New England and New York: [specimens] 42499-42560. No. 352 1901

U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

9-891

LAKE SUPERIOR DIVISION.

INSTRUCTIONS.

1. Ordinarily at least two pages of this book will be devoted to one section. On the left-hand page, place a map of as much of the section as has *actually been seen.* Denote rivers, lakes, marshes, etc., by the usual topographical signs. Denote the ledges of rock, when no structure is made out, by cross-hatching, making the cross-hatching cover as nearly as possible the areas occupied by the exposures. If the rock is a massive one, but still more or less plainly bedded, use the same sign with a dip arrow and number attached, showing the direction and amount of the dip. Denote a shaly or other very plainly bedded ledge by right parallel lines, and a ledge having a secondary structure by wavy parallel lines running in the direction of the strike, with dip arrow and number attached as before. The greatest care must be taken to avoid confusing slaty or schistose structure with bedding, and in all cases where there is the least doubt about the true bedding direction, indicate it by a query. To each exposure on the face of the map attach the number of the specimen representing it. In mapping the section count each of the spaces between the blue lines as 100 paces, and twenty of these spaces to one mile, or 2,000 paces. Usually the southeast corner will be placed at the bottom of the page, or at the first black line above the bottom of the page, and at the right-hand side. If, however, for any reason, it is desirable to show portions of an adjoining section, the southeast corner may be shifted up, or the map may be turned around and the north placed at the left-hand side of the page. The ruling of the left-hand pages is also arranged so that, if desirable, a larger or a smaller scale can be used, eight inches, two inches, one inch, or one-half inch to the mile. With the two-inch scale, the squares outlined in black represent sections, and those in red, quarter sections and "forties," while the space between the blue lines is 200 paces.

2. On the right-hand page place the notes descriptive of the exposures. Begin in each case with the number of the specimen, placing the number on the left-hand side of the red line, after which give in order on the right of the same red line the position of the ledges as reckoned in paces from the southeast corner of the section and the dip and strike when observable, the latter always being expressed from the north; for instance 4025, 250 *N.*, 300 *W.*, *Strike*, *N.* 78° *E.*, *Dip* 50° *S.* Then follow with a full description of the ledge. When topographical maps are used for locations this paragraph applies only in part.

3. Collect a specimen from every ledge, or wherever there is a change of rock on any one ledge, taking care to get fresh material, unless for a special purpose the weathered surface is desired. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be specimened. The position and extent of the ledges not specimened should be marked on the map, with notes that each is of a rock identical with specimen so-and-so. Under the same conditions small-sized specimens, trimmed to a uniform size of 2 x 2½ x ¾ inches will be allowed, but in all other cases *large-sized specimens*, trimmed to a size of 3 x 4 x 1 inches, must be selected, in accordance with section 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. Specimens should not be placed together without protection in the collecting bag, as the fresh surfaces, important in determining the character of rocks, are thus destroyed. They should be damaged by no temporary mark, but the numbers should be at once marked in at least two places upon the inclosing paper or cloth bags. Specimens may be permanently marked in camp by painting the numbers upon them in white upon a black background, using Silver White and Ivory Black oil tubes for color, with turpentine as a diluent.

4. On the last twenty-five pages of the book give, as may seem desirable, a general account of the examination of the region mapped in the previous pages, correlation of observations, sketches, cross sections, etc.

5. Forward this note book as soon as filled as registered mail matter to C. R. Van Hise, U. S. Geologist, Madison, Wis.

#352

C R Van Hise,

New England and
New York.

1901

Sept. 20, 1901.

Beckett, Mass.

At Beckett with Hobbs and Emerson. We started toward old Washington Center After going a little way perhaps 1/4 of a mile from town we left the wagon road and followed up the brook which is mapped as being in the Beckett gneiss by Emerson, in which he said that he thought there were beds of quartzite, but thought there was no graphite. When we examined the rocks we found them to be apparently a well bedded set of some feldspathic quartzites and white gneisses interbedded which occurs throughout graphite Immediately upon the discovery of the graphite Professor Emerson transferred it from the Beckett to the Hinsdale gneiss, and thought the beds of quartzite were not really quartzite but gneis saying that they were full of feldspar. I became satisfied that this was a sedimentary series. It has a flat dip to the east and dips under the other rocks of the Hinsdale synclinal basin. It is along the west border of this basin, and it seemed to me to be highly probable that the rocks are the continuation of the quartzose beds which dip to the east, west of Hinsdale. I should regard the whole as probably Cambrian and probably the limestone of Hinsdale, the so-called Colesbrook

limestone, which may occupy all of the flatalong the upper part of the Hoosac river and may be a continuation of the Stockbridge, the outcrops found being merely along the borders of the syncline.

In one respect this section would have been very interesting to Wolfe for it undoubtedly does contain interstratified with the quartzites many bands of white gneiss which are completely crystalline, and which resemble certain phases of the white gneiss of Hoosac Mountain. For instance the platy varieties of the gneiss seen on Tophet Brook which I thought at the time I examined them might possibly be sedimentary, but which later I suspected belonged to the original white gneiss
42499 to 42510 core. Specimens 42499 to 42510 represent the Brook section.

After we left the Brook section and continued in a general course N.W. going to lower and lower horizons we came upon a rock which I regarded as a schistose granite and which Emerson said he would place with the Beckett. This, however, has its foliation dipping in such a direction as to pass directly below the sedimentary beds of the Brook
42511 to 42513 section. 42511- 12-13 represent three

phases of this rock.

The first ledges of these rocks which Emerson said he would call Beckett gneiss had various phases the same as the Beckett gneiss east of Beckett station. The white phases represented by 42512, the intermediate phases represented by 42513, which seemed to be the most abundant variety of rock and a dark colored phase represented by 42514.

42512 to 42514

We now continued for some distance northwest until we reached the Manley house, where suddenly we found in the road banded rocks somewhat similar to the Brook section which were not specimened. These strike parallel to the road, but immediately in the field adjacent perhaps a distance of 30 rods, we get exposures which strike at right angles to the road. These rocks Emerson said he would call typical Beckett gneiss, and said he thought certain of the roundish feldspar and quartz areas might be pebbles. The whole seemed perfectly clearly to Hobbs and me to be a schistose granite. Indeed Hobbs would not have mapped this as Beckett gneiss but would have mapped it as a schistose granite. It appears to me to be a much mashed porphyritic granite. Represented by 42515-16-17.

42515 to 42517 incl

Passing a little further along we again came upon a set of ledges striking nearly across the road which are again clearly sedimentary. These rocks vary from nearly pure bands of quartzite carrying much blue quartz to varieties which are very garnetiferous being a garnetiferous schist. The whole series seemed to me to resemble very much the areas in the belt just west of Hinsdale, and especially the areas near Peru which we regarded as sedimentary. They are like them in their ridgy weathering in the quartzose bands, etc., but Emerson insisted that they were unlike them in that the Washington locality contains much blue quartz, whereas he says the other does not This rige of material crosses the road very near old Wasington Center. It is
42520 represented by specimens 42520-1-2-3-4.
to This material is in vertical position
42524 where first struck on the road. Between
inch it are bands of gneissose material which may be either interbedded or infolded. This material is represented by specimen
42522 42522.

We now rturned to the fields and I found a very close contact of the schistose granite and the quartzitic material. Here the last of the schistose granite
42518 represented by specimen 42518 dips at an angle of about 25° north possibly east or west of north and after an interval or a few feet was found a heavy ledge of quartzite material differing from the thin bedded material before found, being in a single bed 4 to 6 feet thick, garnetiferous
42519 and quartzose. Specimen 42519.

Continuing toward the northwest a little way within a half mile or less we came to the other side of the belt of sedimentary rock. Here the schistose granite was again found adjacent to it and here the dip was across the road to the S. E. at an angle of about 70°. In other words, on both borders of the area of sedimentary material the schistose granite dips under the sedimentary rocks with flat dip on one side and moderate dip on the other, and vertical dips near the center. In other words the dips are perfect for a syncline. It seemed to me perfectly clear that the sedimentary series is above the schistose granite and one naturally would connect the sediments with the other sediments which are found above the granites in the region precisely as at the Club House at Dalton. However, Emerson instists that this gneiss called Washington gneiss is pre-Cambrian, and after having found out these facts he immediately agreed that all of the area which he mapped as Beckett and over which we traveled several miles forom Beckett station, is pre-Cambrian. The belt of sediments must be the belt of Washington gneiss running across the road just southwest of Washington Station.

We now went somewhat further to the north and then turned to the S. W. and went about a mile and then went N. W.

This road goes along the junction just southwest of Ashley Pond, of what Emerson has called Washington gneiss. Here a conglomerate was found having a matrix of a gneissose character similar to that which would be made from a recomposed granite. Immediately below this toward the lowland to the S. W. granite was found precisely as in the case described above, and then to the east is a quartzite and conglomerate which Emerson says continues a long way, and which he places as Beckett conglomerate, and which is clearly sedimentary and entirely different from the schistose granite over which we have been traveling most of the day. The succession here is just what one would expect upon the theory of the schistose rusty variety of quartzite being near the bottom of the succession. The schistose granite is below the blue quartz, rusty quartzite above, with conglomeratic layers, and then higher up the clear vitreous quartzite, and thus in both places today where the rusty ridgy quartzite was found it was near the basal gneiss precisely as at Peru.

Professor Emerson believes that there is an unconformity between the rusty quartzite, which he has called a part of his Washington gneiss, and the Chesire quartzite, but so far as I could see there was perfect conformity of structure, no evidence of any break in the hurried examination we made, but the

relations were not closely and satisfactorily examined.

This rock which I have regarded as a sedimentary quartzose series Emerson correlates with the Washington gneiss between Hinsdale and Dalton, because they both contain graphite and blue quartz. It seems to me that the two rocks are as different as possible, one being a mashed granite and the other a sediment, both having their characteristics.

Sept. 21, 1901.

Beckett, Mass.

Drove with Emerson from Beckett S. E. to Alderman's farm. For about three miles we found the normal ledges of the Beckett gneiss precisely as seen on the west slope of the hill at Beckett village. However at the Alderman's farm about a mile east of Beckett center we saw a section in which there is limestone.

Here the Beckett takes on a somewhat more massive aspect and is quarried as a granite. It is here cut
42495 by fine pegmatitic veins, 42495,
42530 42530. A short distance to the east ~~of~~ Beckett is found very close to a limestone about ten feet from this specimen the coarse crystalline
42496 limestone 42496, cont aining chondrodite. Silicates of various kinds including serpentine are found. The serpentine Emerson regards as altered
42497 Chondrodite. Specimen 42497 represents the limestone which is similar
42498 to the Stockbridge. 42498 shows the
42525 chondrodite. 42525 possesses free serpentine nodules about one foot in
42527 diameter. 42527 average specimen of the gneiss 6 feet east of the limestone.

Immediately to the east of the limestone at this locality is a belt of hornblendic rock which is very
42526 heavily garnetiferous, (42526)

42528 close to the limestone. 42528 a
42529 little south along the strike. 42529 further east.

Continuing the section to the east the rock is a white gneiss but this gneiss differs somewhat from the schistose granite below, and the normal
42530 Beckett gneiss 42530 in that it is
42531.markedly garnetiferous (42531). However at the time I thought it to be certainly mashed granite phase of the granite, but felt less certain afterwards.

Continuing to the east there is a considerable interval of no exposure and then we come at a distance of about a half mile to the east to the main heavy belt of Colesbrook limestone.

We now went to Middle field switch marked Bancroft on the map. Here we went west up the railroad track past the Colesbrook section of limestone. Beginning some distance to the west of this limestone the succession from west to east along the track is as follows:

The most abundant rock is what I have called normal Beckett gneiss, that is it is a dense somewhat homogeneous schistose granite banded in places. However it breaks in a beautiful fashion parallel to the laminae as if parallel to bedding, and these bands have curves. Where the ruptures take place by the movements the material weathers out. The bands produced by the rupturing parallel to the schistosity are of

different width and the whole thing externally gives a remarkable resemblance to a sedimentary structure but not one vestige of any sedimentary looking material could be found in the rock itself.

Within this Beckett gneiss are distinctly granitoid areas which Emerson thinks could be separated out. Certainly some of them can. Also there are cutting pegmetite dikes and veins which intersect the foliation of the gneiss and also pegmetites parallel to its schistosity giving in this case alternating bands of red and white material and also big porphyritic red feldspars. This
42532 gneiss 42532-3 continues almost to
42533 the limestone, but before the limestone appears there is seen a belt about 40 feet wide of coarse granitic
42534 like rock (42534) The limestone
42535 42535 is in immediate juxtaposition with the last but clearly is faulted very much, as indicated both by a discrepancy of the bedding of the limestone and the fracturing of the granite and by the fact that the beds of the limestone face the granite
42536 material back of it. 42536 actinolite limestone on the east border at the contact with the Beckett. The bed of limestone is 30 to 40 feet thick.

Next to the east is found again a gneiss having white and dark colored varieties, but differing from the gneiss to the west in being garnet-

42537 iferous. 42537 is the garnetiferous
42538 phase. 42538 biotitic. This contact between the limestone and the gneiss is sharp and no gradation with the possible exception of a foot or two in which the material is pulverized and weathered away as if this had been a sheared and slickensided contact. It might be a fault, but is more probably merely the soft material due to differential movements between the limestone and gneiss.

This belt of garnetiferous white and gray gneiss continues for a short distance perhaps 100 feet when a broader belt of limestone comes in.

Beyond this limestone the first rock to appear is the normal Beckett gneiss precisely as described west of the westernmost belt of limestone. In this Beckett gneiss there is an area of black hornblendic rock very garnetiferous, which is surrounded on both sides by the normal Beckett gneiss. The fact that the white gneiss is between the two belts of limestone both in this section and the sections seen earlier in the morning two miles to the south raises the question at least as to whether or not the garnetiferous white gneiss on top of the limestone is not a sediment and the two belts of limestone the opposite side of a syncline.

The Beckett gneiss from the locality a short distance east of the limestone to the place where the Hoosac schist comes in is perfectly normal, 42539-42540-1-2. The greater portion of it is the even white gneiss, but in places it is beautifully pegmatized 42543, and in places has a distinct banding or dark and light material 42544.

42539 to 42542 incl. 42543 42544

The gneiss continues beyond the station and beyond the bridge where the first crossing of Westfield river is east of the station. Here it is found not in the railroad cut bt a little way to the north in perfectly normal form 42545. and ten feet to the east is four found Hoosac schist. Specimens 42546-7-8 represent the Hoosac schist near the contact. In the railway cut to the east certain varieties of the Hoosac schist are perfectly normal 42549, being very garnetiferous, but this Hoosac schist, as elsewhere, contains certain bands which are more feldspathic and superficially at least resemble the Beckett gneiss in that the bands instead of being straight are more or less crinkled, 42550.

42545 42546 to 42548 incl 42549 42550

As we rode on the railraod to the east toward Springfield I saw again the hornblendic areas which Emerson uses to separate the different members of his schist. I saw the serpentine forms, ~~although~~ near Chester and especially I saw the great granite and pegmatite dikes cutting the upper members of the sedimentary series.

Sept. 22, 1901.

New York City.

With Eckel and Hobbs examined the ledges of Manhattan east of the Bronx limestone where same is much pegmatized and cut by granite. In these localities the rock is very crystalline gneissose and banded, but retained enough of its Manhattan character so that there would be no difficulty in discriminating the formation.

We went east of this easternmost definitely known limestone belt and there saw another area which is regarded by Merrill and Eckel as
42551 Fordham (42551). This assignment is based upon lithological grounds, the rock having the characteristic Fordham structure and white gneiss banding, but no definite relations to the limestone because there is a low ground between this area and the Manhattan in which there are no exposures but which are supposed to be underlain by the limestone.

All of us agreed that the most injected and metamorphosed Manhattan could be readily discriminated from this belt of Fordham. The interesting and impressive thing to me was the likeness of this belt of Fordham to th the Beckett which I had seen east of Beckett station the day before. Indeed the resemblance is very remark-

able there being the white banded gneiss the black biotitic varieties, and the hornblende bands, and the pegmatite
42552 injections all the same. 42552, phase of Manhattan schist east of 42551.
42553 42553 phase of Mahha tan schist same
42554 locality as 42552. 42554 phase of Manhattan schist, Tremont Ave. near
42555 Vyse St. 42555 granite (?) or Man-
42556 hattan(?) Tremont Ave. 42556 Manhattan full of cyanite (?) same locality.

We now continued on in an irregular course toward New R ochelle in the outer band of Manhattan. The rock retained the characters which we all recognized as Manhattan until New Rochelle was reached. The schistose bands always showed abundant cyanite. It contained dense white gneissose bands, but these were crinkled and are very similar to the white gneissose bands of the Hoosac schist seen east of Beckett station. However, in places the parallel injection of the gray granite gave the rock a somewhat uniform banded appearance which in places made it very closely resemble the Becket form especially in fresh cross cuts made by the streams, but when we got on the top of the ledges all Manhattan structures and peculiarities came out very well, namely the fine lamination of the schist, the big muscovites, the abundant garnets, and the very irregular lenticular character of the injection bands of granite widening and narrowing continuously, never continuous as in the case of the even banding of the Fordham.

However, when we reached New Rochelle there appeared a band in which the superficial resemblance to the Fordham variety is very marked. Here there were locally straight banded varieties which resemble the Fordham which no one could separate from the Fordham in hand specimens. However there is here very abundant granitic m material both the somewhat schistose uniform gray granite which Eckel calls Yonkers, but which certainly is very similar to the Beckett gneiss, but perhaps more friable and not banded and also a very great abundance of pegma'ite.

Locally the schists would be found in very narrow areas with somewhat normal forms including the granite and muscovite, although everywhere pegmatite, but where the parallel injection was very uniform and the schists greatly granitized the rock took on an appearance which very closely resembles the Fordham.

The above notes are written on the theory that the rock is of Manhattan, although I doubt if any one who had not studied the region and visited these localities and the Fordham localities would see the criteria by which the two are discriminated. Indeed this is just the situation in which I was when I returned to this region the first part of the present season.

The crinkled schist characteristic is kept to a greater or less extent. The garnets are everywhere prevalent and abundant, in this respect contrasting very strongly with the form in which the garnets are either absent of only sparingly present. The similarity of the two series is rendered still greater by the presence of black hornblendic areas which are believed to be altered dikes which have cut both and have been mashed and metamorphosed at the same time the sediments were metamorphosed.

Another mineral characteristic which was not universal but very widespread in the Manhattan is the presence of pure aluminum silicate and especially fibrolite. It appears to me that the prevalence of garnet and the prevalence of alumina silicates very strongly confirm the idea of metamorphosed sediments for these rocks for these are the minerals which are especially characteristic of metamorphosed shales and sandstones, materials which have been depleted in their alkalies and therefore materials in which such minerals as garnet and fibrolite develope and which do not have enough alkalies so that all the elements can go into feldspar and mica, and which have too much alumina for the ordinary silicates.

However if the complex of rocks which runs along the street car line

from New Rochelle to Larchmont is called Manhattan it is practically only by courtesy as this rock would be decidedly a minimum or subordinate constituent the main mass of the rock being injected pegmatites and granites and what schist there is is thoroughly granitized. I have no doubt that the French geologists would regard the entire product as due to the extreme metamorphism and granitization of the sediments.

Another very important conclusion follows if this rock is Manhattan. That is that there would be a complex comprising metamorphosed schist, gray granite, pegmatite, black hornblende granite, all profoundly metamorphosed, and yet of Hudson river or Silurian age. The simulation to what is called basement complex is very great and the scale on which the same takes place is rather extensive. If the provisional conclusion is verified that this material is Silurian, the discrimination of pre-Cambrian areas east of the easternmost limestone from the metamorphosed and injected Silurian would be a task of extraordinary difficulty/

Sept. 23, 1901.

New York City.

With Eckel we examined the ledges i in the vicinity of Larchmont station and they appeared to me to have the same complexity of character as before.

We then went N. W. to and across
42557 the Harrison diorite(42557) and found the same to be the schistose diorite or grano-diorite seen on the previous trip. In its center it is very sparingly if at all garnetiferous, but along its border it is strongly garnetiferous, as also the rocks which it appears to inject.

Along the N. W. border of the diorite it is exceedingly difficult to give a boundary for it. It varies into a schistose micaceous rock which resembled the core rocks along the border which are called schists. Here the rocks which have some of the characters of the Manhattan and some of the rocks which have the schistose characters somewhat resembling Fordham, and the Harrison diorite seem to be very intricately related, and with bands so like the diorite that I concluded that there is little doubt of the injection of the latter, although this is a difficult thing to absolutely prove because of the similar color of the rock to that of the adjacent gray banded rock and because there is both an

endomorphic and exomorphic effect in metamorphism.

The rock along the N. W. border of the diorite and indeed from there for a considerable distance to the west, and finally back to New Rochelle seemed to me to have comparatively little of
42558 the true Manhattan aspect. 42558 rock from outcrop near Weaver St. 3/4 of a mile west of typical Harrison diorite
42559 area. 42559 another phase of same outcrop. In places it has a micaceous appearance, and a rough surface which I have regarded as characteristic of the Manhattan. Also it is usually garnetiferous, but more commonly the rock is a somewhat even gray banded gneiss which to me in its essential characters resembled the Fordham strongly, although when I put the question to Eckel he said it much more nearly resembled the mashed Harrison diorite. In answer to this I asked if the one was not the alias of the other.

At one place near the Larchmont reservoir a gray fine grained gneiss was found in the more ancient banded schist or gneiss, and both of these are pegmatized. It may be that this more ancient gray schist or gneiss was not mashed Harrison diorite, but there are three elements certainly here, and very likely more.

The complex of rocks with only very faintly defined Manhattan characters

continued all the way to New Rochelle with the exception of a small area nearest Tuckahoe.

Upon nearing New Rochelle there was more of the appearance which I have associated with the Manhattan, that is garnets were present and the rough surface and narrow bands which might seem to be phases of Manhattan. These aspects steadily increased as we went toward Davenport Neck, New Rochelle and a short distance before this was reached certainly the rock assumed aspect which would have been accepted as definite Manhattan the previous day. Here, however, it had the gray bands of intruded and injected material as described heretofore, both a number of inches broad and very fine bands. Down to the augen-like areas which could hardly be discriminated from
42560 the back ground. 42560 white injection band in the Manhattan schist at Davenport Neck. Garnets are very abundant in the Manhattan like areas. It seemed, indeed, practically impossible to draw a boundary between the masses of rocks which I have been thinking as like the basement complex and the Manhattan belts, although I do not regard it to be absolutely proved that there is no break between the two. If a break exists it would be very difficult to discover, for certainly both the newer and the older rocks are profoundly injected.

In favor of the whole being injected Manhattan is the presence of garnet. However, fibrolite for the most part

failed in the broader areas of the complex, although it was found again at New Rochelle as soon as we got to the varieties which take on a distinctly Manhattan aspect.

It seems clear to me that if the area which is like basement complex is not older than the Manhattan that the latter formation is a very subordinate part of it; that is, the broad area not only of the Harrison diorite, but of a considerable area surrounding are mainly injections which include only very small quantities of the Manhattan. On this ground it seems to me that the material in which the Manhattan is so subordinate so that it can be easily recognized, ought to be separated from rocks which can be shown to be sediments. If this is done it would be comparatively easy to provide for the possibility that in the future some areas of the complex may be separated off as pre-Cambrian.

Summing up the situation, all the positive evidence which was found is in favor of the entire complex of rocks about Larchmont and New Rochelle being post-Cambrian, but it must be admitted that a thing which binds the two together is not the likeness of the two but the likeness of the later injection material. Further the fibrolite fails for the central part of the area although the garnets are abundant but no positive evidence in the way of any

basal horizon such as a quartzite was found nor other evidence of two unconformable series, but the exposures are rather bare and suggest an unconformity might readily exist.

It seems to me, in closing, that the matter of the existence of a possible pre-Cambrian core in the vicinity of Larchmont remains an open one.