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the Mineralogical Record

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editorial matter

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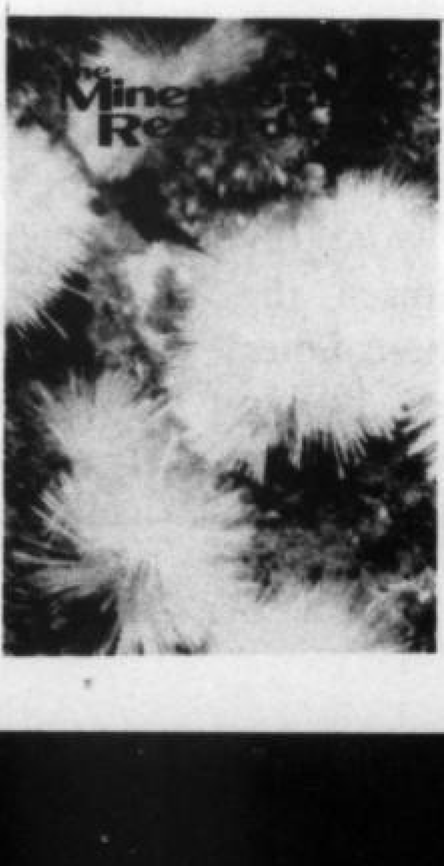

Cyanotrichite with brochantite from the Grandview mine, Coconino County, Arizona. The specimen was collected by Wayne C. Leicht. Photograph by Julius Weber.

EDITORIAL PAGE

Time for action

The time has come to discuss some of the facts concerning publication of the *Mineralogical. Record.* We have attempted, from the beginning, to produce a magazine devoted to serving the interests of mineral collectors the world over. We wanted, and I feel we have created, a magazine in which we can take pride. Unfortunately there is a disadvantage to a format such as we have adopted, it tends to convey an image of success, or at least of substantial financial backing. It is unfortunate because many readers are not made aware of the importance of their active support and our absolute dependence upon such support in order to continue.

The *Mineralogical Record* was conceived out of desperation. The editor tried for many years to persuade someone else to publish a worthy magazine for mineral collectors. While everyone agreed there was a great need, no one appeared even remotely interested in making a start. Finally, by default, I decided to step in and give it a try. The start was made possible through modest contributions from the newly-formed Friends of Mineralogy. Of necessity this support was limited and at no time was it expected to be substantial enough to carry the *Mineralogical Record* until income from circulation and advertising could put it on a self-supporting basis. Additional support was, and is, needed. Frankly we expected the circulation to grow faster than it has to help close the gap. There are now 2,000 subscribers and an estimated 5,000 are needed to break even.

It should be made clear that the only expenditures budgeted are those required to produce the magazine. The editor, his staff, and all contributors are in no way compensated monetarily or materially. Thus far publication of the *Record* has been possible only because many volunteers have been working devotedly on its behalf. The roles of these volunteers are extremely varied. Some search and solicit articles. Others proofread and retype manuscripts. Galleys need to be proofread and made ready for publication. Cover and supplementary photographs are prepared and provided without cost where needed. When each new issue is printed and delivered to my house, neighbors (these are not even mineral collectors!) come in to help prepare the magazines for mailing.

One volunteer has taken upon himself the responsibility of handling all over-the-counter sales. This includes mailing the issues, billing the recipients, and seeking new dealers who are willing to sell our magazine.

Advertising has, of necessity, been largely word-of-mouth as we have no funds for any advertising campaign. Sponsors of major mineral shows have provided space for us to display the Record and take subscriptions. The Friends of Mineralogy organization has assumed responsibility for finding members to represent the *Record* at these shows. Some subscribers have been writing letters to friends urging them to subscribe. Some mineral dealers are even duplicating our fliers at their own cost to send out with their own literature to customers. Dedicated collectors are boosting the magazine in lectures before mineral clubs. Other hobbyist magazines have graciously carried favorable notes and articles about the *Record.* Volunteer "agents" in various sections of the country have harried delinquent renewers, often amassing sizable telephone bills.

The difficulties of the production effort are further magnified because the editor and the editorial staff are all employed in full-time jobs. This means that their contributions are made largely on their own time, evenings and weekends. Obviously each considers it a labor of love based on a strong belief in the future of the *Record* and approval of the nature of its contents.

It is a fact that financial crisis has been looming just around the corner practically from the very beginning. We face another substantial deficit this year. Additional financial support is being sought right now but we cannot be certain that it will be found. However, you may be assured that we have no intention of permitting the *Mineralogical Record* to die without a vigorous struggle. Too many supporters feel that the *Record* is too vital to allow it to fold. Nevertheless, to survive, we may be forced to adopt drastic cost-cutting measures next year. Two obvious alternatives appear to exist. One would be a cheapening of the product. This would involve less expensive printing, paper, artwork, etc., and the possible elimination of color on the cover. The other would be reducing the number of issues to four a year until we can afford six again. The editor and nearly everyone consulted favor the latter course. Naturally we hope that *neither* alternative will prove necessary and we are struggling mightily to avoid the choice.

WHAT CAN YOU DO?

You as a current subscriber can help. If you personally would persuade at least *two* other collectors to subscribe, the increase in circulation would put us in a very healthy condition. It will also save us considerable costs and effort if you would renew your own subscriptions promptly. It is very expensive and time-consuming to pursue slow renewals. Your club can be persuaded by you to urge local public and school libraries in your area to begin subscriptions or even to provide many of them as gifts financed with club funds. Advertisers are most important to financial stability. We can keep them happy only if our readers buy specimens and products while mentioning the advertisement seen in the *Record*. Another activity, which on the surface may not seem too significant, will help immensely. Readers must convince potential readers that the *Record* is NOT too technical to be understood by the average collector. It is true that there are some technical materials in each issue but these do not constitute a substantial portion of the contents. Certainly 75% of the contents can be understood by any collector who really wants to learn about minerals. How many people derive that much pertinent information from any magazine they subscribe to? Certainly vast portions of most magazines go unread. But potential subscribers seem to need convincing that this magazine is at their level.

The decisions about the *Record* then fall upon the shoulders of all of you who are anxious to see it continue. We are doing all we can with severely limited resources. If you personally care about the existence of a magazine serving your needs as a collector you will have to make a genuine effort to help. We know that a sustained effort by all will guarantee our survival. Something less than your full support will make survival in the present form precarious indeed. ■

John S. White, Jr.

TUCSON SHOW ADOPTS NEW FORM OF COMPETITIVE EXHIBITING

A new form of competitive exhibiting first suggested in the Mineralogical Record (Vol. 2, no. 2, p. 51) will be tried out at the annual show of the Tucson Gem & Mineral Society, Tucson, Arizona, February 11-13, 1972. Entrants will display one specimen each of a designated mineral. The specimen with the most impact will be judged (without rules) the winner. There will be three size categories so that each entrant may enter three specimens, one in each category. These will be thumbnail, miniature, and cabinet. The designated mineral will be WULFENITE, not only because of its beauty and variety of color and form, but also because 95% of the known localities for wulfenite are within 125 miles of Tucson, and most of the collectors in the Southwest have specimens of it.

For more information write to:

Mr. Cal Thompson
Tucson Gem & Mineral Show
P.O. Box 6363
Tucson, Arizona 85716

MEETINGS & SHOWS

WHO & WHAT	WHEN	WHERE	CONTACT
1972			
Tucson Gem & Mineral Society, 18th Annual Show	**Feb. 11-13**	Tucson Community Center Tucson, Arizona	**Joe D. Kreps,** 1402 W. Ajo Way #271, Tucson, Arizona
Suncoast Gem & Mineral Society 2nd Annual Gem and Mineral Show	**Mar. 3-5**	Gateway Mall St. Petersburg, Fla.	**Robert S. Willis,** 4350 6th Avenue N. St. Petersburg, Fla. 33713
Geological Society of America, ***Northeast Section*, ann. mtg.**	**Mar. 9-11**	Buffalo, New York	**E. J. Buehler,** Dept. of Geol. Sci., State University of New York Buffalo, N.Y. 14207
Gem. Lapidary & Mineral Soc. of Montgomery Co.—8th Annual "Bouquet of Gems & Minerals" Show	**Mar. 11-12**	Charles Woodward High School Rockville, Md.	**Jim Durborow,** 3006 Kramer St. Wheaton, Md. 20902
Geological Soc. of America, ***Southeastern Section*, ann. mtg.**	**Mar. 27-29**	Tuscaloosa, Alabama	**Fred Handy,** GSA, Box 1719 Boulder, Co. 80302
Geological Soc. of America, ***Cordilleran Section*, ann. mtg.**	**Mar. 29-Apr. 1**	Honolulu, Hawaii	**Fred Handy,** GSA, Box 1719, Boulder, Co. 80302
Geological Soc. of America, ***South Central Section*, ann. mtg.**	**Apr. 6-8**	Manhattan, Kansas	**Fred Handy,** GSA, Box 1719 Boulder, Co. 80302
Cincinnati Mineral Society, 8th Annual Show	**Apr. 22-23**	Colerain High School Cincinnati, Ohio	**Terry E. Huizing,** 5341 Thrasher Dr. Cincinnati, Ohio 45239
South Central Fed. of Mineral Societies Convention and Show	**May 5-7**	New Convention Center Waco, Texas	**Otto Schlemeyer** 1913 Mountainview Drive Waco, Texas 76710
The Rochester Gem & Mineral Show	**May 6-7**	Nazareth College Rochester, N.Y.	**Miss Dorothy Lind,** 190 Weldon Street, Rochester, New York 14611
Geological Soc. of America, ***North Central Section*, ann. mtg.**	**May 10-12**	DeKalb, Illinois	**L. D. McGinnis,** Dept. of Geology, Northern Illinois University DeKalb, Illinois 60115
Geological Soc. of America, ***Rocky Mountain Section*, ann. mtg.**	**May 11-13**	Laramie, Wyoming	**Fred Handy,** GSA, Box 1719 Boulder, Co. 80302
International Gem and Mineral Show	**Jun. 16-18**	Sheraton Park Hotel Washington, D.C.	**Sylvan M. Marshall,** 1825 K St., NW, Washington, D.C. 20006
Mineralogical Society of Arizona (& Rocky Mountain Federation), 1st Annual Show "Gems of the Desert"	**Jun. 23-25**	Veterans Memorial Coliseum, Arizona State Fairgrounds Phoenix, Arizona	**Perry Stufflebeam** 3139 W. Holly Phoenix, Arizona 85009
Amer. Fed. of Min. Societies & Calif. Fed. of Min. Societies, Annual Show "Fantasy of Gems"	**Jun. 29-Jul. 2**	Anaheim Convention Center Anaheim, California	**Don J. Blood,** P.O. Box 3055 Orange, California 92665
Midwest Fed. of Mineralogical & Geological Societies, 32nd Annual Field Trip Convention & 5th Annual Upper Peninsula Gem & Mineral Show	**Jul. 19-24**	Ishpeming, Michigan	**Bob Markert,** Route #1, Box 620 Ishpeming, Michigan 49849
Geological Soc. of America and Mineralogical Soc. of America, ann. mtg.	**Nov. 13-15**	Minneapolis, Minn.	**GSA Headquarters,** Box 1719 Boulder, Colorado 80302
1973			
Geological Soc. of America, ***Cordilleran Section*, ann. mtg.**	**Mar. 22-24**	Portland, Oregon	**Dept. of Earth Sciences** Portland State University, Box 751 Portland, Oregon 97207
Amer. Fed. of Min. Societies & Eastern Fed. of Min. Societies Show	**Jun. 28-Jul. 1**	Charlotte Merchandise Mart, Charlotte, N.C.	**Al Lewis,** P.O. Box 712 Charlotte, North Carolina 28201
Midwest Fed. of Mineralogical & Geological Societies, Convention & Show	**Jul. 26-29**	Cincinnati Convention-Exposition Center, Cincinnati, Ohio	**Terry E. Huizing,** 5341 Thrasher Dr. Cincinnati, Ohio 45239
Geological Soc. of America & Mineralogical Soc. of America, ann. mtg.	**Nov. 12-14**	Dallas, Texas	**Geological Soc. of America,** Box 1719 Boulder, Colorado 80302
1974			
Geological Soc. of America & Mineralogical Soc. of America, ann. mtg.	**Nov. 18-20**	Miami Beach, Fla.	**Geological Soc. of America,** Box 1719 Boulder, Colorado 80302

PERSONALITY SKETCH
COL. CLARENCE M. JENNI

by David A. Burgess

There is a type of man called the "Renaissance Man". Many men are gifted and illustrious in one field of endeavor. What sets this man apart is his exceptional ability in various unrelated fields. His thirst for knowledge, his curiosity, his ability to apply himself to problems scientific, secular or divine and bring forth dramatic contributions for the enlightenment of mankind, is phenomenal. Excellence in any one field would satisfy most men that they had indeed achieved a full life. One individual might well achieve excellence in the arts, armaments, philosophy or make brilliant discoveries in the natural sciences. This is not so of the "Renaissance Man". He has always existed and exists today, to the confusion of the Cassandras that beset our era. It has been my rare privilege and rewarding experience to have known such a man—Col. Clarence M. Jenni, USA (ret'd).

Col. Jenni was born in Webb City, Missouri, 3 November 1896. That city was in the center of the Tri-State lead-zinc district. Although his father was a hoist engineer in the mines, Col. Jenni does not recall that he ever collected minerals or even mentioned them.

In World War I he enlisted in the 5th Marines as a private and participated in five battles including "Belleau Wood". In 1929 he re-enlisted in the 140th Infantry, U.S. Army, and was First Sgt. of Company M until 1930 when he was commissioned in the Reserve as a First Lieutenant. He completed the chemical warfare course and the Battalion Commander's course in 1936 and 1940. Upon general mobilization in 1940 he was promoted to Captain and assigned as Battalion Commander. He was promoted to Major in 1941; to Lieut. Colonel in 1942 and in 1946 was made full Colonel. During World War II he served in France, Germany, Belgium and the British West Indies, in the latter place training troops for jungle warfare in Burma. Later he served in various Pacific stations including Japan, Korea, the Philippines and China.

This honorable and active career, spanning better than three decades, would be sufficient to satisfy most men that had lived well ordered lives and had earned a "rest". It is evident from Col. Jenni's parallel and subsequent endeavors that he was too busy to entertain any such idea. For it was during this army period, between helping to stop the Kaiser's crack troops at Belleau Wood, teaching raw recruits the grisly tactics of jungle survival and arduous duty stations throughout the Far East, that this man felt the urge and found the time to school himself in other areas of scientific knowledge completely foreign to his vocation.

He began the study of paleontology and, stimulated by the enthusiasm and encouragement of Dr. Carey Croneis of the U. of Chicago, added a solid grounding in geology for good measure. The result of these "incidental" endeavors was a donation (on recommendation of Dr. Ulrich of the Smithsonian) of a collection of approximately 20,000 specimens of fossils to the Walker Museum in Chicago, with the additional satisfaction of having three new fossils named after him.

Early in World War II he was stationed near San Diego where a relative dearth of collecting areas rich in fossils prompted him to shift his interest to the collecting and studying of minerals. This eventually led to his greatest contribution to mineralogy, the intensive collecting of and exhaustive research on the minerals of the famous Crestmore Quarry near Riverside, California. By the end of World War II he had become thoroughly conversant with all the literature on the quarry by Eakle, Rogers, Woodford, Crippen, Garner, Dunham, Murdoch, Wilke, Foshag, Tilley, Burnham, Larsen, *et al.* First guided by an enthusiastic and helpful young collector, Jack Swartz, he became fascinated by the intense contact metamorphism and the bewildering number and complexity of the species resulting therefrom. Soon he was spending nearly every weekend in the quarry and, after his retirement, spent at least three days a week there. This dedication to Crestmore continued, with scarcely a break in time, until 1957. By his own estimate, he visited Crestmore more than a thousand times.

The Crestmore minerals generally occur in very limited areas and, since that portion of the workings richest in mineralogical interest known as the "Commerical" was still active, his constant attention to fresh exposures of material was responsible for the saving of many thousands of pounds of fine specimens. For example, he tells of one blast that exposed many square yards of fine afwillite and scawtite crystals accompanied by many calcium silicates in rare occurrences, notably bultfonteinite and a number of unknowns. He rediscovered tilleyite (originally described by Larsen and Dunham 1933) in a float boulder and traced it to the top of the hanging wall finding at least a ton exposed.

He relocated the small area from which came material that, in 1928, Dr. Tilley had identified and described custerite. Col. Jenni's insatiable curiosity led him to the dumps of the long defunct portion of the quarry, the "Lone Star", finding dozens of fine specimens (seam deposits of zinc and lead alterations in fine crystals, such as hemimorphite, anglesite and pyromorphite. Unquestionably his greatest find was that of the magnesium titanite, geikielite. He first noted it on the dumps of an adjoining property and it was identified as such by Murdoch and Fahey. He then found it in the Chino Mine at Crestmore. These two finds represented the second and third reported localities in the world for this exceedingly rare mineral.

Such enthusiasm and dedication was contagious. His researches caught the attention of professional and amateur alike. From the start of his work at Crestmore he received sympathetic and practical help from Dr. Murdoch of UCLA and Dr. Crippen of the California Geological Survey, they gladly identifying and describing hundreds of specimens he submitted to them. The amateur mineral societies began visiting the quarry in droves, regrettably, in some instances, with such avidity of the collecting spirit as to cause the personnel of the company more than one hair-raising incident to save the enthusiasts from bodily harm. But the Riverside Cement Company was magnificent in its cooperation. Col. Jenni's work was supported utterly by Mr. Wightman, the then Director of Mining and by Mr. Peter Nalle, the Mining Superintendent.

This unstinted support of Col. Jenni resulted in a company grant to Harvard that made possible the work of a graduate student (now Dr. Alden Carpenter) to make a significant contribution to the list of minerals existing in the quarry, the rare magnesium-calcium-carbonate, huntite.

On a specimen of the sulfides from the mine, Dr. Hal Miller of Colorado isolated minute quantities of the argentopyrite-sternbergite series.

Col. Jenni's tireless enthusiasm extended to the miners in the underground workings of the Chino mine who, encouraged by Pete Nalle, began a systematic saving of "different" materials encountered in the lenses of the limestone, resulting in some of the finest grossular crystals ever to be found at Crestmore, accompanied by fine masses of epidote, hundreds of pounds of splendent "black jack" mixed with arsenopyrite, pyrrhotite, galena and the sternbergite noted above. Small in quantity, but a precious find, was that of rich green botryoidal crystalline masses of prehnite, not unlike New Jersey material, beautifully tufted with laumontite. Periclase was rediscovered in the mine in relative abundance.

To Col. Jenni all credit is due for giving direction and purpose to a great number of amateurs who have renounced haphazard collecting for personal aggrandizement, a practice justifiably deplored by professional and sincere students of mineralogy alike. These amateurs have become infected by that most benign of viruses, "Crestmoreitis", and have carried on to this day happily doing hours of back-straining, thumb-smashing labor to save tons of fine specimens from the calcining drums. Emulating Col. Jenni's selfless example, they have given generously of their accumulations to the museums and universities here and abroad, where the professionals can scientifically continue the complex research necessary on the bewildering array of species this quarry has brought forth.

I personally know certain of these amateurs who have given well documented collections of select specimens to Princeton, Cranbrook, Michigan College of Mining and Technology, University of Coimbra, Portugal; the Royal Scottish Museum and, properly enough since both are in Riverside County, California, the Riverside Municipal Museum and the Palm Springs Desert Museum. Significantly, all these collections were assembled after the Colonel had left for the University of Missouri, self-evident testimony to the lasting interest and enthusiasm he inspired in others. Col. Jenni has well expressed this: "I think there is here a lesson for all serious collectors. The amateur does not have the knowledge or the equipment for anything but visual identification, whereas the professional does not have the time to collect carefully and methodically, especially when the exposures are quickly destroyed. However, as a team, with a little mutual understanding they are unbeatable".

His own contributions to universities and museums have been tremendous. When he returned to his home state he donated to the university the bulk of his collection which included, besides Crestmore, collections from at least one hundred localities in many states. Over the prior years he had given collections of the finest Crestmore specimens to the California State Geology Survey, the California Academy of Science, UCLA, the Colorado School of Mines, Arizona State U., the Montana Geological Survey, the U.S. National Museum and many museums in England, France and Germany.

Although I had corresponded with Col. Jenni for several years, regrettably I did not have the privilege of knowing him in person until the latter years of his work in the quarry, but that first meeting was memorable to me. I found him down in the "hole" (i.e., the old "Commercial") where, in September, the temperature fluctuates between 105 and 112 degrees. I saw a lean, wiry figure of a man, and it was immediately evident he was composed principally of whipcord and steel sinews for he was beating a boulder of tough quarry rock twice his height and ten times his girth with a twenty pound sledge. As I approached him the boulder split exposing a seam of sparkling crystals. With the glow of satisfaction spreading across his face akin to that of a twelve year old viewing his first catch of a wide-mouth bass, he explained with happy excitement that this was a singularly fine seam of afwillite crystals. With all this hard work and concentrated drive, there was an infinitely kindly patience and eagerness to explain and guide. Times innumerable I have seen him stop his own important collecting to examine with care and discourse upon a chunk of rock proffered by a beginner.

He gave enthusiastically of his time and energy to talks before mineralogical societies. As a speaker his address was informative and precise, holding his audience with unwavering attention. Invariably he brought to these meetings trays of specimens from Crestmore to give to all, and spent uncomplainingly much time answering a barrage of questions following his talk.

He says "I have been too busy collecting and researching to write much". It is true that his published articles are few, but the five published on Crestmore in *Gems and Minerals* (May-September, 1957) are recognized as the definitive treatise on the minerals of the Crestmore quarry, at least for the interested student and amateur collector. His personal correspondence has been enormous. I venture the guess there is no person world-wide who has a true interest in Crestmore, be he researcher, curator, teacher or collector, who does not have at least one hand written letter on file from Col. Jenni.

His continued energy is extraordinary. Some few years ago, learning that he had been gravely ill, I wrote to him much concerned, and being myself of his era, added a flippant remark regarding the contrast in the laudatory paeans to the Golden Years sung by those who are far removed from them, and the feelings of many enmeshed in them. I was properly "put down" and gently censured. He had fully recovered and was very busy teaching the rudiments of geology and mineralogy to some thousands of youngsters in the Columbia, Missouri school system; this, of course, in addition to his continuing research work on Crestmore and detailed planning of a number of summer field trips.

To all of us, professional and amateur alike, the ultimate reward for any contribution we may make to mineralogy is seeing our names in a professional paper with "ite" as a suffix. To all of us who know and admire Col. Jenni, the report in the *American Mineralogist*, Vol 5, 1966: "Jennite, a new mineral" was not only gratifying, but the proper recognition of his fine accomplishments at the Crestmore Quarry.

All credit is due the illustrious men mentioned herein, and many others duly noted in the literature of the quarry who, from 1914 on, collected, researched and published their findings concerning that extraordinary mineralogical phenomena, but their reports were largely confined to professional papers and the academic world. From 1943 until today, these same men generously and fairly acknowledge that one man alone has been the catalyst that has given recognition to the Crestmore Quarry. Its diversity of species rival Franklin, Långban and some of the old historical European localities. Had it not been for the dedication, insatiable curiosity, application and keen observation possessed by Col. Jenni—in short, the qualities of the Renaissance Man—thousands of specimens now secure in museum collections, the many species now identified and the continuing research on many as yet unidentified, would never have come to pass.

It is fitting to note that Col. Jenni's objective, indeed his credo, is identical with the objective of the "Friends of Mineralogy". Col. Jenni has stated it precisely: "I cannot overemphasize the importance of the exchange of information, particularly between the professional and the amateur. I have found most professors of mineralogy and related fields eager to help serious collectors. I also must emphasize the importance of study while collecting. You should study, then visit as many localities as possible to see the rocks and minerals in situ. Close observation and continued curiosity is of course essential. And, above all, every collector should give thought to the ultimate disposal of his collection. Amateurs literally have tons of important material, but they are mere curiosities unless they are available for proper study." ■

To the Editor

Dear Sir:

Congratualtions on V. 2(3) of *Mineralogical Record;* I enjoyed it very much. Now a small brickbat. How about printing the addresses of your authors with each paper?

Michael Fleischer
U.S. Geological Survey
Washington, D.C.

A good idea, one that we are adopting. Ed.

Dear Sir:

I would like to inquire about the possibility of including a brief biographical sketch (with photo) of the guest authors. I feel it would add a personal touch and give the readers a better understanding of the author.

Having traversed the gamut from amateur to the professional geologist, I am pleased to see this excellent magazine fill the void.

William D. Panczner
Clearwater, Florida

Also a good idea, but one not so easily implemented. Thus far we are working on a very tight schedule and we do not always have time to solicit biographies, edit them, and also photographs. However, we hope to bring this about and we agree that it is something readers enjoy seeing. Ed.

Dear Sir:

I was delighted to read your editorial (Vol. II, no. 2) about exhibiting and judging. You spoke my mind! I had suggested a team of three judges with individual scores two years ago, and then take the average, but nobody would listen. I have displayed since 1963, sometimes three or five showcases at a time, but I don't anymore. It has not only become a nightmare, but agony! Who needs this? Where is the fun? The best exhibit should be judged within the framework of the show in which it appears, not on a national or worldwide basis.

Please stress your points.

Mrs. Gertrude Houser
Cincinnati, Ohio

Dear Sir:

While I was representing the *Record* at the San Francisco show several students asked me why the magazine wasn't in school libraries. I have a pretty good idea that most school budgets are too tight right now to allow new subscriptions but I also have a feeling that if the school received the magazine for a year or two as a gift that the school would continue the subscription AND a lot of budding geologists, mineralogists and mineral collectors now in school might be induced to subscribe for themselves.

I think it is so well worth a try that I am enclosing a check for twelve dollars for a 1970-71 subscription for Diablo Valley College.

Vi Frazier
Danville, California

I hope your example is widely imitated. Don't forget, all gifts to schools are deductable. Ed.

Dear Sir:

Thank you for your kind words concerning our publication, "Mineral Collecting in Pennsylvania" (Arem, v. 2, no. 3). Compiling such a publication is a continuous process of adding new information, making corrections, and incorporating new ideas. We hope that we shall be able to make a major revision for the next edition (about 1975), especially since collecting conditions now are changing rapidly. Consequently, any suggestions you or your readers have will be most welcome.

Regarding the question on the use of the term byssolite from Walter Steinau, in Pennsylvania the term is used almost exclusively by collectors for hair-like aggregates of actinolite. Although brittle, the individual fiber crystals do not form a compact or brittle mass but instead are loosely interwoven, acicular, and not uncommonly slightly curved. In these respects it differs considerably in form from the compact and brittle form of serpentine. This latter commonly is referred to as "picrolite" for material from the Pennsylvania-Maryland serpentine belt. Both byssolite (as you note) and picrolite should be used as informal terms only. The term "williamsite" for apple-green, translucent serpentine is another informal name of this type commonly misused as a true mineral name.

Davis M. Lapham
Chief Mineralogist
Pennsylvania Bureau
of Topographic and
and Geologic Survey
Harrisburg, Pennsylvania

Dear Sir:

As a result of the publication of my article, "An occurrence of Buetschliite East of the Rocky Mountains", my attention has been called to the fact that there have been two previous reports of buetschliite in deciduous trees east of the Rockies. Both were in Ontario, Canada: Dawson and Sabina (1958, *Can. Mineral., 6,* p. 290-291) reported buetschliite and fairchildite from a partially burned hickory tree near Deseronto, Ontario; Mandarino and Harris (1965, *Can. Mineral., 8,* p. 380) identified buetschliite and fairchildite from a burned birch near Eganville, Ontario.

I would greatly appreciate you including this letter in a subsequent issue of the *Mineralogical Record* in order to correct the misimpression that my paper gave, *i.e.,* that the Virginia occurrence of buetschliite is the first one east of the Rockies and from deciduous trees.

Richard V. Dietrich, Dean
School of Arts and Sciences
Central Michigan University
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THE COLLECTOR

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While its relative position is not certainly known, mineral collecting now obviously ranks in the forefront of all hobbies. Along with attainment of this position has come a broadening internationalization of sources of supply for material.

At hand is a list, numbered the 2nd, from an apparently new dealer in Switzerland. With over 100 items mentioned it is a creditable effort. Many of the old standbys from Switzerland are offered, such as adularia, smoky quartz, hematite "iron roses," and pink fluorite. Other Swiss minerals, not usually seen on lists, are lazulite, milarite and danburite.

But the remarkable thing about this list to me is the wide variety of specimens offered from countries other than Switzerland. It is a virtual catalog of the more collectable minerals that are currently in supply world wide. Every continent is represented, totalling over thirty countries and states.

Let's mention a few species to demonstrate this range - likely many of these are already in your own collection. Zeolites from Poona, India, finally reaching the international market 100 years after first being noted. Uruguayan amethyst, Argentinian rhodochrosite, and Brazilian rose quartz crystals. From "down under," Dundas, Tasmania crocoite and Broken Hill, Australia rhodonite crystals. Many European specimens, such as pyromorphite from Germany, torbernite from France, and epidote from Austria; Rumanian stibnite, Italian demantoid and Sicilian sulfur.

A variety of species from Tsumeb, South West Africa, including mimetite, azurite, cerussite, cuprite and aragonite; Katangan malachite; and Moroccan roselite and vanadinite. Mexico is well represented with creedite, mimetite, hemimorphite, endlichite and so on. From the United States, rhodochrosite and goethite from Colorado, Arizona cyanotrichite, South Dakota golden barite, and from California, neptunite, benitoite and melanite.If you have all of these, how about the also-listed fluorite from Honduras, wulfenite from Iran, or chrysocolla from Israel? And all these from a new dealer in Switzerland!

We realize that many other dealers would be able to equal or surpass this list, but that even more strongly makes the point that mineral specimens have a notable mobility at present.

Contributing to this dispersion are a number of wholesale and retail dealers, many advertisers in this magazine, who routinely travel the world in search of suitable specimens. Others additionally are quite capable of leaving on short notice to track down examples from any significant new finds anywhere in the world. That these gentlemen can find an adequate marketplace for their efforts, considering the necessary extra charges for their travels, attests to the strength and numbers of the practitioners of our hobby.

More than ever, collectors in many countries are themselves setting out for far places with more or less success. Both collectors and dealers from many countries are beginning to congregate at several shows with an international flavor, here in the United States and in Europe.

All is not quite what it would seem however. In spite of the best efforts of our suppliers around the globe, there are not now and never will be enough of the really top rate specimens to satisfy the demand.

This apparent mobility of specimens is somewhat illusory. Only the minerals in initially large or continuing supply generally make a list such as my Swiss friend has sent out, and then they are the lesser pieces. Many desirable specimens are found only in limited numbers initially. Recent examples might be the crystallized chalcoalumites from Bisbee, Arizona, described in the Record for vol. 2, no. 3. These were almost entirely absorbed by collectors in Bisbee, which has one of the highest per-capita number of collectors of any town.

Also the finest azurites lately produced from the new oxidized zone at Tsumeb - these were reportedly purchased by a travelling American dealer, who was able to resell them to local collectors for as much as he could have asked by bringing them back to the United States.

Even when the find of specimens is quite large, running into the hundreds or sometimes thousands of pounds of crystallized material, there are always those pieces, perhaps ten percent, which stand out above the others. These are usually held back at a premium by the original supplier, and are quite often later dispensed partly as favors by the dealers fortunate enough to handle them.

While tending towards a rich man's avocation, it is still true that building a good collection of fine minerals has always been mostly a matter of being in the right place at the right time, personal contacts, and a liberal dose of luck, every bit as much as the wherewithall to nail down the specimen once located. The luck component can in large part be manufactured through persistent effort and as much exposure to favorable situations as possible.

The most satisfying specimens are those self-collected, but if your tastes run, for whatever reasons, to material from world wide or long depleted localities, this satisfaction is only obtainable to a limited degree. Then other traditional methods of acquisition must be relied on, and there is still a substantial thrill in the chase.

Many collectors do not realize that these most desirable specimens almost never reach a dealer's lists, and quite often, not even his shelves and drawers. Certain dealer's back rooms are legendary, and it is a mark of high esteem to be admitted.

These fine pieces stand much chance of appearing only on one-of-a-kind listings. If you have a favorite dealer who issues such lists, try to make arrangements to have them airmailed, and certaintly use the telephone for early orders if possible.

Best of all is to see the specimens sought directly, whether duplicates of another collector or museum, or at a dealer's shop, or at a mineral show. It is also generally unrealized that at present-day shows, the best specimens rarely persist in the dealer's hands through to the time of opening to the general public. It goes without saying that it is best to be early to a show, but how early? This trend towards pre-opening sales during set-up or even from a motel room seems to be accelerating; at a recent large Federation show it was reported that much of the best material was sold *two* days prior to opening!

At some European shows this is apparently not so critical - a European dealer once stopped through on a buying swing. On inquiry, he said that he had run out of material, and was restocking;had to get back before the show closed!

Especially in the heat of a show, decisions must be made quickly. Those who rely extensively on other's opinions will too often find that the specimens are missing on return for re-examination. My personal rule is to try to make the final decision on the spot, rather than to shop the entire range of offerings available first. Sometimes a "layaway" and return privilege may be extended, but this should be used quickly and judiciously and not abused.

In any circumstances, there is no substitute for development of your own personal judgement of specimens. This requires constant study of texts and magazines, discussions with other collectors, and examination of as many specimens as possible.

Only with this type of background can examples from a new find begin to be evaluated. This is of great interest when it arises because there are significant rewards possible occasionally. Mistakes, both of omission and commission, will be made, but they can be minimized to large degree with sufficient background. Certainly this self-education is an area where persistent effort is a necessity, and can be expected to be amply repaid both in acquisitions and in their later appreciation.

Collecting Rare Sulphosalts in British Columbia

by **J. Douglas Scott**
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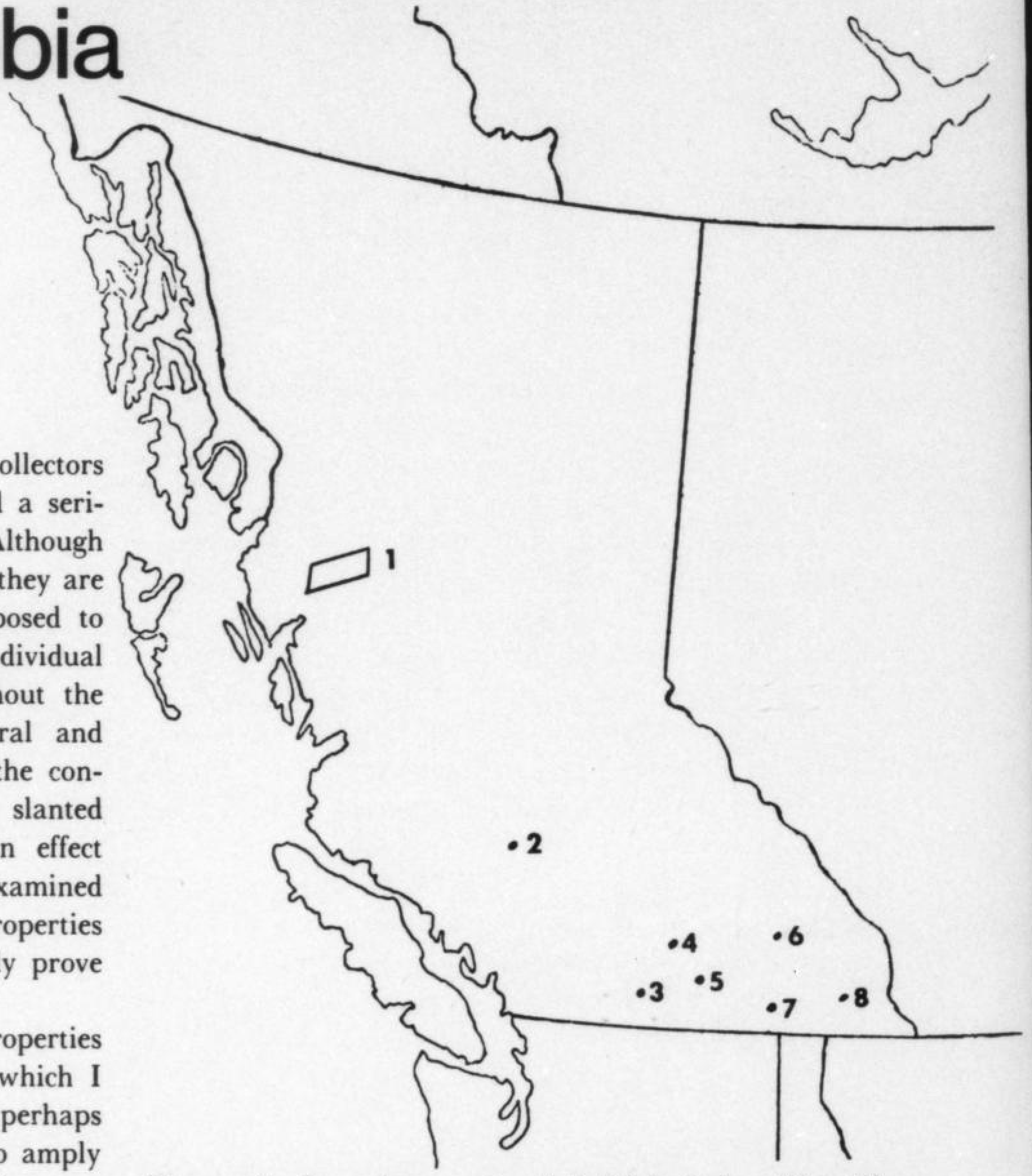

Figure 1 *Location map of British Columbia. The key numbers refer to the following areas: 1. Smithers-Terrace area, along Highway 16/2. Tungsten Queen/3. Good Hope Group/4. White Elephant Group/5. Highland Bell Mine/6. Beaver Group/7. Oxide Claim/8. Society Girl Claim.*

Introduction

The recent increase in interest by mineral collectors in the sulphide-sulphosalt group has emphasized a serious lack in the non-professional literature. Although there are many purely scientific papers in print, they are rarely of significant use to the collector as opposed to the professional mineralogist. Reports on individual deposits are brief and widely scattered throughout the various annual publications of Canadian federal and provincial Mines Branches. To add further to the confusion, the available descriptions are invariably slanted towards the viewpoint of economic geology. In effect this means that, unless a person has actually examined the particular mine, not only are the mining properties difficult to locate but once found they may easily prove not to have been worth the trouble.

In this article I have attempted to select properties in west-central and southern British Columbia which I know will be relatively easy to locate (though perhaps somewhat difficult of access) and which will also amply provide the experienced collector with rare, and in some cases unique, species. Please note that I am writing from the standpoint of a professional mineralogist who has been collecting and studying the sulphosalts for a number of years, and that I am thus able to make tentative field identifications of many of these remarkably similar species; this is essential at some of these localities if the best material is to be collected.

The reports listed are those with the most useful general coverage of the various areas and which are also still in print. They may be purchased from the Geological Survey of Canada, Publications Branch, 601 Booth Street, Ottawa 4, Ontario. The map numbers given at the beginning of each locality description refer to 1:50,000 topographic sheets available from the Map Distribution Office, Department of Energy, Mines & Resources, Ottawa, Ontario, at a cost of fifty cents per sheet.

Wherever possible I have given reference altitudes as well as the approximate altitude of the property under discussion. In the steeply mountainous terrain of British Columbia, a knowledge of the altitude at which a mine is located, together with the surprisingly accurate topographic maps, will enable a person to locate both himself and his destination. Many of the altitudes given were determined from my pocket altimeter, a Swiss instrument made by Thommen (the Everest), which I have found to be not only small, light and convenient but also very rugged and accurate; unfortunately it costs about forty dollars. I cannot over-emphasize the necessity of a good compass, and I feel very strongly that some sort of altimeter is equally necessary.

Most of the properties described are located either in the area accessed by Provincial Highway 16, between Smithers and Terrace, in central British Columbia (where I have spent three summer field seasons on helicopter-supported reconnaissance for large mining companies), or in the strip adjacent to the American border (Figure 1). All the mines and prospects which were visited have been known from the early part of this century, and most have been abandoned since the 1930's.

CENTRAL BRITISH COLUMBIA

Glacier Gulch (South Side Group) 93 L/14 W

There is easy access to the mineralogically important South Side Group pits, first worked during the early 1930's, as the main trail to the new molybdenite workings in the cirque below the glacier passes within 50 feet. Drive north on Highway 16 from Smithers for 1.7 miles; then turn left to pass around Kathlyn Lake on its west side. The new road up the gulch (directly in front of you as you leave the lake) turns west from this road 1.5 miles from the highway. Park at the old mill buildings (elevation 2550 feet) about two miles from the lake, and take the steep trail up the south side of the canyon. The pits lie on a small branch trail to the left of the main trail at an altitude of about 3200 feet.

Numerous small high-grade shipments were made from this property in the period 1933 to 1941; in all, some 130 tons of ore were shipped for a total of over 150 ounces of gold and 30 ounces of silver. All the gold was closely associated with bismuth telluride lenses, and was quarried from a relatively small area, measuring possibly 150 feet in length and rising through a height of 75 feet. The ore was found in sheared and altered crystalline tuff which has been highly silicified and bleached to a dull white color.

In order of abundance, the minerals joseite I ($Bi_{4+x}Te_{1-x}S_2$), bismuthinite (Bi_2S_3), native bismuth, gold, joseite II ($Bi_{4+x}(Te,S,Se)_{3-x}$), hessite (Ag_2Te) and tetradymite (Bi_2Te_2S) are (or were in 1965) collectable in quantity. The majority of the tellurides present are joseite I (not tetradymite, as given by Kindle, 1954). It occurs as platy crystals or masses of a pale steel-gray color, having a perfect basal cleavage. The crystals are usually tarnished to a dull grayish black with bluish or yellow iridescent overtones, but are splendent on fresh cleavages. Fine grains or platelets of gold are found along the platy cleavages of the tellurides and crystal masses are occasionally coated with a film of native bismuth.

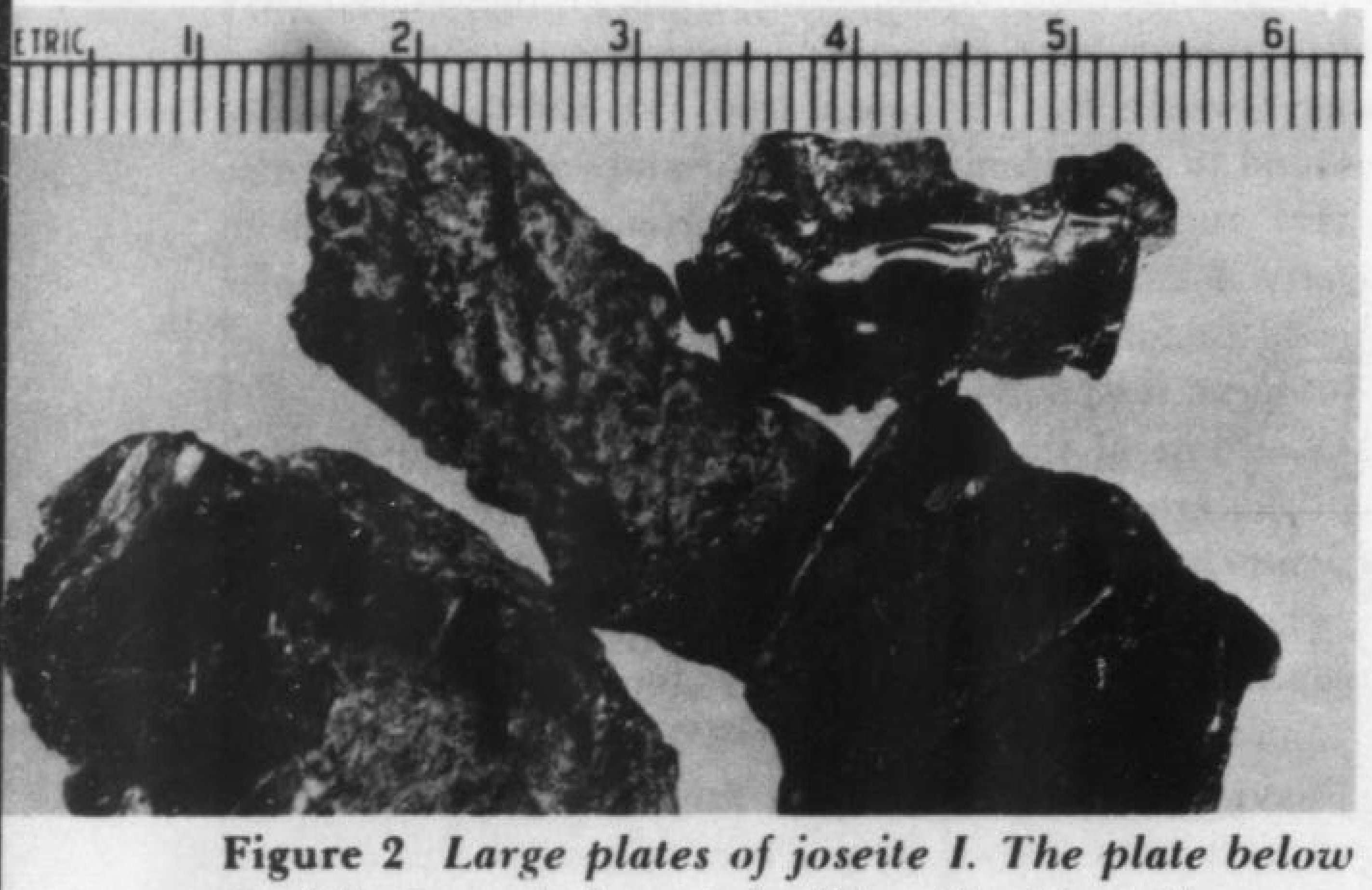

Figure 2 *Large plates of joseite I. The plate below the 2 in the scale is coated with native bismuth.*

In an open cut above the old tramway terminal (directly above the main quarry), the silica-tuff is replaced by a coarsely crystalline quartz pod. Excavation of this pod revealed several pockets which yielded fine large tabular crystals of joseite I (Figure 2), as well as some cleavage masses of bismuthinite.

Some of the best ore came from a narrow shoot on a ledge about 20 feet above the floor of the main quarry. The ledge and quarry floor still have some scattered flakes of joseite I (Figure 3) and the dump below the quarry contains much low-grade silicified tuff.

A heavy hammer is recommended, as the best material will be found along shears or as pockets in the silicified tuff. There is little or no micromount potential at this locality.

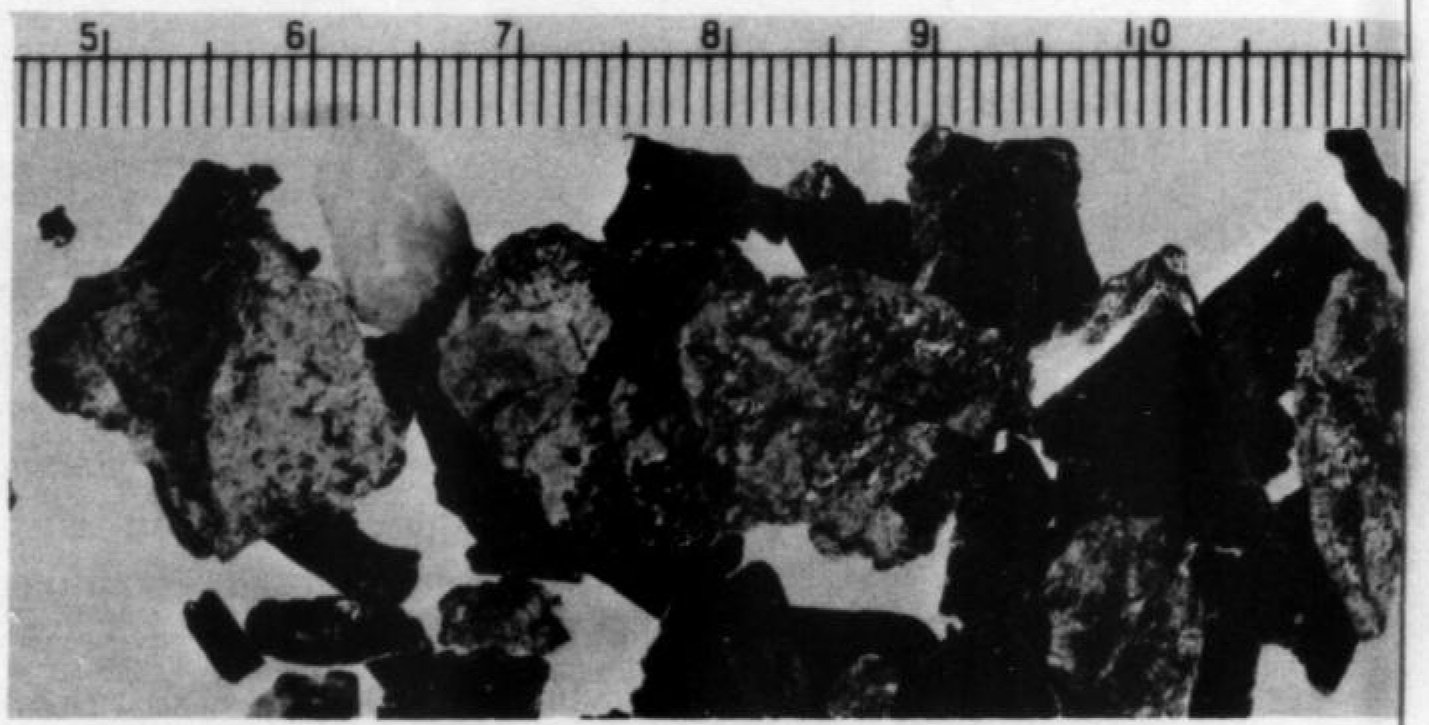

Figure 3 *Loose plates of joseite I, typical material collected from the quarry floor.*

Silver Standard Mine 93 M/5 E

The mine road runs north from the New Hazelton-Hazelton highway just west of the Two Mile Creek bridge (the only one north of the Bulkly River). The Nine Mile Mountain road branches from this 1.2 miles in; take the left fork and proceed for two miles to the fire tower road. Again take the left fork and drive one mile further to the mine.

Much of the ore is banded, with alternating layers of galena, sphalerite and tetrahedrite less than 1 mm thick. There is abundant arsenopyrite. The main mineral of interest at this property is greenockite (CdS) which occurs as rare isolated crystals perched on buff siderite rhombs in open pockets in the massive sphalerite ore. This massive sphalerite is sometimes covered with a dull orange-yellow earthy coating of hawleyite (CdS). The massive arsenopyrite ore should be checked for pockets, some of which contain tiny well-formed chalcopyrite crystals perched on the arsenopyrite crystal terminations.

Comet Group 93 M/5 E

This property lies just off the road to the old Mohawk mine. In the tiny hamlet at the start of the Silver Standard road at Two Mile Creek, turn right (east) just south of the sawmill (elevation 1000 feet) and cross

Two Mile Creek. The road follows the valley floor, crosses Four Mile Creek, and swings around the south slope of the low 'peak' of Four Mile Mountain. The main adit (elevation 1200 feet) is just above this road at a point some 3.1 miles from the Two Mile Creek bridge.

A wide quartz-siderite vein in the adit carries over 15% jamesonite ($FePb_4Sb_6S_{14}$) with subsidiary pyrite, sphalerite and galena. In places, the jamesonite is partly altered to stibiconite. Superb micromounts of jamesonite are readily available, as well as bladed crystals in pockets in the larger ore masses. Because of the extensive alteration of the material, the best specimens will come from breaking large chunks. The most favourable collecting areas are the main adit dump and a small ore pile adjacent to a shallow shaft located 30 feet above the 60 feet N5°E of the adit portal.

Sunrise Group and Lead King Group 93 M/6 W

For those with a four-wheel-drive vehicle and the inclination for a mountain walk, the Sunrise Group on the north face of Nine Mile Mountain is the only Canadian locality where cosalite ($Pb_2Bi_2S_5$) may be easily collected. The adit and associated pits are at an elevation of 4800 feet, and are reached by following the Nine Mile Mountain road (see Silver Standard mine) for about 10 miles to its end in Silver Cup basin (elevation 3400 feet). A well-marked trail leads eastward from here for two miles, over the shoulder of the basin, to the ruined Sunrise cabin just above the timber line at 4250 feet. The old trail to the workings from the cabin has essentially vanished; however, the dumps are visible near the skyline, almost directly upslope (southeast) from the cabin, near the eastern rim of the cirque.

In an open cut some 20 feet above the portal of the main adit (4800 feet), four parallel veins are exposed which contain large pods of massive sphalerite-jamesonite ore. Further upslope at the 5000 foot elevation, another adit has been driven, and some 75 feet southeast along the contour there is a small open cut. A small ore dump in this cut consists almost entirely of solid sulphides, chiefly jamesonite, sphalerite, cosalite and boulangerite, with minor arsenopyrite, galena, argentite, tetrahedrite and stannite.

There are numerous other pits and trenches in the immediate area, some caved, on the dumps of all of which massive sulphosalts may be collected. However, if you are not familiar with the fibrous sulphosalts, do not expect to be able to distinguish between jamesonite, boulangerite and cosalite in the field.

The Lead King Group is visible on the eastern side of the narrow (about 900 feet wide) cirque on whose western rim the Sunrise veins outcrop. This cirque is very steep-walled, and the basin is filled by loose talus so that it is a mountaineering task to follow the veins across the cirque. The group is best reached by continuing past the Sunrise cabin along the pack trail to the Lead King cabin, which lies in an open grassy meadow (4075 feet elevation) just within the timber line at the foot of the cirque. A rather well-marked trail leads to the pits along the eastern rim of the basin at an elevation of about 4800 feet. The property was reinvestigated in the early 1950's, and much of the debris was cleared.

As at the Sunrise, the lenticular veins occur along slickensided fault fissures in the granodiorite. There is rather more jamesonite than cosalite on this property. Some fine stubby jamesonite crystals were collected from an open cut about 50 feet above the inclined shaft (elevation 4700 feet, about 800 feet of the cirque rim). A small adit and open cut just east of the cirque rim at 4700 feet (just south of the trail) have an associated ore dump (perhaps 4 to 5 tons) of sphalerite-galena with minor tetrahedrite.

Rocher Déboulé 93 M/4 E

There are two adjacent mines on this mountain, the Red Rose and the Rocher Déboulé, neither of which is being worked at present. Both are reached by an eight-mile long road (four-wheel-drive at the upper end, mainly because of washouts) which branches east from Hwy. 16 at Skeena Crossing (elevation 700 feet) and follows the north bank of Juniper Creek; there is only one fork, at about 3500 feet. Both branches are about 1 ¼ miles long, the right leading to the Red Rose Mill (4000 feet) and the left to the Rocher Déboulé camp at 4100 feet.

The dumps at both these mines will repay ultraviolet lamping, as there is abundant scheelite, some of it quite coarsely crystallized in the pegmatitic fissure veins. Minor actinolite and hornblende crystals occur at the Rocher Déboulé, as well as a rather odd form of apatite. The apatite occurs as fibrous prismatic crystals of a greenish gray-white color, some of which display radial or spray-like terminations. Large amounts of chalcopyrite are associated with the scheelite ore as well as minor cobaltite and cobalt-nickel sulpharsenides. Some well-crystallized ferberite has also been found, but only at the Red Rose.

Whiskey Creek Group 103 P (not covered by the 1:50,000 series)

Location of this property is somewhat difficult, not because of distance (it is about 100 yards south of Hwy. 16), but from lack of landmarks. Some 23 miles west of Hazelton, watch for a sign for the Kitwanga ferry. Whiskey Creek is then the second large creek past this point (about 5 miles, nearly opposite Woodcock). Turn off the highway just east of the new bridge and follow the east bank of the creek to the old bridge (some 200 feet) where there is space both to park and to turn around.

This property should be visited in the late summer or early fall, as the best vein is actually in the creek bed and will be under water in spring. Climb over the low hill just south of the parking place and descend its farther side to creek level where there is a short adit and some cuts. Immediately north of this adit on the inside of a small bend in the creek, the vein outcrops in the creek bed and walls.

This property is unique, and perhaps the most mineralogically interesting of those described. I am quite sure that more extensive digging than I was able to do will produce more pockets and probably considerably extend the list of species found. To this end, I will gladly perform x-ray identification on any material from this locality (for a small consideration in specimens). I visited the property only by chance and, though intrigued by the odd appearance of the ore, did not discover what I had collected until after I returned to Toronto. As far as I know, the property has not been visited by any collector either before or since.

The vein, perhaps six inches wide, occurs along a small fault in a gray, fine-grained, sericitic quartzite. It strikes north parallel to the creek walls and dips some 20° east into the hill. In the small bend in the creek it is well exposed over several square feet, cut off to the north by the creek but open to the south where it vanishes under shallow debris below the adit. The same or a similar vein also appears on the south (west) bank of the creek at the next bend upstream, some 70 feet south of the adit.

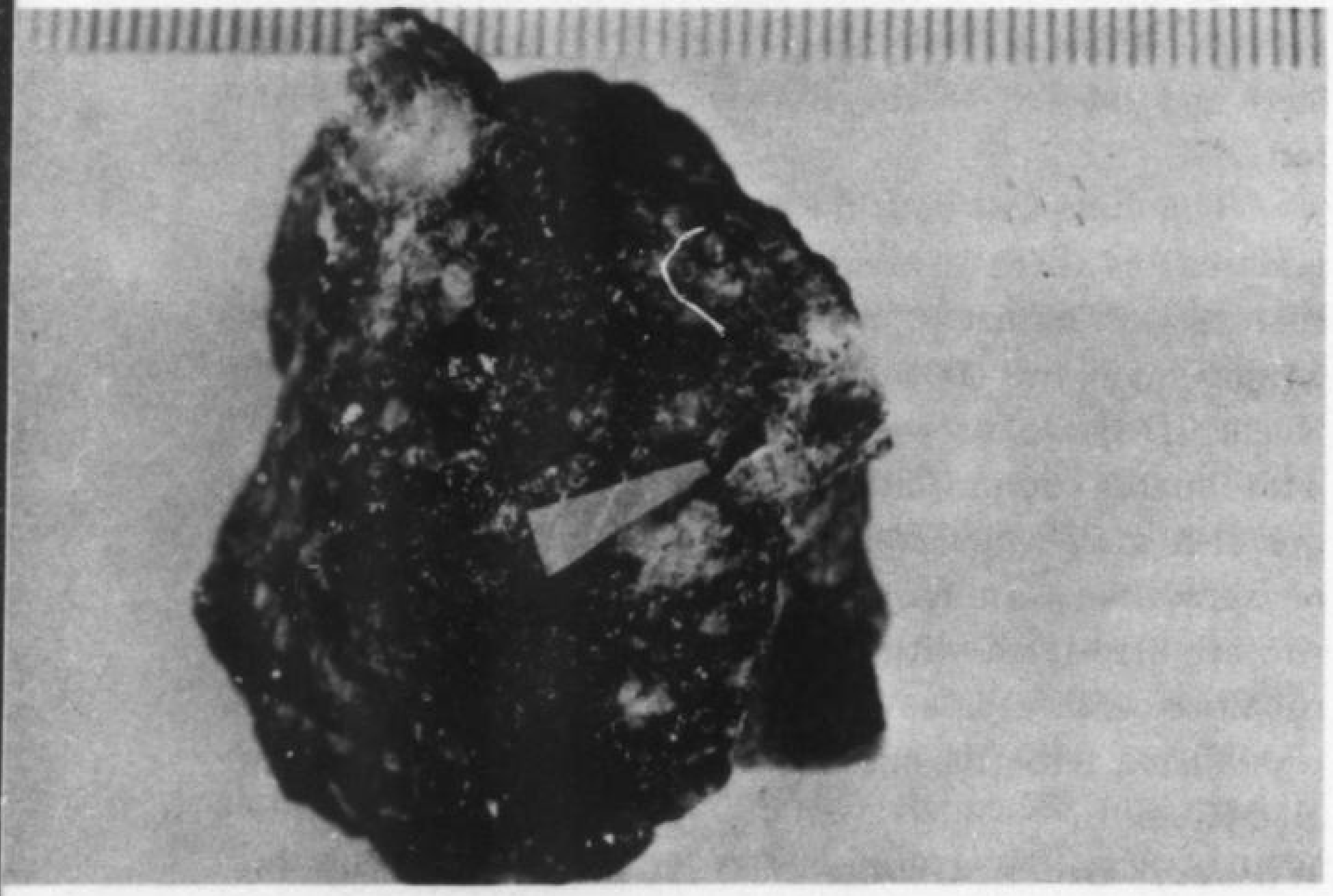

Figure 4 *Seligmannite crystal in vug (arrow). The slightly fibrous metallic mass is also seligmannite. The highlights are tiny arsenopyrite crystals.*

The vein, heavily mineralized with pyrite and arsenopyrite, contains minor amounts of galena and sphalerite. The mineral of interest, however, is seligmannite ($PbCuAsS_3$), which occurs as abundant, dark lead-gray, slightly felted masses in the central portion of the vein. It is frequently tarnished to a bluish sheen. The core of the vein consists of a discontinuous series of tiny vugs which rarely exceed 3 mm in any dimension. Growing from the walls of these vugs are small (1 mm is the maximum seen) lustrous crystal bundles of seligmannite with an iridescent peacock-blue to golden tarnish. These crystals (Figure 4) are identical to and fully as fine as any from the Binnental. This is the only known Canadian occurrence of the mineral.

Grotto and Diorite Groups 103 I/9 W

Both of these adjacent claim groups are serviced by a short, well-bulldozed road; the difficulty lies in reaching the road in the first place. First one gets to Pitman, a tiny flag station on the C.N.R. line which follows the west bank of the Skeena River (Hwy. 16 is on the east bank). I arrived by handcar from Terrace, and on a later trip by helicopter into the valley of Hardscrabble Creek above the canyon. If a handcar is available from the railway, the mine road leaves the railway just north of the bridge over Hardscrabble Creek (elevation 375 feet) or ½ mile south of Pitman. The first ¾ mile of road has an easy gradient; it then rises swiftly to 850 feet in crossing the ridge on which the Diorite Group pits are located, and falls away, equally swiftly, to the Grotto Group camp, which is situated on a glacial bench above the creek at about a 600-foot elevation. The camp is just less than two miles by road from the railway.

There are two main adits. Number 1 is on the north (camp) bank of the creek just above creek level about 150 feet due southeast of the cabin; Number 2 is on the south bank of the creek some 300 feet in a direction S63°W from the Number 1 adit portal. This is effectively diagonally across a shallow bend in the creek, although the two adits are not quite intervisible. Warning—do not attempt to cross Hardscrabble Creek except at low water; the oldtimers named it well.

The major minerals at the Grotto Group are pyrite, chalcopyrite and specularite; however, they have associated with them the rare tellurides petzite hessite, empressite and rickardite. The tellurides have never been observed as masses larger than about 1 to 2 mm in area, and are most commonly intimately associated with chalcopyrite in the quartz veins. Rare isolated specks and thin veinlets have been observed free in the quartz.

The property was worked as recently as 1953 and the adits and trenches are in good condition. There is a water-filled winze in the Number 2 adit; rich telluride ore came from subdrifts off this winze, and therefore the dumps near the adit are the best hunting ground, where the spring floods have not carried them away. There are other small pits and a third adit on the south bank about 400 feet upstream from the Number 2 adit; however, these expose little of interest. There is also a small (10 x 40 feet) area of tightly frozen, lenticular quartz stringers in the andesite on the north bank of the creek, just within the trees and invisible from the creek bed. It lies diagonally upstream across the reverse bend in the creek about 180 feet at N15°W from the portal of the Number 2 adit.

The portal of the Number 1 adit, some 100 feet deep, is about 40 feet from the creek bank, so that much of the dump from this working has also gone downstream in the spring. The best quartz vein material for tellurides on this dump is grayish black in color and contains many thin, open, 1 to 2 mm fractures. Native tellurium is locally abundant as conspicuous, tin-white, prismatic crystals up to 3 mm long, as small cleavage masses to 2 mm square, and as thin films encrusting drusy quartz in the vugs. Empressite ($Ag_{5-x}Te_3$) is much rarer and occurs embedded in the quartz as small velvety-black masses having a distinct conchoidal fracture. It sometimes tarnishes to a brownish color. Rickardite ($Cu_{4-x}Te_2$) is extremely rare and has been found only as thin coatings on those blebs of native tellurium which are adjacent to chalcopyrite. Gold has been observed in polished sections of the material from this dump. The area is rich in potential micromount material, but x-ray identifications are almost mandatory for both empressite and rickardite.

The Diorite Group is reached from the mine road by turning south at the crest of the ridge above the railway and proceeding some 200 feet to the north edge of the canyon of Hardscrabble Creek. The major minerals are chalcopyrite and bornite. I have found one vuggy quartz specimen which has small bornite crystals perched on quartz crystals, but nothing else of interest. The workings are heavily overgrown with second-growth bush and are quite difficult to locate; they are also dangerous in virtue of their proximity to the canyon cliffs.

SOUTHERN BRITISH COLUMBIA

Tungsten Queen

If it is not late summer (low water) and if you do not have a 4-wheel-drive vehicle, do not attempt this one; the map is 92 O/2, but get 92 J/15 also (both sheets of each).

The starting point is Minto mine (good arsenopyrite), some 50 miles by good road northwest of Lillooet. About one mile east of the Minto mine turn north on a gravel road. This road climbs steeply up the valley wall (about 600 feet high) and then passes around Mowson Pond to run into the mountains up the major valley to the north. At the south end of Tyaughton Lake, you will pass the old Peerless mine (some 3½ miles from the main road); it is virtually barren. Follow the road along the west bank of the lake. Some three miles past the Peerless, just beyond the north end of the lake, you will have to go to 4-wheel-drive as the 'road' deteriorates fast. Five miles past the Peerless you will reach a major creek (North Cinnabar); take the right-hand fork, descend the valley, and cross (ford) Tyaughton Creek. Follow this new road north along the east bank of the creek over three small creeks, for about 2½ miles to Noaxe Creek. Just north of Noaxe Creek the road ascends the valley wall in a steep sharp switchback. The Tungsten Queen property is located some 70 feet east of the road, about 2.4 miles north of the Noaxe Creek crossing, or 3500 feet south of Mercury Creek, the second after Noaxe.

This property is the only Canadian locality where large amounts of stibnite and scheelite occur together. Both of these minerals are well crystallized, the scheelite being essentially molybdenum-free and of a very nearly pure white color.

Once you have got this far, push on for another 1½ miles to the old Manitou mine. The dumps here will repay search with superb micromounts of cinnabar in parallel growth crystals. Native mercury is not uncommon in the larger cinnabar-rich masses.

Good Hope Group 92 H/8 E

The village of Hedley lies half-way between Princeton and Keremeos on Provincial Highway 3. About 1.5 miles east of Hedley a very good gravel road leaves Highway 3 and ascends the steep mountain slope to the north of the highway by a series of switchbacks. Two words of caution: the road is occasionally used by logging trucks, and if you do not enjoy cliff-hanging, forget it! The road climbs some 2000 feet in just over one mile (horizontal). It leads onto the Trepanege Plateau which has low relief and a base elevation of some 5000 feet. Just over six miles from Highway 3 the road forks; the left branch leads to the abandoned Hedley Mascot mine and the right crosses the head of the deep ravine of Cahill Creek to lead down its eastern rim. The Good Hope Group is just under two miles from the fork on the right-hand branch. It is possible to drive directly into the broad shallow open cut (elevation 5000 feet). (During or soon after a heavy rain the entire road is dangerous and will be full of bog-holes for the last two miles.)

The tellurides are found in a rather peculiar ore which consists mainly of large prismatic crystals of dark green pyroxene (up to 6 inches long) with interstitial glassy quartz, coarsely crystalline calcite, and locally, patches of reddish brown brecciated garnet. The metallic minerals are found as fracture fillings in the crumpled pyroxene crystals. They include arsenopyrite, pyrite, chalcopyrite, pyrrhotite and molybdenite, as well as the more interesting species native bismuth, hedleyite (Bi_7Te_3), joseite II and native gold. The ore zone is well exposed in the walls of the pit, the best area of search being a narrow band just below the crystalline limestone cap. The hedleyite, joseite II and native bismuth occur as brilliant metallic white cleavage flakes which are in sharp contrast to the green of the matrix. This is the only known locality where hedleyite is found in any quantity.

White Elephant Group 82 L/4 E

This property lies just west of a good gravel road, on the mountain-side some 2300 feet above Okanagan Lake. It is reached from Vernon by following the gravel road down the west bank of Okanagan Lake to Ewings Landing. The mine road branches from this road about 36 miles from Vernon, just past Ewings Landing and one mile north of the Shorts Creek bridge. The road climbs steeply (but not like the Good Hope road!) for 4½ miles to the mine, which is readily recognizable by the enormous dumps of milky quartz, which encroach on the road in places.

Most of the quartz is totally barren, though occasional scheelite patches can be seen with an ultraviolet lamp. It is only that quartz which is (or was) closely associated with massive pyrrhotite-pyrite that the tellurides are likely to be found.

Wehrlite ($Bi_{2+x}Te_{3-x}$) and tetradymite, the minerals of interest, are found as isolated or interpenetrating masses. They are frequently associated with small areas of chalcopyrite and rare films of gold in the quartz near the pyrrhotite lenses. Both are tin-white, the wehrlite tarnishing to a bronze color and the tetradymite frequently to a bluish sheen. They occur both massive, somewhat resembling steel galena, and as tabular foliated cleavages. The material presently collectable is usually small, cleavages not exceeding 1 to 2 mm in area; however, I have seen some truly spectacular crystals and cleavage masses as large as a fist which were found during the early mining.

Highland Bell Mine 82 E/6 E

The Highland Bell is an operating mine, and therefore permission to collect on the dumps must be secured from the mine geologist's office, where there is an excellent small collection of local minerals well worth examining.

The mine, some four miles by good road east of Beaverdell, has been in production since 1916 and has extensive dumps; however, an element of luck enters into a search since much of the early ore was hand-sorted. As can be seen from Figure 5, extensive search is sometimes repaid—the superb acanthite (monoclinic Ag_2S) crystals in calcite veins from this property are perhaps the finest in Canada. (These crystals should never be kept in strong sunlight in a collection as their brilliant jet black lustre will quickly fade.)

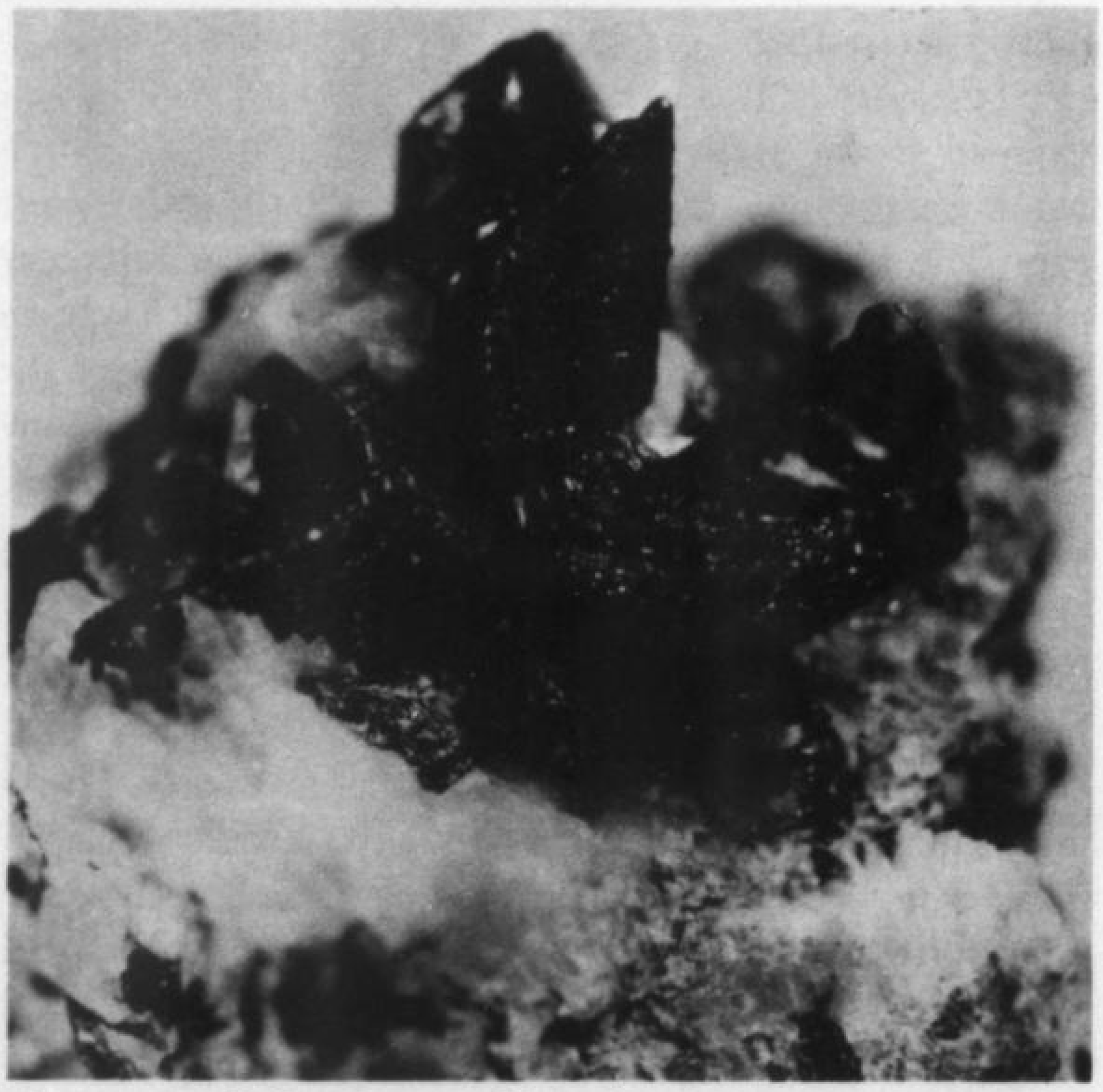

Figure 5 *Skeletal acanthite crystals on calcite. The length of the large diamond-shaped face is about 1 cm.*

Very fine, though small, crystals of pyrargyrite (Ag_3SbS_3) are found in the occasional irregular cavities in the main galena-freibergite-sphalerite ore; this ore is rare on the dumps as noted above.

Oxide Claim 82 F/6 E

This property is just southeast of the village of Ymir (pronounced wymer). It was last 'worked' in 1954 when the main adit was lengthened, but as far as I know there has never been an ore shipment. However, sporadic diamond drilling in the upper zone near the old pits has been continued to the present. In consequence, 4-wheel-drive access is still relatively easy. Take Highway 6 south from Ymir for 1 ½ miles, and then turn left (east) up the Porcupine Creek valley road. This road forks 1 ½ miles from the highway, but as the two branches rejoin 1.3 miles further on, which you take depends on the state of the bridges. About 3.5 miles from the highway at Active Creek (a north-flowing tributary), a branch road turns left (north) to cross Porcupine Creek at an elevation of 3050 feet. This jeep trail switchbacks up the steep southeastern slope of Jubilee Mountain to the old camp (1948) at an elevation of 4350 feet. From the camp there are two choices of roads: the main trail continues up the slope to the main adit at 4570 feet, and a branch trail circles eastward, then switchbacks to the drilling area and several old pits in a saddle in the ridge at 5150 feet.

Both the adit and the old pits were driven on a wide fault zone. The zone is filled with a heavily iron-stained, plastic, impalpable, clay-like material. This material is cut by innumerable fine veinlets of hemimorphite. There are occasional large, relatively pure masses of this mineral within the gouge which, when broken open, are frequently found to contain irregular cavities which are lined with excellent hemimorphite crystals. Both in isolated pockets and perched on the hemimorphite crystals is found the very rare mineral parahopeite ($Zn_3(PO_4)_2 \cdot 4H_2O$). The Oxide Claim is the only North American locality at which parahopeite crystals can be collected. Unfortunately, at a quick glance the parahopeite is very similar to the ubiquitous hemimorphite; its most reliable distinguishing feature is that it always occurs as colorless transparent crystals, whereas the hemimorphite is usually a more or less translucent white color.

Pyromorphite crystals are rarely associated with these minerals, being much more common as separate pockets within the gouge. These pyromorphites are much inferior to the magnificent yellow and green barrel crystals once found associated with penetration-twinned cerussite crystals in limonite and clay-filled fractures at the upper workings of the Society Girl Claim (elevation 5300 feet) some two miles east of Moyie (82 G/5 W).

Beaver Group 82 K/3 E

This property is only for the hardy, or for those working for friendly mining companies. It lies at an elevation of 7475 feet just above the tree line on the south face of Beaver Mountain, and is most easily reached by helicopter. For those who must walk, take the Kaslo-New Denver road to the old town of Retallack. Two miles east of Retallack is the Blaylock bridge over Rossiter Creek. The next creek east of the bridge (1 mile) is Jardine (Beaver) Creek. About 400 feet east of the creek (elevation 2900 feet) an old trail switchbacks up the steep mountain slope to the property, which is referred to on the map sheet as claim group L 2503. The property was last worked in 1893, and I have never climbed the trail.

There are two old adits, one at 7475 feet and the second about 100 feet above this. There are quite extensive hand-sorted ore dumps, as nothing was ever shipped from the property. The ore minerals were galena and chalcopyrite, occuring in quartz veins and a crushed silicified greenstone.

This property is the only Canadian locality where well-crystallized linarite ($PbCu(SO_4)(OH)_2$) may be collected. It occurs as superb prismatic and tabular crystals to ½ inch in length, associated with small, clear, pale yellow prisms of anglesite and tiny colorless rods of cerussite, lining cavities in the coarsely crystallized galena.

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AFMS Federation Trophy Winners NATIONAL SHOW—Seattle, Washington—1971

AFMS TROPHY I	Dr. K. H. West
MINERALS	Butte Mineral & Gem Club
(Classes B-1 thru B-12)	Butte, Montana
AFMS TROPHY II	Mrs. LaVerne Williams
MINERALS	Tualatin Valley Gem Club
(Miniatures)	Forest Grove, Oregon
AFMS TROPHY III	No trophy awarded
MINERALS	
(Thumbnails)	
AFMS TROPHY IV	No trophy awarded
MINERALS	
(Micromounts)	
AFMS TROPHY V	Craig Barkley
MINERALS	Rockamites
(Junior)	Forest Grove, Oregon

Yedlin on Micromounting

It is not often that two famous universities fight over "possession" of one man. But in the case of Dr. George Switzer of the National Museum of Natural History (Smithsonian) this seems to be the situation.

In the May-June, 1971, issue of the RECORD, in our discussion of phenacite we'd mentioned Switzer's involvement with the Mt. Antero, Colorado locality, and his work with the minerals there for his Master's degree at Yale.

On the heels of the publication of that issue Prof. Cornelius Hurlbut (among others) pointed out in a letter to us: "I probably am the 'Nth' person to write to you to point out that George Switzer did his graduate work at Harvard. He collected the Mt. Antero material while here and then took it to Yale when he went there to teach." Dr. Horace Winchell of Yale confirmed this, noting that he, too, did mineralogical work at Harvard, was a contemporary of Switzer, and, along with the whole class envied George Switzer's teaching appointment to Yale. Now Winchell is at Yale, Switzer at the Smithsonian, and phenacite is still a beautiful mineral to collect.

And in line with this the mineral from Lord's Hill, Stoneham, Me., is still coming out. Dana M. Jewell (now there's a name for a mineral collector) 27 Gould St., Melrose, Mass., collected there this summer and is in a trading mood.

Peter J. Dunn, Dep't of Geology, Boston University, has just acquired an old micromount collection—some 1100 mounts. He was approached at the Mt. Sunapee, N.H. show and asked whether he knew of a possible purchaser of the "Lister" collection. He notes: "A fellow walked up to me and asked who would be interested in a large collection belonging to his father, now deceased... I thought of you, Neal, and then I thought of me. So now I am the proud possessor of a beautiful old collection—about 60% of which is of European material from the classic deposits. The mounting is quite crude (Ed. note. Typical of so many old collections. Modern cements, 'scopes and boxes were unavailable 50 years ago.) but the quality of the material is superb."

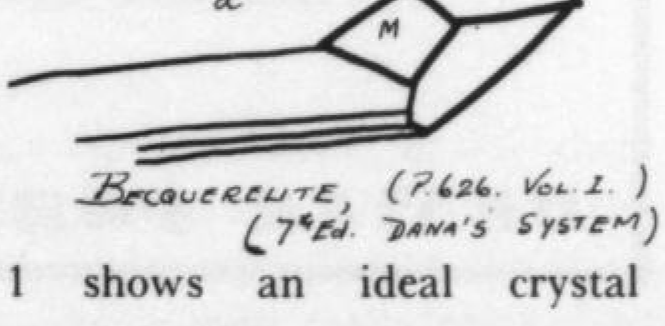
Pete sent us a random handful just to see. Cardboard boxes, oblong, old Philadelphia type workmanship. A couple of hundred of Fiss, Bement, Rakestraw and Brinton. Another couple of hundred marked "E. S. New York". The balance were unmarked. Mounts he sent included childrenite, libethenite from Cornwall, Eng.; leadhillite, caledonite from Scotland; humite, Vesuvius; laurionite, Greece; vivianite, France; apatite, Switzerland and others. This was a haul!

We'd never heard of Lister as a collector. We'd seen and we own mounts with printed labels "E. S. New York" but nowhere were we able to identify the collector. Brinton—yes. (Brinton's quarry, Lancaster Co., Pa.) Fiss, Bement, Rakestraw—yes. All famous early exponents of the micromount art. But recently an old list of members of the New York Mineralogical Club turned up and divulged a name that may be a clue: Ernest Schernikow. We'd appreciate any information anent this, as well as another "oldie" we have: C. E. Hanaman, Troy, N.Y. Same cardboard box. Same Philadelphia technique. Some years ago we visited the mineralogical offices at Rensselaer Polytechnic Institute in Troy, N.Y. (A good mineral collection there.) and no one there could place Hanaman.

Dr. Phil Goodell of the Geology department of the City College of the City University of New York drops a note and advises of the availability of crystallized becquerelite from Happy Jack mine in Utah. "The material", Phil says, "may well show uranopilite and zippeite. Much of it is in minute crystals. A couple of dollars buys a thumbnail sized piece. Johannite, too, may show up." Southwestern Minerals, 7008 Central Ave., S.E., Albuquerque, N.M. 87108.

We have one mount of this stuff obtained at the Baltimore symposium in 1968. (This is the place to improve your collection. Hundreds of specimens are for sale here, varying in price from fifty cents to a couple of dollars. Some are rare or unique—available because so many participants have fine duplicates.) We own, additionally, a specimen from N.W. Territories in Australia, and some half dozen from the most famous locality of all, Kasolo, Katanga, Congo.

The becquerelite from Katanga occurs in amber-yellow striated crystals, usually associated with sulphur-yellow schoepite. Becquerelite is orthorhombic, dipyramidal, prismatic, striated, often showing polysynthetic twinning, creating pseudohexagonal aggregates. Chemical formula—$7UO_3 . H_2O$. Cleavage perfect on 001. (See Frondel, Systematic Mineralogy of Uranium & Thorium. *U.S.G.S. Bull.* **1064,** 1958.) Named for A. Henry Becquerel, French physicist, 1852-1908, who discovered radioactivity. (No, no. The Curies discovered radium.)



Becquerelite, (P.626. Vol. I.)
(7th Ed. Dana's System)

Fig. 1 shows an ideal crystal

sketched from Dana; fig. 2 a cluster of crystals through the 'scope, from Katanga.

St. Hilaire comes up with more. We never thought we'd be enthralled by muscovite, but we've seen a piece of material from the Dimix quarry, collected by Marcelle and Charlie Weber on May 30, 1971, that "sends" us. In one of the silicate vugs, formed by the conjoinder of plates of nepheline and aegirine, appear parallel groupings of elongated muscovite crystals, resembling nothing so much as a partially emptied box of panatella cigars. Sitting alone on the mass, in an upright position, are two penetration twins. Now muscovite is monoclinic, but quite often assumes a pseudohexagonal form, and often shows trigonal outline. Imagine, then, twinning of two of these "trigonal" prisms, to form, on the "C" face, a perfect six pointed star. That's what we saw, and fig. 3 shows what they look like. They're tiny but fabulous. We used 48X for best viewing.

Just received a price list of micromount materials from Mineralogical Research Co., 14770 Whipple Court, San Jose, Cal., 95127. Our "spies" tell us that Eugene and Sharon Cisneros do a fine job of supplying material. For instance—anatase from California, Norway (with parisite) and Switzerland; arsenopyrite, Japan; boulangerite rings, Madoc, Ont.; joaquinite (new locale), Cal.; milarite, Mex.; saleeite, Australia; wickenburgite, Arizona.

We bring you these dealers because there are presently so few suppliers of micromount material. We'll gladly mention in this column any such sources, and mention herein is not predicated upon insertion of advertising. (Ed. note—There will be no objection, however, to placing ads of what you have for disposal.)

Lastly, a letter from Davis M. Lapham, of the Dep't of Environmental Resources of the Commonwealth of Pennsylvania. The letter speaks for itself, and discusses celestite.

"Dear Neal:

From samples sent in to us by mineral collectors we have made positive identification of some unusually fine celestite micromount crystals that I thought you might wish to mention in your MR column.

The celestite occurs in a "limestone" quarry at Blue Ball, Lancaster County, Pa. on the New Holland 7½' quadrangle map. The unit is the Cambrian Elbrook Formation and actually ranges from limestone to dolomitic limestone. Phyllitic interbeds of sericite are common. The quarry is known as the Showalter quarry and is operated by The Blue Ball Stone Co., Inc. Permission can be obtained to collect. The occurrence of celestite in Cambrian carbonate rocks is somewhat unusual in itself since most celestite occurrences of this association are in Silurian limestones.

Although I don't know who may have made the first discovery of celestite here, our record is as follows. The first samples were sent in to us May, 1971 by James Stauffer, Neffsville, Pa. Celestite crystals up to several millimeters across (rather equidimensional to somewhat tabular) were pale blue. The celestite occurs with quartz at the contact with sericite phyllite, along vein-like fractures. Other associated minerals include fluorite (small pale blue and purple cleavages or crystals), scalenohedral and "nail-head" calcite crystals ranging from white to rose-colored, small strontianite clusters that probably are calcio-strontianite (by X-ray intensity and spacing match), and dolomite saddle-shaped rhombs.

The second group of specimens, perhaps the most unusual, were sent to us in Aug., 1971, by B. Brookmyer of Blue Ball, Pa. In addition to the above, these contained small, nearly rectangular plates (almost micaceous) of yellow celestite crystals (X-ray identification). The form together with the very unusual color make these crystals (up to 3.0 mm diameter) prized micromounts. The association for these crystals primarily is quartz and dolomite.

The third group of specimens from this quarry was sent to us by L. Bumm of Blue Ball, Pa. in Sept. 1971. Two distinct crystal forms of celestite are present, but not on the same specimen. One consists of rather flat elongated (prismatic) crystals with pinacoidal or dome terminations. These crystals are white to tan and up to 7.0 mm long. The other crystal form is equant and tabular parallel to (001) with narrow (101) and (011) faces. These crystals are largely colorless with well-developed turbid zones, and are small (up to 2.0 mm across). The turbid zones are discontinuous and apparently crystallographically controlled. Most tabular crystals are perched on the "a" or "b" axis edge faces and some form right-angle interpenetrating crossed plates.

Sincerely,

Davis M. Lapham
Chief Mineralogist"

Buy and Use a good mineral book.

Hidalgoite from Gold Hill , Utah

by **John F. Clarkson**, **Willard L. Roberts**, and
Amos L. Lingard
South Dakota School of Mines and Technology
Rapid City, South Dakota 57701

The Gold Hill mining district in western Tooele County, Utah has yielded another uncommon arsenate mineral, hidalgoite. The area, dormant now, has been mined for arsenic, gold, and copper in the past and yields many arsenic-containing minerals. The most abundant arsenic-containing minerals found here are arsenopyrite, cornwallite, conichalcite, scorodite, adamite, and austinite. The Gold Hill district was the original locality for austinite, a zinc arsenate, which was first described by Staples in 1935.

The hidalgoite was found only on the dump of the Gold Hill mine and was collected because the unusual pistachio green coloring and morphology did not resemble any of the copper arsenates. The mineral occurs in association with gossan-type siliceous iron oxides and appears to have been deposited by filling fractures and cavities. A hand specimen exhibits light green spherulitic aggregates coating numerous large pores and vugs in the dark brown matrix. Because of the sharp color contrast, the mineral was easily hand picked for testing from coarsely crushed material under a binocular microscope.

The mineral was identified by W. L. Roberts who found that the principal X-ray powder diffraction lines (Cu tube, Ni filter) agreed very closely with those given in the ASTM Inorganic Index. The identification was further verified by direct comparison with a diffraction pattern from cotype material. Roberts had obtained a small specimen of hidalgoite from the San Pascual mine, Hidalgo, Mexico some years ago from Dr. George Switzer of the National Museum of Natural History and the X-ray pattern from this material was almost identical to the pattern obtained from the Gold Hill hidalgoite. The slight differences are small shifts (0.1 to 0.2 degrees) in the 2θ values of weak diffraction lines occurring above 40°. All of the peaks below this 2θ value, including the three major ones, correspond exactly.

There are two other localities from which hidalgoite has been reported. The original locality was Hidalgo, Mexico described by Smith, Simons, and Vlisidis in 1953 and the second locality was Cap Garonne, France reported by C. Guillemin in 1955. Hidalgoite is structurally similar to many other minerals, notably plumbogummite, beudantite, hinsdalite, etc., and has been assigned the ideal composition $PbAl_3(AsO_4)(SO_4)(OH)_6$. However, the composition is rather variable and other cations and anions are able to substitute in the structure. The chemical composition of hidalgoite from Gold Hill was determined by Lingard according to the procedure outlined in the Appendix. The results are presented in Table I and compared to the Mexican material and to the hidalgoite from Cap Garonne.

There are two significant deviations in composition from the ideal composition. First, the hidalgoite from Gold Hill is a sulfate deficient variety as is that from Cap Garonne. There is partial substitution of the OH^- anion for $SO_4^{=}$ and, in addition, the Cap Garonne material has some $MoO_3^{=}$ replacing $SO_4^{=}$. Secondly, the hidalgoite from Gold Hill contains an excess of water. These considerations lead to a composition for the Gold Hill hidalgoite which is best represented by $PbAl_3(AsO_4)(SO_4,OH)(OH)_6 \cdot H_2O$.

The measured specific gravity was lower than the previously reported value of 3.96. The specific gravity was determined on four different specimens using three different techniques. Two Berman balance measurements in toluene gave 3.70 and 3.72, a Jolly balance measurement in water gave 3.74 and a value of 3.70 was measured using a 5 ml pycnometer. The average value gives the Gold Hill hidalgoite a density of 3.71 which does not agree very well with the calculated value of 4.15. A similar large discrepancy between measured and calculated specific gravities, 3.96 compared to the calculated 4.27, was noted with hidalgoite from Mexico.

Hidalgoite from Gold Hill is optically very similar to the material from Mexico. The measured mean index of refraction was 1.706 ± .003 for sodium light as compared to 1.73 ± .002 Na.

Appendix

Details of the chemical analysis. A clean piece of mineral weighing 81.7 mg was fused with 300 mg of $LiBO_2$ in a platinum crucible. The melt was dissolved in 50 ml dilute (1:4) HCl, transferred to a 100 ml volumetric flask and made to volume with distilled water. All subsequent determinations were made on aliquots of this solution or dilutions thereof. Standard and blank solutions were prepared in a similar manner.

Aluminum was determined colorimetrically at 525 $m\mu$ after color development with an ammonium salt of aurin carboxylic acid ("aluminon") using U.S. Bureau of Standards Sample No. 99a to obtain a calibration factor.

The silver diethyldithiocarbamate method was used for the determination of arsenic. By this method, the arsenic is reduced to the trivalent form by the addition of stannic chloride following which the arsine is liberated from the solution and bubbled into a solution

Table 1. Analyses of Hidalgoite

	(Weight Percent)				(Moles of Oxides in 1000 mg of Hidalgoite)						
	Gold Hill	*Hidalgo, Mexico*	*Cap Garonne*	*Ideal*	*Gold Hill*		*Hidalgo, Mexico*		*Cap Garonne*		*Ideal*
PbO	36.2	32.84	30.7	35.68	1.622	1.721	1.471	1.579	1.37	1.50	1.60
CuO	0.4	—	0.7		0.050		—		0.09		
ZnO	0.4	0.88	0.3		0.049		0.108		0.04		
Al_2O_3	23.0	24.25	22.2	24.51	2.250	2.344	2.379	2.415	2.18	2.36	2.40
Fe_2O_3	1.5	0.57	2.9		0.094		0.036		0.18		
As_2O_5	20.3	16.27	24.1	18.37	0.888	0.888	0.708	0.714	1.05	1.05	0.80
Sb_2O_5	—	0.20	—		—		0.006		—		
SO_3	4.2	15.03	3.4	12.80	0.526	0.526	1.877	1.877	0.42	0.66	1.60
MoO_3	—	—	3.5		—		—		0.24		
H_2O	13.8	9.7	11.8	8.64	7.67	7.67	5.389	5.389	6.55	6.55	4.80
	99.8	99.74	99.6	100.00							

of silver diethyldithiocarbamate in pyridine to give a red color. The depth of color is proportional to the amount of arsine and is measured with a colorimeter at 560 mμ. Known additions of arsenic to portions of the blank were used to obtain a calibration curve.

A turbimetric method was used for the determination of sulfate which was precipitated as a barium sulfate suspension by the addition of barium chloride. This technique was chosen because of inherent errors in filtering and weighing extremely small quantities of precipitate (i.e., 4% of 81.7 mg). Aliquots of a standard H_2SO_4 solution were used to standardize the method.

Lead, copper, zinc, and iron were determined by atomic absorption using known concentrations of the ions in the diluted blank solutions to obtain calibration curves.

Emission spectrography showed no elements, other than those listed in Table I, present in significant quantities.

The water was directly determined by weighing out a crushed 89.4 mg sample, firing in a covered porcelain crucible at 630°C for three and one-half hours, and then re-weighing. The ignition temperature was chosen on the basis of previous infrared scans of powdered hidalgoite fired at various temperatures. This work had shown a disappearance of the water absorption band (3000 to 3200 cm^{-1}) upon firing at 600°C.

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Biographies

The authors are all staff or faculty members of the South Dakota School of Mines & Technology. The hidalgoite was collected by Dr. Clarkson who is an Assistant Professor of Metallurgy. As an amateur, he collected extensively in Utah during the eight years that he lived there.

W. L. Roberts is Curator of Mineralogy at the Museum of Geology. His extensive background in mineralogy includes being past president of the Rocky Mountain Federation, present president of the South Dakota Federation of Mineral Societies, author of the book *Mineralogy of the Black Hills,* and contributor to various mineral publications.

A. L. Lingard is Assistant Director of the Engineering and Mining Experiment Station. Dr. Lingard has had 20 years experience in the development of instrumental and trace methods of analysis.

COMMENDABLE ACTIVITIES

The Delaware Mineralogical Society has a notebook of collecting sites covering the entire United States which contains entries by members of locations they have visited. This is kept up-to-date and is loaned to members who plan a trip to somewhere in the United States.

The Thames Valley Rockhounds club gives a gift, each year, to a senior in the Groton (Connecticut) school system to honor their first member who passed away. This is given to a student who will continue his or her studies in the Earth Science Field in order to encourage their youth in this important field.

Fig. 1 *Geological setting of the Grandview mine. Note the location of the mine with respect to the Hance and Cremation faults (dark lines).*

Minerals of the Grandview mine

by **Wayne C. Leicht**
482 Morning Canyon Drive
Corona del Mar, California 92625

Fig. 2 *View of Horseshoe Mesa as seen from Grandview Point.*

ABSTRACT

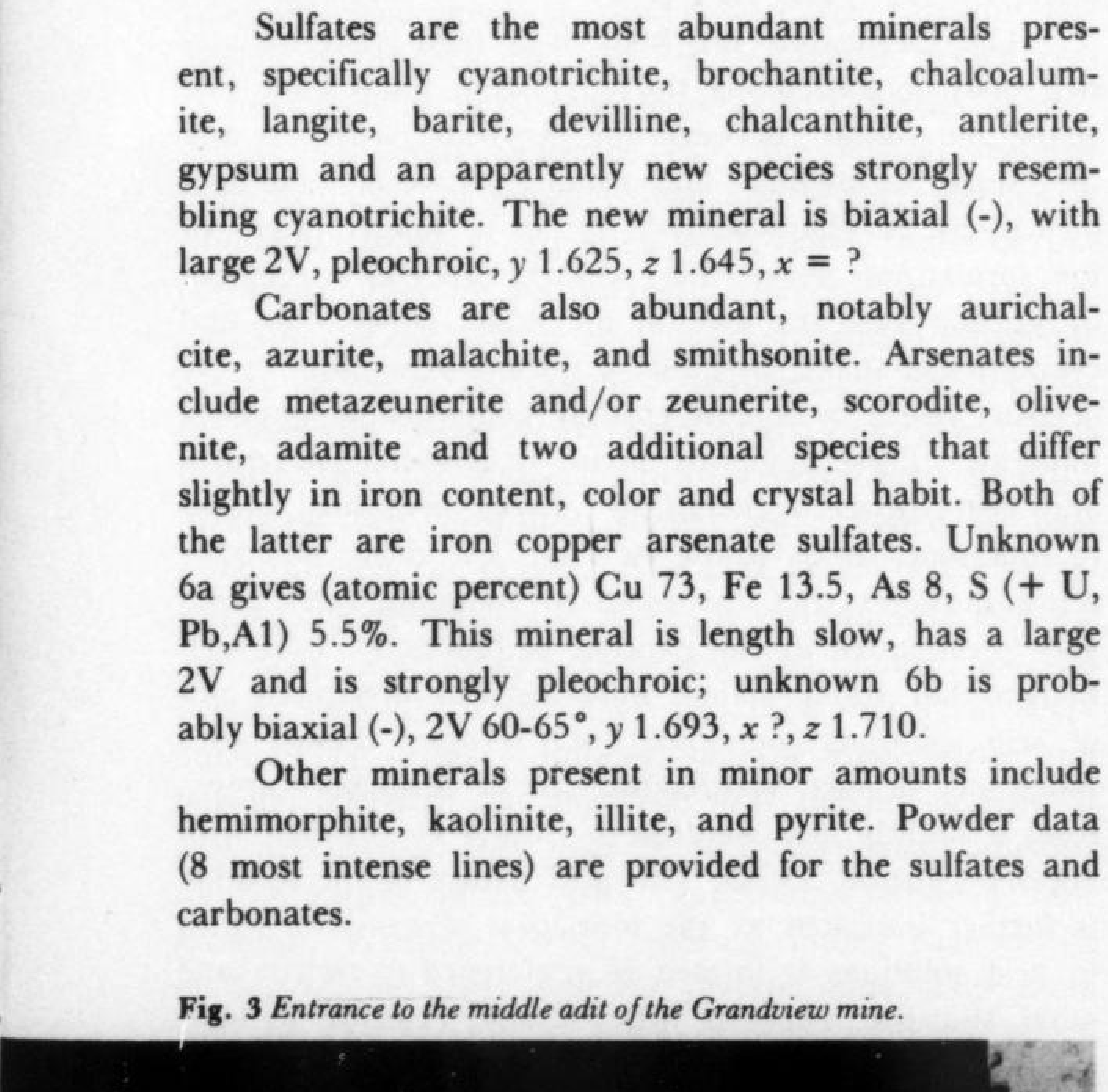
The Grandview mine, Grand Canyon National Park, Coconino County, Arizona was a highly localized, rich copper deposit that was worked between 1893 and 1916. The ores occurred in pod-like structures and veins between chemically altered and brecciated blocks of Redwall limestone. The ore, consisting almost entirely of sulfates, probably was localized in limestone by neutralization of acid solutions carrying metals derived from primary ores later removed by erosion. The presence of a nearly fully hydrated form of zeunerite suggests that the temperature of formation of the deposit was below 65° C.

Sulfates are the most abundant minerals present, specifically cyanotrichite, brochantite, chalcoalumite, langite, barite, devilline, chalcanthite, antlerite, gypsum and an apparently new species strongly resembling cyanotrichite. The new mineral is biaxial (-), with large 2V, pleochroic, y 1.625, z 1.645, x = ?

Carbonates are also abundant, notably aurichalcite, azurite, malachite, and smithsonite. Arsenates include metazeunerite and/or zeunerite, scorodite, olivenite, adamite and two additional species that differ slightly in iron content, color and crystal habit. Both of the latter are iron copper arsenate sulfates. Unknown 6a gives (atomic percent) Cu 73, Fe 13.5, As 8, S (+ U, Pb,Al) 5.5%. This mineral is length slow, has a large 2V and is strongly pleochroic; unknown 6b is probably biaxial (-), 2V 60-65°, y 1.693, x ?, z 1.710.

Other minerals present in minor amounts include hemimorphite, kaolinite, illite, and pyrite. Powder data (8 most intense lines) are provided for the sulfates and carbonates.

Fig. 3 *Entrance to the middle adit of the Grandview mine.*



INTRODUCTION

The Grandview mine* is located on Horseshoe Mesa approximately thirteen miles east of the Grand Canyon Village on the South Rim of Grand Canyon National Park, Coconino County, Arizona. The mine can be reached via a steep, winding, four-mile long trail which begins at Grandview Point and descends some 2,500 feet onto Horseshoe Mesa. The trail is not maintained by the Park Service and requires a special permit for its use.

The mine has not been worked since 1916 and the only visible signs of its existence are the ruins of four old structures and the mine workings consisting of several vertical shafts and adits on three levels. The mine was visited by the author on five different occasions, the most recent of which was in April, 1971. To the best of his knowledge, the studies to be reported in the sections concerned with the origin and minerals of the deposit are the first serious mineralogical and geological work performed on the locality. This past disinterest is particularly surprising inasmuch as this is the locality from which the first reliable optical data for cyanotrichite were obtained (Palache and Vassar, 1926).

The bulk of the present work was concentrated on identifying and describing the minerals that occur at or near the deposit. Several diagnostic techniques were used, including x-ray diffractometry, x-ray spectroscopy, petrographic microscopy and electron microprobe analysis. Altogether, twenty different minerals were collected and identified. Two of these minerals appear to be either new minerals or intimate mixtures of known species.**

HISTORY OF THE AREA

In April 1890, Pete Berry located and performed the first assessment work on the Last Chance claim

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*The mine is now popularly known as the Grandview mine; however, the original mine was probably known as the Last Chance mine. Early assay reports signed by Pete Berry (owner) also listed the Black Diamond and the Silver Bell mines for which the exact location could not be determined. It could be that the adits had different names and were worked separately at various times.

**Further and more detailed work on these minerals is planned by Dr. Robert Winchell, California State College—Long Beach, and the author.

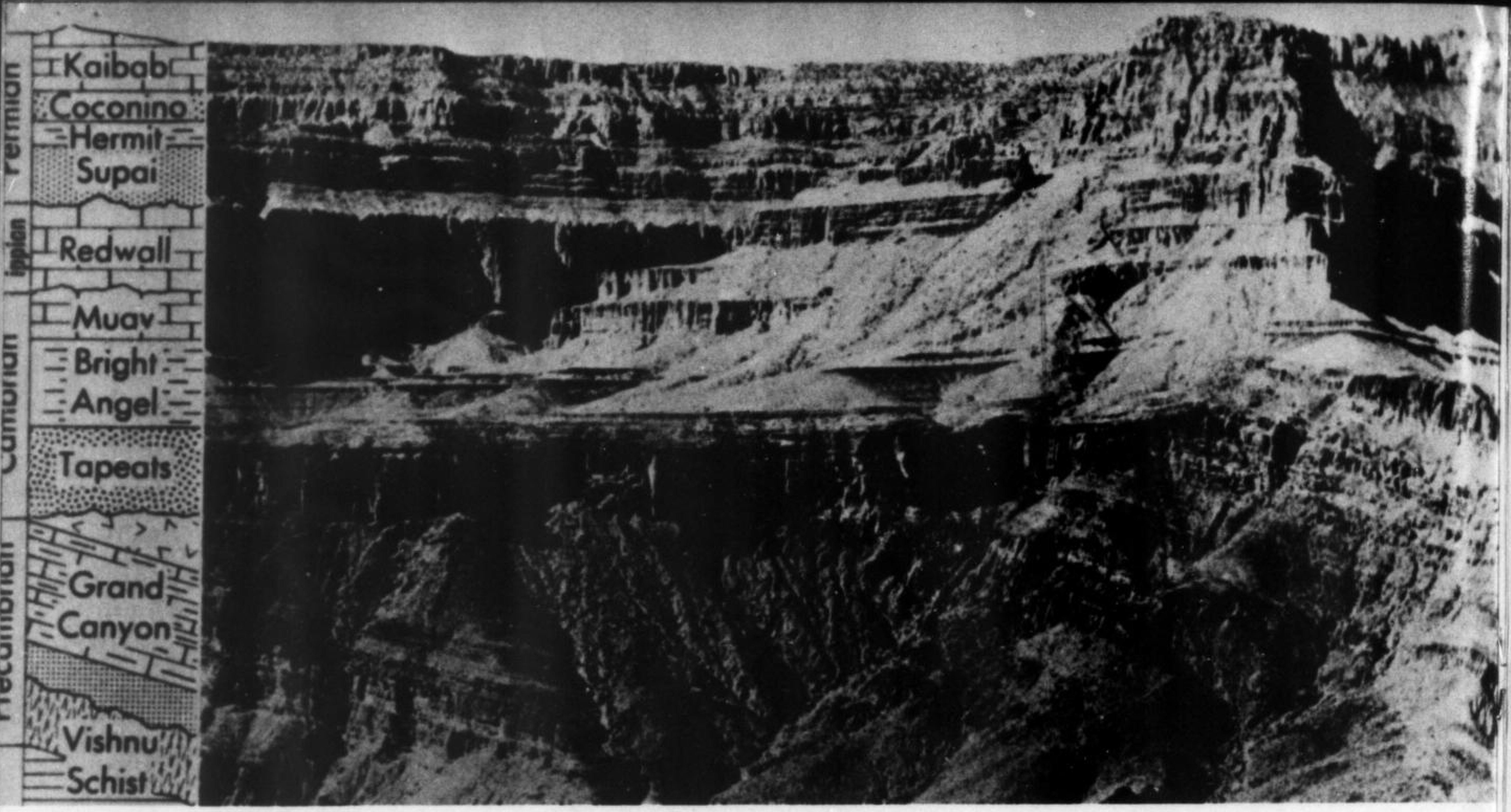


Fig. 4 *Geological cross-section of the Grand Canyon. The Grandview deposit is located near the contact between the Redwall limestone and the Supai formation.*

situated atop Horseshoe Mesa, deep within the Grand Canyon.

To haul the ore up the 2,500 feet to the rim, Berry built the Grandview Trail. The four-mile trail was started in July 1892 and completed in 1893. Although it was built primarily to serve the mine, it also served as a route to lead tourists into the Canyon.

The tourist business became so profitable that in 1892 Berry built the Grandview Hotel near Grandview Point. The hotel soon became the leading tourist attraction on the South Rim. Three years later, Pete Berry and Ralph and Miles Cameron formed the Grand Canyon Copper Company which included both the mine and the Gandview Hotel.

In 1913 William Randolph Hearst appeared on the scene and bought the entire property—mine, trail, hotel, mules and equipment. Hearst had no interest in developing the mine itself but was only interested in the rich tourist trade that was bound to come to the Grand Canyon. Fortunately, before his exploitation of the Canyon began, a Congressional act decreed the area a national park, thus forcing the sale of Hearst's interest to the National Park Service.

In 1916 Pete Berry guided his last tour down the Grandview Trail. He, his wife, and son then moved from the Grand Canyon.

Today, only a dim outline of the hotel remains, southeast of Grandview Point. The trail, although not maintained by the Park Service, is still passable. The rubble of the miners' cabins still remains on the mesa, along with some scattered pieces of mining equipment.

ORIGIN OF THE DEPOSIT

The Grandview ore body is a high-grade sulfate-rich body located along the Cremation Fault zone just below the contact between the Redwall formation and the Supai formation. The contact between these two formations is characterized by karst topography. All the formations above this contact have been removed by erosion over the area of the mine. Brochantite and cyanotrichite make up most of the ore remaining in the deposit, which is almost entirely composed of oxidized minerals. These minerals occur in pod-like structures and veins between chemically altered brecciated blocks of limestone, or as filling in clay. The mode of occurrence indicates that the oxidized minerals were probably precipitated at the expense of limestone. It is well known that stable sulfate minerals will precipitate out of acid solutions containing (SO_4^{-2}) upon contact with limestone. In fact, brochantite can be artificially grown from a slightly acid solution of $CuSO_4$ by titration with NaOH (Silman, 1958). The acid nature of the solution is further indicated by the formation of kaolinite which in acid solutions is formed in preference to sericite and other silicates. There is little, if any, evidence to indicate that the solutions responsible for this deposit were anything but acid in nature. In addition, cations, such as Zn^{+2}, Cu^{+2}, Fe^{+3} and Al^{+3}, are more characteristic of acid solutions than of neutral or alkaline solutions.

The presence of gossan-type limonitic material scattered atop the Mesa suggests that this material is the remnant of the "iron hat" typical of hydrothermal deposits; but the almost complete absence of primary minerals, and of minerals typical of a secondary enrichment zone in any appreciable amounts, make it obvious that the deposit does not fit the classical model of primary sulfides below a zone of secondary enrichment (chalcocite, bornite, etc.), overlain by an oxide zone and capped by iron-rich gossan type rock. Gossan material does not necessarily mean unaltered sulfides exist below. Under relatively low Eh and pH conditions, iron goes into solution in the ferrous state and travels from the oxidation zone. Where these ferrous sulfate solutions encounter limestone, or a similar alkaline medium, the acid is neutralized, and the iron precipitates as ferric oxide or ferric hydroxides.

The deposit is obviously epithermal (shallow depth and low temperatures) and the presence of what seems to be a nearly fully hydrated form of zeunerite makes a reliable thermometer of the upper limit of the temperature of formation. If the temperature of formation was above 65° centigrade one would not expect to find such a high hydration state, for zeunerite alters to metazeunerite at this temperature (Frondel, 1951, found that unlike autunite/meta-autunite in which the waters of hydration are apparently zeolitic, metazeunerite is stable even in a humid environment). Further indication of the low temperature of the deposit is the presence of kaolinite. The optimum temperature for kaolinite formation is between 20° and 70° centigrade, which correlates well with the presence of hydrated zeunerite.

It has been suggested that the deposit resulted from oxidation of primary iron and copper sulfides *in situ* and that these minerals were slowly replaced but not transported by the meteoric waters. This mode of formation is unlikely in that any appreciable syngenetic concentration of sulfides in a sedimentary bed such as the Redwall limestone is exceedingly rare. Also, it is unlikely that the faulting which occurred long after the limestone was deposited should just happen to pass right through the deposit. The lack of any great movement along the fault also makes it very unlikely that the ore body was formed elsewhere and faulted into its present position. There have also been reports of small amounts of primary sulfides, notably chalcopyrite and bornite, found in the limestone near the ore deposit. If they are present, they must be so in very small amounts for the author, in six visits, never found either of these minerals. Waesche (1934) reported finding chalcopyrite on top of the Mesa near the present mine. This could well be the residue of some primary minerals which were originally located in formations above the now eroded surface of the Redwall limestone. Pyrite has been found in one small localized area near the fault zone in the middle adit. This material was obviously secondary in origin.

The following suggested origin of the deposit is, in the writer's opinion, more consistent with the facts as they are now known: The primary minerals (probably arsenopyrite, chalcopyrite, pyrite, sphalerite and possibly uraninite) originated above the Redwall limestone. The formations above the Redwall are known to have contained primary minerals. The Orphan mine, just 14 miles west of the Grandview mine, contained chalcopyrite, pyrite, arsenopyrite, sphalerite, uraninite and other primary minerals which were mined from a nearly circular, vertical pipe structure, that ranges from about 150 to 500 feet in diameter. The pipe extended downward from the lower part of the Coconino sandstone into the Supai formation and may have continued down into the Redwall limestone. The pipe probably formed by solution collapse initiated in the underlying Redwall limestone (Gornitz and Kerr, 1970).

The primary minerals were decomposed by oxidation and hydrolyzation by descending meteoric waters. As the acid water percolated through the formations above (probably the Supai, which is known to contain approximately 5% microcline and orthoclase feldspars, and some sericite) it decomposed the feldspar thus releasing aluminum and the necessary constituents for the formation of kaolinite and illite, which are prevalent in the ore deposit. Folding and faulting associated with the Grandview monocline provided an ideal setting for facilitating downward percolation of surface water, as well as providing an excellent "trap" below in the brecciated limestone. Neutralization of the solutions by limestone prompted precipitation of the suite of sulfate, arsenate, carbonate and silicate minerals found in the Grandview mine. A more extensive study of the origin of the deposit should be done.

MINERALS OF THE DEPOSIT

The minerals identified at the Grandview mine fall into six anion groups: sulfates, carbonates, arsenates, sulfides, oxides and silicates.

SULFATES

The sulfates are by far the most prevalent oxidized minerals. They probably made up most of the ore shipped from the mine during its operation. Brochantite and cyanotrichite are found throughout the deposit in pod-like structures with alternating concentric rings of brochantite and cyanotrichite. In many cases the "kernel" of the pod is composed of a partially dissolved lump of Redwall limestone. Brochantite and cyanotrichite also occur as veins and fillings between brecciated chunks of limestone. The mode of occurrence of these minerals indicates that the sulfates were precipitated at the expense of the dissolving limestone. Within the deposit barite seems to be confined to the edges of the fault which traverses the middle adit. Other sulfates, except chalcanthite, are comparatively rare.

1) *Cyanotrichite* - $Cu_4Al_2(SO_4)(OH)_{12}.2H_2O$

Cyanotrichite occurs in deep azure-blue to pale sky-blue radiating crystals, as well as massive nod-

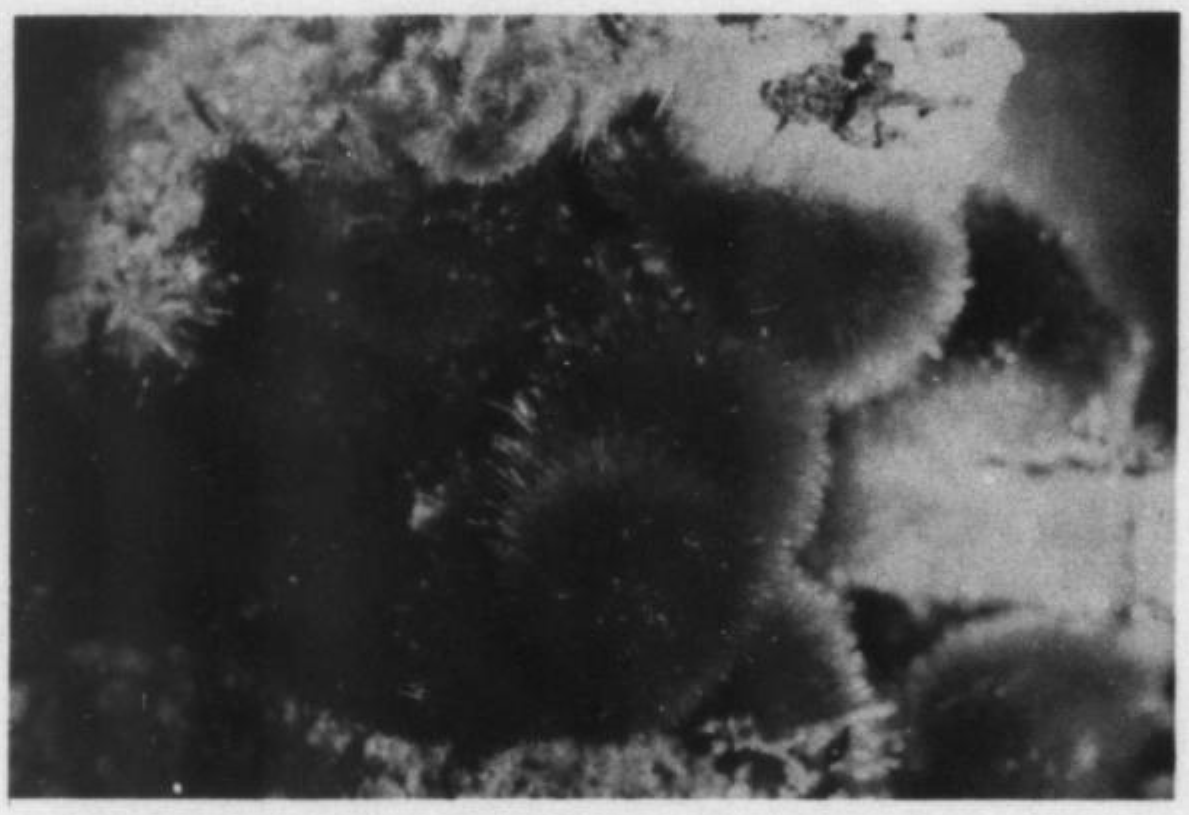


Fig. 5 *Cyanotrichite in radiating groups of crystals. 6X.*

ules and veins. This locality has produced probably the finest specimens of this mineral known. Cyanotrichite is closely associated with brochantite and probably formed coincident with it. Although the Grandview mine (Last Chance mine) is the type locality for cyanotrichite, major discrepancies in the x-ray diffraction pattern, noted by the author and others, suggest additional work needs to be done on this mineral. In addition, the relationship between unknown #5 (described later in this report), woodwardite and cyanotrichite needs further investigation.

Fig. 6 *Acicular form of brochantite on chalcoalumite. 10X.*

2) *Brochantite* - $Cu_4(SO_4)(OH)_6$

Brochantite is the most abundant mineral found in the remaining ore body. It is commonly found as acicular radiating groups intermixed with shorter prismatic forms. The color ranges from emerald to blackish-green in the prismatic form, and light apple green in the more acicular forms. Large, well-crystallized specimens of both forms are common. Occasionally small, spherical, radiating tufts of cyanotrichite are found perched on brochantite. These make particularly handsome specimens and are eagerly sought by collectors.

3) *Chalcoalumite* - $CuAl_4(SO_4)(OH)_{12}.3H_2O$

This mineral occurs as pale-blue to bluish-green botryoidal crusts composed of compact radiating fibers. It occurs sparingly throughout the entire deposit, but some of the better specimens were found on the dumps. Brightly colored crusts lining fissures in clay and limestone produce rather striking specimens, which are deeper in color than those found at the Copper Queen mine, Bisbee, Arizona.

Fig. 7 *Chalcoalumite on kaolinite. 2X.*

4) *Langite* - $Cu_4(SO_4)(OH)_6.H_2O$

Small amounts of greenish-blue silky crusts of langite were noted lining clay cavities in several areas of the mine. It is not common in the mine and is easily confused with coatings of malachite. Of the four specimens which were thought to be langite, x-ray identification revealed that two were malachite and two langite. Malachite coatings tend to be less silky with a slightly different luster. Individual single crystals were not found.

5) *Barite* - $BaSO_4$

Barite is confined primarily to the fault zone south of the middle adit. Its association with aurichalcite and the fact that it is confined to the fault zone suggest that it was probably deposited later than the Redwall limestone. Barite is also found in large masses on the main dump on top of the Mesa. No well-crystallized specimens have been reported from this deposit.

6) *Devilline* - $Cu_4Ca(SO_4)_2(OH)_6.3H_2O$

Two small specimens of devilline were identified during a routine x-ray examination of other unknowns. There is no record of where these specimens were found. Devilline, closely associated with gypsum and another sky-blue mineral resembling serpierite, occurs as bluish-green interlaced crusts of lath-like crystals. Closer examination of the mine should reveal additional specimens of this material.

7) *Chalcanthite* - $CuSO_4.5H_2O$

Chalcanthite occurs in cross-fiber veinlets associated with clay in several places within the mine. Obviously some of this material was formed by water seepage after the mine ceased operations. It ranges in color from bright berlin-blue to sky blue. Other soluble copper sulfates with different hydration states (*i.e.*, boothite, bonattite) may also be present.

8) *Antlerite* - $Cu_3(SO_4)(OH)_4$

This mineral occurs as bright apple green coatings and nodules in clay. It is generally found associated with brochantite and probably formed coincident with it. Well-crystallized specimens of this material were not observed.

9) *Gypsum* - $CaSO_4.2H_2O$

Gypsum was observed filling vugs and veins in several areas in the deposit. Very often it is intermixed with a limonitic gossan-type material which can be found approximately 100 feet inside the middle adit.

10) *Unknown #5*

A microscopic examination of several specimens revealed a sky-blue colored mineral in radiating tufts perched on, and intermixed with, chalcoalumite. Its color is distinctly different from that of cyanotrichite, to which it otherwise bears a strong resemblance. An electron-microprobe analysis of this material revealed that, like cyanotrichite, it is a copper aluminum sulfate of unknown hydration state. However, the x-ray and optical data indicate that it is sufficiently different to warrant further investigation (see end of text for a comparison between the x-ray patterns of cyanotrichite and unknown #5). The individual crystals making up the tufts are quite small, thus making a complete optical analysis difficult. It was determined that unknown #5 is biaxial negative with a rather large 2V angle; strongly pleochroic; $y=1.625$, $z=1.645$, $x=?$. A more detailed study of this mineral is planned by Dr. Robert Winchell, California State College—Long Beach, and the author.

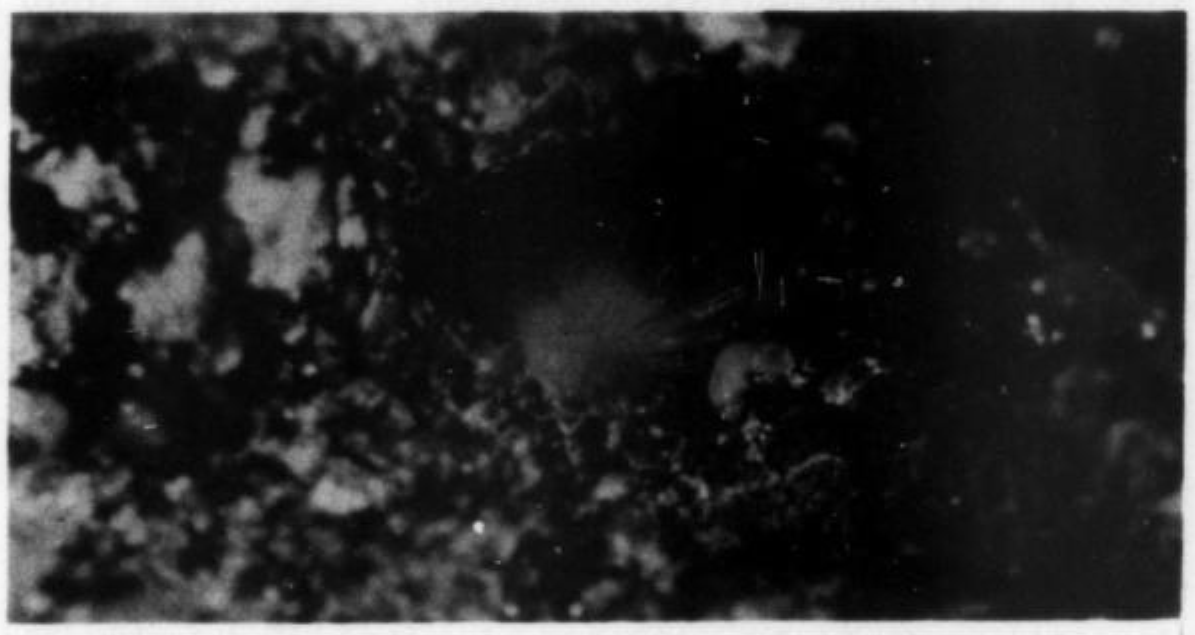


Fig. 8 *Unknown #5. Radiating tufts associated with brochantite and chalcoalumite. 10X.*

CARBONATES

Next to the sulfates the carbonates are probably the most abundant minerals found within the deposit. Early reports indicate that the ore shipped from the mine was mostly malachite and azurite, but these reports were probably in error. Aurichalcite is the most common, with azurite, malachite, and smithsonite less common. The carbonates are generally confined to the contact regions between the Redwall limestone and the ore body, but occasionally they are found in vugs and fissures in the clay.

1) *Aurichalcite* - $(Zn,Cu)_5(CO_3)_2(OH)_6$

This mineral is found in greenish-blue lath-like crystals forming tufted incrustations. Rather well-crystallized specimens can be found to the left in the middle adit along the fault, and to the left of the 202-foot marker of the middle adit. Aurichalcite is almost always found on or near limestone.

2) *Azurite* - $Cu_3(CO_3)_2(OH)_2$

Azurite occurs as deep azure blue short prismatic crystals in clay and limestone vugs. One exceptional specimen shows rather large crystals (approximately 3 cm. long by 1 cm. wide) of azurite altering to malachite.

3) *Malachite* - $Cu_2CO_3(OH)_2$

Malachite, like the other carbonates, occurs sporadically through the deposit, but is not abundant. Usually it is in the form of dark greenish black to pale green botryoidal crusts coating limestone and fissures in the clay. The x-ray data for the dark greenish-black material correlates well with the published data for malachite. However, the light green material shows noticeable shifts in the lines representing larger *d* spacings (see summary of x-ray data). Reportedly, these shifts are not uncommon for malachite in which extensive ionic substitution has taken place.

4) *Smithsonite* - $ZnCO_3$

Small amounts of smithsonite associated with malachite and azurite were observed lining vugs in clay. The color ranges from various hues of pink and green to almost clear. Like most of the other carbonates, it is closely associated with the alteration of limestone.

ARSENATES

The arsenates are, in general, confined to one small area in the northwest wall of the first small stope in the middle adit. They include: metazeunerite/zeunerite (?), olivenite, scorodite, adamite, and unknowns 6a and 6b. The arsenates seem to always be found in dark altered limestone, clay and limonitic rock.

1) *Metazeunerite/Zeunerite* - $Cu(UO_2)_3(AsO_4)_2.?H_2O$

Metazeunerite and/or zeunerite occur as transparent emerald-green and leek-green tabular crystals associated with scorodite, olivenite and unknowns 6a and 6b. Distinctly different x-ray patterns are obtained from material of different color. The leek-green material seems to be close to metazeunerite, whereas the emerald-green material is closer to zeunerite (see summary of x-ray data). The exact hydration state of these two minerals deserves further study. Additionally, an electron-microprobe analysis showed some ionic substitution of phosphorus for arsenic. Very often the leek-green crystals display scaly foliated surfaces typical of the meta-phase micaceous uranium minerals. Metazeunerite was also found on the main dump in cavities in a limonitic gossan-type rock.

2) *Scorodite* - $Fe(AsO_4).2H_2O$

Light brown to grey mammillary masses of this mineral were noted with metazeunerite and olivenite. The masses displayed a radiating internal structure when broken. Individual crystals were not noted.

3) *Olivenite* - $Cu_2(AsO_4)(OH)$

Olivenite occurs as short olive-green prismatic orthorhombic dipyramidal crystals, as well as lighter colored acicular groups. Its mode of occurrence on highly altered metazeunerite indicates that it probably formed later than the other arsenates.

Fig. 9 *Olivenite in acicular crystals on highly altered arsenic rich limonitic rock. 4X.*

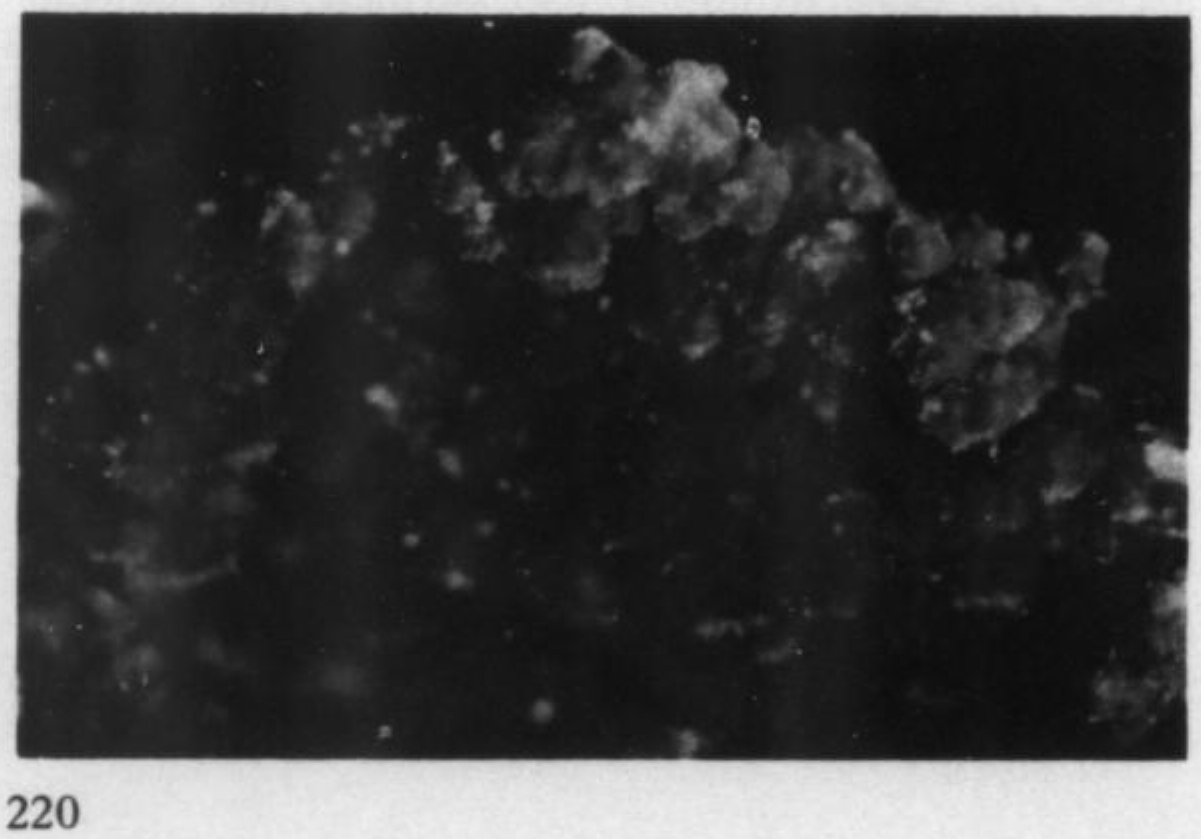
4) *Adamite* - $Zn_2(AsO_4)(OH)$

One small specimen of this mineral was found in the arsenate rich zone with other arsenates.

5) *Unknowns #6a and #6b*

The x-ray pattern for these two substances shows that they are probably the same mineral, but the electron-microprobe analysis indicates that unknown #6a has more iron than unknown #6b. The color and crystal habit of each is quite distinct. Unknown #6a is found as green radiating tufts or as frothy masses of intergrown crystals. Unknown #6b is micaceous in habit and its color tends to be more blue-green. They are both copper iron arsenate sulfates. Micro-chemical analysis gives a positive test for both the arsenate and sulfate radicals. The electron-microprobe also verifies both arsenic and sulphur. Both minerals appear to be homogeneous in composition. The atomic-weight percent of those elements detected in unknown #6a is as follows: copper 73%, iron 13.5%, arsenic 8% and sulphur and other minor elements (U, Pb and Al) 5.5%. The hydration state of either unknown #6a or #6b was not determined. Attempts to match the x-ray pattern with known arsenates, or arsenate/sulfates, containing copper and iron, met with negative results. Under high magnification unknown #6a appears as prismatic crystals out of which are growing many smaller micron size crystals. An electron-microprobe scan across the central crystal onto the smaller crystals indicated that they are probably of the same composition. The extremely small size of the crystals and the fact that the edges of the main crystal are obscured by smaller crystals, make optical data difficult to obtain and at best unreliable. It was nevertheless determined that unknown #6a is length slow, has a rather large 2V angle, and is strongly pleochoic. Unknown #6b is probably biaxial (-) and has a 2V angle between 60° and 65°; $y = 1.693$, $z = 1.710$, and $x =$?.

Fig. 10 *Unknown #6a. Short fibers forming tufts on clay and highly altered metazeunerite. 10X.*



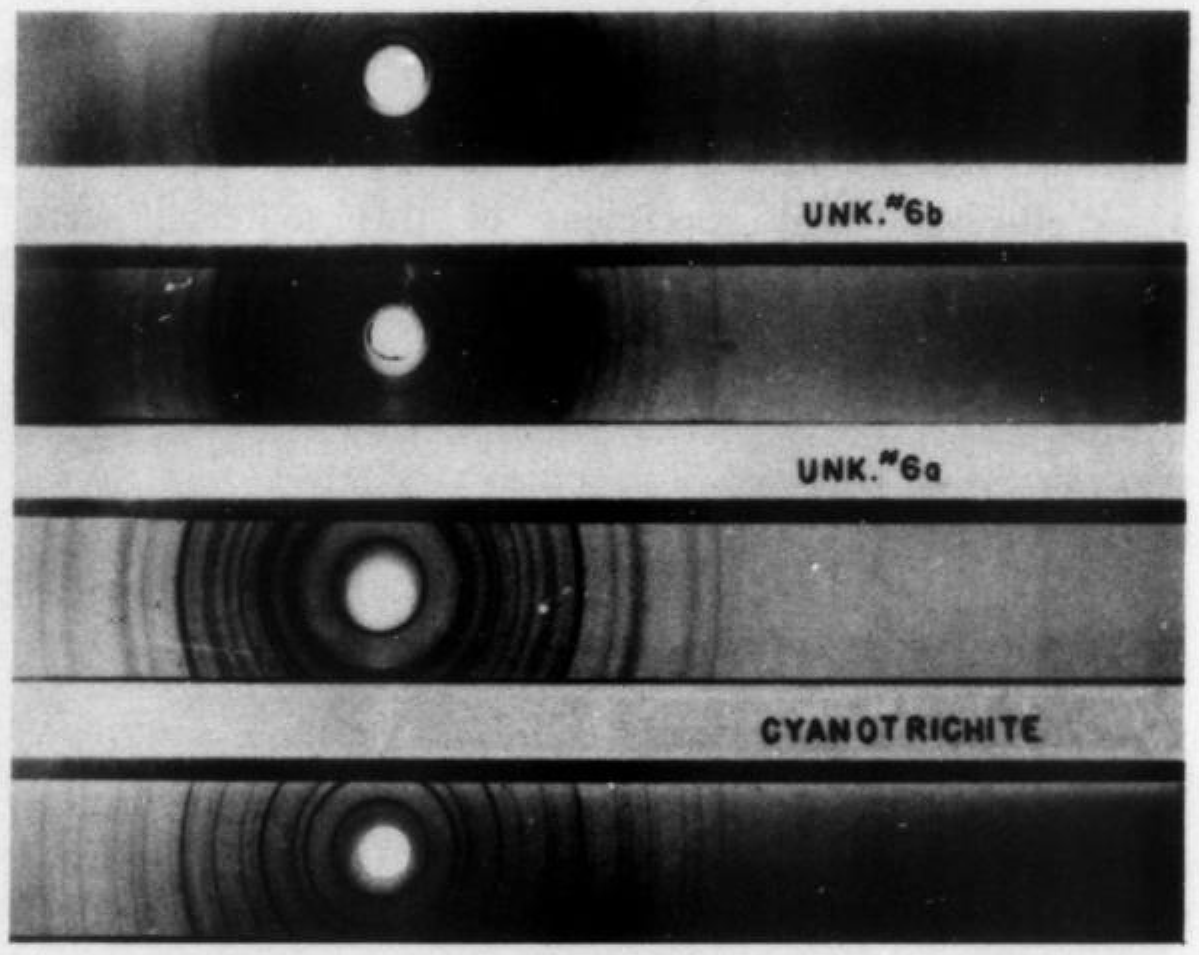


Fig. 11 *Powder patterns of unknowns #6a and 6b, cyanotrichite, and unknown #5. Note the dissimilarity between cyanotrichite and unknown #5.*

SULFIDES, OXIDES AND SILICATES

The sulfides, oxides and silicates make up only a small portion of the remaining ore body. Hemimorphite, kaolinite and illite were verified by x-ray techniques; but little else, beyond sight identification, was done in identifying the remainder of the sulfides, oxides and silicates.

One small clay pod containing pyrite altering to limonite (?) was located in the ceiling near the pillar just to the left of the middle adit. As indicated previously, this sulfide was obviously secondary in origin. Small amounts of chalcopyrite and bornite have been reported in thin sections of the Redwall limestone near the deposit. Kaolinite and illite were identified as the two minerals which make up the bulk of the clay in the deposit. Both kaolinite and illite contain many small particles of quartz.*** Hemimorphite seems to be confined along one small fissure near the arsenate-rich zone of the middle adit. A sooty black coating of a mineral which re-

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***Kaolinite, illite, quartz, chalcopyrite and bornite were identified by Mr. Leigh Price, University of California, Riverside.

Table 1. SUMMARY OF THE X-RAY DATA

(d-spacing of the eight most intense lines in decreasing order)

Brochantite	$\underline{3.91}_{10}$	$\underline{2.53}_{9}$	$\underline{6.50}_{6}$	$\underline{5.40}_{5}$	$\underline{2.69}_{5}$	$\underline{3.20}_{4}$	$\underline{1.74}_{3}$	$\underline{1.56}_{2}$
Aurichalcite	$\underline{6.78}_{10}$	$\underline{2.61}_{8}$	$\underline{3.68}_{6}$	$\underline{2.89}_{4}$	$\underline{2.72}_{4}$	$\underline{1.66}_{4}$	$\underline{3.25}_{3}$	$\underline{2.81}_{3}$
Olivenite	$\underline{2.98}_{10}$	$\underline{4.82}_{9}$	$\underline{5.91}_{5}$	$\underline{2.47}_{4}$	$\underline{4.10}_{4}$	$\underline{2.39}_{3}$	$\underline{2.65}_{3}$	$\underline{1.58}_{3}$
Adamite	$\underline{2.45}_{10}$	$\underline{4.90}_{9}$	$\underline{2.97}_{9}$	$\underline{2.70}_{8}$	$\underline{1.61}_{8}$	$\underline{5.94}_{6}$	$\underline{4.24}_{6}$	$\underline{2.42}_{5}$
Malachite #1	$\underline{2.86}_{10}$	$\underline{3.69}_{9}$	$\underline{5.06}_{8}$	$\underline{5.99}_{9}$	$\underline{2.52}_{6}$	$\underline{2.78}_{6}$B	$\underline{2.82}_{6}$B	$\underline{2.46}_{6}$B
Malachite #2	$\left\{\begin{array}{l}2.81\\ \underline{2.78}_{10}\end{array}\right.^{B}$	$\underline{3.67}_{10}$	$\underline{5.06}_{9}$	6.11_{9}	$\underline{2.52}_{5}$	$\underline{2.46}_{4}$	2.42_{4}	3.01_{3}
Metazeunerite	$\underline{8.50}_{10}$	$\underline{3.69}_{10}$	5.43_{9}	$\underline{3.26}_{8}$	$\underline{3.53}_{7}$	5.01_{6}	$\underline{1.56}_{6}$	$\underline{2.96}_{4}$
Zeunerite	$\underline{10.3}_{10}$	$\underline{3.56}_{10}$	$\underline{5.18}_{5}$	$\underline{2.08}_{5}$	$\underline{1.92}_{3}$	$\underline{4.95}_{3}$	$\underline{3.38}_{2}$	$\underline{1.79}_{2}$
Scorodite	$\underline{5.57}_{10}$	$\underline{4.43}_{10}$	$\underline{3.16}_{9}$	$\underline{2.57}_{8}$	$\underline{3.05}_{5}$	$\underline{2.49}_{4}$	$\underline{2.97}_{3}$	5.03B
Unknown #6a & 6b	13.59_{10}	10.28_{8}	2.58_{5}	2.53_{5}	3.07_{4}	4.50_{3}	1.50_{4}	3.98_{3}
Chalcoalumite	$\left\{\begin{array}{l}8.80\\ \underline{8.30}_{10}\end{array}\right.^{B}$	$\underline{4.25}_{9}$	$\underline{2.00}_{7}$	$\underline{2.29}_{6}$	$\underline{1.72}_{4}$	$\underline{4.78}_{2}$	$\underline{4.57}_{2}$	$\underline{7.86}_{3}$
Unknown #5	6.22_{10}	3.95_{10}	9.60_{8}	5.26_{8}	2.38_{7}	2.81_{6}	2.01_{3}	3.62_{2}
Smithsonite	$\underline{2.74}_{10}$	$\underline{1.70}_{10}$	$\underline{3.54}_{8}$	$\underline{2.33}_{5}$	$\underline{1.95}_{5}$	$\underline{2.11}_{5}$	$\underline{1.49}_{3}$	$\underline{1.52}_{1}$
Langite	$\underline{7.13}_{10}$	$\underline{3.56}_{8}$	$\underline{2.63}_{8}$	$\underline{2.49}_{4}$B	$\underline{2.20}_{1}$	$\underline{2.12}_{1}$	$\underline{1.77}_{1}$	$\underline{5.32}_{1}$
Devilline	$\underline{10.16}_{10}$	$\underline{5.09}_{8}$	$\underline{3.38}_{7}$	$\underline{1.57}_{5}$	$\underline{1.53}_{5}$	2.11_{4}	$\underline{2.38}_{4}$	$\underline{1.85}_{3}$
Cyanotrichite	$\underline{10.16}_{10}$	$\underline{3.87}_{9}$	$\underline{5.26}_{8}$	4.20_{8}	$\underline{2.38}_{7}$	4.95_{5}	$\underline{3.37}_{3}$	$\underline{3.04}_{3}$
Azurite	$\underline{3.51}_{10}$	$\underline{5.15}_{10}$	$\underline{2.52}_{10}$	$\underline{3.66}_{5}$	$\underline{2.34}_{4}$	$\underline{2.29}_{4}$B	$\underline{2.26}_{4}$B	$\underline{2.23}_{4}$B
Hemimorphite	$\underline{3.09}_{10}$	$\underline{3.28}_{9}$	$\underline{6.55}_{8}$	$\underline{2.55}_{7}$	$\underline{2.38}_{7}$	$\underline{5.33}_{7}$	$\underline{4.60}_{6}$	2.85_{5}

The subscript "10" indicates a line of maximum intensity;

2.46B indicates a broad line centered at a *d* spacing of 2.46;

$\left\{\begin{array}{l}8.80\\ 8.30_{10}\end{array}\right.^{B}$ indicates a broad line of intensity 10; 8.80 and 8.30 are the extremes

Underlined *d* spacings are those used in the identification of the mineral and correlate well with the published data.

sembles chalcocite or pyrolusite was observed in several places in the mine.

The minerals reported above are not by any means all the minerals to be found in the deposit. Each trip to the locality results in new minerals to be added to the list.

ACKNOWLEDGMENTS

The writer is deeply indebted to the National Park Service for permitting this study and removal of specimens from a National Park. In addition, many people contributed toward the accomplishment of this work. To name a few: Mr. Edward Saller, Philco-Ford Corporation, Newport Beach, California, for his work on the electron-microprobe analysis; Mr. James McCamot, Philco-Ford Corporation, for his assistance in various x-ray techniques; Dr. Paul Thiene, Philco-Ford Corporation, for assisting in the editing of the report; Mr. G. Stanley Alexander, Santa Ana, California, for his assistance in the optical analysis; Mr. Leigh Price, University of California, Riverside, for his identification of the clay minerals and dialog on the genesis of the deposit; Dr. Robert Winchell, California State College, Long Beach, for supervising and assisting in the identification of several of the minerals; and special thanks to Dr. Joel Arem, National Museum of Natural History, for his assistance in the final critiquing of this report.

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MINERALOGICAL SOCIETY OF AMERICA ELECTS NEW OFFICERS

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FRIENDS OF MINERALOGY

Specimen Preservation by Friends of Mineralogy: Laumontite from the Pine Creek Mine, Bishop, California

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Among the stated goals of Friends of Mineralogy is the preservation of mineral specimens for research, education, and display, especially material from noted, but normally inaccessible, localities. To this end, Friends of Mineralogy, in conjunction with the Smithsonian Institution, organized an expedition[1] to collect the unusually large and magnificent crystals of the zeolite, laumontite, from Union Carbide Corporation's Pine Creek tungsten mine, Bishop, California. The laumontite crystals from this locality are the largest ever reported, with spectacular groups of single crystals up to six inches in length. These exceptionally fine specimens are scarce and not readily available to collectors, museums, research, and academic institutions, as private collecting is not permitted in the mine[2] and only a few specimens have been brought out by miners.

The Pine Creek Mine, opened in 1946, and under the direction of the Union Carbide Corporation since 1935, is situated on the easternmost side of the Sierra Nevada Mountains. The mine is located on a contact of a quartz monzonite intrusive with a large marble member of the Pine Creek pendent (a synclinal group of metasedimentary and metavolcanic rocks). Gray, *et al* (1967) report that the ore bodies consist of scheelite-bearing tactite formed by pyrometasomatic replacement of calcareous sediments along the contact.

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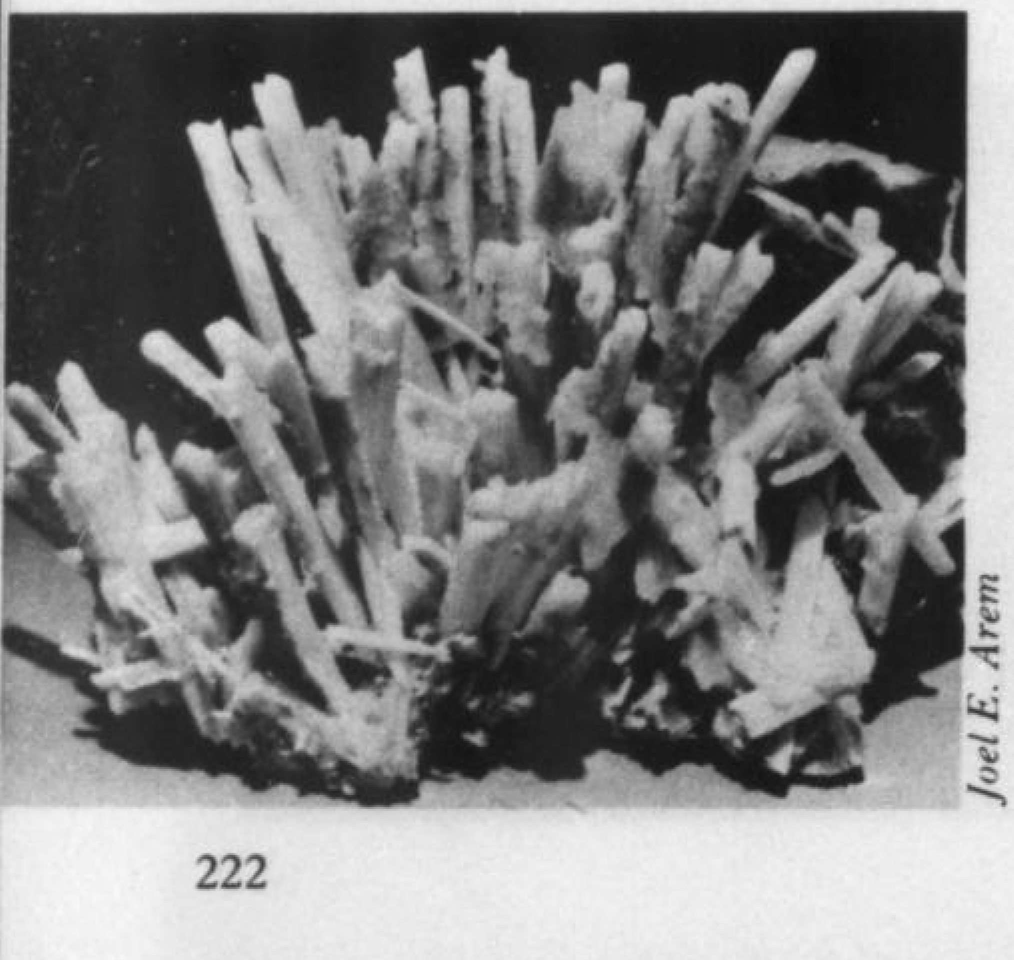
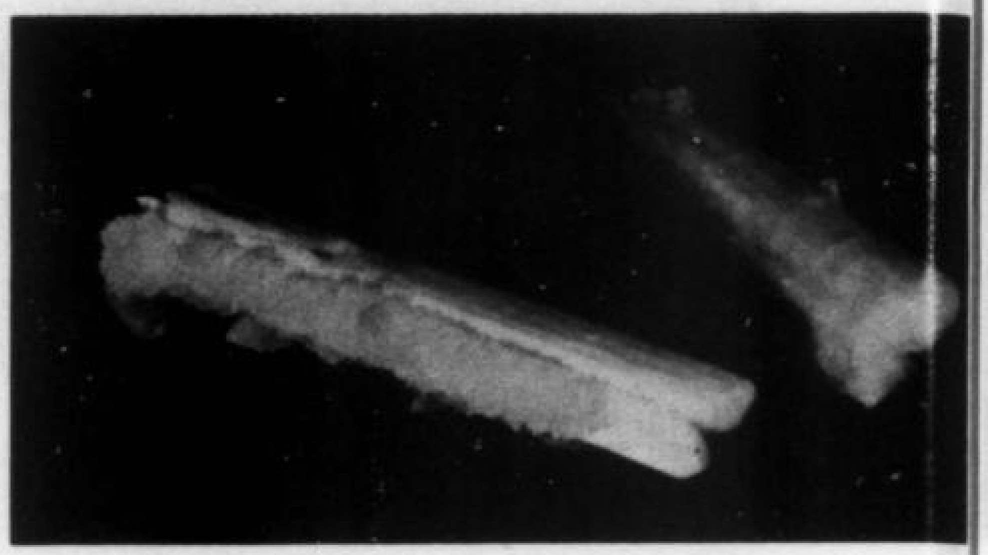

Joel E. Arem

According to Combs (1952) and Lapham (1963), the composition of laumontite can be expressed by the formula:

$$Ca_x(Na, K)_y(Al,Mg,Fe^{3+})_{2x+y}Si_{24-(2x+y)}O_{48}\,.\,16H_2O$$

with $x+y/2$ less than 4, and $x+y$ greater than 4.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Crandallite from Gore, Frederick County, Virginia

by **Richard S. Mitchell and Sandra M. Knowlton**
Lewis Brooks Museum
University of Virginia
Charlottesville, Virginia 22903

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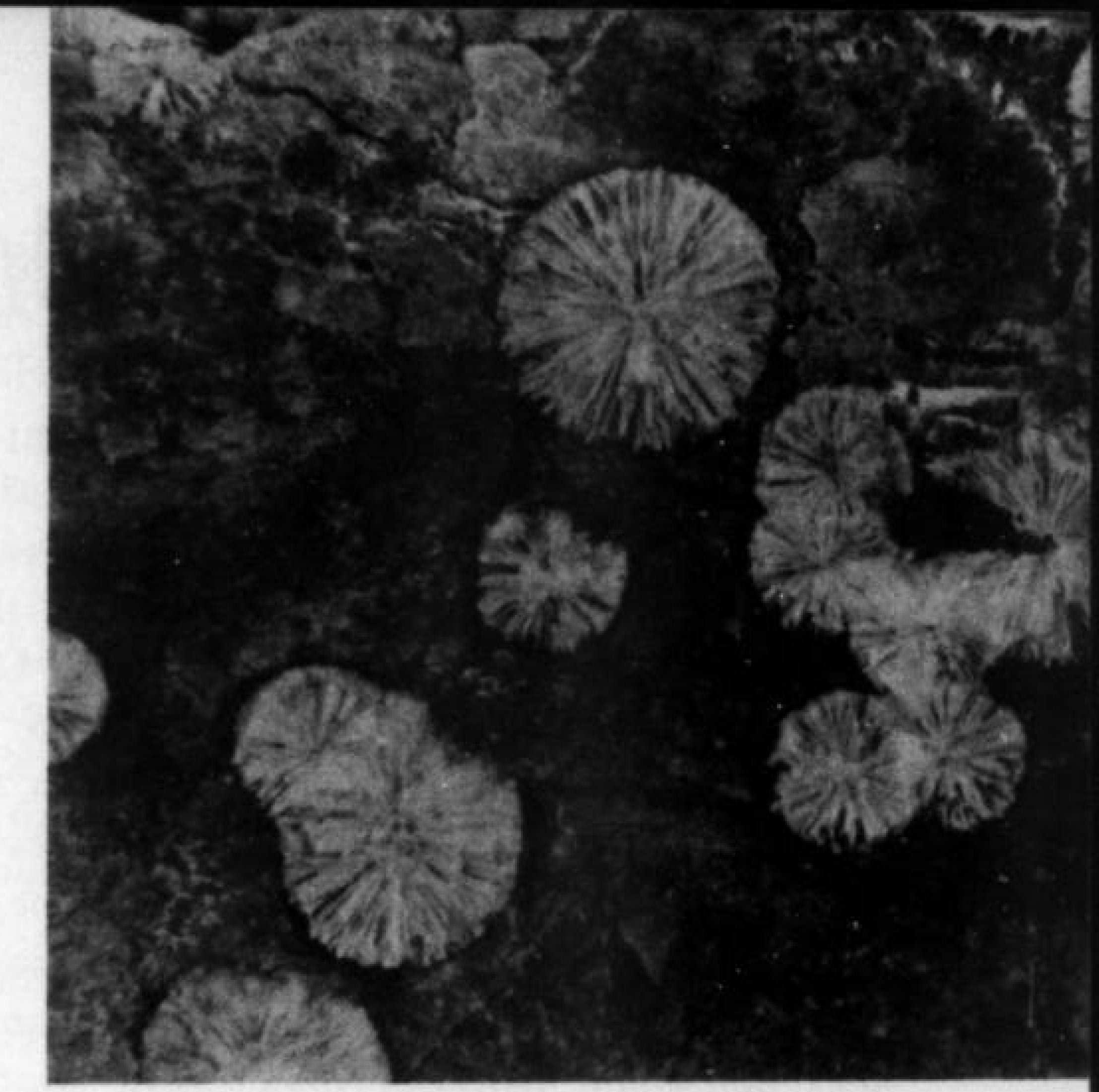
The crandallite occurs as white chalky coatings and as white to brownish chalky spherulites (to 4 mm diameter). The shperulites have a radial fibrous structure. As many as forty small spherulites may be attached to a rock surface one inch square. Larger spherulites often have the form of flattened fibrous disks, while smaller ones are usually hemispherical.

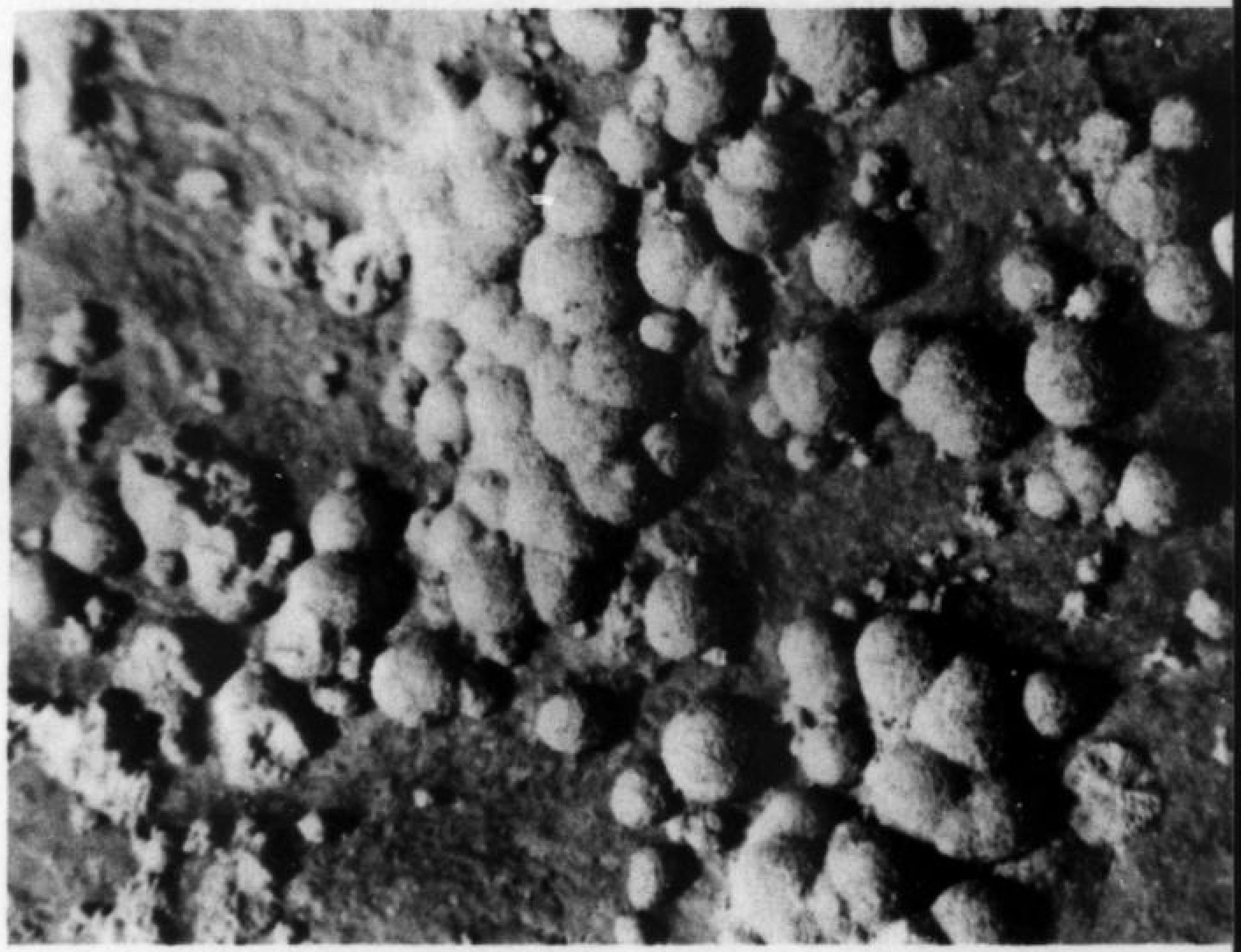
Optical studies showed that the fibers which form the spherulites are elongated at right angles to [0001], an elongation also reported by Palache *et al.* (1951). The Virginian mineral is optically positive with $\epsilon = 1.61_8$ and $\omega = 1.61_6$.

The initial identification of Frederick County crandallite was made by x-ray diffraction analyses. The data are nearly identical to those reported by Owens *et al.* (1960) for crandallite from Utah and Florida. The x-ray data of Table 1 represent an average of measurements of five films made with CuKα radiation in cameras of 11.46 cm diameter. The unit cell, $a = 7.00 \pm 0.02$ Å, $c = 16.11 \pm 0.05$ Å, $a{:}c = 1{:}2.300$, was determined from these data. Using this cell, all possible interplanar spacings allowed by the R3*m* space group were calculated through 1.37 Å (Table 1). The excellent correlation between observed and calculated data verifies the hexagonal nature of the mineral and eliminates the possibility that it is the "triclinic dimorph" reported by Cowgill *et al.* (1963). Their dimorph also requires that reflection (01.2) at 4.85 Å be almost absent. Very weak quartz impurity lines were present on our x-ray diffraction films.

Semiquantitative spectrographic analyses verified the chemical composition by showing the chief cations are Ca, Al, and P. These analyses also showed from 1 to 3.5% SrO, which indicates the crandallite is a strontian variety in the crandallite-goyazite series. Other trace elements of interest are ZnO, 0.35%, and BaO, 0.2 to 0.3%. Admixed quartz and iron oxide impurities were also verified by the analyses.



1. Radial white crandallite on gray chert. (X 5.5)



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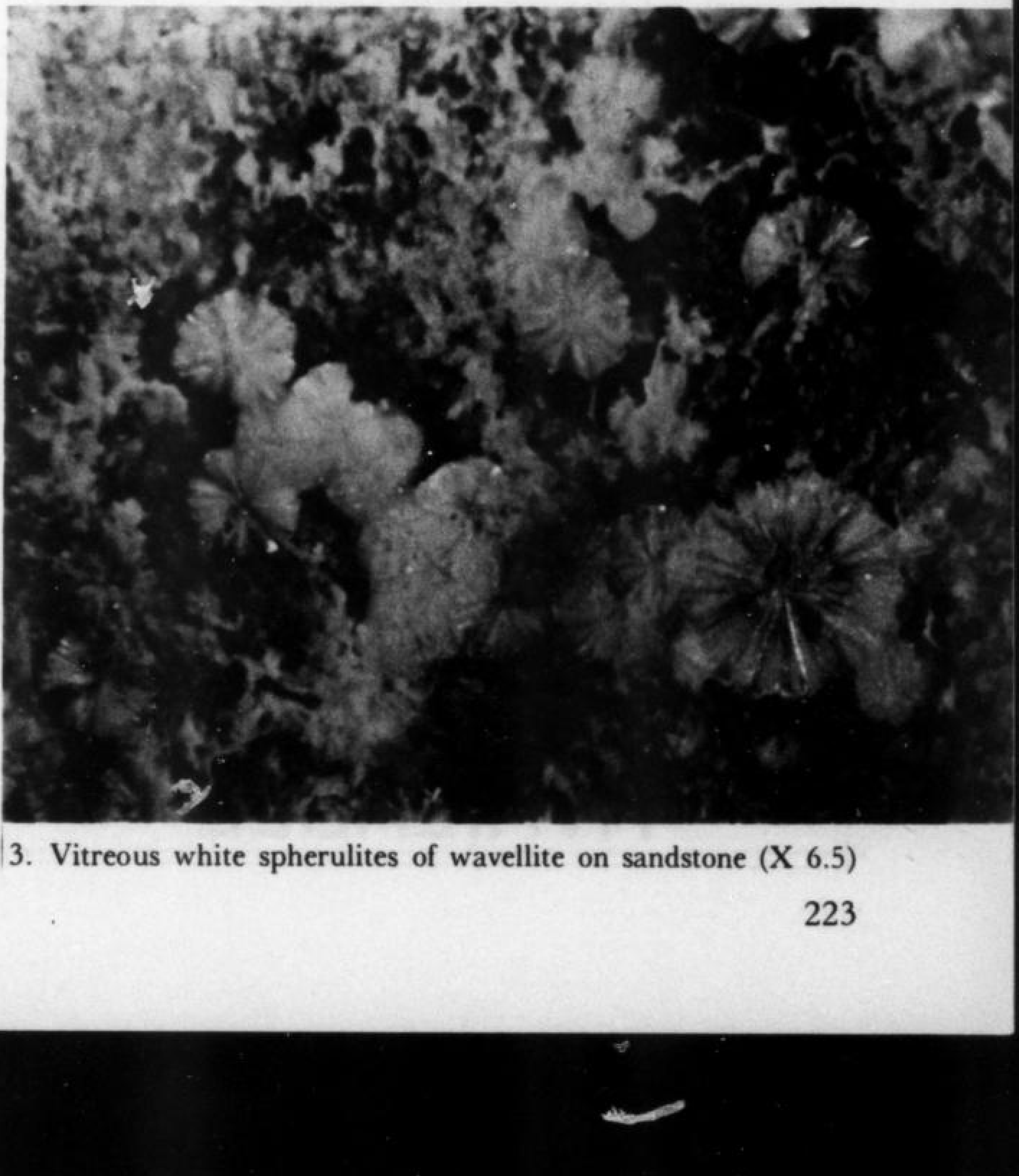

3. Vitreous white spherulites of wavellite on sandstone (X 6.5)

FRIENDS OF MINERALOGY

Specimen Preservation by Friends of Mineralogy: Laumontite from the Pine Creek Mine, Bishop, California

G. A. Novak and **S. G. Oswald**
Department of Geology
California State College at Los Angeles
Los Angeles, California 90032

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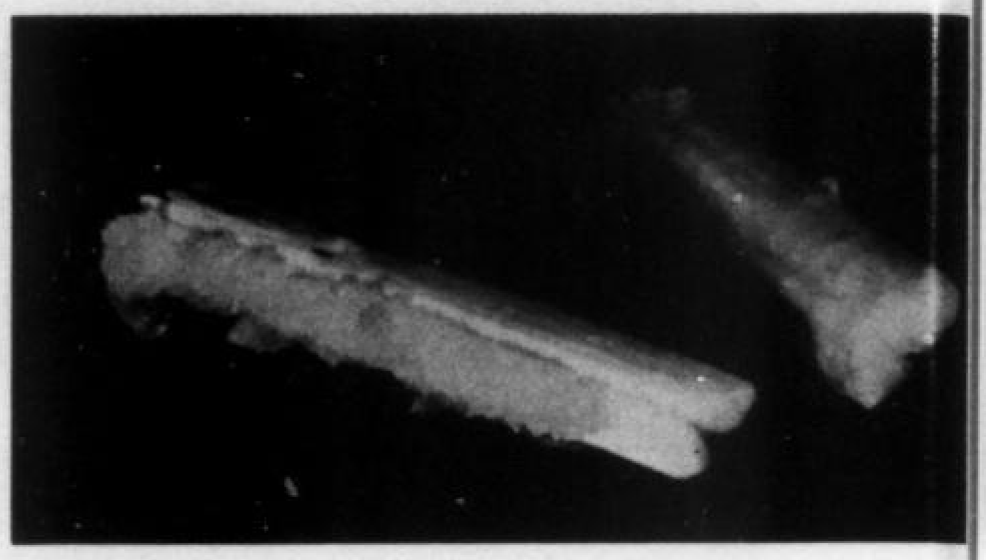
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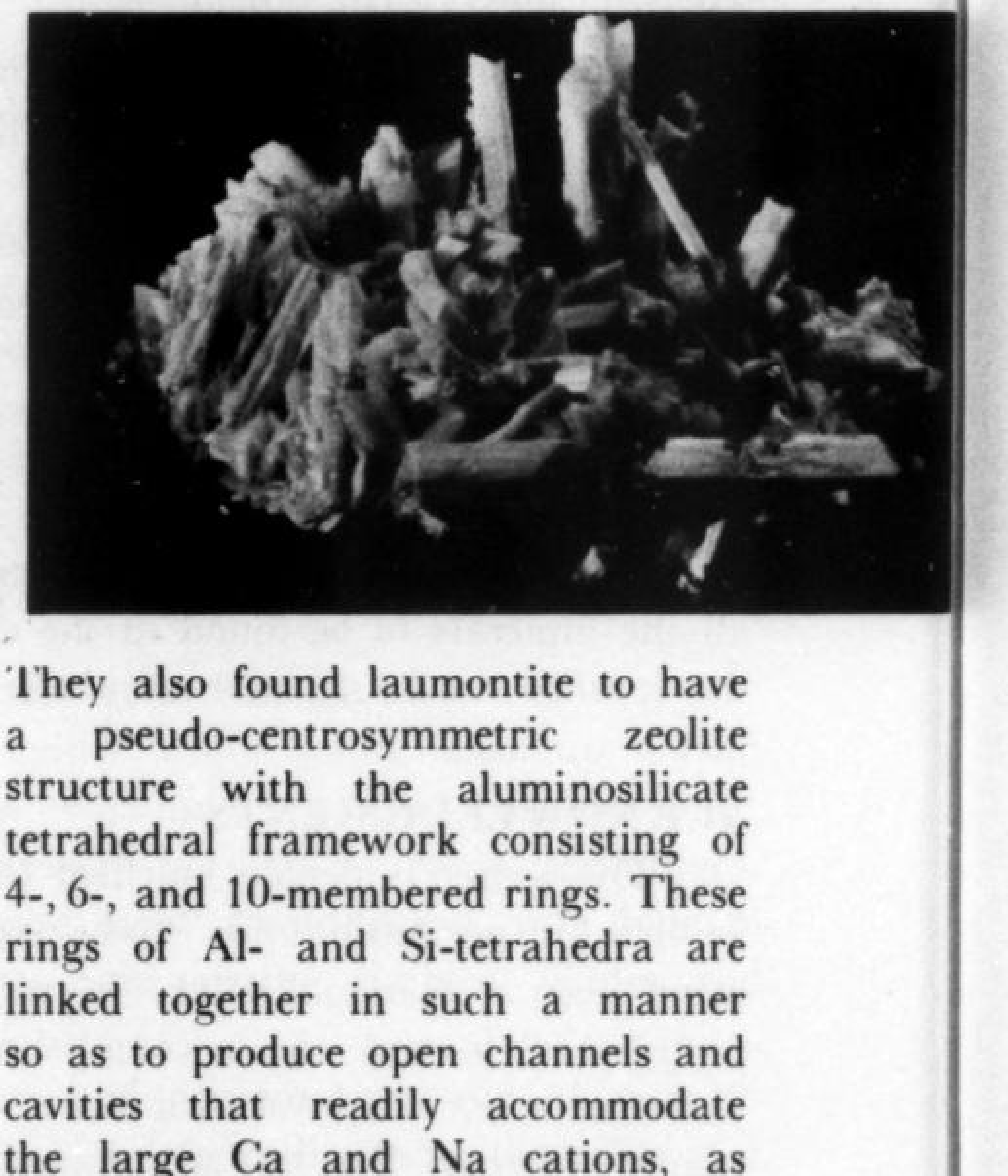
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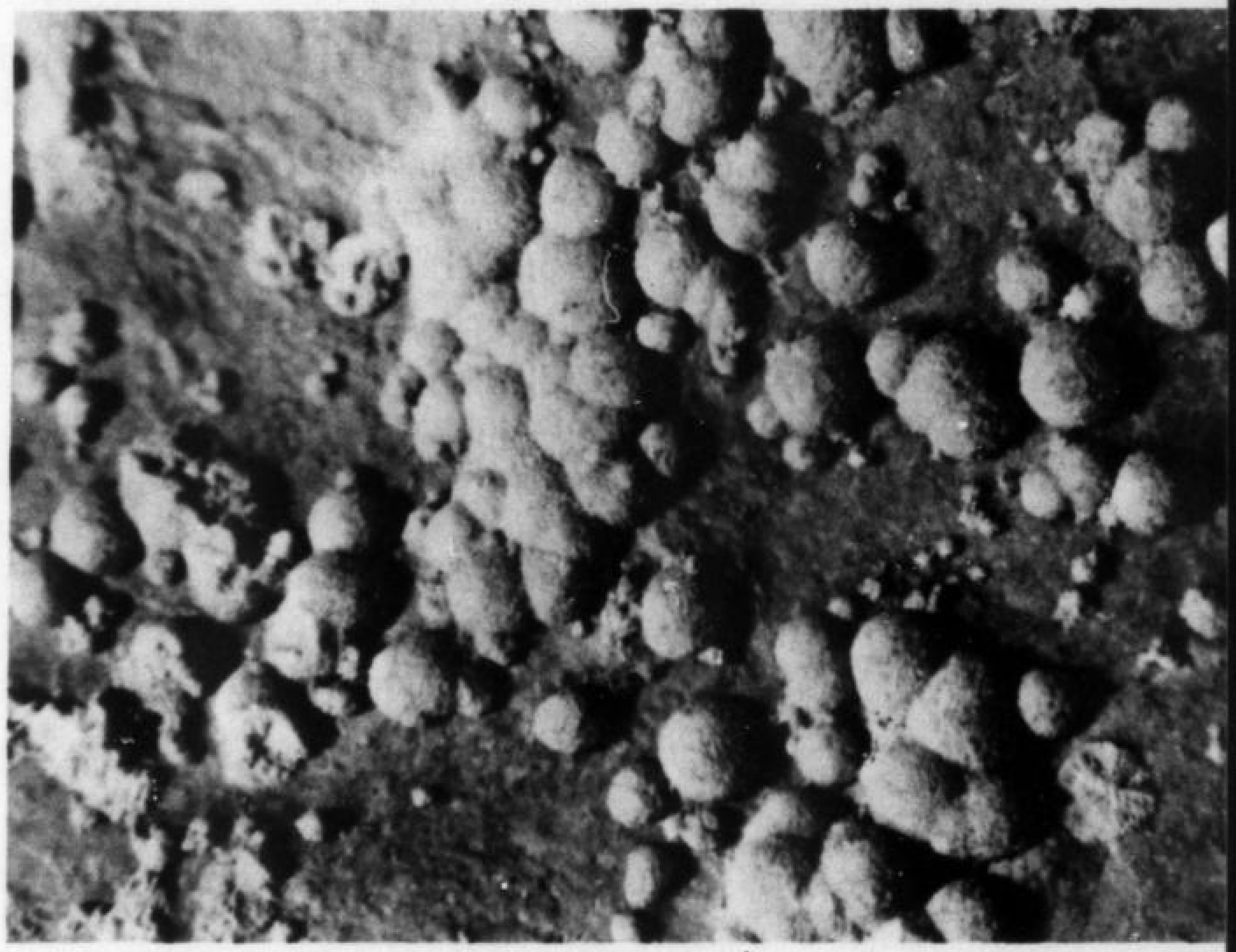
2. Crowded crandallite spherulites on gray chert. (X 5.5)


3. Vitreous white spherulites of wavellite on sandstone (X 6.5)

A small amount of wavellite is associated with the crandallite. It occurs as white to yellowish-green spherulites and fibrous seam fillings. The wavellite spherulites are similar to crandallite in size and form, but are vitreous with rough surfaces, and often greenish. The mineral was verified by x-ray diffraction analyses.

The matrix rocks associated with the crandallite and wavellite are mainly of three kinds. One is a dark-gray medium-grained sandstone, while the other two are fossiliferous (spiculitic ?) cherts, one light gray and porous, the other gray and dense. These rocks are associated with one another in a highly fractured zone in the quarry. This zone is stained with iron oxide, and is the zone where the phosphates are most abundant. Crandallite was not found with the major rock quarried from the deposit. This is a friable, white to buff, coarse to medium sandstone, which has been described by Lowry (1954). Small quantities of wavellite were found on fossil imprints in this rock.

The quarry is in Oriskany sandstone (lower Devonian), and is located near the northeastern end of Sand Ridge, about a mile south of Gore. The deposit has been described by Lowry (1954), and Butts and Edmundson (1966) have discussed the geology of the area.

We wish to express our thanks to Mr. B. A. Taylor who brought to our attention the wavellite at this deposit. Also we are indebted to Mr. W. P. Porter and Mr. Gordon Kirby for the photographs which accompany this paper. The study was supported in part by the University of Virginia Committee on Summer Grants.

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Table 1. X-ray Powder Diffraction Data for Crandallite from Virginia. Cameras of 11.46 cm diameter, nickel-filtered copper radiation.

hk.1	d(calc.) Å	d(meas.) Å	I(obs.)[a]
10·1	5.67	5.70	s
00·3	5.37		
01·2	4.84	4.85	ms
11·0	3.50	3.51	s-
10·4	3.36		
02·1	2.98	2.98	ms-
11·3	2.93	2.93	vs
01·5	2.85	2.85	vvw
20·2	2.84		
00·6	2.69	2.70	mv
02·4	2.42	2.43	w
21·1	2.27	2.26	vvw
20·5	2.21	2.21	m
12·2	2.20		
10·7	2.15	2.17	ms
11·6	2.13		
30·0	2.02		
21·4	1.99	1.99	vvw
01·8	1.91		
30·3	1.89	1.89	s
12·5	1.87		
02·7	1.83	1.84	vvw
00·9	1.79	1.80	vvw
22·0	1.75	1.75	s
20·8	1.68	1.69	vvw
13·1	1.67		
22·3	1.66		
31·2	1.65	1.65	vvw
21·7,30·6	1.62	1.63	vvw
11·9	1.61	1.60	vvw-
10·10	1.56		
13·4	1.55	1.55	vvw
12·8,40·1	1.51	1.51	vw
31·5,04·2	1.49	1.49	w
22·6	1.47	1.47	w
01·11,02·10,40·4	1.42	1.43	w+
32·1	1.39	1.39	vvw
04·5,23·2	1.37	1.37	vvw
		1.36	vvw
		1.34	vw
		1.32	vw
		1.29	w+

[a] Scale of decreasing intensities from visual estimation: vvs, vs, s, ms, m, mw, w, vw, vvw.

An Occurrence of Svanbergite in California[1]

by **H. Earl Pemberton** and **Richard A. Bideaux**
1638 Hill Street
Santa Monica, California 90405
1242 West Pelaar
Tucson, Arizona 85705

Svanbergite, a basic sulfate-phosphate of strontium and aluminum, $SrAl_3(PO_4)(SO_4)(OH)_6$, has been identified as a minor constituent of the kyanite deposit in the Vitrefax formation of the Cargo Muchacho Mountains, Imperial County, California. It occurs as pseudo-cubic rhombohedra up to 2 mm. in diameter, ranging from nearly colorless to honey colored.

The Vitrefax formation consists mainly of muscovite and quartz-muscovite schists with the kyanite confined mainly to the more quartzose parts of the formation. Published studies on the deposit agree that there appears to be a local hydrothermal concentration of the quartz and kyanite (Campbell and Wright, 1950, p. 1521; Henshaw, 1942, p. 154).

Svanbergite was found in a pyrophyllite lens in a section of the formation which is apparently such a hydrothermal concentration of quartz and kyanite. Pyrophyllite has been reported by previous studies from the Vitrefax formation but is not common in the Bluebird Hill area where this lens was found. The association of the svanbergite with pyrophyllite and kyanite apparently parallels the occurrence from which the mineral was first reported at Horrsjöberg. Wermland, Sweden.

The pyrophyllite lens is roughly circular, about 18 inches across, and surrounded by compact subhedral kyanite and sugary quartz. Near the contact with the quartz-kyanite host of the lens, euhedral almandine is fairly common as crystals usually not exceeding 8 mm. The pyrophyllite is well crystallized with euhedral terminations in vugs. It is a very pale green and stained brown with iron oxide only near the edges of the lens and along fracture surfaces of the lens.

The heaviest concentration of svanbergite is in the central part of the lens. Closely associated with the svanbergite are strontian barite and rutile. Quite commonly the barite includes the svanbergite and is also found as a coating on the terminations of pyrophyllite in the vugs. Pinkish euhedral crystals of this unusual barite are not common but do occur filling or partially filling vugs in the pyrophyllite. Especially in the central part of the lens, euhedral deep red crystals of rutile up to 2 mm. are common. Other minerals present in the minor amounts are bluish-black to brown needles of tourmaline in veinlets crosscutting the pyrophyllite mass, thin films of brilliant yellow carnotite on fracture surfaces, and a pale bluish clay mineral.

Identification of the svanbergite, barite, tourmaline and carnotite was by X-ray diffraction. Since the X-ray powder patterns of svanbergite, woodhouseite, etc., are distinguished only with difficulty, X-ray flourescence analysis for selected major elements was carried out on both the svanbergite and barite. The svanbergite showed major Sr and P, with Ba, Pb and As being absent. The barite contains only a small amount of Sr and no Pb; from shifts of half a dozen lines on its X-ray powder pattern it is estimated to contain 20 mole percent Sr.

It had been thought that the svanbergite might prove to be the phosphate analog of weilerite, $BaAl_3(AsO_4)(SO_4)(OH)_6$, since it is coexisting with strontain barite. As this was not the case, it is an indication that this phosphate compound may not be stable under the conditions attending the formation of svanbergite.

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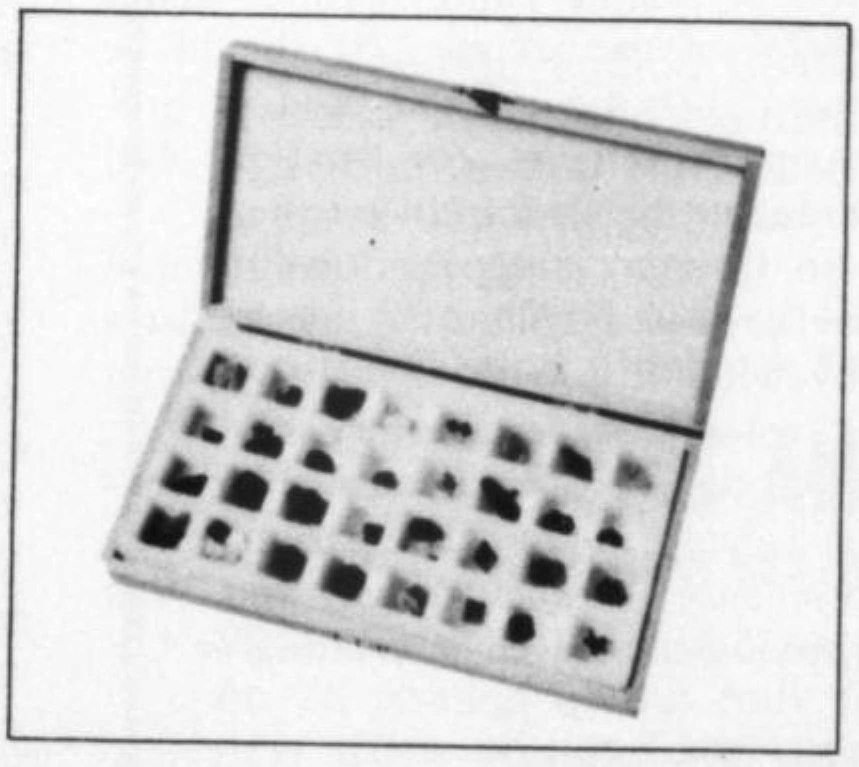

On the Chemistry and Color of Rose Quartz

by **William H. Dennen and Anita M. Puckett**
University of Kentucky
Lexington, Kentucky 40508

The color of rose quartz has been variously ascribed to the incorporation of carbon compounds (Kraatz-Koshlau and Wöhler, 1898· Watson and Beard, 1917), irradiation yielding colloidal Na or Li (Doelter, 1915), to an adsorbed titanium colloid (Hubbard, 1922), to Mn^{3+} compounds in solid solution (Hermann, 1908; Holden, 1924; Masgutov, 1962), or the presence of titanium as a sequioxide (Weinshenk, 1896). More recently the color has been thought to be due to the presence of Cr^{3+} (Ilyukhim and Sviridov, 1967), substitutional Ti^{4+} ions acting as a color center[1] (Brown and Thomas, 1952; Frondel, 1962), a Ti^{3+} - activated color center, (Wright and Weil, 1963) or tiny oriented rutile inclusions (von Vulteé, 1955, 1956; von Vulteé and Leitz, 1956).

The chemical nature of the impurities present in rose quartz should provide strong clues as to the cause of its coloration, but a review of the published analyses of this rather simple substance reveals wide differences and suggests that the variations are more analytical than real. A generally low and uniform content of manganese and titanium, however, are reported by most authors and is substantiated by the results obtained in this study.

In the present study, 27 specimens of rose quartz obtained from the U.S. National Museum and collections at the University of Kentucky were examined spectrographically for a number of non-formulary elements following the procedures of Dennen (1964, 1967).

The trace chemistry of rose quartz was found to be dominated by Li - Al coupled substitution and rather small amounts of other elements were found as compared with colorless quartz. Manganese was below detection limits (<5 ppm) in all of the specimens examined, which is contrary to the color relation proposed by Holden (1924); no chromium was noted (detection $\sim$0.5 ppm) as would be needed for the mechanism of Ilyukhim and Sviridov (1967). The titanium content, although lower than often encountered in colorless quartz, is not inconsistent with either a titanium - activated color center or a moderate population of minute rutile needles - about .002% of the volume. (It should be noted that the method used in preparing specimens for analysis will eliminate inclusions ≥ 1 micron).

Table 1
Median Chemical Data
For Rose Quartz, ppm

Source	n	Li	Na	K	Al	Fe	Mn	Ti	Ca	Mg
1	4	38	58	6	3	3	.45	14		
2					1100	10		30	30	10
3	9					47	3	17		
4	28				635	60	2.3	19		
5	1				222	49	70	288	55	48
6	27	33	17	20	157	9	5	18	2	3.5

n= number of samples

1 Frondel (1962)
2 Cohen and Sumner (1958)
3 Watson and Beard (1917)
4 Holden (1924)
5 von Vulteé (1955)
6 This study

In sum, it appears that none of the proposed coloration mechanisms involving dissolved chemical species is completely satisfactory. Further, since the Ti^{4+} - activated color center identified by the paramagnetic resonance work of Wright and Weil (1963) is destroyed by heating or UV bleaching without affecting the rose color, this mechanism must also be eliminated.

The responsiveness of rose quartz to blackening under x-irradiation may be ascribed to its relatively large aluminum content since the proxy of Al^{3+} for silicon in the tetrahedral site is a precursor for an Al-activated color center (O'Brien, 1955; Bambauer, 1961). The occasional occurrence of smoky zones within untreated material may possibly be explained by exposure of the quartz during growth to transient radioactive solutions or to zonally distributed aluminum.

The aluminum content of rose quartz also provides a means of estimating the temperature at which it crystallized, since the amount of aluminum dissolved is a linear function of the growth temperature, T°C=3.6 (ppm Al) + 33 (Dennen, 1970). For the specimens studied, two thirds of the samples appear to have formed in the range 465-680°C, and the most common crystallization temperatures measured were 610±34°C.

If the temperature of formation of rose quartz is above the high-low

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[1] color absorption within a crystal as a result of point defects due to atomic substitution and consequent disturbance of the local electronic field.

transformation at about 573°C, it could incorporate more proxy ions for silicon than could be retained in this site below the transformation temperature, and the excess would have to exsolve as the structure inverted. Both Al^{3+} and Ti (as either a trivalent or quadrivalent ion) can proxy for Si^{4+} in the tetrahedral site, but the poorer fit of titanium would presumably cause it to be selectively exsolved to appear as needles of a titanium mineral, probably rutile, while Al^{3+} was preferentially retained; such retention of tetrahedral aluminum in the low quartz structure is demonstrated by the ready response of rose quartz to x-irradiation.

Exsolution of titanium in the form of rutile (often as oriented needles) is suggested by the general turbidity and common asterism of rose quartz, and demonstrated by direct observation (von Vulteé, 1955, who gives the dimensions of rutile inclusions as 0.01 to 0.2). Suboriented needles were observed microscopically in nearly all of the samples included in this study.

The conclusion seems inescapable that the color of rose quartz results from Tyndall scattering by tiny oriented rutile needles.

This work was supported by National Science Foundation Grants numbers GA-1397 and GA-19313.

The majority of the samples were provided by the U.S. National Museum.

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The Record Bookshelf

JOEL E. AREM

Rocks and Minerals, *by Lou W. Page,* Follett Publishing Co., Chicago, 1962, 32 pp., ($1.25)

The author of a technical or semi-technical book is faced with many problems involving content, level of presentation and factual accuracy. The same problems are accentuated for the author of an introductory book, especially one aimed at young children. It is no small accomplishment to succeed in writing an interesting, easily read and accurate book for the younger age groups, especially a book on science. Page has succeeded, and thereby provided an excellent route for children to learn what rocks and minerals are and how they form in nature.

Rocks and Minerals is remarkably free of errors considering the degree of simplification it reaches. Except for very minor points ("...shells are made of a mineral called lime." Why not use the correct name, calcite?) explanations of the origin of rocks and their mineral contents are accurate and concise. The book describes igneous, metamorphic and sedimentary rocks and how they form, common minerals and some of their properties, ores and fossils. There are no chapters. Rather, the text "rambles" from one topic to another. This may be disturbing to those who think that diverse subjects should be neatly categorized, but such treatment does not seem to hurt the style and presentation of the material covered. The illustrations are all in color and are excellent. The last part of the book deserves special merit. Included are a list of words younger children might need help in understanding, a discussion of things to do in the classroom or at home, and hints on collecting and storing rocks. This type of information is really very important, in the sense that a youngster who is "turned on" about rocks and minerals might become frustrated unless he can immediately follow up his interest with activities both in and out of doors. What better way to interest a child in nature than to let him discover its secrets for himself?

Rocks and Minerals seems to be a rather frequently encountered title in today's book market. One may get the idea that all of the books on a certain level of interest are much the same. This is certainly not the case. Page's effort stands out as one of the better approaches to a lively, interesting and important area of natural history. ■

The Complete Guide to Rocks, Minerals and Gems, *edited by Hans Tanner,* Peterson Publishing Co., 1970(?), 88 pp., paperbound ($2.00)

The Complete Guide to Rocks, Minerals and Gems is an inexpensive paperbound book aimed at the novice mineral collector and the merely curious non-collector. It is written as an introduction to the various aspects of the hobby and science of minerals. The book makes no pretenses about this orientation, and does exactly what it sets out to do. Unfortunately the result is a rather odd assortment of miscellaneous things, without much coherence or apparent direction.

Following an introduction to the "rock hobby" by Bernard Fuller of the Los Angeles County Museum of Natural History, the *Guide* presents chapters on mineral collecting, identification of minerals, micromounts, gems of the Crown Jewels of Iran, locality information and a digital scheme for mineral recognition. The chapter on collecting is extremely informative in that it answers the question that is perhaps most frequently asked by the person who thinks he might like to start collecting minerals: what is the hobby all about? The language is clear, concise and frank. Topics discussed include recognition of a good specimen, rarity, specimen sizes, cost, field collecting (where to look, mines, obtaining permission), trading, buying from dealers, collection types, cataloging, cleaning specimens, labels, and sources of information. One of the most admirable features of the book is that it does not try to be an end in itself, but rather a guide to obtaining additional information. The intent is spelled out on page 22:

> "It is beyond the scope of this book to give a 'course' in mineral identification. About all we can do is to tell you how to go about it, give you a chart that will simplify the job, and tell you where you can get the information you need."

To this end, bibliographic notes are annotated, a feature to be found in virtually no other book available for the novice collector.

The low cost of the *Complete Guide* necessitates certain economies, as might be expected. The color reproduction is uniformly of such poor quality that it is best ignored as any kind of asset. Numerous errors can be found, especially in figure captions; for example, crocoite (a chromate) is placed with pictures of sulfates, one finds orthoclase "var. adulvia", crystobalite rather than cristobalite, vaguelinite rather than vaquelinite, uranophane (yellow fibers) labeled "uranium" and fluorite cubes called "octahedral fluorite". Mineral structure is termed crystalline, earthy or massive. A specimen showing either a crystal face or a cleavage plane "indicates that the mineral has a crystalline structure" (according to the text). This is hardly a suitable criterion, since *every* solid material has a crystalline structure (noncrystalline substances include glasses, gases and liquids). The whole idea of what constitutes a crystal is somewhat poorly treated.

The choice of chapter topics, for what is supposedly an introduction to a hobby, is questionable. For example, "The Crown Jewels of Iran", while spectacular, are better treated in a magazine devoted to gems. The information in "Field Trip Guide" is completely outdated; the section called "Bonanza" deals with the Northwest Territories of Canada and is out of place in any guide for the novice. One wonders what percentage of the people who read the book will ever collect minerals in this region!

Nonetheless, the amateur collector may overlook minor faults in light of the quantity of information of real use that this book has to offer. The black and white photographs showing "how to do it" are all excellent, but the quality of the specimen photographs varies from good to very poor. The topical coverage, except for the questionable inclusions discussed above, is conscientiously thought out and well executed.

The Complete Guide to Rocks, Gems and Minerals would make an ideal gift for any collector who wants to introduce a friend or relative to the mineral hobby. He should, however, indicate which parts of the book are relevant to the complete novice for whom it is intended. ■

Secrets in Stones, *by Rose Wyler and Gerald Ames,* Four Winds Press, New York, 1970, 64 pp., ($4.75)

Earth science hobbies are hobbies for all ages. Many professional scientists and serious collectors became interested in minerals and rocks when they were very young, and this interest grew and developed throughout their lives. Children often are exposed to mineral and fossil collecting through the interest of their parents. Considering the vast number of "rockhounds" in our society, it is reasonable to expect that there are hordes of eager youngsters who are brimming over with questions about rocks, minerals and fossils. There is no question that books for the younger age groups are needed to supply the answers to some of these questions.

But these books must do more than spark interest—they must be informative and educational. There is a grave responsibility in the hands of authors of such introductory books. Children learn quickly, and their appetites for information are insatiable. But they also tend to believe what they read. The books that they are given must, first and foremost, be factually correct and accurate. Misinformation is so difficult to unlearn that most people carry with them the inaccuracies they learned in school years ago. *Secrets in Stones* does stimulate interest in geological materials, and is well written, but it contains a certain amount of simply wrong information.

The word "stone" is used liberally throughout the book, but nowhere is it defined. In addition, "stone" and "rock" are used interchangeably (rock is not defined either). The term stone is vague at best, and is certainly not scientific or very meaningful (the word usually refers to a building material of some kind). Rock on the other hand, is a rigorous term and *should* be the *only* one used throughout the text. In one part of the book a picture of a quartz pebble is shown. The young reader is given the following test for quartz: "see if it scratches glass and a steel knife. If it does, it is quartz" according to the text. While it may be true that a young collector is more likely to find a pebble of quartz then any other mineral, is it nonetheless fair to leave this kind of misstatement in the mind of a child who may someday struggle with mineral identifications? Further along is a discussion of the origins of rocks. We are told: "now you know the secret of crystals. If a rock is made of crystals, it was once a liquid". In this kind of allegation we are reminded of the disputes between Neptunists and Plutonists, the school of Werner vs. that of Hutton. The authors of *Secrets in Stones* apparently adhere to the Huttonian view of universal magmatism. Were limestones liquid too? Or aren't calcite grains crystals?

The above examples are unfortunate, in that *Secrets in Stones* is an enjoyable book, with superb photographs. Most children could profit considerably by reading it, but only if the errors are clearly pointed out. The price is somewhat high for a book of its size, but this is not a major fault. One of the hardest jobs in the world is to present technical material clearly enough to be understood by the layman, without sacrificing accuracy. It is perhaps even more difficult, due to the language barrier, to reach a young audience coherently and informatively. Wyler and Ames have tried to do this, but have fallen into the almost unavoidable pitfall of oversimplification. Their effort suffers accordingly. ■

Friends of Mineralogy

(Continued from page 222)

damp mine environment with an acrylic plastic to insure preservation of the initial laumontite form. Coating will not arrest the dehydration reaction, however, and the crystals soon after to leonhardite. They can thus be considered pseudomorphs.

Of the material collected, specimens have gone to six museums and educational institutions. The best piece, a truly magnificent cluster of crystals in a 15" group showing calcite plating, is to be displayed at the Smithsonian Institution. The Smithsonian Institution will distribute study material to other museums and institutions for display and research in accordance with the goals of Friends of Mineralogy.[3]

It is hoped that the success of this initial endeavor by Friends of Mineralogy will establish a precedent, whereby the preservation of minerals and localities will become a reality. This trip proves that cooperation between mine operators and collectors can be fruitful indeed. The ultimate beneficiaries are the future generations of mineral enthusiasts who will be able to see and study the material we preserve today.

Acknowledgements

Friends of Mineralogy wish to thank the Union Carbide Corporation for making the collecting of laumontite possible. The authors are especially grateful to them for providing excellent living accommodations and a knowledgeable guide (Jeff Kittel) to assist us.

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[3] *Specimens can be obtained by museums and institutions on request from: Dr. Joel Arem, Crystallographer, Dept. of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560.*

what's new in minerals

There were days, long ago, when I would worry about the end of the supply of mineral specimen material. I no longer worry about it. There are more mineral specimens of high quality in the stock of more dealers than ever before. New mineral dealers are appearing at an increasing rate, and the number of outstanding dealers is also increasing. New and exciting occurrences of minerals are turning up at a frequency that probably matches, or surpasses, any other period in the history of the mineral hobby. As long as there are customers to buy minerals, specimens will continue to appear.

It is somewhat surprising how often we learn of new finds that produce specimens extraordinarily larger or better (sometimes *both* larger and better) than those we had come to accept as superlative. In recent years we have but to think of Panasqueira (Portugal) apatite, St. Hilaire (Canada) catapleiite and serandite, Foote mine (North Carolina) fairfieldite, Congo torbernite, Tanzanian zoisite, Tsumeb (Southwest Africa) smithsonite, dioptase, mimetite, cerussite and scorodite, Swakopmund (Southwest Africa) milarite, Mexican milarite, scorodite, creedite and idocrase, Washington realgar, Rumanian stibnite and barite, and Val Malenco (Italy) andradite (demantoid). So many in this category have come from Brazil that a special listing is required. Included are amblygonite, eosphorite-childrenite, herderite, roscherite, elbaite, brazilianite, microcline (var. amazonite), rose quartz, scolecite, and hematite. There are, of course, many other minerals not so well known.

HEMIMORPHITE

From the seemingly bottomless pit of minerals in Mexico comes another unbelievable *best ever*. Hemimorphite has been found in Santa Eulalia, Chihuahua, in exceptionally large, in part colorless, crystals. These are very different from the famed snow-white groups of divergent crystals on limonite from Mapimi, Durango (Fig. 1). The new hemimorphite is in uncluttered groups of just a few large, well-defined crystals. These emerge from a hematitic matrix in simple tabular forms up to more than 5 cm long and 2-3 cm wide while usually about ½ cm in the third dimension. Two distinct generations of crystal growth are evident on most. The first was milky white. At some time following the cessation of growth of generation I, the crystals became coated with a reddish-brown film of hematite. Subsequent growth produced colorless hemimorphite as extensions of the original crystals. The second stage of growth occurred mainly in one direction, that parallel to the axis of elongation, so most of the crystals did not get fatter. All degrees of development of this second stage can be seen on various specimens. The secondary growth appears to have begun along the edges created by the intersection of the vertical forms (as oriented in Fig. 2) and the terminal forms. Where the growth did not proceed beyond this stage a castle-like wall of colorless hemimorphite completely encircles the hematite-covered surface of the end of the original crystal. In other examples the entire original termination is overgrown but the coated surface can be been through the transparent overgrowth. That this surface is a zone of weakness is evident in the tendency of the overgrowths to break cleanly from the first stage along the coated surface (Fig. 3). Much second stage growth is tinted an attractive light red color by minor hematite inclusions. Some of the transparent hemimorphite is absolutely flawless affording faceters with what is probably the best gem hemimorphite known.

Joel E. Arem

Fig. 1. Hemimorphite, Mapimi, Durango, Mexico. Smithsonian Institution specimen.

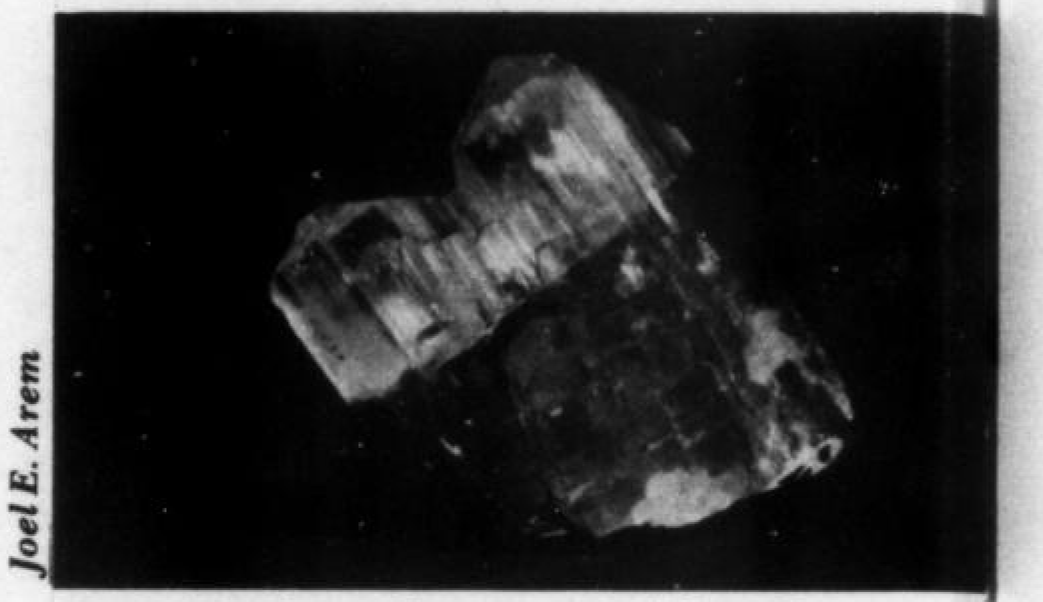

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Fig. 2. Hemimorphite, Santa Eulalia, Chihuahua, Mexico. Single crystal showing colorless overgrowth on coated crystal. Smithsonian Institution specimen.

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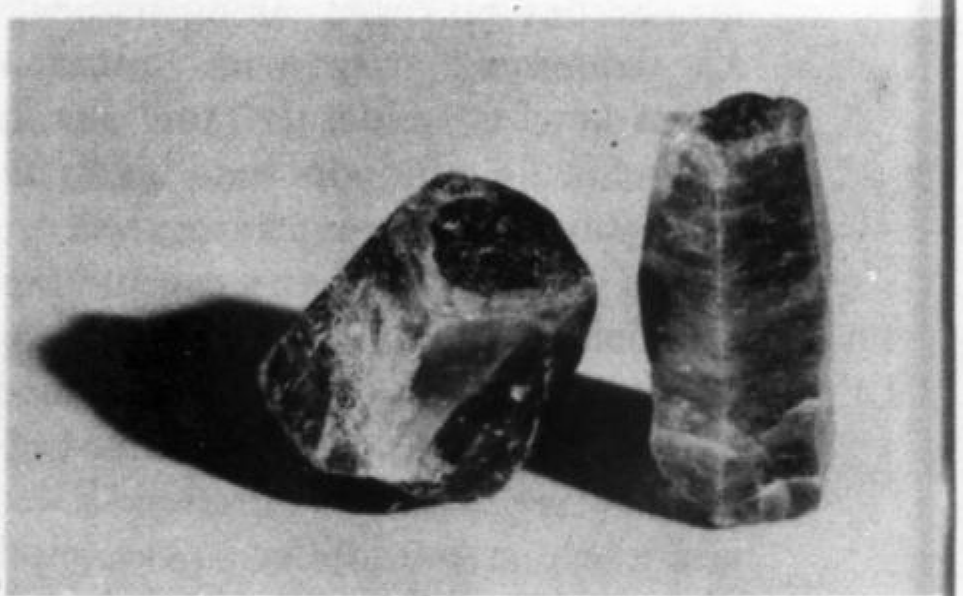
Fig. 3. Hemimorphite, Santa Eulalia. Specimen in which colorless overgrowth has broken cleanly from first growth stage coated with hematite. Smithsonian Institution speciman.



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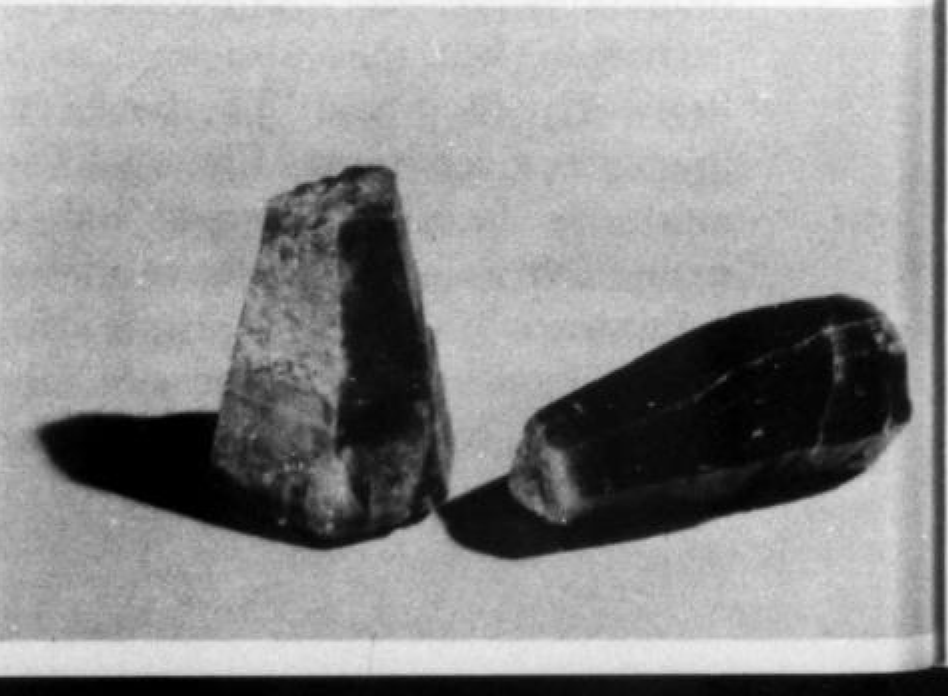
Figs. 4, 5. Parisite, Muzo mine, Colombia. Smithsonian Institution specimens.



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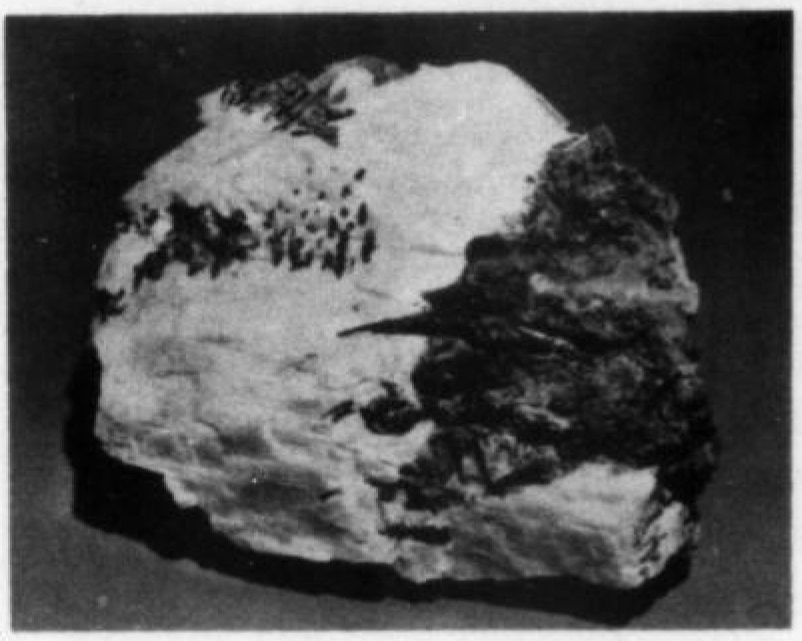
PARISITE

Parisite is a mineral with much appeal to advanced crystal collectors but is an unknown to most collectors. One of the best sources of fine parisite crystals has been the emerald mine at Muzo, Colombia, the type locality. Emerald has so overshadowed the parisite found there that few people realize Muzo has produced what are probably the finest parisite crystals ever found (Fig. 4,5). Even today there is little or no interest in collecting the mineral because of the stronger lure of the emerald. Parisite is still found at Muzo in very nice crystals up to 2 cm long. These are collectable on old dumps outside of the areas currently being mined.



Joel E. Arem

Fig. 6. Parisite, Montana. Smithsonian Institution specimen.

Parisite is a carbonate of calcium, cerium and fluorine. It is found in a breccia composed of sooty black carbonaceous shale (soils the fingers), colorless quartz in fresh sharp pieces, and coarsely crystallized white calcite which formed in openings between the breccia fragments.

Muzo crystals are stout prismatic with undulatory sides due to the "oscillatory combination of steep pyramids" (*Dana's System*, 7th ed.) and are horizontally striated (with 6-fold axis vertical). They are always of a tapering nature, that is, one end is much broader than the other. The pinacoid is prominant. Basal cleavage or parting reveals pronounced zoning paralled to pyramid faces. The larger crystals are dark brown with a waxy luster, smaller crystals are transparent yellow.

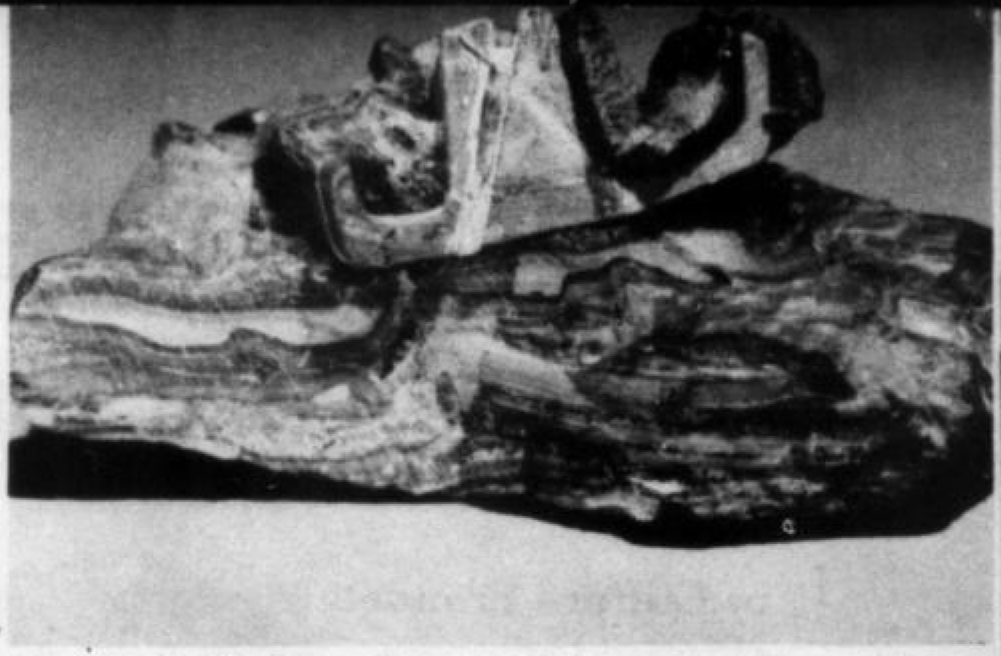
From Montana comes parisite which looks very much like that from Muzo. Crystals up to 4 cm are embedded in yellow-tan coarsely-crystallized calcite and dark-brown siderite that is etched and coated with goethite(?). Simple milky quartz crystals are similarly embedded in the carbonates. These parisite crystals are about the same color as Muzo crystals but are less stout and longer. However they are badly fractured, perhaps from hammering the matrix, making it nearly impossible to remove complete single crystals.

There is some confusion over the locality. Specimens having identical characteristics are labelled both Snowbird deposit, Mineral County *and* F and S mine, Fish Creek, Missoula County. These counties are side by side so perhaps the locality straddles the line and specimens are found on either side. It is also possible that the locality is very close to the line and the collectors were unsure of which county they were collecting in.

VARISCITE

The geologic conditions simply do not exist in central North Carolina for the formation of massive variscite. Thus my scepticism can be understood when I was shown several pieces of banded green variscite said to have come from Winston-Salem. The bands alternate between light and dark green, in part interrupted by minor brecciation. The material greatly resembles banded malachite from Katanga and elsewhere so it is easy to see why another sample (discovered in the collection of the Blue Ridge Parkway, N.C. mineral museum) was labelled malachite. A drop of dilute hydrochloric acid would have quickly demonstrated that the material is not malachite, which effervesces in dilute HCl.

My curiosity was so aroused that I called Boyd Mattision of Charlotte, who knows more about the minerals of North Carolina than anyone. Within a few weeks he had scouted the area and discovered more variscite along with several pieces of grey to cream to lavender colored material, similarly layered. It was found along and on the bottom of a small stream, the Tar Branch, that flows through the city of Winston-Salem. One sample (Fig. 7) led Boyd to suspect that he was the victim of a joke. When it was being sawed, the blade became jammed and the specimen broke along the cut revealing a cast aluminum cleat embedded in variscite. The cleat is obviously not old and its maximum age could, I am sure, be precisely determined, placing an upper limit on the age of the formation of the variscite in which it is embedded. The associated grey, cream and lavender-colored specimens were identified as gibbsite.



Joel E. Arem

▲ Fig. 7. Variscite with aluminum cleat imbedded in it, Winston-Salem, North Carolina. Smithsonian Institution specimen.

My theory to explain how this material formed is as follows. A layered clay (hydrated aluminum silicate) was deposited on the bottom of the river. Turbulance of the river water, perhaps generated by excessive rain and flooding, disrupted these clay layers and redeposited the fragmented clay as a breccia. Phosphorus was introduced into the river upstream (by man). Encountering the clay, phosphorus replaced silicon forming variscite at the expense of clay. That variscite replaced the brecciated material seems evident. If variscite was the original banded mineral, it would have been too tough to have been brecciated by turbulent water, if indeed this is the cause of the brecciation. The presence of gibbsite, aluminum hydroxide, suggests that it (and the clay) probably owe their origin to the introduction of aluminum into the water upstream (also by man). The absence of specimens in place precludes the determination of the sequence of the layers of variscite

(Continued on page 237)

Early Mineral Specimens from New England

by **Clifford Frondel**
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During the 17th century in New England, following the initial colonization, a considerable amount of mineralogical material undoubtedly was sent to England and to European countries. Part of this must have been for practical purposes, to determine the nature and value of the mineral raw materials found by the colonists, but much also was to make known, in a scientific sense, the natural curiosities of a new world. Records of these early mineral specimens, however, are very few. The catalogue by Nehemiah Grew of the collection of the Royal Society of London, published in 1681, mentions numerous specimens from New England. Among them are "Earthen Balls, about as big as mounting Stones, of a Blewish colour, or that of Tobacco-Pipe Clay. With other irregular Lumps of the same nature: found among the Earth of a Hill overturned at Kenebank [Kennebunk, Maine] in New England." These probably were concretions from glacial clays. The New England material in the collection of the Royal Society at the time included four boxes of specimens sent by John Winthrop Jr. (1606-1676) from Boston in 1669.

The best known record is that of John Winthrop (1681-1747), whose collection of minerals and ores from New England was sent to the Royal Society in 1734. A catalogue of the 364 specimens in the collection has been published. Stearns (1964) suggests that the specimens at least in part came from the collection of his grandfather John Winthrop Jr., Governor of Connecticut. In 1753 the collection passed via Hans Sloane into the possession of the British Museum. Unfortunately, with the exception of one specimen, the famous piece of columbite from Connecticut, none of the specimens of either John Winthrop Jr. or of John Winthrop can be found now and identified as such.

There are, however, earlier specimens from New England that still exist. These are listed in a book published posthumously in London by the English naturalist John Woodward in 1729, entitled *An Attempt Towards a Natural History of the Fossils of England.* Woodward died in 1728. The term fossil here refers broadly to things dug from the earth (from the Latin, fossilis, to dig up) and includes minerals and ores as well as the organic remains, both plant and animal, to which the term fossil is now restricted. Woodward's *Catalogue* included specimens not only from England but also "...samples from even the remotest Parts of Europe, from Asia, Africa, and America..." His specimens were in part collected personally, but most or all of the foreign material was sent to him by others, to whom acknowledgment is made in the text.

The specimens from America listed by Woodward include both minerals and true fossils from southern localities, in Virginia, Carolina and Maryland, and a dozen or so mineral specimens from New England and Newfoundland. Woodward's collection is preserved to this day, in the original cabinets, in the Sedgwick Museum of Cambridge University, England. Through the courtesy of Woodwardian Professor Harry Whittington, FRS, Director of the Museum, and with the kind aid of Dr. Colin L. Forbes, Curator, the writer recently had opportunity to examine the material from New England. These specimens, described below, are the earliest known mineral specimens from this region. It is possible to establish the dates in which Woodward acquired his American specimens only between broad limits. He is known to have begun collecting minerals and shells in 1688. The prefaces to the sections of his book dealing with material from foreign localities and with supplementary lists there to date the specimens described in these two sections as having been acquired not later than 1719 and 1725, respectively. The specimens that are not identified as to donor, especially those of lead, copper and iron ores, possibly may have originated from John Winthrop.

He is known to have sent mineral specimens to Woodward at some time before 1717.

Most of the specimens listed below are cited in a section of his book dealing with inorganic materials from foreign countries. The title of this section is *Crystalli and Floures: Incrustations, Stalactita, Stalagmita, Crystals and Spars.* The remaining specimens are listed in a supplement to this section. The specimen numbers are those given in the text. The actual specimens can be located in the cabinets through a handwritten finding list prepared by Samuel Ogden, Woodwardian Professor from 1764 to 1778, who established the present arrangement of the collection and re-numbered the specimens. The labels appearing on the photographs of the specimens are those of Ogden (oval labels) and, in part, of a still earlier cataloguer, Charles Mason (rectangular labels).

No. 46. Crystals in a Cluster, but less. New England, Mr. Bridger. [A small smoky quartz crystal with some smaller crystals at the base. It probably came from Diamond Hill, Rhode Island, but similar crystals occur at very many other places. The term "but less" means only that it was smaller than the preceding specimen from another place. See Figure 1. Quartz crystals are also mentioned in Winthrop's Catalogue of 1734.]

Figure 1. ***Quartz crystals, possibly from Diamond Hill, Rhode Island, Woodward no. 46 (Ogden no. 24).***

No. 49. Four small Crytal Sprigs. New England. Mr. Noyes. [Four small quartz crystals, similar to the above.]

No. 27. A Granate, large, but foul, the Figure extraordinary. New England. Mr. Bridger. [A subtranslucent dodecahedron of almandine garnet about 1⅛ inches in size. The surface is rough, as indicated by the term foul. It could have come from a locality in the garnet zone of the metamorphic schists of the region. Figure 2. Winthrop's catalogue mentions garnet from Connecticut Island in Narragansett Bay, Rhode Island.]

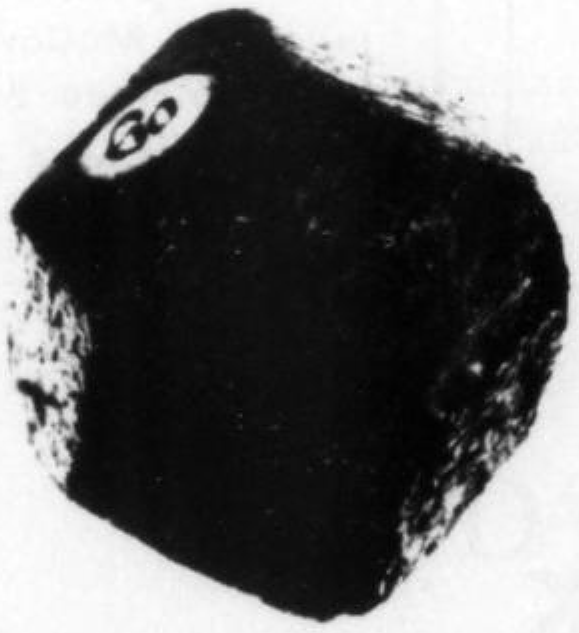


Figure 2. ***Dodecahedron of almandine garnet. Woodward no. 27 (Ogden no. 60).***

No. 11. Two cubick Pyritae, large; from New England. Mr. Bridger. [Two cubes of pyrite, altered to limonite on the surface. Probably from the contact zones in the Sneeches Pond Area, Cumberland, Rhode Island, but possibly from Chester, Massachusetts.]

No. 17. Lead Ore, with White Spar. This ore when freed from the Spar, yields upon Trial 61 lb. in 100 of Lead, and 6 Drachms of Silver. From New England. Mr. Bridger. [A small piece of vein material containing galena. Small vein deposits containing galena are widespread in New England, and the silver content often is high. Figure 3.]

Figure 3. ***Galena in vein material. Woodward no. 17 (Mason no. 17).***

No. 5. Lead-ore, Pottern, from a fissure of a Rock at Day, about 60 miles North-East from Boston, up in the Country, in New England. Captain Crowe. [Galena. This specimen probably is from the Newburyport area, Massachusetts, where sulfide veins containing galena were worked in the period 1874-1879. The Newburyport deposit is said to have been discovered in 1868, when boulders of vein material containing galena were found in the glacial drift, but Woodward's specimen would indicate that the initial discovery was much earlier. Another possible locality within range is near Nashua, New Hampshire, where a galena deposit was known as early as 1682. The term pottern was used in early English metallurgical practice for ores that produced a glaze on earthenware (lead glaze). The terms potters' ore or potter's lead and the old term alquifou also refer to coarse grained galena used by potters in producing a glaze. The phrase "from a fissure of a rock at Day" does not refer to a place of that name, but is an old English miner's term referring to ore that outcrops at the surface, in the light of day. Captain Crowe probably was a ship's captain.]

No. 9. Lead-ore rich. New England. This is exactly like the common Lead-Ore of Mendip. [Galena. Lead ores were early mined in the Mendip hills of England.]

No. 6. Copper-Ore. This yields about 1/7. Connecticut Colony, New England. [Numerous small copper deposits, chiefly of chalcocite, occur in Connecticut and were mined in colonial times and, in the case of that at Bristol, almost to present times. The deposits near Cheshire are supposed to have been known in 1670, and that at Simsbury near Granby was known about 1705.]

No. 26. Iron Ore. New England. [Pisolitic limonite, from a bog-iron deposit. The bog-iron ores of New England were smelted as early as 1644 at Saugus, Massachusetts, and were of interest to John Winthrop Jr. Figure 4.]

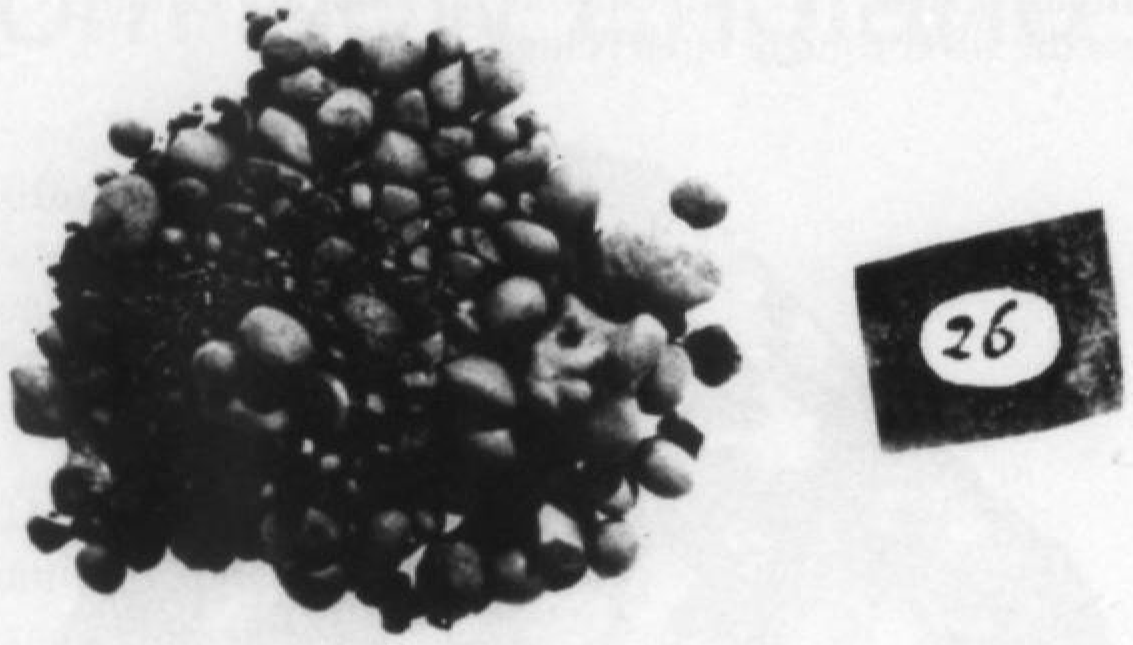


Figure 4. ***Pisolitic bog iron ore. Woodward no. 26 (Mason no. 26).***

> *No. 1. A Reddish Earth. New England.*
>
> *No. 7. This was sent for red Ochre; but 'tis rather a sort of Bole. New England.* [Not earthy iron oxide, but clay stained by iron oxide.]
>
> *No. 28. Spar, white, with a cast of Purple, having in it small Amethysts. New England.* [Small amethyst crystals. Possibly from Bristol, Rhode Island, one of the earliest known amethyst localities in the region.]
>
> *No. 2. Coal, light, but fine as Canell, brought, by an Indian, out of the inner Parts of the Country. New England.* [Cannel coal is an old term for a coal with a high percentage of volatile matter that burns with a steady luminous flame. The only coal in New England is the Narragansett Basin of Rhode Island, but it is metamorphosed, graphitic, and does not burn readily. Possibly from sandstone or shale in the Connecticut Valley, which locally contains veinlets of bituminous matter.]
>
> *No. 2. A Mineral, yielding Sulphur, brought by an Indian from the Inland Parts of the Country. New England.* [Presumably the same Indian. The colonists, dependent on England for munitions, had a considerable interest in deposits of lead and sulphur.]

In addition to these New England specimens, Woodward's *Catalogue* contains numerous other items of mineralogical and historical interest. Among them are specimens of quartz crystals obtained from the Swiss naturalist J. J. Scheuchzer (1672-1733). Scheuchzer made the first angular measurements on the faces of quartz crystals, in 1708, and figured quartz crystals from Swiss localities in various of his writings.

References

N. Grew: A catalogue and description of the natural and artificial rarities belonging to the Royal Society and preserved at Gresham College. London, 1681.

R. P. Stearns: John Winthrop (1681-1747) and his gifts to the Royal Society. Trans. Colonial Society Massachusetts, Public. *42*, 206-232, 1964.

MINERAL NOTES

NEW MINERALS

ROUBAULTITE

La roubaultite $Cu_2(UO_2)_3(OH)_{10} \cdot 5H_2O$, une nouvelle espece minèrale
Fabien Cesbron, Roland Pierrot, and Theodore Verbeek
Bull. Soc. fr. Mineral. Cristallogr., 93, 550-554, 1970

Rouboultite, $Cu_5(UO_2)_3(OH)_{10} \cdot 5H_2O$, was found as small (about 3 mm in diameter), apple-green to grass-green rosettes on a single specimen (9 x 5 x 3 cm) in the oxidation zone of the uranium deposit at Shinkolobwe, Katanga, associated with becquerelite, vandenbrandeite, soddyite, and cuprosklodowskite.

Crystals of roubaultite have a brilliant to slightly greasy luster on fracture surfaces. Cleavage (100) is perfect, (010) is imperfect. Hardness is 3.

The new mineral is named for Professor Marcell Roubault, University of Nancy, France.

Triclinic - space group $P\bar{1}$ pr $P1$
$a = 7.73$ Å $\quad b = 6.87 \quad c = 10.87$
$\alpha = 86°29' \quad \beta = 134°12' \quad \gamma = 93°10'$
Z = 1 S.G. = 5.02 (calc.)
Biaxial (+) with $\alpha' = 1.700 \quad \beta' = 1.800 \quad \gamma' = 1.83$
Pleochroic with X and Y colorless, Z yellow-green.
Strongest x-ray lines: 5.55 (10), 7.74 (9), 6.88 (8), 3.448 (8), 3.226 (8)

DYPINGITE

Dypingite, a new hydrous basic carbonate of magnesium, from Norway
Gunnar Raade
Amer. Mineral., 55, 1457-1465, 1970

The new mineral dypingite, $Mg_5(CO_3)_4(OH)_2 \cdot 5H_2O$, was found in the Dypingal serpentine-magnesite deposit at Snarum (Norway) as a thin cover on serpentine.

Dypingite forms white globular aggregates, averaging 0.3 mm, with radiating fibrous structure. The mineral has pearly luster and is both fluorescent (light blue) and phosphorescent (yellow-green). The hardness and specific gravity could not be measured; the calculated gravity (Gladstone and Dale formula) is 2.15.

Individual fibers of dypingite are minute; they seem to be elongated parallel to the *y* axis. Refractive indices: $\alpha = 1.508$, $\beta = 1.510$, $\gamma = 1.516$.

Dypingite is converted to hydromagnesite, $Mg_5(CO_3)_4(OH)_2 \cdot 4H_2O$, on heating to 150°C.

The mineral is named for the locality.

Strongest x-ray lines: 10.6 (100), 5.86 (90), 6.34 (60), 2.53 (50), 2.17 (50).

NEW DATA

LACROIXITE

Lacroixite: its redefinition and new occurrences (abstr.)
Mary E. Mrose
20th Clay Minerals Conference, Rapid City, S.D., Ann. Meet., Program and Abstracts, p. 10, 1971

Crystallographic considerations based on single-crystal x-ray study of a small fragment of Slavik's type lacroixite from Greifenstein (Saxony), together with the original analytical data, established $NaAl(PO_4)F$ as the empirical formula for lacroixite. Lacroixite is evidently the phosphate analog of durangite, $NaAl(AsO_4)F$; both in turn are isostructural with isokite, $CaMg(PO_4)F$, tilasite, $CaMg(AsO_4)F$, and titanite, $CaTi(SiO_4)O$.

Optical and powder data previously cited in the literature for lacroixite are actually those for an unnamed phosphate of unknown formula which Slavik (pers. comm., 1957) suspected was admixed with lacroixite in the analyzed sample.

Lacroixite recently has been identified on specimens from pegmatites at three additional localities: at Strickland quarry, Portland, Conn., in association with pink apatite, pink brazilianite, augelite, and natromontebrasite; at Konigswart in Marienbad, Bohemia, and Ječlov, near Jihlava, Czechoslovakia, in intimate association with natronmontebrasite.

Monoclinic - space group $A2/a$
$a = 6.89$ Å $\quad b = 8.22 \quad c = 6.425$
$\beta = 115°30'$
Strongest x-ray lines: 2.900 (100), 2.470 (85), 3.159 (71), 2.168 (35), 1.579 (30).

"MINERAL PARKS" for Collectors

Collectors of minerals, rocks, gems, and fossils are faced with fast-changing unfavorable trends in the use of land.

Seriously concerned for a long time with this situation, one of the men in the field of mineral collecting has established for the first time a system of collecting grounds for general public use. It is called Mineral Parks of Colorado, Inc., and has been incorporated as a nonprofit enterprise for recreational purposes by Richard M. Pearl, professor of geology at Colorado College, in Colorado Springs.

It will operate without fee or restriction of any kind. However, the land will be posted to warn against vandalism and use of explosives and firearms, and supervision and facilities will be provided as far as possible. Prof. Pearl hopes that his pioneer effort will be taken up by others elsewhere, especially by those who have more substantial funds.

Colorado is one of the most highly mineralized areas on the globe. As brought out in Pearl's book *Exploring Rocks, Minerals, Fossils in Colorado:* "The eight billion dollars' worth of new primary wealth added to the world by the mines and wells of this state interests the economist, the industrialist, and the historian. But the hundreds of kinds of individual minerals that have come from this area are of even greater interest to the geologist and the mineral hobbyist." Colorado ranks with New Mexico though behind California as a source of many different minerals.

Privately owned land is more and more being closed. Partly this is because of vandalism, usually committed by lone collectors who do not know of the sincere efforts being made by clubs to control the conduct of groups in the field. Partly this is simply because of the increased numbers of collectors. Other land is going into monopolies or is withdrawn and used for building developments, which permanently remove it from scientific and collecting uses. Public land is likewise being restricted from collecting, as shown by recent laws limiting the amount of petrified wood that can be collected in the national forests.

Bruce L. Stinchcomb of the University of Missouri at Rolla recently said that "The events of geologic time have played a more important part in shaping the planet Earth and its habitants than have historical and political institutions which have conventionally been enshrined and protected from destruction by their being in the path of 'progress'." The New Zealand Geological Society has been trying for several years to secure land of scientific interest, helping to preserve it for future generations. Conservation groups in various countries have of course done the same thing, but especially with land that is chiefly of scenic value.

A number of clubs around the country, it should be pointed out, have staked mining claims on U.S. Forest Service lands or on property administered by the Bureau of Land Management. The Colorado Mineral Society, for example, has a smoky-quartz claim on Devils Head, and the Colorado Springs Mineralogical Society has a topaz claim at Tarryall. The annual assessment (improvement) work that is required by federal or state law is done in such cases by club members. An occasional community group, such as the Prineville (Oregon) Chamber of Commerce, maintains free collecting areas.

In 1949, when Prof. Pearl was president of the Colorado Mineral Society, the society sponsored the erection on Colorado Day (August 1) of a bronze plaque in recognition of the establishment of Mount Antero Mineral Park on the highest mineral locality in North America. This, however original an idea (suggested by Chester R. Howard), was a sentimental gesture and had no practical effect.

A fee for admittance and collecting rights is collected at a growing number of localities, and a recent list by June Culp Zeitner named about 160 of these in North America. Various fee schedules are in effect in different places, and guide service is included in several. Gold panning is in a different category, for there are many places that offer this experience to tourists, few of whom are rockhounds. Certain of these operators are of the sort known humorously as "professional old-timers." Blackburn State Park, in Georgia, is an exception, not being a commercial enterprise.

Other arrangements that seem related are promotional schemes to sell real estate by providing collecting opportunities. Collecting rights at the Yogo sapphire deposits of Montana, for example, go with the purchase of land.

Prof. Pearl has been at Colorado College more than 25 years. He is a leading author in the field of mineral education, with sales of his 35 books running in the millions of copies. Three of Pearl's books have been selected among the one-hundred best science books of the year by the *Library Journal.* Three have received awards from the Colorado Authors' League. Translations of his books have appeared in French, Japanese, Persian, and Russian, and one was edited and adapted in a British edition by Prof. J. F. Kirkaldy of Queen Mary College, London.

In addition to his own books, Pearl has written for seven encyclopedias, two science yearbooks, four anthologies, three magazine columns and a syndicated column, and has authored hundreds of articles. He is part owner of *Earth Science,* an international magazine devoted to geologic education and published in Illinois, and was editor-in-chief for a while. He writes the book reviews for this journal and for *Choice,* issued by the American Library Association. He was on the editorial board of a magazine published in Hamburg, Germany, was geological consultant of *Colorado Wonderland,* and was adviser in mineralogy and gemology for the Denver Public Library. He is also editor of the Southwest Section of the *Journal of Geo-*

(Continued on page 237)

Mineral Parks for Collectors

(Continued from page 236)

logical Education, and is a private small publisher of books.

His wife, Mignon Wardell Pearl, a former schoolteacher, is his partner in his mineral collecting and writing activities. At present she is making the maps for the *Historical Atlas of Colorado,* which the Pearls are doing for the University of Oklahoma Press.

Prof. Pearl came into his career as a professional geologist by way of mineral collecting as a boy. He graduated from the University of Colorado with one of the four majors in mineralogy that the school issued during its first century, and he has graduate degrees from Colorado and Harvard University. He operated in Denver one of the first mineral-supply stores in the country, after which he was employed by the du Pont Company in Denver and Shell Oil Company in Tulsa. He has taught extension courses in four colleges and universities.

Pearl was a principal organizer of the Colorado Mineral Society, Rocky Mountain Federation of Mineralogical Societies and served as president of each, as well as the Colorado Springs Mineralogical Society. The first national Scholarship Award of the American Federation was given in his name to the University of Colorado in 1965.

He has received recognition from national organizations in 14 countries. These include being Fellow with Distinction of the Gemmological Association of Australia, and the German Society of the Friends of Mineralogy; Honorary Correspondent of the Belgian Society of Gemmology; honorary member of the Gemmological Association of Canada; first foreign member of the Gemmologists Association of Ceylon; first American member of Brazil; and second Certified Gemmologist of the Gemmological Association of America.

Pearl is also a Fellow of the Meteoritical Society and the American Association for the Advancement of Science and is active in community affairs.

What's New in Minerals

(Continued from page 231)

and gibbsite. An aluminum foundry is located upstream from the site where these specimens were collected.

If any readers can shed light on this unusual "mineral" occurrence, I hope they will come forward and do so. It is interesting to speculate on the acceptability of this material as a mineral if variscite had not already been known to occur under completely natural conditions. Although the definition of a mineral should prohibit the introduction of "species" in which man was directly or indirectly responsible for their origin, numerous examples of such exceptions are in the literature. Included are the five new species formed in a mine fire at Jerome, Arizona, numerous minerals formed by the action of saline water on slag at Laurium, Greece, two tin minerals formed through the oxidation of tin pannikins on the bottom of the James River in Canada, and many others.

J.S.W.

Specimen Requests

The response to requests published in this column has been disappointing. We were quite certain that, given the opportunity, collectors would be eager to supply those in need with desired mineral materials. Thus far no one has come through with hedenbergite from the Franklin-Sylva district, North Carolina for Mary Mrose (see Vol. 2, no. 1, p. 2), "pale-blue, hexagonal, micaceous" mineral from Salida, Colorado or the Ecton mine, Pennsylvania also for Mrose (see Vol. 2, no. 3, p. 123), or greenalite from Mesabi district, Minnesota for Joel Arem (see Vol. 2, no. 3, p. 123). It would be very reassuring if samples of these minerals could be located by readers and sent to the requestors. The following requests afford still more opportunities for readers to demonstrate that they can be counted on for support...

Glauco Gottardi (Instituto di Mineralogia dell' Universita, via S. Eufemia 19, 41100 Modena, Italy) is searching for specimens from every occurrence of epistilbite, mordenite, stellerite, and "epidesmine" in North America. Fine crystals are not necessary; but specimens should be large enough to permit separating 200 mg of pure mineral. He is also interested in heulandite, phillipsite, and chabazite but he already has many speciments from the United States, so please contact him before sending the latter three zeolites. ■

Wanted—minerals identified as beudantite, crocoite, lepidocrocite, olivenite, penfieldite, wurtzite, or any other species not recorded from the Mammoth-St. Anthony mine, Tiger, Arizona. Specimens desired for examination and confirmation of identity; will be promptly returned. Send to: Richard A. Bideaux, 1242 W. Pelaar St., Tucson, Arizona 85705. ■

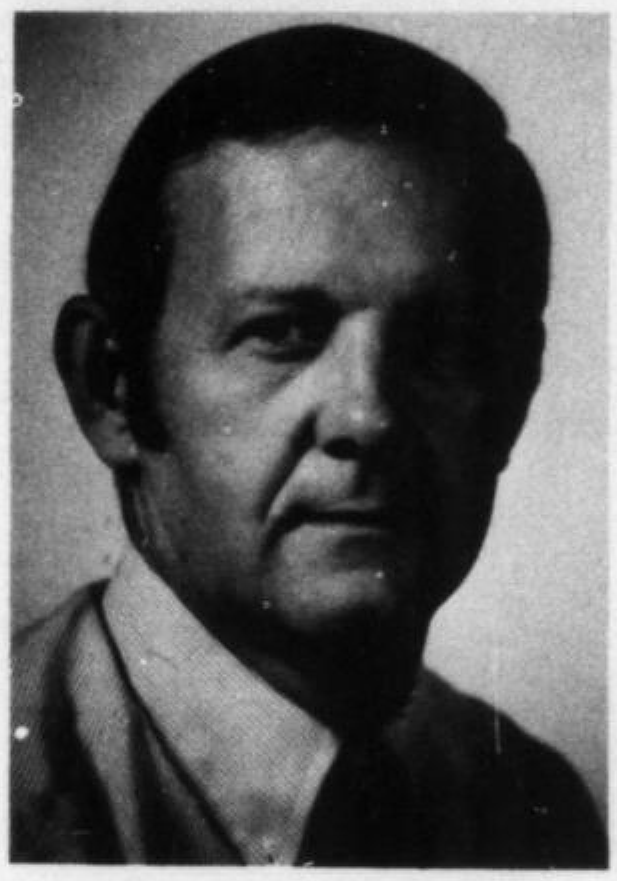
I am writing to request the support of the *Mineralogical Record* and its readers in obtaining display mineral specimens for the Wright State University mineral collection. Wright State is a new university located in Dayton, Ohio.

The Department of Geology is now attempting to obtain display specimens for a permanent mineral collection.

Of primary interest are display specimens, however, all specimens will be greatly appreciated. The name(s) of the donor(s) of each specimen will be affixed to the label of all specimens on display.

Your assistance and that of your readers will be appreciated by the Department of Geology and students both present and future. ■

Ronald L. Sohn
Curator of Minerals
Department of Geology
Wright State University
Dayton, Ohio 45431



The Museum Record

By Paul E. Desautels

Because of many years of association with mineral collections and, obviously, because of a strong vested interest in the Smithsonian collection, I am actively concerned with the welfare of mineral collections everywhere. Museums in general exhibit a rather long term concern with collections as compared to the tendency toward short term existence of private collections. Consequently a good part of my "intelligence" activity relating to collections is expressed in curiosity about what is happening in other museums around the world. Fortunately, toward this end, it is possible for me to visit each year a selection of European museums with mineral collections. This Fall, although my tour was shorter than usual, I was able to renew an acquaintance with several of these and to meet some of the new crop of curators.

The ultimate goal of my trip was to attend the 6th Annual "Giornato di Scambio di Minerali" (mineral exchange day) sponsored by the Museo Civico di Storia Naturale and the Gruppo Mineralogico Lombardo in Milan, Italy. It would be criminal for any collection lover to consider European travel without passing through London either going or coming back or both. Without a doubt one of the greatest collections of the world, and certainly most meticulously and carefully curated, the aggregate of mineral specimens at the British Museum (Natural History) is not to be missed. Later in another column I shall give you my detailed impressions of the museum and its contents. Located in South Kensington on Cromwell Road, the building is quite distant from the British Museum proper but right next door to the fine Geological Survey museum and across the street from the great Victoria and Albert Museum. I spent several days in London on this trip—much of it taken up with its able curator Peter Embrey and with the collection itself. All seems well and I can report that the new large wall cases and their contents look good. Also many of my favorite specimens (the incredible bournonite specimens from Endellion in Cornwall, England and the beautiful and enormous euclase crystal from Tanzania, etc.) are as impressive as they were last time I saw them. Peter Embrey, by the way, expects to be with all of us at the Tucson show again in February.

From London to Barcelona to see the superb private collection of Senor Joaquin Folch came next. This private museum, which has a far better collection than most of the public museums in the United States, is available only by appointment. Senor Folch is no stranger to collectors in the United States and elsewhere since he has been an avid, well-travelled collector for many years. His collection, too, will be described in another column. There have been many notable additions since the last visit but my attention still centered on the superb suites of minerals from Panasqueira, Portugal and from many parts of Spain. Somehow the beautiful specimen groups of large, modified fluorite cubes in lavender-rose to deep purple shades attracted my attention this time. Specimens from this occurrence in Spain are, unfortunately, little known in the United States and perhaps Senor Folch can be induced to describe the occurrence in writing for the *Mineralogical Record.* he, too, incidentally, plans to be at the Tucson show as usual in February.

From Barcelona to Paris brought me from dry, sunny Spain to autumn-chilled Paris in one short plane flight. All was chaos as I arrived in the middle of a subway strike. When the Metro is not operating in Paris the normally severe traffic problems become horrendous. Fortunately, the strike ended next day and it became a simple matter, with the help of Pierre Bariand, to get around to my favorite mineral collection haunts. I've often thought that the three fine, institutional mineral collections in Paris should be consolidated to create what couldn't help but be one of the all-time great collections. In recent years I've changed my mind. There is, first of all, the all-your-eggs-in-one-basket problem. If all had previously been combined under the Natural History Museum in the Jardin des Plantes then all three might be in the state of decay now so obvious in this once superb collection. Through the years, also, each of these French collections has assumed a character of its own. The excellent collection, maintained and expanded at the Ecole des Mines on the edge of Luxembourg Gardens, has become what it is because of the activities of Dr. Claude Guillemin, assisted ably by Paul Sainfeld. Now that Claude Guillemin has become the director of the Bureau des Recherches Geologique et Mineralogique (somewhat like the equivalent of the U.S. Geological Survey) much of the collection curation burden has fallen on Paul Sainfeld and others. This collection remains the finest research collection in France and contains also numerous exquisite specimens which we hope will be described on these pages eventually.

In my mind the prettiest of the three collections in Paris is the new installation in the new buildings of L'Universite de Paris (Sorbonne). Curated by amiable and knowledgeable Pierre Bariand, this collection was conceived and built as a display collection only. I'll leave all the surprises of its description to Pierre except to say that visiting it is like being inside and among the jewels in a jewelbox. There have been several departures from traditional mineral exhibit technique. Pierre will be at the Tucson show in February as a guest of the Tucson Gem and Mineral Society. He plans to lecture with movies and slides on the new installation. His notes and pictures will subsequently be boiled down for an *MR* article. Of course, while visiting this collection it was necessary to make my annual pilgrimage to bow three times before the great cumengite crystal. In my mind I want to make this deep blue, gigantic twin crystal about 3 inches across. Actually it's only about half that size. Why quibble over a measurement when you're in that size range!

Several other cities were included in this junket to look at gems, jewelry, crown jewels and miscellaneous lapidary articles. It took special dispensation from the editor even to mention such things in this column and I certainly won't describe them. However, I don't feel somehow that my interest in these interferes with my love of minerals.

Eventually I did reach Italy and the exchange day was very successful. By good fortune curators were there from Prague, Turin, Paris, Copenhagen, Oslo and elsewhere. I was the only American in sight and was treated royally. One of my hosts was the impressive young curator, Dr. Vincenzo de Michele, of the Milan Natural History Museum. His museum was bombed in World War II and the road back has been hard. Many fine specimens were lost but the collection is slowly recovering. I'll never forget there the largest sulfur crystal I have ever seen. A trifle dark in color and somewhat opaque, it is complete, well formed, with very little surface damage and stands about 1½ feet tall. No, Dr. Michele will not be in Tucson in February. However, he hopes to speak English well enough by the following February so that he has a chance to be invited by the Tucson Society. I think they would both gain from the idea. Strangely, although he speaks no English, Dr. Michele reads and writes it with remarkable facility and, in fact, was the translator for the Italian edition of my book, *The Mineral Kingdom.* Of course, he has his own books to his credit also.

It is, I think, important for mineral collectors everywhere to know of collections, curators and museums around the world. Eventually, through this column, I hope many of them will be introduced.

ERRATA

p. 152 The author of "New Minerals from California" is H. Earl Pemberton

p. 158 The birthdate of Dr. Joseph Murdoch (below photograph) should be 1890

p. 160 The galeite listing in table should be: 21 *Galeite* A. Pabst, D. L. Sawyer and G. S. Switzer, 1955 Searles Lake

p. 160-161 Krauskopfite, macdonaldite and walstromite should be credited to Alfors, Stinson, Matthews and Pabst.

p. 168 In table 2, the value for Gd should be 7. and Mg 0.03 under churchite

p. 171 The type locality for antarcticite is given as being in Australia; it should be Antarctica. Further, Dunning and Cooper are credited with describing the original occurrence of antarcticite; the credit should be given to Torii and Ossaka, *Science, 149, 975-977,* 1965.

p. 185 The address given for Richard A. Bideaux should be 1242 (not 1241) West Pelaar, Tucson, Arizona 85705.

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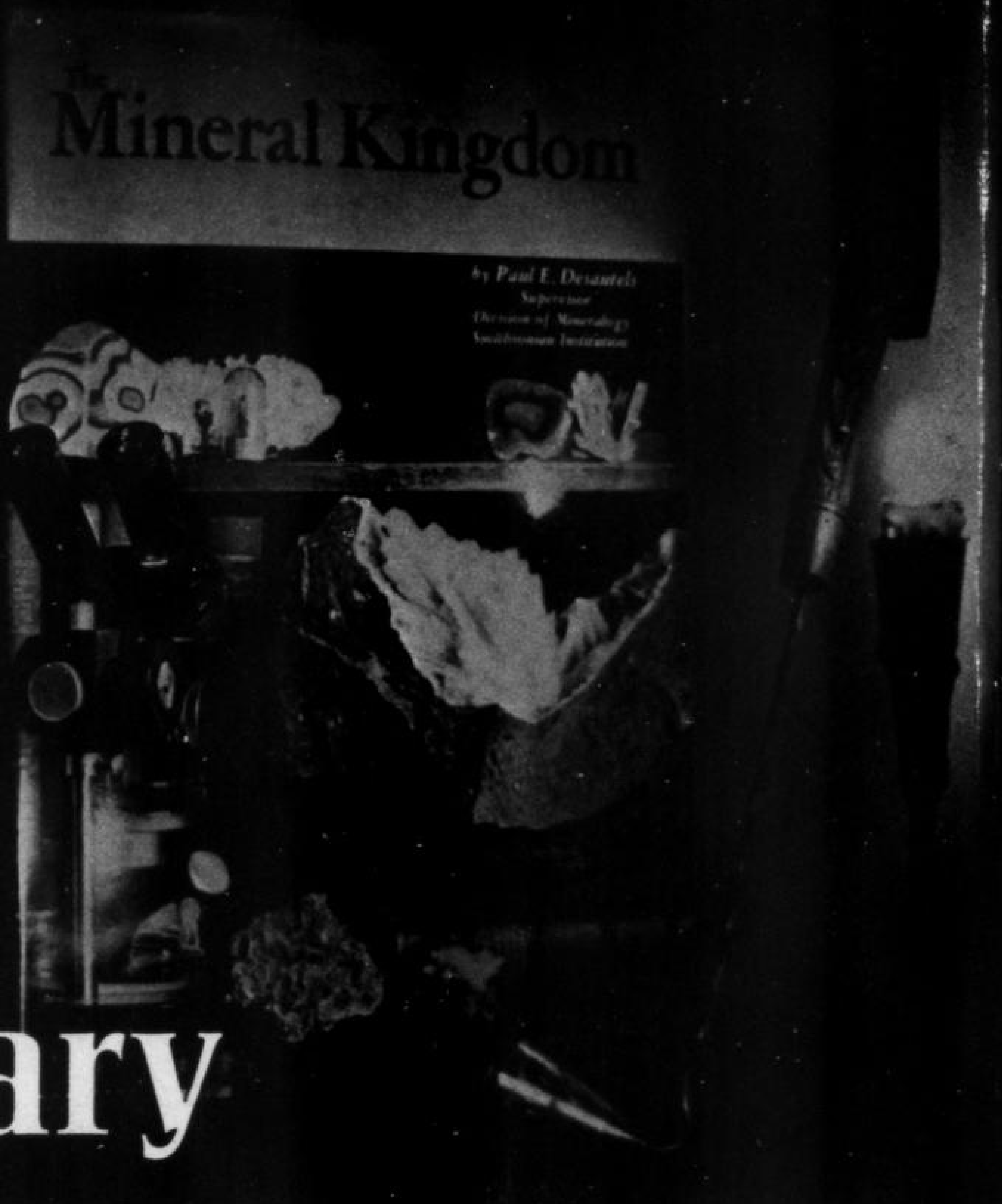

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