307. Seems like an ordinary amygdaloidal conglomerate with a lot of amygdaloidal fragments, with calcite filling and also epidote in the interstices.

308 A. Shows the most copper of any of this series. There is a large crystal of quartz porphyry showing distinct quartz and feldspar phenocrysts, but the ground mass seems almost to be a specular iron ore, being heavily enriched with iron oxide. There are numerous other pebbles of various kinds, and part of the same pebble which has this extra enrichment of iron oxide seems to be blanched.

309. Well-marked conglomerate. Pebbles rather smaller and the matrix composed of small fragments of various sizes. Comparatively little sign of alteration, but a little copper staining. The last matrix appears to be calcite, and there is some epidote.

Belt 50. 310. Dark ophite. Fine grained, massive, with a hackly fracture as though full of little slips.

311. Well-marked amygdaloid with amygdules bordered with red calcite and chlorite and white calcite centers.

312. Fine grained trap with little chlorite and laumontite and calcite on joints.

Belt 49. 313. Fine grained with spots of amygdaloid, with very small pores filled with red or green mineral, probably chlorite or calcite.

314. Fine grained trap. Chlorite slickensides on joints.

315. Fine grained trap. Seems to have a little tendency toward a glomeroporphyritic appearance.

316. Distinctly well-marked ophite. 1-2 mm. Slickensided chlorite on joints, in at least three different directions.

317. Marked ophite, about same grain. Very well marked slickensided chlorite on joints. Some of them also show copper carbonate.

318. Another specimen of Calumet conglomerate. Shows frequent stains of copper. Both A. & B. are Calumet conglomerate.

319. Well-marked ophite. 2-5 mm. Chlorite on joints.

320. Well-marked coarse ophite. Mottles 3-5 mm.

321. Marked coarse ophite. Mottles 6 mm.

322. Marked coarse ophite. One seam heavily coated with chlorite.

323. Coarse ophite. Mottles perhaps 5 mm. Chlorite seams.

324. Well-marked ophite. Mottles 4-5 mm. Heavy seams of slickensided chlorite.

325. Coarse ophite. Mottles about 3 mm. Chlorite seams.

326. Ophitic, growing finer. Mottles 2-3 mm. Much jointed.

327. Fine grained with slickensided chlorite seams all through.

328. Fine grained; large amount of slickensided chlorite.

329. Mottles 1-2 mm. With heavy seams of slickensided chlorite.

330. Fine grained with numerous small chlorite amygdules. Some laumontite and chlorite on seams.

331. Very fine grained, some epidote. A good deal of chlorite disseminated through the rock. Looks as though it might be brecciated trap or chlorite amygdaloid just under the main amygdaloid.

332. Is unquestionably a mistake. Sample is from a big pebble in the Calumet conglomerate, being of the augite syenite type.

333. Is amygdaloid or amygdaloidal conglomerate. Has somewhat fragmental appearance, with red and gray amygdules and calcite and epidote in the interstices. The amygdules are filled with calcite often greenish and coated with chlorite.

334. Fine grained and rather massive, but full of small chlorite amygdules. Ground mass quite brown.

335. None.

336. Brecciated amygdaloid or amygdaloidal conglomerate. There seem to be fragments of gray and red amygdules mixed in together with a good deal of epidote and calcite in the matrix. Probably this is only a brecciated amygdaloid. Cf. with bed at general horizon of the Houghton conglomerate.

337. Well-marked amygdaloid with small and fine amygdules and a bluish or reddish brown matrix and a good deal of epidote in the pores.

338. Similar brecciated amygdaloid, but the amygdaloid is more in spots.

339. May be amygdaloidal conglomerate. They appear to be irregular fragments, of different types of amygdules. There is much epidote in the interstices; as usual the epidote is next the rock and the calcite in the centers. Amygdules proper may be filled with epidote or chlorite and calcite.

Belt 49. 340. Amygdaloidal conglomerate, or amygdaloid of the same type as the previous.

341. Is similar with some rather large cavities filled in with calcite and some other minerals.

Belt 48. 342. Well-marked trap with coating of slickensided chlorite. 2-3 mm. on one face.

343. None.

344. Fine grained ophite; probably 1-2 mm.

345. Probably an ophite. Almost all surfaces old, joints with chlorite covering.

346. Marked ophite. 2-3 mm. Chlorite on joints.

347. Marked ophite. 3 mm. Heavily slickensided with chlorite on joints.

348. Marked ophite. 2-3 mm.

349. Marked ophite. 1-2 mm. Slickensided chlorite on joints.

350. "One of these, but not known which one," on bag.

The two pieces are both of ophites of about same grain, say 2 mm. One has a heavy chlorite seam on one side. The other has also chlorite seams but not quite so much and the mottling is a shade less pronounced. Probably one of these represents one of the previous missing numbers e. g. 343.

351. Ophite. Fine mottling. About 2 mm.

352. Much finer grained. 1-2 mm. Some chlorite and also a seam of calcite.

353. Fine grained with some laumontite coated seams.

354. Chloritic seams. Coarsely amygdaloidal with chlorite and calcite. Base fine grained and brown.

355. Like 354. Amygdules of calcite lined with chlorite, somewhat more numerous.

356. Also fine grained with a few chlorite amygdules. These fine grained specimens seem at times to show the feldspar a little porphyritically. In one seam a little calcite.

357. Fine grained faces covered with chlorite.

358. Well-marked amygdaloid with very small amygdules. Greenish white on a chocolate brown ground. Same type as previous amygdaloid.

Belt 47. 359. Fine grained trap. Chlorite on seams.

360. Massive trap. Mottles about 2 mm. Numerous chlorite seams on joints.

361. Ophite. 2-3 mm. Little chlorite on seams.

362. Ophite. 2 mm. Chlorite and calcite on seams.

363. Well-marked ophite. Mottles 3-4 mm. Chlorite and calcite on seams.

364. Marked ophite about 3 to 4 mm. Little chlorite on seams.

365. Marked ophite. 4 mm.

366. None.

367. Marked ophite. 4 mm. Some chlorite on joints.

368. Marked ophite. .5 mm. perhaps. Heavy chlorite seams.

369. Coarse ophite. 3 mm. Chlorite on seams. Also calcite.

370. Massive ophite. Mottles about 3 mm.

371. Massive ophite. Mottles probably 2-3 mm. Heavy chlorite seams.

372. Marked ophite. Rather fine grained. Well-marked chlorite slickensides.

373. Fine grained ophite. 1-2 mm. Very little chlorite.

374. Fine grained ophite. 1-2 mm. With occasional amygdules of chlorite.

375. Two pieces. Fine grained ophite with occasional chlorite amygdules.

376. Fine grained ophite, with some chlorite amygdules.

377. Fine grained ophite with occasional chlorite flecks.

378. Amygdaloid with large fragments of greenish amygdules, full of epidote and chlorite with quartz amygdules, cemented together by quartz. There is an open porous texture.

379. Amygdaloid with open pores. Field a light brown ground and numerous grayish green amygdules.

380. Amygdaloid with a gray and red amygdaloid mixed. The amygdules are filled with calcite, but are lined with epidote or gray-green chlorite. The whole rock seems highly decomposed.

Belt 46. 381. Fine grained massive trap with red line of decomposed and heavy slickensided chlorite seams.

382. Very fresh looking, fine grained rock, but with much calcite on seams.

383. Fine ophite. Possibly 2-3 mm. With chlorite and calcite on one face.

384. Ophite. About 2 mm. mottling, with little chlorite.

385. Ophite with chlorite and calcite on one face.

386. Fine grained with occasional chlorite amygdules, with rather feldspathic looks.

387. Fine grained trap with few small chlorite amygdules.

388. Fine grained trap with small chlorite and calcite amygdules.

389. Amygdaloid. Yellow-green, full of epidote and quartz, with very good showing for copper. There is also calcite.

390. Amygdaloid. Fine grained, brecciated, red amygdaloid with pink amygdules. Is cemented together largely by epidote. There is also quartz. Cf. the Montreal lode.

391. Fine grained trap with few amygdules and copper stains.

The following samples are, I believe, from the Calumet cross-cut:

A. Massive trap with heavy seams of chlorite.

B. Massive fine grained trap; chlorite and epidote.

C. Fine grained ophite, 1-2 mm. Some chlorite.

D. Is well-marked brecciated amygdaloid with red and gray amygdaloidal fragments, and in interstices epidote and calcite and perhaps some other mineral.

E. Augite syenite pebble with some conglomerate.

F. Heavy ophite. Mottles 2-3 mm. Considerable chlorite.

A bag marked "Calumet Conglomerate" contains samples of conglomerate mainly with other fine grained felsitic pebbles. The ground mass a lighter red and copper a good deal represented by red oxide and green carbonate.

There are too many sections to place on the figure 37. Slight discrepancies between the shafts may not be due to inaccuracies of records but to slight changes along the strike.

A section at 3200 feet in the Centennial that I took with some care is worth recording for the fact that it shows that the third belt under the Calumet conglomerate which it will be noticed is irregular in different sections is not an amygdaloid top at all but a slip. It is a mile north of the main section. The record follows:

51.	Calumet conglomerate Ss. 16544-16546	(27)
52.	Amygdaloid 27-54 Ss. 16547-16548	(16.8)
	Trap 54-62 Ss. 16547-16551	(100.9)
53.	Ophite	
	Amygdaloid 262-? Ss. 16552-16554	
54.		(75.3)
	Trap -816 Ss. 16554-16563	(242.7)
	Slip with dip 35° at 390	
55.	Ophite	
	Amygdaloid 816-840 Ss. 16564-16566	(10.6)
	Trap 840-898	(87.8)
56.	Amygdaloid. Supposed to be Osceola 16	(10)

The Tamarack 13th level cross-cut gave:

51. Calumet conglomerate
52. A. 35 (21.8) and T. 145 (90.4)
53. A. 50 (31.2) and T. 220 (137.2)
54. A. 20 (12.5) and T. 95 (59.2)
55. A. 40 (25) and T. 145 (90.4) with copper
56. Osceola amygdaloid 750 feet from shaft

Below the Osceola the old 4th level Calumet, and 30th level Tamarack sections give substantially agreeing records, allowing for slips, down to and below the Kearsarge conglomerate and close to the Kearsarge amygdaloid. The section might have been extended by Calumet and Hecla drilling but in the figure it is completed by the Old Colony records about two miles northeast which were at the time in a little better shape. However, for the record of the character of the beds in drill holes consult Calumet and Hecla drill holes D. C. and A.

Holes A. D. and C are nearly in line with the long cross-cut of the Calumet and Hecla shown in the plate and continue its section. They are in turn to be continued by drilling on the St. Louis property;[1] Section 19, T. 56, R. 32,

[1]Since completed. See Appendix.

making a section S. 56° 33' W. from Kearsarge shaft No. 20. They are also continued by the drilling around Kearsarge shaft No. 21.

Calumet and Hecla drill hole D. Drilled northwesterly from C, about 400 feet from it, practically at right angles to the beds, dip 50°. About 650 feet above the Wolverine sandstone, and about the horizon of the Kearsarge conglomerate.

1. Overburden (32)
2. Base of ophite (32-53) (21+)
   At d D. 32 2 mm. mottles. Over 42 feet thick,
   This is probably the thick ophite just below the Kearsarge.
   Cf. the 98-foot belt 4577-4701 at Red Jacket and the No. 46 belt in the cross-cut 2579-2632 at Franklin Jr.

70. 3. Amygdaloid d D. (53-63) 10 feet, to
   Ophite d D. -86 23 (33)
   From 78-81 pseudamygdaloid, i. e., spotted by alteration so as to look like amygdaloid. Cf. 14.2+44.2 of a cross-cut, nearby.

71. 4. Amygdaloid? and ophite 86-144 (58)
   Possibly a continuation of Belt 3.
   At 96, 115, and 140 feet we have the
   mottling 2, 2–3, and ½ mm. across.
   Cf. 197 and 203 in cross-cut for 3 and 4 together make up 91 feet against 98.5 of the cross-cut.

72. 5. Red amygdaloid with calcite seams and
   Amygdules (d D. 144-153) 9 feet, top of
   Ophite d D. -158 4 feet (14)
   1 mm. mottling at 155 feet?

   6. Amygdaloid (d D. 157-161) 4, top of
   Melaphyre (d D. 161-164) 3 (7)
   Base below the base of the Kearsarge conglomerate, about (200) to (300) feet.

73. 7. Amygdaloid (d D. 164-166) 2 feet, top of
   Melaphyre (d D. -187) 21 (23)
   The trap is more or less amygdaloidal and somewhat ophitic; 5, 6 and 7 may belong together. The three amygdaloids are probably grouped in the cross-section.

74. 8. Amygdaloid (d D. 187-194) 7 feet, top to
   Ophite d D. -271' 6". 74 (85)
   At 207, 212, 226, 248, 257, 271 feet the
   mottles are 2, 2½, 3, 3–4, 4, 1–2 mm.
   At 235 to 236 there is a green, fine grained amygdaloid bomb.

77. 9. Amygdaloid (d D. 271' 6"-277 to 9) 5 feet, top to
   Melaphyre d D. -320 43 (48)
   From 289 to 304 feet, semidoleritic and pseudoamygdaloid. Then more compact, massive and faintly ophitic.
   Base below base of the Kearsarge conglomerate (356) to (456) ft.

78. 10. Amygdaloid (d D. 320-328) 8 or less feet, top to
   Melaphyre (d D. -264) 36 feet + (44)+
   This melaphyre is faintly amygdaloid for a good part of the way, fine grained and not apparently ophitic. If it is the same belt as No. 2 of C, and it can not well be any lower one, it must be the upper part of the same flow, which is probably over 70 feet thick. Thus

D extends from 320 feet or so to 650 feet above the Wolverine sandstone.

Calumet and Hecla drill hole C. Put down about 400 feet northwesterly from A and at an angle of 50°, so as practically to overlap it.

1. Overburden of till (566)

78. 2. Bottom part of ophite (d C. 566-84) (27+)
   This is coarse, rather feldspathic, pyritic (secondary?) and grows denser. Total (say 74)
   Base above the Wolverine sandstone (288 ft. +)
   Base below the Kearsarge conglomerate (356 to 456+say 74) (430) to (530)

79. 3. Amygdaloid (epidote, chlorite, laumontite and calcite) (84-87)
   top 3 feet of
   Melaphyre (89' 6") 2 (5)

   4. Amygdaloid (4 d C. 89' 6"-91) top 2 feet of
   Melaphyre (which is coarsely amygdaloid to 95 ft.) to 102' 11" (13)
   The lower contact has red trap above, yellow-green below.

80. 5. Amygdaloid, yellow-green (d C. 102'6"-109) 7 feet, and then
   Coarse chloritic amygdaloid (d C. 109-113) 4 feet, top to
   Feldspathic melaphyre (d C. 113-135) 2 (33)
   From 84 to 226 feet may be one throughout coarsely amygdaloidal flow in overlapping gushes, 142 feet thick.

81. 6. Amygdaloid, becoming coarse (d C. 135-142 to 157?) 7 feet, top of
   Feldspathic ophite, Kearsarge hanging, -226½ 84½ (91)
   At 188 to 198 feet, laumontite, at 206 3 to 5 mm. mottles.
   Base (top of Kearsarge amygdaloid) above the Wolverine (145)+

82. 7. Kearsarge amygdaloid (d C. 226½ to 235) 8½ feet, top to
   Ophite, Kearsarge foot (d C. 235 to 281½) 46½ (55+)
   The amygdaloid is dense, with white, red bordered amygdules.
   The ophite is a plagiophyre like Belt 2 of A, quite dense to begin with but with ophitic mottles about 3 mm. across at the (281' 6") end, about the same as A at 108 feet, which would make the thickness 55+ (198-108).
   This is about the right thickness, as we see upon comparison with A. Hole C then gives a record from 90 to 315' 6" above the Wolverine sandstone.

Calumet and Hecla drill hole A, put down practically at right angles to the dip, in a nearly continuous section with E and D on Section 13, T. 56 N., R. 33 W. No correction for true thickness from apparent thickness. The first numbers correspond to those on the section. (Fig. 37).

1. Overburden (54)
2. Begins in the immediate foot of the Kearsarge lode or amygdaloid. the rock still faintly amygdaloid, a red porphyritic melaphyre, with crystals, turned greenish, of labradorite which at 67 feet seem coarser and up to 15 mm. long, the augite becoming ophitic at 75 feet.
   Rough observations of the size of the ophite mottlings are:
   at 86, 107, 108, 121, 134, 156, 164, 171, 179 feet

3 mm., 4–5?, 3, 4, 4–5, 3, 2, 1–2, 1. respectively; the base is a very dense fine grained, blue trap to 198 feet

A plagiophyric ophite, the Kearsarge foot thickness (about 150 feet, allowing for amygdaloid) (144)+

83. 3. Wolverine sandstone. Absent as in Section 23? (0)
and part of the section cut out?

84. (to obtain distance below it subtract about 200 feet).

85. 4. Epidotic, brecciated amygdaloid (d A. 198-203) for 5 feet, top of-
Ophite (d A. 203-273) 70 (75)
mottling at 208, 223, 258 feet
1 to 2, 2 to 3, 3 mm. respectively
at 254 prism shaped augite patches; at 239 to 242, 249 and 254 to 258 veins.

86. 5. Amygdaloid (laumontite, quartzose, veined) (270-279) for 9 ft. the top to-
Ophite, feldspathic and doleritic above, (to 361) 84 (93)
Ophitic mottling at 320, 326-348 feet
3, 2-3 mm. respectively

87. 6. Amygdaloid (d A. 361-367) for 6 feet, top to-
Melaphyre (d A. -370) 3 " (9)

7. Amygdaloid (d A. 370-377 for 7 feet more, then-
Melaphyre -381 for 4 feet (11)
It is fine grained, red, and more or less amygdaloid from 379 down.

8. Amygdaloid (d A. 381-394) for 13 feet, then-
Melaphyre (d A. -397) for 3 feet 16

9. Amygdaloid (d A. 397-399) for 2 feet, then-
Melaphyre (d A. -401) for 2 feet 4

It is impossible from a drill hole record in the case of such belts as 6 to 9 to determine whether they are not fewer belts, or one rather small flow more or less amygdaloidal throughout (40) feet thick. Cf. B 120-163, and Hole 1 near Shaft 21 from 70-92 feet.

10. Sediment on top of scoriaceous amygdaloid. Thickness can not be separated from it. Below the Wolverine sandstone horizon 203 ft.

87. 11. Scoriaceous amygdaloid (d A. 401-405) for 5 feet, on top of-
Feldspathic ophite (d A. -553) 148 feet (153)

This melaphyre remains sparsely amygdaloid, with an occasional speck of copper, some way below 411, and becomes coarse (in one spot 10 mm. feldspar and 7 mm. augite and chlorite amygdules) and doleritic with very little traces of ophitic texture:
at 515 and 540 feet
mottles perhaps 5 and 2 mm. respectively

The base is fine grained green, the contact with the next underlying flow uncertain.

88. 12. Amygdaloid (d A. 553-555) for 2 feet? top to-
Melaphyre (d A. -656) 101 feet (103)

In this melaphyre the feldspar and brown specks (I presume of altered olivine) are conspicuous, and even the magnetite and chlorite, but the ophite mottling is but faintly visible. The bottom 4 feet are first a dark grey, then a red and white amygdaloid and would probably be counted with the underlying amygdaloid in mining.

Belts 11 and 12 seem closely associated and may be one flow with inclusions. Cf. B 233 with A 401. No thoroughly satisfactory

correlation of these holes can be made owing probably to the disturbances near B.

89. 13. Amygdaloid (d A. 656-661) for 5 feet, top of-
Ophite (d A. -752.6) 91.6+ say 145 (160?)

It is coarsely amygdaloid down to 678. The mottling is plainer than from 401 to 556:
at 678, 692, 706, 732, 738, 752
the mottles are about 2, 3, 4, 5, 6, 4–5 mm.
whence I think we are safe in inferring 50 feet or so more of the trap to the next amygdaloid, making the total thickness about 160 ft.

Calumet and Hecla drill hole 1. Near shaft 21. This was put down in the exploratory drift about at right angles to the lodes, i. e., about 50°.

85. 1. Ophite with inclusion spots? of finer grain d 1. 0-70 (70+20?)
at 0, 18, 40, 57, 68 feet we have
mottles 2, 3, 1–2, 2–3, 1–2 mm. It is probably feldspathic.

86. 2. Amygdaloid (red with white amygdules (d 1. 70-84) 14 feet, top to
Melaphyre (d 1. 84-92) 8 (22)
Cf. Hole A, Belts 6 to 9.

3. Sediment mixed with

4. Amygdaloid, marked (d 1. 92-97) 5 feet top to

87? Feldspathic ophite (d 1. ?-232) 135 (140)

At 104 and 113 feet there is red sediment, perhaps filling a seam. At 111 and 155 it is pseudamygdaloid, and at 140 doleritic. In general the ophite mottling is vague but at
130, 204, 213 feet it seems to be
3–4, 3, 5 mm.

5. Amygdaloid (d 1. 232-240) 8 top of
Melaphyre (green epidote) (12)

6. Green sandstone and fluccan (244-256) (12)

7. Amygdaloid, coarse feldspathic (d 1. 256-271) 15, top of
Feldspathic melaphyre (d 1. -330+) 59 (74+)

This melaphyre is doleritic, and epidotic, coarse and feldspathic, with conspicuous brown spots of altered olivine. At 288 is a fine spot inclusion or bomb.

Belt 7 resembles A 12, and Belt 4 may represent A. 11; and Belt 3, A 10; and belt 2, A 6, 7, 8, and 9; Belt 1, A 5. Belts 5 and 6 would then be either part of the amygdaloidal top of 7, or faulted in, or deposited in a hollow of flow 7 before 4 came over.

This would make the top of d 1 come about 102 feet below the horizon of the Wolverine sandstone. According to the mine plan it is about 125 feet below the slide that cuts out the Wolverine sandstone, and in the cross-cut that leads to it there is:
Trap 109 feet.

Amygdaloid (pseudamygdaloid on which a drift was run follow-
a fissure dipping 60° about at right angles to the dip) 14 ft. and-

84. Trap 16 (93)
Amygdaloid (on mine plan) 17 and

85. Trap to beginning of hole 12 (20)

Calumet and Hecla drill hole 2. In exploration shaft 21. Put down under ground as shown in plat; nearly at right angles to the dip.

1. Melaphyre, base of bed (d 2. 1-9) (9+)
2. Scoriaceous conglomerate (d 2. 9-12+) (3+?)
3. Melaphyre? (d 2. 12-15) (3?)

87. 4. Amygdaloid with red sediment, (d 2. 15-20) 5 feet, top of
Feldspathic melaphyre (d 2? to 167) (152?)

Red sediment is frequent along here, but is probably either washed or faulted into seams, so at 40 and 48 feet. The bed is but faintly ophitic. At 56 it is faintly ophitic, 2 mm. At 70 is a coarse amygdaloid streak, probably not a contact, but probably at 81. At 95 it appears finer grained; at 100 2 mm. mottling; at 118, a clay slip, ophitic mottling, 3 mm. At 125 it is coarser, but veined and so altered that the ophitic character is faint. At 149 the mottles appear to be 4 to 5 mm., at 159 2 mm. and 167 a contact.

This belt is so much disturbed that one can not depend upon its thickness, but it corresponds to Belt 4 of Hole 1.

5. Epidotic conglomerate and sandstone, (d 2. 167-175?)

Indurated fine grained grey and green, scoriaceous conglomerate at base.

6. Scoriaceous amygdaloid (d 2. 175-185) 10 top of
Melaphyre, feldspathic ophite (d 2. -282) 97 (107)

The record of the samples is again not clear. Red sediment occurs at 193; an inclusion at 258; at 210-215 there is an amygdaloid streak, possibly a contact (cf. 288 feet in Hole 1) at 223 an epidote streak; at 230 possibly a fine grained contact but no amygdaloid. This may be an inclusion bed or flows more than one closely associated.

7. Sediment, red, with belt below. 0
8. Amygdaloid (d 2. 282-294) 12 feet, top of
Melaphyre (d 2. -315) 6 (33+)

This is epidotic from 294 to 299 feet and shows fine grained inclusions.

The beginning of this hole appears to be not far from (200) feet below the level of the Wolverine sandstone in A but from its position in the mine it is not over 50 feet below the slide representing the Wolverine sandstone. Yet the scoriaceous amygdaloidal belt appears to be the second belt below the Wolverine, at any rate is separated by considerable trap. Thus from 70 to 160 feet extra is taken up in the slide fault, the balance perhaps in the slip which passes through the drill hole at 118 feet.

B. near shaft 21

Ophite coarsest at 97 feet	75 to 118		(43)+
Amygdaloid, top to beds below	118	123	(5)
Amygdaloidal melaphyre	123	163	(40)
Amygdaloid, tops to beds below	163	167	(4)
Melaphyre (faintly ophitic about	218ft).	233	(66)
Scoriaceous amygdaloid		236	(3)
Melaphyre (feldspathic)		305	(69)
Amygdaloid (four feet)			
Melaphyre (feldspathic, rarely doleritic and 434 faintly ophitic)		456	(154)

Sandstone, dark red	463	(4)
Melaphyre (feldspathic and doleritic)	560+	(97)

3 of Shaft 21. All one belt, (82) the Kearsarge foot trap a plagiophyric ophite, very fine grained near the bottom of the hole, mottles at 20, 40, 58, 67, 100, 113, 167 feet are about 1, 2, 3-4, 3, 5, 4, 3-4 mm. across and the end is obviously getting finer and near the top, the Kearsarge amygdaloid lode which was sought. Subsequent exploration proved this to be the case.

§10. OLD COLONY-TORCH LAKE (FIGS. 38 AND 39.[1])

The lower part of the Calumet section is represented by work done on the Old Colony and Mayflower which is incorporated in Figure 37.[2] Of these workings more or less has been examined by members of the Survey at various stages. The main record of the met Section (Fig. 37). Belts 109, 110, and 111 correspond to Torch Lake, Hole No. 2, probably Belts 11, 12 and 13. The Mayflower is also proving this same territory. Some notes by P. S. Smith and W. V. Savicki of an early stage in the work follow and are illustrated by Fig. 39.

The tunnel has already cut three conglomerates.

Facts, etc., furnished by Mr. Chas. Chynoweth of the Centennial mine.

Specimens of conglomerates. Locations shown in notes of W. V. Savicki. Conglomerate from tunnel of the Old Colony Mining Company. A true conglomerate rather dark reddish. Pebbles of amygdaloid trap, a dark trap with narrow decomposed crystals of feldspar, sandstone, considerable calcite in veins and seams. The pebbles are not very well rounded being subangular. The specimen shows a fracture on breaking which cuts across the pebbles.

Conglomerate No. 5 from Leinenen's pit so-called. Rock appears to be a breccia rather than a conglomerate. There is considerable epidote. The fragments are very angular with a smashed up matrix of comminuted fragments cemented with the epidote. There are many open cavities almost like druses. Specimen No. 1.

Conglomerate from pit No. 3, that is the so-called north shaft. This conglomerate looks very much like the specimen from the tunnel, much more so than like the specimen from No. 5.

Capt. Rapson is in charge of the driving of the tunnel being driven by the Old Colony Company.

Sandstone. This is the eastern sandstone not seen in contact.

52, (34.3) Conglomerate, Specimen No. 2.

70, (46.2) Amygdaloid and amygdaloid trap. With bunches of calcite No. 3.

[1]Figs. 38 and 39 are in envelope.

[2]It has been impossible to incorporate current work in this report which is of date 1909. See appendix. Figures 38 and 39, however, include facts gathered by A. H. Meuche, not referred to in the text. But it should be carefully noted that even in Figure 39, the lode labelled "Mayflower Lode" is not that which has been more recently so called. This latter seems to lie a short distance above the St. Louis conglomerate, much in the position of the Isle Royale-Arcadian Lode. Compare the tunnel record at 986 feet.

200,	(132′)	Brecciated amygdaloid, so-called conglomerate by the miners. Specimen No. 4.
265,	(175′)	Sandy like brecciated amygdaloidal trap. Specimen No. 5.
365,	(241)	Same as No. 5. This specimen is No. 5a.
495,	(328)	Small vein of amygdaloid much broken up with some slips and gouges. Too broken to take specimen. Strike of vein N. 3° E. (mag.) The dip is pretty steep, about 65°.
500,	(370)	Specimen 5 b, the same as No. 5.
710,	(468)	Specimen 5c, same as No. 5, only coarser.
830,	(548)	Broken up and altered material followed by an amygdaloidal trap with greenish chloritic balls and particles.
840,	(554)	Dark amygd. trap. No. 6 with epidote? Altered to chlorite with calcite bunches here and there.
865,	(571)	Same as No. 6, but shows feldspar needles No. 6a.
925,	(611)	Clay slips about 3 feet wide, striking N. 12° W.
954,	(630)	Fluccan seam about 6 inches wide with much decomposed material, part of seam is made up of epidote material much chloritized. This seam has caused some caving necessitating lagging.
986,	(651)	Top of No. 6 which shows some copper stains.
987,	(652)	Amygdaloid No. 7 large round amygdules.
1050,	(695)	Dark greenish, somewhat decomposed trap with greenish blotches resembling the luster mottled trap. No. 8.
1100,	(726)	Same as No. 8. Between these two there is a band of amygdaloid much the same as No. 7 but with ill-defined walls.
1155,	(762)	Moderately fine grained amygdaloidal trap much the same as No. 7. No. 9.
1590,	(1049)	No. 10. Amygdaloidal trap with epidote in the amygdules.
1603,	(1058)	Top of amygdaloid separated by a thin fluccan seam from the overlying conglomerate. No. 11. The gouge is about 2″ wide.
1605,	(1060)	Conglomerate No. 11.
1652,	(1090)	Hanging of conglomerate followed by trap. The contact is much decomposed forming a band easily traced by the eye.
1665,	(1099)	No. 12 of the trap overlying the conglomerates. This is an m. c. g. amygd. trap passing gradually into an amygdaloid.
1730,	(1142)	The amygdaloid has the amygdules filled with quartz in large measure. No. 13.
1845,	(1151′)	The hanging of the amygdaloid is at 1745. At 1730 they have turned off drifts N. and S. on the amygdaloid and are now sinking a winze on the hanging. The winze is now down 65 feet, and short drifts have been turned off.
1760,	(1161′)	A coarse even grained trap breaking with great smooth faces very massive. No. 14.
		Between 1800 and 1900 there are many intersecting seams of calcite.
2040,	(1346′)	Same as No. 14. No. 15.
2100,	(1386′)	Seam of broken up and decomposed material.
2210,	(1459′)	A clay slip conducting water in very small amount, but still the most seen in the mine.
2300,	(1518′)	Two intersecting clay slips.
2510,	(1656′)	Breast in same kind of trap.

Length of tunnel as measured 1656: Length of tunnel as measured by the Company at the first of the month 1625:

Specimens 1 to 15 above are described as follows: (of them there are preserved in the Survey collection Ss. 19736 (1), 19737 (5), 19738 (8), 19739 (11), and 19740 (14)).

T. 56 N., R. 32 W.

No. 1. A conglomerate with fully formed pebbles. The cement being a greenish, epidotic mixture of small comminuted fragments of various rocks cemented together with this epidote. Texture is very open and full of cavities. The pebbles noticed in hand specimen are a reddish, much iron stained amygdaloid with round bullet like amygdules. A dark trap very fine grained. Minerals indistinguishable. (19736)

No. 2. A conglomerate with fully formed pebbles, general reddish cast. The rock as a whole breaks across the pebbles and shows no lamination or sandstone layers. Veins of calcite intersect the hand specimen frequently. Amygdaloid, sandstone, trap and felsitic pebbles are observed.

No. 3. Is a dark amygdaloid. Amygdules filled with greenish epidote and calcite. In hand specimen are several copper stains in the amygdules. Rock breaks very angular. Color dark to black. Bunches of calcite of frequent occurrence on joint planes.

No. 4. So-called "conglomerate," which in reality is a much brecciated amygdaloid showing slickensiding on faces. General color black with a good deal of laumontite.

No. 4a. In general the same as No. 4 but with much more chloritic material. joint planes.

No. 5. A sandstone and conglomerate band with rather small pebbles. The pebbles seem to be of a dark more or less siliceous rock whose exact nature cannot be determined in hand specimen. (19737)

No. 5a. Is also a conglomerate but with the small pebbles much less well formed than No. 5. The various pebbles noted are a dark trap, a reddish felsitic rock and the whole is cemented together in large part with a calcite matrix. Specimen is preserved in collection.

No. 5b. Shows essentially the same feature observed in No. 5 and No. 5a. The rock breaks across the pebbles.

No. 5c. A much more amygdaloidal breccia than preceding specimens. The specimen shows numerous slickenside planes and the pebbles are very poorly formed. The largest fragment is of a reddish trap with much elongated amygdules filled with calcite and a little epidote.

No. 6. A moderately fine grained trap verging in part into an amygdaloid with the cavities filled with a greenish chloritic material, probably an alteration product from epidote. The amygdules show elongation in the plane of bedding. Some calcite seams intersect the rock.

No. 6a. Same as No. 6, but in general with coarser grain.

No. 7. A fine grained amygdaloid. The amygdules showing a general paragenesis of calcite and epidote. The epidote has for the most part been changed into a green chloritic mineral. The rock is in general very fine grained, the individual minerals being indistinguishable to the naked eye.

No. 7. Same as preceding but with amygdaloid cavities much smaller and less altered showing passage before noted from epidote to chlorite.

No. 8. A much decomposed poikilitic rock with decomposed feldspar (?) in great abundance. This form merges into No. 7. It is traversed by many small calcite seams which causes the rock to break into angular fragments. (Sp. 19738)

No. 9. A reddish amygdaloid, very abundant small amygdules. The amygdules filled with greenish chloritic mineral. Rock breaks with an angular fracture. Amygdules show only slight elongation in any direction. Some slickensiding.

No. 10. A much less decomposed amygdaloid than preceding. Amygdules filled with greenish epidote, sometimes in beautiful little crystals. Amygdules also filled with radiating calcite. Rock generally fine grained. Texture reddish color.

No. 11. Another so-called conglomerate band by the miners but which appears in the hand specimen as a much brecciated rock. The pebbles if any, are poorly formed and show extreme angularity. The matrix is of epidotic material and the rock in general has an appearance like No. 1, except that the pebbles are not nearly so well formed. The pebbles observed are of a brownish red trap with reddish amygdules of laumontite and dark homogeneous trap, a reddish felsitic looking rock and some ordinary brown trap.

This specimen is preserved in the collection. (19739)

No. 12. Is a moderately coarse grained diabasic trap of very uniform texture occurring in very massive bands.

No. 13. Is a slightly brown, dove colored rock with large amygdules sparingly scattered through the rock. Amygdules filled with calcite, epidote and some chloritic alteration material. The rock is intersected by many calcite veins.

No. 14. A dark homogeneous trap with a moderately coarse grained texture breaking with conchoidal fracture showing considerable quartz, augite, calcite and a greenish chlorite. This rock in the mine occurs in very large massive walls. This specimen is preserved in the collection. (19740)

No. 15. Same as No. 14, but showing some slickensiding and appears a little coarse grained.

Compare the early explorations on the property described in Volume VI, Part II, page 80.

A more systematic record than that of the Old Colony can, however, be made from the work of the Torch Lake Mining Company which follows. The interesting points in this section are the flattened dips toward the lower part, over a boss of felsite or quartz (porphyry), the presence of a coarse quartz porphyry intrusive, shown in the railroad track but missed in the section, and the very pumiceous amygdaloids and felsites of the lower part. The flattened dip toward the contact is confirmed by the shaft at 33° all in amygdaloid at the Old Colony and the results of a section made by the Calumet and Hecla at right angles to their strike (S. 56° 33′ E) from their Kearsarge shaft No. 20 across the Old St. Louis property.

Torch Lake Mining Company. Thacher Loring, President. W. W. Stockly, Engineer and Superintendent. The explorations of this company are a series of drill holes and test pits of great value in determining the geological cross-section at Calumet below the Kearsarge lode. This crosses the property (which consists of two square miles, Sections 35 and 36, T. 56 N., R. 33 W.) at the extreme northwest corner. From this point to Hole 9 the country has not been explored, as comparatively little of the lodes would be found on the property of the company. They would be found on the properties of the Laurium and La Salle adjacent.

At right angles to the strike the distance of Hole 9 from the hanging of the Kearsarge lode is 1865 feet. Assuming this dip to be 42°[1] we have (1865 x .67) (1250) feet below the top of the Kearsarge lode for the position of Hole 9. The succession

[1]This is the dip derived from the Tecumseh holes and used in putting down Tecumseh Hole 2 which stayed in the lode.

of beds is, however, very fairly known from the Franklin Junior, Tecumseh, Caldwell and Arcadian work. Following the latter, we have:

	Kearsarge lode and foot	(161	1089
Arc.			(1250)
64.	Wolverine sandstone often cut out, "Conglomerate 9".		
	The Arcadian section is as follows:		
65.	Ophite	(82)	
66.	Melaphyre	(51)	
67.	Scoriaceous conglomerate	(5)	
68.	Melaphyre (inclusion bed)	(217)	
69.	Scoriaceous conglomerate	(1)	
70.	Melaphyre	(32)	
71.	Ophite	(95)	
72.	Ophite	(143)	(625)
73.	Fault zone or sediment	(25)	
74.	Feldspathic ophite, mottling not well marked, with a little copper	(190)	
	Below base of Wolverine sandstone		(840)
75.	Feldspathic ophite	(122)	(962)
76.	Sandstone 8½ cupriferous	(4)	(966)
	Cf. Old Colony sandstone, 980 feet below the Wolverine.		
77.	Feldspathic ophite, doleritic	(78)	
78.	Feldspathic ophite, doleritic Arc. 21 to 95	(54)	
	From base of Wolverine sandstone		(1100)
79.	Ophite?	(28)	
80.	Feldspathic ophite, doleritic, cupriferous	(120)	(1248)
	Possibly flow No. 2 of Hole 9, 113-268		
81.	Brecciated amygdaloid and feldspathic ophite	(83)	
82.	" " " melaphyre	(15)	
83.	Scoriaceous " " doleritic ophite	(78)	(1424+)
84.	" " " feldspathic melaphyre	(116)	(1540+)
85.	Melaphyre, not ophitic cf. d 9. 392-535	(110)	

The occurrence of copper in Holes 9, 8 and 1 seems to be matched also at about this horizon in the Old Colony, Mayflower and parallel sections.

Specimens 20563 to 20598 are taken from this section and there are microscopic descriptions of 20575, 20578, 20582, 20584, 20587, the Minong-trap-like Bed 59.

Torch Lake drill hole 9. 1380 paces N. 1600 paces W. Section 35, T. 56 N., R. 33 W. Vertical; reduction factor cos 42°=.743.

1. Feldspathic ophite? d 9. 26-113=87+ (65+)

   The reddish specks of (altered olivine) Iddingsite are plain. Augite mottling is not plain. Some hard seams (at 100 one that looks like a dike) occur, and pink prehnite (at 75′ 3″ and at 113). This pink prehnite is like that which occurs in the neighborhood of the Isle Royale lode (Vol. I, Pt. III, p. 15, but cf. also p. 103) and the traps exposed on the street railway cuts in East Houghton.

2. Feldspathic ophite? 155 (115)

   Amygdaloid d 9. 113-146

   Clasolitic and brecciated with chlorite; perhaps an amygdaloid conglomerate; looks conglomeritic; with calcite and epidote.

Trap d 9. 146-268

The altered olivine (iddingsite) is conspicuous; augite mottling is relatively obscure; from 225 to 253 it appears faintly; at 225 2 mm; at 233 3 mm.

There are amygdaloid spots to 161 feet. About 183 there are laumontite seams. At 190 is radiated thomsonite or prehnite; at 183 and 207 are seams at 10° and 5° to the core respectively, probably nearly vertical joints. Toward the base the rock is darker chloritic and the seams at 28°, 34° and 41° to the horizontal are more nearly parallel to the bedding.

3. Feldspathic melaphyre 124 (92)

Amygdaloid d 9. 268-301

Quartzose, calcitic, laumontitic, with a good deal of clasolitic matter and perhaps a contact at 272; at 292 epidote and datolite; from 301 on, trappy with irregular clasolitic seam with curious bedding banding.

Trap d 9. 301-392

From 301-335 are bands of feldspathic seams at angles from about 26° to the core, and cross-fractures at 45°.

4. Feldspathic melaphyre 143 (106)

Amygdaloid d 9. 392-407

Red and white, well-marked with a little clasolitic matter.

Trap d 9. 407-535

also d 8. 20-54

There are occasional amygdaloid spots, and especially from 433 down chloritic spots and seams; at 451 there is a little *copper*, and again at 511 and 530 in seams respectively at 15° and 26° to the core. These are probably in the columnar joints, this being the hanging of a lode.

Top of lode below the top of the Kearsarge lode, (1647) feet, ...

below Conglomerate No. 9 1250-161 + 397 (1486)

5.] Melaphyre. Lode and foot.

Amygdaloid d 9. 535-9.545

d 8. 57-65

Chloritic, red.

A seam of prehnite pink with *copper* at 545. This bed matches quite well Arc. 86 i. e., the marked red amygdaloid with some copper at d 21. 663-667 which is (1650) feet below the base of the Wolverine sandstone No. 9.

The brown specks of altered olivine in Arc. 86 remind one, however, of the top of No. 9, but that is perhaps a matter of the kind of alteration. The general character of very feldspathic beds, faintly if at all, ophitic, is, however, quite similar.

Torch Lake drill hole 8. 1460 N. 1200 W. Sec. 35, T. 56 N., R. 33 W. The top of this matches No. 9 at 503 feet well enough.

A uniform reduction factor is taken of cos. 41° = .755 though the dips may be somewhat less and the hole more nearly perpendicular to the beds at the bottom.

(4.) Trap d 8. 20-54

Feldspathic with black chloritic flecks matching d 9. at 503.

5. Feldspathic melaphyre, copper bearing amygdaloid and foot 121 (91)

d 9. 535-545+

d 8. 57-65 to 85?

From 57-60 the amygdaloid contains pink prehnite; from 62-65 it is not only pink but has green epidote, and spots of prehnitic pink amygdaloid occur to 65. also from 79-85.

Trap d 8. 65 or 85-178

Spots of pink prehnitic amygdules occur throughout the trap. Near 128 it seems to pass a big slide dipping 41°, probably about parallel to the dip of the beds, the rock being much shattered. If Bed 5 were the same as No. 4 something would have been cut out here. At 153 is quite a little *copper* in a seam at about 41° and there are other seams parallel to this and a faint coarse mottling. (1577)

6. Feldspathic ophite 4 mm. 85 (64)

Amygdaloid d 8. 178-190

Coarse with epidote and calcite.

Trap d 8. 190-251 to 263

Faintly mottled 190-200, coarser to 226 3 mm. mottles. There are seams at 5° and at 45° to core, then below at 230 to 235 marked seams at 20° to core. This may be a columnar jointing running nearly north. The grain grows finer from 4 mm. at 226 to 1 to 2 mm. at 247. The base of this flow is red with the feldspars standing out well and a few white amygdules but mainly green. This is like the base of the flows near the Isle Royale lode. The contact is not well marked but from grain and all appears to be down somewhat below 251. This is the first distinct ophite.

7. Feldspathic melaphyre 40 (30) (1641)

Amygdaloid d 8. 251 to 263-270

Spots of amygdaloid not well marked.

Trap d 8. 270-303

Seamed at 5° to 10° and 45° to core.

7 is very probably closely allied with No. 6,—only a preliminary gush.

8. Melaphyre 12 (9) (1672)

Amygdaloid d 8. 303-307

Trap d 8. 307-315

(1681)

9. Melaphyre 8 (6)

Amygdaloid d 8. 315-317

Trap d 8. 317-323

Base, hanging of lode below Wolverine (1687)

10. Melaphyre with a copper bearing amygdaloid 81 (61)

Amygdaloid d 8. 323-337

There is a little *copper* in small seams of 3-5 mm. which run down as a seam from the amygdaloid. In the trap below there is pink prehnite.

Trap d 8. 337-404

Cf. d 1. -15

Feldspathic and epidotic; growing distinctly finer, chloritic and jointed toward the well-marked base. The relation of this to 8 and 9 is uncertain. They may be considered one broad amygdaloidal top.

The top of 1 is feldspathic with a few chlorite amygdules, Sp. 20563 = d 1. 14

(1748)

11. Feldspathic melaphyre, glomeroporphyritic 62 (47)
Amygdaloid d 8. 404-413
d 1. 15 or 18?-29
With epidote and calcite.
Trap d 8. 413-467
d 1. 18?-67

This trap down to 443 remains irregularly streaked and occasionally amygdaloid with pink bordered amygdules, altered, fine grained and glomeroporphyritic, that is, with clots of small feldspar laths. From 448-462 it is massive, coarser and feldspathic, then the glomeroporphyritic appearance becomes more marked toward the base. At the top of Hole 1 there is a similar difficulty in making out exact flows; from 29 to 37 it is feldspathic trap, then a red amygdaloid, then epidote and chlorite amygdules, then pink, white and green amygdules.

Base hanging of lode below Wolverine (1795)

12. Feldspathic melaphyre, glomeroporphyritic, with *copper* 45 (34)
Amygdaloid d 8. 467-473
d 1. 67-77?
Copper at d 8. 471 feet, the first noted in this hole.
Trap d 8. 473-512
d 1. 77-91

The amygdaloid is not well marked, glomeroporphyritic, the contact seems to dip 31° and breaks parallel to it; dip 31° to 41° at the top; grows finer from 499 down. In hole 1.67-77 has pink and white amygdules but the first copper is noted at d 1. 113 in a trap, on chlorite, epidote and calcite, the marked cupriferous amygdaloid which is also glomeroporphyritic being at d 1. 106-110 feet. This is probably amygdaloid 13.

1829.

13. Feldspathic melaphyre, glomeroporphyritic 75 (57)
Amygdaloid d 8. 512-517
d 1. 106-110
Glomeroporphyritic Sp. 20582 is at d 8. 513 a glomeroporphyrite.

Sp. 20582 at d 8. 513. Is a typical glomeroporphyritic amygdaloid with bunches of plagioclase feldspar 1-2 mm. across on a rusty ground with smaller feldspars, chert, quartz, etc.

The amygdules are full of crystalline yellow epidote, calcite, sometimes chalcedony, and chlorite. The calcite is in large areas and latest formed. The epidote has various shades of yellow.

The calcite has negative fluid cavities with bubbles.

I think I recognize some thoroughly altered serpentinous olivine, but it is difficult to distinguish certainly from augite.

The feldspar is much decomposed. Under the microscope the olivine is in large altered phenocrysts altered to serpentine. The augite is .012 to .020 mm. in size. It is about 2-½ feet from the margin. The feldspar is distinctly in two generations. The larger are about .40 x .22 mm. Extinction angles indicate Ab_5 An_3. The ground mass is composed of small microlites .07 to .12 mm. x .02 mm. The extinction angles are very low but it is largely decomposed. The feldspar is replaced not only by epidote but also by some brown material of high refraction and low birefraction. The larger feldspars are grouped and bunched together as they represent an early stage of consolidation but are not sharply defined rhyocrystals. The amygdules are of yellow epidote and chlorite and also calcite altered in formation. There is also a mineral with a refraction much greater than chlorite with birefraction between feldspar and augite, extinction ± 0,—2V, small always and in fibres transverse to the elongation. Its properties are something like brucite. There is also a mineral with low refraction and birefraction and optically negative which is probably laumontite.

Trap d 8. 517-587
d 1. 110-178

At d 8. 546 feet there is a seam of datolite and *copper* at about 45° to core, and at d 8. 580 ft. there is copper in the trap.

At d 1. 113 there is also quite a little copper in a feldspathic trappy rock, then below a brown feldspathic trap from d 1. 156 down, growing finer and more plainly glomeroporphyritic.

Base, hanging of lode, below Wolverine (1886)

By Hole 1 (1880)

14. Copper bearing glomeroporphyrite 53 (40)
Amygdaloid, copper bearing d 8. 587-593
d 1. 178
Amygdaloidal trap d 8. 593-618
-ab.205

There is perhaps a second flow.

This remains somewhat glomeroporphyritic and the amygdules are well charged with copper, a very promising lode.

In No. 1 at 178 feet there is also well-marked copper. The amygdaloid is at first gray chloritic, becoming reddish with epidote and calcite, passing gradually into the trap with amygdaloidal flow lines.

Trap d 8. 618-640
d 1. 205?-227?

Coarse, feldspathic and massive, then glomeroporphyritic; similar in 1; but the contact is not easily located.

Base of Hole 8 below Wolverine sandstone 9 (1926)

(15.) Amygdaloid d 8. 640-648
d 1. 227?
d 1. 178
Red, white and green amygdules, with a little copper.
Trap d 8. 648-676
Feldspathic and glomeroporphyritic.

Hole 1 does not match this very well from d 1. 227 down since d 1. 244 is doleritic and d 1. 258 ophitic and d 1. 227. shows no copper; yet a correlation of d 8. 640-648 with d 1. 178 runs into difficulties too, as d 1. 106-110 is the first amygdaloid above, at a considerably greater distance than d 8. 587. It seems on the whole likely that in 8 are some beds of the cupriferous glomeroporphyritic series that are cut out in 1 perhaps by seams noted at 200 feet. This cupriferous series of relatively feldspathic glomeroporphyritic beds are well matched by the series of beds Arcadian 80-90.

Torch Lake drill hole 1. 1275 N. 1070 W. Sec. 35, T. 51 N., R. 33 W.
Vertical.

Comparing 1 and 2 the correlated dip is about 36° and near the top at 200 feet are flow lines indicating a similar dip tan-1 15 to (11 or 12) (36° to 38°⅔). The dip from Hole 8 to Hole 1 would be also tan-1 409 ÷ 563 ± according to the strike about 36°

Flow lines are noted at	15:12 at 83 feet
	15:11 at 200 feet
seams	15:11 at 322
amygdaloid lines at	15:9 at 478
	60:43

This would indicate a dip of 35°½ and a reduction factor of .813 which makes the thickness of the belts agree with those supposed to correspond in Hole 8.

The copper at the top of 1 and the bottom of 8 may be compared with the Old Colony No. 2 and No. 1 lodes.

Hole 1 begins in a series of amygdaloids and amygdaloidal traps in which the exact number and dividing lines of the different flows it is not easy to make out in disintegrated beds near the surface. The largest number possible would be about as follows:

	Feldspathic trap	d 1. 0-7?	7	(6)
(11′)	Epidotic amygdaloid	d 1. 7?-18?	11	(9)
(11″)	Feldspathic glomeroporphyritic at base	d 1. 18?-37+?		(15)

(11‴) Feldspathic melaphyre with coarse amygdules, pink, white and two shades of green (epidote and chlorite), glomeroporphyritic at base
d 1. 37+ to d 1. 67 (24)

(12′) Another flow (20)
Amygdaloid d 1. 67-77
Coarse pink and white.
At 77 seams at 20° to core.
Amygdaloidal trap 77-91, epidotic, streaked by bands of varying texture, dipping about 38°.

(12″) Glomeroporphyrite (12)
Amygdaloid d 1. 91-100
Trap d 1. 100-106
Judging from Hole 8 12′ and 12″ are one flow.

(13) Glomeroporphyrite (57½)
Cupriferous amygdaloid lode d 1. 106-113, with epidote, calcite and copper even in foot trap at 113
Trap d 1. 113-178
Feldspathic and growing finer and more distinctly glomeroporphyritic from 151 down. This seems quite clearly to be 13 of Hole 8. 512-587.
Base below Wolverine (1886)

(14) Feldspathic melaphyre (49) (40)
Amygdaloid d 1. 178-179+
Gray, calcitic with considerable copper, becoming reddish, with epidote and calcite amygdules.
Trap d 1. 179-227?
Feldspathic, slightly amygdaloid to d 1. 205, with amygdaloid flow lines at 36° dip, and at 200 feet seams, perhaps due to faulting. (1926)

15. Feldspathic ophite, 10 mm. 233 (189)
Amygdaloid d 1. 227-230
Coarse with epidote and chlorite amygdules.
Trap d 1. 230-470
d 2. 0-146
At 244 feet almost doleritic. The augite mottles
at 258, 289, 320, 334, 369, 415 feet
are 2–3, 5, 7, 10, 8–10, 5–7 mm. respectively
Then below it grows finer and between 458 and 470 glomeroporphyritic.
(2115)

At d 2.14 the mottles are 10 mm., and remain about the same to d 2. 65. The iddingsite is conspicuous at d 2. 65-98. From d 2. 98 the grain is finer and the mottling fainter. The correlation of Hole 2 at 146 with Hole 1 at 470 is very good.

No. 15 is so heavy a belt that we may expect to find it quite persistent. Now, we find Arc. No. 92 a heavy belt 211 feet thick or so Arc. 4. 1-32, the foot of which was about 2270 below the Wolverine.

Also in Isle Royale Consolidated Hole 4, 244-449 Bed 3 is also 184 feet thick, has faint mottles, 7 mm. at 314-354, has conspicuous altered olivine and matches excellently, and is the hanging of the Isle Royale lode.

I am inclined to think that all these correlate though it implies that the Arcadian lode is not the Isle Royale but one 180 feet below.

The uncertainty and difficulty may be due to faulting at some part of the formation. So far as the distances are concerned changes in the dip well within the limits of possible error could account for them as well as variation in the thickness of beds. It is curious to note that comparing Arc. 80-92 with Torch Lake 2-15 we come out with just about the same number of beds, though no attention was paid to that feature. The iddingsite, altered olivine, is noteworthy especially from 347 to 415. At 322 is a seaming at 36° and 54° dips, also about 369 chloritic seams at about 15°-20° with the hole, and at 430 feet again.

Sp. 20564 is from drill 1 at 458 feet.

Base below base of Wolverine (2115)

(16) Feldspathic ophite 4 mm.
Amygdaloid d 1. 470-478
d 2. 146-156
Epidotic and laumontitic with amygdaloid lines dipping about 31°, also seams at 14° to the core.
Trap d 1. 478-518
d 2. 156-207
Massive, faintly mottled 4-5 mm. at d 1. 510 feet; faint 3 mm. mottles at d 1. 185
The seams are at 15°½ to the core, also dipping 22° and 53°.

Torch Lake drill hole 2. 1092 paces N., 980 W. Sec. 35, T. 56, R. 33. Vertical. The dip of the beds here is between 33° and 27°½. We take the latter figure which means a reduction factor of .875.

(15.) Feldspathic ophite d 2. 0-146

Note how in this feldspathic bed the iddingsite is prominent.

16. Feldspathic ophite 3 mm. 61 (53)

Amygdaloid d 2. 146-156

With pink, green and white amygdules. This *may* be the Isle Royale lode.

Trap d 2. 156-207

Massive, feldspathic, 3 mm. mottles near 185 ft. Seams make 12°⅓ with the core.

(2168)

17. Feldspathic ophite 3 mm. 83 (72.5)

Amygdaloid d 2. 207-217

Red, brecciated

Trap d 2. 217-290

Feldspathic, faintly ophitic 3 mm. near 256, growing finer toward the bottom. Considerably seamed.

Sp. 20578 is from Torch Lake, Hole 2 at 230 feet. It seems to have had a great deal of olivine, now reddened and changed to "iddingsite." Numerous cavities are filled with fibrous coatings of chlorite. The feldspar extinctions indicate an andesite. The hand specimens show a peculiar rice-like flecking that looks like an ophitic texture in which the augite patches were somewhat prismatic.

(2241)

18. Feldspathic melaphyre 92 (81)

Amygdaloid d 2. 290-300

Red to 292; chloritic amygdaloidal trap -296, then red to 299, then at 300 yellow and green and white.

Trap d 2. 300-382

d 3. -296

Massive, feldspathic, white flecked, seams dipping 50° and 52°, and between 340 and 347 the core follows closely a vertical fissure that splits the drill core. The face of this fissure is slickensided at an angle of about 45° to the core, indicating probably a displacement along the fissure in a direction nearly parallel to the dip. At 376 the dip seems to be (tan -1 15:9) 31° on a seam of red calcite. No. 3 is faintly and coarsely mottled perhaps.

Base below Wolverine (2322)

19. Feldspathic melaphyre 74 (65)

Amygdaloid d 2. 382-393

d 3. 29′ 6″-35

Epidote, chlorite and calcite. Dip 36°½ in No. 3, light green and white and epidotic with a speck of copper.

Trap d 2. 393-456

d 3. 35-96

Massive, feldspathic. The Iddingsite is not conspicuous as above. Joints are at 36° to core (nearly at right angles to dip?) in No. 3 also feldspathic with laumontitic seams at 34° to core; at d 3. 73 feet nearly parallel, at d 3. 67 radiated prehnite.

Base below Wolverine sandstone (2387)

20. Feldspathic ophite 68 (59)

Amygdaloid d 2. 456-465

d 3. 96-99

Contact uncertain; much broken about d 2. 460-463; red; seamed at dip of 15°, then the amygdaloid is greenish.

Trap d 2. 465-524

d 3. 99-134?-167

Curiously mottled, probably decomposed or weathered, ophite mottled, as below 509 the trap and the mottles grow finer. Cf. d 3. 117-130, which has also peculiar mottles, and 130 is at the same time mottled and has chloritic amygdules, being very exceptional, until we get to Hole 7.

Base below base of Wolverine (2445)

(21.) Amygdaloid d 2. 524-530

d 3. 164?-174?

Coarse, epidotic, with calcite and chlorite. Seams dip 39° to 45°; flow lines less, 39° to 34°. At d 3. 134 are flow bands dipping 22° and beneath it is much finer grained.

Trap d 2. 530-557

d 3. 134-167

At this horizon at d 2 520-540 are seams 15:120 and 15:15 and amygdaloid flow lines well developed. The same is true in d 3. 134-156 (15:6 flow; 15:33 seams; 15:15 seam), but the contacts are not plain and the mottling is abnormal and the bed probably disturbed.

Sp. 20578 at d 2. 230 is very thoroughly altered but still shows the diabasic structure of irregular radiating plagioclase laths characteristic of ophites. The interstices between the laths are very red. There is probably also primary iron oxides, some chlorite in an amygdaloid cavity, some calcite disseminated perhaps, also some cherty silica.

The feldspar is rather low angled and appears to be andesite.

Torch Lake drill hole 3. 770 paces N. 775 W. Sec. 35, T. 56 N., R. 33 W. Vertical. The dip of the beds is about 26° ½=tan-1 7:15. The factor for reduction to true thickness is cos. 26° ½=.895

(18.) Feldspathic melaphyre or ophite d 2. 290-382

d 3. 0-29½

(19.) Feldspathic melaphyre d 2. 382-456 74 (65)

d 3. 29½-96 66½ (59½)

(20.) Feldspathic ophite. Peculiarly mottled with flow bands.

d 2. 456-524 68 (59)

d 3. 96-or 167 38 or 71 54

There is no marked contact at 134 but between that and 136 is a finer grained band and at 134 the flow bands show. In the coarser seam near

156 feet the iddingsite shows. The seams are at 45° and 24° with the core. From d 3. 165-167 appears finer and seamed.

Sp. 20566 comes at d 3. 130 — 2445

21. Feldspathic ophite 4 mm? (78?) (70)

2515

Amygdaloid d 2. 525-530+
d 3. 167?-174

Slightly amygdaloidal, gray, with coarse and sparse amygdules. Seams dip 26° ½ to 18° ½ and are laumontitic. The contact is certainly above d 3. 182.

Trap d 2. 530-557
d 3. 174-245

With scattered amygdules, massive at 212, faintly mottled at 223 to 224, 4 mm., at 228 seams at 31°; at 234 feet 18°½. It may be that this bed is partly cut out at the seams.

22. Feldspathic melaphyre 38½ (34)
Amygdaloid d 3. 245-259
Trap d 3. 259-283½
Feldspathic; seams dip 37°

(2550)

23. Feldspathic melaphyre 19½ (17)
Amygdaloid d 3. 283½-292

Contact well-marked, dip lines 37° and 25°. A red and white amygdaloid to 287, then epidotic green and white the next five feet.

Trap d 3. 292-303

Feldspathic (2567)

24. Amygdaloidal melaphyre 9 (8)
Amygdaloid d 3. 303-310
With epidote, chlorite, calcite.
Trap d 3. 310-312

25. Amygdaloidal melaphyre 6 (5)
Amygdaloid d 3. 312-317
Trap d 3. 317-318
d 4. -34 (2580)

26. Amygdaloidal melaphyre 10 (9)
Amygdaloid d 3. 318-321 4.34
Trap d 3. 321-324
Amygdaloid d 3. 324-328
d 4. 43 (2589)

This base shows a well-marked contact with a well-marked dip about 25°.

27. Feldspathic melaphyre 22 (20)
30 (27)
Amygdaloid d 3. 328-341
d 4. 43-45

The contact is shattered and marked and dips about 25°, it is full of epidote and calcite to 333. Toward the base the flow lines dip

33°⅔ and there are pink seams at 26°½ to the core, probably columnar jointing.

Trap d 3. 341-350
d 4. 45-73

At d 4. 62 there is a seam at 27° to core and also nearly parallel. Possibly there is about 8 feet repetition here as Holes 3 and 4 do not exactly agree, but the sum of flows 27 and 28 agree.

(2609)

28. Melaphyre 20 (18)
Amygdaloid d 3. 350-358
d 4. 73-75 10 (9)
Green
Amygdaloid trap d 3. 358-361
Trap d 3. 361-370
d 4. 75-80

Well-marked basal contact dipping 31°. This checks well in both holes. (2627)

29. Melaphyre 19 to 22 (17 to 20)
Amygdaloid d 3. 370-373
d 4. 80-90
A spot of amygdaloid also at d 3. 378. Cf. 3.90
Trap d 3. 373-389 or 392
d 4. 90-111

Fine grained, brecciated and slickensided foot; in No. 4 also jointed and fine grained.

(2646)

30. Porphyritic melaphyre 19 (17)
Amygdaloid d 3. 392-400 24 (22)
d 4. 111-131
Much altered and epidotic to 395
Trap d 3. 400-411
d 4. 131-135?

This trap has in No. 3 3 mm. phenocrysts of feldspar (labradorite), slightly glomeroporphyritic, but more separate than usual. At 401 is a seam (nearly parallel to the dip?) dipping 36°. This flow and the one below are probably all one.

(2663)

Sp. 20567 comes at d 3. 404

31. Porphyritic melaphyre 46 41
36 (32) (41)
Amygdaloid d 3. 411-412
Cf. d 4. 135-137?
Finer, more amygdaloidal, only a spot?
Trap d 3. 412-457
d 4. 137-171
Feldspathic, massive, with good cores.

In No. 4 the clasolitic contact seems to be at d 4. 138 and dips 41°. From d 4. 135-137 is finer, more amygdaloid, with a red ground,—a foot amygdaloid. At d 4. 138 the porphyritic series in which the plagioclase is so conspicuous seems to begin corresponding in that

respect to d 3. 457. In 4 there is also a contact at d 4. 148 with gray amygdaloid to 152 feet and flow lines dipping 25°. Then labradorite and iddingsite conspicuous in the massive trap below, down to d 4. 161, very much like d 3. 434.

(2704)

32. Porphyritic melaphyre 10 (9)
10
Amygdaloid d 3. 457-461
Amygdules not abundant, but markedly porphyritic.
d 4. 171-178
Marked amygdaloid with red ground on which are epidote amygdules and light plagioclase.
d 3. 461-467
d 4. 178-181
Probably just a gush of the flow below.

(2713)

33. Porphyritic melaphyre 14 (12)
Amygdaloid d 3. 467-472 20 18
Marked red, porphyritic, with epidote and calcite.
d 4. 181-186
Slightly amygdaloid contact uncertain.
Trap d 3. 472-481
Porphyritic with Iddingsite and plagioclase on red ground. Dip lines 31° to 41°
d 4. 186-201
Massive, feldspathic, fine seams indicating bedding?, dip about 30°.

(2725)

34. Porphyritic melaphyre 10 (9)
14 13
Amygdaloid d 3. 481-486
Marked gray, flow lines dip from 22° to 31°
d 4. 201-
Porphyritic with 3 mm. plagioclase.
Trap d 3. 487-491
d 4. -215
Plagioclase phenocrysts up to 7 mm. long.

35. Porphyritic melaphyre 11 (10)
Amygdaloid d 3. 491-5
d 4. 215-217 9 8
Epidotic.
Trap d 3. 495-502
Feldspathic plagioclase phenocrysts up to 5 mm. long, with bedding seams dipping 31° and columnar joints at 28°½ to core.
d 4. 217-224
While the exact correlation of individual flows so small as these may be uncertain, on the whole this series of markedly porphyritic beds are quite characteristic and the records in the two holes agree to 10 feet. Cf. in the Central mine section the beds about 2975 ft. below the Wolverine sandstone 97-115. On the other hand we can not identify these

very well further south. Cf., however, beds above the Isle Royale lode on Isle Royale and Douglass streets in Houghton

(36.) Amygdaloid d 3. 502-505-9 (2744)
Amygdaloid, but continues chloritic and porphyritic to the end.
d 4. 224-225
Contact uncertain with epidote and calcite.
Trap 3
d 4. 225-239
Marked iddingsite at 228 feet.

Torch Lake drill hole 4. 690 paces N., 615 W. Sec. 35, T. 56 N., R. 33 W. Vertical. The dip to d. 3 is about 26°⅓ to d. 5 about 24°½. A reduction factor of .9 seems proper.

Specimens 20568, 9, 205670, 1 are from
d 4. 418, 396, 399, 469 feet respectively
Down to d 4. 224 the record overlaps that of three and is given above as follows:

(25) Amygdaloidal melaphyre d 4?-34
Base below Wolverine (2580)
(26) Amygdaloidal melaphyre Am. d 4. 34-39
T. -43
(27) Feldspathic melaphyre Am. d 4. 43-45
T. -73
(28) Melaphyre Am. d 4. 73-75
T. -80
Checks well with d 3. 370 base below Wolverine (2627)
(29) Melaphyre Am. d 4. 80-90
T. -111
Base is top of porphyritic series d 3. 392.
Below Wolverine (2646)
(30) Porphyritic melaphyre d 4. 111-135?
(31) " " Am. d 4. 135?-137?
T. -171
(32) " " Am. d 4. 171-178
T. -181
(33) " " Am. d 4. 181-186
T. -201
(34) " " Am. d 4. 201-215
(35) " " Am. d 4. 215-217
T. -224
Base below Wolverine (by No. 4 7 feet more) by No. 3 (2744)

36. Porphyritic melaphyre 15 (13.5)
Amygdaloid d 4. 224-5
Epidote and calcite, contact uncertain.
Trap d 4. 228-239

Iddingsite, marked at 228 (2758)

37. Porphyritic melaphyre 36 (32)
Amygdaloid d 4. 239-247
Epidotic, altered, cold gray for the first foot, then red porphyritic.

Amygdaloidal trap d 4. 247-275

Feldspar and iddingsite prominent; with amygdaloidal and other spots; at 263-267 the feldspar conspicuous, then to 269 amygdaloidal, epidotic, very likely a streak or inclusion; then porphyritic; a seam at 13° to the core. Contacts are uncertain. All these beds may be one inclusion bed.

(2790)

38. Porphyritic melaphyre 64 (57.6)

Amygdaloidal trap d 4. 280-339

At 285 the feldspar phenocrysts are 7 mm. x 1 mm;

Amygdaloidal d 4. 285-7; also d 4. 288-290; from d 4. 293-299 it is coarsely feldspathic; from d 4. 299-302 amygdaloidal, then below a marked massive glomeroporphyritic trap growing red and more distinctly porphyritic at base.

The contact at the base is the first really marked one below 202 feet. There is a little sediment and a well-defined dip of from 25° to 26°½.

39. A very little sediment. Dip 25° to 26°½.

Base below base of Wolverine

(2848)

40. Porphyritic melaphyre 18 (16)

Amygdaloid d 4. 339-348

Trap d 4. 348-357

Trap grows red and porphyritic at d 4. 355, near the base joints are at about 35°½.

(2864)

41. Porphyritic melaphyre 26 (23)

Amygdaloid d 4. 357-370

Glomeroporphyritic.

Trap d 4. 370-383

Feldspar 5 x 2 mm. There is perhaps a contact near 375 feet. The contact dips 28° (?), but there is also a seam at 25°.

(2887)

42. Amygdaloidal porphyritic melaphyre 68 (61)

d 4. 383-451

d 5. -53

The texture is glomeroporphyritic with pink and green feldspars on a maroon base, and frequent amygdaloid spots, epidote amygdaloid inclusions at d 4. 400-4.420-422, and d 4. 443. Toward the bottom contact the porphyritic texture is plainer, as is almost always true.

Sp. 20569is at 396feet.
" 20570" " 399 "
" 20568" " 418 "

(2948)

The top of No. 5 appears to be this same flow. Beginning in an epidotic amygdaloid at d 5. 23′ 6″ to 24, then glomeroporphyritic, finer and redder to 25, gray to 28, red and epidotic to 29, gray to 32, trappy to 39, gray epidotic to 40, red porphyritic to 41, gray to 42, and glomeroporphyritic to 53.

43. Porphyritic melaphyre 56 (50)

Amygdaloid d 4. 451-457
d 5. 53-71?

Trap d 4. 457-507? or 484?
d 5. 71?-82

Glomeroporphyritic, with amygdaloid spots at 484 and 494. This is where the contact was drawn judging by hole 5 in that hole. Peculiar yellow (siderite?) amygdules; feldspar 3 mm. long; at 473 a line of flow?, at 35° to core; at d 4. 497 cavities with rhombs probably siderite.

Sp. 20571 is at d 4. 469 feet.

In these glomeroporphyritic beds it is difficult to place the base of the amygdaloids or to separate them.

(2998)

44. Porphyritic melaphyre 25 (22)

Amygdaloid d 4. 507?-or 484-510
d 5. 82-117

Contacts not certain. At 100 it is a little spotted and at 114-117 is an epidotic altered seam.

Trap d 4. 510-532
d 5. 117-139

The bottom contact is very well marked and has sediment associated. The dip is 22° to 28°, or another place 25°. The dip also shows well in Hole 5, from d 5. 142 down with dips of flow bands 29°½, at d 5. 118 the coarse feldspar is much like that at d 4. 543.

(3020)

45. Porphyritic melaphyre 26 (23)

Amygdaloid d 4. 532-542
d 5. 139-142

Trap d 4. 542-558
d 5. 142-165

Coarse glomeroporphyritic to 552, then toward base darker and fine grained. Lowest of the porphyritic beds. d 5. 118-123 and d 5. 159 are both like d 4. 544-552.

(3043)

46. Melaphyre 11 10

Amygdaloid d 4. 558-563
d 5. 165-169

Trap d 4. 563-569
d 5. 169-188?

At d 5. 178 a 2 mm. ophite?

(3053)

47. Melaphyre 13 12

Amygdaloid d 4. 569-572?
d 5. 188-

Regular type red; a well-marked contact but not much of the amygdaloid.

Amygdaloidal trap d 4. 572?-582
d 5. -192

(3065)

48. Melaphyre 11 10
Amygdaloid d 4. 582-585
d 5. 192-197
Called amygdaloid spots but apparently quite persistent.
Trap d 4. 585-593
d 5. 197-202

(3075)

49. Melaphyre 40 (36)
Amygdaloid d 4. 593-597
d 5. 202-207
Pink and white
Trap d 4. 597-633 or 635
d 5. -239 or 245
Massive, dark, at d 4. 619 are signs of a 25° dip; at 625-628 a vertical seam. From 630 down it gets red porphyritic. Cf. d 5. 178 a 2 mm. ophite? also d 5. 237 dark but glomeroporphyritic.

(3111)

50. Amygdaloidal melaphyre 23 (21)
Amygdaloid d 4. 633-642
d 5. 239-or 245-?
There is a contact at d 4. 633 and again at 635 just a ropy coil of lava? The amygdaloid is red porphyritic. This corresponds to the well-marked basal amygdaloid in d 5. 239-245. While the exact correlation of these gushes is difficult, the general correlation of glomeroporphyritic red basal looking beds at the top of 5 and in 4 above 561 feet is plain.
Amygdaloidal trap d 4. 642-656
d 5. 245-261?
d 5. 245 with some copper is the best marked amygdaloid and contact. Underneath it passes into a gray and quartzose amygdaloid.

(3232)

51. Melaphyre 4
Amygdaloid d 4. 656-658
d 4. -261
Trap d 4. 658-660
d 4. 261-272

(3236)

52. Melaphyre 31 (28)
Amygdaloid d 4. 660-665
d 5. 272
Yellowish, green (epidotic) and white.
Amygdaloidal trap and amygdaloid -691.
Amygdaloid 670-675 and 678 to 680.

(3164)

53. Melaphyre
Amygdaloid d 4. 691-
Dip 28°?
d 5. 290
This contact has also a marked dip in Hole 5.

Torch Lake drill hole 5. 550 paces N. 350 paces W. Sec. 35, T. 56 N., R. 33 W. Vertical. The dip from the average of 17 observations on joints, flow lines, and contacts is (tan-1 126:255) 26°⅓, by correlation of beds it is 24°¾, but if the strike is more east of north than the main range and not at right angles to Stockly's cross-section, the dip by correlation of the beds would be steeper and there is reason to believe this is the case. It would imply a swing of the strike 20°. Cf. the exposures of Sp. 20575 a Minong-trap-like bed (as recognized by myself years ago in the Douglass Houghton Ravine and by myself and Stockly independently in the cores, and confirmed by microscopic comparison) at d 5. 525. The reduction factor need not be changed.

(42.) Amygdaloidal porphyritic melaphyre d 4. 383-451
d 5. -53
Base below base of Wolverine (2948)
(43.) Porphyritic melaphyre d 4. 451-484?, d 5. 53-82 (26)
Dips of bands 26°½ and 22°. Gray coarse feldspar.
(44.) Porphyritic melaphyre d 4. 484-532, d 5. 82-139 (51)
Epidotic amygdaloid, porphyritic trap, at 100 spotted pink, d 5. 114-117 epidote seam. At 118 coarse feldspar.
(45.) Porphyritic melaphyre d 4. 532-558, d 5. 139-165 (23)+
Flow bands 22° to 39°. Quartz epidote amygdaloid at d 5. 153-7.
(46.) Melaphyre d 4. 558-569, d 5. 165-188 (21)-
Red amygdaloid and trap not markedly porphyritic, possibly ophitic.
(47.) Amygdaloidal melaphyre d 4. 569-582, d 5. 188-192 (4)-
Red to gray, only a gush.
(48.) Melaphyre d 4. 582-593, d 5. 192-202 (9)
From d 5. 192-197 amygdaloid spots; a clasolitic seam at 45° at base.
(49.) Glomeroporphyritic melaphyre d 4. 593-635, d 5. 202-245 (39)-
Feldspar 5 x 2 mm.
(50.) Amygdaloidal melaphyre d 4. 635-656, d 5. 245-261? (14)+
With copper; dips 15° to 25°; amygdaloid gray and quartzose at base.
(51.) Amygdaloidal melaphyre d 4. 656-660, d 5. 261-292 (10)
(52.) " " d 4. 660-691, d 5. 272-290 (16)

(3161)

Or by the record in No. 4 3164 feet (3164)
The beds just above all tend to be feldspathic, amygdaloidal, porphyritic, with red porphyritic bases and not augitic.

53. Melaphyre 9 (8)
Amygdaloid d 4. 691-695+
d 5. 290-294
Red amygdaloid contact dips 25°
Trap d 5. 290-299

(3172)

54. Melaphyre 22 (20)
Amygdaloid d 5. 299-304
Yellowish gray.
Trap 304-321
Seams at 18°½ dip at 309 feet.

(3192)

55. Melaphyre 21 (19)
Amygdaloid d 5. 321-329

Contact dips 22°
Amygdaloidal trap d 5. 329-341

3211

56. Melaphyre 33 (30)
Amygdaloid d 5. 341-9
Gray and mixed.
Trap d 5. 349-374
d 5. 341-351 slightly glomeroporphyritic, then a 2-foot seam altered epidotic; d 5. 357-358 and amygdaloid spot.

(3241)

57. Amygdaloidal melaphyre 13 (12)
Amygdaloid d 5. 374-379
Amygdaloidal trap d 5. 379-387
Varicolored, coarsely amygdaloidal.

3253

58. Porphyritic melaphyre
Amygdaloid d 5. 387-390 28 (25)
Gray, quartzose and epidotic.
Trap d 5. 390-5.415
d 6. 13
d 7. 20
Dark, fine grained, slightly porphyritic; at d 5. 402 a joint at 14° from core (columnar) just above the contact which seems to dip 33°⅔

(3278)

59. Augite porphyrite, Minong trap type 154 (137)
165
135 (3415)
ave 151
Amygdaloid d 5. 415-418
d 6. 13-16 or 25
d 7. 20-23?
Trap d 5.418-569
d 6.16 -178
d 7.23 -155
This is a well-marked horizon and characteristically fine grained, recognized by W. W. Stockly and myself independently, and two or three times over as different from the usual beds and like the Minong trap on Isle Royale. We have a number of specimens:

Ss. 20572	at d 5.	485
3		580
4		516
5		525
6		531
7		535

I do not think there can be any question as to the correlation between the holes.

Sp. 20575 at d 5. 525 feet is an augite porphyrite, U. M. There is little or no sign of olivine, a great abundance of labradorite and a scanty amount of augite which acts nevertheless as a sort of cement between the feldspars and tends to be ophitic.

Labradorite extinctions are Ab_1 An_1 0°-30°; 18°-11°; 12°-18° and in a Karlsbad twin 35-28°, also 4°-5° with 19°-18° in a Karlsbad twin, the former individual much more birefractive.

We have also such extinctions as the following:

14° to 14° (greater birefraction) with 43° to 26° (less birefraction); 18° to 22° with 43° to 27°; 11° to 12° with 7°.

Sections nearly parallel to M (010) show low colors; extinction against P (100) 16°. It must be near Ab_4 An_3. There is primary as well as secondary iron oxide. The former is younger than the feldspar, at any rate in part, and older than the augite.

The augite grains run about .12 mm. from .05 to 2 mm. A tendency to prismatic form is quite noticeable, but the amount of augite is smaller and, while it is interstitial, it varies in form from the xenomorphic to idiomorphic. A fragment of coarser crystallization is enclosed. In this coarser piece the augite is more xenomorphic. The texture is doleritic, since one interstice is filled with chalcedony spherules. There is also replacement by zeolite with very low refraction and birefringence which may be laumontite.

I think it can also be recognized on the street railway line and the course of the Douglass Houghton Creek.

In all places the well developed amygdaloid is thin (in No. 5 from 415-418, red and brecciated; in 7 from 420 to 423 gray with copper, calcite, quartz and epidote.) Then to d 5. 430 it is fine grained, from d 5. 430-468 is slightly coarser but after all always peculiarly fine grained. As the base is approached the columnar joints appear at 22° to the core, 11°⅓ and 31° along about d 5. 500. From d 5. 501-527 is all fine grained trap with no appreciable change in grain. At d 5. 528 feet are minute specks of copper. Was it an extra hot flow or an intrusion? At d 5. 536-539 there is a somewhat amygdaloidal belt, and at 549 the feldspar is much plainer, approaching a porphyritic appearance. At d 5. 562 feet is brown clasolitic matter in the red porphyritic marginal trap, evidently a stringer of that underlying.

In No. 6 the amygdaloid is brecciated a foot to d 6. 36, then fine grained and mixed amygdaloid to d 6. 39, then brecciated and red to 43, then a fine grained trap with minute porphyritic feldspars to 46, then brecciated a foot; and brecciated again at d 6. 51-55, and at d 6. 57-60, at d 6. 62 there is a curious banding dipping 50°, then all the rest the way a fine grained trap; the columnar jointing growing more prominent; at first irregular; from d 6. 115 down plainer, at 29° and 25°½.

In No. 7 the contact is at 17°; then there is a brecciated amygdaloid with quartz and epidote and yellow amygdules; faint mottling? and small amygdules to d 7. 51, 31 feet below the top; cf. d 5. 430+ and 6.39. Below that it, too, is massive. At d 7. 67 to 121 the dip by banding appeared to be 26°½ and at d 7. 88 was a suggestion of 1-2 mm. mottles. From d 7. 121 on down the grain was aphanitic.

60. Sediment d 5. 569-570
d 6. 178-179 ±
d 7. 155

Very thin, only a foot or less, dips 18° to 22° in Hole 5
15°-18°½ " " 6
21° or so " " 7

Base below base of Wolverine (3416) ft.

This is the very first bed that can by any possibility be correlated with Conglomerate 8. The greater distance is no objection but the beds associated are very different.

61. Amygdaloid
d 5. 570-580?
d 6. 179-180
d 7. 155-156
In Hole 6 clasolitic with yellow amygdules.
7 also a thin amygdaloid with marked contact.
d 5. 580?-605
d 6. 180-192+
Amygdaloidal trap d 7. 156-220
In Hole 7 coarse 1-2 mm. feldspars; 2 mm. chloritic blotches; occasional amygdules.
In Hole 6 it is similar. In Hole 5 the chances are there is faulting for while we have feldspathic trap to 580, then there are seams something like a contact dipping 45° to 33°, then for d 5. 587-589 it is spotted, and from d 5. 591-596 red decayed, perhaps the main slip, an amygdaloidal trap to 600; chloritic, feldspathic and amygdaloidal to 605.

(62.)
Amygdaloid d 5. 605-616
Red, passing into chloritic, amygdaloidal, feldspathic trap.
Trap d 5. 631-647
Fine grained; owing to the disturbance it is not at all certain to what this corresponds in Hole 7.

Torch Lake drill hole 6. 440 paces N. 33 paces W. Sec. 35, T. 56 N., R. 33 W. Vertical. This hole is altogether lapped by Holes 5 and 7.

(58.) Porphyritic melaphyre (3278)
d 6. 6-13
Feldspathic, slightly glomeroporphyritic.

(59.) Augite porphyrite d 6. 13-178 (3415)

(60.) Sediment d 6. 178- (1) (3416)

(61.) Feldspathic melaphyre
The indications of dips are:
15:15 ; 15:9; 15:18?; 15:4 and 15:5
at 6, 13, 25, 62, 180 feet respectively
averaging (leaving out the 15:18) about 29°.

Torch Lake drill hole 7. 770 paces N. 1705 W. Sec. 36, T. 56, R. 33. Vertical. Indications of dip are 165:79, i. e., 25°½. It will be as well to keep the reduction factor .9

(58.) Porphyritic melaphyre d 5. 387-415, d 7. 7-20
Amygdaloid with epidote and calcite, slightly porphyritic to d 7. 11.
Amygdaloidal trap to d 7. 17 and finer grained to d 7. 20

(59.) Augite porphyrite of Minong type.
d 5. 415-569; d 6. 13-178; d 7. 20-155
Described above.

(60.) Sediment missing in No. 7 (3416)
Only a foot. Is this the representative of Conglomerate 8.

61. Amygdaloidal melaphyre 65
Amygdaloid d 7. 155-156
Small dip 22° and contact well marked.
Amygdaloidal trap d 7. 156-220
Massive, coarse feldspar 1-2 mm; chlorite blotches up to 2 mm., occasional amygdules. (3475)

62. Amygdaloidal melaphyre 46 (41)
Amygdaloid d 7. 220-244
Pink and green and white, passing into amygdaloidal trap.
Trap d 7. 244-266 (3516)

63. Amygdaloidal melaphyre 20 (18)
Amygdaloid d 7. 266-275
Amygdaloidal trap d 7. 275-286
(3534)

64. Feldspathic melaphyre 49 (44)
Amygdaloid d 7. 286-294
Red to 287, poor thence on.
Trap d 7. 294-335
To 296 a cobweb of feldspar, and an amygdaloidal trap to d 7. 300. At d 7. 305 are laumontite seams, and at 320 nearly vertical. Toward base the trap becomes massive, with iddingsite. The bottom contact dips about 31°.
(3578)

65. Melaphyre 13 (12)
Amygdaloid d 7. 335-342
Pink and gray, then maroon with yellowish white amygdules; at the base two feet epidotic.
Trap d 7. 342-348
(3590)

66. Melaphyre 18 (16)
Amygdaloid d 7. 348-352
Red for one foot then yellowish epidotic.
Trap d 7. 352-366
(3606)

67. Feldspathic melaphyre 13 (12)
Amygdaloid d 7. 366-369
Red top, yellow bottom, like the one above.
Trap d 7. 369-379
Feldspathic with cobweb of 1-2 mm. feldspar.
(3618)

68. Feldspathic melaphyre 12 (11)
Amygdaloid d 7. 379-382
Trap d 7. 382-391
Feldspathic

(3629)

69. Feldspathic melaphyre 34 (31)
Amygdaloid d 7. 391-395
Brecciated, red; dip 31°
Trap d 7. 395-425
12 -13
Feldspathic at 410-413 an amygdaloidal and epidotic streak.

(3660)

70. Feldspathic melaphyre 18 16
Amygdaloid d 7. 425-429
d 12. 13-15
Well-marked gray and white, with 2 feet epidotic at base in Hole 7.
Trap d 7. 429-443
d 12. 15-34
Laumontitic, amygdaloidal to d 7. 435, contact 45°?, then coarse 1-2 mm. feldspars, amygdaloidal also in 12 at 22-26.

(3676)

71. Feldspathic melaphyre 25 22
Amygdaloid d 7. 443-445
d 12. 34-40
Contact or flow streak? a few large amygdules below. Also in 12, scattered pink, white and green amygdules to d 7. 40
Trap d 7. 445-466
d 12. 40-53
Feldspathic. In 12 finer and darker.

(3698)

72. Feldspathic melaphyre 6 (5)
Amygdaloid d 7. 468-471
d 12. 53?-55
In 12 brecciated, epidotic.
Trap d 7. 471-474
d 12. 55-63?
Fine grained in 12, an amygdaloidal trap, probably not an independent flow.

(3703)

73. Feldspathic melaphyre 9 (8)
Amygdaloid d 7. 474-478
d 12. 63?-65? misplaced
Cf. also d 12. 77?-80?
Trap d 7. 478-483
d 12. 65-98 (or 80-98)
In 12 fine grained, feldspathic.

(3711)

74. 13 (12)
Amygdaloid d 7. 483-488
d 12. 98-107
Amygdaloidal trap d 7. 488-496 (or 506)
With pink cupriferous prehnite.
At d 12. 107 is a marked contact with pipe amygdules above.

(3723)

75. 38 (33)
Amygdaloid d 7. 496-506 or 506-
d 12. 140-143
With laumontite and calcite amygdules.
Trap d 7. 506-534
d 12. 143?-157
With occasional amygdules

(3756)

76. Feldspathic melaphyre 40 (36)
Amygdaloid d 7. 534-539
d 12. 157-161
Gray and white, poor in Hole 7. In Hole 12 with two feet epidotic from d 12. 159-161, and more or less amygdaloidal feldspathic to 171.
Trap d 7. 539-574
d 12. 161-194
All feldspathic trap growing finer from d 7. 539-568. In No. 7 vertical seams are much displaced by seams probably nearly parallel to the dip but dipping only 16°?. In No. 12 there appears to be a contact at d 12. 179 and a fine grained feldspathic trap below. Nos. 12 and 7, which below agreed well, here part company. The record is probably most disturbed in 7 near 539 feet.

(3792)

77. Copper bearing melaphyre? 31 (28)
Amygdaloid d 7. 574-575?
d 12. 194-195
In both holes the amygdaloid is poor, yet the contact well marked, then in No. 12 copper on vertical seams or columnar joints, and a little seam of datolite, prehnite and chlorite at d 12. 203 ft.
Trap d 7. 574-605
d 12. 195-226
d 10. 11-15

(3820)

78. Amygdaloidal melaphyre (30)
Amygdaloid d 7. 605-622
d 12. 226-232
d 10. 15-18
Very well marked contact dipping 28°, at first a black and white amygdaloid with a 2-foot epidote seam at the base. No copper was noticed in this but there was some in an epidote seam in the hanging at d 7. 602-3.
In d 12. 226-232 we also have a contact with pipe amygdules, and it is epidotic below, and then, too, in the hanging at 195 and 203 is

some copper. This seems a fair correlation and checks with the marked correlation of d 12. 426 and d 7. 804.

In Hole 10 is a white and green amygdaloid.

Amygdaloidal trap d 7. 622-638
d 12. 232-259? (disturbed).
d 10. 17-45

Minute amygdules d 7. 624-635. In Hole 10 rather massive.

(3850)

79. Amygdaloidal melaphyre 25 (23)

Amygdaloid d 7. 638-646
d 12. 259-260
d 10. 42-45

Maroon, well-marked with dip about 11 in 7.

Much less plain marking like a flow band, with dip about 28 in 12.

In No. 10 an epidotic specked amygdaloid.

Trap d 7. 646-663
d 12. 260-287
d 10. 45-62

In Hole 7 it is an amygdaloid trap; in Hole 12 a feldspathic trap coarsest about d 7. 282; in Hole 10 it is a trap with an amygdaloid speck at d 10. 59.

(3873)

80. Amygdaloidal melaphyre 12 (11)

Amygdaloid d 7. -663?
d 12. 287-292
d 10. 62-65

In d 7. 663 is an epidote band, in No. 12 at 287 is clasolitic and dips 18°½.

Amygdaloidal trap d 7. 663-675
d 12. 292-305
d 10. 65-75

Amygdaloidal in No. 7. In No. 12 a fine grained feldspathic trap.

(3884)

81. Cupriferous lode, and amygdaloidal melaphyre 45 (40)

Amygdaloid d 7. 675-679
d 12. 305-309
d 10. 74-76 to 84 or 94

The contact in No. 7 dips 22° and the amygdaloid is epidote.

The contact in No. 12 dips 28° and shows copper; there is more on the foot.

In No. 10 from 76-84 is epidotic, and then to 94 amydaloid.

Amygdaloidal trap d 7. 679-720
d 12. 309-343
d 10. 76-94-111

In 7 a vein parallel to the hole between 679 and 705 may cut out an amygdaloid, but the streak of amygdaloid trap is probably a mere flow line in No. 12. In No. 10 however it is amygdaloid from 84-94, and again 97-102. Amygdaloidal trap d 12. 324-328.

At d 12. 337 is a calcite seam dipping 22°.

(3924)

82. Amygdaloidal ophite 21 (19)

Amygdaloid d 7. 720-730
d 12. 343-349
d 10. 111-113

Trap d 7. 730-741
d 12. 349-371
d 10. 113-138

The peculiar mixture of specked amygdaloid and mottled (ophitic?) trap comes in 12 at 349-371 and also in 10 from 113 down, and is notable. In No. 7 while there is much marked amygdaloidal trap with small amygdules there is also the effect of shearing at flat angles at 15° to 18°½ from d 7. 720 to d 7. 738 feet respectively. I wonder if they were peculiarly saturated with water in some way; cf. the ellipsoidal greenstones.

(3943)

83. Amygdaloid ophite, very peculiar mottles 29 (26)

Amygdaloid d 7. 741-750 or 755
d 12. 371-375
d 10. 138-141

At Hole 12 the contact is epidotic at 21°⅔

Amygdaloidal trap d 7. 755-770
d 12. 375-391
d 10. 142-161

In 7 banded and irregularly mottled and amygdaloid, also in No. 12 at 375 the amygdaloidal ophite bands dip 45° and there are ½ mm. mottles, at 388 the dip is less than 32°. The minute mottling reminds one of contact phenomena, spilosites, etc. Cf. also Hole 10. 113-120. Arcadian beds Nos. 110 and 111 and certain beds often associated with Conglomerate 6 and 7 seem to possess this peculiarity.

(3969)

84. Ophite 3 mm?, peculiar mottles 34 (30)

Amygdaloid d 7. 770-785
d 12.
d 10. 161-164

Trap d 7. 785-804
d 12. 391-421
d 10. 173-194

Peculiar rice-like elongate 3 mm. mottles at d 10. 172 and 178.

In No. 12 the mottles in coarse and fine bands, the coarse as large as 3 mm. came out well about d 12. 416. The banded, irregular mottles (dip 28°) show in No. 12 above 770 feet.

Epidote with a little leaf of copper at d 10. 173-175; also epidote and copper at d 12. 420-421.

Specked trap d 12. 421-426

Amygdaloidal base d 10. 190-194

(3999)

END OF CENTRAL GROUP?

85. Felsite tuff. Volcanic ash bed (1)

d 7. 804-805
d 12. 426′ 9″
d 10. 194-197

Apparent dip in No. 10 15°

At d 7. 800 is either a little felsite or sediment.

Base below base of Wolverine sandstone (4000)

Sp. 20584 at d 10. 195 represents this bed U. M. It is evidently a bed of felsite ash like the so-called Mesnard epidote. There are small fragments of porphyrite with lath-shaped feldspars to be sure. But most of it is either quartz or feldspar fragments, plagioclase or orthoclase, with very numerous fragments showing the conchoidal outlines of glass chips. The original fragments are outlined by different amounts and distribution of iron oxides. The bulk of the rock is now made up of a patchy mosiac of quartz and feldspar, with considerable disseminated calcite.

Sp. 20597 at d 12. 426 U. M. is not quite so clear. It might be a bit of felsite flow. Perhaps it is from a fragment. It is more charged with epidote and is traversed by a vein or fracture line from which the epidote spreads. There are a few minute phenocrysts of quartz and feldspar not over 1 mm. across.

This is a very important horizon as I correlate it with that of the felsites which occur to the north at intervals, the Mount Houghton felsite. Also compare the felsite on Sec. 4, T. 56, R. 32. It is noteworthy that the quartz porphyry which appears on the railroad track near by does not appear in any of the holes unless this represents it. I am therefore inclined to consider this its effusive equivalent, that being intrusive.

But if this represents the St. Louis or Bohemia conglomerate, (or the jasper belt of Figure 9, Volume VI,) and it is not so far from the line of strike, when we allow for the flat dip, then as we have found no group of beds corresponding to Conglomerate 8 and 6 of Portage Lake we are almost forced to believe that that group corresponds to this felsite horizon and the associated conglomerates of the end of the point, and the big ophitic series below down to the Baltic lode to a corresponding group of ophites which are cut by the Mt. Bohemia gabbro.

(86.) Amygdaloidal ophite 36 (33)

Amygdaloid	d 7.	805-818+	(13+)
	d 12.	427-445	(18)
	d 10.	197-211	(14)

Very marked in No. 7 all the way, specked in No. 12, with 3 feet epidotic at the base in No. 10

Trap	d 12.	445-463	This trap is characterized by fine and
	d 10.	211-233	coarse mottling; distinct even when no

larger than a pinhead.

Torch Lake drill hole 12. 560 paces N. 1320 W. Sec. 36, T. 56 N. R. 33 W. Vertical. This hole is lapped entirely by Holes 7 and 10. The dip by correlation with 10 on Stockly's section is only 14°, but this may be due in part to faulting. The average of observations of dip of flow and contact on the cores is, (omitting two very discrepant), tan-1 (150:71) or 25°⅓. Considering the possibility of faulting and veering strike, it will not be worth while to change the reduction factor from .90 to .97, as the difference is within the range of error, and the beds do not appear thinner in 12 than 7, though they are in 10.

						Thickness in 7.
(70).	425-443	12.13-	34	21		16
(71).	443-468	34	53?	19		22
(72).	468-474	53?	63?	10		5
(73).	474-483	63?	98	35		9
(74).	483-496	98	107-	9		12
(75).	7. 496-534	107	140?	33		33
		140?	157	17		
(76).	7. 534-574	157	179	22		36
		179?	194	15		
(77).	Copper bearing mel. 7. 574-605	12.194	226	32		(28)
(78).	Am. Mel. 7. 605-638	226	259	33		(30)
(79).	Am. Mel. 7. 638-663	259	287	28		(23)
(80).	Am. Mel. 7. 663-675	287	305	18		(12)
(81).	Copper bearing mel. 675-720	305	343	38		(40)
(82).	Am. ophite 720-741	343	371	28		(19)
(83).	Am. ophite 741-770	371-	391	20		(26)
(84).	Ophite 3 mm. 770-804	391	426	35	10.163-194	
(85).	Felsite tuff 804-805	426′ 9″			10.194-197	
(86).	Am. ophite 7.805-817	427+	445		10.197-211	

The samples seem to be a little misplaced in the boxes in Hole 12 and sheared in No. 7. No. 12 at 13 feet matches No. 7 at 425 feet fairly well. The extra thickness of the section in 7 may be due to flat shearing strike faults which can be seen about 535.

It is hardly worth while to try to correlate the rest of the beds of Hole 12 below the felsite tufa with those of Hole 10 in detail because they are both, especially Hole 10, much disturbed and crossed by shearing lines which are very heavy. Also they both consist of a set of beds which evidently are the same formation but are not separable into well-marked beds. They are a continual succession of amygdaloid beds with bubbles (amygdules) now fine, now coarse from 1 to 4 or 5 mm., mainly less than 3 mm. The original rock must have been more or less pumiceous. Occasionally as in beds (82) and (83) an ophitic texture with minute mottles seem to be combined. This is especially true at d 12. 623-636 which is thus far comparable with d 10. 352 to 358, d 10. 402 to 412, d 10. 460-474, d 10. 481-490, d 10. 497-501, and in Hole 11 the beds at the top, but one can not be sure whether these are repetitions by succession or by faulting.

As a whole, one would imagine that the lavas were more pumiceous and had perhaps lost less of their inherent water. The bottom of Hole 12 as a whole laps Holes 10 and 11.

d 12. 427=4000

The following are the notes from d 12. 448 down:

(87.)

(88.) Amygdaloid or amygdaloid trap to d 12. 448. From here on, characteristic amygdaloid and mottled beds -450 feet

Epidote 457

Bands of fine and coarse mottling 463

Amygdaloid 466
Epidotic 469
Sheared at an angle of 45° and vertically. Amygdaloid coarse, and then characteristically fine and pumiceous,—one bed like this in the Victoria section. This continues with the amygdaloid mainly fine, but coarser at 522, 523, 526 feet down to 529
Shearing occurs at a 45° angle.
Coarser amygdaloid 12.541-544
Finer as usual, apparent dip of amygdaloid bands 18°½ 12.546-553
Then amygdaloidal trap, coarse amygdaloid at 12.564
12.571-573
Trappy 12.575-578
Full of bubbles, pumiceous at 12.582
Much seamed 587
Coarse 593-596
Finer -601
Coarse -606
Fine -623
Then amygdaloidal ophite ? mottles 1–2 mm. at 629
½ mm. at 633
Possible contact about 12.636
Cf. 10.443 and 372
(88?) Pumiceous amygdaloid at 12.647
Coarse specked trap with big round and also angular specks at 12.661
Here a shear much laminated at 12.654
Very pumiceous, fine amygdaloid to 12.693
Trap, specked to 12.702
Since d 12. 427 is (4000 ft) below the Wolverine, this is about (4275)

Torch Lake drill hole 10. 360 paces N. 1150 paces W. Sec. 10, T. 50 N., R. 33 W. Vertical. This hole also is lapped pretty thoroughly by 7, 12 and 11. Correlating d 12. 426 with d 10. 195 would indicate a dip of only 14°. Reduction factor .97. Cf. in the Old Colony section the St. Louis conglomerate about 4500 feet below the Wolverine.

(78). Am. mel. d 10. 15-18 d 7. 605
(79). " " 10. 42-62
(80). " " 10. 62-74
(81). " " 10. 74-111? with copper?
(82). " ophite 10. 111-138
(83). " " 10. 138-161
(84). " " 10. 161-194
(85). Felsite tuff. Volcanic ash 10. 194-197 d 7. 805
(4000)

Apparent dip 15°, and as 200 in 7 correspond to 179 here, it is suggested that the beds are struck a little more at right angles. The reduction factor used in 7 was .9. If in 10 the beds are at 15° it should be .97 which will mainly account for the difference in thickness.

86. Melaphyre 36 (32)
Amygdaloid d 10. 197-211
3 feet epidotic at the base.
Trap d 10. 211-230
(4032)

87. Sediment, amygdaloid, conglomerate, red shale, with black and white amygdaloid scoria, much seamed and shattered. Dip 15°.

88. Pumiceous melaphyres
Amygdaloid d 10. 230-233
Trap specked d 10. 233-240
and amygdaloid.
Much seamed at 18°½ and at d 10. 240 a big seam at 16°½. All along from this on, partly perhaps owing to the seaming but more to the character of the beds, it is not possible to mark off exact flows, we have to do as in Hole 12.
The amygdaloid is poor to d 10.246
Then finer, pumiceous 10.248-260
A seam dipping 28° faults bands of amygdules dipping 22°.
Amygdaloid is coarse from 10.260-263
Then specked trap, with decomposed bands across the hole, also a seam at 32° with the vertical.
Much amygdaloid (dip 23°) 266-270
Trap, rotten with clay fluccan, dipping 34°
Amygdaloid, decomposed (dips 13° or so) to 10.282
Amygdaloidal trap to 10.293
Pumiceous amygdaloid to 10.302
Coarser (dip 21°¾) 303
Pumiceous amygdaloid to 308
Of all the amygdaloids the characteristic feature is the very numerous bubbles generally less than 3 mm. across ranging from 1 to 4 or 5.
Amygdaloidal trap to 10.311
Coarse amygdaloid to 10.317
Pumiceous amygdaloid to 10.319
Coarse amygdaloid to 10.323
Specked trappy amygdaloid to 10.333
Pumiceous to 10.337
Then more compact with seams dipping 10° to 15°
Amygdaloid 10. 345-351
With veins at 45° and vertical; lots of calcite, little else secondary.
Mottled 1 mm. at 352
2 mm. at 355?
Amygdaloid yet with coarse and fine mottling in bands 10.358-364
Specked trap 10. 372
There may be a contact here.
Pumiceous amygdaloid (dip 20°) 10.370-380
Brecciated slide and fluccan 10.380-381
Fine grained specked trap to 384
Amygdaloid to 392
Big calcite seam (dip 26°½) at 398
Mottled bands 1-3 mm., seams making a slight angle with the core

are faulted by slides nearly parallel to the dip (14°). The bands of specks and the size of mottles vary in short distances.

There are many big seams at 10.412

A heavy breccia seam nearly vertical, a fissure vein is crossed near 10.441

Amygdaloid, fine, with many nearly vertical seams to 10.457. (22° dip?)

Then bands of fine and coarser mottles from 1-3 mm., dip about 18°.

Fissure	at	10.470
Amygdaloid		10.476-481
Mottled 1 mm. at 483 ⅓ mm. at		10. 488
Marked pumiceous amygdaloid to		10. 497
Fine ½ mm. mottles		10.499
More coarsely ophitic but also amygdaloidal to the end		10.503

These banded amygdaloidal and at the same time mottled beds occur also in Hole 11, down to 705 feet, where it seems to pass into a block of Eastern sandstone. Definite correlations seem, however, impossible.

The bottom should be below the Wolverine about (4275)

Torch Lake drill hole 11. 300 paces N. 850 paces W. Sec. 36, T. 56 N., R. 33 W. This hole is close to the great Keweenawan fault, and in fact if I am not mistaken crosses it and encounters a block of Eastern or Jacobsville sandstone from 705 feet to 798 feet. The other beds it goes through are of the same type as Hole 10. The dip is quite flat in the Keweenaw beds, perhaps 10°. The general correlation is quite clear but individual correlations are far from certain. There must be a number of flows in the belt we call 88. It is possible the amygdaloid conglomerate at d 10. 233 may correspond to d 11. 86, but d 10. 195 is not represented. As the factor to reduce to true thickness is uncertain and probably makes only 3% difference *or less* it is not used.

(4032+)

(88). Amygdaloidal, pumiceous ophites, mottles 2-3 mm. d 11. 36

Amygdaloidal d 11. 36-42

3 mm. mottles 49

Gray and yellow-green -62

Full of irregular and chlorite seams and slickensides.

Angular breccia for d 11. 73-88

Amygdaloid conglomerate?

Dip 18°½ to 22°, also steeper seams parallel to the Keweenaw fault? dipping 51°.

Fine grained chloritic amygdaloid	d 11.	88-119
Banded ophite 1-3 mm.		-133
Amygdaloid and breccia seam		-150
Pumiceous amygdaloid, red and white and clasolitic		156-160
Amygdaloid, often coarse		
Amygdaloid, with clasolitic seams and beds. Dip 25° and shear dips 34° and more		-168

Amygdaloid, mainly fine to d 11. 256, with coarse streaks at d 11. 174-177

181-187

194-196

225-228

229-235

240-243

Seam at 18½°

Ophitic banding with bright red (cf. iddingsite) specks.

Cf. d 10. 402 flow banding 15°? at 235

Amygdaloid coarse at 262

Shearing at 22°

Much red shearing and slickensiding, dip 31°.

Thoroughly brecciated and trappy along	at	11.285
Banded 2 mm. ophite at		11.297
Contact at		11.307
Fine brecciated calcitic amygdaloid		
Sheared at		11.310
And thoroughly decomposed to		11.318
Much seamed at 26° to vertical at		11.322
Decomposed, seamed, with contact at 45° at		332

It is probable that we are getting abnormal dips close to the great fault.

A dip of 36° at		11.338-348
Amygdaloid		11.348-358
Seams dip 15° and 59° in the same direction.		
Fine amygdaloid		11.358-362
Coarser amygdaloid		11.362-370
Mottles 1-2 mm. in trap		11.370-374
Fine amygdaloid		11.374-386
Coarser		11.386-391
Mottles 2 mm.	at	11.394
Seam		11.398-401
Amygdaloid		11.400-406
Mottles 1 mm. in trap		-412
Amygdaloid with many vertical seams and datolite crystals. Sp. 20586		11.412-429
Coarser		-437
Fine amygdaloid		-459
Seams at 45°		
Amygdaloidal ophite 2 mm. mottles		11.459-465
Possibly a contact		468
Amygdaloid, fine grained, dip of bands 18.5°		
Also seams at 15°		
Amygdaloid	to	11.539
Fine grained ophite to		11.543
Basal amygdaloid, dip 18.5°	to	11.545
Possibly a contact of flows here.		
Fine amygdaloid		11.545-547
Fine trap		-551
Poor amygdaloidal trap		-568
Amygdaloid		11.568-575

Amygdaloid, fine grained 1 mm. ophite		-583
Dip about 18°½		
Amygdaloid		11.583-596
Mottles 2-3 mm.		-608
Finer		-612
At this point a big seam about 15° from the vertical.		
Mottles at 622 and 628 feet 1 and 2 mm. respectively.		
There may be a contact at 633 feet.		
2 mm. mottles	at	11.660-664
Much seamed, nearly vertical or at 54°	at	668
A dark chloritic rotten trap		11.696-704

Seams vertical and at 56° and 18°½ therefrom.

Fault the Keweenaw fault about here (4700)?

89. Brown sandstone 11.705-794

The grains of sandstone show quartz and pink feldspar. They do not look like the intercalated Keweenawan sandstones but like the overlying Freda or Jacobsville sandstones. The color is white, mottled with brown. Cf. one of the Isle Royale holes; also one of the Lake holes; also one of the Challenge holes, and the Wyandotte holes.

The first core at 705 is somewhat one-sided, probably the other part (like that just above it) was chloritic. Pink (laumontite). Seams dip at 78° and 46°, the chlorite seams at 74°.

At first the dip is 11°. Seams (parallel to the fault?) at 59°.

The bedding is faulted at d 11. 714

Then the dip is 26°½, then 29°½

Near 794 the brown sandstone seems to dip 64°,—a pressure cleavage perhaps.

Fault.

90. Crosses fault and passes back into ophite seam, is at 34° to d 10. 798

This is evidently not in normal succession beneath the sandstone There is no basement conglomerate. It is of the same curious type at d 11. 646.

91. Much crushed, brecciated and distended amygdaloid. 798-854

This change is abrupt on a sharp clay plane dipping 25°. The rest is a slickensided amygdaloid, pumiceous like the low horizons of Holes 12 and 10, with red clay planes cutting it almost every way, e. g., dip 31° also 50°.

From d 11. 809-819 the breccia shows much shearing at about a 64° dip, with plain mottles.

§11. FRANKLIN JUNIOR. (FIG. 40.[1])

The neighborhood of Section 8, T. 55 N., R. 33 W., has been the center of exploration from the earliest times under the successive names of Albany and Boston, Peninsula and Franklin Junior.

[1]In envelope.

Sections were given in Volume 1,[2] further additions made by Denton in the Proceedings of the Lake Superior Mining Institute and still farther by Hubbard in Volume VI. But much more work has been done since and a compilation of the main section along the 4th level cross-cut of the Franklin Junior with various drill holes is given herewith as Figure 40, with a number of Rhode Island and Franklin drill holes brought into their proper geologic position regardless of their geographic position.

Franklin Junior Mining Company Section. A cross-section of this property is found in the Proceedings of the Lake Superior Mining Institute for 1894, prepared by F. W. Denton in a plate at the end of their Volume II, and again in Volume VI, Plate IX, of the Michigan Geological Survey Reports for L. L. Hubbard. The drill cores are, I think, in the Survey office. It is therefore not necessary to repeat these records in full but we may add additional data and enough from their records to combine into one consistent cross-section. There is one thing to which attention should perhaps be called. The dip of the "Albany and Boston" or Allouez conglomerate is taken as 52°. If it be taken as 48° as in Volume IX and customarily, the relations of Hole A and B will be somewhat changed. Diamond drill hole B was vertical and about five feet lower than the collar of No. 1 shaft in the Albany and Boston conglomerate, and 830 ft. from the foot of the conglomerate. It passes through 35 feet of drift. Then we have for Hole B reduction factor (cos 52°=) .608

1.	Porphyrite			(20)
	Amygdaloid	3	(1.8)	
	Blue trap	30	(18.5)	
	Cf. Arcadian	1	(32)	
2.	Amygdaloid	7	(4)	
	Trap	8	(5)	
	Cf. Arcadian	2	(8)	
3.	Amygdaloid	7	(4)	(36)
	Trap	52	(32)	
	Cf. Arcadian	3	(40)	
4.	Amygdaloid	3	(1.8)	(69)
	Trap	75	(46.2)	
		18	(11 to B 238 feet)	
	Cf. Arcadian	4	(42)	
5.	Amygdaloid	7	(4.3)	
	Trap	76	(46.8) to B 321 feet	
	Copper at B 272 feet			
	Cf. Arcadian	5	(46)	
6.	Amygdaloid	12	(7.4)	
	Trap	57	(35.1) Coarse	

This outcrops just N. W. of the Pewabic shafts, with a few large porphyritic crystals and more or less abundant bands glomeroporphyritic

Trap	30	(18.5)	Very fine black to B 437

This fine black trap came also in the 21st level-cross-cut at 457 feet and in Hole A at 501 feet, and is taken to be the immediate Pewabic lode

[2]In using such terms as Old Pewabic, Pewabic, etc., I refer to them as used in Volume I of these reports, in particular cross-sections, pages 81-86.

hanging. This Hole A was from the 8th level 20 ft. N. of No. 2 shaft and 503 feet below the collar.

7. Pewabic lode and foot (246)
   Amygdaloid d A. 32 (20) B. 437 to 469
   A. 501 to 476
   447-459 in cross-cut
   Trap A. 476-471
   Amygdaloid A. 471-451
   Trap A. 451-416

In the 21st level cross-cut we have the amygdaloid copper-bearing (9 ft.) lode at 447-459 and above it the fine grained trap. From 313-447 feet (133.5) feet (102) is all trap, at bottom band finer grained, then about 50 feet further on coarser, with prominent pink and green feldspar, and doleritic feldspar for some 22 feet. The prominence of the feldspar is partly due to alteration as the rock is wet and a wet seam from which a sample of salt water was taken (see analyses) dips with the foot about 40°. This is a heavy, well-marked bed. I suspect that the doleritic streak is the "green amygdaloid[1] of a record of Hole A in the L. S. M. I., 1894, as then the distances would agree very well, the whole belt A. 451-326 belonging together. The doubling of this amygdaloid at the end of A can be explained as due to some fault repetition,—a northward trending fault throwing the east side to the right or SE. perhaps.

The coarsely feldspathic character is plain also in the Arcadian section in d 5. 346-472; especially at d 5. 372 when the feldspar is 5 mm. long. Also d 6 down to 152; especially 57-98. The thickness also agrees. This is Arcadian 11.

The sections immediately above rarely agree exactly, and this is probably due to fault disturbances.

8. Amygdaloid 295-314 in cross-cut 19 ft.=15 ft.
   d A. 326-301 25 =20

Poor, with rather uncertain relations,—it should perhaps be grouped with the heavy red amygdaloid band below.

9. Amygdaloidal melaphyre or melaphyres (103) to (46)
   Red amygdaloid d A. 301-231=70 (65)
   21st level cross-cut at 251-295=45 (33)
   Trap d A. 231-181=50 (38)
   21st level 234-251=16 (13)

S. 16 with occasional coarse porphyritic crystals and chlorite spots like Ss. 16441-16444 from Tamarack d 4. 2208-2416.

The heavy band of amygdaloids, at the top coarse pink and green amygdaloids with copper, seems to be identifiable in the Tamarack shafts. T 5 b 46. 2569-2630. They are wet, and some old shafts at the Franklin Junior were on them. If this is the old Albany and Boston amygdaloid then probably the identification in XV d is wrong. It seems to match the "Green Amygdaloid" of that section.

10. Ophite (52) to (99)
   Amygdaloid d A. 181-173=8 (6)
   21st level d A. 232-234=2 (2)
   Trap d A. 173-115=58 (46)
   21st level 232-131=101 (97)

[1]Not the "Green Amygdaloid" of Vol. I, Pt. II, p. 86, XV. d. The same amygdaloid will be in one place green, in another red, according to the stages of alteration.

In the cross-cut at 192 feet was a wet seam which I took to be one of decomposition dipping to the south. I took a sample of water (see Analysis, sp. gr. 1.045?). The amygdaloid at 232 is shaly and coarse, perhaps not the contact of a flow.

One must take 9 and 10 together to get a corresponding thickness of about 150 feet. This outcrops between the amygdaloid and conglomerate shafts.

11. The "Mesnard epidote" an ash or porphyry tuff.
   d A. 110-115=5 (4)
   21st level 98=103 (3)

S. 15 Fine grained, brown and yellow-green epidotic mixed, with a glassy conchoidal fracture. This very peculiar bed was also noted on Isle Royale hole VI. 81-91, and in the first Tamarack shaft, at 460 ft. It is really a volcanic ash, having had a large amount of soluble silica and showing conchoidal forms of volcanic ash. I think it may correspond to the Chippewa felsite of the Porcupines. There is no question about the correlation of the cross-cut at 103 ft. and A d 115, though there is some question about the correlation of the points at which the measurements of drill hole and cross-cut begin.

BEGINNING OF CENTRAL GROUP. END OF ASHBED GROUP.

12. Ophite
   Trap d A. 110-105=5 (4)
   21st level 70-98=28 (22)
13. Ophite the "Greenstone" (52 to 54)
   Amygdaloid d A. 105-85=20 (16)
   21st level 68-70=2 (2)
   Fine green trap d A. 85-37=48 (38)
   21st level 0-68=68 (50)
14. Albany and Boston or Allouez conglomerate (Marvine No. 15)
   Fluccan d A. 37-30
   Conglomerate d A. 30-0
   Shaft and drift about 15

This conglomerate has been extensively opened and is described in various reports, Steven's "Copper Hand Book" and Rickard's "Copper Mines of Lake Superior."

The thickness varies greatly in different parts of the mine.

The section is continued south in the 4th level cross-cut which begins 234.57 below the collar of the shaft and at the Kearsarge conglomerate is 197.72 below. The shaft is about 560 above Lake Superior (A. L. S.) Further description will be found in Vol. VI, Pt. II.

15. Melaphyre, feldspathic ophite (81)
   Amygdaloid -41 (31)
   Trap -108 (50)
   Arcadian 20
16. Medora lode and foot ophite (29)
   Amygdaloid 125 (13)
   Trap 146 (16)
   Arcadian 21
17. Ophite (Mandan?) (140)
   Amygdaloid 163 (13)
   Trap 203 (30)

Altered epidotic 221 (14)
Trap 334 (83) [1]seam of calcite 27 ft. from foot

18. "Ragged amygdaloid" and ophite? (41)
Amygdaloid 340 (5)
Trap -388 (36)
Arcadian 23

19. Ophite (51)
Amygdaloid -395 (5)
Trap -456 (46)
Arcadian 24

20. Houghton conglomerate (Marvine's No. 14) dip 49.5° (51)
Felsitic conglomerate -495 (29)
Sandstone -496 (1)
Amygdaloid conglomerate -524 (21)

21. Ophite (60)
Trap -602

22. Ophite (85)
Amygdaloid -617 (12)
Brecciated calcitic epidote, drift on it
Trap -713 (73)

23. Ophite (67)
Amygdaloid -718 (4)
Trap -730 (9)
Amygdaloid -747 (13)
Trap -800 (41)
Seamed

24. Ophite (90)
Amygdaloid -843 (32)
Decomposed,—slide striking northeast and southwest and dipping southeast
Trap -918 (58)

25. Ophite (92)
Amygdaloid -960 (32)
Drift
Trap -1038 60
Sp. 17300 Labradorite, augite, magnetite, olivine

26. Ophite (37)
Amygdaloid -1047 (7)
Trap -1086 (30)

27. Ophite (26)
Amygdaloid 1113 (21)
Trap 1120 (5)

28. Ophite (24)
Amygdaloid -1144 (18)
Trap -1151 (6)

29. Ophite (86)
Amygdaloid -1177 (20)
with amygdaloid conglomerate?
Trap -1264 (66)

[1]Misprint in Vol. VI—85 for 83.

30. Ophite (70)
Amygdaloid 1269 (5)
Trap 1331 (48)
Seam 1332 (2)
Coarse, altered, doleritic, with *copper*
Trap 1353 (15)

31. Ophite (47)
Amygdaloid -1360 (5)
much altered calcitic bunching
Trap -1414 (42)

32. Calumet conglomerate (Marvine's 13) (36)
1414-1461
This is amygdaloidal, as it is also on the La Salle property, 4 in. fluccan, then sandstone largely.

33. Porphyrite, feldspathic melaphyre (92)
at 50 feet from the hanging slip on the N. side of the cross-cut carrying fluccan.
Amygdaloid -1464 (2)
Trap -1581 (90)

34. Porphyrite (42)
Amygdaloid -1634
with clay cavities
Sp. 17332 shows large olivines, augite granules. This amygdaloid has been much drifted on in the Calumet mine for drainage but has no copper.

35. Ophite (103)
Trap -1768 d D. 211
at 65 feet from hanging is a seam dipping 56° westward and other thinner seams showing faulting.

36. Feldspathic ophite (57)
Amygdaloid -1785 (13) d D. 211-247
Trap -1840 (44)
Verges on porphyrite, olivine and feldspar abundant
Shattered; seams dip about 45° east to southeast

37. Ophite (20)
Amygdaloid -1859 (15)
Trap -1864 (5)

38. Calumet amygdaloid and foot ophite (138)
Amygdaloid -1885 (16) d D. 361-398
Trap 2041 (122) d D. 398-468
Upper part shattered, lower part coarsely ophitic. This seems to be a very persistently marked sheet, being the first of five good-sized ophites above the Kearsarge conglomerate

Base, below Calumet conglomerate (451)

39. Osceola amygdaloid and foot ophite (98)
Amygdaloid -2060 (15)
Trap -2166 (83)
Supposedly opened by shaft 660 ft. N. 1200 W. of E. Q. P. of Sec. 8, which shows also 90 feet of overlying ophite

40. Ophite (64)
Amygdaloid -2171 (5)
Trap -2246 (59)

41. Ophite (125)
Amygdaloid -2252 (4)
Trap -2404 (121)

42. Ophite (92)
Amygdaloid -2414 (8)
Trap -2522 (84)

43. Kearsarge conglomerate (45)
Fluccan 16 in.; dip 52° to 52.5°
Porphyry conglomerate 39 ft.
Sandstone 4-½
Arcadian 49

Base from base of Allouez conglomerate 15 — 1971

44. Ophite (32)
Amygdaloid -2581
Trap -(2632 by drill) 2621
The drill went from 2597, 232 feet beyond to 2829
Sp. 17909 5 slightly amygdaloidal, fine grained ophite
17910 10 doleritic, medium grained
17911 15
17912 20
17913 25
17914 30 Finer grained than at 15

45. Ophite 5 mm. (141)
Amygdaloid (2632-2642 by drill)-2660
Trap (2808 by drill)-2798
Sp. 17915 at 35 amygdaloid with sandstone seam
at 39 amygdaloid with sandstone seam
at 47 coarse feldspathic dolerite
17916 55 coarse feldspathic doleritic
17917 60 coarse with clay seam
17918 65 coarse. Is much decomposed. The same decomposed seam and fissure and coarse amygdaloid was found in running the cross-cut at 2660
17919 70
17920 75 flinty seam
17921 87 coarse In the cross-cut this very coarse amygdaloidal trap with pink and white amygdules was noted at about 2700 ft.
17922 93 coarser
17923 98 "
17924 113 coarser
17925 118 Long core, no amygdaloid in this
17926 127 coarse ophite about 5 mm.
17927 137 "
17928 142 "
17929 147 " veined
17930 157
17931 173
17934 179
17935 184
17936 189
17937 191

46. Feldspathic ophite? (73)
Amygdaloid d D. 2798-2805 (6)
17938 211 amygdaloid, compact fine grained
17939 218 amygdaloid, marked
17940 229 red indurated sediment, clasolite, did not show in
17941 amygdaloid at end of hole cross-cut, but cf. F. J. d 4 at 73
Trap d D. 2805-2890 (68)
at 2825 a 2 mm. ophite
Sp. 1 at 2856

47. Amygdaloid conglomerate (5)
d D. 2890-2897.5
Sp. 2 passing gradually into trap below, mixed with red sediment. This is very well marked also at the Wolverine mine cross-cut where it was opened by drifts. It also occurs in the Tamarack 29th level about (240) feet below the Kearsarge conglomerate. Cf. F. J. d 4. 73-81

48. Ophite (52.5)
Trap 2965.7
Sp. 3 at 2947.5 is an ophite

49. Ophite (123)
Amygdaloid to 2974.5 (7)
Trap 3125.5 (116)
Sp. 4 at 3024.5 with 3-4 mm. mottles (74) from bottom
5 at 3075.5 with 2-3 mm. mottles, darker and finer, 38 from bottom?

50. Melaphyre (25)
Amygdaloid -3148.1 (17)
Red and white with marked but small amygdules and clasolitic seams, copper reported.
Trap -3158.7 (8)
The fifth bed below the Kearsarge conglomerate at the Wolverine has also a heavy amygdaloid.

51. Melaphyre (24)
Amygdaloid 3167.6 (7)
Trap 3190.1 (17)

52. Melaphyre (14)
Amygdaloid -3201.1 (8.4)
-3208.6 (6)

Base below base of the Kearsarge conglomerate (482)

53. Amygdaloid to 3215.9 (6) (17)
Trap to 3230.9 (11)

Base below base of the Kearsarge conglomerate (499 ft)
At the Wolverine mine (§ 8 h) the 8th bed is (512) feet below

54. Amygdaloid to 3243 (9) (19)
Trap 3256 (10)

55. Amygdaloid to 3263.6 (6) (15)
Well-marked
Trap to 3267.3 (3)
Decomposed

56. Melaphyre (35)
Amygdaloid to 3288.311
Trap to 3320.3 24.5
The group of small flows leading to one strong amygdaloidal belt seems

to appear also in the Arcadian section 57-61 down to 605 feet below the Kearsarge conglomerate. Cf. amygdaloids 10, 11 and 12 of the Wolverine § 8 h.

57. Ophite feldspathic (55)
Amygdaloid to 338.8 (14)
Trappy with copper
Trap to 3391.8 (41)
Rather coarse and glomeroporphyritic to near contact. The rocks on the north side are not exactly alike as though the drift had veered a good deal in strike.
Sp. 6 is a 1 mm. ophite. Cf. F. J. 4. 139-200

58. Ophite (3-4 mm.) (51)
Amygdaloid to 3407.8 (12)
Trap to 3457.8 (38)
Sp. 7 of the amygdaloid is pink and green with rather coarse feldspar and amygdules also coarse. There is a seam dipping E. about 40°, 23 feet below the top of the trap, and striking about N. Cf. F. J. 4
Wolverine 11th level Belt 15.

59. First Kearsarge amygdaloid and porphyritic ophite (47)
Amygdaloid to 3468.8 (8.4)
Trap to 3518.8 38 plus
Sp. 8 is of the top 2 feet amygdaloid
Sp. 9 is 8 feet below the top and shows a little copper
Sp. 10 is the top of the trap
Sp. 11 is 17.7 from the top
Sp. 12 is 27 from the top
Sp. 13 is just above the base, toward which there is a marked columnar jointing perpendicular to the dip. There is here a genuine repetition.

60. Second Kearsarge amygdaloid and labradorite ophite (78)
Amygdaloid to 3529.4 (8)
Trap 3545.8 (13)-
Sp. 14 is 8 feet from the top of the amygdaloid
The cross-cut ended without reaching the Wolverine sandstone so that the thickness of the belt must be obtained by comparison with records of F. J. d 3, which shows a slide and a little Wolverine sandstone at 375 feet. This would project at 3407 in the cross-cut, but it is more northeast and evidently the strike is not at right angles to the cross-cut as it does not appear to be, but more north of northeast. The top of the Kearsarge is at d 3.250 making 125 feet thickness and a similar thickness is found at the Arcadian 63. (101?) and Rhode Island (112)
Owing to some disturbances it is not possible to weld the cross-cut and the drill holes into one continuous section. We therefore begin over again with the drill holes but give the corresponding numbers of beds.
It is worth noting that Arcadian belt 1 and Franklin Jr. belt 1 correspond very nearly and so do Arcadian 63 and Franklin Junior 61, so that in spite of thickening and thinning and dropping out of individual beds the average number and size is persistent.
F. J. drill hole 3 enables us to continue our numbering from 61 to the heavy ophite 66.

Franklin Junior drill hole 4. Dip of hole 45°. The dip of the beds being

about 48° the correction to reduce thickness along the hole tot rue thickness is negligible.

1. Overburden, till, 0-60
2. Ophite
Trap d 4. 60-73 (13)
mottling from 1 to 2 mm. growing less
(48?) 3. Sediment ? at 73
4. Melaphyre (67)
Trap and sludge d 4. 73-139′ 7″ (67)
Down to 81 it is largely a sludge of epidote, laumontite and calcite, then fine grained throughout, though growing finer with a few chloritic amygdules near the bottom.
Sp. 17967 at d 4.84 has groups of small feldspars like a porphyritic margin
17968 4.110
17969 4.129
17970 4.135
5. Glomeroporphyrite
Amygdaloid d 4. 139-144 (5)
Trap d 4. 144-200 (54)
The amygdules have pink borders, green or white centers, and the bed is brecciated and coarse chloritic amygdules continue to 150 coarsest; near 176.
Sp. 17971 d 4.154
17972 4.170
17973 4.177
17974 4.195
(50?) 6. Feldspathic ophite Kearsarge hanging (133)
Amygdaloid d 4. 200-207 (7)
Trap d 4. 207-333 (126)
Sp. 17975 at d 4.215
17976 4.255
17977 4.292
17978 4.319
The amygdaloid is largely in sludge, brecciated pink and black. Underneath it, from 212-214 the trap is light yellow-green, epidotic, then coarser to about 267 to 300 then finer to the base. At 251 there is an inclusion of a hard green fine grained amygdaloid spot. Toward the base it becomes red and faintly porphyritic. Beneath it the next 209 feet to the Kearsarge is disturbed and amygdaloidal. In the cross-cut too there are many small beds next beneath.
7. Disturbed belts
Amygdaloid d 4. 333-340
Marked red and white brecciated amygdaloid. Sp. 17979 at d 4. 338
Trap to 356 chloritic, to 364 with signs of broken feldspar crystals like the Kearsarge foot, to 381 more massive and feldspathic, then finer, Sp. 17980 at d 4.360
17981 4.378
Amygdaloid d 4. 381-385?
Trap, sludge and fine grained trap d 4. -394

Amygdaloid streak in the sludge d 4. 394-401

Trap d 4. -410, of a feldspathic melaphyre type, broken and sludge (411)

Amygdaloid with porphyritic feldspar ?—415 with prehnite calcite, etc., veined and broken-440, epidote and calcite seam-441

Trap fine grained seamed and broken-448 mottled ? to 560, finer with some amygdules and quartz to 463.

8. Slide or ash bed d 4. 463-475

This appears like a red shale with white flecks though the apparent dips are not at right angles to the hole but (2 or 3:10) presumably 11° to 17° more. At the bottom it seems to pass into a decayed amygdaloid. A section (Sp. 17982) of the red white flecked rock at d 4. 471 feet shows clear irregular areas of calcite, irregularly interlocking, with no unusual signs of pressure twinning, and spreading into the ground, which appears to be made up of small fragments and stained with iron oxide. Farther examination, however, seems to show that it is made almost wholly of epidote with a very little quartz and that not obviously elastic. All the material is highly angular and none of it can be said to be surely sedimentary. It might be a sediment steamed, full of bubbles, later filled with calcite. It does not look like a fluccan.

9. Amygdaloidal melaphyre (17)

Amygdaloid d 4. 475-486 (11)

Amygdaloid has white amygdules with pink borders and a nearly black ground

Amygdaloidal trap d 4. 486-492

10. Amygdaloidal melaphyre (28)

Amygdaloid d 4. 492-508 (with phenocrysts) cold gray (16)

Sp. 17983 at d 4. 493

Trap d 4. 508-520 (reddish, decomposed, fine grained, feldspathic (12)

Lens shows feldspar laths promiscuously

Sp. 17984 at d 4. 508

Sp. 17985 d 4. 515

11. Amygdaloidal melaphyre (7)

Amygdaloid d 4. 520-526 (6)

(pink bordered amygdules as above)

Trap d 4. 526-527 (1)

56? 12. Amygdaloidal melaphyre (15)

Amygdaloid d 4. 527-534

Trap d 4. 534-542 (8)

fine grained

59. 13. Labradorite ophite 1st Kearsarge amygdaloid and foot (49)

Amygdaloid d 4. 542-545 (3)

Trap d 4. 545-591 (46)

Sp. 17986 at d 4. 558

Sp. 17987 d 4. 557

Much broken to 556, with decomposed phenocrysts at 557-560; spotted growing coarser at 579; faintly ophitic. The Kearsarge amygdaloid lies I should think between 475 and 545. In some respects that from 492-508 correlates most closely.

(60). 14. Porphyritic ophite (3 mm.) 2nd Kearsarge amygdaloid (46+20?)

Amygdaloid d 4. 591-596 (5)

Trap d 4. 594-635+ (41) + (20?)

Red amygdaloid to 594 then greenish to 596, reddish to 601, then a greenish spot, at 604 and at 609 and 628 the large feldspar crystals are well marked 10 mm. long and over. The ophite mottling is perhaps 2-3 mm. across and over and the bed is very much like F. J. 3. 307

Sp. 17988 at d 4. 604

17989 d 4. 608

17990 d 4. 628

Franklin Junior drill hole 3. T. 55 N., R. 34 W. Dip of hole 48°. The dip of the beds being about 50° also the correction for true thickness is negligible, being not more than the possible veering of the hole.

1. Overburden, till, i. e., boulders sand etc., d 3. 0-110

(57). 2. Feldspathic ophite (38)

Trap d 3. 110-to 148

Begins coarse faintly ophitic 3 mm. then plainly finer with pipe amygdaloid from 147-148, and joints at 10° and 70° angle with the core. The bottom contact is at 65½° with the hole.

Sp. 17947 is at 144

(58). 3. Ophite 6 mm. (84)

Amygdaloid d 3. 148-158 (10)

Trap d 3. 158-232 (74)

Marked red amygdaloid to 150, then black and white to 158, then with coarse irregular chlorite and calcite down to (169)

Sp. 17949 at 160 feet, under the microscope shows amygdules filled with fibrous coatings of chlorite, and chalcedony in spherulitic aggregates; with labradorite laths; augite ophitic but scanty, about 3 mm. in diameter and abundant olivine pseudomorphs, changed into reddish micaceous matter and serpentine. There are no signs of phenocrysts.

Sp. 17948 is at 149

Sp. 17949 at 160

Sp. 17950 at 189

Sp. 17951 at 206 and 17852 at 217 respectively.

4. Kearsarge? Amygdaloid? (18)

Amygdaloid d 3. 232-238 (6)

Trap d 3. 238-250 (12)

Amygdaloid begins red with numerous, small, white amygdules to 234, then greenish epidotic with large white amygdules to 238, then spotted, decomposed with small chloritic specks and amygdules.

Sp. 17953 at 250 feet has fairly coarse feldspar, but there are no signs of porphyritic crystals.

(59). 5. Kearsarge amygdaloid and foot. Porphyritic ophite

Amygdaloid d 3. 250-254 (4)

Trap d 3. 254-260 (6) (10)

Hard, light gray amygdaloid with large amygdules of quartz

and copper, then a small streak of fine grained melaphyre with chloritic spots and labradorite phenocrysts.

(60). 6. 78

Amygdaloid d 3. 260-262 (2)
Trap d 3. 262-338 (76)

Amygdaloid is dark maroon, with calcite pink bordered amygdules, passing into light gray with large amygdules, and feldspar forms, often not fully showing quartz crystals in the cavities, then reddish fine grained with feldspar crystals 7 mm. and upward long. At 285 much seamed. At 298 it is darker, more plainly ophitic (5 mm.) and then grows finer.

This is typical Kearsarge foot trap and resembles F. J. 4 at 608. The Kearsarge amygdaloid must come between 232 and 260. Which band or whether the whole should be taken as its representative it is not easy to say exactly. Then the others may be considered mere streaks.

Sp. 17954 at 272 ft. and 17955 at 307 feet respectively, may represent it.

(61). 7. (26)

Amygdaloid d 3. 338-361 (13?)
Trap d 3. 361-374 (13)

Fine grained amygdaloid with 7 mm. feldspar crystals at first, then much broken and shattered with epidote and calcite-348; at 353 a little copper in a hollow epidotic amygdaloid which goes to 356; then a hard gray amygdaloid-358 and the amygdaloid begins to fade out but has some well-marked feldspars 20 mm. or so long. At 368 there is 1 mm. ophitic mottling with feldspars still.

Sp. 17956 at d 3. 345 is figured on Plate VII.

(62). 8. Slide 1½ "soft clay sandstone" 374′ 6″-376 (1½)
9. Wolverine sandstone, only a few inches at 376′ 9″ (½)
A light hard sandstone
Arcadian 64
Sp. 17957 at 380

(63). 10. Ophite 3½ mm. (74)

Amygdaloid ? d 3. 377-390 (13)
Trap d 3. 390-451 (61)
Begins chloritic fine grained, not properly amygdaloid
Trap mottles 3 mm., 3½ mm., 2 mm.
at 404, 410, 442
Sp. 17958 at 390
17959 410
17960 442

(64). 11. Ophite 4 mm. (84)

Amygdaloid d 3. 451-455 (4)
Trap d 3. 455-535′ 4″ (80)

Amygdules coarse of chlorite and calcite, a calcite and epidote seam nearly parallel, mottles 3 mm. and 4 mm. at 470 and 490.

Sp. 17961 at 467
17962 524 This is the specimen examined by R. T. Chamberlin for gas.[1] with the following results:

[1]The Gases in Rocks, 1908, pp. 20, 33 and 34.

	Analysis No. 85	Analysis 6 months later	Analysis 1 week later, after wetting
Hydrogen sulphide	0.00	0.00	
Carbon dioxide	1.31	1.33	0.52
Carbon monoxide	0.09	0.08	0.12
Methane	0.09	0.03	0.00
Hydrogen	2.34	0.43	0.12
Nitrogen	0.05	0.05	0.02
Total	3.88 vols.	1.92 vols.	0.79 vols

17963 534 feet showing contact

12. Sediment d 3. 535-537

There is one foot of scoriaceous conglomerate with a dark maroon basic sediment, making an angle of 71° with the drill core. Sp. 17963 at 534 ? shows contact

13. Fluccan at 37′ 10″. Cf. C. & H. A at 401 feet

(65). 14. Feldspathic ophite (7 mm.) (200±)

Amygdaloid d 3. 537-539
Trap d 3. 539-719-18?
Base below base of Wolverine about 360 ft.
This is markedly doleritic; so at 548, 565, 574, 577, 583, 593-598
Calumet and Hecla d A. 401-553 or 656

At 567 is epidotic, at 571 there is a calcite seam. Where it is "doleritic" it appears to have coarse amygdules and the feldspar is often 7 x 1 in size, and the chlorite interstices with occasional spangles of copper are well marked. On the other hand the augite is also often clearly recognizable.

The mottling is 5-7 mm., 7 mm., 3 mm., 2 mm.
at 600-624, 652, 677-700, 700-719,

Sp. 17964 at 567 shows the epidotic phase
17965 596 " " doleritic phase
17966 616 " " very faintly mottled phase

This strikingly resembles the Arcadian bed No. 68 Arc d 2. 315-464+ and d 19. 43 to 139 which is 217 feet thick. Calumet and Hecla d A. 401-553 may be the same, and in the Wolverine cross-cut and Old Colony section it may be identified, with its base between 300 and 400 feet below the Wolverine. Cf. Central mine Belt 70 and the big bed in Manitou 7-5, S. This is either not in F. J. 2 or the very top which is most likely on Belt 9. Cf. 73.

An old shaft the "Kearsarge" shaft about 450 ft. N. and 1250 ft. W., S. E. corner of Section 8, T. 55 N., R. 33 W. is really about 3880 feet across the strike from the outcrop of the Albany and Boston conglomerate. From a vertical shaft 77 feet deep about 470 feet above Lake Superior drifts were run 582 N. W. and 238 S. E. These drifts were, then, not more than 30 feet or so above the 4th level cross-cut, but were about 1550 feet away along the strike. They were not accessible when I visited them but N. Martel reported that to the N. 37° (magnetic) W. they drove 100 feet to a vein on which is an inclined shaft magnetic strike S. 37° E. dip 48° or so (49-50°) which is 158 feet

deep. They drifted on this vein 50 feet. The cross-cut is 15 feet wide and struck the inclined shaft at a depth of 100 feet.

This vein extended from 100 ft. to 115 feet N. W. Then there are three or four little lodes especially one at about 300 feet some 25 feet wide

(12)
(77)

To the S. E. 113 ft. from shaft 12-foot vein taken to be Kearsarge Amygdaloid (86) (9)

It is pretty certain that this is a mistaken identification, but Hubbard and I found on the dump some Kearsarge foot trap so I think it was reached in the N. W. cross-cut, the Wolverine sandstone being perhaps absent as in F. J. 3 hole.

125-153	Trap	(22)
153-166	Vein	(10)
166-237	Trap	(55)

Near by are outcrops of scoriaceous conglomerate and feldspathic melaphyres. Cf. Beds 65 and below, and as near as one can make out from Martel's records the shaft is in a very heavy trap which might be (175) feet thick or more. This may be Arcadian bed (65) and Franklin Junior bed 68. It would agree in character, position and size. Then we should have:

(66). Melaphyre (31)
Amygdaloid (8)
Trap (22)

(67). Amygdaloid (10) (65+)
Trap (55)

Franklin Junior drill hole 2. Dip 42°. About at right angles to the formation, continues the section of F. J. 3 very nearly.

1. Overburden 47 feet

(66). 2. (2+)
Trap d 2. 47 (2)

base below base of Wolverine 360?

(67). 3. (14)
Amygdaloid to d 2. 254 (5)
Red and white
Trap to d 2. 263 (9)

(68). 4. Feldspathic ophite (5 mm.) (117)
Amygdaloid to d 2. 71 (8)
Trap to d 2. 180 (109)
Feldspathic, faintly ophitic
At 82 epidote seam, at 117 doleritic with 5 mm. augite mottles which are plainer toward the bottom, hardly visible at the center.

(69). 5. Feldspathic ophite (33)
Amygdaloid to d 2. 190 (10)
Decomposed, chloritic
Trap to d 2. 213 (23)
At 209 faintly mottled, at 212 to 213 fine grained, dark trap
Cf. Arcadian 70

(70). 6. Feldspathic ophite
Amygdaloid d 2. 218 (5) (67)
Amygdaloid like the Kearsarge but gradually passing into trap and pseudoamygdaloid at the base to 232.
Trap d 2. 270 (52)
Mixed with amygdaloid and pseudoamygdaloid, then coarser and ophitic, from 250 growing finer. Cf. Arcadian 71.

(71). 7. Amygdaloid conglomerate (5) (5)
d 2. 275 (5)
Cf. Arcadian 72 and 73

Base below Wolverine? (596)

(72). 8. Feldspathic ophite (59)
Amygdaloid d 2. 286 (11)
With clasolite seam at 280
Trap d 2. 334 (48)
Amygdaloidal, coarse feldspathic to 308 ft. then ophitic and finer
Cf. Arcadian 73

(73). 9. Feldspathic, doleritic, ophite 8 mm. (209)
Amygdaloid d 2. 343 (9)
Red
Trap d 2. 544 (201)
Often doleritic, at 407-417 dense green with sparse amygdules, an inclusion? Mottles at 368 to 400 8 to 3 mm., at 473 6 mm., at 505 8 mm., at 522 4 mm. Cf. Arcadian 74 and 75.

(74). 10. Red shale and conglomerate d 2. 544-548 (4)
Some copper in the shale. Cf. Arc. 76 and the Old Colony sandstone 966 to 980 feet below the Wolverine, respectively. One bed of ophite may be omitted in this section.
Base below base of Wolverine

(861)

(75). 11. Feldspathic ophite (137)
Amygdaloid d 2. 552 (4)
Trap d 2. 685+ (133+)
Faintly amygdaloid and glomeroporphyritic in streaks with epidote, then grows coarse feldspathic.
Cf. Arc. 77

Franklin Junior drill hole 1

1. Trap d 1. 1-22 (22+)

(76). 2. Melaphyre (104)
Amygdaloid d 1. 22-30 (8)
with copper, veined
Trap d 1. 30-126 (96)
Feldspathic, few coarse amygdules to 45
Cf. Arcadian 78 or 80

(77). 3. Melaphyre (117)
Amygdaloid d 1. 126-153 (27)
Red and white brecciated and somewhat porphyritic to 144, then paler
Trap d 1. 153-243 (90)

Brown specks of altered olivine and green chlorite are abundant; it is full of chlorite seams at 75° to core and toward the base is dense and dark with copper on a chloritic joint. Cf. Arcadian 86.

(78). 4. Melaphyre (93)
Amygdaloid d 1. 243-272 (29)
Marked like that at 336-354 below
Trap d 1. 272-336 (64)
Glomeroporphyritic to 279 ft., then coarser but feldspathic and relatively finer grained, like the Central mine beds in Holes 3, 6, 5 and Torch Lake Belt 7 and thereabout.

(79). 5. Melaphyre (113)
Amygdaloid d 1. 336-355 (19)
Red and white brecciated and porphyritic, marked green at the end.
Trap d 1. 355-449 (94)
This is like 3, feldspathic fine grained to 388, then toward base very dark with plain specks of brown altered olivine, not ophitic, with occasional spots or bombs of pseudoamygdaloid.

(80). 6. Melaphyre (15)
Amygdaloid d 1. 449-455 (6)
Green epidotic, then red glomeroporphyritic
Trap d 1. 455-464 (9)

(81). 7. Copper bearing amygdaloid (43)
d 1. 464-479 (15)
Copper quite freely disseminated; looks worth developing
Trap d 1. 479-507 (28)
The brown specks of altered olivine and glomeroporphyritic character (feldspathic and not ophitic) make it like Torch Lake hole 9, Bed 5, the top of which there is 1486 feet below Conglomerate 9, and may be Belt 7 here. This would harmonize pretty well, with calling belt (76) d 2. 544-548 the Old Colony, because the distance of that below the Wolverine is about 100 feet short, and there is some uncertainty as to whether F. J. No. 2 does immediately continue No. 1.

Franklin Junior drill hole 6 whose location I do not exactly know was about at right angles to the formation.

1. Overburden (39)

(27). 2. Ophite 3 mm.
Amygdaloid F. J. d 6. 39-40
Trap 90
at 45, 54, 64, 76, 82 feet the mottles are
2, 1 to 4 in bands, 3, 2, 1 mm.

(28). 3. Ophite 3 mm.
Amygdaloid d 6. 90- 94
Trap d 6. 94-136
At 107 feet the mottles are 3 mm., and at 110 2 to 3 mm; then finer.

(29). 4. Brecciated amygdaloid or conglomerate
Amygdaloid d 6. 136-154
Dark and pink and brown, at 150 epidotic,

5. Ophite 4 mm.
Trap d 6. 154-284
At 171 epidotic and to this point spotted with amygdules, 230 coarsest 3-4 mm.

(30). 6. Ophite 3 mm. (68)
Epidote d 6. 284-288
Fine grained
Trap d 2. 288-352
At 330 4 mm. ophite

(31). 7. Ophite 4 mm. (47)
Amygdaloid d 6. 352-361
Trap d 6. 361-399
At 366 laumontite skeins; at 378 3 mm. mottles; at 395-398 veined, fine grained. There is evidently some disturbance, and this is quite probably not full thickness.

(32). 8. Amygdaloid conglomerate (Calumet and Hecla?)
Dark red sandy matrix d 6. 399-431 (32)
This has the same basic facies as in the Franklin Junior and La Salle properties,—not that of the Calumet and Hecla property.

(33). 9. Ophite 4 mm. (91)
Trap d 6. 431-522
at 449, 456, 464 feet the mottles are
1 to 2, 2, 3 to 4 mm., then finer

(34 & 35). 10. Ophite 5 mm. (51)
Amygdaloid ? d 6. 522-530 (124)
(175)
Brecciated, not really amygdaloid
Trap d 6. 530-697
The upper part is red and full of laumontite seams, with copper at 580 and 589 feet in an epidotic rock. Here is possibly a separate flow.
At 594, 612, 640 to 660, 673, 686 ft. mottles are
2, 3, 4 , 3, 1 mm.

(36). 11. Ophite 2 mm. (43)
Amygdaloid d 6. 697-710
Amygdaloid brecciated and red and white amygdaloid, the trap for 6 feet has large specked amygdules.
Trap d 6. 710-740
At 706 there are 1 to 2 mm. mottles.

(37). 12. Amygdaloid conglomerate
d 6. 740-769+? (29)
With red sandy matrix and down to 787 brecciated mixed and of doubtful nature. Calumet amygdaloid

(38). 13. Amygdaloid d 6. 769-787 (121)
Brecciated of doubtful nature
Trap d 6. 787-890
At 806, 817, 822, 824 feet the mottles are
1 to 2, 1 to 3, 2 to 4, 4 mm.
It is said to end at "hanging" of Osceola amygdaloid about 459 below base of Calumet conglomerate.

Rhode Island drill hole 4. About 80 feet from the Mineral Range R. R. and 500 feet from the Highway crossing, 1000 feet N., 1970 E. of the S. W. corner, Sec. 4, T. 55 N., R. 33 W., 527 (to 540) above Lake Superior. Dip 45°. From the south quarter post according to a map by M. Dennis is 187 feet in a direction across the strike to No. 3 hole. Thence to No. 2 is 157 feet, thence to No. 1 is 249 feet, thence to strike line of No. 4 is 488 feet, but No. 4 is 345 along strike line to N. E. Strike is N. 40° E. Plate IX.

To get the thickness, measurements along hole should be reduced about 2%.

1. Overburden, drift, hardpan and boulder (67)

(46). 2, Doleritic, feldspathic ophite (83+)
Trap R. I. d 4. 67-149
At 75 calcite seam nearly parallel to hole. Red specks, altered olivine abundant, doleritic texture common, feldspar 5 mm. long, chlorite blotch 2-3 mm., augite 8 x 2 mm., at 95 epidotic with seams of prehnite and copper, with a very faint mottling about 117.

(47). 3. Fluccan and red sediment d 4. 148′ 10-150′-1 (2)
Cf. Sp. 17940 and F. J. 3.173 feet

(47). 4. Glomeroporphyritic melaphyre (18)
Amygdaloid d 4. 149-156 (7)
Marked red, then gray and white with large coarse amygdules.
Trap d 4. 156-167 (11)
Glomeroporphyritic

(47). 5. Melaphyre, glomeroporphyritic (8)
Amygdaloid d 4. 167-168 (1)
With clasolitic matter; then gray and white
Trap d 4. 168-173 (5)
Glomeroporphyrite to 173
Amygdaloid d 4. 173-176- (3)

6. Amygdaloid conglomerate (3)
d 4. 176-179 (3)
Clasolitic matrix, dip 18° or so from being at right angles to core.

7. Melaphyre 16
Amygdaloid d 4. 179-181 (2)
Trap d 4. 181-195 (14)
Fine grained.

8. Amygdaloidal melaphyre (11)
Amygdaloid ? d 4. 195-201 (6)
Much ground up
Amygdaloid d 4. 201-206 (5)

(48). 9. Amygdaloidal conglomerate (5)
d 4. 206-211 (5)
With much sediment
In a way 3, 4, 5, 6, 7, 8 and 9 form one strong belt of amygdaloid conglomerate, but there seems to be a chance for fault repetition.

10. Melaphyre, glomeroporphyrite (10)
d 4. 211-221
Trap
Cf. Beds 4 and 5

(48). 11. Amygdaloidal melaphyre (6)
Amygdaloidal conglomerate d 4. 221-225 (4)
Trap d 4. 225-227 (2)
Fine grained

12. Amygdaloid 227-230 (3) (13)
Coarse pink and white amygdules, with prehnite and copper.
Trap d 4. 230-240 (10)
Dense

(49). 13. Ophite (22)
Amygdaloid R. I. d 4. 240-245 (5)
Green and white, becoming darker
Trap d 4. 245-262 (17)
2 mm. mottles?

(49). 14. Feldspathic ophite 3-4 mm. (88)
Amygdaloid d 4. 262-266 (4)
Greenish gray and white with prehnite and copper
Trap d 4. 266-350 (84)
The mottling is faint and only appears about 307 feet
Amygdaloid spot at 286, 288 etc.
At 313, 334 feet the mottles are about
3–4 & 2–3 mm.

(50). 15. Amygdaloid conglomerate (6)
d 4. 350-356
Well-marked

(52). 16. Amygdaloid d 4. 356-366 (10) (35)
Gray and white, poor at base, but a well-marked, red, glomeroporphyrite with small pink feldspar laths 1 mm. across.
Trap d 4. 366-391 (25)
At 372 yellow with epidote, at 372.8 is still glomeroporphyritic then rather coarse; at 373.3 clasolitic seam; coarser at 381-383; at 389 amygdaloid spot then finer; somewhat amygdaloid.

(53). 17. Melaphyre (17)
Amygdaloid R. I. d 4. 391-397 (6)
Gray and white, then poor chloritic
Trap d 4. 397-408 (11)
Compact with a 2 mm. mottling, perhaps due to the feldspar.
Basal contact marked.

(54). 18. Melaphyre (21)
Amygdaloid d 4. 408-413 (5)
At top large amygdules with prehnite, quartz, epidote and a trace of copper; below poor.
Trap d 4. 413-429 (16)
Slightly mottled (2 mm.) at 421, then finer

(55). 19. Melaphyre (8)
Amygdaloid d 4. 429-434 (5)
Trap d 4. 434-437 (3)
Chloritic

(56). 20. (24)
Amygdaloid d 4. 437-446 (9)
Red and white,—ground to sludge for the first 5 feet, poor below.
Trap d 4. 446-461 (15)

21. (44?)
Amygdaloid d 4. 461-464 (3)
Brecciated red at top, then gray
Trap d 4. 464-505? (41)
Chloritic with amygdaloid bands or bombs—not flow contacts—at 471 and 480, fine grained, faintly mottled (at 494 2-3 mm.) but specked.

22. (7)
Amygdaloidal melaphyre
Amygdaloid d 4. 505-12 (7)
Green (epidotic?) with white amygdules like a bomb, perhaps base of 21.

23. Amygdaloidal conglomerate
At 512 feet a few inches

24. Amygdaloidal melaphyre? (2)
d 4. 512-514
Gray and white, lower foot poor

25. Sandstone d 4. 514-516
Gray, epidotic, with copper, dip 9° to 14° from being at right angles to the core. If this correlates with R. I. 7 at 148 ft., and 746 feet correlates with R. I. 1 at 551, (and of the latter I am the more sure) there is evidently a repetition of some 160 feet there or elision here.

26. Amygdaloidal melaphyre? (6)
d 4. 516 to 522
Green and pink amygdules on dark ground growing dark with white pseudoamygdaloid specks.

27. Amygdaloid conglomerates? (1′ 8″)
d 4. 522-523′ 8″
With gray sandstone cement like 25
From 512 to 535 is very likely all the top of the bed below.

28. Trap ? d 4. 523.8″-535
Fine grained with dark, chlorite amygdules and red clasolites to 527.5. About 529 a seam of mohawkite (copper arsenide) 2 mm. wide, below this compact with chloritic flecks.

(58). 29. Feldspathic ophite (5 mm.) (76)
Amygdaloid d 4. 535-541 (6)
Contact 22° away from right angles to core
Typical gray and white amygdaloid with copper
Trap d 4. 541-611 (70)
Faintly mottled at 559, 576, 582, 589, 597, 612
4, 5, 4, 3-4, 2-3,
Epidote spots at 562 and 564.

(59). 30. Amygdaloidal melaphyre (17)
Amygdaloid d 4. 612-624 (12)
Red and white, then gray and coarse
Trap d 4. 624-631 (6)
Decomposed and amygdaloidal throughout with green amygdules at the base.

31. Amygdaloid R. I. d 4. 631-634 (3) (8)
Marked

Trap d 4. 634-639 (5)
Fine grained fissured with calcite and dark chloritic contact marked.

(60). 32. Kearsarge lode No. 1 with labradorite ophite (86)
Amygdaloid d 4. 639-650 (11)
Red with white amygdules, crystallized quartz and calcite and faint signs of copper, with epidote and porphyrite labradorite. Poor from 644 down
Trap d 4. 650-725 (75)
The crystals of labradorite are marked 15-20 mm. long and seem to grow coarser; about 668 the mottling begins to be visible.
At. 668, 678, 698, 706 feet mottles are
3-5, 4-5, 4, 3 mm. across respectively
At 719 it is distinctly finer and at the bottom it is very dense, bringing out the phenocrysts beautifully, and there seems to be a pipe amygdule.

(61). 33. Kearsarge lode No. 2 with labradorite ophite (19)
Amygdaloid R. I. d 4. 725-735 (10)
Brecciated, almost a conglomerate with conspicuous porphyritic crystals and laumontite.
Trap d 4. 735-746 (9)
Big 20-22 mm. phenocrysts of labradorite and 1 mm. ophitic mottles.

(62). 34. Wolverine sandstone No. 9 d 4. 746-752 (6)
With sediment, slips, copper, prehnite and epidote
Correlate Caldwell d 1. 281-288

(63). 35. Ophite (57)
Trap d 4. 752-809+1 (57+)
Fine grained at beginning like the lower part of a flow; some prehnite and copper to 757. No porphyritic crystals.
At 766, 771, 784, 788, 796, 801-809
2-3, 2-3, 2-3, 2 fine grained

Rhode Island drill hole 1. 390 feet N., 2270 feet E. of S. W. cor. Sec. 4, T. 55 N. R. 33 W. 593 feet across the strike from the S. quarter post. Elevation 515 above Lake Superior. It is about 500 feet from No. 4 on the side of a 10-foot terrace at the head of a ravine to the S. W. Dip about 45°. Correlations with Rhode Island No. 4 will be made by subtracting about 200 feet. But this implies a very considerable fault (See Pl. IX.) between 4 and 1 since from 1 to the line of strike of 4 is 488 feet, the elevation is not very different, so that the difference should be about (488 x sin dip) 360 feet or so. Thus, the difference is 160 feet less than might be expected corresponding to a fault with a horizontal displacement of the northeast side to the north of about 215 feet.

The correlation between drill holes 2 and 1 which are across the strike from each other is such that it is probable that the fault passes between 2 and 1, Hole 2 being on the same side of the fault as Hole 4. Compare also the note on Bed 25 of Hole 4. This would determine the strike of the fault as not far from N. 26° W. Any reasonable correlation of drill holes 2 and 1 gives much too steep a dip. The samples of 1 have not been all looked over by Lane. The record runs as follows:

1. "Overburden 95
2. Trap to 142′ 10″ (48)
3. Epidote to 146′ 5″ (6)
Sandstone to 148′ 3″
Cf. R. I. 4 at 73 ft., and also R. I. 4 at 514 ft.
This latter correlation, while not in harmony with those below, would give a dip fairly in harmony with that from 4 to 2 as though the top of 1 might not be displaced in relation to R. I. 4 at 514
4. (92)
"Vein and trap to 153′ 2″
"Epidote 153′ 8″
"Vein 156′ 10″
"Trap 177′ 2″
"Epidote 179′
showing very pretty samples of copper
"Trap 187′ 10″
"Epidote 191′ 3″
"Trap 208′ 3″
"Trap 240′ 1″
5. "Vein first 254
"Mixed vein and trap 260′ 6″
"Epidote; a little copper 266′ 7″
"Trap 287′ 10″ (34)
6. "Vein 288′ 3″
"Trap 304′ 11″ (17)
"Vein; a little copper 305′ 11″
"Trap 342′ 6″ (38) Cf. R. I. 4,
(59). 541-611
A coarse ophite
(60). 7. "Vein second to 361′ 8″ (19)
"Trap to 373′ 8″" (12) (31)
This is the Kearsarge foot, with large porphyritic labradorite
(61). "Vein to 374′ 8″
"Trap (5″ of epidote showing copper) 383′ 1
"Trap to 499′ 6″" (125) (157)
The sample is the porphyritic ophite, the Kearsarge foot.
From 465 to 478 is a marked 3 mm. ophite. Cf. R. I. 4. 706
"Mixture of trap and vein"
A little copper to 532′ 10″
At 502 white and green, and laumontitic to 507
At 512 fine grained
8. (39)
Copper bearing amygdaloid to 529-532
(61)? "Trap to 550′ 6″"
2 mm. ophite at 547
"Trap to 551"
(62). 9. Wolverine sandstone? No. 9
"Conglomerate showing copper 551 to 551′ 6″" (1)
Cf. R. I. 4.746
(63). 10. "Trap -579
"Trap and epidote -580′ 7″
"Epidote -584′ 7″
"Trap -614′ 8″" End (63)

Rhode Island drill hole 3. 110 feet N., 3280 feet E. of S. W. corner of Sec. 4, T. 55 N., R. 33 W. and 187 feet across strike from S. Q. P. of Sec. 4. It was put down at an angle of 56° to the N. 50° W., through 90 feet of overburden with the idea of following the lode. It went out of the lode but kept on for 500 feet. It was probably directed too steep, not allowing for the fault just mentioned.

Rhode Island drill hole 2. 210 feet N., 2450 feet E. of S. W. corner of Sec. 4, T. 55 N., R. 33 W. 157 feet across strike from 3 and 344 feet from the South quarter post. Elevation about 521 above Lake Superior (6 feet higher than No. 1). Dip 45° for hole. The correlation of d 2. 157 and d 4. 746 implies for the strata a dip of 52° 50′.

1. Overburden 110
2. Ophite
Trap to 112.6
(60). 3. Kearsarge amygdaloid and labradorite ophite (20)
Amygdaloid R. I. d 2. 111.6-117.5 (5)
Trap d 2. 117.5-131 (15)
Broken, but with characteristic feldspar crystals an inch (25 mm.) long on a fine grained ground. This does not seem to be Belt 62 in full, perhaps cut out by the fault.
(61). 4. Kearsarge amygdaloid and labradorite ophite (26)
Amygdaloid d 2. 131-136 (5)
Red and green epidotic
Trap d 2. 136-157 (21)
Trap and coarse amygdaloid with porphyritic labradorite an inch long. The amygdules have heavy chlorite borders, white centers.
Matches R. I. d 4. 725-746.
(62). 5. Wolverine sandstone No. 9 (6)
Epidotic conglomerate d 2. 157 to 159
Then finer cold gray to 160
Good conglomerate core to 163
Matches R. I. d 4. 746-752
6. Vein or fault? (15)
Broken sludge and amygdaloid vein 163 to 178 end.
This may be part of the fault separating 1 and 2 if it has a strong easterly dip.
If R. I. d 4. 746=d 2. 157 then as 4 is 6 feet higher and at an angle of 45° a point at 8 feet down in R. I. 4 will be at the same elevation as R. I. 2 at 0, and a point at R. I. d 4. 589 feet will correspond to the beginning of No. 2. The distance at right angles to the general strike between R. I. 4 at 8 or R. I. 2 at 0 would be 731 feet and the consequent dip=tan-1 $\frac{416}{731-416}$=52° 50′
This is quite a reasonable dip. Rhode Island No. 1 shaft dips 50° 16′. No. 2 dips 49°$\frac{2}{3}$, and the dip on the Kearsarge conglomerates in the long cross-cut is 52.5°.
But R. I. d 1 seems to have the Wolverine at 551 feet, and is 6 feet lower, and is but 249 feet from 2. Hence a point in No. 1 at 8 feet will be (249-8) 241 horizontally from No. 2 at 0 while the corresponding point of the beds to No. 2 at 0 feet will be in No. 1 at 394 feet, and that would be nearly under it but actually a little

S. E. about 12 feet. So that the dip would be steep to the southeast. Such a dip is out of the question and then if the fault did not incline eastward itself No. 2 would have to be crossed by it were it not for the 110 feet of drift. It may be crossed anyway at 117 to 126 feet.

§12. ARCADIAN (FIGS. 41 AND 42.)[1]

This was one of he earliest complete sections and was done under the direction of R. C. Pryor for the Arcadian Copper Company, (A. C. Burrage, Pres.). The locations of the holes have not in all cases been precisely surveyed. The elevations are about 540′ A. L. S. in T. 55 R. 33.

They are approximately as follows:

Above Lake Superior	Elevation	Feet N.	Feet	From Point	Section
5	513	4130	830 E	S. Q. P.	18
6	525	3760	700 E.		
8	535	2600	420 W.		
7	522	2360	970 W.	S. Q. P.	18
1					
2					
19			At 2700 N. W. across strike from No. 2 shaft		
20		1830	230 W.	S. Q. P.	19
21		1640	236 W.		
22					
4	N. W. end of 8th level cross-cut which was 432′ in[2]				
3	S. E. " " " " "				
					30
9			480 S. E.	across strike from shaft	Douglas
10			939 S. E.	across strike from shaft	Douglas
11			1210′	across strike from shaft	Douglas
12	200′ N. E. of No. 11		1250′	across strike from shaft	Douglas
13	200′ S. E. of No. 11		1200′	across strike from shaft	Douglas
14			1748	across strike from shaft	Douglas
15			2038	across strike from shaft	Douglas
16			2518	across strike from shaft	Douglas

The last set of holes from 9 to the end were located by a set of coordinates parallel to the strike of the lode at the Arcadian N. 37° 49′ E. . . . . (R. C. Pryor)

[1]In envelope. This is earlier drilling; not that done by the reorganized company. See Appendix, and also Plates IX and X.
[2]These holes are shown on Fig. 42, but their numbers have been accidentally omitted.

These locations were derived from R. C. Pryor and correspond to the section in Figure 42. But Supt. Shields says he thinks 7 was down near the Albany and Boston conglomerate then and above 8, in which case it might cut the Houghton conglomerate. He also says that they sank on the "St. Mary epidote"—the Mesnard epidote of some reports (See Vol. I, Pt. II, p. 85). It was 51 feet over to the Albany and Boston, which was 72 feet thick.

Abstract of Arcadian Cross-Section.

Belt No.			Feet
1.	First bed, Hole 5	(32) +	
	Base of first bed above the Allouez 15 glomeroporphyrites, and Tobin porphyrites		(760)
	Base of Quincy Hanging and Tobin, Hole 6, 35-57 glomeroporphyrites		(509)
	Base of St. Mary's epidote		(90)
19.	Allouez conglomerate, is Albany & Boston, is Marvines No. 15.		
	Beginning of Arcadian Hole 8 about (820) below the Allouez base.		
38.	Base of Calumet & Hecla conglomerate (8.358) about 1100 feet below the Allouez base.		
	Base of Osceola hanging		about 1507 feet
	Four heavy ophites between		
	Base of Kearsarge-North Star		about 1942 feet
42.	The Kearsarge-North Star conglomerate is apparently Marvine's Nos. 10, 11, 12.		
	Hanging of Kearsarge is a heavy ophite d 1. 262-385. Above is quite amygdaloid.		
	Base of hanging of Kearsarge amygdaloid (726 feet) below the base of the Kearsarge.		
	Kearsarge foot is a markedly plagiophyric ophite (109) feet thick.		
	The base of the Wolverine sandstone is (866) feet below the base of the Kearsarge. (2835) feet below the Allouez base.		
			(2835)
64.	The Wolverine sandstone is probably Marvine's No. 9		
	Down to 76 *feldspathic* ophites with frequent *scoriaceous* amygdaloids and a tendency to glomeroporphyritic texture, much better developed in the Torch Lake and Central Mine section.		
76.	Epidotized copper bearing sandstone (968) feet below the base of the Wolverine sandstone.		
	Arc 20 has doleritic and inclusion beds down to 45; below the base of the Wolverine sandstone.		(1650) feet
92.	Down to 92 hanging of Arcadian mainly ophites; below the base of the Wolverine sandstone.		(2450) feet
	Ophites and inclusion beds		
106.	Conglomerate 8, base below the base of the Wolverine sandstone		(3015) feet
	below the Allouez base		(5840) feet