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# MUDLOG TVD

**COMPANY** ExxonMobil Production  
**WELL** PCU 197-34B8 ST1  
**FIELD** PICEANCE CREEK  
**REGION** ROCKY MOUNTAINS  
**COORDINATES** 39.915659000  
108.261198000  
**ELEVATION** 6649.1'  
**COUNTY, STATE** RIO BLANCO, CO  
**API INDEX** 05-103-11082-01  
**SPUD DATE** 12/13/2008  
**CONTRACTOR** H\_P  
**CO. REP.** M. MARTINEZ/W. GARNER  
**RIG/TYPE** # 320/FLEX 4S+  
**LOGGING UNIT** MLU # 032  
**GEOLOGISTS** J. KEEVAN, C. RECORD  
C. PIERCE  
**ADD. PERSONS** M. PIPER, B.HICKS  
T. WALKER  
**CO. GEOLOGIST** CHRIS ALBA

## LOG INTERVAL

## CASING DATA

**DEPTHS:** 4,000' TO 8,889'  
**DATES:** 9/30/2009 TO 3/4/2010  
**SCALE:** 1" = 100'

16" AT 132'  
10.75" AT 3,976'  
7" AT 8,675'

AT

## MUD TYPES

## HOLE SIZE

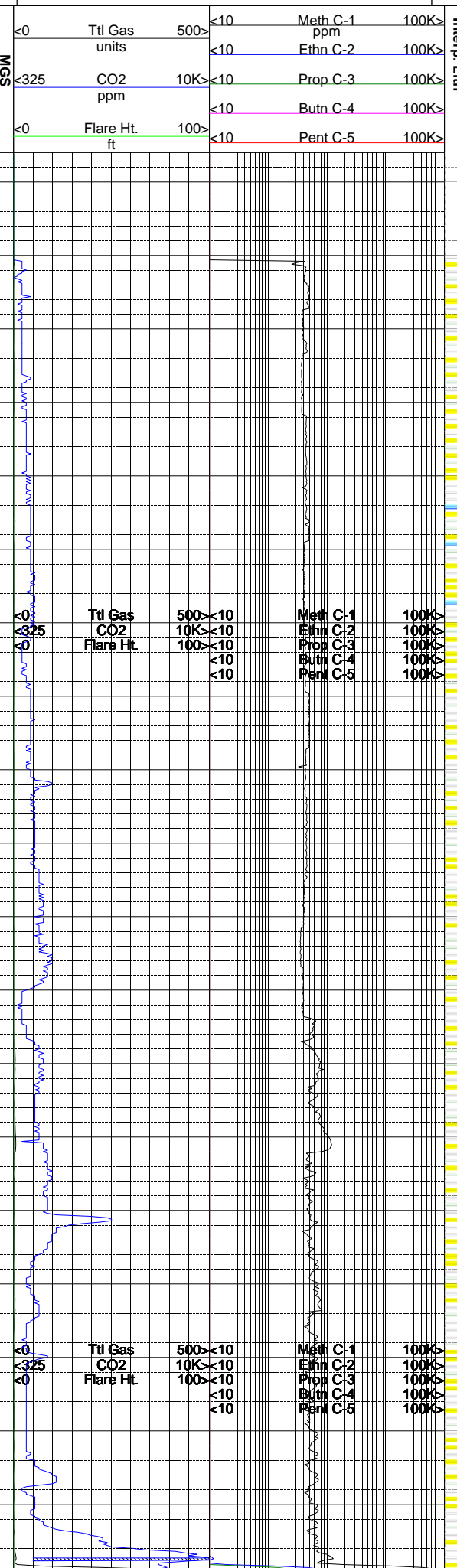
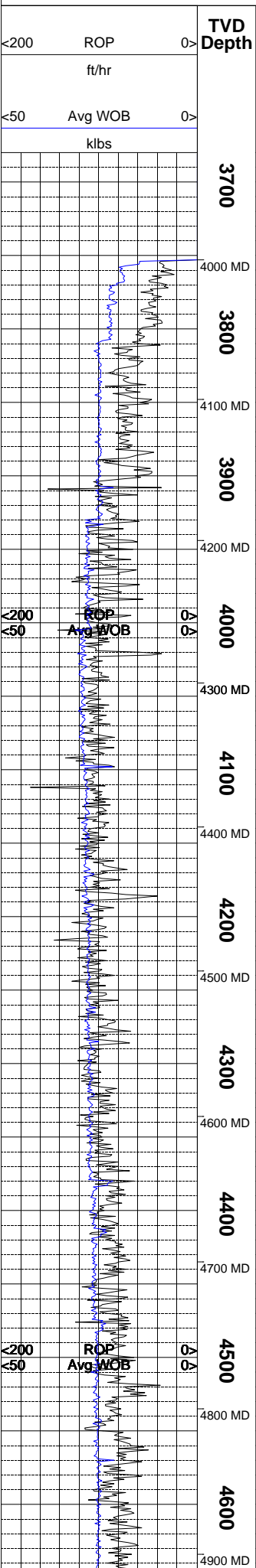
LSND TO 8,889'  
TO  
TO  
TO  
TO

14.75" TO 4,000'  
9.875" TO 8,675'  
6.125" TO 8,889'  
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	KAOLINIC	RECRYSTALLIZED CALCITE	VOLCANICS
CHALK	DIATOMITE	LIMESTONE	RHYOLITE	
CRYSTALLINE TUFF	DIORITE	LITHIC TUFF	SALT	
CHERT - ARGILL	DOLOSTONE	MARL - DOLO	SAND	



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

SANDSTONE = YELLOWISH GRAY TO WHITE IN COLOR; QUARTZ FRAMEWORK; MEDIUM TO FINE GRAIN SIZE; FAIR TO WELL SORTING; GRAINS ARE ROUNDED TO SUBANGULAR WITH MODERATE TO HIGH SPHERICITY; SAMPLE IS FRIABLE TO MODERATELY HARD; CALCITE CEMENT; NO VISIBLE BEDDING; NO VISIBLE VOIDS; NO GAS SHOWS FROM THIS SANDSTONE.

SILTSTONE = DARK YELLOWISH ORANGE TO DARK YELLOWISH BROWN IN COLOR; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO PLANAR FRACTURE; CUTTINGS RANGE FROM PLATY TO WEDGELIKE IN APPEARANCE; DULL TO EARTHY LUSTER EXHIBITED; TEXTURE RANGES FROM SILTY TO GRANULAR WITH SOME GRADATION INTO SANDSTONE NOTICEABLE; THICK TO MASSIVE STRUCTURE APPARENT.

LIMESTONE = LIGHT BLUISH GRAY TO MEDIUM BLUISH GRAY WITH POSSIBLE LIMONITE STAINING; MATRIX DOMINATED - MUDSTONE; MATRIX APPEARS TO BE CLASTIC IN ORIGIN; POINT CONTACTS FABRIC WITH NO DISCERNIBLE POROSITY.

SHALE = LIGHT GRAY TO MEDIUM LIGHT GRAY IN COLOR; CRUMBLY TO PULVERANT TENACITY; IRREGULAR TO BLOCKY FRACTURE; CUTTINGS ARE PLATY TO TABULAR IN APPEARANCE; DULL TO EARTHY LUSTER EXHIBITED; CLAYEY TO SILTY TEXTURE; THIN TO LAMINAE STRUCTURE INTERBEDDED WITH SILTSTONES APPARENT FROM DRILL BREAKS.

SANDSTONE = LIGHT GREENISH GRAY TO WHITE IN COLOR; QUARTZ FRAMEWORK; COARSE TO FINE GRAIN SIZE; POOR TO FAIR SORTING; ROUNDED TO SUBANGULAR GRAINS WITH LOW TO MODERATE SPHERICITY; FRIABLE TO FIRMLY FRIABLE HARDNESS; CALCITE CEMENT; GRAIN SUPPORTED WITH CEMENT FABRIC; NO VISIBLE POROSITY; CHLORITE GRAINS VISIBLE IN MATRIX; NO GAS SHOWS.

SILTSTONE = GRAYISH ORANGE TO DUSKY YELLOW IN COLOR; DENSE TO CRUMBLY IN TENACITY; IRREGULAR TO CONCHOIDAL FRACTURE; CUTTINGS ARE NODULAR TO WEDGELIKE IN COLOR; DULL TO EARTHY LUSTER EXHIBITED; SILTY TO GRITTY TEXTURE; THIN TO THICK STRUCTURE.

SHALE = LIGHT GRAY TO MODERATE GREENISH YELLOW WITH GRAYISH PURPLE HUES; BRITTLE TENACITY; PLANAR TO IRREGULAR FRACTURING PLATY TO SCALY CUTTINGS; DULL TO WAXY LUSTER; SMOOTH TEXTURE; THIN TO LAMINAE STRUCTURE.

SANDSTONE = LIGHT GREENISH GRAY TO LIGHT OLIVE GRAY TO LIGHT GRAY; FRAMEWORK CONSISTS OF MOSTLY QUARTZ; MEDIUM TO FINE SIZED GRAINS WITH POOR SORTING; SUBROUNDED TO SUBANGULAR WITH MODERATE SPHERICITY; FIRMLY FRIABLE WITH CALCITE CEMENT; MODERATE REACTION WITH HCL.

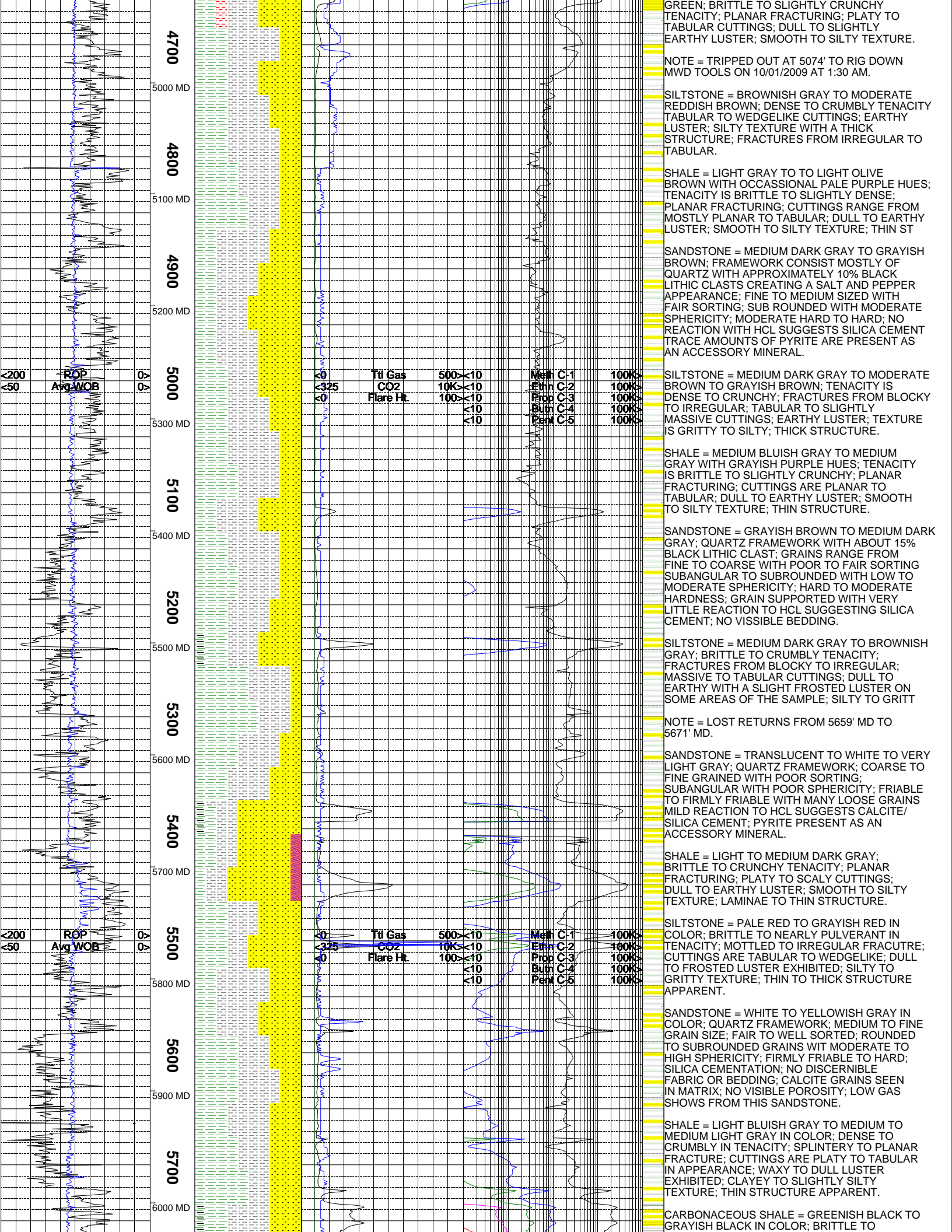
SILTSTONE = PALE REDDISH BROWN TO MODERATE BROWN; DENSE TO CRUMBLY TENACITY; BLOCKY TO IRREGULAR FRACTURING TABULAR CUTTINGS; EARTHY WITH A SLIGHT FROSTED LUSTER; GRITTY TO SILTY TEXTURE; THICK TO MASSIVE STRUCTURE.

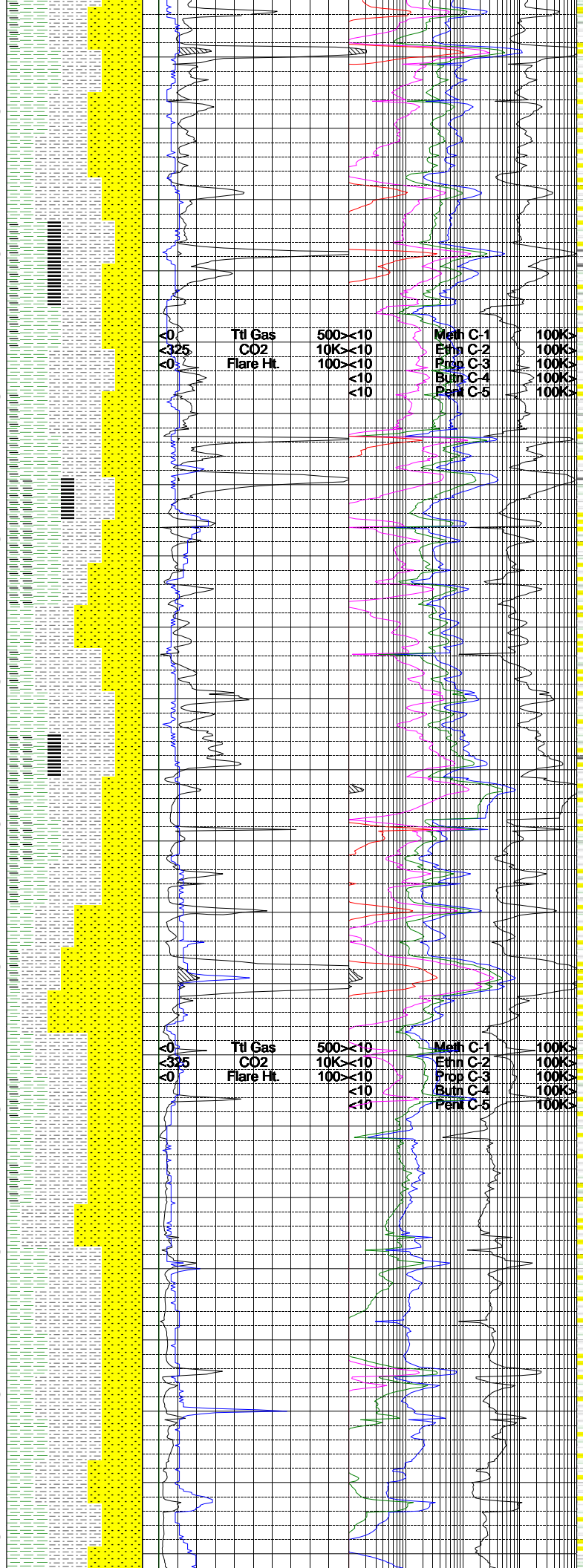
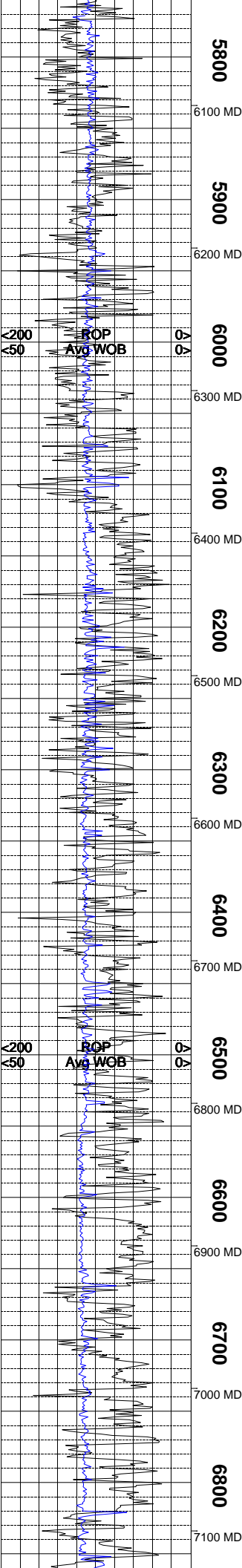
SHALE = MEDIUM BLUISH GRAY TO GREENISH GRAY TO LIGHT GRAY; BRITTLE TO SLIGHTLY CRUNCHY TENACITY; PLANAR FRACTURING; PLATY TO TABULAR TO SLIGHTLY SCALY CUTTINGS; DULL LUSTER; THIN STRUCTURE.

SANDSTONE = BROWNISH GRAY TO MODERATE BROWN TO GRAY COLOR; QUARTZ FRAMEWORK WITH APPROXIMATELY 5% DARK LITHIC CLASTS FINE TO MEDIUM SIZED GRAINS WITH FAIR TO POOR SORTING; SUBANGULAR WITH LOW SPHERICITY; FIRMLY FRIABLE TO MODERATE HARDNESS; LOW REACTION TO HCL SUGGESTS SILICA CEMENT.

SILTSTONE = REDDISH BROWN TO DARK YELLOWISH BROWN; CRUMBLY TO DENSE TENACITY; FRACTURES FROM IRREGULAR TO BLOCKY; TABULAR TO WEDGELIKE CUTTINGS; EARTHY LUSTER; GRITTY TO SMOOTH TEXTURE; THICK TO MASSIVE STRUCTURE.

SHALE = LIGHT GRAY TO GRAYISH YELLOW





PULVERANT IN TENACITY; PLANAR TO MOTTLED FRACTURE; CUTTINGS ARE WEDGELIKE TO TABULAR IN HABIT; GREASY TO DULL LUSTER; SMOOTH TO CLAYEY TEXTURE; THIN TO LAMINAE STRUCTURE APPARENT.

SILTSTONE = PALE OLIVE TO VERY LIGHT GRAY IN COLOR; DENSE TO BRITTLE IN TENACITY; IRREGULAR TO CONCHOIDAL FRACTURE; CUTTINGS ARE WEDGELIKE TO NODULAR IN APPEARANCE; DULL TO EARTHY LUSTER EXHIBITED; SILTY TO GRITTY TEXTURE; THIN TO THICK STRUCTURE APPARENT.

COAL = GRAYISH BLACK IN COLOR; BRITTLE TO PULVERANT IN TENACITY; HACKLY TO PLANAR FRACTURE; CUTTINGS ARE TABULAR TO EQUANT IN APPEARANCE; METALLIC LUSTER; SMOOTH TEXTURE; THICK TO THIN STRUCTURE APPARENT.

SANDSTONE = WHITE TO LIGHT GRAY WITH MODERATE YELLOWISH BROWN HUES; MEDIUM TO FINE SIZED GRAINS WITH FAIR SORTING; SUBROUNDED WITH MODERATE TO HIGH SPHERICITY; HARD TO MODERATE HARD; GRAIN SUPPORTED; QUARTZ FRAMEWORK WITH APPROXIMATELY 5%-10% BLACK LITHIC CLASTS SILICA CEMENT; TRACE AMOUNTS OF PYRITE AND CALCITE AS ACCESSORY MINERALS.

CARBONACEOUS SHALE = DARK GRAY TO BLACK; DENSE TO BRITTLE TENACITY; BLOCKY TO SLIGHTLY CONCHOIDAL FRACTURING; NODULAR TO WEDGELIKE CUTTINGS; EARTHY TO RESINOUS LUSTER; SILTY TO SMOOTH TEXTURE THIN TO THICK STRUCTURE.

SHALE = PALE OLIVE TO MEDIUM LIGHT GRAY TO LIGHT BLUISH GRAY; DENSE TO BRITTLE TENACITY; FRACTURES FROM PLANAR TO SPLINTERY; PLATY TO SCALY CUTTINGS; DULL TO SLIGHTLY WAXY LUSTER; TEXTURE IS SMOOTH TO SILTY; THIN TO LAMINAE STRUCTURE.

SILTSTONE = DARK YELLOWISH BROWN TO BROWNISH BLACK; DENSE TO CRUMBLY TENACITY; FRACTURES FROM MOSTLY BLOCKY TO OCCASIONALLY IRREGULAR; TABULAR TO SLIGHTLY MASSIVE CUTTINGS; EARTHY WITH A SLIGHT FROSTED LUSTER; TEXTURE IS SILTY TO GRITTY; THICK STRUCTURE.

SANDSTONE = WHITE TO MEDIUM DARK GRAY WITH SOME MODERATE GREENISH YELLOW HUES; QUARTZ FRAME WORK WITH APPROXIMATELY 10% BLACK LITHIC CLASTS; FINE GRAIN SIZE WITH WELL SORTING; SUBROUNDED; HARD TO MODERATE HARD; GRAINS SUPPORTED WITH SILICA CEMENT; VERY SLIGHT REACTION TO HCL SUGGESTS SOME CALCITE GRAINS MAY BE PRESENT.

SHALE = LIGHT GRAY TO GREENISH GRAY; TENACITY IS BRITTLE TO CRUNCHY; PLANAR TO SPLINTERY FRACTURING; SCALY TO TABULAR CUTTINGS; LUSTER IS DULL TO WAXY SMOOTH TO SILTY TEXTURE; THIN STRUCTURE.

SILTSTONE = LIGHT OLIVE GRAY TO VERY LIGHT GRAY IN COLOR; DENSE TO BRITTLE IN TENACITY; CONCHOIDAL TO PLANAR FRACTURE; NODULAR TO WEDGELIKE CUTTINGS HABIT; DULL TO EARTHY LUSTER EXHIBITED; SILTY TO GRITTY TEXTURE; THIN STRUCTURE APPARENT.

SANDSTONE = WHITE TO YELLOWISH GRAY IN COLOR; QUARTZ FRAMEWORK WITH ABOUT 3% BLACK LITHIC FRAGMENTS; MEDIUM TO VERY FINE GRAIN SIZE; FAIR SORTING; GRAINS ARE ANGULAR TO SUBROUNDED WITH LOW TO MODERATE SPHERICITY; FRIABLE TO FIRMLY FRIABLE; CALCITE CEMENT; TIGHT SAND WITH NO VISIBLE POROSITY; POINT CONTACT FABRIC WITH NO VISIBLE BEDDING; LOW GAS SHOWS.

SHALE = GREENISH GRAY TO MEDIUM GRAY IN COLOR; DENSE TO CRUCNHY IN TENACITY; HACKLY TO IRREGULAR FRACTURING; CUTTINGS ARE WEDGELIKE TO NODULAR IN HABIT; WAXY TO DULL LUSTER EXHIBITED; CLAYEY TO SILTY TEXTURE, SOME ABRUPT CONTACTS WITH

SILTSTONE = MODERATE REDDISH BROWN TO GRAYISH ORANGE IN COLOR; DENSE TO BRITTLE IN TENACITY; BLOCKY TO PLANAR FRACTURE; CUTTINGS ARE WEDGELIKE TO NODULAR, SOME MASSIVE; EARTHY TO FROSTED LUSTER EXHIBITED; SILTY TO GRITTY LUSTER THIN STRUCTURE APPARENT.

SANDSTONE = WHITE TO VERY LIGHT GRAY IN COLOR; QUARTZ FRAMEWORK, MEDIUM TO FINE GRAIN SIZE; FAIR TO WELL SORTED; GRAINS ARE ROUNDED TO SUBANGULAR WITH MODERATE TO HIGH SPERICITY; HARDNESS RANGES FROM

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6700  
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6800  
7100 MD

>200  
<50  
ROP  
Avg WOB

>325  
<0  
Ttl Gas  
CO2  
Flare Ht.

500x10  
10Kx10  
100x10  
<10  
<10

Meth C-1  
Ethn C-2  
Prop C-3  
Bum C-4  
Pen C-5

100K  
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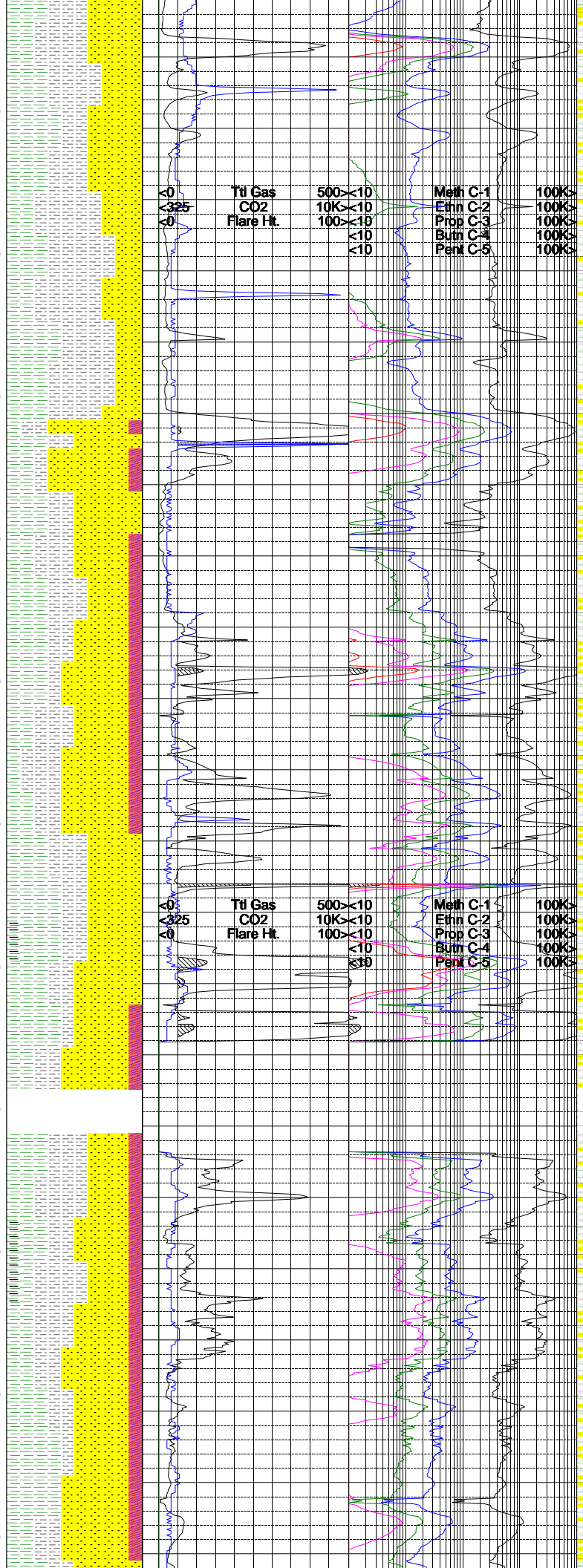
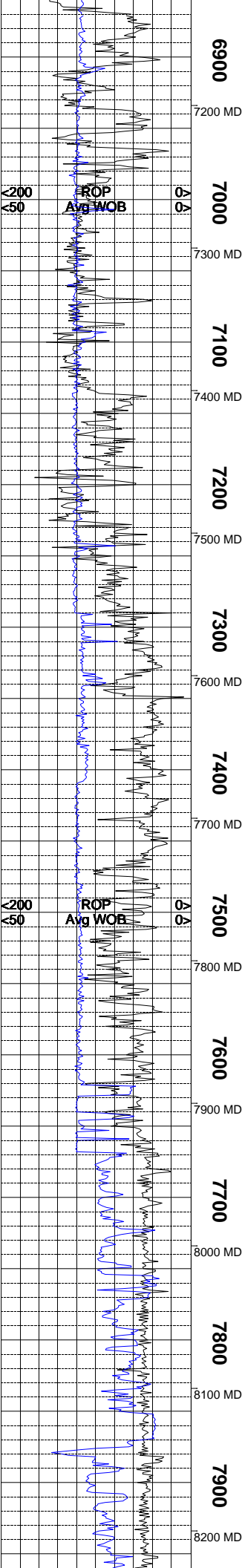
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Avg WOB

>325  
<0  
Ttl Gas  
CO2  
Flare Ht.

500x10  
10Kx10  
100x10  
<10  
<10

Meth C-1  
Ethn C-2  
Prop C-3  
Bum C-4  
Pen C-5

100K  
100K  
100K  
100K  
100K



FRIABLE TO MODERATELY HARD; CALCITE CEMENT; NO DISCERNIBLE BEDDING; NO VISIBLE POROSITY; LOW TO MODERATE GAS SHOWS.

SHALE = LIGHT GRAY TO MEDIUM LIGHT GRAY IN COLOR; BRITTLE TO CRUMBLY IN TENACITY BLOCKY TO PLANAR FRACTURE; CUTTINGS ARE SCALY TO ELONGATED IN APPEARANCE; WAXY TO DULL LUSTER EXHIBITED; CLAYEY TO SLIGHTLY SILTY TEXTURE; THIN STRUCTURE APPARENT.

SILTSTONE = LIGHT BROWNISH GRAY TO LIGHT GRAY IN COLOR; DENSE TO CRUMBLY IN TENACITY; IRREGULAR TO BLOCKY FRACTURE; CUTTINGS ARE NODULAR TO WEDGE LIKE IN APPEARANCE; EARTHY TO FROSTED LUSTER EXHIBITED; SILTY TO GRITTY IN TEXTURE; THICK STRUCTURE APPARENT.

SANDSTONE = LIGHT GRAY TO WHITE IN COLOR QUARTZ FRAMEWORK WITH 3 - 5% BLACK LITHIC FRAGMENTS GIVING A SALT AND PEPPER APPEARANCE; MEDIUM TO FINE GRAIN SIZE WITH SOME COARSE GRAINS; FAIR TO WELL SORTED; GRAINS ARE SUBANGULAR TO SUBROUNDED WITH MODERATE SPHERICITY; EASILY TO FIRMLY FRIABLE; CALCITE CEMENT NO VISIBLE POROSITY; MODERATE TO LOW GAS SHOWS.

NOTE = LOST RETURNS @ 7500'.

SHALE = PALE BLUE TO MEDIUM GRAY; TENACITY IS BRITTLE TO CRUMBLY; PLANAR TO SLIGHTLY BLOCKY FRACTURING; SCALY TO TABULAR CUTTINGS; DULL WO WAXY LUSTER; TEXTURE IS SMOOTH TO SILTY TO SLIGHTLY CLAYEY; THIN STRUCTURE.

SILTSTONE = LIGHT BROWNISH GRAY TO MEDIUM GRAY; DENSE TO BRITTLE TENACITY; FRACTURES FROM BLOCKY TO IRREGULAR; TABULAR TO WEDGE LIKE CUTTINGS; LUSTER RANGES FROM EARTHY TO DULL; TEXTURE IS SILTY TO GRITTY; THIN STRUCTURE.

SANDSTONE = TRANSLUCENT TO WHITE TO LIGHT GRAY; QUARTZ FRAMEWORK WITH SOME CRYSTAL CLEAR SILICA WICH INDICATES FRACTURING AND ABOUT 10% BLACK LITHIC CLASTS; FINE TO MEDIUM SIZED WITH FAIR TO WELL SORTING; SUBROUNDED TO SUBANGULAR WITH MODERATE TO LOW SPHERICITY; FIRMLY FRIABLE TO MODERATE HARDNESS WITH SOME LOOSE GRAINS; STRONG REACTION WITH HCL SUGGESTS CALCITE CEMENT; PYRITE AS ACCESSORY.

SHALE = LIGHT GRAY TO PALE BLUE; BRITTLE TO CRUNCHY TENACITY; FRACTURES FROM PLANAR TO IREGULAR; SCALY TO TABULAR CUTTINGS; DULL LUSTER; SMOOTH TEXTURE; THIN STRUCTURE.

NOTE = LOST COMPLETE RETURNS @ 7856'.

SILTSTONE = LIGHT GRAY TO MEDIUM GRAY IN COLOR; TOUGH TO DENSE IN TENACITY; PLANAR TO IRREGULAR FRACTURE; CUTTINGS ARE NODULAR TO WEDGE LIKE IN APPEARANCE; DULL TO EARTHY LUSTER EXHIBITED; SILTY TO CLAYEY TEXTURE; THIN STRUCTURE.

SANDSTONE = WHITE TO NEARLY COLORLESS IN COLOR; QUARTZ FRAMEWORK WITH CALCITE AND BLACK LITHIC FRAGMENTS PRESENT; COARSE TO VERY FINE GRAIN SIZE; POOR SORTING; GRAINS ARE ANGULAR TO SUBROUNDED WITH LOW TO MODERATE SPHERICITY; SILICA CEMENT; HARDNESS RENGES FROM FRIABLE TO MODERATELY HARD; NO VISIBLE POROSITY; LOW TO MODERATE GAS SHOWS FROM THIS SANDSTONE.

SHALE = GREENISH GRAY TO MEDIUM DARK GRAY IN COLOR; DENSE TO BRITTLE IN TENACITY; IRREGULAR TO CONCHOIDAL FRACTURE; CUTTINGS ARE WEDGE LIKE TO TABULAR IN HABIT; WAXY TO DULL LUSTER EXHIBITED; SMOOTH TO CLAYEY TEXTURE; THIN STRUCTURE APPARENT; NONCALCAREOUS.

SANDSTONE = LIGHT GRAY TO WHITE TO TRANSLUCENT; QUARTZ FRAMEWORK WITH MANY LOOSE GRAINS; MEDIUM TO FINE SIZED WITH FAIR TO WELL SORTING; SUBANGULAR TO SUBROUNDED; MODERATE SPHERICITY; FRIABLE TO MODERATE HARDNESS DEPENDING ON THE SPECIMEN; GRAIN SUPPORTED WITH CALCITE/ SILICEOUS CEMENT AS SUGGESTED BY A STRONG REACTION WITH HCL.

SHALE = MEDIUM DARK GRAY TO LIGHT GRAY; TENACITY IS DENSE TO CRUNCHY; FRACTURES FROM PLANAR TO SPLINTERY; TABULAR TO ELONGATED CUTTINGS; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; LAMINAE TO THIN STRUCTURE.

