



FRANKLIN, FLUORESCENT MINERAL CAPITAL OF THE WORLD

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by
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Tell people that Franklin, New Jersey is noted throughout the world for its myriad fluorescent minerals and your reward is likely to be a blank stare. Tell them that Franklin, along with neighboring Ogdensburg, is the home of a truly unique metal deposit and boredom sets in for sure. But take them for a walk on a dark night across the waste rock dumps atop this ore deposit and they begin to act strangely. Like children in a candy shop, they're intrigued, captivated by the multi-hued colors of these chameleon rocks. Drab-looking by daylight, they burst into color under ultraviolet light. Among the brilliant reds and greens, an occasional rock will flash a bright yellow, or a soft brown, or lush purple, or fiery orange. And if you're really lucky, a rock will respond with patches of three or four colors, calcite, willemite, hardystonite, and clinohedrite competing for your attention. Willemite will even fluoresce with an ethereal glow in sunlight.

Although the night walk gets people's attention instantly, they still find it hard to accept that such an intriguing occurrence takes place in New Jersey, not in some far-away exotic land. To most of us New Jersey conjures up fog-bound turnpikes and speeding cars, gambling casinos and neon lights, oil refineries and endless rows of factories with their clogged parking

Massive wollastonite separated from calcite by a band of feldspar. Rarity and beauty are combined in this showpiece from "The Fluorescent Mineral Capital of the World."

lots. In the hustle and bustle of their daily lives, people tend to forget New Jersey's natural endowments: the rich farmlands of the south, the rolling forest and grazing lands of the northwest, the manicured lawns and rich green golf courses of its suburbs, and the unique zinc-manganese-iron deposits of Franklin and Sterling Hill. Maybe for two or three weeks of the summer people forego the turmoil and cavort on ocean beaches or bask in the glory of a sun-dappled lake. But to accept the existence in New Jersey of one of the world's mineralogical wonders tests their credulity.

Yet they are intrigued by those glowing rocks. They want to know how they got there and why we dig them. What they learn is a story even more incredible than the glowing colors.

Franklin and Ogdensburg (Sterling Hill mine) are neighboring towns nestled in the rolling hills of northwest New Jersey. Each is situated next to a zinc-iron-manganese ore deposit the likes of which exist nowhere else in the world. Scientists still argue over whether these two deposits are one — now separated by natural forces — or two which developed under similar conditions over a billion years ago. For convenience I normally think of them as one.

Veins of green fluorescing willemite, Zn_2SiO_4 , in red fluorescing calcite, $CaCO_3$. Numberless vivid and intriguing patterns of these two minerals have been found throughout the ores at Franklin and Sterling Hill.

The deposit has yielded close to 300 different minerals, a number vastly greater than from any other known source in the world. More amazing, nearly 60 of these minerals exhibit luminescence, in the form of almost instantaneous fluorescence or as days long persistent phosphorescence.

The luminescence of many Franklin species explains the strange behavior noted among miners and mineral collectors over the years. It is reliably reported, for instance, that in the 1940s, as miners watched the broken ore coming into the mill, it was not unusual for one of them to grab a chunk and dash off to the nearest dark telephone booth where fluorescent response might be evoked with a hand-held lamp. Decades earlier, workers might have been observed swinging a flashing, smoking, noisy machine over a jiggling table covered with a watery flow of crushed ore. Their jobs were to monitor the separation of ore from waste rock as the table vibrated throwing the tailings aside. Their machine was an iron spark gap which incidentally emitted weak ultraviolet.

This early application of ultraviolet radiation was successful because the main waste rock of the deposit is calcite rich in manganese which causes it to fluoresce a

Fibrous radiating aggregates of wollastonite against a background of fluorescent calcite. This form of wollastonite appears to be restricted to Franklin.



bright red. Also, one of the major zinc ores, willemite, fluoresces bright green, activated by its manganese content.

Novice visitors may still observe strange doings at Franklin or Sterling Hill. I recall my own first visit to the famous Buckwheat Dump in Franklin. I was startled to see a rumped, hunching dome of blanket being propelled by some unseen force over the dump. It paused and the sound of hammering started. The hammering stopped and the blanket moved on. The "force" turned out to be a collector with his ultraviolet lamp and hammer seeking fluorescent riches cast aside by earlier mining! Night collecting is a common sight here. Collectors look like large violet-hued fireflies as they hover over the rock piles which are being depleted rapidly of fluorescent minerals by this collecting process.

The vast variety of Franklin mineral species suggests that within these ore bodies will be found further evidence of their uniqueness. Frondel (1972), as an example, pointed out that the pyroxenes amphiboles, and micas (all particularly difficult to identify anyway) associated with these zinc ores contain unusually high amounts of manganese and zinc, while the feldspars are rich in barium and lead. That old bug-a-boo of "what constitutes a variety" owes much of its confusion to such complexities.

Composition of the Zinc Ores

The Franklin and Sterling Hill deposit comprises three primary ores: franklinite ($Zn, Mn^{+2}, Fe^{+2}(Fe^{+3}, Mn^{+3})_2O_4$); willemite (Zn_2SiO_4); and zincite (Zn, Mn)O. These are interspersed in a ubiquitous matrix of calcite ($CaCO_3$) that itself fluoresces a beautiful red. Willemite, first reported from Franklin in 1824, does occur as a minor ore elsewhere. But franklinite, identified in 1820, and zincite, in 1810, are found nowhere else on earth except in trace amounts. Combining with these three primary ores are numerous other zinc, manganese, and iron silicates and

oxides as well as many trace elements. Together they form endless complex species and varieties.

Exactly how many minerals occur here is an open, controversial subject. The October 1980 program for the 24th Annual Franklin-Sterling Mineral Exhibit (sponsored by the Kiwanis Club of Franklin) listed 281 names, about five of which still appear in doubt. But surely there will be others not yet announced to take their place. In fact, just as we go to press Pete J. Dunn of the Smithsonian Institute announced the most recent find, sterlinghillite. So rare that but a single specimen has been located, the mineral is a hydrated manganese arsenate. It was found in 0.1 mm clusters of micron-sized crystals, requiring the powerful analytical capabilities of an electron probe for the unambiguous characterization that results in acceptance by the International Mineralogical Association.

At the rate new minerals are being discovered in this mineralogical soup, the total may one day hit 300 species and varieties. But because of the persistent arguments about just what constitutes a variety, we'll let you count for yourself (Table 1).

The exceptionally large number of mineral species identified at Franklin/Sterling Hill should be credited to the diligence of scientific investigators who are constantly dismembering anything unusual, wherever discovered. Extensive crystallographic work on Franklin minerals was started by Charles Palache, professor of Mineralogy at Harvard University. In 1904 he began collecting minerals from Franklin and over the next 30 years systematically studied them. His research culminated in a comprehensive book published by the U.S. Geological Survey in 1935 as Professional Paper 180, "The Minerals of Franklin and Sterling Hill, Sussex County, New Jersey." According to Prof. Clifford Frondel, who succeeded Palache at Harvard, "Palache was a connoisseur of minerals. He could evaluate a specimen as

representative of a locality or type of occurrence; he knew the subtleties of crystal habit, color, association and size that distinguish a fine specimen from a good one; he was a keen judge of the factors that determine the aesthetic and scientific values and, of course, he was master at that virtually lost art, sight identification." Since Palache's death in 1954, dozens of other investigators, professional as well as amateurs, have taken up the torch in the ongoing search for new minerals.

Most of the current work on new minerals is from old specimens. The reason is that the Franklin mine was closed in 1954 and mining is on the wane at Sterling Hill, productivity probably limited to less than a decade hence.

Yet, as mining activity wanes, research activity waxes strong. One noted observer has pointed out, for example, that "of 24 species unique to the area, nine have been found in the last six years, six of the nine in the last three years." Indeed, a number of these species have been named in honor of some of the many amateur mineral collectors who have fallen in love with the place and whose impact on the study of Franklin and Sterling Hill has been considerable. Recently discovered species named after contributing amateurs are: hauckite after Richard Hauck, diligent collector and student of the deposit; kolicite after John Kolic, Sterling Hill miner and collector; gerstmannite after Ewald Gerstmann, who assembled the noteworthy mineral collection now administered by SPEX Industries; kraisslite after Dr. and Mrs. Fred Kraissl, whose studies and financial support at Franklin have been instrumental in preserving this mineral wealth; and marsturite after Marion Stuart, a strong supporter of educational and research projects.

History of the Mines

The extensive literature on the deposit, over 600 titles so far, does not reveal when prospecting first occurred in this region.

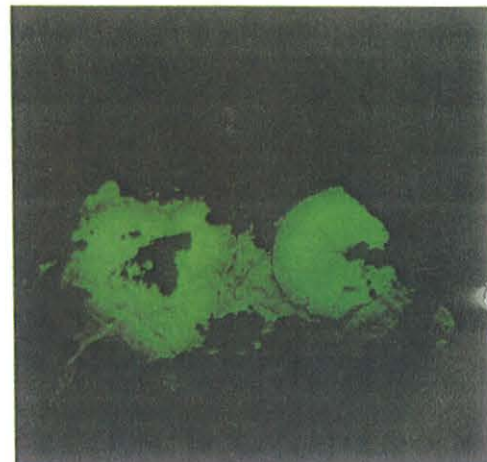
Radiating crystals of willemite from Franklin. These specimens are prized for their persistent phosphorescence, which is highly visible for 30 minutes or more, and has been visually detected as much as several hundred hours later.



Unusually well-defined rosettes of fibrous white willemite. The characteristic radiating structure can be seen clearly in this daylight photograph.



The Franklin radiating willemite at left phosphorescing after removal of 254 nm ultraviolet excitation. The exact causes of this long-lived phosphorescence are unknown.



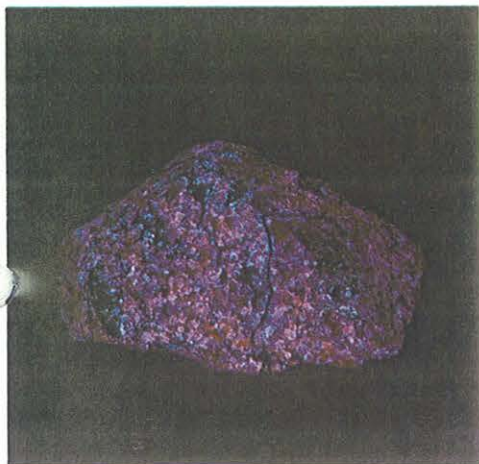
Both ore bodies outcrop distinctively so they should have been discovered early. Yet there is no evidence the Indians mined the area. For that matter there is no evidence of who dug those first pits though speculation favors aboriginal mining of some sort. Dendrochronology, the study of annual and seasonal tree ring growth, suggests the earliest known mining pits at this zinc occurrence are older than 1739. It has long been assumed that these pits were dug by Dutch or Huguenot prospectors known to have been in the area 100 years earlier. It is also assumed these early prospectors mistakenly thought the red oxide of zinc, zincite, was the red oxide of copper, cuprite. An early reference to the area mentions a "copper mine tract."

Unsuccessful copper mining, if it actually occurred, was followed after the Revolutionary War by iron mining and smelting of nearby magnetite iron deposits. Some of these magnetite ores are adjacent to the zinc ores. Efforts to introduce the black franklinite ores (which contain iron, zinc and manganese) into the iron smelters did nothing but foul them as the then unidentified franklinite was too refractory, requiring greater heat than and different smelting procedures from those then available.

Much interest in the ores brought about significant events in the first quarter of the 19th century. Zincite was identified by Dr. Archibald Bruce in 1810. Pierre Berthier did the early chemistry on franklinite in 1819, although its complete metallurgy was not understood until 1880. Willemite was identified by Vanuxem, Lardner and Keating in 1824.

By 1830 Dr. Samuel Fowler had extracted brilliant, white zinc oxide pigment from the zincite which, for the next 100 years, became an essential ingredient in house paint. Fowler also was responsible, in 1838, for the standardization of brass weights and measures for customs houses, zinc for the brass coming from Franklin.

Sphalerite, ZnS, a very rich piece with orange fluorescence due to Mn, and blue fluorescence activated by Ag. This iron-free variety of sphalerite, colorless in daylight, is called "cleiophane," and fluoresces better under 366 nm ultraviolet.



We can only wish the Franklin Mineral Museum could obtain one of these historically important sets. There had been some early mining of hemimorphite at Sterling Hill for brass making, after large pure masses of this secondary zinc silicate were found at the surface. Serious mining followed the successful smelting practices developed in 1852.

As the ores were identified and methods worked out for their extraction and reduction, intensive mining began. Legal complications in mining leases then arose, for the zinc ores were considered separate from the iron ores. After much litigation during the last half of the 19th century, the New Jersey Zinc Company emerged in consolidated form to control both Franklin and Sterling Hill by the century's end.

A Brief Look at the Geology

One look at the accompanying geologic map and you can see that — as is said of the Grand Canyon — something must have happened here. It is heavily faulted (faults are major cracks in the earth's crust) and the rock types shown on the map fall into two categories, metamorphic and sedimentary.

Sedimentary rocks are primarily those formed through deposition of rock particles by water and wind as well as chemical precipitation and sedimentation of both inorganic and organic substances. When first formed they tend to be horizontally bedded since they are deposited on ocean floors (limestones), along shorelines (sandstones and conglomerates), and in lakes and lagoons as well as on continental shelves (limestones and shales).

Metamorphic rocks are the remnants of earlier-formed rocks which have been mangled by crustal action. Heat and pressure of unbelievable force cause these older rocks to be recrystallized, bent, warped, folded, and otherwise changed without melting. The metamorphic group

Here sphalerite is seen with fluorescent willemite and calcite. The fascinating balance of fluorescent colors is achieved by simultaneous exposure to both 254 and 366 nm ultraviolet. The specimen is from Sterling Hill.



of rocks at Franklin and Sterling Hill includes the gneisses (dark banded rocks) and marbles (more or less white carbonate rocks that were once limestone). On the map you will note that the companion ore bodies at Franklin and Sterling Hill are enclosed in Franklin Marble so they have been through the intense heat and pressure of metamorphic action. So have the adjacent Cork Hill Gneiss and Median Gneiss. The Hardyston Quartzite and Kittatinny Limestone, on the other hand, have undergone less harsh treatment. It has been only subjected to what is termed low grade regional metamorphism, which has altered the original structure and chemical constituents only slightly.

The metamorphic rocks containing the ore bodies have been much more victimized by Mother Nature during her more violent fits. Such treatment is commonly termed intense metamorphism. What the accompanying map does not show is that geologic upheavals have been so fierce that older rock formations are found sitting atop younger ones. In a real sense, these rocks have been flipped over like an upside-down cake. Coupled with the faulting and sedimentation, this violence has been responsible for creating the unique ore bodies as we find them today.

Much discussion involves whether the two ore bodies are geologically related. Though they are not exactly alike, it seems difficult to argue that two such bodies could form so close to each other, just over two miles apart, and yet be distinct and separate. It is much easier to postulate that they were once a single mass now separated by a later event. But, though most students of the region lean toward the single deposit concept, there is hard evidence to the contrary. The positions of the ore bodies in relation to the surrounding rock types raises doubt. Their shapes do not seem to be in accord with the theory of a single deposit either.

Be that as it may, most recent writings favor the idea that this was at one time a

Hardystonite, a calcium zinc silicate found only at Franklin, fluoresces strong violet-blue under both 254 and 366 nm ultraviolet. The red fluorescence is due to Franklin's ubiquitous Mn-activated calcite.



single ore body, or at the very least, two simultaneously formed ore bodies, the result of a distinctive set of geological circumstances.

What happened has been the subject of several theories. Back in 1922 Ries and Bowen had their say and later (1935) Palache added his ideas to the historical guessing game.

Rooted in these earlier works, and aided by new evidence and new finds, recently published theories include: Frondel (1972), Frondel and Baum (1974), Cummings (1979), and Squiller and Sclar (1980). No one theory has been developed to explain completely both ore bodies and all the observed evidence. Each theory does have much to commend it to the serious student.

Clifford Frondel is Professor of Mineralogy at Harvard University. John Baum is a retired New Jersey Zinc Company geologist presently serving as curator of the Franklin Mineral Museum. Both have long been involved in Franklin and Sterling Hill research.

It is speculated that during the first 200 million years of the deposit, beginning over a billion years ago, sediments accumulated in a long down-dipping vast trough extending along what is now the East Coast of the United States. Submarine hot springs and lavas contributed to these sediments, and bedded accumulations of zinc, manganese, and iron were eventually enclosed in the carbonate-rich formations. This deposition was followed by a period of regional metamorphism during which the major ore minerals were formed, including franklinite, willemite, and zincite, plus the nearby magnetite beds mentioned earlier. Later, earthquakes elevated the entire area which erosion eventually leveled once more. It is proposed that several such cycles of submergence-emergence-erosion-deposition occurred from about 500 million to

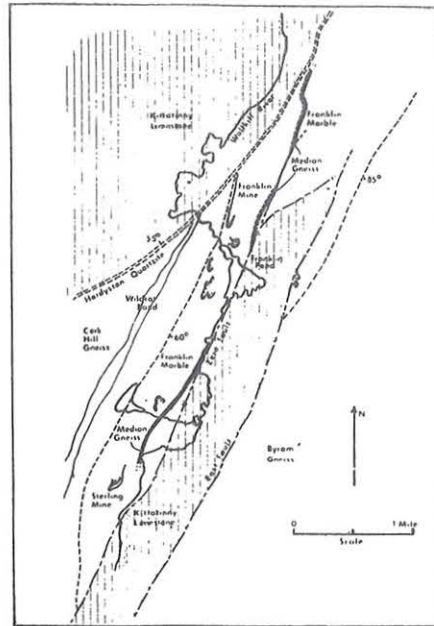


Fig. 1, Sketch map of the Franklin-Sterling Hill area. Based on a map of A.W. Pinger (1950). After Frondel/Baum (1974) *Economic Geology*, Vol. 69, #2, p. 159.

100 million years ago. Faulting allowed the introduction of new material and removal of some old. The new material was, in part, derived from nearby volcanism and related hot springs. Finally, during the last geologic era, the deposits were exposed to erosion, including glaciation, which probably removed the intervening ores and exposed the ends of the enclosed synclinal fold, leaving two separate ore bodies at Franklin and Sterling Hill.

Warren Cummings, a geologist with the New Jersey Department of Transportation, expressed his particular interest in Franklin and Sterling Hill in a 1979 article in *The Picking Table*, an ambitious bulletin of the Franklin-Ogdensburg Mineral Society. He suggests that the deposits were first formed 1200 to 1500 million years ago in a geosyncline (an

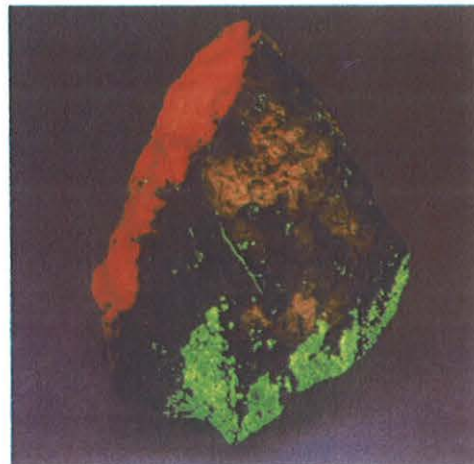
extensive down-warped area of the crust) located along a plate tectonic boundary. Primary materials were normal sedimentary base-metal deposits including iron oxides, apatite, manganese and zinc minerals. These were laid down near active volcanism and hot springs with related hydrothermal activity. Cummings believes the early ores consisted of various minerals, silica, clay, and minor trace elements, all of which contributed to the final assemblage. Sulfur (which should be present if the original ores were normal sulfides) was removed from the protore (first ore) by two distinct and unique events, the exposure and subsidence of the ores which effectively removed the sulfur and oxidized the ores. Later hydrothermal activity and regional metamorphism acted on the remaining deposits and, along with other normal geological processes such as weathering, completed the mineral sequence to create what we find today.

Samuel Squiller of McClellan Air Force Base Central Laboratory, and Charles Sclar of the Department of Geological Sciences, Lehigh University, jointly presented their theory on the Sterling Hill deposit in a paper to the Fifth Quadrennial International Association of the Genesis of Ore Deposits (1980). They think their studies are particularly significant in explaining the Franklin ore body. They describe Sterling Hill as a Pre-cambrian (earth time older than 600 million years) folded and metamorphosed stratiform (layered) deposit of oxides and silicates, the ore being high-rank metamorphic zinc ore (the term high-rank indicated a certain high level of pressure and heat). The deposit started out as a dolomitic mud rich in zinc, manganese, and iron along with silica gel. Metamorphism dedolomitized the mud, forming calcite and the oxides, franklinite and zincite. The term dedolomitization involves the presence and later extraction of magnesium, as dolomite is a mineral

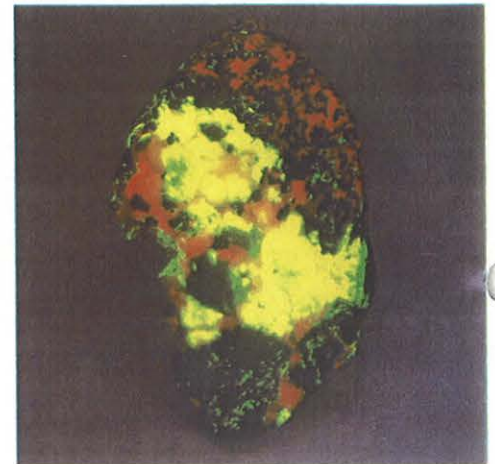
A sugary crust of crystalline clinohedrite, $\text{CaZnSiO}_3(\text{OH})_2$; this mineral is an alteration product of hardystonite, and is often found associated with it, as in this specimen.



Here the rare minerals hardystonite and clinohedrite are bordered by brightly fluorescing willemite and calcite. As many as six fluorescent species are found together at Franklin.



Lemon-yellow fluorescing esperite, $\text{Ca}(\text{Pb})\text{ZnSiO}_4$, contrasted with the rich red fluorescence of calcite. Esperite is unique to Franklin and is among the most intense of all fluorescent minerals.



similar to calcite but containing both calcium and magnesium.

There has been noted a decided lack of graphite in the ore bodies, while the surrounding Franklin Marble suffers no lack. This is an explanation of the dolomitization process. The graphite could have reacted with carbon dioxide to form carbon monoxide which escaped. Action between the already formed zincite and the silica present produced the zinc silicate, willemite. The necessary temperatures for the reactions were produced by metamorphic activity with the zinc present modifying downward the temperature necessary for dolomitization to occur.

Squiller and Sclar carefully studied the franklinite grains and found evidence of the sedimentary nature of the original deposit. They indicate that recent findings concerning gel-like muds from the Red Sea brines support their theory. Zinc could have resulted from hot brines low in sulfides reacting with calcite (common in the oceans) to form zinc-manganese-iron dolomite mixed with silica gel and iron-manganese oxides, all of which yielded what we find at Sterling Hill today.

Clearly these theories have points in common and points of disagreement and new facts may support one of these or yet other theories.

Franklin's Unique Fluorescents

All the unique features identified at Franklin and Sterling Hill it is the minerals' fluorescence that appeals most to the amateur collector. Aside from the ubiquitous manganous calcite with its rich red response and the equally brilliant green response of willemite to short wave radiation, a multi-chromatic rainbow of colors can be evoked from the ore. Spectacular pieces generate as many as six colors, best seen under short wave radiation (2537A) though long wave radiation (3660A) is effective with certain

A white-fluorescing vein of barite, BaSO_4 , in calcite. Fluorescent barite of this shade and brilliance is unusual; thus associated with calcite, it is singularly beautiful, and characteristic of Franklin.

of the species. The long wave radiation lamp is particularly helpful in singling out the fine red fluorescent ruby corundum in the surrounding limestone. Also found in this environment is yellow fluorescing uvite, a species of tourmaline. An excellent suite of both these limestone environment minerals is in the Gerstmann Museum while the Franklin Mineral Museum sponsored by the Kiwanis Club of Franklin, houses the most spectacular fluorescent display. Together, these represent the very finest of public displays from these mines.

Only very limited studies have been conducted on the fluorescent ores. A marvelous opportunity exists for an enterprising student who wishes to delve into a rewarding subject. Fruitful results in correlating the activators and co-activators with the colors and degrees of fluorescence are virtually guaranteed since this aspect of Franklin mineralogy has been largely ignored. Trace-element analysis identifying fluorescent activators could very well provide further valuable clues to the paragenesis of these ores and the origin of the ore bodies. Possible activators present in Franklin are manganese, silver, copper, lead and perhaps uranium. Present indications are that, as the manganese content of the calcite rises to between three and five percent, the fluorescence intensifies. As it approaches 17 percent the fluorescence gradually grades off to nil. Green fluorescing willemite also needs manganese as an activator; synthetically prepared willemite, free of manganese, ignores the ultraviolet lamp.

Though there are nearly 60 reported fluorescent mineral species found at Franklin and Sterling Hill, it must be noted that a few are rare while others are abundant. This always creates confusion and can be misleading when a list is prepared. Occasionally luminescence is so weak as to barely be noted. Correct identification of a species may also be a

The orange fluorescing mineral is "typical" Franklin svabite, $\text{Ca}_6(\text{AsO}_4)_3\text{F}$, in calcite. Several species in the apatite group occur in solid solution at Franklin; they may fluoresce the same due to Mn activation, but nothing on the subject has been published.

problem. Often, reported responses are wrong because the original mineral identification was wrong.

But anyone visiting the remains in the dumps of Franklin or Sterling Hill now should not expect to find too many examples of fluorescent minerals. My first night walk at Franklin was at the Buckwheat Dump and it was a riot of color. Later the now defunct Parker Dump lit up like a Christmas tree for me. By now, however, Buckwheat has been so heavily collected you have to look elsewhere for a rewarding night walk. Probably the best source of assorted self-collected minerals today is the fee-collecting Trotter Dump. Long a part of Zinc Company property, it is now privately owned and can be visited with occasional spectacular results!

Current investigations of the Franklin ores are concentrated in three fields. The reexamining of old collections and earlier work to track down misinterpretations and overlooked species; close scrutiny of any new material mined; and careful examination of material found by the continuous overturning and prospecting of dumps. Amateur collectors highly skilled in recognizing the unusual or unexplained form a veritable army of on-the-spot eyes. Largely self-taught, they constitute a formidable support group for professionals, several of whom maintain sensitive feelers to Franklin from whatever seats of learning they occupy. The specimen in question is soon subjected to complete instrumental investigative and confirmatory procedures.

Some evidence of the work of amateurs can be found in "The Picking Table" which neatly fills the gap between the amateur and professional literature. It deals exclusively with Franklin and Sterling Hill and related knowledge and ranks as one of the finest examples of club-type bulletin activities. Supervising the Buckwheat Dump as well as the Franklin Mineral Museum, Kiwanis also

Solid radiating margarosanite, $\text{Ca}_2\text{PbSi}_3\text{O}_8$, from the SPEX-Gerstmann Collection. Perhaps the best Franklin example of this rare, bright blue fluorescing mineral.



houses a fine mine replica and otherwise lends support to Franklin projects.

The SPEX-Gerstmann collection is the most complete private collection of Franklin and Sterling Hill minerals and displays thousands of specimens arranged according to the Dana System; i.e. each chemical group of minerals (such as oxides) is shown together. Superb suites of willemite, franklinite, uvite, pyrite, and a host of other species can be examined here. Many famous old specimens which had long been dispersed have been gathered into this collection which now includes as highlights pieces from the Brush, Ball, Cahn, Gage, Holmes, Lang, McGovern, Roebling, and Stanton collections.

By initiating discovery of new minerals and providing a place for the housing and preservation of existing collections, the SPEX-Gerstmann and Franklin Museums perform a significant service to science and the community.

The recent acquisition of the John McDonald collection by the Smithsonian is another example of worthwhile preservation. This collection contains some 3600 specimens including a particularly important suite of the mineral sarkinite. Further study of these materials will surely prove fruitful.

The "book" on Franklin and Sterling Hill is clearly incomplete. Research on fluorescent minerals goes begging. Theories on the origin of the companion deposits are vitally alive and ever-changing. Mineralogical research is always overwhelmed with more work than there are trained hands to do it. Fortunately, research on these related deposits surges full speed ahead. Paul Moore at the University of Chicago is particularly interested in the crystal chemistry of the lead silicates in the calcisilicate bodies. Recent literature abounds with results of ongoing research at the Smithsonian Institution. Franklin Museum curator John Baum is

Another rich margarosanite specimen, its radiating structure highlighted by mixed red and blue fluorescence. The causes of the different fluorescent colors are unknown.



vigorously active at the local level and many others are working at their specialties. A billion years of Franklin's geologic history make for exciting times for present-day scientists and amateurs alike.

The next time you are stuck in turnpike traffic or have had it with the moribund world, head for the rolling hills of northwest New Jersey and revel in the history and beauty of America's unique zinc mines and minerals.

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Here margarosanite is displayed with clinohedrite, willemite, and a dull red fluorescing feldspar. This specimen is typical of Franklin for its balance of fluorescent colors and rare mineral species.



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The Picking Table, published semi-annually by the Franklin-Ogdensburg Mineral Society.

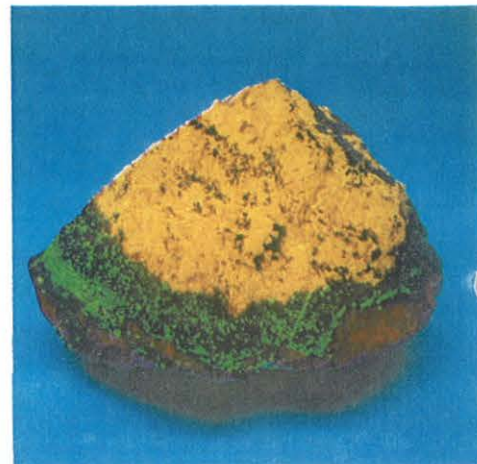
FIRSTS FROM FRANKLIN

- More mineral species have been recorded than from any place in the world.
- At least 20 minerals occur nowhere else.
- Franklin Boasts the world's most spectacular fluorescent minerals, as well as the largest recorded number from one location.
- The largest known crystal of franklinite (about 17 cm on edge) is a specimen now at the Smithsonian Institution.
- Among the largest mineral unit cells known are those of kraisslite, unique Franklin.
- Almost 10% of all minerals found on earth occur at Franklin.

ABOUT THE PHOTOGRAPHS:

The specimens were photographed under ultraviolet light by Henry Van Lenten of Wayne, N.J. Unless mentioned otherwise, 254 nm or "short wave" ultraviolet lamps were employed. These specimens are from the SPEX-Gerstmann Collection as well as the collections of Dr. Warren Miller and Richard Bostwick.

A pyramid of solid orange-fluorescing wollastonite, CaSiO₃, with a base of willemite and calcite. Rare at Franklin and common elsewhere, this mineral is noted here for its fluorescent brilliance, variety of forms, and unusual associations.



MINERAL SPECIES OF FRANKLIN AND STERLING HILL, NEW JERSEY

The following list is based on one edited by John Baum for the 24th Annual Franklin/Sterling Exhibit. Fluorescent minerals are marked (fl) are best seen under short wave ultraviolet radiation and (fl*) is best under long wave. Mineral names in italics are unique to the deposit.

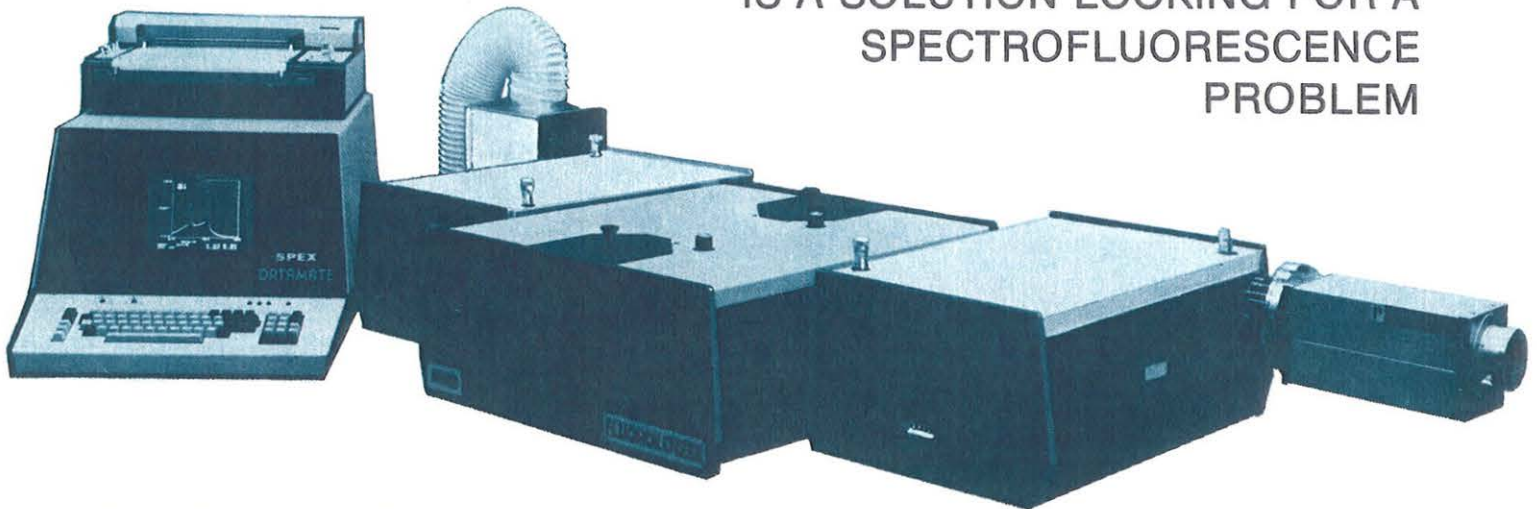
acanthite	chalcopyrite	groutite	manganite	sarkinite
acmite	<i>chlorophoenicite</i>	grovesite	manganosite	sauconite
actinolite	chondrodite - fl	guerinite	manganpyrosmalite	scapolite - fl
adamite	chrysocolla	gypsum - fl	marcasite	<i>schallerite</i>
adelite	chrysotile		margarite - fl	scheelite - fl
akrochordite	chlinochlore	halloysite	margarosanite - fl	scorodite
albite - fl	clinochrysotile	<i>hancockite</i>	<i>marsturite</i>	sepiolite
allactite	clinohedrite - fl	<i>hardystonite</i> - fl	<i>mcgovernite</i>	serpierite
allanite	clinozoisite	hastingsite	melanterite	siderite
alleganyite	conichalcite	hauckite	microcline - fl	sillimanite
almandine	copper	hausmannite	millerite	silver
analcime	corundum - fl*	hawleyite	mimetite - fl	skutterudite
anatase	covellite	hedenbergite	molybdenite	smithsonite
andradite	cryptomelane	hedyphane - fl*	<i>mooreite</i>	sonolite
anglesite	cummingtonite	hematite	monohydrocalcite - fl	spessartine
anhydrite	cuprite	hemimorphite - fl*	muscovite	sphalerite - fl*
annabergite	cuspidine	<i>hendricksite</i>		spinel
anorthite		hetaerolite	nasonite	<i>sterlinghillite</i>
anorthoclase	datolite	heulandite	natrolite - fl	stibnite
anthophyllite	descloisite	hodgkinsonite - fl*	neotocite	stilbite
antigorite	devilline	<i>holdenite</i>	nickeline	stilpnomelane
anophyllite	diopside - fl	hornblende	nontronite	strontianite
arsenite - fl*	djurleite	huebnerite	norbergite - fl	sulfur
arsenic	dolomite	hyalophane - fl		sussexite
arsenolite	dravite	hydrogrossular	orthoclase	svabite - fl
arsenopyrite	dypingite - fl*	hydrohetaerolite	parammelsbergite	synadelphite
augite		hydromica	parasymplesite	talc - fl*
aurichalcite	edenite - fl	hydrotalcite	pargasite	tennantite
austinite	enstatite	hydrozincite - fl	pectolite - fl	tenorite
azurite	epidote		pharmacosiderite	tephroite
	epsomite - fl*	illite	phlogopite - fl	thomsonite - fl
	erythrite	ilmenite	picroparmacolite - fl	thorite
bannisterite	esperite - fl		pimelite	tilasite - fl
barite - fl*	ettringite - fl*	jacobsite	powellite - fl	titanite
barylite - fl	eveite	johannsenite	prehnite - fl	tirodite
barysilite		<i>johnbaumite</i> - fl	psilomelane	todorokite
bassanite	fayalite		pumpellyite	<i>torreyite</i>
<i>baumite</i>	feitknechtite	kaolinite	pyrite	tremolite - fl
bementite	ferroaxinite	kentrolite	pyroaurite	
berthierite	flinkite	<i>kolicite</i>	pyrochroite	uraninite
biotite	fluoborite - fl	koettigite	pyromorphite	uranophane
birnessite	fluorapatite - fl	<i>kraisslite</i>	pyrophyllite	uvarovite
bixbyite	fluorite - fl*	kutnohorite	pyroxmangite	uvite - fl*
bornite	forsterite		pyrrhotite	
brandtite	franklinite	larsenite		vesuvianite
brochantite	friedelite	<i>lawsonbauerite</i>	quartz - fl?	
brookite		lead		willemite - fl
brucite	gageite	legrandite	rammelsbergite	wollastonite - fl
brunsvigite	gahnite	<i>leucophoenicite</i>	realgar	woodruffite
bustamite - fl*	galena	linarite	retzian	wurtzite
	ganomalite	loellingite	rhodochrosite	
cahnite - fl	ganophyllite	<i>loseyite</i>	rhodonite	xonotlite - fl
calcite - fl	gersdorffite		richterite	
carminite	<i>gerstmannite</i>	magnetite	riebeckite	<i>yeatmanite</i>
chrysoberyllite	glaucocroite	<i>magnesium-chloro-</i> <i>phoenicite</i>	roebblingite	
celestite - fl*	goethite	magnesioriebeckite	romeite	zinalsite
celsian	gold	magnussonite	rosasite	zincite - fl*
cerussite - fl*	graphite	malachite	roweite	zircon - fl
chabazite	greenockite	manganaxinite - fl	rutile	zoisite
chalcocite	grossular	manganberzeliite		
chalcophanite				



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