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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 FRU197-33A6
FIELD FREEDOM RANCH UNIT
REGION ROCKY MOUNTAINS
COORDINATES 39.915536
108.285764
ELEVATION GL = 6385'
KB = 6412'
COUNTY, STATE RIO BLANCO, CO
API INDEX 051031153500
SPUD DATE 10/17/2009
CONTRACTOR HELMRICH AND PAYNE
CO. REP. RICKY OWENS
RIG/TYPE 215/FLEX 3
LOGGING UNIT MLU 051
GEOLOGISTS D.CLAAR
B.MARSH
ADD. PERSONS B. JOHANNING
G.BAKER
CO. GEOLOGIST M. BIGGS

LOG INTERVAL

CASING DATA

DEPTHS: 3,852' TO 12,294'
DATES: 03/02/2010 TO 03/16/2010
SCALE: 5" = 100'

10.75" AT 3,862'
7.00" AT 8,465'
AT
AT

MUD TYPES

HOLE SIZE

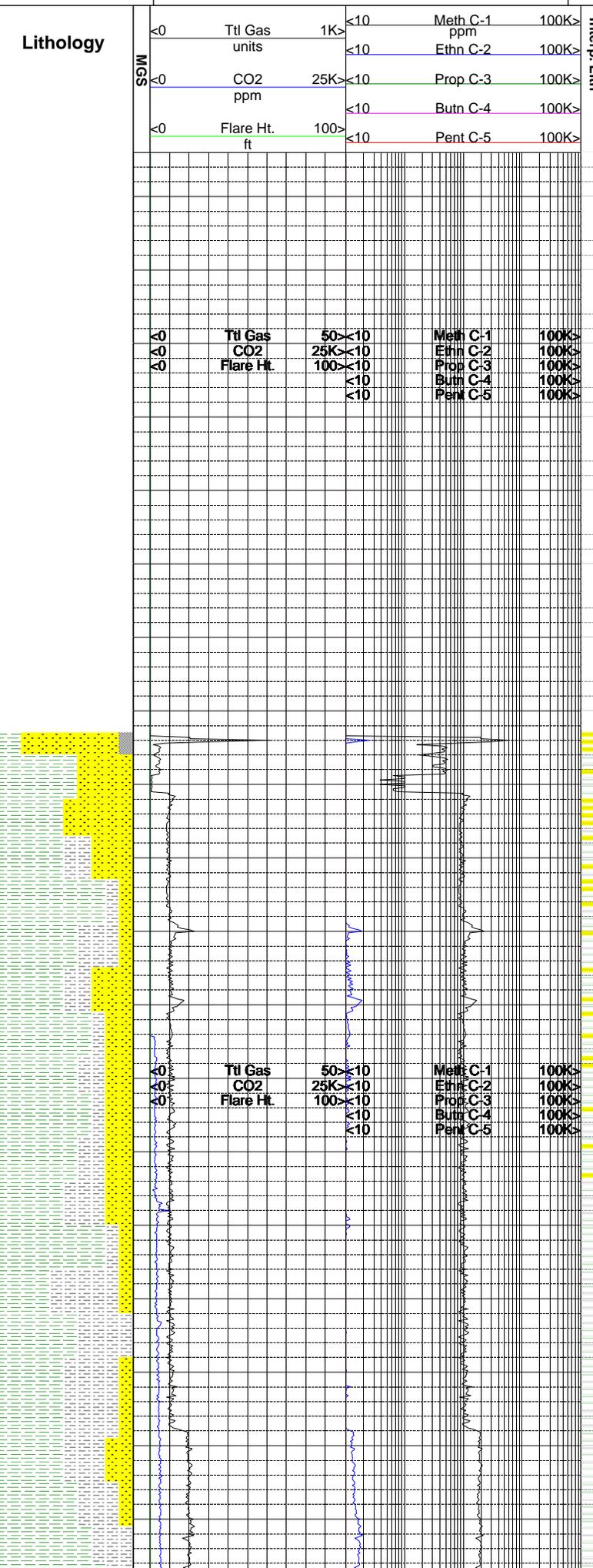
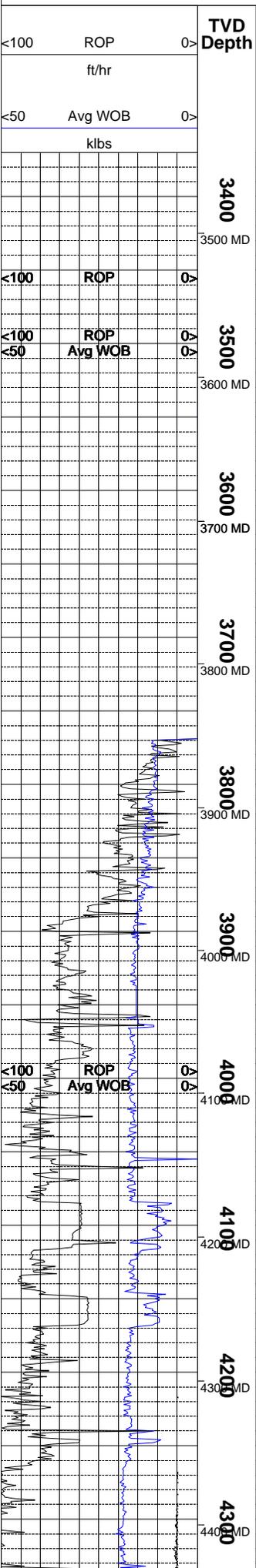
LSND TO 12,294'
TO
TO
TO
TO

9.875" TO 8,465'
6.125" TO 12,294'
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, KAOLINITIC, 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.



**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 THE SIZE OF FLARES 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 = 200PPM METHANE

10.75" CASING SET @ 3,837'

CANRIG STARTED FULL LOGGING SERVICES @ 3,852' ON 03/02/2010.

DRILL TO 3,862' AND PERFORM F.I.T.

SHALE = LIGHT GRAY TO BLUISH GRAY WITH ORANGE-BROWN MUD ENCRUSTED; BRITTLE TO PULVERULENT; IRREGULAR TO PLANAR FRACTURE; MASSIVE TO PLATY TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; THICK STRUCTURE; THICKLY BEDDED WITH SANDSTONE AND SOME SILTSTONE; ABUNDANT AMOUNT OF ORANGE-BROWN MUD IN SAMPLE.

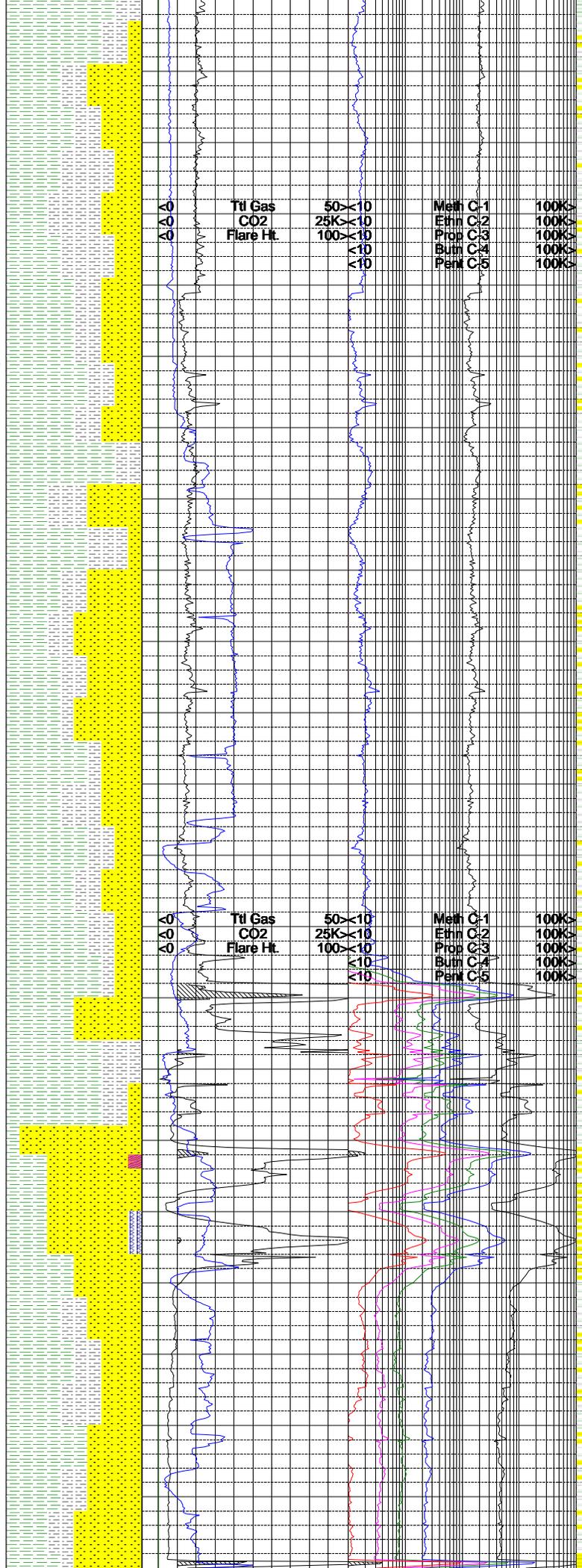
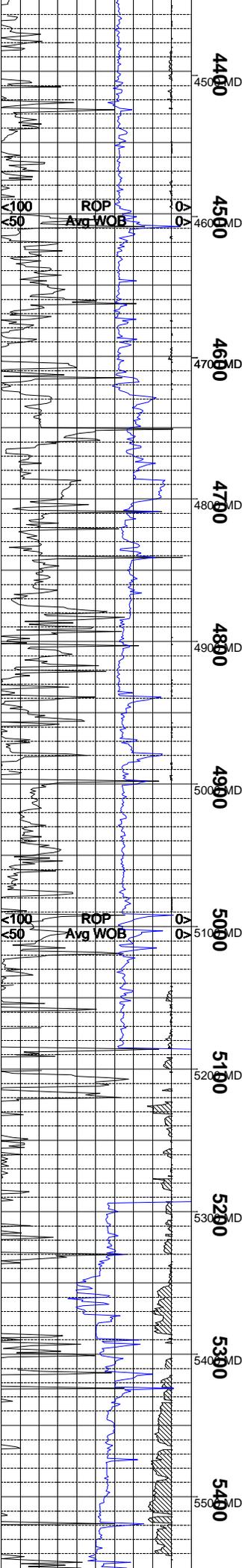
SANDSTONE = WHITE TO TRANSLUCENT TO LIGHT GRAY WITH A TRACE AMOUNT OF DARK LITHICS 0-3%; FINE TO UPPER VERY FINE GRAINED; FAIR TO POOR SORTING; VERY FINE LOOSE GRAINS TO FINE GRAINED SMALL CLUSTERS; SLIGHT TO MODERATE REACTION TO DILUTE HCL; SUB ANGULAR TO SUB ROUNDED; MODERATE TO LOW SPHERICITY; VERY THINLY INTERBEDDED WITH SHALE AND SILTSTONE.

SHALE = BROWNISH GRAY TO GRAY TO LIGHT BLUISH GRAY; BRITTLE TO PULVERULENT TENACITY; IRREGULAR TO PLANAR FRACTURE; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; TRACE AMT OF CLAY IN SAMPLE TRAY; THIN STRUCTURE; THICKLY BEDDED WITH THIN LAYERS OF SANDSTONE OR SILTSTONE IN-BETWEEN.

SILTSTONE = YELLOWISH BROWN TO YELLOW GRAY TO LIGHT BLUISH GRAY; VARICOLORED; MOTTLED IN PART; MOD HARD TO CRUNCHY; SLI PLATY CUTTINGS; IRREGULAR FRACTURE; SPARKLING LUSTER WHEN DRIED; MOD CALC; RARE CARBONACEOUS MATERIAL; SILTY TO GRITTY TEXTURE; OCC CONTAINS VF QUARTZ GRAINS; SME F TO VF GRAINED SANDSTONE INTERBEDS; OCC LOOSE MEDIUM BROWN LS/ CALCITE GRAINS; NO VISIBLE STRUCTURE.

NAHCOLITE = TRACE AMOUNTS IN SAMPLE; CLEAR; CRYSTALLINE; SOFT; WITH OUTER REDDISH CLAY COATING.

SHALE = VARICOLORED; MOTTLED IN PART; LIGHT GRAY TO YELLOW BROWN; MOTTLED GRAY/YELLOW; FIRM TO CRUNCHY TO MOD HARD; IRREGULAR TO BLOCKY FRACTURE; DOM PLATY CUTTINGS; SLI CALCAREOUS; VERY FINE MICA VARIABLE AMOUNTS OF SILT; GRADING TO ARGILLACEOUS SILTSTONE; ROUGH TO SILTY TEXTURE; RARE LIGHT GRAY SANDSTONE INTERBEDS; NO VISIBLE STRUCTURE; TRACE AMOUNTS OF NAHCOLITE IN SAMPLES.



SANDSTONE = LIGHT GRAY; SOME BROWN TO PURPLE TO DARK GRAY SPECIMENS; FINE TO VERY FINE GRAINED; ANGULAR TO SUBANGULAR; LOW TO MOD SPHERICITY; GRAIN SUPPORTED; DOM CALCAREOUS CMT; CLEAN W/ ONLY A TRACE OF CARBONACEOUS MATERIAL; SME REDDISH GRAINS; TIGHT POR; THINLY INTERBEDDED WITH SHALE AND SILTSTONE.

SHALE = VARICOLORED; MOTTLED IN PART; BROWN; LIGHT GRAY TO BLUISH GRAY; YELLOW FIRM TO MOD HARD; MASSIVE TO PLATY CTGS; IRREGULAR FRACTURE; DULL EARTHY LUSTER; NON CALCAREOUS IN PURE SHALE EXAMPLES; VARIABLE AMOUNTS OF SILT; GRADING TO ARGILLACEOUS SILTSTONE; INTERBEDDED W/VARICOLORED ARGILLACEOUS SANDSTONE; NO VISIBLE STRUCTURE.

SILTSTONE = VARICOLORED; MOTTLED; ORANGE BROWN; YELLOW BROWN; TRACE PURPLE; MOD HARD; MASSIVE TO SLI PLATY CUTTINGS; MOD CALCAREOUS; VF MICA; IRREGULAR FRACTURE; DULL EARTHY TO SLI SPARKLING LUSTER WHEN DRIED; SILTY TO GRITTY TEXTURE; SOME VERY ARGILLACEOUS EXAMPLES; NO VISIBLE STRUCTURE.

SANDSTONE = MINOR LOOSE GRAINS; LT GRAY; BRN; HARD PRESERVED SPECIMENS; FINE GRAINED; ANGULAR TO SUBANGULAR; LOW TO MOD SPHERICITY; CALCITE CEMENT; DOM GRAIN SUPPORTED W/SME MATRIX SUPPORTED ARGILLACEOUS EXAMPLES; NO GAS INCREASES.

SHALE = VARICOLORED; MOTTLED IN PART; LIGHT GRAY; YELLOW; YELLOW BROWN; TR PURPLE AND REDBROWN; FIRM TO MOD HARD; PLATY CUTTINGS; IRREGULAR FRACTURE; DULL EARTHY LUSTER; VERY FINE MICA; SMOOTH TO ROUGH TEXTURE TO SILTY IN SILTY EXAMPLES NON CALCAREOUS; MOD CALCAREOUS IN SILTY EXAMPLES; NO VISIBLE STRUCTURE; TRACE AMOUNTS OF WHITE, CRYSTALLINE NAHCOLITE IN SAMPLE TRAYS.

SANDSTONE = VARICOLORED; BROWN; PURPLE LT TO DARK GRAY; HARD; UPPER TO LOWER FINE GRAINED; LOW SPHERICITY; MOD SORTED CALCAREOUS CLAY CEMENT TO CALCITE CMT; DOM GRAIN SUPPORTED; SUBANGULAR GRS; MINOR AMT OF LOOSE GRAINS; TIGHT; NO GAS INCREASES.

SILTSTONE = DARK GRAY WITH HUES OF BROWN; VERY TOUGH TO DENSE TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO TABULAR CUTTINGS HABIT; DULL TO SLIGHTLY SPARKLING LUSTER; SILTY TO GRITTY TEXTURE; THIN STRUCTURE; THINLY INTERBEDDED WITH SHALE.

SHALE = LIGHT GRAY TO GRAY WITH ORANGE-BROWN HUES; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; THIN STRUCTURE; BECOMING MORE THINLY BEDDED WITH SANDSTONE AND SILTSTONE.

NOTE = BIT TRIP BEGAN ON 03/03/2010 AT 21:00 HRS TO CHANGE OUT DIRECTIONAL TOOLS. RESUMED DRILLING ON 03/04/2010 AT 14:00 HRS.

WASATCH G PLACED AT 5254' MD 5154' TVD

START TO LOSE MUD AT 5254'. LOST TOTAL RETURNS AT 5325'. REGAINED FULL RETURNS AT 5325'

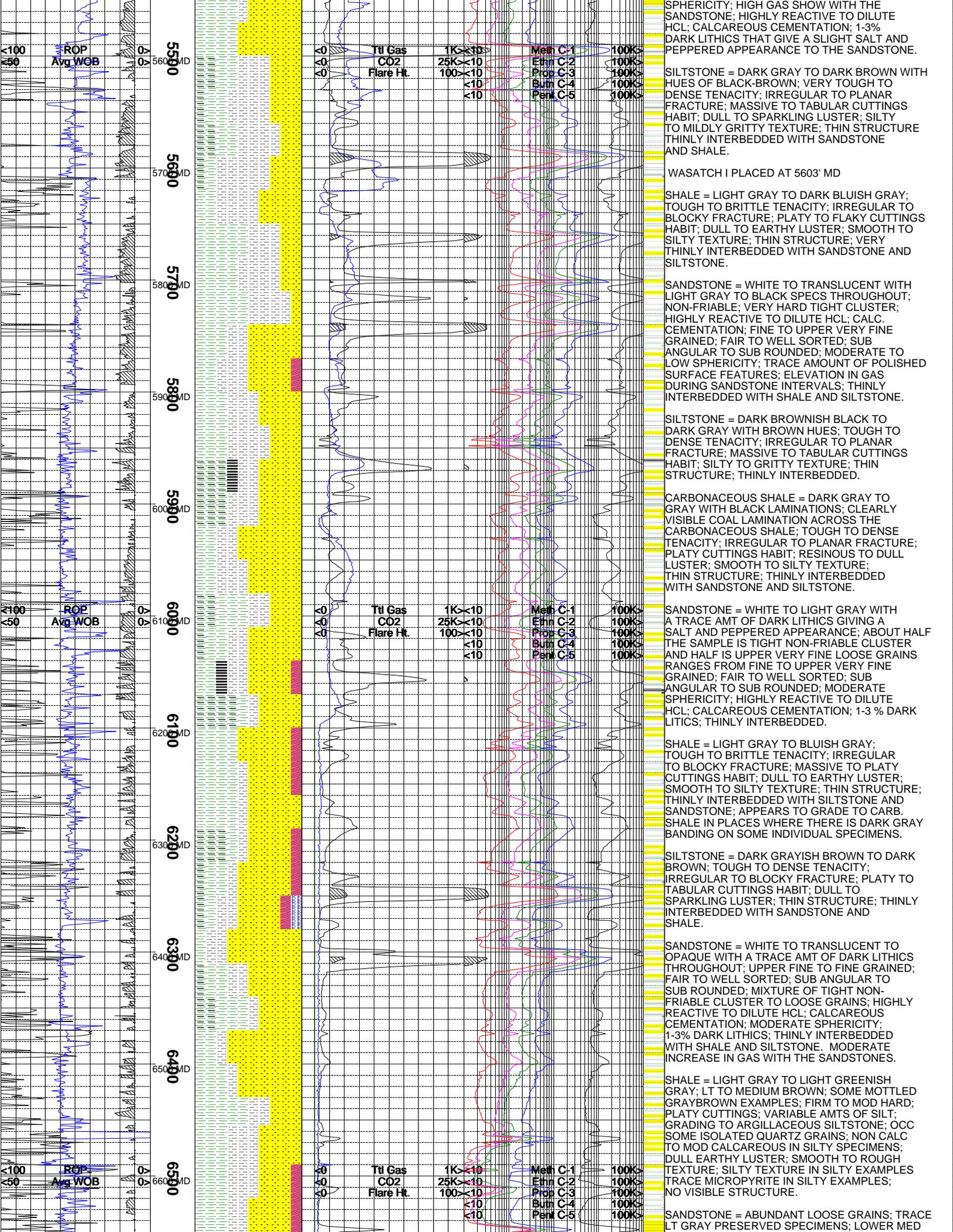
WASATCH G SANDSTONE = ABUNDANT LOOSE GRAINS; FINE TO UPPER FINE GRAINED IN UPPER SECTION; FRIABLE IN UPPER SECTION; BECOMING MEDIUM GRAINED TOWARD BASE; DOM SILICEOUS CEMENT WITH MINOR CALCITE; ABUNDANT LOOSE GRAINS; GRAIN SUPPORTED; LOOSE KAOLIN CLAY OBSERVED IN LOWER SAND INTERVAL; COARSE CALCITE- PROBABLE FRACTURE FILL OBSERVED IN 5260- 5270' SAMPLE; 1300+ UNIT GAS SHOW ON TOP; LOWER GAS DATA IN WASATCH G NOT RELIABLE BECAUSE OF MUD LOSSES.

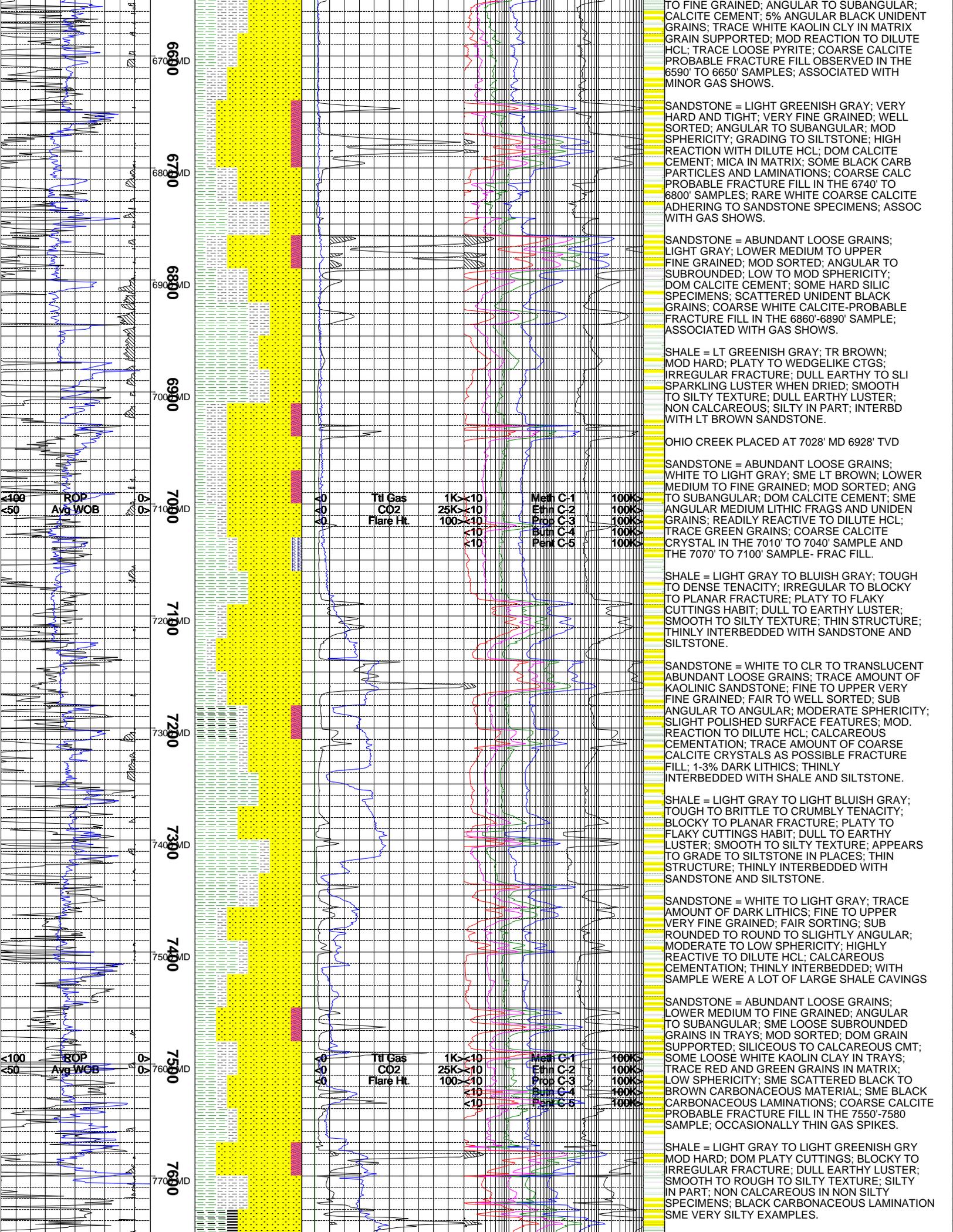
SHALE = GRAY TO BLUISH GRAY WITH HUES OF BROWN; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; THIN STRUCTURE; THINLY INTERBEDDED WITH SANDSTONE AND SILTSTONE.

SANDSTONE = WHITE TO VERY LIGHT GRAY WITH A TRACE AMOUNT OF DARK LITHICS; VERY NON-FRIABLE TIGHT CLUSTERS; UPPER VERY FINE GRAINED; WELL SORTED; SUB ROUNDED TO ANGULAR; MODERATE

Ttl Gas	50	<10	Meth C-1	100K
CO2	25K	<10	Ethn C-2	100K
Flare Ht.	100	<10	Prop C-3	100K
		<10	Burn C-4	100K
		<10	Penl C-5	100K

Ttl Gas	50	<10	Meth C-1	100K
CO2	25K	<10	Ethn C-2	100K
Flare Ht.	100	<10	Prop C-3	100K
		<10	Burn C-4	100K
		<10	Penl C-5	100K





6690 MD  
6700 MD  
6790 MD  
6800 MD  
6890 MD  
6900 MD  
6990 MD  
7000 MD  
7090 MD  
7100 MD  
7190 MD  
7200 MD  
7290 MD  
7300 MD  
7390 MD  
7400 MD  
7490 MD  
7500 MD  
7590 MD  
7600 MD  
7690 MD

ROP  
Avg WOB

ROP  
Avg WOB

Ttl Gas  
CO2  
Flare Ht

1K < 10  
25K < 10  
100 < 10  
< 10  
< 10

Meth C-1  
Ethn C-2  
Prog C-3  
Bum C-4  
Penl C-5

100K >  
100K >  
100K >  
100K >  
100K >

TO FINE GRAINED; ANGULAR TO SUBANGULAR; CALCITE CEMENT; 5% ANGULAR BLACK UNIDENT GRAINS; TRACE WHITE KAOLIN CLY IN MATRIX GRAIN SUPPORTED; MOD REACTION TO DILUTE HCL; TRACE LOOSE PYRITE; COARSE CALCITE PROBABLE FRACTURE FILL OBSERVED IN THE 6590' TO 6650' SAMPLES; ASSOCIATED WITH MINOR GAS SHOWS.

SANDSTONE = LIGHT GREENISH GRAY; VERY HARD AND TIGHT; VERY FINE GRAINED; WELL SORTED; ANGULAR TO SUBANGULAR; MOD SPHERICITY; GRADING TO SILTSTONE; HIGH REACTION WITH DILUTE HCL; DOM CALCITE CEMENT; MICA IN MATRIX; SOME BLACK CARB PARTICLES AND LAMINATIONS; COARSE CALC PROBABLE FRACTURE FILL IN THE 6740' TO 6800' SAMPLES; RARE WHITE COARSE CALCITE ADHERING TO SANDSTONE SPECIMENS; ASSOC WITH GAS SHOWS.

SANDSTONE = ABUNDANT LOOSE GRAINS; LIGHT GRAY; LOWER MEDIUM TO UPPER FINE GRAINED; MOD SORTED; ANGULAR TO SUBROUNDED; LOW TO MOD SPHERICITY; DOM CALCITE CEMENT; SOME HARD SILIC SPECIMENS; SCATTERED UNIDENT BLACK GRAINS; COARSE WHITE CALCITE-PROBABLE FRACTURE FILL IN THE 6860'-6890' SAMPLE; ASSOCIATED WITH GAS SHOWS.

SHALE = LT GREENISH GRAY; TR BROWN; MOD HARD; PLATY TO WEDGELIKE CTGS; IRREGULAR FRACTURE; DULL EARTHY TO SLI SPARKLING LUSTER WHEN DRIED; SMOOTH TO SILTY TEXTURE; DULL EARTHY LUSTER; NON CALCAREOUS; SILTY IN PART; INTERBD WITH LT BROWN SANDSTONE.

OHIO CREEK PLACED AT 7028' MD 6928' TVD

SANDSTONE = ABUNDANT LOOSE GRAINS; WHITE TO LIGHT GRAY; SME LT BROWN; LOWER MEDIUM TO FINE GRAINED; MOD SORTED; ANG TO SUBANGULAR; DOM CALCITE CEMENT; SME ANGULAR MEDIUM LITHIC FRAGS AND UNIDENT GRAINS; READILY REACTIVE TO DILUTE HCL; TRACE GREEN GRAINS; COARSE CALCITE CRYSTAL IN THE 7010' TO 7040' SAMPLE AND THE 7070' TO 7100' SAMPLE- FRAC FILL.

SHALE = LIGHT GRAY TO BLUISH GRAY; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; THIN STRUCTURE; THINLY INTERBEDDED WITH SANDSTONE AND SILTSTONE.

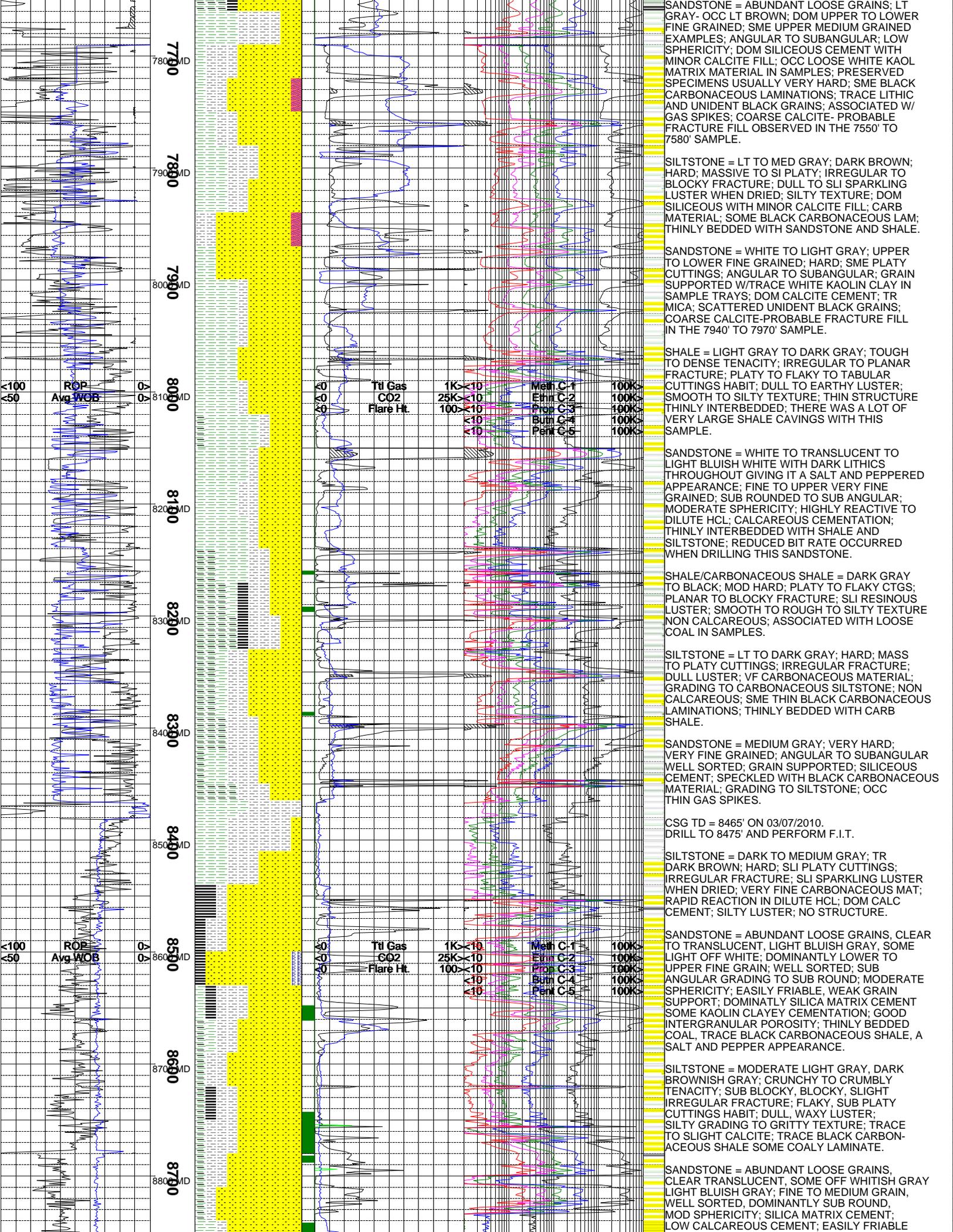
SANDSTONE = WHITE TO CLR TO TRANSLUCENT ABUNDANT LOOSE GRAINS; TRACE AMOUNT OF KAOLINIC SANDSTONE; FINE TO UPPER VERY FINE GRAINED; FAIR TO WELL SORTED; SUB ANGULAR TO ANGULAR; MODERATE SPHERICITY; SLIGHT POLISHED SURFACE FEATURES; MOD. REACTION TO DILUTE HCL; CALCAREOUS CEMENTATION; TRACE AMOUNT OF COARSE CALCITE CRYSTALS AS POSSIBLE FRACTURE FILL; 1-3% DARK LITHICS; THINLY INTERBEDDED WITH SHALE AND SILTSTONE.

SHALE = LIGHT GRAY TO LIGHT BLUISH GRAY; TOUGH TO BRITTLE TO CRUMBLY TENACITY; BLOCKY TO PLANAR FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; APPEARS TO GRADE TO SILTSTONE IN PLACES; THIN STRUCTURE; THINLY INTERBEDDED WITH SANDSTONE AND SILTSTONE.

SANDSTONE = WHITE TO LIGHT GRAY; TRACE AMOUNT OF DARK LITHICS; FINE TO UPPER VERY FINE GRAINED; FAIR SORTING; SUB ROUNDED TO ROUND TO SLIGHTLY ANGULAR; MODERATE TO LOW SPHERICITY; HIGHLY REACTIVE TO DILUTE HCL; CALCAREOUS CEMENTATION; THINLY INTERBEDDED; WITH SAMPLE WERE A LOT OF LARGE SHALE CAVINGS

SANDSTONE = ABUNDANT LOOSE GRAINS; LOWER MEDIUM TO FINE GRAINED; ANGULAR TO SUBANGULAR; SME LOOSE SUBROUNDED GRAINS IN TRAYS; MOD SORTED; DOM GRAIN SUPPORTED; SILICEOUS TO CALCAREOUS CMT; SOME LOOSE WHITE KAOLIN CLAY IN TRAYS; TRACE RED AND GREEN GRAINS IN MATRIX; LOW SPHERICITY; SME SCATTERED BLACK TO BROWN CARBONACEOUS MATERIAL; SME BLACK CARBONACEOUS LAMINATIONS; COARSE CALCITE PROBABLE FRACTURE FILL IN THE 7550'-7580' SAMPLE; OCCASIONALLY THIN GAS SPIKES.

SHALE = LIGHT GRAY TO LIGHT GREENISH GRY MOD HARD; DOM PLATY CUTTINGS; BLOCKY TO IRREGULAR FRACTURE; DULL EARTHY LUSTER; SMOOTH TO ROUGH TO SILTY TEXTURE; SILTY IN PART; NON CALCAREOUS IN NON SILTY SPECIMENS; BLACK CARBONACEOUS LAMINATION SME VERY SILTY EXAMPLES.



SANDSTONE = ABUNDANT LOOSE GRAINS; LT GRAY- OCC LT BROWN; DOM UPPER TO LOWER FINE GRAINED; SME UPPER MEDIUM GRAINED EXAMPLES; ANGULAR TO SUBANGULAR; LOW SPHERICITY; DOM SILICEOUS CEMENT WITH MINOR CALCITE FILL; OCC LOOSE WHITE KAOL MATRIX MATERIAL IN SAMPLES; PRESERVED SPECIMENS USUALLY VERY HARD; SME BLACK CARBONACEOUS LAMINATIONS; TRACE LITHIC AND UNIDENT BLACK GRAINS; ASSOCIATED W/ GAS SPIKES; COARSE CALCITE- PROBABLE FRACTURE FILL OBSERVED IN THE 7550' TO 7580' SAMPLE.

SILTSTONE = LT TO MED GRAY; DARK BROWN; HARD; MASSIVE TO SI PLATY; IRREGULAR TO BLOCKY FRACTURE; DULL TO SLI SPARKLING LUSTER WHEN DRIED; SILTY TEXTURE; DOM SILICEOUS WITH MINOR CALCITE FILL; CARB MATERIAL; SOME BLACK CARBONACEOUS LAM; THINLY BEDDED WITH SANDSTONE AND SHALE.

SANDSTONE = WHITE TO LIGHT GRAY; UPPER TO LOWER FINE GRAINED; HARD; SME PLATY CUTTINGS; ANGULAR TO SUBANGULAR; GRAIN SUPPORTED W/TRACE WHITE KAOLIN CLAY IN SAMPLE TRAYS; DOM CALCITE CEMENT; TR MICA; SCATTERED UNIDENT BLACK GRAINS; COARSE CALCITE-PROBABLE FRACTURE FILL IN THE 7940' TO 7970' SAMPLE.

SHALE = LIGHT GRAY TO DARK GRAY; TOUGH TO DENSE TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO FLAKY TO TABULAR CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; THIN STRUCTURE THINLY INTERBEDDED; THERE WAS A LOT OF VERY LARGE SHALE CAVINGS WITH THIS SAMPLE.

SANDSTONE = WHITE TO TRANSLUCENT TO LIGHT BLUISH WHITE WITH DARK LITHICS THROUGHOUT GIVING IT A SALT AND PEPPERED APPEARANCE; FINE TO UPPER VERY FINE GRAINED; SUB ROUNDED TO SUB ANGULAR; MODERATE SPHERICITY; HIGHLY REACTIVE TO DILUTE HCL; CALCAREOUS CEMENTATION; THINLY INTERBEDDED WITH SHALE AND SILTSTONE; REDUCED BIT RATE OCCURRED WHEN DRILLING THIS SANDSTONE.

SHALE/CARBONACEOUS SHALE = DARK GRAY TO BLACK; MOD HARD; PLATY TO FLAKY CTGS; PLANAR TO BLOCKY FRACTURE; SILTY RESINOUS LUSTER; SMOOTH TO ROUGH TO SILTY TEXTURE NON CALCAREOUS; ASSOCIATED WITH LOOSE COAL IN SAMPLES.

SILTSTONE = LT TO DARK GRAY; HARD; MASS TO PLATY CUTTINGS; IRREGULAR FRACTURE; DULL LUSTER; VF CARBONACEOUS MATERIAL; GRADING TO CARBONACEOUS SILTSTONE; NON CALCAREOUS; SME THIN BLACK CARBONACEOUS LAMINATIONS; THINLY BEDDED WITH CARB SHALE.

SANDSTONE = MEDIUM GRAY; VERY HARD; VERY FINE GRAINED; ANGULAR TO SUBANGULAR WELL SORTED; GRAIN SUPPORTED; SILICEOUS CEMENT; SPECKLED WITH BLACK CARBONACEOUS MATERIAL; GRADING TO SILTSTONE; OCC THIN GAS SPIKES.

CSG TD = 8465' ON 03/07/2010.  
DRILL TO 8475' AND PERFORM F.I.T.

SILTSTONE = DARK TO MEDIUM GRAY; TR DARK BROWN; HARD; SLI PLATY CUTTINGS; IRREGULAR FRACTURE; SLI SPARKLING LUSTER WHEN DRIED; VERY FINE CARBONACEOUS MAT; RAPID REACTION IN DILUTE HCL; DOM CALC CEMENT; SILTY LUSTER; NO STRUCTURE.

SANDSTONE = ABUNDANT LOOSE GRAINS, CLEAR TO TRANSLUCENT, LIGHT BLUISH GRAY, SOME LIGHT OFF WHITE; DOMINANTLY LOWER TO UPPER FINE GRAIN; WELL SORTED; SUB ANGULAR GRADING TO SUB ROUND; MODERATE SPHERICITY; EASILY FRIABLE, WEAK GRAIN SUPPORT; DOMINANTLY SILICA MATRIX CEMENT SOME KAOLIN CLAYEY CEMENTATION; GOOD INTERGRANULAR POROSITY; THINLY BEDDED COAL, TRACE BLACK CARBONACEOUS SHALE, A SALT AND PEPPER APPEARANCE.

SILTSTONE = MODERATE LIGHT GRAY, DARK BROWNISH GRAY; CRUNCHY TO CRUMBLY TENACITY; SUB BLOCKY, BLOCKY, SLIGHT IRREGULAR FRACTURE; FLAKY, SUB PLATY CUTTINGS HABIT; DULL, WAXY LUSTER; SILTY GRADING TO GRITTY TEXTURE; TRACE TO SLIGHT CALCITE; TRACE BLACK CARBONACEOUS SHALE SOME COALY LAMINATE.

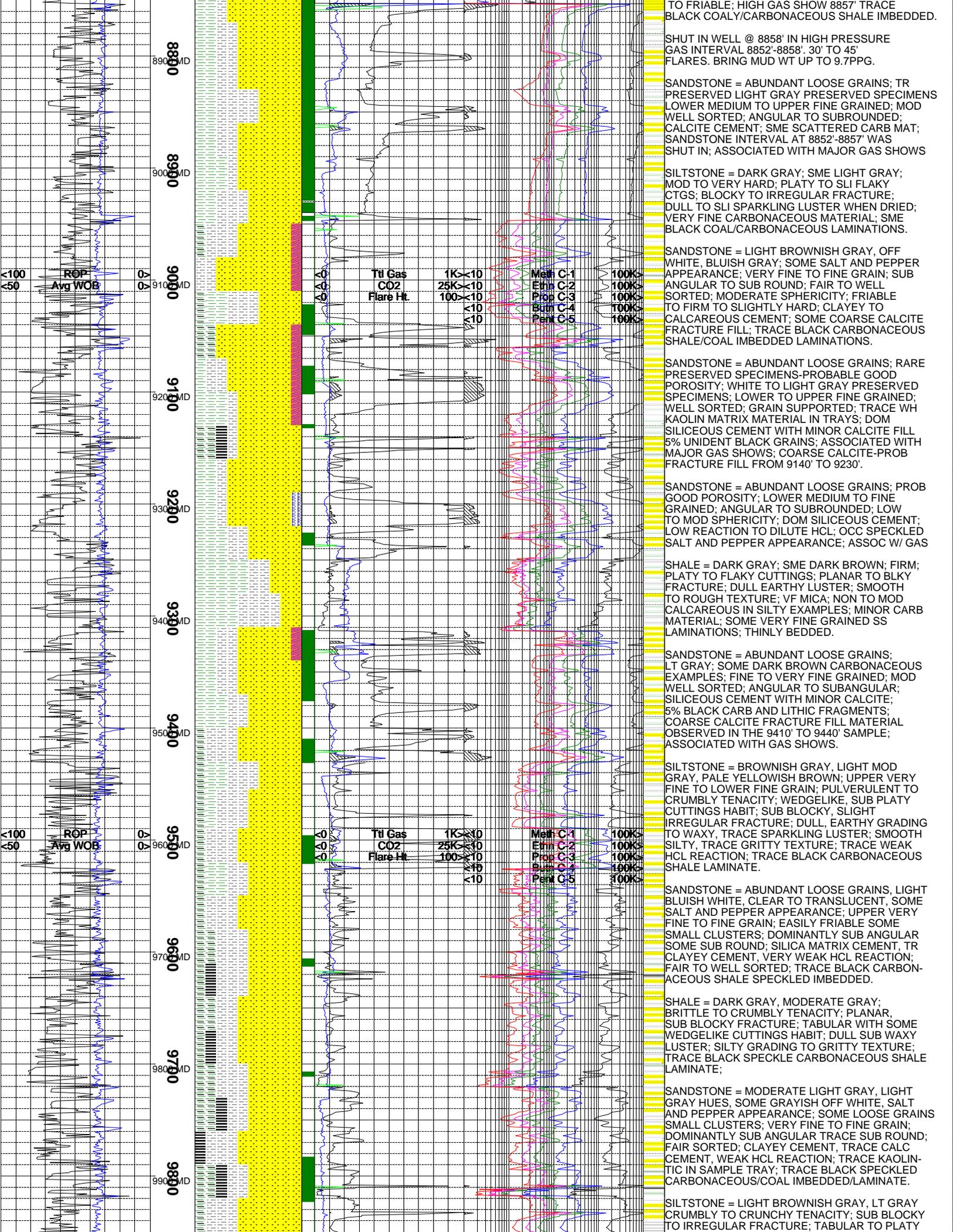
SANDSTONE = ABUNDANT LOOSE GRAINS, CLEAR TRANSLUCENT, SOME OFF WHITISH GRAY LIGHT BLUISH GRAY; FINE TO MEDIUM GRAIN, WELL SORTED, DOMINANTLY SUB ROUND, MOD SPHERICITY; SILICA MATRIX CEMENT; LOW CALCAREOUS CEMENT; EASILY FRIABLE

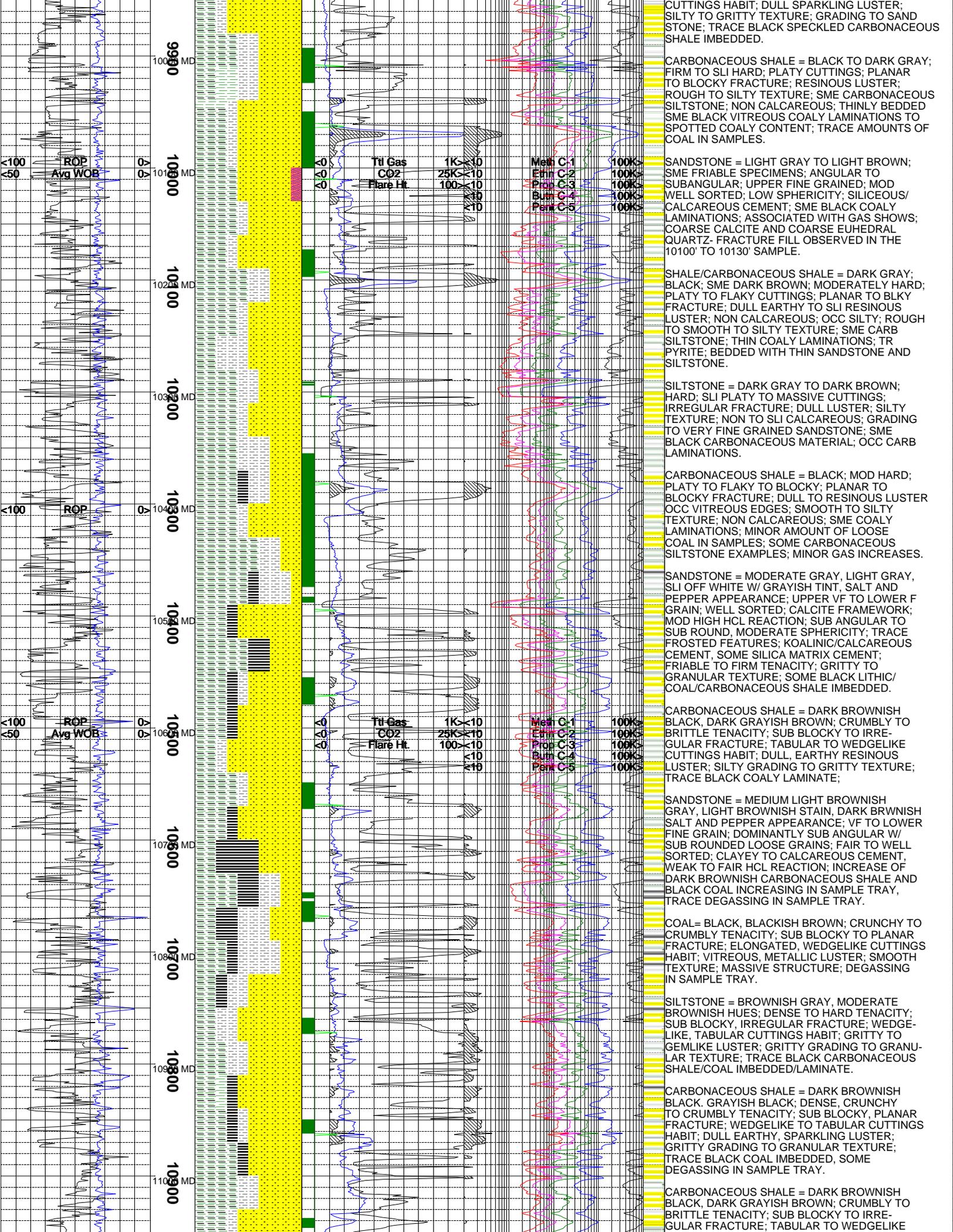
ROP  
Avg. WOB

Ttl Gas 1K < 10  
CO2 25K < 10  
Flare Ht. 100 < 10  
Meth C-1 100%  
Ethn C-2 100%  
Prog C-3 100%  
Burn C-4 100%  
Pent C-5 100%

ROP  
Avg. WOB

Ttl Gas 1K < 10  
CO2 25K < 10  
Flare Ht. 100 < 10  
Meth C-1 100%  
Ethn C-2 100%  
Prog C-3 100%  
Burn C-4 100%  
Pent C-5 100%





9980 MD  
10000 MD  
10100 MD  
10200 MD  
10300 MD  
10400 MD  
10500 MD  
10600 MD  
10700 MD  
10800 MD  
10900 MD

ROP  
Avg WOB

Ttl Gas 1K x 10  
CO2 25K x 10  
Flare Ht 100 x 10

Core C-1 100K  
Core C-2 100K  
Core C-3 100K  
Core C-4 100K  
Core C-5 100K

CUTTINGS HABIT; DULL SPARKLING LUSTER;  
SILTY TO GRITTY TEXTURE; GRADING TO SAND  
STONE; TRACE BLACK SPECKLED CARBONACEOUS  
SHALE IMBEDDED.

CARBONACEOUS SHALE = BLACK TO DARK GRAY;  
FIRM TO SLI HARD; PLATY CUTTINGS; PLANAR  
TO BLOCKY FRACTURE; RESINOUS LUSTER;  
ROUGH TO SILTY TEXTURE; SME CARBONACEOUS  
SILTSTONE; NON CALCAREOUS; THINLY BEDDED  
SME BLACK VITREOUS COALY LAMINATIONS TO  
SPOTTED COALY CONTENT; TRACE AMOUNTS OF  
COAL IN SAMPLES.

SANDSTONE = LIGHT GRAY TO LIGHT BROWN;  
SME FRIABLE SPECIMENS; ANGULAR TO  
SUBANGULAR; UPPER FINE GRAINED; MOD  
WELL SORTED; LOW SPHERICITY; SILICEOUS/  
CALCAREOUS CEMENT; SME BLACK COALY  
LAMINATIONS; ASSOCIATED WITH GAS SHOWS;  
COARSE CALCITE AND COARSE EUHEDRAL  
QUARTZ- FRACTURE FILL OBSERVED IN THE  
10100' TO 10130' SAMPLE.

SHALE/CARBONACEOUS SHALE = DARK GRAY;  
BLACK; SME DARK BROWN; MODERATELY HARD;  
PLATY TO FLAKY CUTTINGS; PLANAR TO BLKY  
FRACTURE; DULL EARTHY TO SLI RESINOUS  
LUSTER; NON CALCAREOUS; OCC SILTY; ROUGH  
TO SMOOTH TO SILTY TEXTURE; SME CARB  
SILTSTONE; THIN COALY LAMINATIONS; TR  
PYRITE; BEDDED WITH THIN SANDSTONE AND  
SILTSTONE.

SILTSTONE = DARK GRAY TO DARK BROWN;  
HARD; SLI PLATY TO MASSIVE CUTTINGS;  
IRREGULAR FRACTURE; DULL LUSTER; SILTY  
TEXTURE; NON TO SLI CALCAREOUS; GRADING  
TO VERY FINE GRAINED SANDSTONE; SME  
BLACK CARBONACEOUS MATERIAL; OCC CARB  
LAMINATIONS.

CARBONACEOUS SHALE = BLACK; MOD HARD;  
PLATY TO FLAKY TO BLOCKY; PLANAR TO  
BLOCKY FRACTURE; DULL TO RESINOUS LUSTER  
OCC VITREOUS EDGES; SMOOTH TO SILTY  
TEXTURE; NON CALCAREOUS; SME COALY  
LAMINATIONS; MINOR AMOUNT OF LOOSE  
COAL IN SAMPLES; SOME CARBONACEOUS  
SILTSTONE EXAMPLES; MINOR GAS INCREASES.

SANDSTONE = MODERATE GRAY, LIGHT GRAY,  
SLI OFF WHITE W/ GRAYISH TINT, SALT AND  
PEPPER APPEARANCE; UPPER VF TO LOWER F  
GRAIN; WELL SORTED; CALCITE FRAMEWORK;  
MOD HIGH HCL REACTION; SUB ANGULAR TO  
SUB ROUND, MODERATE SPHERICITY; TRACE  
FROSTED FEATURES; KOALINIC/CALCAREOUS  
CEMENT, SOME SILICA MATRIX CEMENT;  
FRIABLE TO FIRM TENACITY; GRITTY TO  
GRANULAR TEXTURE; SOME BLACK LITHIC/  
COAL/CARBONACEOUS SHALE IMBEDDED.

CARBONACEOUS SHALE = DARK BROWNISH  
BLACK, DARK GRAYISH BROWN; CRUMBLY TO  
BRITTLE TENACITY; SUB BLOCKY TO IRRE-  
GULAR FRACTURE; TABULAR TO WEDGELIKE  
CUTTINGS HABIT; DULL, EARTHY RESINOUS  
LUSTER; SILTY GRADING TO GRITTY TEXTURE;  
TRACE BLACK COALY LAMINATE;

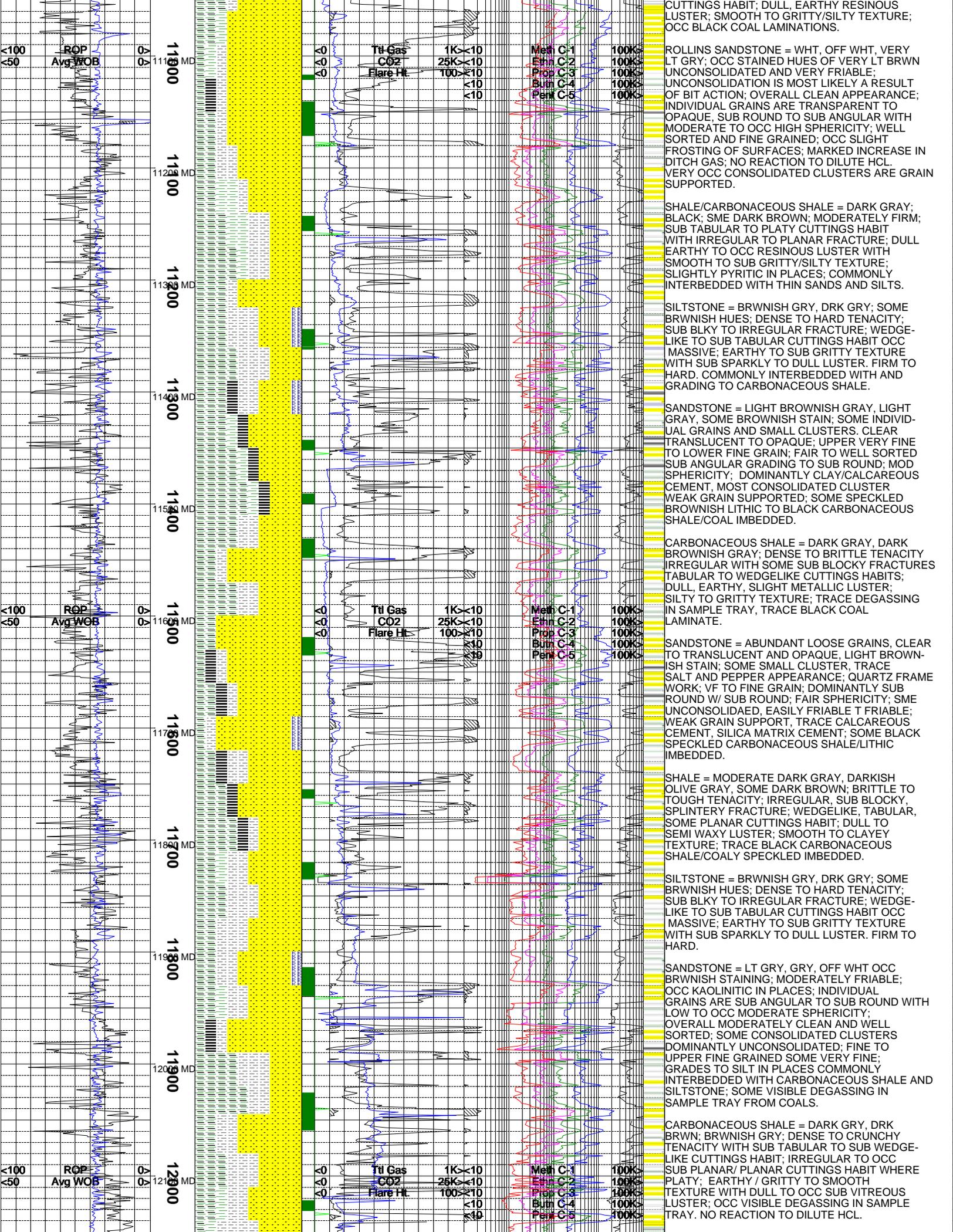
SANDSTONE = MEDIUM LIGHT BROWNISH  
GRAY, LIGHT BROWNISH STAIN, DARK BRWNISH  
SALT AND PEPPER APPEARANCE; VF TO LOWER  
FINE GRAIN; DOMINANTLY SUB ANGULAR W/  
SUB ROUNDED LOOSE GRAINS; FAIR TO WELL  
SORTED; CLAYEY TO CALCAREOUS CEMENT,  
WEAK TO FAIR HCL REACTION; INCREASE OF  
DARK BROWNISH CARBONACEOUS SHALE AND  
BLACK COAL INCREASING IN SAMPLE TRAY,  
TRACE DEGASSING IN SAMPLE TRAY.

COAL= BLACK, BLACKISH BROWN; CRUNCHY TO  
CRUMBLY TENACITY; SUB BLOCKY TO PLANAR  
FRACTURE; ELONGATED, WEDGELIKE CUTTINGS  
HABIT; VITREOUS, METALLIC LUSTER; SMOOTH  
TEXTURE; MASSIVE STRUCTURE; DEGASSING  
IN SAMPLE TRAY.

SILTSTONE = BROWNISH GRAY, MODERATE  
BROWNISH HUES; DENSE TO HARD TENACITY;  
SUB BLOCKY, IRREGULAR FRACTURE; WEDGE-  
LIKE, TABULAR CUTTINGS HABIT; GRITTY TO  
GEMLIKE LUSTER; GRITTY GRADING TO GRANU-  
LAR TEXTURE; TRACE BLACK CARBONACEOUS  
SHALE/COAL IMBEDDED/LAMINATE.

CARBONACEOUS SHALE = DARK BROWNISH  
BLACK, GRAYISH BLACK; DENSE, CRUNCHY  
TO CRUMBLY TENACITY; SUB BLOCKY, PLANAR  
FRACTURE; WEDGELIKE TO TABULAR CUTTINGS  
HABIT; DULL EARTHY, SPARKLING LUSTER;  
GRITTY GRADING TO GRANULAR TEXTURE;  
TRACE BLACK COAL IMBEDDED, SOME  
DEGASSING IN SAMPLE TRAY.

CARBONACEOUS SHALE = DARK BROWNISH  
BLACK, DARK GRAYISH BROWN; CRUMBLY TO  
BRITTLE TENACITY; SUB BLOCKY TO IRRE-  
GULAR FRACTURE; TABULAR TO WEDGELIKE



ROP  
Avg WOB

ROP  
Avg WOB

ROP  
Avg WOB

11900 MD  
11200 MD  
11300 MD  
11400 MD  
11500 MD  
11600 MD  
11700 MD  
11800 MD  
11900 MD  
12000 MD

Ttl Gas 1K <10  
CO2 25K <10  
Flare Ht. 100 <10

Ttl Gas 1K <10  
CO2 25K <10  
Flare Ht. 100 <10

Ttl Gas 1K <10  
CO2 25K <10  
Flare Ht. 100 <10

Meth C-1 100K >  
Eth C-2 100K >  
Prop C-3 100K >  
But C-4 100K >  
Pent C-5 100K >

Meth C-1 100K >  
Eth C-2 100K >  
Prop C-3 100K >  
But C-4 100K >  
Pent C-5 100K >

Meth C-1 100K >  
Eth C-2 100K >  
Prop C-3 100K >  
But C-4 100K >  
Pent C-5 100K >

CUTTINGS HABIT; DULL, EARTHY RESINOUS LUSTER; SMOOTH TO GRITTY/SILTY TEXTURE; OCC BLACK COAL LAMINATIONS.

ROLLINS SANDSTONE = WHT, OFF WHT, VERY LT GRY; OCC STAINED HUES OF VERY LT BRWN UNCONSOLIDATED AND VERY FRIABLE; UNCONSOLIDATION IS MOST LIKELY A RESULT OF BIT ACTION; OVERALL CLEAN APPEARANCE; INDIVIDUAL GRAINS ARE TRANSPARENT TO OPAQUE, SUB ROUND TO SUB ANGULAR WITH MODERATE TO OCC HIGH SPHERICITY; WELL SORTED AND FINE GRAINED; OCC SLIGHT FROSTING OF SURFACES; MARKED INCREASE IN DITCH GAS; NO REACTION TO DILUTE HCL. VERY OCC CONSOLIDATED CLUSTERS ARE GRAIN SUPPORTED.

SHALE/CARBONACEOUS SHALE = DARK GRAY; BLACK; SME DARK BROWN; MODERATELY FIRM; SUB TABULAR TO PLATY CUTTINGS HABIT WITH IRREGULAR TO PLANAR FRACTURE; DULL EARTHY TO OCC RESINOUS LUSTER WITH SMOOTH TO SUB GRITTY/SILTY TEXTURE; SLIGHTLY PYRITIC IN PLACES; COMMONLY INTERBEDDED WITH THIN SANDS AND SILTS.

SILTSTONE = BRWNISH GRY, DRK GRY; SOME BRWNISH HUES; DENSE TO HARD TENACITY; SUB BLKY TO IRREGULAR FRACTURE; WEDGE-LIKE TO SUB TABULAR CUTTINGS HABIT OCC MASSIVE; EARTHY TO SUB GRITTY TEXTURE WITH SUB SPARKLY TO DULL LUSTER. FIRM TO HARD. COMMONLY INTERBEDDED WITH AND GRADING TO CARBONACEOUS SHALE.

SANDSTONE = LIGHT BROWNISH GRAY, LIGHT GRAY, SOME BROWNISH STAIN; SOME INDIVIDUAL GRAINS AND SMALL CLUSTERS. CLEAR TRANSLUCENT TO OPAQUE; UPPER VERY FINE TO LOWER FINE GRAIN; FAIR TO WELL SORTED SUB ANGULAR GRADING TO SUB ROUND; MOD SPHERICITY; DOMINANTLY CLAY/CALCAREOUS CEMENT, MOST CONSOLIDATED CLUSTER WEAK GRAIN SUPPORTED; SOME SPECKLED BROWNISH LITHIC TO BLACK CARBONACEOUS SHALE/COAL IMBEDDED.

CARBONACEOUS SHALE = DARK GRAY, DARK BROWNISH GRAY; DENSE TO BRITTLE TENACITY IRREGULAR WITH SOME SUB BLOCKY FRACTURES TABULAR TO WEDGELIKE CUTTINGS HABITS; DULL, EARTHY, SLIGHT METALLIC LUSTER; SILTY TO GRITTY TEXTURE; TRACE DEGASSING IN SAMPLE TRAY, TRACE BLACK COAL LAMINATE.

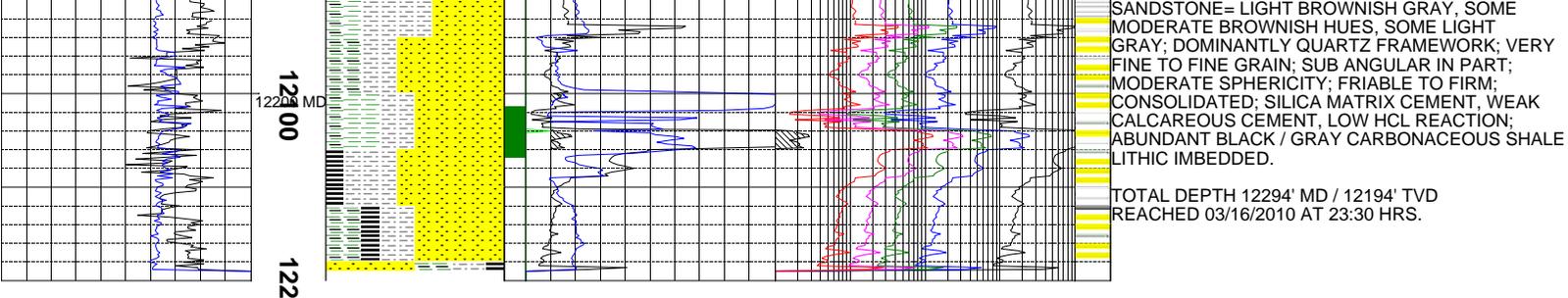
SANDSTONE = ABUNDANT LOOSE GRAINS, CLEAR TO TRANSLUCENT AND OPAQUE, LIGHT BROWNISH STAIN; SOME SMALL CLUSTER, TRACE SALT AND PEPPER APPEARANCE; QUARTZ FRAME WORK; VF TO FINE GRAIN; DOMINANTLY SUB ROUND W/ SUB ROUND; FAIR SPHERICITY; SME UNCONSOLIDAED, EASILY FRIABLE T FRIABLE; WEAK GRAIN SUPPORT, TRACE CALCAREOUS CEMENT, SILICA MATRIX CEMENT; SOME BLACK SPECKLED CARBONACEOUS SHALE/LITHIC IMBEDDED.

SHALE = MODERATE DARK GRAY, DARKISH OLIVE GRAY, SOME DARK BROWN; BRITTLE TO TOUGH TENACITY; IRREGULAR, SUB BLOCKY, SPLINTERY FRACTURE; WEDGELIKE, TABULAR, SOME PLANAR CUTTINGS HABIT; DULL TO SEMI WAXY LUSTER; SMOOTH TO CLAYEY TEXTURE; TRACE BLACK CARBONACEOUS SHALE/COALY SPECKLED IMBEDDED.

SILTSTONE = BRWNISH GRY, DRK GRY; SOME BRWNISH HUES; DENSE TO HARD TENACITY; SUB BLKY TO IRREGULAR FRACTURE; WEDGE-LIKE TO SUB TABULAR CUTTINGS HABIT OCC MASSIVE; EARTHY TO SUB GRITTY TEXTURE WITH SUB SPARKLY TO DULL LUSTER. FIRM TO HARD.

SANDSTONE = LT GRY, GRY, OFF WHT OCC BRWNISH STAINING; MODERATELY FRIABLE; OCC KAOLINITIC IN PLACES; INDIVIDUAL GRAINS ARE SUB ANGULAR TO SUB ROUND WITH LOW TO OCC MODERATE SPHERICITY; OVERALL MODERATELY CLEAN AND WELL SORTED; SOME CONSOLIDATED CLUSTERS DOMINANTLY UNCONSOLIDATED; FINE TO UPPER FINE GRAINED SOME VERY FINE; GRADES TO SILT IN PLACES COMMONLY INTERBEDDED WITH CARBONACEOUS SHALE AND SILTSTONE; SOME VISIBLE DEGASSING IN SAMPLE TRAY FROM COALS.

CARBONACEOUS SHALE = DARK GRY, DRK BRWN; BRWNISH GRY; DENSE TO CRUNCHY TENACITY WITH SUB TABULAR TO SUB WEDGE-LIKE CUTTINGS HABIT; IRREGULAR TO OCC SUB PLANAR/ PLANAR CUTTINGS HABIT WHERE PLATY; EARTHY / GRITTY TO SMOOTH TEXTURE WITH DULL TO OCC SUB VITREOUS LUSTER; OCC VISIBLE DEGASSING IN SAMPLE TRAY. NO REACTION TO DILUTE HCL.



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