Labels of James Manchester

THAUMASITE CRYSTALS
West Paterson,
N. J.
JAMES G. MANCHESTER, NEW YORK CITY

BROWN TOURMALINE
Broadway & 225th Street
Manhattan Island
741
JAMES G. MANCHESTER, NEW YORK CITY

BISMUTHINITE
Baylis Quarry
Bedford
Found May 11, 1935
Westchester Co.
New York
JAMES G. MANCHESTER, NEW YORK CITY

CHALCEDONY
Pseudo. after Coral,
Ballast Point
Tampa, Florida
James G. Manchester

QUARTZ
Hot Springs
Ark.
JAS. G. MANCHESTER
NEW YORK CITY GARNETS

From "The Minerals of Broadway," by J. G. Manchester
Bull. No. 3, New York Mineralogical Club

Plate III
A DISCOVERY OF GEM GARNET IN NEW YORK CITY

JAMES G. MANCHESTER AND GILMAN S. STANTON

New York City

The mica schist and gneiss of Manhattan Island, New York City, as well as the accompanying granite veins, contain many garnets. Some may be found at almost any point, while in parts of the city, notably the region of Mount Morris Park and the south shore of Spuyten Duyvil Creek—the extreme northerly shore line of Manhattan Island—they are thickly disseminated throughout the schist, but all are fractured, semi-translucent and poorly colored, and rarely show a crystal face.

In the granite or pegmatite veins better crystals occur, some of large size, associated at times with tourmaline, and more rarely with beryl. The most notable specimen for size and perfection of crystal form is one found at Thirty-fifth Street and Broadway and now the property of Dr. George F. Kunz. The crystal is free from matrix, weighs nine pounds ten ounces, and is probably the finest large garnet crystal yet found in the United States. A fragment of a somewhat larger crystal of similar form to the Kunz garnet was taken out of the rock by Charles W. McDonald at Broadway and One hundred and sixty-fifth Street. This specimen, with only a few of the crystal faces developed, weighs ten pounds eight ounces, including a small amount of the matrix which is attached.

Single crystals three or four inches in diameter are occasionally found, being mostly modified trapezohedrons. (See Fig. 2). Several of these are included in the New York Mineralogical Club collection in the American Museum of Natural History. The locality that has furnished the greatest number of finely crystallized garnets is Sixty-fifth Street just east of Broadway, discovered by one of us (G. S. S.) in 1888. Hundreds of fine dodecahedrons with trapezohedral truncations, mostly from three-eighths to one inch in diameter, were collected here from a coarse pegmatite vein. (See Fig. 3). The garnets usually occurred at the juncture of the quartz and orthoclase, and were flattened when imbedded in the latter.

1 Trans. N. Y. Acad. Sci., 5, 265, May 31, 1886. See Fig. 1, Frontispiece.
The garnets of the city have been considered to be mostly almandite, altho essonite has been reported as occurring at Tenth (Amsterdam) Avenue and One hundred and thirty-fifth Street and at Fort George, and grossularite is listed, without locality, as from the city. In view of the following facts, analysis might show some to be spessartite or andradite.

In October, 1916, one of us (J. G. M.) discovered a new collecting locality which held out good prospects. During the erection of apartment buildings in the block bounded by Haven and Northern Avenues and West One Hundred and Seventy-eighth and West One Hundred Seventy-ninth Streets, in the Washington Heights section of the city, a large amount of rock was taken out. The material was the usual gneiss and contained many veins of mica, quartz and feldspar, of varying composition. The writers in examining the material found a number of garnet crystals, one a four inch distorted trapezohedron, and the others smaller, poorly defined crystals, of the usual local type. There was also found embedded in a granite vein a half-crystal about three inches in diameter and it was readily seen to be of gem quality and somewhat different from the garnet crystals usually found in the Manhattan rocks. Unfortunately this gem half-crystal could only be removed in fragments, but, the fractures being somewhat parallel to each other, material suitable for cutting purposes was obtained. At first the mineral was thought to be almandite, but a specimen submitted to Dr. W. T. Schaller, was found by him to contain large amounts of aluminium and manganese, with only very small amounts of iron, calcium and magnesium, indicating it to be spessartite. The latter is indeed suggested by the color of the cut stones, which might however, be mistaken for essonite.

The rough material was cut by the Espositer, Varni Co. and pronounced by them to be of fine gem quality and of an unusual color. Upon direct comparison with specimens of the Amelia Court House spessartite in the Morgan Gem Collection at the American Museum of Natural History the New York stones proved to be more brilliant, more perfect, more translucent and of a more beautiful color, being a clear, slightly orange red, rather than the cloudy brownish red of most of the Amelia Court House stones.

In all 39 brilliant and step-cut stones have been cut. Their combined weight is about 19 carats, the largest weighing 1.37 carats.

Among the many garnets found in New York City rocks, some of them remarkable as crystals, none have heretofore been found of gem quality. That this crystal should cut into gems of more than usual beauty was unexpected, and the find is an important addition to the gem stones already listed as native to Manhattan Island.
MAINE MINERAL LOCALITIES.

2. Pulsifer Mine, Mt. Apatite.
FAMOUS MINERAL LOCALITIES: MT. MICA, MT. APATITE AND OTHER LOCALITIES IN MAINE

JAMES G. MANCHESTER AND WILLIAM T. BATHER

New York City

No doubt it is the desire of most collectors of minerals to visit the famous mineral localities in Maine. This desire on the part of the writers has been gratified and a few brief extracts from notes made on their trip may be of interest to readers of this magazine.

The trip was made during the month of June, 1916, and was one of great interest and pleasure. With the aid of an automobile much ground was covered. We were unable, however, to give to each locality visited time and attention necessary to make other than superficial observations. For a technical description of the localities mentioned in this brief article readers are referred to U. S. Geological Survey Bulletin 445, "Geology of the Pegmatites and Associated Rocks of Maine," by E. S. Bastin, which we found to be very useful as a reference and guidebook.

After an all-night journey by train from New York City we arrived in Portland in the early morning. The train for Norway, our first objective, did not leave until afternoon and a few hours were spent in sightseeing in Portland, including a visit to the Maine State Fair, which opened that day. Maine being well known as a source of gem tourmalines, we felt sure that minerals would be on display, and it was a disappointment to find instead everything from canned corn to cream cheese. Train time arrived and after a journey of about 49 miles on the Grand Trunk Railroad we arrived late in the afternoon at the little town of Norway, our first stop. We were in this town for three days and found good accommodations at the local hotel. One of the residents, Mr. George Howe, is the president of the Maine Academy of Science, and is an enthusiast on all matters pertaining
to the natural sciences. Owing to his wide knowledge of Maine minerals his advice as to localities to be visited was of great help. Another resident, Mr. Charles B. Hamilton, a mineralogist and entomologist by avocation, was our companion for several days and in many ways made our stay in Norway one of extreme satisfaction.

The first visit was made to the Noyes mine located on the western slope of Noyes hill in the town of Greenwood, about five miles from Norway. (Fig. 1, Plate 16.) The pit is near the summit of the hill, whose elevation is 1400 feet. To reach the mine it was necessary to climb the steep wooded hillside and over waste material which had been thrown out, and as mica was quite abundant the ascent was somewhat laborious to one used to city sidewalks. The rock in place was a coarse pegmatite, but no pockets were observed. In the pit a few specimens of yellowish green spodumene were dug out. There was plenty of material on the dump to explore and in a few hours’ work there were found specimens of white and purple lepidolite, clusters of quartz crystals associated with the “hydromica” cookeite, fine pale lavender colored apatite crystals of a thin tabular form, and a few sections of beryl crystals. Other minerals are known to occur here, notably cassiterite, herderite and phenacite, but were not noted by us. A systematic and thorough search of this waste pile no doubt would bring forth many specimens.

After lunch we journeyed on to the chrysoberyl locality in the Witt hill region in the northeast corner of the town of Norway. Here a pegmatite ledge had been opened some years before by George Howe and specimens of chrysoberyl, gahnite and zircon were uncovered. There was no trouble in obtaining a good supply of small crystals of chrysoberyl of a thin flattened form showing the repeated twin habit. A few coarse garnets and minute crystals of zircon in square prisms were also obtained.

The next morning an early start was made for the famous Mt. Mica mine, located about 1½ miles east of the village of Paris. (Fig. 1, Plate 15.) It was only a short run from Norway thru the towns of South Paris and Paris, and we were soon on the spot known to all mineralogists. Mt. Mica has an approximate elevation of 900 feet and from its summit affords a fine view of the immediate vicinity. Along the roadway leading up to the mine many large blocks of purple lepidolite were noted, in fact this mineral was extremely plentiful both here and at Mt.
Apatite. No work was in progress and the deeper parts of the pit were filled with water. Mr. Loren B. Merrill, the owner, had worked the mine for about four months during the previous year and discontinued when the water froze over. There were several pockets in evidence and these were filled with water but in the decomposed clevelandite at the bottom a few slender crystals of transparent green tourmaline were found. Most of the quarry waste has been dumped into abandoned workings, and by exploring this material we found enough specimens to fill our bags. Among the minerals were biotite, clevelandite (the variety of albite) cookeite, muscovite enclosing slender crystals of green tourmaline, lepidolite of varying degrees of texture and of purple hues, massive pink and green beryl, pink montmorillonite, pink and green tourmalines in the solid pegmatite, making attractive cabinet specimens, and garnets upon which were noted minute crystals of autunite. Black tourmaline crystals were plentiful, but as usual were hard to remove without fracture. Microscopic crystals of green tourmaline were also found. This mine relies wholly upon the production of tourmalines to keep it in operation and in this respect it is unlike the quarries at Mt. Apatite where the mining of tourmalines is incidental to the production of feldspar. The gem-bearing zone lies below a schist capping and dips at such an angle that as the work progresses more overhead rock has to be removed. The result is that mining at Mt. Mica is growing more expensive and unless methods other than open mining with its hand drilling and a one-horse windlass are adopted it cannot help becoming extinct.

At the foot of Mt. Mica, on land of James E. Bowker, there is an outcrop of pale rose-colored quartz and no doubt a few blasts to remove the surface material would produce specimens of a deeper color. Some of the quartz is semi-transparent and of the asteriated variety, polished spheres of which when held before a single flame show by the transmitted light a six, twelve- or eighteen-rayed star, this latter feature depending upon the transparency of the stone, which in turn is influenced by the number of needle-like inclusions that cause this phenomenon.

After lunch a call was made on Mr. Merrill, the owner of the Mt. Mica mine, who during our short stay made our visit of much interest. In addition to Mt. Mica specimens, Mr. Merrill has a fine collection of other minerals which are attractively displayed. We were shown large sections of gem green tourma-
line crystals, including a smooth nodule weighing 411 carats, which is probably the largest flawless piece of transparent green tourmaline known and its value in dollars runs into the hundreds. On Mr. Merrill's property is a most interesting stone wall. One hears of stone wall geology but here is stone wall mineralogy. The wall is built of large crystals of quartz of varying shades from white to smoky, blocks of purple lepidolite, rose quartz, amblygonite, clevelandite, mica and other minerals from the Mt. Mica mine, the whole making a very attractive and unique display of minerals.

The rest of the day was spent at the Ordway farm, located in the town of Norway. (Fig. 3, Plate 16.) Mr. Hamilton, our host and guide, discovered this locality some years before, and put in a few blasts by permission of the owner. Here was observed an outcrop of fine grained granite thru which ran a single pegmatite vein. This vein was made up mostly of an opaque smoky quartz and attached to the walls of the granite adjoining either side of the vein were beautiful white orthoclase crystals. It was difficult to extract the hard matrix, to which were attached the fragile crystals. However, a number of orthoclase crystals were obtained, one specimen in particular being a perfect crystal about two inches long and one inch thick jutting out from the matrix. Broken fragments of columbite crystals were also found. Further blasting on this property was stopped by the owner, which is unfortunate, as there is every evidence that more orthoclase crystals could be obtained. It is a fact indeed that almost everyone who owns a piece of land in Oxford County upon which there is an outcrop of rock believes he has a gem mine.

Finding our specimens accumulating fast, the next morning was spent in boxing and shipping them home. In the afternoon we left Norway for Auburn, traveling by automobile with the mail carrier. Except for one or two detours the road kept quite close to the Little Androscoggin river.

The following day we were joined by Prof. Freeman F. Burr, a fellow member of the New York Mineralogical Club. Prof. Burr's home is in Maine and since our visit he has been appointed State Geologist of that State. Mt. Apatite, our next objective, lies about six miles west of Auburn and is easily reached by trolley. As some collectors and other visitors to Mt. Apatite had in the past abused the privilege and committed depredations on the property, visitors were not allowed in the quarries and watchmen
were on guard. We called on P. P. Pulsifer, the owner of one of the mines at Mt. Apatite, who lives a short distance from the mine. We found in him a kindly and courteous gentleman. While at Mr. Pulsifer's house we were shown what is probably the finest purple apatite crystal yet found at Mt. Apatite. It is of a beautiful amethyst color, cloudy in portions but in small areas perfectly clear and of gem quality; the crystal measures 3.8 cm. by 4.3 cm. in the horizontal direction and 3 cm. in the vertical direction and weighs slightly over 100 g. At the time of our visit it was valued at $500 and it is a pleasure to note here that this specimen has since been installed in the famous collection of Col. Washington A. Roebling, of Trenton, N. J.

Mr. Pulsifer accompanied us to Mt. Apatite and as our time was limited we only visited two of the workings, the Pulsifer and the Towne mines; this latter mine has since been taken over by Mr. Pulsifer. Practically the whole of Mt. Apatite is made up of pegmatite with an occasional trap dike. These dikes, so Mr. Pulsifer informed us, are regarded as a good sign as they seem to denote the presence of gem material. (Fig. 2, Plate 16.) The Pulsifer mine was opened in 1901 and has been worked more or less since that time. (Fig. 2, Plate 15.) Many beautiful crystals of pink and green tourmaline have been taken out and it was here that the famous purple apatites were found. No pockets were exposed, and the mine was not in operation at the time of our visit. There was, however, a good sized dump of waste material, and in turning this over there were found specimens of lepidolite, amblygonite, clevelandite, almost transparent and bluish-green tourmalines associated with mica, a few small purple apatites in a white quartz matrix, and quartz crystals of various sizes from one to four inches in diameter, mostly of the smoky variety.

The Towne feldspar and gem mine is about 100 yards from the Pulsifer mine, and was opened in 1907. Here also was a large dump and while it did not look as fresh as the material at the Pulsifer mine and had the appearance of being well picked over, many specimens were found. Among them fine purple lepidolite which occurred in granular aggregates of small scales and in large curved crystals with rounded botryoidal surfaces one-half inch or more in diameter, amblygonite, clevelandite of

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1 This crystal has been described by Professor Ford: *Am. J. Sci.*, [4], 44, 245–246, 1917; abstract in *Am. Min.*, 3, (6), 138, 1918. See also minutes of N. Y. M. C. meeting, page 175, below.
the white lamellar variety, green tourmaline in mica, and small crystals of herderite coating quartz crystals. One could not help noticing the large number of smoky quartz crystals of various sizes, but nearly all being coated with discolored albite, they were unattractive as cabinet specimens.

After lunch the next stop was at the Berry feldspar quarry in the town of Poland just across the Little Androscoggin river opposite Mt. Apatite. This quarry was opened in 1900 and has been worked for feldspar. The general character of the rock is similar to that at Mt. Apatite. At the time of our visit two pockets were exposed, both a foot or more across and several feet deep, from which there had been removed several barrels of kaolin without uncovering a single tourmaline crystal. (Fig. 2, Plate 16.) We worked in one of the pockets and after digging out some more kaolin in the further end of the pocket broke down the thin wall of an adjoining chamber. The chamber was filled with decomposed clevelandite, which usually denoted the presence of gem tourmalines, but after removing all the material in the pocket as far as the arm could reach we were rewarded with a few doubly terminated pinched quartz crystals, white in color. These were all the specimens found here and we were fortunate indeed to obtain these as the quarry had not been in operation for six months and every pleasant Sunday it is "black with collectors," so we were informed.

Adjoining Mr. Berry's mine is the Havey prospect where some fine gem tourmalines have been taken out. There was no collecting here as there was no dump in evidence and there was no loose material on the floor of the quarry. This ended our search for minerals and we returned to Auburn late in the afternoon. We left Auburn the next morning and ten hours later stepped off the train in New York City.

To those who may be planning a visit to Maine mineral localities it would be well to make the trip later in the year, say in September or October, when there would be an accumulation of fresh waste material on the dumps at the active mines. There should be very little trouble in gaining access to the various properties, especially if the visitor has come from a distance, for we found the owners very willing and obliging.
The Bergen Archways
(A view of Cut No. 4 during construction)
THE MINERALS OF THE BERGEN ARCHWAYS

JAMES G. MANCHESTER

New York City

Bergen Hill is about 19 kilometers (12 miles) long and 1.6 kilometers (1 mile) wide, comprizing a range of bluffs of Triassic diabase. It commences at Bergen Point and runs behind Jersey City and Hoboken to a point in Weehawken about opposite Thirty-fifth Street in New York City. Here it comes close to the Hudson River and continues north for some 29 kilometers (18 miles) to Piermont, being known as the Palisades.

The Bergen Hill region has long been noted as a locality for zeolites and associated minerals. When the announcement was made that the Erie Railroad Company had begun the construction of an open cut thru the hill, local collectors interested in mineralogy looked forward to the collecting of fine specimens. This interest was fully justified from the history of past borings thru Bergen hill. In the construction of the Pennsylvania cut at Mount Pleasant, the Erie and the two Lackawanna tunnels at Jersey City, the West Shore tunnel at Weehawken, and the Susquehanna tunnel at Edgewater, mineral specimens of unusual beauty were taken out. These have been so highly prized that they have found permanent resting places in museums and private collections thruout the world. The locations of these various operations are shown on the map, Fig. 1, on the succeeding page.

The construction of the new cut was commenced in October, 1906, and with a force of 1,100 men working in day and night shifts, the work was completed in June, 1910, requiring three and two-thirds years to build. The cost of this new entrance to New York City amounted to $8,000,000. The task of cutting thru the hill was stupendous. The cut is 1,300 meters long, and 80 per cent. of this was thru solid rock. It has an average

1 The Bergen Archways is the name given to the Erie Railroad open cut thru Bergen Hill, Jersey City, N. J.
Fig. 1. Map of the Bergen Hill—Palisades Region.
Showing location of railroad cuts and borings thru the ridge.

depth of 25 meters and is 17 meters wide at the bottom. It is for the most part open, but intersecting streets made it necessary to tunnel nearly 400 meters in all. One hundred and twenty-five thousand cubic meters of earth and 500,000 cubic meters of rock were taken out.

The progress of the work was closely watched by local collectors and at first did not hold out much prospect for specimens. Later, when the work was well under way, minerals began to come out. The writer’s first visit to the cut was about the time the dirt covering had been removed and of course no specimens were found. Sometime later, thru a letter of introduction to the resident engineer, Mr. F. B. Moorshead, free access to the cut was obtained.

In constructing the cut the work was divided into four sections. In the first three sections, commencing from the easterly end, practically no minerals were found. In cut No. 4, between Bevans Street and the Hudson Boulevard, a view of which is shown in the frontispiece, was located the mineral zone, and every mineral here noted came from that section. The specimens were found in almost vertical veins and as the workings became deeper these veins looked like bands of ribbon running down the sides of the cut, ranging in width from less than a centimeter to open ellipsoidal cavities almost wide enough to insert one’s head and shoulders. At first the rock was taken to a dump a short distance away, but as the work progressed most of the material was put thru a crusher and made into road metal. The rock was removed with such speed that there was little chance to examine the material before it was loaded into cars and taken away. To obtain specimens it was therefore necessary to go into the workings and prospect among the rocks soon after a blast. The writer was able to devote three or four hours a week for about a year to collecting at the cut, and obtained a bountiful supply of minerals. On some of the trips a load of specimens weighing 25 kilograms (55 pounds) would be obtained in a half hour’s work. As the rock was being put thru the crusher night and day it is no exaggeration to say that tons of good mineral specimens were lost.

Among the zeolites and related minerals found were: stilbite, laumontite, gmelinite, analcite, natrolite, apophyllite, pectolite and datolite, and of common occurrence with these were quartz, calcite, pyrite, chalcopyrite, sphalerite and diabantite. While
the minerals from the extrusive basalts of West Paterson, Great Notch, and Upper Montclair, are found in cavernous openings, amygdules, vugs, etc., the Bergen Archways minerals were confined to veins. Prehnite, heulandite and thomsonite, found so abundantly at the former localities, were not noted, tho Dana lists these minerals from Bergen Hill. A brief description of minerals found by the writer follows; they are taken up in the order of the genetic table of minerals of zeolite deposits, prepared by Mr. Gordon.¹

**DIABANTITE:** A chlorite mineral provisionally assigned to diabantite was found in seams and crevices of the trap, in foliated and concentric forms, of a greenish black color. During the construction of the cut there were a number of accidents to the laborers caused by the material sliding after a blast. No doubt it was the presence of this chlorite as the binding material that caused the rock to slip; for it is very greasy in nature, and in fact was not inaptly called by the workmen "soapstone."

**PYRITE:** This mineral was of frequent occurrence and, in fact, upon almost every specimen collected at least traces of it could be found. This is interesting when it is considered that there is no record of pyrite having been found in the trap rock at the Paterson or Hopewell, N. J., quarries.² Those noted were of the common cubic form, ranging in size from microscopic to 4 mm. in diameter. Calcite crystals showing a second growth of crystal faces were found that contained numerous minute pyrite crystals on the original faces, but none on those of the second growth.

**CHALCOPYRITE:** Several specimens of chalcopyrite crystals were found embedded in the diabantite coating the trap rock. Small tetragonal crystals were noted on a crystal of calcite. Some vein material was found containing a center of calcite with two outer edges consisting of feldspar. By etching out the calcite there were exposed at the point of contact beautiful crystals of chalcopyrite and pyrite. Other specimens, after etching out the calcite would show the chalcopyrite embedded in clusters of small milky quartz crystals attached to the vein wall. Vein material was also found filled solidly with pectolite, and lying between the pectolite and the vein wall would be crys-

PLATE 11.

Minerals of the Bergen Archways
1. Natrolite (¼)
2. Calcite (¼)               3. Pectolite (½)
tals of chalcopyrite. A description of some crystals obtained from one of the calcite filled veins is presented by Dr. Edgar T. Wherry, at the end of this paper.

**Sphalerite:** This was occasionally found in black massive crystalline aggregates with few crystal faces, associated with calcite, datolite and stilbite. The largest specimen measured about 7 cm. in diameter.

**Quartz:** While quartz is plentiful in the crevices of most New Jersey traps, very little was noted at this locality, and then only lining the narrow veins filled with calcite. By etching out the calcite, clusters of small milky quartz crystals would be exposed.

**Calcite:** Calcite crystals occurred in abundance, in sizes up to 12 cm. in diameter. Many resembled those taken from the old Erie tunnel, over fifty years ago. They were mostly of an amber yellow color, but owing to a slight roughening on the crystal faces, were seldom transparent (Plate 11, Fig. 2). However, a few transparent specimens were found, and in color resembled the beautiful golden brown calcites from Joplin. Occasionally a large crystal would be found broken, and this would furnish fine specimens of clear calcite of the Iceland spar variety. Crystals were found of simple rhombohedral habit embedded in a matrix of pale green datolite, and scattered over the whole are small flake-like crystals of stilbite. Clusters of calcite crystals associated with datolite and stilbite, their order of sequence invariably being a base of datolite, then calcite and then stilbite, which sometimes would be followed by another layer of small calcite and pyrite crystals. One specimen 12 cm. in diameter is a fine example of twinned rhombohedrons. "Paper-spar" crystals implanted on rhombohedrons, and stilbite crystals implanted on and at right angles to the rhombic faces of the paper-spar crystals, but not on the edges of the crystals, were also noted.

There were also taken out compound crystals consisting of two superposed habits corresponding to two generations of calcite deposition. The earlier generation is represented by crystals of a simple rhombohedral habit consisting of the negative rhombohedron (Fig. 2, a). In a number of instances these rhombohedral elements occur uncombined with the combination of the later generation and attain a size of 5 cm. on an edge. They have in these instances a markedly cubic aspect. The compound
crystals which were noted consist of the rhombohedral element noted above, upon the polar angles of which are superposed in parallel position the scalenohedral combination shown in figure 2, b. The compound crystals average 10 mm. in vertical length.¹

ANALCITE: One of the most striking minerals of the zeolite group is analcite. It is not as common as some of the other zeolites one meets with in the New Jersey trap rocks. Remarkably fine specimens were found, consisting of nearly transparent colorless crystals, of ideal symmetry, embedded in a matrix of beautiful pale green datolite crystals, some of the latter showing small crystals of datolite implanted on the larger ones, evidently a second generation (Plate 12, Fig. 1). Other specimens showed analcite of a milky color deposited on datolite and on calcite, with beautiful apophyllite crystals on the analcite (Plate 12, Fig. 2). Still others showed analcite crystals on apophyllite. This series of specimens makes an interesting illustration of the varying sequence of these minerals.

GMELINITE: One of the most interesting minerals collected was gmelinite, which is not common at Bergen Hill. There were found several specimens of twinned gmelinite of a pinkish color, corresponding in forms to fig. 1, p. 593, in Dana’s System, associated with datolite, apophyllite, and diabantite.

PECTOLITE: This mineral is often met with in New Jersey trap rocks, but after many visits to the cut it seemed as tho it

MINERALS OF THE BERGEN ARCHWAYS
1. ANALCITE (§)
2. ANALCITE (§)
was never coming out; as the workings became deeper, however, pectolite came to view. It was found in a number of interesting forms. Columnar or fibrous masses, with fibers often 10 to 12 cm. long, were very glassy and strongly triboluminescent. Some groups of stout crystals had fine terminations, which is quite rare for this mineral. Sometimes specimens of the trap rock would be found with a faint white streak no wider than a pencil line. On breaking the rock along this line, a very thin layer of pectolite of silky luster would show the familiar radiations of this mineral (Plate 11, Fig. 3). Another type was grouped cornucopia-shaped aggregates of fine capillary crystals with more or less space between each. No doubt this arrangement was caused by some alteration in the original mineral (Plate 13, Fig. 4). One slab 12.5 x 20 cm. is coated with datolite crystals, the datolite being partly covered by rhombohedral crystals of calcite and fine prisms of apophyllite, with silky tufts of pectolite implanted on both the calcite and apophyllite crystals.

Datolite: A mineral of many forms is datolite, and the Erie cut was extremely prolific in it. To this locality must be given credit for producing single crystals of datolite completely and symmetrically developed, showing on the surface no evidence of previous attachment to other minerals (Plate 13, Fig. 2). They are colorless, perfectly transparent and their faces have a brilliant luster. Their size ranges from microscopic to 8 mm. in diameter. But of chief interest is the almost ideally symmetrical development which they possess, a thing of considerable rarity among datolite crystals.\(^1\) (Fig. 3). The first lot of these crystals was found loose in the material on the ground just below a vein in

the trap rock. Later one specimen of rock was found the surface of which was coated with a filamentary mineral resembling asbestos. The matted filaments, when mounted in balsam, were found to entangle a multitude of microscopic crystals of several minerals easily distinguishable from each other in polarized light. Embedded in this were single crystals of datolite, apophyllite and laumontite. Some of the larger crystals of datolite under the microscope show inclusions of a fine, hair-like, asbestiform mineral. It is probable that the datolites, on crystallizing out of the vein-filling solution, attached themselves to these threads or filaments. As the datolite crystals increased in size and weight, and the solutions which tended to support them withdrew, the asbestos fibers could no longer stand the strain and they fell to the bottom of the cavities. Fine colorless transparent crystals of datolite were also found lying in the angular spaces between interpenetrating rhombohedrons of calcite. Others were noted as inclusions in a large crystal of amber yellow calcite.

Fig. 4. Datolite

Mr. H. P. Whitlock, in studying a number of specimens sent to him, found that all four types described by E. S. Dana from the original Bergen Hill locality were represented by the Erie cut crystals, and in addition two forms apparently new to the species were encountered (Fig. 4). Of the new forms, \( k \) (132) was noted on ten crystals of the suite measured as an exceedingly narrow series of planes. In several instances only one plane of the form was noted on a single crystal. The pyramid \( Y \) (255)

PLATE 13.

MINERALS OF THE BERGEN ARCHWAYS

1. Apophyllite (1/5)  
2. Datolite (× 3)  
3. Apophyllite (1/2)  
4. Pectolite (1/4)
The single plane of this form noted is small but well defined and gave a fair reflection of the goniometer signal.\(^1\)

**Apophyllite:** Apophyllite crystals were found abundantly in various forms, mostly associated with datolite and analcite; the most common form being the cuboid, with striated diametral prism \(a\), pearly base \(c\), and well developed pyramid (Plate 13, Fig. 1). Some of the crystals are brilliant, glassy, and almost transparent, and, being embedded in a matrix of pale green datolite crystals, make very attractive specimens. Others are of a milky color and resemble those found in the West Paterson quarries. Another form of apophyllite not so common is the thin tabular habit, similar to that from Lake Superior, as figured in Dana; these are associated with fine crystals of white analcite (Plate 13, Fig. 3). Implanted on large crystals of apophyllite are clusters of apophyllite prisms about 1 x 4 mm., terminated by \(p\) and \(c\), all transparent, and evidently secondary. One group of crystals on altered trap is a fine example of apophyllite altering to pectolite. The basal planes on most of the apophys- lites collected are coated with a sprinkling of minute crystals of pyrite suggesting pepper dust.

Among the lot is one crystal showing a new pyramid for this mineral (Fig. 5). The crystal is quite clear and colorless, measures about 4 cm. in vertical length and is partly embedded in a matrix thickly encrusted with small apophyllite crystals. The pyramid is present as a series of eight narrow but well developed planes, truncating the edges between the \(a\) and \(p\) faces, The angles measured for this form correspond to the indices (711) and the letter \(h\) has been assigned to it.\(^2\)

The entire lot of specimens collected is a typical collection in itself, showing as they do all the usual forms of apophyllite, with several not so common; and crystals altering to pectolite are but rarely found anywhere.

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NATROLITE: Another member of the zeolite family popular with collectors is natrolite. Fine specimens of radiating groups, associated with datolite, apophyllite and pyrite, were found. Tufts of natrolite made up of groups of stout crystals with the "picket-fence" terminations were taken out and are probably as good as those from any locality (Plate 11, Fig. 1).

LAUMONTITE: Found only in microscopic crystals of the common form, showing the prism $m$ and oblique termination $e$, entangled with microscopic crystals of datolite and apophyllite; the whole mass held together by an asbestiform mineral.

STILBITE: Sheaf-like aggregates of stilbite crystals were rare; those noted were mostly flattened six-sided crystals coating datolite and calcite. A specimen was found showing individual crystals of stilbite, tabular in habit with the forms shown in Dana's System, Fig. 3, and a millimeter or two in diameter. The outer portions of these crystals are colorless and transparent, but each contains an opaque white nucleus or "phantom" crystal, with the same shape as the crystal as a whole, and occupying about half its volume.

CHALCOPYRITE CRYSTALS FROM THE BERGEN ARCHWAYS

EDGAR T. WHERRY
Washington, D. C.

The crystals of chalcopyrite mentioned by Mr. Manchester in the preceding paper as brought to view by dissolving out calcite vein material proved to be well suited to crystallographic measurement, which was undertaken by the writer, using a Goldschmidt 2-circle goniometer. Two types were found to be represented.

In Type 1, the average development of which is shown in figure 1, the unit sphenoid, $p$ (111) is dominant. The negative unit sphenoid, $p$, (111), is always present as small to medium sized faces, and the base, $c$, (001), as a well-marked narrow face. In addition the prisms $a$ (100) and $m$ (110) are distinctly developed, tho mostly only in the midst of striations, and the second-order pyramid $e$ (011) occurs similarly, in marginal striations. The figure shows, in somewhat idealized manner, the positions of these forms and of the striations observed on a single crystal.

equality in the total number of atoms, (2) equality in the number of oxygen atoms, and (3) equality of molecular volume.

In conclusion I would enquire what is to become of lepidolite and the dark micas? In a revision of his lepidolite theory we found Winchell pleading: "Is it not possible that even in modern analyses the tenor of alkalis is actually a little too low." Four out of the six analyses then under examination were by Kunitz, whose results we are now being asked to regard as about 0.7 per cent too high!

The United States National Museum has acquired by purchase for the Roebling Collection a twin crystal of cerussite of exceptional size. It measures $12 \times 9 \times 4.5$ cm., and weighs $1.5$ kgs. The crystal is triangular in shape and is twinned on the prism $r$ (130). It was found in the famous Tsumeb district of South-west Africa.

The next annual meeting of The Mineralogical Society of America will be held in New York City, in conjunction with that of the Geological Society of America and other affiliated Societies. The sessions will start Thursday and continue to Saturday, December 27-29, 1928. The American Association for the Advancement of Science will also meet in New York City at the same time. Sessions will be held at the American Museum of Natural History and at Columbia University.

Dr. Friedrich Becke, professor of mineralogy at the University of Vienna, has been elected a foreign member of the Swedish Academy of Sciences.

Professor Ludwig Milch, director of the Institute of Mineralogy and Petrology at the University of Breslau, died Jan. 5, at the age of 60 years.

The death has recently been announced of Dr. Julius Hirschwald, professor of mineralogy and geology in the University of Berlin, and of Professor Arthur Schoenflies, of the University of Frankfurt, the well known author of "Theorie der Kristallstruktur."

**PROCEEDINGS OF SOCIETIES**

**NEW YORK MINERALOGICAL CLUB**

**Regular Monthly Meeting of March 21, 1928.**

A regular monthly meeting of the New York Mineralogical Club was held in the Academy Room of the American Museum of Natural History on the evening of March 21, at 8:15 p.m. The president, Dr. Paul F. Kerr, presided, and there was an attendance of 42 members.

The Committee on Nominations submitted the following names for officers for the year 1928-29, to be voted on at the annual meeting on April 18th.

*President:* Herbert P. Whitlock.
*Vice-President:* Frederick I. Allen
*Secretary:* Howard R. Blank.
*Treasurer:* Gilman S. Stanton.

The President introduced the speaker of the evening, Dr. Waldemar T. Schaller of Washington, D. C., who addressed the Club on "Borate Minerals from the

Mojave Desert, California." Dr. Schaller before beginning his paper called the attention of the Club to some excellent specimens of a remarkable pink muscovite which was encountered in mining lepidolite in a pegmatite of northern New Mexico, and discussed its relation to the lepidolite.

Taking up his main theme, the borates of the Mojave desert, the speaker discussed the derivation of borate minerals in general, and enumerated the conditions under which boron-containing rocks break down, and how from the decomposed products borates are produced. In this connection he showed a number of slides illustrating a wide range of topographic conditions, and explained why a dry valley was necessary to the secondary deposition of borate minerals. The speaker then traced the history of borate mining in the southwest, dwelling particularly on the new commercial borates, kernite, mohavite and kramerite. He outlined the unsuccessful efforts which had been made to reproduce kernite in the laboratory, regarding which he stated that he had no explanation to offer.

In the discussion Mr. Shreve asked what mineral was the ultimate source of the boron. In reply Dr. Schaller mentioned volcanic fumeroles as being closely associated with boron emanations, and connected the fumerole minerals with the source of boron. He did not consider the tourmaline present in granitic rocks as occurring in sufficient quantity to produce borate deposits.

A rising vote of thanks was tendered to Dr. Schaller for his highly important and interesting address. The meeting adjourned at 9:35.

HERBERT P. WHITLOCK, Secretary

Regular Monthly Meeting of April 18, 1928.

A regular monthly meeting of the New York Mineralogical Club was held at the American Museum of Natural History on the evening of April 18, 1928. The president, Dr. Paul F. Kerr, presided, and there was a total attendance of 71 persons.

A motion was carried that the Club accept the invitation of Colonel William Boyce Thompson of Yonkers, N. Y., extended through Mr. Fred J. Pope, to visit his mineral and jade collection on the afternoon of Memorial Day, May 30th.

The following officers were elected for the year 1928–29:

President: Herbert P. Whitlock.
First Vice-President: Frederick I. Allen.
Second Vice-President: George E. Ashby.
Secretary: Horace R. Blank.
Treasurer: Gilman S. Stanton.

The newly elected president then assumed the chair and expressed his appreciation to the Club in a brief address.

The speaker of the evening, Mr. James G. Manchester, a member of the Club, was then introduced, and addressed the gathering on "The Minerals of New York City and Vicinity." Under this head he included the territory within a 50-mile radius of the City. Noteworthy finds of minerals within the limits of Greater New York were first discussed, after which the speaker considered nearby counties of New York, Connecticut, and New Jersey. The talk was illustrated by lantern slides, and by many fine specimens, the fruits of 30 years of collecting by Mr. Manchester within the territory covered.
After a vote of thanks had been tendered to the speaker, a motion was carried that the Club publish Mr. Manchester's paper as soon as he is ready to present it in final form.

At the conclusion of the meeting some of the recently described minerals from Franklin, N. J., were exhibited by Mr. Hoadley, and a few hafnium minerals were shown by Mr. Lee.

Horace R. Blank, Secretary

Regular Monthly Meeting of May 16, 1928.

A regular monthly meeting of the New York Mineralogical Club was held at the American Museum of Natural History on the evening of May 16, 1928, with the president, Dr. Herbert P. Whitlock, in the chair. Forty-five members were present.

After a brief business meeting, Dr. Chester A. Reeds, curator of geology at the American Museum of Natural History, addressed the Club on "Rivers That Flow Underground." Such subterranean streams are usually short and of small volume compared to surface rivers, and often appear at the surface as large springs. They are best developed in limestone regions, where they carve for themselves channels and caverns by solution of the rocks through which they flow. If elevation of the land takes place, the streams abandon their underground courses to seek new ones at still lower levels, leaving the former channels dry and open to exploration.

The speaker cited as examples underground rivers in the Endless Caverns, Va., Mammoth Cave, Ky., and others in France, Jugo-Slavia, and Greece. The lecture was illustrated with many lantern slides showing the formations encountered in the interior of caves, and by a number of specimens of stalactites and stalagnites.

The ensuing discussion led to the conclusion that the rate of deposition of calcium carbonate in cave formations was very variable under different conditions, but that in many known instances it was much more rapid than a frequently quoted rate of 1 inch per 2000 years.

After passing a vote of thanks to Dr. Reeds the meeting adjourned.

Horace R. Blank, Secretary

PHILADELPHIA MINERALOGICAL SOCIETY

Academy of Natural Sciences of Philadelphia, April 5, 1928.

A stated meeting of the Philadelphia Mineralogical Society was held on the above date, with an attendance of thirty-one members and visitors. The president, Mr. Clay, presided. Mr. William Slimm was elected a junior member and Mr. Gordon nominated Mr. Herbert W. Brandeis and Dr. A. Bertram Gilliland for full membership.

Dr. A. C. Hawkins of Rutgers University addressed the meeting on "Mineral Occurrences—New and Old." The speaker described a number of localities within seventy-five miles of Philadelphia, and especially the copper mines at Chimney Rocks, New Jersey, and the localities near New Brunswick which yield glauberite casts and calcite pseudomorphs in the red shales. This talk was illustrated by specimens and lantern slides and provoked considerable discussion at the close of the
The talk was greatly appreciated and Dr. Hawkins was tendered a rising vote of thanks.

Dr. Egee presented to the Society for its archives an interesting collection of photographs illustrating field trips and activities of the Society in the early days. Mr. Trudell announced the publication of the long awaited CRYSTALLOGRAPHIC TABLES OF MINERALS which have been compiled by Mr. Gordon in conjunction with Professor Goldschmidt of Heidelberg.

J. C. Boyle, Acting Secretary

A stated meeting of the Philadelphia Mineralogical Society was held on the above date with the vice-president, Mr. Boyle, presiding. Thirty-seven members and twelve visitors were present.

Dr. A. B. Gilliland and Mr. H. W. Brandeis were elected to membership. The evening was devoted to a discussion of “Microscopic Mineralogy.” The subject was introduced by Mr. F. J. Keeley who in his talk traced the development of the mounting of minerals for microscopic examination and display. This idea originated largely from the work of two Philadelphia men, Rev. Rakestraw and George Fiss.

Five microscopes on revolving tables were available and under the direction of Dr. L. C. Wills, the members of the society enjoyed a splendid exhibit of box mounts of minerals.

F. A. Cajorl, Secretary

A stated meeting of the Philadelphia Mineralogical Society was held on the above date, with the president, Mr. Clay, in the chair. Thirty-three members and six visitors were present.

Mr. E. H. Cienkowski addressed the society on “The present status of some New England Mineral Localities.” The speaker described in detail a trip taken by him and two of the junior members during Easter week to the following points of mineral interest: Paterson, N. J.; Peekskill and Bedford, N. Y.; Danbury, Conn.; the essonite locality at New Redding was visited, also Branchville, Roxbury, Portland, Haddam Neck, South Glastonbury, Conn.; the datolite locality at Westfield, Mass., and the Chester emery mines. Information was given of the collecting conditions at these localities and a large number of minerals secured on this trip were displayed.

Mr. Cienkowski then introduced the “Junior Minerologists,” an organization which has recently been formed by the younger members of the Society. Mr. Morris and Mr. Squiers explained as the purpose of the organization the stimulating of interest in mineralogy among boys of high school age. The activities of the organization will include the publication of a small paper giving items of interest to young mineral collectors.

Mr. Biernbaum reported that both the upper and lower quarries at Paterson, N. J., will open soon but that it was improbable that visitors would be admitted to either. Mr. Squiers reported that the old Phoenixville lead mines are to be covered over as the area in which they are located has been purchased to be used as a hunting ground. Mr. Storck exhibited calcite geodes from the shales at New Brunswick, N. J.

F. A. Cajorl, Secretary
NEWARK MINERALOGICAL SOCIETY

Minutes of the Regular Monthly Meetings of February, March, April and May.

On the afternoon of February 5th, Mr. Wm. H. Broadwell read a paper on "Mercury." A complete history of this metal was presented covering nomenclature, age, common and rare mineral species containing mercury, uses, (and abuses), etc. All the various mineral species were exhibited. Mr. Broadwell also made the statement that as high as 50 per cent of mercury is being recovered from scrap rubber.

At the March meeting twenty-four members were present. The committee on the New Jersey State list of minerals advised that this work be postponed. Mr. Broadwell reported upon and had on exhibition the latest new mineral from Franklin, calcium-larsenite. He stated that this mineral showed a bright canary yellow fluorescence under the iron arc, quite distinctive from that of willemite.

The April meeting was held on March 29th at Columbia University, New York City, in order to view the Eggleston collection of minerals. Dr. Blank of Columbia University spoke on "Some Applications of the Polarizing Microscope as Applied to the Identification of Minerals." At the close of the address the members examined many specimens under microscopes, illustrating the various points brought out in the address.

The May meeting, the last indoor meeting until October, opened with an attendance of twenty-one members. Several reports were given. The Outing Committee reported that a field trip would be arranged for some Sunday in May. Mr. J. G. Manchester then gave a lecture on "The Artistry of Minerals." This was illustrated by means of one-hundred colored lantern slides.

Wm. H. Broadwell, Secretary
Famous "Rolling Rock" Saved from Destruction

By JAMES G. MANCHESTER

The Rolling Rock, unique and grand,
Was snatched from dynamiting hand.
Bold symphony in equinoxe
Is saved for earnest girls and boys.
Fond Mecca of school pilgrimage;
Proclaim its value, guess its age,
And when you show your friends the town
Pause at this boulder of renown.
In magnitude it stands alone,
Divine the sermon in this stone.
Recite its story, tell its worth,
Grin master-piece of mother earth.
Its tilting grace none can disprove,
Gibraltar that a child can move.

Pampered Plymouth Rock was loved and kept;
Will Troy* her Rolling Rock accept?
The die is cast, it shall remain
Where nature placed it, long to reign
In its own park on primal throne,
An honored, awe-inspiring stone.

-J. Edmund Estes.

Located at the junction of County Street and Eastern Avenue in the easterly section of Fall River, Massachusetts, is the famous Rolling Rock. The rock foundation in Fall River is granite. The Rolling Rock is a coarse conglomerate, or puddingstone, which has been brought to this spot by glacial action and deposited by the slowly melting ice upon a granite base which had previously been smoothed down by the glacier. The contrast in the two rocks increases the interest with which the Rolling Rock is regarded. Its horizontal circumference is 58 feet and its medium perpendicular thickness is eight feet. Its weight is estimated to be 140 tons. There is abundant evidence that the Rolling Rock was a rockstone up to quite recent times for it is so recorded in books relating to this subject, wherein it is recited that by the use of both hands it could be rocked so as to oscillate at the top two or three inches. Small stones and other material at the base act as wedges, thereby preventing such a demonstration at this time.

With the entry of the automobile as a mode of transport, the old rock, jutting into a narrow street, was considered to be a menace by some people, while others looked upon it as a remarkable natural monument which must be preserved. For twenty-five years it has been a subject of contention between these two forces. The matter was finally brought to a head when the city government ordered its destruction. Men and tools arrived on the scene but friendly Court proceedings held up the work temporarily. The local newspaper, the HERALD-NEWS, took up the fight to save the rock and brought it to a successful conclusion. Much interest was aroused and contributions came from people in all walks of life, societies and clubs participated, and the school children sent in their pennies to the fund. Mr. J. Edmund Estes, who had struggled for many years in an endeavor to save the rock, purchased the land upon which the rock rests at a cost of $6,000 and donated it as his contribution, the public subscriptions paying for the grading and curbing. On November 25th, last, the Rolling Rock and the little park that encloses it were formally dedicated and presented to the city in the presence of over 2,000 people. The exercises consisted of songs by the school children, band music, and a number of appropriate speeches. Now that the rock has been set aside for all time as a natural monument in such a beautiful setting everybody is pleased. The people of Fall River are to be congratulated upon their civic pride in preserving this remarkable geological wonder which has been the Mecca for years of those who enjoy visiting scenes that illustrate the powerful forces of nature such as is expressed in the Rolling Rock.

*The old name applied to the territory now known as Fall River.

Mr. and Mrs. Frank W. Wilson of Meriden, Conn., recently exhibited fifty-six cabinet specimens in one of the store windows in their city. These specimens were from their collection and created much interest and favorable comment from those who were fortunate in viewing them. As an added attraction, their copy of the March issue of ROCKS AND MINERALS was also prominently displayed and a number of new subscriptions were obtained for us. We wish many more of our subscribers and friends were to display their minerals in a similar way; it might be the means of starting off many new collectors.

Hafnium—by Paul M. Tyler. An 11-page pamphlet on this interesting element has recently been issued as Information Circular 6457 by the U. S. Bureau of Mines, Washington, D. C.

During 1930, Utah ranked first in the United States in the production of silver, third in copper after Arizona and Montana, and third in lead after Missouri and Idaho.

Burning of Precious Stones: Electrical furnaces for this purpose are manufactured by Heraeus & Co., (Electrical Department) Hanau, Germany.
The Metropolitan Mineral Area of New York City

By JAMES G. MANCHESTER

"One of the most interesting mineral fields in the world is contained in the territory lying within a radius of fifty miles (80 kms.) of New York City. This area, commonly known as the Metropolitan District, comprises portions of three states, occupying a very small part of the southwesterly section of the State of Connecticut, the southeasterly portion of New York State, and the northerly part of the State of New Jersey. This area, with the exception of a few scattered sections in the outermost portions, is the territory at present receiving serious attention on the part of the Regional Planning Committee formed to study the future growth of New York City and to recommend certain civic improvements to meet the same.

"This region having been subjected to vast rock movements through the uplifting and submerging that took place when this part of the continent was in the making, many veins, dikes, vugs and pockets were formed and it is here that Mother Nature throughout these millions of years has wielded her magic wand to produce these beautiful mineral crystals which are so much admired. The pre-Cambrian gneisses of the hills covering a large part of this area, the Triassic red sandstones and shales in the Newark series, the diabasic and basaltic trap ridges of the Palisades and the Watchung Mountains, the serpentines and limestones which appear in a number of well-defined deposits, are all rich in mineral content.

"In addition to this vast movement resulting from earth making the rocks have suffered subsequent disruption by man. Probably no like area on the face of the globe has been subjected to such intensive artificial removal of rock through engineering enterprises. The first settlers, almost as soon as they had erected shelters, were obliged to look about for materials to use in the arts and industries, for it is from the earth's crust that those material things which are necessary for life and happiness are drawn. Much prospecting has been done in the search for ores and many mines have been operated. To provide water for its millions of inhabitants, reservoirs and aqueducts have been established. For the erection of gigantic buildings extensive excavations have been made in the rock floor. To facilitate transportation miles of streets, tunnels and railroad cuts have been constructed, in many instances through solid rock.

"One usually associates mining activities with the open country and the wilds of distant mining camps. The fact that such operations have been conducted almost within the confines of a great city is not generally known to many of the inhabitants thereof.

"In looking over the past history of the district we find that in this area over 300 iron mines and more than twenty copper mines have been operated at one time or another, but the discovery and opening up of new fields in the West and in foreign countries created a competition which could not be met, so that at present no copper mines have been in operation for twenty years or more, and only a few iron mines are producing at this time. Many of these iron mines, however, have never been worked out and if their ore (magnetite) ever becomes scarce in other regions the many abandoned mines in the district may once more take their place in the industry and be made to supply large quantities of ore for an indefinite period. The iron mine ore mined on Staten Island and in East Brunswick, New Jersey, was used for blast furnaces and partly to produce red ochre paint.

"The white limestone occurring in this area has been worked extensively for flux..."
TUNGSTEN MINE (ENTRANCE)
Trumbull, Conn.

BUCKWHEAT ZINC MINE (OPEN PIT)
Franklin Furnace, N. J. (Showing Franklinite Vein)

TILLY FOSTER IRON MINE
Near Brewster, N. Y. (Pit Filled with Water 620 Feet Deep—Ice Coated)

KINNEL FELDSPAR QUARRY (WASTE PILE)
Bedford, N. Y.
PLATE NO. 7
GRANITE QUARRY
Valhalla, N. Y.

PLATE NO. 8
LIMESTONE QUARRY
Sing Sing (Ossining,) N. Y.

PLATE NO. 9
MARBLE QUARRY
Tuckahoe, N. Y.

PLATE NO. 10
TRAP ROCK QUARRY
(Showing Contact of Basalt of First Watchung Flow on Newark Sandstone)
Upper Montclair, N. J.
for use in the many iron works, for burning into lime and also for agricultural purposes. The remains of abandoned lime kilns may be seen at various places throughout the district. Today much of the limestone is reduced to a fine powder for use as a light abrasive and for the making of artificial stone. Extensive operations of this kind are now under way in Westchester County.

"Several mines rich in zinc and manganese in the Franklin Furnace district of New Jersey have been in operation for seventy years and are big producers at the present time. The Franklin ores are chiefly valuable as a source of zinc, but also on account of the manganese and iron they contain. From them is made a high grade spliter (commercial zinc); zinc oxide, used as white paint and in the arts; and spiegelisen (an alloy of iron and manganese) used in the production of steel. It is reported that about 1830 Dr. Fowler, then owner of the mine, produced a "bluish-white powder" from the ore that he used as a substitute for white lead with which he painted his house, which was perhaps the first time oxide of zinc from the ores of an American mine was used for house painting. It was about 1818 that the first metallic zinc made in the United States was reduced from zincite ore furnished by these mines. This metal was used in preparing brass for the first set of standard weights and measures ordered by the Congress.

"Emery, a variety of corundum, used as an abrasive, is being taken out of the rocks in the Peckskill region and at certain periods in the past has furnished a goodly portion of that ore consumed in this country; here, too, foreign competition has slowed up this industry.

"Feldspar, quartz and mica mines are being operated quite extensively at the present time in a number of localities a few miles north of New York City in Westchester County. One of these mines at Bedford has been in continuous operation for fifty years and over one million tons of ore has been taken out. The ore is crushed to a fine powder and is afterwards shipped to various industrial plants. The quartz is used as a wood filler, for silica paint and as a constituent for scouring soaps. The feldspar is used in the manufacture of china and porcelain ware, putting the fine glaze on that material. The production of mica, despite the fact that it is an important mineral in the rocks of this vicinity, has never attained the basis of a settled industry, the material being of such a quality as would not permit its use for sheetmica purposes. It was formerly allowed to accumulate on the dump; recently a market has been found, with the result that this side of the mining operations is receiving considerable attention at the present time.

"Beryl, which is occasionally met with in large crystals weighing several hundred pounds each, has been collected as a by-product and for years shipped to Germany where a ready market was to be had. The chief use of beryl in industry has been and still is as a constituent of enamels for enameled steel ware. Beryl contains the rare metal beryllium (also known as glucinium), discovered in 1828 by Wöhler, but it is only quite recent that methods have been discovered to isolate it on a semi-commercial scale. This has stimulated the interest in possible sources of beryll which could be relied upon as adequate for commercial production of this metal. Beryllium is a hard and brittle metal and for this reason few uses for it have been found. Heretofore, it has had but a single commercial use, being employed for the windows of certain X-ray tubes. Most of the research on beryllium has been conducted in Germany with a view to its use as an alloying metal with iron, copper and nickel. The recent discovery that beryllium has all the qualities of aluminum and at the same time is a lighter metal has created a demand for beryl and this mineral is now given a prominent place in the products of the Bedford quarries. "The rose-colored quartz at Bedford is not only best known to collectors but to the neighbors of the quarries, for in driving about the vicinity this mineral will be found on display in the front yards and along the walks. Shipments of this material have been made to Europe and the Orient to be carved into ornaments, no doubt much of the finished product finding its way back to the United States.

"Several years ago the newspapers carried the announcement of the discovery by the Danish chemist, Georg v. Hevesy, of the new metal hafnium, and later when a small amount of one of its salts, "two little pinches of white powder, sealed in tiny glass flasks," was received in this country, considerable inter-
est was aroused. Few people, other than members of the chemical profession and local mineralogists, knew that we had deposits of potash in the Bedford region. The potash was discovered in 1825 and a company was formed to operate the mine in 1827 and some work was done but the enterprise was soon abandoned.

"Tungsten ores were mined many years ago at Trumbull, the industry being re-

vived during the world war. The sepa-

ration of the ore was done by the labor of the workers who had mining for the first time in their lives. The ore was shipped to the West, and was used by the United States Government for the production of tungsten wire for the making of incandescent lamps. The first large-scale production of tungsten wire in the United States was started at the Trumbull mine in 1896.

"Mineral deposits of significance in the eastern United States are relatively few and are limited to a small area. The most important of these deposits are located in the Appalachian Mountains, from New Hampshire to Alabama. The most important minerals found in this area are gold, silver, copper, iron, and coal.

"The Appalachian Mountains are a range of mountains located in the eastern United States, extending from New Hampshire to Alabama. The range is about 1,000 miles long and 200 miles wide. The mountains are composed of sedimentary and igneous rocks, and are believed to have been uplifted by tectonic activity. The range contains a variety of minerals, including gold, silver, copper, iron, and coal.

"The deposits of gold in the Appalachian Mountains are found in the form of placer deposits, which are deposits of gold that have been washed out of the stream beds and collected in the river valleys. The gold is usually found in the form of fine dust, which collects in the river beds and is washed downstream.

"The deposits of silver in the Appalachian Mountains are found in the form of veins, which are long, narrow channels that are filled with minerals. The silver is usually found in the form of silver ore, which is a mineral that contains silver.

"The deposits of copper in the Appalachian Mountains are found in the form of veins, which are long, narrow channels that are filled with minerals. The copper is usually found in the form of copper ore, which is a mineral that contains copper.

"The deposits of iron in the Appalachian Mountains are found in the form of veins, which are long, narrow channels that are filled with minerals. The iron is usually found in the form of iron ore, which is a mineral that contains iron.

"The deposits of coal in the Appalachian Mountains are found in the form of seams, which are horizontal layers of coal that are found in the rock. The coal is usually found in the form of anthracite, which is a hard, compact form of coal.

"The deposits of gold, silver, copper, iron, and coal in the Appalachian Mountains are of great economic importance. These minerals are used in a variety of industries, including mining, manufacturing, and construction. The mining of these minerals has been a major source of employment in the Appalachian region.

"The Appalachian Mountains are a region of great scenic beauty. The mountains are characterized by their rugged peaks, deep valleys, and clear streams. The region is also home to a variety of wildlife, including bears, deer, and birds.
Also, those who presented papers at the last annual meeting and indicated their intention to publish them in the American Mineralogist should notify the Editor when these articles will be available. Such action will be of great assistance in planning well balanced numbers for future issues.

The first commercial shaft ever sunk in the United States for potash has now reached a depth of a thousand feet, and potash minerals are ready to ship. The shaft has been sunk in New Mexico in a district recently explored by the U. S. Geological Survey. The shaft has passed through several workable beds of potash minerals, the best of which consists of sylvite.

A book of 325 pages with 127 plates and map, by James G. Manchester on “The Minerals of New York City and its Environs” has recently made its appearance. A review of this interesting work appears in another section of this journal. The book was published as a bulletin of the New York Mineralogical Club and can be purchased for $2.50 (plus 20¢ postage) by addressing the New York Mineralogical Club, care of the American Museum of Natural History, Central Park West and 77th St., New York City.

BOOKS REVIEWS


One Saturday, late in November, about twenty years ago, a New Yorker hurrying home from his daily work, hesitated on his way to the subway to examine an excavation for an apartment house at Broadway and 161st Street. The workmen had left and he descended into the cut. He found what looked like three faces of a feldspar crystal protruding from the rock. Not having any tools, he marked the spot, intending to extract the specimen later. During the night a storm arose, covering the ground with three inches of snow. Early on Sunday morning passing pedestrians stopped to see the strange sight of a man climbing over the rocks, and sweeping off the snow with a small whisk-broom. Two weeks of illness resulted from exposure, but the collector obtained a wonderful oligoclase crystal.¹

Of such enthusiasm was this book written. Mr. Manchester has been one of the most active members of the New York Mineralogical Club, and for many years was its president. In a life crowded with the duties of an executive in an insurance company, he has nevertheless found time to indulge in the hobby of collecting minerals in the excavations and mines about New York, and to gather the data set forth in this volume.

This work treats of the minerals to be found within fifty miles of Columbus Circle in New York City: an area which includes many famous localities such as Franklin Furnace, Sterling Hill, Paterson and Bergen Hill, in New Jersey; Orange County, Bedford, Peekskill and Tilly Foster, in New York; and Branchville, Danbury and Trumbull in Connecticut.

The Introduction describes the geology of the area, with an account of the various mining and quarrying enterprises which have made the district so fruitful to collectors. Exactly 400 localities are then listed alphabetically with the minerals

¹ Now in the American Museum of Natural History, and illustrated on Plate 39.
reported from each. This is followed by a list, also alphabetically arranged, of mineral species, varieties, synonyms and alterations recorded from the area. The 396 mineral species and important varieties have been tabulated in the order of Dana’s System, with the chemical composition, form, color, hardness and specific gravity of each. Some 848 books and papers are listed in the Bibliography. The illustrations include 88 photographs of extraordinary specimens, 29 of mineral localities, and 10 showing the New York Mineralogical Club in the field. The mineral index is a model of completeness, as it not only lists all species, varieties, synonyms and alterations found in the district, but references are also given in each case to the Bibliography, Classified List, Locality List, and to the Illustrations.

Collectors and curators should find this book a faithful guide, and it should go far toward stimulating a local interest in mineral collecting in the excavations of Manhattan.

SAMUEL G. GORDON

DETERMINATION OF THE OPAQUE MINERALS. C. MASON FARNHAM.

The identification and association of minerals serve as the basis on which mining geologists and engineers build working hypotheses regarding the persistency of ore at depth and the recognition of mineral zones. In the past insufficient attention has been given the study relating to opaque mineral identification as only two textbooks on this subject have appeared in English in the past fifteen years. The new book by Farnham therefore does not greet an overcrowded field.

Many reviews ignore the author’s statement of the purpose of his book and proceed to measure its applicability to their chosen fields. Farnham has restricted his choice of methods, “so as to be available with apparatus consisting only of a suitable microscope, a few bottles containing reagents, hand-grinding machines, and a few abrasives.” Other methods may be extremely valuable but, as the author states, are “not practical for the field geologist or the investigator who is located in an isolated mining district.”

While the science of mineralogy at present generally recognizes about 261 opaque minerals, 94 have been shown by the microscope to be mixtures of minerals or belong to doubtful species. (It is the opinion of the reviewer that benjaminite should also have been added to the list of mixtures).

Although the scope of the book is primarily limited to the identification of the opaque minerals, 51 somewhat transparent minerals have been added as they occur associated with the opaque minerals in ore deposits. In the tables sixty-five divisions are recognized based on the effects produced by six standard reagents- HNO₃, KCN, HCl, FeCl₃, KOH, and HgCl₂. Numerous supplementary tables are also included on “Minerals with a Distinctive Color,” “Minerals with a Colored Powder,” “Minerals Arranged According to Hardness, Specific Gravity, Electrical Conductivity, etc.” Fourteen pages are devoted to a description of the technique employed in preparing the polished section while a rather extensive bibliography should prove extremely helpful to the serious-minded student.

The book is up to date including a brief discussion of the behavior of polarized light upon opaque minerals, and should make a strong appeal to both the student in the laboratory and the practical man in the field who, by necessity, is restricted in the number of his reagents and the amount of his equipment.

ERNEST E. FAIRBANKS
PLATE NO. 1

GEM STONES

1—Beryl, var. Golden, Broadway and 158th Street, Manhattan Island.
2—Quartz, var. Citrine, Bedford, N. Y.
3—Tourmaline, Broadway and 218th Street, Manhattan Island.
4—Quartz, var. Amethyst, West Paterson, N. J.
5—Garnet, var. Spessartite, Haven Avenue and 179th Street, Manhattan Island.
6—Beryl, var. Aquamarine, Broadway and 157th Street, Manhattan Island.
7—Datolite, West Paterson, N. J.
8—Quartz, var. Smoky, Broadway and 162nd Street, Manhattan Island.
9—Willemite, Franklin, N. J.
FIFTY YEARS OF MINERAL COLLECTING FROM MAINE TO FLORIDA

By JAMES G. MANCHESTER

(Address at the Mineral Day at the World's Fair (New York City), June 17, 1940)

The first mineral collector either crawled out of a cave, or clambered down a tree, and among the first objects he appropriated for his own use were rocks and minerals owing to their applications for useful and decorative purposes. From that time to this, minerals have played an important part in the arena of humanity and the progress of civilization may be measured by the ability of man to discover in minerals the powers hidden within.

From the cradle to the grave modern man places his chief reliance upon minerals, or their derivatives. The first substances appropriated to the new born babe are mineral substances, boracic acid and nitrate of silver, dropped in weak solution in the eyes to prevent possible blindness, and vaseline, a petroleum product, applied to every other part of the body to soothe the tender skin and hasten its development. Everything man eats, wears, buys or sells, is composed of or produced by the aid of minerals, including the pen with which he signs his last Will. Eventually he will shuffle off this mortal coil on an iron bed and when his body is placed in the ground a rock will mark its last resting place, denoting that beneath that stone is a human body returning to the purely mineral environment from which it originated. Dust to dust.

In recent years more laymen have become interested in minerals and many new societies and clubs have been formed to promote the study of minerals. How can we account for this increased interest? Some say the depression,—people desiring an outlet for their leisure time. Personally, I believe the many new discoveries made involving the use of minerals, which have been given much space in the newspapers, has aroused interest and curiosity among laymen. Then again the schools are giving more time to this branch of the natural sciences, and there is that great organization, the Boy Scouts, from which are recruited many who take up minerals as a hobby. In recent years a number of magazines have been launched which give the story of minerals in a non-technical manner. All these have been factors in arousing an interest in minerals. It is reasonable, therefore, to expect that minerals should attract a large following.

Besides the utilitarian and scientific interest in minerals, there is their aesthetic beauty in which amateur mineral collectors are mostly interested. To the average layman mineralogy is thought to be a deep and difficult study. To appreciate and to understand minerals does not require long hours of study. Tramping over the fields and delving among the rocks in the search for specimens is a healthful diversion.

Longfellow says "All things come round to him who will but wait," but in collecting minerals if you are going to sit around and wait you cannot go places. The slogan of an advertising firm "Keep-
ing everlasting at it brings success; it seems to me applies to the mineral collector. Recreational hours devoted to the collecting and the studying of minerals should not be permitted to encroach upon one's vocational hours. If you have a hobby, ride it, if the hobby rides you, failure in your vocation will result.

I have never regretted the day, when, as a very young man, I was shown a small collection of minerals; the owner of this collection presented me with a quartz crystal from Herkimer County, New York, and from that day to this minerals have been my hobby.

My first mineral crystal collected was found in a small vug or pocket in a glacial boulder of white quartz exposed at low tide on the shore of Narragansett Bay in Rhode Island. This boulder, after being broken away from its rocky ledge by the glacier coming down from the North, had been so rolled about that its angular outline had become much rounded and the rock deposited on the shore of the bay. That this crystal should remain loose in the pocket of this boulder which had been lapped by tidal waters for thousands of years, is beyond comprehension.

My guide and mentor in those early days of collecting, often told me of his collecting experience in Maine, that on one of his trips he brought home many specimens, so many in fact, that when he stepped off the train the bottom fell out of his box and the specimens were scattered about the station. This sounded rather intriguing to a beginner, but it was many years before I was able to visit Maine to find out that my friend was correct in his glowing description of the possibilities of collecting minerals in that State. Upon the occasion of my first visit I met Mr. Pulsifer, the owner of a feldspar mine on Mt. Apatite noted for the wonderful apatite crystals found there. He showed me one specimen, a crystal about 2½ inches in diameter. His price, a few years later the same specimen turned up in New York and was being offered for sale at $400. Later I saw the specimen at Rutgers' University, where Col. Washington A. Roebling had an exhibition of minerals recently acquired. Upon inquiry I found out that the Colonel and the mineral dealer could not come to an agreement as to the terms of the sale. The dealer left and Mrs. Roebling noted the discomfort of the Colonel at not being able to acquire the specimen. Mrs. Roebling arose to the occasion, however, and traced the specimen back to the miner from whom she purchased it at a cost of $250, and later presented it to Colonel Roebling on his birthday. The specimen is now lodged with the Roebling Collection at the Smithsonian Institution in Washington.

Of course all are acquainted with the story how the tourmaline deposit on Mt. Mica was discovered by two boys and to me this was a hollowed spot. Tourmaline, while a comparatively modern stone, has its legends and romances as interesting as some of the older ones. I well remember reading about the complexity of the chemical composition of tourmaline in Ruskin's "Ethics of the Dust", a series of lectures delivered at a girl's school. In telling of tourmaline, Ruskin writes:

"A little of everything; There's always flint, and clay, and magnesia in it; And the black is iron according to its fancy; And there's boracic acid, if you know what that is, and if you don't, I can't tell you today, and it doesn't signify; And there's potash and soda; And on the whole, the chemistry of it is more like a medieval doctor's prescription than the making of a respectable mineral."

Ruskin was an ardent collector of minerals and was a voluminous and passionate exponent of the beauties of nature as expressed in them. He was an inculcator in men's minds of all that is beautiful and lovely, both in nature and in art. He was a close associate of the pre-Raphaelites and believed as they did that art should render the spirit of nature truthfully.

The Portland, Connecticut, pegmatite quarries have always been of interest to the mineral collector. On one occasion I witnessed the destruction of a large pink beryl crystal by one of the quarry workmen. Soon after along came a teacher with a class of boys. The teacher told his class that the mineral was rose quartz but later changed his determination when he was advised that much of the coloring was due to blood from the cut fingers of a too enthusiastic mineral collector picking over the fragments for gem material. There are many interesting mineral localities in Connecticut, notably the cyante at Judds Bridge, the garnets at Redding and the iron mine dumps at Roxbury.

A locality that stands out in my memory is the Diamond Hill section of Herkimer County, New York, noted for the remarkable quartz crystals found there. I shall never forget the sensation of walking over the newly ploughed fields in the early Spring, after a light rain, and there sparkling in the sunlight were those lustrous quartz crystals looking like gems from the lapidary, resting on its own pedestal of earth. The pioneers in building their stone fences in this area were not interested in the quartz crystals that fell out of the cavities when the rock was being broken but the modern collector searches along the stone walls to collect these gem-like crystals.

Fortunately indeed is the mineral collector who resides in the Metropolitan area of New York City. Here are rocks of various geological horizons—sedimentary, igneous and metamorphic. Probably no other like area in the world has been subjected to such a vast artificial removal of rock thru engineering enterprises. In this area there have been operated from time to time no less than three hundred iron mines and twenty copper mines, but the discovery of richer deposits in other localities was also the handmaiden of these operations. In Colonial times the rocks provided the sulphuric acid and arsenic required in those days. Rich deposits of zinc and manganese are present and these mines have provided much wealth to their owners.

Several incidents stand out in my memory in connection with the collecting of minerals in this area. Entering late one Saturday afternoon an excavation on upper Broadway, where the rock was being removed for the erection of an apartment building, I saw in the material evidence of a feldspar crystal. The removal of this specimen was put over until the next day. During the night there had been a snowstorm and everything out of doors was covered with three or four inches of snow. Early that Sunday morning people on their way to church witnessed the strange sight of a man climbing over the rocks and brushing off the snow with a whisk broom. Eventually the rock was found and the crystal removed. The specimen turned out to be a remarkably well developed orthoclase crystal. The sequel to this Sunday morning romance was the receipt of a letter from the publishers of a well known encyclopedia asking permission to reproduce an illustration of this particular specimen in a forthcoming edition of the encyclopedia.

On another occasion there was a fine specimen of Gem chrysoberyl found in an excavation at Broadway and 164th Street. There had been a thunderstorm that afternoon and after dodging in and out of doorways trying to reach home without getting wet, the sun came out and in examining the rocks in this particular excavation, which were black from the rain, that stood out against the dark background a yellowish-green chrysoberyl crystal. Many other gems and semi-precious stones have been taken out of the Manhattan rocks but time does not permit a detailed description except to say that the list includes aquamarines, golden beryls, spessartite garnets, citrine quartzes and brown tourmalines. The specimens themselves may be seen in the collection of the New York Mineralogical Club on display in the American Museum of Natural History, New York City.
The hills of Westchester County, in the vicinity of Bedford, New York, are mined for mica, quartz and feldspar. These operations, begun by a discouraged farmer, have been actively worked for nearly seventy years. Upon the occasion of my first visit to the locality hand drilling was in use, black powder for blasting purposes, and a huge stone wheel crushed the ore, the power being furnished by a horse harnessed to the wheel and plodding along a circular pathway. This is a far cry from the modern mill in operation at the present time. The powdered rock is shipped to various industrial plants. In the removal of this rock many minerals of interest to the collector have been uncovered, some 52 varieties having been listed.

The Bedford locality is known for its fine rose-colored quartzite, the material being suitable for cutting into ornaments. Just at the turn of the century, upon one of my visits, there were collected semi-transparent rose colored quartz. This was turned over to a lapidary for cutting and polishing and in the finished material was a polished sphere showing a six-rayed star by transmitted light. The story of this find was published two years later similar material, mounted in jewelry, appeared on sale in jewelry stores. The material had been cut into spheres, the position of the star located and then cut into hemispheres, the backs of which were treated with quick-silver; the star is noted by letting the light enter the stone to be reflected from the mirrored or gilded back; the trade name of starlite had been given to the stone, a name subsequently given to the blue-tiegon from Siam.

A number of radio-active minerals are found in the Bedford quarries. The most interesting of these is the mineral uraninitite, a uranium oxide. An examination of the rocks will sometimes disclose a small black uraninitite crystal surrounded by a brown halo on the matrix; this halo is caused by emanations from the radium content of the uraninitite crystal. The mineral uraninitite degenerates thru a series of minerals, of which radium is one, ultimately reaching the end product which is called uranium-lead. Physicists have computed the breaking up of the uranium atom and it is possible to make a computation as to the maximum age of any rock from the proportion of uranium and uranium-lead present. It is reported that such an analysis applied to the Bedford deposit has demonstrated that the age of the rocks in the Metropolitan area is vastly in excess of what the early geologists supposed.

Across the Hudson River there are the famous Palisades of the Hudson which have provided minerals of unusual interest, many of which are scattered in museums throughout the world. This trap ridge has been pierced by many tunnels and open cuts for transportation purposes, requiring the removal of a vast amount of rock. During the construction of the Erie Railroad 'orange line' of New York City (1908-1911), I visited the workings nearly every Saturday afternoon for two years, regardless of weather conditions. Construction was conducted twenty-four hours a day in eight hour shifts. During these two years I met only one other collector, who, being busy during the day with his job as a house painter, had to confine his collecting to nights. On several occasions, when the days were growing shorter during the Winter months, I met him coming to the excavation with a lantern. He was an enthusiastic and discriminate collector and many of his specimens found their niche in the Roebling and Canfield collections now in the Smithsonian Institution.

The most outstanding specimens collected in the Erie "open cut" excavation were some loose datolite crystals showing no contact with the matrix. These were found at the end of a small cavity. The problem was, how did these crystals form without showing evidence of attachment to a matrix? Upon examination with a pocket magnifier, it is noted that running through the crystals are fine threads of an abietiform mineral. No doubt when the solution in this cavity was changed to a solution that would produce datolite crystals the threads of asbestos still ran across the cavity and it was around these threads that the crystals were formed. When the solution evaporated the crystals fell to the bottom of the cavity where they were found.

We all know of the wonderful minerals collected in the Watchung trap rock quarries of New Jersey. The mineral that I remember mostly is a specimen of natalolite collected at the lower New Street quarry in West Paterson. One Saturday morning, many years ago, I called Mr. Gratacap, then curator of minerals at the American Museum of Natural History, and asked if the West Paterson quarry had renewed operation for the season. He said, yes, that a collector had been in to the museum the day before and showed him some splendid natalolites that had just been taken out. I visited the quarry that afternoon and to prevent the collection of someone having recently worked in one of the cavities, I took up the work where the previous collector had left off and after a while removed from the cavity a very fine cluster of natalolite crystals. Natalolite, when conditions are right, has a tendency to crystallize out in bunches of crystals looking like pom-poms or pom-poms. This particular specimen I had taken out was half a hemisphere. When it was illustrated in a recent bulletin of the New York Mineralogical Club I received a letter from the curator of minerals in a foreign museum saying that he felt quite sure that they had the other half of my specimen in their museum. After some correspondence it was decided that this was so. There were very few collectors in those days and who the particular person was that discovered the cavity the day before has never been found out as it was many years after the occurrence that the matter was brought up.

The clay pits in this area are not without interest to collectors. I know of nothing more thrilling than that experienced in breaking open the siderite or clay ironstones found in the clay pits of New Jersey. To break open one of these stones in the bright sunlight and watch the moisture disappear and the sparkling pyrite crystals with their iridescent colors slowly come to view is a joy reserved only for those fortunate enough to be present.

Time permits the mention of only one more locality. Very many years ago I sent from my New England home a few cents to a mineral dealer in New York City and obtained a specimen labeled "Chalcedony pseudomorph after coral, Tampa Bay, Florida." This particular specimen acquired in those early days seemed so attractive that throughout all these years I have had a desire to visit the locality where this specimen came from. After a lapse of more than forty years this desire has been fulfilled and for the past four winters many pleasant hours have been spent collecting in the vicinity of Tampa and the experience gained is the culmination of all collecting and what I have done before. The red stones are found during a very low tide in what are known as the silex beds at Ballast Point in Hillsborough Bay, not Tampa Bay. The local residents know nothing, or care nothing about them. The locality has been the mecca for collectors for over one hundred years. The varieties of chalcedony noted are said, sardonyx, blackonyx, carnelian, agate, flint and chert. Much of the material is suitable for cutting into semi-precious stones for jewelry mounts. There is an endless display of color. To collect successfully one must depend upon the wind, the water, the tide and the moon. It is rare indeed that these elements will co-operate for the benefit of mineral collectors.

As I said at the beginning my first quartz crystal was found in a glacial boulder exposed at low tide and probably what may mean my final collecting days were spent in tidal waters gathering these remarkable specimens in Florida,—an unusual experience, that one's mineral collecting over a long period of time should begin and end in the water, almost the last place to look for mineral specimens.

We who collect minerals as a hobby...
have much to be thankful for. Our interest takes us from what may be called the drudgery of an everyday existence. We see in these mineral crystals a continual struggle for perfection; they show the marvellous work of Mother Nature produced when she was in one of her best moods. To study and to ponder over these creations is a diversion that cannot help but make this a happier world to live in and the approaching night seem but the awakening of a new dawn. It's been a great life.

Editor's Note: Mr. Manchester is one of America's most noted collectors. He is author of Minerals of New York City and its Environs, a book which has become immensely popular with collectors.

GEODE LOCALITY IN OHIO

By HOWARD R. GOODWIN

Curator of Minerals, Ohio State Museum

While most mineral collectors are familiar with the geodes found in Indiana, Illinois, Missouri and Iowa, perhaps there are few who are aware of the occurrence of geodes in Ohio. Within the last few years, however, the writer has made a number of trips to Highland and Adams counties, in Ohio, where, released by decomposed limestone, numerous fossil corals and other marine organisms are found loose in the soil. Among these fossils some interesting and attractive geodes have been found and now are to be seen in the collections of the Ohio State Museum, Columbus, Ohio.

While many specimens proved to be solid chert or crystalline quartz when broken open, some were composed of concentric layers of crystallized quartz slightly separated from each other allowing development of the crystals on each side. The unbroken specimens of this type present the appearance of gigantic puff-balls, some having well defined stems. The outer surface is generally smooth with scattered holes and shallow pitting which suggest some form of sponge, while in size they range from two to six or more inches in diameter. Some contain more or less black powder in small cavities or between the quartz layers. Others have asphaltum which gets very sticky in a warm room and these are not recommended for the cabinet.

Silicified corals of irregular and hemispherical form, the outer surface showing the coral cells perfectly preserved usually prove to be real geodes, the inner walls lined with sparkling quartz crystals or botryoidal chalcedony. At times a single crystal of calcite is implanted on the quartz, or a cavity may be completely filled with a mass of calcite.

In some cases curved plates of crystallized quartz are arranged in such way as to suggest a partly opened flower, but these are rare. A lucky break will often expose a dome of crystals in one half while the other half forms the roof, all covered with glittering quartz. Many of the large concretions of the Ohio shales prove to be geodes, some having several cavities, the walls are usually lined with pearlspor though quartz is not rare. It is not unusual to find calcite or barite crystals in singles and groups implanted on the pearlspor or quartz and in one case calcite, selenite, barite and pyrite crystals were scattered over the pearlspor. The two latter mentioned however are in a bad state of decomposition.

The specimens in the museum collection represent many trips and a deal of hard work and are the result of an undying interest in the pursuit of mineral specimens.

READING HILLS TOUR

A mineralogical tour through the jasper localities of Eastern Pennsylvania will be held on Sunday, Aug. 25, 1940.

See page 275, this issue, for more particulars.
HAMPTON-BAYS, L. I., June 28

—James G. Manchester, former assistant manager of the real estate department of the Mutual Life Insurance Company of New York, died tonight in Southampton (L. I.) Hospital, at the age of 76.

Born in Fall River, Mass., Mr. Manchester was a life member of the Archaeological and Historical Society of Ohio State and a fellow member of the American Association for the Advancement of the Science of Mineralogy.

Surviving are his widow, Clara; a stepson, William W. Enner of Southampton, and a grandson, James G. Manchester of Maywood, N. J.
JAMES GREENFIELD MANCHESTER

SEPT. 20, 1871—JUNE 28, 1948

James Greenfield Manchester was born Sept. 20, 1871, in Fall River, Massachusetts. Working for a living from the earliest recorded period of his life, he perfected himself in whatever he undertook, and the record shows that he was highly thought of in his native city. He learned typing and stenography, and then proceeded to create beautiful designs with typewritten characters, which won the award as best in the United States, in the Columbian Exposition at Chicago in 1893.

Coming to New York City at the request of his very close friend the Rev. Percy Stickney Grant of the Church of the Ascension, he became Treasurer of that Institution. Soon after this, he became Assistant Treasurer of the New York Mutual Life Insurance Company, and still later Assistant Manager of their Real Estate Division.

He was elected a Fellow of the American Association for the Advancement of Science, and declared a Life Member of the Ohio Archaeological and Historical Society.

He was a past President of the New York Mineralogical Club, Inc., succeeding Dr. George F. Kunz of Tiffany & Company. He joined the Club at the March 11, 1908, meeting and used to joke about the hard time he had getting into it. He was a Fellow of the Mineralogical Society of America and a member of the Rocks and Minerals Association.

Mr. Manchester adopted mineralogy as a hobby and became very expert in the appreciation of fine specimens. He made a superb collection of minerals, and presented it, with specially designed cases, to the City of Fall River. This collection is now on exhibition in the Public Library in that city. He also has a collection of minerals at the American Museum of Natural History in New York City.

With Gilman S. Stanton, he published an article called "A Discovery of Gem Garnet (Spessartite) in New York City" (American Mineralogist, Vol. 2, No. 7, July, 1917, pp. 85-86, 3 fgs.). He published a number of papers but his major work was the book on "The Minerals of New York City and Its Environs".

Mr. Manchester stated more than once, to the Editor of Rocks and Minerals, that his final attempt and long ambition was to write up the geode locality of Ballast Point, Tampa, Florida. These geodes are composed of chalcedony pseudomorph after coral. After considerable delay, due to the difficulty in having the corals accurately identified, the article was finally finished and appeared in the December, 1941, Rocks and Minerals. This scholarly article with its many fine photos and nice map became intensely popular and before the issue was a month old, thousands of reprints were made of the article to supply public demand. The cost of printing the article and the many reprints were all taken care of by Mr. Manchester—this was another item in his endeavor to further the collecting of mineral specimens.

After retirement, he established residence in Florida, spending his summers in the little white cottage at Hampton Bays, Long Island, N. Y., which his numerous friends so well remember. During his winters in Florida he investigated and collected more of the pseudomorphs of chalcedony. From these he had many beautiful cabochon stones cut, and a great many photographs in natural colors were made.

Through his many lectures before Clubs, High School groups, Boy Scout organizations, and fine article in Rocks and Minerals, the Ballast Point geodes became widely known throughout the United States. He also spoke publicly on other matters of mineralogical interest, using his numerous natural-color slides of mineral specimens and localities.

He made up a great many collections of minerals, including a number of representative species, which he gave away to young people who showed an active interest. These he dressed up with bright colored specimens purchased from dealers and furnished them with trays also purchased at his own expense. His donations to the major museums in this country were so extensive that his friends say that there are very few museums in the eastern United States which do not have specimens labelled, "Gift of J. G. Manchester."

Mr. Manchester died in the Southampton Hospital at Southampton, L. I., N. Y., on June 28, 1948, at the age of 76. He survived by his wife Clara A. Manchester and a grandson, James G. Manchester.

His friendly generosity and great hospitality will be long remembered.
Co-author with Gilman Shattuck Stanton. The minerals of New York City and its environs. Published by the New York Mineralogical Club, 185 pp., 127 pls., 1 map (Jan. 1931).
Dr. A. C. Hawkins

X-RAY MICROSCOPE DEVELOPED

STANFORD UNIVERSITY, CALIF., SEPTEMBER 21—A Stanford physicist has developed an x-ray microscope, it was reported today by the university.

The discovery by Dr. Paul H. Kirkpatrick, nationally known expert in the field of x-rays, is expected to provide scientists eventually with a new tool for the examination of minute objects not readily penetrable by light or electrons.

Its resolving power, or range, based on the performance of early models and theoretical studies, is expected to be somewhere between that of the best type of optical microscope and the electron microscope.

While the new device will not have the magnifying power of the electron microscope, its developers believe it will be much simpler in construction and will offer the advantage that living specimens can be examined. Since objects examined under a beam of electrons have to be in a vacuum, this dries up and kills living tissues.

The largest magnification which the scientists have achieved with early models of the x-ray microscope is about 70 diameters, although they have made no attempt to get high magnification in the present stage of their research.

Dr. Kirkpatrick hopes that fully developed models of the device will permit scientists to x-ray objects less than a millionth of an inch in size. This is about 20 times smaller than can be seen with an optical microscope using the shortest wave light.

Development of the first x-ray microscope model climax a year's research financed by the Research Corporation of New York. The first scientific report of the discovery will be published tomorrow in an article by Dr. Kirkpatrick and Albert V. Baez, a graduate student in physics, in the September issue of the Journal of the Optical Society of America.

An x-ray microscope had long been considered an impossibility because x-rays show almost no reflection, and because of a peculiar quality of the rays which makes it impossible to reflect them off anything except at a very low angle.

This can be compared to the way a stone skips in water. As any boy knows, a stone dropped into water will sink to the bottom. But if it is thrown at a low angle, it will bounce repeatedly off the surface of the water.

Dr. Kirkpatrick bounces the x-rays off one mirror, set up vertically, to another reflector, which is horizontal. One mirror brings the x-rays together on a horizontal plane; the second brings them together on a vertical plane.

The mirrors, about the size of a ten cent piece, look flat, but are actually concave. They are really a tiny segment of a theoretical curve which has a radius of about 30 feet in the current phase of the research, and which may be reduced even smaller.

It was quite a trick to make these tiny mirrors, which are comparable in precision to those of a fine telescope lens. Some of them were ground by Barton L. Stuart, Superintendant Engineer; others were made by Dr. G. D. Hanna, of the California Academy of Sciences in San Francisco.

To date the scientists have used platinum, iridium, gold, and various metal alloys as coating for the mirrors. An alloy of nickel and platinum gives the best results so far, although a variety of metals and alloys remain to be tested, even though some can be eliminated by mathematical theory.

The metals are deposited on the mirror surfaces by an ingenious device which gives a regulated thickness to the deposit. It is a sort of selective sieve which lets a given amount of metal through to a given area of the mirror.

To date Dr. Kirkpatrick and his associates have concentrated their x-ray microscope beam on a fine gauze screen, which has about 200-300 meshes to the inch. The tiny squares of this screen come up clear and sharp in these first efforts. They have also taken successful microscopic x-rays of a wire so fine that it cannot be seen with the naked eye in ordinary light.

At present the scientists are using an ordinary x-ray tube as their source of x-rays, although they are planning to make special tubes which will produce more of the "soft" x-rays—those with a longer wave length—which are needed for successful microscopic x-rays.

The "hard" x-rays—which are the x-rays used in ordinary x-ray equipment. They have too great a penetrating power for microscope work and go completely through small objects without creating contrast film.

Use of the longer waves, as would improve the resolution of the mirror, may permit the critical angle—the angle at which the x-ray reflection to be raised to about three degrees, which is made for greater intensity in the beam.

The wave length which the soft x-rays find most effective is about 0.1 nanometers, while the wave length of the hard x-rays is about 100 nanometers. (An angstrom, the unit of measurement, is about 0.1 nanometers, or 1/1000 of a millionth of a meter.)

Dr. Kirkpatrick and his staff have two well-known facts about light microscopes for their research: the hard x-rays reflect at a low critical angle, and the short wave length is the kind used in ordinary x-ray equipment. They have too great a penetrating power for microscope work and go completely through small objects without creating contrast film.
MEMORIAL OF JAMES GREENFIELD MANCHESTER

Gilman S. Stanton,

New York City.

James G. Manchester, born in Fall River, Massachusetts, on September 20, 1871, was a man whose love of fine mineral specimens found expression in a lifetime of devoted service to his fellow collectors and enthusiasts. He was not of those favored few who, born to wealth, could expand his interests without thought of cost, but one of the many who through continuous effort achieved success not only in his career of business, but in his mineralogical avocation as well. As a young man, he studied typing and stenography, in which he became so proficient that his beautiful and intricate patterns and designs created by means of typewritten characters won for him at the Columbian Exposition in 1893 the award of best in the United States. At the request of his close friend, Reverend Percy S. Grant, Rector of the Church of the Ascension in New York City, he moved there to act as treasurer of the church. Soon thereafter he became Assistant Treasurer of the New York Mutual Life Insurance Company, and later the Assistant Manager of their Real Estate Division, which he efficiently organized and systematized.

Having adopted mineralogy as his hobby, he rapidly became an enthusiastic and vigorous collector with an unerring eye for good specimens and an indefatigable zeal for extracting them. His appreciation of fine minerals did not degenerate into mere acquisitiveness, and he was constantly and generously bestowing choice specimens and collections upon his fortunate friends and associates. A superb collection in specially designed cases was presented to the city of Fall River, where it is exhibited in the public library. Another was contributed to the American Museum of Natural History in New York City. To young people who displayed an active interest in mineralogy he gave representative species, as well as entire suites of specimens obtained at his own expense. Many eastern mineralogical museums contain choice material labeled "Gift of J. G. Manchester." His continuing advocacy of the pleasures of mineral collecting and study resulted in many lectures and well-illustrated demonstrations before clubs and high school and Boy Scout groups.

He became president of the New York Mineralogical Club, succeeding George F. Kunz, and in that capacity he was instrumental in securing many notable speakers for the Club, partly at his personal expense. Through his generosity, the organization was able to publish his careful compilation, "The Minerals of New York City and Its Environs."

Upon retirement, he spent most of his winters in St. Petersburg,
JAMES GREENFIELD MANCHESTER
1871-1948
Florida, where he interested himself in the Ballast Point locality at Tampa, famous for specimens of corals replaced by chalcedony. These he had photographed in color and cut into cabochons. The article describing these unusual chalcedony pseudomorphs after coral, published in *Rocks and Minerals* proved so popular that many additional reprints were prepared to supply the public demand. The cost of the preparation of this article as well as the reprints was borne by Mr. Manchester. He was a fellow of the American Association for the Advancement of Science, the Mineralogical Society of America, a member of the Rocks and Minerals Association, and a life member of the Ohio Archaeological and Historical Society.

By his first wife, Florence Pilkington, born July 12, 1873, died Oct. 23, 1919, he had a son James G. Manchester, Jr., born March 19, 1896, died April 4, 1943, who in turn is survived by a son, James G. Manchester III, born March 18, 1943. His second marriage was to Mrs. Clara A. Ehmer on June 14, 1923, who survives him. Mr. Manchester died on June 28, 1948, at Southampton, Long Island, at the age of seventy-six. He was a man of kindly generosity and hospitality, capable of communication to others his love of beautiful minerals.

**BIBLIOGRAPHY**


The minerals of New York City and its environs. Published by the New York Mineralogical Club, 185 pp., 127 plates, 1 map (1931).
