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MUDLOG TVD

COMPANY ExxonMobil Production
WELL Freedom Unit 197-33A8
FIELD Piceance Creek
REGION Rockies
COORDINATES 39.915617000
108.285739000
ELEVATION GL:6387
KB: 6414
COUNTY, STATE Rio Blanco, Colorado
API INDEX 05-103-1140-100
SPUD DATE January 28, 2010
CONTRACTOR Helmerich and Payne
CO. REP. Ricky T. Owens
RIG/TYPE 215/ Flex 3
LOGGING UNIT MLU051
GEOLOGISTS George Baker
Brenda Marsh
ADD. PERSONS Devin Claar
Bill Johanning
CO. GEOLOGIST Melanie Biggs

LOG INTERVAL

CASING DATA

DEPTHS: 3,900' TO 12,457'
DATES: 1/28/2010 TO 2/12/2010
SCALE: 1" = 100'

10.75" AT 3,914'
7.00" AT 8,646'
4.5" AT 12,457'
AT

MUD TYPES

HOLE SIZE

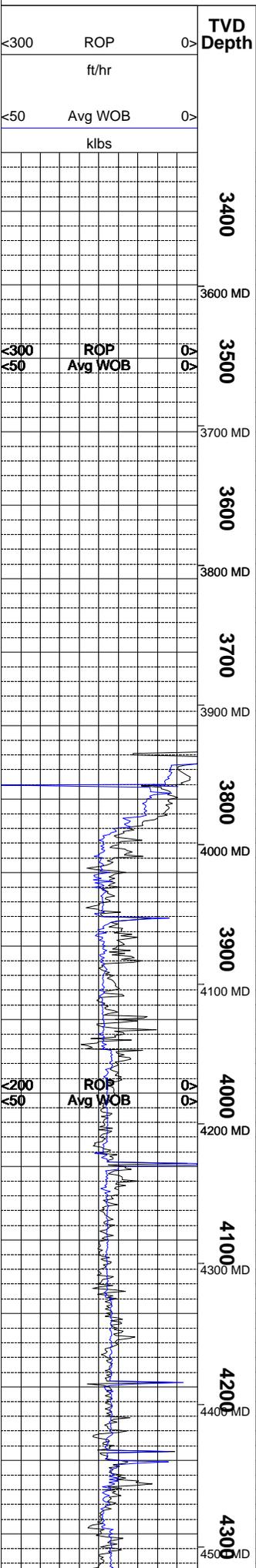
SPUD TO 3,900'
LSND TO 12,457'
TO
TO

9.875" TO 8,648"
6.125" TO 12,457'
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	

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	



TVD Depth (MD)	Lithology	MGS				
		Ttl Gas units	CO2 ppm	Flare Ht. ft	Meth C-1 ppm	Ethn C-2 ppm
3400		<10	<10	<10	<10	<10
3500		500K	50K	100K	100K	100K
3600		<10	<10	<10	<10	<10
3700		<10	<10	<10	<10	<10
3800		<10	<10	<10	<10	<10
3900		<10	<10	<10	<10	<10
4000		500K	50K	100K	100K	100K
4100		<10	<10	<10	<10	<10
4200		<10	<10	<10	<10	<10
4300		<10	<10	<10	<10	<10
4400		<10	<10	<10	<10	<10
4500		<10	<10	<10	<10	<10

Interp. Lith

Remarks
Survey Data, Mud Reports, Other Info.

ALL ROCK COLORS ARE REFERENCED TO THE GSA ROCK COLOR CHART. ROCK CONSTITUENTS ARE DESCRIBED WET AND LISTED IN ORDER OF MOST ABUNDANT TO LEAST ABUNDANT. ALL SAMPLE DEPTHS ARE REFERENCED TO RKB.

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 = 10000 PPM
 ETHANE = 1000 PPM
 PROPANE = 1000 PPM
 I-BUTANE = 1000 PPM
 N-BUTANE = 1000 PPM
 I-PENTANE = 1000 PPM
 N-PENTANE = 1000 PPM

WHEN THE MUD IS RUN THROUGH THE GAS BUSTER THE INTERVAL IS MARKED ON THE MGS COLUMN AND SIZE OF FLARES NOTED.

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

1 UNIT OF GAS = 200 PPM METHANE

SHALE = BLUISH GRAY TO GRAY MOTTLED WITH ORANGE-BROWN HUES; BRITTLE TO PULVERULENT; IRREGULAR TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR CUTTINGS HABIT; DULL TO VERY EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; THICK STRUCTURE; THICKLY BEDDED.

SANDSTONE = GRAY TO CLEAR TO OFF WHITE WITH HUES OF BROWN; FINE TO VERY FINE GRAINED; VERY SMALL TIGHT CLUSTERS; FAIR SORTING; SUB ANGULAR TO SUB ROUNDED MODERATE TO HIGH SPHERICITY; CALCAREOUS CLAY CEMENT AND GRAIN SUPPORTED; MOD. REACTION TO DILUTE HCL; SLIGHTLY CALCAREOUS; VERY THINLY INTERBEDDED.

SHALE = LIGHT GRAY TO BLUISH GRAY TO LIGHT ORANGE-BROWN; BRITTLE TO PULVERULENT TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO TABULAR CUTTINGS HABIT; DULL TO VERY EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; THICK STRUCTURE; THICKLY BEDDED WITH VERY THIN LAYERS OF SANDSTONE OR SILTSTONE ALTERNATING.

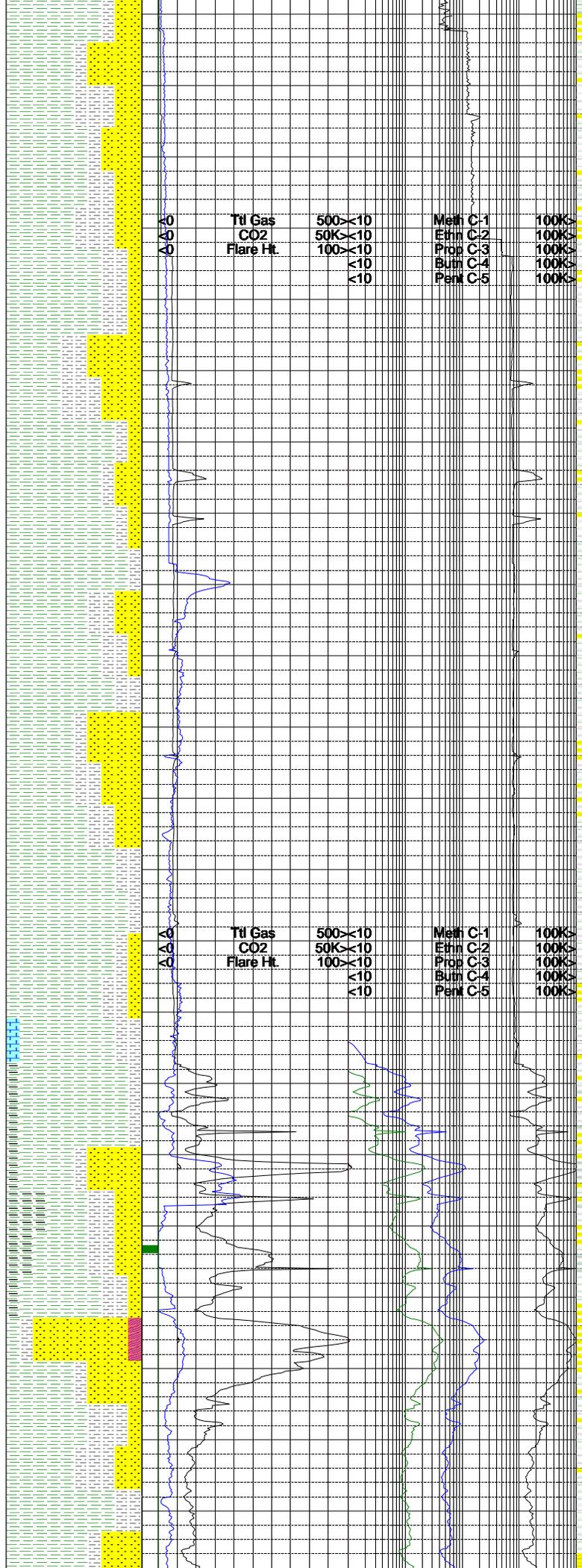
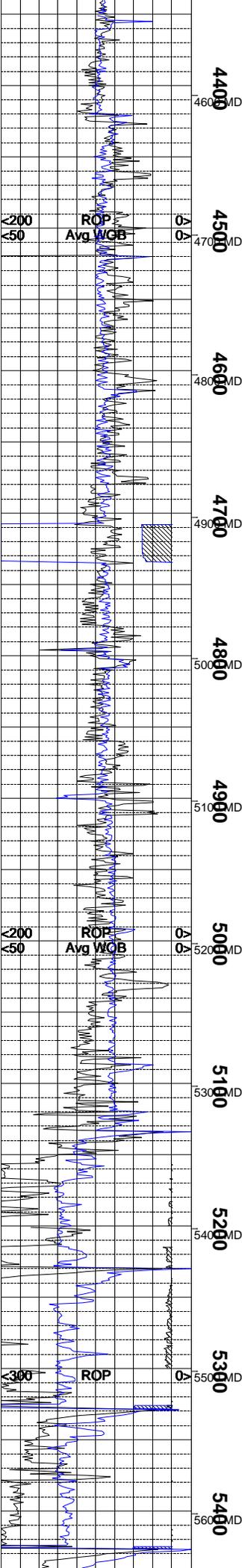
SILTSTONE = DARK BROWNISH GRAY TO BROWN WITH BLACK SPECS; VERY HARD AND DENSE; IRREGULAR TO BLOCKY FRACTURE; TABULAR TO WEDGELIKE CUTTINGS HABIT; EARTHY TO SPARKLING LUSTER; SILTY TO GRITTY TEXTURE; THIN STRUCTURE; VERY THINLY BEDDED.

SHALE = LIGHT GRAY TO GRAY WITH LIGHT BROWN HUES TO LIGHT BROWN TO ORANGE BROWN; CRUMBLY TO CRUNCHY TENACITY; IRREGULAR TO PLANAR FRACTURE; DULL TO VERY EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; APPEARS TO GRADE TO SILTSTONE IN PLACES; THICKLY BEDDED.

SANDSTONE = CLEAR TO WHITE TO OPAQUE WITH HUES OF GRAY AND YELLOW; MOSTLY LOOSE GRAINS; FEW TIGHT CLUSTERS; FINE TO UPPER VERY FINE GRAINED; SUB ANGULAR TO SUB ROUNDED; MODERATE SPHERICITY WHEN IN CLUSTERS; SLIGHT REACTION TO DILUTE HCL; GRAIN SUPPORTED; THINLY INTERBEDDED BETWEEN THICKER BEDS OF SHALE.

SHALE = GRAY TO GRAYISH BLUE WITH LIGHT ORANGE-BROWN SPECIMENS; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO TABULAR CUTTINGS HABIT; DULL TO EARTHY LUSTER; CLAYEY TO SILTY TEXTURE; THIN STRUCTURE.

SANDSTONE = WHITE TO TRANSLUCENT TO OPAQUE WITH A TRACE AMT OF DARK LITHICS WITHIN THE CLUSTERS; VERY SMALL TIGHT NON-FRIABLE CLUSTERS; FINE TO UPPER VERY FINE GRAINED; FAIR SORTING; SUB ROUNDED



TO ROUND; MODERATE TO HIGH SPHERICITY;
 MODERATE REACTION TO DILUTE HCL; CLAY
 AND CALCAREOUS CEMENTATION; THINLY
 INTERBEDDED; NO GAS SHOWS.

SHALE = GRAY TO BLUISH GRAY TO YELLOWISH
 BROWN; CRUNCHY TO BRITTLE TENACITY;
 IRREGULAR TO BLOCKY TO PLANAR FRACTURE;
 PLATY TO TABULAR CUTTINGS HABIT; DULL TO
 EARTHY LUSTER; SMOOTH TO SILTY TEXTURE;
 THIN STRUCTURE; THINLY INTERBEDDED
 WITH SANDSTONE AND SILTSTONE.

SANDSTONE = LT GRY, VERY LT GRY, WHT OFF
 WHT; MEDIUM TO UPPER MEDIUM GRAINED
 OCC LOWER FINE GRAINED; INDIVIDUAL
 GRAINS ARE TRANSPARENT TO OPAQUE; SUB
 ANGULAR TO SUB ROUND WITH LOW TO
 MODERATE SPHERICITY; MODERATELY TO WELL
 SORTED; DOMINANTLY CONSOLIDATED WITH A
 CALC/CLAY CEMENT; ACCESSORIES INCLUDE
 DARK LITHIC AND MAFIC FRAGMENTS LESS
 THAN 3%. SL TO NO INCREASE IN DITCH GAS;
 MODERATE TO STRONG REACTION TO DILUTE
 HCL.

SHALE = GRAY TO BLUISH GRAY TO YELLOW
 WITH HUES OF LT BRWN; MOTTLED APPEARANCE
 DENSE TO CRUNCHY TENACITY WITH SUB
 BLOCKY TO ELONGATED SUB TABULAR CUTTINGS
 HABIT; HACKLY TO IRREGULAR FRACTURE;
 DULL EARTHY LUSTER WITH SMOOTH TO SL
 GRITTY/SILTY TEXTURE; THINLY INTERBEDDED
 WITH SILTS AND SANDSTONES; GRADES TO
 SILTSTONE IN PLACES.

SILTSTONE = GRY, REDDISH BRWN SOME YLWSH
 BRWN; FIRM TO DENSE TENACITY WITH
 MASSIVE TO OCC SUB TABULAR CUTTINGS
 HABIT; IRREGULAR FRACTURE; EARTHY TO SUB
 SPARKLY LUSTER WITH GRITTY EARTHY
 TEXTURE; SL CALC IN PLACES; COMMONLY
 INTERBEDDED WITH SHALES AND SANDSTONES.

SANDSTONE = LT GRY, GRY, GRY WITH HUES
 OF PURP AND GRY WITH HUES OF REDDISH
 BRWN AND OCC YLW; INDIVIDUAL GRAINS ARE
 TRANSLUCENT TO OPAQUE; SUB ANGULAR TO
 SUB ROUND; FINE TO UPPER FINE OCC UPPER
 MEDIUM GRAINED; MODERATE TO LOW
 SPHERICITY; MODERATELY SORTED; SL TO NO
 REACTION TO DILUTE HCL; DOMINANTLY
 GRAIN SUPPORTED IN A CLAY OCC SL CALC
 MATRIX; OCC GRADES TO SILTSTONE; FRIM TO
 HARD; MODERATELY FRIABLE.

SHALE = GRAY TO BLUISH GRAY TO YELLOW
 WITH HUES OF LT BRWN AND REDDISH BRWN IN
 PLACES; OVERALL MOTTLED APPEARANCE;
 DENSE TO CRUNCHY TENACITY WITH SUB
 BLOCKY TO ELONGATED SUB TABULAR CUTTINGS
 HABIT; HACKLY TO IRREGULAR FRACTURE;
 DULL EARTHY LUSTER WITH SMOOTH TO SL
 GRITTY/SILTY TEXTURE; THINLY INTERBEDDED
 WITH SILTS AND SANDSTONES; GRADES TO
 SILTSTONE IN PLACES.

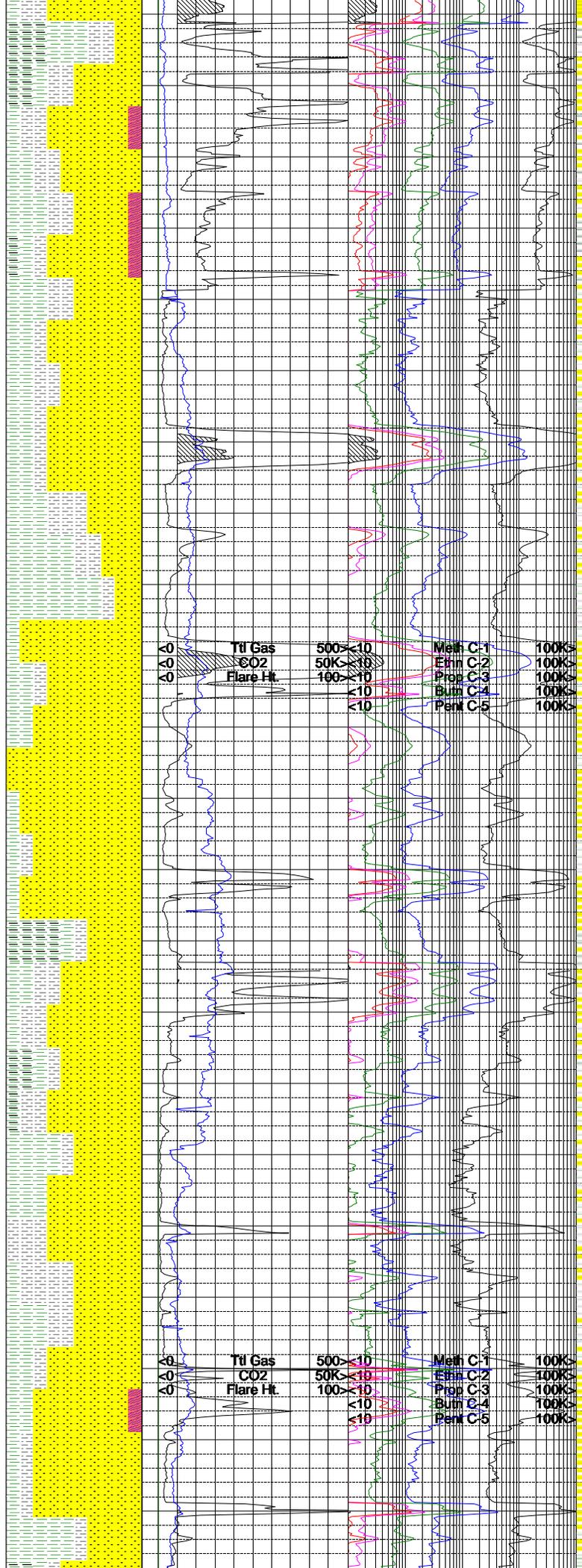
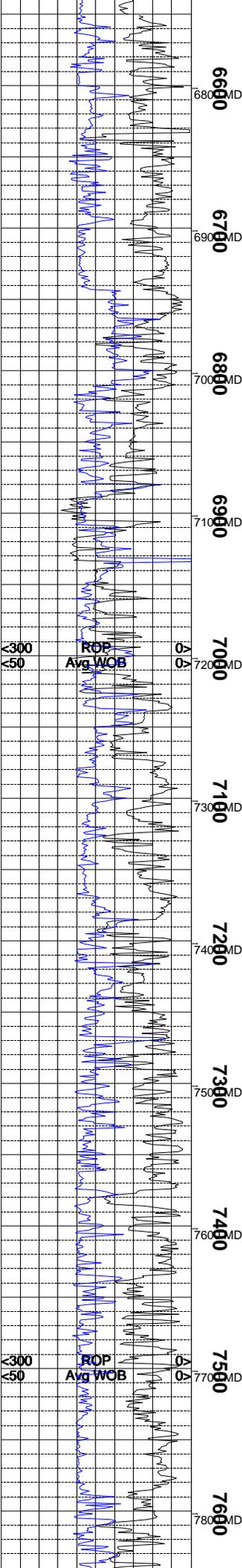
SILTSTONE = GRY, REDDISH BRWN SOME YLWSH
 BRWN; FIRM TO DENSE TENACITY WITH
 MASSIVE TO OCC SUB TABULAR CUTTINGS
 HABIT; IRREGULAR FRACTURE; EARTHY TO SUB
 SPARKLY LUSTER WITH GRITTY EARTHY
 TEXTURE; COMMONLY THINLY INTERBEDDED
 WITH SHALES AND SANDSTONES. TRACE
 LIMESTONE IN SAMPLE 3-5%.

NOTE = TRIP OUT OF HOLE AT 5315 FOR
 DIRECTIONAL TOOLS 01-29-2010 @ 4:11HRS.
 RESUMED DRILLING AHEAD 01-30-2010 @
 10:10 HRS. MAXIMUM TRIP GAS 1486u.

SHALE = GRAY TO BLUISH GRAY TO YELLOW
 WITH HUES OF LT BRWN AND REDDISH BRWN IN
 PLACES; OVERALL MOTTLED APPEARANCE;
 DENSE TO CRUNCHY TENACITY WITH SUB
 BLOCKY TO ELONGATED SUB TABULAR CUTTINGS
 HABIT; HACKLY TO IRREGULAR FRACTURE;
 DULL EARTHY LUSTER WITH SMOOTH TO SL
 GRITTY/SILTY TEXTURE; THINLY INTERBEDDED
 WITH SILTS AND SANDSTONES; GRADES TO
 SILTSTONE IN PLACES.

SANDSTONE = WHT OFF WHT VERY LT GRY;
 INDIVIDUAL GRAINS ARE TRANSPARENT TO
 OPAQUE; DOMINANTLY UNCONSOLIDATED MOST
 LIKELY AS A RESULT OF BIT ACTION;
 CONSOLIDATED CLUSTERS ARE MODERATELY
 FRIABLE TO FIRM; GRAIN SUPPORTED IN A
 CLAY/KAOLIN CEMENT; ACCESSORIES ARE LESS
 THAN 3%; OVERALL SUB ANGULAR TO SUB
 ROUND; WITH LOW TO MODERATE SPHERICITY
 AND MODERATELY TO WELL SORTED; SOME
 VISIBLE FRACTURE FILL IN SAMPLE;
 GRAINS ARE UPPER MEDIUM TO LOWER FINE
 GRAINED IN SIZE. MARKED INCREASE IN
 DITCH GAS.

SHALE = GRY, LT GRY, YLWSH GRY WITH
 HUES OF BRWN; GRY WITH HUES OF PURPLE;
 VARICOLORED MOTTLED APPEARANCE;



HABIT; EARTHLY TO OCC GREASY LUSTER WITH SMOOTH TO GRITTY TEXTURE; OCC DARKER CARBONACEOUS LAMINATIONS; SLIGHTLY PYRITIC IN PLACES; INTERBEDDED WITH SHALES AND SILTS.

SHALE = GRY, LT GRY, LT BRWN, BRWN WITH HUES OF GRY, GRYISH GRN IN PLACES; DENSE TO CRUNCHY TENACITY WITH SUB MASSIVE TO SUB WEDGELIKE OCC FLAKY CUTTINGS HABIT; IRREGULAR TO HACKLY FRACTURE; SMOOTH TO SL EARTHY TEXTURE WITH WAXY TO DULL LUSTER; OCC SL PYRITIC IN PLACES; MODERATE TO NO REACTION TO DILUTE HCL. TRACE LIMESTONE/ OR VERY LIMY SHALE.

NOTE = TOH FOR BIT AT 6940' PRIOR TO DRILLING OHIO CREEK 01-31-2010 @ 10:05 HRS. RESUMED DRILLING 02-01-2010 @ 16:00 HRS.

SANDSTONE = WHITE TO LIGHT GRAY WITH SOME CLEAR AND TRANSLUCENT GRAINS; AS WELL AS SOME DARK LITHICS GIVING A DIRTY SALT AND PEPPERED APPEARANCE; FINE TO UPPER VERY FINE GRAINED; FAIR TO WELL SORTING; MODERATE SPHERICITY; HIGHLY REACTIVE TO DILUTE HCL; CALCAREOUS CEMENTATION; THINLY BEDDED WITH ALTERNATING BEDS OF SHALE AND SILTSTONE.

SHALE = LIGHT GRAY TO GRAY WITH BLUISH HUES; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; PLATY TO TABULAR CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; THIN LAMINAE; VERY THINLY INTERBEDDED WITH SANDSTONE AND SHALE; APPEARS TO GRADE TO SILTSTONE ON SOME SPECIMENS.

SILTSTONE = BROWNISH GRAY TO GRAYISH BLACK; TOUGH TO DENSE TENACITY; IRREGULAR FRACTURE; TABULAR CUTTINGS HABIT; DULL TO SPARKLING LUSTER; SILTY TO GRITTY TEXTURE; THINLY INTERBEDDED WITH SANDSTONE AND SHALE.

OHIO CREEK SANDSTONE = WHITE TO VERY LIGHT GRAY TO CLEAR AND TRANSLUCENT GRAINS; ABUNDANT LOOSE UNCONSOLIDATED GRAINS AND VERY FRIABLE CLUSTERS; SOME DARK LITHICS THROUGHOUT GIVING A SALT AND PEPPERED APPEARANCE; SLIGHT TO MODERATE REACTION TO DILUTE HCL; SLIGHTLY CALCAREOUS CEMENTATION WHEN IN CLUSTERS; MAINLY GRAIN SUPPORTED OR LOOSE GRAINS; FINE GRAINED; SUB ANGULAR TO SUB ROUNDED; MODERATE TO LOW SPHERICITY; SOME POLISHED SURFACE FEATURES FROM POSSIBLE BIT ACTION; THICKLY BEDDED WITH SMALLER BEDS OF SHALE OR SILTSTONE IN BETWEEN.

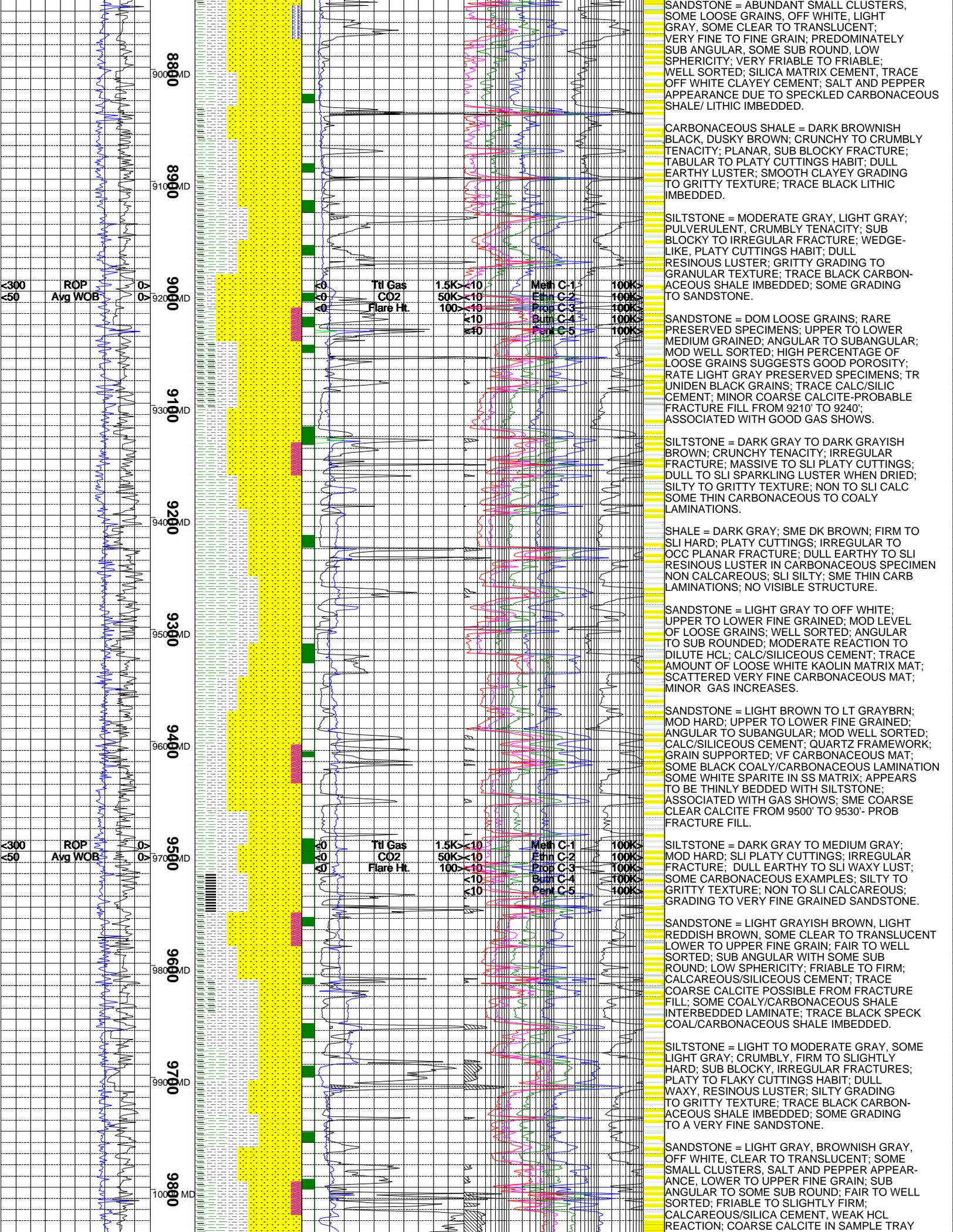
SHALE = LIGHT GRAY TO MEDIUM GRAY TO GRAY WITH HUES OF BLUE AND MOTTLED W/ WHITE SPECS; DENSE TO BRITTLE TENACITY; PLANAR TO MOTTLED FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; DULL TO EARTHY TO VERY SLIGHTLY SPARKLING LUSTER; SMOOTH TO GRITTY TEXTURE; APPEARS TO GRADE TO SILTSTONE IN PLACES; THIN LAMINAE; VERY THINLY BEDDED WITH SANDSTONE.

SILTSTONE = DARK GRAY TO BROWNISH GRAY TO BROWNISH BLACK; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; TABULAR TO WEDGELIKE CUTTINGS HABIT; SILTY TO GRITTY TO GRANULAR TEXTURE; THIN STRUCTURE; VERY THINLY INTERBEDDED WITH SANDSTONE.

SANDSTONE = LIGHT GRAY TO LIGHT GREENISH GRAY; VERY FINE GRAINED; SUBANGULAR; WELL SORTED; VERY FINE CARBONACEOUS MATERIAL; TRACE MICA; DOM CALCITE CEMENT ARGILLACEOUS IN PART; THINLY BEDDED WITH SHALE; GRADING TO SILTSTONE.

SHALE = LIGHT GREEN TO GREENISH GRAY TO LIGHT GRAY; FIRM; PLATY TO FLAKY CTGS IRREGULAR TO BLOCKY FRACTURE; SLI CALC; DULL EARTHY TO SLI WAXY LUSTER; SMOOTH TO ROUGH TEXTURE; ISOLATED QUARTZ GRAIN; COMMONLY SANDY TO SILTY; THINLY BEDDED.

SANDSTONE-WF800- LIGHT TO MEDIUM GRAY IN PRESERVED SPECIMENS; UPPER TO LOWER MEDIUM GRAINED IN PRESERVED SPECIMENS; TRACE AMOUNT OF CONGLOMERATIC SPECIMENS WITH COARSE TO FINE QUARTZ GRAINS; ABNT LOOSE COARSE QUARTZ IN THE 7710' TO 7740 SAMPLE; ANGULAR TO SUBANGULAR GRAINS; DOM SILICEOUS CEMENT WITH MINOR CALCITE FILL; SME BLACK COALY LAMINATIONS; SALT AND PEPPER WITH BLACK MAFIC GRAINS IN SOME SPECIMENS; TRACE GRAY CHERT AND CHLORITIC MICA; MINOR GAS; COARSE CALC PROBABLE FRACTURE FILL IN THE 7710' TO 7740' SAMPLE.



8880 MD
9000 MD
9100 MD
9200 MD
9300 MD
9400 MD
9500 MD
9600 MD
9700 MD
9800 MD
9900 MD
10000 MD

ROP
Avg WOB

Ttl Gas
CO2
Flare Ht

1.5K < 10
50K < 10
100 < 10
< 10
< 10

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

100K <
100K <
100K <
100K <
100K <

SANDSTONE = ABUNDANT SMALL CLUSTERS, SOME LOOSE GRAINS, OFF WHITE, LIGHT GRAY, SOME CLEAR TO TRANSLUCENT; VERY FINE TO FINE GRAIN; PREDOMINATELY SUB ANGULAR, SOME SUB ROUND, LOW SPHERICITY; VERY FRIABLE TO FRIABLE; WELL SORTED; SILICA MATRIX CEMENT, TRACE OFF WHITE CLAYEY CEMENT; SALT AND PEPPER APPEARANCE DUE TO SPECKLED CARBONACEOUS SHALE/ LITHIC IMBEDDED.

CARBONACEOUS SHALE = DARK BROWNISH BLACK, DUSKY BROWN; CRUNCHY TO CRUMBLY TENACITY; PLANAR, SUB BLOCKY FRACTURE; TABULAR TO PLATY CUTTINGS HABIT; DULL EARTHY LUSTER; SMOOTH CLAYEY GRADING TO GRITTY TEXTURE; TRACE BLACK LITHIC IMBEDDED.

SILTSTONE = MODERATE GRAY, LIGHT GRAY; PULVERULENT, CRUMBLY TENACITY; SUB BLOCKY TO IRREGULAR FRACTURE; WEDGE-LIKE, PLATY CUTTINGS HABIT; DULL RESINOUS LUSTER; GRITTY GRADING TO GRANULAR TEXTURE; TRACE BLACK CARBONACEOUS SHALE IMBEDDED; SOME GRADING TO SANDSTONE.

SANDSTONE = DOM LOOSE GRAINS; RARE PRESERVED SPECIMENS; UPPER TO LOWER MEDIUM GRAINED; ANGULAR TO SUBANGULAR; MOD WELL SORTED; HIGH PERCENTAGE OF LOOSE GRAINS SUGGESTS GOOD POROSITY; RATE LIGHT GRAY PRESERVED SPECIMENS; TR UNIDE BLACK GRAINS; TRACE CALC/SILIC CEMENT; MINOR COARSE CALCITE-PROBABLE FRACTURE FILL FROM 9210' TO 9240'; ASSOCIATED WITH GOOD GAS SHOWS.

SILTSTONE = DARK GRAY TO DARK GRAYISH BROWN; CRUNCHY TENACITY; IRREGULAR FRACTURE; MASSIVE TO SLI PLATY CUTTINGS; DULL TO SLI SPARKLING LUSTER WHEN DRIED; SILTY TO GRITTY TEXTURE; NON TO SLI CALC SOME THIN CARBONACEOUS TO COALY LAMINATIONS.

SHALE = DARK GRAY; SME DK BROWN; FIRM TO SLI HARD; PLATY CUTTINGS; IRREGULAR TO OCC PLANAR FRACTURE; DULL EARTHY TO SLI RESINOUS LUSTER IN CARBONACEOUS SPECIMEN NON CALCAREOUS; SLI SILTY; SME THIN CARB LAMINATIONS; NO VISIBLE STRUCTURE.

SANDSTONE = LIGHT GRAY TO OFF WHITE; UPPER TO LOWER FINE GRAINED; MOD LEVEL OF LOOSE GRAINS; WELL SORTED; ANGULAR TO SUB ROUNDED; MODERATE REACTION TO DILUTE HCL; CALC/SILICEOUS CEMENT; TRACE AMOUNT OF LOOSE WHITE KAOLIN MATRIX MAT; SCATTERED VERY FINE CARBONACEOUS MAT; MINOR GAS INCREASES.

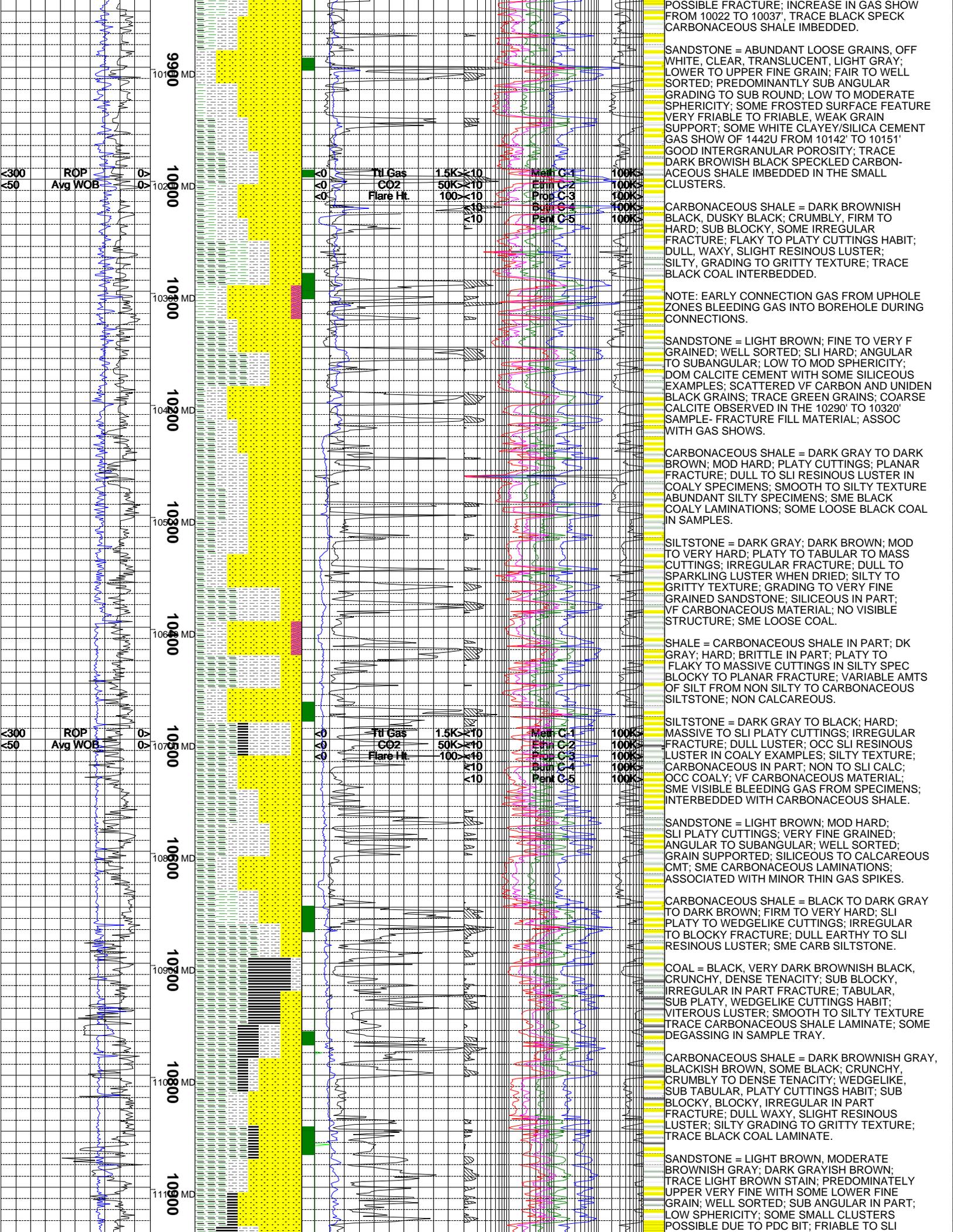
SANDSTONE = LIGHT BROWN TO LT GRAYBRN; MOD HARD; UPPER TO LOWER FINE GRAINED; ANGULAR TO SUBANGULAR; MOD WELL SORTED; CALC/SILICEOUS CEMENT; QUARTZ FRAMEWORK; GRAIN SUPPORTED; VF CARBONACEOUS MAT; SOME BLACK COALY/CARBONACEOUS LAMINATION SOME WHITE SPARITE IN SS MATRIX; APPEARS TO BE THINLY BEDDED WITH SILTSTONE; ASSOCIATED WITH GAS SHOWS; SME COARSE CLEAR CALCITE FROM 9500' TO 9530'- PROB FRACTURE FILL.

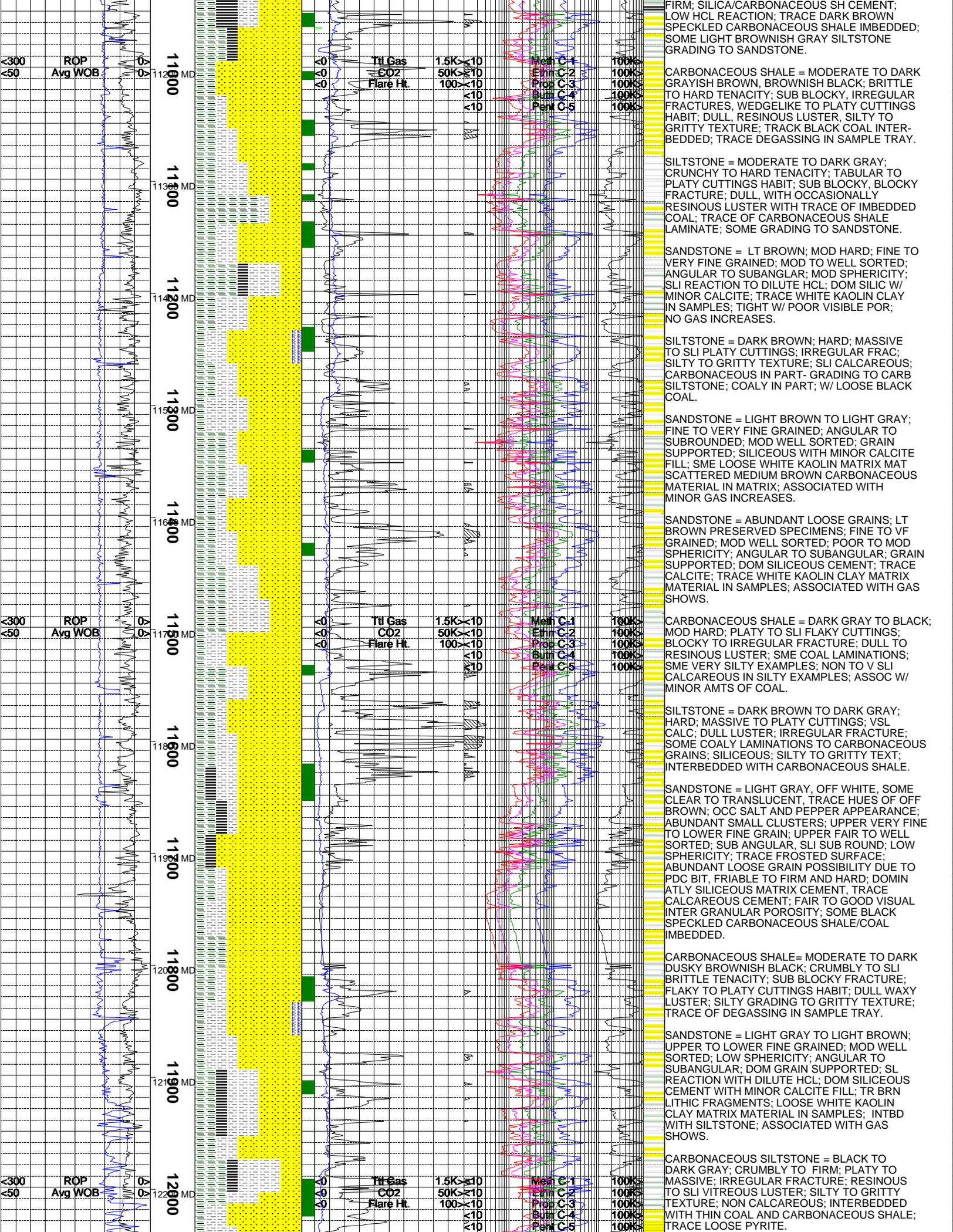
SILTSTONE = DARK GRAY TO MEDIUM GRAY; MOD HARD; SLI PLATY CUTTINGS; IRREGULAR FRACTURE; DULL EARTHY TO SLI WAXY LUST; SOME CARBONACEOUS EXAMPLES; SILTY TO GRITTY TEXTURE; NON TO SLI CALCAREOUS; GRADING TO VERY FINE GRAINED SANDSTONE.

SANDSTONE = LIGHT GRAYISH BROWN, LIGHT REDDISH BROWN, SOME CLEAR TO TRANSLUCENT LOWER TO UPPER FINE GRAIN; FAIR TO WELL SORTED; SUB ANGULAR WITH SOME SUB ROUND; LOW SPHERICITY; FRIABLE TO FIRM; CALCAREOUS/SILICEOUS CEMENT; TRACE COARSE CALCITE POSSIBLE FROM FRACTURE FILL; SOME COALY/CARBONACEOUS SHALE INTERBEDDED LAMINATE; TRACE BLACK SPECK COAL/CARBONACEOUS SHALE IMBEDDED.

SILTSTONE = LIGHT TO MODERATE GRAY, SOME LIGHT GRAY; CRUMBLY, FIRM TO SLIGHTLY HARD; SUB BLOCKY, IRREGULAR FRACTURES; PLATY TO FLAKY CUTTINGS HABIT; DULL WAXY, RESINOUS LUSTER; SILTY GRADING TO GRITTY TEXTURE; TRACE BLACK CARBONACEOUS SHALE IMBEDDED; SOME GRADING TO A VERY FINE SANDSTONE.

SANDSTONE = LIGHT GRAY, BROWNISH GRAY, OFF WHITE, CLEAR TO TRANSLUCENT; SOME SMALL CLUSTERS, SALT AND PEPPER APPEARANCE, LOWER TO UPPER FINE GRAIN; SUB ANGULAR TO SOME SUB ROUND; FAIR TO WELL SORTED; FRIABLE TO SLIGHTLY FIRM; CALCAREOUS/SILICA CEMENT, WEAK HCL REACTION; COARSE CALCITE IN SAMPLE TRAY





FIRM; SILICA/CARBONEOUS SH CEMENT;
 LOW HCL REACTION; TRACE DARK BROWN
 SPECKLED CARBONEOUS SHALE IMBEDDED;
 SOME LIGHT BROWNISH GRAY SILTSTONE
 GRADING TO SANDSTONE.

CARBONEOUS SHALE = MODERATE TO DARK
 GRAYISH BROWN, BROWNISH BLACK; BRITTLE
 TO HARD TENACITY; SUB BLOCKY, IRREGULAR
 FRACTURES, WEDGE LIKE TO PLATY CUTTINGS
 HABIT; DULL, RESINOUS LUSTER, SILTY TO
 GRITTY TEXTURE; TRACE BLACK COAL INTER-
 BEDDED; TRACE DEGASSING IN SAMPLE TRAY.

SILTSTONE = MODERATE TO DARK GRAY;
 CRUNCHY TO HARD TENACITY; TABULAR TO
 PLATY CUTTINGS HABIT; SUB BLOCKY, BLOCKY
 FRACTURE; DULL, WITH OCCASIONALLY
 RESINOUS LUSTER WITH TRACE OF IMBEDDED
 COAL; TRACE OF CARBONEOUS SHALE
 LAMINATE; SOME GRADING TO SANDSTONE.

SANDSTONE = LT BROWN; MOD HARD; FINE TO
 VERY FINE GRAINED; MOD TO WELL SORTED;
 ANGULAR TO SUBANGULAR; MOD SPHERICITY;
 SLI REACTION TO DILUTE HCL; DOM SILIC W/
 MINOR CALCITE; TRACE WHITE KAOLIN CLAY
 IN SAMPLES; TIGHT W/ POOR VISIBLE POR;
 NO GAS INCREASES.

SILTSTONE = DARK BROWN; HARD; MASSIVE
 TO SLI PLATY CUTTINGS; IRREGULAR FRAC;
 SILTY TO GRITTY TEXTURE; SLI CALCAREOUS;
 CARBONEOUS IN PART - GRADING TO CARB
 SILTSTONE; COALY IN PART; W/ LOOSE BLACK
 COAL.

SANDSTONE = LIGHT BROWN TO LIGHT GRAY;
 FINE TO VERY FINE GRAINED; ANGULAR TO
 SUBROUNDED; MOD WELL SORTED; GRAIN
 SUPPORTED; SILICEOUS WITH MINOR CALCITE
 FILL; SME LOOSE WHITE KAOLIN MATRIX MAT
 SCATTERED MEDIUM BROWN CARBONEOUS
 MATERIAL IN MATRIX; ASSOCIATED WITH
 MINOR GAS INCREASES.

SANDSTONE = ABUNDANT LOOSE GRAINS; LT
 BROWN PRESERVED SPECIMENS; FINE TO VF
 GRAINED; MOD WELL SORTED; POOR TO MOD
 SPHERICITY; ANGULAR TO SUBANGULAR; GRAIN
 SUPPORTED; DOM SILICEOUS CEMENT; TRACE
 CALCITE; TRACE WHITE KAOLIN CLAY MATRIX
 MATERIAL IN SAMPLES; ASSOCIATED WITH GAS
 SHOWS.

CARBONEOUS SHALE = DARK GRAY TO BLACK;
 MOD HARD; PLATY TO SLI FLAKY CUTTINGS;
 BLOCKY TO IRREGULAR FRACTURE; DULL TO
 RESINOUS LUSTER; SME COAL LAMINATIONS;
 SME VERY SILTY EXAMPLES; NON TO V SLI
 CALCAREOUS IN SILTY EXAMPLES; ASSOC W/
 MINOR AMTS OF COAL.

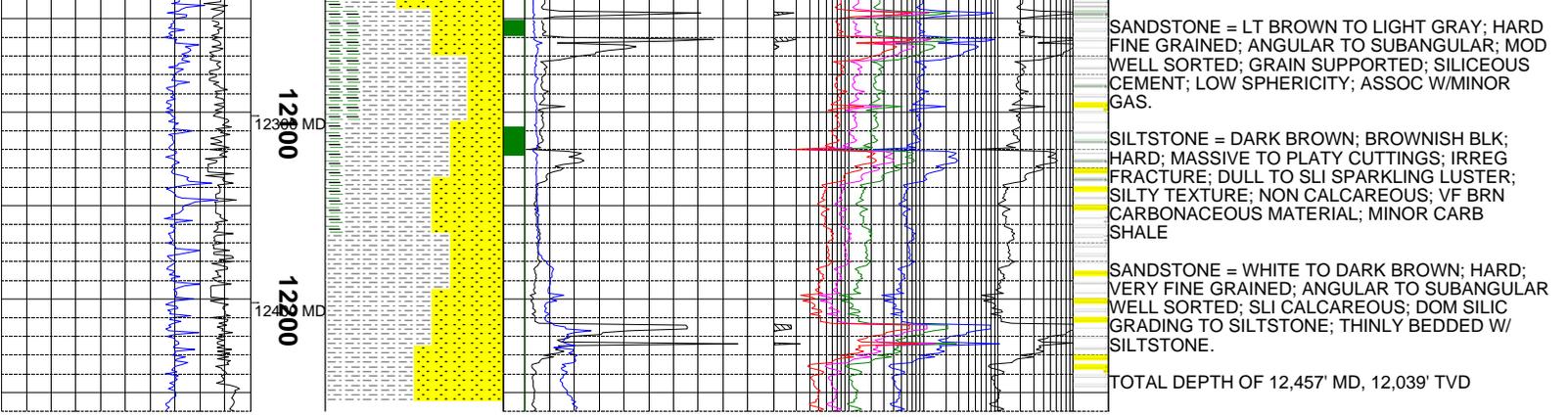
SILTSTONE = DARK BROWN TO DARK GRAY;
 HARD; MASSIVE TO PLATY CUTTINGS; VSL
 CALC; DULL LUSTER; IRREGULAR FRACTURE;
 SOME COALY LAMINATIONS TO CARBONEOUS
 GRAINS; SILICEOUS; SILTY TO GRITTY TEXT;
 INTERBEDDED WITH CARBONEOUS SHALE.

SANDSTONE = LIGHT GRAY, TRACE WHITE, SOME
 CLEAR TO TRANSLUCENT, OFF HUES OF OFF
 BROWN; OCC SALT AND PEPPER APPEARANCE;
 ABUNDANT SMALL CLUSTERS; UPPER VERY FINE
 TO LOWER FINE GRAIN; UPPER FAIR TO WELL
 SORTED; SUB ANGULAR, SLI SUB ROUND; LOW
 SPHERICITY; TRACE FROSTED SURFACE;
 ABUNDANT LOOSE GRAIN POSSIBILITY DUE TO
 PDC BIT, FRIABLE TO FIRM AND HARD; DOMIN
 ATLY SILICEOUS MATRIX CEMENT, TRACE
 CALCAREOUS CEMENT; FAIR TO GOOD VISUAL
 INTER GRANULAR POROSITY; SOME BLACK
 SPECKLED CARBONEOUS SHALE/COAL
 IMBEDDED.

CARBONEOUS SHALE= MODERATE TO DARK
 DUSKY BROWNISH BLACK; CRUMBLY TO SLI
 BRITTLE TENACITY; SUB BLOCKY FRACTURE;
 FLAKY TO PLATY CUTTINGS HABIT; DULL WAXY
 LUSTER; SILTY GRADING TO GRITTY TEXTURE;
 TRACE OF DEGASSING IN SAMPLE TRAY.

SANDSTONE = LIGHT GRAY TO LIGHT BROWN;
 UPPER TO LOWER FINE GRAINED; MOD WELL
 SORTED; LOW SPHERICITY; ANGULAR TO
 SUBANGULAR; DOM GRAIN SUPPORTED; SL
 REACTION WITH DILUTE HCL; DOM SILICEOUS
 CEMENT WITH MINOR CALCITE FILL; TR BRN
 LITHIC FRAGMENTS; LOOSE WHITE KAOLIN
 CLAY MATRIX MATERIAL IN SAMPLES; INTBD
 WITH SILTSTONE; ASSOCIATED WITH GAS
 SHOWS.

CARBONEOUS SILTSTONE = BLACK TO DARK
 GRAY; CRUMBLY TO FIRM; PLATY TO
 MASSIVE; IRREGULAR FRACTURE; RESINOUS
 TO SLI VITREOUS LUSTER; SILTY TO GRITTY
 TEXTURE; NON CALCAREOUS; INTERBEDDED
 WITH THIN COAL AND CARBONEOUS SHALE;
 TRACE LOOSE PYRITE.



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