Green Mountains, Vermont, and The Adirondacks of New York : [specimens] 18144-18327. No. 97 1890

Van Hise, Charles Richard, 1857-1918
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U. S. GEOLOGICAL SURVEY

FIELD SECTION BOOK

No. 97.

Green Mountains, Vermont, and
The Adirondacks of New York.

C. R. Van Hise, 1890

18144 - 18327

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 page is also arranged so that, if desirable, a smaller scale can be used, two inches, one inch, or even 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, for instance 4025, 250 *N.*, 300 *W.*, *Strike*, *N.* 6° *E.*, *Dip*, 50° *E.* Then follow with as full a description of the ledge as possible. 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, but chips of them must be taken. 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. In all cases collect chips for slicing. 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. It is desirable that specimens 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.

#97

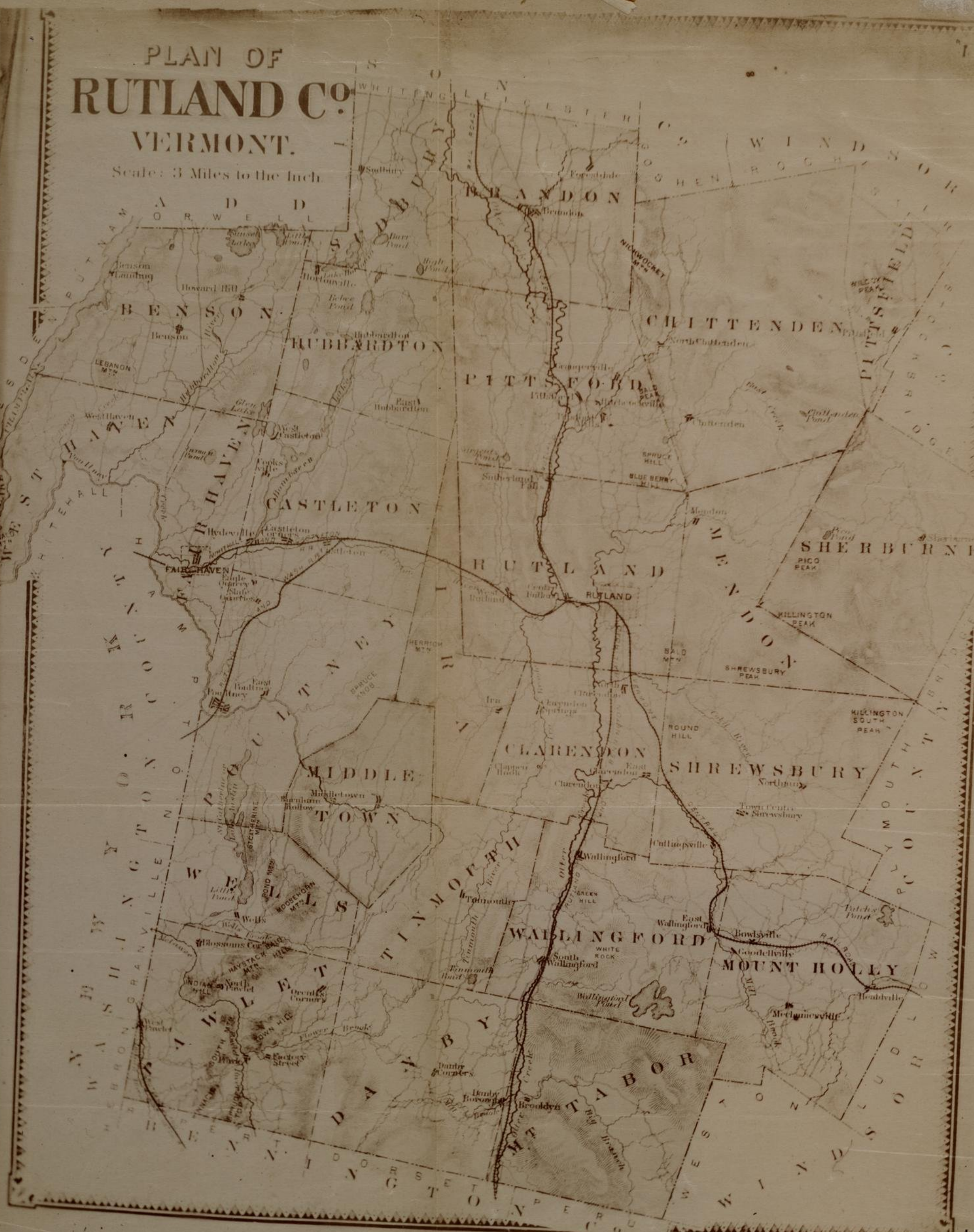
July 29th, 1890.
Cuttingsville Vt. to Rutland Vt.

We examined the so-called East Clarendon section, beginning with the lowest members near the Sugar House. The section was made from east to west.

18144. Gneiss nearest Sugar House.
18145 Granite gneiss.
18146 Biotite-gneiss
18147 Granite-gneiss farther on.
The whole of the above have the foliation dipping at a high angle - 80° or more to the west.

18148 Hornblende-gneiss found as layers of small size and several feet in diameter in a very coarse granite-gneiss.
The alternations above as a whole are very like the fundamental complex of Lake Superior.

18149 Passing along appear 18149, biotite gneiss; 18150, fine grained


PLAN OF
RUTLAND Co.
VERMONT.
Scale: 3 Miles to the Inch
BRANDON
SUDBURY
BENSON
HUBBARDTON
CHITTENDEN
PITTSFORD
PITTSFIELD
CASTLETON
FAIR HAVEN
WEST HAVEN
RUTLAND
MENDON
SHERBURNE
PICO PEAK
KILLINGTON PEAK
SHREWSBURY PEAK
KILLINGTON SOUTH PEAK
POULTNEY
IRA
CLARENDON
SHREWSBURY
MIDDLE TOWN
WELLS
TINMOUTH
WALLINGFORD
MOUNT HOLLY
PAWLET
DANBY
MT. TABOR
ADDISON
ORWELL
WHITING
LEICESTER
GOSHEN
WINDSOR
ROCHESTER
PLYMOUTH
LUDLOW
WESTON
BENNINGTON
DORSET
RUPERT
PERU
WASHINGTON
GRANVILLE
HAMPTON
WHITEHALL
NEW YORK
Brandon
Benson
Hubbardton
Castleton
Rutland
Center Rutland
West Rutland
Wallingford
South Wallingford
East Wallingford
Clarendon
East Clarendon
Danby
Brooklyn
Wells
Mechanicsville
Healdville
Bowlsville
Cuttingsville
North Chittenden
Chittenden
Sutherland Falls
BALD MTN
ROUND HILL
WHITE ROCK
GREEN HILL
HAYSTACK MTN
SPRUCE HILL
SPRUCE KNOB
HERRICK MTN
MOOSEHORN MTN
LEBANON MTN
NICKWACKET MTN
BLUE BERRY HILL

18150 granite.

18151 Passing along appears 18167,
granite gneiss on one use of ravine;
18152 Beneath is found 18152, fine
grained gneiss or schist;
18153. granite interlaminated with 18152.
This is on the west side of the
ravine about 20 ft. from 18151.

18154 Two phases of schist a little
farther on; about 10 paces.

18155}
18156} Two phases of schist side by side
about 10 steps farther on.
18157 Schist showing granite or peg-
matite vein, a little farther on.
18158. Schist of about the same character
as 18157.
The rock begins now to have a
clastic appearance.
18159. Pegmatite vein in the same.
18160}
18161} Dudley schist, quite plainly frag-
18162 mental. These grade into 18162,
conglomerate and this alternates
18163 with 18163, a much squeezed
quartzite.

18464 Cement rock or schist, perhaps 100 feet further on.
The whole of the above, that is from 18444 to 18464, are from the East Clarendon section.

The transition from the gneiss through the crystalline schists to the plainly clastic rocks appears to be continuous in the above section. It is exceedingly difficult to say at what point the crystalline series ends and the clastics begin, if they are separable. The whole is interlaminated with pegmatite veins and big eyes & nodules of feldspar.
Dumpelly's transition theory, Lawson's fusion and injection theory, and Winchell's metamorphism theory apply about equally well.
Winchell would readily count hundreds of alternations of fine and coarse gneiss in the 150 feet which would separate the conglomerate 18462 from the

granite 18151.
Lawson would find proof of granitic injections in the pegmatite veins which are in general parallel to the lamination, but which also cuts across the lamination; while Pumpelly's theory applies perfectly. The foliation and folding where the conglomerate is found corresponds.

Photo 1049 Foliation and cleavage of quartz conglomerate into the plainly recognizable clastics of the Clarendon section.

Fort Ann, New York. July 30, 1890.

We went by train from Fort Ann to Comstock, New York.

18165. Gneissoid hornblende-gneiss, the first found on our way northeast from Fort Ann. This is leadily bedded and exposures of it continue for a little way, and then appears coarse crystalline limestone containing large crystals of feldspar, fragments of granite and hornblende-gneiss, and fine granitic material.

18166. Limestone.

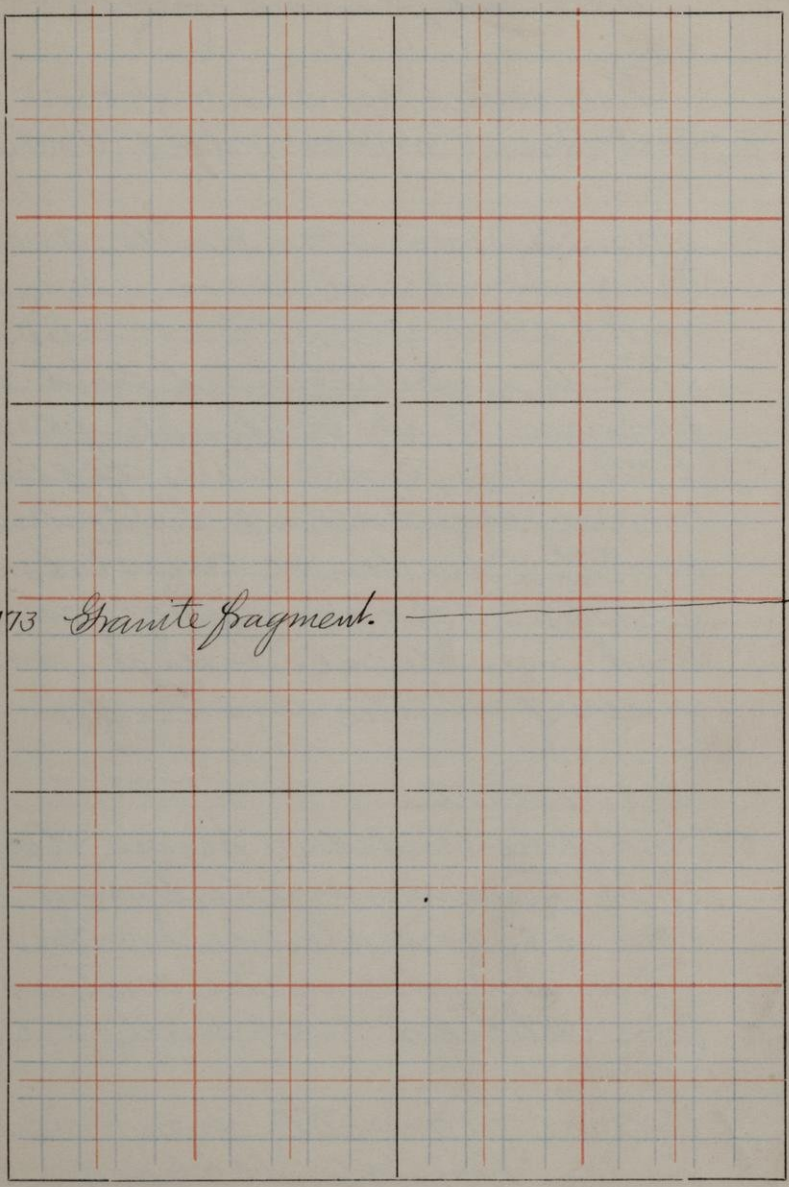
18167 Fragment from huge block of protruding underlying mass of hornblende rock.

18168 Specimen from the contact zone between 18166 and 18167.

18169 Coarse pegmatite from vein in the hornblende block.

5 1/2

T. R.



Walcott took photographs of 18167 and 18168 and 18169.

18170 Portion of graphitic hornblende rock from small elongated patches in the same hornblende rock.

18171 Feldspar crystal or part of one taken from the limestone.

18172 Hornblende-gneiss from another block in the limestone.
(Walcott photographed)

Photo. 1050. Granite block in crystalline limestone near Fort Ann, New York.

Photo. 1051. Block of hornblendic rock in crystalline limestone near Fort Ann, New York.

18174 Going one mile northwest of Fort Ann is found 18174, granite gneiss;

18175 hornblende-gneiss;

18176 Crystal of feldspar from same. These rocks lie north and under the limestone. Whether unconformably under them is a question. They are so regarded by Walcott. The crystalline limestone is placed by Walcott as pre-Cambrian.

18177 Red gneiss which shortly appears and continues for some distance.

Going a little farther on road towards Comstock the Potsdam sandstone or quartzite is found. This sandstone is above and in contact with the gneiss. Its induration is plainly due to ordinary enlargement.

18178 Garnetiferous gneiss at railroad cut adjacent to quarry on (above) Potsdam sandstone.

18179 Gneiss on which the sandstone rests

18180 Potsdam conglomerate above gneiss.

18181 Quartzite from same a few rods farther east.

18182 Siliceous granitite a little farther on toward Comstock.

The general course of the road in passing from Port Ann to Comstock is north and south. The strike of the rocks is approximately the same. The gneiss dips at rather a flat angle to the east; the same is true of the limestone. Walcott says the dip of the latter is less than that of the gneiss. The graphite in the crystalline limestone was found by Pumpelly to be along the contact between the foldes or projecting masses of the underlying gneiss. The specimens of graphitic rock collected by me was from a narrow layer

of gneiss in the limestone. Pumpelly suggests that these relations of the graphite make it possibly of secondary origin. There appears to be a physical break between the limestone and gneiss, but the question arises, whether it is not possible that the phenomena described are due to some other cause than shore action?

18/83 Garnetiferous schistose quartzite making up the chief part of Bare Ledge just north of Comstock Station. The strike is here north and south; the dip is 20° east. This quartzite is fundamentally different from the Potsdam quartzite before mentioned. While that is plainly detrital, this is a thoroughly crystalline quartz-schist. The quartzite is regularly bedded and makes up most of the ledge. It is, however, interlaminated with thin layers

18184 of 18184, garnetiferous schist. The series in appearance is strongly bedded.

In passing north from the station at Comstock we have the following section: After the regularly bedded quartzite
18185 above mentioned comes 18185, very garnetiferous quartzite. This is apparently interlaminated with a dark green garnetiferous
18186 rock, 18186, which is taken to be an eruptive either intruded subsequent to the uplifting or a contemporaneous volcanic, but in any case it in a general way follows the bedding of the quartzite.
18187 Above this again appears 18187, garnetiferous quartz schist.

The above specimens, 18183—18187 are practically a continuous exposure.

Then occurs an interval of

a hundred yards, and there
1818S. appears 1818S, coarse crystalline
graphitic lime-stone; and
above or back of this is found
1818g. 1818g, hornblende-gneiss.

That we have here at Comstock a bedded series of once clastic rocks can hardly be doubted. The quartz-schists, &c., are very regularly bedded, while the underlying granite-gneiss is apparently irregularly stratificative. That this gneissic series is older than the Cambrian can hardly be doubted. That it is newer than the hornblende-gneiss, underlying the lime-stone — in case this is a bedded series — is absolutely certain.

The only question arises, whether the contact between the bedded rocks and the underlying hornblende granite-gneiss may not be an intrusive one. At any rate the bedded

series apparently represents the Algonkian.

We next drove to a quarry some distance from Comstock, where the lime-stone was found associated with granite gneiss and hornblende-gneiss.

18190 Hornblende-gneiss or granite below limestone.

18191 Another phase of hornblende rock below limestone.

18192 Crystalline limestone.

18193 } Pebbles of parts of blocks of
18194 } gneiss and granite in the
18195 } limestone.

18196 Limestone near gneiss; that is, calcareous gneiss.

18197 Gneiss overlying the limestone.

18198 Peculiar phase of garnetiferous

rock just above limestone.

Returning towards the station,
18199 is red gneiss;
18200 is white hornblendiferous gneiss.
These two are like the bedded gneiss overlying the limestone at the station.

At the above quarry 18190–18198, there appears to be very clear indications of an old shore line against which the limestone has been deposited and from which it has received fragments. Above it follow the regularly laminated gneisses which are supposed to be modified clastics.
If we do not have a shore line unconformity at this place the phenomena must have been produced by an overthrust fault. It will be decisive in favor of the clastic character of the series

above the underlying gneiss is fragments of that could be found in the flat overlying, regularly bedded, gently dipping gneiss.

Compare this occurrence with that seen at Green Mountain. It will be remembered that at the Holtonville Cheese Factory July 28th, was found below the crystalline limestone a gneiss of the granitoid type, and over it a white quartzose gneiss. Again at Bear Mountain Whittle says the limestone has upon its opposite sides, different kinds of rock. May it not be that in the Green Mountains, as well as in the Adirondacks, we have a pre-Cambrian clastic gneiss?

The succession (starting at about a mile from Port

Now to the first quarry at which the Potsdam sandstone occurs) is the fullest seen during the day.
It is probable that the red gneiss and white garnetiferous gneiss at and near the Potsdam quarry belongs to the series overlying the coarse limestone.
If this is the case, we have in this vicinity the following succession:
hornblende gneiss;
unconformity, intrusive or sedimentary?
limestone;
red bedded gneiss;
white garnetiferous gneiss;
unconformity;
Potsdam quartzite.

July 31, 1890.

We went west from Whitehall, New York, to west of the crest of the mountain which lies between Whitehall and South Bay.

On this vicinity the gneiss is flat-lying and dips both to the east and the west in going in either of these directions from the crest of the mountain.

The following section is taken from west of the crest to Whitehall.

18201 } Two phases of the garnet-
18202 } iferous gneiss at the western most point reached.

18203 Coarse hornblende-gneiss, the exposure of which occurs in dome-like form.

This is like the lower gneiss below the limestone near Fort Ann and Comstock. The regular bedded gneisses appear to be dipping away from it, as though this were an older island about which the bedded gneisses were deposited.

18204 Fine grained eruptive(?) rock occuring in 18203.

18205 White quartzose gneiss a few steps farther on. The layers of the gneiss here come together in such a way as to appear exactly like false bedding in a sandstone. If this is the true explanation it is a case of this structure being retained in a rock which has become thoroughly crystalline; and this is still further suggestive that as supposed, 18201-4, represents a more ancient series,

18205 Veins a part of an near shore knob.

18206 Coarse pegmatite veining 18205.

18207 White gneiss containing big roundish areas of feldspar, a little farther back.

18208 Augen gneiss, a little farther on.

18209 Black garnetiferous phase, still farther on.

18210 Different phases of eruptive rocks a little farther on towards Whitehall.

18211 Quartzitic gneiss, farther on and up the hill.

18212 Garnetiferous quartz rock.

18213 White gneiss at the crest.

From the section thus far

we have been passing to higher and higher horizons because climbing a steep hill. The dip at the top of the ridge is east. The strike is N. 70° W. In a little way the strike appears to be N. 70° W. and the dip at a low angle to the north. White gneiss continues as we pass on down the last slope of the ridge for some distance. The strike lower down is N. 85° W.; the dip about 20° N.

18214 Specimen of one of the coarse phases of the Gabunian white gneiss.

18215 } Three phases of dyke rock
18216 } taken from a dyke which
18217 } is found in the road on
18218 } the way to Whitehall, running from the aphanitic phase, 18215, on the side of the dyke, to a coarse rock, 18218,

on the other side of the exposure.

18219 Quartzose phase of gneiss
18220 interdominated with 18220 garnetiferous phase; the two some little distance farther down the road towards Whitehall.

18221, coarse quartzite; farther on.

18222 After a little appears 18222, dyke rock or eruptive in dome-like form; the quartzite apparently mantling over it. A little farther below appears the white garnetiferous gneiss.

18223 Garnetiferous schist; very coarse phase, at bottom of hill just before going into Whitehall.

Friday, August 1st, 1890.

We visited the graphite mine about four miles west of Hague. The graphite was found to occur in brilliant crystalline scales in a thoroughly crystalline gneiss. The strike of the gneiss is north east and southwest and the dip about 20° southeast. The underlying and overlying rocks are coarse granitoid gneiss which contain pegmatite veins of quartz and feldspar which are in general parallel to the schistosity of the gneiss. The garnets weather out and give the rock on the old surface a pitted appearance.

Photo. 1052. The coarse banded and contorted gneiss associated with the graphite mine four miles west of Hague.

18224
18225
18226 } Three phases of graphite schists which vary in structure.

18227 Quartzose and feldspathic seam in the graphitic vein.

18228 Overlying garnetiferous gneiss.

18229 Garnetiferous pegmatite in 18228.

18230 Overlying garnetiferous gneiss in Lowe's pit.

Is it possible that this graphite is other than of organic origin? The bedded appearance of the rock, its regular outline, and the way that it is interlaminated with other bedded rocks, very strongly suggests the occurrence of coal seams in Pennsylvania and Ohio. The overlying gneiss resembles the bedded white gneisses of Comstock and Fort Ann.

About one half mile from the graphite mine, on our return to Hagues, is a test-

pit for iron. Here is a small cut in which is exposed the following succession:

18231 Magnetite.
18232 Magnetite and siderite.
18233 Siderite.
18234 Siderite and limestone.
18235 Limestone.
18236 Gneiss.

Between 18231 and 18235 there are transitions, and one other layer of siderite occurs in the limestone 18235.

All of the above layers are cut by a dyke, 18237, about eight feet wide, which extends to the bottom of the cut. The dip of the layers are about 30° away from the dyke. Upon the north side of the dyke gneiss only was found, indicating that along it faulting has occurred.

18237.

18238 Limestone.

18239 Garnetiferous gneiss; the two in exact contact at this place.

Can the whole of the limestone, siderite and magnetite be due to vein action influenced by the contiguity of the dyke, or are they really beds as they appear to be, and their abrupt appearance on the other side of the dyke due to faulting along it?

The gneiss, 18236, is in every respect in appearance the typical white gneiss of Comstock and Fort Ann.

Westport, New York,
Saturday, August 2, 1890.

We visited the granite quarries on point across the bay from Westport.

The following section was made beginning at the upper quarry:

18240 Coarse labradorite gabbro.
18241 The same, with garnets about pyroxene.
18242 The same showing laminated or bedded arrangement of feldspar.

18243. Now passing to the second quarry is found 18243, white feldspar rock;
18244 Garnetiferous biotite phase of same.
18245 More finely laminated phases.
18246 Still more foliated phase at ~~boundary~~ landing below quarry.

The most laminated of these rocks appear to be gneiss, and

yet they grade into the plainly eruptive gabbros.

Now leaving the quarry and going some distance up a by-road, a section is found in which is limestone containing blocks of the gabbro.

18247 } Two of the least dioritic
18248 } phases of the gabbro.

18249 } Limestone, one of which
18250 } contains a large crystal of
18251 } calcite.

18252 A part of boulder or block one foot in diameter occuring in 18251.

18253 Gneiss-schist under the limestone.

18254 Limestone at another place where there is a natural exposure, going east. The thickness of the limestone is estimated to be from 50 to 75 feet.

Climbing up the cliff where this limestone is exposed, and above
18268 the limestone, is found (18268) gneiss

18256 A phase of pebble or block of material found in the limestone ledge. At the wall's edge the rock is a well laminated gneiss, as regularly bedded as those which have been regarded as of sedimentary origin at Comstock and Port Jervis, yet there is little doubt in my mind that this gneiss passes by imperceptible stages into the massive gabbro of the quarry, and is really but a foliated peripheral phase of an eruptive rock.

The remainder of the day was spent in driving, without stopping, from Westport to Budd's, a few miles east of Mount Marcy. The rock all the way was the hypersthene gabbro of the region.

It appeared to become coarser in character as we passing toward the interior of the mountains.

Sunday, August 3rd, 1890.

We returned from Bedés to Westport by way of Mineville and Fort Henry.

18257 Labradorite or coarse gabbro, near Bedés.

18258 Very coarse phase of gabbro one half mile east of bottom fence of road just south of Bedés.

A little farther on we found schistose phases alternating with the massive phases. Garnetiferous phases also abound, and are abundant in proportion as the rock is schistose. This fact taken in connection with those observed at the quarries near Westport, leave little doubt that the garnet is a secondary development resulting mainly from dynamic action.

18259 Fine grained phase about ½ mile east. 8-0

18260 Coarse garnetiferous phase of the gabbro. Above this appears with the gabbro black laminated phases which are apparently intimately associated with the ordinary phase.

18261 A specimen of this black gabbro

Shortly before Minerville is reached appears a different kind of
18262 rock, 18262, granite-gneiss.

18263 } Two phases of gneiss or granite
18264 } overlying the red-beds of Minerville. Veins of granite cut the beds. Are these really dykes or is their position due to movements of some sort with subsequent infiltration along the cracks?

Before reaching the Chemung red beds, a layer of limestone containing fragments of gneissic material, and resting upon gneiss, was seen beside the

road. This occurrence is in all respects like that at Fort Ann, except that the underlying rock and contained fragments are different. The limestone is graphitic. About the fragments are graphitic borders; the underlying rock and the fragments are alike.

18265 } Three phases of the underlying
18266 } garnetiferous gneiss. 18267 is
18267 } a laminated phase of the garnetiferous hypersthene gabbro.

18268 Graphitic limestone.

18269 } Specimens taken from the
18270 } fragment like blocks in the limestone.

Upon passing along first at the center of a cluster of houses at the Cheever Store the limestone is found

underlying the gneiss, in most respects similar to that underlying the limestone just above the village.

18271 } Hornblende phases of gneiss
18272 } interlaminated with white feldspathic material above the limestone.

18273 Contact specimen of the limestone and gneiss.

At a quarry a little farther on, just beyond the village, the limestone is serpentinous,

18274

18275 A serpentinous phase of rock which shows movement, rich in garnet and serpentine.

18276 Coarse graphitic limestone at this same quarry.

Going along the road, a

little way towards Westport a test pit is found from which has been taken a good deal of lean iron ore. At the top of the pit from which the ore is taken is an exposure of limestone exactly like that before found.

18277 Lean ore.
18278 Gneiss which occurs above the limestone.

The iron ores of Mineville appear to be beds in the gneissoid granite rock and are interlaminated with phases which are almost like the laminated gabbro of the Adirondacks.

Rumpelly inclines to the belief that the ores are altered carbonates as at the Lake Superior division. This probability is increased by the association of siderite

and magnetite at Ackerman's (Specimens 18281-18289.)

The question, however, remains open as to the origin of the original siderite. Is it bedded in place or is it a secondary vein formed by filtration? If the latter, into what manner is the iron oxide produced from the siderite? The occurrence of the dyke rock at Ackerman's inclines one to think of dry heat as the agent of the change. This locality and the occurrence at the bottom of the Cleveland at Ishpeming, Michigan, are remarkably similar. If these deposits are really vein formations, why do not also the limestones which include the fragments of adjacent rocks also appear in the veins?

August 4 and 5 were used in reading proof at Westport.

Wednesday Aug. 6, 1890.

We again visited the locality about the Cheever Mine from which specimens 18265-18270 were taken.

We found the blocks as described in the limestone and took photographs of them.

Photo 1053. Photograph of two blocks of gneiss in coarse limestone near Cheever Mine; taken from distance of eight feet. The blocks are from 16 to 18 inches in diameter.

The limestone here contains a huge projecting mass of the gneiss which has a decided block like appearance. A short distance below down the road toward the Cheever, and towards the north, the gneiss appears to be in contact with the limestone, at least two thick beds of gneiss being apparently interstratified with it.

Photo. 1054. Bed of gneiss two feet thick in limestone at exposure on road a short distance from the Cheever mine. At the right limestone is found above and below the gneiss. A fault occurs at the place where the hammer lies. and the upper layer of limestone is cut off.

Photo. 1055. Hornblende-

gneiss underlying limestone at exposure on road a short distance from Cheever Mine. The extremely irregular character of the contact between the gneiss and limestone is to be noted.

Photo. 1056. Gneiss overlying limestone at exposure by road near Cheever Mine. The photograph shows the extremely irregular contact of the two rocks.

On the theory of a shore line it is difficult to account for the interlamination of the gneiss and limestone. If the gneiss is regarded as a subsequent intrusion the irregular contacts and the interlaminations are explained. If after this has occured, we believe that movement has taken place, and this has

of fragments of the gneiss, the blocks could be explained. Also it is to be remembered that if a section were made parallel to the place between the gneiss and limestone shown in the photograph 1055 it might be so located that the main mass seen would be limestone and the gneiss would be seen in ravines protruding blocks. Upon the whole it seems easier to explain the phenomena as the result of intrusions and dynamic movements than by an unconformity above a shore line.

There is no question that the large blocks, boulder like forms and interstratified beds are all the same, and they appear to be much foliated phases of the hypersthene gabbro. If this is the case, their igneous character can hardly be questioned. So far as this is concerned, however, this eruptive rock might be older than the lime-

stone and the latter deposited upon it.

18279 Garnetiferous hypersthene rocks from one of the beds of rock bounded upon both sides by limestone.

18280 Unusually graphitic piece from a small boulder. On the larger boulders the graphite is a reaction border. On the small fragments the reaction graphite penetrates quite to their centers.

Walcott suggests that the interbedded hypersthene rock is a recomposed one and thus makes the whole series a detrital one, limestone alternating with clastic material.

18281 Contact specimen of limestone & gneiss.

18282 is a contact specimen of the gneiss and limestone at photograph 1054.

18283 is black hornblende or tourmaline phase of gneiss from huge block above described.

East (across the road) in a pasture is a dyke, 18284, two feet wide cutting the crystalline limestone.
18284 This is the first unkistakable dyke which has been noted in the crystalline limestone, although they have been frequently seen in the hypersthene gabbro.

Going west the other side of the road, the limestone continues for 200 or 300 feet. Then appears the overlying rock.

18285 White quartzose gneiss like that found before reaching Mindville on the return trip from Budis. Over this is a hornblendic tourmalinic and garnetiferous gneiss

well bedded. The strike is N. 10° E., the dip 25° W.

On the limestone is found
18286. vein quartz, 18286 carrying plumbago.

At the Chuvee mine the following section was made:
18287 Hornblende gneiss, last of ore; dip 60° west estimated
18288 Ore and feldspar.
18289 Feldspar rock in ore.
Next would come ore. (No specimen taken.)
18290 Gneiss west of ore; dip estimated 60° towards the west. Then followed a beautiful conglomerate or breccia of limestone with different sorts of fragments contained in it. The limestone just here does not dip west more than 15° or 20°. This suggests that here is an unconformity. The numerous different fragments in the limestone have

more the appearance of genuine conglomerate than anything heretofore seen.

Photo. 1057. The limestone breccia or conglomerate containing fragments of various sorts, West of the Chazen Mine.

The remainder of August 6th was used in teaching St. Albans, Vt.

Thursday, Aug. 7/90.

The rode from St. Albans, Vermont, west for two or three miles; then drove north along the road which runs near great Appalachian over thrust fault as determined by Walcott.

18290A 18291 Limestone (Chazy), containing obscure fossils, west of the fault.

18292 18293 The overlying limestone, said by Walcott to be Cambrian; from the other side of the fault. The vertical throw of the fault is estimated at from 10,000 to 14,000 feet. The movement along the fault must be greater than this upon account of its low dade. The Chazy limestone has a high dip, estimated to be 80° to the east.

18293 Olenellus Thompsoni (Hall);

type of genus from Parks quarry, Georgia, Vermont.

18294 Protypus Senectus (Billings).

18295 Flattened Kutorgina Cingulata (Billings).

All of the above found and named by Walcott.

18296 Specimen of coarse phase of rock at the quarry, interlaminated with much finer and more slaty phases.

Above Parks's quarry follow the Georgia Slate.

We walked west over the limestone series, along or near Walcott's section, to the end of the outcrops near the flat-lying lands east of the lake.

18297 Head of Olenellus at considerable lower horizon than the quarry; the lowest at which in this section recognizable Trilobites are found.

18298 Other fossiliferous species from the same locality.

In going towards the lake we pass over various phases of light gray and colored limestones, one of which the following are specimens:

18299 Mottled pink limestone.

18300 Red limestone. In this phase Annelids were found by Walcott upon his return, that is, in its weathered portions.

18301 Calico limestone near western end of Walcott's section.

Certain of the rocks for some distance were quite siliceous and contain a good deal of fragmental quartz, but none seem so siliceous as to be more than a siliceous limestone. The whole series is distinctly a limestone after having the slates of Park's quarry; the dips are to the East and flat — estimated

at 10° to 20°.

Returning now to Park's, we next travelled last over a considerable thickness of slates and shales, which are knotted more or less, and have arenaceous beds and also beds of limestone. We passed a "kentill" of the limestone and sandstone of considerable thickness. This series all dip to the last as before, although at a higher angle. A short distance east of Georgia Center we go down into a valley without exposures, and then arrive at a prominent bluff which contains limestone at the top of the Calico type of fossil the character which one would expect if 1830 were squeezed more or less. At the top of the hill the dip was about 30° East. Is this limestone

the basal Cambrian near Champlain brought up by faulting?

18302 Limestone at top of this hill.

18303 Limestone at some distance down western slope.

Antwerp, New York,
Saturday, August 9th, 1890.

We drove from Antwerp to Gouverneur.

From Antwerp the road runs north and northeast towards Sterling mine, which is about 2½ miles in a straight line northeast of Antwerp. On our way we found
18204, granitoid gneiss. In getting to the Sterling we had to drive beyond it in a general northeast and southwest course and return about ¼ or ⅓ of a mile southeast.

Before reaching the Sterling, on the main road we found interbanded and coarse crystalline limestone,
18305, and granitoid gneiss,
18306. The gneiss is apparently below the limestone,

the dip being at a high angle to the northwest. The contact of the limestone and gneiss is very irregular and the exposure is at such an angle as to give the limestone near the contact the appearance of having huge blocks of the gneiss in it. These are here plainly due to the irregular plane of contact. The exposure is here fresh as developed by blasting. Had it been a natural surface I have little doubt that we would have had the same appearance here found at the limestone a short distance from the Chevrey; that is, we have in this exposure one such as was said to be possible by passing a plane in the right direction at the Chevrey.

At the Sterling the specular

soft and magnetitic ores are
in very irregular forms, intimately mingled with a curiously
18307. brecciated rock, 18307, 18308,
18308. 18309, which has very strongly
18309. the appearance of being a fragmental. Everywhere are
sicksides (18309) and other
evidences of most extensive
movements. It appears probable that the apparently
clastic rock is really a pseudo-
conglomerate.

A short distance to the south
east of the mine is an ex-
posure of granitoid gneiss,
18310, which is in every respect
like that found on the road
to the Sterling.

Above the ore, upon the north-
west side of the pits, is the
18311. Potsdam sandstone, 18311

18312. Quartzite, said by the superintendent to be in the form

of veins in the ore.

18313 Another phase of brecciated rock associated with the ore.

West of Keene is an ore pit known as the Keene Mine, upon the east side of which is the Potsdam sandstone. Along the contact with the ore is a breccia which is apparently
18314. a Ribungo breccia, 18314.

Photo. 1058. Looking about north toward ore-pit, and showing indistinctly the contact Ribungo breccia. The strike of the plane of contact is apparently west of north, and the general dip about 25° east.

Driving along a little farther we come to the Caledonia Mine, which is an open pit. The ore has gone below the Potsdam sandstone, which here

pitches towards the south.
Thrown out with the ore and along with the dump is sandstone and breccia, showing that here, as at the Kennedy and Sterling, there has been movement and brecciation.
The appearance is very strongly that of a friction breccia, rather than a conglomerate, but it is not impossible that to some extent the rock is really a detrital one.
The gangue material with which the ore is associated is this peculiar breccia.
In some of the mines, as the Sterling and Caledonia, the breccia has a hard green material as the matrix, to which the miners apply the name serpentine. But this serpentine is a good deal of feldspathic material as well as quartz. The ore is certainly a contact deposit, but its source was not determined.

It may be derived from the limestone which is not far above the ore at some of the mines. However no limestone was seen in such a position as to show that it really is the source of the ore.

18315 Cambrian sandstone near Sterling.

18316 White granite gneiss about half way between Keene and Gouverneur.

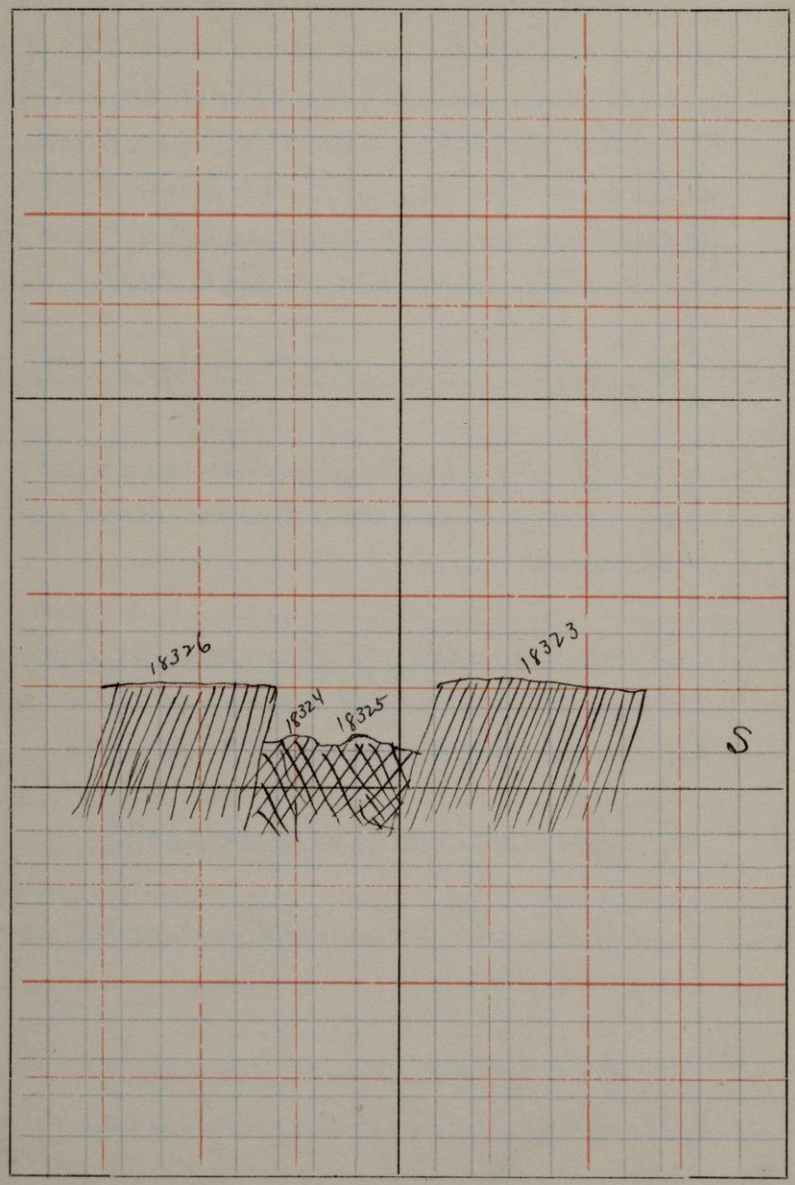
18317 } Two phases of crystalline lime-
18318 } stone or marble about one mile below Gouverneur.

18319 Tourmaline in marble.

18320 Peculiarly stained marble at Gouverneur.

18321 White feldspar last of Webb's quarry. Large masses of it are interlaminated with the gneiss and in contact with

T. R.



the limestone.

At Webb's quarry the following section was seen:
At the south a short distance from the opening is a massive
18822 red granite, 18822.
Going north there appears granite gneiss as follows:
18823 Granite, south side of an east and west striking layer of limestone which dips to the south.
18824 } Limestone about two feet thick,
18825 } which shows natural etching.
18826 Gneiss north of same.

This limestone is more like that on the east side of the Adirondacks than any found at the west. There is no question that this layer of white limestone 18824–18826 is interlaminated with the gneiss. The layer is only about two feet thick; it has been less resistant than the gneiss and has weathered

away every where for several inches, and at intervals for two feet or more farther than the gneiss. It has also been weathered deeper along the planes of contact. As a result of this the dip of the rock can be determined. It has an high angle 80° about to the north, the strike being approximately east and west. The only explanation which can be given for this limestone other than regarding it as a bed is to consider it as vein.

18327 Limestone of Nebo's quarry, the ordinary gray rock of this kind in this locality.