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Houston, TX  
(281) 784-5500  
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New Iberia, LA  
(337) 364-2322  
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(907) 561-2465

# MUDLOG TVD

**COMPANY** ExxonMobil Production  
**WELL** FRU197-33B2  
**FIELD** FREEDOM RANCH  
**REGION** ROCKIES  
**COORDINATES** 39.921413000  
-108.282489000  
**ELEVATION** G.L: 6459.9'  
RKB: 30.2'  
**COUNTY, STATE** RIO BLANCO, CO  
**API INDEX** 051031142700  
**SPUD DATE** 3/19/2010  
**CONTRACTOR** HE  
**CO. REP.** W.GARNER  
**RIG/TYPE** HP321  
**LOGGING UNIT** MLU#31  
**GEOLOGISTS** B.DELANEY  
C.RECORD  
**ADD. PERSONS** M.FRANCO  
**CO. GEOLOGIST** C.ALBA

## LOG INTERVAL

## CASING DATA

**DEPTHS:** 4521' TO 12754'  
**DATES:** 06/06/2010 TO 06/17/2010  
**SCALE:** 1"=100'

16" AT 150'  
10.75" AT 4512'  
4.5" AT 12744'  
AT

## MUD TYPES

## HOLE SIZE

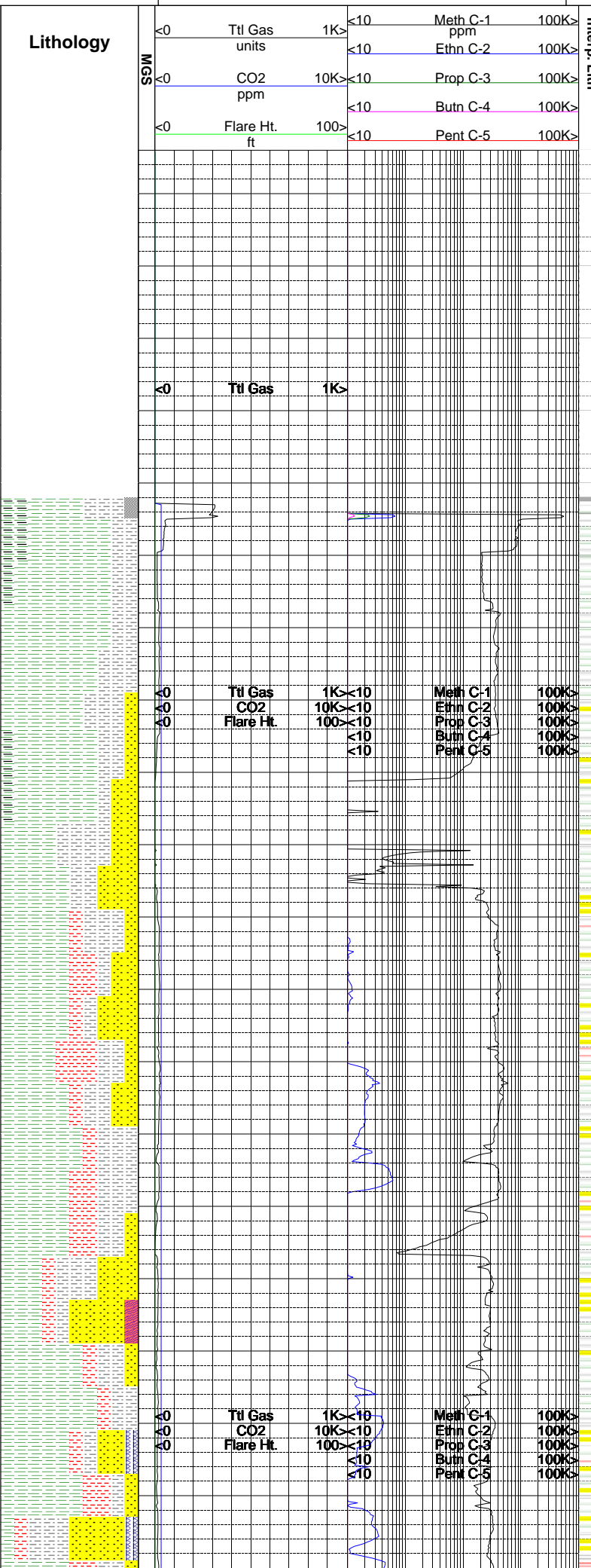
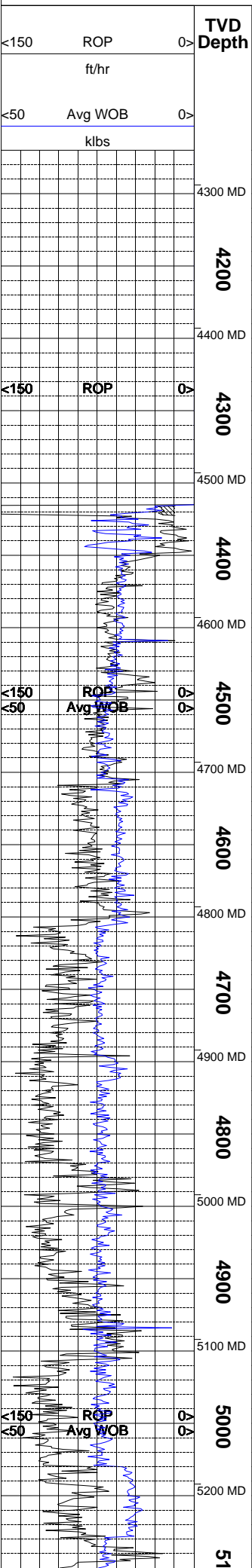
WATER-BASED TO 4521'  
LSND TO 12754'  
TO  
TO

14.75" TO 4521'  
8.9" TO 11870'  
7.875" TO 12754'  
TO

## ABBREVIATIONS

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

ALL SAMPLE COLOR DESCRIPTIONS REFERENCED TO THE G.S.A. ROCK COLOR CHART.

ROCK CHARACTERISTICS AND CONSTITUENTS ARE LISTED FROM MOST ABUNDANT TO LEAST ABUNDANT PERCENTAGE OF SAMPLE.

GAS CALIBRATED TO S.P.L.W.A. STANDARDS (2% ME = 100 UNITS). GAS CHROMATOGRAPHY EQUIPMENT CALIBRATED TO A TEST GAS COMPOSED OF THE FOLLOWING:

METHANE = 9,990 PPM  
 ETHANE = 1,010 PPM  
 PROPANE = 980 PPM  
 I-BUTANE = 1,000 PPM  
 N-BUTANE = 1,000 PPM  
 I-PENTANE = 1,000 PPM  
 N-PENTANE = 1,000 PPM

EPOCH WELL SERVICES COMMENCED LOGGING THE FRU 197-33B2 WELL ON 6/6/2010 @ 4522' MD.

CARBONACEOUS SHALE =BLACK TO BROWNISH BLACK TO OLIVE BLACK TO VERY DARK BROWNISH GRAY; SLIGHTLY DENSE TO MODERATELY TOUGH TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL VERY SLIGHTLY SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; POOR GRADE CARBONACEOUS SHALE VISIBLE BEDDING WITH POOR GRADE SHALE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SHALE = VERY LIGHT GRAY TO LIGHT GRAY TO MEDIUM LIGHT GRAY TO OCCASIONAL MOTTLING WITH GRAYISH RED PURPLE; VERY SLIGHTLY DENSE TO SLIGHTLY BRITTLE TO MODERATELY CRUMBLY TENACITY; IRREGULAR TO EARTHY-HACKLY FRACTURE; SUB-PLATY TO WEDGE LIKE CUTTINGS HABIT; SMOOTH TO CLAYEY TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

SILTSTONE = LIGHT GRAY TO LIGHT BLUISH GRAY; BRITTLE TO CRUMBLY TENACITY; SEMI HACKLY TO PREDOMINATELY BLOCKY FRACTURING; CUTTINGS TEND TO BE WEDGE-LIKE TO SEMI TABULAR IN HABIT; GREASY TO SLIGHT FROSTED LUSTER; GRITTY TO SILTY TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

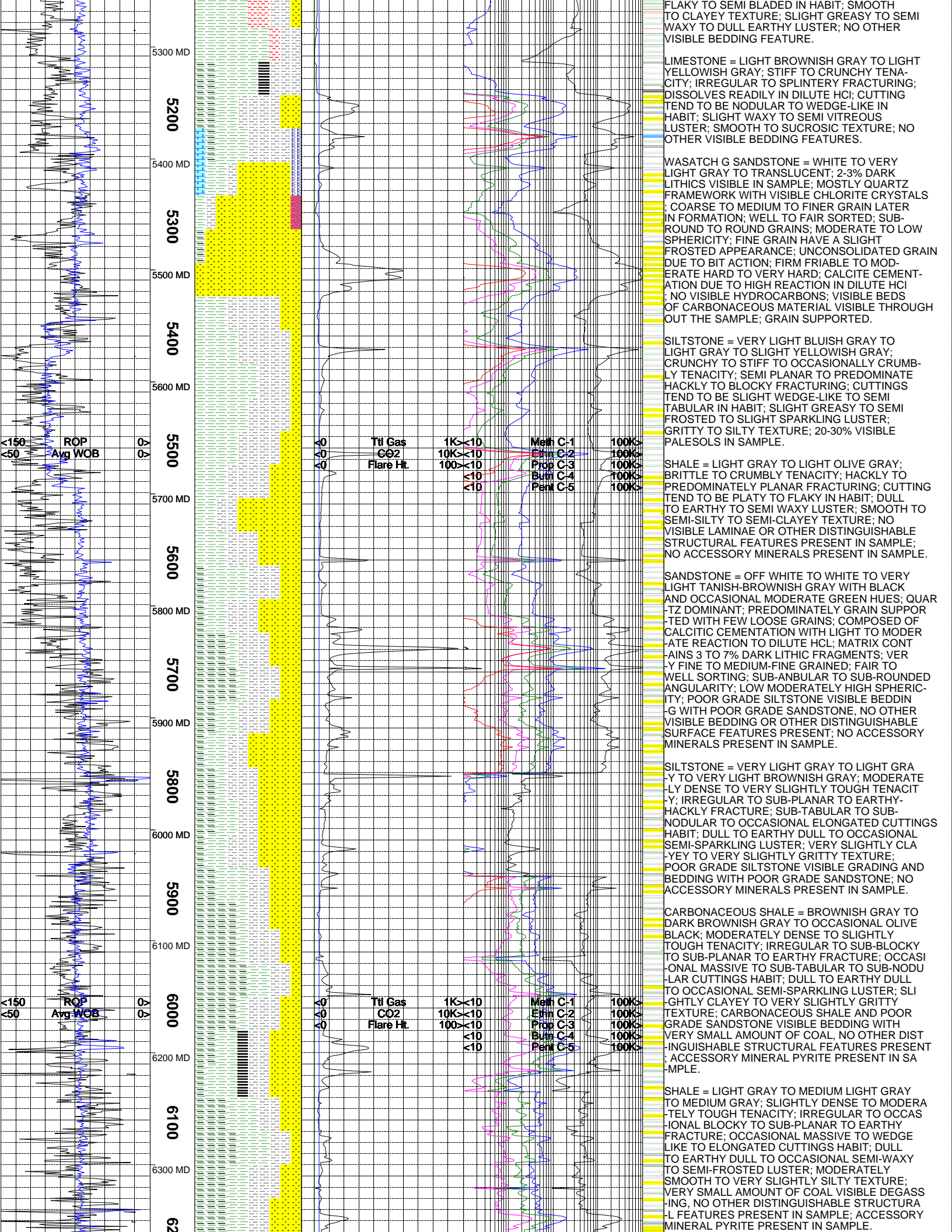
CLAYSTONE = LIGHT YELLOWISH GRAY TO LIGHT BROWNISH GRAY; NO VISIBLE FRACTURE IN SAMPLE; CUTTINGS TEND TO BE PLATY TO FLAKY TO OCCASIONALLY THINLY TABULAR; DULL EARTHY TO SEMI GREASY LUSTER; NO OTHER VISIBLE BEDDING FEATURES.

SHALE = VERY LIGHT GRAY TO A MOTTLED YELLOWISH GRAY DUE TO CHEMICAL WEATHERING IN SAMPLE; PREDOMINATELY PLANAR TO SLIGHT HACKLY FRACTURING; DULL TO EARTHY LUSTER; NO OTHER VISIBLE BEDDING FEATURES.

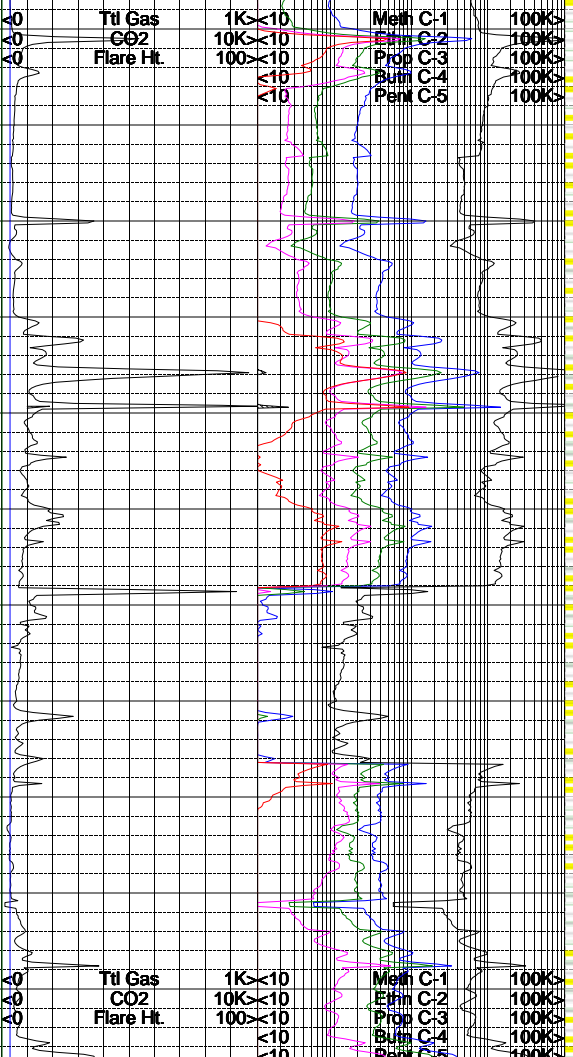
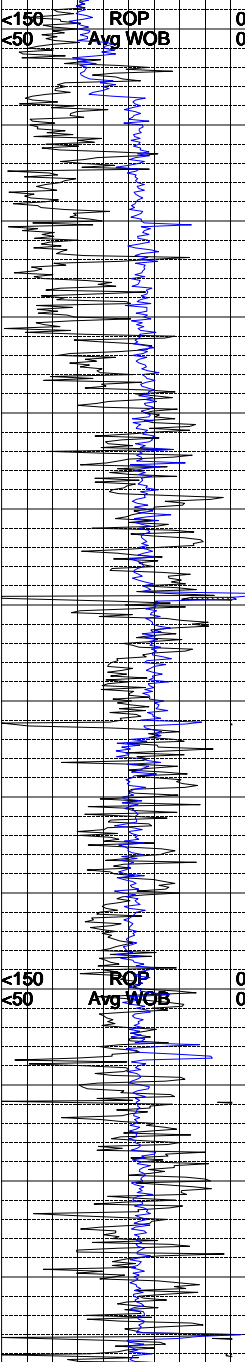
SANDSTONE = GRAYISH ORANGE PINK TO LIGHT BROWNISH GRAY; MOSTLY QUARTZ FRAMEWORK WITH 1-2% DARK LITHICS VISIBLE IN SAMPLE; SUBANGULAR TO ANGULAR GRAINS; FINE TO MEDIUM GRAIN SIZE; MODERATE TO LOW SPHERICITY; FIRM FRIABLE TO MODERATE HARD TO OCCASIONALLY FRIABLE; CALCITIC CEMENTATION DUE TO HIGH REACTION IN DILUTE HCL; VISIBLE CALCITE FRACTURE FILL IN SAMPLE; GRADES INTO A FINE GRAIN SILTSTONE.

SILTSTONE = LIGHT GREENISH GRAY TO LIGHT YELLOWISH GRAY; BRITTLE TO CRUNCHY TENACITY; PREDOMINATELY HACKLY TO SEMI PLANAR FRACTURING; CUTTINGS TEND TO BE PLATY TO WEDGE-LIKE TO OCCASIONALLY BLADED IN HABIT; SILTY TO SLIGHT GRITTY TEXTURE; SEMI GREASY TO SLIGHT FROSTED LUSTER; NAHCOLITE CRYSTALS VISIBLE THROUGH OUT THE SAMPLE.

SHALE = LIGHT GRAY TO LIGHT BROWNISH GRAY TO LIGHT OLIVE GRAY; BRITTLE TO CRUMBLY TO SLIGHT CRUNCHY TENACITY; SEMI HACKLY TO PREDOMINATELY PLANAR FRACTURING; CUTTINGS TEND TO BE PLATY TO SLIGHT



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6300 MD  
62



FLAKY TO SEMI BLADED IN HABIT; SMOOTH TO CLAYEY TEXTURE; SLIGHT GREASY TO SEMI WAXY TO DULL EARTHY LUSTER; NO OTHER VISIBLE BEDDING FEATURE.

LIMESTONE = LIGHT BROWNISH GRAY TO LIGHT YELLOWISH GRAY; STIFF TO CRUNCHY TENACITY; IRREGULAR TO SPLINTERY FRACTURING; DISSOLVES READILY IN DILUTE HCl; CUTTING TEND TO BE NODULAR TO WEDGE-LIKE IN HABIT; SLIGHT WAXY TO SEMI VITREOUS LUSTER; SMOOTH TO SUCROSIC TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

WASATCH G SANDSTONE = WHITE TO VERY LIGHT GRAY TO TRANSLUCENT; 2-3% DARK LITHICS VISIBLE IN SAMPLE; MOSTLY QUARTZ FRAMEWORK WITH VISIBLE CHLORITE CRYSTALS; COARSE TO MEDIUM TO FINER GRAIN LATER IN FORMATION; WELL TO FAIR SORTED; SUB-ROUND TO ROUND GRAINS; MODERATE TO LOW SPHERICITY; FINE GRAIN HAVE A SLIGHT FROSTED APPEARANCE; UNCONSOLIDATED GRAIN DUE TO BIT ACTION; FIRM FRIABLE TO MODERATE HARD TO VERY HARD; CALCITE CEMENTATION DUE TO HIGH REACTION IN DILUTE HCl; NO VISIBLE HYDROCARBONS; VISIBLE BEDS OF CARBONEOUS MATERIAL VISIBLE THROUGH OUT THE SAMPLE; GRAIN SUPPORTED.

SILTSTONE = VERY LIGHT BLUISH GRAY TO LIGHT GRAY TO SLIGHT YELLOWISH GRAY; CRUNCHY TO STIFF TO OCCASIONALLY CRUMBLY TENACITY; SEMI PLANAR TO PREDOMINATE HACKLY TO BLOCKY FRACTURING; CUTTINGS TEND TO BE SLIGHT WEDGE-LIKE TO SEMI TABULAR IN HABIT; SLIGHT GREASY TO SEMI FROSTED TO SLIGHT SPARKLING LUSTER; GRITTY TO SILTY TEXTURE; 20-30% VISIBLE PALESOLS IN SAMPLE.

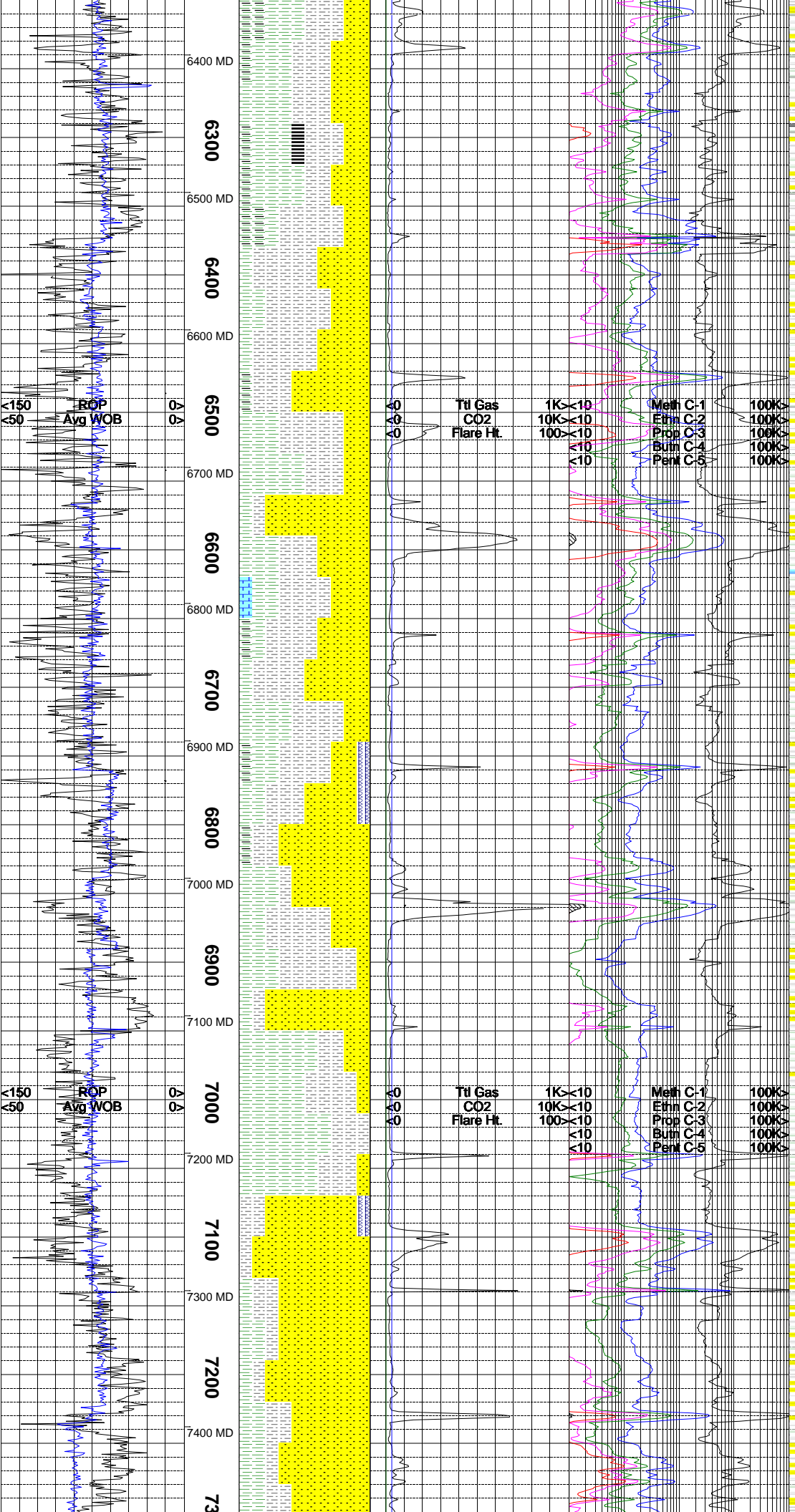
SHALE = LIGHT GRAY TO LIGHT OLIVE GRAY; BRITTLE TO CRUMBLY TENACITY; HACKLY TO PREDOMINATELY PLANAR FRACTURING; CUTTING TEND TO BE PLATY TO FLAKY IN HABIT; DULL TO EARTHY TO SEMI WAXY LUSTER; SMOOTH TO SEMI-SILTY TO SEMI-CLAYEY TEXTURE; NO VISIBLE LAMINAE OR OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = OFF WHITE TO WHITE TO VERY LIGHT TANISH-BROWNISH GRAY WITH BLACK AND OCCASIONAL MODERATE GREEN HUES; QUARTZ DOMINANT; PREDOMINATELY GRAIN SUPPORTED WITH FEW LOOSE GRAINS; COMPOSED OF CALCITIC CEMENTATION WITH LIGHT TO MODERATE REACTION TO DILUTE HCl; MATRIX CONTAINS 3 TO 7% DARK LITHIC FRAGMENTS; VERY FINE TO MEDIUM-FINE GRAINED; FAIR TO WELL SORTING; SUB-ANGULAR TO SUB-ROUNDED ANGULARITY; LOW MODERATELY HIGH SPHERICITY; POOR GRADE SILTSTONE VISIBLE BEDDING WITH POOR GRADE SANDSTONE. NO OTHER VISIBLE BEDDING OR OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SILTSTONE = VERY LIGHT GRAY TO LIGHT GRAY TO VERY LIGHT BROWNISH GRAY; MODERATELY DENSE TO VERY SLIGHTLY TOUGH TENACITY; IRREGULAR TO SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR TO OCCASIONAL ELONGATED CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; VERY SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; POOR GRADE SILTSTONE VISIBLE GRADING AND BEDDING WITH POOR GRADE SANDSTONE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONEOUS SHALE = BROWNISH GRAY TO DARK BROWNISH GRAY TO OCCASIONAL OLIVE BLACK; MODERATELY DENSE TO SLIGHTLY TOUGH TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; CARBONEOUS SHALE AND POOR GRADE SANDSTONE VISIBLE BEDDING WITH VERY SMALL AMOUNT OF COAL, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SHALE = LIGHT GRAY TO MEDIUM LIGHT GRAY TO MEDIUM GRAY; SLIGHTLY DENSE TO MODERATELY TOUGH TENACITY; IRREGULAR TO OCCASIONAL BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE TO ELONGATED CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-WAXY TO SEMI-FROSTED LUSTER; MODERATELY SMOOTH TO VERY SLIGHTLY SILTY TEXTURE; VERY SMALL AMOUNT OF COAL VISIBLE DEGASSING, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.



**SANDSTONE =** VERY LIGHT GRAY TO LIGHT GRAY TO OCCASIONAL MEDIUM LIGHT GRAY WITH BLACK HUES; QUARTZ DOMINATE; PREDOMINATELY GRAY GRAIN SUPPORTED WITH VERY FEW LOOSE GRAINS; CONTAINS CALCITIC CEMENT WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 5 TO 8% DARK LITHIC FRAGMENTS; MEDIUM TO MEDIUM-COARSE GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; POOR GRADE SILTSTONE VISIBLE IN SANDSTONE.

**SILTSTONE =** LIGHT OLIVE GRAY TO MEDIUM LIGHT GRAY TO MEDIUM GRAY; CRUNCHY TO STIFF TO OCCASIONALLY CRUMBLY TENACITY; IRREGULAR TO PLANAR TO PREDOMINATELY HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SEMI TABULAR IN HABIT; SLIGHT FROSTED TO SEMI GREASY TO DULL EARTHY LUSTER; SILTY TO SEMI GRITTY TEXTURE; VISIBLE PYRITE VEINS IN CARBONACEOUS SHALE BEDS; NO OTHER VISIBLE BEDDING FEATURES.

**SHALE =** LIGHT MEDIUM GRAY TO LIGHT BLuish GRAY; BRITTLE TO CRUMBLY TO SLIGHT CRUNCHY TENACITY; PREDOMINATELY PLANAR TO SLIGHT BLOCKY FRACTURING; CUTTINGS TEND TO BE WEDGE-LIKE TO SEMI ELONGATED TABULAR IN HABIT; DULL EARTHY TO SEMI WAXY TO SLIGHT GREASY LUSTER; SMOOTH TO SLIGHT SILTY TO SEMI CLAYEY TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

**SANDSTONE =** WHITE TO TRANSLUCENT TO VERY LIGHT GRAY; MOSTLY QUARTZ FRAMEWORK WITH A 1-3% OF LIGHT GREEN CHLORITE CRYSTALS VISIBLE IN SAMPLE; MOSTLY COARSE TO VERY COARSE TO OCCASIONALLY MEDIUM GRAIN SIZE; UNCONSOLIDATED GRAINS DUE TO BIT ACTION; FIRM FRIABLE TO MODERATE HARD; CALCITE CEMENTATION DUE TO MODERATE TO HIGH REACTION IN DILUTE HCL; POOR TO FAIR TO WELL SORTED; SUBROUND TO ROUND GRAINS; LOW TO MODERATE SPHERICITY; GRAINS HAVE A SLIGHT POLISH APPEARANCE; GRAIN SUPPORTED; NO VISIBLE HYDROCARBONS IN SAMPLE; VISIBLE CARBONACEOUS MATERIAL IN SAMPLE.

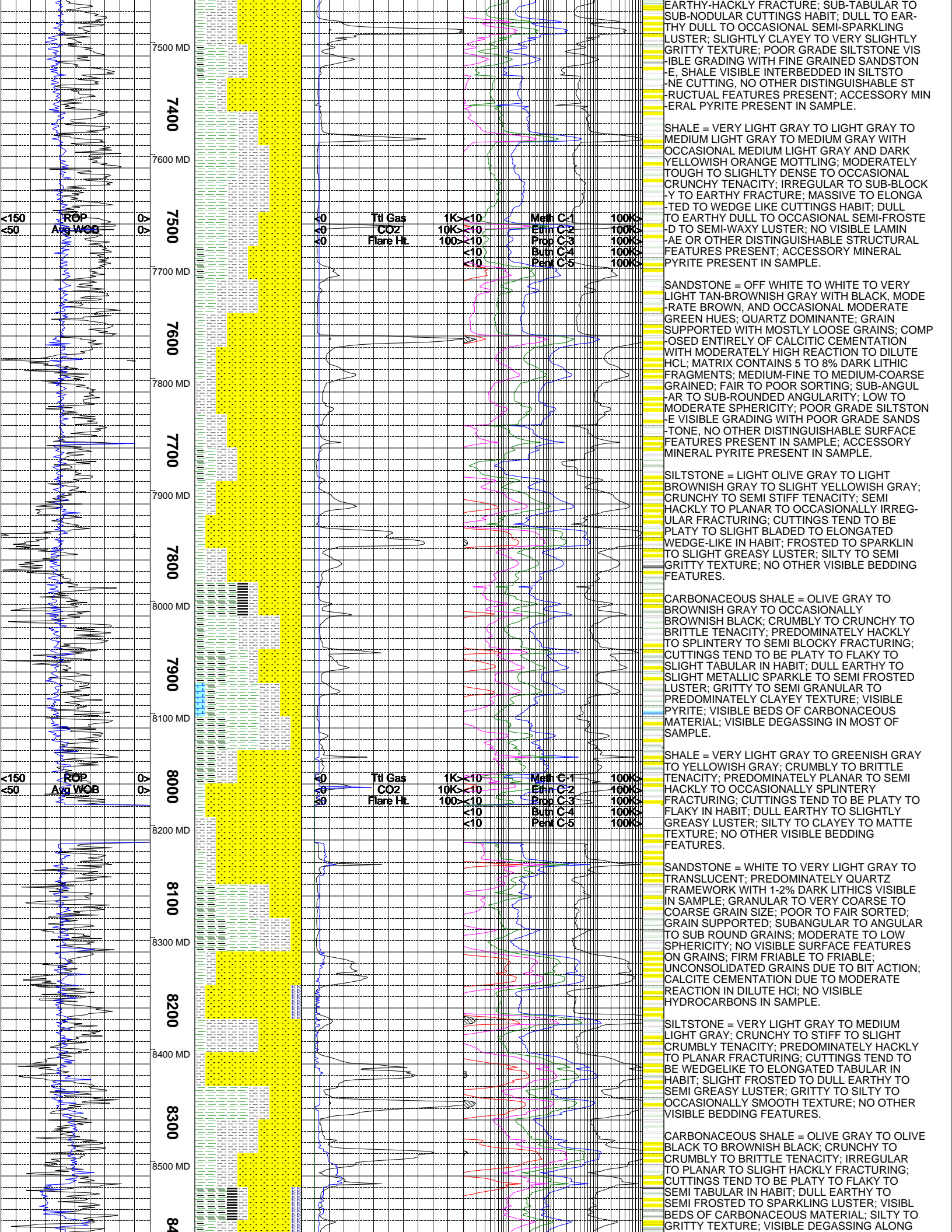
**SHALE =** LIGHT BLuish GRAY TO LIGHT GRAY TO VERY LIGHT GRAY; PREDOMINATELY BRITTLE TO CRUMBLY TO OCCASIONALLY CRUNCHY TENACITY; PLANAR TO HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SLIGHTLY NODULAR; DULL EARTHY TO SEMI GREASY TO SLIGHT SPARKLING LUSTER; SILTY TO CLAYEY TO MATTE TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

**CARBONACEOUS SHALE =** LIGHT OLIVE GRAY TO LIGHT BROWNISH GRAY TO BROWNISH GRAY; VISIBLE BEDS OF CARBONACEOUS MATERIAL VISIBLE THROUGH OUT THE SAMPLE; CRUMBLY TO CRUNCHY TO SLIGHTLY BRITTLE TENACITY; PLANAR TO SEMI BLOCKY TO OCCASIONALLY HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO SEMI WEDGE-LIKE TO ELONGATED TABULAR IN HABIT; DULL TO SLIGHT GREASY TO SPARKLING TO SEMI FROSTED LUSTER; SILTY TO GRITTY TO OCCASIONALLY SMOOTH TEXTURE; VISIBLE DEGASSING ALONG CARBONACEOUS MATERIAL BEDS; VISIBLE PYRITE BANDS IN MOST OF SAMPLE.

**SHALE =** VERY LIGHT GRAY TO MEDIUM LIGHT GRAY TO LIGHT BLuish GRAY; CRUMBLY TO BRITTLE TENACITY; PREDOMINATELY PLANAR TO SLIGHT HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SLIGHT WEDGE-LIKE IN HABIT; SLIGHT FROSTED TO SEMI GREASY TO DULL EARTHY LUSTER; SILTY TO CLAYEY TO MATTE TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

**OHIO CREEK SANDSTONE =** WHITE TO VERY LIGHT GRAY TO TRANSLUCENT; 2-3% DARK LITHICS VISIBLE IN SAMPLE; MOSTLY QUARTZ FRAMEWORK; VERY COARSE TO COARSE GRAIN SIZE; SUB ANGULAR TO SUBROUND GRAINS; MODERATE TO LOW SPHERICITY; GRAINS HAVE A SLIGHT PITTED APPEARANCE; GRAIN SUPPORTED WITH MOSTLY LOOSE GRAINS; CONTAINS CALCITIC CEMENTATION WITH MODERATELY HIGH REACTION TO DILUTE HCL; FAIR TO POOR SORTING; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, POOR GRADE SILTSTONE VISIBLE BEDDING WITH SHALE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; ACCESSORY MINERAL PYRITE VISIBLY IN CONTACT WITH SHALE CUTTING IN SAMPLE.

**SILTSTONE =** VERY LIGHT GRAY TO LIGHT GRAY TO OCCASIONAL LIGHT BLuish TO LIGHT GREENISH GRAY; SLIGHTLY DENSE TO SLIGHTLY BRITTLE TO SLIGHTLY CRUMBLY TO CRUNCHY TENACITY; IRREGULAR TO SUB-PLANAR TO



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8200  
8400 MD  
8300  
8500 MD  
8400

ROP  
Avg WGB

Ttl Gas  
CO2  
Flare Ht

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

1K < 10  
10K < 10  
100 < 10  
< 10  
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EARTHLY HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHLY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; POOR GRADE SILTSTONE VISIBLE GRADING WITH FINE GRAINED SANDSTONE, SHALE VISIBLE INTERBEDDED IN SILTSTONE CUTTING, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SHALE = VERY LIGHT GRAY TO LIGHT GRAY TO MEDIUM LIGHT GRAY TO MEDIUM GRAY WITH OCCASIONAL MEDIUM LIGHT GRAY AND DARK YELLOWISH ORANGE MOTTLING; MODERATELY TOUGH TO SLIGHTLY DENSE TO OCCASIONAL CRUNCHY TENACITY; IRREGULAR TO SUB-BLOCKY TO EARTHLY FRACTURE; MASSIVE TO ELONGATED TO WEDGE LIKE CUTTINGS HABIT; DULL TO EARTHLY DULL TO OCCASIONAL SEMI-FROSTED TO SEMI-WAXY LUSTER; NO VISIBLE LAMINAE OR OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SANDSTONE = OFF WHITE TO WHITE TO VERY LIGHT TAN-BROWNISH GRAY WITH BLACK, MODERATE BROWN, AND OCCASIONAL MODERATE GREEN HUES; QUARTZ DOMINANT; GRAIN SUPPORTED WITH MOSTLY LOOSE GRAINS; COMPOSED ENTIRELY OF CALCITIC CEMENTATION WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 5 TO 8% DARK LITHIC FRAGMENTS; MEDIUM-FINE TO MEDIUM-COARSE GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, NO OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT IN SAMPLE; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SILTSTONE = LIGHT OLIVE GRAY TO LIGHT BROWNISH GRAY TO SLIGHT YELLOWISH GRAY; CRUNCHY TO SEMI STIFF TENACITY; SEMI HACKLY TO PLANAR TO OCCASIONALLY IRREGULAR FRACTURING; CUTTINGS TEND TO BE PLATY TO SLIGHT BLADED TO ELONGATED WEDGE-LIKE IN HABIT; FROSTED TO SPARKLING TO SLIGHT GREASY LUSTER; SILTY TO SEMI GRITTY TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

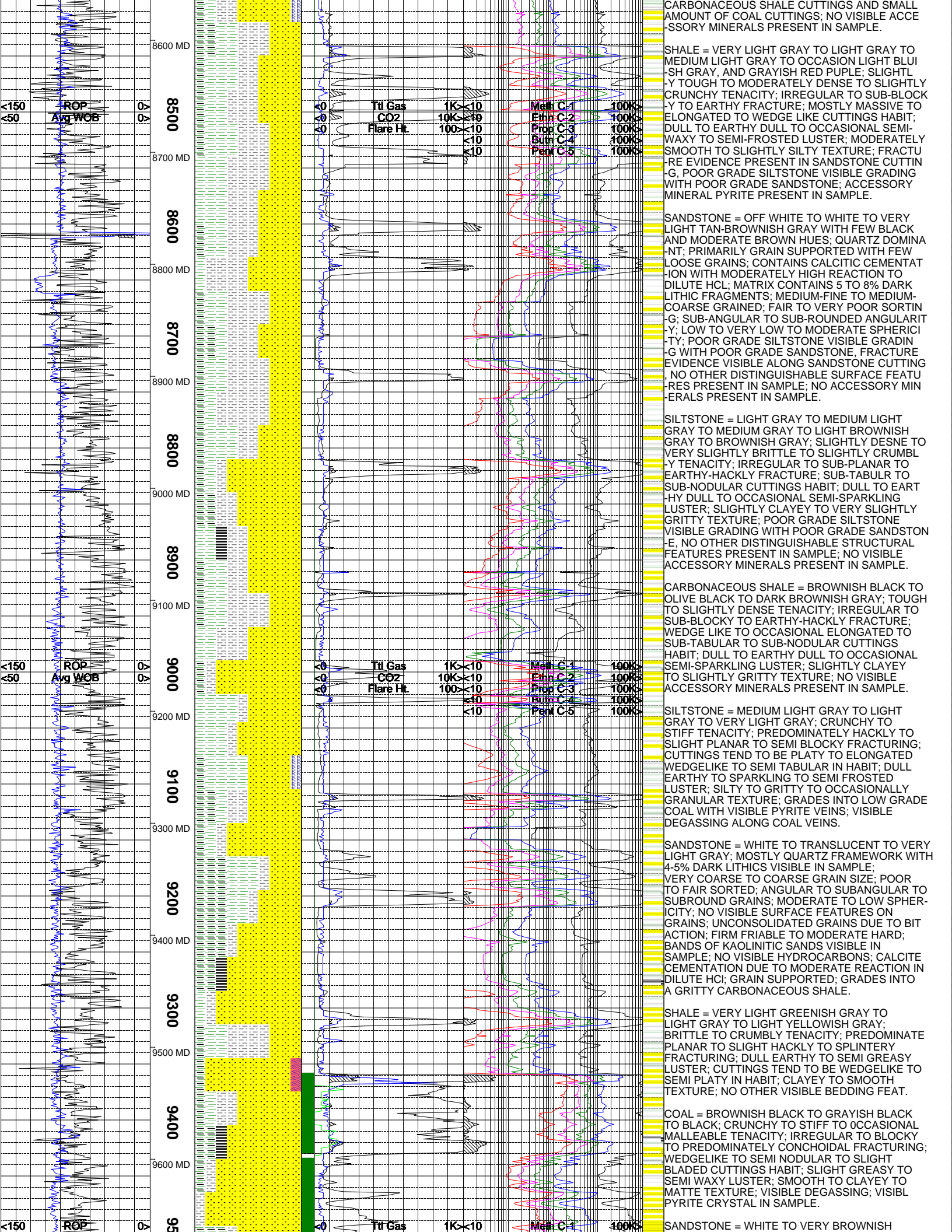
CARBONACEOUS SHALE = OLIVE GRAY TO BROWNISH GRAY TO OCCASIONALLY BROWNISH BLACK; CRUMBLY TO CRUNCHY TO BRITTLE TENACITY; PREDOMINATELY HACKLY TO SPLINTERY TO SEMI BLOCKY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SLIGHT TABULAR IN HABIT; DULL EARTHLY TO SLIGHT METALLIC SPARKLE TO SEMI FROSTED LUSTER; GRITTY TO SEMI GRANULAR TO PREDOMINATELY CLAYEY TEXTURE; VISIBLE PYRITE; VISIBLE BEDS OF CARBONACEOUS MATERIAL; VISIBLE DEGASSING IN MOST OF SAMPLE.

SHALE = VERY LIGHT GRAY TO GREENISH GRAY TO YELLOWISH GRAY; CRUMBLY TO BRITTLE TENACITY; PREDOMINATELY PLANAR TO SEMI HACKLY TO OCCASIONALLY SPLINTERY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY IN HABIT; DULL EARTHLY TO SLIGHTLY GREASY LUSTER; SILTY TO CLAYEY TO MATTE TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

SANDSTONE = WHITE TO VERY LIGHT GRAY TO TRANSLUCENT; PREDOMINATELY QUARTZ FRAMEWORK WITH 1-2% DARK LITHICS VISIBLE IN SAMPLE; GRANULAR TO VERY COARSE TO COARSE GRAIN SIZE; POOR TO FAIR SORTED; GRAIN SUPPORTED; SUBANGULAR TO ANGULAR TO SUB ROUND GRAINS; MODERATE TO LOW SPHERICITY; NO VISIBLE SURFACE FEATURES ON GRAINS; FIRM FRIABLE TO FRIABLE; UNCONSOLIDATED GRAINS DUE TO BIT ACTION; CALCITE CEMENTATION DUE TO MODERATE REACTION IN DILUTE HCL; NO VISIBLE HYDROCARBONS IN SAMPLE.

SILTSTONE = VERY LIGHT GRAY TO MEDIUM LIGHT GRAY; CRUNCHY TO STIFF TO SLIGHT CRUMBLY TENACITY; PREDOMINATELY HACKLY TO PLANAR FRACTURING; CUTTINGS TEND TO BE WEDGELIKE TO ELONGATED TABULAR IN HABIT; SLIGHT FROSTED TO DULL EARTHLY TO SEMI GREASY LUSTER; GRITTY TO SILTY TO OCCASIONALLY SMOOTH TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

CARBONACEOUS SHALE = OLIVE GRAY TO OLIVE BLACK TO BROWNISH BLACK; CRUNCHY TO CRUMBLY TO BRITTLE TENACITY; IRREGULAR TO PLANAR TO SLIGHT HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SEMI TABULAR IN HABIT; DULL EARTHLY TO SEMI FROSTED TO SPARKLING LUSTER; VISIBLE BEDS OF CARBONACEOUS MATERIAL; SILTY TO GRITTY TEXTURE; VISIBLE DEGASSING ALONG



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9400 MD  
9600 MD  
9500 MD

Ttl Gas	1K < 10	Meth C-1	100K >
CO2	10K < 10	Eth C-2	100K >
Flare Ht	100 < 10	Prop C-3	100K >
	< 10	But C-4	100K >
	< 10	Pent C-5	100K >

Ttl Gas	1K < 10	Meth C-1	100K >
CO2	10K < 10	Eth C-2	100K >
Flare Ht	100 < 10	Prop C-3	100K >
	< 10	But C-4	100K >
	< 10	Pent C-5	100K >

Ttl Gas	1K < 10	Meth C-1	100K >
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SSORY MINERALS PRESENT IN SAMPLE.

SHALE = VERY LIGHT GRAY TO LIGHT GRAY TO MEDIUM LIGHT GRAY TO OCCASION LIGHT BLUI-SH GRAY, AND GRAYISH RED PURPLE; SLIGHTLY TOUGH TO MODERATELY DENSE TO SLIGHTLY CRUNCHY TENACITY; IRREGULAR TO SUB-BLOCKY TO EARTHY FRACTURE; MOSTLY MASSIVE TO ELONGATED TO WEDGE LIKE CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-WAXY TO SEMI-FROSTED LUSTER; MODERATELY SMOOTH TO SLIGHTLY SILTY TEXTURE; FRACTURE EVIDENCE PRESENT IN SANDSTONE CUTTING. POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SANDSTONE = OFF WHITE TO WHITE TO VERY LIGHT TAN-BROWNISH GRAY WITH FEW BLACK AND MODERATE BROWN HUES; QUARTZ DOMINANT; PRIMARILY GRAIN SUPPORTED WITH FEW LOOSE GRAINS; CONTAINS CALCITIC CEMENTATION WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 5 TO 8% DARK LITHIC FRAGMENTS; MEDIUM-FINE TO MEDIUM-COARSE GRAINED; FAIR TO VERY POOR SORTING; SUB-ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO VERY LOW TO MODERATE SPHERICITY; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, FRACTURE EVIDENCE VISIBLE ALONG SANDSTONE CUTTING. NO OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SILTSTONE = LIGHT GRAY TO MEDIUM LIGHT GRAY TO MEDIUM GRAY TO LIGHT BROWNISH GRAY TO BROWNISH GRAY; SLIGHTLY DENSE TO VERY SLIGHTLY BRITTLE TO SLIGHTLY CRUMBLY TENACITY; IRREGULAR TO SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE. NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO VISIBLE ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONACEOUS SHALE = BROWNISH BLACK TO OLIVE BLACK TO DARK BROWNISH GRAY; TOUGH TO SLIGHTLY DENSE TENACITY; IRREGULAR TO SUB-BLOCKY TO EARTHY-HACKLY FRACTURE; WEDGE LIKE TO OCCASIONAL ELONGATED TO SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO SLIGHTLY GRITTY TEXTURE; NO VISIBLE ACCESSORY MINERALS PRESENT IN SAMPLE.

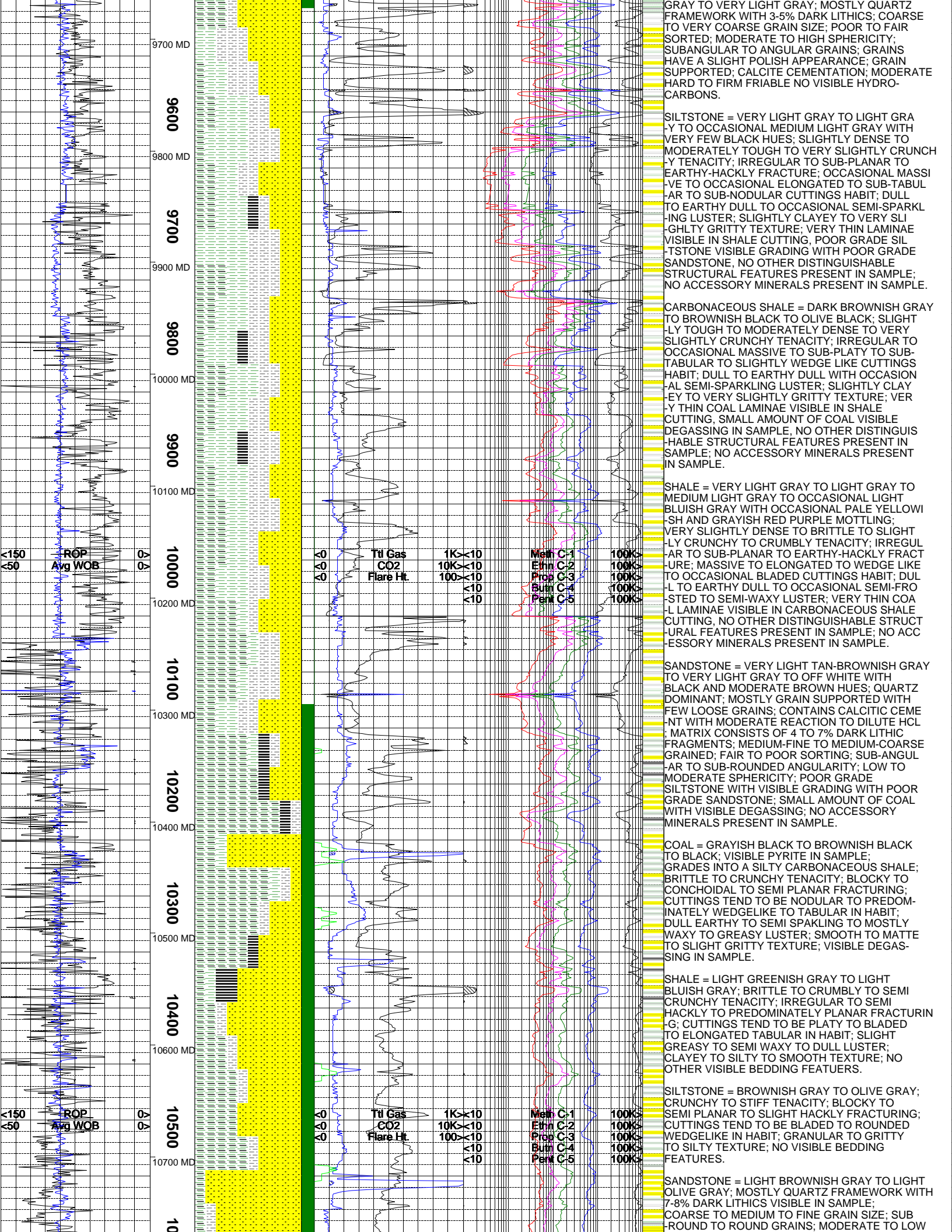
SILTSTONE = MEDIUM LIGHT GRAY TO LIGHT GRAY TO VERY LIGHT GRAY; CRUNCHY TO STIFF TENACITY; PREDOMINATELY HACKLY TO SLIGHT PLANAR TO SEMI BLOCKY FRACTURING; CUTTINGS TEND TO BE PLATY TO ELONGATED WEDGELIKE TO SEMI TABULAR IN HABIT; DULL EARTHY TO SPARKLING TO SEMI FROSTED LUSTER; SILTY TO GRITTY TO OCCASIONALLY GRANULAR TEXTURE; GRADES INTO LOW GRADE COAL WITH VISIBLE PYRITE VEINS; VISIBLE DEGASSING ALONG COAL VEINS.

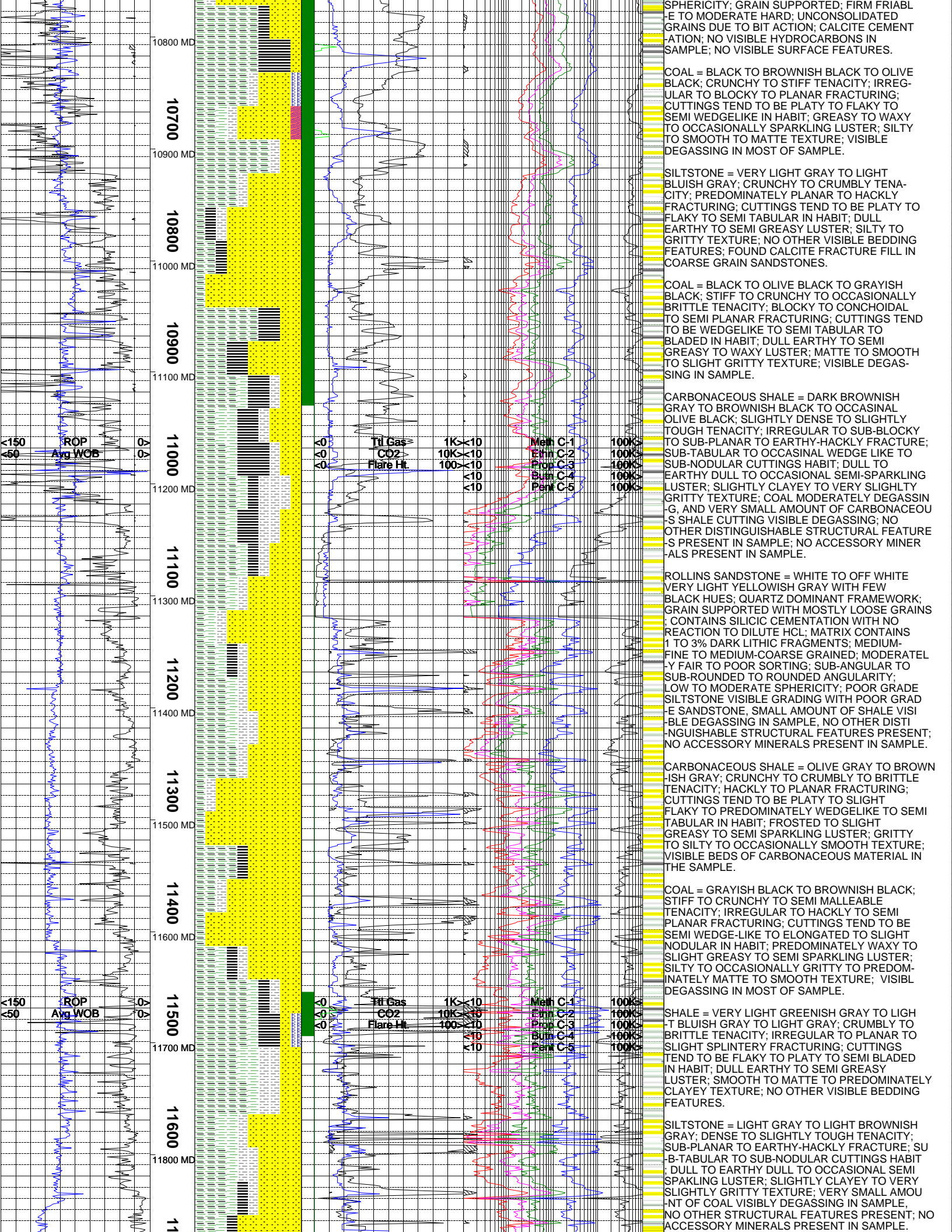
SANDSTONE = WHITE TO TRANSLUCENT TO VERY LIGHT GRAY; MOSTLY QUARTZ FRAMEWORK WITH 4-5% DARK LITHICS VISIBLE IN SAMPLE; VERY COARSE TO COARSE GRAIN SIZE; POOR TO FAIR SORTED; ANGULAR TO SUBANGULAR TO SUBROUND GRAINS; MODERATE TO LOW SPHERICITY; NO VISIBLE SURFACE FEATURES ON GRAINS; UNCONSOLIDATED GRAINS DUE TO BIT ACTION; FIRM FRIABLE TO MODERATE HARD; BANDS OF KAOLINITIC SANDS VISIBLE IN SAMPLE; NO VISIBLE HYDROCARBONS; CALCITE CEMENTATION DUE TO MODERATE REACTION IN DILUTE HCl; GRAIN SUPPORTED; GRADES INTO A GRITTY CARBONACEOUS SHALE.

SHALE = VERY LIGHT GREENISH GRAY TO LIGHT GRAY TO LIGHT YELLOWISH GRAY; BRITTLE TO CRUMBLY TENACITY; PREDOMINATE PLANAR TO SLIGHT HACKLY TO SPLINTERY FRACTURING; DULL EARTHY TO SEMI GREASY LUSTER; CUTTINGS TEND TO BE WEDGELIKE TO SEMI PLATY IN HABIT; CLAYEY TO SMOOTH TEXTURE; NO OTHER VISIBLE BEDDING FEAT.

COAL = BROWNISH BLACK TO GRAYISH BLACK TO BLACK; CRUNCHY TO STIFF TO OCCASIONAL MALLEABLE TENACITY; IRREGULAR TO BLOCKY TO PREDOMINATELY CONCHOIDAL FRACTURING; WEDGELIKE TO SEMI NODULAR TO SLIGHT BLADED CUTTINGS HABIT; SLIGHT GREASY TO SEMI WAXY LUSTER; SMOOTH TO CLAYEY TO MATTE TEXTURE; VISIBLE DEGASSING; VISIBLE PYRITE CRYSTAL IN SAMPLE.

SANDSTONE = WHITE TO VERY BROWNISH





10800 MD  
10700  
10900 MD  
10800  
11000 MD  
10900  
11100 MD  
11000  
11200 MD  
11100  
11300 MD  
11200  
11400 MD  
11300  
11500 MD  
11400  
11600 MD  
11500  
11700 MD  
11600  
11800 MD

ROP  
Avg WOB

CH<sub>4</sub>  
CO<sub>2</sub>  
Flare Ht

1K < 10  
10K < 10  
100 < 10

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

100%  
100%  
100%  
100%  
100%

SPHERICITY; GRAIN SUPPORTED; FIRM FRIABLE TO MODERATE HARD; UNCONSOLIDATED GRAINS DUE TO BIT ACTION; CALCITE CEMENTATION; NO VISIBLE HYDROCARBONS IN SAMPLE; NO VISIBLE SURFACE FEATURES.

COAL = BLACK TO BROWNISH BLACK TO OLIVE BLACK; CRUNCHY TO STIFF TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SEMI WEDGELIKE IN HABIT; GREASY TO WAXY TO OCCASIONALLY SPARKLING LUSTER; SILTY TO SMOOTH TO MATTE TEXTURE; VISIBLE DEGASSING IN MOST OF SAMPLE.

SILTSTONE = VERY LIGHT GRAY TO LIGHT BLuish GRAY; CRUNCHY TO CRUMBLY TENACITY; PREDOMINATELY PLANAR TO HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO SEMI TABULAR IN HABIT; DULL EARTHY TO SEMI GREASY LUSTER; SILTY TO GRITTY TEXTURE; NO OTHER VISIBLE BEDDING FEATURES; FOUND CALCITE FRACTURE FILL IN COARSE GRAIN SANDSTONES.

COAL = BLACK TO OLIVE BLACK TO GRAYISH BLACK; STIFF TO CRUNCHY TO OCCASIONAL BRITTLE TENACITY; BLOCKY TO CONCHOIDAL TO SEMI PLANAR FRACTURING; CUTTINGS TEND TO BE WEDGELIKE TO SEMI TABULAR TO BLADED IN HABIT; DULL EARTHY TO SEMI GREASY TO WAXY LUSTER; MATTE TO SMOOTH TO SLIGHT GRITTY TEXTURE; VISIBLE DEGASSING IN SAMPLE.

CARBONACEOUS SHALE = DARK BROWNISH GRAY TO BROWNISH BLACK TO OCCASIONAL OLIVE BLACK; SLIGHTLY DENSE TO SLIGHTLY TOUGH TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO OCCASIONAL WEDGE LIKE TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; COAL MODERATELY DEGASSING, AND VERY SMALL AMOUNT OF CARBONACEOUS SHALE CUTTING VISIBLE DEGASSING; NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

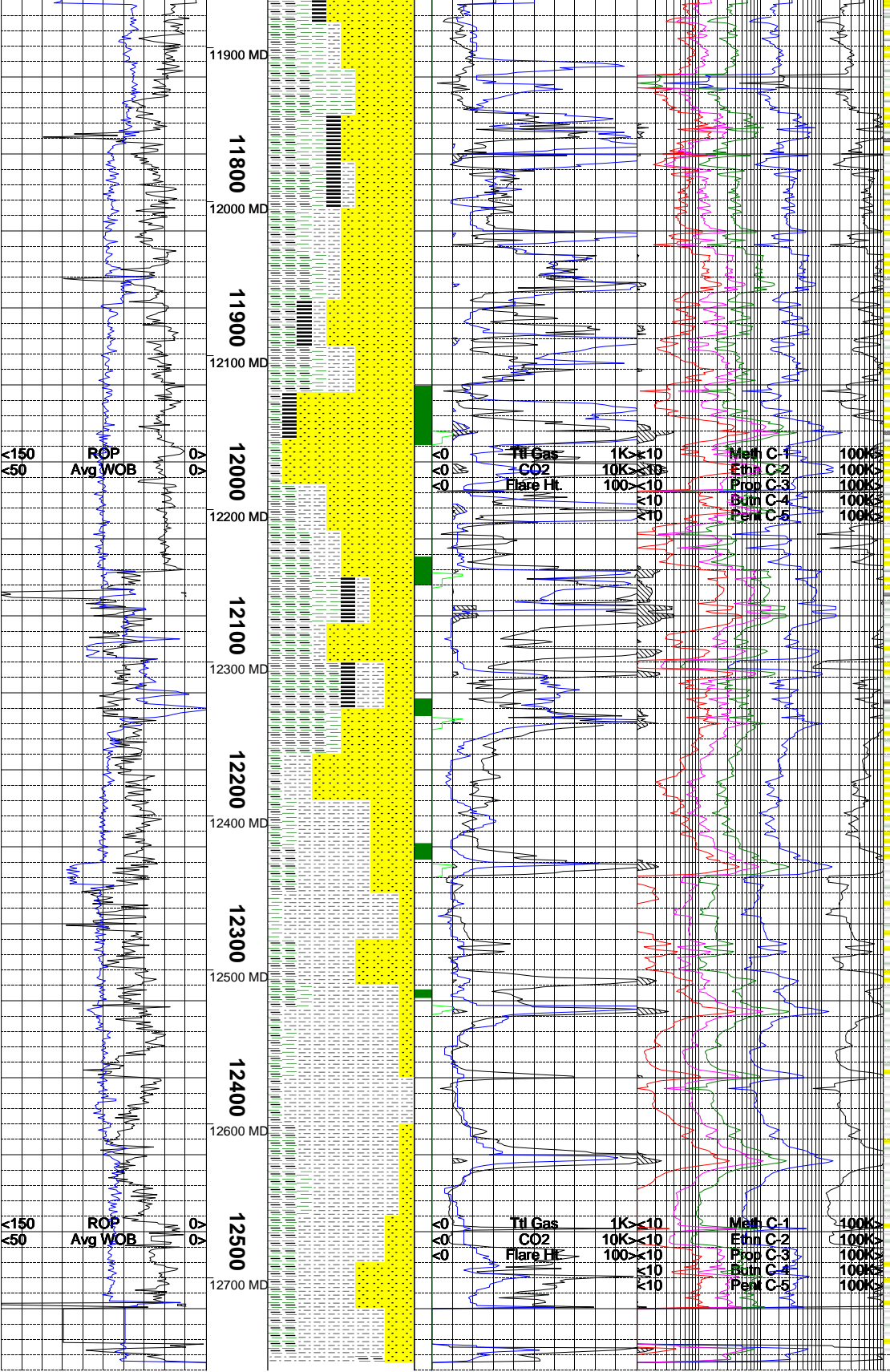
ROLLINS SANDSTONE = WHITE TO OFF WHITE VERY LIGHT YELLOWISH GRAY WITH FEW BLACK HUES; QUARTZ DOMINANT FRAMEWORK; GRAIN SUPPORTED WITH MOSTLY LOOSE GRAINS; CONTAINS SILICIC CEMENTATION WITH NO REACTION TO DILUTE HCL; MATRIX CONTAINS 1 TO 3% DARK LITHIC FRAGMENTS; MEDIUM-FINE TO MEDIUM-COARSE GRAINED; MODERATELY FAIR TO POOR SORTING; SUB-ANGULAR TO SUB-ROUNDED TO ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, SMALL AMOUNT OF SHALE VISIBLE DEGASSING IN SAMPLE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONACEOUS SHALE = OLIVE GRAY TO BROWNISH GRAY; CRUNCHY TO CRUMBLY TO BRITTLE TENACITY; HACKLY TO PLANAR FRACTURING; CUTTINGS TEND TO BE PLATY TO FLAKY TO PREDOMINATELY WEDGELIKE TO SEMI TABULAR IN HABIT; FROSTED TO SLIGHT GREASY TO SEMI SPARKLING LUSTER; GRITTY TO SILTY TO OCCASIONALLY SMOOTH TEXTURE; VISIBLE BEDS OF CARBONACEOUS MATERIAL IN THE SAMPLE.

COAL = GRAYISH BLACK TO BROWNISH BLACK; STIFF TO CRUNCHY TO SEMI MALLEABLE TENACITY; IRREGULAR TO HACKLY TO SEMI PLANAR FRACTURING; CUTTINGS TEND TO BE SEMI WEDGE-LIKE TO ELONGATED TO SLIGHT NODULAR IN HABIT; PREDOMINATELY WAXY TO SLIGHT GREASY TO SEMI SPARKLING LUSTER; SILTY TO OCCASIONALLY GRITTY TO PREDOMINATELY MATTE TO SMOOTH TEXTURE; VISIBLE DEGASSING IN MOST OF SAMPLE.

SHALE = VERY LIGHT GREENISH GRAY TO LIGHT BLuish GRAY TO LIGHT GRAY; CRUMBLY TO BRITTLE TENACITY; IRREGULAR TO PLANAR TO SLIGHT SPLINTERY FRACTURING; CUTTINGS TEND TO BE FLAKY TO PLATY TO SEMI BLADED IN HABIT; DULL EARTHY TO SEMI GREASY LUSTER; SMOOTH TO MATTE TO PREDOMINATELY CLAYEY TEXTURE; NO OTHER VISIBLE BEDDING FEATURES.

SILTSTONE = LIGHT GRAY TO LIGHT BROWNISH GRAY; DENSE TO SLIGHTLY TOUGH TENACITY; SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; VERY SMALL AMOUNT OF COAL VISIBLY DEGASSING IN SAMPLE, NO OTHER STRUCTURAL FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.



SANDSTONE = OFF WHITE TO VERY LIGHT GRAY TO VERY TAN-BROWNISH GRAY; QUARTZ DOMINATION; MATRIX CONSISTS OF 7 TO 9% DARK LITHIC FRAGMENTS; MOSTLY GRAIN SUPPORTED WITH FEW LOOSE GRAINS; QUARTZ CUTTINGS RANGE FROM TRANSLUCENT TO MOSTLY SMOKY; MEDIUM-FINE TO FINE GRAINED; POOR TO MODERATELY WELL SORTING; SUB-ANGULAR TO SUB-ROUNDED TO ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; SMALL AMOUNT OF COAL VISIBLE DEGASSING IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONACEOUS SHALE = VERY DARK BROWNISH GRAY TO BROWNISH BLACK TO OCCASIONAL OLIVE BLACK; SLIGHTLY DENSE TO SLIGHTLY TOUGH TENACITY; IRREGULAR TO SUB-PLANAR TO SUB-BLOCKY TO EARTHY FRACTURE; SUB-TABULAR TO SUB-NODULAR TO OCCASIONAL WEDGE LIKE CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; VERY SMALL AMOUNT OF COAL VISIBLE DEGASSING IN SAMPLE; ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SANDSTONE = WHITE TO TRANSLUCENT TO VERY LIGHT GRAY TO LIGHT BROWNISH GRAY; MOSTLY QUARTZ FRAMEWORK WITH 2-3% DARK LITHICS VISIBLE IN SAMPLE; VERY COARSE TO COARSE TO OCCASIONALLY FINE GRAIN; WELL TO VERY WELL SORTED; SUBROUND TO ROUND GRAINS; MODERATE TO LOW SPHERICITY; GRAINS HAVE A SLIGHT POLISH APPEARANCE; A SILICIOUS CEMENT DUE TO LOW REACTION IN DILUTE HCl; GRAIN SUPPORTED; NO VISIBLE HYDROCARBONS; LESS THAN 1% KAOLINITIC SANDS VISIBLE IN SAMPLE.

SHALE = VERY LIGHT GREENISH GRAY TO LIGHT GRAY TO SEMI LIGHT BLUISH GRAY; BRITTLE TO CRUMBLY TENACITY; HACKLY TO PREDOMINATELY PLANAR TO SLIGHT BLOCKY FRACTURING; CUTTINGS TEND TO BE WEDGE-LIKE TO SEMI ELONGATED TABULAR IN HABIT; SEMI GREASY TO DULL EARTHY LUSTER; SILTY TO SMOOTH TO SLIGHT CLAYEY TEXTURE.

CARBONACEOUS SHALE = BROWNISH GRAY TO LIGHT OLIVE GRAY; VISIBLE BANDS OF CARBONACEOUS MATERIAL; CRUNCHY TO STIFF TO SLIGHT CRUMBLY TENACITY; IRREGULAR TO BLOCKY TO SEMI HACKLY FRACTURING; CUTTINGS TEND TO BE PLATY TO ELONGATED TABULAR IN HABIT; PREDOMINATELY GREASY TO SEMI WAXY TO SLIGHT FROSTED TO SPARKLING LUSTER; PREDOMINATELY GRITTY TO SILTY TO SEMI GRANULAR TEXTURE; NO OTHER VISIBLE BEDDING FEATURES OR ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = WHITE TO LIGHT GRAY TO LIGHT BROWNISH GRAY; MOSTLY QUARTZ FRAMEWORK WITH 3-6% DARK LITHICS VISIBLE IN SAMPLE; KAOLINITIC SANDS MAKE UP THE MATRIX FOR 4-5% OF THE SAMPLE; MOSTLY GRAIN SUPPORTED WITH FEW LOOSE GRAINS; MEDIUM-FINE TO MEDIUM GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; NO VISIBLE SURFACE FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CORCORAN MARINE SILTSTONE = LIGHT BROWNISH GRAY TO MEDIUM BROWN TO BROWNISH GRAY; MODERATELY DENSE TO CRUNCHY TENACITY; SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO SEMI-WEDGE LIKE TO SUB-TABULAR CUTTINGS HABIT; DULL TO EARTHY DULL LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; NO VISIBLE BEDDING OR OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

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