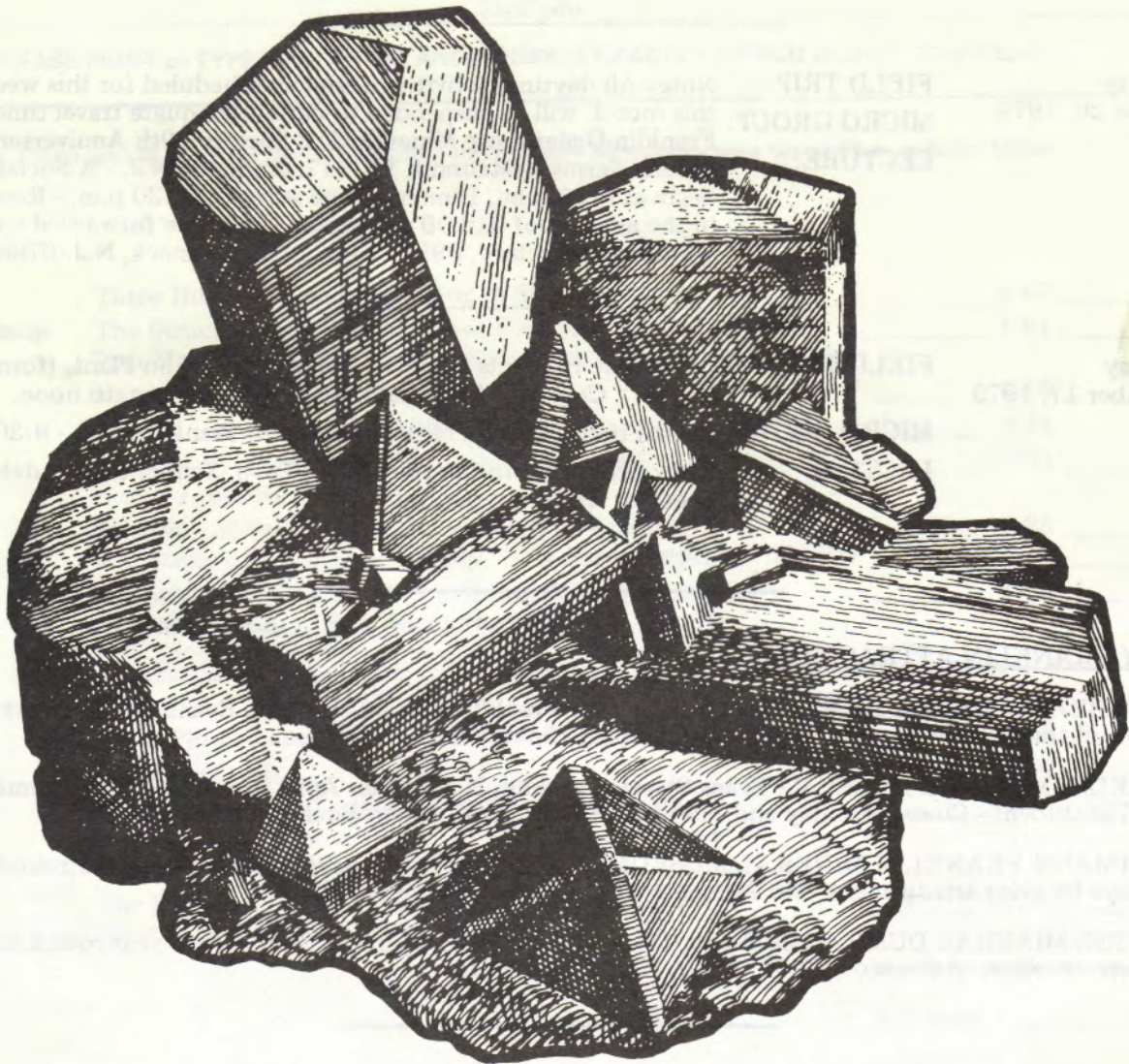


# THE PICKING TABLE

**JOURNAL OF THE FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY**



**Volume 20**

**September 1979**

**Number Two**



## Fall Program

### FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY, INC.

1979

Regular Society activities consist of field trips, micro-mineralogy study sessions and lecture programs. Field trips vary in time and location according to schedule. Morning micro-mineralogy study sessions take place from 9:30 a.m. to noon in Kraissl Hall at the Franklin Mineral Museum. Afternoon lecture programs begin at 2:00 p.m. at the Hardyston Twsp. School, Rt. 23, Franklin, N.J. - premeeting activities begin at 1:00 p.m.

Saturday  
September 15, 1979

**FIELD TRIP:** Trotter Mineral Dump; Main Street, Franklin, N.J. - 9:00 a.m. to noon.  
**MICRO GROUP:** Kraissl Hall; Franklin Mineral Museum, Franklin, N.J. - 9:30 a.m. to noon.  
**LECTURE:** **NOTE: THIS LECTURE WILL TAKE PLACE IN KRAISSL HALL**  
Speaker: Mrs. Alice L. Kraissl - "The Micro-minerals of Franklin and Sterling Hill"

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Saturday  
October 20, 1979

**FIELD TRIP:** Note: All daytime activities normally scheduled for this weekend of this month will be suspended to permit adequate travel time for the  
**MICRO GROUP:** Franklin-Ogdensburg Mineralogical Society 20th Anniversary Dinner  
**LECTURE:** Perona Farms Restaurant, Rt. 517, Andover, N.J. - A Social Hour will begin at 6:30 p.m., Dinner will be served at 7:30 p.m. - Reservations in the amount of \$10.00 per person should be forwarded to Mrs. Helen Warinsky, Secretary, 695 Suffern Road, Teaneck, N.J. 07666

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Saturday  
November 17, 1979

**FIELD TRIP:** Limestone Products Corp. of America, Franklin Plant, (former Farber Quarry), Cork Hill Rd., Franklin, N.J. - 9:00 a.m. to noon.  
**MICRO GROUP:** Kraissl Hall; Franklin Mineral Museum, Franklin, N.J. - 9:30 a.m. to noon.  
**LECTURE:** Note: We return to the Hardyston Twsp. School on this date.  
Speaker: To be announced.

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### DAILY FRANKLIN ATTRACTIONS

**BUCKWHEAT MINERAL DUMP** - Entrance thru the Franklin Mineral Museum, Evans Street, Franklin, N.J. - Open April thru November - Admission \$1.50 adult; 75¢ student.

**FRANKLIN MINERAL MUSEUM** - Evans Street, Franklin, N.J. - Open April thru November - Admission \$1.50 adult, 75¢ student - Closed Monday and Tuesday - Hours also apply to Buckwheat Mineral Dump.

**GERSTMANN FRANKLIN MINERAL MUSEUM** - 14 Walsh Road, Franklin, N.J. - Open year round on weekends. Weekdays by prior arrangement - No Admission Fee - Donations accepted.

**TROTTER MINERAL DUMP** - Main Street, (Behind Boro Hall), Franklin, N.J. - Open year round except during inclement weather. Admission \$2.00 - Mngr. Nick Zipco on call.

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**The Picking Table** is published semi-annually by the Franklin-Ogdensburg Mineralogical Society, Inc., P.O. Box 146, Franklin, N.J. 07416, a non-profit organization. Editor: Bernard T. Kozykowski, 305 Avenue L, Matamoras, Pennsylvania 18336, Assistant Editor: Frank Z. Edward, 726 Floresta Drive, Palm Bay, Florida 32905. All rights reserved. Subscription: \$7.00 per year which includes membership in the Society. Contributed articles and news items are welcome. Acceptance is subject to the approval of the editor.

## F.O.M.S. OFFICERS FOR THE YEAR 1979

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1st Vice President	John E. Mac Donald, P.O. Box 138, Hope, N.J. 07844
2nd Vice President	Ewald Gerstmann, 14 Walsh Road, Franklin, N.J. 07416
Secretary	Helen Warinsky, 695 Suffern Road, Teaneck, N.J. 07666
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John Kolic '79	Robert A. Svecz '79
Alice L. Kraissl '80	Ralph E. Thomas '80
Wilfred R. Welsh '79	

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Field Trip	John E. Sebastian
Historical	John L. Baum
Identification	Ewald Gerstmann
Museum	John L. Baum
Nominating	Wilfred R. Welsh
Program	John E. Mac Donald

## F.O.M.S. NOTES

This Fall marks the twentieth anniversary of the Franklin-Ogdensburg Mineralogical Society, Inc. Our Society held its first meeting on the second floor of the Neighborhood House in Franklin during the weekend of the then infant Franklin-Sterling Hill Mineral Show. During the two decades that have passed since that first meeting our Society has successfully established, "a framework for a series of active programs designed to benefit the community, the collector and those interested in the minerals, mineralogy and geology of Franklin and Sterling Hill, New Jersey." In pursuing these programs our members have benefited from outstanding field trips, study sessions, lectures and Society sponsored publications.

In honor of the occasion, our Society will hold a 20th Anniversary Celebration Dinner, Saturday evening, October 20, 1979, at the Perona Farms Restaurant, Rt. 517 (between Andover and Sparta), Andover, N.J. In consideration of the traveling distance of many of our long time members who would like to attend the dinner, as well as the length of the day, our regularly scheduled field trip, micro-mineral study session and afternoon lecture program will be suspended until the following month.

The evening's activities will include several speakers and a mineral auction to benefit the Society. There will be a social hour beginning at 6:30 p.m.; dinner will be served at 7:30 p.m. Information concerning the menu can be obtained from our September bulletin. Advance reservations in the amount of \$10.00 per person are requested; checks should be made payable to the F.O.M.S. Please forward your reservations to: F.O.M.S. Dinner, c/o Mrs. Helen U. Warinsky, Secretary, 695 Suffern Road, Teaneck, N.J. 07666

We strongly urge you to attend, it will surely be a very enjoyable evening. Many of you have friends who are no longer participating in Society activities as they once were; we suggest that you encourage them to attend our gathering as well. They need not be currently active members.

Each Fall we must elect the officers and trustees who will serve us during the coming year. Our Nominating Committee, chaired by Past-President Wilfred R. (Bill) Welsh, must present a slate of candidates at our October meeting. If you have a preference for someone to serve in a particular office, or are yourself interested in serving, please convey your wishes to Mr. Welsh before the October meeting. Absentee ballots will be mailed to all of our members in October. The election of officers and trustees will take place at our November meeting.

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### F.O.M.S. MINUTES

In the Fall of 1978 we announced our intention to provide a synopsis of the minutes of the business and Executive Committee meetings of the Society. As a point of information, there are far fewer business or Executive Committee meetings than general membership meetings.

Our first business meeting of the current year was conducted in March. At that time, retiring Treasurer Rudolph C. Appeld reported the balance in the Society treasury at the end of 1978 was \$2,505.73. Newly elected Treasurer, William J. Trost, reported the balance in the treasury had increased to \$2,783.30 during the first three months of 1979. Upon recommendation of Editor Bernard T. Kozykowski, a motion was made and unanimously carried, in which the Society would purchase an I.B.M. Selectric Composer which would be used to prepare future issues of the Picking Table. It was further provided that the purchase price of \$2,000.00 be equally covered by funds from the treasury and donations from the general membership.

In June, the Executive Committee approved Perona Farms Restaurant as the location for our 20th Anniversary Celebration Dinner and directed that appropriate information be provided in the September bulletin. The committee received formal acknowledgement of possession of the I.B.M. Selectric Composer from Bernard T. Kozykowski and gave approval to having the machine remain in the possession of the editor as long as he holds the post.

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Many of the operating costs of our Society, as with so many things today, are on the rise. In an effort to meet these expenses, the Executive Committee will soon ask the general membership to approve a proposal that will raise our annual individual membership dues from \$5.00 to \$7.00, while at the same time provide for a family membership in the amount of \$10.00 per year. Individual members would be permitted to participate in all Society activities and would receive one copy of our journal, family members would be permitted to participate in all Society activities and would receive only one copy of our journal.

The decision to seek an increase in our annual dues was not an easy one to make. It has been under discussion for quite some time. Unfortunately, current economic conditions dictate that we reevaluate our financial position. The last increase in our annual dues occurred six years ago at a time when the inflationary spiral we see today was just beginning. Sadly, we can no longer ignore it. The increase is modest. Your support of this proposal is needed. We still consider membership in the Society to be an inexpensive and worthwhile activity.

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### THE 23rd ANNUAL FRANKLIN-STERLING HILL MINERAL SHOW

The 23rd Annual Franklin-Sterling Hill Mineral Show sponsored by the Kiwanis Club of Franklin will be held on Saturday, October 6th and Sunday, October 7th, 1979. Show hours on Saturday: 9:00 A.M. to 8:00 P.M., and on Sunday: 10:00 A.M. to 6:00 P.M.

Please take special notice of the dates of this year's show. Traditionally, the "Franklin Show" had been held on the second weekend of October. A few years ago another mineral show occurring on the same date in Detroit, Michigan began to grow into what has become one of the nation's major mineral shows. In recent years, many participants in the show at Franklin have expressed a desire to visit the "Detroit Show." Responding to the growing number of requests, the Kiwanis Club has rescheduled the "Franklin Show" so that it occurs before the show in Detroit, thus enabling the participants in the show at Franklin to enjoy both shows.

The admission price for the Franklin show will be \$2.00 per adult and \$1.00 per child. The admission price permits entry into the Franklin National Guard Armory with its dealers and exhibitors, to the Franklin Mineral Museum and Mine Replica with its outstanding mineral exhibits, fluorescent mineral display and unusual mine replica depicting a typical working place down in the Franklin mine, and also to the Buckwheat Mineral Dump for mineral collecting. Shuttle buses will provide free transportation between all areas of activity so that you may leave your automobile in one of the free parking areas that will be provided.

Last year the Kiwanis Club began to retire the traditional "flat-tiered" type display case and replaced them with modern "federation" type display cases. Of twenty four display cases, eight were "federation" type cases. At the time it was realized that the modern and traditional display cases, in combination, actually complimented each other - save a rather distasteful paint covering the older cases. This year the number of each type of display case will remain the same, however, the older "flat-tiered" cases have been sanded down and refinished to show their original wood grain finish.

This year's mineral exhibits promise to be the finest to date. There will be numerous displays of famous Franklin "classics." These fine displays will be highlighted by a newer compliment of minerals; the recently encountered minerals occurring at the Sterling Hill mine, some of which are totally new to science.

The Franklin-Sterling Hill Mineral Show has become a tradition among mineral shows in this part of the country. Its many exhibits of outstanding minerals from the Franklin and Sterling Hill mines, exceptional dealers, and unusual program of activities at the Franklin Mineral Museum make this show one that should not be missed. A great many of our long time members were first exposed to minerals at this show. We strongly encourage you to attend and bring a friend.

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## A MINERAL NEW TO SCIENCE

### Lawsonbauerite

In the last issue of the Picking Table we were fortunate to announce the discovery of a mineral, new to science, at the Sterling Hill mine. We are pleased to announce the discovery of yet another mineral, new to science, from the same mine. Your editor quotes the following, intact, from recent communication received from Pete J. Dunn, Dept. of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560.

"A new mineral has been found at Sterling Hill, Ogdensburg, Sussex County, New Jersey. It is colorless but alters to a dark coating and is associated with zincite, pyrochroite and other species. The new mineral is the manganese analog of torreyite and has been named LAWSONBAUERITE in honor of the late Lawson H. Bauer, who was the chief chemist of the New Jersey Zinc Company until his death in 1954. Subsequent to the formal description, more details will be published on this species in the Picking Table."

We congratulate Elizabeth A. Bauer, daughter of the late Mr. Bauer, and extend our thanks to Mr. Dunn for providing the Picking Table with this announcement.

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## MINERALOGICAL RESEARCH

### Quoting "The Record"

The article which follows, entitled "Contributions to the Mineralogy of Franklin and Sterling Hill, New Jersey," by Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560, appeared in the Mineralogical Record, Vol. 10, No. 3, May-June 1979, pp. 160-165.

When we quote from another publication, we prefer to provide an abstract of the article or reset it. However, to do so with the following article, we found, left us wanting. Therefore, we have decided to provide a reproduction of the article as it appeared in the Mineralogical Record. The article is significant in that it describes the occurrence of several minerals that were not previously known to the locality, though they do occur elsewhere. In addition to this, it also provides us with valuable research information on other locally occurring minerals that might have been lost to the author's notes. We are indebted to the publisher, John S. White, and Mr. Dunn for granting permission for its reproduction in this journal.

# Contributions to the Mineralogy of Franklin and Sterling Hill New Jersey

by

Pete J. Dunn

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

## INTRODUCTION

The recent examination of a number of specimens from the Franklin-Sterling Hill mineral deposit has revealed the occurrence of a number of species not formerly known to occur there. Brief descriptions of these minerals, together with various notes gathered over the last few years, are presented here to give the reader increased knowledge of the variety of minerals from the deposit, and to remind the collector of the enormous potential of this still-producing mineral locality, the most remarkable one in America.

## AUSTINITE $\text{CaZn}(\text{AsO}_4)(\text{OH})$

The specimen containing austinite (NMNH #142698) was called to the author's attention by Fred Parker of Livingston, New Jersey, who noted the uniqueness of some brown spherules. The specimen is from the Sterling Hill mine in Ogdensburg, New Jersey, and consists of a plate of calcite encrusted on one side with kraisslite (Moore and Araki, 1978) and, on the other side, sparse hemimorphite, followed by kraisslite and finally by austinite.

The austinite occurs as brown spherules and hemispherules up to 0.2 mm which occur both isolated and as continuous encrustations. The color is a uniform medium brown. The most striking characteristic of the spherules is the radial texture and the splintery fracture along the fibers composing the spherules. This is easily observed when the spherules are broken (Fig. 1), and also serves to distinguish between the austinite and light brown spherules of carbonate minerals (which lack this fibrosity) in the Sterling Hill arsenate assemblage.

The density, measured by flotation in heavy liquids, is  $4.1 (\pm 0.1) \text{ g/cm}^3$ . Optically, the fibers composing the spherules are length-fast with a refractive index of  $n_D = 1.755$  parallel to the fiber axis. The austinite was chemically analyzed with an electron microprobe using an operating voltage of 15 kV and a beam current of  $0.15 \mu\text{A}$ . The data

were corrected using the Magic-4 computer program. The standards used were synthetic ZnO for zinc, manganite for manganese, synthetic olivenite for arsenic, and hornblende for all other elements. There is no appreciable strontium ( $\geq 0.3\%$ ), lead or sulfur in this austinite. The resultant analysis, given in Table 1, indicates that this austinite contains small amounts of iron and magnesium and appreciable manganese. Hence it is properly termed a manganous austinite.

Table 1. Microprobe analysis of austinite from Sterling Hill

	$\text{CaZn}(\text{AsO}_4)(\text{OH})$	
	Theoretical	Sterling Hill
CaO	21.46%	20.20%
ZnO	31.13	28.51
FeO	0.00	0.47
MgO	0.00	1.26
MnO	0.00	3.89
$\text{As}_2\text{O}_5$	43.96	43.22
$\text{H}_2\text{O}$	3.45	3.45*
Total	100.00	101.00

\*water from theoretical composition

Accuracy of data:  $\pm 3\%$  of the amount present.

## ADELITE $\text{Ca}(\text{Mg},\text{Zn})(\text{AsO}_4)(\text{OH})$

The rare arsenate, adelite  $\text{CaMg}(\text{AsO}_4)(\text{OH})$ , has been found in an old specimen from the Franklin mine. It occurs as medium yellow tabular crystals, up to 5.0 mm, enclosed in hodgkinsonite which is coated with barite, allactite, rhodochrosite, franklinite, and a second generation hodgkinsonite. The matrix of the specimen is a layered, granular, willemite-franklinite ore. The morphology of the crystals



**Figure 1.** SEM photomicrograph of a cross-section of Sterling Hill austinite showing the radial habit and fibrosity (315X).

could not be determined with reliability inasmuch as they are imbedded in hodgkinsonite and are brittle, precluding their removal intact. The adelite does not fluoresce in ultraviolet radiation.

The adelite was chemically analyzed by electron microprobe using the same standards as were used for the austinite described above. The material is a zinc-rich adelite but magnesium is greater than zinc, in atom-percent. The formula should be expressed as  $\text{Ca}(\text{Mg},\text{Zn})(\text{AsO}_4)(\text{OH})$ ; the analysis is given in Table 2. The sample is in the Smithsonian collection under catalog #R5412.

**Table 2.** Electron microprobe analysis of zincian adelite

	$\text{Ca}(\text{Mg},\text{Zn})(\text{AsO}_4)(\text{OH})$	
	Theoretical**	Franklin
CaO	23.60	24.63
ZnO	14.39	14.23
MgO	9.85	9.74
MnO	0.00	1.60
FeO	0.00	tr
$\text{As}_2\text{O}_5$	48.38	46.36
$\text{H}_2\text{O}$	3.78	3.44*
Total	100.00	100.00

\* $\text{H}_2\text{O}$  by difference

\*\*calculated for Mg:Zn = 58:42.

Accuracy of data:  $\pm 4\%$  relative.

#### ARSENIOSIDERITE $\text{Ca}_3\text{Fe}_4(\text{AsO}_4)_4(\text{OH})_6 \cdot 3\text{H}_2\text{O}$

Arsenosiderite was initially reported from the Taylor mine in Franklin by Palache (1935), based on optical determinations by E. S. Larsen and a microchemical test by E. V. Shannon. A re-examination of this material by Frondel (1972) showed it to be a manganese calcium silicate and not arsenosiderite.

This mineral, in the Canfield collection at the Smithsonian (NMNH C4222), has been examined by the author. The material is composed of

dark brownish-red rosettes and agrees well with Palache's description. A wavelength-dispersive microprobe scan indicates only manganese, calcium, silicon and possibly sulfur as essential constituents with traces of barium, zinc and iron. The mineral is very likely a new species but cannot be characterized at this time due to the facts that it is chemically inhomogeneous and single-crystals could not be found, despite arduous searching. The strongest lines in the X-ray diffraction pattern are: 11.2 (100), 2.58 (80), 3.58 (40), 2.92 (40), 3.58 (40) and 9.50 (40), in Å with intensities visually estimated.

At the time of the koettigite-pharmacosiderite find at Sterling Hill some 5 or 6 years ago, a light brown mineral was noted on some specimens. It occurs as thin crusts and the material occasionally comes in very small rosettes. No single crystals of the mineral were found, but the X-ray diffraction pattern is very similar to that of arseniosiderite; the only differences are some diffuse extra reflections and an overall broadening of the reflections. A wavelength-dispersive microprobe scan indicated that the mineral contains only calcium, iron and arsenic as essential cations. However, this "arsenosiderite" is also chemically inhomogeneous and a definite characterization is not possible. The mineral may be an impure arseniosiderite or a related unknown mineral. The specimen is in the Smithsonian collection under catalog #143363.

#### HYDROTALCITE $\text{Mg}_6\text{Al}_2(\text{CO}_3)(\text{OH})_{16} \cdot 4\text{H}_2\text{O}$

Hydrotalcite, reportedly from the Franklin orebody and not from Sterling Hill, forms tabular, soft, hexagonal crystals associated with spinel, hodgkinsonite, calcite, willemite, and serpentine. The sequence of formation is: a 5 mm band of brown serpentine, followed by a 3 mm layer of willemite, followed by spinel crystals, then hodgkinsonite crystals, then hydrotalcite and calcite. The hydrotalcite crystals as an unknown were called to the author's attention by Alice Kraissl.

Optically, the crystals of hydrotalcite are seen to exhibit an anomalous birefringence and have  $n\omega = 1.520$ , measured in sodium light. Semi-quantitative microprobe analysis indicates that the crystals contain no iron, and contain only magnesium and aluminum as essential cations. The presence of carbonate was determined by effervescence in hydrochloric acid. Small amounts of zinc and manganese substitute for magnesium.

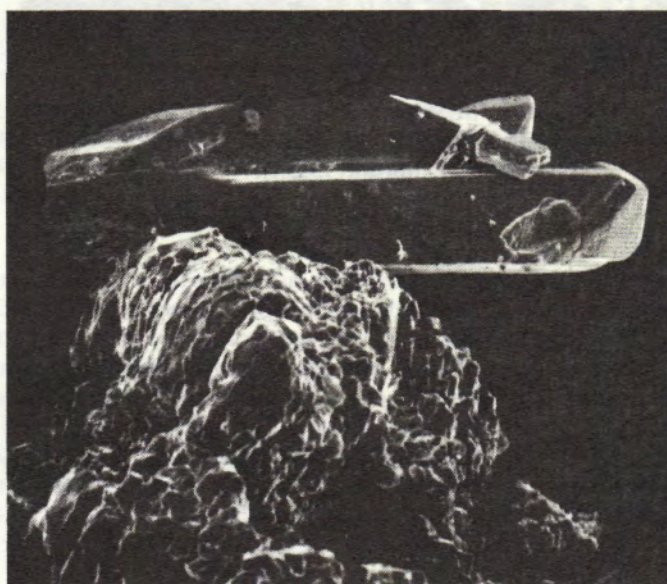
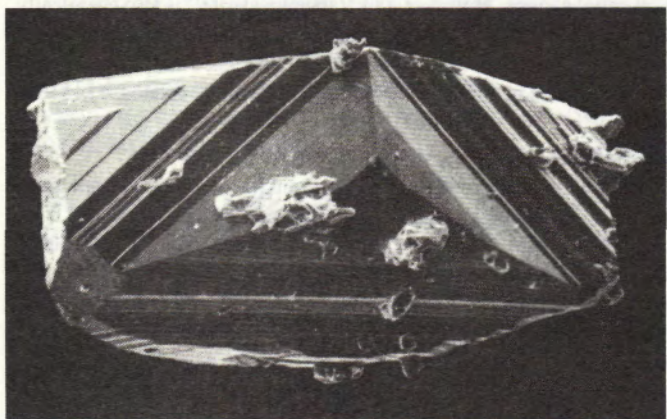
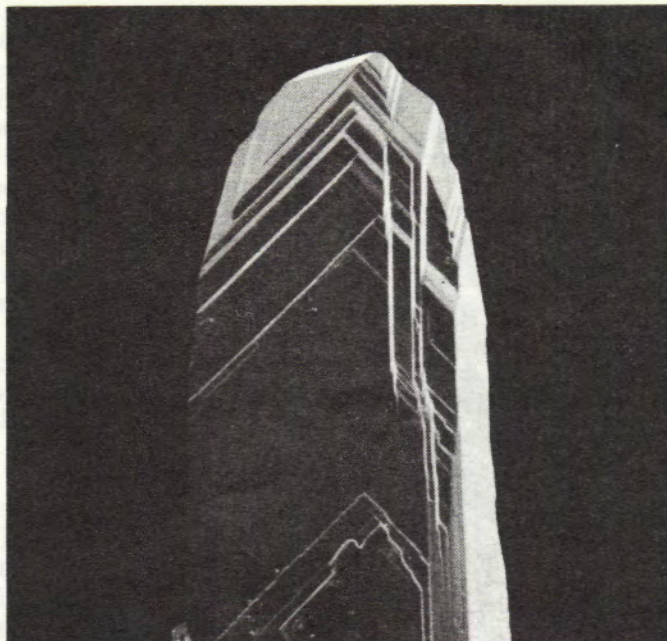
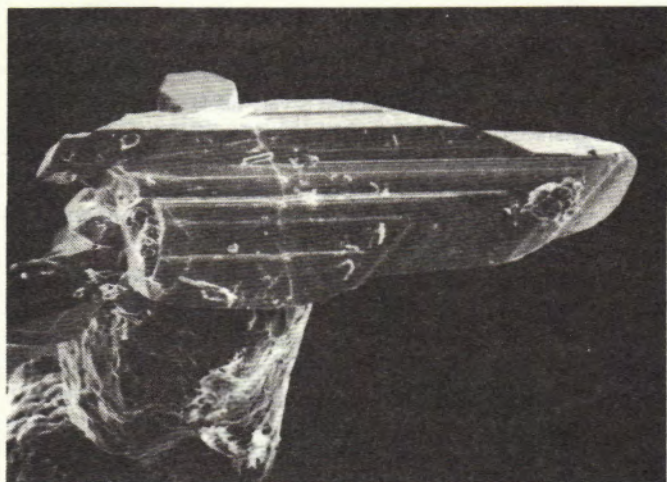
The X-ray diffraction pattern of the Franklin hydrotalcite is in good agreement with the published data for the species (JCPDS #14-191) except for the absence of the unindexed reflection at 1.85 Å in the JCPDS data. The sample is in the Smithsonian collection under catalog #143397. Duplicate material is in the mineral collection of Alice Kraissl of River Edge, New Jersey.

#### ARSENOPYRITE $\text{FeAsS}$

In early 1978, mining at Sterling Hill encountered a zone of calcite and realgar at the 1100-foot level. The realgar occurs as very small crystals (up to 1.0 mm) in vugs in calcite. However, it should be noted that dissolution of the calcite in acid does not yield euhedral realgar crystals, but only formless blebs. The crystals are restricted to the vugs in the calcite and apparently were the last mineral to form in the assemblage.

To gain some knowledge about the nature of the other minerals seen as microscopic blebs in the calcite, a 20-gram piece was dissolved in HCl and the insoluble residue examined by X-ray diffraction and SEM (scanning electron microscope). The results are most interesting. The dominant mineral in the assemblage is arsenopyrite which occurs in beautiful crystals of prismatic habit (see Figures 2, 3, 4, 5, and 6). Several crystals of a bladed prismatic habit were observed. At first glance, they appeared to be stibnite but X-ray diffraction proved them to be arsenopyrite. Blebs of an orange colored mineral proved to be microcline with realgar inclusions. Other minerals present include quartz, graphite and a clinopyroxene. The specimen is in the Smithsonian collection under catalog #143055.

The paragenesis and occurrence of these species is remarkably similar to that noted by Palache (1941). The specimen examined here is



Figures 2, 3, 4, 5, and 6. Scanning Electron photomicrographs of arsenopyrite from Sterling Hill, Ogdensburg, New Jersey (100X, 77X, 120X, 95X, 105X).

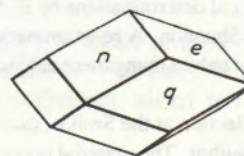
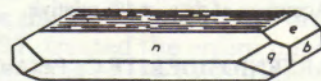
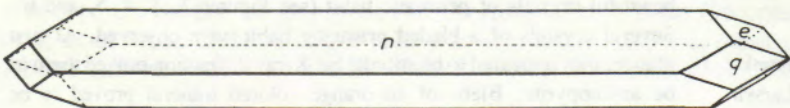


Figure 7. Crystal drawings of Sterling Hill arsenopyrite (from Palache, 1941).



reported from the 1100-foot level at Sterling Hill, whereas the assemblage noted by Palache was from the 900-foot level.

#### ZIRCON $ZrSiO_4$

A re-examination of the Sterling Hill specimens of ruby corundum with margarite resulted in the observation of tiny, light brown zircon crystals and dull green blebs of titanite, both verified by X-ray diffraction. The zircon crystals are euhedral and sharp, but are sparse on the specimens, in contrast to the much more abundant dark red rutile. A SEM photomicrograph of this zircon is shown in Figure 8.



Figure 8. SEM photograph of zircon from Sterling Hill, Ogdensburg, New Jersey. (234X) NMNH #C6101.

#### MONOHYDROCALCITE $CaCO_3 \cdot H_2O$

A very light green mineral encrusted on calcite was called to the author's attention by John MacDonald of Hope, New Jersey. The light green mineral resembles hyalite opal at first glance, but a closer inspection reveals the opacity and fibrous nature of this mineral, which effervesces in hydrochloric acid. The X-ray powder diffraction pattern is in excellent agreement with that of Marschner (1969) for monohydrocalcite. Semiquantitative analysis by electron microprobe revealed only calcium with no detectable magnesium, iron, manganese or zinc in substitution for calcium. The lack of magnesium is notable in that other described monohydrocalcites do have small amounts of magnesium and some investigators have postulated that it might be an agent in the formation of the species. Monohydrocalcite occurs most often in a spherical habit (Taylor, 1975) and the surface of this Sterling Hill occurrence is slightly rounded, the surface being the tips of fibrous crystals. The Sterling Hill monohydrocalcite is fluorescent in ultraviolet radiation and the response colors are medium, dull-green in shortwave and medium dull yellowish green in longwave ultraviolet. The monohydrocalcite described by Taylor (1975) fluoresces also, but without the green color. Hence, the property of fluorescence may be an essential one of monohydrocalcite, but the resultant color may depend on different chemical impurities. There is no phosphorescence in the Sterling Hill sample. For an interesting discussion on the stability of monohydrocalcite, and an altogether delightful and readable paper, the reader is referred to the work of Taylor (1975). The specimen from Sterling Hill described herein is in the Smithsonian collections under catalog #144032.

#### STRONTIANITE $SrCO_3$

Strontianite has been verified by X-ray diffraction on some specimens from Franklin. The mineral occurs as white acicular crystals in radiating bundles on calcite in vugs in a calcite-franklinite ore. The crystals are easily differentiated from chlorophoenicite by effervescence in hydrochloric acid and a strontium flame test. The most striking characteristic of this Franklin strontianite is its snow-white color. The mineral is not fluorescent in ultraviolet radiation.

#### PICROPHARMACOLITE $H_2Ca_4Mg(AsO_4)_4 \cdot 11H_2O$

A fan-like array of white acicular crystals up to 5 mm, occurring on calcite, was called to the author's attention by John Kolic. The X-ray diffraction pattern is in good agreement with that for picroparmacolite. Semi-quantitative chemical analysis by electron microprobe revealed that it is essentially a magnesium calcium arsenate with MgO about 2.5% by weight. This Sterling Hill picroparmacolite is fluorescent in ultraviolet radiation. The response colors are medium yellowish white in longwave and weak yellowish white in shortwave ultraviolet. There is no phosphorescence. Other picroparmacolite samples in the Smithsonian collections also responded to ultraviolet with similar colors, and fluorescence may be a characteristic of the species. The studied sample is in the Smithsonian collections under catalog #143981.

#### MANGANAXINITE $Ca_2MnAl_2BSi_4O_{15}(OH)$

The yellow manganaxinite from Franklin, New Jersey, is well known as a collector classic. The color of the mineral is an unusually (for axinite) rich yellow rivaled only by tizenite from the Cassagna mine, Liguria region, Genova, Italy. The crystals are sharp and the morphology, described by Palache (1935) and Aminoff (1919), adds to the appeal that these specimens have to collectors.

Many axinite specimens were studied to determine their correct nomenclature (Dunn *et al.*, 1979) and a large number of Franklin specimens (36) were included to ascertain if there were any occurrences of tizenite among the Franklin axinites and to determine the range of composition of the available specimens.

Of the thirty-six specimens analyzed, all were manganaxinite. The samples with the highest and lowest manganese contents are noted in Table 2 (analyses #1 and #3). Incidentally, the specimen with the lowest manganese content was also the one with the highest zinc content. There is little solid solution towards ferroaxinite or magnesoaxinite (Jobbins *et al.*, 1975) in the Franklin axinite; iron is present only up to 1.75% FeO and magnesium only up to 0.50% MgO. In general, the composition of most Franklin manganaxinite is rather constant and the manganese content of 31 samples fell between the limits given in Table 3 (analyses #1 and #2).

Some of the Franklin manganaxinite is known to fluoresce under short and longwave ultraviolet illumination with a medium to intense red color and no phosphorescence. Most of the well-crystallized, bright yellow manganaxinite does not fluoresce at all, but some of the very light yellow and granular whitish yellow material does fluoresce. Of the 10 specimens in the Smithsonian collection which were analyzed, only two fluoresced and both were the lighter colored material.

#### SCORODITE $Fe^{3+}(AsO_4) \cdot 2H_2O$

The crystals described herein were first noted by George Pigeon of New York City, who correctly identified them as belonging to the scorodite-mansfieldite series on the basis of microchemistry and determination of the optical properties.

The crystals are associated with pharmacosiderite and were found in July, 1972, in the Sterling Hill mine. This scorodite occurs in light yellow euhedral crystals, up to 1.0 mm in size, and resembles in habit the crystals from Djebel Debar in Algeria which are depicted by crystal drawings in *The Dana System of Mineralogy* 7th Ed., 2, 764. The X-ray diffraction pattern of this scorodite is in excellent agreement with published data given by Dasgupta *et al.* (1966). Partial microprobe analysis of this Sterling Hill scorodite indicates that it is essentially end-member scorodite in composition, with no aluminum present, and

**Table 3. Microprobe analyses of manganaxinite from Franklin**

	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	MgO	CaO	ZnO	MnO	B <sub>2</sub> O <sub>3</sub>	H <sub>2</sub> O	Total	Museum #	Analysis #
Manganaxinite (theory)	42.25	17.92			19.70		12.46	6.11	1.56	100.00		
Franklin, New Jersey	42.13	15.52	0.83	0.12	16.10	1.20	16.68	6.11*	1.56*	100.25	HU# 89930	#1
Franklin, New Jersey	42.25	15.91	0.11	0.11	19.62	2.82	10.83	6.11*	1.56*	99.32	HU# 109397	#2
Franklin, New Jersey	42.28	16.33	0.22	0.30	19.17	4.49	8.81	6.11*	1.56*	99.27	HU# 114594	#3

#Total iron calculated as Fe<sub>2</sub>O<sub>3</sub> in accordance with the determinations published by Palache (1935).

\*B<sub>2</sub>O<sub>3</sub> and H<sub>2</sub>O given as the theoretical value.

Operating conditions and standards given in Dunn *et al.* (1979)

Accuracy of data: ±3% relative.

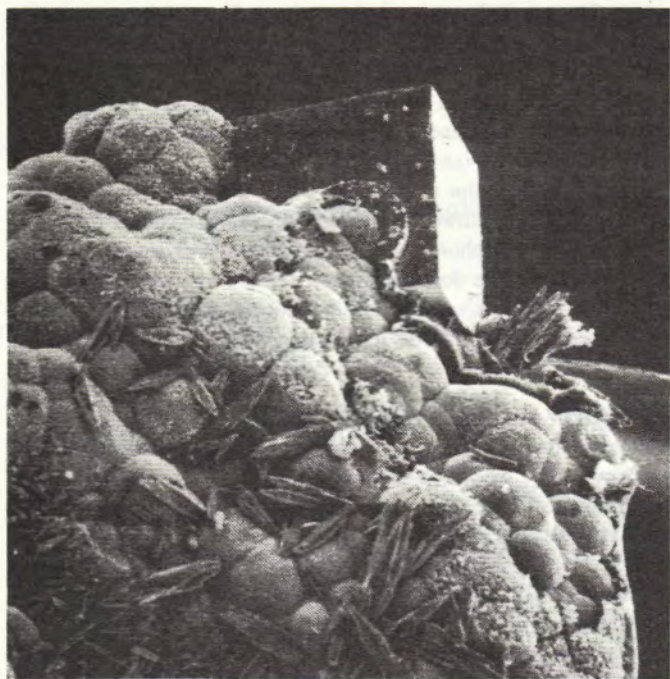
no solid solution to mansfieldite. There are very small amounts of manganese, but only as traces. The samples are in the collections of George Pigeon and the Smithsonian Institution (NMNH #143795).

### GREENOCKITE CdS

The greenockite crystals described here were found in the Sterling Hill mine in late 1977 and called to the author's attention in January of 1978 by Fred Parker of Livingston, New Jersey. The greenockite crystals are bright yellow in color, elongated up to a length to width ratio of 6:1, and are approximately 0.2 mm in maximum dimension. The crystals are associated with a botryoidal light brown sphalerite, galena and pyrite, all on calcite (Fig. 9).

The order of deposition is calcite followed by sphalerite, then followed by galena and greenockite which may have formed at the same time. The greenockite occurs as color bands varying from deep to light orange-yellow. Although nothing is known of the exact placement of the specimen *in situ*, the greenockite appears to have been responsive to a water table or fluid level and the variation in color of the greenockite resembles color bands obtained during chromatography experiments or Liesegang rings. The greenockite is prismatic in habit (Fig. 10) and the crystals, although not euhedral, appear to be composed of a steep pyramid as the dominant form.

Analysis by electron microprobe using synthetic greenockite and synthetic zincite as standards indicated that the crystals are inhomogeneous over very small (5 micron) areas, and are zincian greenockite. Semi-quantitative analysis indicates a Cd:Zn ratio of 3:2 and the ratio



**Figure 9. Scanning electron photomicrograph of botryoidal sphalerite, galena, and acicular greenockite from Sterling Hill (127X).**



**Figure 10. Acicular greenockite on sphalerite from Sterling Hill. (SEM photomicrograph at 600X).**

varies but slightly from crystal to crystal. The described specimen is in the Smithsonian collection under catalog #142896. The X-ray diffraction pattern of this zincian greenockite is very similar to the published data for greenockite but has slightly smaller *d* values, likely reflecting the smaller size of the zinc atom in substitution for cadmium.

### HUEBNERITE MnWO<sub>4</sub>

Huebnerite occurs on a small specimen owned by Mrs. Elna Hauck of Bloomfield, New Jersey. No specific locality information is available for the specimen, but it appears to have come from the Franklin deposit. The huebnerite crystals are associated with willemite crystals which were formed before the dark red huebnerite, and with franklinite, the latter in small (0.2 mm) crystals which are composed of the cube and tetrahedron. The franklinite was the last mineral to form in the assemblage.

The huebnerite crystals are of simple morphology. Removal of the best crystals was not advisable, but a visual examination of form development allows some observations. The crystals, up to 1.0 mm in size, are for the most part equant, but some crystals are elongated on [010]. The forms present are {010}, and {h0l} pinacoids which compose most of the surface area of the crystals.

The huebnerite was identified by X-ray diffraction. The powder pattern matches that of the Pasto Bueno, Peru, huebnerite and is in good agreement with the published data for the species. Both the huebnerite and associated franklinite were analyzed with an electron microprobe utilizing an operating voltage of 15 kV and a beam current of 0.15 μA. Synthetic scheelite was used for a standard for calcium and tungsten,

synthetic ZnO for zinc, manganite for manganese, and hornblende for iron. The resultant data were corrected using the MAGIC-4 computer program. The analysis yielded: MnO 24.19%, FeO 0.24%, ZnO trace, WO<sub>3</sub> 77.16%, sum = 101.59%. The lack of zinc in the mineral is somewhat surprising.

Huebnerite is to be expected at Franklin in view of the abundance of manganese in the deposit and the previously reported occurrence of scheelite. Further investigation might possibly find an occurrence of sanmartinite, ZnWO<sub>4</sub>, in view of the abundance of zinc in the orebody. The associated franklinite was also analyzed to determine if it is jacob-site, the manganese end-member of the series. It is franklinite, with some enrichment of manganese at the margins of the crystals.

#### DYPINGITE Mg<sub>5</sub>(CO<sub>3</sub>)<sub>4</sub>(OH)<sub>2</sub>•5H<sub>2</sub>O

The specimen containing dypingite was found in the north orebody of the Sterling Hill mine by Richard Bostwick, who called it to the author's attention. The dypingite occurs as white hemispherules up to 0.5 mm which coat the surface of a calcite-zincite-sussexite rock in a random fashion. The spherules are bright white with a pearly luster. When broken, a fibrous texture is seen and the spherules are composed of acicular crystals radiating from a common origin. The pattern that the hemispherules make on the surface of the rock is most interesting. Although they are in part randomly distributed, there are long, irregular stringers of side-by-side "chains" of these hemispherules which wander over the surface of the specimen like meandering lines of colons ::::::::::::::. This feature was not noted in the original occurrence in Norway (Raade, 1970) and was not present on a specimen from San Benito County, California, which was examined by this author. The cause of the irregular and disjointed lines of hemispherules is not explained; they do not seem to follow inter-mineral boundaries in the rock on which they are deposited.



**Figure 11.** Scanning electron photo-micrograph of a spherical aggregate of dypingite from Sterling Hill (425X).

The identity of the dypingite was confirmed by X-ray diffraction; the pattern is in good agreement with the data given by Raade (1970). Optically, Sterling Hill dypingite is length-fast with parallel extinction and the mean refractive index is  $n = 1.515$ . This dypingite fluoresces in ultraviolet radiation. The response colors are: weak light grayish blue in shortwave ultraviolet and medium light blue in longwave ultraviolet. It is interesting to note that there is no phosphorescence and that the same responses were observed on the San Benito specimen. However, the

original material from Dypingdal in Norway, although also fluorescent with a light blue color, was also phosphorescent. The absence of this characteristic in the Sterling Hill material and that from San Benito may indicate that the phosphorescence is not a true characteristic of the species but due to some impurity or activator in the Dypingdal material. Semiquantitative analysis by electron microprobe indicated that only magnesium is present in addition to the carbonate determined by acid test, and that there is little or no substitution by other cations.

#### PUMPELLYITE Ca<sub>2</sub>MgAl<sub>2</sub>(SiO<sub>4</sub>)(Si<sub>2</sub>O<sub>7</sub>)(OH)<sub>2</sub>•H<sub>2</sub>O

In his monograph on the Franklin-Sterling Hill mineral deposit, Palache (1935) mentioned the occurrence of a mineral similar to zoisite as pseudomorphs after a feldspar, likely microcline. Several of these crystals are in the Smithsonian collection. One of them, NMNH #C2353, was examined by X-ray diffraction and found to be composed of pumpellyite, likely replacing the original feldspar crystal. A preliminary analysis of this pumpellyite indicates that it contains approximately 2.8% MgO and only 1.7% FeO. It is pumpellyite with but minor substitution of iron in solid solution toward the iron-bearing end-member, ferropumpellyite.

#### ACKNOWLEDGEMENTS

The author is indebted to the following people who provided much of the stimulus for these individual studies and whose perspicacity and familiarity with the Franklin-Sterling Hill minerals was largely responsible for noting the occurrence of many of the minerals described here. Special thanks to Jenny Areson, Lee Areson, John Baum, Richard Bostwick, Vic Cianciulli, Ewald Gerstmann, Elna Hauck, Richard Hauck, John Kolic, Bernie Kozykowski, Fred Kraissl, Alice Kraissl, John MacDonald, Warren Miller, Fred Parker, George Pigeon, Steve Sanford, Bob Svecz and Nick Zipco. This research was supported, in part, by a grant from Mrs. E. Hadley Stuart.

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## RESEARCH NOTES

### Ganophyllite

A paper entitled "The Crystal Structure of Ganophyllite, a complex manganese aluminosilicate," by D.A. Jefferson, published in Acta Crystallogr. (?), Vol. A34, 1978, pp. 491-497, and in Mineralogical Abstracts, Vol. 30, No. 1, March 1979, page 16, provides additional data on this mineral. An abstract follows:

"X-ray precision photographs of ganophyllite indicate two distinct variants: one monoclinic and the other a hitherto unreported triclinic form. Both structures can be interpreted in terms of structural columns which can be stacked in varying sequences along either of the (011) planes."

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### Magnussonite

A paper entitled "Magnussonite, manganese arsenite, a fluorite derivative structure," by Paul B. Moore and Takaharu Araki, appeared in the American Mineralogist, Vol. 64, No. 3 and 4, March-April 1979, pp. 390-401. Scientific detail on the structure of magnussonite found at Langban, Sweden and Sterling Hill, is given.

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### Sussexite

Another locality for the occurrence of sussexite has been reported in a paper entitled "The Occurrence of Sussexite from the Matsuo mine, Kochi Prefecture, Japan," by Matsubara, Kato, Tiba and Kuwano which appeared in the Memorial National Science Museum, Tokyo, Vol. 9, 1976, pp. 71-75. The sussexite reportedly was found in fine grained manganese ore with alabandite, jacobsonite, alleghanyite and rhodochrosite.

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### Dendrites

The following article appeared in the Chemical and Engineering News, May 14, 1979, page 36, and is offered here by former trustee Alex Knoll.

#### "DENDRITE STRUCTURAL COMPOSITION DETERMINED" .....

What chemical compounds make up dendrites - black, crystalline delicately fernlike patterns that fascinate rock collectors - finally has been deciphered by geochemists Russell M. Potter and George R. Rossman of the California Institute of Technology. The textbooks, it seems, have been dead wrong all these years. The crystals in dendrites are too small for standard X-ray diffraction, so the presumption has been that they are formed of the common manganese dioxide mineral pyrolusite. Potter and Rossman, however, discerned the true composition by infrared transmission spectroscopy. Dendrites are indeed manganese oxides, they say, but in such crystalline forms as romanechite, hollandite, todorokite, and cryptomelane - everything but pyrolusite. None of the dendrites examined were mixtures. Each contains only one form of the mineral."

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**Editor's note:** Whether or not this article is germane to dendrites as they occur at Franklin can be argued. However, past experience suggests our "inorganic ferns" have not been thoroughly studied. It would not be surprising to find such a study supporting the preceding article. The outcome might well reveal todorokite or cryptomelane - both of which are known to occur locally. Romanechite and hollandite are not known to occur at Franklin or Sterling Hill.

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## GEOLOGICAL PERSPECTIVE

We look forward to presenting papers written for the Picking Table, particularly when they come from our members. The article which follows was written by Warren Cummings, a graduate geologist, who has developed a keen interest in the geology and mineralogy of Franklin and Sterling Hill.

## FRANKLIN and STERLING HILL IN THE BEGINNING

by

Warren Cummings

Franklin-Sterling Hill minerals attract the attention of a great many people to say the least. Most serious collectors understand that the assemblage seen today is the result of several processes sporadically superimposed upon one another over the last 1000 million years. However, little consideration is given to the origin of the mineralization. A little food for thought on the subject is offered here.

The answer to what made the Franklin-Sterling Hill ores unique lies in the events surrounding the earliest history of the deposits. The environment in which the primitive ores formed has been greatly obscured by metamorphism and deformation. Even so, it is possible to discern some broad generalities and make some educated guesses to fill in the gaps.

In the period 1200 to 1500 million years ago the Franklin-Sterling Hill area was part of a broad sedimentary and volcanic basin, a geosyncline, that partially encircled ancestral North America as the Appalachian geosyncline did during the Paleozoic. Like its Paleozoic counterpart, the Precambrian basin lay along a convergent plate boundary for much of its history.

The local portion of the basin seems to have been adjacent to an exposed land mass, perhaps a volcanic island. Sedimentary deposits were largely arkosic sandstones, graywacke and lesser amounts of shale, sometimes carbonaceous or calcareous. Limestones were largely restricted to small algal reefs and local tide flat deposits formed during periods of low clastic influx. There seems to have been at least one period of prolonged clastic sedimentary quiescence which allowed massive buildups of algal limestones in large restricted bays. Interbedded with these sediments were volcanics, mostly rhyolite, quartz keratophyre and spillite.

Hydrothermal activity was widespread during much of the depositional period. This activity consisted of submarine hot springs whose heavy brines settled into seafloor depressions and precipitated chemical sediments. Such chemical sediments occur as stratiform layers in many rock types ranging from volcanics to carbonates. The metallic minerals may have been massive or disseminated depending upon the rate of clastic influx during precipitation. In most cases the hydrothermal deposits were iron oxide and apatite. However, where the metal-rich brines encountered carbonates, varying amounts of manganese and zinc also accumulated.

The dichotomy between the iron-apatite ores, so common in the gneisses, and the zinc-iron-manganese ores of Franklin, Sterling Hill and Sulphur Hill (Andover) may not be as great as it first seems. There are several examples of intermediate compositions, mostly iron ores in carbonate rocks containing up to several percent manganese and, rarely, small amounts of zinc. The most important deposits of this type are the Furnace bed at Franklin, the hematite orebody at Andover (once a magnetite-pyrite deposit), and the Ahles mine north of Oxford. There is also at least one case where a small, stratiform sphalerite-galena-pyrite deposit, exposed in the old Edison cement quarry near Butzville, occurs no more than a few hundred feet along strike from a small manganese magnetite pod once known as the Raub mine.

It seems likely that all the ore deposits in the Precambrian rocks of the region originated in much the same manner. The chemical variation within the group reflects, in part, differences in the environments of deposition.

Zinc, iron and manganese are common in many hydrothermal fluids both ancient and modern. All three elements (and often copper, lead and silver) frequently occur together in veins but do not often do so in stratiform sedimentary deposits. The different chemical factors controlling the transport and deposition of each element, especially the greater mobility of manganese and its low affinity for sulphur as opposed to iron and base metals, are very effective separators in a sea floor environment. Iron oxide, with various amounts of manganese, is often closely associated with sedimentary base metal deposits but usually as a spatially separate "iron formation" as at the Edison quarry-Raub mine locality.

Cases like Franklin and Sterling Hill, where the base metal is intimately associated with large amounts of iron and manganese in a sedimentary bed, are quite rare, but are neither unknown elsewhere nor unexpected. The most spectacular examples of this type of mineralization are Broken Hill, New South Wales, Australia and the modern deposits forming at the bottom of the Red Sea.

The primitive ores at Franklin, Sterling Hill and Sulphur Hill probably consisted of sphalerite, pyrite, arsenopyrite, oxides and carbonates of iron and manganese, silica and clays. Many trace elements were present because manganese oxides and clays are effective scavengers of ions. The original minerals precipitated from a brine, perhaps similar to those found today in the Red Sea, near the Salton Sea, Calif., and in the oil fields of central Mississippi. The most important common features of these modern examples are: (1) a very high chloride content, (2) a very low sulphide content, and (3) the apparent derivation of the metals from the country rocks. Volcanism is not essential and may or may not be associated with hydrothermal activity. The relationship of volcanism to New Jersey's ore deposits is unknown but it probably played at least a supporting role.

The abundance of primary iron oxides and the general lack of pyrite in the region's mines suggests the metals were transported as chlorides in a sulphide deficient fluid. It may be that zinc (and lead) is found in deposits in limestones because there the organic content was high enough to allow the production of bacterial  $H_2S$  which precipitated  $ZnS$ .

Through the time of their original formation the Franklin, Sterling Hill and Sulphur Hill ores seem to have been normal sedimentary base metal deposits, compositional "end members" perhaps, but normal none the less. Shortly after their birth a truly rare turn of events set Franklin and Sterling Hill far apart from all the others. Sulphur Hill escaped these changes and remains relatively simple mineralogically.

Early in their history the Franklin and Sterling Hill deposits were subaerially exposed and the sulphides thoroughly oxidized except for a few remnants at Sterling Hill. Zinc was fixed as smithsonite, hemimorphite, zinc-manganese oxides and, possibly, willemite. Oxidation and leaching may also have concentrated some of the highly dispersed trace elements.

Exposure of ore deposits is common in tectonically active areas. However, uplift and subsidence are usually long term trends. An ore deposit brought close enough to the surface to be oxidized is almost always eroded away. Franklin and Sterling Hill are unique because the direction of tectonic motion reversed at precisely the right time. The oxidized ores were reburied and eventually metamorphosed and hydrothermally altered. The odds against such a timely reburial and preservation are great (although it has happened at Franklin twice). The odds against these events happening to an ore of initially uncommon composition must be staggering.

Once the sulphur was removed by oxidation, metamorphism and hydrothermal activity were able to act upon a group of elements rarely found together in a non-sulphide environment except near surface exposure. During the post-oxidation history of Franklin and Sterling Hill common geologic processes acted upon the unusual elemental assemblage to produce the mineralogy seen today.

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## THE PICKING TABLE

In the last issue of this journal we recommended that our Society invest \$2,000.00 in the purchase of an I.B.M. Selectric Composer in order to assure the efficient composition of future issues of the Picking Table. At our March meeting those present unanimously endorsed this proposal and together with many other members contributed over \$1,000.00 toward the purchase of the machine. Today the composer is the property of the Society. Hopefully, it will reinforce our effort to make the Picking Table a legitimate repository of knowledge of Franklin and Sterling Hill, New Jersey.

A great many people have encouraged and supported this effort. Your editors wish to take this opportunity to express our sincere appreciation. Thank you

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## The Picking Table Index

The back of this issue contains an index for volumes seven thru twenty. This remarkable undertaking is the fine work of Mrs. Alice L. Kraissl, to her, we express our deepest appreciation.

## WHY MICROS?

by

Alice L. Kraissl

As you know from the Picking Table and our monthly bulletins, a group of F.O.M.S. members interested in the study of Franklin-Sterling Hill micro-minerals has been meeting at the Franklin Mineral Museum the mornings of our regular F.O.M.S. meeting days.

What you may not know, or perhaps have not realized, is that perfect crystals of many minerals can be seen only under the microscope. Of course, cabinet size specimens of gorgeous crystals are something we would all like to have, but even with a mineral as abundant as quartz it is difficult to find large crystals that are free from some sort of blemish. With the "micros" we seek, nature has seen fit to protect these treasures in tiny vugs or in seams, where they safely await our efforts at discovery. Where else would you be able to gaze upon perfect crystals of lavender tephroite, rosy hodgkinsonite, golden axinite or water-clear willemite, to name just a few?

No doubt the first question heard would be, "where can I find such specimens?" In reply the first suggestion would be to carefully examine, under a microscope or 10X loupe, your present collection of Franklin-Sterling Hill minerals. When I first did this, I was truly amazed at the number of specimens containing crevices or vugs in which micro-crystals were visible. Speaking from experience, sometimes breaking off just a small corner of such a specimen can yield enough material for several micromounts, though, a specimen must show real potential before breaking it.

There is no reason at all why micro-minerals must be mounted in the standard "micro boxes." As long as one can examine a specimen under the "scope," if it is a host to good micro-crystals, it need never be broken down; in fact, wherever possible it is desirable to leave it intact so that all associated minerals can be fully studied and appreciated.

Of course, it doesn't take long to realize that the greatest advantage of micromounts is the space savings they afford. One can store thousands of micromounts in a case measuring 2½' x 4½' x 15". This same case, even with severe crowding, could probably not accommodate more than fifty cabinet size specimens. Considering the current trend toward reducing living space in today's inflation-ridden society, it is pleasant to know that one can have a beautiful collection of many minerals without needing a museum to house it.

If you have followed recent developments in Franklin-Sterling Hill mineralogy as reported in the May-June 1979 issue of the Mineralogical Record, you should know that of the new minerals reported for the locality, as well as species new to science from this area, most were found only in "micro" form. If you wish to see them, as well as many of the "old timers," you will have to resort to peering through a microscope. If you do this, the author is certain that you will find spread before you a whole new world of mineral interest.

The micro-mineral study group that meets at the Franklin Mineral Museum has spent a considerable amount of time examining material from the Buckwheat Dump, and has found it very rewarding. Many specimens of brookite, a rare mineral, have been found by one of our members who wrote a very interesting account of this pursuit for the March 1979 issue of the Picking Table. To the author's knowledge, over forty different mineral species have been found as "micros" from the Buckwheat Dump, some unsurpassed for delicacy and beauty. Actually, the opportunity for self-collecting micro-minerals of a quality one would be happy to add to his or her collection is, in the author's opinion, greater with less expenditure of effort, than is possible in the case of cabinet size specimens of Franklin-Sterling Hill minerals.

If you have a microscope or a faint glimmer of curious interest, come join us at one of our study sessions at the museum, from 9:30 A.M. to Noon, the mornings of our regular meeting days. You will find inspiration in the minerals which members bring for viewing, and a spontaneous fellowship which is truly delightful. To pique your interest, a list of minerals found in recent years on the Buckwheat Dump follows.

## MINERALS FOUND ON THE BUCKWHEAT DUMP

(Many as micro-crystals)

### Found in Dolomite

Albite	Hemimorphite
Arsenopyrite	Marcasite
Aurichalcite	Microcline (pink)
Brookite	Pyrite
Chalcopyrite	Quartz
Chlorite	Rutile
Dolomite	Smithsonite
Goethite	Sphalerite
Graphite	Stilpnomelane
Hematite	Talc

### Found with Camptonite

Albite	Ilmenite
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### Found in massive Franklinite-green Garnet (by David Cook)

Cahnite	Franklinite
Flinkite	

### Found in coarse Calcite

Apatite (blue)	Molybdenite
Fluorite	Pyrolusite
Graphite	Willemite (pale green malformed crystals)
Greenockite	Zircon

### Found in grayish Calcite-Sonolite association (by David Cook)

Eveite	Spinel
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### Found in massive Rhodonite-Franklinite (by Mr. and Mrs. Frank Phillips)

Baumite	Rhodonite
Brunsvigite	

### Other

Andradite	Microcline
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Specimens of the above minerals are in the author's collection of micro-minerals. In addition, we have heard that anatase has also been found in the dolomite, and have seen one specimen belonging to one of our members, so there is always a chance that a fortunate person might unearth another such desirable crystal.

As mentioned earlier, come join us and see if you don't come down with a severe case of "microitis" too.



## HISTORY OF THE FRANKLIN AND STERLING

### ORE DEPOSITS

by

Elwood Delos Shuster (deceased)

The mining industry has a record that is contemporaneous with written history of the human race. Since the beginning of the bronze age, following the period when man knew not of metals or their use, the progress of civilization has been, to a great degree, influenced by the development and progress of the arts of mining and metallurgy, and their related industries.

In the beautiful valley of the Wallkill River, in Sussex County, New Jersey, situated about 45 miles from New York City, are located two great mines of zinc ore. These are in the towns of Franklin and Ogdensburg and are known as Mine Hill and Sterling, respectively. A casual traveller by train or motor car would not suspect that he was passing through a locality that is known to every well informed geologist and mineralogist in Europe and America.

This locality produces a great variety of minerals; more than one hundred and forty different ones have been produced since its discovery.

The zinc ores of this district are unique in their character and mineral constituents. They are not known to exist as a commercial ore in any other mining district in the world. The veins of ore are exposed at the surface for a distance of several hundred feet at each mine.

The question is often asked, "Who first discovered these mineral outcrops?" The examination of deeds, legal documents and scientific reports give much interesting data, yet the question remains unanswered.

The tract of land now known as Sterling (named after Lord Stirling, an American patriot), was granted to Anthony Rutgers by the Proprietors of East Jersey on May 4, 1730. The early deeds recorded at Perth Amboy, N.J., refer to this tract as the "Copper" tract. The red oxide of zinc (Zincite) exposed in the veins, was, no doubt, at the time thought to be copper ore. More than one hundred years later, in 1852, Major A.C. Farrington, a mining engineer, made a very comprehensive report upon the mines at Mine Hill and Sterling Hill. At that time he endeavored to determine the age of the old mine at Sterling, by counting the rings of a stump of a large cedar tree that had grown in one of the old mine pits. From this data he was able to state that the old pits were opened as early as 1739, showing that these mineral deposits have been observed for about two hundred years.

The first permanent homes in the Wallkill Valley were built about the year 1765. Robert Ogden was one of the first settlers and his four sons were prominent in the affairs of the Colony and filled offices of trust and responsibility during the Revolution.

One of the first men to recognize the prospective value of Mine Hill and Sterling Hill was Doctor Samuel Fowler, who located at Franklin in 1808 as a practicing physician. He was a man of scientific attainments, giving much attention to mineralogy. He was also active in civil and political affairs and served in the House of Representatives of the United States from 1833-37. He acquired large real estate interests in Sussex County. Among his possessions were Mine Hill and Sterling Hill. From 1810 to 1836, with the aid of men of science, he put forth every effort to reduce these ores to products of commerce. He knew that fortune and fame awaited any one who could reclaim the great mineral wealth that lay dormant in the hills. The complex character of the ore being entirely different from any known ore of zinc, and lack of knowledge of its metallurgical treatment, made the task exceedingly difficult. He was successful, in a major degree, in producing both metallic zinc and zinc oxide, but not to the extent that warranted him to continue his operations. On September 1, 1836, he sold all of the mineral interests he owned in Sussex County, New Jersey. This deed is the original of all conveyances of mineral titles in the Wallkill Valley.

During this period a law was passed by Congress, authorizing a standard set of weights and measures to be made. The zinc metal that was used for making the brass for these standard weights, was produced from the "New Jersey Red Oxide of Zinc." This ore came from the "Weights and Measures" opening. This pit was on the outcrop of the westerly vein at Mine Hill. The entire vein was removed in 1905, which destroyed the identity of this historic spot.

Colonel Samuel Fowler soon after the death of his father in 1844, by purchase or inheritance, acquired with other property, both Mine Hill and Sterling. He sought financial aid to carry forward the development of the mines. Numerous stock companies were organized, each controlling a part of the ore producing areas. The New Jersey Exploring and Mining Company was the first to operate Sterling Hill. It purchased from Colonel Fowler, the northerly section of the zinc vein. The mill and shaft now operating at Sterling are located upon this tract. The interests of this company were conveyed to New Jersey Zinc Company (organized 1852) who operated the property until 1880, when the interests of New Jersey Zinc Company became the property of New Jersey Zinc & Iron Company. A part of the southerly area of Sterling, later known as the Marshall Mine, was acquired by the Consolidated Exploring & Mining Company in 1849. Another abutting tract was sold by Colonel Fowler to the Sussex Zinc & Copper Mining and Manufacturing Company, in 1853.

These three early corporations and their successors in title (with the exception of a 15 year period) have been producing zinc ore for the last 80 years. The recorded history of Mine Hill begins in 1750, when on June 6th, 93 and 16/100 acres of land were granted to the heirs of Anthony Sharp. Soon thereafter it became known among geologists as Mine Hill.

During the early operations at Sterling Hill, the idea prevailed that two veins of ore existed, each different in character, although adjacent, yet forming one ore-body. The front vein was called the Zinc Vein, and the vein underlying was known as the Franklinite Vein. Later developments, at both Mine Hill and Sterling, proved that the ore-bodies were of the same general character, consisting of a mixture of Zincite, Franklinite and Willemite, in varying combinations. This wrong conception on the part of Colonel Fowler actuated him to separate the mineral titles at Mine Hill.

On March 10, 1848, Colonel Fowler executed a deed to the Sussex Zinc & Copper Mining and Manufacturing Company, wherein he conveyed "All the zinc, lead, copper, silver and gold ores, and also all the other metals, or ore containing metals, except the metal called Franklinite," within the Mine Hill farm. About two years later Colonel Fowler conveyed to the Franklinite Mining Company "All the reserved ore called Franklinite," within the same 93 and 16/100 Mine Hill farm. To add difficulties to the situation Mine Hill was later subdivided into two areas known as North Mine Hill and South Mine Hill. We now find several corporations holding varying interests and titles in different areas of Mine Hill.

Reviewing court records, one learns that one mining company holding title or a lease to mine the Franklinite would be mining. When the ore, being mined as Franklinite, in part, contained at times a preponderance of Zincite or Willemite, the company holding title to the zinc, would start court proceedings for ejectment, damages, and possession of the mine. This would sometimes be granted after passing from the lower to the Chancery Courts. The successful litigants of the zinc title, now in possession, would begin operating. Then the conditions would be reversed. Franklinite would predominate in the ore mined, and the case would again go into the courts. The former court decision would be reversed and those holding the Franklinite title would obtain possession. Space in this review does not admit of even a brief synopsis of the litigation, covering a period of 40 years, to determine finally the ownership of the vast wealth of ore lying in Mine Hill. A complete story of this legal battle would be a record of the most interesting, intricate, and important litigation to be found in the court records of New Jersey.

Financial as well as legal difficulties existed during the period of mine exploiting and development. We select the following as an example of many records. In 1853, Mr. Oakes Ames sold to The New Jersey Franklinite Company fifteen tracts of land in the Franklin district. Different titles were conveyed in the various tracts. Mr. Ames secured payment by mortgage on the property conveyed. Seven years later the property was sold by Sheriff's sale and purchased by Mr. Ames. The same year, 1860, he again sold the same interest to the Boston Franklinite Company. Three years later, 1863, Mr. Ames, to satisfy a mortgage, again purchased a part of the interests of the Boston Franklinite Company. In 1872 the entire interests of the Boston Franklinite Company were acquired by the Franklin Iron Company. These interests comprised titles, in fee and minerals, to some sixty parcels of land, but did not include any zinc or Franklinite titles in Mine Hill.

From 1852 to 1896 Mine Hill and the properties to the northeast were operated by a number of corporations. The output of the mines gradually increased in volume and importance as the demands warranted. The three companies mining at Mine Hill in 1896, were: The New Jersey Zinc & Iron Company, the Lehigh Zinc & Iron Company and the Sterling Iron & Zinc Company. In 1897, all the interests of these companies, together with the mines at Sterling, were acquired by The New Jersey Zinc Company. In 1896 a mill for the separation of the ore was erected on the property of the Sterling Iron & Zinc Company. This mill, after 1897, treated the entire mine output at Mine Hill. A larger mill was erected in 1900 to treat the greatly increasing tonnage of ore produced. About fifteen years ago a mill of similar type was built at Sterling to treat the ores of that mine.

The zinc mining and milling industry at Franklin and Ogdensburg has been one of constant and gradual growth. With this activity have developed two communities which have the benefit of excellent schools, hospital service, community houses, supervised swimming, playgrounds, and social activities, all of which are incentives to clean living and good citizenship.

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