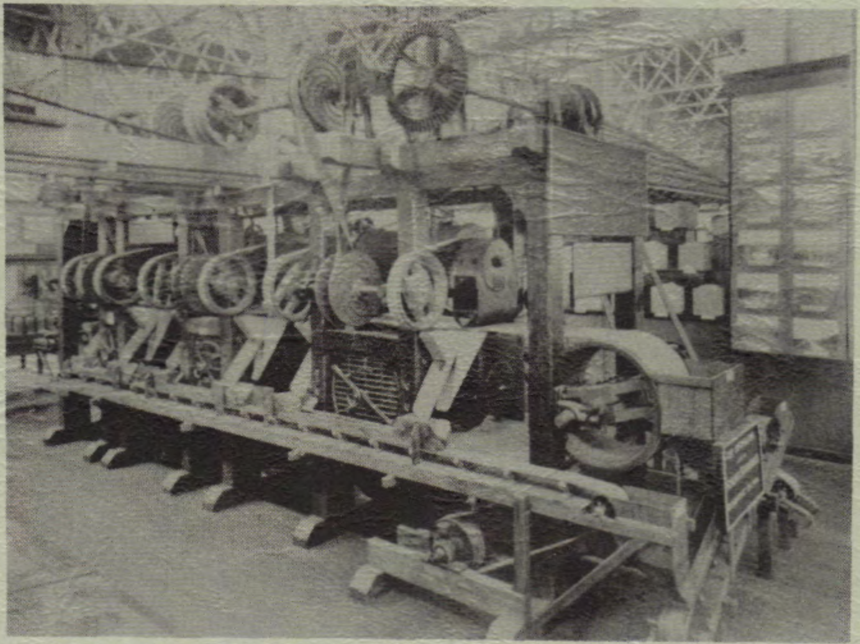
THE PICKING TABLE



The Wetherill Magnetic Separator. See page 4 for feature story.

JOURNAL of the FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY, INC.

SPRING, 1988 VOLUME 29, No. 1

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The
PICKING TABLE
Journal of the Franklin-Ogdensburg
Mineralogical Society, Incorporated

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* *

PHOTOGRAPHS SUPPLEMENTING THE FEATURE ARTICLE ON PAGE 4.

The Front Cover Photo. This view of the Wetherill Magnetic Separator, while on display at the Louisiana Purchase Exposition in St. Louis in 1904, was taken by William H. Rau of the Official Photographic Company. The Wetherill offices were located in New York City, hence the overhead sign indicating that the separator represented a commercial enterprise from New York. Photo is from the archives of the Franklin Mineral Museum. **See two other photographs on the inside back cover.**

SPECIAL ANNOUNCEMENT

Bill Trost, FOMS President, has scheduled a Meeting of the Officers and Trustees of the Society, to be held at 1:00 p.m., March 19, 1988, at the Hardyston Township School. This meeting will replace the one normally held in January or February prior to the first meeting of the Society for the year. Please note, that all members of FOMS are welcome to attend.

from the Editor's Desk

Omer S. Dean
10 Bumble Bee Lane
Norwalk, CT 06851

A letter from Dr. Paul B. Moore
The Society extends its sincere thanks to Dr. Paul B. Moore, University of Chicago, Department of Geophysical Sciences, 5734 S. Ellis Avenue, Chicago, IL 60637, for his enlightening letter which is shown below in its entirety.

September 8, 1987

Dear Mr. Dean:

Allow me to amplify Prof. Braithwaite's (Picking Table, 1987, 28 #2, p. 15) concluding formula for roeblingite, which he derived in part from infra-red spectroscopic results. Crystal structure analysis is the brilliant jewel of our science, if done properly. We solved and refined (R = 0.066) the structure of roeblingite from Langban, Sweden.

Counting atoms, the cell contains $2Pb_2Ca_6(SO_4)_2(OH)_2(H_2O)_4[Mn(Si_3O_9)_2]$. *This leads, upon rearranging the constituents, to* $Ca_{12}Mn_2Pb_4(SO_4)_4Si_{12}O_{36}(OH)_4(H_2O)_8$ *which matches with Prof. Braithwaite's formula except that all atomic species in parentheses are ligated to metals and do not occur solely as hydrogen bonded or zeolitic systems. In the latter case, they would be separated by a dot (.) in the formula.*

The structure revealed a pleasant surprise. A fraction of roeblingite can be written as $Pb_4Ca_8Si_{12}O_{36}$. *This is identical to the contents of paragenetically associated margarosanite. Both structures consist of* $[Si_3O_9]$ *cyclosilicate trimeric rings. The regions in both structures are similar.*

Therefore, roeblingite can be considered a "fattened" margarosanite! Moral: Crystal structure analysis is so much easier to do, and less ambiguous than any other techniques.

Reference: MOORE, P.B. and SHEN, J. (1984) American Mineralogist, 69, 1173-1179.

Sincerely,
/signed/
Paul B. Moore
Professor, Chemical Crystallography

An interesting statistic
Through July, 1987, a total of 730 publications dealing with Franklin-Sterling Hill have appeared in the literature. Dr. Pete J. Dunn, Smithsonian Institution, has ascertained, during his bibliographic work, that 365 or 50% have been published in the last 25 years. Are you as surprised as I am?

Closing of the Sterling Mine
Readers, who reside outside Sussex County, New Jersey, will be interested to know that the Sterling Mine is now officially closed. The mining operations ceased on Good Friday, 1987, and a skeleton crew was retained to man the pumps to keep the mine from flooding and to maintain the equipment. The decision to abandon the mine was made in the fall; equipment was removed from the mine in November and December; and entrances to the mine have been sealed off with concrete. There has been extensive media coverage, both pro and con, of the environmental and economic aspects of the closing. John Cianciulli has indicated he would be willing to provide the Picking Table with an unbiased summary of the facts for use in the next issue. It seems appropriate that an event of such historical interest to this Society be covered by this journal.

* * * * * * * *

IN MEMORIAM

Lee S. Areson (1916-1987)

When one learns of the passing of a dear friend, it is difficult, indeed, to accept the finality of the moment. Perhaps even more difficult is recalling the many precious moments, taken for granted along the way, that we all shared. Lee S. Areson left us quietly in his sleep on July 27, 1987, at the accomplished age of 71, after a long struggle with congestive heart disease.

Most of us came to know Lee and his wife, Jennie, as members of the Franklin-Ogdensburg Mineralogical Society. Certainly, Lee must be recognized as one of the Society's most avid mineral collectors, whose activities spanned over a quarter century. His pursuit of minerals, which began with his digging a pit that met the swamp at the very bottom of the Buckwheat Dump, culminated in his assembling a Franklin mineral collection that rivaled such contemporaries as Ewald Gerstmann, Richard Hauck, and Nick Zipco.

A successful businessman in everyday life, he became a mineral dealer as well. In recent years he headlined the Franklin dealers at the annual Kiwanis Franklin Mineral Show, having succeeded the late John S. Albanese and Frank Z. Edwards. Lee and Jennie participated in many mineral shows across the country, including Tucson. During his travels, Lee became well known as an "emissary of good will" from Franklin.

There was much more to Lee Areson than many of our members ever knew. His enthusiasm for collecting and dealing in Franklin minerals was exceeded only by his support for the Society and the Franklin Mineral Show which spirited his endeavor. Lee was not inclined to be party to partisan interests which, all too often, tended to detract from the common cause. Instead, he chose to respect each viewpoint while he, in his turn, strongly supported those views which provided the greatest benefit to the group. His counsel proved invaluable to those of us who would be caught up in the arena of local concern. He was also quick to provide financial support for those things which would further our common interest. For instance, when the call went out for donations to support the *Picking Table*, in its transformation into the quality format we have today, Lee Areson matched all other contributions combined.

Figure 1. Lee Areson, seldom photographed, caught at a happy and proud moment.

Recognizing the success of that support, he contributed monies for the first four pages of the proposed color issue of the journal. In each instance, he refused to accept any form of recognition for his contributions.

The best indication we have as to the sincerity of Lee Areson in his devotion to Franklin came during, what was for him, a trying circumstance. Several years ago, it was proposed that a mineral, newly discovered, be named in Lee's honor. As significant as the occasion was for him, he declined by saying, "if he could have his druthers, he would druther not, since it was not a Franklin mineral". His devotion to Franklin made it impossible for him to accept the honor. This situation proved to be a major disappointment to those involved. However, that was Lee Areson.

Lee S. Areson leaves behind his wife, Jennie, two sons, Lee and David, and two daughters, Jean and Sally. To them, we extend our most sincere condolences, and express our sense of loss of a dear friend, who shall not be forgotten.

Bernard T. Kozykowski
Past President

* * * * * * * * * * *

THE DEVELOPMENT OF FRANKLIN ORE CONCENTRATION

John L. Baum
70 Route 23 N
Hamburg, NJ 07419

Important as ore bodies are as sources of mineral specimens, they are of no value as sources of metal unless their metallic content can be recovered. The Franklin and Sterling ores could not be made to produce zinc metal in commercial quantities until franklinite could be separated because it thwarted the smelting process. Such success as was obtained making zinc metal resulted solely from laboratory batch processes, and the early companies were forced to attempt to exist on the production of zinc oxide readily manufactured from these local ores. The world was not ready for quantities of zinc pigment, however.

In its effort to utilize its zinc oxide production, the New Jersey Zinc Company pushed ready-mixed paint. In an earlier paper we have seen the claims made for the superiority of zinc oxide over lead oxide as a pigment, with emphasis on covering power, durability, and safety. The fledgling Zinc Company in 1851 employed Samuel Wetherill to supervise the grinding in oil of zinc oxide as well as to awaken the interest of the painting trade. He was well qualified because he had worked at the lead oxide plant belonging to his father and uncle at Philadelphia. He invented a process by which franklinite-zincite ore mixed with anthracite could be heated to the point where the zinc could be driven off (to be captured as zinc oxide), and the remaining clinker later smelted to form an iron-manganese alloy called spiegel. Unfortunately, there was no use for spiegel until the Bessemer process of manufacturing steel created a need for it, as happened in due time.

The production of rich zincite-franklinite ore became increasingly difficult as the tenor of zincite faded, and the desired ore was costing $27.00 a ton to mine while run of the mine franklinite could be mined for fifty cents a ton or less. As bad luck would have it, such ore contained other minerals, silicates, which made it difficult to smelt and production of zinc oxide was about to be reduced to the point where the newly created demand for it might be hazarded. A chance observation by Dr. G. H. Cook, State Geologist, saved the day, however. He was aware that the addition of lime to refractory furnace feed had proven beneficial in other instances, and so it was in this case. Franklinite was restored to the good graces of the New Jersey Zinc Company.

The zinc content of willemite was not unknown to the mining interests of this time and it became apparent that if franklinite could be separated from the ore and willemite and zincite from the remainder, zinc oxide, spiegel and zinc metal could be produced as separate products. The Lehigh Company undertook to solve this problem. The company had been mining at Franklin and acquired the Parker lease which gave the Company an ore free of the litigation which so tormented output from the rest of the orebody.

In 1845, Francis Alger wrote that a magnet attracted some franklinite crystals. If a magnet of sufficient strength could be devised, perhaps all franklinite could be attracted. The Lehigh Company's research on the subject of magnetic separation resulted in patents on several processes but it remained for John Price Wetherill to develop the method for commercial application.

The Wetherills were mining people from away back. We have mentioned Samuel Wetherill, who invented the process of roasting the franklinite-zincite ore. He was the father of John Price Wetherill and lived from 1821 to 1890. We mentioned the lead oxide plant at Philadelphia run by Samuel's father and uncle whose names were respectively--now get ready for this--John Price Wetherill and Samuel Wetherill. Closer to Franklin, the Fowlers, Dr. Samuel Fowler and his son Colonel Samuel Fowler, are confusing enough, but the Wetherills top them with the brothers John and Samuel having a grandfather also named Samuel Wetherill. These were all people of great merit and prominence with strong ties to Philadelphia.

White lead was first manufactured in this country in 1804 in Philadelphia by Samuel Wetherill. This Samuel was the uncle of the Samuel who was the first to work with the Zinc Company. He came to the Zinc Company's attention while still an employee of the Philadelphia company because of his developing a process for making zinc oxide and metal. Pennsylvania ores were mined by the Wetherill interests, one of these being a lead deposit that was discovered along the banks of Perkiomen Creek on the Mill Grove Plantation in 1804. In 1813, Samuel Wetherill, uncle, bought the land and built a smelter. The land remained in the hands of the Wetherill family until 1951 as a summer residence. Today it is better known as the one-time home of John James Audubon, who lived there from his arrival in America until his departure to study birds in the mid-West in 1808. The home is a shrine to the noted naturalist and at the time of my pilgrimage one of the Commissioners of the County overseeing the property was a Wetherill (not, however, either a Samuel or a John Price).

John Price Wetherill, the inventor, wrote in 1897 an article for the *Engineering and Mining Journal* detailing the need for and development of the Wetherill magnetic separator. Working for the Lehigh Zinc and Iron Company of which he was an officer along with August Heckscher (member of another dynasty enriched by association with Franklin mining), Wetherill installed his machines in the Parker Shaft mill which initially treated 200 tons of ore a day. Through the years tremendous improvements were made in the electromagnetic separator by Wetherill and his assistant, Louis G. Rowand, who eventually became his successor. Wetherill founded his own company to promote his patents. Our cover photograph shows an example of his device set up at an industrial exposition.

In essence, the process involves a thin band of dry pulverized ore on a belt passing beneath an electromagnet with a transverse belt between the magnet and the granular ore. As a grain of franklinite passes beneath the magnet, it is pulled up against the cross-belt and projected into a suitable receiver. The theory is simple but the execution complex because of the number of variables involved. Franklinite varies in the degree of response to a magnet because there are several varieties: ore with a red streak is weakly magnetic and ore with a black streak is highly magnetic; the chemical composition varies between franklinite and magnetite; and there are high-manganese inclusions which are seldom seen except in laboratory studies. The presence of other minerals attached to the ore adds still another factor. This can be handled by finer crushing. On the other hand, there is no value in fine-crushing everything when some grains don't require it. The thinner ore stream on the belt slows the process in both this and successive steps. This production of dust(via finer crushing) is expensive, wasteful of the ore, and a health-hazard to the workers.

As John Price Wetherill fine-tuned the operation, experimenting with grain-size, the gap between magnet and ore, intensity of the magnet, speed of the belt, thickness of the ore stream and so on, he also had to develop by design or adaptation of commercial equipment, the remainder of the concentration system. The sizing of grains was important in the concentration process of both franklinite and the zinc-bearing remainder, and the screens required elevators--belts with buckets to raise the feed for the next step. Some of this equipment had been refined earlier by Thomas Edison and his advice was sought. A design for a screen on tracing cloth with Edison's signature as approved is on exhibit at the Franklin Mineral Museum.

Interesting experiments can be done by hanging a small mineral specimen by a thread and approaching it with an Alnico magnet, trying to get the specimen to swing. Success with magnetite is to be expected, but garnet and high-manganese calcite are a surprise. This test suggests that after a relatively weak electro-magnet removes pure franklinite, a stronger magnet on the remaining material can further concentrate the mill feed and leave less work for succeeding steps. Accordingly, there were long lines of electromagnets filling a level of each of two large buildings at Franklin in later years. Many magnetic products were sent through additional crushing and back into the stream of feed to make a purer magnetic product. Visitors to the mill were taken aback when, before the tour, they were asked for their watches, which were left in the mill engineering office since the magnets could reach out and do wonders to a hairspring. The experimental laboratory in the same area had a device for demagnetizing mineral grains so that they could be used in repeated tests of milling techniques. The device worked equally well on watches, so on Franklin's closing I adopted it.

The number of improvements and new developments led to numerous patents and a few adaptations so esoteric that visitors were forbidden to take pictures within the mill buildings. We hurried visitors past some of these. The company was very touchy about many matters and photographs were near the head of the list until Franklin closed. Since the development of the Wetherill magnetic separator was undertaken during the days of the Lehigh Zinc and Iron Company, preceding consolidation under the reborn New Jersey Zinc Company, secrecy was not so tight. Accordingly, the record tells us more about John Price Wetherill's successors than about their inventions.

We have seen that Louis G. Rowand assisted Wetherill at Franklin in his early work, and the patent record indicates that improvements were largely his until his assistant, in turn, replaced him. These replacements were based on retirement as the New Jersey Zinc Company was a very paternalistic outfit and an employee had to make a real effort in order to be mistreated, at least past midcentury when the Franklin Mine closed. Rowand was with the Zinc Company for 38 years. He was, as might be expected, an authority in the magnetic separation of lowly magnetic materials. Prior to the development of flotation of zinc ores, Rowand designed the recovery method used in concentration of Western marmatite ores. In addition to screens and driers, his patents covered electric fire alarms, electric furnaces and pulleys. His engineering knowledge was based on observation and experience. One of his stories related his experiences as a Pony Express rider out of Deadwood, South Dakota. The fact that he was born about five years late even to be present at such an event, let alone know what was going on, escaped many of his listeners. A Zinc Company executive described him as brilliant and ingenious to a remarkable degree, and as a lovable character.

Rowand's assistant was Jackson Pellett, a graduate engineer from a remarkable family. There were three brothers, the other two being a dentist and a surgeon-country doctor. The latter had a remarkable talent and designed surgical instruments adapted by the profession. Rowand, while at Franklin, had three daughters, two of which married two of the Pelletts, the dentist and the engineer. Jackson Pellett developed the Pellett classifier, an adaptation of a laboratory device which involved a rising column of water and descending finely-ground ore with the magnetics removed. This was a device slighted during our tours of the mill but fascinating to watch through a window in the column where the mix swirled while deciding what to do. The concentrate went to the Wilfley tables, and the Pellett classifier made their use possible on the finer sizes.

Perhaps every successful venture requiring novel techniques has found in response to need such ingenuity and dedication as demonstrated in this one phase, mineral concentration, of the Franklin operation. Certainly, the New Jersey Zinc Company, never one of the nation's larger corporations, attracted men who rose to the challenge. The men mentioned here are but a few of those who contributed so much to the operations at Franklin and through the development of the American zinc industry, to the nation.

REFERENCES--By topic and source

Samuel Wetherill -- *National Cyclopaedia of American Biography, Vol.7 (1897),* page 506; James T. White & Co., N.Y.

John James Audubon -- Handout, Audubon Shrine and Wildlife Sanctuary, Mill Grove Farm, Aububon, PA.

The magnetic separator and Wetherill men -- *The Engineering and Mining Journal*, New York; July 17, 1897, pp 65-66; July 24, 1897, pp 99-100.

Lewis G. Rowand -- Memorial, *Journal of the American Institute of Mining Engineers*, New York, January 1945, page 157; Obituary,*New Jersey Herald*, Newton, New Jersey, week of December 2, 1944.

Magnetic separator patents -- nine on file, U.S. Patent Office. (Earliest March 3, 1896; last March 9, 1937)

Separator photograph -- William H. Rau, Official Photographic Company, Louisiana Purchase Exposition, St. Louis, 1904.

NOTES FROM THE LABORATORY

&

Changes to the list of species from Franklin and Sterling Hill

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

John L. Baum, Curator
Franklin Mineral Museum
Evans Street
Franklin, NJ 07416

Additions to the list

Cuprostibite: This species has been found, in 20 micron irregular grains, associated with domeykite, as described below.

Domeykite: This species has been found, in 20 micron irregular grains, associated with native copper and cuprostibite in massive gray willemite from Franklin. It will be described by Burke and Dunn in 1988, and will be reported in *The Picking Table.*

Fluckite: This species was found by Dr. Sidney A. Williams on a specimen from Sterling Hill, and reported in *The Picking Table, Vol.28, #2,* page 3.

Franklinfurnaceite: This species was described from Franklin by Dunn *et al.* (1987) and is abstracted in this issue of *The Picking Table.*

Junitoite: This species was found by Mr. Paul Desautels and identified by PJD. It occurs as flattened bundles of off-white platy crystals, associated with hemimorphite, aragonite, and calcite in a seam in massive franklinite.

Otavite: This species was found by Dr. Sidney A. Williams, and was reported in *The Picking Table, Vol.28, #2,* page 3.

Deletions from the list

Jennite-like mineral: Investigation has indicated that this material is not assuredly a single phase. Only one specimen has been investigated in detail. Some purported specimens have been shown to be mixtures of hardystonite and other minerals. Responsibility for specimens sold belongs to the seller.

Stibnite: Stibnite was deleted from the last list; however, we wish to mention that the material referred to by Palache (1941), and found in the collection at Harvard University, is zinkenite.

Talmessite: This material was correctly listed as the new mineral, parabrandtite, on the last list. An abstract of the article describing parabrandtite appears elsewhere in this issue.

Tyrolite-like mineral: Investigation has shown that this may not be a single mineral. Accordingly, it is deleted. Responsibility for the previous erroneous listing belongs to PDJ.

Nomenclature changes

To be consistent with the scientific mineralogic nomenclature, and consistent in format within the list of species, the following changes have been made:

Oyelite-like mineral instead of oyelite *.

Stilpnomelane, Mn-dominant, instead of parsettensite.

Pumpellyite-(Mg) instead of pumpellyite.

Changes to the Unique List

Franklinfurnaceite is the only addition to the Unique List since the 12/31/86 listing.

EDITOR'S NOTE:
An alphabetical listing of Franklin-Sterling Hill minerals, dated 12/31/87, appears on the next two pages. For the definition of the Franklin-Sterling Hill area and the criteria for additions or changes to the list, the reader is referred to The Picking Table, Vol. 28, #1, pages 4 and 5.

OSD

* * * * * * * * * * *

THE FRANKLIN-STERLING HILL AREA MINERAL SPECIES LIST (12/31/87)

Key: Species followed by dates were first described from this area during the year indicated. Species in boldface type remain unique to the area. An asterisk indicates further confirmation is required.

Acanthite
Acmite
Actinolite
Adamite
Adelite
Akrochordite
Albite
Allactite
Allanite
Alleghanyite
Almandine
Analcime
Anatase
Andradite
Anglesite
Anhydrite
Annabergite
Anorthite
Anorthoclase
Anthophyllite *
Antigorite
Aragonite
Arsenic
Arseniosiderite
Arsenopyrite
Atacamite
Augite
Aurichalcite
Austinite
Azurite
Bakerite
Bannisterite -1968
Barite
Barium-pharmacosiderite
Barylite
Barysilite
Bassanite
Bastnaesite-group mineral
Baumhauerite
Baumite -1975
Bementite -1887
Berthierite
Biotite
Birnessite
Bornite
Bostwickite -1983
Brandtite
Brochantite
Brookite
Brucite
Bultfonteinite
Bustamite
Cahnite -1927
Calcite
Canavesite
Carrollite
Caryopilite
Celestite
Celsian
Cerussite
Chabazite
Chalcocite
Chalcophanite -1875
Chalcopyrite
Chamosite
Charlesite -1983
Chlorophoenicite -1924
Chondrodite
Chrysocolla
Chrysotile
Clinochlore
Clinochrysotile
Clinoclase
Clinohedrite -1898
Clinohumite
Clinozoisite
Conichalcite
Connellite
Copper
Corundum
Covellite
Cryptomelane
Cuprite
Cuprostibite
Cuspidine
Datolite
Descloizite
Devilline
Digenite
Diopside
Djurleite
Dolomite
Domeykite
Dravite
Dypingite
Edenite
Epidote
Epsomite
Erythrite
Esperite -1965
Euchroite
Eveite
Fayalite
Feitknechtite -1965
Ferrimolybdite
Ferristilpnomelane
Ferroaxinite
Flinkite
Fluckite
Fluoborite
Fluorapatite
Fluorapophyllite
Fluorite
Forsterite
Franklinfurnaceite -1987
Franklinite -1819
Friedelite
Gageite -1910
Gahnite
Galena
Ganomalite
Ganophyllite
Genthelvite
Gersdorffite
Gerstmannite -1977
Glaucochroite -1899
Goethite
Gold
Goldmanite
Graphite
Greenockite
Grossular
Groutite
Grovesite
Guerinite
Gypsum
Halloysite *
Halotrichite
Hancockite -1899
Hardystonite -1899
Hastingsite
Hauckite -1980
Hausmannite
Hawleyite
Hedenbergite
Hedyphane
Hematite
Hematolite-like-mineral
Hemimorphite
Hendricksite -1966
Hercynite
Hetaerolite -1877
Heulandite
Hexahydrite
Hodgkinsonite -1913
Holdenite -1927
Huebnerite
Humite
Hyalophane
Hydrohetaerolite -1935
Hydrotalcite
Hydroxyapophyllite

Hydrozincite
Illite
Ilmenite
Jacobsite
Jarosewichite -1982
Jerrygibbsite -1984
Johannsenite -1938
Johnbaumite -1980
Junitoite
Kaolinite
Kentrolite
Kittatinnyite -1983
Koettigite
Kolicite -1979
Kraisslite -1978
Kutnohorite
Larsenite -1928
Laumontite
Lawsonbauerite -1979
Lead
Legrandite
Lennilenapeite -1984
Leucophoenicite -1899
Linarite
Liroconite
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Loseyite -1929
Magnesiohornblende
Magnesioriebeckite
Magnesium-chlorophoenicite-1924
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Magnussonite
Malachite
Manganaxinite
Manganberzeliite
Manganese-hoernesite
Manganhumite
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Margarosanite -1916
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Metazeunerite
Microcline
Mimetite
Minehillite -1984
Molybdenite
Monohydrocalcite
Mooreite -1929
Muscovite
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Pectolite
Petedunnite -1987
Pharmacosiderite
Phlogopite
Picropharmacolite
Pimelite
Powellite
Prehnite
Pumpellyite-(Mg)
Pyrite
Pyroaurite
Pyrobelonite
Pyrochroite
Pyrophanite
Pyroxmangite
Pyrrhotite
Quartz
Rammelsbergite
Realgar
Retzian-(La) 1984
Retzian-(Nd) -1982
Rhodochrosite
Rhodonite
Richterite
Riebeckite
Roeblingite -1897
Romeite
Rosasite *
Roweite -1937
Rutile
Safflorite
Sarkinite
Sauconite
Schallerite -1925
Scheelite
Schorl
Scorodite
Seligmannite
Sepiolite
Serpierite
Siderite
Sillimanite
Silver
Sjogrenite
Skutterudite
Smithsonite
Sonolite
Spessartine
Sphalerite
Spinel
Starkeyite
Sterlinghillite -1981
Stilbite
Stilpnomelane
Stilpnomelane (Mn-dominant)
Strontianite
Sulfur
Sussexite -1868
Svabite
Synadelphite
Talc
Tennantite
Tephroite -1823
Thomsonite
Thorite *
Thortveitite
Tilasite
Tirodite
Titanite
Todorokite
Torreyite -1929
Tremolite
Turneaureite -1985
Uraninite
Uranophane
Uranospinite
Uvite
Vesuvianite
Wallkilldellite -1983
Wendwilsonite -1987
Willemite -1824
Wollastonite
Woodruffite -1953
Wurtzite
Xonotlite
Yeatmanite -1938
Yukonite
Zinalsite -1958
Zincite -1810
Zinkenite
Zircon

TOTALS:

Confirmed species--	324
Species requiring further confirmation--	5
Species first described from area--	65
Species unique to area--	35

TEAMWORK: THE KEY TO PALACHE'S ACCOMPLISHMENTS

F. W. Miller
7 Centre Street, #24
Cambridge, MA 02139

In the last article about Palache and his work, I briefly discussed the loyalty that developed between him and his correspondents. These people, who sent specimens and information about occurrences to him, were accorded generous thanks and recognition by Palache. These acknowledgments abound in Professional Paper #180, and demonstrate that this, like many great accomplishments accredited to a single individual, is, in reality, the result of excellent and extensive teamwork. Some of the correspondence cited in this column is indicative of how widespread that teamwork was in Palache's efforts over the years to produce, finally, his magnum opus on Franklin and Sterling Hill.

Following that idea further, we can look at a letter of Edward S. Dana on the stationery of the "Office of the American Journal of Science, New Haven, Connecticut", dated July 22, 1909, and bearing a rubber stamp marking of "Seal Harbor, Me." It refers probably to what later was published in the journal as "Contributions to the Mineralogy of Franklin Furnace, N. J." (*Amer. Jour. Sci. (4) 29*, 177-187, 1910). It appears that Palache was anxious to have these 'notes' published, and that Dana couldn't find definite space for them. The complete text follows:

Dear Professor Palache,

The journal can certainly find place for your interesting notes "sometime" - but it is much space crowded for some months ahead and I am using all my resources in cramming without catching up. If you are in a hurry you can probably do better elsewhere. Otherwise I will take care of the MS (manuscript).

I trust that the summer is passing pleasantly with you.

Sincerely yours,
E. S. Dana

A second handwritten letter from Dana, dated August 18 attests to Palache's impatience, and Dana's attempts to reassure him.

My Dear Professor Palache,

Your letter of the 10th reached here some few days since. I can assure you that I am deeply interested in your work on the Franklin minerals and look forward with pleasure to seeing its results. It certainly seems that the notes of which you speak ought to be published and that in my Journal in which so much similar work has appeared. My difficulty lies in the fact that the 8-hour day accepted for the printers the present year has increased my bills so as to wipe out all my former margin. Overrunning, therefore, has to be paid for by me personally (at about $3 per page) and though I am doing it right along, there soon comes a limit. I have a long series of lay papers from Day of the Geophysical Society and until I know the extent to which he will be able to help in the way of publication I do not know how I stand. Your paper, I judge, would make about 12 pp. and I think I should be able to handle it the latter part of the year but I cannot speak positively -- if you want to wait till I get to New Haven (Sept. 24th) I shall then be able to decide but if matter which I cannot refuse presses in, the decision may be to let Groth (Paul Groth, Editor of Zeitschrift fur Kristallographie, which was comparable to the American Journal of Science) *carry your paper alone.*

With kind regards.

Sincerely yours,
E. S. Dana

Another group of letters indicates an ongoing relationship of sorts with Mr. R. B. Gage of the New Jersey Geological Survey Laboratory. Gage performed analyses for Palache, and evidently kept an eye out for specimens for Palache as well as other collectors. *Gageite* was named after this Mr. R. B. Gage -- it is interesting to note that so many of Palache's correspondents were favored with mineral names, but not Palache himself during his lifetime, except for one which was later discredited. It was not until 1983, that a new mineral from Franklin, *charlesite*, was named in Palache's honor. The following is a look at some of their correspondence, which was easily read because it was typewritten.

Trenton, N. J.
January 24, 1910

Prof. Chas. Palache,
Cambridge, Mass.
Dear Sir;

In reply to yours of 21 inst, I guess I did not make myself very plain. I have not determined the alumina in the dark micaceous mineral as yet but have saved the solution of the oxides after weighing and will determine it soon now. This is not the mineral I meant as sand stone but a light colored one which is found most always surrounded by the rhodochrosite. I also intended to say that my sample was not quite pure and it is not at all impossible that the zinc I got come from sphalerite. I have some more of the dark mineral but it does not show the micaceous structure like what I used before. I am sending this to you and if you think you can get enough of the mineral out of what both of us have so it will be quite free from impurities, I will be glad to analyze it so we can settle the matter. I have no way of separating material of this nature from the gangue here or would not ask you to do so.

Col. Roebling has just purchased a calamine specimen from the Foote Mineral Co. that has the largest crystals on it of any I ever saw. They are over an inch long and at least ¼ inch wide and perfectly clear and all well terminated. It comes from Mex. Also a specimen of the alamosite about 2 inches square.

Yours very respectfully,
R. B. Gage

Only a portion of Palache's answer to the foregoing letter remains available for our viewing.

Jan./31st/1910.

Mr. R.B. Gage, Trenton, N.J.
Dear Sir:

I have your letter of 24th inst. I am sending on all that I could get together of the green micaceous mineral which is I think almost free from sphalerite. It would do to make some sort of a test for alumina I should think. The massive material is too much mixed with magnetite to be separable. I think the gray and pink granular material such as is seen on the fragments you sent on is massive friedelite.

I am sending on also three other bottles containing minerals which I would be glad to see analyses of if you care to make them. The ones numbered one and two are from the specimen of white granular mineral from Franklin I showed you when you were here. I separated two portions in heavy solution, one between 2.89 and 2.95, another bet. 2.84 and 2.89. They are pretty close together and probably are same thing but I am most interested in the lighter portion number 2. I have an analysis of a substance corresponding to no. 1 in Specific gravity showing it to be a silicate of alumina and calcium chiefly with water and traces of alkalies, manganese iron and zinc. It is somewhere near prehnite but the ratio is poor and I think my material may have had mixed with it some of No. 2 which may have the same components but in different proportions. The third bottle has in it fragments of a large crystal which I take to be tephroite but which was labelled in the .....

Gage's response to Palache's letter gives us a hint as to the content of the lost portion. Gage confirms some of the identifications, and asks about the parisite specimens he evidently sent Palache, but which do not appear as a species in the Franklin list.

Trenton, N.J.
Apr. 12, 1910.

Prof. Chas. Palache,
Cambridge, Mass.
Dear Sir;

I have at last finished the analyses of the samples you sent me over a month ago and the results surprised me very much as I don't doubt they will you also. I was hoping it would be a new mineral but I guess such is not the case. It appears to be a wollastonite, most likely natroxonotlite if I have guessed correctly. The other samples I ran SiO determinations on and No. 1 is no doubt the same as No. 2 since I got 49.64% SiO. The sample No. 3 contains 31.78% SiO and no Fl. which shows I think that it is not chondrodite but tephroite.

The black mineral I have done nothing with as yet as I am going to F. F. soon and want to try to get some more of this material so there will be no question about its purity, and also have more to work on.

Have you ever done anything with the parisite specimens as yet? Mr. Roebling has asked me about them several times. I also see Dr. Krantz has them for sale and wonder where he secured them.

Respectfully yours,
R. B. Gage

Another interesting letter is from Col. Warren, then at MIT, discussing formula understandings, colleague to colleague. (Editor's Note: This handwritten letter contained many abbreviations. Clarifications are enclosed in parentheses.)

Massachusetts
Institute of Technology
Boston
July 16, 1907

Dear Palache,

I had so many things to think of and do last spring that I only gave a very brief time to figuring on that mineral and that on board train. I seem to have slipped a cog & messed things up some.

I have gone over the calcs. and confirm your figs. as you will see by the enclosed sheet. The ratio is surprizingly sharp and I can see no reason for considering the chemistry of the formula $R^{II}_2Si(O,F_2)_4$ *otherwise than sound. So far as our present light on the relation of* $\underline{F_2}$ *to* $\underline{O}$ *goes, I never expected to see that anal. made* (of) *any use. In fact I never gave it an*(y) *serious attention for one reason or another. Am glad you have had the skill & patience to work it up.*

We are all moved into our new home in Auburndale and are much pleased with it.

Have been to Nova Scotia to look at the Barytes mine at Five Islands, also to the meeting of the U.A.A.S. up on Champlain. Did some heavy collecting in the iron regions.

Mrs. Warren & No.2 are at the Vineyard for a short time. No. 1 & I are at home, shall spend the rest of summer here I think. Am going to complete my Cumberland art(icle) *that is write it up this week or next. How can I get into your Min. Library this Summer? I have some refs. I want to look up. Will return your Weinschenk separater shortly.*

Give my regards to Mrs. Palache please.

Sincerely yours,
C. H. Warren

(P.S.) *We must get the small girls & boys together someday this fall & have a general meet*(ing).

CHW

The last item involves W. T. Schaller of the U. S. Geological Survey. It is a strange handwritten note asking about "translucent franklinite".

Feb. 6, 1915

Dear Prof. Palache:

I have a faint recollection that you showed me once some translucent franklinite. If I am correct, can you please send me a fragment (very small piece will suffice) for a determination of its refractive index. If I am mistaken, don't bother.

Did the box of minerals I sent Prof. Wolff arrive O.K.?

With best regards to Prof. Wolff & yourself

Sincerely yours
W. T. Schaller

(P.S.) *The gahnite ("dysluite") I analyzed for you some years ago, has n = 1.818±.005*

It should be noted that it was W. T. Schaller who raised so many questions about Palache's 1915 manuscript, and asked for so many revisions, that Palache almost abandoned the project. He was encouraged in later years to take it up again, and it was Harry Berman and Larry Laforge who helped him with restructuring and rewriting what became the classic Professional Paper #180.

* * * * * * * * * *

Mineral Notes

New To Science

Franklinfurnaceite

$Ca_2Fe^{3+}Mn_3^{2+}Mn^{3+}Zn_2Si_2O_{10}(OH)_8$

A paper entitled "Franklinfurnaceite, a Ca-Fe^{3+}-Mn^{3+}-Mn^{2+} zincosilicate isotypic with chlorite, from Franklin, New Jersey", appeared in the American Mineralogist, Vol. 72, pp 812-815, 1987. The authors are: Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560; Donald R. Peacor, Department of Geological Sciences, University of Michigan, Ann Arbor, Michigan 48109; Robert A. Ramik, Department of Mineralogy and Geology, Royal Ontario Museum, Toronto, Ontario M5S 2C6, Canada; Shu-Chun Su, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061; and Roland C. Rouse, Department of Geological Sciences, University of Michigan, Ann Arbor, Michigan 48109. The following is an abstract of that article.

Introduction

A mineral resembling bannisterite and ganophyllite was encountered during the petrographic studies of the zinc silicate assemblages from Franklin, New Jersey. Although it has similarities (X-ray powder pattern) to members of the chlorite group, it has unique characteristics. The new mineral has been named *franklinfurnaceite* after the old name for the community in which the Franklin mine was situated. Type material is preserved at the Smithsonian under catalogue #C6309.

Physical and Optical Properties

Franklinfurnaceite occurs as very thin, platy crystals, tabular on {001}, with {001} the dominant form. A rough face (index unknown) is also present and has very thin, serrated edges. Maximum crystal size is 0.3 mm; crystals often occur intergrown to form polycrystalline aggregrates. Franklinfurnaceite is dark brown, has a brown streak, a vitreous luster, and is extremely brittle. Hardness is estimated to be 3 (Mohs). Cleavage is perfect on {001}. The density, measured by heavy-liquid techniques, is 3.66 g/cm^3.

Optically, it is biaxial negative, 2V = 79°. Indices of refraction are $\alpha = 1.729(4)$, $\beta = 1.798(4)$, and $\gamma = 1.802(4)$. In thin section it demonstrates intense pleochroism with X = very dark brown, Y = brown, and Z = deep brown.

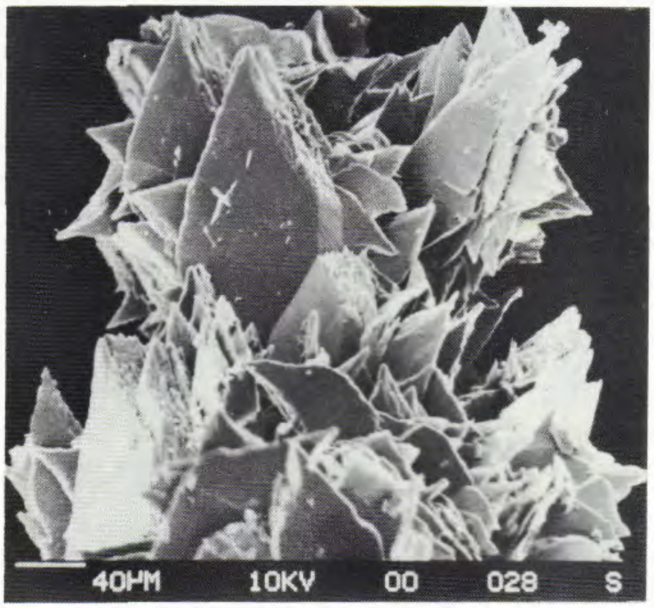


Fig. 1. Cluster of franklinfurnaceite crystals, showing the parallel to subparallel habit of the aggregate. Scale bar is 40 µm.

Chemical Composition

A wet-chemical analysis of franklinfurnaceite was omitted due to paucity of the material. However, it was chemically analyzed using an ARL-SEMQ electron microprobe (see *Table 1* for results).

The structure contains $Zn_4Si_4O_{20}$ sheets analogous to the aluminosilicate sheets in phyllosilicates. Franklinfurnaceite is properly termed a zincosilicate since the Zn is tetrahedrally coordinated.

Crystallography

Weissenberg and precession photographs show franklinfurnaceite to be monoclinic with space

TABLE 1. Microprobe analyses of franklinfurnaceite

Sample no.:	JEM 1093	R19144	C6309
SiO_2	14.5	14.6	15.0
Al_2O_3	0.8	1.3	0.4
Fe_2O_3	9.4	8.6	9.3
MgO	3.6	4.3	0.6
CaO	14.3	13.7	12.6
ZnO	22.7	23.6	24.1
MnO	17.0	17.3	19.0
Mn_2O_3	9.5	9.6	10.6
H_2O	n.d.	n.d.	8.4
Total			100.0

Note: Precision of data is ±3% of the amount present for major elements. F absent or present only as traces. Oxidation state of Mn calculated by crystal-structure refinement.

group $C2/m$, $C2$, or Cm, with lattice parameters a = 5.483(7), b = 9.39(3), c = 14.51(1) Å, β = 97.04(8)°, and V = 741(2) Å^3. Least-squares refinement of powder-diffraction data yielded the foregoing lattice parameters. The only similarity in powder patterns for franklinfurnaceite and the chlorite group is in the lines having large interplanar spacings. The lattice parameters for franklinfurnaceite are similar to those for one-layer chlorite. This coupled with some aspects of composition and physical properties (e.g., a perfect {001} cleavage), suggest that franklinfurnaceite and chlorite-group minerals are closely related. The principal features of franklinfurnaceite structure are (1) six-membered rings of alternating ZnO_4 and SiO_4 tetrahedra in tetrahedral sheets of the talc-like layer, (2) Mn^{3+}, Mn^{2+}, and (Mn^{2+},Mg,Zn) ordered in three sites in the trioctahedral sheet of the talc-like layer, (3) (Fe^{3+},Al) and (Mn^{2+},Mg,Zn) ordered in two sites in the dioctahedral gibbsite-like interlayer and, (4) Ca in octahedrally coordinated sites between the talc-like and gibbsite-like layers. The franklinfurnaceite structure is the first verification by crystal-structure analysis of the hypothesis put forth by Belov (1950) that Ca might enter the chlorite structure in octahedral sites between the talc-like layer and brucite-like interlayer, if it were paired with octahedral-cation vacancies in the latter.

Occurrence

Franklinfurnaceite occurs in the Franklin mine, Franklin, Sussex County, New Jersey. It was first discovered in the collections of the Smithsonian Institution. Although it has been found in private collections, it remains a very rare mineral.

Franklinfurnaceite occurs in vuggy intergrowths with five other minerals (willemite, clinohedrite, hodgkinsonite, hetaerolite, and franklinite), all of which contain tetrahedrally coordinated zinc. Franklinfurnaceite is the last mineral to form in this uncommon assemblage. The franklinfurnaceite occurs as a complex intergrowth of flat plates, which appear prismatic in cross section. The willemite occurs as subhedral to euhedral crystals completely enclosed in massive hodgkinsonite. The hetaerolite occurs as small, angular, brecciated grains as does some hodgkinsonite. Some euhedral crystals of both of these minerals coat vuggy surfaces. Intergrowths of franklinfurnaceite (which crystallized late in the sequence) and the other minerals imply overlap in the growth of these minerals.

* * * * * * * * * *

Parabrandtite

$Ca_2Mn(AsO_4)_2\cdot 2H_2O$

An article entitled "Parabrandtite, the manganese analogue of talmessite, from Sterling Hill, Ogdensburg, New Jersey" appeared in Neues Jahrbuch Miner. Abh., Vol. 157, #2, pp113-119. The authors are: Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560; Donald R. Peacor, Department of Geological Sciences, University of Michigan, Ann Arbor, MI 48109; Shu-Chun Su, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061; and Frederick J. Wicks, Department of Mineralogy and Geology, Royal Ontario Museum, Toronto, Ontario M5S 2C6; and Fred J. Parker, W. R. Grace & Company, 7379 Route 32, Columbia, MD 21044. The following is an abstract of that article.

Introduction

This mineral was first noted by Fred J. Parker in 1981. Its similarity to talmessite, $Ca_2Mg(AsO_4)_2\cdot 2H_2O$, combined with its occurrence in the red willemite ore at Sterling Hill (noted for Mg/Mn solid solution series), prompted an investigation of its chemical composition. The outcome of this study is a new mineral, *parabrandtite*. This name was chosen because of the crystallographic relation between this mineral and brandtite, its polymorph. The type material is preserved at the Smithsonian Institution under catalogue #NMNH 163210.

X-ray crystallography

Weissenberg and precession methods were used to study a cleavage fragment. Parabrandtite is triclinic with space group $P1$ or $P\bar{1}$. Refined lattice parameters, using least-squares and data from a Gandolfi photograph, are $a=5.89(1)$, $b=7.031(7)$, $c=5.64(1)$Å, $\alpha=96.77(10)$, $\beta=109.32(10)$, $\gamma=108.47(8)°$, $V=202.3(7)$Å^3.

Physical and optical properties

Parabrandtite is colorless, transparent; the streak is white. It has perfect cleavage on {010} and {110}; hardness is estimated as 3 - 4(Mohs scale); and the luster is vitreous. The density, using heavy liquid techniques, is 3.55(8)g/cm^3.

Parabrandtite forms in aggregrates (0.5-1.5mm in diameter) of crystals arranged in parallel growth. There is no discernible fluorescence in ultraviolet radiation.

Parabrandtite is optically biaxial, positive. $2V_z = 79.9(0.4)°$. Indices of refraction are $\alpha = 1.701(2)$, $\beta = 1.721(2)$, and $\gamma = 1.751(2)$. This mineral is triclinic and its optical orientation is described by three Euler angles: $\theta = 48.4°$, $\psi = 132.7°$, and $\phi = 64.6°$.

Chemical composition

Parabrandtite was analyzed using electron microprobe techniques. The results yielded FeO 0.2, MgO 0.8, CaO 25.1, MnO 14.7, ZnO 0.7, As_2O_5 51.3, H_2O 8.3, sum = 101.1 weight percent. The unit cell contents for parabrandtite, using unit cell parameters and measured density, are calculated as: $(Ca_{1.94}Mn_{0.06})(Mn_{0.84}Mg_{0.09}Zn_{0.04}Fe_{0.01})As_{1.93}O_{7.80}\cdot 2H_2O$, or ideally, $Ca_2Mn(AsO_4)_2\cdot 2H_2O$, with Z = 1. Thus, parabrandtite is the Mn-analogue of talmessite, $Ca_2Mg(AsO_4)_2\cdot 2H_2O$.

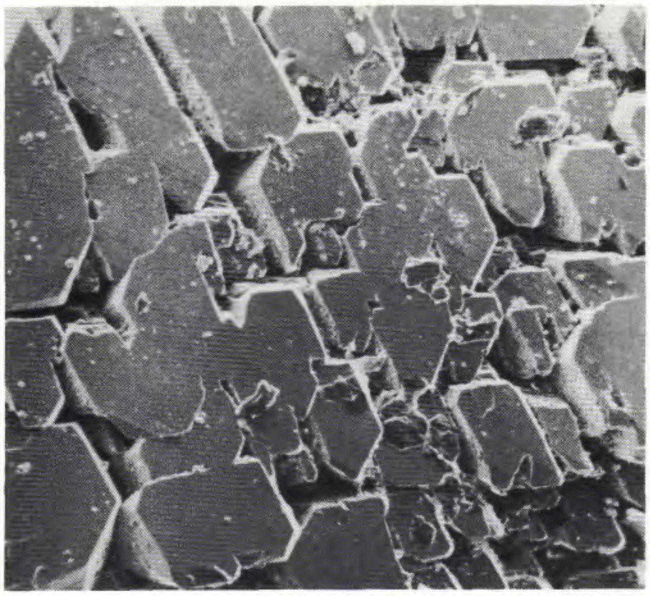


Figure 1. SEM photomicrograph of typical "composite" pinacoid habit of parabrandtite. Horizontal field is 0.5 mm.

Occurrence

Parabrandtite is from a cavity in a vein in primary ore (comprised of franklinite, pink calcite, and red willemite) from the Sterling Mine, Ogdensburg, Sussex County, New Jersey. A simple secondary assemblage consists of parabrandtite and sarkinite which appear to have formed contemporaneously. Some of the sarkinite in this assemblage is oxidized to a nearly black color. This is known from only one occurrence, the one from which the type specimen of parabrandtite and two others were recovered.

* * * * * * * * * *

FRANKLIN MINERAL MUSEUM

Curator's Message

While the March 19 meeting of the Franklin-Ogdensburg Mineralogical Society is expected to be at the Hardyston Township School in Franklin as formerly, it is planned to hold Society meetings scheduled for the remainder of the year at the Museum. Kraissl Hall was built for this purpose and has served well for lectures during the annual mineral show. By Spring opening of the Museum on April 15, it is anticipated that the mine replica will again be in good order following improvements for the benefit of visitors. The closer association of Club members with the Museum, brought about by the change of meeting location, is expected to be of mutual benefit. The Museum ended the past year operating seven days a week due to popular demand and thanks to the sacrifice of Steve Sanford, our enthusiastic Manager, and his staff. Sales have increased continually and it has become difficult to keep some merchandise in stock. We will resume our customary Spring schedule of Friday through Sunday and look forward to seeing our old friends and making new ones shortly.

John L. Baum

Editor's Note: You may want to consider membership in the Franklin Mineral Museum, Inc. The fees are: Annual \$5.00; Five-year \$10.00; and Life \$50.00. Membership privileges permit the member unlimited admissions to the Museum during its open season. This could be of considerable advantage and convenience to FOMS members when FOMS meetings become a regular thing in Kraissl Hall. Please be advised, however, that the membership fees do not include the privilege of admission to the Buckwheat Dump.

* * * * * * * * *

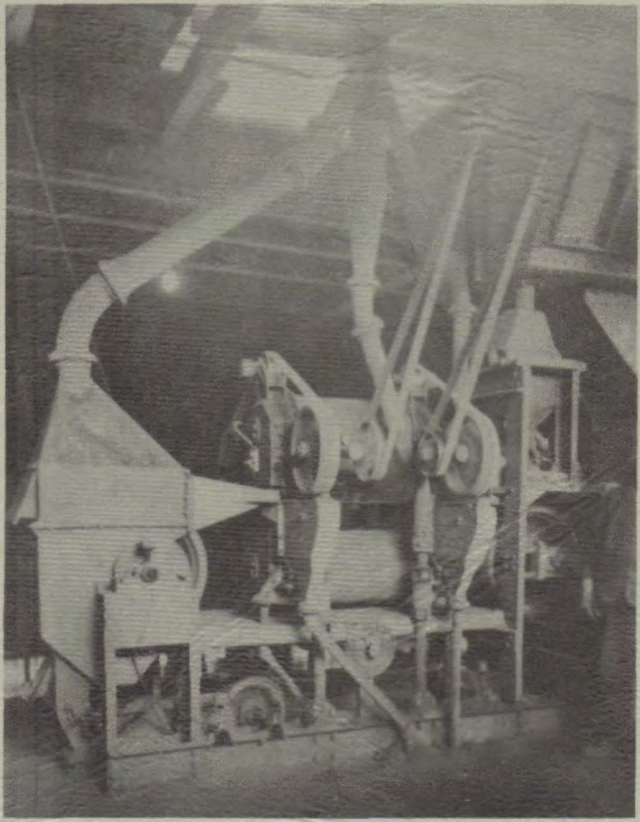
THE SPRING ACTIVITY SCHEDULE -- 1988

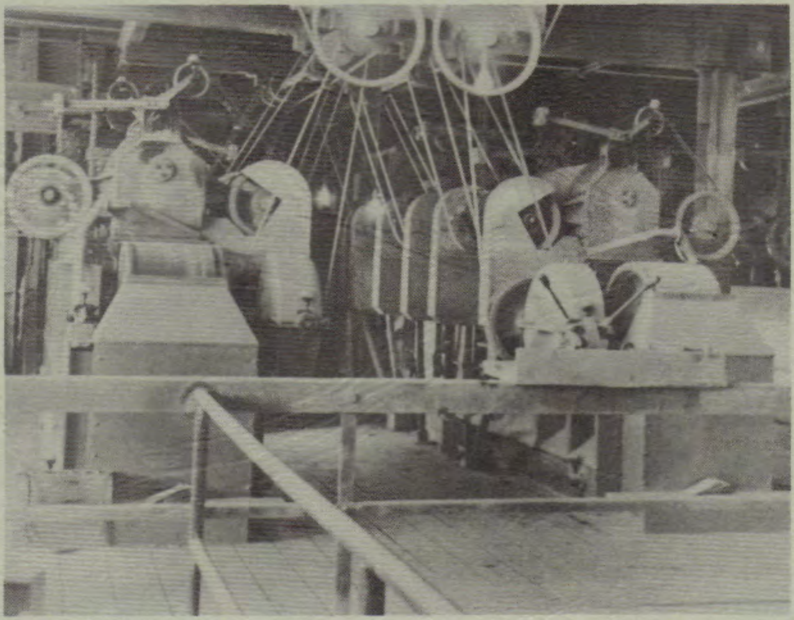
The FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY, Inc.

The regular activities of the Society consist of lecture programs, field trips, and micro-mineralogy study groups. The regular meetings of the Society are held on the third Saturday of March, April, May, June, September, October, and November. The pre-meeting activities begin at 12:30 p.m. and the meetings begin at 1:30 p.m. Lecture programs are part of the regular meetings. Visitors are welcome at the Society's meetings and lectures. Consult the following seasonal schedule for specific time and place of activities.

* *

Saturday **March 19, 1988**	Program	**A Franklin Update** (General Participation) **& Mini-Auction** (Seller receives 80%, FOMS 20%). Make this program a success. Bring slides & information plus good material for the auction. Hardyston Township School, Route 23, Franklin; **1:30 p.m.**
	Field Trip & Micro-Group:	**Mineral Exchange Program** - SWAP & SELL - FOMS members only. Hardyston Township School, 10:00 a.m. to 1:30pm. Note: Micro-Group sessions return to Kraissl Hall next month.
Saturday **April 16, 1988**	Program:	**"The unusual ore minerals at Sterling Hill: Products of an unusual combination of geologic processes"** by Craig Johnson, Doctoral Program, Dept. of Geology and Geophysics, Yale University. Kraissl Hall, Franklin Mineral Museum, 1:30 p.m.
	Field Trip:	**Old Andover Iron Mine**, Limecrest Road, Andover, N.J. 9 a.m. to noon.
	Micro-Group:	Kraissl Hall, Franklin Mineral Musueum, Franklin, N.J. 10 a.m. to noon.
Saturday **May 21, 1988**	Program:	**"Mill Site status report: the minerals, the move, etc."** by Bernie Kozykowski, et al. Kraissl Hall, F.M.M.; 1:30 p.m.
	Field Trip:	**Buckwheat Dump**, Evans Street, Franklin, N.J. 10 a.m. to noon.
	Micro-Group:	Kraissl Hall, Franklin Mineral Museum, Franklin, N.J. 10 a.m. to noon.
Sunday **May 22, 1988**	Field Trip:	**Limecrest Quarry**, Limecrest Products Corporation of America, Limecrest Road, Sparta, New Jersey. This is an Interclub Outing. 9:00 a.m. to 3:00 p.m.
Saturday **June 18, 1988**	Program:	Topic unspecified at this time. The program will be given by Carl Francis, Curator, Harvard Mineralogical Museum. More information will be forthcoming in the near future. Kraissl Hall, Franklin Mineral Museum; 1:30 p.m.
	Field Trip:	**Franklin Quarry (formerly, Farber Quarry)** Limecrest Products Corporation of America, Cork Hill Road, Franklin, N.J. 9:00 a.m. to noon.
	Micro-Group:	Kraissl Hall, Franklin Mineral Museum, Franklin, N.J. 10:00 a.m. to 12:00 noon.





MAGNETIC SEPARATORS
R. L. McCann file photographs from the archives of the Franklin Mineral Museum

(Left) A view of the Preliminary Magnetic Separator, Separator House B, Franklin Mill, 1918. This unit worked on the finest-sized ore.
(Above) Magnetic Separators Nos. 11 and 12, Sterling Mill, showing atmospheric conditions with fans in operation, 3/22/38.

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