

# THE PICKING TABLE



JOURNAL of the FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY, INC.

SPRING/FALL 1985

VOLUME 26



# F.O.M.S. Notes

## PRESIDENT'S MESSAGE

This is a double Picking Table, combining the Spring and Fall Issues for 1985 as Volume 26, Numbers 1 and 2. With the 1986 Spring Issue (Volume 27, No. 1) The Picking Table will return to its customary semiannual publishing schedule, with a Spring Issue appearing on March 1, and a Fall Issue on September 1.

This current issue marks Omer Dean's assumption of the position of Editor. He will be assisted by other members of the Editorial Board, John L. Baum and myself. Mr. Dean is to be welcomed; his considerable experience, executive ability, and enthusiasm will enable continuation of a journal of which we can all be proud.

The Picking Table actively solicits for publication articles and notes of interest to the Franklin-Sterling Hill mineral collecting community. Submissions should be typed and double-spaced. Inquiries and manuscripts may be addressed to the Editor:

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

The Picking Table exists to inform the FOMS membership about all aspects of Franklin-Sterling Hill--mineralogical, geological, historic, and contemporary. It is intended to reflect the concerns and desires of these members, and cannot function properly without their support and input. Please, let's hear from you.

RCB

## FRANKLIN MINERAL MUSEUM

### A PROGRESS REPORT

The Trustees of the Franklin Mineral Museum have determined to pursue enlargement of the Museum facilities in order to accommodate additional displays of minerals both local and world-wide as well as artifacts relating to the mining history of the Franklin-Sterling area. In addition, larger lecture space is required. A conceptual plan donated by Bernie Kozykowski, architect and Society member, has been accepted and a fund raising campaign is under way. Exxon Corporation has contributed

as have a number of individuals. The target is in excess of a quarter of a million dollars for construction, the difficult part of fund raising because more readily obtainable monies are generally limited by the endowment organizations to educational equipment and programs.

People who have donated to the Museum in the past have been able to see just how well their gifts have been used and no one who works for the Museum has done so without sacrifice. The lecture hall will be located at the rear of the lobby which will be enlarged by relocation of the restrooms to the front of the building. Kraissl Hall, the passage to the mine replica and the exterior area between the lobby and the replica building will become two exhibit halls under the proposed plan. Enlargement of the present exhibition hall is made possible by moving the office and furnace rooms to the rear of the building adjacent to the new lecture hall. All public rooms will be on the same level. Programs are proposed which will acquaint visitors with various aspects of the earth sciences. Negotiations are currently underway with the Borough for acquisition of the Buckwheat Dump and the requisite zoning changes to permit the planned development.

JLB

## ABOUT THE COVER PHOTOGRAPH

### The Picking Table at Franklin

Ore from the shaft skips was dropped into a bin and passed through a revolving screen under a water spray to remove anything under three inches. The remainder passed in review on the revolving picking table on its way to the coarse crusher. Older mill men pulled off tramp steel and wood from the mining operation, and on occasion, waste rock. The picking table represented heaven to mineral collectors. There was an iron-spark lamp in a booth in one corner for testing fluorescence but little time to use it. A lost hammer-head missed on the table could shut down the entire coarse crushing operation.

JLB



# The PICKING TABLE

Journal of the Franklin-Ogdensburg  
Mineralogical Society, Incorporated



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# A DAY IN THE STERLING MINE

BY  
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There is a mine nestled among the hills of North Jersey. Men have walked its deep-buried passageways for 135 years. This mine is an interesting and unique locale, with contrasts ranging from the sublime to the ridiculous. Come along and spend a day in this, the Sterling Mine.

It's 6:45 in the morning and we've already donned our work clothes and are heading for a hole in the side of the hill. This is the entrance to the adit, a horizontal tunnel that intercepts the main shaft deep inside Sterling Hill. As we enter the adit, the mine smell rises up to greet us; it's made up of odors of wet wood, old blast fumes, and rusty wet steel. The passageway is damp and is lit by a scattering of light bulbs depending from the ceiling or back. After a hundred-yard walk we come to a brightly lit, warm room where cap lamps and batteries are arrayed in yellow and black rows. The rectangular battery attaches to our wide leather belts and the lamps are fixed to our hard hats. Continuing onwards, the passage opens into a huge chamber hewn from gray to white marble which forms the hill and is, in fact, the matrix for the ore body. The inclined shaft with its boxwork of steel I-beams slants downward into the earth at one end of the adit. Positioned around the room are benches occupied by miners in their dusty, sometimes oily work clothes. For the most part they're talking quietly in small groups, trying to wake up painlessly. Some are drinking steaming coffee from quart thermoses. We pick up our metal number tags and sit on a bench, letting the surrounding conversation wash over us: talk of tons per manshift, bonuses paid, working conditions; talk of working on cars, and whose old lady is cheating and with whom; talk of old timers comparing shift bosses of days gone by.

Just as the clock hits 7:00 a.m., the bosses stride quickly in, deposit their book work in the bosses' shanty, and begin giving the men on their crew the day's instructions. We are told to go to 800 stope, scale loose and roofbolt. The cage, a set of stairs on rails suspended from a cable, is quickly loaded. Men are packed in like sardines. It holds about 40, with 3 men per step. With a rushing clatter, rather like a railroad train, the cage descends into the shaft. It stops, now and



again, at levels spaced about 100 feet apart. We get off at the 430 level, stepping off into a well-lit station, and immediately walk back into the dark tunnels (or drifts in mining parlance), heading for our working place.

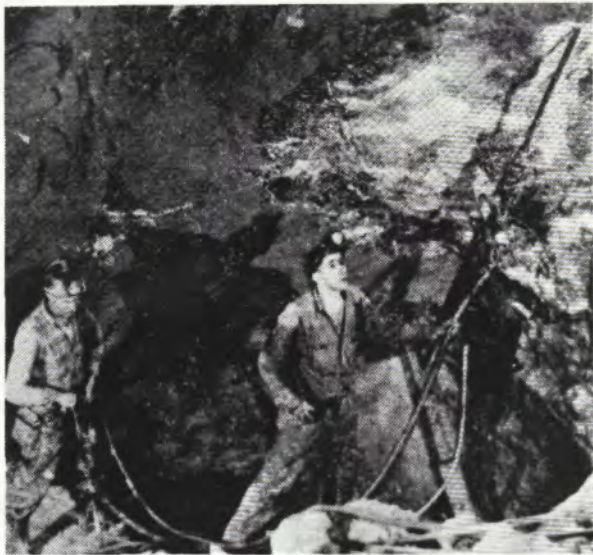
Another pair of miners has gotten off with us. They are Jake and his helper, who drive the drifts through which we walk. The driftsmen sit down and open their thermoses, and Jake launches into the latest sighting of Luke



the Spook, one of Sterling's resident ghosts. We'd like to stay and hear the yarn through, but we've heard the night shift hit willemite crystals and are anxious to see for ourselves. We climb a long set of ladders and enter 800 stope. It is a huge room several hundred feet long and up to 30 feet high, pitch black except for the beams from our cap lamps and is now, before we commence, silent as only the deeps of the earth can be.

We walk south a bit and come to a 20 feet high heap of broken ore: the muck pile. Climbing up the muck, we come to the place where the night shift left off. There is a clutter of drill steels, a tangle of air and water hoses, some 6 foot roofbolts, and the drill. A quick survey tells us that the crystals have all been taken, leaving behind only a scatter of shattered gray prisms.

We get organized and are now ready to begin the day's labors of roofbolting. First the loose chunks of ore and rock must be brought down with pry bars, then a 7 feet long hole drilled and a roofbolt inserted and tightened down with the drill. This secures the back of the stope against a rock fall. We work briskly and are soon sweating.



About 2 hours have passed when suddenly we see a string of lights appear from the level above. It turns out to be the Zinc Company's geologist with about 30 West Point cadets. We stop working so he can be heard over the drill. Part of his patter reaches us..."a completely unique assemblage of ore minerals comprises Sterling's ore body...the minerals found here, literally by the millions of tons, are rare and insignificant

elsewhere...the ore was repeatedly subjected to geological events that mixed and remixed a peculiar set of elements into an unparalleled group of unusual and rare species...the main product of the mine is zinc, but iron and manganese are also produced...the ore, richest known in zinc content, is composed of red or black glassy willemite, blood red ruby zincite, and black franklinite, all accented by snow white calcite." As he talks, the drill has been leaking water, as usual, and has cleaned the ever-present mud from the broken ore and revealed some of the beautiful colors of the ore minerals. The geologist and his flock wander off and we resume work. Soon the bosses come by to check out the situation, talk for a while and depart, leaving sage advice in their wake.

It's about 11:30 and we're scaling a large piece of loose from the back of the stope. We jam the bar into a crack and pry upwards. The crack widens a a two ton block thuds down shaking the muck pile. Scattered up and down the fresh surface are 1½ to 2 inch gray hexagonal willemite crystals—beautiful! The first step though, is to bolt the ground above. Soon after we hide six crystal specimens in a safe spot where passing eyes will not spot them. Then back to work for the short time remaining before lunch.

Here it is: LUNCHTIME! We go down to the level and head back to the station where the Zinc Company has built an eating shanty. A heater keeps the air temperature up into a comfortable range. Frequently one of the guys will put a can of soup on the heater while he works and more than once the can has gotten too hot, gone off like a bomb and sprayed the shanty with chicken and noodles. No exploded cans greet us today and the lunch break passes quietly. Conversation centers around one of the workers who had for the last Fourth of July, set off three sticks of dynamite in a field near town.

Plodding back to the working place afterward, we talk over the mineral riches we may be passing in the drift. It's impossible to tell, because the years of blasting fumes, drilling mist, and trickling waters have formed a sticky, muddy covering over the rocky walls. The reference to riches is not academic, for some mine workers supplement their income selling rocks to the highly competitive mineral collectorzs.

As we arrive in the stope, the roar of the



diesel front-end loader reverberates through the humid atmosphere, as it carries ore from the muck pile and dumps it into a yawning crib. The steel-lined crib conducts it down to the 500 level where it is carted away in a train of ore cars.

After working for another hour, while the loader roars and snorts below us, there is a sudden silence from that end of the working



place. Then comes the wagging of a cap lamp that signals "stop what you are doing". We slither down the pile and find the loader's rear tire to be flat. Bob, the loader operator and soon to be boss, wants help...no wonder, with 25 lug nuts to loosen. Just as the wheel is being removed, we hear a sharp snap followed by a crash, while the stope beneath us trembles. A quick ascent of the pile reveals a 20'x8'x3' slab that has fallen from the hanging wall and crushed our equipment. We look at one another and shrug—what else can you do?

Recovering the usable tools and getting replacements occupies the rest of the shift and three o'clock rolls around quickly. We come out into the lights of the shaft station and see three men at the drinking fountain, filling an 8 inch fill hose with water. The other end is attached to a compressed air outlet. Upon inquiry, we discover that the cageman, who directs the hoist as to which level to take the cage, is feeling frisky today: he's been throwing rags soaked in oily water at people as he whisks by their level. He scored a couple of direct hits. His victims

wait by the shaft with their vengeance weapon til the cage passes, and turn on the air. A 16 foot column of dirty water bursts forth, inundating the surprised cageman as he sweeps past. This was to end his pranks for nearly a week.

The cage soon comes up from below, dripping cageman and all, but it is audible long before its arrival at our station. A far cry from the funereal morning load, the final trip for the day is full of laughing, shouting men, many of whose comments raise a smile, but must remain unprintable. We climb aboard the nearly full cage, move up a step and tuck in: there is no protection from the steel shaft beams as they flash past.

Back in the adit, we straighten up gratefully and unload quickly. Retracing our steps of this morning, we are out of the adit in a trice. Arrgh, that sunlight is blinding. Back down the hill and into the changehouse we go. As we clean up, a couple of men are showing the mineral specimens they picked up today, getting advice on their probable identity and value.

We are soon back in street clothes and out of the door, heading for the car and eager to end the day. By the auto is the curator of the Franklin Mineral Museum and he can't keep the excitement out of his voice. The mineral we took him for identification was a puzzle and he forwarded it to Harvard. Mineralogists there have determined it to be a species new to science. As the story unfolds in the months to come, the baby pink sprays will be named gerstmannite in honor of a well-known local collector. There are ten or eleven known specimens of gerstmannite and a tablespoon would hold all the world's supply of it. Collectors pay young fortunes for a piece.

In any case, it is a pleasant way to end a long day. On the way home, we reflect on the paradoxes of the mine. It is at once a place of bone-grinding weariness and repetitious, sometimes mindless labor, but which on the other hand attracts the highest practitioners of modern science. It's a place where grim dangers are offset by a puckish sense of humor. Sterling Hill is a place of mystery, where living ghost stories are found side-by-side with geological puzzles whose solutions are lost in the mists of Precambrian time.

*The Picking Table, Spring/Fall 1985*



We part, each to his own rituals of rest, for tomorrow, early, we must be ready for another day in the mine.

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#### Editor's Comments

Most of us would like to know more about members who contribute articles to The Picking Table. The following information may help satisfy that need. I would like to thank Dick Bostwick for his help in securing these descriptive notes and Steve Sanford for permitting us to share them with our readers.

Stephen Sanford's fascination with the mines, miners, and minerals of the Franklin area dates from 1968, when a penchant for exploring extinct New Jersey iron mines led him to the Franklin Mineral Museum and a copy of Palache's USGS Professional Paper 180. His interest flowered when, in his words, "it became evident how strange Franklin was."

In subsequent years his education followed two tracks, above and below ground. He studied geology, mineralogy, and paleontology at Rocky Mountain College and the University of Wyoming. He worked first at Idaho's Sunshine Mine, and then at New Jersey's last two operating mines, the Mt. Hope Mine and the Sterling Mine.

During several stints with the New Jersey Zinc Company between 1970 and 1975, he laid the foundations for his two mineral collections. One is a comprehensive assortment of crystal classics and rare species. The other is a unique 60 piece geological collection, which graphically illustrates the many geologic features and processes to be found at Franklin and Sterling Hill.

His other avocations include photography, wargaming, and motorcycling. Steve's article is what Steve refers to as a composite recollection of all his experiences underground at Sterling Hill.

OSD



## HAUCK'S COLLECTIBLES

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## the Mineralogical Record

the bimonthly journal for mineral collectors

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# The Unique List: What it Means

BY  
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Each year the F.O.M.S. publishes, in the brochure for the Franklin-Sterling Hill Mineral Exhibit, a list of minerals found at Franklin and Sterling Hill, and a separate list of those species found only at these deposits; this latter list comprises what we might call the "unique list."

The present list, as shown below, contains thirty-five species, a bit more than 1% of all those known to man, and a bit more than 10% of the total number found at these deposits. We know that they are unique for the moment, but as the years pass, some are added to this "unique" list, and some, having been found elsewhere, are deleted. For example, we have in recent years found additional occurrences of leucophoenicite, larsenite, clinohedrite, and others, and they have been deleted. On the other hand, of the 35 currently listed species, 21 have been described in the last 10 years.

Is there any way to establish whether or not a given species will be permanently or temporarily unique to the Franklin-Sterling Hill area? Yes; it can be predicted, in part, on the basis

of the chemical composition of these minerals. Those species which have parts of their chemical composition in common with the unique geochemical characteristics of the orebodies are most likely to stay on the unique list for quite some time. These characteristics include, in part, the coexistence of manganese and zinc, and the occurrence of this combination with silicon and/or arsenic. Using such compositional characteristics, we can predict that minerals fitting these criteria will be long term "unique-to-the-deposit" species. Such minerals are preceded by an asterisk on the list printed below.

The species not preceded by an asterisk are those which have been found here at Franklin and Sterling Hill for the first time, but which are likely to be found elsewhere as other deposits are investigated.

These arguments are a bit simplified, and it well may be that other species, in particular esperite and minehillite, and possibly hardystonite, will be long term "unique" minerals for Franklin and/or Sterling Hill.

## MINERALS UNIQUE TO FRANKLIN AND STERLING HILL

BAUMITE	$(\text{Mg}, \text{Mn}, \text{Fe}, \text{Zn})_3 (\text{Si}, \text{Al})_2 \text{O}_5 (\text{OH})_4$
BOSTWICKITE	$\text{CaMn}^{3+}_6 \text{Si}_3 \text{O}_{16} \cdot 7\text{H}_2\text{O}$
CHARLESITE	$\text{Ca}_6 (\text{Al}, \text{Si})_2 (\text{SO}_4)_2 [\text{B}(\text{OH})_4] (\text{OH})_{12} \cdot 26\text{H}_2\text{O}$
* CHLOROPHOENICITE	$\text{Mn}_3 \text{Zn}_2 (\text{OH})_6 [\text{As}_{0.5} \text{H}_{0.5} (\text{O}, \text{OH})_3]_2$
ESPERITE	$(\text{Ca}, \text{Pb}) \text{ZnSiO}_4$
* GERSTMANNITE	$(\text{Mg}, \text{Mn})_2 \text{ZnSiO}_4 (\text{OH})_2$



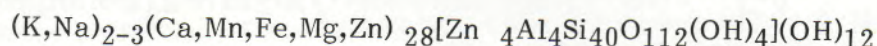
HANCOCKITE	$(\text{Pb}, \text{Ca}, \text{Sr})_2 (\text{Al}, \text{Fe}^{3+})_3 (\text{SiO}_4)_3 (\text{OH})$
HARDYSTONITE	$\text{Ca}_2 \text{ZnSi}_2 \text{O}_7$
* HAUCKITE	$(\text{Mn}, \text{Mg})_{24} \text{Zn}_{18} \text{Fe}^{3+}_3 (\text{SO}_4)_4 (\text{CO}_3)_2 (\text{OH})_{81}$
* HENDRICKSITE	$\text{K} (\text{Zn}, \text{Mg})_3 \text{Si}_3 \text{AlO}_{10} (\text{OH})_2$
* HODGKINSONITE	$\text{Zn}_2 \text{Mn} (\text{SiO}_4) (\text{OH})_2$
* HOLDENITE	$(\text{Mn}, \text{Mg})_6 \text{Zn}_3 (\text{OH})_8 (\text{AsO}_4)_2 (\text{SiO}_4)$
JAROSEWICHITE	$\text{Mn}_2 \text{Mn}^{3+} (\text{AsO}_4) (\text{OH})_6$
JERRYGIBBSITE	$\text{Mn}_9 (\text{SiO}_4)_4 (\text{OH})_2$
JOHNBAUMITE	$\text{Ca}_5 (\text{AsO}_4)_3 (\text{OH})$
KITTATINNYITE	$\text{Ca}_4 \text{Mn}^{3+}_4 \text{Mn}^{2+}_2 \text{Si}_4 \text{O}_{16} (\text{OH})_8 \cdot 18\text{H}_2\text{O}$
* KOLICITE	$\text{Mn}_7 \text{Zn}_4 (\text{AsO}_4)_2 (\text{SiO}_4)_2 (\text{OH})_8$
* KRAISSLITE	$\text{Fe}^{3+}_2 \text{Mg}_4 \text{Mn}_{44} \text{Zn}_6 (\text{AsO}_4)_6 (\text{AsO}_3)_4 (\text{SiO}_4)_{12} (\text{OH})_{36}$
* LAWSONBAUERITE	$(\text{Mn}, \text{Mg})_9 \text{Zn}_4 (\text{SO}_4)_2 (\text{OH})_{22} \cdot 8\text{H}_2\text{O}$
LENNILENAPEITE	$\text{K}_{6-7} (\text{Mg}, \text{Mn}, \text{Zn}, \text{Fe})_{48} (\text{Si}, \text{Al})_{72} (\text{O}, \text{OH})_{216} \cdot 16\text{H}_2\text{O}$
* LOSEYITE	$(\text{Mn}, \text{Mg})_4 \text{Zn}_3 (\text{CO}_3)_2 (\text{OH})_{10}$
* MAGNESIUM-CHLOROPHOENICITE	$(\text{Mg}, \text{Mn})_3 \text{Zn}_2 (\text{OH})_6 [\text{As}_{0.5} \text{H}_{0.5} (\text{O}, \text{OH})_3]_2$
MARSTURITE	$\text{Mn}_3 \text{CaNaHSi}_5 \text{O}_{15}$
* MCGOVERNITE	Complex $\text{Mg}, \text{Mn}, \text{Zn}, \text{Fe}^{3+}$ arsenosilicate
MINEHILLITE	$\text{K}_{2-3} \text{Ca}_{28} [\text{Zn}_4 \text{Al}_4 \text{Si}_{40} \text{O}_{112} (\text{OH})_4] (\text{OH})_{12}$
* MOOREITE	$\text{Mg}_9 \text{Mn}_2 \text{Zn}_4 (\text{SO}_4)_2 (\text{OH})_{26} \cdot 8\text{H}_2\text{O}$
* NELENITE	$\text{Mn}_{16} \text{Si}_{12} \text{O}_{30} (\text{OH})_{14} [\text{As}^{3+}_3 \text{O}_6 (\text{OH})_3]$
OGDENSBURGITE	$\text{Ca}_3 \text{ZnFe}^{3+}_6 (\text{AsO}_4)_5 (\text{OH})_{11} \cdot 5\text{H}_2\text{O}$
RETZIAN - (La)	$\text{Mn}_2 \text{La} (\text{AsO}_4) (\text{OH})_4$
RETZIAN - (Nd)	$\text{Mn}_2 \text{Nd} (\text{AsO}_4) (\text{OH})_4$
* SCHALLERITE	$\text{Mn}_{16} \text{Si}_{12} \text{O}_{30} (\text{OH})_{14} [\text{As}^{3+}_3 \text{O}_6 (\text{OH})_3]$
STERLINGHILLITE	$\text{Mn}_3 (\text{AsO}_4)_2 \cdot 4\text{H}_2\text{O}$
* TORREYITE	$(\text{Mg}, \text{Mn})_9 \text{Zn}_4 (\text{SO}_4)_2 (\text{OH})_{22} \cdot 8\text{H}_2\text{O}$
WALLKILLDELLITE	$\text{Ca}_4 \text{Mn}^{2+}_6 \text{As}^{5+}_4 \text{O}_{16} (\text{OH})_8 \cdot 18\text{H}_2\text{O}$
* YEATMANITE	$[\text{Mn}_5 \text{Sb}_2] [\text{Mn}_2 \text{Zn}_8 \text{Si}_4] \text{O}_{28}$



# Mineral Notes

## New To Science

### MINEHILLITE



*In the Picking Table, Vol. 25, #1, it was indicated that the Franklin area had a mineral new to science, minehillite, per a personal communication from Pete J. Dunn. The paper describing this new species has been published in the American Mineralogist, Vol. 69, pp 1150-1155, and is entitled "Minehillite, a new layer silicate from Franklin, New Jersey, related to reyerite and truscottite." The authors are Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution; Donald R. Peacor, Department of Geological Sciences, University of Michigan; Peter B. Leavens, Department of Geology, University of Delaware; and Frederick J. Wicks, Department of Mineralogy and Geology, Royal Ontario Museum. The following is an abstract of this article.*

The new mineral was encountered during the examination of the lead silicate minerals from Franklin, New Jersey. It appeared similar to margarosanite but differed in its response to ultraviolet radiation. Subsequent examination showed it to be a new species and a member of the reyerite-truscottite-gyrolite group. All of these hydrated Ca-hydroxy-silicates have layered structures, and minehillite represents a new variation on this structure scheme.

The species was named for Mine Hill, in Franklin,

Sussex County, New Jersey. The Franklin deposit cropped out on Mine Hill and the mines that were later consolidated as the Franklin Mine were developed beneath Mine Hill. The holotype specimen (NMNH #150332) is preserved, together with a cotype (NMNH #C6412-1), in the Smithsonian Institution.

Minehillite is colorless but may appear white when it occurs as massive aggregates. Many samples, especially those associated with wollastonite, are gray to black in color due to abundant platelets of native lead dispersed



## MINEHILLITE (Continued)

throughout. The luster is vitreous on fracture surfaces and very pearly on cleavage surfaces. The [0001] cleavage is perfect and easily produced. The hardness (Mohs) is approximately 4. The calculated density of  $2.94 \text{ g/cm}^3$  agrees closely with the  $2.93 \text{ g/cm}^3$  measurement obtained by use of heavy liquid techniques. Minehillite fluoresces medium dull violet in short wave-length and duller violet in long wave-length ultraviolet radiation. There is no discernible phosphorescence.

Optically, minehillite is uniaxial, negative, with indices of refraction  $\omega=1.607$  and  $\epsilon=1.604$  (both  $\pm 0.002$ ), determined in sodium light using a spindle stage.

Precession and Weissenberg X-ray diffraction techniques were utilized in the study of minehillite cleavage fragments. Chemical analysis was performed by an ARL-SEMQ electron microprobe. The very small amount of variation in composition, particularly among the octahedral cations, shows that minehillite has very limited solid solution even though the parageneses are quite diverse. The chemical composition of minehillite is remarkably constant.

The location and geologic relationship of minehillite in the Franklin Mine are unknown. However, the northern end of the west limb of the orebody is suggested by margarosanite being associated with this new species. Minehillite appears to have been moderately abundant in that several dozen specimens are now known.

Several sets of associated minerals are found among the samples in this study. The holotype minehillite appears to have formed on a broad, flat fracture in microcline. This microcline is gray in color and has 1-2 mm allanite crystals liberally distributed throughout. In another closely related assemblage, minehillite forms at the contact between microcline and a chalky-white mixture of wollastonite, grossular, and vesuvianite. The grayish-black color so noticeable in this last assemblage is caused by abundant inclusions of native lead. In still another assemblage, minehillite occurs in a band 1 cm thick between broad-bladed margarosanite and pink calcite. This pink calcite contains crystals of clinopyroxene.

All of the elements in minehillite can be derived from the precursor minerals named above, with the exception of zinc. There are no minerals with Zn as an essential constituent in these assemblages. Thus, it may be that Zn was present as a now-replaced phase (willemite, most likely; zincite, a possibility) or that it was introduced in solution. The latter possibility is strong in that hydrothermally deposited willemite is ubiquitous at Franklin, and frequently occurs as late-stage vein-fillings and crack-fillers in fractured crystals. These observations and the textural relations imply that minehillite is a secondary, relatively low-temperature, hydrothermal, replacement mineral.

The tentative formula for minehillite, based on analogy to reyerite, is stated at the beginning of the article.



The FRANKLIN-OGDENSBURG MINERALOGICAL SOCIETY, Inc.

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## RETZIAN-(La)

$\text{Mn}_2\text{La}(\text{AsO}_4)(\text{OH})_4$ , with  $Z=2$

*A new rare-earth analogue of retzian and retzian-(Nd) is described in an article entitled, "Retzian-(La), a new mineral from Sterling Hill, Sussex County, New Jersey," written by Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution, Donald R. Peacor, Department of Geological Sciences, University of Michigan, and William B. Simmons, Department of Earth Sciences, University of New Orleans. The article appeared in Mineralogical Magazine, December 1984, Vol. 48, pp 533-535. The following is an abstract of that article.*

John Kolic, a miner at Sterling Hill, brought some reddish-brown crystals to the attention of the authors in early 1983. The crystals were found to be members of the retzian family of minerals and were La-rich. Thus, a new mineral, the La-analogue of retzian and retzian-(Nd), was named retzian-(La) in accordance with Levinson's rules for naming rare-earth analogues of known species. The type material is preserved in the Smithsonian Institution (catalogue #NMNH 160290) and in the collection of Mr. John Kolic.

### Chemical Composition

The chemical analysis of retzian-(La) was performed using an ARL-SEM-Q electron microprobe. The results were as follows in weight %:

MnO	25.2	$\text{Nd}_2\text{O}_3$	8.2
MgO	3.7	$\text{Pr}_2\text{O}_3$	5.1
ZnO	1.2	$\text{Sm}_2\text{O}_3$	2.2
$\text{As}_2\text{O}_5$	26.5	$\text{Y}_2\text{O}_3$	2.5
$\text{La}_2\text{O}_3$	10.6	$\text{H}_2\text{O}$	7.7
$\text{Ce}_2\text{O}_3$	8.8	Total	101.7%

These data yield a chemical formula, ideally:

$\text{Mn}_2\text{La}(\text{AsO}_4)(\text{OH})_4$ , with  $Z=2$ .

### Crystallography

Precession and Weissenberg single-crystal X-ray diffraction studies showed retzian-(La) to be orthorhombic with space group Pbn. Lattice parameters are:  $a=5.670(7)$ ,  $b=12.01(1)$ , and  $c=4.869(8)$  Å. Most crystals have a pseudo-hexagonal appearance, largely defined by six faces consisting of the prism  $\{110\}$ , and the pinacoid  $\{010\}$ . The faces of the latter may be bright and shiny as opposed to the dull luster of the other forms. The faces indexed

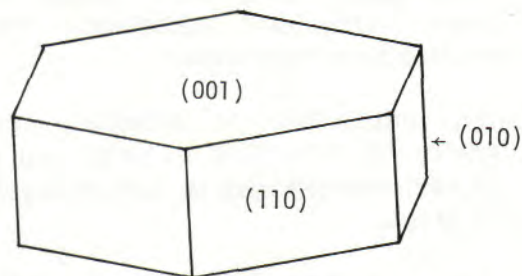


Fig. 1. Clinographic projection of pseudo-hexagonal habit of retzian-(La).

during the optical goniometer study were a large pinacoid  $\{001\}$ , prism  $\{110\}$ , pinacoid  $\{010\}$ , and prism  $\{150\}$ . Faces of the latter form are very small.

### Physical and Optical Properties

Retzian-(La) is dark reddish-brown in color with a light brown streak. The luster is vitreous and the mineral is transparent. The hardness (Mohs) is approximately 3-4. The density has a calculated value of  $4.49 \text{ g/cm}^3$ . The measured density, using heavy-liquid techniques, was greater than  $4.2 \text{ g/cm}^3$ . Cleavage was not observed; The fracture is even. Retzian-(La) is not fluorescent in ultraviolet radiation. It is optically biaxial, positive,  $2V=82(9)^\circ$  (meas.),  $69^\circ$  (calc.). Indices of refraction, measured in sodium light, are:  $\alpha=1.766(5)$ ,  $\beta=1.773(5)$ , and  $\gamma=1.788(5)$ .

### Occurrence

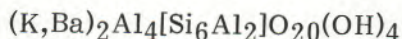
This new mineral was found on a single specimen from Sterling Hill. The euhedral crystals varied in size from 0.1mm to 0.5mm and were found on an altered fracture surface in highly calcic willemite-franklinite ore. The ore surface was blackened by todorokite stains (X-ray verified). The retzian-(La) was among the last phases to form, as were acicular willemite crystals.

*The Picking Table, Spring/Fall 1985*



# Research Reports

## BARIAN MUSCOVITE



In December 1984, an article appeared in *Mineralogical Magazine*, Volume 48, pp562-563, entitled "Barian muscovite from Franklin, New Jersey." The author was Pete J. Dunn, Smithsonian Institution. The following is an abstract of that article.

Bauer and Berman (1933) reported a barium-rich muscovite from Franklin, New Jersey, and noted its similarity in composition to a barian variety of muscovite previously known as "oellacherite." They reported the BaO content at 9.89 wt.%, which being one of the highest for muscovite, has been referred to in later studies (Deer et al., 1962). Heinrich and Levinson (1955) studied this Franklin mica and they noted the X-ray powder diffraction data were consistent with the 1M polymorph of muscovite.

Unlike common micas, this muscovite is fine-grained and thus cleavage is not evident. The texture is microgranular, the luster is dull, and the color is deep pink-violet. It is associated with hendricksite, euhedral andradite, and native copper.

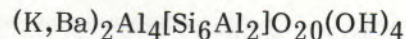
The sample studied by Bauer and Berman (1933), when viewed in thin-section, is seen to be an exceedingly fine-grained mixture of many phases. Muscovite is predominant and barite is very abundant, forming lath-shaped crystals which are rimmed by hyalophane. Native copper is randomly distributed as microscopic, flattened, skeletal crystals.

Preliminary microprobe analyses of several samples of such material indicated that the previously reported BaO content was in error because BaO values varied from 4.8 to 6.3

wt.%. Accordingly, additional analyses of the samples by microprobe were made using the following standards; hornblende (Si,Al,Fe,Mg,Ca,Na), microcline (K), manganite (Mn), benitoite (Ba), and rhodonite (Zn). The samples studied were from the Smithsonian collection (NMNH 105848 and C6258). The latter sample was Bauer's. The compositions of both samples were similar. The resultant analysis yielded weight percents as follows:

SiO <sub>2</sub>	43.5	Na <sub>2</sub> O	0.2
Al <sub>2</sub> O <sub>3</sub>	34.1	MnO	0.8
MgO	0.7	ZnO	0.2
K <sub>2</sub> O	9.7	H <sub>2</sub> O	4.47
BaO	6.3	Total	100.0%

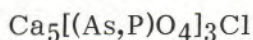
From the above data, the formula for barian muscovite can be stated ideally as:



The present analysis, when compared with that of Bauer and Berman (1933), shows a near reversal in the given BaO and K<sub>2</sub>O values (namely, 6.33% K<sub>2</sub>O and 9.89% BaO), suggesting at first reading that the figures might have been switched by accident. However, this is mere conjecture and the abundance of barite inclusions in the muscovite provide a ready source of excess Ba. In either case, the Ba content of this muscovite is lower than was originally reported and is presented here for the record.



## TURNEAUREITE



*The formal paper describing this mineral, which is new to science, appeared in the Canadian Mineralogist, Vol. 23, pp 251-254. It was entitled "Turneaureite, a new member of the apatite group from Franklin, New Jersey, Balmat, New York, and Langban, Sweden." The authors were Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution; Erich U. Petersen and Donald R. Peacor, both of the Department of Geological Sciences, University of Michigan. The following is an abstract of this article.*

A systematic study of the arsenate apatites has extended over most of the last decade. These investigations brought about the discovery of the new species morelandite (Dunn & Rouse 1978), and johnbaumite (Dunn et al. 1980). A more recent part of the investigation has characterized hedyphane as an ordered phase  $\text{Ca}_4\text{Pb}_6(\text{AsO}_4)_6\text{Cl}_2$  (Rouse et al. 1984). Hedyphane had formerly, and erroneously, been considered as a member of the apatite group with the general formula  $(\text{Ca},\text{Pb})_5(\text{AsO}_4)_3\text{Cl}$  and was usually assigned the niche in the arsenate apatite group with Ca as the dominant divalent cation. This assignment was found to be in error by Rouse et al. (1984) because all known samples of hedyphane have essential Pb and Pb in excess of Ca. Thus the redefinition of hedyphane created a vacancy in the apatite-group series, such that there was no known phase with  $\text{Ca} > \text{Pb}$ ,  $\text{As} > \text{P}$ , and  $\text{Cl} > \text{F}$  or  $(\text{OH})$ . Such a mineral has been found now at three localities: Franklin, New Jersey, Langban, Sweden, and Balmat, New York.

The authors have named the new mineral, which fills the vacancy mentioned above, turneaureite, in honor of Dr. Frederick Stewart Turneaure, Professor Emeritus at the University of Michigan. This was done in recognition of his many contributions to the mineralogy and geology of economic mineral deposits.

### Crystallography

Both precession and Weissenberg single crystal X-ray diffraction studies were made of the Langban crystals. There were no observed deviations from the hexagonal system. All observations were consistent with space groups  $\text{P6}_3/\text{m}$  and  $\text{P6}_3$ ."

### Physical & Optical Properties

Only the turneaureite from Langban provided crystals of the size and quality necessary for species characterization. The Langban turneaureite occurs as colorless, slightly turbid, prismatic crystals up to 1.5 mm in length. This turneaureite has a vitreous to slightly greasy luster. The streak is white, the hardness (Mohs) is 5, and the fracture is uneven. The cleavage, however, was not observed. The density, as measured by heavy-liquid techniques, is  $3.60 \text{ g/cm}^3$  versus a calculated value of  $3.63 \text{ g/cm}^3$ . Turneaureite fluoresces a bright orange in short-wavelength ultraviolet radiation, but is not discernibly fluorescent in long-wavelength ultraviolet radiation. Phosphorescence is weakly discernible in massive material from Franklin. Optically, turneaureite is uniaxial negative, with indices of refraction  $\omega 1.708(3)$ ,  $\epsilon 1.700(3)$ , measured in sodium light.

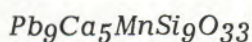
### Occurrence

The Franklin turneaureite occurs as greyish-white massive material with a duller luster than the Langban crystals. The associated minerals at Franklin include: magnetite, andradite, and manganoan calcite. All occur in centimeter-size crystals or aggregates. It is surmised that turneaureite was locally abundant.





## GANOMALITE



A recent paper appeared in *Mineralogical Magazine*, Vol. 49, September 1985, pp 579-582, entitled "Ganomalite from Franklin, New Jersey, and Jakobsberg, Sweden: new chemical and crystallographic data." The authors were Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution; Donald R. Peacor, John W. Valley, Charles A. Randall, all of the Department of Geological Sciences, University of Michigan. The following is an abstract of that paper.

Dunn (1979) in his preliminary description of ganomalite from Franklin cited a microprobe analysis which included 2.44 wt. % MnO. Previously analyzed specimens from Jakobsberg and Langban, Sweden, demonstrated similar Mn content. The implication was that Mn is an essential and constant constituent of ganomalite although it is generally accepted to be a Ca-Pb silicate ( $\text{Pb}_6\text{Ca}_4\text{Si}_6\text{O}_{21}(\text{OH})_2$ ). A detailed study of numerous Franklin and Jakobsberg ganomalite samples, prompted by the above observation, forms the basis for this paper.

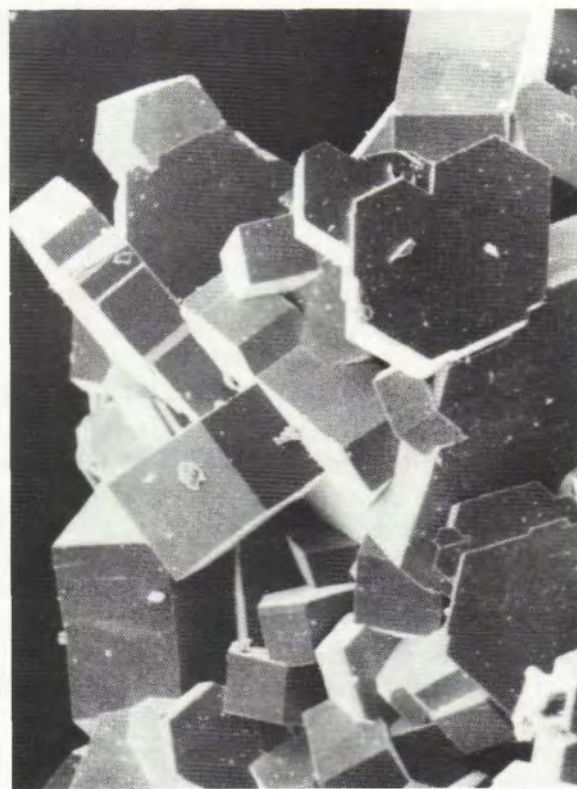
The Franklin, New Jersey, ganomalite occurs as euhedral crystals enclosed in clinohedrite or which encrust vugs in clinohedrite-willemite within andradite-franklinite assemblages. This study is based on data derived from crystals belonging to the latter assemblage. The paragenesis was described by Dunn (1979) and little remains to be added except to note that in thin section, ganomalite is seen as euhedral crystals in direct contact with nasonite, and both species are contained within clinohedrite.

Analyses were performed on the samples using an ARL-SEMQ electron microprobe. Table I, within the text of the paper, lists analyses which, with one exception, are consistent with Engel's probable formula for ganomalite:  $\text{Pb}_3\text{Ca}_2\text{Si}_3\text{O}_{11}$  with  $Z=3$  and with some minor Mn. The exception, however, is that Mn is present in relatively constant amounts, amounting to one Mn atom per 5 Ca. Based on these findings the apparent formula for ganomalite is  $\text{Pb}_9\text{Ca}_5\text{MnSi}_9\text{O}_{33}$ , with  $Z=1$ . The authors point out also the strong implication that Mn (or a cation of similar radius; perhaps  $\text{Fe}^{2+}$  or Mg) is essential to the stability of ganomalite.

### Editor's Note

The SEM photomicrograph of ganomalite which appears below was not part of the foregoing paper. It was provided by Dr. Pete J. Dunn, Smithsonian Institution, for the ready reference of our readers. The specimen is NMNH Catalog #C2227, and is seen here at approximately 80x.

OSD





In the December 1984 issue of *Neues Jahrbuch Mineralogie Abhandlungen*, Volume 150, pp 259-272, there appeared an article entitled "The nickel-arsenide assemblage from Franklin, New Jersey: description and interpretation." The authors are Ing S. Oen, Geologisch Instituut der Universiteit van Amsterdam, Amsterdam, The Netherlands, Pete J. Dunn, Department of Mineral Sciences, Smithsonian Institution, Washington, D.C., and Cornelis Kieft, Netherlands Organization for the Advancement of Pure Research, Amsterdam, The Netherlands. The following is an abstract of that article.

### **Introduction**

The nickel-arsenide assemblage was found in the Franklin Mine, Franklin, Sussex County, New Jersey in the 1880's. The preliminary report was published by Koenig (1890). Koenig recognized the occurrence of nickeline (niccolite), but ascribed the white nickel-arsenides to "chloanthite." It was Holmes (1935, 1945) who found these white nickel-arsenides to be admixtures of rammelsbergite, parammelsbergite, and gersdorffite. Holmes also found skutterudite to be a minor component of the assemblage.

This assemblage was found at a depth of approximately 100 meters beneath a stratum of yellow garnet. The amount found has been reported to be as little as 14 kg and as much as 135 kg. This localized nickel-arsenide assemblage is an anomaly in the overall bulk of the Franklin deposit (predominantly oxide/silicate ores). The occurrence is noteworthy because the Franklin ores contain sulfides (mostly sphalerite) and arsenides (limited to loellingite and arsenopyrite) in no more than accessory amounts.

### **Macroscopic Description**

The nickel-arsenides occur as dendrites in a coarse-grained matrix of calcite, fluorite, sphalerite, and a stilpnomelane-group mineral. Some of these dendrites are several centimeters in size. Polished slabs show 1-2 mm thick dendrite branches of pink-colored nickeline rimmed by white diarsenides and gersdorffite. Near the end of the branches the white rim enlarges in a cauliflower-like fashion. Sections across these portions show rotund, concentrically zoned aggregates of rammelsbergite and gersdorffite. Both of these minerals show a strong variation in Fe-, Co-, Sb-, and S-contents. The trunks of the dendrites have a very thin replacement and growth zone of

rammelsbergite, covered by a film-thin zone of gersdorffite, and a very thin outer growth zone of Ni-rich loellingite showing strong variation in Ni- and Co- contents. Magnetite occurs locally along the fringe of the dendrites. Calcite between the dendrites is locally recrystallized and impregnated with parammelsbergite, skutterudite, safflorite, arsenopyrite, and gersdorffite. The associated fluorite assumes a violet color adjacent to the arsenides. Other minerals present are pimeite (a green nickel silicate) and secondary annabergite,  $Ni_3(AsO_4)_2 \cdot 8H_2O$ .

### **Mineralogy and Textures**

Small areas on samples of this nickel-arsenide assemblage were subjected to microprobe analysis and X-ray powder diffraction procedures. In sample C503-2, the nickeline showed a 0.005-0.2mm thin rim of white diarsenides enclosing a conspicuous thin median band of brownish gersdorffite. Although microprobe analysis was inaccurate, due to fine grain size, it indicated that the gersdorffite had a similar range of Fe-Co compositions as in sample R822-1, that granules of safflorite occurred in the gersdorffite, and that the inclusion lining consisted of calcite and magnetite particles. The gersdorffite band separated an inner rim of rammelsbergite from an outer rim of Ni-rich loellingite. The inner rim consisted of a growth zone of regular thickness of rammelsbergite showing polysynthetic twin lamellae subperpendicular to the zone.

Magnetite was often found at the tips of loellingite protrusions. Among the other findings were that several arsenide phases occurred as very rare accessory minerals in the calcite gangue. Included were skutterudite, which formed 1-2 mm modified, equant crystals, and safflorite and arsenopyrite which occurred



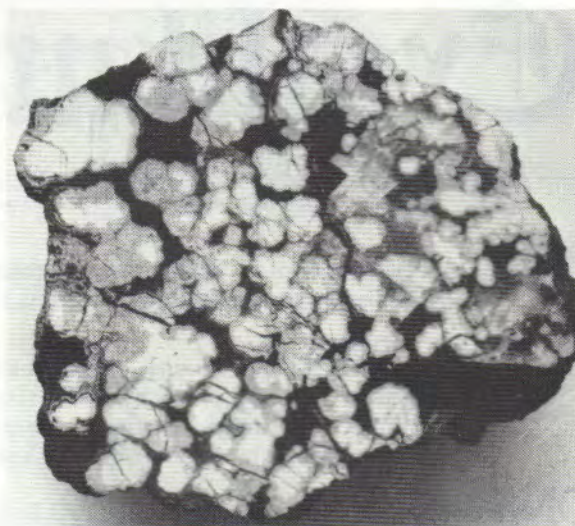
as very small (0.1 mm and 1.0 mm respectively) euhedral crystals. Also observed was pararammelsbergite as isolated, spongy masses in the gangue.

### Discussion

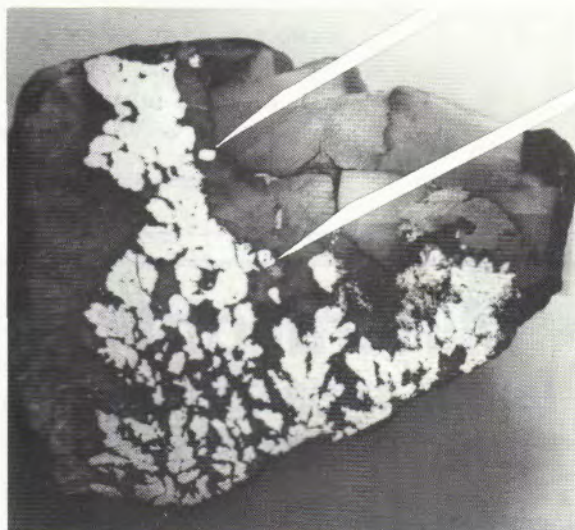
Dendrite crystallization involves a high precipitation rate relative to diffusion rate in solution of the dendrite forming substances. The precipitation of dendrites generally requires high concentrations in supersaturated solution and a quiescent environment (Vanhook, 1961; Tiller, 1964; Radkevich, 1966). The high precipitation rate results in rapid decrease of supersaturation (which suppresses further growth of the dendrites) and in a relative increase of the concentration of the other components, which may then crystallize. The study of ore textures indicates that dendritic minerals have generally been involved in subsequent reactions with later fluids that resulted in the formation of new minerals. The formation of the nickeline dendrites with replacement and growth rims of Ni-Co-Fe diarsenides and gersdorffite can be explained on the basis of a crystallization model that assumes non-equilibrium crystallization of the nickeline dendrites from a metastable supercooled solution and subsequent reactions with residual solution.

### Editor's Comments

The foregoing abstract was made with the collector in mind. The article deals with fine grain detail as opposed to the course grain detail which is within the sensory scope of the collector and the samples he is apt to have in his own collection. The original article is on file at the Franklin Mineral Museum and those of you who desire the full treatment should make it a point to look it over the next time you are in the Franklin area and the museum is open. The original article has many photomicrographs of sliced sections of this assemblage. Unfortunately, they do not reproduce well and can not be a part of the above abstract. However, Dr. Pete J. Dunn has been kind enough to supply us with photographs which depict cross-sectional slices of samples from the assemblage (but which were not part of the above discussed research). These photographs are printed with the permission of the Smithsonian Institution.



NMNH, Catalog #R822. The specimen diameter is approximately 2 inches. This is probably a slice across the top of dendrites. The black gangue is impure stilpnomelane; the white gangue is calcite. The round or irregular bright grains are cross sections of dendrites, and they are altered to gersdorffite (gray colored rims). The silver (white) areas of the dendrites are rammelsbergite. There is no nickeline except for tiny residuals.



Harvard University, Catalog #117576. The specimen diameter is 3 inches maximum. Nickeline dendrites, enclosed in calcite gangue (matrix), are rimmed by rammelsbergite toward their upper extremities. The dull black mineral on the right is magnetite. Several isolated crystals of skutterudite are in the center of the section as indicated by the white lines.



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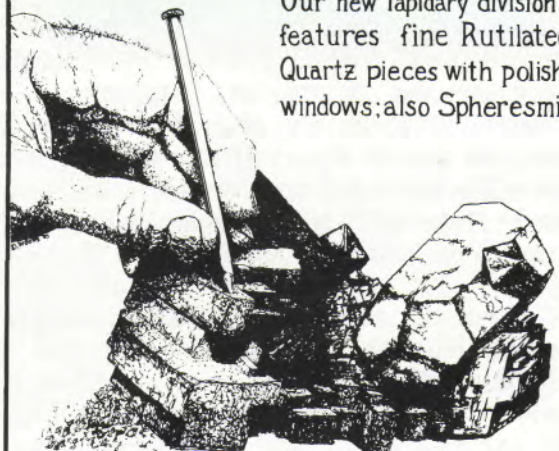
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