EPOCH WELL LOGGING, INC.

COMPANY	NAHAMA & WEAGANT ENERGY Co.
WELL	C.E.R # 41-21-64
FIELD	MIST
LOCATION	1137.62'S & 485.86'W f/the NE corner of Sec 21, T6N, R4W, W.B. & M.
COUNTY, STATE	Columbia, Oregon
API WELL INDEX NO.	
ELEVATION	1089.89' G.L. 1101.39' K.B.
DATES	FROM 10-31-90 TO 11-7-90
DEPTHS	FROM 30' K.B. TO 2121' K.B
SPUD DATE	10-31-90
DRILLING CONTRACTOR	Taylor Drilling Inc. Rig #5
MUD COMPANY	Beaver Mud Company
LOGGING GEOLOGISTS	Craig Silva Bill Gilmour

SCANNED

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 to 600' Polymer to 2121'

CASING RECORD

16"	AT	30'
	AT	
	AT	
	AT	

HOLE SIZE

13 3/4"	AT	536' K.B.
8 1/2"	AT	2121' K.B.
	AT	
	AT	

SAND/SANDSTONE · SHALE · SILTSTONE · CLAY · DIATOMITE · CONGLOMERATE · LIMESTONE · DOLOMITE · BASALT · TUFF · FOSSIL · MICA · LIGNITE · GLAUCONITE · PYRITE

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

PENETRATION | ANALYSIS OF RETURNS

DRILL RATE (FT/HR) drilling data · DEPTH · 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; PENTANES, C-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........6-10 cuttings
Common............10+ cuttings
Abundant..........present thru entire sample.

Note: POOH @ 100' to P/U mud motor.

Sandstone: yel org, org yel to grysh org chngng to lt to med gry @ 140'; v fn to lo med; prly srtd; highly oxidzd displaying zonation above 140'; variably carbonaceous; occ reworked ash clay lams; abd to com muscvt; glauc below 140' w/ incs argil content; noncalc.

MW 9.0+ Vis 51 Sd 6% Sol 5.5%
FL N/C pH 9.0 Cl-300p.m

Sandstone: m dk gy-olv gy, vfL-fU, dom vfL-vfU; dom mtx spprtd; v com grd to sltst/clyst; sbang-rd; dom spher; dom qtz w/ mnr acc mafic mnrls, glau, muscv; apps sptty zns of "cleaner" gr spprtd qtz ss w/ com glau; non-calc; v fri-sft-brit; rr volc brecc frgs.

Siltstone: lt gy-m dk gy, lt olv gy-olv gy; sft-brit; mas, non shly; gen blky; grd to both clyst & ss; non-calc; erthy lstr; gen com micmica/mica; smooth-occ abnt abrsv text; com dk blk maf acc mnrls & glau in sdy sltst; sptty carb mat; apps incrng grainlness.

Claystone: m dk gy-lt gy, olv gy-lt olv gy; v sft-brit, dom frm-mod sft; mnr v sft sol fraction; erthy lstr; smooth-abrsv text; grd to both sltst & vf clyey ss; apps tuff l/p but gen non-expansive; sft cly has p cohes & adhes.

Sandstone: v closely gradational to sdy sltst & sdy clyst; m gy-m dk gy, m olv gy-olv gy; vfL-fU, dom vfL-vfU; dom cly/slt mtx spprtd, rr gr spprtd; sbang-rd; dom spher; dom cmpsd colorless & trnsp qtz w/ mnr fld, dk(blk) maf mnrls, & sptty-occ com glau; non-calc; sft-sli hd, dom frm-mod brit; rr mica mtx, v rr pyr aggs.

Note: grad incr amt vf-f disaggregated sd grs & glau grs.

Siltstone: m gy-m dk gy, m olv gy-olv gy; abnt sdy sltst grd to slty vf ss, also grd to slty cly+st; sft-brit, pred brit; mas, non-shly; gen blky; erthy lstr; dom abrsv text; non-calc; occ micmica.

Sandstone: m olv gy-olv gy, m gy-m dk gy; closely grd to sdy sltst & sdy clyst; dom vfL-vfU; dom slt/cly mtx spprtd, v mnr gr spprtd; sbrd-rd; dom spher; dom colorless & trnsp qtz w/ mnr fld, dk blk (aug) & red (volc lith) maf crs, & com w dissem vf glau grs; non-calc; fri-mod ten; pred brit.

Note: POOH @ 421' to L/D motor.

Claystone: lt gry; mod firm; variably slty; occ homo; often occurs as thin lams w/l sltstn; non calc; rr microcarb; grds to argil sltstn.

Carbide lag 10.3 min @ 469', 83u
SPM #1=65, 101% theor, 11 mn dur

Sandstone: olv gry-wet, lt gry-dry; mod to firm; vfL to vfU; v prly srtd; dom argil + silty grdng to sdy sltstn; gr spprtd; lo p+p; noncalc; occ carb mat; com mscv; abnd glauc; occ red lgn grs; poss chlor; dom qtz + fspr; rr pyr.

MW 9.2 Vis 120

Siltstone: m olv gry; firm; v sml structureless ctgs; v scy; v argil grds to argil ss; cor glauc; non-calc; micromica; com mtrx spprtd; dull lstr; abrsv tex.

Sandstone: lt gry-dry, m olv gry wet; vfL to fU; mod indur; prly srtd; dom argil; slty; dom mtrx spprtd; lo p+p; sbang; dom qtz + fspr; occ glauc; dcrsd micromica; tnly carb; rr lgn grs; noncalc; dom grds to sdy sltstn.

Note: lost circ @ 588'; LCM added very poor sample returns.

Note: change mud system over to polymer.

Carbide lag 6.1 min @ 620', 253u
SPM #1=63, 121% theor, 5 min dur

Claystone: m olv gry to brnsh gry; firm; slty; dull earthy lstr; com intrlamd w/ + grdng to sltstn; noncalc; occ sl glauc; occ microcarb.

Siltstone: m olv gry; firm; sml to incsngly med szd, irreg shpd ctgs; incsngly argil; sdy; dcrsd glauc; noncalc; sl microcarb; grds from slty clystn to argil ss.

MW 8.9 Vis 47

Sandstone: med gry to lt olv gry; vfL to vfU; mod indur; incsngly argil + silty, grdng to sltstn; prly srtd; matrx spprtd; structureless; dom qtz; sl glauc; noncalc; rr lgn grs.

Limestone: yelsh gry; sl hrd; v argil; dom grds to marl; structureless; ash mtrx; dull chlky lstr; sl glauc.

Note: abundant LCM added to mud

Claystone: lt-m olv gy, m lt gy-m gy; sft-frm, occ brit; v closely grd to sltst & ss, dom slty; formless-blky; erthy lstr, rrly wxy; smooth-com abrsv text; contains occ-com evenly dissem f glau; vis vf intbddg.

Note: tr-sptty mica aggs/schist frgs, clstc lith frgs in sltst; also tr basalt frgs, scttrd lrg trnsp grs of xln qtz.

Siltstone: v closely grd to clyst & ss; m-lt olv gy, m gy-m lt gy; mas, non-shly; mod brit-frm, occ sft, rrly hd(lmy); gen tough; gen blky; erthy lstr; dom abrsv text; pred non-calc, rrly lmy; com-v com f dissem glau; occ w thn lams or zns of grn(glau) clyst.

Sandstone: closely gradational to sdy sltst & clyst; m lt olv gy, m gy-lt m gy; vfL-vfU; dom mtx spprtd; dom sli-mod brit, occ sft(fri), sptty hd lmy ss; sbrd-rd; dom spher, "cleaner" pcs w srtd; cmpsd pred colorless & trnsp qtz w/ mnr fld & dk(blk) maf mnrls & com-locally abnt glau; vis thnly intbdd w/ clyst & sltst.

MW 8.8 Vis 200+ Sd lost circ
FL 6.4 Sol 3.4 pH 9.0 Cl- 350ppm

Claystone: m-lt olv gy, m gy-m lt gy; sft-frm, occ brit, rrly hd (lmy); closely grd to clyey sl+st & ss; formless-blky, mas; erthy lstr, smooth-com abrsv text; contains com-abnt sd grs; contains sptty-locally com dissem f glau; sptty sft solb cly fraction.

Siltstone: closely gradational to slty clyst & slty ss; m-lt olv gy, m gy-lt m gy; mas, non-shly; mod brit-frm, occ sft, rrly hd; crumbly-mod tough; dom blky; erthy lstr; dom abrsv text, locally com smooth; pred non-calc, rr hd lmy sltst; com-v com dissem f glau; vis vvf intbddg.

Limestone: apps tr-sptty v thnly intbdd ls & v lmy clyst/sltst/ss; pale yelsh brn, lt brnsh gy, lt gy; dom hd, occ brit, tough; gen erthy(slty) lstr, smooth-rrly abrsv text; apps sdy/slty mdst w/ chiky to marly to dom dns app.

Note: @ 1040': significant incr in sft, solb, lt gy clay; distinct color change in bulk spl color.

Clay: lt gy-m lt gy, v lt gy(dry); sft-v sft; partially solb; erthy lstr; smooth text; p adhes; mod cohes; gen pasty consistency; com forms gmy lumps; non-calc; apps to contain scttrd-abnt sd grs.

Note: very poor sample quality, abnt LCM in mud, spls contain less than 5% cuttings.

Sand: note apr incr in % of both sd & cly; vfL-fL; disaggregated in cttgs; sbrd-rd; dom spher; w srtd; pred colorless & trnsp qtz w/ com glau & mnr blk maf mnrls & fld; note shell frg.

Clay: lt gry to lt brnsh gry; v soft; lumpy; sl sticky; mod sol; occ sl calc; derived from dom claystone fm; contd abnd LCM.

Carbide Lag 14.3 mn @ 1154', 77u
SPM #2=53, 131% theor, 7 mn dur.

Siltstone: lt gry, lt brnsh gry, occ olv gry; soft; solu; v argil; dom grdng to slty clystn; non to occ v sl calc; tr sdy; rr glauc.

Tuff: v lt gry to wht; v sft; semi-transl; fluffy tex; floculated; solu; non-fl; poss mud additive.

Note: partial returns; abnd LCM

MW 8.6 Vis 90

Note: Partial returns while drilling; Well flowing w/ pumps off @ 1247'; lower Vis to 70, build volume.

Note: abundant LCM in spls; very poor returns; cuttings are less than 1% of total spl.

Note: sptty frgs of pyr nods & aggs of mic pyr xls; also trs of forams & spine shaped fos frgs.

Sand: dom disaggregated grs, sptty pcs of consolidated ss; note com grs free calc, ss frgs v calc; lt gy-v lt brnsh gy, vfL-fU; sbang-rd; dom spher; mod w srtd; consdtd pcs gr spprtd & calc cmtd; also pcs grd to sdy sltst; cmpsd dom of colorless-lt wh & trnsp qtz w/ mnr mafic mnrls, fld & glau; note trs pyr & foram frgs.

Clay: m lt gy-lt gy, v lt gy(dry); sft-v sft; mod-poorly solb; occ forms sft v sli gmy lumps; non-calc but com w/ grs of free calc; erthy-ashy lstr; smooth-sli satiny text; apr contains scttrd sd grs; also com-abnt lt yelsh brn clay that apps sfter & more solb.

Note: sptty pcs of tuff, pale brn-med yelish brn, sli frm; consistent trs of mic-nodular & aggtd pyr; consistent trs of forams & shell frgs.

Note: continued very poor sample quality; v abnt LCM in samples; describable cuttings represent less than 2% of total returns.

Siltstone: grddg to slty clyst; m lt olv gy, m gy-lt m gy, also lt brnsh gy-brnsh gy; mas, non-shly; formless-blky; erthy lstr; sl abrsv text; com w/ dissem f glau; gen non-calc but sptty pcs of v sdy sltst v calc, lmy.

Note: continued sptty vf lse grs of calcite & pcs of hd consolidated calc cmtd ss; bulk spls gen show easily observable evsc.

Note: after 1490': distinctive trs of pyrtzd lignite; also significant incr in amt of pyrite in spls.

Sandstone/Sand: 80-90% disaggregated in spls but also sptty com pcs v fri calc cmtd ss; med lt gy-med gy; vfL-mU, dom fL-fU; ang-rd, dom sbang; sbprismoidal-discoidal, dom sbdscoidal; mod w srtd; apps gr spprtd; est 80% qtz: colorless-wh-lt gy, trnsp-trnslcnt; note com grs of musc/chlor mica; fld pred trnsl v lt gy; sptty red volc grs; com foram.

Clay: lt gry to brnsh gry; v soft; v sol; sl kaolinitic; fn sandy; slty; occ sml lumps; noncalc; rr forams; occ wht kaoln strks; pr cohes + adhes; dom goes into mud system.

MW 9.0 Vis 85 PV 32 YP 34 YP 9/20
FL 5.8 pH 8.5 Cl- 300ppm sol 4.9

Sand: clr, cloudy, occ wht; vfL to vfU; ang to sbang; prly srtd; lo spher; dom loose; com calc cmtd; immature; dom qtz + fspr; com microxstln pyr aggs; com mica, occ chlortzd; occ kaoln alts of fspr; tr glauc; clayey; dom going through shakers.

Note: fn sands lost through 20 mesh shakers.

Lignite: strong trace; black to blksh brn; firm; brittle; com pyrtzd; occurring as thin seams w/l sandstone dom as immature peat.

Sandstone: lt gry; vfL to vfU; wl cmtd; occurring as hard bones; sbang; clean; gr spprtd; occ intrstl pyr; mica; chlor; dom qtz + fspr; tr kaoln alts; v wl indur, often splitting across grs; rr carb mat.

Sand: clr to cloudy; vfL to vfU; ang to tr sbrnd; immat; entirely loose; assoc w/ com lt brnsh cly; mod wl srtd; qtz; fspr; rr lith grs; com pyr + muscvt; tr chlor; tr carb mat; occ calcite; rr altrd shell frags.

Note: contd abnd LCM added; LCM consists of 98% sample volume

Clay: lt brnsh gry; v soft; v thin soupy consis; silty, sandy; pr cohes + adhes; v solu, easily going into mud system; sl kaolntc; noncalc; nonexpandable.

Sandstone: wht to med gry; vfL to occ to med; sbang; prly srtd; dom gr spprtd; calc cmtd; occ wht kaoln matrx; occ intrstl pyr; tr carb mat intrlms; lo p+p; dom qtz; abnd fspr; occ mica; rr glauc.

MW 9.2 Vis 90

Siltstone: bcmng mod brn; soft; solu; v argil grdng to silty clystn; sml, sbrnd ctgs; occ strkd w/ carb mat; calc on select altrd foram inclusions; fn sandy.

Carbonaceous material: blk, v dk brn; soft + fria to tr britt; dom imat; grds to peat; assoc + lamd w/ mod brn sltstn/clystn; rr pyrtzd.

Sand: clr, cloudy; vfL to Umed; dom sbang; dom loose, com calc cmtd; mod srtd; immature; dom qtz; com fspr; occ kaoln alts of fspr; occ mica, occ chlor; dcrsd microxstln pyr; occ carb mat; strg tr kaoln cly accumltns; tr calcite.

Claystone: lt brn to mod brn; v soft; slty; solu; occ carb; occ kaolntc; non to spotty calc; dom goes into mud system; structureless; grds to v argil sltstn; occ sandy.

Sandstone: lt brnsh gry, lt gry, tr wht; vfL to Umed; wl indur to fria; calc cmtd; dom sbang; prly srtd; equal clean + matrx spprtd, dom gr spprtd; fair to lo vis por; occ kaoln mtrx; dom qtz; abnd fspr; abndt mica; occ chlor; abnd intrstl + free microxstln pyr; tr carb mat; rr lithic grs; rr shell frags.

Note: continued abundant LCM added to mud system; very poor sample quality; LCM is 90-98% of total cuttings returns.

Sand/Sandstone: cttgs approx 90% disaggregated sd grs & 10% pcs of consolidated ss; lt gy-med lt gy; range vfU-mU, dom fL-fU; ang-sbrd, dom ang-sbang; sbprismoidal-discoidal, dom sbdscoidal; immat; mod w srtd; apps gr spprtd w/ pred weak calc cmttn, apr thn zns (bones) of hd-vd ss w/ strng cmttn; rr ss pcs w/ pyr cmttn; abnt free calc grs in spls & vis grs of calc as mjr constituent of ss; compsd of approx 70% qtz w/ 10-20% fld & 10%+ mica & lesser maf mnrls & lithic(volc) frgs; qtz: colorless-wh-v lt gy, trnsp-trnslcnt; fld: same col/trnsparncy as qtz but pred tabular & prismoidl (sanidine?); mica: dom silver gy col(biot?) w/ com brnz, trnsp, & grn micas(prob biot, musc, chlor, phlogopite?); pos rr glau; rr basalt frgs; tr foram.

Run Halliburton E-Logs @ 2121'
DIG/AVL/GR, DIPMETER, SDL/DSN/GR