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Houston, TX (281) 784-5500
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MUDLOG TVD

COMPANY ExxonMobil Production
WELL PCU 297-12A7
FIELD Piceance Creek Unit
REGION Rocky Mountain
COORDINATES Lat. 39.889005 N
Lon. 108.23726 W
ELEVATION GL: 7183.9'
KB: 7214'
COUNTY, STATE RIO BLANCO, CO
API INDEX 05-103-11161-00
SPUD DATE 10/12/2008
CONTRACTOR HP Drilling
CO. REP. J. Woods, M. Sadler
RIG/TYPE 326 / Flex Four
LOGGING UNIT Canrig Unit 36
GEOLOGISTS J.Kokes
B.Laiche
ADD. PERSONS H.Strickland
P.Strickland
CO. GEOLOGIST Chris Alba

LOG INTERVAL

CASING DATA

DEPTHS: 3995' TO 12866'
DATES: 5/22/2009 TO 11/22/2009
SCALE: 1" = 100'

10 3/4" AT 3980'
7" AT 8881'
4.5" AT 12866'
AT

MUD TYPES

HOLE SIZE

WATER BASED TO 3995'
LSND TO 5500'
DSF TO 5882'
LSND TO 12866'

14 1/4" TO 3995'
9 7/8" TO 8896'
6.125" TO 12866'
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.

<200	ROP	>0
	ft/hr	
<50	Avg WOB	>0
	klbs	
<1	Depth of Cut	>0
	in/rev	

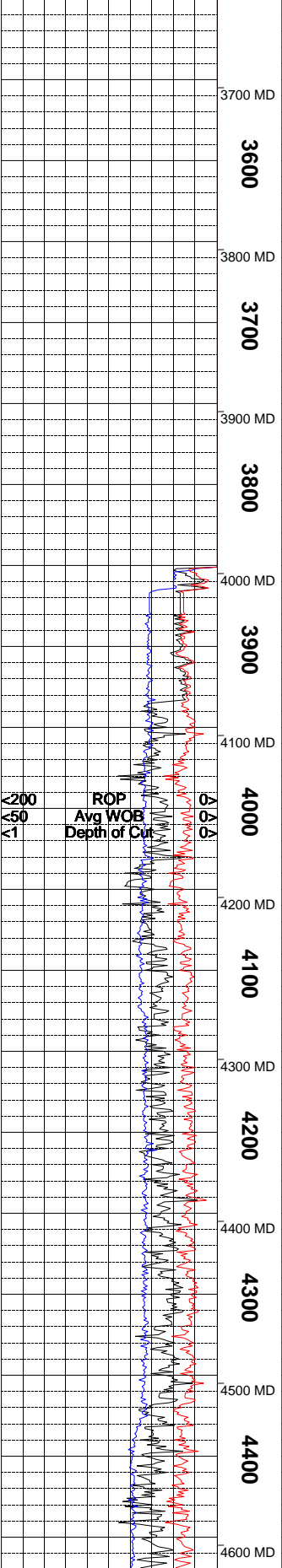
TVD Depth

Lithology

<0	Ttl Gas	500	<10	Meth C-1	100K
	units			ppm	
<10			<10	Ethn C-2	100K
				ppm	
<0	CO2	50K	<10	Prop C-3	100K
	ppm			ppm	
<10			<10	Butn C-4	100K
				ppm	
<0	Flare Ht.	100	<10	Pent C-5	100K
	ft			ppm	

Interp. Lith

Remarks
Survey Data, Mud Reports, Other Info.



3700 MD

3600

3800 MD

3700

3900 MD

3800

4000 MD

3900

4100 MD

4000

4200 MD

4100

4300 MD

4200

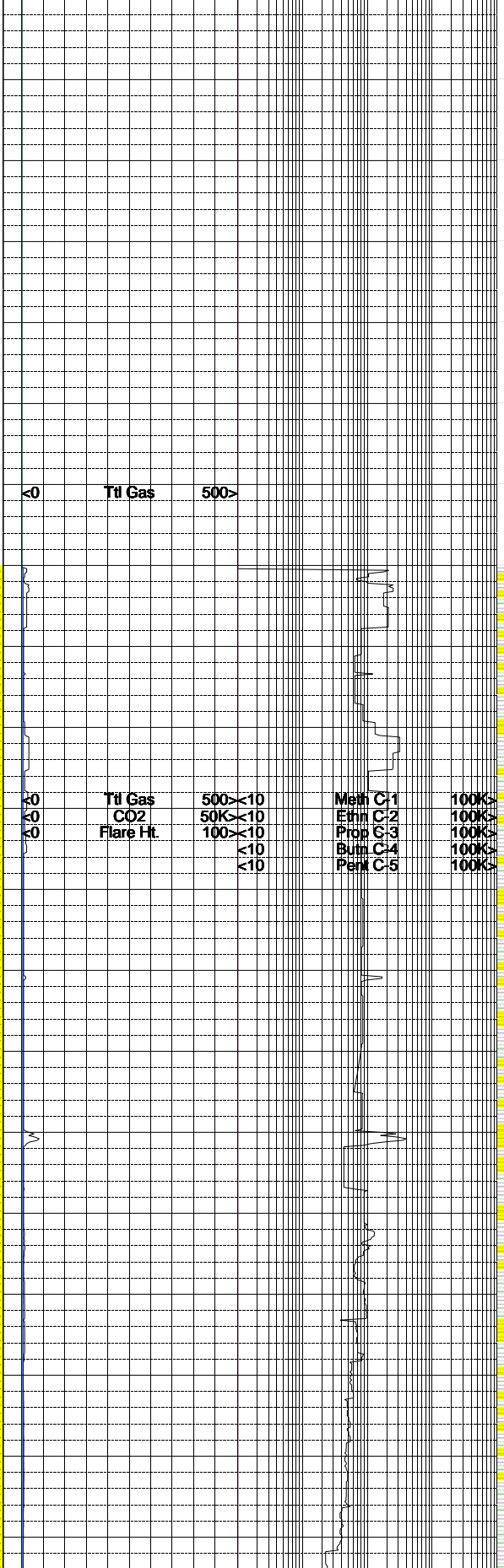
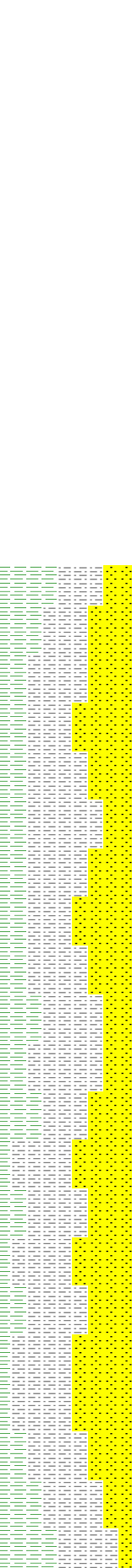
4400 MD

4300

4500 MD

4400

4600 MD



Interp. Lith

ALL ROCK COLORS ARE REFERENCED TO THE CONNECTION GASES AS WELL AS TRIP AND DOWNTIME GASES ARE NOTED ON THE LOG. LARGE CONNECTION GASES WHICH APPEAR ON THE MUD LOG USUALLY REFLECT UPHOLE GAS INTERVALS BLEEDING GAS INTO THE BOREHOLE DURING CONNECTIONS.

GAS CHROMATOGRAPHY EQUIPMENT IS CALIBRATED TO A TEST GAS COMPOSED OF METHANE = 10040 PPM
ETHANE = 990 PPM
PROPANE = 1000 PPM
I-BUTANE = 1010 PPM
N-BUTANE = 1000 PPM
I-PENTANE = 1000 PPM
N-PENTANE = 1000 PPM

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

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

1 UNIT OF GAS = 200 PPM METHANE

SET 10 3/4" SURFACE CASING AT 3980'

EPOCH COMMENCED LOGGING ON 5/22/2009 AT 3995' MD.

SANDSTONE = LIGHT PALE BROWNISH YELLOW, LIGHT MODERATE BROWN, SOME CLEAR TO TRANSLUCENT; UPPER VERY FINE TO FINE GRAIN SIZE; POOR TO FAIR SORTED; SUB-ANGULAR, SUBROUND IN PART; CLEAR TO FROSTED SURFACE FEATURES; EASILY FRIABLE TO FRIABLE; CLAY MATRIX CEMENT TRACE CALCAREOUS CEMENT; LITHE AND SILTSTONE INTERBEDDED.

SHALE = MODERATED YELLOWISH BROWN; CRUMBLY, TENACITY; SUBBLOCKY FRACTURE; WEDGELIKE, TABULAR CUTTINGS HABIT; DULL EARTHY LUSTER, SILTY, CLAYEY TEXTURE; MASSIVE TO THICK STRUCTURE.

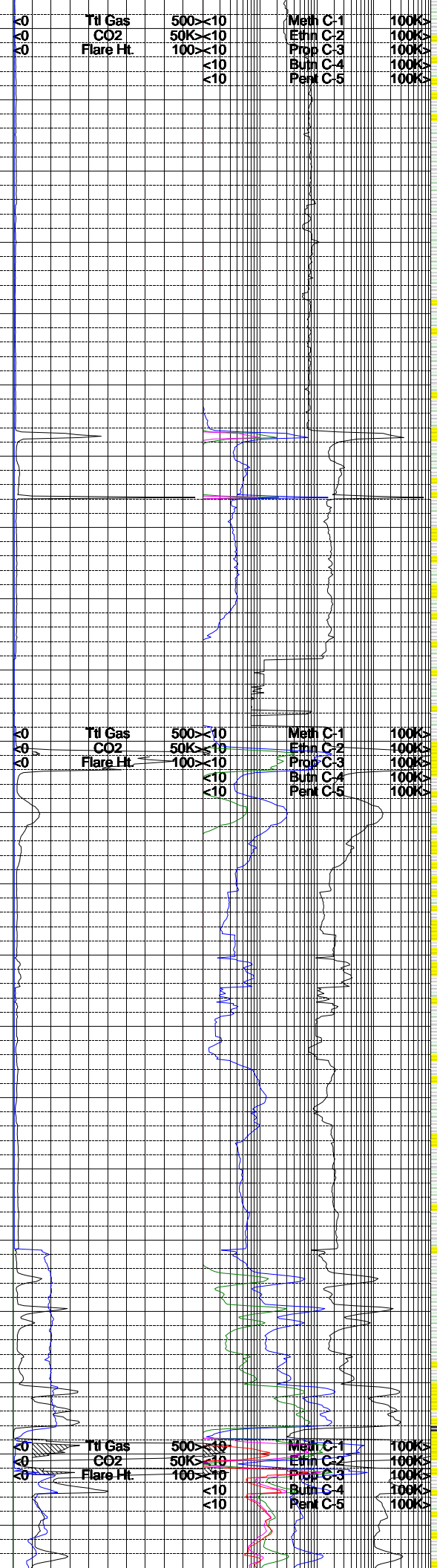
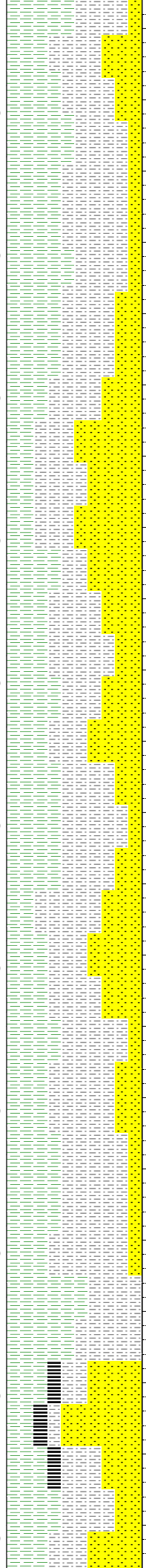
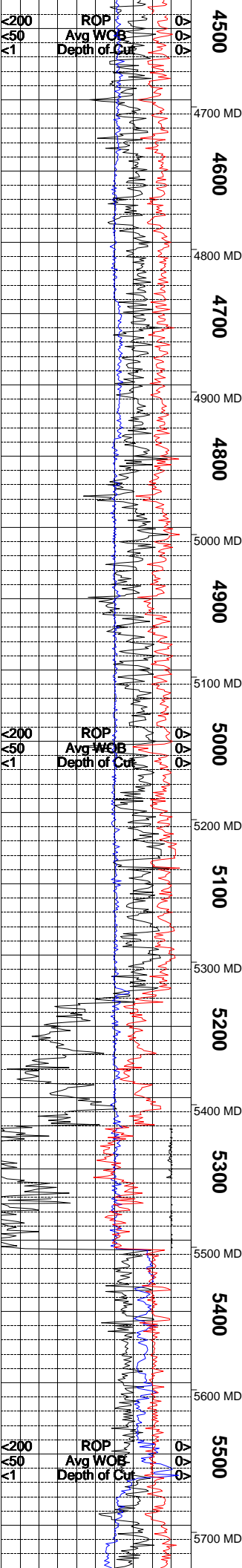
SANDSTONE = LIGHT PALE BROWN, VERY LIGHT GRAY, OFF WHITE WITH SLIGHT TRANSLUCENT GRAINS; PREDOMINATELY QUARTZ FRAMEWORK; LOWER FINE TO SOME UPPER FINE GRAIN; POOR SORTING; SUBANGULAR TO SUBROUND; TRACES FROSTED SURFACE FEATURES; EASILY FRIABLE TO SOME FRIABLE; CLAY MATRIX CEMENT, TRACE CARCAREOUS CEMENT; SOME GRAIN SUPPORTED; TRACE SILTSTONE INTERBEDDED.

SILTSTONE = LIGHT YELLOWISH BROWN, MODERATE PALE YELLOWISH BROWN; PULVERULENT, CRUNCHY TENACITY; EARTHY SUBBLOCKY FRACTURE; WEDGELIKE CUTTINGS HABIT; DULL SEMI EARTHY LUSTER; GRITTY TO GRANULAR TEXTURE; THIN STRUCTURE; GRADING TO SANDSTONE.

SHALE = BROWNISH YELLOW ORANGE, PALE TO MODERATE YELLOWISH BROWN, OCCASIONALLY MEDIUM GRAY WITH SLIGHT GREENISH HUES; FIRM; CRUMBLY TO OCCASIONALLY MODERATELY TOUGH; IRREGULAR, SUBBLOCKY, RARELY WEDGE-LIKE CUTTINGS HABIT; MATTE TO RARELY SLIGHTLY RESINOUS LUSTER; DOMINANTLY SMOOTH TEXTURE; MODERATELY CALCAREOUS; LOCALLY SILTY, GRADING IN PART TO AND INTERBEDDED WITH SILTSTONE; POOR TO MODERATE FISSILITY.

SANDSTONE = VERY LIGHT GRAY TO WHITE; OCC WITH SLIGHT BROWNISH HUES; FIRM CLASTS RANGE FROM VERY FINE LOWER TO FINE LOWER; SUBANGULAR TO SUBROUND; MODERATELY SORTED; QUARTZ RICH, SCATTERED TO COMMON DARK GRAY TO BLACK LITHICS; CLAY MATRIX; LIGHT CALC CEMENT; LOCALLY SILTY, GRADES TO AND IS INTERBEDDED WITH SILTSTONE.

SILTSTONE = MODERATE TO DARK YELLOWISH BROWN, LIGHT GRAY, OCCASIONAL SLIGHTLY OLIVE HUES; FIRM TO MODERATELY HARD; CRUMBLY TO OCCASIONALLY MODERATELY TOUGH; EARTHY LUSTER WITH SCATTERED SPARKLES; ABRASIVE, GRITTY



TEXTURE: MODERATELY CALCAREOUS; INTERBEDDED WITH AND INTERGRADATIONAL WITH SHALES.

SHALE = MODERATE TO DARK YELLOWISH BROWN, BROWNISH YELLOW ORANGE, OCCASIONALLY MEDIUM GRAY WITH SLIGHT GREENISH HUES; FIRM; CRUMBLY TO OCCASIONALLY MODERATELY TOUGH; IRREGULAR, SUBBLOCKY, RARELY WEDGE-LIKE CUTTINGS HABIT; MATTE TO RARELY SLIGHTLY RESINOUS LUSTER; DOMINANTLY SMOOTH TEXTURE; MODERATELY CALCAREOUS; LOCALLY SILTY, GRADING IN PART TO AND AND INTERBEDDED WITH SILTSTONE.

SANDSTONE = WHITE TO VERY LIGHT GRAY; COMMON "PEPPERED" APPEARANCE; FIRM CLASTS RANGE FROM VERY FINE LOWER TO FINE LOWER; SUBANGULAR TO SUBROUND; MODERATELY SORTED; QUARTZ RICH, SCATTERED TO COMMON DARK GRAY TO BLACK LITHICS; CLAY MATRIX; LIGHT CALC CEMENT; LOCALLY SILTY, GRADES TO AND IS INTERBEDDED WITH SILTSTONE.

SILTSTONE = MODERATE TO DARK YELLOWISH BROWN, LIGHT GRAY, COMMON GREENISH GRAY TO OLIVE HUES; FIRM TO MODERATELY HARD; CRUMBLY TO OCCASIONALLY MODERATELY TOUGH; EARTHY LUSTER WITH SCATTERED SPARKLES; ABRASIVE, GRITTY TEXTURE; MODERATELY CALCAREOUS.

SANDSTONE = PALE TANISH STAIN OFF WHITE; LIGHT YELLOWISH PALE BROWN; SOME CLEAR TRANSLUCENT QUARTZ FRAMEWORK; UPPER VERY FINE, PREDOMINATELY FINE GRAIN; POOR SORTING; TRACES SUBROUND, SUBANGULAR IN ANGULARITY; LOW SPHERICITY; SLIGHT SEMI FROSTED SURFACE FEATURES; FRIABLE TO SEMI FIRM FRIABLE; CLAY MATRIX CEMENT, VERY MINOR CALCAREOUS CEMENT; DARK GRAY TO GRAYISH BLACK LITHICS AND SOME DARK BROWISH SILTSTONE INTERBEDDED.

SHALE = VERY PALE GRAYISH ORANGE, LIGHT PALE YELLOWISH BROWN, TRACES LIGHT OLIVE GRAY; PULVERULENT, SEMI CRUMBLY TENACITY; EARTHY, SUBBLOCKY SLIGHT IRREGULAR FRACTURE; WEDGELIKE SLIGHT BLOCKY CUTTINGS HABIT; DULL EARTHY, CLAYEY TEXTURE; THIN STRUCTURE; TRACE SILTSTONE INTERBEDDED.

SILTSTONE = YELLOWISH BROWN, PALE LIGHT BROWN; BRITTLE TENACITY, IRREGULAR FRACTURE; WEDGELIKE TO TABULAR CUTTINGS HABIT; RESINOUS LUSTER; GRITTY TEXTURE; MASSIVE TO THIN STRUCTURE. GRADING TO SANDSTONE.

SANDSTONE = WHITE TO VERY LIGHT GRAY; COMMON PALE YELSH BROWN HUES; FIRM CLASTS RANGE FROM VERY FINE LOWER TO FINE LOWER; SUBANGULAR TO SUBROUND; MODERATELY SORTED; QUARTZ RICH, SCATTERED TO COMMON DARK GRAY TO BLACK LITHICS; CLAY MATRIX; LIGHT CALC CEMENT; LOCALLY SILTY, GRADES TO AND IS INTERBEDDED WITH SILTSTONE.

SHALE = PALE GRAYISH ORANGE, LIGHT TO MODERATE YELLOWISH BROWN, TRACES LIGHT OLIVE GRAY; CRUMBLY TO MODERATELY TOUGH TENACITY; IRREGULAR AND SUBBLOCKY CUTTINGS; MATTE LUSTER; SMOOTH TO MODERATELY SILTY TEXTURE; SLIGHTLY TO MODERATELY CALCAREOUS; GRADES TO AND IS INTERBEDDED WITH SILTSTONE.

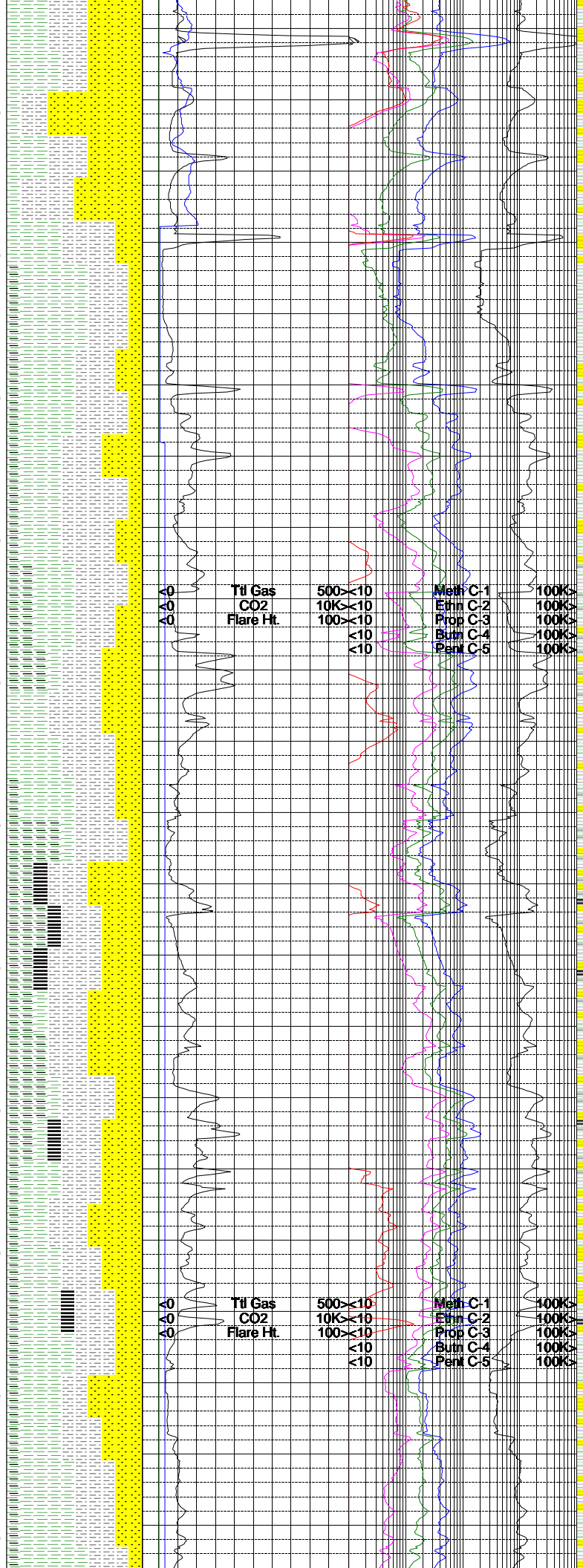
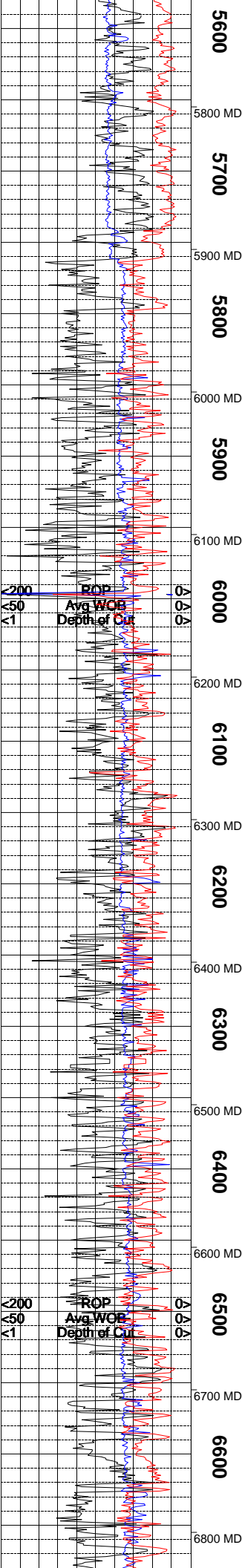
SHALE = MEDIUM GRAY, LIGHT BLUISH GRAY, LIGHT GRAYISH RED PURPLE, DARK YELLOWISH ORANGE; CRUMBLY TO PULVERULENT TENACITY; IRREGULAR EARTHY FRACTURE; PLATY TO WEDGELIKE WITH SOME ELONGATED CUTTINGS HABIT; WAXY EARTHY LUSTER; CLAYEY TEXTURE; THIN STRUCTURE.

SILTSTONE = LIGHT TO MEDIUM BROWN, LIGHT BLUISH GRAY, SOME PURPLISH HUE; VERY FINE GRAIN; MODERATE HARD TO FRIABLE; GRITTY, SILTY TEXTURE; EARTHY LUSTER; THINLY BEDDED WITH SHALE.

NOTE: SAMPLES ARE APPROX. 80% L.C.M.

NOTE: LOST RETURNS AT 5650'.

SANDSTONE = WHITE TO VERY LIGHT GRAY, OCCASIONALLY LIGHT GREENISH GRAY; FRIABLE TO HARD; CLASTS RANGE FROM VERY FINE LOWER TO FINE UPPER, RARE MEDIUM LOWER GRAINS; MODERATELY SORTED; SUBANGULAR TO SUBROUND; DOMINANTLY QUARTZ WITH SCATTERED DARK GRAY TO BLACK LITHICS; OCCASIONAL CARBONACEOUS MATERIAL; DOMINANTLY GRAIN SUPPORTED; CLAY MATRIX; LIGHTLY CALCITE CEMENTED;



INTERBEDDED WITH SILTSTONE AND SHALE.

SHALE = MEDIUM GRAY, GRAYISH RED, LIGHT BLUISH GRAY, DARK YELLOWISH ORANGE; CRUMBLY TO CRUNCHY TENACITY; HACKLY TO EARTHY FRACTURE; PLATY TO WEDGELIKE CUTTINGS HABIT; DULL EARTHY LUSTER; CLAYET TO SILTY TEXTURE; MASSIVE STRUCTURE.

SILTSTONE = LIGHT GRAY TO BLUISH GRAY, GRAYISH RED, PALE BROWN; FRIABLE TO FIRM FRIABLE; GRITTY TEXTURE; EARTHY WITH SOME SLIGHTLY SPARKLING LUSTER; THICK STRUCTURE; SOME GRADING TO VERY FINE SANDSTONE.

SHALE = DARK TO DUSKY YELLOWISH BROWN, LIGHT TO MEDIUM GRAY, LIGHT GREENISH GRAY; FIRM TO HARD; CRUMBLY TO TOUGH; BLOCKY, TABULAR AND OCCASIONAL PLATY CUTTINGS HABIT; EARTHY TO OCCASIONALLY SLIGHTLY SHINY LUSTER; DOMINANTLY SMOOTH TO OCCASIONALLY SILTY TEXTURE; NON TO SLIGHTLY CALCAREOUS; OCCASIONALLY WITH HIGH CARBONACEOUS CONTENT; POOR TO FAIR FISSILITY.

SANDSTONE = WHITE TO LIGHT GRAY WITH COMMON VERY LIGHT BROWN HUES; COMMON "PEPPERED" APPEARANCE; FIRM TO MODERATELY TOUGH; CLASTS RANGE FROM VERY FINE LOWER TO FINE LOWER; SUBANGULAR TO SUBROUND; MODERATELY SORTED; DOMINANTLY QUARTZ WITH SCATTERED MEDIUM TO DARK GRAY LITHICS; OCCASIONAL CARBONACEOUS MATTER; VARIABLE GRAIN/MATRIX SUPPORTED; WHITE CLAY MATRIX; CALCITE CEMENTED; SILTY IN PART, GRADES TO AND IS INTERBEDDED WITH SILTSTONE.

SHALE = LIGHT TO MEDIUM GRAY, LIGHT BLUISH GRAY, GRAYISH ORANGE, GRAYISH RED SOME PALE REDDISH BROWN; TOUGH CRUMBLY TENACITY; IRREGULAR HACKLY FRACTURE; PLATY TO WEDGELIKE WITH OCCASIONAL ELONGATE CUTTINGS HABIT; WAXY EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; ABUNDANT CARBONACEOUS MATERIAL WITH TRACE AMOUNT COAL IN SAMPLE.

SHALE = DUSKY YELLOWISH BROWN, DARK GRAY, BROWNISH BLACK, SMALL AMOUNT LIGHT BLUISH GRAY, DENSE CRUMBLY TENACITY; HACKLY EARTHY FRACTURE; TABULAR WEDGELIKE CUTTINGS HABIT; WAXY EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; SLIGHTLY FISSILE STRUCTURE; OCCASIONAL PYRITE INCLUSIONS.

COAL = BLACK; BROWNISH BLACK; DENSE, BRITTLE, CRUNCHY TENACITY; BLOCKY, SOME CONCHOIDAL, AND EARTHY FRACTURE; FLAKY, TABULAR CUTTINGS HABIT; VITREOUS LUSTER; SMOOTH TEXTURE; THICK STRUCTURE, SOME OUTGASSING VISIBLE.

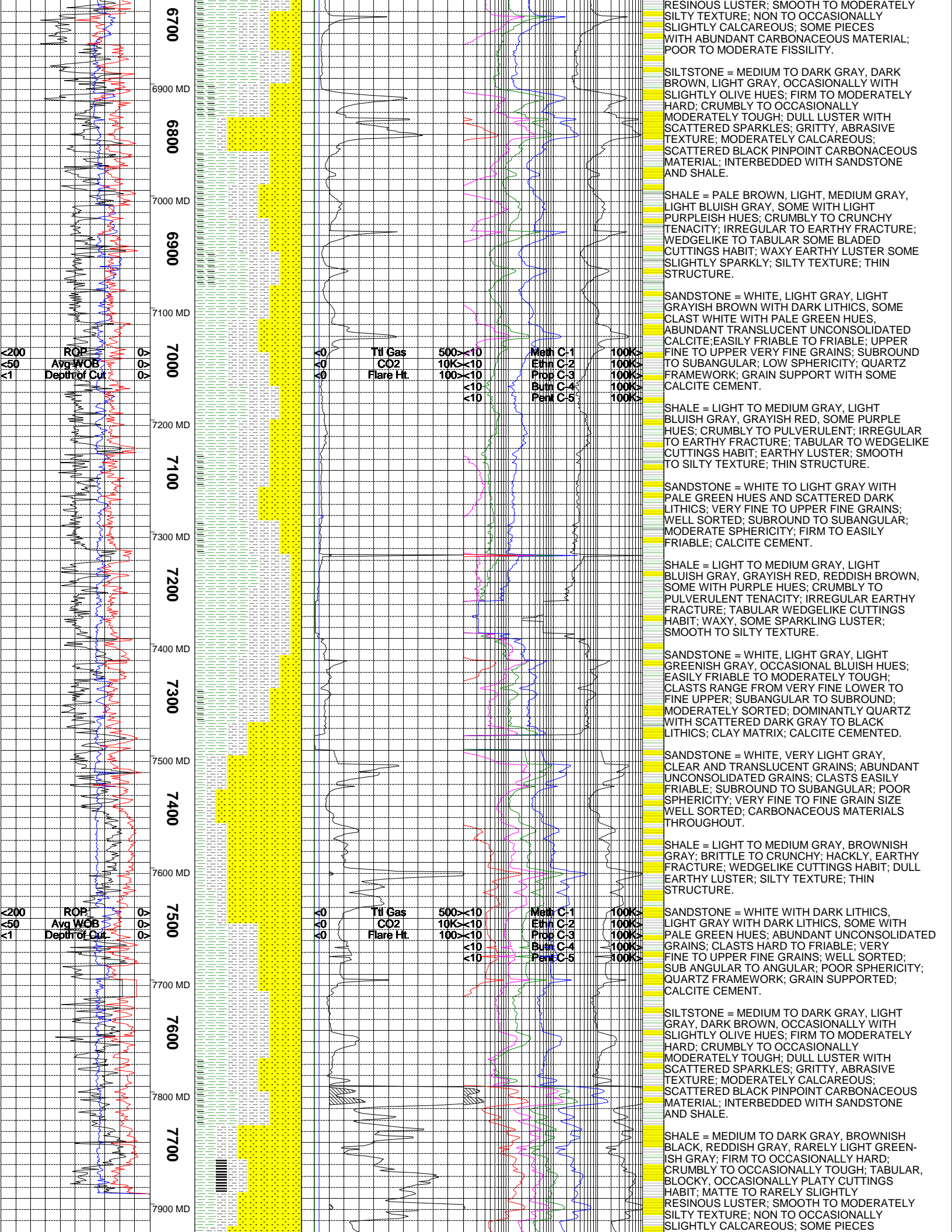
SANDSTONE = LIGHT GRAY WITH DARK LITHICS PALE BROWN WITH DARK LITHICS; FIRM FRIABLE TO FRIABLE; VERY FINE TO FINE GRAINS; WELL SORTED; MODERATE SPHERICITY QUARTZ FRAMEWORK; SUBANGULAR TO SUBROUND; CALCITE CEMENT.

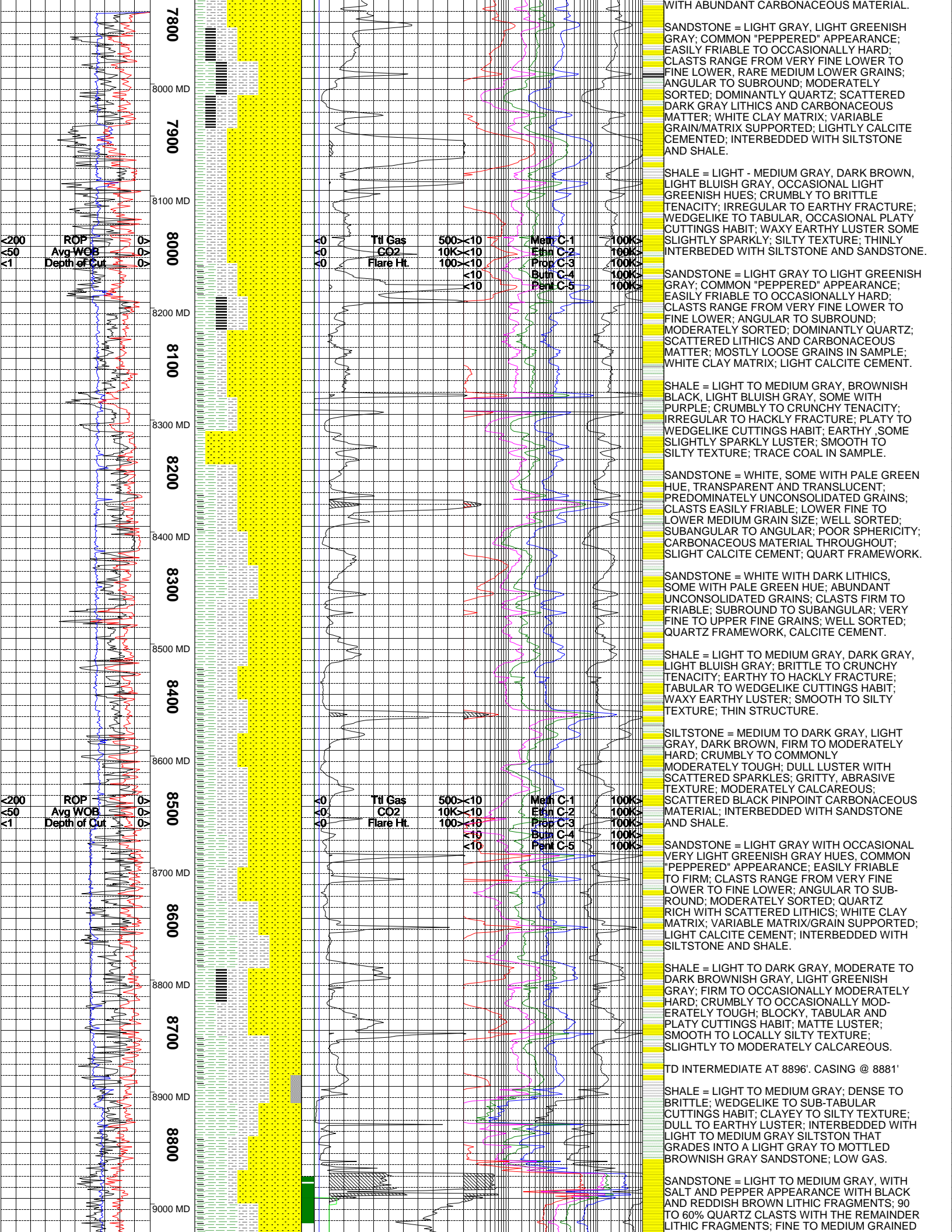
SHALE = MEDIUM TO DARK GRAY, BROWNISH BLACK, GRAYISH RED, SOME VERIGATED; DENSE, BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO EARTHY FRACTURE; TABULAR TO WEDGELIKE WITH SOME ELONGATE CUTTINGS HABIT; WAXY, EARTHY SOME SLIGHTLY SPARKLING LUSTER; SMOOTH TO SILTY TEXTURE; MASSIVE STRUCTURE.

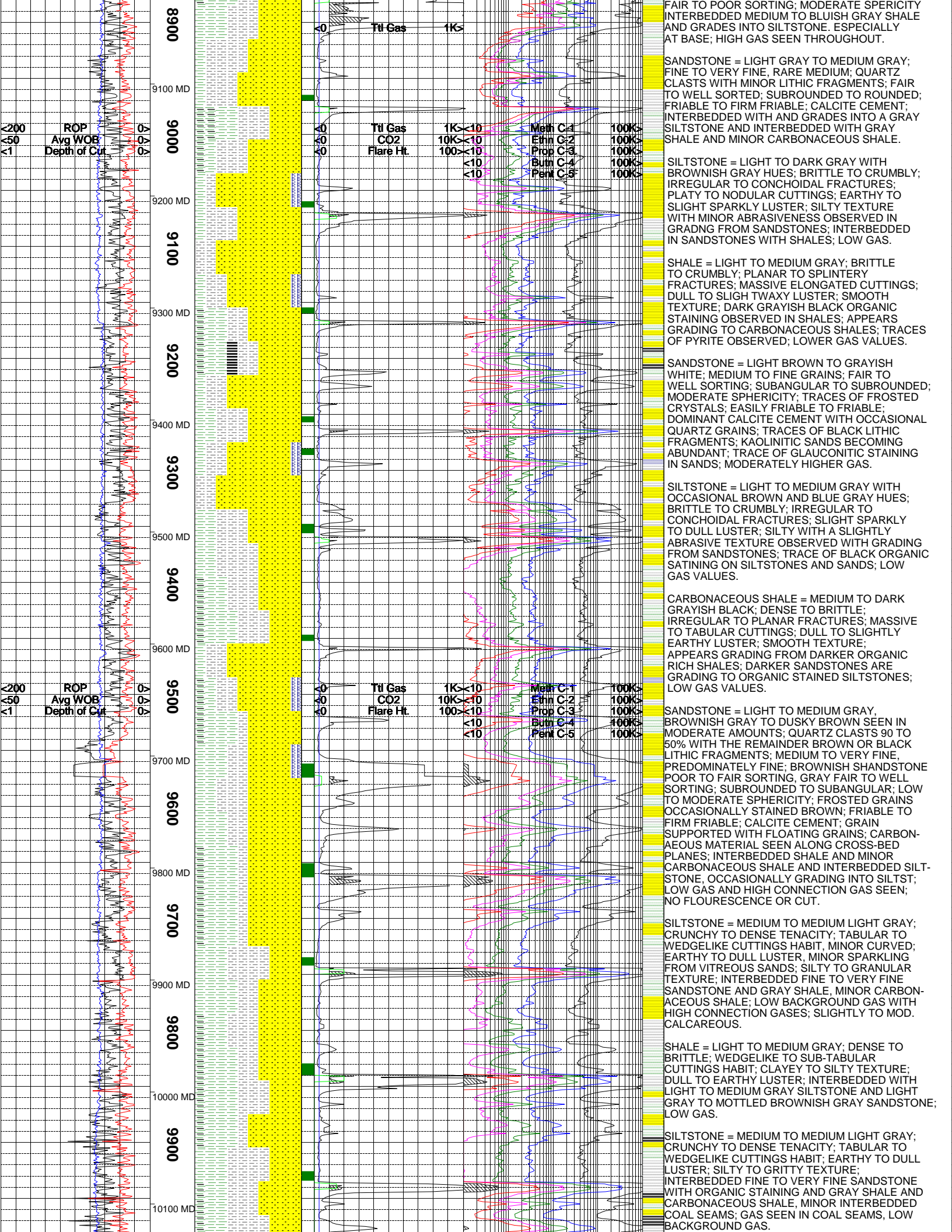
SILTSTONE = DARK TO MEDIUM GRAY, DARK BROWN, LIGHT GRAY, OCCASIONAL SLIGHTLY OLIVE HUES; FIRM TO MODERATELY HARD; CRUMBLY TO OCCASIONALLY MODERATELY TOUGH; EARTHY LUSTER WITH SCATTERED SPARKLES; ABRASIVE, GRITTY TEXTURE; MODERATELY CALCAREOUS; INTERBEDDED WITH AND INTERGRADATIONAL WITH SHALES.

SANDSTONE = LIGHT GRAY TO WHITE, OCCASIONALLY WITH SLIGHT GREENISH HUES; EASILY FRIABLE TO MODERATELY TOUGH; CLASTS RANGE FROM VERY FINE LOWER TO FINE LOWER; SUBANGULAR TO SUBROUND; MODERATELY SORTED; DOMINANTLY QUARTZ, SCATTERED DARK GRAY LITHICS; MOSTLY MATRIX SUPPORTED; WHITE CLAY MATRIX; MODERATELY CALCITE CEMENTED; INTERBEDDED WITH SHALE AND SILTSTONE.

SHALE = MEDIUM TO DARK GRAY, BROWNISH BLACK, REDDISH GRAY, RARELY LIGHT GREENISH GRAY; FIRM TO OCCASIONALLY HARD; CRUMBLY TO OCCASIONALLY TOUGH; TABULAR, BLOCKY, OCCASIONALLY PLATY CUTTINGS HABIT; MATTE TO RARELY SLIGHTLY







FAIR TO POOR SORTING; MODERATE SPHERICITY INTERBEDDED MEDIUM TO BLuish GRAY SHALE AND GRADES INTO SILTSTONE. ESPECIALLY AT BASE; HIGH GAS SEEN THROUGHOUT.

SANDSTONE = LIGHT GRAY TO MEDIUM GRAY; FINE TO VERY FINE, RARE MEDIUM; QUARTZ CLASTS WITH MINOR LITHIC FRAGMENTS; FAIR TO WELL SORTED; SUBROUNDED TO ROUNDED; FRIABLE TO FIRM FRIABLE; CALCITE CEMENT; INTERBEDDED WITH AND GRADES INTO A GRAY SILTSTONE AND INTERBEDDED WITH GRAY SHALE AND MINOR CARBONACEOUS SHALE.

SILTSTONE = LIGHT TO DARK GRAY WITH BROWNISH GRAY HUES; BRITTLE TO CRUMBLY; IRREGULAR TO CONCHOIDAL FRACTURES; PLATY TO NODULAR CUTTINGS; EARTHY TO SLIGHT SPARKLY LUSTER; SILTY TEXTURE WITH MINOR ABRASIVENESS OBSERVED IN GRADNG FROM SANDSTONES; INTERBEDDED IN SANDSTONES WITH SHALES; LOW GAS.

SHALE = LIGHT TO MEDIUM GRAY; BRITTLE TO CRUMBLY; PLANAR TO SPLINTERY FRACTURES; MASSIVE ELONGATED CUTTINGS; DULL TO SLIGH TWAXY LUSTER; SMOOTH TEXTURE; DARK GRAYISH BLACK ORGANIC STAINING OBSERVED IN SHALES; APPEARS GRADING TO CARBONACEOUS SHALES; TRACES OF PYRITE OBSERVED; LOWER GAS VALUES.

SANDSTONE = LIGHT BROWN TO GRAYISH WHITE; MEDIUM TO FINE GRAINS; FAIR TO WELL SORTING; SUBANGULAR TO SUBROUNDED; MODERATE SPHERICITY; TRACES OF FROSTED CRYSTALS; EASILY FRIABLE TO FRIABLE; DOMINANT CALCITE CEMENT WITH OCCASIONAL QUARTZ GRAINS; TRACES OF BLACK LITHIC FRAGMENTS; KAOLINITIC SANDS BECOMING ABUNDANT; TRACE OF GLAUCONITIC STAINING IN SANDS; MODERATELY HIGHER GAS.

SILTSTONE = LIGHT TO MEDIUM GRAY WITH OCCASIONAL BROWN AND BLUE GRAY HUES; BRITTLE TO CRUMBLY; IRREGULAR TO CONCHOIDAL FRACTURES; SLIGHT SPARKLY TO DULL LUSTER; SILTY WITH A SLIGHTLY ABRASIVE TEXTURE OBSERVED WITH GRADING FROM SANDSTONES; TRACE OF BLACK ORGANIC SATINING ON SILTSTONES AND SANDS; LOW GAS VALUES.

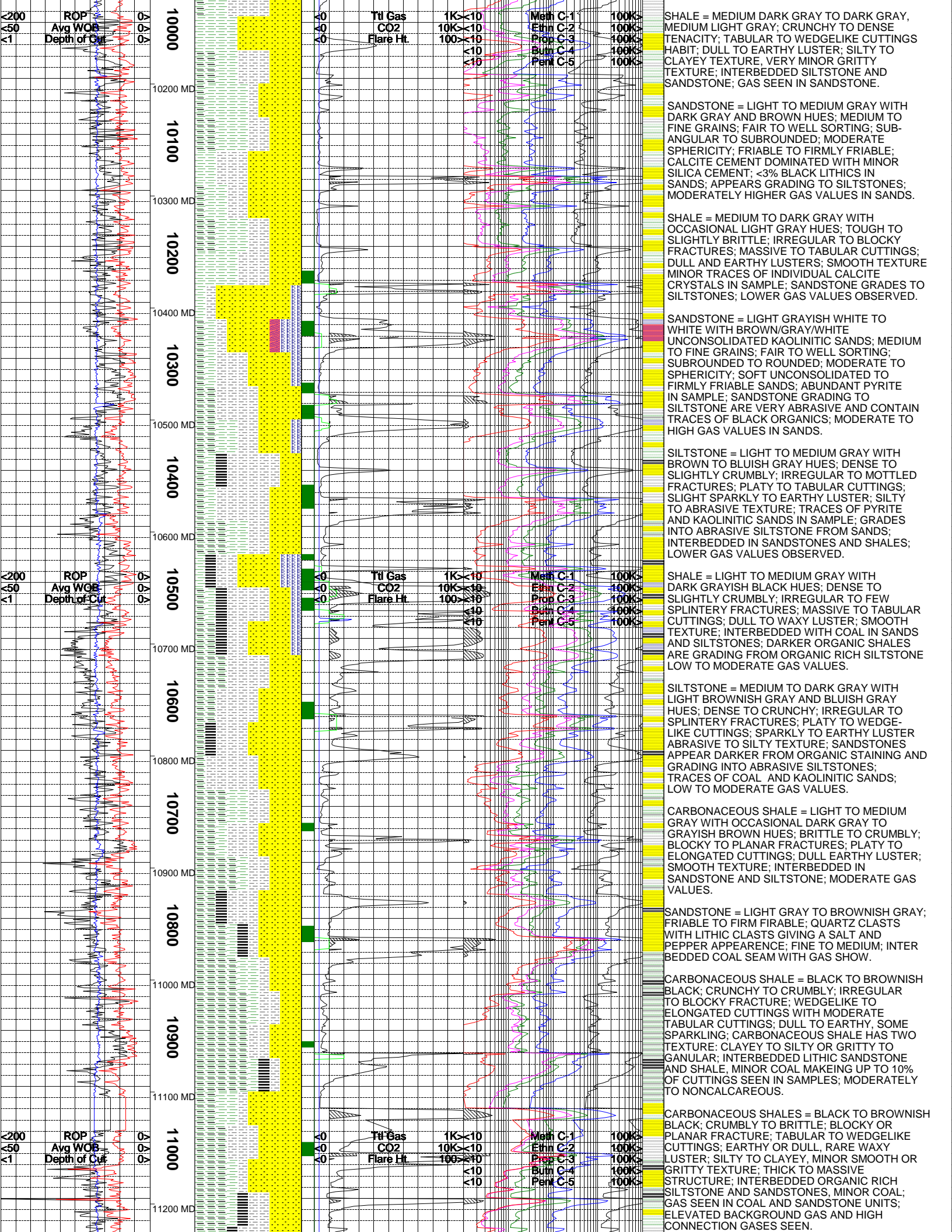
CARBONACEOUS SHALE = MEDIUM TO DARK GRAYISH BLACK; DENSE TO BRITTLE; IRREGULAR TO PLANAR FRACTURES; MASSIVE TO TABULAR CUTTINGS; DULL TO SLIGHTLY EARTHY LUSTER; SMOOTH TEXTURE; APPEARS GRADING FROM DARKER ORGANIC RICH SHALES; DARKER SANDSTONES ARE GRADING TO ORGANIC STAINED SILTSTONES; LOW GAS VALUES.

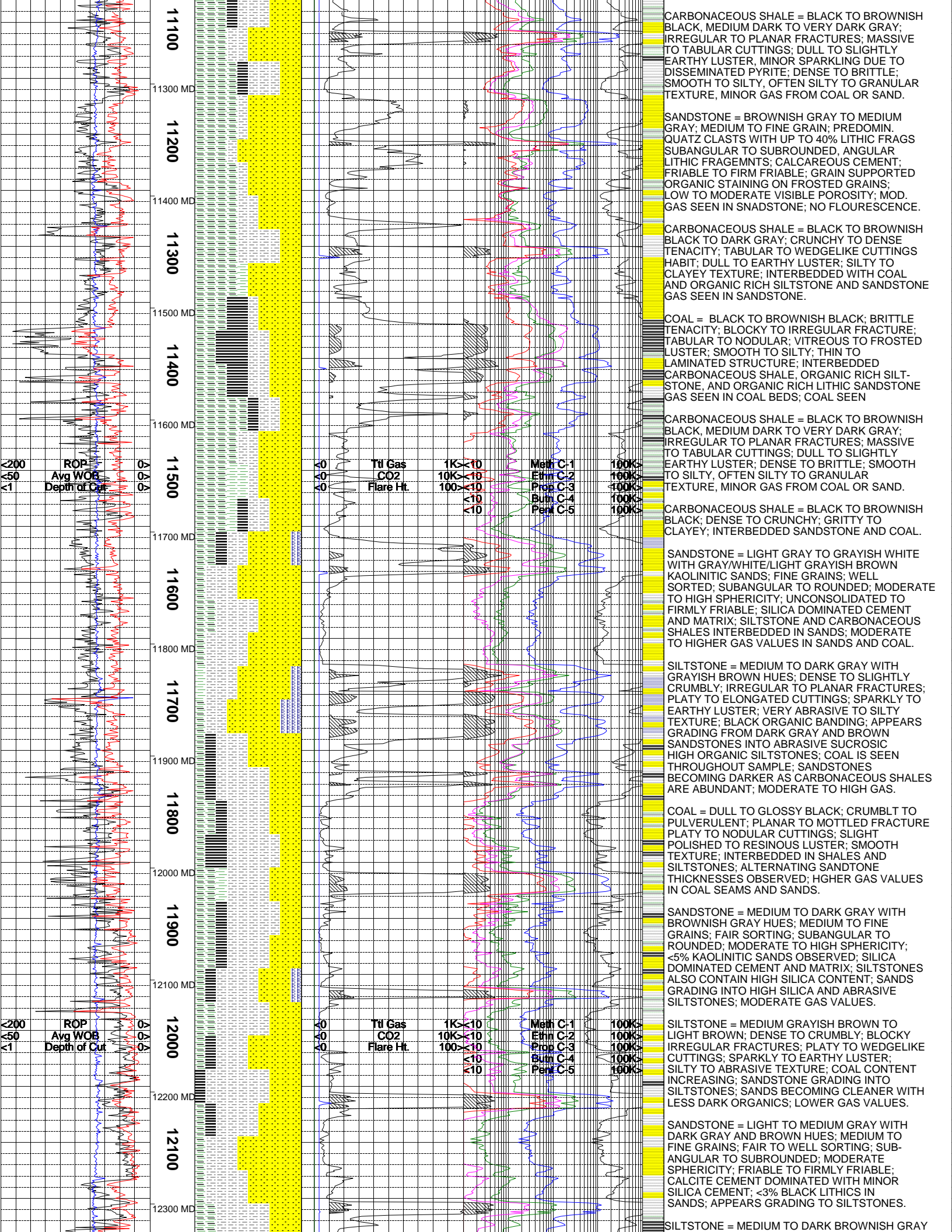
SANDSTONE = LIGHT TO MEDIUM GRAY, BROWNISH GRAY TO DUSKY BROWN SEEN IN MODERATE AMOUNTS; QUARTZ CLASTS 90 TO 50% WITH THE REMAINDER BROWN OR BLACK LITHIC FRAGMENTS; MEDIUM TO VERY FINE, PREDOMINATELY FINE; BROWNISH SHANDSTONE POOR TO FAIR SORTING, GRAY FAIR TO WELL SORTING; SUBROUNDED TO SUBANGULAR; LOW TO MODERATE SPHERICITY; FROSTED GRAINS OCCASIONALLY STAINED BROWN; FRIABLE TO FIRM FRIABLE; CALCITE CEMENT; GRAIN SUPPORTED WITH FLOATING GRAINS; CARBONACEOUS MATERIAL SEEN ALONG CROSS-BED PLANES; INTERBEDDED SHALE AND MINOR CARBONACEOUS SHALE AND INTERBEDDED SILTSTONE, OCCASIONALLY GRADING INTO SILTST; LOW GAS AND HIGH CONNECTION GAS SEEN; NO FLOURESCENCE OR CUT.

SILTSTONE = MEDIUM TO MEDIUM LIGHT GRAY; CRUNCHY TO DENSE TENACITY; TABULAR TO WEDGELIKE CUTTINGS HABIT, MINOR CURVED; EARTHY TO DULL LUSTER, MINOR SPARKLING FROM VITREOUS SANDS; SILTY TO GRANULAR TEXTURE; INTERBEDDED FINE TO VERY FINE SANDSTONE AND GRAY SHALE, MINOR CARBONACEOUS SHALE; LOW BACKGROUND GAS WITH HIGH CONNECTION GASES; SLIGHTLY TO MOD. CALCAREOUS.

SHALE = LIGHT TO MEDIUM GRAY; DENSE TO BRITTLE; WEDGELIKE TO SUB-TABULAR CUTTINGS HABIT; CLAYEY TO SILTY TEXTURE; DULL TO EARTHY LUSTER; INTERBEDDED WITH LIGHT TO MEDIUM GRAY SILTSTONE AND LIGHT GRAY TO MOTTLED BROWNISH GRAY SANDSTONE; LOW GAS.

SILTSTONE = MEDIUM TO MEDIUM LIGHT GRAY; CRUNCHY TO DENSE TENACITY; TABULAR TO WEDGELIKE CUTTINGS HABIT; EARTHY TO DULL LUSTER; SILTY TO GRITTY TEXTURE; INTERBEDDED FINE TO VERY FINE SANDSTONE WITH ORGANIC STAINING AND GRAY SHALE AND CARBONACEOUS SHALE, MINOR INTERBEDDED COAL SEAMS; GAS SEEN IN COAL SEAMS, LOW BACKGROUND GAS.





CARBONACEOUS SHALE = BLACK TO BROWNISH BLACK, MEDIUM DARK TO VERY DARK GRAY; IRREGULAR TO PLANAR FRACTURES; MASSIVE TO TABULAR CUTTINGS; DULL TO SLIGHTLY EARTHY LUSTER, MINOR SPARKLING DUE TO DISSEMINATED PYRITE; DENSE TO BRITTLE; SMOOTH TO SILTY, OFTEN SILTY TO GRANULAR TEXTURE, MINOR GAS FROM COAL OR SAND.

SANDSTONE = BROWNISH GRAY TO MEDIUM GRAY; MEDIUM TO FINE GRAIN; PREDOMIN. QUARTZ CLASTS WITH UP TO 40% LITHIC FRAGS SUBANGULAR TO SUBROUNDED, ANGULAR LITHIC FRAGMENTES; CALCAREOUS CEMENT; FRIABLE TO FIRM FRIABLE; GRAIN SUPPORTED ORGANIC STAINING ON FROSTED GRAINS; LOW TO MODERATE VISIBLE POROSITY; MOD. GAS SEEN IN SANDSTONE; NO FLOURESCENCE.

CARBONACEOUS SHALE = BLACK TO BROWNISH BLACK TO DARK GRAY; CRUNCHY TO DENSE TENACITY; TABULAR TO WEDGELIKE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SILTY TO CLAYEY TEXTURE; INTERBEDDED WITH COAL AND ORGANIC RICH SILTSTONE AND SANDSTONE GAS SEEN IN SANDSTONE.

COAL = BLACK TO BROWNISH BLACK; BRITTLE TENACITY; BLOCKY TO IRREGULAR FRACTURE; TABULAR TO NODULAR; VITREOUS TO FROSTED LUSTER; SMOOTH TO SILTY; THIN TO LAMINATED STRUCTURE; INTERBEDDED CARBONACEOUS SHALE, ORGANIC RICH SILTSTONE, AND ORGANIC RICH LITHIC SANDSTONE GAS SEEN IN COAL BEDS; COAL SEEN

CARBONACEOUS SHALE = BLACK TO BROWNISH BLACK, MEDIUM DARK TO VERY DARK GRAY; IRREGULAR TO PLANAR FRACTURES; MASSIVE TO TABULAR CUTTINGS; DULL TO SLIGHTLY EARTHY LUSTER; DENSE TO BRITTLE; SMOOTH TO SILTY, OFTEN SILTY TO GRANULAR TEXTURE, MINOR GAS FROM COAL OR SAND.

CARBONACEOUS SHALE = BLACK TO BROWNISH BLACK; DENSE TO CRUNCHY; GRITTY TO CLAYEY; INTERBEDDED SANDSTONE AND COAL.

SANDSTONE = LIGHT GRAY TO GRAYISH WHITE WITH GRAY/WHITE/LIGHT GRAYISH BROWN KAOLINITIC SANDS; FINE GRAINS; WELL SORTED; SUBANGULAR TO ROUNDED; MODERATE TO HIGH SPHERICITY; UNCONSOLIDATED TO FIRMLY FRIABLE; SILICA DOMINATED CEMENT AND MATRIX; SILTSTONE AND CARBONACEOUS SHALES INTERBEDDED IN SANDS; MODERATE TO HIGHER GAS VALUES IN SANDS AND COAL.

SILTSTONE = MEDIUM TO DARK GRAY WITH GRAYISH BROWN HUES; DENSE TO SLIGHTLY CRUMBLY; IRREGULAR TO PLANAR FRACTURES; PLATY TO ELONGATED CUTTINGS; SPARKLY TO EARTHY LUSTER; VERY ABRASIVE TO SILTY TEXTURE; BLACK ORGANIC BANDING; APPEARS GRADING FROM DARK GRAY AND BROWN SANDSTONES INTO ABRASIVE SUCROSIC HIGH ORGANIC SILTSTONES; COAL IS SEEN THROUGHOUT SAMPLE; SANDSTONES BECOMING DARKER AS CARBONACEOUS SHALES ARE ABUNDANT; MODERATE TO HIGH GAS.

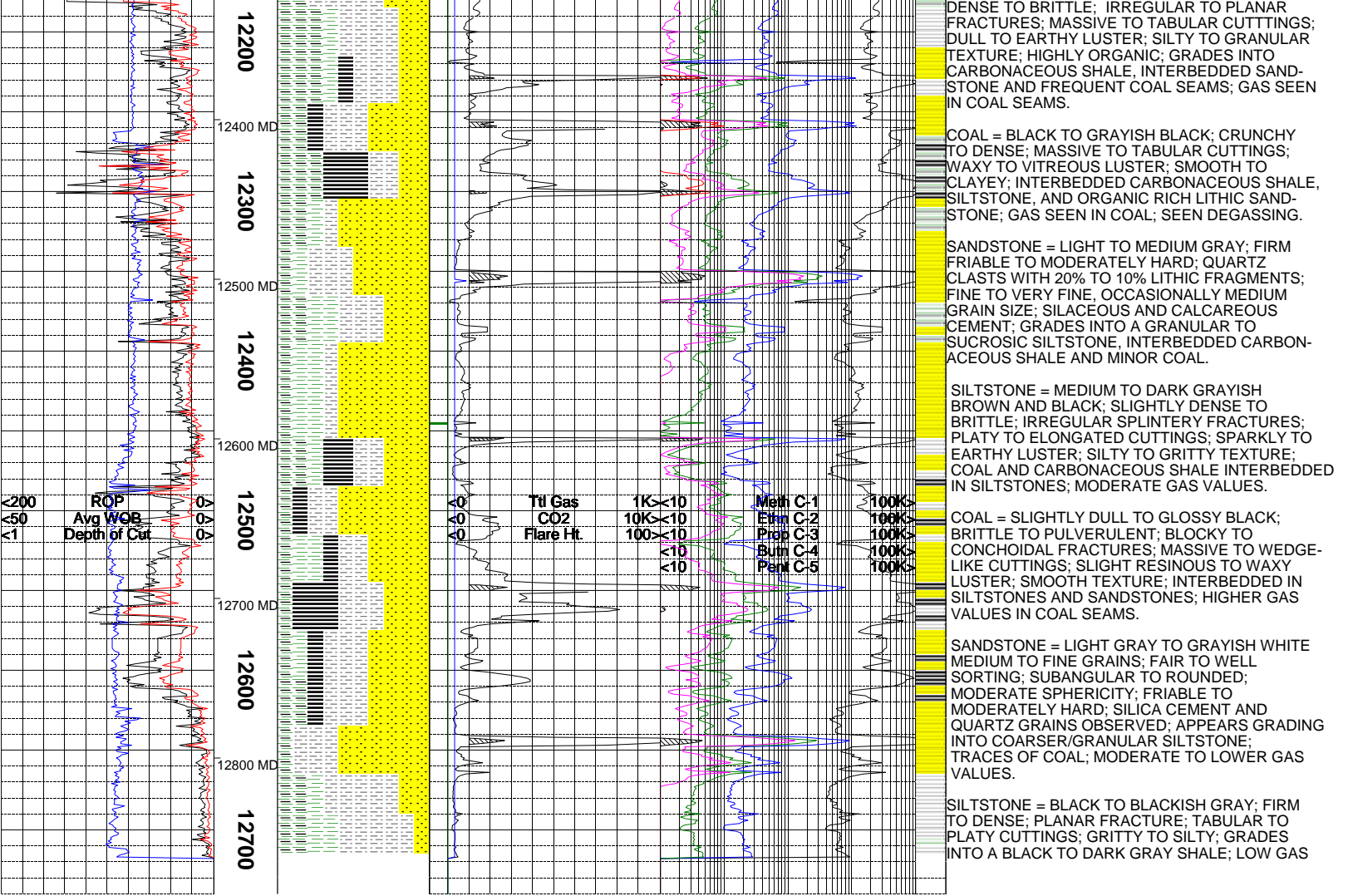
COAL = DULL TO GLOSSY BLACK; CRUMBLT TO PULVERULENT; PLANAR TO MOTTLED FRACTURE PLATY TO NODULAR CUTTINGS; SLIGHT POLISHED TO RESINOUS LUSTER; SMOOTH TEXTURE; INTERBEDDED IN SHALES AND SILTSTONES; ALTERNATING SANDTONE THICKNESSES OBSERVED; HGHER GAS VALUES IN COAL SEAMS AND SANDS.

SANDSTONE = MEDIUM TO DARK GRAY WITH BROWNISH GRAY HUES; MEDIUM TO FINE GRAINS; FAIR SORTING; SUBANGULAR TO ROUNDED; MODERATE TO HIGH SPHERICITY; <math><5\%</math> KAOLINITIC SANDS OBSERVED; SILICA DOMINATED CEMENT AND MATRIX; SILTSTONES ALSO CONTAIN HIGH SILICA CONTENT; SANDS GRADING INTO HIGH SILICA AND ABRASIVE SILTSTONES; MODERATE GAS VALUES.

SILTSTONE = MEDIUM GRAYISH BROWN TO LIGHT BROWN; DENSE TO CRUMBLY; BLOCKY IRREGULAR FRACTURES; PLATY TO WEDGELIKE CUTTINGS; SPARKLY TO EARTHY LUSTER; SILTY TO ABRASIVE TEXTURE; COAL CONTENT INCREASING; SANDSTONE GRADING INTO SILTSTONES; SANDS BECOMING CLEANER WITH LESS DARK ORGANICS; LOWER GAS VALUES.

SANDSTONE = LIGHT TO MEDIUM GRAY WITH DARK GRAY AND BROWN HUES; MEDIUM TO FINE GRAINS; FAIR TO WELL SORTING; SUB-ANGULAR TO SUBROUNDED; MODERATE SPHERICITY; FRIABLE TO FIRMLY FRIABLE; CALCITE CEMENT DOMINATED WITH MINOR SILICA CEMENT; <math><3\%</math> BLACK LITHICS IN SANDS; APPEARS GRADING TO SILTSTONES.

SILTSTONE = MEDIUM TO DARK BROWNISH GRAY



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