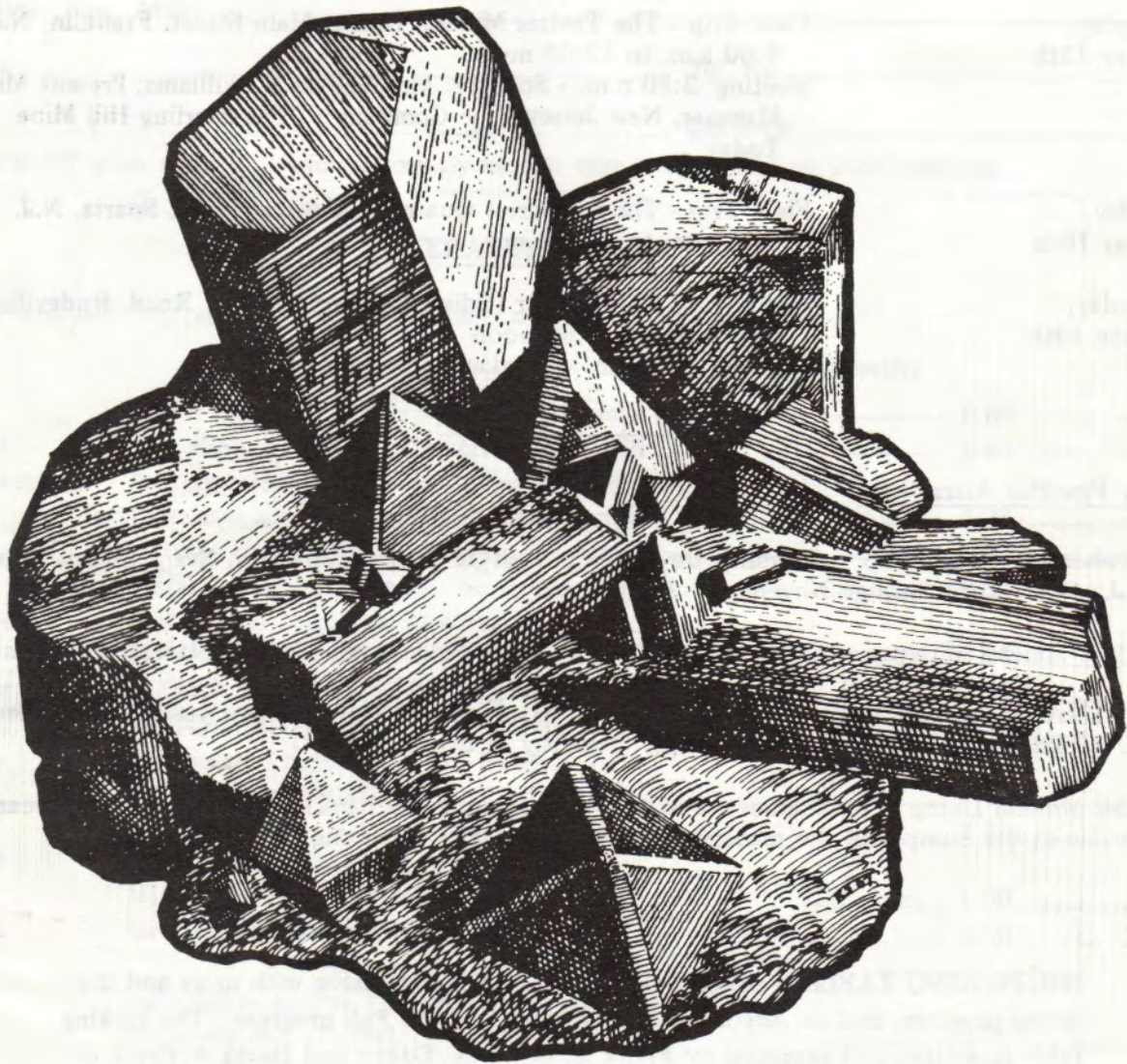


THE PICKING TABLE

JOURNAL OF THE FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY



Volume 17

March 1976

Number 1

CLUB PROGRAM — SPRING 1976

All meetings will be held at the Hardyston School, intersection of Routes No. 23 and No. 517, Franklin, N.J. Pre-meeting activities start at 1:00 P.M. Speaker will be introduced at 2:30 P.M.

- Saturday,
March 20th Field Trip - GERSTMANN Franklin Mineral Museum; 14 Walsh Rd.,
Franklin, N.J. — 9:00 a.m. to 12:00 noon.
Meeting 2:30 p.m. - Speaker: Mr. Richard Hauck; Past President of the
F.O.M.S. - "Collectors and Collections of Yesterday".
- Saturday,
April 17th Field Trip - Franklin Mineral Museum and Buckwheat Mineral Dump;
Franklin, N.J. - 9:00 a.m. to 12:00 noon
Meeting 2:30 p.m. - Speaker: Mr. Thomas Peters; Curator of The
Paterson Museum - "Micro Crystals of Franklin, New Jersey".
- Saturday,
May 15th Field Trip - The Trotter Mineral Dump; Main Street, Franklin, N.J.
9:00 a.m. to 12:00 noon
Meeting 2:30 p.m. - Speaker: Mr. William B. Williams; Present Mine,
Manager, New Jersey Zinc Company - "The Sterling Hill Mine
Today".
- Sunday,
May 16th Field Trip - The Limecrest Quarry; Limecrest Road, Sparta, N.J.
9:00 a.m. to 3:00 p.m.
- Saturday,
June 19th Field Trip - The Bodnar (Edison) Quarry; Quarry Road, Rudeville, N.J.
9:00 a.m. to 12:00 noon
Meeting 2:30 p.m. - Speaker to be announced.

Daily Franklin Attractions

Buckwheat Mineral Dump — Entrance through the Franklin Mineral Museum, Evans Street, Franklin, N.J. Open April through November. Daily fee.

Franklin Mineral Museum — Evans Street, Franklin, N.J. Open April through November. Admission fee.

GERSTMANN Franklin Mineral Museum — Walsh Road, Franklin, N.J. Open year round on weekends; on weekdays by arrangement. No charge, courtesy of owners.

Trotter Mineral Dump — Main Street, Franklin, N.J. (behind the bank). Open most of the year. If no one at the dump, call the manager, Nick Zipco. Daily collecting fee.

THE PICKING TABLE is issued twice a year; a February issue with news and the Spring program, and an August issue with news and the Fall program. The Picking Table is written and prepared by Frank Z. Edwards, Editor and David A. Cook as Assistant Editor. Cover design by Kenneth Sproson. The Editor welcomes information on Franklin and Sterling Hill for publication in this journal. Please mail directly to Frank Z. Edwards, 726 Floresta Drive, Palm Bay, Florida 32905.

F.O.M.S. OFFICERS FOR THE YEAR 1976

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Field Trip	John E. Sebastian
Historical	John L. Baum
Identification	John L. Baum
Museum	John L. Baum
Nominating	John L. Baum
Program	Wilfred R. Welsh
Publication	Frank Z. Edwards and David A. Cook

F.O.M.S. Notes

There are several changes in the list of officers and trustees for the year 1976. Bob Thomas and Jennie Areson, because of job changes and other pressures, have declined a second term of office. Bill Welsh has moved up to the office of 1st Vice President with Al Lord as the new 2nd Vice President. Helen Warinsky is the new Secretary. John Kolic has replaced Frank Edwards as trustee. The three new officials are all long time members of the F.O.M.S. and have performed capably in other capacities for the Society. They are able and welcome additions to the Executive Board.

Arrangements have been completed for the Spring program. Field trips to productive localities have been planned by Field Trip Chairman John C. Sebastian. An interesting schedule of speakers has been assembled by our new Program Chairman, Bill Welsh. All members, and their guests, are invited to participate in these activities.

John Sebastian has again issued his appeal for members to assist him on his Safety Team to provide proper supervision of Field Trip activities. If we are to continue our commendable field trip record, we must have your cooperation. Please contact John directly if you would like to assist him.

Your receiving this issue of The Picking Table confirms your membership in our Society for 1976. Membership renewals for this year were due as of January 1st. Delinquent members were duly notified and given until March 1st to renew their membership. At that time, their membership was officially terminated, had they chosen not to renew. Former members who wish to be reinstated may do so at any time by submitting their dues for the current year to the Treasurer. Your participation in Society activities is greatly appreciated, only through your support can we continue with our important programs.

As a member of the New Jersey Earth Science Association, the F.O.M.S. will participate in the 4th Annual Show to be held at the Student Center, Seton Hall University, South Orange, N.J. on Saturday, August 21st and Sunday, August 22nd, 1976. Featured in last year's show were the Smithsonian Institution, The American Museum of Natural History, the Newark Museum, the Morris Museum of Arts and Sciences, the Paterson Museum, and Rutgers University. There was a total of 63 exhibits of high quality; working demonstrations of interest to young and old; and well stocked booths of dealers from all over the country. An even larger Show is planned for this year. Plan to attend. The New Jersey Earth Science Show is rapidly gaining a reputation for excellence in the East. Come and see why.

Belatedly, we report the death in recent months of two of the great names in the history of the Franklin Mine — Clarence M. Haight, Superintendent from 1928 to 1954 and Allen W. Pinger, Chief Geologist from 1930 to 1954. Both men were key officials in the successful operation of the Mine for many years until its closing in 1954. After the F.O.M.S. was organized, both men encouraged our infant Society by acting as speakers as well as contributing papers, advice and information. The Society owes them a debt of gratitude and we extend our sympathy to their survivors.

A correspondent recently wrote that "more and more of the former Mill at Franklin is disappearing. All that remains now are the two smoke stacks of the old boiler house, the Palmer Shaft hoist house, the old change house, the old mine office and a couple of smaller buildings near the latter. Everything else is gone, demolished for salvage and removed from the site. Sad testimony to a bygone day."

Inexorably, time is removing men and former landmarks in Franklin and memories grow dimmer. Now, more than ever, in this Bi-Centennial Year when history appears more exciting and important, an effort should be made to record the observations of surviving miners and to save historical locations on Mine Hill. The establishment of the Franklin Mineral Museum was an important step in the efforts of the people of Franklin to preserve their history. Can and will they go further in that direction? The F.O.M.S. and mineral collectors everywhere hope they do, and will cooperate in such efforts. In the meantime, the F.O.M.S. will continue to record Franklin history in The Picking Table by publishing all items and information of current interest plus articles on the past. The Franklin Mineral Museum is a most important repository for information and relics of Franklin history. We urge contributions to their permanent collections.

Please note the change in the operating dates of the Franklin Mineral Museum and Buckwheat Mineral Dump. They will open for the season on April 1st and will close on November 30th. Both attractions offer a great deal to the visitor at a nominal admission fee.

The nearby Trotter Mineral Dump is open all year. Except in inclement weather, the manager, Nick Zipco, is usually on hand. If you find the gate closed, a telephone call to his home may reopen them. The collecting fee remains the same as in previous years.

The GERSTMANN Franklin Mineral Museum is also open year round, courtesy of Ewald and Helen Gerstmann. A prior telephone call is always appreciated. There is no charge for admission, however, donations will be thankfully accepted.

For the mineral collector, there is always something to see and do in Franklin. A visit to all of these attractions, at least once a year, is a most worthwhile venture.

Zinc/Willemite/Zincite

I recently read an article on Zinc in the Geological Survey Professional Paper No. 820 on U.S. Mineral Resources. This article contains considerable information of general and geological interest to our members. We quote below some pertinent portions. This volume is available from the Superintendent of Documents, Washington, D.C. Full title is United States Mineral Resources, Geological Survey Professional Paper No. 820, 1973, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. The article or chapter on Zinc is also available as a separate insert. It is entitled "Zinc" by Helmuth Wedow, Jr., Thos. H. Kiilgaard, Allen V. Heyl, Robert E. Hall - pages 697-711. We quote:

"Zinc stands fourth among all metals in world production exceeded only by iron, aluminum and copper. Zinc is utilized chiefly in the automobile, household appliance, and hardware industries. It has three major uses:

- 1) For zinc base alloy die castings.
- 2) For galvanizing iron and steel products.
- 3) For the manufacture of brass - the copper, zinc alloy.

In the United States these three uses account for 90% of the total production. Other important uses are

- 1) rolled zinc metal
- 2) zinc compounds for a variety of industrial products such as zinc oxide in rubber and paint

In 1969 the consumption of zinc in the United States was 1,797,110 short tons. Before 1937 the United States was self sufficient in zinc. In 1969 imports totaled 50% of our requirements due not so much to the depletion of domestic products as to the lower cost of imported materials in relation to production costs at domestic mines. This imbalance was further aggravated in the mid '70's because of the closing of seven domestic zinc smelters between 1969 and 1972 brought about by obsolescence coupled with anti-pollution regulations. Imported materials are mostly ores and concentrates processed by U.S. smelters near seaports.

Willemite is the chief zinc mineral in the recently discovered sizeable deposits of Beltana and Aroona in the Flinders Range of South Australia; and willemite, zincite, hemimorphite, and hydrozincite constitute the ore minerals in the extensive deposit at Vazante in Minas Gerais, Brazil.

In contrast to the enrichment of zinc ores obtained in temperate climates, where the zones of oxidation are shallow, are the enriched oxidized ores of zinc found in tropical weathering regimes. Here, the oxidized ores are perhaps best likened to laterites in that the process forming them, in effect, is laterization. Perhaps one of the best documented deposits that can be classified as a zinc bearing laterite is that at Vazante in Minas Gerais in Brazil. This deposit is estimated to contain more than five million tons of zinc; lead, copper and vanadium may also be recoverable. Carvalho and others (1962) have described the Vazante deposit and the exploration of it during the 1950's. Epigenetic zinc, lead, and copper (?) sulfides in a lower Paleozoic rock were decomposed by weathering with the development of a strong ferruginous gossan. Beneath the gossan, an enriched zinc deposit was formed by the deposition of willemite and other secondary zinc minerals, some galena and sphalerite were replaced by supergene chalcocite. Continued weathering further enriched the zinc with the formation of hemimorphite and hydrozincite on a major scale. Further alteration followed with the consequent formation of zincite and additional hydrozincite.

The latter stage of enrichment probably began at some time during the Tertiary, and it continues today with additional concentration being effected by eluvial processes. The formation of the zincite and hydrozincite in the last stage strongly suggests the desilication process so typical of the last stage of laterization in the formation of the bauxite and iron and manganese oxide ores in the tropics. It is now an easy step of speculation to concur with the hypothesis of Rastall (supported by Palache, pages 23-24) that the Franklin-Sterling Hill oxide-silicate ores in New Jersey are merely a metamorphosed ancient iron-manganese-zinc laterite.

The previously mentioned high grade willemite replacement deposits in Cambrian dolomite in the Beltana district of South Australia are also considered tentatively as having been formed by Tertiary supergene enrichment, although no association with primary sulfides has yet been discovered. Muller and Donovan (1971) reported 1-2% zinc in weakly mineralized limestone with some of the zinc in solid solution in dolomite. Also that Tertiary lateritic material, which overlies the limestone in places appears to be capable of absorbing up to 2% zinc."

Sterling Hill Minerals

We have another interesting and valuable report from a miner correspondent on recent mineral finds at Sterling Hill. For your information and records, we quote:

"Operations continue at Sterling Hill. The North Ore Body is still producing ore, however, the number of working places has diminished to the point where it is impossible to determine just how much longer this once rich portion of the ore body will remain open. Termination, forecast for the end of 1975, will surely occur some time this year.

Since the last issue of The Picking Table, there have been several recurrences of minerals rarely seen at the Sterling Hill mine:

NATIVE SILVER was uncovered during mining activities in the latter part of the year. It was encountered in what is referred to as 1010 Stope, a new location for this mineral, at Sterling Hill.

A narrow vein of sphalerite and chalcocite intrudes into the ore vein in the north end of the stope. A system of joints cuts the ore and sulfide veins. Where the joints cut the sulfide vein, the chalcocite appears to have been partially leached away. In and around these chalcocite grains are tiny wires of Native Silver.

The largest wire observed was about 1/16 inch long.

On a few pieces, the wires were clustered thickly enough to be clearly visible to the naked eye. In addition to the uncovered Native Silver, the leaching of the two sulfide minerals also produced minor amounts of malachite and hydrozincite.

Mine coordinates for this new location are approximately 1180 N by 990 W, 20 feet below the 700 level, in that part of the deposit referred to by the old timers as the "East leg of the West vein".

BRANDTITE was encountered during mining activities in the late summer of last year. It was initially observed during hand mucking operations in what is referred to as 1120 Stope, and later found in a small chunk of ore which was slushed from the same working place, probably just before the initial observation.

This rare arsenate mineral has been encountered only once before at Sterling Hill (see The Picking Table, volume 1, number 1, page 6 also volume 7, number 2, page 6). The location of this occurrence is different from the first.

The ore vein in this working place is composed of brown willemite and franklinite in an unusually high concentration, lean in calcite, making it one of the richer active working places in the mine. A portion of this part of the vein has been finely fractured and cemented together with secondary white willemite and other minerals of hydrothermal origin. Within these fractures are numerous white sprays of Brandtite. The first specimen, of this new occurrence, displayed a single, almost complete, 1/2 inch rosette of Brandtite. The second specimen revealed numerous acicular sprays from 1/8 to 1/2 in length, all of which are embedded in or partially covered by white willemite. There is also an orange mineral intimately associated with the Brandtite, which may prove to be realgar or orpiment.

Identification of the mineral as Brandtite was determined by John L. Baum using optical means. He noted "the indices of refraction check with those given by R. V. Gaines in the American Mineralogist, volume 44, pages 199-200."

Mine coordinates for this new location are, approximately 1100 North by 850 West, 30 feet above the 1000 level, in the East leg of the West vein.

WOLLASTONITE was found during mining activities early this year. It was encountered in what is referred to as the 1120 North crosscut, on the 900 level. This location was previously recorded (The Picking Table, volume 13, number 1, pages 4-6.) As one might expect, the Wollastonite appeared much as previously described.

A small mass of marble, within this zone, contained finely developed individual Wollastonite crystals and crystal bundles, up to 3/8 inch in width and several inches in length. The crystals are seen in both parallel groups and scattered about, in jackstraw fashion, in a calcite matrix devoid of the brown garnet and green pyroxene common to the remainder of this zone.

Under short wave ultraviolet radiation, the wollastonite displays a fair orange fluorescence, reminiscent of the spectacular Franklin specimens, but no where near as bright. The calcite also responds, but only with a very weak red fluorescence. Under long wave ultraviolet radiation, the Wollastonite responds with a very weak orange fluorescence. The brief, faint blue white phosphorescence previously described for this occurrence, is also exhibited. It is important to note that minor amounts of willemite (on occasion) are intimately mixed with the Wollastonite and seriously detract from and perhaps even quench the fluorescent response of the Wollastonite.

SPHALERITE continues to be encountered in various forms during mining operations. Recent activities in what is referred to as 1460 Pillar have yielded unusually fine crystals.

Much of the pillar is cut by hydrothermal veins which are common to this part of the ore body. Some of the open veinlets have produced well formed tristetrahedral crystals of sphalerite, 1/8 to 3/16 inch on edge, of a delicate blue color. Often associated with these crystals are delicate parallel growths of bronze willemite crystals and jet black hetaerolite crystals. There is a weak orange fluorescence under long wave ultraviolet radiation, along with a weaker phosphorescence, typical of most Sterling Hill sphalerite.

Mine coordinates for this occurrence are approximately 1460 N by 400 W 10 feet below 1400 level in what is referred to as the cross member."

In the last issue of The Picking Table, volume 16, number 2, August 1975, on pages 13-15 we reported the mineral finds at Sterling Hill of another miner friend. After this man received his copy of The Picking Table, he was kind enough to write with additional information, which we now quote:

"Do you remember the letter that you quoted in the February 1975 issue of The Picking Table regarding the blue sphalerite? (3rd paragraph, page 4). This very extraordinary appearing sphalerite — it is pastel blue — is the same material upon which Dr. Miller performed his recent spectrographic analysis, reporting an Ag content. (See The Picking Table, August 1975, page 12).

The notes I sent you looked different in print than I remembered but were quite acceptable. I did notice, however, a product of my misspent hours in penmanship class. In the sixth paragraph discussing "the deformation attendant to the folding and attenuation . . ." rather than the word alteration which appeared there. I think this is an important distinction and would not like to mislead anyone. Please correct. Again, it is directly traceable to my handwriting.

Another comment — The green pyroxene mentioned in your note No. 2 as occurring with the rhodonite crystals was anhedral gahnite, which in a few specimens developed into nice octahedra.

Recently, I examined some unusually colored crystals from the North Ore Body that were labelled Pyroaurite. While I have never seen a Franklin Eveite in the flesh, the photos I have seen strongly resemble this material. I hope to make contact in the near future with a physical chemist who is interested in examining unusual Franklin minerals by the single crystal x-ray method. He believes that he will be able to work with the extremely minute quantities involved."

Editor's Note — At the Annual Franklin Mineral Show, last October (1975), several exhibitors featured specimens found at Sterling Hill during the past year. The second of two pieces of Brandtite described above was on display. It was an excellent specimen of this rare species. Since it is of uncommon interest, we hope that it is displayed again in this Fall's Show.

Also on exhibit was a specimen of the golden barite crystals described fully in The Picking

Table, August 1974, volume 15, number 2, pages 9-10. This most attractive hand size specimen featured a dozen or more clear golden micro crystals of barite perched on a fold in a fissure surface covered with beautiful pink micro crystals of rhodochrosite. The specimen came from the 1010 stope, 800 level. I was informed that the fissure extends upward and that more specimen material may be encountered in future mining operations.

Also noted, from the same stope and general working area, was a piece of ore showing on a fracture surface, 8 or 9 splendent, sharp, complex micro crystals of franklinite.

The Sterling Hill Mine continues to produce good specimen material of great interest to the scientist and collector. We are very fortunate that several observant miners are not only discovering such material but are noting locations, associations and geological conditions. On record, such information is invaluable for the future researcher. We thank these men for reporting their findings and observations to us.

New Minerals

Gerstmannite

The International Mineralogical Association has approved the designation of Gerstmannite as a new mineral. From the Sterling Hill Mine, Gerstmannite is structurally related to holdenite and hodgkinsonite from Franklin. The research work was performed by Dr. Paul B. Moore of the University of Chicago. Publication of his discovery paper is anticipated shortly in the American Mineralogist. Complete details will be given at that time.

Dr. Moore advises that Gerstmannite is orthorhombic with a formula of $8 \text{ Mn Mg (OH}_2\text{)[ZnSiO}_4\text{]}$. It is structurally allied to holdenite, manganostibite, and hodgkinsonite. The detailed structure type, however, is new to scientific intelligence.

Sulphur

In the Fall of 1964, I obtained for my collection several pieces of Marcasite from the Sterling Hill Mine. Since these were massive and interesting only as representative of the species, they were placed in boxes and stored. Last year, I opened one of these boxes and found that I no longer had any marcasite. The entire piece had altered to crystals and crystallized Melanterite. The snow white crystals are sharp, and attractive under the microscope. Perched on top of the melanterite are several pinhead sized blebs of sulphur, evidently exsolved from the sulfide marcasite. Later, the native Sulphur was confirmed by Jack Baum. The specimen has been donated to the Franklin Mineral Museum and will be placed on exhibit. Please add Sulphur to your list of validated Franklin/Ogdensburg minerals.

Research Reports

Arseniosiderite

In a paper announcing three new mineral species, Paul B. Moore and Jun Ito, "Jahnsite, Segelerite, and Robersite, Three New Transition Metal Phosphate Species" in The American Mineralogist, volume No. 59, January/February 1974, pages 49 - 59, the following information on Arseniosiderite is included:

"This species, long of uncertain status, occurs at many localities as a low temperature oxidation product of lollingite and arsenopyrite. In addition it replaces earlier arsenates such as scorodite. Palache, Berman and Frondel (1951) list it as hexagonal or tetragonal, based on optical data. The color is golden yellow in fine masses to reddish brown, in fibres to deep reddish or brownish black in granular material. It is extremely dichroic, reddish brown to practically colorless, according to Larsen and Berman (1934)."

Dr. Moore establishes that arseniosiderite and mitridatite are isotypes of the robertsite structure and provides optical and x-ray data for these three new species. He proposes the following formula for arseniosiderite - $\text{Ca}_3\text{Fe}^{+++}_4 (\text{OH})_6 (\text{H}_2\text{O})_3 [\text{AsO}_4]_4$

Ettringite

Paper by M. Punzet and U. Ludwig - "The Chemical Stability of Ettringite" *Tonindustr. Zeit.*, volume 98, pages 181-187, *Mineralogical Abstracts*, volume 26, number 4, December 1975, page 292. Abstract as follows:

During the reaction of tricalcium aluminate or tricalcium aluminate hexahydrate with gypsum and $\text{Ca}(\text{OH})_2$, ettringite is the first phase to form.

Fluoborite

In *The Picking Table*, February 1974, volume 15, number 1, page 10 we reported the discovery of Fluoborite at the Edison (Bodnar) Quarry, Rudeville, N.J. by two members of the Department of Geology, the University of Delaware. The professional paper has now been published. It appears in *The Mineralogical Record*, July/August 1975, volume 6, number 4, pages 174-175. It is entitled "Fluoborite, A New Locality" by Lance E. Kearns. Some pertinent data from this article is quoted below:

"The rare mineral fluoborite has been found at the Edison (Bodnar) Quarry, Rudetown, N.J. Fluoborite is a hydrous magnesium borate with the formula $\text{Mg}_3(\text{BO}_3)(\text{F}, \text{OH})_3$. Fluoborite was initially discovered at Norberg, Sweden (Geijer, 1926) and later identified and described from the Sterling Hill mine, Sussex County, N.J. (Bauer and Berman, 1929), and from several other localities (Segnit and Lancucki, 1963).

The Edison Quarry is located in the coarsely crystalline, white Franklin limestone (marble) five and half miles northeast of the Sterling Hill mine, Ogdensburg, N.J. The fluoborite is limited to one small area of the quarry where it occurs as relatively abundant, translucent to transparent crystals in 5-10 cm thick bands in the marble. The fluoborite layers alternate with layers of isolated norbergite grains (verified by X-ray powder pattern), and probably chondrodite. Small plates of graphite are equally distributed throughout both layers. Several small reddish brown spinel octahedrons were also found with the fluoborite.

Two of the previously reported fluoborite associations are: (1) pyrochroite, mooreite, hydrous zinc carbonate (hydrozincite), zincite, willemite, fluorite, and rhodochrosite in hydrothermal veins at the nearby Sterling Hill mine (Bauer and Berman, 1929; Palache 1935), and (2) calcite, ludwigite and chondrodite in a contact metasomatic deposit at the Norberg, Sweden, type locality (Palache, et al, 1951). The Rudetown locality is neither contact metasomatic nor hydrothermal.

Reports of the crystal habit of fluoborite have described the mineral as "hairlike material in fluffy, loosely felted aggregates filling cavities" (Palache, 1935), or as "acicular hexagonal prisms . . . sometimes arranged in stellate groups . . ." (Palache, et al, 1951).

Fluoborite from Rudetown is in slightly rounded, hexagonal prismatic crystals with rough, pyramidal terminations. The largest crystal collected measures 3mm x 11mm. One observed, but unobtainable, crystal at the quarry measured 13mm in cross section. The average crystal size is about 2mm x 5mm. Cleavage is good, (001).

The Rudetown fluoborite exhibits a strong cream colored fluorescence in shortwave ultraviolet radiation. The long wave UV evokes no response, and there is no observed phosphorescence. Prior to this find fluoborite had not been reported as a naturally occurring fluorescent mineral."

Technical data is also provided. For this information, consult the original article.

Additional information is provided in an article by A. Dal Negro and C. Tadini "Refinement of the Crystal Structure of Fluoborite". *Tschermaks Min. Petr. Mitt.* volume 21, 1974, pages 94-100; *Mineralogical Abstracts*, volume 26, number 4, December 1975, page 277. Abstract follows:

"The crystal structure of fluoborite, $Mg_3(F, OH)_3(BO_3)$, has been refined using x-ray data to a conventional R of 0.029. The structural model proposed by Takeuchi as well as the space group $P6_3/m$ have been confirmed."

Franklinite

Another occurrence of franklinite. Reported by J. Litochleb in a paper "Franklinite at Hranicna in Silesia". *Casopis Min. Geol.* volume 19, 1974, pages 301-305. *Min. Abst.*, Volume 26, number 3, September 1975, page 221. Abstract as follows:

Franklinite (0.00Xmm) and gahnite inclusions in magnetite of a hematite-magnetite ore with accessory galena, sphalerite, and pyrite are situated in a dolomite with amphibole, biotite, and apatite. VHN of franklinite is 636/kg/mm² (range 625-653). Electron microprobe analyses gave ZnO 20.4-25.6, Al₂O₃ up to 2.5 and MnO 0.2%. Zn spinels point to paragenetic connection of metamorphosed magnetite and sulphide ores."

Sphalerite/Zincite

"X-Ray Diffraction Study of the Sphalerite-Zincite Transformation". A paper by M. O. Figuerredo and J. Lima-De-Faria in the *Rev. Fac. Cienc.*, Lisbon, Portugal, volume 17, 1972, pages 73-88. Abstract follows:

"The lattice complexes of zinc atoms in sphalerite and zincite structures have the same geometrical relationship as the arrangements of packing atoms in cubic close packing and hexagonal close packing. This analogy, and a certain continuity of these lattice complexes through the reaction interface, would account for the transformation to proceed topotactically and also for the observed four packing orientations of zincite, in spite of the complete substitution of oxygen for sulphur. A detailed mechanism of this transformation is proposed which fits well the kinetic and crystallographic data."

Zinc Silicates

A paper by K. G. Tiller and J. G. Pickering "The Synthesis of Zinc Silicates at 20°C and Atmospheric Pressure" appeared in *Clays & Clay Mining*, volume 22, 1974, pages 409-416. *Min. Abstracts*, volume 26, number 3, Sept. 1975, pages 192-3. Abstract follows:

"Zinc silicate minerals are found in nature in the oxidation of some sulphide orebodies. Previous laboratory studies have contributed to knowledge of the formation and relative stability of such minerals. The aim of these experiments was to extend previous studies to the synthesis of zinc silicates under low temperature (20°C) conditions analogous to surface weathering environments such as in soils. Results established that a 2:1 layered zinc silicate equivalent of stevensite was the main product and that, in the presence of aluminum, a 1:1 layered zinc silicate was also formed. Involvement of a brucitic zinc hydroxide was not supported. Such layer silicates, but not willemite nor hemimorphite, could have an important, but complex, role in the control of chemical reactions of Zn in soils."

Crystal Structure

A paper by D. Grigoriev "Sectorial Structure of Crystals" published in *Acta Univ. Carolinae, Geol. Rost Vol.*, 1973, pages 79-96. *Min. Abstracts*, volume 26, number 4, December 1975, page 271. Abstract follows:

"Besides their atomic structure, crystals also possess sectorial structure (dislocations, domains, blocks, the growth of crystal edges, etc.). The term "anatomy of crystals" is proposed by the author for zonal, mosaic, and sectorial structure. The law of the sectorial structure of crystals has now been defined as follows: real crystals consist of the pyramids of crystal growth, of the surfaces of combination edges, and of the lines of growing peaks; pyramids of growth of different forms of combination edges, surfaces of growth of different forms of combination edges, lines of growth of the peaks of different forms, all of them differing chemically and physically. During its origin the form of the crystal can undergo deformation due to inhomogeneous outer conditions which entails

the deformation of sectorial structure. Only such elements of the symmetry of the crystal remain unchanged after deformation which are in accordance with the elements of the symmetry of the environment. Sectorial structure is sometimes a defect of technical monocrystals. It reflects special conditions during crystallization of minerals; examples discussed include "hour glass" structures in eudialyte, muscovite, and synthetic diamond."

Post Palache Mineral Review

Charles Palache's Professional Paper No. 180 - The Minerals of Franklin and Sterling Hill, Sussex County, New Jersey - is particularly valuable to the Franklin student and mineral collector because it sums up so well the scientific information available up to 1934 on Franklin/Sterling Hill minerals. Since 1960, The Picking Table has kept our readers up to date on new finds and scientific literature. In the in-between period of 1934-1959, minerals new to these orebodies were discovered and announced in various publications. Such information, however, is scattered and of limited access to the average collector. To close this gap and remedy this situation, we propose in this and future issues of The Picking Table to review the literature and information available on the minerals found during this period. In this issue, Roweite, Yeatmanite and Sparkinite will be discussed. Since this is a last minute decision, your editor has been unable to contact other sources for additional data on these species. If you can supply additional information on these minerals that would be of interest to our members, please write to Frank Z. Edwards, 726 Floresta Drive, Palm Bay, Florida 32905. In the next issue we intend to review the minerals Johannsenite, Arsenic, Realgar, Orpiment, and Torreyite. Again, any information that you can supply on these minerals for our review will be greatly appreciated.

Roweite

It is perhaps fitting that we begin our review with one of the truly rare minerals, Roweite, found only at Franklin. The original paper "Roweite, A New Mineral from Franklin, N.J." by Harry Berman and F. A. Gonyer, appeared in the American Mineralogist, April 1937, volume 22, number 4, pages 301-303. Pertinent portions from this paper are quoted:

"The new mineral was found on a single small specimen from the Franklin zinc mines, collected a number of years ago by Mr. George Rowe and preserved since then as an unidentified species. The specimen, of which about a quarter was used in our study, is a narrow veinlet of almost pure roweite with only small fragments of attached ore. The new mineral is intimately associated with a silky white fibrous material, which from its optical properties and a qualitative chemical examination, appears to be thomsonite. Franklinite, willemite, and zincite are present in small amounts, the willemite rather more intimately associated with the vein material, the other two minerals presumably part of the wall of the vein.

The crystals of roweite are light brown in color, lath shaped and without measureable terminations. A poor cleavage observed under the microscope is inclined to (001) at 48° ; it corresponds approximately to (101) for which the calculated angle is $51^\circ 14'$. No cleavage was observed in the prism zone.

The density of roweite is 2.92 ± 0.02 . The hardness is about 5. The crystals are brittle and break with an even fracture across the elongation. Professor Palache kindly determined the following: Roweite fuses at 1 (candle flame) to a black glass, colors the flame faintly green; with boron flux a strong green (boron). In closed tube turns brown, gives off water and after long heating melts to a glass. Perfectly soluble in dilute HCl, solution giving boron reaction with turmeric paper.

Formula for roweite — $4[H_2(Mn, Mg, Zn)Ca(BO_3)_2]$. The following is a list of natural borates with compositions of the type $H_2WX(BO_3)_2$:

Roweite	$H_2MnCa(BO_3)_2$
Sussexite	$H_2Mn_2(BO_3)_2$
Magnesiumsussexite	$H_2(Mn,Mg)_2(BO_3)_2$
Ascharite	$H_2Mg_2(BO_3)_2$
Camsellite	$H_2Mg(BO_3)_2$

No simple calcium borate of the chemical types here given is known in nature. Sussexite, ascharite and camsellite are fibrous and said to be orthorhombic. Magnesiosussexite is a mineral intermediate in composition between sussexite and camsellite. The authors do not consider roweite to be a calcium sussexite but rather a distinct species with manganese and calcium in equal atomic proportions, and therefore in nonequivalent structural positions, just as they presumably are in bustamite, johannsenite and glaucochroite. The definite ratio $Mn + Mg + Zn : Ca = 1:1$, and the differences in optical properties between roweite and sussexite, show that roweite is a distinct species and not an end component of a series with sussexite.

The authors take great pleasure in naming this mineral after Mr. George Rowe of Franklin, for many years Mine Captain and for as many years an ardent collector of Franklin minerals."

The authors also provided chemical analyses, optical and structural data which are not quoted here.

The data from this investigation appears in the Dana's System of Mineralogy, 7th Edition, volume 2, pages 377-8.

On February 24, 1937, two years prior to the above publication, Harry Berman wrote to Dr. Lawson Bauer as follows: "I received a letter the other day from Captain Rowe saying that he had already told you something of the new mineral we have found in his collection and are going to name in his honor. I believe this is the proper thing to do since Rowe has actually preserved a great many fine things from Franklin.

Roweite is a hydrous manganese calcium borate with a formula analogous to that of sussexite with half the manganese replaced by calcium. The relation between rhodonite and bustamite might be considered in the same way, and I believe roweite to be not simply a calcium sussexite but a distinct species just as bustamite is distinct in every respect from rhodonite.

There are no terminated crystals of this material but we have succeeded here in determining the symmetry as well as the dimensions of the unit cell from an X-ray study. This shows the mineral to be definitely orthorhombic and also shows that the composition as we have it is correct with four molecules of $H_2MnCa(BO_3)_2$.

The mineral is light brown in color, consisting mostly of radial aggregates of tiny laths or of cross fibers in the narrow vein in which it occurs.

The size of the original specimen was about three quarters of a square inch by one quarter of an inch in thickness. I have sent Captain Rowe some of it and I am sending you another piece under separate cover. As far as I know, these three specimens represent the total of all the roweite, but I am hoping that some more will turn up soon."

In the August 1974 issue of The Picking Table, volume 15, number 2, pages 17 and 18, we reported on two investigations which provided new data on Roweite. As we requote portions of these reports note the difference in associations and physical data given:

"Roweite, found at an unspecified location in the zinc mines of Franklin, N.J., was described by Berman and Gonyer (1937). Only a single specimen from the type locality (Harvard University Collection No. 96262) is known to exist; although other specimens may exist in some of the numerous private mineral collections from the Franklin district. The work reported here was performed on a few cleavage fragments of the type specimen. We have selected a new unit cell in the conventional setting and have redetermined X-ray, optical and physical data for roweite.

In the original description the mineral was said to occur in a narrow veinlet (approximately 6mm thick) of almost pure roweite intimately associated with a silky white, fibrous material which was believed to be thomsonite. We found roweite in very close association, and in places intergrown, with clinochrysotile but with no associated thomsonite. The wall forming minerals of the roweite veinlet are franklinite, zincite, and willemite, inclusions of these minerals are sparse in some roweite crystals. The most abundant included material, however, is clinochrysotile with which roweite may occur as parallel or, less commonly, as complex intergrowths. Roweite replaces anhedral masses of calcite which are in optical continuity throughout a roweite crystal and which

shows effects of solution. Much of the roweite, however, is essentially free from inclusions of any kind. This was confirmed by the slight amount of insoluble residue found in the analysis of purified roweite by Gonyer (Berman and Gonyer, 1937).

Roweite is amber to brownish: thin plates are transparent and colorless. Hardness 4½. Cleavages are (100) fair, (001) and (021) poor. The specific gravity (Meas) = 2.935. "Additional data - structural, optical, x-ray, etc. are provided.

This investigation was by Lorenzo F. Aristarain, Richard C. Erd and C. Donald Eberlein. Their paper appeared in the *American Mineralogist*, Jan/Feb 1974, volume 59, nos. 1 and 2, pages 66-70. The second paper, appearing in the same issue of *The American Mineralogist*, pages 60-65 was by Paul B. Moore and Takaharu Araki - "Roweite, Its Atomic Arrangement". Dr. Moore, using a single crystal of Roweite provided by Aristarain and Erd, determined the crystal structure of roweite and a corrected formula of $4\text{Ca}_2\text{Mn}_2(\text{OH})_4[\text{B}_{40}\text{O}_{70}(\text{OH})_2]$.

Discussion — Despite repeated assertions that only a single specimen of Roweite is known to exist, it is certain that at least three or four specimens are known. The Rowe specimen is now at Rutgers University. Upon his death, Capt. Rowe donated his entire collection to that institution. On several occasions in the past few years, this Roweite specimen has been on exhibition. About six years ago, Rutgers restored their Mineral Museum and many fine specimens from the Rowe collection were placed on exhibit. At this time, I do not know if the Roweite is included among these minerals on display.

After Mr. Bauer's death, his collection was divided between the Smithsonian Institution and Harvard University. I do not know which of these two institutions obtained the Roweite specimen.

Harvard surely retained the original specimen described by Berman and Gonyer. Where then, did the Aristarain/Erd specimen come from? I cannot believe that this is only one specimen and not two. The Berman specimen had associated white thomsonite; the other specimen has as a major associate green clinochrysotile. I cannot believe that Berman would mistake clinochrysotile for thomsonite. I do believe that it is a fourth specimen.

Regardless, roweite is a very rare mineral and a real prize in any collection.

Yeatmanite

Yeatmanite is another of the very rare minerals found only at Franklin. Its discovery was announced in the August 1938 issue of *The American Mineralogist*, volume 23, number 8, pages 527-530, in a paper by Charles Palache, Lawson H. Bauer and Harry Berman entitled "Yeatmanite, a New Mineral, and Sarkinite from Franklin, N.J." Some quotes from this paper follow:

"In the Spring of 1937 a few specimens were found in the mine at Franklin, in which an unfamiliar pink mineral attracted attention. Mr. Bauer examined this mineral and made micro-chemical tests which revealed the presence of arsenic, manganese and zinc. Optical tests showed the characters of sparkinite, a mineral found before only at Langban and Pajsberg in Sweden. The sarkinite is embedded in green willemite, the two forming together a narrow vein in massive granular ore. In the willemite is a very small amount of an additional mineral in the form of clove brown plates, which proves to be a new species. It is described in the following pages and to it has been given the name yeatmanite, in honor of Pope Yeatman, the distinguished mining engineer, who has been closely associated during recent years with mining and milling operations at Franklin.

The plates of yeatmanite are embedded in willemite and reach a maximum dimension of 1.3 x 0.7 cm. with a thickness of 1 mm. Generally irregular in outline or lath shaped, one or two were found with pseudo-hexagonal crystal form. These are clearly twin crystals and were at first taken to be composed of orthorhombic individuals. Optical examination, however, proved that the striae shown on the broad face are due to lamellar twinning on (010) and that the individual is really triclinic.

Yeatmanite has an excellent cleavage on a (100). It is brittle. The color is deep brown in the larger pieces and light brown in thin fragments. The streak is very light brown. Hardness is 4. The density as determined by H. Winchell on a sample of .073 gm., using a micropycnometer, is 5.02 ± 0.10 .

This sample contained some willemite and a small percentage of calcite.

Two specimens were chemically analyzed. Both analyses yielded substantially the same formula, which is $(\text{Mn,Zn})_{16}\text{Sb}_2\text{Si}_4\text{O}_{29}$, with about equal molecular parts of Mn and Zn.

Yeatmanite fuses at about 4 to a black slag. It is easily soluble in dilute HCl.

Yeatmanite shows no clear relation to any previously described antimonisilicate. It is the first mineral to be found at Franklin containing antimony. Its discovery, as well as that of sarkinite, adds two more features of resemblance between the mineral assemblages of Franklin and Langban."

In this paper, crystallographic details, optical properties and chemical analyses are also provided.

Additional information has been provided by Paul B. Moore in his paper "Catoptrite and Yeatmanite — Stuffed Pyrochroite Structures?" (Amer. Min. Sept/Oct 1966, volume 51, pages 1494-1500) in which he gives data obtained by an x-ray study of catoptrite. The structure of this mineral, not yet fully determined, is shown to be closely related to pyrochroite. And that reorientation of the yeatmanite cells reveals a close relationship to that of catoptrite.

Reference to these findings is made in a paper by Cornelius Klein, Jr. and Clifford Frondel describing the find of "Antimonium Groutite" in a paper published in the American Mineralogist, May/June 1967, volume 52, numbers 5/6, pages 858/859, as follows:

"The presence of Sb in groutite is of interest in connection with the puzzling silicoantimonides of magnesium catoptrite and yeatmanite (the latter is known only from Franklin). These complex minerals are structurally related to pyrochroite (and groutite) and may be stuffed derivatives thereof, (Moore, 1966)."

Discussion — Again, very few specimens of Yeatmanite are known. In the original paper, chemical analyses of two samples was made. In the Moore paper, he thanked Prof. F. E. Wickham for providing the type specimens. I assume that at least the two specimens referred to are still in the Harvard collections. I also believe that at least one "type" specimen is in the Smithsonian collection. Other than these, I know of no other verified Yeatmanites. All of the antimony minerals at Franklin and Sterling Hill are exceedingly rare so that Yeatmanite specimens will always be very few in number. Nevertheless, Dave Cook has expressed the opinion that yeatmanite specimens do exist in private collections but are not recognized. I sure would like to find one in my collection.

Sarkinite

Reference has already been made to the original find of sarkinite in the paper by Palache, Bauer and Berman (see article on yeatmanite above). In that paper, the only additional information provided on sarkinite is given as:

"The pink mineral with which yeatmanite occurs shows no crystals. It is of a lively pinkish red color and shows a trace of cleavage in one direction. The optical properties are: Biaxial, negative, $r < v$. Indices: $n_X=1.790$, $n_Y=1.794$, $n_Z=1.798$, all + .003.

The chemical analysis yields a formula in good agreement with type material of sarkinite, which, however, contains no zinc."

In the Dana System of Mineralogy, 7th Edition, volume 2, pages 855-6, sarkinite is listed as a basic arsenate of manganese with the formula $\text{Mn}_2(\text{AsO}_4)(\text{OH})$. Hardness 4-5; density 4.04 - 4.18; monoclinic, prismatic, class 2/m; cleavage (100) distinct; fracture subconchoidal to uneven; crystals commonly thick tabular and slightly elongated; also short prismatic also granular; as spherical forms. Color dark red to reddish yellow to yellow. Luster greasy. Streak red to yellow. It has been found at Langban and two other Swedish locations, the Harstig Mine, Pajsberg, and the Sjo Mine, Orebro.

In a paper by Paul B. Moore and JoAnn Molin-Case "Crystal Chemistry of the Basic Manganese Arsenates: V. Mixed Manganese Coordination in the Atomic Arrangement of Arsenoclasite", the American Mineralogist, volume 56, Sept./Oct. 1971, pages 1539-1552 (The Picking Table, February 1974, volume 15, number 1, page 11), the introduction stated:

"Arsenoclasite, $Mn_5(OH_4)(As_4)_2$, was first described by Aminoff (1931) as a new species from the famous Langban mines, in the province of Varmland, Sweden. It occurs in the paragenesis adelite-sarkinite-arsenoclasite in calcite filled fissures cutting hausmannite impregnated dolomitic marble from the "Irland" drift. Both arsenoclasite and sarkinite crystallized later than the adelite but it is difficult to decipher the relative positions in time for the first two species. Flink (1924) discussed the occurrences of sarkinite at Langban and noted some specimens with the characteristic flesh red color of sarkinite but with one perfect cleavage. As shown by Aminoff, "sarkinites" with perfect cleavage proved to be arsenoclasite."

Discussion — Sarkinite is another of the rare minerals from Franklin/Sterling Hill. More specimens, however, are known than the roweite and gerstmannite previously described. At Franklin, verified sarkinite have been pink to red in color, in small blebs or masses, no crystals known. Again, Dave Cook believes that there are more sarkinites in Franklin specimens than appears in collections. He suggests that you look for pink to red minerals in calcite and willemite veins in ore. If that pink or red mineral does not fluorescence green, then test for arsenic. If arsenic shows out, then the piece should be further verified.

In view of the Aminoff findings quoted by Moore, it is also deemed expedient that Franklin sarkinites be reexamined. Sarkinites with perfect cleavage have been mentioned; these may prove to be arsenoclasite.

For our historical section, we have another paper by John L. Baum, which I am sure you will find both interesting and informative.

The Franklin Open Cut

John L. Baum

The surface mining operations of the Franklin Mine are generally referred to as the Buckwheat Pit or Open-Cut, but at least four different activities are indicated. The earliest was the Weights and Measures opening which survived from its excavation in the 1830's into the early 1900's. The Trotter mine resulted in a relatively narrow slot, 500 feet in length, while the Buckwheat Pit occupied the keel of the ore body South of the great dike. Last to be excavated were the fill quarries, of which evidence of three remains. Farthest North is at the Trotter yard, Northeast of the old shaft, and forms a great pit floored with sand tailings, all of them fluorescent. Here the hanging wall was blasted down and the stone drawn down into the mine for use as fill. A smaller excavation of similar purpose lies just North of the dike at the South end of the Trotter workings, and yet another, seldom seen in its entirety, is the Taylor fill quarry which can be viewed through the gap in the dike on the East Side of the Buckwheat Pit. Because of Buckwheat Pit started recovery of ore by removing the roof of the earlier Taylor Mine workings, it has also been referred to as the Taylor Mine Open Cut. In no way was the Buckwheat Pit itself the earliest opening at Franklin, giving way to underground workings when it got too deep. Rather it was a development which followed discovery through underground mining that the East and West limbs of the ore body were joined on the surface and underground, creating a plunging fold which could be more economically mined following removal of the overlying barren rock.

August Hecksher, General Manager of the New Jersey Zinc Company at Franklin, in his annual report for 1897, stated as follows:

"At South Mine Hill, underground mining has been abandoned. Commencing with March, we have been stripping off the overburden of earth and limestone. A large portion of the outcropping part of the deposit has already been laid bare. Its character and extent have justified our expectations. The overburden removed during the year is somewhat over 100,000 tons at a cost slightly in excess of \$40,000. Against this we credited about \$12,000 for limestone sold and for ore removed and shipped away in the process of stripping. The remaining \$28,000 has been written off.

During the current year, stripping operations will be continued and ore shipments will be light. It is proposed to erect a large concentrating plant, in some convenient location connecting it by rail with the mine and to separate the franklinite and willemite, so that either may be available at any point. This follows the policy adopted for North Mine Hill, where a concentrating plant is now successfully separating our ores, a portion of which we have sold to advantage both here and abroad.

Preliminary surveys have been made and it is proposed, with the opening of Spring, to promptly proceed with the erection of the new concentrating plant so as to have it ready, if possible, by the end of the year."

The foregoing establishes the start of the Buckwheat Open Cut as March 1897, and dates construction of the replica mine building as 1898. Of the sprawling plants at the Parker Shaft and at Taylor-Buckwheat, besides a few masonry foundations, all that remains are the two engine houses, one as a storeroom for the N.J. Bell Telephone Company (at the Parker location) and the other as shelter for the replica. The operations in the Open Cut were completed prior to the time of World War I.

More historical information is supplied by a Sussex County historian, Clifford Ott, in the records of the Sussex County Historical Society:

"About 1830, Dr. Fowler invented a process, since lost, for producing bluish white zinc oxide powder. From the powder he made a paint which he used on his house. The paint was not very good because of poor pigments, but it increased interest in the possibilities of using zinc as a base. A zinc base makes paint last longer. There was a widespread demand for metallic zinc to make zinc oxide. But New Jersey mining companies found it impossible to refine zinc profitably in the small amounts demanded by the paint industries.

This important obstacle still remained when the federal government brought workmen from Belgium in 1838 to make the zinc for the first standard set of brass weights and measures. Zinc ore from Franklin was used. Eleven years later the Sussex Zinc Company opened a plant in Newark for manufacturing zinc tableware and other articles. The newspapers of the day believed that the zinc plated knives and forks would soon replace silver.

Meanwhile chemists and metallurgists were looking for a good, cheap way to make zinc oxide. But while scientists worked overtime in their laboratories, a furnace tender in a Newark chemical factory accidentally hit on a method for making the compound. One day his furnace cracked. To close the hole he put an iron gate across it and covered it with a mixture of coal and pieces of zinc ore which he picked up in the yard of the zinc company next door. In a short time a cloud of white powder was rising from the grate. He carried his discovery to Samuel Wetherill and Samuel T. Jones of the Zinc Company, and before long the large scale manufacture of zinc oxide was begun in America. Zinc oxide could thereafter be made directly from the ore.

Wetherill invented the process used since 1852. Zinc ore mixed with coal is distributed over burning coal on a perforated grate, and a strong air current is sent up through the grate. White zinc oxide is formed. From the furnace these powdery floating particles of zinc oxide move through a system of cooling pipes to what are known as bag rooms. Here the zinc oxide, which looks somewhat like ordinary flour, is caught in muslin bags, about 45 ft. long and 20 inches in diameter. This collecting apparatus has been changed very little since Samuel Jones invented it for use with Wetherill's furnace process.

Plants for making zinc oxide were opened in Bayonne and Jersey City. They took most of the output of the Jersey zinc mines for this purpose. The ore was mined slowly and laboriously by men toiling in faint candle light or the glow of oil lamps in the pits at Franklin and Ogdensburg. With crude explosives, picks, shovels and crowbars they crumbled the tough rock into pieces small enough to be carried to the surface. Piled on heavy wagons, the ore traveled over the hills to the canal boats at the Northern end of Lake Hopatcong, from where it was shipped slowly along the Morris Canal to Jersey City.

And, finally, a letter sent to me by Dick Hauck, written by Frank L. Nason (Mining Geologist) on March 2nd, 1926 to R. M. Catlin, then Superintendent of the Franklin Mine. This letter indicates the usually benevolent attitude of the New Jersey Zinc Company toward the scientific investigations of the mine and its minerals.

"In direct answer to your question in your letter of the 27th ult., the work proposed by Mr. Martens will not be of the slightest assistance to me. The question, as to the origin of ores has been diligently studied for years by the ablest of scientific men. Today, there is absolutely no consensus of opinion on the subject. My work lies along wholly different lines. I take the existence of an ore body as a fact, whatever the origin, and if it is broken by a fault or is petering out, I try to study out its possible extension.

Do I favor such work as Mr. Martens is doing?

With all my heart, if the New Jersey Zinc Company wishes to spend money on purely scientific investigations with no hope of immediate economic return, I shall be more than glad to cooperate in every way possible with any investigator they choose to employ.

I believe that you have made arrangements with Mr. Lundberg to experiment with his electro-magnetic method of prospecting. I most heartily approve of this. This method is based on purely scientific methods and, to my mind, has promise of economic success. You can contrast this attitude of mine to that in respect to the microscopic study of the Mine and Sterling Hill rocks and associated minerals.

Very truly yours,

Frank L. Nason

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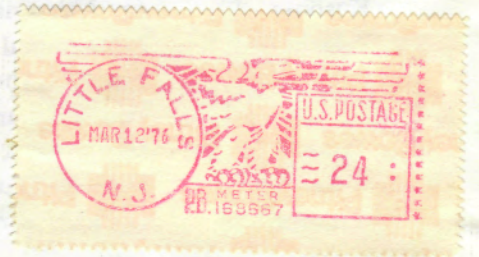
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