the Mineralogical Record

volume one • number two
SUMMER 1970

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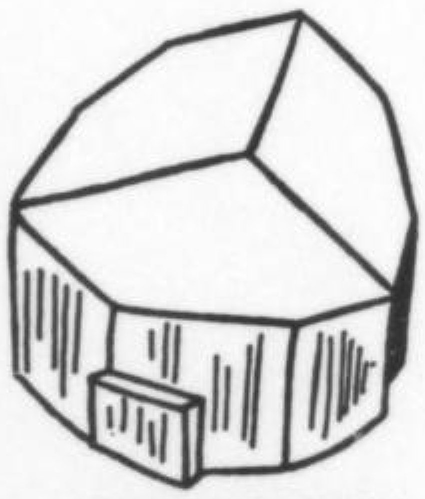

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feature articles

page

departments

COVER

Cover painting by Mrs. Ingebord Vass. Microcline (amazonite) with smoky quartz from the Pike's Peak region, Colorado. Specimen on exhibit at the Smithsonian Institution.

editor & publisher
John S. White, Jr.
Division of Mineralogy
The Smithsonian Institution

managing editor
James M. O'Leary

address
the Mineralogical Record
Post Office Box 783
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editorial matter

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fm friends of mineralogy

Swarthmore-Leidy Collection

Arthur Montgomery

Major aims of the Museum Commission of the International Mineralogical Association (IMA) are to compile a World Directory of mineral collections and Catalog of mineralogical type material. In 1959 some of us served on the committee preparing a directory of U.S. mineral collections. We were active for more than a year, drawing up a questionnaire, sending it to curators or owners of all known collections in the country, and tabulating the results. My job was to cover several east-central states including Pennsylvania. It is sad that such an auspicious start never has been completed by the IMA. One reason for the founding of our new amateur-professional group *Friends of Mineralogy* is the urgent need for continuing a world-wide survey of collections. The purpose of this report on the Swarthmore-Leidy collection is to suggest how great and unexpected are the rewards to mineralogy from making such a survey.

One reply to the questionnaire came from Swarthmore College, which has no geology program. A science department head there wrote that the relics of the college mineral collection would be given to any responsible person or institution interested. I promptly went to Swarthmore to investigate. The heavy dilapidated wooden boxes, piled all over in dark basement surroundings, hardly seemed worth prying open. But the minute the contents of several were revealed, the atmosphere changed. It was known that the Joseph Leidy collection had gone to Swarthmore. Leidy was a famous Philadelphia paleontologist who taught at Swarthmore and collected minerals as well as fossils during the latter eighteen-hundreds. We badly needed Pennsylvania minerals at Lafayette College, and the Leidy material could prove invaluable. I first cleared the matter through the chairman of our U.S. Directory Committee, George Switzer, who approved of anything we could do to preserve what was left of the collection. The science department head arranged for the material to go to our geology department at Lafayette as a "permanent loan," provided it stayed there and the specimens were put to good use.

The opening, unwrapping, repacking and removal of everything hidden in those old boxes proved exciting. Most of the job I did myself, with minor student help; a number of trips were needed. Some boxes contained mostly junk, such as massive chert and hematite, apparently added later to replace whatever had been removed by theft. Other boxes, so badly broken and inaccessibly placed as to have escaped the attention of marauders,

(Continued on page 38)

Trophy Winner

Mr. Don Newsome of Van Nuys, California won the trophy for best competitive fluorescent display at the California Federation of Mineralogical Societies Show in June. Mr. Newsome is a member of LERC Rockcrafters.

The trophy, presented by Gus Meister, President of CFMS, is donated each year by Ultra-Violet Products, Inc., San Gabriel, California for best competitive fluorescent display.

Mr. Newsome's display consisted of fluorescent minerals from Franklin, New Jersey only. These were willemite, svabite, clinohedrite, margarosanite, wollastonite and barite, hardystonite in one case; norbergite, axinite, esperite, hydronzincite, tremolite, pectolite, and calcite in the other case. This group well represents the very beautiful minerals that come from Franklin. ☐

IN THE NEXT ISSUE . . .

"'Type' Specimens in Mineralogy"
Peter G. Embrey and Max H. Hey

"Mineral Rings and Cylinders"
Richard A. Bideaux

"[illegible] from Switzerland"
Max Weibel

"Rutile from Watertown, Connecticut"
Wm. A. Henderson, Jr.

"Cornetite from Saginaw Hill, Arizona"
BoSaw Khin

"Eakerite, a New Tin Silicate"
Peter B. Leavens, John S. White, Jr. and Max H. Hey

editorial page

The *Mineralogical Record* is appearing at a propitious and exciting time when the hobby of mineral collecting is growing at an extraordinary rate. This is due, in part, to the increased leisure time that so many people now have. More important, there is a growing fascination for minerals brought about by a proliferation of mineral shows and the introduction of earth science courses in most elementary and secondary schools. This growth is coming at a time when showy mineral specimens are experiencing a rapid escalation in price so that most newcomers and many established collectors can afford only the common minerals in beautifully crystallized specimens.

These conditions should, and we hope will, lead to the development of systematic mineral collections in which the primary objective of the collector is to assemble good, representative samples of many different mineral species, beautiful or not. The exercise of building a systematic mineral collection is important because in classifying one is forced to learn. The collection becomes an instrument of study rather than just an attractive array of colorful and beautiful objects. By organizing the specimens in the mineral cabinet the collector organizes them in his mind and he begins to associate minerals which share certain characteristics. The nature of this association will depend upon the type of classification he uses.

There are several ways in which mineral collections may be systematized. The usual scheme is to follow the chemical classification adopted by most mineral textbooks; native elements, sulfides, sulfosalts, oxides, etc. However, one may choose a genetic system in which minerals are grouped according to the nature of the conditions in which they formed, such as: the minerals of regionally metamorphosed rocks, those of contact metamorphic rocks, those of traprocks, authigenic minerals, the minerals of oxidized copper deposits, etc. A collector with a strong interest in crystallography may elect to arrange his minerals by crystal system. Thus the isometric minerals would be grouped together and perhaps secondarily subdivided into the classes of the isometric system.

There are many people among the hobbyists who have put together superb collections of exhibition quality specimens and yet they know little more of the science today than they did at the start. They literally can't distinguish quartz from calcite without the labels. We feel that this is unfortunate because the study of minerals can be so exciting and rewarding. There is so much that can be learned on almost every level of endeavor.

If the rising prices and other factors—increasing competition for fewer specimens, mechanization of mining which reduces collecting opportunities, disappearance of productive old-time localities, and numerous other detrimental factors—combine to force this change, we do not find this any cause for alarm. Rather it is a cause for rejoicing that out of a combination of factors over which we have no control, a wholly desirable and worthwhile activity may be launched on a very large scale. We see promise in this developing trend of a great boost in the quality of understanding of minerals among collectors—something which we feel has been a long time in coming.

Of course, in pursuing the study of minerals, collectors need not forsake the show specimens. Systematic collecting does not require the purchasing of expensive specimens so the collector may still have the resources to purchase an exhibit specimen from time to time. Further, the "super-specimens" can still be seen in public museums, which are appearing in increasing numbers in recent years. Hobbyists will find their enjoyment of museum collections greatly enhanced through their efforts to understand mineralogy.

John S. White, Jr.

To The Editor . . .

Dear Sir:

The *Mineralogical Record* should prove to be a most refreshing and welcome addition to current mineralogical literature of the profession. The articles of the first issue showed careful consideration to both professional and amateur readers. The variety of article material, a combination of the historical with the recent, was well presented. One additional section of the journal which may find acceptance is the listing of rare and unusual mineral species for trading.

The future success of this journal will depend greatly on the contributions of the subscribers, both professional and amateur.

Sincerely yours,
Mr. Gail E. Dunning

Dear Sir:

Volume 1, No. 1 of the *Mineralogical Record* has been received. It is indeed an impressive effort both physically and editorially. We sincerely wish you and it every success. We'll give it a plug in the next issue of G&M.

Sincerely,
Don MacLachlan,
Editor and Publisher
Gems and Minerals

Dear Sir:

Congrataulations to you and the staff of the *Mineralogical Record* for a very fine and much needed publication that offers articles by renowned mineralogists, written in a language for laymen and yet avoiding the condescending pap that is written for rockhounds.

Sincerely yours,
Virginia L. Blackford, Ph.D.

Dear Sir:

You are to be commended on a very excellent first issue. Best of luck and I hope you can maintain the high standards which you have established.

Bill Lehnert

Dear Sir:

Just received Vol. 1, No. 1 of *Mineralogical Record*. A fine job! You were ahead of me as to Neal Yedlin.

Michael Fleischer
U.S. Geological Survey

Dear Sir:

May I extend my heartiest congratulations on a job well done!

Frankly I was surprised at the beauty of the 1st issue of the *Record* quite in addition to the excellent editorial matter. I do hope that subscriptions are coming in as they should. I know of a number of locals who have received the magazine and they like it too.

Just sent off a letter to Dick Bideaux on many topics connected with the *Record* and ideas on articles etc. Possibly there will be some fruit in it.

Again my best wishes and keep up the splendid job!

John Sinkankas
Earth Sciences Literature

Dear Sir:

The *Mineralogical Record,* Volume 1, No. 1 is a very impressive publication, and you and your associates are to be highly congratulated on it.

David E. Jensen, Secretary
Ward's Natural Science Establishment

Dear Sir:

While I am swamped with tourists (and HIPPIES) I just have to take time to compliment you on the excellence of your first issue. The quality of the copy and the illustrations is superb, not to mention that great cover shot, for which I can't dig up a better word.

Walter H. Wright
The Original Curio Store and Prospectors Shop

(Continued on page 72)

Collection

(Continued from page 36)

turned out to be treasure troves. Nothing of great value tended to appear, like gem-quality topazes or diamond crystals, but minerals of all kinds came forth in quantity: many beautifully crystallized beneath layers of dust; some of extremely rare species; others representative of early classic localities of eastern North America. No collection could have better enlarged and strengthened what we already had at Lafayette College.

Descriptive notes, to be given in the concluding installment of this report, will make clear the high quality and mineralogical importance of the roughly thirteen hundred specimens we secured. Let me mention here, however, a few of the surprising discoveries made in that damp, dark basement. Among Pennsylvania minerals, for example, were three superb matrix aquamarines from Deshong's quarry, Leiperville, with part-transparent prisms up to 1x4 inches; two sharply-crystallized, long-prismatic "andalusite" clusters, Upper Pridence, of 2x5" and 5x7" size; an outstanding Wheatley Mine anglesite group showing glassy, clean-cut, one-inch crystals with galena and quartz crystals: a bred-brown almandine from Avondale, Leiperville, displaying a perfect 1-inch crystal in matrix; and a unique 3x6" velvety golden-yellow cacoxenite from Hellertown. Other specimens of both extra-fine crystallized quality and unusual locality interest that turned up included: tremolite, diopside and dravite from Gouverneur and scapolite and wollastonite from Natural Bridge, all in matrix; zoisite and diopside, Ducktown; corundum, including fine ruby and sapphire, Franklin, N.C.; bournonite and tetrahedrite, Herodsfoot mine, Cornwall; campylite, Drygill, Cumberland; gold, coarse flakes in a Tertiary cemented "fossil placer," Gold Run, California.

No description of specimens, however outstanding, can begin to get at the educational and scientific value of this collection. The locality information and representation

(Continued on page 44)

PRESERVING MINERAL LOCALITIES

(from the Friends of Mineralogy)

Joel E. Arem
Smithsonian Institution

Mineral collectors often take for granted an aspect of their hobby that is necessary for the success of many field trips—free access to operating quarries and mines. It may not be too far-fetched to suppose that the best mineral specimens in the world are still in the ground, but if so it will take extensive mining to reveal them. This type of operation is beyond the reach of most amateurs, who must rely on the good will of commercial enterprise in order to recover specimen material.

Most frequently, the management of a mine or quarry is not at all interested in mineral specimens. Much to the horror of zeolite enthusiasts in eastern New Jersey, the aim of a well placed dynamite blast is to break loose as much totally barren, solid rock as possible. All the nice mineralization is avidly shunned. The same arguments apply in almost all quarries, since profits are made on quantities of gravel, crushed stone and road metal, and not on the mineral specimens that may happen to be present. The profit motive should not be taken lightly, since this alone provides the incentive to begin quarrying or mining in the first place. To be profitable an earth-moving operation must be productive, and anything that can detract from total output (such as collectors standing on a rock pile that a bulldozer wants to push out of the way) must be avoided by the men in charge.

In this light, what possible reason could these men have for allowing collectors into their operations at all? Actually, there are several good reasons for allowing access, yet they depend entirely on the attitude of the mine or quarry owners.

At a time when pollution is a vital issue in our society, emphasis should be placed on the preservation of all esthetic qualities of our environment. Mineral specimens fall in this category, and indeed their beauty is a primary reason for their desirability. Responsibility for the preservation of fine specimens is often in the hands of the mine owner, who must be made aware of the irreparable loss of such material in normal quarry or mine operations. The owner cannot stop all productivity in his holdings while collectors attack the latest blast area, but he should be conscious of the mineralogical content of his property. This awareness should extend to the scientific (educational and research) value of specimen material, as well as the esthetics.

The task of educating mine owners and quarry men belongs to the collectors themselves, and many opportunities exist for achieving this goal. The collecting community must never forget that access to a mine or quarry is a privilege, not a right, and permission must be obtained whenever entry is desired. The procedure to be followed must always be the one that least antagonizes the management, and this usually means following two prime rules: collectors in a mine or quarry follow to the letter all safety regulations, and individuals in a collecting group are policed by the leaders of the group, and not by mine or quarry workers. Many a quarry boss has closed his property to collectors because of insurance risks, and because of time lost when quarry workers stopped their work to retrieve a wandering collector.

An excellent set of ground rules has been developed by a group of Canadian mineral collectors for gaining access to a quarry, and it may serve as a model for similar application elsewhere.

In 1966, several members of the Montreal Mineral Club realized that Expo '67 would attract a relatively large number of collectors to their area, and that many of these would desire access to the (now quite famous) Mt. Ste. Hilaire mineral locality. The quarry had previously been closed to collectors, but the club offered to act as a clearing house for groups and individuals wishing entry. Reluctance on the part of the quarry owners was overcome after proof of responsible conduct was demonstrated. The club members took on the job of policing the quarry and enforcing safety regulations. This arrangement worked very well through 1967 and 1968.

Gradually, however, more and more collectors have been bypassing the club and appearing alone at the quarry gates. It is sometimes easy to get the watchman to look the other way for a short time, but accidents occur in split seconds, and this type of action may well close the quarry for good. In the long run, management will not tolerate interruption of quarry activity, and collectors stand to lose more than they can possibly gain by abuse of privileges. More and better material can be collected in 10 trips to a quarry that stays open than in one or two trips after which the quarry closes its doors.

No one is more knowledgable of collecting areas than the local residents. No one is better equipped to deal with local quarry owners than these same people, and keeping such localities open depends on the goodwill maintained between management and collectors.

Mineral groups should actively pursue liaison with local mine and

(Continued on page 67)

The Moctezuma Tellurium Deposit

by Richard V. Gaines

Location

The Moctezuma mine is located in west central Sonora, Mexico, near the town of Moctezuma. The road distance to this town from Hermosillo is 210 kilometers northeast, and from the International Boundary at Douglas, Arizona is 175 kilometers south.

Access to the mine from Moctezuma is by a very poor road 22 kilometers south by southwest. The first 14 kilometers are over a recent lava plateau, after which it is necessary to ford the Moctezuma River, always a chancy enterprise. The last 8 kilometers up and down hills to the mine are passable only when the mine is in operation and the road kept in good repair. As there has been no activity at the mine since 1964, the road is, at the present writing, most probably impassable even to four wheel drive vehicles. Walking the last 8 kilometers is not too difficult in winter, but high summertime temperatures and lack of potable water near the mine make such an effort inadvisable from April through October.

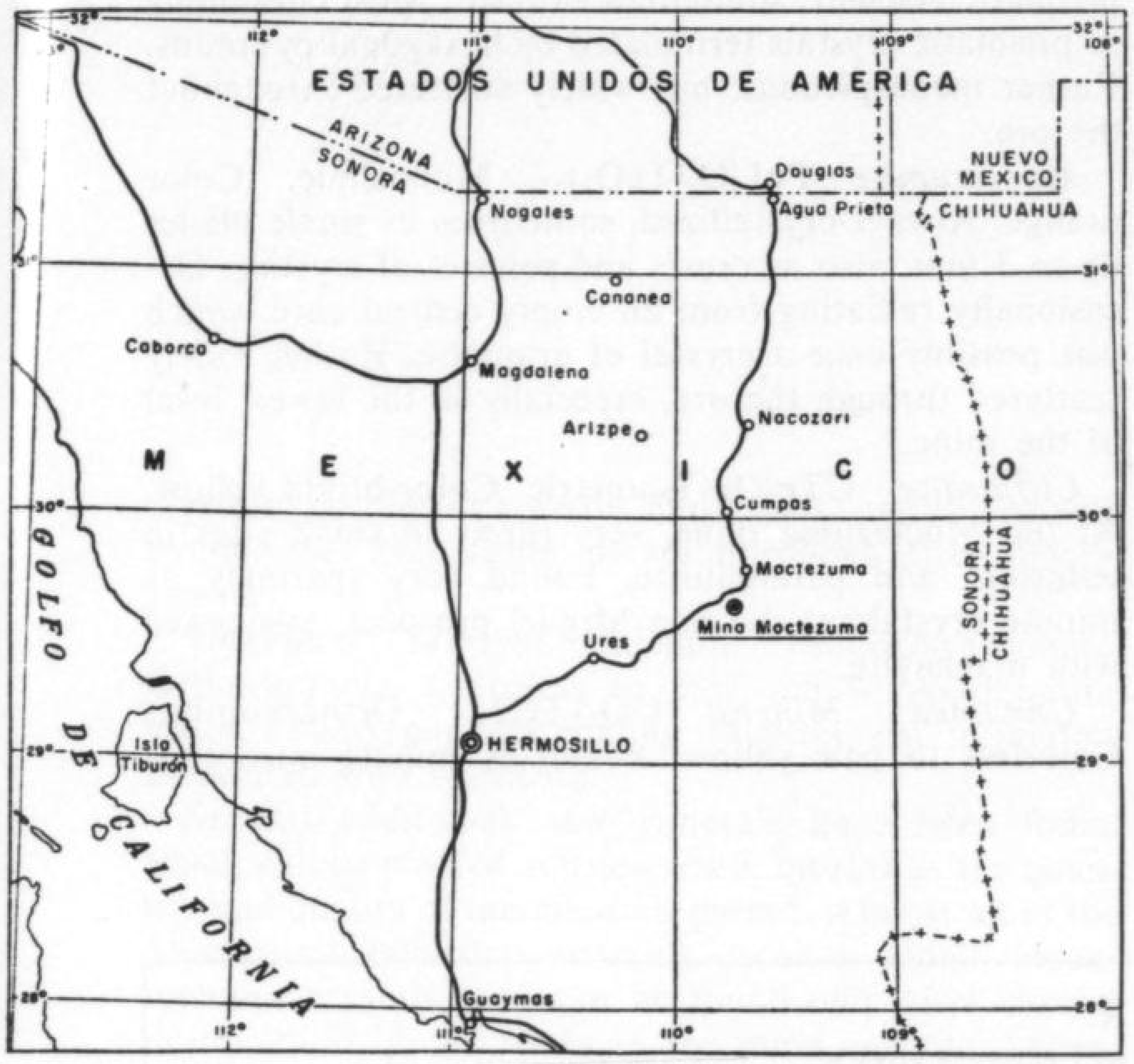
History

The Moctezuma mine was discovered by a rancher in 1935. Regular shipments to the smelter at El Paso started the following year, and continued intermittently through 1945. A total of 2,900 tons of hand sorted gold ore was shipped, which gave a net smelter return of over $180,000, or about $62.00 per ton. Although the ore shipped was extremely high in tellurium, no payment was made for it nor was any other notice taken of it.

In 1960, coincident with an increase in the value of tellurium, the mine was acquired by a Mexican mining firm and systematic sampling and exploration was begun. The work undertaken included repairing and unwatering the mine workings, mapping the surface and underground geology, sampling the mine and the dumps, and diamond drilling. Insufficient ore was found to justify building the treatment plant which would have been required to recover tellurium from the complex ore, under prevailing economic conditions, and the mine was closed down awaiting improvement in the market.

The San Miguel prospect is located about 10 kilometers northwest of the Moctezuma mine, near the crest of the range of hills lying west of the Rio Moctezuma, and about 1/2 mile north of the Moctezuma-Hermosillo highway. This prospect was discovered in 1961 and was explored by a tunnel about 100-feet long and a shallow shaft at the tunnel adit.

The rock is an exceedingly tough barite-quartz intergrowth containing pyrite, tellurium, tetrahedrite, and possibly rickardite as primary ore minerals, and jarosite, mackayite and minor emmonsite and tellurite as oxidized minerals coating joints in the rock. A few specimens of cliffordite and cerargyrite were also found, and one specimen of the new uranyl tellurite (unnamed).



Geology

The Moctezuma mine is in a sub-parallel group of at least five quartz veins which occupy fault or tension fractures in steeply dipping and folded tuffaceous sediments of probable late Cretaceous or early Tertiary age. The wall rock has been hydrothermally altered and the veins extensively brecciated prior to and during tellurium mineralization. Oxidation of the ore is nearly complete above the first mine level, and extends irregularly down to the deepest level in the mine, 88 meters below the surface. The deposit is epithermal in character, and small vugs and crustification are common.

Mineralogy

The first hint of an unusual tellurium occurrence at Moctezuma came from occasional rich specimens of native tellurium brought out to assayers and other mining people during the 1940's. These were usually alleged to have been found near Cananea, about 150 kilometers northwest of Moctezuma. On the basis of such specimens, the new species paratellurite was described by Switzer and Swanson in 1960.

Investigation by the writer and others about that time revealed the true source of the specimens, and shortly after exploration was begun four more new minerals (spiroffite, denningite, zemannite and colloidal ferric tellurite) were noted by J. A. Mandarino in specimens sent to him by S. J. Williams, who had in turn obtained them from the writer. It was several more years before detailed descriptions of these new minerals were forthcoming, and even now other new species await complete description.

Altogether, 39 minerals have been found at the mine, of which 19 are tellurium minerals and 12 of these are new to science. This exceptional abundance stems from the unusual circumstance of a vein rich in tellurium, carrying also iron, zinc, manganese, uranium and lead, which has become deeply oxidized permitting the formation of numerous tellurite compounds. These minerals are listed in Table 1, arranged in their approximate order of abundance.

Of these, gold is not certainly primary, but may be the oxidation product of gold tellurides. No gold tellurides have been observed in the ore, but neither has gold been observed except in an oxidized environment. "Blakeite" is an ill-defined species, and while a mineral very similar to the described mineral has been found at Moctezuma, it is not postively identical with "blakeite" from Goldfield, Nevada.

Pyrite is fairly widespread throughout the orebody in small crystals and druses, but is less abundant in the ore than tellurium.

Altaite and tetradymite were found only as microscopic blebs embedded in native tellurium, in polished sections.

A more complete description of the remaining tellurium minerals follows:

Tellurium. Te. Hexagonal. Color silver white. Found throughout the orebody in fine grained masses and veins, usually intimately intergrown with porous networks of minute quartz crystals. Partly altered to paratellurite, which in this environment looks black probably due to included submicroscopic tellurium. Some of the masses reached several kilograms in weight.

Bambollaite $Cu(Te,Se)_2$. Tetragonal. Color sooty black. Found very sparingly associated with klockmannite, selenium, tellurium and chalcomenite. No crystals observed.

Tellurite TeO_2. Orthorhomic. Color orange-yellow. Found throughout the orebody. Occasionally seen in quartz vugs in beautiful sprays of crystals 2 cm. or more long.

Paratellurite TeO_2. Tetragonal. Color pale straw yellow, also nearly black. Waxy luster. Found as coatings, usually closely associated with tellurium. Sometimes pseudomorphous after tellurite crystals, which then look dull and opaque instead of transparent.

Emmonsite $Fe_2(TeO_3)_3 \cdot 2H_2O$. Symmetry unknown. Color yellowish to dark green. Found throughout the mine as crusts, rosettes and sprays of curved hairlike crystals up to 5 mm. long.

Mackayite $Fe(Te_2O_5)OH$. Tetragonal. Color yellowish green to olive green. Has not been found at the Moctezuma mine, but occurs abundantly at the San Miguel prospect about 10 kilometers northwest. Found as druses of minute crystals, generally less than 1 mm, coating fractures in a quartz-barite gangue.

Sonoraite $FeTeO_3(OH)\cdot H_2O$. Monoclinic. Color yellowish green. Found in crystals, sheaves and rosettes on limonitic coatings associated with emmonsite. Only three specimens found.

Poughite $Fe_2(TeO_3)_2SO_4\cdot 3H_2O$. Orthorhombic. Color yellow to buff. Found as mammillary crusts and crystals associated with pyrite undergoing oxidation. Only three specimens found.

Ferric tellurite (unnamed) Formula not known. Colloidal. Color dark brown. Found as lustrous mammillary crusts with limonite and emmonsite.

Spiroffite $(Mn,Zn)_2Te_3O_8$. Monoclinic. Color pink to reddish purple. Found in quartz associated with denningite, tellurite, zemannite and tellurium. No good crystals found.

Denningite $(Mn,Ca,Zn)Te_2O_5$. Tetragonal. Color usually light green, but occasionally colorless to brown and purplish brown. Found in quartz with spiroffite, etc. Rarely in fine platy crystals up to 1 cm. square.

Zemannite $(Na,H)(Zn,Fe)_2(TeO_3)_3\cdot nH_2O$. Hexagonal. Color light to dark brown. Always crystallized, with habit widely varying from hexagonal tabular to prismatic acicular, sometimes twinned. Most commonly as prismatic crystals terminated by hexagonal pyramids. Rather inconspicuous, but widely scattered throughout the ore.

Moctezumite $PbUO_2(TeO_3)_2\cdot$ Monoclinic. Color orange. Always crystallized, sometimes as single blades up to 3 mm, also as crusts and rosettes of crystals. Occasionally radiating from an empty central core, which was possibly once a crystal of uraninite. Rather widely scattered through the ore, especially in the lowest level of the mine.

Cliffordite UTe_3O_8. Isometric. Color bright yellow. At the Moctezuma mine, very rarely in small vugs in tellurium and paratellurite. Found very sparingly as minute crystals at the San Miguel prospect, associated with mackayite.

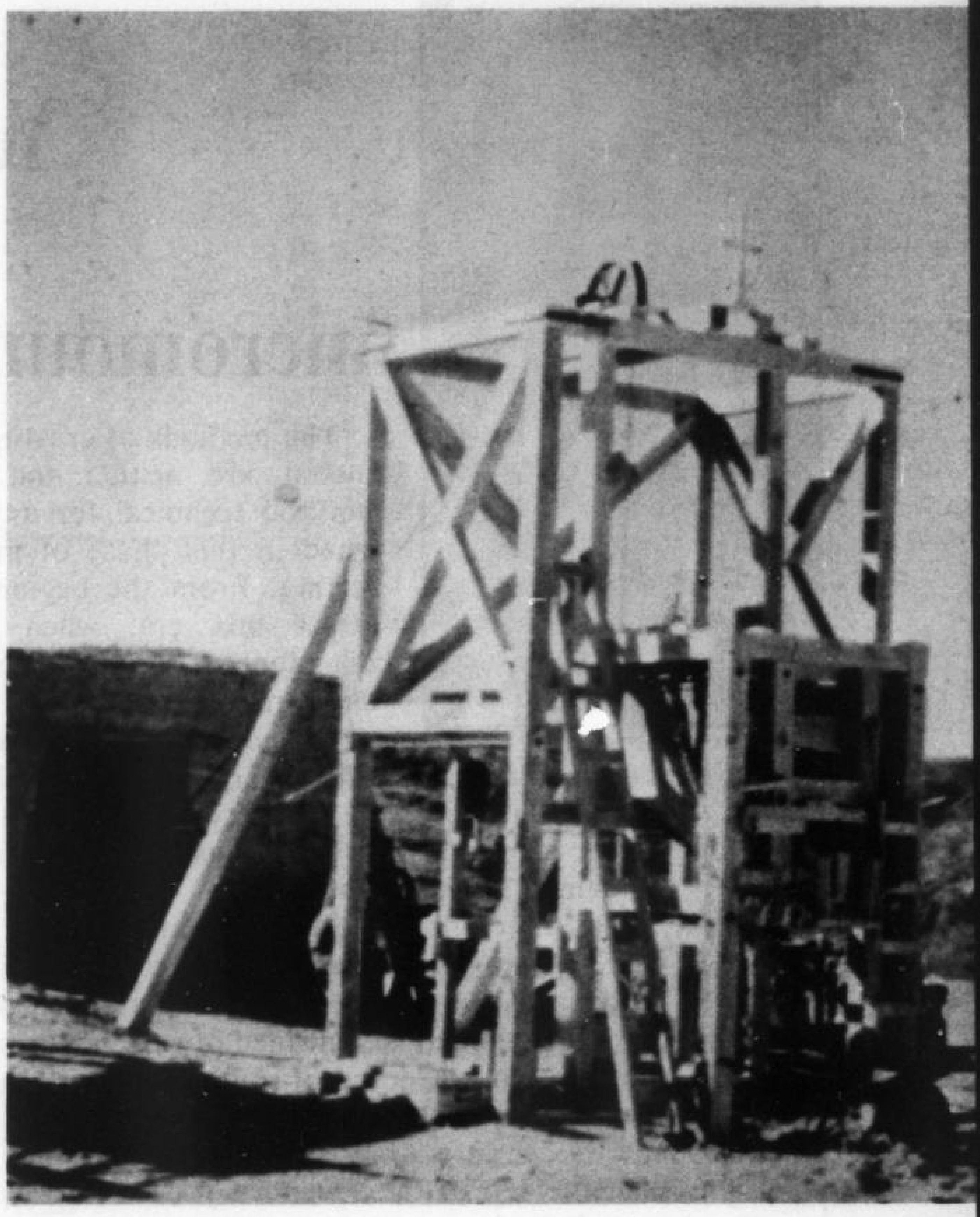
Unnamed Mineral $UO_2\cdot TeO_3$. Orthorhombic. Colorless to pale yellow. Found as minute micaceous

TABLE I.
THE MINERALS OF THE MOCTEZUMA, SONORA TELLURIUM DEPOSIT

Gangue Minerals	Primary Sulfides, etc.	Oxide Minerals	Oxide Tellurium Minerals
Quartz	Tellurium	Limonite	Tellurite
Barite	Pyrite	Pyrolusite	Emmonsite
Illite	Selenium	Gypsum	*Paratellurite
Kaolin	Altaite	Jarosite	*Moctezumite
Fluorite	Tetradymite	Azurite	*Zemannite
Calcite	Klockmannite	Anglesite	*Unnamed colloidal ferric tellurite
	Cinnabar	Malachite	*Spiroffite
	Gold	Chalcomenite	*Denningite
	*Bambollaite	Wulfenite	*Unnamed uryanl tellurite
			*Poughite
			*Cliffordite
			†Mackayite
			"Blakeite"
			*Sonoraite
			*Unnamed calcium tellurite-carbonate

*New Mineral

†From the San Miguel prospect only



The entrance to the Moctezuma mine shaft as it is today.

crystals, usually in rosettes and crusts, associated with emmonsite. Sometimes pseudomorphous after moctezumite.

Unnamed Mineral Calcium Tellurite-carbonate. Orthorhombic. Colorless to pale yellow. Adamantine luster. Found sparingly coating fractures; also intimately associated with spiroffite.

Several additional new minerals have been found which will be studied and described, insofar as the quantity and quality of the minerals permit. Almost all of the Moctezuma tellurium minerals occur as small, inconspicuous crystals, and can be found only after careful examination of the rocks in the mine and the dumps.

When exploratory activities stopped, the mine filled with water to above the third level. The first and second levels are dry, but rock pressure which caused the shaft timbers to twist and buckle, and dry rot on the ladders, make entry into the workings very hazardous.

The dumps contain upwards of 10,000 tons of material, most of which is barren waste. When last visited, tellurite, emmonsite and zemannite could be found by a patient search, and with luck, a few of the other tellurium minerals. However, during the exploration phase the dump was repeatedly combed for material to be used in tellurium extraction tests, so that today there is little to be found.

Since the Moctezuma mine is the prime locality in the world for the oxidized minerals of tellurium, it may be appropriate to list the three other known members of this small group of minerals, none of which has so far been found there:

Teineite	$CuTeO_3 \cdot 2H_2O$. Orthorhombic. Found in Japan.
Montanite	$Bi_2TeO_4(OH)_4$(?). Monoclinic. Found in Montana.
Rodalquilarite	$Fe_2(TeO_3)(HTeO_3)_3Cl \cdot \frac{1}{2}H_2O$. Triclinic. Found in Spain.

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IN PREPARATION

Uranyl tellurite (unnamed mineral)—Gaines, R. V., A new uranyl tellurite from Moctezuma; Sonora.

Calcium tellurite-carbonate (unnamed mineral)—Mandarino, J. A. et al. ☐

Yedlin on micromounting

The methods of creating a micromount are neither too numerous nor too technical for anyone interested in this phase of mineral collecting. From the beginning of the paper box era, when Rakestraw abandoned the glass microscope slide mounts in favor of oblong paper containers, up to the present day, methods varied little. True, the materials have improved and a greater variety has become available. Boxes, cements, inks and plastics have changed; the fundamentals have not.

The material is selected, trimmed to size (Watch it. Don't destroy a fine specimen merely to fit it into a standard sized box. Containers are far more easily come by than good minerals.), cleaned of extraneous matter, and cemented to a pedestal of some sort—cork, balsa wood, toothpick, cactus thorn, plastic rod or what have you, and this, in turn, secured to the bottom of the container, with the top of the specimen just about level with the top of the box.

Good labeling is essential. It is best for the pertinent data to be attached to that portion of the box that houses the specimen, so that they cannot become separated from the mineral and thus be of no value. Name and locality may be affixed to the lid as well, for easy and quick location and identification. What data to affix to the box? Only and all the information that cannot be ascertained elsewhere: name, variety, mineral associations, exact locality, and perhaps the source and cost, and the date acquired. Such things as chemical formula, physical properties, etc., pertain not only to this specimen but to all specimens of this species, and are to be found in all descriptive works. (This applies to file cards and catalogs as well.) With some 40 specimens of azurite in a collection it is not necessary to show the formula, hardness, density, cleavage, crystal system, etc., etc. on every card. Spend more time on the specimen, and a minimum on the "carpentry".

The early collectors, to 1912 or so, had instruments with quite limited fields of vision. When the mineral was in sharp focus, even at low magnification, little but a minute area was visible, and so the cork pedestal, the glue and supporting members were not seen, and therefore did not matter. So many of the old collections show this lack of construction care. We have seen (and reported) mounts where a single crystal of pinhead size reposed on a 3/4 inch cork base in a pool of red sealing

(Continued on page 54)

Collection

(Continued from page 38)

have been especially helpful. Labelling is remarkably complete for many American occurrences. For example, a good California gold comes from the Polar Star Mine, Dutch Flat, Nevada County. Suites of minerals, supplying invaluable data on rock association and paragenesis, help to more fully document such old-time Pennsylvania localities as Fritz Island, Vanartsdalen's, Wheatley, Unionville, Texas, Leiperville, Frankford. The average specimen quality proved so high, moreover, that we placed 500 of the best of them in our systematic collection and 150 more in our Pennsylvania collection. Most of these are comparable to the best we had before in most of the commoner minerals, and many new localities have been added. About a hundred additional specimens went into our student study collection, while at least 500 were relegated to first-class duplicate status.

That's not all. In the summer of 1967 more than half of the better duplicates went to Millersville State College, at Millersville, Pa. Mineralogy courses had just been started in the geology department there and specimens for teaching and display were urgently needed. Dr. William McIlwaine has since told me that about 175 of them have been used for teaching, and 125 for exhibit. That influx of fine specimens, incidentally, led to new cases, supplementary materials, and resultant strengthening of the whole geology program at Millersville. Swarthmore's aid was required too, for permission to so extend the "permanent loan" had to be secured. All who have been involved will agree that this collection is being put to fullest use.

More will be said later to better characterize the material—to see what particular kinds of minerals and types of specimens are present and how these, individually and collectively, give us a partial picture of what the whole collection must have been originally. In the meantime, the story of the Swarthmore-Leidy collection suggests how vital a world-wide inventory of collections can be to mineralogy. □

Specimen Cleaning Reagents

Kent C. Brannock

A number of chemical reagents are commonly used for cleaning mineral specimens, often without due attention to their potential hazards. I would therefore like to review some of the possible dangers involved in the use of these chemicals as well as to give some guidelines for their use.

Due to the extreme toxicity of sodium cyanide and potassium cyanide, their use should not be attempted except by properly trained people with adequate safety precautions. The use of sulfuric acid should also be avoided since it can cause severe burns, and the solution's heat in water is so great that when diluting, the acid must always be added to water, rather than water added to it. In addition, it offers no real advantage over other acids which are much safer to use. This is also true of nitric acid, which is a strong oxidizing agent and can cause severe burns. In no case should an untrained person use a mixture of nitric and hydrochloric acids—aqua regia—which is an extremely potent and hazardous oxidizing agent.

Having discussed reagents which are not recommended for cleaning mineral specimens, let us now turn our attention to the commonly used ones and the precautions which should be taken in their use.

Oxalic Acid

Oxalic acid is generally bought as the solid acid, and is used in water solution, either at room temperature or hot. The dust is hazardous when inhaled or touched, and the acid is an irritant and can cause skin irritation or burns. Oxalic acid and its solutions should be used with adequate ventilation, and one should avoid spilling, contacting skin, eyes or clothing. The acid is very toxic on ingestion and should be kept away from children.

Calcium oxalate is quite insoluble in water so oxalic acid should not be used for cleaning specimens containing soluble calcium minerals such as calcite. As in the case of all acid cleaning materials, after cleaning a specimen with oxalic acid, it should be thoroughly and repeatedly soaked in fresh water to prevent slow leaching and discoloration, especially with iron-bearing minerals. If the water used for the removal of oxalic acid from cleaned specimens is hard, *i.e.* if it contains much dissolved calcium, a scum of precipitated calcium oxalate may form on the specimen, and in this case distilled or demineralized water should be used in place of hard water.

Hydrochloric Acid

This acid is generally obtained as "concentrated" hydrochloric acid, about a 36% solution in water. The vapors are irritating and corrosive, and conc. hydrochloric acid can cause skin burns. Diluted to 5 - 10%, it is widely used for cleaning specimens, and there is no hazard connected with its dilution as in the case with sulfuric acid. The oral toxicity of dilute hydrochloric acid, in small amounts, is negligible. Complete removal of residual acid from cleaned specimens is even more important than in the case of oxalic acid in order to avoid stains.

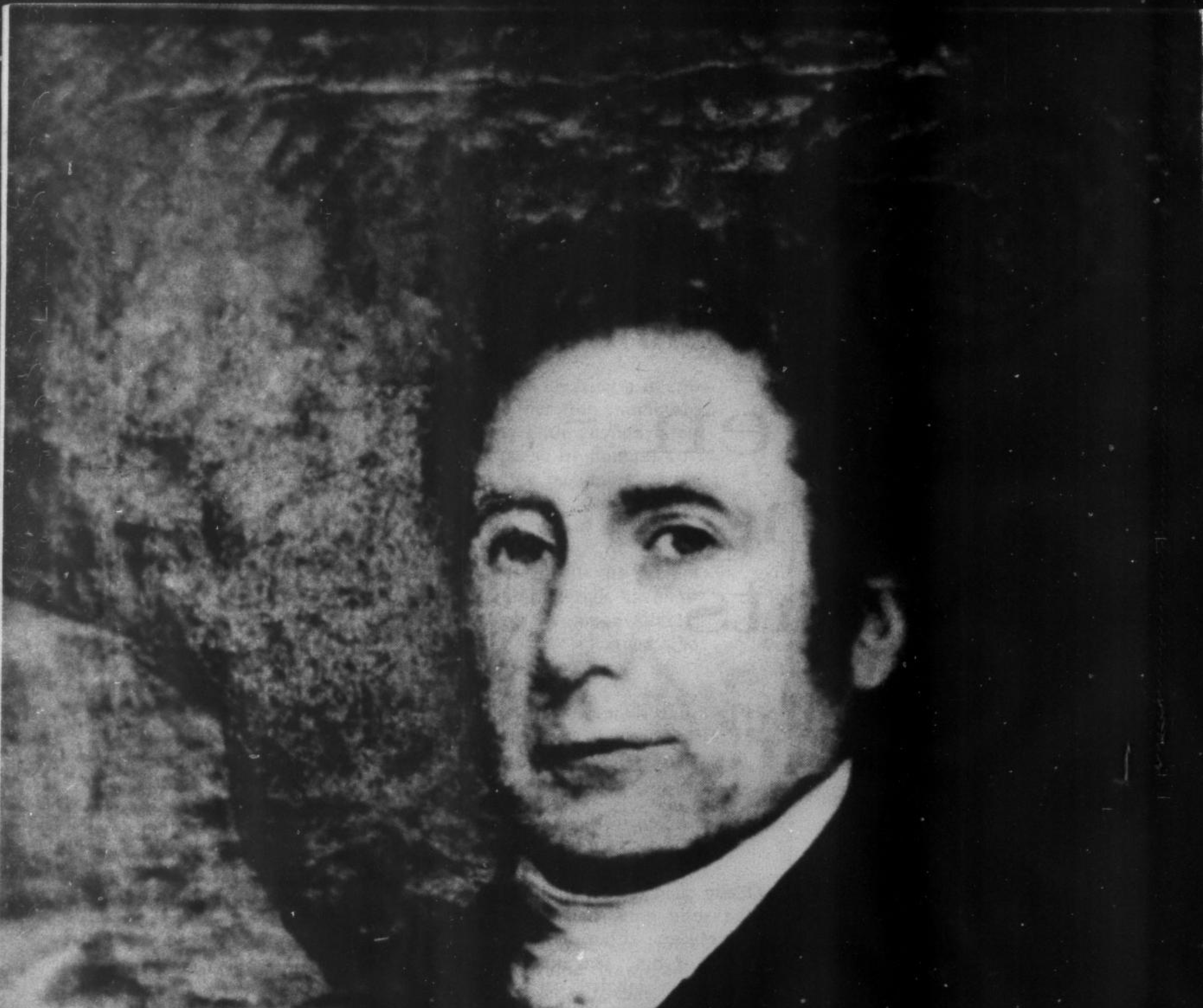
Acetic Acid

Glacial acetic acid (essentially 100%) can cause serious burns and is a severe irritant. It is always diluted in water and there is no heat hazard in its dilution. The acid is relatively weak, and when dilute (3 - 10%) offers virtually no hazard. In fact, for cleaning purposes, one might just as well use vinegar, which is dilute acetic acid.

Sodium Bisulfite (or sodium metabisulfite)

This is a specialty cleaner, and is useful for removal of thin stains of manganese oxides. It is obtained as the pure solid and is used as a saturated solution in water at room temperature. It is a weak acid and is not particularly hazardous except that its solutions evolve sulfur dioxide. The latter is a very toxic gas, so that sodium bisulfite should be used under well-ventilated conditions or out-of-doors.

It is worth repeating that *all chemicals used for cleaning minerals should be kept inaccessible to children.* In the event of skin or eye burns from any of these chemicals, the affected areas should be *thoroughly* flushed with water, contaminated clothing should be removed and a physician should be consulted. If toxic vapors are inhaled, the victim should be carried to fresh air, made to lie down and be kept warm, and again a physician should be consulted. □



New Minerals from New England

by Clifford Frondel • Department of Geological Sciences, Harvard University

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Parker Cleaveland (1780-1850)

The names that have been given to the 99 new or supposedly new mineral species that have been discovered in New England up to the present time are listed in Table 1. The list includes the author and year of description—the full references are given in a footnote—together with the original locality and the present status of the name. The names of the 32 minerals in the list that are today accepted as valid mineral species are printed in heavy type. The remaining minerals have become discredited for various reasons, among them, their proven identity with some earlier known mineral, inadequate or erroneous descriptions, or the impure or altered nature of the substance described.

The first more or less specific identification of minerals in New England appears to have been made by the English traveller John Josselyn in his book *Two Voyages to New-England made during the Years 1638, 1663,* published in London in 1674. In describing points of interest in Maine, he stated that "Twelve miles from Casco-bay, and passable for men and horses, is a lake called by the Indians Sebug, on the brink thereof at one end is the famous rock shap'd like a Moose-Deere, diaphanous, and called the Moose-Rock. Here are found stones like Crystal, and Lapis Specularis or Muscovia glass both white and purple."

In Josselyn's *New England's Rarities,* published in 1672, the locality is given as Sebebug Pond [the present day Lake Sebago]. The term Crystal referred to transparent quartz; the white Muscovia glass was muscovite, and the purple perhaps was lepidolite. Josselyn, during his first trip in 1638, visited his brother, a settler at Scarborough, Maine, for about a year. He had made a more lengthy visit in 1663. The time of Josselyn's mineralogical observations is not known, but specific identifications of minerals were undoubredly also made in the 1600's by John Winthrop the Younger. Winthrop, son of the first Governor of the Massachusetts Bay Colony, gathered a collection of the minerals and ores of the region, but there are no records of his specimens.

There are numerous earlier published references to ores and rocks in New England but they are less specific as to mineralogy. For instance, Captain John Smith in relating a voyage northward from Virginia in 1614 noted that Massachusetts had both iron-ore and stone to build iron furnaces. The bog-iron ores in the coastal region as far north as Maine were also reported by several early writers. Wood (1634), in his *New England's Prospect,* and both Josselyn (1674) and Johnson (1654) mentioned lead ores at various places. The recognition of iron and lead ores and of pyrite in the Virginia settlements dates back to earlier times.

The first copper ore in New England was found in 1648 on land belonging to Governor John Endicott of Salem on the boundary between Danvers and Topsfield in Essex County, Massachusetts. The mine was worked, but nothing is known of the mineralogy to this day. Also noted by Verrazano and other early voyagers along the north Atlantic coast was metallic copper, used as ornaments by the Indians.

In following years, extending up to the beginning of the 19th century, only a small amount of detailed mineralogical work was done on the ores and mineral occurrences of New England. It was not until 1818 that the first new mineral was described from this region by local people. The immediate reason for this low activity, especially compared to the rapid growth of the mineralogical sciences in Europe at that time, was that very few people in New England had a practical knowledge of mineralogy in Colonial and Revolutionary times.

Most of the mineralogical identification of ores and rocks was done by experts sent from Europe to develop the mining industry, or was done in Europe on specimens shipped from the Colonies. In this connection, Benjamin Silliman said that prior to 1810 it was almost impossible to have a common stone or mineral correctly identified in the United States. "We speak from experience, and well remember with what impatient, but almost dispairing curiousity, we eyed the bleak naked ridges . . . that were the scenes of our youthful excursions. In vain did we doubt that the glittering spangles of mica, and the still more alluring brilliancy of pyrite, gave the assurance of the existence of the precious metals in those substances; or that the cutting of glass by the garnet, and by quartz, proved that these minerals were the diamond; but if they were not precious metals, and if they were not diamonds, we in vain required of our companions, and even of our teachers, what they were" (Silliman, 1818).

Columbite was the first new mineral to be discovered in New England. The original specimen was found in the 17th century at an unknown place in Connecticut, probably in the Middletown area, and in 1753 came into the possession of the British Museum, where it is still preserved (cf. Frondel, 1970). It was analyzed by the English chemist Charles Hatchett in 1802, who discovered a new element in it, columbium, and the mineral itself was named columbite by Robert Jameson in 1805.

Some early mineralogical work in the United States was also done outside of New England. Much of it centered around the famous zinc deposit at Franklin, New Jersey. Archibald Bruce described the new mineral zincite from this locality in 1810, and mineralogical studies were made by Thomas Nuttall, Lardner Vanuxem, John Torrey and other American naturalists before 1823, however a considerable part of the early 19th Century work on the mineralogy of Franklin was done abroad. The study by Gerhard Troost in 1823 on the pyroxenes from Franklin was one of the first American papers on descriptive crystallography.

The first new mineral to be both discovered and described in New England was chelmsfordite. It was described and named by J. F. Dana and S. L. Dana in their small book *Outlines of the Mineralogy and Geology of Boston and its vicinity*, published in Boston in 1818. James Freeman Dana and Samuel Luther Dana, relatives of the Yale mineralogist James Dwight Dana, were brothers, and both chemists. The introduction to their book begins "It is a common remark, that the vicinity of Boston is no field for the mineralogist. To this opinion we must ascribe the coldness and indifference, with which mineralogy is here treated. . . . It will be found, that more than forty simple minerals and several rocks occur within a few miles of Boston. . . ." Their account of the local minerals, however, probably did little to either inform or enthuse the natives.

"The first new mineral to be both discovered and described in New England was chelmsfordite."

The chelmsfordite, from a metamorphosed limestone bed in schist at Chelmsford, Massachusetts, was described in terms of its external characteristics. With no chemical data, and was placed as a subspecies under Schaalstone [schaalstein, Werner's name for wollastonite], which the authors stated they had never seen. The mineral later turned out to be wernerite. The more or less altered forms of wernerite are difficult to identify, by older methods, and have led to numerous erroneous identifications or supposed new species, including the nuttallite of Brooke (1824) from the similar and nearby occurrence at Bolton, Massachusetts.

In the 20 years following the description of chelmsfordite, from 1818 to 1838, no less than 21 supposedly new minerals were described from New England. The number of publications devoted to essentially mineralogical and geological topics, and excluding books, showed a parallel increase. A total of only about 15 publications on these topics appeared in the roughly 200 years between the time of the earliest settlements and 1810. In a typical mineralogical publication of the later 1700's the reader might find an account such as this one by the historian Jeremy Belknap, in the 785th volume of the Memoirs of the American Academy of Arts and Sciences. He noted a deposit of copperas [the hydrated iron sulfate melanterite] at Lebanon, New Hampshire [now in York County, Maine, due to a boundary change] in the weathered outcrop of sulfide deposit. In marked contrast, a total of about 110 publications on mineralogical topics came out during the period from 1810 to 1830.

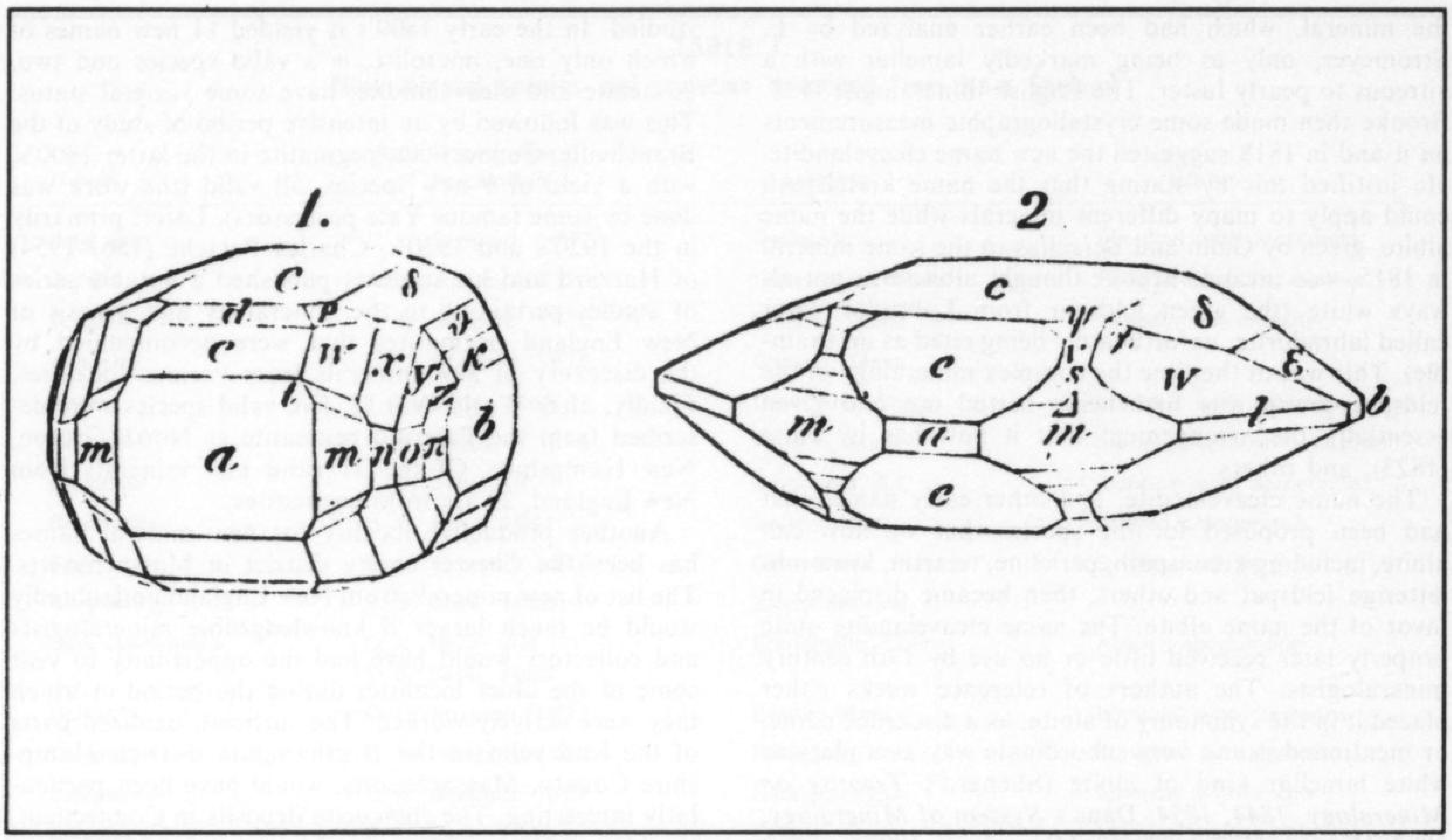
This great burst of new minerals and new publications accompanied the introduction and extremely rapid growth of the natural sciences and chemistry in the colleges of New England during the early decades of the 19th century. The Departments of Geology now in the older colleges of the region had their beginnings at that time. Earlier the colleges had been very largely classical and theological in their leanings. This activity in the natural sciences very largely stemmed from the energy and enthusiasm of Benjamin Silliman (*1779-1864*) of Yale and, among others, his students Amos Eaton and J. D. Dana. The founding of the American Journal of Science by Silliman in 1818 was an important factor, as were the lecturing activities, at the popular level, of Silliman and of Eaton. The American Mineralogical Journal, published in 1810 in New York City by Archibald Bruce, was a fore-runner of Silliman's journal.

The description of new minerals in New England sometimes has been accompanied by a little acrimony. One of the more strenuous controversies took place from 1842-1845 between C. U. Shepard (*1804-1886*) of Amherst and J. E. Teschemacher (*1790-1853*), a chemist of Boston, on the status of a new mineral found by Shepard in pegmatite at Chesterfield, Massachusetts, and named microlite. It centered on the distinction from pyrochlore, a problem rendered difficult by the inadequate chemical analytical techniques of the time. The matter was enlivened only by Shepard's remark that "The dimensions of the controversy to which this little mineral has already given rise seem half entitled to place it under gigantolite." Shepard's belief that microlite was a distinct species was based "on grounds which show a very superficial knowledge of the whole subject," according to Teschemacher, but it finally proved to be a good mineral.

"Of the 34 names Shepard proposed for New England Minerals, only four have become accepted."

The generally low level of crystallographic knowledge and practice in the United States in the first half of the 19th century also led to particular difficulties. Among them was a discussion in 1844-1846 between Edward Hitchcock, Francis Alger, C. U. Shepard and Benjamin Silliman on the crystal morphology of a new mineral, lincolnite. Named after Levi Lincoln, a Governor of Massachusetts, it had been described by Hitchcock from a locality at Deerfield, Massachusetts, in 1831. The mineral ultimately turned out to be identical with heulandite.

One of Hitchcock's interests was the clay concretions



This drawing of beryllonite crystals from Stoneham, Maine was based on a description of the mineral by E. S. Dana (1888).

found in the clays of the Connecticut River, later described by Tarr (1935), for which he sought to "do for them what the Abbe Haüy did for crystallography" in the way of finding definite laws to explain their shape.

The early mineralogical work in this country was essentially descriptive and topographic in nature, with emphasis on composition, occurrence and use, and later developed more along chemical rather than crystallographic lines. In the latter 19th century, largely as a consequence of the great expansion of the mining and metallurgical industries in the United States at that time, mineral chemistry, analytical chemistry and geochemistry became the outstanding strength of American work on minerals and rocks.

About two-thirds of the 99 supposedly new minerals from New England have been discredited or set aside in place of other names. The mortality was particularly high among names proposed in the early 19th century. Inadequacies in the early mineralogical techniques are largely to blame, but it also must be taken into account that a broader view has been held in the past of what constitutes a new mineral deserving a specific name.

Some early authors were more generous or perhaps more lax than others, especially C. U. Shepard. Shepard was an ardent collector and student of minerals and meteorites. Of the 34 names he proposed for New England minerals only four have become accepted: danburite, amesite, microlite and corundophilite. In fact, of the 122 new mineral names Shepard proposed regardless of locality, only 16 have survived. This, still is a lot. J. D. Dana once remarked concerning some of Shepard's supposed new minerals that "until they are fully described by the author, and complete analysis given, with other evidence that they are good species, they can have no claims to recognition in the science." Today, new mineral names and a definitive description must be submitted to and approved by an international committee, appointed for the purpose by the International Mineralogical Association, before they can be published.

In a few instances local mineral names originally proposed in the sense of distinct species, and then made invalid, have survived in a minor varietal status. This is the case with one of the most typical and best named of New England pegmatite minerals, cleavelandite. It was first found before 1817 in pegmatite either at Chesterfield, Massachusetts, or at Topsham, Maine, and specimens found their way to Europe where they were described by several investigators. It is not now known who found the first specimens or who sent them to Europe. They may have been sent by Colonel George Gibbs of Newport, Rhode Island, who was the leading American mineral collector of the time.

It is well known that Parker Cleaveland sent specimens of what is now called cleavelandite (from a pegmatite at Topsham) to Gibbs, sometime before 1817, who recognized it as a distinct form of feldspar. The mineral was first described by the German mineralogist J. F. L. Hausmann (1817) as kieselspath, in the sense of a name for the whole species now called albite. He described the mineral, which had been earlier analyzed by F. Stromeyer, only as being markedly lamellar with a vitreous to pearly luster. The English mineralogist H. J. Brooke then made some crystallographic measurements on it and in 1818 suggested the new name cleavelandite. He justified this by stating that the name kieselspath could apply to many different minerals while the name albite, given by Gahn and Berzelius to the same mineral in 1815, was invalid. Brooke thought albite was not always white (the green feldspar from Labrador, later called labradorite, unfortunately being cited as an example). This was at the time the complex mineralogy of the feldspar group was first being sorted out and given essentially the arrangement that it now has by Rose (1823), and others.

The name cleavelandite, and other early names that had been proposed for the species that we now call albite, including kieselspath, pericline, tetartin, krummblätterige feldspat and others, then became displaced in favor of the name albite. The name cleavelandite quite properly later received little or no use by 19th century mineralogists. The authors of reference works either placed it in the synonomy of albite, as a discarded name, or mentioned it in a very subordinate way as a platy or white lamellar kind of albite (Shepard's *Treatise on Mineralogy, 1844, 1854;* Dana's *System of Mineralogy,* 1892; Hintze's Handbuch *der Mineralogie,* 1896).

In more recent times, primarily in response to a growing interest in the mineralogy and genesis of pegmatites during the 1920's and 1930's, cleavelandite began to come back into use, especially in New England, as a varietal designation for a more or less sharply defined kind of albite found in the replacement zones of pegmatites. Cleavelandite in this sense refers to material usually relatively coarsely crystallized, somewhat more platy in shape than usual and often in lamellar aggregates, that tend to be warped or curved or in crudely divergent or subradial groupings. Cleavelandite is not a very satisfactory term since its characters are superficial, and quite gradational - even at a single locality such as Chesterfield or Topsham. The use of the term seems mostly determined by the genetic context in which the material occurs. In any case, the name cleavelandite seems unlikely to fall into dissuse at least in New England.

The name boltonite, erroneously given in 1832 to a mineral from metamorphosed limestone at Bolton, Massachusetts, and shown to be forsterite by J. Lawrence Smith over a century ago, also seems to be imperishable at least amongst mineral collectors in New England. Goshenite, a name given by Shepard in 1844 to a mineral later found to be beryl, from Goshen, Massachusetts, has also maintained some usage among collectors, and in the gem trade for colorless and transparent beryl. This is not quite appropriate because the original goshenite was also described as being bluish, greenish and pale rose. Cyrtolite could be rejuvenated as a variety of zircon containing hydroxyl ion.

It is interesting to note that there are individual localities in New England that have been particularly productive of new minerals. Among the pegmatite localities, for which the region is justly famous, the Chesterfield-Goshen area in western Massachusetts was the first to be studied. In the early 1800's it yielded 11 new names of which only one, microlite, is a valid species and two, goshenite and cleavelandite, have some varietal status. This was followed by an intensive period of study of the Branchville, Connecticut, pegmatite in the latter 1800's, with a yield of 9 new species, all valid (the work was done by some famous Yale professors). Later, primarily in the 1920's and 1930's, Charles Palache (1869-1954) of Harvard and his students published a notable series of studies pertaining to the mineralogy and genesis of New England pegmatites that were accompanied by the discovery of new minerals from various localities. Finally, after World War II, five valid species were described from the Palermo pegmatite at North Groton, New Hampshire. Of the 31 valid new minerals from New England, 23 are from pegmatites.

Another productive locality for new mineral names has been the Chester emery district in Massachusetts. The list of new minerals from New England undoubtedly would be much larger if knowledgeable mineralogists and collectors would have had the opportunity to visit some of the older localities during the period in which they were actively worked. The surficial, oxidized parts of the lead veins in the Northampton district, Hampshire County, Massachusetts, would have been particularly interesting. The chalcocite deposits in Connecticut, the Mount Mica pegmatite in Maine, and the lead-silver veins, containing sulfantimonides, in the Sullivan area of Maine and the Newburyport district, Massachusetts would also have been revealing.

Some of the new minerals from New England haven't yet been found elsewhere in the world. Others have been found in numerous locales. Hurlbutite, described by Mary Mrose from material collected on a Sunday excursion to the Smith pegmatite near Newport, New Hampshire, has now been found at four foreign localities. Lithiophilite, gibbsite, danburite and microlite are widespread. A list also could be made of new minerals discovered in other regions for which the second known locality was New England. Among them are brazilianite, roscherite, phosphophyllite, huhnerkobelite, lacroixite and switzerite.

Grateful acknowledgement is made to Mary E. Mrose of the U.S. Geological Survey, Washington, D.C., for reviewing the manuscript and for supplying additional information.

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TABLE 1.
New mineral species and varieties described from New England

Name	Author and year of description	Locality	Status
Adamsite	C. U. Shepard, 1857	Derby, Vt.	Identical with muscovite
Aglaite	A. A. Julien, 1877	Chesterfield, Mass.	Pseudomorphous mixture
Amesine	C. U. Shepard, 1876	Chester, Mass.	Synonym of amesite
Amesite	C. U. Shepard, 1876	Chester, Mass.	
Annite	J. D. Dana, 1868	Cape Ann, Mass.	Identical with lepidomelane
Asbestite	C. U. Shepard, 1876	Pelham, Mass.	Identical with anthophyllite
Bowenite	J. D. Dana, 1850	Smithfield, R.I.	Identical with serpentine
Brodrickite	H. C. Dake, 1941	Bolton, Mass.	Altered phlogopite?
Berylite	C. U. Shepard, 1876	Chesterfield, Mass.	Synonym of beryl
Beryllonite	E. S. Dana, 1888	Stoneham, Me.	
Beta-spodumene	G. J. Brush and E. S. Dana, 1880	Branchville, Conn.	Altered spodumene
Boltonite	C. U. Shepard, 1832	Bolton, Mass.	Identical with forsterite
Calyptolin	C. U. Shepard, 1851	Haddam, Conn.	Synonym of calyptolite
Calyptolite	C. U. Shepard, 1851	Haddam, Conn.	Identical with zircon
Canaanite	S. L. Dana, 1844	Canaan, Conn.	Identical with pyroxene
Cerium Ochre	C. T. Jackson, 1844	Bolton, Mass.	Inadequate description
Chathamite	C. U. Shepard, 1844	Chatham, Conn.	Variety of chloanthite
Chelmsfordite	S. L. Dana and J. F. Dana, 1818	Chelmsford, Mass.	Identical with wernerite
Chlorophyllite	C. T. Jackson, 1841	Unity, N.H.	Pseudomorph after cordierite
Cleavelandite	H. J. Brooke, 1823	Chesterfield, Mass.	Variety of albite
Columbiconite	C. U. Shepard, 1876	Middletown and Haddam, Conn.	No description
Columbite	R. Jameson, 1805	Middletown, Conn.?	
Cookeite	G. J. Brush, 1866	Hebron and Paris, Me.	
Corundophilite	C. U. Shepard, 1851	Chester, Mass.	
Cryophyllite	J. P. Cooke, 1867	Cape Ann, Mass.	
Cummingtonite	Dewey, 1824	Cummington, Mass.	
Cumatolite	C. U. Shepard, 1867	Goshen, Mass.	Synonym of cymatolite
Cymatolite	C. U. Shepard, 1867	Goshen, Mass.	Altered spodumene
Cyrtolite	W. J. Knowlton, 1867	Rockport, Mass.	Altered zircon
Danaite	A. A. Hayes, 1833	Franconia, N.H.	Variety of arsenopyrite
Danalite	J. P. Cooke, 1866	Cape Ann, Mass.	
Danburite	C. U. Shepard, 1839	Danbury, Conn.	
Deweylite	E. Emmons, 1826	Middlefield, Mass.	
Dickinsonite	G. J. Brush and E. S. Dana, 1878a	Branchville, Conn.	
Emerite	C. U. Shepard, 1865	Chester, Mass.	Identical with corundum
Eosphorite	G. J. Brush and E. S. Dana, 1878c	Branchville, Conn.	
Eremite	C. U. Shepard, 1837	Watertown, Conn.	Identical with monazite
Euchlorite	C. U. Shepard, 1876	Chester, Mass.	Altered biotite
Eucryptite	G. J. Brush and E. S. Dana, 1880	Branchville, Conn.	

(Continued next page)

Table 1 (Cont'd)

Name	Author and year of description	Locality	Status
Eumanite	C. U. Shepard, 1851	Chesterfield, Mass.	Brookite?
Fairfieldite	G. J. Brush and E. S. Dana, 1879	Branchville, Conn.	
Fasciculite	E. Hitchcock, 1823	Hawley, Mass.	Synonym of actinolite
Ferrocalcite	J. D. Dana, 1868	New England?	Variety of calcite
Ferrocolumbite	C. U. Shepard, 1844		Ilmenite?
Ferro-ilmenite	Hermann, 1870	Haddam, Conn.	Variety of columbite?
Fibrolite	E. Emmons, 1826	Cummington, Mass.	Synonym of cummingtonite
Fillowite	G. J. Brush and E. S. Dana, 1879	Branchville, Conn.	
Frondelite	L. M. Lindberg 1949	North Groton, N.H.	
Gibbsite	J. Torrey, 1822	Richmond, Mass.	
Goshenite	C. U. Shepard, 1844	Goshen, Mass.	Identical with beryl
Graftonite	S. L. Penfield, 1900	Grafton, N.H.	
Haddamite	C. U. Shepard, 1877	Haddam, Conn.	Identical with microlite
Hamlinite	W. E. Hidden and S. L. Penfield, 1890	Stoneham, Me.	Identical with goyazite
Hampdenite	A. D. Roe, 1906	Hampden Co., Mass.	Serpentine
Hampshirite	R. Hermann, 1849	Chester, Mass.	Talc pseudomorph
Hampshirin	C. U. Shepard, 1876		Synonym of hampshirite
Hebronite	F. von Kobell, 1872	Hebron, Maine	Synonym for amblygonite
Hermannite	A. Kenngott, 1853	Cummington, Mass.	Synonym of cummingtonite
Hermannolite	C. U. Shepard, 1876	Haddam, Conn.	Identical with columbite
Humoferrite	C. U. Shepard, 1876	Whately, Mass.	Synonym for limonite
Hurlbutite	M. E. Mrose, 1952	Newport, N.H.	
Hydronephelite	F. W. Clarke, 1886	Litchfield, Me.	Altered mixture
Indicolin	C. U. Shepard, 1876	Goshen, Mass.?	Identical with tourmaline (indicolite)
Kieselspath	J. F. L. Hausmann, 1817	Chesterfield, Mass.	Synonym of albite
Landesite	H. Berman and F. A. Gonyer, 1930	Poland, Me.	
Lepidochlore	C. U. Shepard, 1859	Mt. Pisgah, Maine	Impure chlorite?
Lincolnite	E. Hitchcock, 1833	Deerfield, Mass.	Identical with heulandite
Lithiophilite	G. J. Brush and E. S. Dana, 1878a	Branchville, Conn.	
Masonite	C. T. Jackson, 1840	Natick, R.I.	Identical with chloritoid
Melanolite	H. Wurtz, 1850	Somerville, Mass.	Identical with delessite
Microlite	C. U. Shepard, 1835	Chesterfield, Mass.	
Natrophilite	G. J. Brush and E. S. Dana, 1890	Branchville, Conn.	
Neomesselite	C. Frondel, 1955	Palermo, N.H.	
Newportite	J. G. Totten, 1852	Newport, R.I.	Identical with chloritoid
Nuttalite	H. J. Brooke, 1824	Bolton, Mass.	Identical with wernerite
Palermoite	M. E. Mrose, 1953	North Groton, N.H.	
Paracolumbite	C. U. Shepard, 1851	Taunton, Mass.	Synonym of ilmenite
Parailmenite	C. U. Shepard, 1880	Taunton, Mass.	Synonym of ilmenite

(Continued next page)

Table 1 (Cont'd)

Name	Author and year of description	Locality	Status
Parathorite	C. U. Shepard, 1857	Danbury, Conn.	Identical with thorite
Pelhamine	C. U. Shepard, 1876	Pelham, Mass.	Altered anthophyllite?
Pelhamite	J. P. Cooke and F. A. Gooch, 1875	Pelham, Mass.	A hydromica
Phaestine	A. Breithaupt, 1823	Pelham, Mass.?	Diallage
Phyllite	T. Thomson, 1828	Sterling, Mass.	Identical with chloritoid, and mica
Reddingite	G. J. Brush and E. S. Dana, 1878a	Branchville, Conn.	
Richmondite	G. A. Kenngott, 1866	Richmond, Mass.	Identical with gibbsite
Rubellin	C. U. Shepard, 1876	Chesterfield, Mass.	Synonym of rubellite
Scheelitine	F. S. Beudant, 1832	Southampton, Mass.	Synonym of stolzite
Scovillite	G. J. Brush and S. L. Penfield, 1883	Salisbury, Conn.	Identical with rhabdophane
Sillimanite	G. T. Bowen, 1824	Chester, Conn.	Name given in place of fibrolite
Sterlingite	J. P. Cooke, 1874	Sterling, Mass.	Identical with muscovite
Strunzite	C. Frondel, 1957	North Groton, N.H.	
Taenite	E. Hitchcock, 1841	Massachusetts	Identical with feldspar
Torrelite	T. Thomson, 1836	Middletown, Conn.	Identical with columbite
Triploidite	G. J. Brush and E. S. Dana, 1878b	Branchville, Conn.	
Tungstic Ochre	B. Silliman, 1822	Monroe, Conn.	Identical with tungstite?
Washingtonite	C. U. Shepard, 1842	Washington, Conn.	Identical with ilmenite
Whitlockite	C. Frondel, 1941	North Groton, N.H.	
Wolfeite	C. Frondel, 1949	North Groton, N.H.	
Zircarbite	C. U. Shepard, 1877	Rockport, Mass.	Inadequate description

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Louis Shrum profile of a collector

by Kent C. Brannock

Not all notable mineral activists are blessed with the opportunity to develop in a hot-bed of mineralcgical activity as did Paul Seel, our first personality (vol. 1, no. 1). Operating in more isolated environments and having little contact with professional mineralogists and knowledgeable collectors, there are many people who have, nonetheless, stimulated the collecting of minerals by others and who have made notable achievements on their level of activity. One such individual is Louis Shrum.

Mineral collectors visiting Louis Shrum's home in Lincolnton, North Carolina, can count on spending an enjoyable time viewing his many fine specimens, painstakingly mounted in plastic boxes. Even the extremely inquisitive will find that Louis' patience never appears to waver as he answers questions about specimen after specimen, and relates stories about his numerous collecting experiences and those of his many fellow collectors.

An active trader, Louis has many contacts all over the U.S. and Europe. This network of friends has helped him obtain some of his favorite specimens. The prizes of the Shrum collection include a cassiterite crystal from Cornwall, England; a hiddenite crystal on quartz crystals and an emerald crystal from Hiddenite, North Carolina; a bicolor tourmaline from Elba, Italy; and an erythrite crystal from Bou Azzer, Morocco, all carefully labeled and catalogued in his precise manner.

Shrum, 42, began collecting in Lincoln County, North Carolina, where he was born and still resides with his wife, Moenner, and daughter Patricia Denise.

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YEDLIN

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wax or yellow glue . . . where the framework of supporting corks could be likened to a collapsed house of jackstraws, and the specimen lost in a maze of extrania. This, we surmise, was due to slow drying cements, no longer a factor. Today, no excuse exists for making a sloppy mount, and our recent observation of present day work discloses that today's operative is skilled, artful and knowing, with judgements and abilities superior to those of the "old-timers."

The state of Rhode Island, until recently not noted for its wealth of mineral species, has come into its own. The rare danalite has always been available from the areas near Cumberland, and suites or serpentine associates have been collected since early times. Recent road construction, however, has provided eager collectors with material hitherto noteworthy for its appearance in the Alps. Gneisses, schists and a few pegmatites have provided such things as anatase, brookite, monazite, adularia, rutile, golden sphene twins, molybdenite, ferrimolybodite, and some zeolites. These occurred, for the most part, in the "augen" gneiss, the "eye pods" which sometimes swell the layered metamorphic rock.

It was in December of 1968 that Gilbert George sent us a batch of stuff from the blasting of the roadway at Cranston, R.I., Route 295. Periodically more material was received from him, and as the type of rock changed, so did the minerals. A vein of lead and other sulfides was uncovered, and the mineral assemblage resembled that of the Loudville, Mass. locality, a couple of hundred miles to the Northwest. Galena, cerussite, anglesite, pyromorphite and wulfenite appeared, in micro specimens, although some clusters approached cabinet size. A recent letter from Mr. George, 82 Chapin Ave., Providence, R.I. 02909, indicates some other things. We quote, in part:

"May 17, 1970. Dear Neal, ... Fluorite crystals in many forms and colors were found at the road cut for Rte. 295 near Central Ave., in Johnston, R.I. Dark purple octahedra modified by the cube occur. Colorless cubes, showing the octahedron and trapezohedron, with the modifying faces a dark purple, were also found. Cubes of blue, pink and green exist. Peculiarly, some of the lighter colored material fluoresces green, an unusual color for the mineral.

"Sometimes fluorite occurs here in dark purple octahedra inside colorless cubes. This has been taken to indicate temperature variation—the {001} indicating low temperature formation and the {111}, high.

"Other minerals found at this cut were apatite (with sulfides), pyrite, sphalerite, galena, muscovite, pyrolusite, wad, leucoxene, anatase and brookite. Since the primary mineral ilmenite is common in this state, the last three are abundant. Most of the above are suitable for micromounts only, but anatase from Rte. 146 road cut reached 1/8 inches in size.

"Other recent finds in R.I. are large scheelite crystals, at the intersection of Rtes. 295 and 195 in Johnson, about 1000 ft. west of the original location, indicating that more may turn up. Some of this scheelite seems altered to powellite, fluorescing orange on the blue-fluorescing original mineral. Associates here were pyrite, chalcopyrite, pyrrhotite, colorless to dark green fedlspar, sphene, fluorite, and vermiform chlorite. I'll keep you posted. Best wishes, Gil."

This material (we're back with our own comments) doesn't last long. Roads are engineered so that any cuts, whether rock or earth, balance areas of fill. The blasted rock doesn't remain in place for any extended period, but is moved almost immediately to a low spot, compacted, and covered with gravel to attain its final contour. The contractor usually has a completion bond up, with penalty clauses for time delays. Hence it behooves a collector to be on the spot as soon as possible. In a few days the spot may no longer be there!

We are continuously confronted with the question "What shall we mount? Single crystals, groups of crystals, matrix specimens?" Our answer is: Mount anything you want, provided it falls within the limits (how we dislike that word) defining a micromount—a natural mineral, in crystals, mounted, labeled, requiring magnification for proper viewing.

At the 1970 Tucson show Phyllis Sonnenberg asked us to look at a micro and comment. We opened the plastic box and could see nothing. Thought we'd popped the specimens, and were about to offer apologies, when we peered at it at 30 X. Turned out to be a cerussite twin from the Mammoth mine, cemented to the point of a cactus thorn (oh, the advantages of living in southern Arizona). Fine and dandy, but slight movement showed another important thing—included was a movable bubble. So much for one end of the spectrum.

At the other end the late Gunnar Bjareby of Boston used a great

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building a one-circle optical goniometer

William A. Henderson, Jr.

Most micromounters do not realize that they possess two of the three components needed to make a one-circle optical goniometer. Moreover, the third component is by far the cheapest. The three are: a light source, a telescope or microscope, and an arrangement for rotating a crystal and measuring the angle of rotation. Only the last is not at hand, and that is easily constructed.

But why would anyone want a goniometer? As any mineral book will explain, a goniometer is used to measure the angles between faces on a crystal. An optical goniometer is used to measure the angles between the faces on very small crystals, and to do it accurately. Such measurements are very useful for two reasons. First, they can be used to determine what crystal forms are present on the crystal. Second, they can be used as a check on the identify of minerals.

Micromounters, who suffer frequently from lack of sufficient material for testing, are again lucky that identification by this technique does not destroy the specimen even to the extent of necessitating the removal of the crystal from the matrix (most of the testing I have done has been on specimens still in their micromount boxes). Moreover, the small crystals of micromount size are more perfectly developed and show a greater variety of forms for investigation than larger specimens.

Do you want to try your hand at it? You will only need to make the device for holding and rotating the crystal or micromount box. I made my first one by mounting a wooden dowel through close fitting holes in two blocks of wood so it could rotate. On one end of the shaft, I glued a small wooden tray to hold the specimen. In it I put a lump of roofing compound (clay will do) which can be molded to hold the crystal in the right position. On the other end of the shaft, I glued a fairly large, clear plastic protractor (available from stationery stores for a dime or so) so that its center coincided with the center of the goniometer's shaft. The protractor rotates past a marker line drawn on the goniometer base. The goniometer is mounted on three legs (faucet washers) for greater stability. About 12 inches long, the only critical dimensions on the goniometer are enough height for the shaft to clear the microscope base and enough length for the shaft to bring the sample holder under the microscope optics. Figure 1 shows the goniometer in front and end views.

Several steps are necessary in using the goniometer in order to get good results. The sequence is as follows:

1. To get a smaller light source, stop the regular microscope light source down by putting a piece of aluminum foil pierced by a half inch hole over the front of it.

2. Arrange the light so it is pointing steeply down from above the scope. The light should be perhaps eight inches above the goniometer shaft and about four inches in front of the microscope optics, directly in front of the scope. Either a monocular or binocular microscope can be used, although a monocular microscope is better. I use my binocular microscope, but only one ocular.

3. Set up the goniometer under the 'scope so that its shaft is perpendicular to the line between the 'scope and the light.

4. Stick the specimen in the clay and arrange the crystal so it is exactly in line with the shaft. That is, sighting along the shaft, it must point directly at the crystal.

5. Wiggle the crystal about and mold the clay so that the edge between the two crystal faces you want to work on is exactly coaxial with the shaft. That is, the crystal edge must be pointing in the same direction as the shaft and be in line with the center of the shaft. Focus the microscope on the crystal edge. When this is properly done, rotation of the shaft without moving the microscope, goniometer base or light will make each of the crystal faces in turn reflect light strongly through the microscope. All that should be necessary is a very slight adjustment of the microscope focus.

6. Turn off all other lights to avoid unwanted reflections.

7. Rotate the shaft so the first face reflects through the 'scope as strongly as possible. Record the angle reading on the goniometer, estimating to the nearest tenth of a degree. Rotate the shaft so the second face reflects. Record the second angle. Repeat the process four or five times and find the average difference between the readings on the two faces. This is the angular relationship between the two faces. A sample of the calculations performed on octahedron faces of fluorite is as follows:

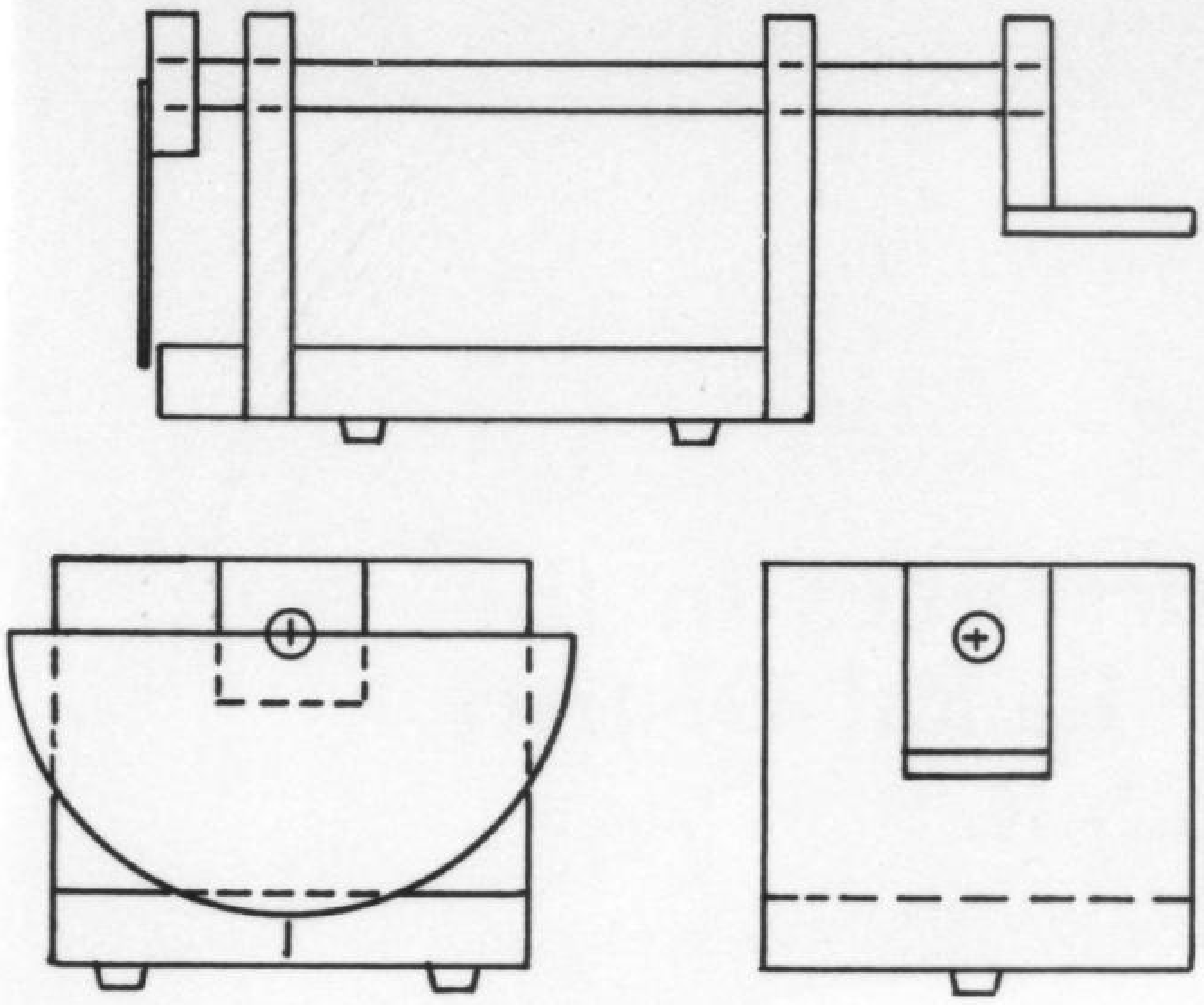

Fig. 1. Front and end views of a one-circle optical goniometer, showing location of axle, protractor and sample holder.

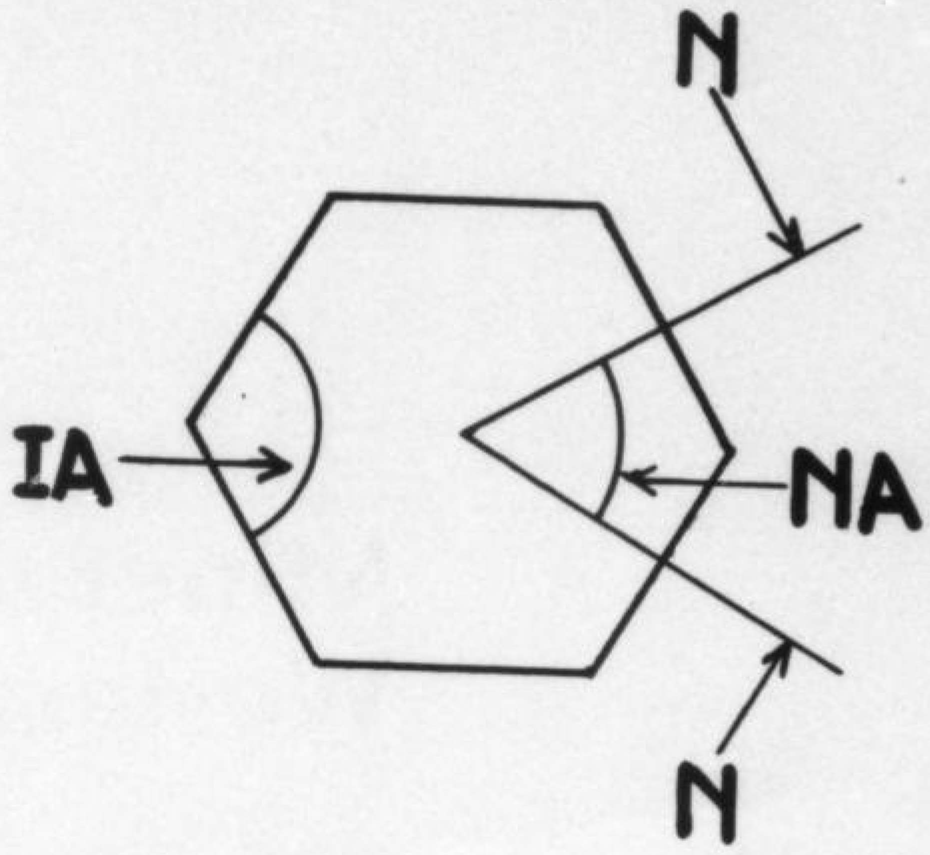

Fig. 2. This shows the relationship between the interfacial angle (IA) and the normal angle (NA) of the faces of a hexagonal prism.

First angle	Second angle	Difference	
123.9	53.8	70.1	
124.2	53.8	70.4	
123.0	53.0	70.0	
123.2	53.4	69.8	
123.7	53.6	70.1	
		70.1	Average difference

This average difference of 70.1° is about 70°6′ (70 degrees 6 minutes) and compares favorably with the literature value of 70°31′ for the angular relationship between octahedron faces.

The above is the angle between the ***normals*** to the two faces, not the angle between the faces themselves. A normal is a line drawn perpendicular to a face. The relationship between the two for the prism faces of a hexagonal crystal is given in Figure 2. The normals to two faces are designated by the letter N. The interfacial angle (IA) is 120°. The normal angle (NA) is 180° less the interfacial angle or 60°. This relationship that NA plus IA is equal to 180° is true for any pair of faces of any crystal.

A listing of the angles between the various faces on a crystal is only of value to collectors when it can be compared to literature values or used in calculations based on literature values. Sinkankas' superb book ***Mineralogy for Amateurs*** makes excellent use of interfacial angles drawn on each crystal diagram. ***Dana's Textbook of Mineralogy*** gives polar or normal angles for the more common crystal forms of minerals. ***Dana's System of Mineralogy*** uses a third type of notation which is too complex to describe here.

Angles between faces are usually given in a form such as *ao*, $(100)\wedge(111) = 54^\circ 44'$. This means that the polar angle between the *a* of cube face and the *a* or octahedron face of an isometric mineral is 54 degrees and 44 minutes.

To check the accuracy of the homemade goniometer, I measured the angles between different faces on several micro garnet specimens. In all cases but one, the angles measured between the dodecahedron, trapezohedron and other faces of garnets were within one degree of the literature values. In most cases, they were within a half a degree. Thus, it was possible to identify exactly the crystal forms present and, in the process, to confirm the identification of the crystals as garnet.

One group of crystals sight identified as garnet gave angles which did not fit for an isometric mineral, thus illustrating the value of the optical goniometer as a tool for mineral identification. The story of this case of mistaken identify will be told in a subsequent article.

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Mineral Occurrences in the Western Lake Baikal District U.S.S.R.

D. D. Hogarth, Department of Geology, University of Ottawa

The metamorphic rocks at the western end of Lake Baikal in Siberia have long been known as a source of prime grade phlogopite mica and fine quality lapis lazuli. The mica has been used in the electrical industry and the lapis lazuli as a decorative stone. Gigantic crystals of phlogopite and rich blue lapis lazuli specimens from this district grace the cabinets of many museums of the U.S.S.R. and some of the larger museums of the western world. Mica is still being mined today but on a declining scale; lapis lazuli is probably about to enter its fourth period of mining activity.

Rocks of the district are largely coarsely crystalline and metamorphosed (The Khamardaban Series). The stratigraphy and petrography have been discussed recently by Belitchenko and Khrenov (1969). The age of these rocks is generally regarded as Precambrian but K/Ar ratios give scattered dates ranging between 350 and 850 m.y., the uncertainty is probably the result of the Baikalian and Caledonian orogenies. There is a prevalence of amphibole, pyroxene and biotite gneisses with subordinate, but thick, bands of marble. Mineral assemblages of the gneisses such as hypersthene - diopside - plagioclase - hornblende and sillimanite - garnet - microcline - biotite suggest metamorphism at very high temperatures and pressures. These rock types, and especially an abundance of granite pegmatites and giant phlogopite veins, call to mind of those of the Grenville province of Ontario and Quebec. Such well known geologists as the Academicians Korzhinskii, Fersman, Obruchev and Smirnov have all worked in this region. Korzhinskii's doctoral dissertation (Korzhinskii, 1940, 1947) deals with the paragenesis of calcite-phlogopite veins and lapis lazuli deposits near Slyudyanka. The writer had the opportunity to visit mineral occurrences in the Lake Baikal district during a 5-day field excursion in August, 1967.

Because of language difficulties and the difficulty of obtaining up-to-date information it is thought that a brief account might be of interest. Particular attention is given to the present day workings and mineral associations.

Slyudyanka phlogopite occurrences

Slyudyanka (meaning mica-bearing) is a town of about 20,000 inhabitants. The income of most of this population appears to be dependent on the mica industry. Seven hundred and fifty persons are directly employed by the mines. Miners earn about 250 rubles a month, more than twice the national average wage.

The mica region of Slyudyanka extends 7 kilometers south and east from Lake Baikal. The first geological and mineralogical description was by Erik Laxman in 1785 (Kalinin, 1939a, p. 115). Although some mica was taken out in 1762, serious mining did not begin until 1925. At present, mining is mainly conducted from 2 open pits and 4 shafts (3 mines) along a depth of 3 kilometers on the east side of the Uluntui valley. All underground workings are interconnected. There are 5 inactive mines and the large waste dumps are visible from a considerable distance.

Underground levels are cut at 20 meter intervals. A considerable flow of water was encountered in mining and the deepest level was inaccessible until a drainage tunnel was cut from the mines to Lake Baikal. Veins are mined by shrinkage stoping. The walls are strong and nearly vertical and the finished stopes are mostly left

The valley of the Slyudyanka River, looking upstream from the Perival Marble Quarry.

Typical rugged topography at the west of the Lake Baikal.

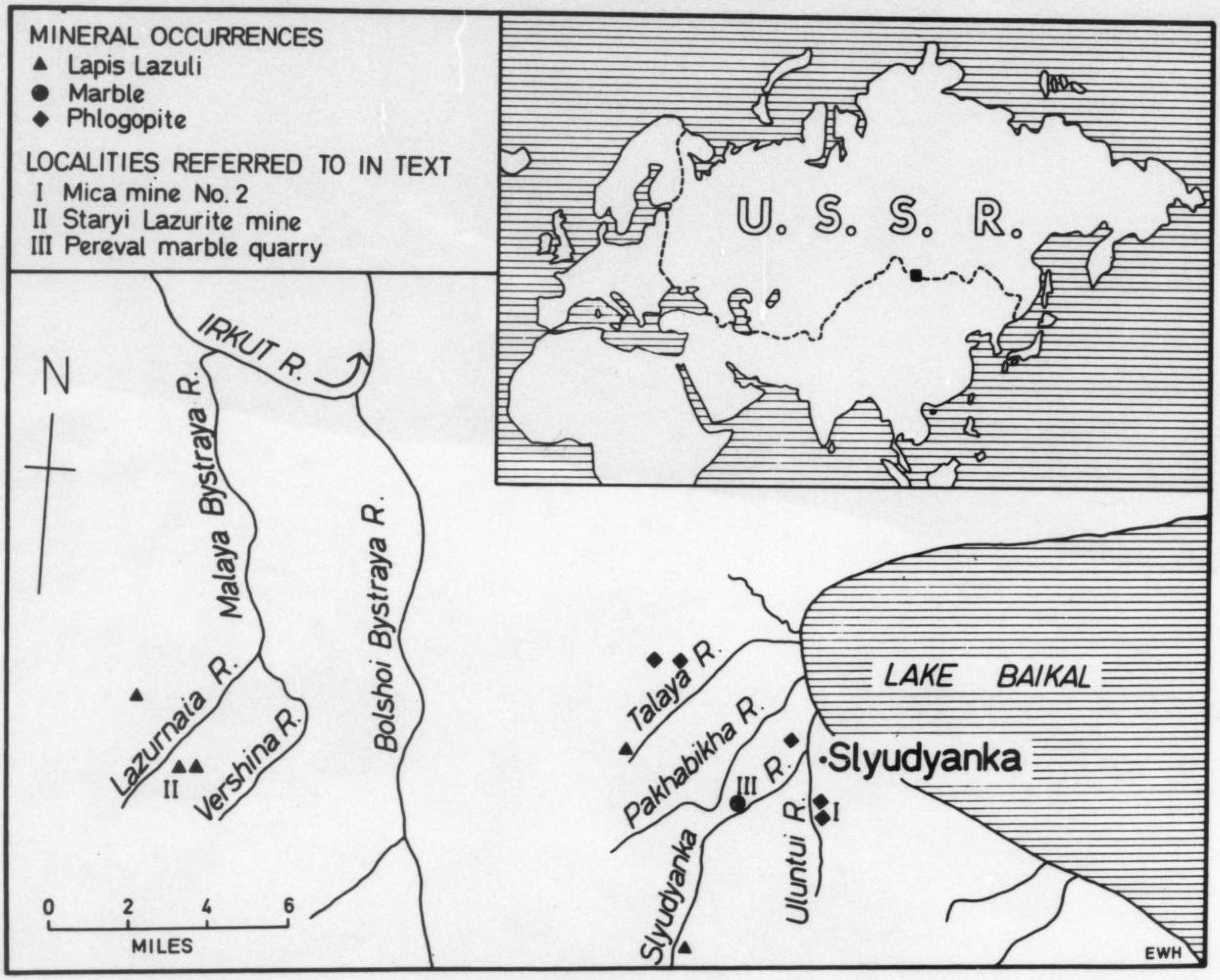
open. The workings remain at a constant temperature of about 4°C (39°F) throughout the year. Open pit mining is now conducted on a small scale.

Mica is taken to Slyudyanka for concentration and to Irkutsk for processing. A rather large proportion is prime splitting grade.

The large mines are nationally owned, but veins in abandoned quarries are mined privately. In these cases a miner procures a license insuring his right to the vein. Ore is sold to the government with contract for delivery at the vein. Some of the old pits are deeply gouged with veins that have been privately mined.

Phlogopite veins cut a series of coarsely crystalline marbles, gneisses, and quartz-diopside rocks. Veins tend to be concentrated in two horizons: in biotitic gneiss and diopsidic gneiss. Veins in diopsidic gneiss are usually better zoned than those in biotitic gneiss. This zoning is described by Kalinin (1939a), Kalinin and Ronenson (1957), and Vasilyev *et al.* (1969, p. 88). Generally, pyroxene lines the edge of the veins with very coarse dark pyroxene crystals projecting inward. These crystals are succeeded by phlogopite books, some of considerable dimensions. The centre of the veins is filled with pink, brown, or cream calcite which may hold isolated crystals of phlogopite, scapolite, pyroxene or apatite. In some veins barium feldspar (hyalophane) takes the place of calcite in the core. Calcite is usually absent from unzoned veins.

Mica-bearing veins are rather closely spaced and dip nearly vertically. They tend to be perpendicular to the foliation of the host rock. Veins are more continuous vertically than horizontally; the larger veins can be traced about 30 meters horizontally and are about 60 meters deep. They range in width up to 6 meters, averaging 1.5 meters. Some veins are found at 200 meters in depth (i.e. vertically below their surface projection). Further details of these veins are given by Vasilyev *et al.* (1969) and Kuznetsova (1969).



A detailed account of the mineralogy is given by Kalinin (1939b), who lists 91 minerals from the Slyudyanka area, about half of which are from the mica veins. Pink calcite, phlogopite, clinopyroxene ('baikalite'), potassium-feldspar, scapolite and apatite are the principal vein-minerals, probably in that order of abundance. In the veins proper, sphene was the only other mineral noted during the writer's excursion but garnet, epidote, plagioclase and hornblende were seen at the contact with pegmatite.

Phlogopite may be seen underground in Mine No. 2 in crystals measuring 0.3 meters across the cleavage and 1 meter along the prism axis. Phlogopite in diopsidic gneiss is usually darker than that from biotitic gneiss and is called tsyganka (gypsy woman); crystals tend to be oriented with cleavages parallel to the vein. Cross-cutting veins and those containing pink microcline usually hold considerable phlogopite whereas concordant veins and those containing grey hyalophane have little phlogopite. Large hyalophane crystals are visible in several places in the deeper levels of Mine No. 2.

Apatite is a very common mineral yet is never concentrated in economic amounts. It is normally blue-green; yellow-green and especially reddish brown varieties are comparatively rare. Crystals tend to be either perpendicular or parallel to the vein boundaries.

Pegmatite dykes are abundant on the east side of the Uluntui River. Grain size is rather uniform and rarely exceeds 5 cm. Quartz and microcline are the main constituents, but near the periphery is found an abundance of other minerals including biotite, sphene, zircon, hornblende, garnet, epidote, allanite and betafite ('mendeleyeevite').

Theories of genesis of the veins involve metasomatism of the surrounding rocks, with enrichment in potassium, magnesium and fluorine. In a very general way there appears to be a spatial relationship between 'monzonite' and pegmatite on the one hand and phlogopite veins on the other, although the genetic relationship is not clear (see Vislavnykh and Yanchukovskii, 1963 and Suloev, 1939). Certainly some veins are apparently older than these rocks. Korzhinskii (1940, 1947) believes that these

Slydyanka certainly lives up to its name, which means "mica bearing"

veins arise by precipitation from solutions in equilibrium with dolomite and pegmatite.

A detailed account of changes during the metasomatic process is given by Barabanov (1954). Alteration of pyroxene to amphibole and plagioclase to scapolite characterize pervasive alteration. The formation of microcline occurs within 10 cm. of the vein margin.

Lapis lazuli near the Malaya Bystraya River

Lapis lazuli[1] was held in very high esteem and played a part in the early exploration and colonization of western Baikal. Lapis lazuli was reported from Siberia at least as long ago as the last part of the 18th century. For example, Sage (1777, vol. 1, p. 284) reported deeply colored lazurite associated with pyrite and white zeolites from Siberia. It was discovered in the Slyudyanka River by Erik Laxman in 1787 as a result of an expedition sent to Baikal by Catherine the Great to investigate the validity of reports that, in 1784, boulders of lapis lazuli had been found in the river bed. Unfortunately, it is not clear from Laxman's letters whether lapis lazuli was found in the bedrock or only as boulders. Lapis lazuli was later found in place in the Slyudyanka River valley, 8 km above the Pereval marble mine and in the Talaya River valley to the northwest. The Malaya Bystraya or Malo Bystrinsky deposit was discovered *in situ* by Grigor Permikin in 1851. To the writer's knowledge, the only other lapis lazuli deposits in the U.S.S.R. are in the Pamir region.

The Malaya Bystraya lapis lazuli deposit is in the foothills of the Khamardaban Mountain range and can now be reached by a piste (trail) running 16 km south from the Slyudyanka-Mongolia highway, up the narrow Malaya Bystraya valley. The piste crosses the river 5 times and at high water level it is necessary to abandon vehicles at the first ford. Nothing remains of the railway line built to the deposit in Permikin's time. The country is thickly forested, mainly by white pine ('cedar') but large patches, which in summertime are red with fireweed, have been cleared by forest fire and caterpillar damage.

Mining was started by Permikin who in 1851 mined 6,100 lbs (avoirdupois) and, in 1852, 11,900 lbs from river gravels and open pit. In the last year he employed 30 laborers. In the early period of mining considerable difficulty was encountered in guarding the property against plundering herdsmen. Material for decorative stone and ultramarine was cut and cleaned at a small plant, powered by horses, at Kultuk at the north end of Lake Baikal. The product was sent to Tzarina Cath-

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[1] Lapis lazuli, as used here, refers to the gemstone, a mixture of the mineral lazurite and one or more other minerals.

Lapis Lazuli from Malaya Bystraya shown cut in thin section. The large well-formed dodecahedra of lazurite (dark gray) is in a matrix of calcite and minor diopside (light gray).

erine's factory at Petergorf near Leningrad for further processing.

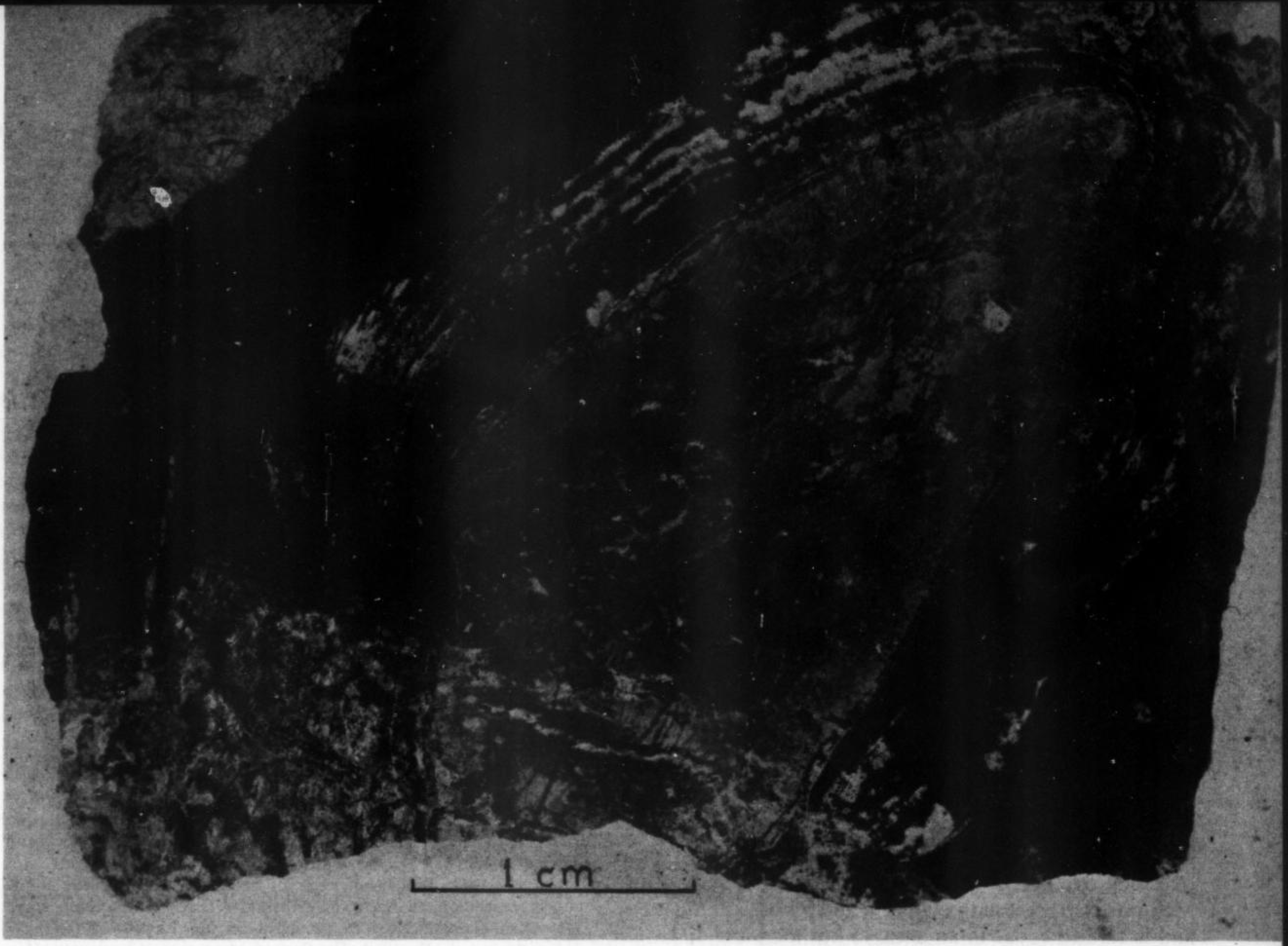
In the 1870's and 1880's there was a revival of interest in Baikal lapis. During the three major periods of activity (1787, 1851-1857, 1870-1890) about 50 tons of lapis lazuli were taken out, mostly from the Malaya Bystraya deposit. An excellent historical outline of these early periods is given by Fersman (1922, pp. 172-189).

Active exploration was conducted in 1930-1931 (Poliakova, 1932). The prospecting party traced the limits of lazurite-bearing rock by penetrating the omnipresent overburden with a number of shallow pits. From 1965 to 1967 the deposit was explored by surface and underground work. Two large deposits, the Staryi and Novyi, have been tested by core drilling, open pit and adit. The Staryi (Permikin's) deposit has shown the most promise and has been examined in greatest detail; the adit level is 40 m below the surface exposure.

Should mining be resumed at this occurrence, lapis lazuli will be used for decorative and industrial purposes. For decorative purposes the rock must be of sufficient size for the cutting of slab 5 centimeters square. Poorer grade portions of the deposit will be mined for pigment (natural ultramarine). For the latter purpose lazurite will be separated in heavy liquid, it being lighter than the gangue material and forming a float product (Pashkov *et al.*, 1966).

Each deposit is near a major flexure in marble around a stock of syenite. The folding is said to have produced fractures along which sodium and sulphur-rich solutions could permeate and produce the solid solution lazurite-hauyne ($3NaAlSiO_4 \cdot \frac{1}{2}Na_2S$ - $3NaAlSiO_4 \cdot CaSO_4$). However there is little evidence for deducing the relative ages of the marble and "syenite" (a poorly foliated diopside-microcline-andesine gneiss). Only faulted contacts of these two rock types are seen.

At the Staryi deposit a lens of lapis lazuli lies within a band of marble. The marble, here about 500 m thick, is calcitic, with diopside, phlogopite, and feldspars. The mineralized lens is not solid lazurite-hauyne; fragments of lapis lazuli are separated by barren marble, called myakot, in a fault breccia. Poliakova (1932, p. 16) calculated 4% by volume lapis lazuli from a bulk shipment taken from an adit driven into the high grade zone. Certainly the average for the 20,000 square feet of mineralized area would be much lower. The hanging wall contact of the ore-zone with dolomitic marble is sharp and faulted; the footwall contact is not exposed.



This thin section of Lapis Lazuli from Malaya Bystraya shows dark concentric layers of lazurite surrounding a hauyne layer (light gray) about 2 mm wide.

The mineralogy of the deposits is rather simple. Usually calcite, lazurite-hauyne, diopside, phlogopite and pyrite are the only minerals visible in hand specimens but native sulphur and blue apatite are not rare and pyrrhotite has been noted in the darker marble. Blue scapolite veinlets cross diopside-calcite rock in the adit of the Staryi deposit.

Commonly the lazurite shows pronounced zonal arrangement with massive light-coloured lazurite displaying a variable and transitional depth of colour, near the centre. This is surrounded by a sharply defined rim of deep blue to almost black crystalline lazurite. Solid 'nodules' of lapis lazuli up to 400 kg, were noted by Poliakova (1932, p. 17). Most pyrite and phlogopite grains are concentrated near the periphery. The lapis fragments are separated by white and very coarse-grained marble containing phlogopite plates and a few isolated crystals of native sulphur, feldspar and quartz. The feldspars sometimes penetrate lapis areas. Lapis also occurs in veins but some lapis is itself veined by calcite. Some veins of green lazurite were also seen by the writer, but the purple lazurite displayed in museums could not be found.

A notable feature is the occurrence of single crystals of lazurite in coarser portions of the calcite-lazurite rock. Dodecahedrons up to 1 cm in diameter were collected; Fersman (1922) mentions crystals to 1.5 cm in diameter.

Microscopically lazurite-hauyne varies in depth of colour even within a single grain. Sections of rather deep blue lapis examined by the writer were seen to be very impure, with lazurite-hauyne not exceeding 30% and the remainder made up of about equal quantities of calcite and diopside. Many lazurite grains are altered to a mineral having the optical properties of mordenite. (Kalinin, 1939b, p. 218, notes the zeolites endophite and scolecite). Commonly lazurite is isolated from diopside by a rim of plagioclase or calcite. Korzhinskii (1947, pp. 45-51) notes local development of nepheline-diopside, nepheline-calcite-phlogopite and diopside-spinel rocks associated with lapis lazuli.

In the Slyudyanka River valley lapis lazuli occurs in the desilicated portions of granite pegmatites which intrude marble. The main occurrences are described by Voskoboinikova (1938). The paragenesis is discussed by Korzhinskii (1947) and Khoreva (1955). Silica is shown to be depleted and magnesium progressively enriched outward from the core of the pegmatite; silica becomes enriched and magnesium depleted in marble towards the pegmatites.

Pereval marble mine near Slyudyanka

The geology and operations of the Pereval Mine have been briefly described in the AZOPRO guidebook (Shafeev, 1969, pp. 75-77). At this time marble is quarried to provide lime for cement. The equipment and mining methods are modern and operations are conducted on a large scale. The ore is transported by cable-car about 1 mile to the plant. There are two productive marble layers with MgO content 2-1/2 - 3-1/2%. The lower layer is 40 - 80 m thick and is separated by 60 - 80 m of high-magnesia marble from the upper layer, which is 80 - 120 m thick.

Some very interesting minerals are found in the marble as minor impurities, particularly in the upper layer. Amongst these should be mentioned lavender scapolite (glaucolite). Close to the scapolite is the yellowish to emerald green clinopyroxene 'lavrovite'. An early analysis (Hermann, 1870; Doelter 1914, pp. 563-564) shows that this is an aluminous diopside containing 2.57% V_2O_5, although later analyses show appreciable chromium but little vanadium (Kalinin, 1939b, pp. 195-196). Associated with the lavrovite is the questionable mineral species 'vanadiolite', possibly a mixture of augite and a vanadate (Hey, 1962, p. 216) but no vanadiolite could be located during the excursion.

Between the quarry and the cement plant are outcrops of a peculiar rock with alternating layers of white quartzite and granular blue-green apatite, a very attractive rock composed of sharply contrasting colours. This rock was also seen on the Uluntui and Slyudyanka Rivers and is said to occur in an area 40 km long and 10 to 12 km wide (Sakharova, 1956). It has been investigated as a source of phosphate but the average content of P_2O_5 in the larger units is very low ($<$ 3%). Sakharova considers these rocks to be metamorphosed phosphorite beds. The apatite here contains negligible amounts of rare earths as compared with that from calcite veins (traces to 0.22% RE_2O_3 recorded by Kalinin, 1939b, p. 238).

Acknowledgments

The writer would like to take this opportunity to thank those people who assisted in arranging and conducting his excursion. Initial correspondence was by Dr. J. D. Babbitt of the National Research Council with Dr. S. G. Korneev of the Soviet Academy of Science and by Dr. J. M. Harrison of the Department of Energy, Mines and Resources with Dr. A. Sidorenko of the Soviet Ministry of Geology. The excursion was arranged by Dr. L. Tauson and colleagues of the Institute of Geochemistry, Irkutsk and Dr. E. I. Semenov of the Institute of Geology and Mineralogy of the Rare Elements, Moscow (IMGRE). My efficient and hospitable guides were Drs. L. Chernyshev and A. Almukhamedov of the Institute of Geochemistry, Dr. E. I. Semenov of IMGRE and Mr. O. Ongotuev, chief geologist of the Slyudyanka region.

Dr. J. M. Moore of Carleton University, who visited the Baikal Region with the AZOPRO excursion of 1969, reviewed the manuscript and made many helpful suggestions.

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□

YEDLIN

(Continued from page 55)

many boxes 2" x 2" in size. He mounted slabs of minute crystals, refusing to break up fine groups merely to fit them into a box. Bjareby had another technique. He collected nothing that he didn't study constantly, and a mere hoarding of specimens was not his bag. Most of his boxes, then, contained from 4 to 6 specimens, to show different habits of the same mineral, or different associations or localities. A splendid concept, although most of us are dedicated to the "one man, one vote" theory. A single specimen in a single box. Space is not a factor. Personally, we use all methods. One of our mounts is a plastic box, 6" long, containing 12 specimens of pyromorphite from Phoenixville, Pa., the old Wheatley mine. You start at number 1 under the 'scope and slide the box along as each in turn is viewed. Different habits, characteristics, associations and crystal forms are studied. Recommended for some items.

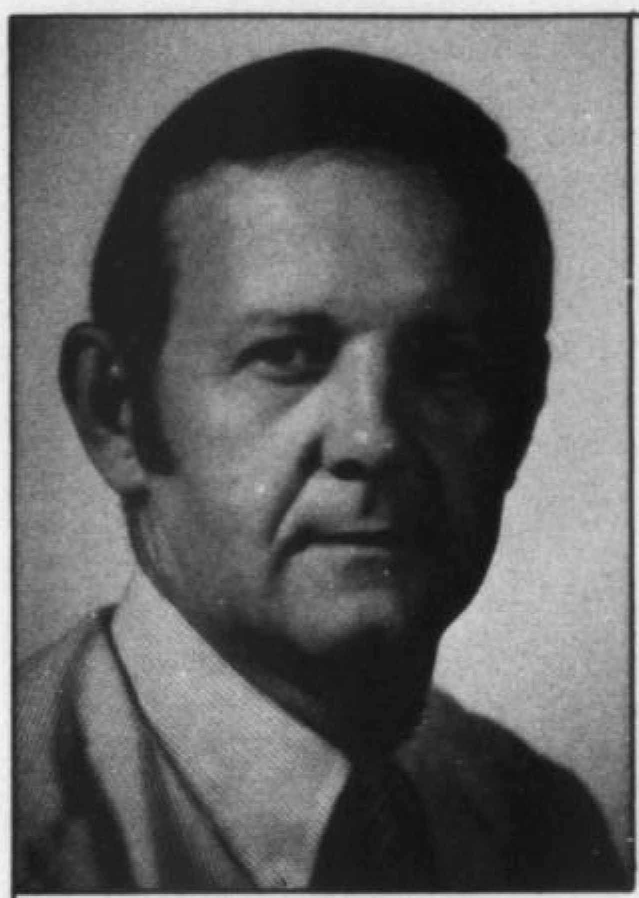
Here's a source for swapping minerals. We recently received a 16 page booklet containing about 250 names of mineral collectors in the Lombardy, Italy area, who want to swap. Here is part of the accompanying letter:

"Our amateur mineralogist ass'n, . . . is interested in coming in touch with you in order to promote mutual co-operation in the following fields—mineralogical information, assistance to each other during visits to the two countries, mineral exchange. Please find booklet issued by our group containing the names of Italian collectors of minerals. In order are name, address, age, date when collection started, how collection increased (field, exchange, purchase), type of collection, number of specimens, number of species. Our group issues a monthly bulletin in which we can publish items of mutual interest."

Need we say more? Write to Gruppo Mineralogico Lombardo, Museo Civico di Storia Naturale, Corso Venezia 55—20121 Milano, Italy.

And buy and use a good mineral book.

Neal Yedlin □



the museum record

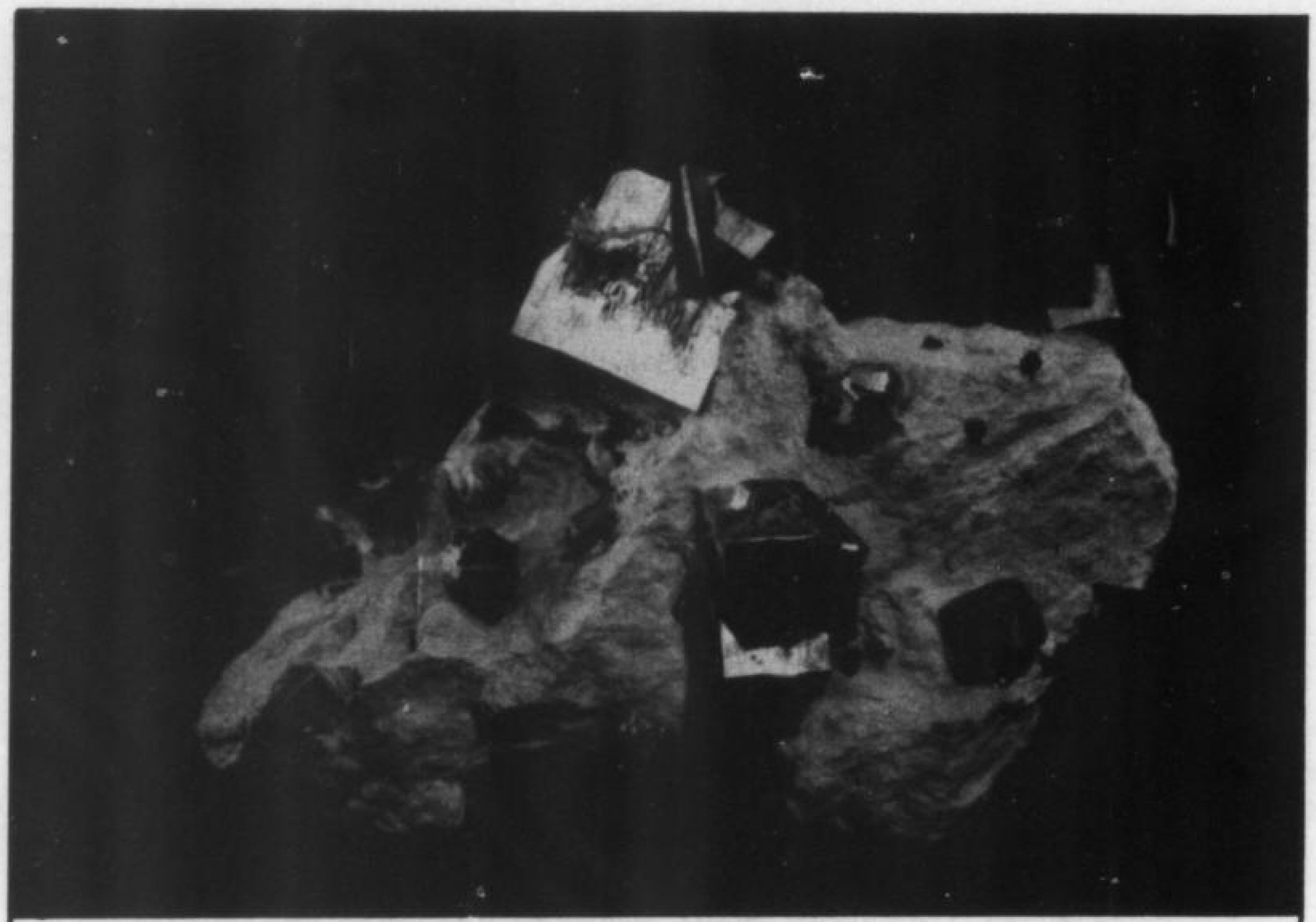
by Paul E. Desautels
the Smithsonian Institution

When an unusual action is taken on behalf of one of the world's great mineral collections it is certainly news. In February of this year the Department of Geology of Harvard University made news by acquiring the services of a new associate curator. For many years this very important mineral collection has been curated by Dr. Clifford Frondel. Because of his stature as a professional mineralogist, the demands of his research and graduate teaching programs, and more recently his position as Department Chairman, Dr. Frondel has been forced to divert his attention away from the collection. With the part-time assistance of graduate students he has barely been able to stave off disaster. Now, at last, it will be possible for him to see that the collection is cared for in a way he has always envisioned it should be.

The new associate curator is twenty-two year old Lawrence B. Bailey, who arrived fresh from a B.S. degree in Geology at Eastern Michigan University in Ypsilanti. Larry Bailey has been an active mineral collector for fifteen years and has all sorts of contact experiences with the sources of mineral specimens. At home in Michigan he and his wife—who is a school teacher with a minor in geology—were active members of the Jackson Mineral Society and the Huron Valley Mineral Society. They and Larry's parents have done considerable field collecting. Larry himself has been collecting in Canada, Mexico and various places all across the United States.

At Harvard the major immediate concerns of the new associate curator have been to clean, order and renovate the present exhibits and to introduce new ones as time, money and facilities permit. There are many wonderful plans in the making and this column will keep you informed as they develop. Right now the display room for fluorescent specimens is undergoing renovation. Completion is projected for about mid August. Making allowances for slippage in this type of program I am told we can certainly count on seeing this new display by the end of August. Although the exhibits are a major concern at the moment, the duties of the position also include general care of the large collection and the acquisition of specimens by any of the usual methods.

(Continued on page 67)



Lee Boltin

Pyrite - Logrono, Ambassaguas, Spain

What's New In Minerals

The American Federation of Mineralogical Societies' annual show, held at Fort Worth, Texas in June of this year, had an oversupply of mineral specimen dealers (80) but attendance was poor. Mineral specimen buyers simply didn't attend. This was unfortunate, not only because of losses suffered by the dealers, but also because there was an abundance of very fine specimen material for sale. The following is a report of many of the minerals seen, and some not seen, at the Fort Worth Show.

As has been the case for many years, Mexican minerals made up the greater part of the really exciting specimen material. Adamite from Mapimi has never been more beautiful and it is still offered at bargain prices. Lovely groups of Los Lamentos orange wulfenite were available in large numbers but will undoubtedly disappear quickly. The bright-yellow "cauliflowers" of mimetite from San Pedro Corralitos were also abundant and modestly priced. The recent discovery at Santa Eulalia of olive-green crystals of mimetite in clusters was represented by many excellent specimens. The crystals are not as lustrous as pyromorphite from several classic localitites but for mimetite—the arsenic member of the series—they are among the best specimens ever found. Becoming less abundant but still available at the show were those beautiful plates of amethystine-tipped quartz crystals from Vera Cruz. The quartz geodes (coconuts) from Chihuahua are still plentiful but they are becoming harder to dig and prices are creeping up. Other Mexican minerals available at the show in small numbers included legrandite, creedite, hemimorphite, milarite, Guerrero amethyst and buergerite. Mexican minerals recently abundant but nearly absent at the show were danburite, Charcas calcite, topaz, stibiconite ,pseudomorphs, gypsum, arsenopyrite and idocrase.

(Continued on page 74)

Shrum

(Continued from page 54)

Louis's first collecting interest dates from 1937 when he lived on a farm where he found many Indian artifacts. However his first real interest in minerals was kindled in 1958 when two local collectors, Dolph Crouse and Marshall Goodson, took him to a quartz locality. This first trip hooked him completely and he has been a collector ever since.

During the next few years, Louis collected at numerous well-known localities in the area; the Friday farm in Gaston County, North Carolina, for amethyst (some sceptered); the Hiddenite mine at Hiddenite, North Carolina, for rutile, hiddenite (green spodumene), etc.; and the Fisher farm at Iron Station, North Carolina, for amethyst. He has also obtained many fine "old timer" specimens of the Hiddenite area from his good friend Dewey Moose.

His collecting at the Foote Mineral Company spodumene mine at Kings Mountain, North Carolina, deserves special mention. As far back as 1963, Louis had collected crystals which local collectors then thought to be stilpnomelane; but which later turned out to be the new mineral switzerite. In 1965, Louis met Jack Eaker of Kings Mountain, who works for the Foote Mineral Company. Since then, he and Jack have collected many of the rare and new minerals from the Foote mine, especially when it was at its peak for collecting (1966 - 1968). Both men have supplied many scientifically valuable specimens to the Smithsonian Institution.

Louis realizes the importance of self-education in mineralogy. Deprived of exposure to competent guidance by others, he found that the only way in which he could develop a scientific knowledge of minerals was to become an avid buyer and reader of mineralogy books. As a result, his library of mineral publications is now very extensive.

Early in his mineralogical career, Louis joined the Southern Appalachian Mineral Society. Lat-

(Continued on page 70)

museum record

(Continued from page 65)

The latest report from North Carolina informs me that Bob Middleton is working again this summer as Parkway Ranger at the Gillespie Gap Museum. This museum, a sort of stepchild of the National Park Service, has struggled desparately through the years to stay open and offer to thousands of tourists pouring through North Carolina mineral country a chance to see some of the local minerals and to get acquainted with local geology. It is a marvelous educational and promotional opportunity which is poorly handled by the Park Service. Bob Middleton has been waging a one man campaign to improve things as best he can. Perhaps persistence will pay off and help will eventually come from the Park Service or some local source. At least the museum is open and functioning with a knowledgeable ranger present.

If you haven't been up the Hudson River to Yonkers, New York it would be worth a trip to see the new art and science cultural center which is called the Hudson River Museum. Unlike larger museums, which have permanent exhibits, the Hudson River Museum continually changes its exhibits so that the public may return time and again, each time to enjoy seeing something entirely different. Frank Chambers, who many of you know, is curator of the Geology Department and is responsible for planning the geological and mineralogical exhibits.

Those not living in the area within reach of the Franklin Mineral Museum, Franklin, New Jersey are not likely to know much about this very active, specialized museum. There will be more about it in later columns but one of its activities is very timely for mineral collectors this summer. The old Buckwheat mineral dump near the famous Franklin mines has been leased by the museum for a period of three years from the Bourough of Franklin. Under the lease, in return for certain improvements and covering insurance, the museum is permitted to charge admission fees for collectors. A fence has been erected around the dump, an access ramp has been constructed from the museum to the collecting area and supervisory personnel installed. The cost of running the dump—including turning over the rock and ore accumulations with heavy equipment—is covered by admissions which also take care of the annual payment to the Borough. This new plan has been devised to improve the operation of the dump, formerly handled by the Borough, so that mineral collectors will find their visits more convenient and more productive. ☐

Locality

(Continued from page 39)

quarry owners, and offer their services in enforcing safety regulations. In this way, these groups can *insure* that their favorite localities will not be closed due to the irresponsibility of a small number of visitors. In turn, management should refer all requests for collecting access to the local club, so that arrangements for entry can be made.

Once management is convinced of the desirability of preserving mineral specimens, and of the sincerity and integrity of local mineral groups, mine and quarry access can be easily obtained. Such rapport is necessary for recovering valuable specimens and would add a measure of responsibility to mineral collecting. Attainment of these goals will make a really fine hobby that much more enjoyable and rewarding.

Friends of Mineralogy will be interested in compiling and later publicizing data on mineral clubs and localities where such helpful arrangements are being made. Contact FM, c/o The Mineralogical Record, in connection with all such information which will be gratefully received. Ed. ☐

TILASITE from BISBEE, ARIZONA

Sidney A. Williams
Western Exploration Office, Phelps Dodge Corporation

Tilasite was first described by Sjögren (1895) from an occurrence at Langban, Sweden. A second occurrence was later described at Kajlidongri, Jhabua State, India, by Smith and Prior (1911).

A third occurrence was found at Bisbee by Robert L. Lutz and Robert B. Carr during geological reconnaissance and brought to my attention.

Tilasite occurs here in veinlets cutting clean crystalline limestone. The veinlets occur in outcrop near the White Tail Deer mine in the southern part of the Bisbee district. These veins have a gangue of calcite and braunite and carry both tilasite and conichalcite. Both latter species are well crystallized.

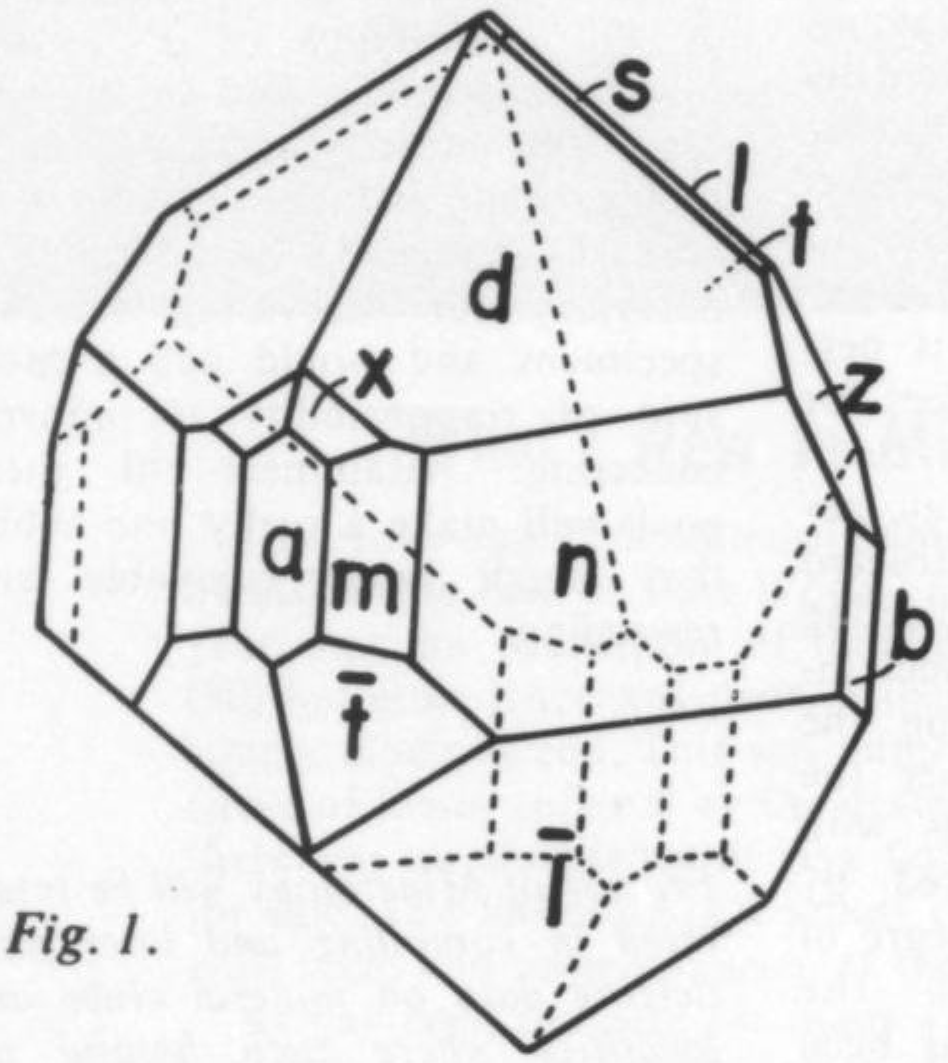


Fig. 1.

Crystals of tilasite are easily found at the locality. They range in size up to 6 mm but the smaller ones are better suited for measurement. Many of the crystals clearly show their monoclinic *m* symmetry and are quite complex. A typical crystal is shown in Figure 1.

The following forms were noted at least once: *b* {010}, *a* {100}, *n* {120}, *m* {110}, *d* {011}, $\bar{d}$ {011}, *h* $\{10\bar{1}\}$, *x* {111}, *l* {111}, $\bar{l}$ $\{11\bar{1}\}$, *s* {122}, t {211}, $\bar{t}$ $\{21\bar{1}\}$, *z* {131}, {373}, and {231}. Only {373} is certainly a new form. Others may be new, but it was not possible to compare polarities of crystals studied by various workers.

The orientation used for this study has $c < a < b$; the transformation matrix Smith and Prior to Williams is 001/010/100. The various values reported in the literature and based on morphological study, are shown in Table 1 (after suitable transformations).

Rotation and Weissenberg films of tilasite gave the cell constants in Table 2. These are compared with results of previous workers. The space group in the orientation adopted was found to be Aa, or Cc in the old setting.

Powder data agree well with data in the ASTM file (from Strunz), although a few fainter indexable lines were found. The results are tabulated in Table 3, and indexed in the new orientation (Strunz Williams, 001/010/100). The lines were indexed from results of a computer program written by F. B. Millett.

Acknowledgments

I am grateful to Messrs. Lutz and Carr for bringing the material to my attention and showing me the locality. Frank B. Millett helped in the computations.

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TABLE 1

MORPHOLOGICAL CELL CONSTANTS OF TILASITE

	Smith & Prior	Aminoff (1923)	Williams
a	0.8391	0.8454	0.853
c	0.7503	0.7436	0.749
β	120°59.5′	121°00′	121°42′

TABLE 2

X-RAY CELL CONSTANTS OF TILASITE

	Aminoff (1933)	Strunz (1938)	Williams
a	7.57Å	7.56Å	7.553Å ± .015
b	8.93	8.95	8.951 ± .014
c	6.62	6.66	6.701 ± 016
B	121°00′[1]	120°59′	120°58′
a:b:c	.848:1:.741	.845:1:.744	.844:1:.749

[1] determined goniometrically

TABLE 3

INDEXED POWDER PATTERN OF TILASITE

Ni-filtered CuKa radiation, Straumanis mount, 114.59 mm camera diameter

I/Io(est.)	*d(meas.)*	*d(calc.)*	*hkl*
3	5.073	5.066	$11\bar{1}$
5	4.819	4.835	011
3	4.473	4.475	020
3	3.687	3.682	120
3	3.482	3.475	$21\bar{1}$
10	3.246	3.238	200
	3.246	3.257	111
8	3.073	3.073	$20\bar{2}$
7	2.860	2.873	002
9	2.682	2.684	$13\bar{1}$
		2.676	$12\bar{2}$
6	2.625	2.624	220
3	2.534	2.533	$22\bar{2}$
2	2.405	2.395	$31\bar{1}$
		2.418	022
5	2.341	2.340	$23\bar{1}$
6	2.266	2.274	211
		2.270	131
5	2.096	2.104	$11\bar{3}$
3	1.993	1.999	122
		1.997	$31\bar{3}$
4	1.913	1.910	$33\bar{1}$
4	1.889	1.885	$40\bar{2}$
2	1.841	1.841	240
3	1.763	1.765	042
7	1.743	1.748	202
1	1.717	1.714	311
		1.719	$15\bar{1}$
6	1.689	1.689	$33\bar{3}$

Note: 40 more lines to 0.7992Å

Shrum

(Continued from page 66)

er, when Dr. Emmet White and others formed a club closer to Lincolnton in Valdese, North Carolina, he joined it and has since served as vice-president, show chairman, and president. The Valdese Club has presented an ultraviolet lamp and a collection of fluorescent minerals to Rutherford College, as well as a study collection to the Western Piedmont Community College.

By 1968, the number of collectors in the Lincolnton area had increased to the point where he and Don Faulkenbury organized the Foothills Mineral Society. Louis is now serving his second term as its president. In less than two years the club has attracted more than 40 members and is undertaking the very ambitious project of raising money for and stimulating interest in a natural history museum for Lincoln County.

Louis' speciality is "thumbnail" sized specimens (he likes single crystals as near to one inch as possible). His excellent taste in specimens and neatly labeled and catalogued collection assures success in competition. Shrum's thumbnail exhibit took best-in-show awards at Spruce Pine, North Carolina, in 1966 and 1968, and at Charlotte, North Carolina, in 1969. In addition, his taste and preference for thumbnail specimens was reflected in the number of award-winning entries by members of the Foothills Mineral Society at the Spruce Pine and Valdese shows in 1969.

This column is intended to present a series of biographical sketches of individuals who merit special recognition for their contributions to the science of minerals and to the hobby of mineral collecting. In order to present a "new face" with each issue we are depending on our readers to provide the character sketches. It is important that the "personality" be informed by the writer before copy about him is submitted for publication. His approval must be sent directly to the magazine. We hope enough sketches are offered to enable us to present one in each issue. □

Bavenite from

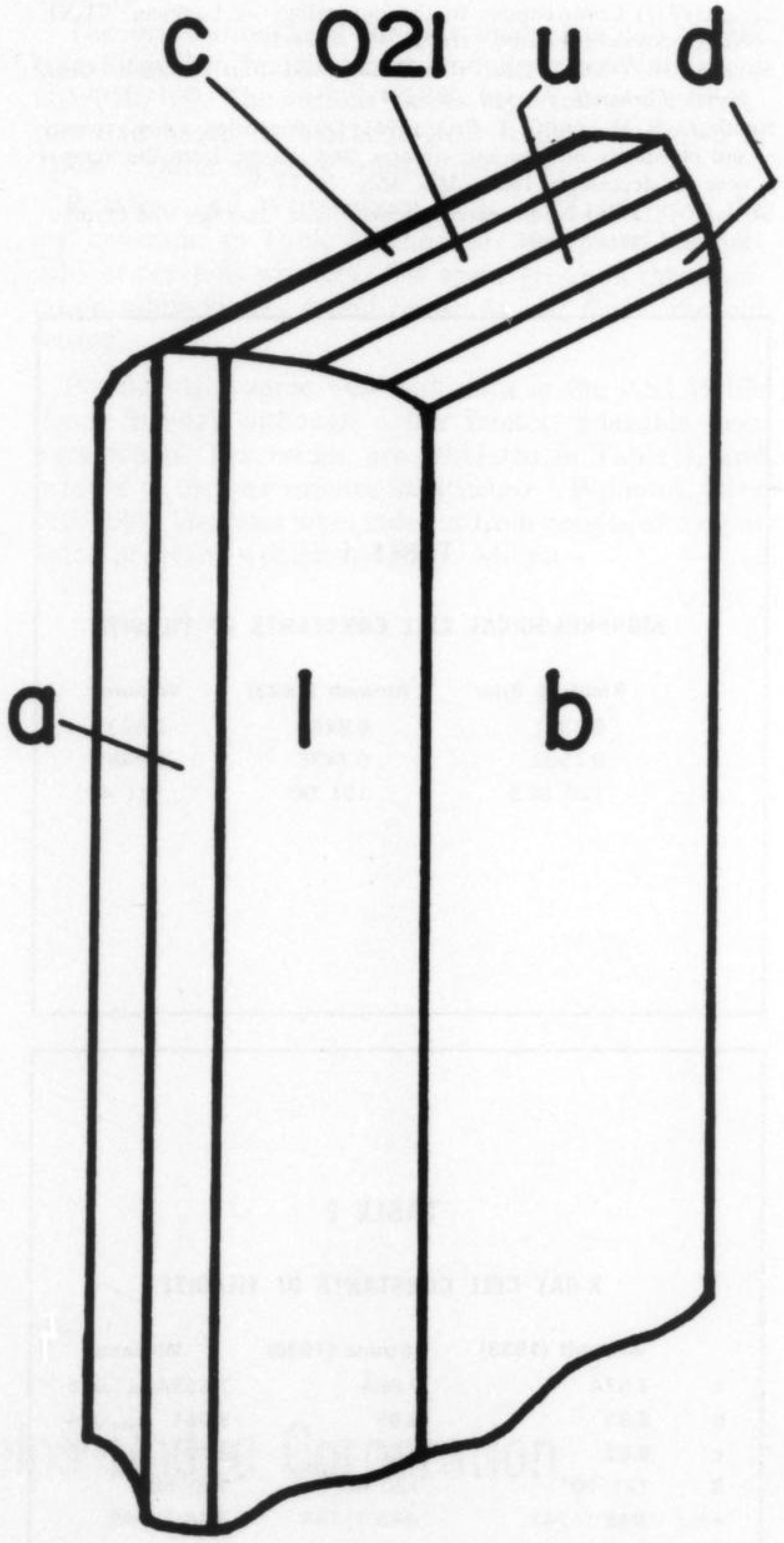

Figure 1. Bavenite from Haddam, Connecticut

m Connecticut

William A. Henderson, Jr.

Bavenite has a history fraught with vicissitude. It was first described and named by Artini (1901) from an occurrence as small, prismatic crystals in pegmatite druses in the granites of Baveno, Italy. From its crystal forms, Artini decided that bavenite was monoclinic, and described it as a hydrated calcium aluminum silicate.

Schaller and Fairchild (1932) reported on bavenite from Mesa Grande, California. Their material was found as a pseudo-morphic alteration product after beryl, so they suspected it of being a beryllium mineral. Careful analysis showed that indeed it was. Interestingly, beryllium was often mistaken for aluminum in early analyses. The two elements are much alike chemically, and analysis by some common older methods did not distinguish them. Now, with more sophisticated analytical methods, many of the minerals described in the older literature as aluminum-bearing silicates are being correctly identified as beryllium aluminum-bearing silicates. The latest work on vavenite (Switzer and Reichen, 1960) indicates that the composition of bavenite is best described as $(Be,Al)_4 Ca_4(SiO_3)_9 \cdot xH_2O$, with beryllium and aluminum proxying for each other in tetrahedral coordination.

The older monoclinic assignment for bavenite has also been changed. Ksanda and Merwin (1933) and all later workers have described bavenite as orthorhombic on the basis of single crystal X-ray work.

And finally, bavenite came perilously close to being known by another name. Prior to the work of Artini, bavenite was incorrectly described under the name pilinite by von Lasaulx (1876). However, pilinite was not further examined nor were new locatities found, while bavenite was further characterized from several new localities, and only recently has it been shown that the two are the same. Hence, the name bavenite is retained even though pilinite has priority.

Bavinite occurs in granites and granitic pegmatites, chiefly as an alteration product of beryl, but is also found very rarely in alpine veins in the Swiss Alps. Reported from numerous foreign countries, notable United States localities include Amelia Courthouse, Virginia; Kings Mountain, North Carolina; and the Himalya Mine, Pala, California. It has been found once previously in Connecticut at the Hewitt Quarry, in Haddam (Schooner, 1966).

Specimens of the bavenite described here were first brought to the attention of the author by Mr. and Mrs. Charles H. Weber, Jr., of Fairfield, Connecticut, who suggested that it might be bavenite. It was found in a roadcut on the new Route 9 in Haddam. There it occurred in a black tourmaline-feldspar-quartz pegmatite of small size intruded into gneiss. The bavenite was formed as an alteration product of beryl and was associated with albite, chlorite and another secondary beryllium mineral, bertrandite. Most of the bavenite was found in or close to hexagonal cavities after beryl or cavities still partially filled by corroded beryl crystals. Only small amounts of unaltered beryl were found.

The mineral was identified as bavenite from its X-ray powder pattern. Excellent agreement as to intensity and position of more than twenty diffraction lines was obtained between the pattern of the unknown and published patterns for bavenite.

Most of the bavenite was indistinctly crystallized as irregular blades and needles or platey, massive material. Infrequently, the bavenite formed sharper white to light tan fans and radiating groups of tabular crystals up to 2 mm in length, 1 mm width and 0.2 mm thickness. These latter crystals are as good as any the author has seen from other localities. A few of these were just suitable for measurement with a homemade optical goniometer (Henderson, 1970). The faces found, indexed using the unit cell of Claringbull (1940) and orientation of Ksanda and Merwin (1933), were ***a*** {100}, ***l*** {120}, ***b*** {010}, ***d*** {051}, ***u*** {031} and ***c*** {001}. Calculated and observed angles agreed within less than 1°. A previously undescribed form, {021}, was found. The calculated angles for this form are: $\phi = 0°$, $\rho = 23°\ 14'$. The angles found were: $\phi = 0°$, $\rho = 23°$. The crystals were, as is often the case, striated on {010} || [001]. A perfect {100} cleavage was found. A typical crystal is illustrated in Figure 1.

A single superb specimen of bavenite was found consisting of crystals so large that they have the pale, apple-green color of prehnite. This material has the same optical properties as bavenite, and is undoubtedly the same mineral. The crystals comprise five fans on albite with black tourmaline. Each crystal is about 4 mm square by 0.2 mm thick and shows only the forms *a, b* and *u*. The ends of the fans are {100} and the sides {031}; i.e., the axis about which the fans are arranged is the *c*-axis. This specimen is unlike any other of bavenite ever seen by the author.

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meetings & shows

WHO & WHAT	WHEN	WHERE	CONTACT
Intl. Mineralogical Assn. & Intl. Assn. on the Genesis of Ore Deposits, mtg.	**Aug. 24-Sept. 6**	Aug. 28-29 in Tokyo and Aug. 31 in Kyoto, field trips.	**Dr. I. Sunagawa,** Geol. Survey of Japan, 8 Kawada-cho, Shinjukuku, Tokyo, Japan
Geological Assn. of Canada & Mineralogical Assn. of Canada, ann. mtg.	**Aug. 31-Sept. 2**	Winnipeg	**R. F. J. Scoates,** Manitoba Mines Branch, 900 Norquay Bldg., Winnipeg 1, Manitoba, Canada
Northwest Fed. of Min. Societies, combined convention and show	**Sept. 5-7**	State Fair Grounds, Great Falls, Mont.	**Ben Kolski,** 208 Riverview 2 East, Great Falls, Mont. 59401
Baltimore Mineral Soc., 14th annual micromount symposium	**Sept. 26-27**	Stemmers Run Jr. High Sch., Baltimore, Md.	**H. V. Corbett,** 3220 Berkshire Rd., Baltimore, Md. 21214
Assn. of Earth Science Editors, ann. mtg.	**Oct. 12-13**	Washington, D.C.	**W. D. Rose,** Oklahoma Geological Survey, University of Oklahoma, Norman, Okla. 73096
Clay Minerals Society, ann. mtg. of North American Clay Minerals Conference	**Oct. 13-17**	Miami Beach, Fla.	**W. E. Moody,** Ceramic Engineering, Georgia Institute of Technology, Atlanta, Ga. 30332
Greater Detroit Gem & Mineral Show	**Oct. 23-25**	Light Guard Armory, Detroit, Mich.	**Mrs. C. L. Towle,** 22114 Allan-a-Dale, Birmingham, Mich. 48810
Mineralogical Society of Southern Calif., annual show	**Oct. 31-Nov. 1**	Pasadena City College, Pasadena, Calif.	**Bruce Lee,** 830 Fairview, Apt. F, Arcadia, Calif.
Geological Society of America & Mineralogical Soc. of America	**Nov. 11-13**	Milwaukee, Wisc.	**GSA Headquarters,** Box 1719, Boulder, Colo. 80302
1971			
Tucson Gem & Mineral Society, 17th annual show	**Feb. 12-14**	Fairgrounds, Tucson, Arizona	
Calif. Fed. of Min. Societies, annual convention and show	**July 2-4**	Ventura Fairgrounds, Ventura, Calif.	**Bruno Benson,** 207 S. Pueblo, Ojai, Calif. 93023
Amer. Fed. of Min. Societies & Northwest Fed. of Min. Societies, annual show in conjunction with Seattle regional show	**Sept. 3-6**	Seattle Coliseum, Seattle, Wash.	**Ed Messerly,** 3017 N.E. 97th, Seattle, Wash. 98115

To The Editor

(Continued from page 38)

Dear Sir:

My *Mineralogical Record* arrived several days ago and I am most pleased to see that it proves to be a journal of good taste in style and solid contributions in matters concerning our science. Best wishes toward a continuing success!

Paul B. Moore
Associate Professor of
Mineralogy and Crystallogr.

Dear Sir:

Congratulations on the very fine first issue of the *Mineralogical Record.*

We feel that this magazine will fill a long felt need for a publication of this type.

Being enthusiastic micromounters we were very pleased that Mr. Yedlin has been chosen to head up this department.

We shall look forward to forthcoming issues and wish you every success in this venture.

Yours truly,
Marvin H. Deshler

Locality— Minas Gerais, Brazil

The Brazilian state of Minas Gerais is enormous. Yet, many mineral specimens that reach us on the U.S. specimen market carry only *Minas Gerais* as a place of origin. Other labels carry place names such as Governador Valadares, Belo Horizonte, Conselheiro, etc. These are usually names or partial names for important cities in Brazil but they do not constitute appropriate names for the mineral occurrences in question. Mineral collectors who have visited Brazil report that even in the collection of the Departamento Nacional da Producao Mineral, in Rio de Janeiro, the proper localities are not given.

Why don't we get the correct place names? There are several reasons. Perhaps the simplest is that the cities mentioned are centers for mineral dealers and for cutting, polishing and selling gemstones. There is also the constant problem a dealer has in protecting his sources. He does this by keeping quiet about the actual mines and quarries where his best material is obtained. One can hardly blame him as far as his livelihood in the gemstone trade is concerned but from the mineral collector's point of view the practice is deplorable. The true locality must be available for a specimen to be of maximum value to a collector and any value at all to a professional mineralogist.

Precise locality names are easy to obscure. For example, the localities around Governador Valadares are spread out for more than 150 miles from the city. This group of occurrences alone, then, covers an enormous area. It is as though a mineral specimen found in the neighborhood of Albany, New York was labeled New York City. Brazilian labeling from this area has an ancient history. It probably started when, in the latter part of the 16th century, prospectors travelled upstream along the Doce River. They found many species other than the gold and silver they were seeking. Green tourmaline, which they thought was emerald, was a frequent find. Now and then you still hear such stones referred to as "Brazilian emerald", "peridot of Brazil" and "Brazilian chrysolite". There is a discussion of this in *Precious Stones* by S. M. Burnham published in 1886 by Bradlee Whidden Co., Boston, Mass.

During World War II, U.S. prospectors and government agencies based in Governador Valadares searched for uranium, electronic grade quartz and other strategic minerals. The region produced quantities of mica during this period for use as electrical insulation and particularly for special aviation-type spark plugs. After the war, mineralogical investigations by F. Pough, W. T. Pecora, A. de M. Barbosa, M. L. Lindberg and many others led to the description of numerous new minerals from the region. Some of these have found their way into our collections. Moraesite, faheyite, tavorite, barbosalite and avelinoite (= cyrilovite) remain quite rare. Brazilianite, on the other hand, has been abundantly available and is desirable for collections because of its large, showy crystals. Pecora and Fahey collected many of their minerals at the pegmatite quarry "Corrego Frio". They described the locality precisely. It is near a place called Divino about 25 miles NE of a relatively large town, Sao Thome, on the Doce River. Very fine brazilianite comes from this precise locality and also from others such as Pammarole and Linopolis. The unusually large gem spodumene crystals (kunzite) that came on the market in the 60's were found, beginning in 1961, at the Urupuca quarry. This material, too, was poorly labeled as originating at Governador Valadares or perhaps at Santa Maria de Suassuhy. Because it was gem cutting quality material the pressures were even greater to hide the locality or to even consider it unimportant.

Here, then, lies a problem. Over a period of time much of these obfuscating labels will probably be straightened out. However, there is an obvious need for someone who knows—first hand—the sources of some of our classic Brazilian specimens to make and publish a detailed listing of species and sources. Obviously, the same need exists for other regions—Mexico in particular. The pages of this magazine are open to anyone who wants to accept the challenge. □

Q/A column

We invite questions from our readers about mineralogical problems for which they cannot find satisfactory answers. If we can we will provide answers. If we cannot, and we feel that one or more of our readers can do so, we will put the question "up for grabs".

Because this is the first issue in which the Q-A column appears, the following questions are posed to give you an idea of the format we will use. Names and addresses of those posing questions will be printed only when a direct response is indicated. Otherwise only name initials, city and state will be used to identify the writer.

WE WILL NOT IDENTIFY MINERALS AND ROCKS so please do not send them to us for this purpose.

Can you tell me the correct source of the beautiful amethyst-tipped quartz crystal groups that have been coming from Mexico in recent years? I have seen them labelled with the names of some half dozen different localities in Mexico?

The mineral dealers most likely to know all agree that the amethyst comes from Vera Cruz (city), Vera Cruz (state), Mexico.

The names sphene and titanite both are found in wide use today. Is one name more proper than the other?

According to Michael Fleischer, Chairman of the New Minerals and Mineral Names Commission, IMA, the name titanite won out by a 9-3 vote of the Commission in Cambridge, England in 1966. The name sphene, therefore, should be abandoned.

I am a ninth grade science teacher and must teach a unit about rocks and minerals next year for the first time. I have no training in earth sciences and I am in great need of assistance. Where is the best place for me to obtain information about the geology of my area and assistance in gathering specimens of rocks and minerals for teaching?

I sympathize with you and I know that this is a widespread problem as more and more secondary schools are adopting earth science programs. For information about local geology you might contact the Geological Survey of your state and also all geology departments in colleges and universities in your area. For specimens, you might make an appeal to the nearest mineral clubs which all too often are willing to help and aren't made aware of the need for their aid. Most clubs conduct collecting trips in which members can pick up lots of good samples of common minerals, samples they wouldn't want for their exhibit collections but massive pieces that would be perfect for teaching. Most clubs also have the talent among the membership to identify these samples so they should be able to provide a quantity of properly labelled specimens to get you started. ☐

What's new

(Continued from page 66)

The single crystal collector could still find bargains on the counters. Chief among these were pyrite crystals from Logrono, Ambassaguas, Spain and superb "ruby" corundum crystals from Madagascar—both very inexpensive.

In the expensive category there were many wolframite, apatite and arsenopyrite specimens from Panesquiera, Portugal. Also, even though considered rare a few years ago, stibnite in good specimens from Baia Sprie, Rumania, appeared plentiful. Geode sections of Uruguayan amethyst reappeared in large numbers at this show and ranged widely in price depending on color and size. The collector with lots of money could have picked from among many Tsumeb, Southwest Africa cerussites and cuprites. In contrast, descloizite from Berg Aukas, which only two years ago was practically being given away, has almost disappeared.

Limited numbers of very fine specimens from several classical American localities unexpectedly turned up. These included fine pink tourmaline crystals, loose and on quartz, from the Stewart mine, Pala, California, almandine in schist from Fort Wrangell, Alaska and beautiful transparent brown barite crystals on matrix from Elk Creek, Meade County, South Dakota.

It is rare to see such a wealth of fine mineral specimens at any but the Tucson Show. Any collector with money to spend could have found enough at Forth Worth to assemble a top quality collection of very showy specimens. ☐

NEW DATA FOR PLATTNERITE

by

John S. White, Jr.

The existing data for plattnerite are not very good as most were obtained from poor quality, natural material and synthetic crystals. New X-ray, morphological, chemical and physical property data are reported here. Crystals from the Ojuela mine, Mapimi, Durango, Mexico were used in this investigation. Also, an unusual twin from White Pine County, Nevada is described.

Plattnerite typically occurs in oxidized lead ore deposits and the localities providing well-crystallized material seem limited to semi-arid areas. In addition to the Ojuela mine and White Pine County, Nevada occurrences, recent finds include the Tchach-Mille and Dare-Zandjir mines, Yezd, Iran (Bariand, 1959), Kurgashinkan, U.S.S.R. (Golovanov, 1959), seven localities in Arizona (Galbraith and Brennan, 1959 and Bideaux, Williams and Thomssen, 1960), and others in the Goodsprings, Nevada area (Takahashi, 1960).

Ojuela mine plattnerite is developed on soft, porous limonite-goethite as druses and sprays of sharp crystals. Hemimorphite and calcite are commonly associated minerals but cerussite, rosasite, aurichalcite, murdochite, wulfenite and hydrozincite are also found. Some of the other secondary minerals at the Ojuela mine have been described by Foshag (1937), Mrose (1948) and Desautels (1963).

Historical Background

Lead dioxide was first described as a mineral species in 1837 by August Breithaupt who named it schwerbleierz. The mineral later was given the name plattnerit by Haidinger (1845). Numerous contributions have been made to the data relating to plattnerite but because of the lack of measurable natural crystals and clean material, much of this information is inaccurate, incomplete, and contradictory. Breithaupt's type material, believed to have come from Leadhills, Scotland, was poor and his description of it led Greg and Lettsom (1858) and Dana (1868) to relegate plattnerite to the status of "a doubtful species." Breithaupt's "hexagonal" crystals of the mineral were thought to be pseudomorphs after pyromorphite and the specific gravity seemed too high for lead dioxide.

In 1889, Yeates (1892) identified a specimen from the You Like lode, Hunter mining district, three miles northwest of Mullen, Idaho as plattnerite. This material was mostly massive but included crystals on which goniometric measurement was made by Edward F. Ayres (Yeates and Ayres, 1892). The poor quality of these measurements was noted by Ayres, but they were good enough to establish the mineral as tetragonal.

Structural data were added by Darbyshire (1932) through x-ray powder patterns of artificial crystals. His unit cell dimensions are given in Palache, Berman, and Frondel (1944). Davidson (1941) added morphology measurements which were obtained from synthetic crystals. He recognized four forms, only one of which, {011}, has been observed on natural crystals. The {011} twin was first reported by Davidson, as recognized on his synthetic crystals.

No significant refinement of the data has appeared in the literature since the work of Darbyshire and Davidson.

Composition

Plattnerite is the tetragonal dimorph of lead dioxide, having a unit cell content of 2[PbO_2]. It is the βPbO phase; the orthorhombic dimorph αPbO_2, described by Zaslavskii et al (1950, 1952), is not known to occur in nature.

The chemistry of plattnerite is simple and not in question so a wet chemical analysis was not performed. A sample of approximately 500 mg was submitted to the U.S. Geological Survey for a semiquantitative spectrographic analysis. Results of the analysis are presented in Table I. The total amount of trace constituents is less than 0.2 weight per cent. The largest contributor is iron at 0.1 per cent which is almost certainly due to admixed limonite-goethite.

TABLE I.
SEMIQUANTITATIVE SPECTROGRAPHIC ANALYSIS OF PLATTNERITE FROM THE OJUELA MINE, MAPIMI, DURANGO, MEXICO

ELEMENT	PERCENT	ELEMENT	PERCENT
Pb	Major	Mn	0.002
Fe	0.1	Ag	0.0001
Si	0.015	B	<0.003
Al	0.01	Ba	0.0003
Mg	0.003	Cr	0.0001
Ca	0.03	Cu	0.005
Na	0.01	Mo	0.02
Ti	0.005	Tl	0.005

Analyst—Helen Worthing, U.S.G.S., Washington, D.C.

The small size of the crystals necessitated a partial crushing and hand-picking, under the microscope, of the clean crystals and crystal fragments. Many contained cavities at the attached end which were filled with limonite-goethite. All of the crystals seen to contain such cavities were discarded from the selected sample. This process was also used in preparing material for a density determination.

Physical Properties

Plattnerite is jet-black with a brilliant luster which dulls somewhat upon exposure. Extremely thin, platey crystals from White Pine County, Nevada are translucent yellow to red in color under the petrographic microscope (Fig. 3). The powder is deep chestnut brown. The mineral is brittle and it breaks conchoidally. No cleavage was detected and no refinement of the refractive indices or the hardness was obtained.

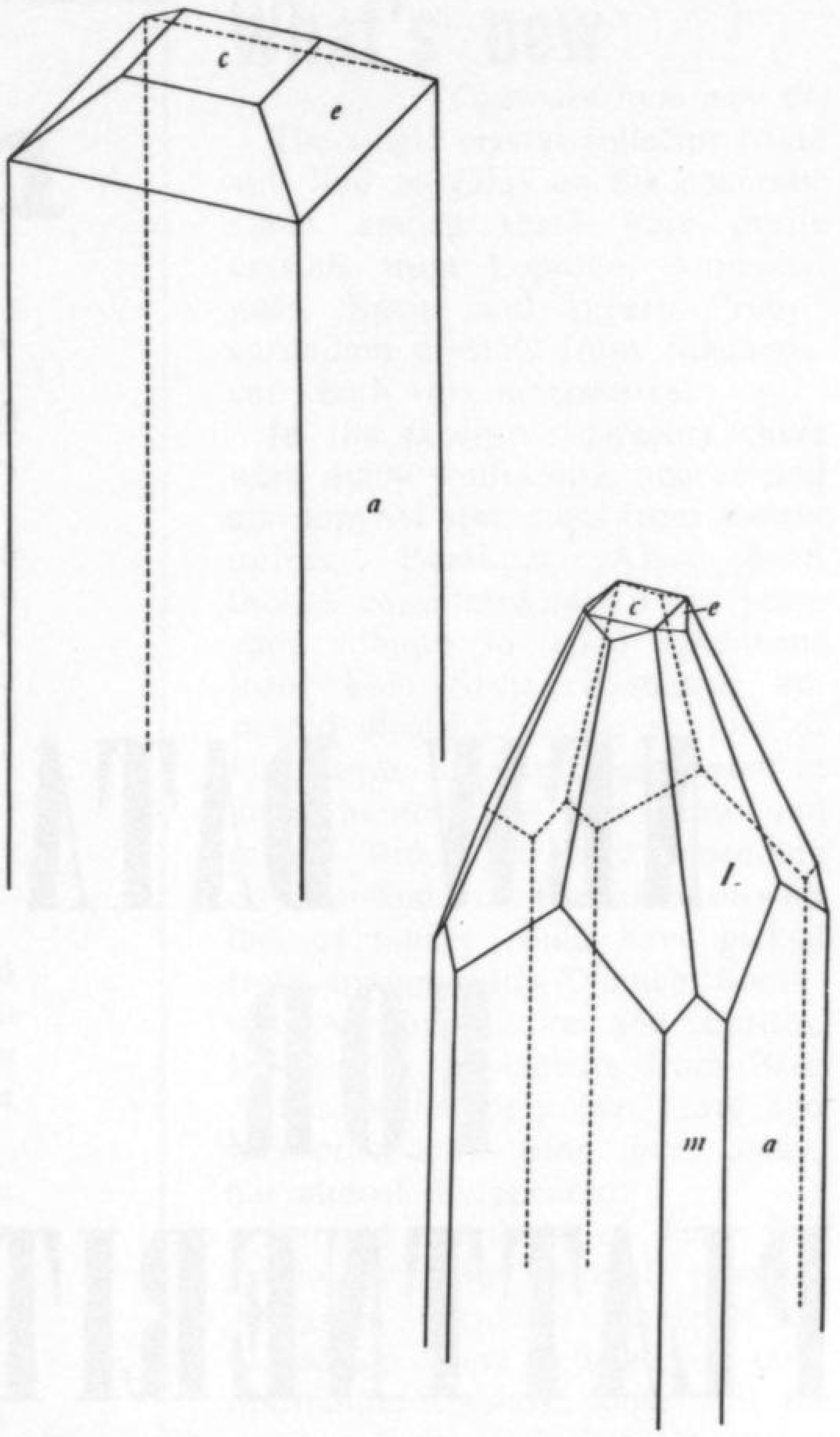


Fig. 1. Crystals of Plattnerite which were found in the Ojuela Mine, Mapimi, Durango, Mexico.

Density was determined on a Berman density balance, using toluene of known density. An average of eight measurements gave a density of 9.564 ± 0.074 g/cm^3. One reading was made with the pycnometer, using toluene, which gave a density of 9.57. These values are in agreement with a theoretical density of 9.563 calculated from x-ray data. Table II includes densities obtained by a number of investigators.

Crystallography

Plattnerite is isostructural with rutile; and the class symmetry is ditetragonal dipyramidal ($4/m2/m2/m$). Crystals from the Ojuela mine are prismatic, elongated parallel to [001], and rarely exceed 1 mm in length. Some are doubly terminated and many are cavernous. The faces are sharp and brilliant producing excellent

TABLE II.

REPORTED DENSITIES FOR PLATTNERITE

Density	Locality	Reference
9.392* 9.448	Leadhills (?), Scotland	Breithaupt (1837)
9.4	Leadhills, Scotland	Greg and Lettsom (1858)
9.411	Idaho	Wheeler (1889)
8.56	You Like lode, Idaho	Yeates and Ayres (1892)
8.5	You Like lode, Idaho	Schneiderhohn (1931)
8.5-9.45	Synthetic crystals	Davidson (1941)
8.95	Kurgashinkan, USSR	Golovanov (1959)
9.564 ± .074	Ojuela mine, Mexico	White (this paper)
9.563 (Calc)	Ojuela mine, Mexico	White (this paper)

*Two determinations

signals for goniometric measurement. Crystals are relatively simple; no more than five forms were recognized. Most exhibit all of the following five forms: first order prism *a* {010}, second order prism *m* {110}, ditetragonal dipyramid *L* {131}, tetragonal dipyramid {011}, and pinacoid *c* {001}. Many exhibit only the second order dipyramid and prism. The two most common habits are shown in Fig. 1a, b. A tendency toward unequal development is noted such that the symmetry of the terminal forms is not usually obvious. Most of the crystals on a single specimen have developed the same habit and approximate size.

The crystals from the You Like lode described by Ayres (Yeates and Ayres, 1892) were substantially different. Most displayed only the second order prism and a steep second order dipyramid {031}, with and with-

TABLE III.

PLATTNERITE ANGLE TABLE

(a) White* Symmetry $4/m2/m2/m$ *a:c* = 1:0.6830

Forms:		Phi	Rho	A	$\bar{M}$
c	001	----	0°00′	90°00′	90°00′
a	010	0°00′	90 00	90 00	45 00
m	110	45 00	90 00	45 00	90 00
s	011	0 00	34 20	90 00	66 30
l	131	18 26	65 11	73 19	66 03

*Weighted mean of measurements on the nine best crystals from the Ojuela mine, Mapimi, Durango, Mexico

(b) Ayres (Yeates and Ayres, 1892) *You Like lode, Mullan, Idaho*
a:c = 1:0.67643

Forms:				
c	001	----	0°00′	
a	010	0°00′	90 00	
e	011	0 00	35 20½	
v	031	0 00	63 46	
x	332	----	-----	(shown on crystal drawing but no angle data are given)

(c) Davidson (1941) - synthetic crystals *a:c = 1:0.6785*

Forms:		Meas. (Arith. Mean)		Computed	
e	011	0°00′	34°09½′	0°00′	34°09½′
-	111	44 30	43 30	45 00	43 49
-	121	63 30	56 30	63 26	56 38
-	230	32 32	85 00	33 40	90 00

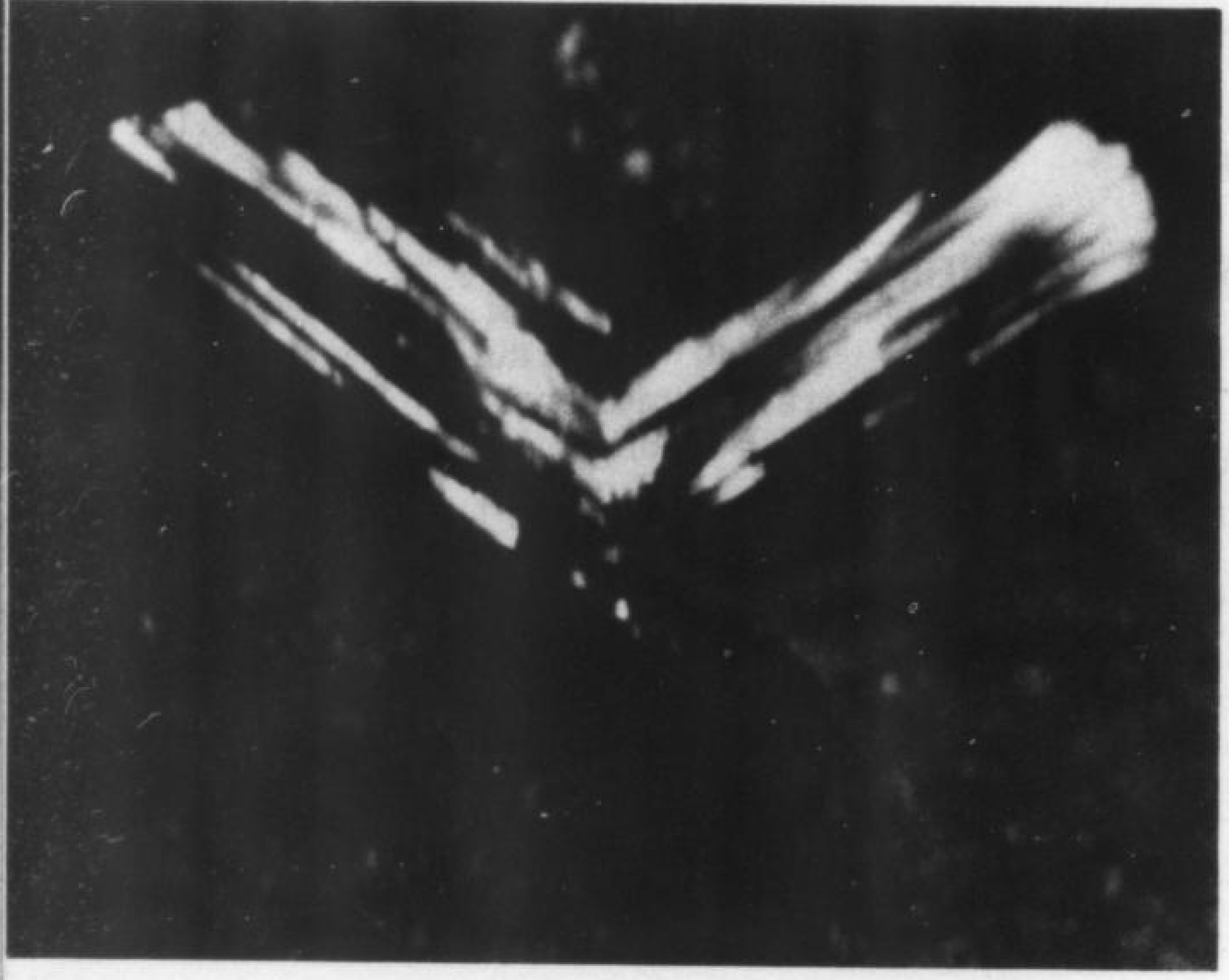
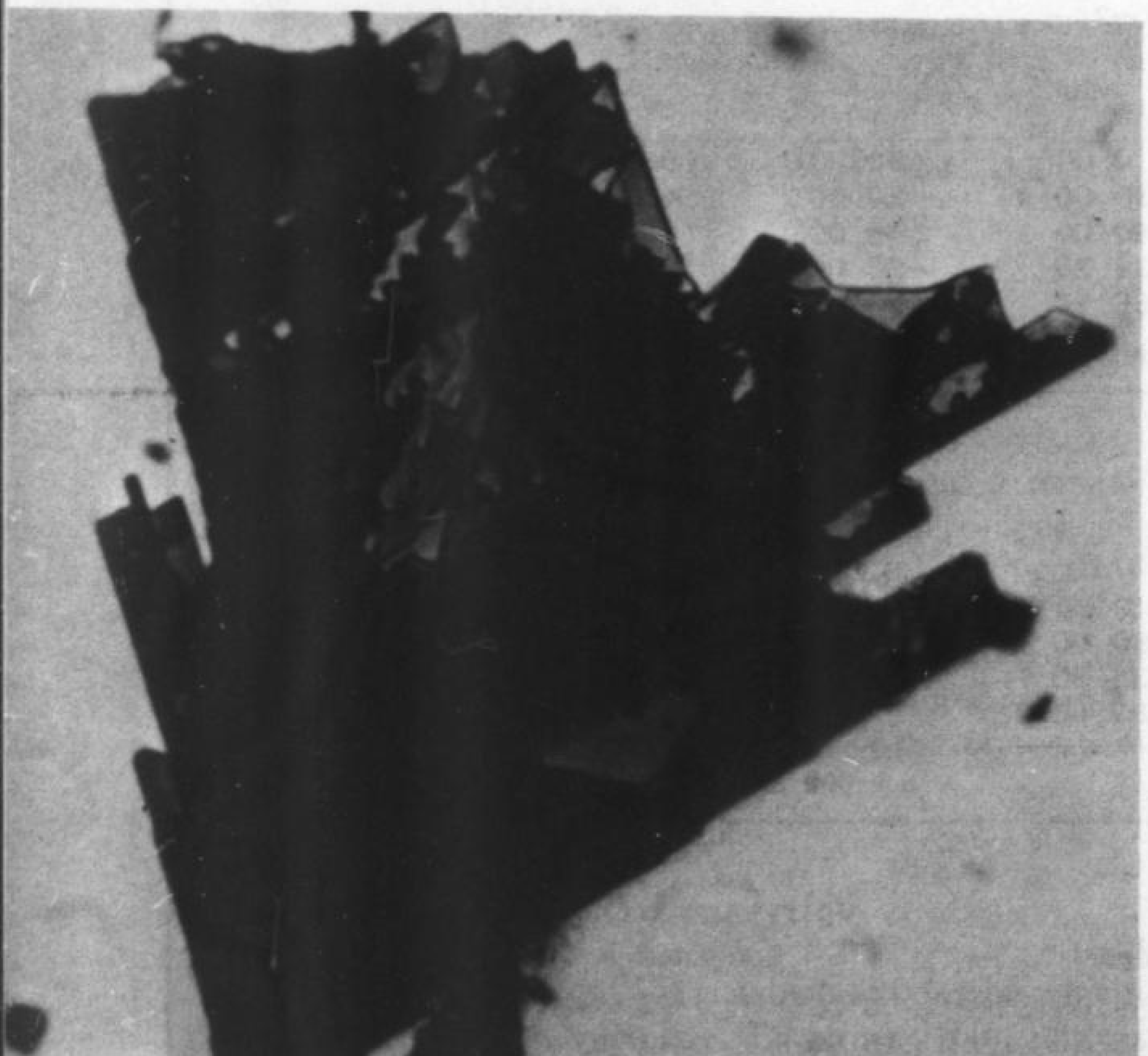


Fig. 2. Plattnerite twinned on {011}; from the Ojuela Mine, Mapimi, Durango, Mexico. (100X)

Fig. 3. Plattnerite crystals twinned on {011}; from White Pine County, Nevada. (100X)



out the pinacoid. Ayres recognized the dipyramid {011} and identified a first order dipyramid {332) on some crystals. His measurements are included in Table III.

Davidson (1941) was able to synthesize plattnerite crystals but these crystals did not exhibit faces which could be reliably measured—"the chief difficulty was caused by the minuteness of the pyramid faces. Although these crystals sometimes grow to a length of nearly 3 mm their ends are usually mere points. . . . No normal signal was obtainable on any of the surfaces, but because of the small size of the pyramid faces it was possible to use a 'pinhole' image in measuring the angles."

The axial ratio derived from goniometric measurements of nine crystals from the Ojeula mine is *a:c* = 1:0.6830. This agrees with the axial ratio *a:c* = 1:0.6838 calculated from the powder pattern.

Twinning

Plattnerite twins on {011} as do rutile and cassiterite of the rutile group. Crystals exhibit both contact and penetration twins, the former predominating at the Ojuela mine. Polysynthetic twins were observed by the author but they are rare. Like rutile, the twins are usually flattened on (100) and are deeply furrowed parallel to the elongation. Twinned crystals rarely have visible terminal faces, but taper to a narrow, irregular edge. A photomicrograph of one such twin is presented as Fig. 2.

Davidson (1941) was the first to observe twinned plattnerite. He reported that long, tapering synthetic crystals formed crosses at angles of 68°.

Twinned, tabular crystals in complex clusters were observed by the author on a specimen for which the locality information is no more specific than White Pine County, Nevada (Fig. 3). The twinning was demonstrated to be on {011} by precession x-ray photographs of the twins which showed the lattices superimposed at the twin angle. The {011} twin is thus the only law demonstrated for plattnerite.

X-ray Study

An x-ray diffraction powder photograph was taken of plattnerite from the Ojeula mine using the Debye-Scherrer method with a Wilson film positioning and nickel filtered CuK$_\alpha$ radiation. The film was measured for shrinkage which was found to be negligible. The relative intensities were measured from a graph of the pattern made with a Siemens recording photometer. The largest peak was assigned an intensity of 100 and the other lines scaled proportionally.

Thirty-six lines were measured and indexed (Table IV) and unit cell parameters determined. The powder data of Darbyshire (1932) are included for comparison. Darbyshire's data appear on card 8-185 of the Powder Diffraction File prepared by the American Society for Testing Materials. Refinement of the powder data and unit cell parameters were done with a least squares computer analysis written by Evans et al (1963). The

TABLE IV.
X-RAY POWDER DATA FOR PLATTNERITE

OJUELA MINE				YOU LIKE LODE[1]			
Measured		Calculated		Measured		Calculated	
I[2]	d_{hkl}	d_{hkl}	*hkl*	I	d_{hkl}	d_{hkl}	*hkl*
100	3.500	3.50230	110	10	3.51	3.494	110
94	2.793	2.79525	011	8	2.80	2.787	011
40	2.469	2.47650	020	4	2.47	2.471	020
6	2.438	2.43434	111				
5	2.224	2.21505	120				
80	1.855	1.85365	121	9	1.852	1.849	121
17	1.752	1.75115	220	3	1.749	1.746	220
13	1.692	1.69300	002	1	1.689	1.687	002
19	1.568	1.56628	130	4	1.566	1.562	130
23	1.524	1.52425	112	4	1.523	1.519	112
19	1.486	1.48399	031	4	1.484	1.480	031
14	1.398	1.39763	022	2	1.395	1.393	022
19	1.274	1.27294	231	4	1.274	1.270	231
7	1.240	1.23825	040	1	1.238	1.235	040
11	1.218	1.21717	222	2	1.215	1.213	222
7	1.169	1.16743	330	1	1.168	1.164	330
14	1.151	1.14972	132	3	1.148	1.146	132
14	1.133	1.13214	141	3	1.133	1.129	141
9	1.109	1.10753	240	2	1.108	1.105	240
9	1.102	1.10368	331	1	1.100	1.101	331
12	1.005	1.11564	123	4	1.005	1.002	123
6	0.972	0.97136	150	1	0.972	0.969	150
13	0.961	0.96109	332	1	0.960	0.958	332
15	0.951	0.95075	051 341	4	0.952	0.948	051 341
7	0.934	0.93370	151	4	0.929	0.931	151
10	0.927	0.92682	242				
12	0.887	0.88759	251	4	0.888	0.886	251
6	0.877	0.87558	440	½	0.877	0.874	440
9	0.872	0.87207	233	3	0.872	0.870	233
6	0.851	0.84943	350	1	0.851	0.848	350
8	0.842	0.84650	004	4	0.842	0.844	004
20	0.823	0.82256	413	5	0.822	0.824	060
8	0.802	0.80100	024	1	0.800	0.799	024
11	0.793	0.79170	161	3	0.792	0.790	161
9	0.784	0.78314	260	1	0.784	7.782	260
12	0.778	0.77772	442	2	0.778	0.776	442

(Camera diameter 114.59 mm Ni filter, CuKα = 1 5418 Å°)

1. Darbyshire (1932)
2. Relative intensities measured from Siemens recording photometer trace.

cell dimensions are a = 4.9525 ± 0.0004 Å and c = 3.3863 ± 0.0004 Å and the cell volume is 83.06 ± 0.01 Å^3.

Single crystal precession pictures were taken with crystals mounted so as to precess about the [001] and [100] axes. Systematic extinctions confirmed that the space group is the rutile type, *P4/mnm*, as previously determined by numerous investigators (van Arkel, 1925; Ferrari, 1925; Goldschmidt, 1926; and Zaslavskii, 1952).

Acknowledgments

The writer wishes to express his gratitude to Paul E. Desautels and George Switzer, both of the National Museum of Natural History, for suggestions and guidance in the early stages of this investigation. I am also indebted to Helen Worthing and Daniel E. Appleman of the United States Geological Survey for the spectrographic analysis and the refinement of the x-ray data, respectively. The valuable criticisms of John W. Anthony of the University of Arizona were particularly appreciated.

All of the specimen material used in this study came from the mineralogical collections of the National Museum of Natural History. The Ojuela mine specimens bear catalog numbers R15009 and R15381, and the White Pine County, Nevada specimen is number R16109.

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(Continued next page)

Mineral Notes

NEW MINERALS

WICKENBURGITE

Sidney A. Williams
Amer. Mineral., *53*, 1433-1438 (1968)

Wickenburgite, $Pb_3Al_2CaSi_{10}O_{24}(OH)_6$, is an oxide zone mineral associated with lead ores and found in abundance at several prospects near Wickenburg, Maricopa County, Arizona. It is associated with phoenicochroite, mimetite, cerussite and willemite. The white, colorless or pink, vitreous, tabular, hexagonal crystals have space group $P6_3/mmc$, $a = 8.53$ and $c = 20.16$ Å, Z = 2. The hardness is 5, G = 3.85 (meas.). The strongest x-ray lines are 10.09 (10), 3.257 (8), 3.392 (6), 3.355 (4), 2.639 (4) and 5.962 (3). Crystals are uniaxial (−) with $\epsilon = 1.6480$ and $\omega = 1.6918$.

The mineral fluoresces dull orange in short wave *u.v.* The name is for the locality.

HEMIHEDRITE

Sidney A. Williams and John W. Anthony
Canad. Mineral., *9*, 310 (1967)

Hemihedrite, in orange to nearly black triclinic (hemihedral) crystals, is found at the Florence lead-silver mine, Pinal County, Arizona and at the Rat Pack claim near Wickenburg, Maricopa County, Arizona. The mineral has a saffron yellow streak, with H = 3, and S. G. = 6.42 (meas.).

Chemical analysis yields the formula $ZnPb_5(CrO_4)_3F_4O$, with two formula units in a unit cell of dimensions $a = 9.497 \pm .001$, $b = 11.443 \pm .002$, $c = 10.841 \pm .002$ Å, $\alpha = 120°30'$, $\beta = 92°06'$ and $\alpha = 55°50'$ space group $P1$. The strongest x-ray lines are 3.301 (100), 4.872 (90), 4.364 (80), 3.164 (80) and 3.102 (80). The refractive indices are high: $n\alpha = 2.105$, $n\beta = 2.32$, $n\gamma = 2.65$; the mineral is optically (–) and exhibits strong dispersion.

Hemihedrite occurs in the oxide zone of lead-bearing veins, associated with cerussite, phoenicochroite, vauquelinite, willemite and wulfenite. The name is in allusion to the morphology.

DISCREDITED MINERALS

TAVISTOCKITE = mixture of FLUORAPATITE and KAOLINITE; also WAVELLITE

P. G. Embrey and E. E. Fejer
Min. Mag., v. 37, pp. 123-127, 1969

Tavistockite from the George and Charlotte mine, Tavistock, Devon, England, originally described as "hydrated calcium-aluminic phosphate (?)", is shown by optical and x-ray examination to be a mixture of fluorapatite and kaolinite. Specimens labelled tavistockite from the Stenna Gwyn mine, St. Austell, Cornwall, England (9 examined from 5 different collections) are wavellite. ☐

PLATTNERITE

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The Record Bookshelf

The books reviewed below are not necessarily recent but they all have been published within the last ten years. They have more than that in common however. Each is an excellent presentation of material which should be of great interest to mineral collectors and is presented in a nontechnical manner so it can be read with understanding by all who want to broaden their knowledge of minerals. In addition, they are modestly priced paperback books so that collectors may build a fine mineral library to supplement their mineralogy texts at a relatively low cost. The reviews are by Joel Arem, The Smithsonian Institution.

Minerals in Industry, by W. R. Jones, Pelican Books (Penguin Pub. Co.), 1963, 314 pp. (4th Ed.), paperback ($1.45).

To many economic geologists, a large phosphate deposit can be more enticing (in terms of potential profits) than a gold mine. To most mineral collectors and laymen such an outlook might seem surprising, but this reaction is understandable. Little publicity is given in current literature to the source and application of nonmetallic mineral products in our society. This information gap is admirably filled by Jones' book.

Minerals in Industry is solidly packed with information, not only about the occurrence and distribution of mineral resources but also about the use of mineral products. Our society depends as much for its operation on feldspar, barite, potash, clay and sand as it does on iron, manganese and copper. Jones therefore treats all such materials on an equal basis, and the resulting text is a thorough survey of occurrence, production and application of virtually all mineral products used by industry.

Most readers will be surprised to learn of the utility of some natural materials usually thought to be without much value (such as nepheline and chert). The book is full of surprises. Nearly 300 pages of useful data make the $1.45 purchase price of this publication a true bargain. Every mineral collector and most professional mineralogists will benefit from the acquisition and study of this excellent paperback.

Crystals and Crystal Growing, by Alan Holden and Phylis Singer, Anchor Books (Doubleday and Co.), 1960, 320 pp., paperback ($1.45).

Holden's approach to the science of crystals is somewhat unique, in terms of the motivation provided for serious study. From beginning to end, *Crystals and Crystal Growing* extolls the sheer wonder and beauty of crystalline perfection.

The text reads quickly, partly because of the question-answer conversational format. Material is introduced through association—the reader is made aware of everyday objects and events that illustrate key scientific principles. Once recognized and assimilated, these principles then explain concepts the reader may have thought more difficult and abstruse.

Discussion of such topics as solutions and solubility diagrams, crystal symmetry and structure, and piezoelectricity is highlighted by easily performed experiments. A unique feature of the book, and perhaps its principle asset, is a chapter on growing crystals, complete with formulas and color photographs of the desired results. The formulas are reliable and easy to follow, and involve materials that are readily obtainable.

Holden presents, in eminently readable form, information acquired in a long career of crystal growing, much of this time spent at Bell Research Laboratories. He is extremely capable of distilling great insight into few words, and these are delightfully illustrated by Phylis Singer. The book is certainly a most valuable addition to the library of anyone interested in crystals.

An Introduction to Crystal Chemistry, by R. C. Evans, Cambridge University Press, 1966, 410 pp., (2nd Ed.), paperback ($2.95).

Evans' book has long been used as an introductory text for teaching crystal chemistry, and the revised edition (1964) was welcomed by many instructors. Now available in paperback, the book is a worthwhile addition to the library of any student of mineralogy and mineral chemistry.

Evans attempts to systematize the knowledge gained through X-ray study of crystals in terms of general chemical principles and bonding theory. Thus, while all mineral structures are not treated in detail, the fundamentals needed to understand such detailed treatment are clearly presented.

The first few chapters of the book deal with atoms, bond types, crystal state, and lattice theory. Pages 1 - 50 can be assimilated by anyone who was not overwhelmed by high school chemistry, and more theoretical sections can be skipped without losing the thread of the discussion. The rest of the text is devoted to systematic crystal chemistry of elements, alloys and compounds, as characterized by specific bond types.

Although much of the material covered is of interest primarily to chemists, many topics of mineralogical interest (such as crystal structures and morphology, defect structures, hydrates and order-disorder) are discussed. Most of the material in the chapters on systematic crys-

Bookshelf

tal chemistry is presented in a somewhat dry and straightforward manner. Nonetheless, Evans' book is one of the more readable crystal chemistry texts, and the low price of the paperback edition puts it in range for purchase by the serious mineral collector.

Mineral Tables: Hand Specimen Properties of 1500 Minerals, by R. V. Dietrich, McGraw-Hill Book Co., 1969, 237 pp., paperback ($3.95).

One may argue with some justification that no book of mineral tables is actually much help in identifying an unusual or rare mineral, or even a common mineral displaying unusual properties. But if such tables do serve a useful purpose in many cases, the compilation of Dietrich is outstanding in its thoroughness and usability.

This book is divided into two sections. The first lists minerals in terms of color and then hardness. Minerals with submetallic luster, instead of being arbitrarily placed in one section or another, are included with both metallic and nonmetallic luster, a distinct advantage in such a subjective evaluation. The second section alphabetically lists minerals in groups according to specific elements, and here again duplication occurs for the sake of completeness. The index gives all pages where a species is mentioned.

The supplementary information in the mineral listings includes crystal system, specific gravity, chemical class (such as sorosilicate, sulfide, sulfosalt, etc.), some very carefully selected (and well chosen) remarks, and finally the page number occurrence of each species in such standard reference works as Dana's System (7th Ed.), Winchell and Winchell, and Deer, Howie and Zussman. This feature alone justifies purchase of the book.

Covering over 1500 mineral species, the book is unusually complete and up to date. One may not favor the use of tables for mineral identification but, if he does, Dietrich's compilation is a welcome library addition. The reference information and chemical listing will keep the book in constant use.

The Story of Fluorescence, Raytech Equipment Co., 1965, 60 pp., paperback ($1.25).

Good things do, frequently come in small packages. This short guide to understanding fluorescence is an example of this notion. Appearing deceptively elementary at first glance, the book is actually one of the most comprehensive and lucidly brief summaries of luminescence theory and application available. *The Story of Fluorescence* introduces material by suggesting experiments to be performed with an ultraviolet lamp. The reader is thus able to immediately visualize each point discussed, and theoretical material becomes much more understandable. The text deftly explains such terms as erythema, spectrophotometry, quanta and photons, and such advanced concepts as selective absorption, electromagnetic radiation, orbital electron transfer and fluorescence activation, all in a few pages and with astonishing rigor. Accuracy is not sacrificed to achieve simplicity.

An additional feature of the book is a survey of applications of fluorescence in various fields, such as medicine and criminology. About half of the text is devoted to a summary of characteristics of fluorescent minerals, with a separate chapter for material from Franklin, New Jersey.

The very low price of this paperback makes it a genuine bargain, since it covers some material found only in advanced texts, and some information found virtually nowhere else. Its value in terms of information per page exceeds most other books available to the serious mineral collector.

Crystals and Light, by Elizabeth Wood, D. Van Nostrand Co., 1964, 160 pp., paperback ($1.95).

The difficulty of writing a comprehensive and accurate treatment of subjects as complex as crystal structure and optical crystallography, though normally great, is even more acute when the expected reader is not technically oriented. Nonetheless, Wood has succeeded admirably in presenting a clear and concise introduction to these topics, that is useful to both the university student and the advanced amateur collector.

Since optical properties of crystals are symmetry dependent, Wood first discusses certain basic concepts of crystal structures and symmetry, elementary diffraction theory, and the behavior of light in crystalline materials. The rest of the text is devoted to optical crystallography. While the treatment parallels most college level texts, Wood's presentation is more verbal, almost entirely nonmathematical, escaping the dry tone of the average textbook. Accuracy and coverage of subject material do not suffer because of this, a feat much to the credit of Dr. Wood.

The bibliography is complete enough to satisfy the professional, and well-chosen for the sake of the less advanced student. Although a microscope is really needed to appreciate the usefulness of the information given, *Crystals and Light* enables the reader to extract much more detail from any comprehensive mineral description. Since one of the distinguishing attributes of the professional mineralogist is the ability to read current literature intelligibly, knowledge of crystal optics can be a profitable goal for the amateur anxious to deepen his background and enhance his technicial proficiency.

ERRATA (from v. 1, no. 1)

p. 11	the show in Tucson was not sponsored by the American Federation, it was sponsored by the Rocky Mountain Federation and the Tucson Gem and Mineral Society.
p. 13	column 1, line 13 add l after hk
p. 23	column 1, line 45 should read Franklin, N.J., not N.Y.
p. 26	the space group should be $P2_1/c$, the β angle should be 107° 44.7′ ± 7.0′ add l after hk (also in Table 3, p. 27)
p. 31	Vice President is Julian R. Goldsmith, University of Chicago; Francis J. Turner is Past President.
p. 33	column 1, line 2 $(11\bar{2}\bar{2})$
p. 33	column 1, line 3 - 84°33′

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