the Mineralogical Record

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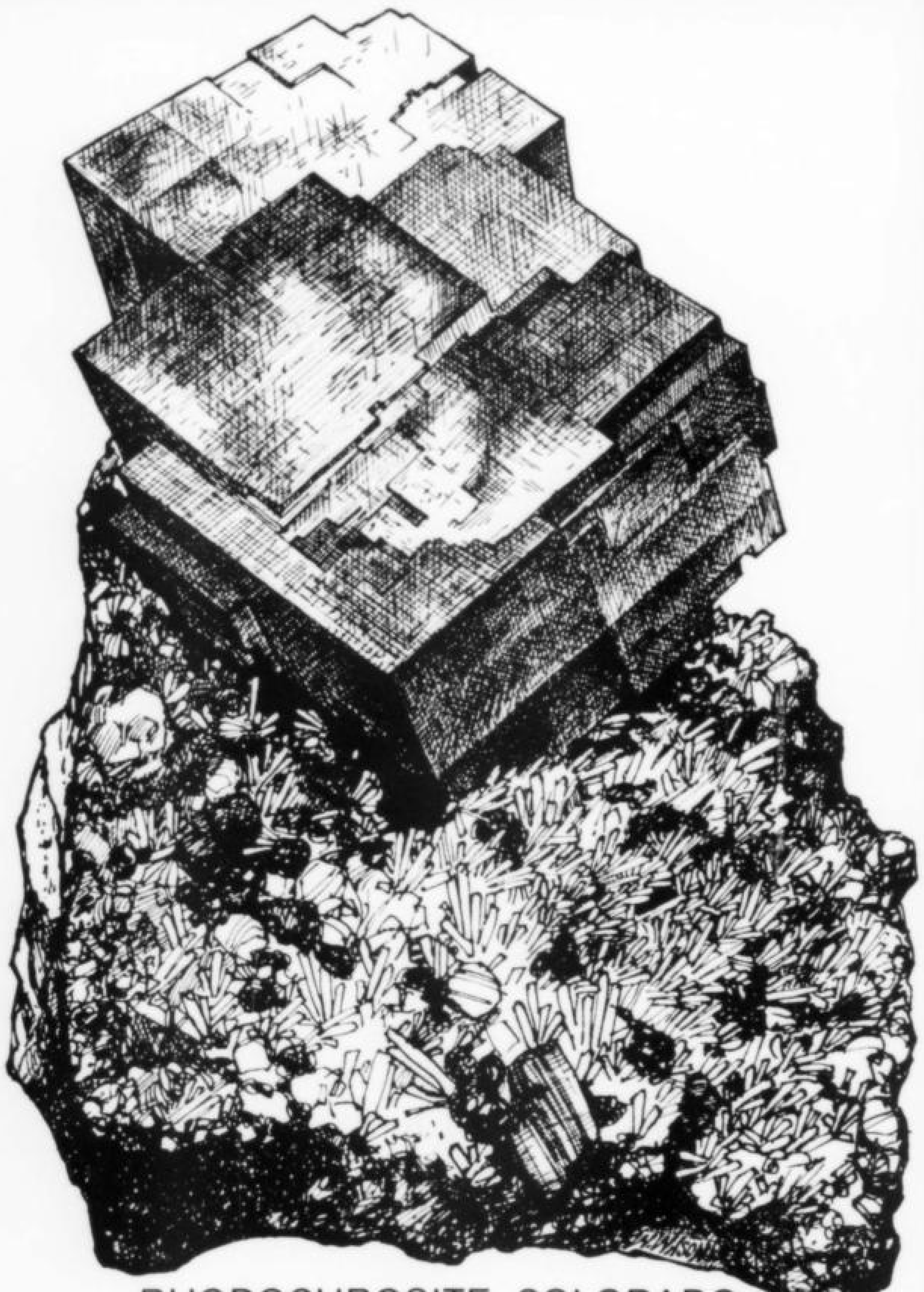
Volume Six/Number Five
SEPTEMBER-OCTOBER 1975



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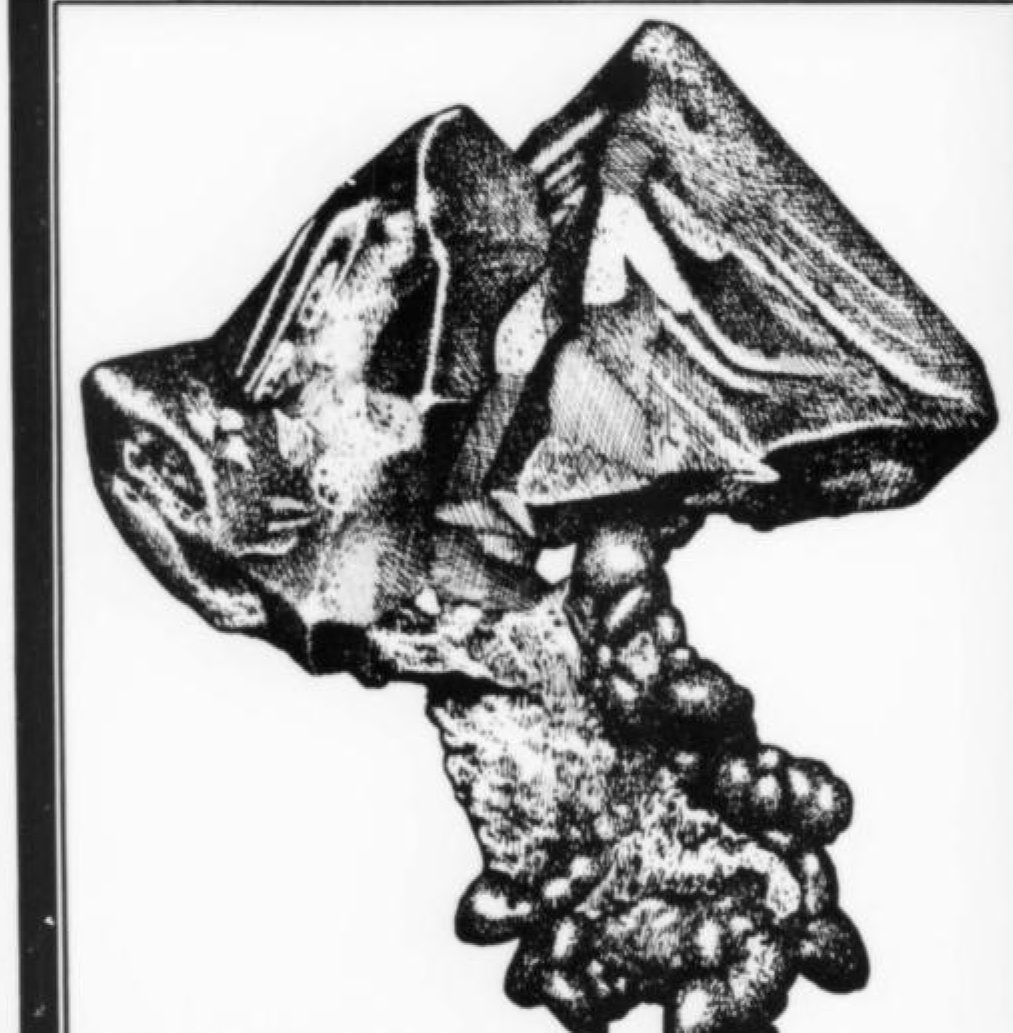

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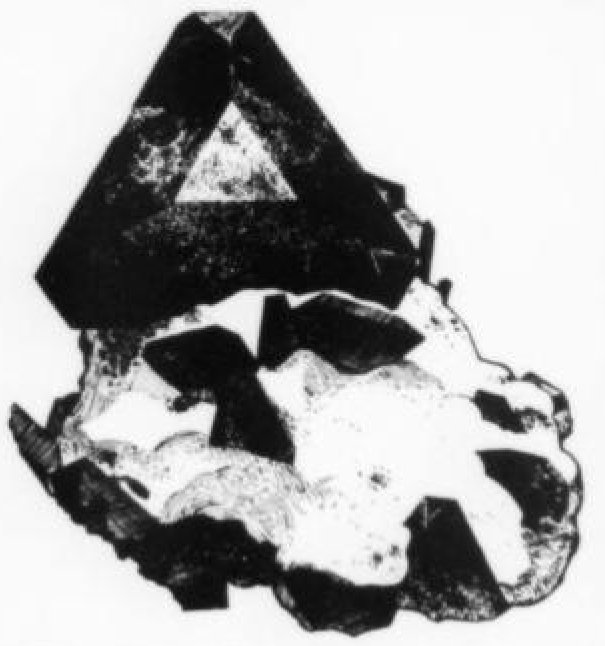

BENITOITE; CALIFORNIA

the Mineralogical Record

Volume Six/Number Five
September—October, 1975

affiliated with the Friends of Mineralogy

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Flattened oriented inclusions of hematite, in part altered to goethite, in muscovite. There are also minor pyrolusite dendrites. This cover was not made from a photograph, but directly from a cleavage of muscovite. Mitchell County, North Carolina. R. A. Bideaux collection.

design & composition

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editorial matter

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Guest Editorial

SO YOU THINK YOU HAVE FOUND A NEW MINERAL?

Pete J. Dunn
Department of Mineral Sciences
Smithsonian Institution
Washington, D.C. 20560

Due to the fast expansion of the mineral hobby, fine cabinet specimens are becoming rare, and increasingly costly to obtain. This has led to a strong growth rate in the hobby of micromounting, which has many advantages, already adequately covered by Neal Yedlin and others. The surge in micromounting has led to the intimate examination of specimens from hundreds of localities, and the discovery of numerous species previously unknown to science. The observant micromounter, even though accustomed to seeing minerals in sometimes uncommon habits, occasionally encounters a mineral which he or she is unable to identify. Consulting more seasoned micromounters, or collectors more familiar with the specific locality, may frequently result in a definite identification. But what to do with the unknown which, after diligent attempts by seasoned experts, remains an unknown? Although there are no hard-and-fast guidelines (each situation is different), the following are offered as reasonable courses of action.

THINGS TO DO:

1. Separate all specimens containing the unknown from your stock of duplicates and temporarily house them in a special box.
2. Write down all pertinent details while they are fresh in your mind. Note the associated species, the locality, and the particular part of the mine or quarry from which the specimens came, the date of collection, and the names of other collectors who were with you that day and may have similar specimens. Place this information in the box with the minerals. This way your knowledge is recorded first-hand and can be used at any future time.
3. Attempt to procure, if you have not already done so, a piece of the matrix rock or soil.
4. Contact a museum mineralogist, or any responsible research mineralogist known to you to find out if there is any interest in examining your unknown. If there is no interest, don't hesitate to try another mineralogist.
5. In the event of a favorable response, send the mineralogist a *good* specimen of the unknown, preferably one with crystals. Attach a list of your data, and a *very clear, concise* description of what particular mineral you are discussing in your letter. A sketch of the specimen indicating where the unknown is located might be very helpful. If the mineral occurs in crystals, sketch one of them. It is usually best to send the specimen by mail rather than hand it to the scientist at a mineral show. In this way, the specimen comes directly to the laboratory without being lost in the confusion of a show or a mineral club meeting.

THINGS NOT TO DO:

1. Do not assign some favorite name to the material. This only clutters up the nomenclature and adds to misunderstandings while generating confusion. It is an irresponsible action and one to be strongly discouraged. Minerals are named only by the scientist who describes them. The best temporary designation is simply UNKNOWN #—from a given locality.
2. Do not give samples of your mineral to fellow collectors as an unknown. If it turns out to be a new mineral, and one of which only a few specimens exist, this can result in the loss of much time and a lot of diffi-

culty in later attempts to gather up the available specimens to obtain adequate material for analyses and accurate characterization of the species. If it is a new mineral, your specimens will then become *type* material, and small specimens should be sent to major museums around the world eager to possess such scientifically important specimens. Although it may not be apparent from your local perspective and collector's instinct, it is far more important that these specimens be in major repositories than in your friends' collections. If adequate material exists to meet the needs of both the science and the hobbyist then you, as the initial discoverer, should enjoy the pleasures of the distribution. Please wait, however, until the mineral is identified or characterized.

3. Do not attach conditions to the gift of the mineral to be examined. Any responsible mineralogist will acknowledge your significant discovery when the description of the mineral is published (although a few have not). You, in turn, should be patient, for new minerals are not analyzed and described overnight. Almost all of the "easy" minerals have been found, and contemporary discoveries frequently pose some unique problems which may take time to solve before the mineral is completely characterized. Please leave the scientist free to grapple with the mineral, and not with your impatience as well. The process of describing a new mineral is frequently a tedious and frustrating task, and the mineralogist is frequently starting from "scratch", so to speak. Research in the literature consumes much time, and serious mineralogical work requires extensive time. Long-term projects such as monographs on mineral groups sometimes require long-term loans of several years' duration. The donation of mineral specimens for research purposes is indeed a noble deed and in the best interests of enlightenment.
4. Mineral scientists, like other scientists, are not all perfect. There are some mineralogists who accept a project and then procrastinate for years without ever issuing a definitive report. These scientists are few, fortunately, and you will find most active research mineralogists quite eager to describe your unknown. We need your discoveries, and appreciate your vital contributions to the mineralogy of the Earth.

The above thoughts are offered in the hope that they will serve as one more link between the collector and the scientist.

friends of mineralogy

Vandall King

Region I of Friends of Mineralogy, under the aegis of Marcel Weber, has begun a series of field trips to notable localities. First of these was a visit, last fall, to the Dunton Quarry at Newry, Maine, under the sponsorship of John Marshall, Dean McCrillis, and Dale Sweatt, operators of the property, all of whom are F.M. members. The finding of a new pocket of gem tourmalines a few years ago startled the mineralogical world, and thousands of carats of superb gems and crystallized specimens were unearthed. Miscellaneous by-products at the mine were dumped, and it was in this area of the operation that F.M members held forth, collecting such accessory minerals as uralolite, beryllonite, and some 38 other species.

The operators provided "taxi" service from the base of the hill to the quarry, some nine-tenths of a mile at about a 30 degree slope upward, enabling everyone to visit and collect. All areas of the operation were visited, and the actual "mine" and its operation were observed.

Of particular interest was a feature uncovered by recent excavation. The apparent feeding vent of the pegmatite was found in the footwall. It dipped almost vertically, and was about 20 inches in diameter. A small basalt dike paralleled this vent. This may lead into other gem pockets, and will be thoroughly explored.

This trip was an important step in operator-collector relations. With self-insurance and a wider base of contacts, Friends of Mineralogy may someday be able to arrange field trips to other currently producing deposits. Such visits are particularly important, for the study of progressive zones of rock formation, the preserving of rare easily-weathered minerals, and the recording of data of the stages of the mining should be in literature and in accessable storehouses.

Neal Yedlin

I received a letter from a member in the area near Detroit, Michigan. He was bitter about the attitude of a "dealer" in the Michigan copper country, who ignored verbal agreements and played one prospective purchaser against another. He had seemingly bought several superb specimens - a hundred or so pound silver-copper "half-breed", several copper "skulls" etc., had agreed upon a price, and had agreed upon a price, and had returned home to sell some stock and property to pay for his buys. A few days prior to his returning for the specimens he received a letter telling him the price had gone up, etc., and that some had already been sold to someone else. His missive wanted to know what had happened to the moralities, and agreements among mineral collectors who used to stand by their words.

Friends of Mineralogy deplores this attitude among members of the mineral fraternity, as well as of people throughout the world who are prone, in this day and age, to ignore agreements, oral and written, with a casualness that is the despair of those who stand by their contracts. But F.M. is not a policing agency; was not formed to correct the legal and moral ills of those interested in the hobby. Nor can it act in an advisory capacity in this type of situation. There are legal remedies. There are pursuasive restraints. There are "letters to the editor", with names and numbers. (Be prepared for legal suit in the event that you have no admissable proofs.) It is axiomatic that a purchaser should buy immediately (and have the cash to consummate the transaction) any specimen he sees and covets. Invariably, proving his good judgment in the choice of specimens, the item is gone when he decides to buy it later. But we do decry the attitude of the hustlers, opportunists and thieves who follow in the wakes of honest collectors.

Regional Directors: Please have your reports of activities in my hands as soon as possible. Only by such participation can other regions know of and join in your activities. Reach me at 129 Englewood Drive, New Haven, Connecticut 06515

SYMPOSIUM

The Friends of Mineralogy, region 12, is sponsoring a Mineral Symposium on the theme, "Zeolites and Associated Minerals". The program will take place in Portland Oregon on Oct. 4, 1975. Speakers will include John Sinkankas of San Diego California, Kr. William Wise of the University of California at Santa Barbara, and others. Other activities will include informal workshops, dealers, Swapping, and a mineral auction. For further information and registration forms contact; Robert J. Smith, Friends of Mineralogy, Bx 197 Mailroom, Seattle University, Seattle University, Seattle, Washington 98122.

All news and material relating to FM, for Record publication, should be sent to Neal Yedlin at: 129 Englewood Drive, New Haven, Connecticut 06515, U.S.A.

FINE MINERALS

WODGINITE, Baixo, Brazil. Superb brill. term. loose xl. 1-1/4 x 1/2 x 1/4	$225.00
STIBICONITE, Mexico. Ext. sharp x 1 pseudo Stibnite. 3-1/2 x 3/4 x 5/8	65.00
BERTRANDITE, Nantes, France (type loc.) Minutely xld. on rock 4 x 3 x 1-1/2	35.00
AMETHYST, Wyloos Sta. Australia. Fine stout xl. 2 x 2 x 2	25.00
PYRITE, Matchless M., S.W.A. Xld. ball w. matrix. 1-1/2 x 1-1/4 x 3/4	20.00
CHILDRENITE, Tavistock, England. Bright xls. on matrix 1-1/2 x 1 x 3/4	45.00
NATROCHALCITE, Chuquicamata, Chile. Well xld. on matrix. 2-1/2 x 2-1/4 x 2	150.00
TOURMALINE, Plumbago, Newry, Maine. Well term. green xl. 2 x 1 x 1-1/2	80.00
ANGLESITE, Meretice M., New Caledonia. Sm. fine xls. on matrix 3-1/4 x 1-1/2 x 1	60.00
SMITHSONITE, Leadhills, Scotland. Nice botryoidal blue on matrix 3 x 2-1/2 x 1	45.00
SPINEL, Amity, NY Fine oct., 1 x 1 x 1 on matrix. 2 x 2 x 1-1/4	75.00
PHENAKITE, Takowaja, USSR. Fine loose xl. 1-1/4 x 1 x 1	45.00
HERDERITE, No. Groton, NH. Very fine compound loose xl. 1 x 3/4 x 3/4	20.00
XENOTIME, Iveland, Norway. 3 1/2" xls on edge of 4-1/2 x 3 Biotite plate.	150.00
POLYBASITE, Mexico. Superb group of 2 large xls. No matrix. 2 x 1-1/2 x 1	375.00
ILVAITE, Tetyukhe, USSR. Brill. xls. up to 1/2 on Quartz xls. 2-1/2 x 2-1/2 x 1-1/2	125.00
ACANTHITE, Mexico. Huge compount xl. No matrix. 2 x 1 x 1-1/2	150.00
BROOKITE, Ellenville, NY. Bright 1/4" xl. on Quartz. Rare. 3 x 1-3/4 x 1-1/4	60.00
CYLINDRITE, Poopo, Bolivia. Well xld on matrix. 2-1/4 x 1-1/2 x 1	130.00
GERMANITE, Tsumeb. SWA. Pure mass. 2-1/4 x 1-1/2 x 1-5/8	27.50
ZIRCON, Templeton, Quebec. Two term xls in parallel position. 2 x 1 x 1/2	175.00
LINARITE, Yannery Hills, Australia. Mass w. some Malachite. 2 x 2 x 1-1/4	20.00
AXINITE, Scopi, Switz. Xld. on rock w. Adularia. 3 x 3 x 1-1/2	65.00
CARROLLITE, Kambove M., Zaire. Two fine 3/8" xls. *in matrix*. 4 x 2 x 2	350.00
PYROMORPHITE, Braubach, Germany. Very well xld. on matrix. 3 x 2-1/2 x 1	150.00
CHALCOCITE, Bristol, Conn. Solid mass w. xls. on two sides. 4-1/2 x 3-1/2 x 2-1/2	100.00
SIDERITE, Nova Lima, Brazil. Fine xls. up to 1" on matrix. 3 x 2 x 1	30.00
SERANDITE, Quebec. Very fine term xl. w. Acmite, etc. 1-3/4 x 7/16 x 3/8	125.00
LEGRANDITE, Mexico. Superb brill. compound term. xls. 1 x 1/2 x 3/8	200.00
CERUSSITE, Tsumeb, SWA. Very fine clear butterfly twin xl. 7/8 x 1/2 x 1/2	50.00
CHRYSOBERYL, Bahia, Brazil. Very fine butterfly twin xl. 3/4 x 3/4 x 1/2.	65.00
PREHNITE, Asbestos, Quebec. Superbly xld. on matrix. 7/8 x 3/4 x 1/2	75.00
AZURITE, Chessy, France. Good xld. mass. 3-1/4 x 3 x 1-1/4	75.00
DYSCRASITE, E. Germany. Richly micro xld. on Arsenic. 1-3/4 x 1 x 3/4	35.00
BETA-DUFTITE, Tsumeb. SWA. Richly micro xld. on matrix. 1-1/2 x 1 x 1/2	40.00
APATITE, Foote M., N.C. Bright lavender xls. covering matrix. 6 x 2 x 1-1/2	135.00
THOMSONITE, Paterson, NJ. Xld. completely covering matrix. 5-1/2 x 4-1/2 x 2	300.00
AXINITE, Bahia, Brazil. Huge term gemmy xl. 4 x 2 x 5/8	550.00
JAMESONITE, Mexico. Magnificent *brilliant prism* 1-1/2 x 3/8 on xld. Pyrite Superb and rare. 2-1/4 x 2 x 1-1/2	350.00
PINK FLUORITE, Carthage, Tenn. Very fine loose xl. 3/4 x 3/4 x 1/2	20.00
BIKITAITE, Foote M., N.C. Richly micro xld. on matrix. 2-1/2 x 2 x 5/8	125.00
FAIRFIELDITE, do. Superbly xld. on matrix. 3 x 2 x 1/2	200.00
CASSITERITE, Schlackenwald. Large (up to 1-3/4) brill. xls. No mat. 2 x 1-1/2 x 1	250.00
EUCHROITE, Libethen, Hungary. Well xld. on matrix. 1-3/4 x 1-1/4 x 1/2	30.00
SMALTITE, Cobalt, Canada. Well xld. on matrix. 2-1/4 x 1 x 3/4	55.00
HUTCHINSONITE, Peru. 1/4" xl. w. Orpiment on matrix. 2 x 1 x 1/2	25.00
ENARGITE, do. Group of large term. xls. Parallel pos. No matrix. 2 x 2 x 1	75.00
McGOVERNITE, Franklin, NJ. Rich on matrix 3 x 2 x 1-1/2	50.00
DATOLITE, Charcas, Mexico. Pale green xls. up to 1" on mat. 3 x 2-1/2 x 1	45.00
TOPAZ, Brazil. Fine 5/8" xl. on xld. Lepidolite. 1-3/4 x 1-1/4 x 1-1/4	70.00

* * *

Lawrence H. Conklin

Mineralogist

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PERSONALITY SKETCH

NEAL YEDLIN
An Impression

by Joe Rothstein

The north shore of Long Island, New York, is made up of low sprawling hills which, being composed of material left by the retreating Ice Age glaciers, are known as random tills. These random tills sweep west from Orient Point to Fort Salanga and then veer obliquely southwest crossing Brooklyn in the vicinity of Prospect Park, young Neal Yedlin's personal mining claim, continue west through the middle of Pennsylvania and eventually die out in northern West Virginia. Neal, and his lifelong buddy, Lou Perloff, spent their early collecting years probing the random tills for the New England minerals deposited on their doorstep. Whether both of them arrived in the world clutching a binocular microscope, we have never enquired. We once asked Neal where he and Lou had found anything to interest two kid collectors, in Brooklyn, of all places, where the geology as far as minerals are concerned is hopeless, and he told us about the terminal moraine bit. Neal took his finds to the Brooklyn Children's Museum and from then on he was a mineralogist. Well, not right away. There was high school and college, law school and studying for the bar and becoming an attorney, a stint in the Army in World War II that included parachute jumping, and a brief fling at pro football with the long defunct Brooklyn Dodgers at historic Ebbets Field.

Yedlin joined the New York Mineralogical Club on January 18, 1933, and is the only current member who was present at both the 50th and 75th anniversaries. When we caught up with him in the late 40s (he was already established as Mr. Micromounter, doing a monthly column for Pete Zodac's *Rocks and Minerals* magazine) our first impression was friendliness. He is a big, amiable guy, with a big smile, a flair for conversation, an inviting, permissive manner, that leads to a "let's ask Neal." However, the mineral YEDLINITE wasn't named that just because of Neal's personality.

Whether or not he chewed up Dana and washed it down with fermented pegmatite juice, we don't know. We've sat at the microscope turntable in his basement workshop in New Haven and looked through part of his collection of some 10,000 micromounts. His "buy and read a good mineral book" slogan is not whim and whimsy. The room devoted to his library houses one of the best extant private collections of books on mineralogy. He doesn't have to leave the house either, to examine a mineral or to study its paragenesis.

Neal shares his knowledge, his enthusiasm, and his wit. His lectures start off with an anecdote, and being a scholar and a member of the bar, sometimes he can't resist a parable. His good humor is infectious from the first sentence which is about how long it takes him to win his audience. His slides are things of incredible beauty and his contribution to photographic technique considerable. His attention to crystallographic detail is that of a perfectionist. He once told me, "Joe, never show a slide unless the audience can identify the mineral on the screen." His high standards are one reason why he is in such great demand as a speaker. Another reason is that audiences know that a Yedlin talk is always an enjoyable evening.

The man and his books and his minerals are quite an experience. All the unselfish years he spent in writing his column on micromounting and graciously crediting his colleagues with new methods, discoveries, and techniques, symbolize the man. But our first impression still holds up the strongest—the man is friendly.

Note: The editor is anxious to have more readers submit Personality Sketches for publication in the Mineralogical Record. This will be a regular feature if only more such sketches are received. Ed.

THE GUNNELL CRYSTAL COLLECTIONS

by Robert W. Jones
3520 N. Rose Circle Drive,
Scottsdale, Arizona 85251

Figure 1. **A youthful and jaunty Mike Gunnell, originator of the Gunnell Comparative and Descriptive Crystal Sets.**

Not long ago I came across a decidedly interesting learning aid in the field of crystallography. I recalled having seen a *Gunnell Comparative Crystal Collection* years ago (at Scott William's mineral shop) but had forgotten about it. Seeing one recently reminded me how good they really are for an interested amateur bent on studying crystal form and systems. I checked with E. M. (Mike) Gunnell and he had no objection to my describing his collections in hopes the effort might help some people to develop their own. The cost of crystals today and the difficulty in getting them has put a crimp in Mike's business of supplying these collections, especially to the larger schools and universities, and interested individuals. With some forethought Mike did stockpile enough material so he can still offer a few sets but he no longer is able to serve as a broad source for comparative and descriptive material.

Just what are comparative and descriptive collections? In a nutshell, they are sets of crystals, usually singles without matrix, which represent all of the crystal systems and many of the common classes of symmetry one might encounter in collecting and studying, whether at home or in the field. These were designed as a direct visual aid to learning crystallography—showing faces, habits, and the several forms most commonly found with minerals crystallizing in each of the six systems. The major difference between "comparative" and "descriptive" is that the comparative sets Mike made have the faces of each crystal inscribed in India or white ink with the most commonly used form notations from such standard textbooks as Kraus, Hunt, and Ramsdell's *Mineralogy*, and Hurlbut's *Dana's Manual of Mineralogy*. Anyone using one of Mike's comparative collections with these books can easily develop a feel for crystallography by actual experience with specimens. The descriptive collections do not have the form notations, serving instead as examples to be studied in association with the text pictures and the written descriptions supplied by Gunnell. Both types of collections have an identification key which is an important reference to be used in conjunction with the crystal set.

Since some readers may have used these collections while others are totally unfamiliar with them, a brief history of how they were developed might be of interest.

When Mike was doing undergraduate work at Knox College, Galesburg, Illinois, in the 1920's, he acquired a set of paper "Patterns for the Construction of Crystal Models" by Frank Smithson, London. These patterns were published by Thomas Murby and Company, London, and Van Nostrand, New York. There were thirty six patterns to be cut out and glued together, each representing the crystal forms of some mineral. Miller indices and the mineral name were imprinted thereon. The disadvantages to "cut and paste" are as obvious as the fragile state of any paper model. The later "Three Dimensional Models of the Basic Crystal Forms Construction Kit" by Arthur Gude of Golden, Colorado, followed the same concept as the Smithson set. When Mike studied under Drs. Kraus, Hunt, and Ramsdell at the University of Michigan in the early 1930's he encountered the well known Krantz pear wood crystal models, still in use today. Mike realized that someone would eventually recognize that paper and wooden models have their limitations and the "natural way" to learn crystal forms, actually using real crystals, would be best, in spite of minor imperfections in the crystals. The realism offered by such a collection would more than offset such imperfections and distortions and would, in fact, give the student a more direct approach to crystal study. Mike doesn't know if he was first to market natural crystal sets with form notations as a study aid, but he has done it successfully for over twenty five years and that is notable.

His first collections were marketed in 1944. They were the comparative set only, consisting of twenty crystals with form notations and identification key. These were unique at the time. He followed later with the descriptive set, purposely omitting the form notations. He felt this work could be left to the student as a learning aid. The descriptive collections were not unique, since at least one science supply house was then marketing similar materal. Thus his early offerings were limited in variety but as interest grew he was able to offer a greater selection of sets. The smaller sets were made up of twenty to thirty-five individual crystals. The more extensive sets offered contained sixty properly notated crystals. In all, Mike developed ten different comparative and descriptive collections by the year 1955. At that time it was still possible to get large numbers of crystals of excellent form to an inch or more in size so that having suitable material for each collection was no problem. By contrast, the severely limited sources of today and the great increase in value of specimen material the entire hobby has experienced in recent years places severe limits on the availability of crystals for collectors. Mike still makes up special collections when called on to do so, within the limits of available material.

Regardless of the type or size collection Mike assembled the same philosophy prevailed. Mike says, "My goal has been to offer a product that might promote greater, more generally acceptable appreciation among mineral collectors of the practical, usable value of some understanding and knowledge of some of the basic principles of geometric crystallography.....". Other goals he incorporated into the collections support this main objective. The collections were to include examples of all six crystal systems, and provide crystals of both simple and complex forms, including examples of twinning and pseudomorphism. This was done with attractive and colorful crystals of better than average quality. Insofar as was possible, the commonly encountered minerals were well represented. Should you attempt to develop your own set of properly notated single crystals for study these goals should be adopted and followed.

What made the Gunnell collections outstanding was that they were, in effect, hand made with each in some way uniquely different from all the others. The species he used varied with supplies and the crystal notations depended upon which crystals were included. However, quality consistency was achieved by using the aforementioned texts as a guide. In addition, Mike maintained and used a large comprehensive reference collection of crystals he had developed for that purpose, a collection he still uses today. As a result, he was always able to guar-

A
COMPARATIVE COLLECTION
of
NATURAL CRYSTALS
of
VARIOUS MINERALS
ILLUSTRATING
THEIR CHARACTERISTIC
CRYSTAL SHAPES

"*Just As Nature Makes Them*"

To aid the mineral collector in identifying
natural crystals he finds in field,
quarry, mine or mountain.

By E. MITCHELL GUNNELL
Denver, Colorado

Figure 2. **Box label inside the lid of the "Comparative Collection".**

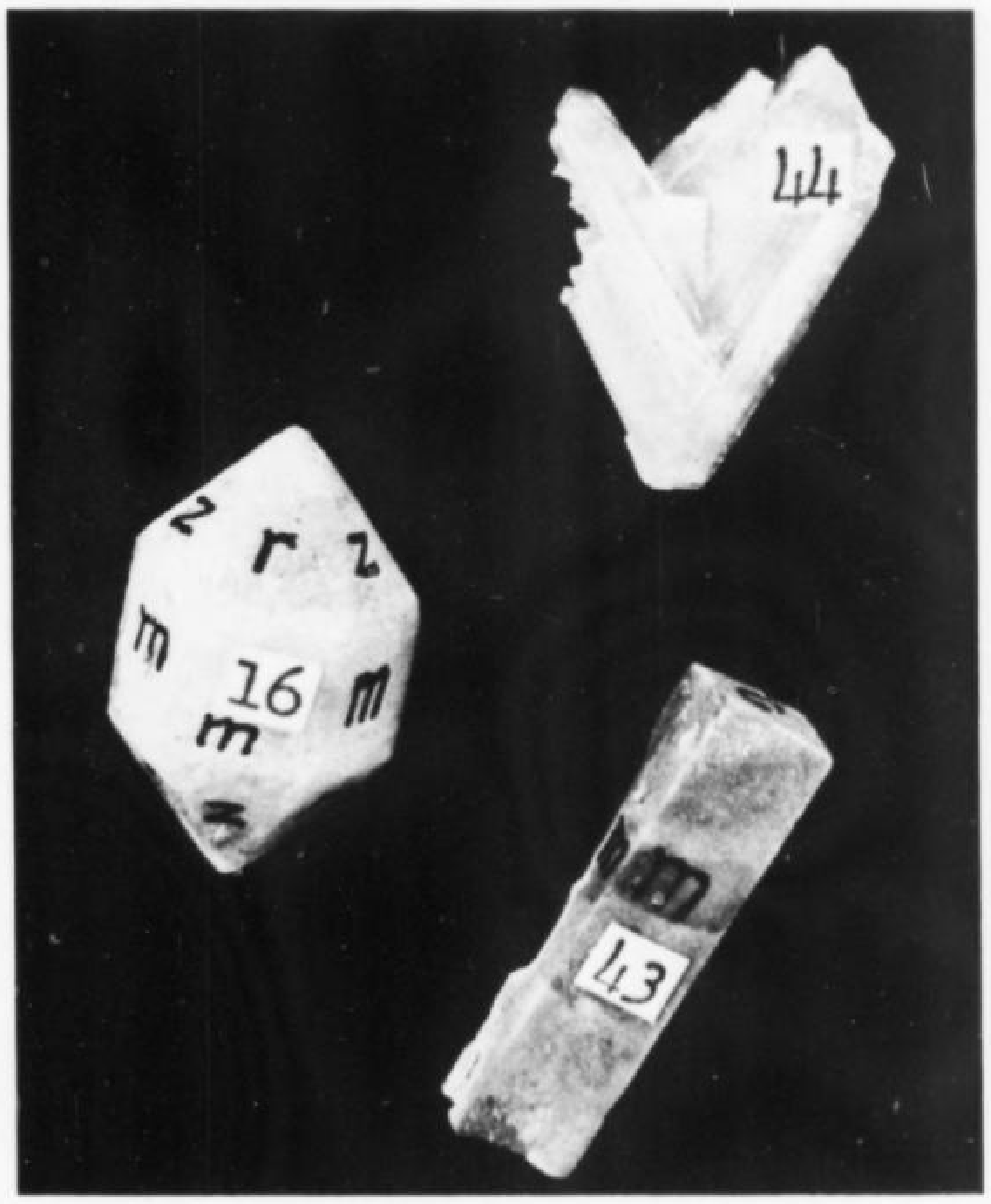


Figure 3. **Fine crystals in their own right, these three beauties are from a Gunnel Set. Clockwise they are: twinned cerussite (44), cerussite from Mexico (43), and quartz, New Mexico (16).**

antee each individual collection for accuracy regardless of the variations in crystals used from unit to unit.

How might an individual develop his own comparative or descriptive crystal set today? To guide the reader in this endeavor we thought it best to ask Mr. Gunnell to make some helpful suggestions, which he was glad to do, as follows:

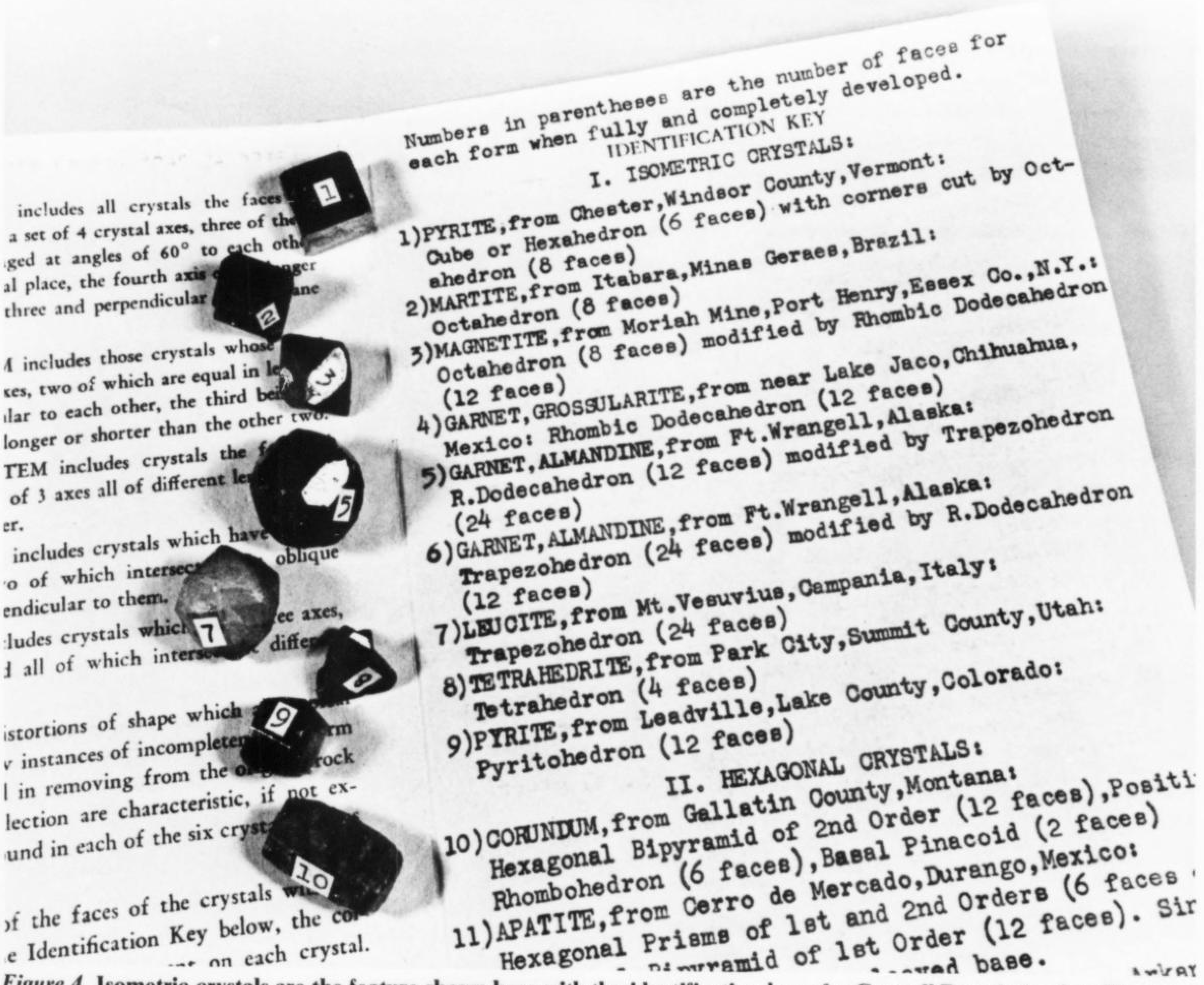
1) To produce a quality set for educational use, be prepared to put into it many long hours of work that is often frustrating, eye straining, and tedious. Perserverence in your efforts is essential, however, even if it requires several years to complete the project.

2) If you do not presently possess sufficient, small, quite perfect loose crystals of all types—simple forms, combinations of forms, twins, pseudomorphs—and belonging in all six crystal systems, that you can aggregate into as good a crystal form set as you may want, you must seek them out by purchase or trade. Often good singles can be removed from previously damaged groups of low value. Your set should contain at least twenty crystals to start, more being preferable as this will increase comprehension. Do not hesitate to add several crystals of the same mineral to illustrate various forms and combinations of forms.

3) A sturdy compartmented box of wood or cardboard is necessary, with compartments padded and somewhat larger than the crystals you intend to put in them. Keeping your crystal set thusly will protect it while allowing portability of the entire set.

4) In any crystal set, uniformity of size of crystals is recommended. One that contains crystals of many sizes, from very tiny to very large, is not attractive. Moreover, the larger crystals might not fit the compartmented box properly while the very tiny ones would seem lost. It may also be impossible to properly letter the notations on faces of extremely small crystals. By experience I have learned, and recommend, using crystals of from 3/4ths to one inch in size as best.

5) When selecting crystals be sure to acquire those that are completely developed, or nearly so, when possible, show little distortion, and have smooth lustrous faces. Today the prices asked for many crystals are discour-



includes all crystals the faces
a set of 4 crystal axes, three of th
ged at angles of 60° to each oth
al place, the fourth axis
three and perpendicular

includes those crystals whose
xes, two of which are equal in le
lar to each other, the third be
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on each crystal.

Numbers in parentheses are the number of faces for each form when fully and completely developed.

IDENTIFICATION KEY

IDENTIFICATION CRYSTALS:

I. ISOMETRIC CRYSTALS:

1)PYRITE,from Chester,Windsor County,Vermont: Cube or Hexahedron (6 faces) with corners cut by Octahedron (8 faces)

2)MARTITE,from Itabara,Minas Geraes,Brazil: Octahedron (8 faces)

3)MAGNETITE,from Moriah Mine,Port Henry,Essex Co.,N.Y.: Octahedron (8 faces) modified by Rhombic Dodecahedron (12 faces)

4)GARNET,GROSSULARITE,from near Lake Jaco,Chihuahua, Mexico: Rhombic Dodecahedron (12 faces)

5)GARNET,ALMANDINE,from Ft.Wrangell,Alaska: R.Dodecahedron (12 faces) modified by Trapezohedron (24 faces)

6)GARNET,ALMANDINE,from Ft.Wrangell,Alaska: Trapezohedron (24 faces) modified by R.Dodecahedron (12 faces)

7)LEUCITE,from Mt.Vesuvius,Campania,Italy: Trapezohedron (24 faces)

8)TETRAHEDRITE,from Park City,Summit County,Utah: Tetrahedron (4 faces)

9)PYRITE,from Leadville,Lake County,Colorado: Pyritohedron (12 faces)

II. HEXAGONAL CRYSTALS:

10)CORUNDUM,from Gallatin County,Montana: Hexagonal Bipyramid of 2nd Order (12 faces),Positi Rhombohedron (6 faces),Basal Pinacoid (2 faces)

11)APATITE,from Cerro de Mercado,Durango,Mexico: Hexagonal Prisms of 1st and 2nd Orders (6 faces Hexagonal Bipyramid of 1st Order (12 faces). Sir base.

Figure 4. **Isometric crystals are the feature shown here with the identification key of a Gunnell Descriptive Set. The interloper at the bottom is a hexagonal corundum from Montana.**

agingly high. Nevertheless, you may consider that some you must buy are so essential for your set that you will be willing to pay their cost. To exemplify, I bought 3/4ths inch Red Cloud wulfenite crystals in the 1940's and 50's for a few dollars each, using them in many crystal collections as representative of a tetragonal symmetry class. Today if one can even find good crystals, it will cost very dearly. Nonetheless, the particular crystal is so perfect for a forms suite that you may find it necessary to acquire in spite of price.

6) You will find it best to put facial letters on black or dark colored crystals with white drawing ink; while on colorless, white, or light colored crystals black drawing ink stands out best. After drying, coat the inked notations with thin acrylic lacquer, using a camel's hair artist's brush. For removal, acetone (nail polish remover) may be used.

7) With sufficient knowledge and skill Miller indices can be included on your crystal faces. They are, however, not necessary and were left off the Gunnell crystal collections as being a complication. They are, at first, beyond the capabilities of the beginning collector. The use of facial notations is more desirable and recommended. Correct letter designations for the common crystals are available in standard texts as are indices, which may be added as your skill with a goniometer becomes proficient.

The author realizes that this article is not an exhaustive treatment of the subject. But it does, he hopes, suggest a mechanism for interested amateurs to expand their horizons in crystallography study. As development of such a study device proceeds, questions will certainly arise. It is suggested that you direct questions to Mr. E. M. Gunnell, 3365 E. Kentucky Ave., Denver, Colorado 80209. He has agreed to place his years of experience in such matters at your disposal. May I suggest you enclose a self-addressed envelope for his convenience.

The author is indebted to Mr. Gunnell for his hours of correspondence, which was a great help in developing this article. We are also indebted to Keith Hodson, Scottsdale, Arizona for the loan of his Gunnell crystal collections used as subjects for the accompanying photographs taken by Jeff Kurtzeman, Phoenix, Arizona.

Figure 5. **With faces identified by letter, these four crystals would serve as study pieces. They are: garnet (5), quartz (17), twinned staurolite (47) and orthoclase (55).**

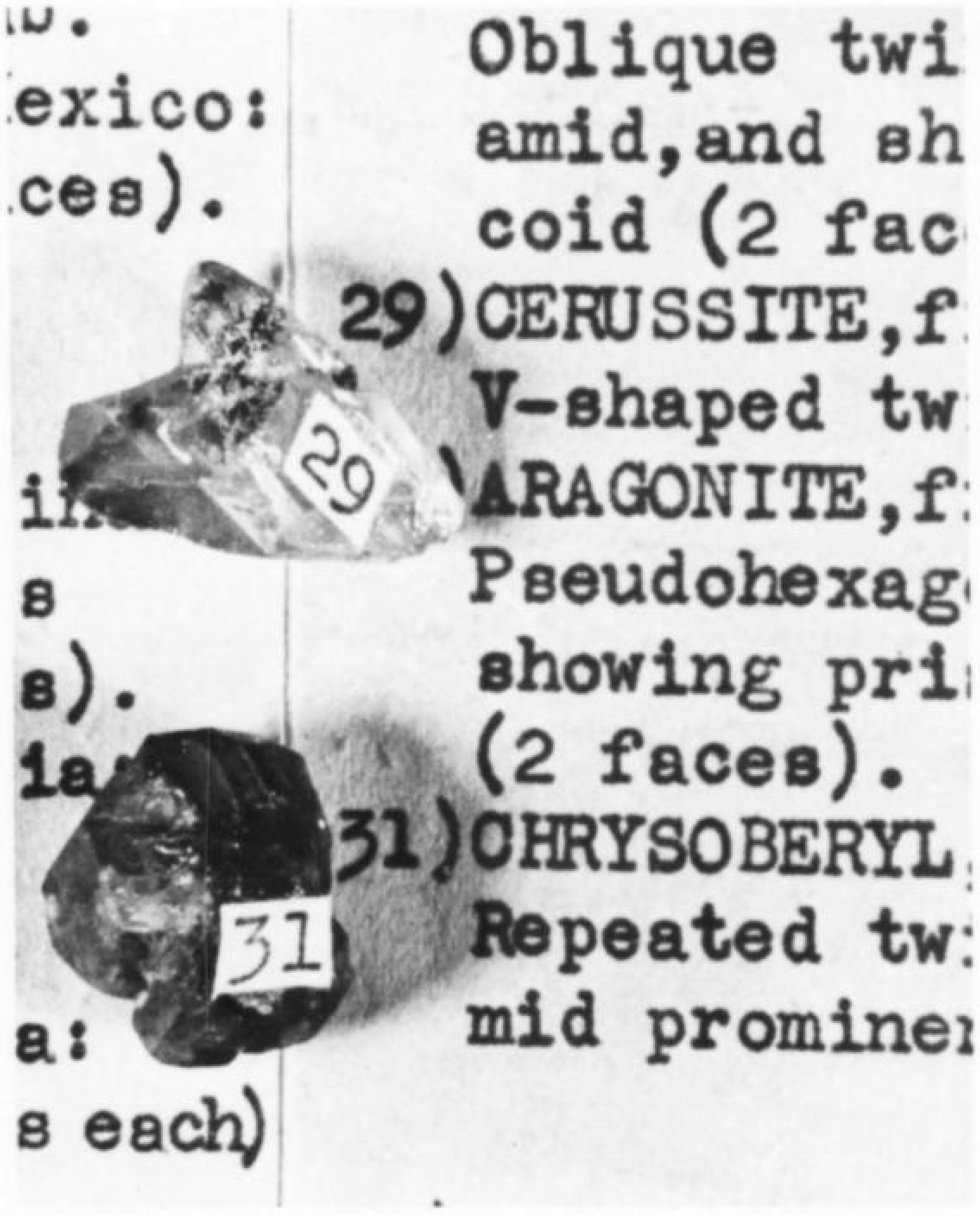

Figure 6. **The identification key from a Gunnell Descriptive Set forms the background for two thumbnails of cerussite and chrysoberyl.**

Some Random Remarks About Collecting And Collectors


drawing by Dale Anderson

Caricature of Russel P. McFall as a mineral collector in the field.

by Russel P. McFall
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FRESNO, CALIF. 93704

Over 55 years of collecting minerals and associating with other collectors in all their infinite variety, I have frequently been asked what kind of people collect and why they do and what they do with their collections. Sometimes the questions were well meant, sometimes not.

Several years ago a golfer to whom I had just been introduced abruptly asked: "Tell me, why does my wife want to collect crystals?" We were standing in the bright warm January sunshine of Thousand Palms, California, where I had gone with a mutual friend to see her collection. I replied that possibly she found it more fun to pursue a new crystal specimen than a golf ball.

I might have quoted Arnold Bennett, the eminent British novelist, who once wrote: "Collecting is a world habit. Collectors practice it consciously, with a definite, recognized aim. The rest of us practice it more or less consciously."

A convenient and perhaps psychologically correct assumption explains the collecting hobby as a manifestation of the instinct to survive, an instinct that man shares with other animals to gather food and other necessities against the coming of winter or a time of scarcity. Lewis Mumford, scholar, critic and student of man, put this in one sentence: "Granary, bin and cellar are village prototypes of library, archive, museum and vault."

Like the use of alcohol, this instinct to gather and preserve is obviously suppressed in many people, such as the total abstainers who boast that they do not "collect", or it may become a disease in those who can't leave collecting alone.

Catherine the Great, empress of Russia, who collected paintings, gems and young men, once cried: "It is not love of art; it is voracity. I am not a connoisseur; I am a glutton."

More single-minded but just as intemperate was the Colorado collector whose house I had to enter by the back door because he had allowed the front porch steps to rot away in his zeal to complete a magnificent collection of crystals.

More catholic, but as unreasonable in his tastes, was the Illinoisan, a bachelor, of course, who once told me that he collected in 110 different categories. Whether his categories included one reported by Cecil R. Munsey Jr., a writer on collecting hobbies, I do not know. Munsey's prize example collected woodpecker holes.

Accumulation of objects itself is not collecting, even when the accumulation consists of minerals gathered entirely for scientific purposes, or for financial speculation, although both motives can coexist with the spirit of true collecting.

In their book, *Lock, Stock and Barrel*, Douglas and Elizabeth Rigby defined this activity as "the intentional and selective gathering of related objects which, when assembled, form a uniform and meaningful entity."

An entity is something organized for a single purpose or with a single theme, such as a collection of the minerals of the Mammoth mine at Tiger, Ariz., or wulfenites from all known sources, or even an attempt to have representatives of all known minerals as a well known lawyer and several micromounters have done.

And to whom shall the entity be meaningful? Certainly to the collector, who may be trying to get minerals from all Dana locations, or a suite of calcite crystal habits. And meaningful to show judges, to the people who view it, and perhaps even to the collector's family. And it must be meaningful if it is to retain its intrinsic value or perhaps some day be a museum memorial to the donor.

For some happy souls, and they have their place even if not among collectors, accumulation is enough. As one told me, "For us, there is just one thing we do with our rocks. We look at them and enjoy them," "them" being a bottle of black sand, a slab of fossils, an ore sample, a splinter of marble supposedly brought back by grandpa from the Acropolis, and a beach pebble.

Such people have the spirit but not the content of a true collecting hobby. For, in essence, collecting is a hobby, an interest set apart from that of the day's work, a leisure hour activity that has meaning and fills the hours with joy and satisfaction. The nature of such an activity will depend, of course, on the individual collector's taste, background and circumstances.

Fortunately, the earth science hobbies, including as they do mineral, gem and fossil collecting, geology, lapidary and jewelry work, are broad enough to include a wide spectrum of temperaments and to encourage growth of interest, skill and knowledge as well as the social pleasures of association with like-minded people.

In his amusing and irreverent book, *The Collectors*, Philippe Jullian writes: "The passion which excites emulation and allows people to singularize themselves while remaining within the framework of morality and social organization is collecting. It encourages the ambition and flights of fancy refused us by a society in which all spirit of enterprise is limited to the office and all ideas are provided by the television. Above all, it helps to pass the time that people do not know what to do with, once their work is over. And, at the office, the clerk dreams of a Holy Grail of postage-stamps or tin soldiers, and the banker of a library brimming with incunabula or a gallery covered with Royal Academicians."

Jullian is of the opinion that the best collections are formed between the ages of 30 and 60, "the age when people found fortunes and reputation," even though they may have carried over their interest from childhood. It is probably true that in the years of maturity, the collector wakens, as the Rigbys put it, "to the sudden realization that he has, without intent, become a collector." It may have been picking up a pebble on the beach, as the founder of the Kraft company did, or picking up a bargain piece of jade to cut up for lapidary work that led the founder of the Lizzadro museum to collect, or a casual field trip with his son's geology class that led a member of the Funk seed corn family into starting a mineral museum. Most boys and girls, and later as men and women, pick up a colorful pebble now and then, but whether that incident leads on to systematic collecting depends on whether the spirit of the collector is rampant in the individual.

There are shining examples, however, on the geology and geophysics faculties of Harvard and the University of Chicago, on the staffs of several state geological surveys, and in the ranks of dealers and minerals consultants that come instantly to mind of men who did not wait for middle life to make their mark as collectors.

Despite such examples, and they are many, it has been my experience that many successful businessmen are attracted to mineral collecting late in life by its aesthetic appeal, and what better way is there than to open the door to the hobby with a golden key. A handsome crocoite, a swirling patterned malachite or a superb tourmaline—they speak for themselves of the beauty of Mother Nature's handiwork, especially to those who can afford them.

An Oklahoma collector illustrated this well as he was showing a costly dioptase group to some friends. One asked, "Why do you handle it so carefully; what good is it?" to which the collector merely replied, "You look at it."

If such a collector applies himself to his hobby with the energy he put into his business, he will in time derive from it the added pleasure of learning where his treasures came from and where they belong in the scheme of things.

Aesthetic satisfaction is one of the primary values of mineral and gem collecting, but to the serious student of mineralogy the hobby reveals an even greater beauty—that of the orderliness of crystal structure and the infinite variety within the mineral kingdom. Thus his collection opens up to him a whole new world to enjoy as he conquers it.

The micromounter is especially privileged in this respect. His minute specimens, obtainable at reasonable cost and easily stored, reveal crystal perfection in all its complexity of shape, color and mineral associations, and challenge his ingenuity and knowledge with problems of identification. He also, like the lapidary, enjoys a delicate craft, that of preparing his mineral crumbs for the microscope, and the possibility, perhaps once in a lifetime, of seeing a hitherto unknown mineral before his eyes.

Besides the collector roused by beauty and the one deep in study, there is a third type of collector, the systematic temperament with a driving impulse to assemble all possible examples of one mineral, such as fluorite or calcite or the barites I love so well; examples of all minerals from one locality, such as my favorites, the Michigan copper mines, or examples of the whole range of the mineral kingdom. Most collectors of this type started young in life and have built up their collections over a long stretch of years. Some have had the advantage of being associated in some way with mines or an industry which gave them unusual opportunities to collect. For instance, most of the major collections of the Franklin, New Jersey, minerals were obtained in this way.

Across the United States there must be several thousand well-housed, well-catalogued, well-cared-for private collections which ably represent the wide dimensions of mineral collecting and the skill, knowledge and solid investment of time and money of their owners. I have often been surprised to find such a collection where I had never suspected one existed.

In *The Collector*, Jullian remarks, with some hint of sarcasm, that "every collection is inspired by the same basic factors: fear of boredom, desire for immortality, aesthetic sensibility, vanity, or speculation." He was speaking primarily about art collectors so that he illustrated his remark by saying that "these days Rothschild stands less for business concerns, jewels and property than for Rembrandts, Watteaus and Sevres."

"Old men," he writes, "unburdened of business cares... their children married off—become, in sum, bachelors and men of means, the collector's ideal state," but, he warns, some collectors "stay mentally fixed at the age they began collecting, and we shall find children's collections continued into old age."

Pride in having exceptional specimens, the distinction of being recognized as an authority, are vanities often discernable in collectors, but fortunately they are usually byproducts of the enthusiasm of the hobby rather than the motives for pursuing it. Similarly, the desire to form a monument in some museum to the collector's name is rarely a goal; it is a consequence of having to terminate the activity that formed the collection.

Speculation, however, is another matter. "Any good collector knows," write the Rigsbys, "that if he creates an excellent collection, one not too greatly based on a momentary fad or fashion, he is likely to have something that will retain much of its value even in bad times."

What they are saying is that the value grows out of the collecting, not the opposite. The collector's knowledge and zeal are the elements that add a financial increment to the more intangible rewards of pleasure in their exercise.

At the present time colored gems, like gold, have been driven to unexampled heights by scarcity and the traditional use of them as a hedge against inflation and disorder. High prices have likewise brought a great many classic mineral specimens to the market out of museums and private collections. Whether this is a healthy market for him each collector must decide for himself.

"Taste," wrote the French philosopher Montesquieu," is the aptitude to discover rapidly the amount of pleasure each thing can cause in men." A mineral specimen that is reasonably perfect, pleasing in form and color, well positioned and representative of its species, will almost always be a good investment. E. Mitchell Gunnell, the noted Denver mineral dealer, advises against buying "beaten-up" specimens, but he admits that in his many years of owning, selling and handling specimens, he has seen few absolutely perfect pieces. The demand for perfection, he says, must be tempered to the rarity, age, history and other attributes that limit perfection. "For many specimens," he writes, "are unique for one reason or another, and 'irreplaceable' in the sense that a second opportunity to acquire one may never again be presented."

Further sound advice is given by the November 1935 issue of *Ward's Mineral Bulletin*. It is natural for a boy or girl to begin collecting with any kind of material, it says, but as the collector grows in years and experience he should weed out all except his best examples and confine his future purchases to specimens of excellent crystallization, good color and preferably on matrix, which, it says, "constitute a safe investment in days of uncertain financial return."

Forty years ago Ward's Natural Science Establishment was advising the collector to acquire large specimens. Today it undoubtedly would fall in with the trend toward thumbnails, miniatures and small cabinet pieces.

In its indorsement of quality collecting. Ward's bulletin cites the role of private collectors in creating the exhibits in major museums. "Take a look at the label cards in one of our great public or university mineral collections. A little search will bring to light that whole sections of the display were once privately owned and were acquired by the museum either through donation or purchase. Often the private collection has formed a nucleus around which the institution has gathered extensive and systematic exhibits."

And it is true that to the zeal of collectors museums, libraries and research institutions owe many of their most precious holdings. To study a writer, the scholar must have access to his writings; to study minerals with the sophisticated tools of modern science the crystallographer and mineralogist must have suites of specimens and precise record about them. The names of Canfield, Vaux, Roebling, Kunz and many others are remembered for their contributions in this form.

But the true collector is not, and should not be, motivated by the needs of posterity and science. He collects for a more personal reason, his own enjoyment, and ownership is one strong element in it. "In every form of collecting," write the Rigbys, "ownership is an essential part of the pattern. The joy of standing before one's accumulated pile and being able to say 'This belongs to me,' is the culmination of the feeling that begins with ownership of the first item."

Arnold Bennett put it more succinctly: "The collector has a museum of his own, and he is the curator."

But there comes a time when limitations of space or age or death bring the curator's career to an end. What then? Shall the collection be passed down in the family, and that is an ideal solution if there are eager collectors in the next generation? Shall it be dispersed by sale, or given to a museum or university in the collector's name, perhaps to reduce the inheritance tax on his estate?

As letters to *The Mineralogical Record* make plain this is not an easy choice. On the one hand is the position taken by A. Edward Newton, the eminent book collector, who specified: "My wish is that my drawings, my prints, my curiosities, my books...shall all be dispersed under the hammer of the auctioneer, so that the pleasure which the acquiring of each one of them has given me shall be given again, in each case, to some inheritor of my taste."

Nearly a century before, Edmond de Goncourt, 19th Century French novelist, had made a similar testimony in his will, which directed that "all my objects or art... which have lent happiness to my life shall not go to the icy tomb of a museum," but should be auctioned off so that other collectors might have the joy of owning them.

Citing this in *The Mineralogical Record*, John Sinkankas sensibly suggested that unique mineral specimens should be placed in a "responsible" museum, but that most collections have little value to a major museum except to be used as trading material with other museums.

In making the decision each collector must weigh Newton's advice, and decide whether his collection contains much of museum and research library quality, and recognize that many museums and universities are careless about the care and the use made of their specimens, and few of them will agree to keep together a donated collection.

One disposition of a collection, that of Max Hillmer of a western Chicago area suburb, compromised several of these conflicting sentiments. His family was not deeply interested in minerals and had no space to keep the collection or the knowledge to maintain it. Consequently in his will Hillmer left some large specimens to the Lizzadro Museum of Lapidary Art in nearby Elmhurst, and some to the excellently-administered Jones collection in Heidelberg college, Tiffin, Ohio, along with his specimen cases. The residue was left to his club, the Earth Science Club of Northern Illinois, for sale at its annual auctions. The will also specified that he was placing no limitations on the sales or restrictions on exhibition of the material.

Carlyle, I believe, once said that the healthy state is the unconscious one; that we rationalize about an activity or condition only when it is in a declining state. But mineral collecting obviously is not in that state, despite these random remarks derived from a long experience and much reading. Let us hope it never will lose its charm.

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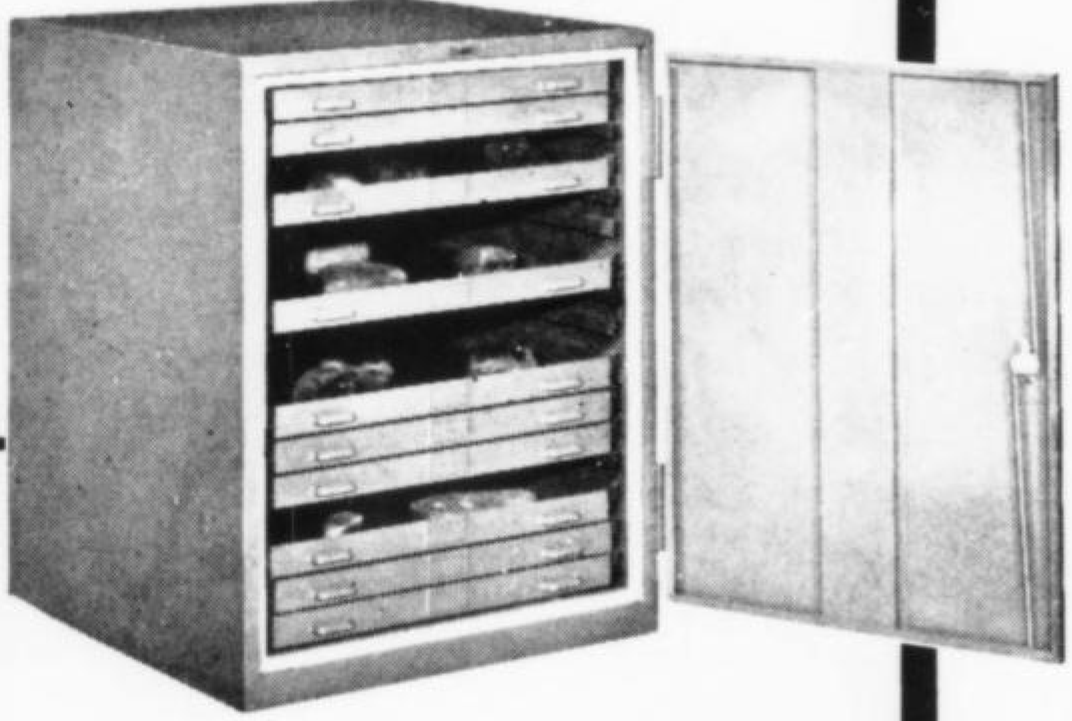

New Barite Find in Southern Illinois

by John Carlon, **Curator, Illinois State Mineral Museums, Illinois State University, Normal, Illinois**
and James R. Winchell, **5332 Canada Vista Place, N.W., Albuquerque, New Mexico 87120**

Barite occurs sporadically throughout the fluorspar mining district of southern Illinois. This well-known mining area, noteworthy for its fine fluorite and other outstanding specimens, lies at the southeastern tip of the state and embraces the counties of Pope, Galantin, Saline, and Hardin.

Although barite specimens from this area have long been known, these familiar crystals have been rather small, up to one inch in size and usually of the clear, white, grey, or blue variety in color. However, a spectacular find of large, tabular, straw-yellow crystals was recently uncovered.

In August of 1974 a work crew was blasting an area for an underground tool shop at the 350 foot level adjacent to the main fluorite ore body at the Gaskin mine in Pope County, Illinois. The following morning another crew, clearing the debris from the previous night's explosions, discovered a small cavity about ten feet in length and two feet in height. The greater portion of this pocket was lined with fluorite cubes three to five inches on edge. Toward the center of the pocket occasional bright straw-yellow tabular barite crystals about one to one and one-half inches in size began to appear on the fluorite. These barite crystals increased in number and size until at the extreme end of the pocket the fluorite was almost completely covered with large barite crystals. At this end of the cavity some of the tabular crystals measured three and one-half inches across, four inches in length, and as much as one inch in thickness.

The most outstanding specimen from this pocket was a crown of straw-yellow barite crystals on a base of blue-

Figure 1. **Barite with fluorite, Gaskin mine, Illinois. Specimen approximately 7 x 6 x 5 inches. Funk Gem and Mineral Museum, Illinois State University. Photo by Barry Moore.**

Figure 2. **Barite with fluorite, Gaskin mine, Illinois. Closer view of specimen in Fig. 1. The fluorite was backlighted with incandescent light. Photo by Barry Moore.**

purple fluorite cubes. The specimen is in excess of seven inches in length, six inches in width, and five inches in height. The individual barite crystals on this piece measure two to two and one-half inches across, three to three and one-half inches in length and up to five-eights of an inch in thickness. The orthorhombic crystals occur tabular on {001}, and have a bright mirror finish. This specimen had been attached to the roof of the cavity and had been dislodged by the discharge of the explosives in the blasting operation. Fortunately it dropped undamaged to the floor of the cavity.

This golden crown of barite on fluorite eventually was purchased by J. L. Wroan and was first exhibited publically at the 1975 Tucson Gem and Mineral Show in Tucson, Arizona. It will be housed at the University Museum's Funk Gem and Mineral Museum, Illinois State University, Normal, Illinois, which is presently in the process of reorganizing and redesigning its mineral displays. It is the intention of the university to develop a regional museum of midwestern specimens with special emphasis on minerals from the State of Illinois.

White and grey being the predominant colors, barite can also be found in various shades of yellow, reddish-brown, and blue as well as in clear transparent crystals.

Some of the barite crystals found in this area exhibit the unique property of photosensitivity. Upon exposure to ultra-violet light, various changes occur including a change in color. This color change is generally from white to blue or blue-grey, but certain of the recent find of straw-yellow crystals from the Gaskin mine also possess this property and will change in color to a less aesthetic greyish-green. Exposed to direct sunlight this change will occur in a matter of a few hours. For this reason, barite crystals which are photosensitive should be protected with ultra-violet filters to perserve their original color.

In this locality barite frequently occurs near or adjacent to the margins of the main ore body (Bradbury, 1959). This appears to be the case with this new occurrence which was in limestone near the main fluorite ore body.

Barite is often found as a coating of small crystals on fluorite, calcite, sphalerite, and other minerals of the area. These crystals are generally small, however crystals up to one inch in size are not uncommon. In the West Green mine (North Green shaft) well-developed crystals have been known to reach as much as four inches in length.

Although barite is reguarly distributed throughout the area, the quantity varies considerably from mine to mine and from one level to another in any particular shaft. Since it is seldom found below the 400 foot level, the abundance of barite crystals has steadily decreased as a result of deeper mining operations.

These deposits, having long been known, are of little commercial value. J. C. Bradbury (1959), geologist with the Illinois Geological Survey, states that the only commercial barite mine of the district was the Little Jean barite mine which operated from 1918 to 1922 in Pope County on the southern edge of the district near Golconda. This mine, which ran to a depth of only 75 feet, contained a vein deposit approximately 75 feet in length. Bradbury further suggests that commercial mining of barite might have been possible at some mines such as the Minerva mine #1 except for the presence of witherite. Witherite ($BaCO_3$) is extremely difficult to separate from the barite ($BaSO_4$), making commercial mining of barite impractical.

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The Uranium-Vanadium Deposit of Mounana, Gabon

by F. Cesbron and P. Bariand
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INTRODUCTION

The uranium-vanadium deposit of Mounana, in the province of Haut-Ogoué, Gabon, is situated on the road from Franceville to Lastourville, approximately 25 km north of the important manganese deposit of Moanda. It was discovered in December, 1956, by N. Morin and J. Lecomte, geologists of the French "Commissariat a l'Energie Atomique" (C.E.A.). It occurs in Francevillian sandstones and mining by open pit started in 1961 with the "Compagnie des Mines d'Uranium de Franceville" (COMUF).

The ore is treated on the spot, the uranium being dissolved by sulfuric acid (this acid is locally produced), then precipitated as magnesium uranate. This product is shipped to France where metallurgical processing gives uranium metal ingots weighing about 200 kg each.

GEOLOGY

The Francevillian series, which underlies the basin of the upper Ogoue valley, is Precambrian. It is a very thick series and accurate stratigraphic mapping is difficult because outcrops are rather scarce. The area is gently rolling (average elevation 500 m) and covered by laterite on which grow tall grass, shrubs and scrub trees (savannah); dense jungle growth occupies every drainage. In these drainages are found the best outcrops and geologists follow them in the course of prospecting.

Some cliffs, however, afford interesting places for observation of the different Francevillian beds; these are coarse, arkosic, argillaceous or psammitic sandstones, pelites, jaspers, rhyolitic tuffs, schists and some conglomerates, all of them in nearly horizontal beds (F. Weber, 1969).

Manganiferous beds (oxides and hydroxides), interbedded in pelites, can locally reach an average thickness of 5 m and constitute very important deposits, as at Moanda, worked by the "Compagnie Minière de l'Ogoué" (COMILOG).

The Mounana deposit forms a fault wedge in sub-vertical coarse sandstones of the lower Francevillian (FA) (Middle Precambrian: about 1740 M.Y.) in the hanging wall of a nearby vertical fault (f_1) with a NNW direction. This fault puts the sandstones in contact with the Chaillu anatectic granite (Fig. 1). Two other faults (f_2 and f_3) separate this wedge from pelitic sandstones belonging to the Middle Francevillian (FB). These beds are near-vertical near the fault f_3 but quickly resume a nearly horizontal attitude toward the northeast (Des Ligneris and Bernazeaud, 1960).

Mineralization is thus controlled on one hand by the wedge structure of the faults (Fig. 2), on the other hand by the lithology, the uranium occurring mainly in coarse sandstones (FA) usually bounded by fine sericitic sandstone beds. The pelitic sandstones (FB) are devoid of mineralization.

The deposit is about 140 m long, with a maxmum width of 40 m, and 150 m deep. It was worked by open pit to the 70 m level and then by underground mining. Later, other mineralized pods of less importance were opened near the main mine, particularly the Oklo mine, some very rich parts of which behaved as fossil natural nuclear reactors (the water in the porous sandstone acting as a neutron moderator) with a resulting impoverishment of the U^{235} isotope and a U^{235}/U^{238} ratio lower than usually expected; it was routine analysis of this ratio which attracted attention to this deposit.

MINERALOGY

The Mounana deposit shows two distinct zones: a) the deep zone called "black-ore zone", where uranium and vanadium are in their lower valencies and form different minerals. There is, in addition, a very rich vanadium pillar in the middle of the deposit where oxides and hydroxides of this element are present, sometimes very abundantly.

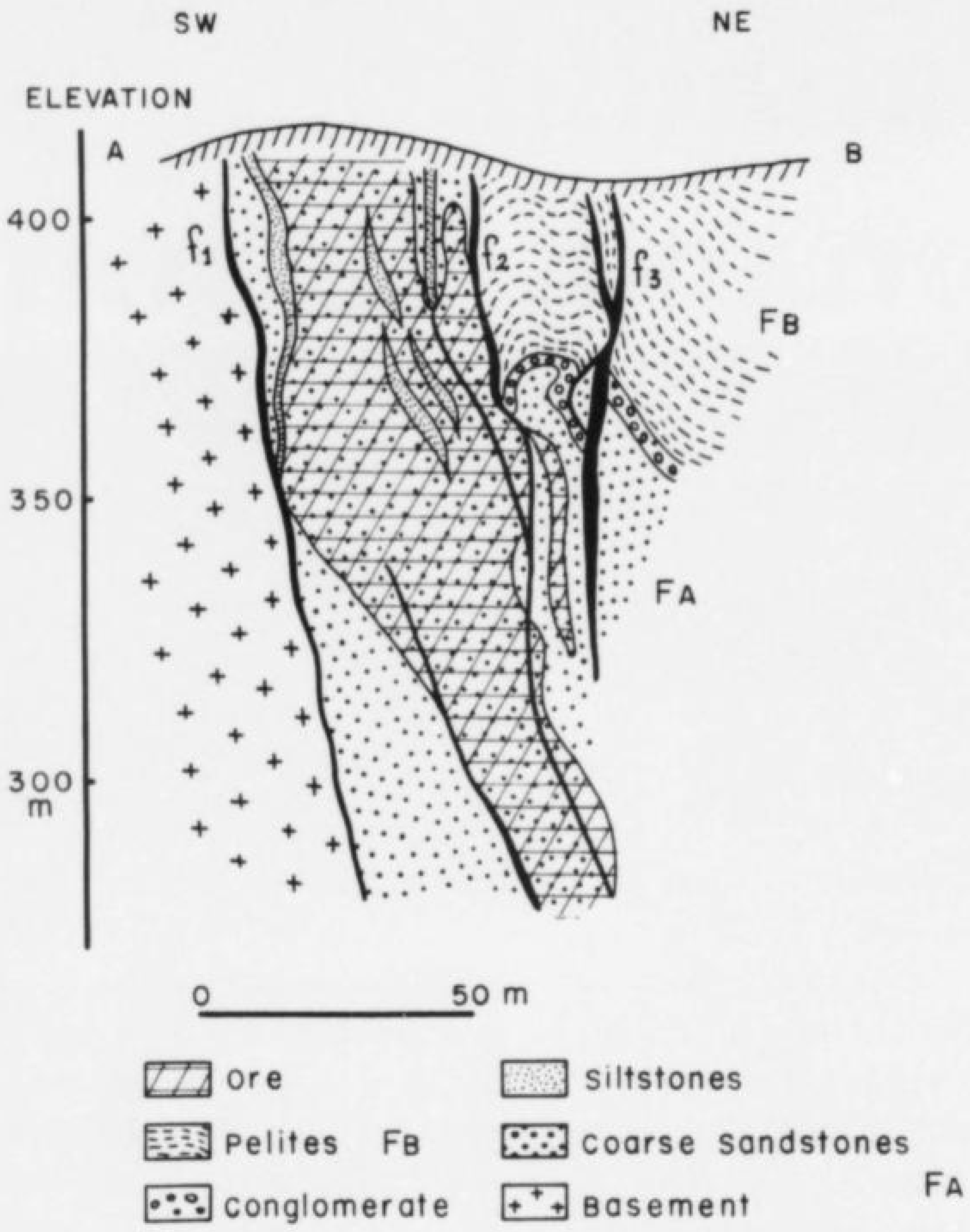


Figure 1. **Idealized cross-section of the Mounana deposit. (from F. Weber)**

Figure 2. **Location of the mineralization (cross-hatched area) at the elevation 350 m. Dashed lines represent the traces of the faults at this level. The heavy line represents the trace at the surface of the main fault f_1. (from des Ligneris and Bernazeaud)**

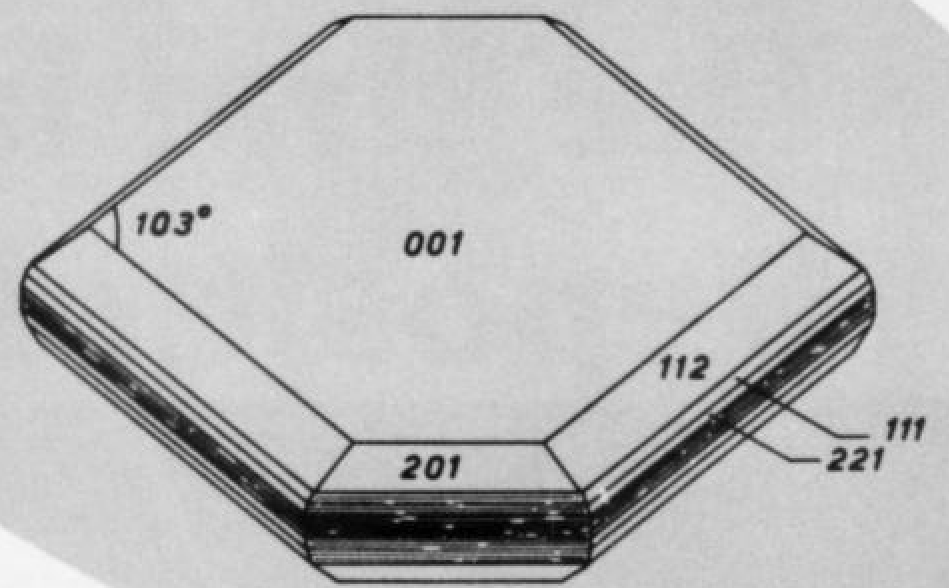


Figure 3. **Crystal of francevillite.**

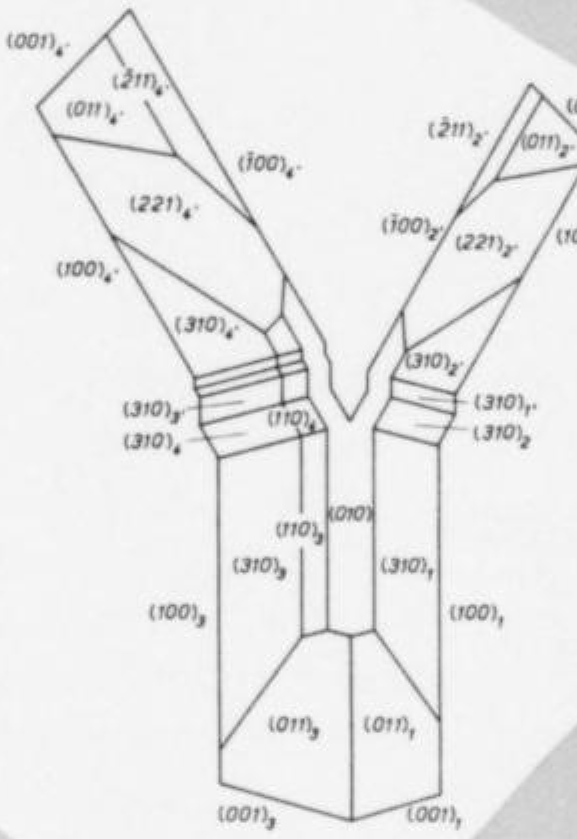


Figure 7. Twin of chervetite on (100) but the composition plane here is (100).

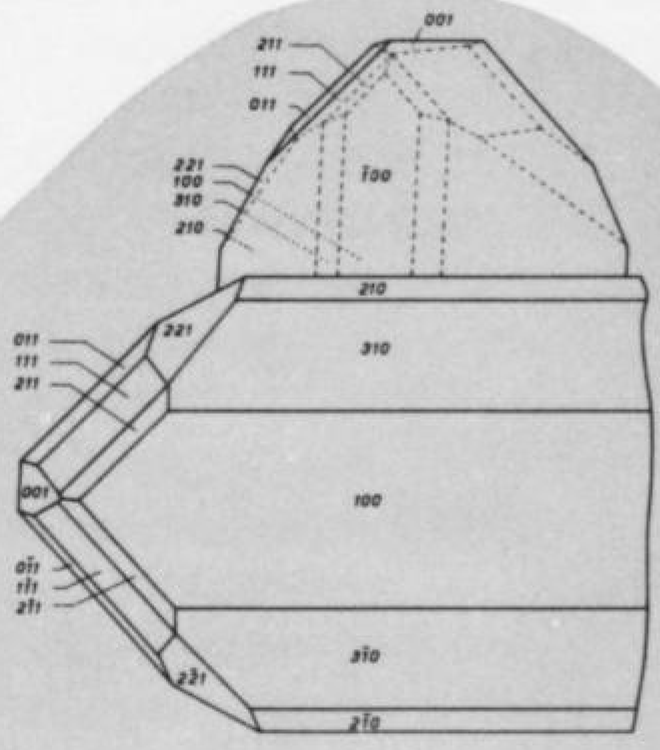


Figure 8. Crystals of chervetite twinned by rotation around [011].

b) The oxide zone, about 40 m thick, where the bulk of the mineralization was composed of aluminum, lead and baryum uranyl-vanadates. This part, now completely removed by mining, was the most interesting for the mineral collector.

a. "Black ore zone"

In the uranium-rich part the predominant ore is uraninite, UO_2, with accessory coffinite $U(SiO_4)_{1-X}(OH)_{4-X}$. These two minerals are associated with asphaltic material, galena, sphalerite, copper sulfides (chalcopyrite and chalcocite), iron sulfides (marcasite, pyrite, greigite) and phyllic minerals. All these species comprise the sandstone cement. Accessory minerals are zircon, tourmaline, rutile and sometime abundant barite filling fractures.

In the vanadium-rich part, sandstones display a more compact aspect and show in thin section a mosaic of enlarged quartz grains while barite is rare or even absent. The three principal minerals are as follows:

Karelianite V_2O_3. This rhombohedral mineral is only known in one other deposit, Outokumpu (Finland), with a high temperature paragenesis that is not the case at

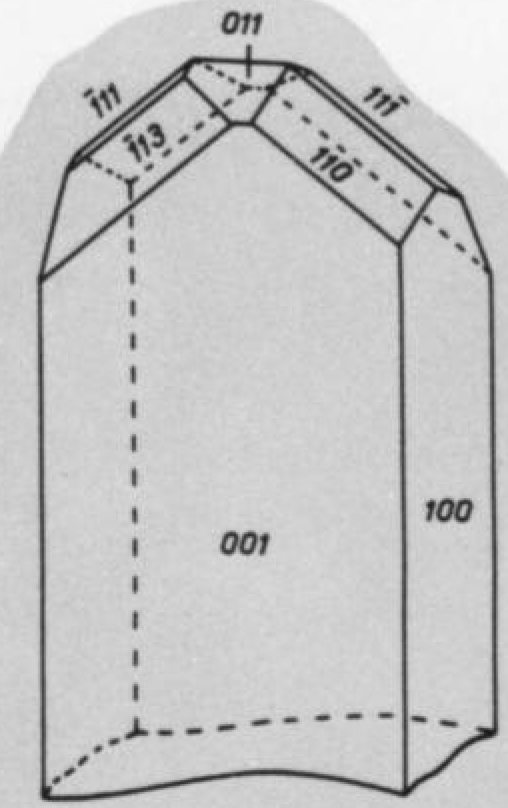


Figure 4. Crystal of vanuralite.

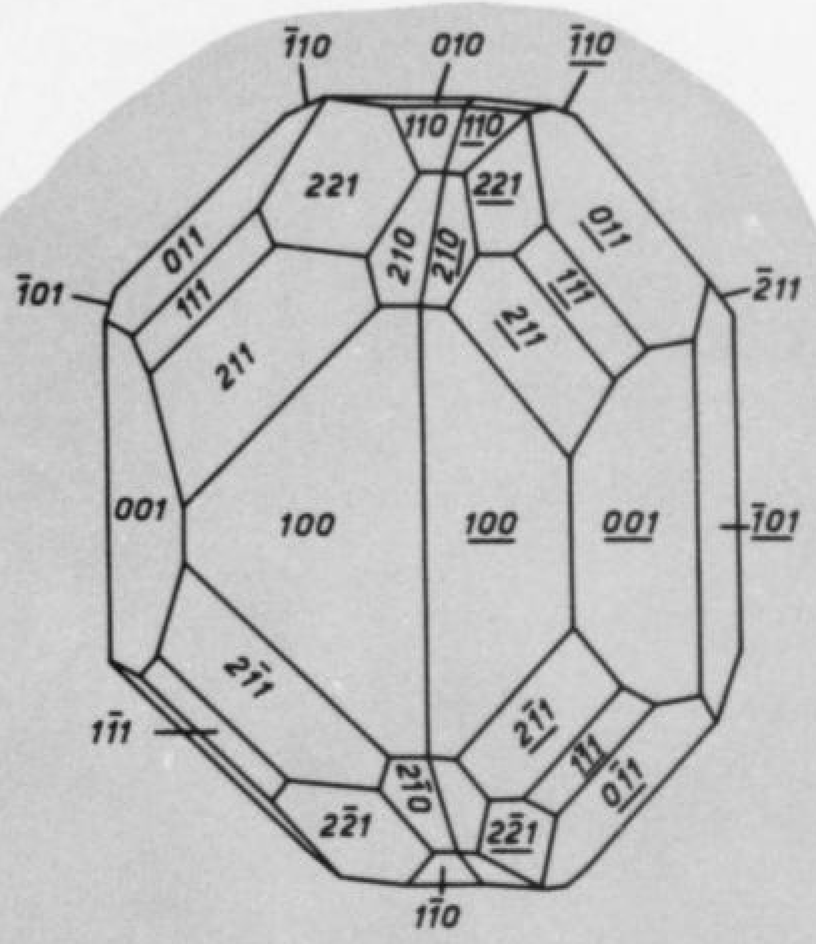


Figure 5. Crystals of chervetite twinned on $(\bar{1}01)$.

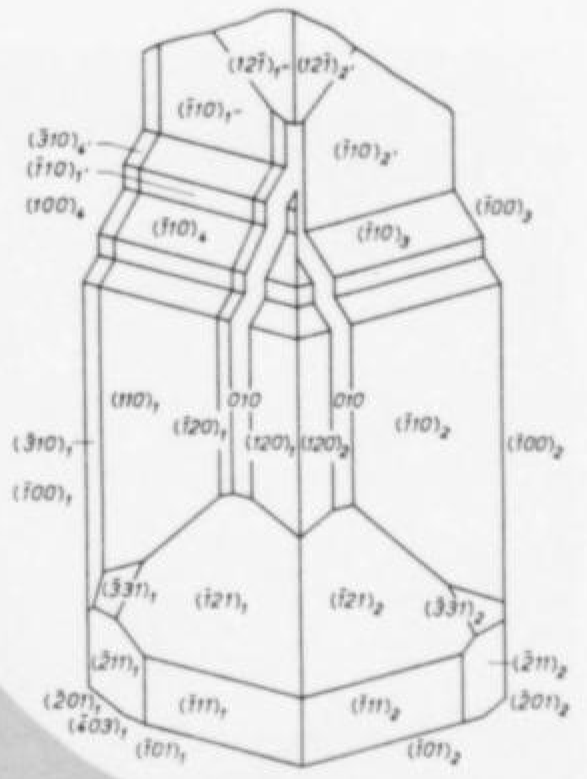


Figure 6. Twin of chervetite on (100). Crystals 1-4 and 2-3 are also twinned on $(\bar{1}01)$.

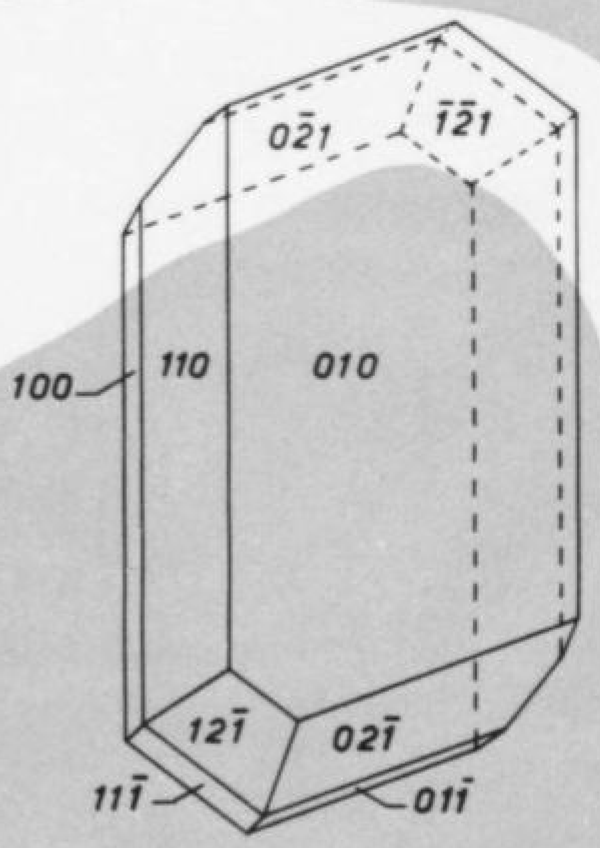


Figure 9. Crystal of mounanaite.

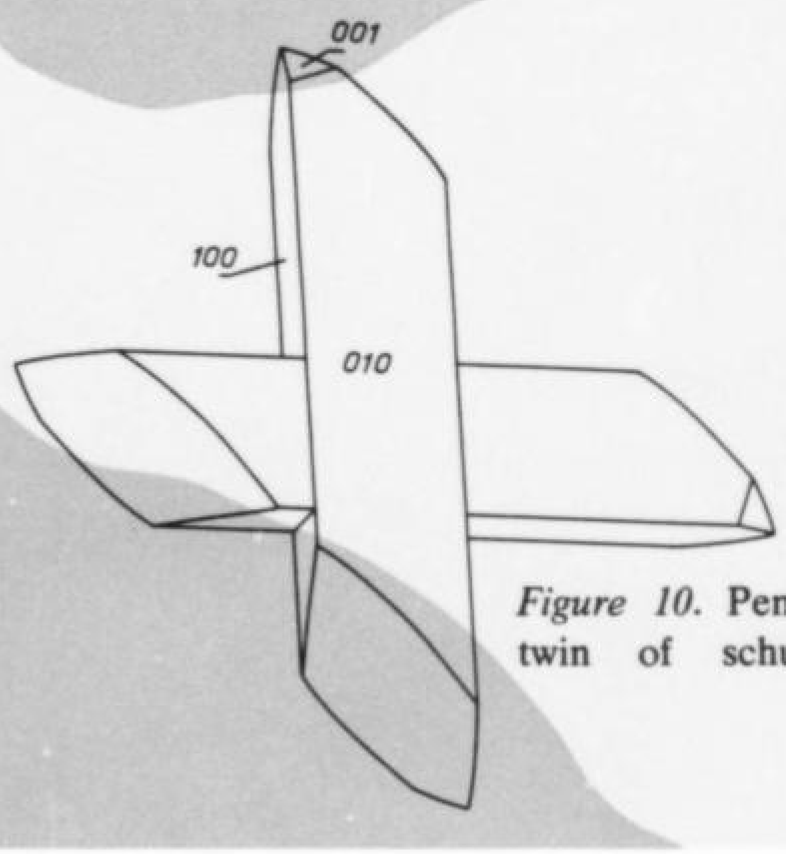


Figure 10. Penetration twin of schubnelite.

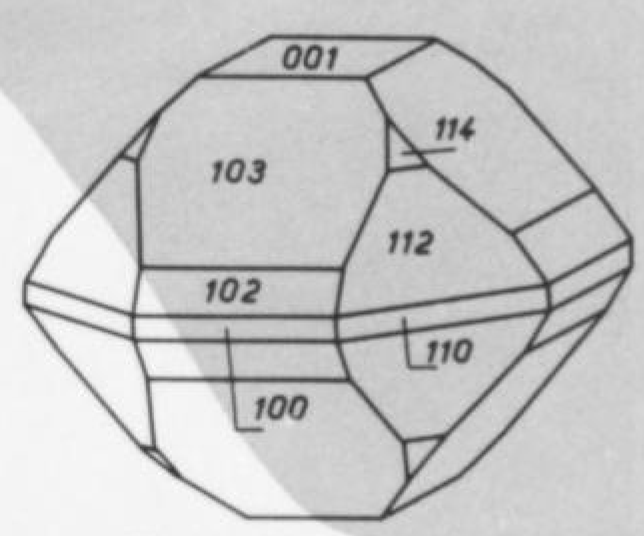


Figure 11. Crystal of torbernite.

Mounana. Usually it forms anhedral grains, no more than 0.5 mm, inside phyllic material or quartz; in the latter case, karelianite often occurs as clusters of needles.

Montroseite VO(OH). Montroseite is usually microcrystallized and very often replaces karelianite crystals. This species is unstable and yields paramontroseite, VO_2, also orthorhombic.

Roscoelite $KV_2(AlSi_3O_{10})(OH)_2$. This mica has a structure similar to that of muscovite; it constitutes an important fraction of the sandstone cement and envelopes the two earlier minerals.

Sulfides are the same as in the predominant uranium zone but there are some other vanadium minerals.

Nolanite. This iron-vanadium oxide has a poorly-defined composition. Found elsewhere only at Fish-Hook Bay, Saskatchewan, and at Kalgoorlie, Australia, it is very rare at Mounana.

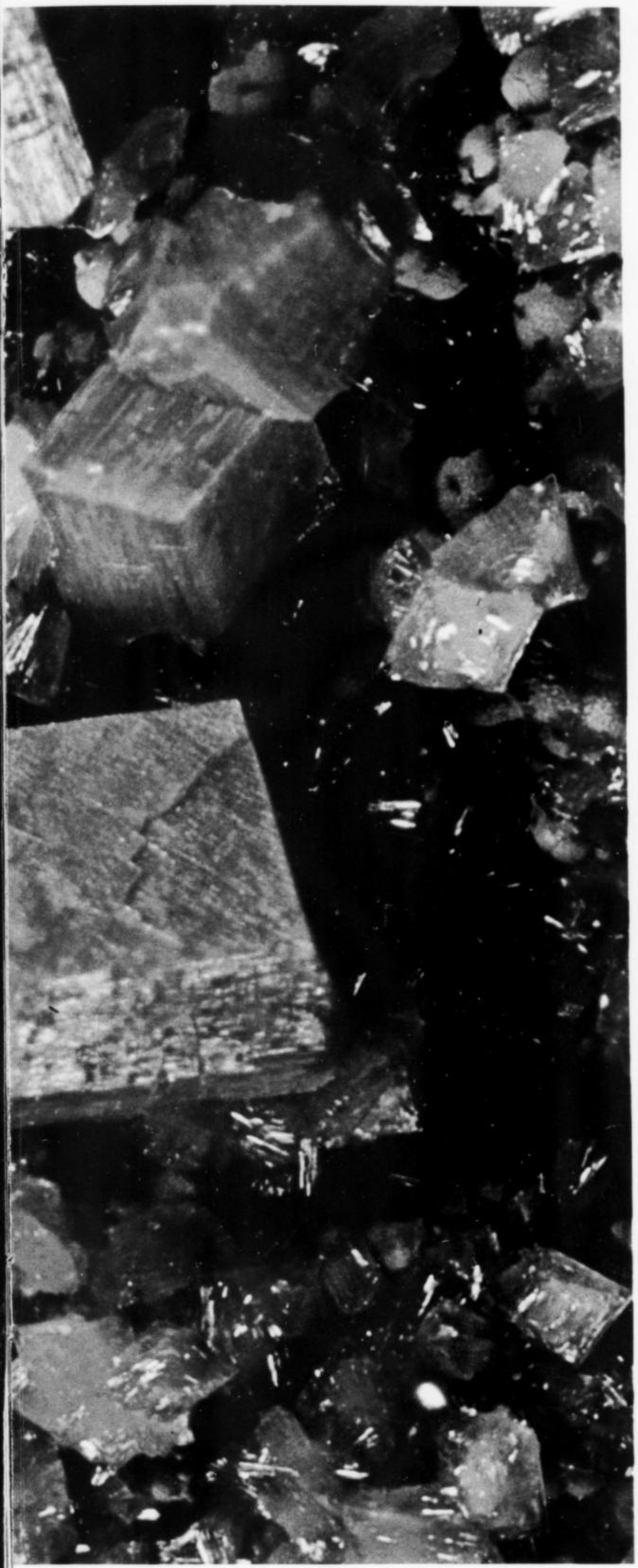
Duttonite $VO(OH)_2$. This monoclinic mineral is usually poorly crystallized in the Colorado Plateau deposits but can show at Mounana micaceous crystals, flattened on the cleavage (100), up to 1 mm in aggregates, with a brown color, becoming greenish with alteration.

Lenoblite $V_2O_4{\bullet}2H_2O$. Lenoblite is an orthorhombic polymorph of duttonite and appears as microcrystalline crusts in sandstone fissures. Its color is originally sky blue but darkens with oxidation. A minor constituant at Mounana, lenoblite has since been found in the lower Paleozoic formations of Kyzyl-Koum, Kazakhsthan.

Bariandite $V_2O_4{\bullet}4V_2O_5{\bullet}12H_2O$. This monoclinic mineral is structurally related to the corvusite of the Colorado Plateau deposits and is the only spectacular vanadium oxide of the Mounana mine. Bariandite occurs as flexible fibers elongated on the *b*-axis, flattened on (001) (a perfect cleavage) with a shining black color (very different than the rich violet color in the picture in *Encyclopedia of minerals*, plate 11). Crystals up to 3 mm in size are implanted perpendicular to the walls of fractures and can cover surfaces of several square centimeters.

These two new minerals (Cesbron and Vachey; 1970, 1971) are usually associated with duttonite and occur only in the upper part of the black-ore zone.

Figure 12. **Partially dehydrated torbernite octahedrons on francevillite.**



b. Oxide zone.

This zone was exceptional. Its ores are composed mainly of elsewhere unknown uranyl-vanadates, and seven new vanadium minerals were discovered and described between 1957 and 1971.

Sandstones display a strong alteration and are sometimes very friable and porous, owing to leaching of primary uranium and vanadium minerals. Uranium and vanadium ions, oxidized to their highest valency, associate themselves in uranyl-vanadates filling cracks of the sandstones, sometimes several centimeters thick, and often on a thin limonitic crust.

1 *Uranyl-vanadates*

Carnotite $K_2(UO_2)_2(VO_4)_2 \cdot 1\text{-}3H_2O$. Well known in Colorado Plateau deposits, carnotite is rare at Mounana and occurs only at the limit between the black-ore and the oxide zone as microcrystallized nodules ranging from 2 mm to 7 mm in diameter often mixed with quartz grains, with a pale, sometimes greenish-yellow color. Exceptionally carnotite crystals with a very unusual habit were found with duttonite and bariandite. They were elongated on [001] (usually carnotite is tabular on (001) with the prism showing reduced (010) and large but curved {210} forms; an oblique striation follows the (001) cleavage trace.

Francevillite $Ba(UO_2)_2(VO_4)_2 \cdot 5H_2O$. This orthorhombic mineral (Branche et al.; 1957) forms a complete series extending to curienite, the lead end-member. Francevillite is the most abundant uranyl-vanadate of the mine: usually the ratio Ba/Pb is close to 2/1 and crystals are orange-yellow to orange colored; however, barium end-members (13.9% BaO and 2.05% PbO) are green and their transparent cleavage lamellae display a greenish-yellow color.

Lozenge shaped crystals (Fig. 3) are tabular on (001) - a perfect cleavage - and bounded by [201] and [112], orthorhombic dipyramids {111} and {211} are less common. The forms {100} and {110}, observable on synthetic crystals, were never observed and are replaced by alternance of vicinal faces giving horizontal striation. Sometimes francevillite occurs as complete orthorhombic dipyramids {hh1} formed by numerous vicinal faces with striations parallel to the edges of the lozenge. Crystals 8 mm large were not uncommon.

Unlike heinrichite and uranocircite (barium uranyl-arsenate and uranyl-phosphate), francevillite has no lower hydrate.

Curienite $Pb(UO_2)_2(VO_4)_2 \cdot 5H_2O$. Curienite is the lead end-member of the previous series and the original sample contained 20.09% PbO and only 0.84% BaO (Cesbron and Morin, 1968). This species occurs only as canary-yellow micro-crystalline powder covering first generation francevillite, with a crust up to 5 mm thick, it is also associated with chervetite and mottramite, the latter being sometimes pseudomorphosed by curienite. Under the microscope, stacking of lozenge-shaped, tabular crystals can be observed.

Vanuralite $Al(UO_2)_2(VO_4)_2(OH)_2 \cdot 11H_2O$

Metavanuralite $Al(UO_2)_2(VO_4)_2(OH)_2 \cdot 8H_2O$

It is impossible to distinguish these two minerals macroscopically; vanuralite is monoclinic (Branche et al., 1963) with spear-shaped crystals elongated on the *b*-axis and flattened on (001) which is a perfect cleavage (Fig. 4). Color is pale to canary yellow and crystals often form clusters or compact aggregates with an arborescent structure like acanthus leaves. Metavanuralite (Cesbron, 1970) is triclinic and similar to vanuralite; a reversible transformation is connected with the relative humidity: vanuralite is stable above a relative humidity of 47% and metavanuralite between 47 and 28%, the loss of $3H_2O$ induces a translation of the $[(UO_2)V_2O_8]^{2n-}_{n}$ sheets, parallel to the perfect cleavage (001), and the symmetry becomes triclinic.

Rarely in association with francevillite, vanuralite frequently covers a mixture of mounanaite and limonite. The maximum crystal size is 3 mm but the filling in fissures was sometimes 4 cm thick!

2 *Other vanadates*

Chervetite $Pb_2V_2O_7$. This monoclinic lead pyrovanadate (Bariand et al., 1963) is surely the most interesting mineral of the oxide zone because of its great variety of habit. Crystals are transparent and colorless to grey or brownish with a strong resinous luster similar to that of cerussite. Sometimes prismatic on [010] chervetite is usually flattened on (100) with elongation along *b* or *c*-axis; the (100) face always shows striae parallel to the *c*-direction but other faces are smooth. Some crystals reached one centimeter and 28 different forms and three twin laws where observed (Cesbron, 1965).

The twin on $(\bar{1}01)$ is the most common and can be simple or multiple; some twin lamellae are so thin that they appear on (100) only as striae parallel to the twofold axis (Fig. 5). This twin can give too a deeply striated habit to prismatic crystals.

***Figure 13*. Aggregates of francevillite crystals on microcrystallized mounanaite.**

The twin on (100) is much rarer and was mainly observed on crystals elongated on the *c*-axis. Sometimes this law affects crystals already twinned on ($\bar{1}$01): Figures 6 and 7 show such complex structures.

The twin with [011] as a twin axis has the composition plane (100): in such a twin, the *b*-axis (7.14Å) of the first crystal is parallel to the *c*-axis (7.08Å) of the second crystal and vice-versa. This twin (Fig. 8) was not uncommon in the lower part of the oxide zone.

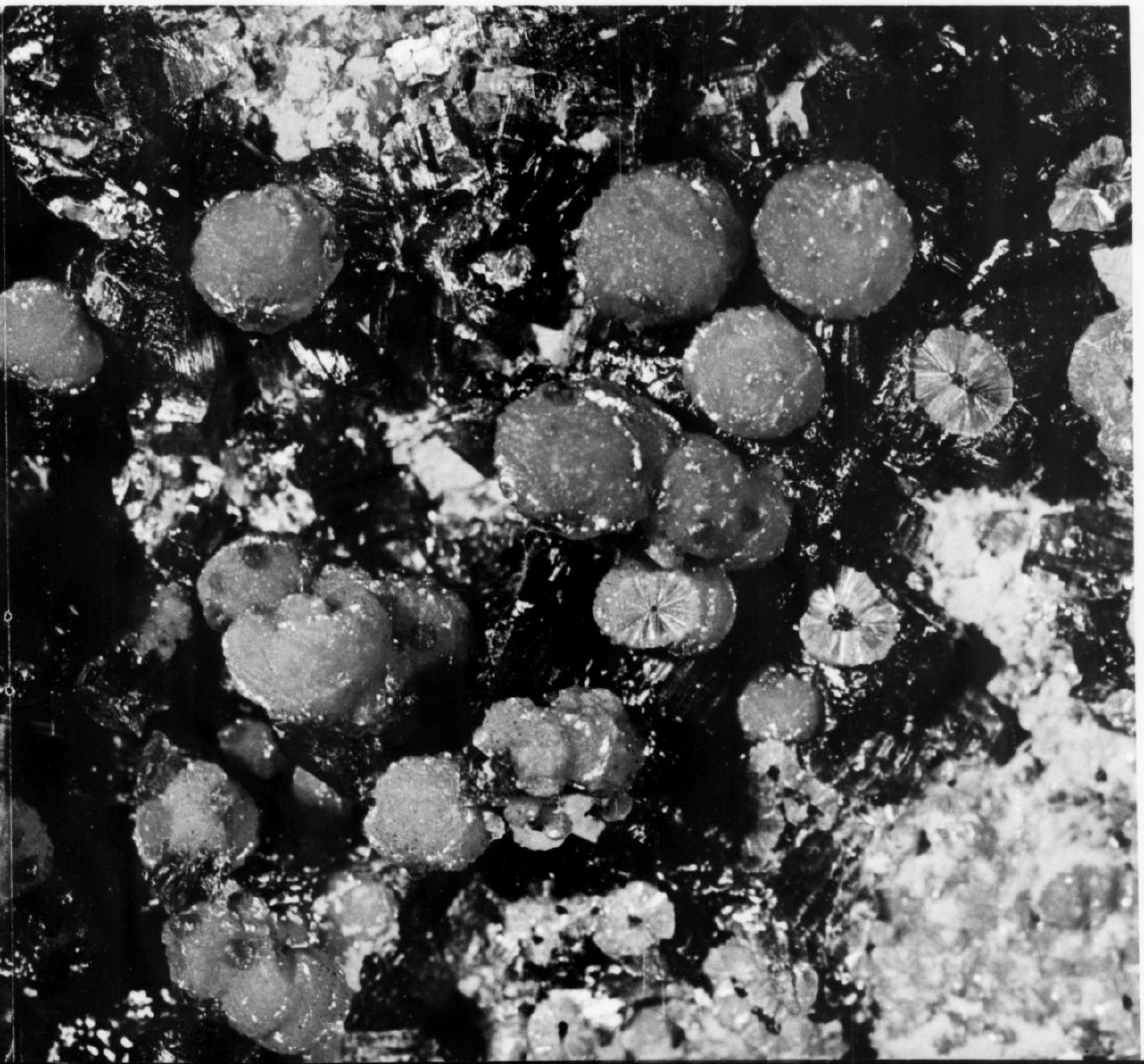
Chervetite was very widespread in the deposit and was observed even in the upper part of the black-ore zone where it occurred with duttonite and bariandite. It usually was in association with very rare wulfenite, mounanaite, curienite, francevillite or mottramite. When associated with the two later minerals, chervetite presents clusters of thin brittle laths twinned about [011].

Mottramite (Cu,Zn)Pb(VO_4)(OH). This orthorhombic mineral is usually associated with green francevillite and sometimes curienite. Crystals up to 2 mm are shining black but thin splinters are transluent and greenish-black. Well-crystallized and with smooth edges, mottramite shows dominant {210}, {201} and {011} and accessory {010}, {120}, {203} and {212} forms.

A microprobe analysis detected only between 0.1 and 0.05 Zn and this mottramite is virtually the pure end member of the mottramite-descloizite series. To the best of our knowledge the perfection of the crystals in the series relates to Zn content and crystals of pure mottramite are doubtless very rare.

Mounanaite $PbFe_2(VO_4)_2(OH)$. Mounanaite (Cesbron and Fritsche, 1969) is triclinic and crystals are elongated along the *c*-axis and flattened on (010); they are very often twinned about [001] and exhibit reddish-brown color. With this latter habit mounanaite is associated with francevillite and curienite, both on limonite. This species can occur also as a microcrystallized coating mixed with limonite in fissures in the sandstone and covered by vanuralite. Some crystals (Fig. 9) can display a pseudo-hexagonal habit when equant.

***Figure 14*. Spherulites of orange francevillite on chervetite, in association with curienite (canary-yellow) and tiny red spherulites of wulfenite. This later mineral was very rare at Mounana. The dark core of the spherulites is goethite.**



Schubnelite $Fe_2V_2O_8 \bullet 2H_2O$. Schubnelite is triclinic too, and occurs as short prisms always twinned as shown in Figure 10. Crystals are no longer than 0.5 mm and are brownish-black to black. This unimportant mineral is very rare and found only in the deepest part of the oxide zone associated with velvety incrustations of fervanite.

3 *Other uranates*

Uranocircite $Ba(UO_2)_2(PO_4)_2 \bullet 8H_2O$. This tetragonal mineral is often confused with autunite and was encountered only in the f_2 fault on mammillary pitchblende with tiny brownish-yellow crystals of renardite $Pb(UO_2)_4(PO_4)_2(OH)_4 \bullet 8H_2O$. Uranocircite crystals are yellowish-green, sometimes stained with limonite, and can reach 4 mm in size.

Torbernite $Cu(UO_2)_2(PO_4)_2 \bullet 10H_2O$. Torbenite displays two different and rather unusual habits:

1) as tetragonal prisms (100), with a *c/a* ratio of about 4 to 5.
2) as dipyramidal crystals (Fig. 11) with dominant {103} and accessory {114} and {102} forms.

Always in association with francevillite, torbernite crystals were transparent and emerald-green when first discovered; they quickly became opaque and apple green with dehydration.

Kasolite $Pb(UO_2)(SiO_4) \bullet H_2O$. It is the only uranyl-silicate found at Mounana. Orange yellow crystals, no more than 0.5 mm in size, occurred only in the f_2 fault at the limit between the two ore zones.

Uranopilite and *johannite*, both uranyl-sulfates, are the usual minerals of recent formation.

***Figure 15*. Francevillite coating and sometimes replacing metatorbernite crystals.**

Process of oxidation

Primary mineralization was deposited not only at low temperature but also in a strong reducing environment, as shown by the organic materials, hydrocarbons, sulfides, greigite (var. melnikovite) etc. Indeed, the occurrence of karelianite, according to the Eh-pH diagram published by Evans and Garrels (1958), and the association of uraninite and montroseite (Garrels, 1955) indicate strong reducing conditions (low redox potential). It is probable too that conditions were acid since karelianite begins to precipitate at a pH of 3 and montroseite at a pH of 4.

However, minerals such as karelianite and uraninite are easily oxidized; uranium changes from U^{4+} to U^{6+} and vanadium from V^{3+} to V^{4+} and then V^{5+}, giving additionally compounds with an intermediate degree of oxidation. For example bariandite, $V_2O_4 \bullet 4V_2O_5 \bullet 12H_2O$, has a degree of oxidation of 4.80 (this degree is defined by the formula $\frac{4n+4n'}{n+n'}$, where n is the number of atoms of V^{4+} and n' the number of atoms of V^{5+} in the chemical formula).

According to Garrels (1955), when V^{4+} begins to oxidize to V^{5+}, uranium is already completely oxidized to the U^6 state and is very readily soluble as $(UO_2)^{2+}$ ions. Thus when vanadium reaches the V^{5+} state, it reacts with uranyl ions and forms slightly soluble uranyl-vanadates which precipitate and prevent the complete leaching of uranium.

Minerals such as duttonite, lenoblite and bariandite, occurring in the upper part of the black-ore zone and only in fractures of the sandstones, were probably deposited by precipitation under reducing conditions (sulfides) from vanadic solutions descending from the upper levels and this zone is one of supergene enrichment (Geffroy et al., 1964). This also explains the occurrence of chervetite (V^{5+}) with duttonite (V^{4+}), since we obtained synthetic chervetite by action of solubilized V_2O_5 directly upon galena (at 180°C and with nitric acid to obtain acid conditions). One part of the V^{5+} produced chervetite with the lead from galena and the other part was reduced giving an amorphous precipitate with vanadium as V^{4+}.

The occurrence of chervetite is interesting from another aspect; the total absence of Cl^- ions in the area. Experimental studies show that chervetite is unstable in an acid environment when Cl^- is present, and that it transforms to vanadinite which is unknown in this deposit despite the abundance of vanadium and lead.

In the oxide zone, lead in curienite and barium in francevillite and uranocircite came from galena and barite; the latter mineral is known to be quite insoluble, but it is possible to obtain francevillite by synthesis with the action of urano-vanadic solutions on barite; the pH must be low. Aluminum in vanuralite came from roscoelite and altered feldspars of the arkosic sandstones, iron in mounanaite from iron sulfides, with limonite as an intermediate step from which mounanaite seems to be derived. Copper in torbernite and mottramite derives from copper sulfides; a little native copper was observed at the boundary of the two distinct ore zones. In addition there are no calcium minerals at all in this deposit; tyuyamunite is unknown and autunite, previously recorded, was in fact uranocircite.

The pH in the oxide zone must have been acid since synthesis of curienite, mounanaite and francevillite requires a pH lower than 3. This fact is also confirmed by the absence of such minerals as sengierite $Cu(UO_2)_2(VO_4)_2(OH)_2 \bullet 6H_2O$ or volborthite $Cu_3(VO_4)_2 \bullet 3H_2O$, whose pH of formation is between 4 and 7 for sengierite and between 3 and 6 for the later species. Melanovanadite, $2CaO \bullet 2V_2O_4 \bullet 3V_2O_5 \bullet nH_2O$, characteristic of a basic environment, was reported by Chervet (1960) but we never observed this species and its existence seems doubtful in light of the absence of calcium at Mounana. A little dolomite occurs but distant from, and lower in the section than, the mineralized beds (Weber, 1969). Clearly the oxidation of

Figure 16. **Clusters of vanuralite crystals, stained with limonite, on mounanaite.**

***Figure 17*. Chervetite crystals twinned on {101} with francevillite. Here chervetite is prismatic along[010].**

sulfides created an acid environment, and the acidity was enhanced by vanadic solutions. However, humic acids, originating from decayed vegetal material in such an equatorial climate, might also have played an important role.

Comparison with Colorado Plateau deposits

It is interesting to compare these two kinds of uranium vanadium deposits, although Mounana is unique and the Colorado Plateau deposits very numerous.

Though montroseite, paramontroseite, roscoelite and duttonite are known in these two kinds of deposits, the presence of karelianite at Mounana must be stressed. On the other hand minerals such as doloresite $3V_2O_4\bullet4H_2O$, häggite $V^{3+}V^{4+}O_2(OH)_3$, corvusite $V_2O_4\bullet6V_2O_5\bullet nH_2O$, navajoite $V_2O_5\bullet3H_2O$ and melano-vanadite have never been found at Mounana. However, there is in this mine a new hydrated oxide of V^{5+} now in the course of study.

The difference between the oxide zones is very striking. Carnotite and tyuyamunite are abundant in the Colorado Plateau, but rare or absent at Mounana where only carno-

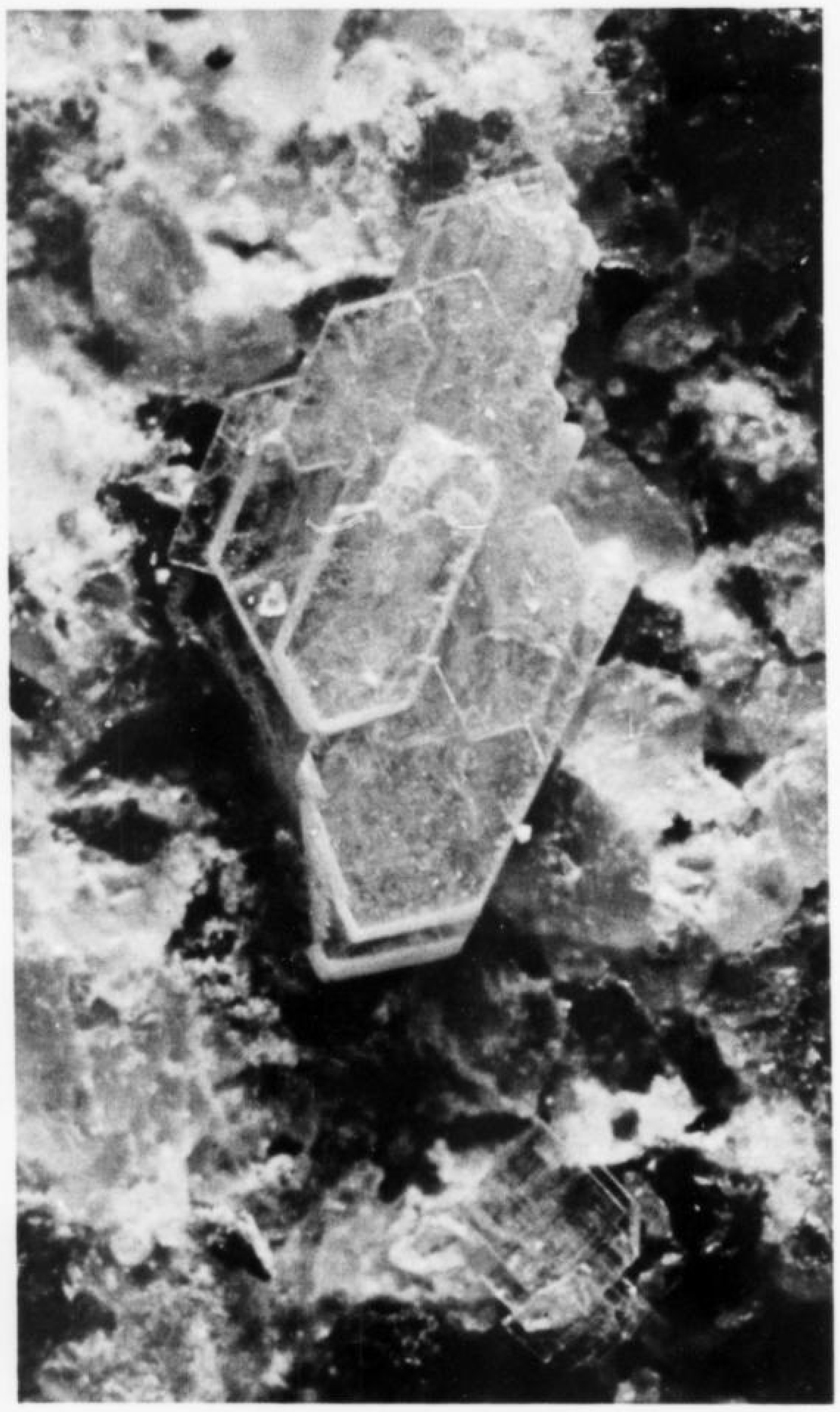


Figure 18. **Francevillite crystal on coarse sandstone matrix.**

tite occurs as a minor constituant at the boundary between the two ore zones. It is unstable in acid conditions and transforms into francevillite (carnotite is very easily transformed artificially into francevillite by the action of barium solutions). In contrast, lead and barium uranyl-vanadates are unknown in the Colorado Plateau, but aluminum occurs and gives rise to a mineral such as steigerite $A1VO_4 \bullet 3H_2O$, but no vanuralite. The numerous calcium vanadates like rossite, hewettite, pascoite or calcium-uranyl vanadate like rauvite were never observed at Mounana.

The range of pH in the oxide zone is broader in the Colorado deposits, where conditions can be very acid (presence of navajoite and rauvite) but also slightly basic as shown by the presence of rossite $CaV_2O_6 \bullet 4H_2O$ whose pH of formation lies between 6.5 and 8.5 according to Marvin and Magin (1959).

In conclusion, the Mounana deposit is characterized by a narrow domain of acidity and by a rather remarkable mineralization affording vanadates and uranyl-vanadates unknown elsewhere.

Acknowledgments. We are indebted to our friend S. A. Williams for reviewing and criticising the manuscript (and also for syntax correcting!).

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Figure 19. **Aggregates of meta-uranocircite crystals on pelitic matrix; mammillary uraninite is usually found, with renardite, in association with these crystals.**

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The crystal drawings first appeared in Bulletin de la Société française Minéralogie et de Cristallographie *(see references). The color photographs are all by Nelly Bariand, and the magnification is between five and ten times.*

What's New in Minerals?

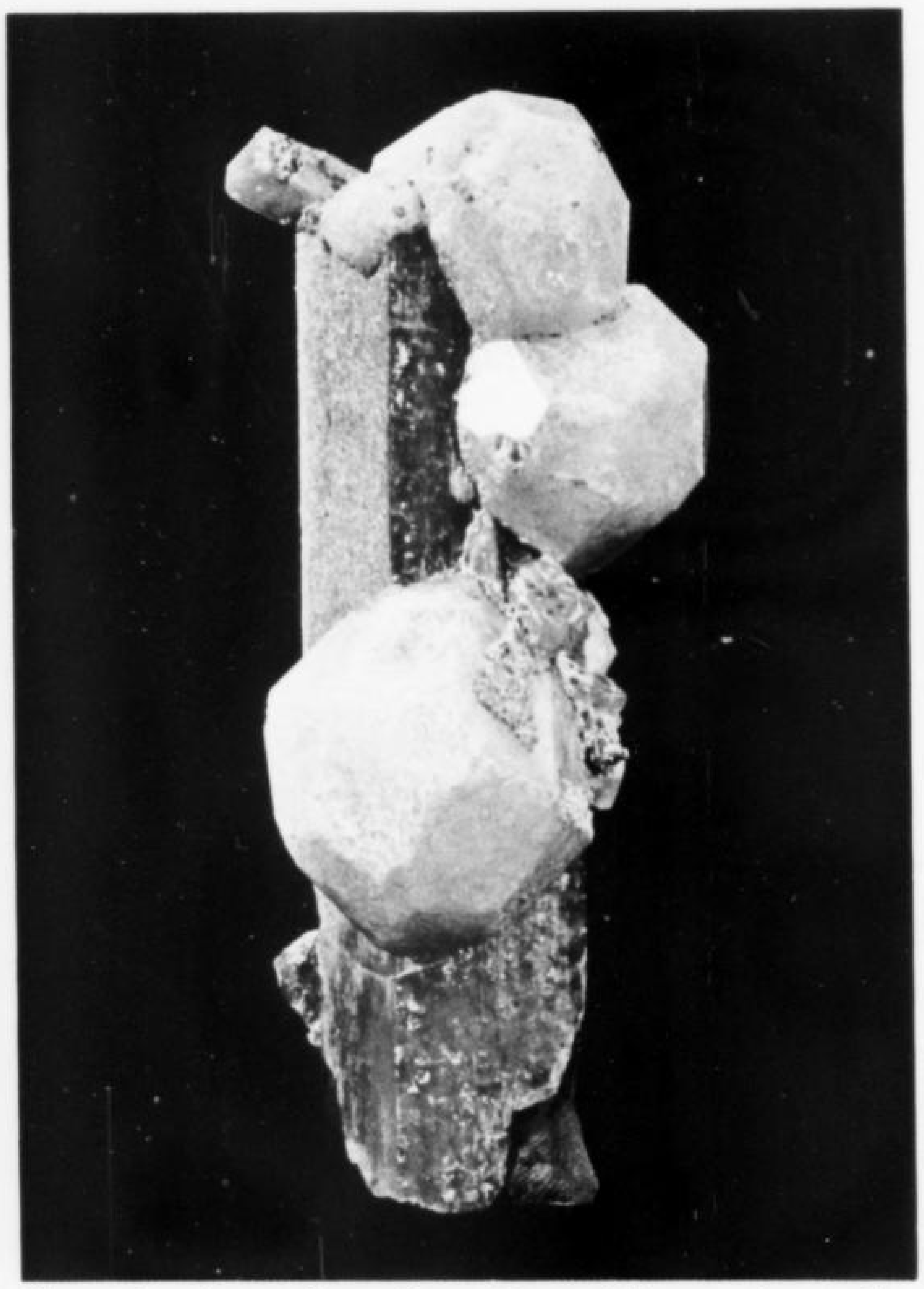


Figure 1. **above, Serandite with analcime and natrolite. Mt. St. Hilaire.**

Figure 2. **below, Topaz on lepidolite. Virgem da Lapa, Brazil.**

SERANDITE

A Smithsonian "bragging specimen", the extraordinary analcime on serandite shown in Figure 1 from the De-Mix quarry, Mont St. Hilaire, Quebec, Canada, was given to the U.S. National Museum of Natural History by its finder Gilbert George of Providence, Rhode Island. It is exactly 10.5 cm high and the largest analcime crystal is approximately 3 cm in diameter. A natrolite crystal can be seen at the top left. The photograph is by J. S. White, Jr.

It should be noted that the De-Mix quarry will be open to collectors only on the following days: September 13 and 14, October 11 and 12, hours from 9 A.M. to 4 P.M. The fee is $40.00 per group for the day. Any group applying for admission must provide evidence that they are covered by a civil liability insurance policy of at least $500,000.00 for both people and property.

TOPAZ, ETC.

A new locality has recently been producing some very fine specimens of topaz, elbaite, lepidolite, herderite and albite. It is the Virgem de Lapa pegmatite, Minas Gerais, Brazil. The topaz is a lovely deep blue to yellow to pink color and the crystals are often quite large. The elbaites are also large and a lovely deep green to blue-green in color, some doubly terminated. These are associated with blue to violet herderite in very large crystals and with pink to pale lavender lepidolite. Many of the specimens come with exceptionally fine albite as well.

Unfortunately, we understand that the Brazilian government has closed this remarkable mine so we can only hope that the situation will improve and that specimens can once more be obtained.

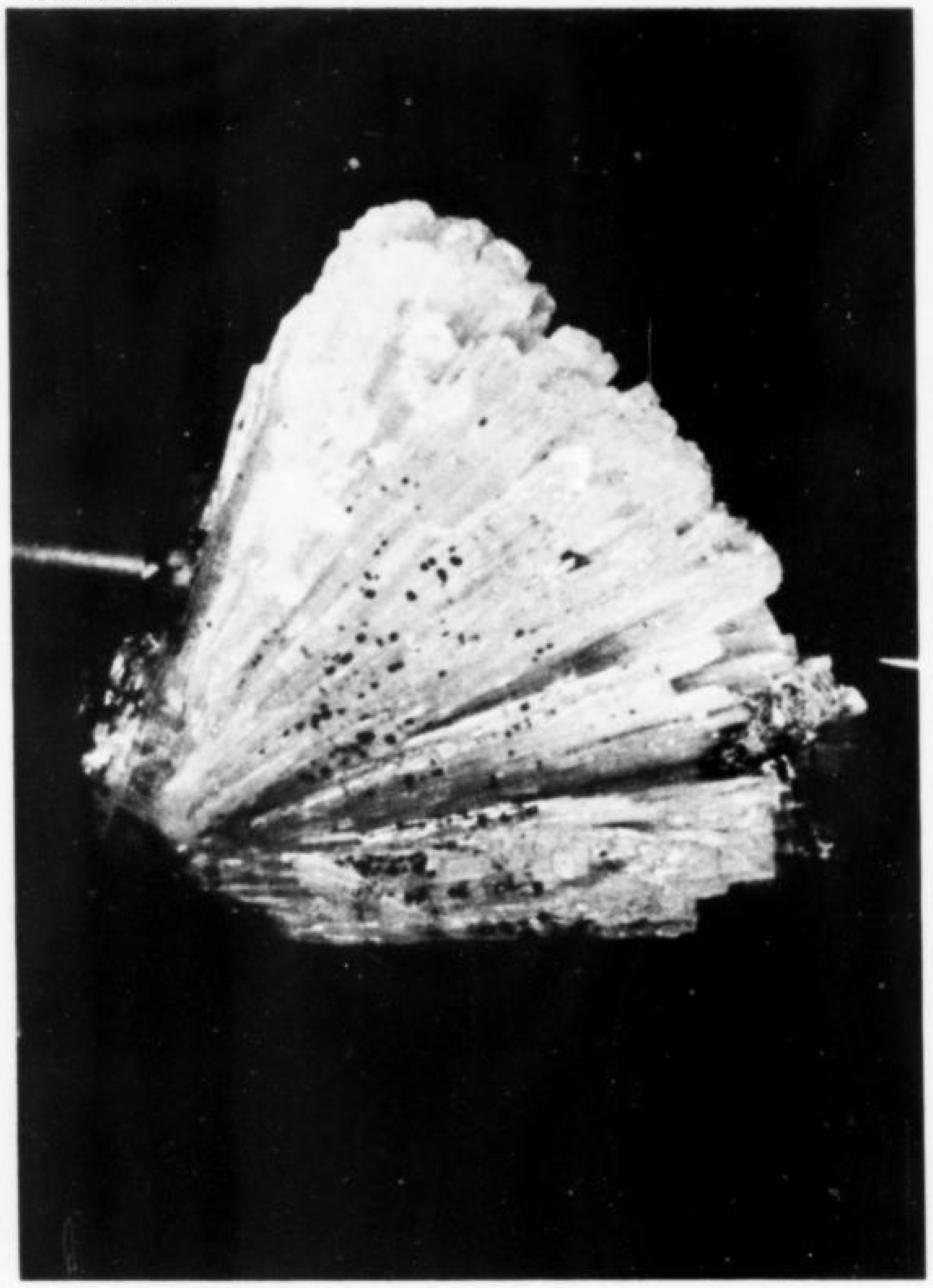
The photograph Figure 2 shows one of these topaz specimens recently offered by Colorado Gem and Mineral Company, Tempe, Arizona. It is attached to a mass of lepidolite. The topaz crystal measures 7 x 5 cm. The photograph was taken by Jack Lowell, who operates the Colorado Gem and Mineral Company.

BOLTWOODITE

The rare potassium uranium silicate, boltwoodite, has recently been found in very good specimens at a locality reported as Arandis, Southwest Africa. The discovery was first made known by Sydney Pieters of Windhoek, Southwest Africa, who submitted a specimen to the Smithsonian

Figure 3. **Boltwoodite. Arandis, Southwest Africa**

Figure 4. **Alamosite with melanotekite. Tsumeb, Southwest Africa**



for identification and subsequently donated another ten specimens to the Institution.

Figure 3 depicts one of these specimens. The dull yellow crystals are in radial sprays of an acicular habit. The crystal group in the photograph is exactly 1 cm in the longest dimension, uncommonly large crystals for the species. These crystals fluoresce a soft reddish-orange under long wave UV; there is no response to short wave.

ALAMOSITE

Another exciting find at the remarkably prolific locality of Tsumeb, Southwest Africa, is of alamosite, a rare silicate of lead. The group of white, radial crystals illustrated in Figure 4 is 3.5 cm long. The dark spots on the crystals are hemispheres of another lead mineral, melanotekite, the lead iron silicate. Also reported to occur with alamosite at Tsumeb is fleischerite, an exceedingly rare, one locality, lead germanium sulfate. Tsumeb is the type and only reported locality for fleischerite. The specimen in the photograph is in the Smithsonian collection.

This occurrence has recently been described by Olaf Medenbach and Karl Schmetzer in a paper entitled "Alamosite ($PsSiO_3$) von Tsumeb - ein neuer Fundpunkt (Alamosite from Tsumeb - a new occurrence of $PbSiO_3$)", *Neues Jb. Miner. Abh.*, **123**, 138-147. Included in the paper is an oblique reference to a new species found in association, kegelite, also a lead silicate.

MORDENITE, ETC.

A recent note from Maxwell Hudson, New South Wales, Australia, informs of a new occurrence of several interesting zeolite group minerals. These are mordenite, ferrierite and heulandite, all found in small crystals with calcite, pyrite and pale yellow, radial clusters of prehnite on quartz with botryoidal chalcedony. They were discovered in an old abandoned quarry at Kembla Grange, on the south coast of New South Wales. The identifications were performed by the New South Wales Department of Mines in Sydney. Mr. Hudson generously donated specimens to the Smithsonian Institution.

SWINEFORDITE - THE SECRET IS OUT

The April, 1975, *Newsletter* of the Eastern Federation of Mineralogical and Lapidary Societies carried the following item:

"NEW MINERAL DISCOVERED?

Greenville: The Forsyth Gem and Mineral Club bulletin reports that the East Carolina University News Bureau has announced the discovery of a new mineral in a cave at King's Mountain. Dr. Pei-lin Tien, assistant professor of Geology at ECU says the mineral, which he has named Swinefordite . is fpind along the fraxtures of cave walls at a site about 30 miles west of Charlotte. The mineral is green and resembles petroleum jelly." (Quoted *exactly* as it appeared)

Well now, actually the mineral was discovered by Peter B. Leavens of the University of Delaware who, with Dr.

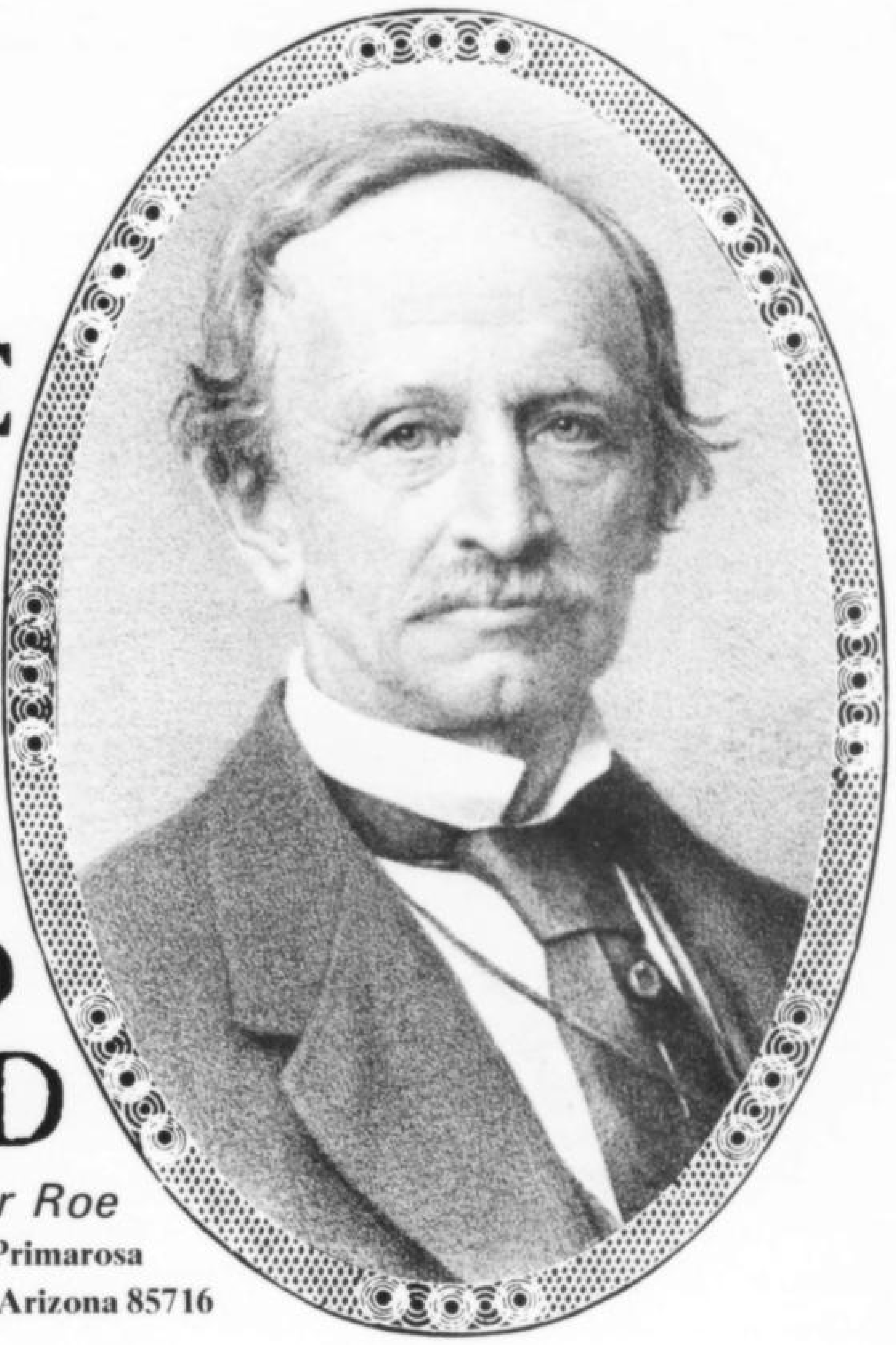
Tien, has described it. It is a clay mineral of the montmorillonite group. It has the capacity to absorb water and increase its volume many times, in which state it does indeed resemble petroleum jelly. When dry, however, it looks more like "mountain leather". It is found in fissures in a quarry in pegmatite operated by the Foote Mineral Company near Kings (not King's) Mountain, North Carolina. It does not occur in caves. The color is a greenish-gray. The "site about 30 miles west of Charlotte" is one of the most important, productive and unusual mineral localities in the United States. In less than ten years collectors have found nearly 100 different minerals there, including about a dozen very rare ones and a handful of new species.

One wonders if a New Jersey club bulletin would ever refer to Franklin as "a site about 35 miles northwest of Newark." As far as I know this is the only published description of swinefordite.

Boy, are we red faced!

NOTICE

A large number of defective issues of Volume Six, May-June (#3) were mailed without our being aware of it. If you received such an issue, please do let us know and we will replace it. The problem occurred in the bindery and there was nothing we could do to prevent it, but we can provide good copies upon request. Don't delay!



THE C.U. SHEPARD MINERAL COLLECTION AND THE TWO DRS. SHEPARD

by Arthur Roe
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In 1886 the Smithsonian received as a gift a collection of about 270 meteorites from Dr. C. U. Shepard, Jr., of Summerville, South Carolina, in memory of his father, who had gathered the specimens and who died in May of that year. In 1887 Dr. Shepard sent to the Museum a box of rutile, and in December, 1889, he sent his father's mineral collection of about 5050 specimens (containing about 400 species) as a loan to the Smithsonian. The conditions of the loan were spelled out in his 1912 Will. The mineral collection, the four cases in which it was displayed, and a leather-bound catalog of the collection handwritten by his father were left to his Executors to be given to "... that one of my nephews, the sons of Louis Shepard DeForest or Edith James Wallach who shall first, in the judgement of said Executors, develop a taste for mineralogy sufficiently attested to by study and practice therein, otherwise the aforesaid collection of minerals... (is) to be retained by the aforesaid United States Museum in Washington." Fortunately for the Museum, none of the nephews was mineralogically inclined and, in 1929, some fourteen years after Shepard's death, the collection was officially given to the Museum. It is now being recataloged and, because of its historical interest, will be kept intact. One specimen, a citrine quartz, was requested by and given to a nephew of Shepard in 1940 as a memento of his uncle.

Dr. C. U. Shepard, the elder, was one of the earliest distinguished American mineralogists. Born on June 29, 1804, in Little Compson, Rhode Island, he studied for a year at Brown University before entering Amherst College in 1821. After graduation he spent almost a year studying under Professor L. Nuttall; then he gave private lessons in mineralogy and botany in Boston for several months. The next two years were spent fruitfully in Benjamin Silliman's laboratory at Yale; he had the title of Lecturer on Natural History at Yale from 1830 to 1847. In 1832-3 he assisted Professor Silliman in a U. S. Government-sponsored study of the culture of sugar cane and the making of sugar; the plans recommended in the report were adopted. Apparently, during this study he made contact with the Medical College of Charleston, South Carolina, for he held the position of Professor of Chemistry and Natural History there, except for the Civil War years, from 1833 until about 1870 (apparently, overlapping appointments in academic institutions were common in that era). In 1835 he was the associate of Dr. Percival in the State Geological Survey of Connecticut. In 1845 he joined the faculty of Amherst College with the title of Professor of Chemistry and Natural History, which in 1852 was changed to Professor of Natural History; in 1877 he became Professor Emeritus.

Professor Shepard was an avid collector, not only of minerals, but also of meteorites, shells, fossils, and plants. A pamphlet[1] published in 1859 describes his collections

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[1] *Notice of Collections in Natural History, preserved in the Shepard Cabinet at Amherst College (Massachusetts)*, Amherst, Massachusetts, August 3, 1859.

at Amherst. The collections were housed on the second floor of "Wood's efifice," a fireproof octagonal building crowning"... the most beautiful eminence on the grounds." There were more than 500 species of shells, 6000 species in the herbarium, 6000 geological specimens (rocks and fossils), the meteorite collection representing 124 authentic localities (the largest collection in the world at that time was in the Imperial Cabinet in Vienna, containing 139 localities), and a series of mineral collections totalling more than 10,000 specimens. The minerals were arranged according to the plan in Shepard's Treatise, 3rd Edition, 1856. First there was a systematic collection; Shepard was proud "... of the completeness of the mineralogical series... Few collections surpass it in this respect. Much attention has also been given to a representation of many of the species in all their varieties, especially those of crystalline form. The specimens being scrupulously protected against handling, dust, and excess of light, they exhibit their colors and lustre to unusual advantage... no specimen is admitted into the systematic series that has been artificially modified in any way. The main collection is intended to show the contents of the entire mineral kingdom in their most important relationships, and in their modified condition." Next to the systematic collection was a series of minerals classified chemically, each specimen's label giving its name and formula. Next was a collection of imperfectly determined species, followed by one illustrating the natural properties of minerals. There followed a collection of polished and "artificially wrought" minerals. There was also a display of Sopwith's geological models, and a number of "instruments of geological research" — goniometers, balances, etc.

The collection was sold to Amherst College[2] in 1872; the price was to be a certain percentage of the assessed value, but not more than forty thousand dollars. "When the purchase was finally made in 1872, it took the assessors only five minutes to agree on the forty thousand dollar figure."

Unfortunately, at about the time of the purchase, the Shepard collection was moved to the more spacious Walker Hall, where it was destroyed by fire in 1882. At that time it was supposed to have "outranked in magnitude and value the public collections in London, Paris, and Vienna!" An extant catalog of the collection, about 90% complete, shows more than 25,000 mineral specimens before the fire.[2]

Immediately after the disastrous fire, Shepard started another collection, which was eventually given to Amherst by C. U. Shepard, Jr., after his father's death. The elder Shepard also provided smaller collections to the Natural History Society of Montreal and to the Charleston, South Carolina, Museum.

The collection given to the Smithsonian in 1929 contained about 5050 specimens, according to Dr. E. T. Wherry, then Mineralogist at the Smithsonian, who in 1915 counted the collection at the Executor's request. Most of the specimens are what now would be called "thumbnails" or "miniatures." A majority of them are from the United States, although there are many specimens from other countries. The largest number of specimens of any one species is of rutile, most of it from Graves Mountain, Georgia (which was owned for some time by Dr. C. U. Shepard, Jr.) Other species from that locality (including lazulite) and from Arkansas and North Carolina are well represented. Of particular note are: an exceptional suite of English fluorite; calcite from the Harz Mountains; Russian beryls; titanite and apatite from Ontario; brookite from Magnet Cove; and phosphate minerals (monite, monetite, etc.) from the phosphate caves on islands in the Caribbean.

The collection also contains many (47) of the 140 species described by Shepard as new minerals; these are currently in the Smithsonian collection of Type minerals rather than in the Shepard Collection. Some of the missing Type specimens may have been destroyed in the 1882 fire, although Shepard's meteorite collection and a few valuable smaller mineral specimens were in a safe and were not destroyed.

Considering the price of minerals today, the value placed on the Museum's Shepard Collection is of some interest. When it was shipped from South Carolina to Washington, D.C., in December 1889, it was insured for $1800, which Dr. Shepard, Jr. said in a letter was "... less than half the value my father put on it." After the younger Shepard's death in 1915, the collection was evaluated (at the request of the Executors) by Dr. Wherry of the Smithsonian, who set a figure of $1500; this included about a dozen uncut gems. The Executors expressed surprise at this low value, as they were of the opinion that Shepard had put a value of at least $10,000 on it. It was assumed by the Museum staff that this latter figure included the previously donated meteorite collection. A letter from the Museum to the Executors in 1915 states in part: "During the life of Dr. Charles U. Shepard, Senior, this collection had a much greater value than at present, owing to the time spent and money expended in bringing so many specimens together at a period when there were so few collectors in the field. Today there are many dealers in minerals, communication is convenient, and much that at one time were rarities are now obtained during mining and quarrying operations in large quantities. Furthermore, many of the species are very small and of practically no commercial value, though, in view of the very early date at which they were collected, they are of much scientific as well as sentimental value. The collection does, however, contain some material of real scientific importance for the present time."

Another Smithsonian letter of 1915 told the Executors that "... the entire Smithsonian collection (of minerals) —

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[2] Development of the Amherst College Mineral Collection, C. A. Francis *Min. Rec.* **5**, 190-192, 1974.

one of the largest and finest in the country — could probably be replaced at $10,000 - $15,000." (As this is being written, the Museum is negotiating for a single specimen for which the asking price is over $20,000).

The elder Shepard's mineralogical activities were not confined to collecting; he was a prolific author of more than a hundred publications on mineralogy alone - not counting meteorites. His *Treatise on Mineralogy* appeared in its first edition in 1832 (Vol. 1) and 1835 (Vol. 2). The second edition was published in 1844, and the two volumes of the third edition appeared in 1852 and 1857, respectively. Other interesting publications include a *Catalog of Minerals Found within about 75 Miles of Amherst College* (1876), *Report on the Mount Pisgah Copper Mine* (1859), and a *Report on the Copper and Silver-Lead Mine at Canton, Cherokee County, Georgia* (1856).

One reform advocated by Shepard in his *Treatise*, and carried out in labelling his collection, was that all established minerals end in *ite*, and minerals not yet well established end in *ine*. He admitted this would present difficulties with quartzite - already an established name for a rock formation - but endorsed Dana's earlier suggestion that the name of the rock, quartzite, be changed to quartzyte. He proceeded to follow his scheme, though he did not advocate carrying the scheme to its logical conclusion and use goldite, silverite, etc.

Shepard was always on the lookout for new minerals, and he described about one-hundred and forty of them - the first in 1832 and the last in 1882. Of these, only twelve remain as valid species: amesite, aphthitalite, corundophilite, danburite, microlite, monetite, nitrocalcite, nitromagnesite, oxammite, schlorlomite, tincalconite, and warwickite. Of these, the Smithsonian has only five of his type specimens. Most of the new species were described in the *American Journal of Science*, though some were first mentioned in his *Treatise*, and some in more obscure periodicals such as the *Rural Carolinian.*

Several factors were involved in the rather large proportion of Shepard's new minerals that are no longer valid, having been proved to be mixtures or identical with previously known minerals. Chemical analysis then was less exact than today, X-rays were unknown, and communication was far from instantaneous. Four of his minerals have not found recognition because they were chemicals found in spring water. It must also be reported that on occasion he reported a mineral as new without a full description of its properties and determination of its composition. He was taken to task for this by Dr. Fredrick A. Genth[3] ; Shepard answered Genth at some length[4] and Genth, having been sent (at Shepard's request) a copy of this answer, in turn answered the answer[5] —as often happened in the good old days when journals were less crowded and more receptive to polemic than today.

J. D. Dana also took a dim view of over-hasty publication. In the third Supplement to *Dana's Mineralogy*[6], Dana states, "The only minerals (since the last Supplement) have been announced in a mining report, and in this volume (p. 96), by Professor C. U. Shepard.

It is a matter of regret that mineral species are so often brought out, especially in this country, without sufficient and full descriptions. It is not meeting the just demands of the science of mineralogy to say that a mineral has *probably* certain constituents, or to state the composition in a general way without a complete and detailed analysis; especially when there are no crystallographic characters to afford the species a good foundation. We have a right to demand that those who name species, should use all the means the science of the age admits of, to prove that the species is one that nature will own, for only such belong to science; and if enough of the material has not been found for a good description, there is not enough to authorize the introduction of a new name in the science. The publication of factitious species, in whatever department of science, is progress not toward truth, but into regions of error; and often much and long labour is required before the science recovers from these backward steps."

Shepard, in his above-mentioned[4] reply to Genth, probably also had Dana's remarks in mind when he wrote: "In conclusion, I have only to observe, that although it is much to be desired, in notices of new minerals and new localities, that the greatest circumspection should be observed, still something perhaps may not unreasonably be allowed in mitigation of a certain amount of inadequacy and imperfection in these first announcements, since it is better to publish, occasionally, novelties in science, than to retain specimens upon the shelves of our cabinets for too long a time, unexamined and undescribed: for even a hint on the road to discovery will often stimulate to research and bring new inquirers into the field, whereby the ends of true science are sure to be promoted, although it may now and then prove less satisfactory to the ambition of the first observer, who fails in monopolizing the undivided merit of a discovery. But a little humility and love of truth will ever be a sufficient compensation for such trifling losses. The time has come, moreover, when to establish a species in mineralogy on a perfectly secure basis, is attended with greater difficulty than formerly. The easily recognized species have long ago been described. Accident, it is true, may from time to time, develop those which are as well pronounced as any; but it will not be strange if many minerals, really distinct in nature, will demand the most thorough sifting on the part of many observers, in order to bring out their characteristic differences. For one, I shall ever hold myself ready to engage in any such researches, whatever may be their

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[3] *Am. J. Sci.*, (2) **23**, 415-427, 1857.

[4] *Am. J. Sci.*, (2) **24**, 38-44, 1857.

[5] *Am. J. Sci.*, (2) **24**, 133, 1857.

[6] *Am. J. Sci.*, (2) **22**, 246, 1856.

ultimate success; though I may perhaps by pardoned for hoping that they meet a juster appreciation than my late attempts in this way have had the good fortune to experience."

Obviously, the IMA Commission on New Minerals and Mineral Names had not yet been invented, though the need for it was clear!

The last years of Dr. Shepard's life were spent largely in Charleston, South Carolina, where, among other things, he prepared the handwritten catalog of his collection (now at the Smithsonian) before his death in 1886.

Dr. Shepard's son, Charles Upham Shepard Jr., was born in New Haven, Connecticut, on October 4, 1842. He graduated from Yale University in 1863 and received the Doctor of Medicine degree from Gottingen University in Germany, with high honors, in 1867. (It was reported that, had his dissertation been written in Latin rather than German, he would have received the highest degree a German University could bestow.) He became Professor of Chemistry at the Medical College of Charleston in 1867, where he remained until his retirement in the early 1900s. He died on July 4, 1915, in his 73rd year at his farm "Pinehurst" near Summerville, South Carolina.

In addition to his interest in minerals, he devoted much of his time after retirement to two divergent interests—the commercial growing of tea, and research on the phos-

NEW MINERALS DESCRIBED BY CHARLES UPHAM SHEPARD

Species now valid are in bold type; currently accepted names for the others are given. The date shown is the year Shepard published the mineral's description. A listing of Shepard's publications, arranged chronologically, is given in United States Geological Survey Bulletin **747**, p. 939-941, by John M. Nickels, 1924. Specimens now in the Smithsonian have the NMNH catalog number.

NAME	DATE
Adamsite = Muscovite	1857
Ambrosine (NMNH 128739)	1870
Amesite (Amesine)	1876
Antillite (NMNH 128740) = Serpentine (?)	1872
Apatoid (name later withdrawn)	1846
Aphthitalite	1835
Aquacreptite (NMNH 128741) = Serpentine (?)	1868
Arkansite (NMNH 128742) = Brookite	1846
Bagotite (NMNH 128738) = Thomsonite	unpbl. mms.
Beresofite (NMNH 128737) = Crocoite	1844
Bisphosphammite (inadequate description)	1870
Bismuthaurite = Maldonite	1857
Boltonite (NMNH 128743) = Forsterite	1832
Calcimangite (NMNH 128744) = Spartaite	1865
Calcozincite = calcite + zincite	1876
Calstronbarite = calcite + barite	1838
Calyptolite = Zircon	1851
Chalcodite (NMNH 128745) = Stilpnomelane	1851
Chaldnite = Enstatite	1846
Chalypite = graphite + cohenite (?)	1867
Chantonnite = ?	1846
Chathamite = ferrian Chloanthite	1844
Cherokine = Plumbogummite + Pyromorphite	1856
Columbiconite (NMNH 128732) (no description)	1876
Copperasine (inadequate description)	1859
Corundophilite	1851
Cymatolite (NMNH 128734) = altered Spodumene	1867
Danburite	1839
Dimagnetite = ps. of Magnetite after Ilvaite	1852
Ducktownite = Pyrite + Chalcocite	1859
Dyslytite = Schreibersite	1846
Dysyntribite = impure muscovite (?)	1851
Edwardsite (NMNH 128736) = Monazite	1837
Elroqueite (NMNH 128747) = Melanolite	1877
Epiglaubite = Brushite (?)	1856
Eremite = Monazite	1837
Erusibite (inadequate description)	1859
Euchlorite = Biotite	1876
Eumanite = Brookite (?)	1851
Ferrocolumbite = Tantalite	1844
Ferrosilicite = meteoric ferrous silicate	1859
Fowlerite (NMNH 128748) = zincian Rhodonite	1832
Glaubapatite = mxtr. Monetite + Apatite	1856
Glossecollite (NMNH 128749) = Halloysite	1857
Goshenite = Beryl	1844
Graphitoid = meteoric Graphite	1867
Guanapite = Taylorite	1870
Guanoxalite = potassium ammonium oxalate sulphate; doubtful species	1870
Haddamite (NMNH 128722) = Microlite	1870
Hagemannite (NMNH 128723 = Thomsenolite + Ralstonite	1866
Harrisite = ps. of Chalcocite after Galena	1856
Hermannolite (NMNH 128724) = Columbite	1870
Hitchcockite (NMNH 128725) = Plumbogummite	1856
Houghite (NMNH 128726) = ps. Hydrotalcite after Spinel	1851
Howardite = meteoric silicate of iron and magnesium	1848
Humoferrite (NMNH 128727) = Limonite	1876
Hydroniccite = Zaratite	1877
Hydronickelmagnesite = Pennite	1848
Iodolite = a meteoric alkali sulfide	1846

phate beds, and established a laboratory for the development of fertilizers. This work gained him international repute, and he worked on phosphate deposits and fertilizers both in Europe and Canada during the last twenty-odd years of his life. His interest in fertilizers developed early, for in January 1870 he addressed the first meeting of the Charleston County Agricultural Society on "Sources of Plant Food."

The fact that tea could be grown in South Carolina had been known for at least a hundred years, but no one had tried it commercially until Dr. Shepard, shortly after his retirement, started the venture at "Pinehurst." He was emminently successful, his tea became known far and wide, and the farm became a considerable tourist attraction in the early part of this century. (In Washington, D.C., Pinehurst tea was introduced to the Cosmos Club by Dr. George P. Merrill of the Smithsonian's Mineralogy Division and was commercially available at Burchell's store on F Street.)

Even though the Shepard Collection now at the Smithsonian represents only a small fraction of the minerals collected over the years by the elder Dr. Shepard, it contains many interesting specimens, some from localities long since defunct. When cataloging is complete, sometime in 1975, it will be available for viewing by interested mineralogists.

Jenkinsite = a Serpentine	1852
Kabaite = petroleum found in a meteorite	1867
Keatingite (NMNH 128728) = Fowlerite = zincian Rhodonite	1876
Kupaphrite = Tyrolite	1835
Lederite (NMNH 128729) = Titanite	1840
Lepidochlore = Mica + Chlorite	1859
Leucanterite (inadequate description)	1859
Leucopyrite = Lollingite	1835
Luoclacite = calcium bicarbonate in a spring	1857
Luochalybite = ferrous bicarbonate in a spring	1857
Luodiallogite = manganese bicarbonate in a spring	1857
Luomagnesite = magnesium bicarbonate in a spring	1857
Marmasmolite = Sphalerite + Sulphur	1851
Marcylite (NMNH 128701) = mxtr. Tenorite + Covellite	1854
Microlite (NMNH 128730)	1835
Mignumite = Magnetite	? ms only
Monetite (NMNH 123822, 128714)	1882
Monite (NMNH 128715) = carbonate/hydroxyl Apatite	1882
Moronolite = Jarosite	1857
Natrobromite = sodium bromide in a spring	1857
Natrodine = sodium iodide in a spring	1857
Niccochromite (NMNH 128716) (inadequate descr.)	1877
Nickelstibine = Ullmannite	1835
Nicopyrite = Pentlandite	1857
Nitramine (doubtful natural occurrence)	1857
Nitroclacite	1835
Nitromagnesite (NMNH 128717)	1835
Oktibbehite = meteoric iron + nickel	1867
Olivinoid = meteoric Olivine	1848
Ontariolite (NMNH 128718) = Wernerite	1880
Oxacalcite = Whewellite	1844
Oxammite	1870
Ozarkite = Thomsonite	1846
Palladinite = PdO (?) Inadequately described.	1857
Paracolumbite = Ilmenite	1851
Parailmenite = Ilmenite	1880
Parathorite = Thorite	1857
Partschite = meteoric Schreibersite (?)	1853
Pelhamine (NMNH 128720) = altered Anthophyllite (?)	1876
Perlimonite = Limonite	1857
Phosphammonite (Phosphamite) doubtful	1857
Phosphochromite (NMNH 128746) (inadequate description)	1877
Pyroclasite (NMNH 112737) = Apatite	1856
Pyroguanite = Apatite	1856
Pyroiodesine (NMNH 128721) = Serpentine (?)	1872
Pyromelane (NMNH 128750) = Brookite	1856
Pyrophosphorite = Whitlockite	1878
Rahtite = Sphalerite	1866
Rastolyte = a Vermiculite (?)	1857
Redondite = ferrian Variscite	1869
Rutherfordite = Fergusonite	1851
Schorlomite (NMNH 128705)	1846
Schreibersite = meteoric ?; not Schreibersite of Haidinger	1846
Selencuprite (NMNH 128706) = Berzelianite	1835
Solfatarite = Mendozite or Alunogen	1835
Sphenomite = a meteoric silicate	1846
Stephensonite = Malachite	1859
Sulphoselenite = Selensulphur	1835
Svanbergite = Platiniridium (not Svanbergite of Iglestrom, now valid)	1857
Syhedrite (NMNH 128708) = impure Stilbite	1865
Telaspyrine = tellurium-containing Pyrite	1877
Tincalconite	1878
Troostite (NMNH 128709,10) = manganoan Willemite	1832
Vanuxemite (NMNH 128711) = impure Hemimorphite	1876
Warwickite (NMNH 128712)	1838
Washingtonite (NMNH 128713) = Ilmenite	1842
Williamsite (NMNH 128704) = Antigorite	1848
Xanthitane (NMNH 128703) = altered Titanite	1856
Zircarbite (NMNH 128702) = ?	1876

"A NEW MINERAL - ALMOST"

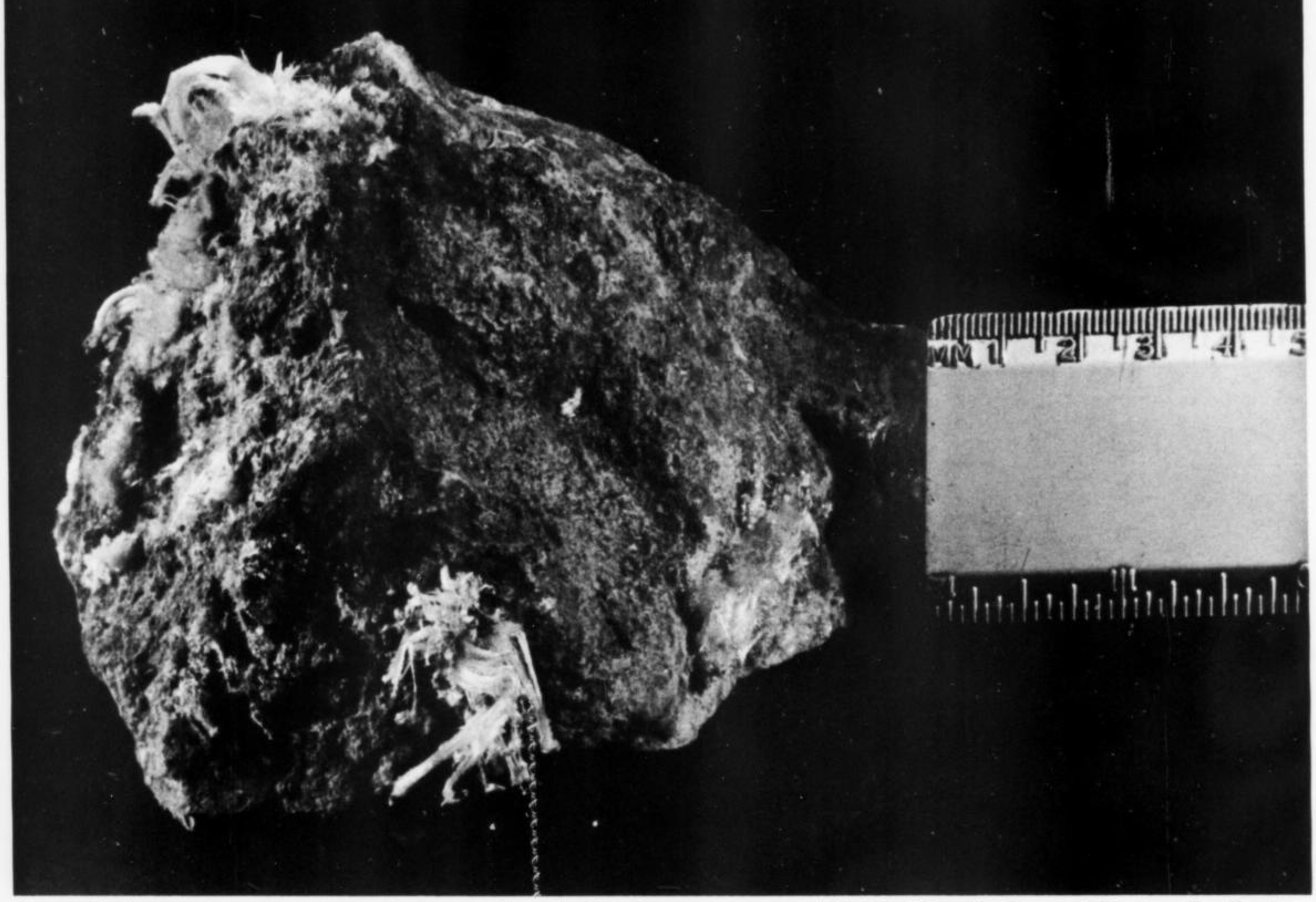

Figure 1. **Ammonium nitrate crystals on rough rock. Specimen property of H. M. Stitt, St. Bernard De Lacolle, Quebec, Canada.**

LT.COL. Q. WIGHT
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The question "What is a mineral?" is one of those deceptively simple queries which we answer with great authority to school children, yet spend hours squabbling about among ourselves. At first glance it appears to be a simple problem of definition. Consider, however, the case of two collectors from the Montreal Gem and Mineral Club in the summer of 1971-

The two collectors were working in Mont Saint Hilaire, on a site which had recently been blasted. Mont Saint Hilaire is, of course, noted not only for the profuse occurrence of rare and unknown minerals, but for the unusual habits displayed by the common or garden variety. It pays, therefore, to keep a sharp eye out, and that is precisely what these two were doing. Half way up a pile of iron-stained rubble, one man came across a sight that set his toes curling. There, in the bright sunshine, was a rock a foot across, and growing all over one end was a half-inch of beautiful white fur!

Clutching his find to his chest, he staggered down the pile, hoping, like all true mineral collectors, that his partner had had a sudden call to Patagonia, and he could keep it all to himself. His partner, however, again like all true mineral collectors, was right on top of him as soon as he hit the ground. Together they surveyed the find. The rock was crumbly, and deeply stained with iron oxide. It had obviously come from a weathered zone near the top of the cut, and it had tumbled for some distance, but the fine silky fur of crystals covering the end was undamaged by the fall. The growth was delicate as dandelion down, and resembled nothing they had come across before. True, there were other acicular and delicate crystals in the quarry, but the association of this one was unlike any of those.

"Where there's one, there's two", said the second collector, and off he went up the pile. Soon there were half a dozen smaller specimens surrounding the large one. The question now was how to get them home? Wrapping was out of the question. As it was, the first find was too big to carry any distance. Here, luck stepped in. Two heart-in-the-mouth chisel strokes, and the furry end split off neatly in two pieces—one for each collector. The decision was then made. Carry the big specimens by hand to avoid crushing, and wrap the others to be used for analysis. Gingerly, there wended their way home.

At home, the finder spent half an hour explaining his brilliance as a collector to his wife (who gave up listening to him years ago), then unwrapped one of the smaller pieces.

There was no trace of fur on the specimen!

There was no trace of fur in the wrapping!

There was just a dirty, crumbly, rusty rock.

Dumbfounded, he called his partner. Yes, the other big one was fine. No, he hadn't unwrapped any. Wait a minute. Oops! All the fur had disappeared from the other wrapped specimens!

Hastily, they photographed their remaining hand-carried pieces to preserve a record, then started ploughing through texts looking for clues to the identity of the fur. The rock was iron stained. Fibrous melanterite? Unfortunately both iron and sulphate tests require reagents not commonly found in the average kitchen. (They should be in the average collector's kit—but chemicals are becoming harder to obtain at the amateur level, since so many can be used for clandestine purposes.) Wait a bit—melanterite tastes sweetish; what does this taste like? TERRIBLE! Scratch melanterite. Epsomite? Tastes bitter. Maybe. Solubility in acids? Hard to tell. The crystals disappeared instantly in water, and showed no appreciable reaction with hydrochloric acid.

At this point the finder was reaching for his blowpipe when he took another glance at the big specimen. In obtaining crystals for test, he had cleaned off one spot about thumbnail size right down to bare rock. But there was no bare patch now—it had all grown back! He went quietly to bed instead.

At breakfast the next day he cast a furtive glance at the rock. It looked peaked; it had lost its tone. At noon his wife called him at work. "That furry rock of yours", she said, "has gone BALD!" It was true. The rock was completely bare. The only unusual sign was a slight dampness in the paper it was sitting on. He called his partner.

The other specimen was just fine. No change at all. The time had obviously come, however, for some professional help. Fortunately for Canadian collectors, although professional mineralogists are few in Canada, they are very helpful. Dr. J. Mandarino, of the Royal Ontario Museum, listened sympathetically to a long tale of woe and accepted a parcel of rock for study.

In the meantime, the original rock sat quietly and largely ignored on the shelf. Bald and barren, it was just another rough chunk of iron-stained junk. After a couple of days, however, its appearance began to change once more: two days later it had regained all of its original furry splendour!

The thought that it might be a living growth had, of course, occurred to the collectors. They had soon abandoned this idea, however, since they knew of no living material, plant or animal, which dissolved so rapidly in water, and was downy yet brittle. When plucked from the rock with tweezers it came away instantly. There was no tug or resistance to indicate a rooted organism. It had to be a mineral.

Then the blow fell. Dr. Mandarino reported back. The beautiful, elusive and temperamental fur was ammonium nitrate. AMMONIUM NITRATE? That explained the behaviour. Ammonium nitrate, NH_4NO_3, is a very hygroscopic compound which rapidly absorbs atmospheric water. It has an unstable crystal structure also, undergoing polymorphic transformation above 32.1° C (89.8° F) from orthorhombic to monoclinic. On the day the rock was discovered, the weather had been clear and dry with temperatures in the low eighties. At the time of the disappearance of the fur, however, the temperature had hit 91° F, and the humidity had been correspondingly high. This had caused a double change—crystal structure and solution. The fur in the possession of the second collector had remained unchanged because it had been kept in a air-conditioned apartment. Similarly, the original specimen had regained its crystals after the temperature came down and the air became drier.

But ammonium nitrate has never been confirmed as a naturally occurring mineral species. Where did it come from? Again, Dr. Mandarino had the answer. "It's an explosive," he said, "Ask the quarry workers." A quick call to Mr. Poudrette, operator of that section of the quarry, confirmed the diagnosis. "I use an ammonium nitrate-fuel oil slurry", he said. "It's tricky to handle, but does a good job."

The mystery was solved. Explosives leaching from a bore hole had permeated the surrounding rock. All that remained were two furry rocks and two disappointed collectors.

These collectors had come to the crux of the problem which has had mineralogists at each other's throats for years. At what point on the scale of being does a chemical compound cease to be just a chemical compound and become a "mineral" as well? In this instance there was little justification for the use of the term mineral, since the material had only recently been placed in the bore hole, and had travelled in all probability only a few feet and in unchanged condition. On the other hand, there arises the spectre of the status of the altered smelter products of Laurium, the sublimated by-products of mine fires, and the unique occurrence of romarchite on a lost eating utensil in a Canadian river.

It looks as though to-day's explosives, fertilizers, industrial pollutants and discarded garbage may well be tomorrow's minerals. When are we going to decide?

To the Editor

DYNAMITE AD

Dear Sir:

Please answer one question relative to the dynamite Pala Properties, Inc. ad in Volume 6, number 3. Was it you who added the "censored" bar? I was not aware that Pala Properties operated a "moon" stone store!

Barry De Vita
Parsippany, New Jersey

We confess, we added the bar. Ed.

COMPETITIVE EXHIBITS

Dear Sir:

Your question about judging mineral exhibits must be my comment. Why can't pure mineralogy and art be used to good advantage? Unquestionably, exhibits are to be predicated upon the former to promote learning or appeal to the informed. It is also true that color, form, and composition are invaluable dynamics for creating or regenerating interest.

When introducing this phase of the science program, I always began with displays of local stones, in the rough, arranged beside matching ones that had been cut and polished to reveal their hidden beauty. I relied upon the esthete to attract and become a motivating force in discovering a new world. It is one of nature's most effective propellants and often provides the thrust which develops a genuine interest in mineralogy. It can also be that refreshing pause which delights the most perceptive eye. We must acknowledge its potential.

In pursuit of mineralogy, the refining process exerts a strong pull toward the pure. Yet if there is to be growth, balance becomes an imperative. Art can be a direct road to balance. It should play a subordinate role, for if overdrawn, it lacks honesty and becomes offensive, satiating, or misleading. This retards growth and vitiates the effort of those who gave mineralogy its status and dimension.

There is need for a reappraisal of value and a definition of clearcut, workable guidelines. There is even greater need of dialogue between the purists and exhibitors so that the best interests of mineralogy may be served.

(Mrs.) Esther Mazzola
Verona, New Jersey

Dear Sir:

Now you've done it! Your editorial in the May-June 1975 *MR* has opened up the biggest can of worms in the Federation larder, competitive exhibits and judging.

Let's face it, as long as mineral competition is treated like a stepchild at Federation shows (and others as well) it will always raise controversy and rancor. Competition as I now perceive it is inconsistent, ill-managed, and lacks direction.

First, science and art in mineral competition should be totally divorced from each other. Let exhibitors get "arty" if they wish but judge that artistic ability separately and have a separate awards category for it. Meantime, keep the integrity of the educa-

tional and scientific values of exhibits intact by judging them with a different set of rules designed solely for that purpose. Presently, if two displays are judged under the same rules, that which has slightly less educational and scientific value can easily win over another on the basis of artistry rather than science and education. How ridiculous! Granted, we are dealing with a hobby and provision must be made for all facets of the hobby, but let us identify each facet and treat it well. It is equally unfair to score an exhibit extremely low in the point standings if the exhibitor has done a masterful job of artfully displaying what he has, though it may be scientifically and educationally average when compared to those standards.

The biggest problem faced by the Federation, or any group putting on a mineral competition today, is the judging. At present, consistency in training and selection of judges is totally inadequate. It would be considered hilarious if so many exhibitors were not hurt by the system. It is clear that many fine Federation officers have tried valiantly to deal with the problem. They have tried voluntary workshops to train judges. A judge's workcard which records active participation and a file of available judges is maintained in an attempt to deal with the problem but the problem won't go away. Judging is still heavily criticized (fairly or not), accused of being inconsistent, lacks feeling and common sense, and (at best) designed to discourage competition. True or not, that is where judging and competition stand today.

A solution can be found only through the work of the Federation. This body politic must be the one to bring some sense to mineral competition and it can do it through the development of a judges training program.

Naturally, there must be a critical analysis of the existing rules done in the light of a sound set of goals and philosophy which must necessarily be established first. However, when all

is said and done, all the rules in the world are for naught if the judicial system is lacking, both educationally and in consistency.

Obviously, competition is important or hundreds of square feet of space and thousands of hours would not be devoted to it at every Federation show. Why not assign a portion of each Federation's budget equal to this degree of importance such that the money could then be available for the proper training of judges? Until an actual school for judges is developed there will always be a problem with competitive judging. The very nature of the existing system has built-in problems.

A good educational training program for judges would have to include a thorough inculcation of the rules, training in mineral identification and availability, and annual seminars in rules changes as well as the latest information relative to minerals. The Federation itself must support this program with a continually updated new-and-discredited species list, bulletins to alert judges on current developments relative to mineral competition. Not only should there be a force of master judges developed but a continual training program should be maintained for clerks, judge trainees, and the like.

The big problem with this would be getting people to participate. The answer may be to make it worth their while. Currently, judges at all Federation shows are volunteers. Granted they are given a token stipend, be it fifteen, twenty-five dollars. But where else can you get expert consultation services so cheap?

Can you expect judges to remain on the floor throughout much of a show to answer questions, be challenged, and this after spending six to twelve hours judging? The situation as it now stands invites problems! If hundreds of dollars, and sometimes much more, can be spent to bring in special exhibits to a show surely a good corps of judges is worth as much. Would a hundred dollars a day be too much for an expert judge? Wouldn't it be easier to hold that judge accountable for his work if he were paid well and Federation trained?

As long as competitive exhibiting is treated as a second rate part of shows there will always be problems. If it is as necessary a part of major shows as would seem, then let's put it on a proper financial basis and expect improvement and success. If mineral competition is not so important, then let's admit defeat and do away with it completely.

Robert W. Jones
Scottsdale, Arizona

Dear Sir:

Vol. 6, number 3 just arrived and your editorial is most interesting. Having been a collector for 25 plus years I remember when spectacular crystals and minerals drew my interest. Then I took a different look at the ores and the coppers, irons, etc., and began collecting them. Now I spend hours with them.

In 1964 I entered an Eastern Federation Show. Having attended many Federation shows and studied my rules handbook, I entered in class "any mineral, any size". Was I knocked down! A certificate of participation! I was staying at the show motel and asked one of the judges late one night to review my case. I was told the specimens were mediocre. I had heard that many times in connection with other displays. I pointed out one of my specimens and asked "Is the mediocre?" and the judge said "No". I pointed out another. Same answer. Then I asked why I didn't get some points on labels, rarity and showmanship. Labels were O.K. but nothing for showmanship as my specimens were not set in rows. Nothing in the rules said they had to be set in rows. Two rarities were admitted but was told "we have seen better in western shows"! That settled it. I said "Never again". If eastern specimens are compared with Dr. Bancroft and David Wilber's and other's specimens, what chance do we have?

Let me explain one of my rarities I pointed out. It is a clear beautiful yellow sulfur crystal 1/2" x 3/4" in a vug of anhydrite rock, covered with hundreds of sharp dogtooth calcite crystals, taken from top of a salt dome at New Gulf, Texas. Given to me in 1952 by a geologist who worked for Texas Gulf Sulphur. There never will be another, nor have I seen any others, as shortly after they started using the Frasch process.

I think shows will be much more interesting when judges appreciate nature's minerals, whether spectacular or not, as collectors do.

Naomi McGregor
Oceanport, New Jersey

When complex rules are interpreted by arbitrary judges, what can you expect? Ed.

Dear sir:

Your editorial in the May-June issue of *MR* is interesting. It merely agrees with what I have been saying; that there is no difference between exhibiting minerals and works of art. The display is the most important thing. A thing of beauty is a joy forever, and obviously it isn't the world's finest bayldonite specimen...Points off for it! All that is needed is the specimen plus label giving chemical composition and locality. I know of a Master exhibitor who only puts down the name of the state or country; he might make a mistake if he spells too many words on his label. There is no attempt to educate the public; it is up to the viewer to know what he is looking at. Do you realize that any healthy person can walk away with a trophy by playing this game; all that is required is a pretty specimen plus artistic design. We used to joke about a fellow back in Brooklyn saying that all he knew was where he bought the specimen and how much he paid for it.

If you want to see what is required in writeups go to a stamp show. The writeup is all-important, and counts as much as the specimen. I once showed some expensive stamps and took a 2nd because there was no writeup. Exhibiting minerals has a way to go. If an exhibitor has an unusual specimen let him state why it is. But of course that would throw it in the educational category and make him ineligible for mineral exhibition categories. I once saw a fine educational exhibit that was not given to top prize (in that category) because the judges said it was too detailed. Ha ha. So much for my thoughts.

One other thing. From time to time I collect specimens that I feel a museum might be interested in. This may sound silly, but can you suggest several museums (other than the Smithsonian and American Museum of Natural History) that I might give specimens to?

Henry H. Fisher
4636 Dundee Ave.
Columbus, Ohio 43227

We will let the museums suggest themselves. Ed.

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ON LIABILITY UNDERGROUND

Dear Sir:

I have just read Wendell Wilson's letter in regard to changing the laws so mine operators would no longer be liable for injuries received by collectors while on their property. It is a thought, but I feel that my companies are morally responsible for the safety of people. This also applies not only to experienced miners, but the collectors and all various inexperienced, including the trespassers.

Mining has taken me 8000 feet below surface in heat and foul air, where rock pressures cause drifts to buckle inwards in hours, and experienced miners have serious accidents purely because their reflexes were not up to par. I have seen a man brought to surface with an arm torn to shreds because his partner did something stupid. I have smelled the decaying body of a man buried under tons of rock and timber while the rescuers toiled 7400 feet below surface 24 hours a day for two weeks to dig him out, only for another burial.

I could go on, and on, but please remember we are our brother's keeper, and perhaps legally we can change the laws, but we cannot shirk the moral responsibility for a person's safety. Remember, very few collectors are experienced miners and are totally oblivious of danger in mines or quarries.

Let's think a little more on this problem of the collector-mining operation. I am sure there is an answer, it will just take a lot of thinking. May I have more on this?

William J. Fink
President
Economic Mineral Investigations Ltd.
Porcupine, Ontario, Canada

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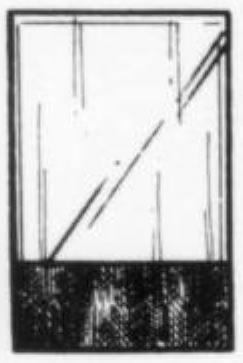

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