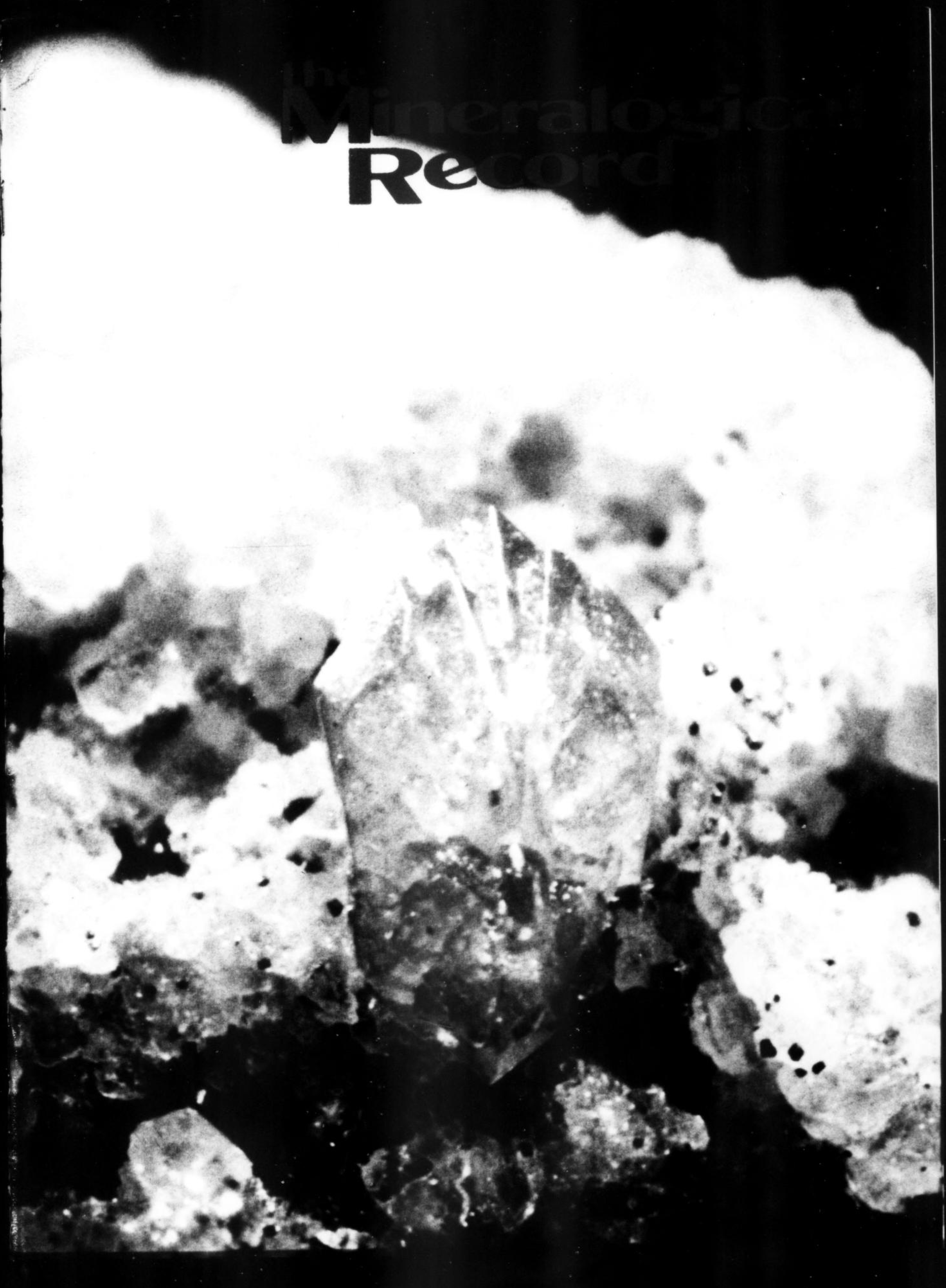
the Mineralogical Record



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# the Mineralogical Record

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## feature articles

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**Cover:** Pinkish multiple crystal (1 mm long) from Cornog Pennsylvania, on calcite crystals together with pyrite cubes. Photomicrograph by Julius Weber.

# Specimen Requests

The idea of a "Mineral Specimen Requests" column as suggested by Bill Henderson may, I believe, serve an additional purpose—to inform researchers about collections which are *not* what might be expected on the basis of pertinent literature and/or the location of the collection. Negative information of this kind may save time and reduce frustration.

An example of such a collection is the J. Reinhard Blum Collection of pseudomorphs which is currently housed in the Department of Geology at Yale University, New Haven, Connecticut. Blum's book *Die Pseudomorphosen des Mineralreichs* which appeared in four editions between 1843 and 1879, along with four other accounts (e.g., M. Delesse's *Recherches sur les pseudomorphoses* of 1859) about the collection have become standard references.

Actually, and I hasten to add that Horace Winchell warned me, the collection contains *few* good pseudomorphs in the modern sense of the designation. Instead, it consists in a large part of misidentified specimens (very likely misidentified because of the methods and procedures generally utilized during the mid 1800's), several of which are not pseudomorphic in any modern sense; a number of natural incrustations; and a few laboratory prepared specimens such as a cleavage rhombohedron of calcite upon which a 1.0 mm thick coating of malachite was deposited and which is referred to as "Malachite nach Kalkspath."

Richard V. Dietrich
Central Michigan University
Mount Pleasant, Michigan

Anyone having specimens in his collection labelled hedenbergite from any of the following mines of the Franklin-Sylva district, North Carolina:

Buoy #1 mine
Ledford Cove mine
Big Ridge mine
Allman Cove mine

is requested to send small samples (one cm$^3$ is more than adequate) to:

Miss Mary Mrose
Rm G 241 H
G.S.A. Building
U.S. Geological Survey
Washington, D.C. 21242

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## A MODERN MINERAL RUSH

An article in *The Diamond News and S. A. Jeweller*, vol. 34, no. 2, p. 23, 1970, described the unusual ground rules for a modern diamond rush near Koster, in the Western Transvaal—a rush planned in advance. The discoverer had been working 200 claims for some months and struck it rich with a 48.12-carat diamond, in addition to a number of smaller stones. Once the government was convinced that the ground was rich enough, it was proclaimed for alluvial diggings.

On November 11, bona fide diggers who have been actively engaged in digging diamonds for three months before proclamation lined up on the Swartrand sites. The diggers' names were put into a hat. As their lots were drawn, one by one, the diggers raced to peg three claims, each measuring 4 square yards. After a week, each digger was allowed to peg a further three claims. It is reported that many grizzled diggers employed runners to dash for them to the sites they had chosen.

Billed as "probably the last alluvial diamond rush in South Africa", it must have been an interesting scene to witness.

## EDITORIAL PAGE

# Mineralogical Fellowship

One of the letters published in this issue (from Bruce M. Benthin) contains the term *mineralogical fellowship*. It is a term I cannot recall having seen or heard before. The promoting of mineralogical fellowship is an attractive idea and has, from the beginning, been one of the unstated objectives of this publication. It is an objective of the Friends of Mineralogy as well.

A frequent lack of fellowship is evident among mineral collectors. The failure to respect the rights of property owners through destruction and littering of collecting areas, the failure to share the news of good collecting sites, the failure of mineral clubs to aid schools by providing mineral specimens for teaching, terrible antagonisms growing out of unavoidable inequities in the judging of competitive mineral displays are some of the instances that come to mind. It is perhaps true that such failures are, like warfare, inherent in human nature and can't be totally eliminated. Hopefully, we can expect improvement. It is worth the attempt.

It was gratifying to read in a recent Newsletter of the Eastern Federation of Mineralogical and Lapidary Societies about some of the activities of member societies. The accounts demonstrate that mineralogical fellowship exists in a very real sense. We applaud the Eastern Federation for calling attention to these activities and thus encouraging other groups to follow suit. These activities are, for the most part, only recently adopted. We can hope that this signals an increasing awareness of the many ways in which fellowship can operate. The Rhode Island Mineral Hunters, for example, have prepared and distributed 525 mineral sets since the project was started in 1965. These went to science teachers in 102 junior and senior high schools, to elementary schools in 31 cities and towns, to scout troops and campfire girls, and to junior members of the club. At the request of the National Park Service, the Frederick County (Maryland) Rock and Mineral Club is preparing an exhibit of the rocks, minerals and geology of Frederick County and the Catoctin area for a museum in the Catoctin Mountains. The club also installed a display case of rocks and minerals in the Children's Museum in Frederick. The Newark (New Jersey) Mineralogical Society placed a temporary exhibit at the Newark Museum and arranged to have members on duty to answer questions from visitors. The Monmouth (New Jersey) Mineral and Gem Club is preparing a mineral display for loan to the county schools during the coming school year. The Lincoln County (Maine) Gem & Mineral Society is aiding the Main State Museum in the preparation of a reference collection of typical mineral specimens from Maine mines and quarries. It is donating specimens from quarries at Bowdoin and Topsham. The emphasis is on "typical" specimens rather than extraordinary ones. Collectors are not expected to give up their most treasured specimens.

There are many more activities of this sort undertaken by mineral clubs and there must be countless projects not yet formulated. I have long known of scholarship money being awarded to worthy students, club purchases of mineral specimens for university and municipal museums, and group efforts to clean up and control important localities.

There is another aspect of fellowship which we can all do something about. The growth of mineralogical fellowship requires a bringing together of the community, or fraternity, of mineral specimen enthusiasts. The *Mineralogical Record* was begun purposely to be the vehicle through which this could be accomplished. We are, therefore, striving to make it the publication that collectors can call their own, hence the heavy emphasis on reader participation. The minimum amount of direct reader participation seen so far derives from a weak response to our pleas for such material. We stand ready to make space available for all kinds of news items, grievances, suggestions, requests and ideas. In doing this we are taking a positive step toward promoting *mineralogical fellowship*. Why not join the fellowship yourself? ■

John S. White, Jr.

# Delafossite Cu Fe $O_2$ from the Kirwin Mineralized Area, Wyoming.

**G. J. Jansen, Climax Molybdenum Company**
**Extractive Metallurgy Laboratory**
**Golden, Colorado**
**and**
**N. C. Schieltz, Colorado School of Mines**
**Golden, Colorado**

Delafossite, $CuFeO_2$, an uncommon copper mineral, has been found in the Kirwin Mineralized Area of American Metal Climax, Inc., in Park County Wyoming. Palache et al (1944) list occurrences of delafossite at Bisbee, Arizona; Kimberly and Eureka, Nevada; and at the Pope-Shenon mine near Salmon, Idaho. A search of Chemical Abstracts disclosed no other more recently reported occurrences in the United States.

The Kirwin Mineralized Area, in the Southern Absaroka Mountains of Northwestern Wyoming, is in Townships 45 and 46 North, Ranges 103 and 104 West. Early Tertiary volcaniclastic and volcanic rocks have been intruded by granodiorites and andesites which has resulted in the formation of a typical porphyry copper-molybdenum deposit (Wilson, 1964).

The sulfide ore zone is mantled by an oxidized zone. In the course of examining specimens from the oxidized zone, a soft, friable velvety black material that filled shallow indentations in the surface of the specimens was seen. Amorphous iron oxides rimmed the pockets of the black material. Examination by emission spectrography showed only copper and iron. X-ray powder diffraction showed the material to be delafossite.

The X-ray powder diffraction data on the Kirwin delafossite are compared in Table I with data on a specimen of delafossite from Bisbee, Arizona and with data from ASTM Card 12-752.

The patterns of the Kirwin and Bisbee specimens were made with copper radiation which gave an overall weak line pattern with much of the energy transformed into fluorescent radiation, hence the weakness in the intensities.

The writers are grateful to O. H. Rostad, Senior Geologist, Amax Exploration, Inc. for the loan of the Bisbee, Arizona delafossite.

**REFERENCES**

Palache, Charles, Harry Berman, and Clifford Frondel, (1944) *System of Mineralogy*, 7th ed., 1, John Wiley and Sons, New York.

Wilson, William H., (1964) The Kirwin Mineralized Area, Park County, Wyoming, Geological Survey of Wyoming Preliminary Report number 2.

**TABLE I X-RAY DATA FOR KIRWIN, BISBEE, AND ASTM DELAFOSSITE**

| ASTM Card 12-752 | | | Kirwin, Wyoming Delafossite | | Bisbee, Arizona Delafossite | |
|---|---|---|---|---|---|---|
| h k l | I | d | | d | | d |
| | | | EW | 5.84 | | |
| | | | EW | 4.401 | | |
| | | | | | EW? | 4.187 |
| | | | | | VW | 3.324 |
| | | | EW | 3.309 | | |
| 006 | 35 | 2.86 | W | 2.845 | W | 2.855 |
| 101 | 18 | 2.58 | EW | 2.582 | VW | 2.553 |
| 012 | 100 | 2.508 | M(1) | 2.501 | W(1) | 2.502 |
| | | | VW | 2.376 | EW | 2.376 |
| 104 | 25 | 2.238 | W | 2.239 | VW | 2.247 |
| 015 | 6 | 2.083 | EW | 2.080 | EW? | 2.147 |
| | | | EW? | 1.987 | | |
| | | | EW? | 1.945 | | |
| 009 | 10 | 1.092 | | | EW? | 1.901 |
| | | | | | EW? | 1.812 |
| | | | EW? | 1.720 | EW? | 1.718 |
| 018 | 35 | 1.658 | W | 1.658 | VW | 1.659 |
| | | | EW | 1.536 | | |
| 110 | 40 | 1.512 | W | 1.513 | W | 1.511 |
| $1\cdot0\cdot\overline{10}$, $0\cdot0\cdot\overline{12}$ | 20 | 1.434 | W | 1.434 | VW | 1.430 |
| | | | | | EW | 1.369 |
| 116, $0\cdot1\cdot\overline{11}$ | 18 | 1.336 | W | 1.339 | VW | 1.331 |
| 202 | 12 | 1.295 | VW | 1.296 | EW | 1.295 |
| 024 | 10 | 1.253 | EW | 1.249 | EW | 1.253 |
| 119 | 6 | 1.184 | | | | |
| 208 | 10 | 1.119 | VW | 1.117 | | |
| $0\cdot1\cdot\overline{14}$ | 6 | 1.108 | VW | 1.107 | | |
| $0\cdot2\cdot\overline{10}$, $1\cdot1\cdot\overline{12}$ | 18 | 1.040 | W | 1.040 | | |
| 122 | 16 | .984 | VW | .985 | | |
| 214 | 10 | .965 | VW | .965 | | |
| | | | EW | .952 | | |
| | | | VW | .899 | | |
| | | | VW | .876 | | |
| | | | VW | .858 | | |

**Note:**

EW = extremely weak
VW = very weak
W = weak
M = medium
(1) = strongest line
? = position not too reliable due to extreme weakness.

# Mineral Auctions at Sothebys Of London

**by Brian Lloyd**
**Natural History Department, Sotheby and Co.**
**London**

Sothebys of London have been famous for over 200 years as auctioneers of literary property and works illustrative of the fine arts. It came as somewhat of a surprise to most when, in July 1968, we held a sale of "Mounted birds, butterflies, minerals and 'other Natural Curiosities.'" This sale was very much of a gamble. This type of material had not been sold by public auction in London since before the second world war. In those days the firm of J. C. Stevens, now long closed, used to auction natural history collections consisting mainly of butterflies and shells.

This first natural history sale of Sothebys offered a large collection of minerals assembled by Her Grace, the Third Duchess of Northumberland, in the first half of the nineteenth century. The collection was sold in 23 lots for just under $6,000 (£2,500). Many of the prospective bidders were surprised by the high prices these minerals brought. However, such has been the increase in mineralogical interest in this country that the finer lots would fetch considerably more if offered now. For instance, a group of axinite crystals from Dauphine, in France, made only $120 (£50). A group of light green Russian topaz crystals raised only $156 (£65). In contrast, a really fine group of long, clear quartz crystals from Dauphine fetched $432 (£180). This price would unlikely be reached again if the quartz should be offered for resale in the next few years. Non-geological lots in the same sale included a golden cowrie shell at $132 (£55), finely preserved mounted birds from Ushaw College in Durham, and various George IV and William IV collectors cabinets. The sale totalled $15,689 (£6537). This first sale was followed by another in December of a similar mixed collection of mounted birds, shells, minerals and so on. An emperor's slit shell from Japan fetched $180 (£75) and 6 decorative geodes from Mexico $456 (£190). The sale total was $13,063 (£5443), out of which $6163 (£2568) was bid for the minerals. The high price for the geodes resulted from their having been selected from a large consignment. They were out of the ordinary, but it was still a high price. Actually, I have not seen better geodes for sale in England. From these two sales certain patterns emerged; there is a definite demand for general natural history public auction sales but the greatest interest is shown in the geological and conchological specimens. Consequently, a large sale of minerals and shells was held in March 1969 bringing a total of $29,530 (£12,304).

Fig. 1. BARYTES. An extremely fine group, the two tabular barytes crystals of a green-yellow colour attached to the third doubly terminated crystal, with some iron stained dolomite and small barytes crystals, **from Frizington, Cumberland, England; 6 × 5 × 3 in.**

Fig. 2. MICROCLINE var. AMAZONITE. A large terminated green-blue crystal, **from Pike's Peak, El Paso County, Colorado; 3×2-1/2×2-1/2 in.**

While there is a great interest in shells in Britain, they do not bring high enough prices to justify financially an entire auction. In the future these will have to be included in general natural history sales. However, for minerals the story is entirely different. In June 1969, we held a sale of minerals belonging to one owner. The 176 lots totalled $15,646 (£6519), with the top price of $1,200 (£500) being given for a 15 kg meteorite from Arizona.

Sothebys mineral sales are successful because, at the moment, it is almost impossible to buy numbers of rare or decorative minerals in the United Kingdom. There are a few dealers, but they sell their finest specimens as soon as they come in. Unless one happens to be on the spot at the right time one is unlucky. With public auction sales everyone has a chance as a detailed catalogue appears three to four weeks before the sale. Also, the speciments are on public view in well-lit surroundings for at least two days before the auction. For sellers, there is the hope that, at auction, two people who really want the same lot will bid each other up. The result is a seemingly ridiculous price. However, it should be remembered that the value of any article is exactly what someone is prepared to pay for it, and no more. There is no fixed scale of prices for minerals as there is, say, for coins and stamps, with all dealers charging roughly the same price for roughly similar specimens. Brazilian amethyst and tourmaline are still plentiful and the former inexpensive. I notice that both, especially the tourmalines, are becoming scarce and no doubt the price structure will suddenly break down with dealers charging widely differing and rapidly rising prices.

At Sothebys we get comparatively high prices for currently available Mexican and American minerals. American dealers and collectors often tell me how astonished they are with these prices. While they may be inexpensive in America, there is virtually no one in London who sells these specimens in quantity and variety. To fly over for, say, the Tucson show to buy specimens would be prohibitively expensive. To buy unseen through the post from an unknown dealer in the States seems a bit of a gamble.

While Sothebys mineral clientele may not be as yet mineralogically sophisticated enough for the rarest and not too attractive specimens, its taste in what is good-to-look-at is impeccable. After all, a collector of anything, unless he is very knowledgeable, will want the most pleasing-to-look-at objects in his chosen category. One has to be a very sophisticated collector indeed to appreciate a rather dull looking monazite crystal however important it may be. Sothebys clientele wants the most attractive and well formed minerals because collecting here is rather in its infancy after a long delayed rebirth. Given a couple more years our collectors will be avidly seeking the monazite crystal I have just scorned. They will be eager to pay a high price for such a rarity.

Sculptural specimens fetch the highest prices. On October 15th we sold a large native copper specimen for $1320 (£550). I was told this was

Fig. 3. WULFENITE. A very fine and colourful specimen, the bright orange tabular crystals are scattered about on a descloizite matrix, **from Villa Ahumada, Sierra de Los Lamentos, Chihuahua, Mexico; 7×5×3 in.**

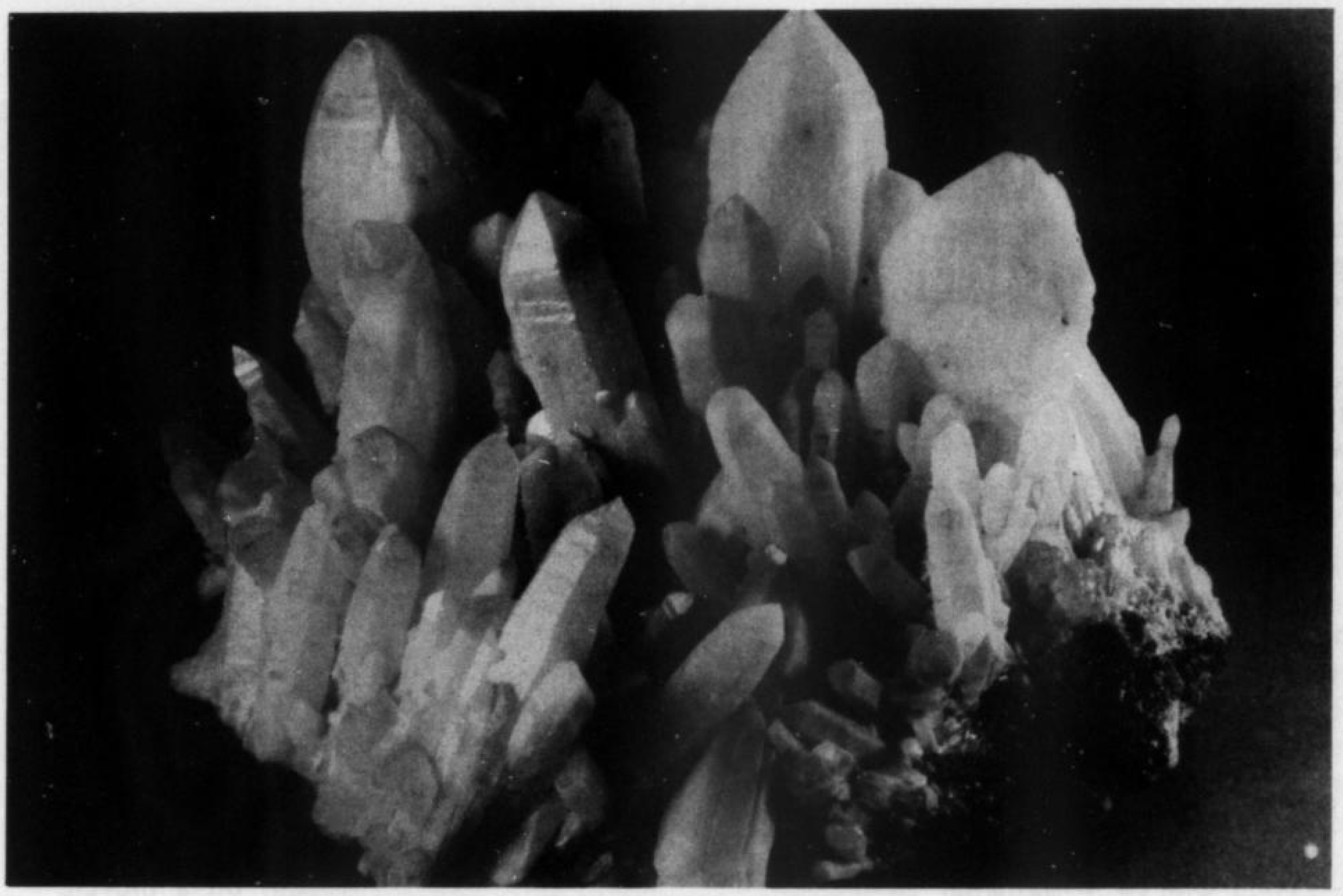


Fig. 4. QUARTZ. A fine and attractive group of well formed, milky-white crystals, most free standing to 3 in. high, **from Ouray, Colorado; 8 × 7 × 6 in.**

a very high price as these are available in the States. The proof of this will lie in whether or not we are ever sent a similar specimen for sale. I know it is possible to get large copper specimens from Michigan, but a specimen that combines sufficient sculptural shape, crystal form and the right size, must fetch a high price.

Each mineral specimen to be sold should be appraised and valued according to its perfection of crystal form, colour, shape, size, scarcity and locality. While this may seem fairly obvious it is surprising the amount of minerals I have been sent which are priced by weight! We have sold Cumberland Haematite for $216 (£90) for a well shaped specimen, and for only $24 or $48 (£10 or £20) for the same size but less attractive specimen. Cumberland haematite, by the way, is high priced in the U.S.A., but because it is relatively common here, good specimens can be purchased for as little as $48 or $72 (£20 or £30).

I am pleased with the prices we get for polished petrified wood. In March 1969 we sold two specimens, one 18 inches in diameter and the other 24 inches, for $2,400 (£1000) the two. In March 1970 a specimen 17 inches by 18 inches sold for $456 (£190) and another 15 inches in diameter for $864 (£360). If you, as a bidder, just want a few really colourful and interesting mineralogical specimens, what better than to include some polished fossil wood? Even so, the price for petrified wood has dropped considerably now. In the same sale, of March 1969, buyers saw 374 lots of minerals, fossils and shells sell for a total of $47,500 (£19,792). The best price was $4,860 (£3,200) for a 17 foot long Ichthyosaur from the classic locality of Lyme Regis. It was sent for sale by the Grant Institute of Geology, University of Edinburgh. There were 24 lots of Bohemian, Silesian and Slovakian minerals fetching $1452 (£605). This was a satisfactory price which indicates that there are an increasing number of collectors who appreciate the rarities. The sale enabled them to fill gaps in their collections with very difficult to find specimens from remote localities.

From the American point of view the most interesting sale so far was on October 15th, 1970, when 180 lots of minerals were sold for $16,442 (£6851). Many of the specimens came from owners who had originally acquired them by exchange with the United States National Museum (Smithsonian Institution), Division of Mineralogy. Some had been exchanged as excess from the Carl Bosch collection and others similarly from the Washington Roebling collection. The bargain of the sale was a very large and colourful amethyst group from Brazil at $336 (£140). This low price was more than offset by high prices on some of the other specimens. It is difficult to say whether some of these prices were high or not as specimens of this quality, though available from U.S. specimen dealers, have not been sold at auction in London before. For instance, a polished blue and green nodule of Bisbee, Arizona azurite/malachite fetched $240 (£100), rubellite crystals on matrix from Pala, California $384 (£160), galena from Kansas $240 (£100), and barytes from Cumberland, England $156 and $180 (£65 and £55). Colourful specimens, as usual, fetched good prices with the exquisite amethyst tipped quartz groups from Mexico at $72 to $96 (£30 and £40) each, four small specimens of adamite at $72 (£30), and Utah variscite nodules between $48 and $96 (£20 and £40) each.

One of the questions I am most frequently asked is "Who buys Natural History specimens at Sothebys?" The answer may be fairly obvious to a mineral or shell collector. It should be remembered, however, that collecting these things is still in its infancy here and is unlikely to reach the same proportions as in the U.S.A. for another few years. In the States there are masses of collectors of minerals and shells. Their collecting needs are being met by established rock shops, mineral dealers, and shell dealers. Various magazines such as the *Lapidary Journal*, the *Hawaiian Shell News*, and now the *Mineralogical Record* keep them informed. In London two years ago there was only one established mineral dealer. Now there are at least three dealers, as well as various shops that have a few specimens in their windows. Interest is growing rapidly and the saleroom is always packed for mineral auctions. The buyers can be divided into three broad categories. There are those who have the taste and money to buy a natural object for interior decoration—be it exquisite shell, mounted bird, case of rare butterflies or colourful mineral. The prices for them are reasonable when compared with those of man-made objects of art more commonly sold at the major auction houses. These people, perhaps rather ignorant of the technicalities of mineralogy, have the taste and money to build fine collections. It will not be too long before they have amassed the knowledge to be experts on the subject. They will then be demanding better and rarer minerals in addition to those that are visually beautiful.

Our buyers also include the private collectors from Britain and the continent, and sometimes from the U.S.A., who are here on business or holiday. Finally, there are the various museums in Britain which have, until now, found it difficult to increase their store of material. Their sources of Natural History specimens, except through exchange with other museums, have been very limited. Specimens can be bought direct from America, but it is a complicated and risky business unless one knows the procedures and the dealer very well. At least at Sothebys one is free to examine the actual specimens in detail before bidding at the sale. The unbiased catalogues are, within reason, made as detailed as possible. They are often copiously illustrated to stimulate the sale.

The recent mineral and natural history auction sales at Sothebys which have drawn such enthusiastic crowds of bidders have succeeded here in revitalizing a market whose future growth now seems assured.

# Elmer B. Rowley: Teacher, Collector, & Mineralogist

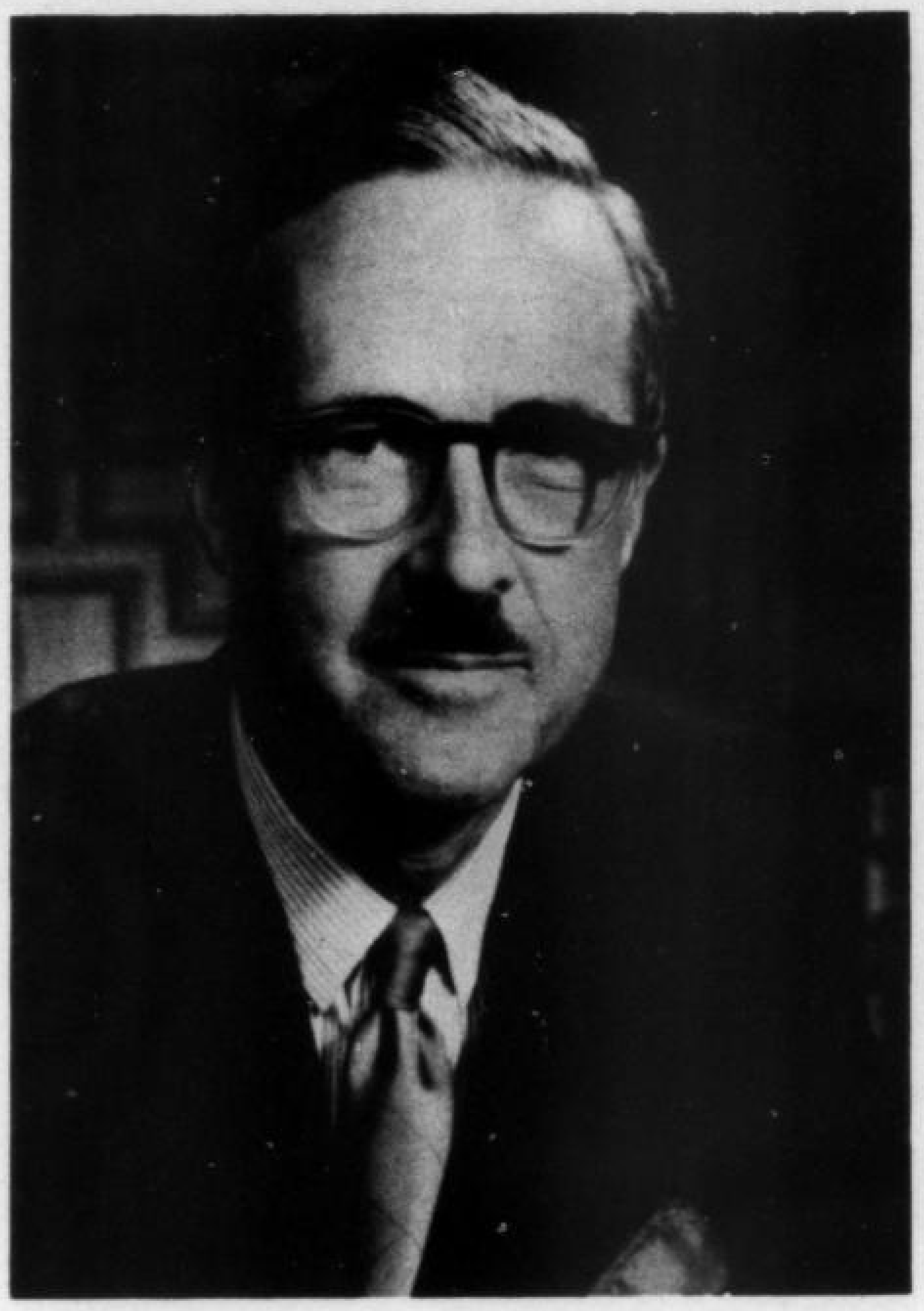
**by D. M. Lapham, Chief Mineralogist**
**Pennsylvania Geological Survey**

On a bright fall day in the Adirondack region of New York State, autumn colors dot the landscape in Seurat-like profusion. The invigorating air of the outdoors beckons. In 1942 it beckoned bicyclists rather than automobile excursionists because, if you remember, gasoline was in short supply and not to be wasted on frivolous enterprises. Had you been stationed along the 20-plus miles of hilly road between Sacandaga Reservoir on the southeast side of the Adirondacks and Glens Falls, New York further to the east, you might have noticed a man on a bicycle pumping furiously with a load of canvas sacks. Even more surprising would have been the cargo itself,—black tourmaline crystals hand-chiseled from a matrix of rose quartz, on their way from Day, New York to such places as the Harvard mineral collection, to museum collections in Albany, New York City, and eventually to London. These crystals were extraordinary, as much as six inches in diameter and a foot or more long; so was the man who would bicycle more than forty miles round trip to arduously collect them and to describe this pegmatite for the benefit of future collectors and professional mineralogists. That man was Elmer B. Rowley of Glens Falls, New York.

In 1948 an adult education course in mineralogy and geology was begun at the Glens Falls Senior High School under the auspices of the University of the State of New York. About 20 adults and one high-school senior enrolled in the course. In those days, there was no formal Earth Science course given in the high schools and the hobbies of mineral and fossil collecting were not the well-known, popular leisure-time activities that they have since become. In this class, a dress manufacturer, an electrical engineer, a Russian immigrant, and a wholesaler of film and radio parts were among those who sat listening to a profusion of the unfamiliar, rolled blithly across their ears in unpronounceable polysyllables. The distance in understanding between these pupils and a Bravais lattice or a trisoctahedron seemed unbridgeable. Likewise, the distance in time between the Ordovician crinoidal limestone outside once quarried as "Glens Falls Marble" and the present time of that classroom was a concept almost beyond grasp. Nevertheless, both teacher and pupils persevered, learned, enjoyed and a new crop of hobbyists was born. In fact, the teacher persevered for another 12 years, covering such subjects as crystallography, introductory geology, and the origin of minerals and mineral deposits. This man, too, was Elmer Rowley.

These two recollections give the flavor of this man, a mineral collector who enthusiastically pursued the many aspects of mineralogy without having had any formal training in the subject. Now an insurance company executive assistant and Fellow of the Mineralogical Society of America, he began collecting seriously in 1933, when the depression left no one in the area with the money or inclination for mineral collecting. Today with 17 publications to

*(continued on page 15)*



# Memorial to Dr. V. B. Meen

It is with deep regret that I report the death of Dr. V. B. Meen, Chief Mineralogist of the Royal Ontario Museum. He passed away at his home in Toronto on January 7, 1971.

Dr. Meen was born in Toronto on July 1, 1910. He received his B.A., M.A., and Ph.D. in mineralogy from the University of Toronto, and pursued post-doctoral studies at the University of Minnesota in 1937 and at the United States National Museum in 1938. His professional experience was extremely varied, including geological field work for the Ontario Department of Mines, wartime service in their Assay Laboratories, and a long career through all the academic ranks in the University of Toronto.

Vic's real love was the R O M and he served in various positions of authority both in mineralogy and geology. In 1964 he was appointed Chief Mineralogist and focussed all his interests and talents on the field of gemology. The fact that the R O M gem collection grew from practically nothing to the position of high rank it now holds, is due almost entirely to Vic's Work. His interest in astronomy, no doubt springing from his work on meteorites, made him an enthusiastic supporter for the addition of a planetarium to the R O M. He spearheaded a project for this acquisition, and the McLaughlin Planetarium was opened officially in 1968.

Vic published seven books and approximately fifty papers of scientific and popular interest. His publications reflect an unusual diversity of interests, ranging from "pure" mineralogical studies on various minerals, through meteorites and meteor craters, to the broad field of gems and gemology.

Vic was active in many organizations. These included not only professional societies but amateur mineral clubs as well. Constantly be was sought after by many groups for his informative and stimulating talks. For his activities among the mineral collecting fraternity, he was awarded several honorary memberships. He served as Honorary President of the Walker Mineralogical Club since 1957.

Probably he will be remembered best for his explorations of the Chubb Crater and for his last major achievement, the study of the Crown Jewels of Iran. This detailed study of a virtually unknown major gem collection resulted in a number of short papers and the magnificent book, "The Crown Jewels of Iran," co-authored with A. D. Tushingham and illustrated by L. Warren. This major work is a last testament to his labors.

Vic is survived by his wife, Thelma, his parents, one brother, two sisters, three married daughters and two grandchildren.

*J. A. Mandarino*

# LOCALITY: MINAS, GERAIS, BRAZIL

## A Response

**Alvaro Lúcio**
**Caiza Postal 1286**
**Belo Horizonte, Brazil**

As a mineral collector living in Belo Horizonte, capital of the state of Minas Gerais, Brazil, I could well understand the problem presented in the *Mineralogical Record* (Vol. 1, no. 2, p. 73). The article went directly to the problem when writing that mineral dealers protect their sources by keeping quiet about the actual mines and quarries where their best material was obtained. Many times even the dealers do not know the correct places since they purchased the specimens from a "garimpeiro" who always conceals or gives the wrong place names. "Garimpeiro" is a term used in Brazil for poor miners using rather primitive mining methods. The mines are called "garimpos."

Visiting many "garimpos," mines, and quarries, I was able to find the proper localities for many mineral occurrences. The true localities for the most important specimens from *Minas Gerais* are given below. Most of the minerals mentioned are pegmatite minerals. Although the pegmatites are generally worked by hand, some are worked by companies with a reasonable degree of mechanization. I hope this information may be useful to collectors all over the world.

albite—colorless, transparent, in perfect crystals, sometimes twinned in nice groupings with siderite, dolomite, quartz and other minerals. Morro Velho gold mine, Nova Lima (county).

amblygomite—perfect, colorless crystals, 1 to 4 inches in size. Sandspar's mines, at Taquaral (locality), Itinga (county).

anatase—perfect, 1 cm long, dipyramidal crystals. Paiolhinho (locality), Tapira (county).

andalusite—sometimes in gem color and transparency, nice crystals. Santa Maria (locality), Cruzeiro Novo (county).

apatite—tabular crystals of a delicate pink color and transparent. With siderite, albite, quartz and other minerals in very beautiful groupings, Morro Velho gold mine, Nova Lima.

beryl—this mineral is found in many pegmatites of the northeast area of the state of Minas Gerais. Many sizes, from small tabular crystals to one ton. Tabular crystals remarkable for the richness in faces other than the prismatic forms come from Barreiro (locality), Itinga (county). Some other important places for beryl are: Figueira (locality), Peçanha (county), T. Ottoni, and G. Valadares (counties). There are several localities for the variety morganite is tabular, deeply colored, transparent, and very rich in pyramidal faces. It is sometimes bicolored, pink and green, and also with inclusions of transparent green tourmaline. Very beautiful specimens for the transparency, color, size and variety of crystalline faces come from Lavra da Serra do Urucum (mine), Galileia (county).

brazilianite—in large, showy crystals and sometimes in nice groupings. Possible localities for this mineral are Divino (locality), Conselheiro Pena (county); Pammarole and Linopolis.

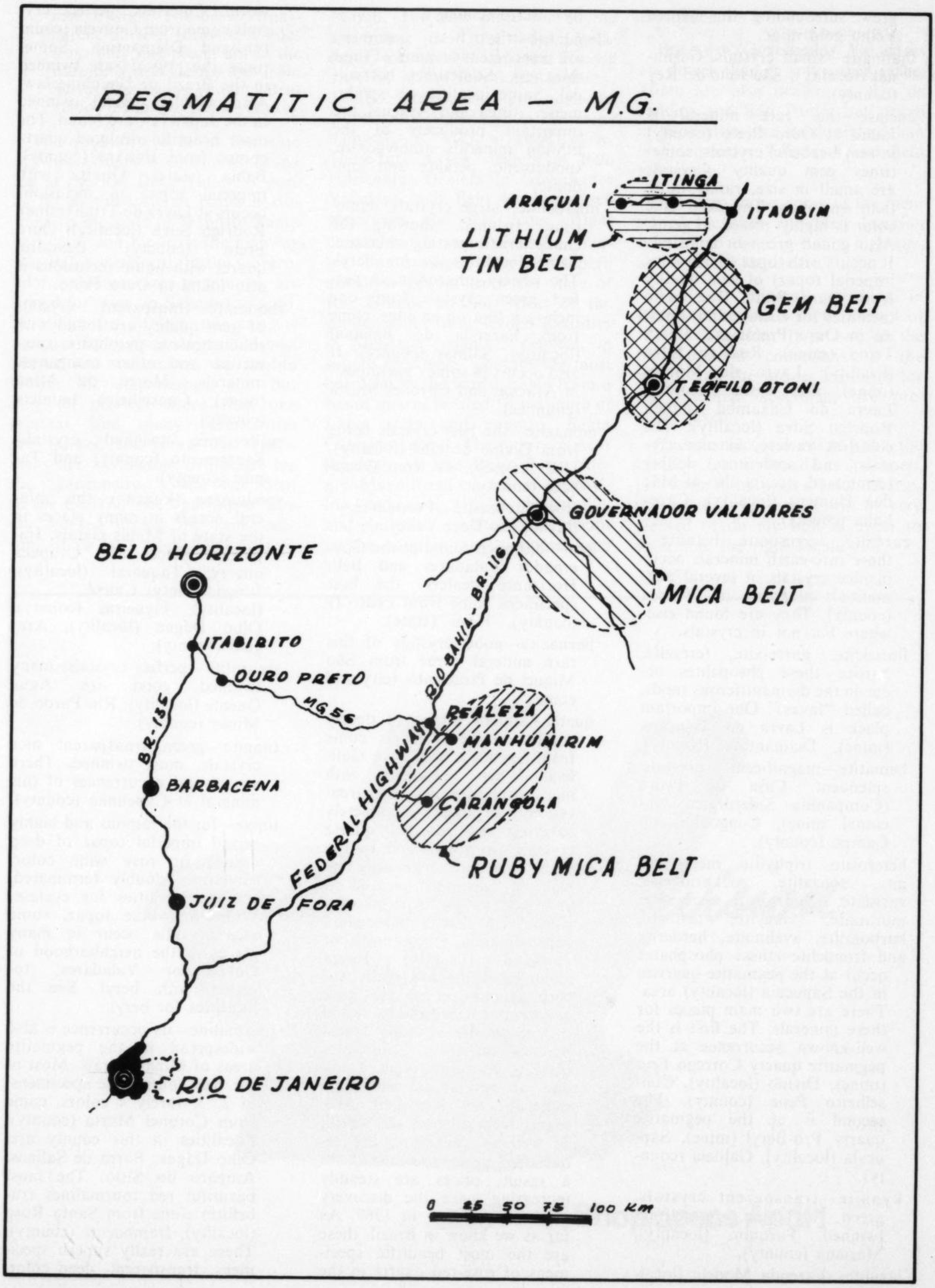
cassiterite—perfect crystals, bipyramidal, 1 to 3 inches on an edge, some perfect and complete interpenetration twins. Rarely transparent pink crystals. Companhia Estanífera mine or Olho Dágua mine, both in Itinga (county).

childrenite—good crystals in unexpected sizes, the largest in the world, with a superb change of color. Crystals were found up to 5 to 8 inches along the prism. Pro-Beryl mine, Sapucaia (locality), Conselheiro Pena (county). Also from one or two "garimpos" in Galileia (county) and Mendes Pimental (county).

chrysoberyl—perfect crystals, from small to 4-5 inches on the edge, many twinned. Some very nice complete cyclic twins, like a star. Deep green color, sometimes gem quality. There are three possible places, only one in the state of Minas Gerais. This is Americana (locality), Teofilo Ottoni (county). Found at the Governador Valadares dealers, but from Tancredo (locality), Santa Teresa (county), Espirito Santo (state), or from Cachoeira (county), Bahia (state). Tabular blue "alexandrite" crystals, rarely transparent and sometimes twinned occur at Faria Lemos (locality), Santa Luzia de Carangola (county).

columbite-tantalite—like beryl, found in many pegmatities in the state. Possible places are the same as those for beryl.

cubanite—in nice acicular crystals associated with pyrrhotite, chalcopyrite, siderite and dolomite in superb specimens, Morro Velho gold mine, Nova Lima. The siderite and dolomite occur in very nice groupings, the former in a beautiful color, transparent, and the latter colorless crystals. These Nova Lima groupings with siderite, dolomite, albite, quartz, pyrrhotite, sometimes cubanite, or scheelite in deep red color, apatite, or gold, are really magnificent specimens. Nova Lima is only 10 km south of Belo Horizonte, and the city


PEGMATITIC AREA — M.G.
ITINGA
ARAÇUAI
ITAOBIM
LITHIUM TIN BELT
GEM BELT
TEÓFILO OTONI
GOVERNADOR VALADARES
MICA BELT
BELO HORIZONTE
ITABIRITO
OURO PRETO
MG-56
BR-135
RIO BAHIA - BR-116
REALEZA
MANHUMIRIM
BARBACENA
FEDERAL HIGHWAY
CARANGOLA
RUBY MICA BELT
JUIZ DE FORA
RIO DE JANEIRO
0 25 50 75 100 KM

grew surrounding the Morro Velho gold mine.

djalmaite—small crystals. Germinal (locality), São João del Rey (county).

euclase—this rare mineral is found at Ouro Preto (county) in very beautiful crystals, sometimes gem quality. Crystals are small in size, rarely more than one inch. The deep blue color is highly prized in gems. Also gound green or colorless. It occurs with topaz (the famous imperial topaz) of gem quality from Ouro Preto. The main localities for euclase and topaz, all in Ouro Preto, are: Lavra Trino (mine), Rodrigo Silva (locality); Lavro do Moraes (mine), Boa Vista (locality); Lavra do Caxambú (mine), Rodrigo Silva (locality). The colorless variety, in nice crystals and sometimes doubly terminated, occurs also at Mãe dos Homens (locality), Capelinha (county).

euxenite, fergusonite, betafite—these rare-earth minerals occur in nice crystals in several pegmatite quarries in Ferros (county). They are found elsewhere but not in crystals.

florencite, gorceixite, ferrazite, hartite—these phsopahtes occur in the diamantiferous sands, called "favas." One important place is Lavra da Tejucana (mine), Diamantina (county).

hematite—magnificent crystals, splendent. Casa de Pedra (Companhia Siderúrgica Nacional mine), Congonhas do Campo (county).

heterosite, triphylite, metastrengite, souzalite, rockbridgeite, variscite, dumortierite, scorzalite, moraesite, faheyite, tavorite, barbosalite, avelinoite, herderite and frondelite—these phosphates occur at the pegmatite quarries in the Sapucaia (locality) area. There are two main places for these minerals. The first is the well-known occurrence at the pegmatite quarry Corrego Frio (mine), Divino (locality), Conselheiro Pena (county). The second is at the pegmatite quarry Pro-Beryl (mine), Sapucaia (locality), Galileia (county).

kyanite—transparent crystals, green or blue, sometimes twinned. Furquim (locality), Mariana (county).

lazulite—Fazenda Modelo (locality), Serro (county).

lepidolite—the best specimens are transparent, in spite of their thickness. Sometimes botryoidal. Same localities as spodumene. Itinga and Araçuaí are important producers of the lithium minerals amblygonite, spodumene, petalite and lepidolite.

microcline—large crystals, sometimes twinned, showing the characteristic grating structure. Same localities as for beryl. The variety amazonite, in perfect green crystals from one inch to a foot on an edge, come from Fazenda do Bananal (locality), Salinas (county). It also occurs in some "garimpos" in Aracuai and Coronel Murta (counties).

monazite—the best crystals come from Divino de Ubá (locality), Ubá (county), or from Guanhães (county).

natromontebrasite—Presidente Bueno, Rio Doce Valley.

opal—although found at the Governador Valadares and Belo Horizonte dealers, the best specimens come from Pedro II (county), Piauí (state).

phenacite—good crystals of this rare mineral come from São Miguel de Piracicaba (city and county).

quartz—superb druses of deeply colored rose-red quartz come from Sapucaia and from Galileia. When associated with nice eosphorite in transparent yellow crystals completely covering the rose-red quartz crystals from one end to the other, they come from only one place, a "garimpo" located on an island at the Jequitinhonha River. The island is located approximately 3 km north of Taquaral (locality), Itinga (county). There are really superb specimens for the rose quartz crystal size and color and the eosphorite crystals transparency and color. Sometimes there is also white apatite and one or two more phosphate minerals, not identified. Museums from all over the world, as well as collectors, are requesting these specimens. As a result, prices are steadily increasing since the discovery of the occurrence in 1969. As far as we know in Brazil, these are the most beautiful specimens of rose-red quartz in the world. Colorless, perfect crystals come from Gouveia (county) and Diamantina. Sometimes the crystals are twinned in the Brazil or Dauphine law. Also, tabular crystal twinned in the Japan law are found. The most beautiful rutilated quartz comes from Ibitiara (county), Bahia (state). Quartz with imperial topaz in inclusions occurs at Lavra do Trino (mine), Rodrigo Silva (locality), Ouro Preto (county). Beautiful quartz with liquid inclusions is also found in Ouro Preto.

rhodonite—transparent crystals of gem quality are found with rhodochrosite, pyrolusite, spessartine and other manganese minerals. Morro da Mina (mine), Conselheiro Lafaiete (county).

rutile—nice twinned crystals. Sacramento (county) and Tapira (county).

spodumene (kunzite)—this mineral occurs in many places in the state of Minas Gerais. Important places are: Urupuca quarry; Taquaral (locality), Itinga (county); Cuieté (locality), Figueiras (county); Olho Dágua (locality), Araçuaí (county).

staurolite—perfect crystals, many twinned, good size. Agua Quente (locality), Rio Pardo de Minas (county).

titanite—green, transparent, nice crystals, most twinned. There are several occurrences of this mineral at Capelinha (county).

topaz—for the famous and highly prized imperial topaz of deep orange or rose wine color, sometimes doubly terminated, see the localities for euclase. White and blue topaz, some nice crystals occur in many places in the neighborhood of Governador Valadares, together with beryl. See the localities for beryl.

tourmaline—its occurrence is also widespread in the pegmatite areas of Minas Gerais. Most of the best tourmaline specimens, of 2, 3, rarely 4 colors, come from Coronel Murta (county). Localities in this county are: Olho Dágua, Barra de Salinas, Amparo do Sítio. The most beautiful red tourmalines (rubellite) come from Santa Rosa (locality), Itambacuri (county). These are really superb specimens, transparent, deep color, nice crystals. The brown transparent variety (dravite) comes from only one place, not in the state of Minas Gerais, but from Serra das Éguas (mine), Brumado (county), Bahia (state).

The pegmatite area in the state of Minas Gerais is enormous. Starting at the Rio Doce Valley, it goes as far as the state of Bahia northward to the state of Wspirito Santo eastward, and far from the highway Rio-Bahia westward. In the Governador Valadares area pegmatites are mined for mica, in Salinas for beryl, in Itinga for lithium minerals, in Araçuai for cassiterite, in Coronel Murta for tourmaline, in Teofilo Ottoni for aquamarine, etc. But they all produce more than one mineral, and many pergmatities are worked for gems. The specimens are a valuable byproduct for the "garimpeiros," who sell them to the dealers. The "garimpos" are not worked during the rainy season, which lasts from November to March. The best place for buying specimens is Governador Valadares, located 490 km from Rio de Janeiro, at the Rio-Bahia highway. Teofilo Ottoni, 141 km north of Governador Valadares in the same highway, is also a good place. There are a few dealers in Belo Horizonte. Dealers in Governador Valadares and Belo Horizonte sell specimens not only from Minas Gerais, but from all over the country. For example, they sell superb amethyst geodes from the state of Rio Grande do Sul. Most of the geodes come from several localities in Soledade (county). Zeolites, in superb specimens, perhaps the most beautiful in the world, come from a basalt quarry located 10 km south of Lages (city and county), Santa Catarina (state). The quarry is near the highway São Paulo-Porto Alegre. Magnificent crystals of apophyllite, analcime, stilbite, heulandite, and phillipsite, isolated or in groups in the basaltic matrix, come from this place.

Prices in Governador Valadares are lower than in any other place. There are also dealers in Rio de Janeiro and São Paulo, but prices in these cities are much higher than in Governador Valadares and Belo Horizonte.

The map shows some of the mentioned localities and their location referred to the Rio-Bahia highway, and to Belo Horizonte.

The best mineral collection in Brazil is the Ouro Preto School of Mines collection. It is one of the best mineral collections in the world, and the proper localities for the Brazilian specimens are precisely given.

If any collector wants to know the locality for a Brazilian specimen, just write to me with a brief description of the specimen. I will be very pleased to do my best in order to determine the right locality.

# FRIENDS OF MINERALOGY

## The Folch-Girona Collection

**Arthur Montgomery**

Although known to be one of the great private collections of the world, the Folch-Girona mineral collection in Barcelona has not been seen by many. Acting on the kind invitation of Mr. Joaquin Folch-Girona (commonly known as "Mr. Folch"), I was able to visit Spain in late September, 1970, and spend more than two days viewing the collection. All that is reported about this collection falls far short of the reality: the superb quality of the minerals, beauty of the displays, and artistry and elegance of the small private museum in which the specimens are housed. Not least among the pleasures of seeing the collection, is that of being with Mr. Folch, experiencing his genial personality and hearing him tell about the Spanish minerals he has personally collected and cherished since early boyhood. It is hoped that this report on the Folch collection, made in behalf of *Friends of Mineralogy*, will be of interest to many readers of the *Mineralogical Record* who know about the collection but have never seen it.

The collection contains a little over 11,000 specimens. These are housed in an attractive, spacious, museum room within a number of large well-lighted display cases and combination display-drawer cabinets. The fluorescent lighting, by reflection off the ceiling and from tubes hidden within the glass-covered display cases, is excellent everywhere but especially fine in the two gem cases. A rough sketch-plan of the museum is shown in the accompanying illustration. The vertical display cases along the walls are three-shelf affairs; the two apart from the gem cases are partitioned into four separate units each, with storage drawers below. The three long, double-sided, centrally-located, display-drawer cabinets have display sections covered with sloping glass at the top, are partitioned into four double-sided units in a smaller cabinet and into six in the two larger, and contain four deep, roomy, drawers below each single display-case unit. Minerals are arranged systematically (according to Strunz) throughout the three display-drawer cabinets (units 1 through 29), with most of the smaller-size specimens (averaging 2×3" to 3×4") housed in the drawers in individual paper trays. Specimens of unusual interest and beauty and those of largest size are in special exhibits in the wall display cases. All display specimens are nicely mounted on bases of white plastic-foam material. Several unusual large museum specimens are placed on separate pedestals.

The cataloguing comprises a card-index file with large cards giving extensive information among which locality, history, source and purchase or collecting data are unusually complete. With the specimens at present are the purchase labels and/or the owner's handwritten labels, supplying data on history of purchase or collecting. New up-to-date labels will supersede the old ones soon. Every specimen in the collection is carefully and neatly numbered and keyed to the file. Two part-time associate curators, Messrs. Jorge Calafell-Prat and Rafael Torró-Gracia, assist Mr. Folch in the cataloguing, care and upkeep of the collection.

The entire collection is excellently displayed or easily accessible and viewable in the large well-kept drawers. Average quality per specimen

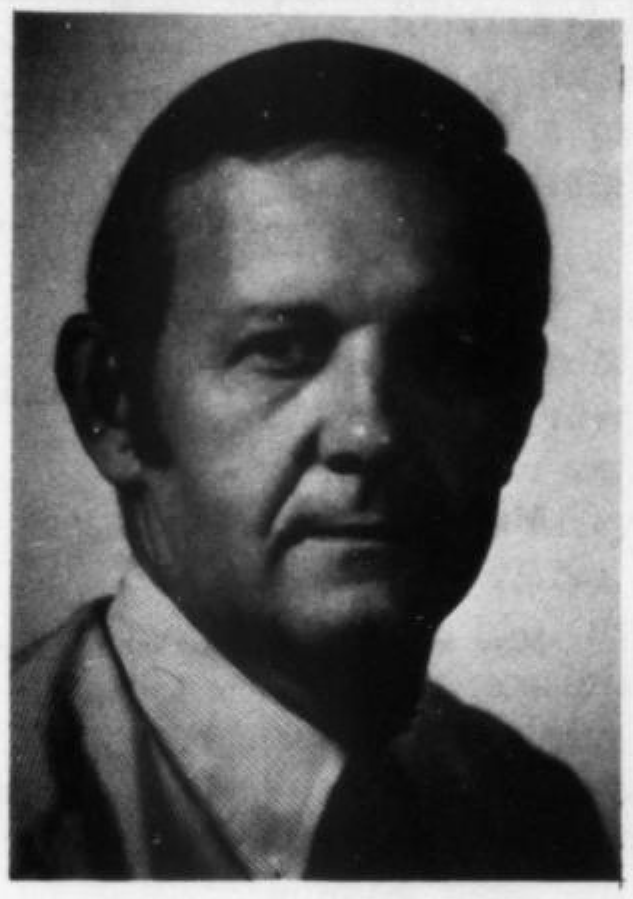
*(continued on page 32)*

**PERSONALITY COLUMN**
*(continued from page 8)*

his credit, mostly concerned with the Adirondack region, he is the source of knowledge and inspiration for a large group of collectors in the Albany-Schenectady and Glens Falls areas. He also has acquired an outstanding collection of more than 4000 mineral specimens, many of which he used in teaching crystal form and mineral identification. For example, a student faced with a foot-long perfectly developed crystal of schorl will not forget the meaning of a hemimorphic rhombohedral crystal of trigonal habit. Similarly, what more fascinating way to learn gems than from a 25-pound Brazilian gem topaz crystal, now in the British Museum in London.

Even more important than these "exhibits" have been the many new localities discovered by Elmer and the unusual minerals he has ferreted out from them. Indeed, I have never met another man who has had his ability to find and identify on sight so many extraordinary specimens regardless of how many others had been searching there before him. Among others, he has found such rare species as allanite, monazite, cyrtolite, polycrase, idocrase (two crystals of which are among the finest large crystals ever discovered), fergusonite, kasolite, and fourmarierite. Many of these he has confirmed with the assistance of professional mineralogists such as Professors Frondel and Hurlbut of Harvard and Professor Winchell of Yale. He knows as perhaps too few collectors do that an accurate description and mineral verification are essential not only to the science but also to the fullest enjoyment of mineralogy as a hobby. One such locality described by Elmer, the idocrase (vesuvianite) locality in Essex County, New York (in ***Rocks and Minerals,*** Nov.-Dec., 1948), I shall never forget. Visiting the locality with him in 1949 on one of his "class" field trips, I began looking around for a likely place to dig in the weathered, granular, metamorphosed limestone. He saw my confusion and pointed to a large boulder at the base of a small tree. "Look under that glacial erratic. Probably no one

*(continued on page 16)*



# The Museum Record

### Paul E. Desautels

When mineral collectors happen to be travelling it seems customary to try arranging a schedule—family plans, business meetings, camping stops—that includes at least one mineral museum. There is a lot to be said for the fun of looking at mineral specimens, other than your own, now and then. Because I feel this way it has always been a source of annoyance to me that there is no guide book locating collections. I have often discovered, too late, that some trip has carried me past a fine display collection that was only ten minutes off the track. In the course of my work I have been able to assemble a fairly good museum file through the years, based on personal visits, but of necessity it is incomplete. What we all need are some good collection surveys for each state (and country), prepared by someone who has taken the trouble to investigate thoroughly.

Recently, Dr. Richard Dietrich has brought to my attention such a list, for the state of Michigan, which appears in the ***Geology of Michigan*** by John A. Dorr, Jr. and Donald F. Eschman, University of Michigan Press, Ann Arbor. For your potential enjoyment, pertinent parts of the list are given here.

Wayne State University, Detroit—mineral exhibits
Adrian College, Adrian—mineral collection
Hillsdale College, Hillsdale—mineral collection
Albion College, Albion—mineral exhibits
Battle Creek, Leila Arboretum, Kingman Museum of Natural History—mineral, fossil and other exhibits
Kalamazoo, Nature Center (north of town)—mineral collections
Western Michigan University, Geology Department, Science Building, Kalamazoo—collections of minerals, rocks and fossils
Chamberlain Memorial Museum, Three Oaks—mineral collection
The University of Michigan, Ann Arbor, Exhibit Museum, Museum Building—many exhibits including minerals, rocks, astronomy, planetarium, anthropology, zoology, botany, and fossils
The University of Michigan, Ann Arbor, Department of Geology and Mineralogy—extensive mineral and rock collections and displays
Nature Center, Kensington Metropolitan Park, Milford—mineral exhibits Michigan State University, East Lansing, Geology Department, Natural Science Building—minerals and fossils
Michigan State University, East Lansing, The Museum—displays of minerals, fossils, and other natural history materials

*(continued on page 17)*

# MEETINGS & SHOWS

| WHO & WHAT | WHEN | WHERE | CONTACT |
|---|---|---|---|
| **Gem, Lapidary and Mineral Society of Montgomery Co. (Md), 7th ann. "Bouquet of Gems and Minerals" show** | **Mar. 13-14** | Charles Woodward H.S.<br>Rockville, Md. | **Jim Durborow,** 3006 Kramer St., Wheaton, Md. 20902 |
| **Geological Society of America, *North Central Section,* annual meeting** | **Apr. 29-May 1** | Lincoln, Nebraska | **W. J. Wayne,** Dept. of Geology Univ. of Nebraska, Lincoln, 65808 |
| **Matawan Mineralogical Society, 6th Rock, Mineral and Fossil Show** | **May 1-2** | Keyport High School<br>Keyport, New Jersey | **Julius Kurowsky,** P.O. Box 693 Freehold, N.J. 07729 |
| **Geological Society of America, *South Eastern Section,* annual meeting** | **May 6-8** | Blacksburg, Va. | **M. C. Gilbert,** Dept. of Geological Sciences, V.P.I., Blacksburg, Va. 24061 |
| **Geological Assn. of Canada and Mineralogical Assn. of Canada, annual meeting** | **May 13-18** | Sudbury, Ontario<br>Canada | **D. H. Williamson,** Dept. of Geology, Laurentian Univ. Sudbury, Ontario, Canada |
| **Eastern Federation of Mineralogical and Lapidary Societies, annual show** | **June 11-13** | Olympic Arena<br>Lake Placid, N.Y. | **M. F. Witherell,** Bristol, Vermont 05443 |
| **South Dakota State Gem and Mineral Show** | **June 25-27** | Rapid City, S.D. | **Scott C. Moses,** P.O. Box 492, Deadwood, S.D. 57732 |
| **Calif. Fed. of Min. Societies, annual convention and show** | **July 2-4** | Ventura Fairgrounds<br>Ventura, Calif. | **Bruno Benson,** 207 S. Pueblo Ojai, Calif. 93023 |
| **Midwest Federation of Mineralogical & Geological Societies, convention and show** | **July 22-25** | Richland Co. Fairgrounds<br>Mansfield, Ohio | **B. F. Parr,** 1488 Marion Ave. Rd. Mansfield, Ohio 44906 |
| **Mineralogical Soc. of America, summer mtg. (Pegmatite Phosphate Symposium), jointly with Clay Minerals Soc., ann. mtg., and North American Clay Minerals Conf.** | **Aug. 8-12** | Rapid City<br>South Dakota | **D. H. Garske,** S. D. School of Mines, Rapid City South Dakota 57701 |
| **Amer. Fed. of Min. Societies & Northwest Fed. of Min. Societies, annual show in conjunction with Seattle regional show** | **Sept. 3-6** | Seattle Coliseum<br>Seattle, Wash. | **Ed Messerly,** 3017 N.E. 97th. Seattle, Wash. 98115 |
| **Conference, Physics & Chemistry of asbestos minerals** | **Sept. 6-9** | Louvain University<br>Belgium | **G. Poncelet,** Laboratoire de Physico-Chimie Minerale, Institut des Sciences de la Terre de Croylaan 42, 3030 Heverlee, Belgium |
| **Rocky Mountain Federation Show** | **Oct. 1-3** | Topeka, Kansas | **R. C. Roderick,** 2106 East 6th. Topeka, Kansas 66607 |
| **Geological Soc. of America and Mineralogical Soc. of America, annual meeting** | **Nov. 1-3** | Washington, D.C. | **GSA Headquarters,** Box 1719 Boulder, Colorado 80302 |
| **Greater Detroit Gem & Mineral Show, 2nd Ann. symposium for mineral collectors** | **Nov. 5-7** | Light Guard Armory<br>4400 E. Eight Mile Road<br>Detroit, Mich. | **Charles Towle,** 22114 Allan-A-Dale Birmingham, Mich. 48010 |
| **1972** | | | |
| **Geological Society of America, *South Eastern Section,* annual meeting** | **Apr. 15-17** | Tuscaloosa, Alabama | **T. A. Simpson,** Geological Survey of Alabama, Drawer O University, Ala. 35486 |
| **Geological Soc. of America and Mineralogical Soc. of America, annual meeting** | **Nov. 13-15** | Minneapolis, Minn. | **GSA Headquarters,** Box 1719 Boulder, Colorado 80302 |

*(continued from page 15)*

has ever bothered to dig beneath it around that tree root. It's a likely place for a fine crystal." We began to work together. Finally a large while "rock" with flat planes emerged. As an ignorant high-school student, I had no idea what we had found, even whether it was rock or mineral. Today it is in my mineral collection—a fine scapolite crystal.

Elmer Rowley has always been generous—generous with his mineral finds, with his time, and with his knowledge. If you are in the vicinity of Glens Falls in north-eastern New York State, stop in for a visit and share with him the enthusiasm of mineralogy.

**THE MUSEUM RECORD**
*(continued from page 15)*

Lansing, 505 N. Washington Street, Michigan Historical Museum—mineral and fossil exhibits
Grand Rapids Public Museum, Grand Rapids, 54 Jefferson Avenue, S.E.—displays of minerals, fossils, zoological and anthropological materials
Cranbrook Institute of Science Museum, Bloomfield Hills—many superb displays of minerals and fossils
Port Huron Public Library Museum, Port Huron, 1115 Sixth Street—exhibits of minerals and fossils
Saginaw Museum, Bristol and N. Michigan Streets, Saginaw—mineral displays
Jenison Trailside Museum, 5 miles north of Bay City at Bay City State Park—mineral exhibits
Alma College, Alma—mineral collection
Con Foster Museum, Clinch Park, Traverse City—exhibits of minerals and fossils
National Ski Hall of Fame, Ishpeming—mineral exhibits
A. E. Seaman Mineralogical Museum, Michigan College of Mining and Technology—very extensive mineral exhibits and mine models

In past years I have visited several of these and have found the Cranbrook Institute to be my favorite. There will be more about that museum in a later column.

Very likely this is only a partial list to which our Michigan readers can add considerably more. Please let me know if you can find others. It would be very interesting too, finding out about these collections in more detail. I will be delighted to pass on your evaluations as you visit those listed here. With just a few responses from that part of the country, and from those who have been there, we should all be able to decide quickly which collections and exhibits are worth the effort of planning to get there even if they are *ten minutes off the track.* ■

# Q/A column

**What can you tell me about the so-called honessite from Hall's Gap, Kentucky? I have been expecting data on this mineral to appear in the American Mineralogist. Is this mineral to be regarded as a pseudomorph after millerite, with the sulfide altered to sulfate?**

**F. A. Cajori, Denver, Colorado**

*The honessite status is about as confused as a mineral's status can possibly be. It has never been adequately described and its describers used such terms as "sulfate (or sulfate series)," "not uniform," and "with CaO as a major or minor constituent" (Heyl, Milton and Axelrod,* Amer. Mineral., **44,** *995-1009, 1959). In their paper they state "The chemical literature . . . lists many syntheses of basic nickel sulfates. It is not possible, however, to identify either these sulfates or the Wisconsin substance precisely enough to say that any one of them has a particular formula. Attempts to synthesize a compound having properties like those of the Wisconsin mineral were unsuccessful."*

*Unaccountably the name was approved by the IMA in its early days when there were only six voting members. While honessite is not recognized as a mineral by Strunz (*Mineralogische Tabellen, *1970), it is given full status by the usually conservative Hey (*Appendix to Chemical Index of Minerals, *1963).*

*So, while the Hall's Gap material appears to be honessite, the question remains—"What is honessite?". Until further work is done the name has about as much significance as the names wad and limonite. There is no doubt though that the Hall's Gap material formed through alteration of and is clearly pseudomorphous after millerite.*

**Are Booth's and Lane's mines, Monroe Conn. still in existence and open to the general collecting public? If so, how can you get to the mines and what can still be easily found there?**

**Bill Kohlberger, Hackensack, N.J.**

*The following directions are taken from* The Mineralogy of Connecticut and Southeastern New York State *(1961), by Ronald E. Januzzi, p. 208: BOOTH'S MINE—travel south from Monroe on Route 111, turn left onto Route 110 and proceed 1.1 miles, turn left onto blacktop road. The locality is 0.1 miles along this road on the right side. LANE'S MINE—travel south from Monroe on Route 111 1.4 miles, turn right onto Elm Street for 1.4 miles. Inquire at home on left side of road for specific directions and permission.*

*Information about the minerals of these mines is hard to find. Native bismuth has been reported from both of them and Booth's mine is also credited with pyrrhotite, chalcopyrite, pyrite, sphalerite and arsenopyrite. We could learn nothing about what one might hope to find there at the present time but perhaps some of our readers can come to our aid.*

**In examining some quartz crystals from Colorado, I have found some that have hematite on three faces of the termination only—why this selective coating?**

**Carroll Withers, Lakewood, Colo.**

*Quartz is not a hexagonal mineral, but is a trigonal (rhombohedral) mineral. The 6 faces of a* hexagonal *pyramid are all equivalent; meaning, they offer identical surfaces to any*

*(continued on page 27)*

# Calcian Ancylite from Pennsylvania: NEW DATA

**AUTHORS**

**F. A. Keidel,[1] A. Montgomery,[2] C. W. Wolfe,[3] and R. P. Christian[4]***

## ABSTRACT

New data have been obtained on ancylite from Cornog, Pennsylvania. Ancylite, an orthorhombic mineral of composition $(Ce, La)_4 (Sr, Ca)_3 (CO_3)_7 (OH)_4 \cdot 3H_2O$ (thus a hydrated basic carbonate of strontium, calcium, and the cerium group of rare earths) occurs in minute, pale-pink crystals at the Keystone Trappe Rock quarry, Cornog, Chester County, Pennsylvania. Most crystals (the largest ones are 1-2 mm in length) possess but two forms: {111} and {120}. Most of the observed crystal faces are curved. The refractive indices are: $\alpha = 1.654$, $\beta = 1.733$, $\gamma = 1.772$, birefringence 0.118, biaxial negative with $2V$ = 60-70 degrees, $r<v$ barely perceptible. Ancylite crystals from Cornog typically are perched on calcite or embedded in cellular calcite and quartz masses. X-ray photographs give unit cell dimensions of: $a = 4.97$, $b = 7.24$, and $c = 8.50$ A. Color effects in the material can be explained on the basis of characteristic lanthanide absorption bands and variations in incident light.

Work on Cornog ancylite by the authors of this paper was distributed as follows: Montgomery, review of earlier work and literature, geology and occurrence of ancylite, and descriptive mineralogy; Keidel, crystal collecting, mineral separation and optical-absorption measurements: Wolfe, crystallographic data and x-ray analysis; Christian, x-ray fluorescence spectroscopic analysis.

## Introduction

Ancylite (ankylit) was first discovered by Gustav Flink in 1897 at Narsarsuk (Narssarssuk) near the southwesterly tip of Greenland. He described it four years later (Flink, 1901), including a chemical analysis by R. Mauzelius. The tiny, pale-yellow, octahedral-like orthorhombic crystals, associated with parisite, cordylite, and aegirine in pockets within a nepheline-syenite complex, show curved faces which gave rise to its name (for "curved" in Greek) and cause extreme inaccuracies in crystallographic measurement.

In 1923, S. G. Gordon collected extensively at Narsarsuk and obtained numerous specimens of ancylite. He determined the optical properites, incorrectly given in the first edition of the Larsen optical tables (Larsen, 1921). He reoriented the crystals with improved recognition of the forms and supplied new data on interfacial angles and crystallographic elements (Gordon, 1925). His crystallographic and optical data are those given for ancylite in *Dana's System of Mineralogy* (7th ed., vol. 2, 1951, pp. 291-293). The crystallographic data given here for superior crystals from Pennsylvania prove Gordon to have failed, as did Flink, in securing satisfactory data on interfacial angles and the derived crystallographic elements.

More than a dozen occurrences of ancylite have been described since Flink's original paper. Most of the finds were made in Russia. Nearly all are found associated with carbonates and alkalic igneous rocks, chiefly syenitic pegmatites. Other Russian occurrences have been reported more recently, mostly in rocks from the Kola Peninsula but also from similar types of alkalic rocks elsewhere. Distinct crystals are generally absent but, where present, have formed very late.

Three occurrences have been described from localities in the United States and Canada. Ancylite was found in the Bearpaw Mountains of Montana (Pecora and Kerr, 1953) in hydrothermal veins associated with mafic and felsic alkalic igneous rocks. It was later discovered in Ravalli County, Montana (Heinrich and Levinson, 1961) in carbonatic alkalic-type hydrothermal veins associated with marble and amphibolitic gneisses. Mandarino, Harris and Bradley (1965) recorded data for an ancylite-like mineral from St. Hilaire, Quebec, occurring in nepheline-syenite pegmatities in association with carbonates and alkalic-type minerals; certain of its properties, as its pinkish color and optical-absorption effects, are similar to those of the crystals from Cornog described in this paper and its x-ray powder pattern is almost identical with those of crystals from both Nararsuk and Cornog.

Where separations of the fairly pure mineral have been made, chemical analyses typically show a ratio of roughly 2:1 for rare earths (chiefly Ce and La) compared to the sum of Sr and Ca, plus additional minor substituting cations. In most reported analyses Sr greatly exceeds Ca. The published analyses for Ca-

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*Publication approved by the Director, U.S. Geological Survey.

rich and Sr-lean (or Sr-free) ancylite (calcio-ancylite being defined in Dana's System, p. 293, as the end-member with $Ca > Sr$) refer in part to calcian ancylite from a nepheline-syenite pegmatite in the Kola Peninsula (Tschernik, 1923) and record but a single occurrence of "calcio-ancylite" from an uncertain locality in western Russia (Tschernik, 1904).

## Geological Occurrence at Cornog

The original discovery of ancylite at the Keystone Trappe Rock quarry 1/2 mile east of Cornog, Chester County, Pa., 2 miles north of Lyndell and about 30 miles west of Philadelphia, was made in the nineteen-forties by S. G. Gordon. He had difficulty in identifying the mineral, and seems only to have mentioned the new find to others. This is why, by the early nineteen-sixties and long after Gordon's death, no more than vague rumors persisted about a possible occurrence of ancylite at the Keystone quarry.

In 1965 R. M. Eisenhauer picked up a loose fragment of amphibolite gneiss in the Keystone quarry showing several minute pale-pink crystals associated with well-crystallized calcite, pyrite, and actinolite. Eisenhauer at once suspected the crystals might be ancylite, recalling the similar habit shown in Gordon's crystal drawing in Dana (Fig. 3). A single crystal was determined to be ancylite by one of the authors (A.M.) by means of its optical properties and x-ray powder pattern. In 1967 Keidel found many more of the same crystals in small calcite-lined cavities of a large freshly-mined block of amphibolite lying near the entrance to the Keystone quarry. All of that material was studied at Lafayette College. It was not until 1968, with quarry operations abandoned, that Keidel and Montgomery were able to locate the source of the ancylite at the base of the quarry wall near its northwest corner (Fig. 1).

The Keystone quarry has an irregular shape, measuring roughly 700 feet northeast-southwest by 500 feet northwest-southeast, and is nearly 200 feet deep at its lower level. Quarrying has gone on intermittently from 1907 until 1968. The quarry was worked for crushed road-metal material and massive blocks for foundations and is now partly under water. During the nineteen-fifties and sixties the quarry became a highly productive mineral specimen locality, thanks to the generous cooperation of H. T. Galt, operator and owner until 1968. In the early sixties clinozoisite prisms of large size were found in fracture fillings of calcite and quartz in the amphibolite near the base of the southeast wall of the quarry. Blasting later exposed open pockets there (Fig. 1) in which were discovered excellent crystallized specimens of prehnite, actinolite, clinozoisite, axinite, titanite, apatite, adularia, albite and quartz. Coatings of hair-like actinolite (byssolite) occurred closely intergrown with those minerals. Montgomery (1964) suggested that these pockets and their crystallized contents are similar to Alpine-cleft minerals, where the chemical constituents of the pocket crystals have been derived from the wall-rock and the newly-formed species chiefly represent regenerated minerals common in, or chemically related to, the adjoining rocks. The newly-formed crystals at Cornog were deposited in the cavities by hydrothermal solutions which first attacked and leached the wall-rock of some of its constituents. A complex paragenetic sequence of minerals and several periods of mineralization have been inferred for these occurrences (Montgomery, 1969). No trace of ancylite was ever found in that part of the quarry.

The rocks exposed in the Keystone quarry are mostly amphibolitic (hornblende-plagioclase) gneisses

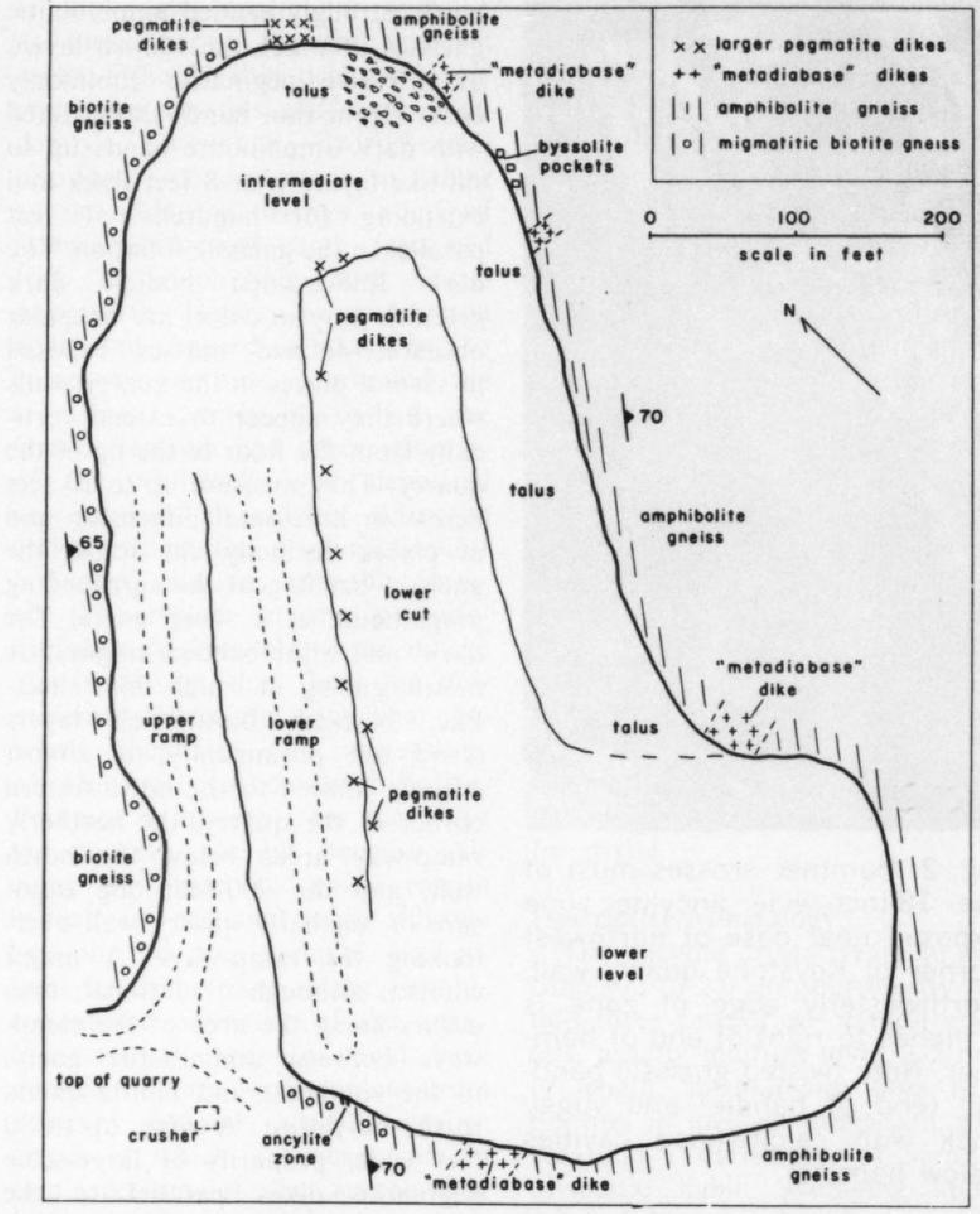


Fig. 1. Map of Keystone quarry, near Cornog, Pa., showing geology and location of the ancylite zone.

Fig. 2. Hammer crosses most of the 18-inch-wide ancylite zone exposed near base of northwest corner of Keystone quarry wall. Northwesterly edge of zone is 5 inches to right of end of hammer. Note twisted gneissic banding (end of handle) and vuggy rock with calcite-lined cavities below hammer.

and migmatitic biotite gneisses. Also present are some dark bodies, very fine-grained and massive, and many smaller, whitish, layer-like dikes of coarse-grained granitic pegmatite spotted by abundant coarse, irregular or pod-shaped, grains of pale- to deep-bluish quartz. The latter two rock types display crosscutting relationships with respect to the foliated and well-banded amphibolites which Bascom and Stose (1938) incompletely mapped during early quarrying as "gabbroic gneiss" belonging to the Precambrian Pickering Gneiss. The dark, fine-grained bodies they regarded as "metadiabase" dikes of still later Precambrian age. The general area is one of very complex geology, with the Precambrian rocks here exposed forming part of the upfolded Honeybrook mass which grades westward into the Mine Ridge anticline.

The main part of the quarry is excavated in the greenish-black, strongly-banded amphibolitic gneisses in which the whitish layers of intrusive pegmatite commonly occur, from thin bands intercalated with dark amphibolite bands up to sill-like layers 6 or 8 feet thick and extending for hundreds of feet parallel to the gneissic foliation. The dark fine-grained bodies, dark greenish-gray in color, are irregular obscurely-defined masses exposed in several places in the quarry walls where they appear to extend vertically from the floor to the lip of the quarry. They measure up to 20 feet across in horizontal dimension and at places distinctly cut across the gneissic banding of the surrounding amphibolite at a sharp angle. The dark- and white-banded, migmatitic biotite gneiss, in which thin, sheet-like, blackish biotite-rich layers stand out prominently, is almost entirely limited to the northwestern corner of the quarry, the northerly ramp-way areas below the north wall, and the 700-foot-long exposure of northerly quarry wall overlooking the ramp-ways. A major contact, although gradational, thus occurs along the area of the ramp-ways between amphibolite gneiss to the southeast and biotite gneiss to the northwest. A zone, up to 30 feet wide, primarily of large-scale pegmatite dikes parallel to the surrounding gneissic foliation lies along a good part of the north-easterly end of this contact. The strike of gneissic foliation and banding throughout the quarry ranges from N3OE to N5OE with a very steep, southeasterly dip averaging about 70 degrees.

The ancylite occurrence is limited to one narrow rock zone paralleling the layering of the biotite gneiss near the base of the northwesterly corner of the quarry wall. The gneiss here for some tens of feet both north and south of the ancylite zone consists mainly of a dark-and-light interlayering of gray-black, biotite-rich, granulitic bands, usually less than an inch thick and sometimes almost wholly biotite films and sheets, with whitish, pegmatitic layers. The latter appear to be of later origin than the biotite-rich bands, possibly injected into the host rock as thin sheets of granitic magma so as to become interlayered with it in lit-par-lit fashion. The resultant well-banded gneiss thus may be termed a migmatite. The thickness of individual layers of biotite gneiss and of pegmatite varies from less than an inch to more than 6 inches.

The almost vertical, layer-like, ancylite-bearing zone within the migmatitic biotite gneiss is about eighteen inches wide horizontally and extends from the quarry floor upward for about 20 feet in the wall above, where it pinches out or changes character so as to become indistinguishable from the surrounding gneiss. This zone is distinguished from the adjacent rocks by the: (1) irregular, deformed and twisted attitude of its gneissic layering; (2) presence of numerous irregular cavities, from narrow curving open fractures an inch or two long to lenticular pockets several inches wide and 8 or 10 inches in length, partly paralleling but also athwart the associated gneissic banding; (3) abundance of white calcite, much of is crystallized, with single crystals up to half-inch size, in and around the cavities which are almost all calcite-lined; (4) abundance of brassy-yellow pyrite both as a spotting of small cubes and as streaky films and masses through much of the rock, especially within and around the calcite-lined pockets; (5) presence throughout the zone of bright-greenish actinolite in felted mats of densely-aggregated, slender blade-like prisms of small size, as well as separate, clean-cut prisms intergrown with calcite crystals in and around the pockets. The rock comprising the zone, although distinquished by these features, nevertheless consists mostly of well-banded migmatitic biotite-actinolite gneiss not very different from, and in part gradational into, the surrounding rocks. Isolated masses of almost typical biotite gneiss, up to a foot in size, stand out here and there within the zone, but with the gneissic banding near their borders bent, disrupted and sheared off by sharp contact with crosscutting, streaky and vein-like rock. This latter rock contains "smeared-out" mattings of grass-green actinolite blades and much granular whitish calcite; shows disrupted, partially broken-off and displaced bands of pegmatite which have been also in part unmistakably etched and dissolved away; and is full of highly-irregular, curving, crystal-lined fractures and pockets.

> Thin-section petrographic study of the migmatitic biotite gneiss surrounding the ancylite zone reveals these features: the thin dark layers consist of parallel trains of densely-aggregated biotite flakes of brownish to greenish-black pleochroism with interstitial grayish highly-sericitized and sausseritized feldspar; some biotite aggregates grade into mats and sprays of tiny slender greenish actinolite blades; streaks of minute dark granules, partly of epidote and iron-oxide, are strung out in and around the biotite trains, as are locally-abundant small lenticular grains of indistinct patchy perthite grains of medium size full of specks of kaolinite, calcite and sericitic material, except at the borders where clear rims of albite occur; small irregular grains of calcite are sparsely present in the feldspar or spotted along quartz-feldspar contacts in all sections studied; small cubes of pyrite occur in some sections; quartz grains of all sizes surround the feldspar, the larger showing undulatory extinction.

> Migmatitic biotite gneiss from the pockety calcite-rich ancylite zone displays similar mineralogical and textural relations except for the following features: actinolite blades, of a brighter grass-green, are in clean-cut, isolated, as well as aggregated, crystals and abundant both in intergrowths with biotite and also strung out in parallel orientation through the feldspar and quartz; quartz is mostly in finely-granulated streaks and veinlets crossing ragged indistinct perthite grains; pyrite cubes ranging from 0.01 to 0.04mm in size are common, and sometimes abundant; calcite is common from small grains scattered through feldspar and against quartz up to grains of large size and irregular shape; in several sections scarce zircon grains, around 0.02mm in size and associated with biotite, occur as relic, fractured and broken-apart aggregates surrounded by wide dark borders possibly of iron-oxide; in two sections several round, fuzzy, partly-translucent, gray-brown grains, of average 0.01 to 0.02mm size and rimmed by wide black halos as well as by radially-aggregated clusters of transparent epidote prisms, may represent partly-altered crystals of allanite.

### Origin

The rocks peculiar to the ancylite zone seem to be a locally highly-sheared and recrystallized version of the surrounding migmatitic biotite gneisses. The minerals of the ancylite pockets are generally the same, except for ancylite, as those normal to the adjacent rocks, although they occur in larger and better crystals and more abundantly. Late-stage hydrothermal solutions, concentrated in their action along a narrow zone of intensely-deformed and fractured rock in which the more brittle pegmatite layers were broken apart and exposed to attack by the corrosive solutions, penetrated the fractures, partly dissolved the quartz, feldspar and other minerals of the wall-rock, and deposited new crystals of calcite, actinolite and pyrite in the cavities. Similar late-stage solutions probably formed the crystals in the prehnite-byssolite pockets elsewhere in the quarry, except that there the new minerals reflect the somewhat different chemistry and mineralogy of the associated amphibolite. Prehnite is missing from the ancylite pockets, possibly because calcium was used to make calcite instead of prehnite; while fibrous byssolite of the prehnite pockets finds its counterpart in the cleanly-crystallized actinolite of the ancylite cavities. Ancylite could have derived its rare-earth content from adjacent altered allanite grains, traces of which are observable in thin sections of the surrounding biotite gneisses and large crystals of which also occur in granitic-pegmatite dikes within 100 feet of the ancylite zone.

This paragenetic interpretation, based on thin-section study and the mineralogical and geological relationships observed throughout the Keystone quarry, suggests that ancylite could have formed elsewhere within the biotite gneiss. The only requirements would have been late localized shearing to create openings within the gneiss, and attendant hydrothermal solutions to leach the wall-rocks surrounding those openings so as to dissolve out some of their chemical constituents (including rare earths from breakdown of allanite) and deposit new crystals of late-stage minerals, including ancylite, inside the enlarged pockets.

It is the belief of one of the authors (A.M.) that the final transformed rock of the ancylite zone, rich in actinolite and calcite, owes its actinolite to breakdown and recrystallization of relics of earlier hornblende once present in darker layers of the biotite gneiss, and owes its calcite, at least a part, to the albitization and freeing of calcium from breakdown and recrystallization of earlier calcium-sodium plagioclase, sausseritized relics of which are still evident in the dark bands of the biotite gneiss. The coarse-grained calcite commonly present in the pegmatite dikes exposed in the quarry, especially in portions of those close to contacts with amphibolite, is an example of such recrystallized calcite. The late hydrothermal solutions could have picked up most of their contained elements from the biotite gneiss which they penetrated and altered; they only would have needed to bring in, as new elements, an abundance of carbon-dioxide to make calcite and sulfur for pyrite.

### Descriptive Mineralogy

The ancylite crystals vary in size from 0.2 to 2.0 mm but mostly fall into three categories: largest crystals, usually multiple units, 1-2 mm in length; medium-size ones near 0.5 mm in greatest dimension; and smallest individuals, of slender prismatic habit, averaging about 0.2 to 0.3 mm in length.

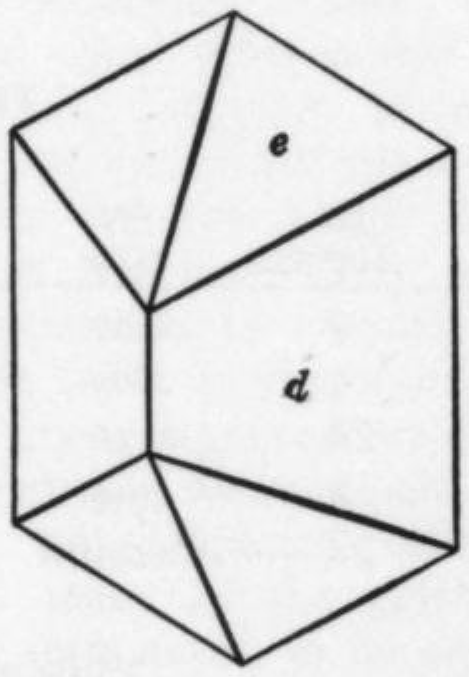


Fig. 3. Drawing of S. G. Gordon (1925, p. 2) of an ancylite crystal from Narsarsuk, Greenland, as given in **Dana's System of Mineralogy** (7th ed., vol. 2, 1951, p. 292).

A specific gravity determination of 3.95 was made by F. Cuttitta of the U.S. Geological Survey on a 7.9 mg. portion of the fine-grained crystal concentrate prepared for x-ray fluorescence analysis. The determination was made with a micropycnometer according to the method described by May and Marinenko (1966).

Crystals of ancylite from Cornog are translucent and show a vitreous to distinctly greasy luster on fracture surfaces. The great majority exhibit a pale-pink color which shows up well in daylight or under non-fluorescent lamps, but disappears under ordinary household fluorescent-lamp illumination. In the latter case the crystals do not become completely colorless, but display a pale bluish-gray tinge. A few crystals fail to display pinkish color under any illumination, but remain whitish, grayish, or even brownish.

The optical properties of crushed fragments, which appear colorless in transmitted polarized light, are as follows: biaxial negative; refractive indices: $\alpha = 1.654$, $\beta = 1.733$, $\gamma = 1.772$ ($\pm 0.003$); birefringence = 0.118; $2V = 60\text{-}70$ degrees; $r < v$ barely perceptible.

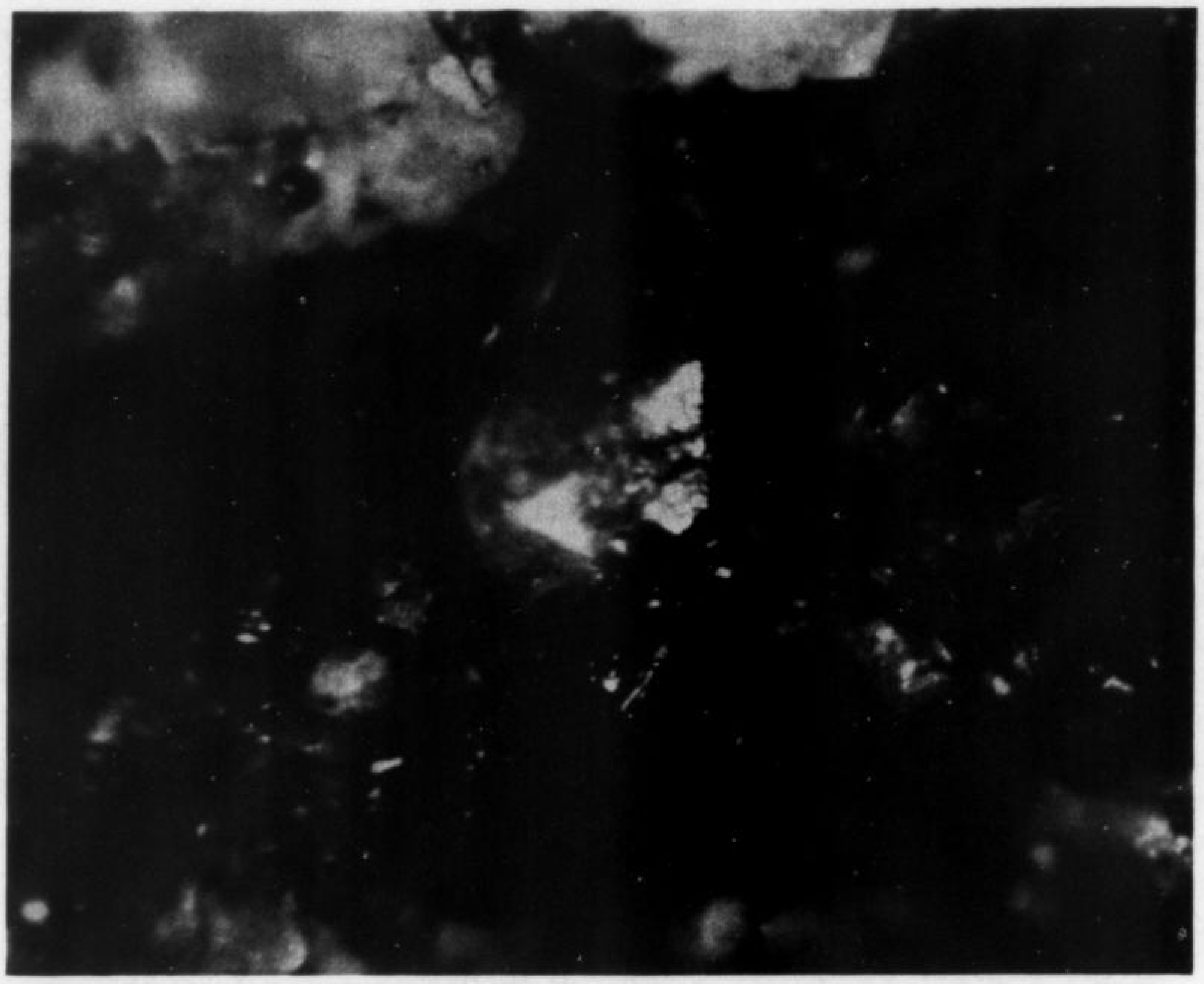


Fig. 4. Ancylite crystal (1 mm long) from Cornog, Pa., perched on calcite crystals and intergrown with actinolite blades. The vertical prism face (120) is illuminated. Photomicrograph by Louis Perloff.

The ancylite crystals occur typically perched on calcite crystals or on cellular masses of etched calcite or quartz. The distribution and abundance of crystals in the calcite-lined cavities are highly variable, and may be in part dependent on the size of the cavities. Perhaps fifty percent of the cavities studied contained a small number of crystals. Specimens collected from some pockets have contained numerous crystals, from up to a dozen of larger size to as many as fifty closely-associated individuals of the smallest category. The distribution appears to be entirely haphazard, both from cavity to cavity as well as within any one pocket. Removal and breaking-up of a mass of rock within the ancylite zone, measuring more than 1x2x10 feet and weighing nearly a ton, have produced from the small open fractures and irregular pockets within it perhaps 2,000 crystals, most of them of smallest size.

Some crystals are intergrown with calcite crystals or masses; a

**TABLE 1.** Crystallographic measurements of ancylite

| Form | No. Times | Av. Size | No. Crystals | Phi range | Rho range | Wgted phi | Wgted rho | Calc. phi | Calc. rho |
|---|---|---|---|---|---|---|---|---|---|
| {100} | 2 | line | 1 | 88°53′-92°55′ | 90°00′ | 90°00′ | 90°00′ | 90°90′ | 90°00′ |
| {010} | 1 | line | 1 | 2 30 | 90 00 | 2 30 | 90 00 | 0 00 | 90 00 |
| {120} | 24 | large | 6 | 36 51 -37 37 | 90 00 | 36 55 | 90 00 | 36 55 | 90 00 |
| {101} | 4 | line | 3 | 90 15 -93 33 | 55 20 -57 48 | 90 00 | 56 34 | 90 00 | 58 55 |
| {111} | 24 | medium | 6 | 56 15 -59 26 | 58 29 -64 14 | 56 21 | 63 21 | 56 21 | 63 21 |

Angle tagle for ancylite — Orthorhombic; dipyramidal 2/m 2/m 2/m

**a**:**b**:**c** = 0.666:1:1.108; **p**:**q**:**r** = 1.660:1.108:1
**q**:**r**:**p** = 0.666:0.603:1; **r**:**p**:**q** = 0.906:1.502:1

| Forms | Phi | Rho | Phi | Rho | Phi | Rho |
|---|---|---|---|---|---|---|
| b {010} | 0.00 | 90 00 | 90 00 | 90 00 | - | 0 00 |
| a {100} | 90 00 | 90 00 | - | 0 00 | 0 00 | 90 00 |
| d {120} | 36 55 | 90 00 | 90 00 | 53 05 | 0 00 | 36 55 |
| h {101} | 90 00 | 58 55 | 0 00 | 31 05 | 58 55 | 90 00 |
| e {111} | 56 21 | 63 21 | 47 39 | 41 56 | 31 05 | 60 19 |

few appear intergrown with actinolite blades or with pyrite cubes around 0.5 to 1.0 mm in size. A good many crystals are also coated by, or intergrown with, in their outer portions, exceedingly minute pyrite cubes smaller than 0.05 mm in size. Rarely, whitish, etched and partly-dissolved, stubby-prismatic crystals of apophyllite, up to 5 mm in size, or blade-like crystals of whitish barite, up to 0.5 mm in length, are found closely associated with the ancylite. The relative positions of the crystals of all these minerals suggest very late-stage growth, similar to that of all the ancylite crystals observed, upon surfaces of earlier-crystallized calcite or etched masses of calcite or quartz.

## Morphological and X-ray Crystallography

### Morphology

No claim is made in this study for highly precise determination of the elements of ancylite, but the ones given undoubtedly have much higher validity than those obtained by Gordon (1925). Crystals are very small, less than 1 millimeter for the most part, and signals from faces of such crystals are poor even when the faces are completely planar. There was a slight curving to most of the measured faces and the quality of the signals was uniformly bad. In fact, the only signal which could be obtained was a blur of light in the field of the telescope. In the cases of the very small faces no signal was secured; but the faces could be well observed with the microscopic arrangement of the goniometer, and the position of brightest reflection from the face was set before making the angular readings.

Most of the crystals showed a well developed prism form and, to facilitate orientation of the crystal for measurement, this prism was set vertically. All of the crystals showed a well developed pyramidal form which was arbitrarily designated as {111}, even though such a designation required that the dominant prism be indexed as {120} rather than {110}. X-ray determination of the unit-cell constants corroborated this choice.

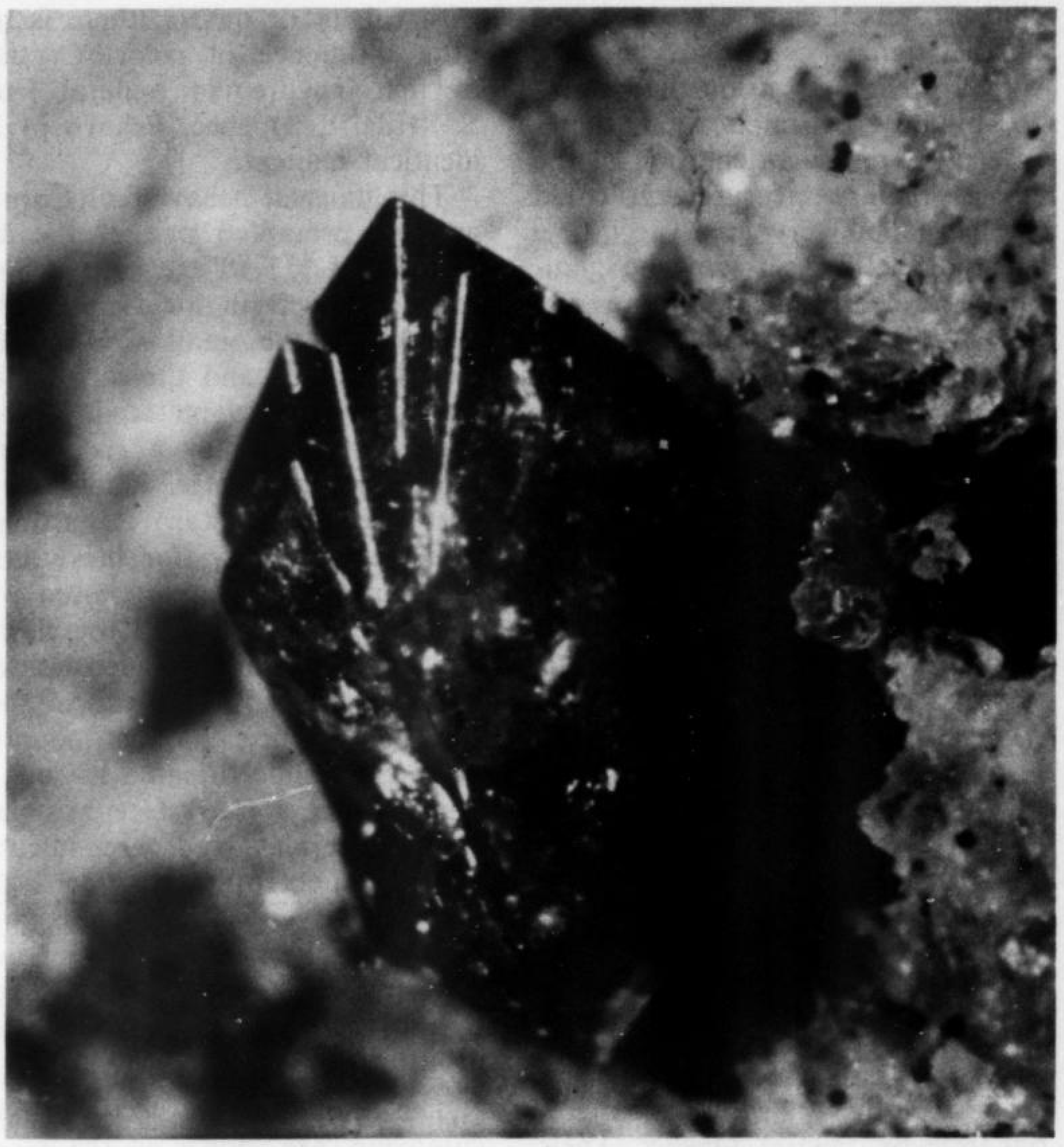
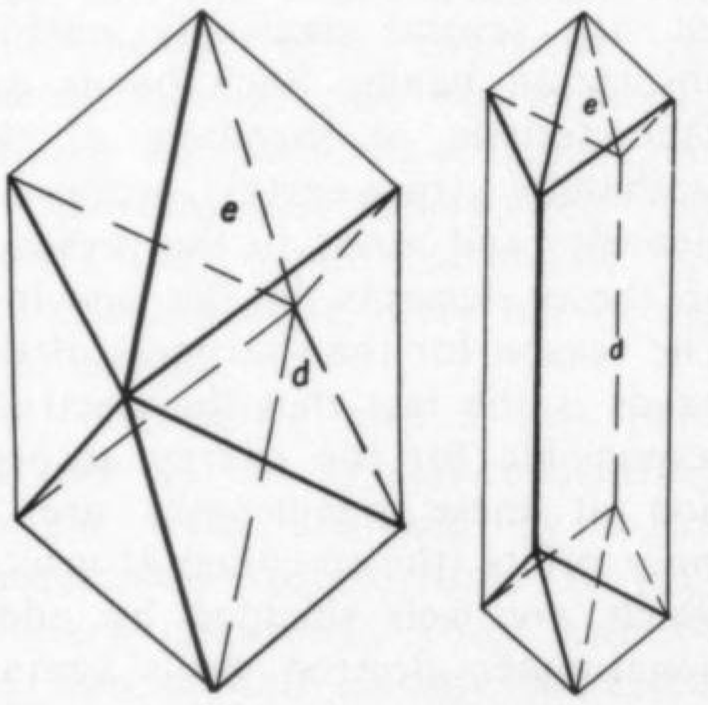


Fig. 5. Ancylite crystal (1 mm long) from Cornog, Pa., showing typical multiple unit made up of several subparallel individuals. The (101) line face is illuminated. Photomicrograph by Julius Weber.



Figs. 6a and 6b. Ancylite crystals from Keystone quarry, Cornog, Pa., showing dipyramidal habit (6a, left) common in larger individuals and slender prismatic habit (6b, right) typical of smallest crystals. The habit of dipyramidal crystals (6a) becomes pseudo-octahedral with the common rounding of the e faces (111) to make pairs of these appear as if single faces.

Two principal habits were observed. The most common is a pseudo-octahedral habit with a roughly equal development of the forms {111} and {120}, as indicated in Fig. 6a. Other crystals are characterized by the larger development of the form {120} and are stout prismatic to elongated prismatic in habit, as shown in Fig. 6b.

Six crystals proved suitable for goniometric measurement. The results are tabulated below. Although many of the crystals are doubly terminated, in no case were both ends of the crystal measured. There is no doubt, however, that the crystal class is orthorhombic, dipyramidal - *2/m 2/m 2/m*. The wide range of measurements listed for each form indicates the poor quality of the signals. Three crystals of the six measured were measured twice, and one three times, to ascertain the degree of precision with which the signals could be centered. As a result, it was concluded that the angular positions of the signals could not be read with a greater precision than about 30 minutes. By implication, therefore, the original orientation of the crystals before measurement could not have had very great accuracy. The correlation between the goniometric elements and those obtained by X-ray measurements seems remarkable, and may be somewhat fortuitous:

| | $a$ to | $b$ | to $c$ |
|---|---|---|---|
| goniometric | 0.666 | 1 | 1.108 |
| X-ray | 0.686 | 1 | 1.175 |

### X-ray measurements

Rotation and zero- and first-layer Weissenberg photographs were taken about the $c$ [001] and $b$ [010] axes, with the following results: $a$ = 4.97 Å, $b$ = 7.24 Å, $c$ = 8.50 Å (all ± 0.05 Å); $a{:}b{:}c$ = 0.686:1:1.175.

Mandarino, Harris and Bradley (1965) reported cell dimensions of: $a$ = 7.24, $b$ = 8.49 and $c$ = 5.02 Å based on x-ray measurements on crystals of their ancylite-like material from St. Hilaire, Quebec. Their data are in excellent agreement with those given above for ancylite from Cornog, except for the choice of axes. Their choice of axes follows the conventional orientation (c < a < b) for orthorhomic crystals; our x-ray measurements were made with the strongly developed {120} form set parallel to the $c$-axis, thus following the orientation adopted by Gordon (1925), and Flink (1901) before him, for ancylite crystals from Greenland. The space group of "ancylite" from St. Hilaire, as determined by Mandarino, Bradley and Harris, is *Pmmm*.

### Optical-absorption Measurements

One of the most striking features of the ancylite from Cornog is its peculiar color behavior dependent on the type of illumination in which it is viewed. Although the crystals appear distinctly pink in daylight or under incandescent light, the color is pale bluish gray when ordinary fluorescent (cool white) illumination is used. Under the latter conditions, the small ancylite crystals are very difficult to recognize on matrix when surrounded with calcite or quartz; there is too little difference in color. Crystals of the ancylite-like mineral from St. Hilaire, Quebec, behave in an identical manner.

This unusual behavior of Cornog ancylite prompted one of the authors (F.A.K.) to measure its absorption spectrum for visible light. Because of the small size of individual crystals and the availability of so very little material, it was necessary to employ a special microspectrophotometer, kindly made available in the Botany Department of Yale University, for these measurements. The sample chosen was a single crystal selected for clarity and freedom from included matter; it was about 0.5 x 0.2 mm in size. For convenience, it was mounted on a glass slide oriented in such a manner that a (120) face was parallel to the glass and perpendicular to the spectrophotometer light beam. The crystal thickness was 0.13 mm. The spectral transmission measurements were made relative to the clear glass slide and are in arbitrary units.

The results of the spectrum measurements are shown on the graph (Fig. 7) where the relative intensity of the transmitted light is plotted against wavelength in Angstrom units. Of particular interest are several unusually narrow absorption bands. Such bands are characteristic of members of the lanthanide (rare-earth) group of elements and attest to the presence of these elements in the ancylite. The reason for the sharpness of the bands is the fact that the electrons responsible for the energy absorption at these wavelengths are in inner orbits (the so-called 4f orbits) which are well shielded by additional outer electron shells against environmental disturbance. The shielding also results in the absorption spectrum being almost completely independent of the chemical or physical environment of the ions and is in contrast to the much broader and chemically dependent spectra of most other entities such as the transition element ions.

A comparison spectrum (Moeller and Brantley, 1950) of a solution of the compound $NdCl_3$ in water is also shown in the graph. This not only indicates that a major cause of the observed absorption bands in ancylite is the element neodymium, but also illustrates the extent to which the bands are independent of the chemical environment, an aqueous solution being entirely distinct from a solid carbonate crystal. By careful comparison, a rough estimate of this element's concentration in ancylite, about 6-12 wgt. percent, was obtained. Most other lanthanides which may be present either have no strong absorption in the visible spectrum or else occur in relatively small amounts in the ancylite. Apart from neodymium, only praseodymium appears to contribute measurably to the spectrum. Incidentally, it is possible to observe the absorption spectrum visually under a microscope by substituting an appropriate hand spectrograph for the microscope eyepiece (W.M.D. Bryant, personal communication).

Returning to the question of color, it is now possible to understand how the absorption bands that are present affect the appearance. It will be noticed (Fig. 7) that two major absorbing regions show up in the green and yellow parts (5000-6000 Å) of the spectrum. When the ancylite is observed in incandescent light (or daylight) which contains a substantial fraction of orange and red (6000-7000 Å), the effect of the absorption of some of the green energy, but only a little of the red, is to make the material look pink relative to a white object such as a uniformly reflecting sheet of paper. With ordinary fluorescent light, however, there is very little orange and red (greater than 6000Å) in the source present; thus the absorption of neighboring green and yellow under this illumination tends to cause the ancylite to appear more blue than does a white object. This behavior of ancylite is typical of materials containing neodymium which consequently exhibit narrow absorption bands near the center of the visible spectrum. A Corning Glass didymium (neodymium plus praseodymium) filter is an example of such a material. Its color behavior is almost identical to that of Cornog ancylite. If other spectrally diffuse coloring agents, how-

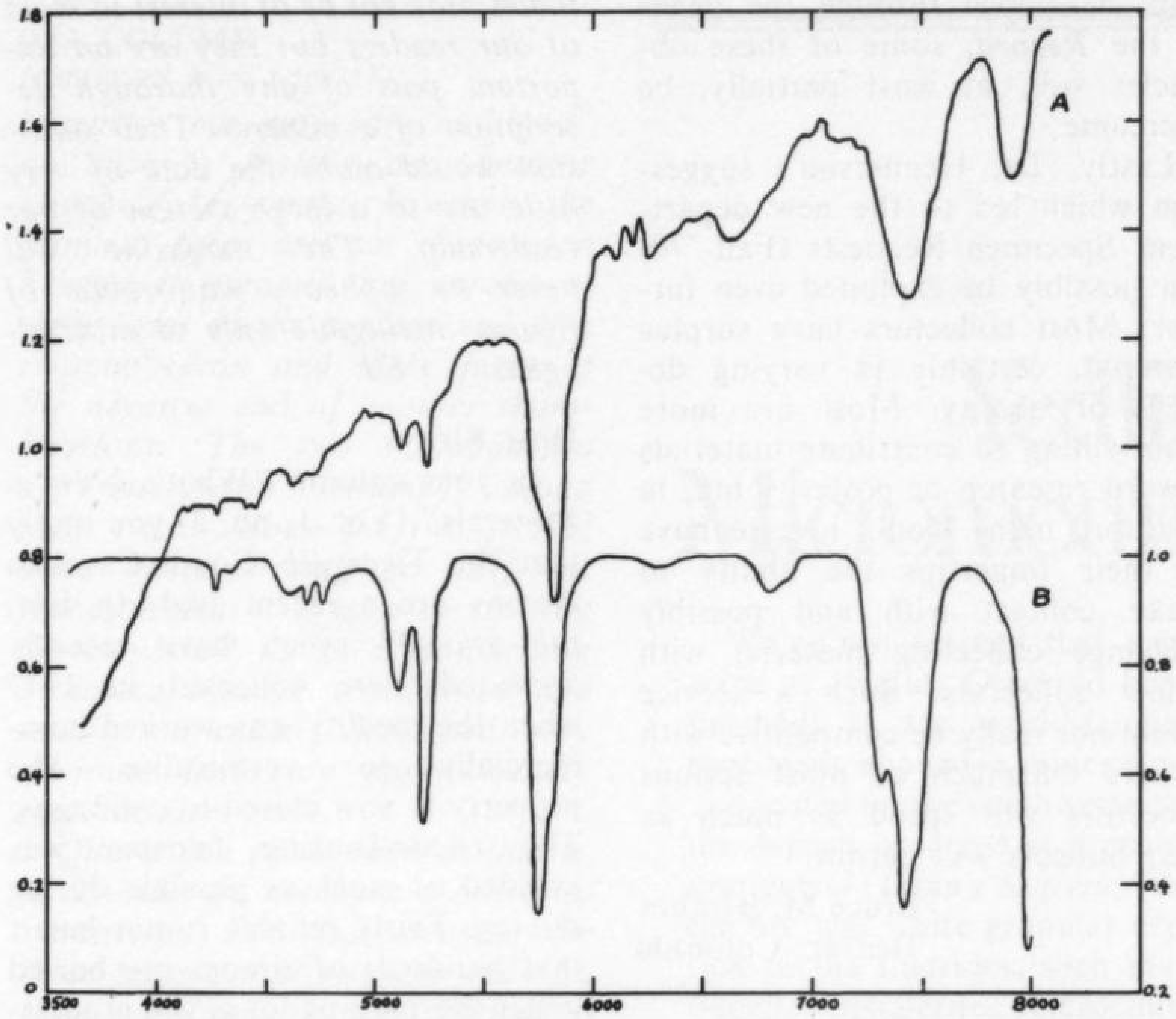


Fig. 7. Optical-transmission spectra: A—of ancylite, Cornog, Pa. (0.13 mm thick); B—of $NdCl_3$ in water recalculated for 10 g per 1. and sample thickness of 1.0 cm, from data of Moeller and Brantley (1950).

ever, such as iron (which is contained in Greenland ancylite) are also present in the sample, it is to be expected that the color effects caused by the neodymium will be largely masked.

## Chemistry

A qualitative electron microprobe analysis of a single crystal of Cornog ancylite was made in 1967 in the Department of Geological Sciences at Harvard University through the courtesy of Dr. Clifford Frondel. Major constituents were found to be Ce, La and Ca. Minor constituents were reported to be Nd and Sr. The elements Ba, Fe, Mn and Y were not detected.

A sample of about 50 mg of separated ancylite crystals was prepared for the x-ray fluorescence spectroscopic analysis by one of the authors (F.A.K.). The crystals (at least 1000 of them, ranging in maximum dimension from about 0.2 mm to 1 mm) were selected on the basis of relative freedom from obvious inclusions. Calcite, actinolite, quartz, and other low-density fragments accidentally accumulated in the concentrate were floated off with methylene iodide. The sample was then reexamined microscopically and non-ancylite grains, mostly pyrite and zircon, plus ancylite with inclusions or attachments, were manually removed. Special care was taken to remove all particles of calcite. It is estimated that considerably less than 2% of impurities, chiefly pyrite and actinolite, were left in the final sample.

A high-purity and a less pure fraction of the crystal-concentrate sample were analyzed by x-ray fluorescence spectroscopy. A preliminary qualitative x-ray scan of the sample had already indicated that only the rare-earth elements La, Ce, Pr, Nd and Sm were present in measurable amounts ( > 0.2%). Because of the small size of the two samples analyzed (less than 20 mg, for both) two other major constituents, $CO_2$ and $H_2O$ (which amount to 25-30% or more in most ancylite analyses) were not determined. Remaining undetermined also were any minor cations such as Fe, Ba and Mn. The analyses are summarized in Table 2.

**TABLE 2.** X-ray fluorescence spectroscopic analyses of ancylite from Cornog, Pa.

| Constituent | Ancylite (very pure) | Ancylite (not pure) |
|---|---|---|
| $La_2O_3$ | 14.6 | 13.5 |
| $Ce_2O_3$ | 24.6 | 23.2 |
| $Pr_2O_3$ | 2.55 | 2.35 |
| $Nd_2O_3$ | 8.66 | 7.95 |
| $Sm_2O_3$ | 0.34 | 0.32 |
| $Y_2O_3$ | 0.00 | 0.00 |
| CaO | 8.35 | 9.20 |
| SrO | 3.07 | 3.27 |
| TOTAL | 62.17 | 59.79 |
| milligrams used: | 8.62 | 9.78 |

### Analytical details

The rare earth samples and standards were prepared by a method similar to that described by Rose and Cuttitta (1968). The standards were prepared by dissolving weighed amounts of pure ignited oxides in dilute $HNO_3$. Less than 10 mg. of the minerals were weighed and placed in 10 ml. beakers. Three ml. of 1:1 $HNO_3$ were added and the samples allowed to stand overnight. The samples were then heated and brought to dryness in a steambath. The evolution of $CO_2$ was very noticeable. Known amounts of each standard stock solution were added to 10 ml. beakers and allowed to dry on a steambath. To each beaker (both samples and standards) was added 0.8 ml. of 5:95 $HNO_3$, and the solutions heated gently to dissolve the salts. Then 400 mg. of chromatographic cellulose powder was added to each beaker, along with a drop of methyl red indicator. All solutions were mixed thoroughly with a teflon rod, dried overnight at 90 C. and brought to a constant weight of 420 mg with the addition of cellulose powder. Each sample was then thoroughly mixed, ground and pressed at 40,000 psi into a 1-inch disc, on a backing of about 2 g of cellulose powder.

A single channel flat crystal x-ray spectrometer with a platinum target was used for this study. An operating voltage of 50 Kv with current of 40 ma was used in all measurements, along with a LiF

*(continued on page 36)*

# To the Editor

Dear Sir:

The time has come. Congratulations are not nearly as much in order as are heart-felt thanks to those of you who have made the *Mineralogical Record* possible. The first three numbers have been superb. In fact, the most difficult aspect associated with the *Record* is the anticipation associated with the next issue.

Perhaps a few additional comments may be worthwhile at this point. The middle-of-the-road position assumed by the *Record*—between the professional journals and lapidary oriented publications—is one filled with a tremendous responsibility. Herein lies the true interest and cohesive element for many amateur collectors with a mineralogical bent. To them the lapidary publications leave a huge void and the professional publications, a chaos of confusion.

Others as well as I fall into this category. Some of us have had the opportunity for formal education on the subject, but far more have acquired their knowledge through self-study and sheer interest in the subject. Many of us also are of an age where our occupational responsibilities preclude our frequent association with older, more experienced collectors. This most certainly does not mean that our interest or desire for more knowledge is less keen. We do not ask for a condescending attitude, but rather for understanding and encouragement.

Collectors, as opposed to professionals and, to a limited degree, dealers, are reluctant to disclose detailed sources of what they individually consider to be prime specimen material. Part of this attitude is due to jealousy, no doubt, but much also is due to the observation of the callous and uninformed when collecting. The needless destruction of a cluster of fluorite or galena cubes, sphalerite or calcite, from a lack of understanding or willingness to understand cleavage is but a simple example of that which we are aware and abhor. This and the inconsideration for private property which closes collecting grounds to others are sufficient causes for silence. Perhaps, through the common cause of mineralogical fellowship, developed through the pages of the *Record*, some of these obstacles will, at least partially, be overcome.

Lastly, Dr. Henderson's suggestion which led to the new department Specimen Requests (Fall '70) can possibly be exploited even further. Most collectors have surplus material, certainly in varying degrees of quality. Most are more than willing to contribute materials toward research or posterity but, in addition, many would love to have at their fingertips the ability to make contact with and possibly exchange collecting material with fellow collectors. Such a service would not really be competitive with dealers inasmuch as most serious collectors will spend as much as their budgets will permit.

Bruce M. Benthin
Denver, Colorado

Dear Sir:

I have just received my third issue of *Mineralogical Record* and I wish to give you my compliments on a fine publication. I especially enjoy Neal Yedlin's column because it is written in a style which is geared for the hobbyist and advanced collector, not the expert.

Your column "What's New in Minerals" is a good one for me as a dealer and it is written for collectors, not geologists. I enjoy the major articles too even though they sound and look like the *American Mineralogist*. I wonder how many collectors understand those tables—or want to?

I wish to ask you sir if you plan to have the *Mineralogical Record* go the same way as the *American Mineralogist*, that is, get so technical in mineral description that the gap between *Rocks and Minerals* and the *American Mineralogist* is still empty? I do hope not.

John Hiller Jr.
Shelton, Connecticut

*We have no intentions of allowing the* Record *to become any more technical than it now is. We see no need for another* American Mineralogist *or for another magazine on the other end of the spectrum. We will stand by our stated intention of trying to serve those who really want to read about minerals. The tables may not be of interest to most of our readers but they are an important part of any thorough description of a mineral. Their omission would make the data of very little use to a large section of our readership. The magazine will never be topheavy with tables of figures intelligible only to mineralogists. Ed.*

Dear Sir:

In your column "What's New in Minerals" (Vol. 1, no. 3) you imply that the Tigerville, South Carolina zircons are a recent find. In fact, the crystals which have recently appeared were collected in 1947 when the locality was worked commercially for vermiculite. The property is now closed to collectors. The zircon-bearing feldspar was avoided as much as possible during mining. Fairly reliable rumor has it that hundreds of zircons are buried under the parking lot at the processing plant near Greenville.

K. C. Brannock
Kingsport, Tennessee

Dear Sir:

It is a great pleasure indeed to have received the 3 issues of your magazine and I congratulate you for your achievement. Being a plain amateur and not a scientist I appreciate the interesting compromise of the *Mineralogical Record* between the technical reviews and the superficial ones. May I also congratulate you for the fine quality of the printing and of the photos.

To peruse the *Mineralogical Record* is for my friends and I quite fascinating, but a little depressing too. Collectors of the old world we feel distressed when learning that you happen to find nice mineral specimens in almost every state of the U.S., while in Europe the mines, veins and dumps have been plundered since the Roman times! And to look at photos of beautiful minerals from Arizona and Colorado is like recalling to our minds the lure of the "roaring Camps" of the Old West.

With my best wishes for the success of your magazine and my best regards.

Yours sincerely,
Prof. M. Santoni
Lyon, France

## Q/A COLUMN

*(continued from page 17)*

*impurity that may care to "land" on such a surface and become attached. In quartz, however, the terminal faces are not those of a hexagonal pyramid but consist of three faces of the positive end of a rhombohedron and three faces of the negative end of another rhombohedron. The two rhombohedra are intergrown (twinned) along their* c *axes. Since the two sets of three faces belong to different rhombohedra, it is easy to see why the combined six faces comprising a normal quartz termination are usually not equally developed, only alternate faces are approximately equal in size.*

*Quartz is a polar mineral; that is, its crystals do not have a center of symmetry. For this reason the three faces comprising one end of a rhombohedron are not identical to the three faces of the other end. A normal quartz termination, therefore, consists of six faces, three each from structurally different ends of two intergrown rhombohedra. What all this means is that hematite, in becoming attached to quartz, is able to detect that the environment of alternate faces differs, and can select those faces most compatible with its structural requirements. These favored environments are alternate faces on the terminal end of a quartz crystal.*

**For some current research at the Pennsylvania Geological Survey, we would appreciate information on the association sulfur—salammoniac—cryptohalite—bararite, particularly the latter two. Dana's System of Mineralogy (Vol. II) lists occurrences at Vesuvius, in India, and in Bohemia. Any more recent information than that referenced here would be appreciated.**

**Davis M. Lapham, Chief Mineralogist, Bureau of Topographic and Geologic Survey, Harrisburg, Pa. 17120**

*The staff of the* Mineralogical Record *has no additional information to offer. If any of our readers have any information we suggest that they write to Dr. Lapham directly.*

# Yedlin on Micromounting

We've just learned that a great locality is no more! The cryolite mine at Ivigtut, Greeland has run out of ore and is closed, barren, finished! It was world-famous industrially and scientifically, and specimens abound in mineral collections both here and abroad.

Located on the southwesterly tip of Greenland, in the Arksuk Fiord, the deposit occurred as a pegmatite body in a granite stock, intrusive into gneiss (*Dana's System,* 7th ed., Vol. II, p. 112). For the most part the ore was white granular cryolite but the deposit included, in addition to the fluorides, such minerals as siderite, galena, chalcopyrite, fluorite, sphalerite, microcline, quartz, pyrite, molybdenite, arsenopyrite, plus small amounts of cassiterite, wolframite, columbite and zircon.

Of prime interest to the micromount collector, for the material is sometimes available in the stocks of dealers and in the breaking up of old collections, is the cryolite, $Na_3AlF_6$, and its alterations—the rare fluorides. These would, of course, include crystallized cryolite, as well as pachnolite, thomsenolite, ralstonite, gearksutite, chiolite, cryolithionite, jarlite and prosopite. The first four listed here are perhaps the most interesting from the point of view of the micromounter, for they are usually to be found together, can be identified visually, and they occur in good crystals.

Operationally the locality was a mining company dream. The ore was first mined at sea level, and ore carriers could float up to the stock piles and be loaded without the need of hoists, conveyors, cranes, etc. Later higher mining took advantage of gravity, and little or no power was needed. When the ore body was followed below sea level it was raised by power methods, but was still stockpiled at pier's edge.

Regular mining began in 1849, with the end product sodium carbonate, an industrial and household necessity. Mining for this purpose tapered off at the beginning of the 20th century, but the subsequent discovery that cryolite could be used as the solvent for alumina in the electrolytic extraction of aluminum from bauxite stimulated the operation of this mine.

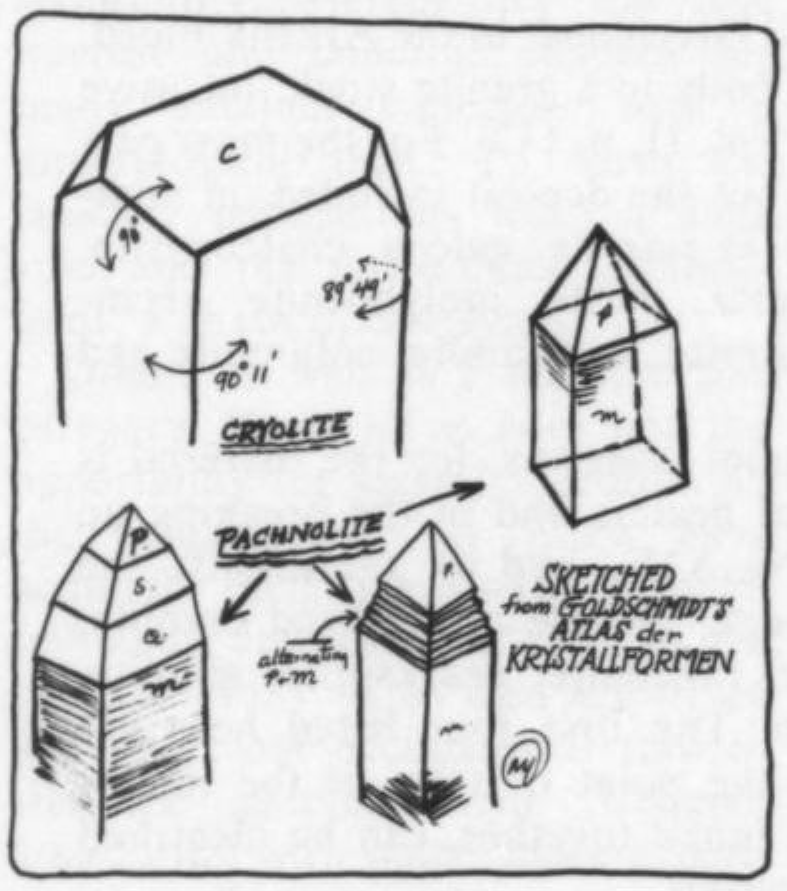
Other localities for this material, but in rather unimportant quantities, are Miask, Urals; Huesca Province, Spain; and St. Peter's Dome, El Paso County, Colorado.

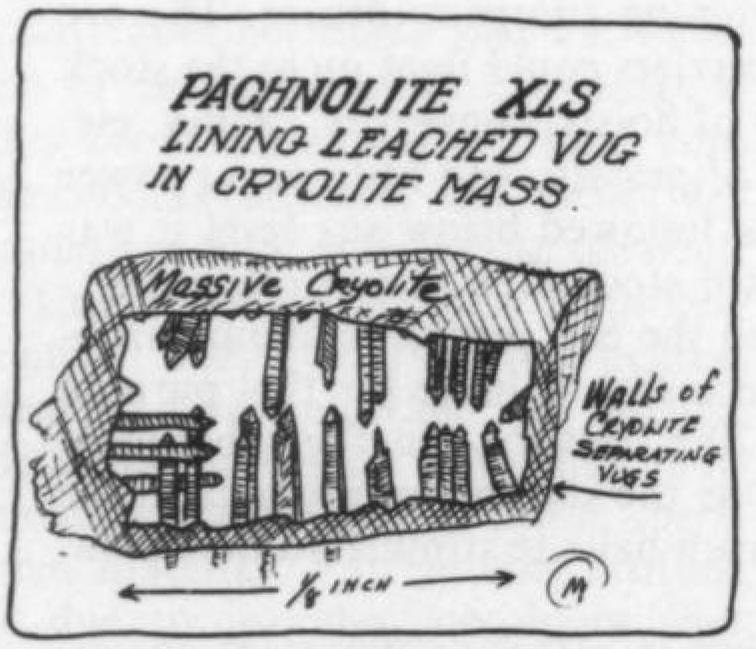
At the first conference of micromounters, held at Santa Barbara, California, in February, 1966, specimens of crystallized thomsenolite appeared. These were blue-grey, prismatic, and were striated at right angles to the *c* axis. The locality was a new one—Honeycomb Island, Juab County, Utah. Fine specimens were available.

Now as to micromount material, the best is to be found in the iron-stained leach vugs in cryolite, which is not, repeat, ***not*** snow-white and lovely to look at. Here you will find crystals of cryolite which are almost cubic in appearance for, although monoclinic, the ***beta*** angle is 90°11′, very close to 90°. Cryolite has no cleavage but parting on

***(continued on next page)***

{001} and {110} produces cubelike forms that adds to the difficulty of instant recognition. Our own specimens have a giveaway. Opposite corners, in pairs, are beveled. This seems to be more or less characteristic of the mineral. This bevel habit is shown in the accompanying sketch from Goldschmidt's *Atlas der Krystallformen*. Here too you will find pachnolite, $NaCaAlF_6 \cdot H_2O$, monoclinic; thomsenolite, with the same formula and crystal system, but with different habit and structure (see sketches herewith); and ralstonite, $Na_xMg_xAl_{2-x}(F,OH)_6H_2O$, which is easy to determine for it is isometric, and always occurs in brilliant clear octahedra.





We've but briefly touched on these minerals, omitting the less common and perhaps less interesting to the micromount collector. One more thing. Ralstonite very often lines a vug in the ore, and has thomsenolite crystals seemingly growing out of the ralstonite faces. There is no consistent growth habit, and epitaxy is not indicated, at least in the specimens we've studied in our own collection. In some cases the thomsenolite seems to emerge in haphazard directions from a valley formed by the joinder of two ralstonite crystals.

The late J. C. Boyle, of Philadelphia, Pennsylvania, former curator of minerals at the Childrens' Museum of Brooklyn, New York, used to tell of the Danish ore boats which dumped this Ivigtut material on the open docks at Philadelphia in the 1920's and 1930's. Many an ardent collector spent gainful hours gathering choice specimens and, since micromounting was in full swing during this era, the old collections show fine samples of these minerals.

We suggest two things: first, that you treasure this material, for fine specimens will shortly be a thing of the past. Second, that you add to your library by obtaining Bøggild's *Minerals of Greenland*. This fine tome is a requisite for anyone truly interested in serious mineral collecting and study. Large (8 Vols., 442 pp., map, plates and line drawings), it describes the minerals of all Greenland, including the Ivigtut area, and especially the Narsarsuk deposits, where minerals similar to those of Mt. St. Hilaire, Quebec; Little Rock, Arkansas; and others are found. Be certain you ask for the English translation. Available from Francis Paul, 49 Fourth Avenue, Mt. Verson, N.Y. 10550. Also at Antiquariaat Junk, Post Box 5, Lochem, Holland. Price, under $15.00

We've been going through some old notes and memos, and turned up a page of reminders of things to do in winter, when field work is not the most easily accomplished. You'll be reading this in spring, but even so the suggestions and admonishments will be appropriate. These are things we propose to do now. Go thou and do likewise.

1. Mount and label all things you were saving for a rainy day. It is now snowing, and there is no better opportunity to assimilate into your collection those things you were too busy to process. NOW.
2. Discard. If the specimen doesn't "grab" you immediately, and cry out to be trimmed, mounted, and added to your collection, forget it. Throw it away! Don't mount from a sense of duty. Don't say "This I really should have. They tell me its rare and unusual. . . ." If the specimen is really worthy, it will make up your mind for you. All else is superfluous.
3. We have always insisted that you do not save space by collecting micromounts. A cabinet specimen collector gets his crystal in the field and that's it. A micromounter finds a boulder full of pits and vugs. He brings it all home for later processing. It is now later than you think. Break the masses down and discard anything you wouldn't mount for yourself. Exchanges should be of DUPLICATES, not of discards.
4. Catalog your collection. Any system will do, just so long as the specimen and catalog refer to each other. Keep extraneous matter out of your file cards. Data available in books—chemical formulas, hardness, density, etc., etc., which pertain to all specimens of this species need not be in your files. Name, locality, associations, unusual habits, source, cost—this is the information that should be preserved.
5. Work your tools over. Clean and sharpen forceps, knives, and needles. Replenish corks, balsa sticks, boxes, labels, and inks. Clean and adjust your most important tool—the microscope. Get a supply of bulbs for your lights, and consider seriously acquiring a new (and expensive) light, either A.O., B&L., or other which uses a transformer to bring the visibility factor to a maximum.
6. Answer those letters. Complete that exchange. Write to that dealer who may have Scottish greenockites, before they are all gone.
7. Weed things out. Last year you thought specimen X was tops. You mounted 3 of them. They cost

five dollars. At Tucson you got a piece for a dollar far better than the original stuff. Be tough. Out with the old; in with the new. Looking at the material for a year was worth the "five." In this life we pay for experience.

8. Get out books, maps, reports, field trips notes of mineral clubs. Plan your collecting excursions and vacations. Get advance permission to visit collecting areas and quarries. Plan to visit dealers and suppliers of mineral materials. They perform a most important function in this hobby of ours. If dealers did not purchase and stockpile specimens, they would never be saved at the mines.

9. Buy and use a good mineral book—this month ***Minerals of Greenland.***

10. If you read this you have already subscribed to the ***Mineralogical Record.*** It is time to renew your subscription, and to influence at least two others to subscribe—beginning with Vol. 1, no. 1 while it lasts. Else you are not really a mineral collector and don't deserve it.

*Neal Yedlin, The Micromounter*

*Editor's note: This is also a good time to write that article for publication in the Mineralogical Record!*

## Rock and Mineral Exchange

The National Association of Geology Teachers and the American Geological Institute's Earth Science Curriculum Program have begun a novel and exciting project which should attract broad support. They have established a clearing house for the exchange of rocks, minerals, fossils and earth science curriculum ideas between earth science teachers at the elementary, junior high, high school, and college levels. It is to be known as the Rock and Mineral Exchange Service (RMES).

Interested teachers should send a list (with quantities) of items they want, a list of items they can trade, and a self-addressed envelope to RMES, Post Office Box 2403, College Station, Texas 77843. RMES has moved from the address in Arlington Heights, Illinois where it was originally established.

# MINERAL NOTES

## New Minerals

### BIDEAUXITE

Sidney A. Williams
Min. Mag., **37**, 637-640, 1970

Bideauxite, $Pb_2AgCl_3(F,OH)_2$, occurs in colorless crystals at the Mammoth-St. Anthony mine, Tiger, Arizona. Crystals turn pale lavender in strong light, and become dull. The mineral shows adamantine luster, is brittle to sectile with no cleavage, and the fracture is conchoidal.

Only two specimens are known to exist. Crystals vary in size from 2 to 7 mm. The cube and octahedron are dominant but are modified by {011}, {113} and other minor forms.

Bideauxite occurs with leadhillite, matlockite and anglesite on a matrix of cerussite, anglesite and galena. It sometimes envelops and replaces boleite, and some crystals are filmed with later cerussite. The mineral has been confused with cerargyrite but microchemical and x-ray tests are distinctive.
Isometric (hexoctahedral)—space group $Fd3m$

$a$ = 14.117 Z = 16
G = 6.274 H = 3
$n$ = 2.192 (Na light)
Strongest x-ray lines: 2.718 (10) (511,333), 3.530 (9) (400), 2.497 (9) (440), 4.259 (7) (311), 4.076 (7) (222), 3.240 (7) (331).

### HODRUSHITE

M. Kodera, V. Kupcik and E. Makovicky
Min. Mag., **37**, 641-648, 1970

Hodrushite is a sulfosalt of copper and bismuth found in the Rosalia ore vein at Banska Hodrusa, Czechoslovakia, associated with quartz, hematite, chalcopyrite and wittichenite (?). The mineral forms acicular crystals less than 1 mm long, irregular grains and aggregates, and platy and columnar crystals up to 5 mm long. Hodrushite is steel-grey, metallic and brittle, with no distinct cleavage. It quickly tarnishes in air to a brownish-bronze color.

Wet chemical analysis gives a formula that can be idealized as: $Cu_8Bi_{10}Me_2S_{22}$, where Me is principally Bi. In chemical and x-ray properties hodrushite closely resembles cuprobismutite, but the differences are detectable on single crystal photographs. Monoclinic—space group $A2$, $Am$, or $A2/m$.

$a$ = 27.205 $b$ = 3.927 $c$ = 17.575
$\beta$ = 92°09′ (±10′)
G = 6.18 H = 3.5 - 3.8
Strongest x-ray lines: 3.102 (vs), 3.63 (s), 2.715 (s), 3.22 (ms), 2.545 (m).

# "Stevensite": A Review

**Joe Rothstein** 201 West 77 Street New York, New York 10024

In the summer of 1969, when the road bed of Interstate 80 was being blasted out of the tough basalt on the western slope of Garrett Mountain in the northern part of the First Watchung Range in West Paterson, New Jersey, a group of local, veteran zeolite collectors were right on the heels of the bulldozers and front-end loaders. As the material was unearthed they would look into a vug of rhombohedral crystals and, without hisitation, identify calcite, chabazite or gmelinite. Perhaps (with but slight hesitation) they would note natrolite or scolecite. Rarely would they hedge. Since my retirement some four years ago I managed to do some serious mineralogical study at the College of the City of New York and, after twenty-five years of collecting, became impressed with what I did not know. Occasionally the confident, casual field identifications by my Paterson friends would therefore provoke me just a little.

Collecting at Garrett Mountain had begun slowly in June, and by late August and early September it was booming. At this stage pink *pectolite* appeared and stumped the local experts until Gene Vitali identified it as "stevensite." Gene is the sort of *dean* of the old-timers who used to conduct their cracker-barrel sessions in the old Upper New Street quarry. These sessions shifted a few hundred yards west when the road work on Interstate 80 commenced. After Gene's identification all of us made a great show of being knowledgeable when we were asked to identify the pink material and sometimes we just showed off without being asked.

I remember checking ***Dana's Textbook of Mineralogy*** (Ford, 1932) soon after the first find of "stevensite" and being slightly surprised at not seeing it listed. I knew that the next step was to look at Hey's ***Chemical Index of Minerals,*** but that would have to wait until I could get over to the American Museum of Natural History—a block from my apartment—and perhaps check out the mineral in some depth. It was a few months later that I actually looked it up and found out that it was first described, in 1873, as a talc pseudomorph after pectolite, and that currently it is classed in the montmorillonite group of clay minerals.

Where the pectolite form can still be seen, "stevensite" pseudomorphs make showy mineral specimens, and I would hazard that this recent material is superior to *old-time* specimens. Three fairly good specimens have gone to the American Museum of Natural History (New York), the Canadian National Museum (Ottawa), and the largest one to the College of the City of New York. A more detailed study of "stevensite" seemed like a good idea because the paucity of references indicated that it would be a limited research project. In early spring I started to peck away at it. When I learned that I was becoming involved in clay mineralogy, I got that "discouraged amateur" feeling But when I discovered that several knowledgeable collectors were somewhat hazy on the mineral, I decided to go ahead. After all, in more than two decades of roaming through the First Watchung Range, from Bound Brook to Paterson, even in the days when we actually could get into the quarries, I had never seen this pink pseudomorph. I imagine that this summer will find the material dispersing into the rest of the country. But don't look for it on Interstate 80, as the landscaping is finished and the West Paterson police, while friendly, do not like collectors digging up the grass.

## Early Work

Professor Albert R. Leeds, of Stevens Institute of Technology, Hoboken, New Jersey, first found this altered pectolite in the Bergen Hill area of New Jersey, which is quite near Hoboken. In 1873 he introduced the name at a meeting of the N.Y. Lyceum of Natural History. In December, 1897, ***Mineralogical Magazine*** and ***The Journal of the Mineralogical Society (Great Britain)*** listed new mineral names not to be found in the 6th edition of Dana's ***A System of Mineralogy.*** "Stevensite" was listed as a talc pseudomorph after pectolite, and referenced in ***Dictionary of the Names of Minerals*** (Chester, A. H., 1896). So, by 1900, "stevensite" was entrenched in the literature as a form of talc.

In 1916, M. L. Clenn of Erie, Pennsylvania, reported on a new locality for "stevensite." Mention is made of a single vein of a peculiar mineral call "magnesium" (talc?) found by the quarrymen in the old Hartshorn quarry in Springfield Township, Essex, New Jersey. The locality was pinpointed as 16 miles south of Paterson, which would put it in the vicinity of the present Houdaille quarry at Summit, New Jersey. Some of the pectolite at the Hartshorn quarry was described as being of the usual type—silky radiations of the fine needles—but the greatest part of it showed evidence of alteration, the color becoming more and more pinkish and the luster more and more waxy toward the tips of the radiating crystals. A specimen of Hartshorn quarry material is on exhibit at the American Museum of Natural History, but looking down through the glass I could not observe the luster and color changes noted above. The properties of most of the altered

Stevensite, Great Notch, New Jersey.
Specimen measures 4 inches across.
Smithsonian Institution collection (#C2459).
Photograph by Joel E. Arem

material were given by Clenn as:

> Color white to pinkish (colored by manganese); luster waxy; translucent; structure compact, tough with occasional shrinkage cracks; brittle; fracture hackly; feel smooth; hardness 2.5; specific gravity 2.15—2.20; *n* about 1.50, chiefly isotropic and amorphous.

"Stevensite" probably formed as a result of reaction of pectolite with magnesium-rich solutions, derived from the action of percolating water on basalt. A possible reaction would be:

$$4HNaCa_2(SiO_3)_3 + 9Mg(HCO_3)_2 + 3H_2O =$$

pectolite + magnesium + water =
bicarbonate

$$3H_2Mg_3(SiO_3)_4\cdot H_2O + 8Ca(HCO_3)_2 + 2Na_2CO_3$$

"stevensite" + calcium + sodium
bicarbonate carbonate

Manchester (1931) still later described "stevensite" as a talc pseudomorph after pectolite. Manchester listed the material as coming from the Bergen Hill locality, therefore from the intrusive diabase of the Palisades sill, between Jersey City and Weehawken. The material was also noted from several localities in the First Watchung Range in the West Paterson area. This is a region of pillow basalts derived from a 200 million year old fissure lava flow. Strunz (1941) considered the material to be a talc pseudomorph after pectolite. Hey, in 1950, hadn't changed the description but when the 2nd edition of *Chemical Index of Minerals* appeared in 1955, Hey modified the description of "stevensite" due to the appearance of new data.

Faust and Murata (1953) reported the results of a new study. These authors concluded, on the basis of x-ray and staining tests and differential thermal analysis that "stevensite" is a member of the montmorillonite group of clay minerals. A chemical analysis of the Hartshorn quarry material showed:

| | | | |
|---|---|---|---|
| $SiO_2$ | 57.30 | $Na_2O$ | 0.03 |
| $Fe_2O_3$ | 0.32 | $K_2O$ | 0.03 |
| MnO | 0.21 | $H_2O^+$ | 7.17 |
| MgO | 27.47 | $H_2O^-$ | 6.19 |
| CaO | 0.97 | | |
| | | Total | 100.19 |

This results in the formula: $(Mg, Mn, Fe)_3Si_4O_{10}(OH)_2$.

Additional work by Brindley (1955) on "stevensite" from Springfield showed that it consists of talc-like layers, some of which do not swell in water or organic liquids and others that swell like montmorillonite (or saponite). Thus, "stevensite" could be described as a talc-saponite interlayered mineral. Saponite is a member of the montmorillonite group and both montmorillonite and talc are monoclinic.

The stevensite problem was not yet closed, however, Faust, Hathaway and Millot (1959) restudied the mineral and concluded that stevensite actually can be regarded as a montmorillonite clay mineral. It is an unusual one, however, in that portions of the structure contain defects (missing atoms) and these regions have montmorillonite-like properties. Other parts of the structure, without defects, have the attributes of talc. The latter are a small percentage of the total structure, and are too small to be detected by x-rays. Such defects are apparently not uncommon in layer-structure silicates.

The problem of the nature of "stevensite" seems now to be more or less solved. One ought to be able to recognize the mineral easily in any new occurrence. It has one advantage over its white-fanged parent pectolite, it doesn't become impaled in the fingers. But the fact that it is a clay mineral causes it to lose its appeal, at least for me. Clay mineralogists might retain some level of enthusiasm for this pink alteration product, but I don't seem able to do likewise. This is undoubtedly due to the prejudices of an exhibit specimen collector—the idea, however silly, of one's cabinet specimen slowly becoming a plastic lump is very unappealing. Such behaviour is not at all what one should expect from a pretty crystallized specimen. Despite such prejudices, collectors should retain an interest in all minerals, hence the study of "stevensite." At least I can say that I learned something in the process and, after all, there is always the chance that someone, somewhere, actually likes the stuff. And if this is the case, there is always the possibility of exchange.

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## FRIENDS OF MINERALOGY

*(continued from page 14)*

seems unusually high. Many exhibit minerals are of exceptional beauty. Mr. Folch estimates that 6,000 of his specimens are of first-class status; and this appears to be a well-founded belief. He says he has 875 mineral species.

In this report, descriptive data will be given only for the more important material, and in collective fashion generally. It is not practicable to describe individual specimens, except in sepcial cases, although such information has been compiled for a large number. The gem cases will be treated first; next the wall display cases; and finally the display-drawer cabinets housing the systematically-arranged minerals.

Gem case I, to one's right on entering the museum, chiefly contains transparent gem-quality crystals together with some specimens of spectacular color or unusual perfection and beauty. Most of the loose crystals are water-clear examples of Brazilian beryl, tourmaline, spodumene, topaz, brazilianite and hematite. Outstanding Columbian emeralds are present; further items are a good polished Utah variscite, and a remarkable crystal of Brazilian rutilated quartz. Hidden sub-specimen illumination, so as to light up internally certain large transparent and richly-colored crystals, is a feature of this exhibit. In the display are included several notable large crystallized groups of Spanish fluorite and sphalerite. Although transparent, colorful and beautiful in their own right, these somehow look a bit drab and commonplace beside the brightly-colored gem crystals. It is as if the Spanish minerals were placed here to vie with such show material. Oddly enough, it is specimens like these of the Spanish minerals which are by far the truly important ones to give the whole collection its unique stature; while the gems and show pieces, despite their extreme beauty, can be duplicated elsewhere. One sees in this gem case the two things: that which can give a collection stature and meaning; and that which cannot.

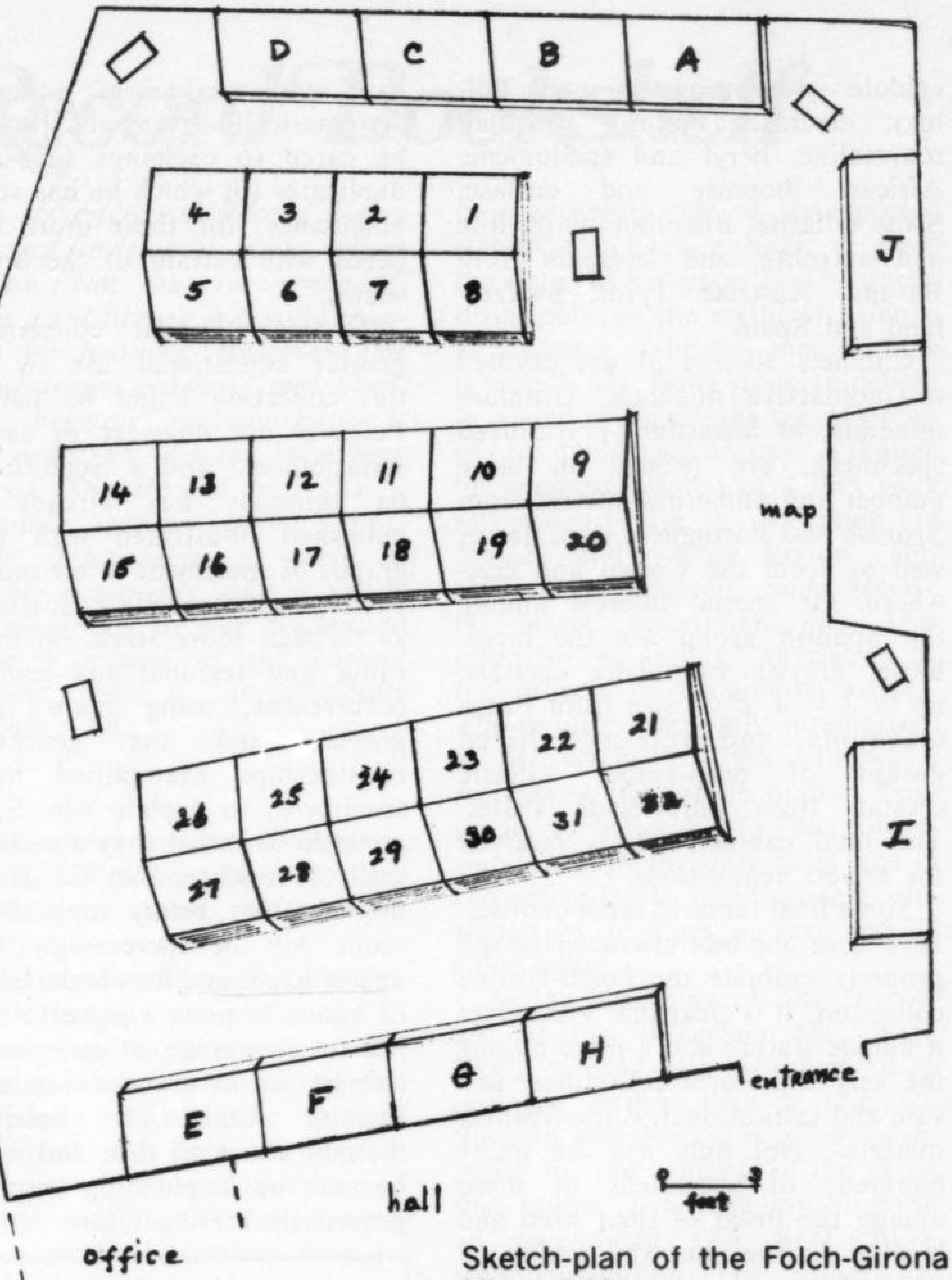
Gem case J is almost a replica of I. Some large cut stones, including a fine Brazilian topaz, and a superb greenish Brazilian aquamarine prism, are show pieces of the top two shelves. The bottom shelf contains some excellent paragenetic crystal groups: among them, a Brazilian rubellite-lepidolite-cleavelandite, Panasqueira wolframite-apatite, and a Swiss adularia-calcite.

A striking Spanish dolomite group from Navarra, measuring around 8×10×18" and with near-transparent twin crystals up to 3×4" size, stands on a pedestal close to case J.

Wall cases A and B, at the far end of the museum from the entrance, are devoted to quartz-family minerals. Outstanding are Swiss smoky and colorless crystals, in large loose individuals and clusters, and exquisitely-tinted Brazilian amethyst. Many types of agate and other varieties of quartz are represented in these two displays. Case C consists of various minerals of a showy nature and exceptional crystallized quality, including Elba pyrite, polished Argentine rhodochrosite, pseudocubic and platy Brazilian hematite, and a beautiful metatorbernite from Katanga measuring 5×7×10" and covered on one surface with sharp emerald-green plates of near 1" size. Case D is mostly a color show, in red, orange, yellow and green, with many wulfenite groups (especially Mexico and Arizona) together with outstanding Moroccan vanadinites, Spanish (Ciudad Real) pyromorphites and good mimetite, descloizite and crocoite from the usual localities.

Wall cases H, G, F and E (left of entrance) concentrate wholly upon Spanish minerals and those from the famous mines of Panasqueira just across the Portuguese border. Here is much of the truly unique material of this collection, imparting to it invaluable regional representation and historical meaning. Case H displays extraordinary specimens from the mines of Bellmunt (Lérida Province), many collected by Señor Folch when active in mining in his younger days. Groups of galena cubes and octahedra, single crystals up to 5" size, are most impressive. Similarly striking are great clusters of whitish tabular barite crystals in fan-shaped aggregates, some of these associated with the galena. Fine specimens of acicular millerite are here also, together with well-crystallized examples of breithauptite and related rare nickel-bearing species. Case G shows notable fluorite groups of various colors, chiefly blue, violet and green, made up of cubes 4-5" across in numerous examples. These are from Colunga, Asturias Province. Additional striking features are magnificent large crystallized groups of sphalerite from Santander (world famous for its transparent specimens), of rich amber shades, unsurpassed water-clear quality, and well-developed crystal form. Here too are many large, and beautifully sharp, crystals of pyrite, both in limonite-coated cubes up to 5" size (Valdenegrillos, Soria) and as model-like, lustrous pyritohedra and cubes, loose and in clusters in a clay matrix Ambasaguas, Logroño). Not least in this case are excellent specimens of gold in quartz (Vega de Leon), silver in large, rich, sponge-like masses (Almeria), and cinnabar in pure, bright-red cleavages (Tarna).

Case F is mostly devoted to Panasqueira material and the quality exhibited, in crystallized minerals of all sizes and descriptions, is probably the best to be seen anywhere. The wolframite groups, made up of sharp, perfect, tabular, lustrous-black crystals up to 1×3 ×5" size; the apatites, stout-tabular, crystals in all shades of green, gray and violet, model-like in perfection and partly water-clear, perched on crystals of quartz and other associated minerals; the arsenopyrite crystal clusters, silvery-white aggregates of multiple crystals solidly massed together or intergrown with wolframite, cassiterite and quartz; the cassiterites, clusters of brilliant-black twinned crystals, more than 1" in size, intergrown with quartz especially; all these defy description, and are overwhelming for beauty and paragenetic interest. Case E, again shows Spanish minerals, except for one absolutely unequalled Panasqueira apatite specimen, surely one of the several finest examples of this mineral known. This consists of two great greenish tabular crystals, perfect, glassy and almost clear, and fully 2×3" in size, implanted upon a cluster of transparent quartz prisms. The rest



Sketch-plan of the Folch-Girona Mineral Museum

of the case features notable specimens of pyromorphite (El Horcajo, Ciudad Real, Castilla Province) in vivid grass-green clusters of prismatic crystals; scheelite (Estepona, Malaga) in loose, rough, but complete, translucent, yellow to deep-amber, octahedral-like crystals, from 1×1-1/2" to 2 ×2-1/2" size; chillagite (rare tungstenian wulfenite from Mina Teresita, near Barcelona) in small clusters of tan, platy crystals; groups of emerald-green metatorbernite crystals (Andujar); and brannerite (Mina Dieresis, Fuenteovejuna, Cordoba) in a single outstanding grayish crystal, opaque and measuring 1/2 × 1 × 2-1/2" in size.

Where the display-drawer cabinets duplicate to a considerable extent, but mostly in smaller sizes, the Spanish and Panasqueira minerals already described, these will receive brief mention only. Drawer cabinet 1 (with larger specimens displayed at the top under sloping glass) contains the native elements. Among about 30 excellent golds, nearly half are Spanish, including nuggets up to 1" size from several localities in Salamanca Province. Together with the silver and copper specimens (Norway, Michigan and Arizona being well represented) are many from Spain (Almeria and Villanueva, and Rio Tinto, especially). Numerous examples of Spanish bismuth (from near Córdoba) are here, also good shells of arsenic. A fine 1" platinum nugget from the Urals is in the top display panel.

Drawer cabinet 2 (with top section light-proofed by means of a roll-up cover) begins the sulfides, featuring stibnite (Japan and Roumania outstanding; a number of Spanish from Almuradiel, fine realgar and orpiment (new U.S. finds as well as older European plus Spanish), and many superbly beautiful Santander sphalerites including large cut gems. Cabinet 3 features pyrrhotite (extra-good Mexican and Roumanian), a single Transvaal sperrylite with a lustrous 1/4" cube in matrix, and numerous excellent crystallized specimens of Spanish maucherite, hessite, pearceite, gruenlingite, tetrahedrite, stannite and chalcopyrite. Cabinet 4 (top display panel covered) contains notable Almaden cinnabars (a number of beautifully-crystallized matrix specimens being unsurpassed for quality), also very fine crystallized examples of Spanish galena, freieslebenite, millerite, bismuthinite, jamesonite, miargyrite and pyrargyrite. Three superb proustites (Chile) and 2 bournonites with very large crystals (Harz and Cornwall) are in the top display panel. In the drawers of cabinets 4 and 5 are an unusually complete representation of top-quality crystallized sulfosalts, with what look like most of the rarer species present. In the drawers of cabinet 5 also are many specimens of Panasqueira arsenopyrite; in its display panel are more of these together with perfect loose crystals and brilliant crystal clusters of pyrite from Elba, Piedmont and Spain.

Spanish fluorites are a feature of cabinet 6, along with many striking examples from England and Switzerland. With other halides are crystallized specimens of Spanish embolite and calomel. Hematite is of special interest in cabinet 7, beginning the oxides, with many Swiss eisenrosen and lustrous Brazilian clusters. Some unusually fine Tsumeb cuprites are here, also good crystallized specimens of Spanish spinel, magnetite and valentinite. Cabinets 8 and 9 complete the oxides, containing unequalled Panasqueira cassiterites, as well as outstanding examples of this mineral from Bolivia, Brazil and Africa. Choice rutile crystals from Grave's Mt. and Switzerland are here together with a good Spanish representation. Exceptional matrix specimens of Swiss anatase are included, as are fair ones of Spanish anatase, brookite and ilmenite.

Among the carbonates in cabinets 9, 10, 11, 12 and 13, are many noteworthy calcites, siderite groups from Panasqueira, and Tsumeb smithsonites, together with unexcelled matrix groups of Spanish twinned dolomites and aragonites. One great glassy part-clear crystal of Monte Poni phosgenite, measuring 2 × 3-1/2 × 5", is in a class by itself. Tsumeb cerussites are magnificent, but there seems to be much duplication in the numerous, almost identical, glassy, clear, twinned crystal clusters. Tsumeb azurite is very well represented.

Sulfates are well covered, especially for rare species, in cabinets 14 and 15, but do not appear to be up to some of the other classes in quality and interest. In cabinet 16 are many Panasqueira wolframite groups, probably the best in the world, with lustrous, black, model-like crystals up to very large size, in loose individuals and groups of every description associated with beautiful crystals of apatite, arsenopyrite, siderite and quartz. Spanish scheelite is also outstanding here in many extraordinary examples. Exceptional wulfenite groups, of all kinds and colors, from numerous localities, including some Spanish, and with several unique Spanish chillagite platy clusters included, are featured in this cabinet.

Cabinets 17, 18 and 19 house the phosphates, one of the best-represented classes in the collection. Panasqueira apatite groups, of every size and type, are incredible, but almost up to them in perfection and beauty are the Swiss lilac crystals from Val Casatscha. Notable and numerous are the Spanish pyromorphite clusters; crystallized Spanish mimetite and vanadinite are further items. Arizona vanadinites are very well represented, as are the Moroccan. Beautiful additional minerals include Bolivian and Idaho vivianite, Moroccan erthyrite and roselite, and adamite and ludlamite from Mexican and other localities.

Quartz and the silicates occupy cabinets 20 through 29. Only a few unusual or notable items will be given special mention. Of particular note are Brazilian and South Carolina amethyst; grossularite from Canada, Pollux (Swiss) and Ala; topaz (blue from Urals and many Brazil); sphene (Swiss and Brazil); epidote (Knappenwand and Pollux); idocrase (Pollux); Brazilian tourmaline, beryl and spodumene; African dioptase and euclase; Swiss milarite; Brazilian apophyllite and natrolite; and feldspars from Baveno, Austrian Tyrol, Switzerland and Spain.

Cabinets 30 and 31 are devoted to radioactive minerals. Uranium minerals, in beautifully-crystallized specimens, are present in large number and numerous species from Spanish and Portuguese localities as well as from the Congo and elsewhere. Of special interest among the Spanish group are the large, loose, grayish brannerite crystals, up to 2 × 4 × 6" size from Fuenteovejuna, and well-crystallized groups of deep-amber saléeite crystals from Villaviéjade Yeltes. The final cabinet, 32, is reserved for newest acquisitions.

Some final remarks seem in order. How does one best characterize and properly evaluate the Folch-Girona collection? It is clear that what gives it unique stature and a place among the very top world collections, private and institutional, is the Spanish material. Not only are the many hundreds of specimens of these among the finest of their kind and locality known, but the wealth of detailed source and historical data accompanying them is to be found nowhere else. Numerous of the most rare and beautiful of these minerals were personally collected by Mr. Folch, dug out of now long-abandoned mines more than 50 years ago, and so preserved for posterity. The Panasqueira minerals, perhaps the best there are, are also a unique feature of this collection; but such a flood of these specimens has descended upon the world market, that they cannot be judged truly unique anywhere. The remainder of the collection, superlative as it is, can be mostly duplicated in the larger institutional collections.

Mr. Folch is fully aware of the scientific, historical and regional importance of his Spanish minerals. It is to be hoped that in his remaining years he will be less concerned with acquiring duplicate types of material, and ever more determined to make his Spanish representation still finer and more complete. He could also do much to fill in certain gaps and weaknesses among his systematically-arranged species, if he cared to exchange first-quality duplicates (of which he has such an abundance) for these more urgent needs with certain of the big museums.

A final thought concerns the greater educational use to which this collection might be put. Mr. Folch is not unaware of such responsibilities; and a Spanish book on minerals has already been published, illustrated with photographs of specimens in his museum. Much could be done educationally, as through more stress on mineral suites and regional and geological occurrences, using maps, photographs, and the geochemical relationships exemplified by the specimens, to explain why Spanish minerals are what they are and why they occur where they do. It is not unlikely that before long the museum will be increasingly visited and utilized, and its wonderful array of minerals made a powerful stimulus to encourage a resurgence of interest in natural science among Spanish youth. Mr. Folch has thought about all this, and we may be sure he is planning wisely and generously for the future. ■

# Record Bookshelf

*The Mineralogical Record wishes to present reviews of books whose purchase can be recommended, since a good library is a solid foundation for learning. However, this is not always possible, and occasional negative recommendations are in order, as with the book here reviewed. The Record feels that a responsible review policy must include unfavorable as well as favorable comments, and it would be a disservice to our readers to present a picture of the current literature that is unrealistically favorable.* **Ed.**

**The Discovery of the Wingstars,** *by Russell T. Wing, Russ T. Wing Co., Excelsior, Minn., 1970, 42 pp. ($15.00)*

Many self-professed geniuses have, in the past, claimed access to knowledge or truths somehow hidden from others. Consequently the development of scientific thought has evolved as a field strewn with the corpses of smashed theories and forgotten dogma. Wishes, whims and unproved declarations have no place in the real world, and reality is the last court of appeal. When "revelation" takes the place of rational thinking, the inevitable result is mystical, often nonsensical, and most assuredly wrong.

*The Discovery of the Wingstars* propounds the idea that virtually the entire Minnesota glacial moraine is composed of rock fragments that have orbited the earth—the result of a catastrophic collision of the earth with another celestial body about 5 million years ago. The entire theory is based on the presence of a *glaze,* a surficial polish assumed by the author to be due to melting. This leads, in quick succession, to the equally erroneous assumption of atmospheric frictional melting, hence meteoritic travel, hence cataclysmic explosion to get the rocks into space. Facts, such as the impossibility of melting limestone and dolomite in the atmosphere, or the proven origin of surficial polish by weathering and erosional processes, are swept aside in a gathering tide of unsupported statements. Even a brick is given the status of a meteorite! (Of course, if one calls on the mythical Atlantis as a source of bricks, then nothing is amiss). Mr. Wing seems to delight in a kind of logic—the use of premises to build conclusions—although the premises (stated as if they were self-evident) are a collection of fantasy and science fiction. This mystical pseudologic could receive no better description than that given by the author: "revelation by the process of uncommon sense." The result is also aptly summarized by Mr. Wing: ". . . that's the way I feel about this whole matter. Fantastic. Unbelievable." This conclusion, perhaps the only valid one in the entire book, is adequately supported by 6 pages of text and 23 color plates.

At the beginning of *The Discovery of the Wingstars* Mr. Wing credits himself with the talents of an inventor, rather than a scientist. Such an introduction is quite appropriate for the contents of the pages that follow. The book can be given an unqualified DO NOT BUY recommendation. The rather exhorbitant cost of the book makes this suggestion an easy one to follow. ■

**Joel E. Arem**

**The Fabulous Keokuk Geodes, Volume I,** *by Stephen R. Sinotte, Wallace-Homestead Co., Des Moines, Iowa, 1969, 292 pp. ($19.95)*

Geodes have long been a source of wonder and fascination for geologists and mineral collectors, but very little has been written concerning their origin and mineralogy. Sinotte has chosen the famous Keokuk, Iowa area geodes for a thorough treatment of types, geologic setting, formation and mineral content. This type of coverage has long been needed.

Sinotte's book is photographically very appealing. Photographs of geodes *in situ* in dolomite and photomicrographs of the minerals found in geodes have all been chosen with care, and all are of excellent quality. The detailed account of minerals found within geodes from specific localities within the Keokuk area (and variations related to lithology of the surrounding formations) is both convenient and useful.

Sinotte has, however, attempted too much. This book would, if merely descriptive, be very desirable to almost any mineral collector. Written solely from a technical point of view and with adequate support for theoretical discussions, the book might be of some use to professional mineralogists. Instead an unharmonious blend of these two outlooks prevails, and the result is something far too laborious for the casual collector and not nearly rigorous enough for the professional. Good descriptive material is buried by weighty-sounding technical jargon, much of which is used incorrectly. For example, ***euhedra*** (used as a singular noun, though this form is plural) is applied to a botryoidal layer of silica (chalcedony), although the term means well-formed crystals. Many misspellings also appear, such as terrigenuous (for terrigenous) and metalic (for metallic). The use of undesirable terminology is far too frequent; for example, "iron pyrite" and "crystalline quartz." One drawing (p. 138) is labelled "trisoctahedron" but the figure is a combination of the dodecahedron and octahedron.

Sinotte argues that thermodynamic equilibrium is attained with a minimization of entropy, just the reverse of the correct thermodynamic viewpoint. This error is perpetuated in both the text and the glossary, and is especially critical since it undermines the Eh-pH arguments used in another part of the book. Many other aspects of chemistry and physics (such as diffusion) are treated in great detail, though not rigorously enough to be of use to the professional, and far too ponderously to be of any value to the mineral collector. The overall impression is that most of the technical material present has been included because it sounds *scientific* and not because it has any

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particular relevance to the subject of the book. A case in point is the inclusion of numerous crystal structure diagrams which contribute nothing to a discussion of the origin and mineralogy of geodes.

The failure of the author to include an index greatly hampers the usefulness of the book.

As a picture book on geodes and geode minerals, Sinotte's work is unique in the literature. As a technical work on geode formation, the book is overburdened with material of little or no use to the average reader, and much of it not carefully presented. The book does include various arguments used in the past to explain the formation of geodes. However, a very critical reading of Sinotte's manuscript by scientists well-versed in thermodynamics, solution geochemistry and crystallography would have resulted in a much more useful and accurate text.

*(continued on page 47)*

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**ANCYLITE**

*(continued from page 25)*

analyzing crystal (200 reflection), sealed proportional detector and pulse height analyzer set to a baseline of 4 volts. A helium atmosphere was used in the determination of all elements except Y and Sr, which were determined in air. The $L\alpha$ lines of La, Ce, Pr, Nd and Sm and the $K\alpha$ lines of Ca, Sr, and Y were the analytical lines used for measurement. Pr was corrected for interference by the $L\beta_1$ line of La, Nd was corrected for the Ce $L\beta_1$ line, and Sm was corrected for interference by the $L\beta_2$ line of Ce.

Conclusions

Noteworthy among the analytical results are the relatively high Nd content, among the rare earths, and the predominance of Ca over Sr. The latter finding suggests that this mineral from Cornog should be termed a calcian ancylite.

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# what's new in minerals

### Pink Prehnite

The latest issue of *Earth Science*, Jan.-Feb., 1971, contains an article by N. King Huber about the amygdule fillings of the Keweenawan volcanic rocks of Isle Royale National Park, Michigan, and the Lake Superior region in general. This material has long been called thomsonite and has been a widely used gem material. Recent studies by Dr. Huber have shown that the "thomsonite" amygdules are actually pink copper-bearing prehnite. The copper is in the elemental form and is finely disseminated throughout the pink prehnite. Green prehnite is also found in the park and it too contains copper, but in larger irregular masses with virtually no fine dispersed material.

Amygdules at some other localities in the Lake Superior region (notably Grand Marais, Minnesota) are actually thomsonite. The pink prehnite may be readily distinguished from thomsonite on the basis of specific gravity and hardness. Prehnite is usually more translucent than thomsonite and experienced collectors can tell them apart on sight. The pink prehnite does not develop the spectacular patterns and color variations present in the best thomsonite and, for this reason, Isle Royale "thomsonites" have always been considered of inferior gem quality.

### Antarcticite

Gerhard Muehler describes the "second" occurrence of antarcticite, $CaCl_2 \cdot 6H_2O$, in a short note in ***The Bulletin of the Mineralogical Society of Southern California*** (Nov., 1970). It is found "as divergent groups of prismatic crystals and compact aggregates in the exposed near-surface trapped brines of Bristol Dry Lake, San Bernardino County, California. This is only the second known occurrence of the naturally crystallized mineral. The type locality is Don Juan Pond, Victoria Land, Antarctica. Such remoteness makes the Bristol Dry Lake deposit even more interesting and rare. The mineral possesses some rather unusual properties which make it difficult to preserve. It is highly hygroscopic and becomes unstable at temperatures above 30°C. Immersion in anhydrous mineral oil protects it for a period of time but, when temperatures approach 30°C the mineral becomes unstable and breaks down. The only likely means of preservation seems to be refrigeration—a means not readily available to the average collector."

Actually refrigeration is probably available to most collectors but, when showing your collection, how can you open your refrigerator and avoid having to share your BEER?

### Boron, California

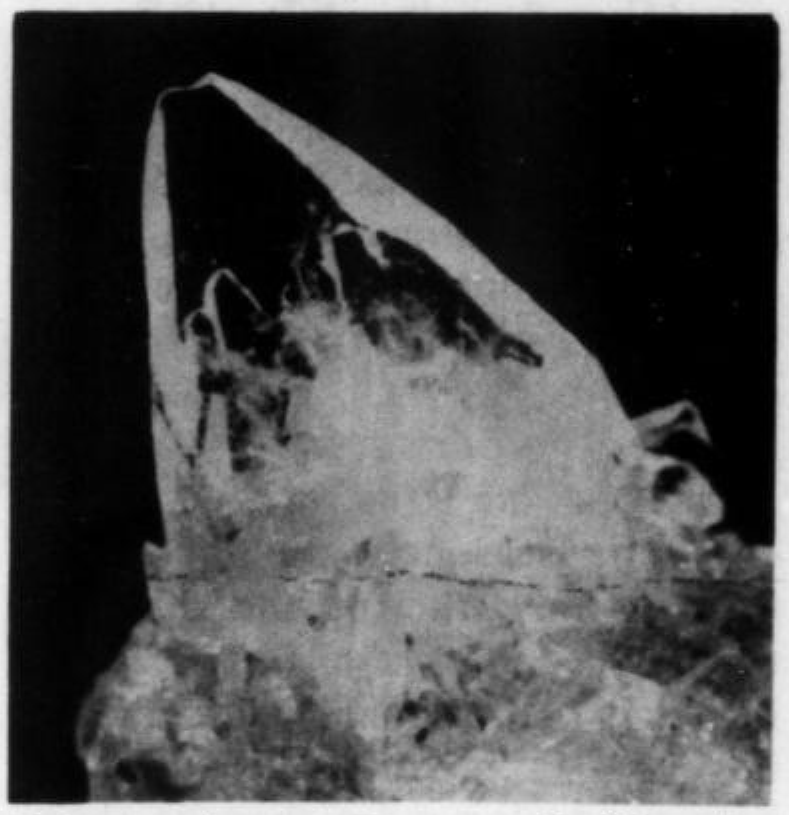
In the same issue in which the antarcticite occurrence was described, Veryle Carnahan reported on some interesting recent finds at Boron, California. Included are:

TODOROKITE as black crystals, blebs and seams in concretions. The crystals resemble pyrolusite.

RHODOCHROSITE in pale-pink, platy rosettes formed on microscopic analcime crystals and grains.

ARSENIC in concentrically layered grains and crude crystals, rarely tin-white, most of it tarnished black.

ARSENOLITE as extremely small transparent crystals coating some of the arsenic.



Colemanite, Boron California
Photo by Joel E. Arem

SEARLESITE in beautiful crystals of micro size in vugs in searlesitic rock. The crystals are thin tabular and colorless.

COLEMANITE geodes lined with crystals.

PSEUDOBROOKITE is found in vesicles in altered red basalt as translucent, reddish-brown, striated, tabular crystals of extreme small size. A yellow mineral found with it may be anatase. The pockets also contain numerous micro crystals of ilmenite, hematite, hypersthene and lepidocrocite. The basalt can be collected on the dumps.

ANALCIME in micro crystals in the centers and cracks of nodules formed on calcite and associated with pyrite.

UNKNOWN "B-14" is found as a copper-red, fibrous inclusion in borax and displays a chatoyancy that is very distinctive. It is reported to contain antimony and sulfur and appears to be an alteration of stibnite.

The dumps at Boran are open to collectors but only on Saturday. It is expected that collectors will obtain permission at the gatehouse before driving onto the property.

### From a tin of salmon?

A recnt paper, "The crystal structure of struvite, $MgNH_4PO_4 \cdot 6H_2O$", by A. Whitaker and J. W. Jeffrey, *Acta Cryst.* (1970), vol. B26, p. 1429, contained the following: "Attempts to grow crystals suitable for investigation failed but finally a naturally occuring specimen was obtained by courtesy of Dr. M. Rosemeyer of University College, London, who found it in a *tin of salmon*. It appeared to consist of a polycrystalline mass of approximate size 15 × 8 × 8 mm, colorless at one end changing to a light yellow at the other. When broken open it was seen to consist of a parallel growth of columnar crystals."

Anyone want to go on a field trip to the fish market?

**A modern mineralogical mystery**

One of the frustrations experienced by seasoned mineral collectors lies in harboring the suspicion that a specimen is mislabelled, but knowing that probably nothing can be done to prove it. Mexico has been producing more than its share of these frustrations. About two years ago there appeared on the market "from Mexico" what is undoubtedly the finest scorodite ever found and ludlamite and vivianite to rival the best known. The locality given for the scorodite is Zacatecas; the ludlamite and vivianite, the San Antonio mine, Chihuahua. Unfortunately, the scorodite closely resembles specimens from Ouro Preto, Minas Gerais, Brazil. Not only color but crystal habit and matrix type and appearance are similar. Oddly enough the ludlamite and vivianite are almost indistinguishable from the famed Colquechaca and Llallagua, Bolivia specimens—again not only in color but in habit and matrix. These resemblances are not enough in themselves to build a base. However, when the following facts are also considered, the possibility of misrepresentation becomes quite believable:

1. All three lots of minerals appeared at about the same time through closely related channels.
2. Only a very few specimens of each were ever circulated. All of these were rather choice specimens and, contrary to the usual pattern, there was no second rate material.
3. All are minerals for which localities in South America are noted.
4. None are associated in these specimens with familiar Mexican gangue minerals with the exception of some colorless fluorite on the vivianite and ludlamite specimens.

There is a strong suspicion, to the writer at least, that these are specimens collected long ago in Brazil and Bolivia. Very possibly they were packed away in the personal effects of the original collector who then went to Mexico to live. They could have been stolen from the collector or from friends or relatives to whom he had entrusted them. They may even have been found innocently following his death and the finder, not knowing the proper localities, made up new ones in Mexico. The implication of the fictionalized localities is that the specimens were stolen. If simply the usual ploy to conceal a new discovery in Mexico, why haven't additional specimens been appearing? Certainly sufficient time has elapsed for them to appear.

Anyone who can shed any light on this particular mystery would lay to rest some uncertainties about several rather remarkable mineral specimens. ■

# A Note on "Lancasterite" from Cedar Hill & Texas, Pennsylvania

**Richard Haefner**
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A few months ago, as I was looking through some old journals, I came across an article on the discovery of "lancasterite." My curiosity about this *mineral* led to further investigation, and I soon found an interesting story of some research conducted by famous mineralogists of the last century.

The article, "On the New American Mineral, Lancasterite," by Prof. Benjamin Silliman, Jr., appeared in the March, 1850 issue of the *American Journal of Science*. The author was part of the famous father-and-son pair of mineralogists. The elder Silliman was the founder of the *American Journal of Science*, and the mineral sillimanite was named for him. J. D. Dana studied under the elder Silliman, and later married his daughter. The younger Silliman was both Dana's brother-in-law and close professional associate.

Professor Silliman wrote: "Among the minerals associated with the serpentine of Texas, Lancaster County, Pennsylvania, received through the kindness of Mr. L. White Williams of Westchester, one . . . has proved to be a new hydrous carbonate of magnesia, for which I propose the name *lancasterite*."

Mr. Williams, the collector of the original specimens, was a well-known amateur mineralogist of the time. He was the man, by the way, for whom "williamsite" (a gem variety of serpentine also from Texas, Pa.) was named.

Professor Silliman described "lancasterite" thus: "Foliated like brucite, affording thin pearly laminae, inelastic and somewhat flexible. Also small crystals, which appear to be monoclinic (?) with an eminent pearly diagonal cleavage . . ."

In those days a chemical analysis was the final authority in mineral identification. An investigator would select a homogeneous-appearing substance, with physical properties (such as hardness and specific gravity) different from other minerals familiar to him, and have a chemical analysis made. If the analysis differed in kind or amount of chemical constituents from other published analyses, he had discovered a new mineral. Accordingly, Professor Silliman had Dr. H. Erni, of Yale, analyze Williams' specimens, and the analysis did indeed differ from other published analyses.

Dr. Erni had some difficulty in obtaining consistent results with his analysis. The proportions of the chemical constituents varied from specimen to specimen, but after a series of trials, he managed to obtain fairly constant results. The mineral "lancasterite" was thus established in the literature. "Lancasterite" was also listed that year (1850) in Dana's new third edition of his *A System of Mineralogy* (p. 213).

Three years after the discovery, in 1853, the mineralogists J. L. Smith and G. J. Brush collected some "lancasterite" while on a field trip to the Wood's mine, Texas, Pennsylvania. The first specimen they analyzed truned out to be identical to analyses for hydromagnesite. Puzzled by this result, they decided to separate the two types of "lancasterite" which Silliman had described and analyze them separately:

> "Lancasterite is described as occurring 'foliated like brucite,' but sometimes in crystals 'resembling somewhat stillbite or gypsum.' As we desired to see whether these forms were identical in chemical composition, a portion of the foliated mineral was carefully selected. . . . the foliated variety gives the exact composition of brucite. . . . Some of the small (radiated) crystals 'resembling stilbite or gypsum' were then analyzed; analysis showed them to have the same composition as hydro-magnesite.
>
> "These results go to prove that lancasterite is not a distinct species, but a mechanical mixture of brucite and hydro-magnesite."
>
> —*American Journal of Science,* March, 1853

A comparison of Erni's analysis with the analyses of Smith and Brush strongly suggests that Erni was analyzing two minerals together, for the percentages that Erni determined lie between the extremes Smith and Brush determined for the two types of "lancasterite":

| | | Smith and Brush | |
|---|---|---|---|
| constituent | Erni* | foliated[1] | radiated[2] |
| Magnesia | 50.4% | 66.3% | 43.2% |
| Carbonic acid[3] | 27.0 | 0.7 | 37.3 |
| Water | 21.5 | 32.3 | 20.1 |
| Protoxyd of Iron | Less than 1% | Less than 1% | Trace |

*Each number represents the average of two analyses

[1] actually brucite—magnesium hydroxide

[2] actually hydromagnesite—hydrous magnesium carbonate

[3] in modern usage, the carbonate content

This explains why Dr. Erni had trouble obtaining consistent results. The specimens he analyzed contained differing amounts of brucite and hydromagnesite.

Silliman's mistake was not one of observation, for he clearly recognized the two forms of "lancasterite"; but he erred in assuming the two forms were two habits of the same mineral. The inconsistencies of Dr. Erni's analyses should have alerted him to the possibility of two minerals being present. But still, it is not difficult to understand why Silliman failed to recognize the two minerals comprising "lancasterite." There are two reasons for this.

First, the two minerals are quite intimately mixed and very close in color (the same shade of white). The mixing is so intimate that Smith and Brush noted "great difficulty was found in obtaining the brucite perfectly pure owing to its intimate association with the hydromagnesite."

The second reason Silliman failed to recognize the two minerals in "lancasterite" is that no one had ever before found hydromagnesite crystals! The original description of hydromagnesite is that of a white powder or chalky material (Dana's *A System of Mineralogy,* first edition, 1837, p. 199). Smith and Brush report the discovery of hydromagnesite crystals in a separate article immediately following their discussion of "Lancasterite" (*American Journal of Science,* March, 1853):

> "The hydro-magnesite above mentioned is extremely beautiful,. . . Its structure is highly crystalline and in some instances forms distinct crystalls, . . . It occurs at Wood's Mine, Texas, Lancaster County, Pa., in seams which are sometimes half an inch in thickness, and at Low's Mine (the Line Pit Mine) in veins, generally from one-tenth to one-fifth of an inch wide, having a beautifully radiated structure. "We are not aware that this species has heretofore been observed with a crystalline structure."

Thus Texas, Pennsylvania is the world's original locality for hydromagnesite crystals.

"Lancasterite" can still be found. It occurs in the Cedar Hill serpentinite quarry, in southern Lancaster County, just a mile from the original locality at Wood's mine. It generally occurs in thin seams in the serpentinite rock. You can see the seams broken loose as white surfaces on boulders. The surfaces consist largely of white, platy brucite, but if the light catches it correctly, you may also see a radial pattern of white prismatic crystals of hydromagnesite mixed with the brucite. Some collectors have found such radial sprays up to four and five inches across.

A few years ago I examined a specimen of this Cedar Hill material which the Smithsonian's National Museum of Natural History had in its collections. The two constituents of that specimen were identified, by x-ray studies, as brucite and hydromagnesite. This confirms the analysis of Smith and Brush and also verifies that the Cedar Hill material is identical to the original "lancasterite" from the nearby Wood's mine.

I consider it fortunate that we still have a locality near Texas, Pennsylvania where we can collect "lancasterite," for this ***mineral,*** from an old and famous area, commanded the attention of the most eminent mineralogists of the last century. "Lancasterite" should properly be labelled brucite and hydromagnesite, but if you should have a specimen of this material, perhaps you will also want to add the original name LANCASTERITE in parentheses.

# MINERAL COLLECTING AT MONTE REDONDO, PORTUGAL

by RICHARD V. GAINES

THE small country of Portugal is geologically complex and boasts a surprisingly large and active mining industry. Among the active mines are many which have produced outstanding mineral specimens; one of these at Monte Redondo, is easily accessible and offers attractive collecting possibilities.

Monte Redondo is a small town near the coast 155 km north of Lisbon. To get there one takes the Lisbon-Porto highway to Leiria (136 km) and from Leiria the highway toward Figueira 19 km north to Monte Redondo. About 0.4 km south of the town is a small road to the left (eastward); one follows this road a few hundred meters to where there appears to be a long, low mound; at this spot there is a stone quarry and associated structures and equipment and it is in this area that one can collect.

In the vicinity of Monte Redondo the prevailing rocks are alluvium and the Miocene sediments of the coastal plain; however, in a number of localities along this plain are intrusions or sills of basic igneous rock, all rather similar in character. The quarry at Monte Redondo is in one of these which consists of dolerite—a rather fine grained, very hard medium grey rock consisting essentially of an intergrowth of calcic plagioclase feldspar, amphibole and pyroxene, with the usual accessory constituents. The rock is quarried as a source of crushed stone for construction purposes, and of small hand-hewn cubes of dimension stone (cubes roughly 8 cm. on edge) which are extensively used in Portugal for paving roads and highways.

The quarry consists of two or more large pits, and is mined by drilling and blasting. Within the pits around the bottom, the rock is dense and featureless with few joints and no vugs, but near the upper rim of the quarry it can be seen that there are numerous vugs, which are usually lined with crystals. This suggests that the present surface outcrop is at no great distance below the surface at the time the dolerite was emplaced as a sill or small extrusion, and that while the molten rock was still fluid gas bubbles within it rose only to be trapped and frozen in place a short distance below the surface, which of course cooled and solidified first. Probably while the rock was still hot, gases and hydrothermal fluids percolated upward through the rock and through these trapped bubbles, resulting in the crystallization of the several minerals contained therein.

Quarry and three volunteer helpers (it was Sunday), Monte Redondo, Portugal

Mineralogy is relatively simple and the following species have been identified:

Plagioclase feldspar
(oligoclase)
Actinolite
Titanite
Apatite
Prehnite
Calcite
Ilmenite
Pyrite
Limonite

Following is a description of these minerals.

***Oligoclase*** This mineral lines most of the vugs and forms druses of white equant crystals up to a maximum size of about 1 cm. It was the first mineral to form in most vugs.

***Actinolite*** This mineral was contemporaneous with or later than the oligoclase. It completely fills some vugs as masses of dark green to black crystals, but more commonly forms druses of hair-like crystals which may attain unusual length.

In the best and most spectacular examples actinolite forms beautiful randomly oriented networks of crystals up to 15 cm long, in vugs 20 cm - 30 cm across. Thickness of the crystals is sufficient so that they are stiff and do not bend as in the case of byssolite. Naturally, such specimens are fragile and difficult to extract or transport without damage; a number of exceptional specimens of this type are on exhibit in the Mineralogical Museum of the Technical University at Porto. To be able to secure such a specimen one would have to be on the spot immediately after a blast, as the operation of loading and transporting the rock to the crusher or the dump destroys the best examples; however, good specimens with crystals up to 3 cm long could be collected on the dump at the time of my visit. These acicular "nests" of actinolite crystals are equal to or better than those from any other locality known to the writer.

***Titanite*** Titanite was deposited after crystallization of actinolite and oligoclase was essentially complete. It forms yellow-green to olive-green untwinned crystals of great brilliance and sharp crystal habit. The size of the crystals is fairly uniform, ranging from 3 mm to 6 mm across. Usually it is found scattered and in clusters implanted upon the oligoclase; more rarely, on actinolite.

***Apatite*** Apatite, which is not common, forms colorless to white prismatic crystals ranging in size up to 4 cm long by 3 mm diameter. These crystals are terminated by first order pyramids. It apparently formed late in the sequence of crystallization.

***Prehnite*** Prehnite, which is fairly abundant, forms inconspicuous sheaves and rosettes of colorless crystals on the druses of oligoclase crystals lining the cavities. These sheaves of radiating blades attain a maximum dimension of about 2.5 cm.

***Calcite*** The only calcite seen was as groups of dogtooth crystals on actinolite, and as small (1 mm or less) crystals implanted upon and penetrated by actinolite hairs. These crystals are simple rhombohedra, pseudocubic and equant, and are sparsely scattered on actinolite. In these specimens the little white calcite crystals against the dark background of the vugs appear to be suspended in air like stars in the firmament; such specimens are most attractive and, naturally, hard to find.

***Ilmenite*** Some of the oligoclase-lined vugs also contain thin platy crystals of ilmenite up to 1 cm or more in diameter; also, more equant flattened rhombohedra were seen.

***Pyrite and Limonite*** A few of the vugs contained remnants of pyrite crystals, now almost completely altered to limonite.

The best collecting at the time of my visit was toward the south side of the deposit where there is an extensive dump of large vuggy rock fragments. Evidently the porous and somewhat softer nature of this material makes it unsuitable for dimension stone and it is discarded. For collecting purposes, however, the rock is hard and tough and a fairly heavy hammer is necessary in order to make any impression at all on the larger pieces.

Anyone wishing to collect there should, of course, ask permission first from the operators of the quarry.

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## CONTEST

The Fluorescent Mineral Society will sponsor two contests. One will be to name the semi-annual digest of the Fluorescent Mineral Society. The digest will be informative and technical in nature dealing primarily with fluorescent and luminescent minerals. The second contest will be to design an emblem or seal for the Fluorescent Mineral Society. The emblem must have the name or initials of the Fluorescent Mineral Society and depict fluorescent minerals. First prize for each contest is $5.00 and a free membership in the Fluorescent Mineral Society. The contests are open to everyone. Entries must be sent to the Fluorescent Mineral Society, 7039 Encino Ave., Van Nuys, Cal. 91406 before March 1, 1971.

# MINERALS OF THE SPINEL GROUP FROM ALLEGHANY COUNTY, NORTH CAROLINA

**Kent C. Brannock**
**Kingsport, Tennessee**

Alleghany County, North Carolina, is situated in the northwest portion of the state, and bounded on the north by Grayson County, Virginia. It contains localities for three minerals of the spinel family: galaxite, gahnite, and magnetite. These minerals are described in this article as well as the current collecting status for each. Some minor errors concerning the localities which have appeared in the literature are pointed out.

Galaxite, the manganous spinel, was first described by Ross (1932) as occurring in a vein near Bald Knob in Alleghany County. The occurrence is accurately located in the original paper as being one-half mile southeast of Bald Knob, a small peak (3,650 feet) 3 miles northeast of the county seat, Sparta, 7 miles southeast of Independence, Virginia, and 12 miles southwest of Galax, Virginia. The name galaxite came from the town of Galax, as well as the plant galax, which grows abundantly in the area. Dana and Ford (1932) report the locality as near Galax, Alleghany County, North Carolina, rather than near Sparta, North Carolina.

Galaxite is ideally $MnAl_2O_4$; however, the Bald Knob material contains a relatively large amount of iron. It is possible that a complete series may exist between galaxite and hercynite, $FeAl_2O_4$. Galaxite occurs as brilliant black grains of 0.01 to 0.5 mm in a distinctly banded matrix containing predominantly spessartine, rhodonite, mangniferous calcite, alleghanyite, tephroite, and quartz. Rarer minerals of the assemblage are gruenerite, anthophyllite, actinolite, phlogopite, margarite, chlorite, apatite, pyrite, pyrrhotite, and chalcopyrite. Galaxite has not been found elsewhere in nature; however, it is known as a component of steels and slags and has been prepared as a synthetic compound.

It is interesting to note that Boyd (1897), in a rather obscure reference, reported that "in the Todd settlement, near Creola P.O., spinel crystals, of large dimensions, are found in what is usually accepted as a persistent lead of manganese oxide, but may be corundum holding manganese, which extends, without intermission through that part of the county, N.E. and S.W." Boyd's accompanying map shows the words "Mn Spinel" at the locality! The Creola post office, no longer in existence, was about 5 miles northeast of the Bald Knob locality in Gryason County, Virginia. Ross (loc. cit.) and Dietrich (1970) reported several occurrences of spessartine in the same general area of Grayson County, Virginia. A closer examination of the minerals of these localities would be of considerable interest.

The Bald Knob locality is also the type locality for the monoclinic manganese analog of chondrodite, alleghanyite. It occurs in the banded assemblage as brownish-pink to bright pink grains up to 5 mm in diameter and in areas free from quartz, since it is not stable in the presence of quartz, at least under the conditions of its formation. The formula for alleghanyite originally given by Ross is $5\ MnO \cdot 2\ SiO_2$; however, it is now generally accepted as $Mn(OH,F)_2 \cdot 2\ Mn_2(SiO_4)$, e.g., Dietrich (1966), based on its analogy with chondrodite. It is worth noting that tephroite ($Mn_2SiO_4$), the manganese analog of the orthorhombic mineral olivine, occurs in the Bald Knob assemblage, and it is stable in the presence of quartz. The X-ray diffraction patterns of alleghanyite and tephroite are remarkably similar, so should not alone be relied on to distinguish the two minerals, which may easily be done optically.

Ross (loc. cit.) reported an earlier description by Rogers (1919) of an unidentified mineral from San Jose, California, which is probably alleghanyite, and

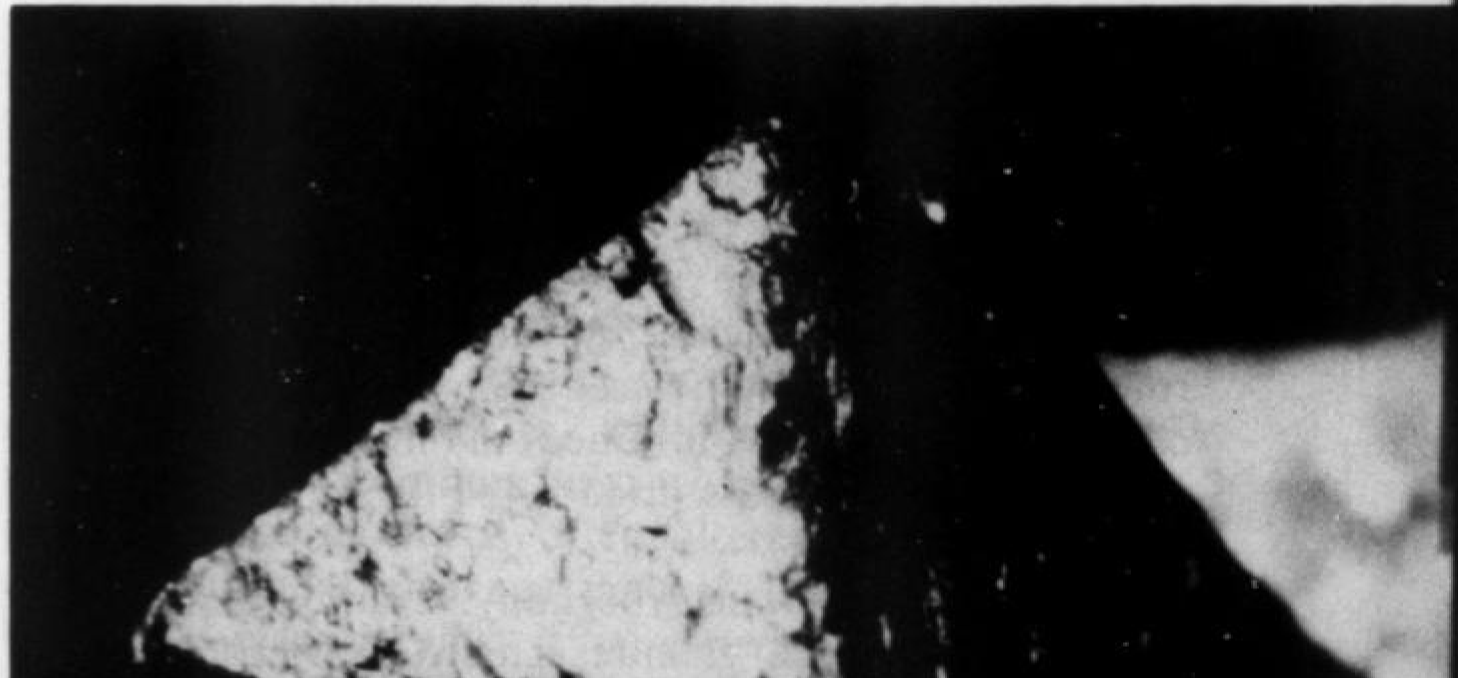

Fig. 1. Magnetite from the Walt Cheek property, Alleghany County, North Carolina. The crystal is nearly 1 inch across. Photo by Ben Kinkead.

Miyamoto et al. (1962) have reported alleghanyite from the Taguchi district in Japan.

The Bald Knob locality (from personal experience, many of the local residents do not know Bald Knob, even though it is clearly identified as such on area maps) is on the property of Mrs. L. Crouse who lives on county road 1415, north of state highway 18, 3 miles northeast of Sparta. Specimens of the complete assemblage can still be collected on the small dump, and Mrs. Crouse is very generous in giving permission to collectors. Most of the dump material is entirely blackened on the surface by manganese oxides; however, the freshly broken material is readily recognized by its distinctly banded appearance.

Fig. 2. Gahnite crystals from Stratford, Alleghany County, North Carolina. The crystals measure 1/2 inch across. Photo by Ben Kinkead.

Another spinel, magnetite, in simple octahedra in a chlorite schist, is abundant in a several-acre field about 2.5 miles southeast of the Bald Knob locality. The magnetite occurs on the property of Mr. Walt Cheek who will usually give permission for collecting. Mr. Cheek's home is reached by turning south from state route 18 onto county road 1433 and then northeast onto county road 1434 for about 0.4 mile. The collecting area is directly across road 1434 from Mr. Cheek's home.

The third spinel in Alleghany County is the zinc ( $\sim$ 27% Zn) spinel, gahnite, $ZnAl_2O_4$. Dietrich (1970) reported gahnite from Grayson County, Virginia: "Dark green octahedra up to 25 mm along *a* from near Independence are in the collection of the Smithsonian Institution." The latter specimens were collected in the 1930's by the late Dr. W. T. Schaller, of the U.S. Geological Survey, and actually came from a locality near Stratford in Alleghany County, North Carolina (Schaller, personal communication; the confusion in locality arose from the fact that Independence, Virginia, was the last town through which Dr. Schaller passed on his way to the locality). The occurrence is a very limited one on a hillside opposite the Walnut Branch Church on county road 1332 about 1 airline mile west of the village of Stratford. When first visited by the author in 1940, loose crystals of gahnite as well as crystals in quartz and an altered mica schist were abundant as float. The gahnite occurs mostly as simple octahedra, and less commonly as octahedra with minor dodecahedral faces, and as classic spinel law twins. It is dark green, brilliantly gemmy in small spots, and frequently shows multiple parallel growth faces in the single crystals. It is accompanied by fresh, cinnamon colored, hexagonal prisms of staurolite up to 30 mm in length, and rarely by large, twinned crystals of balck rutile. The locality at present is depleted as far as surface materials is concerned, and the owner does not allow collecting.

It is noteworthy that there is no trace of gahnite anywhere else in the immediate vicinity; however, dark brown, single crystals of staurolite are common as float in the general area. The gahnite occurrence lies generally on a belt of schistose rocks, locally rich in staurolite, sometimes kyanite, and less commonly rutile, which trends SW to NE. These rocks are exposed under the bridge where U.S. highway 221 crosses the south fork of New River in Ashe County to the west of Alleghany County; in Grayson County, Virginia, south of Independence (Dietrich, 1970); and in the town of Galax, Virginia.

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# Rodingite near Thetford Mines, Quebec

**Woodrow Thompson**

In the Eastern Townships area of southern Quebec the Appalachian geosyncline contains thick sequences of Paleozoic meta-sediments and meta-volcanics of Cambrian to Siluro-Devonian age. Intruded into the older rocks are dunites, peridotites, and pyroxenites of the Taconic orogeny. The area is interesting to the mineralogist because of the wide variety of ore deposits that occur there. The most famous of these are the large asbestos quarries around Thetford Mines and Asbestos. Other mines have been worked for talc, copper, chrome and molybdenum. The subject of this report is a most unusual dike rock at the Reed-Belanger chrome mine.

Located near the village of Coleraine, the Reed-Belanger mine was a significant chrome producer through World War II. Since then a combination of low grade ore and competition from foreign markets has curtailed operations. The chromite occurs as granular bands in the serpentinized ultra-mafic host rock. Most of the ore is found in altered dunite and encloses fresh olivine in places. Cutting the serpentine are some white dikes with interesting mineral assemblages. Among the constituents are grossularite, diopside, albite, calcite, and aragonite—all white. Because of their mineralogy and mode of occurrence these dikes are defined here as rodingites.

Rodingite is an uncommon rock which has been described from several widely scattered localities. Mention should be made of these before turning to the Reed-Belanger dikes. The type locality is on the Roding River in Nelson, New Zealand (Baker, 1958). Although the present author has little information on this site (Table I), one may generalize about the other examples in geologic literature. Some early authors thought that rodingite was a primary magmatic differentiate, or that it formed when a magma enveloped blocks of limestone (Marshall, 1911). The current view is that rodingite is an alteration product. In most cases it is a metamorphosed basic dike in an area of serpentinites. The original dike was dolerite in some cases (Bilgrami and Howie, 1960), but more commonly a gabbro that was altered by lime-rich, siliceous hydrothermal solutions. The waters probably came from the serpentinization of neighboring rocks, including harzburgite, peridotite, and other ultrabasics. The alteration was usually post-serpentinization, but xenoliths of rodingite are known to occur in serpentine (Bloxam, 1954).

**TABLE I**

**Analyses of some rodingites and the average gabbro. (after Baker (1958), Bloxam (1954), and Qaiser, et al (1970)**

| | I<br>% | II<br>% | III<br>% | IV<br>% |
|---|---|---|---|---|
| $SiO_2$ | 35.61 | 38.04 | 36.36 | 49.50 |
| $Al_2O_3$ | 21.59 | 15.07 | 25.64 | 18.00 |
| $Fe_2O_3$ | 1.14 | 1.78 | 0.27 | 2.80 |
| FeO | 5.41 | 3.02 | 0.50 | 5.80 |
| MgO | 6.30 | 9.62 | 3.05 | 6.62 |
| CaO | 25.75 | 25.84 | 32.50 | 10.64 |
| $Na_2O$ | - | 0.18 | 0.49 | 2.82 |
| $K_2O$ | - | 0.04 | 0.14 | 0.98 |
| $H_2O^+$ | 3.93 | 4.19 | 1.03 | 1.60 |
| $H_2O^-$ | 0.11 | 1.15 | 0.04 | - |
| $CO_2$ | nil | nil | - | - |
| $TiO_2$ | 0.15 | 0.82 | nil | 0.84 |
| $Cr_2O_3$ | - | - | 0.06 | - |
| MnO | 0.02 | 0.21 | nil | 0.12 |
| $P_2O_5$ | nil | 0.24 | 0.05 | 0.28 |
| total | 100.01 | 100.20 | 100.13 | 100.00 |

| | |
|---|---|
| I | Rodingite, Anderson's Ck., Beaconsfield, County Devon, N. Tasmania. |
| II | Rodingite (garnetized gabbro), Byne Hill, Ayrshire, Scotland. |
| III | Rodingite, Naranji Sar, Malakand, West Pakistan. |
| IV | Average gabbro of Daly. |

The mineralogy of rodingite is very diverse. It may include grossularite, zoisite, diopside, idocrase, prehnite, hornblende, calcite, chlorite, and others. Of these the most common are grossularite, zoisite, and prehnite. The garnet is often altered plagioclase and displays original cleavage cracks. The remnant hornblende is rare because it is generally changed to a chloritic mineral (Baker, 1958). Augite in the original dike is also replaced (Turner, 1934). If the hydrothermal solutions were more aqueous than normal, prehnite tended to form instead of grossularite. The transition from gabbro or dolerite to rodingite has usually involved the introduction of CaO, $CO_2$, and $H_2O$. $SiO_2$, FeO, $Fe_2O_3$, $Na_2O$, and $K_2O$ diminished. According to Baker much of the CaO needed for garnetization can be leached from Ca-plagioclase and mafic minerals in the original dike. The remainder may be derived from serpentinization of the ultramafics. These conclusions are consistent with the geology of rodingites from West Pakistan (Bilgrami and Howie, 1960; Qaiser *et al,* 1970), Newfoundland (Watson, 1942), and British Columbia (Watson, 1953).

Rocks of rodingite composition (though not recognized as such) have been previously described from the Eastern Townships of Quebec. They are undoubtedly similar to the Reed-Belanger dikes. Olsen includes these calc-silicates in the "acid rocks" that he studied at Asbestos, Quebec (Olsen, 1961). He believes that they are at the amphibolite facies and are gabbros that were metasomatically altered to a degree depending on structural attitude. The resultant rocks are mixtures of microcline, albite, diopside, zoisite, grossularite, and prehnite. Thus they are identical to rodingite. The "side effects" that Olsen mentions may be observed at the Reed-Belanger mine as well. Serpentine near the contact with the acid rocks is dense and black; and antigorite is replaced by shreds of talc.

Graham proposes a very unique origin for the rodingitic rocks of Quebec (Graham, 1917). He claims that granitic magma invaded the ultramafics and leached CaO, $Al_2O_3$, and MgO from their pyroxenes. These elements were incorporated into the dikes and caused them to grade from regular aplite, through garnetiferous aplite, to garnet-idocrase-diopside. This gradation may have been ubiquitous, but erosion has stripped many dikes down to the granitic part. Graham concludes that any remaining granitic solutions may have caused regional serpentinization. However, Larsen showed that this was not quantitatively possible (Olsen, 1961).

Therefore, one may conclude that the calc-silicate rocks in the Thetford Mines area have the mineralogy of rodingite, and they are similar in genesis. This is further substantiated by the author's work on the dikes of the Reed-Belanger mine. The two dikes seen here differ in size and form, but they have the same composition. One is planar, about a foot wide, and exposed along its length for about eight feet (Fig. 2). The other is an irregular mass that is much larger. The minerals in these rodingites include grossularite, diopside, albite, calcite, aragonite, and talc. Grossularite, albite, and diopside are the principal constituents. The garnet and feldspar form a fine-grained mixture that is hard to identify in hand specimen, although colorless cyrstals of grossularite to 1/4" filled a vug in one specimen. The X-ray diffraction pattern for this garnet corresponds exactly to the theoretical composition of grossularite. The garnet in other rodingites is apt to be hydrogrossular (Deer *et al,* 1962) with a composition of $Ca_3Al_2Si_2O_8(SiO_4)_{1-m}(OH)_{4m}$. The garnet-feldspar combination makes up the greater part of the rodingite at the Reed-Belanger pit. Two other minerals that one finds in the dikes are calcite and aragonite. One specimen in the author's collection has crystals of both minerals in association with grossularite crystals. The calcite forms small clear-to-white cleavages or rough white crystals in vugs. Aragonite occurs as radiating needles or as aggregates that resemble the stilbite "wheat sheaves." Finally, diopside is the primary mineral in another sample. Near the diopside-serpentine contact are shreds of talc and a few grains of chromite. An interesting feature of the rodingite dikes is the dark, intense serpentinization that is always seen at their margins. Olsen says that the serpentine in contact with the white dikes (at Asbestos) is a mixture of biotite, stilpnomelane, and penninite in an antigorite matrix (Olsen, 1961). The antigorite is partially replaced by talc, as seen in a Reed-Belanger sample. Idocrase is notably scarce at this mine. One piece was found, containing pale-green micro crystals. It is usually more common in rodingites, and the lilac idocrase at the nearby Montreal Chrome Pit is colorfully associated with green chrome diopside.

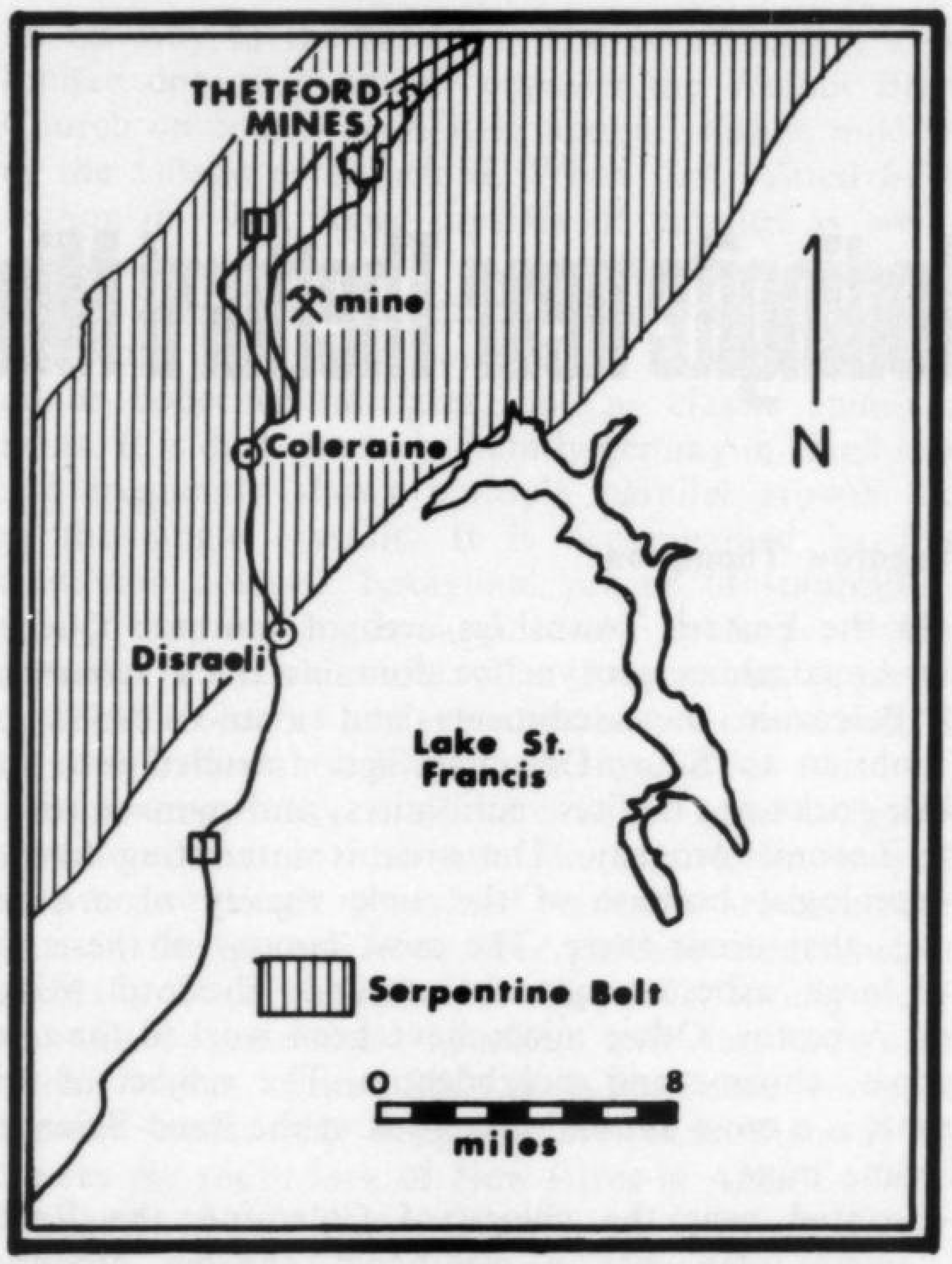

Fig. 1. Location of the Reed-Belanger mine.

In conclusion it would seem that the Reed-Belanger rodingites represent altered dikes of the kind described by Baker and others. Although these dikes were probably gabbroic, one must admit the possibility of their being altered aplites. In any event the rodingites contain unique mineral assemblages that warrant further study. It is hoped that this article has called attention to their presence in the Appalachian serpentine belt. This rock has been the source of many fine mineral specimens in the Thetford Mines district. Mineralogists may hope to find similar occurrences to the south in the serpentinites of Vermont and other states.[1]

*(continued on page 48)*

## THE RECORD BOOKSHELF

*(continued from page 36)*

*An Abbreviated Manual of Franklin Minerals, by Ervan F. Kushner, (order from Ervan F. Kushner, Room 502, 5 Colt Street, Paterson, New Jersey 07505), 1970, 183 pp. ($10.00)*

This manual of the minerals of Franklin, New Jersey represents a new departure in books for the collector. The format is loose-leaf, with a page devoted to each mineral that occurs at Franklin. In essence, the manual is a compilation of selected information from several readily-available mineralogical textbooks, and includes Palache's famous monograph (*U.S.G.S. Professional Paper 180*, 1935, reprinted 1960) on the minerals of Franklin and Sterling Hill. The format of the data should serve as a model for field notebooks on collecting trips, or for the catalog of a personal collection. This format provides space for mineral name, formula and group, crystal system, physical properties (including fluorescence), associations, remarks, and an accession number (for a personal collection). The page references in the texts used to compile the data are included.

Basically Kushner has done what any individual collector of Franklin minerals could do in time. The manual does eliminate duplication of this effort, and Kushner even provides extra blank pages for the addition of data.

Unfortunately, the recent technical literature has not been extensively searched for information. Several articles by Frondel *et al*, in American Mineralogist (*e.g.*, Vol. 51, 1966, pp. 1388-1393 and 1406-1413) give new data on celsian and hyalophane from Franklin, report zincian aegirine-augite, and also suggest that the name jeffersonite (much used by collectors) should be set aside due to lack of species significance. Frondel cites a large volume of additional references, many appearing within the past 10 years, and so Kushner's manual is, from a technical viewpoint, not up-to-date. Nonetheless, the loose-leaf and convenient page format provide a working base for the collector. The individual can thus update and revise the manual as he sees fit, add information he considers pertinent (consulting professional mineralogical literature, if desired), and thereby make the book a personal, usable guide to the minerals of Franklin.

**JOEL E. AREM**

## ERRATA

Please substitute the following under Optical Properties in the article Cornetite from Saginaw Hill, Arizona, by BaSaw Khin, Vol. I, no. 3, p. 118:

### OPTICAL PROPERTIES

The mineral is light blue to dark blue in transmitted light and is nonpleochroic. The optic orientation is X = b, Y = a and Z = c. All the crystals examined are biaxial (-) with a slight variation in isogyre spacings. Dispersion is strong $\rho < \nu$. The refractive indices are as follows:

*Refractive Indices of Cornetite*

| | F | E | D | C |
|---|---|---|---|---|
| $\alpha$ | 1.781 | 1.767 | 1.744 | 1.721 |
| $\beta$ | 1.852 | 1.840 | 1.821 | 1.802 |
| $\gamma$ | 1.861 | 1.848 | 1.829 | 1.809 |
| $\gamma - \alpha$ | .080 | .081 | .085 | .088 |
| 2V (calc.) | 38°01′ | 35°30′ | 34°33′ | 31°37′ |
| 2V (meas.) | 28°00′ | 26°30′ | 23°45′ | 21°00′ |

Vlues of the refringence have been corrected for dn/dt and with the exception of the $\beta$-index, which may vary between + .002, the rest are within + .0005.

## Rodingite

*(continued from page 46)*

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# COINCIDENCE!

Dr. Michael Fleischer of the U.S. Geological Survey has served with distinction for many years as the chairman of the New Minerals and Mineral Names Commission of the International Mineralogical Association. Before new minerals can be described in Journals, abstracts of the descriptions must be submitted to Dr. Fleischer who duplicates and distributes them to mineralogists representing each of the roughly two dozen member nations. These experts may then vote either for or against the mineral on the basis of their interpretation of the data presented.

While serving in that position there have been two remarkable coincidences involving these abstracts. In 1966 Dr. Fleischer received, on the same day, abstracts from two different laboratories describing the same mineral! Naturally two different names were proposed, one by a Russian pair consisting of A. I. Komkov and E. I. Nefedov and the other by two Americans, Mary E. Mrose and Laura E. Reichen. The Russian authors, when confronted with this extraordinary development, graciously deferred to the Americans in the matter of the name and the mineral, now approved, is known as posnjakite.

More recently an equally remarkable coincidence occurred. Arriving in Dr. Fleischer's office on the same day from two different laboratories were abstracts for two different lead-iron arsenate minerals from the same locality; Tsumeb, Southwest Africa. The descriptions of these minerals have not yet been published so the names cannot be used since it is the authors' privilege to introduce the names in their publication of the descriptions.

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