the Mineralogical Record

Volume Seventeen, Number Two
March-April 1986 $7.50

The Mineralogical Record Inc. is a non-profit organization
The Mineralogical Record magazine (USPS-887-700) is published by the Mineralogical Record Inc., 7413 N. Mowry Place Tucson, Arizona 85741

Subscriptions
$27 per year, $52 for two years, $600 lifetime, domestic and foreign. Payment in U.S. dollars.

Mailing addresses & phone nos.:

Circulation, back issues, reprints
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602-297-6709

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

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Articles

Departments

COVER: Marsturite epitaxially overgrown on rhodonite crystals 3 to 5 mm in size, from Franklin, New Jersey. Smithsonian specimen; photo by Victor Krantz. See the article by Dunn and Leavens on p. 123 of this issue for a full description.

notes from the EDITOR

"MINERAL MUSEUMS of EUROPE"

For several years now a book has been brewing in Germany on the Mineral Museums of Europe. Sounds like a great idea, and it is. The primary photographer is Rainer Bode, former editor/publisher of the journals *Emser Hefte* and *Magma,* and also of several interesting books. Bode and Olaf Medenbach, who provides some photos too, are among the top three or four mineral photographers in Europe. Co-publisher (with Bode) and author of the text is Uli Burchard, a German mineral dealer and author.

The book covers a large number of Western European mineral museums in detail, showing color photos of their finest specimens and discussing in detail each museum's history and collection. This is fascinating material for Europeans to read, and even more so for Americans who will never have the chance to travel to Europe and seek out these places personally.

When Bode and Burchard first told me about this project they were curious as to whether there would be an American market for such a book, even though it would be written in German. My first reaction was that if it was going to be primarily a pretty picture book there would be no problem, since Americans can read species and locality names in German well enough. However, when I visited the Munich Show this past October, they showed me a hard-bound proof copy of the book and, even though my German is rusty, I could tell that this was much more than a picture book. It really cried out to be translated into English.

Upon returning to the States I called Betty Llewellyn, a long-time patron of mineral museums in the U.S. She agreed that an English edition would be an exciting and valuable thing to have. So, over trans-Atlantic telephone with Burchard, we hammered out a plan. After the color work was printed, the German text would be masked out and the presses kept rolling. An English translation would be prepared at the British Museum and typeset. Then the English text could be printed in black ink on the masked-off press overrun, saving the cost of going back to press for four-color work. Betty agreed to underwrite the extra expenses and become a co-publisher of the English edition.

A total of 1500 copies have been prepared, with no foreseeable possibility of going back for more. Using the standard publisher's mark-up formula, this book, despite the savings on color printing, should be priced at about $100 based on production cost. However, because Betty wishes to do this as a service to the scientific and collector communities, she is reducing her own profit practically to nil, and is pricing the book at only $49.50. Furthermore, she has graciously chosen the Mineralogical Record as her distributor, and copies will be available in July through our book department (P.O. Box 1656, Carson City, NV 89702—Add $3 U.S. postage, $4 foreign).

For people really interested in owning a collector's item we are preparing a special leather-bound edition of 100 copies. They're not bound yet, but you may reserve a copy by writing to me at the editorial office (4631 Paseo Tubutama, Tucson, AZ 85715), and you'll be billed when the books are ready to be shipped.

Fifteen hundred copies total is not a large number . . . remember, we have over 6000 subscribers reading this now. We expect the book will sell out relatively quickly, especially in view of the price. Trust your old editor; this is a book opportunity not to be missed if you can help it.

THE SWART FILES

In 1907 the American Zinc, Lead and Smelting Company established a subsidiary for the purpose of evaluating mining properties. Their Western Representative was Walter Goodwin Swart, operating out of Denver. Swart, an experienced and respected mining engineer, spent eight years traveling through the western states and Mexico examining mines and prospects for the company. His voluminous files are now a part of the American Zinc Company Archives in the Western Historical Manuscript Collection of the University of Missouri at Rolla.

The files are arranged geographically into folders, and the list of these folders runs to 12 computer-printed pages. According to Associate Director Mark Stauter, a particular folder might contain one item or several hundred. Typical documents include site reports, correspondence, assay results, maps, charts, brochures and evaluations. Fortunately for mining historians around the country, it is not necessary to visit Rolla to study this material. Nearly all of the files have been microfilmed and are available to anyone via interlibrary loan or purchase.

I have examined a few of these microfilm rolls and found all sorts of interesting items, especially unpublished company reports which sometimes contain photos, maps and mine diagrams. This is valuable information to have preserved. Inquiries regarding the Swart files may be directed to:

Western Historical Manuscript Collection
Room G-3, Library
University of Missouri
Rolla, MO 65401-0249
Tel: (314) 341-4874

THE HARVARD MINERALOGICAL MUSEUM ASSOCIATION

The Harvard Mineralogical Museum Association is an organization designed to enable interested collectors to have a more direct involvement in the Museum and its activities. This relationship ranges from volunteer activities to direct contributions and gifts-in-kind. Currently a few of the members have volunteered their time on a weekly basis to help with collection management such as the cataloguing of the Hancock collection. Also, a new, working micromount collection has been started and now numbers something above 1000 specimens. Volunteers help too with refining locality information, an important function with a collection as wide and varied as Harvard's, about to celebrate its 200th birthday.

Members of the Association receive a periodic newsletter, attend many museum functions including the Geological Lecture Series, enjoy free museum admission and a discount in the museum shop. The Association also sponsors annual trips to areas of mineralogical interest, such as Iceland and Cornwall, England. Planned for this coming July is a 10-day trip to Iceland, Scotland and Wales. Anyone interested in joining the work of the Association, or in going on the trip next July, is invited to contact F. W. Miller, Secretary, Harvard Mineralogical Museum Association, 24 Oxford Street, Cambridge, MA 02138.

MICROMOUNTERS DIRECTORY

The *International Directory of Micromounters* is published biennially (in "even" years) by the Baltimore Mineral Society at the time of its Micromount Symposium in September. The 13th edition will be published in September of 1986. In order for it to be as correct and up-to-date as possible, the following information is needed.

(continued on p. 104)

Mineral Specimen Mislabeling

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Mineral specimen labels should be viewed with circumspection rather than reverence. Their data carry no guarantees of accuracy, and misinformation of various types abounds.

INTRODUCTION

A few years ago, when our article on mineral fakes was in preparation (Dunn, Bentley and Wilson, 1981), it was originally intended to include a discussion of fraudulent labeling. The subject seemed conceptually distinct, however, and so it was saved for a separate article which we present here.

In the simplest sense, a mineral specimen label is an object which conveys descriptive, comparative, historical or geographical information about a mineral specimen. The label may be constructed, embellished or embossed with a wide variety of materials. Hence, labels are found in a variety of colors, sizes, textures and inks. In fact, it is somewhat of a mark-of-distinction for some collectors to take pains to ensure that their labels do not resemble anyone else's. Enough said about the physical object; the matter which concerns us here is the information that is on the label, how it got there, and how it is interpreted by the scientist, the collector and the curator.

EARLY COMMENTARIES

Mineralogical literature is rather rich in comments and opinions concerning labels and their true meaning. Because there is only so much information which appears on a specimen label, the main consideration is whether that information is correct. Arthur Chamberlain (1895) remarked as follows:

> A bad habit – We refer to the labeling of specimens as "the best yet found" or "the largest yet discovered," employed by some collectors and dealers. Such remarks may have some weight with the new possessor of a specimen, but if he has opportunity for comparison, he finds that his correspondent or dealer was not truthful. This untruthfulness as regards details of specimens, is the result of habit or of ignorance, and should be abandoned.

From our perceptions of the current mineral marketplace, the advice of Chamberlain has gone largely ignored. The very phrases he admonished a century ago are still a part of some dealers' selling techniques.

Judging from his earlier writings on fakes, it would appear that W. S. Valiant of Rutgers College was the prime proponent for the forces of good in mineralogy. In his *A Stony Sermon* (1900) he goes on to attack labeling errors and the method of their occurrence. Ridicule is a very effective way of leaving an impression in the minds of readers, and he excelled at it.

> There are sermons in stones, and many lecturers have discussed the matter from a great variety of texts, in pulpit and rostrum, and in the newspaper; but there are many sides to stones and all of them have not been sermonized.
>
> Specimens sent to me for determination, often bear labels telling what the thing is supposed to be, and such are often quite interesting.
>
> A slab of fossiliferous marble was labeled "petrified flesh of a fish, or something, from the Welland Canal." Many specimens in collections are labeled in a similar way; and a good way it is, for "or something" would cover anything on or in the earth. The locality is the first and most important part of a label, for if we know where the specimen was found, we stand some chance of finding it again, if of any value. In the present case, "something from the Welland Canal" would be as perfect a label as we could wish.
>
> Another in the same lot was labeled "Lava from near Philadelphia, Pa., Sept. 12th, 1899." Instinctively, I looked toward a west window at my side, and saw a glare of red light and clouds of vapor rising over eastern Pennsylvania. There

was no lightning or noise of any kind indicative of a volcanic eruption, and cumulus clouds were abundant, so I let it go as a usual accompaniment of sunset in autumn. But the "lava" was black and fresh, looking as if it had just been taken from a fresh overflow, and a slight attack of daydreaming did the rest; the date referred to was the date it was collected, and not the date of the eruption (it was black limonite).

A young lady asked me to look at her collection. Among other very curious "curios" mentioned as inducements to call, was "a piece of petrified salt pork," and a "petrified potato." The first, translucent brown rind, an inch of pure white fat, then thinner layers of dark red and white, alternately. I asked her why she called it petrified salt pork: but the label had called it salt pork, and a *label* never (?) lies; and, "Besides that, the man who labeled it, found it himself, and had ought to know." I presume the entire hog was there, or somewhere. However, she finally consented to have it labeled agate, and the "petrified potato" was labeled *Zaphrentis gigas*—a fossil coral.

But a remarkable "meteor" fell recently in New York City. It was of a fine blue color and as light as cork. It passed just in front of a policeman, who picked it up and later gave it to a collector of minerals, with full and elaborate data as to the "fall." This was actually sent to the writer for verification; a wad of paper pulp evidently thrown at the policeman by one of the factory girls.

A lighted cigar stump was thrown from an upper window in this city. A young man saw it fall, evidently from the sky. A short time after, he went after it, and found a cinder from coal ashes. This he presented to a lady collector, who cherishes it as a meteorite, which Mr. so and so "caught in the act of falling."

Errors in labeling were not only the province of the amateur collectors. Just as fakes were known in scientific mineralogy, so too were labeling problems. One of these was addressed quite interestingly by Edgar T. Wherry and Miltiades Glenn in 1917:

> In the mineral collection of the U.S. National Museum there have been for many years two specimens of an orange-brown botryoidal mineral labeled glockerite. According to the catalog they were collected by Dr. Oscar Loew in 1874. Recently Dr. E. S. Larsen of the U.S. Geological Survey, in the course of compiling data on the optical properties of all available mineral species, examined fragments from these specimens but found them to be totally different from other glockerites, and suggested that analysis of them would be desirable.
>
> Later analysis showed that the specimens are evidently merely chalcedonic silica, containing ferric sulphate and water as impurities . . . . In conclusion, it may be pointed out that while the properties of this mineral agree in a rough way with the descriptions of glockerite given in textbooks, some tests should certainly have been made before it was so labeled. The use of something besides mere superficial aspect for identification cannot be too strongly urged.

More recently, Peter Zodac wrote in his column in *Rocks and Minerals* about the ways in which localities carelessly recorded can befuddle and confuse mineral science. This is especially true if a species is found at one locality but through poor locality identification might be reported from another locality as Zodac (1941) describes here:

> In the examination of mineralogic literature much confusion frequently arises from the loose manner in which localities have been reported. A section which may contain a number of mines or quarries is often listed apparently as a single occurrence. Sometimes a village or township and a county, or a village and a state have the same name and it frequently happens that the village or city is not in the county of the same name nor even in the state. For example, Chester and Delaware are two counties in Pennsylvania noted for minerals. Chester is also a large city in Delaware County. We have frequently run across minerals from Chester, Pennsylvania. Was the locality the city of Chester or Chester County? Worse still, we have run across items in which chromite or serpentine was listed as coming from Texas. To the uninitiated this would mean the State of Texas; to the one who knows, it is Texas, Lancaster County, Penn.
>
> Judging from a number of reports, lansfordite and nesquehonite occur in two distinct localities—villages of Lansford and Nesquehoning, about 4 miles apart, in eastern Pennsylvania. Both minerals occur together and at one locality only—in a coal mine tunnel in Nesquehoning. Lansfordite was found some years ago by a college student (one of a group who had made Lansford its headquarters). When it was discovered that the mineral was a new species, the student could not recall its exact locality except that it was found around Lansford, it was named lansfordite. A short time later the exact locality was found and at it another mineral that received the name nesquehonite. But why did some of the later reports persist in featuring two localities?
>
> At Oneco, Conn., are two granite quarries, Oneco and Marriot, which have produced a number of interesting specimens. On our second visit we learned that Marriot and Son had bought the Oneco quarry and were working it (the one which we had first visited) and that their original one had been abandoned. Here is an example of how a quarry might receive a wrong name by a careless collector.
>
> There is an old abandoned magnetite mine near Peekskill, which is known as the Hopper mine, Travis Corners mine, Edison mine, Nelson mine and Canopus mine. When this mine appears in print, its five names should be given.
>
> Another source of confusion arises when a mine or quarry is situated near a county or state line and its nearest post office is in the adjacent county or state. Or worse still, the mine or quarry could be right on the line.
>
> These are but a few instances of how mines or quarries are often incorrectly, loosely or carelessly recorded. There are many others which we might mention in a later editorial.

ACCURACY PROBLEMS

Most collectors, dealers, curators and researchers presume to a large extent that the information on mineral specimen labels is reliable. This tendency is perhaps prompted by the subconscious feeling that, even if the label data is inaccurate in some way, it is still the only data available for the specimen, and is perhaps better than none. Furthermore, it has often been said that "a mineral specimen without a label is worthless," and who wants to render a specimen "worthless" by impugning its stated locality?

It might be argued that inaccurate labeling does not constitute fraud if the error was committed innocently and unknowingly. But who can say to what extent wishful thinking has played a part, or where hedging and honest attributing become influenced by other motivations? Therefore we deal in this section with all such errors, and let the reader decide where the term "label fraud" is warranted.

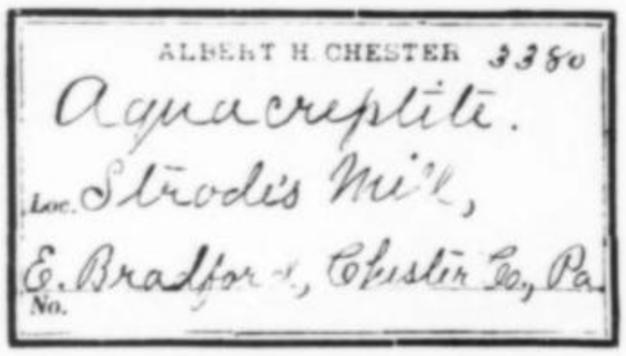
Erroneous labeling, whether fraudulent or not, is widespread. The truth is that the information given on a label is exactly what the writer chose, for his own reasons, to put there; no more, no less. The label does *not* guarantee that the specimen is of a particular

species or that it is from a particular locality. We might broadly divide labeling errors into two obvious types; the *misnomer,* in which the species given is incorrect, and the *mislocation* in which the locality given is incorrect.

The Misnomer

The *misnomer* is probably the less common of the two because mineral collectors are generally better at spotting such errors than they are at spotting a mislocation. Still, this type of error is a great nuisance to the species collector who must rely on the identifications provided by dealers or other collectors for rare species which cannot be identified by sight. Such species are commonly present only in exceedingly small quantities and may lack crystal form and other identifiable characteristics entirely. The number of powdery white species, for instance, is legion, and simple methods of positive identification for each are scarce or nonexistent.

The origins of most mineral label misnomers are relatively few in kind, including at least the following:



What is "Aquacreptite" now known as?

Outdated identifications

It is not unusual to find older labels bearing identifications which subsequent research has proven to be incorrect. This may happen, for instance, when an unknown species is designated as some similar but known species, followed by the description and naming of this formerly unknown species at a later date. An example of this sort of error is the occurrence of desautelsite which was originally thought to be pyroaurite, based on the data available at the time. There may be a tradition at a certain locality of calling all specimens of one type by a particular name, when it may later be shown that such material represents a different species or even a group of species. Yet another example would be the case of the redefinition of a species necessitating label changes that are not always made.

Analytical errors

Even a trained X-ray analyst can make an error resulting in a misidentification. Interpretations can also be at fault since the X-ray data for some species are ambiguous. Chemical analyses could similarly fail to indicate a polymorph.

Is it really Kaolinite, or some other clay mineral instead?

Erroneous sight-identification

Whether by honest error or wishful thinking, it is not uncommon for the original finder of a specimen to identify it incorrectly, accidentally generating a misnomer. It is also not uncommon for a collector or curator to decide that the identification on the label (if any) is incorrect, and to re-identify it incorrectly. This is usually accompanied by discarding or defacing the original label (see below under misattribution).

Fraudulent identification

Some specimens are purposely misidentified so that they can be sold at a higher price, whether by the original finder, a dealer middle-man, or by a collector.

Over-generalized identification

Species names are often assigned to many specimens in a large lot on the basis of only one or two identifications. It sometimes happens that not all of the material is the same species, and some specimens become misidentified.

Premature identification

The premature usage of "grape-vine" data for a new species, the description of which has not yet been published, often leads to misnomers. A potential new species, for instance, may be defined as two or more species before actual publication; or the researcher may change his mind about how to name the new species. Nothing is certain until publication is achieved (and even then one must be a little careful).

How many collectors would make errors translating and recopying this old label?

Label copying error

A variety of possibilities for error arise in the recopying of old labels, a task necessary because many specimens outlive the paper of their labels, and because of nomenclature changes. Sloppy copying, inability of the copier to spell carefully, inability of the copier to transliterate names from non-Roman alphabets or from illegible handwriting (common on old labels), all produce their share of labeling misnomers.

Pseudomorphism error

Although most collectors know that isometric argentite changes in structure to become monoclinic acanthite at temperatures below 179°C, it is remarkable how many specimens continue to be labeled argentite (what they were instead of what they are). More subtle is the case of pseudomorphism taking place *in the collector's cabinet,* due to loss of water and other changes. A good example is the dehydration of torbernite to metatorbernite, invalidating a label that was originally correct.

Certainly misnomers are more of a problem for the amateur than the professional, considering that a trained mineralogist with access to sufficiently sophisticated research instruments can usually make a correct identification. Harm can be caused, however, by the spread of incorrect data in people's minds, especially in cases where misnomers exist in university study collections used by students, or at heavily attended public exhibitions.

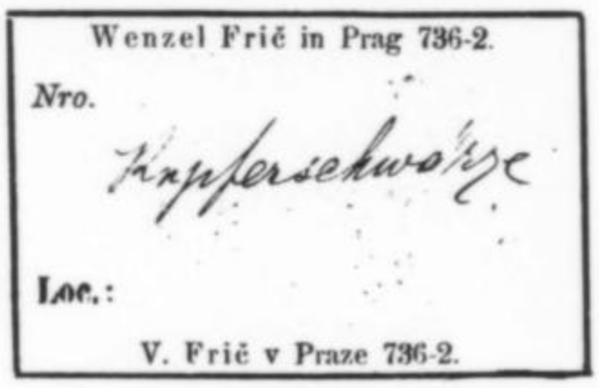
The Mislocation

The *mislocation,* or erroneous locality designation, is far more difficult to detect and correct than the misnomer. In addition, its origins are more numerous, including at least the following:

Locality secrecy

Attempts are sometimes made to disguise the true locality by giving a false substitute. This may be done in order to keep a locality secret from other collectors, perhaps because the original collecting was done illegally. This type of data camouflage usually takes the form of nonspecific, overgeneralized locality designations, but commonly turns to falsification through the use of fictitious mine names or even incorrect counties, states or countries. Many old abandoned mines have become renamed in this way, through the popular acceptance of the new mine name after the locality has become generally known, thereby legitimizing the mislocation. An example from Arizona is the name *Apache mine* for the mine designated as the *Vanadium shaft* on the Globe, Arizona, quadrangle map. Government policies of secrecy regarding strategic mineral deposits can also lead to false information.

A classic case in European mineralogy is the mineral milarite which, it eventually turned out, had been inadvertently *named* after a purposeful mislocation. It was first described from Val Mila in Tavetsch, Switzerland. The local Tavetsch strahlers had actually found all of the material in nearby Val Giuv, but purposely gave the wrong location to safeguard the type locality from other collectors and thereby maintain their monopoly on the new species.



Should the locality be guessed at?

No-locality avoidance

As mentioned above, collectors and dealers are loathe to have or sell specimens which are totally devoid of locality data. Consequently, locality designations are sometimes fabricated to fill the void. Although it cannot be proven, there is evidence that the fabrication of localities is more widespread than one might imagine.

Localities of purchase

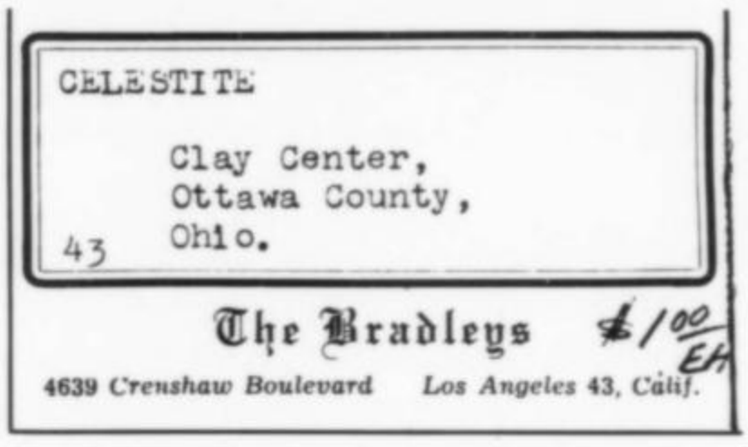
Dealers, lacking better data, may simple give the locality as the place where the specimen was *purchased,* presuming that place to be near the true but unknown (to them) locality. A good example of this is the designation *Governador Valadares, Minas Gerais, Brazil.* It is doubtful that any quantity of significant specimens has ever occurred within the confines of the city of Governador Valadares, but a great many have been purchased there.

Excessive abbreviation

Laziness on the part of many label writers and copiers or just a lack of space on the label has given rise to the elimination of the word "near" from a great many labels. The localities *near Yuma, Arizona* and *Yuma, Arizona* are very different, the former perhaps capable to indicating a locality 30 to 40 km distant from the latter. The shortening of *Yuma County, Arizona* to *Yuma, Arizona* or of *Old Yuma mine, Arizona* to *Yuma, Arizona* are also unfortunate, the latter especially so because the Old Yuma mine is *not* in Yuma County, nor near the town of Yuma, Arizona. Many collectors doubtless have their own horror stories about excessive abbreviation, but we give only a few illustrative examples here.

Recycled errors

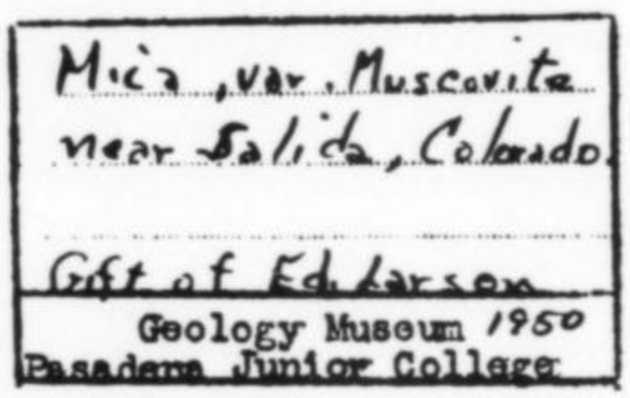
Incorrect localities for some specimens are sometimes inferred from previous errors. Comparisons with incorrect or outdated analytical/locality data in the literature, or comparisons with specimens previously attributed to incorrect localities (with no mention that it was an attribution) may yield new labeling errors of the same type.



Is it really from Clay Center, or one of the many quarries near several other Ohio towns?

Desirable localities

There exists a small army of mineral collectors who search for specimens from the localities mentioned in the mineralogical books of J. D. and E. S. Dana. There is no small temptation on the part of sellers to cater to these "Dana collectors" with intentional mislocations, and so we find "Dana locales" among the most common mislocations. Other collectors are not without their locality preferences as well. For instance, several mines and prospects in the general area of the Red Cloud mine in Arizona produce red wulfenite indistinguishable from that for which the Red Cloud mine is world famous, and such specimens are invariably labeled as coming from the Red Cloud mine. Dealers have been known to relabel specimens with localities their customers are interested in.



How far away is "near," and in what direction?

Where am I?

It can be very difficult for a field collector, particularly in remote areas having many unnamed abandoned mines, to know exactly where he is when a particular specimen is found. It can be even more difficult underground where the sense of distance and direction is distorted or obscured. Hence the locality given and truly believed by the original collector can be wrong.

Dump origins

Mislocations can arise from collecting on dumps or other non-*in-situ* areas followed by the making of tacit assumptions regarding the source of the material. This can be a knotty problem in areas where mining companies transport waste rock considerable distances from the mines, perhaps dumping waste from more than one mine in the same place or (worst of all!) using the waste rock from one mine to backfill portions of a different mine nearby.

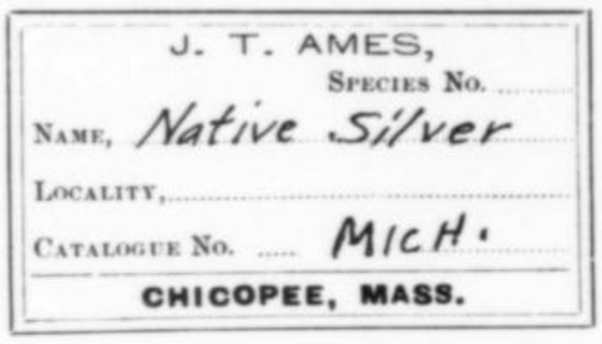
Switched labels

In collections having many specimens of the same species from different localities, there is the danger of labels being switched, especially if catalog numbers on the specimens are worn, illegible or missing. In addition, some very old specimens may carry several

catalog numbers, each pertaining to a collection of which the specimen was formerly a part, and possibly leading to confusion at a later date.

Fake specimens

If the specimen itself is fake, what does the given locality mean? If could be the locality of the crystal or of its matrix, or neither. We suggest all localities on fake specimens be termed "purported localities." (See Dunn, Bentley and Wilson, 1981.)


J. T. AMES,
SPECIES No. .....
NAME, Native Silver
LOCALITY, ...
CATALOGUE No. ..... MICH.
CHICOPEE, MASS.

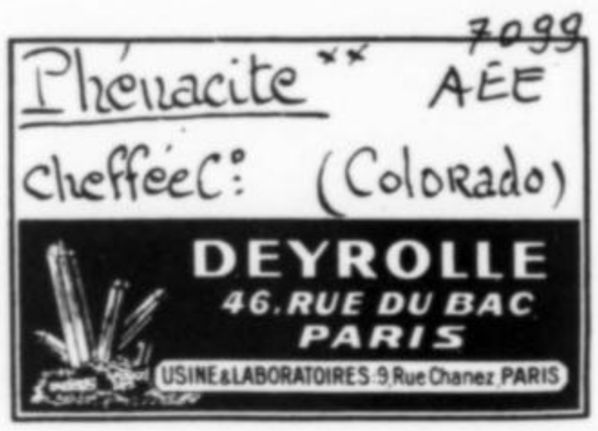
Would it not be tempting to expand upon this brief locality?

Excessive expansion

Collectors, dealers and curators are often tempted to expand the locality data given on a label when they think they know it in more detail. Innocent efforts of this type can introduce significant errors. For example, consider the place name *Trotter mine, Sussex County, New Jersey*. The components of this locality designation decrease in specificity from left to right. Examining a different label reading *Trotter mine, New Jersey,* we may be tempted to add the town and county so as to have greater completeness. This, however, assumes that there is and was but one Trotter mine in all of New Jersey, and if this assumption is incorrect the specimen could be attributed to the wrong mine. If the label read *Trotter mine, Franklin, New Jersey,* we might reasonably add *Sussex County,* but only after a careful geographic search indicated that there was no town named Franklin in any other county in New Jersey. However, if the label read *Franklin, Sussex County, New Jersey,* and we decided to add *Trotter mine,* we could introduce possibly incorrect specific information not deduced from hierarchical geography, but rather from pure, irresponsible speculation. This is not an uncommon practice, and yet it is a tragic one which can pollute the body of mineralogical knowledge with incorrect information. As a general rule, never add data of increasing specificity without indicating it as speculation, and be extremely careful in adding any data of decreasing specificity.

Erroneous attribution

Having come to the inescapable conclusion that many specimens are mislabeled, the obvious solution is to correct as many as possible when they are recognized. However, in doing so (by attributing the specimen to a locality thought to be more correct) the attributor should bear in mind his own fallibility and not destroy the old label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Phénacite ** AEE
Cheffée C°: (Colorado)
DEYROLLE
46, RUE DU BAC
PARIS
USINE & LABORATOIRES 9 Rue Chanez PARIS

Most likely Mt. Antero . . . but what if it isn't?

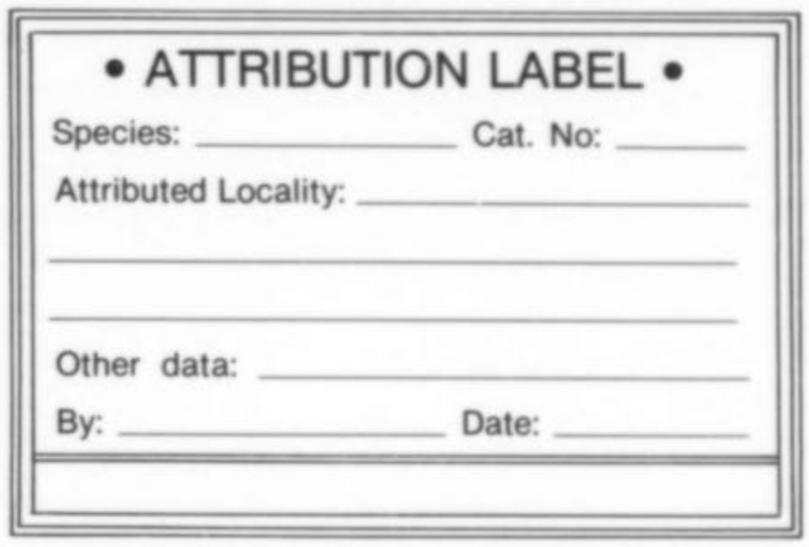
or any other records that accompany the specimen. Few museums and almost no collectors or dealers make any distinction between the originally noted locality and later attributions. The British Museum of Natural History is a notable exception, putting newer attributed data in square brackets. By leaving the original locality designation intact while adding the new attribution, we permit someone in the future to judge both locality statements and question either one. The attribution may be written on the old label, but it is better to prepare a second label indicating the attributed locality, the attributor and the date. The attribution label can then be attached to the original.

Attributions should always be viewed with circumspection because they are opinions by definition and not established facts. Misattributions are bound to occur.

SUGGESTIONS

The proliferation of labeling errors can be minimized if dealers, collectors and curators will take reasonable precautions. Suggested guidelines are as follows:

1. Never discard old labels. Retaining them, perhaps attached to the back of subsequent labels, will guard against copying errors and errors due to unwarranted expansion of the locality information. Some historical data will also be preserved.


• ATTRIBUTION LABEL •
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Attributed Locality: _____
_____
_____
Other data: _____
By: _____ Date: _____

Sample attribution label (reproduction permitted)

2. Use attribution labels, so that guests and visitors may provide possibly helpful information *properly qualified* as to source.

3. Keep abreast of published data on species and locality identifications, and update labels as necessary.

4. Use square brackets to indicate data added to original label information.

5. Avoid abbreviating data.

6. For self-collected specimens, give detailed locality information, noting especially if specimens were collected on a dump.

7. For specimens purchased from locals or natives who give no locality data, place your attributed locality in square brackets and/or note location of purchase ("Purchased in Mapimi, Durango, Mexico").

These precautions will guard against some, but not all, of the sources of labeling errors. Little can be done by responsible collectors against the carelessness and dishonesty of others which give rise to misidentifications. We can only suggest that people work to ferret out and correct existing errors, and that they not place undue trust in the information found on any label. It would certainly be too cynical to suppose that *most* labels are wrong; the vast majority are probably reasonably correct. But increased awareness and healthy skepticism will help in identifying and dealing with the rest.

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(continued from p. 98)

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THANKS LARRY!

In Robert Cook's article on Graves Mountain, we added a never-before-published photo of George F. Kunz, which was kindly loaned to us for that purpose by Lawrence H. Conklin. Unfortunately, the credit slug was erroneously given as "MRL" (Mineralogical Record Library). So, a belated thanks, Larry! (The picture will also appear in Larry's book on Kunz; see vol. 16, no. 5, p. 328.)

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Mineral Localities in Austria

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Austria has many small occurrences which are mineralogically very interesting, even though it is not particularly rich in economic mineral deposits. Localities in the eastern Alps are especially important. Several of these are famous worldwide and are represented in many public and private collections.

INTRODUCTION

Austria can be divided into three principal areas: the crystalline complex of the Bohemian Massif on the north, the eastern Alps (covering roughly two-thirds of Austria), and the Tertiary basin which separates them and extends to the east.

Specimens from some of the occurrences, particularly from the Alpine clefts, are known to only a few people. Despite perfect crystallization and good size, these minerals are poorly known outside Austria because generally only a few specimens or a single crystal comprised the discovery in each case. Prime examples include the fantastic scheelite from Dunkelklamm, datolites from Kratzenberg in Habachtal, the apophyllites from Grosser Lienzinger in Hollersbachtal, bornite from the Frossnitz area in eastern Tyrol, the rare euclases from Modereck-Hocharn Ridge, remarkable holmquisite crystals from Koralpe in Carinthia, and so on. We present here a collector's overview to some of the important minerals and their localities in Austria.

MINERALS

Epidote

The most important locality in the Alps (and in all of Austria) is undoubtedly Knappenwand in the Untersulzbachtal,* where the famous epidotes occur. The deposit was discovered in 1865 by a mountain guide from the nearby village of Bramberg, and has since provided a profusion of superb epidote crystals and crystal groups. The occurrence has been visited by countless collectors over the years, and has even been mined from time to time in the past. Nevertheless, fine specimens continue to be found, and many excellent pieces were recovered just recently during scientific investigations there financed and organized by the Natural History Museum of Vienna. In addition to epidote, beautiful apatite, scheelite, titanite, quartz, albite, acicular actinolite (*byssolite*), various habits of calcite and several other species were found. An 8-cm group of two water-clear apatite crystals with byssolite inclusions probably ranks as one of the finest apatite specimens in the world. [Ed. note: an article on this famous locality is scheduled for the next issue.]

Beryl

Books have been written about the emeralds from Leckbachrinne in Habachtal, Salzburg. Though it is not the only emerald locality in Europe or even in Austria, it is visited by many people each year. Interestingly enough, even such a heavily frequented locality can still yield newsworthy discoveries. Phenakite crystals to

*Translatable components of Austrian locality names include the following: -tal = valley, -berg = mountain, -burg = town, hohen = high, unter = lower, ober = upper, -boden = valley floor, -bach = brook or stream, gross = great, schwarze = black.

10 cm were found there a few years ago, right near the surface. Some of the crystals were of gem quality and yielded cut stones of up to 55 carats.

Aquamarine beryl can also be found in the Alps, particularly in the Hohen Tauern, the central and highest part of the eastern Alps. The best crystals came from the so-called "Beryller" in Untersulzbachtal, and reach 8 cm in length. They are a deep blue in color and are partially gemmy. Fine aquamarines to several centimeters are also known from the Felbertal scheelite mine in Salzburg, though most are heavily fractured.

Kainosite and Synchysite

In recent years one of the most popular localities among collectors and micromounters has been Hopffeldboden in the Obersulzbachtal. Here many rare crystals and microcrystals have been found, including orange crystals of kainosite to 1.5 cm, well-formed synchysite, hematite "iron roses," and fluorite in a range of colors.

Fluorite

Fluorite is a relatively common mineral in the Alpine clefts. The largest and finest examples from the eastern Alps have come from the old Achselalm lead-zinc mine in Hollersbachtal. In the course of mining, a cleft was opened which yielded fantastic fluorite octahedrons to 12 cm (nearly 5 inches) in size. The best of these are now in the collection of the University of Padua, Italy.

Very fine fluorite crystals, bi-colored rose and green, have been found in various tunnels of the Hohen Tauern electric power station (e.g., the Schlegeis gallery and Theresien gallery near Böckstein). Remarkable specimens have also come from clefts at Hocharn (west side), which are bi-colored deep purple and rose, and reach several centimeters in size.

AUSTRIA

Scheelite

Scheelite has been found as fine crystals at many places in the Hohen Tauern, including Rauris, Stubachtal, Hollersbachtal, Untersulzbachtal, Krimmler-Achental and Laperwitzbachgraben near Kals. However, the most beautiful Austrian scheelite was found in the Dunkelklamm in Habachtal in 1898 by A. Wurnitsch (he was also the discoverer of epidote at Knappenwand). The crystal is a well-formed tetragonal dipyramid, water-clear and free of damage; and it weighs 550 grams, well over a pound! Unfortunately the discovery consisted of this single crystal alone, but perhaps more will be found some day. In any case, the crystal is currently on exhibit at the Natural History Museum of Vienna.

Datolite

The largest and finest Austrian datolite crystals have come from an Alpine cleft on the northern slope of Kratzenberg in Habachtal. These reach a remarkable 11 cm in size, and crystals nearly as large have been found just recently near the head of the Obersulzbachtal. Excellent specimens in groups of many crystals have come from Lienzinger in Hollersbachtal; they occur with corroded quartz, thick tabular apophyllite crystals to 5 cm, adularia (orthoclase), calcite, chlorite, titanite and laumontite.

Titanite

Titanite is widespread in the Alps, and many fine single crystals and groups have been collected from numerous localities. Excellent specimens have been reported from occurrences in Laperwitzbachgraben near Kals in eastern Tyrol (with large scheelite and milarite crystals), in Stubachtal (discoveries made just recently), at Schiedergraben in Felbertal, at Teufelsmühle in Habachtal, and from Schwarzes Hörndl in Untersulzbachtal. The largest titanite crystals in the Alps have come from the Schwemmhoisl quarry near Deutschlandsberg in Styria. Titanite crystals to 18 cm (7 inches!) in size have been found at this quarry, associated with large quartz crystals, fine ilmenite, albite and axinite.

Rutile

Deep red rutile crystals forming reticulated sheets (*sagenite*) have been found recently at Stubachtal. The collector who found these (A. Steiner of Bramberg) was awarded the Alpine Strahler Prize at the 1983 Munich Show.

Also well-known are the rutile crystals in quartz from Modriach at Packalpe, and from various occurrences at Saualpe in Carinthia.

Brookite and Bornite

The Grossvenediger Range has yielded some of the finest crystallized minerals in the eastern Alps. Excellent epidote, apatite, emerald, titanite, scheelite, fluorite, datolite, aquamarine, kainosite and many other species have come from the northern side of the mountain chain; however, from the southern side have come the largest and finest brookite and bornite crystals in the Alps.

Thin, tabular brookite crystals to 7 cm have been found at Vorderen Eichamspitze in eastern Tyrol. The largest bornite crystal, from the nearby Frossnitz Alpe, measures 5.6 cm. One crystal from Frossnitz now in the collection of the Natural History Museum of Vienna measures 4.3 cm. The locality was discovered in the late 1800s, but no new finds have been made there since then.

Figure 1. **A view of the Sulzbach Valleys, Untersulzbachtal (left) and Obersulzbachtal (right). The town of Rosental is in the lower foreground. Photo by the author.**

Euclase

To the west the Zillertal and Tuxer Alps in Tyrol adjoin the Grossvenediger. From near the Austrian-Italian border, mainly on the Italian side, have come remarkable euclase specimens. The Zillertal Alps are well-known among collectors for excellent amethyst, hematite "iron roses," and large apatite crystals. Fine specimens continue to be found there, some very recently. The "iron roses" from Saurüssel reach 15 cm (nearly 6 inches) in size and compare well with the famous Swiss examples.

From the same assemblage have come fine apatite and amethyst. The thick, tabular apatite crystals reach 10 cm, and the variegated purple amethyst crystals, some of them sceptered, are known as large as 34 cm. The largest apophyllite crystals in the Alps, up to 5 cm, have come from excavations at the Floitental-Stilluppgrund power plant.

Garnet

The occurrence of garnet near the Berliner Hütte in Zemmgrund must certainly be mentioned. The garnets have been mined intermittently in the past, and cut and sold as "Bohemian garnets." Crystals to 12 cm have been found in Pusygraben near Lölling in Carinthia. The rough for a garnet-encrusted box 3 x 5 x 7.5 cm came from Stubalpe in Styria; the box is now on exhibit in the gem collection of the Natural History Museum of Vienna.

Lazulite and Wagnerite

Many collections today contain beautiful lazulite crystals from a locality near Wurfen in Salzburg. It was discovered in the late 1800s. Crystals reach several centimeters and commonly show a very deep blue color. From the same assemblage have come partially transparent crystals of wagnerite up to several centimeters in size; these are among the finest known crystals for the species. The best are on exhibit in the British Museum (Natural History).

Wulfenite

There are far too many interesting occurrences in Austria to list here, but we must not forget the various metal mines, of which the Bleiberg-Kreuth lead-zinc mine in Carinthia is perhaps the most famous. Wulfenite from the oxidation zone at Bleiberg was first described by F. X. von Wulfen in his rare and beautifully illustrated book *Karnthnerischen Bleyspate* (1785). Haidinger named the new species for von Wulfen a few years later.

Wulfenite at Bleiberg occurs in various habits and colors. Thick, tabular crystals to 2.5 cm have been found in recent years at the Stephanie mine in the eastern part of the district; they are the largest known Austrian wulfenites. Cerussite, calcite in large scalenohedrons, barite, galena and hemimorphite have also been found in nice crystals at Bleiberg. And Bleiberg is the type locality for hydrozincite and ilsemannite. [Ed. note: an article on this famous locality is currently in preparation.]

Other Occurrences

Many other well-known and popular occurrences exist in Austria. The so-called "Prehnitinsel" ("prehnite island") in Habachtal has yielded well-crystallized fluorite, apatite, adularia (in crystals to 15 kilograms!), prehnite, laumontite, apophyllite and others. Schwarze Wand on Hollersbachtal is known for fine hessonite (=grossular) garnets. Totenkopf in Stubachtal has yielded large magnetite crystals, yellow apatite, gem-grade peridot, perovskite, diopside and vesuvianite. From the northern part of the Eiskögele in Stubachtal have come what are probably the largest quartz crystals ever found in the Austrian Alps: single crystals up to 618 kg (1360 pounds), now on exhibit in the Haus der Natur in the city of Salzburg.

Several very rare minerals have been found recently: friedrichite, eclarite and aschamalmite from the Grossvenediger area, and the Mg-borate karlite from the Zillertal Alps.

Figure 2. **In addition to epidote, the Knappenwand locality is famous for remarkable apatite specimens. This one, measuring 8 cm (3 inches) across, consists of two thick, tabular, water-clear crystals with actinolite ("byssolite") inclusions. Natural History Museum of Vienna collection and photo.**

Figure 3. **One of the fine Knappenwand epidotes, 15 cm across, in the Natural History Museum of Vienna collection. Photo by R. Seemann.**

Figure 4. **The bornite occurrence at Frossnitz is among the most interesting cleft mineralizations in the Alps. The crystal shown here measures 4.3 cm and is associated with albite, calcite and native gold. Natural History Museum of Vienna collection and photo.**

Figure 5. **A fine group of "sagenite" (reticulated rutile) 8 cm across, on quartz, from Schrattwand in Stubachtal, Salzberg. Found by A. Steiner in 1983 and still in his collection; photo by L. Niedermayr.**

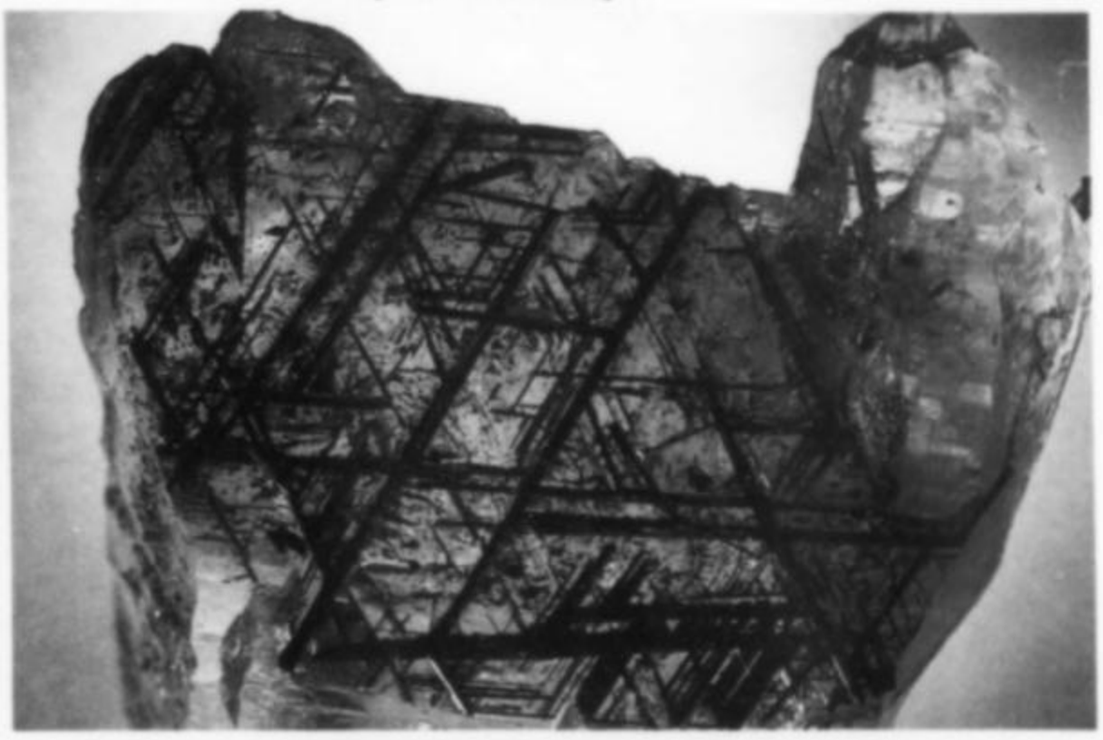

Figure 6. **Titanite crystals to 1.5 cm from Teufelsmühle, Habachtal. Werner Lieber photo.**

Figure 7. **Wulfenite crystals to about 1 cm, from the Stefanie mine, Bleiberg, Karnten (Carinthia). Smithsonian collection.**

Crystalline basement rocks of Carinthia and Styria have also yielded many interesting finds: remarkable epidote crystals from Gertrusk, prehnite and axinite from Weinsberger Graben in Saualpe, large spodumene crystals imbedded in pegmatite, and very fine violet holmquistite aggregates of radially fibrous crystals from Brandrücken at Koralpe, to mention a few. Not far away from Brandrücken fine specimens of hessonite and vesuvianite have been found. The pegmatites at Millstätter Seenrücken in Carinthia have recently yielded some rare phosphates including wardite, childrenite, brazilianite, scorzalite, amblygonite, augelite and heterosite.

Among the commercial mines, the magnesite mines of Oberdorf an der Laming and Hohentauern in Styria and the Mitterberg copper mine in Salzburg have been sources of interesting specimens. The Styrian Erzberg near Eisenerz is the locality for beautiful "iron flowers" of aragonite, and also excellent crystals of cinnabar and metacinnabar in cavities in siderite. Oberdorf an der Laming provides partially transparent magnesite crystals to 10 cm and also various habits and colors of strontianite. The Hohentauern mine produces dolomite crystals to 15 cm (pale orange in color), and gem-quality apatite crystals to several centimeters in size. The Mitterberg copper mine at Hochkönig has produced fine crystallized chalcopyrite, arsenopyrite and, in recent years, native gold with uraninite and brannerite.

CONCLUSIONS

This compilation covers only a small selection of Austrian occurrences; probably several others should have been mentioned as among the most significant. But it was not my intention to give a full listing of interesting occurrences. Rather I wished to convey to the reader a sense of the excitement we feel here for Austrian minerals, and to show in part some of the fine things that have been discovered here. With luck we can expect that more fine mineral occurrences will come to light in the future.

Vanadinite from the J. C. Holmes Claim Santa Cruz County, Arizona

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In 1982 and 1983, a deposit of vanadinite was worked which immediately became one of Arizona's premier occurrences, along with the Old Yuma, Gray Horse, and Apache mines. Specimens are distinctive and easily recognized because of their color and morphology.

LOCATION

The J. C. Holmes claim is located in Santa Cruz County, Arizona, at the southeastern end of the Santa Rita Mountains. The site is about 3 km northwest of the town of Patagonia, near Temporal Gulch, in Sec. 36, R15E, T21S. Access from Highway 82 is via the first turn-off on the northern outskirts of Patagonia, eventually branching to the left near a ridgecrest and arriving at the town dump. From the dump one proceeds downhill to the right on a poor dirt road to the first gully, and then left along the gully by foot to the outcrop. The site is all but invisible within this steep-sided gully until one is virtually on top of it.

The local climate is high desert (Upper Sonoran vegetation zone) characterized by grasses and sparse cacti, juniper, piñon pine and mesquite with trees and bushes scattered across the undulating foothills, and large cottonwoods in the creek and canyon bottoms. Local streams are intermittent, although a few local springs are permanent.

Local animal life can be dangerous. The area is open range for Brahman cattle, and the bulls have been known to chase mineral collectors (including even the editor of the *Mineralogical Record* . . . these animals have no respect). Rattlesnakes and scorpions are common. But the most interesting native life form is the giant, and poisonous, desert centipede (*Scolopendra heros*), which achieves its largest known size in this area. Generally attaining a maximum length of 20 or 30 cm elsewhere in the Southwest, specimens as large as 46 cm (18 inches!) have been dislodged from the rocks at the Holmes claim by startled collectors.

HISTORY

The deposit was apparently first staked by a prospector named J. C. Holmes; at least this is the name turned up on early claim papers by the late mineral dealer Dick Jones (see Bideaux, 1983). Jones rediscovered the site in the 1950s but did very little work there. In later years, however, Jones took a number of other local collectors to see the outcrop, and so knowledge of its existence did not perish with his death.

By coincidence, several people who had known of the claim descended on it separately beginning in November, 1982, and all made important discoveries of specimens. These people included Neal Pfaff, Lou Heinle, Charles and Joy Freed, and us. The claim is currently owned by Neal Pfaff (Columbus, Ohio) and one of us (GN); collecting without permission is strictly forbidden.

GEOLOGY

Rhyolite of the Bathtub formation (Cretaceous) is cut by many steeply dipping, east-west trending, subparallel faults. Most of these contain quartz veins, or silicified zones, and are probably local effects of the Gringo Gulch pluton, a Tertiary dacite porphyry intrusion (Drewes, 1971).

There is no trace of sulfide ore mineralization remaining at the Holmes claim, although galena is probably the primary mineral, judging from other Arizona deposits. Vanadium, as trace amounts in the ground water, reacted with weathering galena. This resulted in the crystallization of vanadinite and a little mottramite at and just below the former water table in the quartz vein, in a roughly

Figure 1. **Red vanadinite crystals to 1.3 cm; from the Holmes claim. Novak collection.**

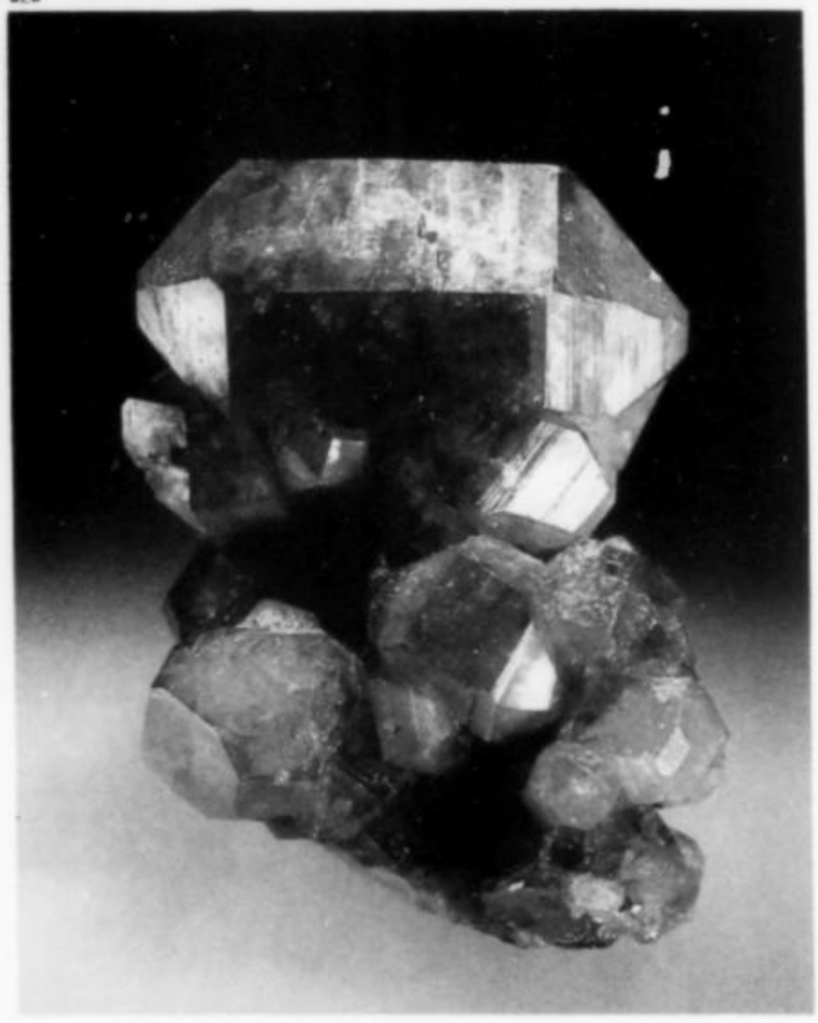

Figure 2. **Yellow vanadinite crystal, 1 cm; from the Holmes claim. George Godas collection.**

Figure 3. **Red vanadinite crystals in parallel growth, 3.3 cm tall; from the Holmes claim. Novak collection.**

horizontal zone. Vanadinite is found on breccia fragments and lining cross-fractures probably developed as a result of minor post-silicification movement on the fault.

Aside from the main occurrence, several other prospect pits and short adits have been driven nearby in other places on the quartz vein. None of these, as far as we know, have been excavated in recent times and none appear to be significantly mineralized.

MINERALS

Vanadinite $Pb_5(VO_4)_3Cl$

Vanadinite from the Holmes claim is transparent to opaque, dull to very bright in luster, and yellow to yellow-orange, orange and orange-red in color. Single crystals as large as 2 cm have been

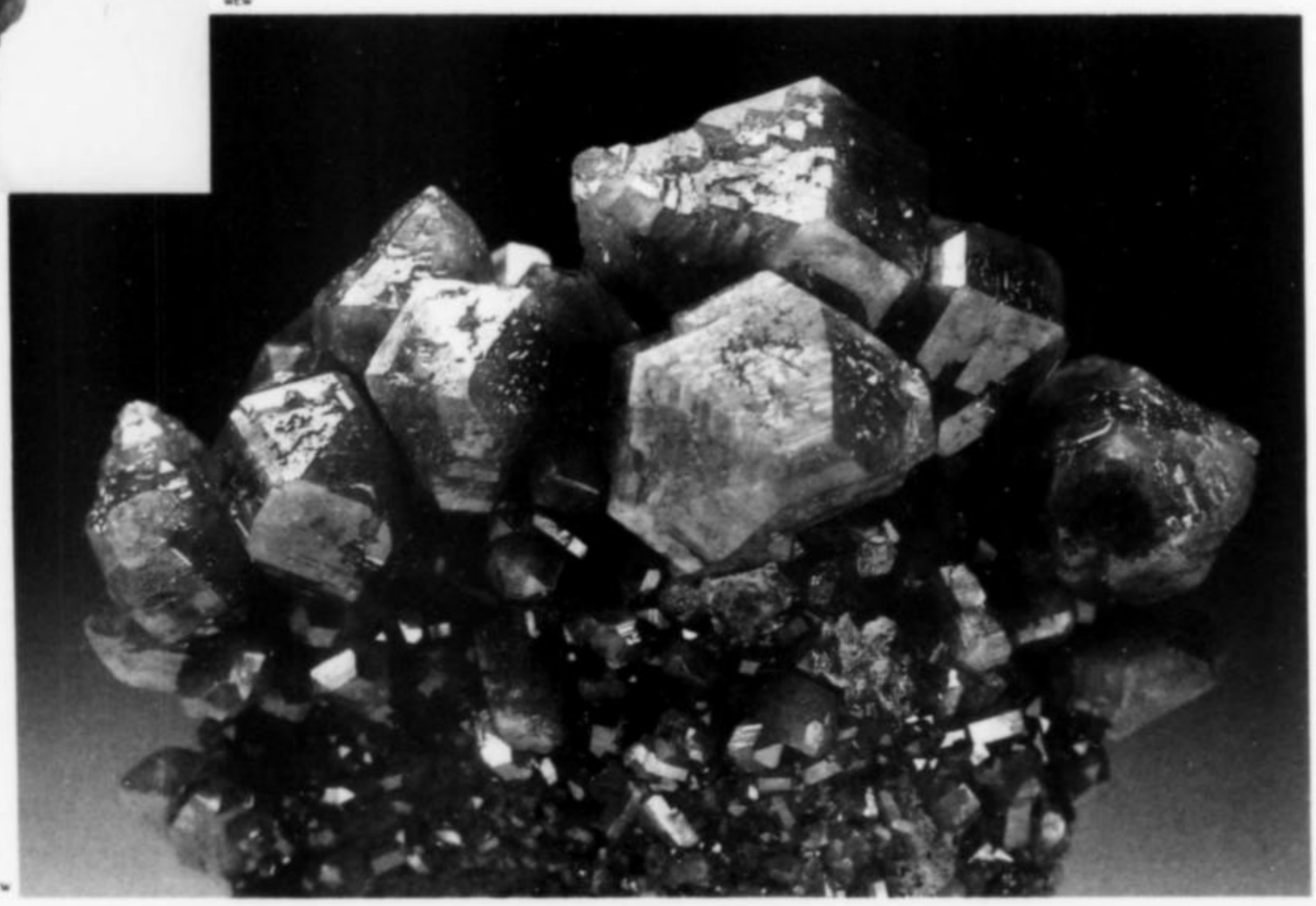

Figure 4. **Orange vanadinite crystals to 1.2 cm showing stepped growth; from the Holmes claim. Mark Hay collection.**

Figure 5. **Red-orange vanadinite crystal of distorted habit, flattened into tabular form along a prism face; from the Holmes claim. Novak collection.**

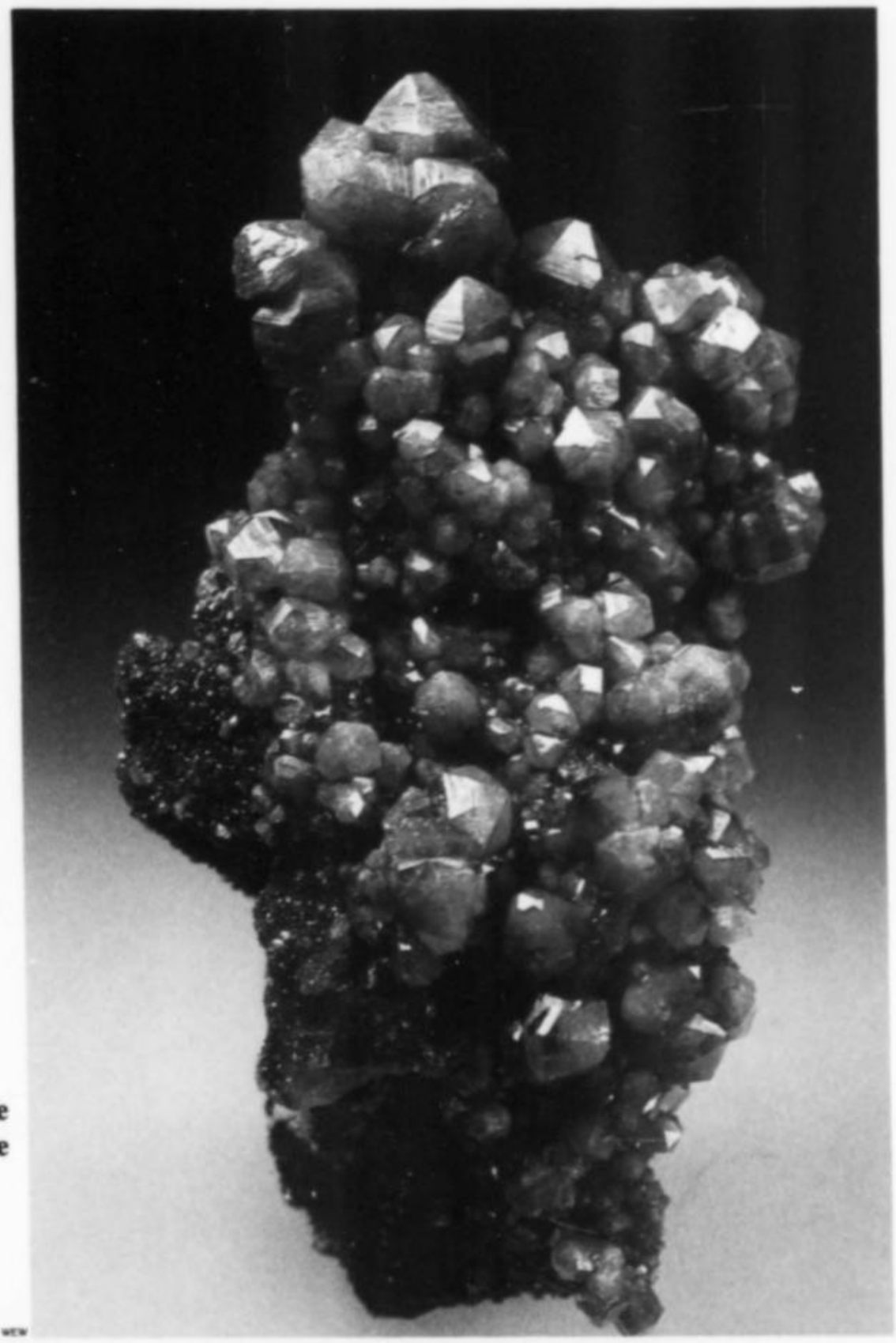

Figure 6. **Large group of orange vanadinite crystals 8 cm tall; from the Holmes claim. Besse collection.**

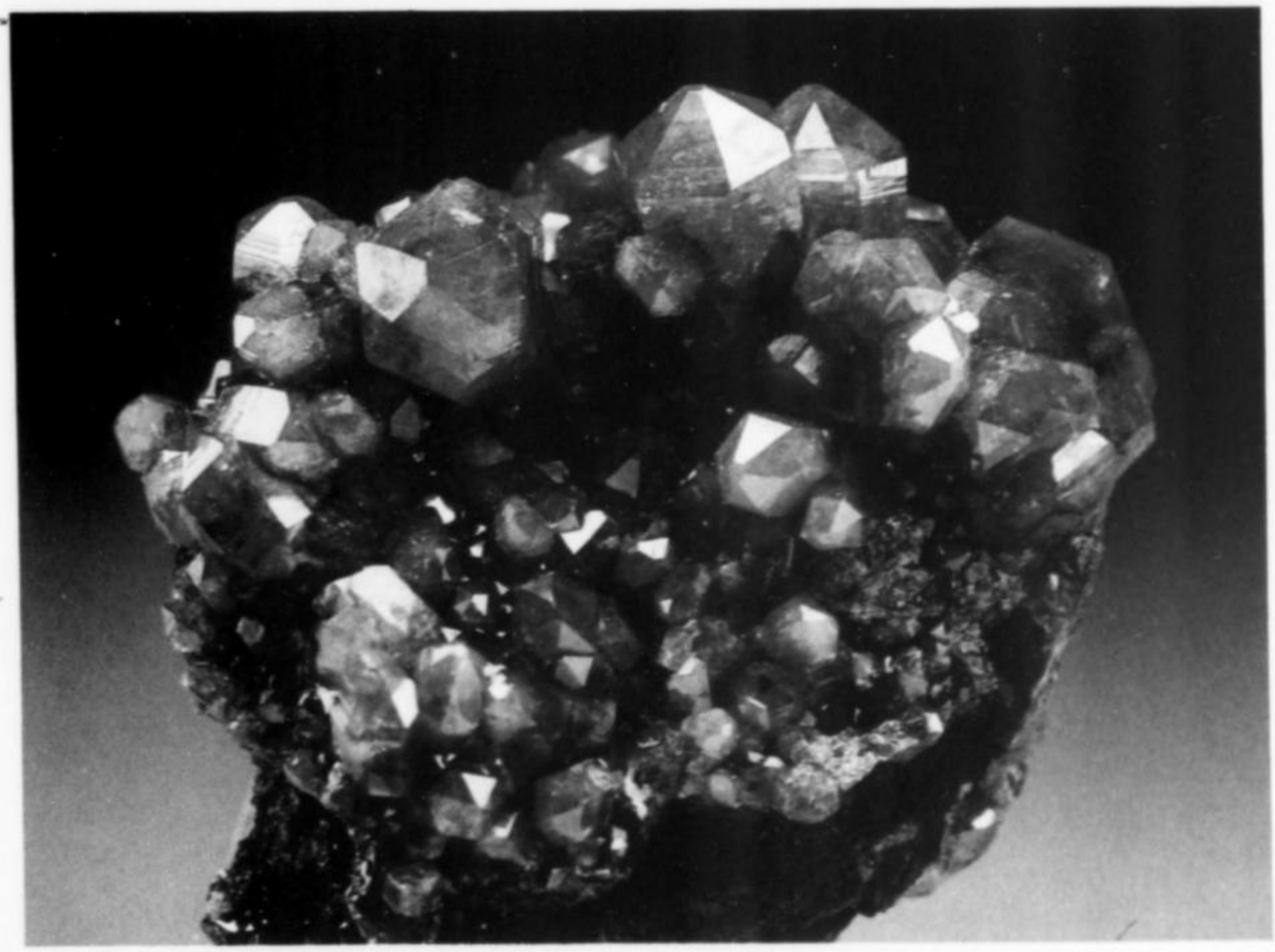

Figure 7. **Fine thumbnail-size group of variable-color yellow to orange vanadinite crystals 2.4 cm across; from the Holmes claim. Tom Gressman collection.**

Figure 8. **Outcrop of the silicified fault zone showing collector-dug workings in a roughly horizontal band. Note person at center for scale.**

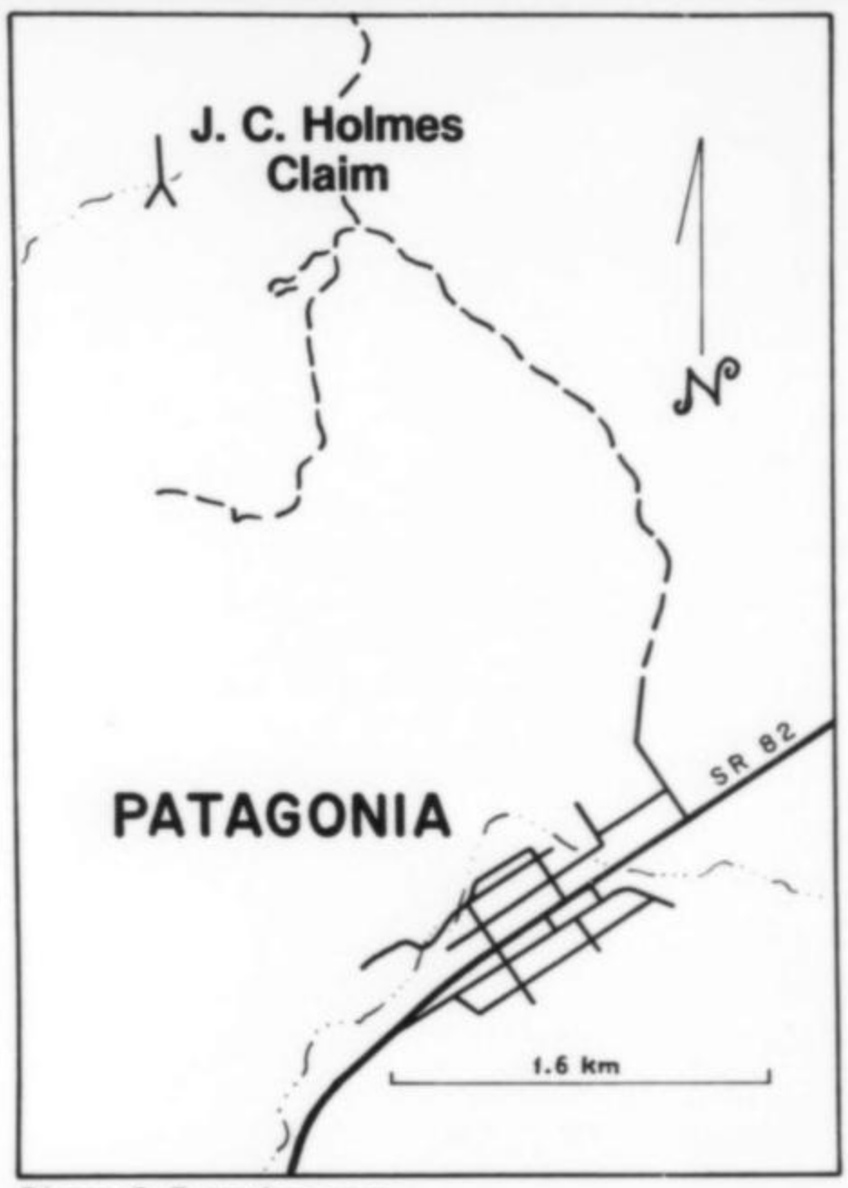

Figure 9. **Location map.**

found, although most are 5–10 mm. Parallel-growth aggregates reach 4 cm in size. The habit is equant to slightly elongated along *c*, dominated by the simple hexagonal prism $m\{10\bar{1}0\}$ and dipyramid $x\{10\bar{1}1\}$ in roughly equal development. It is the prominent dipyramid which makes these specimens so morphologically distinctive. The dipyramid is sometimes truncated by a small development of the *c* pinacoid {0001}, but in other cases *c* is absent. The rare dipyramids $y\{20\bar{2}1\}$ and $z\{30\bar{3}1\}$ are also occasionally seen to a minor degree. The accompanying photos and crystal sketch illustrate variations in the habit.

Some crystals exhibit viscinal *x* and *y* faces, some show a stepped growth, and some a hopper development. In a few cases distortion has yielded a tabular habit, flattened on *m*. The forms *m*, *x*, and *y* are commonly striated perpendicular to the *c* axis.

A semiquantitative spectrochemical analysis indicates that the vanadinite is relatively pure end-member in composition. Only a minor amount of As_2O_3 and a trace of P_2O_5 were detected.

Many specimens have a dull luster which is probably the result of weathering. The occurrence is virtually at the surface, or just a meter or two below. However, some pockets were found to be filled with a dense clay relatively impermeable to solutions, and the vanadinite removed from this material has retained its bright luster.

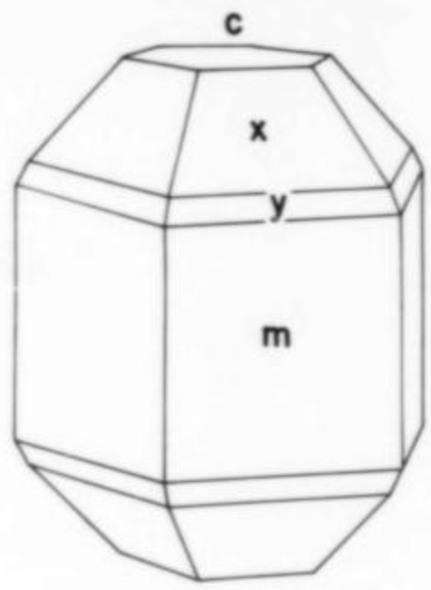

Figure 10. **Crystal sketch showing common forms and habit for Holmes vanadinite.**

Figure 12. **Early illustration showing an Arizona cowboy startled by a giant poisonous centipede of the type common around the Holmes claim (Beebe and Clegg, 1955).**

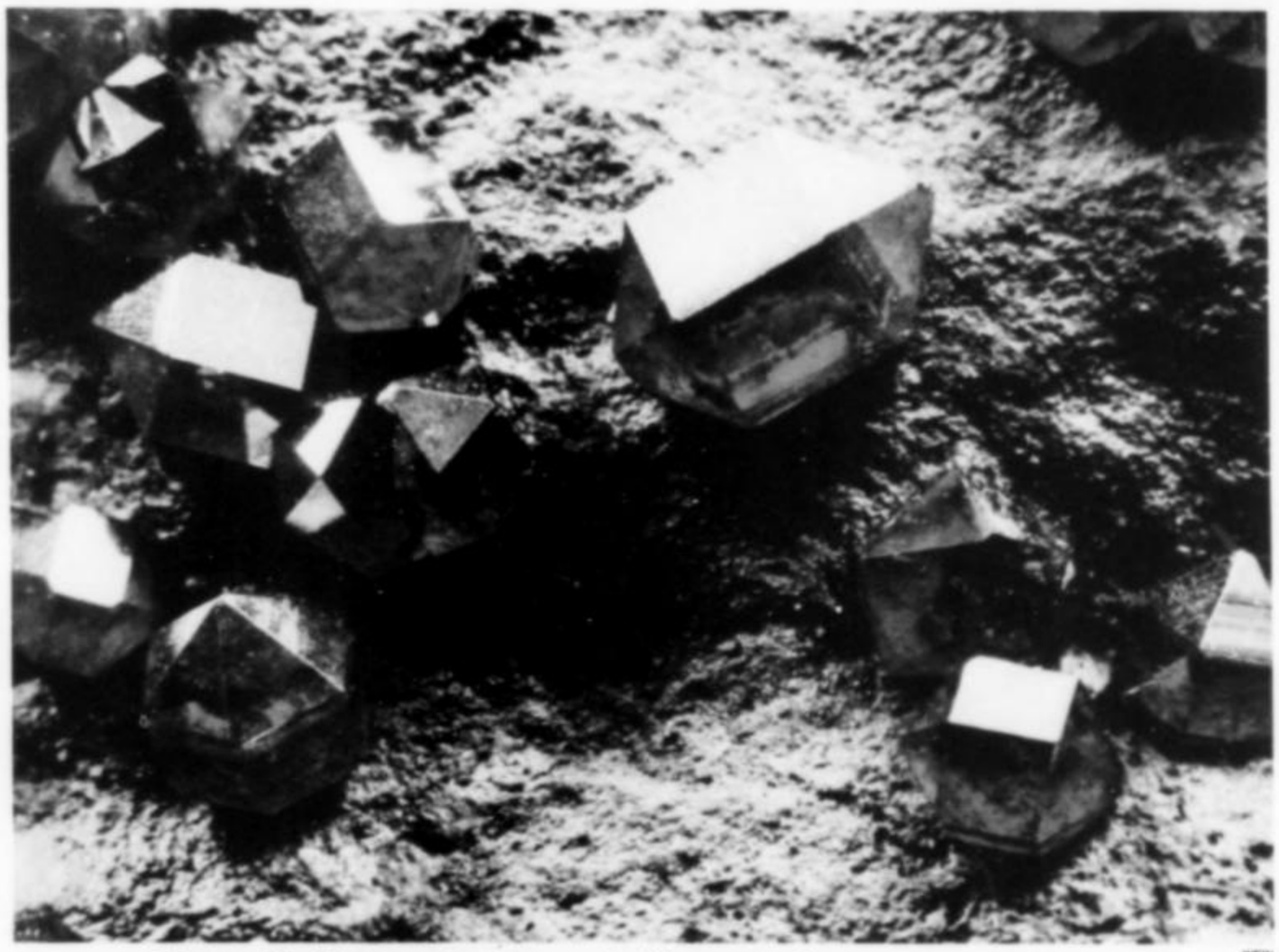

Figure 11. **Gemmy, transparent yellow vanadinite crystals to 3 mm; from the Holmes claim. Mark Hay collection.**

Mottramite $(Cu,Zn)Pb(VO_4)(OH)$

Mottramite commonly forms thin, yellow-orange scales on matrix surfaces between vanadinite crystals. It is easily mistaken for vanadinite. No chemical analysis has been performed, but the X-ray data resemble the pattern for mottramite more closely than descloizite.

Hematite Fe_2O_3

Dark gray to black crusts, tabular crystals and tiny rosettes of hematite are common but not abundant. The crystals do not exceed 0.5 mm and are generally not found on vanadinite.

Quartz SiO_2

Euhedral quartz crystals line flattened vugs in the silicified zones, but not the perpendicular cross-fractures containing vanadinite. Vanadinite is rarely found in the quartz vugs.

Clays

Pocket clay at the Holmes claim is a brick-red mixture of interlayered montmorillonite-chlorite with traces of kaolinite and limonite. It is well-indurated and very difficult to remove from specimens, becoming almost as hard as porcelain when completely dry. Several days of soaking in water are necessary to soften it somewhat, and ultrasonic cleaning is not effective. Successful removal requires a lot of "elbow grease."

The pockets nearest the surface have commonly had their clay filling washed out. Some of these are open and others have been subsequently filled by a light-colored sand or brown soil.

CONCLUSION

Vanadinite from the J. C. Holmes claim is one of Arizona's most distinctive finds in recent years and easily ranks with other prominent occurrences statewide. The deposit, however, is very small; it may well be worked out already. Furthermore, it is under claim and is home to several biological hazards. Consequently, collecting there is not recommended.

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the Michigan Gold Belt

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Placer gold has been reported from various places in Michigan but the only known location for gold-bearing veins is an area northwest of Ishpeming known as the "gold area" or "gold belt." Most of the local prospects are open, and the belt is today a popular collecting area.

LOCATION

Most of the 20 or so gold mines and prospects that once operated in Michigan were located within a few kilometers of Ishpeming, a town which is better known for its iron mines. The most famous of the gold mines is the Ropes mine, located in Section 29, T48N, R27W. The majority of the gold mines and prospects are located within Townships 48–49, Ranges 26–28W.

HISTORY

The discovery of gold in Michigan is usually credited to the first State Geologist, Dr. Douglass Houghton. In 1845 Houghton, who was conducting what was to be his last geological survey of Michigan's upper peninsula, was exploring the southern shore of Lake Superior and was camped near the mouth of the Chocolate River. Another group of men attached to the survey was operating several kilometers from this location, near the present-day city of Negaunee. One day Houghton visited Samuel Hill at the Negaunee camp to see how things were going on that end of the survey. According to well-circulated reports, Houghton arrived at Hill's camp in the afternoon and, after resting and refreshing himself, left camp and went out among the hills. No one knows exactly where he went but it is believed that he headed in the general direction of the highly mineralized area which lies north of the present-day city of Ishpeming.

He returned before dark and approached Hill, asking him if he knew that they were camped in a gold area. Hill replied that he did not and Houghton then produced several nuggets of coarse gold which he claimed to have found in a nearby stream bed.

Hill then inquired as to the nature of the deposit and Houghton replied that he did not have the opportunity to examine the outcrops in great detail. Houghton requested that nothing be said about the discovery because he was concerned about the possibility that men currently working on the survey might leave and go prospecting on their own.

It was later rumored that Houghton had stated something to the effect that people would go wild when he told what he knew about precious metals in the Lake Superior Country.

Unfortunately Dr. Houghton did not live to verify his discovery; he was drowned in a Lake Superior storm that fall. He left no notes or records documenting the location of his find.

Reports of gold in Michigan surfaced again in 1864. DuBois and Williams, analytical chemists of Philadelphia, found gold in ore specimens they were analyzing from the Holyoke silver mine, which was located about 13 km north of Ishpeming. The gold-bearing quartz assayed at several hundred dollars a ton.

Consultants were employed to make a determination on the feasibility of increased mining activity at the Holyoke mine.

Unfortunately these consultants had no previous experience in the area and knew very little about the geology. That fact, combined with poor management of the Holyoke mine and the skepticism of most investors, lead to the closing of the Holyoke and other local silver-lead mines in 1866.

It is worth mentioning that several years later the Fire Center Gold Mining Company did some work near the location of the old Holyoke mines. They took several thousand dollars worth of gold from a shaft sunk in granite which contained many small stringers of gold-bearing quartz. Other quartz veins containing small amounts of gold were found on the property but were not mined or satisfactorily investigated.

The largest, most productive, and most famous gold mine in Michigan was discovered by Julius Ropes. Ropes moved to Ish-

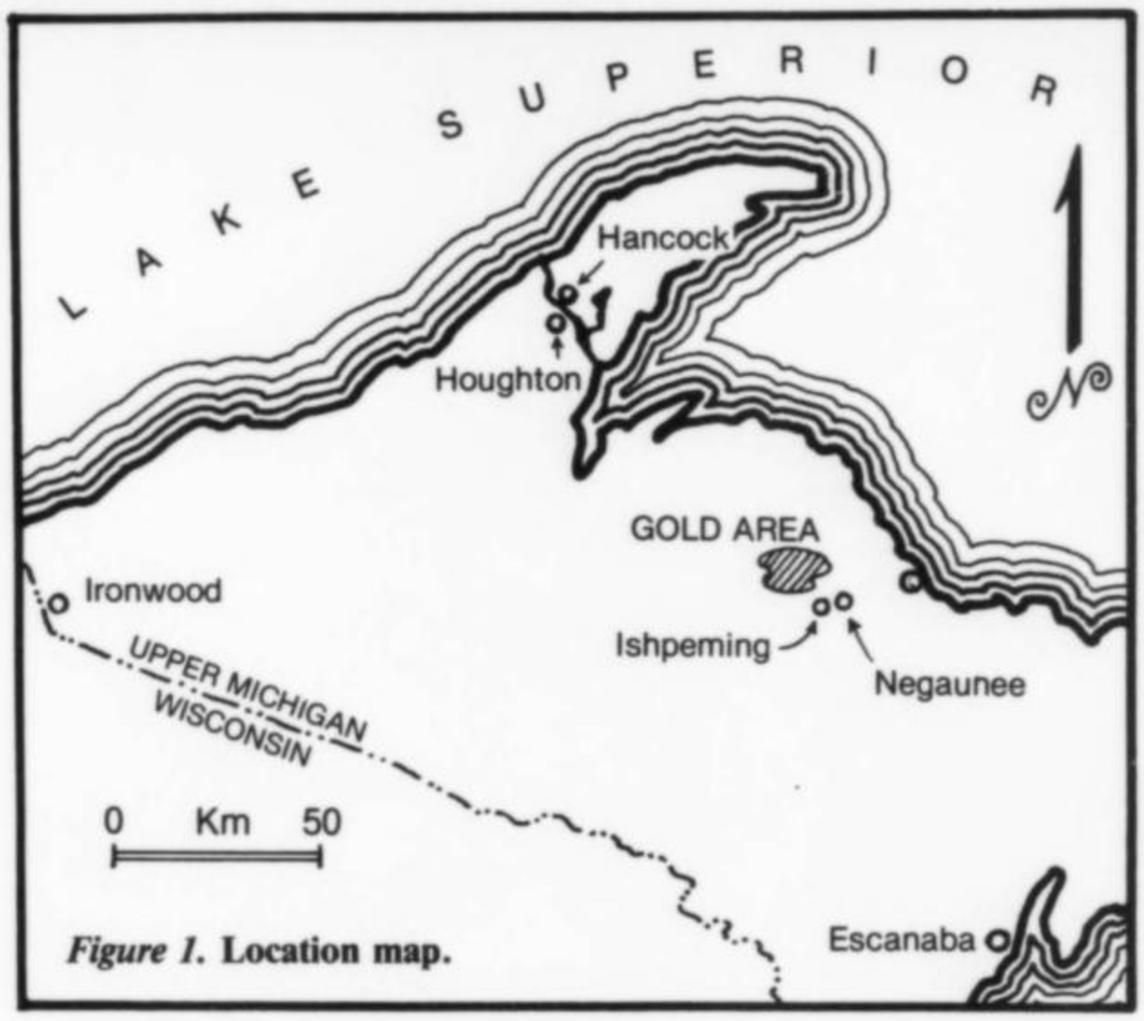

Figure 1. **Location map.**

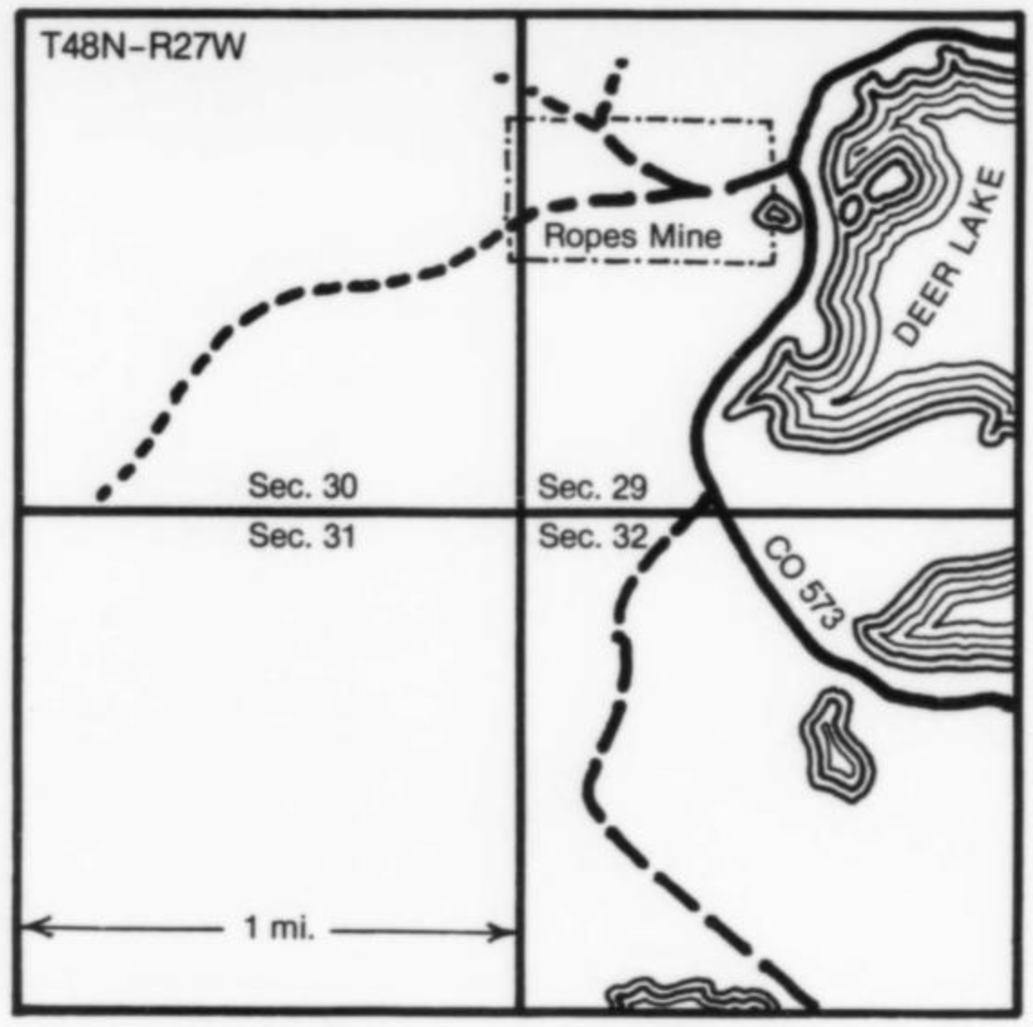

Figure 2. **Julius Ropes, discoverer of the first gold mine in Michigan. Photo: Marquette Historical Society.**

peming in 1867 and, although a druggist by trade, his real interest was in geology. For several years he spent his spare time prospecting north of town. Ropes became quite well-known in Ishpeming and, because of his diligent field study, was considered to be an expert on the geology of the area. He was once asked to settle an argument between two loggers who felt that they had found a piece of petrified wood. Ropes identified the specimen as asbestos and, upon ascertaining the location of the loggers' find, began an extensive geological study of the area. He spent the next several years examining the asbestos veins and serpentinized marbles which were located some 8 km north of Ishpeming.

In the early summer of 1881 he found a gold-bearing quartz stringer on the north side of a valley in Section 29, T48N, R27W. Encouraged by his find he continued searching in this section and located the mineralization some 260 meters west of his original find. Assays of the quartz from the point of discovery gave values as high as $442 a ton, the values being principally in gold.

The find stimulated a great deal of local interest but did not cause a general stampede into the hills as similar discoveries had done in the Western states. In the first place most of the land around Ishpeming was privately held and, secondly, there was the usual skepticism by many on the possibility of gold in Michigan. Consequently, Julius Ropes had much difficulty in convincing potential investors that there was great potential for gold and silver there; the major interest in this area had always been iron ore. Ropes did eventually convince enough people, however, and in 1881 the Ropes Gold and Silver Mining Company was organized with a capital stock of two million dollars (80 thousand shares of $25 each).

Mining began in the fall of 1882 and in the summer of 1883 a five-stamp mill was placed in operation. At this time the main shaft was about 9 m deep. The first month's run netted $14.85 per ton of ore treated, which was very encouraging. From this run the amalgam was smelted and the first precious metal bullion train (buckboard and team) ever driven in the state of Michigan made the trip from the mine to the National Bank in Ishpeming.

Subsequent mining activity at the Ropes mine necessitated the building of a larger mill. In 1884 twenty stamps were added to an enlarged mill and, in 1890, a forty-stamp mill was operating. At this time the main shaft had a depth of 260 m with 16 levels. Although the ore began to vary in richness, the company did fairly well for several years.

One of the major problems encountered at the Ropes mine was the lack of funding to properly explore and exploit the lode. Another problem arose at the stamping mill. The rock proved to be very difficult to stamp because of its high content of talc. The talc tended to act as a cushion under the stamp heads and sometimes

Figure 3. **The Ropes gold mine, ca. 1892. Photo: Marquette Historical Society.**

Figure 4. **Interior of the Ropes mill, ca. 1892. Photo: Marquette Historical Society.**

clogged the screens. As a result of the processing problems an estimated one-third of the gold and silver mined was lost in tailings.

By the mid 1890s the combination of low-grade ore, little working capital, and labor problems began to take their toll. In July of 1897 the mine closed after producing gold and silver valued at $647,902. The peak production year had been 1889 when 31,000 tons of ore was processed yielding $99,715 worth of gold.

During the period of time in which the Ropes mine was in operation extensive exploration was conducted in an area west of the mine. This exploration led to the opening of some 20 small gold mines and prospects. The most notable of these properties, located about 5 km west of the Ropes mine, became the Michigan gold mine. The Michigan Gold Company began work at the site in July of 1887 and immediately encountered several pockets of very rich ore. Some of the samples were said to be among the richest found anywhere and were placed on exhibit at the chicago World's Fair in 1895. After several shafts were sunk and a considerable amount of drifting had been done, the high-grade ore deposits were exhausted. The Michigan gold mine was closed down in 1893 after producing $18,000 worth of gold. Work was resumed at the mine in 1933 but shut down after little production.

Since 1933 the Michigan and other small gold mines and pits have been little more than a fascinating area for rock and mineral collectors. The old Ropes, however, has had a somewhat more colorful history.

Several attempts were made to reopen the mine in the late 1890s and in 1899 the property was purchased at auction by Corrigan, McKinney & Company. In 1900 and 1901 this company set out to claim the gold that had been lost in the tailings during the years of the mine's operation. Some 30,000 tons of the old tailings were cyanided and $54,682 in gold was recovered.

Since the turn of the century several companies have bought and sold the Ropes property, including one concern that had planned to open the old mine to tourists.

In 1975 the property was purchased by the Callahan Mining Corporation of Phoenix, Arizona. Exploration was conducted at the site from 1979 to 1981 and the decision to reopen the old Ropes mine was announced in June of 1983. The 2.5 million dollar exploration program conducted by Callahan revealed an orebody estimated to contain 1,600,000 tons of ore averaging 0.129 oz. of gold per ton. It is now estimated that the Ropes mine will again become a major gold producer in 1986 or just over a century since Julius Ropes made his initial discovery.

GEOLOGY

The Michigan gold belt lies within a series of green, largely volcanic rocks which are Archean in age and geologically similar to other greenstone belts which exist in the Superior Province north of Lake Superior. The belt runs west from Marquette and passes just north of Ishpeming and Negaunee; it represents the easternmost extent of granite-greenstone terrain in Michigan. The greenstone is bounded on the north and south by rocks of the Mar-

Figure 5. **Decaying foundations near the Ropes mine today. Extensive dumps are located nearby.**

quette Range which contain the iron-bearing series, on the west by younger granites, and on the east is covered by Lake Superior and perhaps by the Jacobsville sandstone. The greenstone belt consists of over a thousand meters of felsic to mafic volcanic rocks which have been intruded by Archean peridotites and granitic plutons. The intrusives are of Laurentian Age; the basement complex, the Mona and Kitchi schists, are of Keewatin (lower Precambrian) age.

In general, the gold occurs in quartz veins or lenses, less often in the pyritized wall rocks. The veins of the gold belt have been found to vary considerably in width. Widths from only a few cm up to 12 m have been reported in the literature. In addition to free gold, of which many spectacular samples were found during the early exploration and mining days, other minerals reported to exist in the gold belt include quartz, tourmaline, chlorite, dolomite, pyrite, pyrrhotite, calcite, epidote, feldspar, tremolite, magnetite, chalcopyrite, sphalerite, tetrahedrite, molybdenite, powellite, bismuthinite, fluorite, bornite, galena, talc, asbestos and silver.

THE ROPES OREBODY

The Ropes orebody consists of a series of lenticular quartz formations which cut diagonally across a vertical tabular body of Keewatin schist. The schist stands in a shear zone between two bodies of Laurentian peridotite. Due to the shape and location of the orebody, the early miners referred to it as the "mineral dike." Since the schist itself and the peridotite on each side are altered and strongly sheared, it is believed that the position, attitude, and relationships of the "mineral dike" were determined by intrusive activity and faulting.

There were two distinct types of ore found in the Ropes mine: the quartz veins, and the surrounding mineralized schist. Most of the production from the mine came from the nearly vertical quartz veins which stood *en echelon*. The largest of the lenticular veins were up to 12 m in thickness, about 60 m in extent horizontally, and about 75 m vertically. There were eight of these major shoots in the old mine.

A halo of hydrothermally altered and pyritized schist surrounded the quartz veins. It is very probable that this ore was recognized during the years of exploration, as many openings were made in it during the search for additional quartz veins. But it was not mined, possibly because it was low-grade ore and, secondly, the gold would have been nearly impossible to recover using the amalgamation and gravity methods available at that time.

MINERALOGY

The many old mines, quarries and prospect pits of the Michigan gold belt have produced a wealth of minerals for collectors over the years. Although the Ropes mine is currently in operation, access can probably be gained to the property with proper authorization. Other old mines and pits in the area are still accessible to the collector. There have also been gold finds in various placer deposits in the Ishpeming area. In most cases only a few colors per pan have been reported but nuggets have been found.

Asbestos

Asbestos minerals occur in veins throughout the peridotites of the gold belt area. In a quarry adjacent to the Ropes mine it occurs as massive green chrysotile. Asbestos is also found associated with magnetite and possibly chromite.

Bismuthinite Bi_2S_3

It was reported that ore containing bismuthinite was taken from a shaft at the Michigan gold mine. This report, however, has never been verified.

Bornite Cu_5FeS_4

Bornite has been found in quartz veins associated with the hydrothermal deposits of the gold belt. It is usually associated with pyrite.

Calcite $CaCO_3$

Calcite is found associated with quartz-carbonate veins in the gold belt where it occurs as a gangue material.

Chalcopyrite $CuFeS_2$

Chalcopyrite occurs in the gold belt area as a minor constituent of the gold-bearing quartz veins, along with tetrahedrite and scheelite.

Chlorite group

Chlorite is found in the Marquette Range as trioctahedral chlorite in altered dikes.

Dolomite $CaMg(CO_3)_2$

Dolomite occurs in Marquette County as accessory primary grains and as secondary veinlets in siderite-chert rock. Dolomite is found in abundance in the talc schist at the Ropes mine.

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

Epidote may be found in the area north of Negaunee as small, imperfect crystals associated with quartzose veins in chlorite schists.

Feldspars

Feldspars may be found in gold belt area pegmatites.

Fluorite CaF_2

Fluorite specimens have been found in a pegmatite outcrop near the Ropes gold mine.

Galena PbS

Specimens of galena have been found at the Michigan gold mine and other mines and prospects north of the Michigan. It is found in quartzose fissure veins associated with pyrite and sphalerite.

Gold Au

Gold is very rare on the old dumps but specimens have been recovered. Free gold is usually associated with vein quartz. The specimens are far from spectacular in appearance but are nonetheless exciting to find.

Magnetite Fe_3O_4

Magnetite may be found throughout Marquette County. It generally occurs in soft ores with hematite and martite, and in hard ores with specular hematite.

Molybdenite MoS_2

Specimens of molybdenite have been found on the dumps of the Michigan gold mine. It occurs as a foliated, soft, lead-colored material.

Pyrite FeS_2

Pyrite is common in quartz veins at the mines and prospects. It generally occurs as cubic crystals. Pyrite is also common in the wall rock at the Ropes gold mine.

Pyrrhotite $Fe_{1-x}S$

Pyrrhotite is found at the Michigan gold mine in quartz veins.

Quartz SiO_2

Quartz is relatively common in the gold belt and usually occurs as massive, white vein material.

Silver Ag

Silver has been found in many gold mines and test pits in Marquette County. It is usually associated with quartz-lead-zinc veins in small faults and shear zones.

Sphalerite ZnS

Sphalerite occurs in minor amounts in the gold-quartz-tetrahedrite veins of both the Ropes and Michigan gold mines as well as other small mines in the Dead River area.

Talc $Mg_3Si_4O_{10}(OH)_2$

Pale green talc deposits crop out in various areas of the gold belt. At the Ropes mine the talc schist was formed due to the alteration of peridotite.

Tourmaline group

Tourmaline is found at the Ropes and Michigan gold mines in quartz-tetrahedrite veins. It occurs as black, acicular crystals in quartz.

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

Tremolite is found in the basalts of the Mona schist exposures throughout the gold belt.

ACKNOWLEDGMENTS

The author would like to thank Shirley Peano of the Marquette Historical Society for her assistance in gathering research materials and for some very interesting and stimulating conversation regarding the history of the gold area.

The author would also like to thank the librarians and employees of the Michigan State Archives, The State Library of Michigan, Michigan State University Library, Michigan History Division (Dept. of State), The Michigan Geological Survey, and the Callahan Mining Corporation for making available much information for use in this article.

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Marsturite epitaxial on rhodonite from Franklin, New Jersey

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INTRODUCTION

Marsturite, ideally $Mn_3CaNaHSi_5O_{15}$, was originally described from Franklin, New Jersey, by Peacor *et al.* (1978). That occurrence consisted of bladed, triclinic, colorless crystals (Figs. 1 and 2) associated with rhodonite, willemite and abundant manganaxinite. Only the type specimen was known at the time of description, and only one more, of similar appearance, has been found in the ensuing eight years.

Recently, as a part of investigations of the petrography of Mn-Ca silicate assemblages at Franklin, some colorless overgrowths on rhodonite crystals from Franklin, previously considered to be bustamite, were examined and found to be marsturite. A review of the literature indicated that these overgrowths had been previously examined (Larsen and Shannon, 1922) and tentatively assumed to be a rhodonite near bustamite in composition, on the basis of optical and goniometric measurements. This assignation of species was accepted by Palache (1935) and he mentioned the occurrence under bustamite in his monograph on Franklin and Sterling Hill. The description of this material by Larsen and Shannon is excellent; it reads in part:

> The rhodonite occurs in freely developed crusts made up of prismatic forms [crystals] which reach 3 millimeters by 5 millimeters in size and have an elliptic cross section and serrated edges. They are terminated by a lustrous and somewhat curved face. When closely examined these are seen to have a lozenged-shaped core of deep pink rhodonite surrounded by an outer zone made up of small crystals of a paler or more brownish color, the contact between the two zones being sharp. The core shows fine polysynthetic twinning, although the major portion has a single orientation, the laminae in twin position being very thin. The outer zone, although made up of numerous small crystals, shows no twinning and extinguishes as a unit, indicating that its component crystals are in exactly parallel position . . . .

The relations described by Larsen and Shannon (1922) are evident in Figures 3 and 4, which show, in cross-section, the rhodonite core and the marsturite overgrowth with serrated edges; the cover photo for this issue and figure 5 show the general appearance of the specimens.

CHEMICAL COMPOSITION

This occurrence of marsturite was confirmed by use of X-ray powder diffraction techniques, comparison of optical data, and by microprobe analysis. At the time of Larsen and Shannon's description, there was inadequate material from the outer zone (now shown to be marsturite) to permit a chemical analysis with the techniques then available. The microprobe analysis given here was obtained using an ARL-SEMQ electron microprobe with an operating voltage of 15 kV and a sample current of 0.025 μA, measured on brass. Standards used were rhodonite (Si,Ca,Mn,Zn), and hornblende (Fe,Mg,Na). The data were corrected using standard Bence-Albee factors. The rhodonite core is homogeneous and its composition, not given here, is virtually identical to that given by Larsen and Shannon (1922). The marsturite zone is chemically homogeneous, and similar in composition to the type material. The analysis is given in Table 1, together with that of the type marsturite. Additionally, the optical data of Larsen and Shannon (1922) are included and compared with those for the type material (Peacor *et al.*, 1978). these data are in excellent agreement, leaving no doubt that the mineral is marsturite.

OPTICAL EXAMINATION AND ORIENTATION

The optical orientations of both marsturite (Peacor *et al.*, 1978) and rhodonite (Palache, 1935) are known with precision, and provide a means of determining the orientation of the marsturite over-

Table 1. **Chemical and optical data for marsturite.**

	#1	#2
SiO_2	49.3	48.94
FeO	0.5	0.24
MgO	0.1	0.12
CaO	11.5	12.46
ZnO	0.5	0.0
MnO	34.8	34.16
Na_2O	3.9	4.08
Total	100.6	100.00
Optic sign	+	+
2V	large	60°
α	1.687	1.686
β	1.692	1.691
γ	1.709	1.708

#1. NMNH #C2485-1, optical data from a similar sample; adopted from Larsen and Shannon (1922).
#2. NMNH #127923, type material; analytical and optical data from Peacor *et al.* (1978).

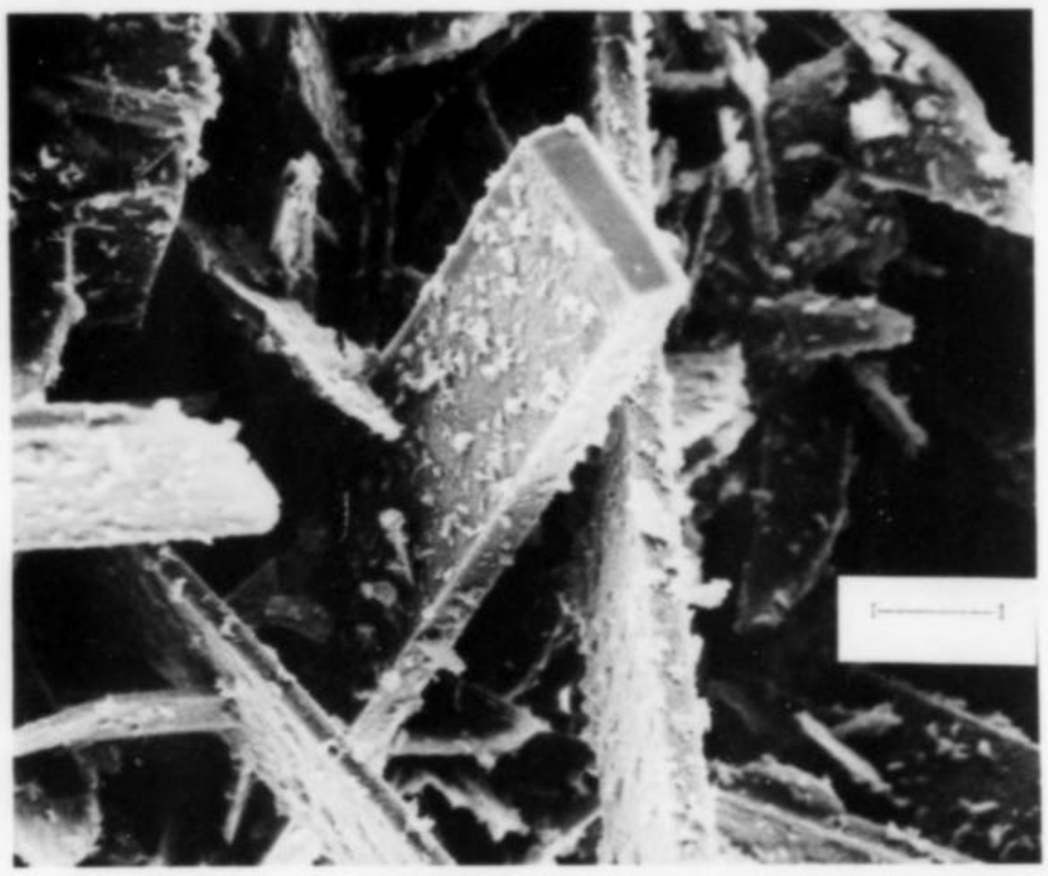

Figure 1. **Euhedral lath-like marsturite crystals from the type material; Franklin, New Jersey. Scale bar is 250 μm.**

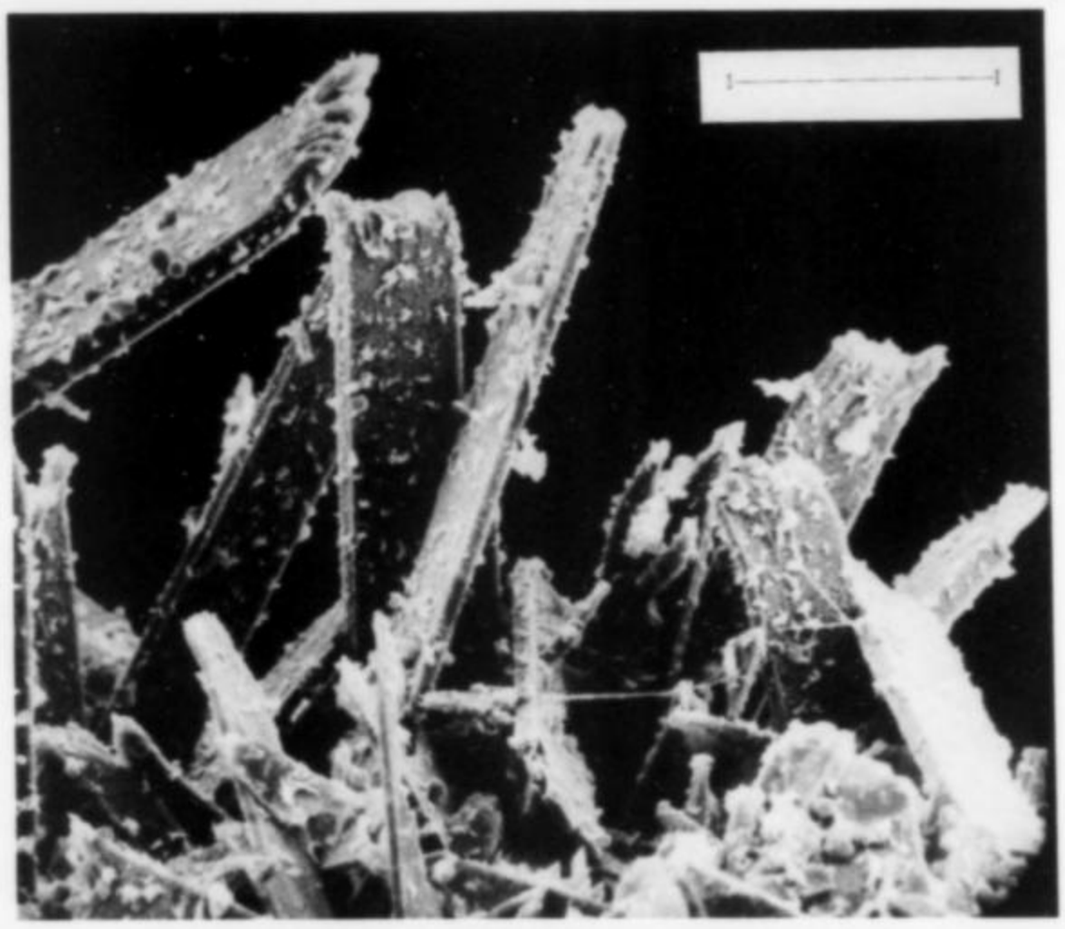

Figure 2. **Cluster of lath-like marsturite crystals showing irregular terminations; Franklin, New Jersey. Scale bar is 250 μm.**

Figure 3. **Transmitted-light photograph of two marsturite crystals from the newly identified material, showing the rhodonite core (colorless) and the marsturite rim (gray). Long dimension of the crystals, parallel to *a*, is 3.0 mm. The crystals are lying on the (001) cleavage; Franklin, New Jersey.**

Figure 4. **The same crystals shown in Figure 3 are here shown in polarized light with crossed nicols.**

growth. The optical orientation of rhodonite is referred to the older morphological crystal axes and must be re-oriented to newer, structural axes used by Perutz (1937) and Mamedov (1958); the planes $(\bar{1}\bar{1}0)$, $(00\bar{1})$, and $(1\bar{1}0)$ of the old orientation become, respectively, (100), (010), and (001) of the new. When this is done, it becomes clear that marsturite and rhodonite have similar, although not identical, optical orientations, with *X* near *c*, and *Z* near *b*, and similar unit cell parameters. In this orientation, the axial dimensions and interaxial angles of rhodonite are almost identical to those of marsturite: for rhodonite from Franklin, $a = 7.66$, $b = 12.20$, $c = 6.68$Å, $\alpha = 86.0$, $\beta = 93.2$, and $\gamma = 111.1°$ (Hilmer *et al.*, 1956), and for marsturite, $a = 7.70$, $b = 12.27$, $c = 6.68$Å, $\alpha = 84.26$, $\beta = 94.10$, $\gamma = 111.04°$ (Peacor *et al.*, 1978). A number of orientations have been used for structural analysis of rhodonite; these are summarized by Peacor and Niizeki (1963).

The marsturite overgrowth coats the rhodonite with the exception of one prominent face, which corresponds to a cleavage plane for both minerals. Examination of the interference figures shown by a cleavage flake shows off-centered but nearly parallel views of the optic axial plane of both, with one optic axis and one bisectrix visible. Retardation plate tests show that the bisectrix is *X* for both

Figure 5. **Appearance of a hand-specimen of marsturite overgrowths on rhodonite; Franklin, New Jersey. Long dimension of the crystals is 3–4 mm.**

figures; thus the cleavage is {001}, designated {010} in the old morphological orientation of rhodonite.

Close examination of the orientations of the optic axial planes in the two minerals shows that the *a* and *b* axes are also coincident in the two minerals and that the principal contact surface between marsturite and rhodonite is approximately (010), which would provide the best fit of the unit cell translations of the two minerals. The overgrowth marsturite crystals are elongated on *b,* with prominent {001} pinacoid, as in the original description (Peacor *et al.,* 1978). The rhodonite crystals are tabular on {010} (old {001}), and elongated parallel to *a,* corresponding to the common habit illustrated by Palache (1935, Fig. 67).

PARAGENESIS

The paragenetic occurrence of the type marsturite was described based on the type sample. Now that this additional material has been identified, the assemblage, which is generally the same for the type and this material, can be better described. Based on ten similar specimens, the assemblage is described as one consisting chiefly of yellow manganaxinite crystals partially encrusting rhodonite crystals which coat a fracture surface in gneissic willemite-franklinite ore devoid of calcite. Because all of the samples occur on very similar ore, and the fracture surface intersects the banding of the ore at a near-constant angle, and because the mineralogy of the assemblage is relatively invariant, it is likely that these samples came from a restricted and localized occurrence within the Franklin mine. Other associated minerals are willemite and ganophyllite. The sequence of formation is pink rhodonite, followed by yellow manganaxinite and brown ganophyllite, with colorless hexagonal prisms of willemite among the last phases to form. The exposed rhodonite crystals, not covered by manganaxinite, are the ones which have marsturite rims; hence, they might have formed last. The assemblage is in other ways a notable one in that it is one of only two known ganophyllite assemblages at Franklin (Dunn *et al.,* 1983). The presence of alkalies in both ganophyllite and marsturite suggests unusual conditions; such alkali assemblages are rare in secondary vein occurrences at Franklin.

ACKNOWLEDGMENTS

PJD thanks the trustees of the Franklin Mineral Museum for their continued assistance and cooperation. The photographs were taken by Victor Krantz of the Smithsonian Institution photographic laboratories, to whom we express our gratitude.

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A new zinc magnesium carbonate and data for other unnamed species from Franklin and Sterling Hill, New Jersey

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INTRODUCTION

The mineral described below was found by the writer about twelve years ago in samples from Sterling Hill, New Jersey. Its uniqueness was noted then, but a description was deferred in hope of finding single crystals, analysis of which would permit a rigorous definition. Many samples have been encountered in subsequent years, but none has been of adequate quality to permit the accurate definition of this mineral as a valid species. Because it is unique in nature, and not rare at Sterling Hill, the incomplete description is recorded here; perhaps other samples will be found elsewhere, permitting its eventual characterization. It remains at present an unnamed mineral.

DESCRIPTION

This zinc-magnesium-carbonate-hydroxide mineral occurs in a consistent, extremely fine-grained texture. Many samples have a frothy, bulbous aspect; others commonly have an apparent cleavage, lending a layered appearance to the aggregate. Those specimens not showing such features have a texture resembling clay. The mineral is invariably white with a pearly luster; the luster may be dulled on museum specimens or those which have been extensively handled. It is opaque in aggregate, but transparent in thin section. The fracture of the aggregate is irregular. One of the more unique physical aspects of this mineral is its density, which is approximately 0.865 g/cm^3 in the aggregate. Compression by hammering yields a density of 2.52 g/cm^3, but this is an arbitrary value; the true density could be much higher, and the above value should be accepted only as a minimum.

Optically, this mineral is weakly anisotropic with low birefringence. The mean index of refraction is $n = 1.556(3)$. No other optical data could be determined due to the fine-grained nature of the mineral. In longwave ultraviolet, this mineral fluoresces a weak violet, but fluorescence is not discernible under shortwave ultraviolet light.

Spectrographic analysis and wavelength-dispersive microprobe scans indicate that Mg, Zn, Mn, Ca, Cl and Fe were the only detectable cations. The mineral is completely soluble in HCl and effervesces with considerable enthusiasm. Microprobe analyses, with CO_2 determined by carbon analyzer, and H_2O determined by the Penfield method, yielded: FeO 0.1, CaO 0.1, MgO 30.9, MnO 3.6, ZnO 31.6, CO_2 12.7, H_2O^+ 16.4, H_2O^- 2.4, Cl 0.8, sum = 98.6, less O = Cl 0.2, total = 98.4 wt. %. An empirical formula, calculated on the basis of 19 oxygen atoms, is: $Mg_{5.13}(Zn_{2.60}Mn_{0.34}Ca_{0.01}Fe_{0.01})_{\Sigma 2.96}(CO_3)_{1.93}(OH)_{12.18}Cl_{0.15}\cdot 0.98H_2O$, or ideally $\mathbf{Mg_5(Zn,Mn)_3(CO_3)_2(OH,Cl)_{12}\cdot H_2O}$. However, this formula is but a representation of the composition of the aggregate, which may include impurities as described below.

The nature of the fine-grained crystal size precluded single-crystal studies. The strongest diffractions in the X-ray powder diffraction pattern are (*d* in Å, I/Io): 7.47(100), 5.66(20b), 3.038(20), 2.694(60), 2.614(20), 2.515(20), 1.569(40), and 1.550(4). These diffractions are common to all studied specimens of this mineral. However, the available powder patterns of the various specimens found to date all show extra reflections, most of which are weak, but not identifiable as known species. It appears that there may be a mixture of at least two phases in most specimens of this mineral, and that both of them are unknown to scientific knowledge. The dominant one is described here; the minor phase appears to have some silicon present, and may be a silico-carbonate. Even if this is a mixture, it is clear that an unnamed mineral is present.

The preponderance of the known samples have come from Sterling Hill, where it is associated with hetaerolite and zincite as the dominant associated species. Less common associates include chlorophoenicite, willemite, dolomite, hodgkinsonite and celestine. Most occurrences are simply labeled as being from Sterling Hill; one of the more spectacular bulbous occurrences was in the 1570E stope, on the 1300 level. Samples in the Bauer collection were labeled as fluoborite, and others so labeled may repose in other systematic collections. This mineral is readily differentiated from fluoborite by its effervescence in HCl.

At Franklin, this mineral might have been less common. Only one specimen is known, consisting of sparse white spherules associated with sphalerite on the Franklin holdenite specimen, formerly in the collection of Charles Key, and described by Dunn (1981).

OTHER UNNAMED MINERALS FROM FRANKLIN AND STERLING HILL

Below are listed data for some other minerals from Franklin and Sterling Hill which remain unidentified. In most cases, there is inadequate material to permit full characterization. X-ray diffraction lines are given in order of decreasing intensity.

• Acicular bright-yellow crystals associated with flinkite, cahnite, jarosewichite (Dunn *et al.*, 1982), and hausmannite, from Franklin. Energy-dispersive X-ray analysis (EDAX) indicates only Ba, Mn,

and U as detectable cations. Powder X-ray diffraction (XRD) lines are (*d*, in Å): 3.28, 3.53, 2.95, 2.12, and 6.40. The pattern has some similarities to that of carnotite. The mineral is very rare and was called to my attention by Mrs. Alice Kraissl. (NMNH #143784.)

• Yellow, fibrous green coatings on calcite/mica matrix from Sterling Hill. EDAX indicates Zn and U as major elements; the samples are of doubtful purity. The strongest XRD lines are 6.30, 2.70, and 8.40. The mineral was moderately abundant in impure samples. It was called to my attention by Richard Bostwick. (NMNH #144807.)

• White pearly spherules in vuggy franklinite-willemite ore from Sterling Hill. EDAX shows only Zn as a detectable cation; the mineral effervesces in HCl and is therefore in part a Zn carbonate. The strongest XRD lines are: 18.0, 9.0, 2.94, 6.00, and 1.57. The mineral is rare and was called to my attention by Thomas Peters. (NMNH #147353.)

• Bright blue fibrous crystals with red willemite and franklinite from Sterling Hill. EDAX shows only Cu as a detectable cation. The mineral is readily soluble in HCl without effervescence, suggesting it might be a hydroxide, nitrate or oxalate. The strongest XRD lines are: 3.95, 4.75, 2.50, 1.72, 3.20, 1.85, 1.93, 4.35, and 2.78. The mineral is rare and was called to my attention by Ewald Gerstmann and Fred Parker. (NMNH #146924.)

• Black acicular crystals, associated with willemite from Franklin. Wavelength-dispersive analysis (Dunn *et al.*, 1982) shows that it is a Mn-Zn-arsenate-hydroxite, consistent with a highly oxidized clorophoenicite-like mineral. The strongest XRD lines are: 10.90, 3.02, 2.33, 2.509, and 1.814. The mineral is rare and was called to my attention by Andrew Dilatush and James Kaufmann. (NMNH #149091.)

ACKNOWLEDGMENTS

I thank Joseph Nelen for carbon and water determinations, and Andrew Roberts for assistance in checking the data. The paper was improved by critical readings by Richard C. Erd, Richard W. Thomssen, and Wendell Wilson.

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Mcguinnessite from a serpentinite body in Maryland

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The mineral mcguinnessite has been found in an active quarry of the Rockville Crushed Stone Corporation, 6.4 km (4 miles) west of Rockville, Montgomery County, Maryland. The quarry is in a serpentinite body that is generally dark green to black and fine-grained, consisting of antigorite with finely disseminated magnetite. The serpentinite is intruded by rodingite in large, light-colored, generally vertical dikes and irregular masses. A complete account of the geology of this deposit listing the 44 minerals that have been identified there is given by Larrabee (1969).

Mcguinnessite, a member of the rosasite group having the chemical formula $(Cu,Mg)_2CO_3(OH)_2$, was originally described from Red Mountain, Mendocino County, California, by Erd *et al.* (1981). A detailed description of that locality and its geology was given by Pabst *et al.* (1977).

Other occurrences have been reported. From southwestern Lancaster County, Pennsylvania, Smith (1978) reported a "magnesium rosasite" which is probably mcguinnessite. An occurrence was reported at Gabbs, Nevada (Oswald and Crook, 1979). More recently, a mineral found in a serpentinized area of Kraubath, Styria, Austria, was studied and shown to be mcguinnessite (Weninger, 1981; Postl, 1978). Also, the mineral was found at Bou-Azzer, Morocco, in massive dolomite (Schmetzer and Tremmel, 1981). Most recently a new occurrence was reported by Read (1984) in New Zealand at the Champion mine in a body of serpentinized mafic and ultramafic rocks.

The Rockville quarry is in a pluton of probable Ordovician age which intruded into the Wissahickon formation of probably late Precambrian age. Larrabee (1969) described the rocks and minerals as follows:

> The rodingite is composed of bright green chromium diopside, cinnamon-colored to pink grossular, white diopside, zoisite, and small amounts of other minerals, including prehnite and hydrogrossular. The dikelike intrusive rocks provide striking contrast to the host ultramafic and are approximately parallel to each other. Most of them dip steeply or vertically. . . . Most rodingite-serpentinite contacts are sheared and have chlorite, tremolite, picrolite, or calcite and dolomite along the shear planes. The presence of tremolite in adjacent serpentinite indicates that calcium escaped from the gabbro during its metasomatism to rodingite.

Small veins recently encountered include chrysotile and clinochrysotile, tremolite, talc, chlorite, calcite, dolomite, aragonite, deweylite,* magnesite, and, rarely, hydromagnesite, clinochlore, coalingite "films," grossular, prehnite, opal and chalcedony.

The mineral specimens collected, including mcguinnessite, are

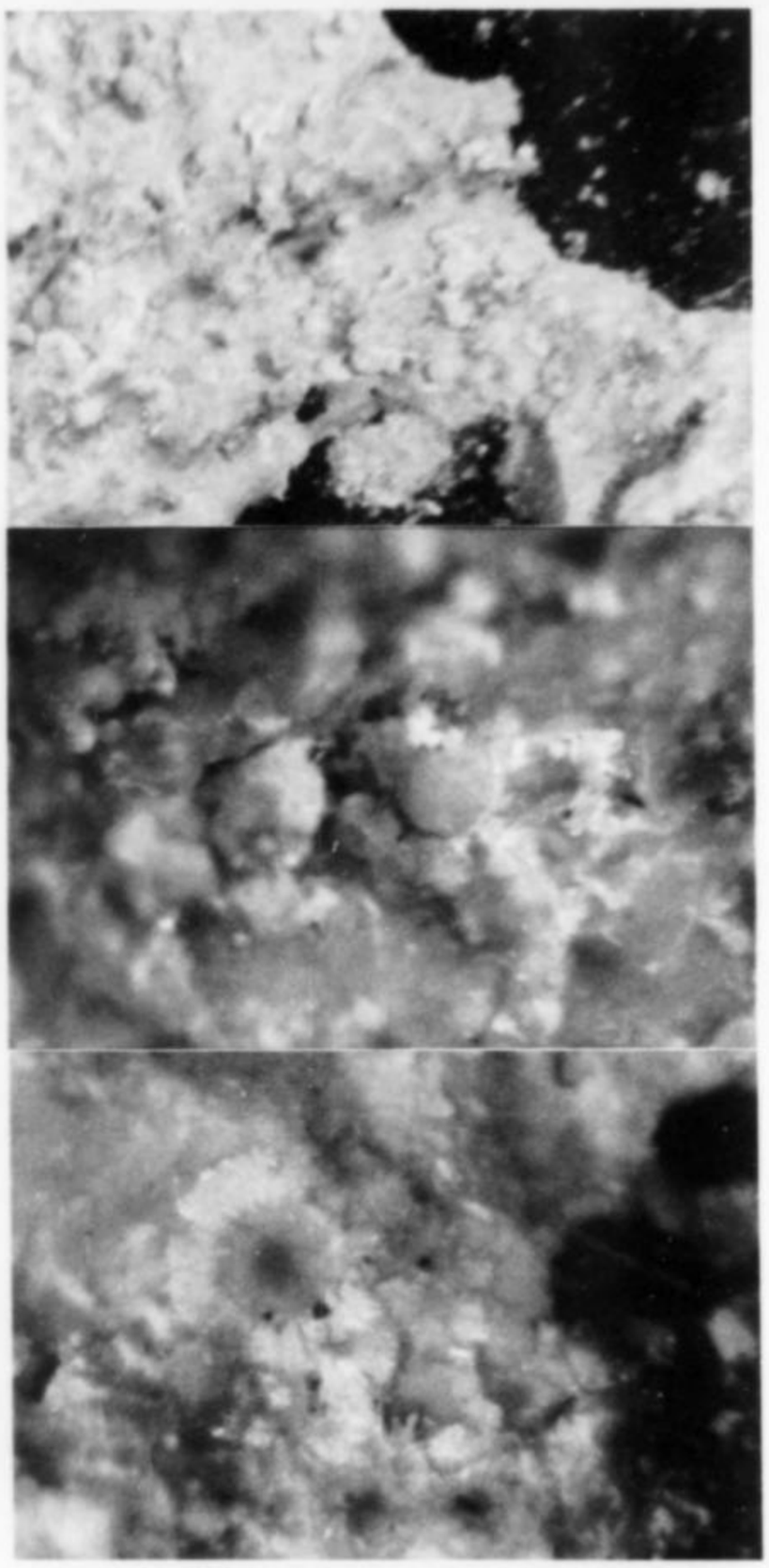

Figure 1. **Mcguinnessite from the Rockville quarry, Montgomery County, Maryland. Top view: 7x; middle: 30x; bottom: 20 x. Photos by Paul Smith.**

from the east wall of the quarry near a deweylite vein. The rocks had been blasted from the upper wall of the quarry. Specimens of hydromagnesite were located in the area. Only one large rock had the blue coating of mcguinnessite on a film probably of deweylite. A piece of rock with about 200 cm^2 of this mineral, all that was observed, was broken from a boulder of many tons in weight.

The mcguinnessite was identified at the U.S. National Museum of Natural History by P. J. Dunn utilizing X-ray diffraction techniques. Another mineral from a nearby vein at a lower level in this quarry was identified as rosasite. This is of local interest as it had not been previously reported from the quarry. A specimen of Rockville quarry mcguinnessite has been donated to the U.S. National Museum of Natural History.

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* Deweylite is a mixture of disordered clinochrysotile or lizardite with a talc-like mineral (Bish and Brindley, 1978).

Native copper from Prospect Park, New Jersey

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In 1929, an unusual occurrence of bornite as a vein filling in basalt was uncovered during quarrying operations in the traprock quarry located on Planten Avenue in Prospect Park, New Jersey (Peters and Peters, 1978); those authors stated that no verified specimens of native copper had been examined by them. Among the specimens collected by one of us (A.L.), many years ago, was one measuring approximately 5 x 7.5 cm in size and containing massive bornite with associated quartz crystals and etched calcite. Solution cavities within the calcite contained beautiful dendritic growths of native copper only a fraction of a millimeter in size.

Examination of the copper by means of the scanning electron microscope has revealed a startling array of crystal forms and habits illustrative of the diversity of this species. The native metals, particularly gold, silver and copper, commonly exhibit a marked pseudo-symmetry as a result of symmetrical distortion during crystal growth. Some of the habits illustrated here show this; pseudo-hexagonal (rhombohedral) pseudo-symmetry, twinning, and parallel stacking of the crystals are evident in the electron micrographs. All of the specimens depicted here were found within a 1 square centimeter sample. It is amazing to find such a diversity of crystal habits and forms in such a small volume of space. Readers interested in the diversity of crystal forms typical of copper should consult Dana (1886) for a comprehensive discussion of this subject.

A half-dozen of the copper dendrites were separated from their matrix by hand picking under a binocular microscope for an energy dispersive analysis. The scan revealed only the presence of copper (major peak) and a very small amount of iron. Silver, gold, bismuth, arsenic and antimony were sought as impurities but not detected.

The scanning electron micrographs accompanying the article contain insets of idealized crystal drawings that conform to the images seen.

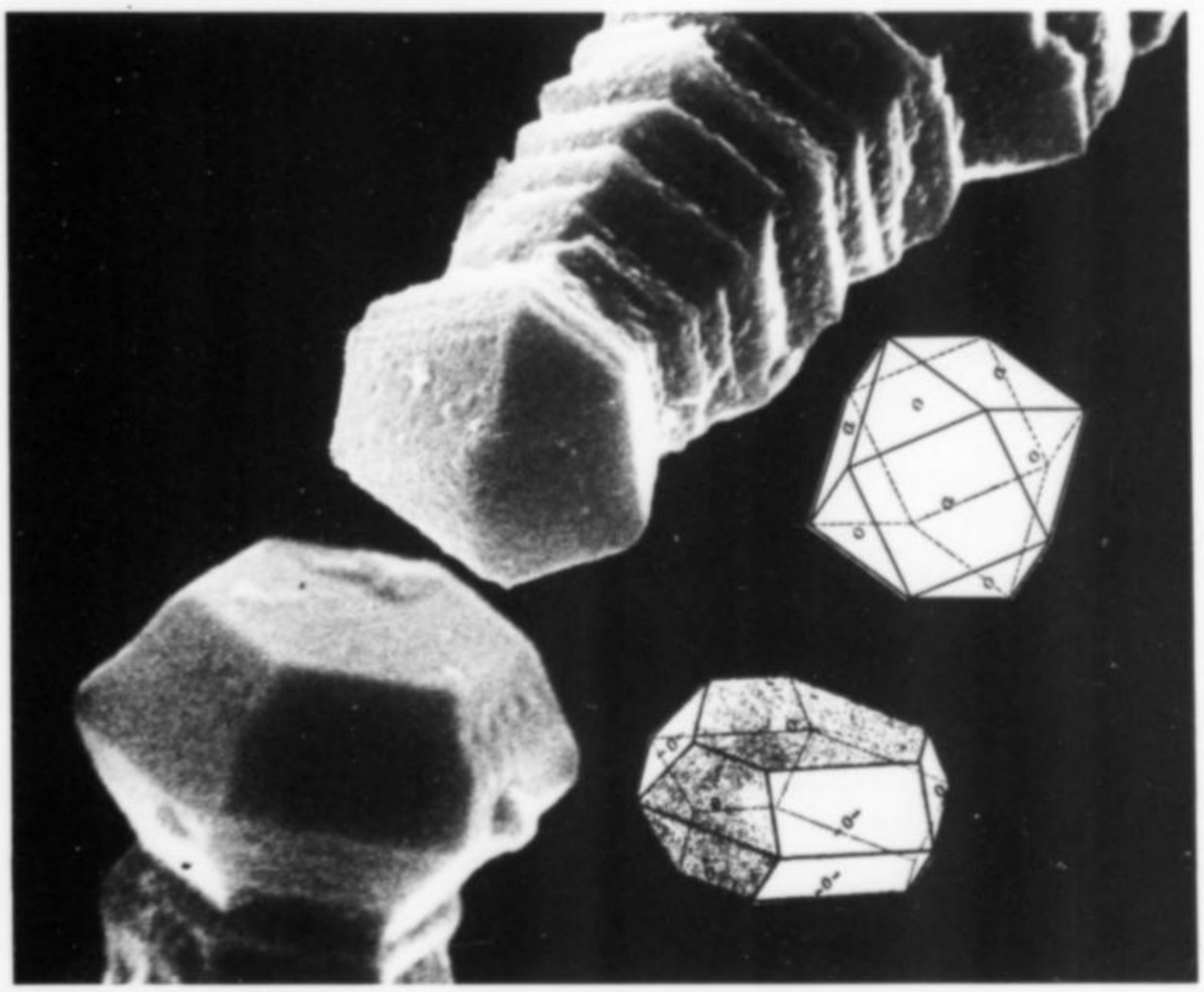
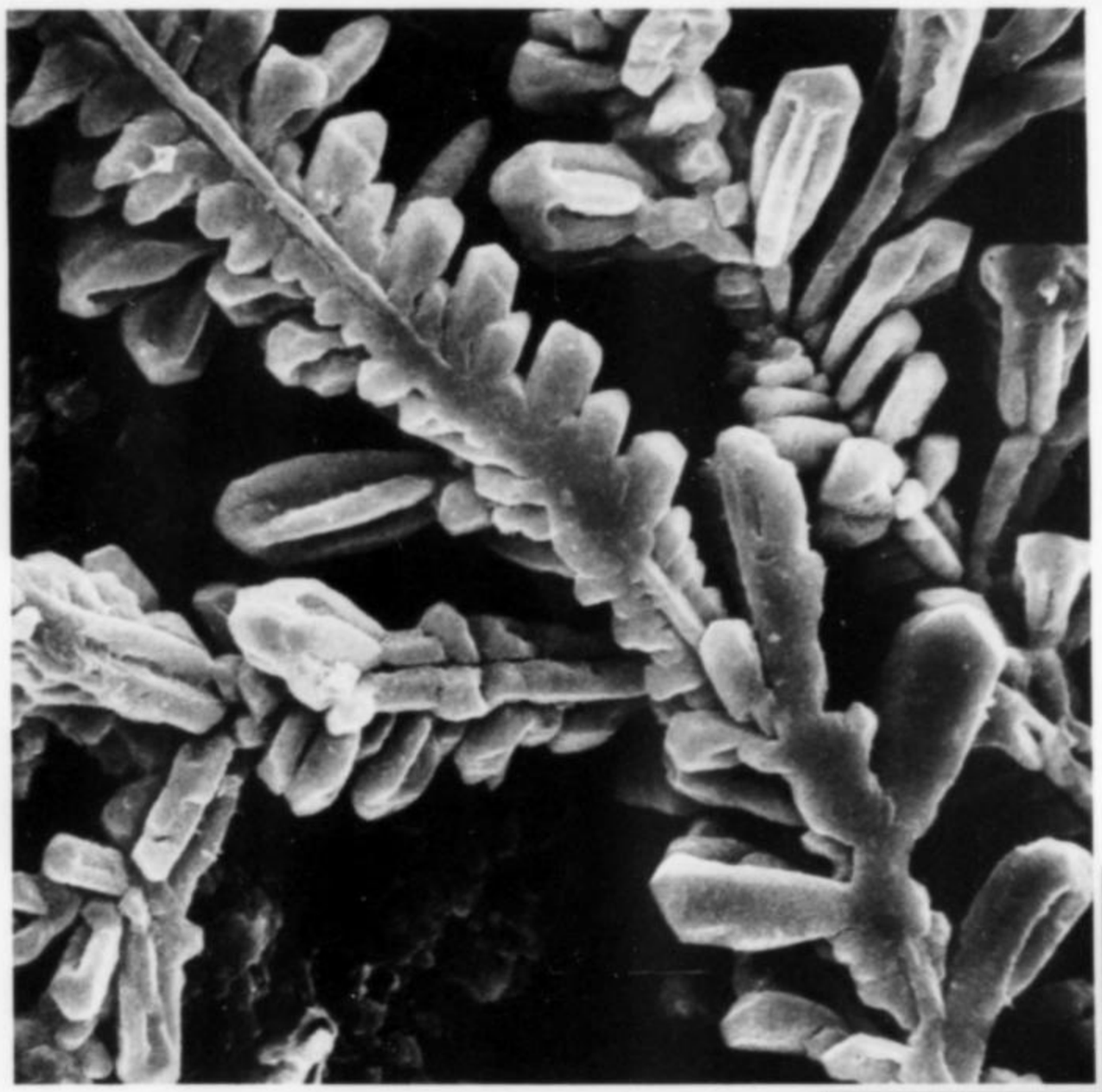


Figure 1. **Copper, Prospect Park, New Jersey. The termination of the upper crystal in the micrograph is 2.5 micrometers in diameter. It is a cuboctahedron viewed down the two-fold axis. An idealized crystal drawing is shown at top right. The bottom crystal can be interpreted as any of the following choices – they all yield essentially the same morphology: (1) an untwinned cuboctahedron, (2) a twinned cuboctahedron, (3) a distorted cuboctahedron that is symmetrically distorted to yield a crystal reflecting hexagonal pseudo-symmetry, or (4) a flattened spinel twin. The crystal drawings are from Goldschmidt (1918).**



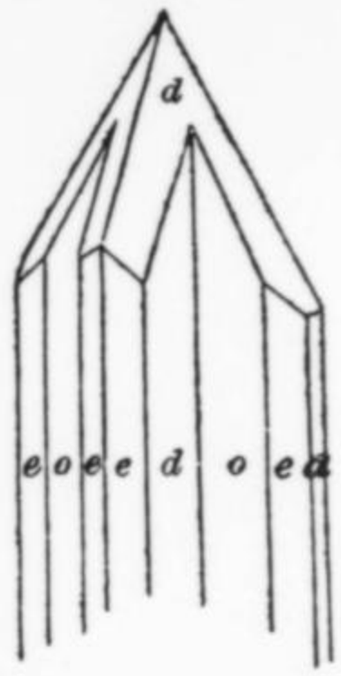
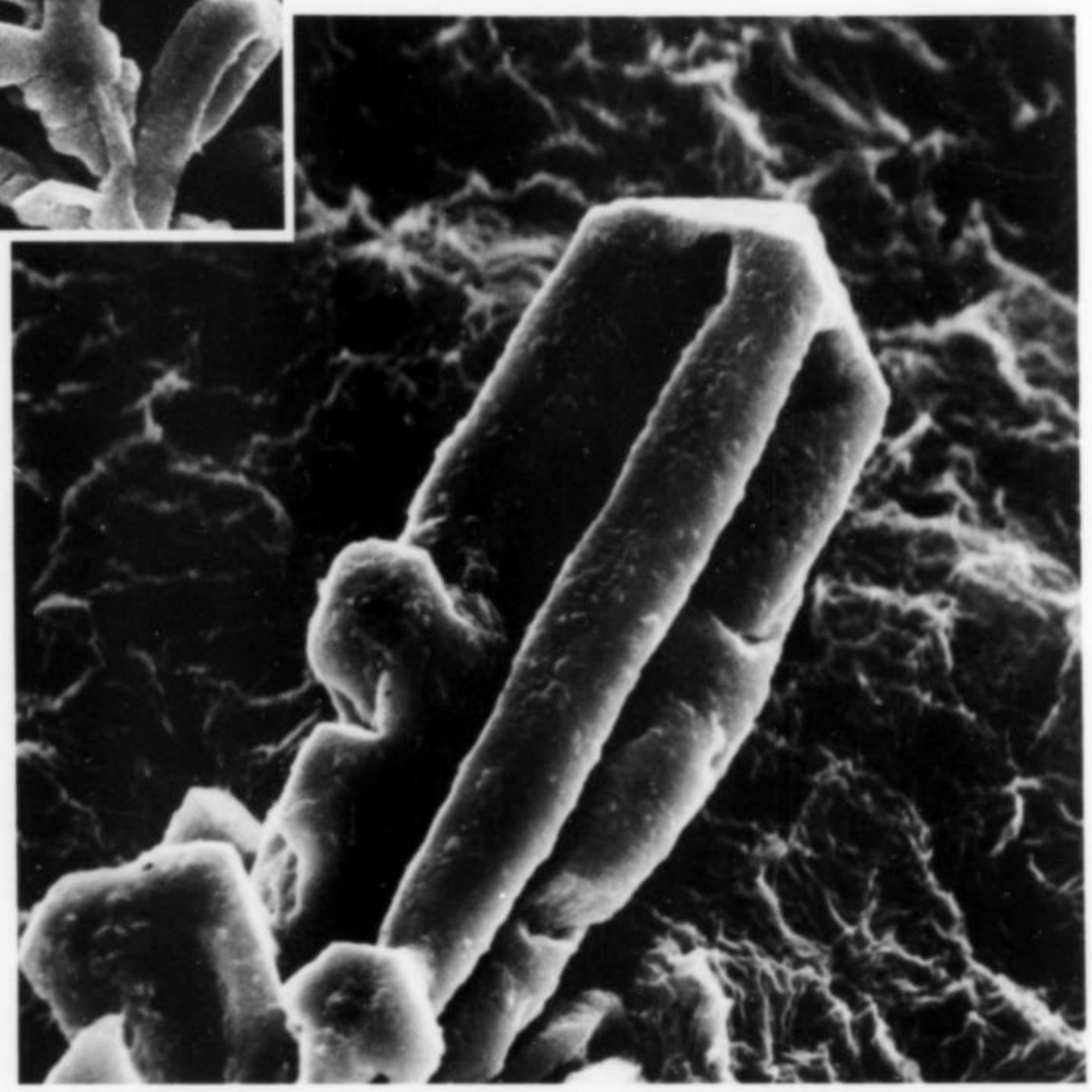


Figure 3. **Spinel-twinned copper, Prospect Park, New Jersey. The main twin is 4–5 micrometers long. Compare with the idealized crystal drawing above.**

Figure 2. **Copper, Prospect Park, New Jersey, showing dendritic growth. "Individual crystals" are probably spinel twins. The crystal dendrites usually arrange themselves at 60 degree angles to the main branch, an additional form of twinning. The "individual crystals" are 4–5 micrometers long. The crystal drawing to the right represents an idealized version of a spinel twin (Greg and Lettsom, 1858).**



It is hoped that the results of our work will stimulate other Paterson mineral enthusiasts to re-examine their specimens for species not yet verified from this world-famous locality.

ACKNOWLEDGMENTS

We would like to thank Russell Titus, Curator of Mineralogy of the Paterson Museum, and George Harlow, Eric Dowty and Joseph Peters of the Department of Mineral Sciences of the American Museum of Natural History, New York, for a critical review of this note. Additionally, we thank Robert J. Koestler, formerly of the Interdepartmental Laboratory of the A.M.N.H., and Christian Grube, photo-archivist of the Paterson Museum, for their technical expertise in the production of the scanning electron micrographs accompanying this paper. Mr. Grube also redrew two of the idealized crystal drawings. Finally, we thank Robert Klimentides, formerly of the Department of Mineral Sciences, A.M.N.H., for the energy dispersive analysis of the copper.

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Whewellite from South Dakota and a review of other North American localities

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INTRODUCTION

Whewellite, $CaC_2O_4 \cdot H_2O$, has been found in South Dakota as the largest and finest crystals of this mineral known from North America and possibly the world. The occurrence was first mentioned by Roberts *et al.* (1974) as the fourth locality in North America, but it has not been previously described in the literature. Other North American localities include Havre, Montana; San Juan County, Utah; Milan, Ohio and the recent discovery of whewellite with weddellite at Biggs, Oregon.

It is interesting to note that although whewellite (calcium oxalate monohydrate) and weddellite (calcium oxalate dihydrate) are uncommon in the mineral world, biologically they occur abundantly as calculi in the urinary tract of man and other mammals (Gibson, 1974) and are often associated with vegetal remains (Graustein *et al.*, 1977). These occurrences will not be elaborated upon here. In the geological environment, whewellite has been found in limestone concretions, coal seams and hydrothermal veins. Dodd (1981) noted that whewellite has been found in carbonaceous chondrite meteorites.

SOUTH DAKOTA WHEWELLITE

Occurrence

Whewellite was first found in South Dakota by one of the authors (WLR) in the mid-1950s. Specimens were collected from septarian limestone concretions along the banks and in the stream bed of Elk Creek in Meade County, South Dakota, and have since been found in concretions along the Cheyenne River, also in Meade County. The whewellite-bearing concretions are found in the Gregory member of the Cretaceous Pierre shale. The concretions vary in size from 30 cm to a few meters in diameter. Concretions over 30 cm in diameter are generally in the form of oblate spheres, are septarian and often contain invertebrate fossils. Those smaller than 30 cm in diameter are usually round, solid, fossiliferous and lack septa. Fossils encountered in both types of concretions are chiefly pelecypods and cephalopods.

Whewellite, which is not common at this locality, can be found in the larger calcite-veined concretions. These concretions are partially hollow and the smooth, interior surfaces are lined with layers of brown to yellow fibrous calcite. Some of the layers fluoresce a bright creamy white in shortwave ultraviolet light. The fibrous calcite forms a smooth surface on which later pale yellow to yellow-orange crystalline calcite has been deposited. These crystals are usually rhombohedral and partially etched. Whewellite occurs implanted on the calcite crystals. Other minerals found in the concretions, but not necessarily associated with whewellite, include prismatic crystals of golden barite and white, slender prismatic crystals of gypsum.

Description

Whewellite crystals from this locality are short to long prismatic and occur as single crystals or in groups of subparallel, somewhat divergent individuals. Crystals range in size from less than a centimeter up to several centimeters in length. These are the largest and finest crystals reported for this mineral in North America and

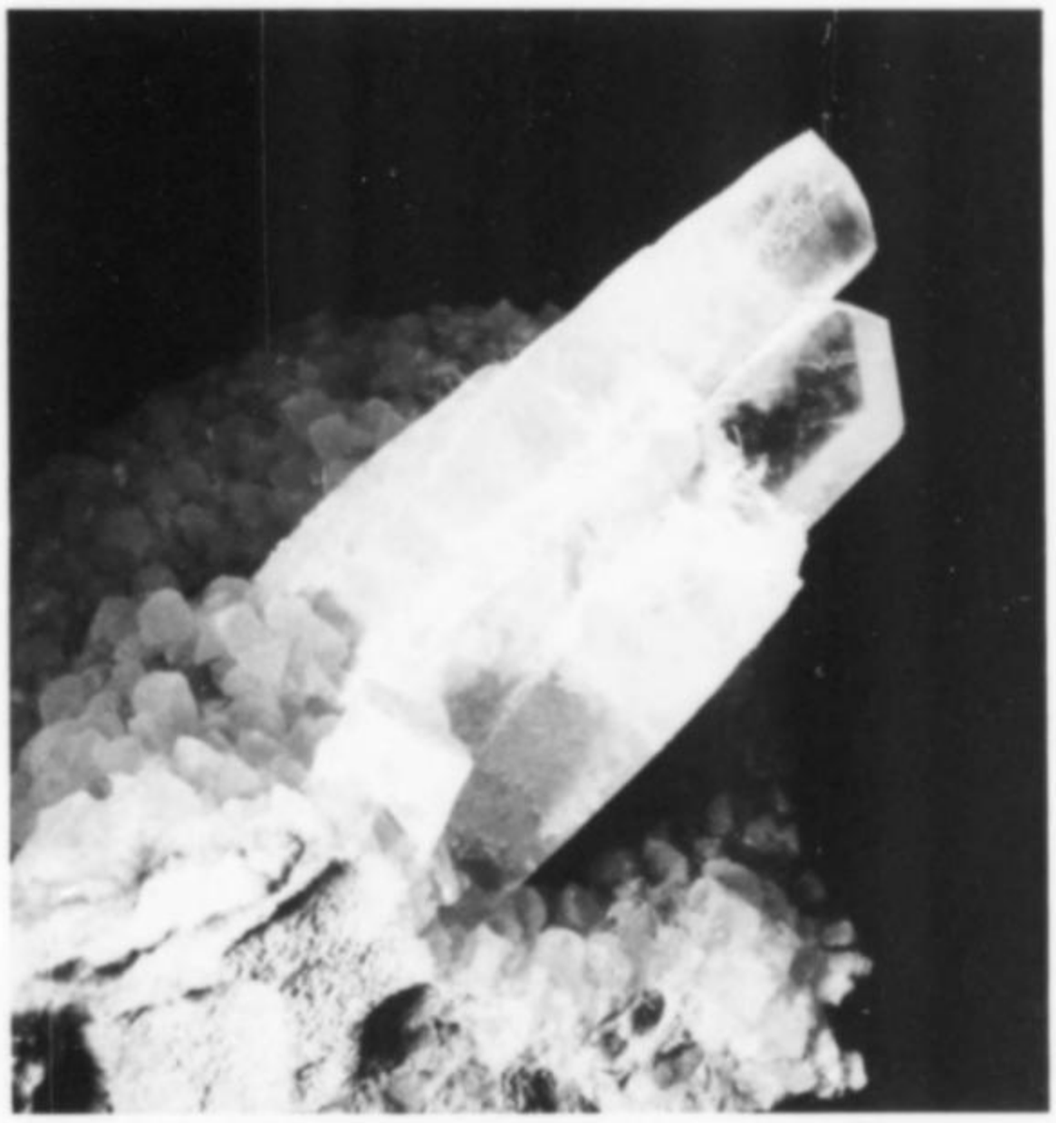

Figure 1. **Whewellite on calcite, from near Elm Springs, Meade County, South Dakota. The largest crystal is 6 cm in length. Museum of Geology specimen; Kurt Triscori photo.**

possibly the world. The largest crystal reported from South Dakota to date measures 1.2 x 15.25 x 23 cm. An outstanding whewellite specimen is shown in Figure 1.

Whewellite crystals are colorless to white and are transparent to translucent. Some crystals or zones within a crystal have a yellowish hue and these yellowish crystals or zones fluoresce vivid yellow-green in shortwave ultraviolet light. Whewellite from South Dakota has a hardness (Mohs) of 3, is brittle and has a conchoidal fracture. Cleavage in four directions is observed: {101} good, {001} and {010} distinct, and {110} poor. Crystal faces have a vitreous to dull luster; cleavage surfaces are vitreous to pearly. Some crystals have a thin, partial coating of very fine-grained white calcite. The density, as determined by heavy liquid techniques, is 2.19 ($\pm$ 0.02) g/cm^3.

Optically, whewellite from South Dakota is biaxial positive with indices of refraction $\alpha = 1.490$, $\beta = 1.552$, and $\gamma = 1.650$ (all $\pm$ 0.002) measured in sodium light. The 2V is approximately 80° and dispersion is not discernible. Optical data for South Dakota whewellite are compared to those of other North American whewellites in Table 1.

The three strongest diffraction lines for the mineral from this locality are 2.348(100), 1.814(90) and 3.527(85). Lattice parameters, determined through least-squares refinement of X-ray diffraction data, are a = 6.279(2), b = 14.514(4), c = 10.036(4)Å, β = 109°47′(1) and V = 860.6(3)Å^3. X-ray diffraction data for South Dakota whewellite are in good agreement with other published data.

Table 1. **Selected optical and physical data for whewellite from South Dakota and three other North American occurrences.**

	1	2	3	4
α	1.490(2)	1.491(2)	1.491(2)	1.498(2)
β	1.552(2)	1.556(2)	1.555(2)	1.553(2)
γ	1.650(2)	1.650(2)	1.654(2)	1.649(2)
2V(+)	80°	84°	82°	80°
SG		2.21(5) (Berman)		
	2.19(5) (suspension)	2.19(1) (suspension)	2.21(1)	2.21
H(Mohs)	3	2.5	3	3

1. Meade County, South Dakota (this study).
2. San Juan County, Utah (Gude *et al.*, 1960).
3. Havre, Montana (Pecora and Kerr, 1954).
4. Milan, Ohio (Leavens, 1968).

OTHER NORTH AMERICAN LOCALITIES

Montana

Whewellite was first discovered in North America in a fossiliferous septarian limestone concretion near Havre, Montana. As described by Pecora and Kerr (1954), the whewellite-bearing concretion was found in the late Cretaceous Bearpaw shale and was an oblate spheroid about 60 cm in diameter and 30 cm thick. It should be noted that the Bearpaw shale in Montana is not the equivalent of the Gregory member of the Pierre shale in South Dakota; the former is somewhat younger than the latter, as is evident from its higher stratigraphic position (Mallory, 1972).

Surfaces of the vuggy inner portions of the concretions are lined with an early generation of yellow to brown-yellow fibrous calcite followed by pale yellow, rhombohedrally terminated calcite crystals. The fibrous calcite fluoresces bright yellow in shortwave ultraviolet light and the larger calcite crystals do not fluoresce (Pecora and Kerr, 1954). The 3 x 8 x 25-mm prismatic whewellite crystal was found perched on the yellow calcite crystals. The surface of the transparent whewellite crystal is coated by a thin, pink encrustation of aragonite and calcite. Pecora and Kerr attribute the pink color of these minerals to organic dyes. Other minerals found in concretions from this area include barite, gypsum and quartz. These authors suggested that the whewellite was formed by circulating groundwaters that acquired oxalate from nearby organic material in the sediments.

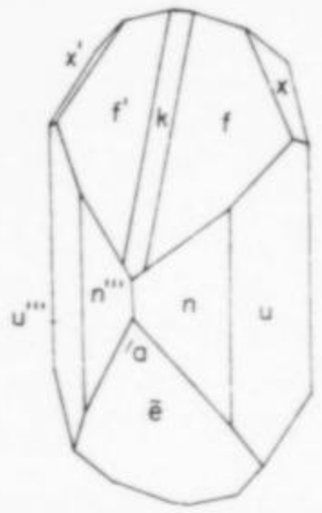

Figure 2. **Crystal drawing of whewellite from the Radon mine near Moab, Utah (Gude *et al.*, 1960).**

Utah

Gude *et al.* (1960) described the second North American occurrence of whewellite from the Radon uranium mine near Moab, San Juan County, Utah. They noted that the three whewellite crystals found at this locality occurred in celestite-lined vugs along the "Radon" fault which transects the lower portion of the Triassic Chinle formation just above its lower contact with the Permian Cutler formation. The largest of the three crystals examined by Gude and his co-workers measures 1.5 x 2 x 2.5 cm and is intergrown with celestite and minor amounts of pyrite, marcasite, calcite and some black asphaltic material. Parts of this large crystal were covered with a thin layer of gray, loosely adhering microcrystalline calcite. The surface of the whewellite crystal is milky white but on a broken portion it is blue-gray and translucent (Gude *et al.*, 1960). The other two crystals are 2 cm and 3 mm in maximum dimension; the smaller of the two was used in their study.

Mineral paragenesis at this locality, as described by Gude *et al.* (1960), began with the deposition of yellow celestite blades up to several millimeters which were contemporaneous with and followed by 0.3 mm crystals of pyrite and marcasite. The two sulfides were followed in sequence by black, conchoidally fractured, asphaltic material. Subsequent to the asphaltic material, whewellite formed and was succeeded by colorless calcite crystals and tufts of strontianite.

Gude and his co-workers suggested that the oxalate portion of the whewellite was derived from asphaltic material or the same source as the asphaltic material which may be the carbonaceous debris in the Chinle formation.

Ohio

The third occurrence in North America, described by Hyde and Landy (1966) and by Leavens (1968), is from an area near Milan, Ohio. Whewellite occurs in limestone concretions in the Huron shale member of the Upper Devonian Ohio shale. These concretions may be several meters in diameter but most are less than two meters. Whewellite occurs as cleavage masses up to 8 cm across associated with calcite and minor amounts of barite. Leavens stated that no terminated crystals were observed. Hyde and Landy (1966) noted that "crystallized" samples (probably cleaveable masses) up to 2.5 x 5 x 7.5 cm were collected. Hyde and Landy reported that

several pounds of whewellite were recovered from 25 concretions. Leavens also reported that much of the whewellite is etched and is surrounded by a thin crust of friable calcite. He noted that whewellite was also permeated along cleavage cracks by calcite and concluded that this calcite is probably an alteration product of whewellite. Associated minerals other than calcite and barite include dolomite, ferroan dolomite and pyrite, all of which are earlier than whewellite. Leavens suggested further that the whewellite from this locality may have formed during a period of strongly reducing conditions in the presence of decaying organic matter.

Oregon

Mandarino and Witt (1983) noted the fifth occurrence of whewellite in North America (South Dakota being the fourth) in their description of weddellite from Biggs, Oregon. Weddellite and whewellite are found in jasper nodules in lacustrine sediments sandwiched between basalt flows of Miocene age. Whewellite from this locality occurs as pseudomorphs after weddellite and as small euhedral crystals.

PARAGENESIS

The paragenesis of South Dakota whewellite may be more easily understood in the light of other occurrences. The geological and geochemical environment of whewellite from other North American, as well as several European and Eurasian localities, are associated with some form of organic material, whether it be fossil remains, carbonaceous trash, bitumen or asphaltic material. In the case of the South Dakota occurrence, fossils are moderately abundant in the concretions and the shale itself if carbonaceous. Thermodynamic data on whewellite, as given by Leavens (1968), indicate that conditions for whewellite formation are rather restrictive and require a reducing environment, such as the presence of decaying organic material.

Considering the above factors, it is very likely that whewellite from South Dakota may have been precipitated under reducing conditions by circulating oxalate-bearing connate or meteoric waters that acquired the oxalate component from decaying organic material in the sediment. The formation of whewellite commenced at some time after the earlier formed calcite, but the thin, fine-grained coatings of white calcite are probably an alteration product of whewellite generated by groundwaters at a later time.

ACKNOWLEDGMENTS

The authors are grateful to Robert Falls for the least squares refinement of the X-ray data and J. A. Mandarino for his critical review of the paper.

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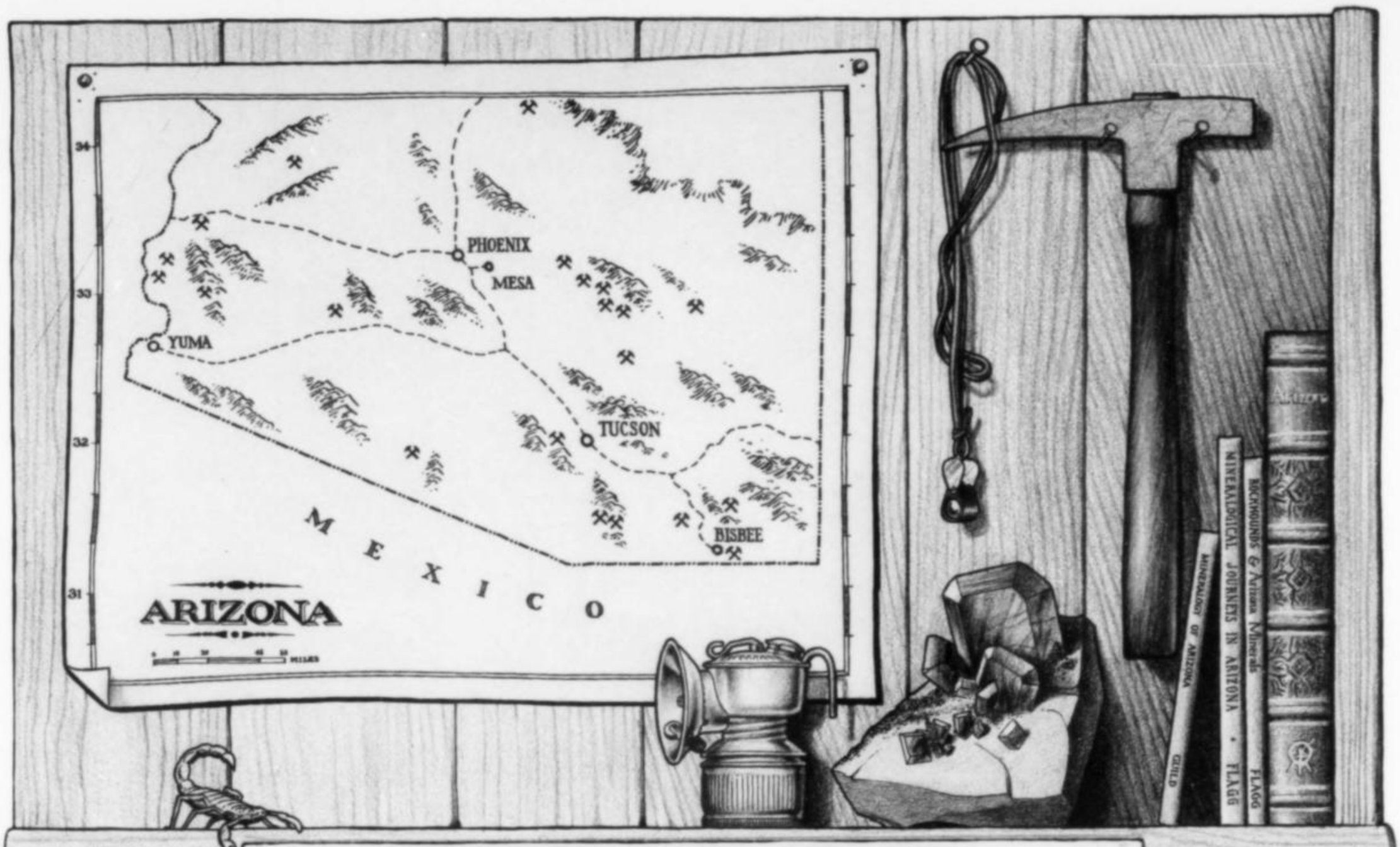

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Microminerals

Bill Henderson

Magnetic Minerals and a Micro Magnetism Detector

In the far distant past, so obscured by the mists of time that his name is long forgotten, a magical guest left me a wondrous device for determining the magnetic properties of microminerals. The device, simplicity itself, is shown in Figure 1.

Some 20 cm (8 inches) in height, the thing has only two parts. The first is a base with two vertical sides. In my case, the base and sides are of plastic, and the sides are attached to the base by filling the open base with epoxy resin. The base can be made in any number of ways, but the absolutely essential requirement is that the bearing surfaces of the top edges are smooth and level. Even a playing card will do, if it fulfills this condition. The second part is a vertical arm (soda straw or balsa stick) to the bottom of which is attached a small but powerful magnet. I have been using two magnets, one 6 x 12 mm and the other 6 x 6 mm. The former is attached with glue to a soda straw, while the latter is attached to a balsa stick with sticky putty. The magnet and arm are supported by a thin sewing needle. The needle should be placed so that the whole arm is in very delicate balance, just able to stay upright. This is best done by making the upper arm too long on purpose and then trimming it with a razor blade until the proper balance is achieved.

I like to adjust mine until the arm sways a bit by itself. It should be ever so slightly susceptible to air currents in the room and should respond visibly if directly breathed upon. If it's flipping endlessly about, the thing is too sensitive, however.

To use it, a microcrystal of a mineral suspected of being magnetic is brought near the magnet. It can be on matrix and even in its micro box. If the mineral is fairly magnetic and the crystal not overly small, the magnet will be attracted to the specimen, and the vertical arm will sway. With weakly magnetic or small crystals, the movement will be very slight, and the specimen should be tested repeatedly after the arm stops moving. If movement is seen each time the specimen is brought near the magnet, then the movement is truly due to magnetism and not to air currents. Of course, don't breathe on the apparatus while using it.

A still more sensitive technique is to move the specimen toward and away from the magnet in phase with the frequency of the swinging arm. The arm then moves further with every approach of the magnet. This method requires a little practice, but using it, one can get really large swings of the arm from very small or weakly magnetic specimens. Again, one should repeat the operation several times to be sure the magnetism is real.

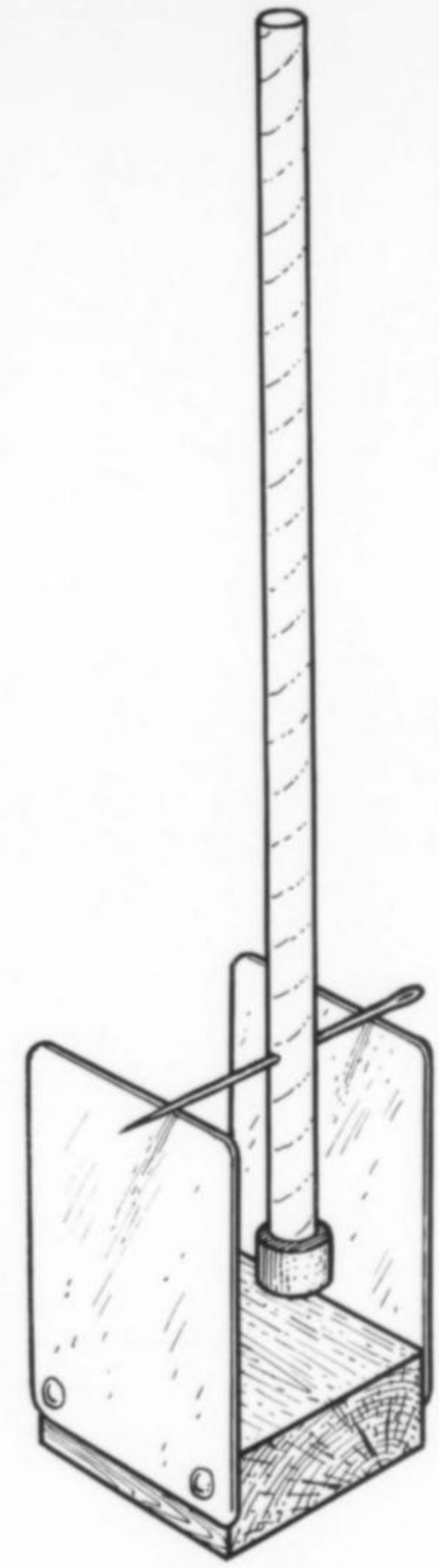

Figure 1. **Micromagnetism detector as described in text. Comprised of a soda straw arm with small, round magnet attached at the base and supported on a sewing needle pivot, this moving part resting on two sides with a smooth and level bearing surface and affixed to a base.**

Occasionally, of course, the magnetism detector will be responding to magnetic minerals in the matrix, and not to the micro crystals being tested. It sort of spoils things a bit, but where possible, a tiny crystal should be detached from a magnetic specimen and tested with the magnet. Of course, being loose, it will jump right to the magnet. If the detector described here gives no response, it is not necessary to detach a crystal for further tests.

Mineral books seldom have much to say about magnetic minerals. Rutley's *Elements of Mineralogy* (1970), for instance, says that only magnetite and pyrrhotite are attracted to a bar magnet, while other minerals are attracted by electromagnets. Not true, as I will show shortly, but it offers scope to those who wish to construct electromagnetic magnetism detectors. The same text gives the following list of magnetic minerals:

Highly magnetic – magnetite, pyrrhotite
Weakly magnetic – siderite, iron-rich garnet, chromite, ilmenite, hematite, wolframite

Far more will be found in texts on separating ore minerals. Magnetic separation is often used to separate continuously high volumes of finely ground ore, and the method is of great economic importance. Otherwise non-magnetic minerals are sometimes briefly roasted in air to partially oxidize them to magnetic species which can then be separated. Magnetic separation was used on Franklin, New Jersey, ore, for instance. Taggart's *Handbook of Mineral Dressing* (1951) lists the following magnetic minerals:
Highly magnetic – magnetite, franklinite, ilmenite
Weakly magnetic – pyrrhotite, siderite, hematite, zircon, limonite, corundum, pyrolusite, manganite, smithsonite

Still, as any advanced collector knows, the above lists are not complete. A number of rarer species are listed in Dana and other texts as being magnetic, and still more can be found by reading the recent literature.

The rest of this column is a description of the specimens in the author's collection which he found to be or are reputed to be magnetic. No particular order will be followed, but the spinel group, which contains several magnetic minerals including magnetite and franklinite, will be described first.

Magnetite $FeO.Fe_2O_3$

Even a crystal as small as the 0.3 mm one shown in Figure 2, causes a violent response on the part of the magnetism detector. All crystals in the author's collection are strongly magnetic and, indeed, no other mineral is more so. The cuboctahedral crystal shown, from Shawville, Quebec, is interesting because the octahedron faces are brilliant while the cube faces are heavily pitted and dull.

Franklinite $ZnO.Fe_2O_3$

All specimens of franklinite the author has tested are from Franklin, New Jersey, and all are quite strongly magnetic. The one in Figure 3 is unusual in that the major form is the cube. It shows dodecahedral faces as well. The crystals in Figure 4 are cuboctahedrons, as are so many crystals of minerals in the spinel group.

Jacobsite $MnO.Fe_2O_3$

Superb crystals of jacobsite (Fig. 5) are found at the Iron Monarch quarry, Iron Knob, South Australia, and are currently available from a number of Australian micromount collectors. The crystal shown is only weakly magnetic, and the mineral is so described in the literature. The crystal shown is a cuboctahedron.

Other Spinel Minerals

A number of other spinels, variously described as magnetic, are as follows.

Mineral	*Composition*	*Magnetism*
Magnesioferrite	$MgO \cdot Fe_2O_3$	Strong
Trevorite	$NiO \cdot Fe_2O_3$	Strong
Magnesiochromite	$MgO \cdot Cr_2O_3$	Weak
Chromite	$FeO \cdot Cr_2O_3$	Weak

Of these, the author has only one specimen of magnesioferrite from Kaiserstuhl, Germany, and it shows weak magnetism. Of chromites from six localities, only those from Sunndalen brudd, Åheim, Sunnmøre, Norway, show even weakly magnetic properties, while the other species are missing from his collection.

Hematite Fe_2O_3

Hematite may or may not be magnetic, and perhaps the magnetic specimens are completely or partially altered to magnetite. This has been shown unequivocally to be the case for magnetite pseudomorphs after hematite from the Sterling mine, Antwerp, New York (*Mineralogical Record,* July-August, 1984). Fifteen specimens in

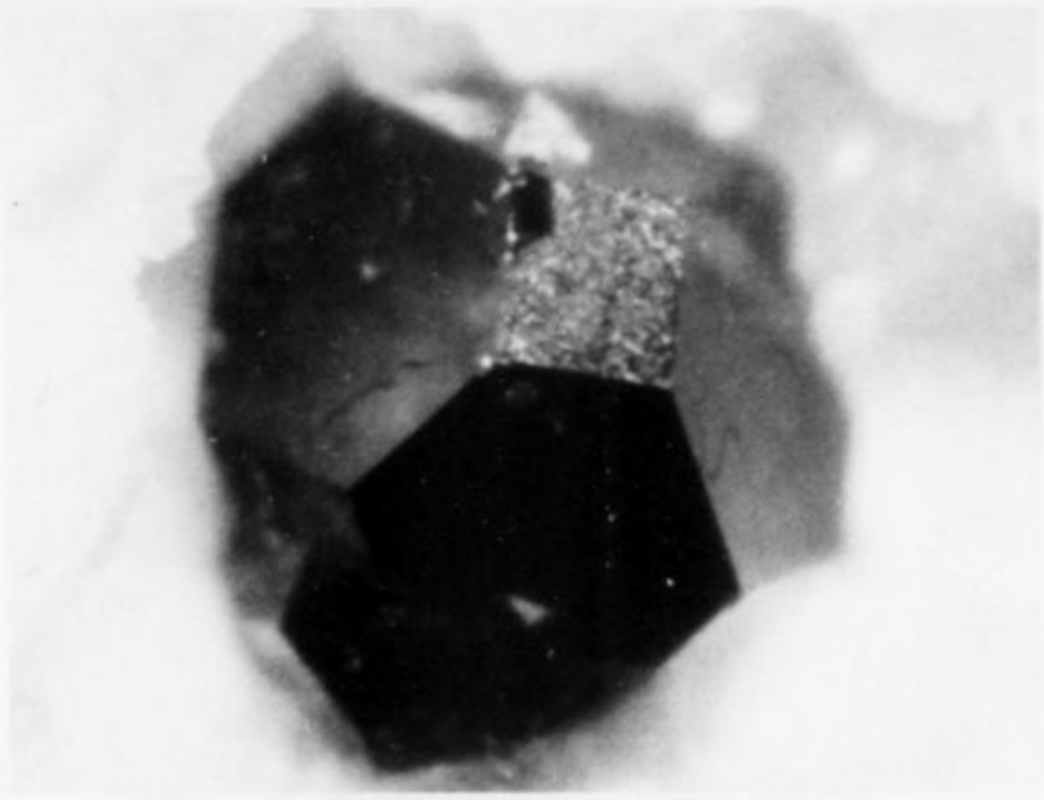

Figure 2. **Jet-black, cuboctahedral, 0.3-mm crystal of magnetite from a road cut near Shawville, Quebec, Canada.**

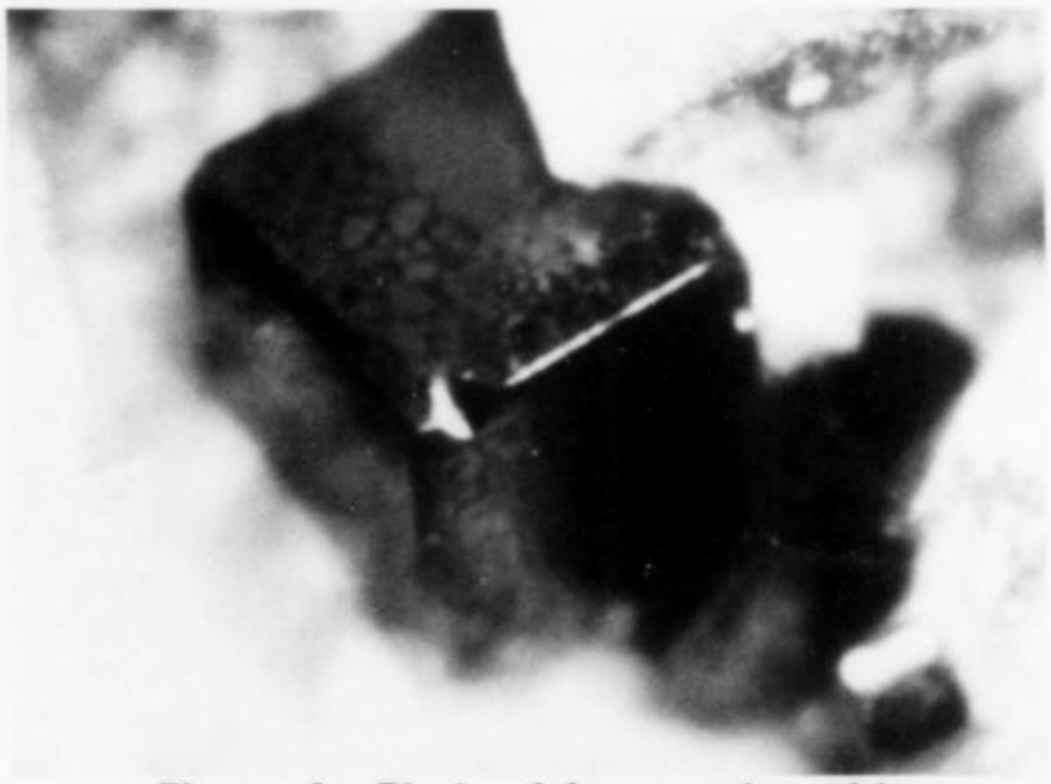

Figure 3. **Black, 0.2-mm cube with dodecahedral modifications of franklinite, from Franklin, New Jersey. Marcelle Weber specimen.**

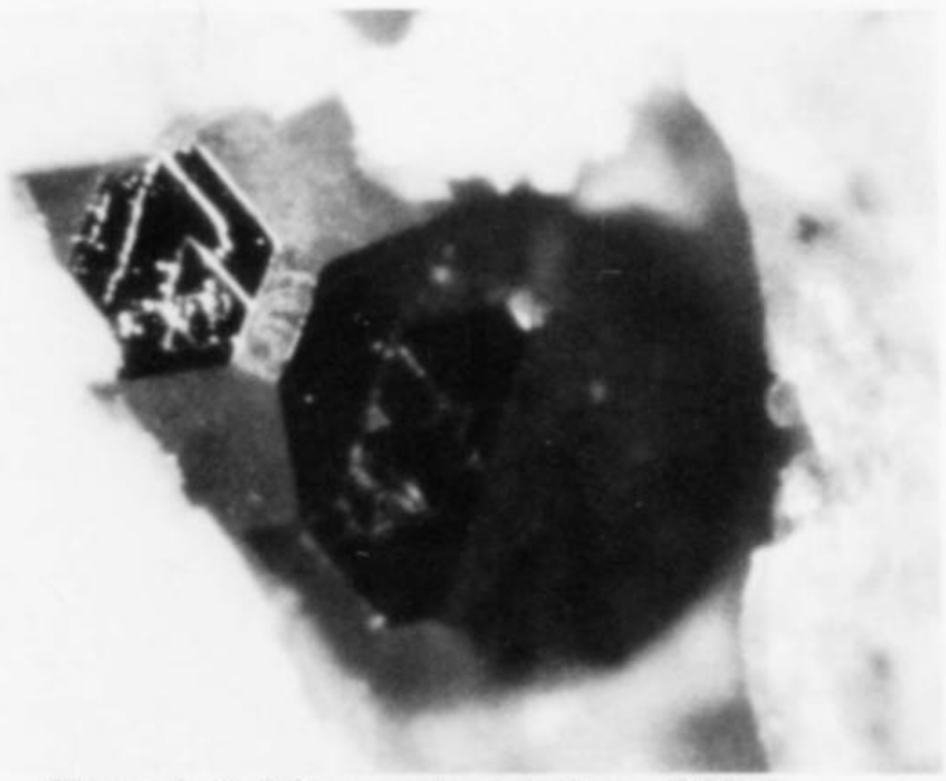

Figure 4. **A 0.3-mm cuboctahedron of black franklinite in marble from Franklin, New Jersey.**

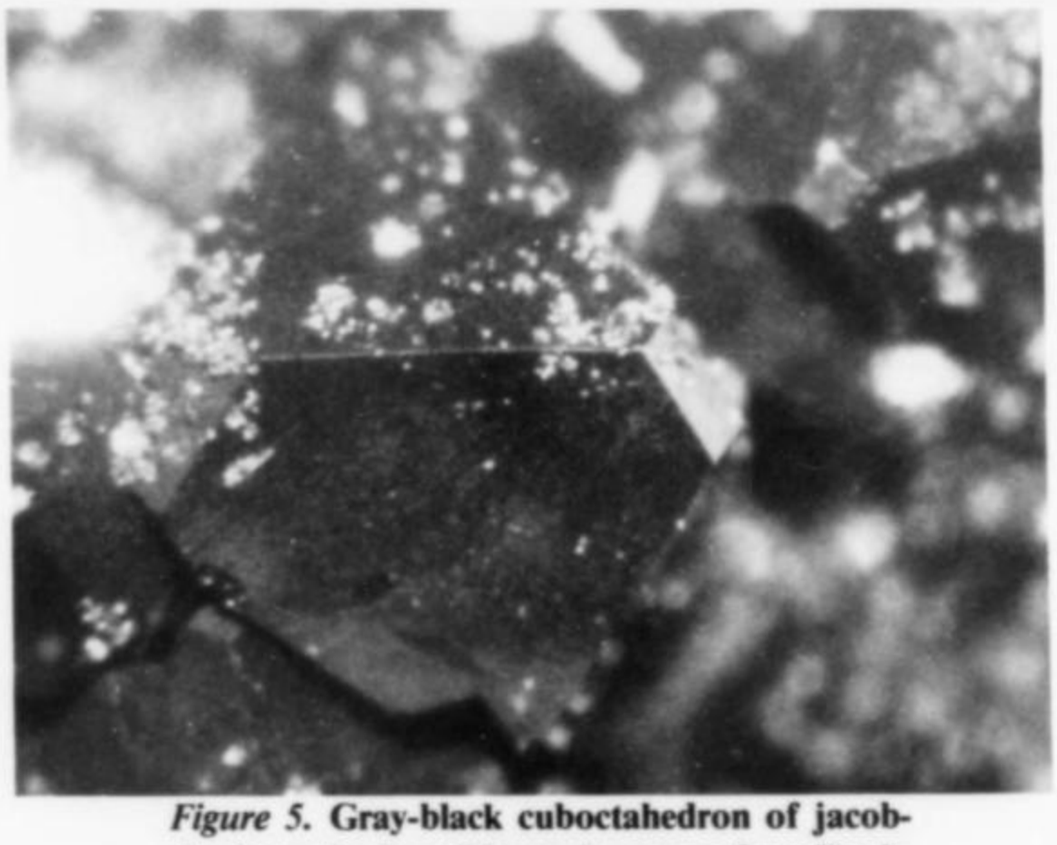

Figure 5. **Gray-black cuboctahedron of jacobsite from the Iron Monarch quarry, Iron Knob, South Australia, Australia. The crystal is 0.4 mm across.**

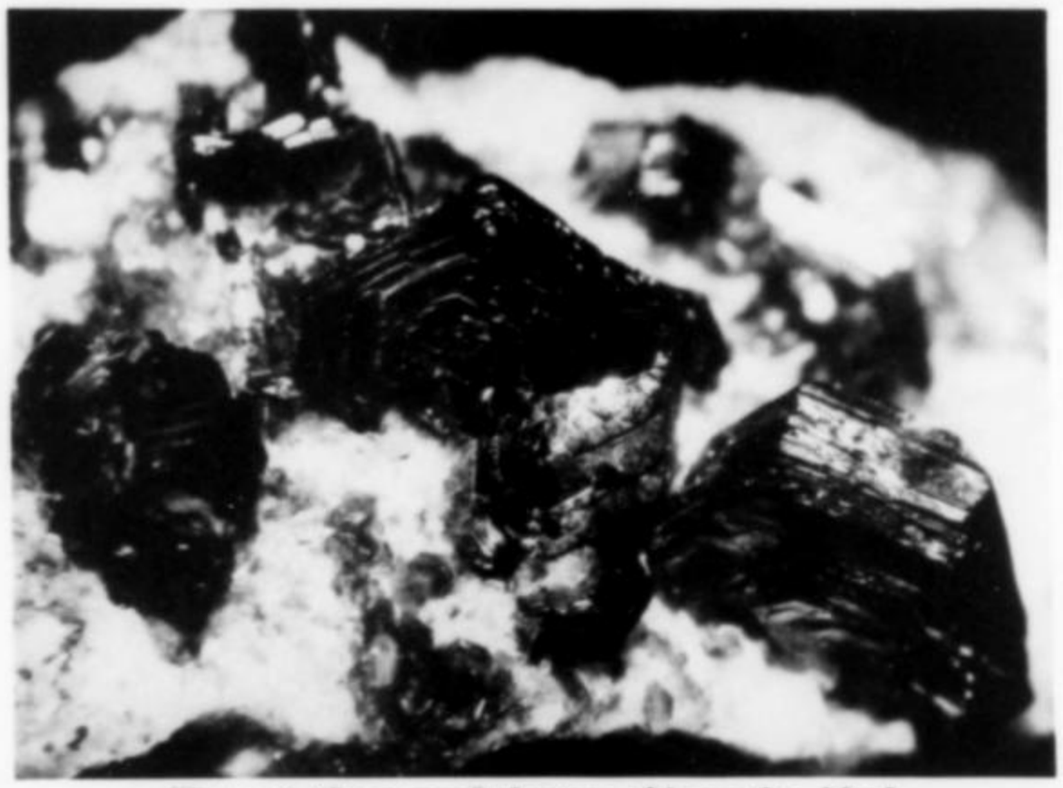

Figure 6. **"Iron rose" clusters of hematite, black with iridescent blue tarnish, from Cervandone, Wallis, Switzerland. The field of view is 11 mm across.**

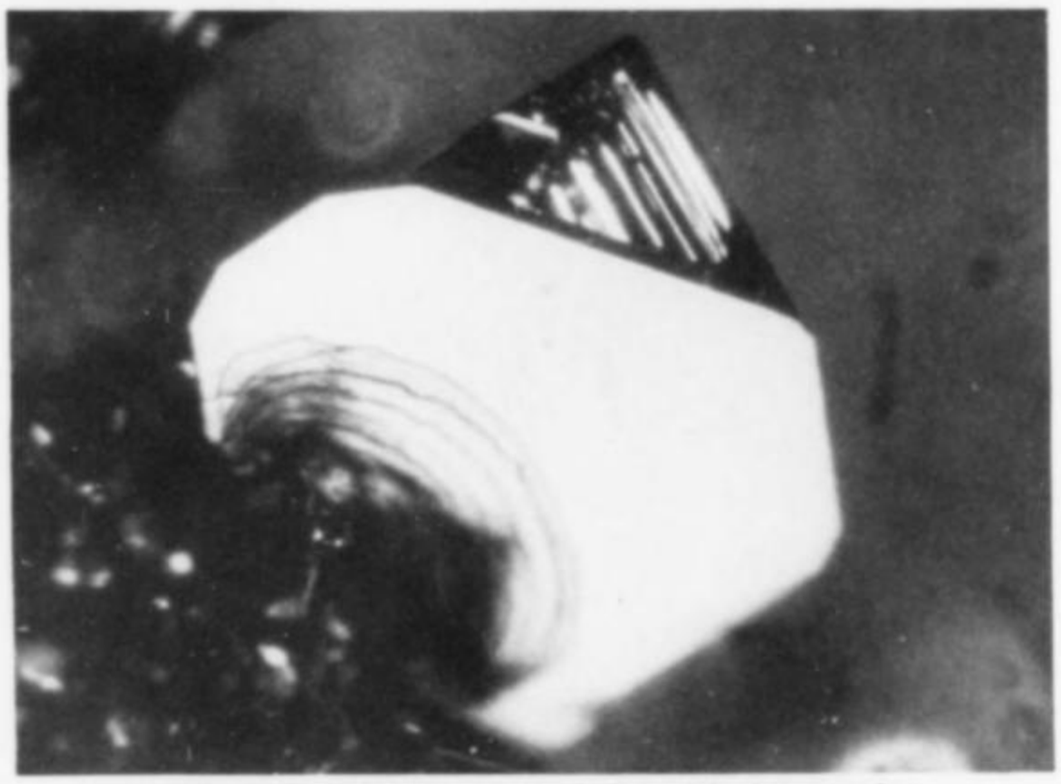

Figure 7. **A 0.5-mm crystal of jet-black hematite from Sattelberg bei Kruft, Eifel district, West Germany. The rhombohedral faces are striated and cavernous, while the *c*-face shows step growth.**

the author's collection are magnetic, while four are not. The iron rose of hematite shown in Figure 6 and the single crystal from Sattelberg near Kruft in the Eifel district, Germany (Fig. 7) are both magnetic. The latter is remarkable for the brilliance of its faces and the deeply cavernous nature of the rhombohedral faces. The strongly etched hematite from Mont St-Hilaire, Quebec, shown in Figure 8 is non-magnetic.

Ilmenite $FeTiO_3$

Ilmenite is variously listed as strongly or weakly magnetic. Of the specimens in the author's collection, nine are strongly magnetic, four weakly magnetic, and two show no magnetism. The ilmenite shown in Figure 9, also from Mont St-Hilaire, Quebec, is shown not because it is magnetic (which it is not) but because it's a very pretty one. Identification of this specimen is based on its crystal form, associated minerals, and on its gray-black streak.

Goethite FeO(OH)

Goethite is sometimes listed as being magnetic; however, not one of the 21 specimens from 16 localities in the author's collection is sensibly magnetic.

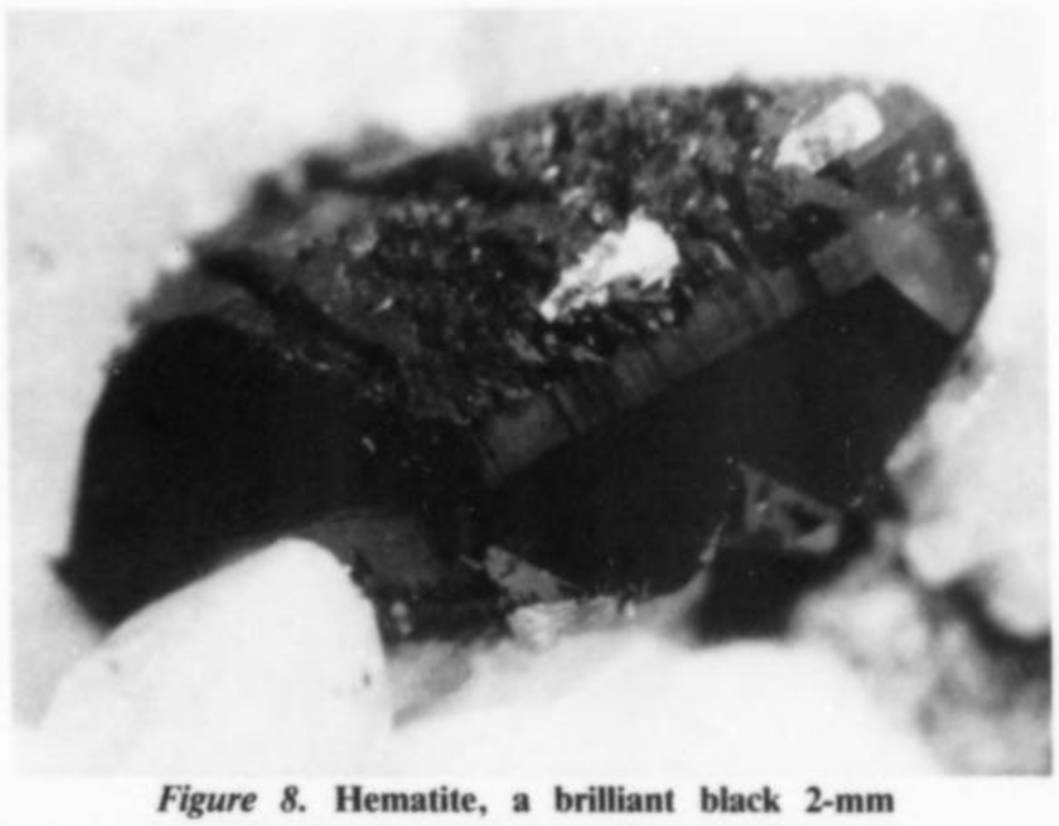

Figure 8. **Hematite, a brilliant black 2-mm crystal, deeply etched, with natrolite and analcime, from Mont St-Hilaire, Quebec, Canada.**

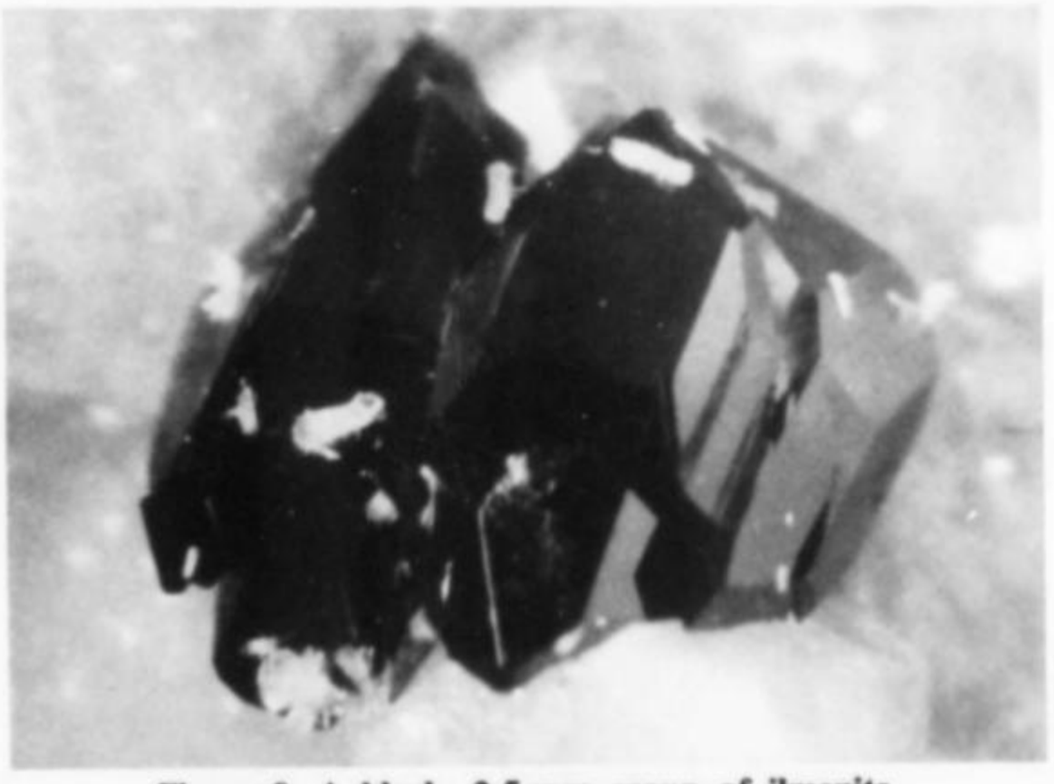

Figure 9. **A black, 2.5-mm group of ilmenite crystals on analcime. From a silicate vug, Mont St-Hilaire, Quebec, Canada.**

Hoegbomite $Mg(Al,Fe,Ti)_4O_7$

This mineral is said to be magnetic. However, the author has the mineral from only one locality, and that is as very thin overgrowths on another species. The crystals are not magnetic.

Siderite $FeCO_3$

Siderite is another species which sometimes is and sometimes is not magnetic. Fourteen specimens tested were, while seven others were not. Siderite from the Narre Warren quarry (Fig. 10) is magnetic, as is the material in Figure 11 from Oregon City, Clackamas County, Oregon. The former is interesting for its crudely botryoidal form and its association with excellent phillipsite, while the latter displays a peculiar bowtie form. The last siderite shown, the pseudo-octahedral crystals from Cornwall, England, in Figure 12, are non-magnetic.

Ferberite-Huebnerite $FeWO_4$-$MnWO_4$

The members of the wolframite group are weakly magnetic. Two specimens of the manganese end member, huebnerite, from two different localities, tested negative, while four out of six ferberite specimens were weakly magnetic. Ferberite from Nederland, Boulder County, Colorado (Fig. 13), gave only a very weak response to the detector despite the large size of the brilliant, deep black crystals.

Hypersthene $(Mg,Fe)_2Si_2O_6$

Very few silicate minerals are themselves magnetic, and hypersthene is probably not one of them. The author tested the hypersthene from Summit Rock, Douglas County, Oregon (Fig. 14), because he knew it to be highly altered to hematite. Sure enough, the deeply cavernous crystal was strongly magnetic. A crystal was removed from the matrix and checked separately, since the matrix contains magnetite as well as hematite. The loose crystal was also found to be magnetic. Unaltered hypersthene from the same area and others caused no response from the magnetism detector.

Almandine-Andradite $Fe_3Al_2(SiO_4)_3$-$Ca_3Fe_2(SiO_4)_3$

Since iron-rich garnet has been described as magnetic, tests were run on more than two dozen specimens of almandine and andradite. All tested negative or very weakly positive, so weakly as to be quite doubtful.

Pyrrhotite $Fe_{1-x}S$

Among the sulfides, pyrrhotite is well known to be moderately to strongly magnetic. The greater the deficiency of iron in the analysis (the greater x is in the formula), the more magnetic the pyrrhotite tends to be. Thirteen specimens of pyrrhotite were tested, and all but two were strongly or moderately magnetic. I will return to those two in a minute. Micro (and macro) pyrrhotites are available in profusion from the Morro Velho mine, Brazil. The single plate of pyrrhotite shown in Figure 15 is from this locality. It is somewhat altered on the surface such that it shows iridescent blues and reds in addition to its naturally brassy color. The very tiny crystals of pyrrhotite shown in Figure 16 are remarkable for their source, paragenesis and associations. They are found in what appears to be basalt, are in association with zeolites, and come from, of all places, Boron, California.

Crystals of the only non-magnetic "pyrrhotite" in the author's collection are shown in Figure 17. At least, they were given to him as pyrrhotite. However, after they failed the magnetism test, they

Figure 10. **A light tan, 2-mm ball of "basket-weave" siderite from the Narre Warren quarry, Berwick, Victoria, Australia. Associated with phillipsite crystals (lower right).**

Figure 11. **Dull brown, 0.6-mm siderite crystals from Oregon City, Oregon. The striated crystals appear to be steep rhombohedrons terminated by the base.**

Figure 12. **Siderite in pseudo-octahedral crystals, light yellow in color, from Cornwall, England.**

Figure 13. **Jet-black crystals of ferberite to 2.5 mm in length, from Nederland, Colorado.**

Figure 14. **A cavernous, 0.8-mm long crystal of brick-red hypersthene from Summit Rock, Oregon. The crystal is highly altered and coated with epitaxial hematite.**

were more closely examined, at which time it was obvious that they are beautifully and multiply twinned crystals of marcasite, not pyrrhotite at all. The moral, of course, is that the presence or absence of magnetism has significant diagnostic value.

Griegite $FeS.Fe_2S_3$

Greigite is an extremely rare, cubic iron sulfide which is known to be magnetic. The SEM photographs of greigite (Figs. 18 and 19) were very kindly supplied by William B. Wise, and are used because the crystals are really too small to be made out using a light microscope. The crystals are crude cubes, and, in Figure 18, are

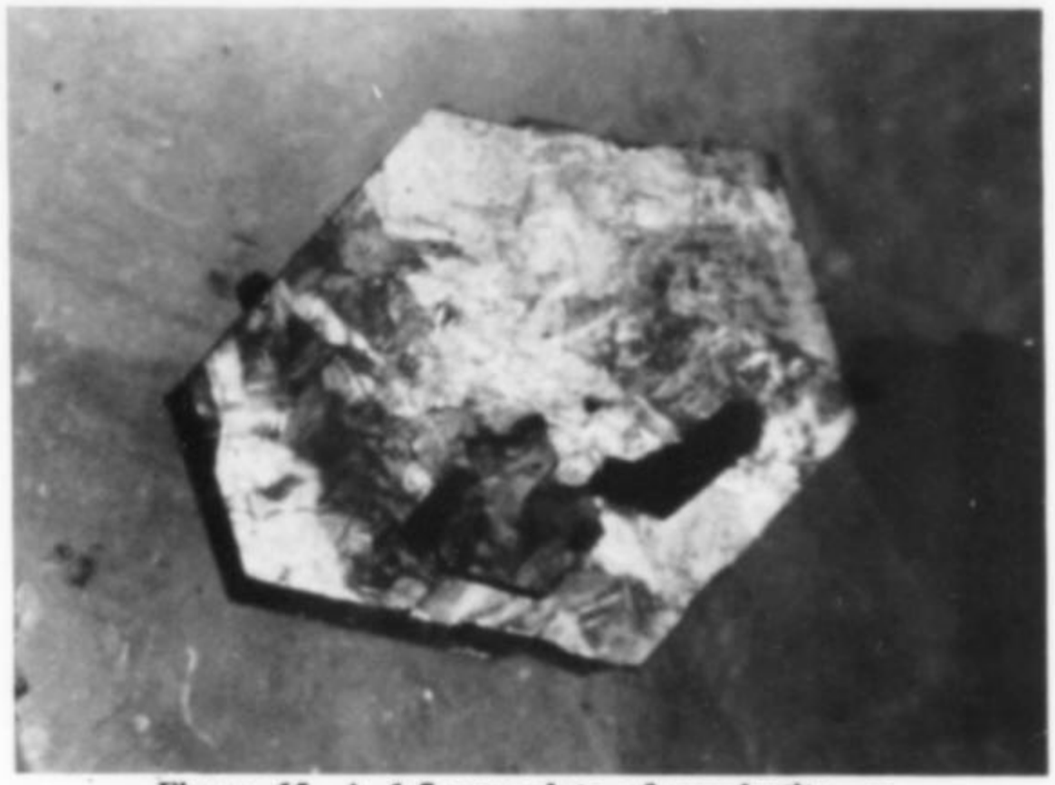

Figure 15. **A 1.5-mm plate of pyrrhotite on dolomite from the Morro Velho gold mine, Minas Gerais, Brazil. The crystal is golden yellow with red and blue tarnish.**

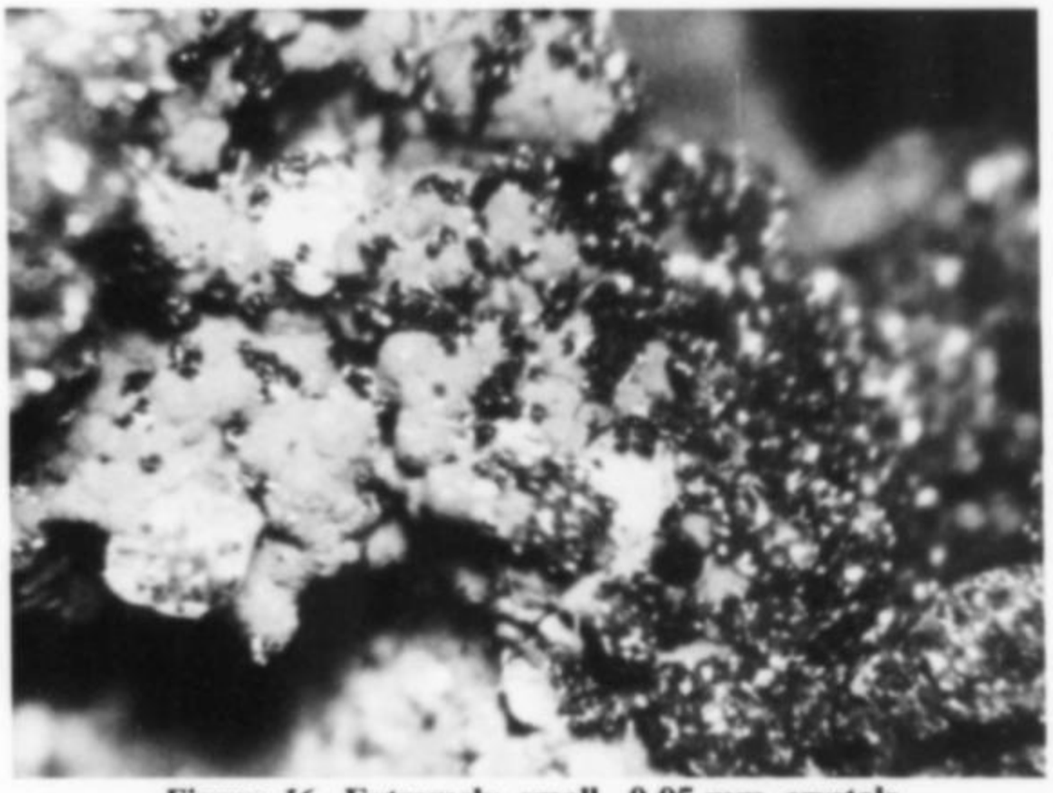

Figure 16. **Extremely small, 0.05-mm crystals and crystal groups of pyrrhotite with analcime, from Boron, California. The crystals vary from brass-yellow to dark brown in color.**

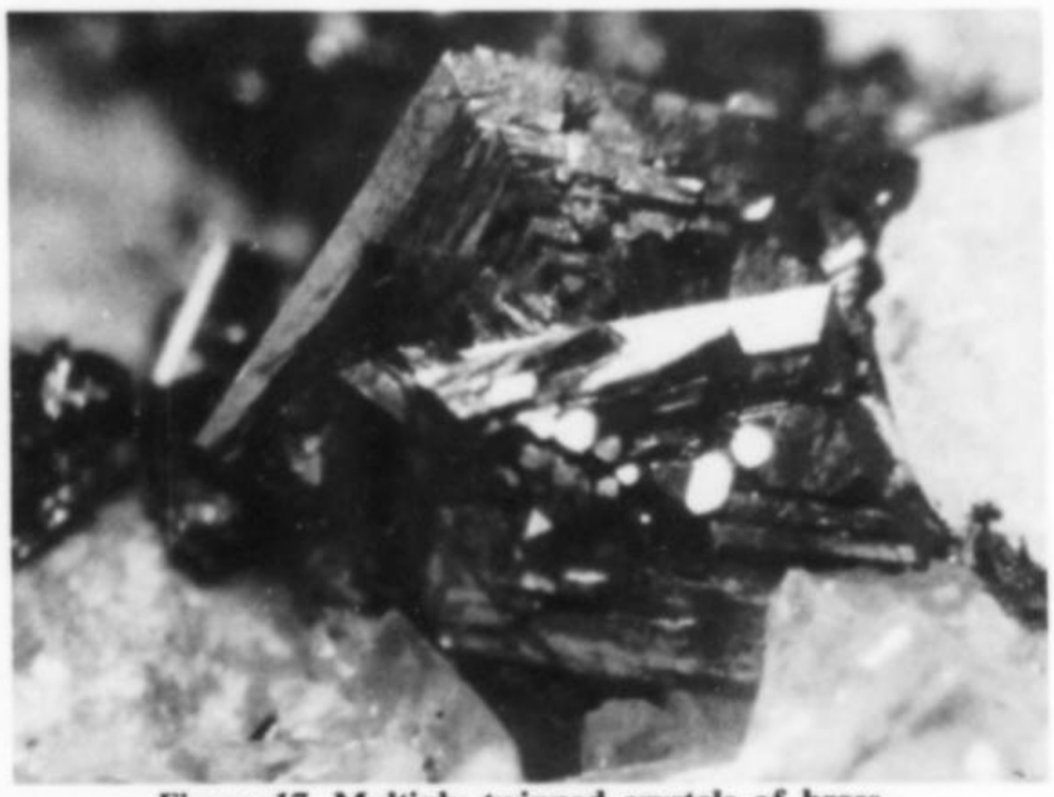

Figure 17. **Multiply twinned crystals of brass-yellow to red-brown marcasite to 10 mm in size on calcite. From the Noyes mine, Madoc, Ontario.**

Figure 18. **Extremely small crystals of greigite with and on analcime. The largest analcime crystal is about 0.8 mm in size. From Boron, California. SEM photo by William B. Wise.**

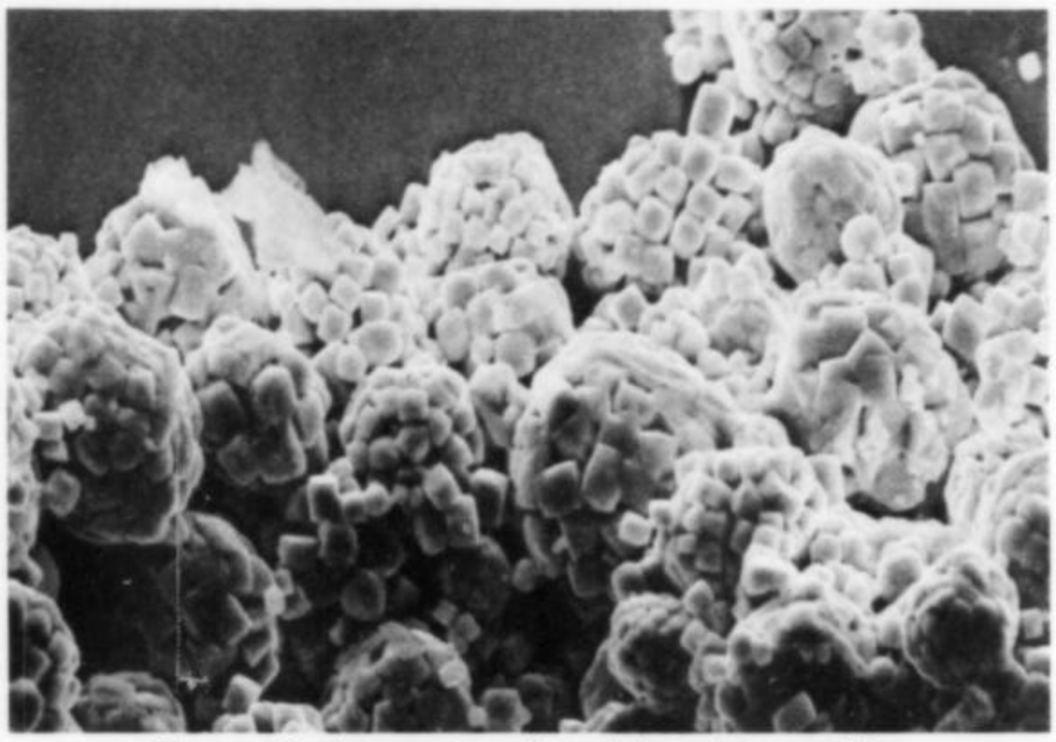

Figure 19. **Aggregates of crudely cubic crystals of greigite from Boron, California. William B. Wise SEM photo.**

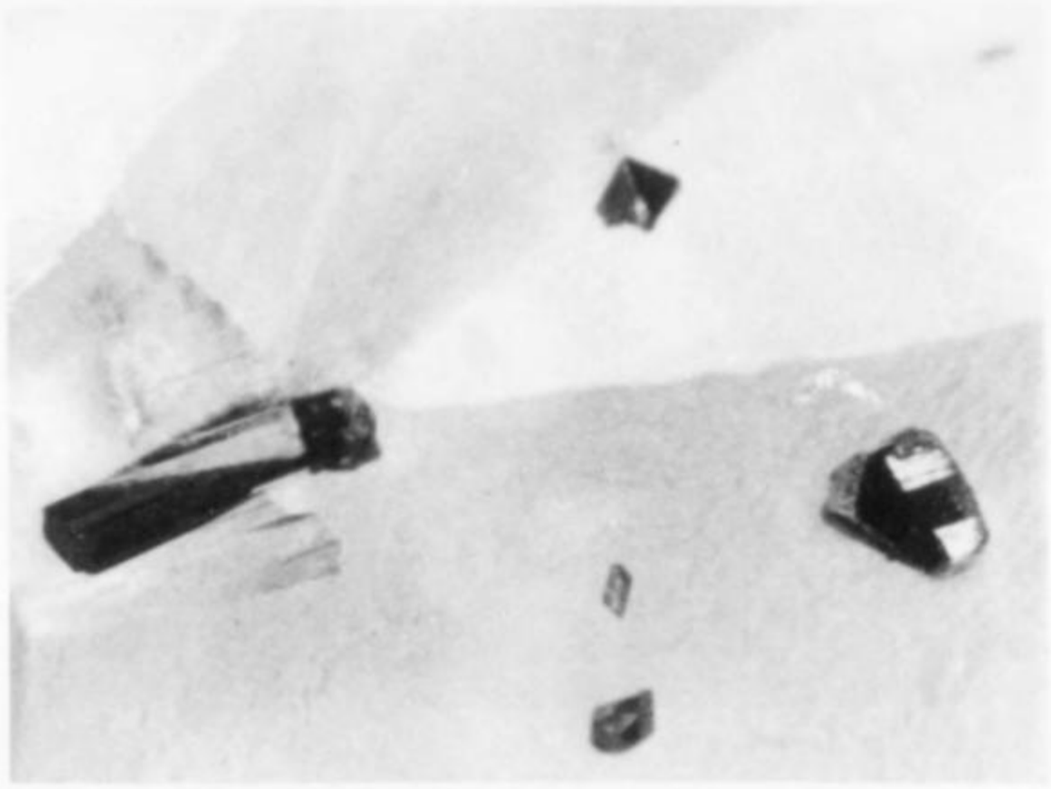

Figure 20. **A columnar and striated crystal of cubanite, 1.2 mm long (lower left), a pseudo-octahedral crystal of chalcopyrite (upper center) and pyrrhotite crystals (lower right), on dolomite. All the crystals are brassy yellow. Marcelle Weber specimen, from the Morro Velho gold mine, Minas Gerais, Brazil.**

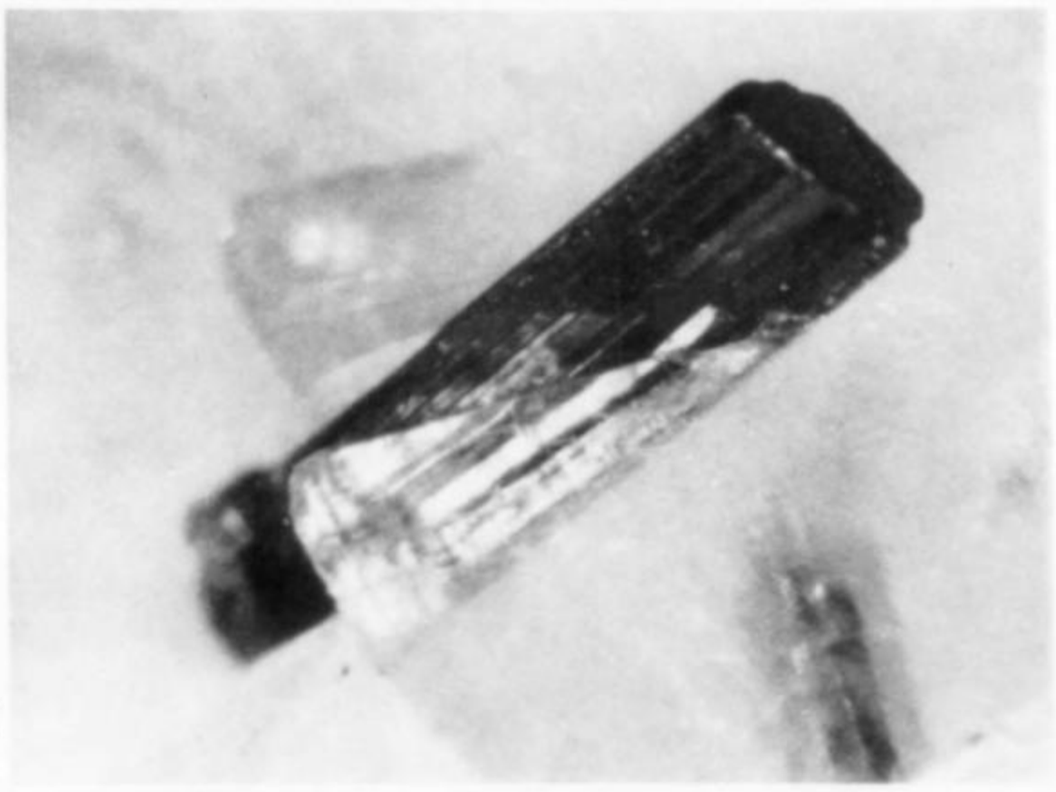

Figure 21. **Enlarged view of the cubanite crystal shown in Figure 20. Marcelle Weber specimen.**

shown growing on analcime crystals. The specimens are also from Boron, California.

Cubanite $CuFe_2S_3$

Very nice cubanites have recently been available or described from the Morro Velho mine, Brazil, and Chibougamau, Quebec. Cubanite is another of the small number of magnetic sulfides. In Figure 20 are shown crystals of three iron sulfides on matrix from Morro Velho. They are cubanite, pyrrhotite and chalcopyrite. Of these, the first two are magnetic. A closeup of the cubanite is shown in Figure 21. Close inspection shows that the crystal is growing from a crystal of dolomite, and has interrupted the growth of the dolomite.

In some ways, the phenomenon of magnetism in minerals is much like that of fluorescence. Both can be counted upon in some species, may be found occasionally in others, and may be spuriously present in still others through alteration or the presence of mineral overgrowths. Still, when used with caution, magnetism can have some diagnostic value (as, for example, in distinguishing members of the spinel family or distinguishing marcasite from pyrrhotite). Since micromineral collectors often have precious little to go by when making identifications, the micromagnetism detector described here is well worth making and using.

A final word. The hardest part of making this magnetism detector is finding a source for the little magnet. The author will be glad to send United States and Canadian readers, in return for one dollar (U.S.) and a stamped, self-addressed envelope, not one but two wee magnets eminently suited to the purpose.

Good hunting!

Wm. A. Henderson, Jr.
174 East Hunting Ridge Road
Stamford, CT 06903

Book Reviews

***Natural Zeolites,* by Glauco Gottardi and Ermanno Galli, published (1985) by Springer Verlag, New York. Hardcover, 23.5 x 16 cm, 409 pages. Part of a series on Minerals and Rocks, #18; $59.00.**

This book is a delight for the species mineralogist and the serious mineral collector. It fills a need for such a specialized volume, and does so very well. The book is well bound, lies flat when open, has adequate margins and "white-space" for notations, has easy to read type and spacing, and is well designed. The paper, although having some small amount of print-through visibility, is adequately opaque. The volume is well illustrated, largely with SEM photographs and crystal drawings, and the photographs are of good size; in fact, many are oversized.

There is an introductory section of general information on zeolites, followed by sections (7 in number, and arranged structurally) devoted to the 32 individual species. These species-specific pages comprise 280 of the 409 total pages! The descriptions of the species consist of history, nomenclature, crystallography, chemistry and synthesis, optical and physical properties, thermal and other physico-chemical properties, occurrences and genesis, and uses and applications. This is a technical volume, oriented primarily toward the professional mineralogist. However, there are several features which will be of substantial assistance to the collector, in particular the excellent photography, the morphological descriptions (albeit brief), and the most significant aspect of all: a detailed and plentiful amount of locality information, nicely presented, organized by country of occurrence for each species, and supported by a detailed locality index of 18 pages. There also is an index by mineral/synthetic zeolite. Two appendices give X-ray powder diffraction data, and infrared spectra data.

This is a fine book, indispensable for the professional and of great use to the serious mineral collector. For me it will be a valued reference. However, to the collector unaccustomed to purchasing technical reference works, the price will seem rather high and could be a deterrent.

Pete J. Dunn

***Geology of World Gem Deposits,* edited by S. L. VanLandingham. Published (1985) by Van Nostrand Reinhold Company, 135 West 50th Street, New York, New York 10020. Hardcover, 18 x 26 cm, 406 pages; $46.50.**

The title does not prepare the reader for the rather peculiar concept of this book. One might expect a series of geographically divided chapters giving an overview of each important area as Sinkankas did in his excellent *Emeralds and Other Beryls.* Not so.

Chapters 1 and 2 consist of facsimile reprints of magazine articles (dating mostly between 1950 and 1980), rather in the style of the *Benchmark* series published by Dowden, Hutchinson and Ross. Unfortunately, many of these 22 articles are far from being benchmarks in the literature, and as a whole they do not even come close to a thorough or balanced coverage of the subject.

The remaining 55% of the book is essentially bibliography. Chapter 3, mistitled "Review of the geology of world gem deposits," is actually a series of reference citations in paragraph form, organized by subject. There is no discussion of geology as such. However, the author comes into his own here and gives a very knowledgeable, useful survey of the literature. The bibliography itself (to which chapter 3 refers, and to which it serves as a subject index) runs to 127 pages, followed by 32 pages of index in the usual columnar form.

The value of this book lies in the bibliography, which makes a nice complement to the ones in Sinkankas's books (including *Gemstones of North America*) and *Gill's Index.* Anyone capable of actually using the bibliography will have little use for the smattering of article reprints included. Whether the contents justify the price is another question.

W.E.W.

***Dictionary of Rocks* by Richard S. Mitchell. Published (1985) by Van Nostrand Reinhold Company, 135 West 50th Street, New York, New York 10020. Hardcover, 18 x 26 cm, 228 pages; $29.95.**

Mineral collectors are by nature somewhat concerned with nomenclature. On the one hand they like to be proficient at identifying specimens by the correct name. But they also like to be able to identify *names* encountered on old labels and in the literature. Here they face two possible problems which might lead to frustration: (1) the name in question might be an obsolete one not found in most current reference works, and (2) the name might be a rock name which would not be listed in mineralogical compilations. Consequently the collector wishing to be prepared needs a reference for rock names, and Mitchell's *Dictionary of Rocks* is an excellent choice. In fact, it is the first such work in English, devoted exclusively to rock nomenclature, and Mitchell has compiled his list of names from an extensive bibliography of previous works.

For most terms Mitchell gives the derivation of the name, the first (and subsequent, if any) definition, the author and date of its introduction into the literature, a classification (e.g., "igneous plutonic"), and a note on its occurrence. Well over 4000 names are treated in this manner, and a number of photographs including 32 in color augment the descriptions.

Introductory material covers basic concepts of how rocks and minerals differ, the major rock classes, notes on how rocks are named and the names derived, a list of definitions, a brief glossary, and a two-page bibliography of the most important references.

This is a useful, well-thought-out and concisely formulated basic reference which, as the old saying goes, deserves to be on every collector's shelf.

W.E.W.

Herbert Sbodda

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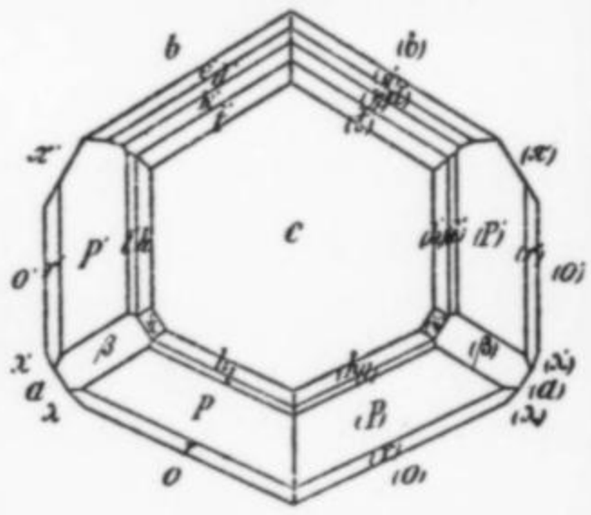

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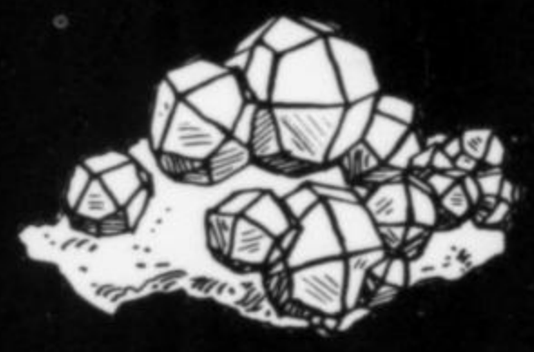

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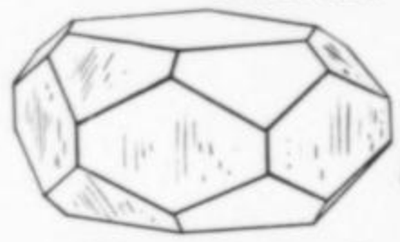

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Letters

FAKED PYRRHOTITE

This letter is to suggest you warn *Mineralogical Record* readers about the blue pyrrhotite coming from Brazil. These are being sold by a couple of dealers in Belo Horizonte and Governador Valadares, Minas Gerais.

The blue color of these crystals is intense and beautiful, but unfortunately not natural. It is produced by soaking ordinary brown pyrrhotite crystals in an alkaline solution containing copper.

Alvaro Lucio
Belo Horizonte, Brazil

HURLBUTITE

Chris Van Laer recently sent me news about the Butte hurlbutite (mentioned in *What's New,* v. 16, p. 497, as having been reported in *Mineral News*). It has been identified by the Gemological Institute of America and the Harvard Mineralogical Museum as *danburite*. There is still something noteworthy about it though: this appears to be only the second occurrence of danburite in a pegmatite. It has been found at the Anjanabonoina pegmatite in Madagascar as well.

Lanny R. Ream
Editor, *Mineral News*

BACK ISSUES

I appreciated your offer in the November-December issue (p. 440) regarding a one-year subscription in trade for a Gold Issue. Whereas I will not part with my issues of the *Mineralogical Record,* I can make you a real deal for *National Geographic* and *Sunset* . . . by the pound. Seriously, if you get any takers on the three-years-for-a-Colorado-I-issue (vol. 7, no. 6), I'd like to buy it. I began subscribing in 1978 and have been working my way backwards, with only 11 issues remaining to complete my set. (They are listed as an asset in my will so no fool executor tosses them out.)

As to subscription price, I'd rather pay extra for quality and value than to receive just paper.

James L. Bowersox
Poway, California

Thus far we've had only three takers on that offer . . . two gold issues (which I'm keeping) and a Colorado-I.

Ed.

MORE ON MAILERS

The last two copies of my *Mineralogical Record* were folded double by the rural mail carrier, leaving a permanent crease in the magazine. I hate to see those beautiful front covers damaged that way.

Michael L. Ebers
Crossville, TN

I am usually pleased with the postal service, but my latest Tourmaline Issue was shoved into my mailbox and badly creased. May I suggest that you have the words "Please Do Not Fold" printed in large letters across the address sheet so the carrier will see it?

Henry H. Fisher
Columbus, OH 43227

A fine idea. As soon as I received your letter I called our printer and had the change made in time for the Silver Issue. Let me know if it works. Incidentally, have you considered getting a larger mailbox?

Ed.

Just thought I'd drop a line and let you know how much I appreciate your publication just the way it is (and in the plastic wrapper).

M. F. Madlen
Cheyenne, Wyoming

SMART MONEY

You were right on a few issues ago (v. 16, n. 3, p. 169) when you were talking about how only geniuses and intellectuals read our beloved rag. So here's my $43 for another two years of the best.

Signed,
One of the In Crowd
R. Woodside
Chilliwack, B.C.

Was that what I said? Then it must be true.

Ed.

TOURMALINE ISSUE

Your latest issue on Tourmaline (vol. 16, no. 5) was a classic—one of the best yet. I enjoyed it especially for the coverage of Maine tourmaline by Carl Francis . . . so many fine illustrations and excellent historical data.

Reading it reminded me that back in 1934 I exchanged some Pikes Peak minerals with Benjamin Burbank, who had written of the big find of topaz, herderite and tourmaline at Fisher's quarry, Topsham.

W. D. Nevel visited me in 1938 and I purchased from him a white quartz scepter with a brilliant, doubly terminated smoky quartz crystal perched on the end, from Mt. Mica. This was not long before his fatal accident.

In 1948 I acquired from Katharine Hamlin three very nice Mt. Mica tourmalines from the 1891 find (with descriptive notes in Fred Pough's handwriting, making them doubly interesting). Through my dear friend Edwin Over I obtained a couple of facetted Mt. Mica tourmalines also from the Hamlin stock. So you can see that pleasant memories were brought back by your tourmaline issue.

George M. White
Colorado Springs, CO

Congratulations on a fine issue (Tourmaline) that just arrived. I was particularly interested in Carl Francis's article, since it has information that I've been trying to obtain for years on areas where I once collected.

I do have some corrections in terminology to suggest: two of the articles (p. 362, p. 415) mention "rhombohedral" terminations on tourmaline, one (p. 416) uses the term "scalenohedral," and one (p. 404) refers to "prismatic" terminations. Since tourmaline is hemimorphic these are impossible, and should instead be "trigonal pyramidal," "ditrigonal pyramidal" and "pyramidal" respectively.

William R. Cook, Jr.
Cleveland Heights, Ohio

Points well taken. *Ed.*

FAN MAIL (AND COMPLAINTS)

This letter is to renew my subscription for another two years, and to pass on my congratulations for another year of top quality articles. It is refreshing, in this day and age, to find a truly dedicated group of people such as yourselves. I find the articles, columns and editorials consistently clear, accurate and technically precise, and yet at the same time eminently readable. Having written articles myself for other journals, I appreciate just how hard it is to achieve such

excellence and really, I take my hat off to you all.

Rick Turner
Johannesburg, South Africa

Dear Readers,

I realize that it is insufferable of an editor to publish blatant praise such as the above but, being proud of the magazine, I sometimes lose control of myself and do it anyway. The following letter, on the other hand, is from a dissatisfied reader.

Ed.

I just received the Tourmaline Issue of the *Mineralogical Record*. I think it is a beautiful issue. However, there were a couple of things missing that prompted me to write.

First, where is "What's New in Minerals?" or "Letter from Europe"? These columns have been very sporadic or non-existent over the last year or so! I enjoy these columns, especially after reading the drier but well-done mineral articles. I like to read about who's who in mineral collecting, what's showing up at the shows, and what collectors overseas are doing.

Second, I do not mind the occasional special issue, such as the Tourmaline Issue. I *do* mind getting a special issue just about every other time. Let's see more of the "regular" issues that have more of a variety of mineral and locality articles. That way every issue is special!

One final point. I realize history is very much a part of mineral collecting and mineral localities. But mining artifacts and antiques do *not* belong in the magazine.

I hope that you will consider these matters in future editorial decisions. Overall, I feel the magazine is a very good one except for the few matters mentioned above. You are to be commended for the difficult and monumental task of keeping the *Mineralogical Record* coming out issue after issue.

Carl Olson, Jr.
Winston, Georgia

In answer to your questions:

(1) I write "What's New" as often as possible. Unfortunately I can't travel as much as would be necessary for six columns a year, nor am I certain there is that much new to write about. Lately I've been getting more help from local correspondents attending shows not on my schedule, and this is much appreciated.

(2) "Letter from Europe" ceased a few years ago, mainly because the author no longer lived in Europe. At present, however, I agree that we could use more columnists and will entertain proposals from anyone who might be willing to write regularly for us. People-related articles and columns (for example the Bandy diary and the Cassirer memoirs), especially those containing collecting stories, are very popular and I love reading them myself. I wish we could find more of them of sufficient quality and interest.

(3) ***Fewer*** *special issues? That would certainly be easier from an editorial standpoint . . . special issues require several times as much work to put together. But yours is the first such complaint we've had, and my feeling is that most readers would disagree. Nevertheless, I realize that regular issues have their own advantages, and will strive to keep a reasonable balance.*

(4) Mining antiques have indeed received some coverage in the Mineralogical Record *over the years, and it's true that they are of only peripheral interest to mineral collectors. Probably very little will appear on them in the future. However, our eclectic readership is very fond of peripheral collecting, and we will always be going off on the occasional tangents from time to time. Perhaps they will involve antique scientific (mineralogical) instruments or collectible books on mineralogy. These subjects are interesting and educational even to readers not actively involved if they will just give them a chance. If one keeps one's interests (or at least one's reading) too narrow life can get boring.*

Ed.

DEALER MURDERED

Subhash Jain, owner of Real Gem Corporation in Chicago, was shot and killed by thieves on October 10 as he was returning a rental car at the Detroit Airport. More than $400,000 in precious stones, which Jain was carrying in a black leather shoulder bag and briefcase, were taken. Witnesses reported that Jain was accosted by two men, one white and one black, who had been waiting near the car rental agency entrance. The assailants fled in a late-model, four-door, gold-colored Chevrolet Impala.

A total of $15,000 reward has been offered (by the American Gem Trade Association, the Indian Diamond and Colored Stone Association, and Herbert A. Duke of International Gem and Jewelry Shows Inc.) for information leading to the arrest and conviction of those involved. Ray Zajicek, AGTA President, said that "by attacking one dealer they have attacked us all."

For more information contact the Hart Agency Inc., 3625 North Hall, suite 640, Dallas, Texas 75219 (214-528-3281).

(compiled from press releases)

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What's New in Minerals?

by Wendell E. Wilson

DETROIT SHOW 1985

The following notes on the Detroit Show were provided by Gloria Ludlum:

• Many fine fluorite specimens were available from a recent series of finds at the Annabel Lee mine in southern Illinois. Mining was initiated at the site by the Ozark-Mahoning Mining Company in 1984; the first ore and good mineral specimens surfaced in 1985. Fluorites from the Annabel Lee are reminiscent of those from the famous Cave-in-Rock district only 3 km to the south, and in fact are being removed from the same horizon. Crystals are cubic, commonly 2.5 to 10 cm on edge, and range in color from purple and blue to yellow (in some cases zoned). Associated minerals include galena, barite, celestite, sphalerite, calcite and marcasite. The galena comes in fine, lustrous crystals to 2.5 cm, commonly in groups. Celestite has not been found at all since May 1985, but up to that time had been collected in pale blue crystals on specimens of thumbnail and miniature size. Barite was originally found in brownish crystals to 2 cm or so, but following the show some nice, large (to 10 cm), yellow-orange zoned crystals on purple fluorite were found; other shades of barite, from tan to brown, gray, yellow, white and pale blue were as well. (These were being sold by Ross Lillie, Howard Schlansker, Chris and Neal Pfaff, and Joe Kielbaso.)

• Rod Tyson of Edmonton, Alberta, displayed interesting specimens of pyrite and sphalerite from Nanisivik, Baffin Island. He was also selling attractive analcime/aegirine specimens from Mont St-Hilaire, Quebec. The white analcime crystals to 2.5 cm are in many cases perched on black aegirine blades to 5 cm.

• Large quantities of celestite were available from a new find made by John and Brett Medici and Joe and Mark Kielbaso, at a quarry in Portage, Wood County, Ohio. According to John, the pocket measured 1.5 by 2.5 meters and was revealed in the sump area when a dry spell caused the water level to drop. The crystals are white to gray and pale blue, with typical celestite crystal forms. The largest crystal measures 38 cm and weighs nearly 8 kg. This, another large crystal weighing 7 kg, and thousands of smaller ones had sloughed into a pile in the center of the pocket. A few remained attached to the pocket walls. Much breccia was mixed in with the crystals in the lower meter of the pocket, where some unusual crystal shapes and doubly terminated crystals were found. A great variety of crystal habits characterize the smaller crystals (1 to 7 cm) from this zone. This is an important find, and includes some of the highest quality large celestite crystals ever found anywhere.

• Ken and Betty Roberts had a nice selection of sphalerite specimens from Pico de Europa, Santander, Spain. These are brown to reddish orange crystals up to 7.5 cm in size, acquired from an old collection.

• Wayne and Dona Leicht were selling some major specimens from the Lewis Land collection. These include a 13-cm apophyllite crystal on matrix from Centreville, Virginia, a large benitoite (very scarce these days), and two superb tourmalines (Himalaya mine and Minas Gerais). The Himalaya mine tourmaline has two pink/green bicolored crystals to 15 cm on pale smoky quartz, and the Brazilian piece consists of three burgundy crystals to 10 cm.

• *Mountain Minerals International* of Louisville, Colorado, had a large selection of Indian minerals. Highlights included large sheafs of white to cream-colored stellerite, chabazite crystals to 2.5 cm (pale pink to deep orange), and some very aesthetic specimens of laumontite with gyrolite, and some unusual yugawaralite crystals to 3.8 cm from the Bombay area.

• Pamour Mines had a show booth virtually filled with gold specimens from the Timmins, Ontario, mines. Prices ranged from $4 to $18,000.

• Brad Van Scriver (now living in Tucson) had some interesting monazite specimens from Serra Espinosa, Minas Gerais, Brazil. These were thumbnail specimens, mostly pale brown twins without matrix.

• One of the most attractive new discoveries to surface at the Detroit Show was the cobaltian calcite from Zaire. See below in the Munich Show report.

MUNICH SHOW 1985

A month can't be considered wasted in which the world's best something shows up on the market. In October it was cobaltian calcite. The new find is from Mupine, Shaba province, Zaire. Several superb pieces were brought to the Detroit Show a week before by Gilbert Gauthier (and were snapped up by Ken and Betty Roberts, Chris Wright and others). More was to be seen at Munich. This material is a giant improvement on any such calcite previously known. The crystals are large, commonly 2 cm and in some cases over 4 cm. They are nicely formed and exhibit two distinct habits. Some are lustrous and sparkling with many faces, including at least four different scalenohedron forms (on the same crystal), one bipyramid form and two rhombohedron forms. The other habit has a rhombohedral termination and less lustrous stepped sides composed of oscillatory rhombohedron/scalenohedron (?) faces yielding an accordion-like aspect. The color, at its best, is an exquisite, strong pink with a magenta case. And, to top it off, the crystals have significant transparency although I didn't see any that were actually facetable. A few are associated with velvet malachite for a nice color contrast.

Though the best of the cobaltian calcites are indeed superb, a large number seen at Munich were damaged and poorly trimmed: everything from smashes and bashes to dings, pings, and wilbers. Obviously the miners (or whomever) could use some training in basic collecting skills. Only a few flats total were available, but Gauthier seems confident that more of this material will be forthcoming. Time will tell.

As to other new discoveries seen at Munich, the pickings were decidedly slim this year. A few new and unusual pieces of South African sturmanite, some large hyalophane crystals from Yugoslavia, and a myriad of micromount occurrences mostly of interest only to the local collecting community came closest to being "new." That is not to say there wasn't plenty of fine material to choose from, but it was by and large pretty familiar stock: Moroccan vanadinite (will it *ever* end?), German marcasite from Misburg, kaemmererite from Turkey, liddicoatite from Madagascar, fake emerald matrix pieces from Colombia (all manufactured by members of one family down there, according to my confidential sources), Romanian stibnite, Italian stibnite, Hagendorf minerals and so on.

Figure 1. **Lustrous, multifaceted crystal of cobaltian calcite 5 cm long, with malachite, from Mupine, Shaba, Zaire. Roberts Minerals specimen.**

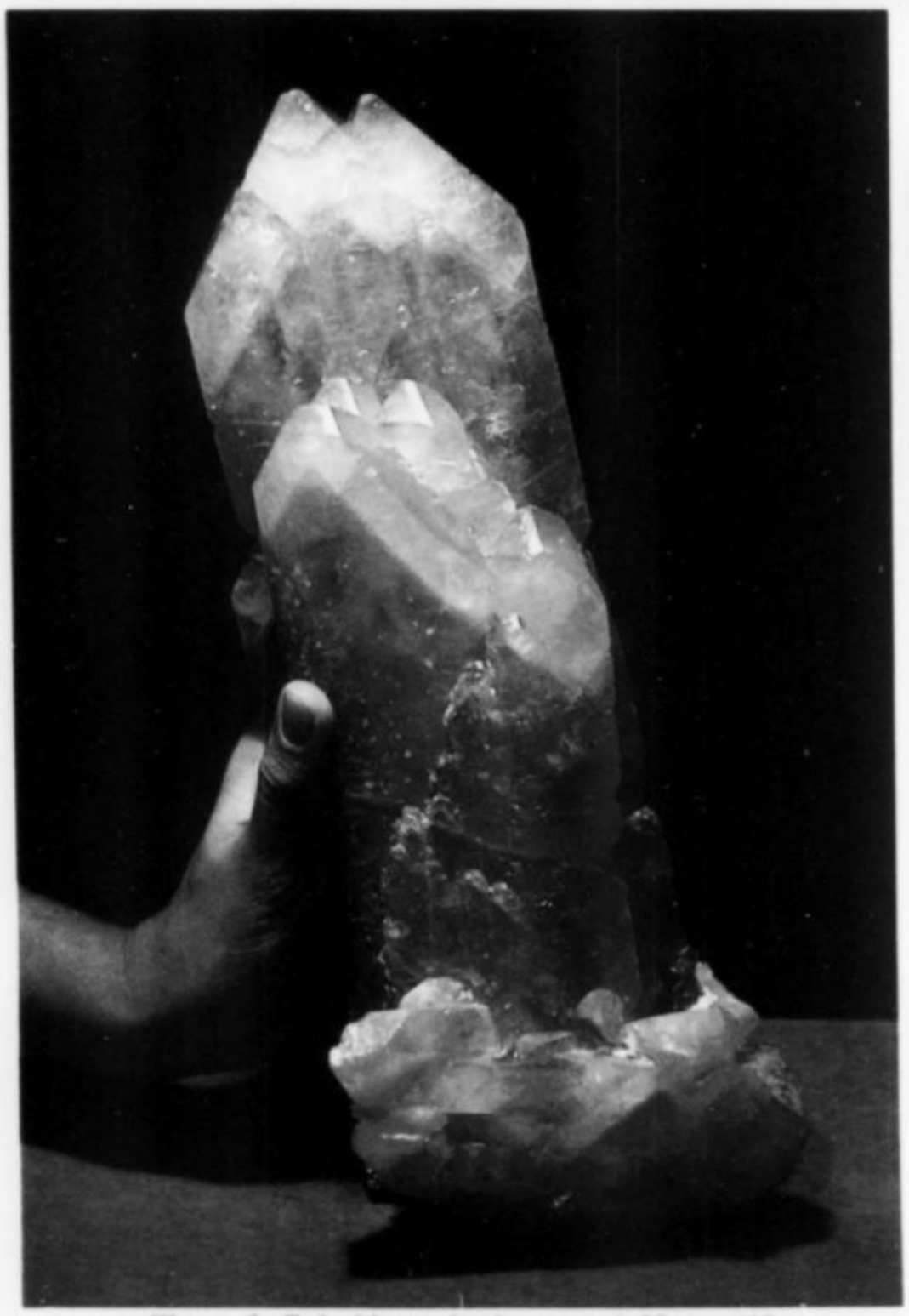

Figure 2. **Pale blue celestite crystal 38 cm (15 inches) tall, from a quarry at Portage, Ohio. John Medici specimen and photo.**

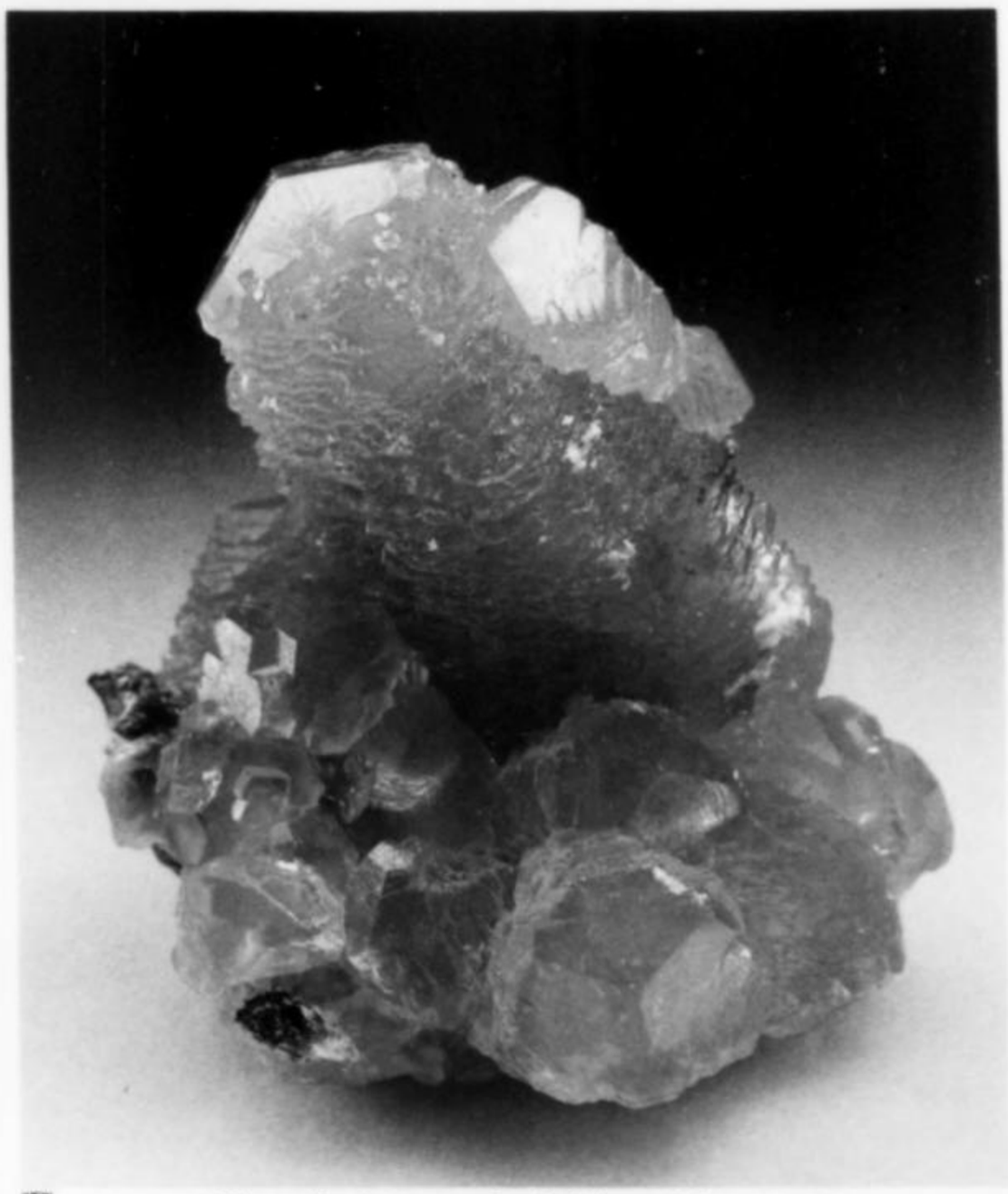

Figure 3. **A group of cobaltian calcite crystals to 5.7 cm, showing oscillatory faces and rhombohedron terminations. From Mupine, Shaba, Zaire; Roberts Minerals specimen.**

Figure 4. **Golden topaz crystal, 9 cm, on smoky quartz from near Mimosa, Espirito Santo, Brazil. Behnke specimen; photo by Joanne Schmaltz.**

Figure 5. (upper right) **Aquamarine beryl crystal, 18 cm, from Lavra da Invreja, Marambainha, Minas Gerais, Brazil. Behnke specimen; photo by Joanne Schmaltz.**

Figure 6. **Large elbaite group, weighing about a kilogram and measuring 10 cm, from the Genipapo mine, Aracuai district, Minas Gerais, Brazil. Behnke specimen, photo by Joanne Schmaltz.**

Figure 7. **At the Munich Show, from left to right: Wayne Leicht (*Kristalle*), show chairman Johannes Keilmann and wife Hermi, and *Mineralogical Record* associate editor (of photography) Erica Van Pelt. Photo by Harold Van Pelt.**

Although not manning a booth at the show, Miriam and Julie Zweibel (*Mineral Kingdom*) had in their motel room three extremely fine Tsumeb azurites, all recently mined from pillars on the 7th level. That's way up in the highest and earliest-mined portion of the deposit. The three specimens each came from a different pocket and each has a different habit. One is lustrous and elongated in habit, one is tabular and partially altering to malachite, and another is large and blocky with a little alteration. A few flats total were removed, nothing too voluminous, but the fact that pillars are now being taken out suggests that a last gasp of productivity may be underway for this most famous locality.

The one truly exceptional thing about this year's Munich Show was the collection of guest exhibits gathered together by show chairman Johannes Keilmann. The topic: tourmaline. Fine crystal specimens sparkled from a large array of cases filled by European museums, American museums and private collectors. Perhaps the most extraordinary exhibit was the liddicoatite room, a black-walled, darkened room of considerable size (capable of holding perhaps 20 or 25 spectators), with a center island. Mounted on all of the walls were slabs of liddicoatite in every color of the rainbow, in dazzling color combinations, from 1 to 15 cm across (mostly large), and all back-lit by high-wattage bulbs. Liddicoatite, for those who have forgotten, is a relatively recently described member of the tourmaline group which occurs mostly at the Anjanabonoina pegmatite in Madagascar (an article on that locality is on file for the second tourmaline issue). Many of the crystals are very complexly color-zoned, and show this feature best when cut into slabs perpendicular to the *c* axis and polished. The Munich exhibit contained, by my count, *702* polished, back-lit slabs and all were different. Some were in a series showing slabs from a single crystal and how the zoning pattern changes from one end to the other. Others were fascinating single slabs or pairs. And when I say a rainbow of colors I mean to include all of those shades you don't normally expect to see in tourmaline, such as yellow, yellow-orange, orange, bluish violet, gray, brown, etc. The effect of the exhibit was stunning, and perhaps will never be duplicated again.

The show topic for next year? Petrified wood. Well, fossils are big business in Europe, and Keilmann must cater to his dealers and their clientele.

There was one serious drawback to the Munich Show, and here I must digress for a brief editorial. The problem is the European penchant for heavy smoking. The air in the huge show hall developed a blue haze that actually caused medical difficulties for several people. The great majority of Americans (75%) don't smoke, and consider this kind of forced exposure a personal affront. Making matters worse are the European brands of cigarette, which give off a whiter, denser, stronger smoke than American brands. Better ventilation in the show hall and some sensitivity and moderation on the part of smokers would be much appreciated.

It may have been smoky, but a trip to Munich also means great beer, great food and superb chocolates. There's a good side to everything, and Munich is a wonderful, stylish city. I still recommend the trip highly.

BRAZILIAN DISCOVERIES

The following notes on recent finds in Brazil are from Russ Behnke:

Discoveries made in Brazil's pegmatite region during the past year show that Brazil is still a leading world source for exceptional topaz, beryl and tourmaline crystals.

Perhaps the most exciting recent find consisted of a few golden topazes from an old aquamarine mine near Mimosa, Espirito Santo. One of these crystals is a nearbly flawless golden color, 8 x 9 x 9 cm, on a nicely terminated 12 x 20-cm smoky quartz crystal (Fig. 4). The color of this topaz matches some of the better anglesites and golden beryls on the market these days. Other interesting pieces, less gemmy and colorful but still exciting, include a floater group of topaz and a very few single crystals up to 3 kilomgrams. The mine, which has been worked for crudely crystallized aquamarine suitable only for cutting, has produced colorless topaz in the past, but this is its first and perhaps only production of golden crystals.

Beryls are continuing to come out of Brazil and aquamarines of exceptional size and clarity have been found at Lavra da Invreja, Marambainha, Minas Gerais. Approximately 350 kg of rough and a few intact crystals were found in a single pocket in a hillside. The mine is located near the small hamlet of Marambainha, located about 12 km from the famous, long-running locality of Marambaia; one should not be confused with the other. Marambainha

crystals are a rich blue, sometimes shading into a blue-green, and they are very nicely etched. The largest terminated crystal from the find measures 5 x 18 cm and weighs 4100 carats (Fig. 5). A particularly clean example from this find is now in the collection of the Los Angeles County Museum of Natural History.

Tourmalines continue to come from many of the old localities. The Santa Rosa area, where the last great strike was in 1968, once again produced a number of 8 x 20-cm crystals with deep pink cores and turquoise-blue exteriors. Smaller crystals on quartz make especially pleasing specimens, and most of these specimens were quickly absorbed by the market before or at the 1985 Tucson show. Very recently, the Genipapo mine in the Aracuai district yielded four fine rubellites to 1 kilogram each from a single pocket (see Fig. 6). These are purplish red crystals somewhat reminiscent of Madagascar liddicoatite, and they probably represent the finest rubellites since the Jonas discovery. Some cutting material was found with these crystals, but the crystals themselves are translucent rather than transparent.

Lavra da Natinho, near Governador Valadares, has been the source of many interesting tourmalines up to 20 cm in size. These crystals are mostly olive green with brownish green or yellow terminations. Some are associated with lepidolite. These were available at the last Tucson show, and most were reasonably priced.

No more than 40 fine tourmaline crystals were found recently at Itinga. These are zoned in pleasant shades of red and green, sometimes both parallel and perpendicular to the *c* axis, and they are quite gemmy, with an unusual orange termination. The largest crystals from here are about 3 x 25 cm, and some are associated with lepidolite and quartz crystals.

The Cruzeiro mine continues to produce fine specimens, and currently "watermelon" crystals, some of them quite gemmy and fine, are being uncovered. Deep blue caps are found on some of the more transparent crystals, and some specimens are available with matrix. Taquaral is also producing a few fine tourmalines. These are of a most pleasing pink or reddish pink color, and some are associated with balls of mica. These crystals range up to 5 cm long, and are not yet available in the quantity one might desire for such attractive specimens.

ARKANSAS COOKEITE

Cookeite is not normally found as attractive specimens, but Jimmy McNeil (1175 Mt. Moriah Rd., Memphis, TN 38117) reports an exceptional occurrence found recently at the Stand On Your Head #1 claim, in the Ouachita National Forest, Saline County, Arkansas. The cookeite occurs as individual spherules and botryoidal groups, with spherules ranging in size from 1 to 7 mm. The spherules have a pleasant translucent frosty aspect and reveal their micaceous nature only when broken. The interesting thing about these specimens is the color: pale green to dark blue, in some cases resembling chrysocolla or other botryoidal copper minerals. Colorless quartz crystals of the typical Arkansas type are commonly associated, along with a little rectorite (X-ray and chemical identifications courtesy of the Smithsonian Institution).

The cookeite is found in outcrops of solution quartz veins cutting sandstone. Several cabinet specimens, perhaps 25 miniatures and 100 thumbnails of good to high quality have been recovered.

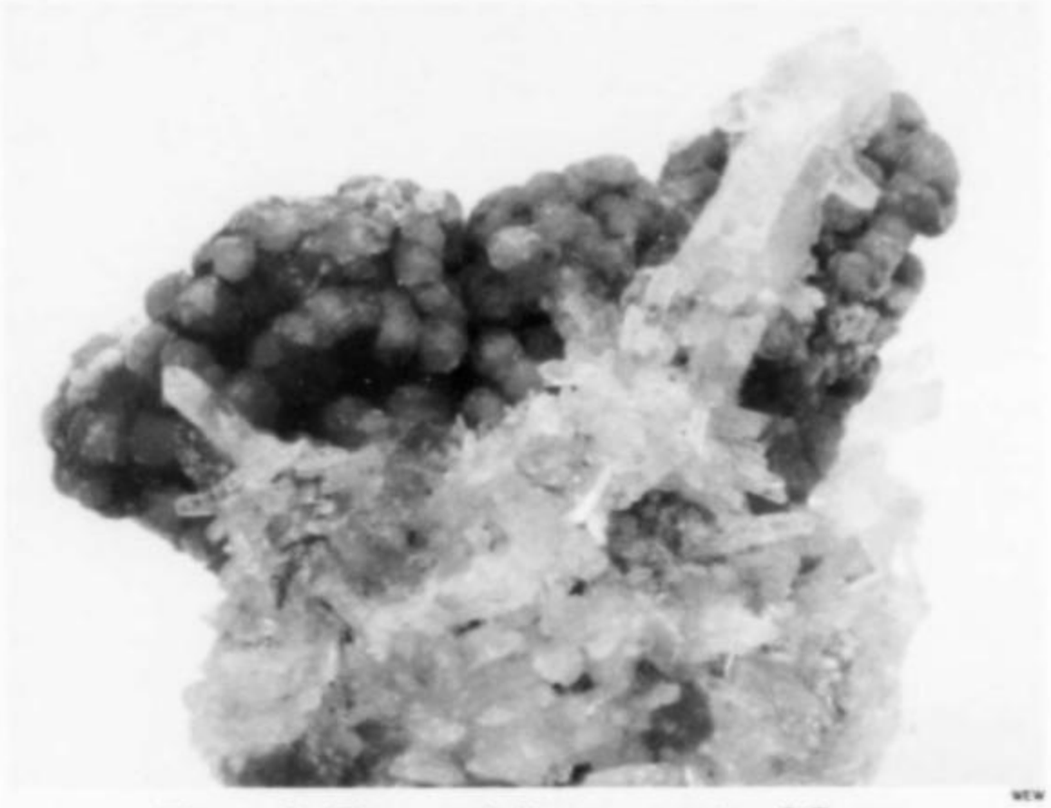

Figure 8. **Blue cookeite on quartz, 3.7 cm across, from Saline County, Arkansas. Jimmy McNeil specimen.**

MARYLAND CALCITE

The following information was provided by George Konig of Bethesda, Maryland, and his collecting partner, David Dinsmore.

In November Konig and Dinsmore encountered a remarkable (for Maryland) pocket of calcite crystals at the Medford quarry, located 3 km west of Westminster in Carroll County. The quarry is currently shut down, and is the older of two owned by the Genstar Materials Corporation.

This is a marble quarry exploiting a unit known as the Wakefield marble. The crystal-bearing zone extends for about 100 meters along the southeast side of the pit bottom. Here the rock is heavily faulted and fractured, a condition favoring the formation of crystal

Figure 9. **Fishtail-twin calcite, 9.6 cm tall, from the Medford quarry, Carroll County, Maryland. Specimen: David Dinsmore, photo: George Konig.**

Figure 10. **Calcite crystals from the Medford quarry, Carroll County, Maryland. The largest crystal is 9 cm. Specimen and photo: George Konig.**

pockets. Thus far two large pockets have been discovered, measuring 0.6 x 1 x 2 meters and 1 x 1.2 x 2.5 meters. Eight "medium-size" pockets and a score of small ones have also been exposed.

Most calcite crystals have been found as a solid encrustation growing inward from all the pocket walls. Over 1500 specimens of varying quality have been collected so far. These include crystal sizes from 1.5 cm to 25 cm (10 inches!), with the average being about 9 cm. Several crystal-covered plates to half a meter in size have been removed.

The crystals are mostly scalenohedral in habit, but a few rare fishtail twins have been found, as well as some crystals of bladed and nailhead habit. Three generations of calcite growth are discernible. The first stage is milky white with strong orange-red fluorescence. The second, not present on all crystals, is an unattractive opaque tan (non-fluorescent). The third, present on about 70% of all crystals, is very lustrous, transparent and sparkling due to multi-stepped faces. In some cases the second stage has been preferentially etched out, indicating some chemical difference. Overall color ranges from white to cream or tan and very dark brown.

Konig and Dinsmore feel the quarry still has great potential for more pockets. In the meantime, they will be displaying and selling specimens at the Rochester Symposium in April and, as of this writing (December), plan to offer some in room 105 at the Desert Inn during the Tucson Show (which will be history by the time this reaches print).

Incidentally, in this day of crotchety property owners, the personnel of the Genstar Corporation are to be highly commended for taking an enlightened view toward specimen preservation. Thus far they have been very friendly and cooperative with clubs wishing to schedule collecting time in the quarry.

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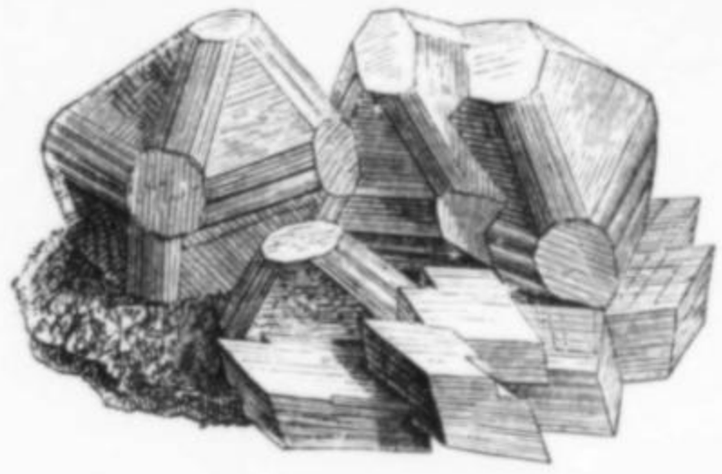

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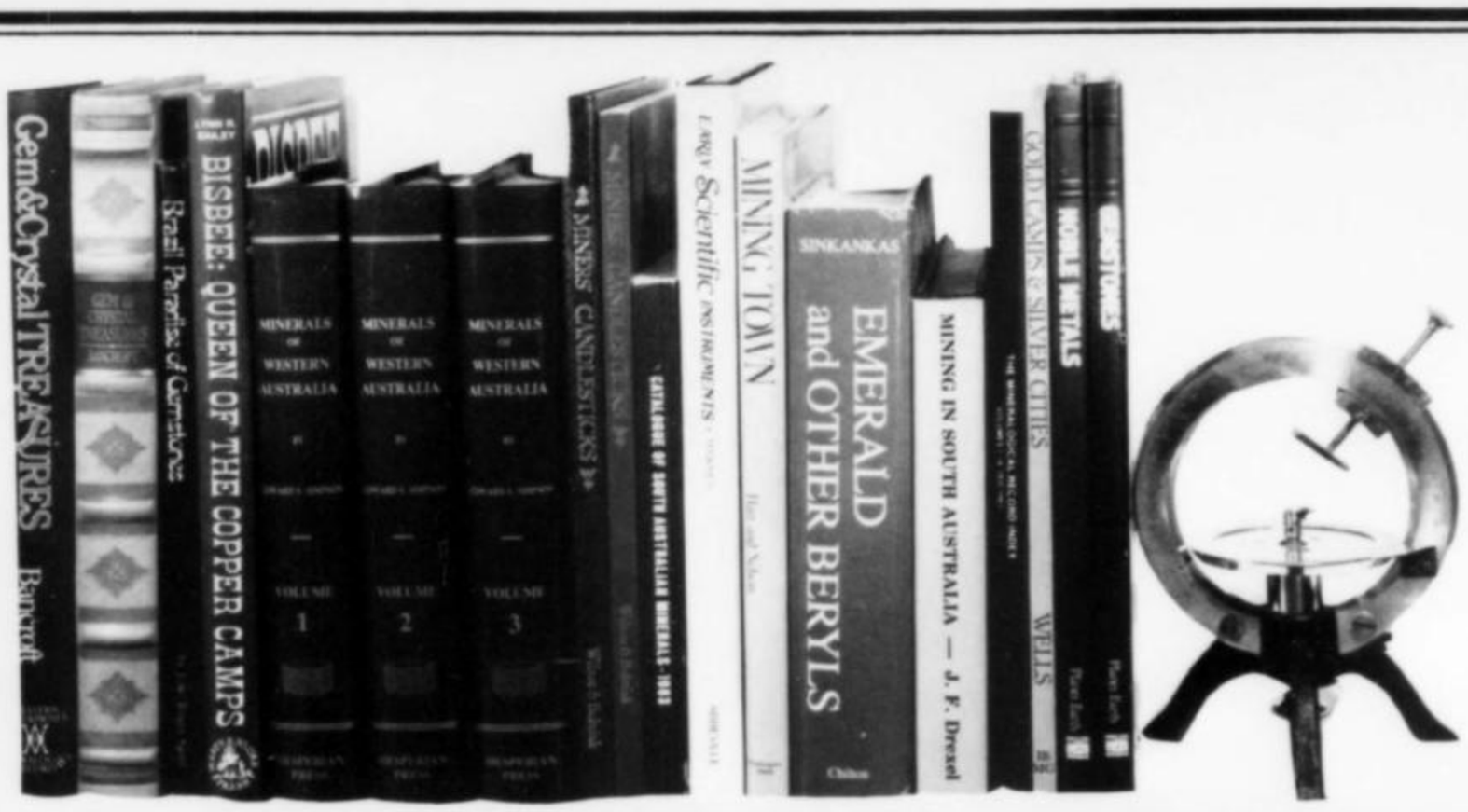

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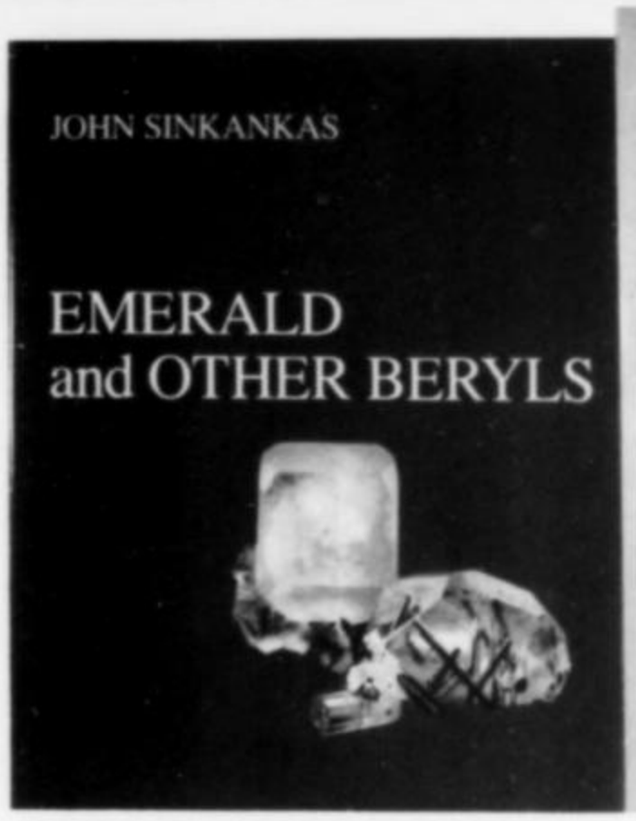

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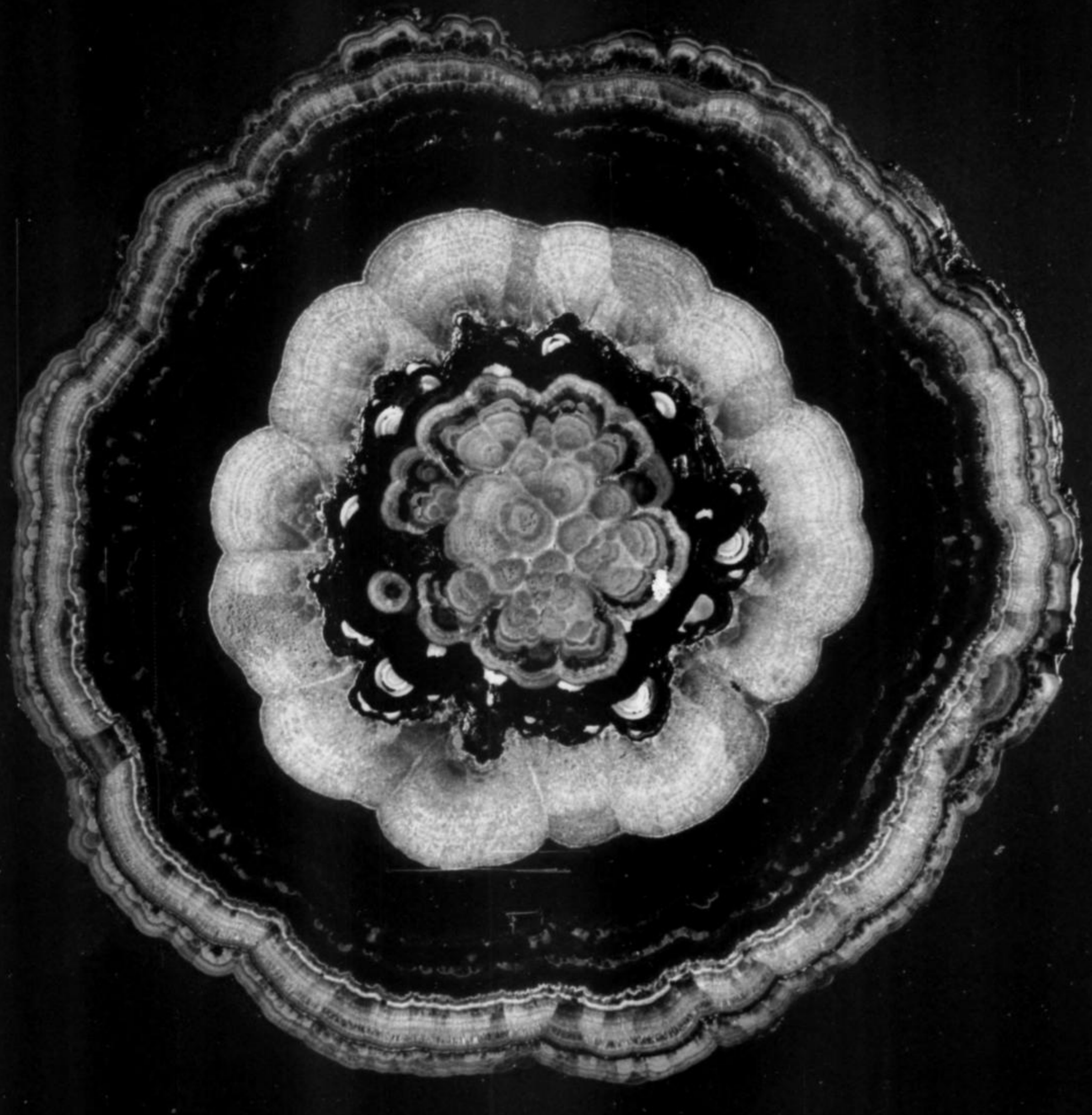

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