Book 349 - 30 insert after page 18.

p 131 Bellevue, Hole 19, 250-300 ft N. of Cement Plant. (Elevation 866 A.F or level of G.T R.R. tracks).

Limestone			2
"		to	4
"			6
"			8
S S red			10
Limestone			12
"			16
Blue argillaceous limestone and calcareous shale			18
Light bluish or grayish limestone			20
Bluish gray white limestone			24
Blue shale			26
Lighter blue and more calcareous shale			28
Light gray and blue			30
Blue calcareous shale			36
Lighter blue			38
Blue			40
Light gray blue	44	to	46
Gray blue, darker			48
Blue gray	52	to	58
Darker blue gray		to	60
Lighter blue gray			62
Darker blue gray			68
Light gray	70	to	76
(Darker blue gray - overlap of samples)	74	to	78' 6"
Gypsum blue clay, pyrite	76	to	78
" " " " qtz, white			80
" " " " " sand white			82
" " " "			84
" " " "			86
" " " "			92
More shale, less gypsum, pyrite, darker			98
" " " " gray sludge			104
Blue shale, some gypsum "			106
Mainly gypsum, some clay "			112
Gypsum, clay, pyrite			114
Largely gypsum, calc.clay, pyrite			116
Blue clay " "			118
Argillaceous blue clay, calcareous Blue clay chiefly			120
Section listed just above			144
White quartz sand, blue calcareous clay, gypsum			148
Blue argillaceous limestone, pyrite, quartz sand			164
" " " or calc. shale " "			172
Buff gray, argillaceous limestone, sandy			174
Light bluish gray, very sandy and argillaceous limestone	180	to	186½
Light buff gray, calcareous sandstone			190½
Light gray argillaceous, sandy limestone (dol). white ls y			204½

Marshall apparently not reached but a strong flow of water at the bottom may indicate the top of this formation.

p 132. Drillers record of above hole.

Dirt		3
Lime rock	to	18
Blue clay		20
" "		26
Sandrock		30
Clay and gravel		39
" "		50
" "		54
Blue clay, black and white rock		76
" "		104
" "		110
Sand		118
Blue clay		124
" "		140
" "		144
Quick sand		148
Sand		164
Sand		190
Run over		194½
Sand		204½

p 133 Burt Portland Cement Quarry. Section on E side of quarry.

pp 134-5 Analyses of various kinds of stone, Burt Quarry, Bellevue.

	SiO_2	Al_2O_3	Fe_2O_3	CaO	$CaCO_3$	MgO	$MgCO_3$	
White limestone	1.30	.66	.99		95.98		2.04	10 to 1
Blue Cryst.ls. silicious	15.90	1.71	4.04		74.93		3.18	of high
Blue arg.ls. "	14.45	3.49	2.51		72.04		7.29	calc to
Red shale, silic. ls.	4.65	1.52	3.95		67.46		22.18	other
Gray Sandy, Fer. ls	16.80	3.83	4.47		61.40		13.83	
Blue clay	59.40	11.05	3.45	13.45		2.00		
Yellow SS	91.9	1.21	2.79	2.60		1.30		

Blue SS not finished Nov. 26, 1914

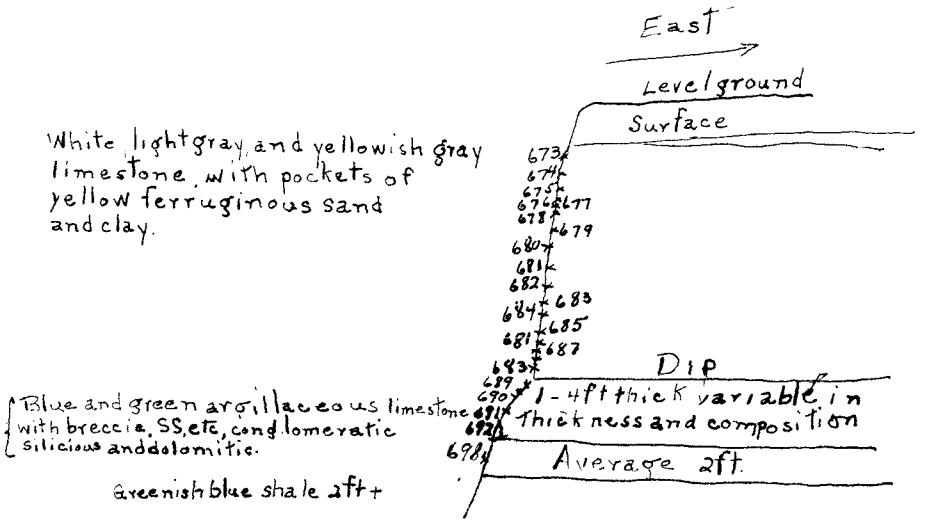
Every 3 hours, 1 spoonful, 80 per min. Collect every 3 hours. (?)

p 136 Bellevue Nov. 24. Burt Portland Cement Quarry.

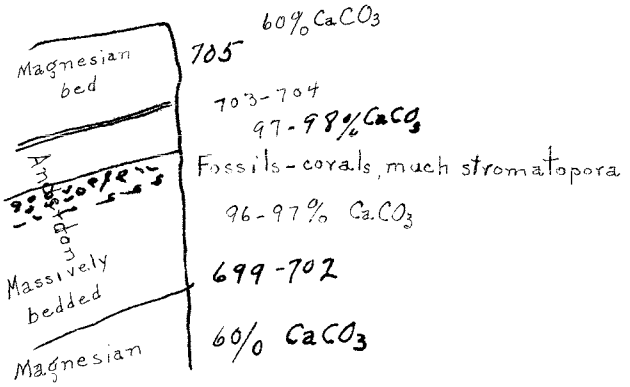
The Burt Portland Cement Co. quarry is located about one third of a mile west of the Grand Trunk depot at Bellevue and on the north side of the tracks, the cement plant being between the tracks and the quarry. The total acreage of limestone land held by the company is about 150 and only five or six acres have been worked out adjacent to the plant.

Many years ago lime kilns were operated here and these several old pits, now filled with debris. The haphazard methods of quarrying by these old lime burners and the unsystematic development of the quarry by the Solvay Co. of Detroit, the former owners, made bad conditions for quarrying. Since the Burt people have been operating, the property, operations have been carried on with the idea of developing a continuous face as far as possible. The company have two steam shovels and by the aid of these, the isolated blocks and areas of stone are being removed. The Solvay Co. dumped their strippings directly on the best stone discovered as yet in the quarry and this debris is now being removed.

Burt Portland Cement Quarry
Section on East Side of quarry



Solvay Quarry (Formerly Church Co)
Section in Lower Pit



p 156 Contd. The surface or stripping varies from about 2 ft to five but generally it is less than 3 feet. Locally there are so-called "sand pits" which seem to be sinks filled with glacial debris. Some are known to be twenty feet in depth but none seem to be more than two or three rods across. The average thickness of the surface over the property not immediately adjacent to the quarry has not been determined or well investigated.

The limestone apparently dips northeast and thickens in that direction, but unfortunately the city lies in that direction and quarrying to the NE is practically at an end. The limestone beds proper of the quarry are from 12 to 15 feet thick and form the upper strata. Beneath the true limestone lies a series of soft clay or shale, clayey limestones or calcareous shales. According to the dip the upper limestone should feather out to the west and southwest. Since the land slopes toward westward to the river, probably this limestone will be found to be much thinner or absent entirely in that direction. To the SW however, lime kilns were operated formerly thus showing that the limestone extends in that direction for more than a half mile at least.

The upper limestone has imbedded in it a sandstone lens, clean, light gray sand. At the base of the limestone, there is a zone of conglomeratic material - pieces of limestone, sandstone and quartz pebbles and grains in a calcareous shaly matrix of light green color.

p 138 Sibley Nov. 28, Bolvay Quarry (Formerly Church & Co.)

Diagram of above.

Three levels. Second level reaches to the magnesian bed at the top of the section above. Third level takes up this bed, and the underlying Anderdon down to the Monroe dolomite below.

p 141. Nov. 29, 1914. France Stone Co. Monroe.

Left Delray in morning, arrived at Monroe about 10 A.M. Met Supt and foreman of quarry, a Mr. J.W. Smith, and Mr. J.L. Lydick Gen. Supt or Dist. Supt was absent.

The quarry covers an area of about 20 acres. The upper level is about 12 or 14 ft high, the lower about 28 feet or in all 40 feet. The quarry property consists of about 89 acres of quarryable stone.

The stone in the upper level is of two distinct kinds - one, a mass of dolomite breccia and the other a massive to well-bedded stone. The first runs in belts thro the quarry and forms a source of serious trouble in that its quality is so poor that it is unsuitable almost for any purpose, especially concrete or road material. The other stone is fair to good for concrete inthe upper ledges except just below the drift. The highest layers are oxidized to yellowish or white mottled colors. The rock is granular dolomite but the lower layers are much darker with distinct, bituminous streaks, giving rise to distinct parting planes. The stone is generally not particularly hard or tough in the upper level. The stone in the lower level smells strongly of petroleum when struck. Locallya thin-bed of yellow sandstone (8-12 in thick) is present.

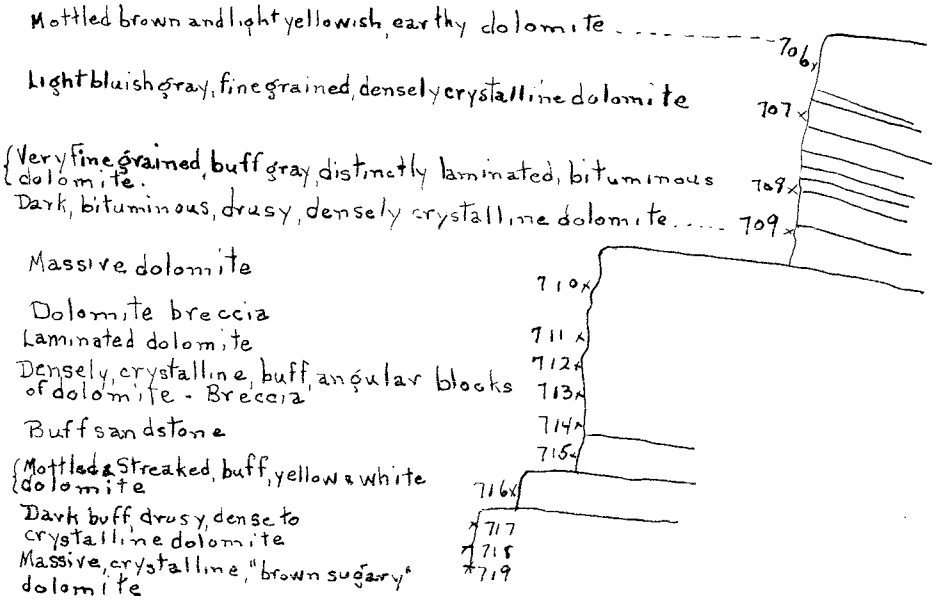
The plant consists of a crusherhouse, storage bins, crusher is a 42 inch Gates. Power is electric furnished from Toledo. Plant and equipment new and not completed. Old plant burned last year.

p 142. Diagram of above Quarry.

p 145. Morris Cummings Quarry - Monroe.

Stone quarried for small building block and concrete. No crusher or plant. Dip is strongly to the north - local dip only. Beds correspond in detail to the France Stone Co. which is a short distance to the west.

Section of France Stone Co. Quarry.



Strong dip to the W. and SW., - local dip only. Normal dip is N.W.

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p 146. Shore Line Stone Co. Dec. 3, 1914.
Location 1½ mile NE Monroe on L.S. & M.S.Ry. Crusher plant and boilerhouse - No.9 crusher. Produce crushed stone only. Face of quarry 35 feet. Massive stone top to bottom. Sec.43 Ft on S. side. Crushers, 9, 5, 3. 1000 T cap. Two drilles. Overburden 5 ft average. Hand Stripping. Stiff blue clay.

American Silica Co. Rockwood, Detroit (Now 11-7/17) R.C.Pryor. W.B.Hoar, Timekeeper, A.T.Pryor, Gen. Mgr. P J.Dempsey, Gen.Mgr-Supt. 1915
Capacity of washery and crusher 250 T per day. 1 steam shovel.
700 T storage capacity.

Diagram of section of above.

p 147. Shore Line Stone Co. Monroe, Nov.30,1914

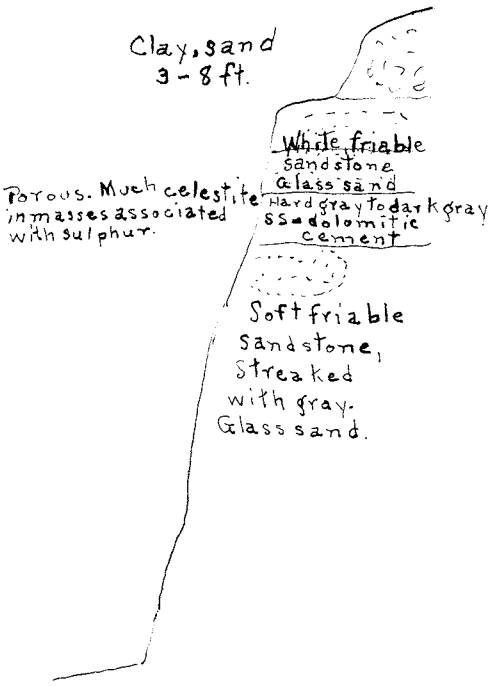
Diagram of above.

p 149. Dec. 2, Dundee. Macon Quarry Co, 2 miles NE of Dundee, Monroe Co.

p 150. W.N. Thayer, instructor in Geology in the Emery Institute, Cincinnati. M. A. from Cinn. Univ.

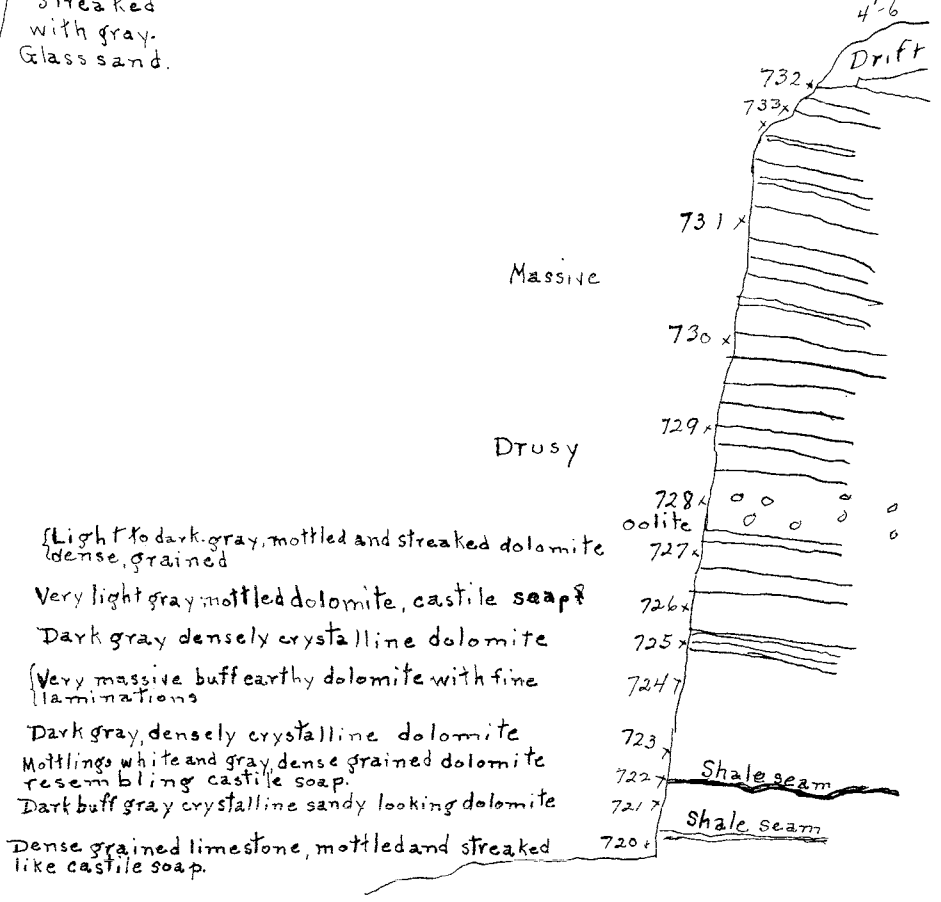
p 151/ Mill Creek Quarry 4 miles SE Mackinac City, Cheboygan Co. Notes.
Sp. No2 from Sta 35 or 34 On creek bank. Stone similar to that in Quarry.
Sp. No 3 (2 pieces) Creek bed 1200 ft from mouth or at Sta. No 7.
Sp.4, Sta. 36. No.4 at top and No.3 at bottom. 6 ft ledge.
Sp.7 top at Sta. 12, 500 ft upstream.
Sp.8 bottom " " 12 " "
Sp.9, Top of terrace at 700 ft, 16 ft above creek.
Sp. 11 & 12 at Sta. 15. Ledge 18 ft above creek. Very little overburden.
Sta. 18 & 20. This is the face from which the Geol. Survey sampled and analyzed 22 ft face to creek bottom.

pp 162-3 Black Lake. Traverse and diagram/



1.

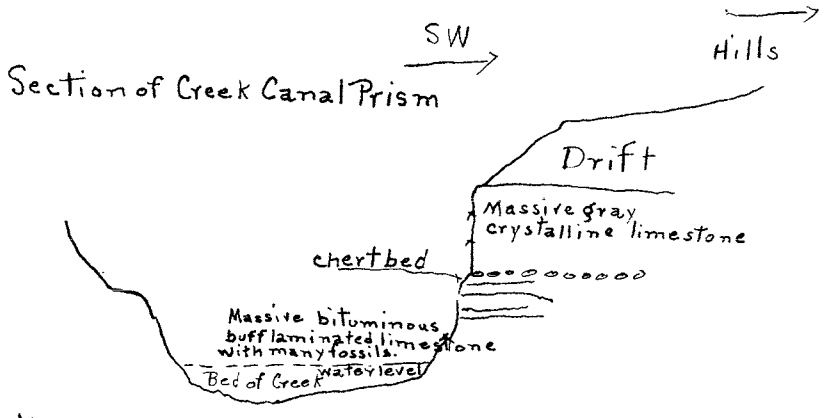
Page 147



2.

Shore Lime-Stone Co. Monroe.

Page 149



3

Macon Quarry, 2 mi. N.E. of Dundee, Monroe Co.

Book 353 - 1 insert after page 18

p 1. Sun table.
p 2. No map on S Fr.(?) East of E. 8th line on Sec. 17, West on line between 13 and 14 - 39 - 29.
North fr. (?) West as far as W½ of W½ 12, East about to line between 16/15 - - 16-39-28

p 3. Indiana Mine.
Strike about east and west but compass was badly off so could not determine exactly. Compass points with formation parallel to it. The Indiana mine is an open pit mining a low grade ore, really an iron formation not an ore body. The mine is opened by a vertical shaft 100 ft to first level. This is the only level and is used to mill the ore down from the pit. The overburden was stripping. The shaft is in the footwall. The formation belongs to the Trader members and dips about 45° on the average south. Exact strike could not be obtained. Assuming an E-W strike, the axis of the anticline and syncline of mine folds, strike S 65 W. The axis of the fold that is overturned (?) dip 75° S and pitch 25° west. All observations on mine folds made ar east end of pit.

p 4. In the east end of the pit the formation is exposed for 45 paces across the strike. The foot and hanging are not exposed. The rocks are typically ferruginous chert. The chert is interbanded with the iron bands which consist of blue specular hematite characteristic of this range. Near the base of the formation the rock the rock is on plane (?) like a fine grained graywacke (?) banded bed, the bands (?) contain considerable hematite (?). The Traders quartzite - - -
The general strick in the pit is a curve(?) . At the east level(?) the strike turns slightly NE and at the west end slightly NW, assuming this strike in the center is E-W.
p 5. Diagram of structural movement in Indiana pit.

p6. The Trader formation as exposed in the pit consists from base up of 1st a gray fine banded ferruginous rock, contains considerable iron matter, such(?) matter with a yellow tinge on the surface of bedding and joint planes. This rock contains much chert (some chert) bands but appears to have considerable fragmentary material mixed (mineral) with it. Above this is a ferruginous chert with gray and dark red chertp generally fine grained, alternates with bands of blue steel hematite. This rock weathers red.
Above this a fine banded plane more slaty in appearance and contains red bands of hematite and chert and mixed (?) hematite and possibly fragmentive material.

pp 7-33 Traverses with diagrams and sections as exposed in the various holes of the Loretto mine

p 34. Note on outcrop of Hanbury slate near crossing of Wis. Central and main line of C. NW in Sec. 13, near Loretto mine. See W.I.Robinson notes. The main strike of schistosity is N 63 W, of formation N 80 E (or W) and I conceive that the structure is like this.
Diagram of above.

p 35. Notes on exposure of quartzite near Sturgeon Falls. Strike of schistosity near contact in fine grained bed N 65 E. Major joints N 76 W, Dip 40 N. ♣ (?) of quartz is larger below falls. N 65 W, dip 75 N. Major joint N 55 E, Dip 55 S, Iron follows this. Joint min(or). N & S dip 70 - 80 W.

p 36. Diagram of traverse carried thro on p 37.

p 37. Aug. 9, 1920 250 W - 490 N of center 13, 510 N - 130 W of center 13.

p 37. Note A. Contd. Shaft with dump in cherty iron formation and probably some ore (about 300 tons). The formation is dark colored, very little red showing and consists of alternate bands of blue stell hematite and dark red gray and purple jasper. From general appearance the material looks like Curry rather than Traders. Note. B. Shaft in same material as at Pit A.

pp 38-40 Diagram of traverses. Also diagramsof above notes.

p 40. Note. This outcrop of dolomite consists of alternate layers of cherty, massive, fine banded dolomite with which are interbedded layers of from 1 to 4 ft of intraformational conglomerate.

p 41. The conglomerate contains partly rounded and angular pebbles of conglomerate. The long axis is almost invariably parallel to the strike of the rock. And above the conglomerate layer near the base of the exposure are more of these slaty beds of slight reddish tinge.

Diagram of above.

p 43. Notes on outcrop of conglomerate, 900 paces W of E ¼ Sec. 3-39-29. See W.I.R. book for further information or comment.

This outcrop is a conglomerate made up largely of pebbles of white cherty quartz and possibly quartzite. These pebbles appear to be chert from an iron formation and there is one large boulder of jasper containing blue steel ore typical of the Vulcan iron formation. The pebbles are all oriented (?) with their long axis striking N 63 W. Dip is uncertain but probably steeply South. For the most part the pebbles are angular to partly rounded as if not transported far. The matrix is massive quartzite material with a considerable amount of iron oxide. A significant feature is the termination of the southern belt of Magnetic just east of the exposure.

At the west end of this exposure there are pebbles of gray slate. Some pebbles possibly dolomite were found in float conglomerate near outcrop.

p 44. American Mine.

Shaft rich red ferruginous chert characterized by a deep purplish red tinge. Very similar in appearance to the Mansfield formation. Strike at American pit nearly N & S and dip vertical on east side of pit and about 75°E on west side of pit. Probably a fold formation, looks like bed (?) Gogebic at Mansfield and practically as rich at America.

pp 45-49 - Diagram of traverses.

p 50 J. M. Longyear drilling at Mansfield, South of bridge. Section.

p 51. Notes. Noted pit 75' N and 30' E of "C" shaft W. Vulcan. Pit in brier slate. dipping S 70°. Strike about east and west. Exposure marked of quartz veins dipping N 70° Strike about N 80 W. Minor fold (illustrated)
pitches ? at flat dip Brecciated zone.
Marked by truncated zone in axis which dips N about parallel to quartz veins

Spec. B 1. Sketch along end into pit north of "C" shaft.

Note C. The iron formation in the west pit of No. 4 shaft is a hard black weathering rock made up of bands of hard blue steel ore and silica. Some of the silica is blood red or purple and as a whole the rock more resembles the Curry than the Traders, tho from the position (or maybe pitch) it ought to be Traders. The iron formation weathers characteristic hard black, more like a hard ore. Spec. BB.

p 52. Notes. Spec. B 4-5-6.
Spec. B 4 from small cave just south of No. 2 shaft. This rock is fine banded light grayish red rather coarse grained and earthy in appearance. It may be altered graywacke or possibly an altered dike overlain by iron formation which is typical Curry with purple wide bands of chert and in between slaty and cherty iron formation. Spec. B 5 Curry I. F. Spec. B 6. Slaty phase interbedded with more cherty phases.
Spec. B 7 dike ? from entrance to pit No. 3. The rock is dark green to light gray and in places stained red and brecciated. It is a small dike cutting across the formation. Strike N 80 W, dip 75°N. On the east side of the entrance the rock into which the dike is intruded is brier slate dipping 60°S and striking about E-W. On the west side of the opening the rock is slate and dip S but strike NE.

p 53. On the SE end wall of the pit the following (or folding) in the slate is like this sketch.
Diagram.

This locality like the pit near #4 shaft is marked by quartz veins running up thro the axis of the drag folds. The big quartz vein in the sketch occupies the axis of the syncline. The folds pitch east about 10° and the same is true of the gentle open syncline just south of the quartz vein. The rock is all brier slate. Thin banded red slate.

p 54. Note D # 3 pit.
The East wall of the pit exposes slate with a small amount of formation near the base. In general the strike is north and south but it is a series of minor folds pitching east. The west side of the pit is hard black Traders iron formation striking nearly N & S and dipping E at about 20°. (?)
Two possible hypotheses are given as explaining the(strike)change in strike in this pit. One a cross fault with the east side the down the side. The other that we have here the plunging - more of a drag fold. (Illustrated)

Near the north end of the pit is a block of Traders Iron formation that may not be in place, but in general it appears as if it were. This block has an ore breccia on its east side and butts (?) up against sandstone ?. This fact indicates faulting but is not conclusive. The folding is indicated by the general appearance of the pit and the occurrence of formation under slate on the east side of the pit at the base of the cliff.
In addition to the above facts there is a fault breccia along the south side of the pit striking about n 65 W. This may be a fault breccia.

Note E. New pit south of #2 pit all in brier slate. Strike N 70 W. dip 70 S. prominent quartz vein. Strike N 60 W, dip 70 N and apparently cut in on line of weakening (?) axis of minor folds.

p 56. Spec. B 8. Traders Iron formation, typical.
Spec. B 9. Red dolomite just north of pits and trenches near Baxter - (?).

Woods Shaft, Spec/ B 10. This shaft according to the map was sunk just south of the contact between the Curry iron formation and the Hanbury slate. The clump (or dump) shows typical Curry formation and some red banded slate. The latter may be the hanging Hanbury but it might come from brier on a cross-cut. The jasper is a typical Curry, bands of purple spotted silica and bands of blue slate ore. The broken surfaces of the rock do not weather red as in the case of the Traders and the rock has a more slaty or platy cleavage.

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p 57. Spec. B 10 contains instead of the rhombohedral blocky cleavage that seems to be characteristic of the Traders, the chert (Spec. B 10) sample and strike dip is typical. It is not a dense chert but seems to be made up of fragments, sometimes blood red grains with grains of blue steel hematite, sometimes the chert seems to be interstitive around the hematite grains, other times the hematite seems to be interstited around around the chert. Should be examined microscopically. The rounded grains are somewhat suggestive of grunertite.

p 58. Spec. B 11. From small dump at exploration shaft on Traders north of Verona Shaft. The formation exposed is typical trader. 1st. It breaks into smaller fragments on the dumps, an average of under an inch is the rule, though larger are of course seen. The fragments are blocky and rhombohedral.

The dumps have a reddish tinge, typical Traders characteristic, while the Curry dumps are black. The jasper is lighter red than the Curry , often a vermillion making it appear very much like the Negaunee jaspers. The jasper is denser and these fragmental ? planes similar to the Curry are seen. The grains are finer and much of the silica bands are dense red-blood-red jasper. One could say Curry jasper is purple Trader blood red. Spec. 11 B is chip of Traders jasper. The iron oxides is blue steel hematite but with a slight reddish tinge.

Spec. 12 B, #1 Shaft East Vulcan.

From N end of pit. The formation about 50' thickness is exposed in the pit. The hanging slate is exposed but not the foot. In the north end of the pit is a wide red silica band 7" to 1". The silica has every appearance of being fragmentive with blood red rounded spots in a dark purple matrix. Spec. 12 B. The iron formation dips nearly vertical but at the shaft there is a roll over to the north so the formation dips south.

Small diagram.

Pit at mouth of tunnel to No. 3 shaft, East Vulcan.

Diagram showing relation of minor fold to strike and quartz vein cutting through sheared zone in axis of folding.

Fold pitches East, plane dips north, formation dips vertical. This fold exposed 25 paces in pit from mouth of tunnel on east side of pit.

Cross section of above fold.

p 61. Diagram - Plan of Pit.

The south end of the pit is in red slate. In - (?) the banding is not easily seen but seems to be parallel with the cleavage which strikes N 80 W and dips vertical. The fold described above is in the slate.

The iron formation is exposed north of the slate. In general color it is Traders rather than Curry as there is considerable reddish stain along bedding planes and joint planes. It breaks into plates and large fragments, a Curry characteristic and the bedding is wavy, another Curry characteristic.

At the top of the pit on the north side is a large fold ,only part of which is exposed, apparently the top of an anticlinal zone (?). The formation is here brecciated and broken. The fold axial plane appears to strike N 60 W and pitch east. Dip uncertain but probably north. Robinsons collection of specimens of chert from the formation for later study. Spec. 13 B .

p 63. # 3 shaft East Vulcan. Shaft comes up the (or thro) old open pit. This pit is in dark blank, typical Curry I. F. in color and akl other characteristics. There is a fold in the formation exposed in the pit.

Book 353 - 5 insert after page 18.

(or stope)

p 63. Spec. 15 B. Note A. Strike(or shaft ?) coming to surface 150 paces W and 50' N of No. 3 shaft, East Vulcan . Hard black formation striking N 65 W about 6 feet of ore shows on east face. Fold small in cross section (illustrated) similar to fold in slate at pit at mouth of tunnel #3 shaft. Formation black like Curry. Dip of formation nearly vertical. Specimen is rather near ore.

p 64 Diagram of #1 Tunnel

p 65. Location of N.3 shaft tunnel, East Vulcan. Shaft 890' N 800 L of 10/11/15/14 Mouth of tunnel 500' N and 675' E of 10/11/15/14/ Tunnel is 400 feet long. Strike N 13½ E.

Mouth of Jones pit tunnel is 830 W and 500 S of center Sec. 10. Strike N 15 E. 320' to Jones pit shaft.
Strike of #1 tunnel N 30 E.
Strike of #2 tunnel N 25 E.

p 66. Diagram illustrating folds.

p 67. 500'. Note A. Chert badly brecciated and weathered from surface. Chert bands from 8 to 4 inches. Chert is dark colored. Interbanded with chert are seams of dark blue hematite. Slight reddish stain on joint. Spec. of chert 17 B.
Spec. 22 B from 450. From about 480 to 450 the rocks are badly folded and the folds pitch east.
Note A. The contact between the slate and the South or Curry formation seem to be a stepping (?) plane. On one section the beds of slate cut into the plane thus. The jasper is uncertain. Diagram.
Just at the contact there seems to be a conglomerate phase in the jasper which has been cross-cut by ore. Spec. 25 B.

p 68. Diagrams of folds.

p 69. Horizontal section of small folds in slate.

Cross section of main fold near 300. This fold is 8 inches across and pitches 10° East.

At 300 the banding in the slate averages ½ inch in thickness. That is the colored bands. At 350 the banding was part as fine as pencil lines with some bands a half an inch thick.
At 385 there is a folded zone with marked dip (?) and minor folds of the typ- (?) One fold pitched east.

p 70. Toward the base of the Brier from 200 south the banding becomes fine and less exposed. At 100 it is difficult to distinguish.
There is no marked cleavage in strike. Dip strikes up as zone approaches Traders.
At 100 there is a quartz vein striking at nearly right angles to cross cut and dipping 75 N.
Trader formation . upper 30 ft hard jasper with wide bands and thin bands. Some bands 6 inches wide. Silica predominates only in band. Some jasper flinty and dark, other bright red and other spotted.

Book 354. L. P. Barrett No year found. Plats of Explorations and cross section of mines and drillings in Iron County. Made in connection with Iron County Map. Entirely technical - maps etc. Iron River Notes.

Book 355 July 5, 09. R. C. Allen Iron River Notes. Diagrams, Traverses and description of specimens. See additional sheets.

Book 356 - Apparently 1920. Mine appraisals - Eureka, Longyear, Meteor, Castile, Plymouth, Brotherton, Yale, Colby, Ironton, Winona, Newpost, Paleous, Keweenaw, Townsite, Ashland, Bates, Munro, Hiawatha, Rogers, Homer, Bristol, Davidson, Zimmerman Dunn-Richards, Tobin, and Odgers.

Book 357 - No year - No name. Description of Traders formation in the Vulcan, East Central, Brier Hill, Forest, West Vulcan, Norway, and Quinnesec mines. See additional sheets.

Book 358- L.P.Barrett. No year given. Only a few pages of notes on the sale of stock of Kirkland Lake, and misc. notes and description of drill cores from Tully and Kalz explorations.

Book 359 - L.P.Barrett. No year given. Notes on Low grade ore investigations Analyses of samples from Loretto, Berkshire, Warner, Amasa Porter, West Chapin, Pine Bluff, East Central, Norway, Forest, McKenna, Oliver, Pewabic, Breen, Chapin-Ludington.

Book 360 - From Handwriting could be Barrett. First part of book description of buildings and mine of the Golden Age Mine. Then follow a few pages description of Lands of Limestone Co. in Sec. 20,21,28, T 35 N. R 6 E. by R.A.Smith. Then a page noting equipment of Demming Mine. See additional sheets.

Book 361. No name Handwriting could be L.P.Barrett. No year. List equipment production, valuation of Mich. Gypsum Co. U.S.Gypsum Co., France Stone Co., Sibley Quarry , White Marble Lime Co., Fiborn Limestone Co. Northern Limestone Co. Mich. Alkali Co. Great Lakes Stone & Lime Co. Also cross sections of level in the Central Co and Colby Mine. Lists a number of backers and owners of Central Copper Co.

Book 362 . Iron County Rocks - Specimens 25371-25707 No name or year. See additional sheets.

Book 363 - O.F.Ravell - Hiawatha Development Co. Survey almost entirely in figures and readingsin Indian Lake. Garden Pen., Whitedale, Engadine, Calspar, Gould City, Drummond Island, Detour, Trout Lake and Ozarks.

Book 364. O.F.Ravell, 1930. Only a few pages of notes mostly figures. Survey around Whitedale, Maple Grove, Cooks. Same as above.

Book 365 - Party, Way, Belknap, Calvert, Walker. Surveys almost entirely in figures. Locality, Burnt Bluff, Garden pen., McDonald Lake, SW cor sec. T 42,12 W.Mackinac county/ Only a few pages

Book 366 - Same handwriting as above. Surveys in T 43 N, R 15 W. Marble head, Gould City and Drummond Island. Almost entirely figures. July 1930.

Book 367 - Party - Calvert, Walker, Sohlberg, Belknap. Surveys in vicinity of Manistique, Whitedale, St. Ignace. 1930. Almost entirely in figures.

Book 355 - 1 insert after page 19

R. C. Allen

p 1. Diagram of Jumbo exploration.

The outcrop mapped on this page presents various phases of what appears to be greenstone. The rock is shattered along innumerable planes so that it breaks up in small irregular blocks. At X are two massive blocks of typical shperoidal greenstone. The spheroids are however only weakly developed but the suggestion of spheroidal parting are unmistakable. The weathered surface is typical of Sp.95. Spec. 20 to 23 are typical phases of this rock.

p 2. July 5. With Ray Willoughby visited outcrops south of the Brule River in Wis.

At the Jumbo exploration along the south side of the Brule just east of the bend in the river near the W¼ post of Sec. 23-42-34, Mich.is an outcrop of greenstone about 200 feet long. The rock is sheared along many planes so that it breaks up into innumerable small blocks . Near the south end of the outcrop are two massive phases which have escaped the shattering which has affected the greater part of the rock and here it has the unmistakable appearance of spheroidal greenstone. The spheroidal parting is however weakly developed. In parts the rock appears to be Tuffaceous.

Specimens 20,21,22,23 are typical phases from this outcrop. Speciman 20 is a slaty phase into which the greenstone actually grades. Pyrite is abundant in all of the greenstone producing a red rusty outcrop which seems to have induced exploration as a drift was begun in the face of the outcrop but abandoned after 2 or 3 ft of progress.

South of the outcrop of greenstone are some old pits on the dumps of which was found banded chert and some black slate. The slate and greenstone appear to be interbedded in an outcrop south of the bend above referred. (traverse of E.B. 1908) but this outcrop was not seen.

p 3. The Dolomite which occurs in outcrop south of dam about 1 mile east of Saunders was examined. In placesthis rock is coarsely crystalline and free from quarts, in others quartz and chert make up over half of the rocks. Brecciation and shearing have obliterated bedding and dip and strike could not be observed.

This rock appears again at a rock cut 2100' south of the crossing of the Brule by the Connorsville branch of the C & NW Ry . Where not sheared this rock is coarsely crystalline but for the most part it is intensely sheared in direction about N 80 E. In places the rock has developed a slaty cleavage. The weathering of the rock shows it to be highly charged with iron. The following di agram is a fold observed in coarse rim-like material in this rock.

p 4. Diagram

Folding in dolomite rock cut 2100' S of point of crossing of Brule by C.N.W. near Saunders.

Diagram

Prominent Joint System in dolomite at dam on Brule R. 1 mi. below Saunders.

p 5. Spec. 27. Dolomite from hill at down 1 mile below Saunders on Brule River.
Spec. 28. Chert bands from dolomite at dam on Brule R. 1 mi. East of Saunders.
Spec. 29. Banded chert from pit on Jumbo Expl. about 100 paces. South of Greenstone outcrop on Brule River.
Spec.30 Veinlet in dolomite in cut 2100' S of R.R. bridge across Brule, S. of Saunders
Spec.31. Dolomite - location same as Spec. 30.
Spec. 32. Dolomite location, same as Spec. 30.

p 6. July 7. With Ray Willoughby visited the 275' and 350' levels of the Zimmerman Mine. See blue prints. The general trend of the Iron formation is approximately E & W. The hoisting shaft of the mine is sunk in iron formation, but prospect shaft 40' W of hoisting shaft is said to be in black slate. From the hoisting shaft at the 350' level a drift has been run due E a distance of 420' in iron formation all the way. The dip of the formation is, on the whole, steeply to the N but this general dip changes locally due to folding. The iron formation appears to lie between 2 walls of black slate, which are encountered in cross-cuts to the N and to the S. Work has been stopped in every case where these slates have been encountered in cross cutting. The width of the iron formation in this level seems to increase toward the E. This may be due to flattening of the northward dip which is well shown in the ends of the southward cross cuts at the E. end of the works, and to repetition by folding, as numerous closely compressed folds occur. The axes of these folds are usually along a N-S direction. A few small bunches of ore are encountered on this level and in each case they were associated with more highly deformed and folded areas in the iron formation. A body of ore from which some 6000 tons had been stoped, lies between the 2nd and 4th levels. The body is some 90-100' long, measured on the horizontal plane on the 4th level, from whence it trends upward at an angle of some - ° to some distance above the 3rd level. The south wall of the ore body shows black slate at one point on the 3rd level, about the middle of the ore body, and soap rock is said to form the N wall.

The boundaries of the ore body are not sharply defined by these walls. Very frequently lean ore, showing chert content highly decomposed and soft intervene between the walls and the rich ore. he body forms, on the whole, a "chimney" pitching toward the E. On the E & W the ore grades off into lean ore and iron formation. At nearly a central point between the 3rd and 4 th levels the foot and hanging walls seem to approach very near and it is thought by Mr. Burridge, Supt. that the walls come quite together under the body (ore) and cut it off.

p 8. Diagram SW¼ of NW¼ Sec. 36 - 43 - 35 W.

p 9. July 9. With Ray Willoughby worked on Sec. E-W across Stambaugh hill S.36-43-35.

Magnetic Black Slates.

sp. 36. Beginning with an outcrop in the road 40 to 50 paces south of the SE corner of SW of SW of 36 and continuing thence N 30-35°W across the top of the hill as shown by numerous outcrops. Shown on field plat is a belt of banded black magnetitic slates. Spec. 36-37.and 38. The banding is prominent and marked on outcrops by bands of lighter and darker color, less silicious and more silicious etc. The weathered outcrop is yellow to brown. In these slates are found occasional thin bands of chert and in one a short band of red jasper about 1½ inches thick was noted.

The general strike is N about 30-35 W and the dip is vertical or highly inclined toward the west or SW usually 75 to 90°. The schistosity is usually parallel to the bedding or nearly so when the dip is vertical. When the beds are not vertical they cross the schistosity at an acute angle being less steeply inclined than the latter.

The slates are affected by minor folding of the character shown on diagram with plat. The pitch of the minor folds is westward - S-westward and N-westward. In the diagram a minor syncline is overturned toward the south and pitches SW.

Ferruginous Graywacke - Slate.

On the sides of a small ravine in which is the W¼ post of Sec. 36-43-35 is a great deal of loose material which seems to be in place although its outcrop here was not seen, but it occurs on the dump of an old shaft 130 paces W of the W¼ post of Sec. 36-43-35 just south of the line.

p 10.
Sp. 43,44,45,46,47. These rocks are gray- blue- black- brown and red granular not slaty as a rule but sometimes verging toward slate. Usually they are ferruginous and when encountered in drill cores have been termedn "sandstone" by drillers and engineers of the district.

Conglomerate. Sp. 39,40,41,42.

In the loose material referred to in above paragraph there occurs abundant fragments of conglomeratic material. The matrix is of the same material that composes the rocks described above and represented by Spec. 43-47. The pebbles are angular to sub-angular and comprise black slate and whitish and greenish material - much altered and as yet undetermined.

The graywacke slate and conglomerate etc, grade westward into cherty carbonate rocks mixed with the slates and conglomerate as shown in outcrops and talus at the mouth of the small ravine (see plat) and in dumps of shafts about 112 and 130 paces west of the ¼ post. In the dump of a pit and shaft at 112 paces (see plat) is some material which might be called ore. In this dump was found Sp. 47 in which the fragments of chert look very much like pebbles. This specimen resembles another taken by Mr. Conrybear from the footwall of the Dober (?) mine.

p 13 Diagram of traverse.
p 14 July 10 T 43-35

Section on road from Stambaugh Station up the hill to the village. The outcrops of jasper at the south end of Riverton pit are very much crumpled and shattered as is the formation on the walls of the South end of the pit. Sp. 48

Sp. 50. On the extreme S edge of the pit is an outcrop of massive ferruginous graywacke which we correlate with the ferruginous sandstone, graywacke and conglomerate at the W ¼ post of Sec. 36.

Sp. 49. (See plat) appears to be a chloritic mashed phase of conglomerate carrying quartz pebbles and grains and fragments of chert. It correlates with the conglomeratic horizon near the W ¼ post of S. 36 and with similar material in the dump of an old shaft 130 paces west of this post and just south of the ¼ line near the road. This conglomeratic horizon seems to swing southward around the Riverton Pit, possibly forming the footwall of the ore body as similar material - i.e. sandy and graywacke like fine grained material with which the conglomerate is associated , is shown in dumps of pits just south of the north end of the Riverton open pit. South of the conglomeratic and fine grained graywacke - sandstone horizon is a belt of lean unoxidized cherty iron carbonate on the strike of the magnetic black slates on the hill near Stambaugh High School.

pp 16-17 Traverses.
p 17 Note. A pit 100 paces N and 280 paces W of 1/16 post in N.S. Road north of Selden residence shows what appears on dump to be conglomerate. The rock carries chert fragments which resemble pebbles in shape. The matrix is iron oxide and in some cases the contact between pebbles and matrix is not sharp enough to preclude the possibility that the "pebbles" are not cores of cherty iron carbonate which has been replaced with iron oxide.

p 18. Traverse. Pencil note. Outcrop in R.R.track beginning of rails S of Dober R.R. crossing and thence N 100 paces or 240' Striking N 40 to SW. Black slate is interbedded with fine grained chert and unoxidized cherty carbonate. Near N end a belt of yellow weathering graywacke comes in. Dip is westward. Minor folding.

Note. Sp. 61,62,63. The rocks platted on this sheet have been referred to as greenstone by Mr. White of the C.C.Co. On examination they seem to be sericitic mashed and sheared gray to black slates dipping vertically or if inclined - in general northward and eastward . According to Mr. Whiting, Eng. at the Youngs mine they form the footwall of the Youngs mine and accord with the strike of the iron formation in this mine.

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p 19. Outcrops on W. side of R.R. track beginning 510' south of R.R. bridge at Dober mine and thence outcropping for 240', striking N 40-50 W with dip on the average about vertical - perhaps inclined a little eastward. Black slate on south end becoming much interbedded with unoxidized cherty iron carbonate and some ferruginous chert. Near north end a belt of yellow weathering sandy material comes in - graywacke ?

Outcrops of dark partially oxidized I. F. occurs N 51 W., 125 paces from S end of Dober R.R. bridge. Outcrop of yellow weathering (Spec.)Graywacke occurs N 55 W, 200 paces from S end of Dober bridge.

Spec. 66-67. Outcrops of partially oxidized cherty I. F. and slate to graywacke occurs in road and in river bank at and for 25 paces north of bridge across Iron River in south part of Sec. 1-42-35. Strike N 44 W.

p 20. Diagram of location in NW¼ of SE¼ Sec. 16-43-35

Note. This exploration is being conducted by John Sipchen (churn drill). The gray and black slates encountered in these holes are typical of those found elsewhere in the district. The black slates are graphitic and pyritic. The surface covering is from 75 to 80' in depth in all of these holes.

p 21. Note. An attempt to locate by pacing an outcrop of greenstone was made, the topographic map being not sufficiently accurate for the purpose. The diagram of the outcrop on a scale of 200 paces to the inch appears below and distances and directions from crossing of R.R. bridge over Iron River.

N 45 E - 200 paces
N 15 E - 500 p to R.R.
N 87 W - 190 p to bridge

Diagram

Sp. 64.

The rock is a dark medium grained crystalline greenstone (sp 64) and is cut by a very prominent set of joint planes which divide the rock into massive beds. The strike of these planes is N 65 W and the dip 65° SE. So prominent are these planes that a suggestion of saw-tooth structure is seen in the outcrop. Other joint planes are very much less prominent.

Diagram of above structure.

p 22 Diagram with explanation. This point is S 50 E from R.R. bridge across Iron River. Outcrops platted on this page are finer grained and more sheared than those S of the bridge acorss Iron River (See notes of this date) No definite set of joints or shear planes was noted. Spec. 65. Location given S 88 E - 2070 ' to point 290 paces S of SW corner of NW¼ of SE¼ of Sec. 16-43-35. (On R.R.)

p 23 Diagram showing vicinity of Isabella pits.

p 24. July 24,09. Konwinski Shaft.

This shaft is in iron formation which has been somewhat enriched, tho nothing that can be called ore appears on the dump. The shaft is full of water and is cribbed making underground examination impossible, but Mr. - Munroe says that the formation trends E - W thro the shaft. The formation seens to be free from slate and consists of banded cherty iron carbonate altered to jasper. The iron oxide bands are rather hard and are limonite like the are from the James mine. Sp. 69 is typical of the material on the dump.

p 25. Diagram showing location of above shaft.

p 26. Diagram showing Nonaimo Pit and Beta Shaft.

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pp 27-28 Diagrams of exposures near Iron River.

p 29. With Ray Willoughby, platted greenstone outcrops in N½ of N½ of Sec. 13. Greenstones outcrop in a low ridge extending from the road leading diagonally SE across the NE¼ of the NW¼ to within 80 paces of the Iron River. These rocks present a great variety of phases. The location of the different phases is indicated on the accompanying plat and are illustrated by the following specimens. Massive, No. 76; Variolitic, No. 77 (Westhered surface); Variolitic, No.78, (Fresh fracture); Agglomeratic, No. 79 (Fragment embedded in matrix of similar but somewhat finer grain).

Associated with the greenstones are various slaty phases of greenstone, cherty and ferruginous slate, occurring in a talus of angular very large fragments at the base of the hill on the north. These rocks do not outcrop but are evidently very near their place of origin as they show no signs of attrition. These rocks are undoubtedly associated in origin with the greenstones and seem to represent gradational phases between them and the iron formation rocks. Exact descriptions can be given only after petrographic examination but it is recalled that similar slaty rocks may be observed on the hill just east of the Mansfield mine where they are interbedded with spheroidal greenstones. Various phases of these rocks are represented by Spec. 80,81,82.

p 31. Diagram with pencil note.

Crossed Sec. on (?) Lines platted. Hardwood forest. No outcrops. High hill probably of Saunders dolomite since this rock was reported to have been struck at depth of 40' in well near NE cor of SE of SE of 23-42-35.

p 32 Diagrams of traverse in vicinity of 18/17/19/20 and 17/17/20/21 - 42-35

p 33 Diagram of outcrop near Sheridan Hill.

p 34. 7/30/09. With Ray Willoughby, drove from Iron River to Sheridan Hill. Began traverse at point 600 Ft E of SW cor. Sec. 17-42-35 and ran on section line thence E 3300 paces in dense hardwood timber all the way. Red, white, and red dolomite float as abundant on this line but no outcrops were found. Those that are marked on the topographic map of C.K.Leith's do not exist (?) . At a point 1100 paces E and just N of the sec. line is a deep pit on the dump of which are a good many tons of soft friable sandstone (sp 75) which is most probably of Cambrian age, tho no outcrops of this rock were noted. From this point a trail leads south by a little east to a couple of pits on the east slope of the hill. On the dump of the first of these marked on the traverse is found abundant ferruginous, dolomitic, quartzite. (Sp. 70).

The southernmost pit has been cribbed to a depth of 60 to 80' at least below which water conceals the workings. (p 35) The rocks on the dump are (1) gray cherty dolomite, Sp.71, vitreous quartzite, Sp.72, and gradations between the two, and sandstone conglomerate carrying pebbles of the dolomite and quartzite formation. This conglomerate undoubtedly lies at the base of the sandstone formation already noted and marks an unconformity between the Saunders formation and the overlying sandstone. Seamen (quoted by Leith) suggests that this sandstone, a conglomerate, represents the base of the Upper Huronian. This seems highly improbable from the lithologic character of the rocks and the similarity of relations of Cambrian and underlying formations of the Calumet and Menominee district . Sp. 73.

Brule Greenstone.

Near the SE cor in the NE¼ of the SE¼ of Sec. 21-43-35 is an outcrop of greenstone which in its general characteristics seems to more nearly related to the Keewatin greenstones than those of later age.

p 36 Contd. Greenish chloritic material and other material of the color of epidote with abundant calcite lining fracture planes in the rock is characteristic of the weather surfaces. The rock is extremely tough under the hammer and has a pitted surface due to the weathering out of the undetermined dark crystals. The rock has a schistose structure more evident on weathered surface than on fresh fractures, but even in fresh surfaces the constituent minerals seem to have a distilinear arrangement. Sulphides are prominent. Torsion cracks are characteristic.

Glacial striae trend in a general N-S direction but due to an oversight the direction was not measured. Sp. 74.

p 37. Diagrams of outcrops in Sec. 26-42-35.

p 38. 8/2/09/ With Ray Willoughby, drove from Iron River to the farm of Mr. R.D. Williams in 35-42-35. Began traverse at well near the NE cor. of the NW¼ of the SW¼ of 26-42-35. At depth of 15' in this well is ledge of schistose dark ferruginous dolomite. Sp 83. The dip of the schistosity is vertical and the strike of same N 65 W. From this point proceeded SE to pits in the N center of the SE¼ of the SW¼ of the section. These pits have been recently been sunk by R.D.Williams in search of iron ore, and the materials encountered have been referred to the iron formation series by engineers and others of the Iron River district. However, it seems clear from the lithologic character of the rocks that they belong in the Saunders formation and are interbedded with the dolomite and quartzite and probably lie near the base of the series. Sp. 84 to 88 inclusive.

p 39. Similar schistose material grading into massive dolomite may be seen in the R.R. cut about a mile south of Saunders. A dark slaty phase showing perfect cleavage into great plates parallel to the schistosity which strikes N 80 W and dips N 57°. This has been referred to locally as the green rock. No traces of bedding are observable in this exposure, which occurs on the Wisconsin side of the Brule River about 20 rods south of the section line between sections 27 and 34-42-35, Mich.

A still more schistose phase of this rock occurs on the north side of the Brule River in Sec. 19-42-35. These rocks(sp 89) resemble slates in every respect and have been so alluded to but it seems almost certain that these rocks are but an extreme schistose phase of the dolomite. Schistosity is vertical, strikes N 50 E. These slaty phases seem to be prominent on the south sides of the range of hills marking the course of the massive dolomite and quartzite formation. They therefore lie nearer the base of the formation and were in position to receive a greater amount of shearing during the folding to which the rocks have been subjected as the dolomite seems to lie on the Brule greenstones and the granite which occurs a short distance south of the river on the Wisconsin side.

The Brule greenstones.

Typical spheroidal greenstone and greenstone agglomerate occurs in a low ridge beginning a little east of the middle of the S half of the SW¼ of 22-42-35 and extending thence W to near the middle of the S½ of SE¼ of 21-42-35, i.e., to outcrop noted on traverse of 7/30/09. The trend of the ridge is in the direction of the secondary structures in the rocks. They are non-magnetic. The spheroids vary up to about a foot in diameter and are elongated in the direction of strike of the ridge.

Glacial striae.

Three measurements of glacial striae were made on these outcrops. The ridge is a typical"roche mouttonne" and is grooved and polished in beautiful exemplification of glacial erosion. The measured directions of ice movement are, N 10 E, N 5 E, and N 4 E. Some of the grooves are inches in depth and all of them are in the direction noted and are parallel recording the work of a single ice sheet.

p 41. Limestone-sandstone member.

We were fortunate in finding abundant fossils in an outcrop on the north side of the Brule river in the SE¼ of the SW¼ of Sec. 27-42-35. Sp. 90. This outcrop is part of a bed which occupies a considerable area of the bench ground along the north side of the Brule River. Pits have been opened in this formation by R. D. Williams in a N-S line thro the middle of the S½ of Sec. 27-42-35. The formation undoubtedly correlates with the sandstone and conglomerate formation opened in pits on Sheridan Hill, and the difference in altitude of these outcrops marks the minimum thickness of this formation. See map.

The fossils found include specimens of brachiopods, gastropods, orthoceras, crinoid stems, trilobites, bryozoa, corals, ostrocods ?. This assemblage of forms would throw this formation up to about the base of the Silurian but the exact horizon will be determined only after laboratory examination of the fossils.

This much can be stated however, the conglomerate, sandstone and limestone, heretofore regarded as Cambrian or as the base of the Upper Huronian.(Seamen).

p 43. 8/3/09. The James mine.

With Ray Willoughby made underground examination of the James mine. The shaft is located near the center of the NE¼ of the NW¼ of Sec. 23. Depth 400'. From the 300' level drift extends approximately on the strike of the formation 80' east and about 1300' W of the shaft. Dip in this drift is on the average steeply to the S but varies rapidly along the strike a few degrees N or S of the vertical. In the extreme W end of the drift the dip is on the average toward the north. Black carbonaceous slates were encountered in the breast of the W end of the drift. These slates seem to be the S or hanging wall indicating a slight turn of the strike toward the NW. This is borne out by the location of the Gleason shaft in ore formation in the NE¼ of the NW¼ of the same section and a few hundred feet north of the James shaft.

p 44. A slightly NW trend is also indicated by the results of Verona exploration on the Spies property in the NW¼ of the NW¼ of Sec. 24, where ore is encountered a little south of the James shaft. The iron formation is much folded and contorted on the third level where the most common pitch of the folds is toward the west.

A drift has been run W of the shaft on the fourth or 400' level . Ore was encountered in a drift run northward from a point about -'west, lying against a slate wall on the south and grading into jasper on the north which is bounded by a steeply southward dip in wall of black slate. The thickness of the iron formation exposed in this cut is about 138'. The ore body is 23' wide and seems to connect upward with ore on the third level showing similar relations to the slate wall on the S. On the third level the ore is thicker and crosses over a wedge of black slate as shown in a sub about 40' above the third level and descends with a thickness of 73' to the third level and below on the S side of the wedge of slate which is 43' thick as shown by a cross cut on the third level. A cross cut on the third level 200' W of the sub referred to did not strike the slate wedge indicating a pitch of the slate toward the west. In the sub which encounters the crest of the wedge the beds in the iron formation show a beautiful anticlinal structure.

The relations here described are shown in section on accompanying page. They seem to indicate a westward plunging sharp anticline of black slate thickening downward and probably connecting with a corresponding syncline to the north. In other words the footwall slates are caught in a large fold pitching westward of the same general type that may be seen in miniature in a hundred different places in the mine. That this wedge has the structural relations described us borne out by the fact that the iron formation north and south of the wedge has approximately the same thickness, between 125 and 140'.

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p 46. The fact is universal in this mine that the ore is always associated with a wall of black slate. ? .

An illustration of Secondary enrichment.

At one point about -' W of the shaft on the third level is a beautiful illustration of the process of secondary enrichment. Last Sept. at the time of my visit to this mine the third level constituted the bottom of the workings and was wet. At the point referred to, a stream of water probably carrying at least 20 or 30 gallons p per minute issued from the north side of the drift in the trough of a small syncline tightly compressed and overturned toward the south and plunging SE, i.e., into the drift. The trough of the syncline which was only a few feet across was completely altered to high grade ore. The relations described are illustrated below.
Sp. 91 is black slate from the contact between the iron formation and the hanging or S. wall of the mine.
Sp. 92 is a fragment from a layer of quartz in the iron formation.
Sp. 93-94 represent type samples of ore taken from the stock pile of the mine.

Diagrams

Diagram of small fold in James mine showing influence of local water course on ore concentration.

p 48 Somewhat idealized cross section thro James Mine. About 700' W of shaft.

p 49. 8/6/09. The Wild Cat Shaft.

With Ray Willoughby visited shaft located 200' S and 50' E of the NW corner of the NW¼ of the SE¼ of Sec. 18.

The rock on the dump is mainly very much decomposed greenstone. Sp. 95, and some slates and cherty slates, Spec. 96 to 99 inclusive, which from their disposition on the dump seem to overlie the greenstone and are interbedded in part with it. The position of the shaft with references to the dolomite to the south would indicate a steep dip of the rocks in it to the N but the workings are full of water and this inference could not be verified. The phases of slate seen on the dump are similar in all respects to slates observed at the outcrops of greenstone on the Petersen place in the NW of NE Sec. 13-42-35. (Compare notes from Hector). The inference was there drawn that these slates are near or at the top horizon of the greenstone and the same inference may be drawn from the relations shown at the Wild Cat shaft.

The slates at the Wild Cat shaft are locally altered to ore, Sp. 100, but the concentration seems to be slight and purely local and it is not expected that any considerable amount of ore will be found at this horizon.

p 51. 8/6/09. The Baker Mine.

With Ray Willoughby spent the afternoon underground at the Baker mine.

The iron formation in this mine is so folded and contorted as to give no clue to the general trend of the formation. According to the mining captain no slate of any kind has been encountered in the workings. None was seen by us in examination of all parts of the mine except the bottom of the shaft which is vertical and 550' deep. No possible estimate of the thickness of the iron formation is therefore possible from an examination of this mine. The ore occurs quite erratically in bodies of very irregular shape but apparently pitching westward. These bodies are bounded by "rotten" iron formation in which the chert is very much decomposed, so much so as to be sandy to the feel. Spec. 101 to 103 inclusive.

pp 52-59 Diagrams of traverses in 42,43,- 34,35.

p 60. 8/17/09. With Ray Willoughby made traverse as shown on plats of this date.

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p 60. The outcrop of greenstone just west of the crossing of traverse line with Iron River is of the typical spheroidal variety but the spheroids are but weakly developed. A noticeable feature of this rock is its porphyritic character developed locally in spots and along what seem to be flow lines. The porphyritic mineral is feldspar. See sp. 104. This feature of the rock is exceptionally well shown on weathered surface where the porphyritic feldspars are conspicuous in the dense green felsitic ground mass of the rock.

The outcrops of greenstone on the Wis. side of Brule River north and south of ¼ post on S line of 19-42-35 are similar to that above but show no porphyritic development. Certain slaty phases were noted and specimened. Sp. 105,106,107.

p 61. 8/17/09 Searched for a dolomite outcrop supposed to be a short distance NE of the NW corner of the SW¼ SE¼ of 23-42-35 but did not find same. The material in the drift is almost exclusively dolomite and I have no reason to doubt that the outcrop is where it is reported to be. Dense undergrowth and heavy forest prevented its discovery. A settler on the SE¼ of this section vouched for its existence and attempted to locate it for me.

p 62. 8/18/09/ Searched for an outcrop of iron formation reported by Mr. Connebear to be a short distance N. of the SW corner of 33-42-35. We were not successful in finding an outcrop but discovered a number of old pits on the side of the hill in the SW 40 acres of this section. On the dump of one of these pits we found fragments of dark cherty material, of angular form, having the appearance of pieces broken from the ledge. The other pits were apparently bottomed in gravel.

Examined an outcrop of greenstone near the ¼ post on the W line of 19-43-35. The rock has the appearance of coarse grained diabase. Sp. 108
(Note. Location must be incorrect as T 42-35 has no section 19 and 33, the Brule River cuts them out(or east) Thgy would be south in Wisconsin).

pp 63-64 Diagrams.

p 65 8/24/09 With I. D. Scott drove from Iron River north to 19-44,34. Traversed new road from SW corner Sec. 20 due south to junction of the main road in Sec. 6-43-34 and NW to NW corner of SE¼ of SW¼ of Sec. 19. From this point with Victor Demongo as guide examined exposures in Sec. 19 and in Sec. 24,44,35.
About 250 paces east of the center of Sec. 19 is an exposure of what appears to be a typical graywacke. Strike and dip observations were not possible (Sp.109)

In the center of the NW¼ of the SW¼ of Sec. 19 are prominent exposures of extremely schistose greenish sericitic slates. The rock is so highly deformed and metamorphosed that bedding is quite obliterated. Cleavage is perfect in the plane of schistosity which is vertical and strikes E-W. Stringers and blebs of quarts are prominent along schistose planes giving this structure a deceptive appearance of bedding.

p 66 Numerous test pits following an E-W direction along the 8th line forming the north boundary of the south half of the SE¼ of Sec. 24-44-35 (see map) disclose the presence of ferruginous chert associated with black and brownish slates. Structural observations could not be made in these pits but the strike is presumably E-W parallel to the structure observed in the other exposures. The presence of ferruginous sandstone on the dumps of these pits probably represent the base of the paleozoic member found on Sheridan Hill and vicinity.

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p 66 Near the center of Sec. 24-44-35 on the east and west banks of Morrison Creek are outcrops of carbonate slates (sp.110), the dominant parallel structure striking north 72 W. These slates are cleavable in at least four different directions none of which seem to be parallel to the bedding (see sp.110). Drill holes put down near the NW corner of the SE¼ of the Sec. by Corrigan, McKinney & Co. are reported to have penetrated ore. As yet the true of this has not been verified.

pp 68-72 Diagrams of traverses.

p 73. 8/27/09 With I. D. Scott made road traverses in the vicinity of Atkinson as indicated by the accompanying plat.

A brief visit was made to the McColman exploration in the NW of the NW of Sec.17. On the dump at this shaft was found considerable hard limonitic ore which is associated with banded ferruginous slates (sp. 111,112) of brown greenish gray color. More prominent than either of the two foregoing associated rocks is an extremely schistose gray probably sericitic rock (sp.113) abundantly veined with quartz which is also prominent in blebs and irregular masses. This is the rock which has been referred to by I. N. Woodworth as grey slate but it seems more probable that it is an altered equivalent of the greenstone next described.

On the dump of an excavation for a rest house at the side of the road about 300 paces N of the shaft is a large amount of extremely shattered and weathered greenstone(sp.114) carrying abundant calcite and quartz chiefly the former irregularly impregnating the rock. About 50 paces N. of this point the greenstone outcrops. The rock here is extremely schistose and highly weathered but it still retains evidences of its original agglomeratic structure. Schistosity is vertical and strike about N 60 E.

Sp. 115 represents what appears to be an altered greenstone carrying graphite. This spec. was taken from the dump of the McFarland exploration in Sec.13-43-34. Sp. 116 is a ferruginous slate from the same place.

In the NE of the NE of Sec.1-44-36 is an outcrop of graywacke slate (sp 116) Cleavage is well defined on schistose planes which are vertical and strike N 82 W. The bedding is parallel to the strike of the schistosity and dips 54° to the south. This outcrop forms a hogback whose measured direction is parallel to the schistosity for fully 400 paces. The width is about 75 paces. Glacial striae N 20 E.

pp 76-79 Diagrams of traverses.

p 79. Note. Made road traverse as platted. Examined outcrops in Secs. 19,20,29,30, T 44-35. In NW cor. of Sec. 29 a ridge of schistose greenstone in places showing faint agglomeratic and spheroidal structure. There are also dark slaty graywacke weathering white but these are subordinate to the greenstone. Greenstone is dense, fine grained and sometimes cellular on surface. Graywacke phase, Sp. 120.

Near center of Sec. 19 (see top. map) are abundant exposures of schistose green rock. Schistosity N 75 E and dip 70 N. Nothing resembling bedding was observed in this rock but the schistose planes are marked by abundant quartz veining, some veins 18" or more wide and certain fragments elongated in plane of schistosity which resemble those in fragmental greenstone. I am inclined to think that this rock is extremely schistose greenstone. Sp. 119

pp 80-87 Diagrams of traverses p 80. Sp. 121 Balck fine grained, bedding obliterated weathers very light green. Other phases are granular showing quartz & feldspar grains somewhat similar to Sp. 119 from center of 19-44-35.

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p 88 9/15/09. The Berkshire Mine.

With I. D. Scott visited the Berkshire mine and made plan and section of same accompanying this description.

The ore body is 50 to 60 ft wide at the top widening to 75 to 80 ft at the second level and pitches or rather dips steeply to the south. Graphitic slates form the foot or north wall, usually soft but often mixed with chert and becoming hard and massive. There is no well defined south or hanging wall the ore grading away in this direction into ferruginous chert and material generally to lean to mine with profit.

On the first level the ore body pinches out to the east by the approach of the lean material, forming the hanging and the foot wall. To the west, according to Capt. Puddle, the ore body grades into lean material more or less mixed with graphitic slates and connects with the opening known as the Gillis shaft on the "forty".

p 89. 9/15/09. Berkshire Mine 2.

Adjoining "forty". On the second level a drift was driven about 100 feet thro ferruginous chert when a massive brown ferruginous rock was encountered which seems to be a partially oxidized form of the lean iron carbonate rock.

This same rock was observed at no 2 shaft on the 5th level of the Dober Mine but here the rock has a gray color, drill "white" and is totally unoxidized.

A depression about 15 feet in depth is said by the Supt. Mr. Klinglun to follow the top of the ore body. The ore is being mined by the top slicing method.

pp 90-95 Diagrams.

p 96. 9/22/09. The Dober Mine.

With I.D.Scott visited the Dober mine. This mine was opened about 1897 nad has been an almost continuous producer sincethat time. It is being operated by the U.S. Steel Corporation.

The depth of the workings is 600' at the present time and I am told by the captain in charge that drill holes show ore for a vertical distance of al least 180' below the 6th level. The trend of the iron formation in the Dober is NE and the dip of the ore body is toward the NW. The dip is nearly vertical near the surface but becomes flatter in depth and from the fourth level downward averages between 40 and 50°.

The relations of the iron formation and ore to the wall rocks are peculiar and interesting in this mine. At the south end of the ore body the black slate envelopes the ore on the south, east and west and toward the NE end of the black slate swings completely around and encloses the ore body on this end also. This is shown by the workings of the mine and drill holes run horizontally from the mine workings. In the words of the Captain, "you can not get out of the Dober ore body without going thro black slate" and this seems true from what we saw in the mine and from inspection of the mine maps.

These relations can not be explained on any theory of folding and indicate that the iron formation is replaced at least to some extent along the strike by black slate. This suggestion is proven by relations observed in the mine on the fifth level where at one point in the breast of across cut rich ore grades into lean ore carrying carbonaceous material and then into black graphitic slate in the distance of 3 ft, the banding when followed from the ore into the black slate being continuous and unbroken. S. 138,139,140 represent the gradation from the ore into the black slate at this point. The question to be decided is to what extent the black slate has been replaced by ore and to what extent the relations are to be explained by original gradation by deposition.

Mr. Connebear states that he has encountered in drilling rock which have all the appearance of graphitic slates but which containby analysis 20 to 25% of iron. There is no doubt of the truth of the conclusion that much of the black slate in the district is heavily charged with iron carbonate altho on the whole the iron seems to be more frequently carried as pyrite.

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p 98. In the Dober Mine the ore frequently lies with sharp contact on the black slate the banding in the two being parallel but often there is a thin belt of lean ore between the slate and the rich ore suggesting gradational phases by alteration and replacement of the black slate.

No. 2 shaft is in hard dense gray rock probably to be correlated with the unoxidized carbonate rocks. Sp. 141

To the NE of the Dober and connected with it by underground workings is the Isabella mine. The ore in this mine is separated from that in the Dober by about 250' of black slate on the 5th level and like the Dober deposit the ore is completely surrounded by black slate. Gradational phases from ore into black slate are likewise shown in this mine.

Drilling between the Dober body and the Caspian, according to Capt. Wall discloses practically nothing but black slate.

To the east of the Dober body "gray rock" and "green rock" which seem to be unoxidized carbonate rocks lie east beyond the black slate in which the Dober ore body is enclosed. These are the rocks which outcrop on the road leading east up the hill from Stambaugh depot.

Jones Pit Tunnel - Vulcan.

Mouth of tunnel brier slate. Slate practically at right angles to cross cut, dip south at mouth, dipping (?) to vertical near contact with Iron Formation. Iron formation from 47 ft south of 1st drift to 1st drift. At first drift there is a fault plane striking N 80 E, dip about vertical. The fault plane is rather sharply dip north and is marked by a gange and breccia. In the breccia matrix is what appears to be dolomite. Spec. 1 J. On the east side of the tunnel, the appearance is about like that of the N side in character (?). Diagram.
(The last two sentences above are largely guesswork to try to make some sense out of it).

Spec. B 7. Brier slate 5 ft from contact with iron formation. This specimen shows the white band of chert characteristic of the Brier horizon toward the contact with the Trader iron formation.

The iron formation immediately north of the Brier slate is hard and cherty at the contact. Wide bands of chert or mixed chert and iron oxide are characteristic.

According to Capt. Bowd (?) the main cross cut went into slate just beyond the shaft and then entered iron formation which was drifted in and the cross cut continued thro this formation into slate, presumably the talc slate. Another Capt.(?) say(?) only jasper. (More guessing). Inasmuch as there is an iron formation outcrop a short distance from the south end of the tunnel, we then(or thus) have three (?) iron formation to account for in this sections.

Detailed Section Traders. ## 9 Cross cut south from main drift west of #1 Tunnel.
Breast of cross cut red slate.

1st 5 paces. Dark green banded cherty slate. The bands vary from / to / / in width with perhaps some a trifle larger. Just below the red slate there are more thin bands of white chert. The whole has the appearance of a cherty carbonate slate. Spec. # 10 J 1 ft from breast. Spec. # 11 J - 4 paces north.

5 to 10 paces.
5 to 6½ paces south, banded cherty slate similar to 0-5. Spec. 12 J.
At about 7 paces there are some wide black chert bands from 6 inches to 10 inches wide separated by some fine bands of jasper and iron oxide. Spec. 13 J.
From 7 to 8½ hard black jaspilite with chert predominant and bands of from 1 to 4 inches. Spec. 14 J.
At about 9 paces the spotted jasper becomes prominent. It is very hard, breaks with conchoidal or rhombohedral fracture. Spots are specular blue ore in a purplish red jasper. Spec. 15 J.

10-15.
10-12½. Zone of spotted jasper. Rock predominantly chert band. Spotted iron bands are blue steel ore and are subordinate to the chert. Spec. 16 B, taken at 12' S.
12-15. Red jasper phase (or plane). This rock has alternate bands of nearly pure jasper and iron oxide. The jasper is becoming redder and some bands are nearly blood red. At times a single band of jasper will be part purple and part red.

A very interesting feature is the formation of small ore bodies in crushed (?) zones by folding.

Diagram.

The folding does not have to be close, merely (?) rolling, but this rolling is enough to shear the bed and form a little ore (or maybe arc). I wonder if this is not a more important factor in the ore deposits on this range than we are inclined to think.

The bands of jasper are becoming thinner, the average is now about ½ to ¾ inch, altho some up to 2 inches are found.

From 15-20

Jasper fine banded reddish. Jasper iron (or ores) 1 inch and more(most or several) ¼ to ½ inch. Occasional red bands but purplish red predominate. The jasper and iron bands vary from fine pencil lines to perhaps two (?) inches, the average is about ¼. This is a rich horizon and with silica leaching would easily make ore. Sp. 17 B and 17 P.S.

From 20-25.

Chiefly banded jasper similar to 15-20. It appears to have more red jasper than the preceding phase, and a prominent feature are striped jasper - that is, silica band with both dark purple and blood red jasper in bands. Sp. 18 J from 21 S. and Sp. 19 J from 24 S. The latter shows the striped jasper.

25-30.

Formation about the same as in the previous phase but some wider bands of chert are coming in, appear to be chocolate brown or red by lamp light also 2 bands 1 inch wide of purple chert with red spot (or maybe about) at 26 S. and notice a band of same material 2 inches wide at 30. Sp. 20 J from 26 S. Spotted jasper. Spec. 21 J from 27 S. formation. Spec. 22 J from 29 S with chocolate band.

30-35

The drift comes in from 31-34 . The jasper seems to be characterized by fine banded rather heavy ferruginous material some of which might be classed as a ferruginous graywacke alternating with bands of purple and striped jasper from ½ to 2 inches wide. Bands of an inch or more are not infrequent. The formation is quite platy near the drift. The chief change is wider bands of silica from 1 to 2 inches. Spec. 23 J fine banded phase.

35-42.

This is the base of the Traders and is characterized by wide bands of red and striped silica from 1 inch to 6 inchs in width, average 2 inches. Separated by blue steel hematite. Sp. 25 J and 24 J.

Sp. 26 J, Traders quartzite which at 42 is only a few inches thin (?), about the width of the specimens in this section. In other sections attain 12 inches in width. Sp. 27 Talc schist.

This lower horizon might be called the lower coarse red jasper. I have seen spotted purple jasper spotted with red jasper in the horizon close to the Traders quartzite but it is not prominent here.

The spots in the chert consist both of red spec. and rounded spots of specular ore all small. Sometimes the spots persist in the black bands as in Sp. 44 taken from 13 paces S.

15-20. Chert bands less frequent, darker toward 20. Rock hard and Sp. 46 represents the rock where there are no pronounced chert layers.

(Note says above two items belong in 12 level Brier Hill Section (or slate).

#2 Cross cut Section East of #1 Tunnel, East Central Mine. Section of Traders member.

0-10 paces. Hanging red Brier slate at). Just below the hanging are two thick chert bands separated by a thin 2" seam of ore. The chert bands are each about a foot thick. Spec. 28 J.

From here to 10 the horizon is characterized by wide bands of chert of dark color or more properly ferrginous quartzite. The iron is concentrated in small irregular spots and in wavy bands in the darker colored quartz rock.

As you approach 10 banding becomes more definite and some bands of purple jasper with spots of blue hematite were noticed. See Sp. 31. This is similar to the rock seen at this upper horizon in the #9 Cross cut. The rock is intensely hard and quartzite (or quartzose) and the miners say this hardness is characteristic of this horizon. The rock is dark colored and the ferruginous matter is not altogether strongly (or sharply) confined to bands but is mixed in the (?) with quartzite layer. Sp. 29, chert. Sp. 30 , the banded ferruginous zone. When the iron oxide is in base it is wavy and wraps around - (?) of chert.

10-15.

The upper horizon passes rather abruptly into the middle banded jasper at about 12 paces S. Here the narrow band of reddish purple chert and iron oxide come in between 12 and 15. The bands are usually from $\frac{1}{2}$ to 1 inch. Sp. 33 J, S 14, represents this jasper (No. Spec. 32).

15-25

Fine narrow banded jasper. This section seems to get more fine banding than in #9 cross cut.

From 20-25, jasper bands of from $\frac{1}{2}$ to 1 inch wide become more common. The bands are reddish purple and some striped, one rather bright red were noticed. Sp 34, 18 S formation, from this phase.

24-27 Drift.

25-30

Banded jasper bands from fine bands to 2 inches., average $\frac{1}{2}$ to 1 inch, banding getting coarser, predominant color of bands, reddish purple.

30-35. Jasper, getting coarser banded. Seam of ore one foot. Seam of ore at 35 . and at 37 The lower coarse red chert member begins. Sp. 35 J red jasper from 4 inch band at 37 S.

At 40, I found some characteristic spotted chert purple red chert with bright red spots. Sp. 36 J. This horizon seems to be characteristic of the base of the Traders Jasper with red chert bands. Bands from 1 to 5 inches with. At base jasper is spotted with red fragment.

At 41 Traders quartzite 10 inches thick at this section. Sp. 37 J.

Curry Cross Cut - 12th level, Brier Hill.

0-5.

Hard brown banded slate almost a slaty Iron formation. The bands vary in width from $\frac{1}{4}$ inch to fine lines. The banding is very even and persistent and the rock is hard. The rock is heavily ferruginous and seems to be made up of alternate layers of iron oxide and iron oxide diluted matter (?) with perhaps a small amount of chemical silica. Sp. 40 J represents this slate.

At about 5 paces S from the north breast of the North cross cut chocolate red chert bands come in occasionally. These bands are chocolate red and appear to be fragmental or spotted with red grains of lighter color. Much like the spotted jasper in the base of the Traders only the jasper background is dark chocolate red instead of bright red. Sp. 41 J.

5-10

The rock is quite similar to that from 0-5. It differs in that the chert bands chocolate red with blood red spots are more common. These chert bands are lens-like and thicker, and thin rapidly. The other banding is also getting common. Red bands of dark gray and specular are becoming commoner. There are also wide bands of gray rock which are not banded prominently. Sp. 42 and 43 J from this section.

10-15

At 15 there is a fault striking N 80 W, dipping 43°N. The fault plane is marked by a small seam 1 ft of ore and a (seam of parallel fraction planes of small throw. (series)
The strike of the cross cut is N 35 E. This end (or and) the strike of the rock at right angles. The rock dips south at 40° from 0 to 15. Thus the fault plane is practically at right angles to the dip of the rocks.

The rocks are dark gray slaty iron formation with chocolate chert with red specks becoming more frequent, enough so to call the rock at 15 a banded jasper. The rock is black and full of mixed silica and specular ore. The chert bands are in wavy lines and lense out rapidly.

This rock breaks in much larger fragments than did the Traders. It breaks easily parallel to the joints and the joints are clean and not so characteristically wide (or maybe red ?) as was the case with the Traders. It is fairly easy to see the bedding plain on a fractured joint plane. The chert bands vary from ½ in to 3 inches, avergae about an inch perhaps and they are characteristic.

At 15 the other side of the fault which prevent of course getting a true section tho I do not believe the throw is very great. The rock is a banded jasper with bands averaging about ½ to 1 inch wide and being about as frequently as the ferruginous layer. Chert bands still the same chocolate spotted.

20-25

Rock essentially similar , red chocolate chert bands and alternate with fine banded material. Some of the darker bands in the finer banded material looks like thin black chert , and by underground light. Sp. 47 J from 25 S. Dip of rock 50°S. at 20 and 25.

25-30

Practically no change. Hard black jasper with chocolate or (probably purple in daylight) spotted chert in lines and wavy bands. Some zonal banding in the lenses is to be noticed. Sp. 48 J from 32 S.

30-35 formation wide

No essential change. The former appears to be rich fine chert bands and wide ferruginous zones represented by Sp. 49 J from 34 S.

35-40.

Rock essentially similar a dark colored jasper. The rock appears to have chert bands which are nearly black and others that underground look to be dark purplish red. In general the chert is turning(or becoming) denser and less spotted but unusual bands are still apparent showing the red and blue steel hematite specks. Spec. 50 J from about 38 S. represent the iron formation. The pure hematite bands are not wide and are wavy. In fact this seems to be characteristic of this Curry formation . Wavy banding and the chert in lens and bands that thicken and thin and are in general wavy. When the chert is the chief member of the jasper, the waviness shows in the bands of specular hematite. The joint planes are free from red stain and the rock breaks quite readily across the banding and parallel to joint planes. A conchoidal fracture is also quite characteristic.

40-45

Rock similar just at 45. A banded red jasper above for about 3 ft in hard dark black banded jasper and at 45 the purple bands come in again. Sp. 51 J.

45-50

Dark black jasper, wavy banding bed only rarely red bands. Bands of chert are dark colored. Rock seems to be hard by ferruginous, highly ferruginous. Sp. 52 J. dark jasper.

At 50 banding (?) N 60 W, dip 48 S.

At 50 main drift comes in. Prominent set of compressions joins (joints ?) making rock break in triangular (or triangles) tetrahedral and rhombohedrals Strike of Main drift at 50 - N 80 W.
Joint measurement

Strike	N 5 W	dip	65 E.
"	N 85 W	"	47 N
"	N 65 E	"	72 SE

50-55
Black jasper so far as can be examined. Wavy line of bedding due to thickening and thinning of chert bands.
55-70
Black jasper as far as I can examine. Could not examine closely as dynamite is stored in drift. Sp. 55 J , 73 S.
At 83 a sugary white chert. Sp. 56 J. Sp. 57 J. Hanging slate.
Sp. 58 J. Foot Brier slate. N of fault, main drift, 12th level, Brier Hill.

Things to see. Shaft, cross-cut - 15th level. 18th level Cross cut C shaft.
9th level Brier Hill.
Hanging slate exposed in main drift west from shaft. The formation averages from 50 to 60 degrees dip. South it is steeply toward the west end of the level about 65. In the vicinity of the first cross cut north the formation flattens consistently (?) to about 28° at the point where the drift and cross cut meet. The following sets of joint planes are found at the shaft.
Strike of drift and shaft N 59 W.
Strike of formation N 65 W, dip 50 S.

Joints ;	N 80 W	dip	45 N.	Major	
	N 10 E	"	85 E	Cross	major
	N 65 E	"	68 W	"	"
	N 65 W	"	40 N	Major	
	N 30 W	"	45 N	"	

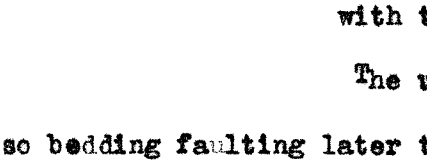
Possible slip cleaving strike about N 65 W, dip 80 S.

2 pages with small diagrams followed by several blank pages.

Camp on Sec. 8. - 22 & 23 - 45 - 31

17th level Brier Hill.
Drift toward Curry. Shaft in Brier slate . Cross cut breaks into Iron formation 13 paces south of curve. Thence drift along formation shows crinkled and rolling formation with seams of ore. At one place there is peculiar looking rock Sp. 59 J. This rock appears to be a coarsely crystalline carbonate and comes in bands parallel to bands of ore. It sort of takes the place of rock bands. The formation is wavy and full of ? of calcite crystals and veins of calcite. Sp. 60 J another phase of this carbonate rock. Can it be approximately a cherty iron carbonate ?

17th level Brier Hill. 1st Cross cut south from B.H. Shaft.
Operative (?) rock made up of black and red bands from 1/32 to ½ inch wide. Bands are very prominent. Sp. 61 J. This rock which is soft and - illustrates the structural tendencies beautifully. The rock dips south at about 60°. It is effected by faulting of several kinds.



Also bedding faulting later than the cross faulting.

This is illustrated by a vein of quartz and chalcite banded which is faulted about as the above sketch. The vein about fills a cross fault plane.

Diagram

Is this rock Brier or does it belong to the Traders ?
It is apparent that the bedding faults cut the beds at slight steeper angles to the bedding.

Diagram

On the cross cut to Brier Hill shaft there seems to be a green slate interbedded in the iron formation and lying just above the heavy chert bed. Above the green slate which is sheared anc chloritic is a banded gray slate. Sp.628. Succeeded by a heavy chert layer and then some thin bedded iron formation characteristic of the Traders formation. Above this there is slate. It is possible that this is the equivalent of the cross formation black and red banded rock found in the cross cut farther east. However to settle this question an examination should be made in other phases (or planes).

The wavy bedded character and the seams of ore seem to indicate a possible ore body in the Traders west and under the present workings. At least it ought to be worth looking for.

7th level Brier Hill. Cross cut in Trader. Breast of cross cut jasper.

From breast to ore drift fine banded jasper until you come to shear zone striking N 60 W., dipping 53 S. Formation strikes about the same, perhaps more N 56 W . Bed dip is steeper, about 60°.

South of shear zone you get some thick red banded chert seams from 2 to 3 inches but not spotted . Bright red in color.

The slate contact comes on the south side of the ore drift. The slate is a soft banded variety with similar banding to the cross formation seen in the 17th level. Its color is different but like that of the cross formation it is much folded and contorted. Spec. 62 J.

A minor drag fold along which a small quartz zone is found. Strike of planes N 80 W dip of plane 75 N. Pitch of fold anticline 27 E.

Sketch of folding.

This structure could pass into a fault with S side upthrown.

Diagram

This side of sketch is also seen.

Indicating again South side upthrown and a bedding fault.

Beyond the soft slates about 15 ft from Traders contact there is a hard cherty phase. The slate in immediate contact with Traders is soft and cherty but there is not as much evidence of shearing as at other localities.

Forest Mine.

With Robinson walked over the Forest mine. The relations are very interesting. North of the shaft there is a low ridge of typical dolomite. On the south side of this hill there is a jasper conglomerate containing large angular and partially rounded fragments of typical Vulcan iron formation. The jasper pebbles look to be largely Trader but some spotted cherts that might be Curry were noted. However, the predominant variety look to be Trader as it is fine banded.

South of the Hill is the Forest Mine with two shafts. (Later note - above conglomerate probably Cambrian).

The dump shows a great deal of dolomite, some slate typical Trader formation, and some limonite (or hematite) chert. Also a small amount of conglomerate similar to that outcropping just north is to be seen on the dump. The formation contains typical blue steel iron formation and small fragments of specular blue ore. The conglomerate lying as it does north of the mine and contains jasper pebbles in a limonite quartzite matrix is very puzzling.

Southwest of the shaft and dump about 250 paces as exposure of a conglomerate with white and red quartzite material. The pebbles are for the most part chert and quartzite and range from size to angular boulders of quartzite nearly 2 ft in diameter. Rarely pebbles showing blue ore or jasper are found. The conglomerate on the mine dump is similar to the exposure.

There are some pits in south end of the mine and the pits have a jasper conglomerate structure with that seen changing to the dolomite north of the mine. I now believe that that conglomerate on the dolomite is Cambrian and therefore of no significance in the Huronian succession.

On the other hand, the heavy conglomerate of chert and quartzite is quite similar to that seen northwest of Loretto and is probably the conglomerate at the base of the Hanbury. Its presumed line is significant with Robinson's statement of the petering out of the Indiana belt of magnetic attraction.

It should be possible to get records of the Forest mine and it might throw light on the structure in this vicinity.

7th level Brier Hill.

10 ft N of shaft is a prominent shear zone in the Hanbury slate. This zone is marked by a steep (or sharp) flat hanging face on the South (or S side) and a crush zone underlying . Strike across cross cut N 65 W, dip 68° S.

South of shear the slaty schistosity dips south at high angles. North of this point it dips north at about 65 to 80°.

2nd Cross cut in Curry east of Shaft. Footwall of Brier slate is a conformable contact. At drift rock strikes parallel to drift. Dip S 70°.

The heavy slate is a sheared black slate and has a nearly vertical dip. Contact marked by quartz vein and brecciate of the Curry formation. The steepening of the Curry formation would in part account for its decrease in thickness.

West Vulcan Mine.

Small faults thro south side of Trader quartzite down at 2nd exposure south of C shaft, West Vulcan. Strike of joint planes in which there seems to be slipping N 30 W , dip 75° N.

18th level.

The socalled Curry formation in the drift and cross cut south of C shaft is a narrow band of red fractured jasper filled with shot of ore. Its south contact is plainly a fault and U suspect its N contact is as well. Wheelright called it Curry but it might be Traders.

I am inclined to doubt Wheelwright's fault plane being so far north as he has mapped it. Probably partly folded and partly faulting. (Can this be Jones Pit fault ?).

18th level, Curry , west of Curry shaft.
Shear south contact of Brier slate and jasper, principal feature in cross cuts east of ore body relations are like sketch - looking west

The hanging along the ore body where exposed is a shear place and is badly broken up. The footwall appears to be conglomerate at the contact. However the gray slate (talc slate) north of the Traders quartzite have probably moved along the buckling (?) planes which are slippery and greasy.
In fact the foot of the iron formation shows evidence of slipping and has to be timbered.
The ore body shows the customary wavy folding. Veins and stringers parallel to the bedding of red carbonate are common. At the extreme west end the mine is entering a fold which will throw the footwall north. Minor drag folds near this locality pitch west.

16 level C shaft. Fault S of shaft.
Diagram

No quartzite exposed at contact. The drift between Curry and C should follow hanging wall. A short distance from Curry shaft is a cross fracture.

17 level C Shaft.
Last (or east) cross cut going toward Curry. Foot of beds marked fault contact No to (or tr) quartzite found. Strike of drift N 15 E. Strike of fault N 75 W. , dip 80 N. South side downthrown, north side upthrown.

Brier slate contact conformable and practically no sign of faulting. Dip of Iron formation south of fault 55 S. Dip of slate N of fault 60 S.

Diagram in SE¼ SE¼ Sec. 10 Vulcan.

Diagram SW - Sw - 11

Note A. Trench in dark gray jasper chert spotted. North end of trench shown some brown banded slate.
Note B. Brier slate folded and marked previously seen on traverse with Smith and Robinson. In one place strike of schistosity N 45 W. Near here, minor folds visable. Sp. K2. Axis of minor fold N 55 W pitch 50 E. plane of axis nearly vertical or steep dip N. Measurement on a few small folds only.
Note C. Pit dump shows marked slates and jasper with purple spotted chert bands of typical Curry type. Can see rock in pit and it looks to be slate, probably close to contact. Slate is marked and possibly fault zone is close by.
Note D. Small outcrop of iron formation. Strike N 70 W. Impossible to say whether Trader or Curry.
Note E. Pit in jasper. Material breaks into small fragments like Traders but chert bands are spotted and more typical of Curry.

Diagram of a cave.

Sketch of section of # 1 shaft cave below pit W. Vulcan mine.

mottled streak (?)

The hanging of the Curry part in this exposure is a marked notched - and red slate overlain by a black slate. There is apparently a fault in the hanging but its position is not possible to locate. A great deal of late caving has taken place making observation of doubtful value.

NW¼ SW¼ 4 , Norway.
Dolomite in an old R.R. cut north of northeasterly, Norway mine pit. Minor syncline 4 ft across pitches west 25°. Strike of fold axis N 75 W.
Sketch looking E . Strong fold and small fault on S side

Some small structure interbedded this side (?) of a fault structure.

Norway Pits. General remarks.
The foot wall along the N. side is not well exposed. It can be inferred to be talus (?) and dolomite. Pits cut by big fault. Strike N 75 W. Dip S 55°.

West of where fault enters S side of pit the hanging of the pit and foot are both dolomite. East of here the hanging wall is Brier slate. Near the east end a dike shows up on footwall side apparently striking about parallel with formation and dipping S at about 60°. The dike appears to be offside in one place with the east side thrown back 10 or 15 feet. Sp. K 5 - dike.
Greens Pit, Norway.
Pit in typical Curry formation. The north side is the foot side and the formation in general dips south at about 30° angle. The footwall slates conformably beneath the jasper are exposed in Barbara (or Barbour) pit to the north.

Contd. Near the east end of the pit the formation swings around and strikes N 80W. In the main part of the pit the strike is N 70 E. The slates in Barbara pit are intruded by a dike, Sp. K 6. The hanging wall side of the Babara pit is a tremendous (?) fault with a shear and crush zone 15' or more wide. Along the crush zone later quartz infiltration has taken place. A cross section of the Barber and Green pit is about and follows looking west.

Diagram

The fault plane is nearly vertical and follows the south end of the pit.

Diagram. Cross section Norway Mine. #8 Shaft.

" " " #9 Shaft

" Drill hole from Barbara Pit N.

" Cross section Norway #4 Shaft

" " " " "6 pit

" " of new shaft on Eragon Section. (No diagram, but one follows on next page with no location or explanation given.)

Magnetic readings South from East Vulcan. Normal scale
continued on next page, with a diagram in vicinity of Sturgeon River. Which explains the one stated next above.

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Diagram. Cross section of West end of Quinnesec Mine. Note. This seems to prove existence of post Cambrian faulting.

#3 hole 150 W of #3 shaft. Sandstone 74 ft.
#4 - 1½ ft from 33. Total depth 241 - S S to 20 ? SS and ore - 241.

Quinnesec mine - Longitudinal section.

Cross section - Quinnesec mine - #1 shaft.

#2 shaft. Quinnesec.
No. 3 and 4 shafts cross section essentially similar to #1 shaft. Ore extends to 9th level in No. 2 shaft, 10th level in No. 3 shaft and 2nd level in No.4 shaft. Average dip No. 2 shaft 50°N, No. 3 shaft 60°N. ore widened until 50' horizontal No 2 and 3 shaft.
In all cases stratigraphy is the same - red slate, ore bed, talc slate, dolomite.

Cross section of drill hole east of Old Quinnesec mine. Note. Drill hole #7 is 520 ft east of #1 shaft. The cross section of drill dole, strike N 20 E.

Cross section of #4 shaft, showing post Cambrian faulting along dolomite talc slate contact.

2 pages of rough diagrams in back with little description.

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24 pages mostly blank, a few having a lot of figures which are meaningless. The Sections, Town and Range given have no meaning. Apparently intended for use and then the book was used for something else.

Golden Age. Shaft cost 125 per foot according to report to state. Expenses of mine, actually cost (?) 325 per foot, should cost $40 per foot. Are building new 3rd mill.

Slate Mining Co. being (?) Good property - lead silica instead of gold. 2 pages of figures.

Contract let for shaft house and mill and no specified time for completion of work. Contractor has only 3 men working and Frame is not up yet. Mill started in August. Conmmtee - - 34 x 150 Ft.

Same slowing (?) work in building. Shaft house above built in ravine and hole dug in hill for shaft house. Gets all the drainage of the county. They have no machine shop and only a small blacksmith forge and anvil. No drill anvil. Small 400 ft. compressor electrically driven. Small hoist, steam driven. 2 small washing pumps.

Cottages. One cottage for laborers (?) one for smith. 3 room shack and office for Supt. 1 brush house, another building. Cook shack. Small storehouse, saw mill. Mill is estimated to cost $35,000.

Only - record of mine map. No geology nor stope map. No record of production or costs.

Table I. Showing value per ton of 23 assays taken on tunnel level. Gold dollar vein. Copied from old stope map at mine office.

Old map shows only a tunnel level under stoped - . Column of figures.

Width of vein along strike on old stope map. Left drift. Column of figures.

Right drift, width of vein in each. Column of figures

The assay and data obtained from old stope map shows working above tunnel but valuable as showing average width and grade of ore stoped and mined under Abernethy.

They have no map of present level and shaft, nor any map, and no basis for estimating value of ore.

There is one map showing part of working but no complete record of stoping. Mr. Abernethy stopping (stoping) ore(or one) block 200' long, stopped to surface about 160 ft. high. A(bernethy) stoped 200 ft 66 ft up to tunnel level. There are other stopes of which there is no record made. Mr. A. left property and prin. to Stephen Cummings (?). Mr. A did considerable other stoping not shown on available maps.

Mr. A. thinks ore on em level is better grade than it was above on both levels. South strata is regular. North strata more bunchy but & mmxm wider . North end has been explored more than south end.

Above notes are apparently in the handwriting of L.P Barrett.

Section 20, T 35 N, R 6 E. Lot 1.

Surface is composed of a continuous swell of beach ridges, extending in a general E-W direction with the exception of a bluff of limestone near the south edge. The elevation of the bluff is about 50 to 60 feet above L. Huron. The surface slopes north from the foot of the bluff. The bluff forms a sharp peninsula extending nearly west. Ledges of limestone are exposed along the top of the bluff for about 30 paces. The surface rises southward from the bluff to the central plateau of Adams Point. The soil is generally to strong or coarse for farming purposes. Most ofLot 1 is covered with dead cedar, spruce and tamarack, partly down. The cedar would make good post and tie timber, though most of it is too small for this.

The area of limestone having an elevation from 50 to 60 feet below lake level is small but it is possible that there is a considerable area along the face ofthe bluff of sufficient elevation above lake level for quarrying.

The gravel is generally too coarse for ordinary purposes. The same is true of most of the gravel in the stronger beach ridges, some being a mass of limestone shingle, rubble and pebbles, with no fine material. The amount of such gravel is enormous. The lake shore from Swan Bay to Presque Isle for a half to a mile inland is one continuous series of beach ridges.

Lot 2. The surface is composed wholly of beach ridges of gravel, rubble and shingle. The surface slopes northward from a general elevation of about 30 to 40 ft. No ledges of limestone are exposed anywhere and considering the generally low-lying position of this lot it is probable that there is little limestone economically quarryable. The SE portion is the more promising, but it is possible that the surface is sufficiently thin over the whole southern third for quarrying. Portions along the east and NE side of Lot 2 are covered with dead cedar, spruce, tamarack, etc. The cedar is suitable for posts but generally too small for ties. Most of the remainder has been burned clean and is now covered with growth of poplar and birch 5 to 10 ft high.

The soil is generally stony and gravelly with sand strips especially in the southern part. It is poor for farming. The gravel is composed largely of limestone and generally is too coarse, being composed chiefly of beach shingle and rubble with little fine material. Some of the gravel however appears to be of fair grade.

Lot 3. The surface is composed of beacg ridges and it varies in elevation from lake level to apparently about 35 ft above. Most of the lot is probably not over 25 feet above the water. No rock is exposed and it appears that the drift is too deep everywhere in this lot for quarrying. The northwestern part contains a fringe of Norway pine near the shore and some groves of small spruce, cedar, balsam, etc. The remainder of the lot is covered by poplar and birch brush. There are a few patches of light sand and gravel soils, but most of it is too stony and coarse for farming purposes.

SE¼ SE¼. The surface is relatively flat, being a part of the central plateau from 60 to 70 ft in general elevation above Lake Huron. No ledges of limestone are exposed but the abundance of angular boulders in places indicates the presence of rock at slight depth. It is probable that the drift is not generally excessive in this forty. The limestone bluff of Lot 1 crosses the NW corner of the forty and then veers to the southeast into section 29. Soil poor, sandy, gravelly and strong. Poplar, birch windfall in the northern part. Poplar-birch brush in the remainder of the forty.

Lot 1. Sec. 21, T 35 N, R 6 E.
Surface composed of beach ridges running NW-SE to N-S. General slope E-NE. Elevation near the west line about 40 ft. Rock exposed near waters edge and it is probable that limestone is at slight depth beneath the rubble in many places. The amount of quarryable limestone above water level is apparently small. Soil stony and very poor. Timber thin, poplar and birch brush with some dead cedar, spruce, etc.

Lot 2. Surface similar to that of Lot 1 but there is a four foot ledge of limestone at about 10 feet above Lake Huron, a few rods from shore at Adams Point. Stone is probably near the surface in other places to the south. Rock runs under water along the shore. Soil stony, coarse and poor. Surface is covered largely with dead cedar, spruce, balsam, tamarack, birch. Cedar suitable for posts but generally too small for ties.

Lot 3. Conditions are almost identical on this lot with those on Lot 2. The gravel is generally too coarse for general use.

Lot 1. Sec. 28, T 35 N. R 6 E.
Surface covered by beach ridges of shingle, rubble, gravel and sand, running roughly NW-SE. General slope E-NE. Soil too stony for farming or for pasture land. Limestone is probably at slight depth in places but in others there is considerable overburden.

Lot 2. Surface covered by beach ridges of rubble, coarse gravel, etc. General slope E-NE. Ridges run NW-SE. Soil poor and stony. No timber. A bluff of limestone occurs along the west side of Lot.1. It reaches an elevation of about 70 ft above L. Huron. It is probable that limestone is at slight depth in places beneath the beach rubble, especially along the front of the bluff. No timber. Poplar and birch brush is the only timber growth. The original cedar, spruce, tamarack has been burned.

SW¼ NE¼. The surface of the NE half of this forty is composed of beach ridges extending in a NW-SE direction. The general slope is E-NE. The southwestern half has a varied surface, being composed of ridge depressions and low bluffs without regular arrangement. The maximum elevation is apparently about 50 feet. The soil varies from sand and gravel to rubble and boulders. It is too light and porous for general farming. The sandy areas may be suitable for pasture.
The limestone bluff of Lot 2 ends just before reaching this forty and there is little or no sign of limestone near the surface excepting near the shore of L. Huron. Except near the center of the forth, the timber growth is poplar and birch brush. There is a few acres of dead cedar.

NE¼ NW¼. The surface is relatively flat and has a general elevation of about 70 ft above L.Huron. At the eastern edge there is a bluff of about 15 to 20 feet along which there are exposures of limestone. The flat plateau ends on the south in two or more drift terraces. Westward and northward the plateau extends into other sections. Low ridges of limestone are exposed near the north line of the forty, showing the generally light drift cover. Near the southern and western edges of the forty the soil is gravelly and less bouldery, indicative of a thicker cover of drift, though tracts of angular boulders here and there indicate that the drift is probably not excessive. This forty undoubtedly contains a large amount of limestone. Timber - poplar and birch brush 5-10 ft high.

N.W.¼ NW¼. The NE half is a level plateau, the continuation of that described above. To the southwest, the surface descends in two strong bluffs 10 to 20 ft high. The general slope in the SW half of the forty is southwest. The elevation is about 70 ft. above L. Huron in the NE half and from 40 to 60 ft in the SW half. Boulder tracts of limestone indicate the presence of ledges at slight depth in some places. Some ledge near the surface. It is probable that the average thickness of the drift on this forty is not excessive. The timber growth is poplar and birch brush. The soil is too poor or stony for farming.

Demming mine. All water pumped from creek to mill. Some question in my mind as whether creek will be adequate the year around. All material has to be hauled by truck or wagon 40 miles from manuftr (?) over limestone (?) roads.
Property is equipped with electric power, hoist and pump by air generated by electrically driven compressor - Ingersoll Round Imperial type 10
10 x 14" and 17 x 14" air.
No development east of shaft on Arrow Creek

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Iron County Rocks - Specimens 25371 - 25707

The specimens included between the above numbers are almost without exception metamorphosed or otherwise altered. In many cases the specimens are probably not representative of the are from which taken as many are loose fragments which have been more exposed than the rock mass or represent merely the weathered exterior.

The bulk of the rocks in the area of collection are biotite schists, of varying proportions of biotite and quartz and with textures varying from schistose to quartzitic nature, graywacke, slate, granite, hornblende, schist, greenstone and greenstone schist, also iron formation. The term graywacke is here used to denote a very dark elastic rock which cannot be classified as an arkose or quartzite, but which has undergone sufficient metamorphism to produce a hard dense rock, in some instances schistosity has been produced. The greywackes are composed generally of fairly large rounded quartz grains with subordinated feldspar and firmly cemented with mica, chlorite etc.

Greenstone refers solely to an altered basic intrusive or extrusive. If schistosity has been produced the term greenstone schist is used. The biotite quartz rocks appear to have been chiefly produced from sediments such as slate or impure sandstones. The origin of the hornblende schists is problematical. Some evidence of igneous origin is present but even these amphibolites could have an origin in an impure sediment. Greenstones and greenstone schists are presumed to be of igneous origin.

Iron formation present is mainly chert, or an imtimate mixture of chert and siderite with some limonite and hematite.

25371 - Hornblende schist

25372- Mica schist (biotite)

3 - Mica schist (biotite)

4,5,6,7 - Biotite schist.

25378 - Graywacke. Consists chiefly of quartz grains, sub-angular to rounded. A few feldspar grains are present. Chlorite and secondary muscovite are present in fine shreds. Hematite is present in large amounts, but is clearly shown to be an alteration from magnetite due to weathering. The hand specimen shows a dark gray to black central portion while the exterior portion is reddish due to weathering. The rock is non-schistose but has been crushed to some extent developing "morter" structure and wavy extinction in the quartz grains.

25379- Schistose Graywacke. Very similar to 25378 except for schistose character. The section is cut across the planes of schistosity showing the structure very well. In addition to quartz and feldspar, chlorite and secondary muscovite are present. Hematite (after magnetite) is abundant. Limonite is also present. "Morter" structure and strain shadows are present.

25380 - Ferruginous mica schist (biotite)

25381-2 - Biotite schist.

25383 - Schistose graywacke. Crushing has been more pronounced than in the case of 25379, with the result that the rock is finer grained and more granulation has occurred, producing a more definite morter structure and other strain features. In addition to quartz which is the chief constituent, various kinds of feldspars, orthoclase, microline, micro-perthite and plagioclase are present. Magnetite and hematite are abundant, limonite and pyrite are also present. Graphite may be present as long stringers, but this is difficult to distinguish from finely granular magnetite. Stringers of chlorite and secondary white mica also occur.

25384 Ferruginous mica schist

25385 - Schistose graywacke. A dark grey to black rock, generally dense, but with rounded grains of quartz visible to the naked eye. Under the microscope the rock is seen to consist largely of quartz grains sub-angular to well rounded, with some orthoclase, microline, micro-perthite, and plagioclase. Secondary muscovite, chlorite abundant magnetite and some hematite (alteration) are present. Also limonite. Feldspar grains are fresh and but little altered. Strain effects are however visible in quartz grains and granulation has occurred.

25386 - Schistose graywacke

25387 - Calcareous slate

25388 - Calcareous slate. A dense mixture of kaolin, pale green chlorite and calcite. Considerable apatite is present, also a few grains of hematite (after magnetite).

25389 - Cherty iron carbonate (iron formation).

25390 - Slate. An aggregate of kaolin, bleached biotite, pale chlorite and quartz. Several grains of pyrite are present, also limonite after pyrite.

25391 - Greenstone schist. Consists of numerous small lath-shaped crystals of plagioclase, kaolin, pale chlorite and bleached biotite. Magnetite, hematite and pyrite are present in small amounts. The rock has undergone crushing and alteration.

25392 - Gneiss. Composed chiefly of quartz and biotite with subordinate feldspar. Although banding has been set up in the rock the feldspar is clear and unaltered. Some bleached biotite is present also magnetite and a few grains of Zircon.(2 slides) The small amount of feldspar and its fresh character indicates possible sedimentary origin.

25393-4 - Biotite schist.

25395 - Calcareous slate. A dense mass of kaolin, calcite, pale chlorite and much apatite. The apatite shows berlin blue interference colors and bi-axial character. It occurs in cracks also scattered thro the body of the rock. The calcite is regularly distributed as small grains, probably resulting from alteration rather than infiltration. Pyrite, magnetite and hematite are present.

25396 - Ferruginous biotite schist.

25397 - Slate

25398 - Ferruginous Talc schist.

25399 - Banded ferruginous quartzite. Consists chiefly of quartz and hematite with much shredded secondary white mica. A combined morter and mosaic structure has been set up. The hematite is secondary after magnetite which is present as a core in most instances. Several grains of tourmaline were identified.

25400 - Hornblende schist. The section is cut across the planes of schistosity and shows the chief constituent to be fresh green hornblende, the crystals being arranged in parallel fashion. Quartz is the other abundant constituent and some plagioclase is present. The fresh green character of the hornblende, the associated minerals and their relationships, point to an igneous origin for the rock.

25401 - Hornblende schist.

25402 Hornblende schist. Section parallel to the planes of schistosity. Rock is similar to 25400, but finer grained. The minerals are green hornblende, quartz and plagioclase feldspar. Calcite has developed in small grains throughout the rock and cracks are filled with calcite and quartz. A little magnetite is present.

25403,4,5 - Hornblende schist.

25406 - Amphibolite. The term amphibolite is here used for a massive, non-schistose rock consisting mainly of hornblende with some quartz and feldspar. They(amphibolites) have undergone some crushing and are believed to represent transition from gabbro or diorite to hornblende schist. Evidence of this is shown in #25407. The plagioclase is andesine or possibly labradorite, few sections being available for testing. Several readings taken gave about 65% Ab - 35% An. The hornblende is green and fresh but has undergone some granulation. Some magnetite is present. The minerals present and their relationships indicate this rock to be of igneous origin.

25407 - Hornblende schist. Similar to 25400 and 25402 but finer grained. An "eye" that has escaped crushing is similar to 25406 hence shows the above to be an intermediate stage.

25408 - Hornblende schist

25409 - Chert

25410 - Hornblende schist

25411,12 - Hornblende schist.

25413 - Calcareous biotite (?) schist (hornblende ?)

25414 - Hornblende schist. A fine grained aggregate of green hornblende, quartz, plagioclase (Andesine), calcite, magnetite, limonite. Large hypidiomorphic crystals of andesine (or Labradorite) are present having escaped crushing. Igneous origin.

25415 - Amphibolite. Similar to 25406, except for smaller amounts of quartz and larger amounts of plagioclase (Labradorite, Ab 50 - An 50) igneous origin.

25416 - Basalt. Consists of small rounded granules of augite enclosing lath-shaped crystals of plagioclase. A few phenocrysts of plagioclase (Bytownite) are present but these lack idiomorphic outlines and appear to have formed in a not very fluid magma, hence two well defined generations of crystallization are not present. There are no phenocrysts of augite. Limonite and chlorite are present and magnetite in very small grains is scattered through the mass.

25417 - Hornblende schist

25418 - Altered pegmatite. The rock appears to have been originally composed chiefly of feldspar which has been almost completely altered to a mixture of kaolin and sericite mica with a little calcite. A few grains of apatite are present in cracks.

25419 - Amphibolite. Composed of green hornblende and plagioclase feldspar in about equal proportions. Brown biotite also present in some instances intergrown with hornblende. Some of the hornblende has been altered to a pale greenish, amphibole and possibly chlorite. Quartz is sparingly present. Accessories are pyrite, magnetite, hematite and limonite.

25420 - Amphibolite. Similar to 25419 except for larger amounts of hornblende and more abundant quartz which is uniformly distributed in small grains. Some of the hornblende is bleached to a pale amphibole with the development of magnetite, hematite and limonite. Large masses of chlorite have also developed.

25421 - Hornblende schist.

25422 - Quartz mica schist (gradation to gneiss)

25423 - Quartz mica schist. Composed chiefly of quartz grains with abundant biotite. The bulk of the quartz grains are small but numerous "eyes" composed of large grains in a mosaic arrangement are present. A few feldspar grains are present. These are partially altered to kaolin, calcite and quartz. The biotite is greenish brown, contains inclusions of Zircon, and in places has altered to chlorite. Garnet is abundant. Some of the crystals are almost perfect hexagons. Magnetite is not abundant. One grain of pyrite noted. This rock has the appearance of having been formed from an impure sandstone.

25424,5,6,7 - Biotite schist.

25428 - Granite

25429 - Muscovite biotite schist.

25430. - Granite. Fine grained, quartz, orthoclase, plagioclase (appears to be oligoclase), biotite, some of which has bleached, some altered to chlorite. Sericite has also developed in the feldspar. Numerous inclusions of zircon occur in the biotite. Quite a few grains of apatite are present, also magnetite, pyrite, hematite, limonite and one grain which appears to be ilmenite, a white decomposition product having appeared.

25431 - Granite

25432,3,4 - Biotite schist

25435 - Granite

25436,7 - Biotite schist

25438-Granite

25439 - Granite - gneissic , probably igneous.

25440 - Gneiss. Fine grained. The orthoclase is clear and difficult to distinguish from quartz. A number of small grains of microline are present also plagioclase. The biotite is greenish-brown, has been bleached in places and some chlorite has developed. Considerable zircon is present in fairly large grains. Epidote and titanite may also be present. Other accessories are magnetite, hematite and apatite.

25441. Epidote gneiss. The most abundant mineral present is quartz. Feldspar is subordinate and in the slide is confined largely to a triangular vein-like area in the central portion of the section. Biotite is abundant but not uniformly distributed thro the rock. Possibly the rock has undergone some metamorphism to account for the irregular distribution of minerals. Strain shadows are however not apparent. The biotite is greenish brown and some is bleached. A large amount of epidote is present which may have been derived from feldspar although biotite is a possibility. The epidote is associated with both feldspar and biotite and is regularly scattered through the slide. Considerable apatite is present generally in the portions where the feldspars are concentrated. Magnetite is the only other accessory.

25442 - Granite

25443 - Granite - fine grained.

25444 - Diorite. Essential constituents present are hornblende, andesine and biotite. The hornblende is brownish-green but in places has bleached to a paler amphibole. The biotite is brown and in places is bleached and altered to chlorite. The feldspar shows pericline twinning in combination with the albite law. Combinations of the Carlsbad and albite twins are also in evidence. Calcite has developed in the andesine. A few grains of quartz are present. Accessories present are apatite in large grains, fairly large grains of titanite, pyrite, hematite, Zircon, magnetite may be present, but the black meatllic mineral appears to be ilmenite, large amounts of brownish leucoxene having formed.

25445 - Biotite schist

25446 - Gabbro. The chief constituents are labradorite and pale augite. Portions of the augite are however brownish and pleochroic. This may be partial alteration to hornblende. Some alteration to chlorite has also occurred. Biotite is present also bleached. Calcite has developed in the labradorite. Small amounts of pyrite, magnetite, hematite and apatite are present as accessories.

25447 - Biotite schist.

25448 - Granite

25449 - Biotite schist

25450 - Gneiss

25451 - Biotite schist

25452 - Granite

25453 - Biotite schist

25454 - Granite stringer in biotite schist.

25455 - Aplite. This is a fine grained highly acid rock consisting of quartz, orthoclase, acid plagioclase, micro-perthite, large amounts of microline and microline micro-perthite. Portions of the section consist of large grains of feldspar and quartz. A small amount of green biotite is present. Accessories are pyrite, hematite, titanite, apatite.

25464 - Hornblende granite. Contains orthoclase, acid plagioclase, quartz, biotite, hornblende, magnetite, ilmenite, sericite, chlorite and bleached hornblende.

25456 - Biotite schist

25457 - Hornblende schist

25458 - Weathered granite

25459 - Granite.

25460 - Granite

25461,2 - Biotite schist

25463 - Gabbro. Augite basic plagioclase, biotite in places intergrown with augite. Augite in places altering to brown hornblende. Feldspar is fresh. Some apatite.

25464 - Out of place. See 2nd specimen listed above.

25465 - Aplite. Quartz, orthoclase, albite, magnetite, considerable hematite, some apatite and a few shreds of muscovite.

25466 - Quartzitic biotite schist

25467 - Biotite schist.

25468 - Granite

25469 - Biotite schist

25470 - Quartzitic mica schist. Non schistose and in hand specimen appears to be a fine grained quartzite. Under the microscope quartz and secondary white mica are seen to be present in about equal proportions. Considerable green biotite is present, also a little magnetite and hematite. This rock is believed to be of sedimentary origin because of the interstitial character of the mica which may have been derived from the argillaceous cement of a sandstone.

25471 - (2 slides). Diorite intruding syenite ?. The hand specimen shows a contact between two different rocks. Both are badly altered but the fact that the syenite ? has been almost completely changed to a mass of kaolin, sericite, calcite and a pale chloritic mineral. Considerable ilmenite is present. The diorite is finer grained and less altered, some fairly fresh plagioclase (andesine) being present. Some quartz is present and considerable calcite has been developed. Ferromagnesian minerals have been converted to chlorite. Considerable magnetite is present.

25472,3 - Biotite schist.

25474 - Quartzitic biotite schist

25475,6 - Biotite schist.

25477 - Calcareous slate. Only a small central portion of the rock has not been leached of the calcite. Tests with acid indicate that the rock is not entirely carbonate, although it has a crystalline appearance similar to marble. Under the microscope the rock is seen to consist of much kaolin and muscovite mica intimately mixed with a large amount of calcite filling cavities and cracks. The rock contains many eyes about which the lamellae have been pressed. These eyes consist of Kaolin and calcite. Originally they may have been feldspar crystals which resisted the initial crushing but later were changed by percolating waters in the shattered rock. Very little quartz is present. Several grains of zircon are present.

25478 -
25479 - Arkose. Rounded to sub-angular grains of feldspar with subordinate quartz imbedded in a matrix of chloritic material and kaolin. Hematite, magnetite and apatite are accessories

25480 - Quartzite

25481 - Gray slate. A fine mixture of quartz, white mica and kaolin. Accessories are magnetite, hematite, limonite.

25482 - Aplite. Badly weathered and much white mica, Kaolin, calcite and dolomite (rhombohedrons) have been developed. The main constituents are quartz, orthoclase and plagioclase. Considerable hematite is intermingled.

25483,4,5,6 - Aplite.

25487 - Black slate. A very heavy dense rock of an irresolvable character. The only constituent that can be positively identified is limonite which is abundantly distributed thro the slide. A small fault is present with a displacement of 7 mm. and a throw of 3½ mm. The fault crack has been filled with limonite and graphite. The fault is readily seen because of stringers of graphite darkening some of the layers.

25488,9,-90,1,2, Slate.

25493,4 - Cherty iron formation.

25495 - Biotite schist. The principal constituents are green biotite, quartz, calcite chlorite and limonite. Cracks and cavities developed by initial crushing became filled with quartz, calcite and chlorite. Later stresses developed strain structures in the quartz. This rock is believed to be of sedimentary origin because of the large amount of biotite present. It is unlikely that such amounts could be developed from an acid extrusive.

25496 - Chert

25497 - Cherty iron formation.

25498 - Banded cherty iron carbonate (cherty iron formation). Consists of cryptocrystalline grains of chert with a great abundance of minute crystals of siderite. Banding is present due to concentration of hematite, limonite, siderite and graphite in certain layers. Quartz has been deposited in small veins throughout the mass.

25499 - Cherty iron formation (iron carbonate).

25500,1 - Slate.

25502 - Aplite.

25503 -

25504 - Slate

25505 - Ferruginous chert (iron formation). This rock is so dense that the bulk of it is irresolvable, but seems to consist mainly of chert. Larger crystals of limonite and magnetite are in great abundance. Limonite is the more abundant of the two and many of the grains have a rhombohedral character, indicating that the limonite was probably formed from siderite. Chlorite is abundantly distributed and in large masses in cavities which also contain white mica and quartz.

25515 - Basalt. The ferromagnesian constituents have been entirely altered to a mass of chlorite and limonite and magnetite. This matrix encloses small unaltered lath-shaped crystals of plagioclase. A few small grains of fresh olivine are present.

25506,7,8 - Slate.

25509 - Cherty iron formation (probably carbonate)

25510,1,2, - Slate

25513 - Aplite

25514 - Slate

25515 - See top of page

25516 - Basalt

25517 - Slate

25518 -

25519 - Biotite schist

25520 - Graywacke

25521 -

25522 - Slate

25523 - Quartzitic mica schist. This might also be called a micaceous, chloritic quartzite, since the most abundant constituent is quartz. White mica and chlorite are almost as abundant. Considerable calcite has been developed, a few grains of apatite and plagioclase are present. The rock appears to have been derived from an impure sandstone.

25524 - Arkose. Large sub-angular to rounded quartz and feldspar in a matrix of smaller quartz grains, chlorite, white mica and calcite. The feldspar grains have partly altered to sericite. Stress has occurred after cementation of the rock as shown by wavy extinction in the quartz. grains.

25525 - Biotite schist.

25526 - Graywacke. Very similar to 25524. Sub-angular to rounded grains of quartz with a few feldspar grains. Sericite and calcite have developed in this latter. The cement consists of quartz, feldspar, greenish brown biotite, muscovite, a little apatite and ilmenite. This specimen shows contact with slate.

25527 - Arkose.

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25528 - Quartzite.

25529 - Arkose. This rock is similar in composition to 25526. In hand specimen however it is greenish. This is probably due to presence of green hornblende and chlorite. These two latter with secondary white mica and quartz form the cementing material. Ilmenite is present. A flake of gold is present but it is impossible to say whether it was imbedded in the rock or not because of the fact that the section was broken up in the making and the gold is not in contact with any other minerals.

25530 - Graywacke. Large angular to rounded grains of quartz and feldspar. The feldspar grains have been largely altered to calcite and sericite. The cement is quartz, calcite, white mica and green hornblende.

25531 - Arkose. Similar to 25529 and 25530 except for presence of more feldspar, calcie and magnetite. Other accessories are apatite, hematite and tourmaline. Chlorite has developed in some instances from hornblende.

25532 - Biotite shcist

25533 - Quartzitic mica schist(biotite)

25534 - Hornblende schist

25535 - Slate

25536 - Chert

25537 - Hornblende granite. The hornblende has been largely altered to chlorite and in some instances to tremolite ?.Orthoclase, perthite and plagioclase are present. Sericite has developed in the orthoclase and calcite in the plagioclase. For this reason no determinations on the plagioclase were possible. Biotite, fresh and bleached is present. Apatite is present.

25538 - Gneiss

25539 - Slate

25540 - Aplite

25541 - Black quartzite

25542 - Micaceous quartzite

25543 - Slate

25544 - Biotite schist

25545,6 - Slate

25547 - Cherty iron formation (carbonate).

25548,9,50,1 - Slate.

25552 - Garnetiferous mica schist.

25553 - Mica Schist

25554 - Slate

25555,6 - Slate

25557 - Quartzite

25558 - Black silicious slate, Kaolin, quartz, white mica, tremolite ?, calcite. Veins of calcite and quartz.

25559,60,1,2 - Slate.

25563 - Quartzose ferruginous chert (iron formation). A roughly banded mixture of quartz and chert . The cherty portions contain much limonite, hematite and magnetite.

25564 - Slate

25565 - Chert

25566 -

25567 - Silicious slate

25568 Greenstone. Altered basalt.

25569 - Silicious slate.

25570,1,2,3,4 - Granite.

25575 - Aplite (phase of granite)

25576 - Granite.

25577 - Hornstone. A dense matrix of chert or quartz with large concentrations of sericite. These were probably formerly feldspar crystals, or may have been formed from Kaolin. Green and brown biotite flakes of various sizes. Calcite and chlorite.

25578,9-Granite.

25580 - Red slate

25581 - Limonite (iron formation)

25582,3 - Slate

25584 - Granite

25585 - Biotite schist.

25586 - Arkose, sub-angular grains of quartz and feldspar, cementing material quartz, chlorite and secondary white mica. Accessories, magnetite, hematite, apatite.

25587 - Biotite schist.

25588 Chloritic (ottrelite)? mica schist. A highly schistose aggregate of quartz, white mica and chlorite or ottrelite with larger flakes of brown and brownish green biotite and very large plates of chlorite or ottrelite, .Magnetite is regularly distributed. This rock appears to have originated from a mica slate.

25589 - Slate

25590 -

25591 - Biotite schist

25592 - Biotite schist with bands of gneiss

25593 - Quartzitic mica schist

25594 - Biotite schist

25595

25596 - Quartz gabbro. The feldspar crystals have been strained and all show wavy extinction which interfered with determination of the character of the plagioclase. It appears however to be labradorite. Augite is abundant and in large grains and masses. In places it is undergoing alteration to brown hornblende. The larger augite crystals sometimes enclose a smaller rounded grains after a poccilitic fashion. A little quartz and biotite are present and calcite has developed in the plagio clase. Pyrite is the only accessory of importance.

25597 - Micaceous quartzite. Mostly quartz grains of small dimensions but a few larger ones have escaped crushing. Brown biotite is subordinate. A few feldspar grains are present. Secondary minerals - calcite, chlorite. Accessories - pyrhotite, magnetite, apatite, tourmaline, zircon. This rock has probably been derived from an impure sandstone.

25598 Quartzitic mica schist.

25599 - Biotite schist

25600, 1, 2 - Biotite schist

25603 - Conglomerate

25604, 5, 6, - Biotite schist.

25607, 8, 9, 10- 11, -Hornblende granite.

25612 - Hornblende granite. Minerals present are quartz, oligoclase, brown biotite, hornblende. Very little of the hornblende is unaltered. It appears to have been bleached to actinolite and tremolite.

25613 Hornblende granite.

25614 - Quartzite

25615, 6, [illegible] - Slate

25[illegible], 8 - Chert

25619 - Slate.

25620 to 25631 - Biotite schist.

25632 - Graywacke. Sub-angular to rounded grains of quartz, feldspar and chert united by a cement largely ferruginous (limonite).

25633 - Hornstone. In thin section this rock is greenish and so dense as to be absolutely irresolvable under the high power. The greenish material may be chlorite and the rock may be a dense aggregate of chert or quartz, mica and chlorite. Magnetite is abundant. From thin section the rock might be mistaken for slate but is not scratched by the knife. It seems to be baked slate with the result that a dense hard silicious rock has been produced. Thermal metamorphism. Resembles basalt in hand specimen.

25634 - Ferruginous chert

25635,6 - Chert

25637. Ferruginous slate. A very dense mixture of quartz, white mica and chlorite. There are numerous large spots of hematite. These have altered from magnetite. Quartz veins cut through the section.

25638,9 - Graywacke.

25640 - Chert - Ferruginous (iron formation).

25641 - Highly ferruginous chert (iron formation)

25642 - Slate

25643 - Silicious slate

25644 - Slate

25645 - Silicious slate

25646 - Chert

25647 - Slate

25648 - Graywacke

25649 - Quartzite.

25650 - Fine grained graywacke. Small angular grains of quartz, feldspar and chert with a cement largely chloritic. Considerable magnetite is present.

25651 - Slate

25652 - Graywacke

25653 - Cherty iron formation (probably carbonate)

25654,5 - Chert

25656 - Slate

25657 - Chert.

25658 - Cherty iron formation (hematite)

25659 - Cherty iron formation

25660,1 - Slate

25662,3 - Ferruginous sandstone

25664,5 - Slate

25666,7 - Chert

25668 - Chert. Veins of quartz cut the rock and small stringers of hematite are present. Hematite is also disseminated in small amounts and present in larger grains. It is always secondary however after magnetite which is also present.

25669 - Chert.

25670 - Weathered gneiss or metamorphosed impure dolomite. It is difficult to determine the origin of this rock as it has been converted to a mass of dolomite, calcite, chlorite, kaolin and subordinate quartz. If the rock has had an igneous origin, it must have been derived from a rock having the composition of a diorite or gabbro, because of the large amounts of dolomite, calcite and chlorite present, and small amount of quartz. The quartz may have been separated out as a product of alteration. The complete condition of alteration in this rock, lack of feldspar grains leads one to incline toward an origin from an impure dolomite. Pyrite is rather abundant, magnetite is sparsely distributed and a little limonite is present.

25671 - Metamorphosed dolomite or weathered gneiss. This rock is very similar to 25670 except for presence of much quartz, lesser amounts of chlorite and absence of kaolin. Several large masses of tourmaline showing anomalous bi-axial character are present. That this is possible is evidenced by strain shadows in the quartz. Several fresh grains of plagioclase are present also some white mica. Limonite is sparsely distributed and a little magnetite and hematite are present. The presence of the fresh plagioclase crystals lends support to the possibility that this rock and likewise No. 25670 which is very similar, may have been derived from an impure sandy dolomite .

25672 - Chert

25673 - Cherty quartzose rock. Badly weathered.

25674 - Greenstone schist. Mostly chlorite, abundant, calcite, quartz, some white mica. Magnetite, hematite and limonite distributed through the rock. The origin of this rock is obscure but from evidence presented by Nos. 25677-8 it would seem to have had an igneous origin from a basalt. However an origin from hornblende schist formed from impure sediments is possible.

25675 - Greenstone

25676 - Quartzitic phase in greenstone schist.

25677 - Greenstone schist. This rock is plainly an altered (pencil note -diabase) The numerous lath-shaped feldspar crystals are still fairly fresh. The ferro-magnesian constituents however have been altered to calcite and chlorite. Magnetite is regularly distributed in small grains and a few large grains of pyrite are present.

25678 - Greenstone schist. This rock is largely chlorite. The remainder of the ground mass is rather indeterminate, considerable white mica is present also altered feldspar. This rock seems to have been derived from the amygdaloidal type of basalt, cavities present being filled ~~wt~~ having been filled with chlorite, calcite and epidote. A few grains of pyrite are present, but magnetite is not abundant.

25679 - Greenstone schist. Minerals present are chlorite, calcite, kaolin, plagioclase, white mica, magnetite (abundant) and limonite. The original texture of this rock has been preserved showing it to be of igneous origin from basalt.

25680 - Slate

25681 - Amygdaloidal Basalt (partly altered to greenstone). The transformation from basalt to greenstone is clearly shown in this slide. The bulk of the rock consists of a fine grained aggregate of small lath-shaped plagioclase crystals, augite and chlorite. Numerous large crystals of augite are undergoing alteration to chlorite. This alteration is noticed around the edges also in the body of the crystals. Cavities are filled with calcite and epidote. Magnetite is uniformly distributed and a few grains of pyrite are present.

25682

25683 - Greenstone.

25684 - Greenstone schist

25685 - Greenstone

25686,7,8 - Greenstone schist.

25689 - Slate

25690 - Breccia

25691 - Chert

25692 - Cherty iron carbonate (iron formation). Consists of bands of chert and fine grained iron carbonate with veins of quartz, calcite and dolomite. Considerable white mica is present in the quartz veins. Small amounts of limonite, magnetite and pyrite are present.

25693 Quartzitic cherty iron formation.

25694 - Cherty iron formation

25695,6,7,8,- Chert

25699 - Cherty iron formation

25700,1,Graywacke

25702 - Basalt or greenstone.

25703. Greenstone schist. A mass of chlorite and other alteration products, with large and small lath-shaped crystals of plagioclase. Cracks are filled with epidote, limonite, hematite, chlorite, biotite and quartz.

25704 - Altered diorite. (Greenstone). This rock appears to have been originally composed of plagioclase and hornblende. The hornblende has bleached to a pale green amphibole and in some instances has altered to chlorite. The feldspar has also undergone alteration.

25705 - Ferruginous slate ? the specimen is so badly weathered that very little can be determined from it. Hematite is the most abundant constituent. White mica and quartz are also abundant.

25706 - Ferruginous slate

25707 - Slate.

25387 - Slate. A dense mixture of chiefly kaolin and chlorite with much zoisite.

25389 - Quartzite. Consists entirely of quartz with exception of small amounts of hematite. The texture of the rock is variable, probably due to crushing. Some portions are uniformly fine and chert like, other portions are a mixture of large and small grains. A combination of mosaic and morter structure is present. Strain shadows are characteristic and the larger grains have been elongated parallel to the schistosity.

25428 - Granite. The principal constituents are quartz orthoclase, plagioclase (oligoclase ?). Greenish brown biotite. Much sericite has developed in the feldspar and muscovite has resulted from bleaching of biotite. The biotite has also given rise to considerable chlorite, and contains inclusions of zircon. Other accessories are apatite, magnetite and hematite. A quartz vein cuts across the section.

25450 - Granite gneiss. The principal constituents are quartz, orthoclase, subordinate plagioclase, abundant greenish brown biotite. The biotite has variously altered in some cases to white mica, others to chlorite and some of the biotite is but partially altered. Accessories are apatite, hematite, magnetite in octahedral crystals, tourmaline (one large grain).

25474 - Granite Gneiss. Quartz, orthoclase, microline, plagioclase, greenish brown biotite, chlorite, magnetite, apatite, abundant zircon.

25480 - Calcareous Arkose. This rock has very peculiar structure. It is composed chiefly of small lath-shaped plagioclase crystals with some larger grains imbedded in these. Much calcite is present in large formless grains and fine granular aggregates. The calcite may have been derived from the plagioclase. In many instances it has collected in cavities. The larger grains are usually surrounded by an aggregate of small quartz or chert grains which are also distributed through the section..

25483 - Arkose. Large irregular grains of quartz, orthoclase and plagioclase, cemented with quartz and sericite. The sericite has no doubt developed from the feldspar crystals which have been extensively altered both at the borders and in the body of the crystals. The feldspar is clouded with finely divided hematite.

25486 - Arkose. Consists of large formless grains of quartz, orthoclase and plagioclase cemented by quartz and sericite, similar to 25483. Hematite is the only accessory of note.

25494 - Ferruginous chert. The bulk of the rock is a fine grained aggregate of chert with veins of quartz and cavities which have been filled with quartz after which deposition the rock was subjected to dynamic metamorphism. As a result the veins and cavity fillings developed mosaic and morter structures and pronounced strain features. Magnetite is fairly abundant also a little secondary hematite.

25499 - Chert. A fine grained aggregate of chert with quartz veins and bands of magnetite. A little calcite is also present.

25508 - Silicious slate contains much finely divided magnetite and hematite also possibly graphite. Several quartz veins cut through the section.

25527 - Arkose. Quartz, orthoclase, microline, microperthite, plagioclase in formless grains with interstitial material composed of quartz, feldspar, chlorite and sericite. Several large flakes of muscovite, chlorite and biotite are present. Magnetite is the chief accessory with a little hematite and apatite.

25540 - Arkose. Practically identical with 25527, with possibly limonite instead of hematite.

25541 - Greenstone. A fine grained mass of small lath-shaped feldspar crystals, much pale chlorite probably resulting from alteration of pyroxene, muck calcite (might be much calcite) and . Accessories are limonite and pyrite (or pyrrhotite).

25547 - Ferruginous chert. Contains much magnetite and hematite. No siderite was observed.

25598 - Sericite schist. A fine textured mass of quartz feldspar, white mica, greenish brown biotite. Larger grains of quartz and feldspar are included in the mass.

25648 - Greywacke. A mass of formless grains chiefly quartz and feldspar (orthoclase, microline, plagioclase) cemented in haphazard fashion by quartz, calcite and chlorite, which are in abundance. Much graphite is present, also a little magnetite, hematite and pyrite.

26522 - Dolomitic marble. Consists wholly of a mosaic of calcite and dolomite with but few impurities.

26523 - Altered peridotite ? (verde antique). The rock consists of a mixture of calcite, dolomite or magnesite with serpentine and talc. Streamers of magnetite are present, also much hematite. The calcite occurs in granular aggregates which may be in part cavity deposition. It is difficult to state positively what the derivation of the rock has been. The abundant carbonate suggests possibly derivation from an impure marble but may be cavity filling. The serpentine does not suggest olivine as much as orthorombic pyroxene or carbonate.

26524 - Pyritiferous slate.

26525 - Chloritic seritite schist. A mixture of sericite, chlorite and quartz with magnetite, hematite and pyrite. The hematite occurs as large splotches and is probably after magnetite.

26526 - Ferruginous schist. This rock consists of a mass of weathered material in such condition that it is impossible to determine the nature of the fresh rock. The bulk of the determinable material seems to be pale chlorite and quartz with hematite and much magnetite. The section is very poor and full of holes because of the soft and friable character of the rock.

26527 - Black calcareous chert. Contains granular aggregates of calcite and a little pale chlorite. Much graphite (or finely divided magnetite) is present, also a few grains of pyrite and magnetite bordered with hematite.

26528 - Chlorite, mica, amphibole rock. This specimen probably taken from a weathered ledge which is too badly altered to permit of determining the nature of the unaltered mass. Chlorite and white mica are present in about equal proportions with many "eyes" of pale amphibole in the chlorite. The original mineral was no doubt hornblende. Most of the white mica is sericite and may have been derived from feldspar. A few large flakes of muscovite must have originated from biotite. Accessories are ilmenite and hematite.

26529 - Serpentine. This rock is typically serpentinous. The only other minerals of importance being talc and a small amount of calcite. The rock has a pseudomorphous structure, the pseudomorphs suggesting olivine. An amorphous serpentine has been deposited between the pseudomorphs which remain dark between crossed nicols upon rotation. Much magnetite is distributed through the slide which in places has given rise to hematite.

26530 - Amygdaloidal lava. The ground mass is glass with green biotite and much ilmenite. Numerous rounded vesicles are present which have been filled with quartz in most cases but in a few with calcite. Some large flakes of green biotite are present in most of the amygdules. This appears to be detrital material but is perfectly fresh. Titanite is present in one of the amygdules. Much magnetite is distributed through the ground mass.

26531 - Slate. Typical. The distinguishable minerals are quartz, kaolin, abundant chlorite, pyrite, magnetite.

26532 - Calcareous slate. Consists of a base of indeterminate minerals probably kaolin, chlorite, quartz, etc, included in which are what appear to have been detrital fragments of feldspar now altered to calcite, kaolin, etc. A little biotite is to be observed. Pyrite is about the only accessory.

26533 - Chlorite - magnetic schist. A banded rock consisting of alternate layers of chlorite and magnetite with a little limonite.

26534 - Altered diorite. Consists of plagioclase, feldspar and chlorite. The feldspar inclines toward the basic end of the series and the original ferro-magnesian constituent appears to have been hornblende. Splotches of iron oxides mixed with other alteration products occur. Calcite has developed in the feldspar. A few grains of apatite are present.

26535 - Altered syenite or diorite. This specimen is too badly altered for positive identification. The bulk of the rock is pale chlorite and a granulated substance which may be bleached amphibole. Some colorless amphibole can be positively determined. The original amphibole was no doubt hornblende some of which has bleached, other which has given rise to chlorite. Some plagioclase is present but too badly altered for determination. A few grains of pyrite are present.

26536 - Greenstone. Altered diabase consists chiefly of altered feldspar and augite. The augite has been partially altered to chlorite. The alteration products of the feldspar appear to be a granulated mixture of minerals, sericite, kaolin, calcite, zoisite (saussurite).

26537 - Chloritic slate.

26538 - Greenstone. Consists entirely of secondary products which do not permit of determining its origin. The bulk of the rock is chlorite mixed with an abundance of calcite and a little quartz.

26539 - Ferruginous slate.

26540 - Weathered diorite.

26541 - Chlorite schist. Chlorite predominates with smaller amounts of quartz and sericite. There are a few large rounded grains of quartz with a smooth sharp outline. This may be cavity deposition. If such is the case later strains occurred for the quartz shows shadowy extinction. Hematite and tourmaline are accessories. Limonite ? is profusely distributed as small rounded or oval shaped grains.

26542 - Chlorite schist. Highly calcareous. Other minerals are muscovite and quartz.

26543 - Weathered hornblende schist. The hornblende has practically all been converted to chlorite. Other minerals arequartz, kaolin, magnetite, limonite, pyrite apatite.

26544 - Greenstone (altered amphibolite). The chief constituent is chlorite, the transition from hornblende being plainly evident. Feldspar (plag.) is abundant and tends toward the basic end of the series. A few grains of pyrite and apatite are present.

26545 - Altered diorite. Hornblende and plagioclase, feldspar are the chief constituents. The hornblende has been largely altered to chlorite. The feldspar approaches labradorite.

26546 - Amphibolite. Hornblende and plagioclase feldspar are the chief constituents. The feldspar is andesine or Labradorite. Considerable quartz is present also a few grains of apatite. There are large masses of indistinguishable alteration products, possibly mixtures of kaolin, calcite, sericite and quartz.

26547 - Weathered diorite. The hornblende has become very pale and the feldspar has altered to a mixture of products. A little quartz is present.

26548 - Chloritic slate.

26549 - Chloritic ferruginous slate. Much chloritic material, hematite and magnetite. Hematite is secondary.

26550 - Hornblende schist. Hornblende is subordinate. Quartz abundant. Hornblende is almost converted to chlorite. Magnetite is present.

26551 (2 slides). Serpentine. The bulk of the rock is a yellowish green serpentine. A little quartz is present also a few shreds of white mica.

26552 - Quartzite. A mosaic of quartz grains. The only other constituents of importance are, considerable magnetite which in places appears to have replaced the quartz, and a little calcite included in the quartz grains.

26553 - Amphibolite. Hornblende predominates with feldspar and quartz. Magnetite (ilmenite ?) is sparsely present. The rock is fresh.

26554 - Kaolinized banded rhyolite.

26555 - Conglomerate. The grains are almost wholly quartz and are sub-angular to oval and rounded. Cement is chiefly calcite with some iron oxide.

26556 - Kaolinized pegmatite.

26557 - Ferruginous slate. The distinguishable constituents are Quartz, a pale green chloritic mineral, and much hematite (probably after magnetite).

26558 - Kaolinized rhyolite.

26559 - Mica schist. Mica resembles sericite in hand specimen but faint greenish pleochroism suggests bleached biotite. Quartz and iron oxide are

26560 - 1-2 - Hornblende schist.

26563,4 - Serpentine

26565,6 - Mica schist

26567 - Sericite Schist. A dense mixture of quartz, white mica, pale chlorite and biotite. A little magnetite is present.

26568 - Graywacke. Angular to irregular grains of quartz, orthoclase, plagioclase, in a matrix of quartz and biotite. Accessories are apatite (abundant) magnetite, zircon (rare).

26569 - Gneiss. Chief constituents are quartz and feldspar, latter much clouded with hematite. Partially bleached green biotite is present. Accessories - magnetite, apatite.

26570 - Mica schist.

26571 - Quartzose mica schist. Brown biotite is subordinate to quartz. A few grains of feldspar and flakes of white mica are present. Apatite, magnetite, zircon (rare)

26572,3-Mica schist

26574 - Staurolittic mica schist

26575 - Quartzitic mica schist

26576 - Staurolitic mica schist. Chief constituents are quartz, staurolite, brown biotite, muscovite, feldspar (subordinate) accessories - garnet (abundant), apatite magnetite, zircon.

26577 - Kaolinized syenite.

26578 - Aplite. Consists chiefly of orthoclase and albite with little or no quartz. A small amount of hornblende chlorite and muscovite is present. Much hematite, apatite, zircon, pyrite with borders of magnetite and hematite.

26579 - Mica schist.

26580 - Diorite. Consists of Labradorite and pale amphibole, with but little else. After grains of pyrite are present. The amphibole appears to have been almost converted to chlorite.

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26581,2 - Mica schist.

26583 - Gneiss. Quartz, orthoclase, oligoclase, biotite, chlorite, apatite, magnetite, zircon.

26584 - Diorite. Hornblende, andesine, chlorite, magnetite, apatite, zircon, white mica, calcite.

26585,6 - Hornblende schist .

26587 - Amphibolite. Fresh green hornblende, labradorite, apatite, magnetite.

26588,9,90 - Mica schist.

26591 - Hornblende schist.

26582 (2 slides) Schistose graywacke. A ground mass of quartz, brown biotite and green hornblende containing larger grains of quart, feldspar and hornblende. The quartz shows shadowy extinction. Pyrite, magnetite and hematite are accessories. In some instances there is a core opyrite surrounded with magnetite which latter is in turn fringed with hematite. A little calcite is present.

26593 - Ferruginous slate. Quartz, chlorite and hematite are the chief constituents.

q6594 - Quartzite.

26585 - Quartzite. This is a pure mosaic of quartz grains with much pyrite. Some pyrite is in the form of excellent cubes and is probably later than the quartzite by replacement. A little magnetite is present. Strain shadows are characteristic.

26596 - Arkose.

26597 - Greenstone (altered andesite or amygdaloid). A mass of alteration products including chlorite, magnetite, hematite.

26598 - Ferruginous quartz schist. Hematite and quartz are about the only constituents.

26599 - Magnetite quartz contact rock. Consists chiefly of magnetite, bleached hornblende and quartz. A few flakes of chlorite and biotite are present, also a few grains of garnet.

26600 - Micaceous quartzite. Non-schistose. Biotite and quartz are the chief constituents. Accessories - apatite, chlorite, muscovite, magnetite, calcite.

26601 - Mica schist. Green biotite, chlorite. Quartz a little feldspar, long shreds of muscovite (bleached biotite), apatite, magnetite, tourmaline.

26602 - Diorite. Hornblende (brownish) labradorite, chlorite, calcite.

26603 - Hornblende schist.

26604 - Diabase typical. The lath-shaped plagioclase crystals (labradorite) are fresh and intersect the augite in such a manner so as to suggest simultaneous or earlier crystallization. The augite is mostly fresh with slight alteration to chlorite in places. Limonite has also developed. In some places biotite appears intergrown with augite. Some of the chlorite may be after biotite. A little green hornblende(probably primary) occurs. Olivine is fairly abundant. Accessories are apatite, pyrite, pyrrhotite, magnetite, zircon.

Book 362 - 20 insert after page 19.

26605 - Hornblende schist.

26606 - Ferruginous chlorite schist. Portions of this rock are wholly chlorite mixed with hematite. Other portions are bands of quartz and chlorite with some calcite.

26607 - Hornblende schist.

26608 Diabase

26609 - Mica schist

26610 - Garnetiferous mica schist.

26611 - Quartzite with pyrite

26612 - Garnetiferous mica schist

26613 - Amphibolite

26614,5 - Hornblende schist.

26616,7,8 - Black chert

26619-20 - Hornblende schist.

26621 - Pyroxenite. Consists almost entirely of bronzite. Brown biotite is present, also a little quartz.

26622 Gabbro ? Contains both orthorombic and monoclinic ? pyroxene. Feldspar is present but subordinate so that the rock may be gradation from 26621. A little quartz is present and biotite is abundant.

26623 - Syenite

26624 - Pegmatite

26625 - Gneiss

26636 - Gneiss. Abundant biotite and feldspar (orthoclase oligoclase), quartz, abundant garnet, apatite, zircon.

26627 - Mica schist.

26628 - Amphibolite

26629 - Diorite. Hornblende, brown biotite, labradorite, chlorite, much calcite in plagioclase also in hornblende. Apatite, zircon, titanite, magnetite.

26630 - Hornblende schist. Chief constituents hornblende and quartz with a little feldspar. An unusual feature is the profuseness of titanite, in large and small grains. Other minerals calcite, pyrite, limonite, magnetite.

26631. Mica diorite. Biotite, andesine, hornblende, chlorite, bleached biotite.

26632 - Altered diorite (greenstone) Andesine or Labradorite, hornblende. Much chlorite after hornblende, magnetite.

26633 - Amphibolite. Hornblende and plagioclase, magnetite, pyrite and pyrrhotite.

26634 - Hornblende schist. Hornblende, quartz, feldspar, limonite, magnetite.

26635 - Quartzose mica hornblende schist. Hornblende, biotite, much quartz and calcite. The latter chiefly in cracks and cavities. Rock appears to be metamorphosed sediment.

26636 - Amphibolite. Hornblende, quartz, chlorite with a little feldspar are chief constituents. Accessories magnetite, pyrite.

26637 - Weathered gneiss. Brown biotite and green hornblende are present in about equal proportions. In addition to quartz and feldspar there is much calcite and a little zircon.

26638 - Hornblende schist.

26639 - Amphibolite.

26640 - Weathered amphibolite (Greenstone) Hornblende and quartz are chief constituents. Some of the amphibole shows bluish green pleochroism and may be a sodic variety. Accessories, magnetite, pyrite.

26641 - Ferruginous slate.

26642 - Amphibolite. This rock is somewhat similar to 26640 but contains much altered plagioclase. It may be possibly altered diorite. Calcite, chlorite, pyrite, magnetite.

26643 - Hornblende schist.

26644 - Garnet-magnetite mica schist. Garnet magnetite amd white mica are the chief constituents, hornblende and limonite are also abundant. Probably a contact rock.

26645 - Amphibolite. Chief constituents are quartz and hornblende with a little feldspar and much calcite. The hornblende shows effects of pressure with shadowy extinction and bent lamellae.

26646 - Magnetite quartz rock.

26647 - Magnetite-amphibole rock consists of much magnetite, pale amphibole and quartz. The amphibole is possibly grunerite.

26648 - Gabbro porphyry. Huge crystals of Augite and labradorite. The feldspar is much altered chiefly to paragonite ? A little calcite is present also chlorite and apatite. Both augite and plagioclase show idiomorphic outlines toward one another.

26649 - Granite

26650 - Pegmatite

26651 - Granite

26652,3 - Hornblende schist.

26654 - Sericite schist. Quartz is most abundant mineral with shreds of sericite large eyes of quartz showing wavy extinction are present. Accessories are magnetite and apatite.

26655 - Ferruginous slate

26656,- Hornblende schist

26657 - Hornblende schist.

26658 - Amphibolite Hornblende. Bleached hornblende, quartz and feldspar.

26654 - Gneiss. Appears as mica schist in hand specimen. Contains however considerable quantities of feldspar. The bulk of the rock is however greenish biotite and quartz. Accessories are magnetite in octahedral and dodecahedral crystals, and a few grains of apatite. Sericite has developed in the feldspar.

26660 - Mica diorite. Biotite, hornblende andesine, chlorite, sericite, calcite, bleached biotite and hornblende, magnetite, pyrrhotite.

26661 - Gneiss

26662 - Granite

26663 - Mica diorite. Hornblende, biotite (labradorite, bleached hornblende and biotite, chlorite.

26664 - Weathered gabbro (greenstone) labradorite, bleached hornblende, chlorite apatite, zoisite. The hornblende appears to be secondary

26665 - Syenite

26666 - Syenite. Orthoclase, plagioclase, green hornblende, brown biotite are the essential constituents. Many secondary products have developed. Among them are calcite, sericite, chlorite, pale amphibole, leucoxene, Accessories are magnetite (ilmenite ?), titanite, zircon, apatite.

26667 - Amphibolite

26668 - Altered amphibolite. The hornblende has been almost wholly altered to a pale amphibole. This latter is abundant and is associated with a mass of indeterminate material which seems to be altered feldspar. Other minerals are abundant calcite and titanite, with pyrite and apatite.

26669 - Gabbro

26670 - Magnetite- quartz rock with small amounts of chlorite and calcite.

26671 - Slate

26672 - Amphibolite

26673 - Tourmaline chlorite contact rock.

26674 - Garnetiferous mica schist.

26675 - Gneiss/.

Book in vault 20

Book 368. Party Calvert, Walker, Way. 1930 Survey in vicinity of Raber, Batesville, Epaufette, engadine, Whitedale. Almost entirely in figures.

Book - no number - 1937 - C.A.Lamey. Copper Survey. Traverses and diagrams in vicinity of Ontonagon Road near Toivola Road

Book no number - Party - Frank Woodruff, David Andrew and C.A.Lamey. Copper survey. same locality as above. Only a few pages of notes entirely in figures. 1938.

Book no number - 1937. Party , Spiroff and Fowler. Copper Survey. Traverses in vicinity of Ontonagon-Challenge Road. Entirely in figures.

Book, no number - 1937 - Copper Survey, Party, Fowler, Woodruff, MacIntosh. Traverses and diagrams in vicinity of Lake Eva. Entirely in figures.

Book no number - no date. Chas. E wright A few paragraphs of descriptions of samples.

Book no number - 1939 Iron Survey. C. A. Lamey Survey and traverses in T 39 N, 28,29 and 30 W. Entirely in figures. See additional sheets.

Book - no number. Osgood, general notes. Misc. addresses. Notes on the property of the Titan, Ohio and Spurr mines and Nevada mines. Also some notes on water levels of Sand Lake and Silver lake.

Book no number - Traverses and diagrams entirely in figures Pt Verna, Winona and Misery river. Found no name or year. Copper survey Control.

Book - no number. 1937 A. N MacIntosh Copper Survey Control. Near old Ontonagon road.

Book - no number 1938 Copper survey. with Diagrams. Spiroff.

Book no number - 1938 Carl A Lamey Copper Survey. Traversesand diagrams.

Book no number - 1939 - Campbell - Copper Survey. Vicinity of Ontonagon and Wyandotte Roads.

Book-no number - 1940 - Carl A. Lamey Sec. 23,24,25,30,31,33,34, T 40,41,N,R 30,31W Traverses and diagrams.

Book No number - 1928. W. Osgood. Misc. data on mines, managers, difficulties attached to promotion of organization, particularly the activities of on H C Stapleton

Book - no number. No date or name. Field notes of Sec. 20,29 in T 58 N, R 31 W.

Book - no number

C.A Lamey 1939 Iron Survey -

pp 1-2. Diagrams showing sections covered in the traverses

p 3. Some Dip needle Observations.
1. Conglomeratic top of Randville, Iron Hill area 22-24
2. Graphitic slate and Iron formation, Iron Hill area 20-23
3. Hanbury ? slate, Marion Park, 33-34
4. Hanbury?slate, along Sturgeon River. S of U.S. 2. Chert beds; dark gray to black dolomitic slate D N - 27
5. Dioritic intrusion into Hanbury? 22
6. Turner's exploration. Fe-cherty material. Some quartzite pebbles (quartz grains separated by dark matrix). Dark gray chert masses. 22 Soft red, earthy hematite. Some dark gray to green slate, reddish in fact, with small quartzitic seams; laminated. Some slate contains numerous muscovite flakes.
7. Hanbury? slate S of Verona shaft near US 2. Grayish to greenish slate, reddish impart with quartzite seams 27. Micaceous in part.
8. Hanbury Hill, along N-S fence. Predominating dolomite quartzite weathering to rusty brown, limonite coating. Quartzite dark grey. Dark gray slate and dolomite bands. Some weathers same as Randville. 28
9. Basic intrusive? into Hanbury ? 28
10. Lake shore (Hanbury Lake) Shear zone 6 ft wide. Dolomite, sheared. Very similar to shear on S side L. Antoine

pp 12-71 Traverses and diagrams in Sec.1,4,5,6,8,9, T 39 N, 28,29 W.

pp 72-74 - Detail traverse and diagrams of Munro Pit.

pp 76-117 - Traverses in Sec.1,2,3, T 39 N, 30 W and Sec. 34, T 40 N, 30 W.

Near back of book 3 diagrams of faults in Munro pit.
2 pages of Traverses in vicinity of Aragon, and Brier Hill mines.

3 pages in back of book
01. Quartzite; laminated, red, fine grained.
02. Dolomite; inconspicuously laminated. One fresh surface reddish gray with some darker streaks; fine grained.
1. Dolomite massive with conchoidal fracture; gray very fine grained.
2. Quartzite; massive; green to black medium grained; vitreous.
3; Quartzite ; massive; purplish gray, fine with scattered coarse grains; moderately vitreous.
3_2. Somewhat conglomeratic phase of 3.
4. Dolomitic slate; inconspicuously bedded, greenish gray; fine grained.
5. Quartzite; massive, interbedded with layers hematite, purplish brown; fine grained; cherty appearance due to conchoidal fracture.
6. Slate; massive; purple to brown, probably shearing to white and reddish; very fine grained; argillaceous odor.
7. Thin bedded to laminated phase of 6.
8. Quartzite massive; purplish dark gray; coarse grained; conspicuous quartz grains in ferruginous matrix.
8_2 and 8_3. Phases of 8, with greenish matrix.
9 and 9_2 . Ferruginous slate: laminated; red to black; fine grained; argillaceous odor.(moderate).
10. Iron formation ; bedded - irregular, lenticular (jasper) lamination shown in hematite; gray with maroon or dark red bands and lenses (jasper); jasper granules in dense matrix.
11. Phase of 10 with coarser jasper granules.
12. Similar to 10 and 11, but with bands of 9 and 5.
13. Essentially same as 11.

14. Iron formation; laminated; jasper granules; argillaceous odor.
15. Quartzite; massive; dark gray to purplish gray; fine grained; nearly vitreous.
16 & 17. Ferruginous slate; well laminated; thinly laminated; dark reddish brown to dark gray; fine grained , strong argillcaeous odor, reddish streak.
18. Quartzite; bedded; white; vitreous; medium grained; 1 inch thick.
19. Same as 16 and 17.
19x. Probably sheared; appears mottled.
20. Ferruginous slate; laminated; bluish dark gray to brown; fine grained; argillaceous odor.
21. Iron formation; bedded ?; quartzitic bands with purplish granules (jasper), chiefly ore.
22 Iron formation, bedded, lenticular ?, lenses of fractured quartzite ? much like 21 ? (White granules ?)
23. Quartzitic iron formation; bright red jasper granules scattered throughout.
24. Quartzite; massive dark (purplish gray); purplish granules with gray hematite and red earthy hematite. (Some white granules).
25. Iron formation with quartzite lenses. Like 22 but thicker lenses.
26 and 27. Ferruginous slate; laminated greenish gray to purple; fine grained; argillaceous odor.
28. Slate; probably bedded; mottled red and grayish to greenish white; sericitic and ferruginous; argillaceous odor.
29. Same as 28 with quartzitic lenses or pebbles (small) lenticular to spherical.
30. Chloritic schist (hematitic).
31. Essentially same as 30
32. Chloritic schist with quartzitic layer or layers. Not argillaceous odor.
33 and 34. Graphitic slate to schist.