

NATIONAL PETROLEUM RESERVE IN ALASKA

GEOLOGICAL REPORT
U. S. NAVY
WEST FISH CREEK NO. 1

HUSKY OIL NPR OPERATIONS, INC.
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Edited by: Ronald G. Brockway

For the

U. S. GEOLOGICAL SURVEY
Office of the National Petroleum Reserve in Alaska
Department of the Interior
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COMPOSITE LITHOLOGY LOG (In Pocket)

GEOLOGIC SUMMARY

INTRODUCTION

The U. S. Navy, West Fish Creek No. 1 well is located in the NE 1/4 of protracted Section 11, T11N, R1W, Umiat Meridian, North Slope Borough, Alaska. The surveyor's plat locates the well 934' FNL and 2033' FEL of the section (see Figures 1 & 2). The West Fish Creek No. 1 well was drilled in early 1977 as part of the final five-well program for the U. S. Navy.

The well was spudded on February 14, 1977 and was plugged and abandoned after reaching a total depth of 11,427 feet (driller). The date of abandonment and subsequent rig release was April 27, 1977.

The West Fish Creek No. 1 encountered no shows, nor was there any reservoir quality porosity developed in either of the primary objectives (Sadlerochit and Lisburne Groups). Another primary objective, the Kuparuk sandstone, was missing due to an erosional unconformity. A few scattered shows in thin, tight sandstones of the Nanushuk Group and the Torok Formation were encountered. None of these shows warranted further evaluation.

PRE-DRILLING PROGNOSIS

The West Fish Creek No. 1 well was drilled on the Fish Creek Platform (Figure 3) in order to investigate an anomalous depositional or erosional phenomenon, which had been interpreted from seismic evidence. The Fish Creek Platform, which is a regionally high structural feature, was believed to have influenced deposition locally or to have been subjected to more intense erosion during the Basal Cretaceous Unconformity. In either case, good reservoir development was hopefully sought.

The primary objectives, sandstones of the Sadlerochit Group and carbonates of the Lisburne Group, were expected to exist on a seismically defined, closed structure. This structural closure, together with hoped for favorable reservoir development, would have upgraded other prospects on the Fish Creek Platform. Another zone, which was considered to be a primary objective, was a sandstone expected to be developed in the basal "Pebble Shale", believed to be approximately equivalent to the productive Kuparuk sandstone of the Prudhoe Bay area. Additionally, sandstones of the Torok Formation were considered to be a secondary objective, along with the Sag River Sandstone.

POST-DRILLING SUMMARY

Results obtained in drilling the West Fish Creek No. 1 well, confirm that, indeed, anomalous conditions do exist on the Fish Creek Platform. Primarily, the anomaly exists in the apparent erosion of the "Pebble Shale" interval and either the non-deposition, or erosion, of the Kuparuk sandstone equivalent. The lack of reasonable reservoir development in any

of the section penetrated, diminishes interest in additional prospects on the Fish Creek Platform. At least this holds true for prospects based on the premise that the "platform" may have favorably influenced the development of reservoir rocks.

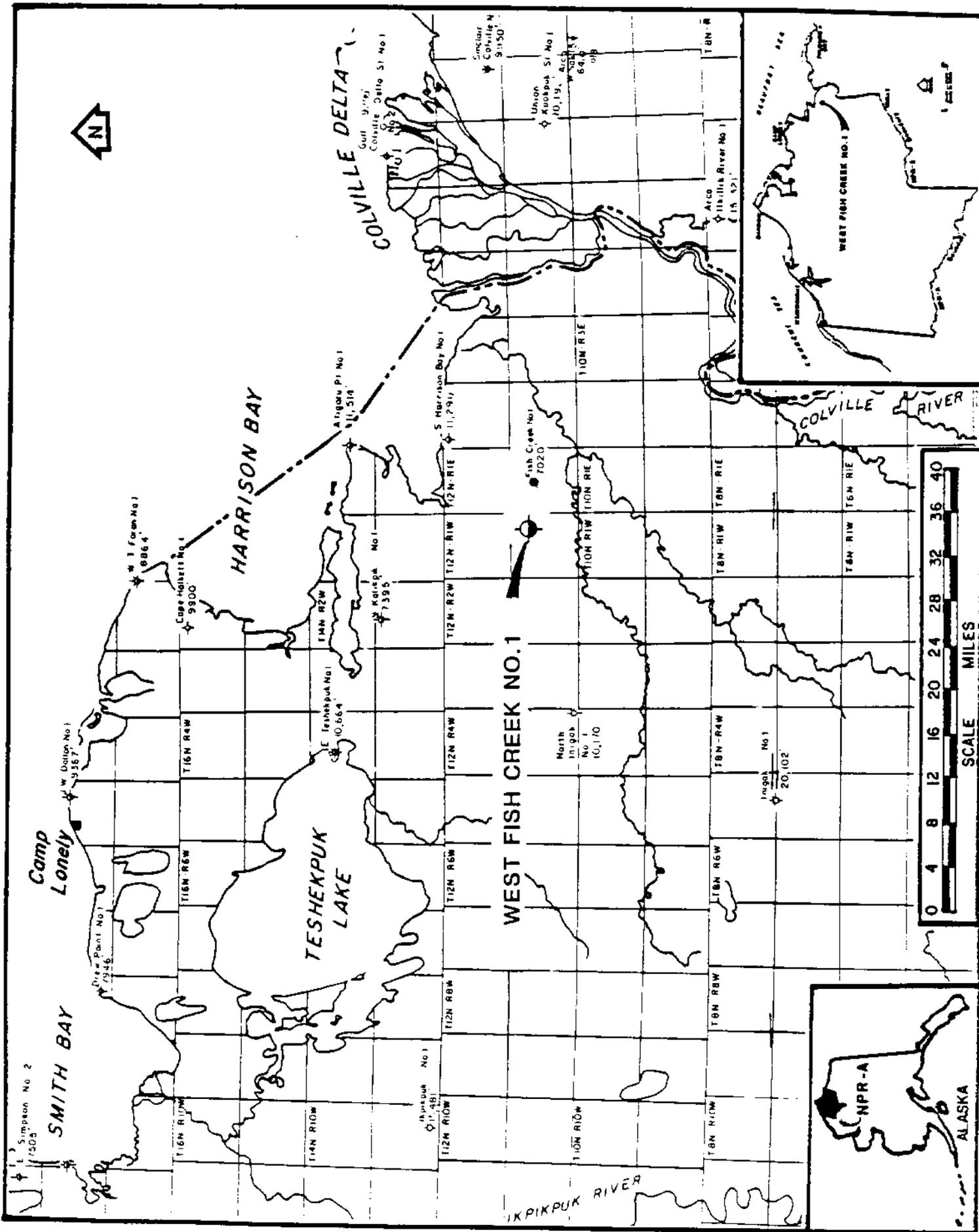
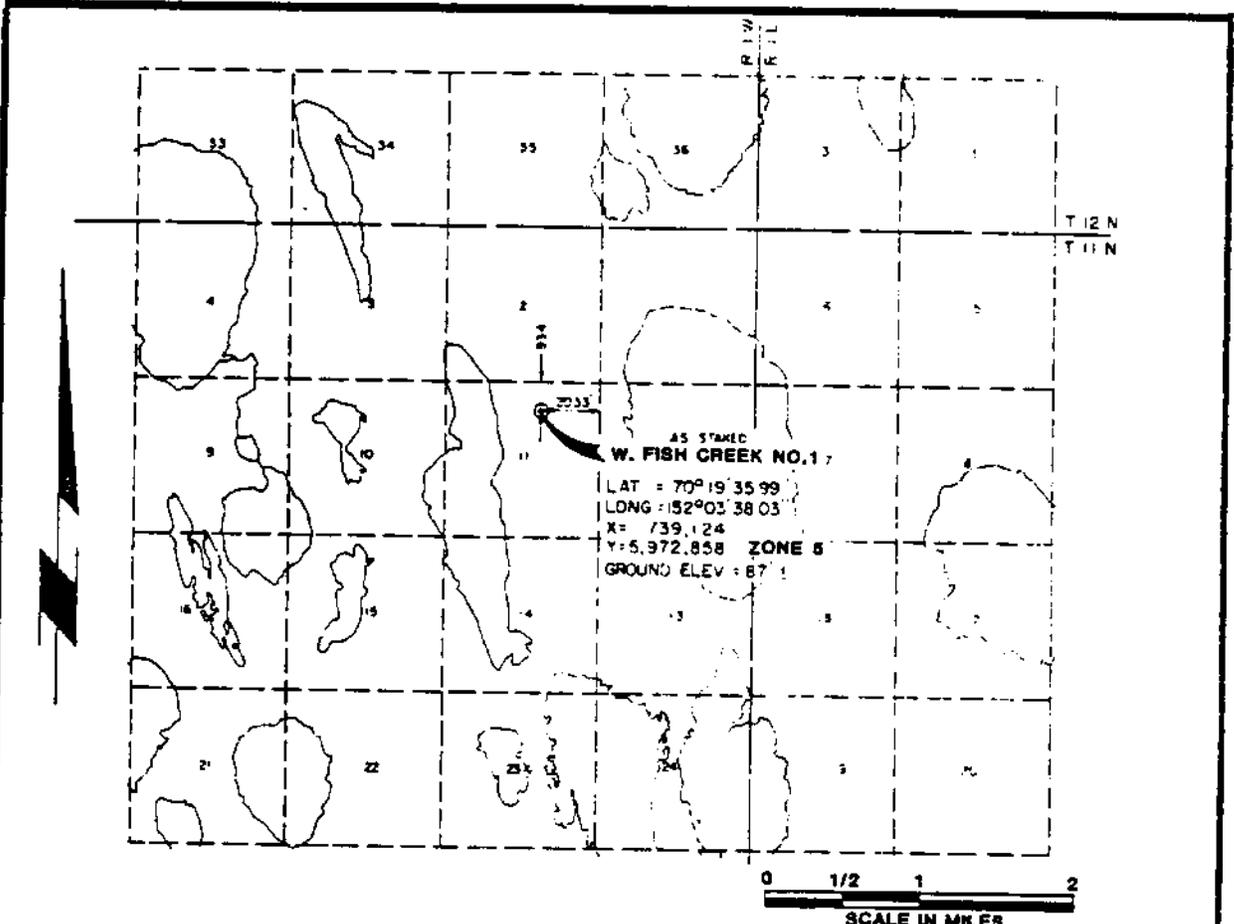


FIGURE 1 - LOCATION MAP - WEST FISH CREEK NO. 1



CERTIFICATE OF SURVEYOR

I hereby certify that I am properly registered and licensed to practice land surveying in the State of Alaska and that this plat represents a location survey made by me or under my supervision, and that all dimensions and other details are correct.



7-22-76 Andrew S. Potts
 Date SURVEYOR

| |
|--|
| <p>WEST FISH CREEK NO. 1</p> <p>Located in <small>SECTION 11, T11N, R11W, UMAT, NENAN, AK</small></p> <p>Surveyed for HUSKY OIL N. P. R. OPERATIONS INC.</p> <p>Surveyed by F. M. LINDSEY & ASSOC. <small>LAND & HYDROGRAPHIC SURVEYORS</small> <small>2502 West Northern Lights Boulevard Box 3</small> <small>Anchorage</small></p> |
|--|

FIGURE 2 - CERTIFICATE OF SURVEYOR - WEST FISH CREEK NO. 1

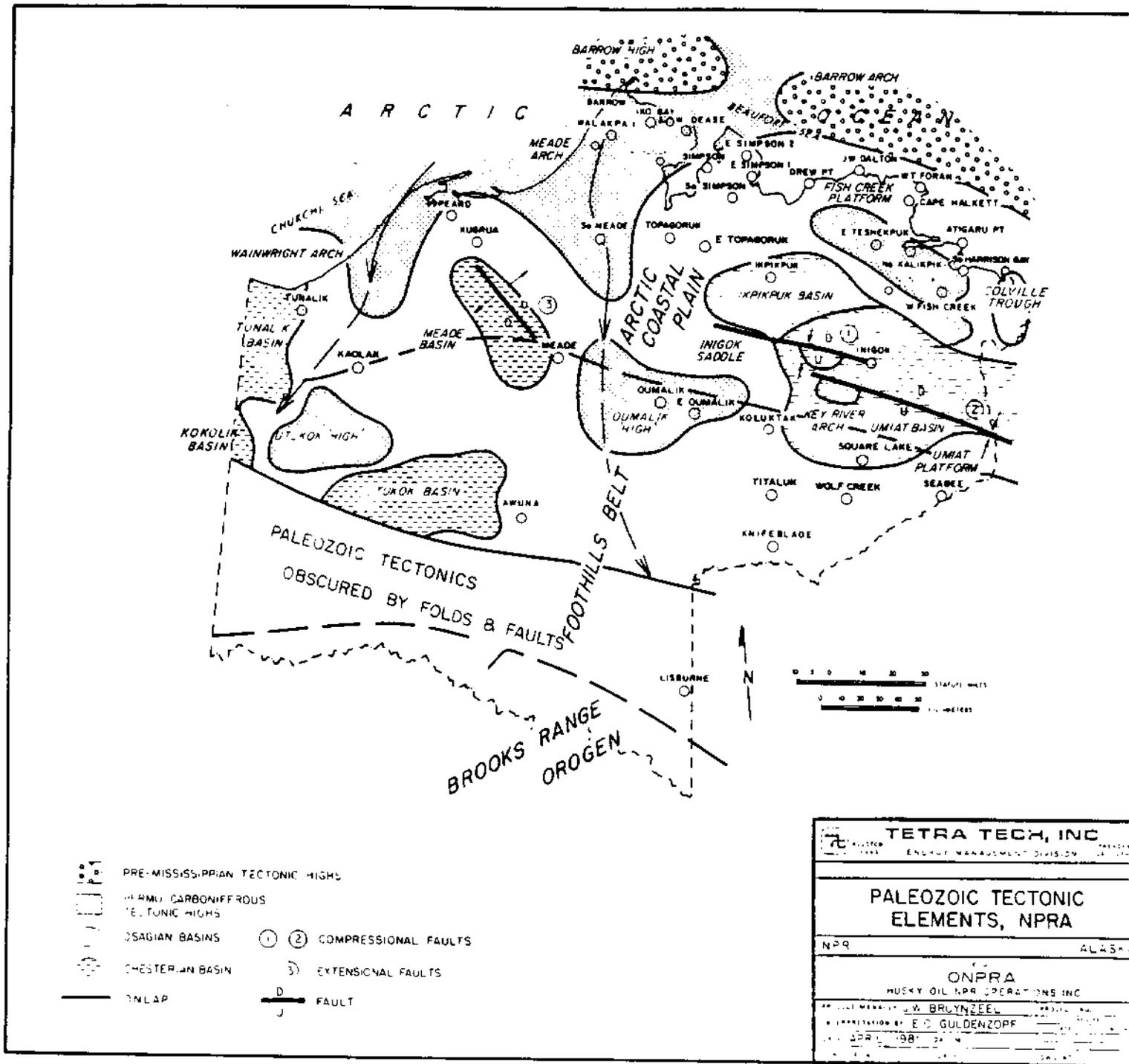


FIGURE 3 - PALEOZOIC TECTONIC ELEMENTS, NPRA - WEST FISH CREEK NO. 1

WELLSITE GEOLOGIST'S REPORT
 No Report in Files
 LATER REPORT BY: GORDON W. LEGG

INTRODUCTION

The U. S. Navy, West Fish Creek No. 1 well was drilled in early 1977 by Husky Oil NPR Operations, Inc. as the last well in a five-well program which concluded the exploration efforts of the U. S. Navy on the Naval Petroleum Reserve No. 4. Naval Petroleum Reserve No. 4 was subsequently transferred to the Department of the Interior, USGS, and redesignated the National Petroleum Reserve in Alaska. The West Fish Creek location had been chosen to investigate the nature of seismic anomalies on the Fish Creek Platform (Figure 3), a relatively high, stable, structural feature, which was believed to have locally influenced deposition.

Drilling was commenced on February 14, 1977 and the well was drilled to a total depth of 11,427 feet (driller), reaching that depth on April 21, 1977. The well was plugged and abandoned and the rig was released on April 27, 1977. At the time of abandonment, the well was drilling in sedimentary rocks of Mississippian age, probable Endicott Group (Anderson, Warren & Associates, Inc.). Argillite basement was not penetrated due to a forced early termination of drilling because of the approach of spring "break-up" (thawing conditions).

Hydrocarbon shows, for the most part, were restricted to rocks in the Nanushuk Group and Torok Formation. These shows were mostly mud-logged gas shows with some faint staining and fluorescence in the cuttings samples; invariably the host rocks for the shows were thin, shaly, and generally tight. There was a slight gas show within the Kingak Formation in a sequence of thinly interbedded sandstones, siltstones and shales. This sequence (7460-7580') had no visible show and contained very poor porosities. Some visible staining with fair to good cuts were observed in the Sag River Sandstone. No other zones exhibited shows of any significance. None of the shows mentioned above warranted additional evaluation.

STRATIGRAPHY

WIRELINE TOPS*

| | Depth Drilled | Subsea Depth <u>KB 113'</u> |
|-----------------------------------|------------------|-----------------------------------|
| No samples | 0-500' | |
| CRETACEOUS | | |
| Colville Group (undifferentiated) | 500' | -387' |
| Nanushuk Group (undifferentiated) | 2,510' | -2,397' |
| Torok Formation | 4,800' | -4,687' |
| "Pebble Shale" | 7,250' | -7,137' |

| | | |
|-----------------------------|---------|----------|
| JURASSIC | | |
| Kingak Formation | 7,290' | -7,177' |
| TRIASSIC | | |
| Sag River Sandstone | 9,217' | -9,104' |
| Shublik Formation | 9,310' | -9,197' |
| TRIASSIC-PERMIAN | | |
| Sadlerochit Group | | |
| Ivishak Formation | 9,580' | -9,467' |
| Kavik Shale Member | 10,172' | -10,059' |
| Echooka Formation | 10,443' | -10,330' |
| PENNSYLVANIAN-MISSISSIPPIAN | | |
| Lisburne Group | 10,500' | -10,387' |
| MISSISSIPPIAN (PROBABLE) | | |
| Endicott Group | 11,310' | -11,197' |

* Tops have been changed from the original data in many instances in order to conform to present usage; paleontological tops are used exclusively in rocks younger than the Kingak Formation.

CRETACEOUS

Colville Group (undifferentiated): 500-2510'

Anderson, Warren & Associates, Inc. identifies the interval from the first samples caught (500') down to 2510' as Late Cretaceous age, Colville Group. Rocks encountered within the Colville Group consist predominantly of claystones, with minor interbedded siltstones and occasional interbedded sandstones, particularly in the interval from 1200' to 1500'. The claystones are typically gray, silty, micaceous, occasionally bentonitic, and rarely tuffaceous. Frequent laminae and thin beds of carbonaceous material and coal are present within the claystones. The siltstones are gray, invariably argillaceous, and grade from the claystones. They are micaceous, and contain frequent nodules and aggregates of siderite. Finely disseminated carbonaceous material and thin stringers of coal are common within the siltstone. The sandstones are mostly light to medium gray, very fine to fine grained, silty, and grade to siltstone. They are carbonaceous, micaceous, and are cemented with a clay matrix, greatly inhibiting the porosity.

Some scattered fluorescence and minor gas shows, mostly from the coals and carbonaceous material, were observed in rocks of the Colville Group.

Nanushuk Group (undifferentiated): 2510-4800'

The interval from 2510' to 4800' has been identified as Early to Late Cretaceous age, Nanushuk Group by Anderson, Warren & Associates, Inc.

Lithologies in the Nanushuk Group do not vary significantly from those of the overlying Colville Group, except that there appears to be a slight increase in siltstones at the expense of the claystones; the section is somewhat more lithified, with many of the claystones now grading to shales. A decrease in organic and coaly material is evident, and there appears to be an increase in calcareous content accompanied by a corresponding increase in the reported occurrence of siderite. Pyrite is more common. A few, thin, scattered, sandstones are present in the section, particularly in the intervals from 2600-3600', 3880-3920' and 4620-4740'. These sandstones are generally gray, very argillaceous, silty and calcareous, very fine grained, frequently carbonaceous, and exhibit poor porosities.

There were a few faint shows scattered through some of the sandstones in the Nanushuk and a few gas shows recorded by the mud-logger, but the sandstones, in every case, were thin, poorly developed, and did not have sufficient porosity to be of interest as possible reservoirs.

Torok Formation: 4800-7250'

Rocks of the Early Cretaceous, Torok Formation are represented in the interval from 4800' to 7230'. The Nanushuk-Torok contact is gradational and indefinite in this (and others) well. In this report the top of the Torok is placed at the first occurrence of a definite Aptian assemblage. There is, however, some lithologic evidence for placing the top of the Torok considerably higher. The base of the formation has been placed at 7250' from paleontology determinations.

Calcareous foraminifera are scarce in the Torok but, according to Anderson, Warren & Associates, Inc., a pyritized radiolarian assemblage is present that is probably Aptian to early Albian in age.

The Torok consists almost entirely of shale from 4800' to 5500'. The shale is dark gray, silty, micaceous, pyritic, and contains both carbonaceous material and siderite nodules. The shale was deposited under marine conditions. From 5500' to approximately 6000', the Torok becomes increasingly sandy with gray, very fine to fine grained, calcareous and carbonaceous sandstones. Very faint fluorescence with weak cuts was observed from 5520-5600' and from 5720-5770'; the sandstones, however, were shaly and silty with low porosities. From 6000' to 6550', the Torok becomes predominantly shale again, with the shales essentially the same as those in the upper part of the Torok section. Finally, an interbedded sequence of shales and siltstones with a few thin sandstones prevail in the lower part of the Torok Formation.

The gas shows and poor visual shows in the Torok were not of sufficient interest to warrant further evaluation.

"Pebble Shale": 7250-7290'

A very thin (40') section has been identified by Anderson, Warren & Associates, Inc. as remnants of the "Pebble Shale". The basis for this

identification is mostly lithological, and is based upon the presence of "floating", frosted quartz grains, which are characteristic of the "Pebble Shale". This section, however, could be included in the basal Torok and contain reworked quartz grains and microfossils from the erosion of pre-existing "Pebble Shale". At any rate, the characteristic "hot" gamma-ray zone is apparently eroded, and the "Pebble Shale" is essentially missing with only a questionable 40-foot section to represent the entire unit.

The lithology of the "Pebble Shale" consists of dark gray to black shales and siltstones, which are micaceous, very carbonaceous and contain "floating", frosted quartz grains.

JURASSIC

Kingak Formation: 7290-9217'

On the basis of paleontological determinations, Anderson, Warren & Associates, Inc. assigns the interval from 7280-9270' as Early-Late Jurassic age, Kingak Formation (7290-9210' based on palynological determinations). The upper limit of the Kingak has been chosen in this report as 7290' (there is a change in the neutron and sonic log characteristics at that point) and the lower limit has been chosen by log correlation and characteristics as 9217', where a distinct lithological change from a shale to a silty sandstone occurs (Sag River Sandstone).

The Kingak Formation consists almost entirely of shale, which is dark gray to gray-black to brown. The shale is blocky to splintery, carbonaceous, micaceous and silty, grading to, and interbedded with occasional siltstones, which are gray, brown and dark brown, argillaceous, micaceous and carbonaceous. A poorly developed sequence of tight, silty, shaly sandstones is present in the Kingak from approximately 7480' to 7600'. These sandstones are fine grained, slightly glauconitic and exhibit poor porosity. A few minor gas shows and scattered very weak hydrocarbon cuts were noted while drilling this section.

TRIASSIC

Sag River Sandstone: 9217-9310'

The sandstone section, which is present from 9217' to 9310', can be easily correlated to similar Sag River Sandstone sections in nearby wells. Paleontology determinations by Anderson, Warren & Associates, Inc. places part of this section in the Kingak Formation, and part in the Shublik Formation, with the point of division at 9270'. On palynological determinations, however, the section from 9210' to 9480' is classified as "indeterminate". In the text of the Anderson, Warren & Associates, Inc. report on Foraminifera, they note the presence of a sandstone at the base of the Kingak, which may be an equivalent to the Sag River Sandstone.

The Sag River Sandstone is gray, siliceous, micaceous, glauconitic, calcareous, and contains numerous chert grains. It is generally hard, and well-indurated with calcareous, siliceous and clay cement. The porosity is generally poor, but there is some poor to fair visible staining with fair to good cuts. The porosity development ranges from 9-12%, which is too low to create acceptable reservoir parameters in the Sag River Sandstone at this location.

Shublik Formation: 9310-9580'

The Shublik Formation has been picked by Anderson, Warren & Associates, Inc. as occurring in the interval 9270' to 9660', on the basis of foraminiferal determinations. The pick, which is used in this report, from 9310' to 9580' is preferred because of the definite lithology change at 9310' from a sandstone (Sag River) to a resistive shaly, silty limestone. The limestone grades downward into a sequence of calcareous shales, siltstones and sandstones at approximately 9500'. This sequence continues to a depth of 9580', where the dominant calcareous cementing material changes to a cementing material dominated by silica. At this point (9580') the base of the Shublik/Top of the Ivishak is chosen.

TRIASSIC-PERMIAN

Sadlerochit Group

Ivishak Formation: 9580-10,443'

Although Anderson, Warren & Associates, Inc. picks the top of the Ivishak at 9660', the top is paleontologically indistinct, since the upper portion of the Ivishak and the lower part of the Shublik are essentially barren of diagnostic fossil assemblages. Other sources have picked the Ivishak top at 9515', 9560' and 9620'. For the purposes of this report, the change in cementing material from essentially calcareous cement to predominantly siliceous cement is chosen as the boundary between the Shublik Formation and the Ivishak Formation.

Rocks of the Ivishak are primarily an alternating sequence of sandstones, siltstones, and thin interbedded shales from 9580' to approximately 9850'. The interval from 9850' to 10,172' is predominantly sandstone with some interbedded shales, and the final interval, from 10,172' to 10,443' is composed almost entirely of shale, which forms to the Kavik Shale Member of the Ivishak Formation.

Sandstones of the Ivishak are primarily fine grained and argillaceous, with silica cement and secondary quartz overgrowths over the sand grains. The sandstone contains abundant chert grains, scattered glauconite grains, and occasionally becomes slightly conglomeratic. The porosity is poor, due mostly to the heavy silica cement in conjunction with infilling clay. No visible shows were observed in sandstones of the Ivishak.

The siltstones within the upper portion of the Ivishak (9580-9850') are various shades of gray, brown, red and maroon, and are typically argillaceous, siliceous, and calcareous.

The shales in the Ivishak range in color from grays to reds, with some green shale present from 9980' to 10,040'. Below 10,040', the shales are mostly medium to dark gray to black.

Sandstones of the Ivishak Formation had been considered to be the primary objective of the Fish Creek No. 1 well. The lack of hydrocarbon shows and the tight, siliceous nature of the sandstones did not warrant any attempt for additional evaluation in the form of cores or tests.

Kavik Shale Member: 10,172-10,443'

The Kavik Shale Member of the Ivishak Formation occurs in the interval from 10,172' to 10,443'. The Kavik in West Fish Creek No. 1 is predominantly a massive shale, both in the observed lithology and from the electric log characteristics. The shales are primarily gray to dark gray, silty, in part, siliceous and micaceous. Near the bottom of the interval, the shales become slightly pyritic.

Echooka Formation: 10,443-10,500'

Anderson, Warren & Associates, Inc. identifies a zone from 10,470' to 10,500' as "Probable Early Permian". Examination of the samples and electric logs indicates that the top of the Echooka Formation appears to be at 10,443' rather than 10,470'.

Rocks of the Echooka Formation consist of sandstones, siltstones and minor shales. The sandstones are gray, fine grained, siliceous and contain significant amounts of glauconite. Porosity is poor. The siltstones are also gray, glauconitic and siliceous. The shales are dark gray and are somewhat more micaceous than those of the overlying Kavik Shale member.

PENNSYLVANIAN-MISSISSIPPIAN

Lisburne Group: 10,500-11,310'

Along with the sandstones of the Sadlerochit Group, the carbonates of the Lisburne Group were considered to be the major objective in drilling West Fish Creek No. 1.

There is exact agreement between the paleontological determinations of Anderson, Warren & Associates, Inc. and the electric log intervals for the Lisburne Group. The top of the Lisburne occurs at 10,500', where both lithology and the electric logs reveal a change from the clastics of the Echooka Formation to hard, dense, resistive carbonates. The bottom of the interval is very distinctive on the electric logs, since there is a marked increase in the gamma-ray and a corresponding decrease in the resistivity at 11,310'. This change in log character delineates the Lisburne Group/Endicott Group boundary.

The Lisburne Group is represented almost entirely by massive limestones, most of which contain numerous fossil assemblages and are grain supported, although exhibiting low porosity due to a matrix of microcrystalline limestone. A very fine to fine crystalline dolomite zone is present from 11,180' to 11,275' which is, in part, equivalent to Anderson, Warren & Associates, Inc.'s Dolomite Unit (11,160-11,310'). Some streaks of dolomite and dolomitized limestones are scattered throughout the remainder of the Lisburne section. A few very thin shale beds are present throughout the section. The Lisburne exhibited very poor porosities, with some zones of poor to fair porosities observed in the dolomitic zones. No shows of hydrocarbons were reported from any part of the Lisburne.

MISSISSIPPIAN (PROBABLE)

Endicott Group: 11,310-11,427' (Total Depth)

Drilling operations on the West Fish Creek No. 1 were terminated before reaching the scheduled argillite "basement". The reason for the premature termination was the approach of thawing conditions which in this area occurs in early May and the difficulties which would have been involved in attempting to drill and rig down after "break-up". When the drilling activity was suspended, West Fish Creek No. 1 was in "Probable Mississippian", Endicott Group (Anderson, Warren & Associates, Inc.).

As previously mentioned, a dramatic increase in the gamma-ray response and a decrease in the resistivity on the electric logs was noted at the Lisburne/Endicott Group contact.

The 117' section of the Endicott which was penetrated, contained an interbedded sequence of limestones, siltstones, shales, and sandstones. The limestones were dense, and contained numerous algae. The sandstones were mostly light brown to brown, very fine grained, siliceous and tight. The siltstones and shales were gray and brown with some green (shale), and were generally calcareous.

HYDROCARBON SHOWS AND POTENTIAL RESERVOIRS

While there were several poor visual shows in rocks of the Nanushuk Group and the Torok Formation, all consisted of only scattered faint staining and fluorescence. A few, weak gas shows were also recorded by the mud-loggers. All of the sandstones in which the shows were noted were thin, shaly and exhibited poor porosity.

Some poor to fair visible staining with fair to good cut was observed in the Sag River Sandstone but porosities were low (9-12%).

The primary objectives of the well, the Sadlerochit and Lisburne Groups, had no shows, nor was there sufficient porosity in the zones to have enabled these rocks to serve as a "host" for hydrocarbon accumulation.

CONCLUSIONS

The primary objective horizons penetrated by the West Fish Creek No. 1 exhibited much lower than hoped for porosity development.

The evidences of unconformable relationships occurring in basal Cretaceous sedimentary rocks over the Fish Creek Platform was confirmed by the virtual absence of the "Pebble Shale".

The West Fish Creek No. 1 well was not only a dry hole, but no encouragement can be generated for the area on the basis of the general lack of reservoir qualities in the rocks encountered in the objective horizons.

PERTINENT DATA AND APPENDICES

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| A. Summary Pertinent Data | A-1-2 |
| B. Drill Cuttings and Core Descriptions | B-1-72 |

SUMMARY OF PERTINENT DATA *

WELL NAME: West Fish Creek No. 1
 API NO.: 50-103-20009
 OPERATOR: Husky Oil NPR Operations, Inc.
 LOCATION: 934' FNL, 2033' FEL, NE 1/4,
 protracted Section 11, T11N, R1W,
 Umiat Meridian, North Slope Borough, Alaska
 COORDINATES: Latitude: 70°19'35.99"N
 Longitude: 152°03'38.03"W
 X = 739,124
 Y = 5,972,858
 Zone 5
 ELEVATION: 113' Kelly Bushing, Pad 92', Ground 87'
 DATE SPUDDED: February 14, 1977
 TOTAL DEPTH: 11,427' (driller)
 11,430' (Schlumberger)
 DATE REACHED
 TOTAL DEPTH: April 21, 1977
 RIG RELEASED: April 27, 1977
 STATUS: Plugged and abandoned
 CASING: 20" @ 104'
 13-3/8" @ 2614'
 9-5/8" @ 9216'

LOGGING RECORD:

| | |
|----------------|---------------|
| DIL/SP | 104- 1,932' |
| | 2,618- 9,070' |
| | 8,860- 9,196' |
| | 9,216-11,424' |
| BHC/GR | 104- 1,935' |
| | 2,618- 9,070' |
| | 9,214-11,415' |
| CNL/FDC/GR/CAL | 2,617- 9,072' |
| | 9,212-11,429' |
| HDT | 2,610- 9,062' |
| | 9,212-11,424' |

LOGGING RECORD: (Continued)

| | |
|---------------------------|----------------|
| HDT Arrow Plot | 2,624- 9,048' |
| | 9,217-11,418' |
| CBL/VDL | 8,400- 9,092' |
| Saraband | 2,620-10,180' |
| Coriband | 10,180-11,400' |
| Mudlog | 500-11,427' |
| Geologist's Lithology Log | 500-11,427' |
| Birdwell Velocity Survey | 1,000-11,430' |

SIDEWALL CORES: ** Run No. 1, 66 shot, 35 recovered.
 Run No. 2, 30 shot, 18 recovered.

CONVENTIONAL CORES: None taken

DRILL STEM TESTS: None taken

WELLSITE GEOLOGIST: S. P. Burden

WELL LOG ANALYST: Armour Kane

DRILLING CONTRACTOR: Parco, Inc., Rig No. 96

MUDLOGGERS: Borst and Giddens

BIOSTRATIGRAPHIC
ANALYSIS: Anderson, Warren & Associates, Inc.

* Copies and/or reproducibles of all
 geologic data are available from:

 National Oceanic and Atmospheric Administration
 EDIS/NGSDC (D62)
 325 Broadway
 Boulder, CO 80303

** Sidewall cores were utilized for various analyses,
 including: lithology, paleontology, and geochemical.

WEST FISH CREEK NO. 1
DRILL CUTTINGS AND CORE DESCRIPTIONS

DRILLED DEPTH
(FEET BELOW
KELLY BUSHING)

| | |
|----------|---|
| 0- 500 | No samples caught. |
| 500- 530 | Claystone: gray, firm, bentonitic, 60%; Shale: gray, rough texture, irregular fracture, soft, in part silty; traces of dark gray shale, white, finely crystalline limestone, finely crystalline pyrite, and bentonite. |
| 530- 560 | Claystone, 80%; Shale: gray, soft, as above; slight increase in darker, firmer shale; trace of pyrite and bentonite. |
| 560- 590 | Claystone, 70%; Shale: light gray, smooth texture, bentonitic; trace of Shale: light green, bentonitic; Calcite: clear to white and opaque, 10%. |
| 590- 620 | Claystone, 60%; Shale: gray, rough texture, irregular fracture, soft, with rare carbonaceous specks; trace of bentonite. |
| 620- 650 | Claystone, 80%; Shale: as above, blocky, firmer; trace of darker shale; small amount of bentonite. |
| 650- 680 | Claystone, 60%; Shale: as above, in general darker gray; trace of bentonite and marcasite. |
| 680- 710 | Claystone, 60%; Shale: as above; trace of bentonite and calcite. |
| 710- 740 | Claystone, 50%; Shale: as above, in general, more silty, with scattered carbonaceous specks; traces of dark gray, carbonaceous shale, gray, bentonitic shale, bentonite, and a dark green, hard mineral (possibly glauconite) in a darker matrix. |
| 740- 770 | Claystone, 95%; Shale: as above; trace of bentonite and pyrite; marcasite replacement of a <u>Gastropod</u> , with some aragonite attached. |
| 770- 800 | Claystone, 95%; small amount of shale; trace of Limestone: brown, subtranslucent, cryptocrystalline, argillaceous; traces of bentonite, pyrite, and pyritized worm casts. |
| 800- 830 | Claystone, 95%; small amount of Limestone: as above; trace of pyrite and pyritized worm casts; trace of black chert and amber quartz nodules. |

- 830- 860 Claystone, 100%; traces of loose sand, coal, in part, with pyrite interbeds, limestone, bentonite, pyrite, and siderite.
- 860- 890 Claystone: as above, gray, unctuous, bentonitic, 95%; trace of siderite and sideritic siltstone; trace of Sandstone: quartz, with scattered chert and rare siderite grains; fine grained, subangular, almost a fused appearance, very calcareous; trace of gray Shale: as above.
- 890- 920 Claystone, 100%; slight increase in sandstone, with increased chert grains, in part, coarser, subangular, poorly sorted; bright yellow fluorescence; bright white cut fluorescence when crushed; trace of siderite and chert.
- 920- 950 Claystone, 100%; trace of Sandstone: as above, in part, glauconitic, in part, friable; sandstone has a bright yellow fluorescence; traces of light green shale, coal, associated with pyrite, bentonite, calcite, and dolomitic ironstone.
- 950- 980 Claystone, as above, 95%; small amount of Sandstone: as above, but coarser, with rare weathered glauconite grains; some heavy residual oil and pyrobitumen, with bright yellow fluorescence; traces of coal, bentonite, calcite, and finely crystalline pyrite.
- 980- 1010 Claystone, 90%; Sandstone: as above, fluorescent; Sandstone: dark brownish-gray, sideritic, with a bituminous matrix, no fluorescence; trace of coal and pyrite.
- 1010- 1040 As above.
- 1040- 1070 Claystone, 100%; trace of Sandstone: "salt and pepper", friable, with bright yellow fluorescence; trace of Sandstone: sideritic, with a bituminous matrix; trace of siderite and coal.
- 1070- 1100 Claystone, 95%; small amount of coal; Sandstone: as above, in part with a bituminous matrix; traces of calcite, pyrite, and siderite.
- 1100- 1130 Claystone, 100%; trace of sandstone, with a bituminous matrix; trace of gray, soft shale; traces of coal, clay ironstone, and siderite.
- 1130- 1160 Claystone, 95%; siderite, with carbonaceous specks, 5%; trace of gray shale and coal.

- 1160- 1190 Claystone, 100%; trace of "salt and pepper" Sandstone, with bright yellow fluorescence; traces of calcite, coal, and siderite.
- 1190- 1220 Claystone, 90%; Coal: rough texture, irregular fracture; trace of gray sandstone.
- 1220- 1250 Claystone: softer, more soluble, 85%; Sandstone: "salt and pepper", mainly quartz, with scattered chert grains; fine grained, subangular, fairly well sorted, friable, scattered yellow fluorescence, 5%; coal, in part, with thin pyrite bands, 5%.
- 1250- 1280 Claystone, 65%; Sandstone: "salt and pepper", mainly quartz, with scattered chert grains; fine grained, subangular, well sorted, well consolidated, very calcareous, with very rare, scattered fluorescence, 30%; siderite, 5%; trace of calcite.
- 1280- 1310 Claystone, 50%; Coal: rough texture, irregular fracture, 35%; Shale: brown, rough texture, irregular fracture, silty, with some coal inclusions, grading to an argillaceous siltstone; trace of Sandstone: as above, in part, with siderite inclusions; trace of bentonite and pyrite.
- 1310- 1340 Claystone, 80%; Sandstone: as above, but softer, more friable, 15%; coal, 5%; trace of siderite, and brown siltstone, with coal inclusions; trace of dark brownish-gray, silty shale.
- 1340- 1370 Claystone, 75%; Sandstone: soft, friable, 15%; Coal: as above, 5%; siderite and sideritic siltstone, 5%.
- 1370- 1400 Claystone: as above, 90%; Sandstone: as above, 6%; siderite, 2%; coal, 2%; trace of dark brown, silty shale.
- 1400- 1430 Claystone, 85%; Siltstone, grading to a fine, "salt and pepper" sandstone, 10%; coal, 5%; trace of sideritic siltstone; trace of dark brown, silty Shale: carbonaceous.
- 1430- 1460 Claystone, 70%; Sandstone: "salt and pepper", quartz and chert, with scattered siderite grains: fine grained, subangular, well sorted, well consolidated, calcareous matrix, tight, 15%; Shale: gray, rough texture, irregular fracture, silty to very silty; trace of siderite, ironstone, and coal.
- 1460- 1490 Claystone, 75%; Shale: as above, grading to a fine siltstone; small amount of sandstone, in part, with some glauconite grains; trace of dark brown siltstone, in part, with coaly streaks; trace of siderite and calcite.

- 1490- 1520 Claystone: as above, 80%; Sandstone: sideritic, as above, 10%; siltstone, 7%; siderite, 3%; trace of dark brown, silty shale and coal.
- 1520- 1550 Claystone: as above, 75%; Sandstone: as above, but not sideritic, more friable; argillaceous Siltstone: as above, 5%; trace of siderite and coal.
- 1550- 1580 Claystone: as above, softer, 80%; Sandstone: as above, no shows, 15%; silty Shale: rough texture, 5%; trace of siderite and coal.
- 1580- 1610 Claystone, 90%; Sandstone: as above, but much more friable; trace of silty Shale: as above; trace of dark brownish-gray, silty shale; trace of siderite.
- 1610- 1640 Claystone, 95%; small amount of siltstone; small amount of sandstone, with some coaly streaks; trace of siderite.
- 1640- 1670 Claystone, 95%; Sandstone: light gray, "salt and pepper", quartz and chert grains; fine grained, subangular, well sorted, friable, soft; Siltstone: gray and brownish-gray, argillaceous; trace of coal and bentonite.
- 1670- 1700 Claystone, 95%; small amount of calcite; small amount of gray siltstone, in part with brownish specks; trace of dark gray, carbonaceous shale; trace of siderite; trace of "salt and pepper" sandstone.
- 1700- 1730 Claystone, 100%; trace of Siltstone: gray, with carbonaceous specks; trace of sideritic siltstone; trace of siderite; trace of "salt and pepper" sandstone; trace of calcite.
- 1730- 1760 Claystone, 100%; trace of friable sandstone; trace of Shale: as above, in part less silty; trace of coal; reduced siderite.
- 1760- 1790 Claystone, 100%; trace of Sandstone, Siltstone, Siderite: as above.
- 1790- 1820 As above.
- 1820- 1850 Claystone, 100%; trace of very friable, "salt and pepper" sandstone; trace of Sandstone: fine to medium grained, quartz and chert grains, with some mafic minerals, subangular to subrounded, poorly sorted, well consolidated.

- 1850- 1880 Claystone, 80%; Sandstone: "salt and pepper", quartz and chert grains, fine grained, subangular, well sorted, poorly consolidated, very calcareous, friable; bright yellow fluorescence, but no cut or cut fluorescence; trace of brownish-gray shale; considerable loose, subrounded, poorly sorted sand grains.
- 1880- 1910 Claystone, 85%; clean Sandstone: as above, with rare siderite and glauconite grains, bright yellow fluorescence, probably chemical; trace of Sandstone: dark brownish-gray, with quartz, chert, finely disseminated pyrite and some sericite; trace of siderite.
- 1910- 1940 Claystone, 100%; trace of clean, "salt and pepper" sandstone; trace of darker sandstone, with some mafic minerals; trace of calcite and sideritic siltstone.
- 1940- 1970 Claystone, 100%; trace of Sandstone: light gray, friable; trace of darker sandstone, with some hornblende.
- 1970- 2000 Claystone, 100%; trace of calcite; trace of soft, friable, "salt and pepper" sandstone.
- 2000- 2030 Claystone, 100%; trace of calcite, siderite, and friable sandstone.
- 2030- 2060 Claystone, 100%; trace of calcite; trace of friable, "salt and pepper" sandstone, in part, with siderite grains; trace of brownish-gray shale, with scattered carbonaceous specks; trace of dark brown, silty shale.
- 2060- 2090 Claystone, 100%; trace of Sandstone: as above; trace of light gray, silty shale; traces of coal, calcite, and siderite.
- 2090- 2120 Claystone, 100%; trace of fine grained, "salt and pepper" Sandstone: soft, friable; traces of calcite, coal, and clay ironstone.
- 2120- 2150 Claystone, 100%; trace of Siltstone: gray, "salt and pepper", grading to a fine grained, friable sandstone; trace of reddish-brown siltstone; trace of bentonite and coal.
- 2150- 2180 Claystone, 100%; trace of Siltstone: light gray to light brownish-gray, in part, with scattered carbonaceous specks; trace of Sandstone: as above, in part, with rare sericite; trace of calcite and black chert nodules.
- 2180- 2210 Claystone, 100%; Sandstone, Siltstone, Calcite and Coal: as above.

- 2210- 2240 Claystone, 100%; trace of Sandstone: "salt and pepper", quartz and chert, with some amber quartz grains and some sericite; trace of dark brown, silty shale.
- 2240- 2270 Claystone, 60%; Siltstone: gray, firm, argillaceous, with scattered carbonaceous specks; Sandstone: "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, calcareous; traces of calcite, coal, and marcasite.
- 2270- 2300 As above; Claystone, 50%.
- 2300- 2330 Claystone, 50%; Shale and Sandstone: as above; trace of dark brown, silty shale; trace of mudstone, with carbonaceous streaks; traces of coal, calcite, and siderite.
- 2330- 2360 Claystone, 60%; Sandstone: as above, in part, glauconitic, in part, sideritic, 20%; Siltstone: as above; traces of coal, calcite, dark brown, silty shale, dark, argillaceous calcarenite, and finely crystalline pyrite.
- 2360- 2390 Claystone, 60%; Sandstone: as above, 30%; reduced argillaceous siltstone, 5%; trace of Limestone: dark gray, microcrystalline, with brown, nonskeletal intraclasts in a dark matrix, 5%.
- 2390- 2420 Reduced Claystone, 40%; Sandstone: as above, 30%; increased Limestone: dark brownish-gray, in part, subtranslucent, crypto to microcrystalline, in part, a calcilutite, 25%; Shale: gray, in part, slightly silty, 5%; trace of calcite; trace of Inoceramus prisms; trace of finely crystalline pyrite.
- 2420- 2450 Claystone: as above, 35%; Sandstone: as above, in general, finer grained, no shows; Limestone: as above, 25%; trace of siderite; Shale: as above; increased calcite.
- 2450- 2480 Claystone: as above, 35%; Siltstone: gray to brownish-gray, in part, with carbonaceous specks, argillaceous, 25%; Sandstone: as above, 20%; Limestone: as above, in part, brown, subtranslucent, cryptocrystalline, 20%; increased calcite; traces of pyrite, siderite, and bentonite.
- 2480- 2510 Claystone, 40%; Siltstone: as above, 30%; Sandstone, 15%; Limestone, 10%; traces of calcite and siderite.
- 2510- 2540 Claystone, 35%; Shale: gray to brownish-gray, blocky, in part, silty, 25%; Sandstone: as above, in general,

- finer, in part, with some kaolinite fragments, 20%; Calcite: clear to white and opaque, 20%; trace of Limestone: white, cryptocrystalline, massive; trace of coal; trace of siderite and sideritic siltstone, with carbonaceous specks.
- 2540- 2570 Claystone, 50%; Shale: as above, 20%; Sandstone: as above, in part, glauconitic, 15%; Calcite, 15%; traces of finely crystalline pyrite, siderite, and dark brown calcilutite.
- 2570- 2600 Claystone: gray, bentonitic, 50%; Shale: gray to brownish-gray, in part, silty, with some carbonaceous specks, 25%; Sandstone: "salt and pepper", quartz and chert, with rare glauconite grains, fine grained, subangular, well sorted, well consolidated, calcareous matrix, tight, 15%; Limestone: white to off-white, dense, massive, cryptocrystalline, 10%; trace of dark brown calcilutite; slight increase in finely crystalline pyrite; traces of calcite, bentonite, and coal.
- 2600- 2630 Claystone, 50%; Shale: gray to brownish-gray, 25%; Sandstone: "salt and pepper", very fine to fine grained, with rare siderite and sericite, 20%; Siderite, 5%; traces of white limestone, pyrite, marcasite, coal, and calcite.
- 2630- 2660 Siltstone: light gray, with carbonaceous specks, 65%; the specks have a high luster; Sandstone: light gray, "salt and pepper", 15%; trace of Shale: dark brownish-gray; traces of siderite, calcite, and bentonite; Claystone, 5%; rounded, light brown quartz nodules, 15%.
- 2660- 2690 Cement, 60%; Siltstone: as above, 25%; Sandstone, 15%; traces of dark gray shale, light green shale, siderite, and quartz nodules.
- 2690- 2720 Reduced Cement, 30%; Sandstone: as above, gray, sideritic, 25%; Siltstone: as above, 20%; increased quartz nodules, 10%; Siderite, 5%; Claystone, 10%; trace of finely crystalline pyrite octahedrons; trace of limestone.
- 2720- 2750 Cement, 20%; Claystone, 15%; Siltstone, 30%; Sandstone, 25%; Siderite, 5%; trace of light reddish-brown siltstone; trace of sideritic siltstone; trace of dark gray, blocky shale; trace of finely crystalline pyrite; reduced quartz nodules, in part, frosted, 5%.
- 2750- 2780 Cement, 60%; Claystone, 20%; Sandstone: as above, 10%; Siltstone: as above, 10%; trace of siderite; trace of dark gray Shale: smooth texture, noncalcareous; trace of reddish-brown, silty shale; traces of white limestone, calcite, finely crystalline pyrite, coal, quartz nodules, and smoky, subangular chert.

- 2780- 2810 Cement, 25%; Claystone, 40%; Sandstone: dark gray, "salt and pepper", fine, subangular, well sorted, well consolidated, calcareous, 15%; Siltstone: gray, "salt and pepper", 10%; trace of coarse, clear quartz Sandstone: indurated, siliceous matrix; traces of siderite, white, cryptocrystalline limestone, calcite, finely crystalline pyrite, and dark gray shale; increased quartz nodules, 10%.
- 2810- 2840 Cement, 20%; Claystone, 30%; Sandstone: gray to dark gray, quartz and chert with rare siderite grains: calcareous, 30%; Siltstone: gray, "salt and pepper", 10%; trace of sideritic siltstone, with some lignitic streaks; trace of Shale: light gray, soft, bentonitic; trace of Limestone: dark brown, crypto to microcrystalline, argillaceous; traces of white limestone, calcite, siderite, finely crystalline pyrite, bentonite, coal, and aragonite.
- 2840- 2870 Cement, 30%; Claystone, 60%; Sandstone: as above, 5%; Siltstone, 5%; trace of volcanic tuff; trace of reddish-brown siltstone; trace of gray shale, in part, silty; trace of coal, in part, with thin pyrite laminae; trace of coarser sandstone, in part, with some rusty staining, and with a fused appearance; trace of finely crystalline pyrite, and bentonite.
- 2870- 2900 Claystone: gray, unctuous, bentonitic, 40%; Cement, 40%; Sandstone: as above, 10%; Siltstone, 10%; trace of dark limestone; trace of white, massive, cryptocrystalline limestone; trace of dark gray shale; trace of sideritic siltstone, with dark, carbonaceous streaks; trace of siderite; trace of calcite; trace of fine pyrite banding in a dark, carbonaceous shale; trace of aragonite.
- 2900- 2930 Cement, 20%; Claystone, 30%; Siltstone: light gray to gray, "salt and pepper", in part, slightly argillaceous, 30%; Sandstone: gray, "salt and pepper", in part, soft, noncalcareous; trace of Shale: dark gray, carbonaceous, laminated, with interlayers of pyrite; trace of dark, argillaceous limestone; trace of siderite; trace of rounded, frosted quartz nodules, in part yellowish-brown in color.
- 2930- 2960 Cement, 20%; Claystone, 30%; Siltstone: gray, "salt and pepper", 20%; Sandstone: darker gray, "salt and pepper", quartz and chert, fine grained, subangular, well sorted, well consolidated, calcareous matrix, no shows; traces of finely crystalline pyrite, coal, calcite, and aragonite.
- 2960- 2990 Claystone, 40%; Cement, 30%; Sandstone, 20%; Siltstone, 10%; trace of clearer quartz sandstone, almost an

- orthoquartzite; increased pyrite; trace of pyritized worm casts; trace of coal, associated with pyrite in thin laminae; traces of marcasite, siderite, calcite, aragonite, and rounded quartz nodules.
- 2990- 3020 Cement, 20%; Claystone, 70%; Sandstone: "salt and pepper", quartz and chert grains, with scattered siderite; in part, the sandstone has scattered phlogopite; small amount of marcasite; trace of black chert nodules.
- 3020- 3040 Cement, 10%; Claystone, 90%; trace of sandstone; trace of dark brownish-gray calcilutite; trace of marcasite; trace of aragonite; trace of bentonite; trace of coal and pyrite laminae; trace of pyrite.
- 3040- 3060 Cement, 10%; Claystone, 90%; trace of sandstone, with phlogopite and rare sericite; traces of limestone, coal, siderite, and finely crystalline pyrite.
- 3060- 3080 As above.
- 3080- 3100 Cement, 5%; Claystone, 90%; small amount of Siltstone: gray, "salt and pepper", slightly argillaceous; small amount of Sandstone: as above; trace of Shale: dark brownish-gray, blocky; traces of pyrite, marcasite, calcite, siderite, lignitic coal, and pyrite laminae.
- 3100- 3120 Cement, 5%; Claystone, 95%; traces of sandstone, siltstone, calcite, pyrite, lignitic coal, and subrounded, yellowish quartz nodules.
- 3120- 3140 Claystone, 100%; trace of cement; traces of very fine sandstone, marcasite, pyrite, and siderite.
- 3140- 3160 Cement, 5%; Claystone, 95%; traces of sandstone, marcasite, pyrite, and siderite.
- 3160- 3180 Cement, 5%; Claystone, 95%; trace of siltstone; trace of volcanic tuff, with small vesicles filled with a light green mineral, probably epidote or chlorite; trace of dark, brownish-gray calcilutite; trace of rounded quartz nodules, with iron staining.
- 3180- 3200 Cement, 10%; Claystone, 90%; trace of Sandstone: gray, "salt and pepper", with some hornblende grains; trace of Siltstone: gray, "salt and pepper"; trace of volcanic tuff, with light green infilling in the vesicles; trace of marcasite, and pyrite.
- 3200- 3220 Cement, 5%; Clay, 95%; trace of sandstone, with hornblende crystals; traces of volcanic tuff, calcite, and some brown, chitinous material.

- 3220- 3240 Claystone, 100%; traces of cement, calcite, marcasite, and pyrite.
- 3240- 3260 Small amount of cement; Claystone, 95%; small amount of Sandstone: darker gray, with some mafic minerals; traces of dark brownish-gray limestone, pyrite, and marcasite.
- 3260- 3280 Cement, 5%; Claystone, 95%; trace of sandstone; traces of calcite, coal, limestone, and siderite.
- 3280- 3300 Claystone, 100%; trace of cement; small amount of siderite; trace of pyrite and marcasite.
- 3300- 3320 Claystone, 100%; increased siderite; traces of pyrite, sandstone, siltstone, and calcite.
- 3320- 3340 Claystone, 100%; traces of cement, sandstone, coal, and pyrite.
- 3340- 3360 Claystone, 60%; Sandstone: light gray, "salt and pepper", quartz and chert grains, fine grained, subangular, well sorted, well consolidated, calcareous matrix, faint brown fluorescence, very light brown cut, yellowish-white cut fluorescence.
- 3360- 3380 Claystone, 60%; Sandstone: as above; small amount of Siltstone: darker gray, argillaceous; trace of siderite and coal.
- 3380- 3400 Claystone, 70%; Sandstone: light gray to gray, as above; Siderite, 5%.
- 3400- 3420 Claystone, 80%; Sandstone: as above, with a greenish-brown fluorescence, very light brown cut; traces of finely crystalline pyrite and siderite.
- 3420- 3440 Claystone, 95%; small amount of Sandstone: as above; trace of siderite.
- 3440- 3460 Claystone, 100%; traces of sandstone, siderite, coal, and pyrite.
- 3460- 3480 Claystone, 100%; traces of siderite, sandstone, and limestone.
- 3480- 3500 Claystone, 95%; slight increase in sandstone; trace of siderite and dark brown shale.
- 3500- 3520 Claystone, 100%; traces of sandstone, siltstone, aragonite, and rounded quartz nodules.

- 3520- 3540 Claystone, 100%; traces of sandstone, pyrite, coal, and siderite.
- 3540- 3560 Claystone, 95%; Sandstone: "salt and pepper", as above, 3%; Siderite, 2%; trace of dark brownish-gray limestone; traces of coal, calcite, finely crystalline pyrite, and dark gray shale.
- 3560- 3580 Increased Sandstone: slightly coarser, dull greenish-brown fluorescence, 5%.
- 3580- 3600 Claystone, 95%; Sandstone, 5%; trace of siderite and marcasite.
- 3600- 3620 As above; trace of bentonite.
- 3620- 3640 Claystone, 100%; traces of sandstone, siderite, and finely crystalline pyrite.
- 3640- 3660 As above; trace of marcasite.
- 3660- 3680 Claystone, 95%; small amount of sandstone; traces of siderite, pyrite, marcasite, and coal.
- 3680- 3700 Claystone, 95%; Sandstone: "salt and pepper", gray, quartz and chert grains; fine grained, subangular, well sorted, calcareous matrix; brownish-green fluorescence, whitish-yellow cut fluorescence; traces of siderite, coal, rounded quartz nodules, and black chert nodules.
- 3700- 3720 Claystone: as above, 95%; Sandstone, 5%; traces of siderite, pyrite, bentonite, and quartz nodules.
- 3720- 3740 Claystone, 95%; Sandstone, 5%; traces of siderite, calcite, pyrite, and quartz nodules.
- 3740- 3760 As above; traces of calcite, pyrite, and quartz nodules.
- 3760- 3780 As above; traces of bentonite and light gray, bentonitic shale.
- 3780- 3800 Claystone, 100%; trace of Sandstone: as above; traces of siderite, pyrite, and bentonite.
- 3800- 3820 As above; trace of coal and aragonite.
- 3820- 3840 Claystone, 100%; traces of siderite, calcite, bentonite, pyrite, dark limestone, and dark gray shale.
- 3840- 3860 Claystone, 100%; traces of sandstone, calcite, and marcasite.

- 3860- 3880 Claystone, 80%; Sandstone: "salt and pepper", quartz and chert grains; fine grained, subangular, well sorted, well consolidated, calcareous matrix, brown fluorescence, very faint crushed cut fluorescence; the scattered bright yellow fluorescence is probably chemical.
- 3880- 3900 Claystone, 80%; Sandstone: as above, with olive-brown fluorescence, 20%; trace of siderite.
- 3900- 3920 Claystone, 90%; Sandstone, 10%; trace of siderite and pyrite.
- 3920- 3940 Claystone, 95%; Sandstone, 5%; trace of siderite.
- 3940- 3960 Claystone, 100%; traces of sandstone, siderite, coal, marcasite, and pyrite.
- 3960- 3980 Claystone, 100%; trace of sandstone and siderite.
- 3980- 4000 Claystone, 95%; Sandstone: "salt and pepper", quartz and chert grains; fine grained, subangular, well sorted, well consolidated, calcareous, olive-brown fluorescence; trace of siderite.
- 4000- 4020 Claystone, 95%; Sandstone, 5%; traces of siderite, marcasite, and calcite.
- 4020- 4040 Claystone, 100%; traces of sandstone, siderite, pyrite, and quartz nodules.
- 4040- 4060 Claystone, 95%; Sandstone, 5%; traces of siderite, pyrite, marcasite, calcite, and quartz nodules.
- 4060- 4080 Claystone, 100%; traces of sandstone, siderite, calcite, coal, and pyritized worm casts.
- 4080- 4100 Claystone, 100%; trace of sandstone, with some kaolinitic infilling; traces of siderite, pyrite, and bentonite.
- 4100- 4120 Claystone, 95%; Sandstone, 5%, with yellowish-brown fluorescence, very faint crushed cut fluorescence; traces of siderite, marcasite, limestone, coal, calcite, and pyrite.
- 4120- 4140 Claystone, 50%; Sandstone: "salt and pepper", quartz and chert, with rare scattered sericite; fine grained, subangular, well sorted, well consolidated, calcareous matrix, greenish-brown fluorescence, very faint crushed cut fluorescence; traces of siderite, bentonite, and coal.
- 4140- 4160 Claystone, 60%; Sandstone: as above, in general, finer, with rare siderite and very rare hornblende, 35%; Siderite, 5%; trace of calcite and crystalline pyrite.

- 4160- 4180 Claystone, 75%; Sandstone, 15%; Siderite, 10%; traces of marcasite, pyrite, calcite, and soft gray shale, with some carbonaceous streaks.
- 4180- 4200 Claystone, 70%; Sandstone, 15%; siderite and sideritic Siltstone, 10%; Siltstone: gray, argillaceous, 5%; trace of calcite, coal, and pyrite.
- 4200- 4220 Claystone, 85%; Sandstone, 10%; in part, with some sideritic grains; siderite and sideritic Siltstone, 5%; trace of Siltstone: gray, argillaceous; trace of pyrite and calcite.
- 4220- 4240 Claystone, 70%; Sandstone, 15%; Shale: gray to dark gray, in part, silty, 10%; siderite and sideritic Siltstone, 5%; traces of calcite, pyrite, and rounded quartz nodules.
- 4240- 4260 Claystone, 60%; siderite and sideritic Siltstone, 20%; Sandstone: as above, 10%; Siltstone: gray, "salt and pepper", 10%; rare quartz nodules.
- 4260- 4280 Claystone, 60%; Sandstone: "salt and pepper", quartz and chert with rare sericite; greenish-brown fluorescence, 20%; siderite and sideritic Siltstone, 15%; Siltstone: gray, "salt and pepper", argillaceous, 5%; traces of calcite, pyrite, and marcasite.
- 4280- 4300 Claystone, 65%; softer; Sandstone: as above, in general, finer grained, more argillaceous, 20%; siderite and sideritic Siltstone, 10%; Siltstone: gray, argillaceous, 5%; trace of Shale: gray to dark gray; trace of calcite and pyrite.
- 4300- 4320 Claystone, 70%; Sandstone: as above, finer grained, more argillaceous, 15%; Siltstone: gray, argillaceous, 5%; siderite and sideritic Siltstone, 10%; trace of calcite and marcasite.
- 4320- 4340 Claystone, 60%; Sandstone, 40%; trace of siderite and calcite.
- 4340- 4360 Claystone, 70%; Sandstone: "salt and pepper", as above, with yellowish-brown fluorescence and bright yellow crushed cut fluorescence, 30%; traces of siderite, calcite, dark brownish-gray calcilutite and Dentalia.
- 4360- 4380 As above; in part, the sandstone is finer grained, more argillaceous; increased siderite and sideritic siltstone; the limestone occurs as thin bands in the siltstone; trace of pyrite and aragonite.
- 4380- 4400 Claystone, 80%; Sandstone, 20%; trace of siderite and sideritic siltstone; trace of calcite and brownish-gray shale.

- 4400- 4420 Claystone, 90%; Sandstone: as above, with reduced crushed cut fluorescence, 5%; siderite and sideritic Siltstone, 5%; traces of marcasite, coal, and rounded quartz nodules.
- 4420- 4440 Claystone, 80%; Sandstone, 15%; Siderite, 5%; traces of calcite, pyrite, and black chert nodules.
- 4440- 4460 Claystone, 95%; Sandstone, 5%; trace of pink orthoclase in the sandstone; traces of siderite, pyrite, and marcasite.
- 4460- 4480 Claystone, 90%; Sandstone: as above, 5%; Siderite, 5%; trace of pyrite and marcasite.
- 4480- 4500 Claystone: gray to dark gray, unctuous, bentonitic, 100%; trace of sandstone; trace of Limestone: dark brownish-gray, cryptocrystalline, a calcilutite.
- 4500- 4520 Claystone, 100%; trace of sandstone, with brownish fluorescence; trace of sideritic siltstone.
- 4520- 4540 Claystone, 95%; Sandstone: as above, 5%; trace of sideritic siltstone; trace of marcasite and dark brownish-gray limestone.
- 4540- 4560 Claystone, 100%; trace of sandstone; trace of siderite and marcasite.
- 4560- 4580 Claystone, 95%; Sandstone, 5%; traces of siderite, sideritic siltstone, pyrite, and marcasite.
- 4580- 4600 As above.
- 4600- 4620 Claystone, 100%; trace of sandstone and pyrite.
- 4620- 4640 As above.
- 4640- 4660 Claystone, 100%; trace of sandstone, siderite, and pyrite.
- 4660- 4680 As above.
- 4680- 4700 Claystone, 100%; Sandstone: "salt and pepper", as above, with some dark, lignitic streaks; traces of siderite, pyrite, and marcasite.
- 4700- 4720 Claystone, 100%; Sandstone: as above; traces of siderite, pyrite, and coal; trace of Limestone: dark brownish-gray, subtranslucent, a calcilutite.
- 4720- 4740 Claystone, 95%; Sandstone: as above, with scattered, greenish-brown fluorescence; trace of calcite.

- 4740- 4760 Claystone, 95%; Sandstone: as above, 5%; trace of Shale: dark brownish-gray, soft, smooth texture; traces of siderite, calcite, and bentonite.
- 4760- 4780 Claystone, 95%; Sandstone: as above, with rare, scattered, heavy residual oil staining; trace of siderite and marcasite.
- 4780- 4800 Claystone, 95%; Sandstone: as above, 5%; traces of siderite, pyrite, coal, and calcite.
- 4800- 4820 Claystone, 100%; trace of sandstone, in part, with some mafic minerals; trace of siderite.
- 4820- 4840 Claystone, 100%; trace of Limestone: light gray to brownish-gray, in part, mottled, cryptocrystalline, a calcilutite; trace of sandstone and black chert nodules.
- 4840- 4860 Claystone, 100%; trace of sandstone; trace of Siltstone: light brownish-gray, with scattered carbonaceous specks; traces of marcasite, pyrite, and pyritized worm casts.
- 4860- 4880 As above.
- 4880- 4900 Claystone, 100%; traces of sandstone, siltstone, calcite, pyrite, and marcasite.
- 4900- 4920 Claystone, 100%; trace of Sandstone: lighter gray, finer grained; traces of siltstone, limestone, and marcasite.
- 4920- 4940 Claystone, 100%; trace of sandstone, sideritic siltstone, dark gray, silty shale, and marcasite.
- 4940- 4960 Claystone, 100%; trace of sandstone, and dense, hard, gray shale, in part, with subrounded quartz nodules; traces of black chert nodules, marcasite, pyrite, and siderite.
- 4960- 4980 Claystone, 100%; trace of sandstone, sideritic siltstone, pyrite, and dark gray shale.
- 4980- 5000 Claystone, 100%; increased marcasite and pyrite; trace of dark gray Siltstone: very argillaceous; trace of sideritic siltstone; trace of dark gray Shale: soft, smooth texture.
- 5000- 5020 Claystone, 100%; trace of "salt and pepper" sandstone, with very faint fluorescence; trace of Siltstone: dark gray to light gray; trace of sideritic siltstone; trace of marcasite and dark gray, silty shale.

- 5020- 5040 Claystone: as above, softer, 100%; trace of Sandstone: as above; trace of Siltstone: gray to dark gray; trace of sideritic siltstone; increased marcasite and pyrite; trace of dark gray to dark brownish-gray shale.
- 5040- 5060 Claystone, 100%; trace of marcasite; trace of Siltstone: as above; trace of siderite and aragonite Dentalia.
- 5060- 5080 Claystone, 100%; trace of marcasite; trace of fine sandstone; trace of Siltstone: as above; trace of siderite.
- 5080- 5100 Claystone, 100%; trace of Shale: gray, rough texture, irregular fracture; trace of marcasite, sandstone, and sideritic siltstone.
- 5100- 5120 Claystone, 100%; trace of fine sandstone; trace of Shale: as above; trace of siderite.
- 5120- 5140 Claystone, 100%; traces of sandstone, marcasite, sideritic siltstone, and dark gray shale.
- 5140- 5160 Claystone, 100%; trace of sandstone; traces of marcasite, pyrite, bentonite, gray, silty shale, and calcilutite.
- 5160- 5180 Claystone, 95%; Sandstone: gray, "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, slightly calcareous, argillaceous, with a faint greenish-yellow fluorescence, 5%, pyrite and coal.
- 5180- 5200 Claystone, 100%; traces of sandstone, marcasite, pyrite and pyritized worm casts, gray to dark gray siltstone, and siderite.
- 5200- 5220 Claystone, 100%; traces of sandstone, marcasite, siderite, and light brownish-gray shale.
- 5220- 5240 Claystone, 90%; Siltstone: gray to dark gray, 10%; traces of siderite, dark gray shale, in part, silty, marcasite, pyrite and pyritized worm casts, sideritic siltstone; Limestone: dark gray, subtranslucent.
- 5240- 5260 Claystone, 80%; Sandstone: as above, 10%; Siltstone, 5%; trace of Shale: light brown to gray; trace of pyrite and black chert nodules.
- 5260- 5280 Claystone, 70%; Sandstone: as above, in part, with rare mafic minerals and faint, scattered fluorescence; Siltstone: gray to brownish-gray, argillaceous; trace of calcite and chert.

- 5280- 5300 Claystone, 50%; Shale: brownish-gray, fairly smooth texture, in part, silty, 45%; Sandstone: as above, 5%; traces of pyrite, bentonite, marcasite, and coal.
- 5300- 5320 Claystone: as above, 40%; Shale: as above, 45%; Siltstone: gray to dark gray, argillaceous, 10%; Sandstone, 5%; trace of pyrite and coal.
- 5320- 5340 Claystone, 30%; Shale: gray to brownish-gray, in part, slightly silty, 20%; Siltstone, 30%; Sandstone: as above, with rare scattered yellowish-green fluorescence, 20%; trace of coarser, clear quartz Sandstone: indurated; traces of pyrite, bentonite, coal, and glauconite grains in a dark matrix.
- 5340- 5360 Claystone, 30%; Shale, 25%; Siltstone, 25%; Sandstone: as above, in part with rare hornblende, 20%; trace of bentonite and pyrite.
- 5360- 5380 Claystone, 30%; Shale, 25%; Siltstone, 25%; Sandstone: as above, in part, with rare hornblende, 20%; trace of bentonite and pyrite.
- 5380- 5400 Claystone, 35%; Shale: brownish-gray to gray, in part, platy, in part, slightly silty, 30%; Siltstone: gray to darker gray, argillaceous, 10%; Sandstone: "salt and pepper", quartz and chert with rare hornblende; fine grained, subangular, well sorted, well consolidated, calcareous, no shows, 25%.
- 5400- 5420 Claystone, 20%; Shale: as above, soft, 45%; Sandstone: as above, 25%; Siltstone, 10%; traces of marcasite, pyrite, and siderite.
- 5420- 5440 Claystone, 20%; Sandstone: as above, with traces of sericite, 40%; Shale: as above, 35%; Siltstone, 5%; trace of marcasite and siderite.
- 5440- 5460 Claystone, 10%; Sandstone: finer grained, more argillaceous, 45%; Siltstone, 30%; Shale, 15%; traces of marcasite, pyrite, and sideritic siltstone.
- 5460- 5480 Claystone, 10%; Sandstone: as above, 35%; Siltstone, 30%; Shale, 25%; traces of marcasite, pyrite, and calcite.
- 5480- 5500 Sandstone: as above, 45%; Siltstone, 20%; Shale, 30%; Marcasite, 5%; trace of pyrite; trace of coal and pyrite laminae.
- 5500- 5510 Shale, 45%; Sandstone, 30%, in part, with rare siderite grains, in part, with rare mafic minerals; Siltstone, 25%; trace of marcasite.

- 5510- 5520 Shale: as above, in part, platy, in part, silty, 50%; Sandstone: as above, slightly friable, with carbonaceous streaks, 30%; Siltstone: gray to darker gray, argillaceous, 20%; trace of marcasite; scattered greenish fluorescence in the sandstone.
- 5520- 5530 Sandstone: more friable, with scattered bright yellowish-green fluorescence, bright yellowish-white cut fluorescence, 60%; Shale: as above, more platy, 30%; siltstone, 10%; trace of marcasite.
- 5530- 5540 Friable Sandstone: as above, with scattered greenish-yellow fluorescence, 65%; Shale: as above, 35%; trace of siderite.
- 5540- 5550 Sandstone: as above, in general, slightly finer grained, with scattered fluorescence, 65%; Shale: as above, platy, 35%; Siltstone, 5%.
- 5550- 5560 Sandstone: as above, slight increase in fluorescence, 65%; Shale, 35%; Siltstone, 5%; trace of marcasite and coal.
- 5560- 5570 Sandstone: as above, with slight reduction in fluorescence, 60%; Siltstone: as above, 20%; Shale: as above, 20%; trace of marcasite, pyrite, and siderite.
- 5570- 5580 Sandstone: as above, with a slight reduction in fluorescence, 55%; Siltstone, 15%; Shale, 25%; Siderite, 5%; trace of marcasite and coal.
- 5580- 5590 Sandstone: as above, 65%, with 20% fluorescence; Siltstone, 15%; Shale, 20%; trace of marcasite, siderite, and coal.
- 5590- 5600 Sandstone: as above, friable, with scattered fluorescence, 60%; Siltstone, 5%; Shale, 15%; Siderite, 10%; trace of marcasite and coal.
- 5600- 5610 Sandstone: as above, slightly coarser, more poorly sorted, 70%; Shale: as above, 20%; Siderite, 10%; trace of coal and marcasite.
- 5610- 5620 Increased Sandstone: more friable, with rare, widely scattered fluorescence, 90%; Shale, 5%; Siltstone, 5%; trace of siderite and marcasite.
- 5620- 5630 Friable Sandstone, 90%, trace of fluorescence; Shale, 10%; trace of coal, siderite, and calcite.
- 5630- 5640 Sandstone: as above, with rare siderite, 90%; Shale: gray to brownish-gray, platy, in part, slightly silty; trace of siderite, bentonite, and coal.

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- 5640- 5650 Shale: as above, 45%; Sandstone, slight increase in greenish-yellow fluorescence, 40%; Siltstone, 15%; trace of reddish-brown, lateritic siltstone; trace of marcasite.
- 5650- 5660 Sandstone, 60%; Shale, 30%; Siltstone, 10%; trace of siderite and coal.
- 5660- 5670 Sandstone: as above, no fluorescence, 60%; Shale, 30%; Siltstone, 10%; trace of siderite and coal.
- 5670- 5680 Friable Sandstone, no shows, 70%; Shale, 20%; Siltstone, 5%; Siderite, 5%; trace of coal, marcasite, pyrite, and lateritic shale.
- 5680- 5690 Sandstone: more argillaceous, 70%; Shale: light gray to gray and brownish-gray, 25%; Siltstone, 5%; trace of marcasite, siderite, and coal; trace of Limestone: dark gray, subtranslucent.
- 5690- 5700 Sandstone: as above, friable, 85%; Shale, 15%; trace of pyrite and siderite.
- 5700- 5710 Sandstone: as above, dark gray, scattered mafics, scattered greenish-yellow fluorescence, 70%; Siltstone, 15%; Shale, 15%; trace of marcasite.
- 5710- 5720 Sandstone: as above, tighter than above, with scattered fluorescence, 40%; Siltstone, 30%; Shale, 30%; trace of marcasite and pyrite.
- 5720- 5730 Shale: as above, in part silty, 50%; Sandstone: as above, with 5% fluorescence, 30%; Siltstone, 20%; trace of marcasite and pyrite.
- 5730- 5740 Shale, 60%; Sandstone, with increased fluorescence, 20%; Siltstone, 20%.
- 5740- 5750 Sandstone: as above, 40%, no shows; Shale, 50%; Siltstone, 10%; trace of marcasite.
- 5750- 5760 Sandstone: "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, calcareous matrix, with 60% bright greenish-yellow fluorescence, bright whitish-yellow crushed cut fluorescence, 80%; Siltstone, 10%; Shale, 10%; trace of marcasite.
- 5760- 5770 Sandstone: as above, 80%; Shale, 15%; Siltstone, 5%.
- 5770- 5780 As above.
- 5780- 5790 Sandstone: as above, with 50% fluorescence, 90%; Shale, 10%; trace of pyrite.

- 5790- 5800 Sandstone: as above, with 40% fluorescence, 90%; Shale: mostly dark gray, in part silty, 10%; trace of marcasite.
- 5800- 5810 Sandstone: as above, 80%; Shale, 15%; Siltstone, 5%; trace of siderite and coal.
- 5810- 5820 Sandstone: as above, with slightly reduced yellowish-green fluorescence, 70%; Shale: light brownish-gray to gray, 25%; Siltstone: gray to dark gray, 5%; trace of siderite and marcasite.
- 5820- 5830 Reduced Sandstone, with reduced scattered fluorescence, 40%; Siltstone, 40%; Shale, 20%; trace of pyrite and rounded quartz nodules.
- 5830- 5840 Sandstone: as above, with 10% fluorescence, 60%; Siltstone, 20%; Shale, 20%; trace of marcasite, aragonite, and smoky chert fragments.
- 5840- 5850 Sandstone, with slightly increased fluorescence; Shale, 30%; Siltstone, 10%; trace of pyrite and calcite.
- 5850- 5860 Sandstone: as above, but more argillaceous, harder, with a trace of fluorescence, 40%; Shale: as above, in part, silty, 50%; Siltstone, 10%; trace of aragonite.
- 5860- 5870 Sandstone: as above, dark gray, argillaceous, 30%; Siltstone, 30%; Shale, 40%; trace of Dentalia.
- 5870- 5880 Sandstone: as above, argillaceous, with very rare fluorescence, argillaceous, 60%; Siltstone, 20%; Shale, 20%; trace of Dentalia.
- 5880- 5890 Reduced Sandstone, with 10% fluorescence, 30%; Shale: as above, in part, silty, 40%; Siltstone, 25%; marcasite and Pyrite, 5%; trace of Dentalia.
- 5890- 5900 Sandstone: dark gray, "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, calcareous, argillaceous, with rare, scattered greenish-yellow fluorescence, 45%; Siltstone: gray to dark gray, argillaceous, 20%; Shale: as above; small amount of marcasite and pyrite; trace of siderite.
- 5900- 5910 Sandstone: as above, 20%; Shale: mostly brownish-gray, fairly smooth texture, blocky to platy, in part, silty, 50%; Siltstone: gray to dark gray, argillaceous, 30%; trace of pyrite.
- 5910- 5920 Sandstone: as above, 30%; Shale, 50%; Siltstone, 20%; trace of pyrite.

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- 5920- 5930 Shale: as above, 50%; Siltstone, 30%; Sandstone: very argillaceous, 20%; trace of Dentalia.
- 5930- 5940 Sandstone: as above, in part, cleaner, slightly coarser, 30%; Shale: as above, in part, platy, in part, slightly silty, 50%; Siltstone: as above; trace of marcasite and pyrite.
- 5940- 5950 Sandstone, 20%; Shale, 60%; Siltstone, 20%; trace of pyrite and siderite.
- 5950- 5960 Sandstone: as above, mostly dark gray, very fine grained, argillaceous, 20%; Siltstone, 20%; Shale, 60%.
- 5960- 5970 Sandstone: as above, in part, less argillaceous and slightly friable, 30%; Shale: brownish-gray, with minor dark gray, fairly rough texture, silty, 50%; Siltstone: gray to dark gray, argillaceous, 20%.
- 5970- 5980 Sandstone: "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, calcareous matrix, argillaceous, 35%; Siltstone: as above, 35%; Shale, 30%; trace of marcasite and pyrite.
- 5980- 5990 Sandstone: as above, 50%; Siltstone, 20%; Shale, 30%; trace of marcasite and pyrite.
- 5990- 6000 Reduced sandstone, with rare siderite grains: more argillaceous, 30%; Siltstone, 20%; Shale, 50%; trace of marcasite.
- 6000- 6010 Sandstone: as above, with rare, scattered siderite, 20%; Shale: brownish-gray with minor gray, rough texture, blocky to platy, in part, slightly silty, 60%; Siltstone: brownish-gray to gray, firm, argillaceous, 20%.
- 6010- 6020 Sandstone: as above, in part, very argillaceous, in part, with very rare siderite grains, 30%; Shale: as above, 50%; Siltstone: as above, in part, with scattered carbonaceous specks, 20%; trace of siderite.
- 6020- 6030 Sandstone: as above, in part, less argillaceous, 30%; Shale: as above, 50%; Siltstone: gray, occurring as lenses in the shale, 20%; trace of siderite and calcite.
- 6030- 6040 Sandstone: as above, 50%; Shale, 40%; Siltstone, 10%; trace of subtranslucent chert fragments.
- 6040- 6045 Sandstone, 30%; Shale, 50%; Siltstone, 20%; trace of calcite; trace of Dentalia.

- 6045- 6060 Sandstone: gray, fine to very fine grained, argillaceous, 40%; Shale: gray to brownish-gray, 40%; Siltstone, 20%.
- 6060- 6070 Sandstone, 30%; Shale: as above, 60%; Siltstone, 10%; trace of bentonite.
- 6070- 6080 Sandstone: "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, calcareous, argillaceous, with rare, scattered greenish-yellow fluorescence, 20%; Shale: gray to brownish-gray, soft, silty in part, platy in part, 60%; Siltstone: gray to darker gray, argillaceous; trace of pyrite.
- 6080- 6090 Increased Sandstone: as above, 30%; Shale, 60%; Siltstone, 10%.
- 6090- 6100 Increased Sandstone, 40%; Shale, 40%; Siltstone, 20%; trace of Dentalia.
- 6100- 6110 Sandstone: as above, 40%, in part, more friable; Shale, 50%; Siltstone, 10%; trace of siderite.
- 6110- 6120 Sandstone: as above, argillaceous, 30%; Shale, 50%; Siltstone, 20%; trace of siderite and marcasite.
- 6120- 6130 Sandstone: as above, in general, finer grained, more argillaceous, 40%; Shale: as above, 50%; Siltstone, 10%; trace of pyrite.
- 6130- 6140 Sandstone: as above, with traces of phlogopite, argillaceous, 40%; Shale: as above, in general, more silty, 40%; Siltstone, 20%; trace of pyrite.
- 6140- 6150 Sandstone: as above, 50%; Shale: as above, with increased gray, soft, silty, in part, platy, 45%; Siltstone, 5%; trace of marcasite, pyrite, siderite, and coal.
- 6150- 6160 As above.
- 6160- 6170 Sandstone: as above, 40%; Shale, 50%; Siltstone, 20%; trace of pyrite.
- 6170- 6180 Sandstone, 50%; Shale, 30%; Siltstone, 20%.
- 6180- 6190 As above; trace of Sandstone: clear quartz, medium grained, siliceous matrix, fused appearance; trace of siderite.
- 6190- 6200 Sandstone: as above, argillaceous, 40%; Shale, 50%; Siltstone, 10%; trace of siderite.

- 6200- 6210 Sandstone, 55%; Siltstone, 15%; Shale: as above, mostly brownish-gray, soft, silty, 30%; trace of pyrite, siderite and Dentalia.
- 6210- 6220 Sandstone: as above, in part, more friable, in part, with fair porosity, 50%; Shale: as above, 35%; Siltstone, 15%; trace of pyrite and Dentalia.
- 6220- 6230 Sandstone: as above, 40%; Shale, 45%; Siltstone, 15%; trace of marcasite.
- 6230- 6240 Slight increase in Sandstone, 50%; Shale: mainly brownish-gray, 40%; Siltstone: mostly darker gray, 10%; trace of marcasite.
- 6240- 6250 Sandstone, 50%; Shale, 25%; Siltstone, 25%; trace of marcasite, calcite, and coal.
- 6250- 6260 As above; trace of calcite and marcasite.
- 6260- 6270 Sandstone: as above, 45%; Shale: brownish-gray to dark gray, fairly smooth texture, soft, in part, platy to fissile, 40%; Siltstone, 25%.
- 6270- 6280 Sandstone: as above, 50%; Shale, 35%; Siltstone, 15%; trace of pyrite.
- 6280- 6290 As above; trace of pyrite.
- 6290- 6300 Sandstone: as above, with a trace of hornblende, 25%; Siltstone, 30%; Shale, 45%.
- 6300- 6310 As above; trace of pyrite, marcasite, and siderite.
- 6310- 6320 No sample.
- 6320- 6330 No sample.
- 6330- 6340 Sandstone: gray to dark gray, "salt and pepper", quartz and chert with rare hornblende; fine grained, subangular, well sorted, calcareous, no shows, 40%; Siltstone: gray to dark gray, "salt and pepper", argillaceous, 30%; Shale: light brownish-gray to dark gray, platy, 30%.
- 6340- 6350 Sandstone: in part, argillaceous, 45%; Siltstone, 30%; Shale, 20%; trace of siderite and pyrite.
- 6350- 6360 Sandstone: argillaceous, 65%; Shale: as above, 20%; Siltstone: as above, 10%.

- 6360- 6370 Sandstone: as above, in part, slightly friable, 70%; Siltstone, 10%; Shale, 20%.
- 6370- 6380 Sandstone: "salt and pepper", quartz and chert grains; fine to very fine grained, subangular, well sorted, well consolidated, calcareous, argillaceous, no shows, 75%; Siltstone: gray to dark gray, firm, argillaceous, 10%; Shale: brownish-gray to gray, soft, platy, 15%.
- 6380- 6390 Sandstone: as above, in part, slightly friable, argillaceous, gray to dark gray, 50%; Siltstone: as above, 10%; Shale: as above, with increased gray to dark gray, 40%; trace of black chert nodules.
- 6390- 6400 Sandstone: as above, more argillaceous, finer grained, 40%; Shale: as above, mostly silty, gray, platy, 55%; Siltstone, 5%.
- 6400- 6410 Sandstone: "salt and pepper", argillaceous, 50%; Siltstone: dark gray, 5%; Shale: brownish-gray to gray, soft, fairly smooth texture, mainly silty, 45%.
- 6410- 6420 Sandstone: as above, finer grained, more argillaceous, 30%; Siltstone, 10%; Shale: as above, mainly platy, 60%; trace of bentonite and coal.
- 6420- 6430 Sandstone: very fine to fine grained, argillaceous, 20%; Shale: as above, 40%; Siltstone, 40%; trace of coal.
- 6430- 6440 Sandstone: as above, in part, more friable, 60%; Siltstone, 10%; Shale, 30%.
- 6440- 6450 Sandstone, 40%; Shale, 40%; Siltstone, 20%; trace of pyrite.
- 6450- 6460 Sandstone: as above, 50%; Siltstone: brownish-gray to gray and dark gray; Shale: brownish-gray to gray, 30%; trace of siderite and calcite.
- 6460- 6470 Sandstone: "salt and pepper", quartz and chert grains: calcareous, 50%; Siltstone, 10%; Shale: mostly platy, mostly silty, 40%; trace of marcasite.
- 6470- 6480 Sandstone: as above, with rare siderite and rare sericite, 60%; Shale: brownish-gray to gray, platy, in part, silty, slightly calcareous, 30%; Siltstone: gray to dark gray, slightly calcareous, 10%.
- 6480- 6490 Sandstone: as above, more argillaceous, 30%; Shale, 40%; Siltstone, 30%.

- 6490- 6500 Sandstone: as above, with rare kaolinitic infilling, 20%; Siltstone, 20%; Shale, 60%; trace of pyritized worm casts.
- 6500- 6510 Sandstone: as above, very argillaceous, 40%; Siltstone, 10%; Shale, 50%.
- 6510- 6520 Sandstone, 30%; Shale, 50%; Siltstone, 20%.
- 6520- 6530 Sandstone, 40%; Shale, 30%; Siltstone, 30%.
- 6530- 6540 Sandstone, 40%; Shale, 30%; Siltstone, in part, micromicaceous, 30%.
- 6540- 6550 Sandstone: as above, very argillaceous, with a trace of phlogopite, 30%; Siltstone, 30%; Shale, 40%.
- 6550- 6560 Sandstone: as above, 30%; Siltstone, 35%; Shale, 35%.
- 6560- 6570 Sandstone: as above, 40%; Siltstone, in part, with some light and dark banding, 25%; Shale: mostly brownish-gray, platy, silty, 35%.
- 6570- 6580 Sandstone: as above, lighter gray, less argillaceous, 60%; Shale: as above, 30%; in general, the shale is much darker; Siltstone: in part, micromicaceous, 10%.
- 6580- 6590 Sandstone: as above, but lighter gray, 70%; Shale: as above, in general, less silty, 20%; Siltstone, 10%.
- 6590- 6600 Sandstone: as above, 70%; Shale, 20%; Siltstone: in part, with carbonaceous specks.
- 6600- 6610 Sandstone: as above, light gray; quartz and chert grains: fine grained, subangular, well sorted, well consolidated, slightly calcareous, no shows, 80%; Siltstone: gray to dark gray, argillaceous, slightly calcareous, 10%; Shale: mostly gray, fairly smooth texture, platy, slightly calcareous, 10%; trace of siderite.
- 6610- 6620 Sandstone: as above, but slightly more argillaceous, with some larger, angular siderite fragments in the sandstone, 70%; Siltstone: gray, in part, with scattered carbonaceous specks, 10%; Shale: as above, gray, with rare light brown, 20%; trace of siderite and coal.
- 6620- 6630 Sandstone: as above, 60%; Siltstone, 25%; Shale: with increased brownish-gray, 15%; trace of Dentalia.
- 6630- 6640 Sandstone: as above, with some coaly streaks, 70%; Siltstone, 10%; Shale: mostly brownish-gray, 20%; trace of coal.

- 6640- 6650 Sandstone, Siltstone, and Shale: as above; increased coal.
- 6650- 6660 Sandstone: as above, 80%; Siltstone, 10%; Shale, 10%; trace of siderite.
- 6660- 6670 Sandstone, 80%; Siltstone: gray, argillaceous, 15%; Shale: silty, 5%.
- 6670- 6680 Sandstone: as above, 60%; Shale: brownish-gray to gray, silty, 25%; Siltstone, 15%; trace of siderite.
- 6680- 6690 Sandstone: with some coaly streaks, 40%; Siltstone, 30%; Shale, 30%; trace of coal.
- 6690- 6700 Sandstone: as above, in general, slightly coarser, 30%; Siltstone: gray, in part, with scattered carbonaceous streaks, 50%; Shale: as above, silty, 20%.
- 6700- 6710 Sandstone: light gray, "salt and pepper", quartz and chert with rare hornblende: fine grained, subangular, well sorted, well consolidated, calcareous matrix, tight, no shows, 80%; Siltstone: very slightly calcareous, 5%; Shale: brownish-gray to gray, platy, in part, silty, very slightly calcareous, 15%.
- 6710- 6720 Sandstone: as above, 40%; Shale: brownish-gray to gray, platy, in part, silty, 40%; Siltstone, 20%; trace of coal.
- 6720- 6730 Sandstone: as above, finer grained, more argillaceous, 70%; Siltstone, 10%; Shale, 20%; trace of coal.
- 6730- 6740 Sandstone: as above, 80%; Shale: as above, platy, silty, 20%; trace of siderite.
- 6740- 6750 Sandstone: as above, 75%; Siltstone: mostly dark gray, 10%; Shale: brownish-gray to gray, platy, 15%.
- 6750- 6760 Sandstone: as above, 60%; Shale, 30%; Siltstone, 10%; trace of coal.
- 6760- 6770 Sandstone, 50%; Shale, 30%; Siltstone, 20%; trace of coal.
- 6770- 6780 Sandstone: as above, more friable, 60%; silty Shale, 30%; Siltstone, 10%.
- 6780- 6790 Sandstone: "salt and pepper", calcareous, 50%; Siltstone, 20%; Shale, 30%.
- 6790- 6800 Sandstone: as above, "salt and pepper", friable, 80%; Shale: gray, with minor lighter brownish-gray, platy, in part, silty, 15%; Siltstone: gray to dark gray, 5%.

- 6800- 6810 Sandstone: friable, 80%; Shale, 20%; trace of argillaceous siltstone.
- 6810- 6820 Sandstone: as above, 40%; Shale, 30%; Siltstone, 30%.
- 6820- 6830 Sandstone: as above, 60%; Shale, 30%; Siltstone, 10%; trace of coal, siderite, and Dentalia.
- 6830- 6840 Sandstone: as above, more argillaceous, finer grained, 50%; Shale: as above, 40%; Siltstone, 10%.
- 6840- 6850 Sandstone: as above, 40%; increased Shale: mainly gray to dark gray, platy to fissile, silty; Siltstone, 10%.
- 6850- 6860 Sandstone: as above, 60%; Shale, 20%; Siltstone, 20%; trace of coal and pyrite.
- 6860- 6880 Sandstone: light gray, "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, slightly calcareous, no shows; Siltstone: brownish-gray to gray, argillaceous, 15%; Shale: brownish-gray to gray, soft, in part, platy, 35%; trace of coal.
- 6880- 6890 Sandstone: as above, with some coaly streaks, 30%; Siltstone, 20%; Shale: blocky to platy, in part, silty, 50%.
- 6890- 6900 Sandstone: "salt and pepper", argillaceous, with rare coaly streaks, 30%; Siltstone: gray to dark gray, in part, with scattered carbonaceous specks, 30%; Shale: as above, 40%.
- 6900- 6910 Shale: gray to brownish-gray, silty, 70%; Sandstone: as above, 10%; Siltstone, 20%.
- 6910- 6920 Shale: as above, 40%; Sandstone, 30%; Siltstone, 30%.
- 6920- 6930 Argillaceous Sandstone: as above, 50%; Shale, 30%; Siltstone, 20%; possible black, chitinous fish scales in the siltstone.
- 6930- 6940 Sandstone, 70%; Shale, 15%; Siltstone, 15%.
- 6940- 6950 Sandstone, 80%; Shale, 10%; Siltstone, 10%.
- 6950- 6960 Sandstone: as above, 85%; Siltstone: mostly dark gray, 10%; Shale: as above, gray and brownish-gray, 5%.
- 6960- 6970 Sandstone: as above, gray, "salt and pepper"; quartz and chert grains, with some silty patches, argillaceous, 80%; Siltstone, 10%; Shale, 10%.

- 6970- 6980 Sandstone: as above, with some hornblende and some coaly streaks, more argillaceous, 85%; Shale: as above, 10%; Siltstone, 5%.
- 6980- 6990 Sandstone: as above, finer grained, more argillaceous, 50%; Siltstone: as above, in part, with coaly streaks, 20%; Shale, 30%.
- 6990- 7000 Sandstone: as above, argillaceous, 40%; Siltstone: as above, 40%; Shale, 20%; trace of siderite and coal.
- 7000- 7010 Sandstone, 20%; Siltstone, 50%; Shale, 30%.
- 7010- 7020 Sandstone, 20%, argillaceous; Siltstone: gray to dark gray, argillaceous, 10%; Shale: as above, mostly gray to dark gray, silty, 70%.
- 7020- 7030 Sandstone: darker gray, more argillaceous, 30%; Siltstone, 10%; Shale: mainly dark gray, with minor gray, platy, in part, silty, 60%.
- 7030- 7040 Sandstone: fine grained, argillaceous, 50%; Siltstone: gray to dark gray, argillaceous, 10%; Shale: gray to dark gray, platy, less silty, 40%.
- 7040- 7050 Sandstone: silty and argillaceous, 60%; Siltstone, 20%; Shale: silty, 40%.
- 7050- 7060 Sandstone: as above, 70%; Siltstone, 5%; Shale, 25%.
- 7060- 7070 Sandstone: dark gray, very argillaceous, 50%; Siltstone, 5%; Shale: mainly blocky, 45%.
- 7070- 7080 Sandstone: as above, 40%; Siltstone: gray to brownish-gray, 20%; Shale: gray to brownish-gray, in part, platy, in part, silty, 40%.
- 7080- 7090 Sandstone, with some phlogopite, 25%; Siltstone: brownish-gray to dark brownish-gray, argillaceous, 10%; Shale: brownish-gray to dark brownish-gray, platy, in part, silty, 65%.
- 7090- 7100 Shale: brownish-gray to gray, soft, smooth texture, platy to fissile in part, in part, silty, very faint crushed cut fluorescence; Sandstone: as above, with scattered coaly streaks, 10%.
- 7100- 7110 Shale: as above, with a yellow, crushed cut fluorescence, blocky to platy, in part, silty, small amount of Sandstone: as above.

- 7110- 7120 Shale: gray to dark gray, in part, platy, in part, silty, no shows; small amount of sandstone.
- 7120- 7130 Shale: gray to dark gray, with minor brownish-gray, with faint yellow crushed cut fluorescence; trace of sandstone.
- 7130- 7140 Shale: as above, with increased brownish-gray, more platy, with crushed cut fluorescence.
- 7140- 7150 Shale: as above, but with more darker gray and more blocky.
- 7150- 7160 Shale: as above, in part, fissile, in part, blocky and silty, with a faint yellow crushed cut fluorescence; the soft, light brownish-gray shale is almost a claystone.
- 7160- 7170 Shale: as above, with more silty zones, and some fissile dark gray shale.
- 7170- 7180 Shale: as above, Sandstone: "salt and pepper", quartz and chert: slightly calcareous, 30%.
- 7180- 7190 Shale: brownish-gray to gray and dark gray, platy, in part, silty, with faint yellow crushed cut fluorescence; Sandstone, 30%.
- 7190- 7200 Shale: as above, mostly gray to dark gray, with crushed cut fluorescence; Sandstone, 20%.
- 7200- 7210 Shale: brownish-gray, rough texture, platy, silty, with faint yellow crushed cut fluorescence; Shale: dark gray, in part, fissile; Sandstone: "salt and pepper", quartz and chert: slightly calcareous, 20%.
- 7210- 7220 Shale: as above, but the brownish-gray has a smoother texture in part and the dark gray Shale is silty in part; faint yellowish-white cut fluorescence; Sandstone: as above, 10%.
- 7220- 7230 Shale: gray to dark gray and brownish-gray, fairly smooth texture, mainly platy, in part, slightly silty; small amount of Sandstone: as above.
- 7230- 7240 As above, with increased lighter brownish-gray Shale; trace of Sandstone: as above.
- 7240- 7250 Shale: brownish-gray, blocky, silty, with minor Shale: dark gray, platy to fissile; faint yellowish-white crushed cut fluorescence; Sandstone: "salt and pepper", argillaceous, 5%.

- 7250- 7260 Shale: as above, increased Sandstone: "salt and pepper", quartz and chert: finer grained, slightly calcareous, 10%.
- 7260- 7270 Shale: as above; some of the dark gray shale is carbonaceous; Sandstone: as above, 10%; trace of coal and subtranslucent chert fragments.
- 7270- 7280 Shale: brown, rough texture, irregular fracture, silty, with a yellow crushed cut fluorescence; Shale: as above, with increased dark gray, carbonaceous shale.
- 7280- 7290 Increased brown Shale: in general, darker, 80%; Shale: gray, in part, fissile; some quartz Sandstone: medium grained, subrounded, siliceous matrix.
- 7290- 7300 Shale: as above; brown shale is darker in color; small amount of Shale: gray to dark gray, platy; trace of sandstone, bentonite, and rounded, medium grained, clear quartz.
- 7300- 7310 Shale: dark brown to brown; Limestone: light brown to dark grayish-brown, mottled, cryptocrystalline, with a dull yellowish-brown fluorescence, 25%; trace of dark gray, fissile shale; rare rounded to subrounded, clear to frosted, medium grained quartz.
- 7310- 7320 Shale: light tan to dark brown, in part, silty, in part, micromicaceous; small amount of light gray to dark gray, platy shale; dull yellowish-brown fluorescence, as above; reduced limestone.
- 7320- 7330 Shale: as above, in part, micromicaceous, in part, fissile; trace of gray siltstone, grading to a fine grained sandstone; trace of pyrite and limestone.
- 7330- 7340 Shale: as above, light tan to dark brown, with minor Shale: gray to dark gray, fissile; dull yellowish-brown fluorescence, fair yellow crushed cut fluorescence; trace of Limestone: brown, argillaceous; trace of gray siltstone, grading to a fine Sandstone: "salt and pepper", quartz and chert grains, calcareous.
- 7340- 7350 Shale: as above, brown; increased Shale: gray to dark gray, fissile; trace of limestone, in part, with calcite fracture filling; slight increase in sandstone, containing some finely disseminated pyrite; fluorescence, as above.
- 7350- 7360 Shale: brown to dark brown, with dull yellowish-brown fluorescence, mainly platy to fissile; some Shale: gray to dark gray, platy to fissile; trace of Sandstone: as above; rare rounded, clear, coarse quartz grains.

- 7360- 7370 Shale: as above, but more fissile, with scattered yellowish-brown fluorescence; Sandstone: as above.
- 7370- 7375 Shale: as above; with increased gray shale; trace of Sandstone: as above.
- 7375- 7380 Shale: as above; trace of Sandstone: as above, light gray, "salt and pepper", quartz and scattered chert grains: fine grained, subangular, well sorted, well consolidated, calcareous, very faint crushed cut fluorescence.
- 7380- 7385 Shale: as above, mostly dark brown, with minor gray, more blocky than above; trace of sandstone.
- 7385- 7390 Shale: as above, mostly brown to dark brown, in part, fissile; small amount of gray shale; Sandstone: as above, more argillaceous.
- 7390- 7395 Shale: as above, mostly dark brown, blocky to fissile, with a bright yellow crushed cut fluorescence; reduced fluorescence.
- 7395- 7400 Shale: as above, mostly brown, more fissile; trace of gray shale; trace of Sandstone: as above.
- 7400- 7410 Shale: as above, less fissile, darker brown; small amount of Siltstone: gray, firm; Sandstone: "salt and pepper", quartz and chert grains: very fine grained, tight.
- 7410- 7420 Shale: as above, mostly chocolate brown; reduced sandstone.
- 7420- 7430 Shale: as above, brown to dark brown and gray, fissile; trace of sandstone and coal.
- 7430- 7440 Shale: as above, darker brown, fissile, and Shale: gray to dark gray; the dark gray shale is carbonaceous.
- 7440- 7445 Sandstone: light pinkish-brown, sideritic, with scattered glauconite and hornblende; the sandstone is mainly quartz grains: angular to subrounded, white and opaque to subtranslucent, fine grained, poorly sorted, well consolidated, calcareous, with poor porosity and a greenish-yellow fluorescence; Shale: dark brown, with some dark gray, carbonaceous, 20%.
- 7445- 7450 Shale: brown to dark brown and gray, blocky to fissile; the dark gray shale is very carbonaceous; trace of gray sandstone and a trace of glauconitic Sandstone: as above.

- 7450- 7460 Shale: as above.
- 7460- 7465 Shale: brown and gray, as above, less fissile; trace of firm gray shale; trace of "salt and pepper" sandstone.
- 7465- 7467 Shale: as above; Sandstone: light brown, mainly quartz grains: fine grained, subangular, poorly sorted, calcareous, with a bright, white crushed cut fluorescence; appears wet; trace of pyrite.
- 7467- 7470 Shale: as above, with light brown sandstone (492 units of gas).
- 7470- 7471 Slight increase in light brown sandstone.
- 7471- 7480 Shale: brown to dark brown, and Shale: gray, as above; small amount of Sandstone: light brown, mainly quartz grains: as above, with a bright whitish-yellow crushed cut fluorescence; trace of coal.
- 7480- 7490 Shale: as above, in general, darker; Sandstone: as above, more friable, with an improved crushed cut fluorescence, 30%.
- 7490- 7500 Shale: as above, dark brown and gray to dark gray, blocky to fissile; Sandstone: as above, in general, finer, lighter brown, more friable; some long shale shards from up the hole.
- 7500- 7510 Shale: as above, dark brown and gray; Sandstone: as above, light brown, very friable, 25%; small amount of Sandstone: gray, "salt and pepper", calcareous matrix.
- 7510- 7520 Sandstone: as above, light brown, 70%; Shale: as above, 30%.
- 7520- 7530 Sandstone: as above, light brown, mainly quartz grains, very friable, very faint yellowish-brown fluorescence, bright yellowish-white crushed cut fluorescence, calcareous, 80%; Shale: as above, mostly gray, 20%.
- 7530- 7540 Sandstone: as above, with an increased portion of light gray, friable, 80%; Shale: as above, 20%.
- 7540- 7550 Sandstone: as above, 30%; Shale: brown to gray, blocky to fissile.
- 7550- 7560 Sandstone: as above, 30%; Shale: dark brown and dark gray, mainly fissile.
- 7560- 7570 Sandstone: as above, quartz grains: fine grained, subangular to subrounded, poorly sorted, calcareous,

- with bright yellowish-white crushed cut fluorescence; Shale: brown to dark brown and dark gray, in part, fissile.
- 7570- 7580 Sandstone: as above, 20%; Shale: dark brown and dark gray; in part, the dark gray shale is silty.
- 7580- 7590 Shale: brown to dark gray, fissile; Sandstone: light brown, as above, subrounded to subangular, 30%; trace of gray, argillaceous siltstone; trace of coal.
- 7590- 7600 Shale: brown, blocky, in part, silty; lesser Shale: gray to dark gray, in part, platy to fissile; trace of Siltstone: gray, argillaceous; trace of Sandstone: gray, "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, calcareous; trace of coal associated with pyrite; trace of Pelecypods.
- 7600- 7610 As above; shale is darker brown in general; in part, the siltstone has carbonaceous streaks; trace of Sandstone: as above, finer grained, more argillaceous.
- 7610- 7620 Shale: brown to dark brown, as above, in part, silty, with a yellowish-white crushed cut fluorescence; Shale: gray to dark gray; Siltstone: as above.
- 7620- 7630 Shale: as above, in general, more silty; trace of gray, "salt and pepper" sandstone; trace of finely disseminated pyrite in the shale.
- 7630- 7640 Increased gray to dark gray Shale: in part, silty, slightly dolomitic; trace of siltstone; trace of Sandstone: gray, "salt and pepper", in part, argillaceous, in part, silty; trace of coal.
- 7640- 7650 Shale: as above, gray and brown, blocky to platy, silty; trace of sandstone, with rare, scattered siderite.
- 7650- 7660 Shale: light gray to dark gray, platy to slightly fissile, slightly dolomitic; Shale: brownish-gray, silty, slightly dolomitic, 40%; dark gray shale is carbonaceous; trace of gray sandstone.
- 7660- 7670 Shale: as above, gray to brown, 50-50; trace of coal.
- 7670- 7680 Shale: gray, blocky to platy, mainly silty, slightly dolomitic; Shale: brown, silty, slightly dolomitic; trace of light gray, bentonitic shale; trace of Sandstone: "salt and pepper"; trace of Siltstone: gray, argillaceous.
- 7680- 7690 Shale: gray, and Shale: brown, as above; trace of siltstone and coal.

- 7690- 7700 Shale: as above; brown Shale, 60%; trace of siltstone; slight increase in Sandstone: slightly friable; trace of light gray, bentonitic shale.
- 7700- 7710 Shale: as above; brown Shale, 75%; trace of light gray, bentonitic shale; trace of Sandstone: as above; trace of coal.
- 7710- 7720 Shale: as above; brown Shale, 80%; Shale is more platy; trace of sandstone and coal.
- 7720- 7730 Shale: brown, blocky to platy, in part, silty, slightly dolomitic; Shale: gray, blocky to platy, in part, silty, slightly dolomitic; trace of Sandstone: friable; trace of coal.
- 7730- 7740 Shale: as above; gray shale is platy to fissile; trace of sandstone; trace of coal; considerable loose silt in the sample.
- 7740- 7750 Shale: brown, and Shale: gray, blocky to platy, in part, silty, slightly dolomitic; trace of Shale: light gray, bentonitic; trace of coal and sandstone.
- 7750- 7760 Shale: as above, in part, fissile; trace of very fine grained Sandstone: argillaceous, silty.
- 7760- 7780 Shale: as above, mostly blocky and silty; trace of Sandstone: clear quartz and scattered chert grains; fine grained, subangular, well sorted, calcareous.
- 7780- 7790 Shale: brown, and Shale: gray, as above, slightly more silty; trace of sandstone.
- 7790- 7800 Shale: as above; small amount of Sandstone: gray, "salt and pepper", quartz and chert grains; very fine to fine grained, well sorted, calcareous; trace of brick-red Siltstone: lateritic, argillaceous.
- 7800- 7810 Shale: as above, more fissile; trace of sandstone, coal, and lateritic siltstone.
- 7810- 7820 Shale: dark brown to dark gray, mainly fissile, in part, silty; trace of Sandstone: mainly quartz, with scattered chert, slightly argillaceous, slightly silty; trace of coal.
- 7820- 7830 Shale: dark brown to dark gray, blocky to platy, in part, silty, slightly dolomitic, yellowish-white crushed cut fluorescence; trace of Sandstone: as above.
- 7830- 7840 Shale: brown, with some light brown; Shale: gray to dark gray; shale is blocky to slightly fissile, slightly

- dolomitic; the dark gray shale is carbonaceous; trace of Sandstone: subangular, friable, silty to argillaceous.
- 7840- 7850 Shale is more fissile; gray shale, 30%; trace of coal; trace of "salt and pepper" sandstone.
- 7850- 7860 Shale: brown to gray and dark gray, 50-50%, fissile, in part, silty; trace of sandstone and coal.
- 7860- 7870 Increased brown to dark brown Shale; dark gray shale is carbonaceous; trace of Sandstone: "salt and pepper", in part, with scattered hornblende.
- 7870- 7880 Shale: as above, mostly brown; minor gray to dark gray; trace of sandstone, in part, with some weathered glauconite grains.
- 7880- 7890 Shale: brown, with minor gray, more fissile shale.
- 7890- 7900 Shale: as above, in part, silty; trace of dark gray shale; trace of sandstone.
- 7900- 7910 Shale: brown and gray to dark gray, blocky to fissile, in part, silty; trace of coal; trace of very light brown, silty shale.
- 7910- 7920 Shale: brown, with rare gray to dark gray; the dark gray shale is carbonaceous.
- 7920- 7930 Shale: brown, with a slight increase in gray to dark gray, blocky to platy, in part, silty, slightly dolomitic; trace of sandstone.
- 7930- 7940 Shale: brown to dark brown and dark gray, as above, more fissile, slightly dolomitic, in part, silty.
- 7940- 7950 Shale: brown to dark brown and gray to dark gray, blocky to platy, with some fissile, slightly dolomitic, with a yellowish-white crushed cut fluorescence; trace of Sandstone: "salt and pepper", calcareous, fine grained, subangular, well sorted.
- 7950- 7960 Shale: as above, mostly brown, rough texture, irregular fracture, blocky to platy, mainly silty; trace of Siltstone: gray, "salt and pepper", argillaceous, slightly dolomitic; trace of finely crystalline pyrite.
- 7960- 7970 Shale: as above, mostly brown, mostly silty; trace of gray, "salt and pepper" sandstone; trace of Sandstone: mostly quartz grains; coarser grained, subrounded, siliceous matrix, in part, argillaceous; trace of finely crystalline pyrite and siderite.

- 7970- 7980 Shale: as above; small amount of dark gray Shale: in part, carbonaceous; trace of Sandstone: "salt and pepper", calcareous; trace of pyrite.
- 7980- 7990 Shale: as above, brown, with a small amount of gray; trace of "salt and pepper" sandstone.
- 7990- 8000 Shale: as above, mostly blocky; increased dark gray, carbonaceous shale.
- 8000- 8010 Shale: brown, blocky to platy, silty, slightly dolomitic, with a yellowish-white crushed cut fluorescence; small amount of dark gray shale; trace of Siltstone: gray, "salt and pepper", slightly argillaceous.
- 8010- 8020 As above, with increased gray Shale; Siltstone: as above; trace of pyritized coal.
- 8020- 8030 Shale: as above, more fissile; the brown shale is darker; trace of siltstone, grading to a very fine grained Sandstone: "salt and pepper", quartz and chert grains; fine grained, subangular, well sorted, calcareous.
- 8030- 8040 Shale: as above; in part, the brown shale is lighter, softer, more silty; the shale is slightly calcareous; trace of fine grained, "salt and pepper" sandstone; trace of pyritized worm casts.
- 8040- 8050 Shale: as above; in part, the soft brown shale is almost a siltstone; trace of fine grained, "salt and pepper" sandstone; trace of finely crystalline pyrite; trace of smoky chert fragments.
- 8050- 8060 Shale: as above; increase in gray, "salt and pepper" siltstone, grading to a fine grained sandstone; trace of siderite.
- 8060- 8070 Shale: brown to dark brown, with a trace of dark gray, as above, rough texture, irregular fracture, silty; trace of "salt and pepper" Sandstone: as above; considerable very fine silt in the sample.
- 8070- 8080 Shale: as above, blocky to platy; trace of Siltstone: gray, firm; small amount of Sandstone: "salt and pepper", quartz and chert grains, occurring as thin, even bands in the siltstone; sandstone has rare, scattered siderite grains; considerable very fine silt.
- 8080- 8090 Shale: as above; trace of gray and brown siltstone; reduced sandstone; trace of marcasite; trace of Inoceramus prisms; trace of Limestone: buff, with smoky chert fragments and rare, light green, weathered glauconite grains; fine Silt: as above.

- 8090- 8100 Shale: as above; small amount of Shale: gray to light gray, smooth texture, bentonitic; trace of sandstone; trace of Limestone: white, cryptocrystalline, with a high silica content, with inclusions of amber quartz and rare smoky chert; reduced fine silt.
- 8100- 8110 Shale: as above, grading to a siltstone; trace of gray, "salt and pepper" siltstone, grading to a very fine grained Sandstone; trace of Sandstone: quartz grains with rare siderite; fine grained, subangular to subrounded, poorly sorted, poorly consolidated, calcareous matrix.
- 8110- 8120 Shale: as above, with brownish-gray shale, 50%, mainly blocky, silty; trace of "salt and pepper" Sandstone: as above.
- 8120- 8130 Shale: brown, blocky to platy, silty, slightly calcareous; trace of silty, gray shale; trace of Shale: lighter gray, bentonitic; trace of Sandstone: gray, very fine grained, argillaceous.
- 8130- 8140 Shale: brown, as above, more platy, in part, silty; Shale: gray to dark gray, smoother texture, 50%; dark gray shale is very carbonaceous; trace of Sandstone: "salt and pepper", very fine to fine grained.
- 8140- 8150 Shale: brown to dark brown and gray to dark gray, blocky to fissile, silty, calcareous, with a yellowish-white crushed cut fluorescence; trace of Sandstone: very fine to fine grained, soft, subangular, poorly sorted, calcareous, with some medium grains.
- 8150- 8160 Shale: as above, slightly calcareous; trace of sandstone with rare kaolinitic infilling.
- 8160- 8170 Shale: darker brown, with a small amount of gray, silty; trace of dark gray, carbonaceous shale; trace of light gray, bentonitic shale; trace of gray, "salt and pepper" siltstone, grading to a very fine grained sandstone; considerable fine, brown silt in the sample.
- 8170- 8180 Shale: dark brown, with a trace of lighter brown; small amount of gray shale; trace of dark gray, very carbonaceous shale.
- 8180- 8190 Shale: dark brown to dark brownish-gray, with minor light brown and gray shale; shale is silty in part, with a whitish-yellow crushed cut fluorescence; trace of gray, "salt and pepper" siltstone.

- 8190- 8200 Shale: dark brown, rough texture, irregular fracture, silty; small amount of light brown, very soft, silty shale; trace of gray shale; trace of coal.
- 8200- 8210 Shale: dark brown, as above, slightly dolomitic, with a whitish-yellow crushed cut fluorescence; trace of gray, silty shale.
- 8210- 8220 Shale: as above, blocky to platy; trace of gray shale; trace of gray, "salt and pepper" siltstone.
- 8220- 8230 Shale: dark brown, as above; Shale: light brown, soft, silty, almost a claystone, 5%; trace of gray Shale: platy, in part, silty.
- 8230- 8240 Shale: dark brown to brown, slightly less silty; Shale: gray to dark gray, platy to fissile.
- 8240- 8250 Shale: brown to dark brown, mainly platy, in part, silty; small amount of Shale: gray to dark gray, smoother texture, in part, slightly silty.
- 8250- 8260 Shale: dark brown, dark brownish-gray and dark gray; the dark gray shale is carbonaceous.
- 8260- 8270 Shale: as above.
- 8270- 8280 Shale: dark brown to dark gray, more platy.
- 8280- 8290 Shale: dark brown and dark gray, blocky to fissile, slightly dolomitic, in part, silty, with a yellowish-white crushed cut fluorescence; trace of Sandstone: gray, "salt and pepper", argillaceous.
- 8290- 8300 Shale: as above.
- 8300- 8310 Shale: dark brown, dark brownish-gray and dark gray, rough texture, irregular fracture, blocky to platy, with some fissile, in part, silty, slightly dolomitic, with a whitish-yellow crushed cut fluorescence; trace of siderite.
- 8310- 8320 As above; trace of lighter brown, soft, silty shale; trace of Sandstone: gray, very fine grained, argillaceous.
- 8320- 8330 Shale: as above, dark gray, in part, silty; trace of Shale: light gray, slightly silty.
- 8330- 8340 Shale: as above, dark brown to dark gray, mostly blocky, in part, silty; trace of Sandstone: gray, salt and pepper, quartz and chert grains; fine grained, subangular, well sorted, slightly calcareous; trace of light gray shale.

- 8340- 8350 Shale: as above, with some light brown, soft, very silty, slightly calcareous; trace of Sandstone: as above; trace of marcasite.
- 8350- 8360 Dark Shale: as above, more platy to fissile; small amount of light brown shale; trace of gray siltstone.
- 8360- 8370 Shale: dark brown and dark brownish-gray, as above; trace of Shale: dark gray, smooth texture; trace of gray, "salt and pepper" sandstone.
- 8370- 8380 Shale: as above, with minor light brown; increased Shale: gray to dark gray, platy; trace of light gray shale; trace of gray, "salt and pepper" sandstone.
- 8380- 8390 As above; the dark gray shale is carbonaceous.
- 8390- 8400 Shale: dark brown, dark brownish-gray and dark gray, slightly dolomitic, with whitish-yellow crushed cut fluorescence.
- 8400- 8410 Shale: as above, with a slight decrease in light brown; trace of Siltstone: gray, "salt and pepper"; trace of calcite.
- 8410- 8420 Shale: as above, with minor dark gray and light brown.
- 8420- 8430 Shale: as above.
- 8430- 8440 Shale: as above, with increased light brown; dark shale and light brown are slightly calcareous.
- 8440- 8450 Shale: dark brown, dark brownish-gray and dark gray, in part, silty, mainly blocky, slightly calcareous, with a white crushed cut fluorescence; small amount of light brown, soft, poorly consolidated, silty shale; trace of marcasite.
- 8450- 8460 Shale: as above; less light brown shale; dark gray shale is carbonaceous.
- 8460- 8470 Shale: as above, mostly blocky to platy; trace of sandstone.
- 8470- 8480 Shale: brown to dark brown, with lesser gray to dark gray, blocky to platy, slightly dolomitic, with whitish-yellow crushed cut fluorescence; trace of "salt and pepper" sandstone; trace of marcasite.
- 8480- 8490 Shale: as above, in part, fissile; trace of gray siltstone.

- 8490- 8500 Shale: as above; some light brown, soft, very silty shale; trace of light gray, bentonitic shale.
- 8500- 8510 Dark Shale: as above, in part, fissile.
- 8510- 8520 Shale: as above, in general, darker; trace of gray, "salt and pepper" sandstone; trace of lighter brown shale.
- 8520- 8530 As above; considerable loose silt in the sample.
- 8530- 8540 Shale: as above, mostly brown to dark brown, with minor gray to dark gray, blocky to platy, in part, silty.
- 8540- 8550 Shale: as above; increased light brown, poorly consolidated, silty shale; trace of Siltstone: gray, "salt and pepper", argillaceous, grading to a fine grained sandstone.
- 8550- 8560 Shale: dark brownish-gray, blocky to slightly fissile, siltier.
- 8560- 8570 Shale: as above, with increased dark gray; small amount of light brown, soft, silty shale.
- 8570- 8580 As above.
- 8580- 8590 No sample.
- 8590- 8600 Shale: dark brown to dark gray, mainly fissile, in part, silty, slightly dolomitic; trace of lighter brown shale, but more compact, not silty; trace of indurated quartz sandstone, with rare chert grains, indistinct grain boundaries, almost an orthoquartzite.
- 8600- 8610 Shale: mostly dark brown, platy to fissile, with minor fissile, dark gray shale; trace of Siltstone: gray, "salt and pepper", with finely disseminated pyrite; trace of marcasite.
- 8610- 8620 Shale: mostly dark brown, blocky to platy, in part, slightly silty, slightly calcareous, with a white crushed cut fluorescence; trace of light brown, soft, silty shale.
- 8620- 8630 Shale: as above, in general, lighter brown, silty, calcareous, micromicaceous; trace of dark gray, carbonaceous shale; trace of marcasite.
- 8630- 8640 Shale: as above, mostly brown, with some dark brown and a trace of gray; trace of Sandstone: "salt and pepper", quartz and chert grains; fine grained, subangular, well sorted, well consolidated, slightly calcareous; trace of clear quartz Sandstone: rare chert grains; indurated, almost an orthoquartzite.

- 8640- 8650 Shale: brownish-gray, and Shale: dark gray; trace of Shale: light gray, soft, silty; trace of Shale: light gray, very hard, less silty.
- 8650- 8660 Shale: as above, in part, micromicaceous; increased light brown Shale: soft, silty, 5%; trace of Sandstone: "salt and pepper", quartz and chert grains; fine grained, subangular to subrounded, slightly calcareous.
- 8660- 8670 Shale: brown to dark brown, in part, silty, blocky to platy, slightly calcareous; Shale: dark gray, 10%; Shale: light brown, soft, silty, calcareous, 15%.
- 8670- 8680 Shale: as above; increased dark brown and dark gray shale; reduced light brown, silty shale; trace of white, soft, poorly consolidated quartz siltstone.
- 8680- 8690 Shale: as above, mostly dark brown; slight increase in light brown, silty shale.
- 8690- 8700 Shale: as above, in general, lighter brown, with light brown, silty shale; trace of brick-red, lateritic, argillaceous siltstone.
- 8700- 8710 Shale: as above, mostly dark brown; light brown, soft shale, 10%; trace of quartz sandstone.
- 8710- 8720 Shale: dark brown to dark gray, in part, silty, softer than above; Shale: light brown, very soft, very silty, 30%; shale is slightly calcareous, with a white crushed cut fluorescence.
- 8720- 8730 Shale: mostly dark brown, with some dark gray, soft, as above; Shale: light brown, soft, silty, 10%.
- 8730- 8740 Shale: dark brown, in part, silty, with a small amount of dark gray; Shale: light brown, poorly consolidated, very silty, 5%; trace of gunmetal-gray Shale: micromicaceous, smooth texture.
- 8740- 8750 Shale: dark brown, as above; small amount of gray to dark gray shale, in part, with some dark hornblende inclusions; trace of Sandstone: gray, "salt and pepper", quartz and chert grains, with some hornblende: fine grained, subangular, well sorted, slightly calcareous.
- 8750- 8760 Shale: as above; dark gray shale, mainly platy, 40%; trace of gray shale, with a slight greenish cast.
- 8760- 8770 Shale: dark brownish-gray, platy to fissile in part, in part, silty, with a white crushed cut fluorescence; trace

of light brown, soft, silty shale; trace of light gray, bentonitic shale; trace of gray to dark gray Shale: less silty; trace of calcite.

- 8770- 8780 Shale: dark brownish-gray; Shale: light brown, very soft, very silty, 25%; trace of gray Shale: smooth texture, platy; trace of "salt and pepper" sandstone.
- 8780- 8790 Shale: dark brown, as above; Shale: gray to dark gray, in part, silty, 30%; Shale: light brown, soft, silty, 20%; gray shale has a very faint crushed cut fluorescence.
- 8790- 8800 Shale: brown, in part, silty, slightly calcareous, blocky to platy, with a white crushed cut fluorescence, 55%; Shale: dark gray, rough texture, blocky to fissile, in part, silty, slightly calcareous, with a faint crushed cut fluorescence; Shale: light brown, soft, very silty, 5%; trace of marcasite.
- 8800- 8810 Shale: dark brown, in part, silty, blocky to platy, slightly calcareous; minor gray to dark gray shale, with a slight greenish cast; trace of gray, "salt and pepper", argillaceous siltstone; trace of Sandstone: gray, very fine to fine grained, slightly calcareous.
- 8810- 8820 Shale: dark brown, as above, more platy; Shale: bluish-gray to dark gray, smooth texture, with a faint crushed cut fluorescence, 10%; trace of gray siltstone.
- 8820- 8830 Shale: dark brown, blocky, in part, silty, slightly calcareous; Shale: light gray to gray, smooth texture, blocky to platy.
- 8830- 8840 Shale: brown to dark brownish-gray, in part, silty, mainly blocky; small amount of gray shale; trace of gray, "salt and pepper" siltstone, grading to a gray, "salt and pepper" sandstone, with some phlogopite.
- 8840- 8850 Shale: brown to dark brownish-gray; trace of gray to dark gray shale, in part, silty; trace of "salt and pepper" Sandstone: as above.
- 8850- 8860 As above; dark brown and dark brownish-gray shale; Shale: gray, mostly with a smooth texture, 20%; trace of Siltstone: gray, "salt and pepper", argillaceous.
- 8860- 8870 As above; gray Shale, increased to 25%; increased siltstone, grading to a fine Sandstone, 5%.
- 8870- 8880 As above.

- 8880- 8890 Shale: brown, blocky to platy, as above; Shale: gray to dark gray, smooth texture, 10%; Shale: light pinkish-brown, soft, silty, calcareous, 5%; trace of fine grained, "salt and pepper" sandstone.
- 8890- 8900 Shale: brown to dark brown and dark brownish-gray, blocky to platy, as above; Shale: gray to dark gray, 10%; Shale: light pinkish-brown, calcareous, silty, 20%; trace of Siltstone: gray, "salt and pepper", argillaceous, in part, with finely disseminated pyrite.
- 8900- 8910 Shale: brown to dark brown, as above; Shale: gray to dark gray, in part, silty, in part, with a slight greenish cast; Shale: mainly pinkish-brown, with a trace of light green, soft, silty, calcareous, 20%; trace of siltstone; trace of sandstone.
- 8910- 8920 Shale: brown to dark brown, mostly platy; Shale: gray to dark gray, 10%; Shale: light brown to very light pinkish-brown, soft, silty, calcareous; trace of "salt and pepper" siltstone; trace of gray, "salt and pepper" sandstone.
- 8920- 8930 Shale: brown, dark brown and dark brownish-gray, blocky to fissile, in part, silty, slightly dolomitic, with a white crushed cut fluorescence; small amount of Shale: gray to dark gray, less silty; trace of Shale: light pinkish-gray, silty, calcareous, almost marly; trace of fine grained, salt and pepper sandstone.
- 8930- 8940 Shale: as above, increased dark brownish-gray and dark gray, in part, very carbonaceous, in part, soft, in part, silty, blocky to platy; Shale: light pinkish-brown to pinkish-gray, soft, silty, calcareous, 5%; trace of marcasite.
- 8940- 8950 Shale: dark brown to dark brownish-gray, very soft, very carbonaceous; small amount of light pinkish-brown to light pinkish-gray, silty shale; considerable dark, coaly silt.
- 8950- 8960 Shale: as above, mostly dark gray, rough texture, irregular fracture, soft, very carbonaceous, in part, silty; trace of dark brown shale; trace of light pinkish-brown shale; considerable dark, coaly silt.
- 8960- 8970 Shale: dark gray, firm, carbonaceous, 60%; Shale: brown to dark brown; small amount of light brown, soft, silty shale.
- 8970- 8980 Shale: gray to dark gray, smooth texture, blocky to platy, slightly dolomitic; the dark shale is soft, very

carbonaceous; Shale: brown, rougher texture, blocky to platy, in part, slightly silty, slightly dolomitic, with a yellowish-white crushed cut fluorescence; trace of Sandstone: "salt and pepper", quartz and chert grains: fine grained, subangular, well sorted, well consolidated, slightly calcareous; trace of brown, silty shale, softer than above, slightly dolomitic.

- 8980- 8990 Shale: mostly gray, mostly platy, with a small amount of dark gray, and a small amount of brown shale.
- 8990- 9000 Shale: dark gray, blocky to platy, firm, carbonaceous, slightly dolomitic, with no crushed cut fluorescence; brown Shale: as above, in part, silty, 5%.
- 9000- 9010 Shale: gray, platy, hard, slightly dolomitic; trace of dark gray, carbonaceous Shale; Shale: brown, blocky to platy, slightly dolomitic, in part, silty, 5%; trace of Siltstone: gray, "salt and pepper".
- 9010- 9020 Shale: as above, but darker gray, more carbonaceous; reduced brown shale; trace of argillaceous siltstone.
- 9020- 9030 Dark gray, carbonaceous Shale: as above; the shale is not completely metamorphosed, but has been subjected to some pressure.
- 9030- 9040 Dark gray Shale: as above; trace of marcasite.
- 9040- 9050 Dark gray Shale: as above; brown Shale: slightly silty, 5%.
- 9050- 9060 Shale: as above, in general, more carbonaceous; increased brown to dark brown Shale: more platy.
- 9060- 9070 Shale: as above, gray to dark gray, less carbonaceous; small amount of brown shale is silty in part; shale is all slightly dolomitic; trace of "salt and pepper" sandstone.
- 9070- 9080 Shale: gray, platy, in part, silty; Shale: dark gray, carbonaceous; Shale: brown, in part, silty, with faint yellowish-white crushed cut fluorescence; trace of Sandstone: mainly quartz grains, with some scattered chert; fine grained, subangular, well sorted, well consolidated, calcareous matrix; no shows.
- 9080- 9090 Shale: gray to dark gray, platy, carbonaceous; Shale: brown, silty, as above, 30%.
- 9090- 9100 Shale: gray to dark gray, platy to fissile, carbonaceous, in part, slightly silty; Shale: brown, platy, in part, silty, 30%; trace of "salt and pepper" Sandstone: friable.

- 9100- 9110 Shale: dark gray, as above, less carbonaceous, slightly dolomitic; Shale: brown, in part, lighter, 40%.
- 9110- 9120 Shale: as above; dark gray shale is carbonaceous in part; Shale: brown to dark brown, 45%.
- 9120- 9130 Shale: as above; trace of light gray quartz siltstone; trace of Sandstone: light gray, with rare, scattered chert grains; fine grained, subangular, well sorted, well consolidated, slightly calcareous; trace of marcasite.
- 9130- 9140 Shale: as above; trace of gray, quartz sandstone; trace of Siltstone: light brownish-red, slightly lateritic; trace of pyrite and marcasite.
- 9140- 9150 Shale: as above; the brown shale is mostly silty; slight increase in sandstone; trace of Siltstone: light brownish-red, argillaceous, slightly lateritic; trace of pyrite and marcasite.
- 9150- 9160 Shale: as above, slightly darker, more carbonaceous, platy to fissile; Shale: brown, platy, as above.
- 9160- 9170 Shale: gray to dark gray, carbonaceous, slightly dolomitic; Shale: brown, in part, silty, platy, slightly dolomitic, 20%.
- 9170- 9180 Shale: dark gray, carbonaceous; Shale: brown to dark brown, platy to fissile, 30%.
- 9180- 9190 Shale: dark gray, platy to fissile, carbonaceous, slightly dolomitic; Shale: brown to dark brown, platy, in part, silty, slightly dolomitic, with a faint crushed cut fluorescence.
- 9190- 9200 Shale: dark gray, as above; increased brown Shale: platy, 40%; trace of gray siltstone; trace of gray, "salt and pepper" sandstone.
- 9200- 9210 Shale: as above; dark gray shale is more carbonaceous, slightly dolomitic; the brown shale is slightly dolomitic.
- 9210- 9220 Shale: gray to dark gray; Shale: brown, in part, silty, 30%; trace of finely crystalline pyrite.
- 9220- 9230 As above.
- 9230- 9240 Sandstone: light gray, mainly quartz with rare, scattered chert grains: very fine to fine grained, subangular, poorly sorted, well consolidated, mainly siliceous matrix, but in part calcareous, with a trace of kaolinitic infilling, fairly tight, slightly argillaceous,

bright yellow fluorescence, mainly chemical, no cut, fair yellowish-white crushed cut fluorescence, 60%; small amount of Siltstone: dark gray, "salt and pepper", argillaceous; Shale: gray and brown, as above.

- 9240- 9250 Sandstone: as above, in part, more indurated; grain boundaries are indistinct and have a fused appearance; in part, the sandstone is more kaolinitic, in part, darker gray, more argillaceous; Sandstone, 75%; trace of Chert: grayish-blue, subtranslucent, angular fragments; Shale: as above, mostly brown.
- 9250- 9260 Sandstone: as above, in part, with a slightly pinkish cast, yellowish-green chemical fluorescence, less indurated, 70%.
- 9260- 9270 Sandstone: as above, in part, more argillaceous, 85%; trace of chert; trace of marcasite.
- 9270- 9275 Shale: dark gray, blocky, carbonaceous, small amount of Sandstone: gray, "salt and pepper", with reddish-brown staining, fine grained, subangular, well sorted, siliceous and calcareous matrix.
- 9275- 9280 Brown silty shale, and dark gray, carbonaceous shale; trace of light gray sandstone; trace of Siltstone: light pinkish-brown, calcareous; some cement cavings.
- 9280- 9290 Shale: mostly dark gray, blocky, slightly calcareous; trace of Sandstone: gray, "salt and pepper", quartz and chert grains: fine grained, subangular, calcareous; trace of white and dark gray laminite; small amount of cement cavings.
- 9290- 9300 Shale: gray to dark gray and brownish-gray, soft, calcareous, in part, silty, in part, carbonaceous, with a yellowish-white crushed cut fluorescence; trace of very fine grained, gray sandstone, in part, containing rounded glauconite grains; trace of Pecten.
- 9300- 9310 Shale: as above; Limestone: white to dark gray, mottled, crypto to microcrystalline, finely brecciated and recemented, a Calcarenite; in part, argillaceous; scattered, pale, greenish-yellow fluorescence; trace of calcite.
- 9310- 9320 Increased Limestone: as above, in part, less argillaceous; some fractures in the limestone, filled with calcite; some larger, light, subangular fragments in the darker limestone; Shale: as above; trace of calcite; some of the limestone is soft, chalky, almost marly; trace of green, glauconitic sandstone from above.

- 9320- 9330 Limestone: as above, in part, lighter gray, some light lutite intraclasts; angular to rounded, nonskeletal in a dark matrix; in part, the dark matrix has a reticulated appearance; limestone, 90%; Shale: as above, very calcareous.
- 9330- 9340 Limestone: as above, with less reticulated limestone; Shale: as above, 20%.
- 9340- 9350 Limestone: white to dark gray, in part, mottled, in part, subtranslucent, cryptocrystalline, finely brecciated and recemented, a calcarenite; in part, very argillaceous.
- 9350- 9360 Limestone: as above; increased white to buff, soft Limestone: crypto to microcrystalline, whitish-yellow cut fluorescence; increased Calcite, 5%; Shale: as above, mostly dark gray, 40%.
- 9360- 9370 Limestone: as above, more argillaceous; trace of white to buff limestone; Shale: as above, 35%; trace of calcite; trace of Pecten.
- 9370- 9380 Limestone: as above, argillaceous to silty; trace of calcite banding in the limestone; Limestone, 50%; Shale: mostly dark gray, calcareous, in part, silty; trace of calcite.
- 9380- 9390 Limestone: as above; some white to buff, marly Limestone, 10%; Shale, 40%.
- 9390- 9400 Limestone: as above; in part, consists of calcite grains in a soft, dark gray matrix; in part, the limestone has a coquinoid appearance; trace of marly limestone; Shale: as above, very calcareous, 40%; trace of calcite.
- 9400- 9410 Limestone: as above, more argillaceous, 40%; Shale: as above.
- 9410- 9420 Shale: dark gray, in part, with a brownish tinge, blocky, in part, silty, calcareous; argillaceous Limestone: as above, 30%; trace of calcite.
- 9420- 9430 Shale: as above, 80%; Limestone: as above, mottled white and dark gray, argillaceous, 20%.
- 9430- 9440 Limestone: as above, 60%; in part, the limestone consists of lithoclasts, dark gray, nonskeletal, noncalcareous, argillaceous and carbonaceous, possibly phosphatic, subangular to subrounded in a white, micritic matrix; Shale, 40%.

- 9440- 9450 Limestone: as above, light gray to dark gray, very argillaceous; in part, the lithoclasts have the appearance of phosphatic pellets, but are too irregular and poorly sorted; Limestone, 50%; Shale: as above, 50%.
- 9450- 9460 Limestone: as above, with less of the dark lithoclasts, 40%; Shale: gray to dark gray, blocky, in part, silty, in part, carbonaceous, calcareous, 60%.
- 9460- 9470 Limestone: as above, with increased dark lithoclasts in a white Limestone matrix, 70%; Shale: as above; trace of calcite.
- 9470- 9480 Limestone: as above, but more argillaceous, darker gray, 50%; Shale: as above, very calcareous.
- 9480- 9490 Limestone: gray to dark gray, argillaceous to silty, harder, dolomitic; trace of Limestone: brown, indurated, very siliceous; Shale: as above, in part, more carbonaceous, 10%.
- 9490- 9500 Limestone: argillaceous, silty, soft, as above; Limestone: gray, silty, harder; small amount of Siltstone: dark gray, argillaceous, dolomitic; Shale: as above, grading to an argillaceous limestone.
- 9500- 9510 Increased Shale: gray and brownish-gray to dark gray, blocky, calcareous to very calcareous; Limestone: as above, 10%; trace of light reddish-brown siliceous limestone; trace of calcite.
- 9510- 9520 As above; the brownish-gray shale is bentonitic, slightly dolomitic; small amount of argillaceous limestone.
- 9520- 9530 Shale: gray to dark gray, calcareous, silty, grading to an argillaceous Siltstone: gray to dark gray, calcareous.
- 9530- 9540 Shale and Siltstone: as above, softer; trace of Limestone: as above.
- 9540- 9550 Shale: gray to dark gray, as above; small amount of limestone; trace of calcite.
- 9550- 9560 Shale: gray to dark gray, silty, grading to an argillaceous siltstone; Limestone: as above, 10%; slight increase in calcite.
- 9560- 9570 Siltstone: gray, well consolidated, argillaceous, dolomitic, 30%; Shale: dark gray, blocky, calcareous, in part, slightly silty, 40%; Shale: gray, platy, noncalcareous, 10%.

- 9570- 9580 Siltstone: gray, in part, with a brownish tinge, well consolidated, argillaceous, 70%; Shale: dark gray, blocky, calcareous, 15%; Shale: gray, smooth texture, platy, noncalcareous, 15%.
- 9580- 9590 Siltstone: gray, mainly quartz grains, hard, dolomitic; some lighter gray, softer siltstone; trace of dark gray shale.
- 9590- 9600 Siltstone: gray to darker gray, hard, argillaceous.
- 9600- 9610 Siltstone: as above, slightly coarser, harder, less dolomitic, with more siliceous cement.
- 9610- 9620 Siltstone: as above, grading to a very fine grained Sandstone: gray to dark gray, subangular, well sorted, in part, argillaceous, with a siliceous matrix, slightly dolomitic; piece of cherty quartz.
- 9620- 9625 Sandstone: light gray to gray, "salt and pepper", quartz and scattered chert grains; fine grained, subangular to subrounded, poorly sorted, well consolidated, dolomitic, in part, kaolinitic, tight, no shows.
- 9625- 9630 Sandstone: as above; Shale: dark gray, carbonaceous, 20%; Shale: gray, bentonitic, soft, smoother texture, 10%; Cement, 10%.
- 9630- 9635 Sandstone: as above, in part, lighter gray; Shale: dark gray, blocky, carbonaceous, 25%; Siltstone: light pinkish-gray, calcareous, 5%; trace of Shale: gray, smooth texture.
- 9635- 9640 Sandstone: as above, 60%; Shale: dark gray, blocky, carbonaceous, 30%; Shale: gray, smooth texture, platy, 10%; Siltstone: pinkish-gray, very calcareous, 10%; trace of limestone; trace of Brachiopods.
- 9640- 9650 Sandstone: light gray; clear quartz grains; fine grained, subangular, well sorted, well consolidated, siliceous matrix, slightly calcareous, almost an orthoquartzite, tight, no shows, 50%; Shale: gray to dark gray, calcareous, in part, silty, in part, carbonaceous; Shale: lighter gray, smooth texture, platy, 10%; trace of pinkish-gray, chalky, silty shale, almost a marly limestone; trace of calcite; some pieces made up mostly of silica flour show a smooth, concave side with impressions of the bit on it.
- 9650- 9660 Sandstone: as above, light gray, very fine to fine grained; minor Sandstone: darker gray, "salt and

pepper", quartz and chert grains with rare hornblende and biotite; fine grained, subangular, well sorted, well consolidated, tight, 60%; Shale: dark gray, carbonaceous, and Shale: gray, smooth texture, as above.

- 9660- 9665 Sandstone: light gray, as above, with clear quartz grains in a white, opaque, slightly calcareous matrix, in part, very fine grained, 50%; reduced dark gray sandstone, 10%; trace of sandstone with a sideritic matrix; trace of chert conglomerate, with smoky Chert: angular to subrounded fragments in a sideritic matrix; Shale: as above.
- 9665- 9670 Sandstone: light gray to gray, mostly quartz grains, indurated, almost an orthoquartzite; Shale: dark gray, carbonaceous, calcareous; Shale: gray, smooth texture, platy.
- 9670- 9680 Sandstone: mainly quartz with rare chert grains; very fine to fine grained, subangular, poorly sorted, indurated, siliceous matrix, tight; very rare phlogopite in the sandstone; small amount of Sandstone: lighter, with some kaolinitic material in the matrix; trace of Shale: dark gray and gray, as above.
- 9680- 9690 Sandstone: light gray, mainly clear quartz grains; fine grained, well sorted, well consolidated, siliceous matrix, an orthoquartzite; trace of light gray siltstone, with a siliceous matrix.
- 9690- 9700 Sandstone: as above; the quartz grains have indistinct boundaries and the sandstone has a fused appearance, is an orthoquartzite in part; in part, the sandstone has a very faint pinkish cast; trace of Shale: dark gray, blocky to platy; trace of Shale: gray, smooth texture, platy; trace of Brachiopods.
- 9700- 9710 Sandstone: as above, in part, an orthoquartzite, in part, slightly coarser grained; trace of compressed silica rock flour; Shale: as above, 10%.
- 9710- 9720 Sandstone: as above, in part, slightly more friable; Shale: as above, 10%; trace of calcite.
- 9720- 9730 Sandstone: as above, in part, coarser grained, in part, slightly more friable, poorly sorted; reduced shale; trace of calcite; trace of Brachiopods.
- 9730- 9740 Sandstone: as above; increased Shale: dark gray, very carbonaceous, calcareous; Shale: gray, smooth texture, platy.

- 9740- 9743 Increased Shale, 30%; trace of calcite.
- 9743- 9750 Siltstone: light gray, firm, quartz grains; tuffaceous, with some kaolinite in the matrix, 40%; Sandstone: as above, light gray, mainly quartz, but, in part, with scattered chert grains; fine grained, subangular, poorly sorted, siliceous matrix, 35%; Shale: dark gray, calcareous, carbonaceous, blocky, 20%; Shale: brownish-gray, smooth texture, platy, noncalcareous, 5%.
- 9750- 9760 Sandstone: light gray to gray, mainly quartz grains; fine grained, subangular, poorly sorted, siliceous matrix, an orthoquartzite in part; rare phlogopite and chert in the sandstone and a trace of kaolinite; trace of light gray, kaolinitic siltstone, possibly tuffaceous; trace of Shale: dark gray, carbonaceous, calcareous, and Shale: brownish-gray, smooth texture, platy, noncalcareous.
- 9760- 9770 Sandstone: as above, in part, glassy quartz in a siliceous matrix; in part, the sandstone is darker gray, with some rare, pinkish staining; rare weathered orthoclase and scattered biotite; arkosic; Shale: dark gray, rough texture, irregular fracture, carbonaceous, calcareous, 5%; increased brownish-gray Shale: platy, in part, micromicaceous; trace of Siltstone: light reddish-brown, indurated; trace of glauconite grains; subrounded, in a sideritic matrix.
- 9770- 9780 Sandstone, mainly clear quartz; in part, darker gray, with scattered mafic minerals, in part, with a very light pinkish tinge; trace of weathered pink orthoclase grains, in part, kaolinitic; sandstone is fine to medium grained, poorly sorted, siliceous matrix; rare sandstone where the quartz grains are outlined by a dark material, possibly pyrobitumen.
- 9780- 9790 Sandstone: as above, light gray, in part, slightly argillaceous, in part, arkosic, with rare, weathered orthoclase crystals, 50%; Shale: brownish-red, lateritic, in part, silty, 20%; Siltstone, with a very slight greenish cast, 30%.
- 9790- 9800 Sandstone: as above, in general, darker, in part, with a pinkish cast, in part, with weathered orthoclase, 20%; Siltstone: brick-red, argillaceous, lateritic, grading to a silty, lateritic Shale, 35%; Siltstone: light gray, firm, kaolinitic, grading to a very fine grained sandstone; trace of finely crystalline pyrite in the sandstone; trace of dark gray, carbonaceous shale; some compressed silica flour.

- 9800- 9810 Sandstone: as above, in part, with some pink orthoclase, 25%; Sandstone: brown, quartz and chert grains; fine grained, subangular, poorly sorted, with a sideritic matrix, 25%; Siltstone: argillaceous, lateritic, 40%; Siltstone: light gray, kaolinitic, 10%; trace of Shale: as above.
- 9810- 9815 Sandstone: as above, darker gray, mainly quartz grains with some mafic minerals; fine grained, subangular, subrounded, poorly sorted, well consolidated, siliceous matrix, in part, friable, with scattered kaolinite in the matrix; small amount of lateritic siltstone; trace of very fine Sandstone: indurated, with a slight greenish cast; trace of dark gray, calcareous shale.
- 9815- 9820 Sandstone: "salt and pepper", quartz and chert grains; fine to medium grained, subangular to subrounded, siliceous matrix, slightly dolomitic, in part, argillaceous; Shale: brownish-red, lateritic, in part, silty, soft; trace of light gray Shale: smooth texture, bentonitic; trace of dark brown Shale; trace of brown sandstone, with a sideritic matrix.
- 9820- 9830 Sandstone: gray to dark gray, "salt and pepper", and Sandstone: clear quartz; fine to medium grained, poorly sorted, siliceous matrix; Shale: brick-red, lateritic, in part, very soft, 25%; Claystone: brown, smooth texture, very soft, 10%; light gray Siltstone, with a slight greenish tinge, 25%.
- 9830- 9835 Sandstone: gray, "salt and pepper", quartz and chert grains, with rare hornblende, siliceous matrix, slightly dolomitic; small amount of Sandstone: brown, with a slight reddish tinge, quartz grains, with a sideritic matrix, 5%; Siltstone: reddish-brown, lateritic, argillaceous, 5%; Siltstone: light gray, with a slightly greenish tinge; trace of dark gray, carbonaceous shale; trace of light gray shale.
- 9835- 9840 Sandstone: gray to dark gray, "salt and pepper", quartz and rare scattered chert; fine to medium grained, subangular to subrounded, poorly sorted, well consolidated, siliceous matrix, well indurated, in part, argillaceous; trace of lateritic siltstone; trace of siltstone, with a light greenish cast; trace of dark gray shale.
- 9840- 9850 Sandstone: as above, but matrix is siliceous and slightly dolomitic, slightly more friable and, in part, with a slight brownish tinge; trace of lateritic siltstone; trace of Shale: very light gray, with a slight greenish cast; trace of light brownish-gray shale.

- 9850- 9860 Sandstone: as above, gray, "salt and pepper", clear quartz and dark chert grains; fine to medium grained, subangular, poorly sorted, well consolidated, in part, more friable, siliceous and slightly dolomitic matrix; trace of lateritic siltstone; trace of Shale: light gray, with a greenish tinge; trace of dark gray shale; trace of brownish-gray shale.
- 9860- 9870 Sandstone: as above, in part, argillaceous, friable in part; Shale: brownish-gray, platy to fissile, 5%; trace of lateritic siltstone; trace of dark gray Shale: less carbonaceous than above, less calcareous, in part, dolomitic.
- 9870- 9880 Sandstone: light gray, mainly quartz grains; fine to medium grained, poorly sorted, siliceous matrix, more friable; trace of dark gray shale; trace of brownish-gray, platy shale; trace of light gray, micromicaceous, bentonitic shale.
- 9880- 9890 As above; trace of light green, silty Shale; trace of Siltstone: reddish-brown, argillaceous, lateritic.
- 9890- 9900 Sandstone: as above, friable, in part, pinkish-gray; trace of lateritic siltstone; trace of light gray siltstone; slight increase in dark gray, blocky, carbonaceous shale, 10%; trace of brownish-gray shale.
- 9900- 9910 Sandstone: as above, but, in general, finer, more kaolinitic, lighter gray; trace of coarser sandstone, with a pinkish-gray color; increased Shale: dark gray, carbonaceous, dolomitic, 20%; trace of lateritic siltstone.
- 9910- 9920 Sandstone: light gray, clear quartz and scattered, smaller chert grains; mainly fine grained, with some medium grained, siliceous matrix, but slightly dolomitic in tight fractures; trace of darker gray, "salt and pepper" sandstone, with some light green weathered grains; trace of light green Shale: kaolinitic, in part, silty; Shale: dark gray, carbonaceous, dolomitic, 10%.
- 9920- 9930 Sandstone: as above, coarser, with scattered chert and rare hornblende; subhedral crystals, subangular, indurated, slightly dolomitic; Siltstone: brownish-red, argillaceous, lateritic, 5%; trace of dark gray shale.
- 9930- 9935 Cement, 50%; Sandstone: as above, mainly clear quartz grains; increased dark gray, carbonaceous, dolomitic shale.

- 9935- 9940 Cement, 10%; Sandstone: as above, but more friable, with grains slightly more rounded, scattered yellowish-green fluorescence, faint yellowish-white crushed cut fluorescence; dark gray Shale: as above.
- 9940- 9950 Sandstone: as above, in part, with a slight greenish cast; Shale: dark gray, slightly dolomitic, 30%; trace of light gray, fissile shale; trace of lateritic siltstone; trace of calcite.
- 9950- 9960 Sandstone: lighter gray, mainly quartz with scattered chert grains; mainly fine grained, with scattered medium grained, subangular, fairly well sorted, well consolidated, siliceous matrix, slightly dolomitic; trace of dark gray Shale: slightly dolomitic; trace of gray to light greenish-gray Shale: platy to fissile; trace of lateritic siltstone.
- 9960- 9970 Sandstone: as above, light gray to gray, in part, with a pinkish tinge, fine to medium grained; Shale: as above; trace of lateritic siltstone.
- 9970- 9980 Sandstone: as above, in part, kaolinitic; Siltstone: brick-red, lateritic, argillaceous, very soft, 15%; Shale: as above.
- 9980- 9990 Sandstone: as above, in part, arkosic, in part, kaolinitic; scattered, very pale, yellowish-green fluorescence; Shale: brick-red, lateritic, in part, silty, very soft, 40%; Shale: dark gray, 10%; Shale: light gray, bentonitic, in part, micromicaceous, 10%.
- 9990- 9995 Sandstone: as above, light gray, with rare, scattered hornblende crystals, in part, kaolinitic; Shale: brick-red, lateritic, soft, 20%; Shale: dark gray, as above, 15%; Shale: light gray to gray, smooth texture, 10%.
- 9995-10,000 Sandstone: as above, in part, darker gray, increased chert, slightly dolomitic; Shale: brick-red, lateritic, firmer, 15%; Shale: dark gray, dolomitic, 10%; Shale: light gray, as above, 5%.
- 10,000-10,005 Sandstone: as above, very fine to fine grained, in part, with a greenish tinge; the darker sandstone appears coarser; Shale: dark gray, 5%; Shale: light gray and light greenish-gray, 3%; trace of Shale: lateritic, in part, silty; trace of calcite.
- 10,005-10,010 Sandstone: as above, slightly coarser, more rounded, more friable, less chert grains; small amount of dark gray shale; trace of light greenish-gray shale, in part, bentonitic; trace of lateritic shale.

- 10,010-10,015 Sandstone: as above, poorly sorted; small amount of dark gray shale; small amount of lateritic shale; reduced light gray shale; trace of Dolomite: creamy-white, dense, massive.
- 10,015-10,020 Sandstone: as above, in part, with a light green tinge, in part, more quartzitic; widely scattered hornblende crystals; Shale: dark gray, 5%; small amount of Shale: light greenish-gray; trace of lateritic shale; trace of calcite.
- 10,020-10,025 Sandstone: as above, darker gray, more argillaceous, with scattered, rare hornblende; trace of finely crystalline pyrite in the sandstone; increased dark gray Shale, 10%; trace of Shale: light gray, in part, with small, widely disseminated pyrite cubes; trace of lateritic shale; trace of calcite; trace of creamy-white dolomite.
- 10,025-10,030 Sandstone: as above, in general, coarser grained; Chert: frosted to smoky, and some quartz fragments; angular, fractured, 30%; trace of dark gray shale; trace of lateritic shale; trace of light gray shale.
- 10,030-10,035 Chert: as above, frosted to smoky, angular fragments, in part, fractured, in part, pyritized, 20%; small amount of Shale: dark gray, hard; trace of brick-red, lateritic shale; a piece of light green, silty Shale: weathered, in part, to a brick-red, evidently the unweathered portion of the lateritic shale; trace of light gray shale; trace of dolomite.
- 10,035-10,040 Sandstone: as above, mainly clear quartz grains; quartzitic; Shale: dark gray, in part, very carbonaceous, 10%; trace of light gray, smooth textured shale; trace of brownish-gray shale, with a slightly rougher texture; small amount of Chert: as above; trace of dolomite, in part, microcrystalline.
- 10,040-10,045 Sandstone: as above, fine to medium grained, mainly subangular with some subrounded; Shale: dark gray, hard, dolomitic, 5%; small amount of lateritic shale; trace of light gray, bentonitic shale, in part, silty; small amount of chert; trace of dolomite.
- 10,045-10,050 Sandstone: mainly clear quartz, with some chert and rare hornblende; fine to medium grained, subangular to subrounded, well indurated, siliceous matrix, dolomitic; Shale: dark gray, blocky, dolomitic to calcareous, in part, very carbonaceous; trace of light gray shale; trace of brownish-gray shale, with a rougher texture; trace of lateritic siltstone.

- 10,050-10,060 Sandstone: light gray, mainly quartz, with scattered chert and rare hornblende; fine to medium grained, subangular to subrounded, poorly sorted, well indurated, siliceous matrix, fused appearance, with indistinct grain boundaries, in part, an orthoquartzite; Shale: dark gray, blocky to platy, calcareous, 20%; trace of Shale: light gray, in part, with a greenish cast, smooth texture, platy to fissile, in part, bentonitic; trace of Shale: gray, platy, noncalcareous; trace of chert; trace of Limestone: creamy white, dense, massive; trace of calcite.
- 10,060-10,070 Sandstone: as above, more rounded, in part, friable; Shale: dark gray, blocky, calcareous; Shale: gray to dark gray, platy to fissile, dolomitic, 40%; Shale: light gray, smooth texture, platy to fissile, bentonitic, 20%; trace of black and white banded siltstone, with the white grains oriented, suggesting plastic flow.
- 10,070-10,080 As above; increased dark gray, carbonaceous shale, 30%; Shale: gray, fairly smooth texture, platy to fissile, 5%; some patches of finer sandstone, with a pinkish tinge; trace of calcite; some cement in the sample.
- 10,080-10,090 Sandstone: as above, in general, finer, less indurated, with scattered kaolinite in the matrix; reduced dark gray shale, 15%; small amount of light gray to gray Shale: smooth texture, platy.
- 10,090-10,100 Sandstone: as above, very fine to fine grained, slightly dolomitic, with some kaolinitic infilling, more friable, with poor to fair fracture porosity; dark gray Shale: as above, carbonaceous, calcareous, 15%; trace of Shale: lateritic, silty; trace of brownish-gray shale; trace of light gray, bentonitic shale.
- 10,100-10,110 Sandstone: as above, with some fracture porosity; reduced dark gray Shale, 10%; trace of Shale: gray, blocky, firm; trace of Shale: brick-red, lateritic, silty.
- 10,110-10,120 Sandstone: as above, finer grained, with very finely scattered chert grains; some fracture porosity; trace of dark gray shale; trace of lateritic Shale: firm, in part, silty.
- 10,120-10,130 Sandstone: as above, quartz and scattered chert, with rare subhedral hornblende crystals; scattered patches of kaolinitic infilling; some fracture porosity; trace of Shale: as above.
- 10,130-10,140 Sandstone: as above, finer grained, with better sorting; trace of lateritic shale; trace of dark gray shale; trace of dolomite.

- 10,140-10,150 Sandstone: as above, slightly darker; Shale: dark gray, slightly dolomitic, 20%; Shale: light gray to gray, smooth texture, bentonitic, 5%; trace of gray Shale: rougher texture, in part, silty; trace of brick-red, lateritic shale.
- 10,150-10,160 Sandstone: slightly darker, quartz and chert grains; very fine to fine grained, indurated, siliceous matrix, very slightly dolomitic, more argillaceous, faint green fluorescence, no cut; trace of dark gray Siltstone; trace of Shale: as above.
- 10,160-10,170 Sandstone: as above, very fine grained; Siltstone: gray, blocky, slightly dolomitic, argillaceous, 40%; small amount of lateritic shale; trace of dark gray shale.
- 10,170-10,180 Shale: gray, blocky to platy, smooth texture, grading to a gray, argillaceous siltstone; Sandstone: as above, 40%; trace of dark gray shale; trace of Limestone: creamy-white microcrystalline.
- 10,180-10,190 As above; Shale: gray, 20%; Siltstone: gray, 50%; Sandstone: as above, 30%; trace of dark gray, calcareous, carbonaceous shale.
- 10,190-10,200 As above; siltstone has a slightly brownish cast; shale is slightly softer; Sandstone, 25%.
- 10,200-10,210 Shale: gray to brownish-gray, soft, almost a mudstone in part, 40%; Siltstone: gray to dark gray, argillaceous, in part, "salt and pepper", in part, with coaly specks, 35%; Sandstone: gray to brownish-gray, very fine to fine grained, argillaceous, 25%.
- 10,210-10,220 Shale: gray to brownish-gray, smooth texture, blocky to platy, 45%, grading to Siltstone: gray to dark gray, in part, "salt and pepper", argillaceous, 40%; Sandstone: lighter gray, quartz with scattered chert: siliceous matrix, 15%.
- 10,220-10,230 Shale: gray to brownish-gray, 30%; Siltstone: gray, in part, "salt and pepper", argillaceous, 60%; Sandstone: very fine to fine grained, argillaceous, 10%.
- 10,230-10,240 As above; Shale, 40%; Siltstone, 50%; Sandstone: in part, lighter, less argillaceous, 10%.
- 10,240-10,250 Shale: as above, mostly brownish-gray, mostly platy, soft, 55%; Siltstone: as above, 35%; Sandstone: as above, light gray, softer, more kaolinitic, 10%.

- 10,250-10,260 Shale: as above, 45%; Siltstone, 25%; Sandstone: light gray to gray, in part, argillaceous, 30%.
- 10,260-10,270 Shale: gray and brownish-gray to dark gray, mostly platy, 55%; Siltstone: gray to dark gray, in part, "salt and pepper", argillaceous, 40%; Sandstone: light gray, "salt and pepper", quartz and scattered chert grains; very fine to fine grained, subangular, poorly sorted, siliceous matrix, 5%.
- 10,270-10,280 As above; Shale, 25%; Siltstone is lighter, less argillaceous in part, 60%; Sandstone is lighter gray, 15%.
- 10,280-10,290 Shale: dark brown to dark gray, soft, smooth texture, blocky to platy, 85%; Siltstone: dark gray, argillaceous, 5%; Sandstone: "salt and pepper", in part, argillaceous, 10%; trace of dark gray, very carbonaceous shale.
- 10,290-10,300 Shale: as above; increased Siltstone: in part, very argillaceous, with some coaly streaks; trace of dark gray, very carbonaceous shale.
- 10,300-10,310 Shale: as above, platy to fissile, in part, slightly silty; trace of siltstone; Sandstone: as above, light gray to gray and brownish-gray, in part, argillaceous, 5%.
- 10,310-10,320 Shale: dark gray, platy to fissile; trace of gray siltstone; Sandstone: light gray to gray, fine grained, subangular, well sorted, siliceous matrix, tight, 5%.
- 10,320-10,330 Shale: as above; some softer, brownish-gray shale; trace of light green Shale: in part, silty; trace of Sandstone: as above, fine grained, in part, kaolinitic.
- 10,330-10,340 Shale: as above, dark gray, platy to fissile, in part, silty; trace of brownish-gray shale; trace of Sandstone: gray, "salt and pepper", very fine to fine grained, argillaceous.
- 10,340-10,350 Shale: as above, dark gray, platy to fissile and brownish-gray, in part, silty; small amount of sandstone; trace of dark gray, carbonaceous shale; trace of light green shale, in part, silty; trace of calcite.
- 10,350-10,360 Shale: dark gray, as above; Shale: brownish-gray, soft, 5%; trace of sandstone.
- 10,360-10,370 Shale: as above, in part, silty; trace of siltstone; trace of Sandstone: as above.
- 10,370-10,380 Shale: dark gray, smooth texture, blocky to platy and minor Shale: brownish-gray, soft, blocky, in part, silty.

- 10,380-10,390 Shale: as above; Sandstone: gray, "salt and pepper", argillaceous, 5%; trace of gray, "salt and pepper" siltstone.
- 10,390-10,400 Shale: dark gray and brownish-gray, as above; Siltstone: gray to dark gray, in part, "salt and pepper", argillaceous, 10%; trace of Sandstone: as above.
- 10,400-10,410 Shale: dark gray to dark brownish-gray, smooth texture, blocky to fissile; trace of light gray Shale: in part, with a greenish cast; small amount of Sandstone: "salt and pepper", quartz and chert grains; fine grained, subangular, well sorted, siliceous matrix, in part, arkosic, with weathered orthoclase crystals; trace of creamy-white dolomite.
- 10,410-10,415 As above; trace of Sandstone: coarser, quartz grains with some dark, argillaceous material in the matrix; trace of white Dolomite: finely crystalline.
- 10,415-10,420 Shale: as above, in part, with some finely crystalline pyrite concentrations; trace of gray, "salt and pepper" siltstone; trace of Sandstone: in part, with a slight pinkish-gray tinge, quartz and chert grains; well consolidated, siliceous matrix.
- 10,420-10,430 Shale: as above, with increased pyrite, mostly small cubes; shale is more blocky, harder; trace of siltstone; trace of Sandstone: as above.
- 10,430-10,440 Shale: as above, with some very fine, pyrite cube concentrations; Sandstone: light gray, as above, in part, with very faint staining surrounding the quartz grains; no fluorescence, but widely scattered, faint, yellowish-white, crushed cut fluorescence, 5%; Sandstone: dark gray, "salt and pepper", quartz and chert with scattered glauconite grains; weathered, in part, siliceous matrix, dolomitic, 25%; Siltstone: gray, "salt and pepper", 10%; trace of pinkish-gray dolomite.
- 10,440-10,450 Shale: as above, dark gray, smooth texture, mainly platy; trace of light gray, bentonitic shale; Sandstone: dark gray, argillaceous, glauconitic, dolomitic, as above, 15%; Sandstone: lighter gray, "salt and pepper", quartz and chert grains; siliceous matrix, 5%; trace of lateritic siltstone, possibly cavings.
- 10,450-10,460 Sandstone: dark gray, argillaceous, glauconitic, as above, 50%; in part, the sandstone contains some very fine pyrite cubes; Sandstone: light gray, as above, 10%; Shale: gray, as above, 40%; trace of light gray shale.

- 10,460-10,465 Sandstone: light gray, mainly quartz with some chert grains; fine grained, subangular, fairly well sorted, siliceous matrix, very slightly dolomitic, 35%; Sandstone: dark gray, argillaceous, glauconitic, as above, 25%; Shale: gray to dark gray, in part, with a slight brownish tinge, platy to fissile, 40%; trace of light gray, bentonitic shale.
- 10,465-10,470 Sandstone: light gray, mainly quartz with scattered, rare chert grains; indistinct grain boundaries, siliceous matrix, in part, an orthoquartzite, in part, arkosic, with weathered orthoclase grains, 35%; Sandstone: dark gray, argillaceous, glauconitic, 25%; Shale: dark gray, smooth texture, platy to fissile, 40%; trace of Dolomite: cryptocrystalline.
- 10,470-10,480 Sandstone: light gray, as above, with a faint crushed cut fluorescence, 35%; Sandstone: dark gray, argillaceous, glauconitic, in general, finer, 20%, with rare pyrite crystals; Shale: brownish-gray to dark gray, smooth texture, platy, 40%; trace of Shale: light gray, bentonitic, smooth texture, Siltstone: dark gray, 5%.
- 10,480-10,485 Limestone: buff to light brownish-gray, in part, slightly mottled, cryptocrystalline, finely brecciated and recemented, a calcarenite, 60%; trace of Limestone: light gray, cryptocrystalline, a calcilutite; Shale: as above, 15%; Siltstone, 15%; Sandstone: more pyritic, 10%.
- 10,485-10,490 Limestone: light brownish-gray, cryptocrystalline, a calcilutite; Calcarenite: as above, in part, with dark, argillaceous outlines to the fragments; trace of rounded brown grains, with a light halo surrounding them, in a buff matrix, possibly algal pellets; trace of Brachiopods with very fine radial striations; small amount of shale and fine grained Sandstone: as above.
- 10,490-10,495 Limestone consisting of dark Amphipora in a micritic matrix; some dark, angular, nonskeletal intraclasts in a light matrix; some oolites in a white to off-white matrix; trace of dark gray Shale: blocky to platy.
- 10,495-10,500 Limestone: very light brown, finely brecciated, a calcarenite; some angular, subtranslucent, light brown lithoclasts in an opaque, white matrix; trace of light gray calcilutite; small amount of light pinkish-brown, marly limestone; trace of Amphipora; trace of shale and glauconitic Sandstone: as above, probably cavings.
- 10,500-10,510 Limestone: as above; in part, the light gray limestone is subtranslucent; slight increase in dark Amphipora; small amount of marly limestone.

- 10,510-10,515 Calcarenite: as above; pinkish-brown, marly Limestone, 10%; light gray Calcilutite, 10%; trace of Amphipora; trace of dark gray shale, in part carbonaceous.
- 10,515-10,520 Limestone: off-white, cryptocrystalline, finely brecciated and recemented, a calcarenite; in part, has the appearance of algal pellets; marly Limestone: as above, 15%; trace of darker gray Limestone: slightly dolomitic; some calcite inclusions in the limestone; trace of Shale: gray to dark gray, platy to fissile, in part, very carbonaceous.
- 10,520-10,525 Limestone: light gray to light brownish-gray, a calcarenite grading to a siltite; Limestone: light gray, cryptocrystalline, a calcilutite, 30%; marly Limestone, with a light brown color, 20%; trace of light green shale; trace of dark gray, carbonaceous shale.
- 10,525-10,530 Limestone: light creamy-brown, cryptocrystalline, a calcarenite, and Limestone: light gray, a calcilutite; reduced marly limestone; trace of angular, frosted chert fragments.
- 10,530-10,540 Limestone: light creamy-brown, as above, 45%; Limestone: light gray, mostly a calcilutite, 25%; rare, uneven, very fine, argillaceous fractures in the limestone; small amount of frosted chert fragments; trace of finely crystalline pyrite; Shale: gray to dark gray, in part, with a brownish tinge, 30%.
- 10,540-10,545 Creamy-white Calcarenite: as above, 35%; Limestone: light gray, cryptocrystalline, with a high silica content, a calcilutite, 25%; marly Limestone, 20%; Shale: gray to dark gray, fissile, 20%; trace of angular, frosted chert fragments; trace of Sandstone: "salt and pepper", fine grained, subangular, well sorted, noncalcareous, siliceous matrix, possibly from above.
- 10,545-10,550 Limestone: predominantly light gray, cryptocrystalline, grading from a calcilutite to a calcarenite; minor creamy-brown limestone; some light gray and light green, translucent Limestone: dolomitic; Shale: gray to dark gray, carbonaceous, 10%.
- 10,550-10,555 Limestone: as above; traces of light green mineral in the limestone, possibly weathered glauconite grains; trace of Amphipora; increased light gray lutite; slight increase in chert; Shale: as above.

- 10,555-10,560 Limestone: as above, in general, platy; trace of light green glauconite in the limestone; very rare patches, with poor intercrystalline porosity and faint oil staining; Shale: as above; Shale: light gray, platy, micromicaceous, 3%; Chert: as above; trace of calcite.
- 10,560-10,565 Limestone: light gray and light pinkish-brown, cryptocrystalline, finely brecciated and recemented, a calcarenite; trace of dark, nonskeletal intraclasts in a light matrix; some argillaceous material in the calcarenite matrix; trace of light gray calcilutite; frosted Chert: as above.
- 10,565-10,570 Limestone: as above; some marly Limestone, 20%; some light brownish-gray Calcilutite: in part, subtranslucent, 20%; some very light green and pink limestone; Shale: gray, fairly smooth texture, platy, 25%; trace of chert; some Sandstone: "salt and pepper", fine grained, clear quartz and rare chert; siliceous matrix, probably cavings.
- 10,570-10,575 Limestone: as above, with an increase in light brownish-gray lutite; the bright greenish-yellow fluorescence is chemical; Shale: light gray, platy, 10%; trace of frosted, angular chert fragments; trace of calcite; the sandstone in the sample appears to be cavings from above.
- 10,575-10,580 Limestone: as above, but mostly a calcarenite; marly Limestone, 20%; slight decrease in chert; trace of light green, bentonitic shale; Shale: gray, platy, as above, 15%.
- 10,580-10,590 Limestone: creamy-white, cryptocrystalline, finely brecciated, a calcarenite; Limestone: light brownish-gray, cryptocrystalline, a calcilutite; trace of marly limestone; Chert: clear, in part dolomitic with carbonaceous inclusions; appears to be Bryozoa replacements; trace of angular, frosted chert fragments; Shale: gray to dark gray, platy to blocky, in part, silty, 30%; trace of a rod-like fossil with longitudinal striations.
- 10,590-10,600 Calcarenite: as above; in part, has some carbonaceous material outlining the fragments; increased Chert: frosted to smoky blue, subtranslucent, 5%.
- 10,600-10,610 As above; the chert contains some rudistids and has been formed by the replacement of limestone with siliceous solutions; small amount of shale.

- 10,610-10,620 Increased calcilutite; Chert: as above, with some rudistids; small amount of shale.
- 10,620-10,630 Calcarenite: as above, in part, with some dark carbonaceous material in the matrix; considerable Stachyodes; reduced chert; chert rudistids show it to be a replacement of a calcarenite; trace of shale.
- 10,630-10,640 Calcilutite: light brownish-gray, cryptocrystalline; trace of calcarenite.
- 10,640-10,650 Calcilutite with increased Calcarenite: as above; slight increase in chert fragments; some Stachyodes and other unidentifiable dendritic Stromatoporoids.
- 10,650-10,660 Increased Calcarenite: in part, with carbonaceous material in the matrix; Calcilutite: as above; small amount of chert; some Stachyodes; trace of Amphipora.
- 10,660-10,670 Creamy-white Calcarenite: as above; light gray calcilutite; increased chert, 25%; trace of Stachyodes; trace of nonporous, dendroid Stromatoporoids (back reef facies); trace of light green shale; trace of gray to dark gray shale.
- 10,670-10,680 As above, mostly a calcarenite; Chert: frosted, angular fragments, 20%; small amount of Shale: as above.
- 10,680-10,690 Mostly a Calcarenite: light gray to light brownish-gray, cryptocrystalline, finely brecciated and recemented; small amount of Calcilutite: light gray, in part, subtranslucent; Chert fragments: angular, frosted, with some rudistids, including dendritic Stromatoporoids.
- 10,690-10,700 Calcarenite: as above, mostly buff, with some light gray; trace of light pinkish-gray, marly limestone; small amount of chert, including some tripolite; some Stromatoporoid rudistids in the chert.
- 10,700-10,710 Buff calcarenite, grading to a siltite; light gray Lutite, 20%; trace of marly limestone; very rare chert.
- 10,710-10,720 Calcarenite: as above; some tan, skeletal intraclasts in a lighter matrix; some algal pellets; frosted, angular, chert fragments, 5%; trace of tripolite; some rudistids.
- 10,720-10,730 Calcarenite: as above; minor light brownish-gray calcilutite; trace of light green limestone; Chert: as above, 5%; trace of tripolite, with some rudistids; trace of Shale: gray, smooth texture, platy.
- 10,730-10,740 Predominantly a Calcilutite: light brownish-gray to light gray, grading to a calcarenite; in part, the calcilutite has a high silica content.

- 10,740-10,750 Calcilutite: in part, subtranslucent; Calcarenite, 20%; trace of chert.
- 10,750-10,760 Calcilutite and Calcarenite, 50-50; increased chert fragments, 5%; trace of light green shale, in part, silty; trace of a Brachiopod.
- 10,760-10,770 As above; trace of marly limestone; reduced chert, 3%.
- 10,770-10,780 Mainly light brownish-gray Calcilutite: cryptocrystalline, platy; Chert: as above, with increased tripolite; some calcite in tight fractures in the chert.
- 10,780-10,790 Increased Calcarenite: in part, a light pinkish-brown; trace of marly limestone; trace of chert; trace of Stachyodes.
- 10,790-10,800 Light brownish-gray to buff calcarenite and calcilutite, in part, subtranslucent; increased chert, 15%; trace of clear, dolomitic limestone, with a high, very fine silica content; trace of coated, algal pellets; Shale: as above, 5%.
- 10,800-10,805 Mainly calcarenite; Chert, 5%; trace of Amphipora.
- 10,805-10,810 Calcarenite and Calcilutite: light gray and light brownish-gray, in part, subtranslucent; rare dark carbonaceous material outlining fragments; trace of smoky chert, with rare rudistids; trace of algal pellets; Shale: gray to dark gray, platy, 5%.
- 10,810-10,820 Calcarenite, grading through a siltite to a lutite; increased Chert, 5%; small amount of Shale: as above.
- 10,820-10,830 Mainly Calcilutite: light gray to gray, in part, subtranslucent, cryptocrystalline, in part, with a subconchoidal fracture; Calcarenite: light gray to gray and buff, 10%; trace of marly limestone; Chert: smoky, angular fragments, 10%; trace of Ostracods.
- 10,830-10,840 As above; increased calcarenite; increased marly limestone; trace of Shale: gray, platy.
- 10,840-10,850 Increased buff calcarenite; calcilutite is gray to dark gray, mostly subtranslucent; marly Limestone, 5%; small amount of Chert: in part dolomitic; it appears to be layered.
- 10,850-10,860 As above; trace of light brown, subtranslucent intraclasts in a lighter, opaque matrix; in general, the limestone is darker gray, more argillaceous; Chert: as above, smoky,

- subtranslucent; trace of gray, fissile shale; some dark gray shale and glauconitic sandstone cavings; trace of Brachiopods.
- 10,860-10,870 Calcarenite and Calcilutite: as above; trace of marly limestone; small amount of chert; trace of shale; trace of Stachyodes; trace of Ostracods; trace of algal pellets.
- 10,870-10,880 Increase in light gray to gray, cryptocrystalline calcilutite; trace of marly limestone; trace of smoky chert; small amount of Shale: as above; trace of Stachyodes; trace of algal pellets.
- 10,880-10,890 Calcarenite and Calcilutite: as above; very rare, very fine, stylolitic partings, low amplitude; Shale: gray, platy, 5%.
- 10,890-10,900 Mostly a calcarenite; small amount of Amphipora: light brown, subtranslucent, in a sparry calcite matrix; trace of Stachyodes; trace of Ostracods; trace of light brownish-gray, angular, nonskeletal intraclasts in a light matrix; trace of unidentified, light dendritic Stromatoporoids in a darker matrix; trace of chert; trace of shale.
- 10,900-10,910 Calcarenite: mostly light gray; considerable dark brown Amphipora; trace of calcilutite; trace of chert.
- 10,910-10,920 Mostly a calcarenite; small amount of calcilutite; trace of chert; trace of selenite; considerable brown Amphipora with most of the matrix a sparry calcite; trace of Stachyodes; trace of gray, fissile shale.
- 10,920-10,930 Calcarenite and Calcilutite: as above, predominantly light gray to gray, increasingly subtranslucent; trace of marly limestone; trace of chert.
- 10,930-10,940 As above, with increased calcilutite; trace of marly limestone; trace of chert; trace of gray shale; some poorly preserved Amphipora.
- 10,940-10,945 Calcarenite and Calcilutite: as above, in part, argillaceous; trace of marly limestone; slight increase in chert; trace of calcirudite; some badly preserved algal pellets.
- 10,945-10,950 As above; mostly light gray to gray with a trace of brownish-gray; trace of marly limestone; trace of chert, in part, with some rudistids; trace of algal pellets; trace of Stachyodes; trace of Amphipora; appears to be recrystallized micrite in the matrix.

- 10,950-10,960 Calcarenite: buff and light gray to gray, in part, subtranslucent, cryptocrystalline, finely brecciated and recemented; trace of finely crystalline, widely disseminated pyrite in the limestone; trace of weathered glauconite in the limestone; trace of gray Shale: blocky to platy; trace of light brown, subtranslucent, angular, nonskeletal intraclasts in a light, mainly micritic matrix, with some recrystallization; trace of algal pellets (no internal structure); trace of dendroid Stromatoporoids.
- 10,960-10,970 Calcarenite: as above; small amount of calcilutite; trace of marly limestone; trace of chert fragments imbedded in the calcarenite; trace of light green shale; trace of gray to dark gray shale; trace of Stachyodes; trace of light brown Amphipora.
- 10,970-10,980 Calcarenite: as above; trace of weathered glauconite grains in the limestone; Calcilutite: as above, mostly gray; increased marly limestone.
- 10,980-10,990 Increased buff Calcarenite: in part, with a pinkish cast; trace of weathered glauconite; trace of calcilutite.
- 10,990-11,000 Calcarenite: as above, with increased pinkish-buff; increased calcilutite; small amount of marly limestone; trace of selenite; trace of light and dark laminite; trace of light gray, microcrystalline limestone; trace of dark, carbonaceous material outlining fragments in the calcarenite; trace of hair-line, horizontal fractures in the calcilutite; Chert: as above, in part, with carbonaceous inclusions.
- 11,000-11,010 Mainly Calcarenite: as above; minor calcilutite; trace of marly limestone; trace of clear chert, with some carbonaceous inclusions; trace of dark gray shale; trace of Stachyodes; very rare Amphipora; trace of large, light brown, skeletal intraclasts in a darker matrix.
- 11,010-11,020 Calcarenite: as above; some carbonaceous material outlining fragments; some nonskeletal lithoclasts, subtranslucent, in a buff matrix; trace of weathered glauconite in the limestone; Chert: mainly smoky with some subtranslucent; trace of Stachyodes.
- 11,020-11,025 Calcarenite and Calcilutite: as above; the calcilutite has a high silica content in part; trace of marly limestone; trace of Stachyodes; trace of Amphipora; trace of algal pellets.
- 11,025-11,030 Mainly Calcarenite: light gray to gray, with some buff; some calcirudite; small amount of Calcilutite: with a high silica content; trace of Stachyodes.

- 11,030-11,035 Mainly Calcarenite: as above; small amount of calcilutite; trace of chert occurring in layers; trace of algal pellets; trace of Stachyodes.
- 11,035-11,040 Calcarenite: as above; some calcirudite with mixed fragments of lutite and siltite; trace of weathered glauconite grains in the limestone; some chert fragments; trace of algal pellets; trace of Stachyodes; trace of Amphipora in a sparry calcite matrix; some nonskeletal, subtranslucent intraclasts in a micritic matrix.
- 11,040-11,050 Calcarenite: buff to gray, cryptocrystalline, finely brecciated and recemented, and Calcilutite: light gray to gray, both subtranslucent in part; small amount of chert.
- 11,050-11,055 Calcarenite and Calcilutite: as above, increasingly subtranslucent; trace of chert; trace of light green shale, with very finely disseminated pyrite; trace of Stachyodes.
- 11,055-11,060 Calcarenite: gray and light pinkish-gray, cryptocrystalline, finely brecciated and recemented, with rare scattered glauconite grains; lesser amount of Calcilutite: gray, in part, subtranslucent; trace of chert; trace of Shale: gray, blocky to platy; trace of algal pellets.
- 11,060-11,070 Mainly Calcarenite: as above; small amount of calcilutite; in general, the limestone is darker, more argillaceous; trace of calcirudite; some scattered glauconite in the calcarenite; trace of very finely disseminated pyrite associated with the glauconite; Shale: as above.
- 11,070-11,080 Calcarenite: light gray to gray and buff; minor calcilutite; increased Chert: smoky blue to white and opaque, with some rudistids; some algal pellets.
- 11,080-11,090 Calcarenite and Calcilutite: as above; trace of gray, microcrystalline, silty limestone; reduced chert; some tripolite; Shale: gray to dark gray, in part, fissile.
- 11,090-11,100 Calcarenite: mostly beige, with some light gray to gray, in part, subtranslucent; lesser amount of calcilutite; increased chert, with some rudistids, 5%; small amount of shale; trace of gray, microcrystalline, silty limestone.
- 11,100-11,110 Calcarenite and some Calcilutite: as above; trace of glauconite in the limestone; Chert: as above, but mainly smoky, 5%; Shale: as above, 10%; trace of light skeletal intraclasts in a darker lutite matrix.
- 11,110-11,120 Calcarenite and Calcilutite: as above, with some scattered glauconite grains, mostly weathered, in the

- subtranslucent calcilutite; increased angular chert fragments, milky to subtranslucent, with a bluish tinge, 30%; trace of light green shale; Shale: as above, 5%.
- 11,120-11,130 Calcarenite: with a pinkish cast, softer, in part, marly; some light gray calcarenite, with rare, scattered glauconite grains; small amount of gray, subtranslucent calcilutite; Chert: smoky, angular fragments, with some scattered glauconite and some dolomite in very fine fractures; in part, the chert is dolomitic and looks like an incomplete replacement by siliceous solutions; traces of very fine, almost colloidal pyrite in the chert; Chert, 40%.
- 11,130-11,140 As above, with light gray to gray Calcilutite increasing; trace of Limestone: light gray, cryptocrystalline to microcrystalline, in part, silty; decreased Chert: smoky to frosted, with less glauconite grains, 15%; trace of Stachyodes.
- 11,140-11,150 Calcarenite: buff and light gray, finely brecciated and recemented, cryptocrystalline; Calcilutite: light gray to gray, in part, subtranslucent; trace of Dolomite: very siliceous, in part, with scattered glauconite grains, in part, with very tight, irregular fractures, healed with calcite; small amount of Chert: as above; trace of Limestone: gray, very silty, almost a calcareous siltstone; Shale: gray, platy, as above.
- 11,150-11,160 Calcarenite: as above, mostly light brownish-gray; small amount of Calcilutite: light gray to light brownish-gray; small amount of chert, in part, with some rudistids.
- 11,160-11,170 Calcilutite: light gray to light brownish-gray, mainly subtranslucent; Calcarenite: light brownish-gray to light gray, with rare pyrite inclusions; increased chert, mainly smoky, 15%.
- 11,170-11,180 Calcarenite: as above, in part, pinkish-gray, with some gray; increased Calcilutite: light gray to gray; Chert: as above, 20%; trace of shale.
- 11,180-11,185 Calcarenite: mainly light pinkish-gray and calcilutite; reduced chert, 10%; trace of shale.
- 11,185-11,190 Dolomite: light tan, slightly argillaceous, very finely crystalline, limestone stringers.
- 11,190-11,194 Dolomite: tannish-gray, dense, slightly calcareous, very finely crystalline.

- 11,194-11,205 Dolomite: light tan, very finely crystalline, slightly calcareous, becoming slightly porous, light gray chert inclusions.
- 11,205-11,213 Limestone: light gray to light brown, sucrosic, slightly argillaceous, very dolomitic, some chert inclusions.
- 11,213-11,230 Dolomite: light brown to light tan, sucrosic to dense, slightly calcareous, cherty inclusions, slightly porous.
- 11,230-11,235 Shale: dark gray, and Limestone: light brown, algal.
- 11,235-11,255 Dolomite: tan, sucrosic, slightly calcareous, cherty inclusions, trace of pyrite, algal(?).
- 11,255-11,260 Limestone: tan, sucrosic, dolomitic inclusions, Shale: dark gray.
- 11,260-11,275 Dolomite: light gray, sucrosic, calcareous, limestone stringers, cherty inclusions, very slightly porous, trace of dead oil.
- 11,275-11,280 Calcarenite and Calcilutite: as above, 50-50; Chert, 10%; trace of white, massive limestone with some carbonaceous inclusions.
- 11,280-11,290 Calcarenite: buff and light gray to gray, finely brecciated and recemented; lesser amount of calcilutite; trace of darker, skeletal intraclasts in a buff matrix; chert, 10%.
- 11,290-11,300 Limestone: light gray and dark gray, mottled, cryptocrystalline, finely brecciated and recemented, softer, in part, sucrosic, a calcarenite; small amount of buff Calcarenite: as above; small amount of calcilutite; trace of Limestone: brownish-gray, silty; small amount of chert; small amount of gray shale.
- 11,300-11,310 Calcarenite: mottled, as above, and buff, light gray to gray; small amount of calcilutite; some very fine pyrite cubes in the limestone; trace of calcirudite, with angular chert fragments; trace of sandstone, clear quartz with scattered dark grains and very fine pyrite cubes; fine grained, subangular, well sorted, calcareous, tight, no shows; trace of chert; trace of light green shale; trace of laminite.
- 11,310-11,320 Calcarenite: mainly light gray, with some carbonaceous inclusions and carbonaceous material outlining fragments; rare pyrite in the limestone; some white, opaque, angular lithoclasts in a darker matrix; slight increase in calcilutite, with rare pyrite cubes; trace of Sandstone: as above, white to light gray, less calcareous; trace of calcirudite; trace of chert.

- 11,320-11,330 Calcarenite: buff to light gray; small amount of calcilutite; some carbonaceous material outlining fragments in the calcarenite; trace of dark Amphipora; trace of chert; Shale: gray to dark gray, rough texture, irregular fracture, 30%; dark gray shale is very carbonaceous; small amount of Siltstone: gray, argillaceous, with scattered, very fine pyrite cubes.
- 11,330-11,340 Calcarenite: pinkish-buff to light gray, with rare glauconite grains; Calcilutite: as above; Shale: as above, 10%; small amount of chert; trace of light green shale; trace of dark gray Shale: argillaceous, glauconitic, pyritic; trace of brown Amphipora; trace of algal pellets.
- 11,340-11,350 Sandstone: mainly clear quartz with very rare hornblende; very fine to fine grained, subangular, well sorted, calcareous, in part kaolinitic, grading to a sucrosic, silty limestone, 55%; Calcarenite: as above, 10%; Calcilutite: as above, 20%; Siltstone: brick-red, lateritic, argillaceous, soft, calcareous, 5%; trace of dark gray, glauconitic, pyritic sandstone; Shale: gray to dark gray, fissile, 10%; trace of dark Amphipora; some compressed silica flour, with bit marks on the concave side of each piece.
- 11,350-11,355 Sandstone: as above, clear quartz grains, white to light gray, very fine to fine grained, slightly calcareous to dolomitic; trace of dark gray, argillaceous, glauconitic sandstone; Calcarenite: very light gray to gray, in part, soft, 20%; Calcilutite: as above; trace of Shale: as above; small amount of lateritic, silty, calcareous shale; trace of chert; trace of dark Amphipora in a micritic matrix.
- 11,355-11,360 Sandstone: as above, very fine to fine grained, dolomitic; Siltstone: gray, calcareous; Calcarenite and Calcilutite: as above, 20%; Shale: brick-red, silty, lateritic, calcareous, grading to a pink, marly, soft limestone, 10%; trace of light green, silty shale; trace of dark gray, fissile shale; trace of chert; trace of dark Amphipora in a micritic matrix.
- 11,360-11,365 Reduced sandstone, in part, with some biotite, 15%; calcarenite and calcilutite, 45%; increased lateritic Shale: silty, calcareous, 20%; Shale: gray to dark gray, rough texture, 20%; trace of light green, silty shale; trace of light green shale, with a waxy luster; trace of chert.
- 11,365-11,370 Increased limestone; greatly reduced sandstone; reduced lateritic Shale: as above; small amount of Shale: dark gray; trace of chert; some rounded siltstone and limestone nodules, probably reworked.

- 11,370-11,375 Increased Sandstone: in part, arkosic, with pink feldspar; Calcarenite and Calcilutite: as above; trace of finely crystalline pyrite in the limestone; Shale: pink to brick-red, lateritic, silty, calcareous, 15%; increased dark gray shale; trace of chert; trace of dark gray Sandstone: fine grained, argillaceous, glauconitic, pyritic.
- 11,375-11,380 Increased Shale: brick-red, lateritic, silty, calcareous, 40%; Calcarenite and Calcilutite: as above; trace of sandstone, in part, with scattered orthoclase crystals, dolomitic; trace of green Shale: waxy luster, with scattered, very fine pyrite cubes; trace of chert; trace of dark gray siltstone with glauconite and pyrite.
- 11,380-11,390 Shale: gray to dark gray, blocky, 60%; Calcarenite and Calcilutite: as above, 20%; Sandstone: mainly clear, quartz grains; siliceous and dolomitic matrix, 10%; Sandstone: dark brownish-gray, poorly sorted, dolomitic, 5%; Siltstone: gray, argillaceous, dolomitic, 5%; small amount of Shale: brick-red, lateritic; trace of Shale: green, with scattered, very fine pyrite cubes, in part, silty; could be the unweathered portion of the lateritic shale.
- 11,390-11,395 Sandstone: light brownish-gray, mostly quartz grains, with some chert; fine grained, subangular, poorly sorted, well consolidated matrix, mainly siliceous, but slightly dolomitic, 90%; small amount of calcilutite and calcarenite; small amount of light green shale; small amount of gray shale; trace of marcasite.
- 11,395-11,400 Sandstone: as above, in part, coarser, well indurated, light brownish-gray to dark gray, 45%; Calcarenite and Calcilutite: light gray to light brownish-gray, 40%; Shale: gray to dark gray, in part, silty, 10%; trace of Shale: light green, with scattered, very fine pyrite cubes; Chert: smoky, angular fragments, with some rudistids, 5%; trace of quartz conglomerate with rounded quartz grains; trace of finely crystalline pyrite.
- 11,400-11,410 Shale: gray to dark gray, in part, with a subconchoidal fracture, blocky to fissile, very hard, in part, silty, 65%; trace of light green Shale: smoother texture, platy to fissile; Calcilutite: light gray to gray; Calcarenite: light brownish-gray to gray; Limestone, 20%; Sandstone: mainly quartz with some chert grains, with some scattered limestone inclusions; medium grained, subangular, poorly sorted, mainly a siliceous matrix, 15%; trace of Sandstone: dark gray, very glauconitic, with scattered pyrite; trace of chert, in part, opalescent; trace of Shale: brick-red, lateritic.

- 11,410-11,420 Shale: dark gray, mainly fissile, 30%; Calcilutite: light gray to gray, with rare dolomite rhombs, 35%; Calcarenite: light gray to light brownish-gray, with rare dolomite rhombs, 30%; trace of light and dark laminite; Sandstone: as above, poorly sorted, siliceous matrix, slightly dolomitic, 5%; trace of Siltstone: gray, "salt and pepper", slightly dolomitic.
- 11,420-11,427 Shale: gray to dark gray, blocky to fissile, in part, silty, 50%; calcarenite and Calcilutite: as above, 40%; Sandstone: light gray to gray, in part, argillaceous, 10%; trace of Sandstone: dark gray, glauconitic, with numerous, very fine pyrite cubes; trace of chert; trace of very finely crystalline pyrite; trace of dark Amphipora in a sparry calcite matrix; some buff, angular, nonskeletal intraclasts in a very light gray matrix.