**EXLOG**

COMPANY: ARCO OIL AND GAS

WELL: HANNA #1
FIELD: WILDCAT
REGION: MORROW Co. OREGON
COORDINATES: Sec 23 T2S R27W E
Fr NE cor 1755'S 1414'W
API INDEX: 36 049 00002
SPUD DATE: JUNE 8, 1988
ELEVATION: G.L. 3220ft.
K.B. 3246ft.
TOTAL DEPTH: 9211ft.
CONTRACTOR: PARKER DRILLING Co.
RIG/TYPE: LAND RIG #92

## LOG INTERVAL

DEPTH: FROM 86ft. 9211ft
DATE: FROM 9 JUNE 88 25 AUGUST 88
SCALE: 1 : 600 UNIT 282
PREPARED: D.BOUSE, G.MAXSON, G SANDSTROM
N.WYCOFF

## HOLE SIZE

36.0" TO 86' 12.25 TO 9211'
20.5" TO 1600' TO
14.75" TO 7331' TO

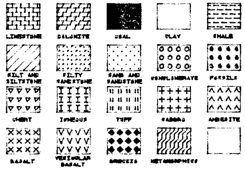
## CASING RECORD

30.0" AT 86' AT
16.0" AT 1598' AT
13.38" AT 7285' AT

## MUD TYPES

GEL - LIME TO 3374'
GEL - DRISPAC TO 4958'
GEL - POLYACRYLAMIDE TO 7300'

## LITHOLOGY SYMBOLS



## EXLOG SUITE

FORMATION EVALUATION LOG

## ABBREVIATIONS

| | |
|---|---|
| NB | NEW BIT |
| RRB | RERUN BIT |
| CB | CORE BIT |
| WOB | WEIGHT ON BIT |
| RPM | REVS PER MINUTE |
| FLC | FLOW CHECK |
| CR | CIRCULATE RETURNS |
| PR | POOR RETURNS |
| NR | NO RETURNS |
| LAT | LOGGED AFTER TRIP |
| BS | BACKGROUND GAS |
| TG | TRIP GAS |
| STG | SHORT TRIP GAS |
| CG | CONNECTION GAS |
| SWG | SWAB GAS |
| SVG | SURVEY GAS |
| C | CARBIDE TEST |
| W | MUD DENSITY |
| V | FUNNEL VISCOSITY |
| F | FILTRATE - API |
| FC | FILTER CAKE |
| PV | PLASTIC VISCOSITY |
| YP | YEILD POINT |
| SOL | SOLIDS - % |
| SD | SAND - % |
| S | SALINITY - PPM cl |
| RM | MUD RESISTIVITY |
| RMF | FILTRATE RESISTIVITY |

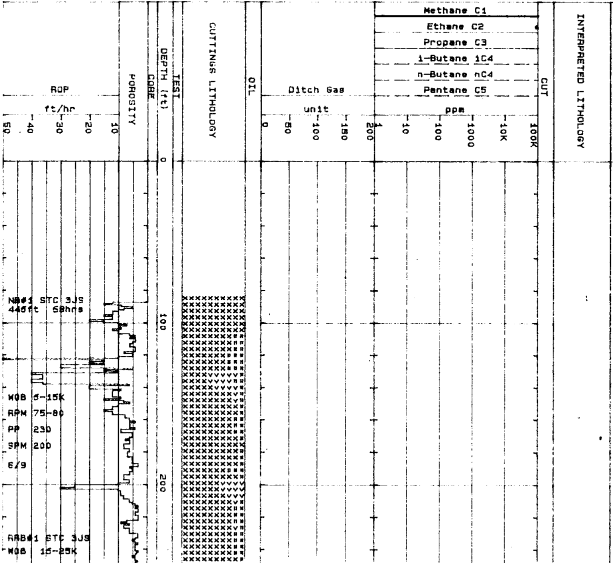
◢ CASING SEAT
▙ CORE/TEST INTERVAL
◀ SIDEWALL CORE
ϟ WIRELINE LOG

SOL - Based on live oil in unwashed cuttings.

# FORMATION EVALUATION LOG

ARCO HANNA #1

Scale 1 : 600



REMARKS

Set 30" casing at 86 ft.
Drilling 20.5 " hole.

W 8.5 V 37 PV 7 YP 10
pH 10 Cl 200 SOL 1%

BASALT: dk gy, hd, dns, mas, micxln, brn limonitic stns on fracs

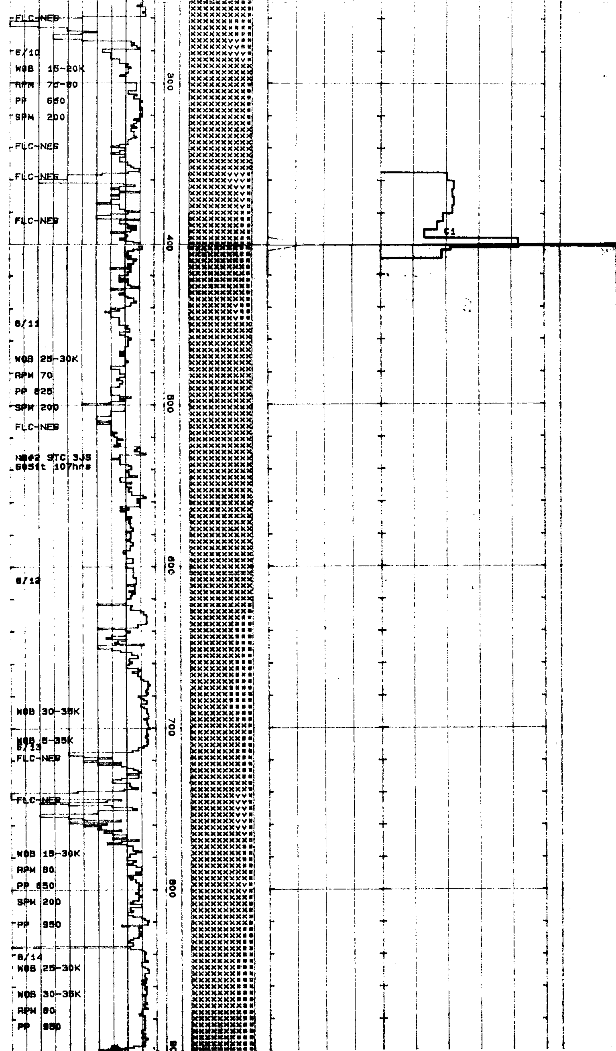
VOLC: blu gy, lt gy, tr dk gy brn, hd mas, micxln-vf xln, pt w/evenly dism qtz, bio, mafics, mnr ashy mat

BASALT: dk gy, micxln, ves & amygdals (pale grn, crm, buff, wh, sft-frm, amor, waxy, irreg-conc frac)

BASALT: dk gy, gy blk, vhd, aph

BASALT: dk gy, vhd, ves, amyg

VOLC: dk gy, lt gy, hd, vfn, xln, hd w/dism vf qtz, mafics, biot, com ashy mtx



VOLC BREC: pred orng rd, mnr yel & lt brn, mas, frm-sl hd, ind, mas. com spec, tuf, ethy, mnr amyg w/plag phen, gn & lt brn zeo, rr calc fil ves

BASALT: dk gy, gy blk, vhd, f xln

150 CC CARBIDE - 30 U
LAG - 9 MIN @ 200 SPM

BASALT: dk gy-blk, vhd, ves w/amyg (gn-dk gn, frm, wxy, hydr), mnr orng rd hd gritty, w/occ vfn mafic & flds phenocryst, tr xln pyr, calc, arag, qtz

[illegible]' .75 deg

BASALT: dk gy-blk, vhd, mas, aph-vf xln, occ mnr amyg, tr to occ lt gy, mod frm-fr ashy mat, rr xln calc, xln pyr

W 8.6 V 40 F 10.8
FC 2/32 pH 10 Cl 200
SOL 2% PV 11 YP10

BASALT: dk gy, aph, vhd, mas, w/minor lt gy-med gy, hd, ashy vols, rr xln calc

BASALT: dk gy, gy blk, aph, vhd, mas, w/occ rr ves w/amyg (lt-dk gn, frm, wxy), rr calc

200 CC CARBIDE - 28 U
LAG - 12 MIN @ 200 SPM

BASALT: dk gy, gy blk, aph, vhd, mas, w/occ rr ves w/amyg (lt-dk gn, frm, wxy), tr-com ashy volc, rr pyr

BASALT: dk gy, vhd, aph w/lt-med gy, hd-vhd, vf xln, pt mat volc, com biot, gd tr pyr, qtz, calc, blk or brn wthrg on fracs

BASALT: dk gy, vhd, aph w/lt-med gy, hd-vhd, vf xln, pt mat volc, com biot, gd tr pyr, qtz, calc, blk or brn wthrg on fracs, occ ashy volc

BASALT: dk gy, dk brnish gy, hd-vhd, ves in pt, amyg (m-dk gn, frm-mod hd, cmo wxy), apr wthrg, com lt gy-wh, frm-med hd ashy volc, tr calc, rr pyr

BASALT: dk gy, blk, hd-vhd, aph, w/lt gy & med gy, hd, ashy & vf xln basalt, com red brn wthrg, tr calc & pyr xls

BASALT: med gy-brn gy, hd, apf-vf xln, com-abnt calc xls, tr xln pyr, rr ves

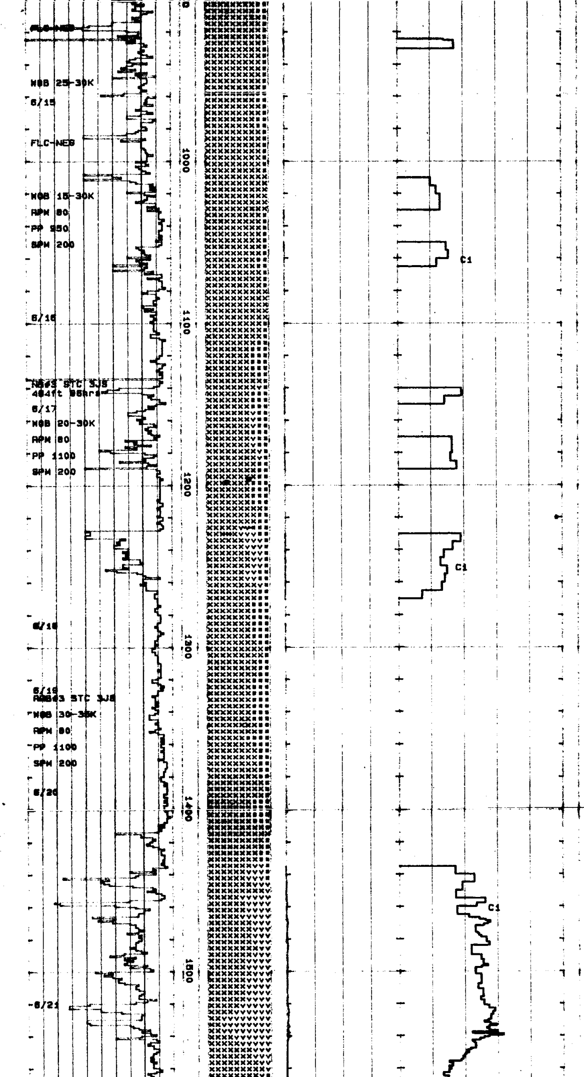
W 8.6 V 40 F 11
FC 2/32 pH 10 Cl 200
SOL 2.5% PV 11 YP 10 SD TR

VOL: med gy-gy-brn, hd, vf w/diss f, xln basalt assoc w/gy wh-lt gy, ashy, com biot, mafics

832' 2.0 deg

W 8.8 Cl 200 Rmf 5.9 @
75 deg F

[illegible]' 1.75 deg



BASALT: m-dk gy, brn gy, hd, occ ves, aph-vf xln, w/gn & orng rd, frm-hd, ves & vein fill, tr pyr, com calc

BASALT: dk gy, blk, hd-vhd, occ ves, aphl-vf xln, w/gn & orng rd, frm-hd, ves & occ vein fill, rr pyr, tr calc, ~~com Fe stn~~

200 CC CARBIDE - 20 U
LAG - 25 MIN @ 190 SPM

BASALT: dk gy, occ gy blk, hd-vhd, aph-vf xln, trce gy wh-lt gy, ashy mat

BASALT: dk gy, hd-v hd, aph, minor vf xln, rr ves, com sft, gn, hydr, vein & ves fill, tr calc

BASALT: dk gy-blk, vhd, aph, rr lt gy-gy wh, ashy mat, tr calc

BASALT: dk gy-blk, vhd, aph-vfxln, mnr pistasio gn bent mat

W 8.6 Cl 200 Rmf 5.9 @
75 deg F

BASALT: dk gy-blk, vhd, aph, tr-com ashy mat, occ m-dk gn frags, sme mod sft, bent, sme sl hd

1104 2.0 deg

BALSALT: dk gy-blk, v hd, mnr ves, aph-vf xln w/lt-dk gn, blu gn, frm-hd, ves & vein fill; occ com m gy, hd, vf volc, w/gy-wh ash, mafics

W 8.6 V 39 F 11
FC 2/32 pH 10 Cl 200
SOL 2% PV 10 YP 10 SD TR

BASALT: med-dk gy, hd-vhd, aph-vf xln, tr-com ves, com mafics, tr qtz, tr-com rd-brn, orng wthrd basalt, occ gn frm-hd amyg&vein fill, wxy-ethy, occ gl

TUFF: lt gy-gy wh, frm-hd, ash, occ dk grs, assoc w/basalt

MW 8.6 Cl 200
Rmf - 5.2 @ 76 deg

200 CC CARBIDE - 31 U
LAG - 34 MIN @ 200 SPM

BASALT: m-dk gy, hd-v hd, aph-vf xln, diss vf mafic xls, tr fldspr, tr ves, dk gn vein & ves fill, tr calc

TUFF: lt gy, frm-hd, w/diss vf blk xls, ashy

BASALT: m-dk gy, gy-brn, vhd-hd, aph-vf xln, mafics, tr calc, occ gn vein fill

W 8.6 V 40 F 11.4 FC 2/32
pH 10 Cl 200 sol 2% PV 10
YP 11

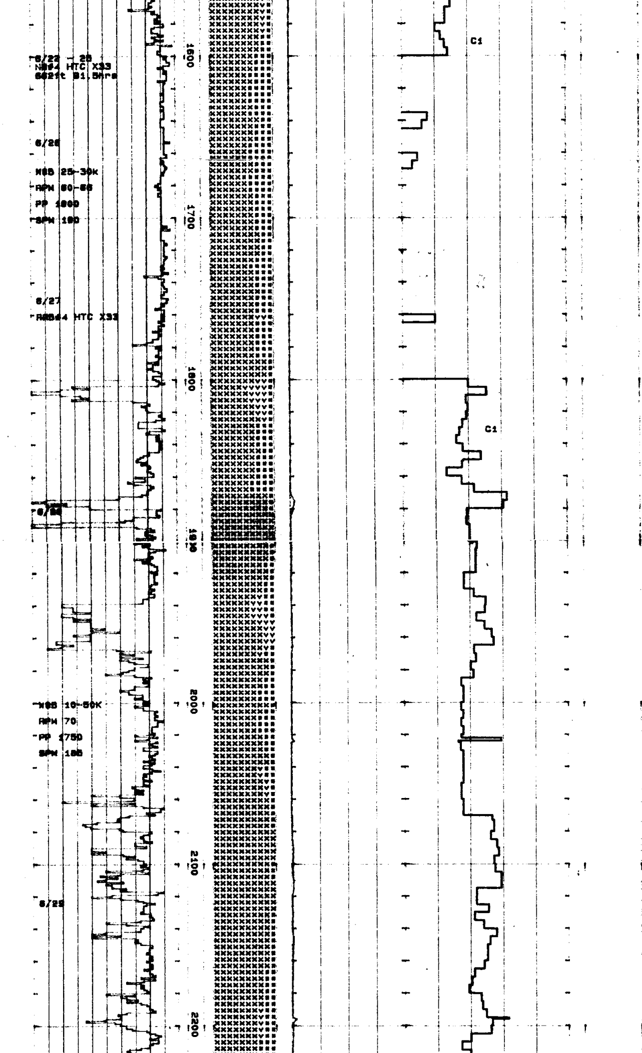
BASALT: m-dk gy, brn-gy, hd-vhd, pt rd brn, wthrd, com ves, w/m-dk gn, firm-hd, vein 7 ves fill

BASALT: m-dk gy, gy-brn, hd-vhd, aph-vf xln, com ves, com rd-brn, orng, brn wthr mat, com gn, blu-gn vein & ves fill, hd-frm, gl-wxy, brit, tr calc

TUFF: lt gy, hd, vf-ashy, diss blk shards

MW 8.6 Cl 150
Rmf - 5.2 @ 72 deg

BASALT: m-dk gy, tr lt gy and rd brn, aph, hd-v hd, tr ves, tr calc



Ran Schlumberger DIL/SFL/GR log

Set 16" 75# K-55 BTC csg at 1598' Drlg 14 3/4" hole

BASALT: m-dk gy-brn gy, hd-v hd, aphanitic, assoc w/lt gy hd TUFF

BASALT: m-dk gy-brn gy, tr lt gy & rd brn, fri-hd, aphanitic, mnr lt gy TUFF

W 8.6 V 36 F 13 FC 2/32 pH 10.7 Cl 200 sol 2% PV 9 YP 9

BASALT: lt-med gy, mnr gy brn & rd brn, hd, vfn xln, lt gy grdg to med gy, assoc w/ firm-hd, lt gy tuff, trcs mafics, occ tr pyr

MW 8.6 CL 200
Rmf - 4.8 @ 77 deg

BASALT: med gy w/ minor lt gy, dk gy & gy brn, hd, aph, assoc w/ firm- hd tuff

BASALT: dk gy, hd-v hd, aph, rare mafics, minor hd, lt-med gy tuff

BASALT: dk gy, hd-v hd, aph, rare mafics, mnr hd tuff, m-dk gy, ves, hd-v hd, com dk gn, firm-hd ves & vein fil, com calc xls

BASALT: dk gy-lt gy, fri-v hd, aph, mnr lt gy tuff, tr dk mafics

1856 2.0 deg

BASALT: dk gy-dk brn, mnr gn, hd-vhd, aph, com dk gn vein fill, calcite xls

W 8.8 V 38 F 14.8 FC 2/32 pH 10.8 Cl 800 sol 3% PV 8 YP 8

BASALT: dk gy, hd-vhd, aph, assoc w/ med gy, hd, tuff, trc calc veins

BASALT: gy brn, med brn, minor gn, rdbrn & orng brn, pt wthrd, firm-hd, ves & frac, sft, firm-hd, gn, rdbrn & brn, clayey fill in ves & veins

BASALT: dk gy-dk brn, dk gn, hd-v hd, aph, com dk gn vein fill, com calc xls

BASALT: med-dk gy brn, hd, vf xln, gn & gn blk vein fill, tr calc xls

2046 1.75 deg

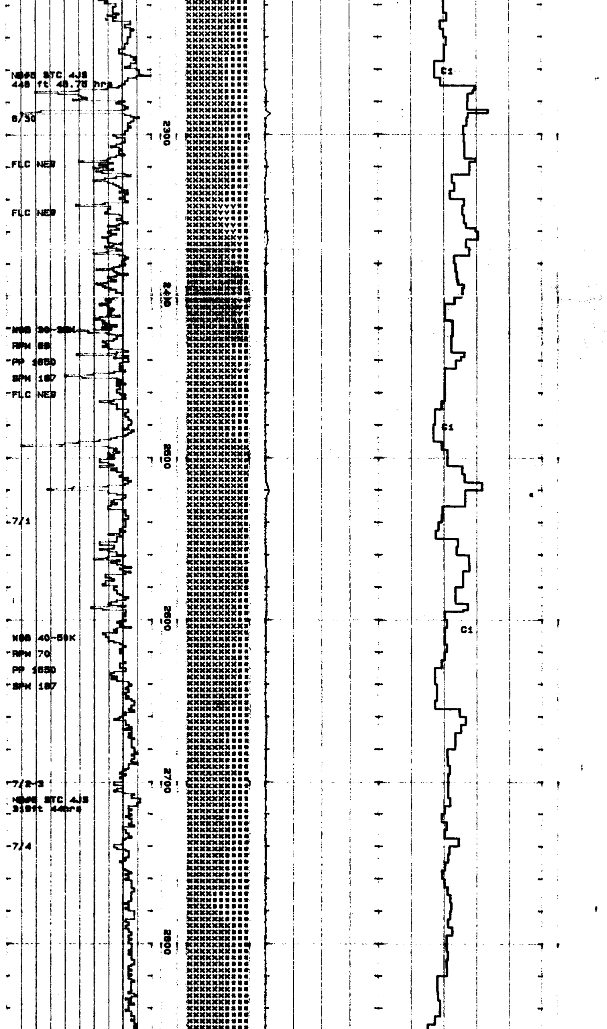
BASALT: brk rd, occ dk gy, hd-v hd, mnr calc xls, tr gn frags

BASALT: dk gy-m gy, brk rd, hd -vhd, com calc xls

200 CC CARBIDE - 21 U LAG - 34 MIN @ 186 SPM

BASALT: dk gn gy-m gy, brk rd, fri-v hd, vf blk incl in transluc m gy frags, tr calc xls

BASALT: med-dk gy, brn gy, rd orng & rd brn, hd, aph, minor ves, vec & veins filled w/ hd gn mat, qtz & zeo



TUFF: lt-med gy, sme buff, hd-vhd, pt ashy, pt welded

W 8.7 V 37 F 15.2 FC
2/32 pH 10.5 Cl 200 sal
4% PV 8 YP 6

BASALT: med-dk gy, occ brk rd-org rd, hd-vhd, aph, tr ves, mnr hd gn-dk gn vein fill, tr calc xls

TUFF: lt-med gy, blk incl, ameg, fri-hd, pt ashy, blk sl' plty incl

BASALT: med-dk gy, occ brk rd-org rd, hd-vhd, aph, tr ves, mnr hd gn-dk gn vein fill, blk incl in med gy frags

BASALT: lt-dk gy, org rd, brn, hd, aph, diss vf maficc, sme ves w/dk gn-blk, firm-hd amys, tr zeol & qtz

TUFF: lt-m gy, hd, pt welded, pt ashy

BASALT: brecciated ?, med-dk gy, trs brn, org rd, gn, hd, vf xln, trs calc veins, w/ hd, brn & gy gouge w/ ang org & gy frags

BASALT: lt-med gy, minor dk gy, gy brn, tr org & gn, hd, vfn xln, com diss mafics, tr pyr xls

BASALT: med-dk gy, hd-vhd, aph, intbd w/med-lt gy fri-firm tuff

2515 1.25 deg

BASALT: med gy, occ dk gy, vhd, aph, occ clr qtz frags, tr pyr

BASALT: dk gy-dk gn gy, com dk gn frags w/ brk rd lines, v hd, dk gn alt in dk gy frags

200 CC CARBIDE - 32 U
LAG - 39 MIN @ 185 SPM

BASALT: dk gy< med-dk gy brn, hd, aph, com diss vf mafics, occ flsprs, rare tr pyr xls

W 8.6 V 36 F 16.2 FC
2/32 pH 10.5 Cl 200 SOL
4% PV 7 YP 4

BASALT: dk brn gy, hd-v hd, aph, w/ sme vfn xln, occ qtz & hd, dk gn veins, assoc w/ lt- med gy, firm - hd, ashy tuff, trcs org rd tuff

Twist off in collars at 2710 ft. Recovered fish on second try. Inspected BHA & HW DP

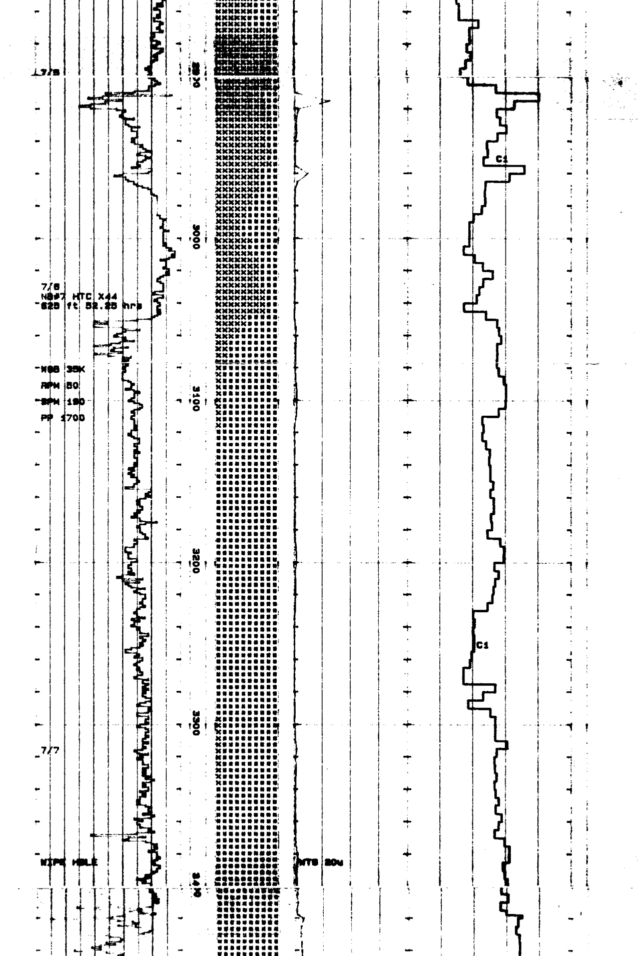
BASALT: dk brn gy, hd-vhd, aph-sl suc tex, occ ang qtz gr, tr gn vein fill, intbd w/ med-lt gy, fri-firm ashy tuff

BASALT: dk brn gy-dk gy, hd-v hd, occ ang qtz gr, tr gn vein fill

BASALT: gy brn-gy, sme dk gy, trs brn & rd brn, hd-v hd, aph - vf xln, com mafic xls, tr gn chlorite?, com calc vein mat

2820 1.75 deg

TUFF: gy brn - buff, hd, welded grdg to lt- med gy, firm-hd, ashy



BASALT: dk gy-dk brn gy. occ dk gn gy. hd-vhd. assoc w/ med gy-lt gy. fri-firm tuff

BASALT: dk gy-dk brn gy. occ [illegible] gy. [illegible] med gy. [illegible] sl slky frags

BASALT: dk brn gy. hd-v hd. com dk gn. v hd frags. occ dk gn vein fill. tr calc xls

BASALT: dk brn gy. occ dk gn. hd-v hd. occ gn & slky wh vein fill. com lt gy. fri. tuff

200 CC CARBIDE - 8 U
LAG - 42 MIN @ 180 SPM

TUFF: lt-med gy. minor dk gy-blk. firm-v hd. pt ashy. pt welded

2981 1.75 deg

BASALT: dk brn gy. w/ blk micxln flecs. hd-v hd. blky. mnr dk gn vein fill. occ slky wh vein fill. tr brk rd frags

TUFF: gn-gn gy. fri-firm. occ hd. vf gr wh & blk incl. mnr dk brn blk basalt

W 8.6 V 34 PV 7 YP 4
pH 10.5 F 17 FC 2/32
Cl 200 Sol 4

MW 8.8 Cl 180
Rmf 5.8 @ 72 deg

TUFF: gy. bn-gy. hd-frm. vf gr w/lt to dk f-m gr incl. calc. ashy. occ gn tuf. hd. gl. occ bnd; tr dk bn-blk bas

TUFF: gy. bn-gy. occ gn. hd-frm. vcalc. ves qtz: m-f gr. clr. sbrnd. vf gr w/f-m gr lith incl: bas. ves bas

TUFF: lt bn. gy. occ gn. sl-v frm. vf gr w/lt-dk incl. orng ves & wthrd mat. qtz. cly. sl calc

TUFF: gy. lt brn-sl gn gy. firm-hd. w/lt-dk f gr incl. mod calc cmt. tr dk gn vein fill

TUFF: lt brn-buff. occ sl gn. firm-hd. w/lt-dk f gr incl. mod calc cmt

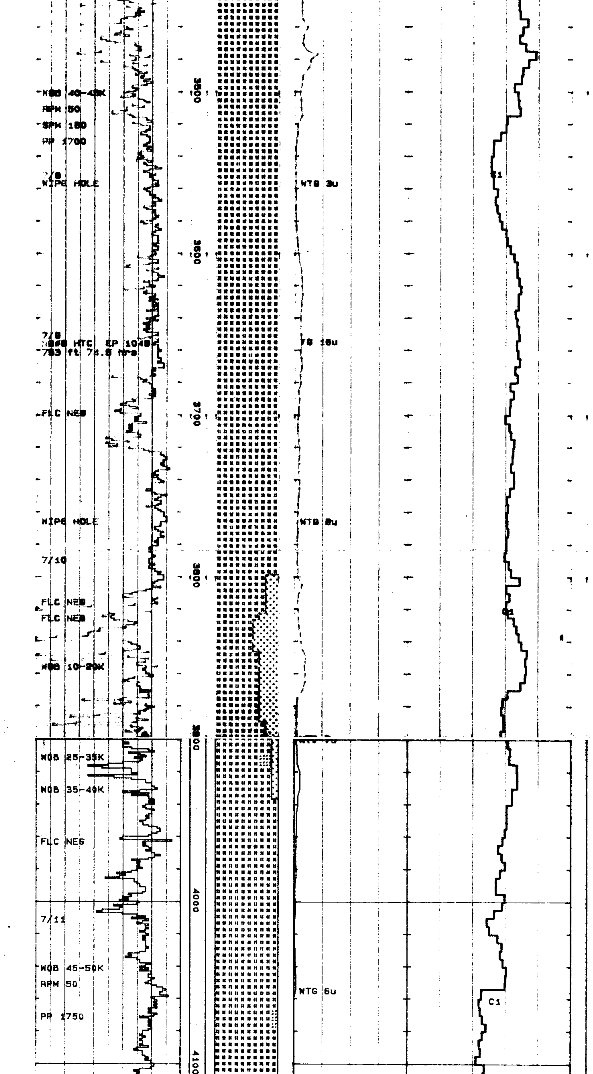
ADD WALNUT SHELLS TO MUD SYSTEM

200 CC CARBIDE - 12 U
LAG - 48 MIN @ 180 SPM

TUFF: med brn-buff. com lt gn. occ rd. [illegible] occ v hd. mod calc [illegible]

[illegible] Rmf 5.8 @ 73 deg

TUFF: trnsl wh-gy. gn. blu-gn. occ buf. orng-bn. tr yel. blk. hd-vhd. gl. calc. tr obsid



TUFF: lt pnk, gy, buf, occ gn, blu-gn, orng-gn, blk, yel, vhd-hd, gl, calc, occ motld or bnd: occ bn, gy tuf, frm-hd, ethy, lt-dk incl: tr obsid

TUFF: lt pnk, gy, buff, com gn-blu gn, com bndg, firm-hd, ethy, lt-dk vf gr incl

W 8.6 V 42 F 17 FC
2/32 pH 10.0 Cl 200
Sol 4% PV 8 YP 10

TUFF: gn, gy gn, com pnk wh, wh, occ blu gn, com brn-rd brn bndg, firm-hd, occ v hd, ethy, vf gr, lt-dk incl

TUFF: dk-lt gy, gy-gn, occ wh, blk, vhd-hd, gl, occ motld or bnd: occ gy, bn tuff, vfrm-hd, ethy, vf gr w/f-m gr lt-dk incl, calc

MW 8.6 Cl 200 V 58
Rmf 6.9 @ 70 deg

TUFF: wh, lt gy, gn, blu-gn, occ dk gy-blk, vhd-frm, gl, com gran agg, occ transl, non-calc, tr obsid, tr cly

3644' 2 deg

TUFF: lt gn, gy-gn, occ wh, dk gy, vhd-vfrm, gl, com gran agg: bn, gy tuf, vfrm, vf gr w/incl, ethy: non-calc, tr obsid, tr bas

TUFF: lt-dk gn, gy-gn, occ dk-lt gy, wh, tr yel, orng, vhd-frm, gl, gl-ethy, gran agg, brec, tr biot, coal, m gr clr sbrnd qtz, cly, bas, non-calc

200 CC CARBIDE - 7u
LAG - 54 MIN @ 100 SPM

TUFF: lt-dk gn, occ dk gy, occ rd, tr orng, hd-v hd, sl ~~calc cmt,~~ ~~occ wh vein fill,~~ mnr biot in gn & lt gn frags

SND: m-f gr qtz, frst-clr, sbrnd, cly or tuf mtx

TUFF: gn-dk gn, occ rd, tr orng, tr blu vein fill in v hd, brn gy frags, mnr biot in gn & lt gn frags

W 8.65 V 50 F 8.8 FC
2/32 pH 10.5 CL 240 Sol
3% PV 17 YP 17

TUFF: m-lt gn, occ wh-lt gy, tr orng, yel, vhd-hd, gl: brec, gl or wh cly mtx w/m-f gr frst-clr sbblky-sbrnd qtz, ethy tuf mtx w/lith frags, tr biot

MW 8.7 Cl 200 V 60
Rmf 5.4 @ 66 deg

SLTST: gy, v-sl frm, blky-sbblky, occ f gr lig incl, calc

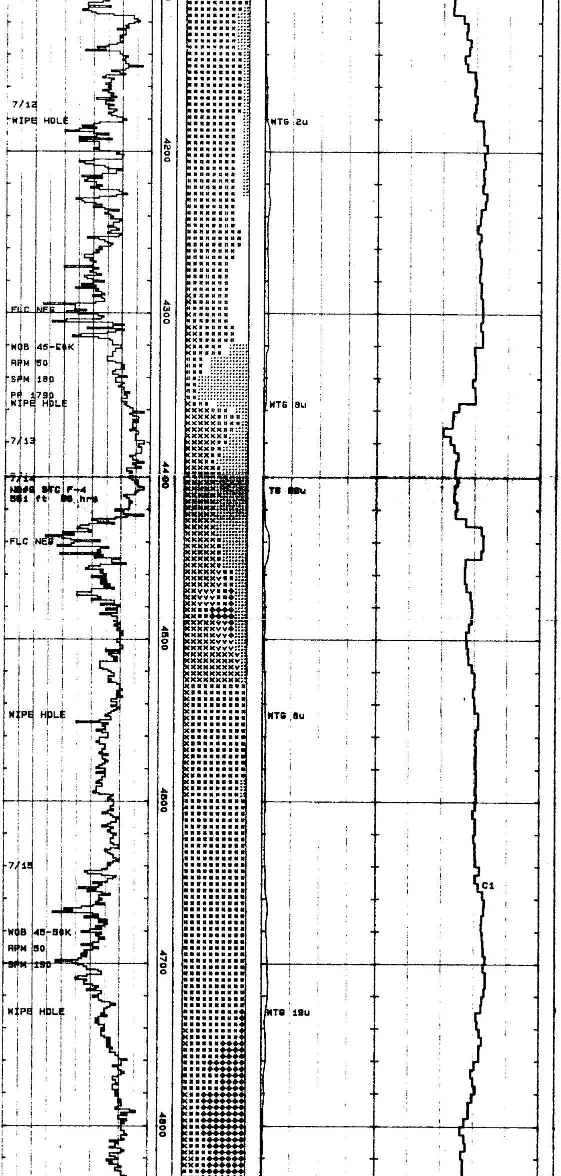
TUFF: lt gy-wh, frm-hd, gl, occ cly, occ m gr qtz incl: gn, gl, occ brec w/lith frags

TUFF: rd brn, gy gn, com wh, firm-v hd, non calc mtx, mnr calc vein fill, tr lt gy frags w/vf gr alt incl

TUFF: rd brn, occ gy gn, mnr wh frags, pred vhd, occ firm, non calc mtx

TUFF: rd brn, gy gn, occ gy, occ mlky wh, hd-v hd, fri-firm wh frags, mnr gn vein fill in rd brn mtx, tr blk hd frags

TUFF: rd-bn, occ blu-gy, vhd-vfrm, gl-ethy, occ motld or bnd, occ arg, tr gn gl vein fil: sltst, gy, mod-vfrm, tuf, vcalc: tr f-m gr frst-clr qtz, psrt



TUFF: rd-bn, dk-lt gy-blu, vhd-frm, ethy, occ gl gran agg w/cly, com bnd or motld, slty, occ blu-gn gl vein fil; tr gy.bn tuf sltst

MW 8.7 CL 220 V 49 Rmf 5.1 @ 71 deg

TUFF: dk rd-brn, occ blu gy-gy, hd-v hd, ethy, occ blu-blu gy vein fill, mod-abnt calc cmt

CLY: lt blu gn-lt gn, fri-firm, sft in prt, stky abnt vf gr, sbang-sbrnd tuf frags in cly mtx

200 CC CARBIDE = 4u
LAG = 59 MIN @ 180 SPM

TUFF: gy-gn, gy-blu, frm-hd, brec w/blu cly mtx & lith frags, calc, occ hd rd-bn tuf, tr sltst

W 8.7 V 49 PV 16 YP 16
pH 10.5 F 5.6 FC 2/32 Cl
200 Sol 4

TUFF: gy-blu, gn-blu, sl frm-hd, com brec w/cly mtx & lith frags, tr hd gy vein fil; CLY: lt blu, sft-frm, stky, sl sol

SLTST: med-dk gy, frm-hd, ethy, gran, micro veins, assoc w/hd, lt gy vein fil, hd bas: poss basaltic mudflow

MW 8.7 V 56 Cl 250
Rmf 4.9 @ 72 deg

BASALT: v dk gy-v dk brn gy, hd-v hd, occ rd slt incl in Basalt frags, tr calc xls

[illegible]

SLTST: dk gy-dk gy brn, firm-hd, occ fri, mnr lams, com org-rd org vein fill, tr calc vein fill

TUFF: lt blu-gn, frm-hd, ethy cly, occ brec w/f gr ang lith frags, calc

BASALT: dk gy-blk, vhd, com rd-bn wthr stn, tr-com VES bas w/gl amygd mat, tr lt gy xln vn fil, sl-v calc

BRECCIA: med-dk bn, occ gy, blu-gn, sft-frm, occ hd, ethy cly or occ tuf mtx w/f gr sbrnd bas & tuf frags, calc

BASALT: dk gy, blk, vhd, occ bn stn, tr ves, sl calc

TUFF: lt gn-blu, occ lt gy, hd-v frm, gl-ethy, occ brec w/blk frm fri ang or gl ang tuf lith frags, com bn stn, vcalc

TUFF: lt gn-lt gy gn, fri-firm-, occ hd, gl-ethy, com vf mgr, ang, blk-dk gy frags in tuff mtx, abnt calc cmt & vein fill

TUFF: lt gn-lt gy gn, brn-lt brn, wh, firm-hd, occ hd-v hd gl-ethy, mnr vf ang, blk-dk gn, clr frags in tuff mtx, abnt calc cmt

200 CC CARBIDE = 6u
LAG - 66 min @ 180 spm

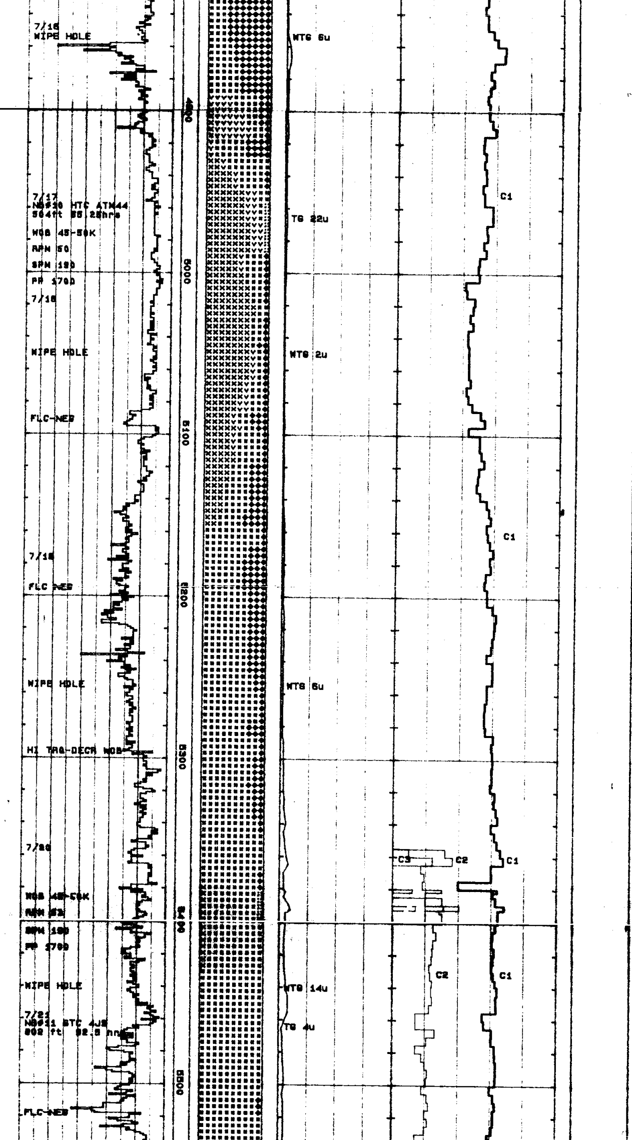
TUFF: lt gn-lt gy gn, rr brn frags, firm-hd, occo v hd, gl-ethy, mnr orng frags, w/vf ang clr gl shrds, calc cmt

MW 8.7 Cl 220 V 45
Rmf 3.9 @ 73 Deg

TUFF: lt-med gy, gy-gn, frm-hd, gl-ethy, occ cly, com hd ethy med gy mtx w/vf gr rnd wh mat, occ BREC: gl mtx w/f gr gn gl tuf frags: sl calc

TUFF BRECCIA: lt gy-gn, gy, tr gy-bn, orng-bn, vhd-hd, gl, occ ethy, com gl dk gn, f-m gr ang tuf frags in gl mtx, com wh mic-ves fil, calc; tr bas

W 8.7 V 50 F 16 FC 2/32
pH 10.8 Cl 200 Sol 3.6X
PV 16 YP 15



BRECCIA: lt gn-dk gn, tr org & brn, hd-v hd, gl, com dk gn & clr, ang-sbang, f-m gr frags, in gl mtx

TUFF BRECCIA: lt-med gy, gy-gn, occ bn, orng-bn, hd-vhd, occ frm, brec: gl, occ ethy, tuf mtx w/ f-m gr, ang tuf frags; calc, tr bas

VESICULAR BASALT: rd-bn alt stn, sl-vhd, occ gl ves & vs fil, calc

MW 8.7 V 48 Cl230
Rmf 3.3 @ 71 deg

TUFF BRECCIA: lt-med gy, blu-gn, vhd-frm, gl-ethy, com wh mic-ves fil, tuf mtx w/ang-sbrnd, f-m gr tuf frags; occ cly, sl calc

4955' 1.75 deg

BASALT: dk gy, gy-gn, occ bn stn, vhd; VES w/lt gy, gy-gn, dk gn gl, transl ves fil; SLTST: dk-med gy, frm-sft, sbrnd, arg, poss alt bas; calc

BASALT: v dk gy-dk gy, gn gy, v hd, mnr rd brn vein fill-bndg, mnr calc vein fill, suc in prt, mnr clr ang incl in basalt mtx; tr pyrite

BASALT: dk gy, gn, blk, vhd, mic-vf xln, occ VES: bn stn, gl-xln fil, occ alt to cly; BREC: gn, gy, mtld, sft-hd, tuf or cly mtx w/f-m gr frags; calc

TUFF: lt gy, v frm, occ sft, gl-ethy, ves; BREC: bn-rd, sft-frm, cly mtx w/m-f gr rnd-ang lith frags, occ rd tuf mtx w/calc xtls

BRECCIA: gy gn-rd brn, hd-v hd, gl-ethy, occ suc, gn, clr & wh alt incl in sl gran mtx, rd & wh bndg, tr pyr

W 8.75 V 48 F 5.6 FC 2/32 pH 10.2 Cl 200
Sol 3.5% PV 14 YP 13

TUFF: lt gn, fri-firm, occ sft, ethy, BRECCIA: dk gn-sl gy gn, hd-v hd, occ suc, gn & clr alt incl, tr rd-brn bndg, tr calc cmt

200 CC CARBIDE - 8u
LAG - 74 MIN @ 188 SPM

TUFF: lt gy, lt-med gy-gn, occ wh, bn, sl frm-hd, ethy-gl, cly alt, BREC: tuf mtx w/m-f gr, rnd-ang lith frags; calc

MW 8.7 V 50 Cl 290
Rmf 2.6 @ 77 deg

TUFF: lt-med gy-gn, gy, tr dk gn, vhd-frm, gl-vfn xln, gran: poss andesite; com sft, ethy, cly, vcalc, occ brec; tr wh-buf, vhd, mic-xln qtz vn fil

TUFF: ltgn-med gy, fri-firm, occ hd, occ blk mic spts, mnr calc cmt

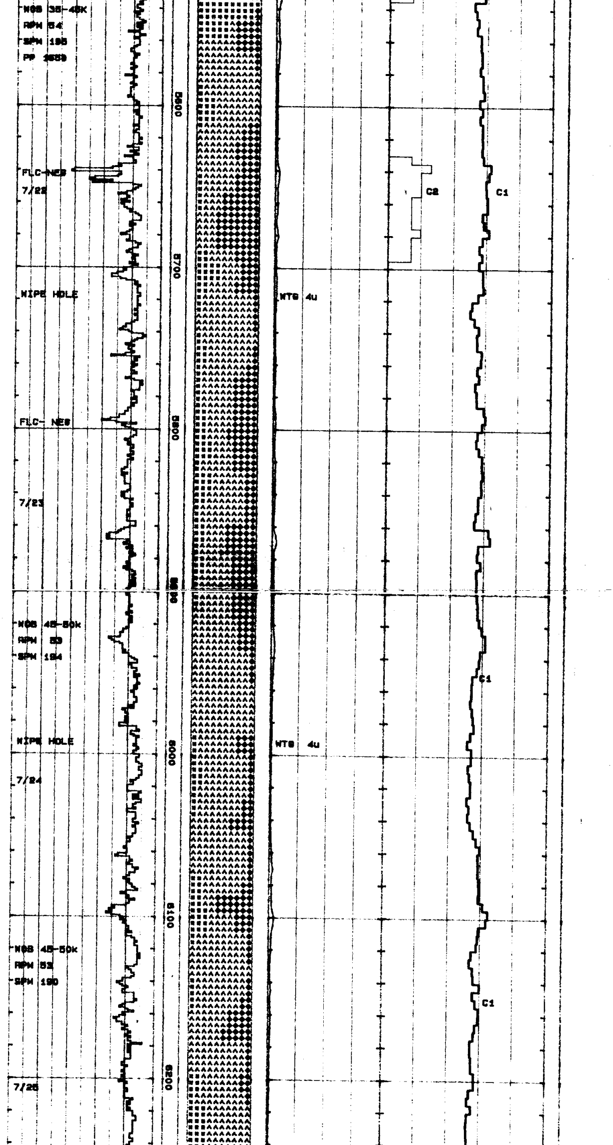
TUFF: gy-lt gy gn, occ dk gn, firm-dh, occ v hd, gen mas, occ plty & slty in dk gy frags, occ mic blk spts in med gy frags, mnr calc cmt

TUFF: lt gy, wh, lt gn, vhd-frm, gl-ethy, tr cly, tr carb: blk, f gr, sl frm; tr gl vn fil; sl calc; occ basalt; no flor, no cut

W 8.7 V 48 F 5.6 FC 2/32
pH 10.6 Cl 240 Sol 3%
PV 13 YP 13

TUFF: lt blu, tr gy, wh, hd-frm, tr vn fil: gn, gl, transl or clr, blky-sbblky qtz; calc; tr-occ bn sltst; tr carb

MW 8.7 V 50 Cl 260
Rmf 2.6 @ 78 deg



TUFF BRECCIA: med gn, gy-gn, occ lt gy, tr orng, motld, vhd-frm, gl gran mtx w/irreg med-crs gr tuf frags: calc: tr pyr, cly

ANDESITE: med gy, gy-gn, hd-vhd, occ ves, f-vf gr xln

200cc CARBIDE - 8u LAG - 77 min @ 186spm duration 30 min

TUFF BRECCIA: lt-med gy, gn gy, trcs brt orng, gn,blk, hd qtz & fldsp xls, rare sft, lt gy - wh tuff

VOL BRECCIA: lt-med gy, gy gn diss bn, lav, orng, gn, ang-rnd clasts,hd-v hd, trcs lt gy tuff

ANDESITE: med-dk gy, occ bn-gy, com orng-bn stn, f-vf gr, hd-vhd, occ wh xln plag laths

TUFF BRECCIA: med-lt gn, gy-gn, wh, motld, hd-frm, f-vf gr gran, gl-occ ethy-cly mtx w/crs-f gr irreg tuf frags: calc

ANDESITE: dk-med gy, bn-gy, com orng-bn stn, f-vf gr, occ f gr wh phncryst, occ ves, tr wh-gy ves & vn fil: calc

MW 8.7 V 50 C1 320
Rmf 2.5 @ 77 deg

ANDESITE: dk-med prpl-bn, occ dk-med gy, vhd-hd, f-vf gr, tr brec w/tuf frags, tr wh, bn vein fill

TUFF BRECCIA: med-dk gn, med-lt gy, motld, hd-frm, gl-occ ethy mtx w/crs-med irreg tuf frags: calc

TUFF: lt gy- gy gn, gy wh, sft-firm, pt clayey

ANDESITE: lt gy gn, gy brn, olv, trcs rd, orng,brn, hd-v hd, pt vec, pt breccia, tr agate

ANDESITE: gn, aph, mas, hd, w/mnr lt gy tuff breccia

TUFF BRECCIA: orng-rd, gn, gy hd, brit, pt wthrd, lt gy, ashy tuff

ANDESITE BRECC: dk-med gy, dk rd-bn alt stn, vhd-frm, rd-bn gy ethy mtx w/crs-fn ang and frags, tr wh, gy non-calc xln vn fil; tr lt-med gy cly: calc

MW 8.7 V 44 C1 250
Rmf 3.2 @ 70 deg

ANDESITE: dk-med gy, com rd-bn alt stn, vhd-frm, f gr-aph occ ves, brec, tr wh-gy xln vn fil, tr pyr vn; tr cly: gy, blu-gy, frm, ethy: calc

5979 ft 2.25 deg

ANDESITE: dk gy, gn gy, mnr rd, orng, brn & blk, hd-v hd, conch -ireg frac, occ fldsp & qtz xls, mnr breccia & gy, firm - hd tuff

ANDESITE: dk-med gy, gy-gn, com red-bn alt stn, vhd-frm, fn-vfn gr, tr-occ ves, brec, tr wh-gy xln vn fil, tr gy cly, calc

TUFF: lt-med gy,occ blu-gy; tr wh w/ f gr diss carb; hd-frm, ethy-gl, f gran, tr cly, brec; calc

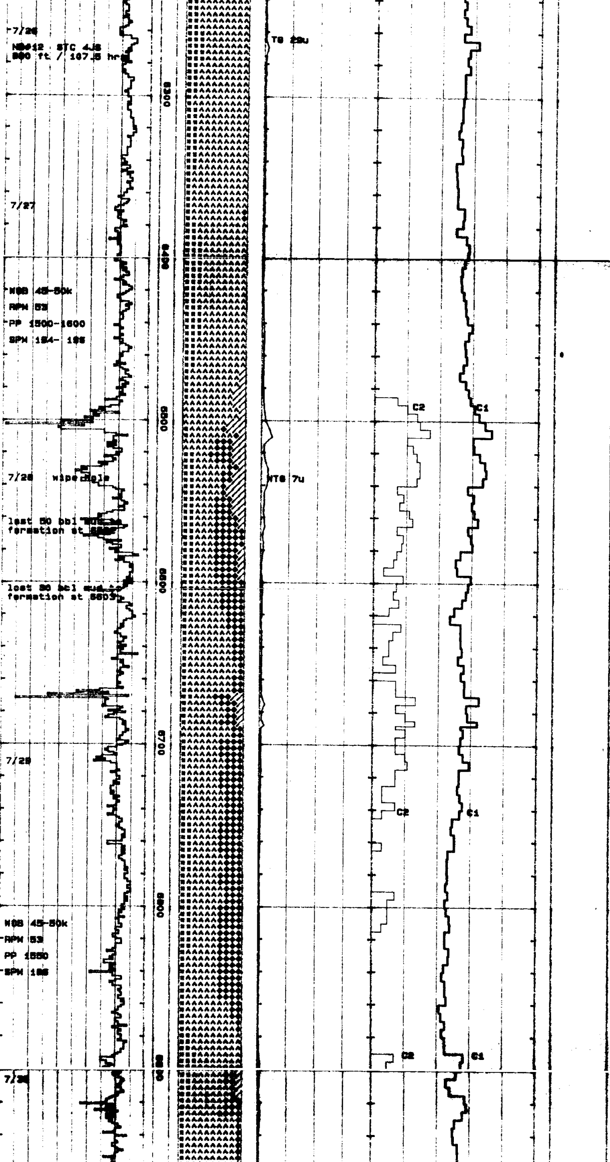
BRECCIA: pred blu tuf/cly, occ bn and mtx, sl frm-hd, ethy, med-f gr rnd-irreg lith frags; sl calc; tr qtz: med gr, clr-frst, blky-sbrnd

ANDESITE: dk-med gy, gy-gn, com rd-bn alt stn, vhd-frm, com ves, com alt to cly, tr wh-gy xln-ethy vn & ves fil: sl calc

BRECCIA: gy, gn, rd, orng, firm-hd, com ang andesite clasts,minor wh silic cmtd zones, com wh & gy-gn gy tuff

200cc carbide - 8 units
lag - 91.5 min @ 189 spm
duration 18 min

ANDESITE: med- dk gy, gn gy, hd- v hd, ireg- conch frac, aph w/occ f blk xls, minor varicol breccia w/ firm- hd tuff mtx, silic & calc veins



MW 8.7 V 42 F 5.7 FC 2/32 pH 10.5 Cl 300 Sol 3% PV 13 YP 11

6258 ft 1.75 deg

ANDESITE: dk gy-gn gy, hd-v hd, ireg-conch frac, aph, w/occ f blk xls, mnr varicol breccia frags, sil & calc vein fill

ANDESITE: v dk gy-dk gn gy, hd-v hd, ireg-conch frac, aph, w/occ f gl blk incl, mnr varicol breccia w/fri-firm dk gy gn tuff mtx, sil & calc vein fil

MW 8.7 V 41 Cl 300
Ref 3.2 @ 75 deg

TUFF: dk gn gy-dk gn, occ med gn, [illegible] clayey [illegible]

ANDESITE: dk gy, gy gn, hd- v hd, aph-vf xln, diss blk & fldsp f- med xls, ireg- conch frac, assoc w/ sft- firm ashy tuff

tr diss pyrite xls in andesite

SLTST: med- dk gy, firm- sl hd, pt clayey, tuff, minor diss vf sd

ANDESITE-TUFF BRECCIA: gn gy, brn gy, tr orng, hd- v hd, abnt hd, wh, xln veins, w/ sme sft, wh vein mat

ANDESITE: lt- med gy, firm-hd, ireg frac, aph w/ diss qtz, fldspr & mafic phenocrysts, occ diss pyrite xls

TUFF BRECCIA: med gy-lt gy, hd-v hd, abnt calc vein fill, com wh-clr xls poss zeol, com sm ang, dk gn-blk lith incl in tuff mtx

W 8.7 V 47 F 5.8 FC 2/32 pH 10.5 Cl 300 Sol 4% PV 18 YP 12

ANDESITE: lt gn gy & dk gy, hd- v hd, ireg - conch frac, pt ves & amyg, com wh, xln zeol type mat

SLTST: med- dk gy, brn gy, firm- sl hd, assoc w/ sft, wh- lt gy, ashy tuff

VOL BRECCIA: lt gy, gy brn, dk gy, crpxln & micxln, hd- v hd, conch frac, sme ves clasts, com zeol type xln mat

200cc carbide - 5 units
lag - 106 min @ 186 spm
duration - 20 min

6724 ft 1.25 deg

adding LCM mica to mud

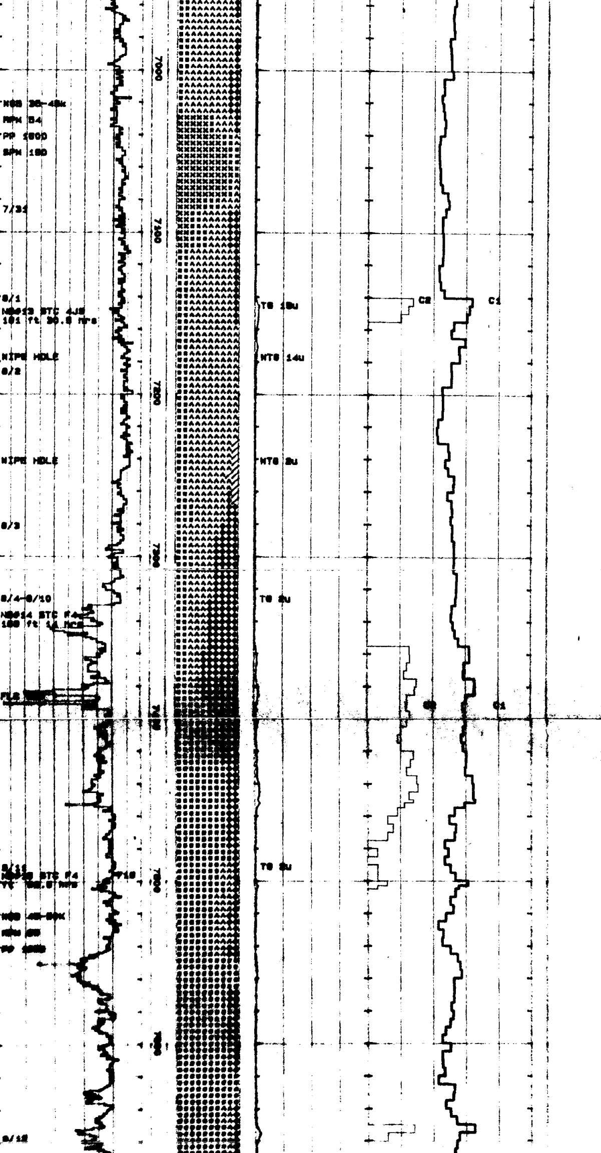
ANDESITE: v dk gn gy-dk gy, occ gy & lt gn, hd-v hd, aph, com wh xls in dk gy mtx, abnt mica mud additive in smpl

ANDESITE: med- dk gy, sme lt gy- gn gy, hd- v hd, ireg frac, tr bnds, com diss mafic phenocrysts, tr calc

TUFF: lt gy, mnr gn gy, firm- hd, ashy, silty

TUFF BRECCIA: lt- med gy, firm -hd, brit, f-c clasts, calc cmtd, com calc, zeol & gyp xls

W 8.7 V 43 F 7.8 FC 2/32 pH 10.5 Cl 300 Sol 3% PV 18 YP 10



ANDESITE: gy gn-lt gy gn, hd-v hd, ireg-conch frac, gen aph, sml blk-v dk gn incl in andesite mtx, tr calc xls, tr pyr

TUFF: gy gn-lt gy gn, occ gy wh, fri-firm, mnr calc cmt, tr pyr, mnr sml blk-dk gn incl

BASALT: med- dk gy, dk brn gy, hd- v hd, dense, brit, mas, ireg frac

MW 8.7 V 40 Cl 300
Rmf 3.15 @ 75 deg

ANDESITE: lt- med, gn gy, hd, brit, ireg -splty frac, assoc w/ gy & gn gy, firm- hd, ashy tuff

Tight hole @ 3290 ft.
Ream to bottom

poor samples . abnt varicol tuffs sloughing

ANDESITE: med-dk gy, gn gy, hd, aph, ireg frac, poor sample

MW 8.8 V 51 S 300
Rm 2.4 @ 75 deg

SLTST: med- dk gy, firm to hd, assoc w/ wh- lt gy, ashy tuff

BRECCIA: gn- gy gn, mnr brn, gy, firm- hd, brit, f- c andesite clastd in vf-f tuff mtx

Run SCHLUMBERGER LOGS: DIL-BHC-GR, FDC-CNL-GR, SHDT

Set 13 3/8", N80, NIPPON, 187 jts, 72#, SLIMELINE CSG at 7286 ft. Drlg 12.25 " hole

BRECCIA: gn-gy gn, varicol, orng & brn, hd-v hd, pred sil cmt, gn gy alt rimed arnd volc clasts, tr bands

200 CC CARBIDE - 31u
LAG - 88 min @ 170 spm

BRECCIA: gn- gy gn, brn, gy [illegible] clasts [illegible] gr [illegible] & [illegible] veins, tr [illegible] w/ gn & gy , frm [illegible]

W 8.8 V 48 PV 14 YP 18
pH 12.5 F 7.4 FC 2/32 Cl
300 Sol 3

TUFF: gn, gy gn, gy, dk brn, hd, brit, com lt gy & med gy, sft- firm, ashy: occ vf diss mica, tr vf xln pyrite in lt gy- wh veins

7484 ft. 2.25 deg

TUFF: wh, buff, tr gn, brn, firm- hd, brit, sl calc

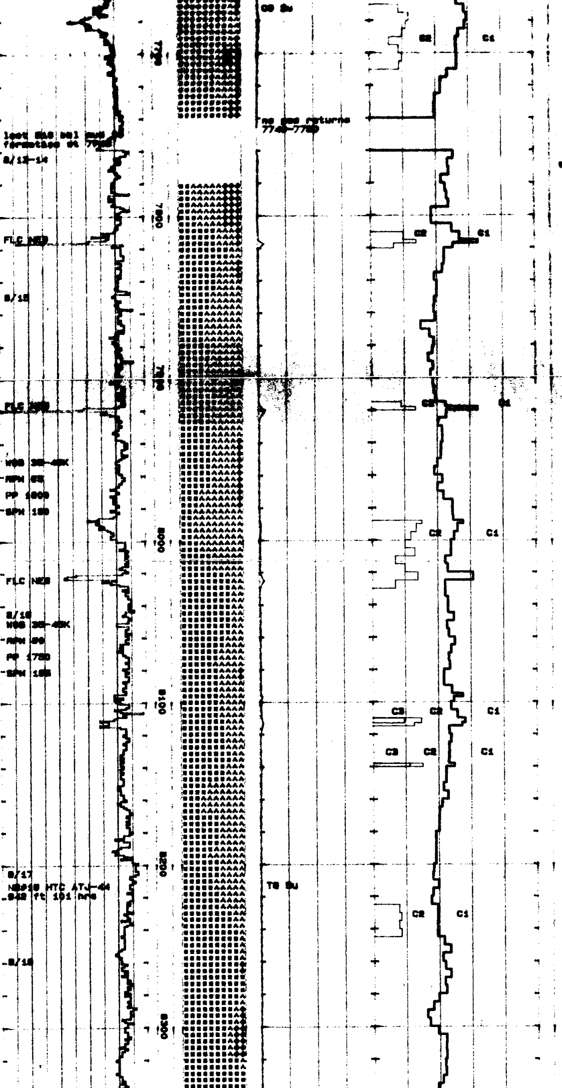
ANDESITE: gy gn- dk gy, occ brn, hd, brit, aph, diss f gr blk xls

TUFF: lt gy- lt gn gy, trce brn, sft-v firm, gritty, pt ashy, v calc

BRECCIA: gy- gn gy, mnr brn, tr orng, hd, brit, vf- med clasts in tuff mtx

TUFF: lt gy- gn gy, med- dk gy, brn, firm- hd, brit, mnr sft- firm, lt gy, ashy tuff, calc

TUFF: lt gy, lt gy gn, occ brn, firm-hd, occ sft-fri, lt gn gy ashy tuff, calc cmt



TUFF: gy gn-lt gy gn, occ brn, fri-firm, occ hd, tr sft lt gy gn ashy tuff, calc cmt, com orng tan-orng frags in lt gy gn ashy tuff mtx

MW 8.7+ V 43 S 300
Rmf 1.4 @ 72 deg

Set plug #1 200 sacks cmt, TOOH, WOC 12 hrs, still losing mud

Set plug #2 300 sacks cmt, WOC 12 hrs, drill cmt with full circ

NO lith samples recov 7740 to 7780

ANDESITE: med- dk gy, gy brn, hd, dense, brit, [illegible] frac, aph

TUFF: gy gn, hd, brit, occ lt-med gy, sft- firm, ashy, occ wh, sft, xln [illegible]

ANDESITE: dk gy-gy, [illegible] [illegible], tr [illegible] vein fill

W 8.8 V 40 F 6.4 [illegible]
pH 11.5 Cl [illegible] Sol [illegible]
[illegible] YP [illegible]

[illegible] occ tan clr, fri, xln

200cc carbide - 20u
lag = 50 min at 185 spm
duration 5 min

BRECCIA: dk gy- gn gy, hd, tuff w/ andesite clasts

ANDESITE: lt gy & med gy gn, hd, brit, ssc, sme flow bandng, micxln- crpxln, occ rd or wh vein of zeo

TUFF: wh, gy, gn, orang, rd, brn, sft- firm, ashy, calc, com wh sft vein mat

WEATHERED TUFF: rd brn-brn, fri-firm, occ hd, suc-grnl, occ wh incl, slty

TUFF: dk gy-dk gn gy, occ gn, pred fri, occ firm-hd, occ clr tab gyp xls, tr calc vein fill

TUFF: lt gy- med gy, sft- sl hd, ashy, trce brn, orng & dk gy weathered tuff

8117 ft 2.25 deg

ANDESITE: dk gy- gn gy, hd, brit, micxln, sme gn, hd, vf micxln w/ diss f-med xls

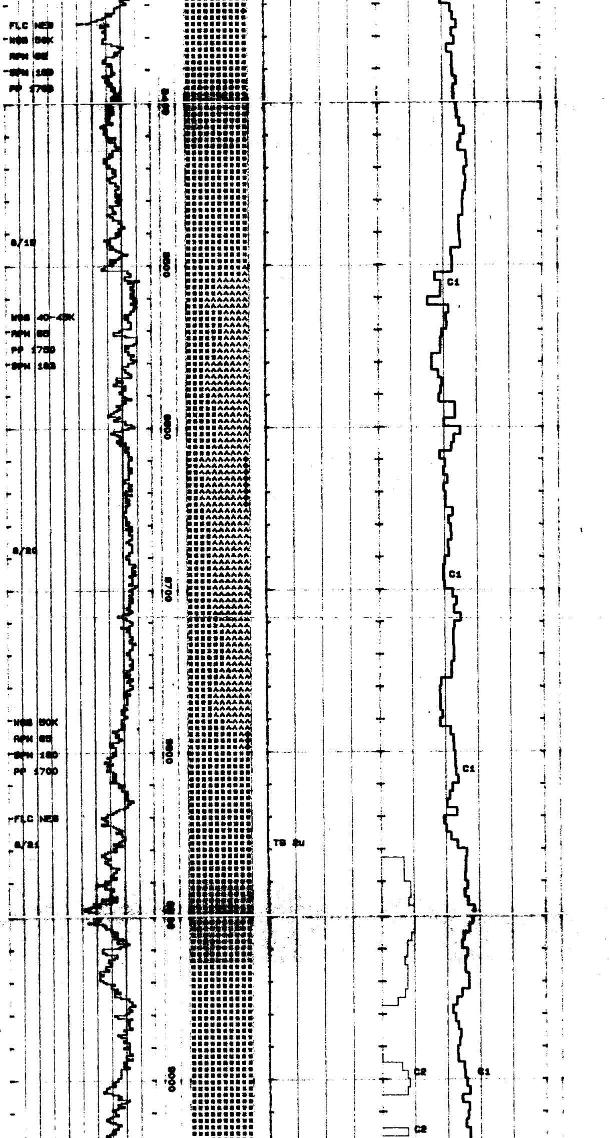
W 8.7 V 42 F 5.6 FC 2/32
pH 11.5 Cl 300 Sol 2% PV
14 YP 8

MW 8.7 V 40 Cl 250
Rmf 1.5 @ 77 deg

TUFF: lt gy, gy-gn, sft-frm, arg, calc, tr beccia w/dk f gr lith frags

TUFF: gy gn-lt gn, firm, fri, occ hd, arg, mnr calc cmt, mnr breccia w/f-m gr, ang-sbang lith frags

TUFF: lt-med gn, gy-gn, occ gy, frm-hd, sbblky-sbang, pred gl, occ wh cly, sl calc, tr gypsum, trnsl-wh xln, & plty clvg



200CC CARBIDE - 16u
LAG - 74MIN @ 100SPM

TUFF: lt-occ med gy, occ gn-gy, hd-frm, ang-sbang, gl-ethy, calc, tr breccia, tr wh, pnk xtln vn fil

MW 8.7 V 42 Cl 800
Rmf 1.8 @ 75 deg

TUFF: lt gy, blu-gy, hd-frm, ang-blky, gl, occ ethy, sl calc, tr wh cly, tr rd-bn alt vn mat, tr brec: tuf mtx w/m-l gr ang lith frags

TUFF: lt gn, firm-hd, occ v hd, mas, vf dk gn & blk liths in tuff mtx, mnr orng-wh vein fill, mnr calc cmt, alt sbang incl in mnr breccia

ANDESITE: blk-v dk brn, hd-v hd, blky, mas, clr-wh micxln xls

W 8.7 V 42 F 8.8 FC 2/32
pH 11.0 Cl 300 Sol tr PV 15 YP 10

ANDESITE: dk gy, occ gy-gn, vhd-hd, ang-blky, f-micxtln, calc, tr wh xtln vn fil

TUFF: lt gy, frm-hd, ethy-occ gl, ashy w/occ dk, f-vf gr dk incl, calc, tr wh cly, tr brec

ANDESITE: dk gy, gy-gn, prpl, com rd-bn alt stn, vhd-vfrm, ang-sbang, vf-micxtln, occ ves, occ wh xtln or wh cly vn & ves fil

MW 8.7 V 42 Cl 300
Rmf 1.8 @ 73 deg

TUFF: med-lt gy gn, gn, occ gn wh, firm-hd, vf dk incl in prt, rr alt frags, mnr calc cmt

ANDESITE: dk gy-gn gy, hd-v hd, occ firm, mnr non calc vein fill, mnr fv gr wh incl in lt gy mas mtx, tr clr xls w/well dsf slvg in prob zeol

TUFF: brn-lt brn, com gy gn-gn, fri-hd, occ sft brn wh frags, non calc, wh micxln frags in dk gn mtx, alt rd brn frags in brn mtx, tr prob zeol

ANDESITE: dk gy, prpl, gy-gn, occ bn alt stn, vhd-hd, f-micxtln, calc, occ ves w/wh or clr xtln fil

TUFF: lt gy, gy-gn, hd-frm, ashy, ethy-gl, sl calc, tr pnk vn fil, occ BRECCIA: ethy tuf mtx w/l-f gr, dk-med gn gl tuf lith frags

MW 8.7 V 43 Cl 250
Rmf 2.1 @ 78 deg

TUFF: lt gy, occ blu-gy, hd-vhd, brit, ang-occ blky, gl, calc, com m-vf gr gl med-dk gn lith incl, occ pnk transl xtln vn fil

Abnt LCM-cottonseed hulls in smpls [illegible]

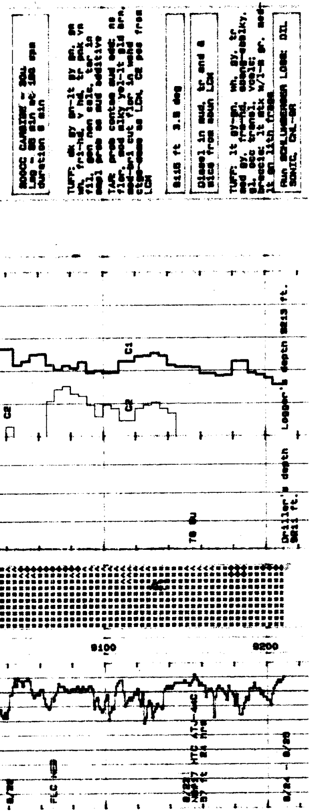
W 8.7 V 46 F 8.8 pH 10.8
Cl 300 Sol 2.5 PV 18 YP 8

TUFF: lt gy, wh, gn-gy, frm-hd, ang, gl, calc, com dissem dk-m gn, vf-m gr rnd-elg incl, tr pnk, wh xtln vn fil

TUFF: lt-med, occ dk gy, gn, wh, tr orng-bn, frm-hd, ang-blky, gl, occ transl, vcalc, tr pnk xtln vn fil

Abnt LCM in smpls

TUFF: med-lt gy gn, occ dk gn, occ multicolor cal bnds, wh, tr pnk-wh vein fill, fri-firm, hd, tr dissm pyr



EXLOG

COMPANY: ARCO WELL: HANNA #1 SHEET NO. 1

# BIT DATA RECORD

| RUN # | BIT DATA | | | | | | BIT RUN | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BIT # | MFR | TYPE | SIZE | IADC CODE | JET SIZES | START DEPTH | DRILLED | HOURS | AVERAGE ROP | WOB | RPM | PUMP PRESSURE | SPM/GPM | IADC BIT CONDITION |
| | 1 | STC | 3JS | 20½ | | 28:28:28 | 86 | 445 | 58 | 7.67 | 10/30 | 60/80 | 800 | 100 | 4 4 I |
| 2 | 2 | STC | 3JS | 20½ | | 15:15:28 | 531 | 605 | 107 | 5.65 | 20/35 | 60/85 | 1050 | 100 | |
| | 3 | STC | 3JS | 20½ | | 18:18:28 | 1136 | 464 | 86 | 5.39 | 10/35 | 60/85 | 1200 | 100 | |
| | 4 | HTC | X33 | 14 3/4 | | 15:15:14 | 1600 | 662 | 91½ | 7.23 | 20/40 | 70 | 1800 | 95 | 6 5 F 1/16 |
| 5 | 5 | STC | 4JS | 14 3/4 | | 15:15:15 | 2262 | 448 | 45 3/4 | 9.79 | 20/45 | 70 | 1700 | 95 | |
| | 6 | STC | 4JS | 14 3/4 | | 15:15:15 | 2710 | 319 | 44 | 7.25 | 20/45 | 70 | 1800 | 95 | |
| 7 | 7 | HTC | X44 | 14 3/4 | | 15:15:15 | 3029 | 625 | 52¼ | 11.96 | 30/45 | 50 | 1700 | 95 | 3 3 I |
| 8 | 8 | HTC | EP1048 | 14 3/4 | | 15:15:15 | 3654 | 753 | 74.5 | 10.1 | 40/50 | 50 | 1800 | 95 | 3 4 I |
| 9 | 9 | STC | F-4 | 14 3/4 | | 15:15:15 | 4407 | 551 | 50.5 | 11.2 | 30/45 | 50 | 1750 | 95 | |
| 10 | 10 | HTC | ATM44 | 14 3/4 | | 16:16:16 | 4958 | 504 | 65¼ | 7.72 | 30/45 | 50 | 1800 | 95 | 4 5 I |
| 11 | 11 | STC | 4JS | 14 3/4 | | 18:18:16 | 5462 | 802 | 92½ | 8.67 | 45/50 | 54 | 1500 | 95 | 2 2 I |
| 12 | 12 | STC | 4JS | 14 3/4 | | 18:18:16 | 6264 | 880 | 107½ | 8.18 | 20/50 | 54 | 1550 | 95 | 2 2 I |
| 13 | 13 | STC | 4JS | 14 3/4 | | 18:18:16 | 7144 | 181 | 30½ | 5.93 | 50 | 54 | 1600 | 95 | 2 2 I |
| 14 | 14 | STC | F-4 | 12¼ | | 15:15:18 | 7325 | 169 | 14 | 12.07 | 40/50 | 65 | 2000 | 88 | 2 2 I |
| 15 | 15 | STC | F-4 | 12¼ | | 16:16:18 | 7494 | 718 | 82½ | 8.7 | 45/50 | 65 | 1800 | 90 | 6 5 F ¼ |
| 16 | 16 | HTC | ATJ-44 | 12¼ | | 20:20:15 | 8212 | 942 | 101 | 9.33 | 35/45 | 60 | 1750 | 90 | |
| 17 | 17 | HTC | ATJ-44C | 12¼ | | 18:18:15 | 9154 | 57 | 24 | 2.38 | 50 | 65 | 1800 | 90 | |