University of Wisconsin-Extension

GEOLOGICAL AND NATURAL HISTORY SURVEY
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THE ROCKS OF CLARK COUNTY

by

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THE ROCKS OF CLARKE COUNTY.

BY: W. D. Smith.

Introduction:

During the summer of 1902 I was engaged in field work on the Wisconsin Geological and Natural History Survey as field assistant to Dr. S. Weidman, State Geologist, and it was then that I collected specimens and made observations of the rocks of Clarke County.

Clarke County is a little to the west of the centre of the state and comprises townships 23, 24, 25, 26, 27, 28, and 29 in Ranges 1 E, and 1, 2, 3, and 4 W of the 4th Prin. Mer. It is bounded on the North by Taylor, on the east by Marathon and Wood, on the south by Jackson, on the west by Jackson, Eau Claire and Chippewa counties. The Black river, a tributary of the Mississippi roughly bisects the county.

Most of the specimens collected came from the banks of or close by ~~the~~ this stream.

Topography.

The relief for this county is for the most part moderate, the region being one covered quite largely by old drift, quite thick in the eastern half but thinning out to a sandy plain in the western half, and having a well established drainage. In this western part where the drift is thin there rise 100 feet to 250 feet above the plain several residual mounds of Potsdam sandstone. These are situated in T.26, R.3 W and are very prominent features of the topography. About three miles Northwest of Neillsville emerging from the thick drift are some more of these sandstone mounds and again one or two somewhat lower one-half way between Neillsville and Greenwood.

The only other marked feature of the topography and probably the most importatt is a long moranic ridge running eastward from Neillsville in T.24, R.2 W toward Marshfield in Wood county, and

north keeping pretty close to the Black river to Greenwood in T.26, R.2 W, thence swinging off to the northwest crossing the county line at the southwest corner of T,28 R.4 W. To the west and south of this ridge the drift becomes quite thin, and indeed in places is altogether lacking. To the north and east the drift is quite thick. varying all the way from one foot to 150 feet thick. While this ridge is quite marked with abrupt southward looking front, at Neillsville, it is by no means easy to define north and west from Neillsville as it besomes considerably flattened out. In fact only by means of well data could it be followed out through most of its northward extension.

The well records obtained during this field work show that sandstone underlies the drift everywhere throughout the County except in local points where for some reason the sandstone had been eroded and the igneous complex laid bare by erosion prior to the deposition of the drift. Such localities are to be found near the present streams as a rule. The sandstone too differs in thickness depending upon the differential erosion before the erosion of the ice deposited its load of til. as indicated by numerous well records and actual contact exposures in the field we are enabled to state that the sandstone layers under the drift are the basal beds if the Potsdam.

The Rocks.

Post-Cambrian

Pre-Cambrian (sedimentary.
(igneous.

The Post-Cambrian rocks are represented by the Upper division of the Cambrian known as the Potsdam. All variations are found from a hard vitreous quartzite to a soft sand easily shovelled. No.6813 is a typical example of the former and 6864 is just hard enough to

keep from curnbling to pieces. We find sometimes these hard and soft layers in close prxoirnity to each other as in the quarry at the railroad bridge where the railroad crosses the Black river just west of Withee in T.29, R.2 W. The exposure at this place gives the following succession and it gives some idea of the varied character of the Potsdam:

	ft.	in.
Base bed of yellow sandstone 6 in. to a foot thick---	3	
Bluish shale ----------		6
Thick beds of streaked yellow and white sandstone -----	7	
Alternating layers of red and blue shale and thin layers sandstone ----------	2-3	
Sandstone in beds 6 in. to foot thick ----------	3	
Alternating layers of shaly sandstone and harder sandstone 3 in. layers ----------	3	
Loose sand white and yellow ----------	1-8	
Drift ----------	4	

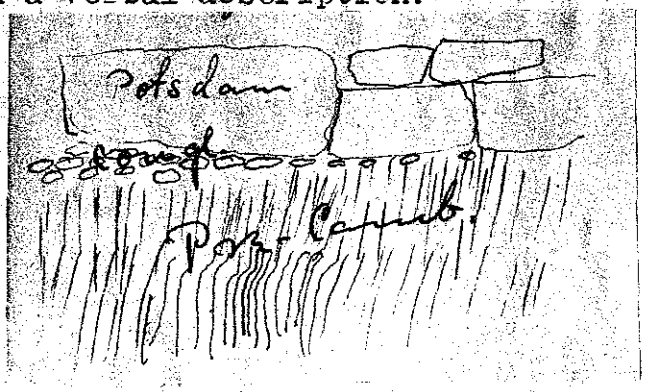
What is remarkable here is the fact that we have layers of loose or very friable sand near the base of what once was a pile of sediments probably 600 or 700 feet thick. Doubtless the layers of shale we find intercolated here have in large measure controlled the underground H_2O and so caused a selection ~~of~~ we cementation.

In several places good contacts were found of the Potsdam and the Pre-Cambrian and before taking up these rock I shall say something of this contact, but first quote from my field notes the following:

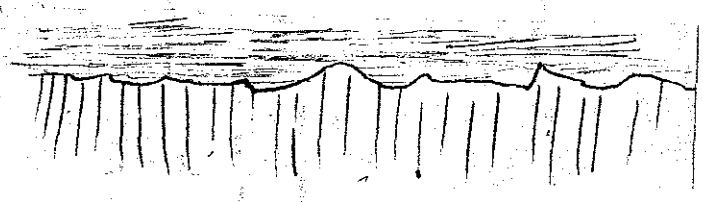
"(6819) Conglomerate, basal, at bottom of the Cambrian sandstone a loose friable, reddish to white sandstone in the lower portions of which are included mostly quartz pebbles, these varying from a fraction of an inch in diameter to half a foot. In places, too, are included glistening mica flashes from the rotten Pre-Cambrian below.

Right below this conglomerate comes the rotten granite (6820) on the bank and in the bed of the stream (Hay Meadow Creek, sec.11, T.24, R.3 W). This weathers to a loose, crumbly micaceous mass which is in part due to great schistocity developed at this point in the granite. The sandstone and rotten granite may both be seen in Hay meadow Creek and Wedges Creek but better in the latter and here is where the contact between the Pre-Cambrian may be seen. ----------
The granite (schist) has a strike of N 70° W and dips to the North by East 25°".

Another good example of this inconformity is that shown on Hay Creek sec.15, T.26, R.4 W. A diagramatic sketch will give a bteer idea than a verbal description:



The conglomerate is found absolutely lacking in places and the contact is sharp and clean cut in places as this second disgramatic sketch will show:



The Pre-Cambrian is here standing practically on edge.

Another striking instance is that shown in sec.1, T.26, R.2 W on Rock Creek near Greenwood. Specimen (6857) granite schist was taken from there. However, here we have in addition to the conglomerate a thin layer of a reddish shale about 2 inches thick just beneath the conglomerate.

The Pre-Cambrian:-

General Discussion.-

As has been said before, the glacial drift overlies the major portion of the County of Clarke, thinning out to the west where it is low and sandy. To the east, and north the country is pretty heavily mantled with drift, but more of this later.

Besides this mantling of drift varying anywhere from one foot to one hundred and fifty and even more, the well records show that the Potsdam underlies this drift as a rule throughout the whole County except in rare instances where for some reason local erosion prior to the glacial epoch had removed the few feet of sandstone and so in these places the drift rests inconformably on the Pre-Cambrian. Sometimes it was possible to examine this material which had been brought from the wells if they were hand-dug wells, but in the case of drilled wells the material, of course, had been pretty well ground up and not ing definite could be made up. In most cases we had to depend upon the testimony of the owner of the well. Of course, they could, except in a very few instances, tell nothing of the character of the rock, save the difference between granite and sandstone. All igneous rocks are, to them, granite. Even this is of immense service to the Geologist.

So that we have to look to the stream for most of our exposures, and naturally the Black River, being the most powerful stream in this part of the country, was the chief field of study of the Pre-Cambrian rocks.

In the lower courses of this river the river-bed is, in some cases, forty feet down in these Pre-Cambrian rocks, but as we up-stream this cutting is less marked and we find the river bed in the northern half of the county pretty generally in sandstone and when

we get up into Taylor County the river is still flowing in the drift, not having yet worked its way down to the sandstone or the igneous rocks, In a few places, however, there are isolated patches of eruptives along the river.

We shall begin our survey of the Pre-Cambrian rocks of Clark County by starting with the southern most exposure, thence proceeding northward.

About 100 yards northwest of the intersection of Arnold creek with the south line of T23, R3 W, this line being also the county line between Jackson and Clark, we find our first exposure. On the west side of the bridge is a small exposure of a dark, more or less basic rock (6826) which, however, is sufficiently acid to place it either among the syenites or diorites. From hand specimen examination it is found to contain principally amphibole, with pink orthoclases, but quartz is a minor constituent. On the east side of the bridge 200 paces up stream is an exposure of a rock (6828) somewhat similar, only the pink feldspars are larger and more abundant. In sec.25, about a mile north of this point we come to our first good exposure of gneiss. The strike is here N 70° W and the dip varies all the way from the vertical to 45° to the North. This gneiss (6825) is made up of distinct bands of different kinds of rock alternating with one another. This is what is meant whenever the term gneiss is referred to in this report. This gneiss outcrops along the road, which follows the west bank of the river, for over a quarter of a mile until it grades off, or seems to grade off into a grayish granite (6814). This is apparently cut in all directions by stringers or small dikes of pink granite (6816) which varies from a very reddish variety to a much lighter kind. Two sets of joints intersect and divide the rock into blocks. These joints are N 30° W and N 25° E. AT this point in the river there is an island on the west side of

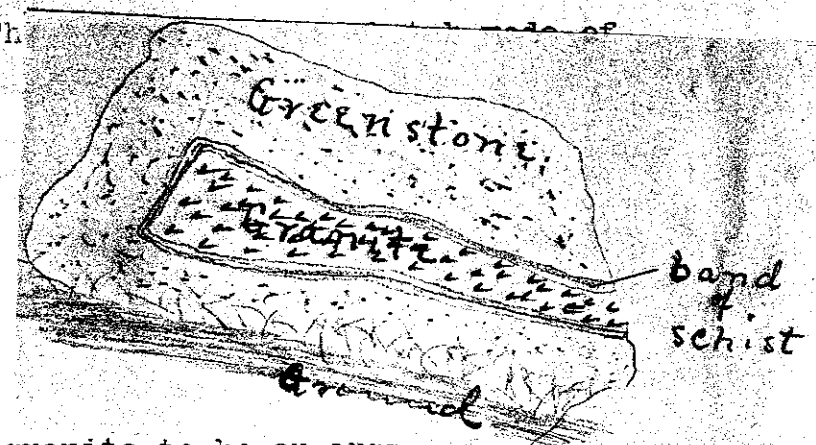
which flowed a smaller arm which has been partially dammed up. This island is for the most part all gneiss or gray granite while to the west across the smaller arm is the reddish granite. In places this granite has become somewhat mashed and certain portions of the gneiss, especially along the contacts between the different kinds of rocks, take on an extremely schistosity, so that we find good schists here too. 6815 is such a specimen. By scraping off a few flakes with a pen-knife, and putting them on a slide for microscopic examination it was found that amphibcel, probably of the variety of actinlite, is the main constituent. This secondary development of amphibole in mashed rock is quite a common metamorphism of diorite. Diorite is what most of this dark interbanded material in the gneiss is. Of these rocks just mentioned we have only one section cut and that is one from 6814, the gray granite. This shows the three principal ingredients of granite with, however, orthoclose largely in excess of the others. The orthoclose is in some cases almost entirely changed to small epidote particles and they seem to have a zonal arrangement in the fledspar. There are one or two individuals of oligoclose. Quartz is found in irregular areas occupying the interstices between the feldspar.

A few feet abpve this exposure of granite the sandstone is found on the hill slope and forming quite a mound. There is no contact shown here.

As we go on further up the river into Town 23, R 2 W, isolated patches of granite and greenstone are to be seen. However, in the SW 1/4 of SW 1/4 of sec. 18, the river flows a considerable gorge in the red granite. This gorge is about 40 feet deep and probably 50 feet wide and extends as a gorge for perhaps 200 yards. Just

above the granite we find hard vitreous sandstone. We must note this fact carefully for as we go on we shall find instances, more than one, of this hard vitreous character of the sandstone where it overlies the granite, and particularly, the red granite. In many places in this county as well as in adjacent area as cited by Dr. Weidman the Pre-Cambrian beneath the Cambrian sandstone has weathered deeply and there is found a considerable thickness of Kaolinized material for the first foot or two. This is a residuum of the underlying basement and does not represent any dynamic metamorphism or washed in material to any extent.

On the east side of the road, which runs along the east bank of the Black River, in the NE 1/4 of sec.8, T.23, R.2 W over in a field there are a number of isolated patches of granite and gneiss exposed and one legge showed the relations pretty clearly between the greenstone and the granite. Th[illegible] the ledge:



The above clearly shows the granite to be an intrusion and [illegible] er than the greenstone, but the interesting features of the exposure is the clean cut band of schist that runs peripheral to the intruding tongue of granite. This is the nicest case of contact metamorphism found the whole summer by me in the field.

At the intersection of Wedges creek and Black river there is quite a patch of red granite exposed. It is of same age without much doubt as that in the gorge and as a thin section was made of it and it being typical, I shall give my petrographical notes on the slide:

Macroscopical:

6812.-- A reddish coarse grained rock which is clearly granite. It contains quartz, pink orthosloce feldspar, and small units, of biotite and muscovite.

Microscopical:

A thin section of this rock shows large feldspars, which are taking on a microperthitic structure; some large grains of quartz, but for the most part small grains; biotite and muscovite, the latter with certain strain effects, such as undulatory extinction give plain evidence that the rock has undergone both mechanical and chemical changes to some degree. A rough estimate was made to get at a quantitative estimate of the different minerals as well as the amount of silica. The following is that estimate:

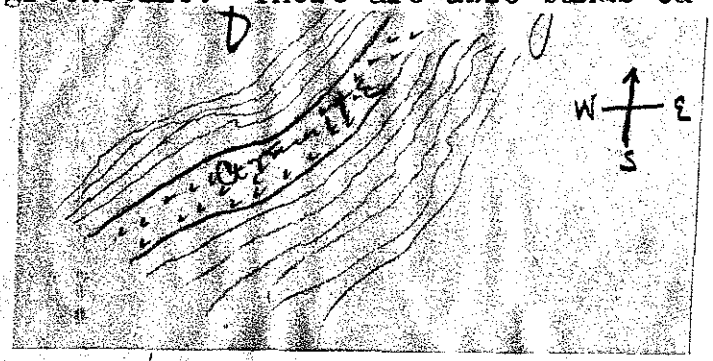
		SiO_2
Feldspar	50%	32
Quartz	40	40
Biotite Muscovite	7	6
Magnetite Hamatite	3	0
	100	78

By this system we have a rough yet quantative method of telling where abouts in the rock series our rock will fall. According to, Kemp's table in his Handbook of Rocks, a rock which has over 65% of silica is classed with the granites.

At the east quarter post of Sec. 5, T.23, R.2 W, there is a small exposure of granite schist. But not until we get to the bend in the river is secs. 23 and 26 do we get any very extensive or interesting exposures.

First, however, I should mention the gneiss in the bed of Cunningham creek. About 1/4 mile up the creek from its affluence with the Black river the stream flows over the upturned edges of

intricately folded and truncated gneiss. The general trend of the gneiss is N 75°W on the south bank, but as it swings across the creek it becomes N 80°E. This is an exposure of typical foliated gneiss. The gneiss consists of laternating bands of fine grained and dark greenstone. There are also bands of coarse granite schist.



In the NW 1/4 of sec.26 on the east side of the road there is quite an exposure, dotting the hill side, of what corresponds to the typical Augen-gneiss. This is really a corase grained granite which undergone some mashing, The rock from hand specimen (6800) is seen to contain large lenses or "eyes" of a pink feldspar around which the darker and more basic ingredients are wrapped. The darker portion for the most part is biotite. Quartz is neither so prominent as the feldspar nor the mica. In places the quartz occurs in stringes next to the feldspar.

In this section the rock gives evidence of metamorphsim both dynamical and chemical. Its structure is decidedly porphyritic. Orthoclose feldspar, much of which has taken on a microslinic structure, is the dominant mineral. This makes up about 50% of the whole slide. It has pretty much its own outlines, but it has been fractured some. Quartz is next in abundance, probably, for it is seen in large and small grains quite thickyy scattered throughout. It consiitutes about 20% of the whole.

Biotite and chlorite (rarely muscovite) 15%. Intimately mixed

the bitotie and chlorite scales is some epidote or allied mineral with high relief and high interference colors in certain planes, which makes up its balance.

The river here flows through a small gorge in the granite and gneiss and at intervals along the way has it laid bare a patch of granite or gneiss until we get up into sec, 15 where large masses of gneiss and granite lie exposed by the section of the rivers swift current.

6803 is typical of the gneiss exposed here. Strikes were observed along the river for ½ mile or more and were found to vary from N 45°W and N 75° W to N 30° E. The dips vary from the vertical to 25.

Just west of Neillsville Depot, about 1/4 mile east of river bridge, in railroad cut, there is a fine grained mashed granite which is very much mashed in places. It has a dip of 45° to west and southwest with an irregular strike which has an average trend to northwest. The schistosity is so well developed in places that the whole had the appearance of a sedimentary. 6801 is a specimen from this cut. The hand specimen shows the two intersecting jointing planes which break the rock up into rather unfform blocks.

As far as I followed O'Neill creek there is nothing different or in any way demanding explanation. However, a few hundred yards east of the wagon bridge over the creek there is one of the largest and finest exposures of gneiss that I have come across anywhere in the county. The rock is predominately acid. It shows much foliation and crumpling of the hand too.

For about 2½ to 3 miles there is scarcely any other kind of rock but red granite exposed along the Black river. The river runs

swiftly through some beautiful dalles in section 2, but strikes gneiss and greenstone again in the next township.

In NE 1/4 of sec. 35, T.25, R.2W is an exposure of gneiss in bed of Cawley creek a slide which when viewed under the microscope shows rock made up of fairly well rounded quartzes and feldspars with no little amount of secondary mica and hornblende. It looks to me as if the rock had a sedimentary origin. Close by is some washed granite.

In sec.16, NE 1/4, T.25, R. 2W. is some more red granite. When we get to Greenwood in sec.3, T.26, R.2 W we find large exposures of gneiss again, but before giving details of this we should say something of a couple of rocks encountered on our way to Greenwood.

6843 in NW 1/4 of NW 1/4 sec.28, T.26, R. 2W is a Hornblende Diorite. The feldspar is Labraclorite. There is also some iron pyrites. The feldspars show considerable alteration to epidote. In the field the rock looks something like a gabbro, being dark green in color. It is somewhat blotchy in appearance and has almost a porphyritic texture.

6835 from SE 1/4 sec.16, T.26, R.2 W is a Diabase, In the hand specimen lath shaped feldspars are about the only minerals that can be distinguished with a microscopic examination. The rock is very dense and black like a basalt examination in thin section to have the ophitic structure of the plagioclases (oligoclose or labredorite). Occupying the intervening space is a pyroxene diallage from its characteristic parting, large extinction angle and lack of marked pleochroism. Around the pyroxene is generally to be found a rim of fibrous green hornblende, (actinolite or smaragdite?). This is found also around the fedlspar. It is an alteration of the pyroxene but hardly of the feld par. Magnetite is quite abundant too. The green

substance which I took for hornblende also surrounds the magnetite. What I called magnetite is doubtless Ilmenite for it has the typical hexagonal skeletin arrangement of ilmenite.

Rock Creek was explored for 2 or 3 miles in the vicinity of Greenwood and nothing but red granite was found along it. However, when we go up the Black River about 1/4 mile from the confluence of Rock creek with it to an island then we get gneiss again and more of it than we have yet come across in one spot. 6851 is a specimen of contact of granite and gneiss and specimens 6838and 6839 are also from this locality. There seems to be a heterogeneous mixture here of basic and acid rock. 6838 when examined in thin section shows common green hornblende, arranged somewhat in parallel, to an abundant constituent. Here and there in the slide basal sections showed that the schistosity had not been correct to its greatest development. Feldspar in small grains is next in adundance. There is also about 15% of quartz. Scattered biotite and hematite flakes practically make up the remainder. The rock is easily made out to be a quartz-diorite. 6837 is probably a mashed granite. It is exposed on the west bank of the river opposite the island and has a schistose structure that is very prominent for several rods. The strike of this structure is N 25° E. The dip is vertical for most part but this changes to 65° to NW within a few rods as you go up stream.

On the north side of the Foster railroad within a few feet of the track about 150 paces east of the bridge over the river in sec.3, T.26, R.2 W there is a very clean cut contact of the sandstone and the red granite. The contact is knife like, there is no conglomerate between and the two are pretty well cemented together so that if a piece of sandstone is dislodged a portion of the granite nearly always accompanies it. The granite where exposed along

here has the appearance of a rounded boss which gave me the impression that it had pushed in a great mass against the overlying sandstone. But the sandstone is not tilted at all and there seems to be no special metamorphism save a hardening of the sandstone and that may not have resulted from any heat effects. No intrusion of igneous rocks in the Cambrian has any where been admitted by the Wisconsin Geologists in this region, so that it is altogether without precedent so far as we knoe in this region, or even north of us in the L. S. region. 6840 is a specimen taken from this contact. Of course, it is not necessary to always have a well defined conglomerate present to make normal shore deposition. In one or two places near by within a foot or so one can see that the grains of sand become much larger almost approaching the size of peas so that we probably have what approaches a conglomeratic phase.

A glance at the accompanying maps will give one an idea of the rocks and their field distribution along the river and as they, with two or three exceptions, are isolated patches only and reflections as a rule of what we have already seen farther south I shall pass rather rapidly over to the exceptions.

First, I should mention the fact that north od the Hemlock Dam in NW 1/4 sec. 15, T.27, R. 2 W for 8 or 10 miles till we get up into sec. 29, T.29, R.2 W, there is not an outcrop, as far as I know, (and every foot of the river was traversed), of igneous rock was encountered. It is all Cambrian sandstone. In the NE corner of sec. 29, T.28, R.2 W, is a good exposure of sandstone showing layers of ferruginious shale sometimes called, locally, "paint rock". 6850 is a specimen of some of this.

At the bend in the river in the NW 1/4 of sec. 32, T.29, R.2W, we have some more greenstone. Specimens 6866, 6867, 6868, 6869, and 6870. 6870 came from a massive portion of the ledge farthest out

to the east. It is a granite or probably a diorite. A few feet to the west it is a typical gneiss as shown by 6866. The gneiss has a N 65°W strike to it. 6867 is from a band of more granite like material which runs through the darker portion of the mass. 6869 is from a more basic portion, which is probably greenstone and of differentage. 6868 is a schist from the greenstone portion where local mashing has occured. All these specimens came from within 10 or 12 feet of each other.

Just south of the one-quarter line of sec.30 at the big bend in the river and a little over a 1/10 mile farther up stream occur exposures which are very interesting for the reason that they are Pre-Cambrian rocks and what is still more interesting they are sedimentary. Just what position in the Pre-Cambrian succession they occupy can not be said at this writing. The exposures are not large and indeed are covered by high water.

6871 is probably an arkose as the microscope reveals a considerable quantity of feldspar grains. Quartz and feldspar in more or less rounded grains are the dominant constituents while there are some mica flakes scattered here and there in the rock and on the surface.

6872 consists largely of feldspar and quartz in rounded grains as in 6871, but there is a large amount of epidote in this slide which has developed secondarily as the rock is a sedimentary one.

At Eidsvold in sec. 28, T.29, R.4 W, we run across typical gabbro for the first time in this region. The exposure is in a gully near the railroad track of the W. C. where the main street of the village crosses it. 6874 and 6877 are specimens of it. A half mile south of the NW corner of sec.1, T.28, R.5 W, in Chippewa County

is quite a large exposure of this gabbro of which 6875 is a specimen. In thin section it has the typical optitic structure of the plagioclose which is basic andesine and labradorite. There is considerable angite in it and also olivine. Magnetite and biotite are both present. Around the magnetite particles there is to be seen an aggregate of some lighter and some greenish mineral, which I take to be chlorite, but some of it may be serpentine as we have serpentine associated with the olivine.

6876 is a specimen of massive granite which is taken to be same age as that red, massive variety already mentioned.

From Taylor County I collected only one specimen of igneous rock, a greenstone, 6879, very fine grained and hard, from the bed of the Yellow river in sec. 26, T.31, R.4 W just at point where the good wagon road ends and the tote road along the river begins. This rock is cut by numerous small joints so that it breaks up into triangular pieces sometimes. As from time to time the road swung close enough to the river I kept a lookout for exposures, but I found scarcely any more rock in place north of this point. Here the drift is of the Late Wisconsin age and so comparatively thick and as a rule the river flows still in the drift this far north. As soon as one leaves the river bank he never sees any ingeous rock in place, at least I found none.

In conclusion we have in Clark and those parts of the adjoining counties mentioned igneous rocks ranging from massive granites gabbros and diabasic rocks, rocks that are as fresh looking as if they were crystallized but yesterday and those which have been mashed and contorted in the worst possible manner. The granite seems not to be confined to any particular belts or areas, but is found in the southernmost part. None, however, was found north of Clark County. The foliated gneiss is best developed in the vicinity of

the cities of Neillsville and Greenwood, but found only in isolated patches north of T.26. The only other feature is the lack of exposures of igneous rocks of any kind for a distance of about 10 miles between the Hemlock dam in T.27 and the W. C. railroad in T.29. It is all sandstone along this stretch.

The igneous rocks wherever we find them are practically on edge wherever in contact with the sands one so that the old eroded surface has been protected there is considerable rotten material found which is explained by Dr. S. Weidman as the residual weathering of the old Pre-Cambrian Pene-palin.

The streams are just getting down into this old surface again by cutting through the overlying drift sheets with which the glaciers have mantled this older land mass.