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API #: 15-189-22394-0000 /

Anadarko Petroleum Corporation

HJV Cornell University B-1

E2/SW/NE Section 6, T33S R36W

Stevens County, Kansas

RECEIVED  
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KCC WICHITA

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## SUMMARY AND CONCLUSIONS

Anadarko Petroleum Corporation's HJV Cornell University B-1 was drilled to a Total Depth of 6510' (6500' - Loggers TD) as a Exploratory well Extension in the Walkemeyer Field, with the the Lower Morrow Sandstones considered the primary objective. The well was spudded on 7/31/01, and drilling was Completed on 8/10/01, with no drilling problems encountered..

Gas Detection and Sample evaluation began at 4100', with unlagged samples caught by the Drilling Crews from 4100' to TD.

Mobil Oil Corp.'s Jordan #3 (approx. 1 mile NNE) was used for correlation.

No significant UpHole shows were observed.

### Lower Morrow

The Lower Morrow was topped at 5979', 5970' (-2911) Logs, 12' low to correlation. Several relatively tight Sands were present here.

From 5979-90' Total Gas increased from 5 to 32u (C1-C3) in a tight, very coarse to fine grained Sandstone, with Calcite cement, secondary Quartz and white clay associated.

Minor glauconite, Pyrite and Limestone fragments were noted. Logs show the interval from 5975-80' to have Rt of 20 ohms, 4% porosity and 100+% Sw. This interval shows no productive potential.

From 6000-06' Total Gas increased from 6 to 30u (C1-C3) in a very tight, limy, very fine to coarse grained Sandstone with abundant Limestone fragments and white clay associated. Minor glauconite and Pyrite were noted. Logs show only 1% Porosity.

From 6028-38' Total gas increased from 6 to 120u in very fine to coarse grained, calcareous Sandstone, with occasional white clay and secondary Quartz associated. Minor glauconite and Pyrite were noted, and occasional dull gold fluorescence with poor cloudy to weak yellow residual cuts were observed. Logs show the intervals from 6019-22' (Rt-40, Porosity-6%, Sw-51%) and 6023-26' (Rt-30, Porosity 7.5% and Sw-45%) to show some productive potential.

From 6050-57' Total gas increased from 5 to 25u (C1-C3), but Logs show the interval (6044-50') to be tight Chester Limestone, with no productive potential.

### St. Louis

The St. Louis was topped at 6386', 6378' Logs (-3319), 15' low to correlation. From 6390-96' Total Gas increased from 3 to 8.5u (C1-C2) in a relatively tight .25-1mm oolitic Limestone with very fine crystalline matrix. Logs show the interval to have Rt of 10 ohms, 7% Porosity and Sw of 86-100%. no production is likely here.

weak sample shows were noted from 6445-60' (6450-60' Logs) in very fine to fine crystalline, .25-1mm oolitic Limestone, but Logs show this interval to be wet, with Rt of 1 ohm. and 17% Porosity (Sw of 100%).

No further significant Sample, Gas or Log shows were noted to TD.

As of 8/11/01, Production Casing was scheduled to be run to TD, to further evaluate the productive potential of the Lower Morrow.

If you have any questions concerning this well, or I can be of any further help in any way, feel free to call me any time. Thank you.

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## WELL RESUME

**Operator:** Anadarko Petroleum Corporation

**Well Name:** HJV Cornell University B-1

**API #:** 15-189-22394-0000

**Location:** 1980' FNL & 1425' FEL, E2/SW/NE Section 6, T33S R36W

**County:** Stevens

**State:** Kansas

**Spud Date:** 7/31/01

**Completion Date:** 8/10/01

**Elevations:** GL- 3059.0' (Drilling and E-Logs Measured from GL).  
KB- 3068.5'

**Total Depth:** Driller's TD- 6510'  
Logger's TD- 6500'

**Contractor:** Murfin Drilling Co., Rig #25

**Pumps:** #1 NATIONAL K-500 5½" x 15"  
#2 EMSCO D-375 5 1/2" x 14"

**Wellsite Geologist:** Mike Dodge

**Company Geologist:** Troy Beserra

**Mud Logging Equipment:** Earth Tech Trailer with 6v Continuous Sampling Total Gas Detector, 6v Dual Column Gas Chromatograph, Start Gas Detection at 4100'. Unlagged Samples Caught by Drilling Crews from 4100' to TD, with One Dry Cut sent to KGS.

**Tool Pusher:** Gus Schwartz

**Company Man:** Bill Glick, John Vigil.

**Mud Company:** Drilling Fluids Inc.

**Mud Engineer:** Jim Reed.

**Type Drilling Mud:** Chemical/LSND.

**Hole Sizes:** 12¼" 0-1757'; 7 7/8" 1757'-TD.

**Casing:** 8 5/8" 23# WC-50 ST&C set @ 1757'.

**Cores:** None.

**DST's:** None.

**Electric Logs By:** HLS

**Logging Engineer:** J. Borell

**Type Logs Ran:** HDIL/MLL/SP/GR from TD to Surface Casing.  
CNL/LDT/Pe/ML/GR/CAL from TD to Surface Casing.  
Sonic/GR from TD to Surface Casing. (GR to Surface)  
Rxo/MSFL/MLL from TD to 3500'.

**Bottom Hole Formation:** St. Louis

**Well Status:** Running Pipe to TD.

## FORMATION E-LOG TOPS AND CORRELATION

| <u>Formation</u>      | Anadarko Petro. Corp.<br>HJV Cornell Univ. B-1<br>E/SW/NE<br>Sec. 6, T33S R36W<br>Stevens Co., KS<br>GL- 3059' | +/- | Mobil Oil Corp.<br>Jordan #3<br>C/S/SE<br>Sec. 32, T32S R36W<br>Stevens Co., KS<br>KB- 3081' |
|-----------------------|----------------------------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------|
|                       |                                                                                                                |     |                                                                                              |
| <u>Chase</u>          | 2570 (+489)                                                                                                    | +5  | 2597 (+484)                                                                                  |
| <u>Council Grove</u>  | 2904 (+155)                                                                                                    | +6  | 2932 (+149)                                                                                  |
| <u>Wabaunsee</u>      | 3313 (-254)                                                                                                    | +5  | 3340 (-259)                                                                                  |
| <u>Heebner</u>        | 4117 (-1058)                                                                                                   | 0   | 4139 (-1058)                                                                                 |
| <u>Toronto</u>        | 4134 (-1075)                                                                                                   | -2  | 4154 (-1073)                                                                                 |
| <u>Lansing</u>        | 4281 (-1222)                                                                                                   | -3  | 4300 (-1219)                                                                                 |
| <u>Kansas City</u>    | 4604 (-1545)                                                                                                   | -4  | 4622 (-1541)                                                                                 |
| <u>Marmaton</u>       | 4976 (-1917)                                                                                                   | -8  | 4990 (-1909)                                                                                 |
| <u>Cherokee</u>       | 5211 (-2152)                                                                                                   | -16 | 5217 (-2136)                                                                                 |
| <u>Atoka</u>          | 5490 (-2431)                                                                                                   | -18 | 5494 (-2413)                                                                                 |
| <u>Morrow</u>         | 5672 (-2613)                                                                                                   | -6  | 5688 (-2607)                                                                                 |
| <u>L Morrow</u>       | 5970 (-2911)                                                                                                   | -12 | 5980 (-2899)                                                                                 |
| <u>Chester</u>        | 6044 (-2985)                                                                                                   | +1  | 6067 (-2986)                                                                                 |
| <u>Ste. Genevieve</u> | 6250 (-3191)                                                                                                   | -6  | 6266 (-3185)                                                                                 |
| <u>St. Louis</u>      | 6378 (-3319)                                                                                                   | -15 | 6385 (-3304)                                                                                 |

### DAILY CHRONOLOGY

| <u>Date</u> | <u>7am Depth</u> | <u>24 Hr. Ftg.</u> | <u>Activity Previous 24 Hours</u>                                                                                  |
|-------------|------------------|--------------------|--------------------------------------------------------------------------------------------------------------------|
| 8/1         | 1130             | 1130               | Rig Up, Mix Mud, Drill Rat & Mouse Holes, Spud @ 11am 7/31, Drill (17), Rig Service, Survey.                       |
| 8/2         | 1757             | 627                | Drill (16½), Rig Service, Survey, Circulate, Short Trip, Circulate, TOH, Run 8 5/8" Casing.                        |
| 8/3         | 2400             | 643                | Run & Cement 8 5/8" Casing, WOC, Nipple Up, TIH, Test BOP's, Drill Cement & Plug, Drill (10), Rig Service, Survey. |
| 8/4         | 3310             | 910                | Drill (23¼), Rig Service, Survey.                                                                                  |
| 8/5         | 4130             | 820                | Drill (23), Rig Service, Survey.                                                                                   |
| 8/6         | 4800             | 670                | Drill (23), Rig Service, Survey.                                                                                   |
| 8/7         | 5330             | 530                | Drill (22¾), Rig Service, Survey.                                                                                  |
| 8/8         | 5878             | 548                | Drill (23), Rig Service, Survey.                                                                                   |
| 8/9         | 6160             | 282                | Trip for Plugged Bit, TIH w/ NB#3, Drill (16), Rig Service.                                                        |
| 8/10        | 6510             | 350                | Drill (22), Rig Service, Circulate, Short Trip.                                                                    |
| 8/11        | 6510             | 0                  | Short Trip, Circulate, TOH for Logs, Logging with HLS.                                                             |

### BIT RECORD

| <u>#</u> | <u>Size</u> | <u>Make</u> | <u>Type</u> | <u>Depth In</u> | <u>Depth Out</u> | <u>Footage</u> | <u>Hours</u> |
|----------|-------------|-------------|-------------|-----------------|------------------|----------------|--------------|
| 1        | 12¼"        | Varel       | ETD1GMS     | 0               | 1757             | 1757           | 33½          |
| 2        | 7 7/8"      | HTC         | EP4975      | 1757            | 5878             | 4121           | 125          |
| 3        | 7 7/8"      | HTC         | GT28C (RR)  | 5878            | 6510             | 632            | 38           |

### DIRECTIONAL SURVEYS

|        |     |
|--------|-----|
| 271'-  | ¼°  |
| 576'-  | ¼°  |
| 852'-  | ¾°  |
| 1100'- | ¾°  |
| 1413'- | ½°  |
| 1757'- | 1°  |
| 2264'- | 1°  |
| 3951'- | ¾°  |
| 4458'- | ½°  |
| 4957'- | ¾°  |
| 5614'- | ¾°  |
| 5878'- | 1°  |
| 6510'- | 1½° |

# MUD RECORD

| <u>Date</u> | <u>Depth</u> | <u>WT</u>                   | <u>FV</u> | <u>PV</u> | <u>YP</u> | <u>GS</u> | <u>WL</u> | <u>CK</u> | <u>pH</u> | <u>LCM</u> | <u>Pm</u> | <u>P/MT</u> | <u>CI</u> | <u>Ca</u> | <u>Sol/Wtr</u> | <u>Cost</u> |
|-------------|--------------|-----------------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|-------------|-----------|-----------|----------------|-------------|
| 8/1         | 1172         | 9.4                         | 36        | 5         | 9         | 6/10      | ---       | 2/32      | 8.0       | 12#        | ---       | -/-         | 1600      | 200       | 7.5/92.5       | \$1655      |
| 8/2         | 1757         | -----Run 8 5/8" Casing----- |           |           |           |           |           |           |           |            |           |             |           |           |                |             |
| 8/3         | 2580         | 8.8+                        | 29        | 2         | 3         | 1/3       | ---       | 1/32      | 7.5       | 0#         | ---       | -/-         | 5300      | 460       | 3.3/96.7       | 3043        |
| 8/4         | 3419         | 9.0                         | 36        | 5         | 9         | 6/10      | ---       | 2/32      | 8.0       | 6#         | Tr        | -/-         | 2100      | 1640      | 4.8/95.2       | 5131        |
| 8/5         | 4197         | 9.1                         | 40        | 9         | 13        | 11/17     | ---       | 2/32      | 8.5       | 8#         | .2        | .05/.15     | 1400      | 800       | 5.4/94.6       | 7050        |
| 8/6         | 4881         | 9.0                         | 36        | 10        | 6         | 3/8       | 15.2      | 2/32      | 9.0       | 5#         | .35       | .1/.4       | 1100      | 80        | 4.9/95.1       | 8945        |
| 8/7         | 5363         | 9.1                         | 50        | 16        | 12        | 8/15      | 9.6       | 2/32      | 9.0       | 4#         | .4        | .15/.3      | 1100      | 40        | 5.5/94.5       | 10,088      |
| 8/8         | 5878         | 9.0+                        | 48        | 14        | 12        | 3/10      | 9.0       | 2/32      | 9.5       | 6#         | .55       | .15/.4      | 1000      | 40        | 5.2/94.8       | 11,297      |
| 8/9         | 6198         | 9.1                         | 47        | 15        | 11        | 5/14      | 8.4       | 2/32      | 9.0       | 7#         | .5        | .1/.35      | 1000      | 40        | 5.4/94.6       | 12,989      |
| 8/10        | 6510         | 9.0+                        | 60        | 17        | 14        | 11/23     | 8.0       | 2/32      | 9.5       | 6#         | .5        | .2/.65      | 1200      | 60        | 5.3/94.7       | 14,744      |

## SHOW EVALUATION

| Log Depths<br>INTERVAL | Rt | Logs<br>POROSITY | Sw   | Samples<br>LITHOLOGY                                                                                                   | GAS INCR                 | EVALUATION                   |
|------------------------|----|------------------|------|------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------------|
| <b>Lower Morrow</b>    |    |                  |      |                                                                                                                        |                          |                              |
| 5975-5980              | 20 | 4%               | 100% | SS- tt, vc-f gr, Calc cmt/sec Qtz, wh cly fld,<br>mmr glau, Pyr & Ls frags, no sample show.                            | 5 to 32 u (C1-C3)        | Tight                        |
| 5988-5992              | 25 | 1%               | 100% | SS- v lmy/about Ls frags, vf-c gr, Calc cmt,<br>wh cly fld, mmr glau & Pyr, no sample show.                            | 6 to 30u (C1-C3)         | Tight                        |
| 6019-6022              | 40 | 6%               | 51%  | SS- vf-c gr, Calc cmt, occ wh cly & sec Qtz,<br>mmr glau & Pyr, vp vis por, occ dull gold<br>flor, p cldy-wk resd cut. | 6 to 120u (C1-C3)        | Marginal Gas<br>Possible Gas |
| 6023-6026              | 30 | 7.50%            | 45%  |                                                                                                                        |                          |                              |
| 6044-6050              | 15 | 4%               | 100% | SS- tt, vf-c gr, wh cly fld/Calc cmt & sec Qtz,<br>mmr glau & Pyr.                                                     | 5 to 25u (C1-C3)         | Chester L.S, Tight           |
| <b>ST. LOUIS</b>       |    |                  |      |                                                                                                                        |                          |                              |
| 6391-6395              | 10 | 7%               | 86%  | LS-.25-1mm ool/tt cln vf xln mtx, chky ip, no<br>sample show                                                           | 3 to 8.5u (C1-C2, tr C3) | Tight, Wet                   |
| 6450-6460              | 1  | 15%              | 100% | LS-.25-1mm ool/clin vf xln mtx, occ lse ool,<br>chky ip, tr dull gold flor, wk resd yel cut.                           | 8 to 15u (C1-C2, tr C3)  | Wet                          |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          |                              |
|                        |    |                  |      |                                                                                                                        |                          | 0                            |

## SAMPLE DESCRIPTIONS

Unlagged Samples were caught by the Drilling Crews from 4100' to TD. Samples are lagged in these descriptions. Formation Tops are Sample Tops.

**4080-4130** SHALE (20%) dark to medium gray, occasionally black, firm, subplaty, calcareous to slightly calcareous, carbonaceous in part, earthy. LIMESTONE (80%) gray brown, light to medium brown, white, light gray, firm, micro to very fine crystalline, slightly fossiliferous, chalky in part, grainy in part, slightly argillaceous in part, trace lightgray translucent milky Chert, no visible to very poor inter crystalline porosity.

### **HEEBNER 4125' (-1066)**

**4130-4160** SHALE (30%) dark gray, gray brown, occasionally medium gray, gray green, trace black, firm, subplaty to splintery, slightly calcareous, earthy. LIMESTONE (70%) light to medium gray, gray brown, medium light brown, white, firm, micro to very fine to fine crystalline, fossiliferous in part, occasionally grainy to micro sucrosic, slightly chalky in part, occasionally slightly argillaceous, no visible to very poor inter crystalline porosity.

### **TORONTO 4140' (-1081)**

**4160-4180** SHALE (50%) medium to dark gray, black, firm, blocky to subplaty, calcareous, carbonaceous in part, silty in part, earthy to smooth to slightly gritty. LIMESTONE (50%) medium to light gray, gray brown, firm, micro to crypto to very fine crystalline, slightly fossiliferous, argillaceous in part, trace Pyrite, no visible porosity.

**4180-4200** SHALE (30%) dark gray, occasionally gray brown, medium gray, black, firm, blocky to subplaty, calcareous, carbonaceous in part, earthy. LIMESTONE (70%) tan, gray brown, light to medium gray, white, firm, micro to crypto to very fine crystalline, slightly fossiliferous, argillaceous in part, trace pelletoidal, trace translucent Chert, no visible to very poor inter crystalline porosity.

**4200-4220** SHALE (10%) as above. LIMESTONE (90%) tan, gray brown, brown, light gray, white, firm, micro to crypto crystalline, predominantly dense, fossiliferous, slightly chalky, argillaceous in part, trace milky translucent Chert, no visible porosity.

**4220-4240** SHALE (10%) dark gray, medium gray, black, firm, subplaty, silty in part, carbonaceous in part, earthy. LIMESTONE (90%) tan, cream, light gray, white, firm, micro to very fine to crypto crystalline, slightly chalky, fossiliferous, trace pelletoidal, occasionally slightly grainy, no visible to very poor inter crystalline porosity.

**4240-4260** SHALE (30%) dark gray, black, medium gray, occasionally green, red brown, firm, subplaty, calcareous, carbonaceous in part, earthy. LIMESTONE (70%) tan, light brown, white, light gray, firm, very fine to fine to micro crystalline, fossiliferous, grainy to granular in part, occasionally chalky, occasional translucent milky lightbrown Chert, very poor to no visible to poor inter crystalline porosity.

**4260-4280** SHALE (40%) dark gray, medium gray, firm, subplaty to platy, calcareous, slightly silty in part, trace carbonaceous, earthy. LIMESTONE (60%) light to medium gray, light brown, white, firm, micro to very fine to fine crystalline, fossiliferous, silty in part, grainy in part, trace pelletoidal, occasional Chert, very poor to no visible inter crystalline porosity.

**4280-4290** SHALE (50%) as above. LIMESTONE (50%) as above, dense crypto to micro crystalline in part, argillaceous in part.

**LANSING 4288' (-1229)**

**4290-4320** SHALE (30%) medium gray, dark gray, black, firm, subplaty to blocky, calcareous, carbonaceous in part, earthy. LIMESTONE (70%) tan, cream, white, light gray, firm, micro to crypto to very fine crystalline, slightly chalky, fossiliferous in part, granular in part, occasional

milky translucent lightbrown lightgray orange Chert, no visible to very poor inter crystalline porosity.

**4320-4350** SHALE (60%) dark gray, firm, blocky to subplaty, calcareous, silty in part, trace carbonaceous, earthy to slightly gritty. LIMESTONE (40%) as above, silty to sandy in part, argillaceous in part.

**4350-4380** SHALE (50%) red brown, dark to medium gray, firm, blocky to subplaty, calcareous, silty in part, earthy. LIMESTONE (50%) white, tan, light gray, light brown, firm, micro to crypto to very fine to fine crystalline, fossiliferous, slightly chalky, grainy in part, occasional translucent milky lightgray lightbrown Chert, very poor to no visible inter crystalline porosity.

**4380-4410** SHALE (40%) dark to medium gray, gray brown, red brown, firm, subplaty to platy to blocky, calcareous, silty in part, trace carbonaceous, earthy. LIMESTONE (60%) tan, cream, light brown, light gray, white, firm, micro to very fine to crypto crystalline, slightly fossiliferous, grainy in part, trace pelletoidal, trace to occasional milky translucent Chert, very poor to no visible to poor inter crystalline porosity.

**4410-4430** SHALE (20%) as above. LIMESTONE (80%) cream, tan, light gray, off white, firm to slightly friable, micro to very fine to fine crystalline, slightly chalky, fossiliferous in part, occasionally pelletoidal, granular to sucrosic in part, occasional milky translucent Chert, very poor to no visible to poor visible inter crystalline porosity.

**4430-4460** SHALE (50%) medium gray, red brown, firm, subplaty, calcareous, silty in part, earthy. LIMESTONE (50%) as above, argillaceous in part, silty in part.

**4460-4480** SHALE (20%) as above. LIMESTONE (80%) light brown, white, light gray, friable to firm, very fine to fine to micro crystalline, slightly chalky, granular to grainy in part, fossiliferous, pelletoidal in part, occasional milky translucent Chert, trace Pyrite, very poor to poor visible inter crystalline porosity.

**4480-4530** SHALE (40%) medium gray, firm, subplaty, calcareous, slightly silty, earthy.

LIMESTONE (60%) white, light gray, light brown, firm to slightly friable, very fine to micro to fine crystalline, slightly fossiliferous, pelletoidal in part, oomoldic in part, occasionally grainy to granular, silty to sandy in part, occasional milky translucent Chert, very poor to no visible inter crystalline porosity, poor visible moldic porosity.

**4530-4550** SHALE (20%) medium gray, firm, subplaty, calcareous, silty in part, earthy.

LIMESTONE (80%) white, cream, light gray, friable to firm, very fine to fine crystalline, silty to sandy, slightly fossiliferous, oomoldic in part, slightly chalky in part, occasional milky translucent lightgray Chert, very poor to no visible to poor inter crystalline porosity, very poor to poor visible moldic porosity.

**4550-4570** SHALE (50%) medium gray, red brown, dark gray, firm, subplaty, calcareous, silty in part, trace carbonaceous, earthy. LIMESTONE (50%) cream, light brown, light gray, white, firm to slightly friable, silty to sandy, fossiliferous in part, slightly chalky in part, trace to occasionally oomoldic, occasional lightgray milky translucent lightbrown Chert, no visible to very poor inter crystalline and moldic porosity.

**4570-4600** SHALE (20%) as above. LIMESTONE (80%) cream, light brown, light gray, friable to firm, very fine to micro crystalline, slightly chalky, slightly fossiliferous, silty in part, oomoldic in part, occasional light to medium brown translucent milky Chert, very poor to poor to no visible porosity.

**4600-4610** SHALE (40%) medium to dark gray, red brown, brown, firm, subplaty, calcareous, slightly silty, earthy. LIMESTONE (60%) as above.

**KANSAS CITY 4610' (-1551)**

**4610-4630** SHALE (20%) as above. LIMESTONE (80%) light brown, cream, light gray, white, firm to friable, very fine to fine to micro crystalline, oomoldic, chalky in part, trace fossiliferous, silty to sandy in part, occasional milky lightgray translucent Chert, very poor inter crystalline porosity, poor to fair moldic porosity.

**4630-4680** SHALE (60%) medium to dark gray, firm, blocky to subplaty, calcareous, silty in part, trace sandy, fossiliferous in part, earthy to gritty. LIMESTONE (40%) light to medium gray, light brown, cream, firm, micro to crypto to very fine crystalline, predominantly dense and argillaceous, fossiliferous in part, trace oomoldic, rare Chert, no visible inter crystalline porosity, trace poor moldic porosity.

**4680-4720** SHALE (40%) medium gray, gray brown, dark gray, firm, blocky to subplaty, calcareous, fossiliferous in part, silty in part, earthy. LIMESTONE (60%) light to medium gray, gray brown, light brown, firm, micro to crypto to very fine crystalline, fossiliferous in part, argillaceous in part, silty in part, trace oomoldic, no visible to very poor inter crystalline porosity.

**4720-4740** SHALE (30%) dark gray, medium gray, firm, subplaty, calcareous, silty in part, slightly carbonaceous in part, earthy. LIMESTONE (70%) light gray, cream, white, light brown, medium gray, firm to soft, micro crystalline, slightly chalky, silty in part, slightly argillaceous, slightly fossiliferous, trace milky lightgray Chert, no visible porosity.

**4740-4750** SHALE (30%) as above. LIMESTONE (70%) light brown, tan, light gray, white, firm to slightly friable, very fine to micro to fine crystalline, slightly fossiliferous, trace pelletoidal to oomoldic, silty in part, grainy in part, occasional milky translucent lightbrown Chert, very poor to no visible to poor inter crystalline porosity.

**4750-4780** SHALE (10%) as above. LIMESTONE (90%) cream, white, light gray, friable to firm, very fine to fine to micro crystalline, slightly chalky, oomoldic in part, grainy in part, silty in part, trace fossiliferous, occasional translucent milky Chert, very poor inter crystalline porosity, very poor to poor visible moldic porosity.

**4780-4790** SHALE (20%) dark to medium gray, gray brown, firm, subplaty, calcareous, silty in part, earthy. LIMESTONE (80%) as above.

**4790-4820** SHALE (40%) as above, occasionally red brown, brown. LIMESTONE (60%) light gray, light brown, white, medium gray, firm, micro to very fine to fine crystalline, slightly fossiliferous, pelletoidal in part, occasionally oomoldic, chalky in part, silty in part, argillaceous in part, occasional milky lightgray brown Chert, no visible to very poor inter crystalline porosity, very poor to poor trace fair moldic porosity.

**4820-4840** SHALE (40%) dark to medium gray, black, firm, blocky to subplaty, calcareous, carbonaceous in part, slightly silty in part, earthy. LIMESTONE (60%) as above.

**4840-4870** SHALE (50%) red brown, medium to dark gray, black, firm, subplaty to blocky, calcareous, silty in part, trace carbonaceous, earthy. LIMESTONE (50%) tan, light brown, light to medium gray, white, firm to slightly friable, very fine to fine to micro to crypto crystalline, slightly fossiliferous, oomoldic in part, chalky in part, argillaceous in part, occasionally silty, trace Chert, no visible to very poor inter crystalline porosity, very poor to fair moldic porosity.

**4870-4910** SHALE (40%) dark to medium gray, gray brown, occasionally red brown, firm, subplaty, calcareous, silty in part, fossiliferous in part, earthy to slightly gritty. LIMESTONE (60%) tan, light brown, light gray, white, firm, very fine to fine to micro crystalline, slightly fossiliferous, oomoldic in part, silty to sandy in part, argillaceous in part, occasionally grainy to granular, occasional milky translucent lightgray lightbrown Chert, very poor to no visible inter crystalline porosity, poor visible moldic porosity.

**4910-4930** SHALE (40%) as above, predominantly dark gray, gray brown, silty. LIMESTONE (60%) cream, light to medium brown, tan, light gray, white, firm, very fine to micro to fine crystalline, slightly fossiliferous, silty, granular in part, occasionally oomoldic, occasionally argillaceous, abundant Chert, very poor to no visible to poor inter crystalline and moldic porosity.

**4930-4980** SHALE (50%) dark to medium gray, firm, subplaty, calcareous, slightly to

moderately silty, micro micaceous in part, trace carbonaceous, earthy to slightly gritty.  
LIMESTONE (50%) cream, light to medium gray, light brown, white, firm to slightly friable, very fine to micro crystalline, slightly fossiliferous, oomoldic in part, silty in part, argillaceous in part, trace to occasional milky lightgray translucent lightbrown Chert, very poor to no visible porosity.

**MARMATON 4988' (-1929)**

**4980-5010** SHALE (20%) as above. LIMESTONE (80%) gray brown, tan, light to medium brown, light gray, off white, firm to very firm, micro to crypto to very fine crystalline, slightly fossiliferous, grainy in part, argillaceous in part, trace Chert, trace micro Pyrite, no visible to very poor porosity.

**5010-5030** SHALE (10%) as above. LIMESTONE (90%) cream, light brown, light gray, friable to firm, very fine to fine to micro crystalline, slightly chalky, oomoldic, slightly grainy in part, occasional milky translucent Chert, very poor to no visible inter crystalline porosity, fair to good moldic porosity.

**5030-5080** SHALE (20%) medium to dark gray, firm, blocky to subplaty, calcareous, carbonaceous in part, silty in part, earthy to slightly gritty. LIMESTONE (80%) cream, tan, light to medium brown, white, firm to slightly friable, very fine to fine crystalline, oomoldic, slightly fossiliferous, slightly chalky in part, trace milky light to medium brown Chert, no visible to very poor inter crystalline porosity, very poor to poor visible moldic porosity.

**5080-5120** SHALE (30%) medium gray, dark gray, firm to soft, blocky to subplaty, calcareous, slightly silty, trace carbonaceous, earthy. LIMESTONE (70%) light to medium brown, cream, light gray, white, firm, micro to very fine crystalline, slightly chalky, slightly fossiliferous, pelletoidal in part, silty in part, occasional light to medium brown lightgray milky Chert, no visible to very poor inter crystalline porosity.

**5120-5140** SHALE (20%) as above. LIMESTONE (80%) gray brown, light to medium brown,

light gray, white, firm to slightly friable, very fine to fine to micro to crypto crystalline, slightly fossiliferous, sandy in part, occasionally pelletoidal, occasional graybrown light to dark brown translucent Chert, no visible to very poor to poor inter crystalline porosity.

**5140-5160** SHALE (20%) medium gray, gray brown, firm, subplaty, calcareous, trace fossiliferous, earthy. LIMESTONE (80%) cream, light gray, white, light brown, firm, micro crystalline, dense, chalky, slightly fossiliferous, argillaceous in part, grainy in part, trace to occasional Chert, no visible porosity.

**5160-5180** SHALE (20%) as above, occasionally dark gray, trace black, trace carbonaceous. LIMESTONE (80%) cream, light to medium brown, light gray, white, firm, micro to very fine to fine crystalline, fossiliferous, slightly chalky, grainy in part, occasionally silty to sandy, occasional milky translucent lightbrown Chert, no visible to very poor inter crystalline porosity.

**5180-5200** SHALE (30%) dark to medium gray, black, firm, subplaty to blocky, calcareous, carbonaceous in part, earthy. LIMESTONE (70%) as above, becoming dense and argillaceous in part, occasional graybrown light to dark brown milky Chert.

**5200-5220** SHALE (40%) dark gray, medium gray, gray brown, firm to very firm, blocky to subplaty, calcareous, trace fossiliferous, slightly carbonaceous in part, earthy. LIMESTONE (60%) gray brown, light to medium gray, light brown, white, firm, very fine to micro crystalline, fossiliferous, argillaceous in part, grainy in part, sandy in part, occasional milky translucent Chert, no visible to very poor inter crystalline porosity.

**CHEROKEE 5220' (-2161)**

**5220-5240** SHALE (30%) as above, trace micro Pyrite. LIMESTONE (70%) cream, gray brown, light brown, light to medium gray, white, firm to friable, very fine to micro crystalline, fossiliferous, silty in part, argillaceous in part, occasionally slightly chalky, occasional graybrown milky light to dark brown Chert, no visible to very poor inter crystalline porosity.

**5240-5280** SHALE (60%) dark to medium gray, firm, subplaty to blocky to platy, calcareous, slightly silty in part, trace fossiliferous, earthy. LIMESTONE (40%) gray brown, light to medium gray, light to medium brown, white, firm, micro to very fine crystalline, fossiliferous, slightly argillaceous, silty in part, trace sandy, trace to occasional Chert, no visible to very poor inter crystalline porosity.

**5280-5300** SHALE (40%) as above. LIMESTONE (60%) gray brown, light brown, light gray, white, firm to slightly friable, very fine to fine to micro crystalline, fossiliferous, silty to sandy, argillaceous in part, pelletoidal in part, occasional milky translucent lightbrown Chert, very poor to no visible inter crystalline porosity.

**5300-5320** SHALE (50%) dark to medium gray, gray brown, firm, subplaty to blocky, calcareous, silty in part, occasionally micro micaceous, trace fossiliferous, earthy. LIMESTONE (50%) light to medium gray, gray brown, brown, white, firm, micro crystalline, argillaceous, silty in part, fossiliferous in part, trace Chert, no visible porosity.

**5320-5380** SHALE (50%) dark to medium gray, black, gray brown, firm, subplaty to blocky, calcareous, slightly silty in part, carbonaceous in part, trace fossiliferous, earthy to smooth. LIMESTONE (50%) gray brown, light to medium gray, brown, trace white, firm, micro to crypto crystalline, predominantly dense, slightly argillaceous, fossiliferous in part, silty in part, trace translucent lightbrown Chert, no visible porosity.

**5380-5410** SHALE (70%) dark gray, occasionally medium gray, firm, blocky to subplaty, calcareous, fossiliferous in part, slightly silty in part, trace micro Pyrite, earthy. LIMESTONE (30%) medium to light gray, gray brown, firm, micro to crypto crystalline, dense, argillaceous, fossiliferous, no visible porosity.

**5410-5430** SHALE (80%) dark gray, occasionally gray brown, firm, blocky to subplaty, calcareous, slightly silty in part, micro micaceous in part, trace carbonaceous, trace micro Pyrite, earthy. LIMESTONE (20%) as above.

**5430-5450** SHALE (70%) as above, becoming dark gray, black, carbonaceous in part. LIMESTONE (30%) gray brown, light to medium gray, firm, micro to crypto crystalline, dense, argillaceous, slightly fossiliferous, silty in part, trace Pyrite, no visible porosity.

**5450-5480** SHALE (60%) dark gray, medium gray, firm, blocky to subplaty, calcareous, carbonaceous in part, silty in part, fossiliferous in part, occasionally micro micaceous, trace micro Pyrite, earthy. LIMESTONE (40%) medium to light gray, gray brown, brown, firm to very firm, micro to crypto to very fine crystalline, predominantly dense and argillaceous, fossiliferous in part, silty to sandy in part, grainy in part, no visible to very poor inter crystalline porosity.

**5480-5500** SHALE (50%) as above. LIMESTONE (50%) light to medium gray, light to medium brown, firm, very fine to fine to micro crystalline, fossiliferous, silty to sandy, grainy in part, trace Chert, very poor visible inter crystalline porosity.

**ATOKA 5500' (-2441)**

**5500-5520** SHALE (70%) dark gray, gray brown, black, firm to soft, subplaty to blocky to platy, calcareous, carbonaceous, silty in part, micro micaceous in part, earthy. LIMESTONE (30%) light to medium brown, firm, micro crystalline, dense, silty to sandy, slightly fossiliferous, grainy in part, argillaceous in part, no visible porosity.

**5520-5570** SHALE (70%) dark gray, black, soft to firm, subplaty to blocky to platy, calcareous to slightly calcareous, carbonaceous, silty in part, micro micaceous in part, earthy to slightly gritty to smooth. LIMESTONE (30%) light to medium gray, light brown, firm, very fine to micro crystalline, silty in part, fossiliferous in part, argillaceous in part, no visible to very poor inter crystalline porosity.

**5570-5610** SHALE (50%) dark gray, black, firm, blocky to subplaty, calcareous to slightly calcareous, carbonaceous, silty in part, earthy to smooth. LIMESTONE (50%) tan, light to

medium brown, light gray, firm to very firm, micro to crypto crystalline, slightly chalky, slightly argillaceous, occasionally silty, trace fossiliferous, no visible porosity.

**5610-5650** SHALE (80%) dark gray, black, firm to soft, subplaty to blocky to platy, calcareous to slightly calcareous, carbonaceous, silty in part, earthy. LIMESTONE (20%) light to medium gray, light to medium brown, firm, micro to crypto to very fine crystalline, slightly fossiliferous, silty in part, argillaceous in part, occasionally chalky, no visible porosity.

**5650-5670** SHALE (60%) as above. LIMESTONE (light to medium brown, light gray, white, firm, micro to very fine to crypto crystalline, slightly argillaceous, silty in part, trace sandy, occasionally fossiliferous, no visible porosity.

**5670-5690** SHALE (40%) dark gray, medium gray, black, firm, subplaty, calcareous, carbonaceous in part, silty in part, earthy. LIMESTONE (60%) light to medium gray, light brown, white, firm, micro crystalline, slightly chalky, silty in part, trace to slightly fossiliferous, argillaceous in part, no visible porosity.

**MORROW 5694' (-2635)**

**5690-5710** SHALE (40%) dark gray, black, firm, subplaty to platy, slightly to moderately calcareous, carbonaceous, trace Pyrite, smooth to earthy. LIMESTONE (60%) light gray, light to medium brown, gray brown, firm, micro to very fine crystalline, silty to sandy in part, trace fossiliferous, chalky in part, argillaceous in part, no visible to very poor inter crystalline porosity, trace brown oil stain, dull yellow fluorescence, poor cloudy yellow cut.

**5710-5730** SHALE (70%) dark gray, black, medium gray, light gray, firm, subplaty to platy to splintery, slightly to moderately calcareous, silty in part, occasionally micro micaceous, trace Pyrite, earthy to smooth. LIMESTONE (30%) as above, no Sample Show.

**5730-5750** SHALE (60%) as above. LIMESTONE (20%) gray brown, light to medium gray, light brown, firm, micro to crypto crystalline, dense, argillaceous, silty in part, trace fossiliferous, no visible porosity. SILTSTONE (20%) light gray, gray brown, friable to firm, non to slightly calcareous, micaceous in part, trace carbonaceous, trace sandy.

**5750-5770** SHALE (80%) dark gray, black, medium gray, firm to soft, platy to subplaty to splintery, slightly calcareous, slightly silty in part, slightly carbonaceous in part, micro micaceous, trace Pyrite, smooth to earthy. LIMESTONE (20%) as above, very fine crystalline in part, sandy in part.

**5770-5790** SHALE (80%) dark gray, medium gray, soft to firm, platy to splintery to subplaty, slightly calcareous, silty in part, micro micaceous, trace sandy, trace Pyrite, trace plant remains, smooth to earthy. LIMESTONE (20%) light to dark brown, light gray, white, firm, micro to very fine crystalline, silty in part, argillaceous in part, no visible porosity.

**5790-5820** SHALE (90%) dark gray, black, medium gray, firm to soft, subplaty to platy to blocky, slightly calcareous, carbonaceous in part, silty in part, micro micaceous, trace plant remains, trace Pyrite, smooth to earthy. LIMESTONE (10%) as above.

**5820-5870** SHALE (90%) dark gray, occasionally medium gray, soft to firm, platy to subplaty to splintery, slightly calcareous, micro micaceous, slightly silty, trace Pyrite, trace plant remains, earthy to smooth. LIMESTONE (10%) light to medium brown, firm, micro to crypto to very fine crystalline, slightly fossiliferous, silty in part, argillaceous in part, trace lightbrown Chert, no visible porosity.

**5870-5940** SHALE (90%) medium to dark gray, soft to firm, platy to subplaty to splintery, slightly to moderately calcareous, micro micaceous, silty in part with occasional lightgray Silt stringers, trace sandy, trace Pyrite, trace plant remains, earthy to smooth. LIMESTONE (10%) white, light to medium brown, micro to very fine to fine crystalline, sandy, trace fossiliferous, trace Pyrite, no visible porosity.

**5940-5975** SHALE (90%) dark to medium gray, firm to soft, platy to splintery to subplaty, slightly to moderately calcareous, micro micaceous, trace Pyrite, trace plant remains, smooth to earthy. LIMESTONE (10%) white, light to medium brown, firm, very fine to fine crystalline, sandy, slightly fossiliferous, trace glauconite, trace Pyrite, no visible porosity.

**LOWER MORROW      5979' ( -2920)**

**5975-5990** SHALE(50%) as above. SANDSTONE (50%) light gray, light brown, friable to firm to loose, very coarse to fine grained, subround to angular, poor sorted, Calcite cement, occasional secondary Quartz, clay filled in part, slightly glauconitic, trace Pyrite, trace Limestone fragments, argillaceous in part, no visible porosity, no stain odor fluorescence or cut.

**5990-6000** SHALE (20%) dark to medium gray, firm to soft, platy to subplaty to splintery, calcareous, micro micaceous, silty to sandy in part, trace Pyrite, earthy to smooth to gritty. SANDSTONE (30%) becoming argillaceous, occasionally Limestone fragments, predominantly tight, no visible porosity.

**6000-6010** SHALE (50%) as above. SANDSTONE (50%) white, light brown, light gray, firm to friable, very fine to coarse grained, angular to subround, poor sorted, Calcite cement, very limy with abundant Limestone fragments, silty in part, slightly glauconitic, trace Pyrite, no visible porosity, no stain odor fluorescence or cut.

**6010-6020** SHALE (80%) as above. SANDSTONE (20%) as above.

**6020-6030** SHALE (90%) dark to medium gray, soft to firm, platy to subplaty, calcareous, micro micaceous, slightly silty, trace Pyrite, smooth to earthy. LIMESTONE (10%) white, lightbrown, light gray, sandy, trace glauconite, trace Pyrite.

**6030-6050** SHALE (30%) as above. SANDSTONE (70%) white, light gray, very firm to loose,

very fine to coarse grained, angular to subround, poor sorted, Calcite cement, occasional secondary Quartz, white clay filled in part, trace glauconite, trace Pyrite, tight, no visible porosity, occasional dull gold fluorescence, poor cloudy to weak residual yellow cut.

**6050-6060** SHALE (30%) as above. SANDSTONE (10%) as above. LIMESTONE (60%) cream, white, light brown, firm, very fine to fine to micro crystalline, chalky, sandy in part, rare fossiliferous, no visible porosity.

**CHESTER 6058' (-2999)**

**6060-6070** SHALE (60%) medium gray, trace light gray, soft, subplaty to platy to splintery, slightly calcareous, micro micaceous, earthy to smooth. LIMESTONE (40%) light to medium brown, cream, white, firm, micro to crypto to very fine crystalline, chalky in part, slightly sandy in part, trace fossiliferous, no visible porosity.

**6070-6080** SHALE (80%) as above, medium to light gray. LIMESTONE (20%) as above.

**6080-6090** SHALE (60%). LIMESTONE (40%).

**6090-6110** SHALE (50%) medium to dark gray, firm, subplaty to platy to blocky, slightly calcareous, earthy to smooth. LIMESTONE (50%) light to medium brown, light to medium gray, mottled, firm, micro to very fine crystalline, fossiliferous, pelletoidal in part, slightly chalky, silty to sandy in part, argillaceous in part, trace Pyrite, no visible porosity.

**6110-6130** SHALE (40%) medium to light gray, soft to firm, subplaty to platy to blocky, slightly to moderately calcareous, silty in part, micro micaceous in part, smooth to earthy. LIMESTONE (60%) light to medium gray, cream, tan, white, firm to friable, very fine to micro crystalline, silty to sandy, slightly chalky, slightly fossiliferous, argillaceous in part, no visible porosity.

**6130-6150** SHALE (20%) as above. LIMESTONE (80%) light to medium gray, gray brown, tan, soft to firm, micro crystalline, slightly chalky, argillaceous, silty in part, slightly fossiliferous, trace Pyrite, no visible porosity.

**6150-6160** SHALE (40%) light to medium gray, red brown, maroon, green, ochre, soft to firm, subplaty to irregular, subchalky to smooth. LIMESTONE (60%) light to medium brown, light to medium gray, green, white, firm, micro to crypto to very fine crystalline, sandy in part, trace very chalky, trace fossiliferous, trace Pyrite, no visible porosity.

**6160-6170** SHALE (20%) as above. LIMESTONE (80%) as above, predominantly tan, cream, light to medium brown, crypto crystalline, trace translucent lightbrown lightgray Chert, no visible porosity.

**6170-6180** SHALE (70%) medium gray, gray brown, soft to firm, subplaty, calcareous, silty, abundant plant remains, trace Pyrite, earthy. LIMESTONE (30%) light gray, light to medium brown, cream, white, firm, micro to very fine crystalline, sandy, argillaceous, fossiliferous in part, no visible porosity.

**6180-6190** SHALE (20%) as above. LIMESTONE (80%) cream, light brown, white, firm to soft, micro to crypto crystalline, slightly chalky, dense, trace translucent Chert, no visible porosity.

**6190-6200** SHALE (70%) gray brown, brown, medium gray, firm, subplaty to irregular, calcareous, occasional plant remains, smooth to earthy to subchalky. LIMESTONE (30%) as above, very fine to fine crystalline in part, sandy in part, fossiliferous in part, trace Pyrite.

**6200-6210** SHALE (70%) as above, occasionally ochre, light gray, maroon, green. LIMESTONE (30%).

**6210-6220** SHALE (40%) predominantly maroon, light gray, green, variegated in part, slightly calcareous. LIMESTONE (20%) as above. SANDSTONE (40%) light to medium green, light gray, white, very firm to firm, very fine grained, silty in part, moderately well sorted, predominantly Silica cement, slightly calcareous, trace micro Pyrite, tight, no visible porosity.

**6220-6230** SHALE (30%) maroon, red brown, green, light gray, ochre, firm to soft, irregular, calcareous, silty in part, earthy to subchalky. LIMESTONE (70%) white, cream, trace brown, maroon, green, firm, micro to very fine crystalline, chalky, slightly fossiliferous, silty to sandy in part, trace Chert, no visible porosity.

**6230-6250** SHALE (50%) red brown, maroon, trace light gray, ochre, green, firm, blocky to subplaty, calcareous, silty in part. LIMESTONE (50%) white, cream, purple, light brown, light gray, firm, micro to crypto to very fine crystalline, slightly chalky, sandy to silty in part, trace fossiliferous, trace milky lightgray lightbrown Chert, no visible porosity.

**Ste. GENEVIEVE      6260' (-3201)**

**6250-6270** SHALE (30%). LIMESTONE (70%) red brown, light gray, maroon, light gray, white, pink, purple, firm, micro to very fine crystalline, silty to sandy, chalky in part, no visible porosity.

**6270-6295** SHALE (30%) predominantly dark gray Cavings. LIMESTONE (70%) red brown, pink, light gray, orange, friable, very fine crystalline, sandy to silty, chalky in part, no visible porosity.

**6295-6320** SHALE (20%). LIMESTONE (80%) light gray, off white, gray brown, friable to firm, very fine crystalline, sandy, chalky in part, trace translucent Chert, no visible porosity.

**6320-6330** SHALE (20%) dark gray, black Cavings. LIMESTONE (80%) cream, buff, white, firm, micro to crypto crystalline, slightly chalky, silty in part, grainy in part, abundant translucent Chert, no visible porosity.

**6330-6365** SHALE (20%) Cavings. LIMESTONE (80%) light brown, tan, firm, micro to very fine to fine crystalline, sandy, chalky in part, trace to occasional translucent lightbrown Chert, no visible to very poor porosity.

**6365-6375** SHALE (40%) medium to light gray, light green, soft to firm, subplaty, calcareous, trace micro Pyrite, subchalky. LIMESTONE (60%) as above.

**6375-6390** SHALE (40%) as above. LIMESTONE (60%) light gray, light brown, white, friable to firm, very fine to fine to micro crystalline, sandy in part, slightly chalky, occasionally pelletal, trace fine oolitic, trace fossiliferous, trace Chert, trace Pyrite, no visible porosity.

ST. LOUIS      6386' (-3327)

**6390-6400** SHALE (50%) as above with abundant Cavings. LIMESTONE (50%) as above with occasionally white, cream, firm, very fine crystalline, .25 to 1 mm oolitic with tight clean very fine crystalline matrix, slightly chalky in part, very poor visible inter oolitic porosity.

**6400-6425** SHALE (50%) predominantly dark gray, black, medium gray Cavings. LIMESTONE (50%) cream, light gray brown, off white, firm to slightly friable, micro to very fine to fine crystalline, slightly chalky, slightly fossiliferous, occasionally fine oolitic with chalky to clean micritic to very fine crystalline matrix, occasionally slightly sandy, trace translucent milky Chert, very poor to no visible inter crystalline and inter oolitic porosity.

**6425-6445** SHALE (40%) Cavings. LIMESTONE (60%) cream, light brown, off white, light gray, friable, very fine to fine crystalline, sandy, slightly chalky, .25 to 1 mm oolitic in part with very fine crystalline matrix, occasional translucent milky lightgray Chert, trace fossiliferous, no visible to very poor inter crystalline and inter oolitic porosity.

**6445-6460** SHALE (50%) Morrow Shale Cavings. LIMESTONE (50%) light brown, cream, off white, friable, very fine to fine to micro crystalline, .25 to 1 mm oolitic with clean very fine crystalline matrix, occasional loose oolites, chalky in part, sandy in part, trace fossiliferous, occasional Chert, no visible to very poor to poor inter crystalline and inter oolitic porosity, trace dull gold fluorescence, weak residual yellow cut.

**6460-6475** SHALE (40%) Cavings. LIMESTONE (60%) cream, off white, light brown, friable to firm, very fine to fine crystalline, slightly chalky, .25 to .75 mm oolitic with chalky very fine crystalline matrix, abundant loose oolites, slightly fossiliferous, occasional translucent milky Chert, very poor to no visible inter crystalline and inter oolitic porosity.

**6475-6485** SHALE (50%) as above. LIMESTONE (50%) as above, becoming very chalky and dense in part, argillaceous in part.

**6485-6510** SHALE (50%) Cavings, dark to medium gray, black, firm, platy to splintery, slightly calcareous, trace Pyrite, smooth to earthy. LIMESTONE (50%) cream, tan, light brown, white, firm to slightly friable, very fine to micro to fine crystalline, slightly to very chalky, fossiliferous in part, fine to coarse oolitic in part with tight chalky micritic matrix, sandy in part, argillaceous in part, trace to occasional Chert, no visible to very poor inter crystalline and inter oolitic porosity.