HALLIBURTON

EXCELL 2000

QUAD COMBO
HRI/BCS/SDL/DSN

5"=100'

COMPANY NORTHWEST NATURAL GAS
WELL OM 23C-11-65
FIELD MIST (BRUER POOL STORAGE)
COUNTY COLUMBIA STATE OR

COMPANY NORTHWEST NATURAL GAS

WELL OM 23C-11-65

FIELD MIST (BRUER POOL STORAGE)

COUNTY COLUMBIA STATE OR

API No. 036-009-00361

Location 227.3' SOUTH AND 1691.5' EAST OF THE WEST 1/4 CORNER OF SECTION 11, WB&M
X = 872393.1
Y = 1294631.2

Sect 11 Twp 6N Rge 5W

Other Services
EMIT

Permanent Datum G.L. Elev 987.1

Log measured from K.B. 19.0 ft. above perm. datum

Drilling measured from K.B.

Elev.: K.B. 1006.1
D.F
G.L. 987.1

Date	AUG-20-2005			
Run No.	ONE			
Depth – Driller	3108'			
Depth – Logger	3086'			
Bottom – Logged Interval	3078'			
Top – Logged Interval	464'			
Casing – Driller	8.63" @ 468'	@	@	@
Casing – Logger	464'			
Bit Size	7.875'			
Type Fluid in Hole	GEL			
Dens. | Visc.	8.8 | 50	|	|	|
Ph | Fluid Loss	----- | -----	|	|	|
Source of Sample	FLOWLINE			
Rm @ Meas. Temp.	1.430 @ 63 F	@	@	@
Rmf @ Meas. Temp.	1.600 @ 53 F	@	@	@
Rmc @ Meas. Temp.	1.860 @ 58 F	@	@	@
Source Rmf | Rmc	MEAS | MEAS	|	|	|
Rm @ BHT	0.854 @ 110 F	@	@	@
Time Since Circ.	2200 08-19			
Time on Bottom	0530 08-20			
Max. Rec. Temp.	110 F @ TD	@	@	@
Equip. | Location	49599 | WDLD	|	|	|
Recorded By	G. ROUSSEAU			
Witnessed By	J MEYER	E. VADER		

Service Ticket No 3886416 API Serial No 036-009-00361 PGM Version XL v5.0

CHANGE IN MUD TYPE OR ADDITIONAL SAMPLES			RESISTIVITY SCALE CHANGES			
Date | Sample No			Type Log	Depth	Scale Up Hole	Scale Down Hole
Depth – Driller						
Type Fluid						
in Hole						
Dens. | Visc.	|	|				
Ph | Fluid Loss	|	|				

			RESISTIVITY EQUIPMENT DATA				
Source of Sample			Run No.	Tool Type & No.	Pad Type	Tool Pos.	Other
Rm @ Meas. Temp.	1.430 @ 63 F	@	ONE	HRIT #211_132	NA	1.50" SO	NA
Rmf @ Meas. Temp.	1.600 @ 53 F	@					
Rmc @ Meas. Temp.	1.860 @ 58 F	@					
Source Rmf | Rmc	MEAS | MEAS	|					
Rm @ BHT	0.854 @ 110 F	@					
Rmf @ BHT	0.819 @ 110 F	@					
Rmc @ BHT	1.032 @ 110 F	@					

EQUIPMENT DATA

GAMMA		ACOUSTIC		DENSITY		NEUTRON	
Run No.	ONE	Run No.	ONE	Run No.	ONE	Run No.	ONE
Serial No.	A-180	Serial No.	4601 264	Serial No.	1741 M741	Serial No.	05
Model No.	NGRT	Model No.	305B BCS	Model No.	SDLT-DA	Model No.	DSNT-X
Diameter	3.625"	No. of Cent.	TWO	Diameter	5.500"	Diameter	3.625"
Detector Model No.	432	Spacing	2 FEET	Log Type	GAM-GAM	Log Type	NEU-NEU
Type	SCINT.			Source Type	CS-137	Source Type	AM241BE
Length	4.00"	LSA [Y / N]	NO	Serial No.	2694GW	Serial No.	DSN-16
Distance to Source	11.0'	FWDA [Y / N]	NO	Strength	1.5 CI	Strength	18.5 CI

LOGGING DATA

GENERAL				GAMMA		ACOUSTIC			DENSITY			NEUTRON		
Run	Depth		Speed	Scale		Scale			Scale			Scale		
No.	From	To	Ft / Min	L	R	L	R	Matrix	L	R	Matrix	L	R	Matrix
ONE	3086'	464'	45	0	150	175	75	55.5	1.65	2.65	2.65	.60	0	SAND
				API	API	USEC	USEC	USEC	GMCC	GMCC	GMCC	%	%	

DIRECTIONAL INFORMATION

Maximum Deviation		deg. @		KOP	

Remarks:

ANNULAR HOLE VOLUME CALCULATED USING 5.50" CASING.

HRID-BCSD-SDLT-DSNT-NGRT RUN IN COMBINATION.

CREW: M. EMERSON, D. BRIGHT. RIG: TAYLOR NO. 9.

HALLIBURTON DOES NOT GUARANTEE THE ACCURACY OF ANY INTERPRETATION OF THE LOG DATA, CONVERSION OF LOG DATA TO PHYSICAL ROCK PARAMETERS OR RECOMMENDATIONS WHICH MAY BE GIVEN BY HALLIBURTON PERSONNEL OR WHICH APPEAR ON THE LOG OR IN ANY OTHER FORM. ANY USER OF SUCH DATA, INTERPRETATIONS, CONVERSIONS, OR RECOMMENDATIONS AGREES THAT HALLIBURTON IS NOT RESPONSIBLE EXCEPT WHERE DUE TO GROSS NEGLIGENCE OR WILLFUL MISCONDUCT FOR ANY LOSS, DAMAGES, OR EXPENSES RESULTING FROM THE USE THEREOF.

HALLIBURTON

HALLIBURTON
EXCELL 2000

Version No: 5.0 | hc:3.0
Data File: 0820_0354_s2241.3.cls
Format File: plot_01_1.spc
Plot Time: 2005-08-20 06:29:16
Log Time: 2005-08-20 05:23:18

Top Depth: 111.50
Bottom Depth: 3093.50

GR
0 API 150

CALI
6 INCH 16

BS
6 INCH 16

SP
-]10[+

RWA
0 OHMM 3

AHV
FT3 →

BHV
← FT3

TENS
10500 500

1:240
FT.

HDRS
.2 OHMM 20

HMRS
.2 OHMM 20

DFL
.2 OHMM 20

NPHI
60. % 0

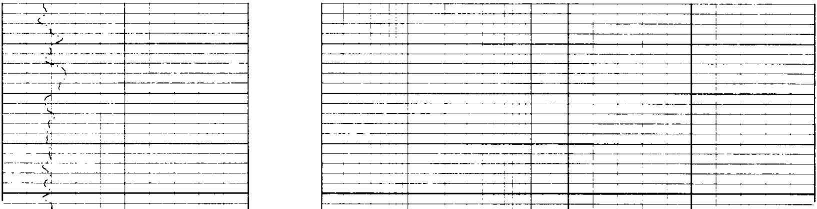
DT
175 US F 75

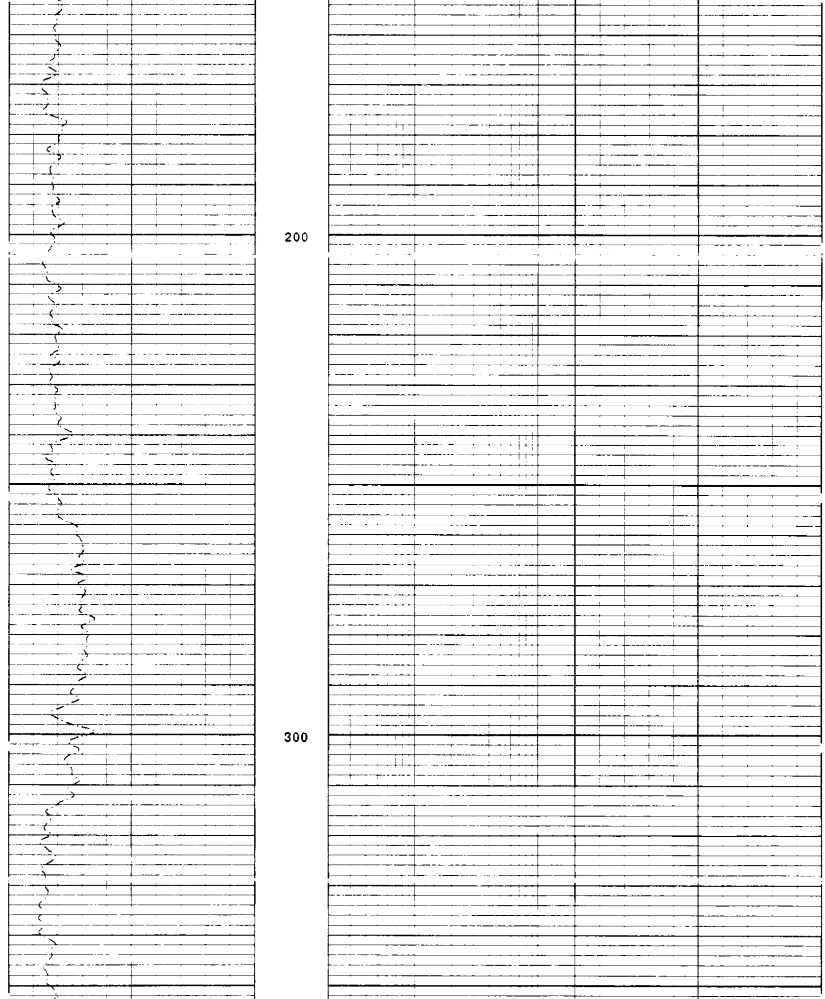
RHOB
1.65 G.CC 2.65

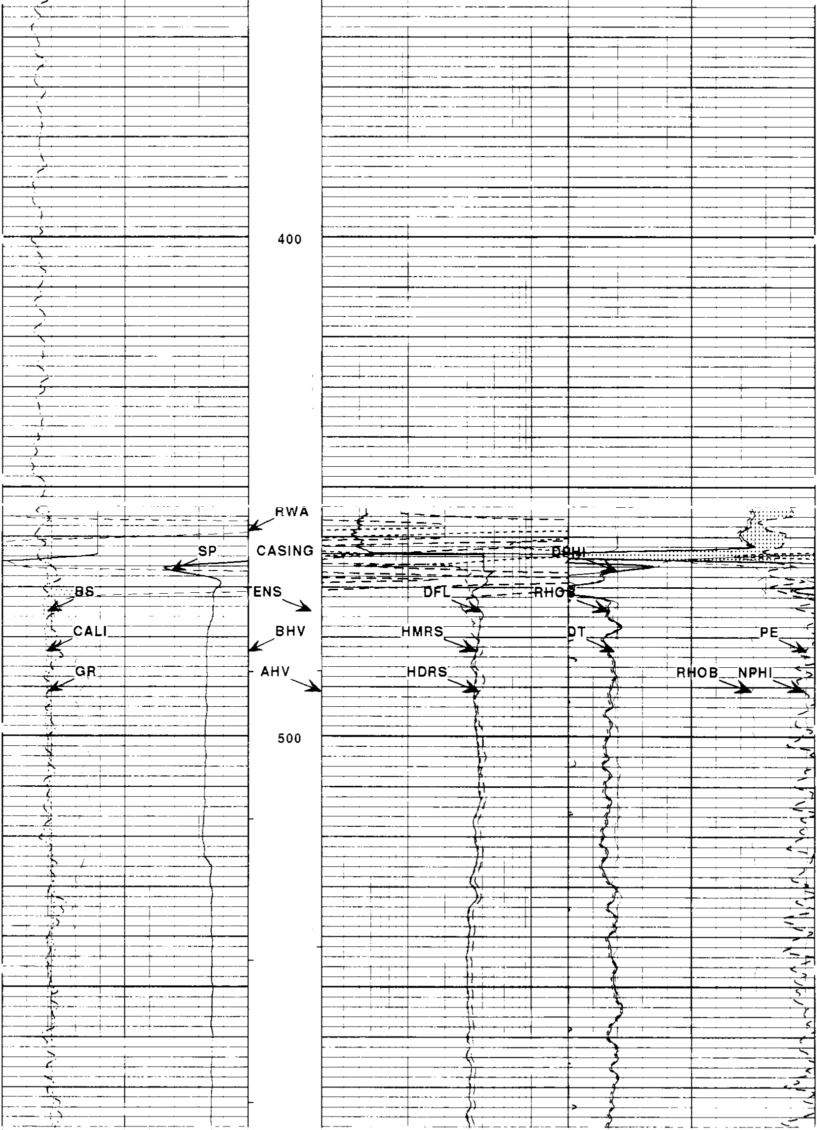
DPHI
60. % 0

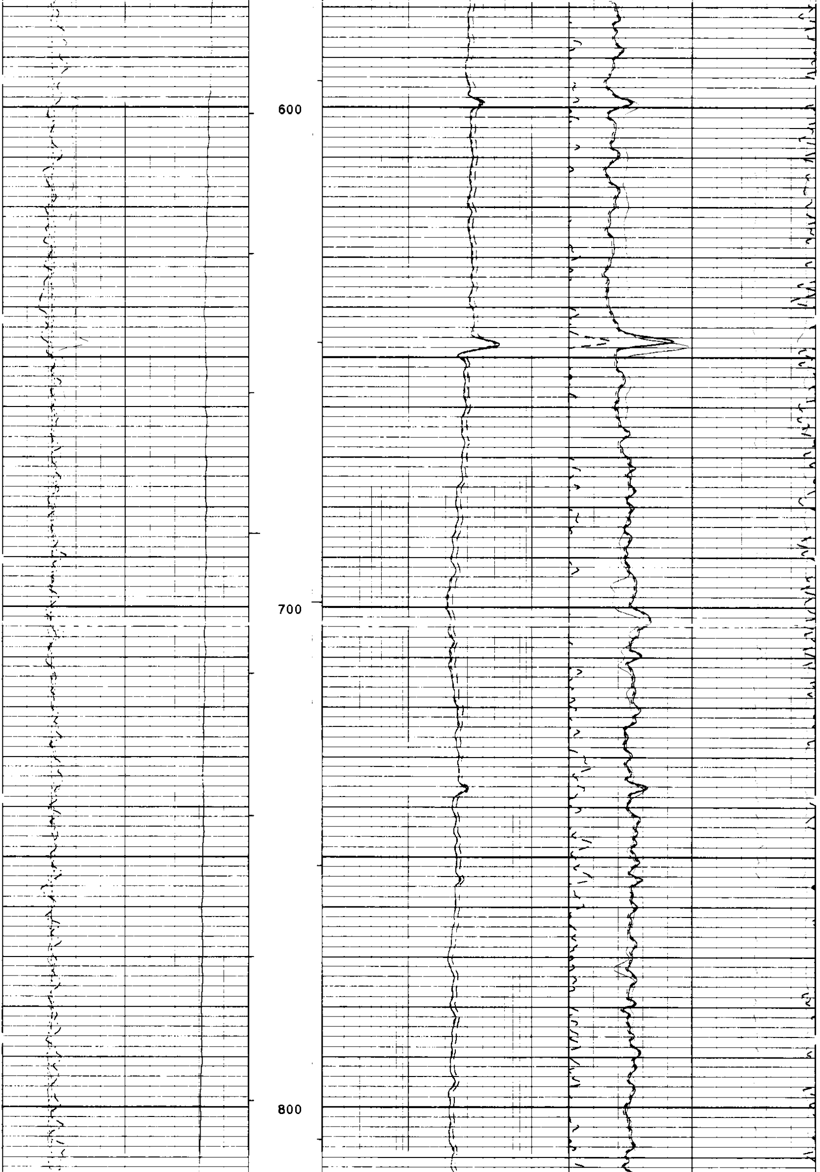
RHOB
-.5 GM CC .5

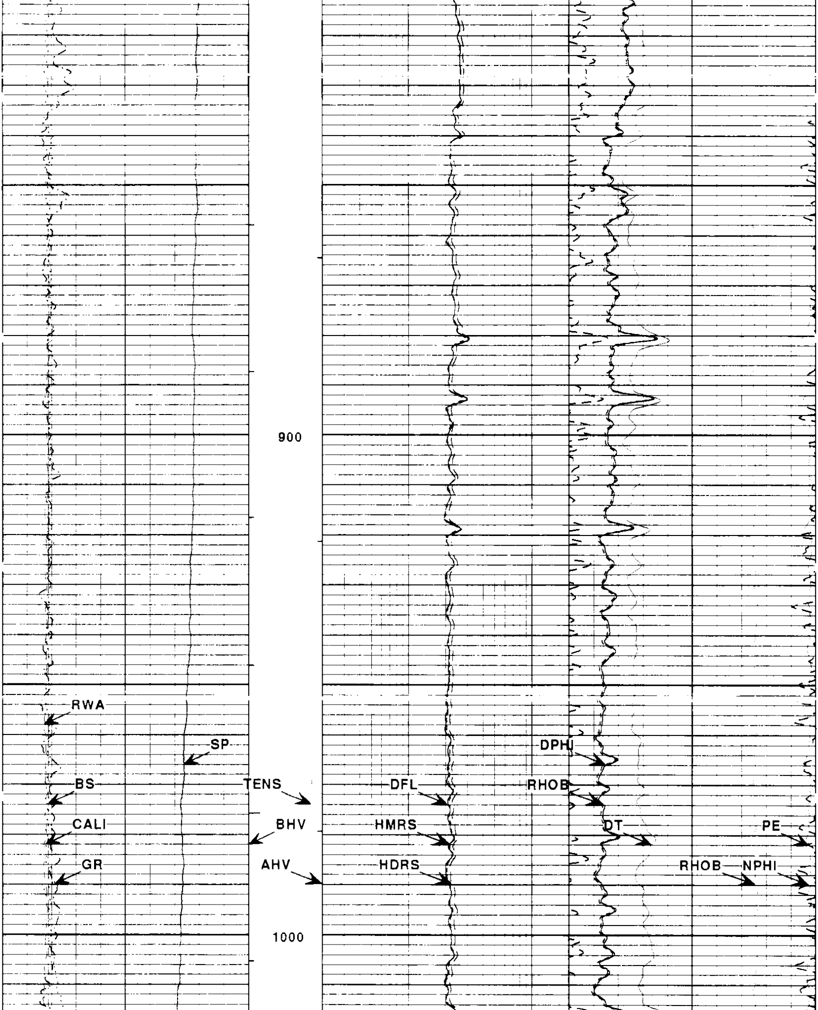
PE
12 2

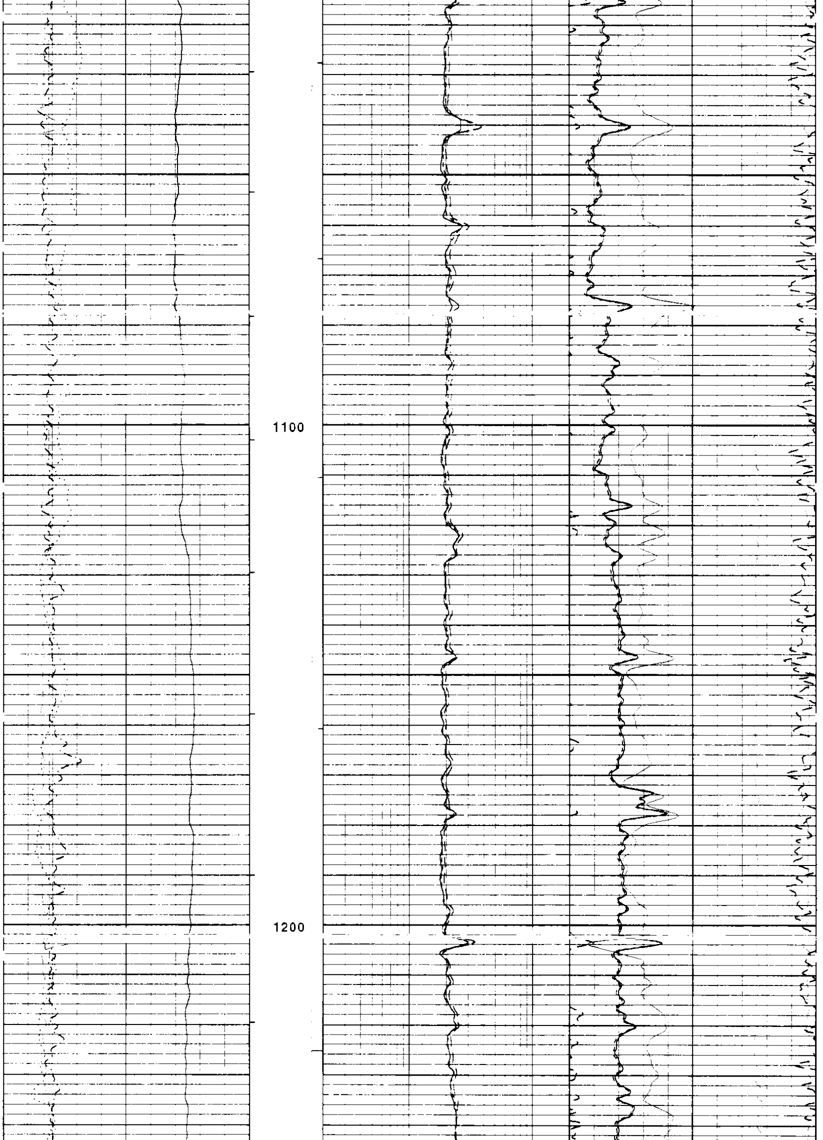


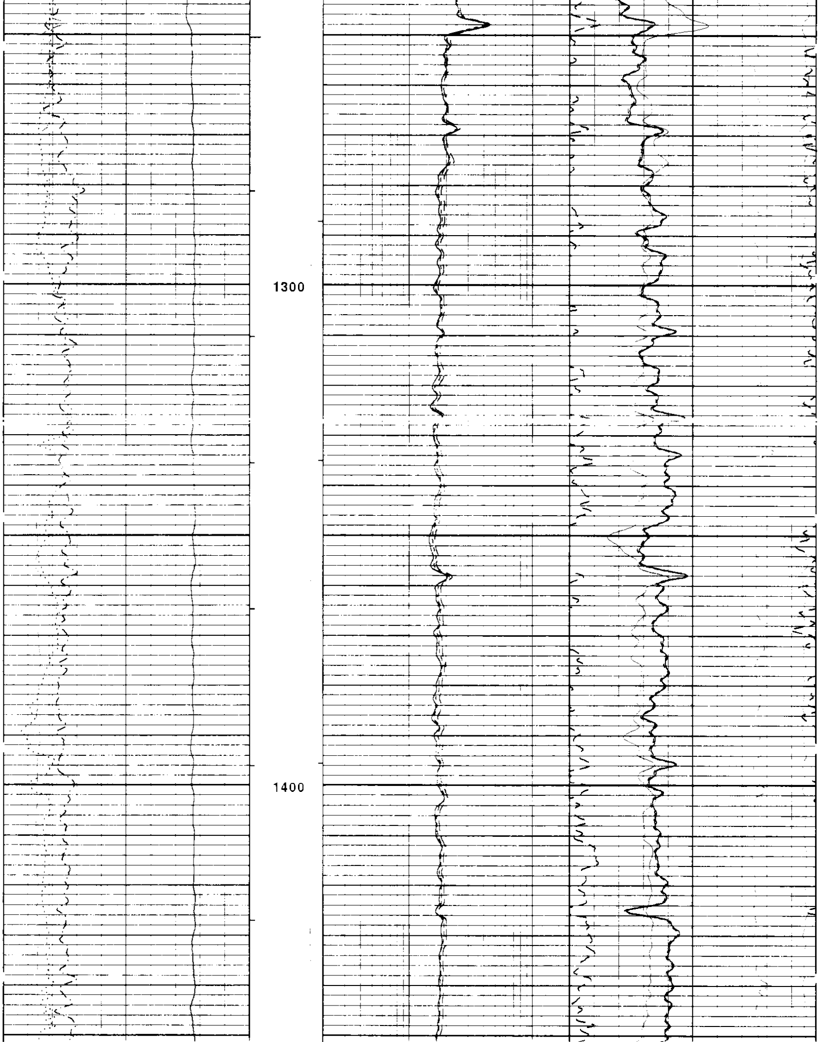


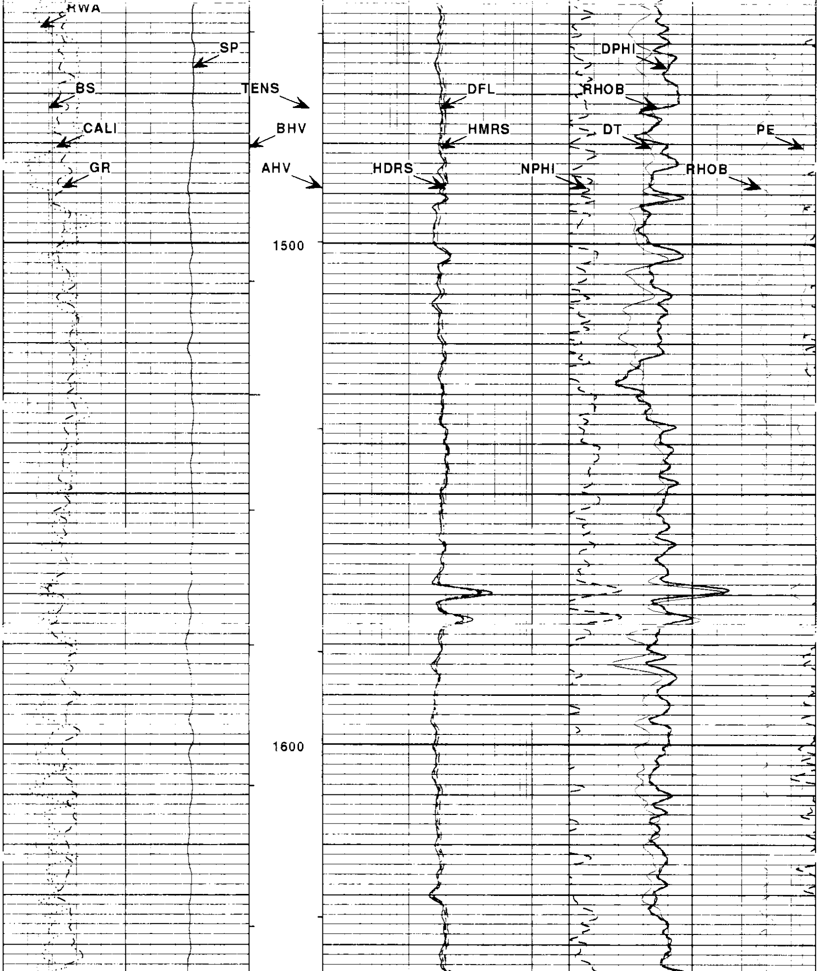


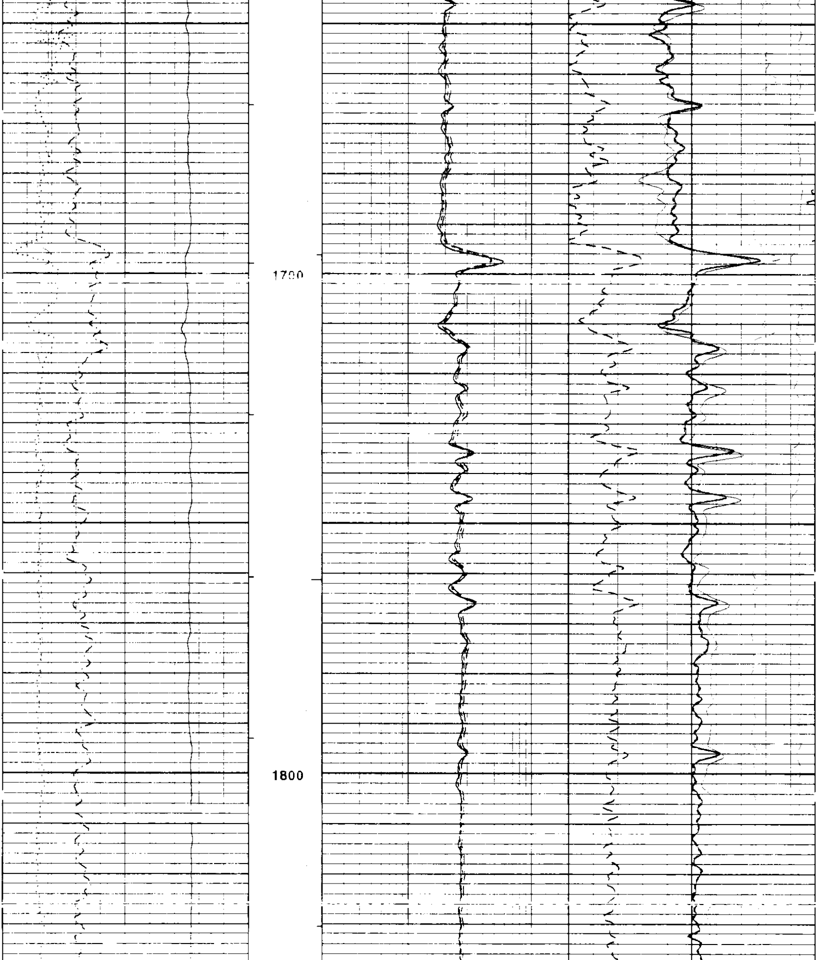


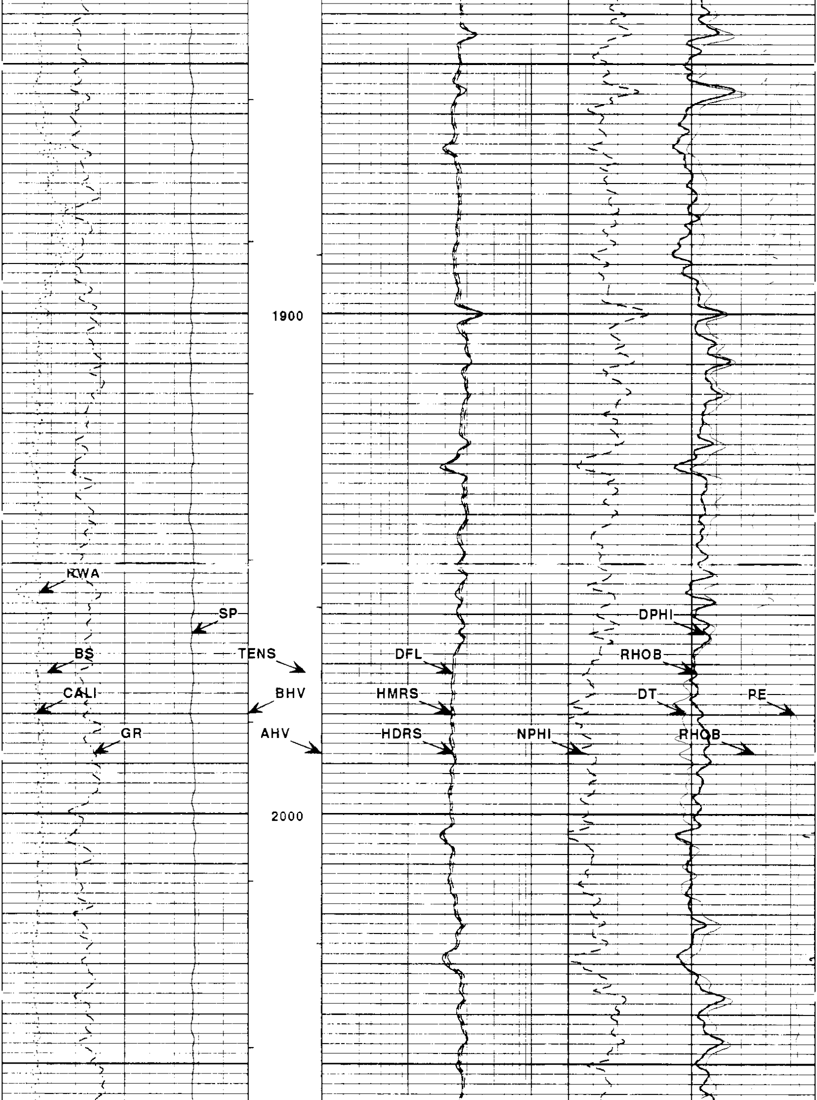


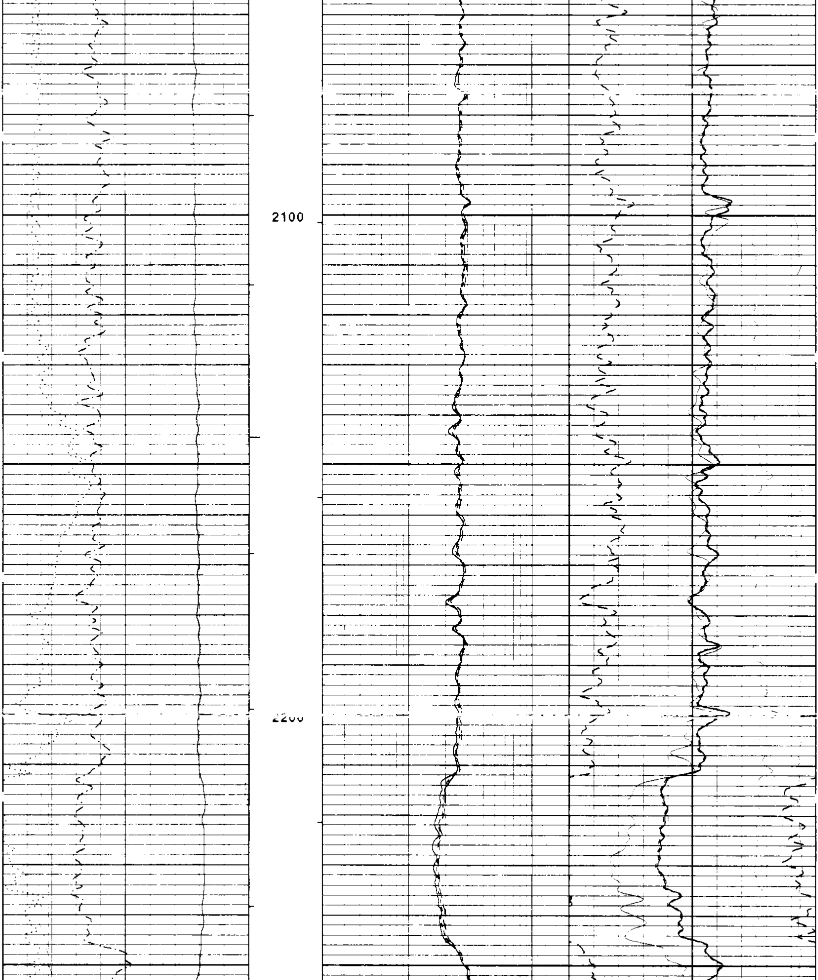


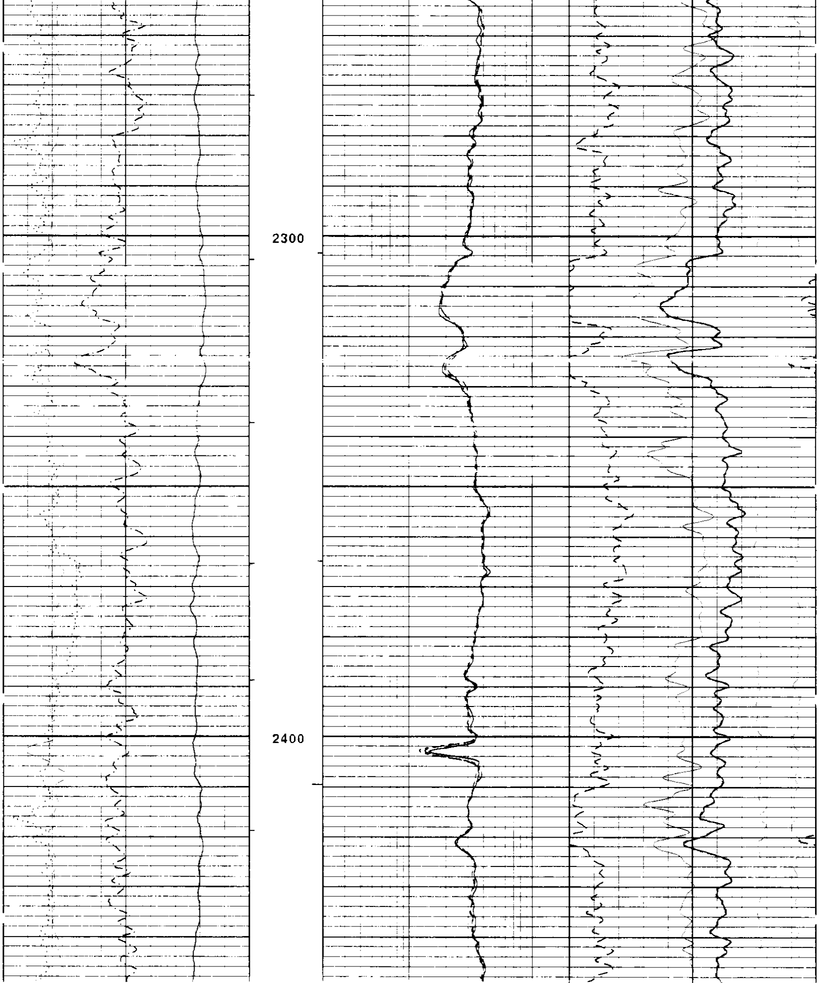


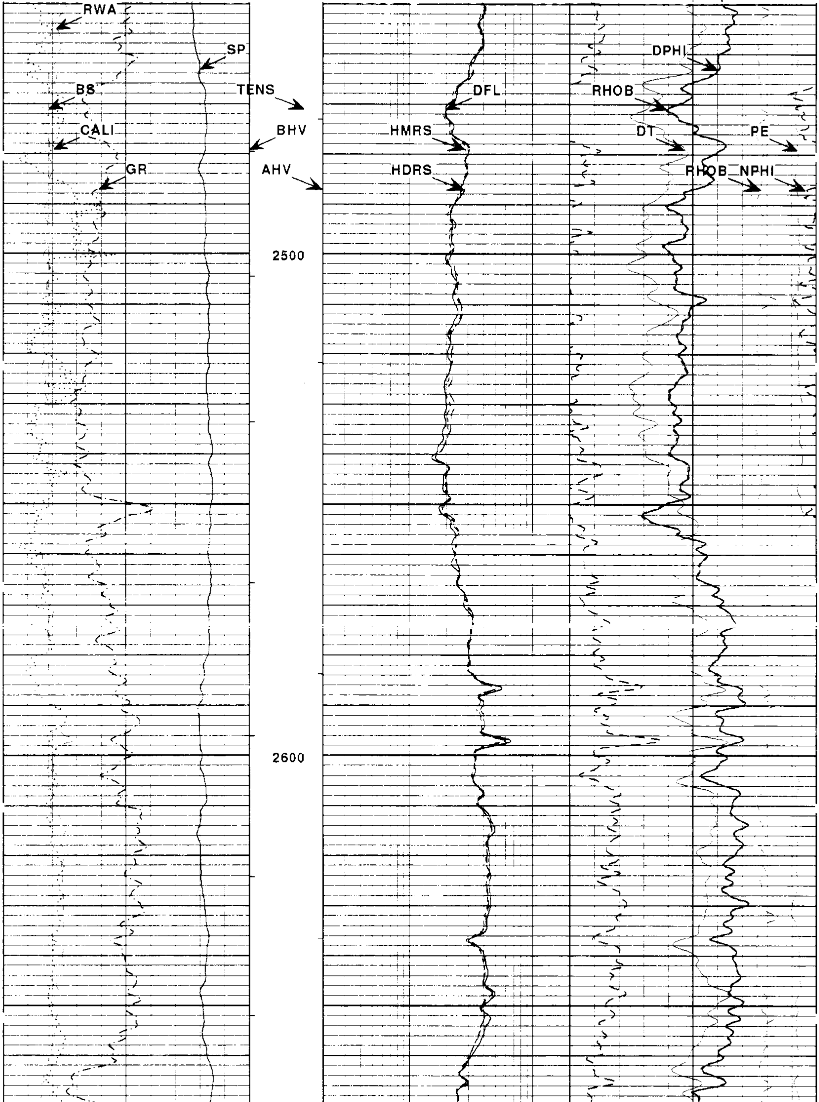


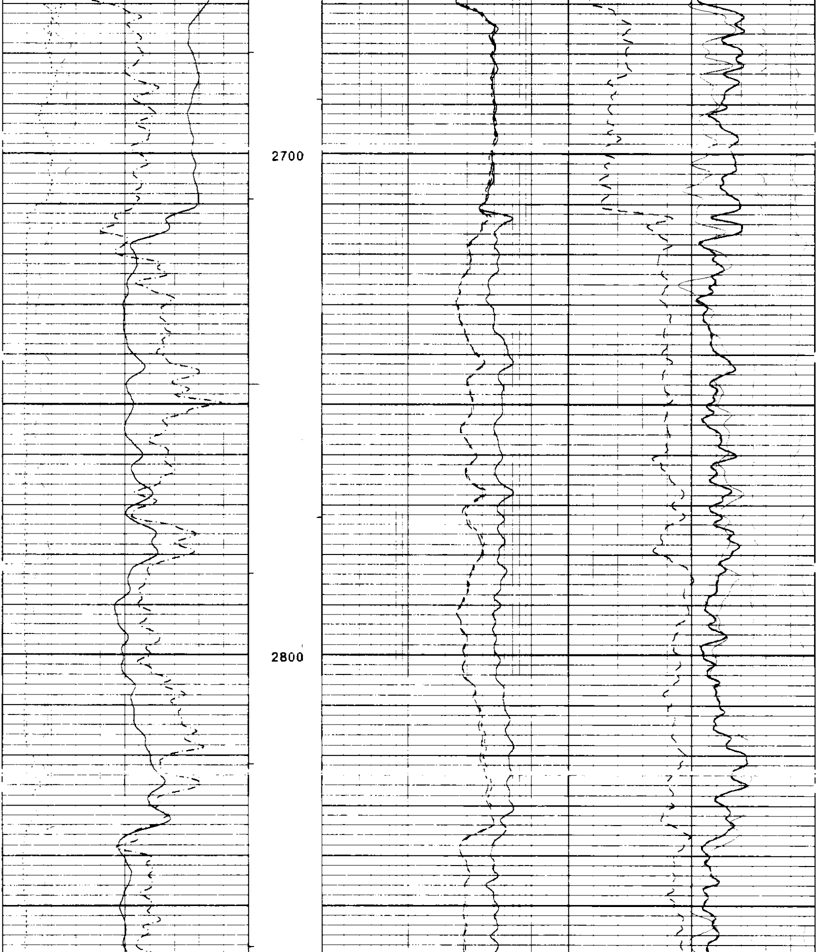


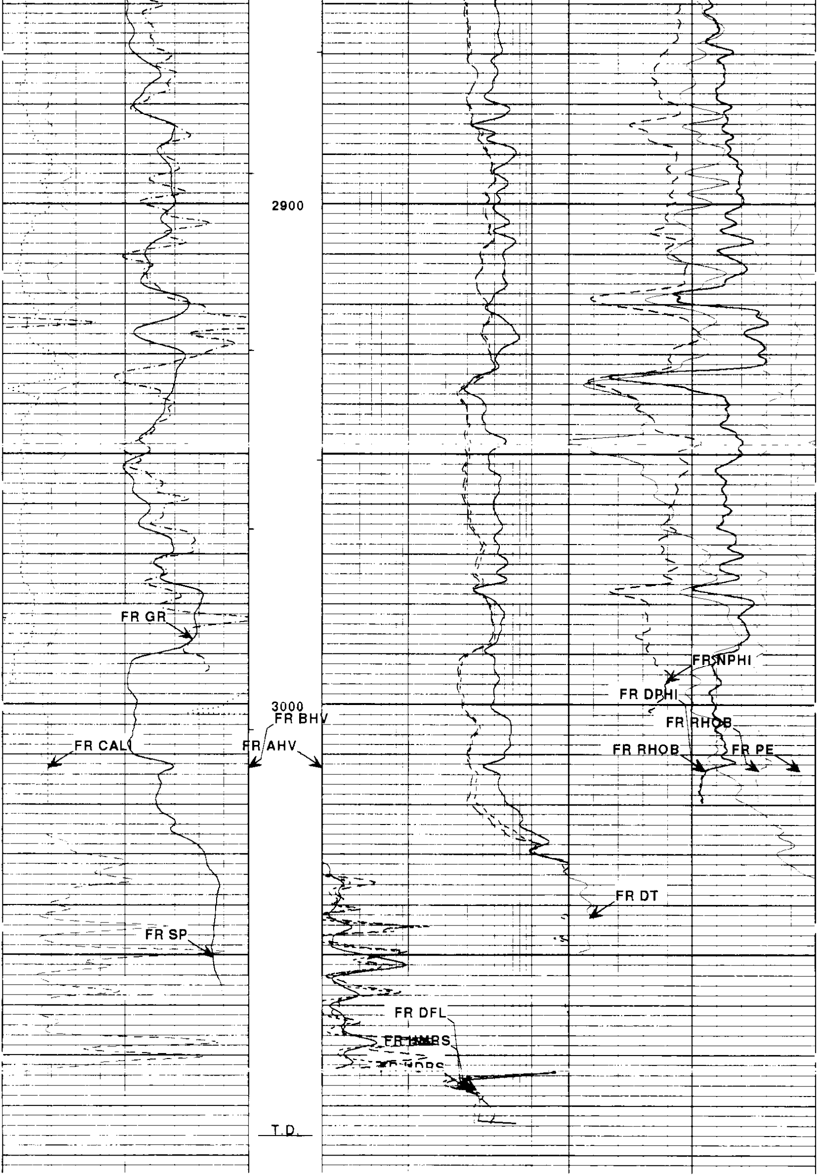












				PE 12 2
RWA 0 OHMM 3				RHOB -.5 GM/CC .5
SP -]10[+	1:240 FT.		DPHI 60. % 0	
BS 6 INCH 16	TENS 10500 500	DFL .2 OHMM 20	RHOB 1.65 G/CC 2.65	
CALI 6 INCH 16	BHV ← FT3	HMRS .2 OHMM 20	DT 175 US/F 75	
GR 0 API 150	AHV FT3 →	HDRS .2 OHMM 20	NPHI 60. % 0	

HALLIBURTON
EXCELL 2000

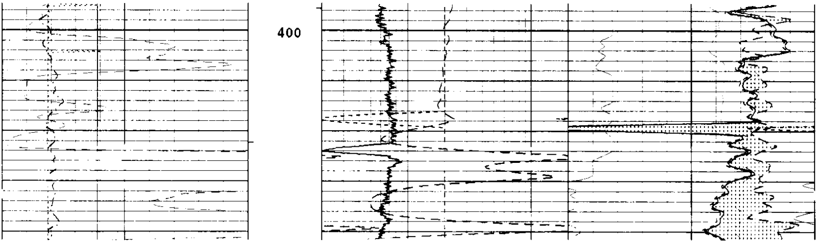
Version No: 5.0 | hc:3.0
Data File: 0820_0354_s2241.3.cls
Format File: plot_01_1.spc
Plot Time: 2005-08-20 05:32:02
Log Time: 2005-08-20 05:23:18
Top Depth: ------
Bottom Depth: 3093.50

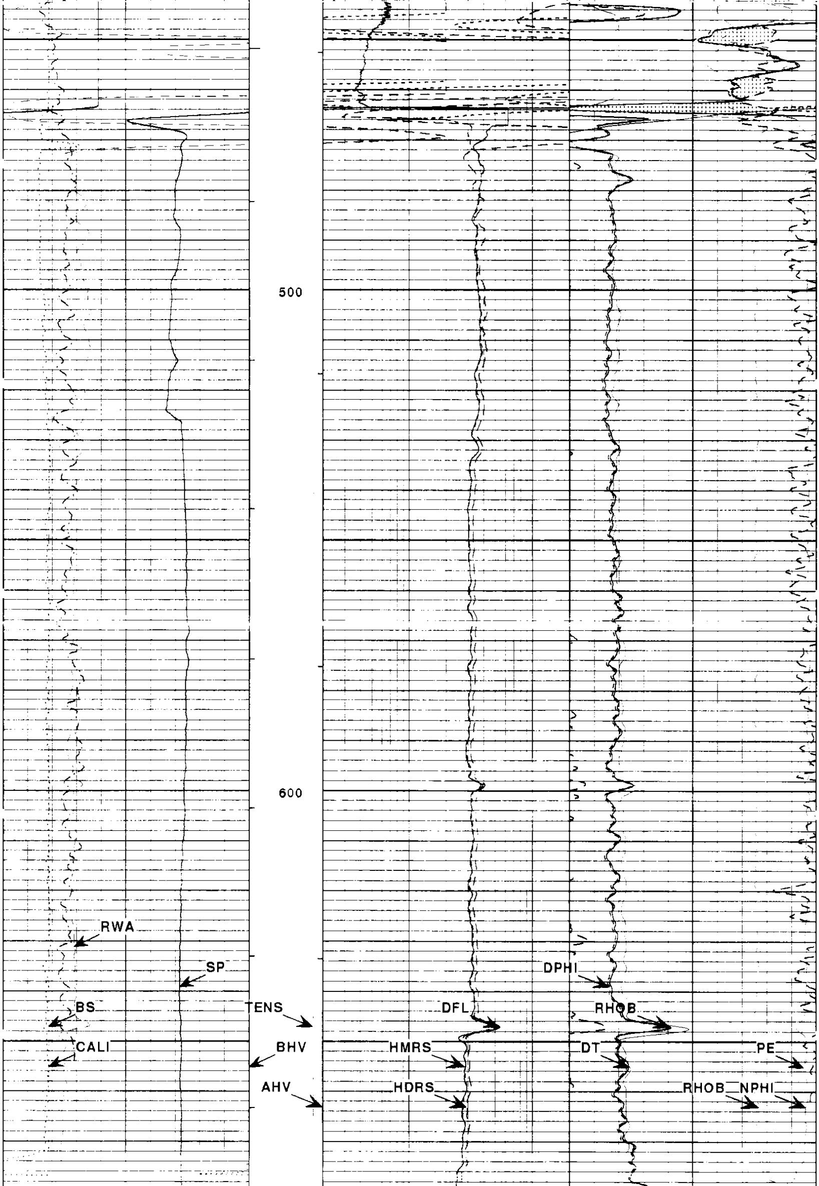
REPEAT SECTION

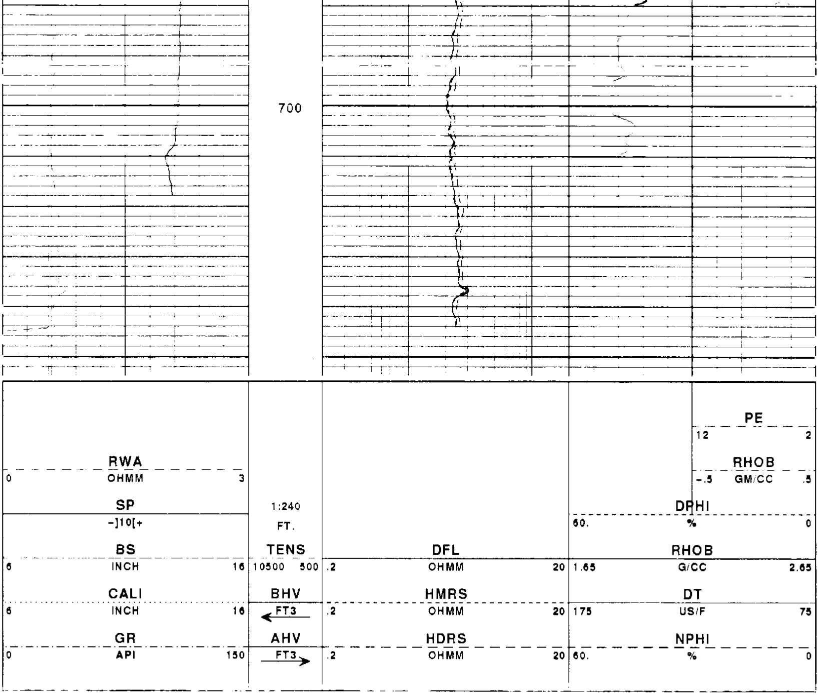
HALLIBURTON
EXCELL 2000

Version No: 5.0 | hc:3.0
Data File: 0820_[illegible]_s2[illegible].cls
Format File: plot_01_1.spc
Plot Time: 2005-08-20 05:10:53
Log Time: 2005-08-20 05:00:01
Top Depth: 394.25
Bottom Depth: 753.75

GR 0 API 150	AHV FT3 →	HDRS .2 OHMM 20	NPHI 60. % 0	
CALI 6 INCH 16	BHV ← FT3	HMRS .2 OHMM 20	DT 175 US/F 75	
BS 6 INCH 16	TENS 10500 500	DFL .2 OHMM 20	RHOB 1.65 G/CC 2.65	
SP -]10[+	1:240 FT.		DPHI 60. % 0	
RWA 0 OHMM 3				RHOB -.5 GM/CC .5
				PE 12 2







HALLIBURTON

EXCELL 2000

Version No: 5.0 | hc:3.0
Data File: 0820_0354_s2241.1.cls
Format File: plot_01_1.spc
Plot Time: 2005-08-20 05:07:50
Log Time: 2005-08-20 05:00:01

Top Depth: ------
Bottom Depth: 753.75

Current EXCELL-2000 Parameter Values
Depth: 9918.667
Date: 20-Aug-2005 04:14
Service Number: 2241
Software Version: 5.0

Mnemonic	Tool	Parameter Description	Value	Units
PERF	DITSHD	PERFORATED INTERVAL	NO	
TD	DITSHD	TOTAL DEPTH	0.	FT
CS_ANT	DITSHD	CASING DEPTH (FOR ANNOTATION)	0.	FT
GR_OK	GAMMA	DO GAMMA CALCULATIONS?	YES	
CASED	SHARED	CASED HOLE?	NO	
CASEOD	SHARED	CASING DIAMETER (OD)	5.5	Inches
MUDWT	SHARED	BOREHOLE FLUID WEIGHT	8.8	Pounds/Gal.
GRSO	GAMMA	GAMMA RAY STANDOFF	0.	Inches
BS	SHARED	BIT SIZE	7.875	Inches

DSN_OK	DSNT_X	DO DSNT_X CALCULATIONS?	YES	
DRILL	DSNT_X	TPL - NEUTRON IN SLEEVE?	NO	
BADHOL	DSNT_X	DSNT_X BAD HOLE CORRECTION	NO	
NLITH	DSNT_X	NEUTRON LITHOLOGY	SAND	
DSNSO	DSNT_X	DSNT_X STANDOFF	0.	Inches
DSNTMP	DSNT_X	DSNT_X TEMPERATURE CORRECTION	NONE	
DSNPRS	DSNT_X	DSNTX PRESSURE CORRECTION	NONE	
VLDTMP	DSNT_X	IS DSNT_X TEMPERATURE VALID?	YES	
SDL_OK	SDL_DA	DO SDL CALCULATIONS?	YES	
EVR_OK	SDL_DA	DO SDL EVR CALCULATIONS?	YES	
AIR	SDL_DA	AIR FILLED BOREHOLE?	NO	
LOGB	SDL_DA	LOGGING CAL BLOCKS?	NO	
SDLTC	SDL_DA	SDL TEMPERATURE CORRECTION?	YES	
VLDT	SDL_DA	VLD CORRECTION TYPE?	NONE	
RHOMAT	SHARED	MATRIX DENSITY	2.65	Grams/CC
RHOFLU	SHARED	FLUID DENSITY	1.	Grams/CC
CAL_OK	CAL_DA	DO CALIPER CALCULATIONS?	YES	
AHVOK	CAL_DA	DO ANNULAR VOLUME CALCULATIONS?	YES	
MLOGOK	MIC_SD	DO MICRO-LOG CALCULATIONS?	YES	
FWSTOK	BCS	DO FWST CALCULATIONS?	YES	
WYLIE	BCS	ACOUSTIC POROSITY EQUATION	HLSP	
DTSHA	BCS	DELTA T SHALE	100.	uSec/Ft.
DTMAT	BCS	DELTA T MATRIX	55.5	uSec/Ft.
DTFLU	BCS	DELTA T FLUID?	189.	uSec/Ft.
DTFT	BCS	USE 1 OR 2 FT DT FOR POROSITY	2	Feet
ARCHA	SHARED	ARCHIE A	0.81	
ARCHM	SHARED	ARCHIE M	2.	
FSEL	SHARED	POROSITY SELECTION FOR F	ACOU	
USEFIX	BCS	USE MINIMUM FIXED THRESHOLD.	NO	
USENOI	BCS	USE NOISE THRESHOLD FOR PICK.	NO	
TDU_OK	TDUF	USE TDU DISPLAY CONTROLS?	YES	
HRI_OK	HRIDE	DO HRI INDUCTION CALCULATION?	YES	
DFL_OK	HRIDE	DO DFL CALCULATIONS?	YES	
PYRITE	HRIDE	PYRITE SWITCH	NO	OHMM
CASING	HRIDE	CASING DEPTH	0.	Feet
HRIDSP	HRIDE	SPIKE REDUCTION FILTER TYPE?	DELT	
HRITC	HRIDE	HRI TEMPERATURE CORRECTION	NONE	
CTEM	HRIDE	CONST TEMPERATURE	75.	
BHT	HRIDE	BOTTOM HOLE TEMPERATURE	120.	Degrees F.
TSURF	HRIDE	SURFACE TEMPERATURE	60.	Degrees F.
BHD	HRIDE	BOTTOM HOLE DEPTH	3108.	Feet
SP	HRIDE	USE DIGITAL SP?	NO	
RMUD	HRIDE	MUD RESIST AT SURFACE (0=Air)	1.429999	OHMM
TRM	HRIDE	TEMPERATURE OF MUD	63.	DEGF
RRMIN	HRIDE	MINIMUM RESISTIVITY FOR MAP?	0.2	OHMM
RRMAX	HRIDE	MAXIMUM RESISTIVITY FOR MAP?	200.	OHMM
XPHLOC	XP_RWA	CROSSPLOT SELECTION FOR XPOR	XPLT	

EXCELL-2000 Calibration Report

Date: 20-Aug-2005 06:51

GAMMA RAY TOOL SHOP CALIBRATION SUMMARY

PERFORMED: 23-Jul-2005 08:06 LAST SHOP CALIBRATION: 15-Jun-2005 10:47
SERIAL NUMBER: A180 MODEL: NGRT-A
BLANKET #: TB-67
TRUCK UNIT NUMBER: 49599 PROGRAM VERSION: 5.0
PERFORMED BY: C. ROUSSEAU

	MEASURED	CALIBRATED	UNITS
BACKGROUND	17	17	GAPI
BACKGROUND+CALIBRATOR	225	222	GAPI
CALIBRATOR	208	205	GAPI
GAPI CONVERSION FACTOR	0.472		GAPI/CPS

GAMMA RAY TOOL BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 03:26 LAST SHOP CALIBRATION: 23-Jul-2005 08:06

	SHOP	FIELD	UNITS
BACKGROUND	17	19	GAPI
BACKGROUND+CALIBRATOR	222	230	GAPI
CALIBRATOR	205	211	GAPI

GAMMA RAY TOOL AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 06:38 LAST SHOP CALIBRATION: 23-Jul-2005 08:06

	BEFORE	AFTER	UNITS
BACKGROUND	19	20	GAPI
BACKGROUND+CALIBRATOR	230	229	GAPI
CALIBRATOR	211	209	GAPI

DUAL SPACED NEUTRON--GIBRALTAR SHOP CALIBRATION SUMMARY

PERFORMED: 23-Jul-2005 09:22 LAST SHOP CALIBRATION: 15-Jun-2005 10:38
SERIAL NUMBER: 05 MODEL: DSNT-X
SOURCE NUM: DSN-16
TRUCK UNIT NUMBER: 49599 PROGRAM VERSION: 5.0
PERFORMED BY: G. ROUSSEAU

** NEUTRON CALIBRATION SUMMARY **

CALIBRATION CONSTANTS

	Prev. Value	New Value	Control Limit On New Value
Gain	1.006	1.010	0.90 - 1.10

WATER TANK SUMMARY
(Horizontal Water Tank)

	Current Reading (Previous Coef.)	Calib. (New Coef.)	Change	Control Limit On Change
Porosity	23.73	23.83	0.10	+/- 0.20
Calibrated Ratio	9.736	9.769	0.032	+/- 0.050

Reference value assigned to tank: 52.720

VERIFIER

	Value	Control Limits
Snow-block porosity	4.96	2.0 - 9.0

PASS/FAIL SUMMARY

Background Check:	PASSED
Gain-Range Check:	PASSED
Snow-block Check:	PASSED

DUAL SPACED NEUTRON--GIBRALTAR BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 03:51 LAST SHOP CALIBRATION: 23-Jul-2005 09:22

** NEUTRON FIELD-CHECK SUMMARY **

```
                                                  Control Limit
                         Shop    Before   Change   On Change
                         ----    ------   ------  -------------
    Snow-Block Por.(pu)  4.96     5.21     0.25     +/- 1.50


                      PASS/FAIL SUMMARY

                 Snow Block Change:        PASSED
                 Snow Block Stats:         PASSED
```

```
     DUAL SPACED NEUTRON--GIBRALTAR AFTER SURVEY FIELD CHECK SUMMARY
  PERFORMED: 20-Aug-2005 06:40  LAST SHOP CALIBRATION: 23-Jul-2005 09:22
```

```
                    ** NEUTRON POST-CHECK SUMMARY **

                                                  Control Limit
                         Before   After   Change   On Change
                         ------   -----   ------  -----------
    Snow-Block Por.(pu)   5.21     5.20   -0.01     +/- 1.50


                      PASS/FAIL SUMMARY

                 Snow Block Change:        PASSED
                 Snow Block Stats:         PASSED
```

```
              SDL (D) WITH (A) MANDREL SHOP CALIBRATION SUMMARY
  PERFORMED: 23-Jul-2005 10:46  LAST SHOP CALIBRATION: 15-Jun-2005 11:54
  SERIAL NUMBER: I741M741       MODEL: SDL_DA
  SOURCE NUM: 2694GW
  TRUCK UNIT NUMBER: 49599      PROGRAM VERSION: 5.0
  PERFORMED BY: G. ROUSSEAU
```

```
                  DENSITY CALIBRATION SUMMARY

                                                 CONTROL LIMIT
                  PREV VALUE    NEW VALUE       ON NEW VALUES
                  ----------    ---------       -------------
 NEAR BAR  GAIN     0.9968        0.9861         0.90 - 1.10
 NEAR DENS GAIN     0.9901        0.9918         0.90 - 1.10
 NEAR PEAK GAIN     0.9753        0.9840         0.90 - 1.10
 NEAR LITH GAIN     0.9780        0.9928         0.90 - 1.10

 FAR  BAR  GAIN     1.0052        1.0068         0.90 - 1.10
 FAR  DENS GAIN     1.0038        1.0016         0.90 - 1.10
 FAR  PEAK GAIN     1.0070        1.0028         0.90 - 1.10
 FAR  LITH GAIN     1.0042        0.9995         0.90 - 1.10

 NEAR BAR  OFFSET   0.0963        0.2039            NONE
 NEAR DENS OFFSET   0.1228        0.1096            NONE
 NEAR PEAK OFFSET   0.2240        0.1488            NONE
 NEAR LITH OFFSET   0.2110        0.0798            NONE

 FAR  BART OFFSET   0.1204        0.1070            NONE
 FAR  DENS OFFSET   0.1292        0.1506            NONE
 FAR  PEAK OFFSET   0.0594        0.0989            NONE
 FAR  LITH OFFSET  -0.0812       -0.0421            NONE

 NEAR BART BKG      1079.8        1079.6          700 -1500
 NEAR DENS BKG       444.2         443.8          290 - 600
 NEAR PEAK BKG       195.9         195.8          130 - 280
 NEAR LITH BKG       186.6         187.1          125 - 270

 FAR  BART BKG       548.7         547.8          350 - 750
 FAR  DENS BKG       223.4         223.3          140 - 300
 FAR  PEAK BKG        99.2          99.6           50 - 130
```

```
 FAR  LITH BKG             97.0            95.2             50 - 130


                          CALIBRATION-BLOCK SUMMARY

                          CURRENT
                          READING       CALIB.                      CONTROL
                          (PREVIOUS     (NEW                         LIMIT
                           COEF.)        COEF.)        CHANGE     ON CHANGE
                         ---------     --------     ---------   ----------
 MAGNESIUM
    Density   g/cc          1.679         1.678        -0.001    +/- 0.015
    Pe                      2.615         2.594        -0.021    +/- 0.15
 ALUMINUM
    Density   g/cc          2.593         2.603         0.010    +/- 0.015
    Pe                      3.195         3.200         0.005    +/- 0.15

                                 TOOL SUMMARY

                            NEAR DETECTOR                      FAR DETECTOR
                       ---------------------------      -------------------------
                        VALUE    CONTROL LIMITS          VALUE    CONTROL LIMITS
                        -----    --------------          -----    --------------
Quality
   Background         -0.0023      +/- 0.0110          -0.0021      +/- 0.0140
   Mag Block           0.0059      +/- 0.0110           0.0107      +/- 0.0140
   Alum Block         -0.0022      +/- 0.0110          -0.0083      +/- 0.0140

Resolution                9.2     6.0  - 11.0               9.7     6.0 - 11.0
Verifier (B+D+P+L)       1906    1250  - 2700               966     600 - 1300

Pad temperature =  30.8


                           PASS/FAIL SUMMARY

                   Bkg Quality Check:              PASSED
                   Bkg Range Check:                PASSED
                   Bkg Resolution Check:           PASSED
                   Bkg Verification Check:         PASSED
                   Magnesium Quality Check:        PASSED
                   Aluminum Quality Check:         PASSED
                   Gains Check:                    PASSED
                   Changes in Cal. Block:          PASSED
```

SDL (D) WITH (A) MANDREL BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 03:29 LAST SHOP CALIBRATION: 23-Jul-2005 10:46

```
                                                           CONTROL LIMIT
                            SHOP        BEFORE     CHANGE     ON CHANGE
                          -------     --------    -------   ------------
    Near (B+D+P+L) cps    1906.3      1896.8       -9.5     +/-   17.5
    Far  (B+D+P+L) cps     965.9       961.8       -4.1     +/-   16.7
    Near Resolution          9.16        9.13      -0.03    +/-    0.5
    Far  Resolution          9.72        9.67      -0.05    +/-    1.0

Pad temperature =  15.1


                           PASS/FAIL SUMMARY

                   Bkg Quality Check:              PASSED
                   Bkg Resolution Check:           PASSED
                   Bkg Verification Check:         PASSED
```

SDL (D) WITH (A) MANDREL AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 06:50 LAST SHOP CALIBRATION: 23-Jul-2005 10:46

	BEFORE	AFTER	CHANGE	CONTROL LIMIT ON CHANGE
Near (B+D+P+L) cps	1896.8	1896.7	-0.1	-/- 19.4
Far (B+D+P+L) cps	961.8	968.6	6.8	+/- 16.1
Near Resolution	9.1	9.1	-0.0	+/- 0.5
Far Resolution	9.7	9.7	0.0	+/- 1.0

Pad temperature = 15.5

PASS/FAIL SUMMARY

Bkg Quality Check:	PASSED
Bkg Resolution Check:	PASSED
Bkg Verification Check:	PASSED

SDL-D CALIPER: A MANDREL SHOP CALIBRATION SUMMARY

PERFORMED: 04-Aug-2005 10:24 LAST SHOP CALIBRATION: 04-Aug-2005 10:23
SERIAL NUMBER: I741M741 MODEL: SDL-DA
TRUCK UNIT NUMBER: 49599 PROGRAM VERSION: 5.0
PERFORMED BY: G. ROUSSEAU

	MEASURED	CALIBRATED	UNITS
VALUE 1	8.141	8.000	INCH
VALUE 2	16.007	16.000	INCH
GAIN	0.00768		
OFFSET	-10.627		

SDL-D CALIPER: A MANDREL BEFORE SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 03:33 LAST SHOP CALIBRATION: 04-Aug-2005 10:24

	SHOP	FIELD	UNITS
VALUE 1	8.000	7.923	INCH

SDL-D CALIPER: A MANDREL AFTER SURVEY FIELD CHECK SUMMARY

PERFORMED: 20-Aug-2005 06:30 LAST SHOP CALIBRATION: 04-Aug-2005 10:24

	BEFORE	AFTER	UNITS
VALUE 1	7.923	7.861	INCH

ENHANCED HIGH RESOLUTION IND. SHOP CALIBRATION SUMMARY

PERFORMED: 23-Jul-2005 07:07
LAST SHOP CALIBRATION: 15-Jun-2005 09:09
SERIAL NUMBER: 211_132
MODEL: HRI
TRUCK UNIT NUMBER: 49599
PROGRAM VERSION: 5.0
PERFORMED BY: G. ROUSSEAU

```
                       HRI MASTER CALIBRATION SUMMARY

     TEST LOOP RESPONSE:

          1 - TEST LOOP CLOSED
                     MEASURED SIGNAL           NOMINAL
                         R          X          R          X
          HRD          1977       1972       1977       1972      MMHOS
          HRM          2839       2832       2839       2832      MMHOS

          2 - TEST LOOP OFF(SONDE ERROR)
                     MEASURED SIGNAL           NOMINAL
                         R          X          R          X
          HRD            -5        -14       +/-15      +/-100    MMHOS
          HRM            -9        -64       +/-15      +/-100    MMHOS

     ELECTRONICS RELATIVE GAIN:

                          SET                  NOMINAL
                     MAGNITUDE   PHASE    MAGNITUDE    PHASE
          HRD          1.01      -1.58    1. +/-0.1    0. +/-5
          HRM          1.01      -1.54    1. +/-0.1    0. +/-5

     Temperature at time of calibration was      78.1   DEG F


          ############################################################
          #                      **** NOTICE ****                    #
          #     THE HIGH RESOLUTION INDUCTION TOOL (HRID) IS A       #
          #   CONTINUAL SELF-CALIBRATING TOOL.  DURING LOGGING, THE  #
          #    TOOL CONSTANTLY SELF-UPDATES ITS COEFFICIENTS.  THE   #
          #    SHOP CALIBRATION IS PERFORMED UNDER VERY STRINGENT    #
          #   CONDITIONS, AND SINCE THE TOOL IS SELF-CALIBRATING     #
          #     DURING LOGGING, NO FIELD OR POST CALIBRATIONS ARE    #
          #          AVAILABLE OR NECESSARY FOR THE HRID TOOL.       #
          ############################################################
```

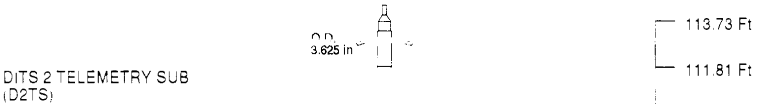
EXCELL-2000 Calibration Summary Table

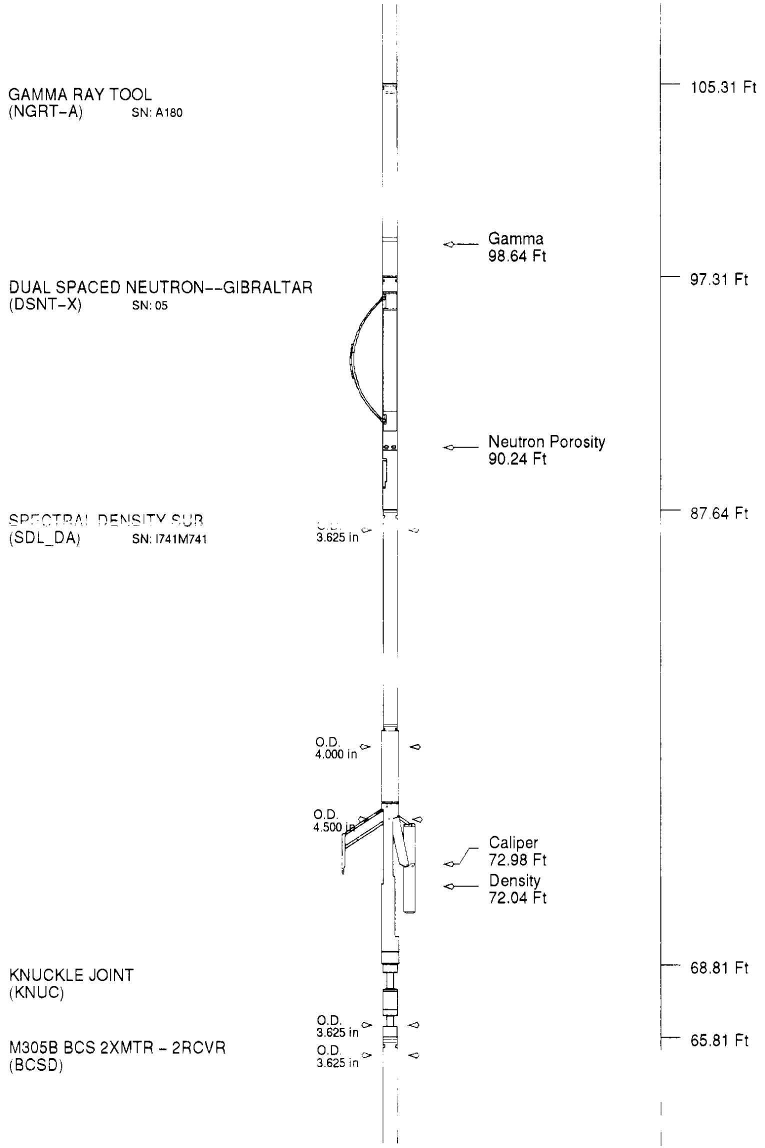
Date: 20-Aug-2005 06:51

Service or Signal	Shop	Before	After	Change	Tolerance
GAMMA	205	211	209	2	+/- 9.0
Snow-Block Por.(pu)	4.96	5.21	5.20	-0.01	+/- 1.50
DENSITY NEAR(B+D+P+L)	1906.3	1896.8	1896.7	-0.1	+/- 19.4
DENSITY FAR (B+D+P+L)	965.9	961.8	968.6	6.8	+/- 18.1
CALIPER VALUE 1	8.000	7.923	7.861	0.062	+/-0.5

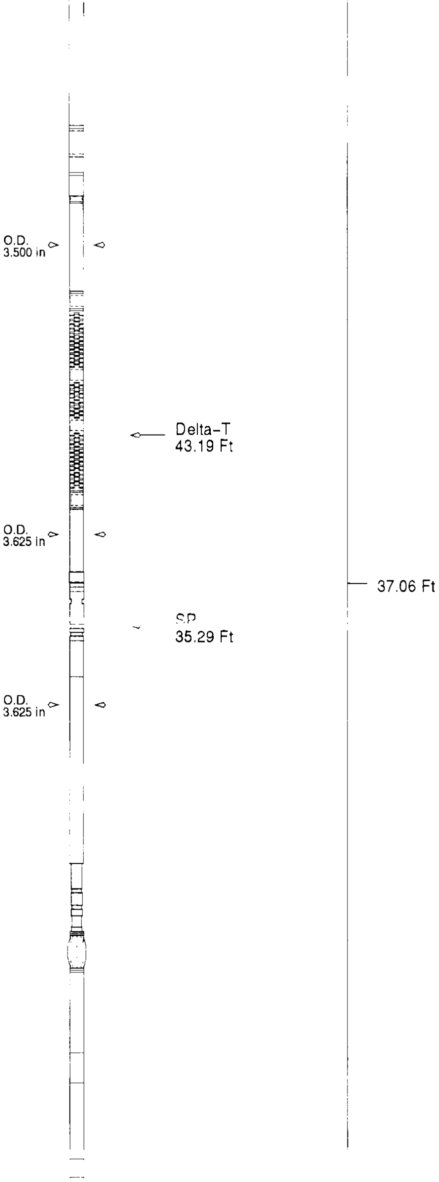
QUAD COMBO
HRI/BCS/SDL/DSN

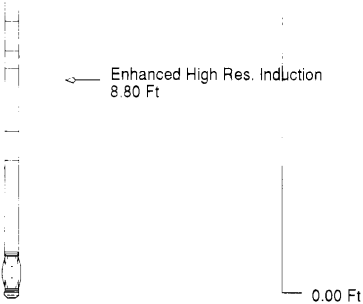
Excell 2000 Tool String Diagram





ENHANCED HIGH RESOLUTION IND.
(HRI) SN: 211_132





Tool Mnemonic	Length (Ft)	Weight In Air (lbs)	Logging Speed (Ft/min)
D2TS	6.50	100.00	N/A
NGRT-A	8.00	151.80	60.00
DSNT-X	9.67	150.00	60.00
SDL_DA	18.83	475.00	60.00
KNUC	3.00	75.00	N/A
BCSD	28.75	515.00	60.00
HRI	37.06	445.00	100.00
Tool String	111.81	1911.80	60.00

COMPANY NORTHWEST NATURAL GAS

WELL OM 23C-11-65

FIELD MIST (BRUER POOL STORAGE)

COUNTY COLUMBIA STATE OR

HALLIBURTON

QUAD COMBO
HRI/BCS/SDL/DSN

5"=100