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Houston, TX  
(281) 784-5500  
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## Drilling Dynamics MD

**COMPANY** ExxonMobil Production

**WELL** PCU 297-11C3

**FIELD** Piceance Creek

**REGION** Rocky Mountain

**COORDINATES** 39.896025 N  
108.254523 W

**ELEVATION** GL: 6882.8'  
RKB: 6913.0'

**COUNTY, STATE** Rio Blanco, Colorado

**API INDEX** 05-103-11473-00

**SPUD DATE** 01/26/2010

**CONTRACTOR** HP Drilling

**CO. REP.** M. Sadler/ M. Wood

**RIG/TYPE** #326/ HP Flex-4

**LOGGING UNIT** MLU #36

**GEOLOGISTS** J. Kokes/J. Keevan  
J. Sell/D. Thibodeaux

**ADD. PERSONS** P. Strickland/D. Bedard  
H. Strickland

**CO. GEOLOGIST** Chris Alba

### LOG INTERVAL

### CASING DATA

**DEPTHS:** 3900' TO 12830'

**DATES:** 04/10/2010 TO 05/25/2010

**SCALE:** 1" = 100'

16" AT 150'

10 3/4" AT 3887'

7" AT 8712'

4 1/2" AT

### MUD TYPES

### HOLE SIZE

Water Based Spud Mud TO 3900'

LSND TO 12830'

TO

TO

14 1/4" TO 3900'

9 7/8" TO 8733'

6 1/8" TO 12830'

TO

### ABBREVIATIONS

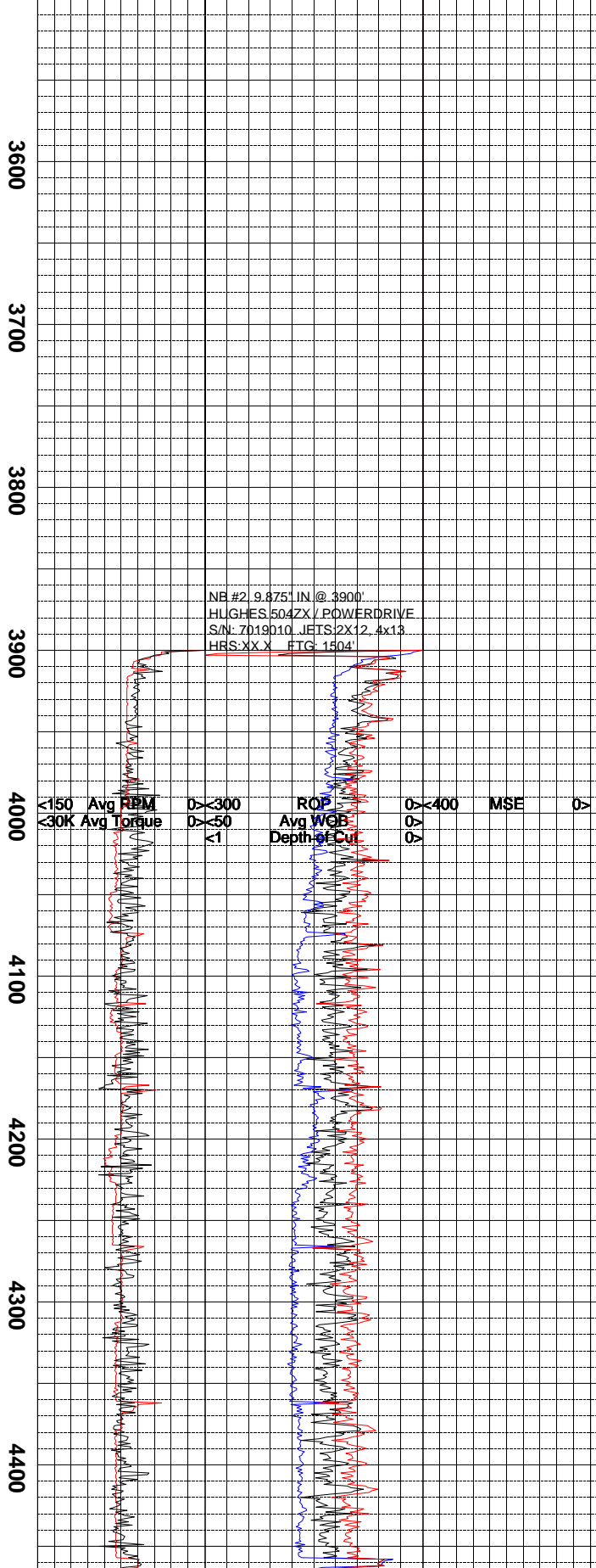
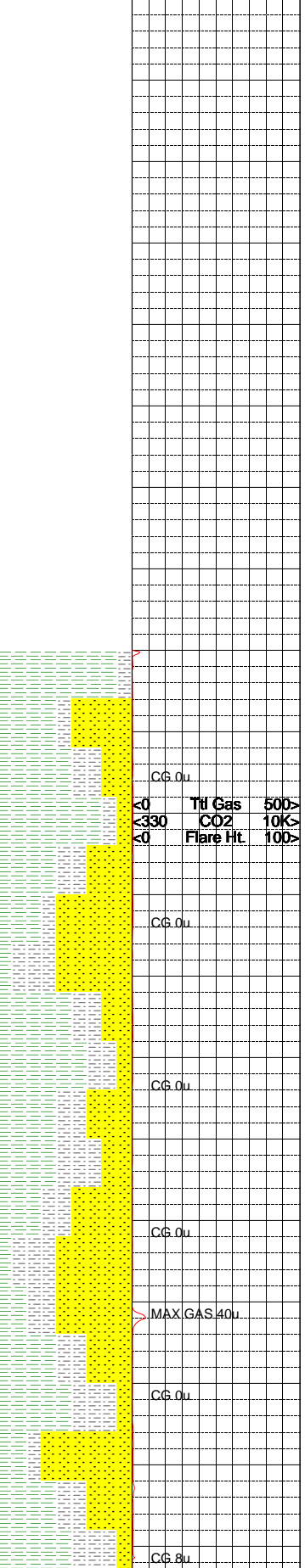
<i>NB</i> NEWBIT	<i>PV</i> PLASTIC VISCOSITY	<i>LC</i> LOST CIRCULATION
<i>RRB</i> RERUN BIT	<i>YP</i> YIELD POINT	<i>CO</i> CIRCULATE OUT
<i>CB</i> CORE BIT	<i>FL</i> FLUID LOSS	<i>NR</i> NO RETURNS
<i>WOB</i> WEIGHT ON BIT	<i>CL</i> PPM CLORIDE ION	<i>TG</i> TRIP GAS
<i>RPM</i> ROTARY REV/MIN	<i>Rm</i> MUD RESISTIVITY	<i>SG</i> SURVEY GAS
<i>PP</i> PUMP PRESSURE	<i>Rmf</i> FILTRATE RESISTIVITY	<i>WG</i> WIPER GAS
<i>SPM</i> STROKES/MIN	<i>PR</i> POOR RETURNS	<i>CG</i> CONNECTION GAS
<i>MW</i> MUD WEIGHT	<i>LAT</i> LOGGED AFTER TRIP	
<i>VIS</i> FUNNEL VISCOSITY	<i>LAS</i> LOGGED AFTER SURVEY	

ALTERED ZONE	CHERT - GLASSY	FELSIC SILIC DIKE	MARL - CALC	SANDSTONE
ANDESITE	CHERT - PORCEL	FOSSIL	METAMORPHICS	SANDSTONE-TUFFACEOUS
ANHYDRITE	CHERT - TIGER STRIPE	GABBRO	MUDSTONE	SERICITIZATION
BASALT	CHERT - UNDIFF	GLASSY TUFF	OBSIDIAN	SERPENTINE
BENTONITE	CLAY	GRANITE	PALEOSOL	SHALE
BIOTITIZATION	CLAY-MUDSTONE	GRANITE WASH	PHOSPHATE	SHALE TUFFACEOUS
BRECCIA	CLYST-TUFFACEOUS	GRANODIORITE	PORCELANITE	SHELL FRAGMENTS
CALCARENITE	CHLORITIZATION	GYPSUM	PORCELANEOUS CLYST	SIDERITE
CALCAREOUS TUFF	COAL	HALITE	PYRITE	SILICIFICATION
CALCILUTITE	CONGLOMERATE	HORNBL-QTZ-DIO	PYROCLASTICS	SILTSTONE
CARBONATES	CONGL. SAND	IGNEOUS (ACIDIC)	QUARTZ DIORITE	SILTST-TUFFACEOUS
CARBONACEOUS MAT	CONGL. SANDSTONE	IGNEOUS (BASIC)	QUARTZ LATITE	TUFF
CARBONACEOUS SH	COQUINA	INTRUSIVES	QUARTZ MONZONITE	VOLCANICLASTICS SEDS
CEMENT CONTAM.	DACITE	KAOLINITIC	RECRYSTALLIZED CALCITE	VOLCANICS
CHALK	DIATOMITE	LIMESTONE	RHYOLITE	
CRYSTALLINE TUFF	DIORITE	LITHIC TUFF	SALT	
CHERT - ARGILL	DOLOSTONE	MARL - DOLO	SAND	

<b>Lithology</b>	<0 Ttl Gas 1K>
	<330 CO2 10K>
	<0 Flare Ht. 100>

<b>Depth</b>	<150 Avg RPM 0>	<300 ROP 0>	<400 MSE 0>
	<30K Avg Torque 0>	<50 Avg WOB 0>	psi
	FTLBS	<1 Depth of Cut 0>	
		in/rev	

**Remarks**  
**Survey Data, Mud Reports, Other Info.**



NB #2, 9.875" IN @ 3900'  
 HUGHES 504ZX / POWERDRIVE  
 S/N: 7019010, JETS: 2X12, 4x13  
 HRS: XX, FTG: 1504

ALL DEPTHS ARE REFERENCED TO RKB.

ALL ROCK COLORS ARE REFERENCED TO THE GSA ROCK COLOR CHART. ROCK CONSTITUENTS ARE DESCRIBED WET AND LISTED IN ORDER OF MOST ABUNDANT TO LEAST ABUNDANT.

ALL CONNECTION GASES, TRIP GASES, AND DOWNTIME GASES ARE NOTED ON THE LOG. LARGE CONNECTION GASES WHICH APPEAR ON THE MUD LOG USUALLY REFLECT UP HOLE GAS INTERVALS BLEEDING GAS INTO THE BOREHOLE DURING CONNECTIONS.

GAS CHROMATOGRAPHY EQUIPMENT IS CALIBRATED TO A TEST GAS COMPOSED OF:  
 METHANE = 10040 PPM  
 ETHANE = 990 PPM  
 PROPANE = 1000 PPM  
 ISOBUTANE = 1010 PPM  
 BUTANE = 1000 PPM  
 ISOPENTANE = 1000 PPM  
 PENTANE = 1000 PPM

WHEN THE MUD IS CIRCULATED THROUGH THE GAS BUSTER, THE INTERVAL IS MARKED IN THE MGS COLUMN; THE SIZE OF FLARES ARE ALSO NOTED ON THE LOG.

EVIDENCE OF FRACTURE FILL IS NOTED ON THE MUD LOG. KAOLIN PERCENTAGE IN SS INTERVALS IS ALSO NOTED ON THE MUD LOG.

1 UNIT OF GAS = 200 PPM OF METHANE

SET 10.75" SURFACE CASING AT 3881'.

CANRING COMMENCED LOGGING ON PCU297-11C3 ON 04-09-2010 AT 16:23 HRS.

SHALE = PALE YELLOWISH ORANGE, MODERATE RED, MEDIUM BLUIISH GREY, PALE PURPLE IN A MOTTLED PATTERN; BRITTLE TO CRUMBLY TENACITY; PLANAR TO SPLINTERY FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; SMOOTH TO CLAYEY TEXTURE; DULL TO EARTHY TO MATTE LUSTER; FISSILE TO MASSIVE STRUCTURE.

SANDSTONE - WHITE TO LIGHT GREY, CLEAR WITH SOME BLACK SPECKLES CREATING A SALT AND PEPPERED APPEARANCE; MEDIUM TO FINE GRAIN SIZE; WELL SORTED; MODERATE TO LOW SPHERICITY WITH SUBANGULAR TO ANGULAR GRAINS; POLISHED GRAIN SURFACES; FRIABLE TO FIRM FRIABLE CUTTINGS; CALCITE CEMENT WITH A MODERATE REACTION TO DILUTE HCL; GRAIN SUPPORTED WITH MASSIVE BEDDING; ABUNDANT DARK LITHIC INCLUSIONS; NO VISIBLE HYDROCARBON INDICATORS.

SILTSTONE = PALE YELLOWISH BROWN TO DARK YELLOWISH ORANGE, BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO SPLINTERY FRACTURE; FLAKY TO SCALY CUTTINGS HABIT; DULL TO SPARKLING LUSTER; SMOOTH TO GRITTY TEXTURE; MASSIVE STRUCTURE.

SANDSTONE = CLEAR, WHITE TO VERY LIGHT GREY, SOME VERY PALE ORANGE; MEDIUM TO COARSE GRAIN SIZE; WELL SORTED; SUBANGULAR TO ANGULAR GRAINS WITH MODERATE TO LOW SPHERICITY; POLISHED GRAIN SURFACES; FRIABLE TO EASILY FRIABLE, ABUNDANT UNCONSOLIDATED QUARTZ GRAINS; CALCITE CEMENT WITH A STRONG REACTION TO DILUTE HCL; GRAIN SUPPORTED WITH MASSIVE BEDDING; SOME DARK LITHIC INCLUSIONS; NO VISIBLE HYDROCARBON INDICATORS.

SHALE = DARK YELLOWISH ORANGE TO GRAYISH ORANGE, MEDIUM TO LIGHT GREY; CRUMBLY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLTY TO FLAKY TO SCALY CUTTINGS HABIT; MATTE TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; MASSIVE STRUCTURE WITH SOME FISSILITY.

SILTSTONE = PALE YELLOWISH BROWN TO MEDIUM LIGHT GREY; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO SPLINTERY FRACTURE; FLAKY TO SCALY CUTTINGS HABIT; DULL TO SPARKLING LUSTER; SMOOTH TO GRITTY TEXTURE; MASSIVE STRUCTURE.

SANDSTONE = CLEAR, WHITE TO MEDIUM

CG. 0u  
 500  
 10K  
 100

<150 Avg RPM 0>  
 <300 ROP 0>  
 <400 MSE 0>  
 <30K Avg Torque 0>  
 <50 Avg WOB 0>  
 <1 Depth of Cut 0>

CG. 0u

4100

CG. 0u

4200

CG. 0u

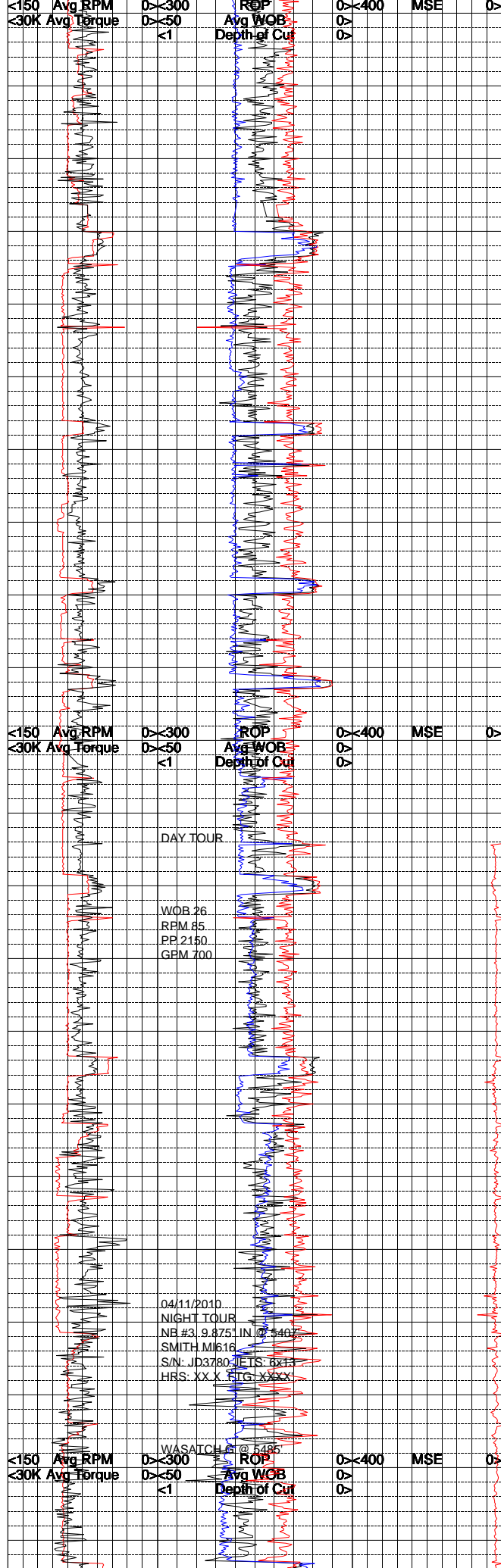
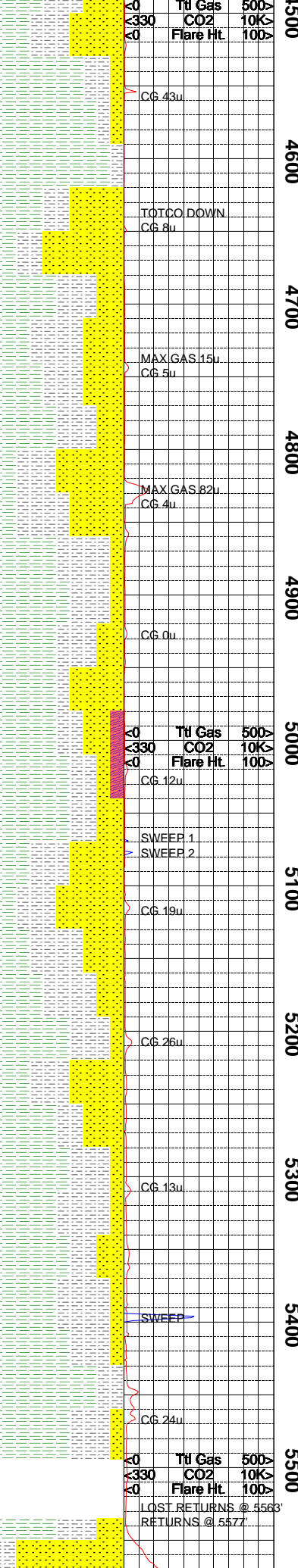
4300

CG. 0u

4400

CG. 8u

MAX GAS 40u



GREY, SALT AND PEPPER APPEARANCE;  
 MEDIUM GRAIN SIZE; WELL SORTED;  
 SUBANGULAR TO SUBROUND GRAINS WITH  
 MODERATE TO LOW SPHERICITY; POLISHED  
 GRAIN SURFACES; FRIABLE TO EASILY  
 FRIABLE, ABUNDANT UNCONSOLIDATED  
 QUARTZ GRAINS; CALCITE CEMENT WITH A  
 SLIGHT REACTION TO DILUTE HCL; GRAIN  
 SUPPORTED WITH MASSIVE BEDDING; SOME  
 DARK LITHIC INCLUSIONS; NO VISIBLE  
 HYDROCARBON INDICATORS.

SHALE = PALE RED, GRAYISH ORANGE TO  
 DARK YELLOWISH ORANGE; BRITTLE TO  
 CRUMBLY TENACITY; SEMI PLANAR TO  
 SPLINTERY FRACTURE; FLAKY TO SCALY  
 CUTTINGS HABIT; MATTE TO FROSTED  
 LUSTER; SMOOTH TO CLAYEY TEXTURE;  
 MASSIVE TO FISSILE STRUCTURE.

SANDSTONE = LIGHT GREY TO MEDIUM GREY,  
 GRAYISH ORANGE TO MODERATE YELLOWISH  
 BROWN; FINE TO MEDIUM GRAIN SIZE; WELL  
 TO VERY WELL SORTED; SUBROUND TO  
 SUBANGULAR GRAINS WITH MODERATE TO  
 LOW SPHERICITY; FIRM FRIABLE TO MODERATE  
 HARD; CALCITE CEMENT WITH MODERATE  
 REACTION TO DILUTE HCL; GRAIN SUPPORTED  
 WITH MASSIVE BEDDING; TRACE DARK LITHIC  
 INCLUSIONS AND MICAS; NO VISIBLE  
 HYDROCARBON INDICATORS.

SILTSTONE = DARK YELLOWISH ORANGE TO  
 GRAYISH ORANGE, BRITTLE TO CRUNCHY TO  
 CRUMBLY TENACITY; IRREGULAR TO SPLINTERY  
 FRACTURE; FLAKY TO SCALY CUTTINGS HABIT;  
 DULL TO SPARKLING LUSTER; SILTY TO  
 GRITTY TEXTURE; MASSIVE STRUCTURE.

SHALE = MODERATE YELLOWISH BROWN TO DARK  
 YELLOWISH ORANGE, PALE RED; BRITTLE TO  
 CRUMBLY TENACITY; SPLINTERY TO SEMI  
 PLANAR FRACTURE; FLAKY TO PLATY CUTTINGS  
 HABIT; MATTE TO SPARKLING LUSTER; SMOOTH  
 TO CLAYEY TEXTURE; MASSIVE STRUCTURE  
 WITH FISSILITY.

FRACTURE FILL = CLEAR TO SEMI OPAQUE  
 CALCITE GRAINS AND RHOMBS; MEDIUM IN  
 SIZE; EASILY CLEAVED; STRONG REACTION  
 TO DILUTE HCL IN SAMPLE TRAY.

SILTSTONE = YELLOWISH GRAY TO MODERATE  
 YELLOW, PALE RED TO GRAYISH RED PURPLE;  
 BRITTLE TO CRUMBLY TENACITY; SUB-PLANAR  
 TO IRREGULAR FRACTURE; FLAKY TO WEDGE-  
 LIKE CUTTING HABIT; DULL TO EARTHY  
 LUSTER, MINOR SPARKLING DUE TO VITREOUS  
 CLASTS; GRITTY TO GRANULAR TEXTURE;  
 INTERBEDDED PURPLISH SANDSTONE AND  
 YELLOWISH SHALE; LOW BACKGROUND GAS.

SILTSTONE = YELLOWISH GRAY MOTTLED WITH  
 LIGHT GRAY, MINOR PURPLISH GRAY TO  
 REDDISH BROWN BRITTLE TO CRUMBLY  
 TENACITY; IRREGULAR TO SUB-PLANAR  
 FRACTURE; FLAKY TO WEDGELIKE CUTTINGS  
 HABIT; EARTHY TO DULL LUSTER; GRITTY TO  
 SILTY TEXTURE; GRADES INTO SHALE OF  
 SIMILAR COLORATION; MASSIVE TO THICK  
 STRUCTURE; LOW GAS.

SHALE = YELLOWISH GRAY TO GRAYISH ORANGE  
 MOTTLED WITH LIGHT GRAY; CRUMBLY TO  
 BRITTLE TENACITY; WEDGELIKE TO SUB-  
 TABULAR CUTTING HABIT; DULL LUSTER;  
 MASSIVE TO THICK STRUCTURE; INTERBEDDED  
 WITH AND GRADES INTO SIMILARLY COLORED  
 SILTSTONE AND INTERBEDDED WITH SANDSTONE  
 WEAKLY CALCAREOUS; LOW BACKGROUND GAS.

SHALE = YELLOWISH GRAY TO GRAYISH ORANGE  
 WITH MINOR PURPLISH GRAY OR LIGHT GRAY  
 HUES; CRUMBLY TO BRITTLE TENACITY;  
 IRREGULAR FRACTURE; WEDGELIKE TO FLAKY  
 CUTTINGS HABIT; DULL TO EARTHY LUSTER;  
 SILTY TO CLAYEY WITH MINOR GRITTY  
 TEXTURE; GRADES INTO AND INTERBEDDED  
 WITH SILTSTONE AS WELL AS INTERBEDDED  
 SANDSTONE; LOW BACKGROUND GAS.

NOTE: POOH TO L/D DIRECTIONAL TOOL.

SHALE = LIGHT GREY TO MEDIUM GREY, LIGHT  
 BLuish GREY; BRITTLE TO CRUMBLY TENACITY  
 PLANAR TO SPLINTERY FRACTURE; PLATY TO  
 FLAKY TO SCALY CUTTINGS HABIT; MATTE TO  
 DULL LUSTER; SMOOTH TO CLAYEY TEXTURE;  
 MASSIVE BEDDING WITH FISSILITY.

NOTE: LOST RETURNS WHILE DRILLING FROM  
 5563' TO 5577' MD.

SANDSTONE = CLEAR, WHITE TO VERY LIGHT  
 GREY; MEDIUM TO COARSE GRAIN SIZE; WELL  
 SORTED; SUBROUND TO SUBANGULAR GRAINS  
 WITH MODERATE SPHERICITY; FROSTED GRAIN  
 SURFACES; MAINLY UNCONSOLIDATED CLEAR  
 QUARTZ GRAINS WITH SOME EASILY FRIABLE  
 CUTTINGS; SILICA CEMENT WITH NO REACTION

04/10/2010

04/11/2010

DAY TOUR

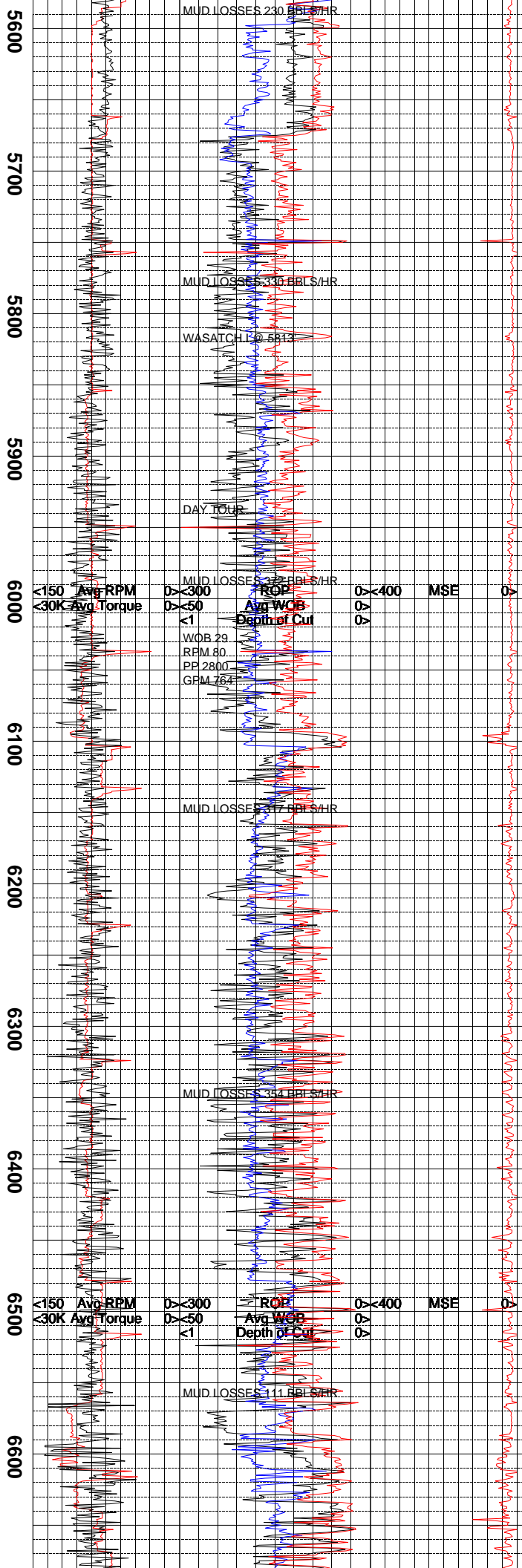
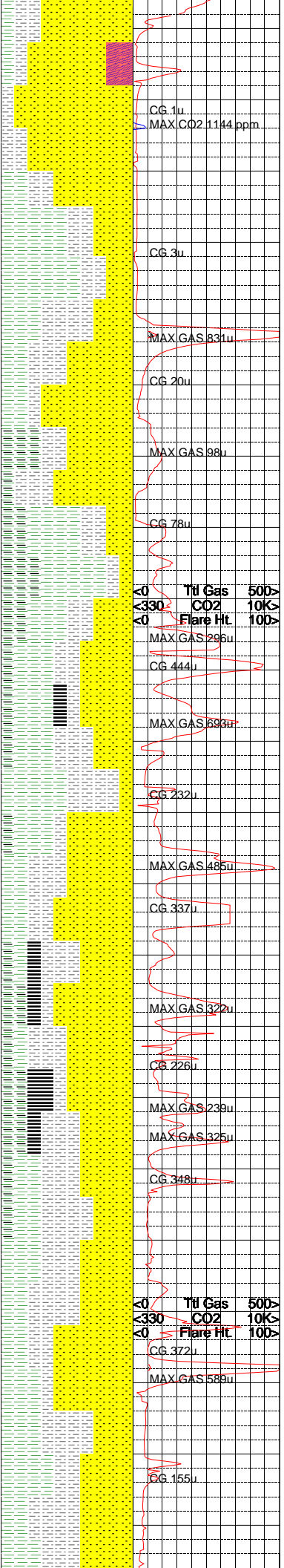
WOB 26  
 RPM 85  
 PR 2150  
 GPM 700

04/11/2010

NIGHT TOUR  
 NB #3 9.875" IN @ 540  
 SMITH M1616  
 S/NL JD3780 JETS: 6x1  
 HRS: XX.X FTG: XXXX

WASATCH @ 5485

LOST RETURNS @ 5563'  
 RETURNS @ 5577'



TO DILUTE HCL; GRAIN SUPPORTED WITH MASSIVE BEDDING; TRACE PYRITE INCLUSIONS AND GREEN CHLOROTOID MATERIAL; NO VISIBLE HYDROCARBON INDICATORS.

SILTSTONE = PALE RED, MEDIUM GREY TO PALE GRAYISH BLUE; SEMI TOUGH TO BRITTLE TENACITY; IRREGULAR FRACTURE; MASSIVE TO SCALY CUTTINGS HABIT; MATTE TO FROSTED TO SPARKLING LUSTER; SILTY TO GRITTY TEXTURE; MASSIVE STRUCTURE.

SHALE = MODERATE RED, PALE BLUE, MEDIUM GREY TO LIGHT GREY, SOME MODERATE YELLOW CRUMBLY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLTY TO FLAKY TO SCALY CUTTINGS HABIT; MATTE TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; MASSIVE STRUCTURE WITH SOME FISSILITY.

SANDSTONE = CLEAR, WHITE TO MEDIUM GREY, SALT AND PEPPER APPEARANCE; FINE TO MEDIUM GRAIN SIZE; WELL SORTED; SUBANGULAR TO SUBROUND GRAINS WITH MODERATE TO LOW SPHERICITY; FROSTED GRAIN SURFACES; FRIABLE TO FIRM FRIABLE CUTTINGS; CALCITE CEMENT WITH A MODERATE REACTION TO DILUTE HCL; GRAIN SUPPORTED WITH MASSIVE BEDDING; SOME DARK LITHIC INCLUSIONS; NO VISIBLE HYDROCARBON INDICATORS.

SHALE = MEDIUM TO MEDIUM DARK GRAY, MINOR LIGHT GRAY; DENSE TO BRITTLE TENACITY; HACKLY TO SUB-BLOCKY OR IRREGULAR FRACTURE; MASSIVE TO SUB-TABULAR CUTTING; EARTHY LUSTER; CLAYEY TO SILTY TEXTURE; THICK TO MASSIVE STRUCTURE; INTERBEDDED SILTSTONES AND SANDSTONES, FREQUENTLY GRADES INTO CARBONACEOUS SHALE; INCREASED BACKGROUND GAS.

SANDSTONE = LIGHT TO MEDIUM GRAY; 90% QUARTZ CLASTS WITH THE REMAINDER LITHIC ESPECIALLY BLACK; SUBROUNDED TO SUB-ANGULAR; FINE TO UPPER VERY FINE; CALCITE CEMENT; GRAIN SUPPORTED; INTER-BEDDED SHALE AND CARBONACEOUS SHALE, MINOR COAL SEEN DEGASSING IN SAMPLE; INCREASE IN BACKGROUND GAS.

SHALE = MEDIUM DARK GRAY TO MEDIUM GRAY; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO SUB-BLOCKY FRACTURE; WEDGELIKE TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SILTY TO CLAYEY, SOME GRITTY TEXTURE; GRADES INTO AND INTERBEDDED WITH SILTSTONE OF THE SAME COLORATION AND INTERBEDDED WITH LITHIC SANDSTONE; LOW BACKGROUND GAS.

SANDSTONE = LIGHT TO MEDIUM GRAY, MINOR BROWNISH GRAY TO BROWNISH BLACK; QUARTZ PREDOMINATELY WITH MINOR LITHIC FRAGMENT INCLUDING BLACK LITHIC FRAGMENTS GIVE A SALT AND PEPPER APPEARANCE; FINE GRAINED FAIR SORTING; FRIABLE TO FIRM FRIABLE; CALCITE CEMENT; FREQUENTLY INTERBEDDED WITH SHALE, CARBONACEOUS SHALE, AND OCCASIONALLY COAL; GAS SEEN IN THE SANDS

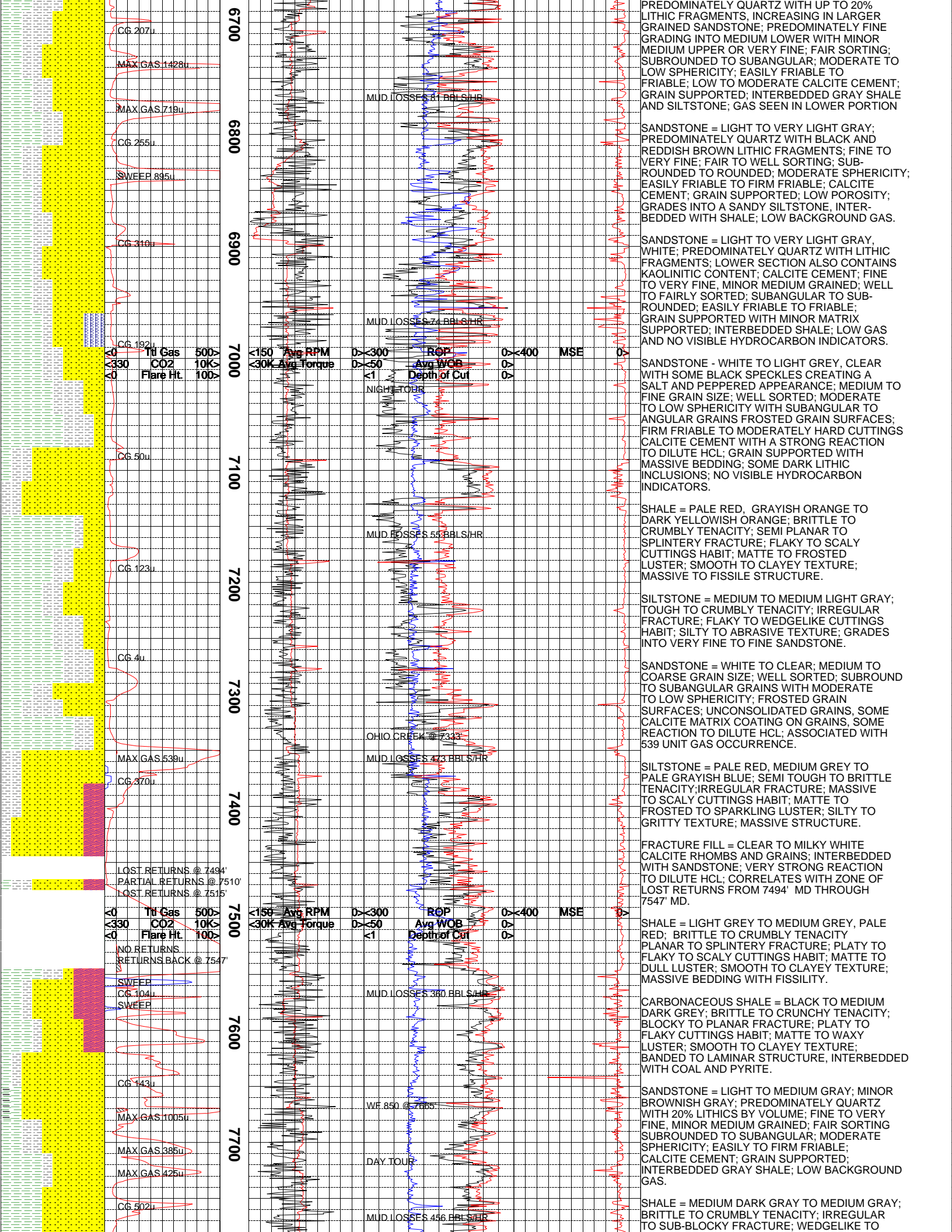
SANDSTONE = LIGHT TO MEDIUM GRAY; MINOR BROWNISH GRAY; PREDOMINATELY QUARTZ WITH 20% LITHICS BY VOLUME; FINE TO VERY FINE, MINOR MEDIUM GRAINED; FAIR SORTING SUBROUNDED TO SUBANGULAR; MODERATE SPHERICITY; EASILY TO FIRM FRIABLE; CALCITE CEMENT; GRAIN SUPPORTED; BEDS OF CARBONACEOUS SHALE AND COAL, GRADES INTO A SILTSTONE; GAS SEEN IN SAND LAYERS.

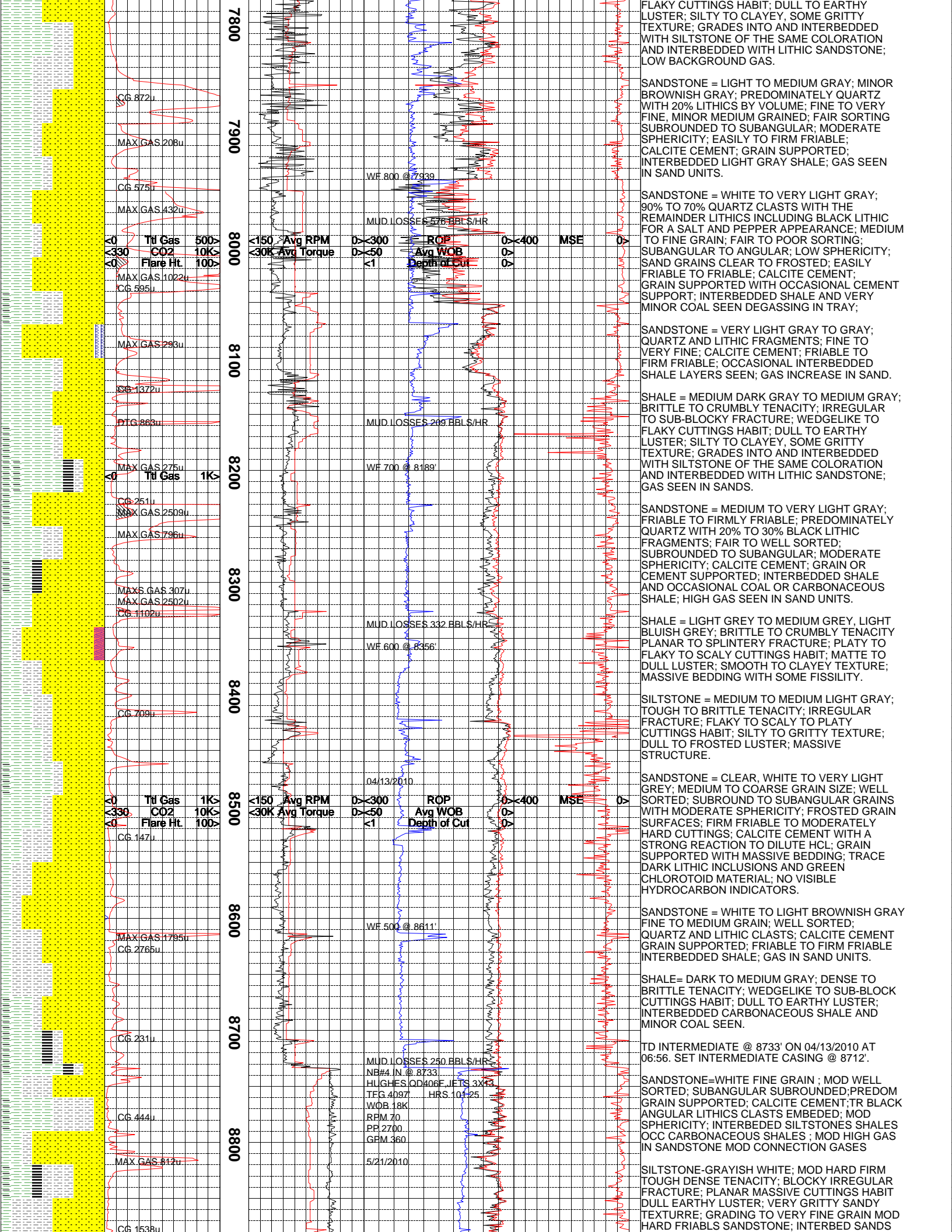
SILTSTONE = MEDIUM TO MEDIUM DARK GRAY; DENSE TO CRUMBLY TENACITY; IRREGULAR FRACTURE; NODULAR TO WEDGELIKE CUTTINGS HABIT; SILTY TO ABRASIVE TEXTURE; GRADES INTO VERY FINE SANDSTONE AND INTERBEDDED SHALE; LOW BACKGROUND GAS.

SANDSTONE = LIGHT TO LIGHT MEDIUM GRAY; FRIABLE TO EASILY FRIABLE; PREDOMINATELY QUARTZ WITH MINOR LITHIC FRAGMENTS; SUBROUNDED TO SUBANGULAR; MODERATE SPHERICITY; FROSTED GRAINS; GRAIN SUPPORTED; MODERATE AMOUNT OF CALCITE CEMENT; INTERBEDDED AND GRADES INTO SILTSTONE, INTERBEDDED GRAY SHALE; GAS SEEN IN SAND BEDS.

SILTSTONE = LIGHT TO MEDIUM LIGHT GRAY; CRUMBLY TO CRUNCHY TENACITY; IRREGULAR FRACTURE; DULL LUSTER; FLAKY TO WEDGE-LIKE CUTTING WITH MINOR TABULAR; GRANULAR TO GRITTY; GRADES INTO A VERY FINE GRAINED SANDSTONE AND INTERBEDDED WITH GRAY SHALE; SLIGHTLY CALCAREOUS; LOW BACKGROUND GAS.

SANDSTONE = VERY LIGHT TO MEDIUM GRAY;





CG 872u  
MAX GAS 208u  
CG 575u  
MAX GAS 432u  
MAX GAS 1022u  
CG 595u  
MAX GAS 293u  
CG 1372u  
DTG 863u  
MAX GAS 275u  
CG 251u  
MAX GAS 2509u  
MAX GAS 796u  
MAX GAS 307u  
MAX GAS 2502u  
CG 1102u  
CG 709u  
CG 147u  
MAX GAS 1795u  
CG 2765u  
CG 231u  
CG 444u  
MAX GAS 812u  
CG 1538u

WF 800 @ 7939  
MUD LOSSES 576 BBL\$/HR  
WF 700 @ 8189  
MUD LOSSES 209 BBL\$/HR  
WF 600 @ 8356  
MUD LOSSES 332 BBL\$/HR  
04/13/2010  
WF 500 @ 8611  
MUD LOSSES 250 BBL\$/HR  
NB#4 IN @ 8733  
HUGHES QD406F JETS 3x13  
TEG 4097 HRS 10425  
WOB 18K  
RPM 70  
PR 2700  
GPM 360  
5/21/2010

FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SILTY TO CLAYEY, SOME GRITTY TEXTURE; GRADES INTO AND INTERBEDDED WITH SILTSTONE OF THE SAME COLORATION AND INTERBEDDED WITH LITHIC SANDSTONE; LOW BACKGROUND GAS.

SANDSTONE = LIGHT TO MEDIUM GRAY; MINOR BROWNISH GRAY; PREDOMINATELY QUARTZ WITH 20% LITHICS BY VOLUME; FINE TO VERY FINE, MINOR MEDIUM GRAINED; FAIR SORTING SUBROUNDED TO SUBANGULAR; MODERATE SPHERICITY; EASILY TO FIRM FRIABLE; CALCITE CEMENT; GRAIN SUPPORTED; INTERBEDDED LIGHT GRAY SHALE; GAS SEEN IN SAND UNITS.

SANDSTONE = WHITE TO VERY LIGHT GRAY; 90% TO 70% QUARTZ CLASTS WITH THE REMAINDER LITHICS INCLUDING BLACK LITHIC FOR A SALT AND PEPPER APPEARANCE; MEDIUM TO FINE GRAIN; FAIR TO POOR SORTING; SUBANGULAR TO ANGULAR; LOW SPHERICITY; SAND GRAINS CLEAR TO FROSTED; EASILY FRIABLE TO FRIABLE; CALCITE CEMENT; GRAIN SUPPORTED WITH OCCASIONAL CEMENT SUPPORT; INTERBEDDED SHALE AND VERY MINOR COAL SEEN DEGASSING IN TRAY;

SANDSTONE = VERY LIGHT GRAY TO GRAY; QUARTZ AND LITHIC FRAGMENTS; FINE TO VERY FINE; CALCITE CEMENT; FRIABLE TO FIRM FRIABLE; OCCASIONAL INTERBEDDED SHALE LAYERS SEEN; GAS INCREASE IN SAND.

SHALE = MEDIUM DARK GRAY TO MEDIUM GRAY; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO SUB-BLOCKY FRACTURE; WEDGELIKE TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SILTY TO CLAYEY, SOME GRITTY TEXTURE; GRADES INTO AND INTERBEDDED WITH SILTSTONE OF THE SAME COLORATION AND INTERBEDDED WITH LITHIC SANDSTONE; GAS SEEN IN SANDS.

SANDSTONE = MEDIUM TO VERY LIGHT GRAY; FRIABLE TO FIRMLY FRIABLE; PREDOMINATELY QUARTZ WITH 20% TO 30% BLACK LITHIC FRAGMENTS; FAIR TO WELL SORTED; SUBROUNDED TO SUBANGULAR; MODERATE SPHERICITY; CALCITE CEMENT; GRAIN OR CEMENT SUPPORTED; INTERBEDDED SHALE AND OCCASIONAL COAL OR CARBONACEOUS SHALE; HIGH GAS SEEN IN SAND UNITS.

SHALE = LIGHT GREY TO MEDIUM GREY, LIGHT BLUISH GREY; BRITTLE TO CRUMBLY TENACITY PLANAR TO SPLINTERY FRACTURE; PLATY TO FLAKY TO SCALY CUTTINGS HABIT; MATTE TO DULL LUSTER; SMOOTH TO CLAYEY TEXTURE; MASSIVE BEDDING WITH SOME FISSILITY.

SILTSTONE = MEDIUM TO MEDIUM LIGHT GRAY; TOUGH TO BRITTLE TENACITY; IRREGULAR FRACTURE; FLAKY TO SCALY TO PLATY CUTTINGS HABIT; SILTY TO GRITTY TEXTURE; DULL TO FROSTED LUSTER; MASSIVE STRUCTURE.

SANDSTONE = CLEAR, WHITE TO VERY LIGHT GREY; MEDIUM TO COARSE GRAIN SIZE; WELL SORTED; SUBROUND TO SUBANGULAR GRAINS WITH MODERATE SPHERICITY; FROSTED GRAIN SURFACES; FIRM FRIABLE TO MODERATELY HARD CUTTINGS; CALCITE CEMENT WITH A STRONG REACTION TO DILUTE HCL; GRAIN SUPPORTED WITH MASSIVE BEDDING; TRACE DARK LITHIC INCLUSIONS AND GREEN CHLOROTOID MATERIAL; NO VISIBLE HYDROCARBON INDICATORS.

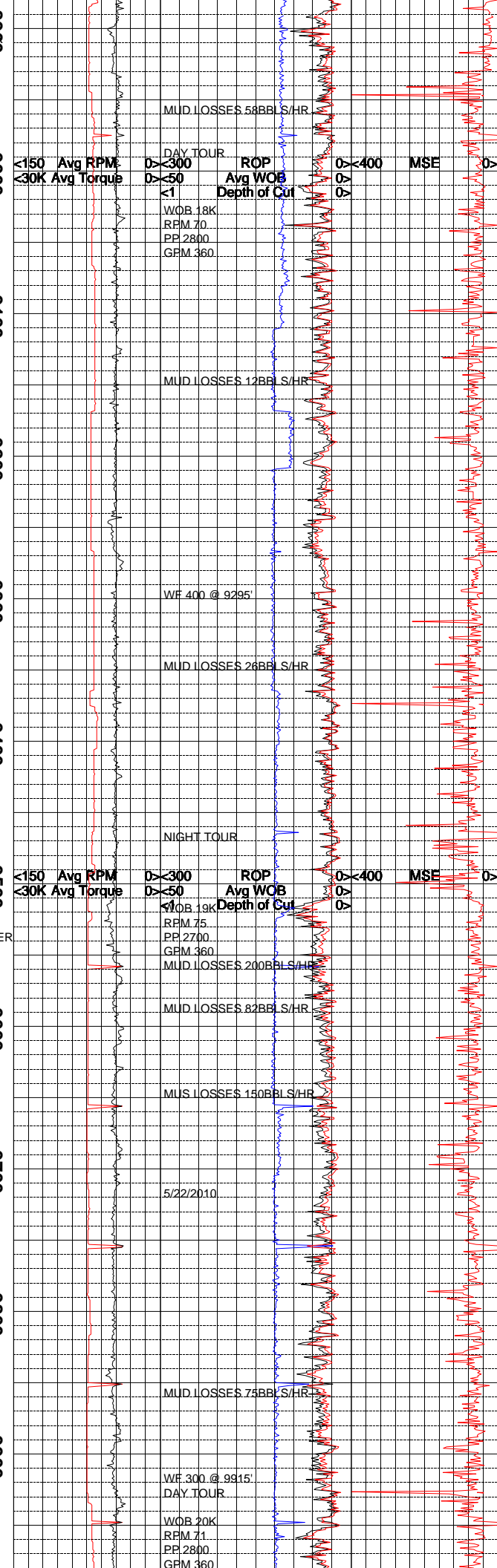
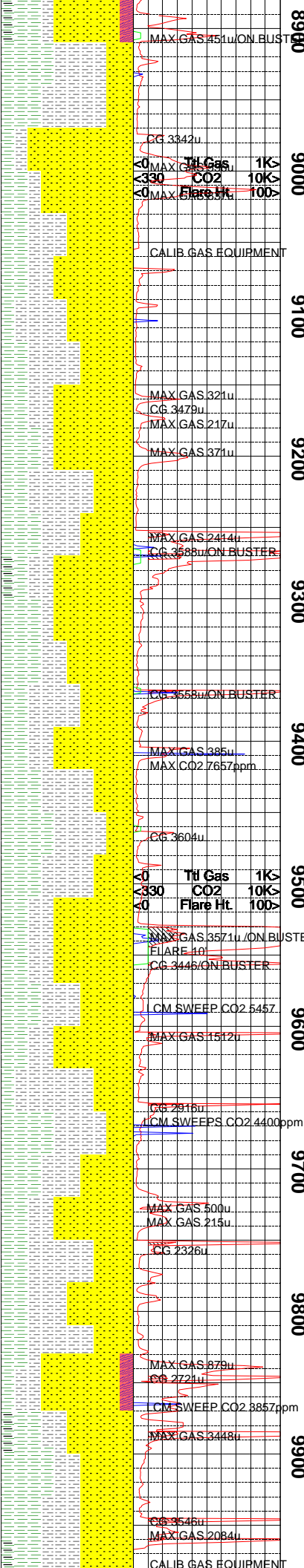
SANDSTONE = WHITE TO LIGHT BROWNISH GRAY FINE TO MEDIUM GRAIN; WELL SORTED; QUARTZ AND LITHIC CLASTS; CALCITE CEMENT GRAIN SUPPORTED; FRIABLE TO FIRM FRIABLE INTERBEDDED SHALE; GAS IN SAND UNITS.

SHALE = DARK TO MEDIUM GRAY; DENSE TO BRITTLE TENACITY; WEDGELIKE TO SUB-BLOCK CUTTINGS HABIT; DULL TO EARTHY LUSTER; INTERBEDDED CARBONACEOUS SHALE AND MINOR COAL SEEN.

TD INTERMEDIATE @ 8733' ON 04/13/2010 AT 06:56. SET INTERMEDIATE CASING @ 8712'.

SANDSTONE=WHITE FINE GRAIN ; MOD WELL SORTED; SUBANGULAR SUBROUNDED;PREDOM GRAIN SUPPORTED; CALCITE CEMENT;TR BLACK ANGULAR LITHICS CLASTS EMBEDDED;MOD SPHERICITY; INTERBEDDED SILTSTONES SHALES OCC CARBONACEOUS SHALES ; MOD HIGH GAS IN SANDSTONE MOD CONNECTION GASES

SILTSTONE-GRAYISH WHITE; MOD HARD FIRM TOUGH DENSE TENACITY; BLOCKY IRREGULAR FRACTURE; PLANAR MASSIVE CUTTINGS HABIT DULL EARTHY LUSTER; VERY GRITTY SANDY TEXTURE; GRADING TO VERY FINE GRAIN MOD HARD FRIABLES SANDSTONE; INTERBED SANDS



SANDSTONE= CLEAR WHITE; FINE OCC MEDIUM GRAIN; MOD HARD EASILY FRIABLE; SUBROUND SUBANGULAR; PREDOM GRAIN SUPPORTED; SLI CALCITE CEMENT; BLACK ANGULAR LITHICS CLASTS EMBEDDED; MOD SPHERICITY; FAIR MOD WELL SORTED; INTERBEDDED SILTSTONES AND SHALES OCC CARBONACEOUS SHALES; NO TRACE HYDROCARBON INDICATORS

SHALE = MEDIUM BLUISH GRAY TO MEDIUM DARK GRAY IN COLOR; DENSE TO BRITTLE IN TENACITY; IRREGULAR TO BLOCKY FRACTURE; CUTTINGS ARE ELONGATED TO TABULAR IN HABIT; SEMI-WAXY TO DULL LUSTER; SMOOTH TO CLAYEY TEXTURE; THIN STRUCTURE; WEAK FISSILITY.

SILTSTONE = LIGHT GRAY TO MEDIUM GRAY IN COLOR; DENSE TO CRUNCHY TENACITY; IRREGULAR TO CONCHOIDAL FRACTURE; CUTTINGS ARE NODULAR TO ELONGATED IN HABIT; DULL TO EARTHY LUSTER EXHIBITED; SILTY TO SLIGHTLY GRITTY TEXTURE; THIN TO THICK STRUCTURE.

SANDSTONE = WHITE TO LIGHT GRAY TO VERY PALE ORANGE IN COLOR; QUARTZ FRAMEWORK; MEDIUM TO FINE GRAIN SIZE; FAIR TO WELL SORTED; GRAINS ARE SUBROUNDED TO SUBANGULAR WITH MODERATE SPHERICITY; SAMPLE IS FIRMLY FRIABLE TO MODERATELY HARD; CALCITE CEMENT; CALCITE AND SOME MICA SEEN IN MATRIX; NO VISIBLE POROSITY LOW TO MODERATE GAS ASSOCIATED WITH THIS SANDSTONE.

SHALE = GREENISH GRAY TO MEDIUM DARK GRAY IN COLOR; TOUGH TO BRITTLE TENACITY CONCHOIDAL TO PLANAR FRACTURE; CUTTINGS ARE PLATY TO TABULAR IN HABIT; WAXY TO DULL LUSTER EXHIBITED; SMOOTH TO CLAYEY TEXTURE; THIN TO THICK STRUCTURE; NONCALCAREOUS.

SILTSTONE = DARK GRAY TO GREENISH BLACK IN COLOR; DENSE TO BRITTLE TENACITY; IRREGULAR TO BLOCKY FRACTURE; CUTTINGS ARE TABULAR TO WEDGELIKE IN HABIT; DULL TO EARTHY LUSTER; SLIGHTLY CLAYEY TO SLIGHTLY GRITTY TEXTURE; THIN TO THICK STRUCTURE.

SHALE = PALE GREEN TO MEDIUM GRAY IN COLOR; DENSE TO CRUNCHY TENACITY; BLOCKY TO IRREGULAR FRACTURE; PLATY TO TABULAR CUTTINGS HABIT; WAXY TO DULL LUSTER; SMOOTH TO CLAYEY TEXTURE; THIN STRUCTURE INTERBEDDED WITH SILTSTONES AND SANDS; LOW BACKGROUND GAS HIGH CONNECTION GASES

NOTE= DRILLED TO 9513 LOST PARTIAL RETURN PUMPED 3 10BBL LCM SWEEPS REGAINED CIR

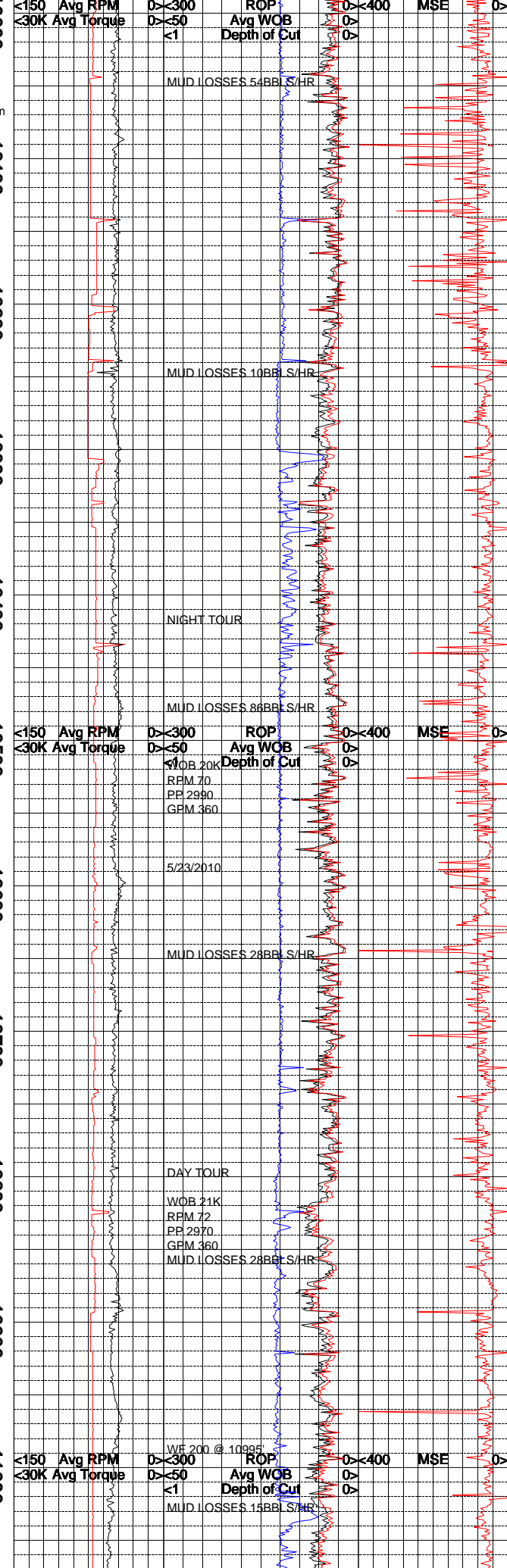
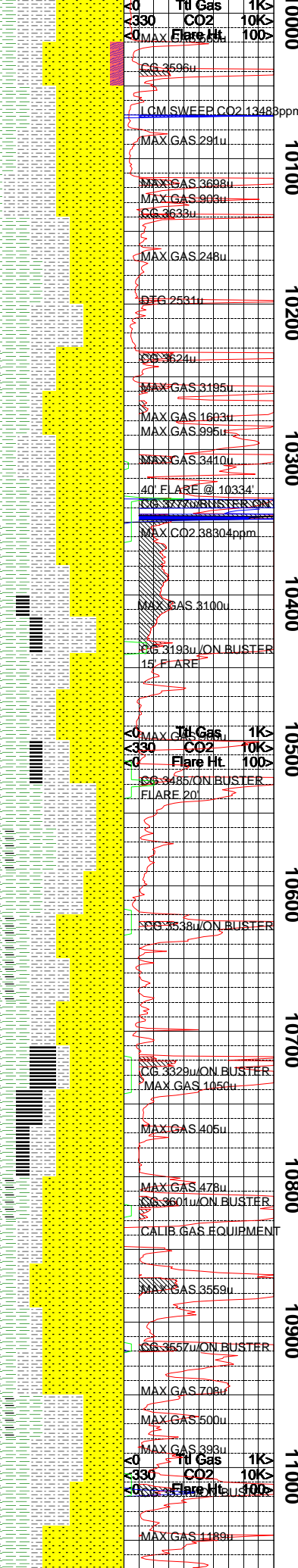
SANDSTONE= WHITE; CLEAR OD HARD EASILY FRIABLE; PREDOM LOOSE CLEAR ANGULAR QUARTZ GRAINS; MOD WELL SORTED; CALCITE CEMENT; TR BLACK LITHICS FRAGS EMBEDDED; MOD SPHERICITY; OCC TRACE KAOLINITE; INTERBEDDED WITH SHALES AND SILTSTONES; MOD GAS OBSERVED, NO TRACE HYDROCARBON INDICATORS

SILTSTONE= GRAYISH WHITE; MOD HARD FIRM; DENSE TENACITY; BLOCKY IRREGULAR FRACTURE MASSIVE PLATY OCC WEDGELIKE CUTTINGS HABIT; DULL EARTHY LUSTER; SMOOTH GRITTY VERY SANDY TEXTURE; THICK STRUCTURE; GRADING TO WHITE VERY FINE GRAIN SANDS INTERBEDDED SHALES LOW GAS READINGS NO HYDROCARBON INDICATORS

SHALE= MEDIUM LIGHT TO GREENISH GRAY; MOD HARD FIRM; DENSE SLI BRITTLE TENACITY; PLANAR OCC SPLINTERY FRACTURE; PLATY TABULAR OCC ELONGATED CUTTINGS HABIT; WAXY DULL EARTHY LUSTER; SMOOTH SLI SILTY TEXTURE; INTERBEDDED WITH VERY CALCAREOUS SANDY SILTSTONES AND SANDS LOW GAS MOD HIGH CONNECTION GASES

SANDSTONE= GRAYISH WHITE WHITE; FINE MEDIUM GRAIN; MOD SORTED; SUBANGULAR SUBROUNDED MOD WELL SORTED; PREDOM GRAIN SUPPORTED, CALCITE CEMENT WITH TR KAOLINITE; TRACE BLACK ANGULAR LITHICS EMBEDDED; MOD HIGH SPHERICITY; TRACE CLEAR XLN CALCITE FILL OBSERVED; HIGH GAS IN SANDSTONE WITH FRACTURE FILL; INTERBEDDED SHALES AND CARBONACEOUS SHALES; MOD HIGH GAS READING IN SANDS VERY HIGH CONNECTION GASES

SILTSTONE = GRAYISH OLIVE TO MEDIUM GRAY IN COLOR; DENSE TO BRITTLE IN TENACITY; IRREGULAR TO BLOCKY FRACTURE; NODULAR TO TABULAR CUTTINGS HABIT; DULL TO FROSTED LUSTER EXHIBITED; SAMPLE SHOWS A SILTY TO GRITTY, OCCASIONALLY GRANULAR TEXTURE SEVERAL PIECES SEEN GRADING INTO FINE



SANDSTONE; THIN STRUCTURE, APPEARS TO BE GRADING TO AND FROM A SANDSTONE.

FRACTURE FILL = CLEAR TO MILKY WHITE CALCITE RHOMBS AND GRAINS; INTERBEDDED WITH SANDSTONE; VERY STRONG REACTION TO DILUTE HCL; CORRELATES WITH LOSS ZONE FROM 10020' TO 10050'.

SHALE = LIGHT BLuish GRAY TO MEDIUM GRAY IN COLOR; SAMPLE SHOWS A BRITTLE TO TOUGH TENACITY; PLANAR TO IRREGULAR FRACTURE; CUTTINGS ARE PLATY TO TABULAR, SOME ELONGATED; WAXY TO DULL LUSTER; SMOOTH TO CLAYEY, OCCASIONALLY SILTY TEXTURE; THIN STRUCTURE.

SANDSTONE = WHITE TO LIGHT GRAY TO NEARLY TRANSLUCENT; QUARTZ FRAMEWORK WITH SOME BLACK LITHIC FRAGMENTS; COARSE TO FINE GRAIN SIZE; GRAINS ARE ANGULAR TO SUBROUNDED WITH LOW TO MODERATE SPHERICITY; EASILY TO FIRMLY FRIABLE; WEAK CALCITE CEMENT, SLOW TO MODERATE DISSOLUTION IN HCL; NO VISIBLE POROSITY OR BEDDING FEATURES; CALCITE GRAINS VISIBLE IN MATRIX; ASSOCIATED WITH LOW BACKGROUND AND HIGH CONNECTION GAS.

SILTSTONE = DUSKY YELLOWISH BROWN TO DARK GRAY IN COLOR; BRITTLE TO CRUMBLY TENACITY; BLOCKY TO IRREGULAR FRACTURE; NODULAR TO TABULAR CUTTINGS HABIT; DULL TO EARTHY LUSTER; SAMPLE HAS A SILTY TO GRITTY, SOMETIMES GRANULAR TEXTURE; THIN STRUCTURE, INTERBEDDED WITH SANDS AND OCCASIONALLY SHALE.

CARBONACEOUS SHALE = BROWNISH GRAY; MOD HARD FIRM; BRITTLE TENACITY; BLOCKY OCC PLANAR FRACTURE; FLAKY PLATY CUTTING HABIT; DULL EARTHY LUSTER; SLI GRITTY TEXTURE; INTERBEDDED WITH SAHLES AND SAND

NOTE: RAISED MW TO 9.6PPG AT 10433; DRILL AHEAD HIGH BACKGROUND GAS HIGH

SANDSTONE GRAYISH BROWN WHITE; MEDIUM FINE GRAIN; SUBROUNDED SUANGULAR; MOD WELL SORTED; PREDOM GRAIN SUPPORTED WITH CALCITE CEMENT AND TRACE KAOLINITE; TRACE BLACK LITHICS CLASTS EMBEDDED; MOD SPHERICITY; INTERBEDDED CARBONACEOUS SHALES OCC THIN COAL BEDS; MOD HIGH GAS IN COAL BEDS; NO HYDROCARBON INDICATORS

SHALE = LIGHT GRAY OCC DARK TO MEDIUM GRAY; MOD HARD FIRM; DENSE SLI CRUMBLY TENACITY; BLOCKY PLANAR OCC TABULAR CUTTINGS HABIT; DULL EARTHY WAXY LUSTER; SMOOTH SLI SILTY TEXTURE; INTERBEDDED CARBONACEOUS SHALES AND SILTSTONES; LOW GAS READINGS NO TRACE HYDROCARBON INDICATORS

SANDSTONE = GRAYISH BROWN; WHITE; MOD HARD FINE MEDIUM GRAIN; MOD SORTED SUBANGULAR SUBROUNDED; PREDOM GRAIN SUPPORTED; TR CALCITE CEMENT; ANGULAR BLACK LITHICS CLASTS EMBEDDED; MOD SPHERICITY; SHALE AND CARBONACEOUS SHALES INTERBEDDED; MOD GAS IN SANDS; NO TRACE HYDROCARBON INDICATORS

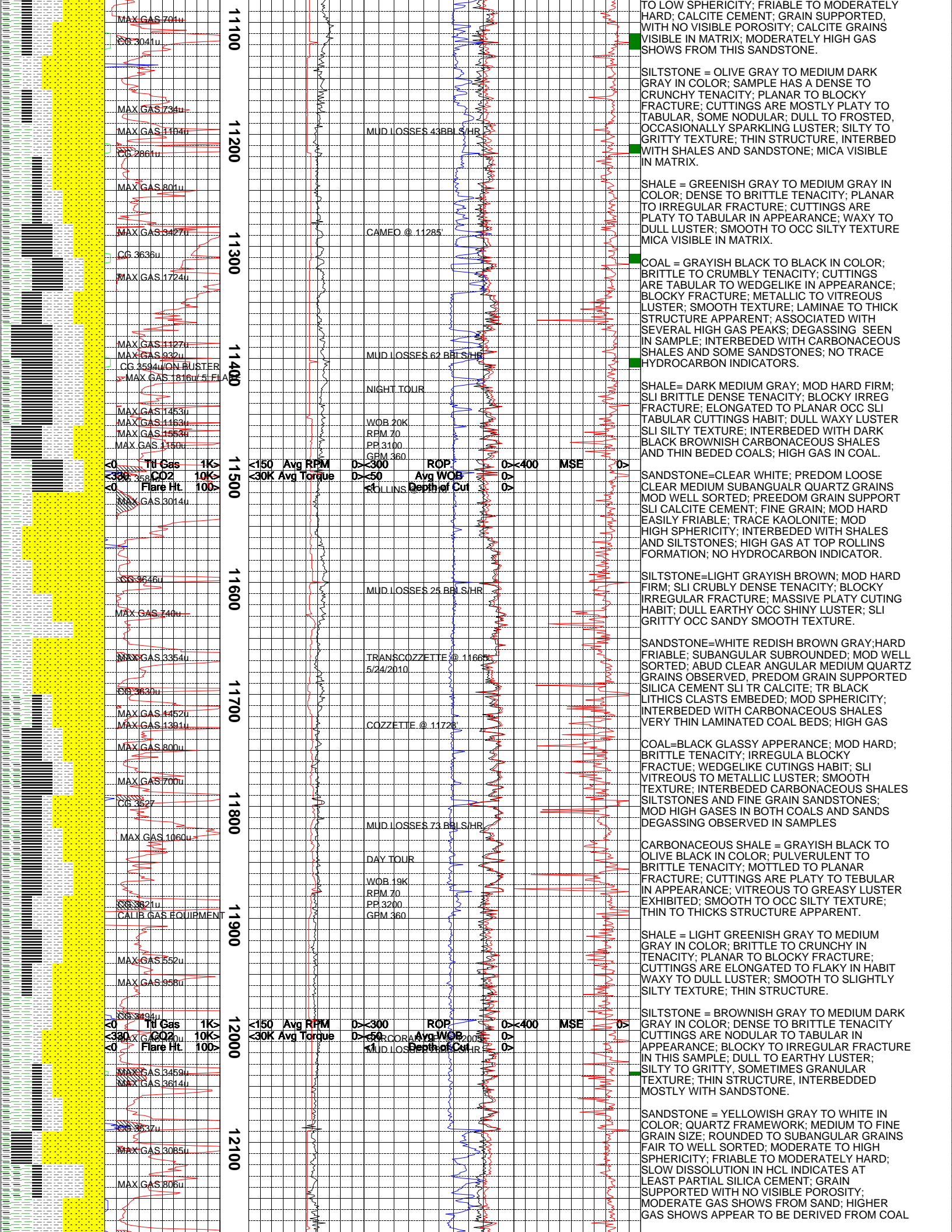
COAL = BLACK GLASSY APPEARANCE; MOD HARD; BRITTLE CRUMBLY TENACITY; BLOCKY SLI CONCHOIDAL FRACTURE; WEDGELIKE CUTTINGS HABIT; METALLIC VITREOUS LUSTER; SMOOTH TEXTURE; LAMINAE TO THIN STRUCTURE; SEEN DEGASSING IN SAMPLE TRAY; ASSOCIATED WITH A 1050 UNIT GAS PEAK.

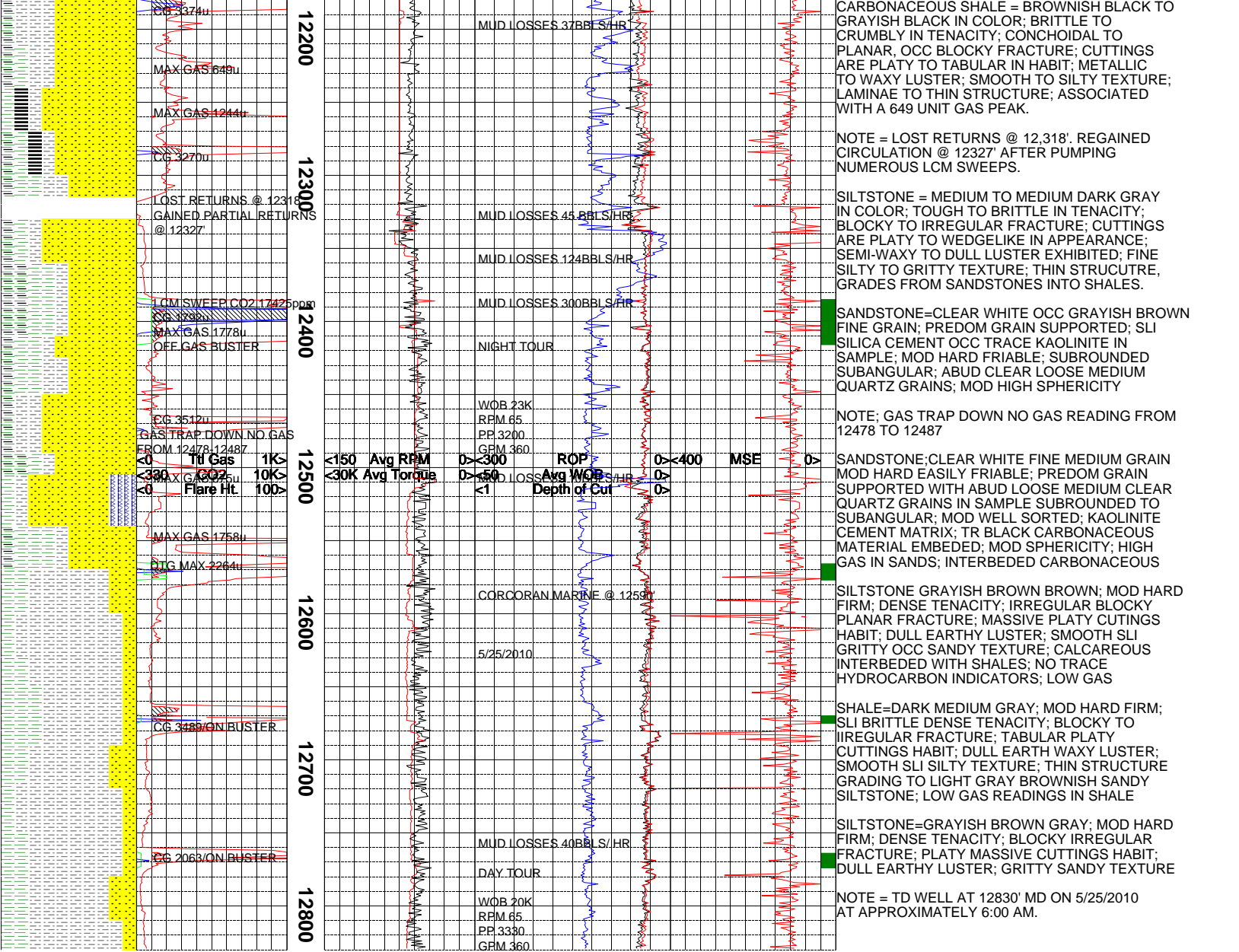
CARBONACEOUS SHALE = GRAYISH BLACK TO OLIVE BLACK IN COLOR; DENSE TO CRUMBLY IN TENACITY; BLOCKY TO IRREGULAR FRACTURE; CUTTINGS ARE NODULAR TO TABULAR IN APPEARANCE; GREASY TO DULL LUSTER; SMOOTH TO OCCASIONALLY SILTY TEXTURE; THIN TO LAMINAE STRUCTURE.

SILTSTONE = BROWNISH BLACK TO MEDIUM DARK GRAY IN COLOR; BRITTLE TO CRUMBLY TENACITY; BLOCKY TO CONCHOIDAL FRACTURE; CUTTINGS ARE MOSTLY NODULAR, SOME PLATY IN HABIT; DULL TO EARTHY LUSTER; SILTY TO GRITTY, OCC GRANULAR TEXTURE; THIN STRUCTURE, GRADES IN AND OUT WITH SANDSTONE.

SHALE = LIGHT BLuish GRAY TO MEDIUM LIGHT GRAY; DENSE TO BRITTLE TENACITY; BLOCKY TO PLANAR FRACTURE; CUTTINGS ARE PLATY TO WEDGELIKE IN APPEARANCE; WAXY TO DULL LUSTER EXHIBITED; THIN STRUCTURE APPARENT.

SANDSTONE = PALE ORANGE TO WHITE IN COLOR; QUARTZ FRAMEWORK; COARSE TO FINE GRAIN SIZE; POOR TO FAIR SORTING; GRAINS ARE ANGULAR TO SUBROUNDED WITH MODERATE





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