 12H_2O$

Locality: Kazennitsa pegmatite vein, Alabashka pegmatite field, Middle Urals, Russia ((Lat. 57°47′ N, Long. 61°03′ E).

Occurrence: In cavities of a granite pegmatite of muscovite-albite-microcline type which cuts biotite granite-gneisses and porphyry granites. Associated minerals are: muscovite, quartz, elbaite, topaz, milarite, calcite, chabazite, stilbite-stellerite, rutile, fluorite, pyrrhotite, sphalerite and pyrite.

General appearance: As a crust (0.1 to 1.2 mm) on quartz, topaz and cassiterite crystals. Individual crystals have dimensions of a few tenths of millimeters.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 2½ to 3. *Tenacity:* brittle. *Cleavage:* {010} poor. *Fracture:* uneven. *Density:* 1.91 g/cm^3 (meas.), 1.88 g/cm^3 (calc.). ***Crystallography:*** Monoclinic, $P2_1/n$, a 14.71, b 9.33, c 15.13 Å, β 89.8°, V 2075 Å^3, Z 4, $a:b:c$ = 1.5766:1:1.6217. Morphology: {100}, {001}, {010}, {023}, {423} and {210}; habit platy on {100} and elongated on [001]. Twinning: none mentioned. ***X-ray powder diffraction data:*** 10.50 (75) (101, $\bar{1}01$), 7.36 (100) (200), 6.95 (90) (111, $\bar{1}11$), 3.316 (60) (411, $\bar{4}11$, $\bar{1}23$, 321, $\bar{3}21$, 313), 3.162 (50) (214, $\bar{2}14$), 2.889 (60) (420, 124, 032), 2.391 (48) ($\bar{2}25$, 206, $\bar{2}06$). ***Optical data:*** Biaxial (−), α 1.453, β 1.459, γ could not be determined, 2V could not be determined, dispersion not observed; nonpleochroic; X ∧ c = 0 to 7°. ***Chemical analytical data:*** Means of eighteen sets of electron microprobe data (with H_2O calculated to give $12H_2O$): Na_2O 14.80, K_2O 0.05, MgO 0.14, CaO 0.20, MnO 11.20, FeO 0.15, P_2O_5 35.23, H_2O (36.46), Total (98.23) wt.%. Empirical formula: $(Mn_{0.95}Mg_{0.02}Fe_{0.01})_{\Sigma 0.98}(Na_{2.86}Ca_{0.02}K_{0.01})_{\Sigma 2.89}P_{2.98}O_{9.87}\cdot 12.13H_2O$. ***Relationship to other species:*** It is the natural equivalent of the synthetic triphosphate.



Kanonerovite

Name: For Aleksandr Anatol'evich Kanonerov (1955–), mining historian (Nizhnii Tagil Museum of Mining Industry of the Middle Urals) and mineral collector who first collected the mineral in 1995. ***Comments:*** IMA No. 1997-016.

POPOVA, V. I., POPOV, V. A., SOKOLOVA, E. V., FERRARIS, G., and CHUKANOV, N. V. (2002) Kanonerovite, $MnNa_3P_3O_{10}\cdot 12H_2O$, first triphosphate mineral (Kazennitsa pegmatite, Middle Urals, Russia). *Neues Jahrbuch für Mineralogie, Monatshefte* **2002**, 117–127.

Laflammeite Monoclinic

$Pd_3Pb_2S_2$

Locality: The Kirakkajuppura PGE deposit in the Penikat layered complex, Finland.

Occurrence: In altered pyroxenite. Associated minerals are: actinolite, clinochlore, chromite, vysotskite, zvyagintsevite, cuprorhodsite-ferrorhodsite-malanite, laurite-erlichmanite, irarsite, keithconnite, Pb-Pd-rich thiospinels of Cu, Fe, Rh and Ir, unnamed Pd_9PbO_{10} and $Rh(Ni,Fe,Cu)_2S_3$, palladian gold, chalcopyrite, bornite and millerite.

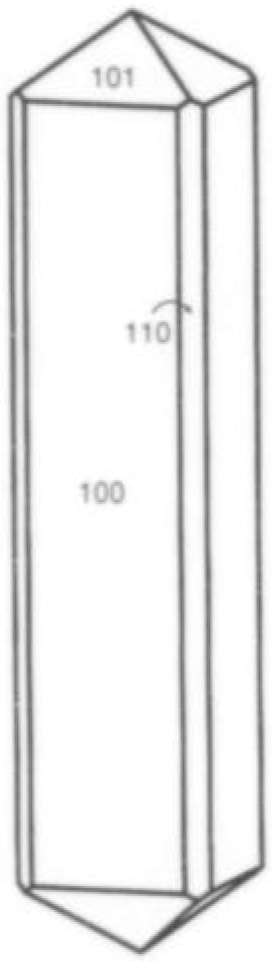
General appearance: Commonly as individual subhedral platelets (up to 150 μm) and as intergrowths with members of the vysotskite-braggite series. The largest subhedral crystal is 0.3 mm.

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color unknown. *Streak:* dark gray. *Hardness:* VHN$_{50}$ 171 kg/mm^2, Mohs 3½. *Tenacity:* quite brittle. *Cleavage:* inferred to be {010} perfect. *Fracture:* not given. *Density:* could not be determined, 9.41

g/cm^3 (calc.). ***Crystallography:*** Monoclinic, by analogy with other parkerite-type phases probably *C2/m*, *a* 11.521, *b* 8.294, *c* 8.321 Å, β 134.38°, *V* 568.3 Å^3, Z 4, *a:b:c* = 1.3891:1:1.0033. Morphology: no forms were observed. Twinning: finely twinned. ***X-ray powder diffraction data:*** 5.953 (6) (001), 4.144 (10) (020), 3.379 (4) (021), 2.917 (9) ($\bar{2}$20), 2.413 (8) (022), 2.365 (7) ($\bar{4}$22), 2.082 (5) (040). ***Optical data:*** In reflected light: cream with a brownish tint, weak anisotropism from brownish gray to grayish brown, weak bireflectance, nonpleochroic. R_1, R_2; ${}^{im}R_1$, ${}^{im}R_2$: (45.3, 46.2; 31.55, 32.45 %) 470nm, (46.5, 47.55; 32.6, 33.75 %) 546nm, (47.7, 48.8; 33.9, 55.05 %) 589nm, (49.6, 50.0; 36.0, 36.3 %) 650nm. ***Chemical analytical data:*** Means of twenty-six sets of electron microprobe data: Pd 39.16, Ir 1.08, Pb 52.01, S 7.90, Total 100.15 wt.%. Empirical formula: $(Pd_{2.96}Ir_{0.05})_{\Sigma 3.01}Pb_{2.02}S_{1.98}$. ***Relationship to other species:*** Possibly isostructural with parkerite, $Ni_3(Bi,Pb)_2S_2$.

Name: For J. H. Gilles Laflamme (1947–), Mining and Mineral Sciences Laboratories, Canada Centre for Mineral and Energy Technology, Ottawa, Canada. ***Comments:*** IMA No. 2000-014.

BARKOV, A. Y., MARTIN, R. F., HALKOAHO, T. A. A., and CRIDDLE, A. J. (2002) Laflammeite, $Pd_3Pb_2S_2$, a new platinum-group mineral species from the Penikat layered complex, Finland. *Canadian Mineralogist* **40**, 671–678.



Manganvesuvianite

Manganvesuvianite

Tetragonal

$Ca_{19}Mn^{3+}(Al,Mn^{3+},Fe^{3+})_{10}(Mg,Mn^{2+})_2Si_{18}O_{69}(OH)_9$

Locality: The Wessels mine and the N'Chwaning II mine, Kalahari manganese fields, Republic of South Africa.

Occurrence: Crystals filling veins and vugs. At the N'Chwaning II mine, it is a rock-forming mineral intergrown with manganese-poor grossular or xonotlite and calcite in lenticular calcsilicate bodies within manganese ore beds. Additional associated minerals are: calcite, serandite-pectolite, strontiopiemontite-tweddillite, mozartite and hydrogrossular-henritermierite.

General appearance: Long prismatic crystals (up to 1.5 cm).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* small crystals transparent, large crystals opaque. *Color:* small crystals red to lilac, large crystals nearly black. *Streak:* white. *Luminescence:* not mentioned. *Hardness:* 6 to 7. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* subconchoidal. *Density:* not measured because of strong chemical zoning, 3.40 g/cm^3 (calc.). ***Crystallography:*** Tetragonal, *P4/n*, *a* 15.575, *c* 11.824 Å, *V* 2868.5 Å^3, Z 2, *c:a* = 0.7592. Morphology: {100} dominant, {110} minor, {101}. Twinning: none mentioned. ***X-ray powder diffraction data:*** not given because of the strong chemical zoning. ***Optical data:*** Uniaxial (−), ω 1.731, ε 1.719, pleochroism strong, O dark red, E yellowish. See COMMENTS. ***Chemical analytical data:*** Means of nineteen sets of electron microprobe data: Na_2O 0.02, MgO 2.35, CaO 35.73, CuO 0.02, SrO 0.11, Al_2O_3 14.73, Mn_2O_3 6.79, Fe_2O_3 1.12, SiO_2 36.15, H_2O 2.67, F 0.06, Cl 0.01, sum 99.76, less O = F + Cl 0.03, Total 99.73 wt.%. Empirical formula: $(Ca_{18.87}Sr_{0.03}Na_{0.02})_{\Sigma 18.92}Mn^{3+}_{1.00}(Al_{8.38}Mn^{3+}_{1.20}Fe^{3+}_{0.42})_{\Sigma 10.00}$-$(Mg_{1.73}Mn_{0.35})_{\Sigma 2.08}(Si_{17.82}Al_{0.18})_{\Sigma 18.00}O_{69.12}[(OH)_{8.78}F_{0.09}Cl_{0.01}]_{\Sigma 8.88}$. See COMMENTS. ***Relationship to other species:*** It is a member of the vesuvianite group.

Name: For the chemical relationship to vesuvianite. ***Comments:*** IMA No. 2000-040. The symbols ω and ε are interchanged for 589 nm in the paper. No empirical formula is given in the paper, but the abstracter has produced the one given here. The crystal drawing was produced here from the information given in the paper and was approved by Prof. Armbruster.

ARMBRUSTER, T., GNOS, E., DIXON, R., GUTZMER, J., HEJNY, C., DÖBELIN, N., and MEDENBACH, O. (2002) Manganvesuvianite and tweddillite, two new Mn^{3+}-silicate minerals from the Kalahari manganese fields, South Africa. *Mineralogical Magazine* **66**, 137–150.

Menshikovite

Hexagonal

$Pd_3Ni_2As_3$

Locality: (1) The Vostok deposit, Lukkulaisvaara layered complex, northern Karelia, Russia and (2) the Chiney layered lopolith in the Kodar-Udokan horst, western Aldan Shield, Chita region, Siberia, Russia. A small grain has been identified also from the Oktyabr' deposit, Noril'sk complex, northern Siberia, Russia.

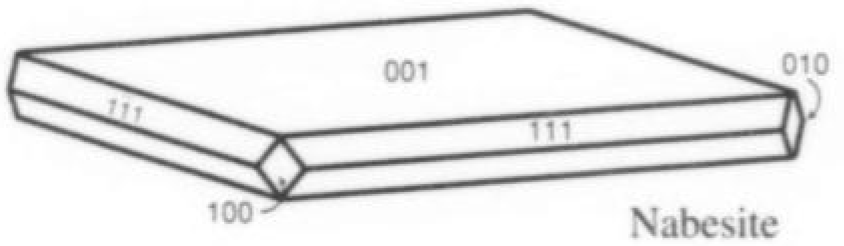
Occurrence: (1) In an altered gabbronorite associated mainly with chalcopyrite, pentlandite, violarite, actinolite and clinochlore; several other PGM species also occur here. (2) In mineralized quartz-feldspar sandstones associated mainly with biotite, amphibole and chlorite; numerous other PGM species and other sulfides also occur here.

General appearance: Anhedral grains (<5 μm to 0.2 mm).

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color not given. *Streak:* not given. *Hardness:* $VHN_{40,50,65}$ 517.1 kg/mm^2, Mohs 5. *Tenacity:* brittle. *Cleavage:* not observed. *Fracture:* not given. *Density:* could not be determined, 5.32 g/cm^3 (calc.) for Z = 2 and 10.65 g/cm^3 (calc.) for Z = 4. ***Crystallography:*** Hexagonal, *P6$_3$/m*, *P6$_3$* or *P6$_3$22*, *a* 8.406, *c* 6.740 Å, *V* 412.4 Å^3, Z 2 or 4, *c:a* = 0.8018. Morphology: no forms were mentioned. Twinning: fine twins are present. ***X-ray powder diffraction data:*** 2.626 (10) (112), 2.477 (10) (202), 2.429 (8) (300), 2.283 (7) (301), 1.978 (7) (113), 1.818 (7) (400), 1.781 (7) (222). ***Optical data:*** In reflected light: pink sometimes with a slight grayish tint, weak anisotropism from light gray to brownish gray, no bireflectance, pleochroism not mentioned. R_1, R_2; ${}^{im}R_1$, ${}^{im}R_2$: (48.4, 50.2; 38.5, 39.3 %) 470nm, (51.2, 53.2; 41.0, 41.8 %) 546nm, (53.2, 55.3; 42.3, 43.3 %) 589nm, (56.6; 58.7, 46.6, 47.8 %) 650nm. ***Chemical analytical data:*** Means of ninety-eight sets of electron microprobe data: Ni 17.77, Fe 0.07, As 33.91, Pd 48.18, Pt 0.07, Total 100.00 wt.%. Empirical formula: $Pd_{2.99}(N_{2.00}Fe_{0.01})_{\Sigma 2.01}As_{2.99}$. ***Relationship to other species:*** None apparent. It may form a solid solution series with majakite, PdNiAs.

Name: For Dr. Yurii P. Men'shikov (1934–), Geological Institute of the Kola Science Center, Russian Academy of Sciences, Apatity, Russia. ***Comments:*** IMA No. 1993-057.

BARKOV, A. Y., MARTIN, R. F., PAKHOMOVSKY, Y. A, TOLSTYKH, N. D., and KRIVENKO, A. P. (2002) Menshikovite, $Pd_3Ni_2As_3$, a new platinum-group species from two layered complexes, Russia. *Canadian Mineralogist* **40**, 679–692.



Nabesite

Nabesite

Orthorhombic

$Na_2BeSi_4O_{10}\cdot 4H_2O$

Locality: On the Kvanefjeld Plateau, in the northwesternmost part of the Ilímaussaq alkaline complex, South Greenland.

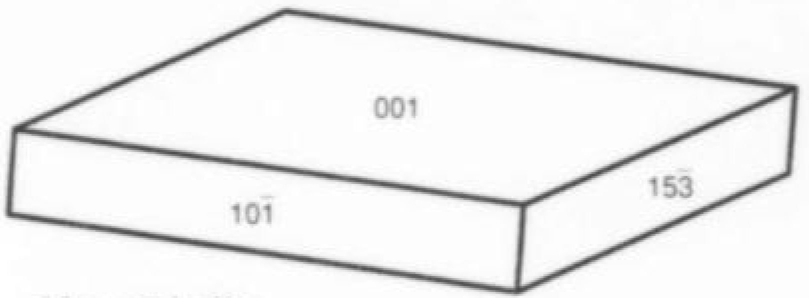
Occurrence: In tugtupite-bearing albitites. Associated minerals are: aegirine, analcime, beryllite, bertrandite, chkalovite, epistolite, galena, manganoan pectolite, microcline, Na-komarovite, neptunite, pyrochlore, sphalerite and tugtupite. Crystal-lined cavities contain albite, nabesite, gmelinite, neptunite, analcime, gonnardite, lovdarite, an unidentified phase presumed to be trona and possibly opal.

General appearance: Crystals range from 0.05 x 0.5 x 0.5 to 0.2 x 5 x 5 mm and occur as aggregates (up to 5 x 10 x 10 mm) of thin platy crystals in parallel or subparallel orientation.

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 5 to 6. *Tenacity:* brittle. *Cleavage:* {110} and {001} good. *Fracture:* uneven. *Density:* 2.16 g/cm^3 (meas.), 2.22 g/cm^3 (calc.). ***Crystallography:*** Orthorhombic, $P2_12_12_1$, *a* 9.722, *b* 10.142, *c* 12.030 Å, *V* 1186.2 Å^3, Z 4, *a:b:c* = 0.9586:1:1.1862. Morphology: {100}, {010}, {001}, {111} and $\{1\bar{1}1\}$; platy on {001}. Twinning: none mentioned. ***X-ray powder diffraction data:*** 6.11B (80) (111), 5.97 (100) (002), 5.07 (35) (020), 3.46 (45) (113), 3.09D (70) (310, 131), 3.06 (50) (222, 004), 2.988D (60) (311). B = broad, D = double. ***Optical data:*** Biaxial (−), α 1.499, β 1.507, γ 1.511, 2V(meas.) 65°, 2V(calc.) 70°; no dispersion; no pleochroism; orientation, X = *a*, Y = *c*, Z = *b*. ***Chemical analytical data:*** Means of three sets of electron microprobe data (Na_2O by SEM-EDS, BeO and H_2O calculated from the ideal formula derived by crystal structure analysis): Na_2O 13.8, K_2O 0.34, BeO (6.26), CaO 0.13, SiO_2 62.4, H_2O (18.05), Total (100.98) wt.%. Empirical formula: $(Na_{1.75}K_{0.03}Ca_{0.01})_{\Sigma 1.79}Be_{0.98}Si_{4.09}O_{10.06}\cdot 3.94H_2O$. ***Relationship to other species:*** It is a member of the zeolite group and is related to weinebeneite, $CaBe_3(PO_4)_2(OH)_2\cdot 4H_2O$.

Name: For the chemical composition: *Na*, *Be* and *Si*. ***Comments:*** IMA No. 2000-024.

PETERSEN, O. V., GIESTER, G., BRANDSTÄTTER, F., and NIEDERMAYR, G. (2002) Nabesite, $Na_2BeSi_4O_{10}\cdot 4H_2O$, a new mineral species from the Ilímaussaq alkaline complex, South Greenland. *Canadian Mineralogist* **40**, 173–181.



Neustädtelite

Neustädtelite

Triclinic

$Bi_2Fe^{3+}Fe^{3+}O_2(OH)_2(AsO_4)_2$

Locality: The dumps of the Güldener Falk mine near Schneeberg-Neustädtel, Schneeberg area, Saxony, Germany. It also has been found on the dumps of other mines in the area: Siebenschlecken, Junge Kalbe, Friedefürst and Peter und Paul.

Occurrence: Associated minerals are: quartz, cobaltneustädtelite, preisingerite and goethite; rarely with mixite, zeunerite and bismutite.

General appearance: Crystal aggregates (up to 0.3 mm) and as very small tabular crystals usually <0.1 mm thick.

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent to translucent. *Color:* brown. *Streak:* light brown. *Luminescence:* nonfluorescent. *Hardness:* 4½. *Tenacity:* brittle. *Cleavage:* {001} good on some crystals. *Fracture:* conchoidal. *Density:* could not be measured, 5.81 g/cm^3 (calc.). ***Crystallography:*** Triclinic, $P\bar{1}$, *a* 4.556, *b* 6.153, *c* 8.984 Å, α 95.43°, β 99.20°, γ 92.95°, *V* 246.9 Å^3, Z 1, *a:b:c* = 0.7405:1:1.4601. Morphology: {001}, $\{\bar{1}01\}$ and "$\{01\bar{1}\}$"; the latter form could not be measured accurately and may be $\{15\bar{3}\}$. Twinning: none observed. ***X-ray powder diffraction data:*** 8.827 (67) (001), 3.766 (83) ($01\bar{2}$, 101, $1\bar{1}0$), 3.542 (94) ($1\bar{1}\bar{1}$), 3.505 (87) (110, $11\bar{1}$), 2.913 (100) (102), 2.798 (48) (021), 2.668 (72) ($10\bar{3}$), 2.549 (43) (013), 1.767 (46) ($22\bar{2}$, 005). ***Optical data:*** Biaxial (−), α 2.02, β 2.09 (calc.), γ 2.12, 2V(meas.) 65°, no distinct dispersion observed; pleochroism strong, X = brown to opaque, Y = yellow, Z = pale yellow; ϕ and ρ relative to (010) X = −3° and 79°, Y = −107° and 37°, Z = 95° and 55°. ***Chemical analytical data:*** Means of thirteen sets of electron microprobe data: CaO 0.15, NiO 0.34, CoO 3.35, CuO 0.07, ZnO 0.09, PbO 0.08, Al_2O_3 0.29, Fe_2O_3 13.92, Bi_2O_3 52.58, P_2O_5 0.23, As_2O_5 26.82, H_2O 2.56, Total 100.48 wt.%. Empirical formula: $(Bi_{1.94}Ca_{0.02})_{\Sigma 1.96}Fe_{1.00}(Fe_{0.50}Co_{0.38}Al_{0.05}Ni_{0.04}Zn_{0.01}Cu_{0.01})_{\Sigma 0.99}[(OH)_{2.44}O_{1.40}]_{\Sigma 3.84}[(AsO_4)_{2.01}(PO_4)_{0.03}]_{\Sigma 2.04}$. ***Relationship to other species:*** It is a member of the medenbachite group, specifically the Fe^{3+}-dominant member.

Name: For the locality. ***Comments:*** IMA No. 1998-016.

KRAUSE, W., BERNHARDT, H.-J., McCAMMON, C., and EFFENBERGER, H. (2002) Neustädtelite and cobaltneustädtelite, the Fe^{3+}- and Co^{2+}-analogues of medenbachite. *American Mineralogist* **87**, 726–738.

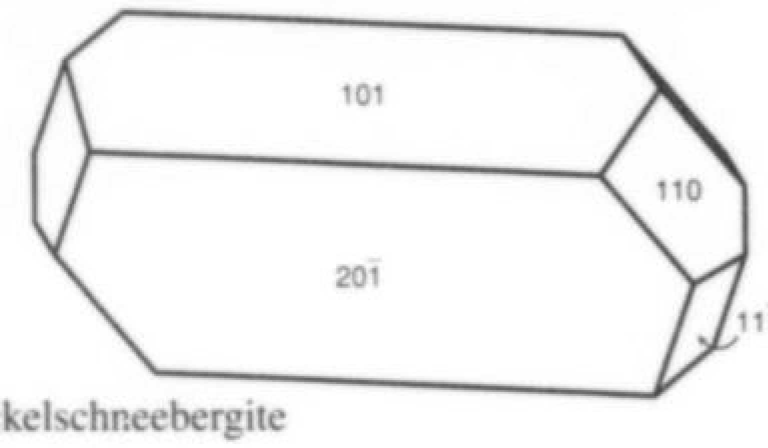
Nickelschneebergite

Monoclinic

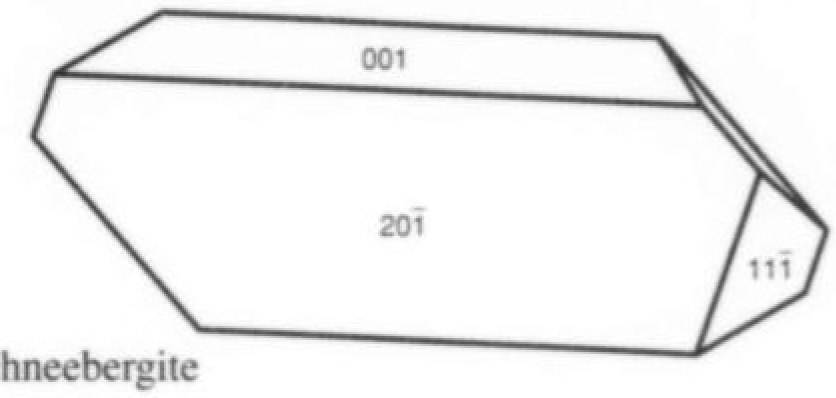
$BiNi_2(AsO_4)_2[(H_2O)(OH)]$

Locality: The mining area known as "Am Roten Berg," approximately 4.8 km southwest of the center of Schneeberg, Saxony, Germany.

Occurrence: In small vugs of coarse quartz with no other associated minerals. On other schneebergite/nickelschneebergite specimens the associated minerals are: cobaltoan/nickeloan



Nickelschneebergite



Schneebergite

ferrilotharmeyerite, cobaltlotharmeyerite, nickellotharmeyerite, preisingerite, waylandite and zeunerite.

General appearance: Aggregates (up to 1 mm) and tabular elongated crystals (≤ 0.5 mm).

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent. *Color:* brown to beige. *Streak:* light brown to nearly white. *Luminescence:* nonfluorescent. *Hardness:* VHN_{15} 250 kg/mm^2, Mohs 4 to 4½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* conchoidal. *Density:* could not be measured, 5.23 g/cm^3 (calc.). ***Crystallography:*** Monoclinic, *C2/m*, *a* 8.995, *b* 6.207, *c* 7.462 Å, β 115.00°, *V* 377.6 Å^3, Z 2, *a:b:c* = 1.4492:1:1.2022. Morphology: $\{\bar{2}01\}$, {001}, {101}, $\{\bar{1}01\}$, $\{\bar{1}11\}$, tabular on $\{\bar{2}01\}$ and elongated on [010]. Twinning: none observed. ***X-ray powder diffraction data:*** 6.759 (29) (001), 4.586 (40) $(11\bar{1})$, 3.196 (100) $(11\bar{2})$, 2.980 (72) (201), 2.821 (44) (021), 2.507 (47) (112), 1.877 (28) (113), 1.702 (57) $(33\bar{1}, 40\bar{4}, 51\bar{1})$, 1.673 (30) $(42\bar{3})$. ***Optical data:*** Biaxial (−), α 1.92 (calc.), β 1.95, γ 1.97, 2V(meas.) 77°, dispersion not determined; pleochroism weak, Y light brown, X and Z pale yellow; X ≈ *c*, Y = *b*, Z ∧ *a* = 25° in obtuse angle β. ***Chemical analytical data:*** Means of seven sets of electron microprobe data: CaO 2.68, NiO 14.75, CoO 7.98, ZnO 0.09, PbO 0.09, Fe_2O_3 2.19, Bi_2O_3 28.54, P_2O_5 0.08, As_2O_5 38.26, H_2O 4.72, Total 99.64 wt.%. Empirical formula: $(Bi_{0.73}Ca_{0.29}Pb_{0.01})_{\Sigma 1.02}(Ni_{1.18}Co_{0.64}Fe_{0.16})_{\Sigma 2.03}[(AsO_4)_{1.99}(PO_4)_{0.01}]_{\Sigma 2.00}[(H_2O)_{1.10}(OH)_{0.93}]_{\Sigma 2.03}$. ***Relationship to other species:*** It is a member of the tsumcorite group, specifically the Bi-dominant analogue of nickellotharmeyerite.

Name: For the relationship with schneebergite. ***Comments:*** IMA No. 1999-028. Dr. Krause kindly supplied the SHAPE data for the drawing produced here.

KRAUSE, W., BERNHARDT, H.-J., EFFENBERGER, H., and WITZKE, T. (2002) Schneebergite and nickelschneebergite from Schneeberg, Saxony, Germany: the first Bi-bearing members of the tsumcorite group. *European Journal of Mineralogy* **14**, 115–126.

Schneebergite — Monoclinic

$BiCo_2(AsO_4)_2[(H_2O)(OH)]$

Locality: The mining area known as "Am Roten Berg," approximately 4.8 km southwest of the center of Schneeberg, Saxony, Germany.

Occurrence: In small vugs of coarse quartz associated with scorodite and barium-pharmacosiderite. On other schneebergite/nickelschneebergite specimens the associated minerals are: cobaltoan/nickeloan ferrilotharmeyerite, cobaltlotharmeyerite, nickellotharmeyerite, preisingerite, waylandite amd zeunerite.

General appearance: Aggregates (up to 1 mm) and tabular elongated crystals (≤ 0.5 mm).

Physical, chemical and crystallographic properties: *Luster:* adamantine. *Diaphaneity:* transparent. *Color:* brown to beige. *Streak:* light brown to nearly white. *Luminescence:* nonfluorescent. *Hardness:* VHN_{15} 250 kg/mm^2, Mohs 4 to 4½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* conchoidal. *Density:* could not be measured, 5.28 g/cm^3 (calc.). ***Crystallography:*** Monoclinic, *C2/m*, *a* 9.005, *b* 6.211, *c* 7.440 Å, β 115.19°, *V* 376.5 Å^3, Z 2, *a:b:c* = 1.4498:1:1.1979. Morphology: $\{\bar{2}01\}$, {001}, $\{\bar{1}02\}$, $\{\bar{1}11\}$, tabular on $\{\bar{2}01\}$ and elongated on [010]. Twinning: none observed. ***X-ray powder diffraction data:*** 4.589 (61) $(11\bar{1})$, 3.193 (100) $(11\bar{2})$, 2.971 (92) (201), 2.820 (61) (021), 2.702 (57) $(31\bar{1})$, 2.498 (62) (112, 310), 1.704 (52) $(33\bar{1}, 40\bar{4}, 51\bar{1})$, 1.674 (51) $(004, 42\bar{3})$. ***Optical data:*** Biaxial (+), α 1.93 (calc.), β 1.95, γ 1.98, 2V(meas.) 85°, dispersion not determined; pleochroism distinct, Y brown, X and Z pale yellow; X ≈ *c*, Y = *b*, Z ∧ *a* = 25° in obtuse angle β. ***Chemical analytical data:*** Means of twelve sets of electron microprobe data: CaO 2.72, NiO 9.35, CoO 13.31, PbO 0.11, Fe_2O_3 2.95, Bi_2O_3 29.01, As_2O_5 38.42, SO_3 0.11, H_2O 4.40, Total 100.38 wt.%. Empirical formula: $(Bi_{0.74}Ca_{0.29})_{\Sigma 1.03}(Co_{1.06}Ni_{0.75}Fe_{0.22})_{\Sigma 2.03}[(AsO_4)_{1.99}(SO_4)_{0.01}]_{\Sigma 2.00}[(H_2O)_{0.91}(OH)_{1.09}]_{\Sigma 2.00}$. ***Relationship to other species:*** It is a member of the tsumcorite group, specifically the Bi-dominant analogue of cobaltlotharmeyerite.

Name: For the locality. The name was used long ago for a mineral which was shown to be roméite and now has been approved by the CNMMN IMA for the present use. ***Comments:*** IMA No. 1999-027. Dr. Krause kindly supplied the SHAPE data for the drawing produced here.

KRAUSE, W., BERNHARDT, H.-J., EFFENBERGER, H., and WITZKE, T. (2002) Schneebergite and nickelschneebergite from Schneeberg, Saxony, Germany: the first Bi-bearing members of the tsumcorite group. *European Journal of Mineralogy* **14**, 115–126.

Symesite — Triclinic

$Pb_{10}(SO_4)O_7Cl_4 \cdot H_2O$

Locality: Merehead Quarry, Somerset, England, United Kingdom (Lat. 51°12′ N, Long. 2°26′ W).

Occurrence: In veins of manganese and iron oxide minerals cutting limestone. Associated minerals are: cerussite, hydrocerussite, paralaurionite, blixite, chloroxiphite, pyrolusite, coronadoite, hematite, parkinsonite and mereheadite.

General appearance: Blebby crystals up to 2 mm long and polycrystalline aggregates up to 1 cm in diameter.

Physical, chemical and crystallographic properties: *Luster:* given as vitreous but the indices of refraction indicate adamantine. *Diaphaneity:* translucent. *Color:* pink ("Venetian pink"). *Streak:* white. *Luminescence:* not given. *Hardness:* 4. *Tenacity:* not given. *Cleavage:* {001} perfect. *Fracture:* not given. *Density:* 7.3 g/cm^3 (meas.), 7.26 g/cm^3 (calc.). ***Crystallography:*** Triclinic, $B\bar{1}$, *a* 19.727, *b* 8.796, *c* 13.631 Å, α 82.21°, β 78.08°, γ 100.04°, *V* 2242.4 Å^3, Z 4, *a:b:c* = 2.2427:1:1.5497. Morphology: no forms were mentioned. Twinning: none mentioned. ***X-ray powder diffraction data:*** 6.573 (4) (002), 3.768 (4) (412, $3\bar{2}1$), 3.286 (9) (004), 2.955 (9) ($41\bar{2}$, $3\bar{2}\bar{3}$), 2.911 (10) (414, $3\bar{2}3$), 2.793 (8) (131, $7\bar{1}1$). ***Optical data:*** The indices of refraction are higher than 2 so optical characterization was done in polarized reflected light. It is gray, nonbireflectant, nonpleochroic and very weakly anisotropic. R_1, R_2; ${}^{im}R_1$, ${}^{im}R_2$: (15.20, 16.30; 4.07, 4.67) **470** nm, (14.20, 15.30; 3.59, 4.17), **546** nm, (13.90, 15.00; 3.44, 4.02), **589** nm, (13.70, 14.70; 3.37, 3.91), **650** nm. Indices of refraction calculated from the reflectance data are n_1 2.15 and n_2 2.18 at 590 nm. ***Chemical analytical data:*** Means of 17 sets of electron microprobe data: PbO 90.66, SO_3 3.15, H_2O (0.73), Cl 5.83, sum 100.37, less O = Cl 1.32, Total (99.05) wt.%. H_2O was calculated here to give $1(H_2O)$. Empirical formula: $Pb_{10.05}(SO_4)_{0.97}O_{7.05}Cl_{4.07}(H_2O)_{1.00}$. ***Relationship to other species:*** It is a Pb-sheet mineral similar to nadorite, $PbSbO_2Cl$, mereheadite, $Pb_2O(OH)Cl$, and thorikosite, $(Pb_3Sb_{0.6}As_{0.4})O_2(OH)Cl_2$.

Name: For Robert Symes (1937–), Department of Mineralogy, Natural History Museum, London, in recognition of his many contributions to the mineralogy of the ore deposits of South-West England. ***Comments:*** IMA No. 1998-035.

WELCH, M. D., COOPER, M. A., HAWTHORNE, F. C., and CRIDDLE, A. J. (2000) Symesite, $Pb_{10}(SO_4)O_7Cl_4(H_2O)$, a new PbO-related sheet mineral: Description and crystal structure. *American Mineralogist* **85**, 1526–1533.

Tatyanaite Orthorhombic

$(Pt,Pd,Cu)_9Cu_3Sn_4$

Locality: The Oktyabr'sky deposit, Noril'sk complex, northern Siberia, Russia.

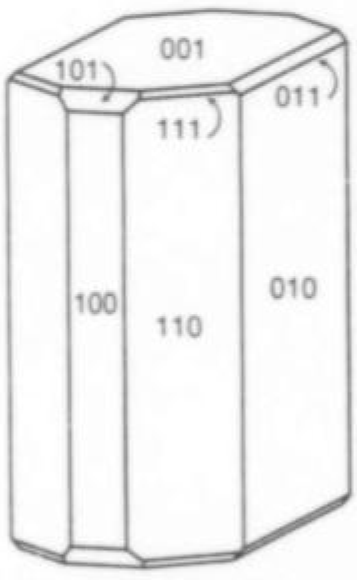
Occurrence: In massive sulphide ore. Associated minerals are: chalcopyrite, a chalcopyrite-like sulphide (e.g., mooihoekite, talnakhite or putoranite), pentlandite, pyrrhotite, cubanite, galena, taimyrite, cabriite, stannopalladinite, atokite-rustenburgite, paolovite, froodite, sperrylite, maslovite, Ag-Au alloy, Fe-rich hydrous silicate, magnetite and calcite.

General appearance: Central zones of large elongate grains (up to ~ 1 cm) and as aggregates of smaller, irregular or platy grains.

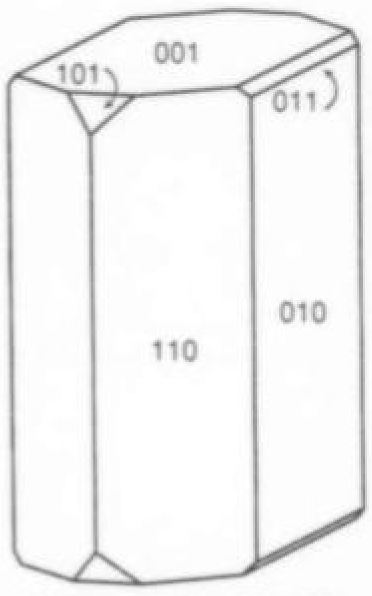
Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color not given. *Streak:* not given. *Hardness:* VHN_{20} 327 kg/mm², Mohs 3½ to 4. *Tenacity:* rather ductile. *Cleavage:* none observed. *Fracture:* not given. *Density:* not measured, 13.55 g/cm³ (calc.). ***Crystallography:*** Orthorhombic, *Pmmm*, *Pmm*2 or *P*222 (by analogy with synthetic material), *a* 7.89, *b* 4.07, *c* 7.73 Å, *V* 248 Å³, Z 1, *a:b:c* = 1.9386:1:1.8993. Morphology: no forms were mentioned. Twinning: polysynthetic. ***X-ray powder diffraction data:*** 2.283 (10) (212), 2.163 (4) (203), 2.030 (2) (020), 1.369 (3) (323), 1.218 (2) (405, 232), 1.143 (2) (424). ***Optical data:*** In reflected light: pink with a lilac tinge, distinct to moderate anisotropism, weak to distinct bireflectance, pleochroic from brownish pink to pinkish lilac. R_1 & R_2: (42.8, 44.1 %) 470nm, (49.5, 50.0 %) 546nm, (51.8, 54.6 %) 589nm, (55.6, 56.8 %) 650nm. ***Chemical analytical data:*** Two sets of electron microprobe data are given. The means of one set are: Pt 45.38, Pd 19.53, Cu 10.62, Fe 0.03, Ni 0.15, Sn 23.02, Sb 0.27, Pb n.d., Total 99.00 wt.%. Empirical formula: $[(Pt_{4.76}Pd_{3.75})_{\Sigma 8.51}Cu_{0.48}]_{\Sigma 8.99}$-$(Cu_{2.94}Ni_{0.05}Fe_{0.01})_{\Sigma 3.00}(Sn_{3.97}Sb_{0.05})_{\Sigma 4.02}$. ***Relationship to other species:*** The platinum-dominant analogue of taimyrite, $Pd_9Cu_3Sn_4$.

Name: For Dr. Tatyana L. Evstigneeva (or Yevstigneeva) (1945–) of the Russian Academy of Sciences, who has studied the minerals of the Noril'sk deposit for many years. ***Comments:*** IMA No. 1995-049a.

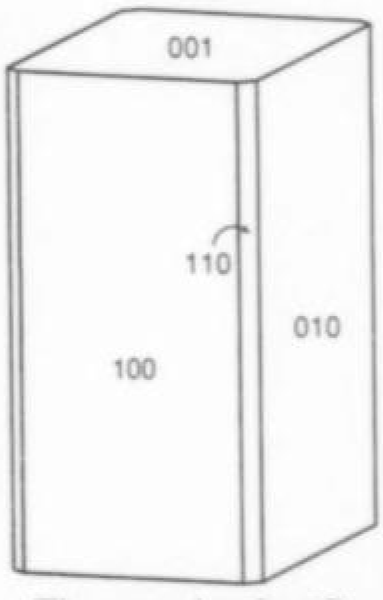
BARKOV, A. Y., MARTIN, R. F., POIRIER, G., TARKIAN, M., PAKHOMOVSKII, YA., and MEN'SHIKOV, YU. P. (2000) Tatyanaite, a new platinum-group mineral, the Pt analogue of taimyrite, from the Noril'sk complex (northern Siberia, Russia). *European Journal of Mineralogy* **12**, 391–396.



Thomsonite-Sr (A)



Thomsonite-Sr (B)



Thomsonite-Sr (C)

Thomsonite-Sr Orthorhombic

$(Sr,Ca)_2Na[Al_5Si_5O_{20}]\cdot 6\text{–}7H_2O$

Locality: At Rasvumchorr Mt. and Yukspor Mt., Khibiny alkaline massif, Kola Peninsula, Russia.

Occurrence: At Rasvumchorr, in veinlets cross-cutting natrolite of ristscorrite pegmatite; associated minerals are: microcline, aegirine, annite, astrophyllite, magnetite, fluorapatite, pyrophanite, thomsonite-Ca, etc. At Yukspor, in a veinlet cross-cutting urtite, as zones in thomsonite-Ca; associated minerals are: calcite, fluorapophyllite, tobermorite, thaumasite and barite.

General appearance: Euhedral crystals up to 0.2 x 0.2 mm (Rasvumchorr) and zones up to 0.02 mm (Yukspor).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* colorless. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* 5. *Tenacity:* brittle. *Cleavage:* {100} perfect, {010} good. *Fracture:* uneven. *Density:* 2.47 g/cm³ (meas.), 2.62 g/cm³ (calc.). ***Crystallography:*** Orthorhombic, *Pcnn*, *a* 13.050, *b* 13.123, *c* 13.241 Å, *V* 2268 Å³, Z 4, *a:b:c* = 0.9944:1:1.0090. Morphology: {100}, {010}, {001}, {110}, {101}, {011}. Twinning: none observed. ***X-ray powder diffraction data:*** 6.63 (7) (002), 4.66 (8) (020, 220), 3.49 (9) (312, 321), 3.19 (8) (223, 232, 322), 2.960 (10) (024, 204, 042), 2.860 (10) (142, 241, 412), 2.691 (10) (242), 2.186 (7) (244, 060, 600). ***Optical data:*** Biaxial (+), α 1.528, β 1.532, γ 1.540, 2V(meas.) 62°, 2V(calc.) 71°; dispersion $r > v$, weak; nonpleochroic; orientation, X = *a*, Y = *c*, Z = *b*. ***Chemical analytical data:*** Means of ten sets of electron microprobe data: Na_2O 3.22, K_2O 0.14, CaO 3.85, SrO 16.27, BaO 0.24, Al_2O_3 27.65, Fe_2O_3 0.03, SiO_2 33.51, H_2O 14.10, Total 99.01 wt.%. Empirical formula: $(Sr_{1.42}Ca_{0.62}Ba_{0.01})_{\Sigma 2.05}(Na_{0.94}K_{0.03})_{\Sigma 0.97}[Si_{5.03}$-$Al_{4.89}O_{19.94}]\cdot 7.06H_2O$. ***Relationship to other species:*** It is a member of the zeolite group, specifically the thomsonite series.

Name: For the relationship to other members of the thomsonite series. ***Comments:*** IMA No. 2000-025.

PEKOV, I. V., LOVSKAYA, E. V., TURCHKOVA, A. G., CHUKANOV, N. V., ZADOV, A. E., RASTSVETAEVA, R. K., and KONONKOVA, N. N. (2001) Thomsonite-Sr $(Sr,Ca)_2Na[Al_5Si_5O_{20}]\cdot 6\text{–}7H_2O$, a new zeolite mineral from the Khibiny massif (Kola Peninsula) and thomsonite-Ca—thomsonite-Sr an isomorphous series. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130(4)**, 46–55.

Tischendorfite Orthorhombic

$Pd_8Hg_3Se_9$

Locality: The Eskaborner Stollen (Eskeborn adit), at the 60-meter level, 5 meters north of the blind shaft IV, near Tilkerode, Harz Mountains, Germany.

Occurrence: In telethermal selenide veins. Associated minerals are: chrisstanleyite, tiemannite, clausthalite, stibiopalladinite, gold, ankerite and calcite.

General appearance: Anhedral to subhedral grains (up to 100 µm).

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* megascopic color unknown. *Streak:* black. *Hardness:* could not be determined because of complex intergrowth with other minerals, but it has a polishing hardness similar to that of chrisstanleyite, greater than that of tiemannite and clausthalite, but lower than that of stibiopalladinite. *Tenacity:* brittle. *Cleavage:* not given. *Fracture:* uneven. *Density:* could not be measured, 9.13 g/cm³ (calc.). ***Crystallography:*** Orthorhombic, *Pmmn*, $P2_1mn$ or $Pm2_1n$, *a* 7.219, *b* 16.782, *c* 6.467 Å, *V* 783.6 Å³, Z 2, *a:b:c* = 0.4302:1:0.3854. Morphology: no forms were mentioned. Twinning: none observed. ***X-ray powder diffraction data:*** 4.819 (40) (101), 4.373 (40) (130), 2.797 (60) (032, 122), 2.743 (100) (151, 231, 240), 2.325 (40) (052), 2.116 (40) (062), 2.091 (100) (261). ***Optical data:*** In reflected light: cream or slightly beige, weak anisotropism, weak bireflectance, nonpleochroic. R_1, R_2; $^{im}R_1$, $^{im}R_2$: (46.8, 51.3; 33.9, 38.3 %) 470nm, (49.4, 53.1; 35.9, 39.5 %) 546nm, (49.9, 53.25; 36.5, 39.9 %) 589nm, (48.95, 52.55; 35.7, 39.6 %) 650nm. ***Chemical analytical data:*** Means of four sets of electron microprobe data: Cu 0.2, Se 32.0, Pd 39.4, Pt 0.1, Ag 1.0, Hg 24.9, Pb 1.4, Total 99.0 wt.%. Empirical formula: $(Pd_{8.05}Pt_{0.01})_{\Sigma 8.06}(Hg_{2.70}Ag_{0.20}Pb_{0.15}Cu_{0.07})_{\Sigma 3.12}Se_{8.82}$. ***Relationship to other species:*** None apparent.

Name: For Dr. Gerhard Tischendorf (1927–), formerly at GeoForschungsZentrum, Potsdam, Germany, for his many contributions to mineralogy and geochemistry and particularly his studies of the formation of selenide deposits of the Harz Mountains. ***Comments:*** IMA No. 2001-061.

STANLEY, C. J., CRIDDLE, A. J., FÖRSTER, H.-J., and ROBERTS, A. C. (2002) Tischendorfite, $Pd_8Hg_3Se_9$, a new mineral species from Tilkerode, Harz Mountains, Germany. *Canadian Mineralogist* **40**, 739–745.

Turtmannite Trigonal

$(Mn,Mg)_{22.5}Mg_{3-3x}[(V,As)O_4]_3[SiO_4]_3[AsO_3]_xO_{5-5x}(OH)_{20+x}$

Locality: The Turtmann valley, Valais, Switzerland.

Occurrence: In jacobsite-rich Fe-Mn ores in Triassic marbles. Associated minerals are: jacobsite, kutnohorite, barite, tephroite and spessartine.

General appearance: In micaceous flakes (up to 200 µm long).

Physical, chemical and crystallographic properties: *Luster:* vitreous. *Diaphaneity:* transparent. *Color:* bright yellow. *Streak:* white. *Luminescence:* nonfluorescent. *Hardness:* could not be measured. *Tenacity:* very brittle. *Cleavage:* {001} perfect. *Fracture:* not given. *Density:* 3.60 to 4.0 g/cm³ (meas.), 3.66 g/cm³ (calc.). ***Crystallography:*** Trigonal, $R\bar{3}c$, *a* 8.259, *c* 204.3 Å, *V* 12068 Å³, Z 12, *c:a* = 24.7367. Morphology: no forms were mentioned. Twinning: none mentioned. ***X-ray powder diffraction data:*** 2.99 (40) (0.1.62), 2.83 (40) (2.2.44), 2.69 (80) $(3\bar{1}\bar{1})$, 2.43 (60) (0.0.84), 2.38 (80) $(1.2.\bar{4}\bar{0})$, 1.561 (100) (140). ***Optical data:*** Uniaxial (–), ω 1.787, ε could not be measured. ***Chemical analytical data:*** Means of fourteen sets of electron microprobe data: MgO 5.27, CaO 0.08, MnO 57.29, NiO 0.21, CoO 0.13, ZnO 0.06, BaO 0.05, Al_2O_3 0.69, SiO_2 8.61, V_2O_5 8.09, As_2O_5 7.47, H_2O (8.06), Total 96.01 wt.%. This is a complex mineral and the derivation of an empirical formula is impossible without more information on the subtleties of the structure. ***Relationship to other species:*** It is probably related to mcgovernite.

Name: For the locality. ***Comments:*** IMA No. 2000-007.

BRUGGER, J., ARMBRUSTER, T., MEISSER, N., HEJNEY, C., and GROBETY, B. (2001) Description and crystal structure of turtmannite, a new mineral with a 68 Å period related to mcgovernite. *American Mineralogist* **86**, 1494–1505.

Tweddillite Monoclinic

$CaSr(Mn^{3+},Fe^{3+})_2Al[Si_3O_{12}](OH)$

Locality: The Wessels mine, Kalahari manganese field, Republic of South Africa.

Occurrence: In calcsilicate rocks formed as hydrothermal alteration of primary sedimentary manganese ore. Associated minerals are: serandite-pectolite and braunite.

General appearance: "Suns" of very thin (~ 0.02 mm) radiating blades (up to 0.5 mm long).

Physical, chemical and crystallographic properties: *Luster:* given as vitreous, but the optical data indicate adamantine. *Diaphaneity:* not given but probably translucent. *Color:* deep dark red. *Streak:* brownish red. *Luminescence:* not given. *Hardness:* 6 to 7. *Tenacity:* brittle. *Cleavage:* {001} perfect. *Fracture:* subconchoidal. *Density:* not measured because of strong chemical zoning, 3.89 g/cm³ (calc.). ***Crystallography:*** Monoclinic, $P2_1/m$, *a* 8.934, *b* 5.718, *c* 10.325 Å, β 114.54°, *V* 479.8 Å³, Z 2, *a:b:c* = 1.5624:1:1.8057. Morphology: {001} elongated parallel to [010]. Twinning: on (100). ***X-ray powder diffraction data:*** 3.513 (50) $(21\bar{1})$, 2.936 (100) $(11\bar{3})$, 2.854 (40) (020), 2.703 (80) (300), 2.586 (80) (202), 2.182 (80) $(40\bar{1})$, 2.149 (40) (221). ***Optical data:*** Biaxial (+), average n 1.825, 2V could not be measured, dispersion not given; pleochroism strong, within the (001) blades dark red parallel to *b* and orange-yellow parallel to *a*, perpendicular to (001) the blades appear magenta to red; orientation could not be determined. ***Chemical analytical data:*** Four sets of electron microprobe data are given. The data for material with the lowest Al-content (H_2O calculated): Na_2O 0.01, K_2O 0.01, CaO 9.78, SrO 18.18, BaO 0.10, PbO 1.42, Al_2O_3 9.35, Mn_2O_3 21.32, Fe_2O_3 5.80, SiO_2 32.50, H_2O (1.48), Cl 0.01, sum 99.96, less O = Cl 0.00, Total (99.96) wt.%. Empirical formula: $(Ca_{0.98}Pb_{0.04})_{\Sigma 1.02}Sr_{0.99}(Mn^{3+}_{1.52}Fe^{3+}_{0.41})_{\Sigma 1.93}Al_{1.03}[Si_{3.04}O_{12.10}](OH)_{0.92}$. ***Relationship to other species:*** It is a member of the epidote group.

Name: For Samuel Milbourn Tweddill FGS, first curator of the Museum of the Geological Survey, Pretoria, Republic of South Africa. He ran the museum from 1897 to 1916. ***Comments:*** IMA No. 2001-014.

ARMBRUSTER, T., GNOS, E., DIXON, R., GUTZMER, J., HEJNY, C., DÖBELIN, N., and MEDENBACH, O. (2002) Manganvesuvianite and tweddillite, two new Mn^{3+}-silicate minerals from the Kalahari manganese fields, South Africa. *Mineralogical Magazine* **66**, 137–150.

Vanadiumdravite Trigonal

$NaMg_3V_6[Si_6O_{18}][BO_3]_3(OH)_4$

Locality: The Sludyanka complex, southern Lake Baikal region, Russia.

Occurrence: In chromium-vanadium-bearing calcite-quartz-diopside metamorphic rocks. Associated minerals are: quartz, calcite, chromian-vanadian diopside, tremolite, di- and tri-octahedral micas, Mg-Fe-V-Cr spinels, uvarovite-goldmanite, eskolaite-karelianite, kosmochlor-natalyite, vanadian titanite and anatase, chromian-vanadian dravite, pyrite, barite and some unnamed minerals.

General appearance: Euhedral and subhedral crystals (up to 0.20 mm).

Physical, chemical and crystallographic properties: *Luster:* resinous. *Diaphaneity:* transparent to opaque. *Color:* dark green to black. *Streak:* yellowish-brownish. *Luminescence:* not given. *Hardness:* VHN_{50} 1417 kg/mm^2, Mohs ~7½. *Tenacity:* brittle. *Cleavage:* {101} and {110} imperfect; parting {001}. *Fracture:* conchoidal. *Density:* 3.32 g/cm^3 (meas.), 3.32 g/cm^3 (calc.). ***Crystallography:*** Trigonal, *R3m*, *a* 16.12, *c* 7.39 Å, *V* 1622 Å^3, Z 3, *c:a* = 0.4584. Morphology: {100}, {110}, {101}, {021}. Twinning: none observed. ***X-ray powder diffraction data:*** 6.54 (9) (101), 4.04 (8) (220), 3.57 (7) (012), 3.04 (9) (410), 2.62 (10) (051), 2.07 (9) (152), 1.951 (5) (342). ***Optical data:*** Uniaxial (−), ω 1.786, ε 1.729, pleochroism strong, O = dark brownish-green, E = yellowish-green. ***Chemical analytical data:*** Means of twelve sets of electron microprobe data: Na_2O 2.64, K_2O 0.32, MgO 7.76, CaO 0.05, MnO 0.02, FeO 1.02, B_2O_3 9.47, Al_2O_3 4.55, V_2O_3 35.12, Cr_2O_3 4.12, SiO_2 32.21, TiO_2 0.36, H_2O 2.57, F 0.24, sum 100.45, less O = F 0.10, Total 100.35 wt.%. Empirical formula: $(Na_{0.94}K_{0.07}Ca_{0.01})_{\Sigma 1.02}(Mg_{2.12}Fe_{0.16}Cr_{0.60}V_{0.12})_{\Sigma 3.00}(V_{5.05}Al_{0.89}Ti_{0.05})_{\Sigma 5.99}[(Si_{5.91}Al_{0.09})O_{18.00}][BO_3]_{3.00}[(OH)_{3.15}O_{0.71}F_{0.14}]_{\Sigma 4.00}$. ***Relationship to other species:*** It is the V^{3+}-dominant analogue of dravite and a member of the tourmaline group.

Name: For the composition and relationship to dravite. ***Comments:*** IMA No. 1999-050.

REZNITSKY, E. Z., SKLYAROV, E. V., USHCHAPOVSKAYA, Z. F., NARTOVA, N. V., KASHAEV, A. A., KARMANOV, N. S., KANAKIN, S. V., SMOLIN, A. S., and NEKRASOVA, E. A. (2001) Vanadiumdravite, $NaMg_3V_6[Si_6O_{18}][BO_3]_3(OH)_4$, a new mineral of the tourmaline group. *Zapiski Vserossiyskogo Mineralogicheskogo Obshchestva* **130(2)**, 59–72.

Verbeekite Monoclinic

$PdSe_2$

Locality: The dumps of the Musonoi Cu-Co-Mn-U mine, western portion of Shaba (formerly Katanga) Province, near Kolwezi, Democratic Republic of Congo (formerly Zaïre); approximately at Lat. 10°44′ S and Long. 25°26′ E. Also at Hope's Nose, Torquay, Devon, England, UK (Lat. 58°28′ N, Long. 3°28′ W).

Occurrence: A primary phase formed from hydrothermal solutions at temperatures up to 120°C. The only directly associated mineral is oosterboschite. Other closely associated minerals are cuprian and palladian trogtalite, selenian digenite and selenian covellite. At Hope's Nose, verbeekite is associated with gold, chrisstanleyite, oosterboschite (?), unnamed Pd_2HgSe_3 and cerussite.

General appearance: A single anhedral grain 200 x 200 µm at Musonoi; at Hope's Nose, a single anhedral grain 25 µm.

Physical, chemical and crystallographic properties: *Luster:* metallic. *Diaphaneity:* opaque. *Color:* black. *Streak:* black. *Hardness:* VHN_5 550 kg/mm^2, Mohs ~ 5½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* uneven. *Density:* could not be measured, 7.20 g/cm^3 (calc.). ***Crystallography:*** Monoclinic, *C2/m*, *C2* or *Cm*, *a* 6.659, *b* 4.124, *c* 4.438 Å, β 92.76°, *V* 121.7 Å^3, Z 2, *a:b:c* = 1.6147:1:1.0761. Morphology: no forms were observed. Twinning: none mentioned. ***X-ray powder diffraction data:*** 4.423 (30) (001), 3.496 (30) (110), 2.718 (100) (111), 1.955 (50) (310), 1.896 (50) $(\bar{1}12)$. ***Optical data:*** In reflected light: nondescript gray, moderate anisotropism, nonbireflectant, nonpleochroic. R_1, R_2; $^{im}R_1$, $^{im}R_2$: (50.80, 52.30; 37.00, 38.40 %) 470nm, (51.85, 52.90; 37.75, 38.30 %) 546nm, (52.20, 53.55; 38.50, 38.60 %) 589nm, (52.40, 54.00; 38.80, 39.60 %) 650nm. ***Chemical analytical data:*** Means of four sets of electron microprobe data: Cu 0.5, Pd 39.6, Se 58.8, Total 98.9 wt.%. Empirical formula: $(Pd_{0.99}Cu_{0.02})_{\Sigma 1.01}Se_{1.99}$. ***Relationship to other species:*** It chemically is the Pd-analogue of sudovikovite (hexagonal $PtSe_2$).

Name: For Dr. Théodore Verbeek (1927–1991) who was the first geoscientist to study the Musonoi palladium mineralization and who co-discovered the mineral with amateur mineralogist Ing. R. Coussement. ***Comments:*** IMA No. 2001-005.

ROBERTS, A. C., PAAR, W. H., COOPER, M. A., TOPA, D., CRIDDLE, A. J., and JEDWAB, J. (2002) Verbeekite, monoclinic $PdSe_2$, a new mineral from the Musonoi Cu-Co-Mn-U mine, near Kolwezi, Shaba Province, Democratic Republic of Congo. *Mineralogical Magazine* **66**, 173–179.

Zincgartrellite Triclinic

$Pb(Zn,Fe,Cu)_2(AsO_4)_2(H_2O,OH)_2$

Locality: The Tsumeb mine, Tsumeb, Namibia.

Occurrence: From material mined during 1975-1980 and purchased by G. Tremmel. Associated minerals are: chalcocite, wulfenite, duftite, "β-duftite" (calcian conichalcite), "cuproadamite" and olivenite.

General appearance: Aggregates (up to 0.5 mm) made up of tabular crystals (<0.1 mm).

Physical, chemical and crystallographic properties: *Luster:* given as vitreous but the indices of refraction indicate adamantine. *Diaphaneity:* transparent to translucent. *Color:* green-yellow. *Streak:* yellow. *Luminescence:* nonfluorescent. *Hardness:* 4½. *Tenacity:* brittle. *Cleavage:* none observed. *Fracture:* not determined. *Density:* could not be measured, 5.37 g/cm^3 (calc.). ***Crystallography:*** Triclinic, $P\bar{1}$, *a* 5.550, *b* 5.620, *c* 7.621 Å, α 68.59°, β 69.17°, γ 69.51°, *V* 200.1 Å^3, Z 1, *a:b:c* = 0.9875:1:1.3560. Morphology: {111}, tabular on {111}. Twinning: none mentioned. ***X-ray powder diffraction data:*** 4.731 (74) (011), 4.669 (86) (101), 3.283 (89) (012), 3.252 (91) (102), 3.185 (66) $(1\bar{1}0)$, 2.999 (100) $(11\bar{1})$, 2.894 (74) $(\bar{1}\bar{1}1)$, 2.880 (70) $(1\bar{1}1)$, 2.535 (65) $(10\bar{2}, 120, 01\bar{2}, 020)$ Krause *et al.* (1998). ***Optical data:*** Biaxial (−), α 1.91, β 1.94 (calc.), γ 1.97, 2V(meas.) 87°, dispersion not determined; pleochroism weak, X = Z pale yellow, Y = yellow; orientation not determined. ***Chemical analytical data:*** Means of sixteen sets of electron microprobe data: PbO 33.49, CaO 0.35, CuO 6.26, NiO <0.05, CoO <0.05, ZnO 11.40, Al_2O_3 0.26, Fe_2O_3 7.23, As_2O_5 34.72, SO_3 0.13, H_2O (4.3), Total (98.62) wt.%. Empirical formula: $(Pb_{0.99}Ca_{0.04})_{\Sigma 1.03}(Zn_{0.92}Cu_{0.52}Fe_{0.60}Al_{0.03})_{\Sigma 2.07}[(AsO_4)_{1.99}(SO_4)_{0.01}]_{\Sigma 2.00}[(OH)_{0.82}(H_2O)_{1.16}]_{\Sigma 1.98}$. ***Relationship to other species:*** It is a member of the tsumcorite group, specifically the Zn-dominant analogue of gartrellite.

Name: For the relationship with gartrellite. ***Comments:*** IMA No. 1998-014.

EFFENBERGER, H., KRAUSE, W., BERNHARDT, H.-J., and MARTIN, M. (2000) On the symmetry of tsumcorite group minerals based on the new species rappoldite and zincgartrellite. *Mineralogical Magazine* **64**, 1109–1126. KRAUSE, W., BELENDORFF, K., BERNHARDT, H.-J., McCAMMON, C., EFFENBERGER, H., and MIKENDA, W. (1998) Crystal chemistry of the tsumcorite-group minerals. New data on ferrilotharmeyerite, tsumcorite, thometzekite, mounanaite, helmutwinklerite, and a redefiniton of gartrellite. *European Journal of Mineralogy* **10**, 179–206.

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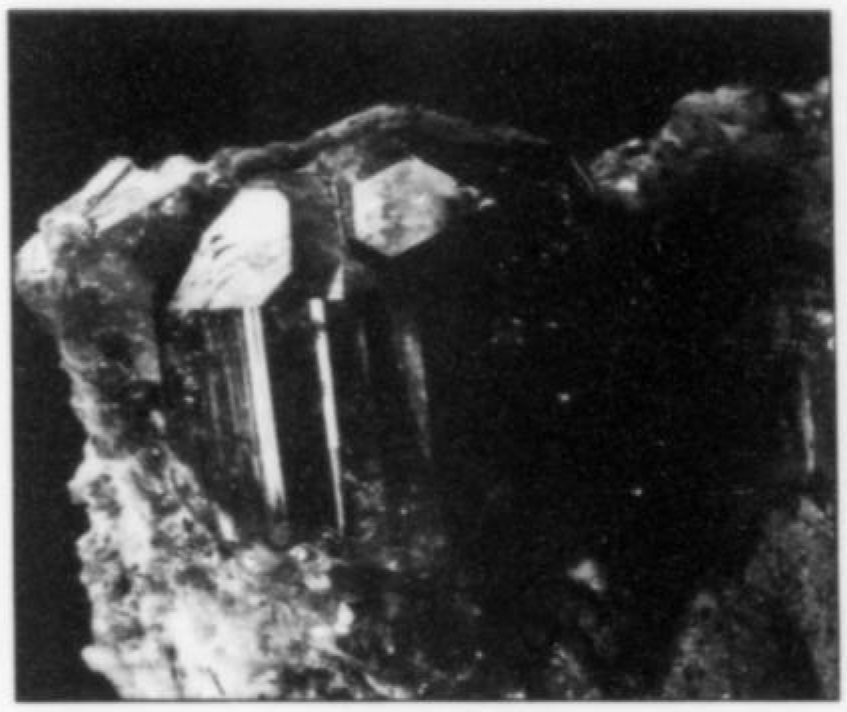

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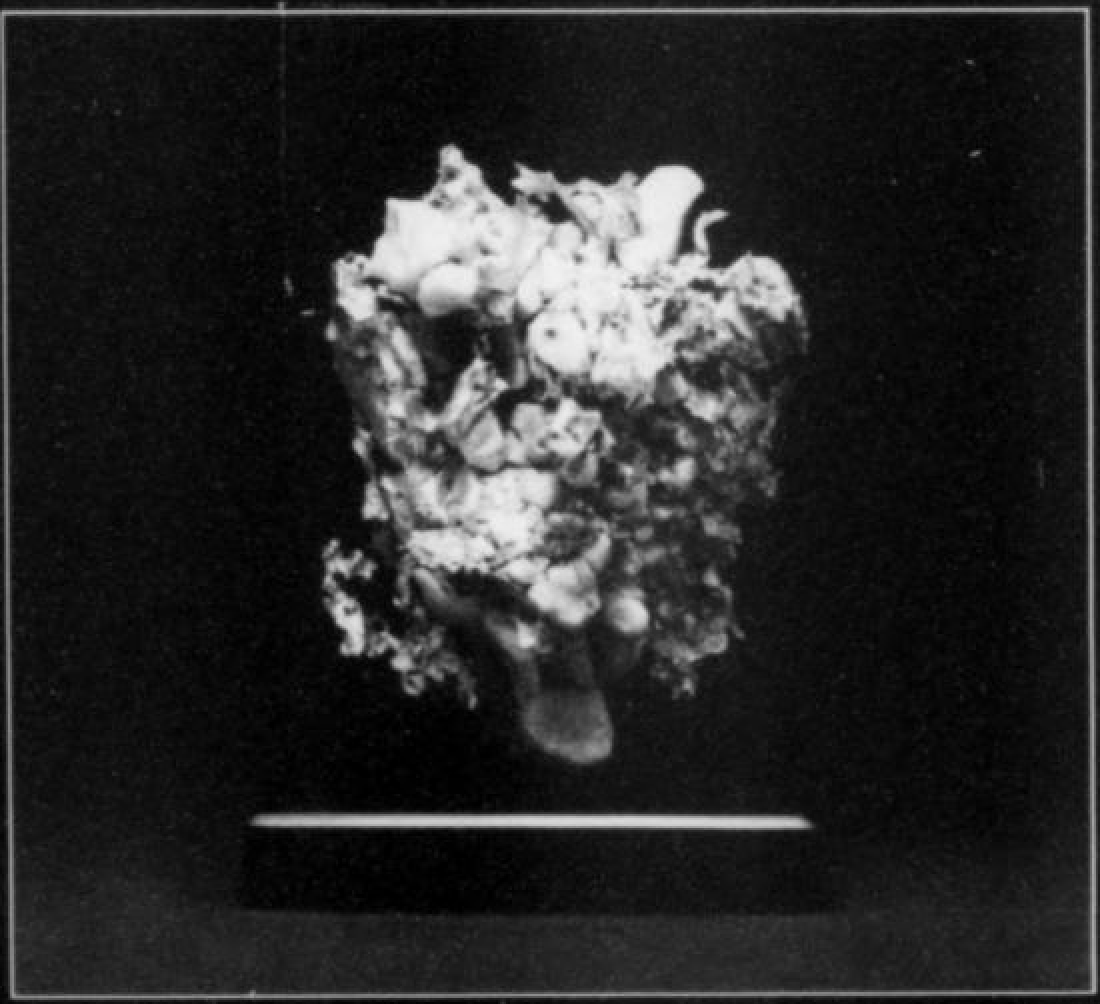

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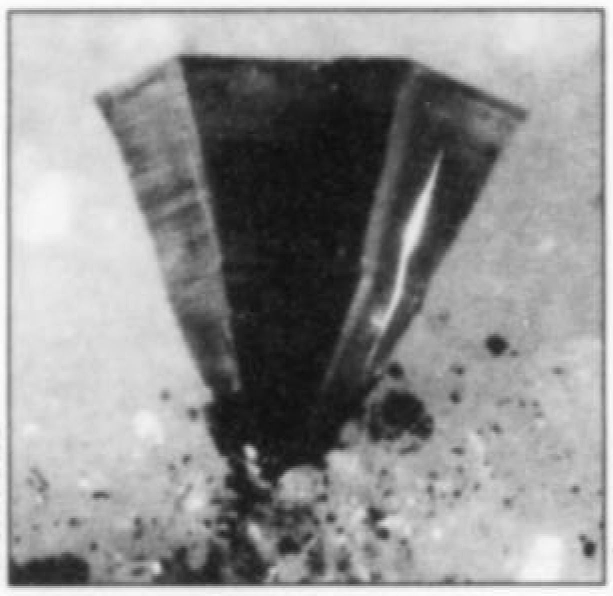

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What's New

in Minerals

Carnegie Show 2002

by Jeff Scovil

[December 20–22]

The Carnegie Show in Pittsburgh has been special right from the start. Curator Marc Wilson created a show with class, in a classy setting—right in the museum itself, among the exhibits and elegant trappings of a bygone era. The timing of the show in late August had been a bit of a problem, sandwiched as it was between the Springfield and Denver Shows. However, the shift to late December seems to have done the trick.

The opening night gala was attended by more than twice the expected number of people. The show theme was "The Emerald City," and, of course, **emeralds**. As you entered the show there was a rear-projection screen showing the classic movie "The Wizard of Oz," and scattered here and there were life-size cut-outs of the characters. As you entered one of the exhibit halls you were greeted by The Wizard himself, on a large television screen, addressing you as in the famous scene from the movie where he is speaking from behind a curtain. Fine emerald crystal specimens as well as beautiful emerald jewelry (both in showcases and around the necks of strolling models) were on display throughout one hall. It was quite a party.

The show was a qualified success as well; buyers still seemed a little cautious, but were there in good numbers, and few dealers seemed to be disappointed. There were even a few new things to see. Ross Lillie of *North Star Minerals* has been busy in Bulgaria, and had several nice examples from recent finds. The Kruchov Dol mine in the Madan District, Rhodope Mountains, has been producing attractive, flattened **quartz** Japan-law twins. And a pocket discovered in the Boldut mine in Muramares, Romania yielded thick **stibnite** crystals growing around and through calcite crystals.

Jim Garabedian and his partner have a sense of humor; they reopened an old garnet mine in Erving, Massachusetts and have renamed it the Two Fat Guys mine. They are getting gem-grade **almandine** crystals from the graphitic schist.

I was surprised to see at the *Superb Minerals* booth a display of green **fluorapophyllite** balls on stilbite which, at first glance, appeared to be more of the find made the year before at Rahuri in Maharashtra, India. Not so, said proprietor K. C. Pandey—they are actually from a new well excavated about 8 km away from the original well site at Rahuri. (One would have to conclude that the intervening 8 km has pretty good specimen potential—more wells will need to be dug in that zone.) The new site is at Momin Aklada, Maharashtra. The apophyllite balls are a bit paler in color that those from the first find, and are not quite as evenly surfaced; some crystals stick out farther than others to produce a mace-like aspect.

A new specimen-mining operation was started last summer in Michigan. Shawn Carlson, Mark Elder, John Rascona and Bob Tolonen, Jr. have made arrangements with the State to mine the old Indiana mine in Ontonagan County for **copper** specimens. John Rascona has been marketing the finds and planned to have some available at the Tucson Show.

Tucson Show 2003

by Tom Moore

[February 2–16]

Late in January a Tucson newspaper, anticipating the city's biggest annual public event, invited everyone to the "lollapalooza" of a gem and mineral show. Although I doubt that I've heard or read that word since maybe the second Eisenhower Administration, "lollapalooza" struck me as perfect, connoting all at once the huge size, noisy flamboyance, and capitalistic camaraderie of the proceedings—the history of which, incidentally, is soon to be chronicled in a special *Mineralogical Record* supplement marking next year's fiftieth anniversary of the Show.

The lollapaloozification (writer/editors get to make up words sometimes) of Tucson in February seemed somewhat subdued this year, probably because of various disturbing situations near and far, including a still-slumping economy, orange-level terror alerts, and the impending war with Iraq. Nevertheless, the weather from late January (when gem and mineral people began arriving in town) through the first two weeks of February was pristine. Some torrential rains during the weekend of February 13–16 dampened things a bit, and gave the air that wonderfully fresh smell that only rain in the desert can produce. Most people seemed as enthusiastic as ever, but attendance was weaker than usual at the hotel shows and at the Tucson Gem and Mineral Show at the Convention Center, perhaps reflecting a reluctance on the part of some people to travel or make significantly self-indulgent expenditures during a terror alert. Such worries proved groundless, however, and all was quiet on the Southwestern front throughout the weeks of The Show.

The Tucson Gem and Mineral Show (that name is trademarked by the Tucson Gem and Mineral Society), generally called "the Main Show" in casual show-speak, is the culminating event of the 30+ shows which the Metropolitan Tucson Convention and Visitor's Bureau has referred to collectively as the *Tucson Gem, Mineral and Fossil Showcase.* This huge conclave of shows and symposia is known among the general Tucson public simply as "the Gem Show," but naturally the mineral collectors never call it that, preferring the phrase "the Tucson Show."

Some slow evolutions were underway in the hotel show scene. Several more high-end dealers joined last year's pioneers at the Westward Look Resort facilities on the north end of town for the Westward Look Show, now looking like an event set to grow steadily. Marty Zinn's hotel show had lost a few dealers from last year's number, and Coco's, the restaurant located very conveniently next door to the Executive Inn, had gone out of business—but then, on the up side, Marty initiated a promising new show

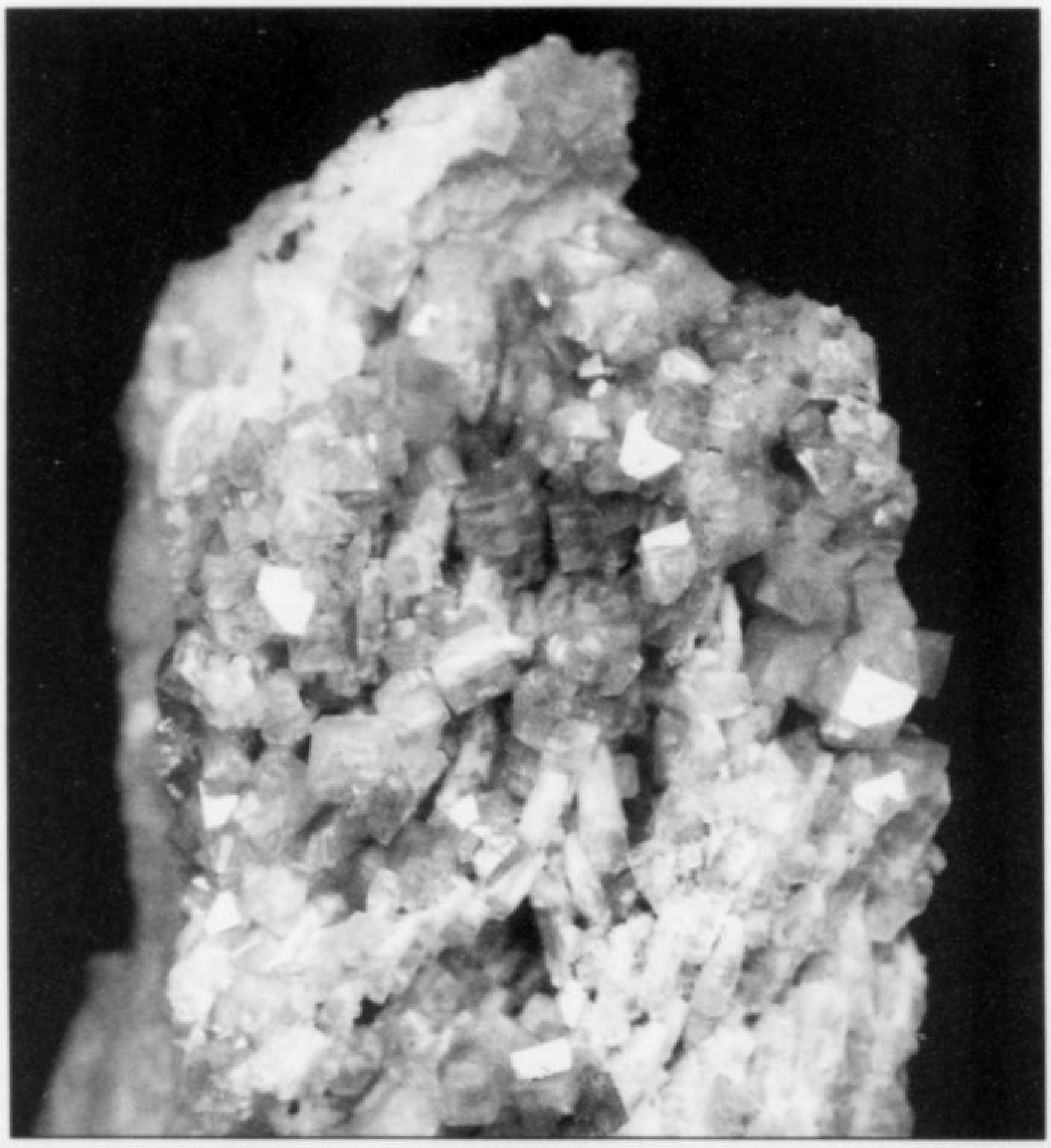
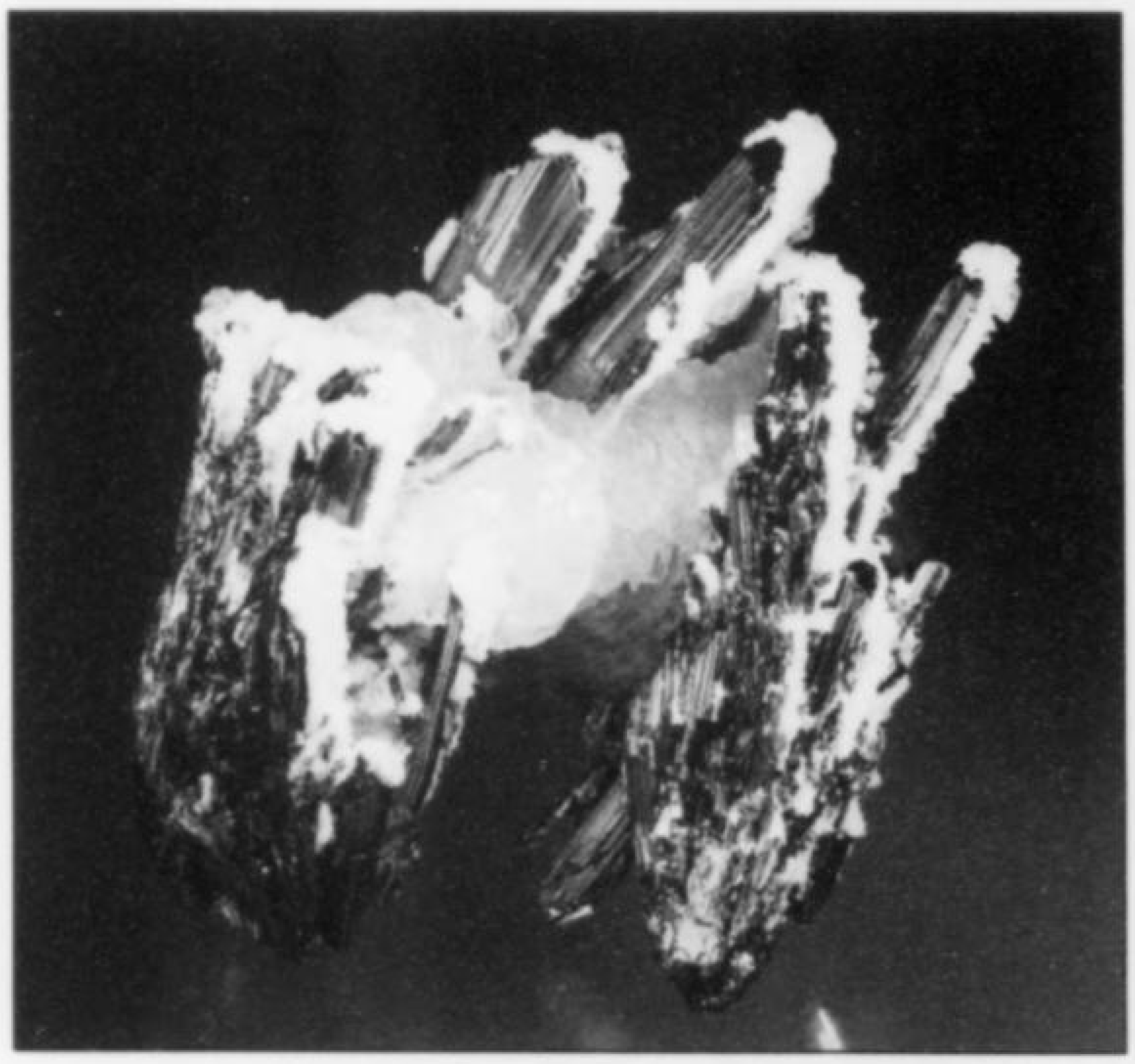


Figure 1. **Kosnarite crystals to 3 mm on albite matrix, 2.5 cm across, from an unnamed pegmatite in the Jenipapo district near Itinga, Minas Gerais, Brazil. Luis Menezes specimen; Wendell Wilson collection and scanner image.**

Figure 2. **Stibnite with calcite, 6.6 cm, from the Boldut mine, Cavnic, Muramares, Romania. Northstar Minerals specimen; Jeff Scovil photo.**



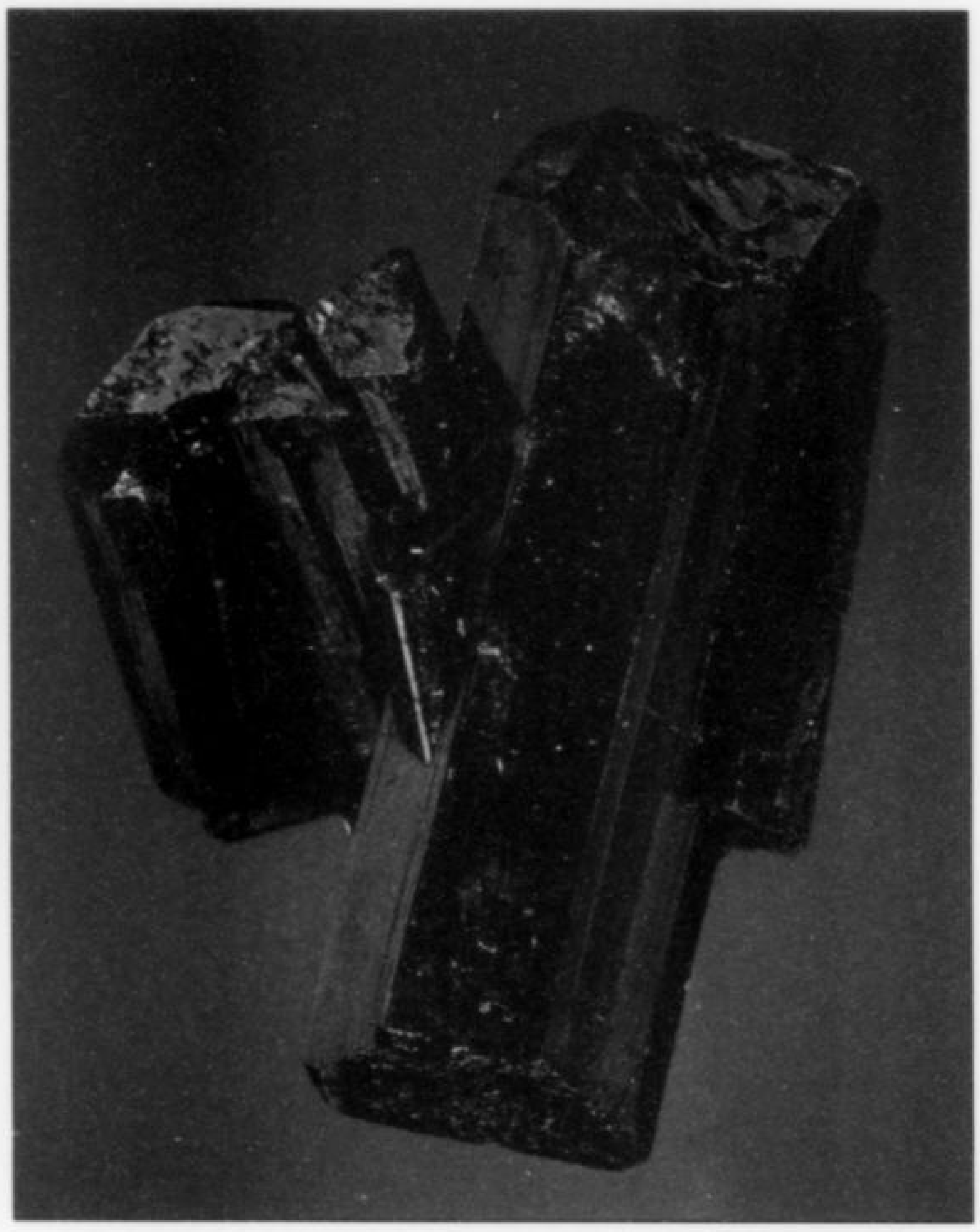


Figure 3. **Epidote crystals, 6.2 cm, from Pakot, Kenya. Wayne Thompson specimen, now in the Carolyn Manchester collection; Jeff Scovil photo.**

Figure 4. **Behierite crystal, 6 mm, with albite and pink elbaite, from Ampasogona-Tatezantsio, Manaiza, Madagascar. Lino Caserini specimen; Jeff Scovil photo.**

Figure 5. Schiavinatoite crystals, 7 mm, from Ampanodiano, Tetezantsio, Mahaiza, Madagascar. Lino Caserini specimen; Jeff Scovil photo.

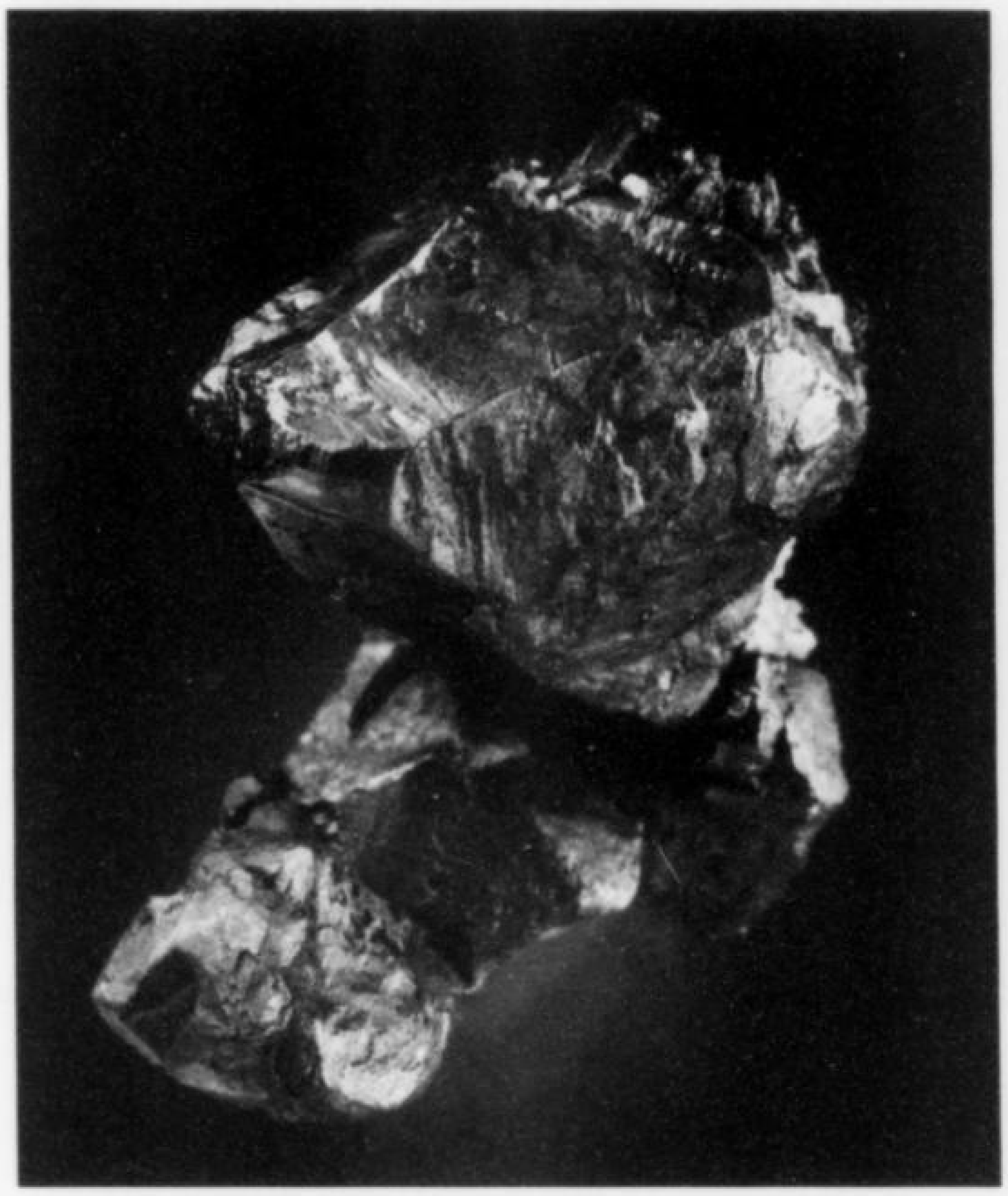


Figure 6. Copper crystal cluster, 1.5 cm, from the Indiana mine, Ontonagon County, Michigan. Shawn Carlson specimen; Jeff Scovil photo.

Figure 7. Fluorapophyllite cluster, 5.1 cm, from Momin Aklada, Maharashtra, India. Superb Minerals India specimen; Jeff Scovil photo.

Figure 8. Galena on quartz, 8 cm, from the Kruchov Dol mine, Madan district, Rhodope Mountains, Bulgaria. Northstar Minerals specimen; Jeff Scovil photo.

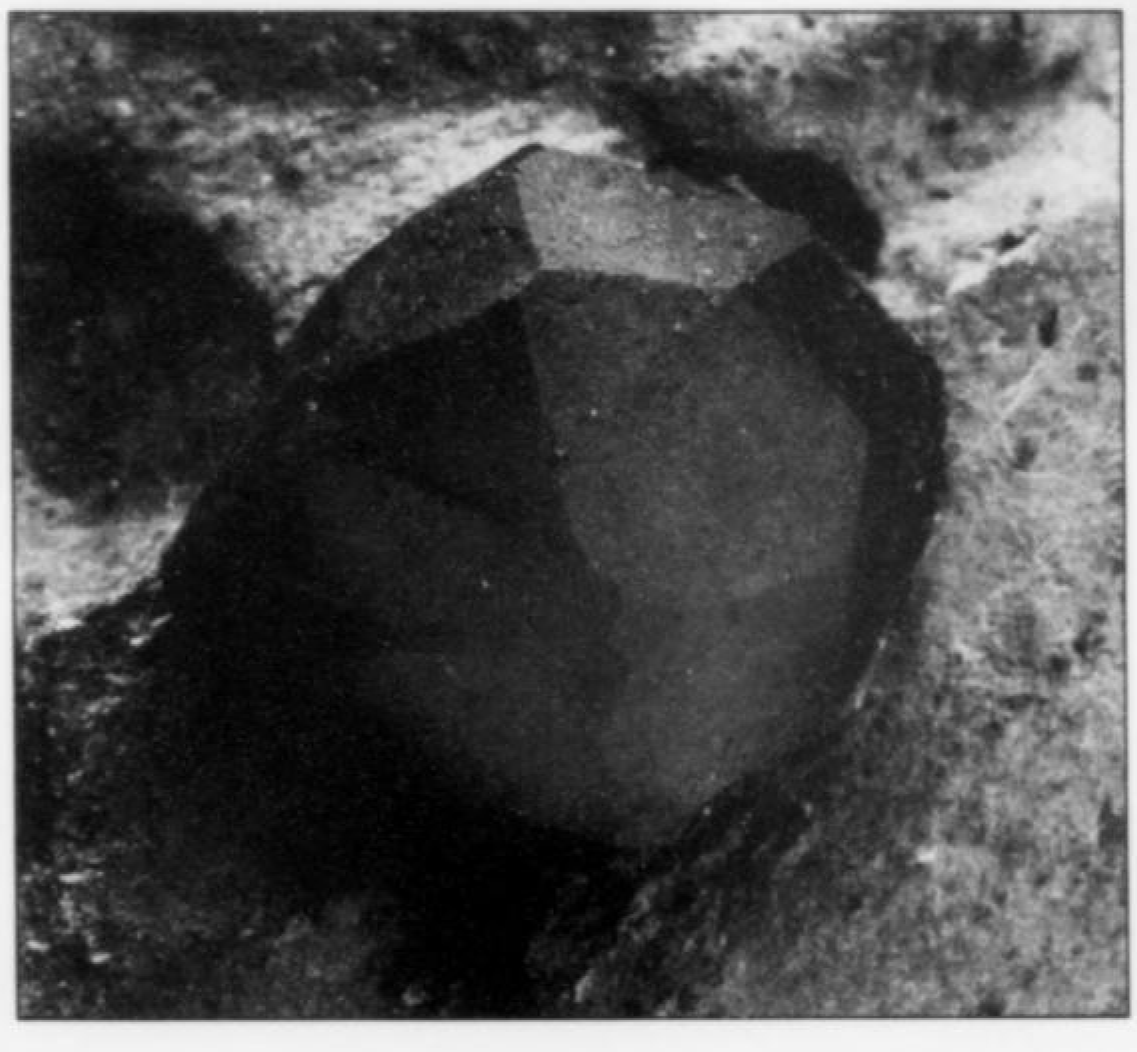


Figure 9. Almandine crystal, 1.3 cm, from the Two Fat Guys mine, Erving, Massachusetts. Jim Garabedian specimen; Jeff Scovil photo.

feature, "What's New in Minerals Day," which took place on Thursday, February 6, in the main lobby of the Executive Inn. Dealers who had latched onto really *new* mineral discoveries were invited to loan good examples to exhibit for the day in a big display case in the lobby; your present correspondent stood by the case all day to answer questions and generally to raise What's New consciousness; at day's end, Jeff Scovil came by to select specimens for photography (with some results seen here). All parties agreed that the exercise was a popular success, and that next year's Executive Inn show will have a similar feature, expanded to several days, plus a Mineralogical Record table nearby. I had thought I would have to get through some boring stretches of afternoon time during this event, but in fact there proved to be no such periods—interest among casual showgoers, as well as participation by the dealers, was high throughout the day.

The What's New tour this time will make just one stop in the U.S., none in Canada or Mexico, and not many in Europe; the major discoveries of the past year almost all occurred in South America, Africa, and Asia. Not only the fabulous new mimetite from China, but also a number of exciting finds in Bolivia, Brazil, Kenya, Madagascar, and Pakistan accounted for most of the buzz.

The United States produced one important, relatively new item: spectacular **millerite** from the Barrick Meikle gold mine near Carlin, Elko County, Nevada. A handful of these millerite specimens appeared in Denver last year, having just been found a few days before that show, and Casey Jones of *Geoprime Minerals* was firing up his engines to go and find more. Later in the autumn, in the "Griffin area" of the Barrick Meikle mine (a satellite orebody), Casey opened a pocket complex in a fault zone and took out about 120 millerite specimens, the majority of them thumbnail and miniature-sized, but a few almost making it to 30 cm across. Yellow-gray, tarnished, mammillary masses of pyrite are the matrix for dense coverages of pale gold to deep yellow-gold millerite in acicular crystals to 1.5 cm. In some specimens, the millerite crystals form discrete though interlocking sprays rising delicately from the pyrite, while other specimens are spiky, glittering, super-fragile loose nests of millerite needles, like Brillo pads of airy gold. Clearly these beautiful specimens must be handled gingerly—and owners must monitor the matrix pieces for signs of "pyrite disease"—but many visitors to the Geoprime room at the InnSuites were finding them irresistible buys anyway (especially as even the best thumbnails rarely cost more than $100).

Late in 2002, a single pocket in the Mundo Nuevo mine near Pasto Bueno, Ancash, Peru produced sharp, highly lustrous **hübnerite** crystals to 4 cm on beds of thin-prismatic quartz crystals (with some Japan-law twins); some specimens also sport pyrite cubes to 5 cm and lustrous crystals of tetrahedrite to 3 cm. Some of the black hübnerite crystal faces are mirror-smooth while others are frosty (both lusters may occur on the same crystal), and strong lighting reveals deep red internal highlights. About 25 excellent specimens, from miniature to large-cabinet size, were being offered in the Executive Inn by Luis Miguel Fernández Burillo (Escosura, 22, Pral. Centro, 50005 Zaragoza, Spain); also, Jaroslav Hyrsl had brought with him a single fantastic specimen from his personal collection.

Stopping by the warehouse of Mike New's *Top Gem Minerals* importing/wholesaling company a few days before the show action began, I was quite delighted to find many hundreds of small specimens of the new **magnetite** now being dug from seams in weathered volcanic rock on Mt. Huañaquino, Potosi, Bolivia. The specimens had not yet been cleaned, so it was a blind (but fun) lottery to guess which of them, beneath their coatings of dried mud, were fine, undamaged examples. Happily, many were: a light scrubbing with a soapy toothbrush was all it took to reveal razor-sharp, bright black, highly lustrous magnetite octahedrons to 1.5 cm resting lightly on the grayish brown rock. The best specimens suggest and rival the best of the oldtime Binntal, Switzerland magnetites; scattered singly or in small groupings around the matrix, or expressing themselves on the surfaces of seam linings of massive magnetite, these are among the world's most attractive magnetite crystals. Elsewhere in the Top Gem warehouse, Jürgen Tron was preparing about a hundred specimens—plates from 4 to 15 cm across—to sell back in Germany, and later in both the hotel and Convention Center shows, several dealers had pieces on hand, most-honorable magnetite mention going to Bolivian specialist Brian Kosnar (*Mineral Classics*, P.O. Box 2, Black Hawk, CO 80422).

Speaking of Brian, he was the one who, with excellent timing, was marketing specimens of the rare species **nikischerite**, described in this year's March/April *Mineralogical Record* from the type locality, the Huanuni mine in Dalence Province, Oruro Department, Bolivia. For specimens of a brand-new species, these 35 or so small thumbnails are actually rather attractive: dark olive-green, lustrous crystal clusters to 1.5 cm, with pyrite, ludlamite, cassiterite and quartz, from a pocket found in November 2000.

Another very rare, Kosnar-related species turned up in the Executive Inn room of Luis Menezes, where three or four flats of specimens of **kosnarite** sold out early in the show. Kosnarite, named for Brian's dad, Rich Kosnar, is a potassium zirconium phosphate described in 1997 and formerly known only in microcrystals: these specimens, collected last September by Luis himself, are by several orders of magnitude the world's best. The locality is a small unnamed pegmatite, one of a swarm of small pegmatites in the Jenipapo district, near Itinga, Minas Gerais, Brazil. The kosnarite crystals are blocky-rhombohedral (pseudocubic), and measure from 1 to 4 mm; they are lustrous, translucent to transparent, and colorless to pale tan and grayish yellow. The crystals are sprinkled attractively over white crystalline to massive albite/amblygonite, some specimens showing incomplete crystals of dark green elbaite and/or microcrystals of the rare species roscherite, zanazziite and greifensteinite. [Interesting historical note: the species ultimately named zanazziite was originally intended to be named kosnarite, but the authors of that description changed their minds – and here, by coincidence, are zanazziite and a *different* species later named kosnarite on the same specimens!] Luis' flats held a few pretty thumbnails, about 15 miniatures, and, of course, many micromount-potential specimens.

Last September also saw the discovery of fine **cassiterite** specimens at Divino das Laranjeiras, Minas Gerais, Brazil—and it was Luis Menezes, again, who had the most ample supply of these, though a few other dealers had some too. Very bright black cassiterite crystals, rich in faces, form tight cyclic twins in ovoid shapes to 2.5 cm, and these perch on lustrous white albite matrix pieces to 20 cm across; tiny prismatic crystals of ferrotantalite may be found on a few specimens. The cassiterite twins are never as large and dramatic as the best of their Chinese brethren, but the sparkling white albite matrix improves and distinguishes them aesthetically.

Epidote from Capelinha, Minas Gerais, Brazil has been known for some time, but around 100 fine specimens found in a single pocket last summer served to propel this generally under-appreciated locality into the news this year. These are "Alpine"-looking specimens, with sharp, lustrous, bladed epidote crystals, deep blackish green with nice inner pistachio-colored highlights, to 6 cm long. These form parallel groups on a matrix of massive epidote with brushy coatings of paler green, acicular epidote crystals. J.J. Abello of *Cailloux* (64, Grand Rue, 04800 Greoux Les Bains, France) was offering specimens from thumbnail-sized to 20 cm

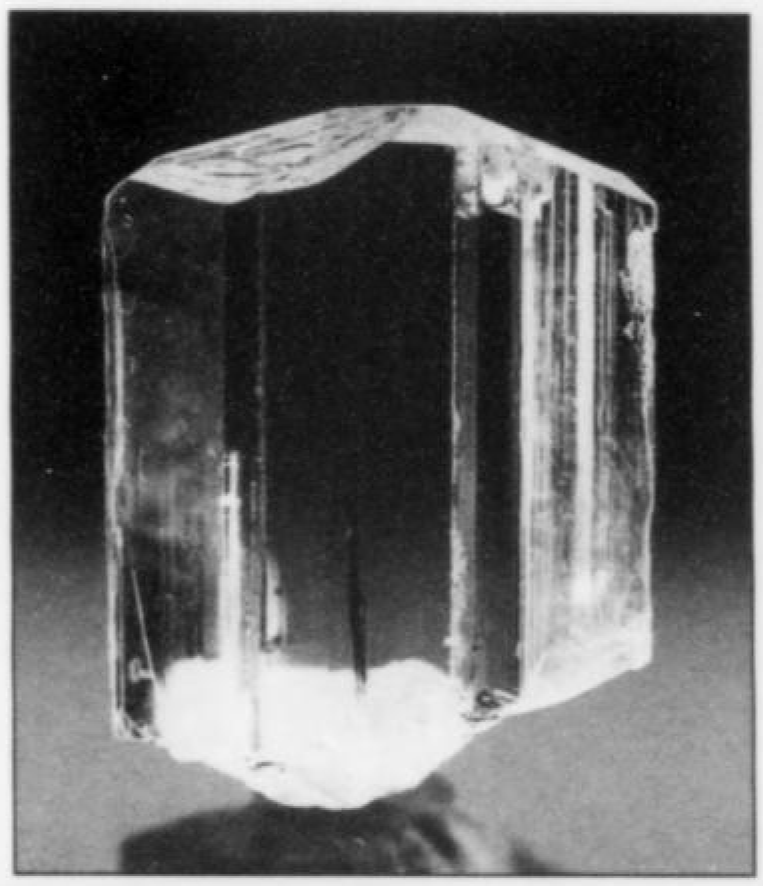


Figure 10. **Richterite crystal, 1.9 cm, from Kiran, Kikcha Valley, Badakhshan, Afghanistan. Mountain Minerals International specimen; Jeff Scovil photo.**

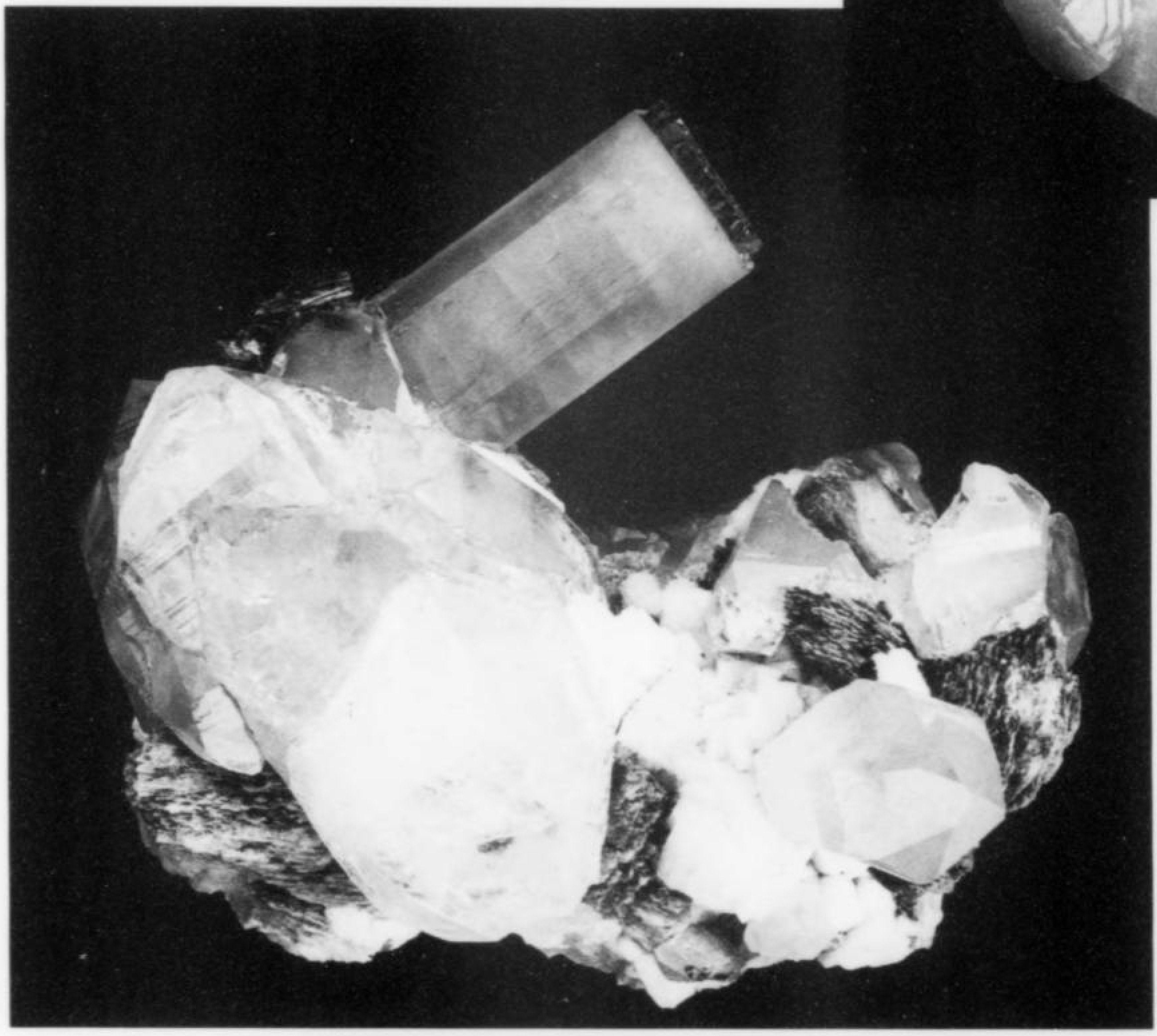


Figure 11. **Calcite with prehnite, 15 cm, from a tunnel near Malad, Bombay, India. Jürgen Tron specimen; Jeff Scovil photo.**

Figure 12. **Aquamarine beryl with microcliae and quartz, 13.5 cm, from Taplejung, Taplejung district, Nepal. Herb Obodda specimen; Jeff Scovil photo.**

Figure 13. **Rose beryl crystal, 2.3 cm, from Mandrasonora, west of Ambatofinandronara, Madagascar. Minerama specimen; Jeff Scovil photo.**

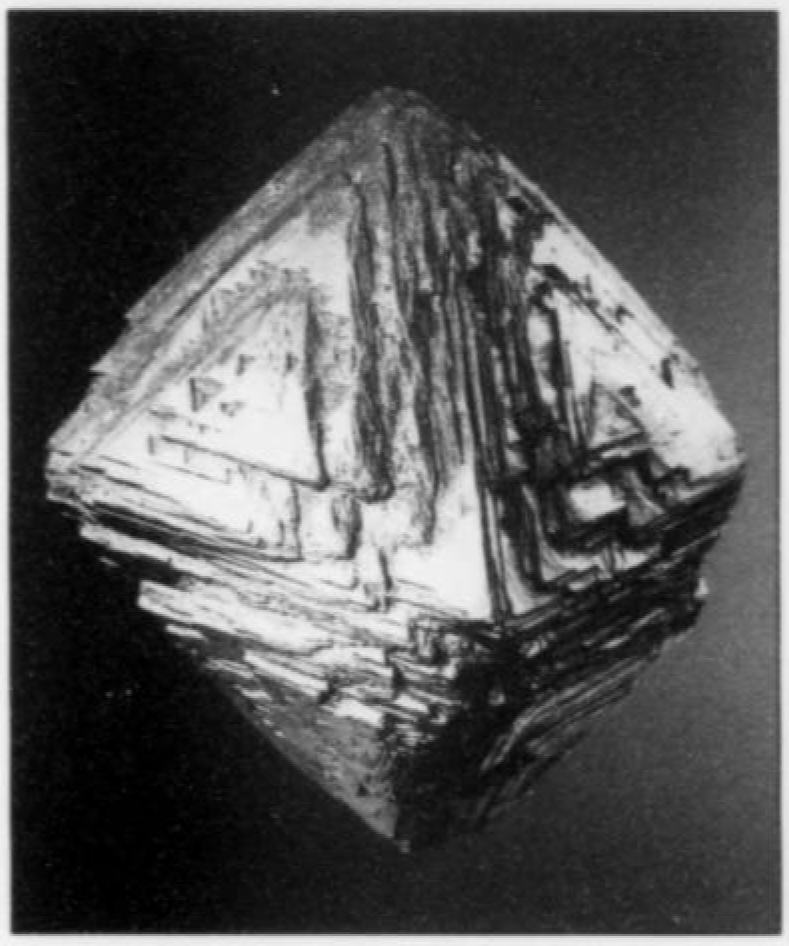
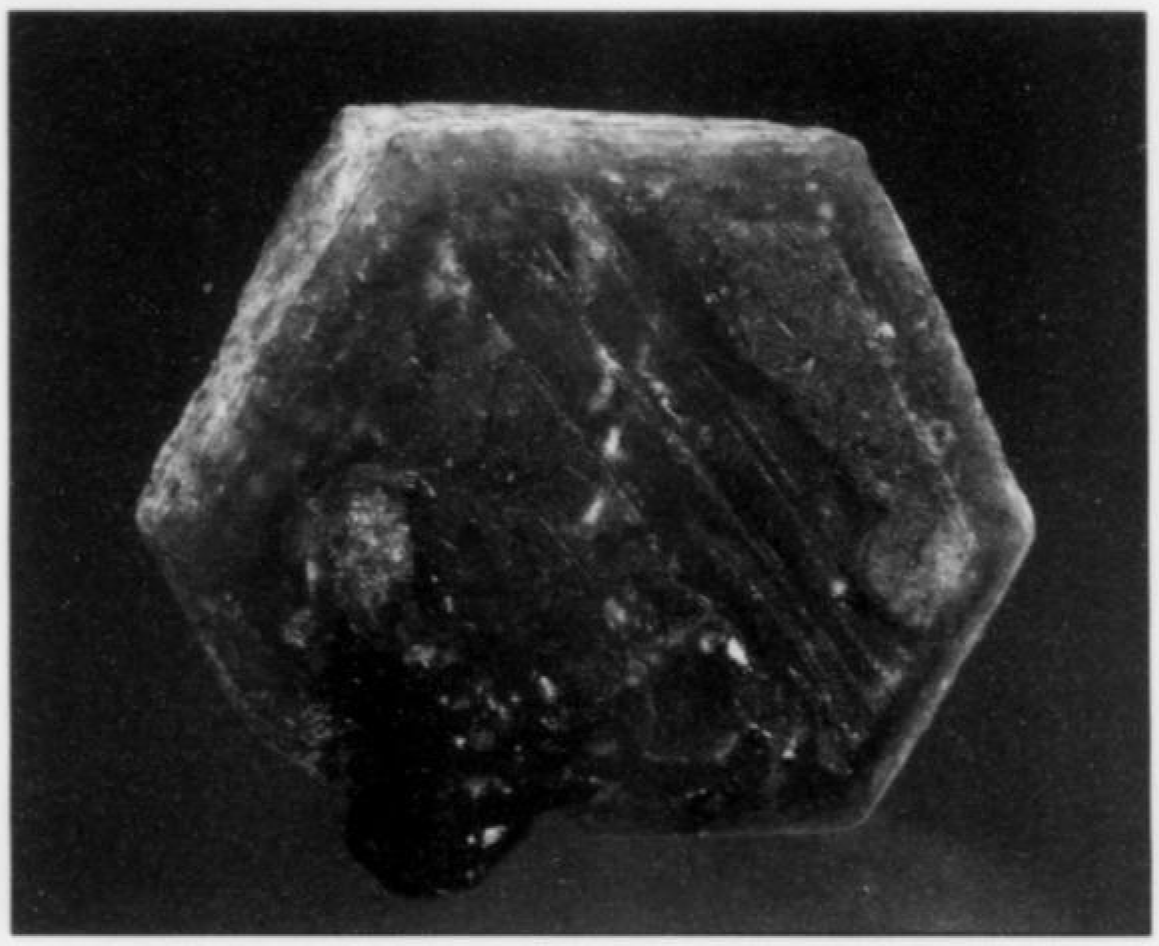


Figure 14. **Magnetite crystal, 3.4 cm, from the Laila base camp, Haramosh Mountains, Pakistan. Herb Obodda specimen; Jeff Scovil photo.**



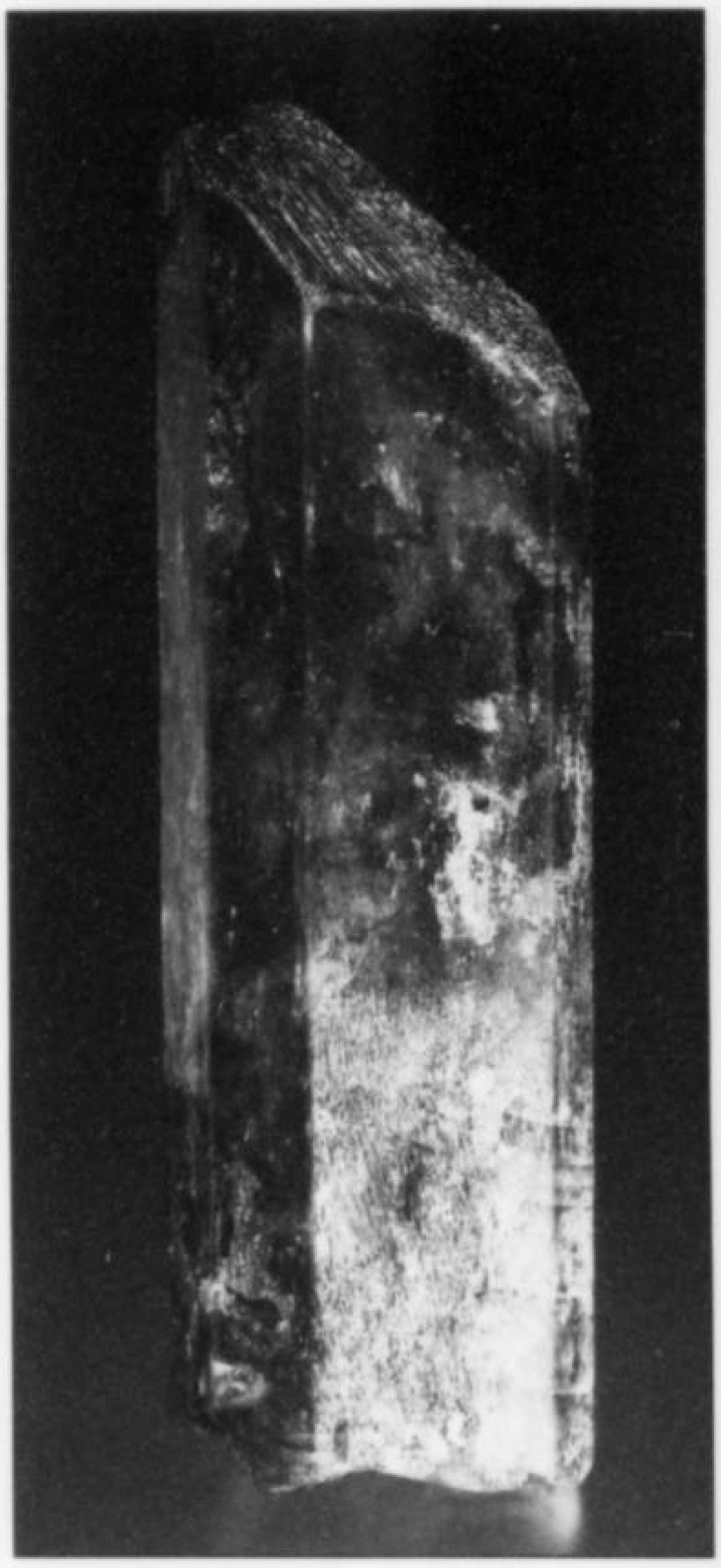


Figure 15. Diopside crystal, 3.2 cm, from Xinjiang Uygur province, China. Collector's Edge specimen; Jeff Scovil photo.

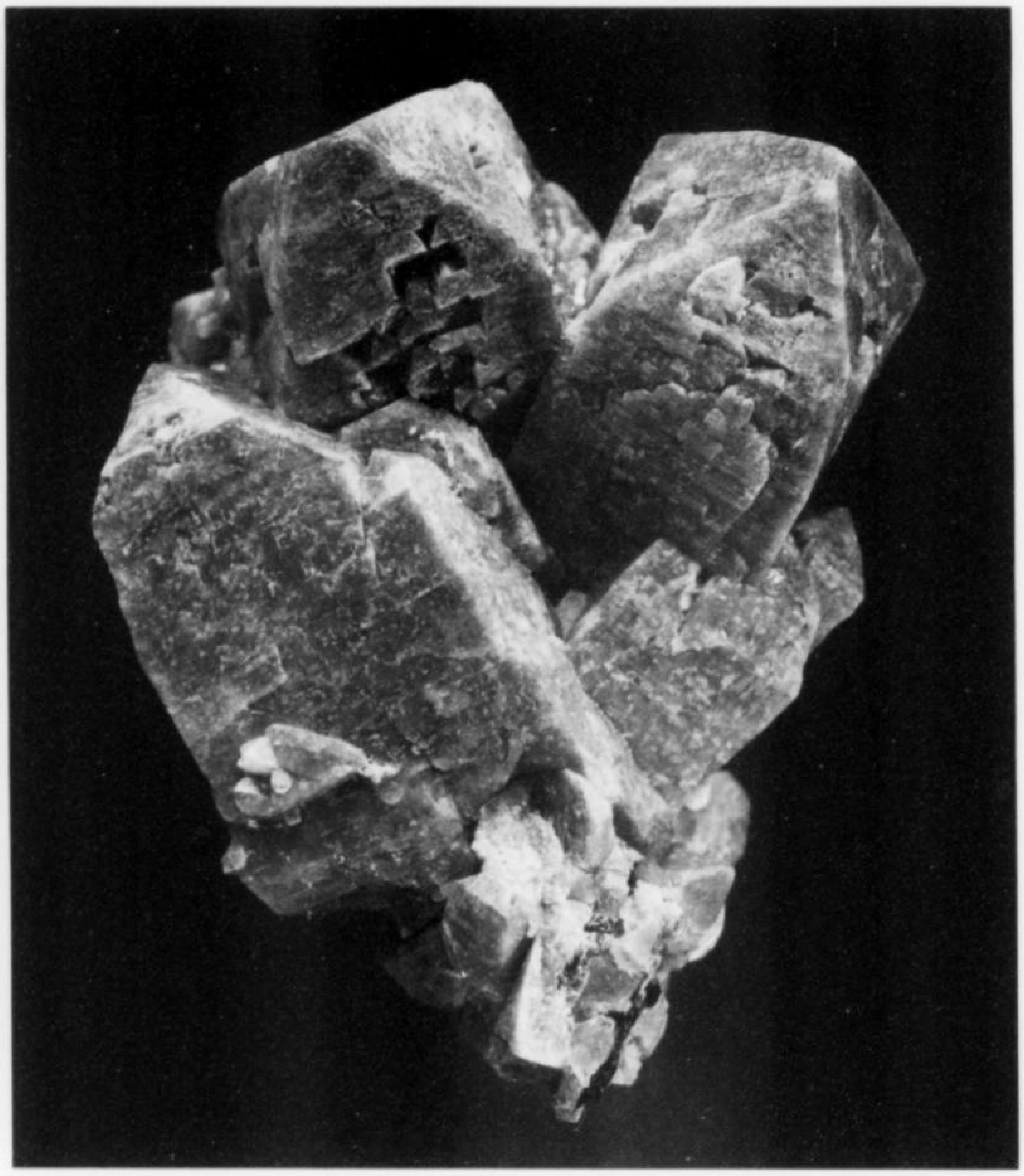


Figure 16. Zircon crystal cluster, 3.2 cm, from the Zomba district, Mount Malosa, Malawi. Lino Caserini specimen; Jeff Scovil photo.

Figure 17. Mimetite crystal cluster, 2.4 cm, from a mine near Bapu, Guangdong province, China. Rob Lavinsky specimen now in the Tom Gressman collection; Wendell Wilson scanner image.

Figure 18. Parisite-(Ce) crystal, 1.9 cm, on aegirine from the Zomba district, Mt. Malosa, Malawi. Lino Caserini specimen; Jeff Scovil photo.

across in his room in the Executive Inn. Also, M. Abello (among other dealers in Brazilian minerals) had some impressive specimens of the stout, glassy brown **hydroxylherderite** crystals found recently at Alto Lavra do Afranio, Linopolis, Minas Gerais—see the photo accompanying Bill Larson's last Ste.-Marie show report (and note the corrected locality data here, which I have on the credible authority of Jordi Fabre).

At the Convention Center show, Frank and Wendy Melanson of *Hawthorneden* were selling specimens of **lepidolite** in an odd habit, found last year at the Toca do Onca pegmatite, Barra da Salinas, Minas Gerais. And I do mean selling: I arrived early at their show booth, but already the Melansons had disposed of some half-dozen cabinet specimens, and only a few thumbnails and one 25-cm plate remained. The lepidolite forms clusters of sharp, pale lavender prisms with diamond-shaped cross sections; terminal cleave-offs enable the viewer to gaze down through a transparent lavender sea, all the way to the crystal bottoms, although the prism and true termination faces are opaque, with a silvery sheen. The lepidolite crystals reach 3 cm and are well individualized in their clusters. Toca do Onca is the locality known in the past for sheaf-like, trigonal, brownish green elbaite in compound crystals to perhaps 15 cm long, although all of these new lepidolite specimens are devoid of associated species.

The Melansons also had about 20 specimens, found last spring, of beautifully gemmy and lustrous **spessartine** of deep raspberry-red color, from the Urucum mine, Galileia, Minas Gerais (the source of some fine and large morganite beryl crystals in the early 1970's). The thumbnail and miniature-sized specimens are loose parallel groups of crystals, most of them somewhat flattened, which one might guess are etched fragments of larger original garnet crystals. However, Frank had at least one matrix specimen showing these irregularly shaped garnet crystals perched individually on white feldspar crystals, so perhaps these represent original growth after all and not an etch phenomenon.

Finally from Brazil, a 51-crystal lot of **elbaite** was divided, late in the show, between Rob Lavinsky and Doug Wallace; the crystals were dug within the past year at the Terra Corrida mine near Colonel Murta, Minas Gerais, and very beautiful things they are too. They are prisms ranging from 3 to 6 cm long, and 1 or 2 cm thick, very lustrous and sharp, lightly striated parallel to c, and terminated (on one end only) by fairly steep trigonal faces. Most strikingly, each crystal is a gemmy, color-zoned sandwich, deep red at both ends and deep green in the center, with fairly sharp boundaries between the zones. There's a certain resemblance here to some elbaites from Afghanistan, but these crystals are handsome beasts (and fine gem stock too), regardless of homeland.

Many hundreds of good **prehnite** specimens have been collected during the past two years from a building-stone quarry at Cerro de las Culebras, Carchalejo, Jaen, Spain, and Luis Burillo (see under Peruvian hübnerite) had about 30 miniature to cabinet-sized specimens in his room at the Executive Inn. Translucent, pale to medium green, lenticular prehnite crystals form typical hemispherical aggregates to 3.5 cm in diameter; the specimens are flat plates, some showing microcrystals of epidote along the seams between prehnite hemispheres. For a 12 x 12-cm plate you'd pay only about $100.

A Spanish oddity in the hands of Jordi Fabre this year was **malachite-coated chalcopyrite** crystals to 3.5 cm perched on vug linings of drusy crystals of yellowish dolomite, from the Eugui quarries, Navarra, Spain (by common consent the place which produces the world's finest dolomite specimens). Over the past twelve years, but increasingly during the past two years, Jordi says, these quarries have sporadically produced the sharp chalcopyrite crystals, all decked in the thin, sparkly or velvety, deep green coats of malachite (complete pseudomorphs are as yet unknown).

Old Tucson Show hands once looked forward to visiting Michel Jouty's Executive Inn room, packed as it always was with central-European exotica. Michel (231 Rte. des Nants, Chamonix, France) is semi-retired now, but this year he could still be visited (by appointment) in the Frontier Motel, just next door to the Executive Inn. Michel has shifted his primary focus to Chinese minerals, but had about 30 outstanding specimens of **faden smoky quartz**, found last July at Pierre Joseph Peak, near Mer de Glace, above Chamonix, France. The crystals are brilliantly lustrous and totally transparent, and they show distinct milk-white faden lines in the medium-smoky darkness down their centers. Most of the specimens are miniature-sized, but there are a few crystal plates to 15 cm wide.

Freibergite is a rare member of the tetrahedrite group in which silver predominates over copper and iron in the cation sites; good crystals have always been rare, and must in any case be analytically verified as freibergite, as they cannot be visually distinguished from tetrahedrite or tennantite. The new freibergites from a discovery late last summer in the famous Herja mine, Maramures, Romania *have* been so verified, and about 50 small-thumbnail-sized specimens were brought to Tucson this year by Ross Lillie of *North Star Minerals*. They are likably eccentric-looking: each specimen is a floater single crystal, or a floater group of two or three crystals, of brownish black, rounded, matte-lustered sphalerite, with exactly one sharp, lustrous metallic gray freibergite crystal of 2 or 3 mm half-embedded, rising as a petite triangle of light above the sphalerite surface. These specimens are, let's face it, small—no more than 1.5 cm in diameter—but once you know them you'll never confuse them with anything else.

Finally from Europe, Bulgarian minerals continue to appear on the market. Good specimens of the usual galena, quartz, calcite, etc. from the Madan district were in abundant supply this year, and Alexander Dikov of *Intergeoresource Ltd.* (P.O. Box 66, 1404 Sofia, Bulgaria) brought for What's New Day something rather different: a specimen from the Ianakiev mine, Erma Reka (outside but adjacent to the Madan district) with brilliant striated **pyrite** cubes to 5 cm on edge, with other sulfides and quartz. This mine has also lately produced lustrous, complex, ultra-gemmy green **sphalerite** crystals to 2 cm.

In an out-of-the-way room at the InnSuites I came across Khaled Aziri (10 Av. Bir Lahlou, 54350 Midelt, Morocco); most of the stock he had brought to Tucson consisted of trilobite fossils, some of great, truly icky dimensions. But Khaled also had a hoard of about a hundred **orthoclase** crystal clusters which he'd collected four months ago in a quarry on a mountainside near Midelt, Imelchelle state, Morocco. The orthoclase crystals are opaque tan to translucent gray with a hint of "moonstone" blue-green, very sharp, and quite lustrous; they reach 2 cm, and form loose clusters (with minimal to no damage) from thumbnail-sized to 10 x 10 cm. With a trillion stone trilobite eyes upon me, I bought three of these pert little specimens for $10 apiece.

That last one was admittedly "modest," but, moving down into Africa, we come upon something truly major: a recent discovery of **epidote** in a locality given as "Northern Frontier District," Kenya, this being reportedly a mountainous jungle region controlled by local tribes, and tricky to prospect in. The three outcrops in metamorphic skarn-like rocks worked so far by famous African mineral explorer Campbell Bridges (discoverer of tsavorite garnet) have produced brilliant, thick, prismatic epidote crystals to 25 cm long, including some doubly-terminated singles and some majestic-looking groups to about 35 cm. The crystal faces are typically mirror-smooth, the color is rich blackish green, the crystal groups' composition is excellent, and, in short, this material easily keeps up with Austrian, Alaskan, Pakistani, and Namibian epidote in the worldwide epidote derby. Wayne Thompson had most of the biggest and most dramatic pieces at the Westward Look and Convention Center shows, while Dave Bunk had outstanding small-cabinet-sized and miniature specimens, plus a few thumbnails. Lustrous black rhombohedral **hematite** crystals to 5 cm have also emerged from the locality, and some of the epidote specimens are adorned by small crystals of quartz, prehnite and titanite.

Four months ago, a single 30-cm vug in altered dolomite in the Kabolela mine, Shaba, Congo, yielded about three flats of gorgeous specimens of **brochantite**—this according to who else but Gilbert Gauthier, who had most of the specimens in the ballroom of the Executive Inn (Jordi Fabre also had a few, in his nearby room off the lobby). The Kabolela mine copper ores were cobalt-rich, and thus the mine was worked for cobalt during the Second World War, closing in the 1950's; recent intrepid specimen-hunters are to be thanked for these fine, newly collected brochantite specimens. Brilliant green acicular crystals to 1 cm form dense carpets of interlocked sprays on brownish black matrix; Gilbert's biggest piece is 20 cm across.

The great manganese-mining field around Kuruman, Cape Province, South Africa is still turning out good specimens of odd species; this year it is **manganoan vesuvianite**, found last fall in a pocket complex in the N'Chwaning mine. The lustrous, deep reddish black, thin-prismatic crystals never exceed 1 cm, but they form lush-looking cavity linings in massive, dull black manganese oxide ore. Several flats of mostly miniature-sized specimens were collected, and good lots were available in Tucson from Rocko Rosenblatt (*Rocko Minerals*, Box 3A Route 3, Margaretville, NY 12455) and from Paul Botha (*Southern Africa Minerals*, P.O. Box 12027, Vorna Valley, 1686 South Africa). Paul also had about a dozen specimens of translucent white **hydroxyapophyllite** in crisp, pseudocubic crystals to 1.5 cm, in miniature-sized groups. And both Rocko and Paul had more recently collected specimens of **poldervaartite** from the same area, in fine crystals to around 1.5 cm, from opaque white to pink to nearly gemmy peach-color—and priced considerably lower than the first-found specimens were selling for in 2002.

Laurent Thomas, under his new business name of *Polychrome France* (polychromefrance@aol.com), brought a gemmy surprise to the hotel show: about 70 loose euhedral crystals, plus a few kilograms of gem rough, of lovely dark-pink to red **beryl** collected in November and December from a pegmatite near Mandrosonoro, Fianarantsoa Province, Madagascar. It is tempting to call the beryl "morganite," because it is pink, forms simple hexagonal prisms of tabular habit, and is high in cesium (as are many of the old California morganites). But, according to Laurent, the material is *so* high in cesium that a pending analysis may very well show it to be a new species, and anyway its color is not quite like that of morganite from any other locality: generally a hard-to-describe rose-pink to raspberry hue. In fact, when backlit the crystals are seen to be dichroic—raspberry-colored when viewed through the prism faces, a peculiar orange/red/purple when seen through the (usually frosted) basal faces. The crystals reach 6 cm across, but the sharpest and cutest are uniformly around 2 cm or less; prices ranged from $100 to $800 per gram. Also found in the pegmatite pocket were gemmy kunzite *and* hiddenite spodumene, citrine quartz, lepidolite, "amazonite" microcline, and elbaite crystals to a foot long.

Nor is the pink beryl the only new goodie that Laurent Thomas brought from Madagascar. In September 2002, about 200 small specimens (from 2.5 to 5 cm) of **ferrocolumbite** were taken from the Tsaramanga pegmatite, between Betafo and Antsirabe: these are black, very sharp, wedge-terminated crystals with submetallic luster, in clean parallel-growth groups without matrix, the individual crystal size averaging around 2 cm. The crystal groups were found enclosed in muscovite and schorl, and some of their surfaces show brown spots of a radioactive mineral (betafite?). Also, at Ampanivana, south of Antsirabe, lustrous jet-black tourmaline crystals determined, surprisingly, to be **elbaite** (the determination was made by Dr. Pezotta of the Natural History Museum of Milan) were dug between November 2001 and June 2002. The elbaite crystals reach 3 cm individually, and occur in floater groups of toenail to miniature size; what is more, grayish white, translucent dodecahedrons of **rhodizite** to 5 mm are sprinkled liberally on their surfaces, for a fetching white-on-black effect. Finally, Laurent offered sharp, lustrous, hunky **amethyst scepters** from one to two *feet* tall, found in summer 2002 at an unnamed prospect near Fianarantsoa; the pocket yielded 50 specimens totaling 500 kilograms weight.

There was not much new this time from the former Soviet Union, but rare-species fans may appreciate news of the very large specimens of **natrosilite**—a simple silicate, but extremely rare—newly found on Kedykverpakhk Mountain, Lovozero massif, Kola Peninsula, Russia. Five specimens of natrosilite in pearly white, translucent to transparent cleavage sheets to 25 cm across, with some edges showing crude crystal faces, were brought to the Executive Inn by the scientists of the Fersman Museum, Moscow.

To move from the natrosilite just a few doors down the hallway of the Executive Inn was to trade rarity for beauty: Konstantin Buslovich (Smolikova 900, Ruzyne, Prague, 16100 Czech Republic) had brought to Tucson some outstanding **pyrite** crystals discovered last summer in the Karzamkul iron deposit, 110 km south of Kustanay, northern Kazakhstan. According to Konstantin, the site is a now-inactive iron ore quarry where magnetite was the chief ore species; and sure enough, massive magnetite is the matrix for sharp, very bright, simple pyritohedral crystals of pyrite, mostly around 1 cm but exceptionally to 2.5 cm. The pyrite crystals sit lightly on the black matrix, sometimes with haloes of drusy epidote and prehnite; thumbnail to small cabinet-size specimens were available by the dozens.

Thick, gemmy, butterscotch-yellow rhombohedral crystals of calcite from the Sarbaiskiï mine, Rudniy, Kazakhstan have become familiar items during the last ten years; indeed I sometimes catch myself calling these very beautiful specimens "Rudniys," for short. But about two years ago (explains Mikhail Anisov of Moscow, anosminfos@mtu-net.ru), about 50 large specimens of a radically different, though equally lovely, type of **calcite** were found in the Sarbaiskiï mine, and Rob Lavinsky (of *The Arkenstone*) had just seven specimens in Tucson. The calcite clusters, all measuring about 25 cm across, and having no matrix, are composed of lustrous, tapering prismatic calcite crystals which come to points; the crystals are transparent/colorless to translucent/white, very clean, and reach 6 cm long individually. Incidentally, the *Sarbaiskiï mine* at Rudniy should not be confused with the *Sokolovskiï quarry*, also at Rudniy. The gorgeous calcites, plus fine specimens of silver minerals, come from the underground *Sarbaiskiï mine*, which chiefly exploits iron ore (magnetite); the *Sokolovskiï quarry* yields good specimens of gmelinite, natrolite, and other zeolite species.

François Lietard brought in about a hundred specimens (out of thousands which were collected, he said) of brilliant floater **quartz** crystals that could pass for Herkimer diamonds; however, they were found near Wama, Dara Ismael, Khan district, Northwest Frontier Province, Pakistan. The colorless, transparent crystals measure from 5 mm to 2 cm, exceptionally to 5 cm, and their interiors are profusely speckled with black flakes of something-or-other which is probably organic (in New York they call similar inclusions in Herkimer diamonds "anthraxolite"), and some yellow-brown smears of something *else* probably organic, as well as a few enhydro bubbles. Think of these new specimens as intriguingly "dirty" Herkimers which could stand a good housecleaning (or detoxing?) inside.

The same new Pakistani locality that has produced the quartz (above) has also turned out striking specimens of gemmy pink **apatite** (probably fluorapatite); François Lietard and Dudley Blauwet (of *Mountain Minerals International*) each had just a few of these. The apatite crystals are very sharp, very lustrous, transparent hexagonal tablets, most of them oddly elongated on one of the horizontal axes, for a pseudo-orthorhombic shape. The crystals are found either stacked in loose groups, or perched at high angles on a brown matrix, surrounded by faden quartz crystals. Yes, the material is beautiful, and whether the limpid pink color is fugitive or not has yet to be seen; anyway, these new apatites are unlike the pink apatites from Nagar, Pakistan, which typically come with muscovite and whose color is *not* permanent. Dudley's specimens are shiny little thumbnails, while François' best is a 7-cm matrix sporting a lone 4-cm apatite crystal.

It's a pleasure now to be able to offer updates on discoveries in the Deccan Plateau in India *since* Berthold Ottens wrote his opus (the January/February 2003 issue of the *Mineralogical Record*)—may the need for such updates never cease. In his Executive Inn room, Dr. Hemant Merchant (72, Casagrande, Little Gibbs Rd., Behind Hanging Gardens, Bombay-400 006, India) had about 10 giant specimens of a new Indian habit of **calcite**, these specimens found in November-December 2002 during excavation for a new water tunnel between Pathanwadi and Kurar, Bombay-Malad (recall that this area was supposedly finished for specimens, urban sprawl having put an end to nearly all quarrying of the spilitic basalts around Bombay). On the new specimens, rhombohedral calcite crystals reach 13 cm on edge, and rest on matrix of pale green prehnite and gray basalt. A first phase of growth resulted in very pale yellow-orange calcite crystals, smooth-faced but not lustrous; a second calcite generation was deposited as a thin, uniform coating on crystals of the first generation, and this later overgrowth is white and highly lustrous, though somewhat rough-surfaced. Some of the specimens, further, display a third generation, as pseudocubic calcite crystals to 1.5 cm ranged in regular rows along edges of the big rhombohedrons.

And then there is Dr. Arvind Bhale of *Earth Science International* ('Yasham,' 166/1+2+3, Aundh Gaon, Pune-411007, India), who had about 30 specimens, from toenail through cabinet size, of celadonite-infused **powellite** found in 2001 at Shakur, Maharashtra state. Consulting our *Indian Zeolites* issue, we see that Shakur is the locality for the well-known cloudy greenish gray heulandite and stilbite crystals which also owe their color to minute, wormlike inclusions of celadonite. The color of the new powellite specimens is the same, and the species is morphologically unmistakable: very sharp, lustrous pseudo-octahedral crystals to 1 cm, occurring as loose clusters and on matrix with good crystals of the familiar green heulandite. In the larger specimens, powellite crystals have grown in "wheels" to 3.5 cm diameter, the crystals in subparallel orientation, their toothy tips protruding all over the surfaces of the wheels.

Time now for our regularly scheduled program presenting what China has lately been turning out for our mineralogical enjoyment. First, in the *Collector's Edge* special "China" exhibit case at the Convention Center there appeared, looming enormously in the back, a part-gemmy, medium to dark green, very sharply formed **diopside** crystal about a foot high, from a new find given (vaguely) as Xinjiang Uygur Province. And Sandor Fuss was busily selling smaller loose crystals of the same kind in the Collector's Edge booth—although "smaller" means between 3 and 8 cm. Many of the diopside crystals are thoroughly gemmy near their terminations and cloudy green lower down; it is their sharpness that is most impressive. Always free of matrix, always singly terminated but never doubly so, the crystals look like much-inflated examples from the old locality of De Kalb, New York, and in general they far surpass the Chinese diopsides which trickled out a few years ago. Rob Lavinsky had three flats of thumbnail-sized crystals as well.

The best that I saw of the now familiar clusters of **hematoid quartz** crystals from Shangping Zhen, Longchuan Counthy, Guangdong Province, China were being offered by Michel Jouty and by Dr. Guanghua Liu of *AAA Minerals China* (Französische Allee 24, 72072 Tübingen, Germany). These specimens often reach jumbo sizes, and can be very dramatic, especially when platy black **hematite** crystals compose sharp rosettes around the bases of the transparent, red-dusted quartz prisms. According to Michel, the specimens with *pale* red, transparent quartz crystals come from the Hichang quarry, Sichuan, whereas the *deep* reds come from the (distant, entirely separate) locality named above. Dr. Liu also had five quartz crystal clusters from Guangdong (with, sure enough, deep red hematite dustings) which sported also a few very sharp, dull brown **helvite** tetrahedrons to 2 cm.

But if any single new item was "the talk of the show" this year, causing many serious collectors to lapse into expostulations and palpitations such as are caused by only the most dazzling of new discoveries (in other words, to make good-natured spectacles of themselves), it was the new **mimetite** specimens which emerged just two months ago from what is reportedly a small lead prospect, the Wu Chuan mine, near Huo Zuo City, Guangxi Province. Chinese miners contracted to Daniel Trinchillo were the original collectors, and they did an admirably professional job of extracting the specimens, most of which show very little or no damage, delicate though they are. Through Daniel, the best of the lot came to Rob Lavinsky of *The Arkenstone*, who was selling them at the Executive Inn show, the Westward Look show *and* Convention Center show; some very good specimens also wound up with Mike Bergmann and a handful of other westerners, and quite a few less impressive (and more damaged) pieces were offered in the Executive Inn by several Chinese dealers, some of whom initially labeled the material pyromorphite (multiple analyses by Marcus Origlieri of the University of Arizona have verified it as mimetite).

Don't write that locality name in your catalog just yet, though. Shortly before press time, we were informed by Rob Lavinsky that the locality name originally cited was false, to protect the secrecy of the find until it could be cleaned out. The miners are said to have carried the material into a different province for sale, just to hide their trail. The latest news is that the mine is actually near Bapu in Guangdong province. Reportedly the entire find consisted of about 3,000 specimens (half of which are still in China), of which less than 200 are top quality. The opinion of the miners is that the occurrence is exhausted, as no more specimens were found for over a month after the big pocket was encountered, despite furious digging. Of course, such hearsay is notoriously unreliable, and even the most honest predictions about what will or will not be found in the future are little more than informed guesswork. Nevertheless, the odds would seem to be against the discovery of substantial additional quantities simply because (unlike the related species vanadinite and pyromorphite) high-quality crystals of mimetite have *never* been found in great quantity at any locality.

Opinions varied as to whether the best of this mimetite is, in its own way, the equal of the legendary gemmy, pale yellow crystals from the "gem pocket" found at Tsumeb in 1972—this to give you an idea of the level of quality we are talking about. Individual mimetite crystals from the new Chinese find reach over 2 cm, but are generally less than 1 cm, occurring as thick crystal crusts on a weathered brown gossany rock. They are extremely sharp hexagonal platelets, standing straight up from matrix as loners or in parallel groups; some crystals have a perfectly flat, mirror-bright basal face on one side, but trail out on the other side in a tapering parallel aggregate. The habit rather resembles that of some Moroccan vanadinite. The crystals are distinctive not only for their high (almost adamantine) luster and razor-sharp edges, but also for their color: from a brilliant yellow-orange (described by some Arizonans as "Old Yuma mine wulfenite yellow") to a deep yellow-orange (reminiscent for me of the color of some Ojuela mine legrandite—especially what with that brown earthy matrix). Most loose crystal clusters are toenail through miniature-sized, though a very small number of killer thumbnails also exists. Cabinet-sized pieces, with flashing sheets of mimetite crystals covering matrix, can exceed 9 cm; and Rob Lavinsky brought to the What's New Day case a 17-cm specimen with a deep open vug lined with mimetite crystals accounting for almost all of its front side. As I said, there's no telling now whether these superlative mimetites will disappear from the market after a year or two (as did the superb Thailand mimetites of a few years ago), or whether they'll only increase in numbers and quality (as did the wonderful Chinese pyromorphites, only now petering out after several years of amazing abundance). Gawk at the pictures here (and on the cover of this issue) while you can . . . it may well be a one-shot find. Rumor has it that the mine collapsed after being so hastily and incautiously exploited for specimens.

Australia checked in this year with about 50 very fine, mostly small specimens of **copper** brought to the Convention Center show by Tom Kapitany of *Crystal World & Prehistoric Journeys* (20 Fiveways Boulevard, Keysborough, Victoria, 3173, Australia). The source is the presently active Selwyn gold mine, Mt. Elliot, northern Queensland, where the copper crystal groups were taken from a single pocket in 2001. Ranging from 2 to 10 cm, the groups consist of lustrous, elongated spinel twins to 1.5 cm, with more copper in branching, curved arborescent growths, and rarely as curling wires. The specimens show no associated species (however, Tom says that the mine produced 3-foot gypsum crystals included by copper around the turn of the 20th century).

So much for the survey of individual What's New discoveries. But I want to note, too, my general impression that a very satisfying number of "old" mineral occurrences from the past five years or so are continuing to produce, often in greater numbers and higher specimen qualities than before; a few of many possible examples follow. Besides the new millerites, beautiful golden **barite** from the Barrick Meikle mine, Nevada, is still being offered generously by several western U.S. dealers. The **poldervaartite** profusion of last year, as mentioned, is still going strong, thanks to *more* pockets recently struck at the N'Chwaning mine, South Africa. **Dioptase** from Altyn-Tube, Kazakhstan has re-appeared, with perhaps a dozen dealers offering specimens with bigger and more lustrous crystals than have ever been seen in the past. **Carrollite** from the Congo, *still* as crystals which would have been accounted wild hallucinations of size and luster only five years ago, may still be had (especially from Brice and Christophe Gobin and Gilbert Gauthier). Brilliant blue **pentagonite** from the Wagholi quarry, Poona, India is reaching record crystal sizes, with radial starbursts of acicular crystals to 2 cm in cavities—here the best people to see are Fasi Makki and Arvind Bhale. An incredible example with crystals to around 6 cm, purchased by Marty Zinn for the Smithsonian collection, will no doubt appear on a future cover. Fine **crocoite** from Australia is now again coming out; the **bastnäsite-(Ce)** crystals from Zagi Mountain in Pakistan are getting bigger and more plentiful all the time; the Erongo Mountains of Namibia continue to pour out supplies of excellent **aquamarine, foitite, aegirine, arfvedsonite** and green **fluorite** crystals; the Russian dealers continue to offer first-rate **pyrrhotite** from Dalnegorsk, and a fantasy-variety of exquisite Dalnegorsk **calcite** too; and, amazingly, superb Moroccan **vanadinite** specimens continue to emerge through various sources, as they have for many years. The many kinds of new and ongoing mineral-action—reflected, too, on many websites, if you absolutely *can't* make it to the big shows—are a comfort indeed in these times of terror, warfare and economic uncertainties. We can take mental refuge amid the treasure trove of wonderful mineral specimens that continue to fill the marketplace. As Wendell Wilson has said, we are truly living in a Golden Age of mineral collecting, which shows no sign of abating. Are we cheered up? Fine, then let's go to the exhibit cases at the Convention Center show.

Exhibits

"Minerals of the Andes" was the show theme—and that was good, first, because it inspired the Smithsonian to bring one of the best of the fabulous Chilean "Vaux" proustites to the show: a 5 x 10-cm crystal cluster reposing in flashing red majesty, not looking its age at all. The same fine Smithsonian case contained a 5 x 5-cm Bolivian phosphophyllite twin and a canfieldite cluster from Bolivia with sharp gray 1-cm crystals; in a separate case (under constant armed guard) the Smithsonian folks placed the nearly-baseball-size 858-carat "Gachala" emerald crystal from Colombia, and a lavish emerald/diamond necklace once owned by Marjorie Merriweather Post.

That had to be the most lavish performance on the Andean theme, but other terrific things from the backbone of South America were displayed by other institutions, e.g. the Colorado School of Mines Geology Museum, the Rice Northwest Museum, the University of Arizona Mineral Museum (this case dedicated to the memory of Dr. Russell M. Honea), the Carnegie Museum (14 great specimens from Bolivia), Harvard (Atacama Desert specimens from the recently acquired Terry Szenics Collection), and the Natural History Museum of Los Angeles County (Bolivian minerals from the Mark and Jean Bandy Collection).

Private collectors who showed us excellent and instructive things from the Andes included Jaroslav Hyrsl, Alfredo Petrov, Alan Day and Scott Werschky, Neil and Cami Prenn, Georg Gebhard, Rock Currier and Carolyn Manchester—and the exhibits put on by the latter two collectors were especially forceful and dazzling, despite all that distinguished company and stiff competition. Carolyn's 4-foot case was comparatively small, and the specimens varied greatly in size, but no impression of "clutter" here; the pieces were just too good. I will long retain luscious images of her thumbnail phosphophyllite (Cerro de Potosi, Bolivia) and pyrargyrite (San Genaro mine, Peru); of her 25-cm plate of pale pink manganocalcite (Pachapaqui, Peru); of her several bright, flawless Peruvian pyrites; and of her four Bolivian vivianites of irreproachable sea-green transparency. As for Rock Currier, well, as a fearless traveler and as a co-author of the *Peru Issue* of 1997, he certainly knew how to fill an Andean case; I'll just settle for mentioning in particular a foot-long, curving matrix of rock with about ten perfect gray 2.5-cm tetrahedral crystals of freibergite studded along the top of it. And he filled a neighboring case, just as big, with specimens from India as well. Rock will be performing again in August, when he brings his *whole* collection (or so goes the story . . .) to the Springfield Show.

There were also fine cases on other themes, which, as usual, I can do little more than name in passing. Locality cases were even more numerous and diverse than usual: among them were a case of 28 fine quartz specimens (mostly amethysts) from the new occurrence at Magaliesburg, South Africa (Rocko Rosenblatt); 13 superb specimens from Russia and Kazakhstan (the KARP guys); minerals of Mexico (Peter Megaw); minerals of the Northern Areas, Pakistan (Bill and Carol Smith); minerals of the Orchard quarry, Buckfield, Maine—with large and gemmy aquamarine and heliodor beryl crystals, plus neat little phenakites and apatites (Gary Freeman); southern Arizona minerals (Arizona-Sonora Desert Museum); green fluorite from the Homestake mine, Arizona (Mark Hay and Dick Morris); recent finds at the 79 mine, Arizona—including several very pretty green smithsonites (George Godas); minerals of the Siegerland district, Germany (Los Angeles County Natural History Museum); elbaite from a giant pocket found last October at the Cryo-Genie mine, California (Gochenour's Minerals); flourite from the North Pennines, England (Jesse Fisher and Joan Kureszca); minerals of the Elmwood mine, Tennessee (Walt Gaylord); a case full of dozens of specimens of Bunker Hill mine, Idaho pyromorphite in a spectrum of colors from green to yellow to red-orange (Mike and Mary Jaworski and Tony Potucek); and a most impressive case full of hundreds of wulfenite specimens of all sizes, some very fine, self-collected at the Glove mine by Peter P. Tescione, Jr.

Three big cases were filled with outrageously fine Chinese specimens, which make you think of others you've seen around on the market of late, and then say "I never knew it got THAT good!" These cases were put in by Collector's Edge, Steve and Clara Smale, and Daniel Trinchillo (the latter case, however, lacked specimen labels or any kind of text, as several showgoers were heard to complain . . . why not *label* such wonderful things, Danny?).

On and on the visitor went, down the rows of cases: quartz in a zillion habits and colors (Roz and Gene Meieran and Bill Larson); a 10,100-carat Burmese ruby crystal in matrix (Pala International); "More Treasures From the Vault" (American Museum of Natural History); "Treasures of Old German Mines," with geologic maps, old photos and documents, and fine, proud, old-dowager specimens (Mineral Museum of Bonn, Poppelsdorfer Schloss); a repeat performance of Dan and Dianne Kile's case (a couple of years ago in Denver) of self-collected specimens from Colorado, and, in a case with its back to this one, a sumptuous collection of petrographic microscopes and equipment—a foretaste of Dan's upcoming *Mineralogical Record* supplement on the subject. At least three cases of different sorts memorialized the late John Sinkankas, and one mischievous case was all about Ed McDole; its centerpiece was Ed's famous bottle of dark brown 151-proof rum out of which McDole Trophy winners once had to drink. Bill and Elizabeth Moller, Matilda Pfeiffer, and a wordy fellow named Thomas P. Moore put in ample selections of their general collections. My apologies to anyone who put in a worthy case that I've overlooked in this survey—but hey, at least I mentioned my own case *last*.

At the Saturday night awards ceremonies, the following superstars were honored. Carolyn Manchester won the Desautels Trophy for best "rocks" in the show, and she won it with *style*, not simply picking the best specimens from her large and varied collection, but restricting herself to just the Andean theme! William H. Larson (Bill's son) won the Lidstrom Trophy for best specimen, with a self-collected Himalaya mine elbaite; this was the first time that a "junior" collector has ever won this award. Jesse Fisher won the Friends of Mineralogy award for best article published during the past year in the *Mineralogical Record*: his "Gem and rare-element pegmatites of southern California." The Pinch Award given by the Mineralogical Association of Canada for the amateur who has contributed most to mineralogical science went to Dr. Mark Feinglos. And finally, the most prestigious of the awards, the Carnegie Mineralogical Award, given to a person or institution who has contributed mightily to mineralogy, mineralogical education, mineralogical journalism, and mineral collecting, went appropriately to Dr. Terry Wallace of the University of Arizona.

So another Tucson Show is now history. But get ready for something *really* special next year, which will be the fiftieth-anniversary Show. All that glitters will no doubt be real gold (the show theme), and a lot of it, at that once-in-a-lifetime event to be held February 12–15, 2004. For now, that's it from lollapaloozaland.

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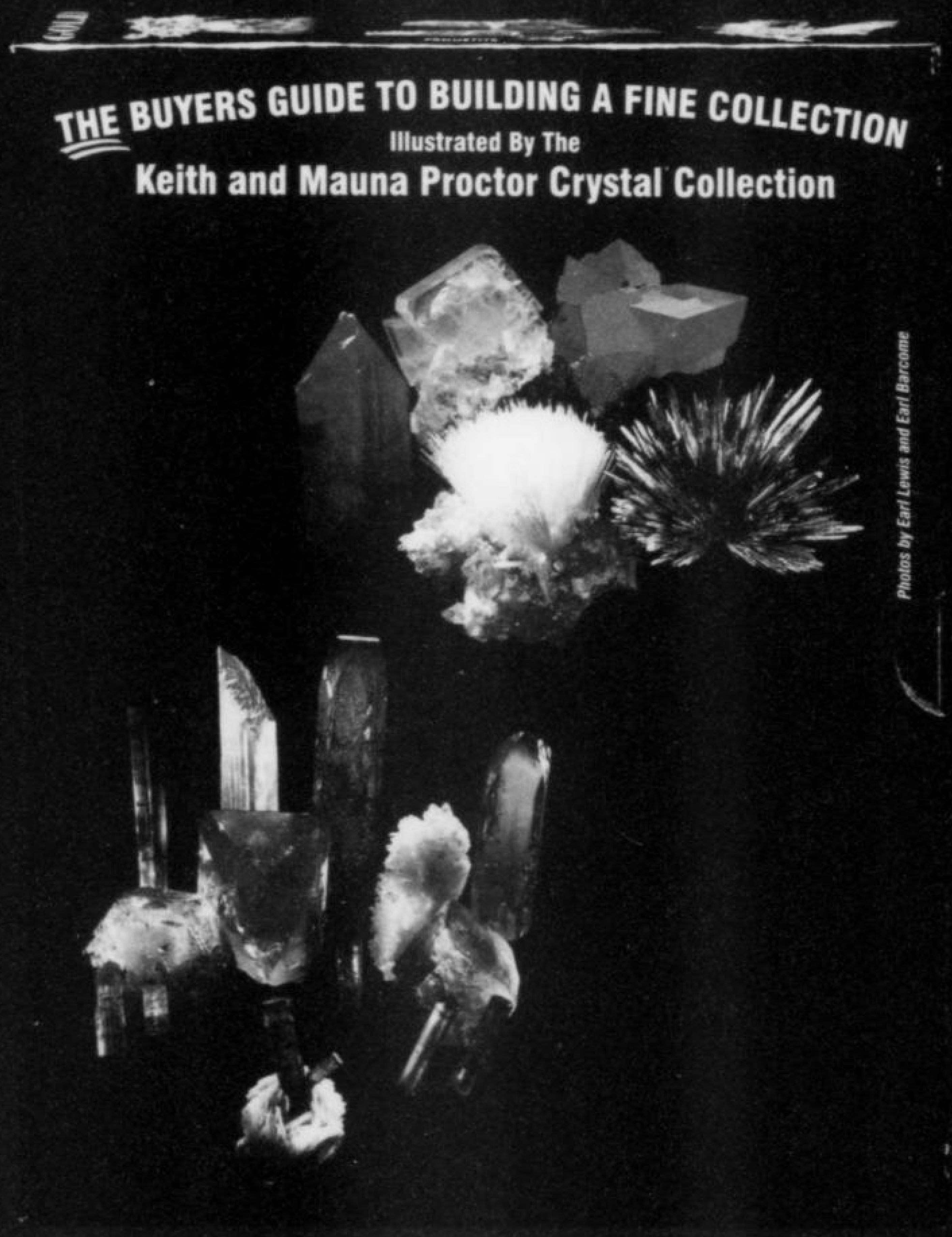

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