Tecton Geologic

COMPANY	Calpine Corporation
WELL NAME	NEGU-13 Redrill 2 (formerly DX-54)
FIELD	The Geysers
COUNTY	Lake
STATE	California
WELL HEAD COORDINATES	421,368N, 1,781,384E 2139'E & 2737'S of the NW corner of Sec 8, T11N, R8W
ELEVATION	3345', GL
RIG - DAY RATE START DATE	5/28/2012
TD DATE	7/16/2012
TOTAL DEPTH	10,458'
TRUE VERTICAL DEPTH	10,092'
TD LOCATION	415'N 1984'E
DRILLING CONTRACTOR	NCPA Rig #1
COMPANY REPRESENTATIVES	Steve Gamble Russ Silva

LOG INTERVAL

DATE LOGGED	5/28/12	TO	7/16/12
DEPTH LOGGED	5795'	TO	10458'
MUD DRILLING	5795'	TO	6270'
AIR DRILLING	6270'	TO	10458'
LOG SCALE	1:600		
UNIT NO.	C32		

LOGGING GEOLOGISTS

Charley Wahl (cw), Patrick Broderick (pb), Dick Dunlap (dd), Drew Fetterman (df),Matt Dobbs(md), Daniel Phelps (dp)

HOLE

10.625"	TO	7960'
8.5"	TO	10458'

CASING

13.375"	FROM	Surface	TO	1270'
11.75"	FROM	1270'	TO	5770'

Liner

7"	FROM	Surface	TO	5102'
8.625"	FROM	5059'	TO	7960'
7"	FROM	7960'	TO	10409'

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		

SYMBOLS

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

REMARKS

All depths from kelly bushing KB=29'

LITHOLOGY

▤	Argillite	⬚	Siliceous Graywacke
⊞	Chert	▧	Metamorphic Ultramafic
▤	Siltstone	–	Weak Foliation
▦	Greenstone	=	Strong Foliation
▨	Serpentine	/	Marginal Alteration
∫	Blueschist	//	Pervasive Alteration
✳	Felsite	\	Weakly Hornfelsic
▤	Clay	\\	Strongly Hornfelsic
⬚	Lithic Graywacke		
^	Argillaceous Graywacke		

STEAM ENTRIES

	Init	Sust
7393'	0	0
7795'	0	0
8156'	15	0
10123'	6	6
10195'	2	2

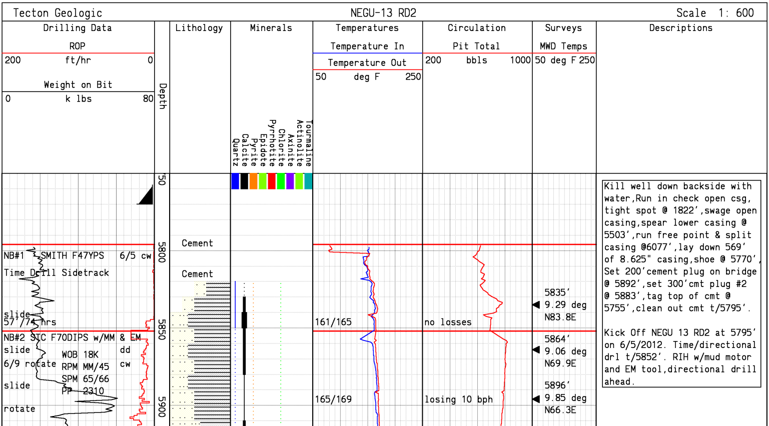
WATER ENTRIES

none

SECONDARY MINERALS

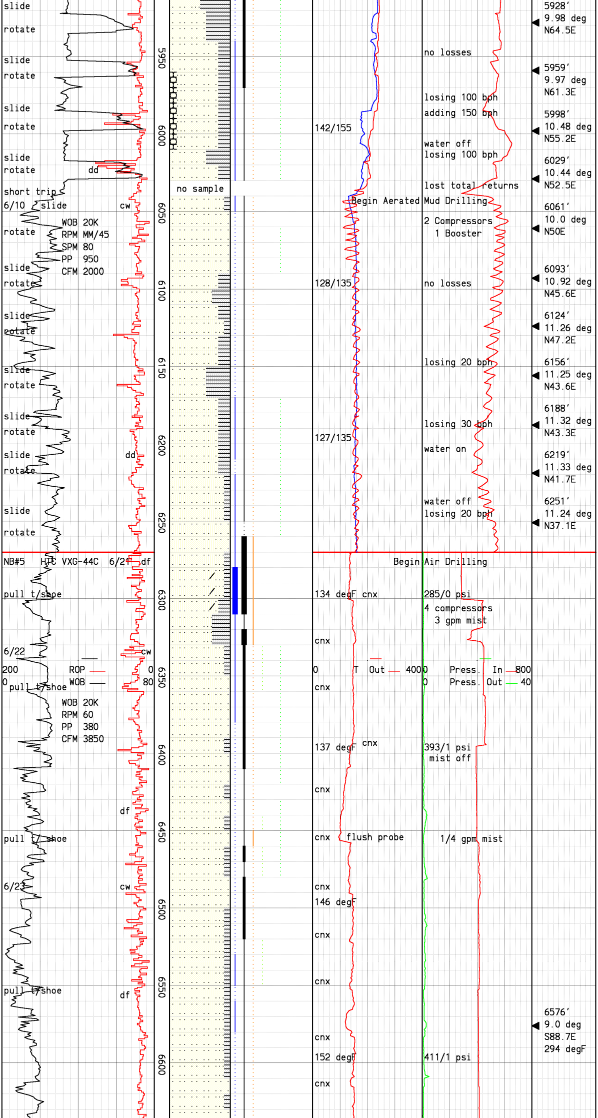
Q = Quartz
C = Calcite
P = Pyrite
E = Epidote
R = Pyrrhotite
Ch = Chlorite
X = Axinite
A = Actinolite
T = Tourmaline

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



Kill well down backside with water,Run in check open csg, tight spot @ 1822',swage open casing,spear lower casing @ 5503',run free point & split casing @6077',lay down 569' of 8.625" casing,shoe @ 5770', Set 200'cement plug on bridge @ 5892',set 300'cmt plug #2 @ 5883',tag top of cmt @ 5755',clean out cmt t/5795'.

Kick Off NEGU 13 RD2 at 5795' on 6/5/2012. Time/directional drl t/5852'. RIH w/mud motor and EM tool,directional drill ahead.



SILICEOUS GRAYWACKE:lt-med gry,dk gry,mod hd-hd,loc britt,well def gr bndrs,r-tr wht qtz vng,r calc,pyr,occ lt chlor wash,intrbdd w/ARGILLITE:dk gry,blk,sft-mod hd,v fn gr,tect polish,slicks,r phyl shn,tr-mnr wht calc vng,r agg bright yl pyr.
CHERT:tan,wht,grn,salmon,v hd,tr qtz microvng,r agg yl pyr.

Lost total returns @ 6035'. POH 2000' to install jet sub and begin aerated mud drlg.

SILICEOUS GRAYWACKE:lt-med gry,dk gry,mod hd-hd,fresh,loc britt,well def gr bndrs,r wht qtz vng,r calc,r dissem pyr,occ r chlor wash,intrbdd w/ ARGILLITE:dk gry,blk,sft-mod hd,v fn gr,r tect polish,r phyl shn,r qtz vng,tr wht calc vng.

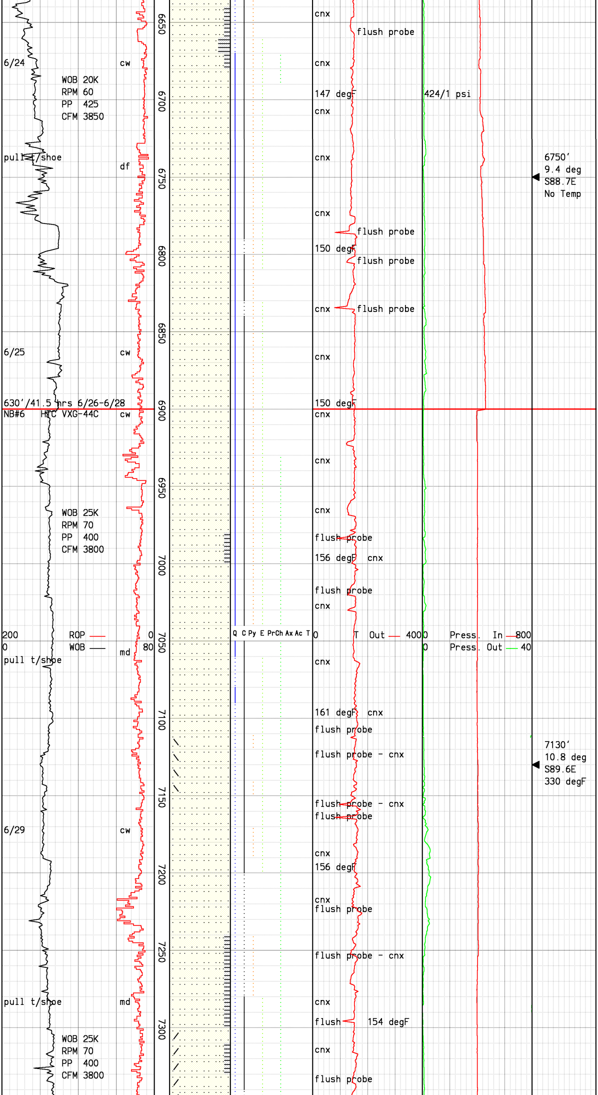
Surging due to mud aeration causing spurious fluctuations in Temperature and Pit Volume

Drill hole to 6942',begin air drilling. Unable to get stabilizers through KOP @ 5795'.Remove stabilizers & ream hole to 6270'. Establish reaming deviated a new hole. Pull up and begin drilling new hole on air at 6270'.

SILICEOUS GRAYWACKE:med-dk gry,med grn gry in sample,hd,brit,fresh,fn gr,dist gr bndrs,well to mod srtd,silty,r-tr wht qtz vng,tr-mnr calc,r disem pyr,occ pale chlor wash,loc r bronze mica,intrbdd w/ARGILLITE:dk gry r blk,sft-mod hd,v fn gr,r phyl shn,tr calc vng.

Drilling Break @ 6472',ROP 20 to 37ft/hr w/small temp incr.

SILICEOUS GRAYWACKE:med-dk gry,grn gry,hd,brit,fresh app,fn gr mod def gr bndrs,r loc altr of felds,r-tr qtz,t-mnr calc,r agg pyr,r pistachio epid,r chlor,intrcltd w/ARGILLITE:dk gry,blk v fn gr,aphan txt,sft-mod hd,loc phyl shn,tr calc vng,r pyr.



SILICEOUS GRAYWACKE:med-dk gry, grn gry,hd,brit,fresh app,fn gr mod def gr bndrs,r loc altr of felds,r-tr qtz,tr calc,occ qtz& calc vng,r agg pyr,r pistachio epid,intrcltd w/ARGILLITE:dk gry,blk,v fn gr,aphan txt,sft-mod hd,loc phyl shn,r qtz vng, tr calc vng,r pyr.

Drilling Break @ 6796',ROP 21 to 38ft/hr.No temp or press incr.

SILICEOUS GRAYWACKE:lt-med gry, grn gry,occ brn,hd,brit,fresh app,fn gr,prly-mod def gr bndrs, loc brecc,spkld app,tr qtz vng, r-tr calc,r agg & dissem pyr,r canary yl epid,r epid as grs in mtx,loc r pale grn chlor stn. Very r Serp frags in hand smpl.

Extended trip for rig repairs.

SILICEOUS GRAYWACKE:lt-med gry, dk gry,lt grn gry,hd,brit, fresh,fn gr,mod def gr bndrs, mod srtd,tr wht qtz vng,tr calc, r disem pyr,r pistachio epid,r chlor,pale chlor wash,r bronze mica,intrbdd w/ARGILLITE:dk gry r blk,sft-mod hd,v fn gr,r phyl shn,tr calc vng.

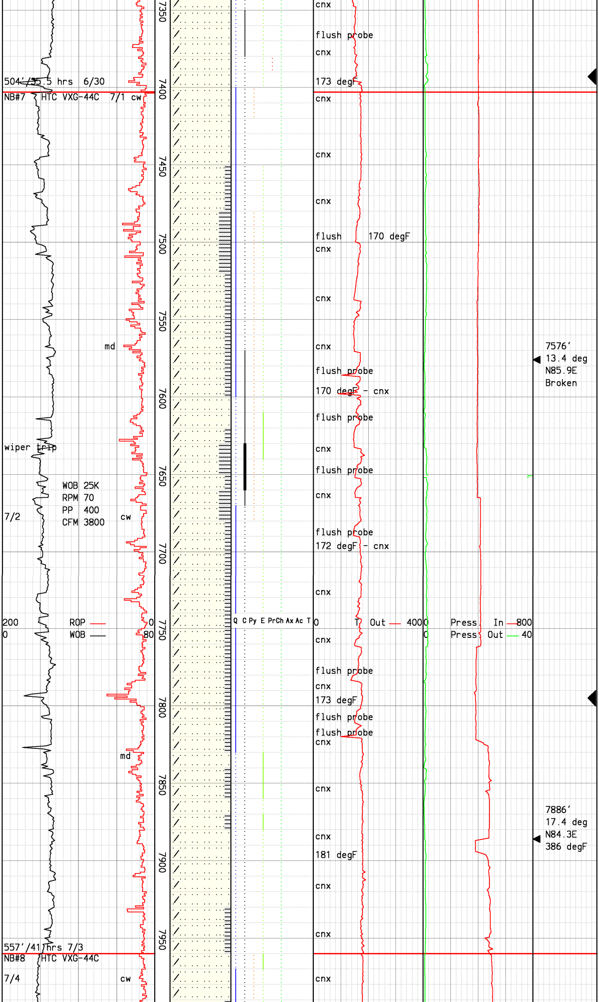
Pull to shoe due to sloughing formation. 86'fill after wipe.

Temperature probe packing off, flushing when necessary.

SILICEOUS GRAYWACKE:lt-med gry, lt grn/gry,hd-v hd,brit,fresh, pred fn gr,mod-well def gr bndrs,mod srtd,loc wk-mod fol, loc v wk hornfelsic txt,r-tr qtz vng,tr calc vng,loc disem pyr,r yel epid stng & pistachio grn epid,r chlor & pale chlor wash.

Drill Break f/7215't/7233', ROP 22-49ft/hr,Possible small temp incr, no press incr.

SILICEOUS GRAYWACKE:lt-med gry, lt grn gry,loc dk gry,hd,brit, fresh,fn gr,mod def gr bndrs, mod srtd,wk fol,tr wht qtz vng, r-tr calc,abs-r disem pyr,r epid w/r epid stn,r chlor,pale chlor wash,intrbdd w/ARGILLITE: dk gry,r blk,sft-mod hd,v fn gr and r calc vng,r yl pyr.



Probable entry at 7393'. ROP f/16-35'/hr, temp f/153-176 degF, no pressure incr, rotary stalling.

USFR = 7,300 lbs/hr
H2S = 166 ppm (air off)
NH3 = 280 ppm (air off)

SILICEOUS GRAYWACKE:lt-med gry, loc dk gry,v lt grn/gry,hd-v hd,brit,v fn-fn gr,pr-mod def gr bndrs,pred prly srtd,fresh-wkly altd incr w/depth,r qtz vng,r-tr calc vng,abs-loc disem pyr,r yel & pistachio grn epid,loc disem pyrr,r chlor & wk chlor wash.

Flush Temp Probe @connections.

SILICEOUS GRAYWACKE:wht-lt gry, loc med gry,mnr v lt grn/gry, hd-v hd,brit,v fn gr,wkly altd, wk blchd app,r-tr,qtz vng,tr calc vng,r disem pyr,r-tr yel & pistachio grn epid,r chlor, intrbdd w/Argillite:med-dk gry, mass-silty,wk phyll sheen,r calc vng,r disem pyr.

Drilling break f/7626-7630', ROP f/17-47'/hr. No temp or pressure increase.

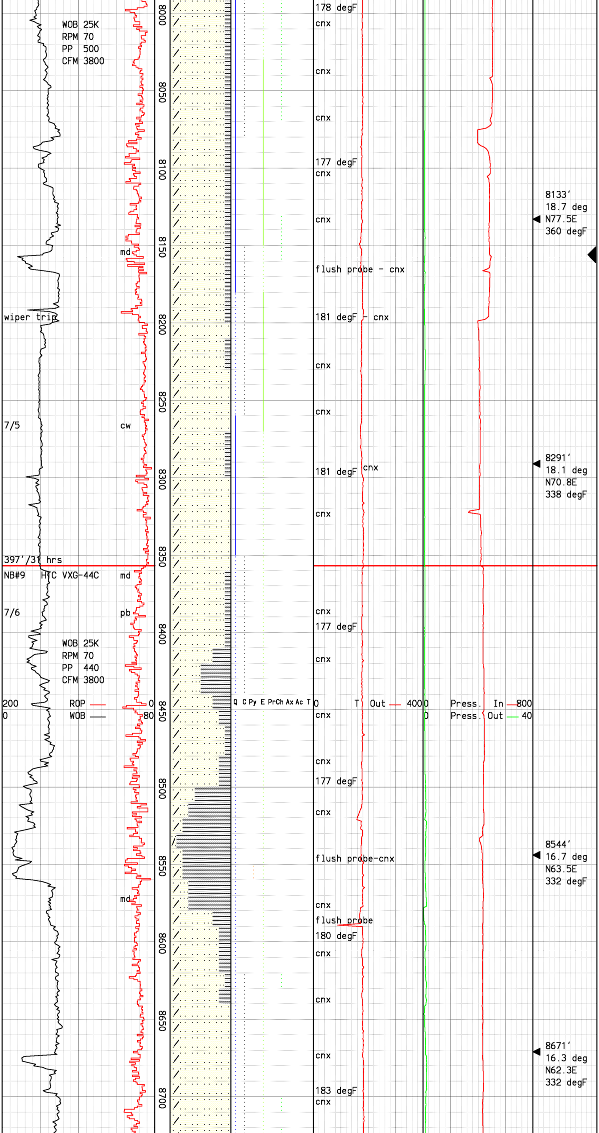
SILICEOUS GRAYWACKE:wht-ly gry, occ med gry,hd-v hd,brit,fn gr, prly def gr bndrs,wkly altrd, loc blchd app,tr wht-clr qtz vng,r calc,r yl-yl grn epid,r chlor stn,intrcltd w/ARGILLITE: blk,dk gry,v fn gr,aphan txt, sft-mod hd,r calc,abs-r yl pyr.

Possible Entry:f/7793-7798' ROP f/32-63ft/hr.Temp incr 5 degF int,5 degF sust, no press incr.

SILICEOUS GRAYWACKE:wht-gry,v hd,brit,v fn-loc med gr,prly-mod def gr bndrs,prly-mod srtd, wkly altd,mnr wk blchd app,r-tr qtz vng,r calc vng,abs-tr pist grn & yel epid,loc chlor, intrbdd w/ARGILLITE:gry-dk gry, mod hd,mod brit,r qtz vng,r calc vng.

USFR = 8,900 lbs/hr
H2S = 177 ppm (air off)
NH3 = 270 ppm (air off)

Drill 10 5/8" hole to 7960'. Reduce hole size to 8 1/2" due to high drag.



SILICEOUS GRAYWACKE:lt gry,dk gry,blchd app,hd-v hd,prly def gr bndrs,wk fol,loc r silty,tr wht-clr qtz vng,r dissem calc, occ r yl pyr,r-tr pistachio grn epid,r chlor stn of felds, intrcltd w/ARGILLITE:dk gry, blk,mod hd,aphan txt,silicic, r qtz,r calc,r pyr.

Possible entry at 8156'. No drilling break, WOB f/26-12k, rotary stalling. No temp incr, init 15psi press incr, stable 3 psi incr. Press drop over next kelly.

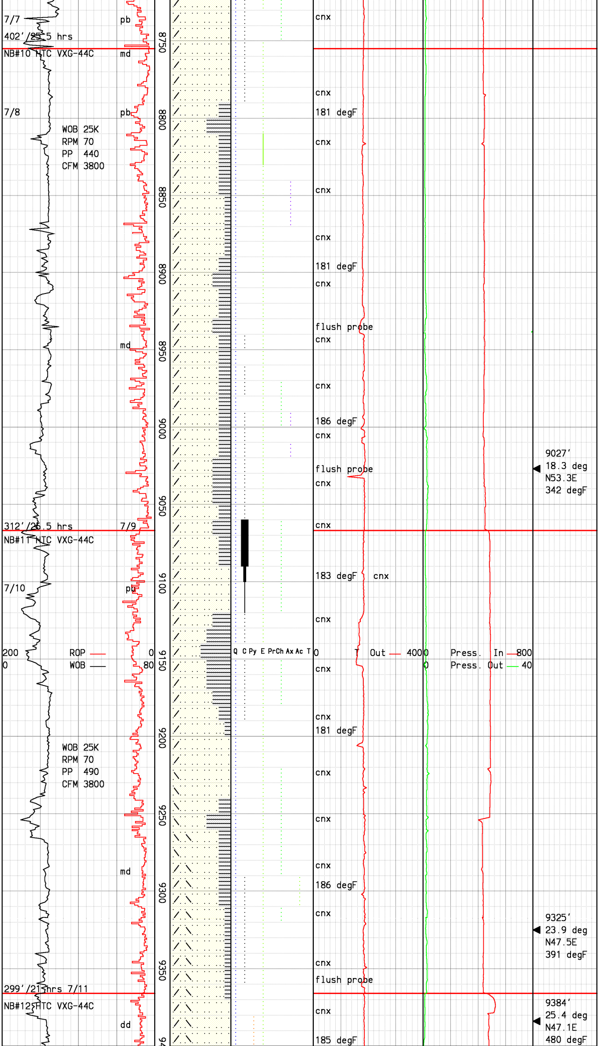
SILICEOUS GRAYWACKE:wht-gry,v hd,brit,v fn gr,prly-mod def gr bndrs,prly-mod srtd,wkly altd, pred wk blchd app,r qtz vng, abs-r calc vng,r-tr pistachio grn & yel epid,loc chlor, intrbdd w/ARGILLITE:dk gry, blk,mod hd,aphan txt,silicic, r qtz,r calc,r pyr.

USFR = 10,200 lbs/hr
H2S = 315 ppm (air off)
NH3 = 260 ppm (air off)

ARGILLITE:dk gry,blk,mod hd, aphan txt, silicic,loc blchd app,intbdd w/SILICEOUS GRAYWACKE:lt-med gry,occ dk gry,v hd,brit,fn gr,mod def gr bndrs,prly-mod srtd,wkly altrd,loc wk blchd app,r qtz vng, abs-r calc vng, r-tr pistachio grn & yel epid.

ARGILLITE:dk gry,blk,mod hd, aphan txt, silicic,loc blchd app,intbdd w/SILICEOUS GRAYWACKE:lt-med gry,wht,occ dk gry,v hd,brit,fn gr,mod def gr bndrs,prly-mod srtd, wkly altrd,loc wk blchd app, r qtz vng,r-tr pistachio grn & yel epid,abs-r pyr vng.

SILICEOUS GRAYWACKE:wht-gry,v hd,brit,v fn-med gry,prly-mod def gr bndrs,prly srtd,wkly altd,pred wk blchd app,r qtz vng,loc calc vng,r pistachio grn & yel epid,loc chlor flakes, loc wk chlor wash,intrbdd w/ ARGILLITE:gry-dk gry,mod hd,mod britt,pred aphan,loc disem pyr.



USFR = 14,100 lbs/hr
H2S = 228 ppm (air off)
NH3 = 250 ppm (air off)

SILICEOUS GRAYWACKE:wht-gry,v hd,brit,v fn-med gr,prly-mod def gr bndrs,prly srtd,wkly altd,pred wk blchd app,r qtz vng,loc calc vng,r pistachio grn & yel epid,abs-r pale pink axinite,loc chlor flakes, intrbdd w/ARGILLITE:gry-dk gry, mod hd,mod brit,pred aphan.

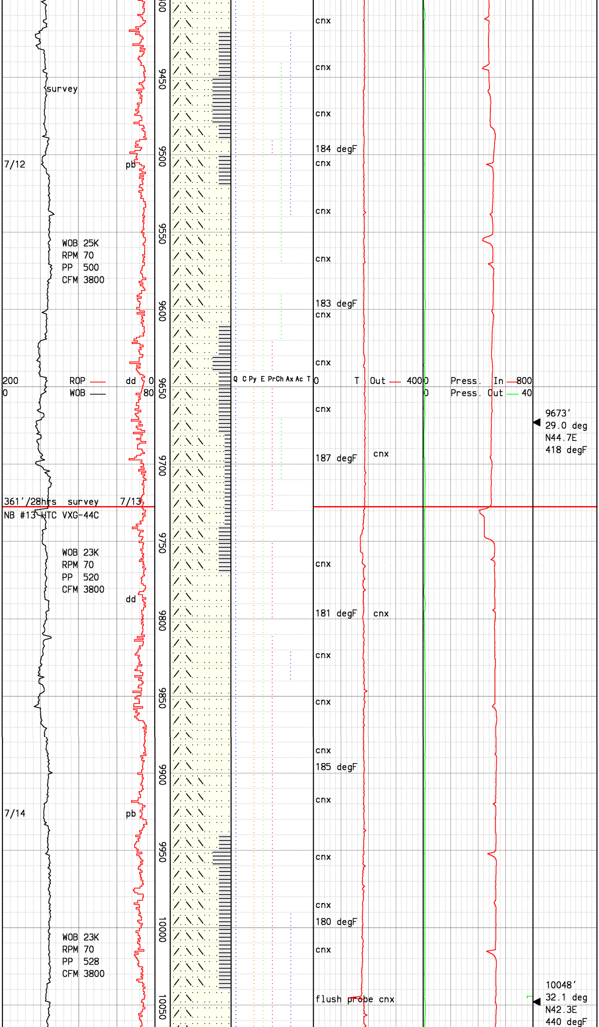
SILICEOUS GRAYWACKE:wht,lt gry-mnr dk gry,v hd,brit,v fn-fn gr, prly-mod def gr bndrs,prly srtd, wkly-mnr mod altd,com-abun wk-mod blchd app,r qtz vng,abs-loc calc vng,r pistachio grn & yel epid,loc wk chlor wash & chlor flakes,abs-loc pale pink axin, intrbdd w/ARGILLITE:AA.

USFR = 12,800 lbs/hr
H2S = 244 ppm (air off)
NH3 = 270 ppm (air off)

SILICEOUS GRAYWACKE:wht,lt gry-mnr dk gry,v hd,brit,v fn-fn gr, prly-mod def gr bndrs,prly-mod srtd,tr wk fol,wkly-mnr mod altd,dec wk blchd app w/depth,r qtz vng,r-abun(poss slough after trip) calc vng,r pistachio grn & yel epid,loc wk chlor wash & chlor flakes,abs-loc pale pink axin,intrbdd w/ARGILLITE:gry-dk gry,mod hd,mod brit,pred aphan, mnr fiss txt.

SILICEOUS GRAYWACKE:wht,lt gry-dk gry,hd-v hd,brit,v fn-fn gr, prly def gr bndrs,tr wk fol, wkly-mnr mod altd,loc-abun wkly hornfelsic,r qtz vng,r-tr calc vng,r pistachio grn & yel epid, loc wk chlor flakes,abs-loc pink axin,loc lt grn/bladed actin,intrbdd w/ARGILLITE:gry-dk gry,mod hd,mod brit,pred aphan,mnr fiss txt.

USFR = 13,000 lbs/hr
H2S = 302 ppm (air off)
NH3 = 260 ppm (air off)



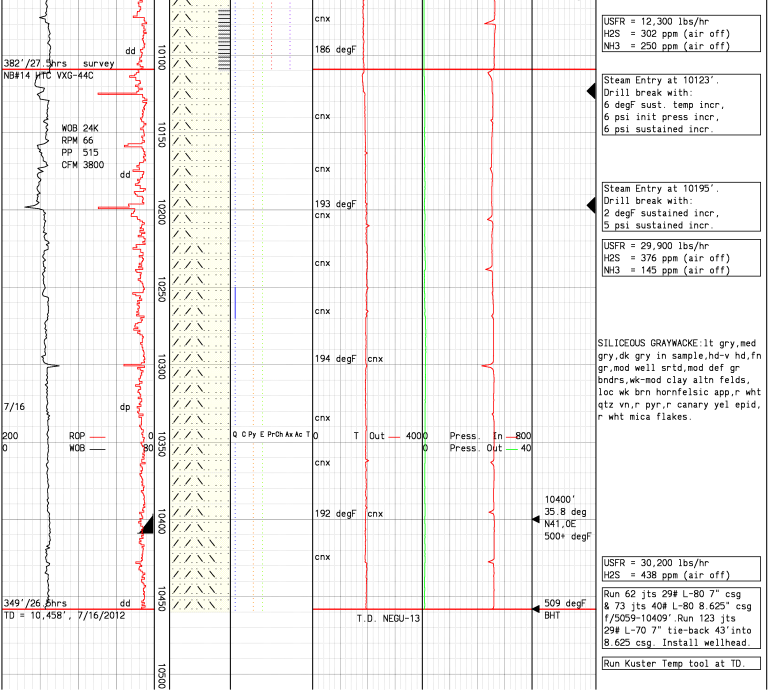
SILICEOUS GRAYWACKE:lt-med gry, med gry sample,hd,brit,fn gr, well srtd,mod def gr bndrs,loc wk fol,loc wk clay altn felds, loc wk hornfelsic app,r qtz vn, r-absnt calc vn,r yel/grn epid, r chltzd biot flks,r pink axin xls,r pyrrho f/9460',loc thnly intrbdd with ARGILLITE:dk gry, steel gry,blk,mod hd,loc brit, loc blky habit,dom silic,aphan-slty,loc fiss,r tecton polish, r pyr vng,r pyrrho vng.

SILICEOUS GRAYWACKE:lt-med gry, tan,med gry sample,hd,brit,fn gr,well srtd,mod def gr bndrs, loc wk fol,loc wk clay altn felds,loc wk hornfelsic app,r qtz vn,r yel/grn epid,r chlrtzd biot flks,abs-r pink axin xls, abs-r pyrrho,loc thnly intrbdd w/ARGILLITE:dk gry,steel gry, blk,mod hd,loc brit,loc blky habit,dom silic,aphan-slty,loc fiss,r tecton polish,r pyr vng.

USFR = 13,000 lbs/hr
H2S = 293 ppm (air off)
NH3 = 182 ppm (air off)

SILICEOUS GRAYWACKE:med gry, med-dk gry in sample,hd,brit,fn gr,mod well srtd,fairly def gr bndrs,loc wk clay altn felds, loc wk hornfelsic app,r qtz vn, r canary yel/pistach grn epid, r chlrtzd biot flk,r pink clear axin xl,r pyrrho,r magnetite, occ intrbdd w/ARGILLITE:dk gry, steel gry,blk,mod hd,loc brit, loc blky habit,dom silic,aphan-slty,loc fiss,r phyll shn,r pyr and pyrrho vng.

SILICEOUS GRAYWACKE:med gry, med-dk gry in sample,hd-v hd,fn gr,mod well srtd,fairly def gr bndrs,loc wk clay altn felds, incrngly hornfelsic app w/depth, r qtz vn,r canary yel/pistach grn epid,r chlrtzd biot flk,r pyrrho,r magnetite,occ intrbdd w/ARGILLITE:dk gry,steel gry, blk,mod hd,loc brit,loc blky habit,dom silic,aphan-slty,loc fiss,r phyll shn,r pyr vng.



USFR = 12,300 lbs/hr
H2S = 302 ppm (air off)
NH3 = 250 ppm (air off)

Steam Entry at 10123'.
Drill break with:
6 degF sust. temp incr,
6 psi init press incr,
6 psi sustained incr.

Steam Entry at 10195'.
Drill break with:
2 degF sustained incr,
5 psi sustained incr.

USFR = 29,900 lbs/hr
H2S = 376 ppm (air off)
NH3 = 145 ppm (air off)

SILICEOUS GRAYWACKE:lt gry,med gry,dk gry in sample,hd-v hd,fn gr,mod well srtd,mod def gr bndrs,wk-mod clay altn felds, loc wk brn hornfelsic app,r wht qtz vn,r pyr,r canary yel epid, r wht mica flakes.

USFR = 30,200 lbs/hr
H2S = 438 ppm (air off)

Run 62 jts 29# L-80 7" csg & 73 jts 40# L-80 8.625" csg f/5059-10409'.Run 123 jts 29# L-70 7" tie-back 43'into 8.625 csg. Install wellhead.

Run Kuster Temp tool at TD.