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(907) 561-2465

Drilling Dynamics MD

COMPANY	ExxonMobil Production
WELL	PCU 197-34A3
FIELD	PICEANCE CREEK UNIT
REGION	ROCKY MOUNTAINS
COORDINATES	LAT: 39.918037 LONG: -108.276941
ELEVATION	G.L.: 6490.8' RKB: 30.2'
COUNTY, STATE	RIO BLANCO, CO
API INDEX	051031154200
SPUD DATE	02/27/2010
CONTRACTOR	HELMERICH AND PAYNE
CO. REP.	J. THOMAS
RIG/TYPE	HP 325 / FLEX 4S
LOGGING UNIT	MLU 48
GEOLOGISTS	M. GROSS D. NEW
ADD. PERSONS	
CO. GEOLOGIST	MELISSA SAURBORN

LOG INTERVAL

DEPTHS: 3858' TO 12800'
DATES: 06/15/2010 TO 07/31/2010
SCALE: 1" = 100'

CASING DATA

10.75" AT 3853'
7.00" AT 8731'
AT
AT

MUD TYPES

SPUD MUD TO 3858'
LSND TO 12800'
TO
TO

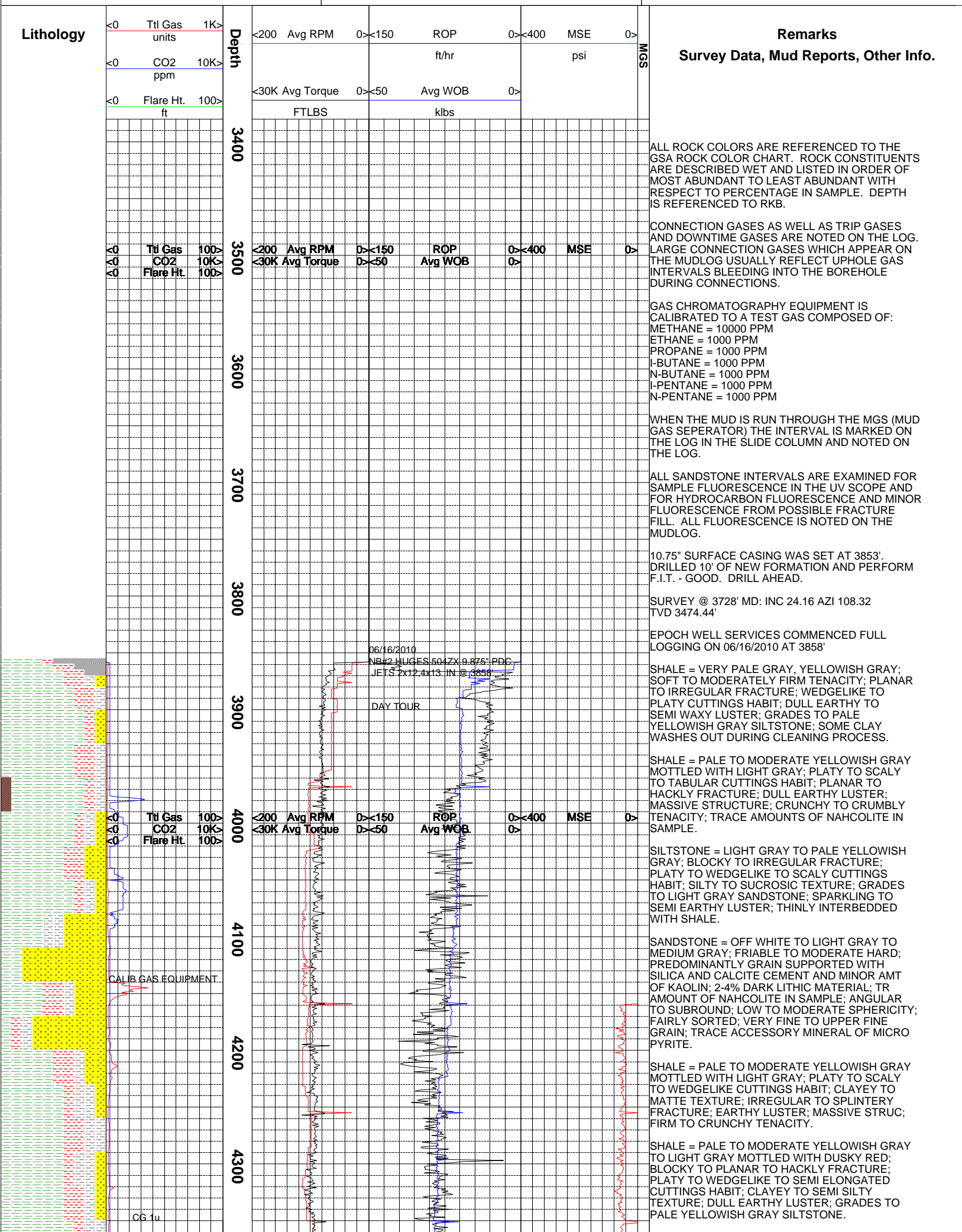
HOLE SIZE

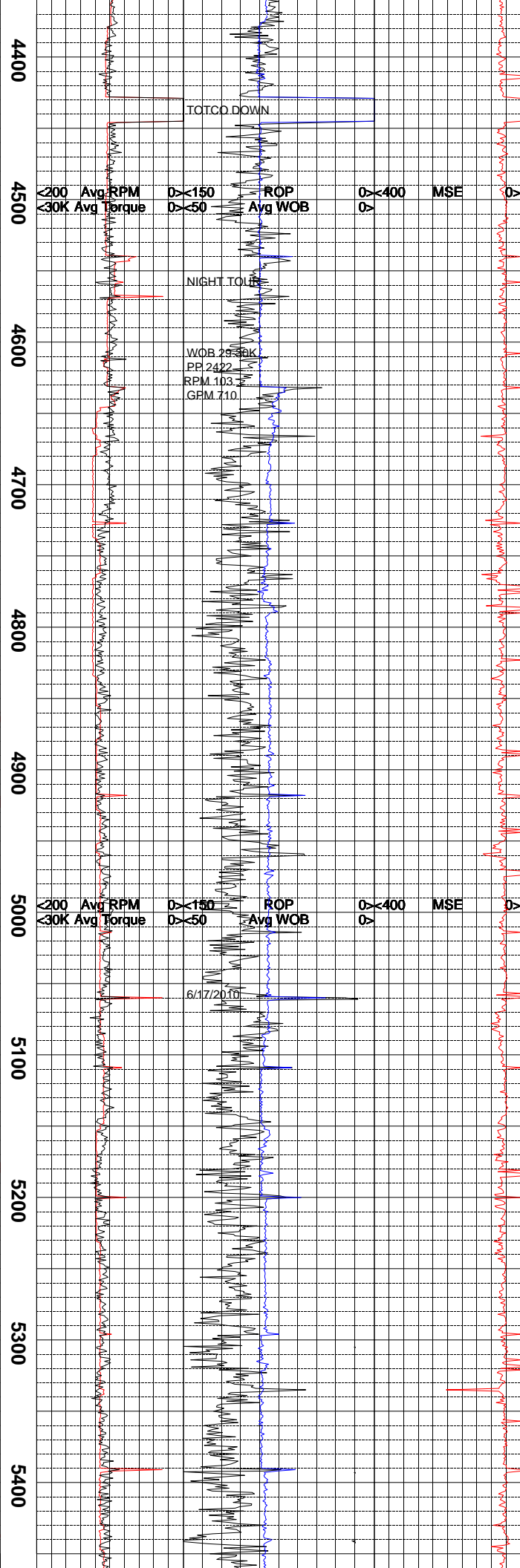
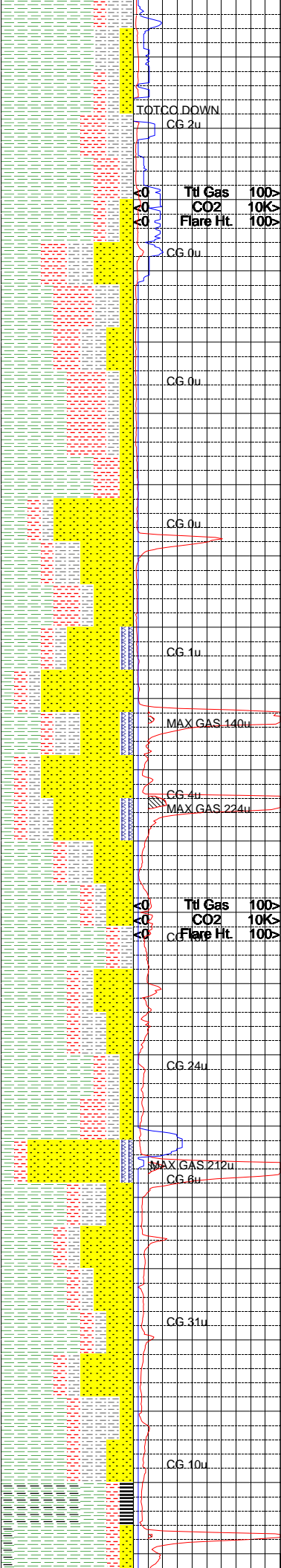
14.75" TO 3858'
9.875" TO 8750'
6.125" TO 12800'
TO

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		KAOLINITIC		RECRYSTALLIZED CALCITE		VOLCANICS
	CHALK		DIATOMITE		LIMESTONE		RHYOLITE		
	CRYSTALLINE TUFF		DIORITE		LITHIC TUFF		SALT		
	CHERT - ARGILL		DOLOSTONE		MARL - DOLO		SAND		





SILTSTONE = LIGHT GRAY TO PALE YELLOWISH GRAY; HACKLY TO IRREGULAR TO PLANAR FRACTURE; PLATY TO SCALY TO TABULAR CUTTINGS HABIT; SILTY TO SEMI GRITTY TEXTURE; SPARKLING TO SLIGHT EARTHY LUSTER; THINLY INTERBEDDED WITH PALE YELLOWISH GRAY SILTSTONE.

SHALE = MODERATE YELLOWISH GRAY TO LIGHT GRAY MOTTLED WITH GRAYISH RED; PLATY TO WEDGELIKE CUTTINGS HABIT; EARTHY LUSTER; CLAYEY TO MATTE TEXTURE; TRACE ACCESSORY MINERAL OF MICA; SOFT TO FIRM TENACITY.

SHALE = MODERATE YELLOWISH GRAY TO PALE YELLOWISH GRAY TO LIGHT GRAY; PLATY TO SCALY TO WEDGELIKE CUTTINGS HABIT; CLAY TO SLIGHTLY SILTY TEXTURE; SPLINTERY TO PLANAR TO IRREGULAR FRACTURE; DULL EARTHY LUSTER; GRADES TO SILTSTONE.

SANDSTONE = MODERATE YELLOWISH GRAY, GRAYISH WHITE, PALE BROWN TO PALE BROWNISH GRAY; UPPER VERY FINE TO UPPER FINE; MODERATELY WELL SORTED; MODERATELY HIGH SPHERICITY; SOFT TO EASILY FRIABLE; ARGILLACEOUS WITH TRACE TO MODERATE CALCAREOUS CEMENT; MOSTLY GRAIN SUPPORTED WITH ABUNDANT MATRIX; INTERSTICES VERY WELL FILLED; NO CUT; NO FLUORESCENCE; POOR VISIBLE POROSITY.

SHALE = MODERATE GRAYISH YELLOW TO DARK YELLOWISH ORANGE, REDDISH PURPLE TO MODERATE RED, VERY LIGHT GRAY TO MEDIUM LIGHT GRAY, GREENISH GRAY TO LIGHT BLuish GRAY; VERY SOFT TO MODERATELY TOUGH; HACKLY TO IRREGULAR FRACTURE; CUTTINGS IRREG TO RARE WEDGELIKE; DULL; SMOOTH TO SLIGHTLY SILTY TEXTURE; STRUCTURE PREDOMINANTLY MASSIVE WITH SOME COLOR SWIRLING; NO FLUORECENCE.

SILTSTONE = LIGHT GRAY, MODERATE YELLOW GRAY, LIGHT TO MODERATE BROWN; SOFT TO MODERATELY FIRM TENACITY; CUTTINGS HABIT MASSIVE TO IRREGULAR; LUSTER DULL; TEXT SILTY TO VERY SLIGHTLY SANDY; MASS STRUC

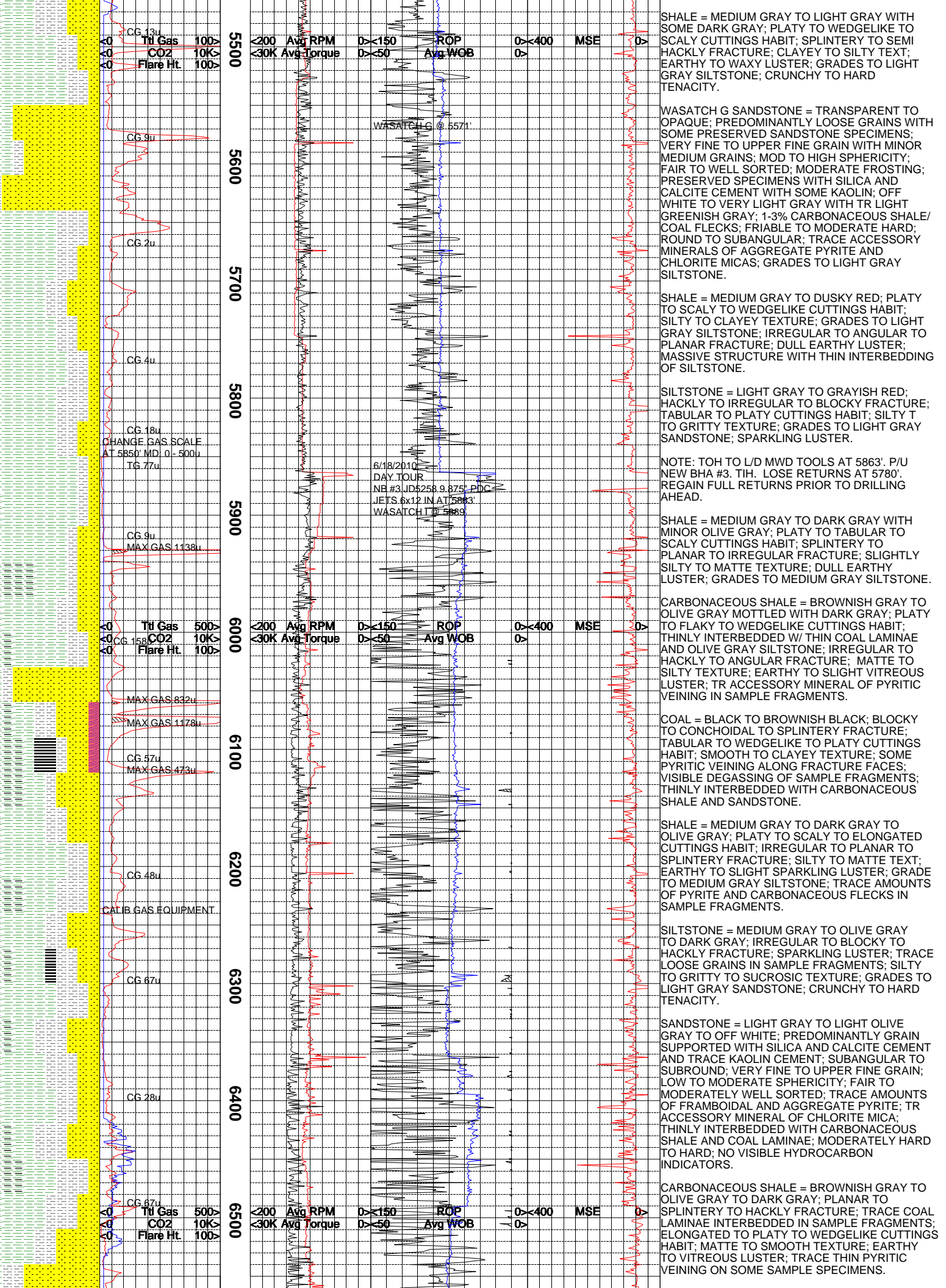
SANDSTONE = WHITE TO VERY LIGHT GRAY; SLIGHTLY SPECKLED APPEARANCE DUE TO <1% DARK FINE LITHICS; FRAMEWORK PREDOMINANTLY COLORLESS TRANSPARENT TO TRANSLUCENT QUARTZ; UPPER VERY FINE TO UPPER FINE; MODERATELY TO MODERATELY WELL SORTED; SUB ANGULAR TO SUB ROUND; SHPERICITY MODERATELY HIGH; EASILY TO FIRMLY FRIABLE; GRAIN SUPPORTED; CEMENT CALCAREOUS W/ MODERATE REACTION TO HCL; INTERSTICES MODERATELY WELL FILLED; NO CUT; NO FLOURESCENCE; MODERATE TO POOR VISIBLE POROSITY; ASSOCIATED GAS SHOWS 140 UNITS AND 223 UNITS.

SHALE = LIGHT TO MEDIUM GRAY, MODERATE YELLOWISH GRAY TO MODERATE YELLOWISH BROWN, LIGHT TO MODERATE RED, DARK GRAY; MODERATELY SOFT TO CRUNCHY TENACITY; FRACTURE IRREGULAR TO HACKLY; CUTTINGS HABIT MASSIVE TO OCCASIONAL WEDGELIKE; LUSTER DULL WITH SOME EARTHY; TEXTURE SMOOTH TO VERY SLIGHTLY SILTY; STRUCTURE PREDOMINATELY MASSIVE W/ RARE V THIN VARVE LIKE LAMINATIONS; SOME MINERAL FLUORESCENCE OBSERVED.

SANDSTONE = WHITEISH GRAY TO VERY LIGHT GRAY, PALE BROWN TO MODERATE BROWN, MODERATE RED TO REDDISH PURPLE; UPPER VERY FINE TO UPPER FINE; MODERATE WELL SORTED; SUB ANGULAR TO SUB ROUNDED; MODERATELY SOFT TO RARE FIRMLY FRIABLE; CEMENT ARGILLACEOUS W/ MODERATE CALC COMPONENT; PREDOM GRAIN SUPPORTED W/ FAIR AMOUNT OF MATRIX MATERIAL; INTERSTICES WELL FILLED; NO CUT; NO FLUORES; POOR TO MODERATELY POOR VISIBLE POROSITY

SHALE = LIGHT GRAY TO MODERATE GRAY, MODERATE GRAYISH YELLOW TO GREENISH GRAY, LIGHT TO MODERATE BROWN; CRUMBLY TO CRUNCHY TENACITY; FRACTURE HACKLY TO IRREGULAR SOME NEAR PLANAR; CUTTINGS HABIT MASSIVE TO IRREGULAR WITH OCCAS WEDGELIKE; LUSTER DULL; TEXTURE SMOOTH TO SLIGHTLY SILTY; STRUCTURE MASSIVE.

CARBONACEOUS SHALE = BLACKISH BROWN TO BROWNISH BLACK, BLACK; SOFT TO CRUMBLY WITH OCCASIONAL CRUNCHY TENACITY; FRACTURE PLANNAR TO IRREGULAR; CUTTINGS HAB MASSIVE TO SOMEWHAT BLOCKY; LUSTER RESINOUS TO DULL WITH RARE WELL DEVELOPED BLACK VITREOUS COAL LAMINAE; TEXTURE SMOOTH; VERY THINLY LAMINATED STRUCTURE WITH COMMON PLANNAR PARTING; COMMON TO ABUNDANT PYRITE; COMMON MODERATE TO SLOW OUTGASSING OF BOTH CARBONACEOUS SHALES AND THIN LAMINAE OF COALS.



SHALE = MEDIUM GRAY TO LIGHT GRAY WITH SOME DARK GRAY; PLATY TO WEDGELIKE TO SCALY CUTTINGS HABIT; SPLINTERY TO SEMI HACKLY FRACTURE; CLAYEY TO SILTY TEXT; EARTHY TO WAXY LUSTER; GRADES TO LIGHT GRAY SILTSTONE; CRUNCHY TO HARD TENACITY.

WASATCH G SANDSTONE = TRANSPARENT TO OPAQUE; PREDOMINANTLY LOOSE GRAINS WITH SOME PRESERVED SANDSTONE SPECIMENS; VERY FINE TO UPPER FINE GRAIN WITH MINOR MEDIUM GRAINS; MOD TO HIGH SPHERICITY; FAIR TO WELL SORTED; MODERATE FROSTING; PRESERVED SPECIMENS WITH SILICA AND CALCITE CEMENT WITH SOME KAOLIN; OFF WHITE TO VERY LIGHT GRAY WITH TR LIGHT GREENISH GRAY; 1-3% CARBONACEOUS SHALE/ COAL FLECKS; FRIABLE TO MODERATE HARD; ROUND TO SUBANGULAR; TRACE ACCESSORY MINERALS OF AGGREGATE PYRITE AND CHLORITE MICAS; GRADES TO LIGHT GRAY SILTSTONE.

SHALE = MEDIUM GRAY TO DUSKY RED; PLATY TO SCALY TO WEDGELIKE CUTTINGS HABIT; SILTY TO CLAYEY TEXTURE; GRADES TO LIGHT GRAY SILTSTONE; IRREGULAR TO ANGULAR TO PLANAR FRACTURE; DULL EARTHY LUSTER; MASSIVE STRUCTURE WITH THIN INTERBEDDING OF SILTSTONE.

SILTSTONE = LIGHT GRAY TO GRAYISH RED; HACKLY TO IRREGULAR TO BLOCKY FRACTURE; TABULAR TO PLATY CUTTINGS HABIT; SILTY T TO GRITTY TEXTURE; GRADES TO LIGHT GRAY SANDSTONE; SPARKLING LUSTER.

NOTE: TOH TO L/D MWD TOOLS AT 5863'. P/U NEW BHA #3. TIH. LOSE RETURNS AT 5780'. REGAIN FULL RETURNS PRIOR TO DRILLING AHEAD.

SHALE = MEDIUM GRAY TO DARK GRAY WITH MINOR OLIVE GRAY; PLATY TO TABULAR TO SCALY CUTTINGS HABIT; SPLINTERY TO PLANAR TO IRREGULAR FRACTURE; SLIGHTLY SILTY TO MATTE TEXTURE; DULL EARTHY LUSTER; GRADES TO MEDIUM GRAY SILTSTONE.

CARBONACEOUS SHALE = BROWNISH GRAY TO OLIVE GRAY MOTTLED WITH DARK GRAY; PLATY TO FLAKY TO WEDGELIKE CUTTINGS HABIT; THINLY INTERBEDDED W/ THIN COAL LAMINAE AND OLIVE GRAY SILTSTONE; IRREGULAR TO HACKLY TO ANGULAR FRACTURE; MATTE TO SILTY TEXTURE; EARTHY TO SLIGHT VITREOUS LUSTER; TR ACCESSORY MINERAL OF PYRITIC VEINING IN SAMPLE FRAGMENTS.

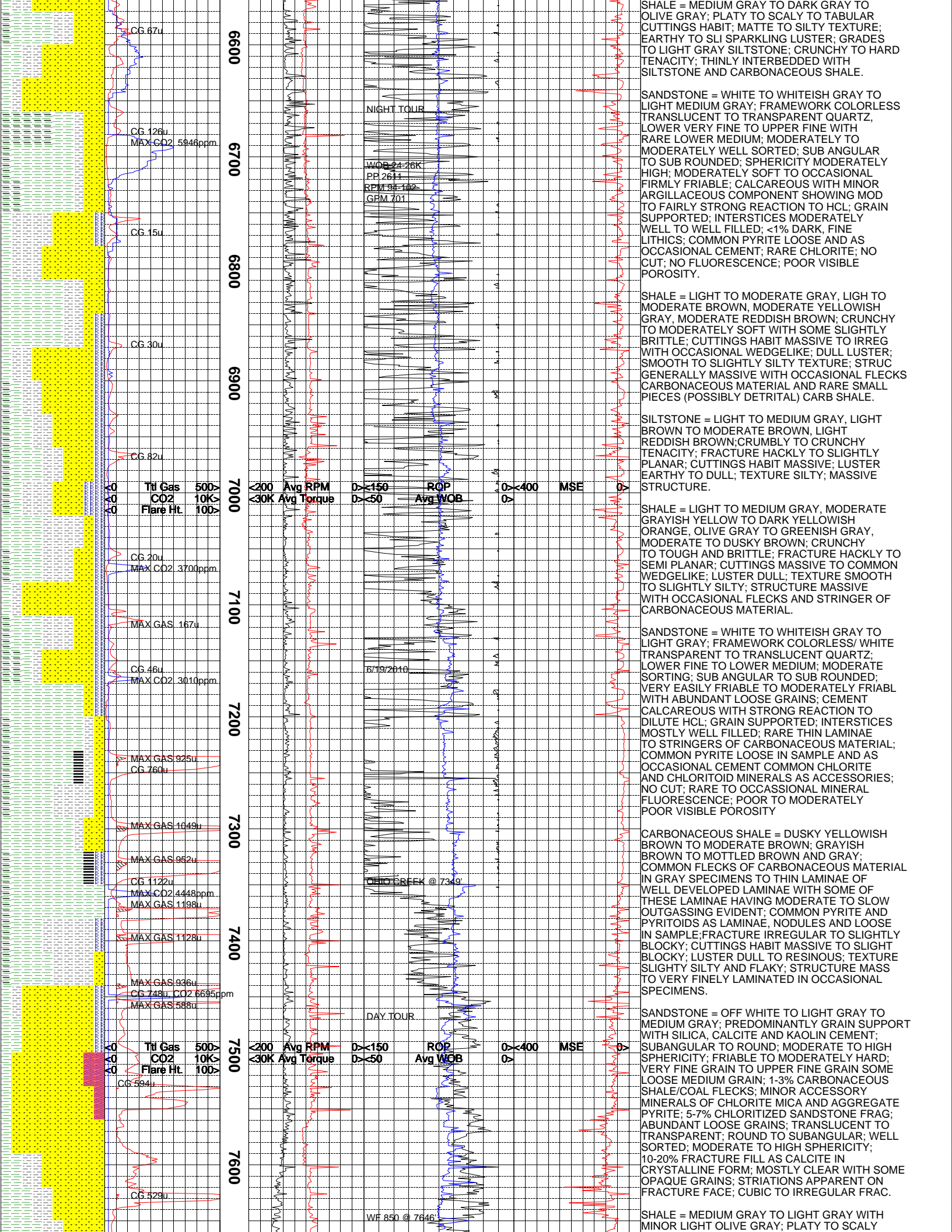
COAL = BLACK TO BROWNISH BLACK; BLOCKY TO CONCHOIDAL TO SPLINTERY FRACTURE; TABULAR TO WEDGELIKE TO PLATY CUTTINGS HABIT; SMOOTH TO CLAYEY TEXTURE; SOME PYRITIC VEINING ALONG FRACTURE FACES; VISIBLE DEGASSING OF SAMPLE FRAGMENTS; THINLY INTERBEDDED WITH CARBONACEOUS SHALE AND SANDSTONE.

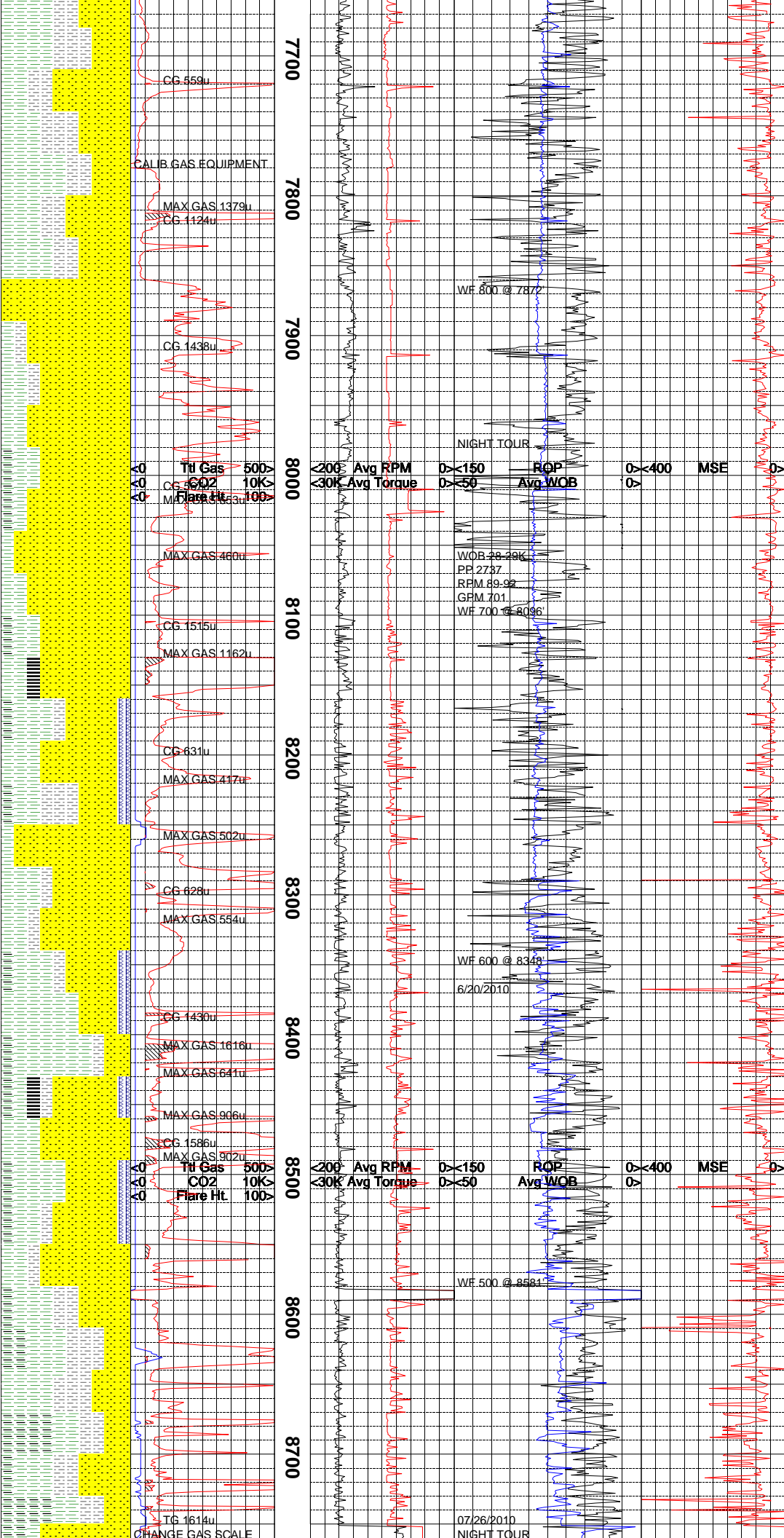
SHALE = MEDIUM GRAY TO DARK GRAY TO OLIVE GRAY; PLATY TO SCALY TO ELONGATED CUTTINGS HABIT; IRREGULAR TO PLANAR TO SPLINTERY FRACTURE; SILTY TO MATTE TEXT; EARTHY TO SLIGHT SPARKLING LUSTER; GRADE TO MEDIUM GRAY SILTSTONE; TRACE AMOUNTS OF PYRITE AND CARBONACEOUS FLECKS IN SAMPLE FRAGMENTS.

SILTSTONE = MEDIUM GRAY TO OLIVE GRAY TO DARK GRAY; IRREGULAR TO BLOCKY TO HACKLY FRACTURE; SPARKLING LUSTER; TRACE LOOSE GRAINS IN SAMPLE FRAGMENTS; SILTY TO GRITTY TO SUCROSIC TEXTURE; GRADES TO LIGHT GRAY SANDSTONE; CRUNCHY TO HARD TENACITY.

SANDSTONE = LIGHT GRAY TO LIGHT OLIVE GRAY TO OFF WHITE; PREDOMINANTLY GRAIN SUPPORTED WITH SILICA AND CALCITE CEMENT AND TRACE KAOLIN CEMENT; SUBANGULAR TO SUBROUND; VERY FINE TO UPPER FINE GRAIN; LOW TO MODERATE SPHERICITY; FAIR TO MODERATELY WELL SORTED; TRACE AMOUNTS OF FRAMBOIDAL AND AGGREGATE PYRITE; TR ACCESSORY MINERAL OF CHLORITE MICA; THINLY INTERBEDDED WITH CARBONACEOUS SHALE AND COAL LAMINAE; MODERATELY HARD TO HARD; NO VISIBLE HYDROCARBON INDICATORS.

CARBONACEOUS SHALE = BROWNISH GRAY TO OLIVE GRAY TO DARK GRAY; PLANAR TO SPLINTERY TO HACKLY FRACTURE; TRACE COAL LAMINAE INTERBEDDED IN SAMPLE FRAGMENTS; ELONGATED TO PLATY TO WEDGELIKE CUTTINGS HABIT; MATTE TO SMOOTH TEXTURE; EARTHY TO VITREOUS LUSTER; TRACE THIN PYRITIC VEINING ON SOME SAMPLE SPECIMENS.





TO WEDGE LIKE CUTTINGS HABIT; MATTE TO SEMI SILTY TEXTURE; EARTHY LUSTER; GRADES TO LIGHT GRAY SILTSTONE; TRACE ACCESSORY MINERALS OF MICA AND PYRITE; TRACE CARBONACEOUS SHALE FLECKS INTERSPERSED IN SAMPLE FRAGS; CRUNCHY TO HARD TENACITY.

SILTSTONE = LIGHT GRAY TO MEDIUM GRAY; HARD TO CRUMBLY TENACITY; SPARKLING TO SLIGHT EARTHY LUSTER; IRREGULAR TO HACKLY TO BLOCKY FRACTURE; TABULAR TO PLATY TO ELONGATED CUTTINGS HABIT; SILTY TO GRITTY TEXTURE; GRADES TO LIGHT GRAY SANDSTONE; THINLY INTERBEDDED WITH SHALE AND SANDSTONE.

NOTE: FORMATION GASES ARE BLEEDING UPHOLE INTO THE WELLBORE DURING CONN.

SANDSTONE = OFF WHITE TO VERY LIGHT GRAY FOR PRESERVED SPECIMENS; PREDOMINANTLY LOOSE GRAINS; TRANSLUCENT TO CLEAR; WELL SORTED; ROUND TO SUBANGULAR; MODERATE TO WELL SPHERICITY; UPPER VERY FINE TO LOWER MEDIUM GRAIN; SOME FROSTED GRAINS; FRIABLE TO MODERATE HARD FOR PRESERVED SPECIMENS; SILICA, CALCITE, AND KAOLIN CEMENT; MINOR ACCESSORY MINERALS OF CHLORITE MICA AND MICRO PYRITE; MODERATE TO HIGHLY CALCAREOUS.

SANDSTONE = WHITE TO LIGHT GRAY; FRAME WORK TRANSPARENT TO TRANSLUCENT COLORLESS QUARTZ WITH MINOR WHITE OPAQUE QUARTZ; LOWER VERY FINE TO LOWER MEDIUM GRAINS; POORLY SORTED; ANGULAR TO SUB ROUNDED; SPHERICITY MODERATE TO LOW; GRAIN SUPPORTED; PRESENTS PREDOMINATELY AS LOOSE GRAINS WITH PRESERVED SPECIMENS VERY EASILY FRIABLE; CEMENTATION CALCAREOUS WITH STRONG, SHORT DURATION REACTION TO DILUTE HCL; INTERSTICES MODERATE FILLED W/ INTERSTIAL VOIDS COMMON; LITHICS <1%, SPARKLING TO SILKY LUSTER, SUB ANGULAR, PRIMOIDAL, SEDIMENTARY; COMMON CHLORITE AND CHLORITOID ACCESSORIES; NO CUT, NO FLUORES; FAIR TO GOOD VISIBLE POROSITY.

COAL = BLACK TO BLACKISH BROWN; FIRM TO BRITTLE; FRACTURE IRREGULAR TO BLOCKY OR PLANAR; CUTTINGS HABIT BLOCKY, TABULAR AND ON LESS WELL DEVELOPED SPECIMENS MASSIVE; LUSTER VITREOUS TO RESINOUS; MICRO-LAMINATED; COMMON TO ABUNDANT PYRITE; COMMON MODERATE OUTGASSING.

SHALE = MODERATE GRAYISH YELLOW TO DARK YELLOWISH ORANGE, MODERATE BROWN TO MODERATE YELLOWISH BROWN, LIGHT TO MEDIUM GRAY; CRUNCHY TO BRITTLE WITH OCCASIONAL TOUGH; FRACTURE IRREGULAR TO HACKLY; CUTTINGS HABIT MASSIVE WITH OCCASIONAL SEMI PLATY AND RARE WEDGE LIKE; LUSTER DULL TO WAXY; TEXTURE SMOOTH TO OCCASIONAL V SLIGHTLY SILTY; COMMON PYRITE NODULES AND LAMINAE SOME SPARKLY SPECIMENS DUE TO DISEMINATED PYRITE; OCCAS THIN IRREG TO DISCONTINUOUS STRINGERS CARBONACEOUS MATERIAL.

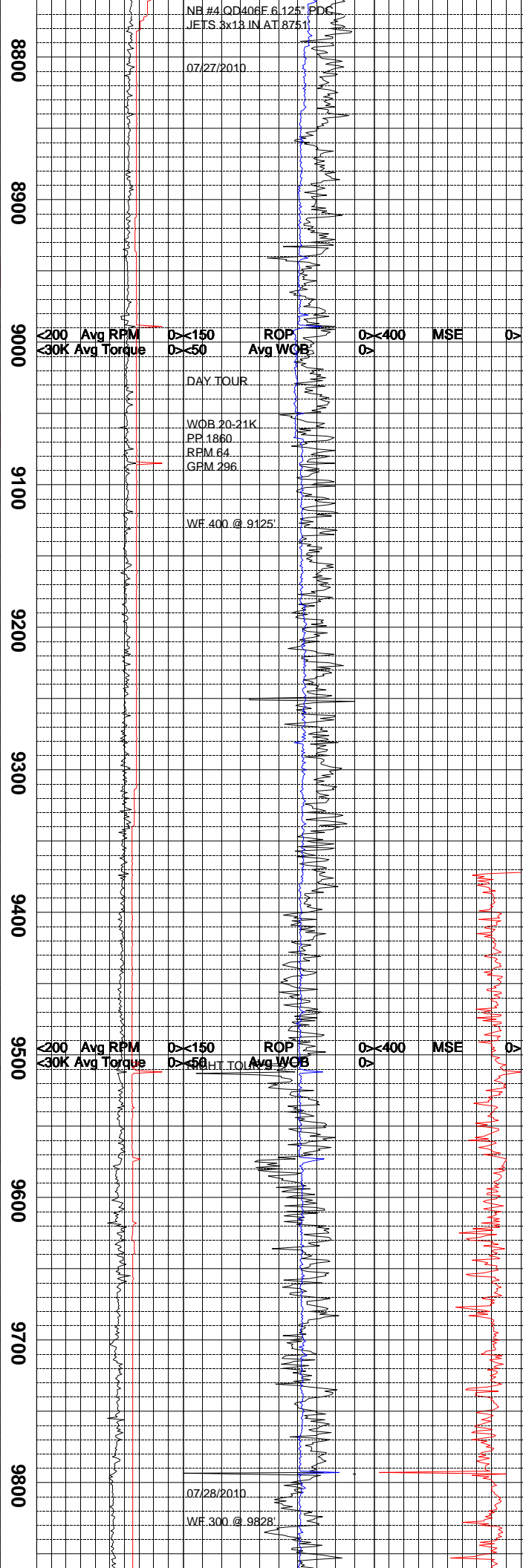
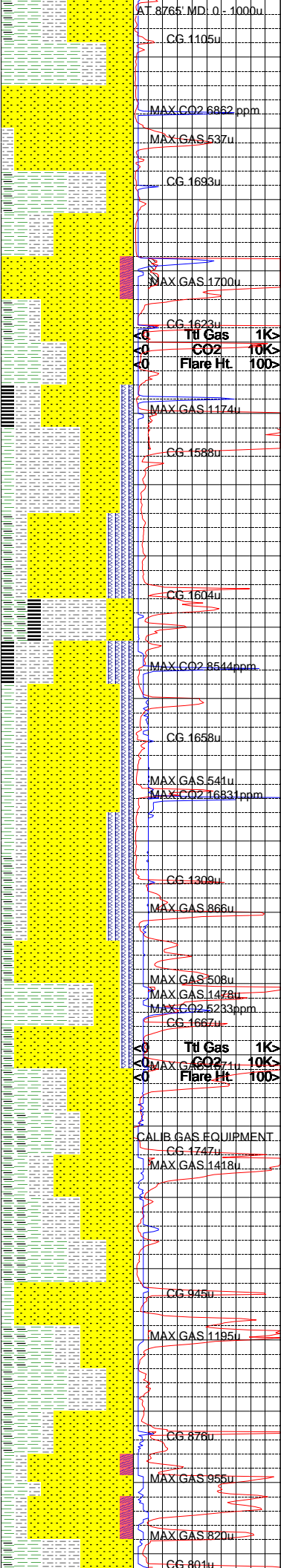
CARBONACEOUS SHALE = DUSKY YELLOWISH BROWN TO DUSKY BROWN, BROWNISH BLACK TO BLACK, MEDIUM GRAY TO DARK GRAY; TENACITY FIRM TO CRUNCHY TO BRITTLE; FRACTURE HACKLY TO PLANAR; CUTTINGS HABIT BLOCKY TO IRREGULAR; LUSTER WAXY TO RESINOUS; STRUCTURE MASSIVE TO THINLY LAMINATED; THIN IRREGULAR VEINS TO WELL DEVELOPED LAMINAE CARBONACEOUS MATERIAL TO THIN COALS; ABUNDANT PYRITOIDES AND PYRITE; SOME MINOR OUT GASSING FROM THIN COAL LAMINAE.

SANDSTONE = OFF WHITE TO VERY LIGHT GRAY FOR PRESERVED SPECIMENS; TRANSLUCENT TO TRANSPARENT FOR LOOSE GRAINS; PREDOM LOOSE GRAINS; VERY FINE TO UPPER FINE GRAIN; SUBROUND TO ROUND; FRIABLE TO MODERATE HARD; MOD TO HIGH SPHERICITY; PRESERVED SPECIMENS SHOW SILICA, CALCITE AND KAOLIN CEMENT; 1-3% CARBONACEOUS SHALE/COAL FLECKS; TR ACCESSORY MINERAL OF CHLORITE MICA; THINLY INTERBEDDED WITH CARBONACEOUS SHALE; GRADES TO LIGHT GRAY SILTSTONE.

COAL = BLACK TO BROWNISH BLACK; BLOCKY TO IRREGULAR TO PLANAR FRACTURE; PLATY TO TABULAR CUTTINGS HABIT; SMOOTH TO MATTE TEXTURE; VITREOUS TO SEMI EARTHY LUSTER; THINLY INTERBEDDED WITH CARBO SHALE; MINOR DEGASSING ALONG FRACTURES.

NOTE: TD INTERMEDIATE WELL AT 8751' MD (8398' TVD) ON 06/20/2010.

SHALE = MEDIUM GRAY TO DARK GRAY; PLATY



AT 8765' MD: 0 - 1000u
CG 1105u
MAX CO2 6862 ppm
MAX GAS 537u
CG 1693u
MAX GAS 1700u
CG 1623u
MAX GAS 1174u
CG 1588u
CG 1604u
MAX CO2 8544 ppm
CG 1658u
MAX GAS 541u
MAX CO2 16831 ppm
CG 1309u
MAX GAS 866u
MAX GAS 508u
MAX GAS 1478u
MAX CO2 5233 ppm
CG 1667u
CALIB GAS EQUIPMENT
CG 1747u
MAX GAS 1418u
CG 945u
MAX GAS 1195u
CG 876u
MAX GAS 955u
MAX GAS 820u
CG 801u

NB #4 QD406F 6.125' PDC
JETS 3x13 IN AT 8751
07/27/2010
DAY TOUR
WOB 20-21K
PP 1860
RPM 64
GPM 296
WF 400 @ 9125'
WF 300 @ 9828'
07/28/2010

8800
8900
9000
9100
9200
9300
9400
9500
9600
9700
9800

<200 Avg RPM
<30K Avg Torque
0>150
0>50
ROP
Avg WOB
0>400
MSE
0>

TOUGH TO MODERATELY CRUMBLY; FRACTURE BLOCKY TO IRREGULAR; MASSIVE TO WEDGE LIKE; SILTY TO ABRASIVE TEXTURE; EARTHY LUSTER; SILTY WITH SOME GRITTIENESS; MASSIVE WITH SOME THIN LENSES OF CARBONACEOUS MATERIAL; TRACE PYRITE AS THIN DISCONTINUOUS LENSES.

SANDSTONE = OFF WHITE TO VERY LIGHT GRAY OVERALL; PREDOMINANTLY GRAIN SUPPORTED WITH SILICA AND CALCITE CEMENT; SOME KAOLIN PRESENT IN SAMPLE; 2-4% COAL/ CARBONACEOUS SHALE FLECKS; TRACE AMTS OF PYRITE; SUB ROUND TO SUB ANGULAR; FAIR TO WELL SORTED; MOD SPHERICITY; VERY FINE TO UPPER FINE GRAIN; FIRM FRIABLE TO HARD; MINOR AMOUNTS OF LOOSE FINE GRAIN SAND; TRANSLUCENT TO CLEAR; MINOR SURFACE ABRASION ON SOME SAMPLE FRAGMENTS; TRACE FRACTURE FILL AT SAMPLE 8970'; IRREGULAR TO CUBIC CALCITE CRYSTALS.

NOTE: UPHOLE FORMATION GASES BLEEDING INTO WELLBORE DURING CONNECTION.

SANDSTONE = WHITE, LIGHT GRAY, MEDIUM GRAY; MEDIUM TO VERY FINE GRAINED; FAIR TO POORLY SORTED; SUB ANGULAR TO SUB ROUNDED; LOW TO MODERATE SPHERICITY; FIRM TO STIFF; CEMENTATION HIGHLY CALC WITH MODERATE KAOLINITIC COMPONENT; PREDOMINANTLY GRAIN SUPPORTED; NO FLUORESCENCE.

SILTSTONE = LIGHT GRAY TO MEDIUM GRAY; DENSE TO BRITTLE; IRREGULAR TO PLANAR MASSIVE CUTTINGS HABIT; EARTHY LUSTER; GRITTY TO GRANULAR; MASSIVE TO WITH TRACE LENSES OF CARBONACEOUS MATERIAL.

COAL = BLACK TO DARK GRAY; BRITTLE TO CRUNCHY; BLOCKY TO HACKLY FRACTURE; MASSIVE TO WEDGELIKE CUTTINGS HABIT; GREASY TO EARTHY LUSTER; SMOOTH TO SILTY; MASSIVE TO THIN STRUCTURE; MODERATE OUTGASSING.

SILTSTONE = MEDIUM GRAY TO GRAYISH RED; TOUGH TO MODERATELY CRUMBLY; FRACTURE BLOCKY TO IRREGULAR; MASSIVE TO WEDGE LIKE; SILTY TO ABRASIVE TEXTURE; EARTHY LUSTER; SILTY WITH SOME GRITTIENESS; MASSIVE WITH SOME THIN LENSES OF CARBONACEOUS MATERIAL; TRACE PYRITE AS THIN DISCONTINUOUS LENSES.

SANDSTONE = WHITE, LIGHT GRAY, PALE RED, TO GRAYISH RED; MEDIUM TO FINE GRAINED; POOR TO FAIR SORTING; SUBANGULAR TO SUBROUND; MODERATE SPHERICITY; MODERATE HARD TO FRIABLE; ARGILLACEOUS CEMENT W/ WEAK CALC COMPONENT; GRAIN SUPPORT; GRAIN SIZE COARSENING WITH DEPTH; NO FLUORESCENCE.

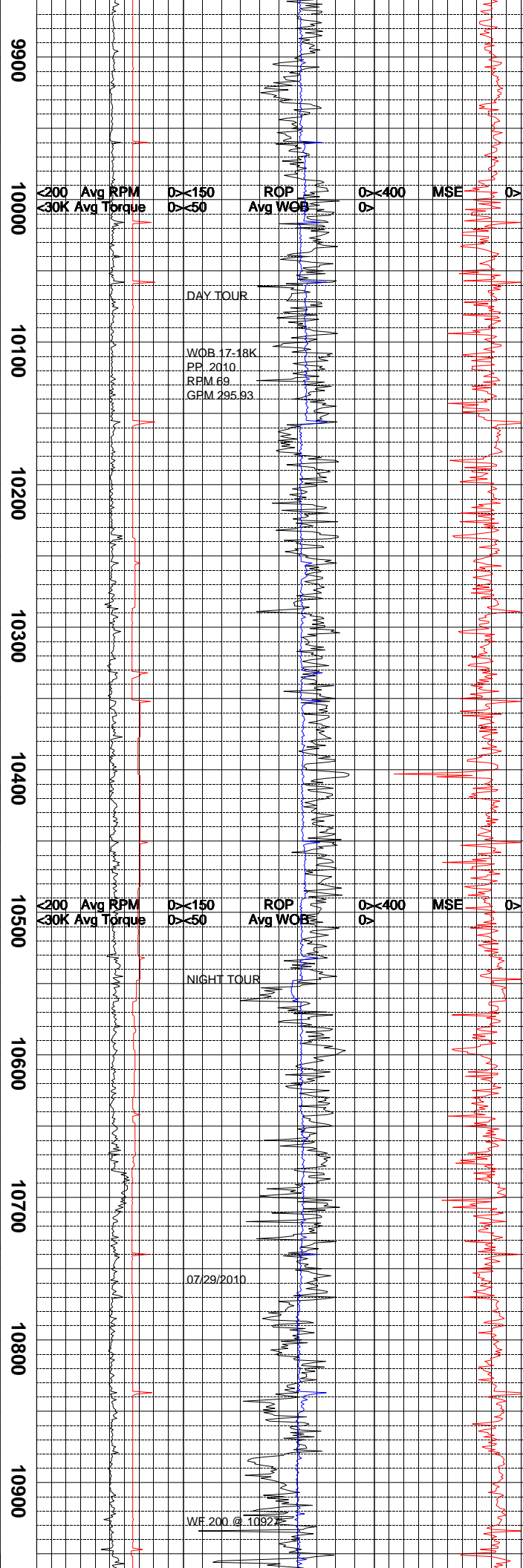
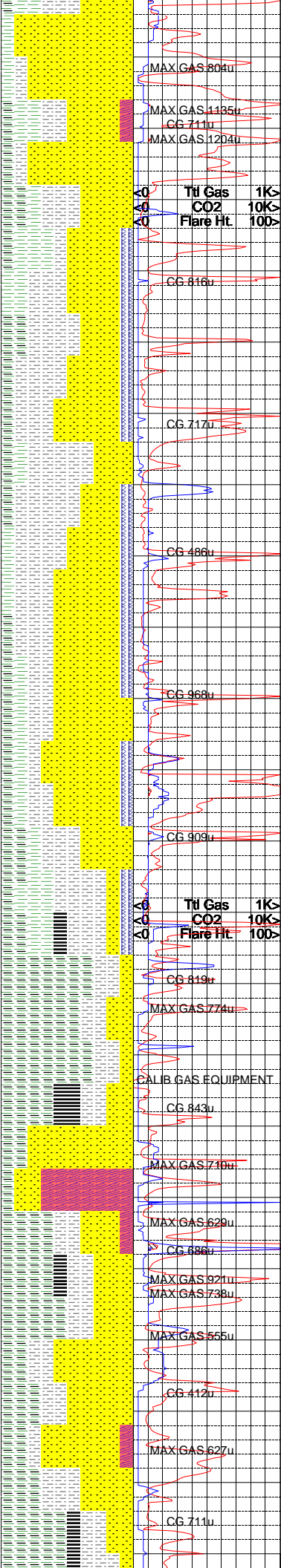
CARBONACEOUS SHALE = DRK GRAY TO GRAYISH BLACK, BLACKISH BROWN TO DUSKY BROWN; TOUGH TO CRUMBLY; IRREGULAR FRACTURE; MASSIVE TO TABULAR CUTTINGS HABIT; DULL TO METALLIC LUSTER; GRITTY TO SOME MATTE TEXTURE; THIN TO MASSIVE STRUCTURE WITH TRACE THIN LAMMINAE COALS AND PYRITE.

SHALE = MEDIUM GRAY TO DARK GRAY; BLOCKY TO PLANAR TO SPLINTERY FRACTURE; PLATY TO TABULAR TO WEDGELIKE CUTTINGS HABIT; MATTE TO SILTY TEXTURE; GRADES TO MEDIUM GRAY SILTSTONE; THIN CARBONACEOUS SHALE LAMINAE INTERBEDDED IN SAMPLE FRAGMENTS; DULL EARTHY LUSTER.

SILTSTONE = MEDIUM GRAY TO LIGHT OLIVE GRAY; IRREGULAR TO SPLINTERY FRACTURE; SILTY TO GRITTY TEXTURE; SPARKLING TO EARTHY LUSTER; TRACE AMOUNTS OF DARK CARBONACEOUS MATERIAL IN SAMPLE FRAGS; PLATY TO SCALY TO SEMI TABULAR CUTTINGS HABIT.

SANDSTONE = LIGHT OLIVE GRAY TO LIGHT GRAY; PREDOMINANTLY GRAIN SUPPORTED WITH SILICA AND SOME CALCITE CEMENT; MINOR AMOUNTS OF KAOLIN; VERY FINE TO UPPER FINE GRAIN; SUB ANGULAR TO SUB ROUND; FAIR SORTING; MOD TO WELL SPHERICITY; TR CARBONACEOUS SHALE/COAL FLECKS IN SAMPLE FRAGMENTS; THINLY COAL LAMINAE IN SOME SAMPLE SPECIMENS; TRACE AMOUNTS OF FRAGMENTED PYRITE; MINOR AMOUNTS OF LOOSE GRAINS WITHIN SAMPLE; TRANSLUCENT TO TRANSPARENT; FIRM FRIABLE TO HARD; GRADES TO LIGHT GRAY SILTSTONE; TRACE AMOUNTS OF FRACTURE FILL IN SAMPLE AT DEPTH; IRREGULAR TO PLANAR TO CUBIC; CLEAR TO OPAQUE; POSSIBLE LOSS OF FLOW; DRILL BREAK AND INCREASE IN GAS DUE TO FRACTURE FILL.

SHALE = MEDIUM GRAY TO DARK GRAY; PLATY



TO WEDGE LIKE CUTTINGS HABIT; MATTE TO SILTY TEXTURE; DULL EARTHY TO SLIGHTLY SPARKLING LUSTER; SPLINTERY TO BLOCKY TO IRREGULAR FRACTURE; GRADES TO MEDIUM GRAY SILTSTONE; THINLY INTERBEDDED WITH CARBONACEOUS LAMINAE.

CARBONACEOUS SHALE = BROWNISH GRAY TO OLIVE GRAY TO DARK GRAY; PLATY TO SCALY TO WEDGE LIKE CUTTINGS HABIT; SLIGHTLY SILTY TEXTURE; IRREGULAR TO PLANAR TO SPLINTERY FRACTURE; THIN INTERBEDDED LAMINAE OF COAL; NO VISIBLE DEGASSING IN SAMPLES; EARTHY TO SLIGHT VITREOUS LUSTER.

SANDSTONE = WHITE, LIGHT GRAY, PALE RED TO GRAYISH RED; PREDOMINANTLY GRAIN SUPPORTED WITH MINOR ARGILLACEOUS MATRIX; MEDIUM TO VERY FINE GRAINED; POORLY TO FAIRLY WELL SORTED; ANGULAR TO SUBROUNDED GRAINS; LOW TO MODERATE SPHERICITY; CALCITE CEMENT WITH LESSER ARGILLACEOUS COMPONENT; INTERSTICIES FILLED WITH ARGILLACEOUS MATERIAL; FINER SANDSTONE SHOWS THIN LENSES OF PYRITE AND BLACK CARBONACEOUS MATERIAL; BIOTITE IS COMMON ACCESSORY MINERAL; NO FLUORESCENCE.

SILTSTONE = LIGHT GRAY, MEDIUM GRAY, PALE RED TO GRAYISH RED; TOUGH TO CRUMBLY; IRREGULAR, PLANAR TO EARTHY FRACTURE; MASSIVE TO WEDGE LIKE CUTTINGS HABIT; DULL TO EARTHY LUSTER; THIN LENSES AND BEDDING SURFACES CONTAIN PYRITE AND BLACK CARBONACEOUS MATERIAL.

CARBONACEOUS SHALE = BLACK TO DARK GRAY; TOUGH TO CRUMBLY; IRREGULAR TO PLANAR FRACTURE; CUTTINGS HABIT MASSIVE, EQUANT TO WEDGE LIKE; METALLIC, SPARKLING TO EARTHY LUSTER; GRITTY TO SUCROSIC TEXTURE; NO VISIBLE DEGASSING IN SAMPLES.

SHALE = LIGHT GRAY, MEDIUM GRAY, GRAYISH YELLOW GREEN TO PALE GREEN; DENSE TO BRITTLE; IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO WEDGE LIKE CUTTINGS HABIT; WAXY TO EARTHY LUSTER; SMOOTH TO GRITTY TEXTURE; GRADATIONAL TO SILTSTONE WITH LENSES TO DISSEMINATED FRAGMENTS OF CARBONACEOUS MATERIAL.

SILTSTONE = GRAYISH BROWN TO DARK DUSKY BROWN SOME BROWNISH BLACK, MODERATE GRAYISH WHITE, FAIRLY SOFT TO CRUMBLY TENACITY WITH RARE CRUNCHY SPECIMENS; FRACTURE HACKLY TO SUB PLANAR; CUTTINGS HABIT MASSIVE WITH COMMON WEDGE LIKE; LUSTER DULL WITH SOME SPECKLED DUE TO FAIRLY RARE DARK PARTICULATES AND COMMON EARTHY; TEXTURE SILTY TO SLIGHT GRITTY; STRUCTURE MASSIVE; ASSOCIATED WITH VERY THINLY INTERBEDDED SHALES AND CARBONACEOUS SHALES AND SOME VERY THIN SANDSTONES.

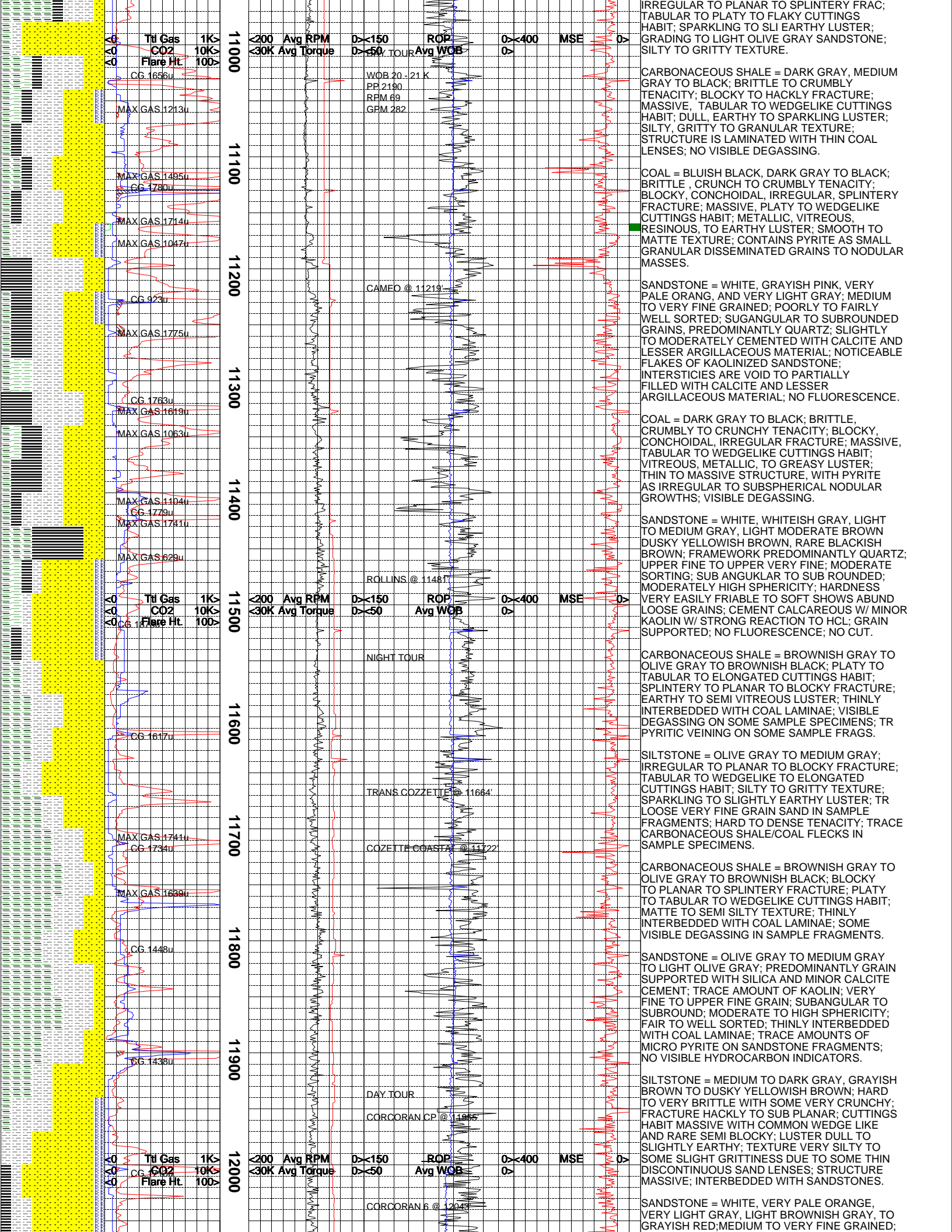
CARBONACEOUS SHALE = BROWNISH GRAY TO OLIVE GRAY TO DARK GRAY; PLATY TO FLAKY TO ELONGATED CUTTINGS HABIT; PLANAR TO IRREGULAR TO SPLINTERY FRACTURE; DULL EARTHY LUSTER; THINLY INTERBEDDED WITH COAL LAMINAE; TRACE DEGASSING ALONG COAL LAMINAE CONTACTS; MATTE TO SILTY TEXTURE.

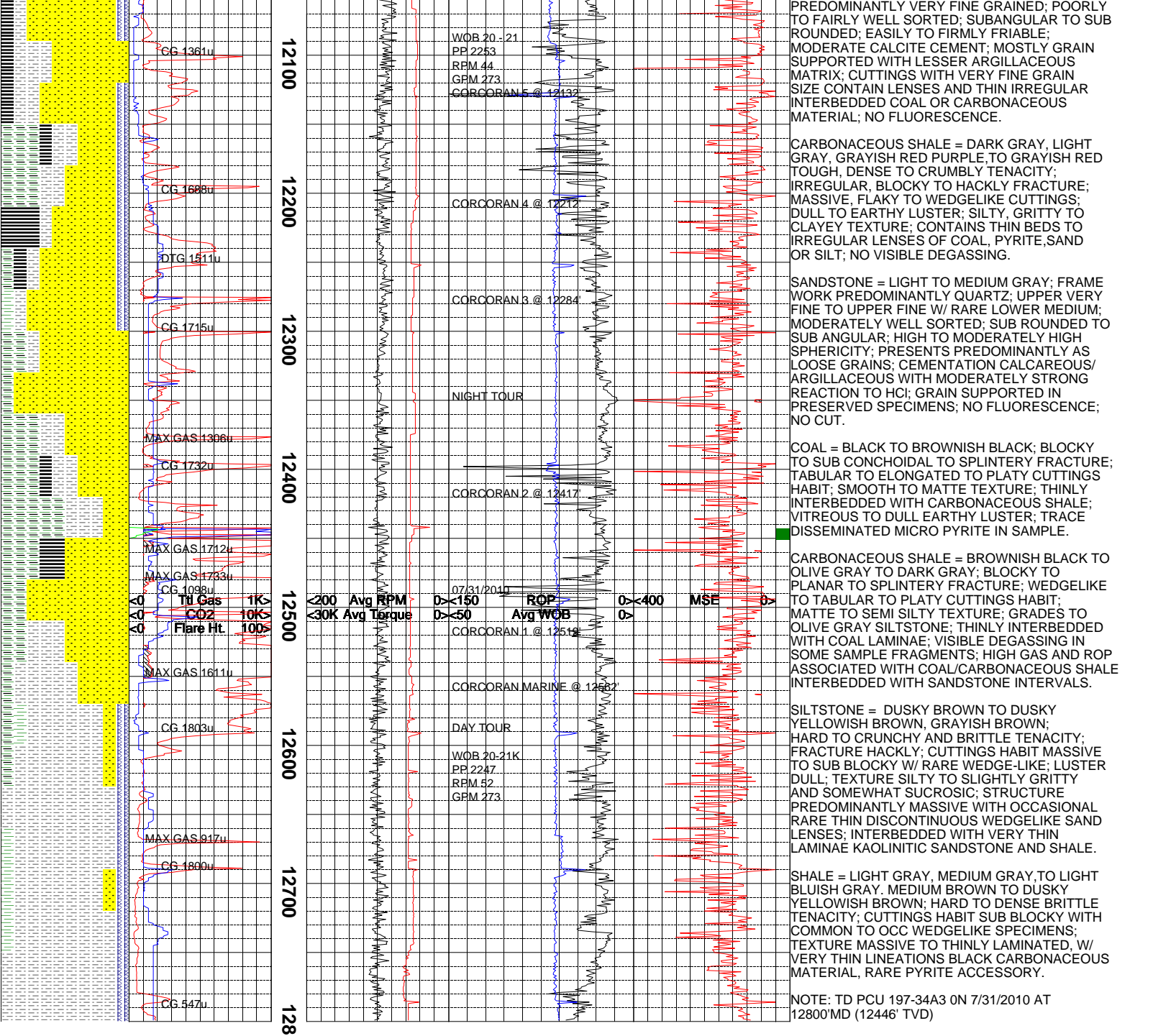
COAL = BLACK TO BROWNISH BLACK; BLOCKY TO SPLINTERY TO PLANAR FRACTURE; PLATY TO TABULAR TO ELONGATED CUTTINGS HABIT; SMOOTH TO MATTE TEXTURE; VITREOUS TO EARTHY LUSTER; SOME VISIBLE DEGASSING ALONG FRACTURES IN COAL SAMPLE FRAGS; THINLY INTERBEDDED WITH CARBONACEOUS SHALE.

FRACTURE FILL = TRANSLUCENT TO CLEAR; IRREGULAR TO CUBIC TO SPLINTERY FRAC; TABULAR TO FLAKY TO PLATY CUTTINGS HABIT; ABUNDANT CRYSTALLINE STRUCTURE IN SAMPLE; MINOR ABRASION ON SOME SAMPLE SPECIMENS; 8% INCREASE IN FLOW ASSOCIATE WITH SAMPLE; SAMPLE PREDOMINANTLY LOOSE GRAINS.

SANDSTONE = OLIVE GRAY TO LIGHT GRAY TO OFF WHITE; PREDOMINANTLY GRAIN SUPPORTED WITH SILICA AND CALCITE AND MINOR KAOLIN CEMENT; VERY FINE TO UPPER FINE GRAIN; FAIR SORTING; MODERATE SPHERICITY; TRACE ACCESSORY MINERAL OF MICRO PYRITE FRAGS; THINLY INTERBEDDED COAL LAMINAE IN SOME SAMPLE SPECIMENS; SUBROUND TO SUBANG; GRADES TO LIGHT OLIVE GRAY SILTSTONE; MODERATE HARD TO HARD TO FIRM FRIABLE; NO VISIBLE HYDROCARBON INDICATORS; TRACE AMOUNTS OF FRACTURE FILL IN SAMPLE; BLOCKY TO PLANAR FRACTURE; TABULAR CUTTINGS HABIT; CLEAR TO OPAQUE.

SILTSTONE = OLIVE GRAY TO MEDIUM GRAY;





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