MICRO-RESISTIVITY LOG

Weatherford®

COMPANY	SHAKESPEARE OIL CO., INC.
WELL	BURNS #1-19
FIELD	SWIFT FOX SOUTHEAST
PROVINCE/COUNTY	GOVE
COUNTRY/STATE	USA / KANSAS
LOCATION	1600' FNL & 335' FWL OF NW/4

SEC	TWP	RGE	Other Services
19	13	30	MAI/MFE MPD/MDN

API Number 15-063-22203

Permanent Datum GL, Elevation 2877 feet
Log Measured From KB
Drilling Measured From KB

Elevations:	feet
KB	2887.00
DF	2885.00
GL	2877.00

Date	22-DEC-2014						
Run Number	ONE						
Service Order	7055-106443839						
Depth Driller	4660.00	feet					
Depth Logger	4661.00	feet					
First Reading	4628.00	feet					
Last Reading	3661.00	feet					
Casing Driller	261.00	feet					
Casing Logger	260.00	feet					
Bit Size	7.875	inches					
Hole Fluid Type	WBM						
Density / Viscosity	9.30	lb/USg	53.00	sec/qt			
PH / Fluid Loss	10.30		6.40	ml/30Min			
Sample Source	FLOWLINE						
Rm @ Measured Temp	1.25 @ 96.0	ohm-m					
Rmf @ Measured Temp	1.0 @ 96.0	ohm-m					
Rmc @ Measured Temp	1.50 @ 96.0	ohm-m					
Source Rmf / Rmc	CALC		CALC				
Rm @ BHT	1.0 @120.0	ohm-m					
Time Since Circulation	6 HOURS						
Max Recorded Temp	120.00	deg F					
Equipment / Base	13057		LIB				
Recorded By	JUSTIN HICKS						
Witnessed By	TOBY ECK						

Last Edited: 22-DEC-2014 05:41

BOREHOLE RECORD

Bit Size (inches)	Depth From (feet)	Depth To (feet)
7.850	261.00	4660.00

CASING RECORD

Type	Size (inches)	Depth From (feet)	Shoe Depth (feet)	Weight (pounds/ft)
SURFACE	8.625	0.00	261.00	36.00

REMARKS

TOOLS RAN: CBH, MCG, MMR, MDN, MPD, MFE, MAI RAN IN COMBINATION.

HARDWARE USED:
MAI: TWO 0.5 INCH STANDOFFS.
MFE: ONE 0.5 INCH STANDOFF.
MDN: DUAL NEUTRON BOWSPRING.
MPD: 8 INCH PROFILE PLATE.

2.71 G/CC DENSITY MATRIX USED TO CALCULATE POROSITY.
ALL INTERVALS LOGGED AND SCALED PER CUSTOMER'S REQUEST.

TOTAL HOLE VOLUME FROM TD TO SURFACE CASING = 1842 CU.FT.
ANNULAR HOLE VOLUME WITH 5.5 INCH PRODUCTION CASING FROM TD TO SURFACE CASING = 1118 CU.FT.

FIELD TICKET NUMBER: 7055-106443839

RIG: H-D DRILLING, RIG #2

OPERATOR(S): J. LAPOINT

MUD PROPERTIES:
CHLORIDES: 2500 MG/L
LCM: 1 PPB

HOLE WASHOUTS AND RUGOSITY WILL AFFECT LOG QUALITY AND REPEATABILITY.

5 INCH MAIN LOG

Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-DEC-2014 09:55
Filename: C:\Minimus 14.05.5331\Data\Shakespeare (Burns #1-19)\MAIN PASS.dta
Recorded on 22-DEC-2014 07:24
System Versions: Logged with 14.05.5331 Plotted with 14.05.5331

Timing Marks
every 60.0 sec

Gamma Ray
API
0 75 150
150 225 300

Bit Size
inches
6 11 16

MMR Caliper
inches
6 11 16

DST Uphole Tension
pounds
10000 0
0 -10000

Depth In Feet

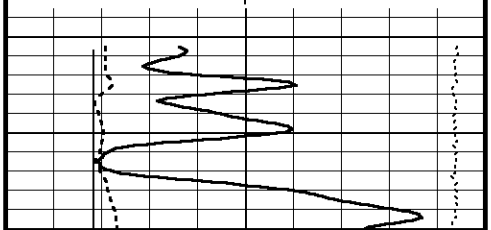
Borehole Temp in deg F

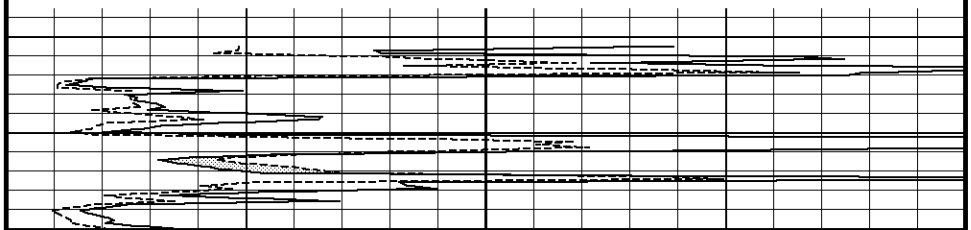
Replay Scale 1:240

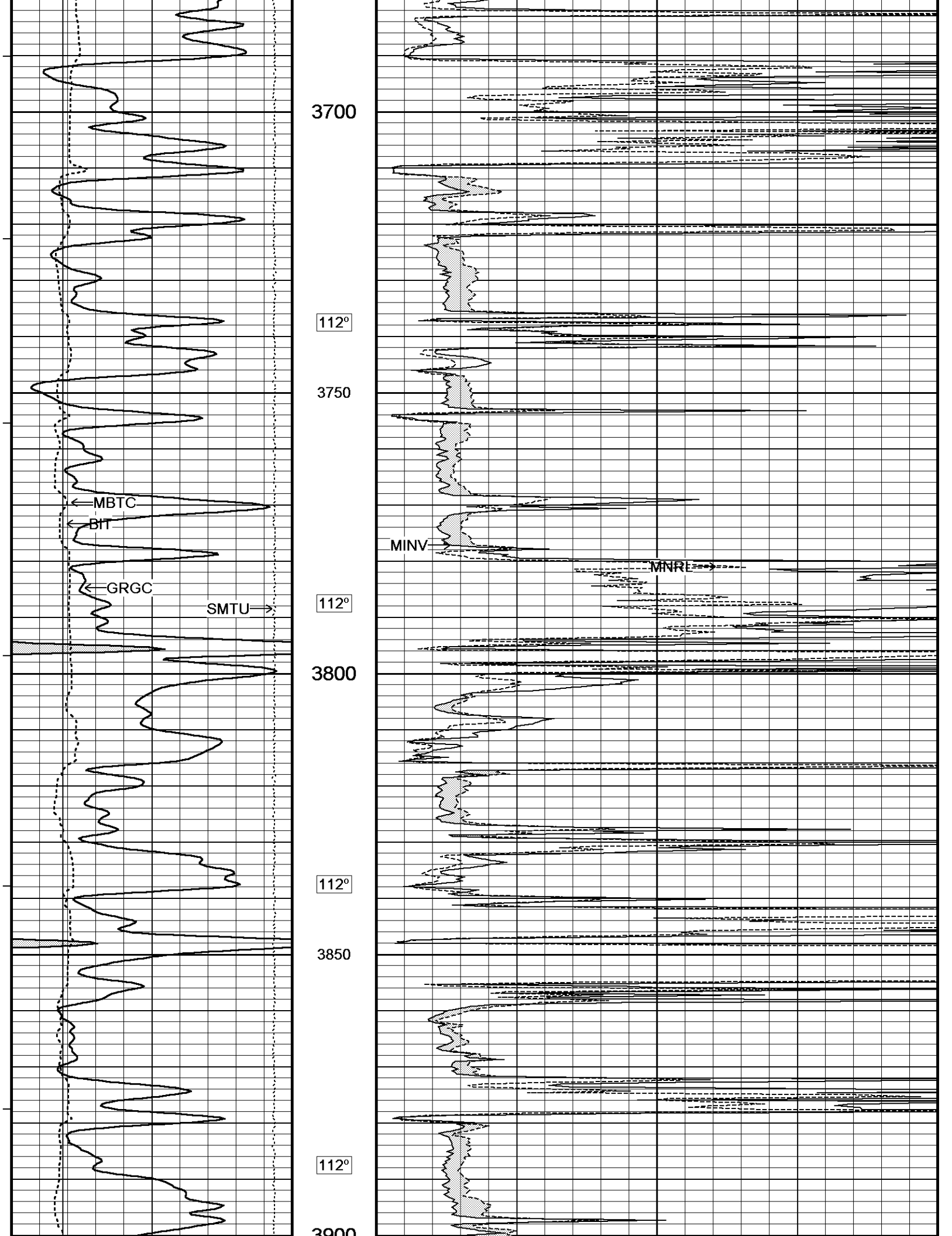
3660

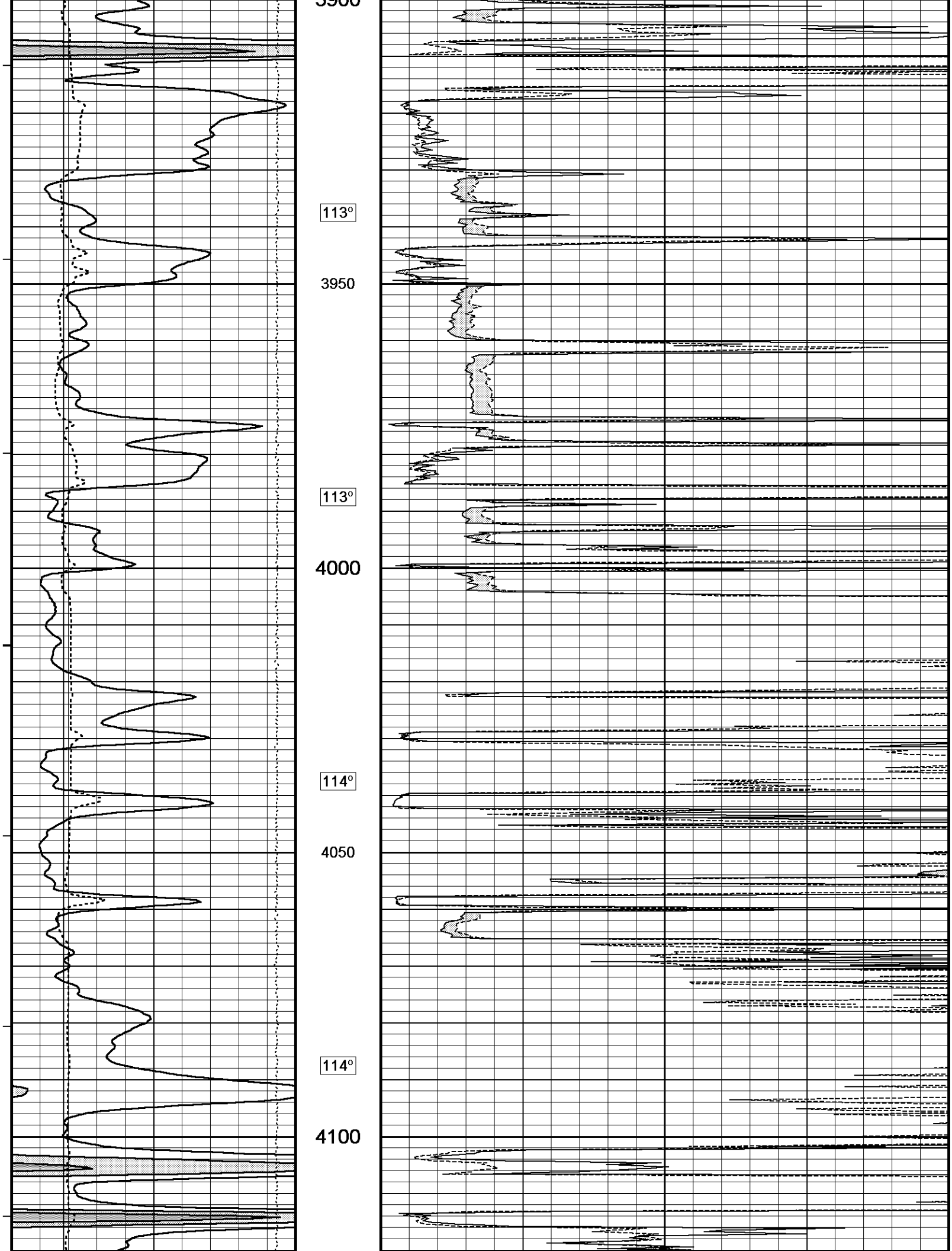
Micro-normal
ohm metres
0 10 20 30 40

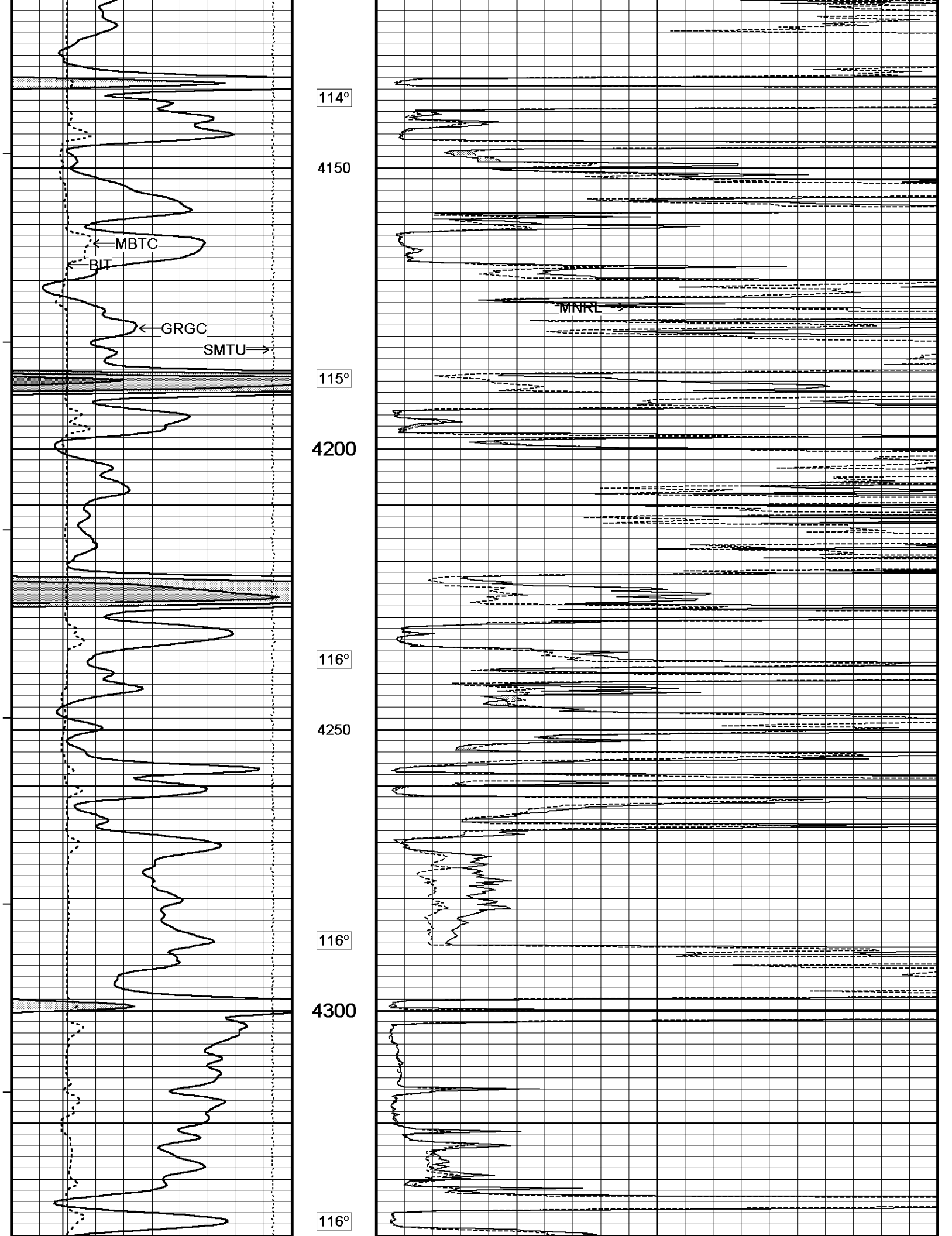
Micro-inverse
ohm metres
0 10 20 30 40

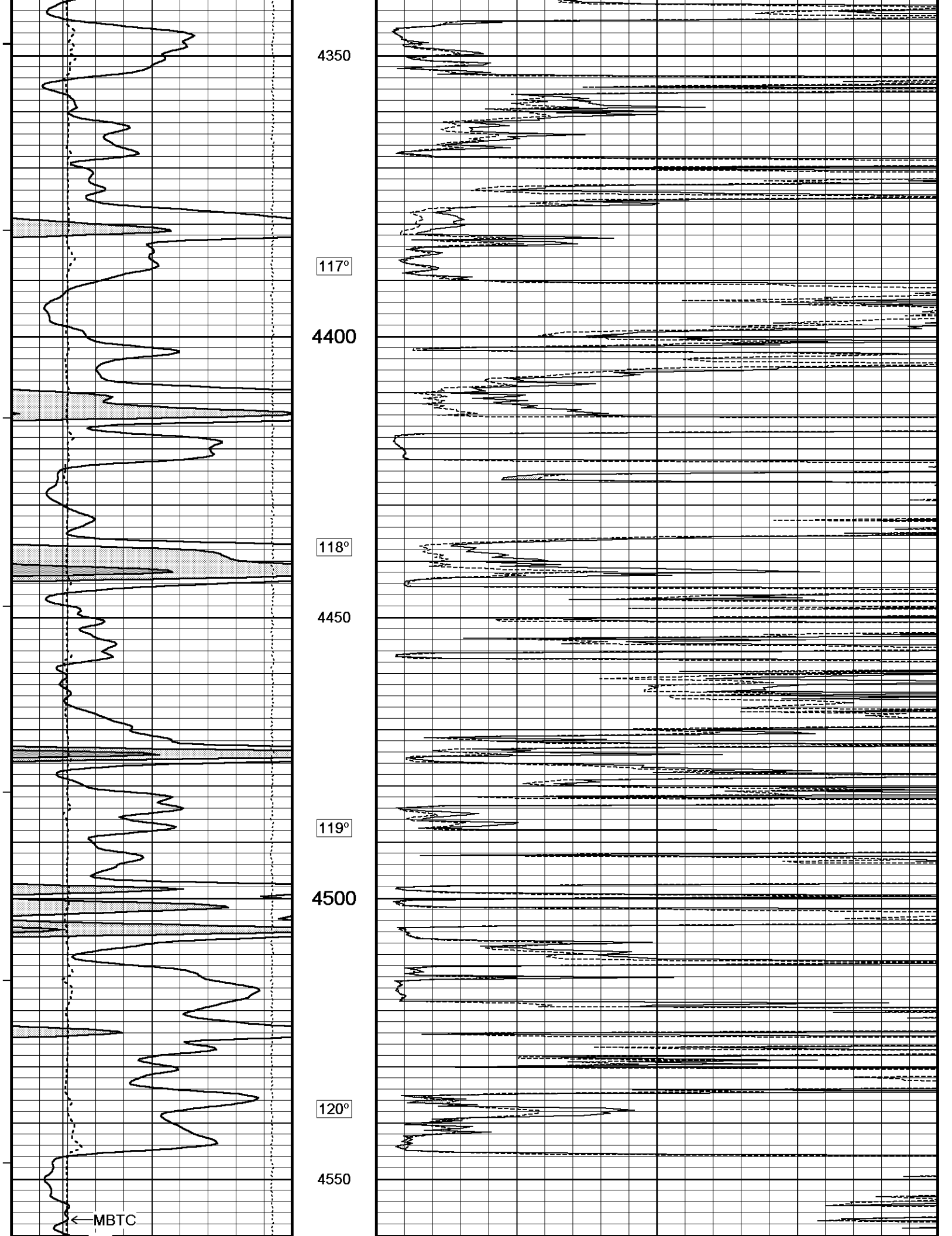


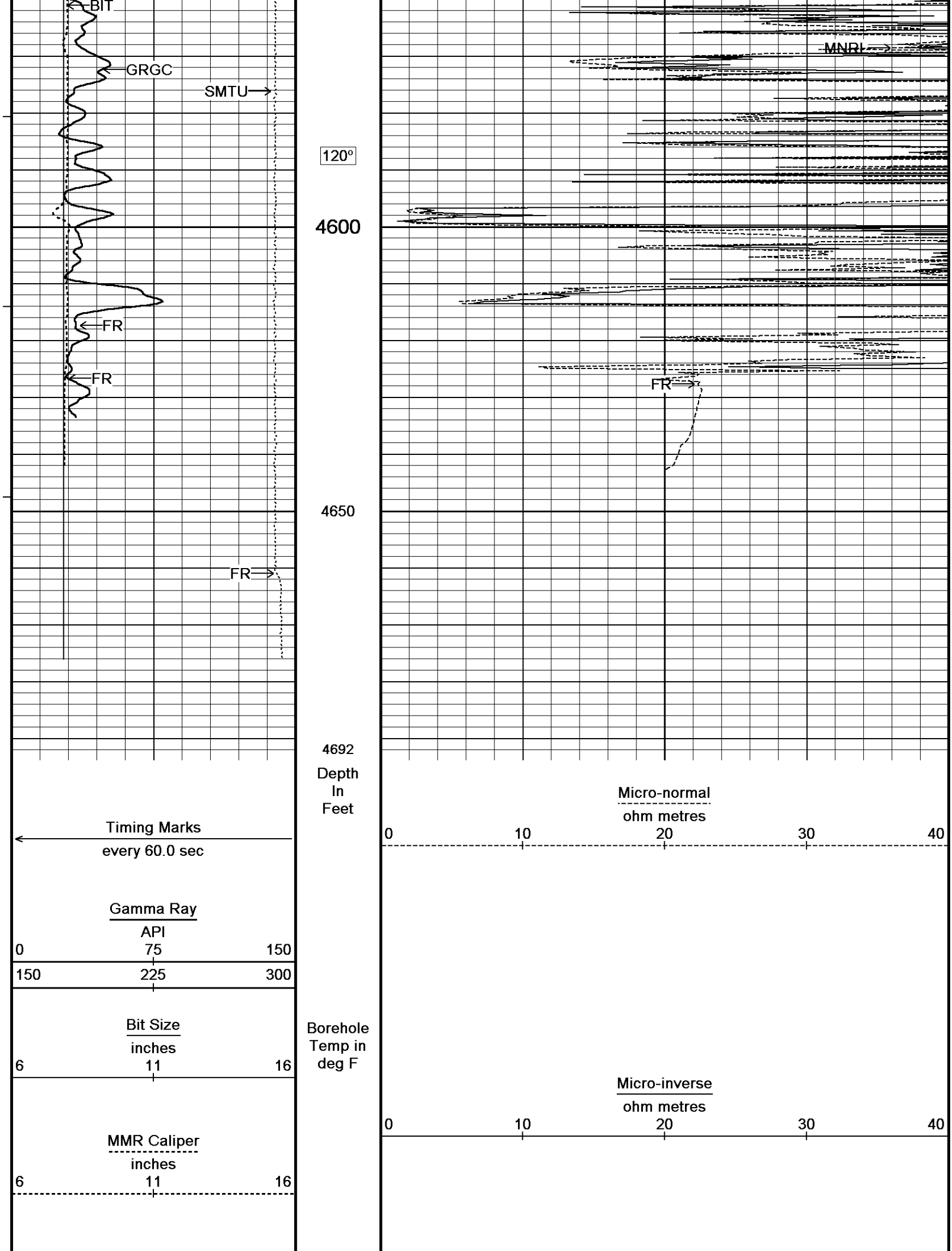



3700
112°
3750
MBTC
BIT
MINV
MNRL
GRGC
SMTU
112°
3800
112°
3850
112°
3900


3900
113°
3950
113°
4000
114°
4050
114°
4100


114°
4150
MBTC
BIT
GRGC
SMTU
MNRL
115°
4200
116°
4250
116°
4300
116°


4350
117°
4400
118°
4450
119°
4500
120°
4550
←MBTC


BIT
GRGC
SMTU
FR
FR
FR
MNRL
FR
120°
4600
4650
4692
Depth
In
Feet
Timing Marks
every 60.0 sec
Gamma Ray
API
0
75
150
150
225
300
Bit Size
inches
6
11
16
MMR Caliper
inches
6
11
16
Borehole
Temp in
deg F
Micro-normal
ohm metres
0
10
20
30
40
Micro-inverse
ohm metres
0
10
20
30
40

DST Uphole Tension
pounds
10000 0
0 -10000

Replay
Scale
1:240

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Minimus 14.05.5331\Data\Shakespeare (Burns #1-19)\MAIN PASS.dta
System Versions: Logged with 14.05.5331 Plotted with 14.05.5331

Plotted on 22-DEC-2014 09:55
Recorded on 22-DEC-2014 07:24

5 INCH MAIN LOG

REPEAT SECTION

Depth Based Data - Maximum Sampling Increment 10.0cm
Filename: C:\Minimus 14.05.5331\Data\Shakespeare (Burns #1-19)\REPEAT PASS.dta
System Versions: Logged with 14.05.5331 Plotted with 14.05.5331

Plotted on 22-DEC-2014 09:55
Recorded on 22-DEC-2014 06:54

Timing Marks
every 60.0 sec

Gamma Ray
API
0 75 150
150 225 300

Bit Size
inches
6 11 16

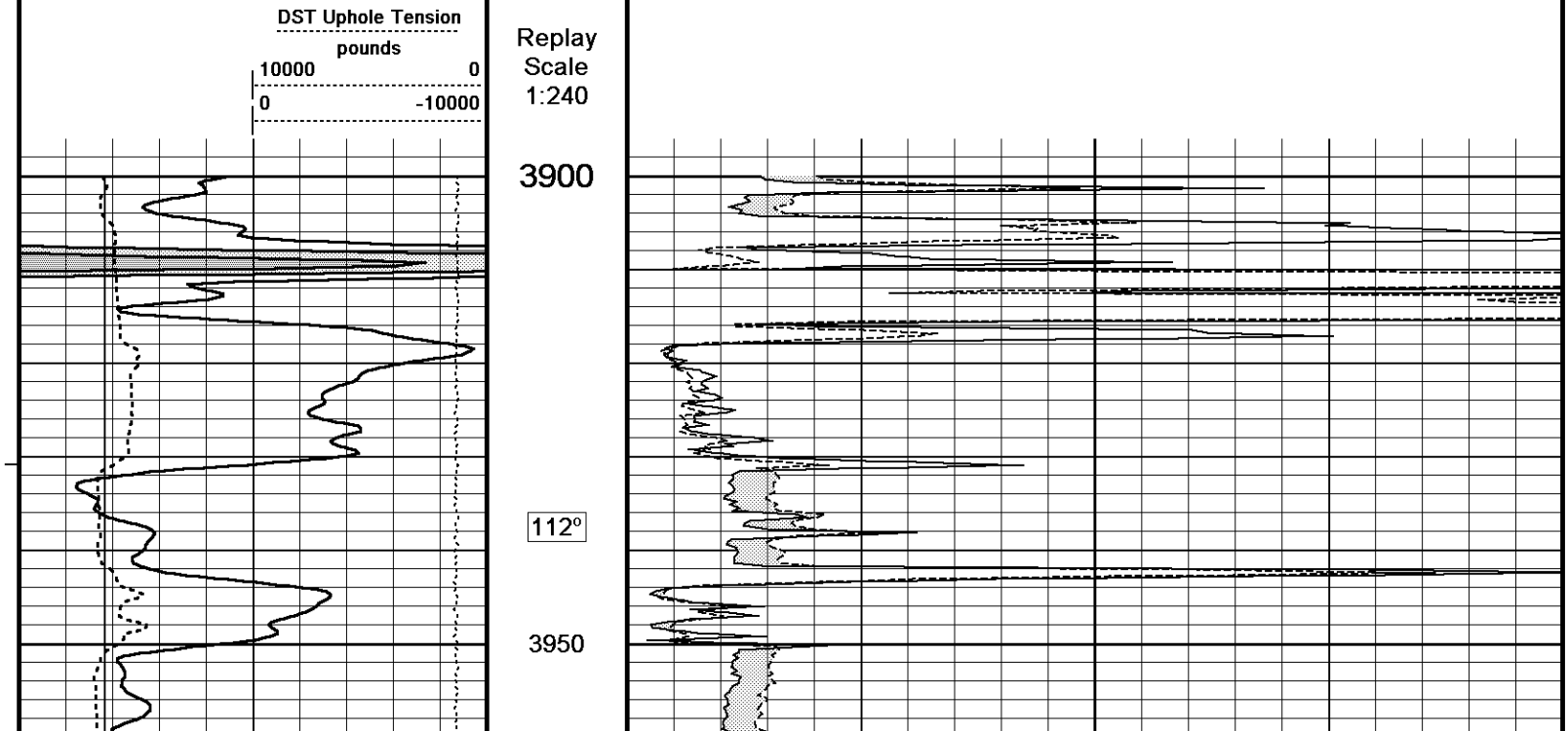
MMR Caliper
inches
6 11 16

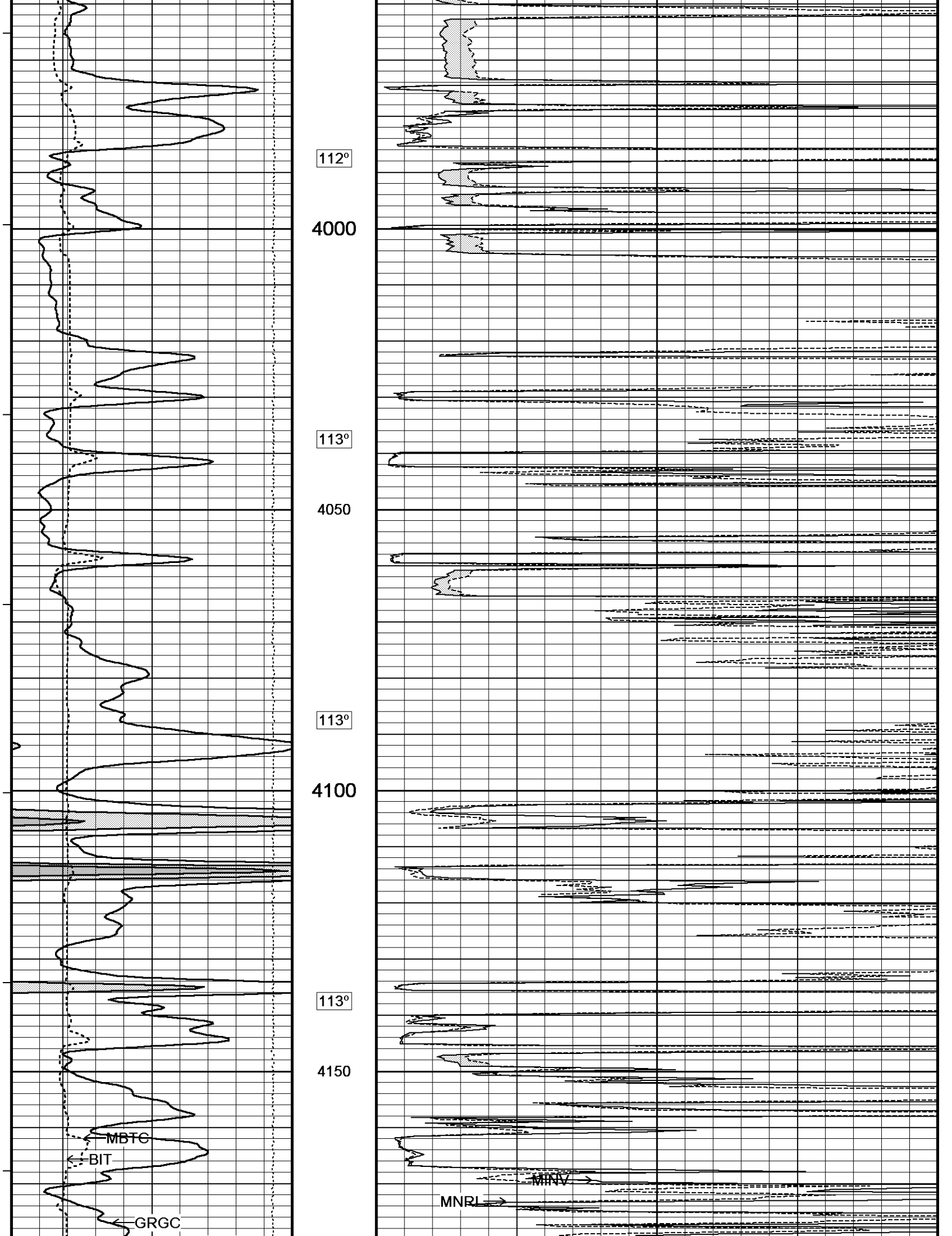
Depth
in
Feet

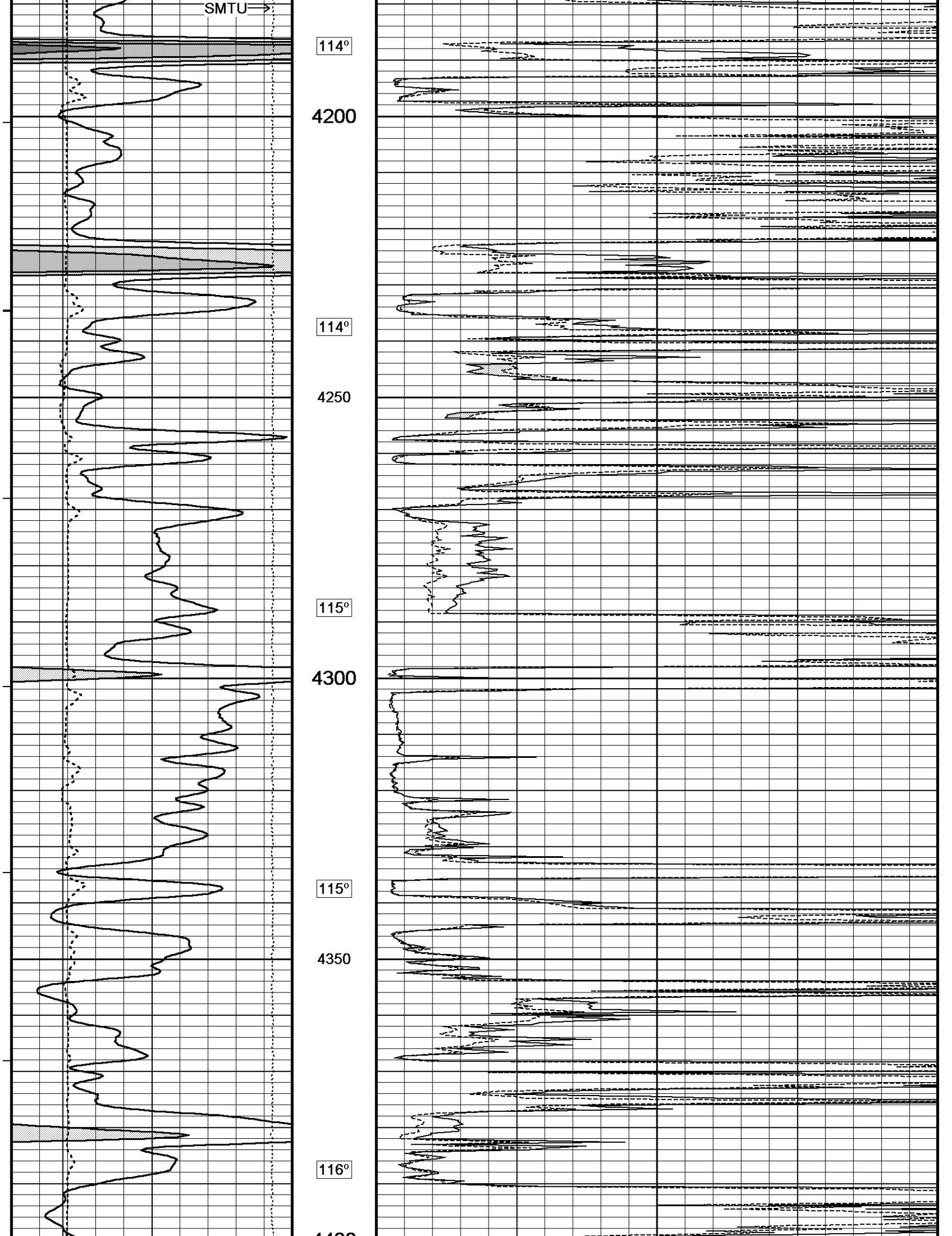
Borehole
Temp in
deg F

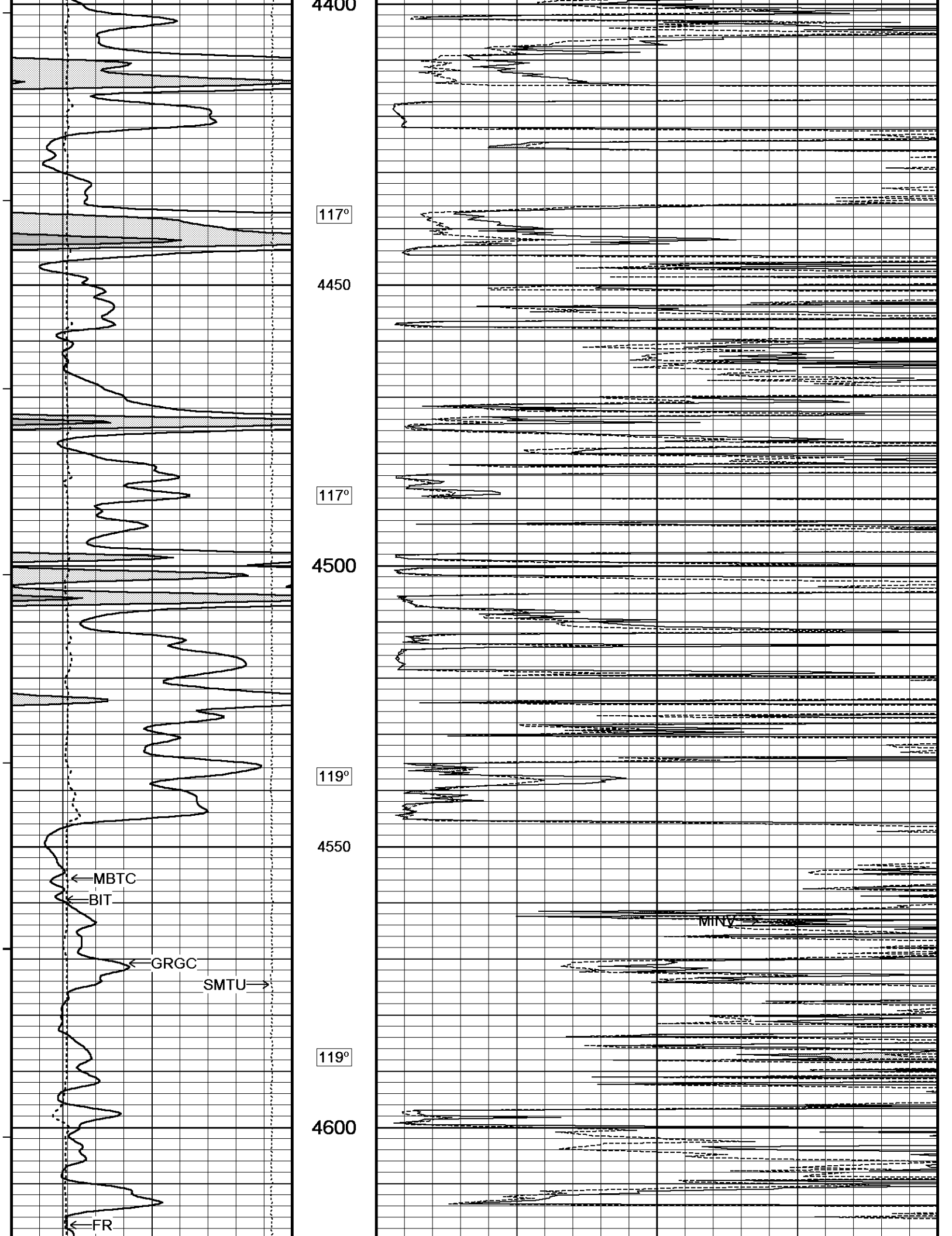
Micro-normal
ohm metres
0 10 20 30 40

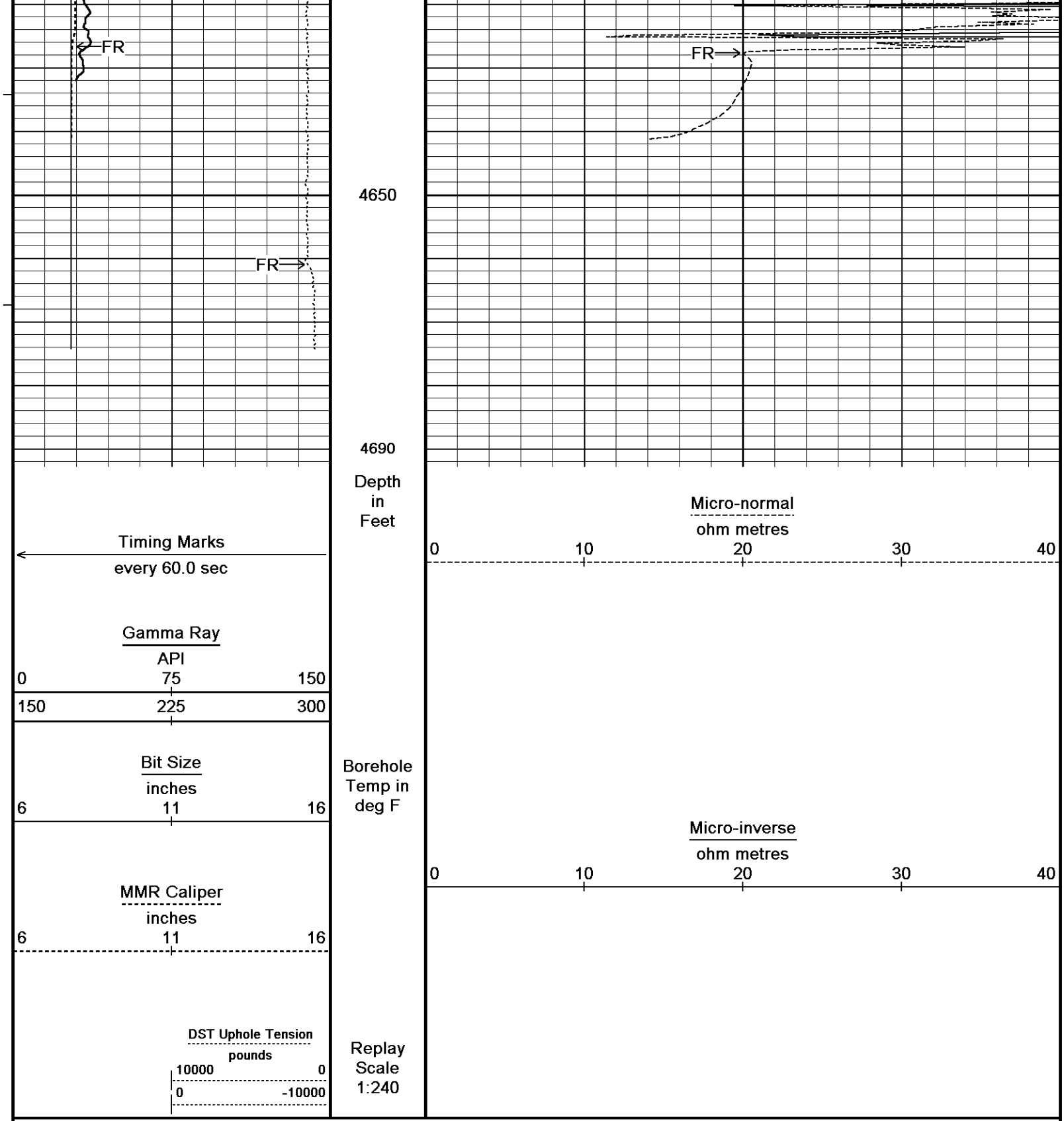
Micro-inverse
ohm metres
0 10 20 30 40




112°
4000
113°
4050
113°
4100
113°
4150
MBTC
BIT
GRGC
MINV
MNRL


SMTU
114°
4200
114°
4250
115°
4300
115°
4350
116°


4400
117°
4450
117°
4500
119°
4550
MBTC
BIT
GRGC
SMTU
MINV
119°
4600
FR



Depth Based Data - Maximum Sampling Increment 10.0cm
Plotted on 22-DEC-2014 09:55

Filename: C:\Minimus 14.05.5331\Data\Shakespeare (Burns #1-19)\REPEAT PASS.dta
Recorded on 22-DEC-2014 06:54

System Versions: Logged with 14.05.5331 Plotted with 14.05.5331

REPEAT SECTION

BEFORE SURVEY CALIBRATION

C:\Minimus 14.05.5331\Data\Shakespeare (Burns #1-19)\DATA.dta

General Constants All 000

Last Edited on 22-DEC-2014,05:34

General Parameters

Mud Resistivity	1.250	ohm-metres

Mud Resistivity Temperature	96.000	degrees F
Water Level	0.000	feet
Borehole Fluid Processing	Wet Hole	

Hole/Annular Volume and Differential Caliper Parameters

HVOL Method	Single Caliper	
HVOL Caliper 1	Density Caliper	
HVOL Caliper 2	N/A	
Annular Volume Diameter	5.500	inches
Caliper for Differential Caliper	None	

Rwa Parameters

Porosity used	Crossplot Porosity	
Resistivity used	Array Ind. One Res Rt	
RWA Constant A	0.610	
RWA Constant M	2.150	
SW/APOR Tool Source	0.000	

Down-hole Tension Calibration SMS 0

Field Calibration on 22-DEC-2014 05:59

Reading No	Measured	Calibrated (lbs)
1	15275.94	0.00
2	15875.13	407.90

High Resolution Temperature Calibration MCG-D.K 443

Field Calibration on 05-MAR-2014,20:50

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

High Resolution Temperature Constants MCG-D.K 443

Last Edited on 22-JUL-2014,11:40

Pre-filter Length	11

SP Calibration MCG-D.K 443

Field Calibration on 29-SEP-2014 14:22

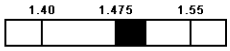
	Measured	Calibrated (mV)
Reference 1	102.0	100.7
Reference 2	-99.4	-100.8

Gamma Calibration MCG-D.K 443

Field Calibration on 06-DEC-2014 23:53

	Measured	Calibrated (API)
Background	74	49
Calibrator (Gross)	1165	774
Calibrator (Net)	1092	725

Gamma Calibration Tolerances MCG-D.K 443

Ratio 1.506 

Counts/API

Gamma Constants MCG-D.K 443

Last Edited on 22-DEC-2014,05:40

Gamma Calibrator Number	GRC038	
GRC-M Calibrator Jig in Use?	NO	
Inactive Background Jig in Use?	NO	
Mud Density	1.11	gm/cc
Caliper Source for Processing	Bit Size	
Tool Position	Centred	
Concentration of KCl		kppm
K Mud Type	Chloride	
K Mud Concentration	0.00	%

Micro-Resistivity Caliper Constants MMR-A 11

Last Edited on

Sonde Configuration	Resistivity Mode

Micro Normal and Micro Inverse Calibration MMR-A 11

Base Calibration on 01-DEC-2014 10:00
Field Check on 06-DEC-2014 23:38

Base Calibration

	Measured		Calibrated (ohm-m)	
Channel	Resistor 1	Resistor 2	Resistor 1	Resistor 2
Micro Normal	10.2	49.9	5.1	25.6
Micro Inverse	10.0	49.5	2.4	12.0

Micro Inverse	10.0	49.5	3.4	16.9

Channel	Base Check (ohm-m)	Field Check (ohm-m)
Micro Normal	93.7	93.7
Micro Inverse	62.3	62.3

Micro Normal & Micro Inverse Calibration Tolerance MMR-A 11

Micro Normal Res. 1	10.2	-5% 10.0 +5%	ohm	Micro Normal Res. 2	49.9	-5% 50.0 +5% ohm
Micro Inverse Res. 1	10.0	-5% 10.0 +5%	ohm	Micro Inverse Res. 2	49.5	-5% 50.0 +5% ohm

Micro Normal Base Check	93.7	-2% 93.28 +2%	ohm-m
Micro Inverse Base Check	62.3	-2% 62.20 +2%	ohm-m
Micro Normal Field Check	93.7	-2% 93.7 +2%	ohm-m
Micro Inverse Field Check	62.3	-2% 62.3 +2%	ohm-m

Micro Normal and Micro Inverse Constants MMR-A 11

Last Edited on 10-JUL-2014,16:35

Pad Type	8-12 in Soft Rubber Inflatable 006-9011-159	
Micro Normal K Factor	0.5110	
Micro Inverse K Factor	0.3380	
Standoff Offset	0.0000	inches

Micro Laterolog Calibration MMR-A 11

Base Calibration on 31-DEC-1999 00:00
Field Check on 31-DEC-1999 00:00

Base Calibration

Measured		Calibrated (ohm-m)	
Ref 1	Ref 2	Ref 1	Ref 2
0.0	0.0	0.0	0.0

Base Check (ohm-m)	Field Check (ohm-m)
0.0	0.0

Micro Laterolog Constants MMR-A 11

Last Edited on 12-MAR-2014,18:50

Pad Type	6 in Solid Nylon B23059	
Micro Laterolog K Factor	0.0128	
Standoff Offset	0.0000	inches

Mudcake Thickness Correction Constants

Mud Cake Source	Constant Value	
Mud Cake Thickness	0.4000	inches
Mud Cake Thickness Caliper	N/A	
Mud Cake Resistivity	0.1500	ohm-m
Mud Cake Resistivity Temp.	68.00	Deg F
Mud Cake Resistivity Source	Constant Value	
Temp. Source Rmc Correc.	N/A	

Caliper Calibration MMR-A 11

Base Calibration on 01-DEC-2014 09:55
Field Calibration on 06-DEC-2014 23:37

Base Calibration

Reading No	Measured	Calibrator Size (in)
1	14033	5.98
2	17158	7.97
3	20363	9.86
4	24256	11.92
5	0	0.00
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.88	7.97

Caliper Calibration Tolerances MMR-A 11

Short Arm Field Cal.	7.88	7.77 7.97 8.17	in

Neutron Calibration MDN-A.B 65

Base Calibration on 02-OCT-2014 11:43
Field Check on 06-DEC-2014 23:57

Base Calibration

	Measured Near	Measured Far	Calibrated (cps) Near	Calibrated (cps) Far
	3078	95	3714	110
Ratio	32.249		33.764	

Field Calibrator at Base

	Calibrated (cps) Near	Calibrated (cps) Far
	1681	2420
Ratio	0.695	

Field Check

	Calibrated (cps) Near	Calibrated (cps) Far
	1669	2414
Ratio	0.691	

Neutron Calibration Tolerances MDN-A.B 65

Near Reading	3078	-25% 3500 +25%	cps	Far Reading	95	-50% 106 +50% cps
Ratio	32.249	-5% 33 +5%				
Base Check	0.695	0.65 0.7 0.75				
Field Check	0.691	0.675 0.695 0.715				

Neutron Constants MDN-A.B 65

Last Edited on 14-DEC-2014,20:36

Neutron Source Id	PN-521	
Neutron Jig Number	5824NE	
Air Hole Processing	Legacy	
Caliper Source for Processing	Density Caliper	
Stand-off	0.00	inches
Mud Density	1.00	gm/cc
Limestone Sigma	7.10	cu
Sandstone Sigma	4.26	cu
Dolomite Sigma	4.70	cu
Formation Pressure Source	None	
Formation Pressure	N/A	kpsi
Temperature Source	Constant Value	
Temperature	68.00	degrees F
Mud Salinity	0.00	kppm
Salinity Correction	Not Applied	
Formation Fluid Salinity Source	None	
Formation Fluid Salinity	N/A	kppm
Barite Mud Correction	Not Applied	

FE Calibration MFE-B.J 352

Base Calibration on 01-DEC-2014 09:46
Field Check on 06-DEC-2014 23:36

Base Calibration

	Measured	Calibrated (ohm-m)
Reference 1	0.0	0.0
Reference 2	963.7	126.8
Base Check		281.5
Field Check		281.6

FE Calibration Tolerances MFE-B.J 352

Reference 2	963.7	-3% 980.0 +3%	ohm
Base Check	281.5	-2% 277.0 +2%	ohm-m
Field Check	281.6	-2% 281.5 +2%	ohm-m

FE Constants MFE-B.J 352

Last Edited on 06-DEC-2014,23:34

Running Mode	No Sleeve	
MFE K Factor	0.1268	
Caliper Source for FE correction	Density Caliper	
Caliper Value for FE correction	N/A	inches

Rm Source for FE correction	Global Value: Temperature Corrected	
Temp. for Rm Corr.	MCG External Temperature	
Stand-off	0.5	inches

High Resolution Temperature Calibration MAI-A.A 158

Field Calibration on 03-APR-2014,15:43

	Measured	Calibrated(Deg F)
Lower	50.00	50.00
Upper	75.00	75.00

High Resolution Temperature Constants MAI-A.A 158

Last Edited on 22-MAY-2014,10:26

Pre-filter Length	11

Induction Calibration MAI-A.A 158

Base Calibration on 03-APR-2014,15:01
Field Check on 11-DEC-2014 09:52

Base Calibration

Test Loop Calibration	Measured		Calibrated (mmho/m)	
Channel	Low	High	Low	High
1	17.2	475.3	9.3	966.2
2	6.1	381.2	7.6	821.4
3	3.8	265.2	5.2	566.0
4	2.7	132.2	2.6	279.2
Array Temperature		22.3	Deg F	

Test Loop Calibration Verified 11-DEC-2014 09:50

Channel	Base Check (mmho/m)		Field Check (mmho/m)		
	Low	High	Low	High	
1	11.8	3814.7	11.8	3814.8	
2	30.0	3531.3	30.0	3531.3	
3	27.2	2982.0	27.2	2982.1	
4	18.1	2098.0	18.1	2098.0	
Deep	14.9	1944.0	14.9	1944.2	
Medium	41.1	3888.3	41.1	3888.4	
Shallow	47.3	5237.5	47.3	5237.4	
Array Temperature		52.0		51.7	Deg F

Induction Calibration Tolerances MAI-A.A 158

Low Conductivity 1	17.2	13.0 / 17.0 / 21.0	mmho/m	High Conductivity 1	475.3	430.0 / 475.0 / 520.0 mmho/m
Low Conductivity 2	6.1	4.5 / 6.0 / 7.5	mmho/m	High Conductivity 2	381.2	345.0 / 385.0 / 425.0 mmho/m
Low Conductivity 3	3.8	1.0 / 3.5 / 6.0	mmho/m	High Conductivity 3	265.2	240.0 / 260.0 / 280.0 mmho/m
Low Conductivity 4	2.7	0.0 / 2.0 / 4.0	mmho/m	High Conductivity 4	132.2	120.0 / 135.0 / 150.0 mmho/m
Background Vx 1	0.0	-110.0 / -32.5 / 45.0	mmho/m	Phase Check Loop 1	0.0	-2.0 / 0.0 / 2.0 %
Background Vx 2	0.0	-35.0 / 20.0 / 75.0	mmho/m	Phase Check Loop 2	0.0	-2.0 / 0.0 / 2.0 %
Background Vx 3	0.0	-60.0 / 2.5 / 65.0	mmho/m	Phase Check Loop 3	0.0	-2.0 / 0.0 / 2.0 %
Background Vx 4	0.0	-50.0 / -17.5 / 15.0	mmho/m	Phase Check Loop 4	0.0	-2.0 / 0.0 / 2.0 %

Induction Constants MAI-A.A 158

Last Edited on 14-DEC-2014,20:36

Induction Model	RtAP-WBM	
Caliper for Borehole Corr.	Density Caliper	
Hole Size for Borehole Correction	N/A	inches
Tool Centred	No	
Stand-off Type	Fins	
Stand-off	0.50	inches
Number of Fins on Stand-off	8.0000	
Stand-off Fin Angle	45.00	degrees
Stand-off Fin Width	0.5000	inches
Borehole Corr. Rm Source	Global Value: Temperature Corrected	
Temp. for Rm Corr.	MCG External Temperature	
Squasher Start	0.0020	mhos/metre
Squasher Offset	N/A	mhos/metre

Borehole Normalisation

DRM1	0.0000	DRC1	0.0000

DRM2	0.0000	DRC2	0.0000
MRM1	0.0000	MRC1	0.0000
MRM2	0.0000	MRC2	0.0000
SRM1	0.0000	SRC1	0.0000
SRM2	0.0000	SRC2	0.0000

Calibration Site Corrections

Channel 1	0.00	mmhos/metre
Channel 2	0.00	mmhos/metre
Channel 3	0.00	mmhos/metre
Channel 4	0.00	mmhos/metre

Apparent Porosity and Water Saturation Constants

Archie Constant (A)	1.00	
Cementation Exponent (M)	2.00	
Saturation Exponent (N)	2.00	
Saturation of Water for Apor	100.00	percent
Resistivity of Water for Apor and Sw	0.05	ohm-m
Resistivity of Mud Filtrate for Sw	0.00	ohm-m
Source for Rt	0.00	
Source for Rxo	0.00	

Caliper Calibration MPD-D.A 482

Base Calibration on 25-NOV-2014 10:21
Field Calibration on 06-DEC-2014 23:39

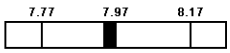
Base Calibration

Reading No	Measured	Calibrator Size (in)
1	16588	3.99
2	26783	5.98
3	37020	7.97
4	46817	9.86
5	57838	11.92
6	N/A	N/A

Field Calibration

Measured Caliper (in)	Actual Caliper (in)
7.93	7.97

Caliper Calibration Tolerances MPD-D.A 482

Short Arm Field Cal. 7.93 

in

Photo Density Calibration MPD-D.A 482

Base Calibration on 25-NOV-2014 10:39
Field Check on 06-DEC-2014 23:43

Density Calibration

Base Calibration	Measured Near	Measured Far	Calibrated (sdu) Near	Calibrated (sdu) Far
Background	1221	1393		
Reference 1	46352	21700	59556	30836
Reference 2	19381	2407	24941	2541

Field Check at Base

1220.9	1393.1

Field Check

1221.5	1392.6

PE Calibration

Base Calibration	WS	Measured WH	Ratio	Calibrated Ratio
Background	231	1093		
Reference 1	20382	46170	0.447	0.371
Reference 2	5852	19247	0.310	0.272

Field Check at Base

230.8	1092.6

Field Check

231.7	1093.4

Photo Density Calibration Tolerances MPD-D.A 482

Near Density Ratio	2.49	-5% 2.52 +5%	Far Density Ratio	20.03	-5% 21.00 +5%
PE Calibration	0.129	0.089 0.110 0.131			
Near Den. Field Check	1221.5	-3% 1220.9 +3%	Far Den. Field Check	1392.6	-3% 1393.1 +3%
PE WS Field Check	231.7	-6% 230.8 +6%	PE WH Field Check	1093.4	-6% 1092.6 +6%

Density Constants MPD-D.A 482

Last Edited on 22-DEC-2014,05:40

Density Source Id	254	
Nylon Calibrator Number	DNCE695	
Aluminium Calibrator Number	DACD698	
Density Shoe Profile	8 inch	
Caliper Source for Processing	Density Caliper	
PE Correction to Density	Not Applied	
Mud Density	1.11	gm/cc
Mud Density Z/A Multiplier	1.11	
Mud Filtrate Density	1.00	gm/cc
Dry Hole Mud Filtrate Density	1.00	gm/cc
DNCT	0.00	gm/cc
CRCT	0.00	gm/cc
Density Z/A Correction	Hybrid	

Matrix density (gm/cc)	Depth (m)
2.71	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00
0.00	0.00

DOWNHOLE EQUIPMENT

C:\Minimus 14.05.5331\Data\Shakespeare (Burns #1-19)\DATA.dta

CBH-C, Cablehead, 11 pin
CBH-C 0 LG: 2.40 ft WT: 24.3 lb OD: 2.244 in

Compact Comms Gamma
MCG-D.K 443 LG: 8.70 ft WT: 63.9 lb OD: 2.244 in

Compact Micro-Resistivity
MMR-A 11 LG: 8.59 ft WT: 81.6 lb OD: 4.882 in

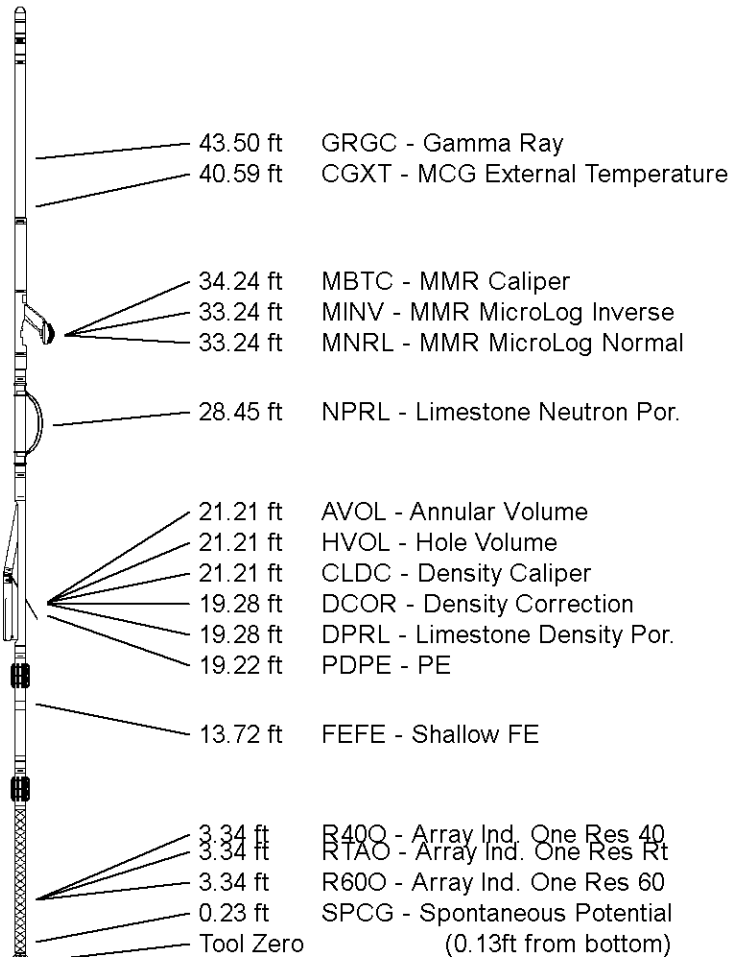
Compact Neutron
MDN-A.B 65 LG: 5.04 ft WT: 50.7 lb OD: 2.244 in

Compact Density/Caliper
MPD-D.A 482 LG: 9.59 ft WT: 90.4 lb OD: 2.449 in

Compact Focussed Electric
MFE-B.J 352 LG: 6.05 ft WT: 48.5 lb OD: 2.244 in

Compact Induction
MAI-A.A 158 LG: 10.81 ft WT: 48.5 lb OD: 2.240 in

Total Length: 51.18 ft Weight: 407.9 lb



-0.13 ft SMTU - DST Uphole Tension

COMPANY	SHAKESPEARE OIL CO., INC.
WELL	BURNS #1-19
FIELD	SWIFT FOX SOUTHEAST
PROVINCE/COUNTY	GOVE
COUNTRY/STATE	USA / KANSAS

Elevation Kelly Bushing	2887.00	feet	First Reading	4628.00	feet
Elevation Drill Floor	2885.00	feet	Depth Driller	4660.00	feet
Elevation Ground Level	2877.00	feet	Depth Logger	4661.00	feet

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MICRO-RESISTIVITY LOG