Nicollet County and Renville County, Minnesota: [specimens] 5147-5193. No. 16 1883-08/1883-09

Hall, C. W.
[s.l.]: [s.n.], 1883-08/1883-09

Hall #16

U. S. GEOLOGICAL SURVEY

FIELD NOTE BOOK

No. 16

August & September, 1883

Nicollet & Renville Co's, Minn.

5147-5193

C. N. Hall.

Survey of the Pre-Cambrian Rocks of the N. W. States.

INSTRUCTIONS.

1. Devote at least two pages of this note book 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. 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 smaller spaces as 100 paces, each of the spaces between the red lines as 500 paces, and four of these large spaces as one mile, or 2,000 paces. Usually the southeast corner will be placed at the first red 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 down one space, 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, after which give in order 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 exposure as possible. Very often the notes for one section will cover more than one page in which case pass to the next right hand page, *repeating the map on each left hand page* as long as the notes, with regard to one section, continue.

3 Collect a specimen from each separate ledge of rock, or whenever 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 the note that it is of a rock identical with specimen so-and-so. Under the same conditions small sized samples will be allowed, but in all other cases *large sized trimmed specimens*, with chips for slicing, must be selected in accordance with § 3, chapter IV, p. 44, Regulations of the U. S. Geological Survey. All specimens are to have numbers painted on them, in white on a black background, in camp.

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, etc., etc.

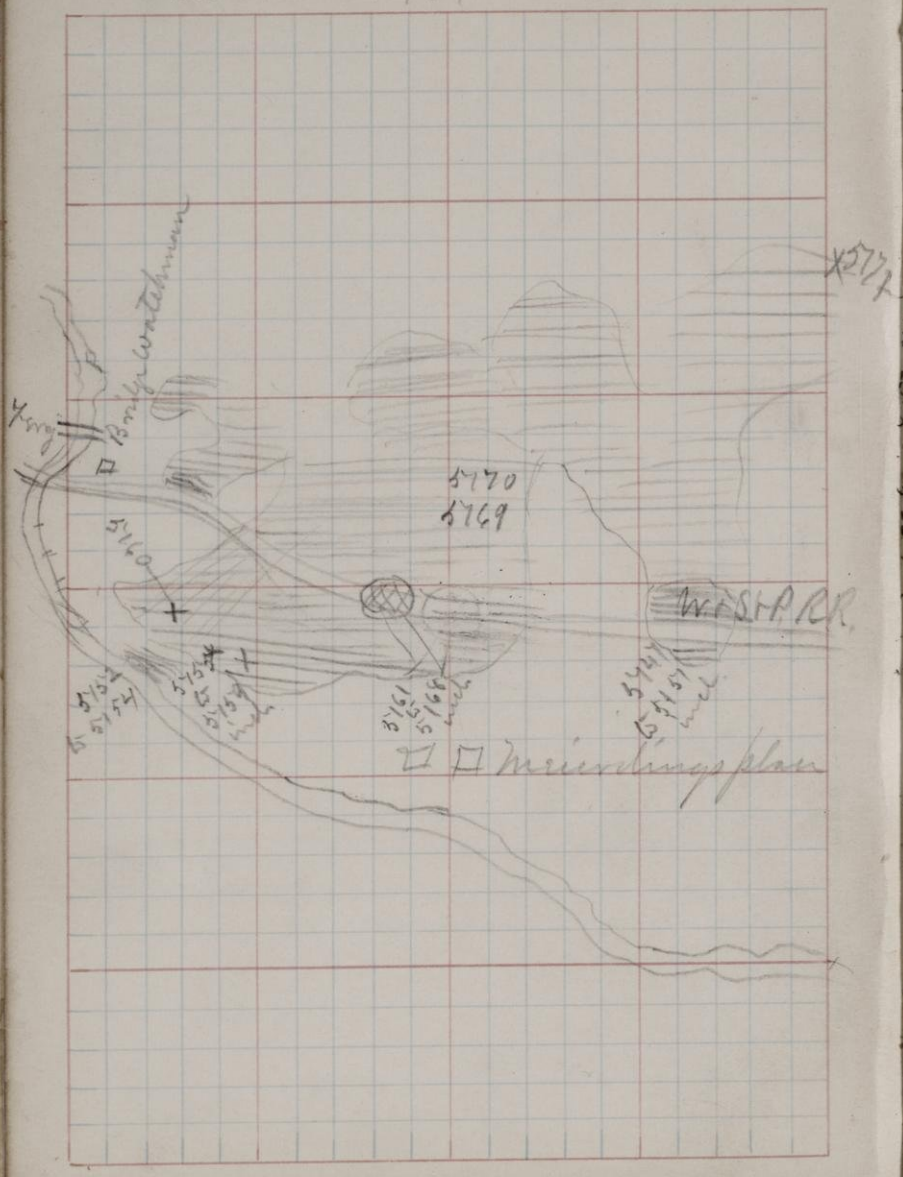
5. Forward this note book, as soon as filled, as registered mail matter, to R. D. IRVING, U. S. Geologist, Madison, Wisconsin.

#16

Nicollet, and Renville Cos, Minn.

C. W Hall
Aug - Sept. 1883

Sec. 2 T. 109 R. 30



3747 850 N; 400 W

Covering a large part of Sec 2 and probably reaching eastward into Sec 1, # 5171

An Extensive Exposure of red Granite and Shale + Sandstone occurs on the north side of the Minnesota river in Sec 2 of T 109; 30

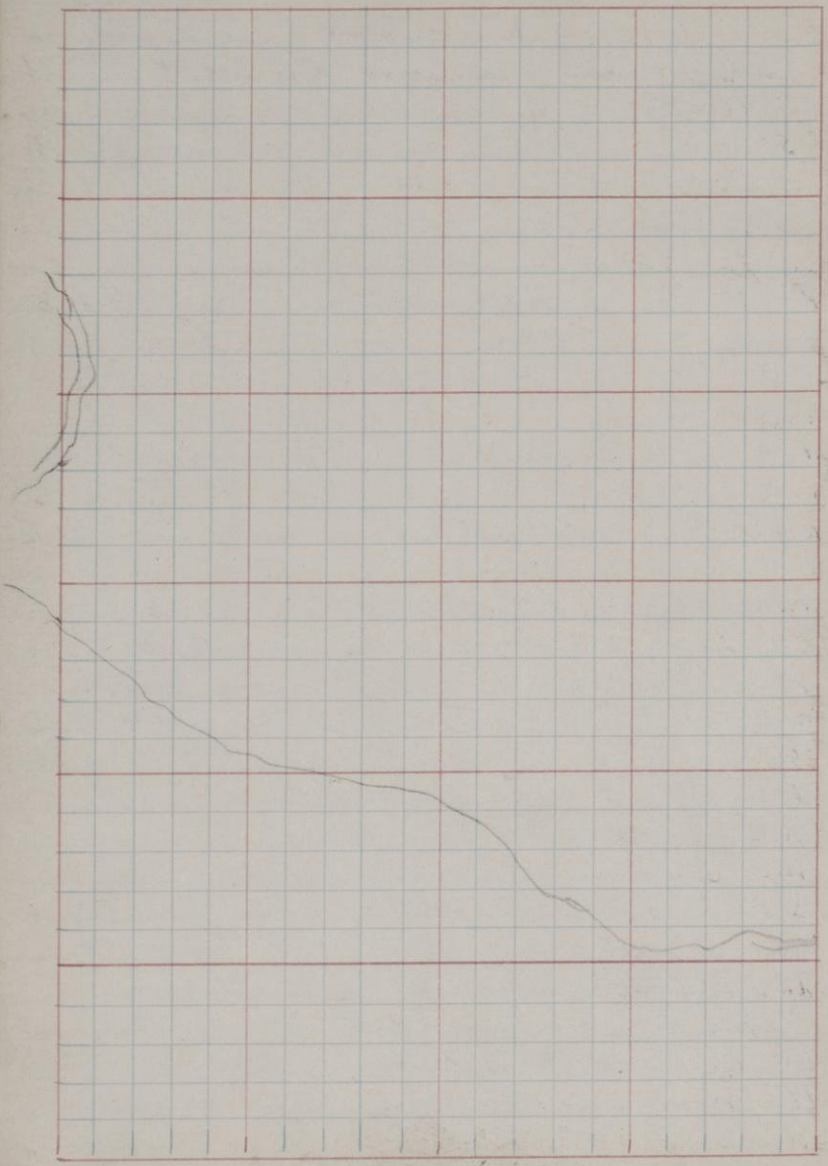
The Exposure at this place is the largest belt of rock yet seen in this summers field work. It begins at the bank of the Minnesota river one hundred paces below the railroad bridge over which the Chicago and Northwestern crosses approaching New Ulm from the East. It stretches along the river for 120 or more paces and reaches back northwardly into the adjoining township — 110 R 30 W.

There is a gradual ascent of the Surface varying from 1° to 25° of inclination with occasional depressions which bear Evidence of unequal Erosion acting upon Layers or Expansions of rock possessing unequal degrees of hardness. Over much of the Surface a Scrubby growth of oak and several other forest trees while down in the moss and among the Sand tufts of grass two or three Species of Cactus grow.

The highest part of the Exposure must be at least two hundred (200) feet above the river and this high point is quite a distance from the Spot where the Layers

(9—891.)

Sec. T. R.



protrude into the channel of the stream. But just above the railroad towards the north and 100 or more paces away a height of 150 or 175 feet is reached in a bold hill, standing sharply above the track, uneven in its contour as well as jagged & broken in its surface. Underneath the summits of this hill and between it and another hill point beyond & towards the northeast is a ravine with steep sides and a narrow bottom. It seems to have been worn to its present depths, at least 50 feet below the summits on either side, by a stream of no mean magnitude in its day running in a southeasterly direction. Over it from either side huge bowlders have fallen after being broken off as they evidently were from the steep walls by the frosts of many centuries. In its narrowest place this gorge is not more than forty or fifty feet wide; above this narrow channel is toward the northwest the gorge widens out into quite an amphitheatre which again soon shuts together into a channel of this ancient stream but little wider than the gorge; then the surface broadens out to the width of a large portion of the exposure.

Passing across this gorge and over another summit still higher than the

on the Southwest of the gorge a mark is reached having a measurement of Several hundred paces in either direction. It bears Evidence around its Sides of having been at one time a broad river channel. The walls in places are quite abrupt showing talus of broken masses many of large Size which have broken loose and fallen from the banks above. From this slough or lake the ascent is quite for Several hundred paces further through the brush and timber to a point or mark as high as the prairie which Stretches off across the country to the North and Northwest.

In this part of the Expedition only a few outcrops occur and these by their Situation and surface features indicate glaciation as the cause of the Scratches and even appearance.

The surface of the rocks on the face towards the river is peculiarly worn and roughened. Everywhere can be seen Evidences of the Erosive action of water. When the Softer layers of the rocks occur presenting their Edges for wear by the tilting of the whole series of Strata broader or narrower Shelf like plats are formed running

parallel with the strike of the layers. This wearing away of the softer layers gives a parallel direction to the exposure — and an appearance of a series of terraces from the base to the summit although this terracing is, of course somewhat obscured by excavations. By this circumstance the softer layers are difficult to see except where by removal of the harder and more enduring layers the former become exposed to view.

When the rock is quartzites and is sufficiently indurated to resist such wholesale removal potholes are frequent varying in size from the dimensions of a drinking cup to hollows 24 inches in diameter and 30 inches in depth.

Again on these hardened surfaces small narrow channels usually only a few inches wide with a length rarely exceeding a few feet are worn out so smoothly that one would think them of very recent formation. Some smooth and rounded knobs of small size undermined with smooth and rounded cavities portends as representatives of harder spots in the layers stand out as if a slight blow would remove them. In the innumerable little hollows and grooves which are especially frequent upon the ridge of the exposure be-

between the depot railroad and the river soil has found lodgment and tufts of grass and thorny stalks of the rock cactus take root and flourish.

This peculiar surface is clearly the result of the erosion and removal by running water rather than of moving ice. The conclusion must be that the river bed was once upon the high surface of the lower half at least of this exposure and that a rapid current and a large stream combined to cut the terrace like plats, gouge out the softer parts of the rock, wear out the pot holes and chisel into such diversity of marking the whole surface of the harder conglomerate. It is said by residents of Fort Ellis that the ~~Indians~~ Indians who left this part of the State after the outbreak of 1862 were wont to assert it to be not so very long ago — indeed within the memory of the oldest among them — when the river filled the valley from bluff to bluff and only in low water was the bank exposed on which Fort Ellis now stands, a long and rather low ridge reaching down from the upper town almost to the very confluence of the Yellowstone and Cottonwood rivers

Under the overhanging and harder material is an excellent opportunity for opening stone quarries; and that opportunity has been improved. The earliest quarrying of which any account could be learned was done in 1858 and a few following years by Mr Schultz who cut the grey stone the heavy rock a few paces above the bank of the river.

What this Excavation was made for is difficult to imagine unless a trench was laid and platform cars were used to take the quarried rock down to the landing, for here is a cut entirely through the most firm and quartzitic part of the rock from 10 to 15 feet deep and 30 feet wide.

Considerable rock has subsequently been taken for buildings in New Ulm and other towns. At the present time Mr Meierding is each year taking out considerable rock for foundations flagging stone, etc, to dimension stone is at present quarried. The railroad makes but little use of these seams of rock. The quarries of limestone at Mankato Kasota + St Peter being so near and producing dimension stone of such large size this Exposure is not deemed worth the working.

The dips of the beds is in the direction north varying from 20° to 30° East at an angle of 8° to 17°.

These directions are not an average, their latitude is too great, but an approximation to the mean of a large number of measurements made at nearly all points upon the Exposure from the river to the highest and most distant point where the smooth glaciated surface disappears under the Edge of the prairie never to appear again on the north side of the Minnesota river so far as the writers information extends

The dips at the river bends and at several of the railroad cuts is very marked; so too at all the quarries opened; but at the uppermost point and quite generally on the highest parts the dip is only slightly visible

In lithological characters the rock differs greatly in different parts of the Exposure. Indeed strong differences appear in one and the same quarry or railroad cut. In a general way it may be said that the lowest beds, those by the river bank, are Sandstones and shaly Sandstones while the

highest beds, the summits of the exposure are quartzites and quartzitic conglomerates.

Between these extreme rock types rock varieties are interstratified in many modifications and intershaded in the greatest complexity. At the same time other material is found to take its place among the layers — for instance a light silver gray micaceous mineral — and by its presence to add to the diversity appearing on every hand. Another fact struck by owners of quarries and which could not well be proved by a cursory examination given of the surface in a day or three days' tour over it was this; the more indurated layers, the quartzite becomes more soft and like ordinary Sandstone the deeper into the quarry the rock is removed so that the deepest layers are not only the best and also the easiest worked but they are most like a typical Sandstone, in that they break with a rougher surface, respond more quickly to the drill and wedge, and are dressed with the precision ~~with~~ of a typical Sandstone rock.

The more shaly sandstone near the

river has numerous layers. Some of them are exceedingly thin and separated by sheets of shaly material carrying fragments & small shining scales of what bears every indication of relationship to the Micha group. These scales appear under a lens to be semi-transparent or translucent of a silvery gray color and to assume a prevailing horizontal position.

In many parts of the quarries are seen ripple marks and other markings resembling on a strongly of the mud cracks seen in some more recent shales & indurated clays. (See Samples 5-15-6) But these markings which look so much like mud cracks are closely associated with the ripple marks, coming from the same quarries and from near the same layers. Slabs showing both these appearances can be taken out at any of these quarries. Several just in either direction. Some of the ripple marks are quite conspicuous are unusually fine and all are very distinct. But it should be said that neither ripple marks nor Mud Cracks (?) were observed in the upper and quartzitic parts of the formation, — probably to be accounted for by the greater coarseness of the grains constituting the rock

While the rock at the mine bank can be called nothing more than a sandstone it is indurated sufficiently to cause some of the quartz grains to break and produce fresh fracture of a bright vitreous lustre under the hammer. Whether the firmness of union thus shown can be taken as an indication of incipient cementing through the deposition of secondary quartz around the granules, thus establishing the quartzytic character of these layers has not been determined by these macroscopic examinations; and whether this character could be observed in the deeper excavations thus supporting the statement of Grammann with with the actual texture of the stone itself was not observed.

The translucent light gray scales were seen at other places far more numerous than at the mine bank — near the railroad in one or two places they almost gave the impression by their numbers of a cementing material, frequently the thin slabs whose surfaces finely glittered with the number of these scales were tested for elasticity or an itacolumitic character which were never found in them.

At these outcrops near the railroad there was a more distinctly friable character to be seen than in the layers below or those above this series of beds. More than that the rocks are badly shattered; many joints run diagonally with the hill in both directions; and many bedding planes divide the mass into layers so thin that they are not well adapted for heavy walls. There are also in this modification more streaks and spots of a lighter color than in the layers below and above. The light colored spots and bands seem to have an equal hardness with the red and also a similar texture. The color has quite likely been changed by some reduction of the ferric oxide.

Upon the first summit above the river from 100 to 140 paces from its bank the most typically indurated rock, the most typical quartzite, was found. (# 5760). It would be a matter of interest to follow this rock along its plane for a considerable distance into the earth to discover if it did become softer and more workable and, in short, more like sandstone as the quarrymen assert it does. Overlying this are a few layers of a soft, highly broken rock partly a sandstone and partly a shaly sandstone, the same

that is cut through in building the railroad and which can be clearly seen in the cuts nearest the railway bridge across the river.

It is not until we pass to the high points of land above the railroad track and before the lake and Slough are reached that the rock assumes over any great extent that coarser appearance caused by the sand grains becoming grouped and as in some of the topmost layers in the gravel becoming pebbles. In short the uniform quartzite of the lower middle beds becomes a typical Conglomeratic quartzite.

In some places of small extent this modification appears to be in layers of not extensive thickness and the pebbles are much coarser, some of them being an inch or more across. Here the material constituting the rock is essentially the same as in the finer textured layers. In both parts, the cement and the fine, the cementing material - the pebbles - resists weathering much better than the cement; the latter to some extent disappears from the surface leaving the former standing out conspicuously rough in comparison with the surface of the finer quartzite.

On outcrops of considerable extent this conglomerate is not coarse; the pebbles are seldom larger than peas but they are worn and rounded and so firmly cemented together that the rock breaks as evenly and as easily as the finer quartzite below. The finer pebbles as well as the coarser show a considerable diversity within the group of the quartzes. Clear transparent individuals were seen evidently broken from quartz crystals others were less transparent and so down to the translucent milky quartz; others pieces showed a light red others a dark red others even a black color. All were very finely granular even to micro-crystalline.

Finally upon the highest and last outcrop of this exposure visited which consists of a fine beautiful quartzite with occasionally a conglomeritic condition visible a curious commuting of the quartz grains in a layer about 1/4 inch beneath the surface this is shown by a clear or more transparent appearance of the rock at this distance below the surface and for a thickness of about 1/4 inch whereas the rock was broken on a surface of considerable age this peculiar band was seen.

5747 850 N; 400 W

This sample was taken from the lower (Sa) side of the railroad at the last cut down the track from the bridge. The stone in this cut is not indurated but can easily be broken between the thumb and finger. The other characteristic most prominent is a mottled appearance caused by numerous light gray blotches some larger & others smaller distributed somewhat unevenly through the mass & especially numerous along the bedding planes. The layers are at this spot highly jointed also. Sloping some 12° with a Strike N 80° E

850 N; 400 W

5748 The same as 5747 but broken vertically to the bedding.

The dip at this spot where these specimens were taken was N 15° W at an inclination of 34°.

5749 850 N; 400 W

This sample is that of a Shale or perhaps better called Shaly Sandstone as it seems decidedly arenaceous. It is finely mottled, picks up easily and breaks in the hand with comparative ease. The locality is the same as that of 5747 with which it seems interstratified

5750 850 N; 450 W

This is a shaly sandstone more argillaceous than the preceding. It shows peculiar markings which are discriminated provisionally Mud-Cracks, which they seem closely to resemble. The locality is the same as the several numbers preceding.

5751 850 N; 450 W

This represents a light colored sandstone to be found in small quantity at the same locality as the above. It does not appear in well defined layers but rather in places where the coloring is wanting.

5752 800 N; 1800 W.

This is an average sample of the sandstone from the river bank. At this place which is in a bend in the stream almost opposite the mouth of the Cottonwood River. The rock has many light colored spots like samples from previously visited localities. The texture is very even altho occasional coarser spots are observable.

575-3 800 N; 1800 W

This sample from the same locality is more shaly than the previous number 574. Thin is in this an interesting alternation of color — light and brown layers alternate in quite regular sequence

575-4 800 N; 1800 W

This from almost the same spot seems to be harder, more sandy & the full than #575-3. This as well as that is somewhat shaly. Color changes are near the same.

575-5 850 N; 1600 W.

Passing directly up from the river and across the road an old gunny is reached in a few paces. Thin ripple marked slabs — or rather pieces from quite extensive slabs were taken from this spot. These slabs came from the bottom of a large gunny worked several years ago extending from the cut made a long time ago by Mr Schultze in a southwesterly direction for many paces The whole height is at least 20 feet from the lowest to the topmost beds in this opening.

5756 850 N; 1600 W

Represents what look very much like mudcracks from the same locality as the preceding ripplemarks.

5757 850 N; 1600 W

Shows a sample from this same locality which shades with tolerable readiness but across the bedding shows considerable firmness & resistance to breaking. It is in some of its layers of a light color alternating a deeper brown which is usually seen on this exposure. It is perhaps an intermediate stage between the quartzite beds above & the shaly sandstone below it.

5758 850 N; 1700 W

In the sandstone or quartzite quarried above the road as we pass from the river at Nos 5752, etc., were taken and the prominent ridge of the exposure. Considerable stone has been removed at different times from this spot and of the character of this sample.

5759 850 N; 1700 W

From this same spot. - The sample shows an abundance of the fine

scales which look as the rock is freshly fractured like scales of mica. They are silvery gray very fine & lie parallel with the bedding planes.

5760 900 N; 1750 W

This is the compact indurated quartzite of a purple brown color occurring on the tops of the ridges coming down towards the river. The surface is worn as by a stream of water many fractures & joints occur and its freshly made fractures are conchoidal. By its induration tendency to cleave along the planes of bedding these disappeared & the rock assumes more of the brick of a massive rock.

This sample was taken 120 paces from the river at 5752. The direction of the ridge here is N 70° E.

5761 900 N 1150 W

This was taken from the quarry of the Reservoir just below the railroad at the spot outlined in the accompanying diagram. It is the lowest of the several layers in the series at this spot to the last coarse rock above the railroad. Dip of strata, near 26°

5762 900 ft; 1150 W

This sample imitative of fossil Slabs was taken at the same locality as the preceding. In all probability fossils of the size and appearance of these cavities cannot be found in this rock.

The suspicion therefore is strong that these impressions are cavities formed when some pebbles of an ancient conglomerate were deposited which pebbles were of a more readily decomposed material than quartz. The light color can be accounted for by supposing a feldspathic mineral which has Kaolinized in the change. The rock is quite fine. But still these spots may represent fossils.

5763 ~~50~~ 900 ft; 1150 W.

From this same outcrop is a variegated Shale. The colors alternate both in streaks + layers and in spots. The red predominates.

5764 900 ft; 1175 W

This also from this same spot, on the South side of the railroad cut 500 feet east of the bridge. It is an indurated Sandstone quite quartzitic in appearance. This rock has been quarried considerably. The layer is not thick — about 4 feet before it interrupted by other + poorer layers.

5765 900 N; 1175 W.

This is a Conglomerate (probably) overlying the preceding two summits most immediately over 5763, to which it bears much resemblance. Some of the individuals of this mass are quite large; many cavities indicating the ~~casts~~ moulds of fossils, brachiopods? also occur which give the rock on exposed surfaces the appearance of a fossiliferous layer. It is fairly indurated but has only a slight thickness, two or three feet at most and these appearances are more likely to be empty and smoothed geodes.

5766 900 N; 1175 W

This overlies the preceding and appears in the railroad cut. Through the inclination of the Strata this modification does not appear South of the track but in a Shattered, Soft Condition on the north side of the track's level. This stone is quite soft in place but hardens somewhat as it dries in the air. Occasional seams are seen in it of a dark colored opaque mineral which was not more accurately identified. These seams are very thin — not more than One Sixteenth of an inch thick

5767 900 ; 1175 W

From the same Exposure as the preceding. It seems to be very similar in several respects to Cattinite and is accordingly named such provisionally. It occurs in a thin layer or rather in several thin layers in the 5766. One or two inches is the thickness. The rock is very soft very fine and apparently fine fine grains of sand. It was impossible to gather anything but small pieces.

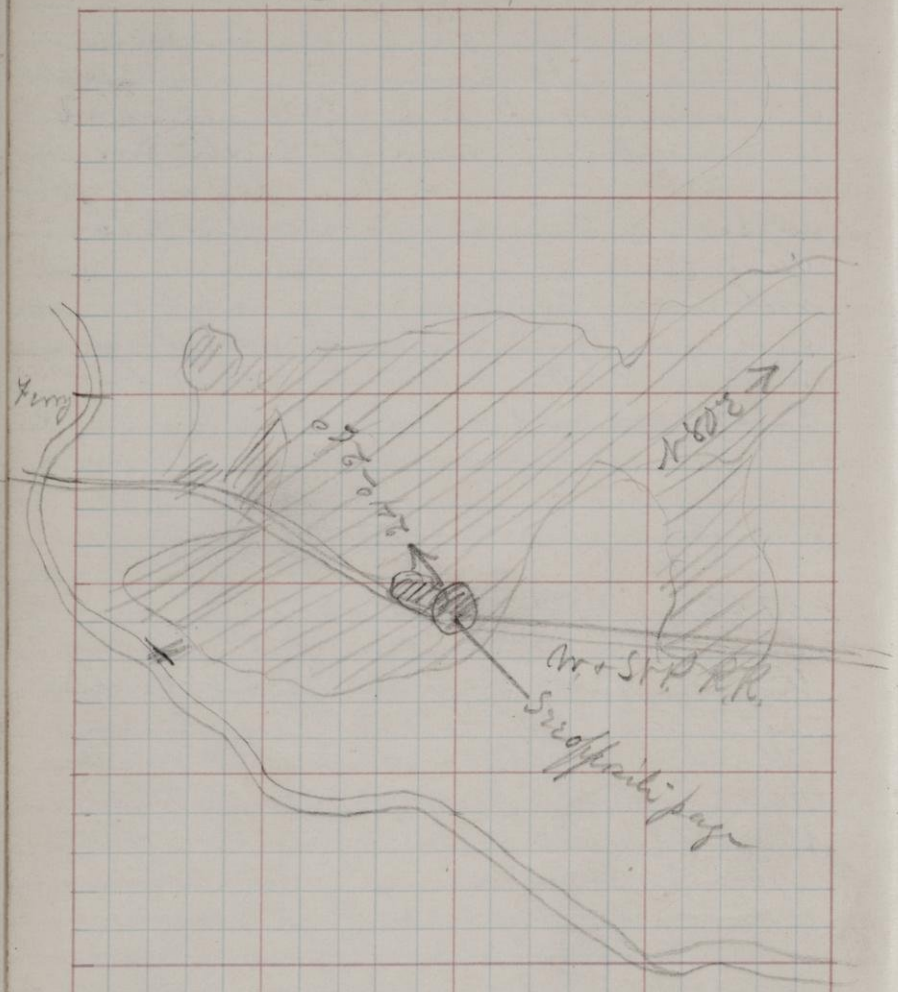
5768 900 N ; 1175 W

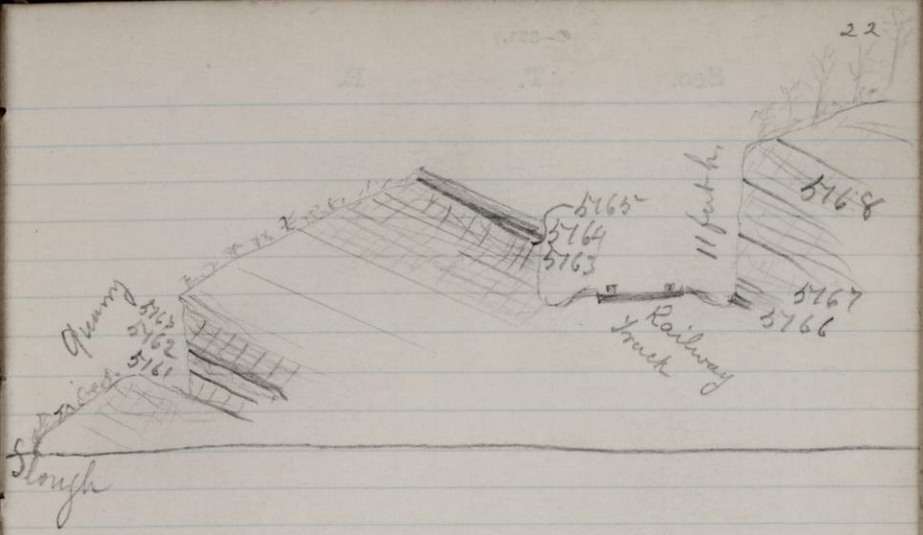
This is the quartzite overlying the series of samples just enumerated viz 5761 – 5768 inclusive. This had a purple tint and the fine texture of the rock 5760 taken from the top of the rocks above the river.

This Exposure is an easterly extension of that highest point just mentioned when # 5760 was taken. That would bring the underlying layers of this spot parallel with the layers opposite just above the river. Beyond this spot no good representations of the Segment of layers can be seen

(9—891.)

Sec. 2 T. 109 R. 20 W





This section is about 800 paces Easterly from the railroad bridge

The dip is about 26° altho varying a little in different spots owing probably to the displacement of the rocks there quarrying or cutting the railroad

The Strike seems to be N 80 E

(The joints are N 15° W and N 65° E

5769 1200 N; 900 W

This is a fine conglomerate from the hill above the railroad, it is 60 ft north considerable and is covered by it and many casts of rock have been removed from the bayou of this variety. The average size of the grains is about that of grains of wheat.

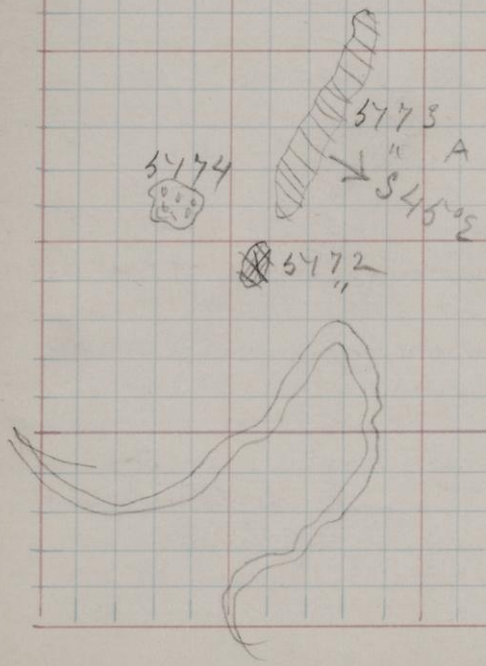
5770 1300 N; 850 W

Lying within this 5769 are two and three thin streaks of the coarser conglomerate shown in this ± 5770
In places this appears to have considerable thickness but metamorphism has obliterated the minor differences and bound the granules firmly together.

5771 1600 N; 1990 W Sec 1, 109:30
Probably taken in Sec 1 at least 1600 N.
This is the sample taken from the Easternmost outcrop visited. The rock is the highest of all above the river; the surface is smooth and bears evident marks of glaciation. A slope of a few degrees towards the Northwest is to be seen. Joints and bedding were not conspicuous.
About ¼ inch below the surface all over it is a gray or schist more transparent than the rest of the bulk. It is hard to tell

(9—891.)

Sec. 27 T. 110 R. 30



3772

450 N 1400 W

In Sec 27 there is an Extensive bed of Conglomerate of varying coarseness

The lower end of this Exposure, and it is its Southern end, lies on the very border of the river bottom and not more than 200 paces from the Channel The Strike from this point is N 20° to 30° E and the distance in that direction is not less than 600 paces as follows:

Length of lower outcrop	100 paces
Across the grass plat interrupting	50 "
From plat to upper end of rock	450 "
	600

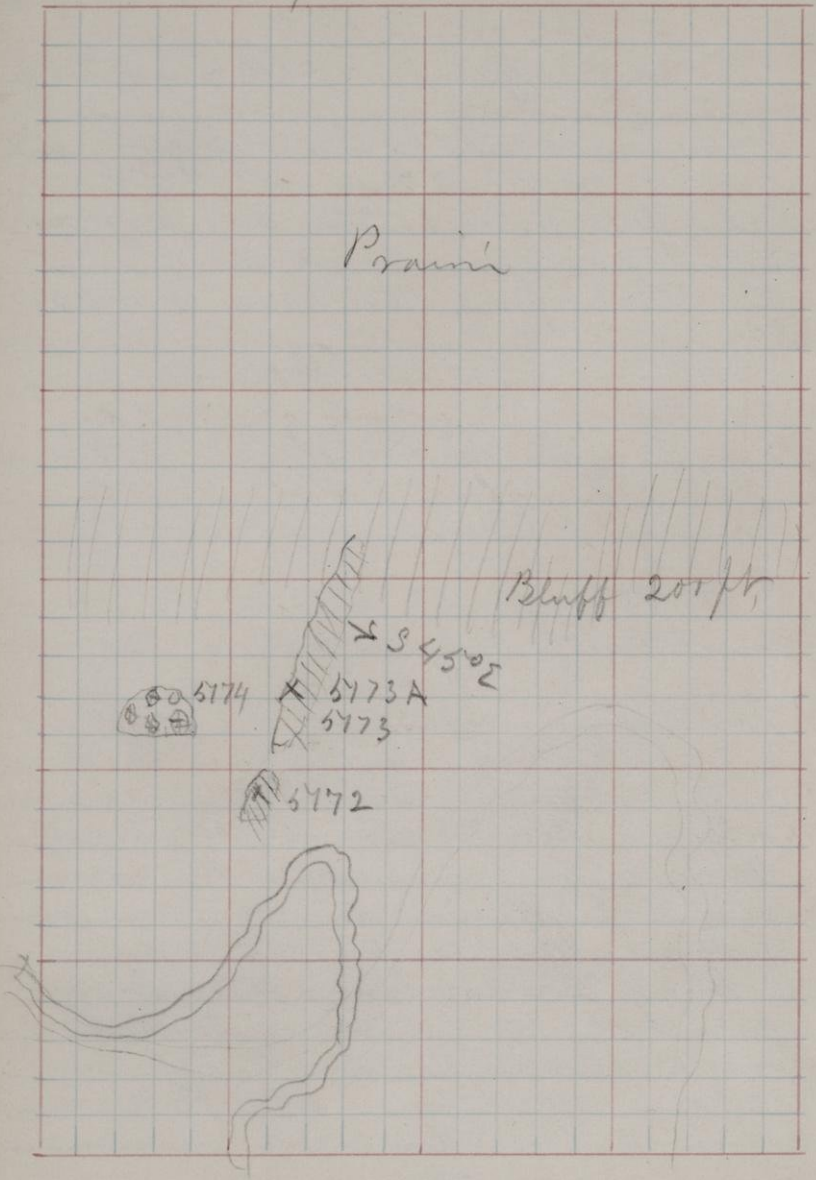
Height of upper end above the river bottom at lower end 100 feet.

The dip does not vary much from 14° at any spot measured and its direction is S 45° E. The westerly face is abrupt in places 15 or 20 ft h + the easterly slope under the hill gently.

The rock varies much in the coarseness of the pebbles. At the lower end where according to the observations made the beds are overlying them higher up the hill, the finest material is found; passing towards the upper end 150 paces the pebbles vary from fine gravel to 6 or 8 inches in diameter.

(9—891.)

Sec. 27 T. 110 R. 30



5772

450 N; 1400 W

In the conglomerate taken from the lower end of the exposure and near the river bottom. The prevailing color is not so dark as that one the exposure 200 paces further up the hill nor is it so light in tone as that at the very northeastern extremity of the exposure.

The pebbles are not large and they are very firmly cemented together — so firmly that the fresh portions of the rock break like the quartzite of Ridgetown 5768 and several other numbers.

5773.

700 N 1350 W

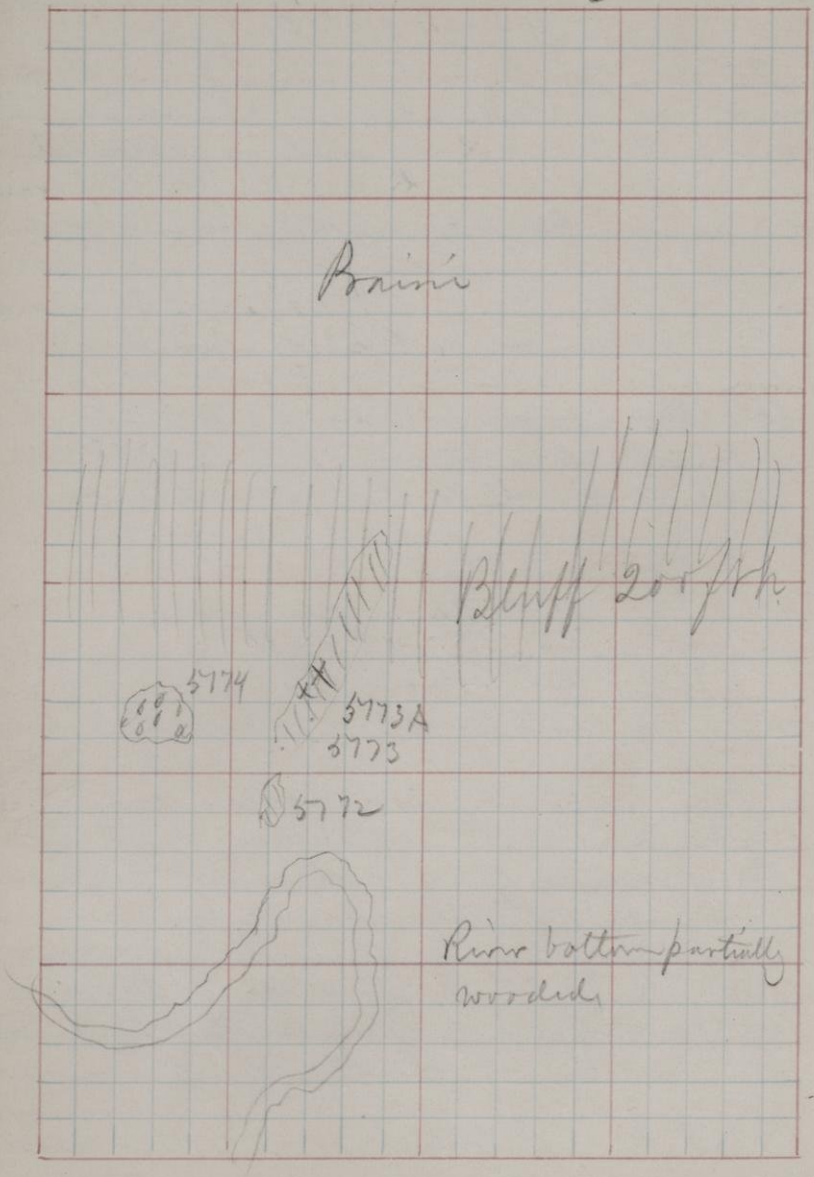
175 N 20° E from the preceding the rock assumes quite a different appearance in several respects; it is redder in color coarser in size of pebble and it is less firmly cemented. There is also greater diversity of appearance in the individual grains.

In fresh samples the induration is quite complete and fractures divide the pebbles as readily as the cementing material itself.

5773 A Pebbles from 5773 to show particularly size and shape.

(9—891.)

Sec. 27 T. 110 R. 30 W



5774

600 + N; 1600 + W.

Only 150 paces from the west and abrupt face of the long stretch of conglomerate just described his several outcrops of granite. They are all, some 6 or 7 in number, to be found on a patch of ground by the edge of the river bottom 200 paces long by 100 paces wide, the longest way being N 25° W. Some of these knobs are more than 5 or 6 feet high.

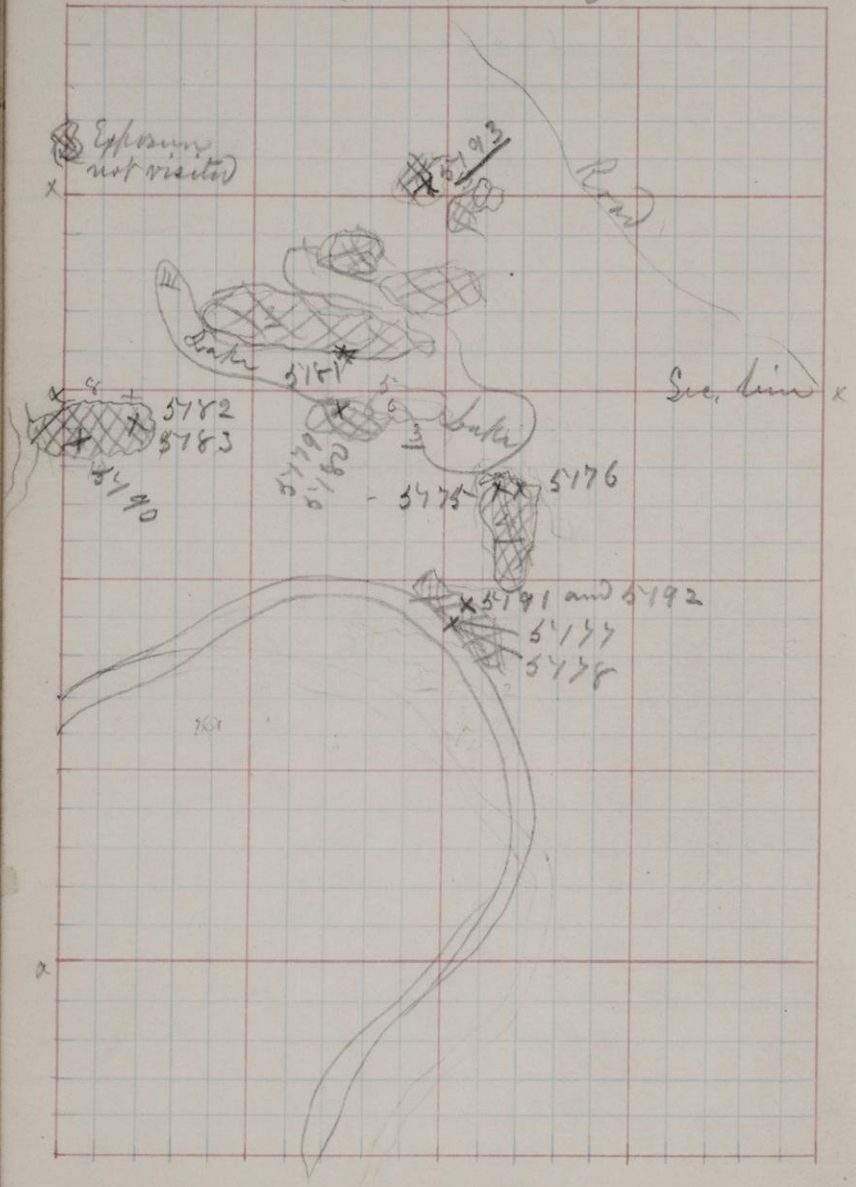
All are weathered and rounded and crumbled so much that it is difficult to break off good fresh samples of the rock.

The set of joints which contain the veins of white quartz running thro the mass in varying width from one to six inches takes nearly north and south direction. Other joints take other directions.

An apparent bedding exists with a dip of 15° towards the N 30° E.

A red and, from its twinned form as observed on cleaved surfaces, apparently orthoclastic feldspar is the predominating constituent. It is that which gives the color and tone to the mass. It seems as if this rock runs under the conglomerate near by. At least the conglomerate if continued westward 150 paces would touch over this granitic rock.

Sec. 22 T. 111 R. 82



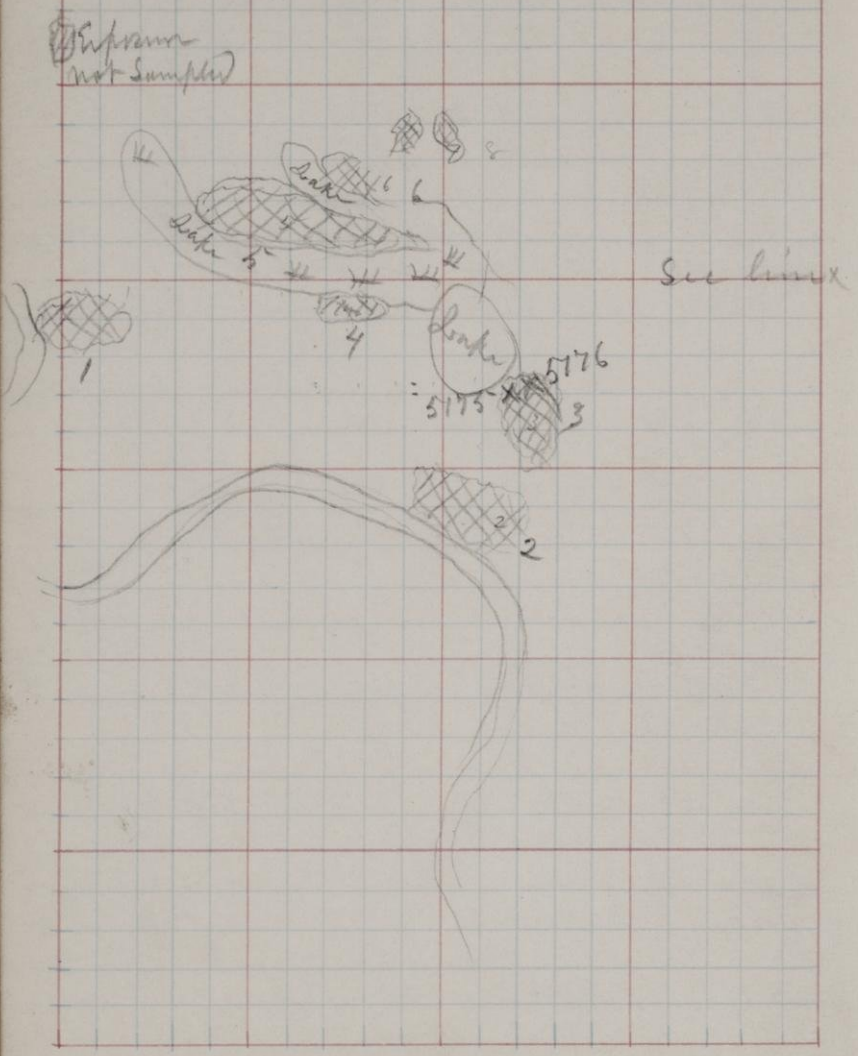
5175 etc, to 5183, and 5190 to 5193 inclusive

The several Exposures lying in Sections 15, 16, 21 and 22 T 111 R 32 W, are all very fresh all with perhaps one or two Exceptions lie within the limits of what may be called the river bottom. These one or two Exceptions lie upon the side of the bluff which borders the somewhat narrow valley along the northeastern side

The surfaces of these Exposures have been worn more probably by river action since the Surfaces lack that smoothness of outline to be seen on all the Exposures of Stearns Co, from of these rocks such a height of over 100 feet above the river bottom. When a soil has covered the rocks considerable decomposition has taken place and a decayed surface precludes the possibility of knowing good typical sections of the rock

In some places - instance near the river at the Southeastern outcrops a Schistose Structure is apparent; at others as at Kindervines on the most westerly outcrops a gneissic Structure is seen while on the outcrops nearest the main road from Avon to St Ridgely the rock is decidedly more granitic than elsewhere

Sec. 22 T. 111 R. 32



5775

1700 ft 800 ft

This rock apparently a granite is one of the toughest samples under the hammer of all those taken during the entire season.

It occurs on the west face of the Expansion where the wall is nearly perpendicular with something of a talus below. The height is 40 or 50 feet – the direction of the wall is N 20° E 45° E

This sample was taken from one of the freshest blocks that had fallen down

Two or three small inclusions of what appeared to be a hornblendic schist were observed.

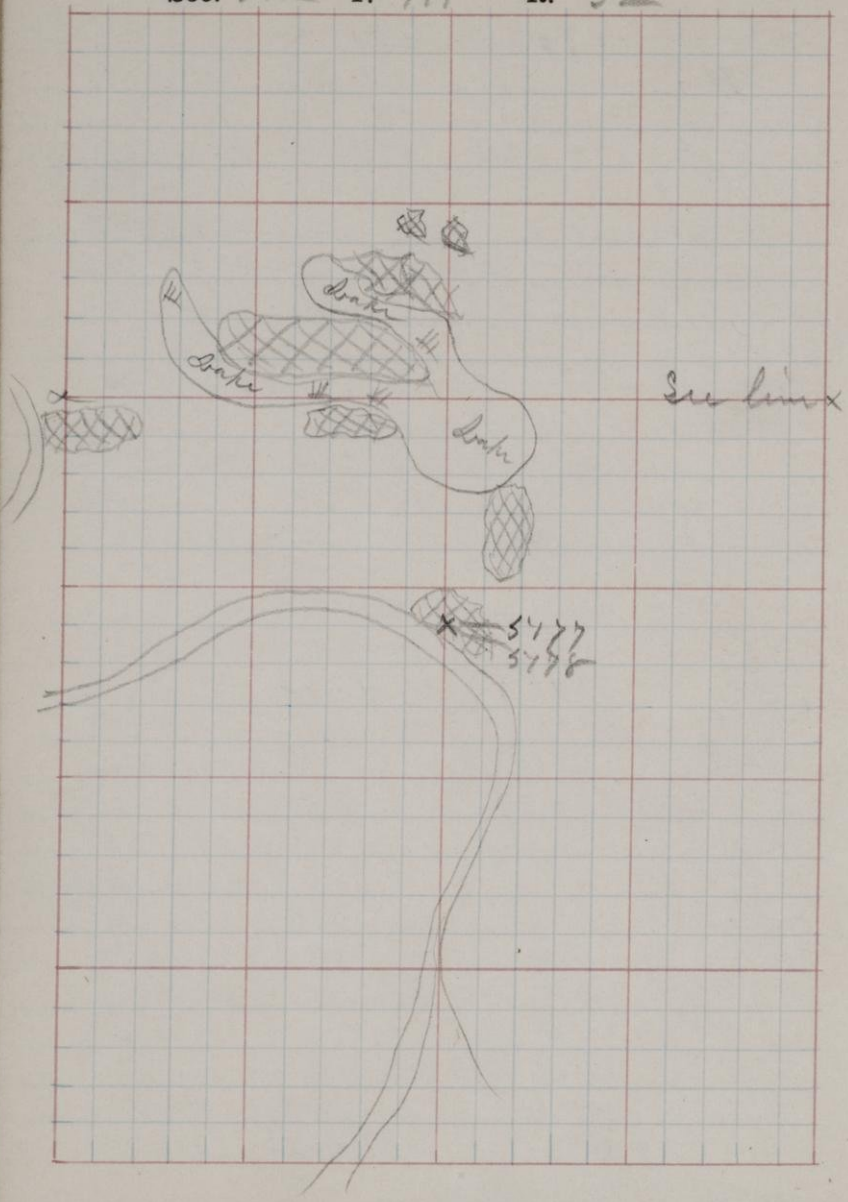
5776

1700 ft. 750 ft

Upon the top of this cliff and about 1/3 way from the wall where 5775 was taken and 50 ft removed from the weathered sample 5176 was taken Occasional quite large feldspar crystals. These crystals appear to be of a clearer red color than the smaller individuals. The general color of the surface is a reddish gray.

Joints N 25° E are the prevailing ones varying somewhat and by their prominence forming the most distinct weathered wall of this expansion.

Sec. 22 T. 111 R. 32



5777

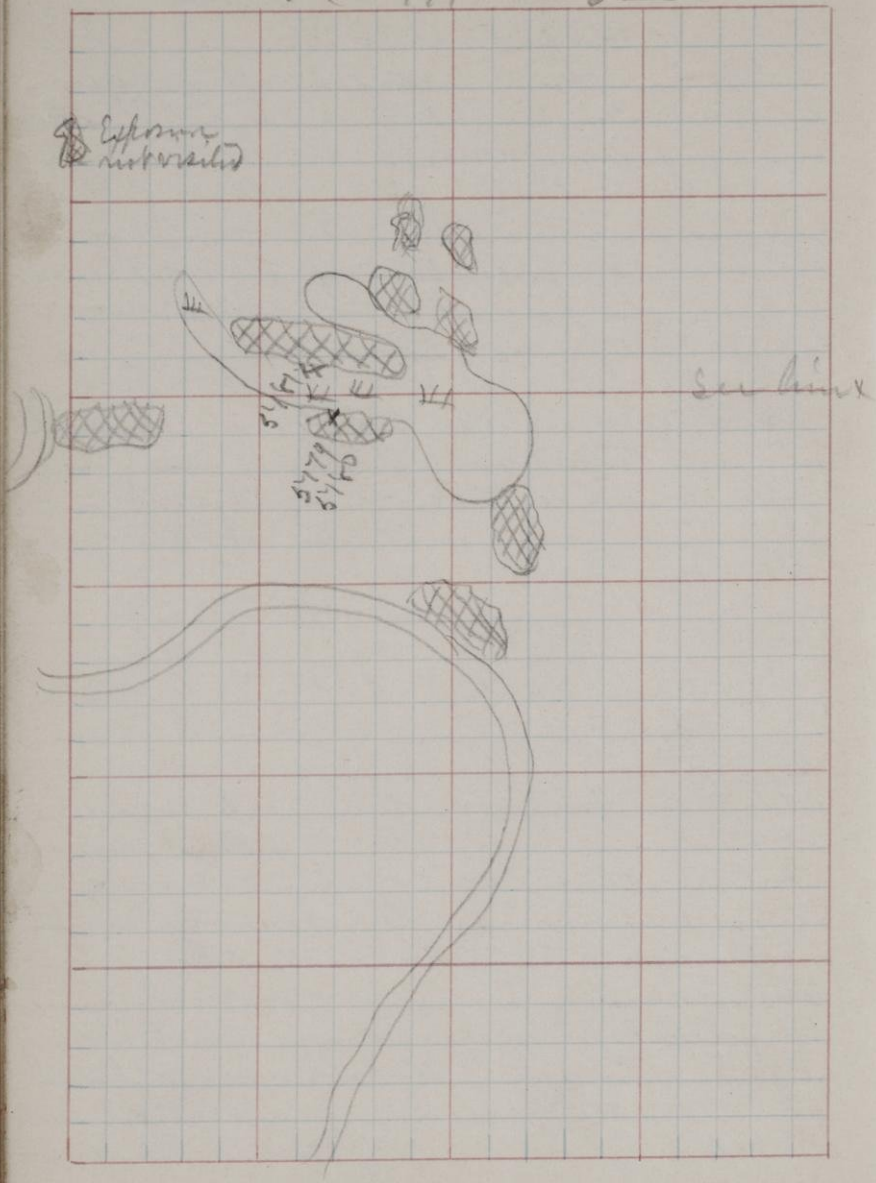
1400 N 1000 W

This sample somewhat weathered like the one preceding but has a slightly darker tone of color and seems to show a more even texture. The extent of the exposure is considerable — it is indeed a continuation of that from which the preceding two nos. were taken — they are separated only by the crossing of earth over a depression or an old river channel between the two. The surface worn by the river is like that just now having — save perhaps in its additional freshness

5778 1400 N 1000 W

From the same outcrop as the preceding and showing a quite large feldspar crystal. The rock was so weathered and the crystal in such position that it could not be removed whole. The face upon the rock was about 7 inches long by 4½ broad. There are several somewhat peculiar colors on breaking a fresh fracture. There seem to be an intimate relation in position with the cleavage of the crystal. The dup-

Sec. 22 T. 111 R. 32



brown color almost red shows a very uneven distribution + it merges into the white. These colorless and light brown and darker brown parts alternate in thin layers at right angles to the principal cleavage plane.

The stone while having suffered so little from weathering is still apparently firm. There are many noticeable inclusions some of considerable size.

Other feldspar crystals occur near but none so large as this one sampled were observed.

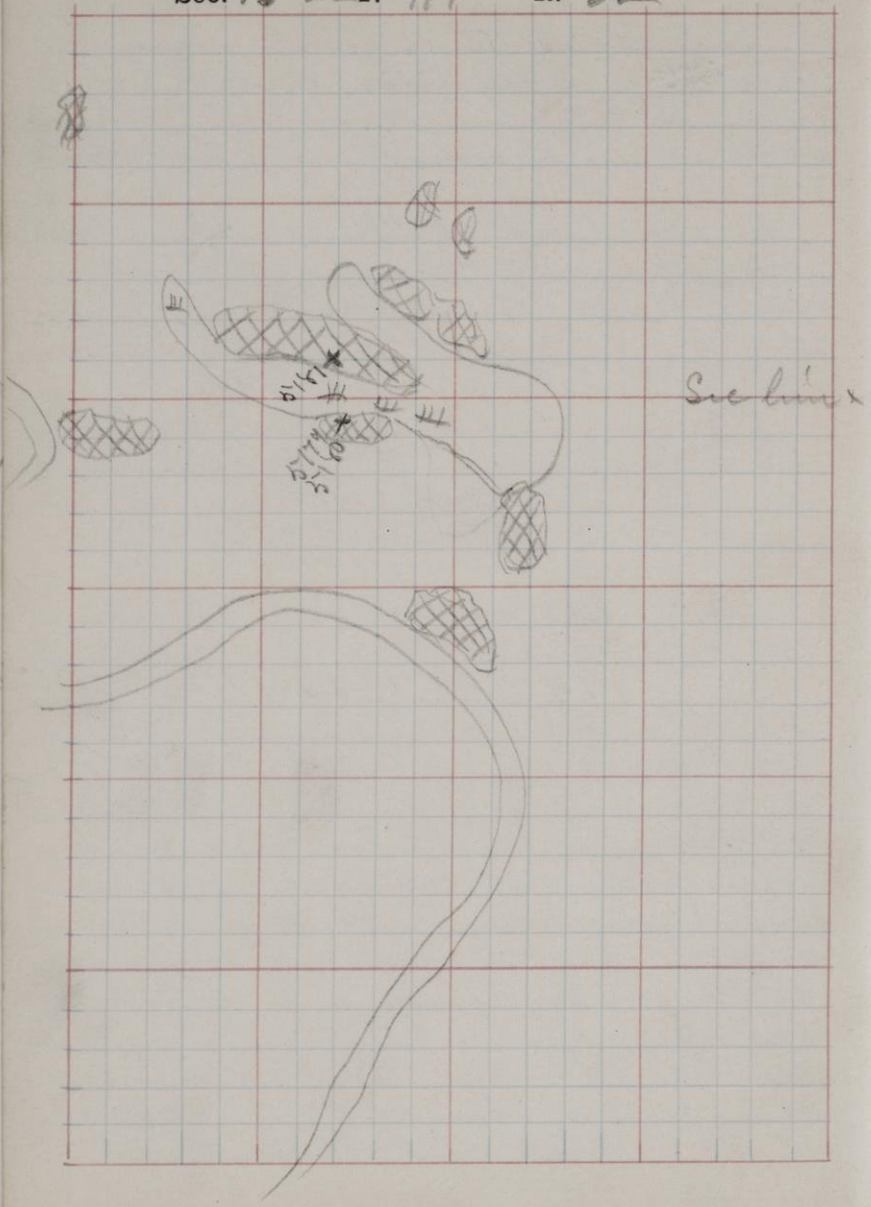
5779

1950 N 1300 W

This rock is very similar to that collected at the localities already visited + sampled with specimens 5778 and 5775. It was broken from the high - not perpendicular - wall at the outcrop on exposure numbered 4 of the series around La Framboise's place.

The joints are heavy and appear to have the same direction essentially as those around 5775. If quarried deep - enough stone of good quality for building could be found.

Sec. 15 + 22 T. 111 R. 32



5780

1950 N 1300 W

In a vein material from the preceding 5779. The vein was about 6 inches wide with sandy vertical. The surface was very smooth - which was possible because of the very fineness of the rock. It is also of a reddish color. There seems also to be a parallel direction to the fine grannules making up the mass of the vein stuff.

5181

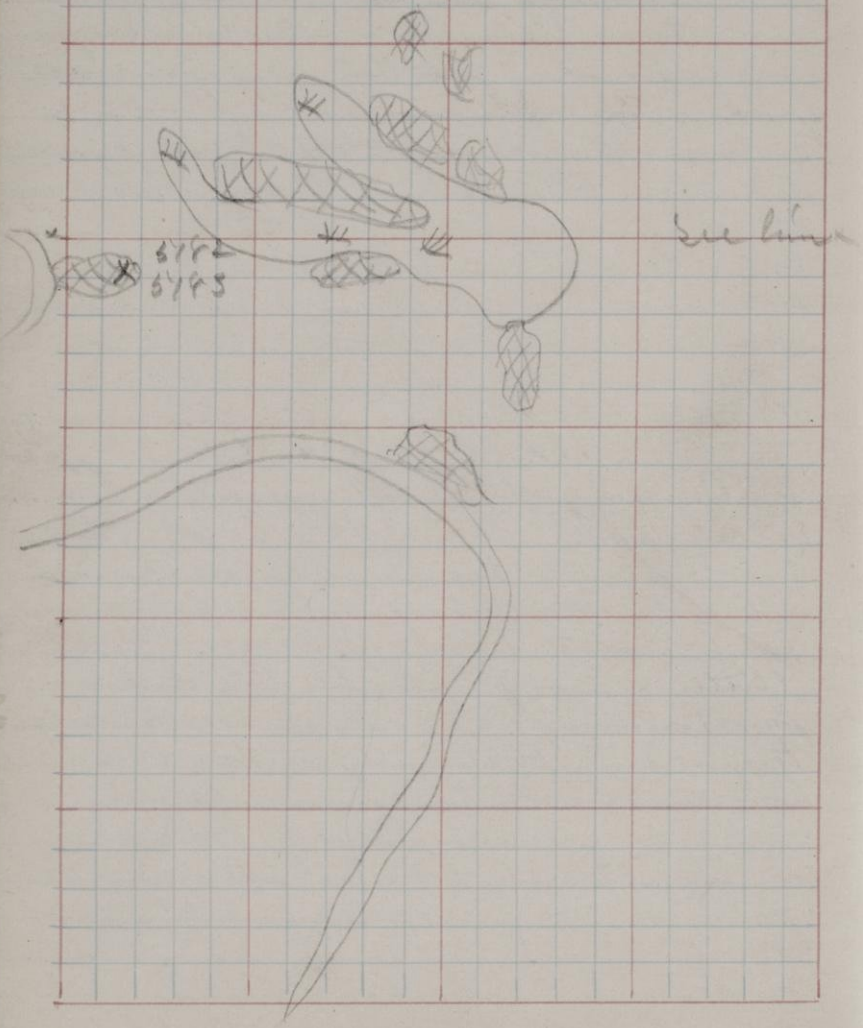
100 N 1300 W.

Crossing the Slough in a direction exactly north about 150 paces the Exposure in Sec 16 was reached. On the South side of this exposure by the water Edge shows some little quartzing. In the deeper parts the rock is exceedingly tough and obstinate under the hammer. No Specimens could be chosen without heavy bruises.

There seems to be but little in the rock except quartz and feldspar

(9—891.)

Sec. 22 T. 111 R. 32



5782

1900 N; 1900 W.

This is the rock from Hindarmouse place Mr H's buildings are all located upon the top of this ledge some 30 feet above the river is just above high water mark. The exposure is 250 feet long bounded by the river on the west end

The rock in some places shows a marked inclination to a gneissic structure which gives an alternation of light and dark colored bands to the rock some especially thro' its bedding

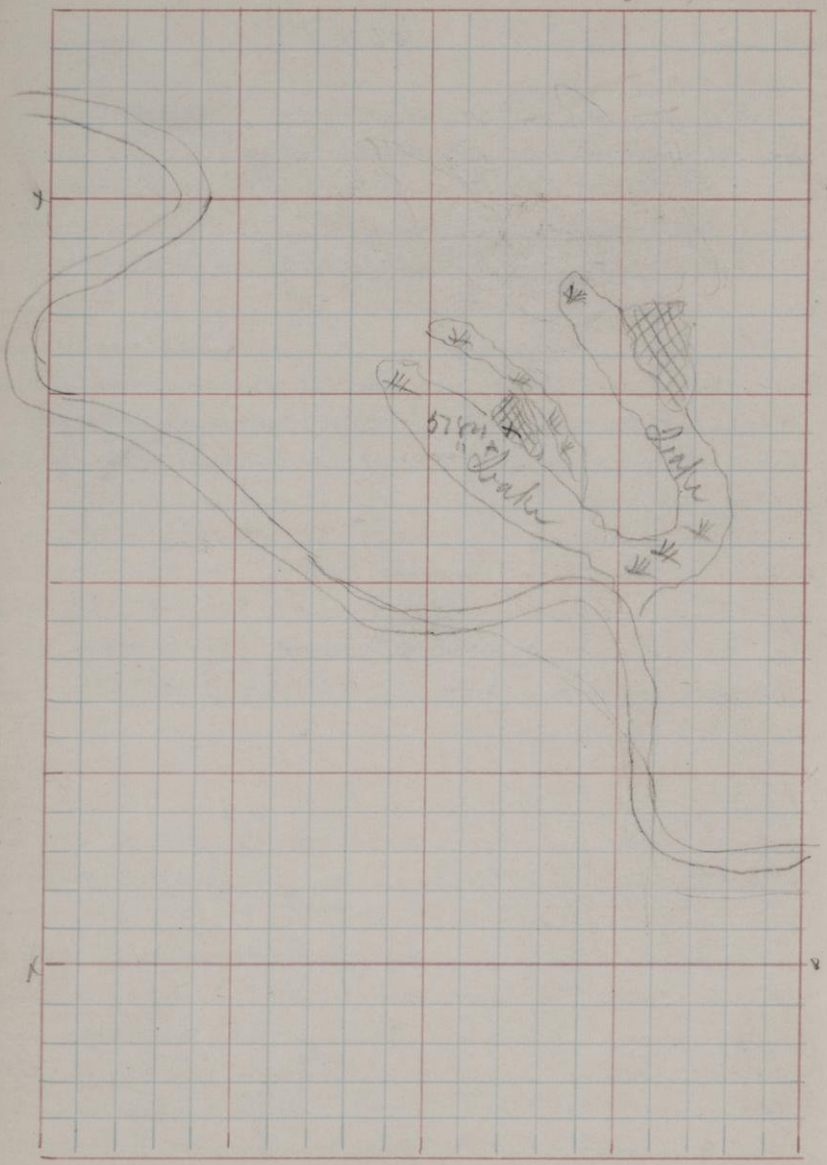
The general features of the rock are not remarkable until a close inspection is given when the quartz shows a peculiar opalescence nowhere else seen in the Summers field work.

5783 1900 N; 1900 W.

Shows some samples of quartz nodules many of which are found in this exposure. There is much difference in the size and shape of these nodules varies greatly and in their respective is nothing noticeable; but in the opalescence and beautiful hues of color are two very interesting peculiarities Indeed this opalescence seems to be a characteristic of this entire locality.

(9—891.)

Sec. 2 T. 111 R. 33 W.



57 84.

1400 N.; 800 W

This Exposure is surrounded by a Slough with water enough on the Southwest to merit the dignity of a lake. Upon this lake or water side of the rock is quite steep but on the North and east its surface slopes off at a very gentle angle, beneath the soil.

The height above the water is about 15 ft. Surface is worn smooth from action of water — this once was no doubt under the river for it shows no evidence of glaciation.

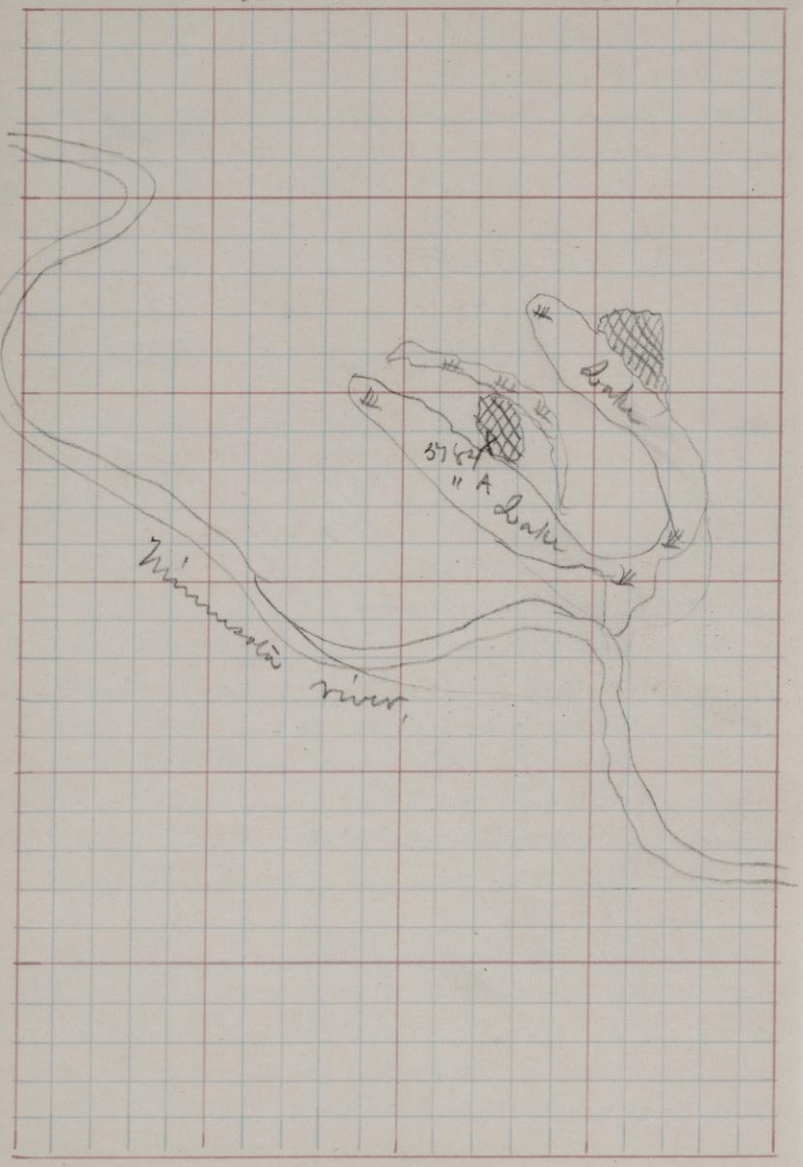
One system of joints runs N 80° W dipping South some 65°; another system N 10° W dipping 65° westerly.

These two systems of joints break the stone up into fine blocks for quarrying since they run from 6 inches to 18 inches apart. Some little quarrying has already been done in winter time along the Southwest (the high) face of the Exposure.

This rock is somewhat weathered but not so much but that its leading characters can be discerned. The feldspars have a reddish color to occur in quite prominent individuals and in large quantity. Hornblende seems to take the place

(9—891.)

Sec. 2 T. 111 R. 33 W.



of mica in part at least, while the quartz appears to be present in unusually large quantity.

No accessory minerals were observed save a few grains of pyrite in one spot but in insignificant quantity.

5764 A.

1400 ft; 800 W

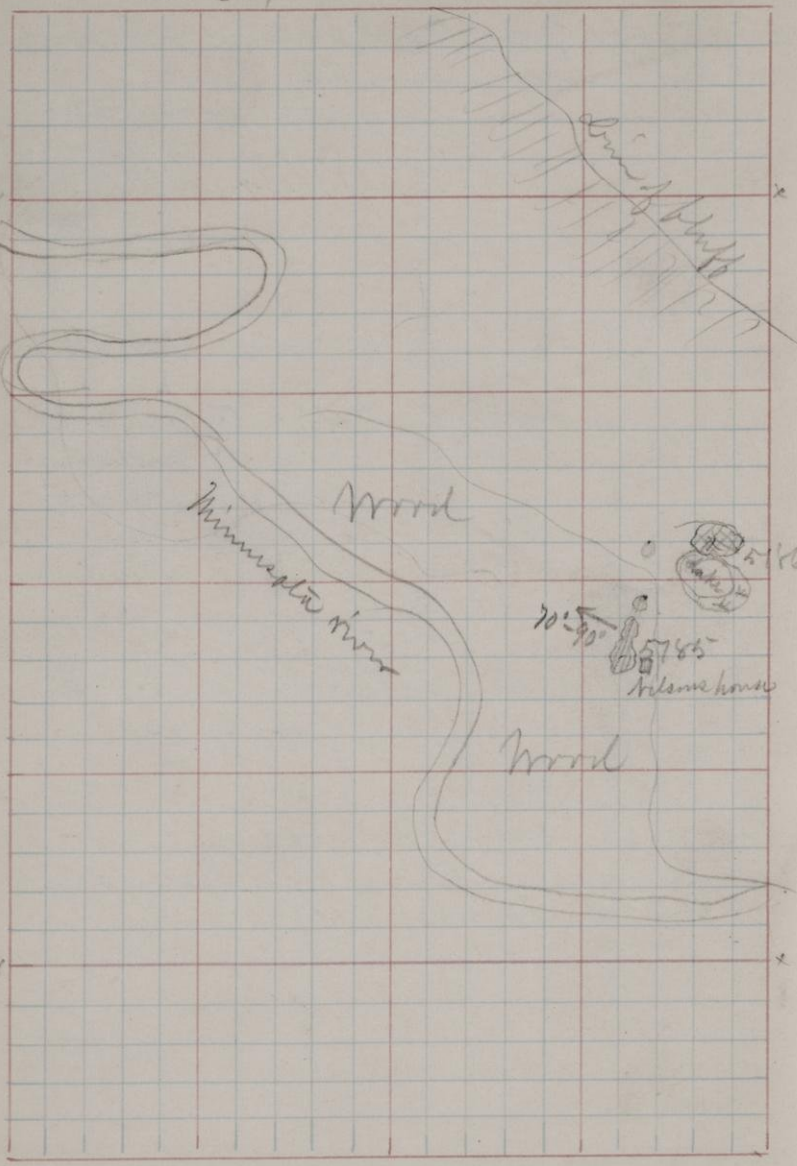
Several quartz veins were observed on the surface of this exposure — a surface 50 to 75 feet wide and 150 feet long north & south but interrupted by a soil covered strip.

These veins were from 1/2 inch to 4 inches wide extending N 65° W in a somewhat varying direction.

The quartz is not so milky as is seen in some localities; neither does it possess that opalescent lustre characteristic of all the outcrops at the La Trombre place.

(9—891.)

Sec. 34 T. 112 R. 33 W



5785

800 ft; 400 W.

On the land of Hagan Nelson occurs a belt of hornblendic schist of the very toughest, compactest kind.

The direction of the belt is N 60° E and is 175 paces long and 50 paces in total width. A part of the exposure is within the Hagans barnyard and another outcrop a continuation of this is seen on SE¼ NE¼ this Sec upon its bedded surface

The rock has a uniformly dark color characteristic of schists; it shows prominent bands of a lighter more feldspathic part on its edges in fact the rock seems on closer macroscopic examination to be too rich in feldspar for a schist and the hornblende (?) is very dull in luster.

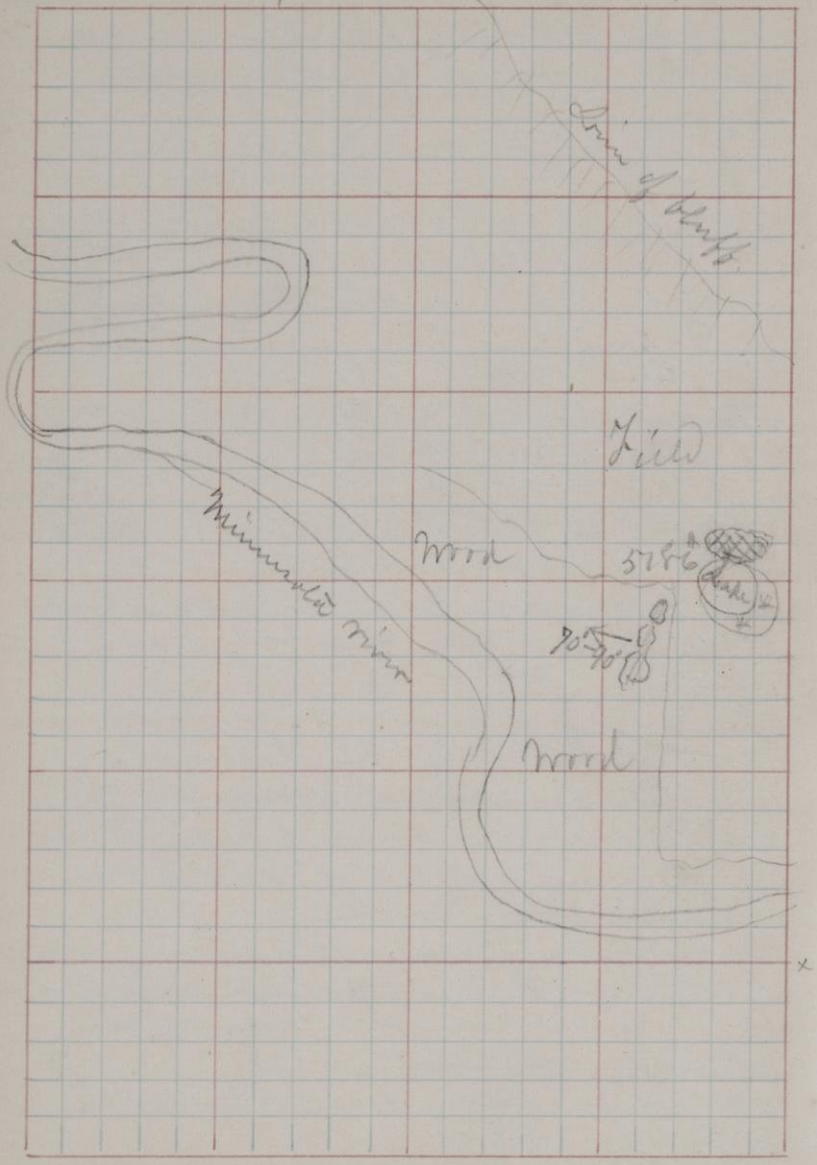
The bands of alternating (lighter) color are not wide as the hand samples show but they are not of uniform thickness sometimes being of paper thinness and again broadening out to an inch or less, rarely more.

These bands take a direction nearly northwest and southeast but certain measurement cannot be made owing to their irregularity.

The dip varies from vertical to 70° westerly southerly

(9—891.)

Sec. 34 T. 112 R. 33 W.



5786 1150 1542
1200 ft; 100 ft.

This exposure is at no place over 10 feet above the surface of the field around it. Indeed much of the area is under the turf but shows its presence for a considerable distance East and north by the dead condition of the grass and stubble.

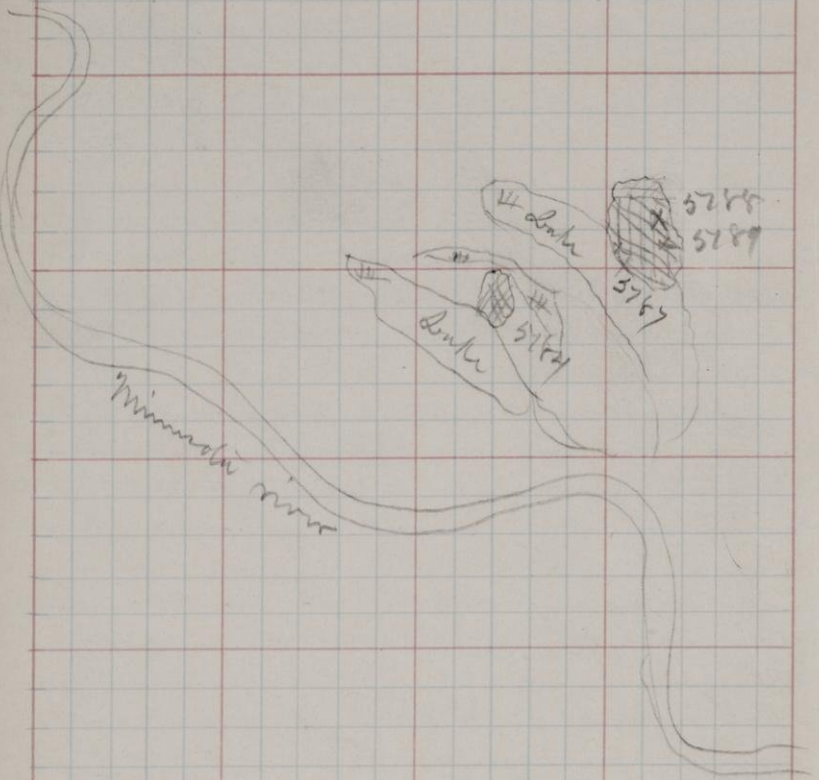
A small lake lies on the South side some 300 feet in diameter touching the rock on its north side and terminating in a marshy tract South and East.

The surface of the rock is much broken and shows for 100 in a N E & W S W course, the highest point being near the water edge.

The rock is an interesting one, the laminae or schists lie in a nearly vertical direction East and West if the E & W joints are vertical.

The rock is quite coarse and naturally not very fresh. There are distributed thro' it peculiar shining surfaces when the dark mineral or some modification of it has a parallel direction. These shining spots, the size of a finger nail are not all parallel with each other. The rock reminds one of that at St Wendel, #5730 but more like that near Little Falls, #5142.

Sec. 2 T. 111 R. 33 W.



5787

1600 N; 450 W.

This Exposure is only 200 or 350 feet East of that sampled by 5784 and its northern end is just northeast of that locality. This like that is bounded South and West by a lake which terminates in a marshy slough track of some acres in extent

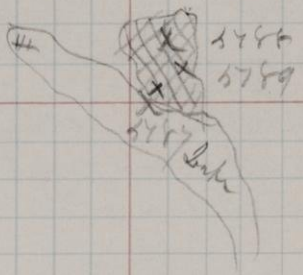
There are two distinct knobs of rock here standing some 10 feet above the water but they and no doubt united beneath the surface

The surface of the rock is very smooth interrupted by occasional grooves reminding one of glacial markings were they not near by pot holes of some size

The grooves lie in the direction of the course of the valley and were no doubt made by the action of the River Warren or by the more recent Minnesota.

One set of joints N 80° W nearly vertical were observed; another N 40° E runs across the whole northern exposure with a dip of 65° to the S.E. This is the most conspicuous joint thus far seen in the Minnesota Valley. Pockets and veins of quartz are often seen; these have a usual direction of N 65° W. and in

Sec. 2 T. 111 R. 33



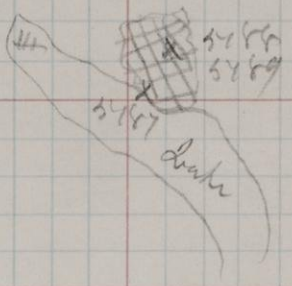
5787
width vary from 8 inches down to mere ribbands.

The rock is a somewhat coarse hornblendic granite. Feldspar quite red. Mica is the principal constituent so far as quantity is concerned. Quartz is more abundant in some places than Specimens than in others. The hornblende (?) mica constituent is quite subordinate in quantity and is metallized to a light dirty green.

In some parts large boulders from 5 to 6 feet have been broken up and carried away but no systematic quarrying has been done upon these two knobs or upon the weakened part of the exposure.

5788
1600 N 350 W
75 or 100 paces Eastward and on another swell of the surface separated from the preceding by water and shrubbery is an excavation made in quarrying rock for the barracks at old Fort Ridgely — all these exposures nos 5784 to this incl. are upon the old fort Reservation —

Sec. 2 T. 111 R. 33



The rock is somewhat coarser in the feldspar individuals some larger than upon the just described surface. The mica is black shining and fresh and in abundant quantity. Quartz runs sparsely disseminated to accessories with obscured

5189

1600 N; 360 W.

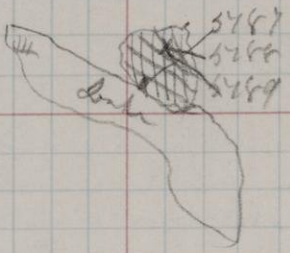
In several places were noticed a series of what were considered inclusions of an apparently different rock, a schist. Its walls of contact were distinctly marked against the granite and in some places bands of granite were observed passing thro' the schist.

This latter appears to extend the whole length of the exposure in a general direction of the laminae N 20° W. dipping 55° to 65° in a westerly direction but full of waving contours and curves.

A slight resinous appearance is seen in some places especially near the surface. The prevailing color is dark + more uniform than that of 5188.

The schistose structure is very apparent

Sec. 2 T. 111 R. 33 W



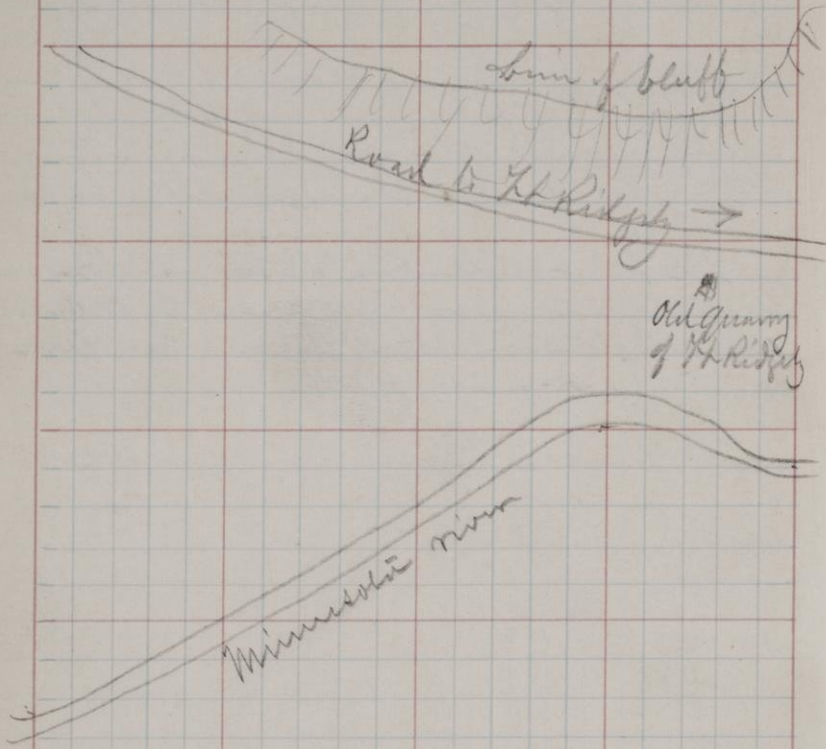
5187 – 5189

Distance from S E corner of rock
Exposure to S line of Sec. also the
County line — 275 feet
" East to Section line 345 "

Width of Exposure from East to West 200 "
Lake front Exposure, West 75 "
" " South 60 "

For a considerable distance Eastward
the rock must be very near the surface
The vegetation shows this.

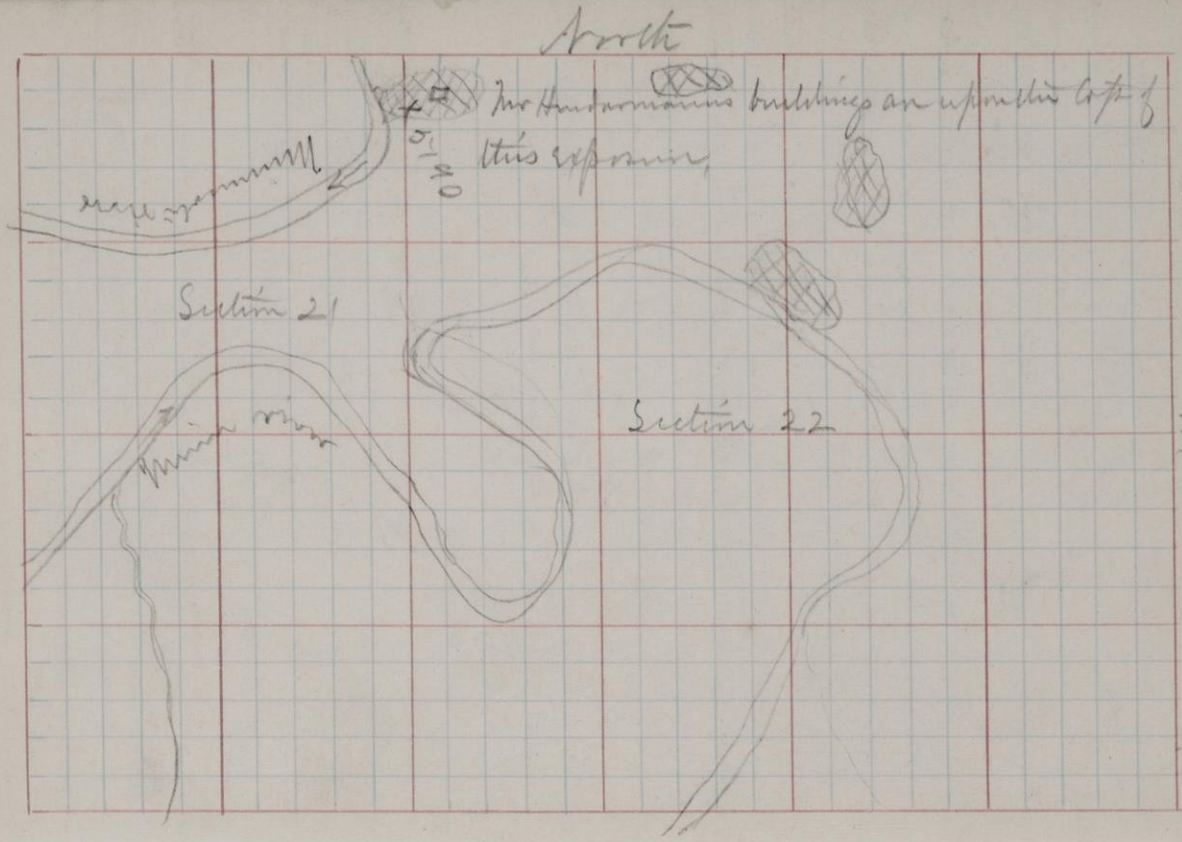
Sec. 1 T. 161 R. 33 W



On Sec 1 of T III R33 W. a few
feet below the highway is a stone pile
thrown into a pit in the field. Mrs Smith
postmaster at F. Ridge said that when
he was a boy granite for the Ft. was
quarried here.

A block lying near by resembled
at looking like the stone formerly taken
from this quarry. The stone is very
similar to that at the quarry
57 & 8 in the color and freshness of the
mica but more like the Franklin
granite in the luster & quantity of the
quartz constituents. It looks some-
what opalescent.

No Samples were Taken since the
rock was not seen in place.



(9—891.)

Sec. 22 T. 111 R. 32 W

5190

1850 ft; 2000 W.

Sept. 5th

On a second visit to Hendersonville the slate shows a more distinctly gneissic or schistose structure than it did a few days before Sept. 2d. This is probably because it can be seen in the light of intervening observations up the river.

The layers dip westerly at an angle of about 20° and show alternating layers of reddish, feldspathic material with dark micaceous mineral.

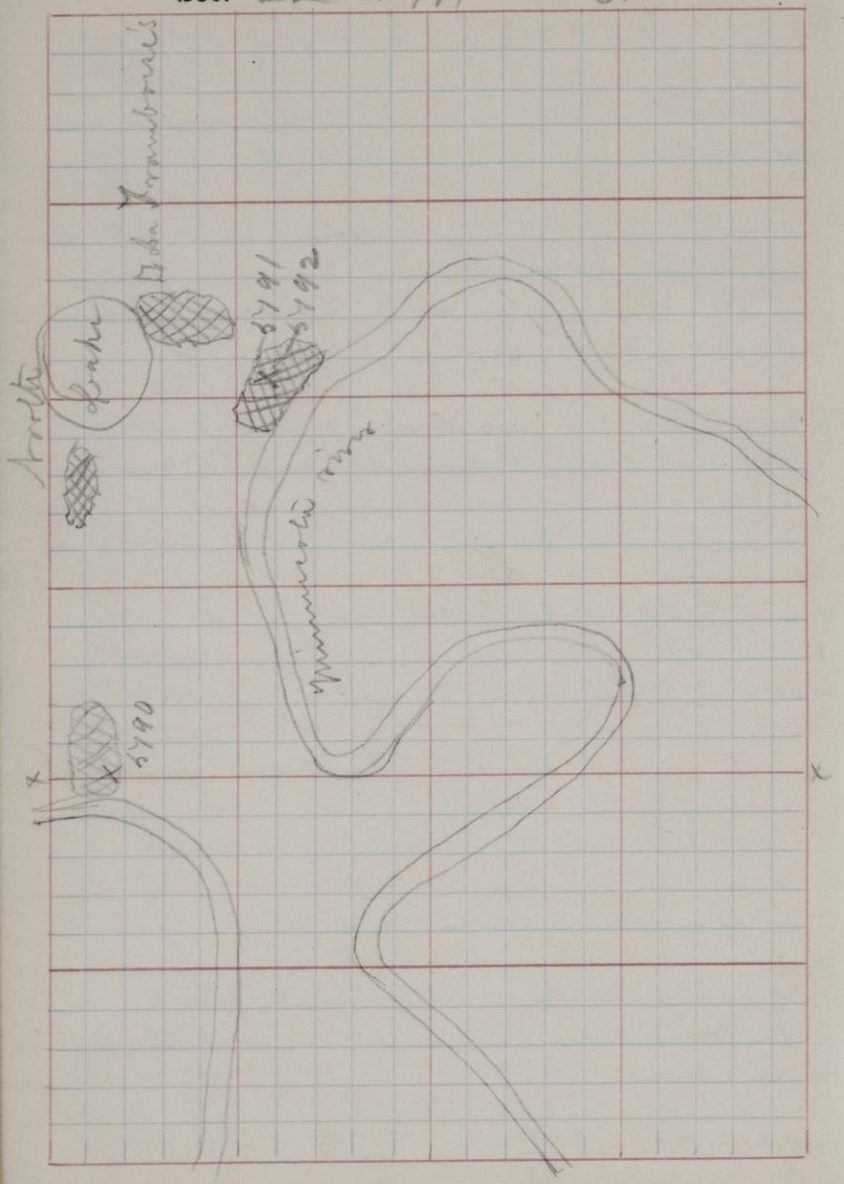
The strike could not with certainty be made out at the spot when the dip was noticed for it was in a wall formed by the quarrying away of a considerable quantity of rock.

This locality was just about mid-way between 21 + 22 and 150 paces South of the Corner post.

The samples show a weathered condition when some of the mica seals exhibit a golden shining appearance so often noted in our drift bowlders of schist and gneiss. This mineral occurs in mica form layers separated by bands of abundant feldspar and little mica.

(9—891.)

Sec. 22 T. 171 R. 32



5791 and 5792
1350 ft; 950 ft.

At the river side of this exposure the rock surface slopes nearly south at an angle of from 50° to 60°. There are also to be observed bandings in the rock in a N 20° to 30° E course curving and binding around included masses possessing a somewhat different mineral composition as well as coarser structure just as might be seen in a schist or a gneiss.

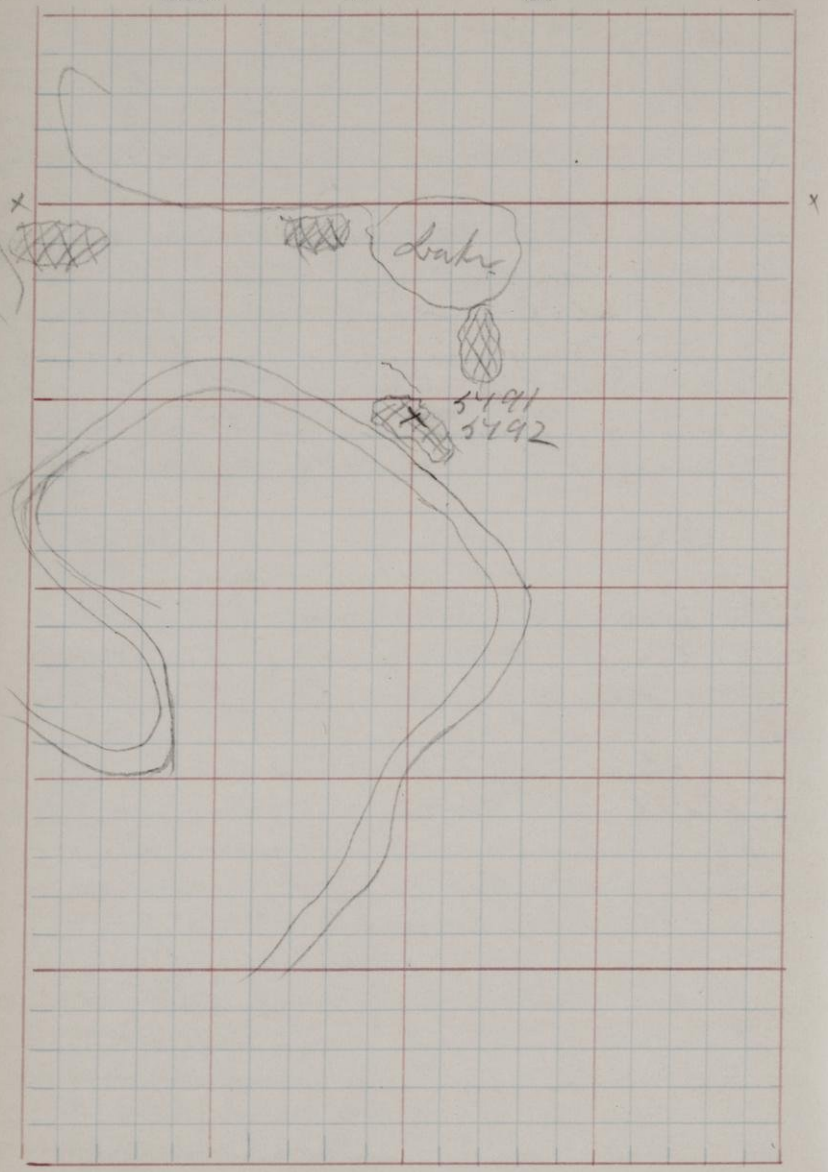
At a few paces from the landing the rock changes to what was gathered today from the samples 5777 and 5778. The boundaries of this newly observed modification, = 5791, could not be traced owing to the covering of trees and turf, but its course as guessed at was east and west.

The joints in this are the same in direction as those in the granite, the main ones being N 70° W dipping southerly about 50° from the perpendicular; N 65° E with an easterly dip of near 75°.

Thus two systems of joints cut the rock, so that, with a gentle inclination in the bedding joints of a degree or two to the east and southeast, a set of

(9—891.)

Sec. T. R.

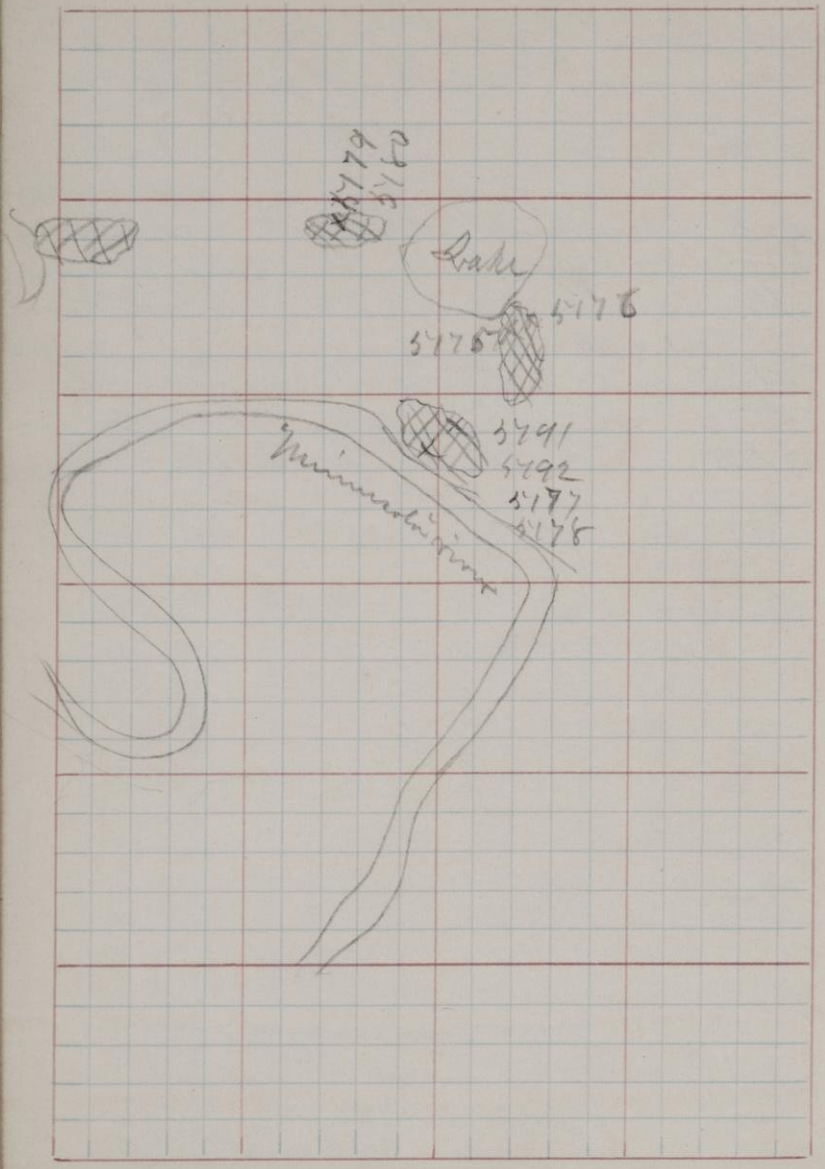


irregular "breaks" of the rocks in that direction can be clearly seen.

5791

is a tolerably fresh Specimen of hornblendic Schist taken some 40 or 50 paces from the river bank. The Scales are so bright and shining that they appear more like mica, Muscovite, and possibly many of them will prove to be that mineral.

Sec. T. R.



5792

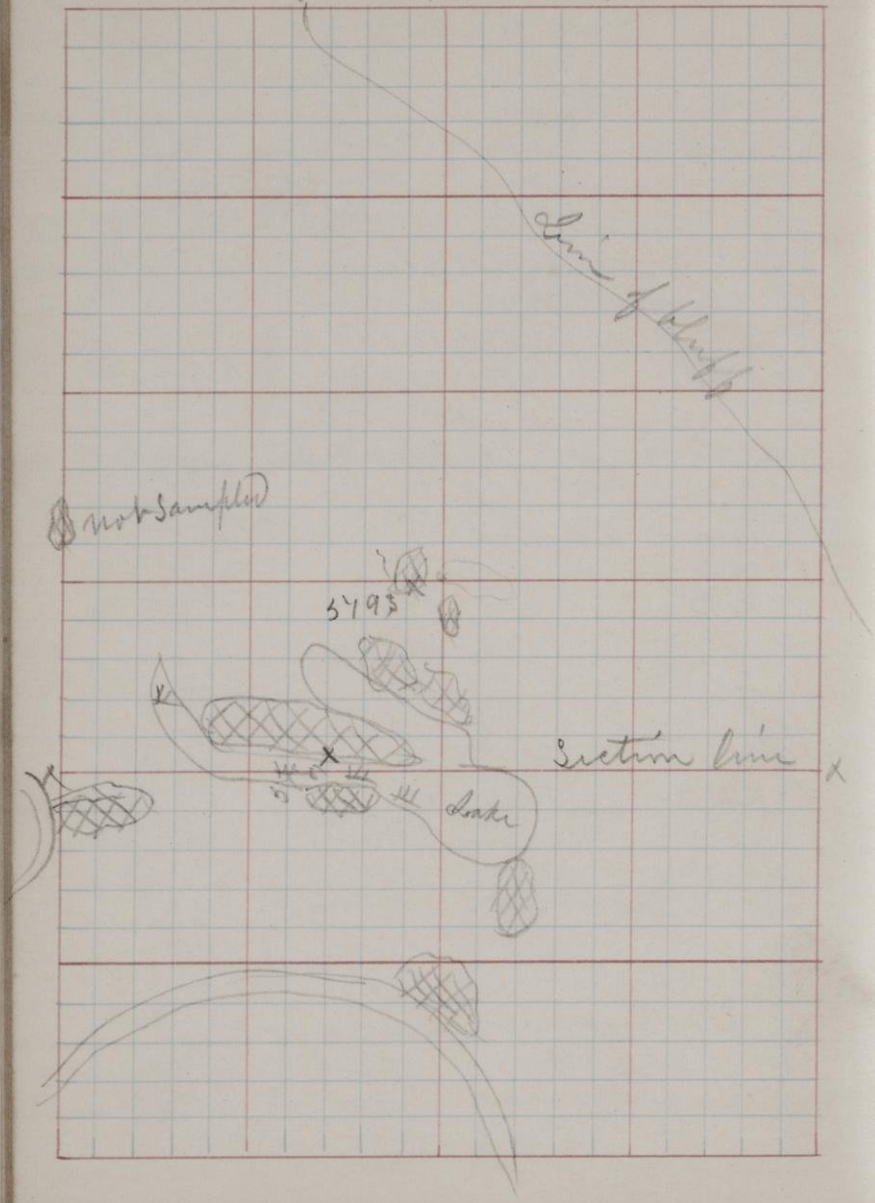
1350 N 950 W

When the rock is more weathered the color seems to fade. The no. 5792 is not of the same mineral proportions very likely as 5791 but it occurs more and where the surface bears every indication of a far greater degree of weathering than does that of the number named.

Here seems to be but little indication of hornblende but light colored microcrystalline feldspars instead.

(9—891.)

Sec. 15 T. 111 R. 32



5793

500 ft; 1150 yr

This rock was taken from near the half section line running north over the bluff between the East and West halves of Section 15. It lies some 2150 or 300 paces from the road from Ione Mine to Fort Ridgely. It is also the highest rock of all the exposures in the La Framboise group. It seems to be the best for quarrying purposes

The joints run N 75° E and N 10° E cutting the mass into rhomboidal blocks.

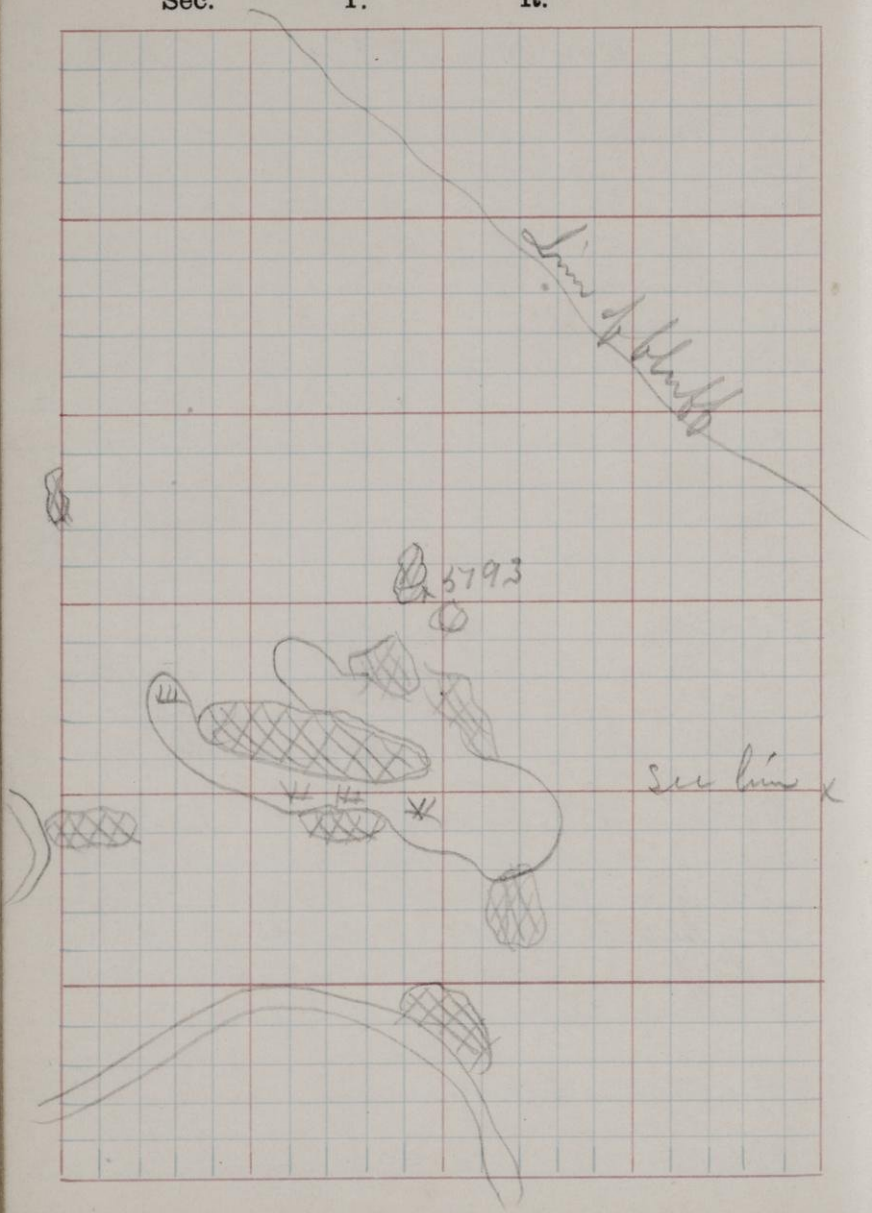
The joints N 75° E dip S E at an angle of 60°

Those N 10° E dip S W at 70°

The dips of the rocks in the bedding planes — whether they be true or false bedding — seem to be at this place N 20° to 30° W. at an angle of near 20°. Compare Winchell Rep. Geol. & Nat. Hist. Surv. Minn. 1873, p. 161.

The feldspar here is quite red and the grains granules show a peculiar opalescence — which characterizes the

Sec. T. R.



group of this whole group. The rock here upon the hill or up towards the bluff is redder in color than that below and bordering the river. Some quarrying has been done

This locality is known as the "La Framboise place" throughout all this part of the valley because one of the early traders & back woodsmen from Minnesota was a trapper and his store by the landing — ± 1777. where Jean was La Framboise,