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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 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

CASING DATA

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

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

MUD TYPES

HOLE SIZE

SPUD MUD TO 3858'
LSND TO 12800'
TO
TO

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

<150 ROP 0>
ft/hr
<50 Avg WOB 0>
klbs

Depth

Lithology

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

Interp. Lith

Remarks
Survey Data, Mud Reports, Other Info.

3400

3500

3600

3700

3800

3900

4000

4100

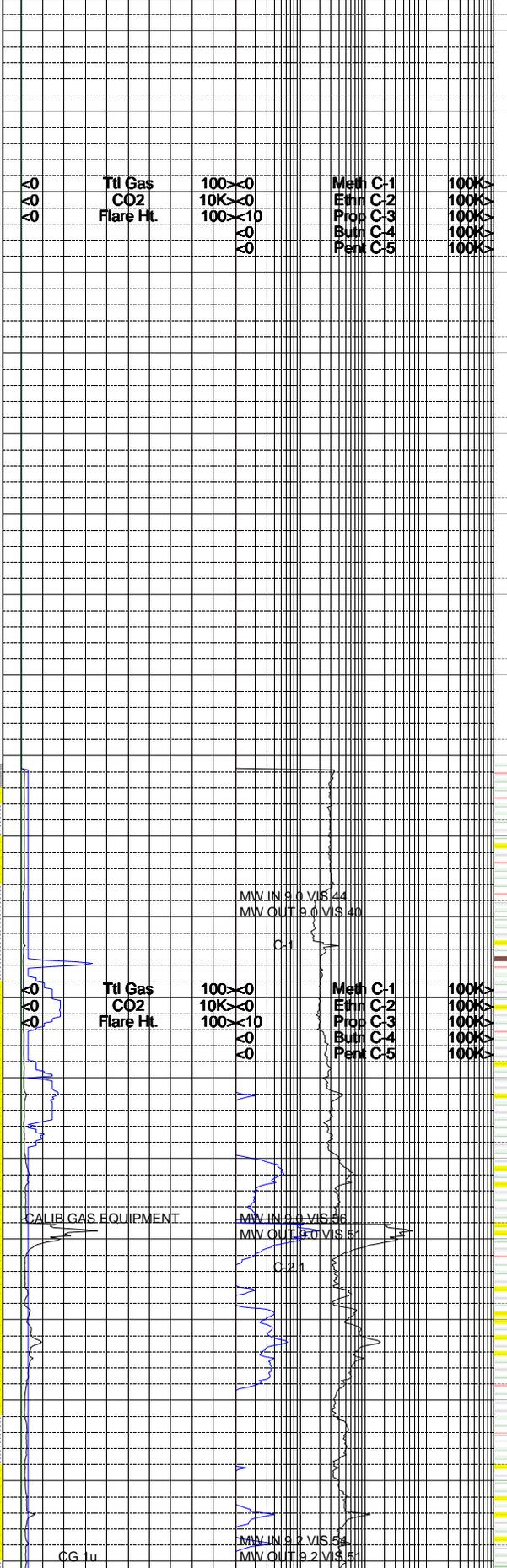
4200

4300

06/16/2010
NB#2 HUGES 504ZX 0.875" PDC
JETS 2x12.4x13.1IN @ 3858'

DAY TOUR

<150 ROP 0>
<50 Avg WOB 0>



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 WITH RESPECT TO PERCENTAGE IN SAMPLE. DEPTH IS REFERENCED TO RKB.

CONNECTION GASES AS WELL AS TRIP GASES AND DOWNTIME GASES ARE NOTED ON THE LOG. LARGE CONNECTION GASES WHICH APPEAR ON THE MUDLOG USUALLY REFLECT UPHOLE GAS INTERVALS BLEEDING 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 MGS (MUD GAS SEPERATOR) THE INTERVAL IS MARKED ON THE LOG IN THE SLIDE COLUMN AND NOTED ON THE LOG.

ALL SANDSTONE INTERVALS ARE EXAMINED FOR SAMPLE FLUORESCENCE IN THE UV SCOPE AND FOR HYDROCARBON FLUORESCENCE AND MINOR FLUORESCENCE FROM POSSIBLE FRACTURE FILL. ALL FLUORESCENCE IS NOTED ON THE MUDLOG.

10.75" SURFACE CASING WAS SET AT 3853'. DRILLED 10' OF NEW FORMATION AND PERFORM F.I.T. - GOOD. DRILL AHEAD.

SURVEY @ 3728' MD: INC 24.16 AZI 108.32 TVD 3474.44'

EPOCH WELL SERVICES COMMENCED FULL LOGGING ON 06/16/2010 AT 3858'

SHALE = VERY PALE GRAY, YELLOWISH GRAY; SOFT TO MODERATELY FIRM TENACITY; PLANAR TO IRREGULAR FRACTURE; WEDGELIKE TO PLATY CUTTINGS HABIT; DULL EARTHY TO SEMI WAXY LUSTER; GRADES TO PALE YELLOWISH GRAY SILTSTONE; SOME CLAY WASHES OUT DURING CLEANING PROCESS.

SHALE = PALE TO MODERATE YELLOWISH GRAY MOTTLED WITH LIGHT GRAY; PLATY TO SCALY TO TABULAR CUTTINGS HABIT; PLANAR TO HACKLY FRACTURE; DULL EARTHY LUSTER; MASSIVE STRUCTURE; CRUNCHY TO CRUMBLY TENACITY; TRACE AMOUNTS OF NAHCOLITE IN SAMPLE.

SILTSTONE = LIGHT GRAY TO PALE YELLOWISH GRAY; BLOCKY TO IRREGULAR FRACTURE; PLATY TO WEDGELIKE TO SCALY CUTTINGS HABIT; SILTY TO SUCROSLIC TEXTURE; GRADES TO LIGHT GRAY SANDSTONE; SPARKLING TO SEMI EARTHY LUSTER; THINLY INTERBEDDED WITH SHALE.

SANDSTONE = OFF WHITE TO LIGHT GRAY TO MEDIUM GRAY; FRIABLE TO MODERATE HARD; PREDOMINANTLY GRAIN SUPPORTED WITH SILICA AND CALCITE CEMENT AND MINOR AMT OF KAOLIN; 2-4% DARK LITHIC MATERIAL; TR AMOUNT OF NAHCOLITE IN SAMPLE; ANGULAR TO SUBROUND; LOW TO MODERATE SPHERICITY; FAIRLY SORTED; VERY FINE TO UPPER FINE GRAIN; TRACE ACCESSORY MINERAL OF MICRO PYRITE.

SHALE = PALE TO MODERATE YELLOWISH GRAY MOTTLED WITH LIGHT GRAY; PLATY TO SCALY TO WEDGELIKE CUTTINGS HABIT; CLAYEY TO MATTE TEXTURE; IRREGULAR TO SPLINTERY FRACTURE; EARTHY LUSTER; MASSIVE STRUC; FIRM TO CRUNCHY TENACITY.

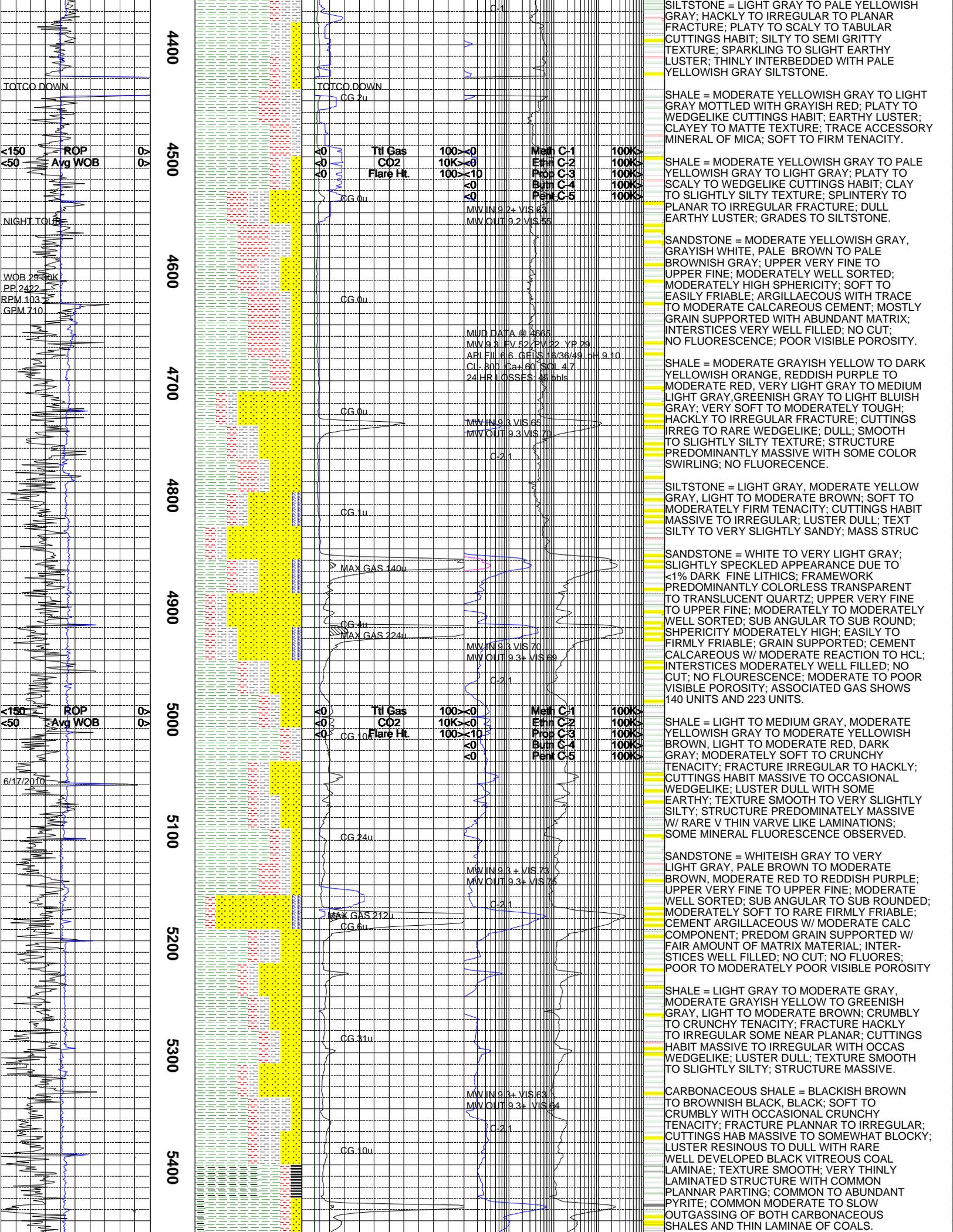
SHALE = PALE TO MODERATE YELLOWISH GRAY TO LIGHT GRAY MOTTLED WITH DUSKY RED; BLOCKY TO PLANAR TO HACKLY FRACTURE; PLATY TO WEDGELIKE TO SEMI ELONGATED CUTTINGS HABIT; CLAYEY TO SEMI SILTY TEXTURE; DULL EARTHY LUSTER; GRADES TO PALE YELLOWISH GRAY SILTSTONE.

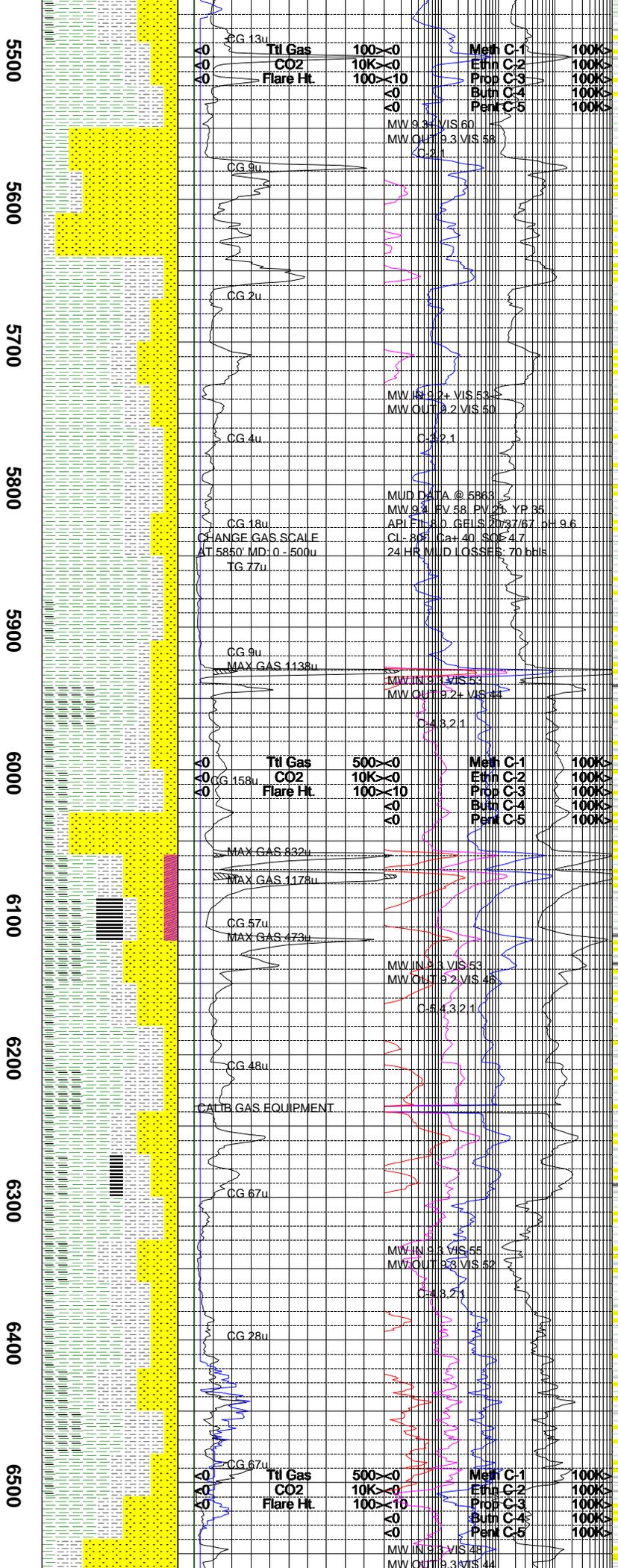
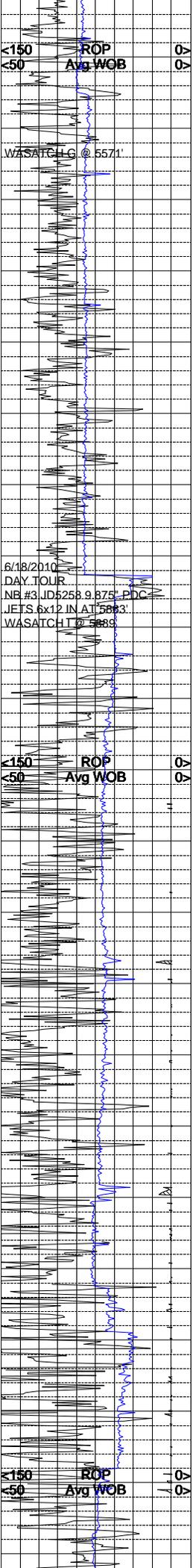
CG 1u

MW IN 9.0 VIS 44
MW OUT 9.0 VIS 40

MW IN 9.0 VIS 56
MW OUT 9.0 VIS 51

MW IN 9.2 VIS 54
MW OUT 9.2 VIS 51





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 TO GRITTY TEXTURE; GRADES TO LIGHT GRAY SANDSTONE; SPARKLING LUSTER.

NOTE: TOH TO L/D MWD TOOLS AT 5863'. P/U NEW BHA #3. TH. 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.

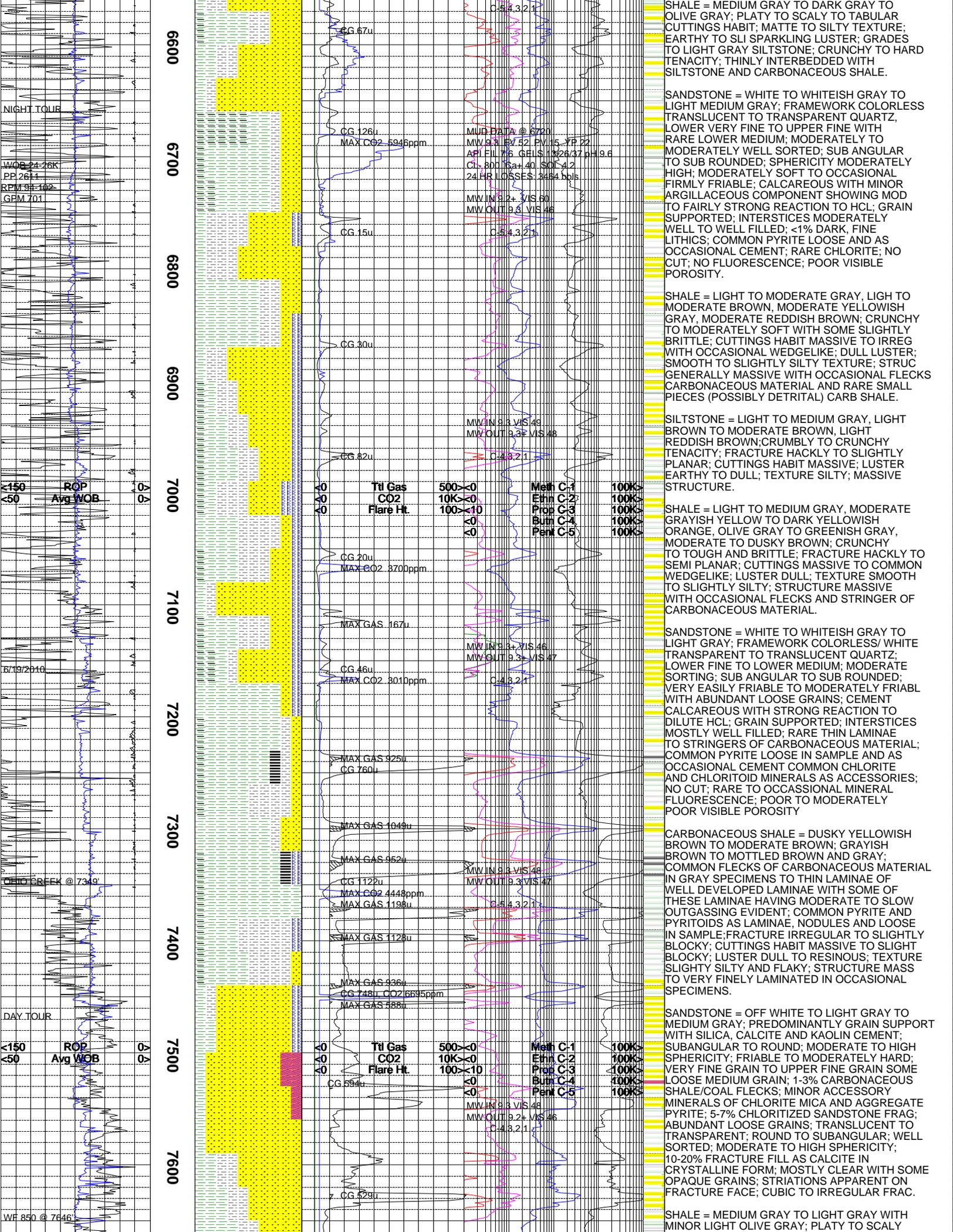
COAL = BLACK TO BROWNISH BLACK; BLOCKY TO CONCHOIDAL TO SPLINTERY FRACTURE; TABULAR TO WEDGELIKE TO PLATY CUTTINGS HABIT; SMOOTH TO CLAYEY TEXTURE; SOME PYRITIC VEINING ALONG FRACTURE FACES; VISIBLE DEGASSING OF SAMPLE FRAGMENTS; THINLY INTERBEDDED WITH CARBONACEOUS SHALE AND SANDSTONE.

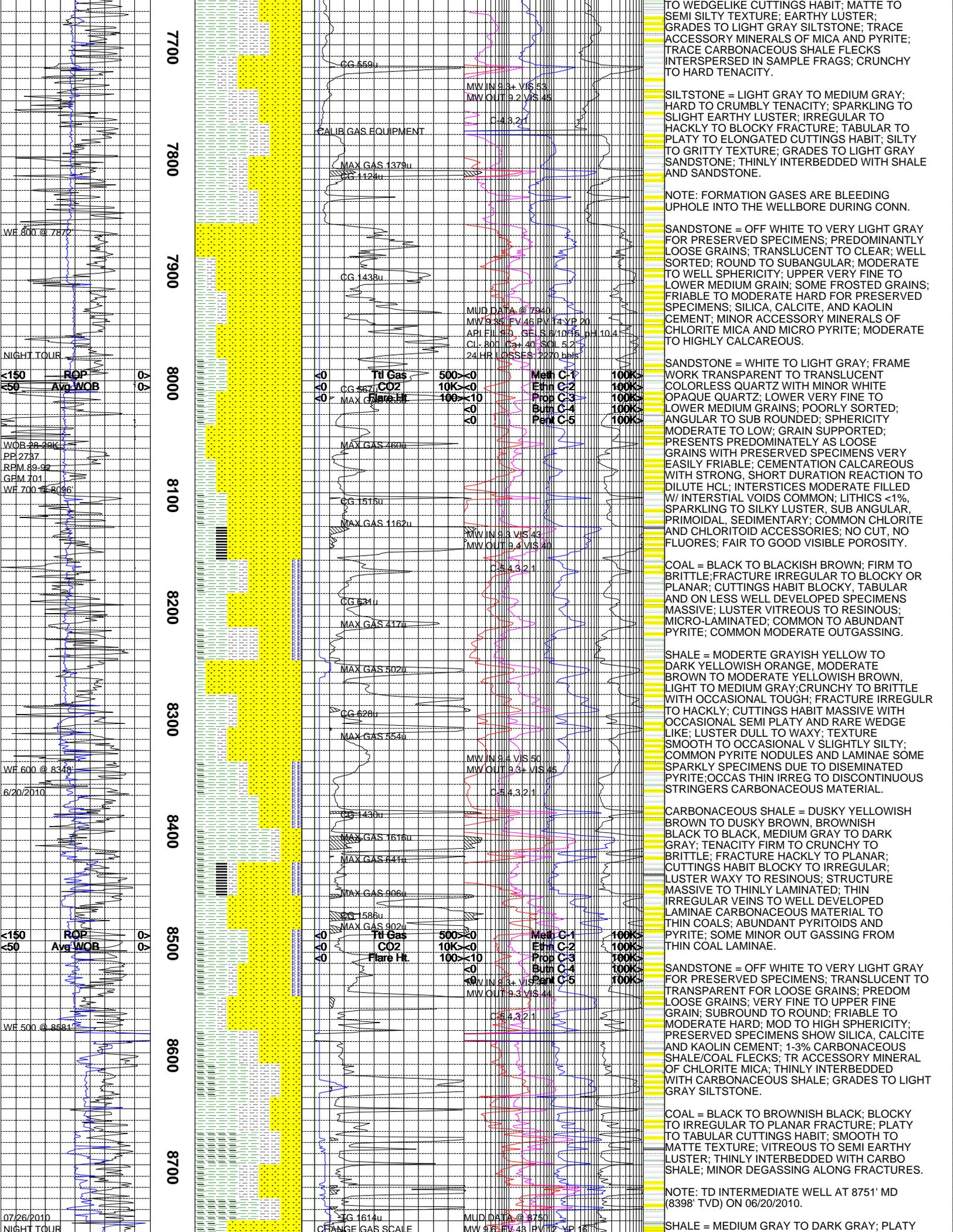
SHALE = MEDIUM GRAY TO DARK GRAY TO OLIVE GRAY; PLATY TO SCALY TO ELONGATED CUTTINGS HABIT; IRREGULAR TO PLANAR TO SPLINTERY FRACTURE; SILTY TO MATTE TEXT; EARTHY TO SLIGHT SPARKLING LUSTER; GRADE TO MEDIUM GRAY SILTSTONE; TRACE AMOUNTS OF PYRITE AND CARBONACEOUS FLECKS IN SAMPLE FRAGMENTS.

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.

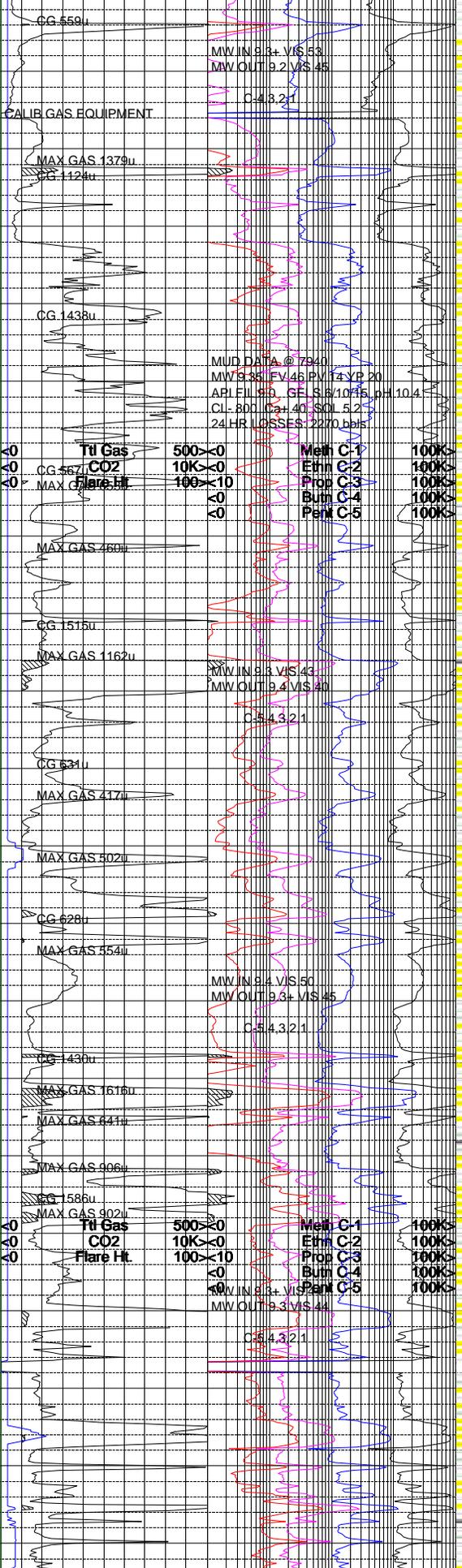
SANDSTONE = LIGHT GRAY TO LIGHT OLIVE GRAY TO OFF WHITE; PREDOMINANTLY GRAIN SUPPORTED WITH SILICA AND CALCITE CEMENT AND TRACE KAOLIN CEMENT; SUBANGULAR TO SUBROUND; VERY FINE TO UPPER FINE GRAIN; LOW TO MODERATE SPHERICITY; FAIR TO MODERATELY WELL SORTED; TRACE AMOUNTS OF FRAMBOIDAL AND AGGREGATE PYRITE; 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.





7700
7800
7900
8000
8100
8200
8300
8400
8500
8600
8700



TO WEDGELIKE CUTTINGS HABIT; MATTE TO SEMI SILTY TEXTURE; EARTHLY 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 EARTHLY 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 PREDOMINANTLY 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 = MODERTE GRAYISH YELLOW TO DARK YELLOWISH ORANGE, MODERATE BROWN TO MODERATE YELLOWISH BROWN, LIGHT TO MEDIUM GRAY; CRUNCHY TO BRITTLE WITH OCCASIONAL TOUGH; FRACTURE IRREGULR 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 PYRITIDS AND PYRITE; SOME MINOR OUT GASSING FROM THIN COAL LAMINAE.

SANDSTONE = OFF WHITE TO VERY LIGHT GRAY FOR PRESERVED SPECIMENS; TRANSPARENT 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 EARTHLY 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

WE 800 @ 7872

NIGHT TOUR

ROP >150
Avg WOB <50

WOB 28-39K
PP 2737
RPM 69-92
GPM 701
WF 700 @ 8096

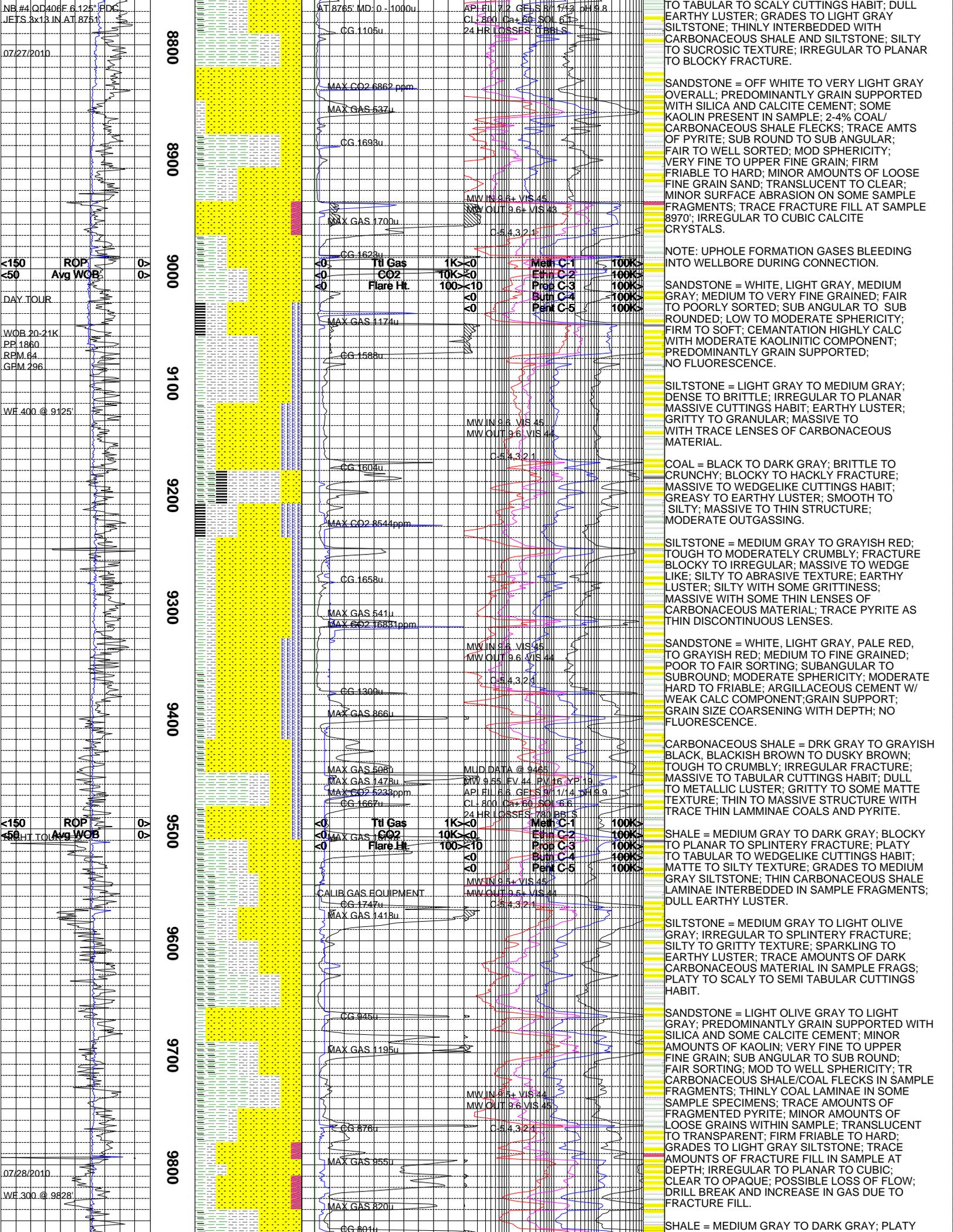
WF 600 @ 8348
6/20/2010

ROP >150
Avg WOB <50

WF 500 @ 8681

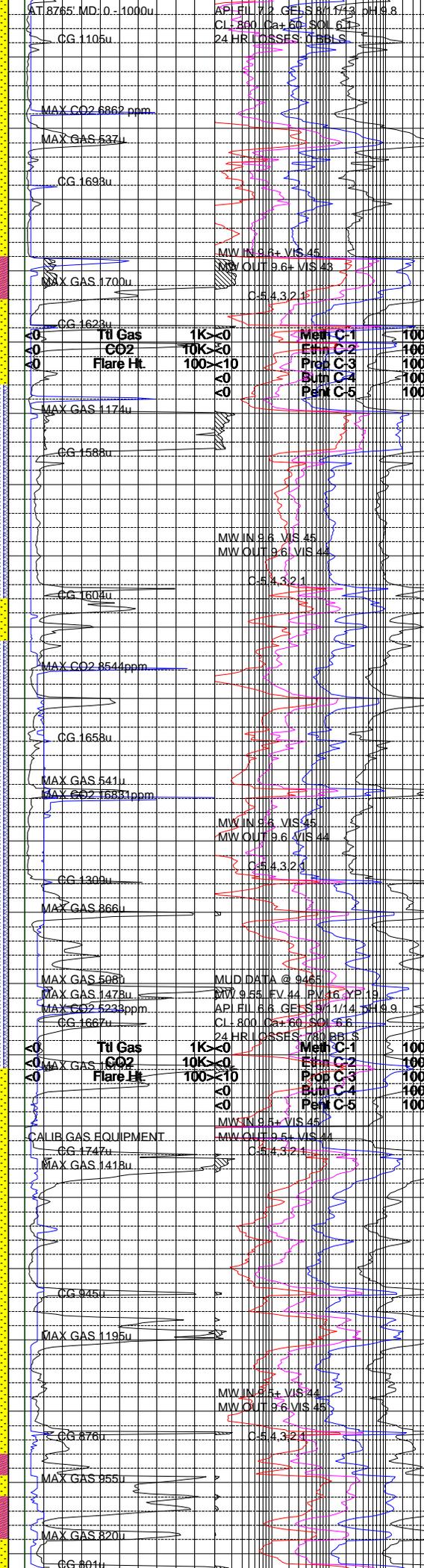
07/26/2010
NIGHT TOUR

CHANGE GAS SCALE



JB #4, QD406F, 6.125" FDC
 JETS 3x1.3 IN AT 875'
 07/27/2010
 <150 ROP
 <50 Avg WOB
 DAY TOUR
 WOB 20-21K
 PP 1860
 RPM 64
 GPM 296
 WF 400 @ 9125'
 <150 ROP
 <50 Avg WOB
 DAY TOUR
 CALIB GAS EQUIPMENT
 07/28/2010
 WF 300 @ 9828'

8800
 8900
 9000
 9100
 9200
 9300
 9400
 9500
 9600
 9700
 9800



TO TABULAR TO SCALY CUTTINGS HABIT; DULL EARTHY LUSTER; GRADES TO LIGHT GRAY SILTSTONE; THINLY INTERBEDDED WITH CARBONACEOUS SHALE AND SILTSTONE; SILTY TO SUCROSIK TEXTURE; IRREGULAR TO PLANAR TO BLOCKY FRACTURE.
 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 SOFT; 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

