

Operator: Clinchfield Coal Corporation

Farm: J. C. Rasnick

Well No: 103

Location: Dickenson County

2950' S. of 37°05') approximate

37°-04'-31"
82°-21'-02"

5150' W. of 82°20')

Elevation: 1504.3' Ground

Total Depth: 3910'

Drilling Commenced: May 6, 1949

Well Completed: October 18, 1949

Results: Gas Well

Samples examined by Jean Sherman (1-1629' and 3342-3910') and Allen D. Williamson, U. S. Geological Survey, Lexington, Kentucky, June, 1950.

GEOLOGICAL LOG

<u>Depth Interval</u> (feet)	<u>Lithology</u>
1-11	Sandstone, yellowish gray (5Y 8/1), fine-grained to coarse-grained, subangular, poorly sorted, moderately porous, silty, slightly micaceous, scattered argillaceous material, scattered green material; 90% quartzose.
11-20	Like sample 1-11.
20-28	Sandstone, very light gray (N8), fine-grained to coarse-grained, subangular, poorly sorted, moderately porous, silty, slightly micaceous, scattered argillaceous material and green mineral; 90% quartzose.
32-40	No sample.
40-46	Siltstone, medium light gray (N6), slightly micaceous, sandy, non-calcareous.
46-52	Siltstone, medium light gray (N6), to medium dark gray (N4), slightly micaceous, sandy, non-calcareous.
52-60	Siltstone, medium light gray (N6), to medium dark gray (N4), slightly micaceous, sandy, non-calcareous; sandstone, very light gray (N8), fine-grained to coarse-grained, subangular to subrounded, silty, slightly micaceous, 90% quartzose.
60-68	Siltstone, medium light gray (N6), to medium dark gray (N4), slightly micaceous, sandy, non-calcareous.
68-74	Siltstone, very light gray (N8) to medium gray (N5), slightly micaceous

sandy; sandstone, very light gray (N8), fine to coarse-grained, sub-angular, slightly micaceous, 90% quartzose.

- 74-78 Sandstone, very light gray (N8), fine to coarse-grained, subangular, poorly sorted, silty, slightly micaceous, scattered argillaceous and green material, 90% quartzose.
- 78-83 Sandstone, very light gray (N8), very fine-grained to fine-grained, subangular, poorly sorted, slightly porous, slightly micaceous, slightly calcareous, abundant argillaceous material, sideritic nodules, 75% quartzose.
- 83-90 Like 78-83.
- 90-95 Like 83-90.
- 95-100 Sandstone, very light gray (N8), fine-grained, subangular to subrounded, moderately well sorted, slightly porous, moderately silty, slightly calcareous, scattered argillaceous material, 90% quartzose.
- 100-107 Like 95-100 with few sideritic nodules.
- 107-113 Siltstone, medium dark gray (N4), argillaceous, with little medium gray (N5), argillaceous shale.
- 113-121 Like 107-113.
- 121-126 Like 113-121.
- 126-135 Like 121-126; with shale, dark gray (N3), carbonaceous.
- 135-140 Siltstone, medium light gray (N6); with little shale, medium gray (N5) carbonaceous.
- 140-145 Siltstone, medium gray (N5), slightly micaceous, some argillaceous material; shale, medium dark gray (N4), carbonaceous.
- 145-150 Sandstone, very light gray (N8), fine-grained to coarse-grained, sub-angular to subrounded, poorly sorted, some flakes of mica, scattered green mineral, silt cement, slightly porous; shale, medium dark gray (N4), fissile; siltstone, medium dark gray (N4), carbonaceous.
- 150-155 Like 145-150.
- 155-161 Like 150-155.
- 161-169 Siltstone, medium gray (N5), slightly micaceous, little sandy; shale,

dark gray (N3), carbonaceous, fissile.

- 169-175 Like 161-169; few pieces coal and few sand grains, some mica and scattered green mineral.
- 175-183 Siltstone, medium gray (N5), slightly micaceous, shale, dark gray (N3), carbonaceous, fissile; sandstone, light gray (N7), fine- to coarse-grained subangular to subrounded, very slightly micaceous, slightly porous, silt cement.
- 183-189 Like 175-183.
- 189-192 Siltstone, light gray (N7), slightly micaceous, slightly sandy; shale, dark gray (N3), as 175-183; sandstone, light gray (N7), fine- to medium-grained, subangular, moderately well sorted, slightly porous, silt cement, scattered green mineral; few pieces coal; much iron-staining and bit fragments.
- 192-198 Sandstone, very light gray (N8), fine- to medium-grained, subangular to subrounded, flakes of mica, scattered green mineral, silt cement, slightly porous 3/4 quartzose; iron staining and bit fragments.
- 198-202 Sandstone, like 192-198, grains more angular.
- 203-206 Sandstone, yellowish gray (5Y 8/1), very fine- to medium-grained, subangular to rounded, flakes of mica, scattered green mineral, silt cement, slightly porous, 3/4 quartzose; some coal and some iron staining.
- 206-210 Sandstone, very light gray (N8), fine- to medium-grained, subrounded to subangular, flakes of mica, scattered green mineral, silica cement with little silty cement, moderately porous, 3/4 quartzose; abundant argillaceous material; some iron staining.
- 210-215 Like 206-210.
- 215-216 Like 210-215 with little siderite.
- 216-224 Sandstone, light gray (N7), fine- to medium-grained, subrounded to rounded, little mica, scattered green mineral, silt and silica cement, slightly porous, much argillaceous material, 3/4 quartzose.
- 220-224 Like 216-224.
- 224-229 Like 220-224; sample dirty; some argillaceous material.
- 229-235 Sample dirty, like 224-229.

- 235-237 Sandstone, very light gray (N8), very fine- to fine-grained, subangular to subrounded, some mica, scattered green mineral, some argillaceous material, silt cement, moderately porous, 3/4 quartzose.
- 237-246 Shale, silty, medium dark gray (N4), carbonaceous, fissile; with some sandstone, like 235-237.
- 246-251 Like 237-246; with some siltstone, medium gray (N5), slightly micaceous, little sandy; no sandstone.
- 251-256 Siltstone, medium gray (N5), and medium dark gray (N4), slightly micaceous, sandy; with little shale, medium dark gray (N4), silty, moderately fissile.
- 256-260 Like 251-256.
- 260-270 Sample very dirty; probably like 256-260.
- 270-275 Shale, medium dark gray (N4), silty, moderately fissile.
- 275-280 Like 270-275.
- 280-286 Like 275-280.
- 286-290 Sample very dirty, probably like 280-286.
- 290-294 Siltstone, medium light gray (N6), slightly micaceous, sandy; and shale, medium dark gray (N4), slightly silty, moderately fissile.
- 294-298 Siltstone, like 290-294; shale, dark gray (N3), some silty, carbonaceous, fairly fissile; with sandstone, light gray (N7), and medium light gray (N6), fine- to medium-grained, subangular, moderately well sorted, slightly porous, silt cement, about 3/4 quartzose.
- 298-300 Sandstone, light gray (N7), silty, fine-grained, subangular to subrounded, slightly micaceous, abundant argillaceous material, moderately porous, 3/4 quartzose.
- 300-302 Sandstone, like 298-300, with more argillaceous material, and some siderite.
- 302-305 Sandstone, medium light gray (N6), fine- to medium-grained, subangular to subrounded, slightly micaceous, moderately porous, silt cement, about 3/4 quartzose; little siltstone, like 290-294; shale, grayish black (N2), very carbonaceous, fissile; one piece pyrite.

- 305-310 Siltstone, medium light gray (N6) and medium gray (N5), slightly micaceous, some sandy; shale, medium dark gray (N4), silty, carbonaceous, moderately fissile.
- 310-314 Like 305-310.
- 314-320 Like 310-314; with few sand grains.
- 320-323 Siltstone, light gray (N7), sandy, slightly micaceous; shale, dark gray (N3), carbonaceous, moderately fissile.
- 323-324 Like 320-323.
- 324-328 Sandstone, very light gray (N8), very fine- to fine-grained, subangular to subrounded, slightly micaceous, silt cement, slightly porous, 3/4 quartzose; shale, dark gray (N3), carbonaceous, moderately fissile; siltstone, medium light gray (N6), slightly micaceous, sandy.
- 328-330 Like 324-328.
- 330-336 Shale, medium dark gray (N4), and dark gray (N3), slightly silty, fairly fissile.
- 336-343 Shale, dark gray (N3), very carbonaceous, fissile; little coal.
- 343-348 Sandstone, light gray (N7), very fine- to fine-grained, subangular to subrounded, slightly micaceous, silt cement, slightly porous, 3/4 quartzose; with shale, medium dark gray (N4), carbonaceous, fairly fissile; little coal.
- 348-353 Sandstone, very light gray (N8), very fine- to fine-grained, subangular to founded, slightly micaceous, very little scattered green mineral, silt cement, moderately porous, about 3/4 quartzose; with scattered fragments of shale, dark gray (N3), fairly fissile; and siltstone, medium dark gray (N4), slightly micaceous, some sandy.
- 353-355 No sample.
- 355-357 Sandstone, very light gray (N8), very fine-grained to fine-grained, subangular to subrounded, slightly micaceous, scattered green mineral, silt cement, slightly porous, about 3/4 quartzose; with less scattered fragments of shale and siltstone, like 348-353.
- 357-359 Sandstone, like 355-357; with numerous bit fragments.
- 359-360 Like 357-359.

- 360-361 Like 359-360.
- 361-362 Like 360-361; with few pieces of coke.
- 363-365 Like 361-362.
- 365-366 Sandstone, white (N9), very fine- to fine-grained, subangular to subrounded, flakes of mica, scattered green mineral and some argillaceous material, fairly well sorted, silt cement, moderately porous, about 3/4 quartzose.
- 368-370 Sandstone, white (N9), very fine- to medium-grained, angular to subangular, with some subrounded, slightly micaceous, scattered green mineral and some argillaceous material, silt cement, slightly porous, about 90% quartzose.
- 370-372 Like 368-370; with little brown mineral.
- 372-374 Like 370-372.
- 374-376 Like 372-374 with bit fragments.
- 376-377 Like 374-376.
- 377-378 Like 376-377.
- 378-380 Like 377-378.
- 380-381 Sandstone, white (N9), very fine- to fine-grained, subangular to rounded, few flakes mica, little scattered green mineral, moderately well sorted, silt cement, moderately porous, about 90% quartzose.
- 381-383 Like 380-381.
- 383-385 Sandstone, like 381-383, better sorting and less carbonaceous and argillaceous material.
- 385-386 Sandstone, white (N9), fine- to medium-grained, subangular to subrounded, flakes of mica, little green mineral, moderately porous, about 90% quartzose.
- 386-387 Like 385-386 with numerous bit fragments.
- 387-390 Shale, dark gray (N3), some silty, carbonaceous, fairly fissile; with some sandstone, like 386-387.
- 390-392 Shale, like 387-390; with less sandstone.
- 392-394 Shale, olive gray (5Y 4/1), some silty, carbonaceous, moderately fissile.

- 394-402 Shale, medium dark gray (N4), little silty, fairly fissile.
- 402-412 Shale, medium dark gray (N4), fairly silty, moderately fissile, with scattered, medium-grained quartz grains.
- 412-418 Shale, dark gray (N3), fairly silty, slightly micaceous, moderately fissile, with few scattered quartz grains.
- 418-423 Like 412-418.
- 423-428 Like 418-423.
- 428-431 Like 423-428; sample dirty.
- 431-436 Sandstone, very light gray (N8), fine- to medium-grained, sub-angular to subrounded, slightly micaceous, fairly well sorted, slightly silty, abundant argillaceous material, silt cement, moderately porous, about 3/4 quartzose; with some shale, like 428-431.
- 436-442 Like 431-436.
- 442-447 Like 436-442.
- 447-452 Like 442-447.
- 452-457 Like 447-452; with few pieces of siltstone, medium gray (N5), slightly micaceous, sandy.
- 457-465 Shale, medium dark gray (N4), silty, slightly micaceous; with siltstone, like 452-457.
- 465-472 Shale, like 457-465; with few fine-grained quartz grains.
- 472-479 Shale, like 465-472; with siltstone, medium light gray (N6), silty slightly micaceous.
- 479-488 Like 472-479.
- 488-495 Like 479-488.
- 495-504 Shale, medium dark gray (N4), some silty, slightly micaceous, moderately fissile.
- 504-512 Shale, like 495-504.

- 512-520 Shale, like 504-512; little siltstone, medium gray (N5), micaceous, shaly.
- 520-530 Shale, dark gray (N3), carbonaceous, fissile; shale, medium dark gray (N4), slightly calcareous, silty, slightly micaceous, moderately fissile.
- 530-535 Shale, medium dark gray (N4), little silty, carbonaceous, moderately fissile, sample dirty.
- 535-538 No sample.
- 538-548 Shale, like 530-535; little sandstone, very light gray (N8), very fine-grained, subrounded, slightly micaceous, silt cement, slightly porous, about 3/4 quartzose.
- 548-555 Shale, like 538-548.
- 555-562 Shale, medium dark gray (N4), carbonaceous, little micaceous, fissile.
- 562-571 Shale, like 555-562.
- 571-574 Shale, like 562-571; and shale, medium gray (N5), micaceous, carbonaceous, moderately fissile.
- 579-586 Like 571-574.
- 586-589 Shale, like 579-586; with little sandstone, very light gray (N8), very fine- to fine-grained, subrounded, little green, slightly micaceous, some argillaceous material, silt cement, moderately porous, 3/4 quartzose.
- 589-594 Like 586-589.
- 594-597 Like 589-597 with few pieces coal.
- 597-600 Like 594-597.
- 600-603 Like 597-600.
- 603-607 Sandstone, white (N9), very fine- to medium-grained, subrounded, to rounded, very slightly micaceous, little argillaceous material,

silt cement, moderately porous, 90% quartzose; with shale, dark gray (N3), little silty, slightly micaceous, carbonaceous, moderately fissile.

- 607-609 Sandstone, like 603-607; with little scattered green mineral; shale, like 603-607.
- 609-612 Sandstone, like 607-609; shale, like 609-612; few pieces of shale, grayish red (5R 4/2), silty, micaceous, fissile.
- 612-615 Sandstone, white (N9), very fine- to medium-grained, subangular to subrounded, scattered green mineral, little mica, some argillaceous material, silt cement, moderately porous, 90% quartzose; shale, like 609-612; no grayish red shale, like 612-615.
- 615-618 Like 612-615.
- 618-621 Sandstone, like 615-618, with little iron staining; shale, like 612-615; siltstone, medium dark gray (N4), slightly micaceous, sandy.
- 621-624 Shale, dark gray (N3), very carbonaceous, fissile; shale, medium dark gray (N4), silty, slightly micaceous, moderately fissile; sandstone, like 618-621.
- 624-626 Sandstone, white (N9), very fine- to fine-grained, subangular to subrounded, few flakes of mica, little silty, slightly porous, silica cement, about 95% quartzose; shale, dark gray (N3), very carbonaceous, fissile.
- 626-629 Sandstone, like 624-626, slightly calcareous; little limestone, light brownish gray (5YR 6/1), finely crystalline, dense; shale, like 624-626.
- 629-633 Sandstone, like 626-629, with few clear quartz grains, shale, like 626-629; and little limestone, medium light brownish gray (5YR 5/1), dense to finely crystalline, silty.
- 633-637 Sandstone, like 629-633 with few pieces angular, clear quartz grains; with shale, like 629-633.
- 637-640 Like 633-637.
- 640-643 Like 637-640.
- 643-650 Sample very dirty; sandstone, limestone, and shale, like 640-643.

- 650-653 Sample dirty; like 643-650.
- 653-658 Like 650-653.
- 658-661 Sandstone, white (N9), very fine-grained, to medium-grained,
angular to rounded, some clear and frosted, little scattered
green mineral, few flakes of mica, silica cement, slightly
porous, about 95% quartzose; limestone, like 629-633; shale,
like 629-633.
- 661-665 Sandstone, like 658-661; shale, medium dark gray (N4), slightly
calcareous, carbonaceous, moderately fissile; limestone, like
629-633.
- 665-667 Sandstone, like 661-665 with some secondary quartz over-growths;
limestone and shale, like 661-665.
- 667-670 Like 665-667.
- 670-673 Like 667-670; little coal.
- 673-679 Sandstone, white (N9), fine-grained to medium-grained, angular
to subangular, moderately well sorted, silica cement, slightly
porous, some clear quartz grains, about 95% quartzose; limestone
like 670-673; shale, medium dark gray (N4), silty, slightly mica-
ceous, fissile.
- 679-685 Shale, dark gray (N3), very carbonaceous, slightly micaceous,
little silty, fissile.
- 685-695 Like 679-685.
- 694-697 Shale, medium dark gray (N4), silty, slightly micaceous, moderately
fissile; with little siltstone, medium gray (N5), micaceous.
- 697-700 Sandstone, very light gray (N8), fine- to medium-grained, angular
to subrounded, poorly sorted, silty, little mica, little scattered
green material, silt cement, moderately porous, about 3/4
quartzose; limestone, brownish gray (5YR 5/1), dense, finely
crystalline; shale, medium dark gray (N4), slightly micaceous,
little silty, moderately fissile.
- 700-705 Sandstone, like 697-700, with little calcareous cement; limestone
and shale, like 697-700.
- 705-708 Like 700-705 with little coal.
- 708-712 Like 705-708 with numerous iron fragments.

- 708-712 Sandstone, very light gray (N8), calcareous, very fine- to fine-grained, subangular to subrounded, poorly sorted, slightly micaceous, scattered green mineral, some argillaceous material, silt cement, moderately porous, about 3/4 quartzose; limestone, medium light brownish gray (5YR 5/1), dense, finely crystalline; shale, medium dark gray (N4), carbonaceous, little mica, little silty, fissile.
- 712-717 No sample.
- 717-720 Like 708-712.
- 720-725 Like 717-720 with less limestone and shale fragments.
- 725-731 Like 723-725.
- 731-738 Like 725-731 with few coal fragments.
- 738-746 Sandstone, like 731-738, with some silica cement; limestone, and shale, like 731-738.
- 746-756 Shale, medium gray (N5), micaceous, silty, moderately fissile.
- 756-762 Like 746-756.
- 762-770 Shale, like 756-762; little siltstone, medium light gray (N6), very micaceous, and argillaceous.
- 762-770 Shale, medium dark gray (N4), silty, slightly micaceous, (two samples for same interval).
- 770-780 Siltstone, medium dark gray (N4), micaceous, sandy.
- 780-790 Like 770-780 with shale, dark gray (N3), very carbonaceous, fissile.
- 790-798 Like 780-790.
- 798-806 Like 790-798.
- 806-812 Like 798-806.
- 812-817 Siltstone, very light gray (N8), very fine- to fine-grained, subangular to subrounded, little calcareous, little silty, slightly micaceous, moderately well sorted, silt or calcareous cement, moderately porous, about 3/4 quartzose; shale, medium dark gray (N4), silty, micaceous, slightly fissile.

- 817-826 Shale, dark gray (N3), micaceous, silty, fissile; sandstone and siltstone, like 812-817.
- 826-833 Shale, grayish black (N2), very carbonaceous, fissile; siltstone and sandstone, as 817-826.
- 833-842 Shale, dark gray (N3), very carbonaceous, fissile; siltstone and sandstone, like 826-833.
- 842-849 Shale, medium dark gray (N4), carbonaceous, fissile; siltstone, medium gray (N5), micaceous, sandy; sandstone, like 833-842.
- 849-855 Like 842-849.
- 855-864 Like 849-855.
- 864-873 ⁷⁴⁶ Sandstone, very light gray (N8), fine- to medium-grained, subangular to subrounded, argillaceous material, moderately well sorted, few flakes of mica, silt cement, moderately porous, about 3/4 quartzose; little shale, medium dark gray (N4), little silty, very carbonaceous, moderately fissile; little siltstone, light gray (N7), very micaceous, sandy.
- 873-883 Like 864-873, with fewer shale and siltstone fragments.
- 883-890 Shale, medium dark gray (N4), carbonaceous, little silty, fissile; and little sandstone, like 873-883.
- 890-896 Like 883-890.
- 896-902 Like 890-896.
- 902-920 Sample very dirty; probably like 896-902.
- 920-925 Like 902-920.
- 925-934 Shale, dark gray (N3), very carbonaceous, little silty, fissile; with little siltstone, medium gray (N5), micaceous, sandy.
- 934-940 Like 925-934.
- 940-944 Sandstone, very light gray (N8), very fine- to fine-grained, subangular to subrounded, little mica, some argillaceous material, poorly sorted, silt cement, slightly porous, about 3/4 quartzose; shale, grayish black (N2), little mica, very carbonaceous, fissile; numerous iron fragments.

- 944-955 Like 940-944 with few coal fragments.
- 952-965 Sandstone, like 944-955, with little scattered green mineral; shale, like 944-955; no iron fragments.
- 965-971 Sandstone, like 952-965, slightly calcareous; shale, medium dark gray (N4), little micaceous, silty, slightly silty.
- 971-978 Sample like 965-971.
- 978-983 Sandstone, like 971-978; shale, medium gray (N5), slightly micaceous, little sandy, moderately fissile.
- 983-986 Sandstone, white (N9), very fine- to fine-grained, subangular to subrounded, moderately well sorted, flakes of mica, argillaceous material, little scattered green mineral, silt cement, moderately porous; siltstone, medium light gray (N6), slightly micaceous, silty; shale, medium gray (N5), slightly micaceous, sandy, moderately fissile.
- 981-992 Sandstone, like 983-986, slightly calcareous; shale, like 983-986.
- 992-995 Sample like 981-992.
- 995-1006 Shale, medium dark gray (N5), very little silty, very carbonaceous, fissile.
- 1006-1016 Shale, medium dark gray (N4), silty, carbonaceous, moderately fissile.
- 1016-1024 Like 1006-1016.
- 1024-1032 Sandstone, medium light gray (N8), very fine- to fine-grained, subangular to subrounded, moderately well sorted, flakes of mica, silt cement, moderately porous, about 3/4 quartzose; shale, medium dark gray (N4), slightly micaceous, silty, moderately fissile.
- 1032-1042 Sandstone, like 1024-1032; with shale, dark gray (N3), very carbonaceous, silty, fissile, sample contains more argillaceous material.
- 1042-1048 Sandstone, light gray (N7), very fine-grained, subangular to subrounded, moderately well sorted, little mica, silica cement, moderately porous, about 90% quartzose; shale, medium dark gray (N4), little mica, silty, moderately fissile; numerous pieces of coal.

- 1048-1057 Like 1042-1048.
- 1057-1059 No sample.
- 1059-1068 Siltstone, medium gray (N5), very micaceous; sandstone, like 1042-1048.
- 1068-1080 Sample like 1059-1068; with shale, dark gray (N3), very carbonaceous, fissile.
- 1080-1090 Like 1068-1080.
- 1090-1097 Like 1080-1090.
- 1097-1105 Sandstone, very light gray (N8), fine- to medium-grained, sub-angular to subrounded, argillaceous material, moderately well sorted, silt cement, moderately porous, few mica flakes, little scattered green mineral, about 3/4 quartzose; little siltstone, medium light gray (N6), little micaceous; shale, medium dark gray (N4), slightly micaceous, fissile; little coal; bit fragments and much iron staining.
- 1105-1110 Sandstone, like 1097-1105, with few pieces of shale, like 1097-1105, no coal.
- 1110-1118 Sandstone, very light gray (N8), very fine- to fine-grained, subangular to subrounded, flakes of mica, argillaceous material, poorly sorted, little scattered green mineral, silica cement, moderately porous, about 3/4 quartzose; very little limestone; little shale, dark gray (N3), finely micaceous, fissile.
- 1118-1127 Sample like 1110-1118, no limestone.
- 1127-1133 Sandstone, very light gray (N8), very fine- to medium-grained, subangular to subrounded, flakes of mica, argillaceous material, poorly sorted, silt cement, slightly porous, about 3/4 quartzose; shale, dark gray (N3), finely micaceous, very carbonaceous, fissile.
- 1133-1137 Sandstone, like 1127-1133; with very little limestone, medium light brownish gray (5YR 6/1), dense, finely crystalline; shale, grayish black (N2), very carbonaceous, fissile; little siltstone, medium light gray (N6), slightly micaceous.
- 1137-1143 Sandstone, like 1133-1137; shale, medium dark gray (N4), to dark gray (N3), slightly micaceous, little silty, moderately fissile.

- 1143-1149 Sandstone, like 1137-1143; shale, medium gray (N5), micaceous, little silty, moderately fissile.
- 1149-1157 Sandstone, very light gray (N8), very fine- to medium-grained, subangular to subrounded, poorly sorted, flakes of mica, silty scattered green and argillaceous material, silt cement, slightly porous, about 3/4 quartzose.
- 1157-1165 Sandstone, like 1149-1157, with little siltstone, medium dark gray (N4), slightly micaceous, little sandy; shale, medium dark gray (N4), very carbonaceous, finely micaceous, fissile.
- 1165-1177 Shale, dark gray (N3), very carbonaceous, finely micaceous, fissile, siltstone, medium gray (N5), micaceous, sandy.
- 1177-1182 Shale, medium dark gray (N4), finely micaceous, very carbonaceous, fissile; with little sandstone, very light gray (N8), very fine-grained, well sorted, little micaceous, little argillaceous material silica cement, slightly porous, about 90% quartzose; few pieces of coal.
- 1182-1185 Shale, like 1177-1182, more silty; few pieces shale, moderate red (5R 4/6), hematitic, some moderate brown (5YR 4/4) limonitic; little sandstone, like 1177-1182; little coal. (Two samples for same interval).
- 1185-1192 Like 1182-1185 (Two samples for same interval).
- 1192-1200 Shale, medium dark gray (N4), micaceous, little silty; siltstone, medium light gray (N6), slightly micaceous; and little shale, grayish red (5R 4/2) to moderate red (5R 5/4).
- 1200-1207 Siltstone, medium dark gray (N4), slightly micaceous; little sandstone, like 1182-1185; few pieces coal.
- 1207-1215 Sandstone, light gray (N7), very fine- to fine-grained, subangular to subrounded, moderately well sorted, little argillaceous silica cement, little micaceous, slightly porous, about 90% quartzose; shale, medium dark gray (N4), slightly micaceous, moderately fissile; little coal.
- 1212-1219 Sandstone, like 1207-1215; shale, dark gray (N3), very carbonaceous, fissile; little coal.
- 1219-1225 Shale, dark gray (N3), and medium dark gray (N4), finely micaceous, little silty, fissile; little sandstone, like 1212-1219.
- 1236-1242 Shale, medium dark gray (N4), micaceous, little silty, moderately fissile.
- 1242-1254 No sample.

- 1254-1260 Shale, medium dark gray (N4) to dark gray (N3), very finely micaceous, very carbonaceous, moderately fissile.
- 1260-1266 Like 1254-1260, with little sandstone, like 1219-1225; few pieces coal.
- 1266-1277 Like 1260-1266; few pieces coal.
- 1277-1285 Shale, medium dark gray (N4), finely micaceous, carbonaceous, fissile; siltstone, medium light gray (N7), sandy.
- 1285-1295 Shale, like 1277-1285; siltstone, calcareous, medium light gray (N6), micaceous, sandy.
- 1295-1301 Shale, medium gray (N5) to medium light gray (N6), finely micaceous, little silty, fissile.
- 1301-1312 No sample.
- 1312-1324 Shale, like 1295-1301.
- 1324-1334 Sandstone, white (N9), fine- to medium-grained, subangular to subrounded, slightly micaceous, poorly sorted, silt cement, slightly porous, about 90% quartzose; shale, dark gray (N3), very carbonaceous, fissile; shale, medium dark gray (N4), little micaceous, fissile.
- 1334-1342 Like 1324-1334, with little siltstone, medium light gray (N6), micaceous, sandy.
- 1342-1350 Sandstone, like 1334-1342 with some scattered green mineral; shale, like 1324-1334.
- 1350-1357 Like 1342-1350.
- 1357-1367 Like 1350-1357, with siltstone, little micaceous, sandy.
- 1362-1366 Sandstone, white (N9), very fine- to medium-grained, angular to subrounded, poorly sorted, little mica, little scattered green mineral, silt cement, slightly porous, about 90% quartzose; shale, medium dark gray (N4), carbonaceous, finely micaceous, moderately fissile; very iron-stained.
- 1366-1374 Shale, medium dark gray (N4), micaceous, fissile; siltstone, little light gray (N7), little micaceous, sandy.
- 1366-1374 Sample like 1362-1366.
- 1374-1377 Sandstone, white (N9), very fine- to fine-grained, subangular to subrounded, moderately well sorted, little micaceous, silt cement, about 90% quartzose; little coal.

- 1377-1385 No sample.
- 1385-1390 Sandstone, white (N9), very fine- to medium-grained, angular to subrounded, poorly sorted, silt cement, some argillaceous material, few fair mica, about 90% quartzose; shale, medium dark gray (N4), very carbonaceous, finely micaceous, moderately fissile; some iron staining.
- 1390-1393 Like 1385-1390; with pieces of angular, coarse-grained milky-white quartz.
- 1393-1394 No sample.
- 1394-1396 Like 1390-1393.
- 1396-1397 Like 1394-1396.
- 1397-1399 Like 1396-1397.
- 1399-1407 Like 1397-1399.
- 1402-1405 Like 1399-1407.
- 1405-1408 Sandstone, white (N9), very fine- to medium-grained, angular to subrounded, poorly sorted, silt cement, little scattered green mineral, little mica, slightly porous, about 90% quartzose; little shale, and milky quartz; like 1390-1393; little coal.
- 1408-1411 Like 1405-1408 with coal.
- 1411-1414 Sandstone, like 1408-1411; shale, dark gray (N3), very carbonaceous, fissile; little coal (cavings?).
- 1414-1416 Like 1411-1414.
- 1416-1418 Like 1414-1416.
- 1418-1419 Like 1416-1418.
- 1419-1421 Like 1418-1419, no coal.
- 1421-1424 Like 1419-1421.
- 1424-1428 Like 1421-1424.
- 1428-1432 Like 1424-1428; with coal (cavings?).
- 1432-1436 Like 1428-1432; with much iron staining.
- 1436-1438 Like 1432-1436.

- 1438-1440 Like 1436-1438.
- 1440-1445 Like 1438-1440.
- 1445-1449 Sandstone, very light gray (N8), very fine- to medium-grained, angular to subrounded, poorly sorted, scattered argillaceous, and green mineral, finely micaceous, silt cement, little calcareous, about 90% quartzose; shale, dark gray (N3), very carbonaceous, finely micaceous, fissile; siltstone, medium gray (N5), little silty, finely micaceous; iron staining.
- 1449-1455 Like 1445-1449; with few pieces coal (cavings ?).
- 1455-1459 Sandstone, white (N9), very fine- to medium-grained, angular to subrounded, poorly sorted, scattered argillaceous and green material, little mica, silt cement, about 95% quartzose; shale, dark gray (N3), silty, carbonaceous, slightly fissile; little coal.
- 1459-1466 Like 1455-1459.
- 1466-1471 Sandstone, white (N9), very fine- medium-grained, angular to rounded, moderately well sorted, little silty, scattered green mineral, flakes of mica, some silica cement, slightly porous; little shale, medium dark gray (N4), silty, little micaceous, moderately fissile; no coal fragments, iron staining.
- 1471-1474 Like 1466-1471.
- 1474-1476 Like 1471-1474.
- 1476-1480 Like 1474-1476; very fine- to fine-grained, better sorted.
- 1480-1483 Like 1476-1480.
- 1483-1484 Like 1480-1483.
- 1484-1487 Like 1483-1484; no iron staining.
- 1487-1490 Like 1484-1487, poorer sorting and iron staining.
- 1490-1497 Shale, medium gray (N5), to medium dark gray (N4), little silty, finely micaceous, moderately fissile; little sandstone, like 1497-1490.
- 1497-1505 Like 1490-1497; with few pieces coal.
- 1505-1514 Shale, medium dark gray (N4), finely micaceous, little silty, carbonaceous, fissile; shale, dark gray (N3), very carbonaceous, fissile.

- 1514-1516 Shale, like 1505-1514; large pieces of coal; sandstone, white (N9) to clear, fine-grained, well sorted, little carbonaceous, mica flakes, silica cement, about 95% quartzose; little siltstone, medium dark gray (N4), little micaceous, coal.
- 1516-1519 Like 1514-1516.
- 1519-1525 Like 1516-1519.
- 1525-1529 Coal; with little sandstone, like 1514-1516; shale, dark gray (N3), very carbonaceous, fissile; little siltstone, medium gray (N5), silty, micaceous.
- 1529-1531 Like 1525-1529.
- 1531-1533 Like 1529-1531.
- 1533-1534 Like 1531-1533, with little marcasite (?) in coal.
- 1534-1538 Like 1533-1534 with less coal.
- 1538-1539 Like 1534-1538.
- 1539-1541 Sandstone, white (N9), very fine- to medium-grained, angular to subrounded, poorly sorted, flakes of mica, little argillaceous material, silica cement and silt cement, slightly porous, about 90% quartzose; little shale, medium gray (N5), slightly micaceous and silty, moderately fissile; little coal; and angular flakes of milky white quartz.
- 1541-1543 Like 1539-1541; with shale, dark gray (N3), very carbonaceous, little micaceous, fissile; little coal.
- 1543-1545 Like 1541-1543.
- 1545-1549 Like 1543-1545 with much iron staining.
- 1549-1552 Like 1545-1549.
- 1552-1555 Sandstone, white (N9), very fine- to medium-grained, angular to rounded, poorly sorted, little scattered green mineral, some silica cement, about 95% quartzose; siltstone, medium dark gray (N4), micaceous, sandy; shale, dark gray (N3), very carbonaceous, fissile; angular pieces of milky white quartz- little iron staining.

- 1555-1560 Like 1552-1555; with little coal, sandstone, fine-grained to coarse-grained.
- 1560-1563 Like 1555-1560.
- 1563-1564 Like 1560-1563.
- 1564-1568 Like 1563-1564 with no coal or green mineral.
- 1568-1572 Like 1564-1568, micaceous, scattered green mineral; little coal, iron staining .
- 1572-1574 Like 1568-1572, very fine-grained to medium-grained.
- 1574-1577 Like 1572-1574 with no green mineral.
- 1577-1582 Like 1575-1577 with very little mica and scattered green mineral.
- 1582-1585 Like 1577-1582.
- 1585-1588 Like 1582-1585; less iron staining.
- 1588-1591 Like 1585-1588.
- 1591-1594 Like 1588-1591; no coal or siltstone.
- 1594-1596 Like 1591-1594; with coal.
- 1596-1599 Like 1594-1596.
- 1599-1600 Sandstone, white (N9) to very light gray (N8), very fine- to medium-grained, angular to subrounded, moderately well sorted, scattered argillaceous material and green mineral, little silty, silt and silica cement, moderately porous, about 95% quartzose; with little coal.
- 1600-1602 Like 1599-1600, poorer sorting and more argillaceous and carbonaceous material.
- 1602-1605 Like 1600-1602 with no coal.
- 1605-1611 Like 1602-1605.
- 1611-1619 Like 1605-1611, micaceous.
- 1619-1623 Like 1611-1619.
- 1623-1629 Like 1619-1623.
- 1629-1636 Sandstone, very light gray (N8), fine- to medium-grained,

subangular to subrounded, moderately well sorted, moderately porous, silty, 90% quartzose; siltstone, medium gray (N5), to medium dark gray (N4), sandy, micaceous; shale, dark gray (N3), carbonaceous, and coal.

- 1636-1637 Like 1629-1636.
- 1637-1640 Like 1636-1637.
- 1640-1643 Like 1637-1640.
- 1643-1648 Sandstone, very light gray (N8), very fine- to medium-grained, subangular, poorly sorted, silty, calcareous, 90% quartzose.
- 1648-1652 Like 1643-1648.
- 1652-1654 Like 1648-1652.
- 1654-1657 Sandstone, white (N9), medium-grained, subangular to subrounded, well sorted, moderately porous, calcareous, scattered carbonaceous material, 95% quartzose.
- 1657-1660 Like 1654-1657.
- 1660-1662 Like 1657-1660.
- 1662-1665 Like 1660-1662.
- 1665-1668 Like 1662-1665.
- 1668-1678 Siltstone, medium gray (N5), slightly sandy.
- 1678-1687 Like 1668-1678, and shale, medium dark gray (N4), silty.
- 1687-1698 Shale, like 1678-1687.
- 1698-1705 Like 1687-1698.
- 1705-1713 Like 1698-1705 with siltstone, medium gray (N5), calcareous.
- 1713-1718 Siltstone, medium light gray (N6), sandy, calcareous.
- 1718-1727 Like 1713-1718; and siltstone, grayish red (5R 4/2).
- 1732-1739 Like 1718-1727 and shale, medium gray (N5), with slight brownish tint, silty.
- 1739-1744 Sandstone, white (N9), fine-grained, subangular, poorly sorted, slightly porous, silty, micaceous, 3/4 quartzose; and shale, like 1732-1739.
- 1744-1751 Shale like 1739-1744; and grayish red (5R 4/2), silty.

- 1751-1756 Sandstone, very light gray (N8), medium-grained, subangular, poorly sorted, very slightly porous, silty, slightly calcareous, micaceous, abundant carbonaceous material, 90% quartzose.
- 1756-1765 Siltstone, medium dark gray (N4), argillaceous; and shale, grayish red (10R 4/2), silty.
- 1765-1770 Siltstone, light greenish gray (5G 8/1), sandy, micaceous.
- 1770-1776 Like 1775-1770; and siltstone, grayish red (10R 4/2), micaceous, argillaceous.
- 1776-1785 Like 1770-1776; and shale, medium dark gray (N4), silty, micaceous.
- 1785-1793 Like 1776-1785.
- 1792-1797 Like 1785-1792; and shale, medium gray (N5).
- 1797-1803 Like 1792-1797.
- 1802-1806 Shale, medium gray (N5) to medium dark gray (N4), silty; and siltstone, medium gray (N5), sandy.
- 1806-1814 Like 1802-1806.
- 1814-1820 Shale, grayish red (10R 4/2), some slickensided; and light greenish gray (5GY 5/1), slickensided, calcareous.
- 1820-1825 Like 1814-1820.
- 1825-1832 Shale, grayish red (5R 4/2), silty, calcareous.
- 1832-1837 Shale, medium dark gray (N4), silty, slightly micaceous.
- 1837-1842 Like 1832-1837.
- 1842-1850 Shale, grayish red (5R 4/20) to medium dark gray (N5), with greenish tint, mottled, silty, slightly calcareous.
- 1850-1856 Like 1842-1850.
- 1856-1861 Like 1850-1856.
- 1861-1866 Like 1856-1861.
- 1866-1871 Like 1861-1866 with siltstone, light greenish gray (5G 8/1), sandy.
- 1871-1875 Like 1866-1871.

- 1875-1878 Like 1871-1875.
- 1878-1883 Sandstone, light gray (N7), with slight greenish tint, very fine-grained, subangular, poorly sorted, slightly porous, silty, calcareous, abundant green mineral, 3/4 quartzose.
- 1883-1888 Like 1878-1883 interbedded with shale, medium gray (N5), gnarly.
- 1888-1895 Shale, grayish red (5R 4/2) to medium gray (N5), mottled, slightly calcareous.
- 1895-1900 Like 1888-1895 interbedded with sandstone, light gray (N7), with slightly greenish tint, very fine- to fine- grained, subangular to subrounded, poorly sorted, slightly porous, silty, slightly calcareous, abundant green mineral; scattered mica, 3/4 quartzose.
- 1900-1905 Like 1895-1900.
- 1905-1909 Like 1900-1905.
- 1912-1920 Siltstone, medium light gray (N6), very sandy, slightly calcareous.
- 1920-1928 Sandstone, light gray (N7), very fine-grained, angular to subangular, poorly sorted, very slightly porous, silty, calcareous, micaceous, 3/4 quartzose.
- 1928-1933 Like 1920-1928.
- 1933-1938 Like 1928-1933 with siltstone, medium dark gray (N4), sandy, carbonaceous.
- 1938-1943 Sandstone, pale yellow brown (5YR 4/2), very fine- to medium-grained, subangular to subrounded, very poorly sorted, slightly porous, very silty, slightly calcareous, micaceous, 3/4 quartzose.
- 1943-1948 Siltstone, medium dark gray (N4), sandy to argillaceous, micaceous, carbonaceous.
- 1948-1955 Like 1943-1948 grading into siltstone, medium dark gray (N4), carbonaceous.
- 1955-1965 Like 1948-1955.
- 1965-1972 Sandstone, very light gray (N8), very fine-grained, angular to subangular, poorly sorted, slightly porous, silty, calcareous, micaceous, lenses of shale, dark gray (N3), silty, carbonaceous.

- 1972-1977 Like 1965-1972.
- 1977-1982 Like 1972-1977.
- 1982-1987 Like 1977-1982.
- 1987-1992 Sandstone, medium brown (5YR 4/1), very fine- to fine-grained, angular to subangular, poorly sorted, very slightly porous, silty, slightly calcareous, micaceous, 3/4 quartzose.
- 1992-2001 Sandstone, white (N9), very fine- to fine-grained, angular to subangular, moderately well sorted, slightly porous, moderately silty, slightly calcareous, scattered mica, lenses of shale, dark gray (N3), carbonaceous, silty, micaceous 90% quartzose.
- 2001-2005 Like 1992-2001.
- 2005-2009 Like 2001-2005.
- 2009-2013 Like 2005-2009 without shale lenses.
- 2013-2019 Like 2009-2013.
- 2019-2033 Like 2013-2019.
- 2033-2044 Shale, medium dark gray (N4), silty, fissile, micaceous.
- 2044-2056 Like 2033-2044.
- 2056-2069 Like 2044-2056.
- 2069-2077 Siltstone, medium dark gray (N4), slightly sandy, micaceous.
- 2077-2087 Like 2069-2077.
- 2087-2097 Like 2077-2087.
- 2097-2108 Like 2087-2097; and shale, medium dark gray (N4), silty, fissile.
- 2109-2124 Like 2097-2109.
- 2124-2129 Like 2109-2124.
- 2129-2143 Like 2124-2139.
- 2143-2155 Like 2129-2143.
- 2155-2166 Like 2143-2155.

- 2166-2176 Shale, medium dark gray (N4), silty, fissile.
- 2176-2186 Like 2166-2176.
- 2186-2195 Like 2176-2186.
- 2195-2201 Siltstone, medium dark gray (N4), micaceous.
- 2201-2214 Shale, medium dark gray (N4), slightly silty, fissile.
- 2214-2218 Shale, dark gray (N3), carbonaceous, fissile with trace coal (cavings?).
- 2218-2224 Like 2214-2218.
- 2224-2228 Siltstone, medium gray (N5), sandy, calcareous; and medium light gray (N6), sandy, calcareous, micaceous.
- 2228-2234 Siltstone, medium gray (N5), calcareous and shale, brownish gray (5R 4/1), carbonaceous.
- 2234-2245 Sandstone, light gray (N7), very fine-grained, subangular, poorly sorted, very slightly porous, silty, slightly calcareous, 3/4 quartzose, grades into siltstone, medium gray (N5), sandy.
- 2245-2249 Sandstone, white (N9), very fine- to fine-grained, subangular, to subrounded, moderately well sorted, slightly porous, calcareous, scattered carbonaceous material, 90% quartzose.
- 2249-2254 Like 2245-2249; with few medium to coarse, subrounded, grains.
- 2254-2257 Sandstone, white (N9), medium-grained, subrounded, well sorted, slightly porous, calcareous, scattered carbonaceous material, 90% quartzose.
- 2257-2266 Like 2254-2257 with abundant pebble fragments.
- 2266-2272 Like 2257-2266 with siltstone, medium gray (N5), to medium dark gray (N4), sandy, micaceous, calcareous, with limestone nodules.
- 2272-2283 Sandstone, white (N9), fine- to medium-grained, subangular to subrounded, moderately well sorted, slightly porous, calcareous, 90% quartzose.
- 2283-2287 Like 2272-2283.
- 2287-2291 Like 2283-2287.

2291-2293	Like 2287-2293.
2293-2295.	Like 2291-2293.
2295-2300	Like 2293-2295.
2300-2301	Like 2295-2300.
2301-2302	Like 2300-2301.
2302-2305	Like 2301-2302.
2305-2307	Like 2302-2305.
2307-2309	Like 2305-2309.
2309-2312	Like 2307-2309.
2312-2321	Siltstone, and shale, medium dark gray (N4), calcareous, abundant limestone nodules.
2321-2327	Like 2312-2321.
2327-2334	Like 2321-2327; and small amount of shale, grayish red (5R 4/2), slightly calcareous.
2334-2340	Like 2327-2334; and sandstone, light gray (N7), very fine-grained, angular to subangular, poorly sorted, very slightly porous, silty, calcareous, micaceous, abundant carbonaceous material, abundant green mineral, 3/4 quartzose.
2340-2345	Siltstone, and shale, like 2334-2340.
2345-2358	Shale, medium dark gray (N4), silty, calcareous, with limestone nodules, like 2340-2345.
2358-2367	Shale, medium dark gray (N4), very calcareous, silty with small amount of limestone, light gray (N7), very finely crystalline.
2367-2378	Like 2358-2367.
2378-2382	Shale, grayish red (5R 4/2) to dusky red (5R 5/4), calcareous, silty, and siltstone, medium light gray (N6), to medium gray (N5) with greenish tint, sandy, slightly calcareous.
2388-2398	Shale, medium dark gray (N4), silty, slightly calcareous.
2398-2405	Sandstone, light greenish gray (5GY 8/1), very fine- to fine-grained, subangular, poorly sorted, slightly calcareous, scattered argillaceous material, 90% quartzose.

- 2405-2410 Like 2398-2405.
- 2410-2415 Like 2405-2410.
- 2415-2428 Sandstone, very light gray (N8), with slight greenish tint, fine- to medium-grained, subangular, moderately well sorted, slightly porous, silty, slightly calcareous, slightly micaceous, scattered argillaceous material, 90% quartzose.
- 2428-2433 Like 2415-2428.
- 2433-2436 Like 2428-2433.
- 2436-2440 Shale, medium dark gray (N4), silty; and grayish red (5R 4/2), silty, slightly calcareous.
- 2440-2450 Sandstone, white (N9), fine- to medium-grained, subangular, moderately well sorted, slightly porous, silty, calcareous, scattered argillaceous material, 90% quartzose.
- 2450-2455 Like 2440-2450.
- 2455-2465 Shale, medium dark gray (N4), silty, calcareous.
- 2465-2474 Like 2455-2465 with small amount of shale, medium gray (N5), very calcareous.
- 2474-2485 Shale, grayish red (5R 4/2), calcareous, lumpy.
- 2485-2494 Like 2574-2585.
- 2494-2502 Siltstone, grayish red (10R 4/2) sandy, micaceous, very slightly calcareous.
- 2502-2513 Like 2494-2502; limestone, light brownish gray (5YR 6/1) to dark gray (N3), dense.
- 2513-2523 Like 2502-2513.
- 2523-2531 Siltstone, medium light gray (N6) to medium dark gray (N5), sandy, micaceous, slightly calcareous.
- 2531-2534 Sandstone, light greenish gray (5G 8/1), very fine-grained, subangular, poorly sorted, very slightly porous, silty, calcareous, 3/4 quartzose.
- 2534-2540 Like 2531-2534.

- 2540-2547 Like 2535-2540.
- 2547-2560 Like 2540-2547 with siltstone, medium gray (N5), calcareous, slightly micaceous.
- 2560-2567 Like 2547-2560; possibly interbedded.
- 2567-2571 Sandstone, very light gray (N8), very fine-grained, subangular moderately well sorted, slightly silty, calcareous, scattered mica; and argillaceous material, 90% quartzose.
- 2571-2579 Like 2567-2571, interbedded with shale, medium dark gray (N4), silty, micaceous.
- 2579-2582 Like 2571-2579.
- 2582-2587 Sandstone, light gray (N7), very fine-grained, subangular moderately well sorted, very slightly porous, very calcareous, silty, scattered argillaceous material, 90% quartzose, interbedded with siltstone, medium gray (N5), to medium dark gray (N4), sandy, calcareous, micaceous.
- 2587-2597 Like 2582-2587.
- 2597-2604 Like 2587-2597.
- 2604-2612 Like 2597-2604.
- 2612-2619 Like 2604-2612, with small amount of shale, medium dark gray (N4), slightly silty, fissile; and limestone, light brownish gray (5YR 6/1) to brownish gray (5YR 4/1), dense.
- 2619-2624 Like 2612-2619.
- 2624-2631 Like 2619-2624.
- 2631-2637 Shale, medium dark gray (N4), fissile, slightly calcareous.
- 2637-2641 Like 2631-2637; and sandstone, very light gray (N8), very fine- to fine-grained, subangular, moderately well sorted, slightly porous, slightly calcareous, scattered carbonaceous material.
- 2641-2646 Like 2637-2641.
- 2646-2650 Shale, like 2641-2646; and small amount of limestone, light olive gray (5Y 6/1), dense.
- 2650-2651 Sandstone, very light gray (N8), very fine- to fine-grained, subangular, well sorted, moderately porous, scattered carbonaceous, material, 96% quartzose.

- 2651-2653 Like 2650-2651.
- 2653-2657 Like 2651-2653.
- 2657-2663 Siltstone, medium gray (N5), sandy, micaceous, carbonaceous.
- 2663-2669 Like 2657-2663.
- 2669-2671 Sandstone, very light gray (N8), fine-grained, subangular, moderately well sorted, moderately porous, slightly silty, scattered carbonaceous material, 90% quartzose.
- 2671-2675 Like 2669-2671.
- 2675-2680 Sandstone, pale reddish brown (10R 5/4), very fine- to fine-grained, poorly sorted, slightly porous, silty, micaceous, 3/4 quartzose grading into siltstone, pale red (10R 6/2), micaceous; and shale, moderately red (5R 5/4) to light brown (5YR 6/4), silty.
- 2680-2682 Sandstone, white (N9) to light gray (N7), very fine- to fine-grained, subangular, moderately well sorted, moderately porous, slightly silty, micaceous, scattered carbonaceous material, and argillaceous material, 90% quartzose.
- 2682-2687 Like 2680-2682.
- 2687-2691 Like 2682-2687.
- 2691-2699 Like 2687-2691, interbedded with siltstone, medium gray (N5), to medium dark gray (N4), sandy, micaceous.
- 2699-2703 Like 2691-2699.
- 2703-2711 Like 2699-2703.
- 2711-2717 Like 2703-2711.
- 2717-2724 Like 2711-2717.
- 2724-2726 Sandstone, white (N9), fine-grained, subangular, well sorted, moderately porous, scattered carbonaceous material, 95% quartzose.
- 2726-2727 Like 2724-2726.
- 2727-2728 Like 2726-2727.

2728-2730	'Like 2727-2728.
2730-2734	Like 2728-2730.
2735-2737	Like 2730-2735.
2737-2740	Like 2735-2737.
2740-2741	Like 2737-2740.
2141-2750	Sandstone, light gray (N7), very fine- to fine-grained, sub-angular, poorly sorted, slightly porous, silty, calcareous, scattered green mineral, and argillaceous material, 3/4 quartzose; interbedded with siltstone, medium gray (N5) sandy, calcareous.
2750-2753	Like 2741-2750.
2753-2757	Sandstone, white (N9), very fine- to fine-grained, subangular, moderately well sorted, slightly porous, slightly calcareous, 90% quartzose.
2757-2765	Like 2753-2757.
2765-2766	Like 2757-2765.
2766-2769	Like 2765-2766.
2769-2771	Like 2766-2769.
2771-2779	Like 2769-2771.
2779-2781	Like 2771-2779.
2781-2784	Like 2779-2781.
2784-2787	Like 2781-2784; with scattered dark carbonaceous material.
2787-2790	Like 2784-2787.
2790-2796	Like 2787-2790.
2796-2799	Like 2790-2796.
2799-2802	Like 2796-2799.
2802-2804	Like 2799-2802.
2804-2811	Like 2802-2804.

- 2811-2813 Like 2804-2811.
- 2813-2815 Like 2811-2813.
- 2815-2816 Like 2813-2815.
- 2816-2821 Like 2815-2816.
- 2821-2823 Like 2816-2821.
- 2823-2825 Like 2821-2823.
- 2825-2828 Like 2823-2825.
- 2828-2833 Like 2825-2828.
- 2833-2839 Like 2828-2833.
- 2839-2842 Like 2833-2839.
- 2842-2845 Like 2839-2842.
- 2845-2847 Like 2842-2845.
- 2847-2851 Like 2845-2847.
- 2851-2855 Like 2847-2851.
- 2855-2860 Like 2851-2855.
- 2860-2862 Like 2855-2860.
- 2862-2863 Siltstone, medium dark gray (N4), sandy, very calcareous, with abundant pyrite.
- 2863-2866 Like 2862-2863.
- 2866-2871 Like 2863-2866; and sandstone, white (N9), very fine- to fine-grained, subangular to subrounded, well sorted, slightly porous, slightly calcareous, scattered argillaceous material, 90% quartzose.
- 2871-2878 Siltstone, light gray (N7), very sandy, micaceous, slightly calcareous.
- 2878-2881 Siltstone, medium gray (N5), slightly sandy, micaceous.
- 2881-2884 Sandstone, white (N9), very fine- to fine-grained, subangular to subrounded, well sorted, slightly porous, scattered carbonaceous material; 95% quartzose.

- 2884-2888 Like 2881-2884.
- 2888-2890 Like 2884-2868.
- 2890-2893 Like 2888-2890.
- 2893-2897 Like 2890-2893.
- 2897-2903 Siltstone, medium gray (N5), sandy, calcareous to medium dark gray (N4), argillaceous.
- 2903-2910 Shale, medium dark gray (N4), very calcareous, silty.
- 2910-2913 Like 2903-2910 with small amount of limestone, light gray (N7), silty.
- 2913-2922 Like 2910-2913.
- 2922-2931 Siltstone, medium gray (N5), to medium dark gray (N4), slightly micaceous, non-calcareous.
- 2931-2936 Shale, medium dark gray (N4), silty, scattered pyrite.
- 2936-2937 Like 2931-3936.
- 2937-2938 Like 2936-2937.
- 2938-2939 Siltstone, medium gray (N5).
- 2939-2942 Sandstone, white (N9), very fine- to fine-grained; subangular, well sorted, slightly porous, calcareous, 95% quartzose.
- 2942-2951 Like 2939-2942, probably interbedded with shale, medium dark gray (N4), slightly silty, micaceous.
- 2951-2953 Like 2942-2951.
- 2953-2955 Like 2951-2953.
- 2955-2958 Like 2953-2955.
- 2958-2963 Like 2955-2958.
- 2963-2973 Like 2958-2963.
- 2973-2976 Like 2963-2973.
- 2976-2983 Sandstone, very light gray (N8), very fine- to fine-grained,

moderately well sorted, slightly porous, calcareous, scattered mica, and carbonaceous material, 90% quartzose; and shale, like 2973-2976.

- 2983-2988 Like 2976-2983.
- 2988-2996 Limestone, medium dark gray (N4), dense, silty, fossiliferous (?).
- 2996-3002 Like 2988-2996 interbedded with shale, dark gray (N3), carbonaceous, fissile, slightly calcareous.
- 3002-3007 Like 2996-3002.
- 3007-3017 Shale, medium dark gray (N4), fissile, non-calcareous; and siltstone, medium gray (N5), argillaceous, calcareous.
- 3017-3025 Like 3007-3017.
- 3025-3028 Shale, dark gray (N3), fissile, with lenses of limestone, medium dark gray (N4), dense, silty, fossiliferous.
- 3028-3031 Like 3025-3028.
- 3031-3035 Limestone, medium gray (N5), finely crystalline, with medium dark gray (N4) nodules and ooliths, silty.
- 3035-3043 Limestone, medium dark gray (N4), with brownish tint, dense, slightly silty; and shale, dark gray (N3), fissile, slightly calcareous.
- 3043-3053 Like 3035-3043.
- 3053-3061 Like 3043-3053.
- 3061-3064 Siltstone, medium dark gray (N4), calcareous.
- 3064-3069 Like 3061-3064; interbedded with shale, dark gray (N3), fissile.
- 3069-3071 Sandstone, white (N9), moderately well sorted, slightly porous, silty, calcareous, scattered carbonaceous material, 90% quartzose.
- 3071-3079 Like 3069-3071 with abundant siltstone lenses.
- 3079-3084 Shale, medium dark gray (N4), silty, non-calcareous.
- 3084-3101 Like 3079-3084.
- 3101-3112 Siltstone, medium gray (N5), sandy, slightly micaceous.
- 3112-3116 Sandstone, medium light gray (N6) to medium gray (N5), very fine- to fine-grained, subangular, very poorly sorted, slightly porous,

very silty, slightly calcareous, abundant carbonaceous material, 3/4 quartzose.

- 3116-3120 Like 3112-3116.
- 3120-3136 Like 3116-3120; and shale, medium dark gray (N4) to dark gray (N3), calcareous, fissile.
- 3136-3150 Shale, medium dark gray (N4), fissile.
- 3150-3162 Like 3136-3150.
- 3162-3171 Limestone, medium gray (N5) to dark gray (N3), dense to medium-crystalline, silty, fossiliferous.
- 3171-3179 Like 3162-3171.
- 3179-3189 Siltstone, medium dark gray (N4), calcareous, micaceous.
- 3189-3200 Like 3179-3189 interbedded with limestone, medium light gray (N6) to brownish gray (5YR 4/1), dense to medium crystalline, fossiliferous.
- 3200-3209 Like 3189-3200.
- 3209-3214 Like 3200-3209.
- 3214-3220 Like 3209-3214.
- 3220-3224 Like 3214-3220.
- 3224-3229 Limestone, medium dark gray (N4), oolitic, silty, dense with few medium crystals.
- 3229-3234 Like 3224-3229.
- 3234-3241 Like 3229-3234.
- 3241-3245 Like 3234-3241.
- 3245-3250 Like 3241-3245.
- 3250-3254 Like 3245-3250.
- 3254-3258 Like 3250-3254.
- 3258-3263 Limestone, light gray (N7) to dark gray (N3), mottled, dense to medium crystalline/.
- 3263-3268 Like 3258-3263.
- 3268-3275 Like 3263-3268 with interbedded shale, dark gray (N3), fissile, slightly calcareous.

- 3275-3285 Shale, medium dark gray (N4), fissile, calcareous.
- 3285-3292 Like 3275-3285.
- 3292-3298 Like 3285-3292.
- 3298-3305 Like 3292-3298.
- 3305-3311 Like 3298-3305 with small amount of limestone, white (N9), finely clastic.
- 3311-3316 Like 3305-3311; and limestone, dark gray (N3), dense.
- 3316-3322 Like 3311-3316.
- 3322-3327 Like 3316-3322.
- 3327-3331 Like 3322-3327.
- 3331-3335 Like 3327-3331.
- 3335-3339 Shale, like 3331-3335.
- 3339-3342 Like 3335-3339.
- 3342-3345 Shale, medium gray (N5), calcareous, finely micaceous, little silty, fissile; with limestone, light brownish gray (5YR 6/1), medium crystalline.
- 3345-3355 Shale, medium dark gray (N4), little silty, carbonaceous, moderately fissile; limestone, medium light gray (N6), with slight brownish tint, finely crystalline, little silty.
- 3355-3365 Lime stone, light brownish gray (5YR 6/1), dense to finely crystalline; to medium gray (N5), medium crystalline, silty; with little shale, medium dark gray (N4), very carbonaceous, fissile.
- 3365-3372 Like 3355-3365 with limestone, light gray (N7), finely crystalline silty.
- 3372-3377 Like 3365-3372.
- 3377-3381 Like 3372-3377 with little shale, medium dark gray (N4), little silty, carbonaceous, calcareous, fissile.
- 3381-3388 Like 3377-3381.

- 3388-3397 Limestone, medium gray (N5), finely crystalline, silty; some light brownish gray limestone nodules; shale, medium dark gray (N4), slightly calcareous, carbonaceous, finely micaceous, fissile, finely crystalline, dense limestone.
- 3397-3402 Limestone, light gray (N7), finely crystalline, dense; little with brownish tint; shale, medium dark gray (N4), carbonaceous, very calcareous, fissile; very little pyrite (?).
- 3402-3410 Like 3397-3402; with pieces of milky white quartz; no pyrite (?).
- 3410-3414 Like 3402-3410.
- 3414-3416 Like 3410-3414 with little pyrite.
- 3416-3419 Like 3414-3416; some oolitic.
- 3419-3422 Limestone, brownish gray (5YR 5/1), dense, very finely crystalline; slightly fossiliferous and oolitic.
- 3422-3427 Limestone, medium light gray (N6), finely crystalline, dense; some with brownish tint, very finely crystalline, dense; some with brownish tint, very finely crystalline, dense little oolitic; shale, medium dark gray (N4), carbonaceous, little silty, fissile.
- 3427-3434 Like 3422-3427.
- 3434-3439 Limestone, medium gray (N5) and light gray (N7), little oolitic, finely crystalline, dense; some calcite; shale, dark gray (N3), very carbonaceous, fissile.
- 3439-3443 Like 3434-3439.
- 3443-3446 Like 3439-3443.
- 3446-3450 Like 3443-3446 with much white (N9) material, soft, and very calcareous.
- 3450-3455 Like 3446-3450; with little pyrite.
- 3455-3463 Limestone, medium light gray (N6), very oolitic; ooliths medium gray (N5), in very finely crystalline matrix; shale, medium dark gray (N4), slightly calcareous, carbonaceous, little silty, moderately fissile; white (N9) material, soft, very calcareous; some limestone, light brownish gray (5YR 6/1), finely crystalline.
- 3463-3469 Like 3455-3463; ooliths some color as matrix.
- 3469-3471 Like 3463-3469.

- 3471-3475 Like 3469-3471.
- 3475-3483 Limestone, medium gray (N5), oolitic, fossiliferous (crinoid stems, very finely crystalline to finely crystalline, dense; and limestones, very light gray (N8), oolitic, brownish tint, finely crystalline to medium crystalline; shale, medium dark gray (N4), very carbonaceous, fissile.
- 3483-3487 Limestone, like 3475-3483; with shale, medium dark gray (N4), very calcareous, carbonaceous, fissile; little marcasite (?).
- 3487-3491 Like 3483-3487; with calcite; no crinoid fragments, very few oolites.
- 3491-3496 Limestone, medium gray (N5), very oolitic, matrix, finely crystalline; limestone, very light gray (N8), medium crystalline, mottled with light brownish gray (N6); calcite fragments; with shale, medium dark gray (N4), non-calcareous, very carbonaceous, fissile.
- 3496-3500 Like 3491-3496; with pieces of soft white (N9) material, very calcareous.
- 3500-3505 Like 3496-3500, not as oolitic.
- 3505-3513 Like 3500-3505; not as oolitic.
- 3512-3518 Limestone, medium dark gray (N4), silty, dense, finely crystalline; limestone, light gray (N7), medium crystalline, some limestone, light brownish gray (5YR 6/1), dense, finely crystalline; shale, dark gray (N3), calcareous, very carbonaceous, moderately fissile.
- 3518-3520 Like 3512-3518; with pieces of calcite.
- 3520-3522 Like 3518-3520.
- 3522-3523 Like 3520-3522; with little marcasite (N1).
- 3523-3528 Like 3520-3522.
- 3528-3534 Limestone, medium dark gray (N4), dense, very finely crystalline; and limestone, light gray, like 3512-3518; with light brownish gray, shale, dark gray (N3), very calcareous, very carbonaceous, fissile; pieces of calcite.
- 3534-3537 Like 3528-3534.
- 3537-3541 Like 3534-3537.

- 3541-3547 Limestone, medium light gray (N7), light brownish gray (5YR 6/1), and white, (N9), mottled, dense, finely crystalline, fossiliferous (crinoid stem plate), few oolites; little limestone, light brownish gray (N5), dense, very finely crystalline; fragments of calcite; and shale, dark gray (N3), very carbonaceous, little silty, fissile.
- 3547-3556 Like 3541-3547 with crinoid stem and oolites; and shale, like 3541-3547 only slightly calcareous.
- 3556-3567 Very dirty, probably like 3547-3556.
- 3567-3576 Like 3556-3567; very dirty.
- 3576-3584 Like 3547-3556; no crinoid stems.
- 3584-3589 Limestone, medium gray (N5), with brownish tint, dense, finely crystalline, oolitic and limestone, very light gray (N8), finely crystalline to medium crystalline, oolitic; fragments of calcite, with shale, medium dark gray (N4), slightly calcareous, finely micaceous, little silty, moderately fissile.
- 3589-3605 Like 3584-3589 with little marcasite (?); shale, like 3584-3589; but non-calcareous.
- 3605-3613 Like 3589-3605; fossiliferous (crinoid stems), but no marcasite.
- 3613-3619 Like 3605-3613; no crinoid stems.
- 3619-3625 Like 3613-3619.
- 3625-3633 Like 3619-3625; with shale, dark gray (N3), very carbonaceous, little silty, non-calcareous, fissile.
- 3633-3640 Like 3625-3633.
- 3640-3649 Like 3633-3640.
- 3544-3649 Like 3640-3649; less oolitic.
- 3649-3657 Limestone, light gray (N7), finely crystalline to medium crystalline; medium brownish gray (5YR 5/1), dense, very finely crystalline; limestone, medium light gray (N6), very carbonaceous, non-calcareous, fissile, and limestone, medium gray (N5), very finely crystalline, dense.
- 3657-3666 Like 3649-3657 with few scattered ooliths.

- 3666-3675 Limestone, medium light gray (N6), slightly brownish tint, very finely crystalline; limestone, very light gray (N8), finely crystalline to medium crystalline; and shale, dark gray (N3) to medium dark gray (N4), very carbonaceous, little silty, fissile.
- 3675-3680 Like 3666-3675.
- 3680-3685 Like 3675-3680.
- 3685-3691 Like 3680-3685.
- 3691-3699 Like 3685-3691; with few scattered oolites.
- 3699-3707 Limestone, medium light gray (N6), very slightly silty, finely crystalline, some oolitic; and limestone, light brownish gray (N5YR 6/1), dense, finely crystalline; shale, medium dark gray (N4), very carbonaceous, little silty, non-calcareous, fissile; sample dirty.
- 3707-3713 Like 3699-3707; with shale, dark gray (N3), very carbonaceous, little silty, fissile.
- 3713-3721 Like 3707-3713; with limestone, medium light gray (N6) becoming very light oolitic.
- 3721-3727 Sample very dirty; probably like 3712-3737; seems to be only slightly oolitic.
- 3734-3743 Like 3727-3724, but no oolitic.
- 3743-3755 Limestone, light gray (N7), oolitic, finely crystalline to medium crystalline matrix, and limestone, medium brownish gray (5YR 5/1), dense, finely crystalline, fossiliferous (crinoid fragments); shale, medium dark gray (N4), carbonaceous, little silty, fissile, non-calcareous; calcite, fragments.
- 3755-3761 Limestone, light gray (N7), very oolitic; sample like 3743-3755 with more crinoid fragments.
- 3761-3765 Like 3755-3761.
- 3765-3771 Like 3751-3765; not as fossiliferous.
- 3771-3778 Like 3756-2771.
- 3778-3782 Like 3771-3778.

- 3782-3788 Limestone, medium light gray (N6), dense, very finely crystalline; limestone, very light gray (N8) matrix with medium gray and medium light gray oolites; and limestone, medium brownish gray (5YR 5/1), dense, finely crystalline fossiliferous (crinoid fragments); and shale, dark gray (N3), very carbonaceous, little silty, fissile, non-calcareous.
- 3788-3793 Like 3782-3788, but less oolitic; with little marcasite (?).
- 3793-3797 Like 3788-3793.
- 3797-3804 Limestone, medium light gray (N6), oolitic, finely crystalline; and limestone, medium brownish gray (5YR 5/1), dense, finely crystalline; with shale, medium dark gray (N4), non-calcareous, very carbonaceous, little silty, fissile, little marcasite (?).
- 3804-3810 Like 3797-3804; fossiliferous (with crinoid fragments).
- 3810-3819 Like 3804-3810 with one piece shale, grayish red (10 R 4/2), silty, finely micaceous, moderately fissile; sample very fossiliferous, numerous crinoid fragments and gastropod (?).
- 3819-3828 Like 3810-3819; with abundant crinoid fragments, one quartz crystal; and no red shale.
- 3828-3831 Like 3819-3828.
- 3831-3836 Like 3828-3831; with fragments of calcite, and one quartz crystal, much less oolitic.
- 3836-3840 Like 3831-3835; non-oolitic.
- 3840-3846 Like 3846-3840; with little marcasite (?); not as fossiliferous.
- 3843-3846 Limestone, light brownish gray (5YR 6/1), dense, finely crystalline; limestone, medium light gray (N6), dense, finely crystalline to medium crystalline and shale, medium dark gray (N4), very carbonaceous, little silty, fissile, little marcasite (?).
- 3846-3850 No sample.
- 3850-3852 Like 3843-3846.
- 3852-3858 Like 3850-3852; with few pieces of siltstone, dark reddish brown (10R 3/4), finely micaceous.

- 3858-3863 Shale, pale red (5R 6/2) to moderate red (5R 5/4) to grayish red (5R 4/2), silty, non-calcareous, finely micaceous, moderately fissile; shale, grayish brown (5YR 3/2), little silty, fissile; little shale, dark gray (N3), very carbonaceous, fissile; with very little limestone, like 3852-3858.
- 3863-3870 Like 3858-3863 with little shale, medium gray (N5), silty, finely micaceous, moderately fissile with little scattered green mineral and marcasite (?).
- 3870-3875 Like 3863-3870.
- 3875-3878 Like 3875-3878.
- 3878-3881 Shale, dark gray (N3), very finely micaceous, little silty, non-calcareous, moderately fissile; and shale, medium dark gray (N4), silty, fissile; small fragments of red shale, like 3858-3863, fragments of calcite.
- 3881-3882 Like 3878-3881 with little shale, medium gray (N5), slightly calcareous, little silty, moderately fissile, much iron-staining. (Two samples for small interval).
- 3883-3885 Like 3881-3882 with less red shale and more calcite; also limestone, light brownish red (5YR 6/1), dense, finely crystalline.
- 3885-3886 Like 3883-3885-with scattered fine-grained, subangular quartz grains.
- 3887-3890 Red and black shale, like 3878-3881, very badly iron-stained; with limestone, medium gray (N5), finely crystalline to medium crystalline with scattered pyrite or marcasite (?) crystals.
- 3890-3893 Like 3887-3890.
- 3893-3897 No sample
- 3897-3899 Like 3887-3890 with no iron-staining.
- 3899-3802 Shale, medium dark gray (N4), carbonaceous, little silty, fissile; siltstone, medium light gray (N6), slightly micaceous, some with brownish tint; with little red shale, like 3878-3881.
- 3902-3905 Like 3899-3902; with little red shale; siltstone, more micaceous.
- 3905-3910 Like 3902-3905; with little marcasite (?).

Samples examined by Jean Sherman,
1-1629 and 3342-3910

Samples examined by Allen D. Williamson
1629 = 3342.

U. S. Geological Survey
Lexington, Kentucky
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