Tecton Geologic

COMPANY	Calpine Corporation
WELL NAME	Wildhorse State 56
FIELD	The Geysers
COUNTY	Sonoma
STATE	California

WELL HEAD COORDINATES
733.7' S, 4125.7' W of SE corner of Sec 2, T11N,R9W
N: 422274.1, E: 1761815.9

ELEVATION	2795', GL
RIG - DAY RATE START DATE	2/2/2010
TD DATE	6/2/2010
TOTAL DEPTH	11687'
TRUE VERTICAL DEPTH	11259'
TD LOCATION	379.5' S and 2553.2' W of Wellhead
DRILLING CONTRACTOR	Kenai
COMPANY REPRESENTATIVES	Fulcher, McConnell

LOG INTERVAL

DATE LOGGED	2/2/10	TO	6/1/10
DEPTH LOGGED	39'	TO	11687'
MUD DRILLING	39'	TO	4800'
AIR DRILLING	4800'	TO	11687'
LOG SCALE	1:720		
UNIT NO.	C23		

LOGGING GEOLOGISTS
Dan Bida (DB), Jeremy Feinberg (JF), Joe Whearty (JW), Evan Ernston (EE), Justin Everts (JE)

HOLE

26"	TO	775'
17.5"	TO	3502'
12.25"	TO	4800'
8.5"	TO	11687'

CASING

20"	FROM	Surface	TO	764'
13.375"	FROM	Surface	TO	3488'
9.625	FROM	Surface	TO	4793'

LINER

7"	FROM	Surface	TO	11687'

ABBREVIATIONS

NB	New Bit	BHT	Bottom Hole Temp
RRB	Re-run Bit	C	Carbide Test
CB	Core Bit	NR	No Returns
WOB	Weight on Bit	LAT	Logged After Trip
SPM	Strokes per Minute	CFM	Cubic Feet per Min
PP	Pump Pressure	BUT	Bottoms Up Temp
RPM	Revolutions per Min		
SFR	Steam Flow Rate		

SYMBOLS

ϟ	Wireline Log	◢	Casing Shoe
◀	Steam/Water Entry	⧓	Flow Test
◂	Deviation Survey	▯	Cored Interval No Recovery

REMARKS

All depths from kelly bushing
KB = 30'

LITHOLOGY

▤	Argillite	⁚	Siliceous Graywacke
⊞	Chert	Q	Quartz Veining
▤	Mudstone	–	Weak Foliation
///	Greenstone	=	Strong Foliation
ʃʃ	Serpentine	/	Marginal Alteration
ʃ	Blueschist	//	Pervasive Alteration
✳	Felsite	\	Weakly Hornfelsic
▤	Clay	\\	Strongly Hornfelsic
⁚	Lithic Graywacke		
^	Argillaceous Graywacke		

STEAM ENTRIES

	Init	Sust
7577'	11#	10#
8176'	15#	15#
8347'	12#	8#
9595'	5#	5#
10249'	8#	8#
11114'	10#	11#
11126'	5#	11#
11246'	13#	13#
11297'	9#	3#

MUD LOSS ZONES

420'
35BPH
2550-4800'
10-1120BPH

WATER ENTRIES

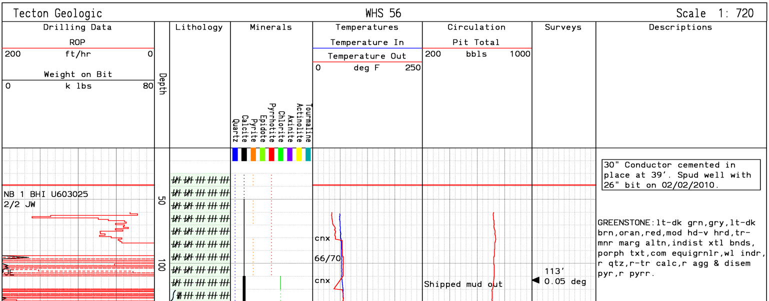
6660-10550'
3-15BPH

SECONDARY MINERALS

Q = Quartz
C = Calcite
P = Pyrite
E = Epidote
R = Pyrrhotite
Ch = Chlorite
X = Axinite
A = Actinolite
T = Tourmaline

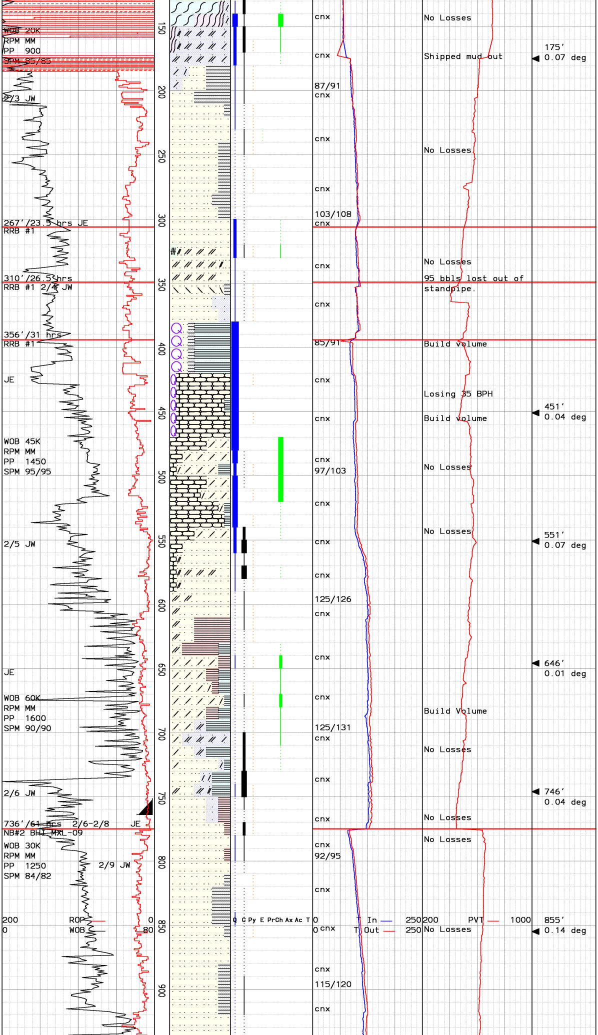
Rare	<< 1%
Trace	< 1%
Minor	1% to 4%
Common	4% to 7%
Abundant	7% to 10%
	> 10%

Tecton Geologic WHS 56 Scale 1: 720



30" Conductor cemented in place at 39'. Spud well with 26" bit on 02/02/2010.

GREENSTONE:lt-dk grn,gry,lt-dk brn,oran,red,mod hd-v hrd,tr-mnr marg altn,indist xtl bnds, porph txt,com equigrnlr,wl indr, r qtz,r-tr calc,r agg & disem pyr,r pyrr.



BLUESCHIST:lt-dk blue,wht,v hd,silic,ang,mass,mnr fol txt,r-com qtz vng,tr-mnr calc agg;intrbdd w/SERPENTINE:lt-dk grn,occ blchd wht,mod hd-hd,occ britt,waxy,r loc pyr vng,r-com chlor,r loc chert frag;intrbdd w/LITHIC GRAYWACKE:lt-dk brn,mod hd-v hd,occ britt,marg-perv altd,mass-equigrnlr txt,com mottld appr,occ micaceous.

SILICEOUS GRAYWACKE:lt-med gry,loc dk gry,occ sl grn cast,hd-v hd,fn-med grs,well def gr bndrs,mod well-well srtd,subrndd-subang grs,r-tr wht qtz vng,r clr qtz,r-tr milky wht agg/vn calc,r dissem/vn pyr,loc r chlortzd grs.Intrbdd w/ARGILLITE:dk gry-blk,mod hd-hd,britt,com phyll shn,r qtz vng,r-tr wht calc vng,r pyr vng.

Drill T/306',Vertitrak broke,POOH,Replace w/new one,RIH & Drill F/306' T/349',Begin losing mud out of standpipe,POOH T/50' Replace O-ring. POOH @ 395' to replace mud motor. Build pit volume,RIH & Drill ahead w/26" bit.

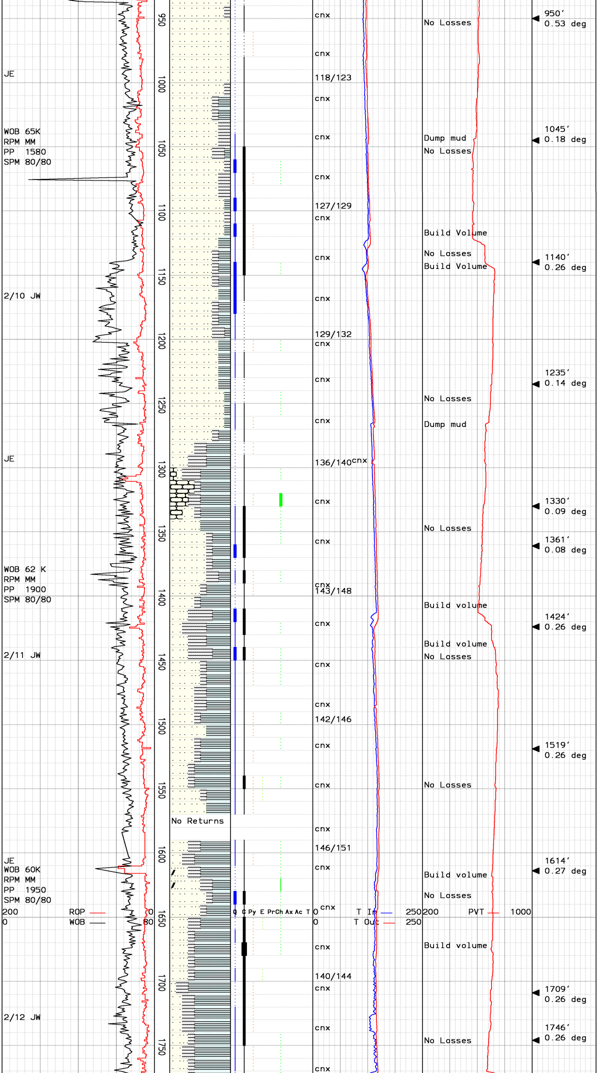
CHERT:dom red,lt gry,brn,lt blu,wht,v hd,ang,cryptocrystalline,conchoidal fract,occ clay altd;assoc w/com-20% QUARTZ VEINING:clr,wht,lt gry,tan,lt oran,v hd,mass,conchoidal fract,dom micro-vng,r loc pyr;assoc w/com-20% CLAY:red,brn,wht,v sft-frm,stky;intrbdd w/SILICEOUS GRAYWACKE:dom lt-dk grn(chlortzn),lt gry,v hd,mod srtd,subrndd-subang,mod well def gr bndrs,occ mott appr,r calc,com chlor.

SILICEOUS GRAYWACKE:lt-med gry,occ dk brn,loc lt grn cast,hd-v hd,prly-mod well srtd,fn-med grs,subang-subrndd grs,well def gr bndrs,tr-abun mod altn,indist gr bnd,chlortzn dec w/dep,loc argillaceous,r-tr wht vn qtz,r-mnr wht agg/vn calc,r disem pyr.Intrbdd W/MUDSTONE:dk red,brn,sft-mod hd,wthrd appr,v fn-fn gr,mass,well indur,r qtz vng,r calc vng,r agg pyr;assoc w/r-20% CLAY:wht,red,v sft-frm,stky.

SILICEOUS GRAYWACKE:lt-dk grn,lt gry,tan,wht,blk,hd-v hd,med gr,subang-subrndd grs,well def gr bndrs,mnr-abun marg altn,wk-str chlortzn(decr w/depth),r-com mott appr,r qtz vng,r-com calc vng/agg,r disem/agg pyr,r-tr chlor;intrbdd w/LITHIC GRAYWACKE:brn,mod hd-hd,britt,fn gr,equigrnlr,marg-perv altn;assoc w/mnr-40% CLAY:wht,tan,v sft,stky.

Drill T/775',POOH.Set 19 jnts of 20",94#,J-55,BTC casing at 764'. Cement to surface.RIH & Drill ahead w/17.5" bit.

SILICEOUS GRAYWACKE:lt-med gry,loc dk gry,occ sl grn cast,hd-v hd,fn-med grs,well def gr bndrs,mod well-well srtd,subrndd-subang grs,r-tr wht qtz vng,r clr qtz,r-tr milky wht agg/vn calc,r dissem/vn pyr,loc r chlortzd grs.Intrbdd w/ARGILLITE:dk gry-blk,mod hd-hd,britt,loc phyll shn,r qtz vng,r-tr wht calc vng,r loc pyr.



SILICEOUS GRAYWACKE:lt gry,tan, occ sl grn cast,hd-v hd,occ britt,dom med gr,mod well-well def gr bndrs,prly-mod well srtd, dom subrndd,granoblastic txt,r-mnr clr qtz vng/disagg,tr-mnr mlky wht calc vng/agg,r loc chlor;intrbdd w/ARGILLITE:dk gry,r blk,mod hd-hd,britt,fn gr, occ slty appr,dom dull,r-tr wht calc vng;assoc w/CLAY:com-20%, lt gry,wht,v sft,sticky.

SILICEOUS GRAYWACKE:lt gry,clr, wht,occ sl grn cast,hd-v hd,occ britt,dom med gr,mod well-well def gr bndrs,prly-mod well srtd, subrndd-subang,granoblastic txt, occ mott appr,tr-mnr clr qtz vng/disagg,tr-mnr mlky wht calc vng/agg,r loc chlor;intrbdd w/ ARGILLITE:dk gry,r blk,mod hd-hd,britt,fn gr,occ slty appr, dom dull,r-tr calc vng,r loc pyr;assoc w/CLAY:com-20%,lt gry, wht,v sft,sticky;absnt-tr red chert frags.

Drilling break @ 1310'.

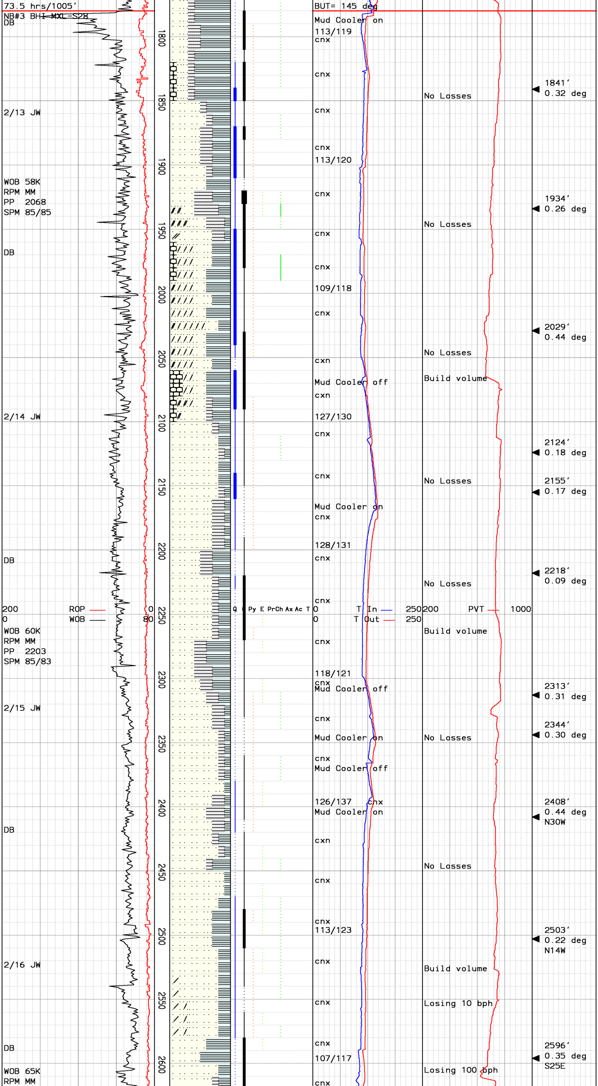
SILICEOUS GRAYWACKE:lt-dk gry, com grn cast,hd-v hd,fn-med gr, dom salt and pep tex,occ modd, occ britt,r-mnr qtz vng/agg,r-mnr milky calc vng/disagg/agg, r-mnr chlor wash,r loc agg pyr; intrcall w/CLAY:wht,lt-med gry, v sft-frm,sticky,no relic txt; intrcall w/ARGILLITE:med-dk gry, mod hd-hd,britt,occ fol,r calc vng/agg;intrcall w/CHERT:lt bl-grn,occ lt brn-gry,v hd,dom translu,occ opq,r agg qtz.;r greenstone frags.

SILICEOUS GRAYWACKE:lt-dk gry, hrd-v hrd, med-crs gr,subang-subrndd clst,pr-mod srtd,clst supp,occ mott txt,loc-r grnstn chert & biot frags,mod-dist gr bnds,wl indrtd,intrbdd w/ ARGILLITE:dk brn-blk,sft-mod, v fn gr,v wl srtd,loc phyl shn,r-t qtz & calc vng,intrbdd w/ CLAY:lt gry-wht,v sft,dull lstr,r agg pyr,r chlr,r epid.

Data Acquision Box power cord damaged & sensors disabled f/1584-1604'.

CLAY:lt-med gry,occ tan,sft, sticky,no relic txt;intrcall w/ SILICEOUS GRAYWACKE:dom lt-dk grn cast,lt-dk gry,hd-v hd,fn-med gr,occ crs gr,occ britt,occ clst supp,occ perv altn/indist gr bndrs,r-mnr qtz agg/vng,r-mnr calc agg/vng,r-tr chlor,r loc pyr agg,r loc epid;intrcall w/ARGILLITE:med-dk gry,occ lt-dk brn,blk,mod hd-hd,britt,occ indur,r qtz agg/vng,r calc agg/ vng (loc 5mm thick vn).

1771':Rapid addition of Water from pill pit to suction pit, resulting in drop of Temp In and Temp Out.



CLAY:lt-med gry,occ lt brn,sft, sticky,no relic txt,intrcall w/ SILICEOUS GRAYWACKE:lt-dk gry, occ dom dk grn,hd-v hd,fn-med gr,occ crs gr,dist gr bndrs,occ britt/clst supp,r-mnr qtz agg/ vng,r-mnr calc agg/vng,r agg chlor,occ r agg pyr,intrcall w/ ARGILLITE:lt-dk gry,occ blk,med hd-hd,britt,occ indur,r calc agg/vng;intrcall w/CHERT:lt bl-grn,occ lt brn,v hd,microxln,r qzt vng.

SILICEOUS GRAYWACKE:lt-med gry, occ dk brn,loc lt grn cast,hd-v hd,prly-mod well srtd,fn-med grs,subang-subrndd grs,well def gr bndrs,tr-abun mod altn,indist gr bnd,mnr-com chlortzn,loc argillaceous;intrbdd w/ ARGILLITE:dk gry-blk,mod hd-hd, britt,loc phyll shn,tr-mnr qtz vng,r-mnr wht calc,r pyr,r epid,r-tr chlor.

SILICEOUS GRAYWACKE:lt-dk grn, occ lt-dk gry,hd-v hd,marg -perv altn,indist gr bndrs,abun hematite stng,occ salt and pep txt,r-mnr euhed qtz incl,qtz agg/vng,r-mnr calc agg/vng,r agg pyr,loc argillaceous; intrcall w/ CLAY:lt-med gry,rd-brn,wht,sft,sticky;intercall w/ CHERT:lt grn,rd-brn,v hd, microxln-aphan,r-mnr qtz vng.

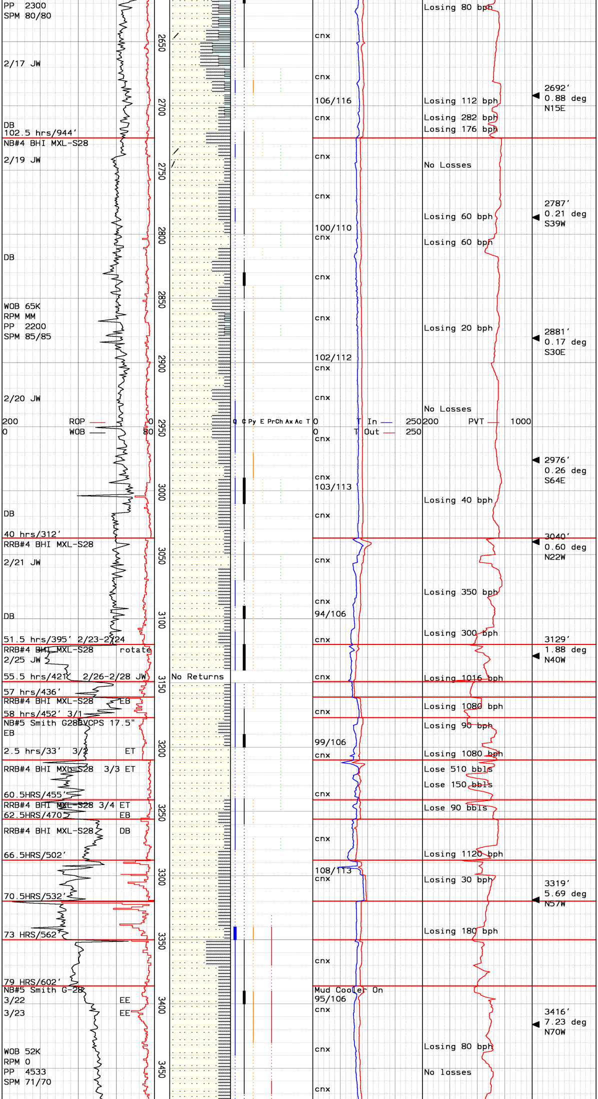
SILICEOUS GRAYWACKE:lt-med gry, loc dk gry,occ sl grn cast, hd-v hd,fn-med grs,well def gr bndrs,mod well-well srtd, subrndd-subang grs,r-tr wht qtz vng,r clr qtz,r-tr milky wht agg/vn calc,r dissem/vn pyr,loc r chlortzd grs.Intrbdd w/ ARGILLITE:dk gry-blk,mod hd-hd, britt,com phyll shn,assoc w/ CLAY:com-20%,lt gry-wht,v sft, sticky txt,r qtz vng,r-tr wht calc vng,r pyr vng.

SILICEOUS GRAYWACKE:med-dk gry, occ lt gry,hd-v hd,fn-med gr, occ crs grn,dom fresh appr,salt and pep txt,dist gr bndrs,occ clst supp/britt,occ lt grn cast, loc argillaceous,r-t qtz agg/ vng,tr-mnr calc vng,occ r agg pyr, occ r agg epid;intrcall w/ CLAY:med-dk gry,wht,sft,sticky; intrcall w/ ARGILLITE:med-dk gry,occ lt gry,mod hd-hd,britt, occ indur,loc fiss,r qtz vng,r calc vng/agg.

Circultaing mud between mud pits and water tank f/2319' t/2330'. No losses to hole.

SILICEOUS GRAYWACKE:lt-dk gry, hd-v hd,fn-med grs,well def gr bndrs,prly srtd,dom salt & pep text,occ foliation,tr-mnr mlky qtz vng,tr-com calc vng,r dissem/agg pyr,r agg pyhro,r chlortzd grs,Intrbdd w/ARGILLITE:med-dk gry,mod hd, britt,dom v fn gr,loc sndy,loc dull,str phyll shn,assoc w/ CLAY:com-20%,lt gry-wht,v sft, sticky txtr qtz vng,r-tr calc vng,r disem pyr.

SILICEOUS GRAYWACKE:lt gry,tan, occ sl grn cast,hd-v hd,occ britt,dom med gr,mod well-well def gr bndrs,prly-mod well srtd, dom subrndd,granoblastic txt, occ mott app,r-mnr clr qtz vng/disagg,tr-mnr mlky wht calc vng/agg,r loc chlor,com-20% mod altrd,pr-indist gr bnd;intrbdd w/ARGILLITE:dk gry,r blk,mod hd-hd,britt,fn gr,occ slty appr,dom dull,r-tr wht calc vng;assoc w/CLAY:com-20%,lt gry,wht,v sft,sticky.



SILICEOUS GRAYWACKE:lt-med gry, loc dk gry,occ sl grn cast, hd-v hd,fn-med grs,well def gr bndrs,mod well-well srtd, subrndd-subang grs,r-tr wht qtz vng,r clr qtz,r-tr milky wht agg/vn calc,r dissem/vn pyr,loc r chlortzd grs.Intrbdd w/ ARGILLITE:dk gry-blk,mod hd-hd, britt,loc phyll shn,r qtz vng, r-tr wht calc vng,r loc pyr assoc w/CLAY:com-20%,lt gry, wht,v sft,sticky.

Losing 174bph @ 2725' while circ to POOH. Cement plug placed f/2650-2725'.

SILICEOUS GRAYWACKE:lt-med gry, pale gry,wht,overall med gry in sample,fri-hd,fn-med gr,mod srtd,well def gr bndrs,r relic tex,com argill altn of felds, loc com flattened mafs, r clr-wht qtz vng,r-tr wht agg calc &calc vng, r vn pyr & pyr grs, loc v wkchlor wash,loc intrbdd w/ARGILLITE:dk gry-blk, firm-mod hd,mass,wk-phyll shn,com dull, r-com milky white qtz frac fill, r wht calc vng

SILICEOUS GRAYWACKE:lt-dk gry, hd-v hd,pr-mod srtd,subang-subrndd,wl indrtd,matrix supp, wl def gr bnd,loc chert and chl frag,r blchd app,loc mott txt,r-tr qtz and calc vng,r agg pyr,loc-r chl;intrbdd w/ ARGILLITE:dk brn-blk,v fn grn wl srtd,sft-mod,loc fiss,r phyl shn,r pyr vng

Trip out to replace Trutrak. RIH with RRB4 and drill f/3037'.

SILICEOUS GRAYWACKE:lt-med gry, occ dk brn,loc pale grn cast,hd-v hd,occ brit,prly-mod well srtd,fn-med gr,subang-subrndd grs,pred well def gr bndrs,loc indist gr bnd,loc mott appr,loc argillaceous,r qtz vng, r-tr cal vng,r chlortzd grs,intrbdd w/ ARGILLITE:dk gry-blk,mod hd-hd, britt,occ fm,loc phyll shn,r-tr qtz vng & frac fill,r-mnr wht calc,r pyr,r chlor.

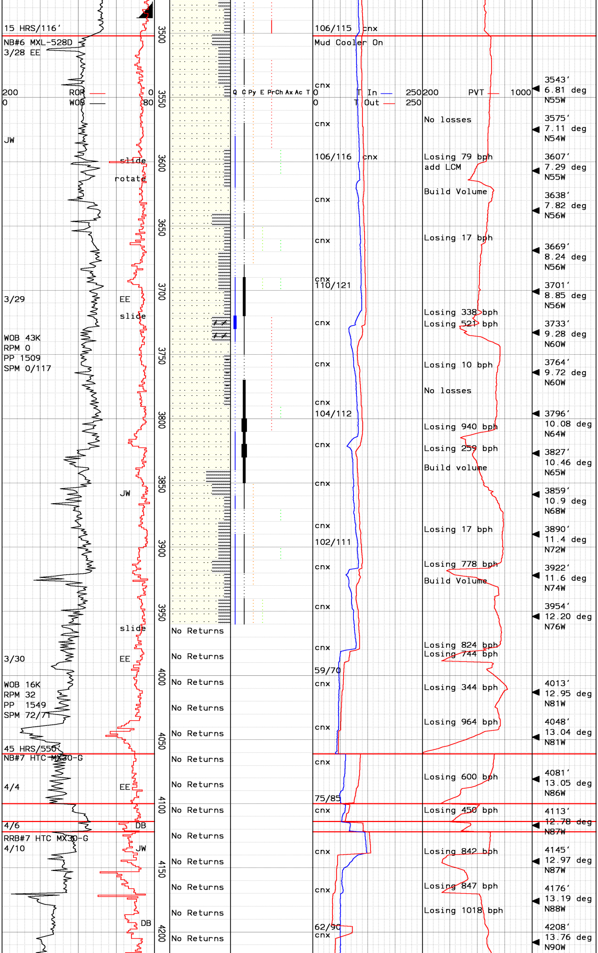
Major losses f/3050-3256'. Set total of 16 cement plugs while trying to regain circ. Get stuck at 3210'while attempting to regain returns, work pipe free.

3276': Total loss in circulation, set plug #16. Additional plugs set for loss zones at: 3288', 3294' and 3306-3320'.

2744-3351': 24 plugs total.

Cleaned out plug to formation, POOH @ 3386' to put on diectional tools and drill ahead.

SILICEOUS GRAYWACKE:lt-med gry, occ dk gry,mod hd-hd,salt and pep txt,med-well srtd,fn gr,well def gr bndrs,fresh appr,clst supp,britt,mnr mlky qtz vng,r disagg clr qtz 1-2 mm,tr disagg pyr,loc tr subhed-euhed pyrr, occ 1-3mm,intrbdd w/Argillite: dk gry,mod hd-hd,v fn gr,phyll shn,britt,r mlky qtz vng.



Drill t/3502',POOH.Set 79 jnts 13.375",88#,K-55 BTC casing & 6 jnts 13.625", 82#,Q-125 BTC casing.Shoe set @ 3488'.RIH and continue directional drilling with 12.25" bit.

SILICEOUS GRAYWACKE:lt-med gry, mod-hrd,pr-mod srt,subang-subrnd,wl indrtd,clst supp,pred dist gr bnd,occ mott app,loc phyl shn,loc argilliceous, intrbdd w/ ARGILLITE:dk gry-blk sft-mod,fn gr,v wl srt,brit txt, loc-r calc vng,disem pyr,r-tr pyrr,r epid,r chl.

SILICEOUS GRAYWACKE:lt gry,tan, occ sl grn cast,hd-v hd,occ britt,dom med gr,mod well-well def gr bndrs,prly-mod well srtd, dom subrndd,occ granoblastic txt occ mott app,r-mnr clr qtz vng/disagg,tr-mnr mlky wht calc vng/agg,r loc chlor,com mod altrd,pr-indist gr bnd;intrbdd w/ARGILLITE:dk gry,r blk,mod hd-hd,britt,fn gr,occ slty appr,dom dull,r-tr wht calc vng

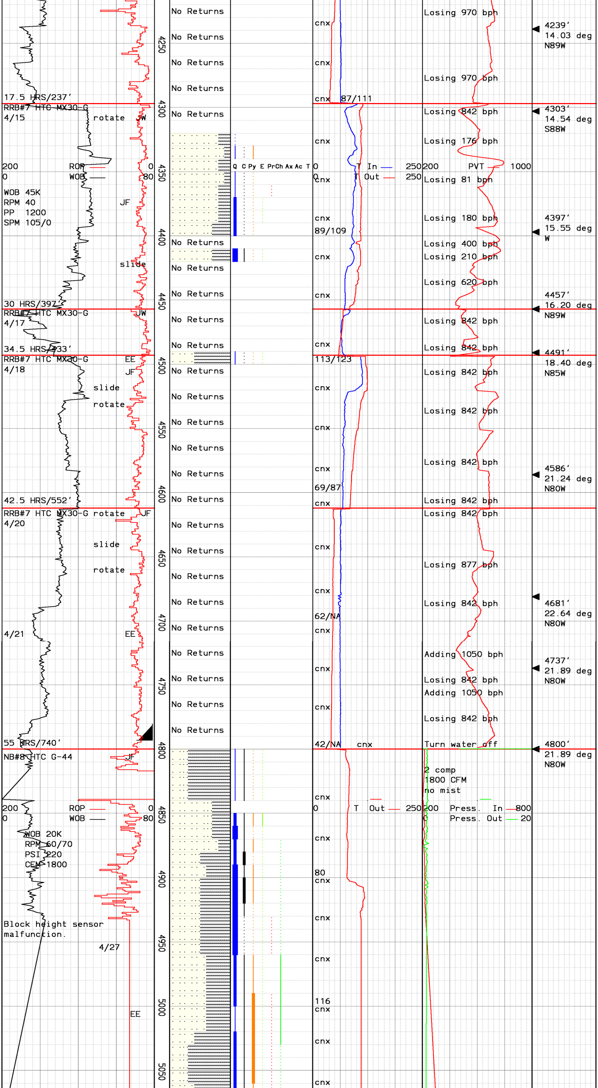
Temperature fluctuations from 3716' & 3814' result of rapid addition of water to pits.

SILICEOUS GRAYWACKE:lt-med gry, hd-v hd,occ brittle,fn-med gr, mod srtd,subang-subrndd grns, salt & pep app,r-mnr clr-wht qtz vng & grns,r-com clr-mlky wht calc vng,r loc pyr & pyrr,r loc chlor;intrbdd w/ARGILLITE:dk gry,lamntd,v-fn grn,loc brittle, loc friable,occ slty appr,loc slightly meta.

SILICEOUS GRAYWACKE:lt-dk gry, hd-v hd,fn-med grs,well def gr bndrs,prly srtd,dom salt & pep text,occ foliation,tr-mnr mlky qtz vng,tr-com calc vng,r dissem/agg pyr,r agg pyhro,r chlortzd grs,Intrbdd w/ARGILLITE:med-dk gry,mod hd, britt,dom v fn gr,loc sndy,loc dull,str phyll shn

Low temp readings result of no returns and water added to pits.

Drilling breaks @ 4152', 4171' & 4224'.



Lose all circ at 4139', drill blind T/4293', POOH, set plug # 40, dir drill ahead w/returns.

SILICEOUS GRAYWACKE:lt-dk gry, wht,blk,mod-hrd,brit,clst supp, wl indrtd,pr-mod srt,subang-subrnd,com-abun alt,predom dist grn bnd,loc-qtz vng,loc pyr,loc epid & epid stn qtz,intrbdd w/ ARGILLITE:dk gry-blk,sft-mod, v fn grn,v wl srtd,loc phyl shn,r-t agg qtz,r-tr calc & r loc clr disag calc rhombs, r-tr pyr

Lose all circ at 4435', drill blind T/4457', POOH, set plugs # 41 & 42 at 4457' & 4493'. Dir drill ahead w/ returns T/4514',lose circ & 470# of pump pressure.

Drill blind F/4514', drilling properties of formation T/4550' consistent w/predom Argillite & lesser Graywacke

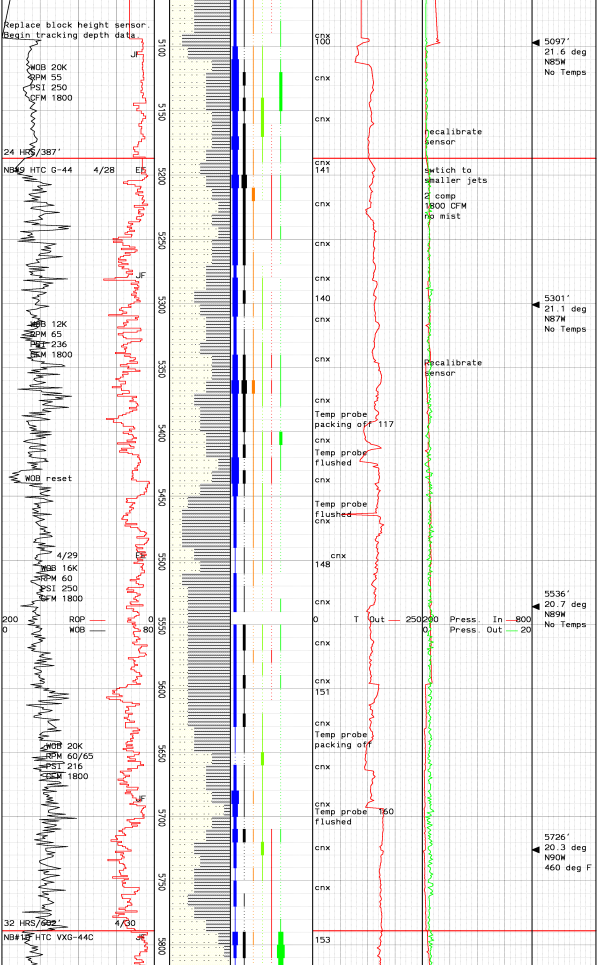
Drill blind to 4612', POOH, set plug # 43, RIH, pump 310 bbls mud down hole, POOH, set plug # 44. Lose all circ while drilling out cement, drill ahead blind.

Drill t/4800',POOH. Set 65 jnts 9.625",43.5#,L-80 HYD 521 casing, 57 jnts 9.625", 43.5#,L-80 BTC casing & 4 jnts 9.625",47.0#,L-80 BTC casing. Shoe set @ 4793'. Rig up for air, drill ahead w/ 8.5" bit and straight hole assy.

Tight hole at 4839'

SILICEOUS GRAYWACKE:lt-dk gry, wht,blk,salt & pepr,mod-hrd, brit,clst supp,pr-mod srt, subang-subrnd,com-abun si alt, predom dist gr bndry,loc-qtz vng,loc pyr,loc epid & epid stn qtz,dissm pyr,chl & chl stn clr qtz qtz vng intrbdd w/ARGILLITE: dk gry-blk,frm-mod hd,v fn grn, v wl srtd,loc wk phyl shn,r-t agg qtz,r-tr calc & r loc clr disag calc rhombs,r-tr pyr

Block height sensor malfunction,loss of depth tracking F/4817-4840' & F/4933-5093', replace with new sensor. Samples collected using tallyand visual estimation of kelly height. Driller noted no drilling breaks and no fill on cnx for this interval.



SILICEOUS GRAYWACKE:lt-dk gry, wht,blk,salt & pepr,hrd,clst supp,loc arg matrix,pr-mod srt, ang-subrnd,com-abun si alt, predom dist gr bndry,mlky qtz vng,r-tr druzy qtz,loc pyr w/in qtz,loc epid & epid stn qtz,chl & chl stn qtz vng intrbdd w/ARGILLITE:dk gry-blk,frm-mod hd,v fn grn,v wl srtd,loc wk phyl shn,r-t agg qtz,r-tr calc & r loc clr disag calc rhombs, r-tr pyr,loc epi vng.

Low returns F/5140-5180'

Drilling breaks of 40,54 & 60 ft/hr at 5206',5251', & 5310'.

SILICEOUS GRAYWACKE:lt-dk gry, wht,blk,salt & pepr,hrd,clst supp,loc abun arg matrix,pr-mod srt,ang-subrnd,com-abun si alt, predom dist gr bndry,pred wk-str rexl,mlky qtz vng,r-tr drzy qtz,loc pyr w/in qtz,loc epid, chl & chl stn qtz vng intrbdd w/ARGILLITE:dk gry-blk,frm-mod hd,loc britt,v fn grn,loc silty, loc rexl mica,r-t agg qtz,r-tr calc & r-tr loc clr disag calc rhombs,r-tr pyr,r loc epi vng.

Drilling breaks of 63 & 48 ft/hr at 5390' & 5409'

SILICEOUS GRAYWACKE:lt-dk gry, wht,salt & pepr,hrd,clst supp, loc abun arg matrix,pr-mod srt, ang-subrnd,com-abun si alt, predom dist gr bndry,pred mod-str rexl,mlky qtz vng,r-tr drzy qtz,r loc subhed qtz,calc frac fill,loc pyr w/in qtz,loc epid, chl & chl stn qtz vng,intrbdd w/ARGILLITE:dk gry-blk,frm-mod hd,loc britt,v fn gr,loc rexl mica,loc brecc,r-tr qtz,r-tr diss calc & r-tr loc clr disag calc rhombs,r-tr pyr,r loc epi vng.

Drilling breaks up to 63 ft/hr F/5602-5607'.

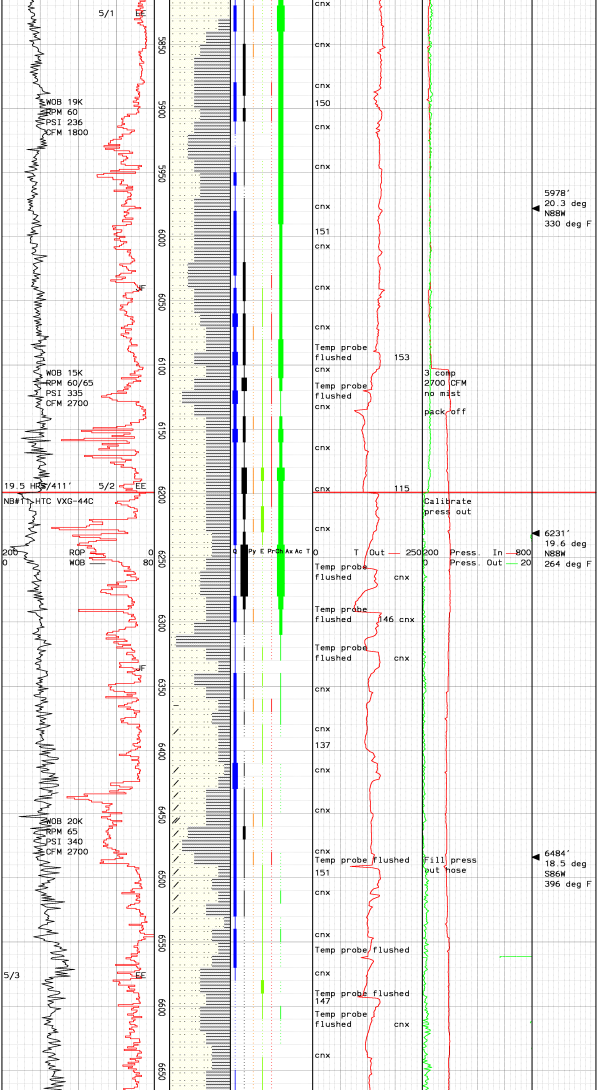
SILICEOUS GRAYWACKE & ARGILLITE: Similar to above, incr of arg matrix of Si GW,loc str rexl, decr in brecc of ARG,loc pyrr w/in qtz vng,loc mnr epi vng, decr druzy qtz,absnt subhed qtz & clr calc rhombs,decr vn & diss pyr,chl stn decr T/pred wk.

Drilling break zones F/5716-5734': ROPs up to 62 ft/hr.

High torque at 5774', pull back and ream 15'.

POOH, RIH, ream F/5036-5788'

Low returns F/5788-5800', pack off, ream on cnx.



Drilling breaks of up to 66 & 75 ft/hr at 5920' & 5949'

SILICEOUS GRAYWACKE:lt-med gry, hrd-v hrd,clst supp,loc abun arg matrix,mod-well srt,subang-subrnd,loc wk fol,predom dist gr bndry,pred mod-str rexl,clr-mlky qtz vng,r-tr drzy qtz,calc vng & frac fill,loc pyrr w/in calc vng,loc pyr w/in qtz,com chl & abun-pred chl stn Si GW, r-tr loc hem alt & hem stn qtz, intrbdd w/ARGILLITE:med-dk gry, frm- hd,loc britt,v fn gr-fn gr,occ mica,r-tr qtz,r-tr diss calc & r-tr loc clr disag calc rhombs,r-tr pyr,r loc epi vng.

Drilling breaks of up to 55 & 57 ft/hr at 5990'& 6029'

Low returns F/6080-6130', ream on cnx, add 3rd comp, v high returns at 6140', drill ahead w/ full returns.

Ream on cnx at 6134', 30# press incr F/pulling back to ream, lumps of v fn cuttings stuck to KB & DP.

Drilling breaks at 6126', 6150', 6159' & 6172',at ROPs of 70, 81, 121 & 80 ft/hr.

High torque F/6140-6165', V high at 6150' & 6156', pull back 10' & 5', ream down.

Crossed Federal/State lease line at 6171', no steam.

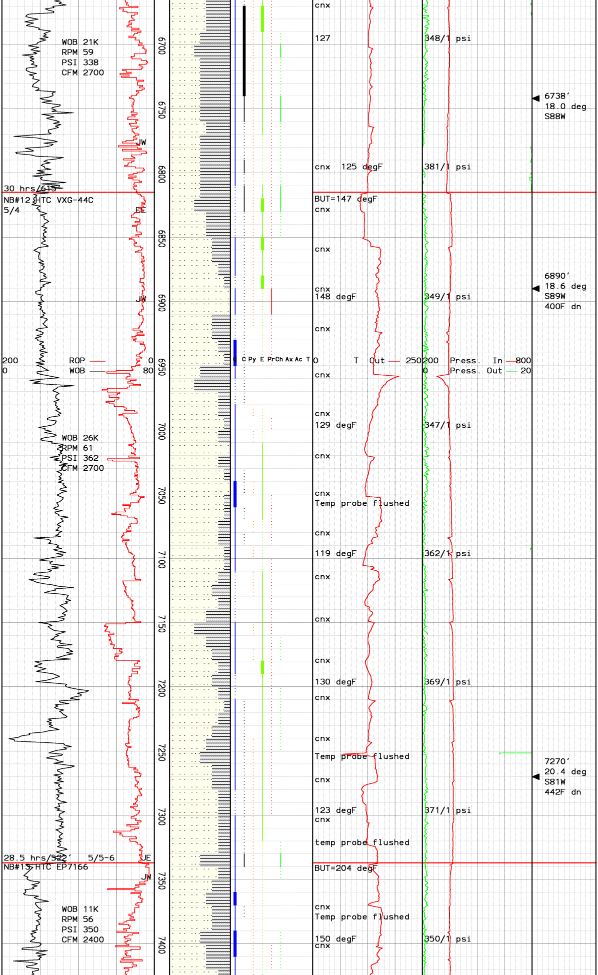
Drilling breaks at 6232' and 6269'. ROPs up to 107 & 71 ft/hr.

Drilling breaks at 6359' and 6404'.ROPs up to 59 & 46 ft/hr.

Drilling breaks at 6428', 6437','& 6489' ROPs up to 57, 115 & 71 ft/hr.

SILICEOUS GRAYWACKE:lt-med gry, hd-v hd,clst supp,loc mnr-abun arg matrix,mod srt,ang-subrnd, loc wk fol,predom dist gr bndrs,clr-mlky qtz vng,r-tr drzy qtz,calc vng & frac fill, loc pyr w/in qtz,com chl & abun-pred wk-mod chl stn Si GW, r-tr loc hem alt & hem stn qtz, loc MARGINALLY ATLERED:similar to above,med gry,hd-v hd,ind gr bndrs,hem & arg alt,loc qtz & calc brecc fill,intrbdd w/ ARGILLITE:med-dk gry,frm- hd, loc britt,v fn gr-fn gr,loc rexl mica,r-tr qtz,r-tr diss calc & loc disag calc rhombs, r-tr pyr,loc diss & vn pyroh.

Well making water at 6-8 bph



SILICEOUS GRAYWACKE:lt gry,tan, occ sl grn cast,hd-v hd,occ britt,dom med gr,mod well-well def gr bndrs,prly-mod well srtd, dom subrndd,occ granoblastic txt occ mott app,r-mnr clr qtz vng/disagg,tr-mnr mlky wht calc vng/agg,r loc chlor,com mod altrd,pr-indist gr bnd;intrbdd w/ARGILLITE:dk gry,r blk,mod hd-hd,britt,fn gr,occ slty appr,dom dull,r-tr wht calc vng,r epid,r pyrr,r chlor

Well making water at 7-9 bph

SILICEOUS GRAYWACKE:lt-med gry, loc dk gry,occ sl grn cast, hd-v hd,fn-med grs,well def gr bndrs,mod well-well srtd, subrndd-subang grs,r-tr wht qtz vng,r clr qtz,r-tr milky wht agg/vn calc,r dissem/vn pyr,loc r chlortzd grs.Intrbdd w/ ARGILLITE:dk gry-blk,mod hd-hd, britt,com phyll shn,r qtz vng, r-tr wht calc vng,r pyr vng.

SILICEOUS GRAYWACKE:lt-dk gry, wht,blk,salt & pepr,hrd,clst supp,loc abun arg matrix,pr-mod srt,ang-subrnd,com-abun si alt, predom dist gr bndry,pred wk-str rexl,mlky qtz vng,r-tr drzy qtz,loc pyr w/in qtz,loc epid, chl & chl stn qtz vng intrbdd w/ARGILLITE:dk gry-blk,frm-mod hd,loc britt,v fn grn,loc silty, loc rexl mica,r-t agg qtz,r-tr calc & r-tr loc clr disag calc rhombs,r-tr pyr,r-tr epi vng

Well making water at 6-8 bph

Drilling breaks at 7117', 7151',& 7211' ROPs up to 41, 66 & 42 ft/hr.

SILICEOUS GRAYWACKE:lt-med gry, loc dk gry,hd-v hd,pred fn gr, loc fn-med gr,well def gr bndrs, silty mtx,pr-mod srtd,subrndd-subang grs,r-tr wht qtz vng,r clr qtz,r-tr milky wht agg/vn calc,r dissem vn pyr,r pyrr,loc r chlortzd grs,intrbdd w/ARGILLITE:dk gry-blk,mod hd-hd,britt,com phyllshn,r qtz vng.

Drilling breaks at 7232',7244' & 7313' ROPs up to 35,38 & 54 ft/hr respectively.

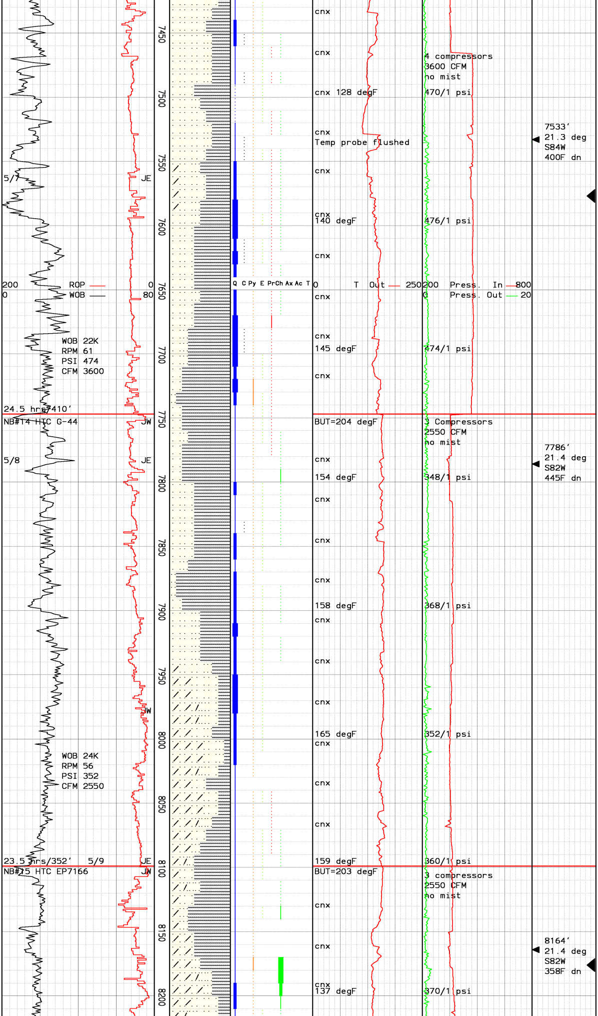
Well making water at 8-10 bph

Well is making ~10bph of water 40' of fill after trip.

Minimal, very fine cuttings over shakers

Drilling break at 7358'. ROP= 61 ft/hr

Drilling break f/7410-7415' ROP= 35-40 ft/hr



Increased cuttings over shakers, mod-course grained.

SILICEOUS GRAYWACKE:As described above, intrbdd w/ ARGILLITE:As described above.

Well making 13 bph of water.

8-10' of fill at connections.

Possible Steam Entry @ 7577'-7580'. Pressure incr 11 psi init,10 psi sust. Temp incr 14 degF init, 7 degF sust.

SILICEOUS GRAYWACKE:Incr silic altn,dom blchd & mottld appr, mnr-com qtz vng/agg;intrbdd w/ ARGILLITE:As described above.

Well making ~5bph of water.

Increased silty Argillite, more fill on connections, encounter tight spots @ 7693' & 7729'.Circulate hole clean @ 7747',POOH on bit run. No fill when back on bottom.

ARGILLITE:dk gry-blk,mod hd-hd, occ britt,v fn-fn gr,dom silty, wk-mod phyll shn,r qtz vng,r-tr dissem/vng pyr,r loc pyrr; intrbdd w/SILICEOUS GRAYWACKE: lt-med gry,wht,hd-v hd,granular txt,fn-med gr,mod well def gr bndrs,loc fol,tr-mnr qtz vng, r epid,r chlor wash.

Well making ~10bph of water, 3-8' of fill at connections.

Minimal, Very fine cuttings over shakers.

SILICEOUS GRAYWACKE:Incr altn, pred blchd wht app,pred indist grn bnds;intrbdd w/ARGILLITE: As described above.

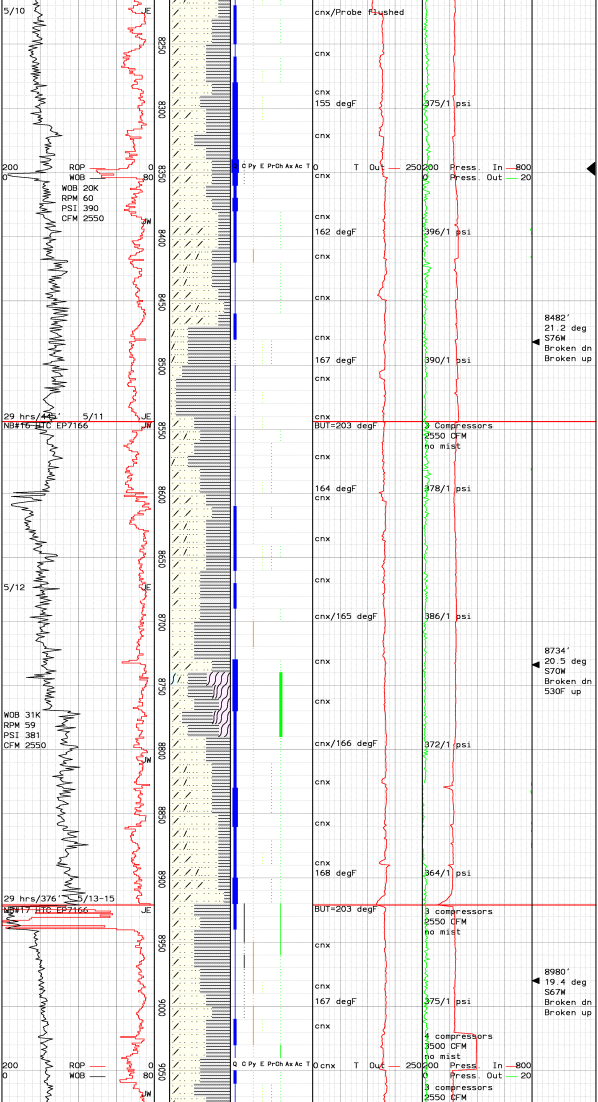
Well making 5-8 bph.

Increased cuttings over shakers. Mod-course grained.

POOH for new bit. RIH, 10' fill on bottom. Drill ahead, minimal cuttings over shakers.

Well making 8-10 bph.

Possible Steam Entry @ 8176'. Pressure incr 15 psi init, 15 psi sust. Temp incr 7 degF init, 2 degF sust.



Drilling break @ 8238':
ROP= 35'/hr, WOB= 15K.
Drilling breaks f/8257-8268':
ROP= 32-43'/hr, WOB= 16K.
Well is not making water.

5-6' of fill at connections.

SILICEOUS GRAYWACKE:As described above; intrbdd w/ ARGILLITE:As described above.

Steam Entry @ 8347'. Press incr 12 psi init, 8 psi sust. Temp incr 7 degF init, 4 degF sust.Drilling break f/8347-8354':ROP=47-77 ft/hr,WOB=21K.

Well making water at 9-11 bph.

SILICEOUS GRAYWACKE:lt-med gry. com wht,loc dom blchd appr 20-60%,hd-v hd,rexln,fn-v fn gr, indist gr bndrs,tr-mnr clr qtz vng,tr mlky qtz vng,tr calc vng,loc r yel epid,r chlortzd grs;intrbdd w/ARGILLITE:med gry-blk,mod hd-hd,dull appr,r disem & agg pyr.

Well making water at 6-8 bph.

Minimal, very fine grained cuttings over shakers.

SILICEOUS GRAYWACKE:As described above,decr blchd app,predom indist gr bndrs, intrbdd w/ARGILLITE:As described above,loc phyl shn, loc biot,loc-r pyr vng.

Increased cuttings over shakers.

Well making water at 9-10 bph

Drilling break @ 8732':
ROP= 42 ft/hr, WOB= 21K.

High torque spot @ 8742'.

SILICEOUS GRAYWACKE:As described above;intrbdd w/ ARGILLITE:As described above; intrbdd w/SERPENTINE:lt grn, clr,mod hd,occ britt,waxy luster,mnr chlor;intrbdd w/ BLUESCHIST:r-10%,blue,clr, violet,hd,mass,silic.

Drilling break @ 8862':
ROP=42 ft/hr, WOB=24k

Well making water at ~10 bph.

Bit began torquing up @ 8901' and 8907'. 89 psi drop in standpipe pressure, 21 degF drop in blooie line temp @ 8920'.Bit stuck and twist off @ 8921'.POOH for fishing run, Recovered fish, RIH & Drill.

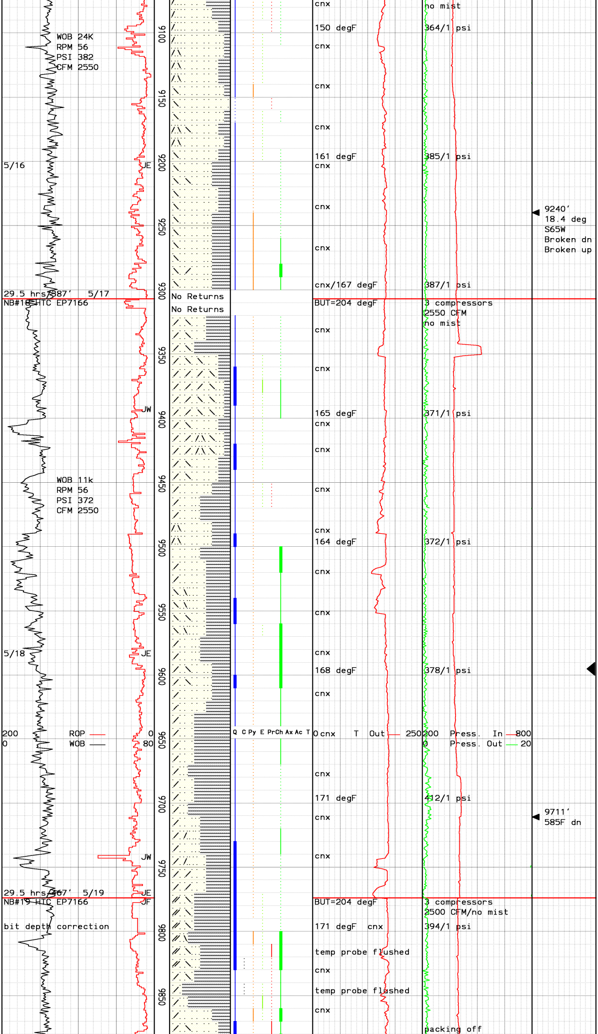
Drilling break f/8921-8940':
ROP= 50-244'/hr, WOB= 3-7K.

2-3' of fill at connections.

SILICEOUS GRAYWACKE:indist-mod well def gr bndrs; intrbdd w/ ARGILLITE:dull,silty,r-tr dissem & vng pyr.

Increased, coarse grained cuttings over shakers.

Well making water at 4-9 bph.



Drilling Break f/9095-9120': ROP=25-39 ft/hr, WOB=17-30k

SILICEOUS GRAYWACKE:As described above,gry,lt-dk brn, lt-dk gr,wl-v wl def grn bnd, pred unaltrd grns,pr-mod srtd, mod-v hrd,com-abun hrnflsc txt, intrbdd w/ARGILLITE:as described above.

2-4' of fill at connections.

Well making water at 3-5 bph.

High torque spot @ 9279'.

SILICEOUS GRAYWACKE:incr altd grs,abun hornfelsic txt w/ brn grndmass,wht qtz/fldspr phenos & blk hrnblnd phenos,tr-mnr chlortzn,com blchd appr;intrbdd w/ARGILLITE:v dull,fn-med gr,r-tr dissem & vng pyr.

No cuttings over shakers f/ 9307-9328'.

9343'-9350' 4th Compressor Added:3500 CFM, No Mist.Temp out dip due to 4th compressor. Return to 3 compressors w/ minimal returns.

Drilling break at 9419' ROP=47'/hr WOB=9-12k

Well making water at 8-10 bph.

SILICEOUS GRAYWACKE:decr blchd app,pred dist grn bnds,mnr-com chlortzd grns,abun hornfelsic txt,wl indrtd,matrix supp,loc-r pyr vng,intrbdd w/ARGILLITE:r-tr phyl shn,loc metallic luster.

3-5' fill at connections.

Temp probe flushed @ 9489', 9521' & 9553'

Minimal cuttings over shakers.

Well making water at 5-7 bph.

Possible Steam Entry @ 9595'. Pressure incr 5 psi init, 5 psi sust. Temp incr 4 degF init, 3 degF sust.

Well making water at ~11 bph.

Unrestricted Steam Flow Rate:

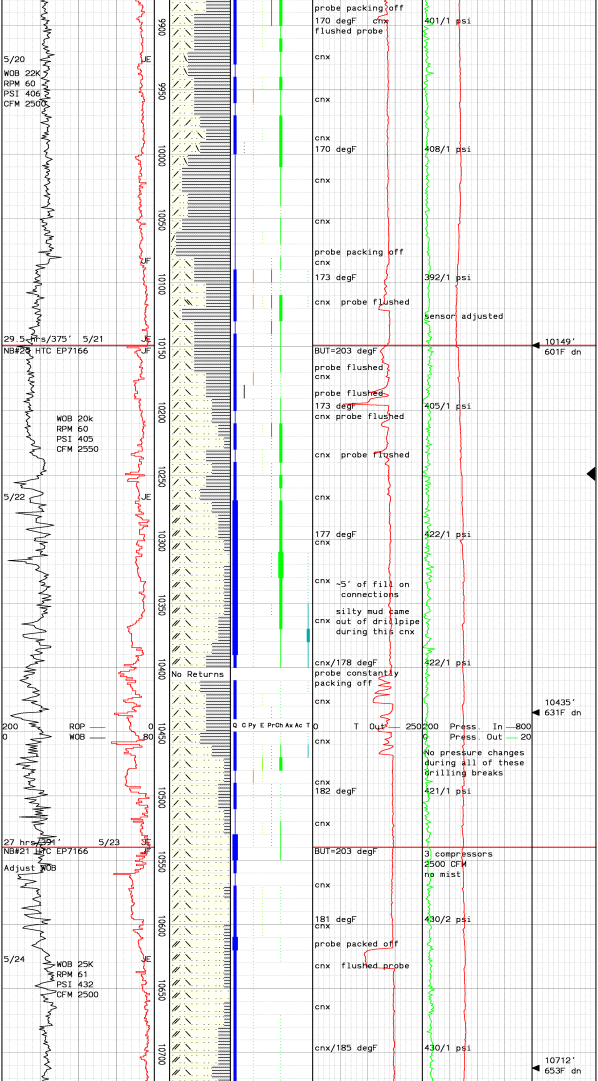
22 psi incr, due to switching compressors or from cleaning out the fractures.

Drilling break @ 9741': ROP=73'/hr, WOB=3-5k

Unrestricted SFR=5,300 lbs/hr
H2S= 218 ppm (Air off)
NH3= 300 ppm (Air off)

Well making water at ~10 bph.

SILICEOUS GRAYWACKE:loc perv alt,str rexl,loc ind gr bndrs, incr well def w/depth,pred hornfelsic txt,mnr-com hem alt & stn,tr-mnr chl & stn,loc mnr fol,intrbdd w/ARGILLITE:pred sugary txt,loc brn cast,mod



rexl,mod hd-hd.

Very fine cuttings and low returns F/9870-9880'

Low returns at 9910'

2-3' of fill at connections.

Well making water at 7-8 bph.

ARGILLITE:As described above, incr brn cast,loc friable grs; intrbdd w/SILICEOUS GRAYWACKE: As described above,decr hem alt & incr chlortzn,abun blchd apr.

Slight pressure out incr of 0.5psi at 10065',pressure in slowly decr psi,temp out incr 1degF. Possibly unpacking.

ARGILLITE:As described above; intrbdd W/ SILICEOUS GRAYWACKE: As described above,loc com str rexl,loc str hornfelsic txt,r loc tour,r-tr loc bio books.

Well making water at ~10 bph.

Unrestricted SFR=5,300 lbs/hr
H_2S= 550 ppm (Air off)
NH_3= 600 ppm (Air off)

RIH T/10119', tag fill (30'), safety ream T/10149', drill ahead w/low returns.

Establish full returns at 10240'.

Possible steam entry at 10249', ROP=38 ft/hr,3 Klbs. Press incr 8 psi init, 8 psi sust,temp incr 3 degF init,2 degF sust.

Very fine cuttings over shakers. Well making water at 7-8 bph. Low returns f/ 10380-10400'.

SILICEOUS GRAYWACKE:incr perv altn w/depth,dom blchd appr,v hd,str rexl,indist-prly def gr bndrs,com hornfelsic txt,com-abun qtz vng/agg,mnr chlor & stn,mnr fol,r-tr tourm;intrbdd w/ARGILLITE:blk,brn,pred sugary txt,mod rexl,friable-mod hd.

Drilling break f/10369-10375':
ROP= 30-36'/hr, WOB= 5-15K.
Drilling break f/10403-10409':
ROP= 38-44'/hr, WOB= 5-10K.
Drilling break f/10424-10427':
ROP= 35-41'/hr, WOB= 5-13K.
Drilling break f/10435-10437':
ROP= 35-53'/hr, WOB= 2-9K.
Drilling break f/10458-10460':
ROP= 49-57'/hr, WOB= 12-17K.

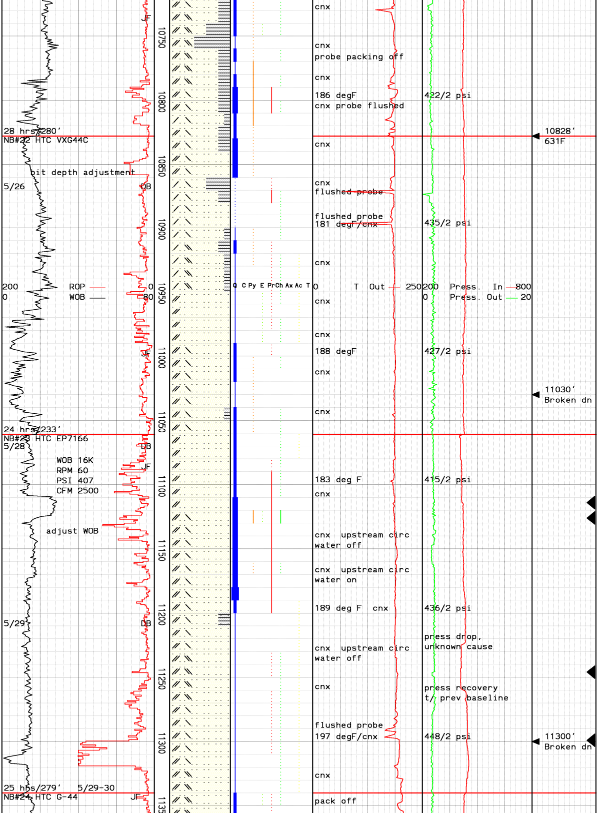
Unrestricted SFR=12600 lbs/hr
H_2S= 1058 ppm (air off)
NH_3= 500 ppm (air off)

Drilling break at 10560-10562'
ROP=53 ft/hr, WOB=10K

SILICEOUS GRAYWACKE:loc incr druzy qtz mnr-com,perv altd,dom indist gr bndrs;intrbdd w/ ARGILLITE:as described above.

Abundant rusty red powder began coating frags at 10370' & incr w/depth. Possible oxidization of minerals or drill pipe. XRD analysis indicates maghemite.

2-3' of fill on connections



SILICEOUS GRAYWACKE:decr gr size t/v fn-fn loc str hornfelsic txt,loc gold bio books;intrbdd W/ARGILLITE: as described above.

SILICEOUS GRAYWACKE:decr alt t/ marginal,decr hornfelsic txt t/ weak;ARGILLITE:as above.

Unrestricted SFR=17500 lbs/hr
H2S= 1193 ppm (air off)
NH3= 900 ppm (air off)

Well making water at ~8 bph.

SILICEOUS GRAYWACKE:wht,brn, dom str hornfelsic txt,incr alt t/ pervasive,bleached app,dom indist gr bndrs,r chlor incl; ARGILLITE:as above;r-m disagg qtz w/ loc-r actin incl,r yellow epid.

Unrestricted SFR=13200 lbs/hr
H2S=891 ppm (air off)
NH3=390 ppm (air off)

Steam entries at 11,114': 10# init press incr,11# stable incr, 1 deg temp incr. & 11,126':5# init press incr, 11# stable incr, 1 deg temp incr.

Steam entry at 11246': 13# init press incr, 13# stab press incr, 1 deg temp incr.

Steam entry at 11297': 9# init press incr, 3# stab press incr, 5 deg init temp incr, 3 deg stable temp incr. Associated fracture zone f/11300-11320'.

Unrestricted SFR=21400 lbs/hr
H2S=1391 ppm (air off)
NH3=500 ppm (air off)