New York and New England: [specimens] 42395-42494. No. 351 1901

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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.

6—747

#351

C R Van Hise,

New York and

New England,

1907

Sept. 5, 1901.

New York City, N. Y.

With Merrill, Hobbs, and Eckel visited various places in and north of New York City.

We first stopped at 155th St., where
the Fordham is exposed on Manhattan
Island.in order to get an idea as to
the characters of this rock. While very
closely plicated, as explained before,
the ledge as a whole is characterized
42395 by a parallel banding (42395); not how-
ever uniform bands, but bands of varia-
ble width, of different colors, gray
42396 and darker gray (42396). Also there
~~42397~~ are some bands of black biotite-schist
missing which follow the others somewhat regu-
larly. This material may include frag-
ments of an older schist; but if so,
the mashing has elongated the fragments
to such an extent that they now appear
to be interbanded parts of the gneiss.

The gray banded gneiss is injected by a gneiss of a somewhat different character, and having a reddish color. These bands narrow and widen more or less; but still are rather persistent. These ledges upon the whole seem to me to be very much less evenly banded than the majority of the outcrops of the Fordham which,as seen at other places later, is a very evenly banded gray gneiss.

We next went west across the limestone valley to Morningside Heights and the Speedway. Here the Man-
42398 hattan (42398) is exposed. This rock is injected with the red granite material precisely the same as the Fordham gneiss. The injection also is of a very complex nature. There is however a very great difference, in that the Manhattan is much more irregular in its structural characteristics. Also there is a mineralogical difference. The Manhattan is more micaceous, the mica is in bigger flakes, more or less wavy, and much of the mica is muscovite; while the mica of the black bands of the Fordham seem to be mainly biotite, are in smaller flakes, and very commonly foliated. The M n-hattan is fibrolitic; while in the Fordham this mineral was not seen.

That is to say, the schist itself is wavy, and the injected materials narrow and widen in breadth very rapidly. Many of the little injected granitic bands vary from a fraction of an inch to several inches long. If one were to pick out a single characteristic difference between the two, it would be the lenticular character of the granitic injections in the Manhattan as compared with the more continuous banding of the Fordham. Besides the injection parallel to the schist, pegmatite masses cut across it. Some of these have the rather exceptional banding or seggregation of minerals which is occasionally found in pegmatite. The pegmatite dike consists of bands alternately composed mainly of quartz and mainly of feldspar. In one case there were five of these bands, starting from feldspar to quartz, feldspar and quartz in the center, and in another case the outer two of these were omitted.

(Photograph typical Fordham ledge and typical Manhattan.)

We next went to Lowerie, which is taken as the type locality of the quartzite. The only remains of it which could be found are little fragments under the abutments of a bridge, the ledge having been destroyed by excavation and building.

We next walked across the limestone valley to the point where the railroad passes over the tresle to the ridge. Here the limestone and schist are exposed at the foot of the hill, and also on the railroad cut above. At the latter place a tunnel was being driven for the purposes of an elevator at a hotel upon the hill. This tunnel starts in the limestone, which gradually carries more or less fragmental material, and becomes a rock which might be called a calcareous schist or a schistose limestone. After the rock has become fairly a schist, a narrow belt of limestone about 8 inches wide comes in fairly pure; then a belt of schist of some feet in width; then again a belt of limestone 5 or 6 feet in thickness; and then the

Manhattan schist. The relations here seem to be clearly those of transition and interstratification between the lime stone and the schist.

Going southwest from the Lowerie station we saw for the first time the Lowerie quartzite in direct contact with the Fordham gneiss. Here the Fordham has its usual typical banded character; then directly in contact with it, with no gradation whatever so far as I could see, is a belt of schistose quartzite showing a lamination parallel to the contact plane which Eckel regarded as bedding, but which seemed to me to be due to differential movement of the parts of the quartzite over one another. There was no appearance whatever of a basal conglomerate; but merely a sudden change in the character of the rocks from typical Fordham to schistose quartzite.

We next went to Yonkers, and then crossed the belt of Fordham by trolley and the little narrow belt marked limestone along a valley where there is a very small stream. This valley for 4 miles from Lowerie shows no exposure, and is mapped as limestone because it is a continuation of a limestone belt which is wider farther to the north. However no exposure is found in this between Lowerie and Nepperman. Near the northern part of the belt is the Fairfield reservoir for the city of Yonkers. At this place, as ascertained by Hobbs from the City Engineer, the

Fordham gneiss and the Manhattan schist come together, these being the only two kinds of rock which are found by the reservoir excavations which are in
42399 solid rock. (42399) represents the the gneiss at the reservoir.

The contact is described by the City Engineer, according to Hobbs, as being more or less irregular. No quartzite was discovered between the two formations, and certainly no limestone exists. This determination by Dr. Hobbs is of very great importance as showing that within the well determined succession north from Manhattan Island the Manhattan schist and Fordham gneiss do come together without any intervening limestone; and if this is so, precisely the same thing may occur in the Manhattan farther east.

We next walked down the railroad track for 3 miles to Lincoln station. Here we saw a short distance to the east of the station the Fordham gneiss; almost in contact with this the Lowerie quartzite; and then in the valley to the west limestone.

Sept. 6, 1901.

New York City, N. Y.

With Merrill, Hobbs, and Eckel went to 167th St. where there is a long belt of Manhattan in the center of a syncline, on either side of which is limestone, and beyond which
42400 are the belts of gneiss (42400) of Fordham township. Here at a number of places the contacts between the Manhattan schist and the lime stone were seen. In all cases there appeared to be interstratification and gradation. After the limestone ceases as a continuous formation a belt of a peculiar
42401 black schist (42401), of some feet in width, comes in, not of the ordinary micaceous type of the Manhattan; then various alternations of schist and limestone which might be called calcareous schist or schistose limestone; then the Manhattan schist. At a number of places here, and especially at the north end of the main Manhattan belt on the north end of the ridge may be seen a series of closely plicated folds plunging to the south.

At no place however were the limestone and schist in such relations to each other for sufficient vertical exposure to be absolutely sure from the localities alone as to which is on top and which is on the bottom. Indeed the only locality which approached this was one where the flat-lying limestone in a little ledge, a half dozen feet in thickness, is over a belt of black schist. However I had no doubt that this black schist here is the equivalent of the interstratified black schist seen at other places; but this exposure is of sufficient size so that any geologist who did not care for general relations might readily conclude that the limestone is the higher formation

We next went north to where the tongue of limestone ends. Here in the bed of Fordham we found the plications of the typical Fordham gneiss with their bands of variable width and heterogeneous character plunging to the south at angles of from 15 to 25°. Upon the inner southward basin of this crinkled Fordham is seen very narrow bands and films of the Lowerie quartzite, or rather quartz-schist Here it is difficult to puts ones finger at the exact place where the quartzite ends and the Fordham begins, but I have no doubt of the unconformity between the two; the great movements at these places, with possibly disintegration and likeness of material at the bottom of the quartzite preventing a sharp separation. However the doubtful belt is only a foot or two in width, above which would be the clear quartzite and below which would be typical Fordham. At this place and others Eckel spoke of the Fordham as being "light" Fordham, and having characters which were unlike other parts of the Fordham. For my own part I was unable to get any distinction which separates this part of the Fordham from other parts which I had seen elsewhere.

We next took a train for Tuckahoe, a and saw the limestone quarries at this place. Eckel and Smith found the
42402 quartzite (42402) on top of the Fordham west of the limestone, and also found the contact between the limestone and Manhattan. Smith reports that at the contact of the limestone and Manhattan the foliation is vertical; that the foliation in the two is parallel; that the breadth of exposure was not sufficient to expose interstratifications if they exist; but that the rock regarded as Manhattan in contact with the limestone where first found was more quartzose.

We then went east across the belt mapped as Manhattan. This rock in part is good Manhattan. In places however it has a black hornblende-gneiss or schist interlaminated with it. Also it has a considerable quantity of granitic injection and granitization. However one cannot say that it is more metamorphic than the Manhattan of Morningside Heights or in portions of Central Park. However, as we went to the southeast we struck a road which went again southwest along a belt which is mapped as much granitized. Here, while areas of rock which looked like good Manhattan were found, the large portion of the material seemed to be granite, and many bands of hornblende-gneiss exist. While there I did not doubt that it was an injected variety of the Manhattan, and probably it is this; but after seeing other areas to the southeast the question arises whether or not there may not be here a small mass of Fordham protruding through the Manhattan.

Sept. 7, 1901.

New York City, N. Y.

With Hobbs and Eckel we first went to Hastings.

Here we found at the limestone quarry the greatest thickness of the quartzite which we have observed. Here the actual contact between the limestone and the quartzite is seen. The lower limestone belt stratigraphically is transformed to a large extent to coarse silicate minerals. Upon this is a belt of several feet in thickness of strong compact quartzite, which somewhat resembled vein quartz, but which I suspect to be a pure quartzose sand extremely metamorphosed. Below this are 5 or 10 feet of very thinly parting quartzite which may have been more or less calcareous, and certainly is the place where the main movement took place. Below this is the typical quartzite, in thin layers with evidence of movement between, as shown by slickensiding, and along which splitting will take place and in which tourmaline is also developed. This structure Eckel had taken to be bedding but it seems to me to be clearly dynamic. However it gives the rock a very thin bedded appearance. At one place near the west side of the exposure at a turn in one of the folds the original bedding of the quartzite was seen. These are in narrow bands of 1/2 inch or less in width having different textures and structures, which at various angles up to right angles, cut across the rock parting above mentioned, showing that the even structure is a dynamic structure which in places at least has no relation to the original bedding, although doubtless it corresponds in many cases rather closely to the direction of the original bedding.

We next went to Ossining, and here saw the schist in the center of the syn-
42403 clinal. (42403) The rock, while less coarsely crystalline than the Manhattan is a crystalline schist containing large flakes of mica and abundant garnet. At Ossining we saw the limestone bedded, at the fertilizing plant.

We next went to Tarrytown, and took the trolley southeast across the Sound t[o] Larchmont.

First we passed through large exposures of gneiss, which upon the whole however is rather more massive and granitic than the varieties which we had seen at the island. At the last place where the Fordham appears the rock is a schistose granite cut by later granites.

We next saw the schist of the first belt to the east of the Fordham. This belt of schist is not well exposed; but near the center Smith found two or three small outcrops in which the rock, while a mica-schist, is not so coarsely

42404 crystalline as the Manhattan. (42404)
We next saw the little belt of
42405 schist (42405) which comes down to just west of White Plains. This schist is similar to that of the first belt seen; but is perhaps even less metamorphosed, approaching pretty closely to the Berkshire variety. In White Plains itself we saw the limestone, and also the little belt of schist which com in fromthe south. This belt is similar to the one immediately to the west of White Plains.

We then took the trolley again, and got on to the east belt of Manhattan. Here we got off from the trolley at the first good ledges, and at once there was a difference in the character of the rock. While it is probably Manhattan, it is much more coarsely crystalline, much more granitized, and contains bands of material which might perfectly well be called the Becket gneiss. While it is not incredible to me that this could be an injected and metamorphosed phase of the Manhattan, yet it seemed to me that it might be something different.

As we continued on the trolley to the southeast there were other large exposures of the Manhattan which we did not examine closely.

42407 Specimen of the least altered Man-
hattan.
42406 A band in the Manhattan.

Other specimens could have been taken which would represent clearly granite intrusive dikes, and the granitizing effect of the intrusion could be seen to extend into the schist throughout its greater part.

The trolley strikes the low ground of the Sound some distance northeast of Larchmont, and then runs in an area marked as Manhattan between the two areas of what Eckel has called Harrison diorite to Larchmont. In this area as we traveled along the rock certainly looked to me much more like Basement Complex than like Manhattan. We have a gray, banded, feldspathic gneiss in which there are dark micaceous bands with rather even foliation, although there is crinkling. In this background we have intrusive granites of at least two different ages, the last being the pegmatitic intrusions. Then just southeast of
Larchmont is a quarry in which there is
42408 the so-called Harrison diorite (42408),
which would be ordinarily called a gray
hornblende-granite. This rock is
42409 schistose (42409), contains garnets and
bands of micaceous material identical
with that seen the first day at the
Fordham gneiss area.

As result of our three days' work I have little doubt that there are in the New York region a complex below the limestone and quartzite of pre-Cambrain age, above this is the quartzite called Lowerie, which Eckel says is found at many localities at the base of the limestone and always against the Fordham. Then comes the limestone, and over this come Manhattan schist, into which the limestone grades with interstratifications.

However the serious outstanding problem is the belt of rock east of the easternmost limestone which Merrill and Eckel have mapped as Manhattan. Eckel says as a whole this has been mapped as Manhattan particularly because there are no limestones in it. This argument might be equally well used as evidence that the Manhattan is pre-Cambrian; for the lowest limestone might be supposed to be synclinal instead of a monocline, and then its failure to reappear is perfectly explained. The question is further complicated by the undeniable fact that at some place as at Fairfield reservoir, near Yonkers, the Manhattan does come against the Fordham. Finally, there occur in the Manhattan belts of rock which have all the ascpects of Basement Complex which Merrill and Eckel have m made no attempt to separate from the Manhattan except as granite dikes and as Harrison diorite. As nearly as I can see therefore, it is entirely possible that the eastern area mapped as Manhattan map include both Manhattan and pre-Cambrian complex, or it may possibly be all pre-Cambrian complex or all Manhattan. My own inclination is to believe that really there is in this area the two sets of rocks, rather than the extreme position. Certainly the areas which are at the borders of the Basement Complex material should be studied in order to ascertain whether or not a basement can be found for the Manhattan in such areas. Contacts of the eastern belt of limestone with the Manhattan should be sought in order to ascertain if here there are interstratifications as elsewhere between the limestone and hhe Manhattan, or whether there is a quartzitse on the east side of the limestone as well as on the west side. The only observation made in this matter is that of Smith who reports a quartzose schist at the east side of the limestone at the Tuckahoe quarry.

Sept. 9, 1901.

Pawling, N. Y.

With Hobbs and Gregory in the forenoon went east from Pawling on the south side of Purgatory hill. Found the limestone interstratified with schist and containing quartzose layers. The latter place was south of a hill and it may possibly have been due to a cross anticline bringing up the lower part of the limestone or the quartzite below it. Limestone southwest, south, and south east of Purgatory hill. Strikes parallel with the contours and dips into the hill at rather flat angles-- 25° to 45° or thereabouts. The hill itself is composed of a coarse garnetiferous schist which is crinkled and in all respects resembles the variety of schist which we have been calling Manhattan. In places the rock is injected with pegmatite.

We next followed the road east XX toward Mizzentop hill, and then branched off to the right of the road to a park known as The Glen, the general course of which is east. Where we first reached the stream the schist is not extremely metamorphosed. It was of a kind which we have called Berkshire. Going down the stream a little way we found the rock more metamorphosed. Going up the stream

for a distance of perhaps a half or 3/4 of a mile we found a remarkable variation in the degree of metamorphism. In places the rock was not an extremely metamorphosed schist. In others it was a coarse muscovite schist. In other places it had a distinctly gneissic structure. Locally, and especially where it was cut with great pegmatite veins or dikes, it contained great bands which resembled the Becket, and at the dam just before the road was reached where are the falls, the rock has a banded gneissic appearanc which is very similar to some phases of the pre-Cambrian. At one place it had a peculiar porphyritic structure. This schist is in such relations to the limestone as to leave scarcely any doubt that it is above it, and yet it has varieties which are like the Berkshire, and yet shows the remarkably metamorphosed varieties such as are characteristic of the Manhattan and also of the Hartland. Specimens
42410 42410 to 42418 inclusive, phases
to of Manhattan from the Glen, section
42418 2 miles northeast of Pawling.
incl. We next followed the road north to Mizzentop hill, finding ledges of schist on the way. Then followed the road which runs diagonally west of north from Mizzentop for about 3/4 of a mile. Then cut

diagonally across the rådge toward Purgatory hill. The extremely metamorphosed varieties in the neighborhood of Mizzentop which are not especially garnetiferous change in passing from one road to the other from Purgatory hill into the ordinary garnetiferous Manhattan phase, and the east spur of this was connected by continuous outcrops. The east spur of Purgatory hill was not connected across the little subordinate depression with the main mass of Purgatory hill schist, but there is no reasonable doubt of the continuity of the two, and therefore apparently no question as to the position of the Hartland varieties of the schist found in the glen above the Limestone (by the so called Hartland varieties of the schist is meant the coarse micaceous kinds of rocks which are especially garnetiferous and have locally a banded gneissic appearance. Numerous specimens representing the different varieties of the rock in the Glen were taken, 42410 to 42418 inclusive.)

In the afternoon we drove west from Pawling. In the limestone bands of schist were found. Then a broad belt of schist which is not extremely metamorphosed and is of a kind which we have called Berkshire.

Specimens 42419-42420, phases of
42419 Manhattan schist west of Pauling
42420 on the Pawling-Poakqueg road. This
schist was found within a few feet
of a white schistose granite or
gneiss which is regarded as pre-
Cambrian, with no intervening lime-
stone or quartzite. We then crossed
the tongue of pre-Cambrian and went
to West Pawling, then went south to
Whaley's pond. Here we saw beauti-
fully exposed a limestone and quartz-
ite dipping to the east at rather
flat angles not more than 40°, prob-
ably about 40-45°. Also the gneiss
with foliation planes in a parallel
direction. The actual contact of
the limestone and quartzite was seen,
but not of the quartzite and gneiss.
These rocks are on the west side of th
pre-Cambrian core, and are overturned
the gneiss apparently being on top
and the limestone at the bottom.

Much of the quartzite is cut up
into thin bands XXXXXXXXX or laminae
parallel to the contact planes, but
the limestone shows no such parting
planes. This belt of sediments
west of the gneiss is separated from
the schist to the east, according to
Eckel, only by about 200 or 300 feet
at the narrowest place. The absence
of the limestone and quartzite be-
tween the schist and gneiss on the
east side apparently must be ex-
plained by overlap or by fault or
by the two combined.

West of the pond the gneiss is again found, the Whaley pond belt being apparently a little syncline but the quartzite and limestone were not seen on the west limb of the fold.

Sept. 10, 1901.
Dover Plains to Merwinville, Conn.

By train from Pawling to Dover Plains, thence by wagon over the broad limestone of the valley of Ten Mille river, thence diagonally up over Dover Mountain over and along along the quartzite. The quartzite apparently has a very considerable thickness. Its dip is to the west at angles of about 45 or 50°. Thus it rises up the slope and in calculating the thickness one must take into account the steep topography.

✓ We then passed on to the pre-Cambrian core, the main limbs of which which are a white granite with schistose granite phases, and black biotitic hornblendic schist or gneiss, and pegmatite. The earliest of the three is the black schistose hornblendic rock. This is injected in a complex XXXX way by the white schistose granite, thus giving parallel gneissose bandings as result, and both cut by the pegmatite. The rock in greatest volume is the white granite. On the south end of Dover Mounatin is a different rock, a coarse schistose porphyritic or augen gneiss, but the relations of this rock to the previous ones were not ascertained. As we went down the subordinate valley of Dover Mountain, we found the quartzite up a considerable distance, showing a subordinate syncline in a general anticline.

After going to the south end of the mountain XM we turned to the east and then northeast toward Bull's bridge. Here we found east of the end of the mountain ledges of schist of the normal type of
42421. Berkshire. 42421 is little metamorphosed phase of schist. East of this are great ledges of limestone. Doubtless limestone occurs between the schist and the pre-Cambrian of Dover Mountain, but if so this was not observed. However, quartzite was found apparently in position at the east foot of the mountain. We crossed the river at Bull's bridge and turned southeast toward Gaylorsville, for the most of the way following the limestone but about a mile from Gaylorsville we examined the rocks to the northeast of the road, making up Spooner Hill and found the same to be garnetiferous schist of the Manhattan variety. We then went to the station at Merwinsville, then went up Long mountain, following the road. Near the foot of the hil limestone was found along the road.

Further on quartzite was seen dipping at steep angles. Immediately beyond this is a big schistose rock containing very large crystals of muscovite. This rock was of a kind which might readily be thought to belong to the Hudson schist, or to the pre-Cambrian, but as a matter of fact is different from either of these rocks, as seen in this immediate vicinity, that is, it is different from the schist of the locality, and also from the core of Dover Mountain. After this rock is passed there is a considerable gap with no exposures , and then are seen the same three varieties of rocks in identical relations as those which make up the core of Dover Mountain, that is, a black schistose rock, a white massive granite with schistose phases injecting the former, and third, pegmatite masses. Also the order of abundance of the three is the same as on Dover Mountain. Without reference to relations one could hardly doubt that the core of Long mountain is pre-Cambrian the same as that of Dover Mountain. (Hobbs took specimens of this peculiar schist).

see notes of Sept 12

Sept. 11, 1901.

New Milford, Conn.

With Merrill, Hobbs, Gregory, and Eckel we walked east from New Milford. After passing the limestone we came upon a dark colored schist
42422 42422-3, upon the slope of the hill
42423 the position of which ~~were~~ was doubtful although I was inclined to think it belonged to the pre-Cambrian. The rock is a dark biotitic schist, and I thought it possibly similar to the dark base of the pre-Cambrian core visited previous two days.

As we continued east we crossed a subordinate but well defined valley in which Eckel thought it worth while to look for limestone. Immediately to the east of this we came upon a broad belt of garnetiferous biotite schist which in all essential respects resembles what we have called the Berkshire or Manhattan schist. In places it has within it hornblendic bands. After having crossed about a mile of this schist, when we reached the road going south toward Bridgewater we turned in this direction. This course brought us to a depression on one side of which were schists of the ordinary form, and east of this was a ridge which Hobbs had marked as granite, but which we found to be a very schistose rock, probably a modified granite. Along the western border of this mass there are interbandings of a dark colored schist, and the granite like material, suggesting the possibility of injections in the schist. As we turned southeast for a short distance in order to make our way to Bridgewater we found the schist on one side of the road and the granite on the other. The schist here was distinctly marked garnetiferous schist, and on the other side of the road the rock seemed to me to be as decidedly a schistose granite.

42424 Specimens 42424-5-6 are phases of
42425 this schist and schistose granite.
42426

As we went south and then west across the strike from Bridgewater we passed over a succession of schists which are markedly garnetiferous,
42427 42427, and in places very banded and gneissose. Toward the latter part of the section the schist took on a more dense uniform black banded biotitic character, somewhat similar to the schists seen first in the morning, but somewhat more gneissose. At the last place where the schist outcropped
42428 it is very gneissose, 42428, and just beyond this is diorite. The diorite is XXXXXXX interlaminated with the schist and contains fragments of it clearly showing that it is an intrusive rock. The diorite continued to the Housatonic river.

We then turned north following the Housatonic. After we passed the belt of diorite we dame upon a gorge of the Housatonic where it has made a
42429 clean cut through this, 42429, which is very similar to the schist first seen in the morning east of New Milford, and which would naturally be a continuation of the same along the strike. This schist is pegmatized and is injected by small parallel dikes of granite. This schist is exposed in great volume. It is certainl different in its general aspects from any large areas of the Berkshire or Hudson schists which we have seen heretofore. It, however, may be a metamorphosed sediment of a somewhat different character. It contains
42430 dark hornblendic bands, 42430, precisely like the Manhattan schist.

As we turned north to go to New Milford the schist continues parallel to the river, but after a time there comes in limestone which, taking the cleavage for bedding, would be above the schist, but which may be structurally below it.

Throughout the day the foliation of the schists of all kinds, as well as of the schistose granite, is to the west at angles varying, but ranging for the most part between 40° and 70°. This condition is anamolous so far as I know west of the Connecticut river, but for the anamoly no explanation was found in our study.

Sept. 12, 1901.

North Adams, Mass.

42590 to 42616

Specimens 42590 to 42616 taken from the central dump of Hoosac tunnel, showing the different varieties of rocks. The slide from 42614 is through a large pebble in the conglomerate.

With Wolfe visited the dump of central shaft of Hoosac Tunnel. Here I saw again the very sedimentary schists, schist-conglomerates, banded schists, etc. which have been brought here from the tunnel. From these abundant and large specimens were taken which show perfectly the characters of the different varieties of rocks. In all of them it is possible by taking them in connection with one another to discover evidence of sedimentary character, even the most crystalline showing rounded blue quartzes. However, the more metamorphic and banded varieties, if taken by this, might readily be regarded as mashed igneous rocks. The matrix of the pebbles and larger fragments have been entirely recrystallized into a well developed schist, but where the rock is conglomeratic or where the blue quartz is plentifull the arrangement of this in bands of varying texture and the irregular distribution of the sediment clearly show the origin of the rock.

In the tunnel dump is also seen the blue quartz gneiss, which is the core rock of Hoosac tunnel of pre-Cambrian age. This also was specimened. The likeness of the banded gneiss and the banded X schist seen yesterday and the similarity of the more homogeneous schists to the black biotitic schists near New Milford, very strongly suggest that the New Milford rock is sedimentary, although it does not appear to be in quite the same stratigraphical position to the Vermont formation although of course the New Milford schist has been more altered.

We next drove two or three miles beyond the central dump, and walked across large ledges of a graywacke-schist to the contact of the conglomerate and granite. The ledges of the graywacke-schist on the way are even grained uniform and homogeneous, and of very great thickness. They are not so metamorphosed, but that their clastic character is evident, as shown by white quartz pebbles and blue quartz grains. But if the rock had been somewhat more metamorphosed it would have made a homogeneous looking gneiss which it would have been extremely difficult if not impossible to separate from a mashed granite. I have nowhere seen a more homogeneous set of sediments than this. Of course it is not absolutely homogeneous, for there are places which are coarser than others, but these are of a kind which would really make a difference in the banding of the metamorphosed rock and make it still more resemble a gneiss. If its metamorphism were carried to an extreme it would produce a white gneiss amazingly like at least in its structures and textures the Beckett gneiss which is quarried. Thus one of my criteria for discriminating metamorephosed igneous and metamorphosed sedimentary rocks fails with reference to this particular area and may fail with reference to its extension, although it does not modify its very frequent applicability as such homogeneous sediments are certainly exceptions.

We next visited the classical contact figured between the schist-conglomerate and granite on the core of Hoosac Mountain. Here the granite is overlain by alternate layers of schist conglomerate and graywacke, some of the pebbles of the conglomerate being like the granite below, but many of them apparently having another source. Indeed apparently the most plentiful pebble was a rather fine grained pinkish to grayish granite rather than the coarse grained angen gneiss of the core of the mountain.

The whole of the graywacke looking phase of the region is called Vermont formation by Wolfe, and is supposed to be of Cambrian age. Where XXXXX upon this formation the rock becomes a garnetiferous schis it is called Hoosac.

Sept. 13, 1901.
East of Adams, Mass. - Tophet Brook

We visited section on a little brook east of North Adams. After leaving the limestone we found quartzite having coarse massive bands between which are other bands which are split into fine layers and much weatered. Taking the banding between the more resistant and the more platy bands as bedding, the dip would be into the mountain. toward the east at a flat angle.

After an interval of about 25 paces with no exposure we came upon a rock rotten and with fine folia with uniform texture, the character of the rock not being certain, but this rock grades into a whitish or grayish gneiss represented
42431 by specimen 42431. (42432 knotted white
to gneiss farther up. 42433 another phase
42435 of the gneiss. 42434 mica gneiss from
incl. Tophet brook above limestone and quartzose limestones. 42435 quartzite layer in gneiss of Tophet brook.) Along the
strike perhaps 100 steps is a gneissoid rock resembling a schistose granite which is sufficiently massive to serve as a quarry rock on a small scale. We then went up Tophet Brook. Here we first found limestone and as we went up the brook the last exposures are more or less arenaceous and might almost equally well be called arenacous limestone or calcareous quartzite.

After an interval of some hundred paces quartzite is found in the brook of massive variety like that seen early in the morning.

After an interval of about 50 paces we came to a gneiss of rather uniform acharacter except that there are minute interlaminations of more micaceous and more quartzose layers with variations als into feldspar, and the banding of which is emphasized by many minute veins some of which are quartz and some of which are quartz and feldspar together. These vein vary from those several inches across to those smaller and smaller until they cann not be distinguished from the original b black background. The effect of the whol is to give the rock a typical gneissose appearance, the bands of which are of alternating light and dark gray. The whole is crinkled; foliation is very rare. Professor Wolfe points out bands somewhat more quartzode than usual,
42436 represented by specimen 42436, (42437
42437 average phase of gneiss just below
42438 sedimentary layer Tophet Brook. 42438
intermediate layer.) which he thinks may be bands of quartzose sediment. Some of the intersecting pegmatitic veins as pointed out by Prof. Wolfe have abundant tourmaline in them. The foliation varies rapidly both along strike and along dip, with numerous crinkles. Dip 25° - 40°.

After an interval six feet up the stream a rock appears which we all

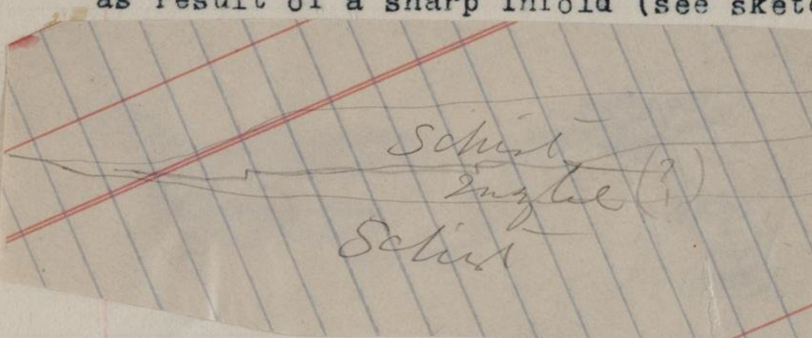
agreed to be properly a sediment. This rock consists of alternating bands of nearly pure quartzite, mica schist, and gradation phases. Some of the pure quartzite bands are as wide as six inches, although the greater number are from 1 - 4 inches in width, or even less The rock is much more uniform in its bedding, having somewhat regular strike and dip, which does not vary rapidly , ranging from 55° to 60° - strike N. 10° E. The rock shows intersecting pegmatite veins at this locality. It does not show the fine veinlet banding of quartzite and feldspar such as in the gneiss, but on the contrary has a pure quartsite veins. The quartzose veins are pretty continuous, in that respect differing markedly from the quartzite feldspar bands in the gneiss eadjacent. The more gneissose phases are repres-
42439 ented by specimen 42439.

Old Mill dam - Tophet brook.

At the old mill dam of Tophet brook we found more large exposures. Here the rock is an albite schist represented by
42441 specimen 42441 which schist is more dense and uniform than the gneiss below, but has also many little layers cutting across it, running along the foliation of quartzite and feldspar, or both, with tourmaline precisely as in the gneiss below. The difference in this respect would be very slight. In places also these bands are very close together precisely as in the gneiss, but the rock as a whole has them

less uniformly distributed. Within
this schist is a band of quartzose mater-
42440 ial (42440), certainly resembling a
quartzite which goes out to a feather
edge on the north side of the brook and
widens out on the south side to a band
four feet in thickness with the possi-
bility of greater width above, and Wolfe
says the hill above is of solid quartzite
Wolfe would identify the schist as a
phase of the quartzite.

It would seem to me as a possibility that the quartzite is in its position as result of a sharp infold (see sketch).



Continuing our section up Tophet brook we came to an extensive series of layers in the vicinity of the cascades which continued some distance. These rocks have a platy structure, but have a gneissoid texture and contain massive bands which a at first sight look like quartzite, but when more closely examined are found to to be very feldspathic and crystalline an seem to me to resemble granite more nearly than quartzite. Both the platy and

this phase are represented by speci-
42442 mens 42442-3-4-5-6-. In this set there
to was just one narrow ledge att the
42446 beginning of the set of exposures
incl. which looked quartzitic. Even if
this is a quartzite it would be possible that this was a little infolded mass and that the major portion of the set of platy specimens are not sedimentary. In short, so far as the platy structures are concerned at this locality and at the old dam mentioned above, the rocks resemble sediments. If there are any quartzite bands in them, but this is doubtful, these would appear in the same way. Upon the other hand the mineral composition and the homogeneous textures are those of igneous rocks rather than heterogeneous sediments, the more schistose bands being merely more mashed and recrystallized phases of the more massive bands on this theory. Certainly there was no clear cut alternation of heterogeneous sediments such as is the case of the interbanded quartzite and gneiss at the exposures found on the brook a short distance above the limestone.

We continued up the brook until we came upon a band of Hoosac schist. This rock here has at once the characters of the rock which we have been calling Berkshire or Manhattan or Hoosac, being a dark garnetiferous biotite shist with crystals of feldspar and I have no doubt that it

belongs to the sedimentary series.
42447 42447 last of platy parting rock just
42448 before the Hoosac schist comes in at
42449 Tophet brook. 42448 another phase
of same. 42449 Hoosac schist just abov
contact with 42447 and 42448.

We now turned back and took road southeast to where the broad triangular belt of Hoosac schist as given on Pl. I of Mon. XXIII, narrows down t to a comparatively fine band. Here we found in this belt of Hoosac schist black carbonaceous and graphitic phase: and its a remarkable coincidence that these characteristics are more general in the Berkshire schists with which this separate triangular area of Hoosac schist is absolutely continuous.

We now left the road and went diagonally across an area of white XX gneiss where large cliffs were exposed to the area of Hoosac schist which is an E-W trend, and to the gneiss which is topographically above this schist. Adjacent to this little belt of Hoosac schist Wolfe showed us a quarry of quartzite which is in just the right position to be between the Hoosac schist and what I regard as pre-Cambrian gneiss described in the previous paragraph. These belts of gneiss both above and below the Hoosac schist belt seem to me to be typically
42450 granitoid gneiss (42450) having red
weathering feldspathic veins, pegmetization, alternation of more and less

refractory material, in short all the characteristics of perfectly crystallin gneiss. With all of these facts Wolfe would agree only he afterwards stated that the hard bands in this place were mainly quartz instead of quartz and feldspar as I thought them. I did not study the ledges sufficiently to verify this point, byt my oimpression is very strong that they are perfectly crystalline gneisses which can in no way be identified with sediments. The Berkshire schist would then be a small recumbent syncline fold precisely as worked out by Wolfe.

Sept. 14, 1901.

By electric car to Adams and thence
from Adams by team to Dry brook. We
began upon dry brook just beyond the
area marked Hoosac schist and came
at once upon quartzite of a somewhat
schistose variety containing argillac-
eous sediments such as would naturally
be found in its upper parts. As we
passed down the rock was clearly a
sediment having the same sort of inter-
stratification of quartzite and gneiss-
ose bands as fully described in Tophet
brook of the previous day. Near what
I consider the base the quartzite be-
came coarse and massive and there was
here exposed on the east side of the
brook the quartzite in direct contact
with white gneissose platy schist. At
the contact the weathering has extended
in a number of feet, pillars of sheared
rock connecting the two. Immediatly
below this is white gneiss which white
gneiss extends from here to the water
and some distance up the brook. This
white gneiss is represented by specimens
42451 42451-2-3. This rock has the same
42452 platy parting and irregularities which
42453 we have heretofore seen in bands of
the doubtful white gneiss areas. All
of the rock represented by the above
three specimens Wolfe would regard as
belonging with the quartzite. However,
it seemed to me that there was the most
remarkable contrast between the quartz-
ite and the three specimens. After an

interval of ano exposure the rock by the brook is a well defined gneiss
42454 (42454) and this Wolfe places with the pre-Cambrian. It, however, seems to me that this rock is allied remarkably in lithological character with the doubtful rock below represented by the three specimens.

We then continued up the brook and found the recognized pre-Cambrian to grade on the face of a cliff into the white platy gneissose variety and at this place Wolfe would have placed the contact between the Cambrian and pre-Cambrian. For my own part I could see no difference on the two sides of the line, and insisted that I would map the rock as pre-Cambrian. Continuing up the brook about 20 paces further is another exposure of the same platy rock and after an interval of about two paces I found a schistose conglomerate containing numerous white quartzite pebbles represented by specimen 42455 which
42455 immediately grades up into well recognized quartzite. It seemed to me that when there is a well recognized difference with a schistose matrix such as would be made out of the other gneiss, that there could be no possible reason for placing the contact at any other place than at the bottom of the schist conglomerate where the weell recognized fragmental characters bggin. If this is so it follows almost to a certainty that I was correxct in placing the contact at the base

of the quartzite lower down the stream on the other side of the anticline.

Wolfe's main reason for believing that the platy gneiss belongs with the sediments is that it is more quartzose and contains more biotite. Also he asks why the rock at the pre-Cambrian near the contact has a platy aspect whereas in other places it does not. My answer to the first question is that from the extreme metamorphism the feldspar alters over to mica and quartz, and thus makes quartz relatively more abundant although the ehcmical composition of the rock remains the same. My answer to the second question is that a contact is a place of great movement and that the somewhat heterogeneous rock along this contact will be mashed into a regular schist which breaks with platy form. Wolfe further said that the white gneiss on Hoosac mountain had hard layers composed of quartz instead of quartz and feldspar as in the pre-Cambrian area. My answer is that in pegmatitic areas the masses are sometimes quartz and sometimes feldspar and sometimes quartz and feldspar together, and these all within very short distances.

We now went to a locality about two miles further south where the same succession is exposed as in the dry brook. Following up a little brook to a hill we first came to quartzite and then at a little falls quartzite conglomerate. Going up a steep hill topographically after an interval of 50 or 100 paces we came to a high series of ledges of white platy schistose gneiss. This Wolfe regarded as a conformable upward succession over the quartzite. After another interval of 50 paces or so we came to ledges of interbanded quartzite and schist of the gneissose variety, just such as are fully described as occurring in the brook of yesterday morning with the possible exception that the schistose bands between the quartzite are more gneissose. The rocks of the ledge, above, are unquestionably sedimentary. The rocks below in the brook are unquestionably sedimentary. However I should certainly regard the intermediate platy gneiss as equivalent to the platy varieties and certainly below the conglomerate in dry brook the structure being a recumbent anticline the center of which is represented by the white gneiss and the two limbs both being represented by the quartzite on top of the hill, and ~~not(?)~~ the conglomerate of the brook below. After finding this bed of quartzite within the bedded schist layers we followed the same for some distance, a half mile or more, showing that the same is a persistent formation and could be seen extending far across the fields in irregular crinulations and a long way toward Hoosac Mountain. Wolfe said it could be mapped in this area as a continuous formation.

This is the classical locality where Wolfe said they had the evidence of the transition of the quartzites into white gneiss. I did not see the transition and both Gregory and Hobbs agreed with me that the transition had not been shown. Wolfe's argument was that the narrow bands of gneiss between the quartzite bands are like continuous belts of gneiss which he has called white gneiss, and that is sufficient reason for throwing them together. My position is that the debris of white gneiss being locally similar in composition to a gneiss by metamorphism compressed into a gneiss indistinguishable from the original rock but the alternations of this with quartzite bands shows the sedimentary character of the whole. The existence of metamorphosed heterogeneous bands of this kind is no evidence that the even uniform dense platy white gneiss is of the same origin, for this rock is of the kind which is produced out of a homogeneous igneous rock. If the belt of recognized sediment were mapped it is certain that it would lie between the recognized sediments to the west and the particular area of disputed rock to the

east, that is, would be in precisely
the position to be a basal member of th
the sedimentary series, the broad area
to the east mapped as white gneiss
in the hoosac monograph being really
✓ pre- Cambrian , and at the present
time Wolfe has recognized that much of
this area really here belongs.
We now went further south where the
quartzite extends in a tongue and here
we found a very crystalline quartzite,
42456 (42456) similar to the most crystalline
phase of the Mesnard quartzite of the
Marquette district. Indeed I might
imagine myself upon the ledges of the
quartzite south and north of Palmer.
However, even this rock where it weath-
ers shows little pebbly projections
showing evidence of its sedimentary
42457 character (42457). A little way furthe
north the rock contains numerous little
42458 flattened pebbles of quartz (42458).
Wolfe says this is the most crystalline
of the areas in which we have indubi-
table sediments. To that I fully
agree, but urge that in this area
even in its most crystalline form it
still showed evidence of its sediment-
ary character, that is to say through-
out the day there was no place in which
we were sure that we had a sediment
from its structural position which did
not show evidence of its sedimentary
origin either by alternate banding of
layers of different composition or by
different coarseness or by exceedingly

clastic material.

At one locality large blocks of conglomerate were foundsomewhat similar to the basic conglomerates, but having a more gneissose matrix. This doubtless belongs in the vicinity somewhere
42459 and from it specimen 42459 was taken as illustrative of how gneissose the matrix of a conglomerate can get and yet the rock by the larger pebbles still show its fragmental character.

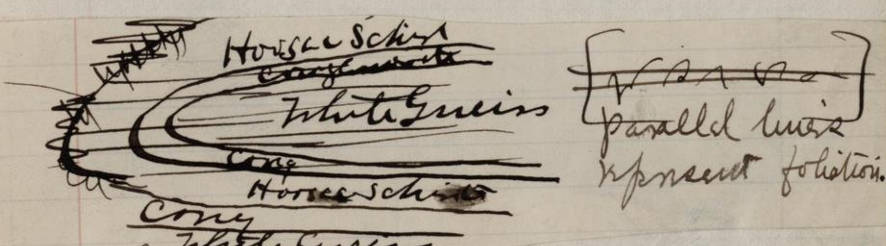
Sept. 16, 1901.
North Adams, Mass.

Wilth Wolfe went about three miles south from North Adams to a place where road turns toward Hoosac mountain from the park. We then went straight up Hoosac Mountain. After passing the limestone we had another interval of no exposures in which we probably passed over the western belt of white gneiss, the first exposure found well up on the slope being the narrow belt of Hoosac schist which extends along the western slope of the mountain north and south. We, however, quickly passed from this up the slope and came upon a white gneiss which had its typical development
42460 and was thoroughly specimened (42460-70)
to in order to compare the material with
42470 the pebbles of conglomerate higher up on the mountain. After a short interval of no exposure after the last white gneiss was found we came upon exposures of conglomerate gneiss which contained numerous pebbles which seemed to me to correspond preciesely with a number of the phases of the white gneiss below. This belt of conglomerate was seen on the ends to wrap over the coarse granitoid gneiss of the core. It was followed for a considerable distance toward the Hoosac schist and found very close to the white gneiss beyond the area where the granitoid gneiss was found, but the two were nowhere found in contact, nor was there so far as I could see any tendency for a transition

between the two. The white gneiss
everywhere perserved its typical char-
acters except that possibly it is some-
what more schistose and banded near the
conglomerate. The conglomerate while
having the gneissose matrix everywhere
distinctly showed its fragmental char-
acter especially on the cross fractures.
The conglomerate gneiss is represented
42471 by specimen 42471-2-3. One big flat-
42472 tened boulder was found one side of
42473 which seemed to be white gneiss and the
other side of which was conglomerate
gneiss. This seems to me to be a con-
tact specimen overturned by falling down
the slope. On this specimen, as else-
where, there was no transition whatever
between conglomerate gneiss and the
white gneiss After following north
along close to the contact between the
white gneiss and the conglomerate for
some distance, the distinction between
the two always maintaining itself, we
came to exposures of the Hoosac schist.
This schist was seen with its typical
character here above the conglomeratic
gneiss. Also it was seen in the same
position at the crest of the hill some
distance further east. In both places
there was a transition band between the
two of some feet in which the pebbles
of the conglomerate faded out, the rock
became less and less of a gneissose
character until it became the typical
garnetiferous schist represented by the
fresh specimens taken from the Hoosac

tunnel (see previous notes.

Going down the slope we folllowed along the contact of the Hoosac schist and in passing straight down the slope we passed through the Hoosac schist into the conglomerate and below this into the Hoosac schist again, this evidently being one of the natural fingers of the Hoosac schist as it turns around to go down the mountain. As nearly as I could tell it would be at the extreme northwest point of what Wolfe has mapped in his monograph as a band of Vermont formation around the Stamford gneiss. At this locality the schist was in normal position above the conglomerate at the upper contact and in the overturned recumbent position at the lower contact as marked by W Wolfe. The strike of the white gneiss would runn directly into the schist. This is entirely true, but is what one would expect in a recumbent fold in which the foliation of all rocks runs in the same direction but the beds turn around an angle. The relations are somewhat like this



As we passed down below the band of Hoosac schist just south of the known conglomerate we again found conglomerate gneiss below it, just as we should, and after a short interval again typical exposures of white gneiss as sketched above.
It therefore appears that wherever we have found continuous exposures between the Hoosac schist and the white gneiss we there have found conglomerate or quartzite between the two. Where neither of these have been found there is always space between the white gneiss and Hoosac schist for such rocks. The certain fact that the Hoosac schist is stratigraphically above the conglomerate gneiss as shown by the exposure on the crest of the mountain with the transition bands above it may be overturned on the slope of the mountain combined with the fact that pebbles in the conglomerate perfectly match the white gneiss seem to me to be be conclusive evidence that the larger areas of the formation which Wolfe has mapped as Vermont formation are pre-Cambrian gneiss and that the bottom of the sedimentary ends there with the conglomerate or the quartzite just below the Hoosac schist.

September 17, 1901
Dalton, Mass.
Rained.

Sept. 18, 1901.

Dalton, Mass.

With Wolfe, Emerson and Hobbs drove from Dalton to the so-called Club House section. Here we found as was expected from our previous visit a well defined conglomeratic quarzite at the base of the Cambrian. This conglomerate extends from the location of the old club house for a short distance to the southeast. For the most part it is recognized at once as a conglomerate, bearing numerous flattened quartz pebbles of quartzite. These easily recognizable varieties were not specimened. At one locality a short distance north of the road the conglomerate varies downward into a schist or gneiss on a perfectly smooth ledge the base of which I think probably belonged to the pre-Cambrian but which Emerson and Wolfe believed to belong with the quartzite, their ground for the same being undbouted gradation between the two and a continuity of foliation. At one place near the road the quartzite gets

42474 to be very plastic (42474-42477) Above,

to the ledge as a whole shows its sedi-

42477 mentary character with perfect clear-

incl. ness, being in places conglomeratic. However, certain bands contained abundant clastic grains of feldspar. When these are mashed with the quartz the rock has a somewhat gneissose aspect. Wolfe thought that it would be difficult to separate 42475 from certain of the gneisses which he had called white gneiss, but which I regard as pre-Cambrian. However, to me the rock looked very different.

To the south and southeast of the ledges of quartzite and conglomerate are ledges of white gneiss both micaceous and hornblendic which all agreed to place with the pre-Cambrian and which were not specimened. Much of the area of sediments Emerson had mapped as Beckett. However this rock is so diferent from the kind of rock which I had known as Beckett further south, and is so allied to the quartzite that I should have put the whole together as another formation of schistose quartzite and conglomerate. After we passed a small area of gneiss of agreed pre-Cambrian age mapped Whaley by Emerson, we came upon another broad area of sedimentary rock which is mapped as Beckett by Emerson, but which I should have called schistose quartzite. The rock in places has different quartzose phases but in other places is somewhat gneissose. Taking this area by itself it might perfectly well have been called a gneiss, but it seemed to me so closely allied to the quartzite formation that
42492 I would have there placed it. 42492-3
42493 represent phases of this broad Beckett

ar

area west of Hinsdale.

We now drove into Hinsdale and out into the area of rock which Emerson has mapped as Hinsdale gneiss. Two varieties found at the only outcrop seen
42478 are 42478-42479. For my own part I
42479 would have been wholly unable to discriminate or separate these from the Washington Gneiss traversed west of Hinsdale.

Continuing in a general course north of east we came upon other broad areas of the formation which Emerson has marked as Beckett for this region. This, like the other Beckett areas mapped was found to be a schistose quartzite and ridgy weathering rock which had a distinctly gneissose aspect, but appearing different to me from the gneisses which are mashed granites. Indeed the most doubtful areas which we found I at once placed as sediments, and also all of the other areas which were most unlike sediments before I saw the interstratified quartzites which proved that the rock was correctly classified. One of the most gneissose phases of this area is represented by
42494 42494. The more quartzitic varieties were not specimened. After going toward the east side of this area of Beckett gneiss we came to a rough branch road which turned to the north. We here went north some distance leaving the wagon. We here came upon an area which Wolfe had seen before, and which he placed with the

pre-Cambrian. This area is represent-
42480 ed by specimens 42480-42483 inclusive.
to With this conclusion I unhesitatingly
42483 agreed and Emerson did, doubtfully.
incl The rocks seem to me to be of a wholly different character from any of the recognized sediments, although Emerson thought that 42480 had a sedimentary appearance. We then returned from what I regarded as pre-Cambrian area to the Cambrian from the first ledges of which was taken a specimen most like the pre-
42484 Cambrian. This is 42484. Even this specimen seems to me to be of a distinctly different aspect from those the most like it in the pre-Cambrian represented by 42480, but even if the t two were indistinguishable I should say that the ledges as a whole could be discriminated with perfect wase.

We next went east and found no exposures for a considerable distance until suddenly we came upon typical ledges of the Hoosac schist showing beautifully albite crystal development which are so characteristic of this
42485 formation. 42485 - 42486 represent
42486 this.

We then turned to the Beckett area and passed toward its west border. For a certain distance we had the usual rusty weathering and schistose varieties which are clearly sedimentary but suddenly upon the road we came upon another kind of rock. The most gneissose and crystalline phase of the quartzite is

42487 42487. The rock upon the road is
42488 represented by 42488. Wolfe and Emerson were inclined to believe this belonged to the quartzite at first, although upon the ~~base (?)~~ face of this I said I would place the tongue with the pre-Cambrian. Going on the fields immediately adjacent we found large exposures of rock whic Wolfe unhesitatingly placed in the
42489 pre-Cambrian (42489). The place where the pre-Cambrian came in was some dis-
t tance east, nearly a 1/4 of a mile, of the Beckett area as mapped by Emerson.

We then turned to the north and here found most interesting recurrence of the quartzite. A tongue of quartzite was bounded both to the north and south by the pre-Cambrian gneisses. How far this belt extends t the east and west was not determined. At one point the quartzite could be seen passing irregularly over the foliation of the gneiss. At another locality immediately adjacent to the road the quartz schist having clearly
42490 its sedimentary characters (42490) graded upward by imperceptible stages into a biotitic hornblende gneiss which all would have unhesitatingly placed in the pre-Cambrian. This gradation after discussion was held by all to be not really in the sense of stratigraphically continuous but due to the infolding and welding together of the pre-sedimentary forma-

tion, represented by the gneiss and the schistose quartzite. For in the general vicinity there are other large areas of the much mashed granite. One
42491 phase of this is represented by 42491 Many of the phases of this are perfectly plainly granitic. When the tongue of quartzite is extended gneiss is found on either side of it. It is perfectly apparent that the quartz schist is in a gentle roll upon the upper surface of the pre-Cambrian gneiss.

From our study of the area during the day it is perfectly clear that the areal distribution of the pre-Cambrian and Cambrian in this region is very intricate. It was agreed upon by all with the possible exception of some reservation by Emerson, that all the distinctly gneissoid phases of rock should be mapped as pre-Cambrian, and that only those varieties should be included in the sediments which in some way distinctly showed their sedimentary character. If this rule were followed out Emerson(s mapping is very defective indeed, for in the band of Beckett east of Hinsdale there would be included considerable areas of both formations.

The Hinsdale area which Emerson maps as Hinsdale gneiss in the center with a regular band of limestone about the same, with the Lee gneiss about this, and with the Washington gneiss about this, is very poorly exposed indeed. It is an area of ponds and heavy drift. According to Emerson's own statement there is only one small area where the exposures are good. It therefore seems to me that the separation of the pre-Cambrian into several formations in this area is wholly hypothetical. The only really structural work which has bee done here is an attempt to trace the limestone as two separate bands, one on the east and one on the west side of the Hinsdale gneiss. Emerson says that in places the limestone is in a definite band on both sides of the gneiss. This locality I did not , but should have s seen. So far as I could see, no exposures whatever cut off the broad area of Hoosatonic limestone from the Colesbrook limestone. As mapped it ends in a broad area a mile wide east of Dalton, bu the limestone is represented as going far up on the slope. Without a plat of the exposures it would be impossible to tell what the relations are. Emerson insists that the two are different, however, because of the great amount of silicates developed in the limestone whereas the other is pure limestone. But he says the Colesbrook limestone is represented by serpentine and sometimes by hornblende bands. I suspect these representations do not belong to the limestone belt, but are part of the pre-Cambrian, and the question would then arise as to the difference of the lithological characters of the certain limestone areas and the Colesbrook limestone. So far as I can see the only evidence which would be of weight is the definitely stated fact that the limestone comes down to the gneiss whereas both to the east and west the quartzite is between the gneiss and the limestone, but this may be readily explained by overlap.

Sept. 19, 1901.

Beckett, Mass.

At Beckett with Emerson and Hobbs, examined the outcrops near the town.

Along the river is a very small quantity of coarse crystalline limestone and a green actinolite rock which Emerson regards as the metamorphosed limestone, and this seemed to me probable. To the west of the limestone are a set of rocks of doubtful character which Emerson was uncertain as to whether they belonged with what he called his Hinsdale gneiss or the Beckett gneiss. At one place I saw a massive ledge and this just at dusk, which I thought to be granitic, but this series of ricks was much better seen in the set of ledges near the brook section the following day.

Just to the east of Beckett on the slope of the hills come in ledges which are in Emerson's typical Beckett gneiss belt. Here the rocks, however, instead of being homogeneous and uniform in in texture and structure, comprise the normal white Beckett gneiss and black biotitic rock, and also hornblendic varieties precisely as in other parts of the Beckett area.