Region about Baltimore, Maryland ; Trip of Pumpelly, Willis + Van Hise in Georgia, North Carolina + Tennessee: [specimens] 12286-12402. No. 94 1890

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

FIELD SECTION BOOK

No. 94.

1890.

Region about Baltimore, Maryland.

Trip of Pumpelly, Willis & Vaughise in Georgia,

North Carolina & Tennessee.

12286-12402

SURVEY OF THE PRE-CAMBRIAN ROCKS OF THE N. W. STATES.

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 figure attached, showing the amount and inclination of the dip. Denote slaty or other very plainly bedded rocks by lines running in the direction of the strike, with figures and a dip arrow attached as before. In all cases where there is the least doubt about the true bedding directions, 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 as 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.

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.

3. The ruling of the left hand page is also arranged so that a smaller scale can be used. Each one of the black lines may represent a section line and the red lines quarter sections and "forties." The scale of the maps may thus be reduced, if desirable, to two inches to the mile (the ordinary town plat scale.)

4. Collect a specimen from each separate ledge of rock, or wherever there is a change of rock on any one ledge. In case of trips made on foot or in canoes, for long distances, neighboring ledges, unquestionably of one kind of rock, need not be sampled, the position and extent of the ledge being marked on the map, with a note that it is of a rock identical with specimen so-and-so. Under the same conditions small sized samples, 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 § 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. In all cases collect chips for slicing. All specimens are to have numbers painted on them, in white on a black background, in the field.

5. 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., etc.

12286 - 12402

#74

Baltimore, Maryland,
February 12, 1890.

In company with Dr Geo. H. Williams, I visited the gneiss quarries upon the northern outskirts of Baltimore, adjacent to Jones Falls.

These rocks are completely crystalline, rather quartzose, generally micaceous, but sometimes hornblendic gneisses. They have a very regular structure, which dips at a high angle in a northwest direction, the strike being approximately southwest and northeast. Viewed closely they are seen to be completely crystalline rocks. Viewed at a distance they appear to be as regularly bedded as the slates and quartzites of the Quartz Slate Member of the Penokee Series. The structure gives a very strong appearance of bedding, for there seems to be an alternation of layers of different character parallel to it. The parting is very distinct, the beds being sometimes heavy and sometimes thin, and these planes are used as lines along which

the quarrymen work. These gneisses differ from any of the fundamental gneisses of the Lake Superior in that they are never banded or contorted. They are sometimes cut by granite veins, which may be pegmatitic or intrusive, sometimes of very small size and yet continuous for long distances. In one case a very irregular narrow vein was observed cutting across the bedding of the gneiss for a distance of 25 or 30 feet.

February 13, 1890.

Trip across the country from Lockraven to Cockeysville and Texas, Md.

For a considerable distance before reaching Lockraven, the railway runs along the northwest slope of a steep ridge. Williams says this ridge is of quartzite. Upon getting off at Lockraven the rock is found to be of the sort that Williams designates by this term to distinguish it from the ordinary gneiss. More accurately, this rock is a micaceous quartz-schist or micaceous gneiss, for it contains apparently a considerable percentage of feldspar.

The general course of travel from this point is in a northwest direction across the strike of the rocks.

For the first half of the distance the winding course of the Gunpowder River is followed. Williams says

the limestone or marble begins at the very base of the ridge. Exposures are found within a short distance. These are very coarse and crystalline, and they have a structure parallel to the gneissic structure of the region which has the appearance of bedding. The marble continues about to Lock-raven dam.

Here was taken photographs ~~1 and 2 of Lock raven dam~~ 9/18, 3, Lock raven structure of crystalline limestone at dam. Looking southwest at exposure which cuts across the strike, and therefor shows structure of the rock. 8:30 A.M.

Near to the dam is a coarse granite dyke, cutting the gneiss or marble (how?)

The gneisses and schists now continue for some miles. Their structure has quite a variation in dip, although its general inclination is always northwest. Much of the rock of this part of the area

is more thinly foliated than the gneiss of Jones Falls or the quartzose gneiss of Lockraven, and the structure has very much less the appearance of bedding. Its variation in dip may be regarded as proof of overturned folds, or it may be regarded as an entirely secondary structure independent of bedding. To determine this point would require the closest of examinations.

About 1/3 of the way between Lockraven and Cockeysville a branch is crossed, which is the boundary line between the schists and another layer of cherty limestone or marble. Upon one side of the stream is the schist, upon the other the marble. The marble is in the valley, and the schist occupies the ridgy country as heretofore. This marble has cherty layers, and contains coarse crystals of tremolite. In all essential respects it is very closely like the Huronian marbles of Lake Superior.

The Gunpowder is followed, with few exposures now, for some distance, until we strike a Turnpike which turns away from it at right angles.

Following this for a short distance we come to a fork, one branch of which goes to Cockeysville, and the other to Texas. Before reaching this fork, and along it, the schists and gneisses are again found.

The road now starts up a steep inclination, upon the steep southeast slope of which the schists and gneisses are found, having a very high, almost vertical, inclination.

Passing beyond this, ledges of almost structureless granite are found. So far as this granite has any structure Williams says it accords with the general dip of the schists and gneisses of the region. It weathers in an entirely different fashion from the schist and gneisses, giving bowlders which

are like the bowlders from the Lake Superior granitoid gneisses, to which rocks it is comparable. To all appearances it is an eruptive rock. From the fact that the schists become more crystalline adjacent to the granite, its position may be explained by supposing it to represent the schists which are wholly fused, or as an intrusion between the schists which has taken on, by dynamic action, a structure parallel to them. Williams is inclined to regard it as an independent intrusion, although it seems to me, so far as I saw the facts, that the other explanation of its origin is an entirely possible one.

This granite area continues for some distance and makes the crest of the hill. In passing down its western slope the micaceous schists are again found. These continue until Cockeysville is reached.

After passing through the granite

area the difference in weathering of the granites and schists is very marked. The granite sticks out in rough decomposed knobs and forms hard bowlders to which the term "hard head" could be applied. The schists are never found in outcrop. They can only be gotten in an undecomposed state by deep cuts; the soil for several feet down is merely rotten schist; The change from the surface soil to the solid rock is a very gradual transition, usually occupying several or many feet.

Going into Cockeysville we pass down a steep slope, the bottom of which, according to Williams, again marks the boundary between the gneissic and marble area

The marble quarries of Cockeysville were examined. These are the quarries from which the great mass of Maryland marble is taken which furnishes the stone for the marble houses of Baltimore,

for the Washington Monument of that city, as well as the Washington Monument at Washington City. They are very extensive and were closely examined. The deep cuttings of the fresh marble give an admirable chance to examine any traces of structure. It was found that the layers of silicate, which presumably represent argillaceous layers in the original limestone, were in an almost absolutely horizontal position. It is quite possible that if the rock of this quarry had been exposed to weathering, that it would have taken on a structure in another direction parallel to the schists of the region. The horizontality of the layers of silicated minerals in this quarry, combined with the universally schistose structure everywhere else being in a northwest direction, is very suggestive that the latter is foliation rather than bedding; although at Jones' Falls and Baltimore it may be quite possible that the two structures coincide. At any rate, it is certain that the foliation of the schists for this region

cannot be assumed to be bedding whether the apparent beds of the gneisses at Jones Falls can be or not. To explain this structure as bedding requires an enormous thickness of sediments; of numerous inverted folds, the sides of which are approximately parallel.

The rocks exposed along the railroad from Cockeysville to Texas are marble, but the exposures were not of sufficient size to give much indication as to structure. It would be interesting to examine such natural exposures closely and ascertain whether these structures are inclined.

Photographs 909 10, 910 11, 911 12, 912 13 & 913 14 Views of east openings of Cockeysville marble quarries.

Photographs 914 15 & 915 16. Views of west opening of Cockeysville marble quarries.

Texas was not reached in time to visit the quarries of that place.

On this walk very interesting relations between topography and the underlying rocks were pointed out. The elongated ridges are of gneiss or schist, and as far as the eye could see their upper parts were practically horizontal for very long distances. The highest rounded hors traversed which seem to reach above the line of the schists is the area of granite. The limestones are universally in the valleys. The boundary line between the limestone and the schists or gneisses is at the base of the hills, the slope being upon the schists and gneisses.

On the return to Baltimore on the Northern Central Railroad outcrops of the basic eruptives of the region were passed.

February 14, 1890.

Trip to Sykesville, Md., on branch of Baltimore and Ohio, running west into the Highlands of Maryland from Relay.

At Relay station, where the change of cars was made, the rock is the massive granite. Along the railroad from Relay to Sykesville were observed granite, basic eruptives, and gneisses, schists and limestones. The limestones, as usual, occupy the valleys.

At Sykesville a granite occurs of a very peculiar character. It contains very numerous fragments of gneiss, schist, limestone, and according to Williams also fragments of granite of a different character. These fragments vary from those which are of extraordinarily irregular form, to those which are well rounded. The fragments of schist and gneiss, differing but little in mineralogical character from the granite, are sometimes somewhat vaguely outlined. The fragments

of marble have a contact zone between the granite and the marble which is composed of silicates. This is usually quite sharply defined from an interior part, which is apparently much metamorphosed and altered marble, having however generally a greenish tint. The nearest outcrops of marble are several miles distant. There can be no doubt that this granite is intrusive and has caught in it very numerous fragments of the schist and gneiss which constitute the country rock.

The railroad was traversed from Dykesville to the next station north, a distance of about 1½ miles, and the same phenomenon was observed at many points along this railway, showing that the mass of granite which thus includes fragments is of considerable size.

Trip of

Messrs. Pumpelly, Stillis and Vanthil

in

Georgia, North Carolina.

and

Tennessee.

April 3rd to 12th, 1890.

Atlanta, Georgia, April 3rd, 1890.

12286 (Granite). From railway pier of bridge of Atlanta & Western Railroad at the Chattahoochee River. This rock is said to have been quarried a short distance west of the river. It is a coarse-grained rock — much like what has been called granite-gneiss in the Lake Superior country. It is said by Professor Pumpelly not to be coarser grained or more crystalline than certain rocks of Cambrian or later age in the New England region.

12287 Foliated mica-schist or gneiss, on west side of river. The specimen is from some large resistant masses which are a part of the country rock; but the surrounding masses have altered to such a degree as to be no more than the coarse sand for a depth of at least 15 or 20 feet, as shown in the railway cuts. How much deeper this decomposition extends is undetermined.

At the cut adjacent were seen "slickensides" of considerable extent, along which

the decayed rock had slipped into the cut, leaving a smooth glittering surface along the plane of movement. The strike of the slickenside is approximately northeast and southwest, and the dip at a high angle, 60° or more to the southeast; that is, the strike is the same as that of the schists themselves on the east side of the river, while the dip is steeper than the dip of the schists.

12288 Slate or schist. From side spur to the south of the main line just east of the river. The strike is approximately northeast and southwest and the dip about 45° southeast. While the specimen does not show it, the schistosity and bedding seem to be nearly or exactly coincident, although this may not be the case.

12289 Dark green schist. } From exposure by
12290 Quartz-schist. } wagon road just east of river. The major portion of the rock of the ledge is the black schist, and the quartz-schist seems to be a layer interbedded with it. The schist specimen shows two

structures, one of which may be bedding. The angle of divergence between the two structures is not great.

12291 Gneiss. A short distance east of river along the railroad track. The specimen is taken to show the foliation of the rock and the fresh looking roundish feldspars which it contains. Upon the upper surface of the exposure the particles of feldspar stand out as oval or roundish nodules which may be picked out by the fingers, it being the most resistant mineral of the rock. These feldspars give the surface a very clastic appearance which is not at all borne out by the fresh rock.

12292 Gneiss. From the same exposure; showing a partially kaolinized portion. Every stage of the process of decomposition until the rock crumbles into a sand is seen.

about 1½ miles east of the river, at the point where the Georgia & Atlantic meets the Atlantic & Western, a knob of the granite-

gneiss is seen under the schist.
12293 represents the altered upper part of the
12294 granite near the schist; while 12294
represents the freshest and most massive
part of the granite. This little exposure
of granite is in a boss-like knob, does
not extend so as to be seen on the
Georgia & Western, only a few feet to the
south, and seems to grade upward into
the soft schist, although this is not
certain; and indeed it is probable that
the change is like that to be described
rather than a true transition.

The slate or schist above the granite
was so much altered that no specimen
was obtained.

12295 Granite-gneiss. From a mass which
is in dyke-like form, and is found upon
12296 both sides of 12296, foliated schist. If it
were not for the character of the granite,
the conclusion might perhaps be reached
that the schist is a dyke rather than
the granite.

The relations above described between 1229394959596 may mean (1st) that the schist is newer than the granite and infolded with it; (2d) that the granite-gneiss represents a completely metamorphosed sediment, and that there is really a transition between the two rocks; (3rd) that it is an independent eruptive; and (4th) that its material is derived from a sedimentary, but has reached a fused condition and thus acted as an eruptive.

In many places along the railroad track the granite has weathered in such a manner as to produce the well known round or oval forms such as are commonly formed by water action. The weathering extends along the joints and leaves the hard kernel as cores. In one place the schist along the railroad was seen to have a very flat dip, and here was also found complex bowing of the strata. For a short distance they are practically horizontal.

Hot Springs, North Carolina.
April 4th, 1890.

A walk was taken up a ravine running east from the French Broad. Upon entering the ravine quartzite is seen upon the right (south side) and limestone on the left side. The strike of the rocks is here east and west. The dip of the quartzite is towards the east, and Willis, from his study of the region, is inclined to believe that the limestone is under, rather than over, the quartzite, the present relations being due to an overturn.

In passing up the ravine the limestone does not continue, and a schist appears which not infrequently is conglomeratic, although the fragments are not of large size. They consist of quartz and feldspar, and upon the weathered surface the quartz appears to be elongated, probably by squeezing. Whether the limestone passes into the schist by lateral transition, or a fault exists here

is uncertain. The change between the limestone and schist or slate takes place within a half mile.

12297 (See Letter to Bailey Willis 5/12/90. No specimen) Limestone at north side of the mouth of the ravine.

12298 Quartzite at south side of mouth of ravine.

12299 Fresh conglomerate

12300 Weathered conglomerate from mouth of east fork of creek, about one mile from mouth of ravine.

We next walked along wagon road on east side of the river to the railroad bridge. The rocks exposed are largely the quartzite 12298, but this alternates with slates and slaty quartzites. The latter series are lithologically very close to the feldspathic quartz-slates at the base of the Cherokee Series.

12301
12301A
12301B
12301C Small specimens of the different phases of the rock, aside from the pure quartzite.

Selected within the mile's distance between Hot Springs and the railroad bridge.

At the railroad bridge the rocks are quartzite which show very distinctly bedding. Here the strike is N. 60° W, magnetic; and the dip about 45° NE.

We crossed the stream on the railroad bridge and returned by the railroad track. The rock is in large part
12302 quartzite, of which 12302 is a specimen of the most vitreous phase.

April 5th, 1890.

The day was spent in walking along the railway track from Hot Springs to Marshall.

12303 Conglomeratic quartzite, containing quartz & feldspar pebbles. In a railway cut about 1 3/4 miles up the French Broad from Hot Springs, opposite Mountain Island.

12304 A dark, fine-grained, crystalline-looking rock from the same place, which occurs in a dyke-like form.

12305 Conglomerate containing a small part of a large slate or schist fragment which resembles the supposed dyke 12304.

12306 Weathered conglomerate nicely showing feldspar. a little farther on. This conglomerate strikes NE and SW, and dips NW. This is supposed by Willis to be the equivalent in its normal position

of the supposed overturned conglomerate found in the ravine about a mile east of Hot Springs, 12299-12300. If this be the case, the conglomerate here has been much less powerfully squeezed than that in the ravine.

12307 Schistose quartzite } The two are
12308 Slate. } interlaminated at the point where the river takes a sharp bend to the south. about 4 miles from Hot Springs, below the Stack House. The strike is NW. and SE; dip, NE at a high angle, estimated 60°.

Below the slate and quartzite, (if these are in their normal position)
12309 is 12309, fresh schistose feldspathic quartzite; a little farther on.

12310 Granite-gneiss. From ravine on south side of railroad cut just above Stack House

12311 a weathered phase of same, which shows a certain pseudo-resemblance

to the fragmental rocks which have been called conglomerates.

12312 Fine conglomerate just above gneiss on top of hill. The appearance of the fresh feldspar in the gneiss suggests that this rock is the source of the detritus for the feldspathic slates and conglomerates, and that we have here an old shore line. In this case the contact of the two rocks ought to be between the granitoid gneiss and conglomerate at the top of the hill. Although the specimen does not show it, the slate or conglomerate has sometimes pebbles two inches in diameter. The slate dips away from the granite, as shown by previous observations.

Continuing along the railway, the granitoid gneiss replaces the slate. It is intermingled with granite of varying degrees of coarseness.

12313 represents a medium phase of granite about ½ mile beyond the Stack House

At one place Professor Pumpelly pointed out a narrow zone of breccia, which seems to be composed wholly of the granite, the whole being thoroughly cemented. The rock is probably a Reibungs breccia. The foliation of the granite is unconformable with the layer of breccia.

12314 Different phases of the breccia zone
12314A and the granite

12315 A black schistose rock contained in the granite; probably squeezed dyke

12316 } Different phases of the granite collected
12317 } in passing along
12318 }

Some distance farther along the track, after passing a saw-mill, the granite passes into granite gneiss, which is coarse, and this into quite regularly banded gneiss. The strike of the latter is N. 20° W., magnetic; dip to the NE. about 45°, estimated.

12319 Granite-gneiss showing the regularly banded phase.

12320 is a layer of quartzite, or a layer composed of quartz and feldspar, which locally is interlaminated with 12319. Between the regularly laminated rock 12319 and the coarse granitoid gneiss there are perfect gradations.

At big bend of river, about 7 miles from Hot Springs, there is an abrupt end of the granite and the appearance of the clastic series with no indication whatever of a transition between the two.

12321 represents the granite-gneiss at this
12322 point and 12322 conglomeratic slate. The strike of the latter is N. 30° E., magnetic; dip, about 50° SE. Willis says the strike of the gneiss when followed up accords with that of the conglomerate. The conglomerate is underlain by slate.

12323 different phases of slate, selected between
12323A last point and a point about 8 miles
12323B from Hot Springs. The strike of the
12323C slate was taken at one place & found
12323D to be N. 10° E., magnetic; dip, 55° E.

about 8 miles from Hot Springs the slate becomes more contorted and crystalline than any which has been before seen. This more crystalline phase of slate is cut by numerous white quartz veins which extend in every direction. These slates in this respect resemble the Vermilion Lake slates. The gneiss adjacent to the slate is, upon the other hand, cut by numerous areas of feldspar, and thus resembles the Vermilion schist which is cut by granite veins. There is some appearance of a transition between the slates and the gneiss at this place. The locality needs farther and more thorough study.

12324 and 12325 represent phases which appear to be intermediate between the slate and gneiss.

12326 a peculiar laminated crystalline schist, containing whitish areas which may represent broken down feldspars.

12327 is the same somewhat more feldspathic; a little farther on towards Marshall.

12328 This appears to grade into 12326, fine-

12329 grained gneiss, and this into 12329, coarse gneiss, the whole being regularly laminated and more coarsely crystalline. If the structure is taken to be bedding, the more crystalline phases rest upon those which are less crystalline. 12329 is at a station 9 miles from Hot Springs.

12330 12330A 12330B 12330C 12330D Interlaminated phases of gneiss, schist and massive rock. All in same short exposure of 50 steps on railway track, a little farther beyond station towards Marshall.

12331 Coarse granite-gneiss. Somewhat farther on.

12332 Granite-gneiss. Just before going into Marshall.

The rock, most of the way after passing the station mentioned to Marshall, is a beautiful augen gneiss, which is particularly well represented by 12332. There is

interlaminated with this gneiss, however, as shown by the specimens of 12330, layers of black, somewhat clastic-looking material and other layers of regularly laminated slaty-looking rock. The appearance of the exposures as a whole is that of a very regular structure which looks as though it might represent bedding.

April 6th, 1890.

On horseback we went in a general course west from Hot Springs to Wolf Creek; then went up Wolf Creek several miles to point where wagon road swings to the left from the creek; then on foot we followed the creek.

The rocks found for a half mile up the creek from this point are micaceous slate and greywackes. There is then a fall of 20 feet or more over granite, the rocks below being slate and quartzite.

12333 Slaty quartzite about 30 feet below granite; strike N. 50° E; dip, 35° NW.

12334 Novaculite. About 40 or 50 feet below fall.

12335 Quartzite within a few feet of the granite upon north side of the stream.

The contact between the rock taken to be quartzite and the granite is a curved one, which conforms in a general

way only to the strike of the slate.

Upon the south side of the stream the supposed quartzite is in direct contact with the granite.

12336 Quartzite. South side of stream at this point.

12337 Quartzite. About 20 feet below granite.

12338 Granite. Immediately adjacent to quartzite

12339 Granite. A few feet up the stream.

12340 Granite. About 50 feet up stream from supposed contact.

Photo. 950. Under the rhododendrons, Wolf Creek, Tenn. Looking across a slate ledge to waterfall over granite.

Photo 951. Under the rhododendrons, Wolf Creek, Tenn. Waterfall over granite onto quartzite at contact of deposition.

If the quartzite really turns out to be a fragmental rock, this, combined with the irregular contact, would seem to be fairly good evidence that here is an old shoreline; for, as seen in hand-specimen, the general character of the supposed recomposed rock is almost identical with that of the granite, and if clastic, it has in all probability derived its material from the latter rock. Also this quartzite appears to grade up into slates and quartzites which are unquestionably fragmental, just as has been frequently observed in the case of a quartzite running down into a contact-rock. This locality is of great interest as showing slates and quartzites of unknown age which resemble lithologically the Lake Superior Huronian and rest in apparent unconformity upon a granite boss. Willis thinks these clastics will, however, turn out to be Cambrian or Post-Cambrian.

Should the quartzite not turn out

to be a clastic, but a finer grained, pseudo-clastic adjacent to the slate, there would then be little evidence that the contact is not that of an intrusive with a sedimentary.

12341 Quartzite. About 100 yards below falls and some distance up on south bank

12342 Slate. About 50 steps farther down stream than 12341.

At Huffs, near the head of Wolf Creek, Tenn. (See Vol XV, 10th Census, 1880) a line of slipping in the granite has been produced, along which is granite breccia, and in its interstices is iron oxide. It has been proposed to use the breccia as an iron-ore. The granite adjacent to the ore has, near the surface, decomposed to a considerable depth.

12343 represents the ore or breccia filled
12344 with iron oxide, and 12344 the freshest granite obtainable at this place.

It is, however, considerably decomposed. Professor Pumpelly suggests that the iron ore has prevented the disintegration of the granite fragments.

After leaving the contact at Wolf Creek on the north side of Bluff Mountain, we went south on the granite area, stopping at the mine above mentioned, and put up for the night at Hollands.

April 7, 1890.

From Holland's we continued our course over the granite to Max Patch in a general southeasterly direction. Here turning east we, after a time, struck and followed Long Branch to the east side of the granite of Bluff Mountain.

12345 Typical Bluff Mountain granite or gneiss.

12346 Blue quartz. From bowlder in ravine supposed to come from granite adjacent.

Near the outer border of the granite area Rumpelly noticed, in a bowlder of granite, an irregular fragment of slate or schist 15 or 18 inches long. This slate was fresh in its interior, and between it and the granite was a contact zone about an inch in width. The granite is the ordinary rock of the region and doubtless belongs near here. The whole appearance is strongly that of a fragment

caught in an eruptive rock.

12347 Granite containing nodule of 12348, slate,
12348 which is taken from 12347. 12348 shows the contact zone of the two.

Upon the steep eastern slope of Bluff Mountain the coarsely crystalline granite-gneiss was observed, with no abrupt change, to become more laminated; then finely fissile and slaty; and finally an evenly and thinly laminated sericitic or talcose schist. The evenly laminated gneissoid phase shows stringy quartz, as though in the past subjected to intense dynamic action.

The laminated gneiss which marks the apparent transition between the granitoid gneiss and slate resembles very closely that in a similar position near the railway station (Barnard's) on the French Broad.

In continuing across the section the fissile slates and schists change again

somewhat abruptly into the granite gneiss of the region; although the peculiar nondescript gneiss containing the white spots and no feldspar were found as an intermediate phase.

Pumpelly suggests that the fresh pink feldspar in the granite-gneiss and the fresh feldspar of the clastic series become the peculiar green disintegrated feldspar of the transition rock as a result of motion along the transition zone. Such supposed movement would also account for the regularly laminated character of the rocks at this place.

12349, 12350, 12351 } Three phases of the peculiar green and white spotted gneiss near the transition zone.

12352 Granite which has a somewhat clastic appearance.

12353, 12354, 12355, 12356, 12357 } Quartzose schists. Representing different phases of the most finely laminated

zone.

12358 Slate.

Between the different members of 12349 – 12358 there appears to be a complete gradation, and 12358 grades upon the
12359 other side of the zone into 12359, chloritic gneiss.

Leaving this place we followed Meadow Creek, which alternately flowed over the slate and granite, but time did not permit an examination of the relations of the rocks.

At many places along the road from Long Branch for several miles on the way to Lusk's were seen numerous fragment-like masses in the granite bowlders like that first observed by Pumpelly, although no rocks showing these areas were certainly seen in place.

The fragment-like areas are of such a shape as to preclude the idea that they are interlaminated in the granite-gneiss. They appear to be for the most part not intensely crystalline, and resemble somewhat closely the more crystalline of the slate series.

These facts suggest the possibility that the granite or a part of it is an eruptive in the slates and has caught fragments of that rock within it.

We rode to near the northeast termination of the Bluff Mountain granite area. We here followed along a creek from below Lusk's house, beginning with the slates, and passing towards the granite area.

The rocks upon which we began are very evenly laminated quartz-feldspar ones, which apparently have been intensely squeezed and are

therefor very schistose. They grade into quartzitic slates which show a weathering like that exhibited by many clastic rocks; and these again change into rocks which clearly appear to be clastic. After a short interval comes the granite.

12360, 12360A Slate
12361 Quartzose and feldspathic schist.
12362 Quartzite.
12363 Conglomeratic schist.

The creek runs east and west; the dip is down creek.

After a short interval — perhaps
12364 50 feet — appears 12364, massive granite

A little farther on again is found
12365 12365, slate.

The slate is in such a position that its strike carries it across the outcrop of granite represented by 12364. This may represent an old

show line, or may mean that the contact is that of an eruptive with sedimentary.

The next went to Spring Creek, and then followed down it to the place at which it swings northwest into the granite area. Here was seen practically the same rock succession as at Lusk's.

12366 Different phases of quartzose schist and quartzite. A short distance from the granite, 25 to 50 steps.

12367 Most clastic-looking phase of quartzose schist found at this place. About 20 steps from the granite.

12368 Granite closest to the quartzite.

12369 Fresh granite-gneiss broken out by blasting. A little farther down the stream.

The above facts as to the relations

of the granites and slates of Bluff Mountain, and the granite-gneiss, slates and schists along the French Broad, point with about an equal degree of probability to the idea of old masses of granite against which the slates have been deposited as a shore line, and that the granites and granite-gneisses are intrusive in the slates. Upon the first hypothesis, the difficulties are the absence of any coarse conglomerates and the presence of the fragments in the granites. Upon the second, is the difficulty of accounting for the vast amount of feldspar in the clastic rocks apparently exactly like that found in the granite. Of course feldspar could be derived from another granite; also it is possible that a part of the granite and granite-gneiss is later intrusive and a part of it older than the clastic series. A farther difficulty arises upon the supposition of its intrusive character,

and that is the absence of anything like granite dykes anywhere in the slates, and this upon the whole seems to have greater weight than the previous point.

Pumpelly suggests the fissile and transition material of the French Broad and of Wolf Creek is due to powerful dynamic action, regarding the granite as older than the slates. He also suggests that the absence of large bowlders of granites in the slates might be caused by having the old shore line, against which the slates are being deposited, deeply weathered and therefore breaking into small fragments instead of forming large bowlders.

Returned to Hot Springs.

April 8th, 1890.

The first half of the day was spent at Hot Springs in getting specimens in order.

In the afternoon we went from Hot Springs, by the way of Rich Mountain and Hurricane Creek, to Laurel Creek, and stopped at S. for the night.

April 9th, 1890.

The first part of the day was used in reaching Flag Pond, Tennessee.

In the afternoon we went up Rocky Fork Creek, which empties into Indian(?) Creek, upon which Flag Pond is located.

After going up the creek for some distance we passed out of the granite area into quartzites and slates. These were traversed for some distance, when we turned about and made a section.

Beginning with the slates, we soon run into quartzites, which are conglomeratic in layers and which alternate with layers of slate, some of which are of considerable width. The pebbles contained in the conglomerate are slate, quartzite and feldspathic quartz schist, which resemble the fragmental rocks near the granite on Bluff Mountain.

Lower down the creek the quartzites are followed by slates, which contain what is taken to be decayed fragments of granite.

The following specimens are taken from west to east, the first being highest up the creek:

12370 Slate.

12371 Feldspathic quartzite containing slate pebbles.

12372 Conglomerate containing white quartz pebbles

12373 Part of a feldspathic quartz-schist pebble.

12374 Pure vitreous quartzite.

12375 Slate, from layer of some thickness in quartzite.

12376 Slate, apparently containing decayed granite pebbles.

12377 Granite-gneiss. A short distance below 12376.

All of the above are on the north side of the creek.

On the south side of the creek was found what was taken to be a basal conglomerate of slate resting on granite. This slate is overlain by quartzite, and in the slate was found granite bowlders, or the top of a small granite boss.

12378 Slate nearest to granite.

12379 Slate containing fragments of granite.

12380 Portions of granite pebbles from the sand.

12381 Quartzite above slate.

12382 Granite-gneiss some distance down stream. Not the most massive or coarsest variety.

The quartzite in the creek is almost vertical. Its strike is in a general way across the course of the creek, but may vary considerably from a north and south course. At this locality there appears to be more chance that close detailed work, possibly combined with excavation, would show a basal conglomerate than in any of the placers visited in the Bluff Mountain region.

April 10, 1890.

The day was spent in going from Flag Pond to Fullens over the top of Big Butt; and thence by railway to Johnson City.

On our way to Big Butt we passed from the granite into an area of slates.

12383 Coarse conglomeratic phase of slate. From Gravelly Knob at one of the highest points of Big Butt.

12384, 12385, 12386, 12387 } different phases of quartzite from north crest and upper slope of Big Butt.

12388 Slate.

12389 Conglomerate interstratified with 12388. This is lower down and dips towards the mountain; that is, under the quartzite.

12390 Feldspathic quartzite well down toward the north base of Big Butt.

The pass somewhat abruptly from the mountains to the Great Valley of Tennessee. This is underlain by a dolomitic limestone which was seen outcropping at several points and was said by Willis to be the Knox dolomite. Safford places a fault line along the base of the mountains and regards the slates and quartzites older, the equivalent of the Ocoee. Willis regards the slates and quartzites as overlying the Knox and as the equivalent of the Nashville series (Hudson River). The differences of elevation of the plain and mountain are regarded by him as due to differential degradation.

April 11th, 1890.

We rode on a slow train from Johnson City to Cranberry Mine, along the East Tennessee & Western North Carolina R.R.

At Elizabethton the road swings sharply to the south. Until we had gotten two or three miles beyond Elizabethton nothing was seen but the little altered slates and the limestones, said by Willis to be of Cambrian or of later age. A short distance farther on we found heavily bedded slates and quartzites dipping towards Elizabethton; i.e., down the river.

After passing through a tunnel the train stopped and the following were obtained:

12391 Quartzite.

12392 Quartzite showing peculiar brownish weathering as though it contained carbonate of iron.

12393 Micaceous slate showing fragmental mica. Interstratified with 12391 & 12392.

In passing southeast the alternating slates and quartzites take on a higher dip. Then after a short interval, in which the exposures were not noticed carefully, the slates are found to dip down stream at a high angle, indicating perhaps that an anticlinal axis has been passed. As we pass along the dips gradually flatten and reach as low an angle as 20° or 30° at most.

After passing through some distance of rather flat lying slates and quartzites they are followed by a short interval without exposures. Then the slates and quartzites again appear and are found to be folded and twisted in a most violent and complex manner.

As we pass along granite was soon seen. There is somewhere here a contact between the granite and slate, or else a transition between clastic & crystalline rocks.

After passing into the granite area, which begins about two miles northwest

of Blevins, no clastics were seen. The granitic area is not uniformly massive granite, but is a complex consisting apparently of banded gneiss, coarse massive granite, black coarse rock, etc. In passing by, the general resemblance of this to the Lake Superior Archaean is noticeable.

The granite runs into gneiss as Cranberry is neared, and for several miles before reaching that place the predominant rock is a somewhat regularly bedded gneiss. This is shown by the exposures between the hotel and Cranberry, and is here very much folded and contorted.

At Cranberry we examined the mine bearing this name. The ore is a magnetite mingled throughout with more or less of hornblende or pyroxene. Oftentimes this bisilicate is in almost pure solid masses. The black deposits which look at first sight like nearly pure iron ore have

to be hand sorted, and the pyroxene or hornblende separated from the magnetite so far as practicable. The ore is cut by granite in masses and vein-like forms. This rock is often epidotic. These granites cut every part of the mine, and in one place a large mass of granite is nearly surrounded by the ore-bearing material.

In passing toward the mountain the change from the ore to the granite does not seem to be abrupt, but the granite becomes more and more prominent until the ore has become inconspicuous. The deposit has been developed so as to show that the ore extends along the strike for more than 1000 feet, and across the strike in certain places some three or four hundred feet.

12394
12395 Granite contained in the ore.

12396 Shows alternations of granite and black layers which resemble the ore in composition.

12397 Ore mingled with hornblende or pyroxene.

12398 } Different phases of Cranberry ore.
12399 }
12400 }

12401 Granite-gneiss in ravine toward mountain above Cranberry Mine; i.e., southwest from the mine.

12402 Gneiss. A short distance up railroad track from the Cranberry.

(See Book 95, page 1, for continuation.)