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Houston, TX (281) 784-5500
Bakersfield, CA (661) 328-1595
New Iberia, LA (337) 364-2322
Anchorage, AK (907) 561-2465

MUDLOG TVD

COMPANY ExxonMobil Production
WELL FRU 197-28A8
FIELD FREEDOM CREEK UNIT
REGION ROCKIES
COORDINATES LAT: 39.934571000
LON: 108.295879000
ELEVATION GL = 6082'
KB = 6109'
COUNTY, STATE RIO BLANCO, CO
API INDEX 051031163100
SPUD DATE 05/06/2010
CONTRACTOR HELMRICH AND PAYNE
CO. REP. RICKY T OWENS
RIG/TYPE 215 / FLEX 3
LOGGING UNIT MLU 051
GEOLOGISTS GEORGE BAKER
BRENDA MARSH
ADD. PERSONS BILL JOHANNING
DEVIN CLAAR
CO. GEOLOGIST MELAINE A. BIGGS

LOG INTERVAL

CASING DATA

DEPTHS: 3,441' TO 12,275'
DATES: 5/04/2010 TO 5/23/2010
SCALE: 1" = 100'

16.0" AT 119'
10.75" AT 3,441'
AT
AT

MUD TYPES

HOLE SIZE

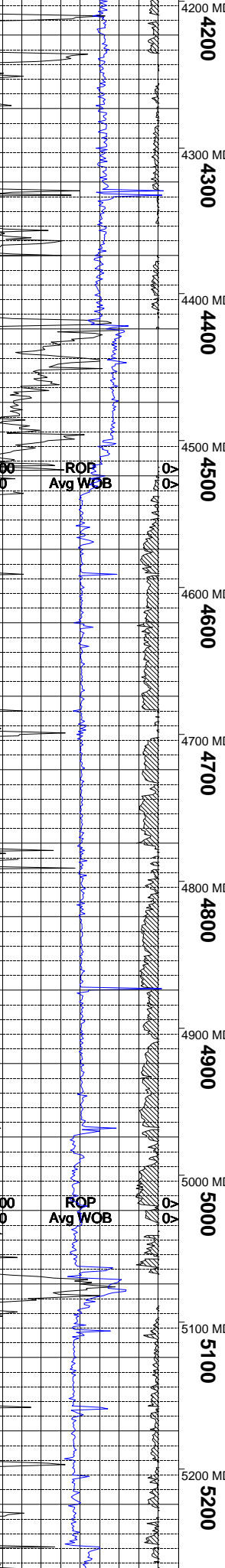
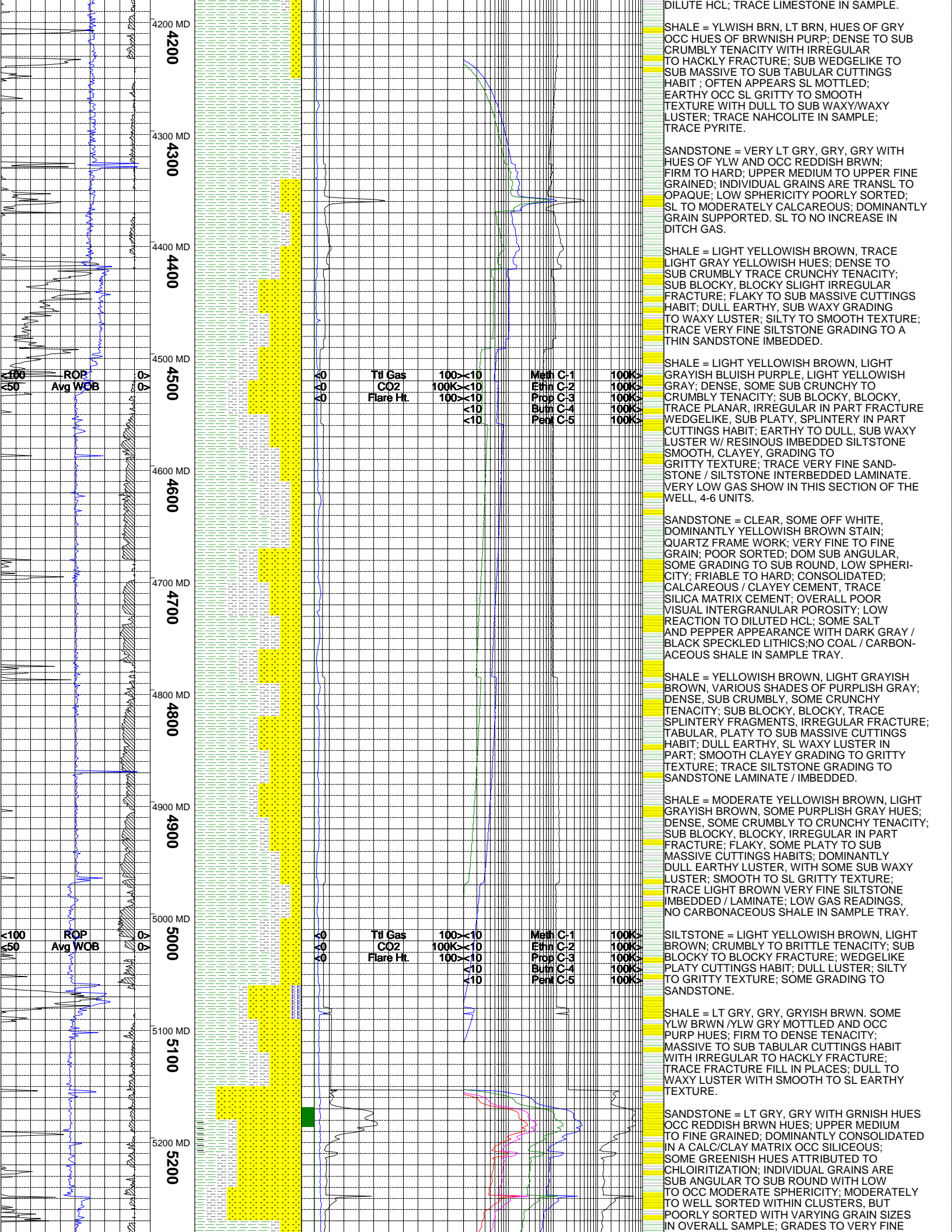
LSND TO 12,275'
TO
TO
TO
TO

14.75" TO 3,441'
8.75" TO 12,275'
TO
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

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



DILUTE HCL; TRACE LIMESTONE IN SAMPLE.

SHALE = YLWISH BRN, LT BRN, HUES OF GRY OCC HUES OF BRWNISH PURP; DENSE TO SUB CRUMBLY TENACITY WITH IRREGULAR TO HACKLY FRACTURE; SUB WEDGELIKE TO SUB MASSIVE TO SUB TABULAR CUTTINGS HABIT; OFTEN APPEARS SL MOTTLED; EARTHY OCC SL GRITTY TO SMOOTH TEXTURE WITH DULL TO SUB WAXY/WAXY LUSTER; TRACE NAHCOLITE IN SAMPLE; TRACE PYRITE.

SANDSTONE = VERY LT GRY, GRY, GRY WITH HUES OF YLW AND OCC REDDISH BRWN; FIRM TO HARD; UPPER MEDIUM TO UPPER FINE GRAINED; INDIVIDUAL GRAINS ARE TRANSL TO OPAQUE; LOW SPHERICITY POORLY SORTED; SL TO MODERATELY CALCAREOUS; DOMINANTLY GRAIN SUPPORTED. SL TO NO INCREASE IN DITCH GAS.

SHALE = LIGHT YELLOWISH BROWN, TRACE LIGHT GRAY YELLOWISH HUES; DENSE TO SUB CRUMBLY TRACE CRUNCHY TENACITY; SUB BLOCKY, BLOCKY SLIGHT IRREGULAR FRACTURE; FLAKY TO SUB MASSIVE CUTTINGS HABIT; DULL EARTHY, SUB WAXY GRADING TO WAXY LUSTER; SILTY TO SMOOTH TEXTURE; TRACE VERY FINE SILTSTONE GRADING TO A THIN SANDSTONE IMBEDDED.

SHALE = LIGHT YELLOWISH BROWN, LIGHT GRAYISH BLUISH PURPLE, LIGHT YELLOWISH GRAY; DENSE, SOME SUB CRUNCHY TO CRUMBLY TENACITY; SUB BLOCKY, BLOCKY, TRACE PLANAR, IRREGULAR IN PART FRACTURE WEDGELIKE, SUB PLATY, SPLINTERY IN PART CUTTINGS HABIT; EARTHY TO DULL, SUB WAXY LUSTER W/ RESINOUS IMBEDDED SILTSTONE SMOOTH, CLAYEY, GRADING TO GRITTY TEXTURE; TRACE VERY FINE SANDSTONE / SILTSTONE INTERBEDDED LAMINATE. VERY LOW GAS SHOW IN THIS SECTION OF THE WELL, 4-6 UNITS.

SANDSTONE = CLEAR, SOME OFF WHITE, DOMINANTLY YELLOWISH BROWN STAIN; QUARTZ FRAME WORK; VERY FINE TO FINE GRAIN; POOR SORTED; DOM SUB ANGULAR, SOME GRADING TO SUB ROUND, LOW SPHERICITY; FRIABLE TO HARD; CONSOLIDATED; CALCAREOUS / CLAYEY CEMENT, TRACE SILICA MATRIX CEMENT; OVERALL POOR VISUAL INTERGRANULAR POROSITY; LOW REACTION TO DILUTED HCL; SOME SALT AND PEPPER APPEARANCE WITH DARK GRAY / BLACK SPECKLED LITHICS; NO COAL / CARBONACEOUS SHALE IN SAMPLE TRAY.

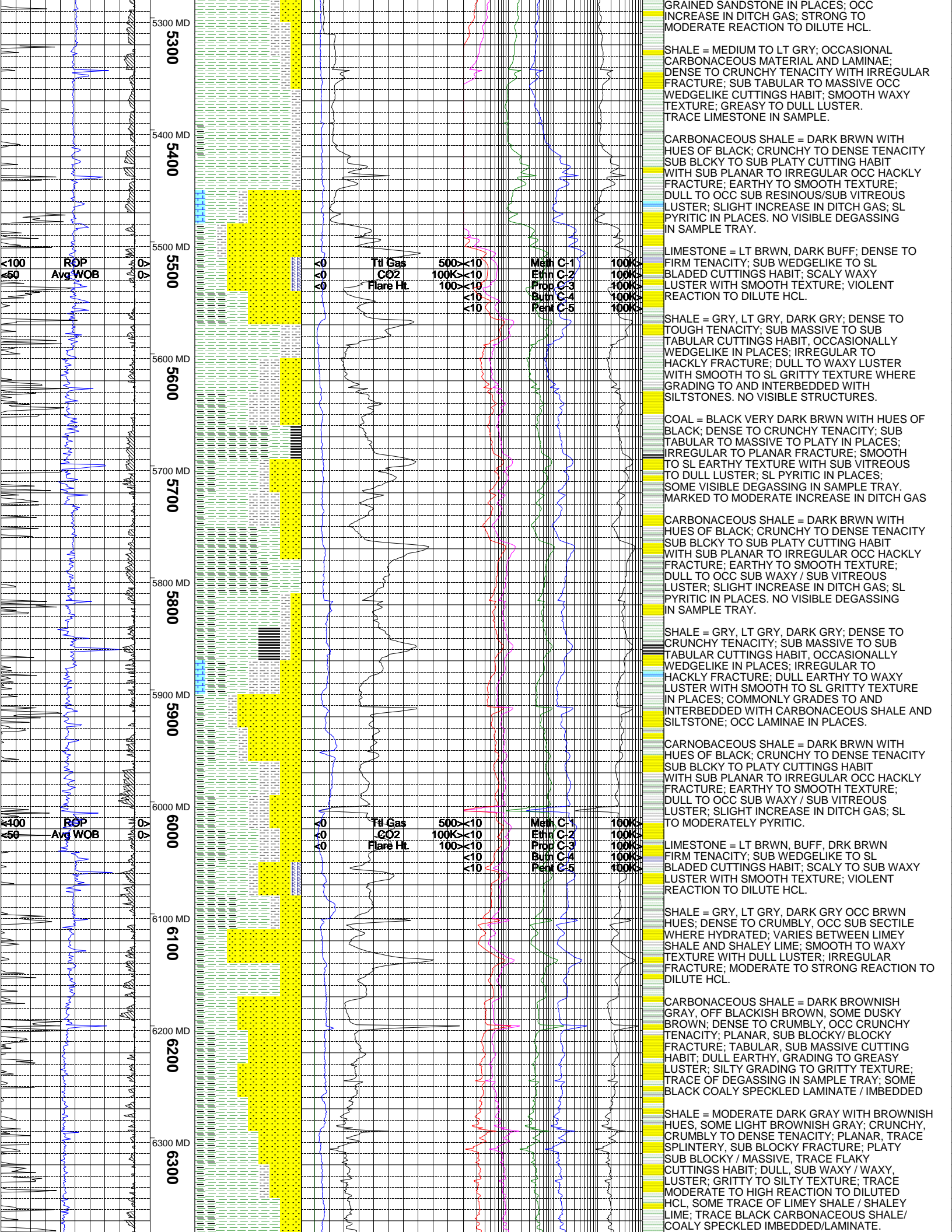
SHALE = YELLOWISH BROWN, LIGHT GRAYISH BROWN, VARIOUS SHADES OF PURPLISH GRAY; DENSE, SUB CRUMBLY, SOME CRUNCHY TENACITY; SUB BLOCKY, BLOCKY, TRACE SPLINTERY FRAGMENTS, IRREGULAR FRACTURE; TABULAR, PLATY TO SUB MASSIVE CUTTINGS HABIT; DULL EARTHY, SL WAXY LUSTER IN PART; SMOOTH CLAYEY GRADING TO GRITTY TEXTURE; TRACE SILTSTONE GRADING TO SANDSTONE LAMINATE / IMBEDDED.

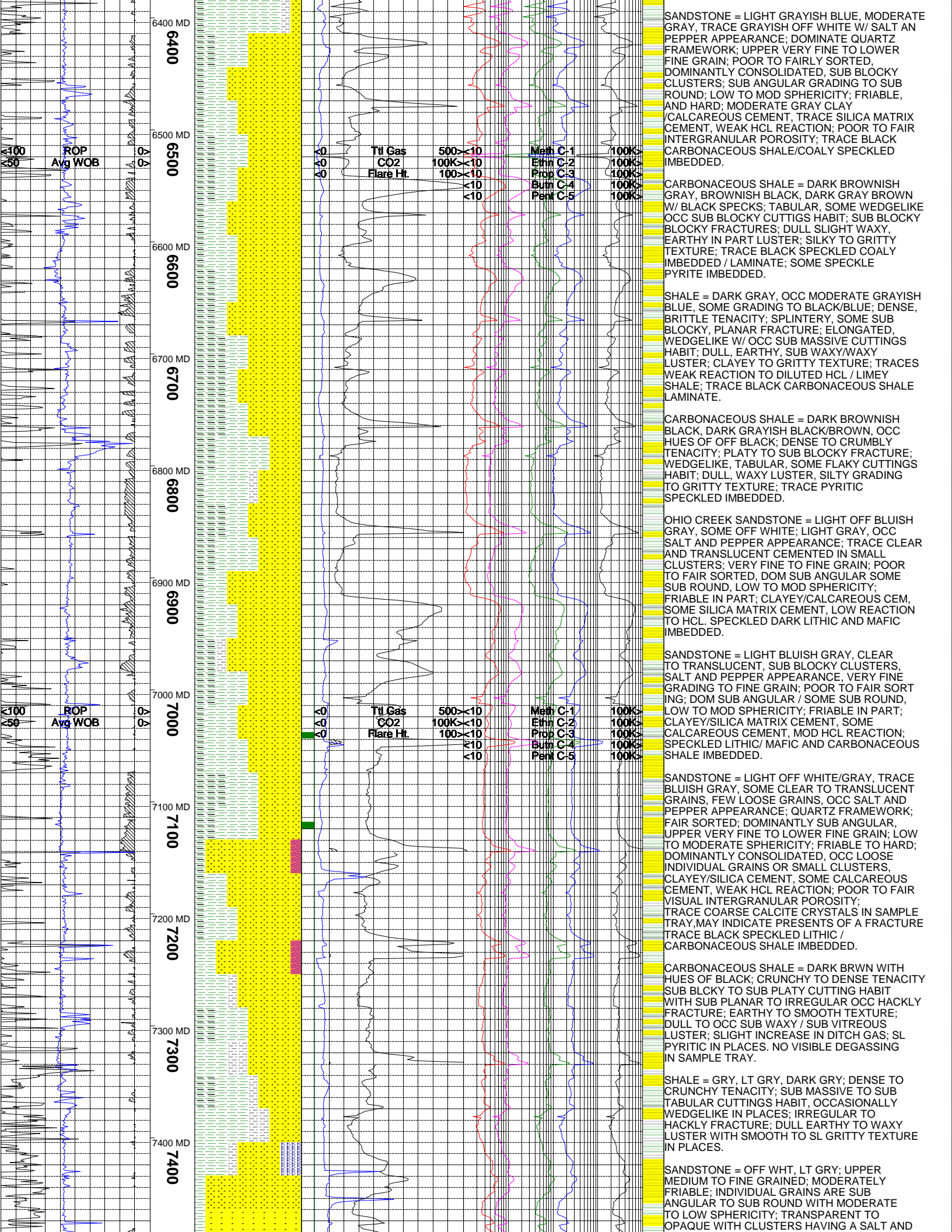
SHALE = MODERATE YELLOWISH BROWN, LIGHT GRAYISH BROWN, SOME PURPLISH GRAY HUES; DENSE, SOME CRUMBLY TO CRUNCHY TENACITY; SUB BLOCKY, BLOCKY, IRREGULAR IN PART FRACTURE; FLAKY, SOME PLATY TO SUB MASSIVE CUTTINGS HABITS; DOMINANTLY DULL EARTHY LUSTER, WITH SOME SUB WAXY LUSTER; SMOOTH TO SL GRITTY TEXTURE; TRACE LIGHT BROWN VERY FINE SILTSTONE IMBEDDED / LAMINATE; LOW GAS READINGS, NO CARBONACEOUS SHALE IN SAMPLE TRAY.

SILTSTONE = LIGHT YELLOWISH BROWN, LIGHT BROWN; CRUMBLY TO BRITTLE TENACITY; SUB BLOCKY TO BLOCKY FRACTURE; WEDGELIKE PLATY CUTTINGS HABIT; DULL LUSTER; SILTY TO GRITTY TEXTURE; SOME GRADING TO SANDSTONE.

SHALE = LT GRY, GRY, GRYISH BRWN. SOME YLW BRWN / YLW GRY MOTTLED AND OCC PURP HUES; FIRM TO DENSE TENACITY; MASSIVE TO SUB TABULAR CUTTINGS HABIT WITH IRREGULAR TO HACKLY FRACTURE; TRACE FRACTURE FILL IN PLACES; DULL TO WAXY LUSTER WITH SMOOTH TO SL EARTHY TEXTURE.

SANDSTONE = LT GRY, GRY WITH GRNISH HUES OCC REDDISH BRWN HUES; UPPER MEDIUM TO FINE GRAINED; DOMINANTLY CONSOLIDATED IN A CALC/CLAY MATRIX OCC SILICEOUS; SOME GREENISH HUES ATTRIBUTED TO CHLORITIZATION; INDIVIDUAL GRAINS ARE SUB ANGULAR TO SUB ROUND WITH LOW TO OCC MODERATE SPHERICITY; MODERATELY TO WELL SORTED WITHIN CLUSTERS, BUT POORLY SORTED WITH VARYING GRAIN SIZES IN OVERALL SAMPLE; GRADES TO VERY FINE





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6700
6800 MD
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7100 MD
7100
7200 MD
7200
7300 MD
7300
7400 MD
7400

ROP
Avg WOB
ROP
Avg WOB

Ttl Gas	500x10	Meth C-1	100%
CO2	100Kx10	Ethn C-2	100%
Flare Ht	100x10	Prop C-3	100%
	<10	Bum C-4	100%
	<10	Pen C-5	100%

SANDSTONE = LIGHT GRAYISH BLUE, MODERATE GRAY, TRACE GRAYISH OFF WHITE W/ SALT AN PEPPER APPEARANCE; DOMINATE QUARTZ FRAMEWORK; UPPER VERY FINE TO LOWER FINE GRAIN; POOR TO FAIRLY SORTED, DOMINANTLY CONSOLIDATED, SUB BLOCKY CLUSTERS; SUB ANGULAR GRADING TO SUB ROUND; LOW TO MOD SPHERICITY; FRIABLE, AND HARD; MODERATE GRAY CLAY /CALCAREOUS CEMENT, TRACE SILICA MATRIX CEMENT, WEAK HCL REACTION; POOR TO FAIR INTERGRANULAR POROSITY; TRACE BLACK CARBONACEOUS SHALE/COALY SPECKLED IMBEDDED.

CARBONACEOUS SHALE = DARK BROWNISH GRAY, BROWNISH BLACK, DARK GRAY BROWN W/ BLACK SPECKS; TABULAR, SOME WEDGELIKE OCC SUB BLOCKY CUTTINGS HABIT; SUB BLOCKY BLOCKY FRACTURES; DULL SLIGHT WAXY, EARTHY IN PART LUSTER; SILKY TO GRITTY TEXTURE; TRACE BLACK SPECKLED COALY IMBEDDED / LAMINATE; SOME SPECKLE PYRITTE IMBEDDED.

SHALE = DARK GRAY, OCC MODERATE GRAYISH BLUE, SOME GRADING TO BLACK/BLUE; DENSE, BRITTLE TENACITY; SPLINTERY, SOME SUB BLOCKY, PLANAR FRACTURE; ELONGATED, WEDGELIKE W/ OCC SUB MASSIVE CUTTINGS HABIT; DULL, EARTHY, SUB WAXY/WAXY LUSTER; CLAYEY TO GRITTY TEXTURE; TRACES WEAK REACTION TO DILUTED HCL / LIMEY SHALE; TRACE BLACK CARBONACEOUS SHALE LAMINATE.

CARBONACEOUS SHALE = DARK BROWNISH BLACK, DARK GRAYISH BLACK/BROWN, OCC HUES OF OFF BLACK; DENSE TO CRUMBLY TENACITY; PLATY TO SUB BLOCKY FRACTURE; WEDGELIKE, TABULAR, SOME FLAKY CUTTINGS HABIT; DULL, WAXY LUSTER, SILTY GRADING TO GRITTY TEXTURE; TRACE PYRITIC SPECKLED IMBEDDED.

OHIO CREEK SANDSTONE = LIGHT OFF BLUISH GRAY, SOME OFF WHITE; LIGHT GRAY, OCC SALT AND PEPPER APPEARANCE; TRACE CLEAR AND TRANSLUCENT CEMENTED IN SMALL CLUSTERS; VERY FINE TO FINE GRAIN; POOR TO FAIR SORTED, DOM SUB ANGULAR SOME SUB ROUND, LOW TO MOD SPHERICITY; FRIABLE IN PART; CLAYEY/CALCAREOUS CEM, SOME SILICA MATRIX CEMENT, LOW REACTION TO HCL. SPECKLED DARK LITHIC AND MAFIC IMBEDDED.

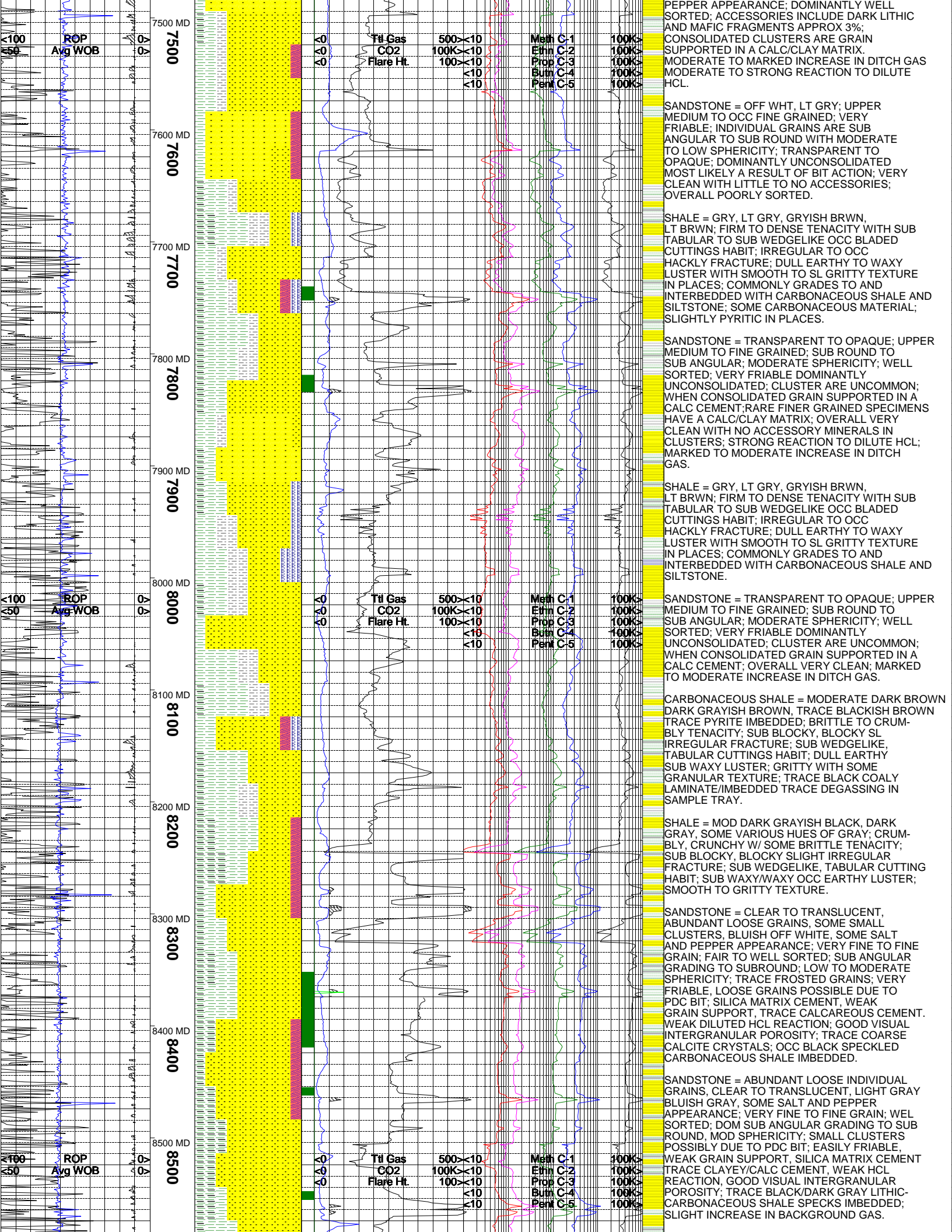
SANDSTONE = LIGHT BLUISH GRAY, CLEAR TO TRANSLUCENT, SUB BLOCKY CLUSTERS, SALT AND PEPPER APPEARANCE, VERY FINE GRADING TO FINE GRAIN; POOR TO FAIR SORT ING; DOM SUB ANGULAR / SOME SUB ROUND, LOW TO MOD SPHERICITY; FRIABLE IN PART; CLAYEY/SILICA MATRIX CEMENT, SOME CALCAREOUS CEMENT, MOD HCL REACTION; SPECKLED LITHIC/ MAFIC AND CARBONACEOUS SHALE IMBEDDED.

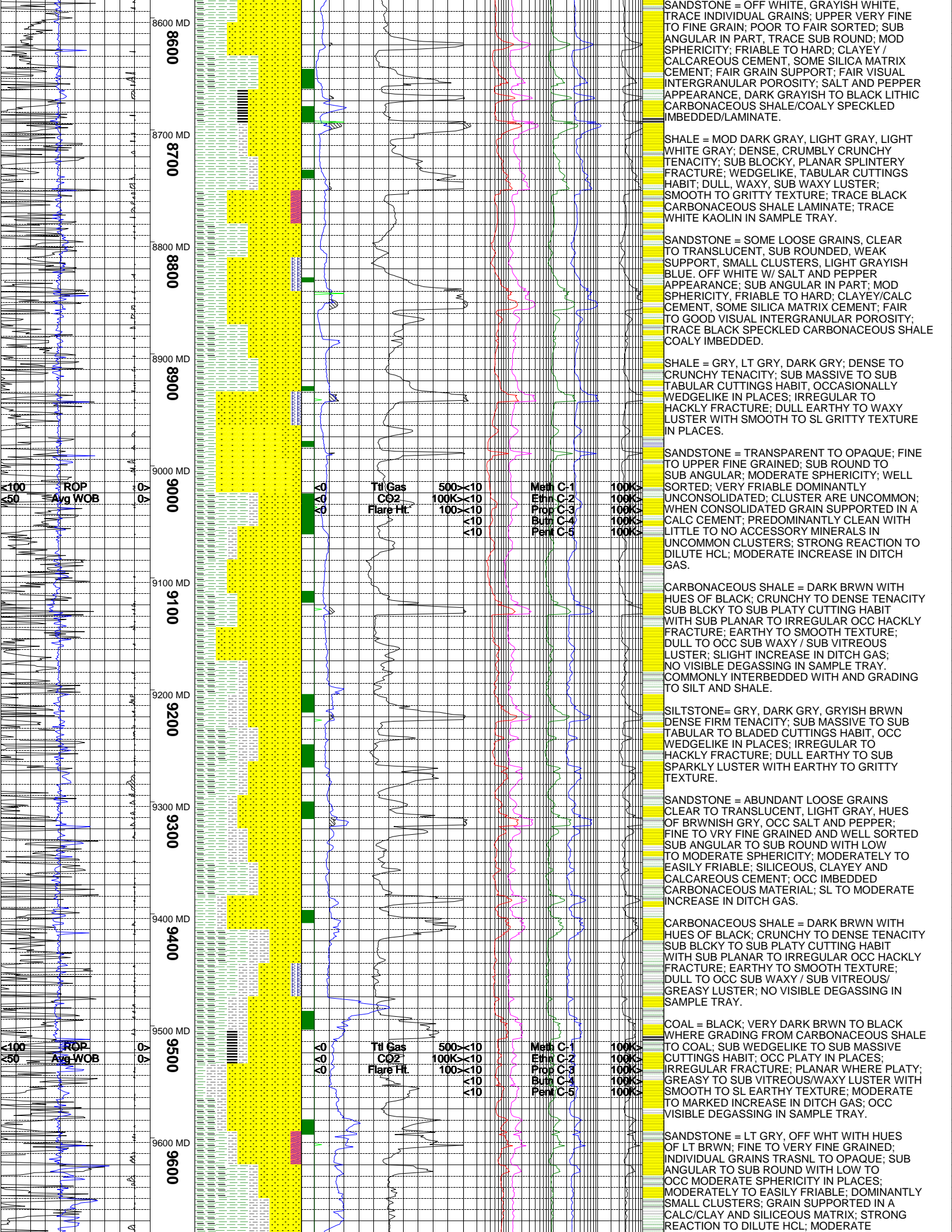
SANDSTONE = LIGHT OFF WHITE/GRAY, TRACE BLUISH GRAY, SOME CLEAR TO TRANSLUCENT GRAINS, FEW LOOSE GRAINS, OCC SALT AND PEPPER APPEARANCE; QUARTZ FRAMEWORK; FAIR SORTED; DOMINANTLY SUB ANGULAR, UPPER VERY FINE TO LOWER FINE GRAIN; LOW TO MODERATE SPHERICITY; FRIABLE TO HARD; DOMINANTLY CONSOLIDATED, OCC LOOSE INDIVIDUAL GRAINS OR SMALL CLUSTERS, CLAYEY/SILICA CEMENT, SOME CALCAREOUS CEMENT, WEAK HCL REACTION; POOR TO FAIR VISUAL INTERGRANULAR POROSITY; TRACE COARSE CALCITE CRYSTALS IN SAMPLE TRAY, MAY INDICATE PRESENTS OF A FRACTURE TRACE BLACK SPECKLED LITHIC / CARBONACEOUS SHALE IMBEDDED.

CARBONACEOUS SHALE = DARK BRWN WITH HUES OF BLACK; CRUNCHY TO DENSE TENACITY SUB BLOCKY TO SUB PLATY CUTTING HABIT WITH SUB PLANAR TO IRREGULAR OCC HACKLY FRACTURE; EARTHY TO SMOOTH TEXTURE; DULL TO OCC SUB WAXY / SUB VITREOUS LUSTER; SLIGHT INCREASE IN DITCH GAS; SL PYRITIC IN PLACES. NO VISIBLE DEGASSING IN SAMPLE TRAY.

SHALE = GRY, LT GRY, DARK GRY; DENSE TO CRUNCHY TENACITY; SUB MASSIVE TO SUB TABULAR CUTTINGS HABIT, OCCASIONALLY WEDGELIKE IN PLACES; IRREGULAR TO HACKLY FRACTURE; DULL EARTHY TO WAXY LUSTER WITH SMOOTH TO SL GRITTY TEXTURE IN PLACES.

SANDSTONE = OFF WHT, LT GRY; UPPER MEDIUM TO FINE GRAINED; MODERATELY FRIABLE; INDIVIDUAL GRAINS ARE SUB ANGULAR TO SUB ROUND WITH MODERATE TO LOW SPHERICITY; TRANSPARENT TO OPAQUE WITH CLUSTERS HAVING A SALT AND





8600 MD
8700 MD
8800 MD
8900 MD
9000 MD
9100 MD
9200 MD
9300 MD
9400 MD
9500 MD
9600 MD

>100 ROP
<50 Avg WOB

>100 ROP
<50 Avg WOB

Til Gas	500	<10	Meth C-1	100%
CO2	100	<10	Ethn C-2	100%
Flare Ht.	100	<10	Prop C-3	100%
		<10	Burn C-4	100%
		<10	Penk C-5	100%

Til Gas	500	<10	Meth C-1	100%
CO2	100	<10	Ethn C-2	100%
Flare Ht.	100	<10	Prop C-3	100%
		<10	Burn C-4	100%
		<10	Penk C-5	100%

SANDSTONE = OFF WHITE, GRAYISH WHITE, TRACE SANDSTONE GRAINS; UPPER VERY FINE TO FINE GRAIN; POOR TO FAIR SORTED; SUB ANGULAR IN PART, TRACE SUB ROUND; MOD SPHERICITY; FRIABLE TO HARD; CLAYEY / CALCAREOUS CEMENT, SOME SILICA MATRIX CEMENT; FAIR GRAIN SUPPORT; FAIR VISUAL INTERGRANULAR POROSITY; SALT AND PEPPER APPEARANCE, DARK GRAYISH TO BLACK LITHIC CARBONACEOUS SHALE/COALY SPECKLED IMBEDDED/LAMINATE.

SHALE = MOD DARK GRAY, LIGHT GRAY, LIGHT WHITE GRAY; DENSE, CRUMBLY CRUNCHY TENACITY; SUB BLOCKY, PLANAR SPLINTERY FRACTURE; WEDGELIKE, TABULAR CUTTINGS HABIT; DULL, WAXY, SUB WAXY LUSTER; SMOOTH TO GRITTY TEXTURE; TRACE BLACK CARBONACEOUS SHALE LAMINATE; TRACE WHITE KAOLIN IN SAMPLE TRAY.

SANDSTONE = SOME LOOSE GRAINS, CLEAR TO TRANSLUCENT, SUB ROUNDED, WEAK SUPPORT, SMALL CLUSTERS, LIGHT GRAYISH BLUE, OFF WHITE W/ SALT AND PEPPER APPEARANCE; SUB ANGULAR IN PART; MOD SPHERICITY, FRIABLE TO HARD; CLAYEY/CALC CEMENT, SOME SILICA MATRIX CEMENT; FAIR TO GOOD VISUAL INTERGRANULAR POROSITY; TRACE BLACK SPECKLED CARBONACEOUS SHALE COALY IMBEDDED.

SHALE = GRY, LT GRY, DARK GRY; DENSE TO CRUNCHY TENACITY; SUB MASSIVE TO SUB TABULAR CUTTINGS HABIT, OCCASIONALLY WEDGELIKE IN PLACES; IRREGULAR TO HACKLY FRACTURE; DULL EARTHY TO WAXY LUSTER WITH SMOOTH TO SL GRITTY TEXTURE IN PLACES.

SANDSTONE = TRANSPARENT TO OPAQUE; FINE TO UPPER FINE GRAINED; SUB ROUND TO SUB ANGULAR; MODERATE SPHERICITY; WELL SORTED; VERY FRIABLE DOMINANTLY UNCONSOLIDATED; CLUSTER ARE UNCOMMON; WHEN CONSOLIDATED GRAIN SUPPORTED IN A CALC CEMENT; PREDOMINANTLY CLEAN WITH LITTLE TO NO ACCESSORY MINERALS IN UNCOMMON CLUSTERS; STRONG REACTION TO DILUTE HCL; MODERATE INCREASE IN DITCH GAS.

CARBONACEOUS SHALE = DARK BRWN WITH HUES OF BLACK; CRUNCHY TO DENSE TENACITY SUB BCKY TO SUB PLATY CUTTING HABIT WITH SUB PLANAR TO IRREGULAR OCC HACKLY FRACTURE; EARTHY TO SMOOTH TEXTURE; DULL TO OCC SUB WAXY / SUB VITREOUS LUSTER; SLIGHT INCREASE IN DITCH GAS; NO VISIBLE DEGASSING IN SAMPLE TRAY. COMMONLY INTERBEDDED WITH AND GRADING TO SILT AND SHALE.

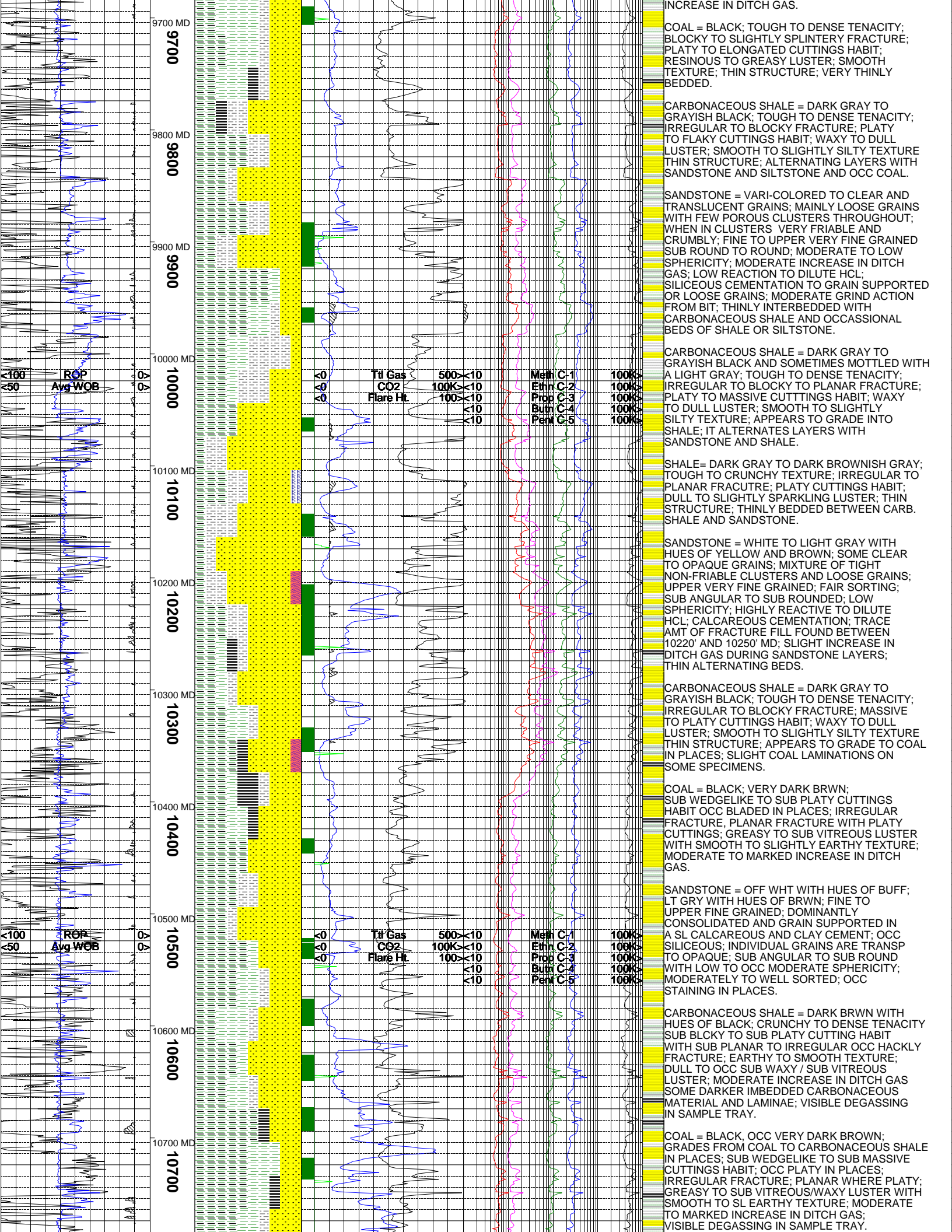
SILTSTONE = GRY, DARK GRY, GRISH BRWN DENSE FIRM TENACITY; SUB MASSIVE TO SUB TABULAR TO BLADED CUTTINGS HABIT, OCC WEDGELIKE IN PLACES; IRREGULAR TO HACKLY FRACTURE; DULL EARTHY TO SUB SPARKLY LUSTER WITH EARTHY TO GRITTY TEXTURE.

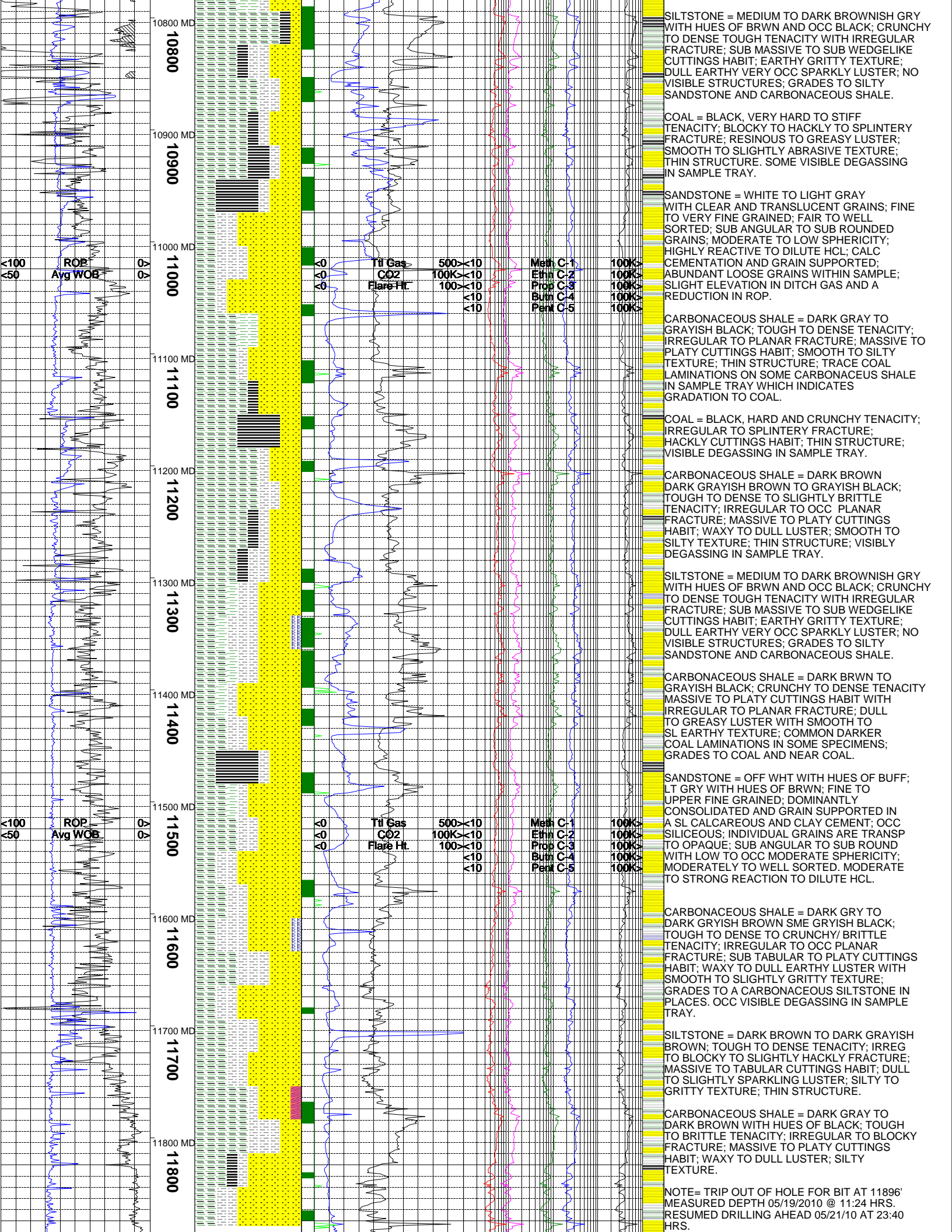
SANDSTONE = ABUNDANT LOOSE GRAINS CLEAR TO TRANSLUCENT, LIGHT GRAY, HUES OF BRWNISH GRY, OCC SALT AND PEPPER; FINE TO VRY FINE GRAINED AND WELL SORTED SUB ANGULAR TO SUB ROUND WITH LOW TO MODERATE SPHERICITY; MODERATELY TO EASILY FRIABLE; SILICEOUS, CLAYEY AND CALCAREOUS CEMENT; OCC IMBEDDED CARBONACEOUS MATERIAL; SL TO MODERATE INCREASE IN DITCH GAS.

CARBONACEOUS SHALE = DARK BRWN WITH HUES OF BLACK; CRUNCHY TO DENSE TENACITY SUB BCKY TO SUB PLATY CUTTING HABIT WITH SUB PLANAR TO IRREGULAR OCC HACKLY FRACTURE; EARTHY TO SMOOTH TEXTURE; DULL TO OCC SUB WAXY / SUB VITREOUS/ GREASY LUSTER; NO VISIBLE DEGASSING IN SAMPLE TRAY.

COAL = BLACK; VERY DARK BRWN TO BLACK WHERE GRADING FROM CARBONACEOUS SHALE TO COAL; SUB WEDGELIKE TO SUB MASSIVE CUTTINGS HABIT; OCC PLATY IN PLACES; IRREGULAR FRACTURE; PLANAR WHERE PLATY; GREASY TO SUB VITREOUS/WAXY LUSTER WITH SMOOTH TO SL EARTHY TEXTURE; MODERATE TO MARKED INCREASE IN DITCH GAS; OCC VISIBLE DEGASSING IN SAMPLE TRAY.

SANDSTONE = LT GRY, OFF WHT WITH HUES OF LT BRWN; FINE TO VERY FINE GRAINED; INDIVIDUAL GRAINS TRASNLT TO OPAQUE; SUB ANGULAR TO SUB ROUND WITH LOW TO OCC MODERATE SPHERICITY IN PLACES; MODERATELY TO EASILY FRIABLE; DOMINANTLY SMALL CLUSTERS; GRAIN SUPPORTED IN A CALC/CLAY AND SILICEOUS MATRIX; STRONG REACTION TO DILUTE HCL; MODERATE





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

>100
ROP
Avg WOB

Tilt Gas
CO2
Flare Ht

500X<10
100KX<10
100X<10
<10
<10

Meth C:1
Ethn C:2
Prop C:3
Burn C:4
Perm C:5

100K
100K
100K
100K
100K

SILTSTONE = MEDIUM TO DARK BROWNISH GRAY WITH HUES OF BRWN AND OCC BLACK; CRUNCHY TO DENSE TOUGH TENACITY WITH IRREGULAR FRACTURE; SUB MASSIVE TO SUB WEDGELIKE CUTTINGS HABIT; EARTHY GRITTY TEXTURE; DULL EARTHY VERY OCC SPARKLY LUSTER; NO VISIBLE STRUCTURES; GRADES TO SILTY SANDSTONE AND CARBONACEOUS SHALE.

COAL = BLACK, VERY HARD TO STIFF TENACITY; BLOCKY TO HACKLY TO SPLINTERY FRACTURE; RESINOUS TO GREASY LUSTER; SMOOTH TO SLIGHTLY ABRASIVE TEXTURE; THIN STRUCTURE. SOME VISIBLE DEGASSING IN SAMPLE TRAY.

SANDSTONE = WHITE TO LIGHT GRAY WITH CLEAR AND TRANSLUCENT GRAINS; FINE TO VERY FINE GRAINED; FAIR TO WELL SORTED; SUB ANGULAR TO SUB ROUNDED GRAINS; MODERATE TO LOW SPHERICITY; HIGHLY REACTIVE TO DILUTE HCL; CALC CEMENTATION AND GRAIN SUPPORTED; ABUNDANT LOOSE GRAINS WITHIN SAMPLE; SLIGHT ELEVATION IN DITCH GAS AND A REDUCTION IN ROP.

CARBONACEOUS SHALE = DARK GRAY TO GRAYISH BLACK; TOUGH TO DENSE TENACITY; IRREGULAR TO PLANAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; SMOOTH TO SILTY TEXTURE; THIN STRUCTURE; TRACE COAL LAMINATIONS ON SOME CARBONACEOUS SHALE IN SAMPLE TRAY WHICH INDICATES GRADATION TO COAL.

COAL = BLACK, HARD AND CRUNCHY TENACITY; IRREGULAR TO SPLINTERY FRACTURE; HACKLY CUTTINGS HABIT; THIN STRUCTURE; VISIBLE DEGASSING IN SAMPLE TRAY.

CARBONACEOUS SHALE = DARK BROWN DARK GRAYISH BROWN TO GRAYISH BLACK; TOUGH TO DENSE TO SLIGHTLY BRITTLE TENACITY; IRREGULAR TO OCC PLANAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; WAXY TO DULL LUSTER; SMOOTH TO SILTY TEXTURE; THIN STRUCTURE; VISIBLY DEGASSING IN SAMPLE TRAY.

SILTSTONE = MEDIUM TO DARK BROWNISH GRAY WITH HUES OF BRWN AND OCC BLACK; CRUNCHY TO DENSE TOUGH TENACITY WITH IRREGULAR FRACTURE; SUB MASSIVE TO SUB WEDGELIKE CUTTINGS HABIT; EARTHY GRITTY TEXTURE; DULL EARTHY VERY OCC SPARKLY LUSTER; NO VISIBLE STRUCTURES; GRADES TO SILTY SANDSTONE AND CARBONACEOUS SHALE.

CARBONACEOUS SHALE = DARK BRWN TO GRAYISH BLACK; CRUNCHY TO DENSE TENACITY MASSIVE TO PLATY CUTTINGS HABIT WITH IRREGULAR TO PLANAR FRACTURE; DULL TO GREASY LUSTER WITH SMOOTH TO SL EARTHY TEXTURE; COMMON DARKER COAL LAMINATIONS IN SOME SPECIMENS; GRADES TO COAL AND NEAR COAL.

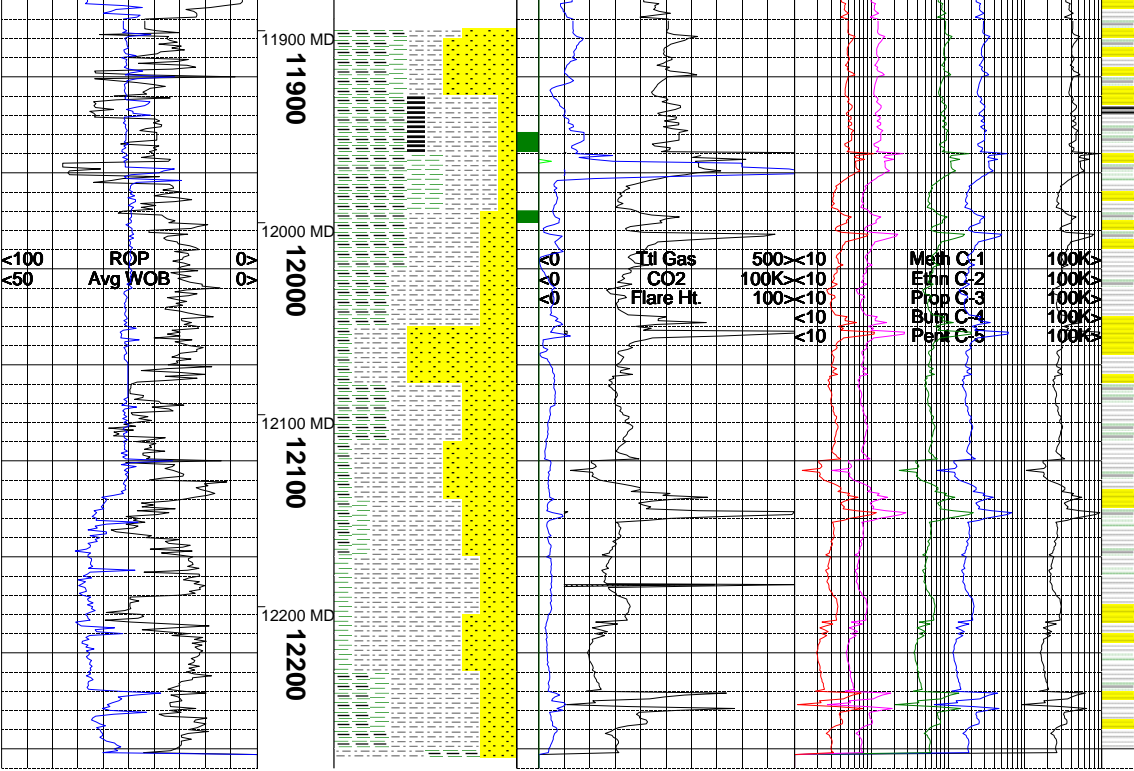
SANDSTONE = OFF WHT WITH HUES OF BUFF; LT GRAY WITH HUES OF BRWN; FINE TO UPPER FINE GRAINED; DOMINANTLY CONSOLIDATED AND GRAIN SUPPORTED IN A SL CALCAREOUS AND CLAY CEMENT; OCC SILICEOUS; INDIVIDUAL GRAINS ARE TRANSP TO OPAQUE; SUB ANGULAR TO SUB ROUND WITH LOW TO OCC MODERATE SPHERICITY; MODERATELY TO WELL SORTED. MODERATE TO STRONG REACTION TO DILUTE HCL.

CARBONACEOUS SHALE = DARK GRAY TO DARK GRAYISH BROWN SME GRAYISH BLACK; TOUGH TO DENSE TO CRUNCHY/ BRITTLE TENACITY; IRREGULAR TO OCC PLANAR FRACTURE; SUB TABULAR TO PLATY CUTTINGS HABIT; WAXY TO DULL EARTHY LUSTER WITH SMOOTH TO SLIGHTLY GRITTY TEXTURE; GRADES TO A CARBONACEOUS SILTSTONE IN PLACES. OCC VISIBLE DEGASSING IN SAMPLE TRAY.

SILTSTONE = DARK BROWN TO DARK GRAYISH BROWN; TOUGH TO DENSE TENACITY; IRREG TO BLOCKY TO SLIGHTLY HACKLY FRACTURE; MASSIVE TO TABULAR CUTTINGS HABIT; DULL TO SLIGHTLY SPARKLING LUSTER; SILTY TO GRITTY TEXTURE; THIN STRUCTURE.

CARBONACEOUS SHALE = DARK GRAY TO DARK BROWN WITH HUES OF BLACK; TOUGH TO BRITTLE TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; WAXY TO DULL LUSTER; SILTY TEXTURE.

NOTE= TRIP OUT OF HOLE FOR BIT AT 11896' MEASURED DEPTH 05/19/2010 @ 11:24 HRS. RESUMED DRILLING AHEAD 05/21/10 AT 23:40 HRS.



NOTE: FIRST SAMPLE AT 11900 WAS OF POOR QUALITY: DOMINANTLY CAVINGS.

CARBONACEOUS SHALE = DARK GRAY TO GRAYISH BLACK WITH COAL LAMINATIONS THROUGHOUT; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; WAXY TO SLIGHTLY VITREOUS TO DULL LUSTER; THIN STRUCTURE; SOME VISIBLE DEGASSING.

SILTSTONE = DARK BROWN TO DARK GRAYISH BROWN; TOUGH TO DENSE TENACITY; IRREG TO BLOCKY TO SLIGHTLY HACKLY FRACTURE; MASSIVE TO TABULAR CUTTINGS HABIT; DULL LUSTER; SILTY TO SLIGHTLY GRITTY TEXTURE.

CARBONACEOUS SHALE = DARK GRAY TO DARK GRAYISH BROWN SME BRWNISH BLACK; DENSE TO CRUNCHY TENACITY WITH IRREGULAR TO OCC PLANAR FRACTURE; SUB TABULAR TO SUB PLATY CUTTINGS HABIT; DULL EARTHY TO WAXY LUSTER WITH SMOOTH TO SLIGHTLY GRITTY TEXTURE; GRADES TO A CARBONACEOUS SILTSTONE AND SHALE IN PLACES.

NOTE = TOTAL DEPTH 12275' MD / 12251 TVD REACHED 05/22/2010 AT 14:01HRS.

Li Gas	500	<10	Meth C-1	100%
CO2	100K	<10	Ethn C-2	100%
Flare Ht.	100	<10	Prop C-3	100%
		<10	Bum C-4	100%
		<10	Pen C-5	100%

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.