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Drilling Dynamics MD

COMPANY EXXONMOBIL
WELL FRU197-33A2
FIELD FREEDOM RANCH UNIT
REGION ROCKIES
COORDINATES 39.915658
108.285631
ELEVATION 6390'
COUNTY, STATE RIO BLANCO, CO
API INDEX 05-103-11098-00
SPUD DATE 2/1/2009
CONTRACTOR HELMRICH AND PAYNE
CO. REP. KEVIN GARDNER
RIG/TYPE 239 / Flex 3
LOGGING UNIT MLU 033
GEOLOGISTS LAYNE GOOD
NICK BAUER
ADD. PERSONS JASON REISENBICHLER
CO. GEOLOGIST MELISSA SAURBORN

LOG INTERVAL

CASING DATA

DEPTHS: 4000' TO 12297'
DATES: 6/26/2009 TO 7/10/2009
SCALE: 1" = 100'

16" AT 130'
10.75" AT 3956'
7" AT 8536'
AT

MUD TYPES

HOLE SIZE

SPUD MUD TO 3983'
LSND TO 12297'
TO
TO

14.75" TO 3983'
9.875" TO 8555'
6.125" TO 12297'
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	

Lithology

<0 Ttl Gas 4K>
units

<0 CO2 8K>
ppm

<0 Flare Ht. 100>
ft

Depth

<150 Avg RPM 0><200 ROP 0><400 MSE 0>

ft/hr

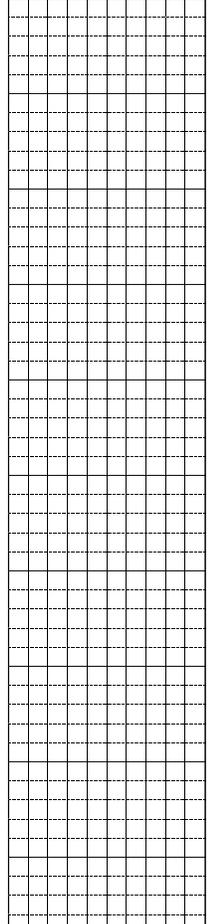
psi

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

FTLBS klbs

MGS

Remarks
Survey Data, Mud Reports, Other Info.



3600

3700

3800

3900

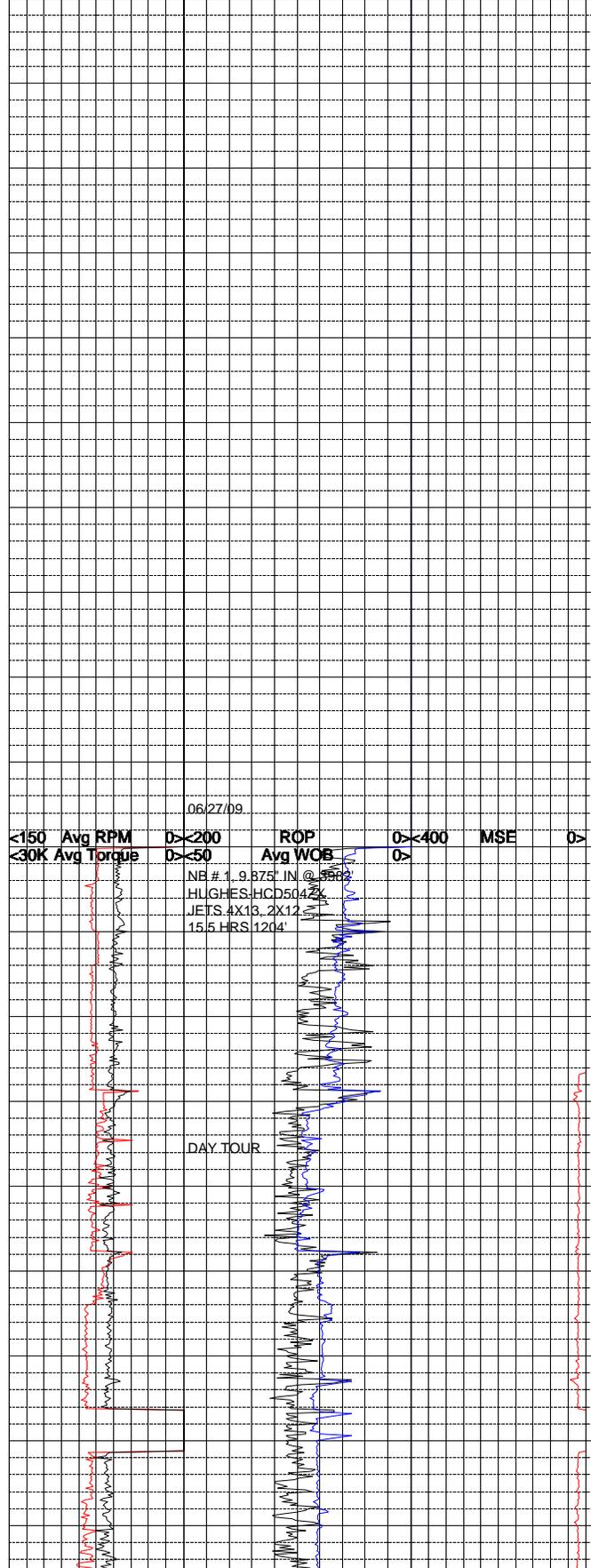
4000

4100

4200

4300

4400



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 BORE HOLE DURING CONNECTIONS.

GAS CHROMATOGRAPHY EQUIPMENT IS CALIBRATED TO A TEST GAS COMPOSED OF:
METHANE = 10000PPM
ETHANE = 1000PPM
PROPANE = 1000PPM
I-BUTANE = 1000PPM
N-BUTANE = 1000PPM
I-PENTANE = 1000PPM
N-PENTANE = 1000PPM

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 FOR HYDROCARBON FLUORESCENCE AND MINOR FLUORESCENCE FROM POSSIBLE FRACTURE FILL. ALL FLUORESCENCE IS NOTED ON THE MUDLOG.

10.75" SURFACE CASING WAS SET AT 3956'

CANRIG DRILLING TECHNOLOGY LTD. COMMENCED FULL LOGGING SERVICES ON 06/26/2009.

SHALE = LIGHT BLUISH GRAY TO LIGHT YELLOW BROWN TO GRAY; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY TO OCC PLANAR FRACTURE; TABULAR TO WEDGELIKE TO OCC NODULAR CUTTINGS HABIT; DULL TO EARTHY TO OCC WAXY LUSTER; SMOOTH TO CLAYEY TEXTURE; THICK TO MASSIVELY BEDDED; TRACES OF PYRITE NODULES FOUND IN SAMPLE TRAY; COMMON CLAYLIKE MUD PROPERTIES; OVERALL NON CALCAREOUS.

SHALE = COLOR VARIES FROM GRAY TO YELLOWISH BROWN TO BROWN; CRUMBLY TO CRUNCHY TO BRITTLE TENACITY; IRREGULAR TO PLANAR FRACTURE; MASSIVE TO FLAKY TO WEDGE LIKE CUTTINGS HABIT; DULL TO EARTHY TO WAXY LUSTER; SMOOTH TO SLIGHTLY CLAYEY TEXTURE; MASSIVE STRUCTURE.

SANDSTONE = COLOR RANGES FROM GRAY TO WHITE TO TAN TO TRANSLUCENT; FINE TO MEDIUM GRAIN; FAIR TO WELL SORTED GRAINS; SUB-ANGULAR TO SUB-ROUND TO ROUND GRAINS WITH LOW TO MODERATE SPHERICITY; EASILY FRIABLE TO FRIABLE; CALCITE CEMENTATION; SAMPLE IS HIGHLY REACTIVE TO HCL SOLUTION; APPROX. TWO TO FIVE PERCENT OF SAMPLE CONSISTS OF DARK BROWN AND BLACK LITHIC FRAGMENTS; NO FLUORESCENCE UNDER UV LIGHT.

SILTSTONE = LIGHT GRAY TO GRAY TO BLUISH GRAY; BRITTLE TO CRUMBLY TO CRUNCHY TENACITY; GENERALLY IRREGULAR FRACTURE; MASSIVE CUTTINGS HABIT; WAXY TO DULL TO EARTHY LUSTER; SILTY TO GRITTY TEXTURE; MASSIVE STRUCTURE.

SHALE = YELLOWISH BROWN TO BROWN TO LIGHT GRAY; SAMPLE HAS BRITTLE TO CRUNCHY TO CRUMBLY TENACITY; PLANAR TO IRREGULAR FRACTURE; CUTTINGS ARE GENERALLY MASSIVE TO PLATY TO FLAKY TO WEDGE LIKE; OVERALL DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; MASSIVE STRUCTURE.

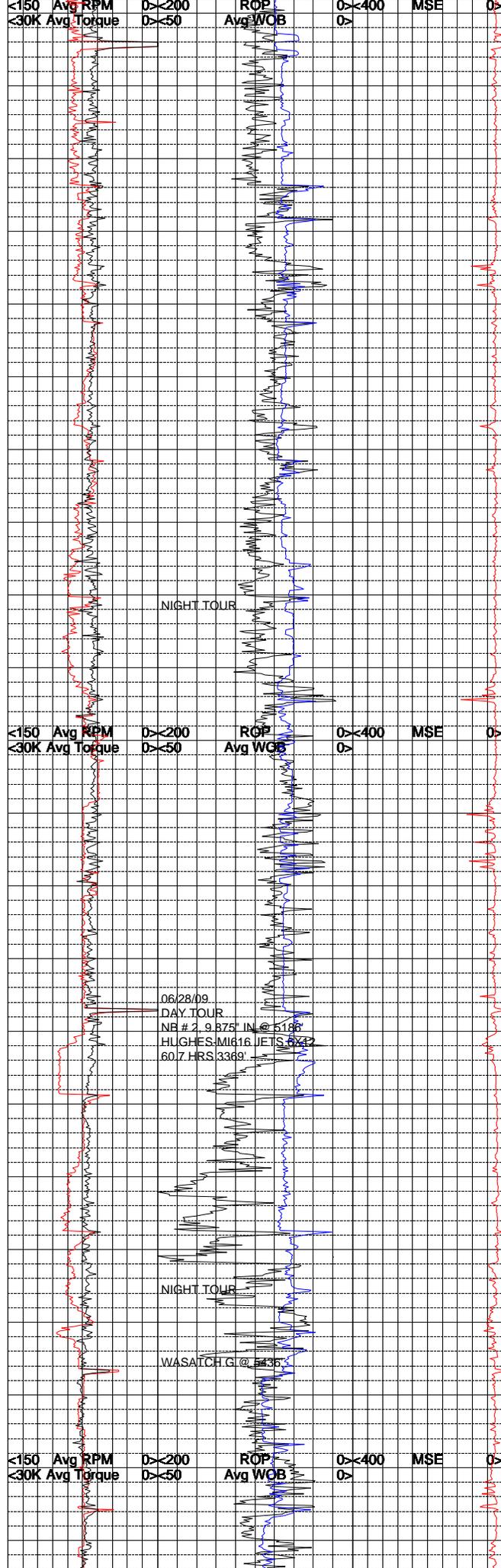
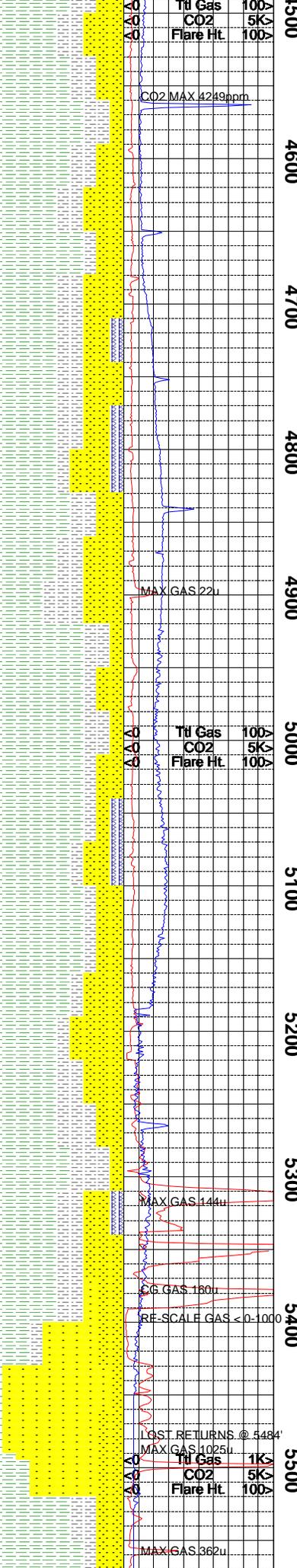
SHALE = COLOR VARIES FROM LIGHT GRAY TO GRAY TO BLACK TO TAN; SLIGHTLY DENSE TO BRITTLE TO CRUNCHY TENACITY; PLANAR TO BLOCKY TO IRREGULAR FRACTURE; PLATY TO FLAKY TO SCALY TO WEDGE LIKE TO MASSIVE CUTTINGS HABIT; EARTHY TO DULL TO WAXY TO OCCASIONALLY FROSTED LUSTER; SMOOTH TO CLAYEY TO SLIGHTLY

06/27/09

NB # 1, 9.875" IN @ 3582
HUGHES-HCD50424
JETS 4X18, 2X12
15.5 HRS 1204'

DAY TOUR

CO2 MAX 3076ppm



GRITTY TEXTURE; GENERALLY MASSIVE STRUCTURE.

SANDSTONE = WHITE TO LIGHT GRAY TO DARK GRAY TO TAN TO TRANSLUCENT; QUARTZ FRAMEWORK; VERY FINE TO FINE TO MEDIUM GRAIN SIZE; GENERALLY FAIR TO WELL SORTED GRAINS WITH LOW TO MODERATE SPHERICITY; FRIABLE TO FIRM FRIABLE HARDNESS; CALCITE CEMENTATION; SAMPLE IS READILY ACTIVE TO HCL SOLUTION; SAMPLE CONTAINS DARK BROWN AND BLACK LITHIC FRAGMENTS.

SHALE = LIGHT BLuish GRAY TO LIGHT YELLOW BROWN TO GRAY; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY TO OCC PLANAR FRACTURE; TABULAR TO WEDGELIKE TO OCC NODULAR CUTTINGS HABIT; DULL TO EARTHY TO OCC WAXY LUSTER; SMOOTH TO CLAYEY TEXTURE; THICK TO MASSIVELY BEDDED.

SANDSTONE = COLOR RANGES FROM GRAY TO WHITE TO TAN TO TRANSLUCENT; FINE TO MEDIUM GRAIN; FAIR TO WELL SORTED GRAINS; SUB-ANGULAR TO SUB-ROUND TO ROUND GRAINS WITH LOW TO MODERATE SPHERICITY; EASILY FRIABLE TO FRIABLE; CALCITE CEMENTATION; SAMPLE IS HIGHLY REACTIVE TO HCL SOLUTION; APPROX. TWO TO FIVE PERCENT OF SAMPLE CONSISTS OF BROWN AND BLACK LITHIC FRAGMENTS; NO FLUORESCENCE UNDER UV LIGHT.

SHALE = LIGHT BLuish GRAY TO LIGHT GRAY TO OCC HUES OF DARK YELLOWISH BROWN; CRUMBLY TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO OCC PLANAR FRACTURE; TABULAR TO WEDGELIKE TO OCC NODULAR AND ELONGATED HABIT; VERY EARTHY TO DULL LUSTER; SMOOTH TO SILTY TEXTURE WHEN CLEAN WITH CLAYEY FEEL BEFORE MUD IS WASHED OUT OF SAMPLE; THICK TO OCC THIN AND BANDED STRUCTURE; OVERALL WELL CONSOLIDATED SHALE MATRIX WITH GRAINS OF QUARTZ SAND AND KAOLINITE PRESENT <10%.

SANDSTONE = WHITE TO OPAQUE WITH TRACES OF LIGHT PINKISH HUES COMMON, DARK BROWN TO BLACK LITHICS APPEAR THROUGHOUT SAND GRAIN MATRIX; FINE TO MEDIUM LOWER TO OCC COARSE UPPER GRAINED; MODERATELY WELL SORTED; SUBROUNDED TO SUBANGULAR; MODERATE SPHERICITY WITH SOME ROUNDED GRAINS PRESENT <5%; FIRM TO BRITTLE TO OCC HARD; MODERATE TO VERY CALCAREOUS; KAOLINITE ALTERATION COMMON THROUGHOUT SAMPLE TRAY; NO VISIBLE HYDROCARBON INDICATORS PRESENT.

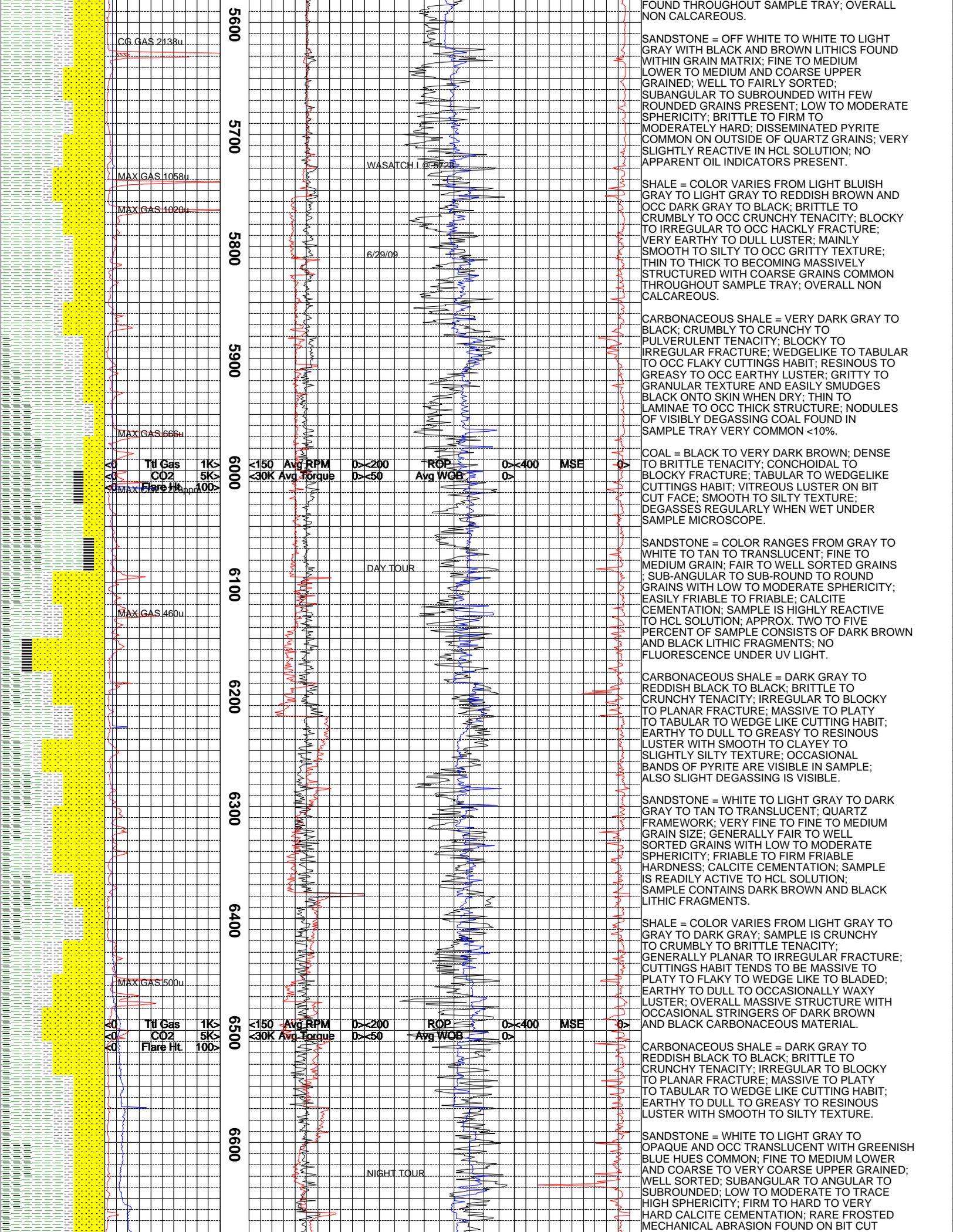
NOTE: TOOH @ 5186' MD FOR DIRECTIONAL TOOL AND NEW BIT.

SHALE = COLOR VARIES FROM LIGHT GRAY TO GRAY TO BLACK TO TAN; SLIGHTLY DENSE TO BRITTLE TO CRUNCHY TENACITY; PLANAR TO BLOCKY TO IRREGULAR FRACTURE; PLATY TO FLAKY TO SCALY TO WEDGE LIKE TO MASSIVE CUTTINGS HABIT; EARTHY TO DULL TO WAXY TO OCCASIONALLY FROSTED LUSTER; SMOOTH TO CLAYEY TEXTURE.

SILTSTONE = DARK GRAY TO LIGHT BROWN; CRUMBLY TO CRUNCHY TO OCC BRITTLE TENACITY; BLOCKY TO PLANAR FRACTURE TO IRREGULAR FRACTURE; SCALY TO TABULAR TO OCC WEDGELIKE HABIT; DULL TO EARTHY WITH RARE SPARKLY LUSTER; SMOOTH TO SILTY TEXTURE; THIN TO THICK STRUCTURE; BREAKS APART INTO PLANAR FRACTURES WITH GRITTY PROPERTIES; VERY FEW BUBBLES OCCUR IN HCL SOLUTION.

SANDSTONE = OFF WHITE TO TRANSLUCENT TO WHITE TO OCC LIGHT GREEN HUES AND DARK LITHICS COMMON; FINE TO MEDIUM GRAINED WITH SOME LOOSE COARSE GRAINS; FAIR TO WELL SORTED; ANGULAR TO SUBANGULAR TO OCC SUBROUNDED; LOW TO MODERATE SPHERICITY; VERY CLEAN QUARTZ GRAINED SAND VERY COMMON IN SAMPLE TRAY; NON TO VERY SLIGHTLY CALCAREOUS OVERALL; PYRITE CLUSTERS ABUNDANT AT WASATCH G CONTACT; NO FLUORESCENCE UNDER UV LIGHT.

SHALE = COLOR VARIES FROM LIGHT BLuish GRAY TO LIGHT GRAY TO REDDISH BROWN AND OCC LIGHT PURPLE GRAY; BRITTLE TO CRUMBLY TO OCC CRUNCHY TENACITY; BLOCKY TO IRREGULAR TO OCC HACKLY FRACTURE; VERY EARTHY TO DULL LUSTER; MAINLY SMOOTH TO SILTY TO OCC GRITTY TEXTURE; THIN TO THICK TO BECOMING MASSIVELY BEDDED OUTSIDE OF SANDSTONE BEDDING PLANES; TRACES OF AGGREGATED PYRITE



CG GAS 2138u

5600

FOUND THROUGHOUT SAMPLE TRAY; OVERALL NON CALCAREOUS.

SANDSTONE = OFF WHITE TO WHITE TO LIGHT GRAY WITH BLACK AND BROWN LITHICS FOUND WITHIN GRAIN MATRIX; FINE TO MEDIUM LOWER TO MEDIUM AND COARSE UPPER GRAINED; WELL TO FAIRLY SORTED; SUBANGULAR TO SUBROUNDED WITH FEW ROUNDED GRAINS PRESENT; LOW TO MODERATE SPHERICITY; BRITTLE TO FIRM TO MODERATELY HARD; DISSEMINATED PYRITE COMMON ON OUTSIDE OF QUARTZ GRAINS; VERY SLIGHTLY REACTIVE IN HCL SOLUTION; NO APPARENT OIL INDICATORS PRESENT.

MAX GAS 1058u

5700

WASATCH I @ 5728

SHALE = COLOR VARIES FROM LIGHT BLUISH GRAY TO LIGHT GRAY TO REDDISH BROWN AND OCC DARK GRAY TO BLACK; BRITTLE TO CRUMBLY TO OCC CRUNCHY TENACITY; BLOCKY TO IRREGULAR TO OCC HACKLY FRACTURE; VERY EARTHY TO DULL LUSTER; MAINLY SMOOTH TO SILTY TO OCC GRITTY TEXTURE; THIN TO THICK TO BECOMING MASSIVELY STRUCTURED WITH COARSE GRAINS COMMON THROUGHOUT SAMPLE TRAY; OVERALL NON CALCAREOUS.

MAX GAS 1020u

5800

6/29/09

CARBONACEOUS SHALE = VERY DARK GRAY TO BLACK; CRUMBLY TO CRUNCHY TO PULVERULENT TENACITY; BLOCKY TO IRREGULAR FRACTURE; WEDGELIKE TO TABULAR TO OCC FLAKY CUTTINGS HABIT; RESINOUS TO GREASY TO OCC EARTHY LUSTER; GRITTY TO GRANULAR TEXTURE AND EASILY SMUDGES BLACK ONTO SKIN WHEN DRY; THIN TO LAMINAE TO OCC THICK STRUCTURE; NODULES OF VISIBLY DEGASSING COAL FOUND IN SAMPLE TRAY VERY COMMON <10%.

MAX GAS 666u

5900

AD Ttl Gas 1K
AD CO2 5K
AD Flare Hit 100

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

COAL = BLACK TO VERY DARK BROWN; DENSE TO BRITTLE TENACITY; CONCHOIDAL TO BLOCKY FRACTURE; TABULAR TO WEDGELIKE CUTTINGS HABIT; VITREOUS LUSTER ON BIT CUT FACE; SMOOTH TO SILTY TEXTURE; DEGASSES REGULARLY WHEN WET UNDER SAMPLE MICROSCOPE.

MAX GAS 460u

6100

DAY TOUR

SANDSTONE = COLOR RANGES FROM GRAY TO WHITE TO TAN TO TRANSLUCENT; FINE TO MEDIUM GRAIN; FAIR TO WELL SORTED GRAINS; SUB-ANGULAR TO SUB-ROUND TO ROUND GRAINS WITH LOW TO MODERATE SPHERICITY; EASILY FRIABLE TO FRIABLE; CALCITE CEMENTATION; SAMPLE IS HIGHLY REACTIVE TO HCL SOLUTION; APPROX. TWO TO FIVE PERCENT OF SAMPLE CONSISTS OF DARK BROWN AND BLACK LITHIC FRAGMENTS; NO FLUORESCENCE UNDER UV LIGHT.

MAX GAS 500u

6200

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO CLAYEY TO SLIGHTLY SILTY TEXTURE; OCCASIONAL BANDS OF PYRITE ARE VISIBLE IN SAMPLE; ALSO SLIGHT DEGASSING IS VISIBLE.

6300

SANDSTONE = WHITE TO LIGHT GRAY TO DARK GRAY TO TAN TO TRANSLUCENT; QUARTZ FRAMEWORK; VERY FINE TO FINE TO MEDIUM GRAIN SIZE; GENERALLY FAIR TO WELL SORTED GRAINS WITH LOW TO MODERATE SPHERICITY; FRIABLE TO FIRM FRIABLE HARDNESS; CALCITE CEMENTATION; SAMPLE IS READILY ACTIVE TO HCL SOLUTION; SAMPLE CONTAINS DARK BROWN AND BLACK LITHIC FRAGMENTS.

6400

SHALE = COLOR VARIES FROM LIGHT GRAY TO GRAY TO DARK GRAY; SAMPLE IS CRUNCHY TO CRUMBLY TO BRITTLE TENACITY; GENERALLY PLANAR TO IRREGULAR FRACTURE; CUTTINGS HABIT TENDS TO BE MASSIVE TO PLATY TO FLAKY TO WEDGE LIKE TO BLADED; EARTHY TO DULL TO OCCASIONALLY WAXY LUSTER; OVERALL MASSIVE STRUCTURE WITH OCCASIONAL STRINGERS OF DARK BROWN AND BLACK CARBONACEOUS MATERIAL.

MAX GAS 500u

6500

AD Ttl Gas 1K
AD CO2 5K
AD Flare Hit 100

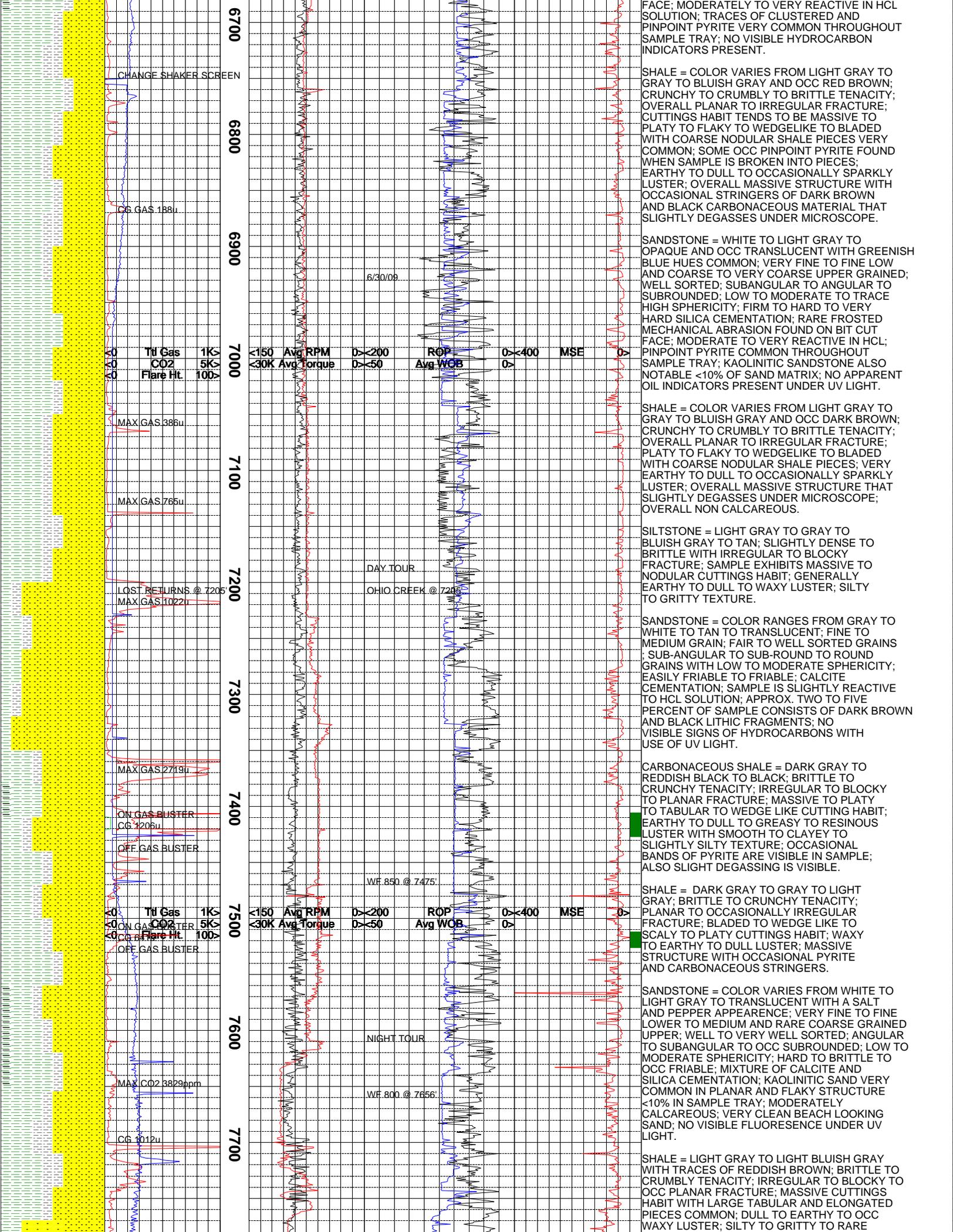
<150 Avg RPM >200 ROP <400 MSE >
<30K Avg Torque >50 Avg WOB

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO SILTY TEXTURE.

6600

NIGHT TOUR

SANDSTONE = WHITE TO LIGHT GRAY TO OPAQUE AND OCC TRANSLUCENT WITH GREENISH BLUE HUES COMMON; FINE TO MEDIUM LOWER AND COARSE TO VERY COARSE UPPER GRAINED; WELL SORTED; SUBANGULAR TO ANGULAR TO SUBROUNDED; LOW TO MODERATE TO TRACE HIGH SPHERICITY; FIRM TO HARD TO VERY HARD CALCITE CEMENTATION; RARE FROSTED MECHANICAL ABRASION FOUND ON BIT CUT



6700
CHANGE SHAKER SCREEN
6800
CG GAS 188u
6900
6/30/09
7000
MAX GAS 386u
7100
MAX GAS 765u
7200
LOST RETURNS @ 7205
MAX GAS 1022u
7300
7400
MAX GAS 2719u
ON GAS BUSTER CG 1205u
OFF GAS BUSTER
7500
MAX CO2 3829ppm
7600
7700
CG 1012u

≤ 150 Avg RPM ≤ 200 ROP ≤ 400 MSE
 $\leq 30K$ Avg Torque ≤ 50 Avg WOB

FACE; MODERATELY TO VERY REACTIVE IN HCL SOLUTION; TRACES OF CLUSTERED AND PINPOINT PYRITE VERY COMMON THROUGHOUT SAMPLE TRAY; NO VISIBLE HYDROCARBON INDICATORS PRESENT.

SHALE = COLOR VARIES FROM LIGHT GRAY TO GRAY TO BLUISH GRAY AND OCC RED BROWN; CRUNCHY TO CRUMBLY TO BRITTLE TENACITY; OVERALL PLANAR TO IRREGULAR FRACTURE; CUTTINGS HABIT TENDS TO BE MASSIVE TO PLATY TO FLAKY TO WEDGELIKE TO BLADED WITH COARSE NODULAR SHALE PIECES VERY COMMON; SOME OCC PINPOINT PYRITE FOUND WHEN SAMPLE IS BROKEN INTO PIECES; EARTHY TO DULL TO OCCASIONALLY SPARKLY LUSTER; OVERALL MASSIVE STRUCTURE WITH OCCASIONAL STRINGERS OF DARK BROWN AND BLACK CARBONACEOUS MATERIAL THAT SLIGHTLY DEGASSES UNDER MICROSCOPE.

SANDSTONE = WHITE TO LIGHT GRAY TO OPAQUE AND OCC TRANSLUCENT WITH GREENISH BLUE HUES COMMON; VERY FINE TO FINE LOW AND COARSE TO VERY COARSE UPPER GRAINED; WELL SORTED; SUBANGULAR TO ANGULAR TO SUBROUNDED; LOW TO MODERATE TO TRACE HIGH SPHERICITY; FIRM TO HARD TO VERY HARD SILICA CEMENTATION; RARE FROSTED MECHANICAL ABRASION FOUND ON BIT CUT FACE; MODERATE TO VERY REACTIVE IN HCL; PINPOINT PYRITE COMMON THROUGHOUT SAMPLE TRAY; KAOLINITIC SANDSTONE ALSO NOTABLE <10% OF SAND MATRIX; NO APPARENT OIL INDICATORS PRESENT UNDER UV LIGHT.

SHALE = COLOR VARIES FROM LIGHT GRAY TO GRAY TO BLUISH GRAY AND OCC DARK BROWN; CRUNCHY TO CRUMBLY TO BRITTLE TENACITY; OVERALL PLANAR TO IRREGULAR FRACTURE; PLATY TO FLAKY TO WEDGELIKE TO BLADED WITH COARSE NODULAR SHALE PIECES; VERY EARTHY TO DULL TO OCCASIONALLY SPARKLY LUSTER; OVERALL MASSIVE STRUCTURE THAT SLIGHTLY DEGASSES UNDER MICROSCOPE; OVERALL NON CALCAREOUS.

SILTSTONE = LIGHT GRAY TO GRAY TO BLUISH GRAY TO TAN; SLIGHTLY DENSE TO BRITTLE WITH IRREGULAR TO BLOCKY FRACTURE; SAMPLE EXHIBITS MASSIVE TO NODULAR CUTTINGS HABIT; GENERALLY EARTHY TO DULL TO WAXY LUSTER; SILTY TO GRITTY TEXTURE.

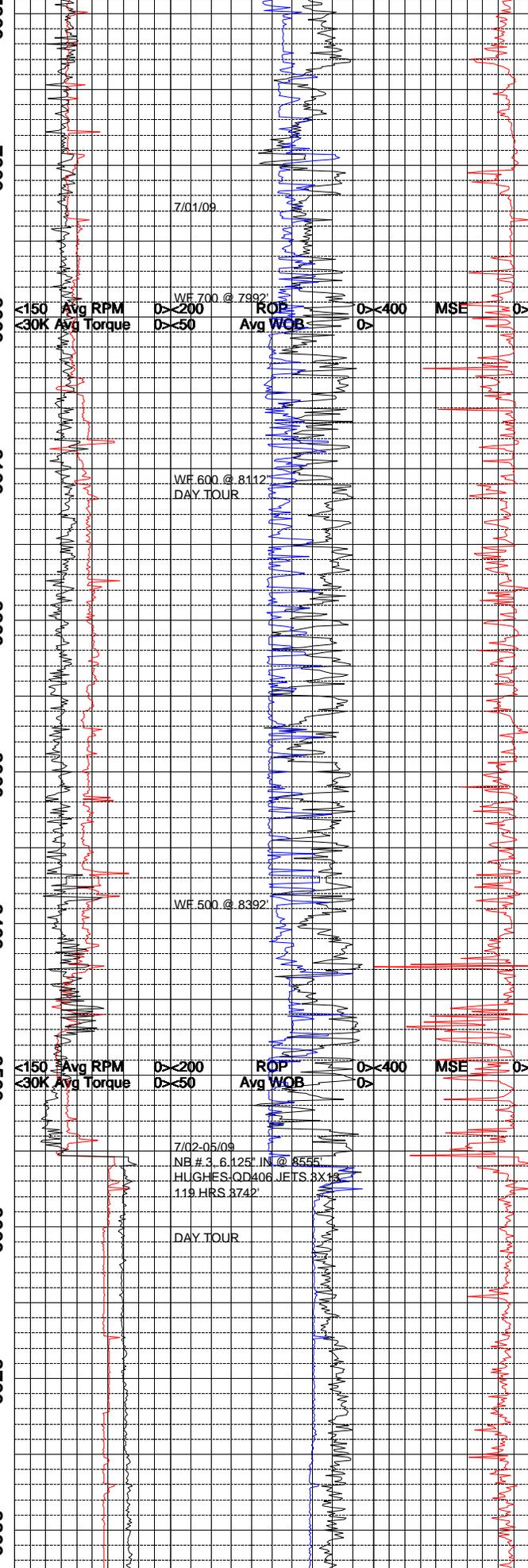
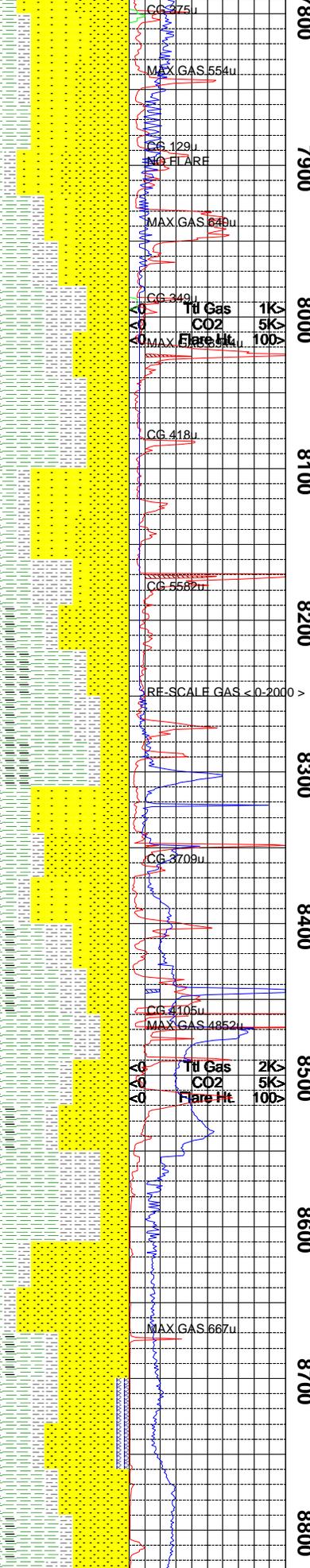
SANDSTONE = COLOR RANGES FROM GRAY TO WHITE TO TAN TO TRANSLUCENT; FINE TO MEDIUM GRAIN; FAIR TO WELL SORTED GRAINS ; SUB-ANGULAR TO SUB-ROUND TO ROUND GRAINS WITH LOW TO MODERATE SPHERICITY; EASILY FRIABLE TO FRIABLE; CALCITE CEMENTATION; SAMPLE IS SLIGHTLY REACTIVE TO HCL SOLUTION; APPROX. TWO TO FIVE PERCENT OF SAMPLE CONSISTS OF DARK BROWN AND BLACK LITHIC FRAGMENTS; NO VISIBLE SIGNS OF HYDROCARBONS WITH USE OF UV LIGHT.

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO CLAYEY TO SLIGHTLY SILTY TEXTURE; OCCASIONAL BANDS OF PYRITE ARE VISIBLE IN SAMPLE; ALSO SLIGHT DEGASSING IS VISIBLE.

SHALE = DARK GRAY TO GRAY TO LIGHT GRAY; BRITTLE TO CRUNCHY TENACITY; PLANAR TO OCCASIONALLY IRREGULAR FRACTURE; BLADED TO WEDGE LIKE TO SCALY TO PLATY CUTTINGS HABIT; WAXY TO EARTHY TO DULL LUSTER; MASSIVE STRUCTURE WITH OCCASIONAL PYRITE AND CARBONACEOUS STRINGERS.

SANDSTONE = COLOR VARIES FROM WHITE TO LIGHT GRAY TO TRANSLUCENT WITH A SALT AND PEPPER APPEARANCE; VERY FINE TO FINE LOWER TO MEDIUM AND RARE COARSE GRAINED UPPER; WELL TO VERY WELL SORTED; ANGULAR TO SUBANGULAR TO OCC SUBROUNDED; LOW TO MODERATE SPHERICITY; HARD TO BRITTLE TO OCC FRIABLE; MIXTURE OF CALCITE AND SILICA CEMENTATION; KAOLINITIC SAND VERY COMMON IN PLANAR AND FLAKY STRUCTURE <10% IN SAMPLE TRAY; MODERATELY CALCAREOUS; VERY CLEAN BEACH LOOKING SAND; NO VISIBLE FLUORESENCE UNDER UV LIGHT.

SHALE = LIGHT GRAY TO LIGHT BLUISH GRAY WITH TRACES OF REDDISH BROWN; BRITTLE TO CRUMBLY TENACITY; IRREGULAR TO BLOCKY TO OCC PLANAR FRACTURE; MASSIVE CUTTINGS HABIT WITH LARGE TABULAR AND ELONGATED PIECES COMMON; DULL TO EARTHY TO OCC WAXY LUSTER; SILTY TO GRITTY TO RARE



CLAYEY TEXTURE; OVERALL THICK TO MASSIVE STRUCTURE; PLANAR EMBEDDED FEATURES FOUND ON BIT CUT FACE; TRACES OF PINPOINT PYRITE COMMON FOUND WITHIN THE SHALE GRAINS; OVERALL NON CALCAREOUS.

SAND = WHITE TO CLEAR AND TRANSLUCENT WITH LIGHT PINK AND LIGHT GREEN HUES; ANGULAR TO CUBIC, VERY HARD QUARTZ GRAINS; FINE TO MEDIUM GRAINED; VERY WELL SORTED AND CONSOLIDATED CLEAN LOOKING SAND; OVERALL SLIGHTLY CALCAREOUS; NO VISIBLE HYDROCARBON INDICATORS UNDER UV LIGHT.

SILTSTONE = DARK GRAY TO LIGHT TAN WITH LIGHT BROWNISH HUES; DENSE TO BRITTLE TENACITY; OVERALL BLOCKY FRACTURE; MASSIVE TO WEDGELIKE TO RARELY NODULAR CUTTINGS HABIT; EARTHY TO DULL TO OCC RESINOUS LUSTER; VERY SILTY TO CLAYEY TEXTURE; THICK TO MASSIVE STRUCTURE; BREAKS INTO PLANAR PIECES AGAINST BIT CUT FACE; VERY SMALL INCLUSIONS OF PINPOINT PYRITE AND SILICIOUS SAND PARTICLES WHEN SCRAPPED WITH METAL TOOL; OVERALL NON TO VERY SLIGHTLY CALCAREOUS.

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO CLAYEY TO SLIGHTLY SILTY TEXTURE; OCCASIONAL BANDS OF PYRITE AND CARBONACEOUS MATERIAL VISIBLE IN SAMPLE.

SANDSTONE = COLOR VARIES FROM GRAY TO WHITE TO TAN TO TRANSLUCENT; FINE TO MEDIUM GRAIN; FAIR TO WELL SORTED GRAINS ; SUB-ANGULAR TO SUB-ROUND TO ROUND GRAINS WITH LOW TO MODERATE SPHERICITY; FRIABLE TO FIRM FRIABLE; CALCITE CEMENTATION; SAMPLE IS SLIGHTLY REACTIVE TO HCL SOLUTION; APPROX. FIVE TO TEN PERCENT OF SAMPLE CONSISTS OF BROWN AND BLACK LITHIC FRAGMENTS; NO VISIBLE SIGNS OF FLUORESCENCE UNDER UV LIGHT.

SHALE = DARK GRAY TO GRAY TO LIGHT GRAY; BRITTLE TO CRUNCHY TENACITY; PLANAR TO OCCASIONALLY IRREGULAR FRACTURE; BLADED TO WEDGE LIKE TO SCALY TO PLATY CUTTINGS HABIT; WAXY TO EARTHY TO DULL LUSTER; MASSIVE STRUCTURE WITH OCCASIONAL PYRITE AND CARBONACEOUS STRINGERS.

SILTSTONE = DARK GRAY TO LIGHT TAN WITH LIGHT BROWNISH HUES; DENSE TO BRITTLE TENACITY; OVERALL BLOCKY FRACTURE; MASSIVE TO WEDGELIKE TO RARELY NODULAR CUTTINGS HABIT; EARTHY TO DULL TO OCC RESINOUS LUSTER; VERY SILTY TO CLAYEY TEXTURE; THICK TO MASSIVE STRUCTURE.

SANDSTONE = WHITE TO GRAY TO CLEAR WITH DARK LITHICS COMMON; FINE TO MEDIUM GRAINED; FAIR TO WELL SORTED; SUBANGULAR GRAINS WITH LOW TO MODERATE SPHERICITY; MAINLY CALCITIC MATRIX; SLIGHTLY CALCAREOUS; NO VISIBLE FLUORESCENCE.

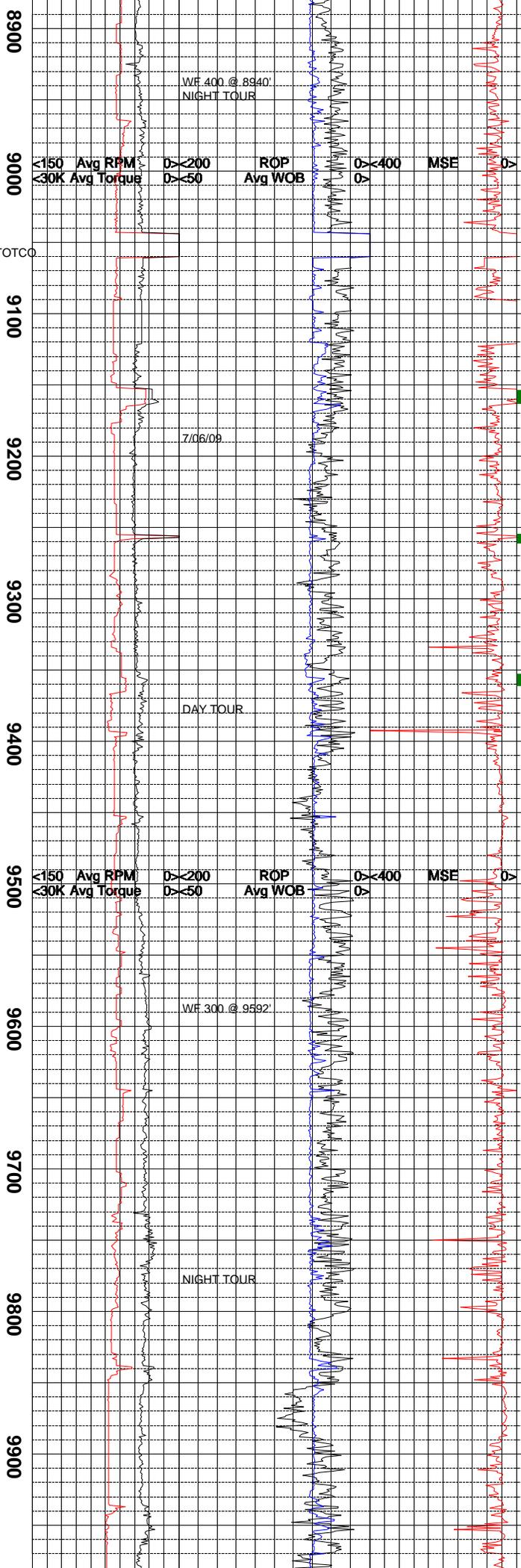
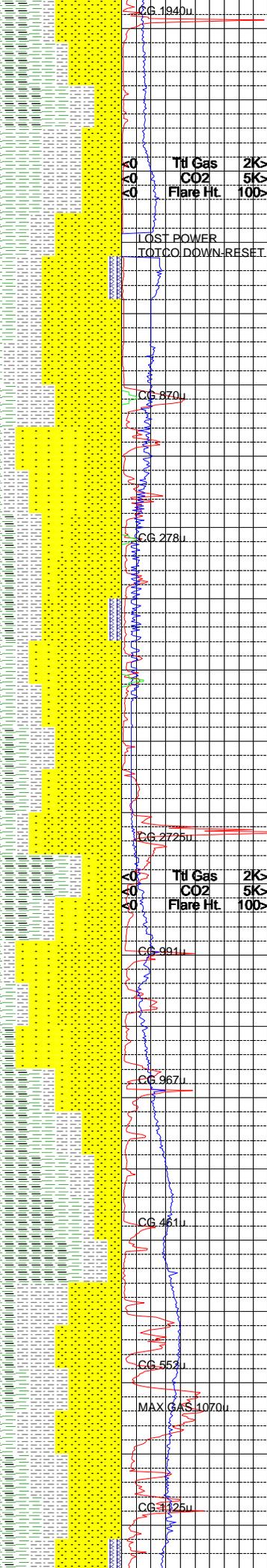
NOTE: TD INTERMEDIATE SECTION @ 8555' MD ON 7/01/09.

NOTE: COMMENCED DRILLING PRODUCTION SECTION ON 7/05/09.

SILTSTONE = DARK GRAY TO LIGHT BROWN; CRUMBLY TO CRUNCHY TO OCC BRITTLE TENACITY; BLOCKY TO PLANAR FRACTURE TO IRREGULAR FRACTURE; SCALY TO TABULAR TO OCC WEDGELIKE HABIT; DULL TO EARTHY WITH RARE SPARKLY LUSTER; SMOOTH TO SILTY TEXTURE; THIN TO THICK STRUCTURE.

SANDSTONE = COLOR VARIES FROM GRAY WHITE TO OCCASIONALLY TRANSLUCENT TO TRANSPARENT; QUARTZ FRAMEWORK; GRAIN SIZE TENDS TO BE FINE TO MEDIUM TO OCCASIONALLY COARSE; GRAINS ARE FAIR TO WELL SORTED WITH GENERALLY ROUND TO SUB-ROUND ANGULARITY AND LOW TO MODERATE SPHERICITY; SURFACE FEATURES INCLUDE OCCSIONALLY POLISHED AND FROSTED GRAINS; SAMPLE IS FRIABLE TO FIRM FRIABLE TO MODERATELY HARD; OVERALL SILICA CEMENTATION ALTHOUGH SLIGHT REACTION TO HCL SOLUTION; APPROX. FIVE PERCENT OF SAMPLE CONSISTS OF BROWN AND BLACK LITHIC FRAGMENTS; NO FLUORESCENCE UNDER UV LIGHT.

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY



TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO CLAYEY TO SLIGHTLY SILTY TEXTURE; OCCASIONAL BANDS OF PYRITE ARE VISIBLE IN SAMPLE; ALSO SLIGHT DEGASSING IS VISIBLE.

SILTSTONE = LIGHT TO DARK GRAY TO OCC DARK BROWN WITH TRACES OF BLACK; DENSE TO BRITTLE TO OCC TOUGH TENACITY; BLOCKY TO IRREGULAR FRACTURE; MASSIVE TO TABULAR AND OCC WEDGELIKE CUTTINGS HABIT; EARTHY TO DULL TO RARE GREASY LUSTER; VERY SILTY TO GRITTY TEXTURE; OVERALL THICK TO MASSIVELY BEDDED; SLIGHTLY REACTS WITH HCL 10% SOLUTION.

SANDSTONE = COLOR VARIES FROM LIGHT GRAY TO WHITE TO OCC TRANSLUCENT WITH A SALT AND PEPPER APPEARANCE; MEDIUM TO COARSE TO OCC FINE GRAINED; FAIR TO WELL SORTED; ROUND TO SUBROUNDED WITH FEW ANGULAR GRAINS PRESENT; BRITTLE TO HARD; LOW TO MODERATE SPHERICITY; MAINLY SILICA CEMENTATION WITH LOOSE QUARTZ CRYSTALS COMMON; MODERATELY TO VERY CALCAREOUS IN HCL SOLUTION; NO APPARENT HYDROCARBON INDICATORS PRESENT.

CARBONACEOUS SHALE = DARK GRAY TO BROWNISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO OCC PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGELIKE CUTTINGS HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER; SMOOTH TO CLAYEY TO SILTY TO SLIGHTLY ABRASIVE TEXTURE; OCCASIONAL PINPOINT PYRITE COMMON ON SAMPLE BIT CUT FACE; DEGASSES VERY SLIGHTLY UNDER NORMAL WHITE LIGHT.

SILTSTONE = DARK GRAY TO LIGHT TAN WITH LIGHT BROWNISH HUES; DENSE TO BRITTLE TENACITY; OVERALL BLOCKY FRACTURE; MASSIVE TO WEDGELIKE TO RARELY NODULAR CUTTINGS HABIT; EARTHY TO DULL TO OCC RESINOUS LUSTER; VERY SILTY TO CLAYEY TEXTURE; THICK TO MASSIVE STRUCTURE.

SHALE = GENERALLY GRAY TO DARK GRAY IN COLOR; BRITTLE TO CRUNCHY TENACITY; PLANAR TO IRREGULAR FRACTURE; PLATY TO FLAKY TO SCALY TO WEDGELIKE TO BLADED TO CUTTINGS HABIT; DULL TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; OCCASIONAL STRINGERS OF PYRITE ARE VISIBLE.

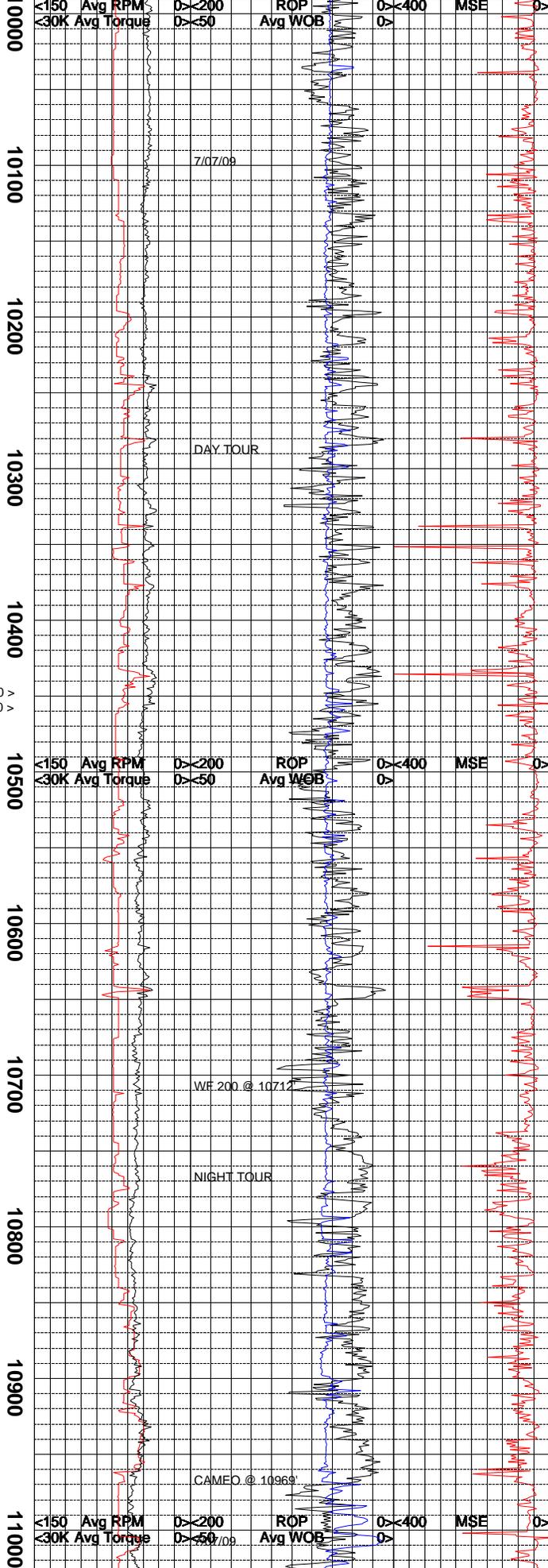
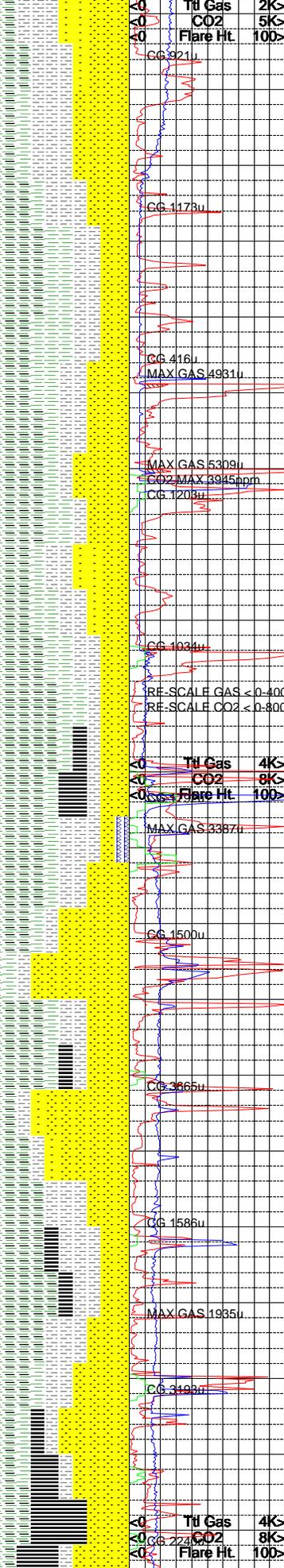
SANDSTONE = COLOR VARIES FROM GRAY TO WHITE TO TAN TO TRANSLUCENT; FINE TO MEDIUM GRAIN; FAIR TO WELL SORTED GRAINS; SUB-ANGULAR TO SUB-ROUND TO ROUND GRAINS WITH LOW TO MODERATE SPHERICITY; FRIABLE TO FIRM FRIABLE; CALCITE CEMENTATION; SAMPLE IS SLIGHTLY REACTIVE TO HCL SOLUTION; APPROX. FIVE TO TEN PERCENT OF SAMPLE CONSISTS OF BROWN AND BLACK LITHIC FRAGMENTS; NO VISIBLE SIGNS OF FLUORESCENCE UNDER UV LIGHT.

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO CLAYEY TO SLIGHTLY SILTY TEXTURE; OCCASIONAL BANDS OF PYRITE ARE VISIBLE IN SAMPLE; ALSO SLIGHT DEGASSING IS VISIBLE.

SANDSTONE = COLOR RANGES FROM OFF WHITE TO TANNISH BROWN TO TRANSLUCENT WITH A SALT AND PEPPER APPEARANCE AND TRACES OF DARK GREENISH HUES; FINE TO MEDIUM LOWER TO COARSE AND OCC VERY COARSE UPPER GRAINED; POORLY TO FAIRLY SORTED WITH SOME WELL SORTED SILICA CEMENTATION; OVERALL SUBANGULAR TO SUBROUNDED; MODERATE TO LOW TO OCC HIGH SPHERICITY; FIRM FRIABLE TO MODERATELY HARD AND OCC HARD; DARK BROWN AND BLACK LITHICS FOUND EMBEDDED WITHIN SAND MATRIX; STRINGERS OF CARBONACEOUS SHALE COMMON; KAOLINIC SAND ALSO VISIBLE WITHIN SAMPLE TRAY <10%; MODERATELY CALCAREOUS; NO VISIBLE FLUORESCENCE UNDER UV LIGHT.

SILTSTONE = DARK GRAY TO LIGHT GRAY WITH LIGHT BROWNISH BLUE HUES; DENSE TO OCC BRITTLE TENACITY; BLOCKY TO IRREGULAR FRACTURE; WEDGELIKE TO TABULAR TO MASSIVE CUTTINGS HABIT; EARTHY TO GREASY LUSTER; VERY SILTY TO CLAYLIKE TEXTURE; THICK TO MASSIVE STRUCTURE OVERALL; LESS THAN 2% OF VISIBLE DEGASSING COAL FRAGMENTS FOUND WITHIN SAMPLE TRAY.

SHALE = OVERALL GRAY TO DARK GRAY WITH LIGHT BLuish HUES; CRUNCHY TO OCC



BRITTLE TENACITY; IRREGULAR TO PLATY TO OCC SPILTERY AND PLANAR FRACTURE; PLATY TO FLAKY TO SCALY TO WEDGELIKE TO TRACE BLADED CUTTINGS HABIT; DULL TO WAXY TO EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; OCCASIONAL STRINGERS OF PINPOINT PYRITE ARE COMMON ALONG WITH SLIGHTLY DEGASSING CARBONACEOUS SHALE FOUND WITHIN SAMPLE MATRIX.

SANDSTONE = COLOR RANGES FROM OFF WHITE TO TANNISH BROWN TO TRANSLUCENT WITH A SALT AND PEPPER APPEARANCE AND TRACES OF DARK GREENISH HUES; FINE TO MEDIUM LOWER TO COARSE AND OCC VERY COARSE UPPER GRAINED; POORLY TO FAIRLY SORTED WITH SOME WELL SORTED SILICA CEMENTATION; OVERALL SUBANGULAR TO SUBROUNDED; MODERATE TO LOW SPHERICITY; FIRM FRIABLE TO MODERATELY HARD AND OCC HARD; DARK BROWN AND BLACK LITHICS FOUND WITHIN SAND MATRIX; STRINGERS OF SHALE AND CARBONACEOUS SHALE COMMON; KAOLINIC SAND ALSO VISIBLE WITHIN SAMPLE; TRAY <10%; MODERATELY CALCAREOUS; NO VISIBLE HYDROCARBON INDICATORS PRESENT.

CARBONACEOUS SHALE = DARK GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGE LIKE CUTTING HABIT; EARTHY TO DULL TO GREASY TO RESINOUS LUSTER WITH SMOOTH TO CLAYEY TO SLIGHTLY SILTY TEXTURE; OCCASIONAL STRINGERS OF CARBONACEOUS MATERIAL AND PYRITE ARE VISIBLE IN SAMPLE.

SANDSTONE = COLOR VARIES FROM GRAY WHITE TO OCCASIONALLY TRANSLUCENT TO TRANSPARENT; QUARTZ FRAMEWORK; GRAIN SIZE TENDS TO BE FINE TO MEDIUM TO OCCASIONALLY COARSE; GRAINS ARE FAIR TO WELL SORTED WITH GENERALLY ROUND TO SUB-ROUND ANGULARITY AND LOW TO MODERATE SPHERICITY; SURFACE FEATURES INCLUDE OCCASIONALLY POLISHED AND FROSTED GRAINS; SAMPLE IS FRIABLE TO FIRM FRIABLE TO MODERATELY HARD; OVERALL SILICA CEMENTATION ALTHOUGH SLIGHT REACTION TO HCL SOLUTION; SAMPLE CONSISTS OF APPROX. TWO TO FIVE PERCENT DARK COLORED LITHIC FRAGMENTS; UNDER UV LIGHT NO VISIBLE SIGNS OF HYDROCARBONS.

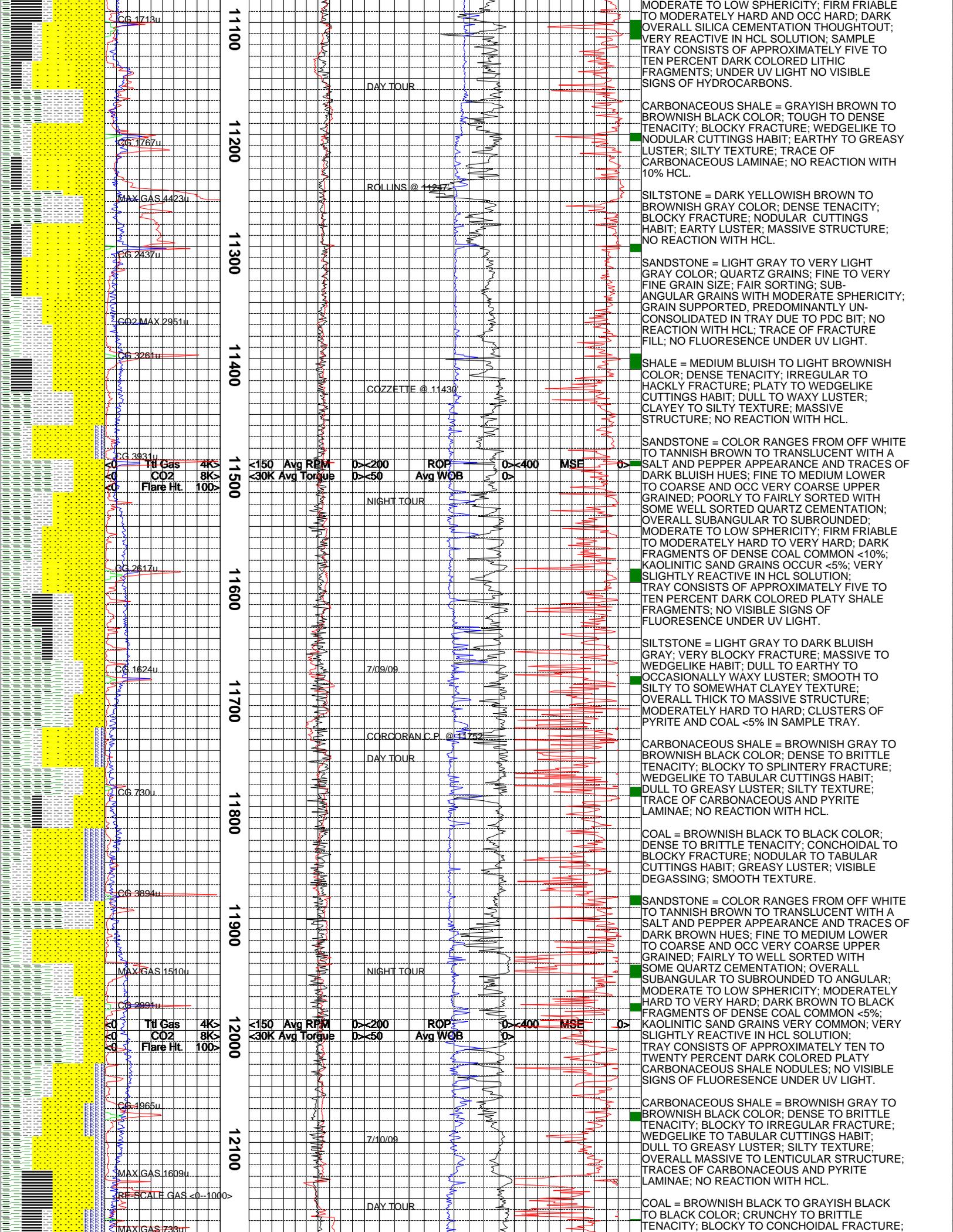
SHALE - COLOR VARIES FROM GRAY TO DARK GRAY TO OCCASIONALLY BLACK; CRUNCHY TO BRITTLE TO SLIGHTLY DENSE TENACITY; IRREGULAR TO PLANAR TO HACKLY FRACTURE; PLATY TO FLAKY TO WEDGE-LIKE TO BLADED CUTTINGS HABIT; SLIGHTLY WAXY TO DULL TO EARTHY LUSTER; TEXTURE IS GENERALLY SMOOTH TO SLIGHTLY CLAYEY; THIN LAMINAE TO MASSIVE STRUCTURE; OCCASIONAL CARBONACEOUS MATERIAL PRESENT IN SAMPLE.

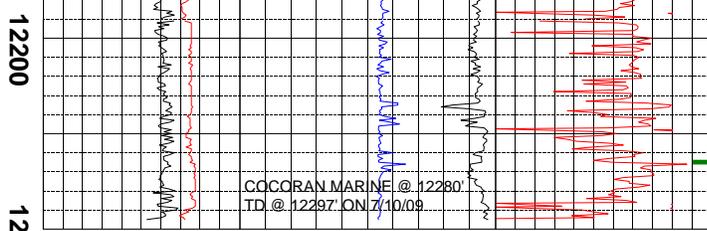
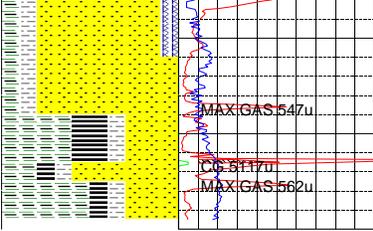
CARBONACEOUS SHALE = DARK GRAY TO GRAY TO REDDISH BLACK TO BLACK; BRITTLE TO CRUNCHY TENACITY; IRREGULAR TO BLOCKY TO PLANAR FRACTURE; MASSIVE TO PLATY TO TABULAR TO WEDGELIKE CUTTINGS HABIT; EARTHY TO DULL TO GREASY TO RESINOUS TO SLIGHTLY SPARKLY LUSTER; OVERALL HAS A SMOOTH TO CLAYEY TO ASHY AND SLIGHTLY SILTY TEXTURE; VERY COMMON OCCURENCE OF CARBONACEOUS MATERIAL AND PYRITE CLUSTERS ARE VISIBLE IN SAMPLE; NON CALCAREOUS OVERALL.

SHALE = GENERALLY GRAY TO DARK GRAY IN COLOR; BRITTLE TO CRUNCHY TENACITY; PLANAR TO IRREGULAR TO BLOCKY FRACTURE; MASSIVE TO TABULAR WITH OCCASIONALLY FLAKY TO SCALY TO WEDGELIKE TO BLADED CUTTINGS HABIT; DULL TO SOMEWHAT WAXY AND EARTHY LUSTER; SMOOTH TO CLAYEY TEXTURE; OCCASIONAL STRINGERS OF PYRITE AND LARGE CARBONACEOUS SHALE NODULES ARE VERY COMMON.

COAL = BLACK TO VERY DARK GRAY; CRUNCHY TO BRITTLE TO OCC DENSE TENACITY; BLOCKY TO CONCHOIDALLY FRACTURED; OVERALL MASSIVE TO TABULAR CUTTINGS HABIT; METALLIC TO VITREOUS LUSTER ON BIT CUT FACE; VERY SMOOTH TEXTURE; WELL LAMINATED TO THICK STRUCTURE; DISTINCT PLANAR FEATURES EMBEDDED WITHIN GRAIN MATRIX WITH VISIBLE DEGASSING COMMON.

SANDSTONE = COLOR RANGES FROM OFF WHITE TO TANNISH BROWN TO TRANSLUCENT WITH A SALT AND PEPPER APPEARANCE AND TRACES OF DARK GREENISH HUES; FINE TO MEDIUM LOWER TO COARSE AND OCC VERY COARSE UPPER GRAINED; POORLY TO FAIRLY SORTED WITH SOME WELL SORTED SILICA CEMENTATION; OVERALL SUBANGULAR TO SUBROUNDED;





TABULAR TO NODULAR TO WEDGELIKE CUTTINGS HABIT; GREASY TO DULL LUSTER; SMOOTH TO GRITTY TEXTURE; MASSIVE STRUCTURE; DE-GASSING IS VISIBLE.

SILTSTONE = BROWNISH GRAY COLOR; BRITTLE TENACITY; IRREGULAR FRACTURE; NODULAR CUTTINGS HABIT; EARTHY LUSTER; SILTY TEXTURE; MASSIVE STRUCTURE.

NOTE = TD PRODUCTION @ 12297' 07/10/09.

COCORAN MARINE @ 12280'
TD @ 12297' ON 7/10/09

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