EPOCH
WELL LOGGING, INC.

COMPANY	NAHAMA & WEAGANT ENERGY Co.
WELL	C.E.R. # 11-16-64
FIELD	MIST
LOCATION	1092'S & 1365'E f/the NW corner of Sec 16, T6N, R4W, W.B.&M.
COUNTY, STATE	Columbia, Oregon
API WELL INDEX NO.	
ELEVATION	1448.3' G.L. 1459.8' K.B.
DATES	FROM 10-3-90 TO 10-10-90
DEPTHS	FROM 42' TO 2338'
SPUD DATE	10-3-90
DRILLING CONTRACTOR	Taylor Drilling Inc. Rig #5
MUD COMPANY	Beaver Mud Company
LOGGING GEOLOGISTS	Bill Gilmour Lewis Suffin

ABBREVIATIONS

NB	BIT	MW	MUD WEIGHT
RRB	RERUN BIT	VIS	FUNNEL VISCOSITY
RTB	RE-TIP BIT	PV	PLASTIC VISCOSITY
CB	CORE BIT	YP	YIELD POINT
T.G.	TRIP GAS	FL	FLUID LOSS (cc/30 min)
S.G.	SURVEY GAS	CL	PPM CHLORIDE ION
W.G.	WIPER GAS	RM	MUD RESISTIVITY
C.G.	CONNECTION GAS	RMF	FILTRATE RESISTIVITY
WOB	WEIGHT ON BIT	LAT	LOGGED AFTER TRIP
RPM	ROTARY REV/MIN	NR	NO RETURNS
PP	PUMP PRESSURE	PR	POOR RETURNS
SPM	STROKES/MIN	MUD TYPE	Gel/water to 600'; Polymer beyond

CASING RECORD

16" cond AT 31.5'
8 5/8" AT 592'
AT
AT

HOLE SIZE

12¼" AT 600'
7 7/8" AT 2338'
AT
AT

·⊡ SAND/SANDSTONE	☐ CLAY	Ⅰ LIMESTONE	T TUFF	▬ LIGNITE
— SHALE	⌴ DIATOMITE	Z DOLOMITE	F FOSSIL	G GLAUCONITE
-· SILTSTONE	Ø CONGLOMERATE	b BASALT	M MICA	P PYRITE

OIL: BASED ON LIVE OIL IN UNWASHED CUTTINGS AND PERCENT STAINING AND FLUORESCENCE OF WASHED SAMPLES.

PENETRATION

EPOCH WELL LOGGING, INC.
DRILL RATE (FT/HR)
drilling data

DEPTH

ANALYSIS OF RETURNS

LITHOLOGY

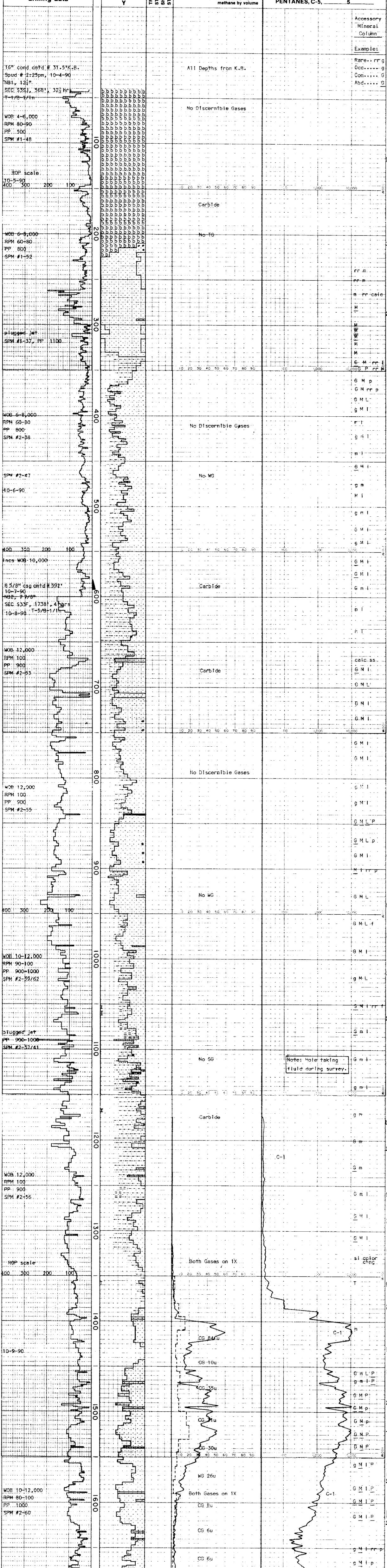
OIL: TRACE, STRONG TRACE, SHOW, STRONG SHOW

GAS — UNITS
DITCH — TOTAL GAS
CUTTINGS GAS
CALIBRATION 100 units = 2% methane by volume

CHROMATOGRAPH — PPM
METHANE, C-1,
ETHANE, C-2,
PROPANE, C-3,
BUTANES, C-4, 4
PENTANES, C-5, 5

REMARKS

LITHOLOGIC DESCRIPTION
MUD PROPERTIES
SURVEYS, OTHER TEST DATA



Note: All colors are referenced to the GSA Rock-Color chart.
-Equipment calibrated to SPWLA standards.
-All carbides 500gms unless otherwise noted.
-Connection, survey, wiper, and carbide gases reported above background; Trip Gas = max gas.

Note: Modifiers in Accessory Mineral Column are referenced to the number of cuttings present in a standard sample tray:

Rare	1-5 cuttings
Occasional	5-10 cuttings
Common	10+ cuttings
Abundant	present thru entire sample.

MW 8.8+ VIS 75

Basalt: typ altered/weathered - mod yel-brn, sli-v frm, occ dk gry/blk fresh hd ctgs; com thn blk to dk brn to orng surf coatings; abd amygdules in select spls composed of pl yel-brn, pl grn, & pl orngsh wht sft waxy amorphous mnrls; pred aphanitic groundmass w/com sm long thin phenocrysts - minor frac grnsh fnly xln ctgs.

Carbide 3.7 min @ 163', 105u
SPM #1=52, 120% theor, 7 min dur

MW 8.9 VIS 63 PV 18 YP 26
pH 9.0 FL N/C Cl- 100ppm

Note: POOH @ 200' to chk bit, OK.

Sandstone: 1st occ 210-20' spl; mod brnsh olv; fria-mod frm; fn-crs, dom med; ang-sbrnd, tr rnd; mod-lo spher; fr-wl srtd; wxy yelsh/grnsh noncalc cmt/mtrx; tr subtle grdng/lineations; dom volcanics - basalt + sftr pl olv amorphous clasts - gd tr red/orng aphanitic clasts; occ clr qtz/plag - oft aprs iron stnd; frly com dk brn coatings/veins; rr muscovite, v rr transl grn serpentine; sli tr hornblende xls.

Note: Incr VIS to 300+ to make connections @ 252' & 282'+.

Sand: Incr rnd clasts + micas w/ incr ROP 262'+; mod brnsh yel overall, indiv clasts are pl yel, yel-brn, orng-yel, occ clr, red, red-orng, dk gry, dk brn, fr grn, pk, prpl; dom fn-med; ang-rnd, dom sbrnd; pred lse, tr fria; dom volcanoclastics - occ clr plag/qtz; incr micas vari muscv, gld(phlogopite?), biot, tr chlorite; rr calc clasts.

Note: 330-40' spl bcms pred grn-gry glauconitic siltst.

Note: V com pyr aggreg @ 350', siltst oft grds to argil ss by 360'.

Sandstone: lt med gry to olv gry; mod frm; v fn to fn; mod to v prly srtd; silty; clean to argil; grds to argil, fn sndy sltstn; lo to fair app por; often oriented carb mat; sl mica; occ glauc; dom qtz + fspr; occ lithic grs; com partial kaoln alts of fspr.

Siltstone: med olv gry to lt brnsh gry; mod firm; sml, structureless ctgs; v argil; v fn sandy grdng to argil fn ss; noncalc; occ organic debris; micromicaceous; tr starting to grd to silty claystn; dull earthy lstr; grainy tex.

Clay: med gry; soft; runny, soupy consis; pr cohes + adhes; v sandy + silty; good solubility; noncalc; derived from high amts of argil matrix.

Wiper trip @ 467', pulled free.

Sandstone: lt med gry, wet, lt gry dry; v fn gr; mod indur to sl fria; variably argil; equal gr + matrix sprtd; prly srtd; lo to occ fair vis por; structureless; dom fspr; abndt qtz; occ organic debris; tr mica + glauc; noncalc; tr mica; com evidence of fspr alts to kaoln when viewed dry; gradational from fn sandy, argil sltstn.

MW 8.8 VIS 100

Sand: cloudy, clr, tr gry, grn; dom v fn upper; sbrnd; mod srtd; dom derived frm hi amts of ss; dom fspr; lesser qtz; mod mature; incs free glauc; tr carb mat; occ mica; tr partial alts of fspr; rr iron stnd grs, poss slough.

Note: mod incs in glauconite

Carbide Lag 14.4 min @ 588', 26u
SPM #2-45, 100% theor, 3 min dur

Survey @ 580', 2°

Note: Change over from Gel/water to Polymer mud.

Note: shaker screens- 20 mesh, front; 40 mesh, back.

Siltstone: olive gry; mod firm; sml to med szd subrnd ctgs; v argil; variably sandy; structureless; grds to argil fn ss; noncalc; dcrsd carb mat; occ micromicaceous.

Sandstone: lt gry to occ whtsh gry; v fn lower; mod wl srtd; calc cmtd; kaolinitic; structureless; responsible for drill bones; v tight; dom fspr + qtz; tr microcarb; dull ashy lstr; no mnrl fl.

Carbide lag 5.5 min @ 681', 405u
SPM #2-52, 116% theor, 4 min dur

Clay: mod dk olive gry; soft; mod thick, sl sticky consis; pasty; v sandy + silty; mod to lo solubility; fair cohesion + adhesion; noncalc; nonexpandable; dom derived from ss + sltstn matrix; clay integrity preserved by polymer mud system.

Sand: clr, cloudy, pl to mod grn; v fn to lo med; sbrnd; abndt unconsol; com argil ss; prly srtd; dom fspr + qtz; glauc; mica; occ sl calc; occ partial alts of fspr to kaoln; occ as thin interlams within argil sltstn; tr organic debris.

Siltstone: olv gry to lt brnsh gry; firm; v argil; fn sandy; grds to argil v fn ss; occ thin fn ss interlams; non to v sl calc; occ micromica; rr organic interlams; sl glauc.

MW 9.0 VIS 55

Note: losing partial returns to the hole @ 850'

Sand: clr, cloudy, lt gry, pl grn; v fn to occ crs, dom lo med to fn; sbang to sbrnd; mod srtd; dom unconsl; com carb mat; tr pyr gr coatings; com glauc; tr lgn grs; occ mica; dom qtz; com fspr; bcmng granular w/ incsng depth.

Conglomerate: grn, cloudy, clr; 2-5 mm; sbrnd to wl rndd; fair spher; smooth, semi-polished tex; unconsol; dom basalt; occ qtz; tr poss plag; assoc w/ incs argil component; poss lag deposit.

MW 9.0 VIS 55 PV 21 YP 14
pH 10.0 FL 6.4 Cl^- 600ppm

Wipe hole to shoe @ 928'

Clay: mod olv gry; soft; mod thick - com aren pasty lumps of prly indur argil ss; gd adhes + cohes; silty; fnly sandy; scat tr sm calc inclu; tr shell frags @ 960'; rehydrates mod fst w/v sli vis expansion.

Siltstone: oft grdntl w/argil ss; brnsh olv gry to grysh brn; sli-mod firm; mod wll rnd ctgs, tr w/sbplanar sides; scat fn sprkls, occ waxy when scored; fnly gritty tex; com lineations defined by com dk brn organic mat, v sli tr incipient fiss; pred noncalc; no spl fl; incr cly content @ 1020'.

Sandstone: v argil; brnsh olv gry; rnd ctgs; fria; com fn mica sprkls; dom fines, tr lwr med; sbang-rnd, dom sbrnd; mod-hi spher; mod wl srtd sn w/abd silt, cly; pred clr qtz & fspr; abd grn clasts both glaucon & lithics; com fn micas - dom chlorite, tr biot; occ lineations - usu gently undulatory, occ grdng to cly-rch lams; pred noncalc; rr shell frags.

Mudstone/Claystone: lt-mod olv gry, occ brnsh, minor frac grnsh gry; mod firm; dull, waxy when scored; occ tr w/sbconchoidal frac; com lineations defined by sparse dissem sn, occ glauconite or organic mat; noncalc; varies f/dom cly to aren clyst to silty & sandy mudst/siltst.

Survey @ 1102', 3/4°

Siltstone: brnsh olv gry; soft to sli firm, eas crushed; fnly gritty tex; mod to v sandy, occ grds to argil ss; occ vague lams; infreq cly-rch grdng to mudst; scat gd tr glauconite; noncalc; tr fr dk brn organic remnants, occ defining lams; no spl fl.

MW 9.0 VIS 42

Carbide Lag 13.0 min @ 1173', 230u
SPM #2-41, 134% theor, 8 min dur

Micrite: gd tr @ 1170'; wht to v pl yelsh gry; v fst to sli frm; dull; fnly gritty tex; no evid struc; single ctgs w/med gry cly mottling; frly pure, effervesces rapidly; no spl fl.

Siltstone: mod olv gry; soft; rnd to sbrnd ctgs; occ fn mica sprkls; fnly gritty tex; mod cly-rch, oft waxy when scored; abd dissem v fn sand, glauconite; v sli tr orng volcanoclastics; noncalc; abd LCM in spls.

Note: abndt wood fiber + cellophane added as LCM.

Claystone: olv to brnsh gry; mod firm; sml sbrnd ctgs; dull earthy lstr; gritty tex; silty; occ thin silty interlams; v sl glauc; grds to argil sltstn; noncalc; occ carb fleks.

Sand: clr, cloudy, pl grn; v fn; dom loose, com argil ss; mod wl srtd; dom qtz + fspr; com glauc; tr lgn grs; sl mica; rr carb mat; spl contam w/ abndt LCM.

MW 9.0 VIs 60 FL 5.6 Cl- 600ppm

Clay: olv gry to lt grysh brn; soft; mod thick, v lumpy consis; fair cohes + adhes; sl sandy; silty; lo solubility; noncalc; v sl expandable.

Survey @ 1356', 0°00'

Clay: grysh brn to brnsh gry; soft; mod thick, lumpy consis; occ sl kaoln; v fn sandy; silty; occ sl calc; fair cohes + adhes; lo solubility; nonexpandable.

Sand/Sandstone: clr, wht, lt gry; v argil; occ calc cmtd ss; v fn lower; prly srtd; sbang to sbrnd; dom fspr + qtz; tr lgn grs; no glauc; rr mica; spls extreamly contam w/ LCM.

Note: contnd poor spl quality due to high amts of LCM

Clay: bcmng lt gry; occ wht kaoln clay accumulations; soft; pasty; bcmng even, less lumpy; sandy, silty; mod cohes + adhes; mod to lo solubility; v sl calc.

Sand: clr, cloudy; v fn; mod wl srtd; sbrnd to rnd; unconsol w/ comm sandy kaoln clay; dom qtz; occ fspr; com microxstln pyr aggregates; tr shell frasg; sl glauc; tr mica; com kaoln; tr carb mat.

Sandstone: whtsh gry; mod wl indur; v fn to occ fn; sbrnd; mod wl srtd; calc cmtd; com kaoln sprtd; lo p-p; cm glauc; rr pry; dom qtz + fspr; often v altrd fspr to kaoln clay accumulations.

Sand: clr, cloudy, tr dk gry, yel; v fn to occ lo med; sbang to occ sbrnd; dom unconsol, occ calc + kaoln cmtd ss bones; mod wl srtd; dom qtz + fspr; occ lgn grs; com glauc; com microxstln pyr aggs; abndt clr mica; rr carb mat.

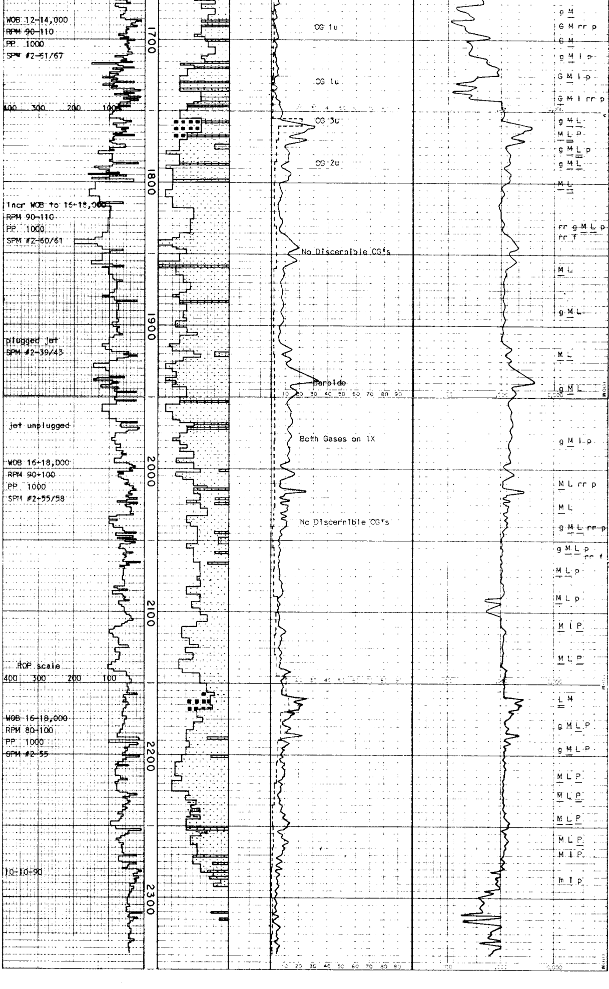
Note: Wiper trip @ 1570', pulled free.

Sand: clr, cloudy, wht, tr gry, red + org; v fn to fn; dom unconsoladated; sbang to sbrnd; mod wl srtd; occ calc cmtd ss bones; dom qtz + fspr; com glauc; abndt transp mica; com framboidal pyr; tr carb mat; tr shell frags; occ lgn grs.

Note: contnd high amts of LCM

Sandstone: nearly wht - scat grn/blk/brn clasts; typ v frm - calcite cmtd - also com soft kaolnic lumps of pred sand; v fn-fn; ang-sbang; mod spher; mod well srtd; dom clr to sli mlky plag & clr qtz; scat tr glauconite, lithics, micas; abd LCM continues.

MW 9.0 VIS 47 PV 24 YP 17
pH 9.0 FL 5.4 Cl^- 400ppm



Sand: dom clr & sli mlky, occ grn, blk, scat med; ang-sbrnd; mod spher; mod well srtd; pred lse, com whtsh kaolinitic lumps - incr amts f/1680'; dom fspr & qtz, com glauconite; com micas, pred muscovite, com chlorite, tr biotite; scat tr pyr aggregates, calc grs.

Sandstone: wht w/scat dk grn clasts; sli-v firm; dom fines, occ med; ang-sbang; mod spher; well sorted; grain supported; calc cmt w/occ softer kaolinitic ctgs; tr lineations, gen aprs mass in ctgs; pred plag, com qtz; com glauconite, micas(dom chlorite, tr biotite, muscovite); sli tr carb material.

Lignite: blk to brnsh blk, v dk brn; soft; fine sand sz to occ 2-3mm blocky ctgs; occ aprs grainy/reworked; eas crushed, tr w/sbconchoidal frac; lo density; com dk brn grainy lams; sli tr whtsh lams of ss/clay; occ v fn pyritized surfs.

Sandstone: lt gry, grysh brn, dk brn, tr wht; incr amts carbonaceous mat w/in ss; v firm - occ sft/frla; dom fines, scat med; ang-sbrnd; mod wl srtd, oft aprs tight on 'bones'; occ kaolinitic mtrx; abd carbonaceous mat typ defining lams; com micas; harder ctgs exhibit a mod yel mnrl fl.

Sand: aprs lt brnsh gry overall, brnsh cast f/lignite, indiv clasts are dom clr to sli mlky, occ blk, grn; dom fines, occ med; ang-occ sbrnd; mod spher; mod well sorted; occ kaolinitic lumps, v sli tr calc cmt @ present, pred unconsol; dom qtz/fspr; com lignite; tr pyr aggreg; com micas - chlorite, muscovite, tr biotite + golden micas(phlogopite?); rr coiled forams.

Note: continued slow seepage to formation; LCM being added; LCM typically constitutes 80-90% of unwashed samples.

MW 9.1+ VIS 54

Carbide Lag 17.9 min @ 1740', 150u
SPM #2-39, 104% theor, 8 min dur

Sand: aprs lt gry overall - indiv grs are dom clr to sli mlky, com grn, blk, rr orng-red; dom fines, occ med; ang-sbrnd, dom sbang; mod-hi spher; mod well srtd; silty; pred lse, tr whtsh kaolinitic + calc lumps; dom qtz & plag, occ glauconite, lignite; com micas - dom chlorite, com biotite oft altrng to chlorite, tr muscovite; sli tr to rr pyr aggregates.

Clay: due to large quan LCM, % clay inferred f/drlng parameters + nature of unwshd spl + # of clayey lumps in wshd spl; overall olv gry(clay frac derived f/ argil mtrx + minor frac drlng fluids); lumps com wht, occ lt grnsh gry, sli tr dk yelsh brn; thin runny to sli pasty consistency except for lumps; lumps typ kaolinitic + sli calc; abd micas thruout + v com lignite; v sli tr rnd granules @ 2010' and 2027' and 2040', poss cavings.

Sandstone: incr tr @ drlng 'bones'; wht w/grn clasts scat thruout; firm; frla w/some diff; dom fines, occ med; ang-sbang; mod well srtd; calc cmt; dom qtz & plag, com glaucon + grn mica; com yel mnrl fl.

MW 9.1+ VIS 50

Sand: clr, cloudy, wht, lt grn; v fn to lo fn; dom unconsl; assoc w/ com wht, kaoln clay; sbang to sbrnd; mod wl srtd; dom qtz + fspr; com clr mica; occ specular pyr; strg tr carb mat; rr lgn grs; abndt LCM.

Clay: mod brn; mod thick, sticky consis; lumpy; mod cohes + adhes; lo solubility; sandy, silty; assoc w/ abndt lignite @ 2160'; noncalc; nonexpandable; mica.

Lignite: blk to brnsh blk; britl; blky; subconch; occ sandy; occ pyrtzd; matte to shiny lstr.

Sandstone: wht to lt gry; v fn to fn; soft + mushy to hrd + calc cmtd; dom matrix + cmtd sprtd; sbang to sbrnd; mo to prly srtd; lo p+p; sl mical occ pyr; tr smeared glauc; contd tr carb mat; structureless; dom forms drilling bones.

Clay: lt gry to lt brnsh gry; soft; thin to sl curdly tex; v fn sandy and silty; com whtsh kaoln accumulations; pr cohes + adhes; sl mica; sl calc in part; mod solu.

Shale: traces only; mod yelsh brn to mod brn; firm; flaggy tex; sl silty; dull matte lstr; pr fiss; occ sl carb; noncalc.

Sand: clr, wht, lt gry; v fn to fn; sbang to sbrnd; mod srtd; dom unconsl, com hrd, calc cmt; equal qtz + fspr; rr lithic grs; com clr mica; com microxstln pyr aggs; tr carb mat; dom assoc w/ kaolntc wht cly.

Clay: lt grysh brn; soft; thin, smt lumpy consis; v silty; occ fn sandy; pr cohes + adhes; lo solubility; noncalc; nonexpansive; sl kaolinitic; abndt LCM contamination.

Survey @ 2329', 2°

DRILLER'S DEPTH 2338'KB @ TD

Run Schlumberger E-logs @ TD: DIL/BHC/GR; SHDT; LDT/CNL/GR.