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MUDLOG TVD

COMPANY ExxonMobil Production

WELL PCU 296-5A01

FIELD Piceance Creek Unit

REGION Rocky Mountain

COORDINATES 39.912053000
108.198567000

ELEVATION 7295.5'

COUNTY, STATE Rio Blanco, CO

API INDEX 051031124800

SPUD DATE 10/21/2009

CONTRACTOR Helmerich and Payne

CO. REP. C.Curtis/ M. Hudon

RIG/TYPE 321 / Flex 4

LOGGING UNIT 031

GEOLOGISTS M. Franco
C. Record/ B.Smelsor

ADD. PERSONS M.Piper
R.McCane

CO. GEOLOGIST Nova Roosmawati

LOG INTERVAL

CASING DATA

DEPTHS: 4665' TO 14288'

DATES: 09/06/2010 TO 10/05/2010

SCALE: 1" = 100'

16.0" AT 150'

10.75" AT 4633'

7.0" AT 10105'

4.5" AT 14265'

MUD TYPES

HOLE SIZE

WATERBASED TO 14288'

TO

TO

TO

TO

14.75" TO 126'

9.875" TO 10119'

6.125" TO 14288'

TO

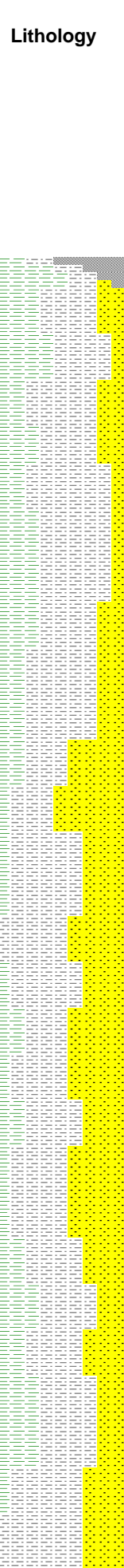
ABBREVIATIONS

<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	

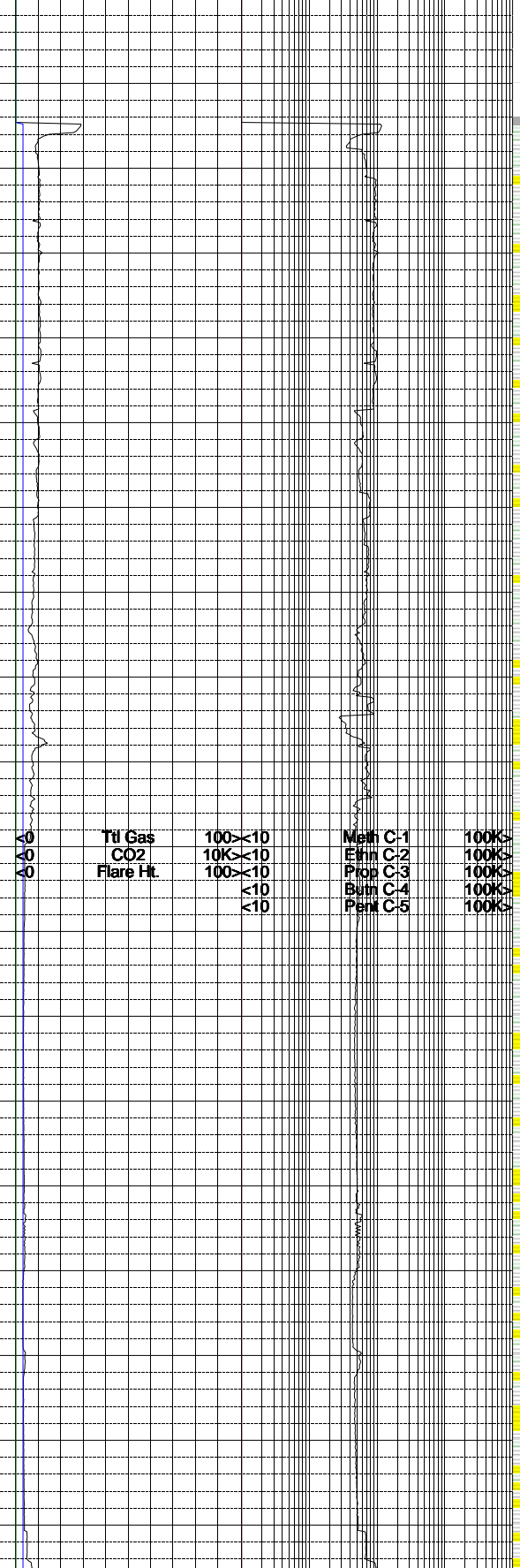
ALTERED ZONE	CHERT - GLASSY	FELSIC SILIC DIKE	MARL - CALC	SANDSTONE
ANDESITE	CHERT - PORCEL	FOSSIL	METAMORPHICS	SANDSTONE-TUFFACEOUS
ANHYDRITE	CHERT - TIGER STRIPE	GABBRO	MUDSTONE	SERICIZATION
BASALT	CHERT - UNDIFF	GLASSY TUFF	OBSIDIAN	SERPENTINE
BENTONITE	CLAY	GRANITE	PALEOSOL	SHALE
BIOTITIZATION	CLAY-MUDSTONE	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	

<200	ROP	>
ft/hr		
<50	Avg WOB	>
klbs		

TVD Depth
4600 MD
4700 MD
4800 MD
4900 MD
5000 MD
5100 MD
5200 MD
5300 MD
5400 MD
5500 MD



MGS	Ttl Gas units	2.5K	<10	Meth C-1	100K
	CO2 ppm	10K	<10	Ethn C-2	100K
	Flare Ht. ft	100	<10	Prop C-3	100K
			<10	Butn C-4	100K
			<10	Pent C-5	100K



Interp. Lith

Remarks
Survey Data, Mud Reports, Other Info.

EPOCH WELL SERVICES COMMENCED LOGGING THE FRU 296-5A01 WELL ON 9/7/2010 @ 4665' MD.

SHALE = VERY LIGHT GRAY TO LIGHT GRAY TO OCCASIONAL PALE RED PURPLE AND LIGHT YELLOWISH TAN GRAY; SLIGHTLY DENSE TO SLIGHTLY CRUMBLY TO SLIGHTLY BRITTLE TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE CUTTINGS HABIT; DULL TO EARTHY DULL TO SEMI-FROSTED LUSTER; MODERATELY SMOOTH TO MODERATELY CLAYEY TO SLIGHTLY SILTY TEXTURE; VERY SMALL AMOUNT OF CARBONACEOUS SHALE VISIBLY EFFERVESCING IN SAMPLE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; TRACE AMOUNT OF ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SANDSTONE = VERY LIGHT GRAY TO VERY LIGHT TANISH BROWN GRAY WITH FEW BLACK AND MODERATE BROWN HUES; QUARTZ DOMINANT; MODERATELY GRAIN SUPPORTED WITH VERY FEW LOOSE GRAINS; CONSISTS OF CALCITIC CEMENTATION WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 3 TO 5% DARK LITHIC FRAGMENTS; MEDIUM-FINE TO MEDIUM-COARSE GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; VERY POOR GRADE SANDSTONE VISIBLE GRADING WITH POOR GRADE SILTSTONE. NO LAMINAE OR OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SILTSTONE = LIGHT BROWN TO TAN TO VERY LIGHT GRAY IN COLOR; GRAIN SIZE IS VERY FINE; VERY WELL SORTED; ANGULARITY IS WELL ROUNDED TO ROUNDED; SURFACE FEATURES NOT VISIBLE; SOFT TO EASILY FRIABLE HARDNESS; GRAIN SUPPORTED WITH FEW LITHIC CLASTS; KAOLINITE CLAY PRESENT IN SAMPLE; SILTSTONE INTERBEDDED WITH VERY SOFT SHALES.

SHALE = VERY LIGHT GRAY TO MEDIUM GRAY WITH SOME SAMPLES BEING A TAN TO BROWN AND SOME HAVING A BLUEISH GREEN HUE; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURES PRESENT; INTERBEDDED WITH SILTSTONE AND SOME SANDSTONE; TRACE AMOUNTS OF KAOLINIC CLAYS PRESENT IN SAMPLE.

SANDSTONE = VERY LIGHT GRAY TO GRAY COLOR WITH SOME BROWNISH RED STAINING; LOWER FINE TO UPPER FINE GRAINED; WELL TO FAIR SORTING; SUBROUND TO SUBANGULAR ANGULARITY; MODERATE SPHERICITY; SOME FROSTED/POLISHED GRAINS; MODERATELY HARD TO FRIABLE HARDNESS; HIGHLY REACTIVE WITH A 10% HCL SOLUTION INDICATING CALCITE CEMENTATION; GRAIN SUPPORTED; DARK LITHIC CLASTS PRESENT IN SAMPLE; NO ACCESSORY MINERAL PRESENT IN SAMPLE.

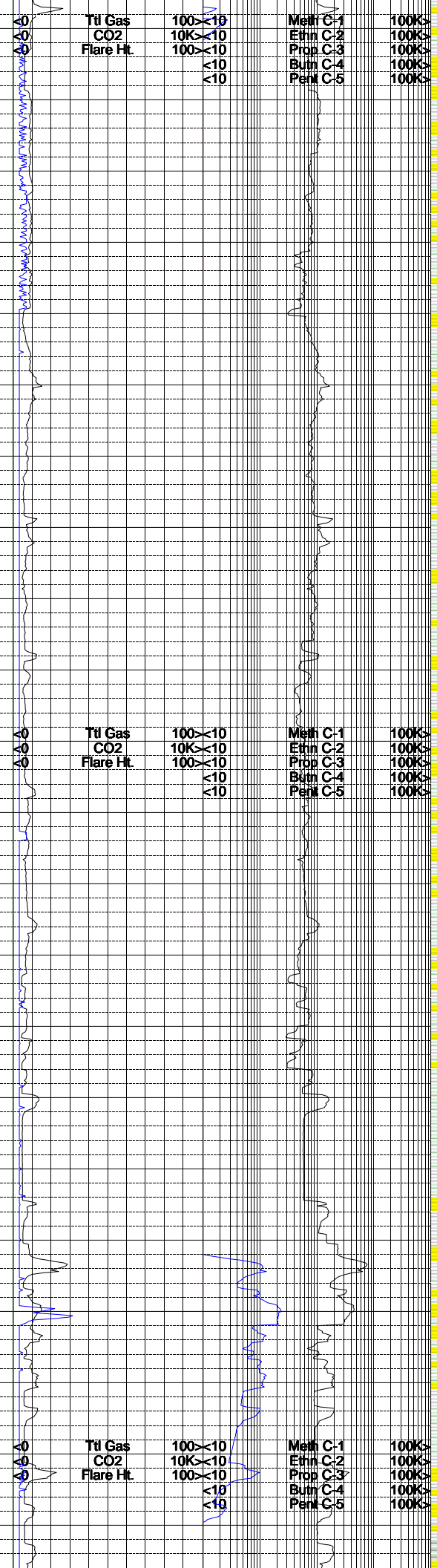
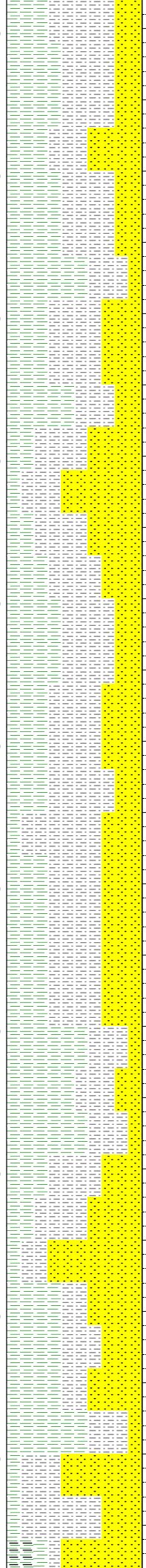
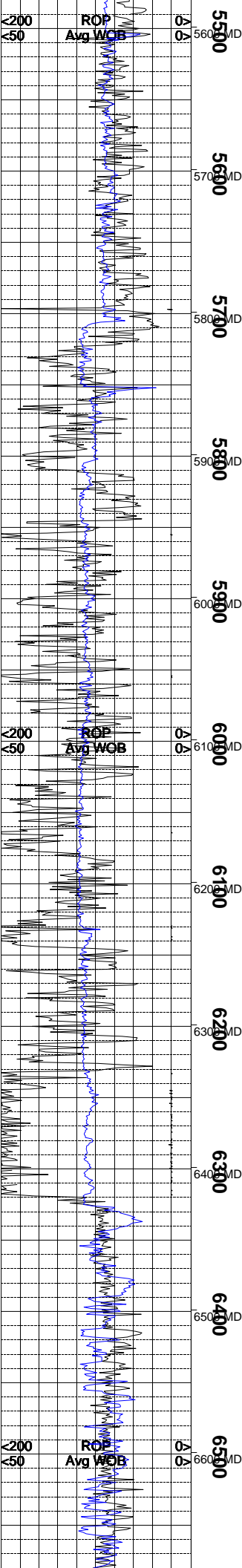
SILTSTONE = LIGHT BROWN TO TAN TO VERY LIGHT GRAY IN COLOR; GRAIN SIZE IS VERY FINE; VERY WELL SORTED; ANGULARITY IS WELL ROUNDED TO ROUNDED; SURFACE FEATURES NOT VISIBLE; SOFT TO EASILY FRIABLE HARDNESS; GRAIN SUPPORTED WITH FEW LITHIC CLASTS; KAOLINITE CLAY PRESENT IN SAMPLE; SILTSTONE INTERBEDDED WITH VERY SOFT SHALES.

SHALE = VERY LIGHT GRAY TO MEDIUM GRAY WITH SOME SAMPLES BEING A TAN TO BROWN AND SOME HAVING A BLUEISH GREEN HUE; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURES PRESENT; INTERBEDDED WITH SILTSTONE AND SOME SANDSTONE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = VERY LIGHT GRAY TO WHITE TO TRANSLUCENT GRAINS WITH SOME REDISH PINK

<200	ROP	>
ft/hr		
<50	Avg WOB	>
klbs		

Ttl Gas units	100	<10	Meth C-1	100K
CO2 ppm	10K	<10	Ethn C-2	100K
Flare Ht. ft	100	<10	Prop C-3	100K
		<10	Butn C-4	100K
		<10	Pent C-5	100K



GRAINS; LOWER FINE TO UPPER FINE GRAINED; WELL TO FAIR SORTING; SUBROUND TO SUBANGULAR ANGULARITY; MODERATE SPHERICITY; SOME FROSTED/POLISHED GRAINS; MODERATELY HARD TO FRIABLE HARDNESS; HIGHLY REACTIVE WITH A 10% HCL SOLUTION INDICATING CALCITE CEMENTATION; GRAIN SUPPORTED; DARK LITHIC CLASTS PRESENT IN SAMPLE; NO ACCESSORY MINERAL PRESENT IN SAMPLE.

SILTSTONE = LIGHT BROWN TO TAN TO VERY LIGHT GRAY IN COLOR WITH SOME SAMPLES BEING REDISH PINK; GRAIN SIZE IS VERY FINE; VERY WELL SORTED; ANGULARITY IS WELL ROUNDED TO ROUNDED; SURFACE FEATURES NOT VISIBLE; SOFT TO EASILY FRIABLE HARDNESS; GRAIN SUPPORTED WITH FEW LITHIC CLASTS; KAOLINITE CLAY PRESENT IN SAMPLE; SILTSTONE INTERBEDDED WITH VERY SOFT SHALES.

SHALE = VERY LIGHT GRAY TO MEDIUM GRAY WITH SOME SAMPLES BEING A TAN TO BROWN AND SOME HAVING A BLUEISH GREEN HUE; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURES PRESENT; INTERBEDDED WITH SILTSTONE AND SOME SANDSTONE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = VERY LIGHT GRAY TO WHITE TO TRANSLUCENT TO PINKISH RED TO BROWN GRAINS; LOWER FINE TO UPPER FINE GRAINED; WELL TO FAIR SORTING; SUBROUND TO SUBANGULAR ANGULARITY; MODERATE SPHERICITY; SOME FROSTED/POLISHED GRAINS; MODERATELY HARD TO FRIABLE HARDNESS; HIGHLY REACTIVE WITH A 10% HCL SOLUTION INDICATING CALCITE CEMENTATION; GRAIN SUPPORTED; DARK LITHIC CLASTS PRESENT IN SAMPLE; NO ACCESSORY MINERAL PRESENT IN SAMPLE.

SILTSTONE = LIGHT BROWN TO TAN TO VERY LIGHT GRAY IN COLOR WITH SOME SAMPLES BEING REDISH PINK; GRAIN SIZE IS VERY FINE; VERY WELL SORTED; ANGULARITY IS WELL ROUNDED TO ROUNDED; SURFACE FEATURES NOT VISIBLE; SOFT TO EASILY FRIABLE HARDNESS; GRAIN SUPPORTED WITH FEW LITHIC CLASTS; KAOLINITE CLAY PRESENT IN SAMPLE; SILTSTONE INTERBEDDED WITH VERY SOFT SHALES.

SHALE = VERY LIGHT GRAY TO MEDIUM GRAY WITH SOME SAMPLES BEING A TAN TO BROWN AND SOME HAVING A BLUEISH GREEN HUE; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURES PRESENT; INTERBEDDED WITH SILTSTONE AND SOME SANDSTONE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = VERY LIGHT GRAY TO WHITE TO TRANSLUCENT TO PINKISH RED TO BROWN GRAINS; LOWER FINE TO UPPER FINE GRAINED; WELL TO FAIR SORTING; SUBROUND TO SUBANGULAR ANGULARITY; MODERATE SPHERICITY; SOME FROSTED/POLISHED GRAINS; MODERATELY HARD TO FRIABLE HARDNESS; HIGHLY REACTIVE WITH A 10% HCL SOLUTION INDICATING CALCITE CEMENTATION; GRAIN SUPPORTED; KAOLINITE CLAY PRESENT IN SAMPLE.

SILTSTONE = LIGHT BROWN TO TAN TO VERY LIGHT GRAY IN COLOR WITH SOME SAMPLES BEING REDISH PINK TO A DARK BROWN COLOR; GRAIN SIZE IS VERY FINE TO FINE TO UPPER FINE; VERY WELL SORTED; ANGULARITY IS WELL ROUNDED TO ROUNDED; SURFACE FEATURES NOT VISIBLE; SOFT TO EASILY FRIABLE HARDNESS; GRAIN SUPPORTED WITH FEW LITHIC CLASTS; KAOLINITE CLAY PRESENT IN SAMPLE; SILTSTONE INTERBEDDED WITH SHALE AND SANDSTONE.

SHALE = VERY LIGHT GRAY TO MEDIUM GRAY WITH SOME SAMPLES HAVING A BLUISH HUE; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURES PRESENT; INTERBEDDED WITH SILTSTONE AND SOME SANDSTONE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = VERY LIGHT GRAY TO WHITE TO TRANSLUCENT GRAINS; UPPER FINE TO MEDIUM GRAINED; WELL SORTED; SUBROUND TO SUBANGULAR ANGULARITY; MODERATE SPHERICITY; SOME SAMPLES SHOW SURFACE FEATURES OF MECHANICAL ABRASION; MODERATELY HARD TO FRIABLE HARDNESS;

Tilt Gas
CO2
Flare Ht

100x10
10Kx10
100x10
x10
x10

Meth C-1
Ethn C-2
Prop C-3
Butn C-4
Perm C-5

100Kx
100Kx
100Kx
100Kx
100Kx

Tilt Gas
CO2
Flare Ht

100x10
10Kx10
100x10
x10
x10

Meth C-1
Ethn C-2
Prop C-3
Butn C-4
Perm C-5

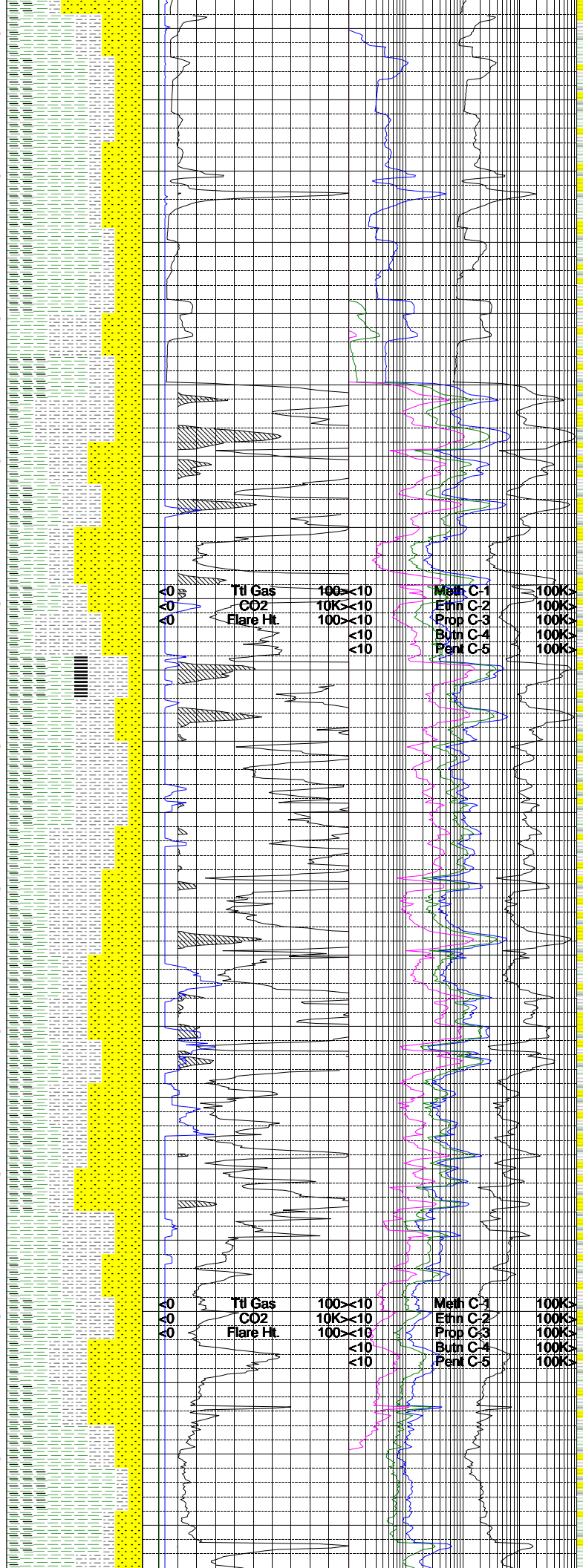
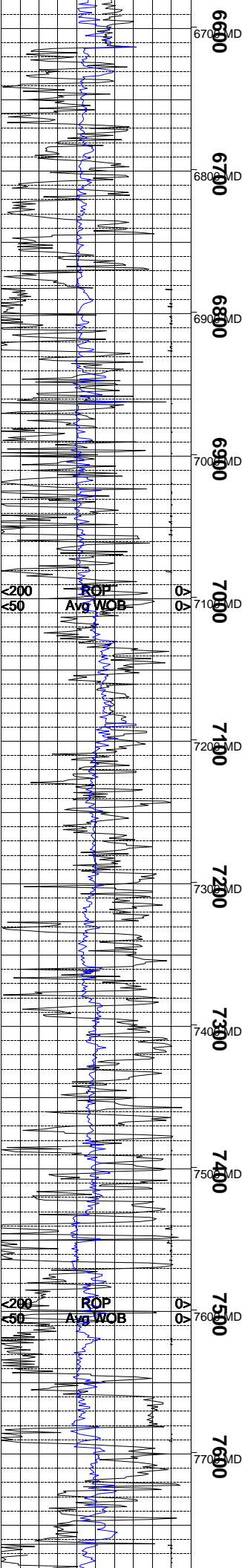
100Kx
100Kx
100Kx
100Kx
100Kx

Tilt Gas
CO2
Flare Ht

100x10
10Kx10
100x10
x10
x10

Meth C-1
Ethn C-2
Prop C-3
Butn C-4
Perm C-5

100Kx
100Kx
100Kx
100Kx
100Kx



HIGHLY REACTIVE WITH 10% HCL SOLUTION INDICATING CALCITE CEMENTATION; GRAIN SUPPORTED; DARK LITHIC CLASTS PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONACEOUS SHALE = VERY DARK GRAY TO ALMOST BLACK IN COLOR; DENSE TO BRITTLE TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; LUSTER IS DULL TO EARTHY; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURE IN THE SAMPLE.

SILTSTONE = VERY LIGHT GRAY TO LIGHT GRAY TO OCCASIONAL MODERATE REDDISH BROWN IN COLOR; SLIGHTLY DENSE TO SLIGHTLY CRUMBLY TO VERY SLIGHTLY BRITTLE TENACITY; IRREGULAR TO SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR TO OCCASIONAL SEMI-PLATY CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TEXTURE; POOR GRADE SILTSTONE VISIBLE BEDDING WITH POOR GRADE SANDSTONE AND POOR GRADE SHALE IN SAMPLE, NO LAMINAE OR OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; NO ACCESSORY MINERAL PRESENT IN SAMPLE.

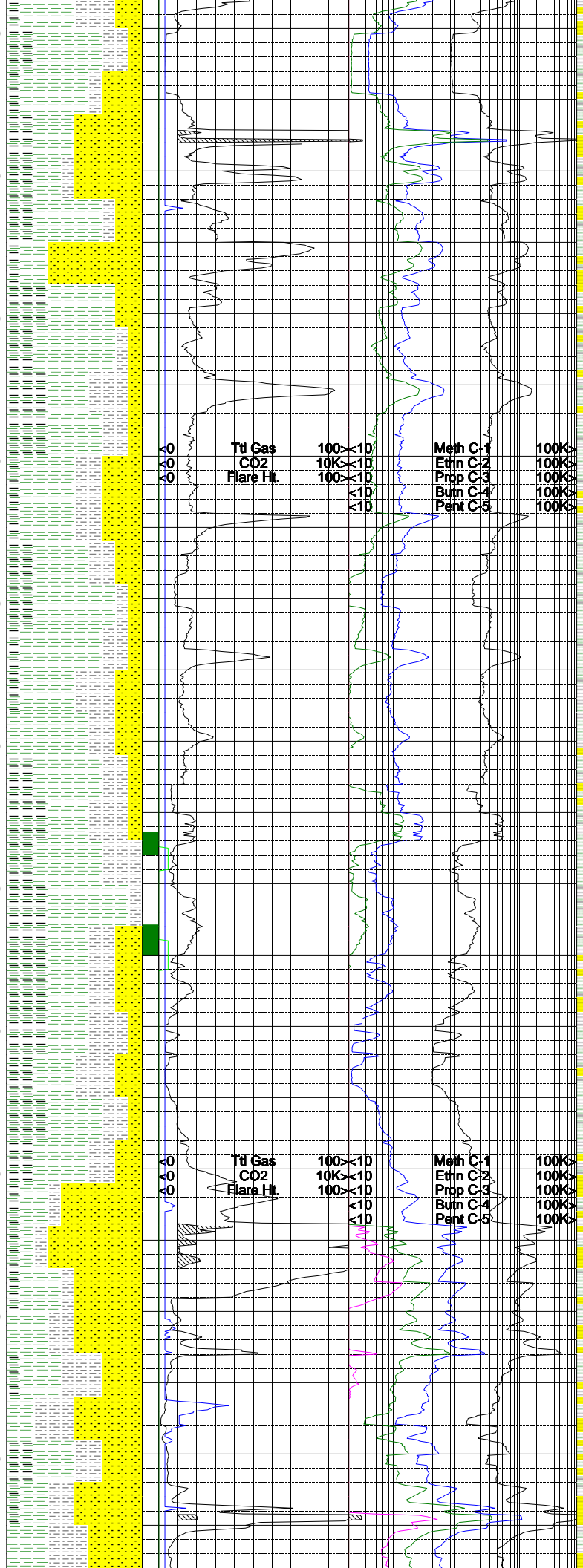
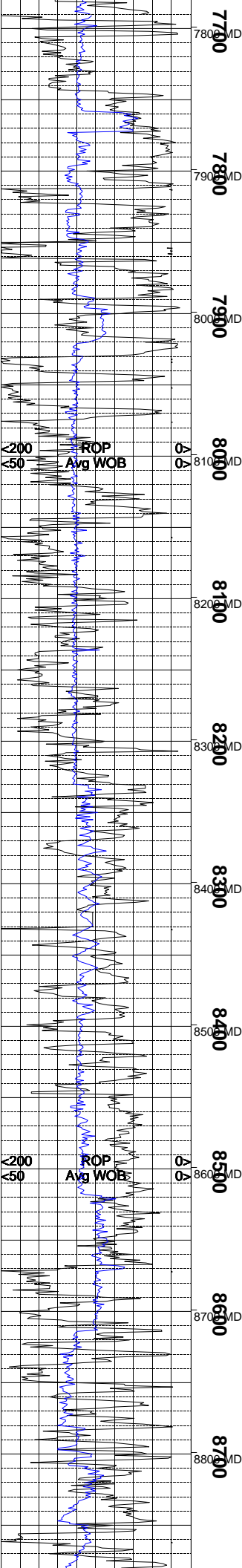
SHALE = LIGHT GRAY TO MEDIUM LIGHT GRAY TO OCCASIONAL LIGHT GRAY AND GRAYISH RED PURPLE MOTTLING IN COLOR; VERY SLIGHTLY TOUGH TO MODERATELY DENSE TO OCCASIONAL CRUNCHY TENACITY; IRREGULAR TO SUB-BLOCKY TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE TO OCCASIONAL ELONGATED CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-FROSTED TO SEMI-WAXY LUSTER; MODERATELY SMOOTH TO SLIGHTLY SILTY TEXTURE; NO VISIBLE LAMINAE OR OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; TRACE AMOUNTS OF ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SANDSTONE = OFF WHITE TO VERY LIGHT GRAY TO VERY LIGHT TANISH BROWN-GRAY TO OCCASIONAL LIGHT BRILLIANT GREEN WITH FEW BLACK AND MODERATE BROWN HUES IN COLOR; QUARTZ DOMINATE; PREDOMINATELY GRAIN SUPPORTED WITH FEW LOOSE GRAINS; CONSIST OF CALCITIC CEMENTATION WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 2 TO 4% DARK LITHIC FRAGMENTS; MEDIUM-FINE TO MEDIUM-COARSE GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO SUB-ROUNDED TO ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; POOR GRADE SILTSTONE VISIBLE GRADING AND BEDDING WITH POOR GRADE SANDSTONE, NO OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONACEOUS SHALE = BROWNISH GRAY TO DARK BROWNISH GRAY TO OCCASIONAL BROWNISH BLACK IN COLOR; MODERATELY DENSE TO VERY SLIGHTLY TOUGH TO SLIGHTLY CRUNCHY TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE TO SUB-TABULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO VERY SLIGHTLY GRITTY TO OCCASIONAL SEMI-SMOOTH TEXTURE; VERY SMALL AMOUNT OF CARBONACEOUS SHALE LIGHTLY EFFERVESCING IN SAMPLE, SMALL AMOUNT OF KAOLINITIC SANDSTONE IN SAMPLE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; TRACE AMOUNTS OF ACCESSORY MINERAL PYRITE VISIBLY PRESENT IN SAMPLE.

SHALE = LIGHT GRAY TO MEDIUM LIGHT GRAY TO MEDIUM GRAY TO OCCASIONAL MEDIUM BROWNISH GRAY IN COLOR; MODERATELY TOUGH TO MODERATELY DENSE TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE TO OCCASIONAL ELONGATED TO SUB-PLATY CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-WAXY TO SEMI-FROSTED LUSTER; MODERATELY SMOOTH TO VERY SLIGHTLY SILTY TEXTURE; VERY SMALL AMOUNTS OF CARBONACEOUS SHALE AND COAL VISIBLY EFFERVESCING IN SAMPLE, THIN COAL LAMINAE VISIBLE IN SHALE CUTTING, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT; TRACE AMOUNTS OF ACCESSORY MINERAL PYRITE VISIBLE IN SAMPLE.

CARBONACEOUS SHALE = BROWNISH GRAY TO DARK BROWNISH GRAY TO OCCASIONAL BROWNISH COLOR; MODERATELY DENSE TO SLIGHTLY TOUGH TO SLIGHTLY CRUNCHY TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE TO SUB-TABULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO SEMI-SPARKLING LUSTER; SLIGHTLY CLAYEY TO SLIGHTLY GRITTY TO OCCASIONALLY SEMI-SMOOTH TEXTURE;



VERY SMALL AMOUNTS OF CARBONACEOUS SHALE WHICH SLIGHTLY EFFERVESED WHEN IN CONTACT WITH A 10% SOLUTION OF HCL; IN SAMPLE, SMALL AMOUNT OF KAOLINITIC SANDSTONE IN SAMPLE; NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT.

NOTE : CHANGE OF THA ATTENUATION FROM x10 TO x100 AT 7879' MD.

SHALE = LIGHT GRAY TO MEDIUM DARK GRAY IN COLOR WITH SOME SAMPLES BEING A VERY LIGHT BROWNISH GRAY OR A BLUEISH GREEN GRAY; TOUGH TO DENSE TO BRITTLE TENACITY; FRACTURE IS PLANAR TO BLOCKY; THE CUTTINGS HABIT IS MASSIVE TO PLATY WITH SOME SAMPLES SHOWING A FLAKY OR SCALY HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TO SILTY TEXTURE; SOME SAMPLES SHOW LAMINAE TO VERY THIN STRUCTURE WITH THE MAJORITY OF THE SAMPLE HAVING NO STRUCTURE; ACCESSORY MINERALS IN SAMPLE INCLUDE KAOLINITE AND A TRACE AMOUNT OF PYRITE.

SILTSTONE = GRAY TO VERY LIGHT GRAY IN COLOR WITH SOME SAMPLES BEING VERY LIGHT BROWN TO A REDISH BROWN COLOR; TENACITY IS DENSE TO BRITTLE TO CRUNCHY; BLOCKY TO IRREGULAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT WITH SOME SAMPLES BEING WEDGELIKE; LUSTER IS DULL TO EARTHY; SILTY TO GRITTY TEXTURE; NO VISIBLE STRUCTURE PRESENT; SAMPLES INTERBEDDED WITH SHALE AND CARBONACEOUS SHALE; SOME SAMPLES ARE NOT VERY WELL CONSOLIDATED; NO ACCESSORY MINERALS PRESENT IN THE SAMPLE.

SANDSTONE = TRANSLUCENT TO WHITE TO GRAY IN COLOR WITH SOME SAMPLES HAVING BEING A RUSTY BROWN AND SOME HAVING A BLUISH GREEN HUE; FRAMEWORK IS DOMINATED BY QUARTZ GRAIN WITH K-SPAR AND LITHIC FRAGMENTS; GRAIN SIZE IS LOWER MEDIUM TO UPPER FINE GRAINED; VERY WELL TO WELL SORTING; ROUNDED TO SUBROUNDED TO SUBANGULAR GRAINS; HIGH TO MODERATE SPHERICITY; SOME INDIVIDUAL GRAINS ARE FROSTED DUE TO MECHANICAL ABRASION; HARDNESS IS HARD TO FRIABLE WITH SOME SAMPLES BEING SOFT AND NOT WELL CONSOLIDATED; VERY LITTLE REACTION WITH 10% HCL SOLUTION; GRAIN SUPPORTED WITH POSSIBLE SILICA CEMENTATION.

NOTE : CHANGE OF THA ATTENUATION FROM x100 TO x10 AT 8339' MD.

SHALE = LIGHT GRAY TO MEDIUM DARK GRAY IN COLOR WITH SOME SAMPLES BEING A VERY LIGHT BROWNISH GRAY OR A BLUEISH GREEN GRAY; TOUGH TO DENSE TO BRITTLE TENACITY; FRACTURE IS PLANAR TO BLOCKY; THE CUTTINGS HABIT IS MASSIVE TO PLATY WITH SOME SAMPLES SHOWING A FLAKY OR SCALY HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TO SILTY TEXTURE; SOME SAMPLES SHOW LAMINAE TO VERY THIN STRUCTURE WITH THE MAJORITY OF THE SAMPLE HAVING NO STRUCTURE.

CARBONACEOUS SHALE = BLACK TO A VERY DARK BROWN COLOR; DENSE TO BRITTLE TENACITY; IRREGULAR TO PLANAR FRACTURE; CUTTINGS HABIT IS PLATY TO WEDGELIKE TO BLADED; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TO SILTY TEXTURE; NO VISIBLE STRUCTURE IN THE SAMPLE.

SILTSTONE = LIGHT BROWN TO TAN TO A REDISH BROWN COLOR; CRUMBLY TO CRUNCHY TENACITY; SOME SAMPLE IS NOT VERY WELL CONSOLIDATED; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL EARTHY LUSTER WITH SOME HAVING A GREASY LUSTER; SILTY TO GRITTY TEXTURE; NO VISIBLE STRUCTURE OR ACCESSORY MINERALS.

SANDSTONE = TRANSLUCENT TO WHITE GRAINS; QUARTZ FRAMEWORK; UPPER FINE TO LOWER MEDIUM GRAIN SIZE; VERY WELL TO WELL SORTING; ROUND TO SUBROUNDED TO SUBANGULAR GRAINS; SPHERICITY IS HIGH TO MODERATE; SOME FROSTED GRAINS; FIRMLY FRIABLE TO HARD; CALCITE CEMENTATION; GRAIN SUPPORTED; FEW LITHIC CLASTS; HIGHLY REACTIVE WITH A 10% HCL SOLUTION; NO VISIBLE FLOURESCENCE.

SHALE = VERY LIGHT GRAY TO DARK GRAY TO A VERY LIGHT BLUEISH GRAY; BRITTLE TO CRUNCHY TENACITY; PLANAR TO IRREGULAR FRACTURE; PLATY TO WEDGELIKE TO BLADED CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; LAMINAE TO THIN STRUCTURE; INTERBEDDED WITH SILTSTONE AND SANDSTONE.

SILTSTONE = LIGHT BROWN TO TAN TO A

<200
>50

ROP
Avg WOB

Tilt Gas 100x<10
CO2 10Kx<10
Flare Hit 100x<10

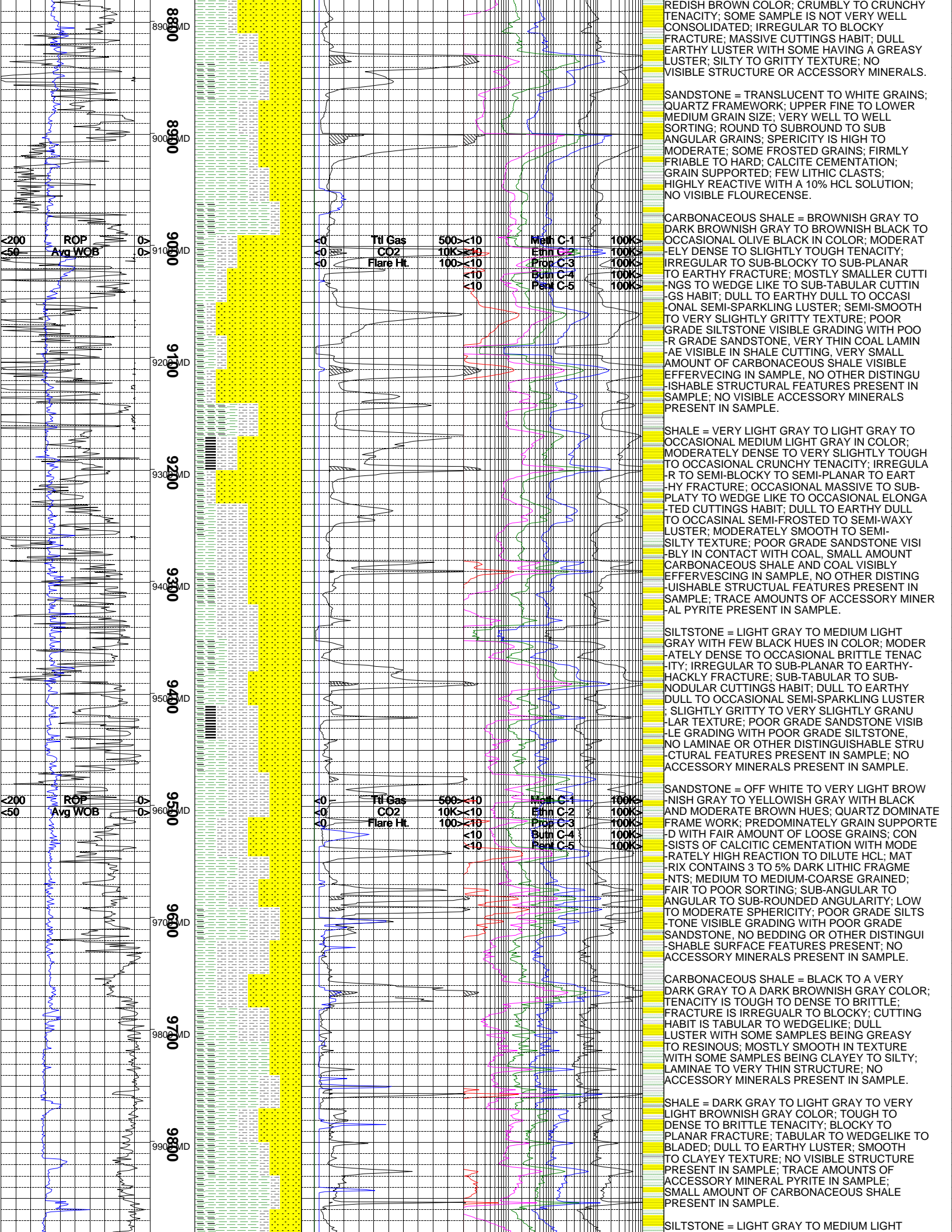
Meth C-1 100K>
Ethn C-2 100K>
Prop C-3 100K>
Butn C-4 100K>
Perm C-5 100K>

<200
>50

ROP
Avg WOB

Tilt Gas 100x<10
CO2 10Kx<10
Flare Hit 100x<10

Meth C-1 100K>
Ethn C-2 100K>
Prop C-3 100K>
Butn C-4 100K>
Perm C-5 100K>



<200
50

ROP
Avg WOB

8890 MD
8990 MD
9090 MD
9190 MD
9290 MD
9390 MD
9490 MD
9590 MD
9690 MD
9790 MD
9890 MD

Til Gas	500	<10	Meth C-1	100K
CO2	10K	<10	Ethin C-2	100K
Flare Ht	100	<10	Prop C-3	100K
		<10	Burn C-4	100K
		<10	Perm C-5	100K

REDISH BROWN COLOR; CRUMBLY TO CRUNCHY TENACITY; SOME SAMPLE IS NOT VERY WELL CONSOLIDATED; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL EARTHY LUSTER WITH SOME HAVING A GREASY LUSTER; SILTY TO GRITTY TEXTURE; NO VISIBLE STRUCTURE OR ACCESSORY MINERALS.

SANDSTONE = TRANSLUCENT TO WHITE GRAINS; QUARTZ FRAMEWORK; UPPER FINE TO LOWER MEDIUM GRAIN SIZE; VERY WELL TO WELL SORTING; ROUND TO SUBROUND TO SUB ANGULAR GRAINS; SPERICITY IS HIGH TO MODERATE; SOME FROSTED GRAINS; FIRMLY FRIABLE TO HARD; CALCITE CEMENTATION; GRAIN SUPPORTED; FEW LITHIC CLASTS; HIGHLY REACTIVE WITH A 10% HCL SOLUTION; NO VISIBLE FLOURECENSE.

CARBONACEOUS SHALE = BROWNISH GRAY TO DARK BROWNISH GRAY TO BROWNISH BLACK TO OCCASIONAL OLIVE BLACK IN COLOR; MODERATELY DENSE TO SLIGHTLY TOUGH TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY FRACTURE; MOSTLY SMALLER CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SEMI-SMOOTH TO VERY SLIGHTLY GRITTY TEXTURE; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, VERY THIN COAL LAMINAE VISIBLE IN SHALE CUTTING, VERY SMALL AMOUNT OF CARBONACEOUS SHALE VISIBLE EFFERVESCING IN SAMPLE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO VISIBLE ACCESSORY MINERALS PRESENT IN SAMPLE.

SHALE = VERY LIGHT GRAY TO LIGHT GRAY TO OCCASIONAL MEDIUM LIGHT GRAY IN COLOR; MODERATELY DENSE TO VERY SLIGHTLY TOUGH TO OCCASIONAL CRUNCHY TENACITY; IRREGULAR TO SEMI-BLOCKY TO SEMI-PLANAR TO EARTHY FRACTURE; OCCASIONAL MASSIVE TO SUB-PLANAR TO WEDGE LIKE TO OCCASIONAL ELONGATED CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-FROSTED TO SEMI-WAXY LUSTER; MODERATELY SMOOTH TO SEMI-SILTY TEXTURE; POOR GRADE SANDSTONE VISIBLY IN CONTACT WITH COAL, SMALL AMOUNT CARBONACEOUS SHALE AND COAL VISIBLY EFFERVESCING IN SAMPLE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; TRACE AMOUNTS OF ACCESSORY MINERAL PYRITE PRESENT IN SAMPLE.

SILTSTONE = LIGHT GRAY TO MEDIUM LIGHT GRAY WITH FEW BLACK HUES IN COLOR; MODERATELY DENSE TO OCCASIONAL BRITTLE TENACITY; IRREGULAR TO SUB-PLANAR TO EARTHY-FRACTURE; SUB-TABULAR TO SUB-NODULAR CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY GRITTY TO VERY SLIGHTLY GRANULAR TEXTURE; POOR GRADE SANDSTONE VISIBLE GRADING WITH POOR GRADE SILTSTONE, NO LAMINAE OR OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

<200
50

ROP
Avg WOB

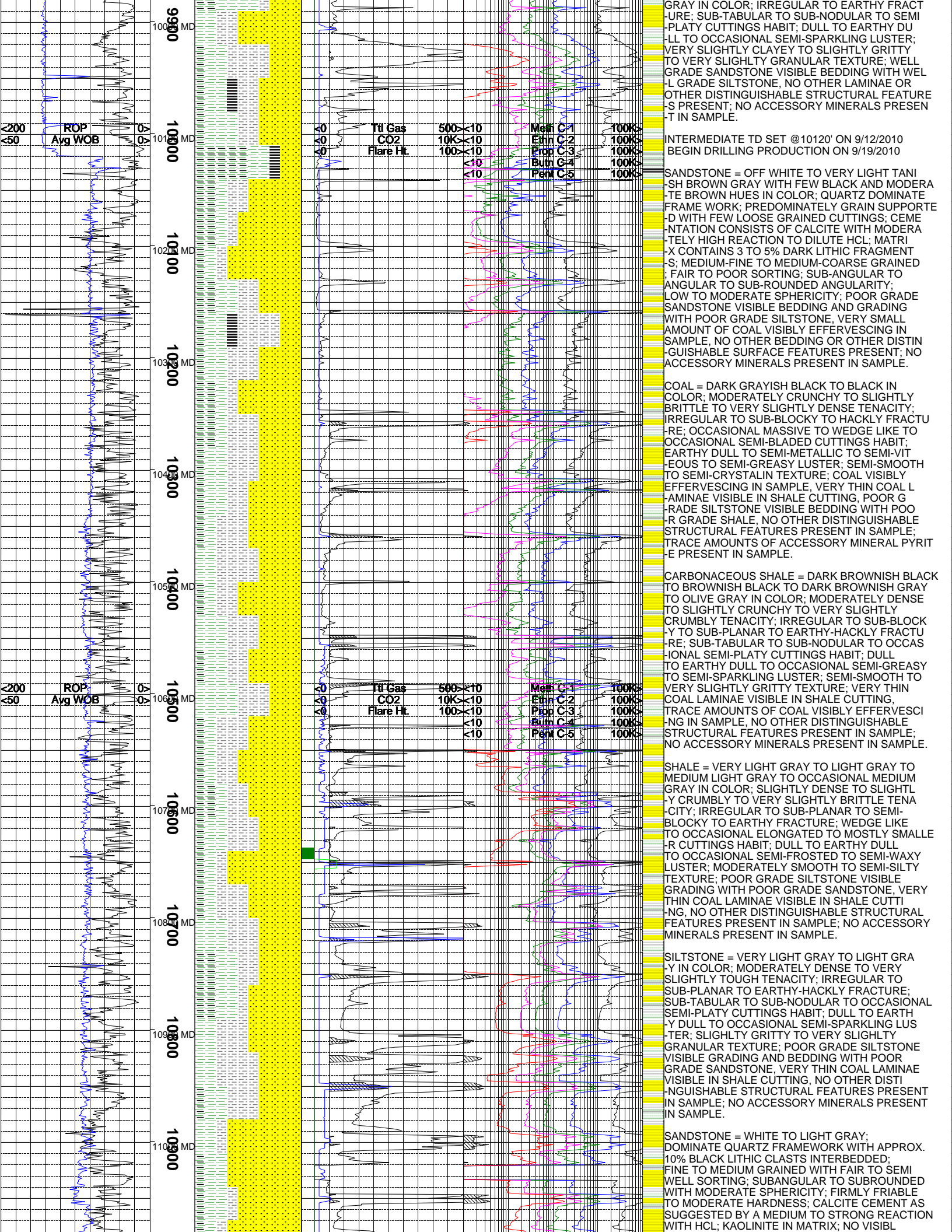
Til Gas	500	<10	Meth C-1	100K
CO2	10K	<10	Ethin C-2	100K
Flare Ht	100	<10	Prop C-3	100K
		<10	Burn C-4	100K
		<10	Perm C-5	100K

SANDSTONE = OFF WHITE TO VERY LIGHT BROWNISH GRAY TO YELLOWISH GRAY WITH BLACK AND MODERATE BROWN HUES; QUARTZ DOMINATE FRAME WORK; PREDOMINATELY GRAIN SUPPORTED WITH FAIR AMOUNT OF LOOSE GRAINS; CONSISTS OF CALCITIC CEMENTATION WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 3 TO 5% DARK LITHIC FRAGMENTS; MEDIUM TO MEDIUM-COARSE GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, NO BEDDING OR OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

CARBONACEOUS SHALE = BLACK TO A VERY DARK GRAY TO A DARK BROWNISH GRAY COLOR; TENACITY IS TOUGH TO DENSE TO BRITTLE; FRACTURE IS IRREGULAR TO BLOCKY; CUTTING HABIT IS TABULAR TO WEDGELIKE; DULL LUSTER WITH SOME SAMPLES BEING GREASY TO RESINOUS; MOSTLY SMOOTH IN TEXTURE WITH SOME SAMPLES BEING CLAYEY TO SILTY; LAMINAE TO VERY THIN STRUCTURE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SHALE = DARK GRAY TO LIGHT GRAY TO VERY LIGHT BROWNISH GRAY COLOR; TOUGH TO DENSE TO BRITTLE TENACITY; BLOCKY TO PLANAR FRACTURE; TABULAR TO WEDGELIKE TO BLADED; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; NO VISIBLE STRUCTURE PRESENT IN SAMPLE; TRACE AMOUNTS OF ACCESSORY MINERAL PYRITE IN SAMPLE; SMALL AMOUNT OF CARBONACEOUS SHALE PRESENT IN SAMPLE.

SILTSTONE = LIGHT GRAY TO MEDIUM LIGHT



ROP
Avg WOB

Ti Gas 500 > 10
CO2 10K > 10
Flare Ht 100 > 10

Meth C-1 100K >
Ethn C-2 100K >
Prop C-3 100K >
Butn C-4 100K >
Perm C-5 100K >

INTERMEDIATE TD SET @ 10120' ON 9/12/2010
BEGIN DRILLING PRODUCTION ON 9/19/2010

SANDSTONE = OFF WHITE TO VERY LIGHT TANNISH BROWN GRAY WITH FEW BLACK AND MODERATE BROWN HUES IN COLOR; QUARTZ DOMINATE FRAME WORK; PREDOMINATELY GRAIN SUPPORTED WITH FEW LOOSE GRAINED CUTTINGS; CEMENTATION CONSISTS OF CALCITE WITH MODERATELY HIGH REACTION TO DILUTE HCL; MATRIX CONTAINS 3 TO 5% DARK LITHIC FRAGMENTES; MEDIUM-FINE TO MEDIUM-COARSE GRAINED; FAIR TO POOR SORTING; SUB-ANGULAR TO ANGULAR TO SUB-ROUNDED ANGULARITY; LOW TO MODERATE SPHERICITY; POOR GRADE SANDSTONE VISIBLE BEDDING AND GRADING WITH POOR GRADE SILTSTONE, VERY SMALL AMOUNT OF COAL VISIBLY EFFERVESCING IN SAMPLE, NO OTHER BEDDING OR OTHER DISTINGUISHABLE SURFACE FEATURES PRESENT; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

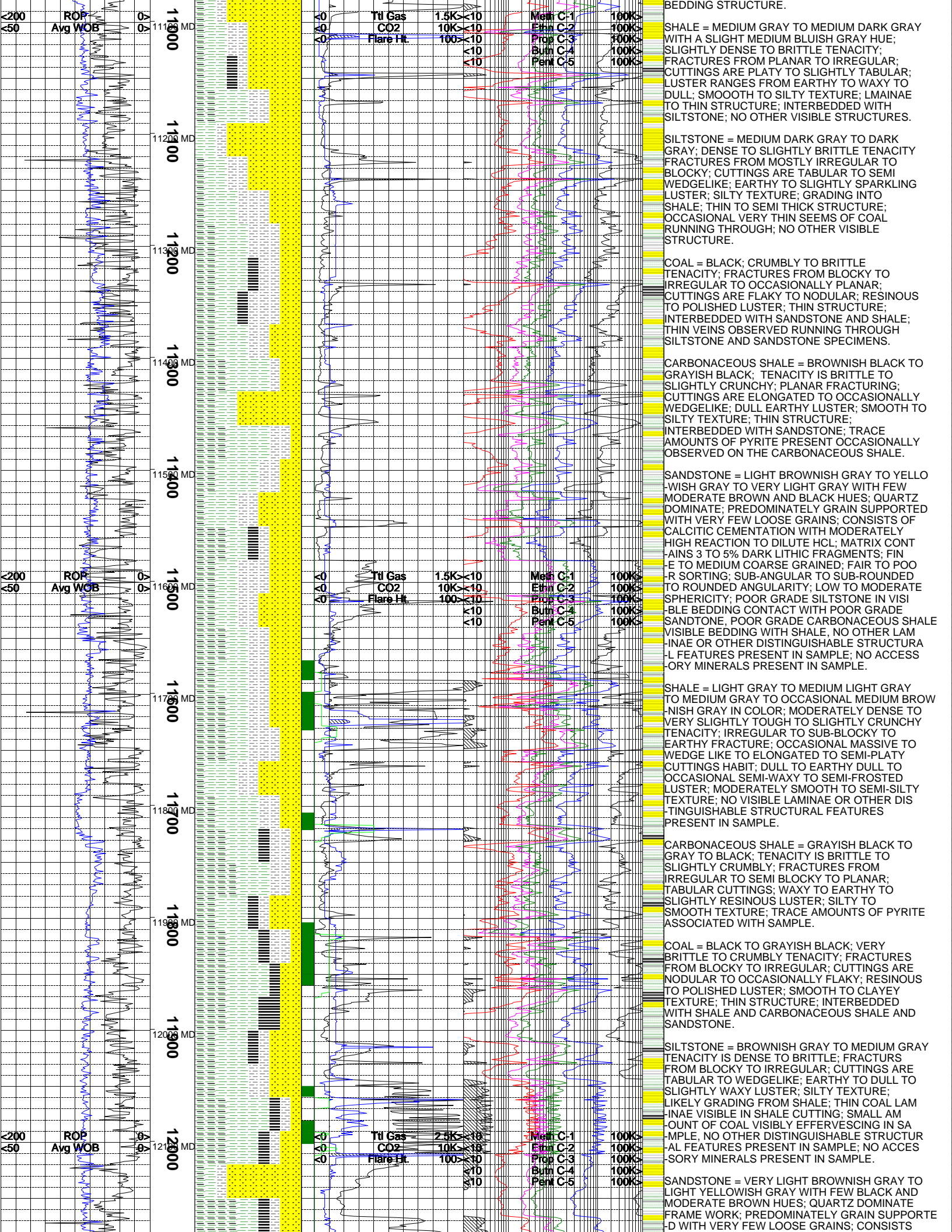
COAL = DARK GRAYISH BLACK TO BLACK IN COLOR; MODERATELY CRUNCHY TO SLIGHTLY BRITTLE TO VERY SLIGHTLY DENSE TENACITY; IRREGULAR TO SUB-BLOCKY TO HACKLY FRACTURE; OCCASIONAL MASSIVE TO WEDGE LIKE TO OCCASIONAL SEMI-BLADED CUTTINGS HABIT; EARTHY DULL TO SEMI-METALLIC TO SEMI-VITREOUS TO SEMI-GREASY LUSTER; SEMI-SMOOTH TO SEMI-CRYSTALLIN TEXTURE; COAL VISIBLY EFFERVESCING IN SAMPLE, VERY THIN COAL LAMINAE VISIBLE IN SHALE CUTTING, POOR GRADE SILTSTONE VISIBLE BEDDING WITH POOR GRADE SHALE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; TRACE AMOUNTS OF ACCESSORY MINERAL PYRITRE PRESENT IN SAMPLE.

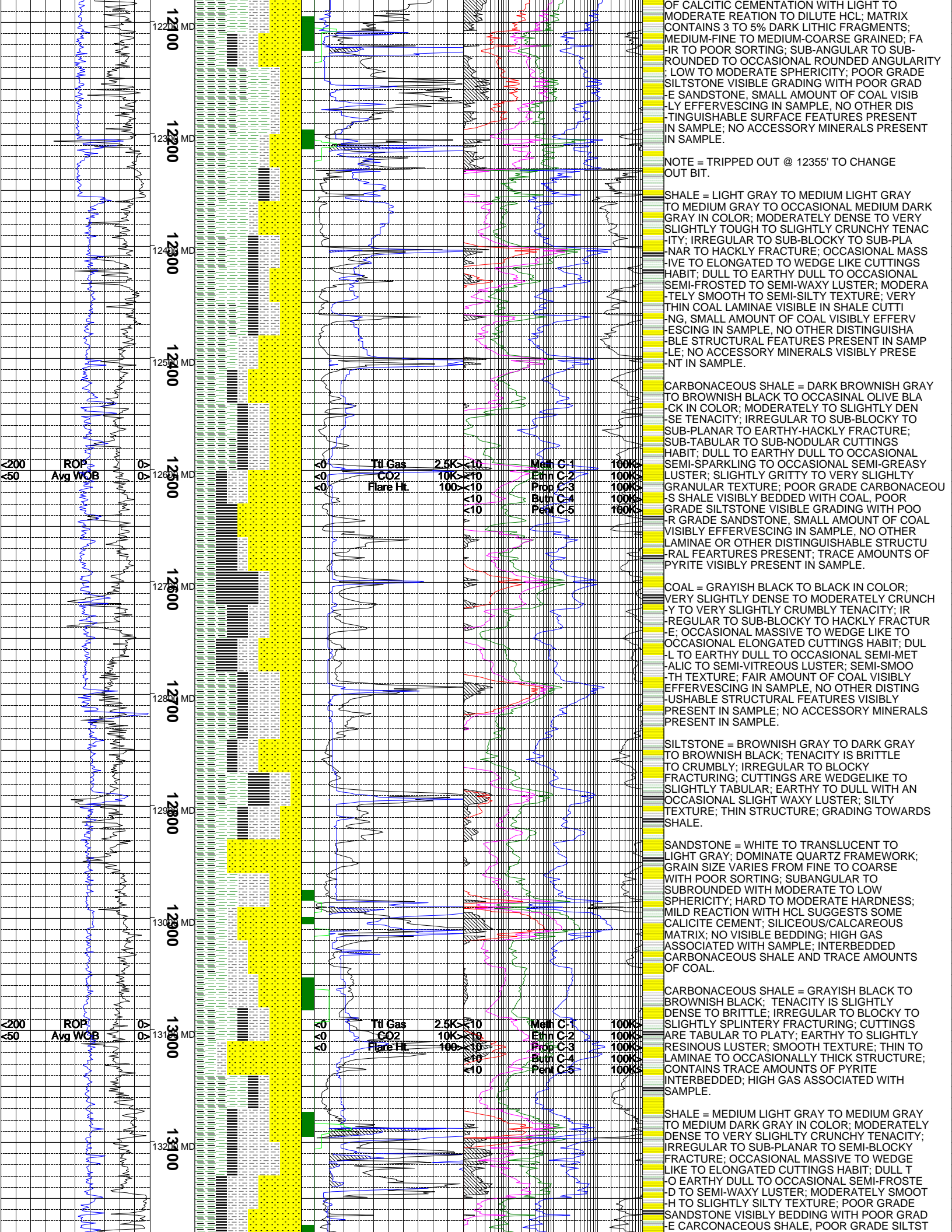
CARBONACEOUS SHALE = DARK BROWNISH BLACK TO BROWNISH BLACK TO DARK BROWNISH GRAY TO OLIVE GRAY IN COLOR; MODERATELY DENSE TO SLIGHTLY CRUNCHY TO VERY SLIGHTLY CRUMBLY TENACITY; IRREGULAR TO SUB-BLOCKY TO SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR TO OCCASIONAL SEMI-PLATY CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-GREASY TO SEMI-SPARKLING LUSTER; SEMI-SMOOTH TO VERY SLIGHTLY GRITTY TEXTURE; VERY THIN COAL LAMINAE VISIBLE IN SHALE CUTTING, TRACE AMOUNTS OF COAL VISIBLY EFFERVESCING IN SAMPLE, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

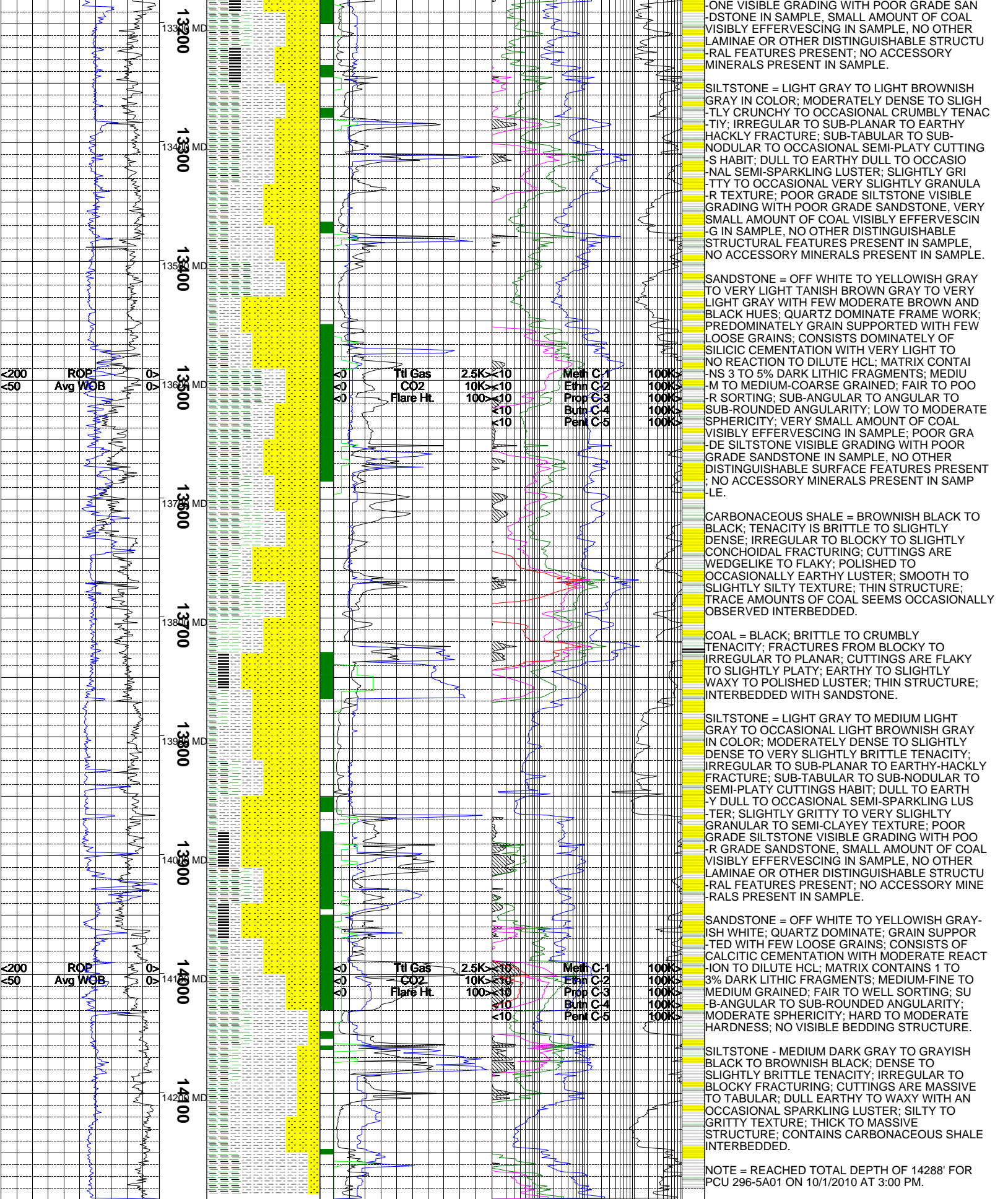
SHALE = VERY LIGHT GRAY TO LIGHT GRAY TO MEDIUM LIGHT GRAY TO OCCASIONAL MEDIUM GRAY IN COLOR; SLIGHTLY DENSE TO SLIGHTLY CRUMBLY TO VERY SLIGHTLY BRITTLE TENACITY; IRREGULAR TO SUB-PLANAR TO SEMI-BLOCKY TO EARTHY FRACTURE; WEDGE LIKE TO OCCASIONAL ELONGATED TO MOSTLY SMALLER CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-FROSTED TO SEMI-WAXY LUSTER; MODERATELY SMOOTH TO SEMI-SILTY TEXTURE; POOR GRADE SILTSTONE VISIBLE GRADING WITH POOR GRADE SANDSTONE, VERY THIN COAL LAMINAE VISIBLE IN SHALE CUTTING, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SILTSTONE = VERY LIGHT GRAY TO LIGHT GRAY IN COLOR; MODERATELY DENSE TO VERY SLIGHTLY TOUGH TENACITY; IRREGULAR TO SUB-PLANAR TO EARTHY-HACKLY FRACTURE; SUB-TABULAR TO SUB-NODULAR TO OCCASIONAL SEMI-PLATY CUTTINGS HABIT; DULL TO EARTHY DULL TO OCCASIONAL SEMI-SPARKLING LUSTER; SLIGHTLY GRITTY TO VERY SLIGHTLY GRANULAR TEXTURE; POOR GRADE SILTSTONE VISIBLE GRADING AND BEDDING WITH POOR GRADE SANDSTONE, VERY THIN COAL LAMINAE VISIBLE IN SHALE CUTTING, NO OTHER DISTINGUISHABLE STRUCTURAL FEATURES PRESENT IN SAMPLE; NO ACCESSORY MINERALS PRESENT IN SAMPLE.

SANDSTONE = WHITE TO LIGHT GRAY; DOMINATE QUARTZ FRAMEWORK WITH APPROX. 10% BLACK LITHIC CLASTS INTERBEDDED; FINE TO MEDIUM GRAINED WITH FAIR TO SEMI WELL SORTING; SUBANGULAR TO SUBROUNDED WITH MODERATE SPHERICITY; FIRMLY FRIABLE TO MODERATE HARDNESS; CALCITE CEMENT AS SUGGESTED BY A MEDIUM TO STRONG REACTION WITH HCL; KAOLINITE IN MATRIX; NO VISIBL







The log data, interpretations and recommendation provided by Epoch are inferences and assumptions based on measurements of drilling fluids. Such inferences and assumptions are not infallible and reasonable professionals may differ. Epoch does not represent or warrant the accuracy, correctness or completeness of any log data, interpretations, recommendations or information provided by Epoch, its officers, agents or employees. Epoch does not and cannot guarantee the accuracy of any such interpretation of the log data, interpretations or recommendations and Company is fully responsible for all decisions and actions it takes based on such log data, interpretations and recommendations.

