



**HOLE**

6.25" TO 500'  
TO  
TO  
TO  
TO

**CASING**

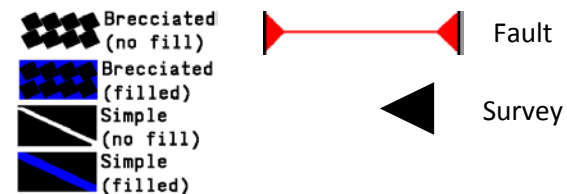
4.5" FROM Surface TO 495'  
FROM Surface TO  
FROM Surface TO

COMPANY Ormat  
WELL NAME Glass Buttes 52-33  
FIELD Glass Buttes  
COUNTY Lake  
STATE Oregon  
WELL HEAD COORDINATES

**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**

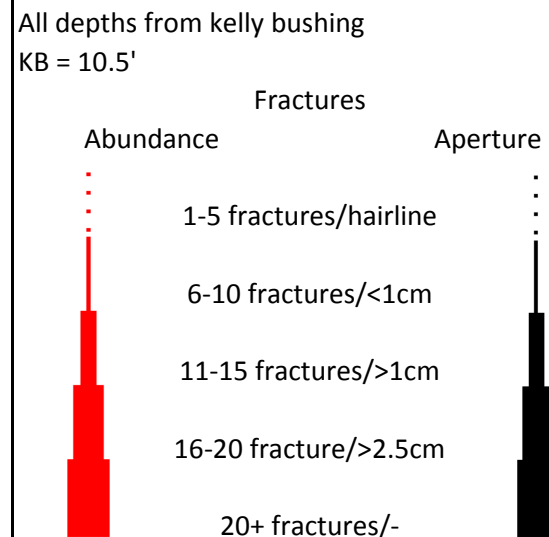


ELEVATION  
RIG - DAY RATE START DATE  
TD DATE

**LITHOLOGY**



**REMARKS**



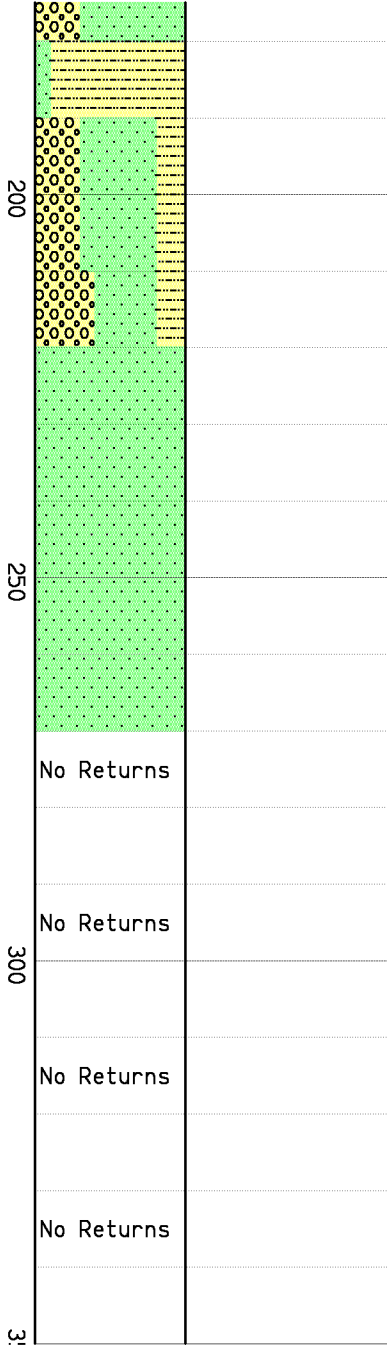
**LOG INTERVAL**

DATE LOGGED 10/26/14 TO  
DEPTH LOGGED 500' TO  
MUD DRILLING 500' TO  
AIR DRILLING N/A TO N/A  
LOG SCALE 1:300  
UNIT NO. H&H  
LOGGING GEOLOGISTS  
Eric Booker, Patrick Broderick

**SECONDARY MINERALS**

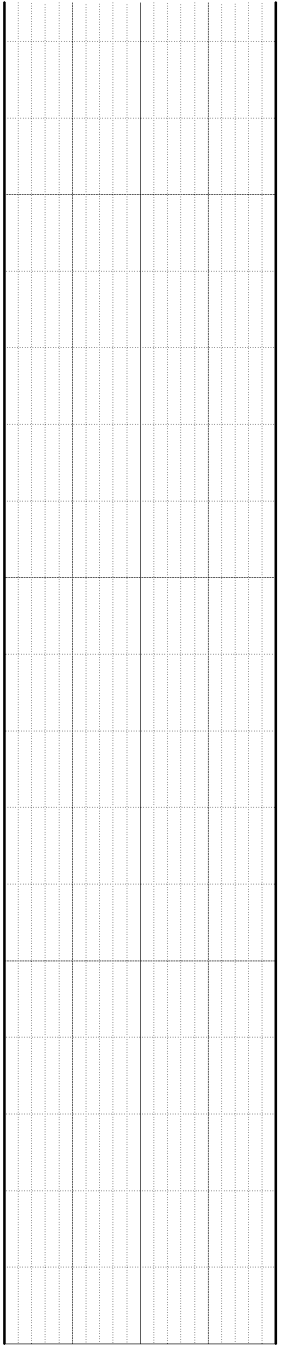
Q = Quartz	Rare	<< 1%
C = Calcite	Trace	< 1%
P = Pyrite	Minor	1% to 4%
Pr = Pyrrhotite	Common	4% to 7%
H = Hematite	Abundant	7% to 10%
Ch = Chlorite		> 10%
An = Anhydrite		
E = Epidote		
C1 = Clay		

Fractures  Aperture Abundance  Type  Notes	Depth (ft)	Lithology	Minerals  Clay Epidote Anhydrite Chlorite Hematite Pyrrhotite Pyrite Calcite Quartz	Descriptions	Sample Pictures	Temperatures	
						Temperature In	Temperature Out
						0	deg F 300
				Basalt: dk gry, blk, loc med gry, hd, v fn gr, well def gr bndrs, friable, r-tr qtz vng, r-tr calc vng, r-tr hem stng, r chlor wash, r clay altrn of felds.			
				Basalt: dk gry, blk, loc med gry, hd, v fn gr, well def gr bndrs, friable, r-tr qtz vng, r-tr calc vng, r-tr hem stng, r chlor wash, r clay altrn of felds.			
				Clay/Sand/Gravel: tan, orange, red, firm-mod hd, unconsolidated, clay to gravel(5mm) frags of basalt, obsidian, scoria, rhyolite & tuff, rndd-angular, r disem calc, tr-abun hem altrn.			



Clay/Sand/Gravel:tan,orange,red,loc grn,firm-mod hd,unconsol, clay to gravel(5mm) frags of basalt,obsidian,scoria,rhyolite & tuff,rndd-angular,r disem calc,tr-abun hem altrn,loc mnr-abun chlor altrn.

Sand:wht,tan,transluc,mod hd,weakly cemented,angular-sub angular frags of qtz,mnr hematite altrn,loc mnr limonite crusting.



50  
400  
450  
51

No Returns

No Returns

No Returns

No Returns

No Returns

No Returns

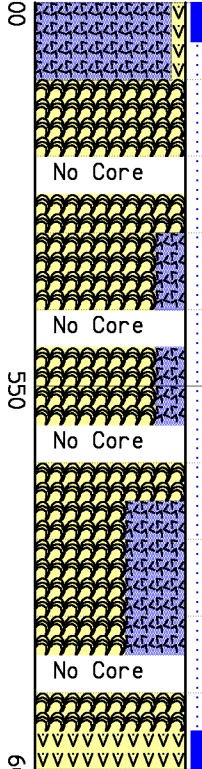
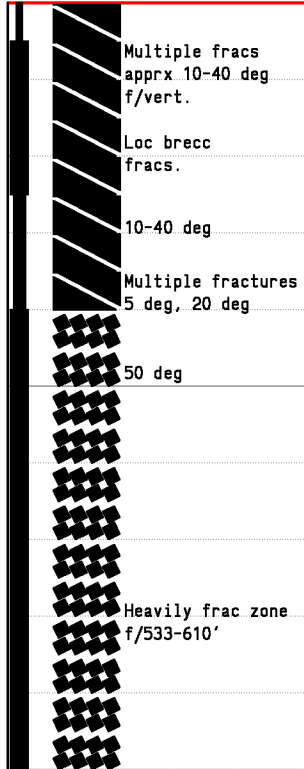
No Returns

No Returns

Note:all fracture  
angle measurments  
are acute relative  
t/core axis

NB#1 ADP, 3.875"

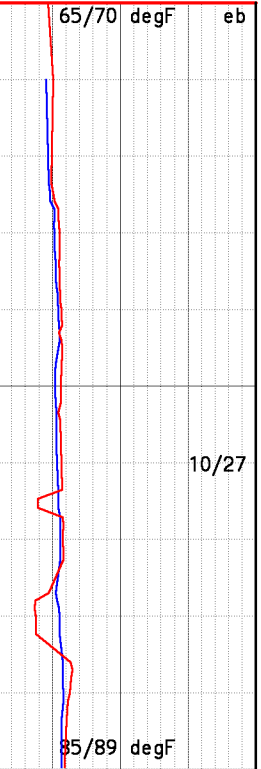
Rotary drill 6.25" hole to 50'.Run 4.5", 11.6#,J-55,  
VFJ casing to 495'.

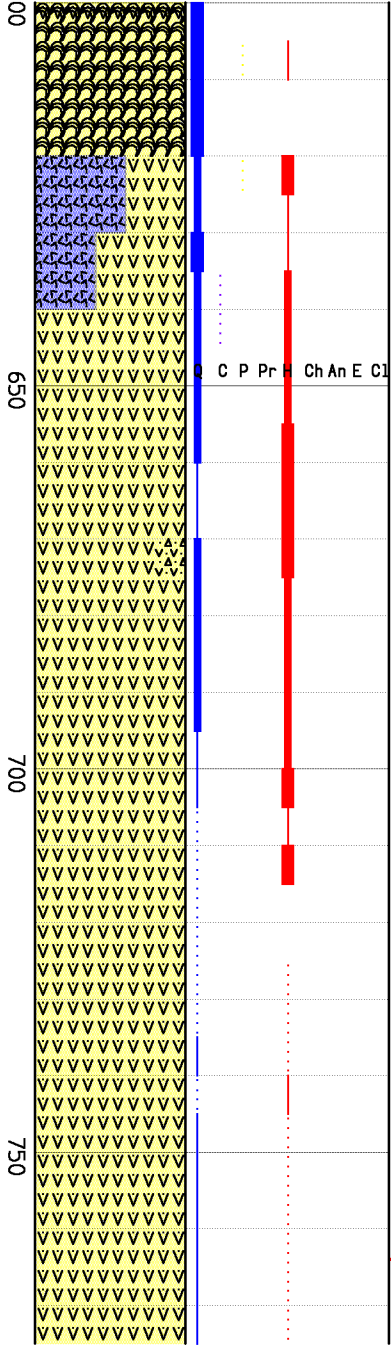
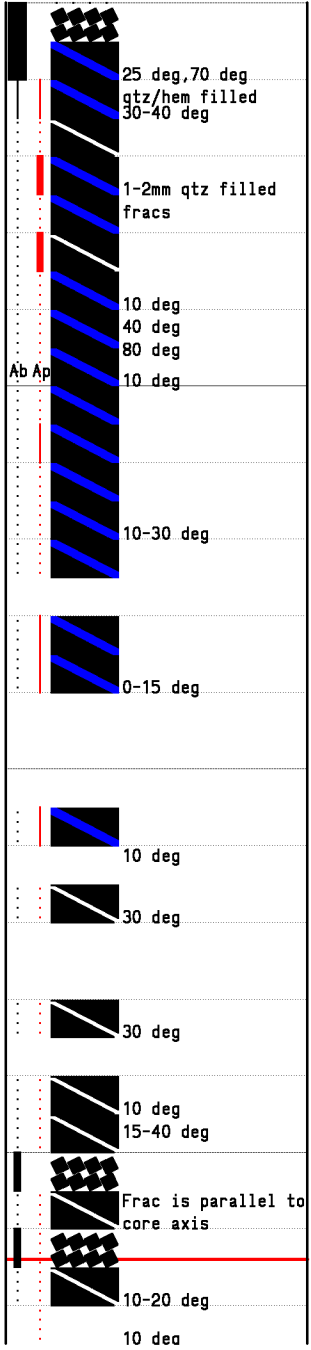


Drill ahead w/NB#3 ADT 6E4 3.895" core bit.

Obsidan: dk gry-blk, loc pnk, tan, grn, hd-v hd, friable, loc v frac/  
crumbly, smooth conc frac planes, com devitr, com mlky wht qtz frac  
fill, com hem stn on frac faces, occ intrcall w/Rhyolite dk lt-dk  
gry, blk, loc pnk, grn rdsh-brn, tan, mass, hd-v hd, loc sft, crumbly,  
friable, com flow banding, microxln w/, txtr becoming glassy, tr-m  
qtz frac fill, r-tr clr qtz amygds, loc silicic, loc biotite phenos  
parallel to flow banding.

Approx 50% recovery in obsidian zone f/510-610'.





Obsidian:lt-dk gry,com frac,vitr lust,hd-v hd,loc sft & crmbly, fri,mass,con frac,con com mlky wht qtz vng & frac fill,r hem stng on frac faces,intrcall/Tuff:dk gry-blk obsidian frags in sft pnk ash matrix.

Rhyolite:lt-md gry,blu-gry,wht,hd-v hd,aphan,silic,com vitr lust,loc plag laths,mnr-mnr qtz vng,pos r pyr,tr-com hem stng.

Lost circulation at 648'.

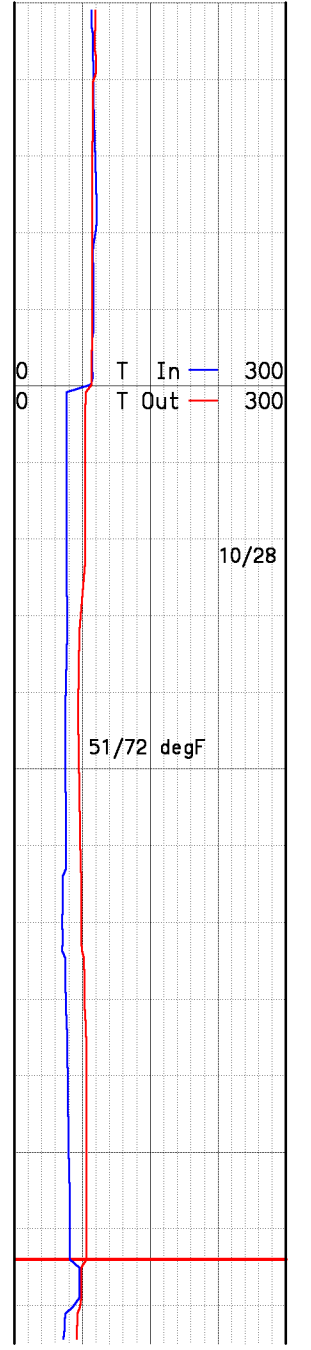
Tuff(Ash Flow):wht,tan,buff,occ pale grn,loc rdsh-brn,hd-v hd, aphan,well indur,loc mott app,mass,occ rhyolite frags in mtx,up to 3 mm,loc brecc @ 675':ang rhyolite clasts in silic mtx.

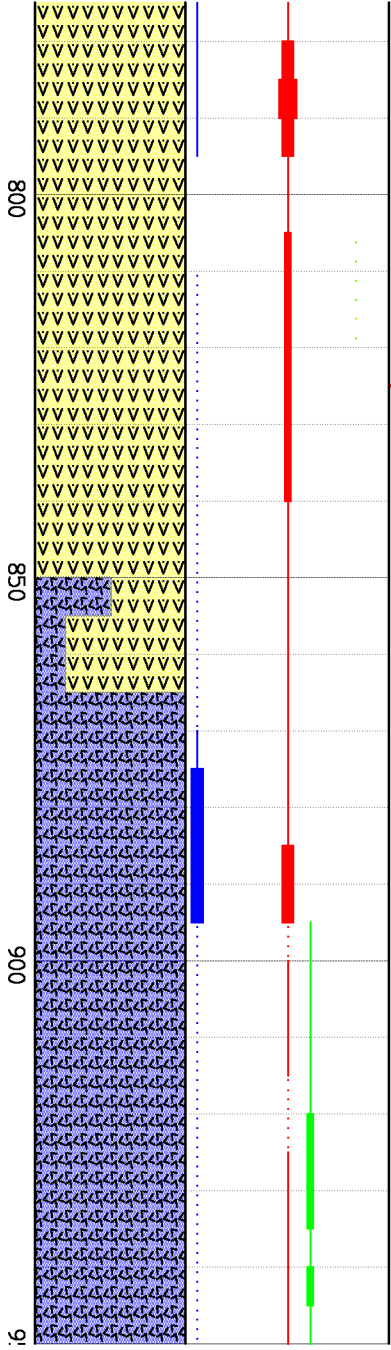
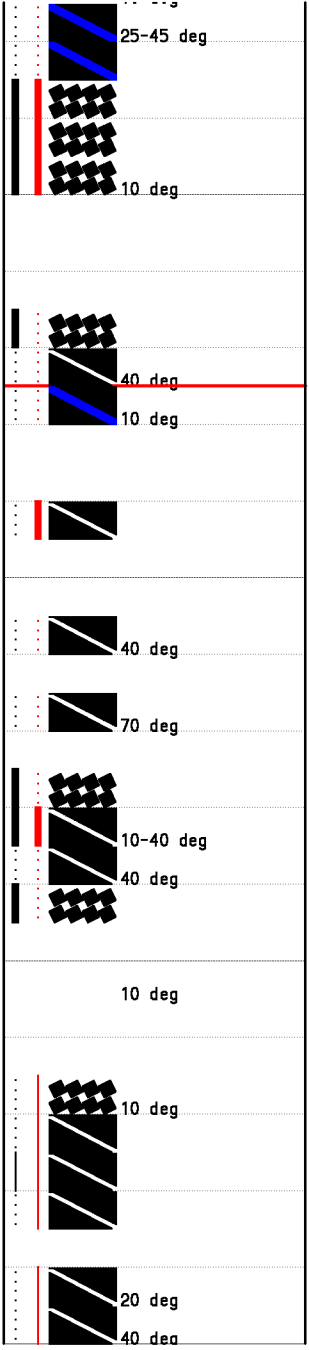
Tuff(Ash Flow):as above,incr pl grn cast,loc sft-frn,blchd app, pr xtlr gr bndrs,r-tr clr druzi qtz in voids,occ hem frac fill, r-tr hem stng on frac faces.

Pull out of hole to change bit.

NB#4 ADT 6E4

Tuff(Ash Flow):wht.buff.occ pl arn.loc rdsh-brn,hd-v hd.aphan.



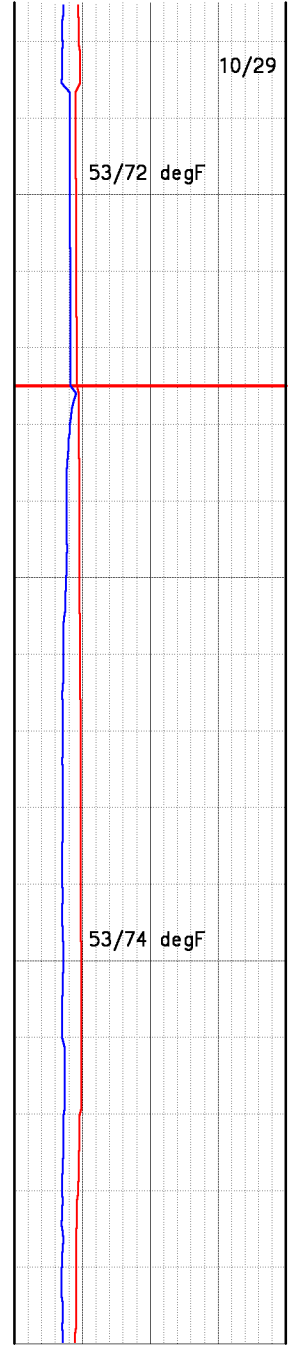


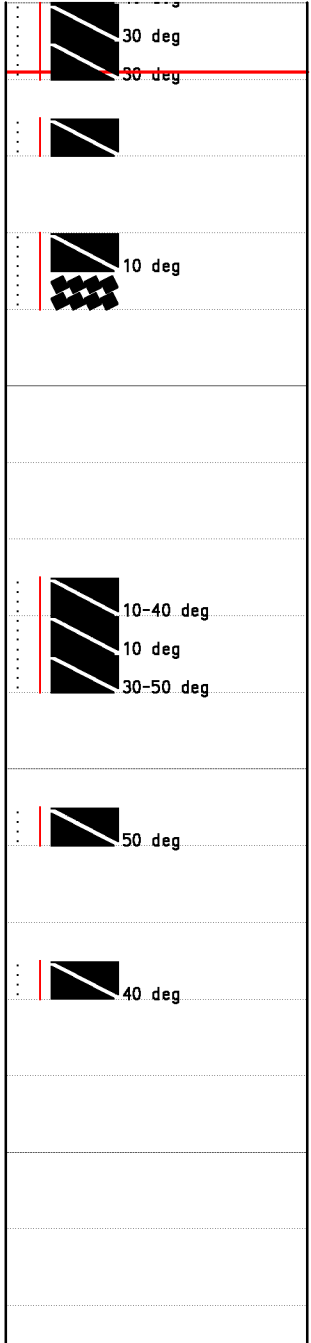
well indur, incr silic w/depth, fri, com brecc frags, r rhyo frags in ash mtx, rdsh-brn pumice in mtx @ 785', tr drsy qtz, red hem stng on frac faces.

Plugged bit, POH.

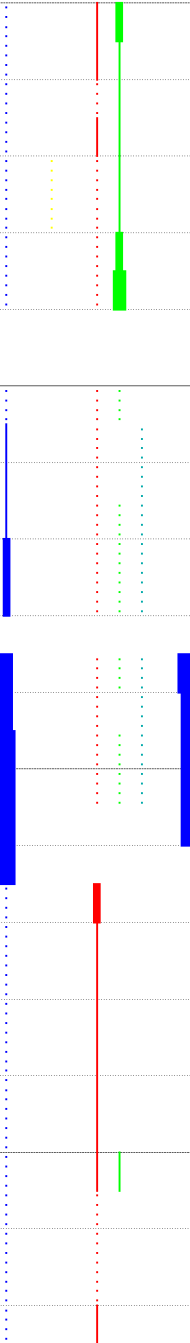
Tuff(Ash Flow): wht, lt buff, com pl grn cast, loc rdsh-brn, pl yel, mott, dom comp rock, frm-hd, well indur, wldd, silic, decr relic txt, loc cross bedding of cobble sz clasts of pum @ 810', loc wht & tan pum, rhyo frags in ash mtx, loc flow banding 30-50 deg to core axis, r qtz druz, r-com qtz vng & frac fill, r-com hem stng on frac faces, v r pl yel/pist grn min nr 820', poss epid.

Rhyolite: lt-med gry, pl grn, hd-v hd, loc sft, mod-str alt, silic, mcroxtln grndmass, r perl txt, mod alt, sub ang to sub rndd clasts in mtx, mnr-com cly alt lath shaped felds, r qtz vng, str chlor alt, r-t rddsh-brn ox on fracs, abund cly @ 928'.





50  
1000  
1050  
1100



Obsidian: med gry-blk, h-v hd, friable, loc v frac/crumbly, smooth conc frac planes, glssy txt, r perl txt, com mlky wht qtz frac fill, com hem stn on frac faces, com anyhd in frac, incall w/ Tuff Breccia: wht, tan, grn hd-v hd, mott, silic, ang-sub rndd clasts of rhyo, pumice & obsidian in ash mtx, abund term qtz xtls lining 3cm open void at 1046'.

Tuff Breccia: wht, tan, grn, buff, v hd, sub rnded-angular frags of obsidian in mtx, silic, r qtz vng & frac fill, r hem stng on frac faces intercall w/Rhyolite(Pyroclastic): wht, tan, hd-v hd, mod-str alt, swirly flow bndg, occ lith in mtx.

NB#6 ADT 6E4 core bit

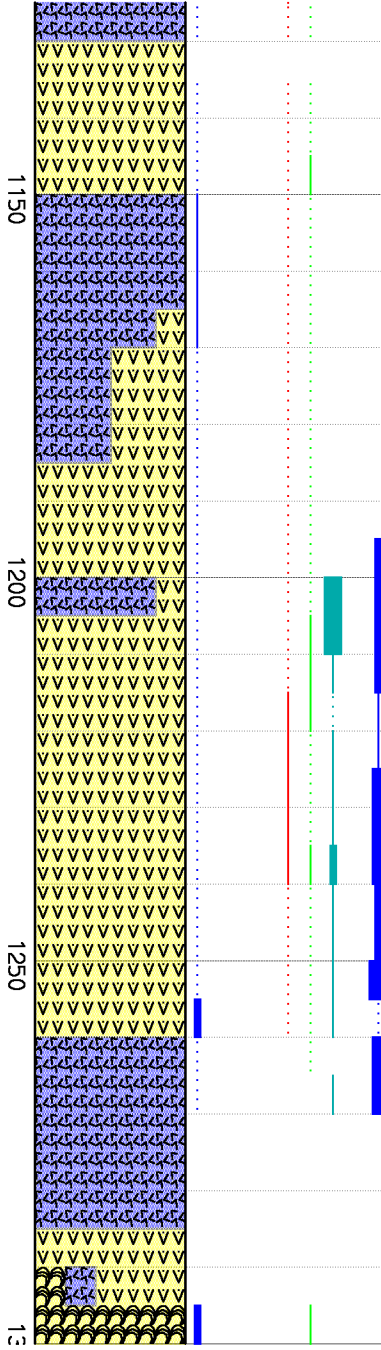
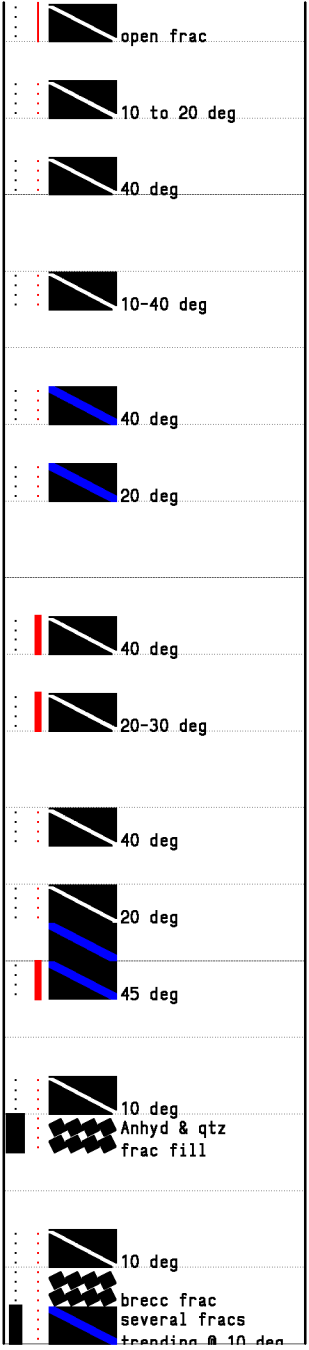
53/64 degF

10/31

52/61 degF

11/1

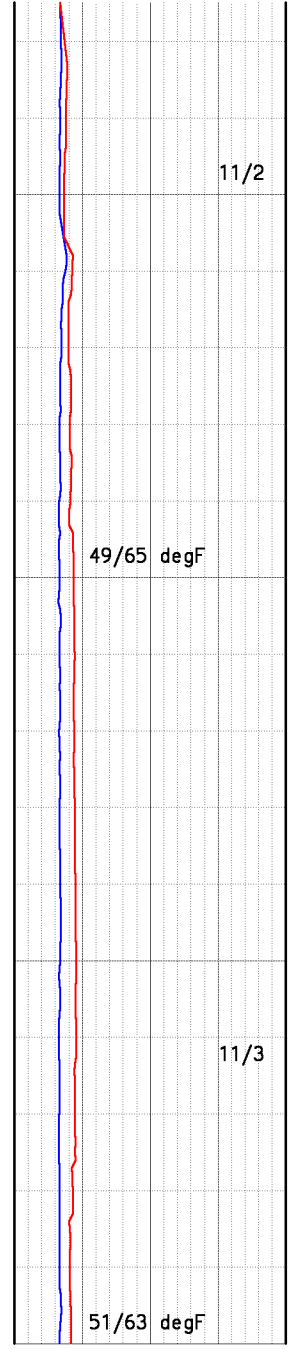


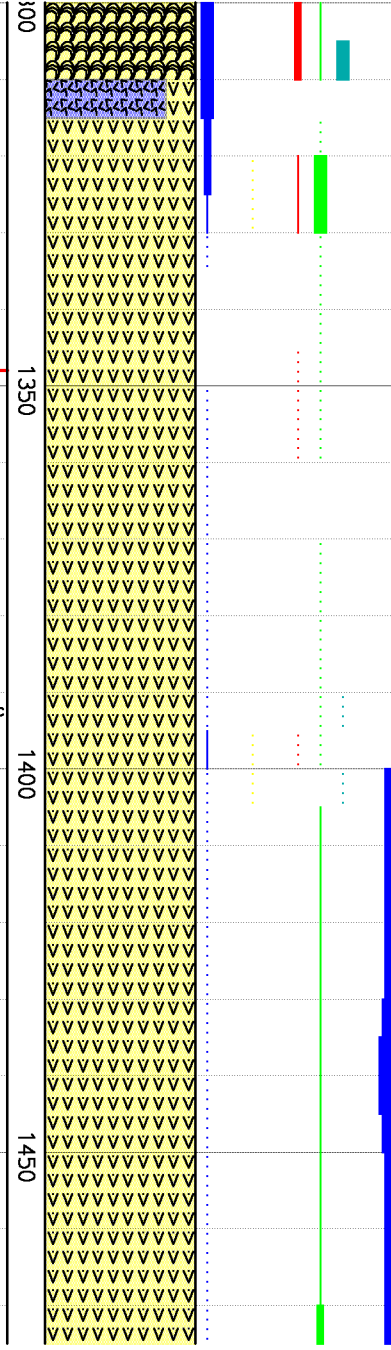
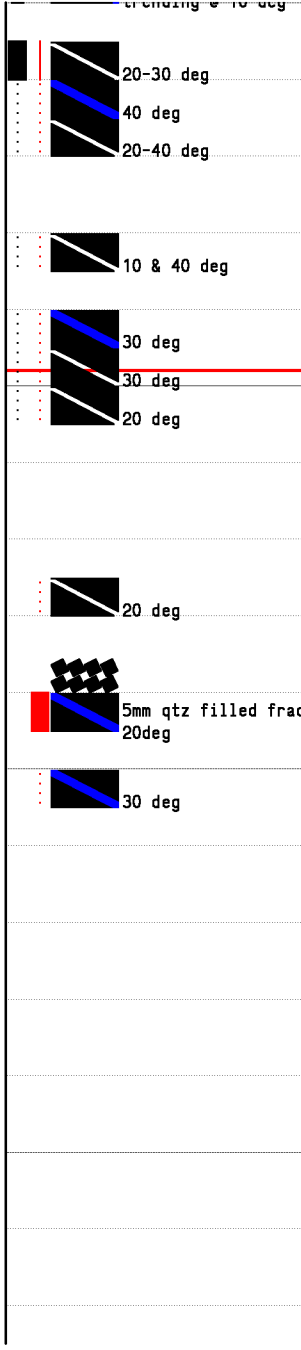


Tuff Breccia:wht,tan,brn occ pl grn,hd-vhd,str silic alt,lt-med gry ang clsts of rhyolite in mtx,loc zone of brwn slty unconsol seds w/1-2 mm sized clasts of obsid @ 1148',com incall w/ Rhyolite:wht,tan,pink,v hd,str alt,com pyroclastic,com swirly flowbanding,peb-cob szd clasts of chalc & obsid in mtx,occ 0.5-1 cm open voids lined w/ qtz xtls,r-tr qtz vng,com grn-yel chlor stng,com rdsh-brn oxid on frac faces.

Tuff(Ash Flow):wht,tan,lt brn,loc grn-yel,mott,hd-v hd,loc frm, v well indur,str alt,no vis gr bndrs,v silic,divitr,abund flow bndg,mod-str chlor alt,open voids up to 5mm lined w/term qtz xtls and druzy qtz,sft wht-pink clay(poss anhydrite)filled frac up to 1.5 cm @ 1203' & 1209',com clay filled voids and vugs,r-tr yel-grn stng on frac faces,r-tr hem,occ incall w/ Tuff Breccia: ang clasts in ashy mtx,r-tr lt brn/mahog str silicic clasts with flow bndg in mtx,loc incall w/Pyroclastic Rhyolite.

Tuff:lt-md gry,blu-gry,blu-grn,pl grn,wht,loc pink,hd-v hd, aphan,silic,str alt,com vitr lust,abun plag laths,abs-r flow banding,com wht frags in mtx,r-mnr qtz vng & frac fill,loc qtz and anhyd lined voids.v r dissemin ovr.tr-com hem stng on frac



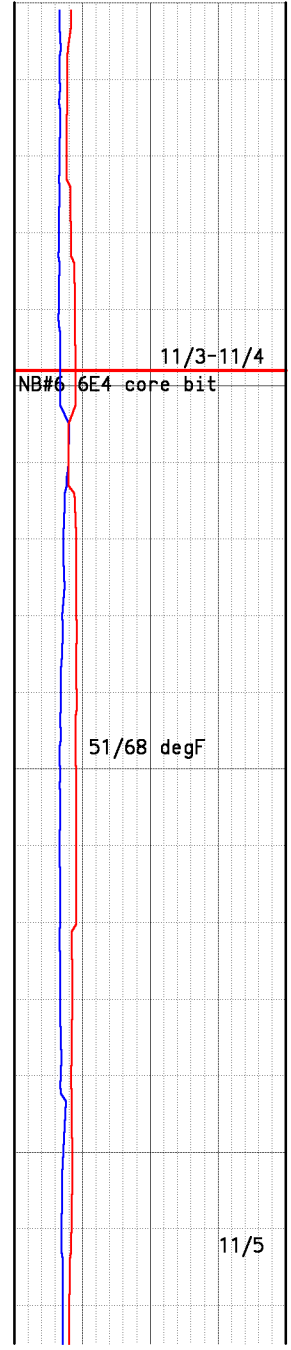


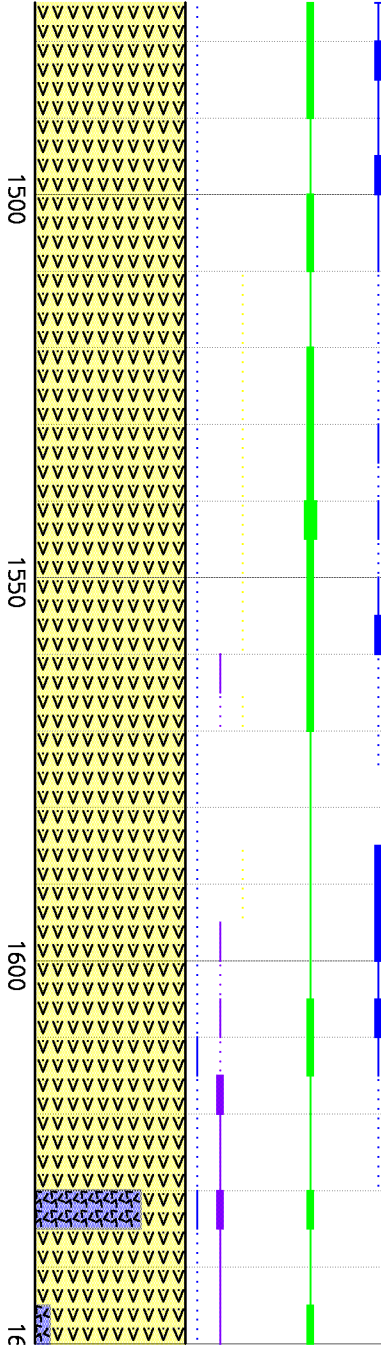
faces, incall w/Tuff: wht, tan, mott app, hd-v hd, loc frm, well indur, no vis gr bndrs, r-tr qtz vng, occ dendrit hem xtls on frac faces, loc anhyd filled frac up to 1.5 cm @ 1203' & 1209', incall w/ Obsidian: dk gry-blck, rdsh-brn, vitr lust, core, conc frac, mnr-com qtz vng.

POH for bit change

Tuff: lt-med gr, grn, mod hd-v hd, well indur, str silic alt, com devitr, loc glassy txt, com lath shaped clay alt felds, r-mnr qtz vugs & vng, r-tr hem on frac faces, occ anhyd frac fill, zone of blk obsid frags @ 1349'.

Tuff: lt-med gry, com pale grn cast, frm-mod hrd, loc v sft, loc crmbly, mod well-well indur, str alt, str devit txt, str cly alt, pr gr bndrs, com 2-3mm ang-sub ang rhyol clasts in mtx, r-tr qtz filled voids & vng, v r dissep pyr, tr chlor grs, 2cm zone of sft cly @ 1440'.





Tuff(Ash flow):lt-med gry,com pale grn cast,frm-hd,loc sft, loc crmbly,mod well-well indur,loc prly indur,mod-str alt,str devit txt,mod cly alt,pr mod def gr bndrs,com 2-5mm ang-sub ang rhyol clasts in mtx,v r disseminated pyr,tr chlor grs.

Tuff(Ash flow):lt-med gry,com pale grn cast,frm-hd,loc sft,loc crmbly,mod well-well indur,loc prly indur,mod-str alt,str devit txt,mod cly alt,pr mod def gr bndrs,com 2-5mm ang-sub ang rhyol & basalt clasts in mtx,loc sub rndd-rndd gravel-cobble sized clasts @ 1555',v r disseminated pyr,loc r calc vng @1565',tr chlor grs.

pb

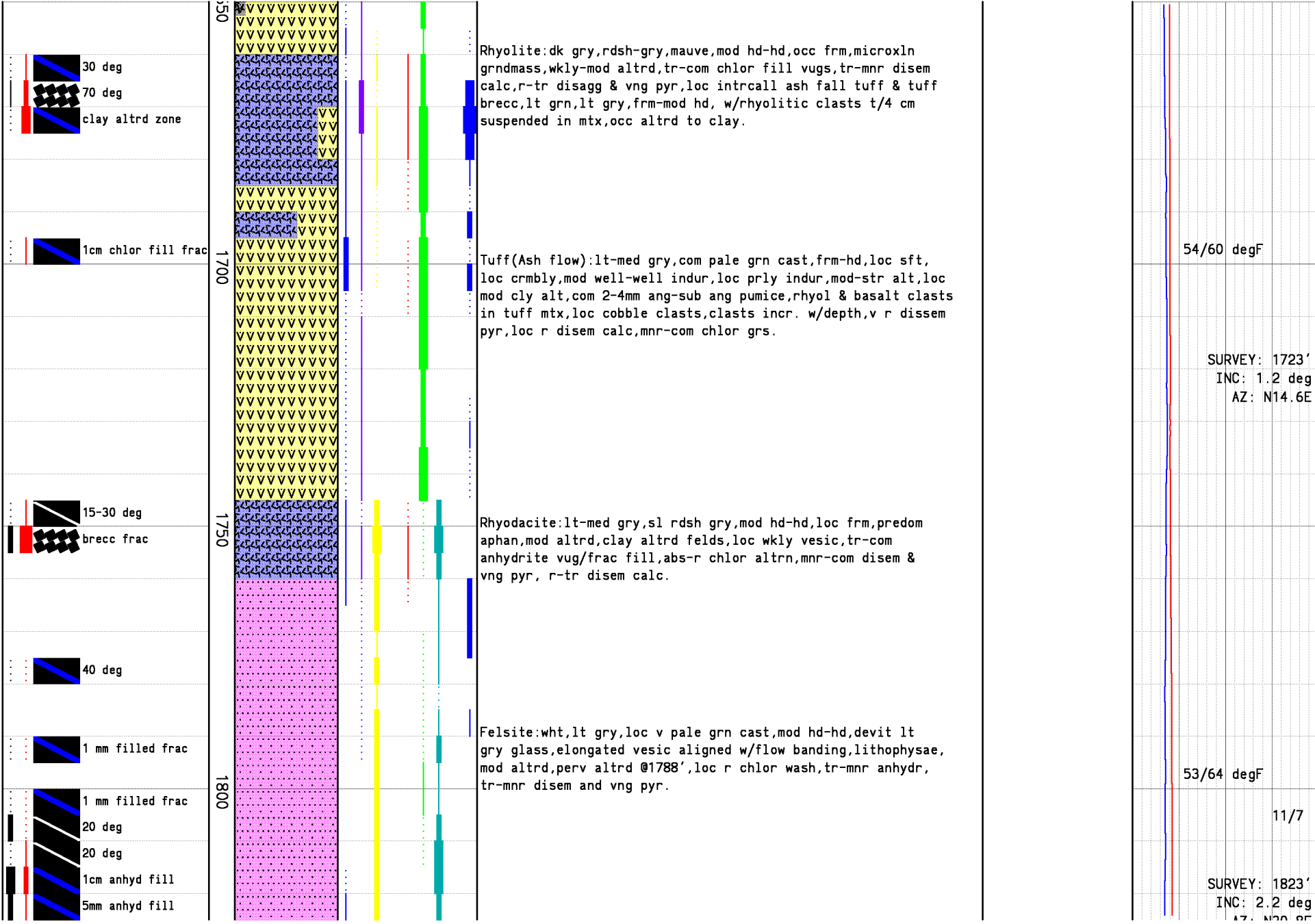
52/57 degF

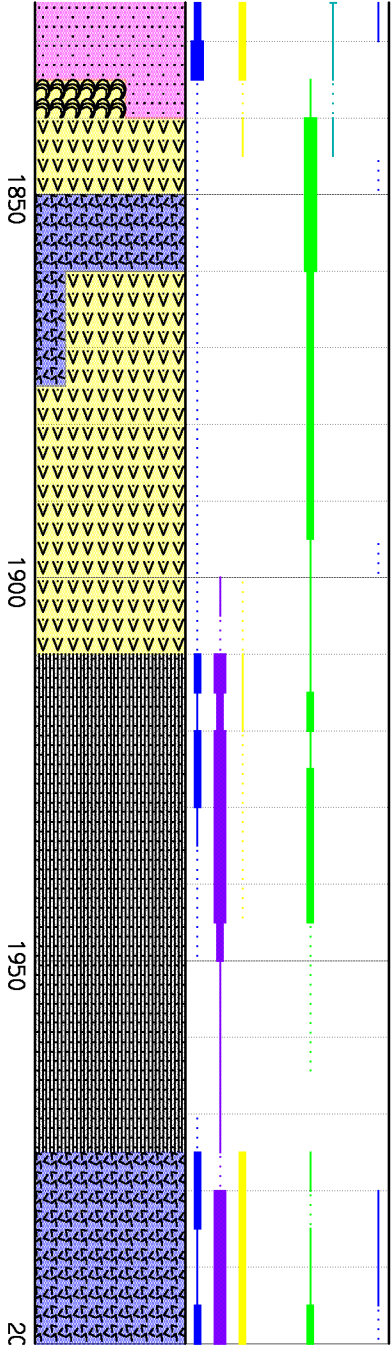
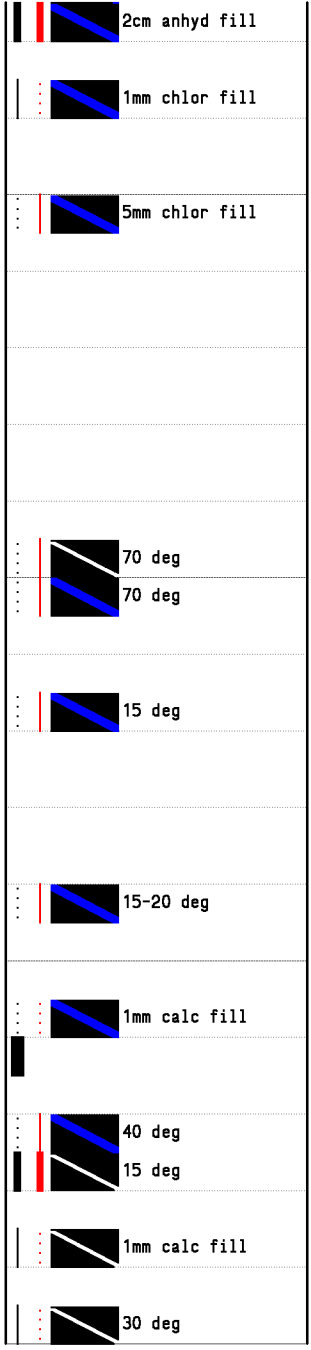
SURVEY: 1523'  
INC: 1.5 deg  
AZ: N34.5E

11/6

52/60 degF

SURVEY: 1623'  
INC: 2.0 deg  
AZ: N18.2E



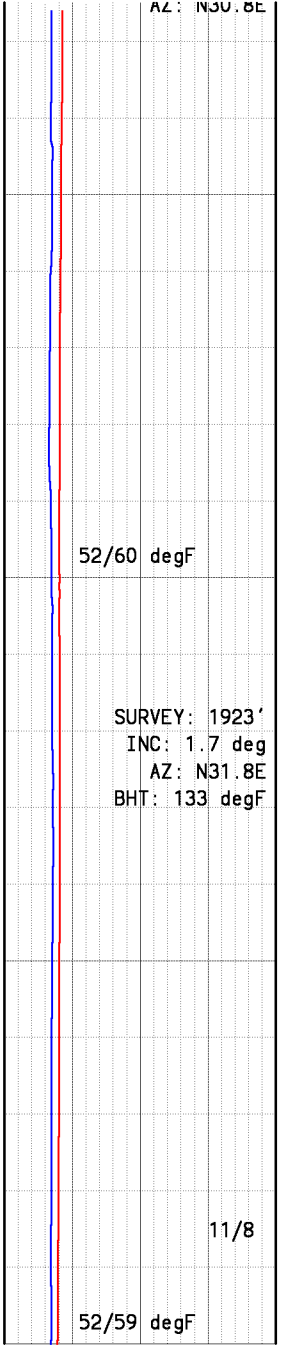


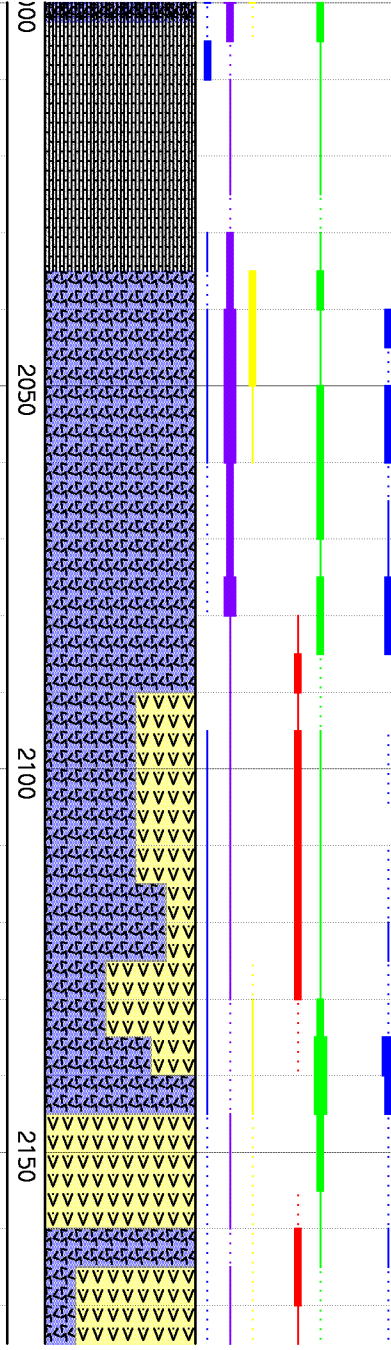
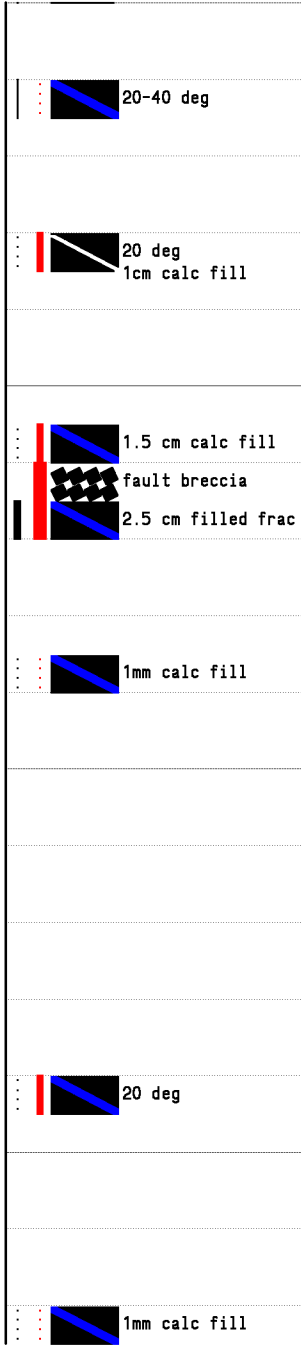
Obsidian:rd brn,blk,dk gry,hd-v hd,friable,mas,uniform,non vesic,tr chlor vng,r opalescent vng, intrcall w/Tuff:dk grn, lt grn,hd-v hd,loc firm,aphan grndmass,r-tr anhydr frac fill, w/loc Rhyolitic clasts t/4cm,intrcall w/Rhyolite:rd-brn,brn-gry,hd- v hd,microxln grndmass,wkly altrd,tr-com chlor frac & vug fill,r opalescent frac & vug fill.

Tuff(Ash flow):lt-med gry,com pale grn cast,hd,loc firm,mod well-well indur,mod-str alt,loc com 5cm ang-sub ang pumice & rhyolite clasts in aphan tuff mtx,r-tr dissem pyr,loc r-tr disem calc,tr-mnr chlor wash and frac fill.

Basalt:dk gry,blk,grn-gry,loc med gry,hd-v hd,well indur, aphan,mas,loc vesic,r-mnr opal frac & vug fill,tr-com calc vng & vug fill,r-tr pyr vng,r-mnr chlor vng, cinnabar veining f/1950 t/1977'.

Rhyolite:lt-med gry,loc pale grn cast,hd-v hd,loc firm, mod well-well indur,loc fri,aphan,silicic,vesic,loc str alt, tr-mnr opal & qtz vug fill,mnr dissem & vng pyr,loc r-com disem & vug fill calc,tr-mnr chlor wash and frac fill,tr clay altrn of felds.





Basalt: dk gry, blk, grn-gry, loc med gry, hd-v hd, well indur, silicic, aphan, mass, non-vesic, r-tr chlor vng, loc cinnabar veining.

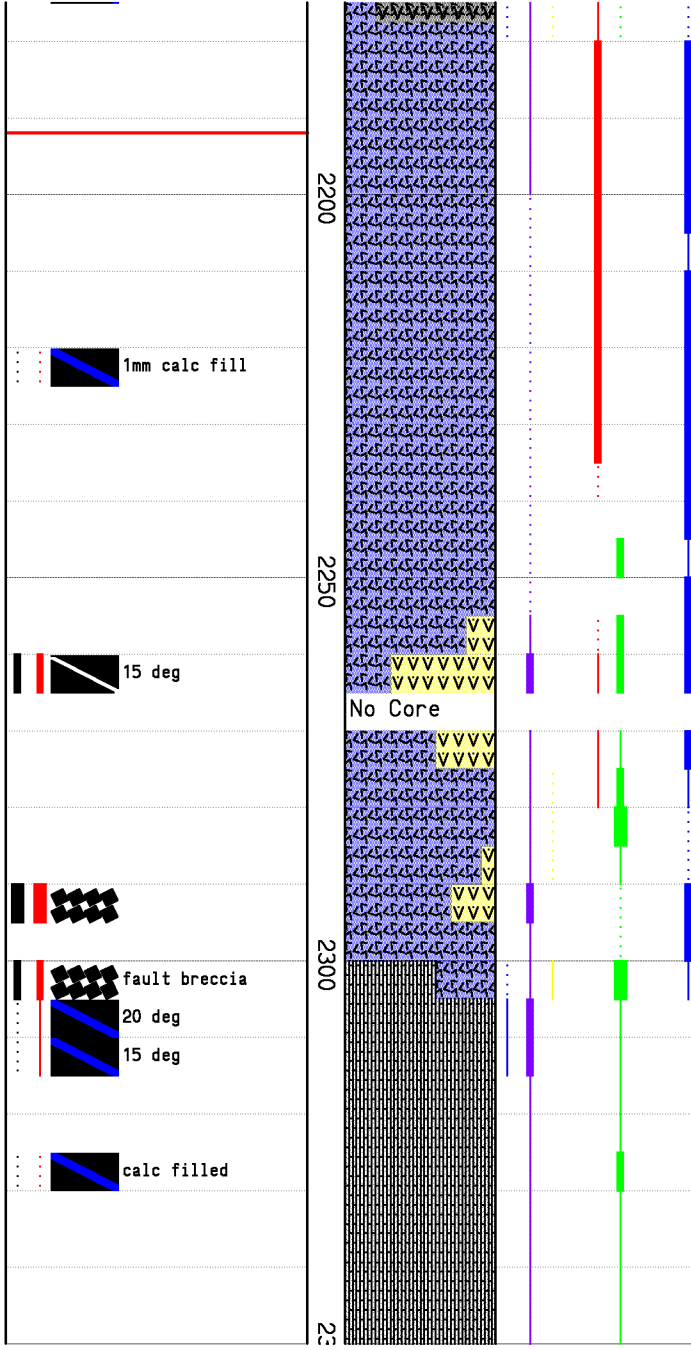
Rhyolite: lt-med grn gry, rd-brn, hd-v hd, loc firm, mod well-well indur, flow banded, aphan, loc vesic t/5mm, mod-prvly altrd, loc strngly oxidized, intrcll w/Brecciated pumice zones f/2053' t/2081': lt-med gry, mod hd-hd, pumice clasts gravel to cobble sized, vesic t/3cm, aphan, mod altrd, tr-com chlor & calc vug fill,

Tuff(Ash flow): pale grn, rd-brn, lt gry, mod hd-hd, loc firm, mod well-well indur, flow banded, gravel to cobble sized clasts t/9cm, aphan, mod-perv altrd, loc brecc f/2140-2150', loc chlortzd zone f/2133-2155', intrcall w/Rhyolite: rd-brn, maroon, hd-v hd, aphan, vesic t/5mm, com oxidized, tr-com chlor & calc frac fill, r-tr clay altrd zones.

SURVEY: 2023'  
 INC: 1.5 deg  
 AZ: N10.1E  
 BHT: 118 degF

51/59 degF

SURVEY: 2123'  
 INC: 2.1 deg  
 AZ: N7.5E  
 BHT: 144 degF

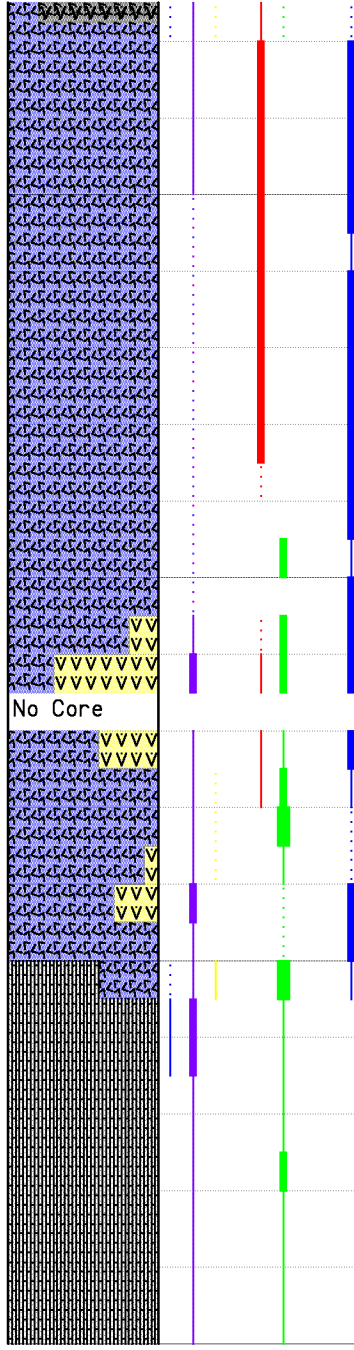


2200

2250

2300

23



Rhyolite:rd-brn,loc grn,mod hd-hd,loc firm,mod well-well indur,aphan,flow banded,sand to gravel sized clasts t/8mm,mod altrd, loc chlortzd zone f/2249-2252',loc tr cinnabar.

Rhyolite:rd-brn,lt-med gry,pale grn,mod hd-hd,loc firm,mod well indur,loc prly indur,aphan,flow banded,loc mottled app, mod-perv altrd,hvly frctrd,fault breccia f/2267' t/2273',loc com oxidized,tr-com chlor & calc frac fill.

Basalt:dk gry,blk,grn-gry,loc med gry,hd-v hd,well indur, aphan, mass, olivine rich,non-vesic,r-tr chlor vng.

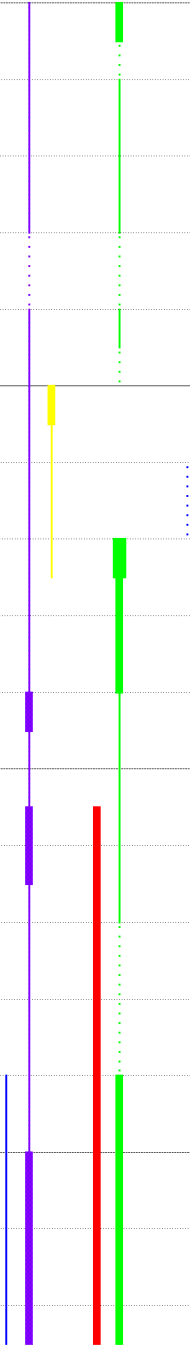
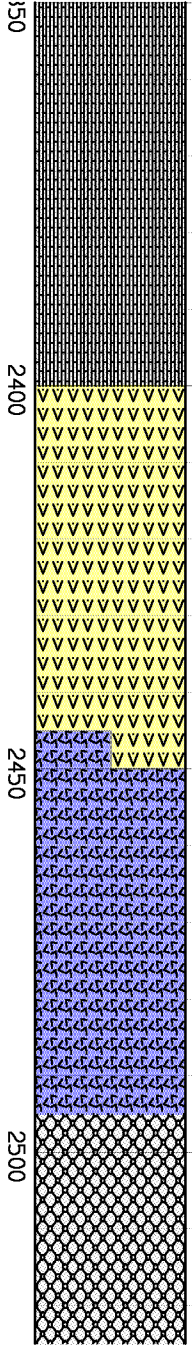
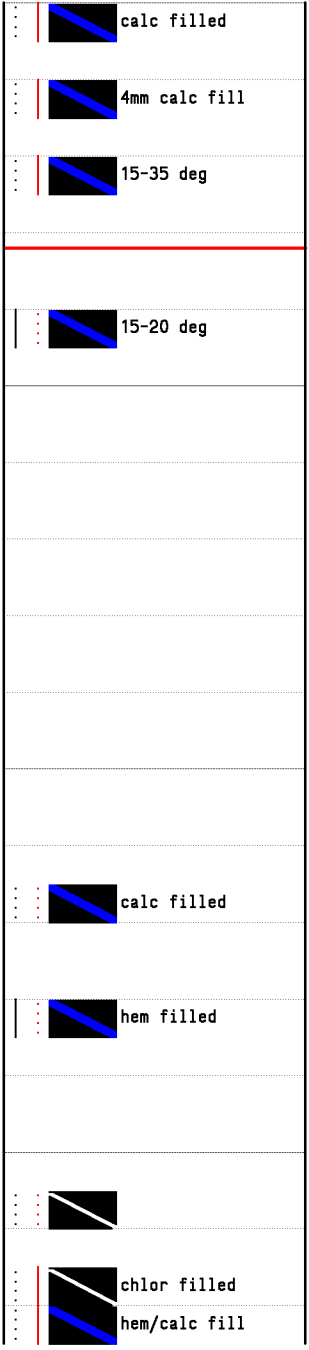
844' / 120 hrs

NB#7 ADT 6E4 core bit  
BUT(BHT)=162 degF

SURVEY: 2223'  
INC: 1.5 deg  
AZ: N16.8E  
BHT: 155 degF  
11/10

47/59 degF

SURVEY: 2323'  
INC: 2.2 deg  
AZ: N11.1E  
BHT: 150 degF

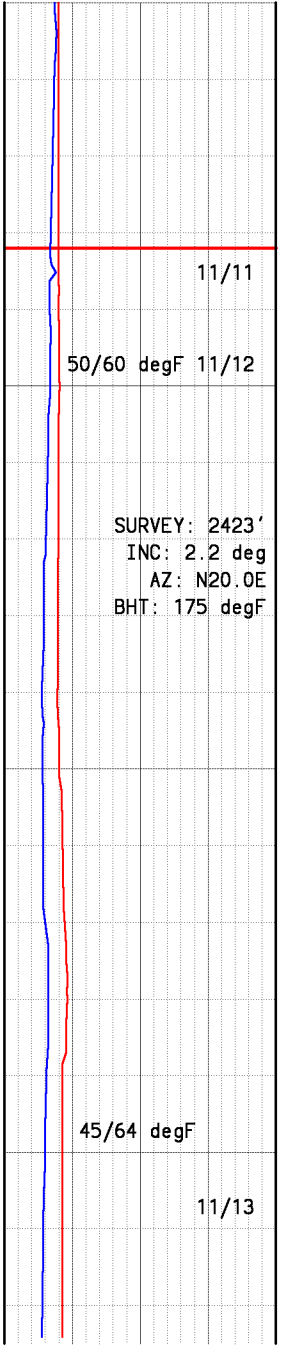


Basalt: dk gry, blk, grn-gry, loc med gry, v hd, well indur, aphan, mass, olivine rich, non-vesic, r-tr chlor vng, r-tr calc vng.

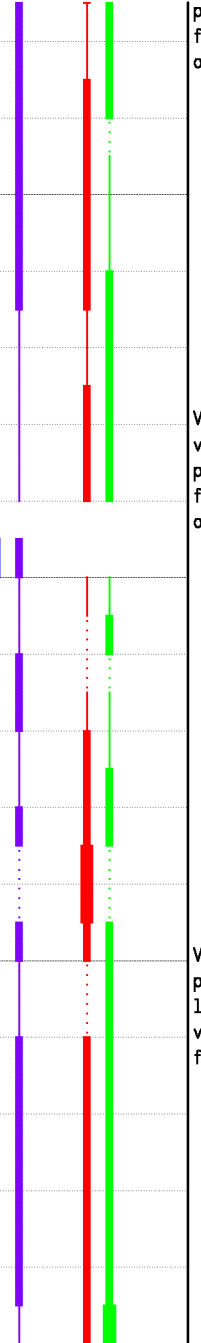
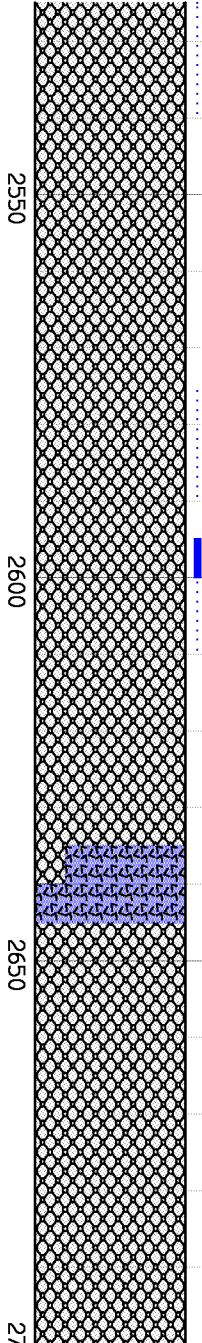
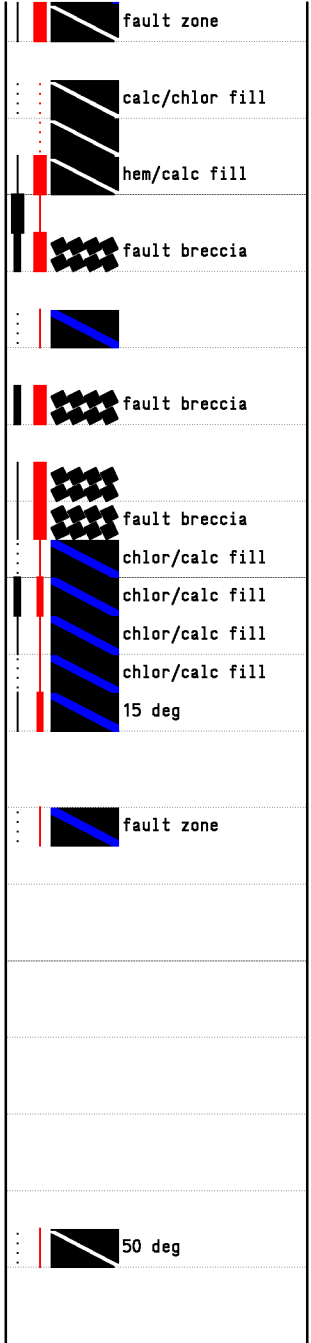
Rhyolitic Tuff(Ash Flow): med-dk gry, grn, pink, rd-brn, mod hd-hd, wl indur, pyroclastic, gravel to cobble sized angular-subrddd clasts of rhyolite, pumice, and obsidian in pink-colored rhyolite and loc chlor washed ash tuff, flow banded, tr-mnr calc vng & vug fill.

Rhyolite: rd-brn, med gry, pale grn cast, mod hd-hd, loc firm, mod well-well indur, incrnngly vesic w/depth, loc non vesic zones, ovoid t/loc elongate vesic t/2cm, mnr hem stng and frac fill, tr-mnr calc and chlor vug fill, r-tr qtz fill.

Vesicular Basalt: lt-med gry, loc dk gry, rd-brn, pink cast, hd-v hd, vesicular, ovoid t/loc elongate vesic t/2cm, loc non vesic, 20-30%







plag phenos t/4mm decr to 10% w/depth,loc tr-mnr chlor wash & vug fill,loc tr-mnr hem vng & vug fill,tr-mnr calc vng & vug fill,r opal vug fill.

Vesicular Basalt:lt-med gry,loc dk gry,rd-brn,pink cast,hd-v hd, vesicular,ovoid t/loc elongate vesic t/2cm,loc non vesic,20-30% plag phenos t/4mm decr to 10% w/depth,loc tr-mnr chlor wash & vug fill,loc tr-mnr hem vng & vug fill,tr-mnr calc vng & vug fill,r opal vug fill.

Vesicular Basalt:lt-med gry,rd-brn,loc dk gry,loc grn cast,loc pink cast,hd-v hd,vesicular,ovoid t/loc elongate vesic t/2cm, loc non-vesic,20-30% plag phenos t/1.5cm,loc tr-mnr chlor wash & vug fill,loc tr-mnr hem vng & vug fill,tr-mnr calc vng & vug fill.



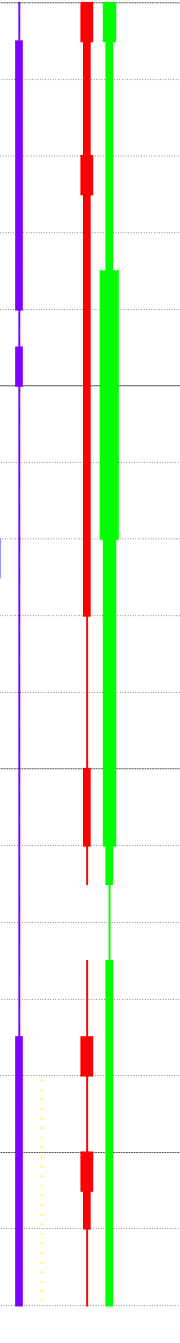
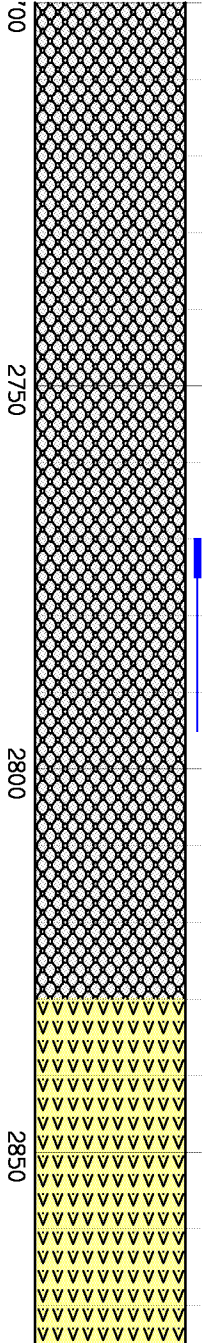
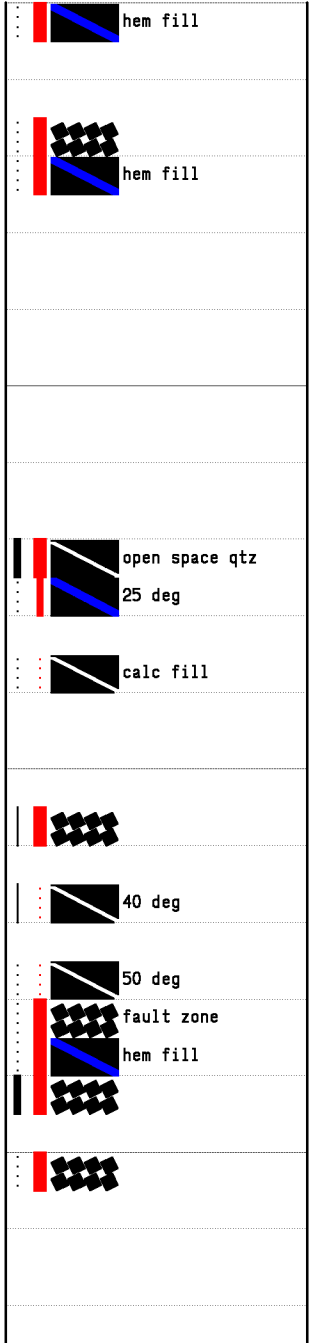
SURVEY: 2533'  
 INC: 2.1 deg  
 AZ: N34.8E  
 BHT: 175 degF

40/62 degF

SURVEY: 2633'  
 INC: 2.0 deg  
 AZ: N28.2E  
 BHT: 170 degF

11/14

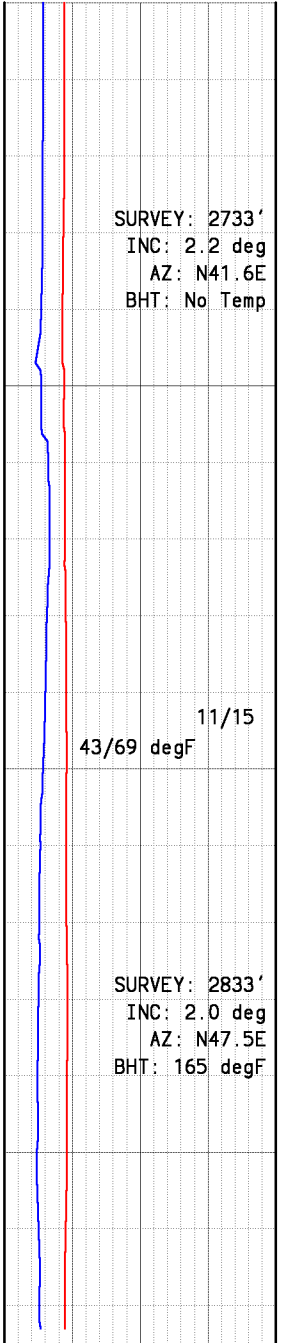
43/66 degF

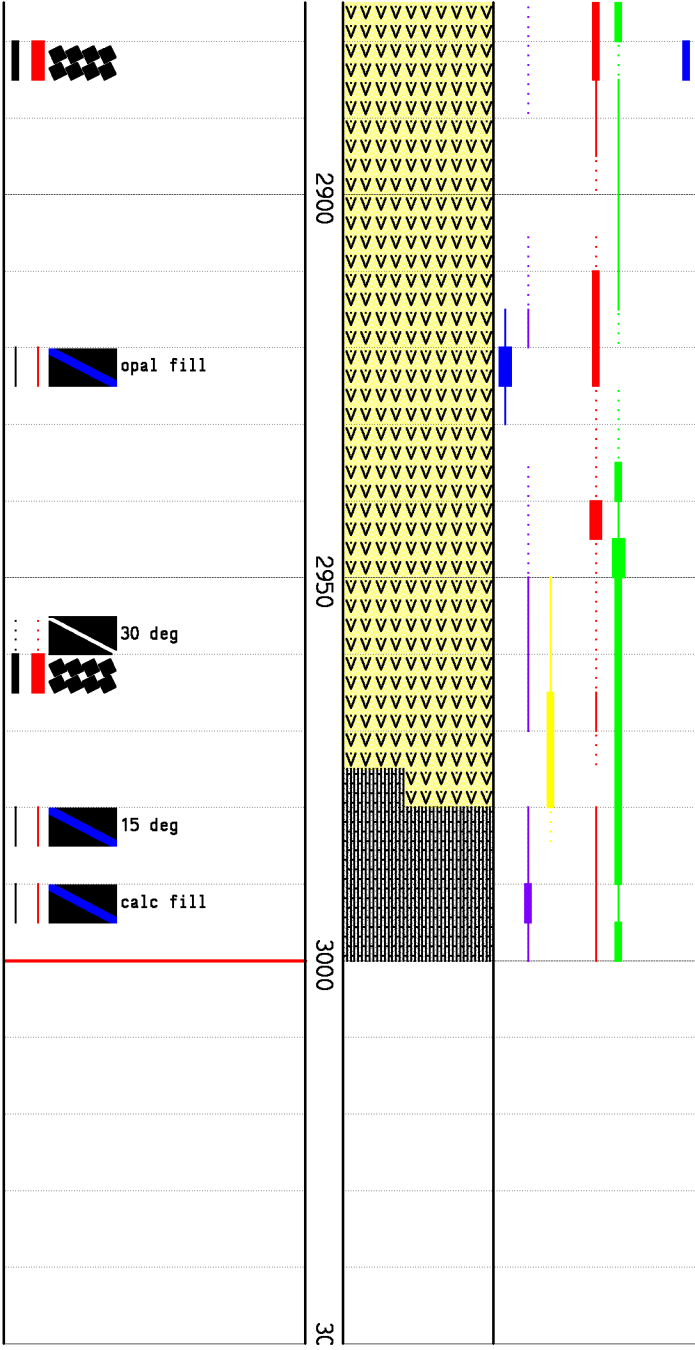


Vesicular Basalt:lt-med gry,rd-brn,loc dk gry,loc grn cast,loc pink cast,hd-v hd,vesicular,ovoid t/loc elongate vesic t/4mm, loc non-vesic,5-20% plag phenos t/1.5cm,mod altrd app,loc tr-mnr chlor wash & vug fill,loc tr-mnr hem vng & vug fill,tr-mnr calc vng & vug fill.

Vesicular Basalt:lt-med gry,rdsh gry,loc grn cast,loc pink cast,hd-v hd,massive,vesicular,ovoid t/loc elongate vesic t/4mm, loc non-vesic,5-20% plag phenos t/1.5cm,mod altrd app,loc tr-mnr chlor wash & vug fill,loc tr-mnr hem vng & vug fill,tr-mnr calc, loc tr open space Qtz xtls. vng & vug fill.

Rhyolitic Tuff(Ash Flow):lt-med gry,pale grn cast,mod hd,wl indur,aphan,massive,mod-perv altrd,loc vesic t/4mm,loc rhyolite frags t/1cm,loc tr-mnr chlor wash & vug fill,loc tr-com hem vn fill,abs-r calc vng and vug fill decr. w/depth.





2900

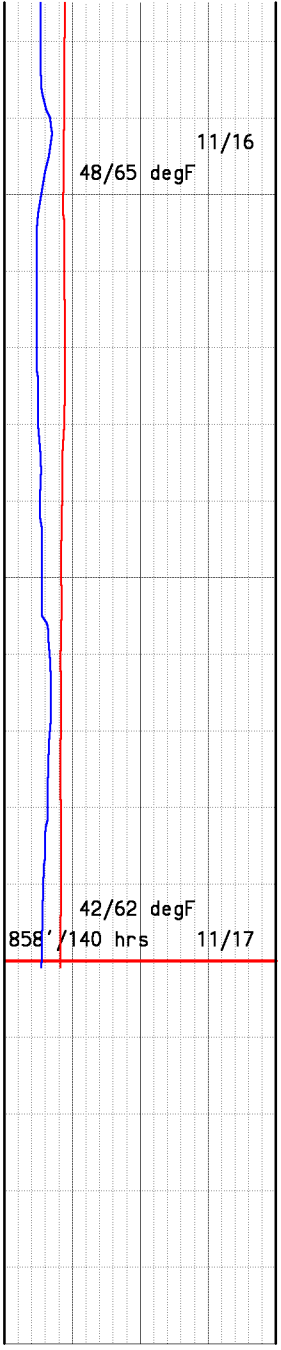
2950

3000

30

Rhyolitic Tuff(Ash Flow):lt-med gry,pale grn cast,rdsh-brn,mod hd,wl indur,aphan,massive,mod-perv altrd,loc vesic t/4mm,loc rhyolite frags t/1cm,loc tr-mnr chlor wash & vug fill,loc tr-com hem vn fill,abs-r calc vng and vug fill decr. w/depth.

Basalt:dk gry,blk,grn-gry,loc med gry,v hd,well indur,aphan,mass, non-vesic,r-tr chlor vng,r-tr calc vng,r-mnr disem cubic pyr,tr hem frac fill.



11/16  
48/65 degF

42/62 degF  
858' /140 hrs 11/17