Central Missouri: [specimens] 15001-15259. 
No. 79 1888

Haworth, Erasmus
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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 2 1/2 x 1/4 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.
For convenience and accuracy, the colors shown on the opposite page will be used in this notebook. Contact lines between any two where traced accurately will be represented by an unbroken black line thus ——, but where there is any uncertainty regarding the exact location of boundaries the division line will be represented by a broken line thus ——.

\[ \begin{array}{c}
\text{Granite.} \\
\text{Porphyry.} \\
\text{Limestone.} \\
\text{Sandstone.} \\
\text{Dike-rock.} \\
\text{Flint-rock, or chert.}
\end{array} \]
This specimen was taken from the porphyry bluff at the foot of a high hill, and is a fair representative of the neighboring porphyry.

See page 9

The specimens were taken from the line of contact between the granite and porphyry. The contact line seems to be pretty plainly marked if one makes a superficial observation, but to find the exact division between the two is not easy. Only a few feet on either side of the line we find characteristic rocks.

Granite, taken from the right bank of the little branch. Large exposures of granite occur here.

This is a very interesting exposure of coarse sandstone or conglomerate. Porphyry boulders as big as a man's head, and considerably water worn are very abundant in the rock, showing that this conglomerate is younger than the neighboring porphyry.

See p. 6.
This specimen were taken from the contact line between the granite and porphyry, on the north slope of Bunker's Hill, the location of which is shown on the map. To the east, the granite is very abundant, and many large boulders from 4 to 7 ft. in diameter are scattered over the surface evidently never having been very far removed. The division line at first sight seems to be quite plain, but careful examination in some places showed that there was no seam or fissure, between the two kinds of rock. 15038 was taken so as to show the two phases. 29 is porphyry 6 in. away, 40 is porphyry 15 in. away, and 41 is porphyry 40 ft. away.

This locality seemed to be so interesting that I visited it a number of times, and finally gathered a new set of specimens. 38 is granite and 39 is porphyry from just across the creek to the right. They were about 27 yds. apart. The bank on the north side is quite low and the rock exposures are not abundant. On the south side there is a high bluff reaching fully 300 ft. at a point about 300 ft. up the stream from the contact line.
Along the ravine at a place from 3/4 to 1/2 mi. south of the north line of the map there is a very peculiar looking rock. It is of almost absolute whiteness and seems to have been originally a coarse conglomerate composed of porphyry boulders and porphyry gravel. As these boulders decayed shells of decayed matter would be formed. In many instances the central part of the boulders are comparatively sound.

15-05-5

This is a porphyry which fairly well represents the porphyry on the hills at the head of the ravine. There is nothing peculiar about it or its mode of occurrence which would distinguish it from other porphyries.

15-05-6

Porphyry taken from the summit of a high hill known as "Compton Hill." The whole of the country as the edge south and west is at once of porphyry hills, with but little difference in the character of the rocks, so far as their macroscopic appearances are concerned.
This specimen of granite came from the north bank of Elruby creek about 1/2 mi. below the old Henson mill. There are heavy exposures of granite for a considerable distance up and down the creek. This would be a splendid place to open up a quarry. In the summer of '86 a little work was done here, but railroad facilities were so poor the work was stopped.

15-050 This granite specimen is from the road-side by the school house on the "Gravel Road." The granite extends farther north here than in some other places.

15-051 This is about the same as 50. The area on this map north of Elruby's creek represented as a granite area is generally covered with soil. But in a great many places the rocks are exposed, and in others granite boulders cover the surface, so there can be no doubt whatever with reference to the nature of the underlying rock.
This specimen is a dyke rock. It was found in a small ravine which runs through the McAllens field on the north side of Shouts creek. The dyke itself could not be found, but the boulders were very numerous, and were so large that the dyke must have been fully 2 ft. thick, and probably much more.

This specimen is granite. It was taken from the left bank of Shouts creek just at the point where the creek leaves the bluff and turns east into the St. Francois. The granite here was unusually fissured into angular blocks like the porphyry, but otherwise seem to be good granite. The portion of this section which lies to the east of St. Francois was not examined in detail, and therefore is not colored on the map.
15066
This specimen is a granite taken from the east side of Mr. H. Allen's field. I could find no ledge and consequently took a specimen from a big boulder in the ravine.

The whole of this section, excepting the small area in the E. W. corner, is in the granite area, and although it is generally covered by soil the granite boulders and occasional outcropping of the solid granite leave no reasonable doubt that the whole of the area is underlaid with granite.

15067
This is dyke rock taken from the ravine just south of the house of John Burk.

The dyke is in the solid granite, is at least 8 or 9 ft. wide, and may be more. It trends N. E. and S. W. Just west of it about 200 ft. another dyke crosses the ravine with the same trend. The whole country through here seems to be full of small dykes, especially to the S. E. of this place. Usually nothing can be seen excepting the boulders which lie on the surface. In every case yet observed in which the trend of the dyke could be determined it was N. E. and S. W.
Just on the west bank of Rock creek 30 yds.
above the contact line between the granite and
poppysh, as shown on the map, a shaft
has been sunk 30 ft. deep. It is now filled
up to a depth of 18 ft. below the surface.
I had the water dipped out and collected
specimens from different places along the
walls. This is a most interesting place. We
have what seems to be a change from the
non-crystalline to the crystalline condition
and this by gradual transitions, and the
whole can readily be seen by examining
the walls of the shaft. There is an absence
of any appearance of intrusive rock.
The changes are much more rapid than
one would have suspected, usually being
quite complete within 1 ft. or less. At the
N. E. corner near the surface is one of the
course spots. Immediately below it the rock
is not macroscopically crystalline, but a few
feet lower the coarseness of grain again be-
comes apparent, and at the depth of 15 ft.
the rocks on the north, west, and south sides
are quite coarse. Specimens were gathered as
follows:
15/108, Klein shaft, middle of N. wall 3 ft. S. of Tin.
15/109, Adjoining T. S. on the E.
This section is wholly occupied by Rock creek Int. The rocks throughout the whole section are porphyry, and there is nothing to contrast with the portions of the hill which extend into other sections.
This specimen is porphyry taken about 75 yds. up the hillside from the ravine. The whole country around is solid porphyry. I traveled through the eastern portion of the section, along the northern line and also the western side but did not pass directly over the summit of the hill. The hill is locally called the Blankenship Mtn.
This specimen is a poor variety of limestone. It was found in the little field N. of the Dallas road. The field is on rather low ground between Rock creek mountain on the east and the Blankenship mountain on the west.

The exact extent of the limestone area could not be determined, but it is evident by quite small, and represents a larger mass which has been carried away by erosion.

Rock creek runs through the section from east to west dividing it into almost equal parts. On the south of the creek near a little branch there is a very small exposure of a fine grained sandstone, the location of which is shown on the map.
This specimen is a coarse sandstone, or a fine conglomerate occurring along a little ravine which leads into Rock Creek. It has many fragments of porphyry in it, which shows that the porphyry is older than the sandstone. The bedding of the rock is approximately horizontal.

This specimen came from a ledge of porphyry by the side of the branch as shown on the map. Macroscopically it shows the flow structure remarkably well.

Porphyry, from the bluff on the north bank of Rock creek on Mr. Payne's farm, nearly 3 mi. W. of F. line of section. It has been studied and described in my Dissertation under No. 287 and is a remarkably good illustration of what I have called the "Poricilitic" structure.

This rock was taken west and a little south of Mr. Payne's house. It is a remarkably light-colored and flinty porphyry.
This section is almost wholly occupied by "Blue Jet." The hill is a mass of porphyry, ledges of which can be found almost all around it. In some places it is precipitous, cliffs 20 ft. or more high, with almost vertical walls extending for considerable distances. In other places the detrital material has rolled down the hillside until it is of even descent, and one can well ride up or down it. Specimen 2 is from the summit of the hill; number 3 is from the western slope about half way down the hillside. It is on the south-eastern portion of this side that the so-called "asbestos mines" are located. Extending southward from the Blue Jet, for a number of miles, is a row of porphyry hills which are very steep and high.
15065. This specimen of granite is very interesting because it is from the same place from which No. 264 in my dissertation was obtained. This No. 264 was noted on account of its feldspar enlagement crystal. The specimen is from a level at a place where there are falls of solid granite about 15 ft. high.

15066. These specimens are interesting because they show gradual transitions from the holocrystalline structure to one strongly approaching the porphyritic. There is a high bluff near about 20 ft. above the water level in the river.

15067. It is from the side of the hill and is a fairly good granite. No. 7 is from the extreme summit and in its every appearance is closely allied to the porphyritic, and in fact must be called a porphyry. There is a vertical wall fully 90 ft. high at the point from which it was taken, and the fissures in the rock are exactly the same as those so common in the porphyries, dividing the rock masses into angular blocks of varying size.

15069. This specimen in appearance is about halfway between granite and porphyry. It was taken from a boulder. The surface at this point is covered with loose rock, some of which are...
15090 This number is from the porphyry of the S.E. part of Blue Mts., just above the so-called asbestos mine. The porphyry on this side of the hill all shows the flow structure quite well, especially on the weathered surfaces.

15099 This porphyry is from the top of a steep hill called "Bald Mts." The hill stands out alone and is very like the frustum of a cone in shape, the upper diameter being about fifteen rods, and the height 340 or 350 ft. Microscopically the porphyry seems to be very glassy.

15100 This is a very peculiar dyke rock which came from an old shaft to the E.W. of Bald Mts. a few rods, at a place where prospecting was done a few years ago. The size of the dyke could not be determined as the surface was entirely covered with soil. The exact location is about 100 yds. east of John Kinnan's house.
Porphyry, in ravine south of J. McDowells house 1/4 mi. The whole of the section is covered with porphyry.

This specimen of porphyry was picked up in the field, and was preserved because it showed the flow structure the best of any rock seen up to that time. Of course it had rolled down from above.

These two specimens are dyke-rocks from the S.E. corner of Blue Tl., near the asbestos mines. Each is from a boulder taken out in mining years ago. The detrital material at this place is quite deep and in a few places spread out in thin sheets an inferior grade of asbestos is found. Some little mining for it was done years ago but nothing discovered further than that above described. In a few other localities from 2 to 5 mi. away indications of similar occurrences were noted. It is quite evident that in order for asbestos mining to be successful the original home of the asbestos must be found which probably is one of the numerous dikes, indications of which are so abundant.
Three two specimens of porphyry were taken from points about ½ mi. apart. The former is from a ravine which passes the south side of the south hill of Blue Ink. The latter from the hills side near the top of the hill.

The whole region is covered by a porphyry hill with no valley land of note. The north part is occupied by the southern extremity of Blue Ink, or rather a little hill which lies just south of Blue Ink.
This specimen is a peculiar dyke rock which occurs in a ravine near the north side of Section 17. Quite a number of angular blocks were seen in the ravine, and finally the dyke rock itself was found cutting through the porphyry on the bank of the ravine in such a way that the right contact line was removed so that the width of the dyke could not be determined. The rock is a very fine grained one, and macroscopically seems to be almost amorphous.

This is a specimen of ordinary porphyry taken from the place indicated on the map.

This also is ordinary porphyry taken from a ravine near the south side of the section. The whole of this section is occupied by porphyry hills excepting a narrow strip of sandstone in a ravine in the N.E. corner, as shown on the map.
15080. This section is nothing but hills of porphyry with an occasional small dyke. The ravines are lined with bold ledges of porphyry and the hillsides are strown with boulders, some of which are very large. The location of the two specimens given can be better seen on the map than described with words.

15081. This is a dyke rock. The dyke itself could not be found, but on the S.W. slope of the hill, the dyke boulders were numerous. This specimen is from one of these.
15788. This section is simply a mass of porphyry hill. But one specimen was taken. The general appearance of the country and the rocks is very like that of all the sections near it to the north and east. Occasionally a ravine leads from the hillside into the valley either to the east or to the west. Along these ravines are numerous ledges of porphyry exposed. Also there are numerous "glades," or places on comparatively level ground over which the rock is exposed.
15093. This is a porphyry from the E. bank of the S. Rock creek, very near the S.E. corner of Section 29, and on the S.W. corner of claimer's line.

15094. This is also a porphyry which has nothing of a special interest about it so far as could be seen either in its field relations or in the character of the rock itself. Its location was near the half mile corner on the south side of the section.

15095. This is a dyke rock which came from a dyke jelly 50 ft. wide and which had a N.E. and S.W. trend. Both the dyke rock and adjacent porphyry were badly fractured. The fissures in which were generally filled with quartz. The look was a very fine grained one.
This specimen is porphyry from the W side of the S park of "Lake Tel. The section is occupied by this hill. No important difference was noted either in the character of the rock or in the mode of occurrence, and a number of other porphyry hills already described.
These specimens of porphyry came from the face N. and its spurs. This hill is one of medium height, is about twice as long N. and S. as it is broad, and is quite steep nearly all the way around. On the east side a spur extends out so far that it can hardly be called a part of the same hill. A ravine rises on the E. side and flows N.E. to the river. Along this ravine the banks gradually become steeper until the river bottom is reached.

Specimen 106 came from the E.E. corner of the hill about half way up the side. No. 107 is from the bed of the ravine above mentioned.
This specimen of porphyry came from a steep and high bluff on the E. bank of the Little St. Francois river near the S.E. corner of the section. The stream runs nearly north. The bluff is from 100 to 125 ft. high and is composed of porphyry. There are many vertical fissures which can be traced from top to bottom of the bluff. They are all very small and are of the same nature as those found everywhere so abundantly in the porphyry. On top of the bluff there are two finger-like projections of rock and is 8 ft. 7 in. wide. One of these is fully 25 ft. high and not more than 5 ft. or 8 in. in diameter at the base. The opposite bank of the creek is very low and offers a good view of the bluff.

This is a specimen of porphyry from the N.W. part of the section, and from the N.W. side of a tolerably high hill. The section was not examined in sufficient detail to warrant me in coloring the map.
This specimen came from immediately on the contact line, between the granite and porphyry. It was taken from a boulder, but as it showed in itself a transition from the coarsely crystalline to that which is much finer it is a valuable specimen. It probably had not been far removed from its original home. The granitic part is lighter in color than the other.

This is a porphyry from the dump pile at the Martin shaft, and probably came from about 75 ft. under the surface; although there is a little uncertainty about it. A shaft was sunk with an angle of about 45° with the vertical on what was supposed to be the same vein which was worked at the Silver Mines.

This section was not examined in sufficient detail to warrant me in coloring the map, although I almost know that the whole of it is porphyry South of the contact line marked.
This is a very coarse sandstone of a conglomerate. In comparatively small area, with the surface exposure as shown on the map is covered with this kind of a rock. The bedding slope, gently with the surface. The rock itself is almost entirely composed of small boulders and coarse gravel of porphyry cemented largely with iron-oxide.

This is a porphyry thrown out in digging a cellar immediately on the contact line between the granite and porphyry. At the south end of the cellar the rock is porphyry; at north end it is granite. It is caved in and partially filled with water, so that the contact could not be seen.

This is granite. The surface for all the granite in this section is level, and is mostly covered with soil.

These were taken from the contact line. A rock was found which seemed to show the transition. I blasted out a portion of it and obtained 250, which is granite, 252, which is porphyry, and 251, which is intermediate.
15245. This is a specimen of quartz from the Apex shaft, and was taken because it so well represents the corrosive action of water upon quartz under certain conditions.

15246. Quartz diabase, from a dyke at Silver Mines. It was in small boulders, the exact location of the dyke not being known. It is very similar to Nos. 15041 and 15045.

15247. Dyke rock from a big dyke just N of a path leading down to the river at Silver Mines. This place called the "Silver Mines" is very interesting. The country rock is granite. Quite a number of dykes cross it at different places tending about N 75° E. In one or more of these places it seems the fissure was not filled with lava, but was left to be filled subsequently with vein stuff. Here we find evidence of pneumatolitic action. There are fluorite, epidote-like, topaz and wolframite, which indicate it.

See p. 60.
15245. Granite from the bed of a ravine called "Mad creek." This whole section is granite excepting a portion in the S.W. corner, near the contact line, which is the S., but the exact boundary could not be determined on account of the soil. The rocks are exposed in different places to a sufficient extent to admit of a quite positive determination of their character.

15255. This is a dark rock taken from a boulder in a branch of the roadside 1/4 mi. E. of Mr. Mayers. It represents a number of large boulders which seem to be piled up window-like, tending N.E. and S.W. It is very probable that they are representatives of a large district concealed from view by the soil covering. Exactly the same kind of boulders occur in a ravine in Mr. Lisander Atkinson's fields just W. of his house in Section 13. They are peculiar in having a very rough surface where they have been weathered.
The principal interest in this section is in connection with the so-called Tin Mines. These are located on the N. side of Tin Tab, a steep porphyry hill about 400 ft. high. There is a very large dyke exposed on the northern side of the hill and which was the cause of a big excitement about 21 yrs. ago. The dyke is about 50 ft. wide and is filled with a very black, compact, glassy rock, which is much more perfect the crystalline at the base than near the top. Its shown a boulder near the top of the hill at a point the highest up of which any dyke boulder was seen.

No. 10 from the tunnel highest up on the hill, which the miners call Tunnel No. 4.
No. 11 from Tunnel No. 3.
No. 12... 2.
No. 13... 1.

These tunnels were driven horizontally into the hill 150 ft. or more, and the specimens were taken from the dump piles at the several locations. The vertical distance between tunnels No. 1 and 4 is about 175 ft. Rocks from this dyke were described quite fully in my dissertation.

A porphyry rock from the summit of Tin Tab.
This specimen is very interesting because it is a quartz bearing diabase-porphyrite dyke rock and is the one described so fully in my dissertation. At the time I gathered the specimen I was unable to locate the dyke but found a place at which the boulders extended at least some distance under the soil and probably were immediately over the dyke itself. Only a few feet away the granite is exposed, and during a subsequent visit to the place I found a dyke 5 ft. in width cutting through the granite and trending N.E. and S.W. There can be no doubt but that there are at least two dykes in this immediate vicinity. Porphyritic quartz crystals and feldspar crystals are very common, scattered all through the rock mass. Some of the feldspar crystals are nearly an inch in diameter.

This is another dyke rock from a small ravine running N.E. It seems that the ravine is immediately over the dyke itself, which is a big one being at least 20 ft. wide. To the S.E. about 200, across the section line, there is another ravine which also seems to follow a dyke. The two rocks seem to be identical and therefore a specimen of the latter was not taken.
These two sections are nearly all composed of porphyry hills. On the extreme N.E. along a small ravine, there are very narrow belts of limestone and sandstone and also the western extremity of the sandstone area described under Section 6, R 5. The hills are very high and abrupt. The porphyry is exposed in nearly all places.

15030. These specimens are coarse grained porphyry, the former of which came from Mr. Barton's "gold mine," that is from the place where Mr. Barton had dug a hole about 4 ft. deep in the solid porphyry. This is a good place to note the different degrees of crystallization in the porphyry. Along the walls of this one little hole several different degrees of crystallization can be seen, and they present such an appearance that it is positive no intrusive rocks are present.

15032. These sandstone from locations as shown on the map. R 5 is a fine grained rock and 15035. The layers were quite thin. R 2 is more coarse grained. At this place there is a large boulder of porphyry imbedded in the sandstone from which specimen No. 32 was taken. The boulder is fully 3 ft. in diameter, and does not seem to be

See p. 61
These four sections are entirely covered with porphyry hills. The southern portion of 12 and 14 slope off towards the large valley called the upper 'Flat woods.' The whole mass of hills are known by the name of the 'Grassy hill.'

There is nothing of especial interest about any of these sections and macroscopically could not well be distinguished from many others.

These four numbers 180-83 are splendid illustrations of the transition stages of crystallization. The first came from the foot of the hill S. E. of Mr. Hendrix's field. The distance along the foot of this spur at which such rocks are exposed is only a few hundred feet. 81 came from 150 yds. up the hill S. from 82. 82 came from 150 yds. to the S. E. from 81. 83, which is a good porphyry, came from 74 the way from to the summit of the big hill N. W. The S. E. from 82. There seems to be a perfect gradation from the coarsest crystalline one to the one which is the most porphyritic.
15750 This specimen of porphyry is from the little hill just across the Township line. The hill is small and almost circular and is entirely surrounded by limestone.

1575-2 We have seen a very interesting change from the ordinary porphyry to a crystalline rock which seems more like granite than porphyry. These specimens are from the head of a ravine N. of the section line. The first is the crystalline, the second the porphyritic variety. They are not more than 15 ft. apart. The ravine seems to be the dividing line between the two different kinds of rock further down.

15752 These specimens are the crystalline variety mentioned above and are located as shown on map.

1575-3 This is a porphyry and lies between 15 2 and 15 4. If we noticed that as we ascended the hill near 15 4 the change from the crystalline to the non-crystalline condition occurs, so that at the top of the hill we have the porphyry alone. Following down the creek we find the same coarse rock.
reaching almost all the way. A change occurs here which is easily seen and traced. At the creek almost immediately opposite the highest point in the road as it runs over the flat hill at the “Shut in” is the line between these two kinds of rock. At one place a ledge was found with a vertical face of 45° or more, and in it the change occurs. At the middle of the bottom edge specimen No. 162 was taken. It is wholly crystalline as can be seen quite plainly with the naked eye. Either to the right or above the change occurs. Specimen No. 161 was taken 5 ft. immediately above 162 with absolutely no indication of a contact line between the two. On the right there is a fissure which might be taken for a contact line, but as there is none above it becomes probable that the one on the right is only a common fissure.

15/151 This is a limestone with many small fragments of porphyry in it. The limestone is in the bed of the creek and extends up the hillside a short distance. The sandstone overlies the limestone and extends.
This section is nearly all limestone. In the extreme N.E. corner there is a circular porphyry hill about 44 feet in diameter. Near the N.W. corner there is another elevation, but it is a limestone hill. Judge Russell's house stands here. It has quite a stone quarry opened. The rock is of the same general character as the limestone throughout the valley. In some places there is so much calcite in the rock that it is practically useless for building purposes. Along the west line of the section, near the middle, is another steep circular hill covered with flint rock but which has limestone at its base.

15159. This specimen of porphyry came from the porphyry hill in the N.E. corner of the section.
Ironton, in part.
These are specimens of porphyry breccia obtained from the bank of the creek at the iron wagon bridge between Picton and Arcadia. It seems to be fragments of compact porphyry cemented together with lava which itself produced a porphyry upon solidification. No. 147 came from the summit of "Church Hill" only a short distance away and is a very compact rock of chondroidal fracture and also shows the flow structure very plainly. The probable explanation is that as the lava flowed down the hillsides the first crust that was formed was broken into fragments by a second flow of lava thus producing the porphyry breccia.

This is a limestone taken from the creek bank just north of the Dixon dwelling. The whole of this valley is covered with limestone excepting "Church Hill" and its spurs.
15-167. Flintrock. In quite a number places in this township, larger or smaller flint hills occur. They invariably have limestone at their bases, and in some undetermined way have an intimate connection with the limestone. The maps illustrate the relative positions of the limestone, flint and fossils much better than can be given by short verbal description.

15-171. This is porphyry from the N.E. side of Lewis 1/2 J. S. of Arcadia. All the top land of this map is covered with limestone.
15163. This is porphyry from the S.W. Spur
of Shepherd Mnt. It is nothing more than
ordinary porphyry.

15764. Limestone—Lewis Mnt. does not extend
quite to the W. side of this T. but a
nack of limestone reaches S. from
Shoebi creek to the larger body
around Logan.
15766. This is flint rock taken from a big boulder 4 1/2 ft. in diameter taken from the N. hillside N. of the switch of the railroad near Tip Top.

15765. Limestone from the R.R. cut, just N. of switch near Tip Top. Here is limestone at the greatest elevation yet seen. The R.R. cut shows quite heavy beds of swell stratified limestone, some layers of which are nearly 2 ft. in diameter, and which dips to the N. quite gently, same as slope of the hill.

15768. Porphyry on N. side of hill as shown on map.

15767. Lyte rock on S. side of same hill, taken from a boulder. The lyte itself was not seen.

15769. Limestone just N. of Mr. Griffy's house. This is very near the line between limestone and porphyry.

15774. Porphyry, from a point just E. of the
This map represents 6 sections.
All these are porphyries from locations as shown on the map and have no special properties which would distinguish them from others.

15217. A very compact limestone from the base of a hill, which is covered with flint.

15220. These are porphyries from the same hill.
One from the north and the other from the southern extremity. The hill is of moderate height and is entirely surrounded by limestone.

15222. Flintrock, which seems to be a sort of highly conglomerate. It is on the top of the hill and represents a kind often seen in this locality.

15223. Limonite. These flint hills sometimes have considerable deposits of limonite, which seems to be of a fairly good grade. Years ago prospecting was done in numerous different places and the ore is still lying in veins on the surface.
These are photographies from the N and S ends of the long porphyry hill marked on the map. On the N side rocks have the flow structure well marked, but I could not be so well seen on the S.

These are from an old shaft on the N.W. part of the Clothbeelson Ink. The "Mangasteink" of former days. The first shows the flow structure very well developed and was taken in shaft account. The second shows the manganese ore in little stalactitic formations which is very good evidence that it was deposited by water.
This section is a most interesting place.
It is the location of the old "Mangarese"
mines on the Cuthbertson Tract described
by Rompelli in his Rep. of Missouri
Geol. Survey 1872. It is the place where
the limestone lands into perchly and according
as his Rep. P. 26. Cuthbertson Tract is
irregular in shape sending a sort of
spur to the N.W. and to the S.W. Pk
shows positive evidence of being an old
lava flow. There are large masses of rock
all twisted and contorted just like
lava frequently is.

The Mangarese ore is often in a fine
black powder, sometimes dry but
often wet and "mucky." It is only
occasionally in solid lumps of any
much size. At other times it is in
small masses or in a powder scat-
tered through the numerous small
openings in the lava. No other place
in the whole area visited is half so
changeable as this. There are many
different looking rocks which at first
sight seem to be entirely distinct,
but which I think are closely related
genetically. Thus there are many places
See P. 63
Section 23 is almost entirely in a level valley called the "Upper Flat Woods." It is entirely under cultivation excepting the western part which is occupied by flint hills. No specimen was taken from it and it is not represented in this Field Book by a map.

15069. This is a porphyry taken from the creek bank just W. of Mr. Clayton's field. N. of the "Flat Wood" school house.

All of this section is level ground and it is only here and there that the rocks are exposed. This specimen seems to be ordinary porphyry.

15070. This is lime stone from a well 30 ft. deep in the yard of Mr. Roebel. No surface rocks are exposed in that vicinity.

15072. This is porphyry from a ledge by the roadside S. of the "Flat Wood" school house. There is an area here of only a few square rods over which the porphyry is exposed.
This map represents four sections. The interesting feature of this area is the alternate appearance of porphyry, limestone, and flint.

15276 This is a porphyry from comparatively low ground. The hill rises to the S.

15287 It is also a porphyry from the high part of the hill. It is interesting to note how the flint and porphyry meet here on the hill without there being any apparent break in the configuration. To the N. and S. valleys soon set in which divide the porphyry hills from the flint hills.

15288 This is also porphyry.

15289 Limestone, taken from a point fully 1000 feet above the valley, making it the highest limestone seen in this corner of the township.

15284 Porphyry, taken from hillside as represented on the map.

15285 Limestone from the creek bed. It has a great many large the porphyry gravel in it.

15286 Are limestone, taken from well stratified layers which have a gentle slope in 8 cc. 0.64
This map represents sections. It is a map of porphyry, flint and limestone alternating.

15-235 There is nothing of special interest in the hand specimens or their mode of occurrence. The limestone is in the valley and is always well stratified and approximately horizontal, but generally has a gentle slope in the direction of the hillside. The map shows the location of the several specimens so that it is unnecessary to mention them in detail.

To the S.W. of this map, across the township line, two other specimens were taken.

15-210 The former is a sandstone which came from layers along a branch.

15-211 The latter is a dyke rock obtained from boulders on the surface, the dyke itself not having been found.
This map represents 4 Sections and is principally occupied by the Biser Mt. This hill is large and high and very irregular in shape. On the extreme N. of Section 30 is a flat hill which reaches across the Section line. The base of this hill is occupied by a very compact limestone called marble by the citizens of the country. Passing immediately E. from this we cross a second hill which is composed entirely of porphyry. On the northern slope of this hill prospecting was done years ago in a vain search for iron ore. The rocks thrown out are of a dark red to black color, waxy lustre, and some of them seem to be the a porphyry trachite. This rock will probably prove of great interest. Passing still farther E. to the S. we ascend the northern spur of Biser Mt. The porphyries of this hill have porphyritic Feldspar which show much more plainly than the average. The northern part of Section 32 and southern part of Section 29 are occupied by a flat hill from which specimen 281 came. See page 65.
Continued from P. 1.

The exposure consists of a narrow strip extending along a little branch, and covers but a few square rods. To the N.E. in a number of places small boulders and gravel of porphyry are scattered over the surface. I was first puzzled because I could not account for them, but it now seems probable they are the remnants of this same conglomerate rock, which may have at one time extended over those areas and which is now entirely disintegrated and largely removed. The rock was now exposed at a dip of 40° 25' to the SE by S.E., giving it a strike WSW by N.

Continued from P. 2.

15042. 42 is from the highest point of this high bluff, which is called "Bingham's Hill." 42 is.
15043. From the bed of the creek immediately below 43.
On the north side of the creek.
15046. Some distance above the contact line there is also a moderate hill but without steep bluffs.
15047. At the top of this hill the rock is so concretely crystallined that it will almost do to cult it.
15048. Granite. 48 was taken from this point.
Near the summit of the tall the rock is not so well crystallined. 46 & 47 are from near the base of the hill.

On my last visit to the place I followed up the creek and gathered specimens from the creek bed all the way along, as is shown on the map. Dept of these are quite coarse but in general the coarseness of texture decreases as the distance from the contact line increases so that a mile or so away crystallization is little, if any more nearly perfect.
than in the ordinary porphyries in other places. The individual specimens will show for themselves the way this change occurs much better than can be described in a field Note-Book.

Quartz-diorase—porphryite. This rock was found in boulders on the north side of the hill, as shown on the map. The dyke itself could not be found, on account of the heavy covering of soil on that part of the hill.

Sand stone. The northern part of this section is covered with sand stone. The portion shown on the map is the southern extremity of a large circular area nearly 8 miles in diameter, almost all of which is probably covered with sand stone. Only a narrow strip on the south side of this valley is within T. 33. W. and consequently a detailed examination of the remainder was not made. Nearly all of the valley is covered with soil and is extensively cultivated. Along the branches and occasionally at other places outcroppings can be seen. Along the little branch in the extreme N.W. part of the map very heavy beds of sand stone are laid bare. At every place noticed the bedding seemed to be homogeneous and thus far there appears to be a total absence of any indications of orographic movements of any extent since the formation of the sandstone.

44 is from the surface at a little ravine, and 49 is from Esq. Brown's well but I could not determine
from what depth it came. The well was sunk about 25 ft. deep and did not pass through the sandstone.

Continued from PT.

15710. W. side of N. E. corner 2 ft. 8 in.
15711. E. side and adjoining 1 ft. 9 in.
15712. N. E. corner 3 ft. below surface.
15713. N. E. corner 4 ft. 6 in.
15714. N. E. 5 ft. 6 in.
15715. W. side of N. E. corner 7 ft. 6 in.
15716. Q. " " " " 8 "
15717. " " " " 11 "
15718. W. " " " " 14 "
15719. S. " " N. W. " " 15 "
15720. Middle of W. side 14 ft.
15721. " " " " 15 "
15722. N. W. corner 15 ft.
15723. S. side N. E. corner 17 ft.
15724. W. " S. E. " " 12 "
15725. Porphyry, surface rock 3 ft. W. corner of shaft.
15726. Coarsest rock seen on dump hill.
15727. Granite from surface at contact line 30 ft. E. N. of the shaft.
15728. Porphyry, surface rock 5 ft. S. W. of 127.
Continued from P. 14.

porphyry, some granite, and others halfway between the two. The ledges of the rock were exposed as granite. It could not be determined exactly from whence the boulders came, but it is evident they have not been moved far and it is quite probable they now exist on the same ground where they were formed.

15064. This is a coarse dyke rock from the spring near the house of Peter Weiss. There is a large dyke here exposed over an area of 150 ft. by 75 ft. or more. The surface covering made it impossible to determine the direction of the trend of the dyke.

15065. This is a granite specimen taken from the hillside near the river as shown on the map. The hill is about 150 ft. high with granite ledges very abundant.

15061. This is a dyke rock at the foot of the high hill mentioned in Nos. 5 and 7. The rock varies in color from dark to light. The latter being composed almost wholly of feldspar.

15078. This is a dyke rock found by the road side leading from Peter Weiss's to Young Peter Weiss. The dyke itself could not be located, but there was a very large amount of boulders scattered over the hillside.

Continued from P. 26.

The two extremes were not more than 20 in. apart.

15258. A coarse grained porphyry from near the
contact line, as shown on map.

15254. This came from an old shaft pond was called Blake by the miners, but it looks very like hornblende which it probably is. This mineral is so scarce in this part of the country that it makes it quite interesting, should it prove to be hornblende. The uppl rock of the shaft is porphyry.

15255. This is a small gray granite, which of course came from near the contact line.

15256. This is porphyry from just across the contact line.

In tracing this contact line great care was taken. The country is sometimes level and exposed with a thin coating of soil, at other times hilly with abundant exposures of rock. It is very noticeable that the line is not sharply drawn. A heavy, cloudy, crystallized area will be followed by the S.W. and some of the porphyries. Just N. of No. 250, for example, the porphyry extends 20 to 30 ft. Such examples are often found.

Continued from p. 27.

The mining was principally done on the largest of these veins which carries argentiferous galena. The vein is not vertical, but dips to the S.E. about 45°, according to Mr. Wiley, who at one time was Superintendent of the mine.
Continued from p. 37.
water worn, and therefore must have rolled
down the hillside while the sandstone was
forming. This is positive evidence that the por-
phyry is older than the sandstone.

157.33. This is limestone from along the same ravine
and is interbedded with the sandstone that
there cannot be any material difference in the
ages of the two rocks. The location is shown on
the map.

157.31. This is porphyry from the summit of the hill above
the Beark lake, as shown on the map.

157.32. These are all porphyries, the last two of which are
from the bank of Skoeks creek. The other is from a
157.44. high point overlooking the creek.

157.33. These are sandstones from the bank of the branch
of Tns. Kenson’s sprit. The bluff here is 18 or more feet
high. Well stratified sandstone overlies limestone beds
and is conformable with them.

157.35. This is limestone from immediately under the two
sandstones just described.
The whole of these stratified rock dip gently to
the N.W., and are good illustrations of what is so
often seen in this township, namely, the stratified
rock forming the bases of hills and having
gentle inclinations in the directions of the hill-
side themselves.

It may here be said once for all that in
no case thus far observed is there any evidence of
the bedding of the stratified rock ever having been
materially changed. Usually these rocks are gently
inclined, but almost invariably in the direction of the slope of the hills. This is most likely due to the rocks having been deposited on a sloping bottom. We look in vain for any evidence of material geographic movement since the stratified rocks were deposited.

Continued from p. 36. [p. 40]

up the Dallas road perhaps all around the hill.
15-155. Porphyry from same place as 151.
15-176. This is limestone from the N.W. corner of the circular hill as shown on map.

15-177. Porphyry from the summit of the hill. This circular hill of porphyry is about 280
1430 ft. high and presents a unique appearance rising as it does from a limestone valley. It is almost circular and a half mile in diameter at base. There is no indication of its having been lifted up through the limestone and probably was formed long before the limestone was deposited.

Continued from p. 46.

Guff's house. It was taken from only a few feet E of the limestone limit.
15170. Limestone from N. hillside in bank of ravine. The hill is apparently composed of flint but the limestone at its base is almost horizontal and seems to pass in under the hill.
15155 - Dyke rock. This is a most interesting occurrence of a dyke rock. It is surrounded by limestone, and on account of its resisting erosion more than the limestone has produced a narrow ridge throughout its entire length, a little more than 10 mi. The ground in most places is so covered with soil that I could not determine whether the dyke itself passed through the limestone, or whether it was formed before the deposition of the latter. It seems probable that the dyke is quite wide, 57 ft or more, but this can not be stated definitely.

Continued from P. 48.

which have surface rocks that seem to be stratified. These overlie the massive rocks of the hill, and are at places apparently different from them, but we always find that on the hillside the Pre-Cambrian stratified rocks extend downward to about the same depth below the surface, no matter at what point on the hill. The examination is made. At one place a trench about 2 ads. long has been dug into the hillside and this shows that any given layer merges into the massive rock of the hill, thus

A shaft sunk would show the layers down to a certain depth with the massive rocks below, but the cut on the hillside looks quite different.

Again, in the ravine W of the hill at one
place the massive rocks by weathering are actually changing into shells and colters.
All these points make it seem probable that the apparent stratification is due, (a) to lava flows, and (b) to weathering.
This is an important question and is explained entirely differently by Pompey, in his Report, as the mentionned.
31. The Manganese ores were probably deposited by water and fill nearly every little opening in the rocks.
15185. This seems to be a dyke rock, but it may not be as some of the country rock looks very much like it.
15186. These three are from the same place, at one of the old mines and were taken to show 15187. that the rock mass certainly is a lava.
16188. 15189. This is a specimen of the manganese ore.
All the remainder on this map are taken to show the similarity of the rock in the different parts of the field. The map shows their location much better than can be given in words.
Continued from p. 50.
the direction of the hillside.
15074. Is a sandstone taken from a boulder found on the top of a hill. Search was made in vain for this rock in situ.
This is flint taken from near 7/4. The hill from which the two came is flint throughout, with limestone at its base.

Continued from P. 52.

All of the specimens not named from these sections are simply porphyry and need not be described in detail.

To the S.W. of section 21, across the township line, is a little knob of very coarse granite porphyry. Some of the porphyriticfeldspar crystals are nearly 2 in. long. This little knob, which is not exceeding 80 by 30 in diameter, is almost entirely surrounded by ravines. To the N.W. a narrow neck reaches across on to the porphyry hills. This locality furnished an excellent opportunity for studying the crystallization question. Specimen 27 is the granite porphyry from the extreme E.E. corner of the above figure.
Specimen 25 is porphyry from 100 yds. up the ravine to the West of the Northern exposure of the granite porphyry. No. 26 is up a little ravine 50 yds. to the North.

No. 27 is the granite porphyry on the hillside about 50 ft. slant up from a spot in the ravine at which No. 25 was taken. This latter is porphyry. No. 29 came from the same ravine about 50 ft. below No. 27.

So far as could be seen in the field, there is a gradual transition from the coarse granite porphyry through No. 27 to which itself is comparable to the fine grained porphyries represented by the other numbers.
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