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Drilling Dynamics MD

COMPANY EXXONMOBIL
WELL PCU 296-6B2
FIELD PICEANCE CREEK UNIT
REGION ROCKY MOUNTIANS
COORDINATES LAT 39.905269000
LON 108.205030000
ELEVATION GL 7363.9
KB 7390.9
COUNTY, STATE RIO BLANCO CO
API INDEX 051031154500
SPUD DATE 01-24-2011
CONTRACTOR HELMRICH AND PAYNE
CO. REP. SCOTT ARENBURG
RIG/TYPE 215 / FLEX 3
LOGGING UNIT MLU 51
GEOLOGISTS G.BAKER, D.CLAAR
B.MARSH, B.JOHANNING
ADD. PERSONS I.FAROOQUI
K.WALLANDER
CO. GEOLOGIST WILLIAM HOFFMAN

LOG INTERVAL

CASING DATA

DEPTHS: 145' TO 10,275'
DATES: 01-24-2011 TO 02-17-2011
SCALE: 1" = 100'

17" AT 145'
10.75" AT 4,627'
AT
AT

MUD TYPES

HOLE SIZE

LSDN TO 10,275'
TO
TO
TO
TO

20" TO 145'
14.75" TO 4,627'
9.875" TO 10,275'
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 ANDESITE ANHYDRITE BASALT BENTONITE BIOTITIZATION BRECCIA CALCARENITE CALCAREOUS TUFF CALCILUTITE CARBONATES CARBONACEOUS MAT CARBONACEOUS SH CEMENT CONTAM. CHALK CRYSTALLINE TUFF CHERT - ARGILL
CHERT - GLASSY CHERT - PORCEL CHERT - TIGER STRIPE CHERT - UNDIFF CLAY CLAY-MUDSTONE CLYST-TUFFACEOUS CHLORITIZATION COAL CONGLOMERATE CONGL. SAND CONGL. SANDSTONE COQUINA DACITE DIATOMITE DIORITE DOLOSTONE
FELSIC SILIC DIKE FOSSIL GABBRO GLASSY TUFF GRANITE GRANITE WASH GRANODIORITE GYPSUM HALITE HORNBL-QTZ-DIO IGNEOUS (ACIDIC) IGNEOUS (BASIC) INTRUSIVES KAOLINITE LIMESTONE LITHIC TUFF MARL - DOLO
MARL - CALC METAMORPHICS MUDSTONE OBSIDIAN PALEOSOL PHOSPHATE PORCELANITE PORCELANEOUS CLYST PYRITE PYROCLASTICS QUARTZ DIORITE QUARTZ LATITE QUARTZ MONZONITE RECRYSTALLIZED CALCITE RHYOLITE SALT SAND
SANDSTONE SANDSTONE-TUFFACEOUS SERICITIZATION SERPENTINE SHALE SHALE TUFFACEOUS SHELL FRAGMENTS SIDERITE SILICIFICATION SILTSTONE SILTST-TUFFACEOUS TUFF VOLCANICLASTICS SEDS VOLCANICS

Lithology

<0 Ttl Gas 500>
units

<0 CO2 10K>
ppm

<0 Flare Ht. 100>
ft

Depth

100

200

300

400

500

600

700

800

900

<150 Avg RPM 0><300 ROP 0><400 MSE 0>

ft/hr

<30K Avg Torque 0><50 Avg WOB 0>

FTLBS klbs

MGS

Remarks
Survey Data, Mud Reports, Other Info.

CANRIG WELL SERVICE COMMENCED LOGGING OPERATION ON 1/26/2011 @ 2:49 HRS AT A DEPTH OF 145'.

CHANGED GAS EQUIP. AT TEN

CALIB. GAS EQUIPMENT

<0 Ttl Gas 500>
<0 CO2 10K>
<0 Flare Ht. 100>

<150 Avg RPM 0><300 ROP 0><400 MSE 0>

<30K Avg Torque 0><50 Avg WOB 0>

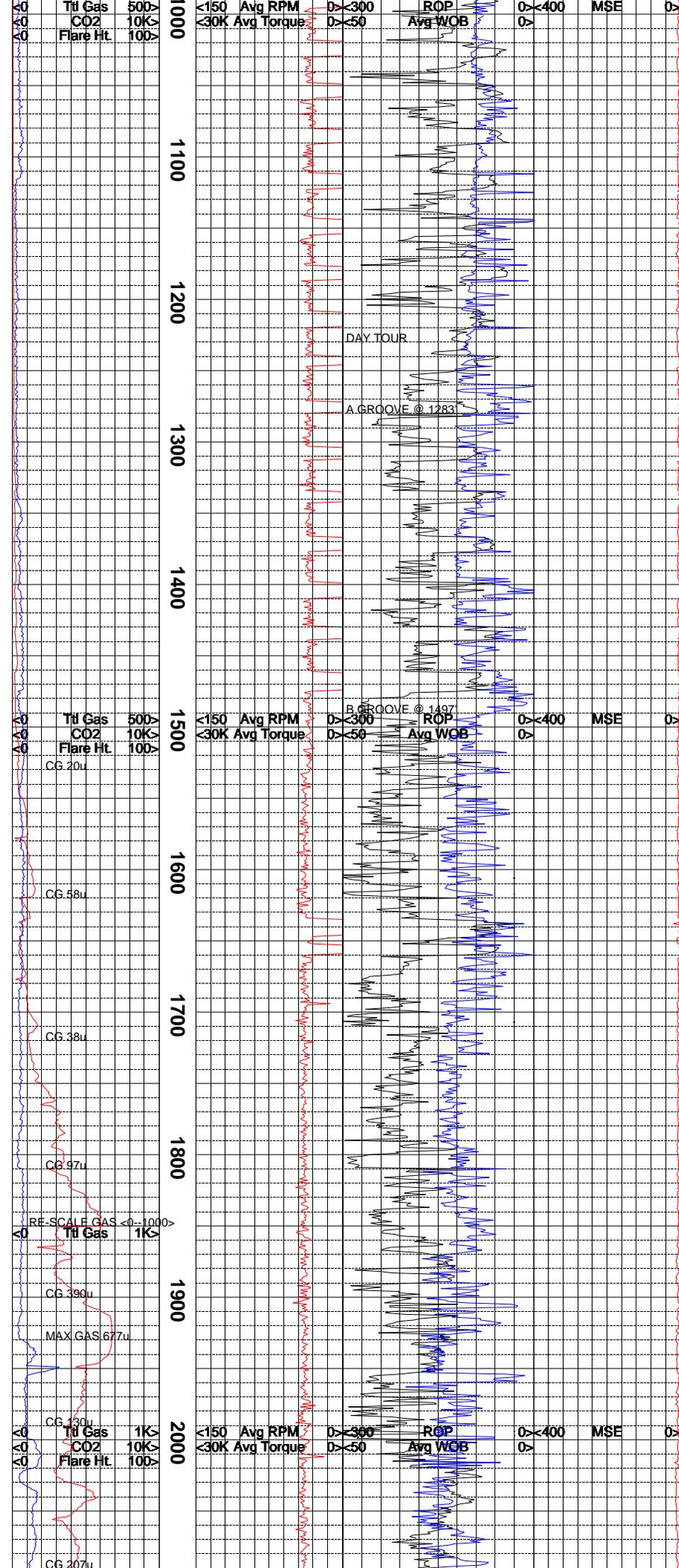
BG GAS 2-3u

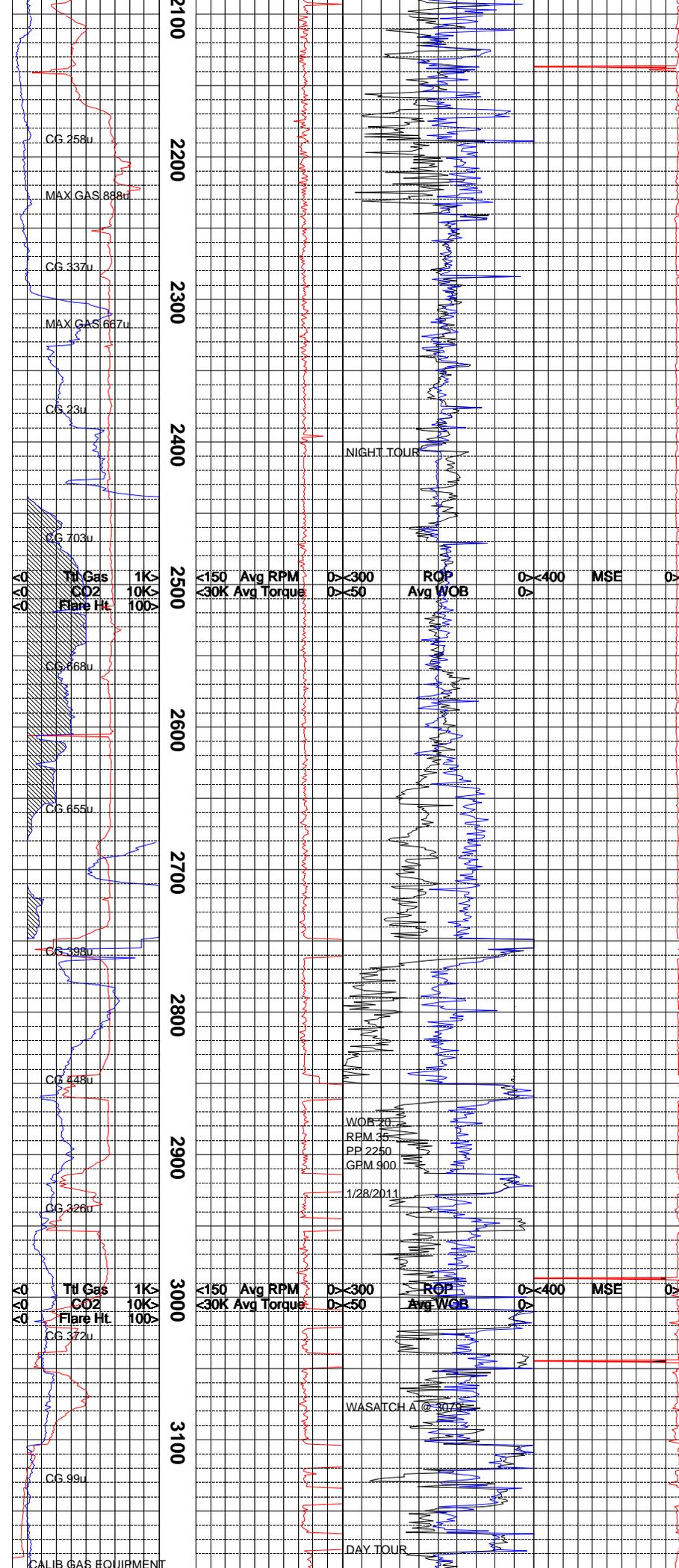
NIGHT TOUR

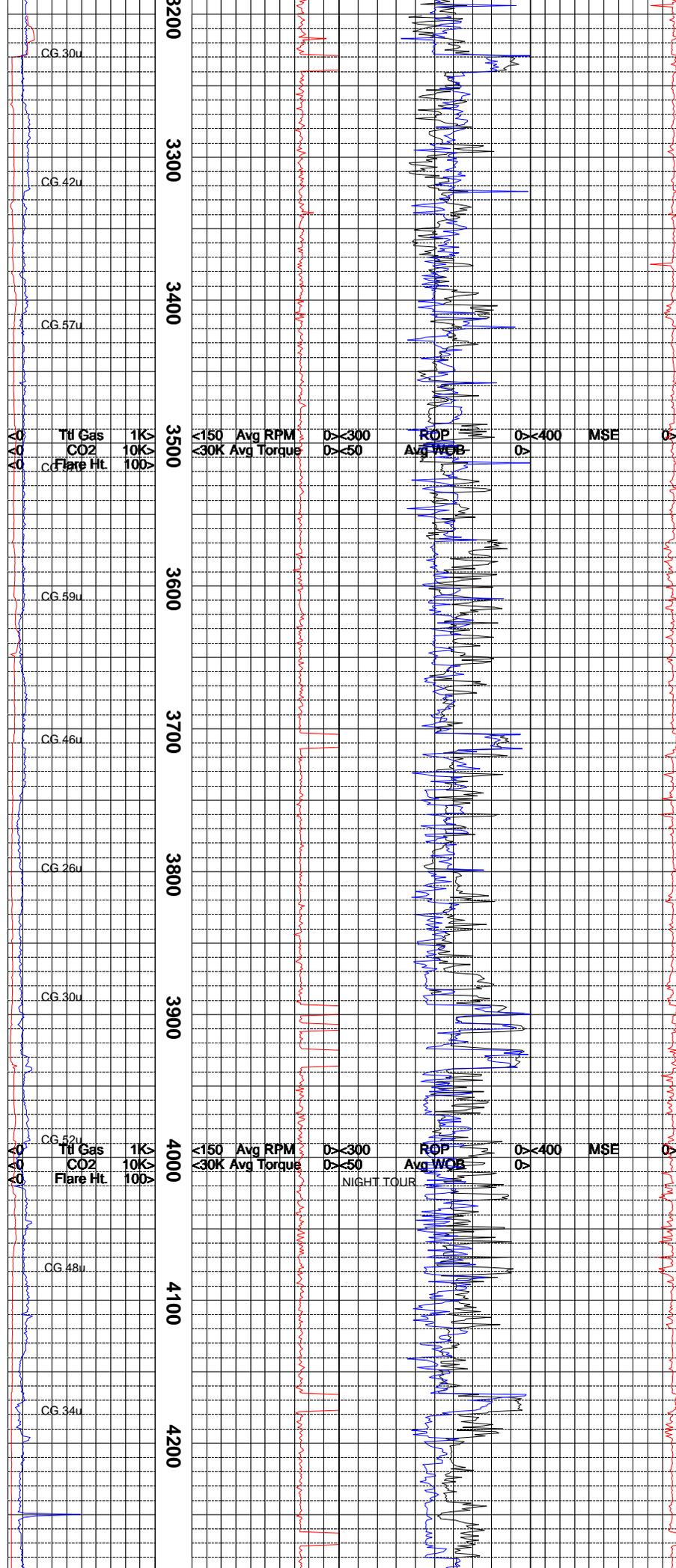
EQUIPMENT TEST 96u

WOB 14
RPM 35
PP 1600
GFM 758

01/27/2011

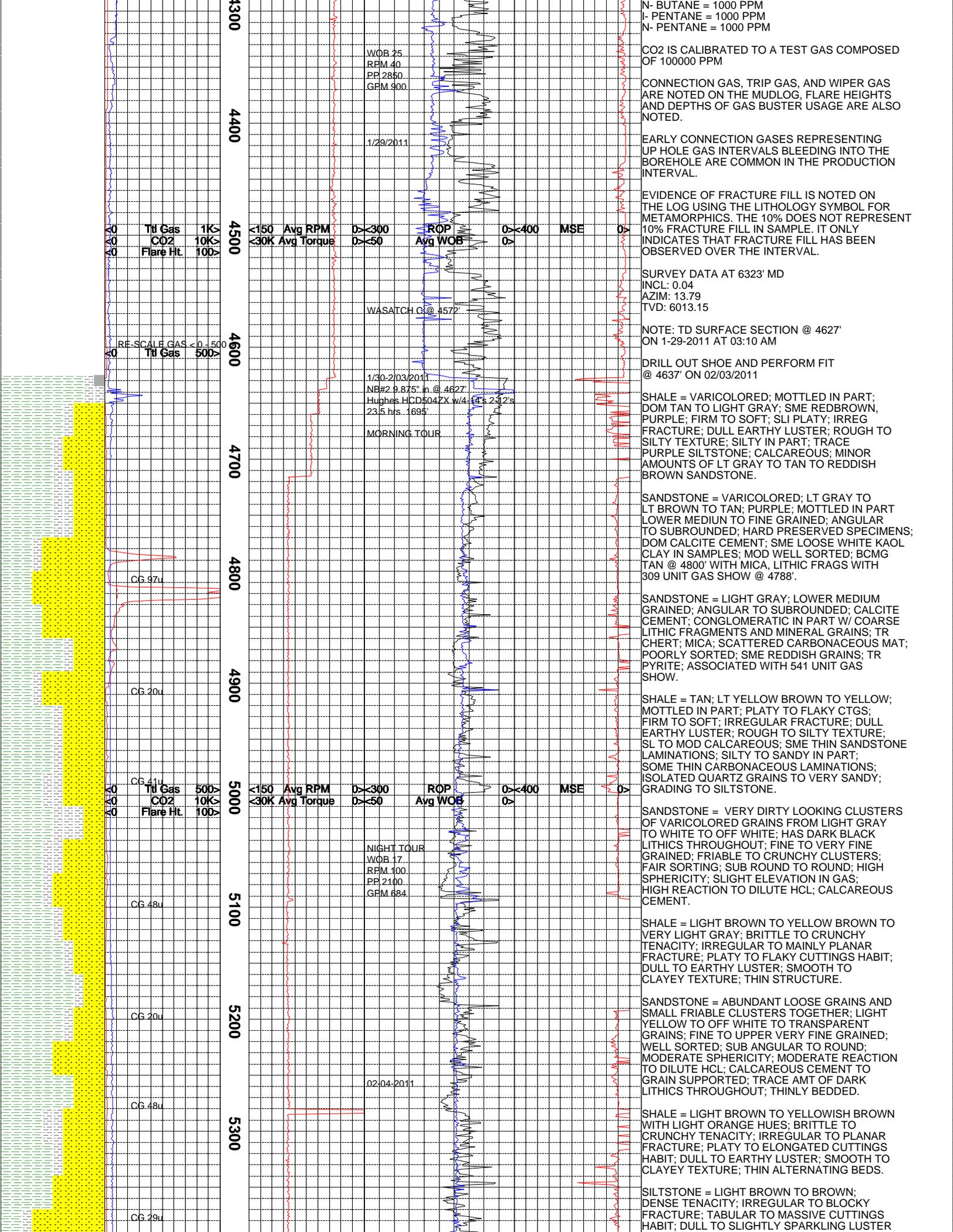






ALL ROCK COLORS ARE REFERENCED TO THE GSA ROCK COLOR CHART, ROCK CONSTITUENTS ARE DESCRIBED WET AND LISTED IN ORDER OF MOST ABUNDANT TO LEAST ABUNDANT, ALL SAMPLE DEPTHS ARE REFERENCED TO RKB.

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

CO2 IS CALIBRATED TO A TEST GAS COMPOSED OF 100000 PPM

CONNECTION GAS, TRIP GAS, AND WIPER GAS ARE NOTED ON THE MUDLOG, FLARE HEIGHTS AND DEPTHS OF GAS BUSTER USAGE ARE ALSO NOTED.

EARLY CONNECTION GASES REPRESENTING UP HOLE GAS INTERVALS BLEEDING INTO THE BOREHOLE ARE COMMON IN THE PRODUCTION INTERVAL.

EVIDENCE OF FRACTURE FILL IS NOTED ON THE LOG USING THE LITHOLOGY SYMBOL FOR METAMORPHICS. THE 10% DOES NOT REPRESENT 10% FRACTURE FILL IN SAMPLE. IT ONLY INDICATES THAT FRACTURE FILL HAS BEEN OBSERVED OVER THE INTERVAL.

SURVEY DATA AT 6323' MD
 INCL: 0.04
 AZIM: 13.79
 TVD: 6013.15

NOTE: TD SURFACE SECTION @ 4627' ON 1-29-2011 AT 03:10 AM

DRILL OUT SHOE AND PERFORM FIT @ 4637' ON 02/03/2011

SHALE = VARICOLORED; MOTTLED IN PART; DOM TAN TO LIGHT GRAY; SME REDBROWN, PURPLE; FIRM TO SOFT; SLI PLATY; IRREG FRACTURE; DULL EARTHY LUSTER; ROUGH TO SILTY TEXTURE; SILTY IN PART; TRACE PURPLE SILTSTONE; CALCAREOUS; MINOR AMOUNTS OF LT GRAY TO TAN TO REDDISH BROWN SANDSTONE.

SANDSTONE = VARICOLORED; LT GRAY TO LT BROWN TO TAN; PURPLE; MOTTLED IN PART LOWER MEDIUM TO FINE GRAINED; ANGULAR TO SUBROUNDED; HARD PRESERVED SPECIMENS; DOM CALCITE CEMENT; SME LOOSE WHITE KAOL CLAY IN SAMPLES; MOD WELL SORTED; BCMG TAN @ 4800' WITH MICA, LITHIC FRAGS WITH 309 UNIT GAS SHOW @ 4788'.

SANDSTONE = LIGHT GRAY; LOWER MEDIUM GRAINED; ANGULAR TO SUBROUNDED; CALCITE CEMENT; CONGLOMERATIC IN PART W/ COARSE LITHIC FRAGMENTS AND MINERAL GRAINS; TR CHERT; MICA; SCATTERED CARBONACEOUS MAT; POORLY SORTED; SME REDDISH GRAINS; TR PYRITE; ASSOCIATED WITH 541 UNIT GAS SHOW.

SHALE = TAN; LT YELLOW BROWN TO YELLOW; MOTTLED IN PART; PLATY TO FLAKY CTGS; FIRM TO SOFT; IRREGULAR FRACTURE; DULL EARTHY LUSTER; ROUGH TO SILTY TEXTURE; SL TO MOD CALCAREOUS; SME THIN SANDSTONE LAMINATIONS; SILTY TO SANDY IN PART; SOME THIN CARBONACEOUS LAMINATIONS; ISOLATED QUARTZ GRAINS TO VERY SANDY; GRADING TO SILTSTONE.

SANDSTONE = VERY DIRTY LOOKING CLUSTERS OF VARICOLORED GRAINS FROM LIGHT GRAY TO WHITE TO OFF WHITE; HAS DARK BLACK LITHICS THROUGHOUT; FINE TO VERY FINE GRAINED; FRIABLE TO CRUNCHY CLUSTERS; FAIR SORTING; SUB ROUND TO ROUND; HIGH SPHERICITY; SLIGHT ELEVATION IN GAS; HIGH REACTION TO DILUTE HCL; CALCAREOUS CEMENT.

SHALE = LIGHT BROWN TO YELLOW BROWN TO VERY LIGHT GRAY; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO MAINLY PLANAR FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; THIN STRUCTURE.

SANDSTONE = ABUNDANT LOOSE GRAINS AND SMALL FRIABLE CLUSTERS TOGETHER; LIGHT YELLOW TO OFF WHITE TO TRANSPARENT GRAINS; FINE TO UPPER VERY FINE GRAINED; WELL SORTED; SUB ANGULAR TO ROUND; MODERATE SPHERICITY; MODERATE REACTION TO DILUTE HCL; CALCAREOUS CEMENT TO GRAIN SUPPORTED; TRACE AMT OF DARK LITHICS THROUGHOUT; THINLY BEDDED.

SHALE = LIGHT BROWN TO YELLOWISH BROWN WITH LIGHT ORANGE HUES; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO ELONGATED CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; THIN ALTERNATING BEDS.

SILTSTONE = LIGHT BROWN TO BROWN; DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; TABULAR TO MASSIVE CUTTINGS HABIT; DULL TO SLIGHTLY SPARKLING LUSTER

WOB 25
 RPM 40
 PP 2850
 GPM 900

1/29/2011

Td Gas 1K
 CO2 10K
 Flare Ht 100

<150 Avg RPM >300 ROP >400 MSE >0
 <30K Avg Torque >50 Avg WOB >

WASATCH CG @ 4572'

RE-SCALE GAS <0-500
 Td Gas 500

1/30-2/03/2011
 NB#2 9.875" in @ 4627'
 Hughes HCD504ZX w/4-1/2" 2312's
 23.5 hrs. 1695'
 MORNING TOUR

CG 97u

CG 20u

CG 41u

Td Gas 500
 CO2 10K
 Flare Ht 100

<150 Avg RPM >300 ROP >400 MSE >0
 <30K Avg Torque >50 Avg WOB >

NIGHT TOUR
 WOB 17
 RPM 100
 PP 2100
 GPM 684

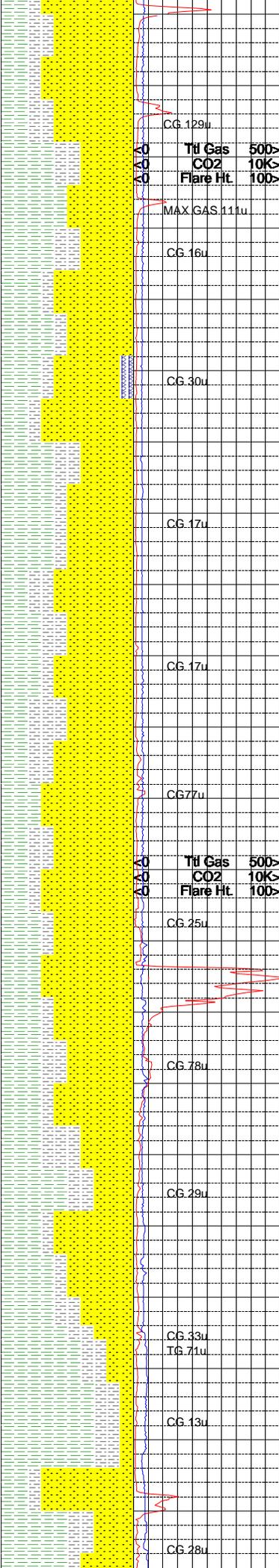
CG 48u

CG 20u

02-04-2011

CG 48u

CG 29u



5400
5500
5600
5700
5800
5900
6000
6100
6200
6300
6400

<150 Avg RPM >>300 ROP >>400 MSE >>
 <30K Avg Torque >>50 Avg WOB >>

CG 129u
 Td Gas 500Y
 CO2 10KY
 Flare Hit 100Y

MAX GAS 111u

CG 16u

CG 30u

DAY TOUR

CG 17u

CG 17u

CG 77u

Td Gas 500Y
 CO2 10KY
 Flare Hit 100Y

CG 25u

CG 28u

CG 29u

CG 33u
 TG 71u

CG 13u

CG 28u

02/05/2011
 NE#3 9.875" in @ 6322
 Smith M166EPX w/6-12
 23.5 Hrs 1695
 MORNING TOUR

WOB 20
 PP 2350
 RPM 400
 GPM 720

WASATCH G @ 6436

SILTY TO GRITTY TEXTURE; VERY THINLY INTERBEDDED BETWEEN SHALE AND SANDSTONE.

SANDSTONE = LIGHT GRAY TO WHITE WITH OCC CLEAR TO TRANSLUCENT GRAINS; MAINLY SMALL TIGHT CLUSTERS; OCC LOOSE GRAINS; FINE TO VERY FINE GRAINED; TRACE AMT OF DARK LITHICS THROUGHOUT; WELL SORTED; SUB ROUND TO ROUND; HIGH SPHERICITY; CALCAREOUS CEMENT; HIGHLY REACTIVE TO DILUTE HCL. MOD. ELEVATION IN BACKGROUND GAS.

SHALE = LIGHT GRAY TO LIGHT BROWN WITH HUES OF YELLOW; BRITTLE TO CRUMBLY; IRREGULAR TO PLANAR FRACTURE; PLATY TO FLAKY CUTTINGS HABIT; SMOOTH TEXTURE; DULL TO EARTHY LUSTER; VERY THIN ALTERNATING BEDS WITH SANDSTONE AND OCC. SILTSTONE.

SANDSTONE = LIGHT GRAY TO WHITE WITH DARK LITHICS SCATTERED THROUGHOUT; FINE GRAINED; MOSTLY LOOSE GRAINS, SOME SMALL FRIABLE CLUSTERS; FAIR SORTING; SUB-ANGULAR TO SUB ROUND; LOW REACTION TO DILUTE HCL; GRAIN SUPPORTED; NO SHOWS.

SILTSTONE = REDDISH BROWN; GRAY; MOTTLED IN PART; SME YELLOWISH BROWN EXAMPLES; DENSE; MASSIVE TO SLI PLATY CUTTINGS; IRREGULAR FRACTURE; SLI SPARKLING LUSTER WHEN DRIED; SILTY TO GRITTY TEXTURE; MOD CALCAREOUS; GRADING TO SANDSTONE.

SANDSTONE = ABUNDANT LOOSE GRAINS; VARICOLORED SPECIMENS; LIGHT GRAY TO WHITE; MOTTLED REDBROWN TO LT BROWN; FIRM TO HARD PRESERVED SPECIMENS; ANG TO SUB ROUNDED; LOWER MEDIUM TO FINE GRAINED; DOM CALCITE CEMENT; LOW SPHER; SME LOOSE WHITE CALC KAOLIN MATRIX MAT IN SAMPLES; TRACE GREEN GRAINS; OCC ASSOCIATED WITH MINOR GAS INCREASES.

SHALE = VARICOLORED; REDBROWN TO YELLOW TO LT TAN; MOTTLED; FIRM TO SLI HARD; SL PLATY TO MASSIVE CUTTINGS; IRREGULAR FRACTURE; SLI CALCAREOUS; VARIABLE AMTS OF SAND AND SILT; ISOLATED QUARTZ TO VERY SANDY SHALE; SMOOTH TO SILTY TEXT; ABUNDANT LOOSE QUARTZ GRAINS; NO VISIBLE STRUCTURE.

SANDSTONE = ABUNDANT LOOSE GRAINS; UPPER TO LOWER MEDIUM GRAINED; LIGHT GRAY TO LT TO MEDIUM BROWN PRESERVED SPECIMENS; ANGULAR TO SUBANGULAR; LOW SPHERICITY; ABUNDANT LOOSE WHITE CALCITE MATRIX MATERIAL IN SAMPLE TRAYS; DOM CALCITE CEMENT; SOME BROWN LITHIC FRAGMENTS RARE BLACK UNIDENTIFIED GRAINS; THINLY INTERBEDDED WITH SHALE.

SANDSTONE = LIGHT GRAY TO LIGHT BROWN PRESERVED SPECIMENS; ABUNDANT LOOSE GRAINS; LOWER TO UPPER MEDIUM GRAINED; ANGULAR TO SUBROUNDED; MOD SORTED; LOW SPHERICITY; CALCITE CEMENT; MINOR WHITE KAOLIN FILL; ASSOCIATED WITH MODERATE GAS INCREASES.

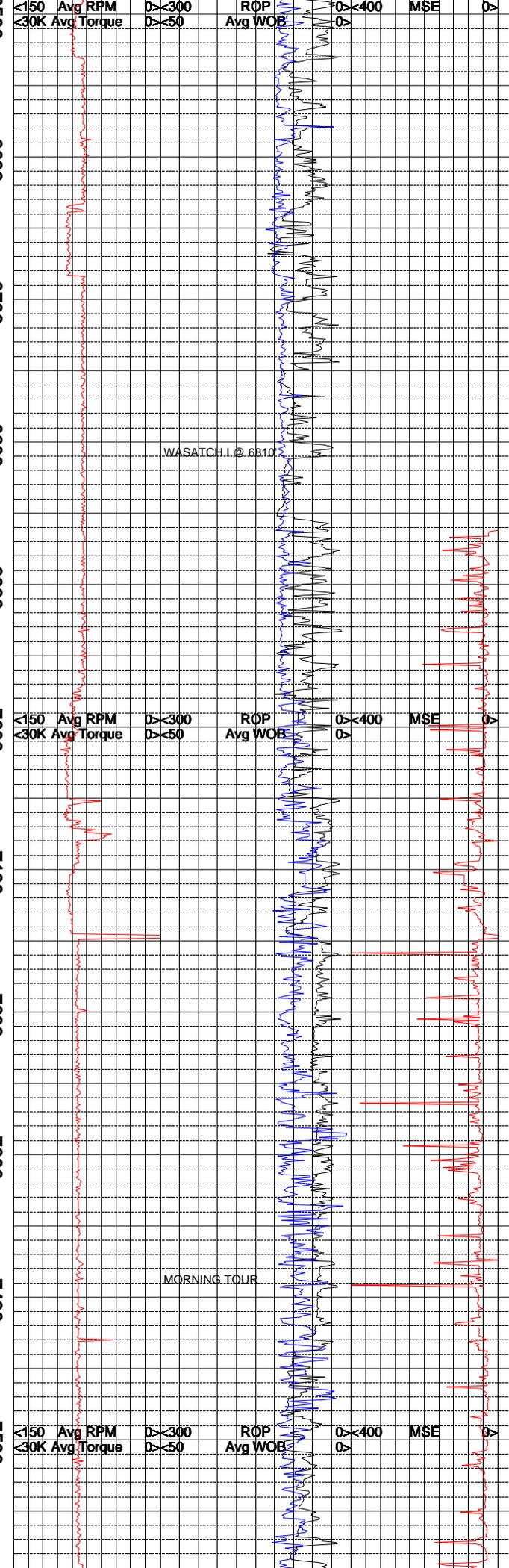
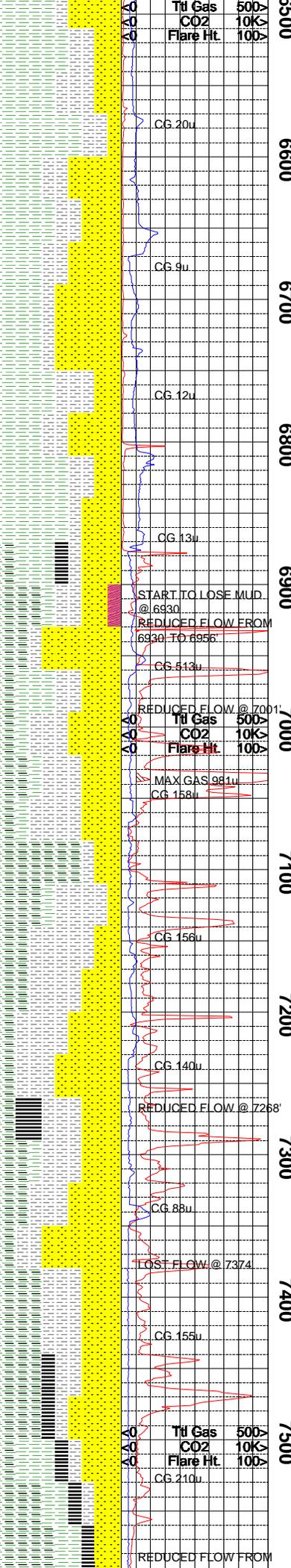
SHALE = YELLOW TAN TO LIGHT BROWN; FIRM TO SOFT; MOTTLED IN PART; IRREGULAR FRACTURE; PLATY CUTTINGS; DULL EARTHY TO WAXY LUSTER; ROUGH TO SILTY TEXTURE IN SILTY EXAMPLES; VF MICA; NON TO VSL CALCAREOUS; SILTY TO SANDY EXAMPLES.

SHALE = LT BROWN; LT GRAY; MOTTLED IN PART; FIRM; PLATY TO MASSIVE CUTTINGS; IRREGULAR FRACTURE; DULL EARTHY LUSTER; ROUGH TO SLI SILTY TEXTURE; SLI CALC; VF MICA; DECREASE SILT CONTENT; NO VISIBLE STRUCTURE.

SANDSTONE = DOMINANTLY LOOSE GRAINS; LOWER MEDIUM TO FINE GRAINED; ANGULAR TO SUB ANGULAR; MOD SORTED; CALCITE CMT SME LOOSE WHITE CLEAN CALCITE; MINOR WHITE KAOLIN CLAY FILL; TR SILICEOUS CMT SME VARICOLORED EXAMPLES.

SHALE = DOM LIGHT GRAY; MOTTLED GRAY YELLOW; SME PURPLE TO ORANGE; FIRM; PLATY TO MASSIVE CUTTINGS; IRREGULAR FRACTURE; SLI TO MODERATELY CALCAREOUS; DULL TO SLI WAXY LUSTER; ROUGH TO SLI SILTY TEXTURE; ISOLATED SILT GRAINS; OCC ISOLATED CARBONACEOUS MATERIAL; TRACE AMOUNTS OF WHITE, CRYSTALLINE NAHCOLITE.

WASATCH G SANDSTONE @ 6436MD = ABNT LOOSE GRAINS; V CLEAN; CLEAR TO LT GRAY CLUSTERS; LT GREEN SPECIMENS; LOWER MEDIUM TO UPPER FINE GRAINED; LOW SPHER; MOD SRDT; ANGULAR TO SUBANGULAR; DOM GRAIN SUPPORTED W/SME MATRIX SUPPORTED CALCITE/SILICEOUS CEMENT; SME WHITE



KAOLIN CLAY FILL; TR CHLORITIC GRAINS; ASSOCIATED WITH MINOR GAS INCREASES.

SHALE = VARICOLORED; MOTTLED; LT GRAY; YELLOW; LT TAN; REDBROWN; PURPLE; FIRM TO MOD HARD; PLATY TO MASSIVE CTGS; IRREGULAR FRACTURE; SLI TO MOD CALC; V CALCAREOUS IN VERY SILTY SPECIMENS; DULL EARTHY TO WAXY LUSTER; DOM SILTY TEXTURE VERY SILTY; SME SCATTERED CARBONACEOUS MATERIAL.

SANDSTONE = LT GRAY TO WHITE; LT GREEN HUES; LT GREEN GRAINS; DOM FINE TO VERY FINE GRAINED; ANGULAR TO SUB ANGULAR; SOME MOTTLED REDBROWN SPECIMENS; MOD WELL SORTED; DOM GRAIN SUPPORTED; CALCITE CEMENT; SME VERY HARD SILICEOUS SPECIMENS; OCC SCATTERED CARBONACEOUS MATERIAL; NO GAS INCREASES.

SANDSTONE = LT GREEN; WHITE/GRAY; FINE TO VERY FINE GRAINED; WELL SORTED; DOM CALCITE CEMENT; ANGULAR TO SUB ANGULAR; GRAIN SUPPORTED; OCC MICRO PYRITE; OCC VF SCATTERED CARBONACEOUS MATERIAL; VERY TIGHT; NO GAS INCREASES.

SHALE = VARICOLORED; MOTTLED; LT GRAY; YELLOW; PURPLE; TAN; FIRM TO MOD HARD; PLATY TO FLAKY CUTTINGS; IRREGULAR FRAC; SL TO MOD CALCAREOUS IN SILTY SPECIMENS; DULL TO SLI SPARKLING LUSTER WHEN DRIED; ROUGH TO SILTY TEXTURE; VERY SILTY; GRADING TO SILTSTONE; OCC ISOLATED VF QUARTZ GRAINS; TRACE AMTS OF CRYSTALLINE NAHCOLITE.

CARBONACEOUS SHALE/SILTSTONE = DOM DK BROWN; TOUGH TENACITY; SLI PLATY CTGS; PLANAR TO BLOCKY FRACTURE; SLI RESINOUS SMOOTH TO SILTY TEXTURE; ASSOC W/ COAL AND MINOR GAS INCREASES; GRADING TO SLTST; SME THIN CALCITE FRACTURE MAT.

SANDSTONE = LIGHT GRAY TO OFF WHITE TO CLEAR AND TRANSLUCENT; MAINLY SMALL TIGHT NON-FRIABLE CLUSTERS; FINE TO VERY FINE GRAINED; FAIR SORTING; MODERATE SPHERICITY; HIGHLY REACTIVE TO DILUTE HCL; CALCAREOUS CEMENTATION; THIN ALTERNATING BEDS.

SILTSTONE = GRAYISH BROWN TO MEDIUM GRAY; VERY TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; DULL TO SLIGHTLY SPARKLING LUSTER; SILTY TEXTURE ALTERNATING BEDS.

CARBONACEOUS SHALE = DARK GRAY TO GRAYISH BLACK; TRACES OF COAL LAMINATIONS THROUGHOUT; TOUGH TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO TABULAR TO WEDGE-LIKE CUTTINGS HABIT; DULL TO WAXY LUSTER THICK STRUCTURE - ALTERNATING BEDS WITH SILTSTONE AND OCC SANDSTONE.

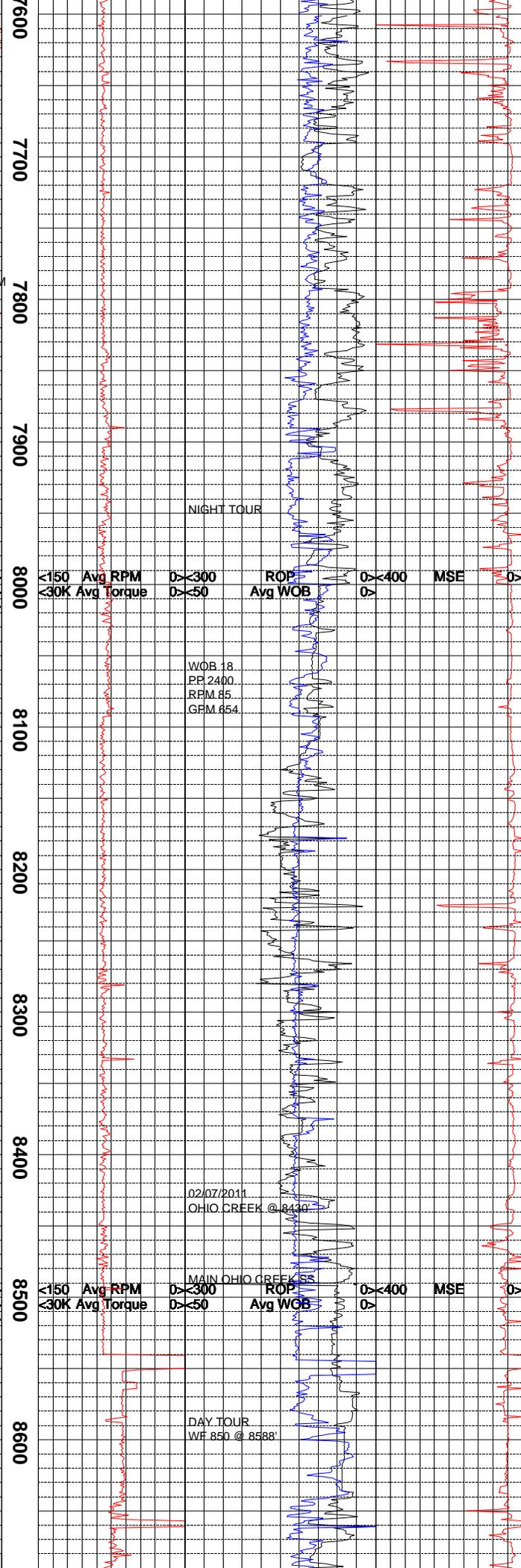
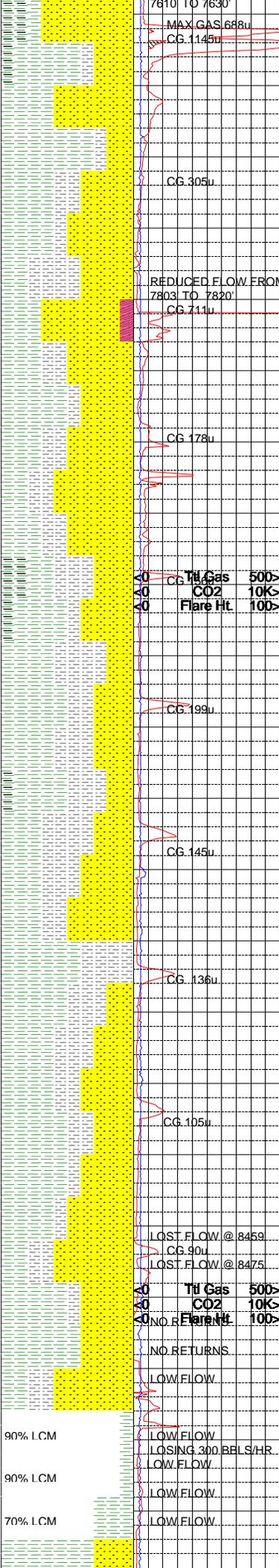
SILTSTONE = BROWNISH GRAY TO DARK BROWN; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; TABULAR TO MASSIVE CUTTINGS HABIT; DULL TO SPARKLING LUSTER; SILTY TEXTURE.

COAL = BLACK; TOUGH TO DENSE TO SLIGHTLY BRITTLE; IRREGULAR TO SPLINTERY FRACTURE MASSIVE TO WEDGELIKE TO ELONGATED CUTTINGS HABIT; DULL TO RESINOUS LUSTER; SMOOTH TO SILTY TEXTURE; THINLY BEDDED.

CARBONACEOUS SHALE = DARK BROWN; BLACK TO DARK GRAY; FIRM TO VERY HARD; PLATY TO FLAKY CUTTINGS; PLANAR TO IRREGULAR FRACTURE; DULL TO RESINOUS LUSTER; SILTY TO ROUGH TEXTURE; VARIABLE AMOUNTS OF SILT; GRADING TO CARBONACEOUS SILTSTONE; MINOR MICRO PYRITE; SME THIN SILTSTONE TO VERY FINE GRAINED SS LAMINATIONS; ASSOCIATED WITH BLACK COAL; SME MINOR GAS INCREASES.

SANDSTONE = WHITE TO LIGHT GRAY; HARD PRESERVED SPECIMENS; LOWER TO UPPER FINE GRAINED; ANGULAR TO SUB ROUNDED; MOD WELL SORTED; DOM CALCAREOUS CMT; SOME CARBONACEOUS TO COALY SPECIMENS; GRAIN SUPPORTED; SOME THIN BLACK CARBON TO COALY LAMINATIONS.

SHALE = LT GRAY; SME LT BROWN; DARK BROWN CARBONACEOUS SPECIMENS; MOD HARD; PLATY TO MASSIVE CTGS; IRREGULAR TO PLANAR FRAC; DULL TO WAXY LUSTER IN LT GRAY SPECIMENS; RESINOUS LUSTER IN CARBONACEOUS EXAMPLES; SMOOTH TO SILTY TEXTURE; NON CALC IN CARBON EXAMPLES; SOME CARBONACEOUS SPECIMENS EXHIBIT THIN COAL LAMINATIONS.



SANDSTONE = ABUNDANT LOOSE GRAINS; CLEAR TO LT GRAY CLUSTERS; FINE GRAINED; WELL SORTED; ANGULAR TO SUB ANGULAR; GRAIN SUPPORTED; DOM CALCITE CEMENT; TRACE WHITE KAOLIN CLAY FILL; V CLEAN WITH TR LT GREEN AND REDDISH GRAINS; ASSOCIATED WITH GAS INCREASE.

SHALE = VARIABLE COLORS FROM REDBROWN TO ORANGE TO VERY LT GRAY TO MEDIUM GRAY; SOFT AND FIRM TO VERY HARD; PLATY TO MASSIVE CUTTINGS; IRREGULAR TO PLANAR FRACTURE; DULL EARTHY LUSTER; SMOOTH TEXTURE; SLI CALCAREOUS; VERY SILTY IN REDBROWN SPECIMENS; MODERATE AMOUNTS OF LAMINATED TO SCATTERED CARBONACEOUS MATERIAL IN LIGHT GRAY SHALE.

SANDSTONE = LIGHT GRAY; SALT AND PEPPER APPEARANCE- SPECKLED WITH BLACK CARB AND LITHIC FRAGMENTS; UPPER FINE GRAINED SUB ANGULAR; MOD W SORTED; DOM CALCITE CEMENT; 5% LITHIC FRAGMENTS; CHLORITIC GRAINS; BLACK COAL LAMINATIONS; MINOR PYRITE; COARSE CALCITE- FRACTURE FILL MATERIAL IN THE 7,800' TO 7,830' SAMPLE.

SILTSTONE = REDBROWN; MOD TO VERY HARD; PLATY TO MASSIVE CTGS; IRREGULAR FRAC; SLI CALCAREOUS; DULL TO SPARKLING LUSTER SILTY TEXTURE; MOTTLED IN PART TO LT GRAY OBSERVED THIN LAMINATIONS IN SS; SME SANDY EXAMPLES.

CARBONACEOUS SHALE = DARK GRAY TO GRAYISH BLACK WITH A TRACE AMT OF COAL LAMINATIONS; TOUGH TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO TABULAR CUTTINGS HABIT; DULL TO WAXY LUSTER; ALTERNATING BEDS.

SILTSTONE = BROWN TO REDDISH BROWN TO BROWNISH GRAY; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO TABULAR CUTTINGS HABIT; DULL TO EARTHY LUSTER; SILTY TEXTURE; BEDS ALTERNATE WITH SHALE AND SANDSTONE.

SANDSTONE = LIGHT GRAY TO WHITE WITH CLEAR TO TRANSPARENT GRAINS THROUGHOUT; SMALL SLIGHTLY FRIABLE CLUSTERS; FINE GRAINED; FAIR SORTING; SUB ANGULAR TO ROUND; MODERATE SPHERICITY; MODERATE REACTION TO DILUTE HCL; CALCAREOUS CEMENT TO GRAIN SUPPORTED; THINLY BEDDED.

SHALE = GRAY TO LIGHT GRAY; TOUGH TO CRUMBLY; IRREGULAR TO BLOCKY TO SLIGHTLY PLANAR FRACTURE; MASSIVE TO PLATY CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; APPEARS TO GRADE TO A SILTSTONE AT TIMES; BEDS ALTERNATE WITH SILTSTONE AND OCC SANDSTONE.

SILTSTONE = BROWN TO REDDISH BROWN TO BROWNISH GRAY; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; MASSIVE CUTTINGS HABIT; SILTY TEXTURE; GRADES TO SANDSTONE; SLIGHTLY CALCAREOUS WITH LOW REACTION TO DILUTED HCL.

SANDSTONE = MAINLY LOOSE GRAINS; WHITE TO OFF WHITE TO CLEAR AND TRANSLUCENT; FRIABLE WHEN IN CLUSTERS; LOOSE SAND; FINE GRAINED OCC MEDIUM GRAINED; FAIR SORTING; SUB ANGULAR TO SUB ROUND; MODERATE SPHERICITY; MODERATE REACTION TO DILUTE HCL; CALCAREOUS CEMENT.

SHALE = LIGHT GRAY TO GRAY; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO PLANAR FRACTURE; PLATY TO MASSIVE CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO SILTY TEXTURE; ALTERNATING BEDS.

SILTSTONE = GRAYISH BROWN TO BROWN; TOUGH TO DENSE TENACITY; IRREGULAR TO BLOCKY FRACTURE; SLIGHTLY CALCAREOUS; DULL TO EARTHY LUSTER; SILTY TEXTURE; GRADES TO BECOME MORE SANDY; THINLY BEDDED.

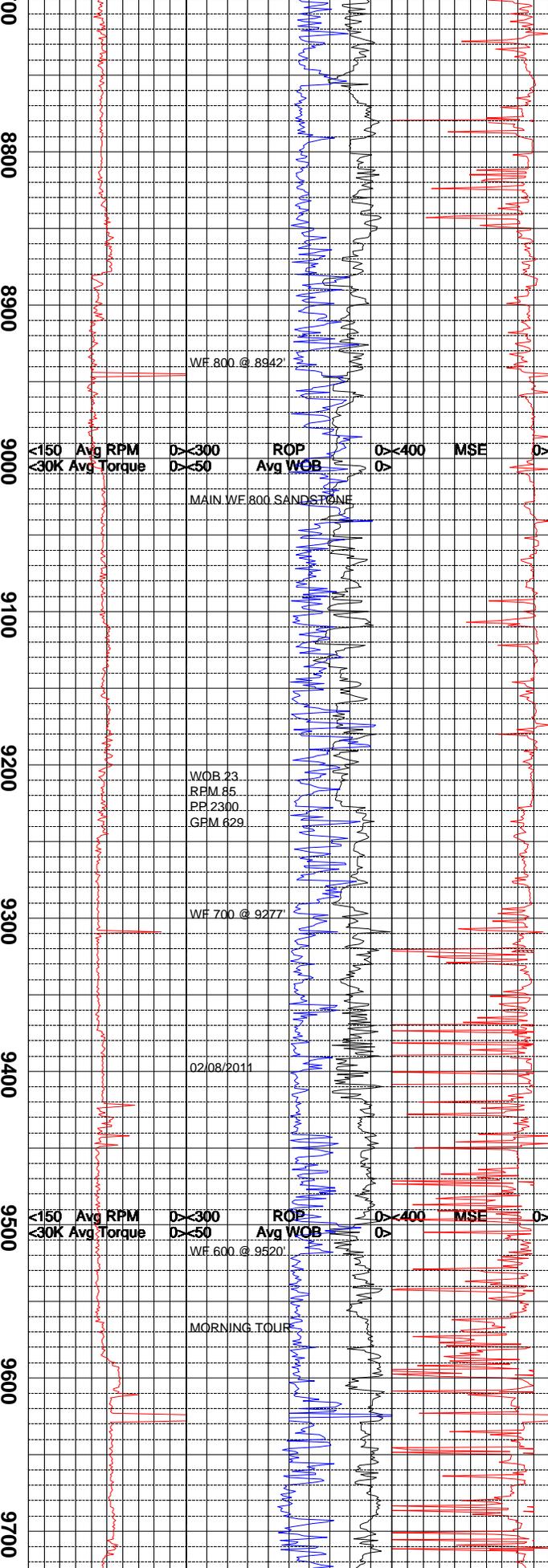
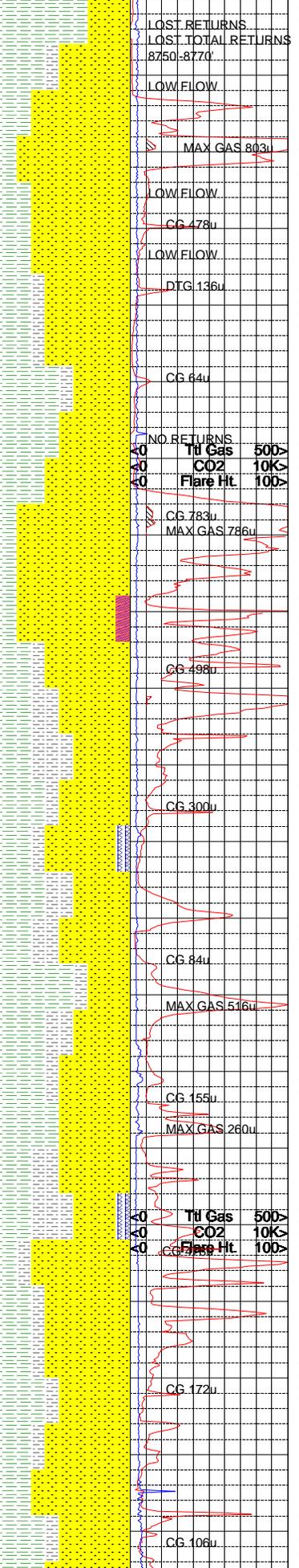
NOTE: POOR SAMPLE QUALITY SAMPLES 90% LCM

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NOTE: GAS DATA NOT RELIABLE AND ERRATIC; REFLECTS MASSIVE DOWNHOLE LOSSES.

NOTE: POOR SAMPLE QUALITY



SHALE = LT TO MEDIUM GRAY; SME GREEN;
 MOTTLED IN PART; FIRM TO MOD HARD;
 PLATY TO FLAKY CUTTINGS; PLANAR TO IRREGULAR
 FRACTURE; DULL EARTHY TO WAXY LUSTER;
 SMOOTH TO SILTY TEXTURE; NON TO VSL
 CALCAREOUS.

SANDSTONE = ABUNDANT LOOSE GRAINS; WHITE
 TO LIGHT GRAY; LOWER TO UPPER FINE GRND;
 ANGULAR TO SUB ROUNDED; DOM CALCITE
 CMT; LOW SPHERICITY; SME DARK BROWN
 CARBONACEOUS MATERIAL; POOR SAMPLE
 QUALITY.

SHALE = LT TO MEDIUM GRAY; SME DARK GRAY
 TO DARK BROWN; FIRM TO MODERATELY HARD;
 PLATY CUTTINGS; IRREGULAR FRACTURE;
 DULL EARTHY TO WAXY LUSTER; VF MICA;
 VERY FINE CARBONACEOUS MATERIAL.

NOTE: GAS DATA NOT RELIABLE- REFLECTS
 MASSIVE DOWNHOLE MUD LOSSES.

SANDSTONE = LT GRAY WITH LT GREENISH
 HUES TO LT GREEN; FINE TO VERY FINE
 GRAINED; ANGULAR TO SUB ROUNDED; MOD W-
 SORTED; MATRIX TO GRAIN SUPPORTED; CALC
 TO SILICEOUS CEMENT; SOME VERY ARG
 SPECIMENS; TRACE LT BROWN AND LT GREEN
 MICA.

SANDSTONE = WHITE TO LIGHT GRAY; LOWER
 TO UPPER MEDIUM GRAINED; ABUNDANT LOOSE
 GRAINS; ANGULAR TO SUB ROUNDED; MOD SRDT;
 DOM GRAIN SUPPORTED; SILICEOUS/CALC CMT;
 TR GREEN MICA; TRACE LOOSE WHITE KAOLIN
 CLAY IN SAMPLES; RARE PRESERVED CLUSTERS
 TRACE LIGHT GREEN GRAINS; SCATTERED BLK
 CARBONACEOUS/MAFIC GRAIN; COARSE WHITE,
 FLAT CALCITE-FRACTURE FILL IN THE 9090'-
 9120' SAMPLE; ASSOCIATED WITH GAS SHOWS.

SILTSTONE = BROWN TO BROWNISH RED;
 TOUGH TO DENSE TENACITY; IRREGULAR TO
 BLOCKY FRACTURE; MASSIVE TO TABULAR
 CUTTINGS HABIT; DULL TO SLIGHTLY
 SPARKLING LUSTER; SILTY TO GRITTY
 TEXTURE; APPEARS TO GRADE TO SANDSTONE
 IN PLACES WHERE IT GETS GRITTIER.

SANDSTONE = WHITE TO LIGHT GRAY WITH
 CLEAR AND TRANSLUCENT GRAINS; TRACE
 AMOUNT OF DARK LITHICS GIVING A SLIGHT
 SALT PEPPER APPEARANCE; ABUNDANT LOOSE
 GRAINS; SUB ANGULAR TO SUB ROUNDED;
 FAIR SORTING; MODERATE SPHERICITY WHEN
 IN CLUSTERS; SLIGHT REACTIN TO DILUTE
 HCL; CALCAREOUS CEMENT WHEN IN CLUSTERS
 TO GRAIN SUPPORTED; MAINLY LOOSE
 GRAINS; ASSOCIATED WITH INCREASE
 GAS.

SHALE = GRAY TO LIGHT GRAY; BRITTLE TO
 CRUNCHY TENACITY; IRREGULAR TO BLOCKY
 TO SLIGHTLY PLANAR FRACTURE IN SOME
 SPECIMENS; MASSIVE TO PLATY CUTTINGS
 HABIT; DULL TO EARTHY LUSTER; SMOOTH
 TO SLIGHTLY SILTY TEXTURE; ALTERNATING
 BEDS.

SANDSTONE = LIGHT GRAY TO WHITE WITH
 TRANSLUCENT AND TRANSPARENT GRAINS;
 A TRACE AMT OF DARK LITHICS GIVING A
 SALT AND PEPPER APPEARANCE; MEDIUM TO
 FINE OCC VERY FINE GRAINS; WELL SORTED;
 SUB ANGULAR TO SUB ROUND; ABOUT 50/50
 COMBINATION OF SMALL NON-FRIABLE
 CLUSTERS AND LOOSE GRAINS; WHEN IN
 CLUSTERS HAS CALCITE CEMENT AND
 MODERATE TO HIGH REACTION TO HCL; NO
 REACTION FROM LOOSE GRAINS; INCREASE IN
 GAS.

SHALE = LT TO MEDIUM GRAY; SME MEDIUM
 BROWN EXAMPLES; FIRM TO MOD HARD;
 PLATY TO FLAKY CUTTINGS; IRREGULAR TO
 PLANAR FRACTURE; VF MICA; SLI TO MOD
 CALCAREOUS IN SILTY EXAMPLES; ROUGH
 TO SILTY TEXTURE; SILTY IN PART; OCC MOD
 AMOUNTS OF CARBONACEOUS MATERIAL.

NOTE: VERY POOR SAMPLE QUALITY- ABUNDANT
 LCM MATERIAL.

SANDSTONE = LT GRAY WITH LT BROWN HUES;
 FINE TO VERY FINE GRAINED; ANGULAR TO
 SUB ROUNDED; MOD SRDTED; DOM CALCITE CMT;
 LOW TO MOD SPHERICITY; TRACE WHITE KAOL
 CLAY FILL; OCC SPECKLED WITH BLACK CARB
 MATERIAL.

SILTSTONE = BROWN TO BROWNISH GRAY;
 HARD TO TOUGH; PLATY TO TABULAR CUTTINGS
 IRREGULAR FRACTURE; SPARKLING LUSTER
 WHEN DRIED; GRITTY TEXTURE; SLI TO MOD
 CALCAREOUS; THINLY BEDDED WITH SHALE AND
 SILTSTONE.

SANDSTONE = LIGHT GRAY TO WHITE; SME LT

