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editor & publisher
John S. White, Jr.
Division of Mineralogy
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circulation manager
Mary Lynn White

design & composition
Bowie Graphic Art Services, Inc.
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address
the Mineralogical Record
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feature articles

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BROOKITE—from a quarry near Eldorado, in the Uwharrie Wildlife Management Area, Montgomery County, North Carolina. The major crystal measures 6 x 5.5 x 0.8 mm. The crystals are attached to quartz crystals. Anatase also was found in the pocket, which was discovered by William R. West. The specimen now resides in his collection. *Photo by Bill West, courtesy Carolina Biological Supply Company.*

Editorial

UNAPPRECIATED GIFTS

If we look into the fate of mineral collections at colleges and universities in this country we will find a very dismal picture. We will discover countless examples, since World War II, of important display collections that have been ignored or forgotten by administrators, and either packed away so they cannot be seen or, worse, decimated by theft or laboratory use by students in mineralogy courses. Let me immediately hasten to emphasize that I heartily endorse the use of mineral specimens for teaching mineralogy, but one should not expose valuable and rare specimens to laboratory use.

One can readily understand the desire of an alumnus to leave his collection to his alma mater. Where it not for the motivation of love of former school, very few institutions of higher learning would have been given collections. The practice was widespread in the late 1800's and in the early part of this century. There appears to have been a greater *natural science* tradition in those days before technicalization and instrumentation assumed ascendency over the science objects themselves, such as minerals, plants, insects. Museums were a common feature on campuses. They were elaborately constructed, dutifully maintained and widely attended. Security was not a problem because the intrinsic value of the specimens had not reached the level where theft was much of a threat. Very few people had any idea of the value of mineral specimens anyway.

Specimens are now monetarily, as well as scientifically, valuable. So, it is disheartening to hear so often of the loss of specimens from this or that college or university. The frequency of major thefts seems to be increasing as the market value of specimens sky-rockets. This is not surprising. What *is* surprising is that so many schools appear to be unaware of the threat or, aware of it, are unwilling to take steps to protect their mineral treasures. Putting the collection securely under lock and key may be a short term solution but what is the point of having a collection that cannot be used or seen?

A common failing of many of the administrators is their reluctance to seek advice as to what should be done with collections for which they must assume responsibility. Sources of proper counsel are not lacking; there are the nation's major mineral museums, the Mineralogical Society of America, the Friends of Mineralogy and the Mineral Museums Advisory Council. Too often administrators pass on the responsibility for the collection to a member of the geology department, usually the one teaching mineralogy (if it is still taught in the department). What is not recognized is that most mineralogy professors are not, and have never been, specimen oriented. In the early history of the science this wasn't true because specimens were still a major part of mineralogy. Today geology students can go all the way through school and have no contact with mineral "specimens". They become professors and suddenly find they have inherited a large collection of objects they simply have no appreciation for. They don't understand what makes the specimens valuable, how to use them properly, how damage may render them valueless, and how tempting they may be to dishonest collectors. Many would not hesitate to take a fine fluorite crystal and use it to demonstrate cleavage or to test hardness. Such a criminal act goes unnoticed unless a student is also a mineral collector. In this instance, the student may feel that stealing the important specimens would not only be a humane and justifiable act, but conscience dictates such a course for the good of the specimens. Those who properly appreciate minerals would find this a terrible dilemma in which to be placed.

The situation is so gloomy that I can see no alternative to at least warning potential donors to colleges and universities of the great jeopardy in which they are placing their beloved

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mineral specimens. Even those colleges and universities having museums of great renown do not offer assurances that proper curation and protection will always be provided. Several such institutions are among those from which valuable specimens have been stolen in recent years. Further, a change in administration, or even professorship, can bring about a totally new attitude toward the collection. In many cases the policy of the institution toward its collection is unilaterally set by one member of the faculty, answering to no one. In many instances this is true because the institution has no "policy" at all in regard to its collections.

Schools do need specimens for teaching and I urge collectors to help them out, but I am not at all convinced that they need display collections. Since they have demonstrated, over and over again, a reluctance to accept the long term responsibility for them, we are forced to conclude that, while no institution in the world can offer perpetual guarantees, colleges and universities are not particularly good places to deposit important mineral collections.

John S. White, Jr.

friends of mineralogy

The newest FM project is the Locality Name Register. The Register is intended to become a companion piece to the *Glossary of Mineral Species 1971*. Research for this compendium is just getting started, but already a great deal of interest and enthusiasm has been generated. We hope that there will be even more support and that as many FM members as possible become directly involved in its compilation.

Why have a Locality Name Register at all? One has only to attend any mineral show or to look over the stock of many mineral dealers to know that there is, alas, very little consistency in the designation of a mineral locality or in its correct spelling. Wouldn't it be wonderful if the collector could have at his fingertips a reference manual which would provide him with a standardized entry for the localities of minerals commonly seen in collections and commonly available on the market today? Of course it would!

The idea for a Locality Name Register may be great, but how do you go about getting one together? It should be obvious to anyone casting even a casual eye on the project that it could get completely out of hand without some reasonable limits being put forth at the outset. While it might be nice to have an exhaustive listing of every locality which has ever produced a mineral specimen, such a goal would not be realistic. How to limit this Register to a manageable size and how to see it in print within a reasonable time span? "*That* was the question!"

When the idea for this project was first discussed, it was decided that we would only attempt to compile a listing of localities which are currently producing quanities of mineral specimens or which have been well-known localities in the near past. Details of older localities are already available in the standard literature. We would not attempt to list localities which are so obscure that the average collector would probably never see a specimen from that location. For example, this Spring, my husband and I found a small vein of pyrite at the Burlington mine near Jamestown, Boulder County, Colorado. We found perhaps a dozen good specimens, two really fine ones, and a couple of flats of junk. We have one of these specimens in our personal collection, but this locality will never appear in the Locality Name Register; it's simply too obscure. On the other hand, a place like the San Francisco mine in Sonora, Mexico, will most certainly appear because of the large number of fine wulfenite and mimeite specimens coming out recently and available to collectors.

Once we decided to limit the Locality Name Register to reasonably prolific or famous specimen-producing contemporary locations, we still had the problem of figuring out how to start gathering information. Earl Pemberton asked me to serve as General Chairman for this project and to act as a central clearing house for all the in-coming information. I agreed, and then I sent out an information letter to all FM Directors and Regional Coordinators outlining this project. I suggested to them that they assign various people in each of their Regions the task of visiting as many mineral shows as possible and undertaking a survey of all displays (competitive, non-competitive, and educational) and dealer stocks to obtain names of localities. What we hoped for was a series of notations, each with the name of a mineral species together with reasonably complete information about where it came from. It is emphasized that this project is not related to the locality preservation project. I suggest a possible format for recording this information, a copy of which is reproduced below.

I indicated to the Regional Coordinators that I would be starting a file of 3" x 5" index cards and that I would prefer to have the data coming in on cards this size. But I also assured them that *anything* in *any* form would be most happily accepted. I also indicated to the Regional Coordinators that they should not worry about possible duplications: it would be part of my job to sift through all the incoming material and weed out the duplicate locality entries.

After I sent out this letter, I also received from several people offers of access to large locality files they had personally compiled over the years. Dick Bideaux has graciously offered us his card file of over 12,000 locality names! This will be a tremendous help in getting the project off to a healthy beginning. If any more of you know of such a compilation (old or new), please let me know about it.

As I receive information from all the Regions, I will code it and enter it into a central file which I will maintain. This file will be arranged by country and by state or province. We hope to receive information up until about December 1, 1974. After that cut-off point, I will be dispersing all the entries to members of a review panel. These authorities will each be experts for a country or countries and they will verify each locality entry for accuracy and

MINERAL SPECIES:

Country:
State or Province:
County:
Nearest Town:
Mine Name:
Other Information: (Where did you get this information, how long did the locality produce, any known associated minerals from this locality, etc.)

comprehensiveness and for spelling. Paul Desautels has accepted to serve as the coordinator for this phase of the project, and he will be enlisting the help of experts from all over the world.

After the locality information has been verified, it will be returned to me, and then it will go to John White for editing and publication. We are tentatively planning on a format which will list the locality names by an alphabetical listing of mineral species. This is probably the most useful format for a collector who has just purchased a mineral and knows what it is but is not sure how to spell the place it came from.

In many ways this is a modest beginning for a long-needed project. But it is also a feasible beginning and one which will produce a usable guide for the collector and the exhibitor. No doubt, as we discover desirable improvements, there will be future updated editions. But now the initial success or failure of the Locality Name Register rests with the FM membership. There is no way to obtain the raw data except to have as many people as possible go to the shows, go to the dealers, go to the public displays, and write down what they find.

Please help, This is YOUR FM project.

Barbara Frank Muntyan
6978 Wapiti Court
Boulder, Colorado 80301
303-443-8462

All news and material relating to FM, for Record publication, should be sent to Dr. Arthur Montgomery at: Dept. of Geology, Lafayette College, Easton, PA 18042

JOSEPH STROMWASSER

Joseph Stromwasser of New York City died on Friday, June 21, 1974 at the age of 61 after a long illness. A self taught zeolite expert Joe roamed the Watchung Mountains of northern New Jersey for forty years and a few old timers still remember him from the 40's digging away in his white hat and blue seaman's suit. A hand specimen mineralogist of the old school who depended on his books, microscope, and an innate feeling for crystallography, Joe was always the leader of the party and the person called over to examine every new find. He delved deeply into the literature when venturing outside local spots and is credited with rediscovering the Stone Arabia quartz crystal locality in Fonda, New York.

A soft spoken, articulate man, Joe made friends with the superintendent of every trap rock quarry in New Jersey, and our Saturday morning trips were always based on Joe's knowledge of what was coming out and where.

A jewelry designer and manufacturer by profession, he made a series of custom mountings for many of his specimens. He was always generous in returning the favors accorded him by the quarry operators and his distinctive pieces were looked forward to at holiday time.

Now, new town houses and garden apartments occupy the floors of many of the old quarries and where we could explore two or three fresh blasts on a Saturday, months go by before by a lucky chance there is even one such opportunity. As we gathered to pay out last respects someone said, "Its the end of an era." Its sad, but it is.

He is survived by his wife, Yetta, a daughter Carol, a son Lawrence, and five grandchildren.

Joe Rothstein

VARIETIES OF SIDERITE

Occuring in Vesicular Basalt Between Moscow, Idaho and Pullman, Washington

by Gary L. Carter
22002 Alamogordo Road, Saugus, California 91350

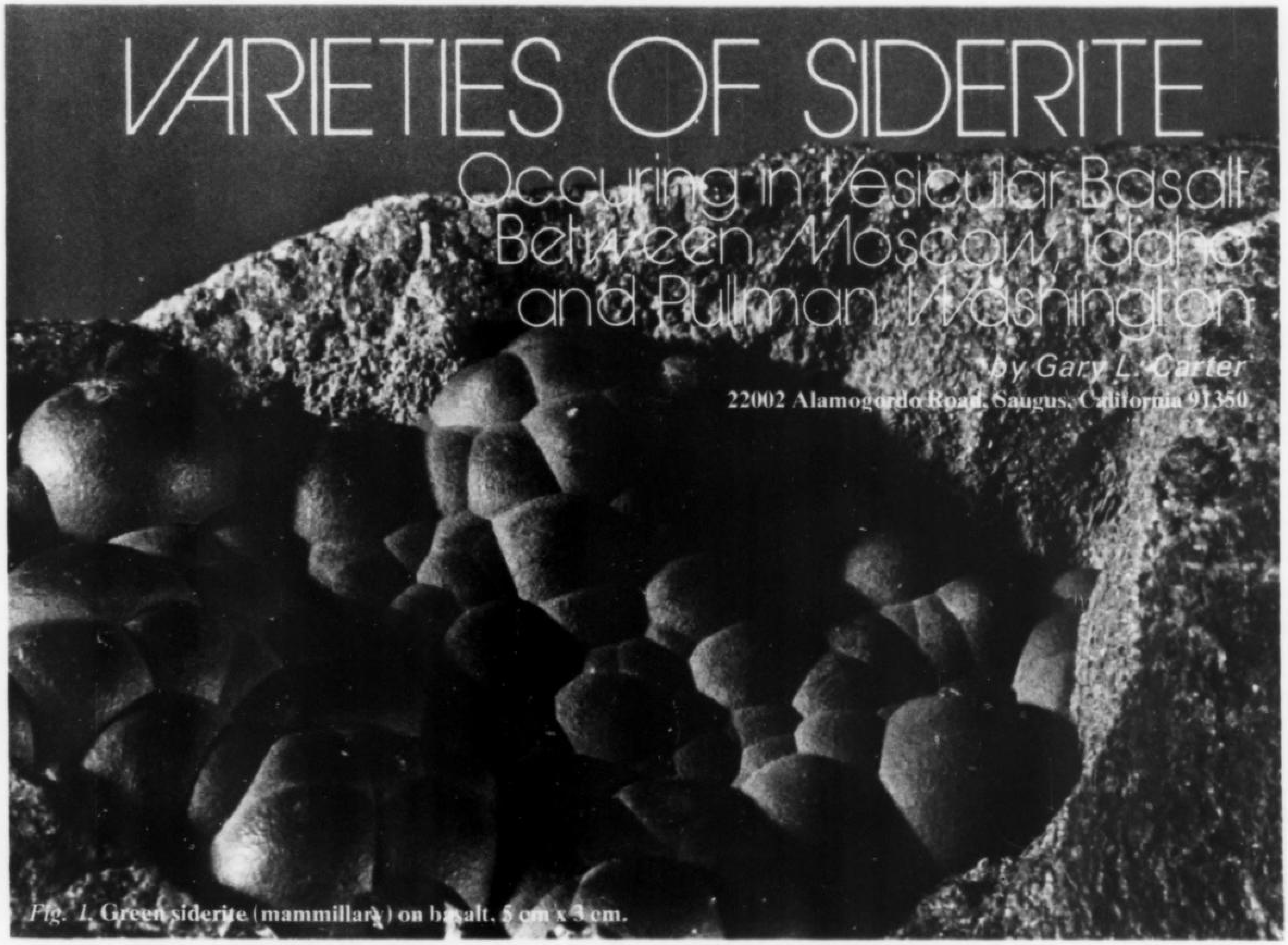

Fig. 1. Green siderite (mammillary) on basalt, 5 cm x 3 cm.

INTRODUCTION

The iron carbonate siderite is a common and widespread mineral found most often as bedded sedimentary deposits, and as a hydrothermal mineral associated with many metallic ore deposits. However, the globular-fibrous form, often referred to as sphaerosiderite, is an uncommon variety. An excellent specimen of this type was shown on the back cover of the *Mineralogical Record* (3, No. 3). Another form of siderite, found while doing graduate work at the University of Idaho in the summer of 1972, is quite unusual. This siderite occurs as bow-tie shaped crystals, and is found with the globular variety in Columbia River basalts near the Washington-Idaho border, about five miles west of Moscow, Idaho.

HISTORY

Sphaerosiderite (also spelled spherosiderite) is the name originally applied to the globular variety of siderite by Hausmann (Palache, Berman, Frondel, 1951). Some texts and collectors still refer to it by this name, however it connotates a habit and is not a meaningful varietal name. This globular variety is known from a number of localities in Europe, but was apparently not reported in the United States until 1916 by Mr. Henry Fair, of Spokane, Washington. The siderite, along with other vesicular fillings, was obtained during excavations in Columbia River basalt in Spokane. In 1923 a suite of these specimens was sent to Earl V. Shannon, then assistant curator of the old United States National Museum. Shannon described this sphaerosiderite, along with other minerals, and reported his findings in a Museum Proceedings Report (1923). He also mentioned briefly the odd bow-tie shaped crystals of siderite, but neither described nor elaborated on them.

In the United States sphaerosiderite has apparently been described only from areas around Spokane, Washington, and Weehawken, New Jersey (Dana and Ford, 1966). The bow-tie shaped crystals, as far as I can determine, have not been mentioned in any treatments of siderite, except that by Shannon.

LOCALITY

The varieties of siderite herein described occur in Miocene age Columbia River vesicular basalts. The basalt is exposed in quarries along an eight mile stretch of Idaho Highway 8 between Moscow, Idaho, and Pullman, Washington. There are three main quarries along this road with the total area of exposure perhaps 1/2 mile in length with basalt up to 80 feet thick uncovered. Most of the siderite was secured from the non-working quarry (Fig. 2), while the Whitlow quarry, near Pullman, contained but one specimen. The first quarry, operated by Northwest Paving Co., had small amounts of siderite. The exposed rocks represent one flow, and are near the eastern boundary of the Columbia Plateau lavas.

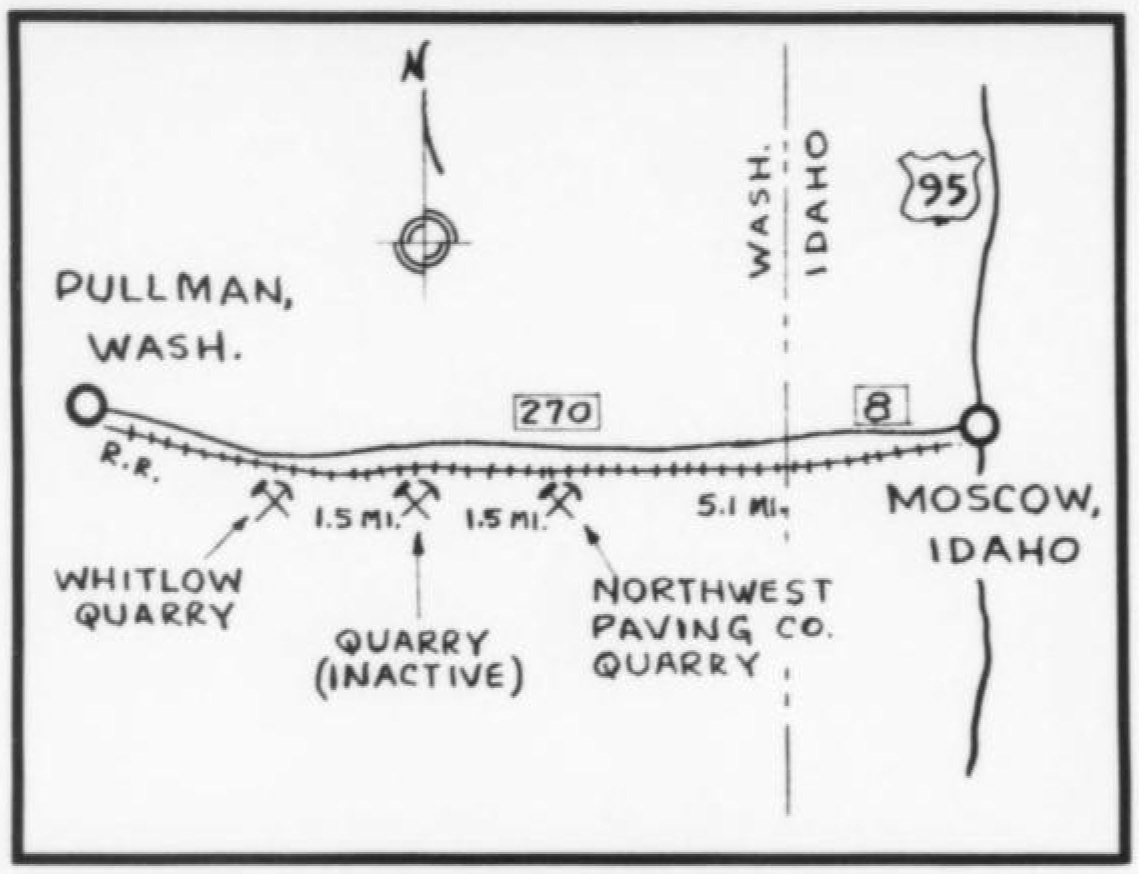

Fig. 2. **Map of area drawn by John Hoffman.**

DESCRIPTIVE MINERALOGY

Sphaerosiderite

The globular siderite is in two forms: Compact, solid balls which, when broken, show a characteristic rhombohedral cleavage: and similar balls which show an internal radial fibrous structure, rather than cleavage. Perhaps, as indicated by Shannon, these globes have their fibrous structure masked by the rhombohedral cleavage.

Both forms vary in color through many shades of green to brown. Most material is dark green with a waxy to vitreous luster. Some specimens show a beautiful chatoyant, silky luster while others have a slight iridescence. The balls are generally small, averaging 5-6 mm in diameter. The largest single sphere noted was 1.5 cm across (Fig. 3).

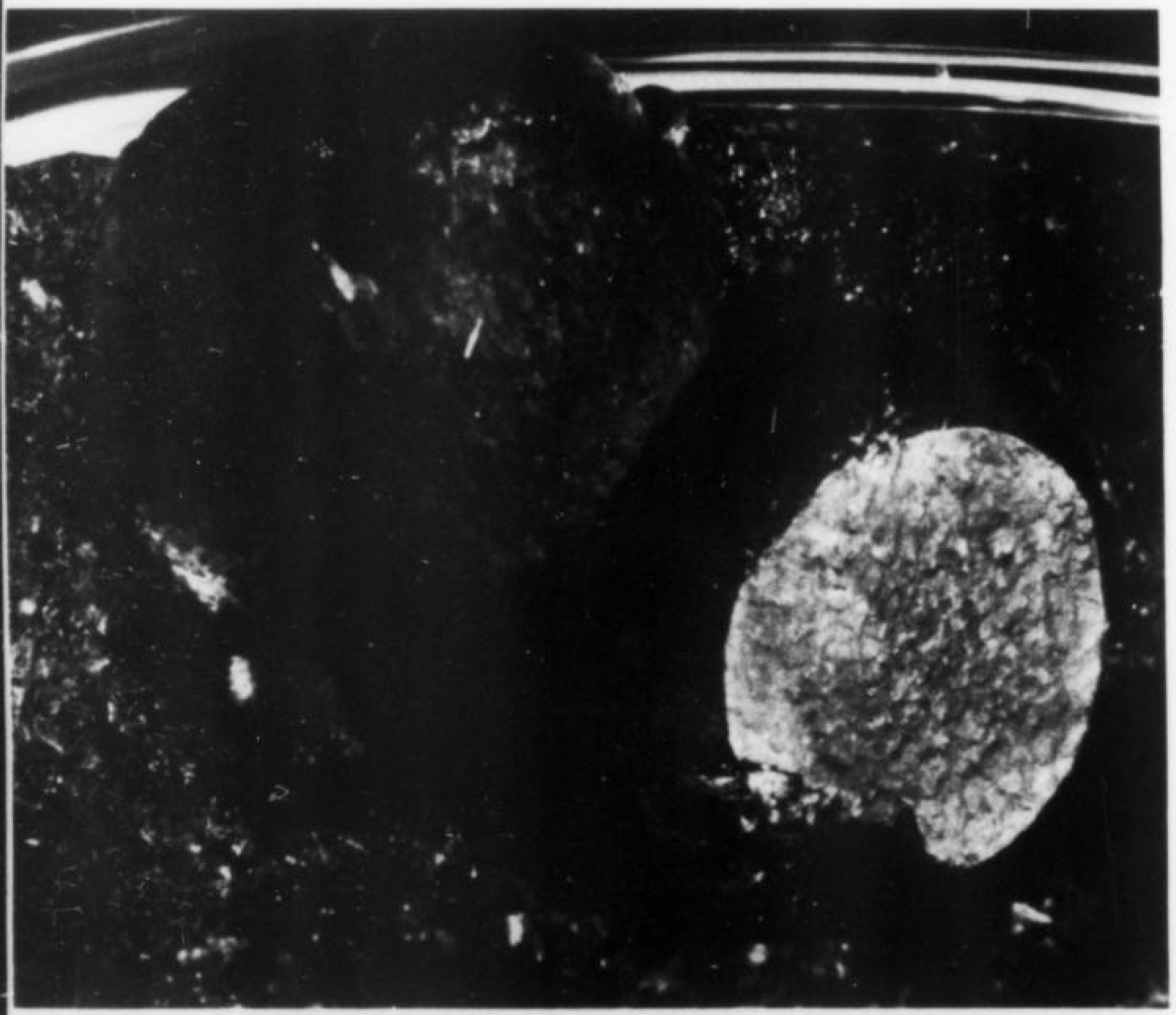

Fig. 3. **Green "sphaerosiderite" on basalt. Each sphere is approximately 1.5 cm across.**

The sphaerosiderite is deposited either directly on the basalt, on a thin coating of pyrite, or on a glassy brown-black material thought to be iron opal. The globes occur singly or in botryoidal masses (Fig. 1), and often form as doubles. It would appear that, in many cases, the globes, especially the doubles, develop from the rapid growth of the top and bottom faces of the bow-tie shaped siderite crystals (described in next section). As more atoms are added, the round globular shape gradually dominates at the expense of the bow-tie shaped crystals.

Evidence for this type development seems to be strong since: (1) there are no crystals over 3 mm in length, perhaps indicating that when an excess of atoms are available the globular variety develops from the small crystals: (2) the globes often show rhombohedral cleavage (the crystals are thought to be composed of an aggregate of rhombs): and, (3) there are many doubles, formed, perhaps, as noted above.

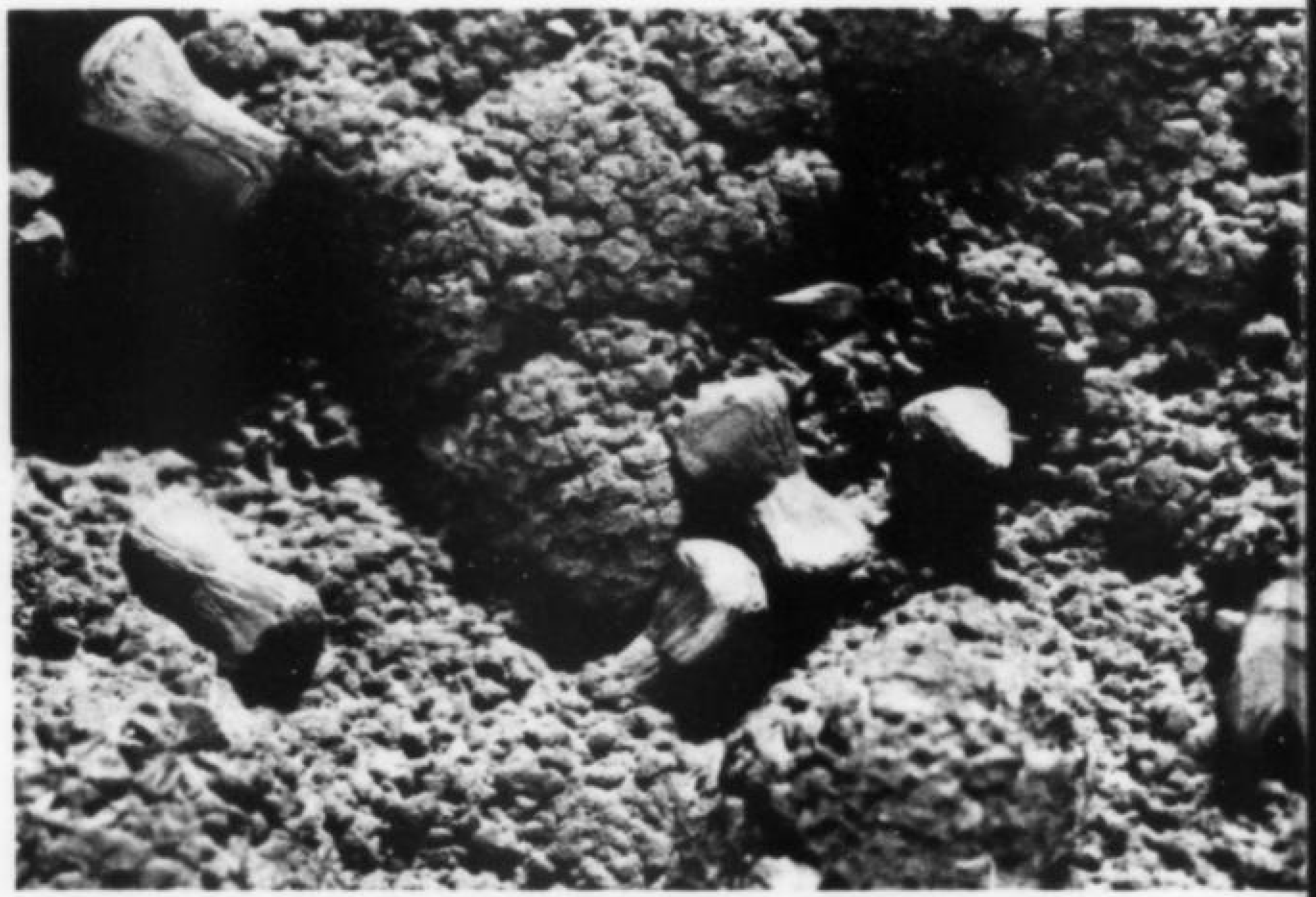

Fig. 4. **Red-brown siderite "bow-tie" crystals 3 mm in length.**

Siderite Crystals

The most intriguing material in the vesicles are the bow-tie shaped trigonal crystals of siderite (Fig. 4). These small crystals range in color through many shades of green to brownish-red, and, in one instance, black. However, all crystals found in the interior of freshly fractured basalt are of a green, almost translucent nature. The other colors may be the result of alteration of the siderite to an iron oxide.

No individual crystal measured more than 3 mm in length, but this was also the average size of all the crystals. No basic difference could be ascertained between the environment of deposition of the crystals and the balls. Only in a few instances do crystals occur associated with the ball-like masses (again indicating that the globes are formed by overdevelopment of crystal faces).

Under the microscope the siderite crystals appear to be composed of an aggregate of rhombs. Rhombohedral cleavage is prominent on many of the broken crystals but, in examining hundreds of individuals, not one isolated sider-

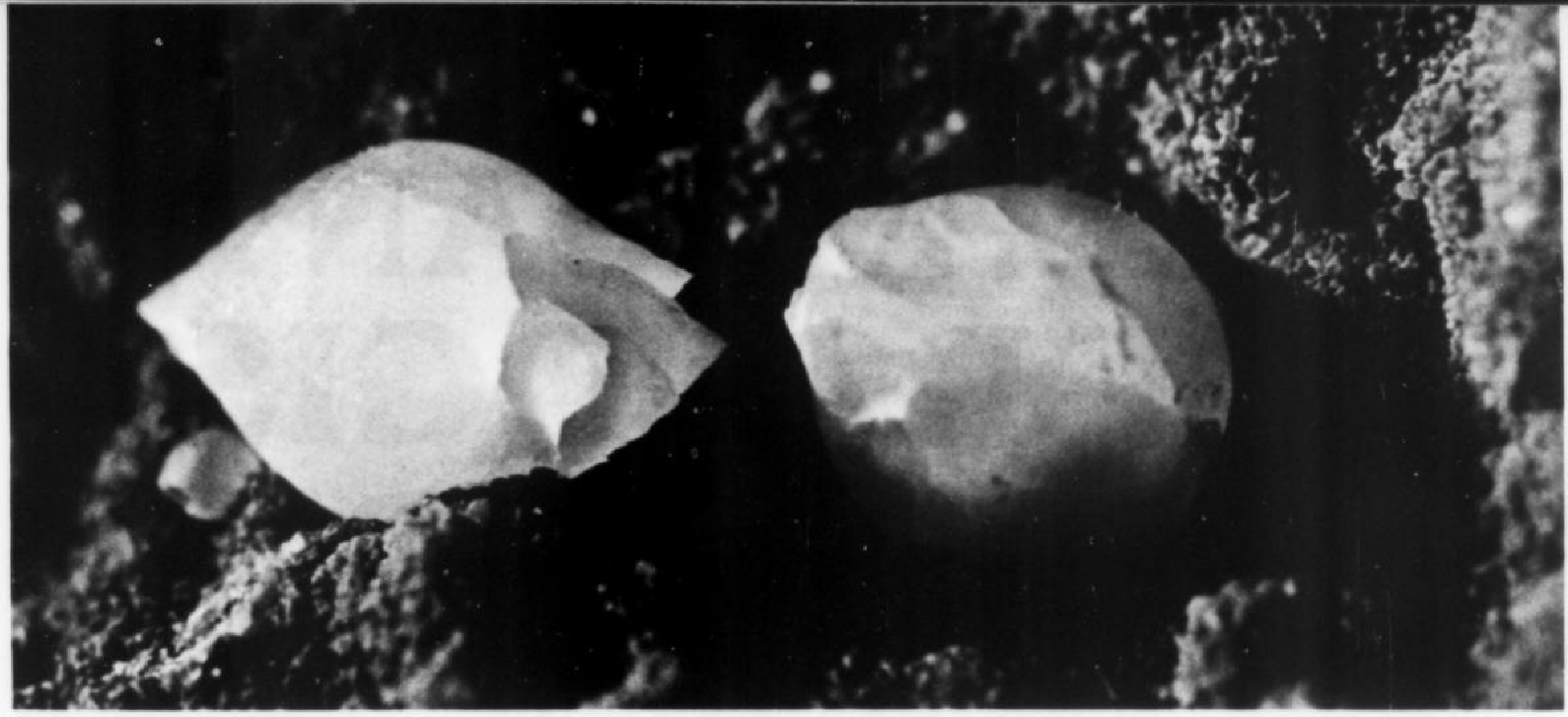

Fig. 5. **Calcite, 1.3 cm in length.**

ite rhomb was observed. Also, the 180° rotation of the lower half of the crystals, and the failure to envision a buildup of rhombs which could produce the external bow-tie shape, leaves this form open to interpertation. Undoubtedly my inexperience was also a drawback in attempting to fully analyze these crystals.

PHYSICAL, CHEMICAL AND X-RAY DATA

Physical, chemical and x-ray information on the various types of siderate just described is of a preliminary nature. No optical work was done. Physical properties of the globes and crystals conform to those reported in any number of texts. Chemical analysis of 1 gram of each variety was preformed by atomic absorption, and nothing unusual was noted.

X-ray information was obtained by powder diffraction using the diffractometer with copper radiation. The three strongest lines for the globular siderite were 3.58, 2.79 and 2.51. The crystal's three strong lines were 3.58, 2.79 and 2.65. Since this was the first time I used the diffractometer the disparity may be due to my inexperience and/or technique.

ASSOCIATIONS

A brief description of some other minerals of the basalt cavities follows, It should be noted that these minerals have been identified on the basis of physical properties only.

Calcite

Widespread, but not abundant, Generally in the form of an aggregation of small rhombs, usually not exceeding 5 mm. White and clear translucent calcite on a green or brown siderite background is quite striking. Ball shaped masses, and three peculiar periwinkle shaped individuals were also noted (Fig. 5). The calcite is always on siderite and, in all instances, it is the last mineral to fill the vesicles.

Pyrite

Occurs as thin, finely divided coatings directly on basalt. No crystals were observed. The pyrite is as widespread, but not as abundant, as the siderite. When pyrite and siderite are in proximity, the iron carbonate is later than the iron sulfide.

"Iron Opal"

This material ranges from honey-brown to black in color. It has a pitchy to glassy luster and appears to be amorphous. The crust of the opal usually is much darker than the underlying material.

The iron opal is generally found lining vesicles and, in some instances, underlies, or completely coats, the siderite.

Hyalite

Poor quality hyalite, probably from silica rich ground or drainage water, is fairly abundant as a late coating on the more weathered basalt. In no instance was hyalite observed in the interior of freshly fractured basalt.

Notable by their absence are the zeolities, I was constantly alert for their appearance, but did not observe any of the zeolite group.

SUMMARY

In view of the large amount of basalt exposed, the siderite is not abundant. The siderite may be found scattered throughout a large portion of the basalt but most of the material is localized in certain sections or areas of the flow. The source of the siderite is apparently from small veinlets, usually not exceeding 2 mm in width, which can be observed weaving through fractures and appearing as globes or crystals when they enter vesicles in the basalts.

Both the sphaerosiderite and the bow-tie crystals are interesting forms and make worthwhile additions to any collection. Collectors should obtain permission at the company offices before entering the quarries.

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AN AMERICAN MINERALOGIST PART V

by Arthur Montgomery

Lafayette College, Easton, Pennsylvania 18042

Third expedition: Bolivia and Chile, 1925

In February of 1925 Samuel G. Gordon was off on his third major expedition. He was returning to the Andes of Bolivia and Chile where he had been so extraordinarily successful in the discovery of rare and new minerals during the several months of collecting there in 1921. More of the new species, vauxite and paravauxite, was needed for study, display and exchange; and Mr. Vaux undoubtedly encouraged the project. He also planned to get to additional mining localities of the high Andes not visited before. The account of this expedition was printed in the Academy Year Book (1926, p. 29-38) and it is given here in full except for the final paragraph of acknowledgments. It is an engrossing story of travel through a little known region and mineral collecting in ancient mines still being worked under the most primitive conditions.

"The Third Academy Mineralogical Expedition: Bolivia and Chile 1925"

New York City was just recovering from a severe February storm, a few ice floes were still to be seen in the East River, when the "Santa Luisa" left its Brooklyn pier, bound for the west coast of South America. Forty-eight hours later, upon entering the Gulf Stream, its passengers shed the heavy overcoats found so comfortable in the more rigorous northern climate. On the sixth day Cape Maysi marked the approach to the Caribbean, with its many flying fish — flashing silver across the fluorescent blue — which, when the crimson clouds, reflecting light from a sunken sun, had turned to purple, became alive with phosphorescent glow as stirred by the ship. Then Cristobal — a clean tropical settlement, with attractive concrete commercial structures, and cool, screened residences, in marked contrast to its neighbor, exotic Colon with its swarming dark population, predatory East Indian merchants, and crowded cabarets.

Early in the morning, as the sun rose over the dank forested hills behind Cristobal, silhouetting the trees on the banks, the "Santa Luisa" started through the canal, and approached the grand staircase of Gatun beside the old French canal. It was evening when Balboa, Panama City, and the beautiful green island of Taboga were left astern. Two days later we passed Santa Elena Point, Ecuador, and encountered the cool Humboldt current. Many seals, dolphins and whales, giving striking evidence of a teeming life, which formed the sustenance also of millions of sea birds inhabiting the guano islands. The first port of call was Talara (Peru) in the oil fields, the derricks of which were visible for miles along the arid coast. Stopes at Salaverry Callao permitted excursions to the Chimu ruins near Trujillo, and those of Pachacamac below Lima.

On Saturday morning, March 7, we arrived at Arica, a sleepy little far north Chilean port tucked in the corner of the Pacific, just where the South American coast turns sharply from a southeastward trend to a southerly course. Only a few years ago its sole railway ran to Tacna, an oasis in the Atacama desert. To Tacna came the rich ores of the Andes borne on llama and mule.

The international train for La Paz left on Monday evening. Throughout the night it gained in altitude, and by

Fig. 1. **The Chojnacota glacier, Cordillera Quimsa Cruz, Bolivia.** ***Gordon photo. From ANSP Year Book, 1925, p. 29-38.***

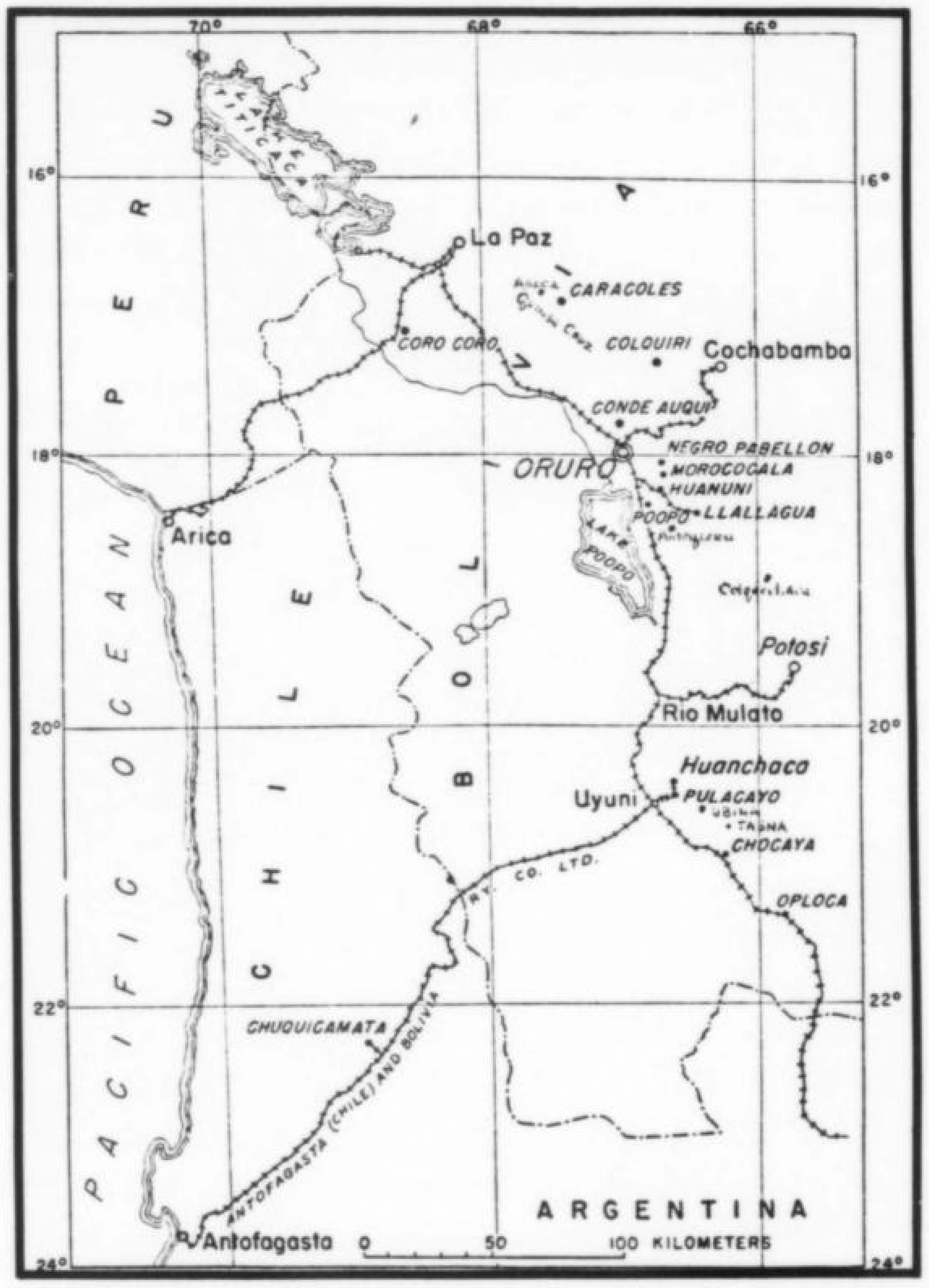

Fig. 2. **Map showing Bolivian tin and tin-silver localities, adapted from F. M. Chace (*Tin-Silver Veins of Oruro, Bolivia*, Ec. Geol., 43, p. 336, 1948). Most deposits visited by Gordon are included.**

sunrise we had passed the giant volcanoes which form the western Cordillera and mark the boundary between the republics of Chile and Bolivia. The ice-capped granitic ranges of the eastern Cordillera soon came into view across the Bolivian plateau. The La Paz river has cut a tremendous canyon into the plateau, and at the bottom of this gorge is the city of La Paz. It is a most picturesquely set capitol. On reaching the edge of the canyon, the train winds down precipitous cliffs, past vividly colored, and grotesquely eroded pillars of sand and gravel. Dominating the horizon on the south is the ice-capped massif of Illimani, more than 21,000 feet in altitude.

Several days were spent in La Paz getting acclimated to the high altitude and the rarified air before proceeding to Oruro. Apparently, the natives have never recovered from their wonder at the railroad, for at every station the entire polulace turns out to see the trains arrive and depart. The rails are lined with cholas — mixed blood Indian women, heavily clad in voluminous, gayly colored dress, vending fruit, meat cakes, or the coffee-colored intoxicating chicha.

Oruro, the chief mining center of Bolivia, is situated at the foot of a group of hills of quartz porphyry. Its population is varied in origin; while most of the inhabitants have Indian blood, there is a considerable European, as well as Syrian representation. The community center of Oruro is its large plaza. On Sundays it presents a gala aspect, for on this day the military band plays, and the Orurenos promenade around the great square in passing streams.

On Monday morning I worked my way through the dense crowds at the station to the Llallagua train. With much ceremony, a bell was rung, and the train departed. Toward noon we passed the mines of Huanuni, stated to be the first mines worked for tin in Bolivia. It was late in the afternoon when the train reached the mines of Llallagua. These mines produce about fifteen percent of the world's annual supply of tin, as well as considerable bismuth. The tin viens are associated with a large mass of quartz porphyry which has been intruded into a fine-grained red sandstone.

While at Llallagua I made my headquarters at Catavi, the site of the mill, about a league distant from the mines. Daily, after desayuno, or breakfast, I mounted a mule and swung into the trail across the barren, monotonous pampa, broken here and there by an occasional ravin. Just below the mines is the native village of Llallagua, pungent with the odor of burning llama dung from the braziers of the Indian households.

At the main tunnel, the Siglo XX, the chico or boy, prepared the mine lamps. Seating ourselves on the electric locomotive, we were rushed into the tunnel for a distance of two miles — a trip made in six minutes — to the main shaft. Huge rooms had been cut into the rock, and the walls echoed with the staccato roar of the drill dressers in the blacksmith shop, and the rhythmic boom of the air compressor. Stepping into a cage we were whisked up to one of the principal levels. Numerous drifts and crosscuts radiated out to various veins. We walked out along a track, stepping aside now and then to avoid a passing ore car, until we came to a place where we could enter a stope.

To those not familiar with mining methods, a word of explanation of stoping will be necessary. Tunnels are driven along the veins at vertical intervals of a hundred feet. These are roofed over with heavy timber. The ore in the vein is then blasted down onto the roof of the tunnel. At intervals in the roof are chutes, through which the ore can be dropped into ore cars. The miners begin at the roof of the tunnel and gradually work upward until all the ore in that section of the vein has been broken up to the next tunnel level, a hundred feet above. Such a working is called a stope.

If a stope has just been started, the climb is short. However, where there has been considerable stoping, a climb of forty or fifty feet may be necessary, or it is sometimes feasible to climb down from an upper level. Several means of access were used, differing in the amount of gymnastics required. We considered ourselves fortunate if there was a series of ladders in various stages of completeness. Missing rungs were frequent, and the reason was apparent. One morning we climbed across a space where a vein had been stoped out. On reaching the opposite end of the ladder we found that it was held in place by a single nail. The next night a fall of rock sent it crashing to the bottom.

Fig. 3. **Glacier at Laramcota, Cordillera Quimsa Cruz, Bolivia.** *Gordon photo. From ANSP Year Book, 1925, p. 29-38.*

Sometimes the wooden ladder would be replaced by one of the swinging wire rope. But not infrequently we had to haul ourselves up a rope, bracing the back, knees, and elbows against the rock sides. Loud shouts of "Guarde ariba" – "look out above" announced our entry into the raise, so as to avoid being greeted with a shower of rock or drill steel.

The stopes presented scenes of great industry: stolid Quechua Indians were operating compressed air drills, or were loading holes with dynamite for the noon or late afternoon blasts. Making our way over the rough floor of broken ore, we carefully examined the face of the vein overhead, and the rock walls on each side. The ore consisted largely of cassiterite, SnO_2, in black crystals or masses through quartz, associated with some bismuthinite and wolframite, and much pyrite. Small cavities were lined with twinned crystals of cassiterite. The bismuthinite formed long blades shooting through the pyrite, sometimes with apatite and vivianite. We were surprised at the large amount of the rather rare mineral wavellite, which occurred in druses of colorless crystals covering quartz crystals, or lining fractures along the walls. A single vein of vauxite and paravauxite was found in one stope.

We found outselves wondering at the origin of this remarkable deposit, and trying to picture the event. What had caused the concentration of so much tin in the original granitic magma? Why had it been deposited in veins at this point? What were the conditions of temperature and pressure? Such problems could not be answered offhand; the phenomena was exceedingly complex, and required much study of the minerals in the vein, and their mutual relation. All pointed to interesting work in the laboratory.

At noon we returned to the surface, and hustled to the dining room presided over by a smiling Japanese. The meal would be enlivened by a discussion of the specimens, or of plans for the afternoon. After almuerzo we wandered over the cancha and dumps. Groups of Indian women sat around piles of ore, breaking it up with heavy hammers, and rejecting the worthless material. At one o'clock we reentered the mine. In a single day from four to seven stopes were visited. At 4:30 P.M. we gathered for tea, which was usually followed by a game of tennis before returning to Catavi.

Some difficulties were encountered in visiting the more remote portions of the mine. The examination of one vein involved climbing down 875 feet of stopes in a single morning, over 500 feet of which were by ladder. Other veins could only be visited by being lowered down a shaft by means of a steel cable at the end of which were two iron hoops into which the legs were thrust. Descents of 300 feet were made in this manner. In three weeks all the working stopes were examined in the more than fifty miles of tunnel in the mine. Fifteen cases of specimens were collected, labelled, and packed in steel-strapped boxes. They were then sewed in burlap for shipment.

Fifty miles to the east of Llallagua are the old silver mines of Colquechaca. Early one Sunday morning, we left Catavi in a coach drawn by four mules. With great skill the driver avoided the larger rocks as we careened along the road. At each native village groups of dogs rushed out to greet us, barking furiously, but an expert touch of the long whip sent them back whimpering.

After two hours and a half of shaking up, we reached Lagunas, where our mules, which had been sent ahead, were waiting. The road was soon replaced by a narrow trail leading down a gorge. The vegetation was sparse, an occasional cactus relieving the monotony of the sandstone cliffs. At the village of Chuquta the trail turned steeply up a high ridge, winding in and out gullies to gain altitude, only to reveal on the other side, other ridges to be crossed. In the afternoon we forded the Rio Blanco, at the tambo of Morochaca. The night was spent at Pocoata, a picturesque village in a beautiful green cultivated valley. The next morning the Rio Pocoata was crossed, and the village was left far below as the trail zigzagged up the mountain. Soon after the white tower of the church on the plaza faded from view we saw the Cerro Hermosa, on the far side of which was the village of Colquechaca.

At noon we clattered down its old cobbled streets, lined with adobe houses with thatched roofs of straw. The principal mines have been practically exhausted. A small collection of minerals was obtained which included pyargyrite, argentite, argyrodite, vivianite, and a specimen of a new mineral since named penroseite.

The next field of operations were the mines of Avicaya, Totoral, Salvador, and Montserrat, grouped about the village of Antequera, about thirty miles south of Oruro. They are easily accessible by automobile in the dry season. The road leads directly southward across the pampa, paralleling the railroad. At Poopo, it follows the shore of Lago Poopo, fed by the Rio Desaguadero which drains Lake Titicaca in the northern part of the plateau. About halfway to Pazna, high up in a gulch, are the abandoned buildings of the Trinacria mine which produced the remarkable mineral cylindrite.

At Pazna, the road turns eastward from the lake. The Avicaya mines are located in the glacial cirque of the mountain east of Urmiri, a little village famous for its hot springs. The Totoral mine is on the opposite side of the mountain. The stopes of the Avicaya mines, great caverns from which the ore has been removed, look out across Lake Poopo to the distant volcanoes of the Chilean border.

The mines of Salvador are just above the village of Antequera. Like every other important silver or tin mine in Bolivia, it was wrecked by the Spaniards in Colonial days. But as the Castilians were interested only in gold and silver, the tin ores were untouched until 1890. The past three decades have witnessed the reopening of many old Spanish workings for tin. At the Montserrat mines, about a league to the north, old Spanish winzes follow the veins downward from the surface by means of steep, winding staircases cut into the rock. Supporting walls extend up one side of the tunnels, abutting by means of arches against

Fig. 4.* The glacier of Monte Blanco, Cordillera Quimsa Cruz, Bolivia. *Gordon photo. From ANSP Year Book, 1925, p. 29-38.

the other side. The Montserrat veins are of peculiar mineralogical composition, containing the minerals teallite, $PbSnS_2$, in black platy aggregates; wurtzite, ZnS, in hexagonal brown crystals; and cassiterite, SnO_2, in yellow needles.

The last tin district visited was that of the Quimsa Cruz. The Cordillera Quimsa Cruz is practically a continuation of the massif of Illimani, being separated from it by the deep gorge of the La Paz River. Arriving at the station of Eucaliptus shortly after midnight, I walked across the sandy cancha to the hotel. After considerable pounding and kicking of the door a sleepy porter let me in. The weekly camione or motor truck left early in the morning for Pongo, and after breakfast I took my seat with the chauffeur. A few natives sitting on top of a pile of boxes and bags comprised the other passengers. Straight out across the pampa sped the machine, gradually gaining in altitude toward the distant mountains. It was not until noon that the Cordillera Quimsa Cruz, a magnificent range of glacier clad peaks, came into view. To the northeast, Illimani appeared just above the horizon, and back of us in the distance, the symmetrical volcanic cone of Sajama in the western Cordillera, each more than 20,000 feet in altitude.

Late in the afternoon we reached the pass between the Quimsa Cruz and the Santa Vela Cruz, about 15,400 feet above sea level. The road then zigzagged back and forth in gradual descent to Pongo, the site of the mill of the Caracoles tin mines. About a league below Pongo is the village of Quime, whose nearby mines produced, during the war, considerable wolframite and scheelite.

At the beginning of May, I left Pongo for a trip along the Quimsa Cruz range. The Alpine-like, ice-clad peaks reach an altitude of over 19,000 feet. Picturesque glaciers feed beautiful green and blue lakes in numerous valleys. The core of the range is granodiorite, flanked by Silurian slates which are exposed in the western valleys. Just east of the Quimsa Cruz pass, a trail leads up a narrow valley to Monte Blanco, where a lateral valley looks out over the Bolivian plateau; while to the south the pyramid of Santa Vela Cruz towers above the surrounding country. A magnificent glacier extends from Monte Blanco to the edge of a blue lake. In the valleys to the north, Chojnacota, Laramcota, Mallachuma, and Attaromachuma, other glaciers, and numerous lakes make the district one of the most picturesque in Bolivia.

The tin mines of Viloca (Araca) are situated in a glacial gorge in the northern end of the range, surrounded by serrated peaks. The veins are in slates, near their contact with the granodiorite of the range. These mines are noted for the beautiful translucent, hair-brown crystals of cassiterite occasionally found.

About 4 o'clock one afternoon I left the Viloca mine, for La Paz, via the La Paz River, accompanied by an Indian, with an extra mule for the baggage. As the trail dropped rapidly down the valley, the vegetation became more luxuriant, with flowers appearing on all sides. It was dark when we reached the village of Araca. After some inquiry we were directed to the Rancho Pampa, a picturesque hacienda set among the trees beyond a small brook. At four o'clock the next morning the pack mule was loaded with the baggage and a bundle of hay. An hour later we turned down the valley again; it was quite dark, but the animals followed the trail instinctively. About sunrise we came into view of Illimani, rising more than 15,000 feet above the bed of the La Paz River, to an altitude of over 21,000 feet. At 10 o'clock we reached the river level. All day long we rode up the river, fording the stream time and time again; the sun beat down unmercifully, each boulder strongly reflecting the heat. There was no drinking water, as the stream drained the city of La Paz. After fourteen hours of riding we reached the hacienda of Millacota, where we spent the night. At 3 o'clock in the morning we were up again, for there is little resting on the trail. It was noon when we reached the picturesque area below La Paz, and two more hours brought us into the center of the city.

As the train, several days later, climbed out of the La Paz gorge, I took a last look at the impressive panorama: the city overshadowed by its encircling walls, and the icy monarchs Caca-Aca and Illimani towering high above the barren, monotonous plateau. With great deliberation the locomotive hauled us southward, meandering with an occasional stream, and stopping not infrequently at some adobe station on the cheerless pampa. Beyond Oruro it skirted the salt encrusted shores of Lake Poopo. At Uyuni one division of the railway continues southward to Buenos Aires, and the other turns westward for Antofagasta in Chile. In the vicinity of Uyuni one sometimes catches a glimpse of the swift vicuna, which soon flee into the mirages of the salt plain.

The Chilean frontier is marked by the volcano Ollague, with its active fumarole, to which I had climbed in 1921. It was sunset when the train passed the borax lake of Ascotan in the midst of the volcanic field. Towards midnight a blaze of electric lights on a hillside several miles to the north, identified the copper mines of Chuquicamata. Soon after, the train pulled into Calama, on the Loa River.

Several days were spent at Sierra Gorda in visiting the old mines in the desert hills nearby. Many years ago their exploitation revealed a number of rare sulfates and chlorides: daviesite, caracolite, paralaurionite, schwartzembergite, and percylite. Today only great gashes in the surface, surrounded by dumps and the remnants of buildings, indicate former activity. Sierra Gorda is situated at the western edge of the nitrate fields, and the smoke of several oficinas rise nearby.

On June 6th, at ten o'clock, I boarded a train for Antofagasta. About an hour later the news came that the entire province had been placed under military control, and it was uncertain whether the train would reach the coast. Cavalry lined the station platforms, while officers went through the

Fig. 5.* Lake and snow peaks beyond, Cordillera Quimsa Cruz, Bolivia. *Gordon photo. From ANSP Year Book, 1925, p. 29-38.

train. But at five o'clock we drew into Antofagasta, and I saw the Pacific again after three months.

Two days on the steamship Teno brought me to Iquique, the famous nitrate port. On visiting the Commander of the army division in charge of the area, I received a pass to the nitrate fields. A railway, crossing the Coastal range, taps the Atacama desert. The nitrate fields are on the eastern side of the Coastal range; across the desert are the western ranges of the Andes. The whole terrain presents the picture of having been plowed up to satisfy the rapacious maw of the numerous nitrate plants or oficinas which dot the arid pampa. Here and there white-shirted workmen may be seen digging the precious salt in trenches. At frequent intervals the train draws up to a station between the two rows of wooden or corrugated iron shacks which constitute a town.

Pintados is such a town on the edge of the Pampa Tamarugal, which stretches eastward to the Andes about forty miles away. Just to the northeast of the station is the oasis of Pica, fed by many seeping springs. A few pits on the hillside of the coastal range, about a mile to the northwest, represent attempts to work small deposits of aluminum sulfates: tamarugite and pickeringite. It was here that the new mineral trudellite was found.

One other district remained to be visited, that of Copiapo, an oasis far to the south, on the Copiapo River. Several days on a passing steamer on the Pacific suffices to bring one to the port of Caldera, where a railway extends to this famous old mining center. Or, it can be reached by means of the longitudinal railway, which extends along the length of the Atacama desert. An old report listed more than 1200 mines or prospects in the vicinity of Copiapo. Nearby are the famous silver mines of Chanarcillo. Since my first visit, the earthquake of 1922 had destroyed much of the proud city, which boasted of the first gas works, railway, the telegraph of South America. Owing to the cessation of mining activity, and the desertion of many of its inhabitants to Santiago, it is doubtful whether it will ever recover its former glory. It is situated on the Copiapo River, which turns the valley into a beautiful green cultivated area, with many vineyards, orchards, and productive fields, in the midst of a barren, arid, and almost rainless desert.

Only a few miles to the southeast is Tierra Amarilla, so named from an oxidized pyrite vein which contained much copiapite, coquimbite, fibroferrite, and other iron sulfates in its outcrop. Many small copper mines are situated on the hillsides.

Visits to Santiago and Valparaiso brought this interesting trip to a close. Thirty-eight cases of specimens were obtained, including two new minerals, penroseite and trudellite, as well as a wealth of fine crystallized material for the museum, and research in the laboratory.

Aside from the evidence of highly successful collecting results documented in this account, one gains insight into Gordon's talents as a mineral collector: his keen eye, persistence in squeezing into almost inaccessible places, knack for getting local personnel to aid him in the work, and tremendous zest for what he was doing. Those old tunnels and stopes in the mines at his favorite Bolivian collecting ground, Llallagua, were extremely dangerous and difficult of access, which helps to explain why mineralogists had failed to exploit them fully. This second visit to Llallagua turned up not only an abundance of the minerals he had already collected there in 1921, but fresh material of excellent scientific interest including a third new phosphate from this locality which he would call *metavauxite*. This species is closely related to the two other new phosphates from Llallagua names for Mr. Vaux. The discoverer made known a preliminary description of metavauxite at a meeting of the Philadelphia Mineralogical Society on April 7, 1927, and an abstract of his talk was printed during the same year in the *American Mineralogist* (Vol. 12, p. 264). Gordon had completely determined the properties of his new species, but he was plagued again by inaccuracies in the chemical analysis. Dr. E. V. Shannon's preliminary analysis, announced at the Philadelphia meeting, had to be corrected later when incorporated into Gordon's eighty-page monograph on the minerals of Llallagua published in the Academy *Proceedings* of 1944, pp. 279-359, as "The mineralogy of the tin mines of Cerro de Llallagua, Bolivia."

Two more species believed to be new were discovered by Gordon during this expedition. These were a nickel-copper-lead selenide from Colquechaca, Bolivia, and an aluminum sulfat-chloride from Cerro Pintados, Chile. The former, contained in a single "float" specimen secured from a miner's collection, he called *penroseite* after the well-known Philadelphia mining geologist and benefactor of American geology and mineralogy, Dr. R. A. F. Penrose, Jr. The latter he named *trudellite* after his good friend and life-long collecting companion, Harry W. Trudell of Philadelphia. Some slight refinements in analytical and determinative data had to be made later on in the case of penroseite; unfortunately, trudellite has now been discredited as a species as a result of recent x-ray study.

The Photographic Record

by *Wendell E. Wilson*

Lighting Techniques

Becoming an accomplished photographer is a never-ending two-phase task. In the first phase one obtains adequate (if not the best) equipment, learns how to create a sharply-focussed picture, and learns how to correctly match light source with film type. Equipment can later be upgraded as needs and finances dictate. Once the basic mechanics are mastered one can move on to the second phase: perfection of artistry and technique. Here one learns to choose just the right background, to arrange lighting to optimize the beauty and important aspects of the specimen, and to create the most pleasing composition. In some ways these latter concepts fall into the "unteachable" category, but some general advice and suggestions can still be given with the understanding that there is really no limit to the possibilities a creative mind can conceive. A periodic return to the study of mechanics is still often necessary to keep up with new techniques and to learn how to execute new and more demanding ideas of your own.

The primary aspect of a good photo is, of course, a good specimen, such as the 3/4-inch Red Cloud wulfenite crystal on matrix in figures 1 through 4, and the Tsumeb azurite crystal (1-1/4-inch), also on matrix, in figure 5.* Figure 1 is a typical beginner's "shot" with a number of problems. (Taking faulty shots to illustrate this column was easy... my crate-full of past failures provided abundant examples!) Notice that the form and surface features are rather difficult to discern. The lighting is even and bright, illuminating the entire background at a boringly uniform intensity. The specimen does not stand out well from the background because contrast between the two is low. The specimen is casting multiple shadows, a distracting effect which should be avoided whenever possible. Matrix fragments have fallen loose and soiled the background paper. The unsightly clay mounting is visible, and the specimen is poorly positioned for depth of field limitations. Finally, a very common error: the specimen does not adequately fill the field of view.

Figure 2 shows an attempted correction of these flaws. The specimen has been repositioned to better fill the field of view and to lie within the plane of sharp focus. To highlight the form and surface features the photographer has reflected his lights from some of the faces. Unfortunately the reflections are glaringly bright: typical "burn-outs". The loose fragments have been cleaned up, and the clay mount has been reshaped and positioned out of sight. Two other very common errors are failure to remove all tiny cotton fibers which may be adhering to the specimen, and failure to gently remove fingerprints from the specimen. Removing fingerprints must be done carefully with a very clean, very soft cloth.

A further refinement is shown in figure 3. The background has been selectively illuminated in a sort of spotlight effect. For some reason the use of a background which becomes darker toward the top is very pleasing to the eye. Lee Boltin is a master at this (see, for instance, the pyromorphite photo which appeared in vol. V, #1 of the *Record*). In figure 3, however, the effect is a little too stark and needs a slight reduction in contrast. Notice that only one shadow is now present; the second light source has been moved to a more distant position and is used only for minor reflections. The remaining light source (a high-intensity desk lamp in this case) has been covered by a layer of Scotch Magic Transparent Tape so that the light is more diffused. A microscope light covered by a piece of frosty tape will produce the same effect. A screen of aluminum foil with a 1/2-inch hole cut in it has been placed on the light source to produce the spot light effect.

At this point it becomes obvious that reflections must be deliberately and carefully placed, rather than left to chance. There are at least four different types of reflections you can use for highlighting specimens. One reflection is the **gradational type**; the intensity increases from one side of the highlighted face to the other, as with the top face in figure 3. This face is still too burned out for comfort, and should be dimmed further. Another is the **uniform type**; intensity is uniform across the face, as in the left face of the crystal in figure 3. A little specimen color or texture should show through uniform reflections, therefore subtlety is essential. Occasionally, pure white reflections can be used on very *small* faces for a little sparkle, but never on significantly large faces. A third type is the **secondary type**; light is bounced off of some type of reflector (e.g. aluminum foil) or off the background paper itself to produce the reflection on the crystal face. In figure 3 the upper right, right, lower, and lower left faces show such reflections. In fact the upper right face shows a reflection which is a combination of the gradational and

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*All photos were taken at f/16 with Tri-X Pan film.

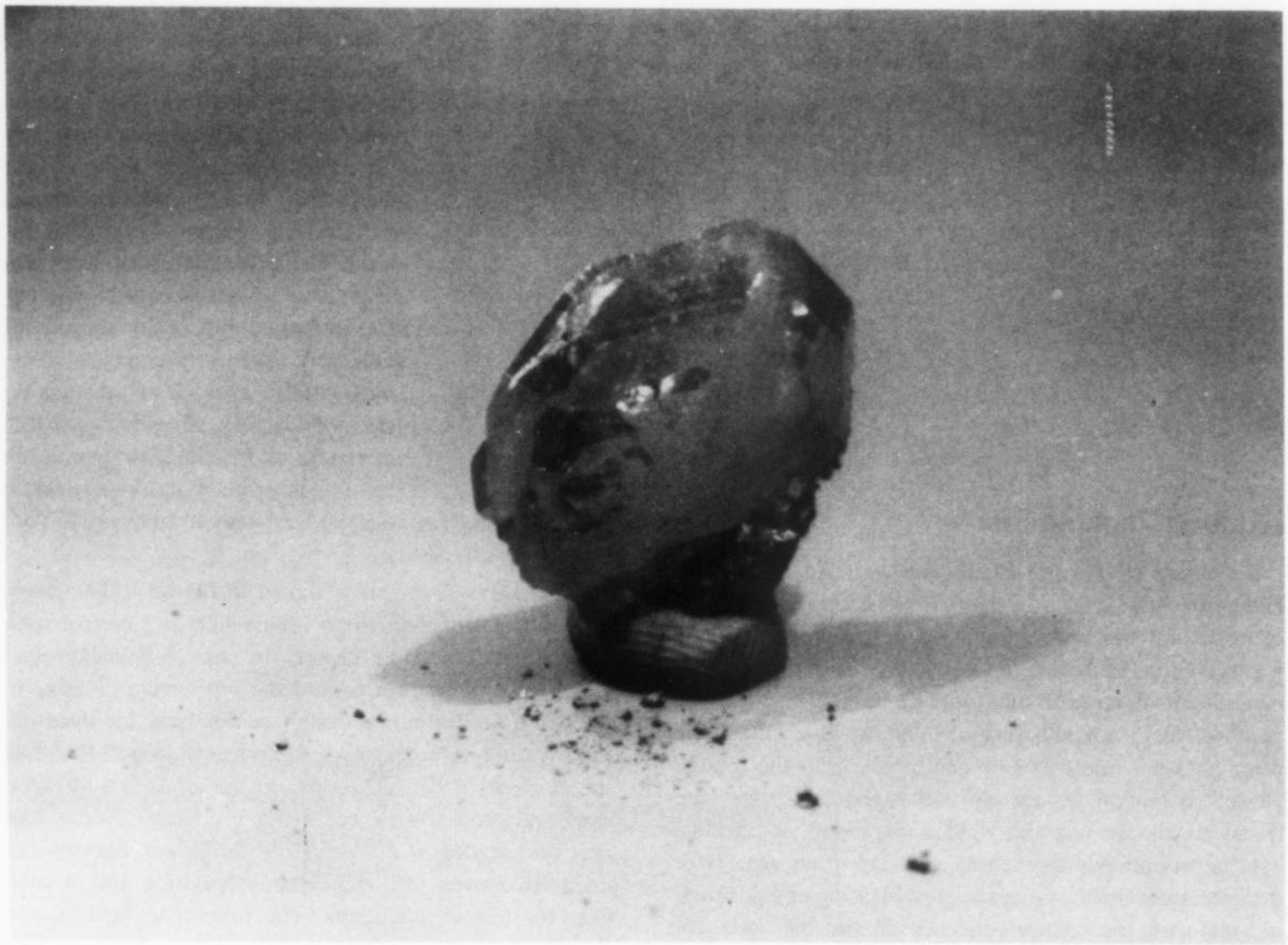


Fig. 1.

Fig. 2.

secondary types. Secondary reflections are usually much less pronounced than the other types, and allow much of the color or internal character of the crystal to show through. The fourth type is the **internal type**; it occasionally happens that an attractive reflection occurs when light passing *through* a crystal is reflected from the inside "surface" of a face. This has the effect of coloring the light in two different ways: the light has passed through the crystal twice (once on the way in, once on the way out) and becomes intensely colored by the color of the crystal. The light also may have been diffracted to produce one or several other "rainbow" colors. The colors seen in this "prism effect" are the wave lengths of light least absorbed by the crystal. It is also possible that the incoming light will be reflected from fractures inside the crystal. If the cracks are small and numerous the specimen may take on a pleasent inner glow. If a narrow beam of intense light is pumped in from just the right direction some specimens will light up like a torch! Another quality of the specimen is revealed which is not normally visible in the showcase.

Figure 4 shows a final, although still not perfect, attempt. The contrast between the top and bottom of the background has been reduced slightly. The lighting angle has been adjusted to eliminate the burnout on the top face. Notice that contrast between the crystal and the background has been maintained all around the crystal. Where the crystal is dark, as in the lower left face, the background is light, and where the crystal is light, as in the bottom face, the background is darker. This helps the crystal to stand out clearly from the background, an especially important aspect in B & W photography where color contrasts do not show up.

Fig. 3.

From this demonstration it can be seen that the photographer, if he is to produce a well-crafted photograph, must labor over his lighting with great patience. Each

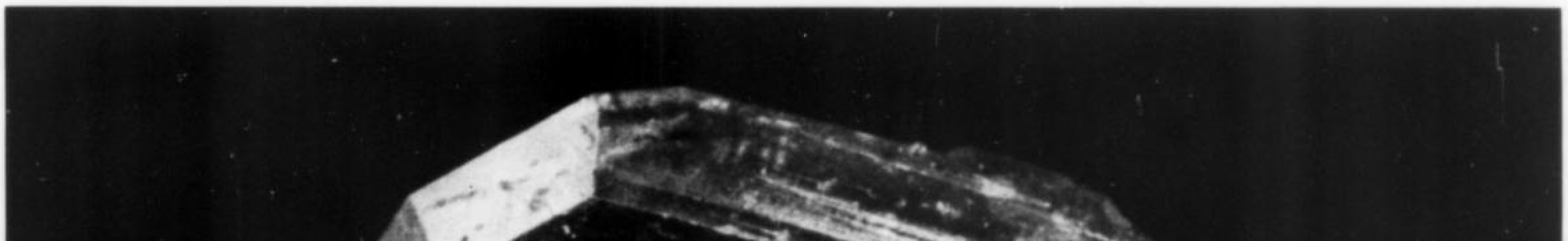


Fig. 4.

Fig. 5.

light source must be moved around to countless test positions while the effect on the specimen is observed through the viewfinder. When the main light sources (usually 2 to 4) have been modified and positioned in the best way, the use of secondary reflectors must be considered. And even with such care, only one in two or three shots, at best, will be reasonably satisfactory.

The general goal of all this monkeying around is to *define* the specimen in an attractive, dramatic, and yet faithful way. If two dark or unhighlighted faces come together on a specimen it is often impossible to tell where they actually join. This leaves the viewer uncomfortably in doubt as to the shape of the specimen. One of the faces needs a reflection of some type placed on it so both are then distinguished. By judiciously using several types and intensities of reflections for variety the total specimen can be aesthetically well-defined. Figure 5 is an example with which I am particularly pleased. Azurite crystals are notoriously difficult to photograph because they are so lustrous and appear black. Each face in figure 5 has been distinguished from its neighbors and from the background. The front face has a brighter reflection than the left face (both secondary reflections bounced off the background paper), and is separated from the upper right face by a thin, bright edge reflection. The other two faces are left black, and a couple of small, parallel crystals on the front are highlighted for variety. (This was the best of 6 shots I took of the azurite)

The disadvantage of surface reflections is that they obscure the color and internal features of transparent and translucent crystals to a varying degree. Thus they provide information to the viewer on the *surface* of the crystal while obscuring information on the *interior*. This creates an unavoidable trade-off situation, and it is up to the photographer to use reflections efficiently so as to do justice to both aspects of the specimen.

Wendell Wilson
8042 Bryant Ave. So.
Bloomington, Minn. 55420

The Museum Record

by Paul E. Desautels

As most of my readers and mineral friends know by now, I am a vigorous advocate for the accumulation of very fine and unique mineral specimens by museums. This includes all such specimens whether they be beautiful or not, large or small, inexpensive or too expensive, in or out of mineral collecting fashion. I've also made my feelings clear that such specimens should be available for reference but that their preservation is necessary primarily for exhibition and archival purposes. I'm not about to abandon this position but I'm beginning to lose the basic instinct that mineral exhibition should be composed 100% of superb specimens and nothing else.

Recently, out of curiosity, I looked up the entry under Museums in one of the standard encyclopedias. There I found a separate entry titled "museums of science". After getting over the shock of seeing the Smithsonian barely mentioned (there was another lengthy entry for this mammoth institution under S), I read the text again and quote it here in part because it has a message which may be significant for mineral museums. "Many early museums of science, *e. g.* the Ashmolean Museum (1683) at Oxford University, originated from gifts of private collections. At first most exhibits consisted of classified and labeled geological or biological specimens. Later exhibition techniques have emphasized the grouping of specimens to illustrate origins, associations, and interrelationships. Exhibition devices include habitat groups, restorations, murals, dioramas, models, and key installations in feature exhibits. The illustration of abstract ideas in biology, *e. g.* evolution and heredity, was extended to physics and chemistry, long neglected in science museums".

Now, the point is that the natural history museum, long the home of major world mineral collections, is thought of in the popular mind as a biology museum. As a matter of fact their staffs often think of them that way too. In these museums it is the biologies that have invented and pioneered in an attempt to tell people what their sciences mean. Paleontology is about the only one of the Earth Sciences admitted freely to this company because it has learned to talk in the same exhibition language as the biologies. As the encyclopedia implies, but does not actually say, chemistry and physics are actively trying to find their way to interpretive exhibits but *mineralogy has not even tried.*

It is true that in certain isolated places there are beginning attempts. The Royal Ontario Museum really blazed a new trail when it sincerely tried to explain mineralogical principles to the public in its new exhibits. But even this effort was only a spare beginning. The new mineral exhibit hall of the American Museum of Natural History, when it opens in another year, will be making a large scale, expensive attempt to do the same thing. Museologists everywhere are watching to see what these attempts are leading to. The Royal Ontario Museum, the Smithsonian, the Geological Survey Museum in London, the Cincinnati Museum of Natural History and others have been generating some rather potent new ideas for interpreting various phases of geology to visitors.

Perhaps the time is long overdue when mineral museums should invite exhibits specialists, educators, psychologists, and others outside the science, to look at the situation and to see what might be done. The zoologists have made excellent and effective use of the habitat group (although we must now speak of these in terms of environment and ecology). Life groups, models, dioramas, open exhibits, participation exhibits, etc., have all been tried. Surely there is more that mineralogy can do besides offering a systematic display or a cleavage display. There is so much to the science of mineralogy that is explainable to the general public (we do tend to underestimate their ability to understand).

I have no idea what would be the best approach, although chemistry and structure must somehow be the base on which the new mineral exhibit will be built, since they are so fundamental to all mineralogy. Perhaps we can envision a room in which museum visitors can actually walk through a maze of gargantuan size which would change its groupings of atoms and their arrangements as the visitor progressed. In sequence it could unravel visually and physically the niceties of differences in space groups, chemical substitution, and even twinning. Of course, not to lose sight of the real world, and since I am an old conservative, the path could be peppered with strategically placed showcases of fine specimens. As I say, I'm not about to suggest that this will work. All I can urge is that we should be thinking of other possibilities than the sterile, classical array of orderly ranks of specimens seen in almost every mineral museum and copied slavishly by amateur collectors at home and in all the public shows.

This kind of stance is, for me, a radical departure from previous positions I have held. However, it is something that must be faced for two reasons. First, whatever our research and other functions may be, there is strong doubt that in our exhibits we have been doing the service we think we have been doing for the general public, or even for the mineralogy student or collector. Second, if we are to maintain a strong position with our fellow natural historians we are going to be forced to show the same imagination they have employed.

Anything I've written here does *not* undermine in the least all the justification I have given in the past for a strong specimen acquisition program for exhibition and archival purposes.

AMETHYST LORE IS FOCUS OF MINERALS EXHIBIT AT AMERICAN MUSEUM OF NATURAL HISTORY

"The Nature of Minerals," a Museum Showcase, opens at The American Museum of Natural History on Wednesday, June 5. The small exhibit, located in Roosevelt Memorial Hall on the second floor enables the visitor to touch and examine a large specimen of quartz and one of beryl.

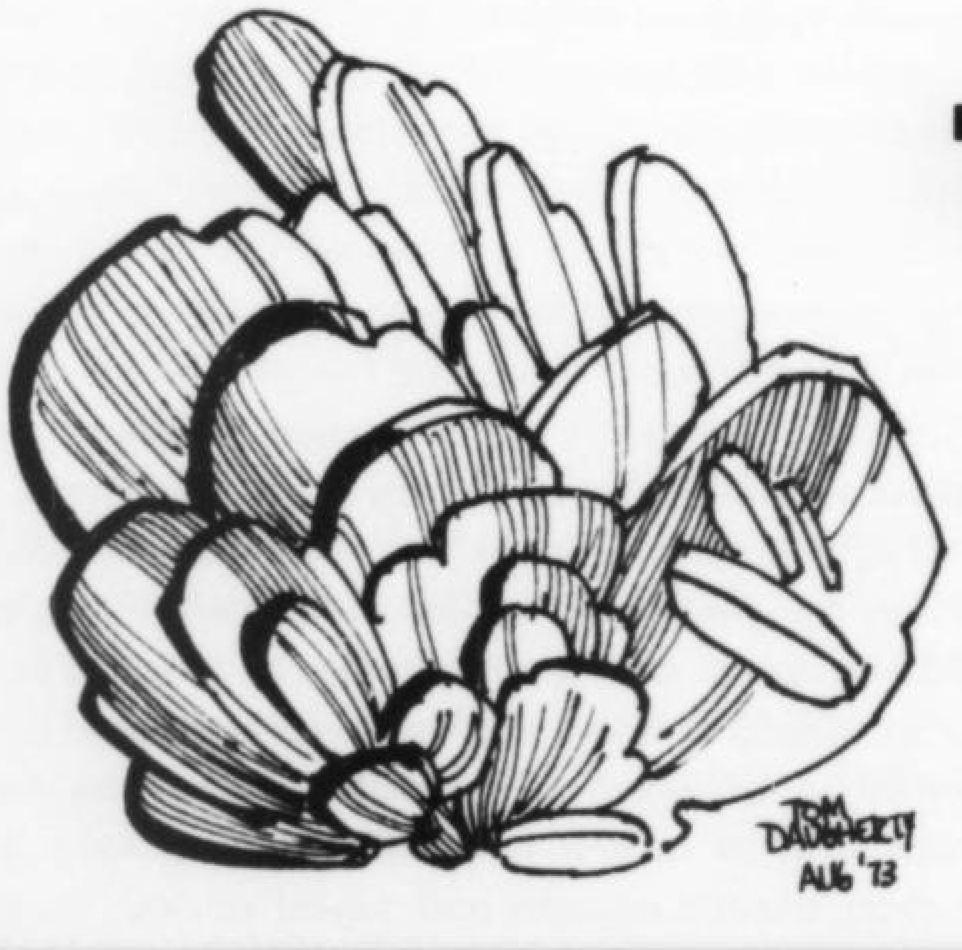
Inside the exhibit case, specimens of sulphur, fluorite, malachite, pyrite, gypsum, calcite and—star of the exhibit—the purple-to-violet colored variety of quartz known as amethyst are displayed to represent their respective relationship to the major classes of minerals, among them, elements, halides, sulfides, carbonates, sulphates, oxides, silicates and chromates.

Another section displays natural amethyst crystals from various parts of the world. In a third section, jewelry, carvings and other hand-worked examples illustrate the use of amethyst as a gemstone. It has been so used throughout the ages, the oldest record going back to 3500 B.C.

The ancient Greeks used amethyst for adornment and as a talisman in the belief that the gemstone would put demons to flight and ward off the intoxicating effects of liquor.

The exhibit "previews" a section of the forthcoming Guggenheim Hall of Minerals and Morgan Hall of Gems, now under construction and due to open in 1975. "The Nature of Minerals" will remain on public view through Labor Day.

The American Museum of Natural History is on Central Park West at 79th Street in New York City. There is an admission charge to the Museum. The amount is discretionary.



Dr. Paul Yaffe

Dr. Paul Yaffe, who died in May of this year, was many things to so many people. Over a forty-year period he served the city school system of his native Baltimore in various capacities. At the time of his retirement in 1971 he was a psychologist and a director of educational testing services for the Baltimore City Schools. A mere listing of some of his extracurricular activities gives only a glimpse into the impact he has had on his associates. Having been a sculptor for many years, Dr. Yaffe was a co-founder of the old Baltimore Art Center and himself an award winner. He was president of the Milford Hampshire Neighborhood Association, a member of the Association for Measurement and Evaluation and Guidance, a member of the National Council on Measurement in Education, a member of the National Education Association, the Maryland Teachers Association, Phi Delta Kappa, the American Oriental Society, and the Scientific Council of the Maryland Academy of Sciences. Besides being past director of vocational guidance service for B'nai B'rith, he was for 25 years a religious school teacher for the Baltimore Hebrew Congregation.

It is remarkable that he also had time to become a connoisseur of fine mineral specimens. Paul's mineral collecting friends knew him best as the very cultured, very verbal, very enthusiastic, perennial president of the Baltimore Mineral Society. The close-knit feeling among members of this prestigeous mineral society, the continued success of its programs, which include the famous annual micromount symposia, and much of the deep love of minerals found in the society can be traced directly to his own personal attitudes and his ability to convince others of their rightness.

We have always felt that Paul enjoyed and appreciated his friends at the mineral society more than he did the minerals. And yet, he knew a good specimen when he saw it. His persistent search for new and suitable calcite specimens, for example, made him known to dealers, curators and collectors all over the world. Some of them found him difficult to please because he was so particular—but all found him a gentleman in the real sense of the word and ended up his admirers.

Members and graduates of the Baltimore Mineral Society will miss Paul most in the mineral collecting fraternity. However, we have all lost a friend and a strong champion for the appreciation of mineral specimens.

COLEMANITE PSEU

Fig. 1. A very choice group of colemanite pseudomorphs on a matrix of hard colemanite impregnated sediment. Colors gra
pseudomorphs.

UDOMORPHS from the Corkscrew Mine, Death Valley, California

Gerhard Müehle
1115 San Martin Drive
Tucson, Arizona 85704

s grade from white at the base to dark brown on the edges of the

The Corkscrew mine, located in Corkscrew Canyon in the Furnace Creek borate area of Death Valley National Monument, California, recently yielded quite a number of large and unusual colemanite ($Ca_2B_6O_{11} \cdot 5H_2O$) pseudomorphs after inyoite ($Ca_2B_6O_{11} \cdot 13H_2O$). The mine previously achieved a somewhat modest reputation for its "large" and rare nobleite crystals ($CaB_6O_{10} \cdot 4H_2O$), a few of which exceeded 3 mm.[1] The mine is still a popular borate collector's haunt because of the fine colemanite specimens of an unusually rich brown to coal black color. These hues are attributable to inclusions of todorokite ($(Mn, Ca, Mg)Mn_3O_7 \cdot H_2O$). It should be noted, however, that permission to visit the deposit is hard to obtain and one can visit the mine without such permission only at the risk of being rudely ejected.

While collecting in the todorokite area, the author uncovered a large pocket of colemanite pseudomorphs after inyoite. The pocket dimensions were roughly one meter by one meter by twenty cm top to bottom. The pocket dipped approximately 40° in accord with the bedding of the old, folded lake sediments, which comprise the borate deposit. All pseudomorphs occurred on the upper wall of the pocket and exhibited all manner of orientations.

The majority of specimens collected were single "plates" with an occasional additional face or plate emerging from the prominent face. The largest single pseudomorph is seven and one half cm in maximum dimension, the average size of the specimens being around three by three cm. The diameter of the specimens, varying from two to seven mm, contrasts markedly with the otherwise large overall dimensions. A few nice cabinet size pieces, displaying several pseudomorphs on a nob of hard, colemanite impregnated sediments, were also obtained. Specimens exhibit a light to dark brown to black color which is probably the result of todorokite inclusion.

The perfection, or "faithfulness", of pseudomorphism varies because of the unusual nature of the replacement process. Some samples are merely very crude replicas. While at the same time, others are quite exact and some even show a number of parallel lines of former inyoite growth.

In 1919, A. F. Rogers analyzed two specimens from the Biddy McCarthy mine at Ryan, California. The specimens were labeled "colemanite after calcite" which turned out to be false. Rogers proved the samples to be colemanite pseudomorphs after inyoite by showing that the crystals were monoclinic instead of hexagonal. Furthermore, the interfacial angles were those of inyoite. Chemical and especially optical tests conclusively proved the specimens to be colemanite; thus colemanite pseudomorphs after inyoite. The Biddy McCarthy mine is in relatively close proximity to the Corkscrew mine. However, the pseudomorph types are radically different.

The formation of the Biddy McCarthy mine pseudomorphs, as described by Rogers, was simply the result of dehydration of inyoite to colemanite. Thus, the original inyoite crystal morphology was very faithfully preserved. The Corkscrew mine pseudomorphs, on the other hand, had a much more complicated origin and they are essentially polycrystalline pseudomorphs after inyoite.

In the author's opinion, two possible explanations for the Corkscrew mine pseudomorphs exist. The first hypothesis states that the pseudomorphs may actually be partially filled colemanite casts after inyoite molds, i.e. pseudomorphs by infiltration. From field observations in the Corkscrew mine and the Meyerhofferite tunnel (which is located close to Corkscrew Canyon), it has become appar-

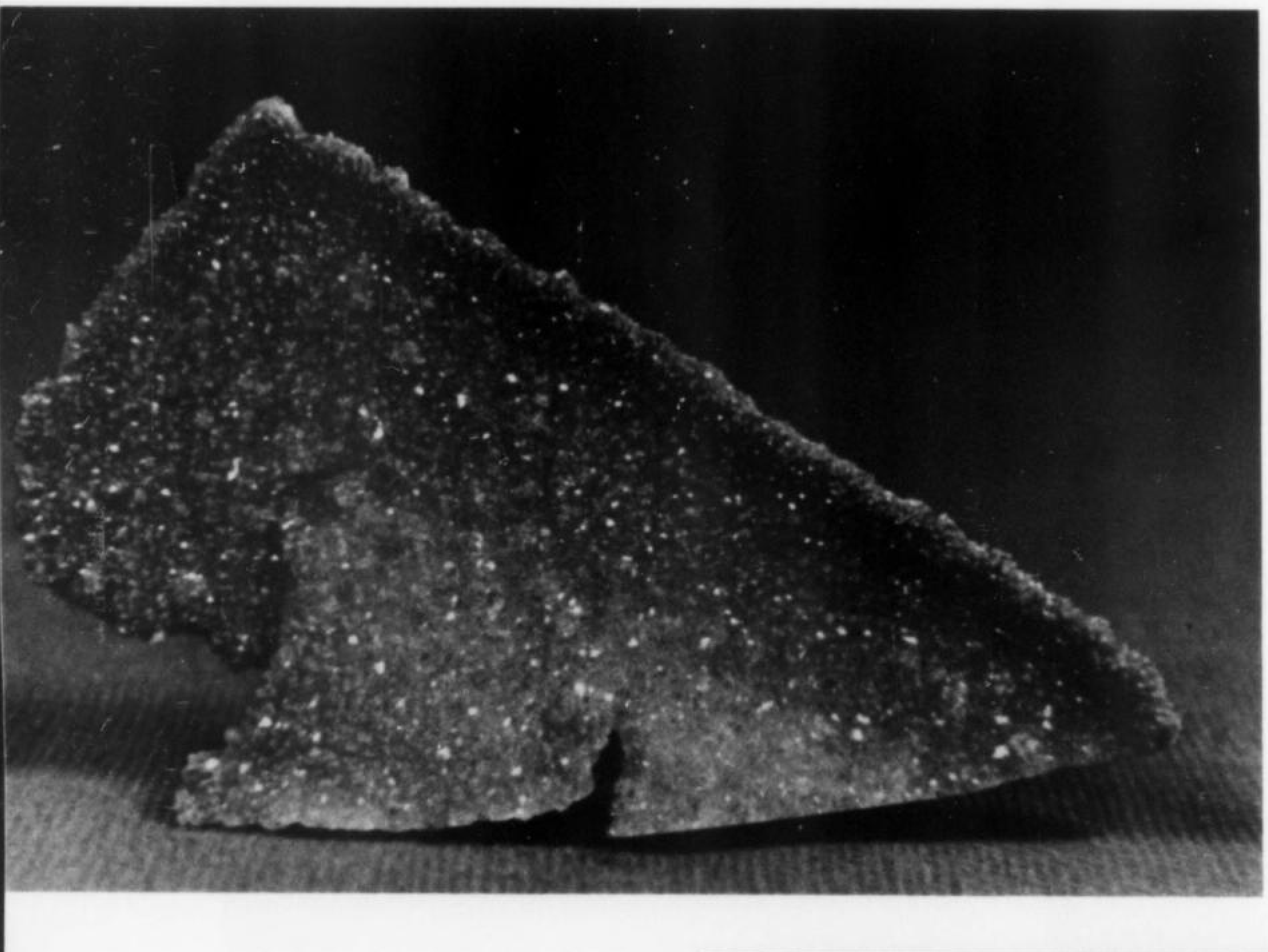


***Fig. 2.* A large single pseudomorph of colemanite after inyoite. The major edge is just in excess of 7.5 cm.**

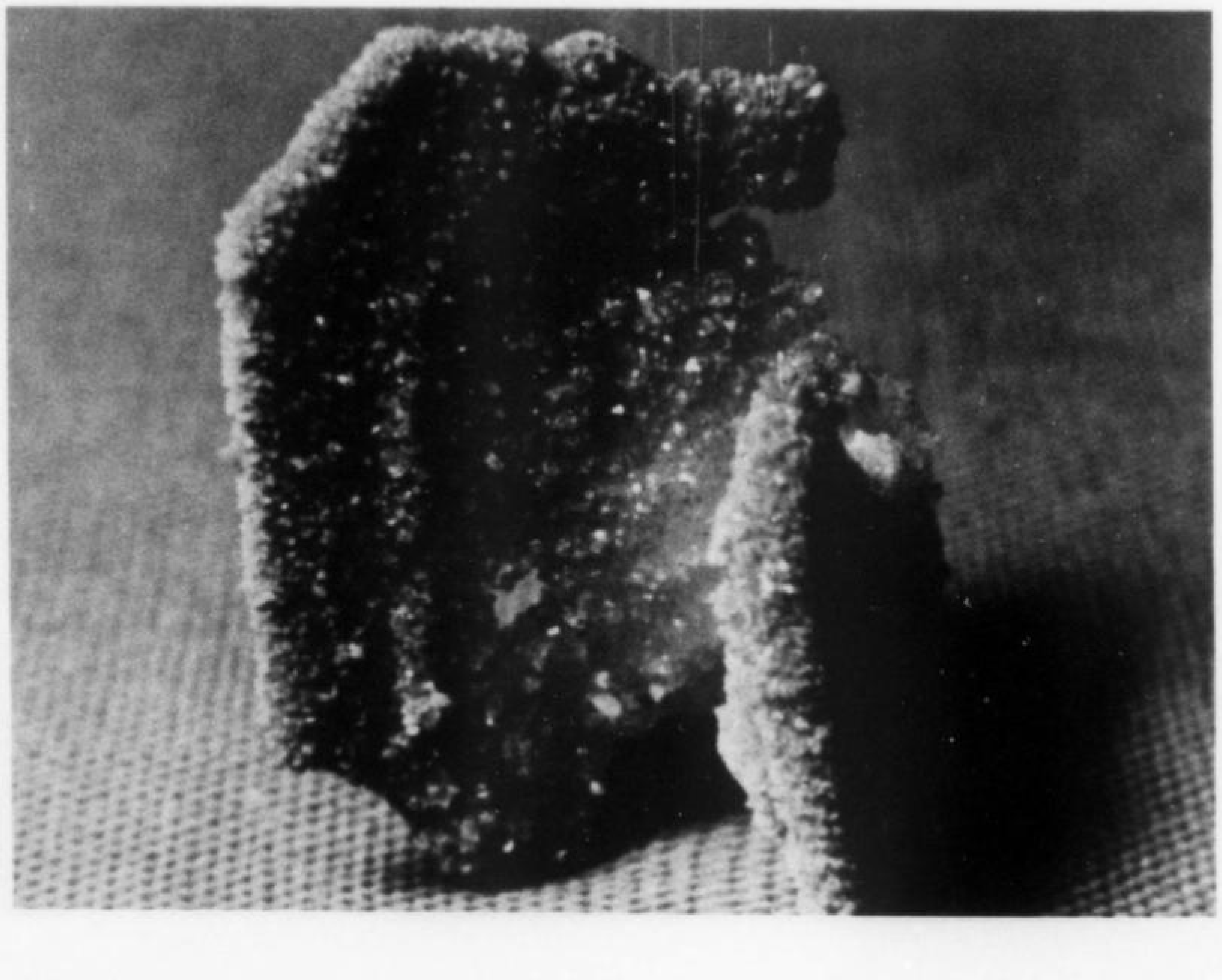


***Fig. 3.* A large miniature size pseudomorph exhibiting growth striae of original inyoite crystal growth. Specimen is approximately 4 cm by 6 cm by 3 cm.**

ent that all the pseudomorphs are of a relatively thin, broad and tabular habit, and only rarely have one or more additional side or face. Furthermore, in the Meyerhofferite tunnel, associated with the pseudomorphs were molds of inyoite in the hardened sediments. The great majority of these molds had some encrustation of minor colemanite crystals. In deducing a conclusion from these observations, a sequence of probable events may be construed. First, the inyoite crystals, having formed in the sediments, are thus completely enclosed by them. Secondly, surface waters leached out the inyoite leaving very perfect molds on the sediments. Thirdly, colemanite was deposited on the bottom and, in some instances, on the sides of the molds—not completely filling them but merely forming a two to seven mm drusy colemanite cryst. And, lastly, subsequent solutions removed portions of the enclosing sediments leaving the colemanite casts after inyoite molds free standing.

As mentioned, a second possibility of explanation exists. This hypothesis relates to free standing inyoite crystals (or meyerhofferite pseudomorphs after inyoite). The author has observed numerous specimens of inyoite and has never seen colemanite on them. However, on a few specimens of meyerhofferite pseudomorphs after inyoite, minute encrustations of colemanite were observed. These partially covered one to several of the pseudomorph's faces. Thus, a possibility for pseudomorphism by encrustation exists. The free standing inyoite crystals first pseudomorphed by dehydration to meyerhofferite. Secondly, a subsequent deposition of minor colemanite on the pseudomorph resulted. And, finally, the meyerhofferite was removed by solutions. This left tabular, free standing, partial encrustation pseudomorphs.

Previously mentioned was a faithful preservation of original inyoite crystal growth lines. These striae parallel the pseudomorph's edge, and seemingly could owe their preservation to either or both of the presented hypotheses.

In conclusion, the author favors the first hypothesis regarding the formation of the colemanite pseudomorphs because a greater porportion of the available evidence supports it. However, the second theory may be equally valid and perhaps in actuality both processes were responsible in the different areas discussed. Whatever the answer may be, the specimens are no less significant. And, with complication comes the pleasure of contemplation.

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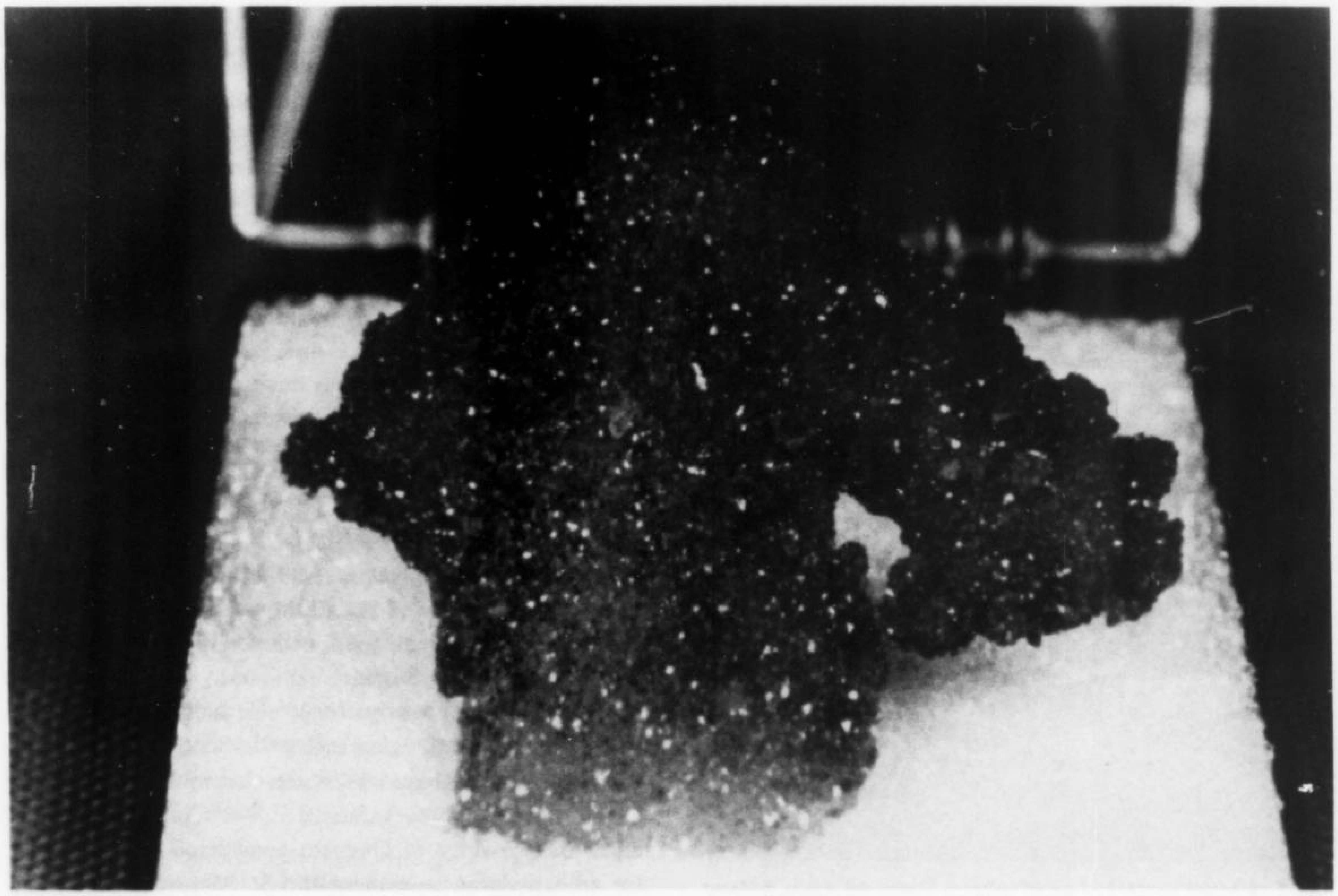

Fig. 4. **A very resplendent and deep brown colored specimen. Size is indicated by specimen box which is about 6.5 cm on an edge.**

THE DISCOVERY OF APATITE

on the Lièvre River. Quebec

Donald D. Hogarth
**Department of Geology, University of Ottawa
Ottawa, Canada**

Fig. 1.* A large crystal of apatite from Emerald mine, Lièvre River area, collected in 1884. *Photograph Courtesy Geological Survey of Canada.

Abstract

Apatite deposits and large apatite crystals were first described from the Lièvre River by Lieutenant F. L. Ingall, of the British Army, in 1829. The exact location is, however, in doubt, it being likely that Ingall confused the Cedar Rapids Portage with the true location, the Litttle Rapids Portage, some 30 miles downstream.

INTRODUCTION

For about 100 years the Lièvre River area has been known for fine specimens of minerals. Particular mention may be made of apatite, whose large crystals grace the cabinets of many museums throughout the world. Others, due to their size, attracted attention but could not be removed intact. In September 1884, a green crystal with a girth of 62½ inches and weighing 550 lbs (other published estimates are 700 and 800 lbs)[1] was taken from the Emerald mine (see Fig. 1 for location) and donated to Mr. W. A. Allan of Ottawa. It was displayed in the Colonial Exhibition in London and subsequently presented to the Geological Survey of Canada (where it now resides). In November 1889, perhaps the gargantua of them all was discovered at the Aetna mine: "A perfectly formed" crystal, 7 feet long and 4 feet wide and estimated to weigh 6 tons[2]. The property owners (The Anglo-Continental Guano Company) took great pride in showing this crystal, *in situ*, to visitors of the mines. For several weeks, the operators attempted to extract this crystal intact, but in the end the crystal was broken.

Apatite itself, largely due to "sugar phosphate" from the Lièvre Valley, was one of Canada's leading mineral products from 1880 to 1890. Other minerals associated with the apatite were phlogopite, diopside and scapolite, themselves common in well formed and giant crystals.[3]

Today, after being abandoned for 80 to 90 years, the mines are in a poor state of repair. Most of the pits are flooded and the dumps are largely grown over, but coarse-grained apatite, at least as fragments of large crystals, is not difficult to come by. It is now interesting to look back on the history of these famous mineral localities and carefully examine the claim of Lieutenant Ingall to the discovery of these deposits in 1829.

FREDERICK INGALL (1795-1862) AND THE FIRST ST. MAURICE EXPEDITION

Frederick Lenox Ingall was born in England and entered the Militia at the age of 14 and the British Army at the age of 18. In 1827 he re-enlisted for service in Canada, as Lieutenant in the 15th Regiment of Foot, having served in Canada twice previously. Ingall's hobbies were Natural History (particularly geology) and amateur theatricals.

When, in the spring of 1829, the Commissioners for the Committee of Crown Lands of Lower Canada (later become the Province of Quebec) considered appointments for an expedition to explore the St. Maurice and Lièvre Rivers, Ingall, with this Army training, administrative abilities, knowledge of geology and other sciences, seemed an obvious choice to undertake its leadership. Ingall was highly recommended by none less than George Ramsay, 9th Earl of Dalhousie (Governor General of the Canadas, 1820-1828) and Sir James Kempt (Governor General of the Canadas, 1828-1830). He therefore filled the post by acclamation.

In June, 1829, the Council of the Natural History Society of Montreal issued Ingall a set of guidelines for acquiring a collection on its behalf.[4] Minerals, as good, transparent crystals were to be specially favoured but those of bluish, light green or purple color should also be sought. The specimens were, for the most part, to be 4 or 5 inches in length, 3 inches in breadth and 3 inches in depth. Duplicates were discouraged.

In late June, the party, consisting of Lieutenant Frederick Ingall, 15th Regiment, leader, Ensign Henry Nixon, 66th Regiment, meteorologist, Joseph Bouchette, Jr. (later replaced by John Adams), surveyor, and six voyageurs, set out from Three Rivers.[5] They travelled by canoe and portage up the St. Maurice River, to Wemintichingue Post (near the present village of Sanmaur), some 200 miles above Three Rivers, then westward to the source of the Lièvre, thence downstream to the Ottawa, to Montreal, and then Quebec; the entire voyage taking about 4 months and overdrawing the budget some £100 (beyond the allotted £500).

Amongst the items forwarded to the Natural History Society of Montreal, were 182 geological specimens.[6] This generosity failed to overwhelm the Society who complained "from the circumstances under which these were obtained, there will be found many specimens of trifling value. Many are of small size and poorly characterized, and many are duplicates, and have been retained only till better specimens could be procured.[7] " Regardless of these failings and perhaps in return for a donation of biological specimens, Ingall was elected a Corresponding Member of the Society on November 30, 1829.[8] Duplicates of some of the specimens were given to the Literary and Historical Society of Quebec.[9]

A MYSTERIOUS REPORT OF APATITE

The first reference to apatite on the expedition is to a specimen of "calcareous spar [calcite] containing crystals of apatite and mica" from an unspecified location at Lac des Sables.[10] The party arrived at Lac des Sables on the evening of October 11 and left on the morning of October 15. It was, however, at the Cedar Rapids Portage on the Lièvre River, 5 miles below Lac des Sables, that Ingall records apatite in "immense quantities". The initial discovery of the large apatite deposits of the Lièvre Valley is sometimes ascribed to Ingall, for his discovery at Cedar Rapids, but before we assign absolute credit in this discovery, the record should be carefully examined.

At noon on October 15, 1829, the party reached the southern end of the Cedar Rapids Portage on the Lièvre River, not far from the present site of Notre Dame du Laus. We quote from Ingall's *Remarks*[11] as follows: "about 10 yards from the west [south] shore, rises a hill of syenite, about 200 feet in circumference, covered with moss and trees. The channel between it and the main shore, consists of calcareous spar, abounding with mica... Immense quantities of apatite (the phosphate of lime) were aggregated in veins, running through the calcareous spar, in the dry channel between the syenite hill and the main shore". Elsewhere in the *Remarks*[12] Ingall notes "calcareous spar, abounding large crystals of apatite and containing some mica, from the Cedar Portage, River Au Lièvre".

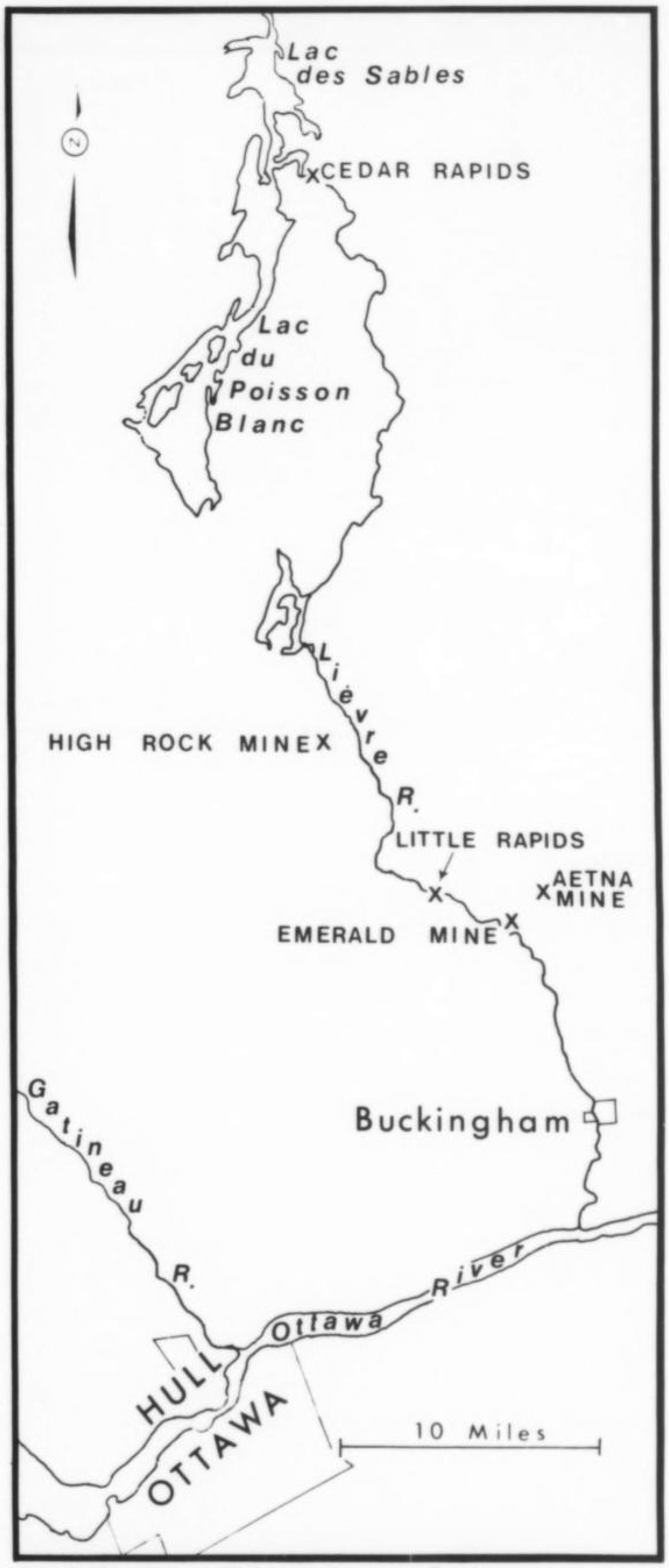

Fig. 2. **The Lièvre River apatite area, Quebec.**

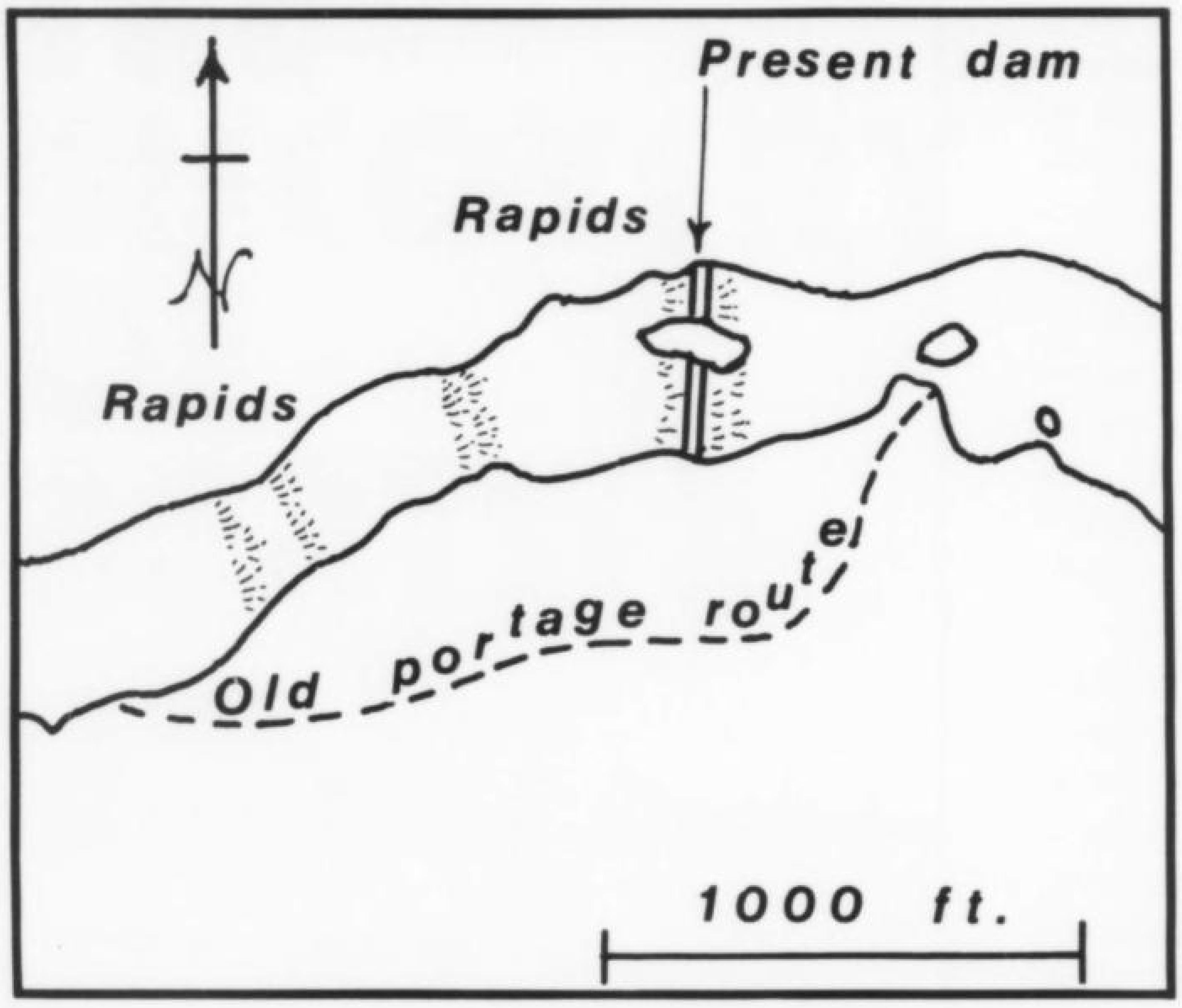

Fig. 3. **The Cedar Rapids Portage drawn from air photographs and old maps.**

It is well known that this location lies outside of the zone favourable for apatite as outlined by Henry Vennor[13], Hugh Spence[3] and others. Investigation of this area by the writer on several occasions, has revealed small quantities of apatite in tiny blue and green crystals, but only after a painful search. "Immense quantities" are certainly not to be found.

One is left with a dilemma for which there would seem to four possible solutions:

1. Ingall is guilty of exaggeration and *immense quantities of apatite* should, more correctly, read *small quantities of apatite*. This solution could seem to be unlikely.
2. Apatite was mistaken for some other mineral. Diopside here is rather abundant and somewhat similar in appearance to the apatite of southern Norway (which Ingall may have seen in museums). It should be remarked that no mention of diopside, an abundant mineral in the "dry channel" was made either in the *Journal* or *Remarks*.

3. The exact location on the Cedar Rapids Portage (see Fig. 2) has not been found in recent years. It is possible that high water has inundated the lower Cedar Rapids and the dry channel described by Ingall now lies three feet below the surface of the water now separating the peninsula from a small island to the north. (The island does not appear on old maps). In this case Ingall's syenite becomes biotite gneiss instead of calc-silicate rock.

Three specimens in the Redpath Museum of McGill University (catalogues NS 4604A, NS 4604B and NS 4605) were inherited from the Natural History Society of Montreal and may be the specimens collected by Ingall from either Lac des Sables or the Cedar Rapids Portage. The specimens contain granular aggregates (up to ½ inch long) of blue apatite with yellowish calcite, white diopside and very pale phlogopite. Similar rock has been seen by the writer at both Cedar Rapids and Lac des Sables, but unfortunately no locality is given with the Museum specimens. In the specimen trays are the labels "No 15 of 1839, formerly 89" and "No 89 is the blue apatite. If so is it not a rare colour? Also is not the base scapolite? It fuses like it. I have a specimen of hauyne of blue colour-can it be that mineral"? The handwriting on the latter label resembles that of F. L. Ingall.

It should be recalled that Ingall described the Cedar Rapids' rock as "abounding in large crystals of apatite" which hardly seems to fit these specimens. Nor can we imagine immense quantities of the mineral lying below the narrow flooded channel. Blocks and boulders on the shore contain almost no apatite.

4. The locality is misquoted in the *Remarks* and *Table 1* It is possible that the apatite was discovered at the Little Rapids Portage, some 30 miles downstream and visited on the afternoon of October 16. Here there were deposits of apatite that could well have been described as "immense." These deposits were discovered (or rediscovered) in the summer of 1872 and became known as the Garrett or Little Rapids mine. There was, immediately at the foot of the rapids, a solid but irregular mass of green crystalline apatite, 15 feet long and 9 feet wide. The apatite was coarsely crystalline and associated with some calcite and a little phlogopite. Smaller masses occurred in the immediate vicinity.[8] The location is now flooded by water from the Little Rapids dam.

The writer favours the last possibility. In his rush to run the final stretch of the Lièvre River, Ingall may have omitted the apatite discovery from his notes (there is no entry in the *Journal*) and the record in the *Remarks* may have

Fig. 4. A dry channel at Cedar Rapids Portage, possibly the one referred to by Lieut. Ingall in 1829.

been purely an afterthought. Other specimens collected by the expedition might shed some light on the situation but, unfortunately, the collections have been split up and most of the labels lost. Ingall's fieldbook has likewise disappeared. The problem may never be solved.

ACKNOWLEDGEMENTS

The writer would like to acknowledge the kind assistance of Mrs. Louise Stevenson, Curator of Geology, Redpath Museum (*sic*. Mrs. Louise Stevenson, Curator of Geology, Redpath Museum, McGill University...) McGill University, Montreal, and the helpful suggestions of Miss L. M. Rider, Reference Department of the Library, McGill University. Much of the literature background was taken from holdings in the Manuscript and Book Divisions of the Public Archives of Canada.

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MINERALS OF THE PIKE'S PEAK GRANITE

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Richard M. Pearl
Colorado College, Colorado Springs

The huge, compound body of rock known as Pikes Peak granite is an interesting and productive source of a diversity of minerals long familiar to and popular with collectors and museums. Certain of its specimens are so distinctive that they can be recognized at sight anywhere in the world. Several of its species, individually and in association, rank with the minerals most in demand among experienced collectors.

The purpose of this article is to survey the Pikes Peak granite and its minerals, and to summarize the knowledge we have today regarding them. It places the region briefly in its historical and geographic setting, and the rock and its mineral constituents in their scientific relationships. No complete list of minerals is attempted, but significant aspects of occurrence are presented. A "complete" bibliography would be impossible, and an extensive one hardly necessary here, but the basic literature is included, emphasizing publications dated 1973.

The Pikes Peak granite is obviously named for its presence on Pikes Peak. Although probably the best known high mountain in the United States and certainly the one whose summit is most often reached—by trail, highway, and cog road—Pikes Peak was, though its historic symbol, never actually involved in the well-remembered Pike's Peak or Bust adventure, which took the gold seekers of 1859 to the so-called Pike's Peak Country, a vague region west of Denver.

The Pikes Peak granite is a composite batholith exposed over an area of some 1,100 square miles (2,800 square kilometers). George I. Finlay, a distinguished predecessor of mine at Colorado College, described its petrology in U. S. Geological Survey Folio **203** (1916), which superseded Folio **7** (1894) by Whitman Cross and the first description by Edward B. Mathews (1895). Finlay noted 10 different types of granite and mapped four of them as Pikes Peak, Cripple Creek, Windy Point, and Mount Rosa granites. Folio **203** gives a selected bibliography to that date.

Robert M. Hutchison at the Colorado School of Mines has studied the granite for several decades and has most recently (1973) labelled the Pikes Peak body as a composite pluton in which he has distinguished three structurally separate but texturally intergrading centers named Buffalo Park, Lost Park, and Pikes Peak. Glenn R. Scott of the U. S. Geological Survey has led his crew on detailed field studies just now reaching the stage of publication. Their reconnaissance map of Scott and Wobus (MF-482, 1973) shows 10 rock units associated with the Pikes Peak granite and gives seven major references to date. Nomenclature and correlation are obviously not completed.

The radiometric age of the granite at which time it intruded the Idaho Springs formation (gneiss, schist, quartzite) is 1.04 billion years, followed by the formation of five satellitic stocks at 1.01 billion years ago (Hutchison).

These evidences of later but still Precambrian activity are somewhat more interesting to the mineral collector than the ordinary minerals of the granite, which are chiefly reddish microcline feldspar (often porphyritic), quartz, hornblende, and biotite. Also of interest are the occasional segregations of hematite, galena, and other metallic min-

Fig. 1. **Phenacite on microcline (amazonite). Topaz Butte (old name for Crystal Butte), near Florissant, Colorado. Crystal approximately 1/2".** ***From the collection of Richard and Linda Kosnar.***

erals; on a few such pockets, small mines have been worked from time to time.

The minerals of specimen interest, however, are almost solely pegmatitic. The scarceness of metallic minerals in veins suggests that the upper levels of the granite have long since been stripped away by erosion. The interior of the body, where the pegmatite remains abundant, has now been exposed. An explanation of pegmatite origin is out of place here except to say that it is generally believed to represent late stages of magma (molten rock) cooling-solidification-crystallization. The open spaces ("pockets"), or miarolitic cavities, produced by shrinkage may be lined or partly or even completely filled (as "frozen pockets") with crystals deposited by the circulating hot fluids before they leave the cooling magma. This is at least the conventional view, good enough for our purpose. The pegmatites exist in the granite, in the older metamorphic rock, and with the injection gneiss that combines the two. Zoning is in places conspicuous.

Frost action and perhaps earth movements have riven many of the minerals apart. Elsewhere, iron oxides have rusted them, sometimes beyond repair. (Clarence G. Coil and others have described detailed methods of cleaning Pikes Peak specimens in *Cleaning and Preserving Minerals*, by Richard M. Pearl.) Certain sizes, shapes, colors, and associations are typical of certain localities within the Pikes Peak region, but there is more likeness than dissimilarity, making it often somewhat difficult to state the exact locality of a given species. Altogether, however, there is so much variability and so many millions (literally!) of potential pegmatite bodies—"all the way down to China," I tell my students with more enthusiasm than scientific accuracy—that this region can never be thought of as becoming worked out.

Now, a few words about actual collecting conditions. First, you must keep in mind that accessibility is relative; mineral claims and other private property rights restrict digging to land held by the U. S. Forest Service. Even so, the present-day concern with ecology does not allow as much leeway as previously. Explosives may be forbidden. The Pikes Peak region is no different from any other part of the country in this respect, however.

Second, a body of pegmatite may exist almost anywhere, and so digging seems feasible only where favorable signs are visible. Quartz float is the chief clue—the late Edwin W. Over, Jr., told of finding nearly 1,000 pegmatites on St. Peters Dome alone by this method. Tree roots tend to detach minerals and bring them to view. No place can be said to be barren until proved so.

Next, the minerals. Amazonstone (amazonite), the bluish-greenish variety of microcline—the cause of the color has been much discussed, especially in Soviet literature, but remains uncertain—is the most noted. Smoky quartz, perhaps smoked by irradiation of the radioactive thorium-

Fig. 2. **Topaz. A fine crystal, clear in color. Originally found by Ed Over. Crystal size about 1-1/2" across.** ***From the collection of Richard and Linda Kosnar.***

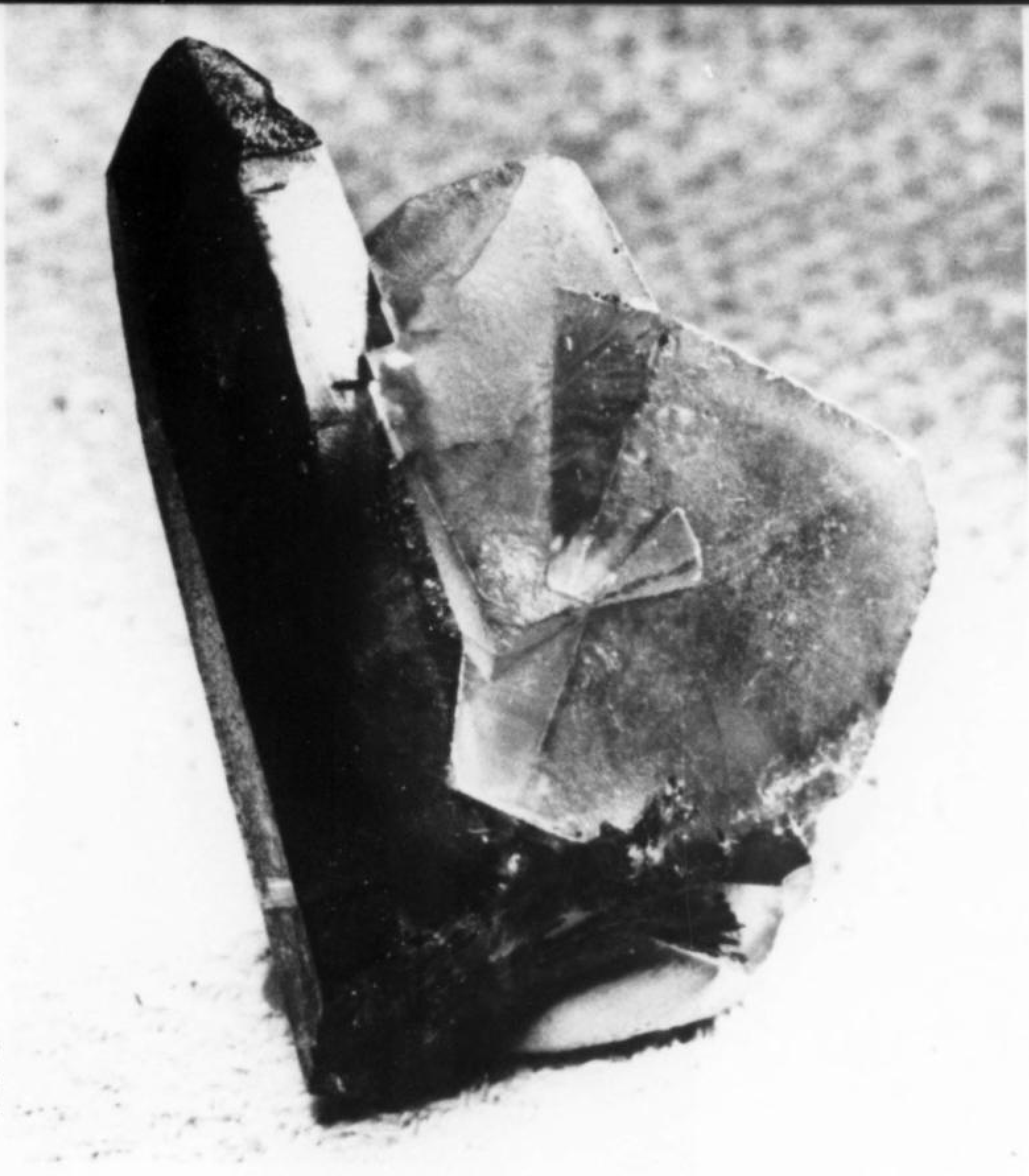

Fig. 3. **Smoky quartz and Fluorite. Nice smoky about 2-1/2" long with pale blue fluorite cubes.** ***From the collection of the Clarence Coil family.***

uranium in the associated zircon, is greatly desired. Amazonstone and smoky quartz make the most highly prized groups of specimens. Rock crystal is sometimes found in crystals weighing tens (perhaps hundreds) of pounds. Topaz, especially the blue; phenakite (usually not recognized); goethite clusters of superb quality; and brown zircon crystals are also in demand. Although none of these is "common," most (except zircon) are now being extracted in sizes and qualities exceeding the best of the classic days.

The Crystal Peak area begins about 2 miles north of Florissant, where the Florissant Fossil Beds National Monument was established in 1969, though not yet fully developed. This area is a rectangle of about 3 square miles, with Crystal Peak the center. The Crystal Beds was the name given to the 3-mile stretch of granite knobs, of which Crystal Peak is the highest. In the older literature, Crystal Peak was called Topaz Butte; locally, it was known as Cheop's Pyramid and the Sore Thumb. Little Crystal Peak, Deer Mountain, and Sheeps Head are other knobs.

In the 1880's, Dr. A. E. Foote, Philadelphia mineral dealer, had a crew of up to 19 men digging in this area, which is important for amazonstone (especially), smoky quartz, topaz, phenakite, and amethyst. Fluorite, goethite, columbite, cassiterite, hematite, allanite, and a few common minerals of no specimen interest also occur here.

Another locality is Crystal Park, a rather level, terrace-like area at the base of Cameron Cone (10,709 feet high). On the slopes of this mountain, which overlooks Manitou Springs and the Garden of the Gods, have also been found the amazonstone, smoky quartz, rock crystal, topaz, and phenakite for which this area is noted. Some of the topaz is pinkish; in 1887, the best phenakite crystal in the United States (460 carats) came from here. Fluorite, columbite, biotite, hematite (in quartz and as pseudomorphs after siderite), hornblende, black tourmaline, and zircon also come from this area.

The author believes Devils Head (9,348 feet high), and especially Long Hollow, to be the best long-term locality in Colorado, good for centuries to come (and especially noted for fine topaz and the first gadolinite in the United States). Large smoky quartz, much rock crystal, a little amethyst, several kinds of feldspar, and minor minerals (including cassiterite, allanite, cyrtolite, and samarskite) also come from here.

From the former Stevens Ranch locality (privately held), Clarence G. Coil has recently taken at least the single finest amazonstone crystal ever found anywhere, and perhaps the two best. The Pikes Peak granite extends to the Royal Gorge, where dozens of quarries have been worked in the past.

The famed gold and silver tellurides of Cripple Creek are indeed found within the Pikes Peak granite, but this Tertiary volcano is entirely unrelated to the enclosing Precambrian rock except by accident of geography, for this is where the eruption occurred, controlled by jointing in the granite.

In spite of the similarities, a few remarks about some of the special features of the Pikes Peak region seem in order.

Fig. 4. **Zircon. Intergrown crystals of chocolate brown, about 3/4" each. Found in 1946 in North Cheyenne Canyon, near Colorado Springs by George White and presently in his collection.**

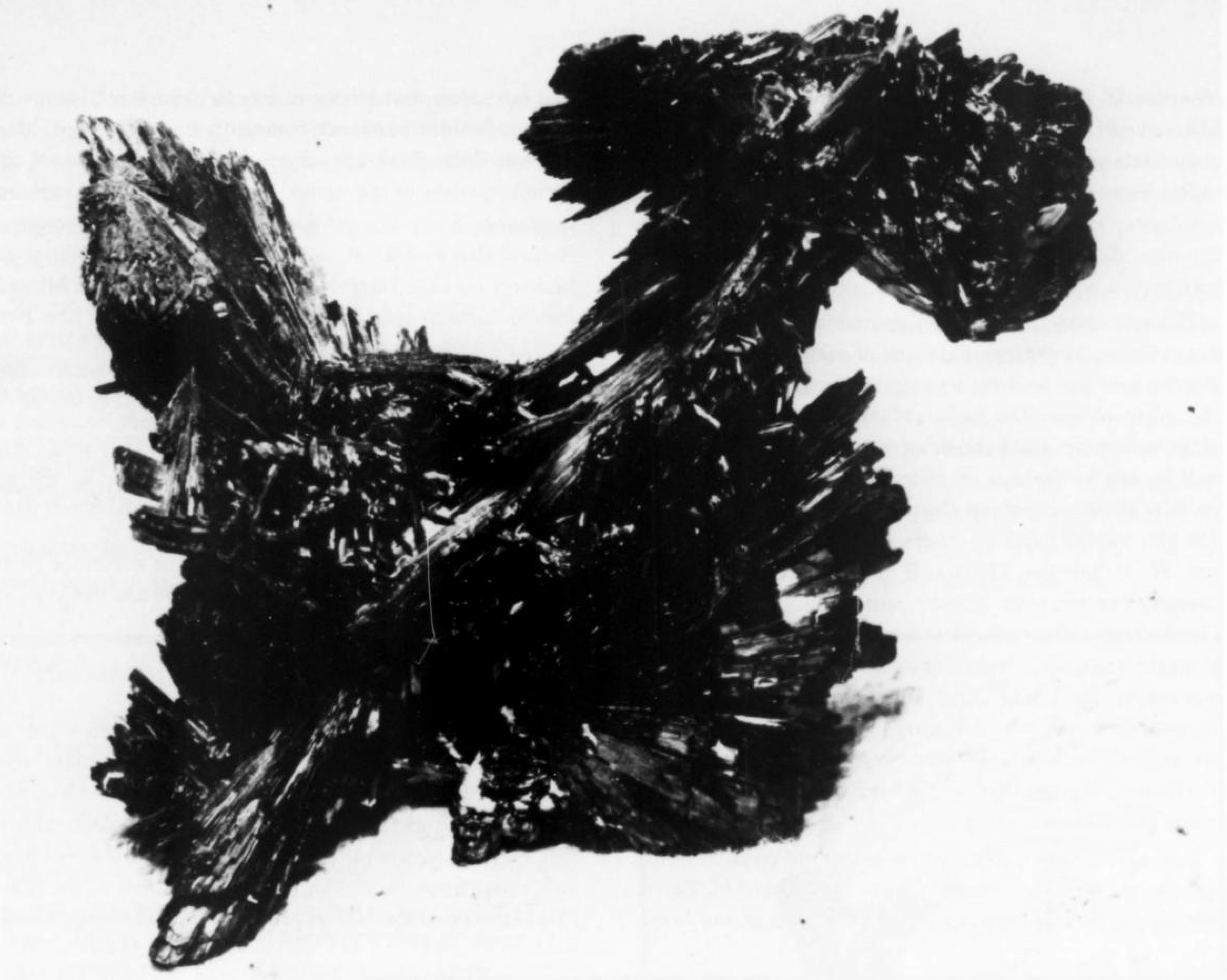

Fig. 5. **Goethite. Charming specimen about 3-1/2" across.** *From the collection of the Clarence Coil family.*

Doubtless, other aspects have been observed without being put in the literature—perhaps purposely because they have proved to be helpful to an individual in his prospecting.

At Crystal Park, a coarse, white phase of the Pikes Peak granite has yielded the best gem specimens. Glen Cove—a ski area, the only mineral locality on the peak itself—is the most dangerous place to work, but its blue topaz of fine quality attracts daring souls. The Crystal Peak area has produced the best amazonstone, excluding one or two privately held properties elsewhere. At Devils Head, the most productive pockets seem to be those having the least iron—a double virtue. The clearest rock crystal here is associated with the best topaz. In this area, amazonstone is not of especially good quality, however.

Two distinctive and rather separate aspects of the Pikes Peak pegmatites should be given individual attention. One is the fluorine-rich area of St. Peters Dome, a 9,665-foot conical peak situated along the Gold Camp Road between Colorado Springs and Cripple Creek. The other is the highly mineralized district known as Royal Gorge Park, on both sides of the Grand Canyon of the Arkansas River, where more different minerals are known than anywhere else in Colorado.

The St. Peters Dome district—the name Mount Rosa belongs here—includes well-known names such as Stove, or Cook Stove, Mountain; Sugarloaf Mountain; Specimen Rock (yielding the first phenakite in the United States); Sentinel Rock; the Eureka tunnel (zircon especially), and the Duffield mine (fluorite and barite). Either this part of the Pikes Peak granite was enriched in fluorine or else later solutions containing such fluorine penetrated it. Purple fluorite is everywhere, both in the granite and its veins and pegmatites. (The last is debated in the *Mineralogical Record*, volume 3, 1972, page 180 and volume 4, 1973, pages 94-95.) Some fluorite is green or white. The other fluorine-bearing minerals are generally difficult to recognize, some have been wrongly identified in the past, and some are hard to find. The names include weberite, cryolite, pachnolite, gearksutite, prosopite, bastnasite, thomsenolite, ralstonite, elpasolite (named for El Paso County), and fluocerite. Astrophyllite, not a fluorine mineral, is famous here, the first in the United States and the most zinc-enriched yet recorded (*Mineralogical Magazine*, volume 39, 1973, pages 97-111). Riebeckite is a distinctive mineral. Zircon, some gemmy but always small, is likewise important. Genthelvite is known only from this locality.

(See also E. B. Gross and E. William Heinrich, *American Mineralogist*, volume 50, 1965, pages 1273-1295.) Additional minerals in the pegmatite include pyrochlore, cassiterite, rutile, fergusonite, xenotime, fayalite, columbite, galena, sphalerite, chalcopyrite, hematite, pyrite, molybdenite, aegirine, thorite, microlite, monazite, kasolite, lanthanite, bertrandite, sericite, and perhaps doverite.

The scattered (18 or more) pegmatite bodies near the Royal Gorge have yielded dozens of minerals. This is, unlike the previous locality, an easy and productive place (or places) to collect. The names Mica Lode, Meyers quarry, Magnuson mine, and School Section mine have been made well known in modern times by E. William Heinrich (especially *American Mineralogist*, volume 33, 1948, pages 420-448, 550-587) and by others, particularly W. P. Headden, W. T. Schaller, Douglas B. Sterrett, and Kenneth K. Landes. The minerals include garnet, fluorapatite, native silver, chrysocolla, malachite, azurite, covellite, chalcocite, monazite, euxenite, lepidolite, columbite-tantalite, beryl, tourmaline (including gems and large "suns"), chlorite, montebrasite, natromontebrasite, triplite, beyerite, bismutite, and others. Vast amounts of graphic granite, a distinctive feature of pegmatite, occur here with several kinds of quartz and feldspar.

Logs to the main nonprivate localities are given in *Colorado Gem Trails and Mineral Guide*, by Richard M. Pearl. They are hopefully exact enough to lead you in and bring you out safely, but a few readers have probably never returned. Besides, roads are constantly being changed. Magnificent Pikes Peak specimens are on display in all the great museums of the world. Visitors to Colorado are encouraged to see the exhibits in the Denver Museum of Natural History and, at Colorado Springs, in the Pioneers' Museum (installed largely by the Colorado Springs Mineralogical Society) and the case in the lobby of the new Penrose Library (a gift of the Coil family).

Some readers might be interested in figures as to size of specimens. Smoky quartz weights have been recorded as 400 pounds ("lost"), 135 pounds (Lake George), 62 pounds (Devils Head), 45 and 44 pounds (Devils Head), 36, 32, and 26 pounds (Lake George).

Amazonstone seems to have reached its maximum of 18 inches in the Crystal Peak area. Qualities are variable, of course, and so are values.

Topaz crystals 2 feet long and one of 17.5 pounds have come from Devils Head.

At the Royal Gorge, tourmaline "suns" up to 4 feet in diameter have come from the School Section mine, and individual crystals have been 3 x 8 inches. Apatite 8 inches long, triplite 6 inches long, block crystals of microcline 6 feet long—these are other finds. Biotite blades 4 feet long have come from the Van Buskirk mine nearby. At the Mica Lode have been found blue-green beryl 6 feet long, masses

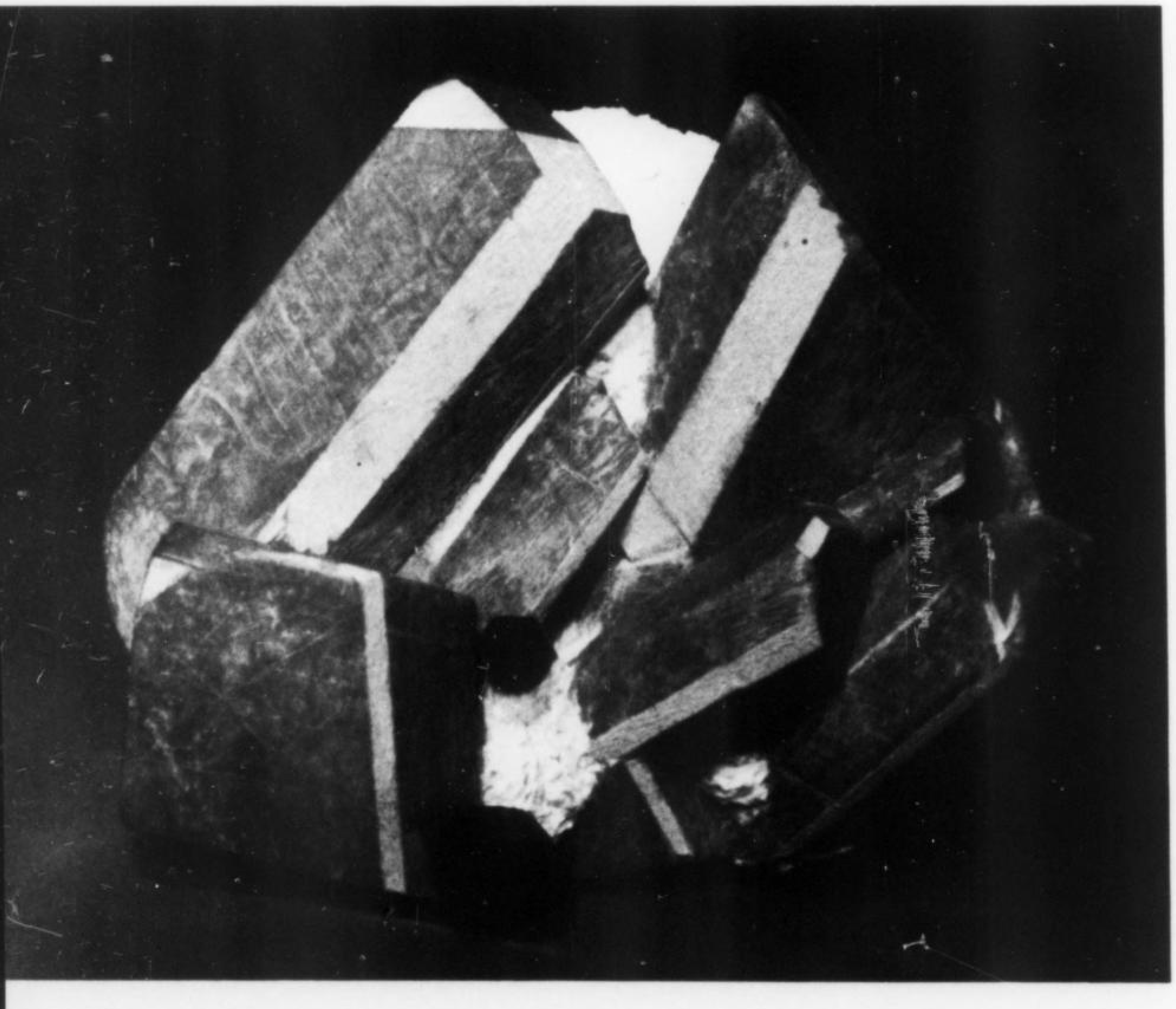

Fig. 6.* Microcline (amazonite). Large crystals on a plate of white albite with an oriented overgrowth of albite and associated with several small smoky quartz crystals. Specimen about 8" across. *From the collection of Richard and Linda Kosnar.

of triplite 2 feet long, blades of greenish muscovite 3 feet long, "ball mica" 30 feet across. Masses of columbite up to 600 pounds in weight are from the Meyers quarry, and beryl 2 feet in diameter.

Fluorite groups and cleavable masses over 20 pounds are recorded at Crystal Peak.

Zircon crystals up to 1.5 x 2 inches have come from the St. Peters Dome district. Gemmy ones are only 0.5 inch high. Hematite pseudomorphs after siderite are about the same size as the larger zircons.

Except the mammoth "lost" quartz crystal of undeniable authenticity, all these figures have been published, and most of the specimens can be traced today.

Besides the references mentioned, there are dozens of others listed in guides to geologic literature. Further entries can be found in the abstract and other bibliographic aids with which your librarian can assist you. The detailed compilation of Edwin B. Eckel in U. S. Geological Survey Bulletin **1114** (1958) simply must be mentioned in connection with any reference to Colorado minerals.

Of the present generation of Colorado Spring collectors, Clarence G. Coil, George W. Fisher, and Raymond F. Ziegler should be especially mentioned. Doubtless, some Denver collectors (certainly C. W. Hayward) have done as well, but their recent activities are not so well known to me. George M. White, of Colorado Springs, may fairly be regarded as the unofficial historian of the Pikes Peak region's mineral wealth. A number of the dealers advertising in the *Mineralogical Record* stock Pikes Peak specimens.

All photographs by Barbara and John Muntyan.

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Development of the Amherst College Collection

Carl A. Francis
Department of Geological Sciences
Virginia Polytechnic Institute and State University
Blacksburg, Virginia 24061

Amherst College is a small liberal arts college located in western Massachusetts. Since its founding in 1821, study of the natural sciences has been an important part of the curriculum and Amherst shares in the tradition of large natural history collections which were such an important adjunct to the largely descriptive researches of the nineteenth century.

Early Collections

Amherst's first geology professor was the Reverend Edward Hitchcock (1793-1864) who, commenting on the existing collections at the time of his arrival, said:

> ...so far as numbers were concerned, our cases looked quite respectable. But to one acquainted with natural history probably the larger part would come under the ironical title of *Jactalites*; that is specimens to be thrown away.[1]

By vote of the trustees Hitchcock was asked to deposit his private geological cabinet in the college cabinet. Thus the nucleus of the early mineral collection was Hitchcock's personal one. During the rest of his tenure as professor and president of the college Hitchcock continued to add to the "cabinet of the college." The catalogue of Hitchcock's mineral collection is reported to have been lost prior to 1871 but a number of specimens, bearing their characteristic salmon-colored label with a fractional number, are still extant.

Upon appointment as state geologist in 1830 Hitchcock was directed to prepare a state collection of rocks and minerals. A number of such collections were prepared, one of which was added to the college cabinet. Approximately fifty specimens remain from that collection, and among them are specimens from historic Massachusetts localities. Particularly notable are the aquamarine beryls from South Royalston.

A collection representing the geology of Connecticut was donated by Professor Shepard in 1838 and a similar collection for Vermont was donated by Professor Adams in 1847. Apparently nothing remains of either collection, but the Adams collection of concretions from the Connecticut River Valley probably dates from this same period.

The Krantz Collection

In 1839 a collection of three hundred small specimens of economic minerals from Europe was purchased from Dr. Krantz of Bonn. Because it had been kept separate from the general collection, it escaped destruction in the disastrous fire of 1882. It has since been merged with the other collections but could and perhaps should be reassembled for its historical interest.

The Missionary Collection

During this period a significant portion of Amherst's graduates entered the missionary field. Geological specimens, among them a few minerals, which were sent back by these alumni, were designated the Missionary Collection.

The C. U. Shepard Collection

The first significant mineral collection acquired by Amherst was that belonging to Professor Charles U. Shepard (1804-1886). Shepard had begun collecting about 1830 and was an industrious collector. He visited many American localities securing vast numbers of specimens which he exchanged widely. During his lifetime he made at least a dozen trips to Europe to exchange specimens with Europe's leading collectors and museums. Thus his collection grew to be a large one representing the great majority of mineral species and varieties from the important American and European localities.

In 1846 Shepard arranged to have his collection exhibited at the college with provision made for its eventual purchase. As per the agreement, Wood's Cabinet, an octagonal fire-proof building was erected to house the collection. There Shepard's mineral and meteorite collections as well as all of the natural history collections belonging to the college were installed. An 1859 guide to the collection notes that the systematic mineral collection was arranged

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[1] Edward Hitchcock, *Reminisences of Amherst College...*, (Northampton, Mass., 1863), p. 74.

according to the Natural History method of classification which was put forth by Shepard in his *Treatise on Mineralogy* (1852-1857). By 1862 Shepard's collection of minerals exceeded ten thousand specimens and the college collection numbered twenty-two hundred. By 1875 Shepard's collection was supposed to have outranked in magnitude and value the public collections in London, Paris, and Vienna!

The agreed purchase price was to be a certain percentage of the collection's assessed value with Amherst's liability being limited to forty thousand dollars. When the purchase was finally made in 1872, the collection had grown so large that only five minutes were required for the assessors to agree upon the forty thousand dollar figure.

About this same time the collections were moved to Walker Hall where more space was available and there the Shepard collection was destroyed by fire in February, 1882. Only the meteorites and small crystallized specimens which had been stored in a safe escaped destruction. At the time of the fire, cataloguing of the collection according to Dana's System of Mineralogy (1872) was about nine-tenths complete. The catalogue is extant and records more than twenty-five thousand specimens. In terms of the size, breadth, and probably quality this was the finest collection Amherst ever received.

Rebuilding

Professor B. K. Emerson, in whose charge the collections were, immediately initiated attempts to rebuild the mineral collection. In the following six years Amherst received four collections which form the core of the present collection.

The F. R. Allen Collection

The first collection acquired after the Walker Hall fire was the gift of Francis R. Allen (1843-1931). It was begun during his undergraduate years at Amherst and won him the Shepard prize as a senior. Many of the specimens had been personally collected from the contemporary New England localities.

The Kunz Collection

Emerson was very interested in the Norman Spang Collection which had previously been offered to the U. S. National Museum for thirty thousand dollars. It was offered to Amherst for the same price or at twenty thousand dollars if a certain friend, probably Clarence S. Bement, would be allowed to select a few hundred specimens from it. Although the President favored purchasing the Spang Collection, he directed Professor Emerson to close with Dr. George F. Kunz whose large but mediocre collection was available at a tenth the price.

Thirteen letters in Kunz's hurried handwriting document the 1883 purchase. The collection required fifty-seven packing crates for its transfer from Washington to Amherst, but size was the only quality to recommend it. The contents, including the gems, are not particularly distinguished. The collection contained a number of lots of specimens from particular localities such as quartz from Hot Springs, Arkansas. These lots did provide considerable potential for exchange. Each specimen was accompanied by a red printed label bearing Kunz's name. At least nine different label styles are to be found in the collection. An additional five hundred dollars was spent with Kunz for a group of choice English specimens which he obtained from Tallings in London. This purchase is the source of Amherst's finest English barites, calcites, and fluorites.

The Second Shepard Collection

Despite the great personal tragedy which the destruction of his collection must have been, Shepard immediately began to build another collection. This collection, like the original, was to be sold to the college, but was donated by Charles U. Shepard, Jr., in 1887 after his father's death. As the younger Shepard owned Graves Mountain, it is not surprising that the second Shepard collection is particularly rich in Georgia rutile. Perhaps three hundred specimens, mostly splendent single crystals of high quality were in the collection. Joseph Wilcox, a noted Philadelphia collector, once tried to buy them to help defray the collection's cost to the college.

This second Shepard collection, although pale next to the collection which had been the work of forty years, remains a significant portion of the present collection.

Another, much smaller, collection containing his father's type specimens was donated by the younger Shepard to the U. S. National Museum where it remains intact. The Charleston (S. C.) Museum and the Natural History Society of Montreal also hold collections made up by Shepard.

The E. B. Underhill Collection

Another collection offered Amherst in the wake of the Walker Hall fire belonged to S. C. H. Bailey of Garrison-on-the-Hudson. This was the second collection brought together by Bailey. His first had been sold to the American Museum of Natural History in 1875. Bailey, a lawyer, thought that a wealthy client of his might be persuaded to underwrite the cost of the collection. The client, E. B. Underhill of Hallock Mills, New York, was a blind man whom Bailey had interested in minerals and for whom Bailey had purchased an extensive collection.

Underhill met with President Seelye and was greatly impressed with his voice. Underhill had a nephew whom he wished to send to Amherst and in lieu of tuition was willing to purchase the Bailey collection for the college. The boy, however, preferred to go elsewhere and there the affair seemed to end. Thus, the announcement that Underhill had bequeathed his mineral collection to Amherst came as a complete surprise.

The collection was valued at five thousand dollars when packed in 1888. It was later described as "a fine collection, well-selected, of good size, and excellent crystals." By today's standards, it would be considered a good reference collection representative of the now classic nineteenth century European and Eastern North American localities.

The Foote Purchase

In the manuscript catalogue of the meteorite collection are listed about eighty specimens purchased in 1916 from the Foote Mineral Company of Philadelphia at twenty percent of their retail price. This bargain sale seems to coincide with the dissolution of Foote's specimen business about 1917. Presumably, the minerals bearing the characteristic Foote label were also acquired at the same time. They are typically small specimens of new or unusual species (e.g., sulvanite, newberryite. However, one of the museum's finest pieces, a large matrix specimen of Red Cloud mine wulfenite, also bears a Foote label and a fifty dollar price tag!

The C. W. Fearing Collection

Clarence W. Fearing (1850-1942) assembled a collection of small specimens which won the Shepard prize for the best student mineral collection in 1875. Upon his death, the collection was presented to Amherst by his daughter. Although the complete dearth of central and western U. S. specimens suggests that Fearing did not pursue collecting much after college, it is a significant collection because it preserves specimens from such exhausted Massachusetts localities as the noted pegmatite at Chesterfield in Hampshire County.

The Stockbridge and Webster Collections

There are two small collections about which little is known. One, bearing labels of H. Stockbridge, Jr., from Baltimore, contained some fine European specimens. The other, bearing labels of C. H. Webster, was a more modest collection. Both seem to date from the nineteenth century.

The J. W. Eggleston Collection

Julius W. Eggleston (1875-1945) was a geologist and teacher who bequeathed his mineral collection and geological library to Amherst, his alma mater. There was, however, some interest in establishing an Eggleston Mineral Museum in Cuttingsville, Vermont. As Amherst wanted to comply with Eggleston's wishes, Professor Bain, then curator, selected from the collection only those specimens which were a significant addition to the college collection. An Eggleston Museum never materialized and the remainder of his collection arrived at Amherst in 1966.

Eggleston's sizeable collection consisted almost exclusively of specimens from the continental United States which he had personally collected or acquired by exchange. Predictably, the strong points of the collection reflect his places of residence. For example, a fine foshagite highlights his suite from the Crestmore quarry. Overall, it is a collection suited for study rather than exhibit and, in all likelihood, was formed for that very purpose.

The H. Schreiber Collection

In 1962, Hans Schreiber, an economic geologist from the class of 1954, donated a collection of one hundred and ten geological specimens, especially lead-zinc ores and their associated gangue minerals. These specimens have well served a variety of the needs of the geology department and museum.

The S. Denton Collection

Through rather unusual circumstances Amherst received a large number of specimens from the collection of Shelly Denton of Wellesley, Massachusetts, in 1969. These specimens were largely of study quality but a few New England pieces are outstanding. Especially significant are two one inch single crystals of Bristol chalcocite of differing habits. The bulk of Denton's collection is exhibited in the Denton Museum of Boston University.

Thus far, this history has related only the acquisitions of major proportion. However, many individual acquisitions have also played a significant role in shaping the collection. Gifts and purchases provide the opportunity to acquire specimens needed to fill specific gaps in the existing collection or acquire exceptional specimens around which to build other areas of specialization. The unused duplicates can be exchanged in favor of new material which helps to keep the collection current.

Usually little information is available about such acquisitions unless perchance a letter has been saved or something noted on a label. It is only in this manner that we know of an exchange with Johnson-Larvis for a suite of specimens from Mt. Vesuvius or Birdseye's gift of large azurite and malachite specimens from the Copper Queen mine in Bisbee.

Unrecorded are the curatorial activities of the various keepers of the collection: Hitchcock, Shepard, Emerson, Bain, and Brophy. As always, it is directly through the interest of the curator or lack thereof that a collection flourishes or is neglected. Amherst's curators have all been professional geologists and curating has been incidental to their teaching and research responsibilities. It is to their credit and Amherst's that the collection exists as it does.

Today the Amherst College collection stands as a small but significant specimen resource. The finest pieces, selected to demonstrate the diversity of the mineral kingdom, are exhibited in Pratt Museum. An extensive collection for student use is located in the mineralogy laboratory and the remainder is in easily accessible storage. The entire collection of several thousand specimens is thought of as a teaching collection and is available for educational purposes—research, exhibition, or otherwise.

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SHEPARD, CHARLES U., (1852-1857), *(A) Treatise on Mineralogy*, 3rd edition, Printed by B. L. Hamlin, New Haven.

The Record Bookshelf

***Use of Earth Sciences Literature*, edited by D. N. Wood. Archon Books, The Shoe String Press, Inc., Hamden, Connecticut 06514, 1973, 459 pp., $20.00 (published and printed in England by Butterworth & Co., 1973)**

***Geologic Reference Sources*, by D. C. Ward and M. W. Wheeler, with a section on geologic maps by M. W. Pangborn, Jr., The Scarecrow Press, Inc., Metuchen, New Jersey, 1972, 453 pp., $12.50 (a revised edition; 1st edition, University of Colorado Press, 1967)**

I was only asked to review the first of these books, but while I was agonizing over the task my attention was brought to the second by a librarian colleague and it seemed appropriate to discuss both together since they cover much the same field. Both works are by professional librarians, the first containing 17 chapters contributed by 14 collaborators (including the editor), and it is perhaps persumptuous to criticize—but with a little encouragement from my librarian colleague I decided to go ahead; after all, some of my best friends are librarians!

I suppose, perhaps incorrectly, that the majority of readers of the *Mineralogical Record* do not have a specialist earth sciences library in their home towns, unlike the average readers of the *American Mineralogist* and the *Mineralogical Magazine* who tend to be professionals with library resources at their places of work. Working here at the British Museum (Natural History), and spoiled by a superb library in the building and ready access to others in London, I have had to try hard to imagine the difficulties of a reader in a small town without a specialist library. As part of the exercise I visited one or two local libraries in London, posing as an anxious amateur trying to learn more about the subject, and found the experience profoundly depressing. The librarians themselves were all courteous and helpful to the best of their ability, but the best I could manage was direction to the *Encyclopedia Britannica* and the odd elderly edition of *Rutley's Mineralogy* (except for one, which had a 1950 edition of the *Chemical Index*); not one suggested a visit to, say, the library at the Geological Museum. So I looked again at the two books with fresh eyes and asked myself how helpful they might be.

Use of Earth Sciences Literature 'has been prepared with a view to its being used as the basis for a course on the literature of the earth sciences but it will also be of use to students and practising geologists who wish to undertake for themselves the task of becoming familiar with the literature', but I feel that it probably succeeds better with the first aim than the second. 'Libraries and their use' (chapter 2), for example, is too technical for the lay reader and while fine for a specialist library is not going to be much help in getting the best out of an ordinary city library. 'Searching the literature' (chapter 8) starts out well and interestingly, but rapidly heads off into the stratosphere. 'Mineralogy, petrology, geochemistry and crystallography' (chapter 11) contains helpful comments on some of the journals and textbooks that are available, but it is selective to the point of detriment to the coverage; among the many books that should—in my opinion—have been mentioned are the two excellent introductory paperbacks *Crystals and crystal growing* by Holden and Singer (Heinemann) and *Crystals and light* by Wood (van Nostrand), and Anderson's superb *Gem testing* (Heywood) [.I mention these because, although only marginally 'earth science', other books on these topics are listed]. All told, a very large number of works receive mention and comment, but their titles are well-buried in running text and consequently difficult to retrieve. For example, it has taken me some time to locate what I noticed on first reading, that (despite a claim in the preface that all literature through 1970 is covered) the only reference to Strunz's *Mineralogische*

Tabellen is to the 2nd edition (1949); the latest edition is, in fact, the 5th (1970).

Geologic Reference Sources is a very different style of book, and goes to the opposite extreme in that—after a short introduction—it consists solely of lists of reference works in four sections (general; subject; regional; geologic maps) and a large number of subsections. I confess that it is somewhat more to my taste, but it also suffers from being rather difficult to locate items in and it is very selective. The preface states that 'the purpose of this guide is to introduce the reader to the literature of the geologic discipline' and that the 'publications selected for the guide range from introductory to highly technical ....most of the books contain good, often excellent, bibliographies'.

My advice on these two works has to be: don't buy them yourself, you won't get much mileage out of them, but by all means persuade your friendly librarian to get them for his reference shelves; they'll be most useful there. [I mean, what else do you do with reference works that don't even mention the *Record*??!!]

Seriously, though, this little exercise has thrown up a very real problem: how does the amateur set about finding out what books to consult? Some introductory texts are very good at making suggestions, but they are in a minority. The review section of the *Record* must be watched, but it's no help with non-current stuff. If you've got a good bookshop handy, and I mean a good one with literate sales staff, you may well do better than a general library if you chase through the publishers' catalogues—and if you get the book through on consignment you are halfway to following Neal Yedlin's regular advice. A letter to our kindly editor might be another way to get advice, but what about all the lost souls who haven't seen or heard of the *Record*? Why not go out NOW, and make sure the *Record* is on the list of periodicals taken by your library; it will help sales, and rescue someone from the outer darkness!

Peter G. Embrey

From the May, 1974 issue of *Rocks and Minerals*, page 296...

"The second level is as interesting as the first. On the second level are nicely shaped calcite crystals, some of which get to be very large. When broken, they display a rhombohedral system."

We noticed that too!

NOTICE

The book *Tsumeb, a Historical Sketch*, reviewed in the March/April (1974) issue, costs six dollars ($6.00) per copy, not four dollars as indicated in the review.

To the Editor

ON THE ROWLEY MINE

Dear Sir:

I wish to congratulate Wendell Wilson for his fine article, "Minerals of the Rowley mine," in the January-February issue of the *Record*. You are also in line for some plaudits for managing the inclusion of the color pictures which contribute greatly to the article.

Some observations on the Rowley deposit and elsewhere prompt me to offer the following comments on several points made by Wilson. In his discussion of the secondary mineral suites, of which four are distinguished, Wilson suggests "segregation into specific areas." It is my observation that the distribution of secondary minerals is predominantly a function of the occurrence of the primary minerals from which the major components of the secondary minerals are derived (oxygen excluded). If differences in the relative abundance of the various secondary lead or copper species are found, then generally there was a similar difference in the relative amounts of primary species. The actual migration and, thereby, segregation, of metal ions in a deposit such as the Rowley mine is of subsidiary importance to the initial availability of the metal ions in determining what secondary species will form and where they will form.

Wilson further offers the point that there is "little, if any, overlap of species between the suites." On this subject I can draw on several personally observed exceptions to illustrate that, in fact, there is overlap of species within the Rowley deposit. Specimens collected in 1956, in the stope of the Jobes shaft, demonstrate relative age for several of the species described by Wilson. Veinlets two to three inches thick, consisting of remnant kernels of galena, some showing thin films of secondary covellite, are surrounded by envelopes of anglesite, caledonite, and cerussite, in that order. This assemblage is cut by partly open fractures which are lined with wulfenite and mimetite crystals. Obviously wulfenite and mimetite formed later than the other lead-bearing species. A trend toward higher Eh at a nearly constant pH of 6 or 7 is permissible here and does not require a reversal in pH as is shown by Wilson in his Fig: 29, page 29.

Two additional occurrences of caledonite were also found in widely separated areas of the mine. The best crystallized material was collected in the back of the stope just south of the Jobes shaft (perhaps Wilson's occurrence). Cerargyrite in numerous small crystals occurs on caledonite and cerussite in this area of the barite vein. Massive caledonite together with linarite occurred as cores in chrysocolla lenses in a small stope above the third chute north of the No. 1 Incline.

These three occurrences of caledonite, each within a somewhat different assemblage of secondary minerals, indicates that there is, indeed, overlap of species between suites. Furthermore, the relationships strongly suggest that different amounts of lead and copper sulfides existed in each of the three caledonite sites prior to oxidation and determined what secondary species would be formed in those sites. In other words, the relative amounts of lead, copper and the various anions resulting from the decomposition of the primary minerals is largely responsible for the variation in species associated in each of the described occurrences.

Vanadinite epimorphs after wulfenite with associated descloizite were found in the southwest drift about one halfway in from the No. 1 Incline. Here is another example of overlap of species between Wilson's suites. In this case, a change in anions available in the groundwater circulating through the deposit has led to replacement and overlap.

Other factors, including limited migration of certain of the metal ions (cations) in the deposit, enter into the process of secondary mineral formation to varying degrees. The structural history of the deposit and the nature and composition of the superimposed aqueous solution (groundwater) during the weathering of the deposit influence the makeup of the secondary mineral assemblages. It is the interplay of permeability and porosity developed by fracturing with oxygenated groundwater that initiates the decomposition of the sulfides and, ultimately, leads to the formation of sulfates, carbonates, chlorides, molybdates, arsenates, *et cetera*. I feel that an in-depth description of this evolutionary process with only an occasional reference to the Eh-pH diagram would have served to illustrate the development of the secondary minerals.

Richard W. Thomssen
Reno, Nevada

Dear Sir:

Your article (by Wilson and Miller) caused some excitement in our house ...surprised was I to see the name Rowley mine...for many a time during my childhood I went to the mine with my parents and Charles Rowley ...(my father did mechanical repairs at the mine now and then). The stories of days at the mine...the Rowleys and Gila Bend are too many to even begin to type at this sitting.

I took this article and went to see Charles Rowley Easter Sunday and of course he was also surprised to see the article...neither of us, at this writing, have had time to read the article in full...the pictures are beautiful... Mr. Rowley is now 82, very active and interesting.

Barbara E. Barratt
Canoga Park, California

BAD TASTE?

Dear Sir,

How could you accept such an advertisement as that by F. L. Smith Minerals on page 91, Vol. Five/Number Two? You, who have so staunchly advocated the search for perfection and absolute accuracy in mineral identification and labeling with no tolerance of any kind of faking, trickery or nature-helping, HOW COULD YOU publish such an advertisement. Never in almost thirty years of reading and studying all Lapidary and Mineral Publications, have I seen such practice advocated or even condoned, as is implied by your publishing this advertisement. Our two regular purchasers of your magazine have returned their copies and ask us not to save anymore for them. Your "Halo" sure got badly tarnished!! We have told serious and learning mineral collectors to subscribe to the Record because of the absolute accuracy and high standards of identification and quality of the editorial staff and the contributing editors. If you are so hard up for advertisers, please send us a contract for the same space and retract the Smith Adv. But never will we advertise with any publication that will accept and publish such solicitation for trickery and fakery, particularly items 2, 3, 4, 5 and how can you assemble "Famous old collections"?. I could go on and on, but mostly I go back to HOW COULD YOU, HOW COULD YOU, HOW COULD YOU?

Yours truly,

Ross W. Glenn
Durango, Colorado

Frankly we thought that our readers would find this ad amusing, and that no one would take it seriously. Obviously we guessed wrong, and we hasten to apologize to all who found it in bad taste. Ed.

Dear Sir:

Was it irresponsibility or was it a failure to comprehend your obligation to your readers and your other advertisers that prompted you to accept the F. L. Smith Minerals advertisement in the recent issues of the *Record*? "We assemble 'Famous old collections' to order" indeed!

If it was a joke, it is in poor taste. If the ad is not a joke, you have denigrated the magazine by publishing it.

Our firm is currently advertising the availability of specimens from the Zimmerman collection. For us to continue advertising what is in reality an 'old collection' alongside an ad that offers to fake an old collection would put us in the untenable position of condoning such fakery. We have had to winnow out specimens from the Zimmerman and other collections that we have handled precisely because some enterprising soul has glued crystals on "suitable matrix", or has "expertly repaired" a broken crystal. Our policy is to label such specimens "Repaired" or to remove the glued material and sell the specimens for true value, not to perpetuate the fraud.

Indeed, we are grateful when one of our customers catches one that has escaped our notice.

To put things in their proper perspective, I have no objections at all to the portion of the ad that features pornographic and scatological specimens. These are as much a valid collector's item as are "picture rocks" and add amusement to what otherwise be a stuffy hobby. But—"Broken crystals artfully terminated"? I think not.

Mimi Merrill
Ridgecrest, California

Dear Sir:

I noted, with much interest, the F. L. Smith ads in the last issues. I guess our hobby is coming of age when we can laugh at ourselves. Fortunately we also have an editor who is not a judge. Congratulations.

L. H. Conklin
New Canaan, Connecticut

Dear Sir:

It is the finest piece of satire ever to appear about mineral collecting.

John Tetrick
Minneapolis, Minnesota

Dear Sir:

I saw Mr. Smith's ad in the recent edition of your magazine and thought it one of the funniest things I have seen. It should be exceeded in hilarity only by some of the letters you receive about it. I can hardly wait. Please publish some of them.

Rock H. Currier
San Marino, California

THE APACHE MINE

Dear Sir:

A brief note on the present status of the Apache mine (Gila County, Arizona). A visit on June 15 found two men pumping water from the 170' level. They are intending to mine 3% copper. They said to pass the word that they can no longer allow collecting.

A great loss!

A. Clark
Kingman, Arizona

NEW MINERAL?

Dear Sir:

The recent discussion of how the term mineral should be restricted led to some reminiscences. In 1913-1917 I was employed as Assistant Curator of Mineralogy and Petrography in the U. S. National Museum, and became expert in identifying mineral crystals under the polarizing microscope. Then during the "first world war" I was invited to transfer to the Bureau of Chemistry of the U. S. Department of Agriculture to apply the same method to the identification of non-mineral crystals of interest to the chemists there. I thus became the first official Crystallographer in the history of the U. S. Government.

There being food shortages, "natural food" enthusiasts were urging people to consume various weedy wild plants as well as to make use of commonly discarded parts of food plants. The first problem I was assign- to study was why people who were cooking and eating the leafy tissue removed from rhubarb stalks were being made ill, with even some fatalities. This proved to be due to the presence in abundance in rhubarb leaves of crystals of potassium hydrogen oxalate, KHC_2O_4, which on boiling dissolve out and, if swallowed, remove lime from the blood of the consumers, resulting in acidosis.

Once the optical properties of potassium hydrogen oxalate were determined, a survey was made of current and potential edible "greens", and it was found to be abundant in various pigweeds, sorrels, etc.; garden spinach contains negligible amounts, but a substitute termed New Zealand spinach is higher. (In a recent National Geographic Magazine article Mountain-sorrel (*Oxyria*) was recommended for human use, but it is dangerously high in K-H-oxalate.)

Crystals of calcium oxalate have long been recognized to occur in plants. Commonest is the monoclinic monohydrate, the habit of which may be either equant or acicular, the latter termed "raphides". This is so insoluble that it accumulates when the vegetable tissue disintegrates and is then assigned the mineral name whewellite. Less frequent is the tetragonal dihydrate, known mineralogically as weddellite.

Since these two oxalates of vegetable origin are unhesitatingly accepted as minerals, there seems no reason why the one here discussed should not also be similarly treated. I hereby formally propose that it be named in reference to its composition_________.

Edgar T. Wherry
Philadelphia, Pennsylvania

We agree with Dr. Wherry, but have deleted his proposed name because new mineral names should be introduced through submission to the International Mineralogical Association, not on the pages of the MR. Ed.

FINEST KIND

Dear Sir:

A brief comment on Wendell Wilson's book review of *The World's Finest Minerals and Crystals*, by Peter Bancroft.

CUPRITE, page 54, nominated by George Botham, London
BROOKITE, page 118, nominated by Edward Sopworth, Croydon, England
ACANTHITE, page 124, nominated by Thomas Farther, London
CALCITE, page 128, nominated by A. M. Wali, London

No one connected with minerals in England seems to have heard of any of these nominees. Their names are not in the London telephone directory. Wendell Wilson comments on the fact that "His panel of judges and consultants reads like a Who's Who of collecting and curating".

Just who are these four mysterious gentlemen? It seems a pity, as there are plenty of people of mineralogical repute who would have been delighted to nominate these and other specimens in the British Museum of Natural History, including, of course, one of their incomparable bournonites.

Brian Lloyd
London, England

At least they called it acanthite, *and not* argentite. *Ed.*

NOMENCLATURE GUIDE

Dear Sir:

I feel that the Nomenclature Guide for Collectors (*MR*, vol. 5, #2) is useful but in some cases unnecessarily restrictive.

In particular, I disagree with the idea that a decorator specimen need be *ugly*. There are many people who appreciate well-crystallized minerals and are also interested in displaying minerals simply to add contrast to their house interior (or exterior). I therefore propose that the definition be changed to read as follows:

Decorator specimen—specimen large enough to accent the interior or exterior of a residence, store, bank, etc. *May* be a very common mineral or have enough damage or other imperfections to make it unsuitable as a museum piece or cabinet specimen. Not necessarily valuable or rare, but has asthetic appeal. Examples: amethyst, quartz geodes, petrified wood, agate slabs.

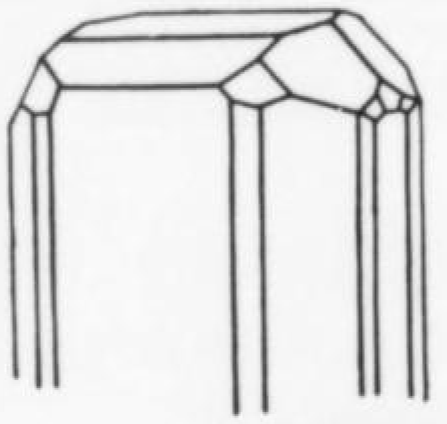
I also propose that the following terms and definitions be adopted:

Cabinet specimen—specimen in very good condition which is larger than miniature in size. Is a very good example of the species, variety, or mineral.

Approval—in a sales transaction by mail, the buyer has the option of keeping or returning the specimen by prearrangement.

Museum specimen—specimen that is an outstanding example of a species, variety, or mineral and is large enough to be appreciated at a distance; and is suitable for display intended for the enlightenment of the general public as well as the student of mineralogy.

Jack Lowell
Tempe, Arizona



Meet me in Dee-troit, Dee-troit!

How will you know me? Very simple, friends. Just look for me. I am probably the "biggest" professional mineralogist in the country. (Few of my competitors will argue that about Larry Conklin.) And to this simple recognition test, which anyone can make on sight, add the fact that I shall be in Detroit with some of the " finest" mineral specimens you have probably seen in a long time anywhere.

Frankly, I enjoy the friendly rivalry between East and West. Yet, although I am an "Easterner" born and bred, I am proud that among my regular customers I serve some of the most knowledgeable of "Westerners". Some have called on me because they know I have been in the business for nearly twenty years and have a very large stock of outstanding minerals from museum quality to the most delightful of smaller specimens; others because they know I pay less attention to the current inflationary pressures that have been sending prices sky-high elsewhere; still others because from recent estate accumulations I have choice minerals from the great classic localities—from East and West both, from Canada, Mexico, England, Colombia, Peru, Chile, Brazil, England, the Continent, and from Africa, Asia and Australia, too. That is why so many foreign collectors and curators who want the best (at still-reasonable figures) make my showroom a "must" stop when they come to the U.S.A.

Anyway, in Detroit you can't miss me. I'll be there—life-size—at Booth E-3 at the International Gem and Mineral Show. Drop by to see me first. If you don't know me you may be surprised at the superb material I'll be showing. Some of the top dealers will be making their selections at the Conklin exhibit. Shouldn't *you* be there too?

* * *

Lawrence H. Conklin

Mineralogist

Office and Showroom
2 West 46th Street
New York, N. Y., 10036
(212)757-2264

P.O. Box 61
New Canaan, Conn., 06840
(203)966-5215

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