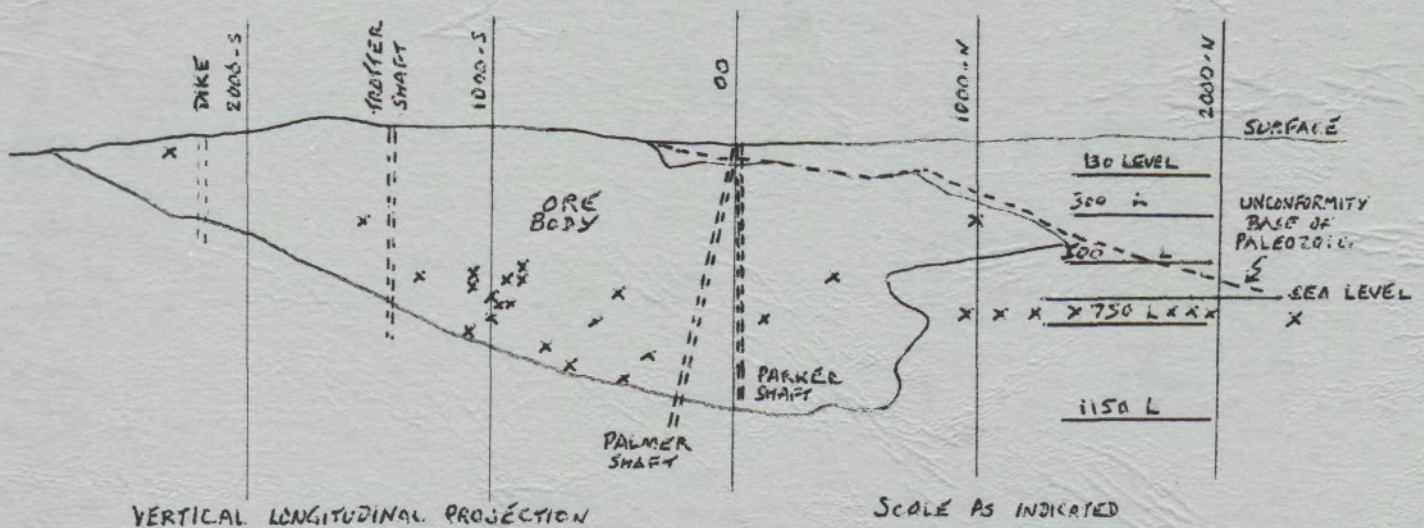


THE PICKING TABLE



LOCATED SPHALERITE OCCURRENCES - FRANKLIN MINE

JOURNAL of the FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY, INC.

SPRING, 1986

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F.O.M.S. Notes

PRESIDENT'S MESSAGE

With the melting of the snow, the rocks of the Buckwheat Dump emerge from their white mantle, and the seismic tremors rumble through the souls of the collector community. Whatever Spring may mean to the average mortal, to FOMS members it brings a special appeal to dig in the dirt, not to plant, but to explore again the crystalline mysteries of Nature.

Let us not lose sight of the fact that we are a community, however widespread, dedicated to a great common interest and purpose: the expansion and preservation of knowledge about the world's most remarkable mineral location. Like all great enterprises, this demands the efforts and participation of many. To the extent that we share our knowledge, our time, and our interest with each other and the world, Franklin lives. If you can write, think about writing for your Picking Table. If you can organize, consider joining a committee. Go to the field trips, the swap sessions, the meetings; look through a microscope; learn, and share what you know. Make this a year of discovery, for yourself and others; surely, something as extraordinary as Franklin-Sterling Hill deserves no less than your best effort. Celebrate the return of the sun by participating in your society's affairs. In this way you can mold FOMS into what you want it to be.

RCB

FRANKLIN MINERAL MUSEUM MESSAGE

The Spex-Gerstmann Mineral Collection has been presented to the Franklin Mineral Museum by Arthur and Harriet Mitteldorf, whose company, Spex Industries, Inc., purchased it from Ewald Gerstmann some five years ago. Upon sale of the company, the Mitteldorfs retained the collection for subsequent donation. Accumulated by Ewald over many years through a pains-taking search, great patience, and at considerable expense, the collection numbers 1979 specimens of which several hundred com-

prise a spectacular fluorescent display. For years the Gerstmann Mineral Museum has displayed the collection for the delight and education of amateur and professional mineralogists alike. The Franklin Mineral Museum is most grateful to Arthur and Harriet Mitteldorf for this most generous donation and to Ewald Gerstmann for its accumulation and for his sponsorship of the Franklin Mineral Museum as the recipient. Transfer of the collection will be effected as soon as suitable space is available to house it.

JLB

ABOUT THE COVER SKETCH

Located Sphalerite Occurrences--Franklin Mine

It is suggested that you refer to this hand sketch, prepared by Jack Baum, while reading his article, "Sphalerite at Franklin, New Jersey", which begins on page 3. It is certain to add to your understanding and reading enjoyment.

OSD

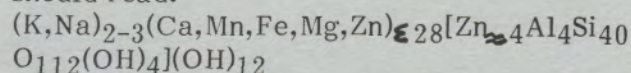
ERRATA

In Volume 26 of The Picking Table several errors appeared:

Page 3, column 2, paragraph 4, last word should be "collectors", not "collectorzs"

Page 5, column 2, paragraph 1, line 1, second word should be "subsequent", not "sebsequent"

Page 7, the formula for minehillite listed under the species name at the beginning of the article should read:



Page 12 should have been page 11 (turneaureite belonged under the "New to Science" category)

Continued on page 12

The PICKING TABLE

Journal of the Franklin-Ogdensburg
Mineralogical Society, Incorporated



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The Picking Table

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1986

Regular Society activities consist of field trips, micro-mineralogy study sessions, and lecture programs. Field trips vary as to time and location according to schedule. Morning micro-mineralogy study sessions take place from 10:00 a.m. to noon in Kraissl Hall at the Franklin Mineral Museum. Afternoon lecture programs begin at 2:00 p.m. at the Hardyston Township School, Route 23, Franklin, New Jersey. Pre-meeting activities begin at 1:00 p.m. - Lectures open to public.

- Saturday
March 15, 1986
- Field Trip: Mineral Exchange Program - SELL & SWAP - FOMS members only.
Hardyston Township School, 10:00 a.m. to 2:00 p.m.
- Micro-Group: SWAP & SELL at Hardyston Township School - 10:00 a.m. to noon.
Micro-Group sessions return to Kraissl Hall next month.
- Program: A Franklin Update (General Participation)
Mini-Auction (Seller receives 80%, FOMS 20%)
Make this a success. Put good material up for auction.
- Saturday
April 19, 1986
- Field Trip: Old Andover Iron Mine, Limecrest Road, Andover, NJ.
9:00 a.m. to noon.
- Micro-Group: Kraissl Hall, Franklin Mineral Museum, Franklin, NJ.
10:00 a.m. to 12:00 noon.
- Program: General Slide Presentation - Bill Trost, Moderator
Bring your favorite slides of Franklin/Sterling Hill minerals,
locale scenes, or other shots of interest to our membership.
- Saturday
May 17, 1986
- Field Trip: Buckwheat Mine Dump, Evans Street, Franklin, NJ.
10:00 a.m. to noon.
- Micro-Group: Kraissl Hall, Franklin Mineral Museum, Franklin, NJ.
10:00 a.m. to 12:00 noon.
- Lecture: "Pennsylvania Fluorescents" by Ralph Thomas.
- Sunday
May 18, 1986
- Field Trip: Limecrest Quarry,
Limecrest Products Corporation of America,
Limecrest Road, Sparta, NJ.
9:00a.m. to 3:00 p.m. This is an Interclub Outing.
- Saturday
June 21, 1986
- Field Trip: Franklin Quarry (Formerly, Farber Quarry)
Limecrest Products Corporation of America,
Cork Hill Road, Franklin, NJ., 9:00 a.m. to noon.
- Micro-Group: Kraissl Hall, Franklin Mineral Museum, Franklin, NJ.
10:00 a.m. to 12:00 noon.
- Lecture: "Micromounts-Past and Present" by John C. Ebner, Jr.

SPHALERITE AT FRANKLIN, N.J.

by
JOHN L. BAUM

70 Route 23 N, Hamburg, NJ 07419

In his letter of April 4, 1911, to J. A. Van Mater, Manager of Mines for New Jersey Zinc, Frank L. Nason, Consulting Geologist, mentions as a "well-known fact" the existence of sphalerite at Franklin: at the south end of Mine Hill, at the north end of the orebody in the white (Franklin) and blue (Kittatinny) limestones, and in gneiss at the Palmer Shaft. According to Frondel and Baum (1974), bulk analysis of Franklin and Sterling Hill ores indicated practically no sulfide at Franklin during the period 1930-1934 but 1.5% at Sterling Hill during 1935. In my (JLB) experience, sphalerite was not often seen at Franklin in the period 1942-1946. The following sphalerite occurrences, recorded on mining maps from 1931 to 1954, at the north end of the orebody were predominantly along the footwall, and in the south end (south of the Parker Shaft) were mostly connected with vein dolomite.

In the north end, two sphalerite occurrences in top slice working places were recorded, plus numerous showings in the 750 level drift north. The top slice occurrences are: (1) 149 NTS (north top slice) -755 (feet vertically below zero elevation at the collar of the Parker Shaft), associated with pyrite in calcite and disseminated magnetite, with fluorite; and (2) 360 NTS, -538, medium-grained marble, i.e., 1/4 - 3/4" plus sparsely banded sphalerite, mica (phlogopite in marble, other mica generally in ore), and pyroxene (undifferentiated as to species by Company geologists) in the magnetite area of the footwall. The 750 level drift north was put in while searching for ore extensions and to permit diamond drill exploration. The ore died out as a mappable unit on this level at 800-N, but traces of willemite or franklinite could be seen to 1000-N and questionable grains of these two minerals

possibly a few hundred feet further north. Samples are not available and ultraviolet lamps were not portable at the time of mapping the passage before it was lost to access. The northernmost ore mapped was at 1400-N, -450 elevation, approximately against the Paleozoic unconformity). Sphalerite was recorded as far as the drift extended northward to 2400-N, but more infrequently. The north end of the drift was 150 feet east of the marble-gneiss contact, as shown by a drill-hole toward the west. One hole drilled east here reports loellingite. Graphite in the horizon of this drift is more often present than absent. Pyroxene is a common associate of sphalerite, pyrite less so. Pegmatite is present along the footwall of the Franklin marble in elongate irregular masses, and magnetite occupies its expected position where not displaced by pegmatite or faulting, since it is a bedded disseminated-to-locally-solid deposit between the zinc ore and the gneiss-marble contact.

At its north end, the Franklin orebody comes up against the unconformity at the base of the Paleozoic. Weathering at the end of the Precambrian was deep, locally along fractures deeper than 1000 feet as evidenced by Hardyston quartzite cave-filling material cut by diamond drill hole 136 east of the Franklin Iron Company's quarry (Pistol Range Quarry). In the quarry here cited, a cave-filling of the same material, mineralized with fluorite, pyrite, and sphalerite, occupies a residual prominence in the center of the quarry, and the Hardyston quartzite can be seen as an inclined, bed-like mass in the far wall, at the south end of the quarry. Beneath the unconformity, franklinite ore itself was locally reduced to a hematitic clay, subsequently indurated, bearing residual ore minerals, and samples

of this, some analyzed, have been preserved. At the base of the Hardyston quartzite is a sand bar of ore minerals, weathered from the ore outcrop in the earliest Paleozoic. Samples are at hand which were taken from an excavation at the corner of Nestor and LaRue Streets in Franklin and subsequently analyzed. The weathering and fracturing, which resulted at the end of the Precambrian, provided ample openings for the introduction of mineral-rich solutions expressed during compression and induration of the overlying Paleozoic rocks, primarily the Kittatinny formation (here a siliceous dolomite bearing, near its base, a trace horizon of violet fluorite). In some places, *i.e.*, Pine Island, New York; Big Island, New York; McAfee, New Jersey; Andover, New Jersey, among others, where Precambrian and Paleozoic limestones were contiguous due to the regional unconformity, zinc mineralization has led to prospecting. In a couple of cases, McAfee and Andover, important Colonial iron ore deposits developed as a result of weathering at the unconformity.

The passage northward on -750 level shows sphalerite with pyroxene as mentioned, in the Franklin Marble, the sphalerite being essentially colorless of a type often referred to as "shines". Many occurrences are here mapped as coarse (grain size larger than 3/4 inch) marble with disseminated pyroxene and sphalerite, but perhaps of greater interest are beds (or more properly, layers) of dolomitic white limestone with sphalerite, dolomitic gray limestone (still Franklin formation) with quartz, sphalerite, pyrite, pyroxene, or a fault zone, dolomitic, with sparse to abundant sphalerite. Another intercept shows banded sulfides, probably pyrite-sphalerite, in gray-to-white limestone with mica, partly dolomitized and graphitic. One would expect pyroxene and mica to be Precambrian along with graphite, but would expect a fair amount of the sphalerite to be a Paleozoic addition based on observation of the numerous drilled prospects along this same unconformity.

An outcrop on Cummins Street, east of Nestor Street, is a roadcut in Franklin Marble and a random sample from here showed sphalerite. This is east of the excavation in the Hardyston quartzite ore sand bar at the corner of Nestor and LaRue Streets by over a hundred feet, and reinforces the idea of sphalerite enrichment

bordering the unconformity.

The spectacular sphalerite crystals with drusy dolomite, hematite, and quartz, mentioned by Palache as seen in the Stanton collection, and on view in the Smithsonian Institution and in the Baum collection, came from a longitudinal stope at the north end of the mine and, judging from the matrix of dolomite where present, represent the type of mineralization which is probably Paleozoic in age. The color of the sphalerite is different from the brown so frequently seen in vuggy dolomite from the Buckwheat Dump, being yellow-green to reddish yellow according to Palache. One specimen at hand consists of crystallized white-to-faintly pink calcite, and clear-to-violet fluorite, both minerals fluorescent, with a crystal group of oil-green sphalerite to 3 cm in size. The stope from which the specimen came was mined up to the unconformity and although a good portion of its empty upper section was accessible until the mid-1940s, the opening did not encourage extended visits. Specimens of this find were obtained from the miner, a shift boss, Bill Martin.

Sphalerite in the Palmer Shaft pillar area was confined to or at least only observed in the footwall on both sides of the magnetite zone, and was mapped as Franklin limestone (marble) plus local sulfides. In general these sulfides would be sphalerite and pyrite, or pyrite and pyrrhotite.

South of the Palmer Shaft pillar area, much of the mine had been mined out by the time of detailed geologic mapping. Isolated pillars were being mined, but despite this random placement of sections, it appears that every occurrence of sphalerite (maps show 21 working places where it is mentioned) is associated with dolomite, either vein dolomite, or dolomitic marble. Acid was not carried underground, so that dolomite had to be obvious in color or texture to be mapped. Most prominent were the gently northward-dipping dolomite veins, up to 6 inches thick, striking roughly east-west. These veins were the source of much of the radiating white willemite, but did not always contain this mineral and, in fact, they generally did not. Dolomite veins could be traced between working places and were and are still visible in the open cut. In addition to the dolomite which was a pale

gray, locally buff, making up the vein with a smooth fracture contact with the wall rock, there was a central zone along which the last minerals to form were observed. Besides white, highly phosphorescent, radiating willemite, there might be sphalerite (as brown crystalline grains), pyrite, galena, chalcocite or bornite, and serpentine. These veins are probably controlled by Paleozoic cross folding and it is quite possible that the other sulfide mineralization, in the south end of the orebody, is of the same age.

Some of the non-linear dolomite vein sphalerite occurrences are as follows:

: 319-S, elev. -868, dolomite-galena-sphalerite at the footwall limestone ore contact.

: 477-S, elev. -644, a dolomite stockwork invading ore with a gray dolomite containing resinous sphalerite plus sparse pyrite and quartz, at the hanging wall.

: 558-S, elev. -753½, footwall limestone has local dolomite with pyrite-sphalerite and local

quartz fragments.

: 1045-S, elev. -796, footwall limestone with abundant brown sphalerite in a dolomitic gray limestone with banded chondrodite or norbergite, pyrite, and galena.

: 1045-S, elev. -645, 2" to 8" gray dolomite seam oriented N-S (!), with abundant pyrite, sphalerite, local malachite stains, in center of orebody.

The foregoing is a recitation of the observations by numerous professionals who worked at Franklin between 1931 and 1954. The conclusions are those of the author. Review of the manuscript by Dr. Pete J. Dunn is gratefully acknowledged.

REFERENCE:

Frondel, Clifford and Baum, John L., "Structure and Mineralogy of the Franklin Zinc-Iron-Manganese Deposits, New Jersey." Economic Geology, Volume 69, #2, March/April, 1974.



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MINERAL NOTES

Research Reports

MANGANESE HUMITES

A definitive article entitled "Manganese humites and leucophoenicites from Franklin and Sterling Hill, New Jersey: parageneses, compositions, and implications for solid solution limits", appeared in the *American Mineralogist*, Volume 70, pages 379-387, 1985. The author was Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution, Washington, D.C. The following is an abstract of that article.

INTRODUCTION

Franklin and Sterling Hill provide an ideal "laboratory" in which to investigate the solid solution relations for a number of reasons. First, all the known Mg- and Mn- humite species occur there; the Mg- humites occur in the host Franklin Marble for the most part, and the Mn- humites in the orebodies themselves. Franklin is also host to the two anomalous, yet related, species, jerrygibbsite and leucophoenicite, the latter occurring in relative abundance. Second, Mn/Mg solid solution is common in the silicates at these deposits, and the activity of Fe is limited; in most cases it has been preferentially absorbed by andradite, which also may serve to isolate silicate reactions from the ubiquitous franklinite. Third, the Mn-humite minerals are moderately common at these deposits, occurring both within the

primary ore and in secondary vein assemblages. Last, the Franklin and Sterling Hill assemblages offer a unique opportunity to study the behavior of zinc in the Mn-humites, an area of investigation not previously pursued and which is worthy of continued investigation, particularly from a structural standpoint. The species discussed are listed in Table 1, together with related phases. The Mg-humites from the Franklin Marble, having already been studied by numerous investigators, have been excluded from this study. Only samples with relations to the ore minerals are included.

Table 1. The humite and leucophoenicite groups.

$M^{2+}:Si$	Humite group	Mn-humite group	Leucophoenicite group
3:1	norbergite	unknown in nature	unknown
5:2	chondrodite	alleganyite	unknown
7:3	humite	manganhumite	leucophoenicite
9:4	clinohumite	sonolite	jerrygibbsite

CHEMICAL COMPOSITION

The samples included in this study were chemically analyzed using an ARL-SEM-Q electron microprobe. The standards used were synthetic

tephroite (Mn,Si), synthetic ZnO (Zn), hornblende (Mg,Fe), and fluorapatite (F) for Mn-rich samples. Forsterite (Si,Mg) and rhodonite (Mn,Zn) were employed for Mg-dominant samples. All samples were individually verified by X-ray powder diffraction techniques prior to analysis.

ALLEGHENYITE

Introduction

Alleghenyite, ideally $Mn_5(SiO_4)_2(OH)_2$, was first noted from Franklin and Sterling Hill by Cook (1969) who cleared up part of the confusion arising from earlier morphological studies. White and Hyde (1982) examined several Franklin samples using TEM techniques. They found several phases associated with alleghenyite (chiefly leucophoenicite and sonolite). However, these minerals were present as fragments and not as intergrowths. Petersen et al. (1984) described a high-Mg alleghenyite from Sterling Hill. Francis (1985) presented a crystal structure refinement on Sterling Hill material of similar composition which demonstrated a high degree of cation ordering. The present study, through extensive analyses, finds that such ordering may be very common in samples from Sterling Hill.

Description

Alleghenyite occurs at both Franklin and Sterling Hill. At Franklin, there are few known assemblages. The best preserved of these was identified by Palache (1928) as leucophoenicite. This material consists of veins up to 3 cm thick, associated with calcite, franklinite, and sussexite. The bulk of this material is alleghenyite: it consists of massive alleghenyite which forms euhedral crystals on exposed surfaces. Leucophoenicite is also present, both as epitaxial overgrowths on the underlying alleghenyite, and as apparently randomly oriented euhedra, perhaps of a subsequent growth period. Although alleghenyite has been found on a few Franklin specimens from other assemblages (e.g., NMNH C6884), most of the preserved pink-colored material from Franklin is leucophoenicite. It is not clear whether this is due to selective retention of specimens or (as the author views it) to the predominance of leucophoenicite due to geochemical conditions.

Alleghenyite at Sterling Hill occurs as euhedral crystals and thin seams which crosscut the ore. These crystals frequently accompany arsenate species in hydrothermal veinlets and formed in apparent equilibrium with rare species such as kolicite, holdenite, magnussonite, adelite, kraisslite, chlorophoenicite, and others. More common species associated with alleghenyite are franklinite, willemite, barite, and carbonates, all of secondary recrystallization. All of the observed species are formed on willemite/franklinite ore which contains abundant calcite. The best samples have been found in recent years. Twinning was not observed in either the magnesian crystals or in the more Mn-rich material from Franklin and Sterling Hill.

Chemical Composition

Microprobe analyses of alleghenyites reveal several features. First is the absence of material with end-member composition from Franklin and Sterling Hill; most material from there is highly magnesian. Second, samples from Franklin are markedly lower in Mg than those from Sterling Hill, reflecting the higher general concentration of Mg in Sterling Hill silicates. Third, there appears to be partial solid solution between most Mn-rich material and that with an Mn:Mg ratio of 4:1, but there is an evident break in solid solution between material with Mn_4Mg_1 and the rest of the samples. The possible ordering of some samples with a Mn:(Mg,Zn) ratio of 4:1 (8:2) might be permissible inasmuch as alleghenyite has space group $P2_1/b$, which has equipoint ranks of 4 and 2. Of particular interest, in all of the analyses of alleghenyite in this study, is the invariance of Zn. Zinc is a common substitute in silicate phases at Franklin and Sterling Hill and its presence is expected. However, in no case is there an alleghenyite sample without Zn, nor is there one with Zn in excess of these invariant amounts. Although it is tempting to dismiss relatively small amounts of Zn as a common octahedral substitute, such dismissal is not warranted here. Some of these alleghenyites co-exist with zincite (ZnO), but the majority have only willemite as an associated Zn-phase, and thus may be saturated with respect to Zn.

Because the amount of zinc is relatively invariant and because the same relation holds for leucophoenicite, there is adequate reason

to propose that Zn is limited in alleghenyite and other humite-related species. It should also be noted that fluorine is common in most alleghenyite, averaging 40 mol% of the (OH) site in magnesian material and generally decreasing with increasing Mn-content.

MANGANHUMITE

Introduction

Manganhumite, formerly unknown from Franklin, is massive, medium brown in color, and occurs in cm-sized masses associated with abundant franklinite and zincite, the latter with much hetaerolite exsolution and traces of manganosite exsolution. Minor associated minerals are alleghenyite and calcite. Willemite is absent.

Manganian humite was found at both Franklin and Sterling Hill. Some Franklin material consists of light brown anhedral blebs, associated with minor franklinite, willemite, and zincite in a rock which is predominantly calcite. In one sample it is present as a brown coating on what appears to be tephroite.

Manganian humite from Sterling Hill is markedly different in texture. The samples are from one occurrence, are massive, medium brown in color, and associated with franklinite, calcite, and minor willemite. Chondrodite is intimately associated with the humite.

Chemical Composition

Microprobe analyses of manganhumite and manganian humite demonstrate much solid solution between Mg-rich material and that with approximately 3.75 atoms of Mg per 7 octahedral cations. Analyses of Franklin material show a gap between this composition and that of the magnesian manganhumite of Moore (1978). Fluorine is found in all samples and occupies approximately 22 to 49 mol% of the (OH) site.

SONOLITE

Introduction

Sonolite, $Mn_9(SiO_4)_4(OH)_2$, was first described by Yoshinaga (1963) from eleven localities in Japan. It has subsequently been found elsewhere, including Sterling Hill and Franklin

(Cook, 1969). The crystal structure was determined by Kato (unpublished; discussed by Ribbe, 1982).

Description and composition

Microprobe analyses of sonolite are best discussed in three clusters. The first group of analyses represents samples only from Franklin. The samples are characterized by primary, varied, relatively simple assemblages of several species which may include manganosite, willemite, sonolite, hetaerolite/franklinite exsolution intergrowths, jerrygibbsite, leucophoenicite, zincite (usually with abundant hetaerolite exsolution), and a relative scarcity of carbonates. These sonolites have near end-member compositions. Of special interest is the relative constancy of zinc (averaging 0.33 Zn per 4 Si). Also notable is the relatively high calcium content (approximately 0.5 of the 9 octahedral cations are calcium).

The second group of analyses represents euhedral crystals from secondary seams and varied vein assemblages at Sterling Hill. The crystals form on calcite-rich franklinite/willemite ore with no associated zincite. There is minor secondary sphalerite. The sonolite crystals are complexly formed, of prismatic habit, and relatively abundant inasmuch as several hundred specimens have been preserved. Representative SEM photomicrographs of several of these crystals are shown in Figures 1 and 2.

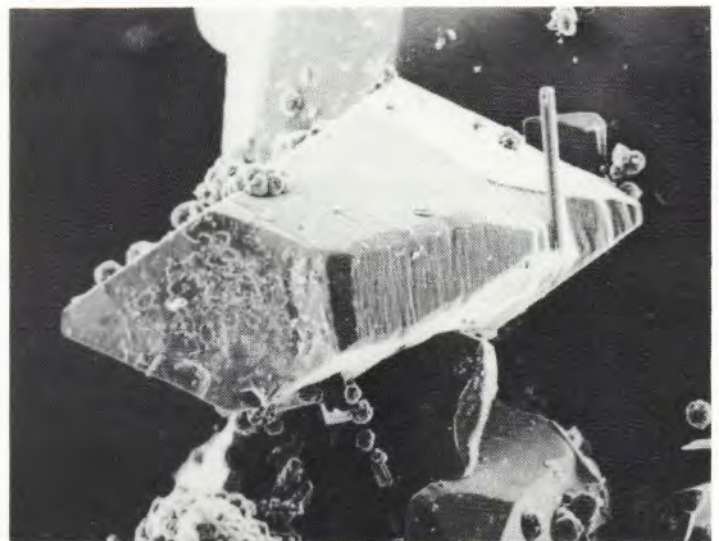


Fig.1. Simple prismatic habit of magnesian sonolite from Sterling Hill, N.J. (Editor's Note: Horizontal width of crystal measures 0.16mm.)



Fig.2. Twinned magnesian sonolites from Sterling Hill, N.J. (Editor's Note: Longest crystal measures 0.8 mm.)

The chemical composition of these crystals is remarkably similar in several respects to that of the ordered alleghenyite (Francis, 1985). The Mg and Zn contents per 4 Si compare closely with those given per 2 Si for alleghenyite, suggesting that this Mg:Zn:Mn ratio might also be ordered and responsive to *P-T* conditions inasmuch as both the ordered magnesian alleghenyite and these magnesian sonolites are found in secondary vein assemblages. Because the space groups of alleghenyite and sonolite are the same, such possible ordering in sonolite may be based on a similar scheme as that noted by Francis (1985) for Sterling Hill alleghenyite. In addition, the relatively invariant Zn content of these sonolites is consistent with that of the more Mn-rich samples found at Franklin.

The third group of analyses represents a very interesting assemblage initially reported by Cook (1969). None of the samples studied herein had zinc contents approaching that reported by Cook (17.6 wt.% ZnO), using XRF analysis. Sonolite occurs as dark brown reaction rims on zincian tephroite which has abundant willemite exsolution. The associated minerals are zincite, franklinite, willemite, and calcite. The ratios of octahedral cations in the sonolite rims on tephroite are similar to those of the underlying tephroite. The mantling may have occurred as a result of hydration of the primary tephroite (personal communication, Carl Francis).

Compositionally, these sonolite reaction rims

are characterized by different Mg:Zn:Mn ratios than those of the previous two groups. Magnesium is more than doubled in content relative to the previous group. A second feature of this cluster is the amount of Zn (0.96 atom average) per 9 octahedral cations. The constancy of composition of these rims from at least three varied parageneses suggests that these samples may represent, like the second group, a possible stable ordering of Mn, Mg, and Zn between sonolite and clinohumite.

General observations on sonolite

In samples from Franklin and Sterling Hill, the octahedral cations occur in two apparent compositional clusters that may indicate special ordering schemes. These are: (a) with Mg:Zn:Mn approximately =1.5 :0.3 :7.2 and (b) with Mg:Zn:Mn approximately =3.4 :1.0 :4.6. Zinc is apparently limited to different degrees in all analyses. Iron is more abundant in clinohumite, and calcium is more abundant in sonolite. Franklin and Sterling Hill sonolites, unlike those studied by Kato, do have appreciable fluorine. It replaces up to 44 mol% of the possible (OH), increasing with the Mg content.

LEUCOPHOENICITE

Introduction

Leucophoenicite, $(\text{Mn,Zn})_7(\text{SiO}_4)_3(\text{OH})_2$, was originally described from Franklin by Penfield and Warren (1899). Subsequent studies of its morphology were published by Palache (1928,1935) and Moore (1967). The crystal structure was solved by Moore (1970).

Description

Until recently, leucophoenicite was known only at Franklin, New Jersey; it has never been found at the genetically related Sterling Hill deposit. Because many of the uncommon minerals at Franklin occur in restricted assemblages, several hundred leucophoenicite samples were examined. The results of this comparison supported the preliminary findings of Dunn et al. (1984) that leucophoenicite is indeed widespread at Franklin and occurs in a wide variety of assemblages, most of which have Ca-bearing associated minerals. A very small number of leucophoenicites occur without calcium-bearing species. These Ca-poor leuco-

phoenicites are very uncommon; they occur in two types of assemblages:

1. With franklinite, willemite, and zincite in assemblages devoid of other associated phases. If other silicates are present, they are tephroite, sonolite, or jerrygibbsite.

2. With manganosite, zincite, and hetaerolite, in samples which are 80-95% manganosite (MnO) by bulk volume. This assemblage was examined in detail in search of the Mn-analogue of norbergite (MAN), which remains unknown in nature. The silicate phases found in this assemblage were tephroite, sonolite, and Ca-poor leucophoenicite. Leucophoenicite is the dominant silicate in this assemblage.

Chemical composition

The microprobe analyses of leucophoenicite show compositional variation. Examination of these data permits a number of observations.

1. Most leucophoenicites are highly calcic. Twenty-two of 27 analyses have Ca values in excess of 0.48 Ca per 3 Si. The calcic material is much more common than this ratio of calcic to non-calcic samples indicates.

2. Zn is a *constant* constituent of leucophoenicite. It is present in all analyses of leucophoenicite obtained by the author, including many not utilized in this study. It is relatively invariant, amounting to approximately 0.3 Zn per 3 Si. The constancy of Zn in all samples studied suggests that either it may be essential to the species, or that there are limits on the amount of Zn permitted in leucophoenicite, or both. No samples contained the very high zinc content (up to 8 wt% ZnO) reported by Cook (1969) using XRF analysis.

3. Fluorine is essentially absent in leucophoenicite. Some samples have traces of F, but these trace amounts are well within the error of microprobe determinations.

The constancy of Zn, in Franklin samples, remains uninvestigated. The available evidence suggests that Zn may play some role in the formation of leucophoenicite and the stability of this phase relative to members of the humite group, where bulk rock compositions are zincian. Similarly, the absence of fluorine might indicate that OH/F ratios affect the selective formation of leucophoenicite relative to the F-bearing manganese humites. These lines of reasoning would apply equally to jerrygibbsite.

JERRYGIBBSITE

Introduction

Jerrygibbsite, ideally $(\text{Mn,Zn})_9(\text{SiO}_2)_4(\text{OH})_2$, was first described from Franklin by Dunn et al.(1984). Subsequent to the original description, several additional samples were found and studied. Their parageneses are similar in several respects to the original samples, i.e.: they are simple assemblages consisting of only zincite, willemite, tephroite, and franklinite, or leucophoenicite, and are notable for the lack of any Ca-bearing species. However, of the five known jerrygibbsite samples, four are texturally distinct from each other, suggesting they were to some extent spatially distributed in the Franklin orebody. Zincite is present in all samples.

Microprobe analyses of jerrygibbsite, like leucophoenicite, appear to be a phase which might have essential zinc. It is noteworthy that Mn does not exceed 32 of the possible 36 octahedral cations (full cell contents with $Z=4$), and that Zn approximates 2 atoms in the full cell. The apparently low Mg content of both leucophoenicite and jerrygibbsite is noteworthy, especially because Mg is easily accommodated in the Mn-humites.

OBSERVATIONS ON SPECIFIC CATIONS

Manganese

No end members are found among the Mn-humite species at Franklin or Sterling Hill, in large part due to ubiquitous Zn substitution and abundant Mg in many samples. Manganese is restricted in leucophoenicite (5.42-6.53 Mn per 7 octahedral cations) and jerrygibbsite (7.79-8.02 Mn per 9 octahedral cations).

Calcium

Calcium is common to both jerrygibbsite and leucophoenicite, but among the humites only sonolite accepts appreciable Ca (up to 0.65 Ca per 9 octahedral cations).

Iron

The Mn-humites at these localities have minimal Fe substitution. Clinohumite accepts up to

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0.2 Fe per 9 octahedral cations.

Magnesium

All the Mn-humites contain Mg, which apparently generates several ordered intermediate phases. Magnesium is apparently quite restricted in both leucophoenicite and jerrygibbsite.

Zinc

There is a "threshold" level of 0.2-0.4 Zn atoms per xSi in all the studied samples (x=2 for alleghenyite/chondrodite, 3 for manganhumite/humite/leucophoenicite, and 4 for sonolite/clino-humite/jerrygibbsite). In both leucophoenicite and alleghenyite, this "threshold" level is relatively constant for all studied samples. Zn is apparently ordered in some Mg-bearing alleghenyites and sonolites. No samples are zinc-free.

Fluorine

Both jerrygibbsite and leucophoenicite are fluorine-free. Fluorine is common to the Mn-humites at Franklin and Sterling Hill, and is roughly proportional to the Mg-content. It should be emphasized that many of these chemical features may be solely responsive to conditions at Franklin and Sterling Hill.

Unresolved matters

The crystal-chemical role of Zn in the Mn-humites is deserving of careful investigation. Both sonolite and alleghenyite exhibit two apparent chemical clusters each, and it appears that these are related to Mn:Mg ratios; however at Franklin, these may be related to Zn content as well. Although alleghenyite and sonolite are both known from other deposits as zinc-free phases, neither leucophoenicite nor jerrygibbsite has been shown to be zinc-free. Hence, leucophoenicite and jerrygibbsite may be characterized by essential zinc, or some limitation on the amount of Mn permitted, or other factors, such that these phases might not be stable in nature as manganese end-members.

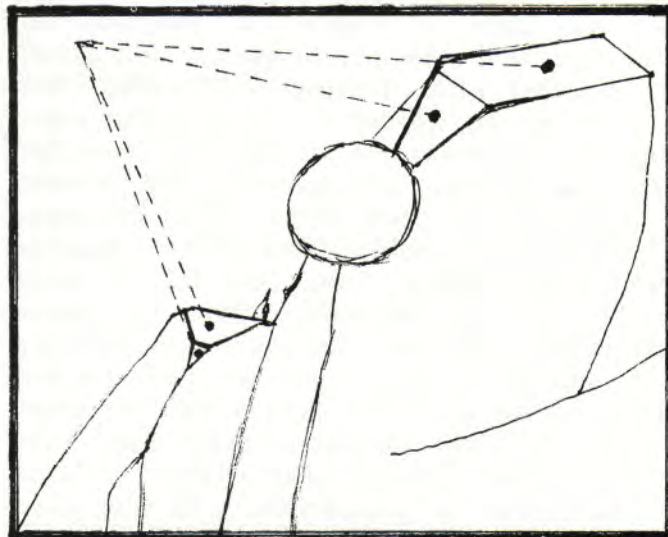
In addition, the equilibrium relations which favor the formation of leucophoenicite or jerrygibbsite rather than manganese humites remain unknown. Similarly, the effects of zinc on the phase relations for the Mn-humites

remain unstudied, and very little is known of the partitioning of cations among the co-existing Mn-humites.

EDITOR'S COMMENTS:

What you have just read may be better described as a condensation than as an abstract. There was so much good information, that it seemed unfair not to give it adequate treatment. The extensive reference list has been omitted due to space limitations.

Below you will find a tracing of an enlargement of the magnesian sonolite twins shown in Fig.2. Lines, made of dashes, point to the terminal and triangular faces (marked with a dot) which seem to be useful visual discriminants for this monoclinic species as it occurs at Sterling Hill.



We are indebted to Dr. Pete J. Dunn for the photomicrographs used in Figures 1 and 2, and also for his bringing the above visual discriminants to our attention. The next issue of The Picking Table will deal further with the manganese humites. If any of our readers have methods of their own for identifying these species, and want to share that information with the membership, then please send your comments to the Editor.

OSD

IN MEMORIAM

MICHAEL PETRO (1916-1985)

Michael Petro died of leukemia on the last day of 1985, at the age of 69. Mike's home at 224 Rutherford Avenue in Franklin, with its sign "Minerals for Sale," had long been a landmark for collectors. There, and at his earlier home several blocks north, he had been a source of local minerals for over thirty years. Rockhounds who frequented the Buckwheat Dump before the establishment of the Franklin Mineral Museum will remember Mike selling collecting permits, and offering specimens from the trunk of his car. Especially during the decade after the closing of the Franklin mine in 1954, Mike's cellar was a major conduit for miners' collections, and many FOMS members cut their collecting teeth on Mike's wares.

Mike was born in Franklin on February 12, 1916, the first son of Hungarian immigrants who married after coming to Franklin. His father, Michael, worked in the Franklin mine, dying of tuberculosis in his forties. Mike followed his father underground, and worked 23 years for the New Jersey Zinc Company. A drill runner at Franklin, Mike tried the Sterling Mine after Franklin closed, but left to work for Plastoid, in Hamburg, where he stayed until retirement age. He loved the Franklin mine, and would often speak of the eagerness with which he and other miners went to work. The Sterling Mine was not so attractive; Mike and many other Franklin miners found it cramped and dangerous in comparison. To him even the ores from the two mines had different personalities: Franklin ore was pretty and easy to handle; Sterling ore was drab, sharp-edged, and risky to work with.

Family and church were Mike's other great interests. He and his wife, the former Ina Robbins, had two children, Betty and Michael, as well as a daughter, Miriam, from Ina's previous marriage. Ina remembers with pleasure family rockhounding expeditions to Black Mountain, N.H., and Herkimer, N.Y. Mike was also a Sunday School teacher, elder, and treasurer of the now defunct Hungarian Presbyterian Church on Evans Street.

Mike is survived by his wife, who graciously provided much of this information; by three

children, one granddaughter and two great-granddaughters; a brother, a sister, and a half-sister. His passing is a reminder that most of the remaining Franklin mine veterans are now in their seventies, and that with the death of each, more portions of an unrecorded world vanish forever. Mike was, in addition to a source of minerals and hospitality, a rich store of Franklin knowledge and lore: mining techniques, mineral locations, mine personalities and anecdotes, and the whole texture of life underground. His death diminishes our heritage, and is another sign of the passing of an era.

RCB



ERRATA (Continued from Inside Front Cover)

Page 11 should have been page 12 as it begins the "Research Reports" category

Page 14, column 1, paragraph 3, line 2, second word should be "coarse-grained", not "course-grained"

Page 15, column 1, paragraph 3, line 3, last word should be "coarse-grain", not "course grain"

Page 15, column 1, paragraph 3, line 13, second word should be "unfortunately", not "unfortunely"

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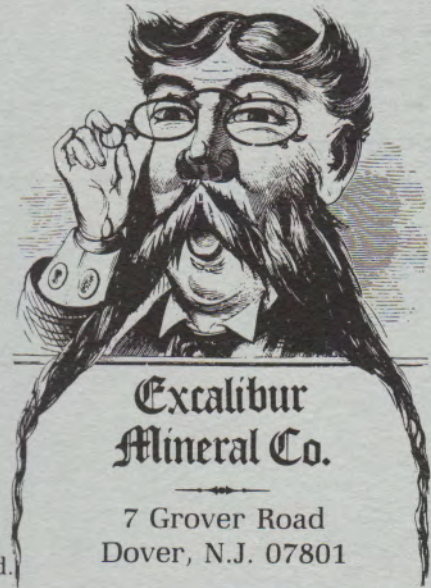
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