Sp. No. 1036.—Compact Chloritic Argillaceous Schist. Color black. The texture is so fine that the single ingredients cannot be seen even with a loupe. Cut with a knife, it leaves a black shining surface. Before the blowpipe in the oxydation flame a small chip of it changes to a grayish-white, which is probably due to a small percentage of carbon. Hardness = 3.5. Streak powder dark-gray. Spec. gr. = 2.73.—Formation XV.—Location near centre Sect. 27 —T. 48—R. 30.—Provisional name used in Report, Argillite (carbonaceous).

Sp. No. 1037.—Dark-gray Anthophyllitic Schist. Containing magnetic and an ochreous brown iron ore. In a thin section under the microscope, the anthophyllite has a brown color, and certain portions of it are gray. Hardness = 4. Streak grayish. Spec. gr. = 3.16.—Formation XVII.—Location near centre N. W. ¼ Sect. 25—R. 30.—Provisional name used in Report, Anthophyllitic Schist.

Sp. No. 1038.—Grayish-green Chloritic Schist. Compact and fine-grained. Under the microscope can be seen several parallel seams of quartz, also a few crystals of hornblende. Hardness = 5. Streak powder gray. Spec. gr. = 2.67.—Formation VIII (?).—Location, S. W. ¼ of S. W. ¼ of Sect. 34—T. 48—R. 28.—Provisional name in Report, Dioritic Schist (feldspathic).

Sp. No. 1039.—Fine-grained Argillaceous Schist. Color greenish. It has a slaty structure and a very distinct parallel cleavage. In a thin section a few fragments of hornblende can be seen. It contains very evenly distributed considerable chlorite. Hardness = 3. Streak pale yellow. Spec. gr. = 2.85.—Formation VII.—Location, N. E. ¼ of N. E. ¼ of Sect. 4—T. 47—R. 28.—Provisional name used in Report, Clay Slate (greenish).

Sp. No. 1040.—Jaspery-brown Iron Ore. The specimen has a banded structure. The brown iron varies in color from a brownish-red to a dirty yellow (ochreous). The grains of quartz under the microscope are very small ($\frac{1}{20}$ millim.). A section taken across the lamination resembles silicified wood. Hardness = 5-7. Streak yellow. Spec. gr. = 3.15.—Formation VI.—Location, N. E. ¼ of

N. E. ¼ of Sect. 4—T. 47—R. 28.—Provisional name used in Report, Limonitic Quartz Schist.

Sp. No. 1041.—Light-gray Quartzite. In a section under the microscope with a power of 100 diameters can be seen several acicular crystals, resembling actinolite. The gray color of the specimen is due to this actinolite-like mineral. It contains an occasional crystal of garnet. Hardness=6.5. Spec. gr.=2.66.—Formation V.—Location, S. E. ¼ of N. E. ¼ of Sect. 4—T. 47—R. 28.—Provisional name in Report, Gray Quartzite.

Sp. No. 1042.—Dark-gray Quartzite. With the microscope can be seen a little hornblende and chlorite. The grains of quartz are smaller than in 1041. Hardness=7. Spec. gr.=2.74.—Formation V.—Location, S. E. ¼ of N. E. ¼ of Sect. 4—T. 47—R. 28.—Provisional name used in Report, Feldspathic Diorite Rock (compact).

Sp. No. 1043.—Decomposed Diorite and Magnetic Ore. The specimen has a grayish-green color. It contains a little chlorite and clay. On a fresh fracture the crystals or grains of magnetic ore can be easily distinguished. Under the microscope the rock appears to have a semifluid structure. The crystals of feldspar are quite large, some of them are bent, while others are broken. Fragments of hornblende are scattered through the section. Hardness=3. Streak powder green to black. Spec. gr.=3.12.—Formation XIII.—Location, Washington Mine.—Provisional name used in Report, Steatitic Schist (with grains of Magnetite).

Sp. No. 1044.—Coarse Granular Magnetic Ore. The crystals of magnetite can be seen with a good loupe. It contains a little quartz and chlorite. Hardness=5.5. Streak black. Spec. gr.=4.28.—Formation XII.—Location, Washington Mine.—Provisional name used in Report, Magnetic Iron Ore.

Sp. No. 1045.—Micaceous Specular Iron Ore and Quartz. The parallel layers of ore and quartz are uneven, thereby giving to the specimen a wavy or corrugated structure, resembling some varieties of gneiss. It contains several small crystals of garnet and

magnetic ore. Hardness=6.5. Streak red. Spec. gr.=3.86.—Formation XII.—Location, S. W. of Old Washington Mine.—Provisional name, Specular Quartz Schist.

Sp. No. 1047.—Brownish-gray Diorite. The surface of a fresh fracture appears to be spotted. Some of the grains of feldspar are colored a pale red. The amphibole is a dark-green. In the section can be seen small crystals of magnetic ore. It contains a very little chlorite. Hardness=5. Streak yellowish-brown. Spec. gr.=2.79.—Formation XIII.—Location, Washington Mine.—Provisional name, Chloritic Rock.

Sp. No. 1048.—Dark-green or bluish-gray Actinolite Rock, with garnets. On a fresh fracture the red garnets set in the dark-green actinolite give the surface a very pretty appearance. With the microscope can be seen several small grains of quartz; also particles of specular and magnetic iron-ore. Hardness=5.5. Streak brownish-red. Spec. gr.=3.21.—Formation XII.—Location, Washington Mine.—Provisional name used in Report, Hematitic Quartzose Schist (garnets).

Sp. No. 1049.—Diorite. The cleavage planes of the hornblende can be readily distinguished. The feldspar is somewhat decomposed. In a section under the microscope can be seen clusters of magnetic or specular iron-ore crystals; also a few grains of quartz. Hardness=5.5. Streak powder grayish. Spec. gr.=3.18.—Formation XIII.—Location, Washington Mine.—Provisional name in Report, Hornblendic Rock.

Sp. No. 1050.—Fine-grained Specular Iron Ore. The specimen has a bright glistening appearance and is inclined to a micaceous structure. It is somewhat friable. Contains magnetic ore and quartz. Hardness=3. Streak brownish-red. Spec. gr.=4.51.—Formation XIII.—Location, Washington Mine.—Provisional name, Specular Slate Ore.

Sp. No. 1051. (Missing).—Formation XIII.—Location, Washington Mine.—Provisional name used in Report, Talcose Schist (micaceous).

Sp. No. 1052.—Dark-green Chloritic Schist. It contains a large percentage of quartz. The grains of quartz are very small. In a section can be seen several crystals and particles of specular ore; also a few crystals of garnet. Hardness=4. Streak brownish-red. Spec. gr.=2.87.—Location, Washington Mine.—Provisional name, Quartzose Schist (with argillite).

Sp. No. 1053.—Chloritic Argillaceous Brown Iron Ore. This is probably a decomposed Diorite. Hardness=2. Streak brownish-yellow. Spec. gr.=2.77.—Formation XIII.—Location, Washington Mine.—Provisional name, Chloritic dyke material.

Sp. No. 1054.—Magnetic Ore. The grains or crystals of the ore can be seen with the naked eye. Hardness=5–6. Streak black. Spec. gr.=4.83.—Formation XIII.—Location, Washington Mine.—Provisional name used in Report, Granular Magnetic Ore.

Sp. No. 1055.—Decomposed Dioritic Schist. Contains chlorite, talc, clay, and magnetic iron ore. Under the microscope a section shows an apparent semifluid structure, and while in this state it is very evident that a flowing movement has taken place. Shred-like or skeleton crystals of hornblende are scattered through the entire section. There cannot be seen even an outline of a feldspar crystal; only fragments remain, that may be recognized in the polarized light. The grains of magnetic and specular ore are grouped together. It contains a few slender crystals of epidote. Hardness =4.5. Streak brown. Spec. gr.=3.13.—Location, Washington Mine.—Provisional name in Report, Chloritic Schist.

Sp. No. 1056.—Dark-gray Quartzite. Contains magnetic ore, pyrites, hornblende, and chlorite. The grains of quartz are small. The pentagonal dodecahedron crystals of pyrites are unevenly distributed. The crystals of magnetic ore are very minute, none of them exceeding $\frac{1}{200}$ of a millm. in diameter. The percentage of hornblende and chlorite is small. Hardness=6.5. Streak green to black. Spec. gr.=2.66–3.30.—Formation XIII.—Location, Washington Mine.—Provisional name in Report, Quartzite (pyritiferous dyke material).

Sp. No. 1057.—Anthophyllite Schist. Contains magnetic iron ore and quartz. A section under the microscope shows a reticulated structure. Certain portions of the anthophyllite are colored brownish-yellow. Hardness=5. Streak pale yellow to black. Spec. gr.=3.52.—Formation X.—Location, Washington Mine.—Provisional name used in Report, Micaceous Ferruginous Schist.

Sp. No. 1058.—Anthophyllite Schist and Quartz. The ingredients are unevenly distributed. There are several red seams in the rock composed of quartz, anthophyllite and hematite ore. In a section can be seen crystals of garnet and magnetic ore. Hardness=5–7. Streak reddish. Spec. gr.=3.00.—Formation X.—Location, Washington Mine.—Provisional name used in Report, Micaceous Ferruginous Schist.

Sp. No. 1059.—Black Magnetic Iron Ore. Contains silica and a little chlorite, also a trace of manganese. Granular and easily friable. Hardness=5.5. Streak black. Spec. gr.=4.70.—Formation XIII.—Location, N. W. ¼ of S. W. ¼ of Sect. 24—T. 48—R. 31.—Provisional name in Report, Granular Magnetic Ore.

Sp. No. 1060.—Specular Ore. The specimen possesses two interesting characteristics, that is, portions of the specular are crystallized in octahedrons, which are slightly magnetic. Hardness=6. Streak brownish-red. Spec. gr.=4.92.—Formation XIII.—Location, New York Mine.—Provisional name in Report, Octahedral Specular Ore (Martite).

Sp. No. 1061.—Anthophyllite and Magnetic Ore Schist. This is a very fine-grained slaty-looking specimen. In a section under the microscope the ingredients appear to be about equally divided. Hardness=6. Streak powder black. Spec. gr.=4.46.—Formation X.—Location, South of the New England Mine.—Provisional name used in the Report, Banded Magnetic Schist.

Sp. No. 1062.—Actinolite Schist. Very fine-grained and has a blackish-green color. Some portions of the rock are partially decomposed. Contains a little magnetic ore. Hardness=5. Streak dirty green. Spec. gr.=3.14.—Formation XI.—Location, South of New England Mine.—Provisional name used in Report, Chloritic Rock.

Sp. No. 1063.—Actinolite and Hornblende Schist. Very similar to 1062. It has a brownish-green color and is more decomposed than specimen 1062. Contains a little pyrites. Hardness=3.5. Streak yellowish-green. Spec. gr.=3.05.—Formation XI.—Location, South of New England Mine.—Provisional name in Report, Chloritic Rock.

Sp. No. 1064.—Quartz and Specular Ore. This is a very fine-grained, reddish-bluish-gray specimen, filled with small cavities, that are beautifully studded with crystals of quartz, garnet, and specular ore. The percentage of quartz and specular ore appears to be about the same. Hardness=6. Streak red. Spec. gr.=3.80.—Formation XII.—Location, New England Mine.—Provisional name used in Report, Hematitic Quartzose Schist.

Sp. No. 1065.—(Missing). Formation XII.—Location, New England Mine.—Provisional name used in Report, Ferruginous Quartz Schist.

Sp. No. 1066.—Same as Specimen No. 1064.—Formation XII.—Location, New England Mine.—Provisional name used in Report, Quartzose Red Hematite Schist.

Sp. No. 1067.—Decomposed Specular Ore. Contains clay. Hardness=2–5.5. Streak blood-red. Spec. gr.=4.34.—Formation —.—Location, New England Mine.—Provisional name used in Report, earthy Hematite.

Sp. No. 1068.—Argillaceous Chloritic Schist. Very compact and has a dark-gray color. With a good loupe can be seen on a fresh fracture small crystals of iron pyrites. Under the microscope, using polarized light, can be seen a few fragments of hornblende. Hardness=4. Spec. gr.=2.95.—Formation XII.—Location, New England Mine.—Provisional name, Chloritic Schist.

Sp. No. 1069.—Hematite Ore and Quartz. The specimen is somewhat decomposed and contains parallel seams of ochreous iron ore. There can be plainly seen white specks of a hydrous silicate of alumina—"Kaolinite." Hardness=2–6.5. Streak red to yellow. Spec. gr.=3.20.—Formation XII.—Location, New England Mine.—Provisional name used in Report, Quartzose Limonitic Schist.

Sp. No. 1070.—Hematite Ore. Somewhat decomposed. Contains fine grains of quartz and a little clay. Hardness=4. Streak yellowish-red. Spec. gr.=3.24.—Formation XIII.—Location, New England Mine.—Provisional name, Hematitic Chloritic Schist.

Sp. No. 1071.—Specular Ore, containing grains of magnetic ore. It has a bluish-black color and submetallic lustre. It contains a little silica. Hardness=6. Streak brownish-red. Spec. gr.=4.46.—Formation XIII.—Location, New England Mine.—Provisional name used in Report, Jaspery Specular Ore.

Sp. No. 1072.—Argillaceous Schist. Very fine texture, of a light-greenish color. It contains a little specular ore and chlorite. Hardness=3. Streak powder pinkish-gray. Spec. gr.=3.08.—Formation XIII.—Location, New England Mine.—Provisional name used in Report, Clay Slate (greenish).

Sp. No. 1073.—Specular Schist. Contains a very little magnetic ore and silica. Hardness=5. Streak brownish-red. Spec. gr.=4.—Formation XIII.—Location, New England Mine.—Provisional name used in Report, Jaspery Specular Ore.

Sp. No. 1074.—Manganiferous Iron Ore. This is a brownish-black ore and has the appearance as if it had been burnt. It contains small specks of Kaolin. Streak brownish-red. Spec. gr.=4.00.—Formation X.—Location, Iron Mountain Mine.—Provisional name used in Report, Manganiferous Siliceous Ore.

Sp. No. 1075.—Jaspery Specular Schist. This ore is slightly banded. Hardness=6. Streak red. Spec. gr.=3.83.—Formation X.—Location, Iron Mountain Mine.—Provisional name used in Report, Quartzose Iron Schist.

Sp. No. 1076.—Same as 1075.—Formation X.—Location, East end of Ogden Mine.—Provisional name used in Report, Quartzose Iron Schist.

Sp. No. 1077. (Missing).—Formation X.—Location, Foster Mine.—Provisional name, Soft Hematite (porous, bronzy).

Sp. No. 1078.—Hornstone.—Formation X.—Location, Foster Mine.—Provisional name used in Major Brooks's Report, Cherty Quartz Schist.

APPENDIX D.

ORE DEPOSITS.

APPENDIX D.

RELATES to the discovery of ore by the United States Linear Surveyors. (See Vol. I., Part I., Chapter I.)

1. *Specimens of Iron Ore collected.*—"Catalogue of specimens collected by William A. Burt, Deputy Surveyor, while surveying Township lines, under Dr. Houghton's contract, dated June 25th, 1844, for surveying with reference to mines and minerals."

East boundary of Township 47 North, Range 27 West.

No. of Specimen.	Sect.	
55	12	Compact quartz rock; No. 2, quartz, with Spathose Iron.
56	12	No. 1, Brown Hematite, steel-gray; No. 2, Taconic steel slate.
57	12	Brown Hematite, steel-gray.
58	12	Quartz, with Spathose Iron.
59	1	Quartz, with Spathose Iron.
60	13	No. 1, Fine, large, granulated, sub-crystalline Spathose Iron; No. 2, same with Quartz; No. 3, Spathose, earthy, sub-laminated Iron.
61	24	Nos. 1 and 2, Spathose Iron; No. 3, Hydrated Carbonate of Iron, with milky Quartz and specks of Mica.
62	13	Spathose Iron, brown, amorphous, sub-laminated.
63	25	Near a pond; 2 specimens Spathose Iron, granular, sub-crystalline.
64	25	Near a pond; Spathose Iron, granular, sub-crystalline.
66	1	Spathose, steel-gray, Iron ore.

In running north on the east line of Sect. 13—T. 47—R. 27, Mr.

Burt's returns are thus: "In some places on N. ¼, the needle would not take any direction, but would dip to the bottom of the box; also at the end of the line. N.B.—Two good solar compasses were used on the town line, and the variations of the needles determined by both. When the variations were about 45° or 50°, the needle appeared to be weak, linked, and nearly destitute of magnetism. Spaltoric and Hæmaltic Iron ore abound on this line."

(Signed). WM. A. BURT, D. S.,
for DOUGLAS HOUGHTON, D. S.

(From official U. S. Land Office records).

2. *Extract from Judge Burt's Diary and Jacob Houghton's Statement.*—In his official diary of the year 1844, William A. Burt says: "East boundary of Township 47 North, Range 27 West. This line is very extraordinary, on account of the great variations of the needle, and the circumstances attending the survey of it. Commenced in the morning, the 19th of September; weather clear; the variation high and fluctuating, on the first mile, section one. On sections 12 and 13, variations of all kinds, from south 87 degrees east, to north 87 degrees west. In some places the north end of the needle would dip to the bottom of the box, and would not settle anywhere. In other places it would have variations 40, 50, and 60 degrees east, then west variation alternating in the distance of a few chains. Camped on a small stream in section 13.

"September 20.—Raining. Staked the line on south half of section 13, the needle being useless.

"September 21.—Snow fell in the forepart of the day, from three to six inches deep. Mr. Ives came to us; had been left lame near corner of Towns. 47 and 48, Ranges 26 and 27."

In this connection, Mr. Jacob Houghton says: "On the evening of the 15th of September, we reached the lake and established the north-east corner of Town. 47 north, Range 25 west, between the Chocolate and Carp Rivers. We thence ran west the township line, between Towns. 47 and 48, and camped at the town corner on the east side of Teal Lake, on the 18th of September.

"On the morning of the 19th we started, running the line south, between Ranges 26 and 27. So soon as we reached the hill to the

south of the Lake, the compass-man began to notice the fluctuation in the variation of the magnetic needle. We were, of course, using the Solar Compass, of which Mr. Burt was the inventor, and I shall never forget the excitement of the old gentleman when viewing the changes of the variation—the needle not actually traversing alike in any two places. He kept changing his position to take observations, all the time saying, 'How would they survey this country without my compass? What could be done here without my compass?' It was the full and complete realization of what he had foreseen when struggling through the first stages of his invention. At length the compass-man called for all to 'come and see a variation that will beat them all.' As we looked at the instrument, to our astonishment the north end of the needle was traversing a few degrees to the south of west. Mr. Burt called out, 'Boys, look around and see what you can find!' We all left the line, some going to the east, and some to the west, and all of us returning with specimens of Iron ore, mostly gathered from outcrops. This was along the first mile from Teal Lake. We carried out all the specimens we could conveniently."

We give here also a statement made by Mr. William A. Burt, a year later, to wit in 1846. (See Jackson's Report, 1849, Part III., page 852, Ex. Doc.)

"It may be reasonably inferred that not more than one-seventh of the number of Iron ore beds were seen during the survey of the Township lines; and if this district of Townships be subdivided with care in reference to mines and minerals, six times as many more will probably be found. If this view of the Iron region of the Northern Peninsula of Michigan be correct, it far excels any other portion of the United States in the abundance and good qualities of its Iron ores."

3. *Description of certain Ore Deposits.*—"In June of the following year, Dr. Houghton and Mr. Burt, with their party, were engaged in sub-dividing the Township above mentioned (T. 47, R. 26), when the former made a personal examination in reference to Iron ore, especially at the corners of sections 29, 30, 31, and 32.

"These rocks (metamorphic group) are throughout pervaded by the argillaceous, red and micaceous oxides of Iron, sometimes intimately disseminated, and sometimes in beds or veins. These are

frequently of so great extent as almost to entitle them to be considered as *rocks*. The largest extent of Iron ore noticed in Township 47, Range 26, is near the corner of sections 29, 30, 31, and 32. There are here two large beds or hills of ore, made up almost entirely of granulated, magnetic, or specular Iron, with small quantities of spathose and micaceous Iron. The more northerly of these hills extends in a direction nearly east and west, for at least one-fourth of a mile, and has a breadth of little less than 1,000 feet; the whole of which forms a single mass of ore, with occasional thin strata of imperfect chert and jasper.

"At its southerly outcrop the ore is exposed in a low cliff, above which the hill rises to the height of 20 to 30 feet. The ore here exhibits a stratified or laminated structure, and breaks readily into sub-rhomboidal fragments, in such manner as will greatly facilitate the operations of quarrying or mining the ore. This bed of Iron will compare favorably, both for extent and quality, with any known in our country." (See Jackson's Report, Ex. Doc., 1849, Part III., page 835).

APPENDIX E.

LITHOLOGY.

APPENDIX E.

Remarks on Rocks between Chocolate River and Granite Point, embracing Marquette Harbor, from unpublished MSS. left by Dr. Douglas Houghton, now in the University of Michigan. (*The figure, parentheses and foot-notes are by T. B. Brooks.*)

CHOCOLATE RIVER is the boundary between the United States and Indian lands. * * * (See Map 1.) It may also be said to be the boundary of Geological Districts, for the westerly curves of the shore come upon the *metamorphic* group at the point where that group of rocks first appears upon the Lake. It is thus the boundary between these rocks,—*formerly considered primary*,—and the sand-rocks (Silurian) already described.

* * * * * *

The Metamorphic Region (Laurentian and Huronian) presents numerous abrupt and conical peaks which have frequent faces of bare rock that is perceptible even at a distance, while the sand-rock region presents "even, unbroken ridges."

Metamorphic Rocks between Chocolate and Presqu'isle.

The Talcose slate and quartz rocks are plainly and regularly stratified, dipping North about 10°, West about 80°.

The Serpentine* rock (our Diorite) is less perfectly stratified, and in fact its stratification may be considered as somewhat doubtful. The rock itself has much the appearance of greenstone, being essentially composed of feldspar and hornblende so intimately blended as not unfrequently to appear homogeneous.

There is associated with the rock sufficient trace of serpentine to give it character. This rock, taken separately, would be regarded as injected greenstone trap, and the only objection I can conceive to

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* Serpentine was a provisional name with Dr. Houghton.

considering it as such, is the fact that it uniformly occurs, dipping *in mass*, in the same direction and angle as that of the talcose slates and quartz rocks; or, in other words, that it simply fills a space between those rocks and never cuts across them, and further, that it has produced no perceptible change in the rocks with which it has been brought in contact.

It is allowed that neither of these circumstances is regarded as conclusive upon the subject, but they have led me to infer that the deposition or formation of the serpentine rocks was coeval with that of the slates with which it occurs.*

The slates seem to have been considerably disturbed at many points, subsequent to deposition, and while yet in an unsolidified state, or when softened by the action of secondary causes; for the talcose slate is not unfrequently much contorted, and in one instance it was noticed to be so much so as to be doubled back on itself. The talcose slate when not disturbed has almost invariably a jointed structure; joints usually dip south about 40°.

It has, frequently intervening, thin beds of milky and greasy quartz, with small imperfect crystals of quartz occupying little druses. Associated with these thin beds or strata of quartz, is a mineral that closely resembles hematitic iron ore, appearing in thin veins or a sub-pipeform structure.†

Beds of a coarse novaculite occur in the talcy quartz rocks just west from the Chocolate River.

The quartz rock alternates with the talcose slates, forming the bulk of the whole mass. (See Fig. 18.) It is usually granular, though sometimes compact, with a conchoidal fracture. It readily separates into blocks in the line of the cleavage, that is, in the line of its dip; which like the slate is N. 10°, W. 80°, the beds varying from a few inches to several feet in thickness. No minerals were noticed in the quartz rock, excepting small quantities of the hematite, before described, and sulphuret of iron.

The *serpentine rock*, as has already been stated, alternates with the quartz and talcose slate rocks. It has much the appearance of

* I conceive that it would be difficult at this time to write a better general description of these rocks of the same length than is here given.

† The Eureka Mine is in this formation.

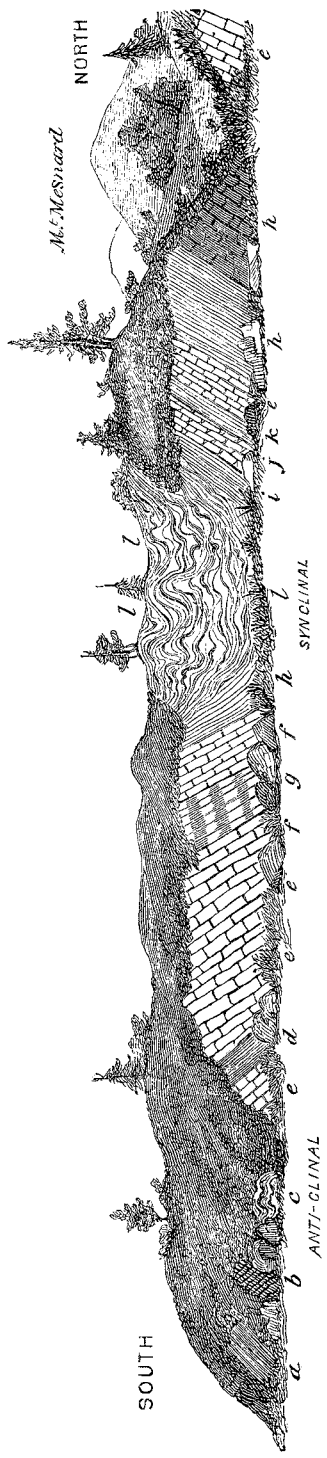


Fig. 18.

GEOLOGICAL SECTION. CHOCOLATE FLUX QUARRY, NEAR MARQUETTE, L. S.

(Illustrating Dr. Houghton's notes). Total length represented, 575 steps.

a. Talco-argillaceous schist; holds epidote, feldspar, calcite and quartz. *b*. Diorite with slate layers. *c*. Talcy argillaceous slate—"bird's-eye"—contorted. *d*. Red quartzite, laminated with white quartz, and having intercalated layers of schist. *e*. Red quartzite. *f*. White quartzite. *g*. Siliceous and quartzite layers. *h*. Talco-argillaceous slate. *i*. Brick-red talcose argillaceous slate filled with siliceous fragments which project from the weathered surface. *j*. Talcy quartzite. *k*. Calcareous quartzite, used as flux. *l*. Brown argillite, associated with reddish and mottled, coarse and fine-grained, sometimes banded and generally siliceous, and often talcy and feldspathic limestone—*much contorted*. This series of rocks are believed to be the equivalent of the Lower or Teal Lake Quartzite, No. V. See Specimens 9 and 10, State Collection; also see Julien's descriptions, Specimens 106 to 113, Appendix A.

a compact trap greenstone. It occupies comparatively a small space of the whole amount of the rock upon the coast. Sulphuret of iron and hematitic iron were noticed in small quantities in the serpentine rock, and milky and imperfect common quartz occur more frequently.

(The non-conformable junction between the quartz schist and the sandstone just east of the Carp, which is given in Dana's Geology, is figured and accurately described.)

(Dr. H. says the very lowest portion is sub-conglomeritic, but the upper part is similar to the ordinary rock of the coast. Both conglomerate and sandrocks are of a deep-red color. He had before divided the sandstones into an upper white and lower red series.)

Granite was seen on point south of mouth of Dead River.* It is composed of quartz, feldspar and hornblende; that at the north of the river is finer grained, of a light-gray color, and contains beautiful specimens of tourmaline in small quantities. The rock at 1st Rapids, in Dead River, is described as of similar character as that at mouth of stream, but less *hornblende*. It is stratified, dipping N. 80° W., and it must probably be regarded as a metamorphic rock altered to a gneiss.

The two islands off Presqu'isle are of granite, like the above.

Presqu'isle.†—At the N.E. point of the island is a cliff of trap rocks 20 to 60 feet high, ¼ mile long; upon this rests the sandrock, which in turn rests on a coarse conglomerate made up of large and small pebbles of primary rock. In one place the conglomerate was 20 feet and the sandrock over it 30 feet thick. This sandrock is of a deep-red color, and is the same in character as the lower group.

The bedding has been much disturbed, the mass raising considerably as it approaches the trap, and at points the disturbance has been so great as to destroy all appearance of stratification. So great has been the action of the elevating power, and so intense the heat of the protruded mass, near the points of junction of the trap, conglomerate and sandstone, that not only all stratification is lost,

* This is the first point west from the Sault where the "true primary" has been observed on the coast.

† This locality was afterwards described by Foster and Whitney. See their Report. Also by Dr. Rominger.

but the character of the rocks is completely changed, and they pass by insensible degrees into trap, it being difficult to determine when the sandstone and conglomerate end and the trap begins.

Portions of the sandrock and conglomerate bear the marks of *fusion* so strongly as to leave no doubt in the minds of an observer. Both sandrock and conglomerate have been shattered in every possible direction, and the veins or fissures thus formed have been filled with impure quartz, and less frequently with calcareous spar, the most minute ramifications down to ⅛ of an inch in thickness, being filled, and occasionally veins may be seen from 1 to 2 inches thick.

(Dr. H. compares the process to the injection of a blood-vessel.) * * * *

The conglomerate and sandstone, but more particularly the latter, are frequently vesicular, the vesicles being numerous but small; they were no doubt the result of the passage of gaseous vapors during the time these rocks were in a state of semi-fusion, or softness. So perfect is the reticulated structure, that it sometimes closely resembles fine reticulated earthy pumice of recent volcanoes.

The present condition of the sandstone and conglomerate is such as to lead to the inference that the *uplift* of the strata took place after the perfect induration.

The trap appears to be fused hornblende rock of a dark, almost black or green color, nearly homogeneous and not columnar, is exceedingly hard and tough, and when struck with a hammer gives a clear, ringing sound. (See Spec. 78, State Collection.)

Occupying an intermediate space between the conglomerate and trap proper, is an irregular mass of rocks, of a coarse but homogeneous texture, traversed in all directions by veins, which veins are filled by injected matter of a dark, almost black color. It is exceedingly difficult to determine to which of the rocks this belongs, but a minute examination has satisfied me that it is a mixture of trap with conglomerate.

We find associated with the trap milky and common quartz, in small crystals, sulphuret of iron, calcareous spar, imperfect serpentine and asbestos, but none of these minerals in great quantities. They usually occur in what may be called the joints of the rocks. * * * *

It is in the upper part of the fused rock—when it is passing into

sandstone, or just within the lower edge of the sandstone—that the principal minerals occur, but at these points the sandrock has so far lost its character as scarcely to be recognized as such; for it appears as a dark-green, nearly black rock, breaking, or rather separating, into small irregular masses, in such a manner that a fair fracture can scarcely be obtained.

In this, as also in the lower or conglomerate portion of the sandrock, thin veins of galena, sulphuret of iron, with a small portion of the green carbonate of copper, occur, connected with gangues which are either quartz or calcareous, or both united. The minerals are sometimes all associated in the same vein. One vein is parallel with the bedding of the rock, and appears like a bed, but the sandrock is so much shattered that it is impossible to determine its original relation with any degree of certainty. The vein alluded to pursues an irregular and tortuous course, dipping at a high angle and thinning out to mere threads and strings, and again swelling to a width of several inches; once it was seen 12 inches. Again, the mineral is in distinct *nests*, separate from the veins.

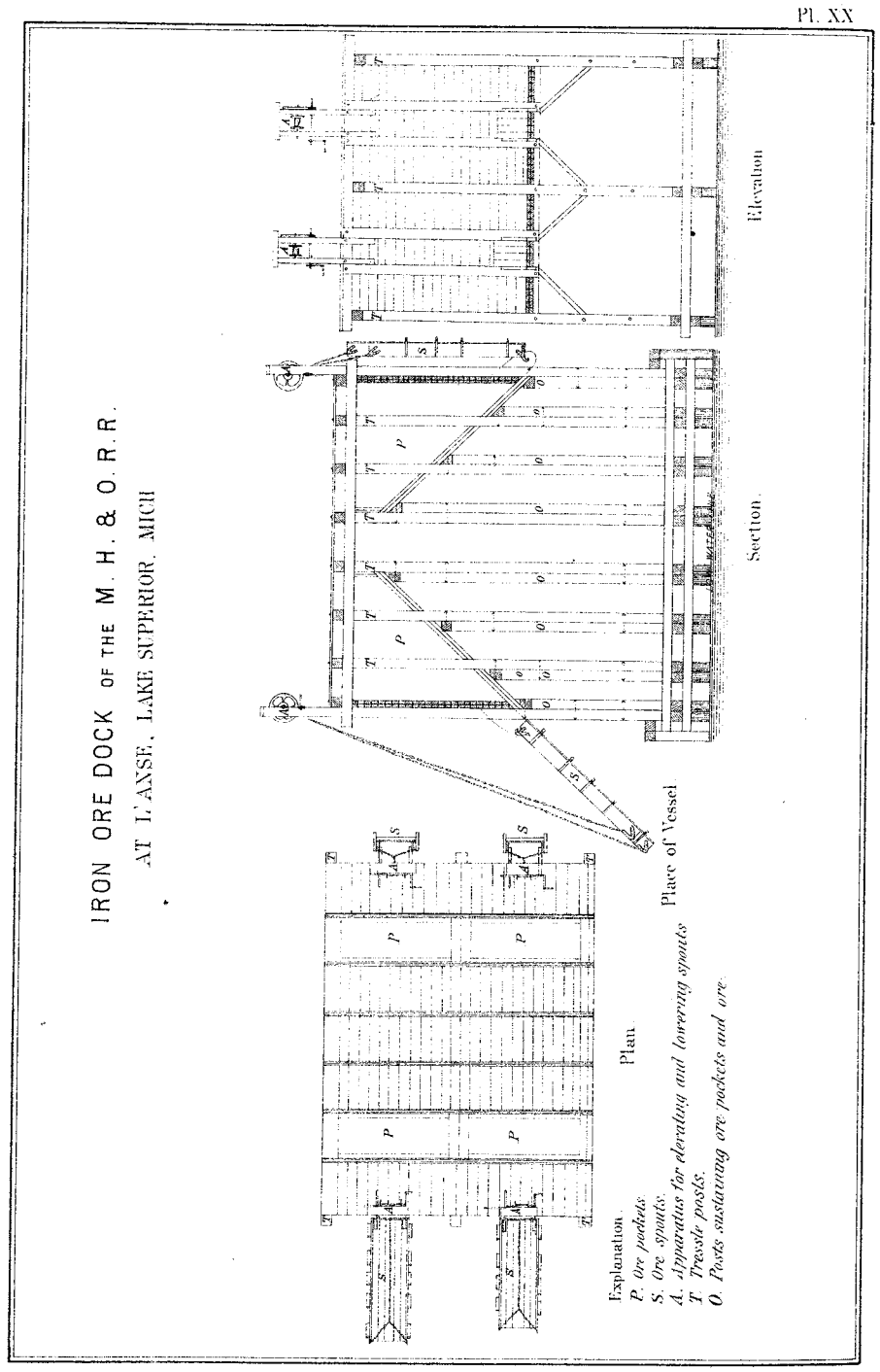
(Dr. H. remarks that he made a careful study of this vein, so as to be able to dispel the illusion held by Indians and traders that there was gold and silver here, this being a favorite landing in passing along the lake-shore in canoes and small boats. These views were not published, owing to Dr. Houghton's death, and not heeded. Mining was afterwards begun here, and ended disastrously.)

APPENDIX F.

IRON-ORE DOCK.

(SEE PLATE.)

Pl. XX



APPENDIX F.

MARQUETTE, HOUGHTON AND ONTONAGON RAILROAD.

L'ANSE, MICH., *January 31st*, 1873.

MAJOR T. B. BROOKS:

DEAR SIR: In conformity with instructions received from Jacob Houghton, Esq., chief engineer, I herewith submit plans and description of the Marquette, Houghton and Ontonagon Railroad Iron-Ore Dock, at this terminus of the road.

The ore dock is 546 feet long, 36 feet wide, by 38 feet high, and is composed of 43 bents, with clear spans of 12 feet. The foundation is of piles—one pile for each post, driven with a 2,000 lb. hammer, falling 35 feet.

The piles are cut off 3 feet above water and capped; above the caps are placed the streak-sills, and on these rest the main bents. The main posts, sills, caps, pocket-posts, pocket-post caps, streak-sills, and side-stringers are 12 × 12 inch timber. The track-stringers are 12 × 14 inch timber. The pocket-posts are not framed with the main bents, but simply rest on the main sills, and are bolted to main posts. The ore dock has 80 vessel pockets, 40 on each side, and at the end are 4 steamboat pockets.

Each pocket will hold about 75 tons of ore. The dock is of sufficient capacity to load four vessels and one steamboat at the same time. For convenience of loading, the vessel pockets are divided into sets of 20; these are again divided into sets of 2. The height of each set above low water is as follows: 20 ft., 19 ft., 20 ft., 21 ft., 22 ft., 23 ft., 21 ft., 20 ft., 19 ft., and 20 ft. The ore is delivered on board the vessels from the pockets by means of spouts. These are of varying length, and as follows: the 1st, 3d, 5th, 7th, 10th, 13th, 15th, 17th, and 19th are 16 feet long; the 9th and 12th are 12 feet long, and the 2d, 4th, 6th, 8th, 11th, 14th, 16th, 18th, and 20th are 18 ft. long.

The steamboat pockets are 12 feet above water, with short

spouts 9 feet long, which deliver the ore into hand-carts, and in them it is wheeled on board the steamer.

The above arrangement of pockets and spouts has been found by experience to be the best adapted for the expeditious loading of vessels.

The spouts are of 2-inch pine plank, lined with ¼-inch tank-iron, and are hinged at the mouth of the pockets. They are raised or lowered by a crab-wrench, placed as shown on the plans.

The outside tracks on the dock are used for discharging the ore into the pockets; the centre track is for empty cars, which are transferred by means of a transfer table, placed between bents Nos. 41 and 42.

The pockets are lined with one course of 3-inch pine plank and one course of 3-inch hardwood plank. The mouths have an additional lining of ¼-inch tank-iron.

The timber used in the construction of the ore dock is white and Norway pine. The smaller details of construction are shown by the accompanying plans, which represent: a front elevation, with spouts removed; a section, with side planking removed, showing angle of inclination, and a plan of top of dock.

Respectfully yours,

C. H. PALMER, JR.,

Assist. Engineer.

NOTE.—Chapter I., Vol. I., contains a description of a dock owned by the same company, with view showing vessels loading.

APPENDIX G.

CENSUS STATISTICS.

APPENDIX G.

United States Census Statistics for the Upper Peninsula of Michigan—Census of 1870.

POPULATION BY COUNTIES.

(Chapter IX., Vol. I., gives the nationality at several Marquette mines.)

Chippewa.

	POPULATION.					Dwellings.	Families.	Voters.
	Total.	Native.	Foreign.	White.	Colored.			
Sault Ste Marie	1213	932	281	610	*3	226	223	§207
Sugar Island	238	126	112	162	†76	48	48	44
Warren	238	139	99	178	‡2	46	48	45
Total	1689	1197	492	950	739	320	319	296

* Also 600 Indians. † All Indians. ‡ Also 58 Indians. § Does not include U. S. soldiers.

Delta.

Centreville	86	43	43	86	....	10	12	8
Delton	833	406	427	828	*5	113	115	137
Escanaba	1370	774	596	1356	†4	205	220	224
Masonville	152	62	90	152	....	19	19	19
St. Martin's Island	101	78	23	101	....	....	....	....
Total	2542	1363	1179	2523	19	347	366	388

* All Indians. † Also 10 Indians.

Houghton.

	POPULATION.					Dwellings.	Families.	Voters.
	Total.	Native.	Foreign.	White.	Colored.			
Adams	670	253	417	670	....	125	117	97
Baraga	160	100	60	155	*5	23	23	33
Calumet	3182	1131	2051	3175	†2	394	518	394
Franklin	2163	1052	1111	2145	*18	465	399	283
Hancock	2700	1113	1587	2693	‖6	400	433	493
Huron	769	373	396	769	....	157	139	93
L'Anse	33	23	10	33	....	14	10	11
Portage	1540	841	699	1520	‡12	245	276	263
Quincy	1117	432	685	1117	....	201	216	120
Schoolcraft	669	225	444	629	§4	120	121	62
Webster	876	467	409	872	4	216	177	95
Total	13,879	6010	7869	13,778	101	2360	2429	1944

* All Indians. † Also 5 Indians. ‡ Also 8 Indians. § Also 36 Indians. ‖ Also 1 Indian.

Keweenaw.

Clifton	615	285	330	615	....	165	114	105
Copper Harbor	359	173	186	358	†1	81	49	114
Eagle Harbor	778	374	404	778	....	215	150	118
Grant	152	83	69	152	....	158	25	27
Houghton	1325	665	660	1321	*2	260	235	268
Sherman	929	449	480	929	....	162	156	171
Sibley	28	30	17	47	....	69	10	12
Total	4205	2059	2146	4200	5	1110	739	885

* Also 2 Indians. † An Indian.

Marquette.

Chocolay	260	95	165	260	....	47	47	40
Ishpeming	6103	1757	4346	6094	*1	893	988	606
Marquette	4617	2186	2431	4497	†58	768	846	985
Munissing	799	305	494	797	‡2	127	127	145
Negaunee	3254	1450	1804	3552	2	517	573	586
Total	15,033	5793	9240	14,900	133	2352	2581	2362

* Also 8 Indians. † Also 62 Indians. ‡ Both Indians.

VILLAGES.

Marquette	4,000
Negaunee	2,559

Mackinac.

	POPULATION.					Dwellings.	Families.	Voters.
	Total.	Native.	Foreign.	White.	Colored.			
Holmes	938	722	216	837	*2	....	....	129
Moran	373	312	61	315	†4	....	....	4
St. Ignace	405	349	56	254	‡19	....	....	38
Total	1716	1383	333	1406	310	....	....	171

* Also 99 Indians. † Also 54 Indians. ‡ Also 132 Indians.

Menominee.

Cedarville	194	109	85	192	*2	23	23	41
Menominee	1597	809	788	1585	†9	224	246	343
Total	1791	918	873	1777	14	247	269	384

* Both Indians. † Also 3 Indians.

Ontonagon.

Algonquin	54	32	22	54	....	8	8	7
Carp Lake	25	17	8	23	*2	5	5	6
Greenland	548	295	253	548	....	98	99	78
Ontonagon	739	512	227	711	†13	141	142	148
Rockland	1479	858	621	1477	*2	265	267	177
Total	2845	1714	1131	2813	32	517	521	416

* All Indians. † Also 15 Indians.

POPULATION OF SCHOOLCRAFT COUNTY.

Whites, 797; Indians, 2.

Grand Total for the Upper Peninsula	44,499	20,437	23,263	42,347	1353	7253	7224	5096

ACREAGE, VALUATION AND TAXES.

COUNTIES.	No. of Towns and Wards.	No. of Acres of Land Assessed in 1871.	Aggregate of Real and Personal Estate as equalized by State Board of Equalization for 1871.	Total of Taxes Apportioned for 1871.
Marquette	9	424,383 00	$3,990,000 00	$4,794 53
Menominee	2	....	1,570,000 00	1,886 52
Keweenaw	7	238,306 43	1,570,000 00	1,886 54
Ontonagon	5	244,959 60	1,310,000 00	1,573 74
Schoolcraft	3	.....	520,000 00	624 85
Chippewa	3	135,904 81	450,000 00	540 68
Delta	4	132,939 00	450,000 00	540 68
Houghton	11	303,422 47	2,100,000 00	2,523 50
Mackinac	3	73,957 21	450,000 00	540 68

APPENDIX H.

MAGNETIC ANALYSIS.

APPENDIX H.

Magnetic Analysis.

TABLE of percentage of powder of various Lake Superior ores lifted by the magnet, with color of same. The chemical analysis of the same specimens is given in Chapter X., Vol. I. The mixed red and black oxides here given are described under Iron Ores in Chapter III., Vol. I., and their magnetic properties in Chapter VIII., Vol. I.

Number of Analysis.	Name of Mine.	Kind of Ore.	Percentage lifted by the Magnet.	Percentage *not* lifted by the Magnet.	Color of Powder.
225	Michigamme.....	Magnetic....	96.42	3.58	Grayish Black.
226	Spurr Mountain.....	Magnetic....	94.91	5.09	do. do.
227	Champion "Slate".....	Specular.....	5.10	94.90	Steel Gray.
228	Champion "Black".....	Magnetic....	96.90	3.10	Steely Black.
229	Jackson "Old Pioneer".	Specular.....	.78	99.22	Purplish Brown.
230	Jackson "Slate"	Specular.....	.29	99.71	Purple.
231	Jackson Hematite.....	Hematite....	.09	99.91	Light Brown.
232	Magnetic.....	Magnetic....	95.91	4.09	Grayish Black.
233	Republic "Specular"...	Specular.....	.04	99.95	Steely Gray.
234	Republic "Magnetic"..	Magnetic....	85.37	14.63	do. Black.
235	Kloman.....	Specular.....	2.79	97.21	do. Gray.
236	New York "R.R. Pit".	Specular.....	6.20	93.80	Brownish Purple.
237	N. York "Taylor's Pit"	Specular.....	15.09	84.91	Purple.
238	N. York Beardslie's Pit.	Specular.....	39.76	60.24	Purplish Black.
239	New England.....	Hematite....	.32	99.68	Raw Umber.
240	Winthrop	Hematite....	.19	99.81	Dark Purple.
241	Rolling Mill.....	Hematite....	1.41	98.59	Purplish Brown.
242	Williams	Hematite....	2.28	97.72	Purple.
243	Himrod.....	Hematite....	.07	99.93	Purplish Brown.
244 to 248	Menominee }	Specular.....	7.58	92.41	Purplish Silver Gray.
249 to 253	Iron Region }	Specular.....	1.21	98.79	do. do. do.

APPENDIX I.

MINING LAWS.

APPENDIX I.

Synopsis of the Mining Laws of Michigan.—One of the first questions asked by a capitalist proposing to invest money in a mining enterprise, is in relation to the laws under which the property is held. These, both State and Federal, vary widely in different portions of the United States, and still more from the elaborate and extensive mining codes of Europe.

The greater part of the mining property of the Upper Peninsula is owned by persons residing beyond the limits of the State, and in some instances by citizens of other countries. The Michigan laws, contained in many volumes, are often not accessible to such persons; so for their benefit, as well as for any others who desire to inform themselves quickly regarding the leading features and requirements of the laws of Michigan relating to mining and manufacturing companies, the following synopsis was prepared by Mr. C. D. Lawton, and has also been overlooked by Messrs. Daniel H. Ball, and James M. Wilkinson, of Marquette.

As several of the provisions of the earlier laws were afterwards amended, the synopsis must be read through to get at the present law.

Synopsis of the Laws in reference to the formation of Corporations for mining, smelting, or manufacturing iron, copper, etc. Approved February 5th, 1853. (See Laws of 1853, p. 53.)

SECTION 1. Provides that all corporations organized under this act shall be capable of suing and being sued in any court in this State; may have a seal and may alter it at pleasure. The majority of the stockholders of each shall elect the officers, prescribe their duties, etc., and determine the by-laws.

SEC. 2. Provides that the number of persons forming the corporation shall not be less than three, that the articles of agreement shall be in writing, that they, their successors and assigns, shall constitute a body corporate under the name assumed by the company; also that no two companies shall have the same name.

SEC. 3. Provides that before any company organized under this act can commence business, the articles must be filed at length in the office of the Secretary of State, and in the office of the clerk of the county in which the company propose to operate. (See 19 Mich., p. 194; also 12 Mich., p. 395.)

SEC. 4. The articles of every such association shall be signed by the persons associating in the first instance, and acknowledged before some person authorized by the laws of this State to take acknowledgments of deeds, and shall state—

First. Distinctly and definitely the purpose for which the same is formed;

Second. The amount of their capital stock, and the number of shares;

Third. The amount of capital stock actually paid in;

Fourth. The names of the stockholders, their respective residences, and the number of shares held by each person;

Fifth. The place in this State where their office for the transaction of business is located, and the county or counties in which their business is to be carried on;

Sixth. The term of its existence, not to exceed thirty years.

SEC. 5. Every corporation shall, annually, in the month of July, make a report, signed by a majority of the board of directors, containing—

First. The amount of capital actually paid in;

Second. The amount invested in real estate;

Third. The amount of their personal estate;

Fourth. The amount of their debts and credits, as near as may be;

Fifth. The name of each stockholder, and the number of shares held by him at the date of such report; and every such report shall be verified, on oath, by the officers signing the same; which report shall be filed in the office of the Secretary of State, and with the clerk of the county where the mine is situated, in said month of July; and if any person shall, as to any material facts, knowingly (and *willfully*) swear or affirm falsely, he shall be deemed guilty of perjury and be punished accordingly; and every company organized for mining or smelting purposes shall within the said month of July,

file a copy of said report with the clerk of the county where the mine of the company is located; and if the directors of any mining company shall, intentionally, neglect or refuse to make such report and file the same and a copy thereof, as hereinbefore provided, each of such directors shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine not exceeding one thousand dollars.

SEC. 6. The amount of the capital stock in every such corporation shall be fixed and limited by the stockholders in their articles of association, and shall, in no case, be less than ten thousand dollars, nor more than five hundred thousand dollars, and shall be divided into shares of twenty-five dollars each. The capital stock may be increased, and the number of shares, at any meeting of the stockholders called for that purpose: *Provided*, That the amount so increased shall not, with the existing capital, exceed five hundred thousand dollars. (See Sec. 6 of an act supplementary to this act, approved February 6th, 1855.)

SEC. 7. Provides that it shall not be lawful to use the funds of the corporation for any other purpose than those set forth in the articles of association.

SEC. 8. Provides that any two members may call the first meeting, by giving 15 days' notice through some newspaper, of time and place of meeting. (All stockholders may appear without notice and act.)

SEC. 9. Provides that there shall be at least 3 directors and not more than 9, one of whom must be a resident of this State; that they shall hold office for one year, or until their successors are chosen.

SEC. 10. Provides that the officers shall be chosen from among the directors.

SEC. 11. Provides that the directors may call in the capital stock from time to time; if any stockholder neglects to pay his installment, after due notice his stock may be sold at public auction.

SEC. 12. Provides that a majority of the directors constitute a quorum, and at a meeting of the stockholders, the majority of the stock shall be capable of transacting business; stockholders may vote by proxy.

SEC. 13. Provides that if an election of directors does not take place at the annual meeting, an election may be held any time thereafter by giving 30 days' notice.

SEC. 14. Provides that the books shall be open to the inspection of the stockholders, and that as often as once a year a statement of the company's affairs shall be laid before the stockholders.

SEC. 15. Provides for the holding of real and personal estate, and that all companies engaged in the mining or manufacturing of iron or copper shall not hold to exceed 10,000 acres of land.

SEC. 16. Provides that the stock shall be deemed personal property, to be transferred on the books only as the directors determine; that the corporation shall have a lien on the stock of the members for debts due the company. (See 17 Mich. Reports, p. 141.)

SEC. 17. Provides that each stockholder shall be individually liable for all labor performed for the company, and such liability may be enforced after an execution against the company shall be returned unsatisfied, or any time after an adjudication in bankruptcy; and further, that any stockholder who shall be compelled to pay such claim shall have right to call upon all stockholders to contribute their part of the sum so paid, and may sue them jointly or severally.

SEC. 18. Provides that every mining corporation shall in the month of July of each year make a report of the amount mined, to be filed with the county clerk and auditor-general.

SEC. 19. Provides for a similar report for any corporation organized for manufacturing purposes.

SEC. 20. Provides for the imposition of specific taxes on mining products, and is superseded by the act of 1872, March 29.

SEC. 21. Provides that the property of the company, not including capital stock, shall be subject to the usual taxation.

SEC. 22. Provides that any legal process may be served, provided the officers of the company cannot be found in the county, by posting it conspicuously at the company's place of business.

SEC. 23. Provides for the personal liability of each of the directors, in case of non-compliance with Sections 3, 5, 18, and 19. (See 19 Mich. Reports, p. 187).

SEC. 24. Provides that in case any corporation shall become insolvent by reason of the violation of the provisions of this act, the directors assenting to such violation shall be liable for all debts contracted thereafter.

SEC. 25. Provides that the Legislature, for just cause, may rescind the charter of any corporation, and may amend or repeal this act.

SEC. 26. Provides that this act shall be subject to the provisions of the act of 1846, chap. 55, title 10, so far as applicable to companies formed under this act. (Sections 27, 28, 29, relate to Salt Companies.)

AN ACT supplementary to the foregoing. Approved February 6th, 1855. (Laws of 1855, page 26.)

SECTION 1. Provides that any company organizing under the preceding act, may have an office anywhere in the United States, and hold its business meetings thereat, such office to be designated in the articles of association, which articles must also designate an office within this State.

SEC. 2. Provides that the first meeting may be held within this State, or at the business office without the State, in which latter

case, 15 days' previous notice must be given in some newspaper in Detroit, and also in the county in which said office is located.

SEC. 3. Provides for the manner of sale of all stock forfeited by reason of the non-payment of assessments; such stock belonging to residents of the Upper Peninsula, shall be sold at the county seat in which the mine is located, 30 days' previous notice being given in some newspaper published on the Upper Peninsula, and such stock belonging to residents of the Lower Peninsula, shall be sold at the office of the company, if the company have an office in the Lower Peninsula, and if none, then in the city of Detroit, 30 days' notice being given in the county where the sale is to be made.

SEC. 4. Provides that all meetings and corporate acts, had by any company organized under the preceding act, had beyond the limits of this State, and within the United States, shall be held valid, in the same manner as if had within the State.

SEC. 5. Provides that any corporation doing business under special charter, may dissolve and reorganize under the previous act. The reorganization to be made within 60 days from date of dissolution of special charter. All demands against the company under the special charter shall remain in force under the new organization.

SEC. 6. Provides that any company organized under the previous act may at any time increase its capital stock to not to exceed $1,000,000, by a vote of two-thirds of the stockholders, and the shares to $50 each, the number not to exceed 20,000. A company may also diminish its capital stock, and the number of shares, and price per share in same ratio. (See Act of February 9th, 1857.)

SEC. 7. Provides for the immediate effect of the supplemental act.

AN ACT to authorize Mining Companies to subscribe and take stock in Plank Roads or Railroads, and to regulate Taxation thereon. Approved February 8th, 1855. Amended and approved March 14th, 1863.

SECTION 1. Provides that any mining company in the Upper Peninsula of Michigan, duly organized, may take stock in any

company organized for the purpose of improving or constructing canals, harbors, plank roads, or railroads, when with a view strictly of facilitating transportation to the mines, and the amount of capital so paid out shall be considered as part of the capital of the road, harbor, or canal company, and as such be taxed, being deducted from capital of the mining company.

SEC. 2. Provides that the president and secretary of the mining company shall, before the first day of May of each year, return to the State Treasurer the amount which the company has so subscribed, and other particulars relating thereto.

AN ACT to confer certain powers on Mining Companies. Approved Feb. 13th, 1855.

SECTION 1. Provides that it shall be lawful for any mining company, duly organized under the laws of this State, to establish its business office anywhere in the United States, provided it also maintain a business office within this State, and that any process served upon the agent in charge of this office shall be binding on the company. The location of such office shall be fixed by the stockholders and certified to the Secretary of State.

SEC. 2. Provides that offices which have been heretofore established without the State shall remain until otherwise changed by the company, provided that within six months hereof an office be located within the State, and a return of the fact made to the Secretary of State.

SEC. 3. Provides that all meetings and corporate acts of any incorporated mining company heretofore had without the State and within the United States, shall have the same legality as if had in this State.

SEC. 4. Provides that in lieu of specific tax on corporate stock of chartered mining companies shall be subject to a specific tax, in manner set forth in Section 20 of an act to authorize the formation of corporations for mining, etc., approved February 5th, 1853. (Amended, 1872.)

AN ACT to authorize Mining Corporations to increase the number of shares. Approved February 9th, 1857.

SECTION 1. Provides that all mining companies heretofore organized shall have power to increase the number of shares to not to exceed 20,000 shares.

SEC. 2. Provides that no such increase of number of shares shall take effect, until the company shall properly file with the Secretary of State the resolution of the board of directors in regard to the same.

AN ACT to authorize the consolidation of Mining Companies. Approved February 17th, 1857. [See Act of 1871.]

SECTION 1. Provides that all mining companies organized under the act of 1853, may consolidate with other such corporations, and in such case the company purchasing shall become vested with all the corporate rights and franchises, in addition, of the company thus absorbed.

SEC. 2. Provides that no such consolidation of mining companies shall take place without the prior consent of the majority of the stockholders of both companies.

SEC. 3. Provides that after consolidation any such company shall have power to call in and cancel its prior certificates of stock, and to reissue new certificates, and cancel the certificates of any stockholder who shall neglect, after due notice, to return his certificates.

SEC. 4. Provides that any corporation thus assuming the franchises and property of another, assumes also its liabilities.

SEC. 5. Provides that in the reissue of stock, there shall be no increase of stock beyond the joint capital stock of the companies thus consolidating.

AN ACT supplementary to the Mining Act of 1853. Approved March 14th, 1865.

SECTION 1. Provides that it shall be lawful for any corporation

organized under the act of 1853 to conduct its operations anywhere within the United States.

SEC. 2. Provides that any corporation organized under the original act, must first cause the articles of association to be filed with the Secretary of State, and with the clerk of the county in which the office of the company in this State is situated.

SEC. 3. Provides that any such corporation, conducting any of its operations without the limits of this State, shall be subject to the laws of this State, so far as applicable.

AN ACT supplementary to the act of 1853, to authorize the formation of Mining and Smelting Companies. Approved March 27th, 1867.

SECTION 1. Provides that no meeting of the stockholders of any company organized under the provisions of the act of 1853, for the purpose of mining or smelting in the Upper Peninsula, shall be legal unless due notice be given of the time, place, and objects of the same, to be previously published, two weeks from an annual and four weeks from a special meeting, in some newspaper in the county in which the business is carried on, or, if no newspaper is published in such county, then in some paper published nearest to the mine or place where the business is carried on: a copy of such notice shall be sent 20 days prior to the meeting to each of the stockholders, unless personal service be made, and certified thereto, upon each and every stockholder. (See Act 6 of Laws of 1872.)

SEC. 2. Provides that no sale, division, or mortgage of any of the property or franchises of any such corporation shall be made, except it be authorized by a three-fifths vote of the entire interest of the stock of the company, at a meeting called in accordance with the provisions of Section 1.

SEC. 3. Provides that any person wishing to perpetuate the evidence of any proceedings, taken under the preceding sections, may—

First. Procure an affidavit of the serving of the proper notices.

Second. Procure an affidavit of publication of notice of meeting.

Third. Procure a certified transcript of the proceedings of such meeting.

Fourth. Secure the record thereof in the Register's office of the proper county, such evidence to remain *prima facie* evidence of the facts.

SEC. 4. Provides that any meeting called as here set forth may adjourn to any time not exceeding sixty days, to any specified place.

SEC. 5. Provides that all acts or parts thereof contravening the provisions of this act are hereby repealed.

AN ACT to authorize the consolidation of Mining Companies. Approved January 27th, 1871.

SECTION 1. Provides that mining corporations may by a vote of three-fifths of the entire capital of each, actually present or legally represented at a meeting called for the purpose, agree to consolidate, and upon the terms of such consolidation. The number of shares and capital stock of the consolidated corporation shall not be greater than the aggregate stock and shares of the companies thus consolidated. No company shall thus consolidate whose capital paid in or whose expenditures for land and improvements are less than $100,000 : before the completion of such consolidation, the several corporations shall file in the office of the Secretary of State the verified certificates of the proper officers of each company, showing the amount of capital stock paid in, the amount expended for lands and improvements thereon. The lands of such corporations shall be known as mineral lands, and shall be in every case adjacent to each other. The capital of no consolidated corporation shall be divided into a greater number of shares than 80,000, and the amount of stock called in shall in no case exceed the aggregate of the unpaid stock of the several corporations at the time of consolidation, and that the par value of the shares shall be fixed at the meeting at which the consolidation is effected, and shall not exceed $25, nor be less than $10, and each certificate of stock issued shall

upon its face state the par value thereof and the amount of assessment to which it is liable.

SEC. 2. Provides that the consolidated corporation shall enjoy the aggregate franchises, rights and estates pertaining to the several corporations, and be subject to the liabilities existing against each, and the several corporations shall exist for the purpose of prosecuting or defending any legal proceedings then pending or subsequently instituted against or by either of them.

SEC. 3. Provides that the officers of the several corporations shall continue to exercise all their powers until the new corporation shall be organized, and thereafter shall continue for the purpose of perfecting said union.

SEC. 4. Provides that any mining company consolidated under this act shall have power to call in and cancel the stock of the several companies, and to issue new certificates of stock in the consolidated corporation to the stockholders in such proportions as each shall be entitled to, and to cancel the certificates of any stockholder who shall not return them after the publishing for 90 days of the notice of the resolution in some daily newspaper in Detroit, also in some paper published in the Upper Peninsula, also in some paper published in the place where the principal business office is located.

SEC. 5. Provides for the repeal of all acts inconsistent with the provisions of this act.

AN ACT to authorize Corporations of other States to engage in Mining, Smelting, or Refining Ores within this State. Approved April 15th, 1871.

SECTION 1. Provides that corporations formed under laws of other States, for the purpose of mining, etc., ores, may engage in such business in this State, and acquire all necessary property, but shall not hold to exceed 6,000 acres of land at one time.

SEC. 2. Provides that said corporations shall be subject to the same requirements as if organized in this State.

SEC. 3. Provides that, except for State taxes and fines, any amount due for labor shall have a first lien over all other claims, on any property within this State belonging to such corporation, in same manner as if the corporation was organized in this State.

SEC. 4. Provides that any corporation doing business in this State shall keep an office, and officer in charge of it, in the county where its business is carried on, and the service of any legal process against such company may be made on such officer. If such officer cannot be found at such place of business, then process may be served by posting a copy thereof in a conspicuous place in such office.

AN ACT amendatory of the foregoing so far as relates to the Imposition of Taxes on Mining and Smelting Corporations. Approved March 29th, 1872.

SECTION 1. Provides that all companies possessed of corporate powers, engaged in mining copper in this State, shall pay to the State a specific tax of 75 cents for each ton of copper obtained, and every such organization engaged in iron mining shall pay a tax of one cent for each gross ton of ore obtained, and every such organization engaged in coal mining shall pay a tax of one-half cent per gross ton. Such taxes to be paid in July, at the office of the State Treasurer, or at such place in Detroit as he may designate. Except for specific taxes upon capital or joint stock, the taxes here designated shall be in lieu of all State tax. Of specific taxes received, whether part due or to accrue from corporate companies engaged in mining in the Upper Peninsula, one-half shall be placed to credit of general fund and one-half to the credit of the counties from which it is received, and be paid to such counties in like manner as other funds, and be used for county purposes.

Nothing herein shall be construed to exempt from State taxation any property not invested in mining or manufacturing as contemplated in this act.

AN ACT to authorize the Auditor-General to assess, by estimated specific Taxes, upon Corporations which might neglect or refuse to make a Report as required by law, and to collect the same. Approved March 29th, 1872.

SECTION 1. Provides that the Auditor-General shall estimate and

charge the amount of specific tax due from any corporation neglecting to return the same, as heretofore provided, from the best information he can obtain, and shall forthwith sign a written statement of the amount so estimated, and send by mail, or otherwise, to any officer or director of the corporation.

SEC. 2. Provides that in case any such corporation neglecting to pay the tax so estimated, after not less than 40 days from receiving such notice, and no appeal shall have been taken, the Auditor-General shall issue his warrant to the sheriff of the county in which the principal office in this State is situated, commanding him to forthwith levy and collect the same, with ten per cent. additional for his own fees, by distress and sale of any property of such company found in this State, and make returns to the State Treasurer within ten days thereafter.

SEC. 3. Provides that the sheriff shall give the usual public notice of sale, by conspicuously posting such notice in three public places ten days previously, within the township, city, or village where the sale is to occur, and that the sale shall be by public auction.

SEC. 4. Provides that if the property so distrained cannot be sold for want of bidders, or is insufficient, the sheriff shall return such fact to the Auditor-General, and the company, still neglecting to pay the tax during 30 days thereafter, shall forfeit its charter and franchises.

SEC. 5. Provides that within 30 days, and not thereafter, from receiving notice of the Auditor-General's estimate, the corporation may appeal therefrom to the circuit court of the county of Ingham, under conditions set forth in this section, and upon a full compliance with which the court shall proceed to the trial of the case, and questions of law therein arising may be carried to the supreme court. In this trial the estimate of the Auditor-General shall be *prima facie* evidence of the amount of specific tax due from the corporation. And if, after filing their appeal, the company fail to notice it for trial during the next two successive terms of the court, said appeal shall upon motion of the Attorney-General

be dismissed, and the Auditor-General shall immediately issue his warrant for the taxes, as before set forth in Sec. 2, and no further appeal shall be taken.

SEC. 6. Provides that the Auditor-General, immediately after the first of May, 1872, shall estimate and collect the specific tax, as provided in Sec. 5, from all companies which have heretofore neglected to report the same, and the proceedings shall be the same.

SEC. 7. Provides that the term corporation, as used in this act, shall include all companies having power of corporate bodies.

APPENDIX J.

METALLURGICAL QUALITIES.

APPENDIX J.

I REGRET exceedingly that the following communication from Mr. Tuttle was not received in time for me to have made some of the corrections suggested by him on the Statistical Sheets XII. and XIII. of the Atlas. I can now do no better than to insert his letter, and trust he will excuse such use made of a communication not intended for publication. I state at the bottom of the table of "Metallurgical Qualities of certain L. S. Ores," on Sheet XIII., that it is "quite incomplete," and there give a reason. For any inaccuracies in the statements I am not responsible, as it is carefully compiled from information furnished by consumers. I made every effort to obtain a valuable paper on this subject from practical men who had had large experience in the use of these ores in Ohio and Pennsylvania, but did not succeed for want of money.

CLEVELAND, O., March 14th, 1873.

MAJOR T. B. BROOKS, C. E.,

Museum of Practical Geology,

Jermyn Street, London.

DEAR SIR: Yours of 7th inst. received, with the advance sheets of statistics, for which I am obliged. I will make some corrections and suggestions. In the list of Blast Furnaces, Sheet XIII., Neshommock Iron Co. should be *Neshannock;* Harbaugh, *Mathois* & Owens, should be *Matthias;* Andrews & Hitchcock Hubbard, the word Hubbard is their *location*, and should be in smaller letters In the caption to this list of furnaces, please add Ohio after Cleveland.

On the same Sheet, the "Metallurgical Qualities," as reported by consumers, is *not worth anything*. A *few*, perhaps four to six of them, are substantially correct, the others are not; as for instance,

"Lafayette Iron Co., Brazil," are under the class of *Washington* ores, whereas we never knew of their having a ton of it; and others are under classes of ores of which they have had but a small proportion of their mixture, say $\frac{1}{4}$ or less. Take the first name on the list, Rawle Noble & Co., who undertake to say $\frac{1}{3}$ Jackson ore with $\frac{2}{3}$ Rossie, Ontario & Champlain made an iron "also for steel," which is absurd. The *bonâ fide* results are, that good assorted red specular alone and also with good magnetic makes good Bessemer steel iron wherever the fuel and flux are also good. Red specular alone is red-short; the granular portion from the magnetic mines is neutral or cold-short slightly; the specular portion of the magnetic mines is red-short, but not quite as red-short as the old red specular; a mixture of old red specular and magnetic makes a *better* iron than *either alone*.

I would advise to omit the "Metallurgical Qualities" table entirely, as it will only mislead all who do not know that it is erroneous.

On the other Sheet, in the "Diagram showing the production and percentage of Iron Ore, etc.," against the end of the line which shows the production of 1st-class red specular ore is placed 58 per cent., which belongs opposite the end of the next line above, which is the line of percentage of yield. This *line of percentage of yield*, in order to *fairly* represent the facts, ought to be accompanied by the words, "average of all grades," say as follows: "Average estimated yield of iron from each year's total shipments of all grades of ore." The facts being that the percentage (average) has been let down *more* by the introduction of so many leaner ores than by the letting down of the standard of the mines which first constituted the total amount. The customers of the Lake Superior Iron Co. *say* to us that they cannot see but that ore was as good during 1872 as it had been *any* previous year. This was *not* true, however, of every one of the old mines.

The *left* end of the line of the percentage of yield has no indication of what degree the line starts at.

With these suggestions, I do not see but you have got the tables as near right as they can well be. They afford a large amount of information, and are the results of a vast amount of labor.

As to *Lake freights*, I think the following will be as near as a brief statement can be made: Lake freights, Marquette to Cleveland, have ranged from $2 to $6.50; average, about $3.20. Lake freights, Escanaba to Cleveland, have ranged from $1.50 to $5.00; average about $2.20.

Shall be pleased to hear from you at any time and do anything I can to aid your work.

Respectfully Yours,

H. B. TUTTLE.

APPENDIX K.

CONTORTIONS OF LAMINÆ.

APPENDIX K.

THE lamination, plication and faulting of the banded ore and jasper (" mixed," or 2d class ore) possess so much interest in connection with the identification of the iron ranges, the location of great folds, and illustrate so beautifully in miniature what seems to have occurred on a grand scale in the whole series of rocks in which they are found, and are withal so beautiful in their contrast of colors and infinity of curves, that a series of carefully drawn sketches will here begin, tracing the contorting and faulting effects from simple parallel straight laminations, as shown in Figure 19, to the true breccia of Fig. 29. The possible bearing of these facts on the origin of some breccias has already received notice in Vol. I., Chap. III., page 89. All the illustrations were obtained from the mixed ore, Formation XII., of the Republic Mountain, except Figures 26 and 27, which are from the Laurentian gneisses of the Gogebic district; in all but these last the dark color represents jasper and the white specular ore. The linear scale varies from $\frac{1}{5}$ to $\frac{1}{20}$ of the original.

Fig. 19.

Fig. 20.

Figs. 19 and 20 represent uncontorted laminæ, the pure ore greatly predominating; in the latter figure are slight indications of subsequent motion.

In Fig. 21 the laminæ, although still comparatively regular as to their general course, show minor kinks and zig-zags in some of the jasper-laminæ.

Fig. 21.

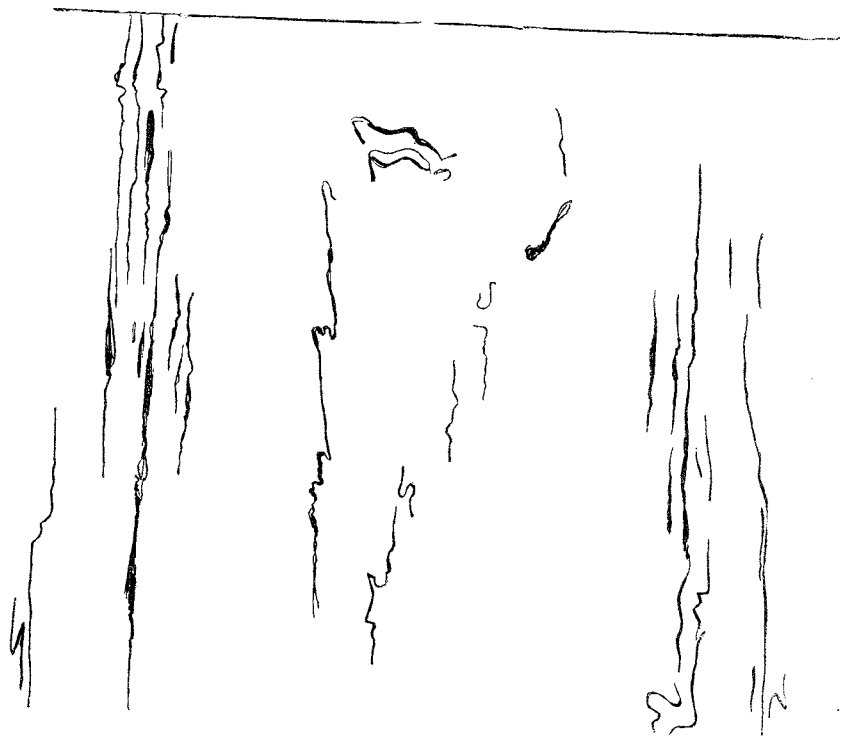


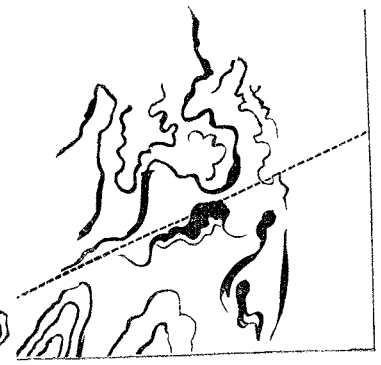
Fig. 22 shows the next stage of progress of bending the layers, together with some variation in their size; a tiny local fault can also be seen.

In Figs. 23 and 24 the process of contorting is carried to such length as to nearly obliterate parallelisms and comparatively uniform size of the laminæ. At *a* in Fig. 23 is a thin lamina of quartz, presenting numerous folds not to be observed in the contiguous and thicker laminæ *c* and *b*. This interesting sketch (scale of one-eighth) was made at 4,600 feet S. E. and 3,700 feet S. W. of the origin of ordinates, Survey of Republic Mountain, Map No. VI.

Fig. 22.

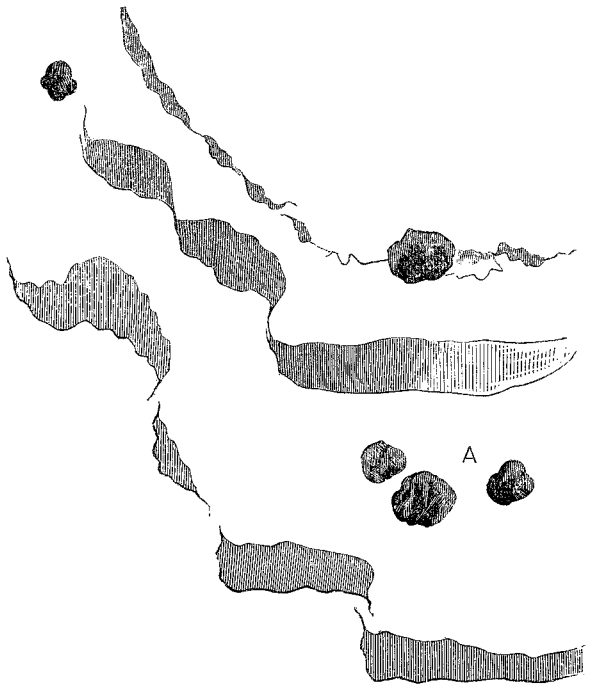
Fig. 23.

Fig. 24.



The thick black lamina of Fig. 24 introduces another phase of the metamorphism, which is the semi-faulting shown in Fig. 25, where comparatively regular jasper-laminæ have by a sheering motion been more or less completely separated into lenticular, prismatic and cylinder-shaped masses. If we suppose a similar motion to have taken place on a plane parallel with the surface of the paper, it is evident that the result would be rude spheres and angular breccia-like fragments. Those familiar with the "pinch and shoot" structure of the deposits of magnetic ores of New Jersey and New York (which can also be seen in some of the more extensively

Fig. 25.



worked Marquette mines), must acknowledge that Fig. 25 presents precisely similar phenomena in miniature. The resemblance of this figure to some plans of Swedish iron mines in my possession is very striking.

Fig. 26, sketched in the Laurentian rocks west of Lake Gogebic, presents some interesting minute vein and faulting phenomena.

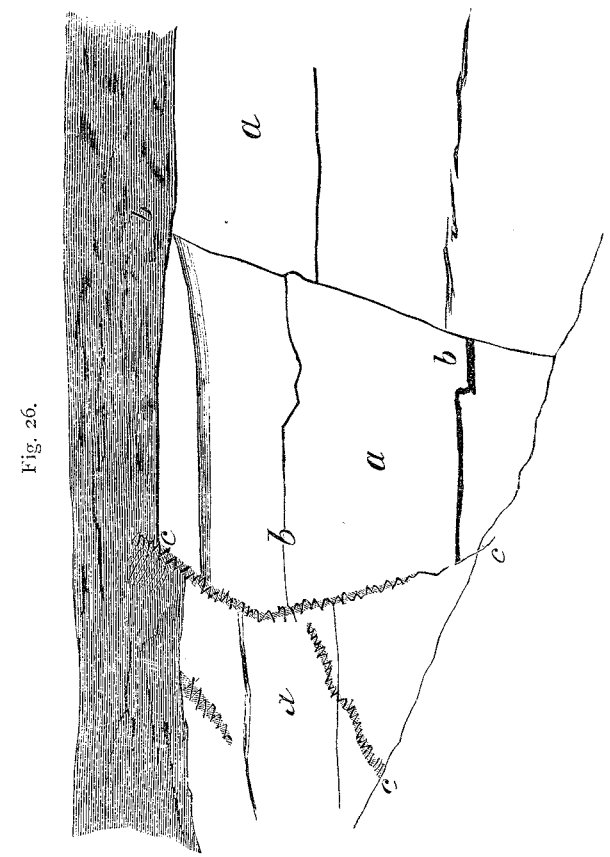


Fig. 26.

The rock *a* is a hornblendic gneiss; *b* is made up of thick and thin laminæ of rosy-white orthoclase and coarse-grained quartz; *c* is still coarser, and of the same composition.

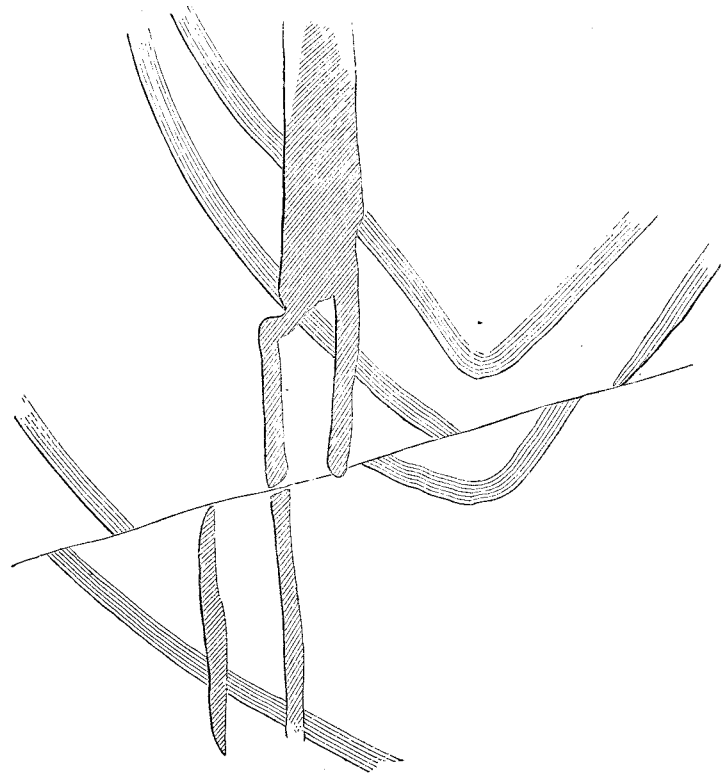
Fig. 27 is from the same region as 26, but in it predominates a mineral resembling both chlorite and mica. The dark-colored layers are magnetic iron-ore, which is rare in the Laurentian. This figure shows very beautiful contortions, and a double system of subsequent faulting. *a*, *a*, are bunches of segregated gangue. The sketch is one-eighteenth of the original.

Fig. 27.

These figures prove conclusively that the same causes were at work in the older rocks, but nothing analogous, so far as I know, has been observed in rocks younger than the Huronian, on the Upper Peninsula.

Fig. 28 was sketched at Republic Mountain, and shows, in order of time—1. Laminæ of jasper, with longitudinal shading. 2. The same laminæ bent, with convexity downward. 3. A vertical vein of quartz, curiously forked in its lower part, cutting both ore and

Fig. 28.



jasper. 4. A horizontal fault, by which the upper half has moved to the right. It may here be observed that quartz veins, except very minute ones, are rare.

Fig. 29, one-tenth of the size of the original, represents (dark) jasper and (white) specular ore, which originally may be supposed to have been arranged in regular alternating parallel layers, but which, owing to subsequent motions and metamorphoses, illustra-

Fig. 29.

ted by this series, is converted into the breccia presented by the figure. This may be regarded as the utmost limit reached by nature in her efforts to obliterate and destroy lamination by means which appear to have been chiefly mechanical.

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