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www.mgmenergy.com

March 8, 2013

Hand Delivered

National Energy Board
444 Seventh Avenue SW
Calgary, AB T2P 0X8

Attention: Patrick Smyth (Chief Conservation Officer)
C/O
Lori-Ann Sharp (Frontier Data Management)

Greetings:

RE: MGM Energy Corp. (MGM) East Mackay I-78 RPS Group Final Geological Report

Please find enclosed the final geological reports by RPS group for the East- Mackay I-78 well.

For questions or concerns, please contact Paul Price at 403-781-7817 or paul.price@mgmenergy.com, or Austin Springer at 403-781-7815 or austin.springer@mgmenergy.com.

Yours truly,

MGM ENERGY CORP.

Austin C. Springer
Geoscience Operations

6 Enclosures Total:

- Two (2) copies of the Geological Report
- Two (2) copies of the Final Strip Log
- Two (2) CDs of the digital Geological Report and Strip Log

Suite 1400, 800 – 5th Avenue SW, Calgary Alberta Canada T2P 3T6
T +1 403 263 0449 F +1 403 269 3175 E rpscal@rpsgroup.com W rpsgroup.com/canada

MGM

MGM - SHELL EAST MACKAY I – 78

300178645012530O
NWT

PERMIT TO PRACTICE
RPS ENERGY CANADA LTD.

Signature _____

Date _____

PERMIT NUMBER: P 4348
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

GEOLOGICAL REPORT

ON

MGM - SHELL EAST MACKAY I – 78
3001786450125300

FOR

MGM

TABLE OF CONTENTS

February 2013

Dave Prior, M.Sc, P.Geol
Wellsite Consultant

RPS ENERGY CANADA LTD. (RPS)
Suite 1400, 800 – 5th Avenue SW., Calgary, Alberta Canada T2P 3T6

WELL DATA SUMMARY

WELL NAME	MGM - SHELL EAST MACKAY I - 78
UNIQUE WELL I.D.	3001786450125300
BOTTOM LOCATION	I 78 64 50 125 30
SURFACE LOCATION	I 78 64 50 125 30
FIELD/REGION	NWT mainland
OPERATOR	MGM

SITE DATA

BOTTOMHOLE Lat / Long	Lat 64 deg, 47' 42.1"; Long 125 deg, 43' 19.1"		
SURFACE Lat / Long	Lat 64 deg, 47' 42.1"; Long 125 deg, 43' 19.1"		
BOTTOMHOLE COORDINATES	UTM Zone 10, 370684.26 m East, 7188197.43 m North, NAD 27		
SURFACE COORDINATES	UTM Zone 10, 370684.26 m East, 7188197.43 m North, NAD 27		
WELL CLASSIFICATION	Exploratory	WELL LICENSE #	1202
AFE NUMBER	12D0006	WELL TYPE:	Vertical
DRILLING CONTRACTOR	Akita 37		

ELEVATIONS

GROUND LEVEL	155.00	(m)
KELLY BUSHING	161.20	(m)

DRILLING DATES

SPUD DATE	January 27, 2013	**TIME**	14:00	Hours
TD DATE	February 15, 2013	**TIME**	09:45	Hours
RIG RELEASE DATE	N/A			

HOLE SIZE & MUD TYPE

SURFACE	311.0 mm, water, casing set at 401.8
MAIN	222.0 mm to 1820.0 m, 216.0 mm, 1820.0 to 2001.0 m, Gel Chem

CASING DATA

SURFACE	I-80, 244.5 mm OD, 224.0 mm ID, 59.53 kg/m, 29 joints, length
	402.9 m, kb-casing head 5.21 m, set at 401.8 m kb
INTERMEDIATE	156.0 mm (7"), planned
PRODUCTION	N/A

GEOLOGICAL DATA

SAMPLE INTERVAL	Surface to Total Depth
GAS DETECTION INTERVAL	25.0 m to Total Depth
CORES	Canol and Bluefish formations
LOGGING SUITE	MWD Gamma 25.0 to 1810.0 m.
WIRELINE LOGGING SUITE	Surface, Gamma Ray, Density, Neutron, Resistivity, SP, Sonic,
	Main - Spectral GR, Dual Density, Neutron, Induction, Caliper,
	SP, Multi-pole Sonic, Image Logs FLEX, MREX.
DRILL STEM TESTS	N/A
ISOTUBE GAS SAMPLES	50.0 m intervals 50.0 to 1750.0 m; 10.0 m intervals 1830.0 to Total Depth

WELL STATUS **Cased.**

FORMATION TOPS

MGM - SHELL EAST MACKAY I - 78

3001786450125300

K.B.(m): 161.0 **G.L.(m):** 155.0

			SAMPLE			high(+)
FORMATION	***TVD(m)***	***SS(m)***	***TVD(m)***	***SS(m)***	***ISO(m)***	***low(-)***
East Fork	10.0	151.0	129.0	32.0	635.0	-119.0
Little Bear Upper	732.0	-571.0	764.0	-603.0	123.0	-32.0
Little Bear Middle	872.0	-711.0	887.0	-726.0	274.0	-15.0
Little Bear Lower	1145.0	-984.0	1161.0	-1000.0	27.0	-16.0
Slater River	1175.0	-1014.0	1188.0	-1027.0	221.0	-13.0
Slater Radioactive Shale	1406.0	-1245.0	1409.0	-1248.0	25.0	-3.0
Arctic Red Upper (Mahny Lk)	1415.0	-1254.0	1434.0	-1273.0	48.0	-19.0
Basal Cretaceous Unconform.	1464.0	-1303.0	1482.0	-1321.0	0.0	-18.0
Devonian, Imperial Lower	1464.0	-1303.0	1482.0	-1321.0	218.0	-18.0
Canyon Sandstone	1717.0	-1556.0	1700.0	-1539.0	31.0	17.0
Base Canyon	1736.0	-1575.0	1731.0	-1570.0	89.0	5.0
Canol Upper	1824.0	-1663.0	1820.0	-1659.0	35.0	4.0
Canol Middle	1857.0	-1696.0	1855.0	-1694.0	5.0	2.0
Canol Lower	1861.0	-1700.0	1860.0	-1699.0	58.0	1.0
Hare Indian	1920.0	-1759.0	1918.0	-1757.0	19.0	2.0
Bluefish	1945.0	-1784.0	1937.0	-1776.0	20.0	8.0
Hume Upper	1965.0	-1804.0	1957.0	-1796.0	44.0	8.0
Total Depth	2020.0	-1859.0	2001.0	-1840.0	-	19.0

DEVIATION SURVEYS

MGM - SHELL EAST MACKAY I - 78

3001786450125300

Wireline surveys on surface hole

Depth	*Inclination*
45.0	1.0
80.0	0.7
110.0	0.7
140.0	0.6
180.0	0.5
220.0	0.5
250.0	0.7
280.0	0.9
310.0	0.8
350.0	0.3
376.0	1.0

SURVEY REPORT

MGM - SHELL EAST MACKAY I - 78

3001786450125300

Vertical Main Hole

Measured Depth Meters	Incl Angle Deg	Azimuth Deg	TRUE Vertical Depth	Vertical Section Meters	N-S Meters	E-W Meters	Dogleg Severity Deg/30
0.0	0.0	128.7	0.0	0.0	0.0	0.0	0.0
6.2	0.0	128.7	6.2	0.0	0.0	0.0	0.0
405.0	0.0	0.0	405.0	0.0	0.0	0.0	0.0
410.7	0.4	128.7	410.7	0.0	0.0	0.0	2.1
459.0	0.1	157.2	459.0	-0.2	-0.2	0.2	0.2
507.1	0.6	168.0	507.1	-0.4	-0.4	0.2	0.3
555.6	0.2	324.8	555.6	-0.6	-0.6	0.2	0.5
603.9	0.6	184.3	603.9	-0.8	-0.8	0.2	0.5
652.1	0.4	4.4	652.1	-0.9	-0.9	0.2	0.6
700.3	0.6	194.4	700.3	-1.0	-1.0	0.1	0.6
748.5	0.4	353.3	748.5	-1.0	-1.0	0.0	0.6
796.5	0.3	197.7	796.5	-1.0	-1.0	0.0	0.4
844.7	0.4	47.4	844.7	-1.0	-1.0	0.1	0.4
892.8	0.5	222.2	892.8	-1.0	-1.0	0.0	0.6
941.0	0.6	22.8	941.0	-1.0	-1.0	0.0	0.7
988.8	0.6	214.1	988.8	-0.9	-0.9	-0.1	0.8
1036.9	0.3	8.9	1036.9	-1.0	-1.0	-0.2	0.6
1085.1	0.4	207.9	1085.1	-1.1	-1.1	-0.2	0.4
1133.4	0.4	33.9	1133.4	-1.1	-1.1	-0.2	0.5
1181.6	0.2	170.6	1181.6	-1.0	-1.0	-0.1	0.4
1229.8	0.2	60.6	1229.8	-1.1	-1.1	0.0	0.2
1277.9	0.2	103.1	1277.9	-1.0	-1.0	0.1	0.1
1326.1	0.1	355.9	1326.1	-1.0	-1.0	0.2	0.2
1374.2	0.2	34.9	1374.2	-0.9	-0.9	0.3	0.1
1422.4	0.4	49.1	1422.4	-0.7	-0.7	0.4	0.1
1470.5	0.4	55.2	1470.5	-0.5	-0.5	0.7	0.0
1518.6	0.3	68.0	1518.6	-0.4	-0.4	1.0	0.1
1566.9	0.6	60.4	1566.9	-0.2	-0.2	1.3	0.2
1615.2	0.5	84.1	1615.2	0.0	0.0	1.7	0.2
1663.2	1.0	79.6	1663.2	0.1	0.1	2.3	0.3
1711.3	0.2	153.7	1711.3	0.1	0.1	2.8	0.6
1759.2	0.7	73.2	1759.2	0.1	0.1	3.1	0.4
1799.0	0.6	62.7	1799.0	0.2	0.2	3.5	0.1
1820.0	0.5	60.1	1820.0	0.3	0.3	3.7	0.1

SURVEY REPORT

MGM - SHELL EAST MACKAY I - 78

3001786450125300

Total Depth

Measured Depth Meters	Incl Angle Deg	Azimuth Deg	TRUE Vertical Depth	DRIFT Station N-S	DRIFT Station E-W	COORDINATE Total N-S	COORDINATE Total E-W	DOGLEG SEVERITY
401.0	0.5	207.8	401.0	0.00N	0.00E	0.00N	0.00E	0.0
411.0	0.4	101.3	411.0	0.03S	0.05E	0.03S	0.05E	6.5
421.0	0.3	72.4	421.0	0.01N	0.06E	0.03S	0.10E	1.7
431.0	0.2	80.9	431.0	0.02N	0.03E	0.01S	0.14E	1.5
441.0	0.3	80.6	441.0	0.01N	0.05E	0.00S	0.18E	1.0
451.0	0.2	73.4	451.0	0.01N	0.04E	0.01N	0.22E	0.6
461.0	0.1	82.0	461.0	0.01N	0.02E	0.02N	0.25E	0.9
471.0	0.2	104.7	471.0	0.01S	0.04E	0.01N	0.28E	1.1
481.0	0.2	16.2	481.0	0.01N	0.03E	0.03N	0.31E	3.2
491.0	0.2	1.5	491.0	0.06N	0.00W	0.08N	0.31E	0.6
501.0	0.3	146.1	501.0	0.01S	0.02E	0.08N	0.33E	5.1
511.0	0.1	124.8	511.0	0.05S	0.03E	0.03N	0.36E	2.0
521.0	0.2	330.7	521.0	0.01N	0.01E	0.03N	0.37E	3.1
531.0	0.1	131.5	531.0	0.01N	0.00E	0.04N	0.37E	3.1
541.0	0.3	153.2	541.0	0.03S	0.02E	0.01N	0.39E	1.7
551.0	0.1	120.9	551.0	0.02S	0.01E	0.01S	0.40E	2.2
561.0	0.2	154.7	561.0	0.01S	0.00E	0.02S	0.41E	1.1
571.0	0.2	132.0	571.0	0.03S	0.02E	0.04S	0.42E	0.7
581.0	0.1	71.6	581.0	0.01S	0.02E	0.05S	0.44E	1.7
591.0	0.3	351.0	591.0	0.04N	0.00E	0.01S	0.44E	2.6
601.0	0.1	136.8	601.0	0.00N	0.01E	0.01S	0.45E	3.9
611.0	0.1	127.2	611.0	0.02S	0.02E	0.04S	0.46E	0.3
621.0	0.1	54.2	621.0	0.00S	0.01E	0.04S	0.48E	1.5
631.0	0.1	149.6	631.0	0.01N	0.01E	0.03S	0.49E	1.5
641.0	0.2	171.6	641.0	0.03S	0.01E	0.06S	0.50E	1.2
651.0	0.0	260.4	651.0	0.01S	0.00W	0.07S	0.49E	2.1
661.0	0.1	320.7	661.0	0.02N	0.00W	0.05S	0.49E	0.9
671.0	0.0	218.1	671.0	0.00S	0.01W	0.06S	0.48E	1.2
681.0	0.1	355.4	681.0	0.00N	0.00W	0.05S	0.48E	1.1
691.0	0.2	341.0	691.0	0.03N	0.00E	0.03S	0.48E	1.1
701.0	0.2	222.4	701.0	0.00S	0.02W	0.03S	0.47E	3.0
711.0	0.1	134.2	711.0	0.02S	0.01W	0.05S	0.46E	2.1
721.0	0.1	10.6	721.0	0.01N	0.00W	0.05S	0.46E	1.7
731.0	0.0	220.6	731.0	0.00N	0.01W	0.04S	0.45E	1.5
741.0	0.2	161.2	741.0	0.03S	0.00W	0.07S	0.45E	1.9
751.0	0.0	352.3	751.0	0.01S	0.00E	0.08S	0.45E	2.5

761.0	0.1	293.1	761.0	0.02N	0.01W	0.06S	0.44E	1.2
771.0	0.1	192.4	771.0	0.00S	0.01W	0.06S	0.43E	1.6
781.0	0.1	295.8	781.0	0.00S	0.00W	0.06S	0.43E	1.0
791.0	0.2	298.5	791.0	0.02N	0.02W	0.05S	0.41E	1.3
801.0	0.0	107.3	801.0	0.00N	0.01W	0.04S	0.40E	2.4
811.0	0.1	319.2	811.0	0.01N	0.00E	0.04S	0.41E	1.5
821.0	0.3	276.8	821.0	0.02N	0.03W	0.01S	0.38E	1.9
831.0	0.2	155.6	831.0	0.01S	0.02W	0.03S	0.36E	3.7
841.0	0.3	86.3	841.0	0.01S	0.03E	0.04S	0.40E	2.7
851.0	0.0	127.0	851.0	0.01N	0.03E	0.03S	0.42E	2.5
861.0	0.1	199.3	861.0	0.01S	0.00W	0.04S	0.42E	1.4
871.0	0.2	76.2	871.0	0.01S	0.02E	0.05S	0.44E	3.4
881.0	0.2	21.3	881.0	0.03N	0.04E	0.02S	0.47E	2.1
891.0	0.1	269.5	891.0	0.02N	0.01W	0.00N	0.46E	2.8
901.0	0.1	67.9	901.0	0.00N	0.00E	0.01N	0.46E	1.8
911.0	0.3	36.2	911.0	0.03N	0.03E	0.04N	0.49E	2.4
921.0	0.1	278.0	921.0	0.02N	0.01E	0.06N	0.50E	3.6
931.0	0.1	165.7	931.0	0.03S	0.02W	0.03N	0.49E	2.0
941.0	0.3	48.3	941.0	0.00N	0.02E	0.04N	0.51E	3.6
951.0	0.1	355.5	951.0	0.03N	0.02E	0.06N	0.53E	2.4
961.0	0.0	194.8	961.0	0.00S	0.01W	0.06N	0.52E	1.1
971.0	0.2	56.2	971.0	0.01N	0.01E	0.06N	0.53E	2.3
981.0	0.2	357.9	981.0	0.04N	0.02E	0.10N	0.55E	1.9
991.0	0.3	241.1	991.0	0.00N	0.02W	0.10N	0.53E	4.1
1001.0	0.0	234.9	1001.0	0.03S	0.03W	0.07N	0.50E	2.3
1011.0	0.2	14.5	1011.0	0.01N	0.00E	0.09N	0.51E	2.1
1021.0	0.0	332.6	1021.0	0.02N	0.01E	0.10N	0.51E	1.4
1031.0	0.1	186.4	1031.0	0.01S	0.00W	0.09N	0.51E	1.4
1041.0	0.1	2.8	1041.0	0.00N	0.00E	0.10N	0.51E	1.7
1051.0	0.0	164.4	1051.0	0.02N	0.00E	0.11N	0.51E	0.7
1061.0	0.1	198.9	1061.0	0.00S	0.00E	0.11N	0.52E	1.0
1071.0	0.1	15.5	1071.0	0.00S	0.00E	0.11N	0.52E	1.7
1081.0	0.1	294.7	1081.0	0.02N	0.00W	0.13N	0.52E	0.9
1091.0	0.2	210.6	1091.0	0.01S	0.02W	0.11N	0.50E	2.4
1101.0	0.0	344.8	1101.0	0.01S	0.01W	0.10N	0.49E	2.7
1111.0	0.2	17.0	1111.0	0.03N	0.01E	0.13N	0.50E	1.6
1121.0	0.0	225.4	1121.0	0.01N	0.00E	0.14N	0.50E	2.3
1131.0	0.0	20.3	1131.0	0.01S	0.01W	0.12N	0.50E	0.9
1141.0	0.2	27.5	1141.0	0.02N	0.01E	0.14N	0.50E	1.9
1151.0	0.1	85.9	1151.0	0.03N	0.02E	0.17N	0.52E	2.1
1161.0	0.0	46.8	1161.0	0.01N	0.01E	0.18N	0.53E	0.4
1171.0	0.1	47.0	1171.0	0.01N	0.01E	0.19N	0.54E	0.5
1181.0	0.1	81.0	1181.0	0.00N	0.02E	0.19N	0.55E	0.6
1191.0	0.1	53.0	1191.0	0.01N	0.01E	0.20N	0.57E	0.5
1201.0	0.1	81.3	1201.0	0.01N	0.02E	0.21N	0.58E	0.7
1211.0	0.1	77.1	1211.0	0.01N	0.02E	0.22N	0.61E	0.0

1221.0	0.1	63.8	1221.0	0.01N	0.02E	0.23N	0.63E	0.3
1231.0	0.2	59.2	1231.0	0.01N	0.02E	0.24N	0.65E	0.2
1241.0	0.1	60.6	1241.0	0.01N	0.02E	0.25N	0.67E	0.3
1251.0	0.1	64.9	1251.0	0.01N	0.02E	0.26N	0.70E	0.0
1261.0	0.1	55.5	1261.0	0.01N	0.02E	0.27N	0.72E	0.3
1271.0	0.1	64.6	1271.0	0.01N	0.02E	0.28N	0.74E	0.2
1281.0	0.1	84.6	1281.0	0.01N	0.02E	0.28N	0.76E	0.5
1291.0	0.1	61.8	1291.0	0.01N	0.02E	0.29N	0.78E	0.5
1301.0	0.1	79.4	1301.0	0.01N	0.02E	0.29N	0.80E	0.4
1311.0	0.2	72.3	1311.0	0.01N	0.02E	0.30N	0.82E	0.4
1321.0	0.1	70.3	1321.0	0.01N	0.02E	0.31N	0.84E	0.6
1331.0	0.1	67.6	1331.0	0.01N	0.02E	0.32N	0.86E	0.0
1341.0	0.2	75.8	1341.0	0.01N	0.02E	0.33N	0.89E	0.7
1351.0	0.1	65.5	1351.0	0.01N	0.02E	0.33N	0.91E	0.3
1361.0	0.2	75.5	1361.0	0.01N	0.02E	0.35N	0.93E	0.3
1371.0	0.1	65.9	1371.0	0.01N	0.02E	0.36N	0.96E	0.3
1381.0	0.1	66.1	1381.0	0.01N	0.02E	0.37N	0.98E	0.0
1391.0	0.1	68.2	1391.0	0.01N	0.02E	0.38N	1.01E	0.0
1401.0	0.1	68.9	1401.0	0.01N	0.02E	0.39N	1.03E	0.0
1411.0	0.1	73.4	1411.0	0.01N	0.03E	0.40N	1.06E	0.0
1421.0	0.2	71.0	1421.0	0.01N	0.03E	0.41N	1.09E	0.6
1431.0	0.3	68.8	1431.0	0.01N	0.04E	0.42N	1.12E	0.6
1441.0	0.3	64.2	1441.0	0.02N	0.04E	0.44N	1.17E	0.7
1451.0	0.3	62.0	1451.0	0.02N	0.04E	0.46N	1.21E	0.5
1461.0	0.2	59.8	1461.0	0.02N	0.04E	0.48N	1.26E	0.5
1471.0	0.3	63.3	1471.0	0.02N	0.04E	0.50N	1.29E	0.6
1481.0	0.3	72.2	1481.0	0.02N	0.04E	0.52N	1.33E	0.5
1491.0	0.2	66.7	1491.0	0.02N	0.04E	0.54N	1.37E	0.4
1501.0	0.2	64.6	1501.0	0.02N	0.03E	0.55N	1.41E	0.5
1511.0	0.3	72.7	1511.0	0.01N	0.04E	0.57N	1.45E	0.7
1521.0	0.3	69.4	1521.0	0.02N	0.04E	0.58N	1.49E	0.2
1531.0	0.2	76.5	1531.0	0.02N	0.04E	0.60N	1.52E	0.4
1541.0	0.2	74.2	1541.0	0.01N	0.04E	0.61N	1.56E	0.0
1551.0	0.3	71.4	1551.0	0.02N	0.05E	0.63N	1.61E	0.3
1561.0	0.3	69.9	1561.0	0.02N	0.05E	0.65N	1.66E	0.7
1571.0	0.4	73.6	1571.0	0.02N	0.06E	0.66N	1.72E	0.7
1581.0	0.3	69.7	1581.0	0.02N	0.06E	0.69N	1.77E	0.7
1591.0	0.3	67.6	1591.0	0.02N	0.05E	0.71N	1.83E	0.0
1601.0	0.4	70.5	1601.0	0.02N	0.06E	0.73N	1.88E	0.3
1611.0	0.3	75.8	1611.0	0.02N	0.06E	0.75N	1.94E	0.4
1621.0	0.2	65.7	1621.0	0.02N	0.05E	0.76N	1.99E	1.1
1631.0	0.2	302.2	1631.0	0.02N	0.02E	0.78N	2.01E	3.8
1641.0	0.3	294.3	1641.0	0.02N	0.05W	0.80N	1.96E	0.9
1651.0	0.1	25.7	1651.0	0.02N	0.01W	0.82N	1.95E	3.0
1661.0	0.6	72.4	1661.0	0.02N	0.05E	0.84N	1.99E	5.0
1671.0	0.9	77.2	1671.0	0.03N	0.13E	0.86N	2.12E	3.4

1681.0	1.0	80.5	1681.0	0.03N	0.16E	0.89N	2.29E	1.0
1691.0	0.8	78.3	1691.0	0.03N	0.15E	0.92N	2.44E	1.8
1701.0	0.3	79.3	1701.0	0.02N	0.10E	0.95N	2.54E	4.7
1711.0	0.3	76.1	1711.0	0.01N	0.04E	0.96N	2.58E	0.7
1721.0	0.4	82.3	1721.0	0.01N	0.06E	0.97N	2.64E	1.1
1731.0	0.4	78.3	1731.0	0.01N	0.07E	0.98N	2.71E	0.7
1741.0	0.5	71.3	1741.0	0.02N	0.08E	1.00N	2.79E	0.6
1751.0	0.5	67.4	1751.0	0.03N	0.08E	1.03N	2.87E	0.8
1761.0	0.5	70.2	1761.0	0.03N	0.09E	1.06N	2.96E	0.3
1771.0	0.6	72.0	1771.0	0.03N	0.09E	1.09N	3.05E	0.4
1781.0	0.5	69.0	1781.0	0.03N	0.09E	1.12N	3.14E	0.5
1791.0	0.6	65.9	1791.0	0.03N	0.09E	1.15N	3.23E	0.5
1801.0	0.6	69.6	1801.0	0.04N	0.09E	1.19N	3.32E	0.3
1811.0	0.6	70.6	1810.9	0.03N	0.09E	1.22N	3.41E	0.0
1821.0	0.6	70.7	1820.9	0.03N	0.09E	1.26N	3.50E	0.0
1831.0	0.6	71.3	1830.9	0.03N	0.10E	1.29N	3.60E	0.3
1841.0	0.6	68.1	1840.9	0.04N	0.10E	1.33N	3.70E	0.5
1851.0	0.7	68.7	1850.9	0.04N	0.11E	1.37N	3.80E	0.3
1861.0	0.9	70.7	1860.9	0.05N	0.13E	1.42N	3.93E	2.3
1871.0	1.3	74.5	1870.9	0.06N	0.19E	1.48N	4.12E	4.5
1881.0	1.9	78.2	1880.9	0.07N	0.27E	1.55N	4.39E	5.6
1891.0	2.4	81.0	1890.9	0.07N	0.38E	1.62N	4.76E	5.2
1901.0	2.7	83.3	1900.9	0.06N	0.44E	1.68N	5.20E	3.0
1911.0	3.0	83.9	1910.9	0.05N	0.49E	1.73N	5.70E	3.2
1921.0	3.1	83.3	1920.9	0.06N	0.53E	1.79N	6.23E	1.4
1931.0	2.7	83.1	1930.9	0.06N	0.52E	1.85N	6.75E	4.2
1941.0	2.0	79.9	1940.9	0.06N	0.40E	1.91N	7.15E	7.6

The first point information

400.96 0.5 207.8 400.96 0.00N 0.00E 0.00N 0.00E

The last point information

1940.96 2 79.9 1940.87 0.06N 0.40E 1.91N 7.15E

Final East West Drift = 7.15 E
Final North South Drift = 1.91 N
Final Drift Distance = 7.40 M
Final Drift Direction = N 75.04 E

WELLSITE BIT RECORD

MGM - SHELL EAST MACKAY I - 78

3001786450125300

SPUD DATE: January 27, 2013

T.D. DATE: February 15, 2013

SURFACE CASING: I-80, 244.5 mm OD, 224.0 mm ID, 59.53 kg/m, 29 joints, length

BIT #	***1a***	***2***	***3***	***4***	***5RR***	***6***
SIZE (mm)	311.0	222.0	216.0	216.0	216.0	216.0
MAKE	Western	HC	Baker H.	Baker H.	Baker H.	Baker H.
TYPE	GX-C03	PDC	BHC606c	GX-20MDX1	BHC606c	409c
SERIAL #	5204676	7131618	7103687	5202128	7103687	7137198
DEPTH IN	0.00	405.00	1820.00	1834.00	1834.00	1851.60
DEPTH OUT	405.00	1820.00	1834.00	1834.00	1851.60	1874.20
METRES	405.00	1415.00	14.00	0.00	17.60	22.60
HOURS	17.00	54.75	5.50	0.00	5.75	6.25
ACC. HRS.	17.00	71.75	77.25	77.25	83.00	89.25
ROP (m/hr)	23.8	25.8	2.5	0.0	3.1	3.6
FOB	4	5-10	3.4	-	6	4.5
RPM	140	0 + 75	66	-	60	35
PP	10000	11000	5900	-	6900	6900
DEN	1140	1045	1065	-	1070	1075
VISCOSITY	43	45	51	-	57	54
MAX DEV.°	1.0°	0.6°	0.6°	-	0.6°	1.3°
REMARKS	***B/G/O/RP***	***B/G/O/RP***	***B/G/O/RP***	***B/G/O/RP***	***B/G/O/RP***	***B/G/O/RP***
	Tri-cone	Mud Motor	Core 1	Circulated	Core 2	Core 3

WELLSITE BIT RECORD

MGM - SHELL EAST MACKAY I - 78

3001786450125300

SPUD DATE: January 27, 2013

T.D. DATE: February 15, 2013

SURFACE CASING: I-80, 244.5 mm OD, 224.0 mm ID, 59.53 kg/m, 29 joints, length

BIT #	***RR4***	***RR6***	***RR4***
SIZE (mm)	216.0	216.0	216.0
MAKE	Baker H.	Baker H.	Baker H.
TYPE	GX-20MDX1	409c	GX-20MDX1
SERIAL #	5202128	7137198	5202128
DEPTH IN	1874.20	1938.00	1960.50
DEPTH OUT	1938.00	1960.50	2001.00
METRES	63.80	22.50	40.50
HOURS	7.25	7.75	9.25
ACC. HRS.	96.50	104.25	113.50
ROP (m/hr)	8.8	2.9	4.4
FOB	13	5	15
RPM	120	55	100
PP	8500	7500	8300
DEN	1095	1085	1085
VISCOSITY	56	55	51
MAX DEV.°	3.1°	2.0°	2.0°
REMARKS	***B/G/O/RP***	***B/G/O/RP***	***B/G/O/RP***
	Tri-cone	Core 4	Tri-cone

DAILY DRILLING SUMMARY

MGM - SHELL EAST MACKAY I - 78

3001786450125300

	24:00 hrs		Drilling	ROP	Mud Properties				
Date	Depth	Progress	Hours	(m/hr)	Density	Vis	WL	pH	Operations Summary
25-Jan-13	0.0	-	-	-	-	-	-	-	Geologist returned, Akita # 37 rigged up.
26-Jan-13	0.0	-	-	-	-	-	-	-	Rigged up.
27-Jan-13	100.0	100.0	4.0	25.0	1045.0	34.0	-	-	Finished rig up, spudded at 14:00 hours, tagged cement at 21.0 m, drilled and surveyed.
28-Jan-13	395.0	295.0	12.5	23.6	1140.0	43.0	-	-	Drilled to 395.0 m, circulated hole clean, blew out top drive and kelly hosed, wiper tripped.
29-Jan-13	405.0	10.0	1.3	8.0	1160.0	66.0	-	-	Wiper tripped to surface, ran in hole, drilled to 405.0 m, surface Total Depth, circulated hole clean, tripped out, rigged up loggers, logged with Baker.
30-Jan-13	405.0	-	0.0	-	1100.0	70.0	-	-	Rigged out loggers, ran in hole, circulated and conditioned, tripped out, ran casing to 401.8 m.
31-Jan-13	405.0	0.0	0.0	-	-	-	-	-	Circulated casing, cemented casing, plugged down at 3:50 hours, rigged out cementers, removed diverter, nippled up BOP's, installed rams.
1-Feb-13	405.0	0.0	0.0	-	-	-	-	-	Nippled up BOP's, function tested BOP's, pressure tested BOP's and accumulator, modified flow T for wear bushing.
2-Feb-13	405.0	545.0	5.0	109.0	1020.0	31.0	18.0	8.0	Laid down collars, made up BHA, ran in, drilled float and shoe, FIT, 6500 kpa surface pressure, no leak off, displaced from cement water to Polymer, drilled main hole from 15:30 hours.
3-Feb-13	890.0	485.0	12.5	38.8	1035.0	38.0	11.0	9.5	Drilled and surveyed.
4-Feb-13	1260.0	370.0	13.5	27.4	1040.0	41.0	10.0	9.4	Drilled and surveyed.
5-Feb-13	1600.0	340.0	13.5	25.2	1045.0	47.0	8.0	9.5	Drilled and surveyed.
6-Feb-13	1820.0	220.0	10.3	21.5	1050.0	48.0	8.0	9.5	Drilled to Core point at 1820.0 m, circulated hole clean, blew top drive, started trip out.
7-Feb-13	1820.0	-	19.3	-	-	-	-	-	Tripped out, laid down directional tools, picked up 6 core barrels and bit, tripped in.

8-Feb-13	1834.0	14.0	5.5	2.5	1065.0	51.0	7.0	9.5	Tripped to 1820.0 m, cut core to 1834.0 m, tripped out, recovered core, began to make up core barrels, waited on replacement part of core tools.
9-Feb-13	1834.0	-	0.0	-	-	-	-	-	Laid down core tools, picked up bit and sub, ran in to 450.0 m, pulled back to circulate at shoe, pulled out of hole, made up core assembly, started running in hole.
10-Feb-13	1851.0	17.0	5.8	3.0	1050.0	60.0	7.0	9.5	Ran to bottom, washed down last stand, cut core #2 to 1851.6 m, torque dropped, jammed off, circulated bottoms up, pulled out of hole, laid down core barrel sleeves, recovered core, reassembled coring equipment, started in hole.
11-Feb-13	1871.0	20.0	6.3	3.2	1075.0	54.0	7.0	9.5	Ran in hole, circulated on bottom, cut core # 3 from 1851.6 to 1874.2 m, jammed off, pulled out of hole, laid down sleeves, recovered core.
12-Feb-13	1938.0	67.0	7.3	9.2	1075.0	56.0	7.0	9.5	Recovered core, racked back core assembly, picked up bit and collars, drilled to 1938.0 m, circulated, tripped out.
13-Feb-13	1960.0	22.0	7.0	3.1	1085.0	55.0	7.0	9.0	Picked up core assembly, tripped in, cut core.
14-Feb-13	1960.0	-	14.5	-	1080.0	51.0	7.0	9.0	Cut core to 1960.5 m at 00:45 hours, jammed off, tripped out, handled core barrels, recovered core, tripped in with drill bit, reamed from 820.0 to 1960.0 m.
15-Feb-13	2001.0	41.0	9.5	4.3	1085.0	51.0	7.0	9.0	Drilled to Total Depth at 2001.0 m, circulated, wiper tripped to 1800.0 m, circulated, tripped out, rigged up wireline tools, began log run 1.
16-Feb-13	2001.0	-	14.0	-	1075.0	80.0	6.5	9.0	Ran wireline tools to bottom, tight, stuck until 07:30 hours, pulled free, logged to surface, rigged out logging tools, tripped in with pipe to 1825.0 m, reamed to 1830.0 m.
17-Feb-13	2001.0	-	-	-	1125.0	95.0	6.0	9.0	Reamed to bottom, filled from 1992.0 to 2001.0 m, circulated, performed two wiper trips to 1800.0 m, rigged up wireline log #2, ran log #2, rigged up log #3.
18-Feb-13	2001.0	-	-	-	-	-	-	-	Ran in to 1980.0 m with image logging tools (run #3), logged up, tried to repeat at bottom, bridged at 1820.0 m, logged up to 1650.0 m, pulled out, rigged out tools, ran in with drill string, circulated and conditioned hole, tripped out, rigged up wireline log # 4.
19-Feb-13	2001.0	-	-	-	-	-	-	-	Ran FLEX-MREX log, rigged out loggers, ran in with pipe for clean out, circulated, tripped out and laid down drill pipe.

WELLSITE LOGGING REPORT

SURFACE HOLE

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*LOGGING COMPANY*	
Hole Size:	311.0	mm			**Logging Co.:**	Baker Hughes
TD Driller:	405.0	m	**Type:**	Gel-Chem	**Engineer:**	Ivan Zaleskikh
Strap:	-	m	**Density:**	1190	**Truck No.:**	Zoo8672
TD Logger:	404.0	m	**Viscosity:**	75	**Start Date:**	29-Jan-13
Casing Driller:	23.0	m	**W.L.:**	N/A	**Start Time:**	16:30 Hours
Casing Logger:	24.0	m	**pH:**	N/A	**End Date:**	30-Jan-13
Hole Condition:	Good				**End Time:**	02:00 Hours

LOGGING SEQUENCE

Run Number	Logged Interval From	To	Hours	Logs	Remarks
one	23.0	404.0	3.5	Gamma Ray, Dual Density,	logging time
				Neutron, Caliper, HDIL-SP,	
				multipole sonic	
		Total Hours:	3.5		

LOGGING OPERATIONS SUMMARY

Date	Start	End	Elapsed	Description of Operation
				Arrived at location on January 28, 2013.
	16:30	19:00	02:30	Rigged up.
	19:00	19:40	00:40	Ran in hole.
	19:40	21:00	01:20	Re-booted system, due to spurious data from a tool.
				Being used to support a centalizer.
	21:00	21:30	00:30	Repeated.
	21:30	22:30	01:00	Logged to surface.
	22:30	00:00	01:30	Washed and removed tools, produced logs.
	00:00	02:00	02:00	Rigged out, printed logs, transmitted logs.

REMARKS & COMMENTS

Tool was 2.0 m long, rig up and rig down were time consuming.

WELLSITE LOGGING REPORT

MAIN HOLE

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*LOGGING COMPANY*	
Hole Size:	222.0/216.0	mm			**Logging Co.:**	Baker Hughes
TD Driller:	2001.0	m	**Type:**	Gel-Chem	**Engineer:**	Colier - Zaleskikh
Strap:	-	m	**Density:**	1075	**Truck No.:**	Zoo8672
TD Logger:	1996.0	m	**Viscosity:**	80	**Start Date:**	15-Feb-13
Casing Driller:	401.8	m	**W.L.:**	6.5	**Start Time:**	12:00 Hours
Casing Logger:	402.2	m	**pH:**	9	**End Date:**	16-Feb-13
Hole Condition:	Poor				**End Time:**	19:00 Hours

LOGGING SEQUENCE

Run Number	Logged Interval From	To	Hours	Logs	Remarks
1	1960.0	402.0	11.0	Gamma Ray, Dual Density,	
				Neutron, Caliper, HDIL-SP,	
				multipole sonic	
	402.0	0.0		neutron, sonic, (	
		Total Hours:	11		

LOGGING OPERATIONS SUMMARY

Date	Start Time	End	Elapsed	Description of Operation
2/15/2013	23:00	24:00	1.0	Rigged up.
2/16/2013	24:00	00:30	0.5	Tested tools.
	00:30	03:00	2.5	Ran to bottom.
	03:00	07:30	4.5	Stuck at 1973.0 m.
	07:30	14:00	6.5	Logged to surface.
	14:00	16:00	2.0	Rigged out tools.
	16:00	19:00	3.0	Prepared logs.

REMARKS & COMMENTS

Tools to bottom at 1996.0 m uncorrected depth, tight on bottom, pulled up with caliper closed, stuck at 1973.0 m, pulled free, logged from 1960 to surface. Spectral Gamma failed at 600.0 m, spliced in downhole data.

WELLSITE LOGGING REPORT

MAIN HOLE

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*LOGGING COMPANY*	
Hole Size:	222.0/216.0	mm			**Logging Co.:**	Baker Hughes
TD Driller:	2001.0	m	**Type:**	Gel-Chem	**Engineer:**	Colier - Zaleskikh
Strap:	-	m	**Density:**	1125	**Truck No.:**	Zoo8672
TD Logger:	1999.0	m	**Viscosity:**	95	**Start Date:**	17-Feb-13
Casing Driller:	401.8	m	**W.L.:**	6	**Start Time:**	16:15 Hours
Casing Logger:	402.2	m	**pH:**	9	**End Date:**	17-Feb-13
Hole Condition:	Good				**End Time:**	22:00 Hours

LOGGING SEQUENCE

Run Number	Logged Interval From	To	Hours	Logs	Remarks
2	1999.0	1600.0	3.0	Spectral Gamma Ray,	
				HDIL-SP,	
				multipole sonic	
	402.0	0.0		Gamma Ray, soni	
		Total Hours:	3		

LOGGING OPERATIONS SUMMARY

Date	Start Time	End	Elapsed	Description of Operation
2/17/2013	16:15	17:15	1.00	Rigged up.
	17:15	17:30	0.25	Tested tools.
	17:30	18:15	0.75	Ran to bottom.
	18:15	21:00	2.75	Logged to surface.
	21:00	22:00	6.50	Rigged out tools.

REMARKS & COMMENTS

Good logging run, no problems. The logs were run from Total Depth to 1600.0 m to collect data from the bottom of the well that was missed on the first run.

WELLSITE LOGGING REPORT

MAIN HOLE

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*LOGGING COMPANY*	
Hole Size:	222.0/216.0	mm			**Logging Co.:**	Baker Hughes
TD Driller:	2001.0	m	**Type:**	Gel-Chem	**Engineer:**	Colier - Zaleskikh
Strap:	-	m	**Density:**	1120	**Truck No.:**	Zoo8672
TD Logger:	1980.0	m	**Viscosity:**	90	**Start Date:**	17-Feb-13
Casing Driller:	401.8	m	**W.L.:**	6	**Start Time:**	21:45 Hours
Casing Logger:	402.2	m	**pH:**	9	**End Date:**	18-Feb-13
Hole Condition:	Poor				**End Time:**	05:00 Hours

LOGGING SEQUENCE

Run Number	Logged Interval From	To	Hours	Logs	Remarks
3	1980.0	1650.0	3.0	Spectral Gamma Ray,	
				STAR/CBIL (image logs)	
		Total Hours:	3		

LOGGING OPERATIONS SUMMARY

Date	Start Time	End	Elapsed	Description of Operation
2/17/2013	21:45	22:15	0.50	Rigged up.
	22:15	22:30	0.25	Tested tools.
	22:30	23:45	0.75	Ran to bottom.
	23:45	24:00	0.25	Began logging.
2/18/2013	00:00	0:30	0.50	Finished repeat (1925.0 to 1820.0 m)
	0:30	4:00	3.50	Logged well, attempted to return to bottom,
				bridged 1820.0 m.
	4:00	5:00	1.00	Rigged out tools.

REMARKS & COMMENTS

Hit bottom fill at 1980.0 m, logged up. Hit a bridge at 1820.0 m while trying to return to bottom to get another pass.

WELLSITE LOGGING REPORT

MAIN HOLE

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*LOGGING COMPANY*	
Hole Size:	222.0/216.0	mm			**Logging Co.:**	Baker Hughes
TD Driller:	2001.0	m	**Type:**	Gel-Chem	**Engineer:**	Colier - Zaleskikh
Strap:	-	m	**Density:**	1130	**Truck No.:**	Zoo8672
TD Logger:	1980.0	m	**Viscosity:**	100	**Start Date:**	18-Feb-13
Casing Driller:	401.8	m	**W.L.:**	6	**Start Time:**	22:15 Hours
Casing Logger:	402.2	m	**pH:**	9	**End Date:**	19-Feb-13
Hole Condition:	Good				**End Time:**	06:15 Hours

LOGGING SEQUENCE

Run Number	Logged Interval From	To	Hours	Logs	Remarks
4	1980.0	1815.0	4.3	Spectral GR, FLEX - MREX	
	1450.0	1385.0	0.5	Spectral GR, FLEX - MREX	
		Total Hours:	4.75		

LOGGING OPERATIONS SUMMARY

Date	Start Time	End	Elapsed	Description of Operation
2/18/2013	22:15	23:00	0.75	Rigged up.
	23:00	23:15	0.25	Tested tools.
	23:15	24:00	0.75	Ran in to 1980.0 m.
2/18/2013	00:00	02:00	2.00	Main pass.
	02:00	03:15	1.25	Finish repeat.
	03:15	04:45	1.50	Logged upper section, pulled to surface.
	04:00	06:15	1.50	Rigged out tools.

REMARKS & COMMENTS

Did not attempt to tag bottom, stopped running in at 1980.0 m and began logging up.

WELLSITE CORING REPORT

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*CORING COMPANY*	
Hole Size:	216.0	mm			**Coring Co.:**	Baker Hughes
Top Core:	1820.0	m	**Type:**	Gel-Chem	**Core Driller:**	Richard Rooney
Bottom Core:	1834.0	m	**Density:**	1065	**Core Driller.:**	Jeremy Leavitt
Interval :	14.0	m	**Viscosity:**	51	**Start Date:**	8-Feb-13
Recovery:	12.7	m	**W.L.:**	7	**Start Time:**	01:30 Hours
Sleeved:	Yes	m	**pH:**	9.5	**End Date:**	8-Feb-13
Hole Condition:	Good				**End Time:**	06:45 Hours

CORING SEQUENCE

Run Number	Core Interval From	To	Hours	Cut / Recovery	Core Bit
1	1820.0	1834.0	5.5	Cut 14.0 m, recovered 12.7 m.	BHC606c
		Total Hours:	5.5		

CORING OPERATIONS SUMMARY

Date	Start	End	Elapsed	Description of Operation
07 Feb 13	10:00	15:00	5.00	Made up 54.0 m core barrel assembly, and bit.
07 Feb 13	15:00	00:00	9.00	Slipped and cut, ran in.
08 Feb 13	00:00	01:30	1.50	Ran to bottom.
	01:30	05:50	3.30	Cut core.
	05:50	05:55	0.10	Rig powered off, no coring, pumps off.
	05:55	07:00	1.10	Cored, jammed off.
	07:00	09:00	2.00	Circulated.
	09:00	15:30	6.50	Pulled out of hole.
	15:30	20:30	5.00	Handled core barrels, recovered core, inspected bit.

REMARKS & COMMENTS

The core was cut into 1.5 m sections, chip sampled and packed in a transport box in a temperature controlled reefer van to prevent freezing.

WELLSITE CORING REPORT

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*CORING COMPANY*	
Hole Size:	216.0	mm			**Coring Co.:**	Baker Hughes
Top Core:	1834.0	m	**Type:**	Gel-Chem	**Core Driller:**	Richard Rooney
Bottom Core:	1851.6	m	**Density:**	1070	**Core Driller.:**	Jeremy Leavitt
Interval :	17.6	m	**Viscosity:**	57	**Start Date:**	10-Feb-13
Recovery:	17.3	m	**W.L.:**	7	**Start Time:**	02:45 Hours
Sleeved:	Yes	m	**pH:**	9.5	**End Date:**	10-Feb-13
Hole Condition:	Good				**End Time:**	08:30 Hours

CORING SEQUENCE

Run Number	Cored Interval From	To	Hours	Cut / Recovery	Core Bit
2	1834.0	1851.6	5.75	Cut 17.6 m, recovered 17.3 m.	RR- BHC606c
		Total Hours:	5.75		

CORING OPERATIONS SUMMARY

Date	Start	End	Elapsed	Description of Operation
09 Feb 13	14:45	20:00	5.25	Made up 54.0 m core barrel assembly, and bit.
09 Feb 13	20:00	24.00	4.00	Ran in.
10 Feb 13	0:00	2:45	2.75	Ran to bottom, circulated clean.
	2:45	8:30	5.75	Cut core, jammed off.
	8:30	17:00	8.50	Pulled out of hole.
	17:00	20:00	3.00	Laid down core sleeves, recovered core.

REMARKS & COMMENTS

The core was cut into 1.5 m sections, chip sampled and packed in a transport box in a temperature controlled reefer van to prevent freezing.

WELLSITE CORING REPORT

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*CORING COMPANY*	
Hole Size:	216.0	mm			**Coring Co.:**	Baker Hughes
Top Core:	1851.6	m	**Type:**	Gel-Chem	**Core Driller:**	Richard Rooney
Bottom Core:	1874.2	m	**Density:**	1075	**Core Driller.:**	Jeremy Leavitt
Interval :	22.6	m	**Viscosity:**	54	**Start Date:**	11-Feb-13
Recovery:	21.4	m	**W.L.:**	7	**Start Time:**	07:15 Hours
Sleeved:	Yes	m	**pH:**	9.5	**End Date:**	11-Feb-13
Hole Condition:	Good				**End Time:**	13:30 Hours

CORING SEQUENCE

Run Number	Cored Interval From	To	Hours	Cut / Recovery	Core Bit
3	1851.6	1874.2	6.25	Cut 22.6 m, recovered 21.4 m.	BHC409c
		Total Hours:	6.25		

CORING OPERATIONS SUMMARY

Date	Start	End	Elapsed	Description of Operation
10 Feb 13	20:00	24:00	5.25	Made up 54.0 m core barrel assembly, and started in.
11 Feb 13	00:00	07:15	7.25	Ran to bottom, circulated clean.
	07:15	13:30	6.25	Cut 22.6 m, jammed off.
	13:30	23:00	9.50	Pulled out of hole.
	23:00	24:00	1.00	Laid down core.
	00:00	02:00	2.00	Recovered core.
	02:00	03:00	1.00	Removed core assembly.

REMARKS & COMMENTS

The core was cut into 1.5 m sections, chip sampled and packed in a transport box in a temperature controlled reefer van to prevent freezing. Core assembly was racked back and a drilling assembly installed to drill to the next core point.

WELLSITE CORING REPORT

MGM - SHELL EAST MACKAY I - 78

3001786450125300

HOLE DATA			*MUD DATA*		*CORING COMPANY*	
Hole Size:	216.0	mm			**Coring Co.:**	Baker Hughes
Top Core:	1938.0	m	**Type:**	Gel-Chem	**Core Driller:**	Richard Rooney
Bottom Core:	1960.5	m	**Density:**	1085	**Core Driller.:**	Jeremy Leavitt
Interval :	22.5	m	**Viscosity:**	55	**Start Date:**	13-Feb-13
Recovery:	21.5	m	**W.L.:**	7	**Start Time:**	16:45 Hours
Sleeved:	yes	m	**pH:**	9	**End Date:**	14-Feb-13
Hole Condition:	good				**End Time:**	00:45 Hours

CORING SEQUENCE

Run Number	Cored Interval From	To	Hours	Cut / Recovery	Core Bit
4	1938.0	1960.5	7.75	Cut 22.5 m, recovered 21.5 m.	BHC409c
		Total Hours:	7.75		

CORING OPERATIONS SUMMARY

Date	Start	End	Elapsed	Description of Operation
13 Feb 13	04:00	08:30	4.50	Made up 54.0 m core barrel assembly.
	08:30	16:45	8.25	Ran to bottom, circulated clean.
	16:45	24:00	7.25	Cut core.
14 Feb 13	00:00	00:45	0.75	Cut core, jammed off.
	00:45	09:00	8.25	Tripped out with core.
	09:00	13:00	4.00	Handled core barrels and recovered core.

REMARKS & COMMENTS

The core was cut into 1.5 m sections, chip sampled and packed in a transport box in a temperature controlled reefer van to prevent freezing.

WELL SUMMARY AND FORMATION EVALUATIONS

MGM SHELL EAST MACKAY I – 78
3001786450125300

The hole was drilled to test for oil in the Canol and Bluefish formations. Total Depth was 2001.0 m, in the Hume Formation.

A rathole was drilled on January 17, 2013 with a rathole rig, setting a conductor to 18.0 m, with samples collected at 2.5 m intervals. Permafrost was observed at the 5.0 m depth.

The well was spudded with Akita 37 on January 27, 2013 with a 311.0 mm insert bit and drilled with water and mud to surface casing depth at 405.0 m on January 29, 2013. Surface hole was logged with Baker Hughes in one run. Casing size was 244.0 mm, (9 5/8”), landed at 401.8 m. It was cemented on January 31, 2013.

BOPs were installed and tested and the main hole was started on February 1, 2013 with a 222.0 mm PDC bit. It was drilled to core point at 1820.0 m. The pipe was tripped and a 54.0 m coring assembly installed. Core run number 1 was done on February 8, 2013 and cut from 1820.0 to 1834.0 m with a 12.7 m recovery. Core number 2 was cut on February 10, 2013 from 1834.0 to 1851.6 m, with a 17.3 m recovery. Core number 3 was cut on February 11, 2013 from 1851.6 to 1874.2 m with a 21.4 m recovery. The coring was done with 216.0 mm bits. The hole was drilled from the end of core 3 to the start of core 4 at 1938.0 m with a 216.0 mm tricone bit. The final core was cut from 1938.0 to 1960.5 m, with a 21.5 m recovery. This core ended in the Hume Formation. The hole was drilled to a final Total Depth of 2001.0 m on February 15, 2013 at 09:45 hours.

The first wireline log, a quad combo, was run to bottom, encountered tight hole when the calipers were opened. Calipers were closed, pulled up to 1972.0 m, and the tools stuck there for a few hours until pulling free. The calipers were opened about 1965.0 m, and the log was run to surface. Data was not collected near the bottom of the well. A cleanout trip was done and the mud weight increased. The second log run, consisting of sonic, induction and spectral Gamma, had no problems. A third run with imaging tools reached 1980.0 m, logged to 1650.0 m, returned to bottom for a repeat and encountered a bridge at 1820.0 m. The log run was completed and a cleanout trip was run with drill pipe. A planned run with neutron and density tools was cancelled because most of the hole had been covered with the first run. The final logging run was the Flex-MREX with spectral Gamma over the Bluefish, Canol and Slater River radioactive shale. The hole was cased and cemented prior to completion operations.

Samples were caught from surface, beginning with the conductor hole, to Total Depth at 2001.0 m. A Continental gas detector and chromatograph were run from 25.0 m to Total Depth. The hole was drilled with Akita Drilling rig 37, supervised by Guy Cusitar and Cody Hart. Baker Hughes directional tools and pulsed Gamma were used from 405.0 to 1820.0 m to keep the hole vertical and to provide Gamma data to correlate with offset well I-77. Baker Hughes logged the hole at surface casing depth and at final Total Depth with wireline tools. Baker Hughes core drillers Richard Rooney and Jeremy Leavitt cut four cores. Continental mudloggers Nouman Afzal and Ukeme Dan collected isotube samples from 50.0 m to 1750.0 m at 50.0 m intervals, and 10.0 m intervals from 1820.0 to 2000.0 m. The drilling supervisors were Trevor Mitchell and Jason Duckworth. John Williams was the on-site drilling superintendent. Shell Canada on-site representatives Andrew Hyde and Nathan Tuckwell assisted with handling of the core. MGM chief geologist Paul Price was on site to pick core points and supervise the coring operation.

FORMATION EVALUATIONS

OVERBURDEN

The first few metres from surface is a fine to medium grained sand. This is underlain by silty clay with abundant black organic matter. The clay and organics are frozen, indicating permafrost.

TERTIARY, SUMMIT CREEK 12.5 m KB, 6.5 m below ground surface

The Summit Creek Formation is a mixture of interbedded fine to medium grained, silica cemented, quartz sandstone, quartz siltstone and mudstone. There are thin coal seams in the mudstone between 25.0 and 30.0 m.

CRETACEOUS, EAST FORK 129.0 m KB, 32.0 m SS

The East Fork Formation is a mudstone with interbedded siltstone and sandstone. The sandstone is predominantly fine to medium grained quartz with minor chert and lithic grains. There is silica cement, some calcareous cement, and generally a silty matrix. Porosity is estimated at 6 to 12%. The siltstone is moderately consolidated, slightly calcareous, composed of quartz with minor lithic content and a clay matrix. Porosity is estimated at trace to 3%, with some 3 to 6% porosity. The mudstone is medium grey, firm, moderately consolidated, and very slightly micromicaceous. The samples to 600.0 m contained soft clay that washed away during the washing process indicating the mudstone is plastic and soft in water.

There is a thin marlstone at 195.0 m. There is a sandstone at 300.0 m with a chert conglomerate at the base. Porosity is estimated at 6 to 12%. The sand is underlain by soft mudstone. There is a fine to medium grained sandstone from 360.0 to approximately 390.0 m. Surface casing was set at 402.0 m. The interval from 440.0 to 550 m is predominantly fine to medium grained quartz and chert sandstone with 6 to 12% porosity. A fine to coarse grained sandstone occurs from 605.0 to 620.0 m with 5 to 8% porosity. This is underlain by interbedded sandstone and medium grey siltstone and shale. There is a very fine to fine grained sandstone from 660.0 to 680.0 m with 5 to 8% porosity. This is underlain by medium grey mudstone with interbedded siltstone and sandstone lenses to the top of the Little Bear Formation.

Gas readings were very low in the East Fork Formation. The gas detector zero base line drifted from –5 to 12 units. There were a few short intervals from 300.0 to 400.0 m of 12 to 20 units. From 400.0 to 625.0 m the gas background was 20 to 50 units. From 625.0 m to the top of the Little Bear the gas readings were 10 to 20 units. Several butane tests were performed to ensure the gas detector was functioning properly.

LITTLE BEAR 764.0 m KB, -603.0 m SS

The Little Bear Formation is a series of thick sandstones separated by thick sequences of mudstone with some siltstone and sandstone beds. The upper sandstone occurs from 764.0 m to 865.0 m with minor mudstone intervals. The sandstone is predominantly fine grained with some medium grains. It is composed of quartz with some grey to black chert. There are localized chert beds of very coarse grains and granules to small pebbles. The grains are generally loose in sample with a few consolidated chips. Silica is the main cementing agent with some clay matrix. Porosity is estimated at 6 to 12% with some 8 to 14% beds. The sandstone is underlain by medium grey mudstone with some sandstone to the top of the Little Bear Middle Sandstone.

Gas readings were 10 to 20 units.

The Little Bear Middle Sandstone occurs from 887.0 to 990.0 m with minor interbedded mudstone. The sandstone varies from fine to medium grained, to very fine to fine grained, in what may be coarsening upward cycles. It is mainly quartz with some black chert giving a salt and pepper appearance. There is a clay to silt matrix and 6 to 12% porosity. There is interbedded sandstone, mudstone and siltstone to the top of the Lower Little Bear Sandstone.

Gas readings were 10 to 15 units from 890.0 to 1000.0 m, then gradually increased into the 20 to 30 range from 1000.0 to 1160.0 m.

The Lower Little Bear Sandstone occurs from 1161.0 to 1184.0 m. It is fine to coarse grained at the top, decreasing in grain size with depth to very fine grained, in a coarsening upward sequence. It is quartz and dark chert at the top, becoming quartzose and argillaceous at the base. It has silica cementation, a clay matrix, 6 to 12% porosity, decreasing to 5 to 8% porosity at the base. This sandstone is underlain by mudstone with interbedded sandstone to the top of the Slater River Formation.

Gas readings were 20 to 30 units.

SLATER RIVER 1188.0 m KB, -1027.0 m SS

The Slater River Formation is predominantly mudstone. It is medium grey, blocky, micromicaceous, locally silty with some interbedded argillaceous siltstone and very fine grained quartz sandstone. The mudstone grades from medium to dark grey, and becomes increasingly hard towards the top of the radioactive shale bed. It appears to grade from mudstone to shale between 1360.0 and 1400.0 m. The mudstone – shale contains some greyish brown silicified or sideritic lenses.

Gas readings were 20 to 40 units from 1190.0 to 1300.0 m, 40 to 80 units from 1300.0 to 1350.0 m, and 60 to 120 units from 1350.0 to 1400.0 m.

The Slater River Radioactive Shale is very dark grey, becoming greyish brown in part. It is firm to hard, micromicaceous, platy, slightly fissile, has traces of pyrite and locally white phosphatic specks. There are trace amounts of bluish grey clay that may be phosphatic. There are minor silty and sandy lenses and rare fossil fragments.

Gas readings peaked at 550 units, and had a background of 300 to 400 units.

ARCTIC RED FORMATION 1434.0 m KB, -1273.0 m SS

The Arctic Red is a silty shale grading to an argillaceous siltstone with minor very fine grained sandstone lenses.

Gas readings were 150 to 220 units.

DEVONIAN, IMPERIAL FORMATION 1482.0 m KB, -1321.0 m SS

The Imperial Formation is a buff coloured quartz siltstone, grading locally to very fine grained quartz sandstone, with trace lithic content and scattered very fine carbonaceous flakes and inclusions. There is a clay matrix and 3 to 6% porosity. It is slightly calcareous and has some thin shale beds. Dark grey shale beds are present toward the base of the formation.

Gas readings were 60 to 140 units. The highest readings are in the dark shales at the base of the formation.

CANYON SANDSTONE 1700.0 m KB, -1539.0 m SS

At this location the Canyon Sandstone is a buff coloured siltstone. It is a moderately consolidated quartz silt with silica cementation, slightly calcareous with a clay matrix, trace black carbonaceous specks and 3 to 6% porosity. It is underlain by dark grey, platy, firm, micromicaceous shale. There is a high Gamma shale marker bed from 1761.0 to 1776.0 m KB, (-1600.0 to -1615.0 m subsea) with a dark grey to greyish brown colouration. This is underlain by medium to dark grey, fissile shale with a slightly waxy appearance. The shale becomes dark to very dark grey toward the top of the Canol. The last few metres were seen in core. They are dark grey, brittle, slightly carbonaceous, moderately siliceous, with traces of pyrite.

The gas readings were 50 to 80 units in the siltstone and 80 to 160 units in the shale. The gas trap was serviced and some information lost from 1800.0 to 1820.0 m.

CANOL FORMATION 1820.0 m KB, -1659.0 m SS

The Canol Formation was encountered at 1820.0 m and cored in three core runs to 1874.0 m with good recovery. The core was sleeved, and samples were taken where the sleeves were cut into 1.5 m lengths for transport. It is a dark grey to brownish grey, hard, siliceous shale. The core was dry, with only one instance of bleeding oil from a microfracture. Sample chips of core all gave a bright white cut, and most chips had a dull brown fluorescence. The bleeding oil had a yellow fluorescence. Finely disseminated pyrite was common, and may be associated with a sulphurous odour from the core. Hairline and slightly wider fractures filled with white calcite were common. There was no evidence of fracture porosity except for the trace of oil. The core appears carbonaceous, but may instead be bituminous. There were rare chips with some dry black bitumen. The 1.5 m lengths of sleeved core were stored in a temperature controlled van to keep them above freezing temperature. The rubber end caps bulged on some of the pieces indicating degassing of the core. Gas readings while coring were 100 to 150 units. The best gas was seen from 1839.0 to 1851.0 with shows of 210 and 290 units.

The Canol was drilled with a tricone bit from 1874.0 m to the top of the Hare Indian at 1918.0 m. This interval was very similar to the core, with sample chips producing a milky streaming cut and a yellow ring cut. Gas readings were in the 100 to 150 units range, with 150 to 200 units from 1884.0 to 1889.0 m.

HARE INDIAN 1918.0 m KB, -1757.0 m SS

The Hare Indian Formation is a dark grey, slightly carbonaceous shale with a slow streaming milky cut, pyrite nodules or pyrite fracture infill, and traces of calcite filled micro fractures.

The gas readings were 100 to 150 units.

BLUEFISH 1937.0 m KB, -1776.0 m SS

The Bluefish Formation was cored from 1938.0 m to the top of the Hume. Small samples were taken at 1.5 m intervals, where the core was cut for shipment. It is a dark grey, firm, slightly siliceous, slightly carbonaceous or bituminous shale with local calcite filled fractures and traces of pyrite. Small fossil fragments and fossil moulds are present on bedding surfaces and in thin beds. It has some weak brown fluorescence and a streaming milky cut. There are some interbedded chalky limestone beds with bitumen staining.

Gas readings were low, in the 40 to 80 unit range.

HUME 1957.0 m KB, -1796.0 m SS

The upper 3.0 m of the Hume Formation were recovered at the bottom of the fourth core. The upper 3.0 m is a slightly translucent, tan coloured microcrystalline limestone. It grades locally to very fine and finely crystalline. In the uppermost metre some pinpoint vugs are present with traces of soft black bitumen. There is trace local tan oil staining, no to local faint yellow fluorescence and a faint milky cut.

The limestone was drilled from 1960.0 m to Total Depth at 2001.0 m. It grades from microcrystalline to cryptocrystalline with depth and becomes chalky and less indurated. There is rare tan oil stain, no fluorescence and a very faint milky cut. There are traces of calcite filled microfractures.

LITHOLOGICAL DESCRIPTIONS

MGM SHELL EAST MACKAY I – 78
3001786450125300

CORE DESCRIPTIONS

CORE 1, February 8, 2013: cut 1820.0 to 1834.0 m, 14.0 m in 5.5 hours. Recovery 12.7 m

Note: sleeved core, cut and sampled at 1.5 m intervals.

1820 m — **SHALE**: dark grey, slightly carbonaceous, well consolidated, firm to hard, pyrite on subvertical to vertical fracture, conchoidal fracture, siliceous, no stain, no fluorescence, slow streaming milky cut.

1821.5 m — **SHALE**: dark grey, slightly carbonaceous, hard, brittle, siliceous, slightly micromicaceous, no stain, no fluorescence, slow streaming milky cut.

1823.2 m — **SHALE**: dark grey, slightly carbonaceous, hard, brittle, siliceous, no stain, no fluorescence, weak to moderate white cut.

1824.7 m — **SHALE**: dark grey, brittle, hard, siliceous, slightly carbonaceous, 2.0 to 3.0 mm disseminated pyrite lamina, minor pyrite on subvertical fracture surface, no stain, no fluorescence, weak to moderate white cut,

1826.2 m — **SHALE**: dark grey, hard, brittle, siliceous, slightly carbonaceous, trace pyrite along bedding plane, conchoidal fracture, no stain, no fluorescence, weak to moderate white cut.

1827.7 m — **SHALE**: dark grey, hard, brittle, siliceous, slightly carbonaceous, conchoidal fracture, very slightly micromicaceous, no stain, no fluorescence, weak to moderate white cut.

1829.2 m — **SHALE**: dark grey, hard, brittle, siliceous, slightly carbonaceous, conchoidal fracture, trace pyrite, no stain, no fluorescence, weak milky streaming cut.

1830.7 m — **SHALE**: dark grey, slightly brown grey, hard, brittle, siliceous, slightly carbonaceous, scattered pyrite on fracture plane, no fluorescence, no stain, weak to moderate milky cut.

1832.2 m — **SHALE**: dark grey, slightly brown, hard, brittle, siliceous, slightly carbonaceous, conchoidal fracture; no fluorescence, no stain, moderate milky cut.

1832.7 m — **SHALE**: dark grey, slightly brown, hard, brittle, siliceous, slightly carbonaceous, scattered disseminated, pyrite, no fluorescence, no stain, moderate milky cut.

No Core 1832.7 to 1834 m, core shoe jammed with rubble chips.

CORE 2, February 10, 2013: cut 1834.0 to 1851.6 m, 17.6 m in 5.75 hours. Recovery 17.3 m

1834 m — **SHALE**: dark grey, slightly micromicaceous, hard, brittle, siliceous, slightly carbonaceous, trace scattered pyrite, no stain, no fluorescence, slow moderate white cut.

1835.5 m **SHALE**: dark grey, slightly micromicaceous, hard, brittle, siliceous, common scattered pyrite needles, slightly carbonaceous, no stain, no fluorescence, strong white cut.

1837 m **SHALE**: dark grey, slightly micromicaceous, hard, brittle, siliceous, trace scattered pyrite needles, slightly carbonaceous, trace bitumen replacing microfossils, trace moldic porosity, no stain, strong fast white cut, sulphurous odour.

1838.5 m **SHALE**: dark grey, brittle, siliceous, slightly carbonaceous, trace disseminated pyrite, fissile, platy, slightly sulphurous odour, no stain, no fluorescence, strong milky cut.

1840 m **SHALE**: dark grey, hard, slightly micromicaceous, slightly carbonaceous, siliceous, pyrite in a 2.0 to 3.0 mm lamina, no stain, no fluorescence, strong milky cut, sulphurous odour.

1841.7 m **SHALE**: dark grey, hard, platy, fissile, siliceous, trace calcite on vertical fracture surface, slightly carbonaceous, trace scattered pyrite, no staining, dull brown fluorescence, slow white streaming cut, weak sulphurous odour.

1843.2 m **SHALE**: dark grey, platy, fissile, hard, siliceous, slightly carbonaceous, trace pyrite, no staining, dull brown fluorescence, slow milky cut.

1844.7 m **SHALE**: dark grey, micromicaceous, hard, siliceous, platy, slightly carbonaceous, no staining, dull brown fluorescence, slow milky cut.

1846.2 m **SHALE**: dark grey, hard, siliceous, platy, common scattered micro-pyrite, no stain, dull brown fluorescence, moderate milky cut, sulphurous odour.

1847.7 m **SHALE**: dark grey, hard, siliceous, slightly micromicaceous, no stain, dull brown fluorescence, slow milky cut, sulphurous odour.

Note: the milky cut dries to a pale yellow ring cut.

1849.2 m **SHALE**: dark grey, hard, siliceous, slightly micromicaceous, trace calcite on vertical fracture surfaces, no stain, dull brown fluorescence, moderate to strong white milky cut.

1850.7 m **SHALE**: dark grey, micromicaceous, hard, siliceous, slightly carbonaceous, trace pyrite, trace pyrite replacing a fossil, no stain, dull brown fluorescence, moderate milky cut, moderate sulphurous odour.

1851.3 m **SHALE**: dark grey, micromicaceous, hard, siliceous, slightly carbonaceous, possible slickensides, local rugose bedding surface or possible pressure solution, microscopic scattered pyrite, no staining, dull brown fluorescence, moderate to strong white cut, weak sulphurous odour.

CORE 3, February 11, 2013: cut 1851.6 to 1874.2 m, 22.6 m in 6.75 hours. Recovery 21.4 m

1853.1 m **SHALE**: dark grey, hard, brittle, siliceous, slightly carbonaceous, scattered micro-pyrite, no visible stain, weak dull brown fluorescence, weak sulphurous odour, bright white streaming cut.

1854.3 m **SHALE**: dark grey, slightly micromicaceous, hard, brittle, siliceous, slightly carbonaceous, no visible stain, dull dark brown fluorescence, no sulphurous odour, bright white streaming cut.

1855.8 m **SHALE**: dark grey, hard, siliceous, slightly carbonaceous, micromicaceous, no visible stain, medium brown fluorescence, no sulphurous odour, bright white streaming cut.

Note: white cut dries to a pale yellow ring cut.

1857.3 m **SHALE**: dark grey, hard, brittle, slightly micromicaceous, siliceous, slightly carbonaceous, no visible stain, dull brown fluorescence, no sulphur odour, bright white streaming cut.

1858.8 m **SHALE**: dark grey, hard, slightly micromicaceous, siliceous, slightly carbonaceous, calcite coating on subvertical fracture, calcite and/or dolomite on horizontal bedding surfaces, trace very fine granular pyrite in very thin horizontal beds, no visible stain, dull brown fluorescence, weak sulphurous odour, bright white streaming cut.

1860.3 m **SHALE**: dark grey, hard, siliceous, conchoidal fracture, slightly carbonaceous, minor thin bedding-parallel pyrite seams, no visible stain, even medium brown fluorescence, weak sulphurous odour, bright white streaming cut.

1861.8 m **SHALE**: dark grey, hard, siliceous, micromicaceous, abundant very fine disseminated pyrite. Slightly carbonaceous, no visible stain, dull brown fluorescence, weak sulphurous odour, bright white streaming cut.

1863.4 m **SHALE**: dark grey, hard, siliceous, slightly carbonaceous, slightly micromicaceous, finely crystalline calcite on subvertical fracture, trace bleeding oil on a tight fracture, oil has a dark yellow fluorescence, no visible stain on shale, even medium brown fluorescence, no sulphurous odour, bright white streaming cut.

1864.9 m **SHALE**: dark grey, hard, siliceous, siliceous, slightly carbonaceous, common very fine disseminated pyrite, one subvertical calcite lined hairline fracture, dull brown fluorescence, weak sulphurous odour, bright white streaming cut.

1866.4 m **SHALE**: dark grey, hard, siliceous, conchoidal fracture, one calcite lined hairline fracture, minor disseminated pyrite, dull brown fluorescence, weak sulphurous odour, bright white streaming cut.

1867.9 m **SHALE**: dark grey, hard, siliceous, conchoidal fracture, slightly carbonaceous, common very fine disseminated pyrite, no visible staining, weak dull brown fluorescence, slightly sulphurous odour, bright white milky streaming cut.

1869.4 m **SHALE**: dark grey, hard, siliceous, slightly carbonaceous, common micro disseminated pyrite, trace calcite along possible subvertical fracture, no visible stain, possible dull brown fluorescence, weak sulphurous odour, slow bright white streaming milky cut.

1870.9 m **SHALE**: dark grey, hard, siliceous, slightly carbonaceous, minor micro scattered pyrite, one vertical hairline fracture no calcite coating possibly mechanically

fractured, no visible stain, slow streaming milky cut.

1872.4 m **SHALE**: dark grey, hard, siliceous, slightly carbonaceous, slightly micromicaceous, minor scattered micro-pyrite, no visible stain, dull dark brown fluorescence, slow streaming milky cut.

1873 m **SHALE**: dark grey, hard, siliceous, slightly carbonaceous, no visible stain, possible weak dull brown fluorescence, no fluorescence, no sulphurous odour, slow streaming milky cut.

CORE 4, February 13, 2013: cut 1938.0 to 1960.5 m, 22.5 m in 7.75 hours. Recovery 21.5 m.

1938 m **SHALE**: dark grey, firm, slightly ductile, slightly micromicaceous, platy, fissile, possible dull fluorescence, faint milky cut.

1939.5 m **SHALE**: dark grey, slightly micromicaceous, firm to hard, slightly silicified, slightly carbonaceous, scattered pyrite cubes to 2.0 mm, numerous black glassy inclusions, trace calcite filled hairline fractures, no visible stain, possible dull fluorescence, moderate streaming cut.

1940.8 m **SHALE**: dark grey, fissile, firm, slightly silicified, carbonaceous, slightly carbonaceous, no visible stain, no fluorescence, moderate streaming milky cut.

1942.8 m **LIMESTONE**: medium grey, microcrystalline, slightly translucent, abundant interstitial bitumen, bitumen stain, no fluorescence, moderate streaming milky cut.

1943.8 m **SHALE**: dark grey, firm to hard, slightly silicified, platy, fissile, no visible stain, no fluorescence, moderate streaming milky cut.

1945.3 m **SHALE**: dark grey, firm to hard, slightly brittle, slightly silicified, slightly carbonaceous, trace pyrite, no visible stain, no fluorescence, moderate streaming milky cut.

1946.8 m **SHALE**: dark grey, fissile, firm to hard, slightly silicified, moderately carbonaceous, polished surfaces possible slickensides, trace calcite fracture coating, no visible stain, medium brown fluorescence, slow to moderate streaming milky cut.

1948.3 m **SHALE**: dark grey, firm to hard, slightly silicified, moderately carbonaceous, slightly micromicaceous, fissile, numerous fossil moulds, no stain, medium brown fluorescence, moderate streaming milky cut.

1950 m **SHALE**: dark grey, firm to hard, fissile, platy, trace calcite filled micro fracture, some limestone lenses in the shale, no visible stain, no fluorescence, slow to moderate streaming milky cut.

1951.5 m **SHALE**: dark grey, firm to hard, slightly silicified, fissile, slightly carbonaceous, trace pyrite cubes, common fossil moulds, no stain, no fluorescence, slow to moderate streaming milky cut.

1953 m **SHALE**: dark grey, firm to hard, slightly silicified, slightly carbonaceous, calcareous beds, common fossil moulds, no stain, no fluorescence, slow to

moderate streaming milky cut.

1954.5 m **SHALE**: dark grey, firm to hard, fissile, slightly silicified, slightly carbonaceous, no stain, possible weak fluorescence, slow to moderate streaming milky cut.

1956 m **SHALE**: dark grey, firm, fissile, slightly silicified, slightly carbonaceous, microcrystalline calcareous beds of fossil fragments, no stain, no fluorescence, slow to moderate streaming milky cut.

1957.5 m **LIMESTONE**: tan, light brown, very fine to finely crystalline, slightly translucent, dense, faint fossil fragments, rare specks of soft bitumen, trace soft bitumen in vugs, trace pinpoint to vuggy porosity, 2 to 3% porosity, spotty yellow fluorescence, faint milky cut.

1958.5 m **LIMESTONE**: medium grey, grey to brown, microcrystalline, slightly translucent, hard, one calcite filled hairline fracture, black fracture surface, bitumen stain, no fluorescence, faint milky cut.

1959.5 m **LIMESTONE**: tan, microcrystalline, slightly translucent, hard, trace calcite filled micro fracture, trace fracture surface with very fine white calcite crystals, trace fossil fragments, possible tan oil stain, no fluorescence, faint milky cut.

LITHOLOGICAL DESCRIPTIONS

MGM SHELL EAST MACKAY I – 78
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SAMPLE DESCRIPTIONS

2.5 m	**SAND**: salt and pepper, predominantly fine to medium grained, minor coarse grained, subrounded to subangular, poorly sorted, silt matrix, quartz, chert, minor lithic grains, loose, estimated 20% porosity.
5 m	**CLAY**: light grey, dense, slightly gritty to silty texture, soft, abundant firm black organic material. Note: Material is frozen with pieces of ice present, permafrost.
7.5 m	**SANDSTONE/SILTSTONE**: very light to light grey, finely banded, very fine to fine grained, common silt, subrounded, moderately sorted, quartz, minor chert, minor lithic grains, weakly consolidated, trace mica flakes, clay to silt matrix, 6 to 10% porosity. Bedrock.
10 m	**SILTSTONE/SANDSTONE**: light grey, quartz silt, grading to lower very fine grained, minor upper very fine grained, moderately sorted, quartz, trace lithic grains, clay matrix, 6 to 10% porosity.
12.5 m	**SANDSTONE**: salt and pepper, predominantly upper fine to upper medium grained, subrounded to subangular, moderately to well sorted, quartz, dark chert, minor lithic grains, trace pink chert, weakly consolidated, minor silica cement, silt matrix, clean, 15 to 18% porosity.
15 m	**SILTSTONE**: light grey, quartz silt, minor very fine grained, grading to very fine grained sandstone in part, trace lithic grains, moderately consolidated, clay matrix, 5 to 8% porosity.
17.5 m	**MUDSTONE**: dark grey, micromicaceous, firm, moderately to well consolidated, trace black, vitreous, coal microlaminae.
20-25 m	70% **SILTSTONE**/30% **MUDSTONE**: medium grey, quartz silt, trace very fine grained, non calcareous, moderately consolidated, grading from siltstone to silty shale, minor coal in micro seams, trace spotty carbonaceous inclusions, tight. Some cement in sample.
25-30 m	2% **COAL**: black, vitreous, brittle, trace silty, occurs as thin seams in mudstone. 70% **MUDSTONE**/30% **SILTSTONE**: medium grey, moderately consolidated, blocky, silty, grading to siltstone in part, common carbonaceous partings, common coal seams, trace pyrite nodules. Trace cement in sample.
30-35 m	95% **SANDSTONE**: salt and pepper, fine to lower medium grained, minor upper medium grained, moderately to well sorted, subrounded to subangular, quartz, 5% dark chert, minor lithic grains, predominantly loose in sample, silica cement, non calcareous, minor siltstone, possibly interbedded, possible clay matrix, estimated 6 to 10% porosity. **COAL**: several chips of coal, possible cavings. 5% **MUDSTONE** and **SILTSTONE**.
35-40 m	60% **MUDSTONE**/20% **SILTSTONE**: medium grey, blocky, moderately firm, consolidated, silty in part, interbedded medium grey, quartz siltstone, trace scattered carbonaceous inclusions and laminae, trace coal in micro seams. 20%

SANDSTONE: as above.

40-45 m — 100% **SILTSTONE**: light to medium grey, quartz silt, minor lithic grains, moderately consolidated, silica cement, clay matrix, minor interbedded silty mudstone, trace carbonaceous inclusions, trace coal micro seams, 3 to 6% porosity.

45-50 m — 90% **MUDSTONE**: medium grey, blocky, firm, minor microlaminae of coal, minor black carbonaceous partings, silty in part, minor siltstone lenses. 10% **SANDSTONE** salt and pepper as above, cavings.

50-55 m — 70% **SILTSTONE**/30% **MUDSTONE**: light grey, slightly salt and pepper, quartz silt, trace very fine grained, trace dark lithic grains, non calcareous, moderately consolidated, clay matrix, trace carbonaceous inclusions, trace porosity.

55-65 m — 70% **MUDSTONE**/30% **SILTSTONE**: medium grey, blocky, moderately consolidated, firm, trace carbonaceous inclusions, silty in part, common siltstone lenses, minor sandstone.

65-70 m — 80% **SANDSTONE**: salt and pepper, predominantly fine to lower medium, trace upper medium, subangular to subrounded, moderately to well sorted, quartz, minor chert, minor lithic grains, predominantly loose, silica cement, clay to silt matrix, trace mica flakes, 5 to 10% porosity. 20% Coarse **MUDSTONE** and **SILTSTONE** chips in sample, probable cavings.

70-75 m — 100% **SANDSTONE**: salt and pepper, as above, consolidated, moderately firm, 6 to 12% porosity.

75-80 m — 100% **SANDSTONE**: salt and pepper, fine to lower coarse grained, moderately sorted, subrounded, quartz, common dark chert and lithic grains, predominantly loose, silica cement, silt matrix, 8 to 12% porosity.

80-90 m — 90% **SANDSTONE**: salt and pepper, rarely pink, fine to lower medium grained, moderately to well sorted, subrounded to subangular, quartz, common lithic and dark chert, predominantly loose, silica cement, slightly calcareous, clay to silt matrix, 5 to 10% porosity. 10% coarse chips of **MUDSTONE** and **SILTSTONE**.

90-100 m — 90% **SANDSTONE**: salt and pepper, fine to lower medium grained, occasional upper medium grained, subangular to subrounded, moderately to well sorted, quartz, common lithic and dark chert, predominantly loose, silica cement, clay to silt matrix, trace carbonaceous inclusions, 5 to 10% porosity. Some mudstone and siltstone in sample.

100-110 m — 95% **SANDSTONE**: salt and pepper, lower fine to upper medium, moderately sorted, subrounded to subangular, quartz, common dark chert, minor lithic grains, predominantly loose, silica cement, silt matrix, trace white clay patches, trace interbedded mudstone, 8 to 12% porosity. 5% **SILTSTONE**: light grey, quartz silt, moderately consolidated, trace porosity.

110-120 m — 40% **MUDSTONE**/10% **SILTSTONE**: medium grey, blocky, firm, silty in part, interbedded with Siltstone: medium grey, quartz silt, minor lithic grains, moderately consolidated, non calcareous to slightly calcareous, trace carbonaceous inclusions, trace porosity. 50% **SANDSTONE** as above, cavings?

120-125 m 60% **SILTSTONE**/30% **MUDSTONE**: light grey, quartz silt, minor lithic grains, moderately consolidated, slightly calcareous, rare mica flakes, trace carbonaceous inclusions, clay matrix, 3 to 6% porosity, interbedded with medium grey mudstone. 10% **SANDSTONE** as above, cavings.

125-130 m 70% **SANDSTONE**: salt and pepper, trace pink, predominantly fine grained, well sorted, subangular, quartz, common dark chert and lithic grains, predominantly loose, silica cement, very slightly calcareous, silt matrix in part, 8 to 12% porosity. 30% **SILTSTONE** and **MUDSTONE** as above.

130-140 m 70% **MUDSTONE**/30% **SILTSTONE**: medium grey, blocky, firm, moderately calcareous, silty in part, trace carbonaceous inclusions, interbedded with light grey calcareous siltstone and very fine grained sandstone.

140-150 m 70% **MUDSTONE/SILTSTONE**: medium grey, blocky, firm, slightly calcareous, silty, interbedded with 30% **SILTSTONE**: light grey, slightly salt and pepper, quartz silt, trace lithic grains, moderately consolidated, moderately calcareous, clay matrix, rare mica flakes, trace to 3% porosity. Trace Sandstone, probable cavings.

150-155 m 70% **MUDSTONE**: medium grey, blocky, firm, silty, interbedded with siltstone, moderately calcareous. 30% **SILTSTONE**: light grey, moderately consolidated, calcareous cement, clay matrix, trace porosity. **SANDSTONE**: one chip, salt and pepper, trace pink, very fine to fine grained, moderately to well sorted, subangular to subrounded, quartz, common lithic and chert grains, calcareous, 5 to 8% porosity.

155-160 m 100% **SILTSTONE**: light to medium grey, quartz silt, minor lithic grains, rare mica flakes, clay matrix, moderately calcareous, grading to silty mudstone in part, local mudstone beds, trace porosity.

160-170 m 100% **SILTSTONE**: medium grey, quartz silt, minor lithic grains, moderately to well consolidated, firm to brittle, clay matrix, rare to trace carbonaceous inclusions, slightly to moderately calcareous, some interbedded mudstone, trace to 3% porosity,

170-180 m 100% **SILTSTONE**: as above, common interbedded mudstone, trace very fine to fine sandstone.

180-195 m 100% **SILTSTONE**: light to medium grey, slightly salt and pepper, quartz silt, minor lithic grains, grading from near clay size to near very fine grained, common microscopic white patches of clay?, slightly to moderately calcareous, minor interbedded silty mudstone, trace to 6% porosity.

195-200 m 5%, **MARLSTONE**: medium grey to green, cryptocrystalline, locally grading to microcrystalline, earthy, hard, brittle, minor clay residue after HCl, less reactive and more clay content in part, trace local rounded mudstone inclusions, tight. 95% **SILTSTONE** as above.

200-210 m 70% **MUDSTONE**: medium to dark grey, slightly micromicaceous, firm. 30% **SILTSTONE**: medium grey, slightly salt and pepper, as above.

210-220 m 50% **MUDSTONE**: medium grey, rounded chips, firm, slightly brittle. 50% **SILTSTONE**: medium grey, firm, brittle, clay matrix, trace porosity. Mixed

lithologies and sawdust, from a hole sweep.

220-230 m — 75% **MUDSTONE**: medium grey, firm, blocky, slightly micromicaceous. 25% **SILTSTONE**: medium grey, moderately consolidated, quartz, minor lithic grains, clay matrix, trace to 3% porosity. Higher viscosity mud producing some clay balls.

230-240 m — 75% **MUDSTONE**: medium grey, blocky, firm. 25% **SILTSTONE**: medium grey, quartz silt, firm, blocky, trace porosity. Trace sandstone.

240-250 m — 70% **SANDSTONE**: salt and pepper, fine to lower medium grained, moderately to well sorted, subrounded to subangular, quartz, common dark chert, trace pyrite, predominantly loose, silica cement, moderately calcareous, estimated 6 to 12% porosity. 30% mudstone.

250-260 m — 70% **MUDSTONE**: medium grey, dense, firm. Chips are rounded and covered in loose 30% sand as above.

260-270 m — 100% **MUDSTONE**: medium grey, dense, firm, minor siltstone.

270-285 m — 80% **MUDSTONE**: medium grey, firm, dense, blocky. 20% silt and sand loose in sample, cavings?

285-305 m — 90% **SANDSTONE**: salt and pepper, fine to lower medium grained, occasional coarse grained chert, moderately sorted, subrounded to subangular, quartz, common dark chert, minor lithic grains, loose, probable silica cement, rare pyrite, estimated 6 to 12% porosity. 10% Minor **MUDSTONE**. Trace white clay chips in 300.0 m sample.

305-310 m — 70%, **CHERT**: white, buff, pebble fragments. 10% **SANDSTONE**: salt and pepper, fine grained, moderately sorted, subangular to subrounded, quartz, minor chert, minor lithic grains, possible matrix for chert conglomerate. 20% **MUDSTONE**, medium grey, firm, blocky, some interbedded siltstone.

310-315 m — 80% **SANDSTONE**: salt and pepper, fine to medium grained, with coarse grained chert to small pebble fragments, poorly sorted, subangular to subrounded, quartz, minor dark chert, minor lithic grains, trace to minor interstitial pyrite, loose, possible silica cement, estimated 6 to 12% porosity. 20% **MUDSTONE**: medium grey, firm, blocky, moderately consolidated, some interbedded siltstone.

315-320 m — 80% **MUDSTONE**: medium grey in part, light green soft and waxy in part, grey to green very hard and brittle, appears silicified in part, non calcareous. 20% **SANDSTONE** as above.

320-335 m — No samples.

335-340 m — Sample of mixed lithologies, coarse chert and quartz grains, grey green silicified shale or altered chert, siltstone, minor sandstone, mudstone. Wet sample appears to be mudstone.

340-350 m — 70% **MUDSTONE**: medium grey, dense, firm, soft and slightly plastic in water. 30% **SILTSTONE** and **SANDSTONE** in sample, possible cavings or interbedded in mudstone.

350-360 m	80% **MUDSTONE**: medium grey, firm, blocky, dense, uniform, non silty, non calcareous. 20% **SILTSTONE** and **SANDSTONE**.
360-370 m	100% **SANDSTONE**: salt and pepper, fine to lower medium grained, moderately sorted, subrounded to subangular, quartz, common chert and lithic grains, loose, silica cement, 6 to 12% porosity.
370-385 m	100% **SANDSTONE**: as above, clay matrix, 6 to 12% porosity.
385-390 m	**SHALE**: 60%, medium grey, firm, blocky, one chip finely interbedded with fine grained quartz sandstone. 40% **SANDSTONE**: loose as above, cavings? Trace **SILTSTONE**: hard.
390-395 m	**SANDSTONE**: Fine fraction of sample is 95% loose fine to lower medium grained sandstone. Coarse fraction is 40% consolidated fine to lower medium grained sandstone. **SANDSTONE**: salt and pepper, fine to lower medium grained, subrounded, moderately to well sorted, quartz, common chert and lithic grains, moderately consolidated, silica cement, hard and very fine grained in part, clean, 8 to 12% porosity. 60% **MUDSTONE**: medium grey, firm, blocky, common fine interbedded sandstone lenses.
395-400 m	Interbedded **SANDSTONE**/**SILTSTONE**/ **MUDSTONE**
400-405 m	Interbedded **SANDSTONE**/**SILTSTONE**/**SHALE**: 50% **SANDSTONE**: salt and pepper, fine to medium grained, very fine grained in part, subangular to subrounded, moderately sorted, quartz, minor chert and lithic grains, rare mica flakes, moderately consolidated, clay to silt matrix, low relief, 5 to 10% porosity. 50% **MUDSTONE**: medium grey, firm, blocky, rare black carbonaceous inclusions.
405-410 m	80% **MUDSTONE**: medium grey, firm, moderately consolidated, slightly silty in part, rare carbonaceous inclusions, slightly micromicaceous, some siltstone lenses. 20% **SANDSTONE**: salt and pepper, fine to medium fair, occasional coarse grained, moderately sorted, subangular to subrounded, quartz, minor chert and lithic grains, loose, silica cement, clay to silt matrix, non calcareous to very slightly calcareous, 6 to 12% porosity. Cement in sample.
410-420 m	Grey mush at shaker, very little lithic material. 80% **MUDSTONE**: medium grey, blocky, moderately firm, slightly micromicaceous, slightly silty. 20% **SANDSTONE**: salt and pepper, fine to medium grained, subangular to subrounded, moderately sorted, quartz, minor chert and lithic grains, loose in sample, estimated 6 to 12% porosity.
420-430 m	Grey mush at shaker, very little lithic material. 90% **MUDSTONE**: medium grey, firm, blocky, slightly micromicaceous, rare carbonaceous inclusions. 10% **SANDSTONE**: salt and pepper, fine to medium, loose grains.
430-440 m	Grey mush at shaker, minor lithic material. 50% **SILTSTONE**: medium grey, firm, moderately consolidated, quartz silt, clay matrix, slightly to moderately calcareous, grading to silty mudstone in part, some interbedded very fine grained sandstone, tight to trace porosity. 50% **MUDSTONE**: medium grey, firm, blocky, silty in part, rare carbonaceous inclusions, slightly micromicaceous.

440-450 m	Grey mush at shaker, moderate lithic content: 50% **SANDSTONE**: salt and pepper, fine to medium grained, moderately sorted, subrounded to subangular, quartz, minor chert, minor lithic grains, predominantly loose, silica cement, slightly calcareous, clay to silt matrix, minor very fine grained lenses, 6 to 12% porosity. 50% **MUDSTONE**, medium grey, firm, silty in part, some interbedded argillaceous siltstone, slightly micromicaceous, trace pyrite.
450-460 m	Shaker material mix of thick grey mud and soft chips. 60% **SANDSTONE**: salt and pepper, fine to medium grained, subangular to subrounded, moderately sorted, quartz, minor to common grey to black chert, minor lithic grains, loose in part, silica cement, slightly calcareous, silt matrix, 6 to 12% porosity. 40% **MUDSTONE**: medium grey, firm, blocky, silty in part, trace carbonaceous inclusions, slightly micromicaceous.
460-470 m	80% **SANDSTONE**: salt and pepper, fine to medium grained, occasional coarse grained, moderately sorted, subangular to subrounded, quartz, common chert, minor lithic grains, rare glauconite, predominantly loose, silica cement, slightly calcareous, silica matrix, 6 to 12% porosity. 20% **MUDSTONE**: medium grey, blocky, firm, silty, some interbedded siltstone, trace carbonaceous inclusions.
470-490 m	90% **SANDSTONE**: salt and pepper, predominant medium grained, fine grained in part, trace coarse grained, moderately sorted, subrounded to subangular, quartz, minor to common chert, minor lithic grains, predominantly loose, friable, silica cement, very slightly calcareous, clay to silt matrix, 8 to 12% porosity. 10% **MUDSTONE**: medium grey, firm, silty in part.
490-510 m	70% **SANDSTONE**: salt and pepper, fine to medium grained, subrounded to subangular, quartz, minor chert, minor lithic grains, moderately consolidated, friable, silica cement, moderately calcareous, clay matrix, 5 to 8% porosity. 30% **MUDSTONE**: medium grey, blocky, firm, silty in part, some siltstone lenses.
510-520 m	80% **SANDSTONE**: salt and pepper, fine to m grained, minor rounded coarse grained, moderately sorted, subrounded to subangular, quartz, common grey to black chert, minor lithic grains, loose, friable, silt matrix, estimated 6 to 12% porosity. 20% **MUDSTONE**: medium grey, firm, blocky, silty in part.
520-530 m	70% **SANDSTONE**: salt and pepper, fine to coarse grained, moderately sorted, subrounded to subangular, quartz, common chert, minor lithic grains, rare glauconite, predominantly loose, silica cement, clay to silt matrix, very slightly calcareous, 5 to 10% porosity. 30% **MUDSTONE**, predominant medium grey, firm, silty in part, trace grey to green, minor light grey to brown with floating fine to coarse sand grains.
530-540 m	As above, occasional chert pebble fragments.
540-550 m	90% **SANDSTONE**: salt and pepper, predominant medium grained, coarse grained in part, minor very coarse grained to granule, minor fine grained, moderately sorted, subrounded, quartz, common grey to black chert, minor lithic grains, loose, silica cement, slightly calcareous in part, clay to silt matrix, estimated 6 to 12% porosity. 10% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous; Some light brown silicified mudstone to argillaceous chert, hard, brittle, minor floating quartz and chert grains.

550-560 m — 80% **SANDSTONE**: salt and pepper, medium to coarse grained, some very coarse grains, moderately sorted, subrounded, quartz, common chert, minor lithic grains, predominantly loose, silica cement, moderately consolidated, slightly to moderately calcareous, clay to silt matrix, rare pyrite, 5 to 10% porosity. 20% **MUDSTONE**: medium grey, blocky, form, silty in part, slightly micromicaceous.

560-580 m — 70% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous. 30% **SANDSTONE**: salt and pepper, fine to medium grained, moderately sorted, subrounded to subangular, quartz, minor chert, minor lithic grains, loose, estimated 6 to 12% porosity.

580-590 m — 90% **MUDSTONE**: medium grey, firm, slightly micromicaceous, minor silty lenses. 10% **SANDSTONE**: as above.

590-600 m — 100% **MUDSTONE**: medium grey, firm, silty in part, minor argillaceous siltstone beds, trace very fine to fine grained sandstone lenses.

600-610 m — 90% **SANDSTONE**: salt and pepper, medium to very coarse grained, occasional granule fragments, poorly to moderately sorted, subrounded to subangular, quartz, common to abundant grey to black chert, minor lithic grains, loose, trace light brown to tan silicified clay as matrix in sandstone, minor tan silt matrix, no fluorescence on tan silt, silt matrix, 5 to 8% porosity. 10% **MUDSTONE**.

610-620 m — 90% **SANDSTONE** (conglomerate): salt and pepper, medium to very coarse grained, some granules, trace chert pebble fragments, poorly sorted, subrounded to rounded, quartz, chert, predominantly loose, silicified tan clay to siltstone matrix, very fine grained matrix in part, 5 to 8% porosity. 10% **MUDSTONE**: medium grey, firm, silty in part.

620-630 m — 50% **SANDSTONE**: salt and pepper, medium to coarse grained, very fine to fine grained in part, occasional very coarse grained, moderately sorted, subrounded to subangular, quartz, common chert, minor lithic grains, silica cement, silica clay and silt matrix, non calcareous to very slightly calcareous, 5 to 8% porosity. 30% **SILTSTONE**: medium grey, quartz silt, grading to very fine grained in part, consolidated, clay matrix, common interbedded mudstone and very fine to fine grained sandstone, trace porosity. 20% **MUDSTONE**: medium grey, firm, silty in part, interbedded with siltstone.

630-640 m — 50% **SANDSTONE**: light grey, very fine to fine grained, grading to siltstone in part, trace very coarse grained, moderately sorted, subangular to subrounded, quartz, minor lithic grains, silica cement, friable, clay matrix, non calcareous to very slightly calcareous, 5 to 10% porosity. 50% **SILTSTONE**: light grey, quartz silt, grading to very fine grained, moderately consolidated, clay matrix, slightly calcareous, 3 to 6% porosity.

640-660 m — 70% **SILTSTONE**: light grey, quartz silt, trace lithic grains, moderately consolidated, friable, slightly calcareous, clay matrix, trace nodular pyrite, 3 to 6% porosity. 20% **SANDSTONE**: light grey, salt and pepper, very fine to fine grained, trace coarse grains, subangular to subrounded, moderately sorted, quartz, minor chert, minor lithic grains, silica cement, clay matrix, 5 to 10% porosity. 10% **MUDSTONE**: medium grey, firm, blocky.

660-670 m — 90% **SANDSTONE**: salt and pepper, very fine to fine grained, minor medium grains, trace chert pebble fragments, subangular to subrounded, moderately

sorted, quartz, minor chert, minor lithic grains, consolidated, moderately friable, trace silica cement, clay matrix, trace pyrite nodules, occasional finely interbedded with mudstone, occasional floating coarse grained chert to pebbles, 5 to 8% porosity. 10% **MUDSTONE**: light grey to green, buff, moderately firm, non calcareous, medium grey, firm blocky in part.

670-680 m — 90% **SANDSTONE**: salt and pepper, very light grey, silt fine grained, predominant very fine grained, trace coarse grained to very coarse grained, moderately sorted, subangular to subrounded, quartz, minor lithic grains, moderately consolidated, friable, trace silica cement, breaks apart in water, clay matrix, trace pyrite, 5 to 8% porosity. 10% **MUDSTONE**: medium grey, blocky, firm, silty in part.

680-690 m — 80% **SANDSTONE**: salt and pepper, very fine to lower medium grained, occasional coarse to very coarse grained, moderately sorted, subangular to subrounded, quartz, minor chert, minor lithic grains, very rare glauconite, loose in part, silica cement, friable, clay matrix, argillaceous to very argillaceous in part, trace pyrite nodules, 5 to 10% porosity. 20% **MUDSTONE**: medium grey, firm, slightly micromicaceous, silty in part.

690-700 m — 70% **MUDSTONE**: medium grey, blocky, firm trace carbonaceous inclusions, trace buff rounded inclusions, silty and sandy in part, interbedded with argillaceous sandstone. 30% **SANDSTONE**: light grey, as above.

700-710 m — 70% **SANDSTONE**: light to medium grey, salt and pepper, very fine to fine grained, subangular to subrounded, quartz, minor chert, minor lithic grains, moderately consolidated, friable, silica cement, moderately to very argillaceous, interbedded with silty and sandy mudstone, 3 to 6% porosity. 30% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous, silty and sandy in part.

710-720 m — 80% **MUDSTONE**: medium grey, firm, slightly micromicaceous, trace carbonaceous inclusions, silty, grading to argillaceous siltstone. 30% **SANDSTONE**: as above.

720-730 m — 100% **MUDSTONE**: medium grey, blocky, firm, silty, grading to and interbedded with argillaceous siltstone, some interbedded argillaceous sandstone, trace pyrite nodules.

730-740 m — 50% **SANDSTONE**: light to medium grey, very fine grained, grading to silt, subangular to subrounded, quartz, minor lithic grains, moderately consolidated, silica cement, moderately to very argillaceous, 3 to 6% porosity. 50% **MUDSTONE**: medium grey, firm, blocky, trace carbonaceous inclusions, silty and sandy lenses and beds, trace nodular pyrite.

740-750 m — 70% **MUDSTONE**: medium grey, firm, silty, grading to and interbedded with argillaceous siltstone, trace carbonaceous inclusions. 50% **SANDSTONE**: light to medium grey, very fine grained, silty, quartz, minor lithic grains, subangular to subrounded, moderately sorted, moderately consolidated, silica cement, argillaceous to very argillaceous, 3 to 6% porosity.

750-765 m — 80% **MUDSTONE**: medium grey, firm, blocky, trace carbonaceous inclusions, silty in part, common interbedded argillaceous siltstone and argillaceous sandstone, trace pyrite nodules. 20% **SANDSTONE**: light to medium grey, predominant very fine grained, minor fine grained, subangular to subrounded,

moderately sorted, quartz, minor lithic grains, moderately consolidated, silica cement, argillaceous to very argillaceous, 3 to 8% porosity.

765-770 m — 95% **SANDSTONE**: salt and pepper, fine to medium grained, moderately sorted, subrounded to subangular, quartz, common chert, minor lithic grains, predominantly loose, silica cement, clay matrix, 8 to 12% porosity, trace interstitial pyrite. 5% **MUDSTONE**: medium grey, firm, silty.

770-775 m — **SANDSTONE**: as above, trace chert pebble fragments.

775-780 m — **SANDSTONE** (Conglomerate): fine to very coarse grained, some larger fragments from granules to small pebbles, subrounded to subangular, poorly sorted, quartz, abundant varicoloured chert, predominantly loose, friable, silica cement, moderately consolidated, trace interstitial pyrite, 6 to 12% porosity.

780-790 m — 95% **SANDSTONE**: salt and pepper, predominantly fine grained, minor medium grained, moderately to well sorted, subrounded to subangular, quartz, minor lithic grains, minor chert, predominantly loose, silica cement, minor clay matrix, trace interstitial pyrite, 8 to 14% porosity. 5% **MUDSTONE**: medium grey, firm.

790-800 m — **SANDSTONE** (Conglomerate): very light grey, salt and pepper, predominantly fine grained, minor medium grained, numerous very coarse grained to small pebble chert fragments floating, subrounded to subangular, poorly to moderately sorted, quartz, minor lithic grains, moderately consolidated, silica cement, minor clay matrix, 8 to 14% porosity.

800-810 m — 95% **SANDSTONE** (Conglomerate): salt and pepper, predominantly fine grained, trace medium to coarse grained, common varicoloured chert granule to pebble fragments, poorly to moderately sorted, subangular to subrounded, quartz, common chert, minor lithic grains, moderately consolidated, friable, minor clay matrix, coarse grains and pebbles appear to float in fine grained sandstone, minor interbedded argillaceous siltstone, 6 to 12% porosity, no staining. 5% **SILTSTONE**: medium, blocky, firm, very argillaceous, grading to mudstone.

810-820 m — 90% **SANDSTONE**: salt and pepper, predominantly fine grained, occasional medium to coarse grained, minor granule to pebble fragments, subangular to subrounded, moderately to well sorted, quartz, minor lithic grains, minor chert, moderately consolidated, friable, non calcareous, silica cement, minor clay matrix, no staining, 6 to 12% porosity. 5% **MUDSTONE**: medium grey, blocky, firm, silty in part. 5% **MUDSTONE**: buff, tan, firm, blocky, hard in part, possibly silicified.

820-830 m — 80% **SANDSTONE**: salt and pepper, predominantly fine grained, minor medium to coarse grained, trace pebble fragments, moderately sorted, subangular to subrounded, quartz, common chert, minor lithic grains, moderately consolidated, friable, silica cement, non calcareous, minor clay matrix, trace pyrite masses, no staining, 6 to 12% porosity. 20% **MUDSTONE**: light to medium grey, firm, blocky, silty grading to argillaceous siltstone in part.

830-840 m — 100% **MUDSTONE**: medium to dark grey, blocky, firm, silty in part, slightly micromicaceous, non calcareous.

840-850 m — 90% **SANDSTONE**: salt and pepper, very light grey, predominantly fine grained, occasional medium and coarse grained, minor chert pebble fragments,

subangular to subrounded, moderately sorted, moderately consolidated, quartz, common chert, minor lithic grains, friable, silica cement, minor clay matrix, no staining, 6 to 12% porosity. 10% **MUDSTONE**: medium grey, blocky, firm, silty in part.

850-865 m — 80% **SANDSTONE**: salt and pepper, predominantly fine grained, very fine in part, minor medium grained, occasional chert pebble fragments, subangular to subrounded, moderately sorted, quartz, minor chert, minor lithic grains, moderately consolidated, friable, silica cement, minor clay matrix, 6 to 12% porosity. 20% **MUDSTONE**: medium grey, firm, blocky, silty in part, buff hard and silicified in part.

865-885 m — 70% **MUDSTONE**: medium grey, blocky, firm, silty in part, buff and brittle in part. 20% **SILTSTONE**: medium grey, blocky, moderately consolidated, grading to very fine sandstone in part. 10% **SANDSTONE**: salt and pepper, light grey, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor chert, minor lithic grains, moderately consolidated, silica cement, clay matrix, 6 to 10% porosity.

885-900 m — 90% **SANDSTONE**: salt and pepper, predominantly fine grained, minor medium grained, subrounded to subangular, moderately sorted quartz, minor chert, minor lithic grains, moderately consolidated, friable, silica cement, clay matrix, 5 to 10% porosity. 10% **MUDSTONE**: medium grey, light grey in part, trace carbonaceous inclusions, firm, blocky, silty in part.

900-915 m — 90% **SANDSTONE**: salt and pepper, very fine to fine grained, moderately sorted, subangular to subrounded, quartz, minor chert, minor lithic grains, moderately consolidated, friable, silica cement, clay to silt matrix, non calcareous, 6 to 12% porosity. 10% **MUDSTONE**: medium to dark grey, blocky, firm, slightly micromicaceous, silty in part.

915-925 m — 90% **SANDSTONE**: salt and pepper, fine to medium grained, moderately sorted, subangular to subrounded, quartz, minor to common chert, minor lithic grains, predominantly loose, silica cement, minor clay matrix, trace nodular and interstitial pyrite, no staining, 8 to 14% porosity. 10% **MUDSTONE**: medium to dark grey, slightly micromicaceous, firm, blocky.

925-940 m — 90% **SANDSTONE**: salt and pepper, predominantly fine grained, grading from very fine to medium grained, subrounded to subangular, moderately sorted, quartz, minor chert, minor lithic grains, moderately consolidated, silica cement, non calcareous, clay matrix, trace nodular pyrite, no staining, 5 to 10% porosity. 10% **MUDSTONE**: medium grey, blocky, firm, silty in part.

940-950 m — 90% **SANDSTONE**: salt and pepper, light grey, very fine to fine grained, moderately sorted, subangular to subrounded, quartz, minor lithic grains, trace chert, silica cement, clay matrix, trace nodular pyrite, 6 to 12% porosity. 10% **MUDSTONE**: medium grey, firm, blocky.

950-955 m — 70% **SANDSTONE**: very light grey, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace chert, consolidated, friable, silica cement, non calcareous, moderately clay matrix, 6 to 12% porosity. 30% **MUDSTONE**: medium grey, blocky, firm, silty in part, interbedded with argillaceous siltstone.

955-960 m — 90% **SANDSTONE**: salt and pepper, predominantly fine grained, lower medium grained in part, subangular to subrounded, moderately sorted, quartz, minor to common chert, minor lithic grains, moderately consolidated, friable, silica cement, non calcareous, clay matrix, trace local tan stain, 6 to 12% porosity, no fluorescence. 10% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous.

960-970 m — 20% **SANDSTONE**: As above. 40% **MUDSTONE**: medium grey, blocky, firm, silty in part, trace carbonaceous inclusions. 40% **SILTSTONE**: medium grey, blocky, moderately consolidated, quartz silt, moderately to very argillaceous, silica cement, friable, slightly calcareous to non calcareous, 2 to 3% porosity.

970-975 m — 80% **SANDSTONE**/**SILTSTONE**: light to medium grey, silt to fine grained, moderately sorted, subrounded to subangular, quartz, minor lithic grains, trace carbonaceous, moderately consolidated, friable, slightly calcareous, silica cement, clay matrix, 3 to 10% porosity. 20% **MUDSTONE**: medium grey, blocky, firm, silty in part, interbedded with siltstone/sandstone.

975-980 m — 50% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous, tan to brown and brittle in part. 50% **SANDSTONE**: salt and pepper, very fine grained, grading to fine grained in part, subangular to subrounded, moderately sorted, quartz, minor lithic grains, moderately consolidated, friable, silica cement, non calcareous, trace interstitial pyrite, clay matrix, 6 to 12% porosity.

980-985 m — 70% **SANDSTONE**: salt and pepper, very fine grained, minor fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous, rare glauconite, moderately consolidated, friable, silica cement, non calcareous to slightly calcareous, clay matrix, some interbedded siltstone, 5 to 10% porosity. 30% **MUDSTONE**: medium grey, blocky, firm, silty in part, slightly micromicaceous, rare carbonaceous inclusions.

985-995 m — 90% **SANDSTONE**: light grey, very fine grained, grading to siltstone in part, moderately sorted, subangular to subrounded, quartz, minor lithic grains, trace carbonaceous inclusions, trace pyrite, moderately consolidated, friable, silica cement, clay matrix, very argillaceous in part, 5 to 8% porosity. 10% **MUDSTONE**: medium grey, firm, blocky.

995-1000 m — 100% **MUDSTONE**: medium to dark grey, firm, blocky, silty, grading to very argillaceous siltstone in part, trace pyrite nodules.

1000-1010 m — 70% **MUDSTONE**: medium to dark grey, slightly micromicaceous, blocky, firm, silty in part, 30% **SILTSTONE**: medium grey, blocky, firm, moderately consolidated, quartz silt, argillaceous to very argillaceous, grading to silty mudstone, trace porosity. Trace: light green, light buff mudstone, trace sandstone.

1010-1015 m — 70% **SANDSTONE**: very light grey, very fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, moderately consolidated, friable, silica cement, trace carbonaceous inclusions, slightly to moderately calcareous, clay matrix, 5 to 10% porosity. 30% **SHALE**: medium grey, tan, trace green, firm, blocky, slightly micromicaceous and silty in part, trace pyrite.

1015-1020 m — 90% **MUDSTONE**: In part tan, blocky, hard, brittle, appears silicified; in part medium grey, blocky, firm, slightly micromicaceous, silty in part, trace fine

carbonaceous inclusions. 10% **SILTSTONE**/**SANDSTONE**: light grey, quartz silt to very fine grained, moderately contaminated, friable.

1020-1030 m — 70% **SANDSTONE**: light to medium grey, very fine grained, grading to siltstone in part, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous inclusions, moderately consolidated, silica cement, non calcareous to slightly calcareous, clay matrix, moderately to very argillaceous, 5 to 8% porosity. 30% **MUDSTONE**: medium grey, firm, blocky, slightly micromicaceous, silty, grading to argillaceous siltstone in part; partly tan, light brown, hard, brittle.

1030-1040 m — 70% **MUDSTONE**: medium grey, blocky, fissile, firm, silty in part; minor tan, hard, brittle. 30% **SILTSTONE**: medium grey, blocky, moderately consolidated, silica cement, argillaceous to very argillaceous, trace carbonaceous inclusions, grading to and interbedded with very fine grained sandstone lenses.

1040-1055 m — 80% **SANDSTONE** (**SILTSTONE**): very light grey, slightly salt and pepper, very fine grained, grading to silt, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous inclusions, moderately consolidated, friable, silica cement, clay matrix, very slightly calcareous, moderately to very argillaceous in part, 5 to 8% porosity. 20% **MUDSTONE**: medium grey, blocky firm, slightly micromicaceous, silty in part.

1055-1060 m — 100% **MUDSTONE**: medium to dark grey, blocky, firm to hard, slightly carbonaceous, slightly silty, grading to argillaceous siltstone in part, trace nodular pyrite.

1060-1065 m — 30% **SANDSTONE** (**SILTSTONE**): salt and pepper, very light grey, silt to very fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous, moderately consolidated, friable, silica cement, clay matrix, 5 to 8% porosity. 50% **SHALE**: as above. 20% **SILTSTONE**: medium grey, blocky, firm, argillaceous; trace porosity.

1065-1070 m — 80% **SILTSTONE**: light grey, quartz silt, grading to very fine grained, quartz, minor lithic grains, blocky, moderately consolidated, friable, argillaceous, trace interstitial pyrite, 3 to 6% porosity. 20% **MUDSTONE**: tan, hard and brittle, in part medium grey, silty, blocky, firm.

1070-1080 m — 50% **SILTSTONE**: medium grey, silt, minor very fine grained, quartz, minor lithic grains, trace carbonaceous inclusions, blocky, moderately consolidated, friable, trace pyrite, silica cement, non calcareous, argillaceous to very argillaceous, 3 to 6% porosity. 50% **SHALE**: medium grey, firm, blocky, slightly micromicaceous, silty in part.

1080-1090 m — 90% **SANDSTONE**: very light grey, salt and pepper, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous inclusions, silica cement, clay matrix, 5 to 8% porosity, 10% **MUDSTONE**: medium grey, firm, blocky, silty.

1090-1100 m — 90% **SANDSTONE** (**SILTSTONE**): light grey, very fine to fine grained, silt to very fine grained in part, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous inclusions, moderately consolidated, friable, silica cement, non calcareous, trace interstitial pyrite, 5 to 8% porosity, some 6 to

12%. 10% **MUDSTONE**: medium grey, blocky, firm, silty in part.

1100-1115 m — 80% **SILTSTONE** (**SANDSTONE**): light to medium grey, silt to very fine sandstone, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous inclusions, silica cement, friable, clay matrix, moderately argillaceous, 5 to 8% porosity. 20% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous, silty in part.

1115-1130 m — 80% **SILTSTONE** (**SANDSTONE**): light to medium grey, silt, grading to very fine grained in part, quartz, minor lithic grains, trace carbonaceous, moderately consolidated, silica cement, friable, argillaceous to very argillaceous, trace to 5% porosity. 20% **MUDSTONE**: medium grey, blocky, firm. silty in part, minor tan brittle siderite?

1130-1140 m — 80% **SILTSTONE**: medium grey, blocky, moderately consolidated, quartz, minor lithic grains, trace carbonaceous, silica cement, non calcareous, argillaceous to very argillaceous, trace to 3% porosity. 20% **MUDSTONE**: medium grey, firm, blocky, silty in part.

1140-1150 m — 70% **MUDSTONE**: medium grey, firm, blocky, slightly micromicaceous, silty, grading to argillaceous siltstone in part. 30% **SILTSTONE**: medium grey, moderately consolidated, quartz, minor lithic grains, silica cement, argillaceous to very argillaceous, trace to 3% porosity.

1150-1160 m — 60% **SILTSTONE**: medium grey, blocky, moderately consolidated, quartz, minor lithic grains, silica cement, argillaceous to very argillaceous, trace to 3% porosity. 30% **MUDSTONE**: medium grey, blocky, firm, silty. 10% **SANDSTONE**: salt and pepper, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous inclusions, moderately consolidated, friable, silica cement, clay to silt matrix, 5 to 8% porosity.

1160-1170 m — 80% **SANDSTONE**: salt and pepper, fine to coarse grained, poorly to moderately sorted, subangular to subrounded, quartz, common chert, minor lithic grains, moderately consolidated, silica cement, slightly calcareous, clay matrix, trace interstitial pyrite, trace spotty gold colour in fine grains and silica cement, 8 to 14% porosity, no fluorescence. 20% **MUDSTONE** as above.

1170-1175 m — 90% **SANDSTONE**: salt and pepper, predominantly fine to medium grained, coarse grained in part, occasional very coarse grained, trace chert pebble fragments, subangular to subrounded, poorly to moderately sorted, quartz, common chert, minor lithic grains, moderately consolidated, friable, silica cement, clay matrix, non calcareous to very slightly calcareous, trace interstitial pyrite, 6 to 12% porosity. 10% **MUDSTONE**: medium grey, blocky, firm, silty, minor tan siderite nodules?

1175-1180 m — 80% **SANDSTONE**: salt and pepper, predominantly fine grained, very fine matrix, minor medium grains, subangular to subrounded, moderately sorted, quartz, common chert, minor lithic grains, moderately contaminated, silica cement, non calcareous, clay to silt matrix, trace interstitial pyrite, some more argillaceous sandstone beds, 6 to 12% porosity. 20% **MUDSTONE**: medium grey, blocky, firm, silty, minor tan brittle siderite nodules?

1180-1185 m — 80% **SANDSTONE**: light grey, salt and pepper, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor to common chert,

minor lithic grains, moderately consolidated, silica cement, clay to silt matrix, argillaceous to very argillaceous, 5 to 8% porosity. 20% **MUDSTONE**: medium grey, blocky, firm, silty in part.

1185-1190 m — 80% **MUDSTONE**: medium grey, blocky, firm, silty in part. 20% **SANDSTONE**: light grey, as above.

1190-1200 m — 100% **MUDSTONE**: medium grey, grading to dark grey, firm, blocky, slightly micromicaceous, slightly silty, minor interbedded siltstone lenses, occasional sandstone lenses.

1200-1215 m — 100% **MUDSTONE**: medium grey, blocky, firm, slightly micromicaceous, silty in part, minor interbedded siltstone and very fine grained sandstone.

1215-1230 m — 100% **MUDSTONE**: medium grey, blocky, firm, silty in part, slightly micromicaceous, minor interbedded argillaceous siltstone and very fine grained sandstone, trace nodular pyrite.

1230-1245 m — 100% **MUDSTONE**: medium grey, firm, blocky, silty in part, some interbedded siltstone and very fine grained sandstone.

1245-1255 m — 60% **SANDSTONE**: salt and pepper, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous, moderately consolidated, friable, silica cement, clay matrix, interbedded with mudstone and siltstone, 5 to 10% porosity. 30% **SILTSTONE**: light to medium grey, silt, grading to very fine grained, quartz, minor lithic grains, moderately consolidated, silica cement, argillaceous, very argillaceous in part, trace to 3% porosity. 20% **MUDSTONE**: medium grey, firm, blocky, silty in part.

1255-1270 m — 80% **MUDSTONE**: medium grey, blocky, firm, silty in part, minor to common interbedded argillaceous siltstone. 20% **SANDSTONE**: light grey, very fine grained, silt in part, subangular to subrounded, moderately sorted, quartz, minor lithic grains, moderately consolidated, silica cement, clay matrix, 5 to 8% porosity.

1270-1285 m — 60% **MUDSTONE**: medium grey, blocky, firm, silty in part, common interbedded sandstone and siltstone. 20% **SILTSTONE**: medium grey, quartz silt, minor lithic grains, moderately consolidated, argillaceous, trace to 3% porosity. 20% **SANDSTONE**:, light grey, very fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous, silica cement, clay matrix, 5 to 8% porosity.

1285-1300 m — 60% **MUDSTONE**: medium grey, blocky, firm, common interbedded siltstone and sandstone. 20% **SILTSTONE**: medium grey, quartz silt, moderately consolidated, silica cement, argillaceous, trace to 3% porosity. 20% **SANDSTONE**: light grey, salt and pepper, very fine grained, silt in part, subangular to subrounded, moderately sorted, quartz, minor lithic grains, trace carbonaceous, silica cement, clay matrix, 5 to 8% porosity.

1300-1315 m — 70% **MUDSTONE**: medium grey, firm to hard, micromicaceous, blocky. 20% **SANDSTONE**: salt and pepper, very fine grained, grading to silt, subangular to subrounded, moderately sorted, quartz, minor lithic grains, silica cement, clay matrix, 5 to 10% porosity. 10% **SILTSTONE**: medium grey, quartz, minor lithic grains, moderately consolidated, silica cement, argillaceous, trace to 3% porosity.

1315-1330 m 60% **MUDSTONE**: medium grey, firm, blocky, micromicaceous, silty in part. 30% **SILTSTONE**: medium grey, quartz silt, minor lithic grains, moderately consolidated, firm, silica cement, moderately to very argillaceous, trace to 3% porosity. 10% **SANDSTONE**: salt and pepper, very light grey, very fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, silica cement, clay matrix, 5 to 10% porosity.

1330-1345 m 70% **MUDSTONE**: medium to dark grey, firm, blocky, micromicaceous, silty in part. 20% **SILTSTONE**: medium grey, quartz silt, minor lithic grains, moderately consolidated, friable, silica cement, argillaceous to very argillaceous, trace to 3% porosity. 10% **SANDSTONE**: salt and pepper, very fine grained, grading to lower fine grained in part, subangular to subrounded, moderately sorted, quartz, minor lithic grains, moderately consolidated, silica cement, clay matrix, 5 to 10% porosity.

1345-1360 m 80% **MUDSTONE** to **SHALE**: medium to dark grey, firm, slightly fissile, micromicaceous, blocky, silty in part, minor interbedded siltstone and very fine grained sandstone. 10% **SILTSTONE**: light to medium grey, quartz silt, moderately consolidated, silica cement, argillaceous to very argillaceous, trace to 3% porosity. 10% **SANDSTONE**: salt and pepper, very fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic grains, moderately consolidated, silica cement, clay matrix, 5 to 10% porosity.

1360-1375 m 90% **MUDSTONE** to **SHALE**: dark grey, blocky, slightly fissile, firm, micromicaceous, silty in part, some interbedded siltstone, trace medium grey to brown silicified siderite? 10% **SANDSTONE**: very light grey, salt and pepper, very fine grained, silt in part, quartz, minor lithic grains, trace carbonaceous inclusions, silica cement, clay matrix, 5 to 10% porosity.

1375-1390 m 100% **MUDSTONE** to **SHALE**: dark grey, micromicaceous, firm, blocky, platy in part, slightly fissile, silty in part, minor to common thin interbedded siltstone and sandstone, trace pyrite.

1390-1400 m 100% **SHALE**: dark grey, micromicaceous, slightly fissile, platy, firm, minor interbedded siltstone and sandstone, minor grey to brown brittle siderite?

1400-1405 m 100% **SHALE**: dark to very dark grey, hard, slightly brittle, platy, slightly fissile, micromicaceous, trace pyrite moderately, rare sandstone, 3 to 5% tan to light grey to brown silicified siderite?, possible silicified shale.

1405-1410 m 100% **SHALE**: dark to very dark grey, micromicaceous, platy, slightly fissile, hard, slightly brittle, trace siltstone, trace scattered pyrite cubes, 5% grey to brown hard brittle, silicified, siderite?

1410-1415 m 100% **SHALE**: dark to very dark grey, hard, brittle, platy, subfissile, trace white phosphate specks, trace pyrite, trace to 2% hard brittle siderite? 5% Clay: buff, very light grey, silty in part, sandy in part, local very fine pyrite crystals, possibly phosphatic.

1415-1420 m 100% **SHALE**: dark to very dark grey, platy, firm to hard, slightly fissile, micromicaceous, minor scattered white phosphatic specks, trace nodular pyrite, trace to minor buff to grey to blue clay, possibly phosphatic, rare coarse calcite crystals.

1420-1430 m 100% **SHALE**: dark to very dark grey, platy, firm to hard, micromicaceous, minor scattered white phosphatic specks, trace pyrite seams, trace sandstone, rare fossil fragments.

1430-1440 m 100% **SHALE**: dark grey, platy, firm to hard, micromicaceous, rare white phosphatic specks, trace micro lenses of siltstone, rare blue to grey clay, rare siderite nodules, trace pyrite.

1440-1450 m 100% **SHALE**: dark to very dark grey, platy to blocky, slightly fissile, micromicaceous, slightly silty and sandy, rare fossil fragments, moderately firm, trace siltstone, trace pyrite.

1450-1465 m 80% **SILTSTONE**: medium grey, quartz silt, very fine grained sandstone in part, minor lithic grains, moderately consolidated, argillaceous to very argillaceous, interbedded with silty shale, trace porosity. 20% **SHALE**: dark grey, platy to blocky, firm, silty. 20% **SHALE**: dark grey as above.

1465-1480 m 80% **SILTSTONE**: medium grey, quartz silt, minor very fine grained, minor lithic grains, moderately consolidated, silica and calcareous cement, friable, moderately argillaceous, trace carbonaceous inclusions, grading to very fine grained sandstone in part, trace to 3% porosity. 20% **SHALE**: medium grey, blocky, firm, slightly micromicaceous, silty in part.

1480-1495 m 100% **SILTSTONE**: buff, silt, grading to lower very fine grained, quartz, trace lithic grains, moderately consolidated, silica cement, slightly calcareous, trace very fine carbonaceous inclusions, clean, clay matrix, 3 to 6% porosity.

1495-1510 m 100% **SILTSTONE**: buff, silt, quartz, trace lithic grains, moderately consolidated, silica cement, slightly calcareous, white clay matrix, minor light grey firm shale beds, rare pyrite, 3 to 6% porosity.

1510-1525 m 100% **SILTSTONE**: buff, very light grey, quartz silt, rare lithic grains, moderately consolidated, silica cement, slightly calcareous, white clay matrix, minor interbedded light grey shale, trace local pyrite cubes, rare black carbonaceous(?) specks, possible bitumen, 3 to 6% porosity.

1525-1540 m 100% **SILTSTONE**: very light grey to light grey, quartz silt, trace very fine carbonaceous/bitumen specks, silica cement, moderately consolidated, slightly calcareous, white clay matrix, minor interbedded light to medium grey shale, 2 to 5% porosity.

1540-1555 m 100% **SILTSTONE**: buff, very light grey, quartz silt, no lithic grains, silica cement, slightly calcareous, white clay matrix, minor interbedded light grey shale, rare pyrite cubes, trace scattered black specks, possible bitumen, 3 to 6% porosity, possible very faint tan oil stain, no fluorescence.

1555-1570 m 60% **SILTSTONE**: very light grey, buff, quartz silt, silica cement, slightly calcareous, white to light grey clay matrix, very fine grading to silty shale, rare calcite filled micro fractures, rare black specks, trace to 3% porosity. 40% **SHALE**: medium grey, micromicaceous, hard, platy, slightly blocky, locally silty.

1570-1585 m 90% **SILTSTONE**: light grey, quartz silt, grading to silty shale, moderately consolidated, silica cement, slightly calcareous, light grey clay matrix, trace to 3%

porosity. 10% **SHALE**: medium grey, hard, micromicaceous, platy.

1585-1600 m — 90% **SILTSTONE**: very light grey, quartz silt, moderately consolidated, silica cement, slightly calcareous, white to light grey clay matrix, trace pyrite, trace scattered black carbonaceous to bitumen specks, 3 to 6% porosity. 10% **SHALE**: medium grey, hard, micromicaceous, platy.

1600-1615 m — 90% **SILTSTONE**: very light to light grey, quartz silt, grading to silty shale, moderately consolidated, silica cement, slightly calcareous, light grey clay matrix, trace scattered black carbonaceous to bitumen specks, 2 to 5% porosity. 10% **SHALE**: medium grey, platy, hard, micromicaceous.

1615-1625 m — 90% **SILTSTONE**: very light grey, buff, quartz silt, grading to silty shale in part, moderately consolidated, silica cement, slightly calcareous, white clay matrix, trace scattered black carbonaceous to bitumen specks, 3 to 6% porosity. 10% **SHALE**: medium grey, hard, platy, silty in part, micromicaceous.

1625-1635 m — 60% **SILTSTONE**: buff, very light grey, quartz silt, grading to very fine grained in part, moderately consolidated, silica cement, slightly calcareous, white clay matrix, trace scattered black carbonaceous to bitumen specks, 2 to 6% porosity. 40% **SHALE**: medium grey, hard, micromicaceous, platy, slightly blocky, rare slickensides.

1635-1650 m — 70%**SILTSTONE**: buff, quartz silt, lower very fine grained in part, moderately consolidated, silica cement, slightly calcareous, clay matrix, rare pyrite, trace scattered black carbonaceous to bitumen specks, rare pyrite filled fractures, 3 to 6% porosity. 30% **SHALE**: medium grey, hard, platy, micromicaceous, silty in part.

1650-1660 m — 60% **SHALE**: medium grey, platy, hard, micromicaceous, silty in part. 40% **SILTSTONE**: light grey, quartz silt, lower very fine grained sandstone in part, grading to silty shale, moderately consolidated, silica cement, slightly calcareous, clay matrix, trace pyrite, trace to 3% porosity.

1660-1670 m — 90% **SHALE**: dark grey, platy, fissile, firm, micromicaceous, rare fossil fragment. 10% **SILTSTONE**: buff, quartz, silt, moderately consolidated, trace pyrite.

1670-1680 m — 100% **SHALE**: dark grey, platy, fissile, firm to hard, micromicaceous, slightly waxy lustre.

1680-1690 m — 50% **SHALE**: medium grey, platy, fissile, firm, micromicaceous, rare pyrite filled micro fracture. 50% **SILTSTONE**: buff quartz silt, moderately consolidated, silica cement, clay matrix, slightly calcareous, trace scattered carbonaceous to bitumen specks, 3 to 6% porosity.

1690-1700 m — 50% **SHALE**: medium grey, platy, firm to hard, slightly micromicaceous, slightly fissile. 50% **SILTSTONE**: buff, silt to very fine grained, moderately consolidated, silica cement, slightly calcareous, clay matrix, trace scattered black bitumen to carbonaceous inclusions, 3 to 6% porosity.

1700-1715 m — 90% **SILTSTONE**: buff, quartz silt, moderately consolidated, silica cement, clay matrix, trace very fine pyrite, trace spotty black carbonaceous to bitumen specks,

3 to 8% porosity. 10% **SHALE**: medium to dark grey, firm, micromicaceous, platy.

1715-1725 m — 90% **SILTSTONE**: buff, quartz silt, moderately consolidated, silica cement, slightly calcareous, white clay matrix, trace scattered black carbonaceous to scattered, 3 to 6% porosity. 10% **SHALE**: medium grey, firm, micromicaceous, platy.

1725-1730 m — 50% **SILTSTONE**: buff, quartz, moderately consolidated, silica cement, slightly calcareous, clay matrix, 3 to 6% porosity. 50% **SHALE**: medium grey, micromicaceous, platy, hard.

1730-1740 m — 90% **SHALE**: dark grey, micromicaceous, firm to hard, platy, slightly fissile.

1740-1750 m — 100% **SHALE**: dark grey, platy, firm, micromicaceous, disseminated pyrite, slightly fissile.

1750-1755 m — 100% **SHALE**: dark grey, grey to brown in part, trace calcite filled micro-fractures.

1755-1760 m — 100% **SHALE**: dark grey to brown, trace calcite filled micro-fractures.

1760-1765 m — 100%**SHALE**: dark grey to brown, platy, fissile, rare cc filled micro fractures, firm, rare pyrite.

1765-1770 m — 100% **SHALE**: dark grey to brown, platy, firm, fissile, micromicaceous, trace pyrite.

1770-1775 m — 100% **SHALE**: dark grey, platy, firm, micromicaceous, trace pyrite.

1775-1780 m — 100% **SHALE**: dark grey, platy, fissile, firm, trace pyrite, trace grey to brown shale.

1780-1790 m — 100% **SHALE**: dark grey, platy, fissile, trace pyrite, slightly waxy lustre, firm.

1790-1800 m — 100% **SHALE**: dark grey, platy, fissile, firm, slightly waxy, rare pyrite,

1800-1810 m — 100% **SHALE**: medium to dark grey, platy, fissile, firm, slightly waxy lustre.

1810-1820 m — 100% **SHALE**: medium to dark grey, fissile, platy, slightly waxy lustre, firm. trace coarse calcite.

1820-1825 m — 100% **SHALE**: dark to very dark grey, platy, fissile, firm, trace pyrite in very fine crystalline masses, slightly carbonaceous, siliceous.

1825-1830 m — 100% **SHALE**: very dark grey, slightly grey to brown, platy, fissile, firm, slightly carbonaceous, trace pyrite, siliceous, no fluorescence.

1830-1833 m — 100% **SHALE**: very dark grey, slightly grey to brown, firm, fissile, platy, slightly brittle, trace to minor pyrite, slightly carbonaceous, siliceous, no stain or fluorescence.

1833-1835 m — 100% **SHALE**: very dark grey, firm, platy, fissile, trace pyrite, slightly carbonaceous, siliceous, slightly micromicaceous, no stain or fluorescence.

1835-1840 m 100% **SHALE**: very dark grey, slightly grey brown, platy, firm, fissile, slightly micromicaceous, slightly brittle, slightly carbonaceous, siliceous, rare calcite, rare white specks possibly phosphatic, trace siltstone, no stain or fluorescence.

1840-1845 m 100% **SHALE**: very dark grey, grey brown in part, brittle, siliceous, slightly carbonaceous, platy, fissile, slightly micromicaceous, trace pyrite, no stain, minor very weak dull brown fluorescence.

1845-1851 m 100% **SHALE**: very dark grey, locally grey brown, firm, brittle, slightly micromicaceous, siliceous, slightly carbonaceous, locally moderately carbonaceous, rare white specks to possibly phosphatic, trace pyrite possibly infilling fractures, rare calcite, trace pyritic siltstone, no stain, minor very weak dull brown fluorescence.

1851-1855 m 100% **SHALE**: very dark grey, locally grey to brown, platy, hard, siliceous, carbonaceous, trace black bitumen along chip margins, crumbly in part, no visible stain, dull medium brown fluorescence, minor yellow fluorescence, bright white streaming milky cut, pale yellow ring cut. 50% Cavings of shale in sample.

1855-1860 m 100% **SHALE**: very dark grey to greyish brown, hard, brittle, siliceous, carbonaceous, trace pyrite fracture infill, subplaty, slightly crumbly, trace carbonaceous siltstone, rare calcite, no visible stain, dull brown to locally yellow fluorescence, fast streaming bright milky cut, dark yellow ring cut.

1860-1865 m 100% **SHALE**: very dark grey to greyish brown, platy, hard, siliceous, carbonaceous, crumbly in part, trace calcite fracture infill, no visible stain, dull brown to medium brown fluorescence, bright white streaming cut.

1865-1870 m 100% **SHALE**: dark brownish grey, very dark grey, subplaty, fissile, moderately siliceous, firm, trace pyrite, trace calcite fracture fill, rare black dry bitumen chips, no visible stain, spotty medium brown fluorescence, bright white streaming milky cut.

1870-1872 m 100% **SHALE**: very dark grey, minor grey brown, hard, brittle, platy, subplaty in part, siliceous, slightly carbonaceous, trace siltstone, trace calcite fracture infill, no visible stain, spotty dull brown fluorescence, bright white milky cut.

1872-1880 m 100% (After trip) **SHALE**: very dark grey, brownish grey in part, micromicaceous, hard, brittle, silicified, trace calcite lined fracture surfaces, carbonaceous, no visible stain, spotty dull brown fluorescence, weak streaming milky cut.

1880-1885 m 100% **SHALE**: very dark grey, micromicaceous, hard, silicified, carbonaceous, numerous calcite filled hairline fractures, no visible stain, spotty to even medium brown cut, moderately streaming milky cut, medium yellow ring cut.

1885-1890 m 100% **SHALE**: very dark grey, brownish grey in part, micromicaceous, hard, brittle, silicified, carbonaceous to bitumen, trace calcite lined fractures, trace pyrite, no visible stain, spotty to even medium brown fluorescence, slow milky streaming cut, medium yellow ring cut.

1890-1895 m 100% **SHALE**: very dark grey, brownish grey, micromicaceous, hard, brittle, silicified, carbonaceous to bitumen, trace calcite filled hairline to very narrow fractures, trace microcrystalline pyrite masses, slightly bitumen appearance in

part, no visible stain, moderately milky streaming cut, medium yellow ring cut.

1895-1900 m 100% **SHALE**: very dark grey, brownish grey, micromicaceous, hard, silicified, carbonaceous to bitumen, trace calcite lined fractures, trace pyritic siltstone, no visible stain, moderately streaming milky cut, medium yellow ring cut.

1900-1905 m 100% **SHALE**: very dark grey, brownish grey, micromicaceous, hard, brittle, silicified, carbonaceous to bitumen, some calcite filled micro fractures, trace fine to medium clear calcareous crystals on fracture surface, trace pyrite, bituminous appearance in part, no visible oil stain, very weak brown fluorescence, moderately milky streaming cut, yellow ring cut.

1905-1910 m 100% **SHALE**: very dark grey, brownish grey, hard, silicified, micromicaceous, carbonaceous to bitumen, trace pyrite, trace calcite filled micro fractures, slightly bitumen, no visible oil stain, even dull brown fluorescence, moderately milky streaming cut, yellow ring cut.

1910-1920 m No samples.

1920-1925 m 100% **SHALE**: very dark grey, minor brownish grey, micromicaceous, hard, silicified, carbonaceous, trace pyrite chips, trace calcite filled micro fractures, no visible stain, even to spotty medium brown fluorescence, slow milky streaming cut.

1925-1930 m 100% **SHALE**: very dark grey, hard, silicified, micromicaceous, trace pyrite chips, silicified, slightly carbonaceous, rare calcite fracture infill, no visible stain, even to spotty medium brown fluorescence, very slow streaming milky cut.

1930-1938 m 100% **SHALE**: very dark grey, micromicaceous, hard, siliceous, slightly carbonaceous, trace pyrite chips, trace siltstone, no stain, even to spotty medium brown fluorescence, slow milky streaming cut.

1938-1940 m 100% (After trip), **SHALE**: dark grey., micromicaceous, firm., platy, fissile, moderately silicified, slightly carbonaceous, rare calcite fracture infill, trace pyrite, trace siltstone.

1940-1945 m 100% **SHALE**: dark grey, micromicaceous, firm, platy, fissile, slightly silicified, slightly carbonaceous, trace white calcite fracture infill, trace light grey, cryptocrystalline calcareous chips, trace pyrite, no visible stain, even to spotty dull brown fluorescence, slow milky streaming cut, yellow ring cut.

1945-1950 m 100% **SHALE**: very dark grey, platy, fissile, hard, silicified, carbonaceous, several calcite filled micro fractures, common light grey cryptocrystalline calcite, no visible stain, dull brown fluorescence, slow streaming milky cut. Note: the light grey calcareous chips are bitumen stained and occasionally contain clean white calcite filled micro fractures.

1950-1955 m 100% **SHALE**: very dark grey, slightly grey to brown, firm to hard, silicified, carbonaceous, platy, fissile, trace pyrite, trace light grey calcareous chips, dull medium brown fluorescence, moderately streaming milky cut, yellow ring cut.

1955-1960 m 100% **SHALE**: very dark grey, grey brown, platy, fissile, hard, slightly micromicaceous, silicified, carbonaceous to bitumen, trace light grey calcareous chips, trace white slightly oil stained siltstone, no visible stain, dull brown

fluorescence, yellow fluorescence in siltstone, moderately streaming cut.

1960-1965 m — 50%, **LIMESTONE**: tan, buff, microcrystalline, cryptocrystalline in part, some fine to medium crystalline, dense, earthy to slightly translucent, minor spotty tan oil stain, no visible porosity, no fluorescence, faint milky to pale yellow cut. 50% **SHALE**: dark grey, cavings.

1965-1970 m — 90% **LIMESTONE**: buff, minor tan, minor very light grey, cryptocrystalline to microcrystalline, some fine crystalline, minor fine to medium grained fossil fragments, dense, earthy to crystalline texture, rare micro sucrosic texture, dense, trace calcite filled micro fractures, trace tan stain, tight, trace milky cut. 10% **SHALE**: dark grey, platy, fissile, firm to hard.

1970-1975 m — 95%, **LIMESTONE**: buff, minor tan, microcrystalline, cryptocrystalline in part, some fine to medium crystalline, slightly translucent, earthy in part, dense, rare brown oil stain, rare pinpoint vug porosity, rare trace intercrystalline porosity, no fluorescence, very faint milky cut: 5% **SHALE**: dark grey, platy, fissile, minor blocky and silty.

1975-1980 m — 95% **LIMESTONE**: buff, minor tan, microcrystalline, cryptocrystalline in part, minor fine to medium crystalline, dense, crystalline texture, earthy in part, trace calcite filled micro fractures, trace brown stain, trace pyrite, tight, no fluorescence, faint cut. 5% **SHALE**: dark grey, medium grey in part, platy, blocky and slightly silty in part, non calcareous.

1980-1985 m — 100% **LIMESTONE**: buff, minor tan, light grey, cryptocrystalline to microcrystalline, earthy to slightly translucent, dense, trace calcite filled fractures, trace pyrite, slightly argillaceous in part, rare tan stain, tight, rare fluorescence, very faint cut. Trace **SHALE**: dark grey, hard, fissile, platy.

1985-1990 m — 95% **LIMESTONE**: buff, trace tan, cryptocrystalline to micro crystalline, rare very fine crystalline, earthy, slightly translucent in part, trace tan stain, rare local intercrystalline porosity, rare weak fluorescence, very faint milky cut. 5% **SHALE**: dark grey, platy, fissile, firm.

1990-1995 m — 100% **LIMESTONE**: buff, minor tan, cryptocrystalline, minor microcrystalline, trace very fine crystalline, earthy, dense, rare tan oil stain, tight, rare intercrystalline porosity, no fluorescence, very faint milky cut.

1995-2001 m — 100% **LIMESTONE**: buff, very light grey, cryptocrystalline, microcrystalline in part, trace very fine crystalline, earthy, minor slightly translucent, trace calcite filled micro fractures, rare pyrite, rare coarse crystalline calcite, rare brown oil stain, tight, no fluorescence, very faint milky cut.

TOTAL DEPTH — **was reached at 2001.0 m TVD (-1840.0 m SS) on February 15, 2013 at 09:45 hours.**

RPS ENERGY CANADA LTD. (RPS)

TERMS

All interpretations and conclusions presented herein are opinions based on inferences from geological, geophysical, engineering and other available data. The report represents RPS`s best professional judgment and best efforts, and should not be considered a guarantee of results.

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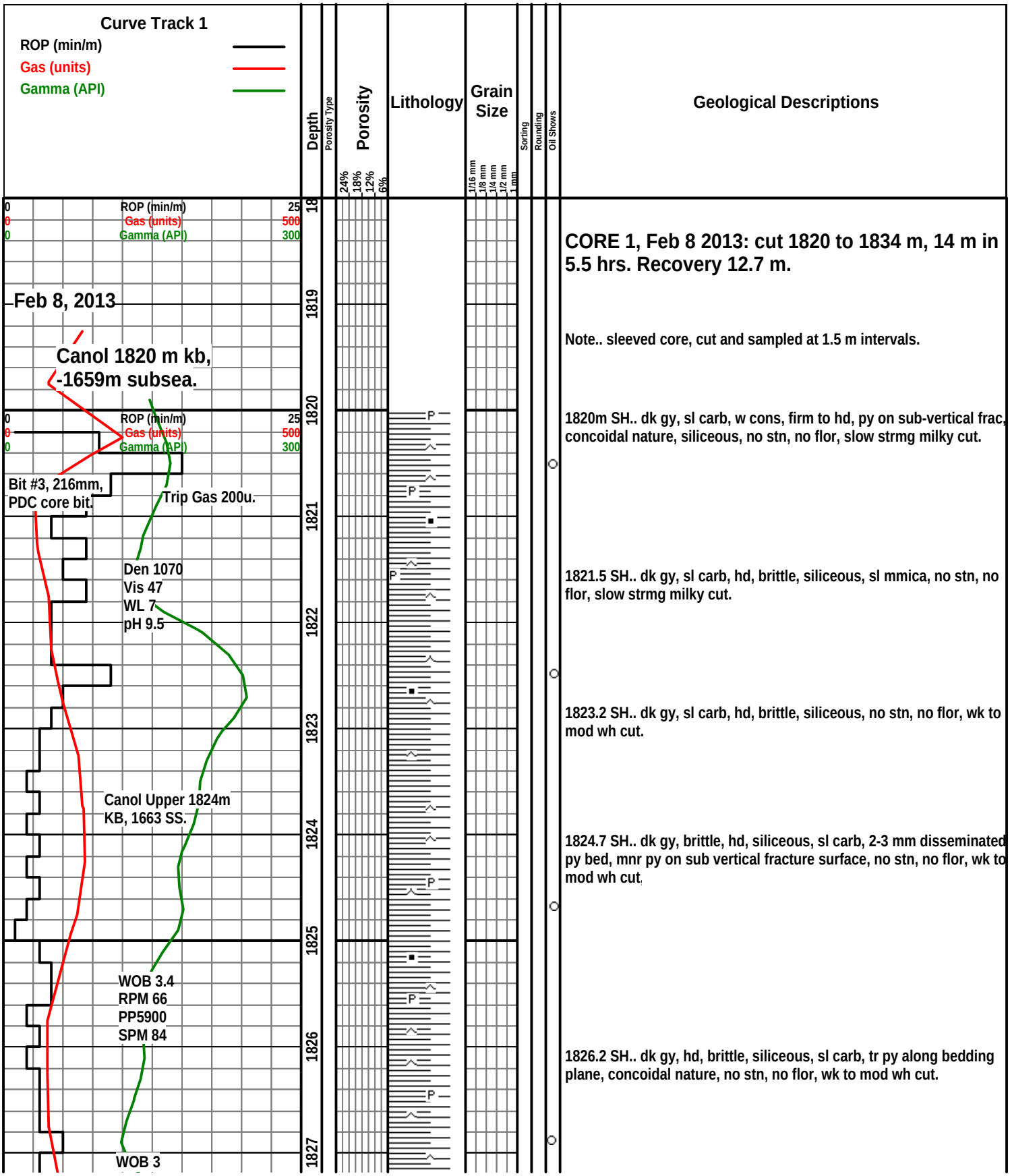
Under no circumstances shall RPS's liability to the customer exceed the amount of fees it received for performing the services under this agreement.

CORE LOG 1:48 SCALE

Contractor: Baker Hughes
Core #: 1,2,3
Formation: Canol
Core Interval: From: 1820 m To: 1874.2 m
Cut: 54.2 m **Recovered:** 51.4 m
Bit type: PDC
Size: 216 mm
Coring Time: 17.5 hrs



CORE 1, Feb 8 2013: cut 1820 to 1834 m, 14 m in 5.5 hrs. Recovery 12.7 m.

Note.. sleeved core, cut and sampled at 1.5 m intervals.

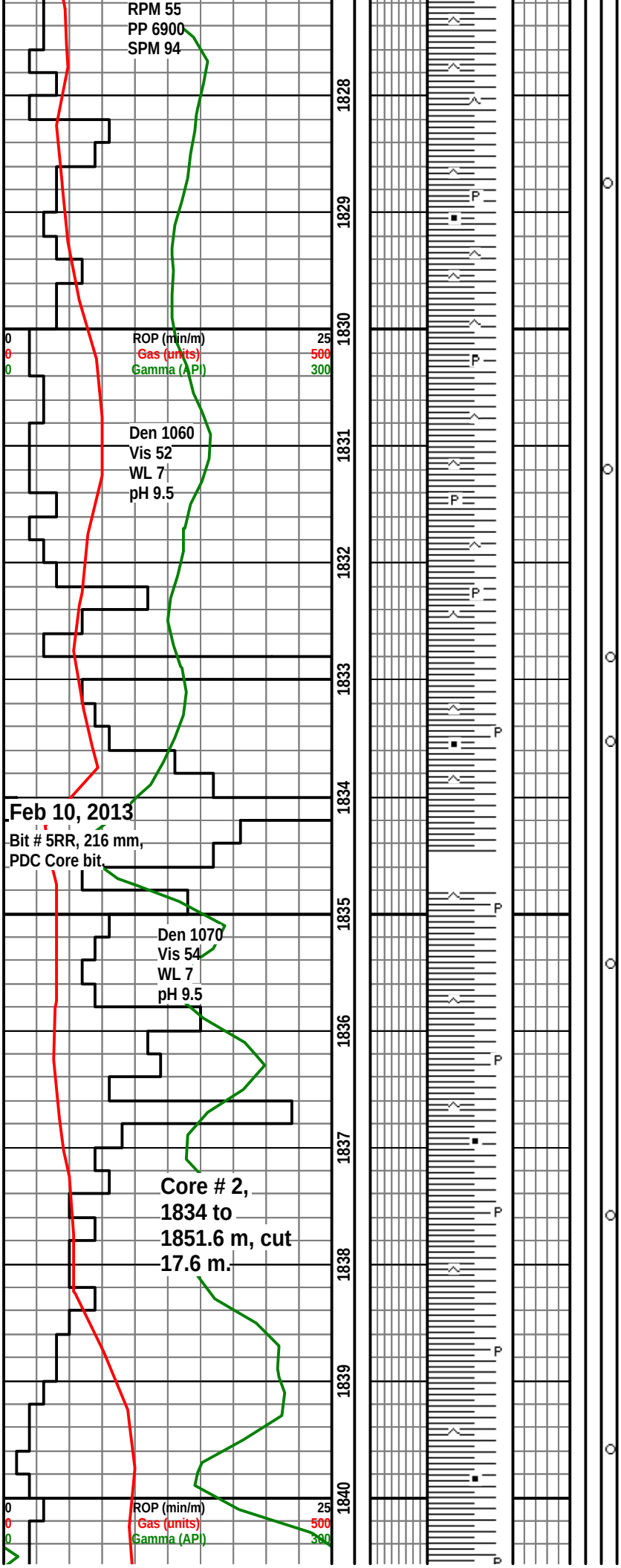
1820m SH.. dk gy, sl carb, w cons, firm to hd, py on sub-vertical frac, concoidal nature, siliceous, no stn, no flor, slow strmg milky cut.

1821.5 SH.. dk gy, sl carb, hd, brittle, siliceous, sl mmica, no stn, no flor, slow strmg milky cut.

1823.2 SH.. dk gy, sl carb, hd, brittle, siliceous, no stn, no flor, wk to mod wh cut.

1824.7 SH.. dk gy, brittle, hd, siliceous, sl carb, 2-3 mm disseminated py bed, mnr py on sub vertical fracture surface, no stn, no flor, wk to mod wh cut.

1826.2 SH.. dk gy, hd, brittle, siliceous, sl carb, tr py along bedding plane, concoidal nature, no stn, no flor, wk to mod wh cut.



1827.7 SH.. dk gy, hd, brittle, siliceous, sl carb, concoidal nature, v sl mmica, no stn, no flor, wk to mod wh cut.

1829.2 SH.. dk gy, hd, brittle, siliceous, sl carb, concoidal nature, tr py, no stn, no flor, wk milky strmg cut.

1830.7 SH.. dk gy, sl brn gy, hd, brittle, siliceous, sl carb, scat py on fracture plane, no flor, no stn, wk to mod milky cut.

1832.2 SH.. dk gy, sl brn, hd, brittle, siliceous, sl carb, concoidal frac no flor, no stn, mod milky cut.

1832.7 SH.. dk gy, sl brn, hd, brittle, siliceous, sl carb, scat dis, py, no flor, no stn, mod milky cut.

No Core 1832.7 to 1834 m, core shoe jammed with rubble chips.

CORE 2, Feb 10 2013: cut 1834 to 1851.6 m, 17.6 m in 5.75 hrs. Recovery 17.3 m

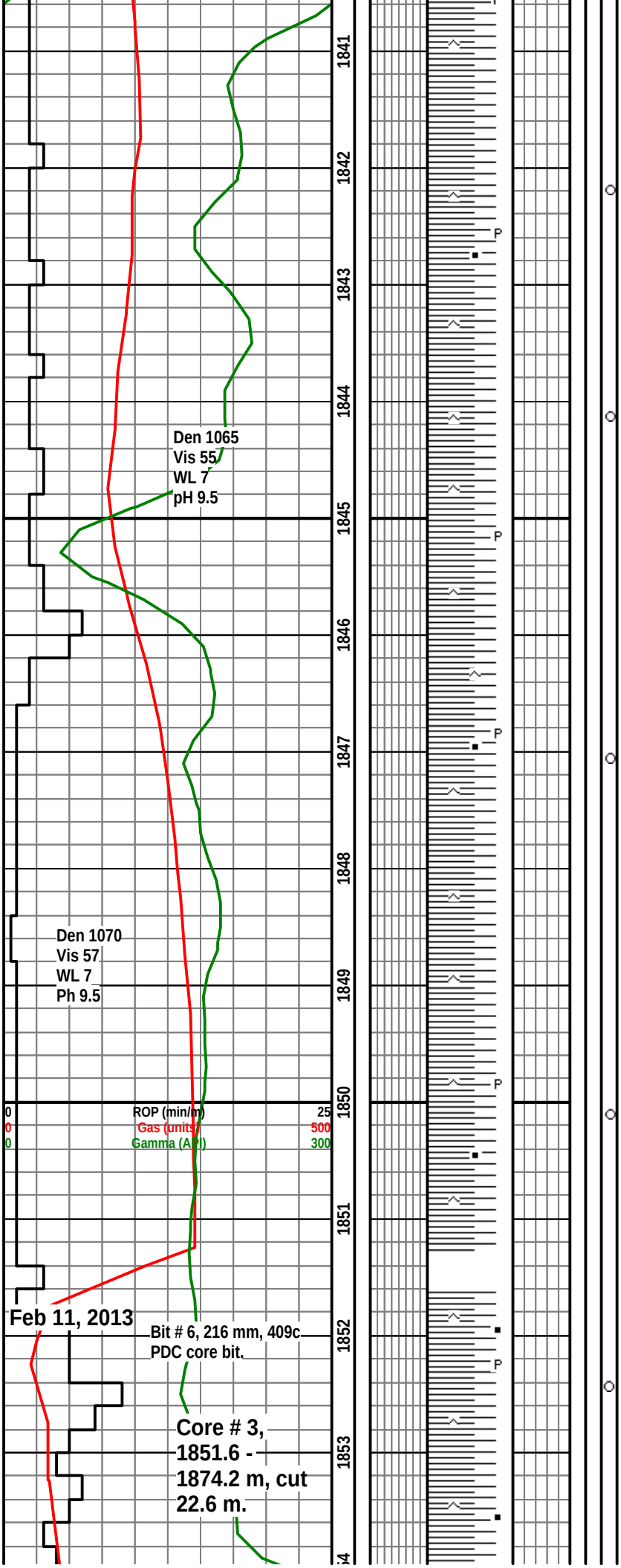
1834 SH.. dk gy, sl mmica, hd, brittle, siliceous, sl carb, tr scat py, no stain, no flor, slow mod wh cut.

1835.5 SH.. dk gy, sl mmica, hd, brittle, siliceous, com scat py needles, sl carb, no stn, no flor, strong wh cu

1837 SH.. dk gy, sl mmica, hd, brittle, siliceous, tr scat py needles, , sl carb, tr bit replacing micro fossils, tr moldic por, no stain, strong fast wh cut, sulfur odour.

1838.5 SH.. dk gy, brittle, siliceous, sl carb, tr dis py, fis, plty, sl sulfur odour, no stain, no flor, strong milky cut.

1840 SH.. dk gy, hd, sl mmica, sl carb, siliceous, py in a 2-3mm bed, no stain, no flor, strong milky cut, sulfur odou



1841.7 SH.. dk gy, hd, platy, fis, siliceous, tr calcite on vertical fracture surface, sl carb, tr scat py, no staining, dull brn flor, slow wh strmg cut, wk sulfur odour.

1843.2 SH.. dk gy, plty, fis, hd, siliceous, sl carb, tr py, no staining, dull brn flor, slow milky cut

1844.7 H.. dk gy, mmica, hd, siliceous, plty, sl carb, no staining, dull brn flor, slow milky cut.

1846.2 SH.. dk gy, hd, siliceous, platy, com scat micro py, no stain, dull brn flor, mod milky cut, sulfur odour.

1847.7 SH.. dk gy, hd, siliceous, sl mmica, no stain, dull brn flor, slow milky cut, sulfur odour

Note.. the milky cut dries to a pale yellow ring cut.

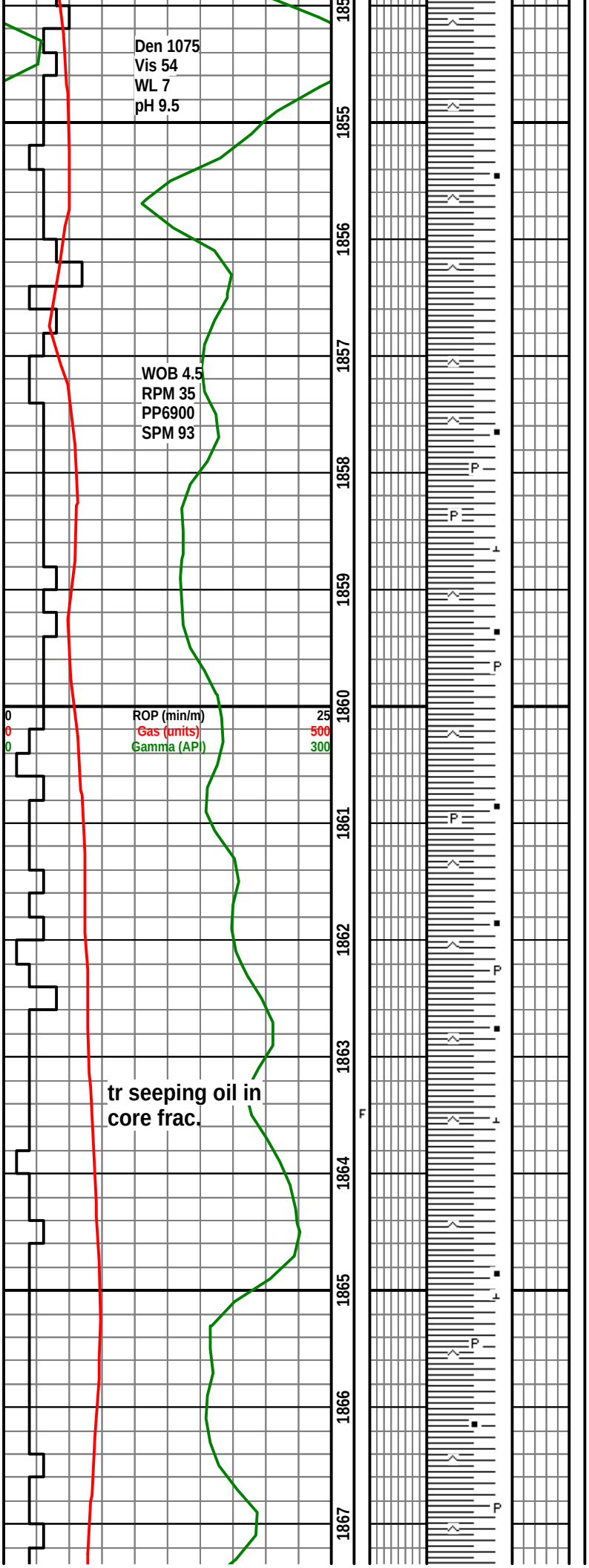
1849.2 SH.. dk gy, hd, siliceous, sl mmica, tr calcite on vertical frac surfaces, no stain, dull brn flor, mod to strong wh milky cut,

1850.7 SH.. dk gy, mmica, hd, siliceous, sl carb, tr py, tr py replacing a fossil, no stain, dull brn flor, mod milky cut, mod sulfur odour.

1851.3 SH.. dk gy, mmica, hd, siliceous, sl carb, pos slickensides, local rugose bedding surface - pos pressure solution, microscopic scat py, no staining, dull brn flor, mod to strong wh cut, wk sulfur odour.

CORE 3, Feb 11 2013: cut 1851.6 - 1874.2 m, 22.6 m in 6.75 hrs. Recovery 21.4 m

1853.1 SH.. dk gy, hd, brittle, siliceous, sl carb, micro scat py, no vis stn, wk dull brn flor, wk sulfur odour, bri wh strmg cut.



1854.3 SH.. dk gy, sl mmica, hd, brittle, siliceous, sl carb, no vis stn, dull dk brn flor, no sulfur odor, bri wh strmg cut.

1855.8 SH.. dk gy, hd, siliceous, sl carb, mmica, no vis stn, med brn flor, no sulfur odour, bri wh strmg cut.

Note.. white cut dries to a pale yellow ring cut.

1857.3 SH.. dk gy, hd, brittle, sl mmica, siliceous, sl carb, no vis stn, dull brn flor, no sulfur odor, bri wh strmg cut.

1858.8 SH.. dk gy, hd, sl mmica, siliceous, sl carb, calcite coating on sub vertical frac, calcite +/- dol on horiz bedding surfaces, tr vf gran py in v thin horiz beds, no vis stn, dull brn flor, wk sulfur odour, bri wh strmg cut.

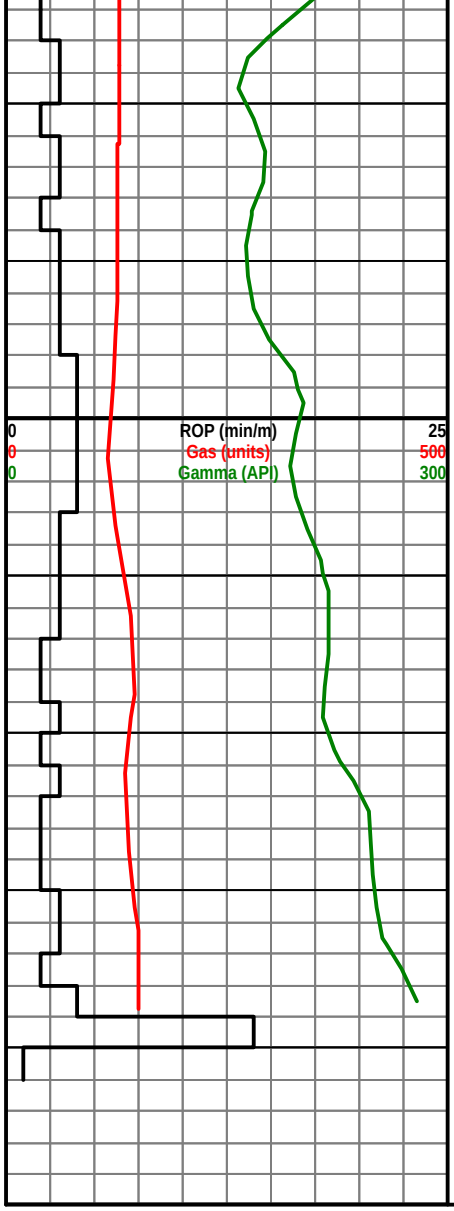
1860.3 SH.. dk gy, hd, siliceous, concoidal frac, sl carb, mnr thin bedding parallel py seams, no vis stn, even med brn flor, wk sulfur odour, bri wh strmg cut.

1861.8 SH.. dk gy, hd, siliceous, mmica, abnt vf dis py. sl carb, no vis stn, dull brn flor, wk sulfur odour, bri wh strmg cut.

1863.4 SH.. dk gy, hd, siliceous, sl carb, sl mmica, f xln calcite on sub vertical frac, tr bleeding oil on a tight frac, oil has a dk yel flor, no vis stn on sh, even med brn flor, no sulfur odour, bri wh strmg cut.

1864.9 SH.. dk gy, hd, siliceous, siliceous, sl carb, com vf dis py, one sub vertical calcite lined hairline frac, dull brn flor, wk sulfur odour, bri wh strmg cut.

1866.4 SH.. dk gy, hd, siliceous, concoidal frac, one calcite lined hairline frac, mnr dis py, dull brn flor, wk sulfur odour, bri wh strmg cut.



1867.9 SH.. dk gy, hd, siliceous, concoidal frac, sl carb, com vf dis py, no vis staining, wk dull brn flor, sl sulfur odour, bri wh milky strmg cut.

1869.4 SH.. dk gy, hd, siliceous, sl carb, com micro dis py, tr calcite along pos sub vertical frac, no vis stn, possible dull brn flor, wk sulfur odour, slow bri wh strmg milky cut.

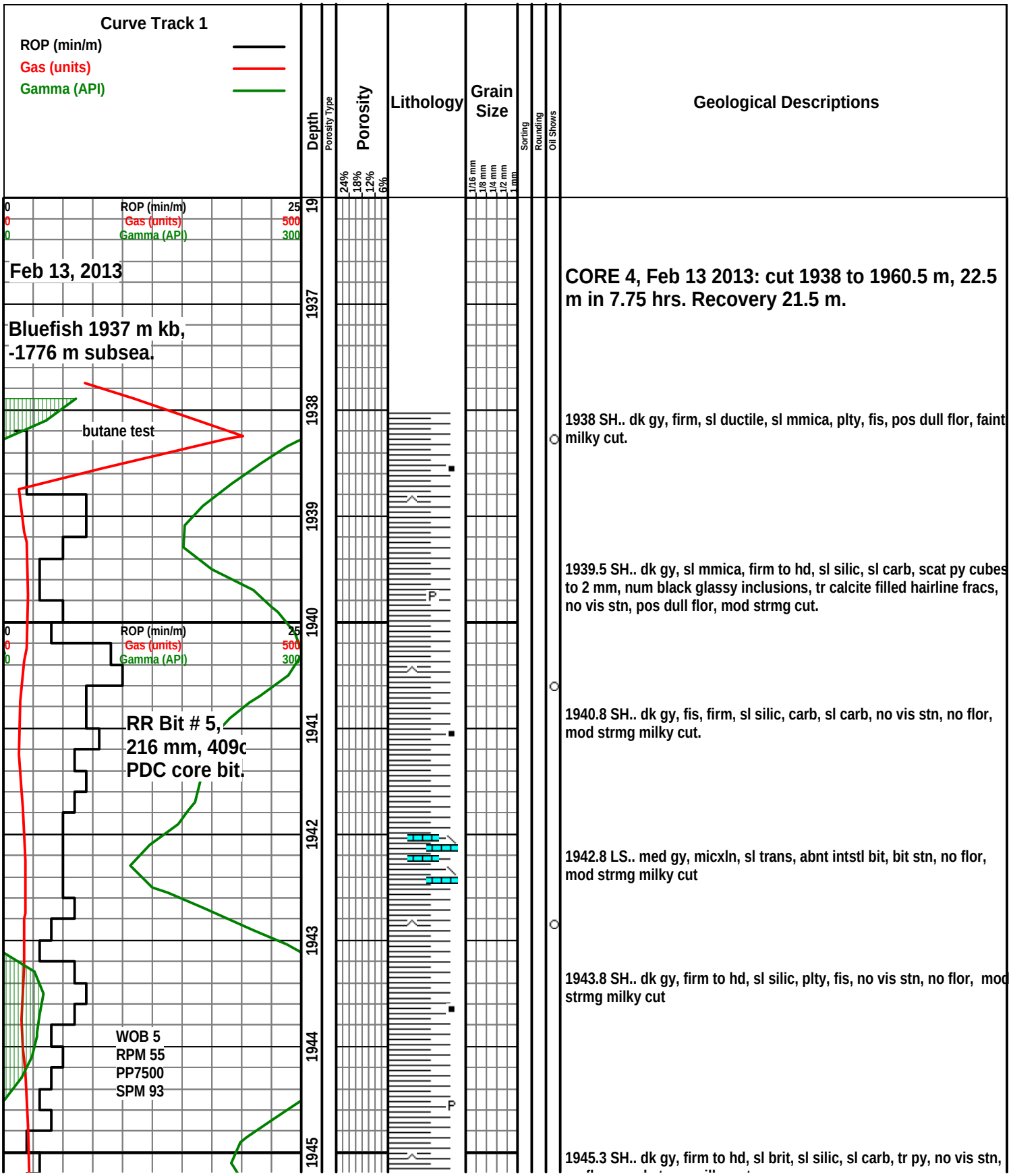
1870.9 SH.. dk gy, hd, siliceous, sl carb, mnr micro scat py, one vertical hairline frac no calcite coating possibly mechanically fractured, no vis stn, slow strmg milky cut.

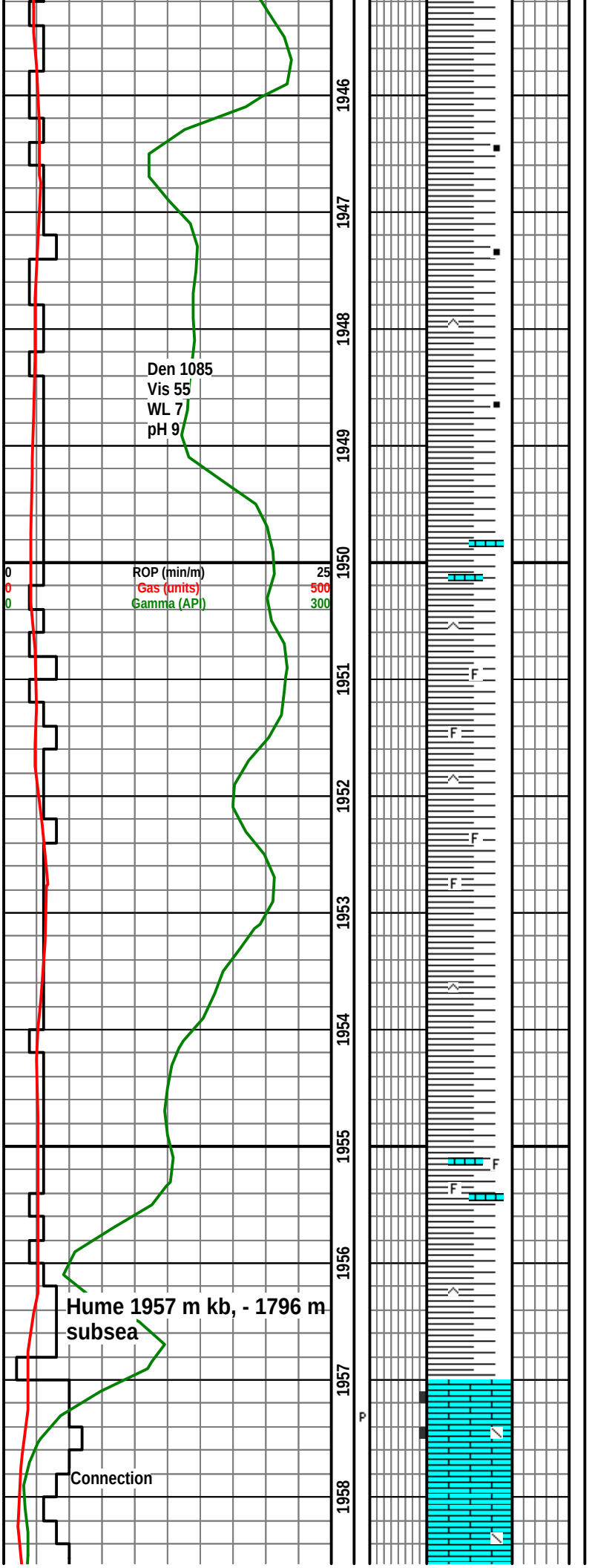
1872.4 SH.. dk gy, hd, siliceous, sl carb, sl mmica, mnr scat micro py, no vis stn, dull dk brn flor, slow strmg milky cut.

1873 SH.. dk gy, hd, siliceous, sl carb, no vis stn, pos wk dull brn flor, no flor, no sulfur odour, slow strmg milky cut.

CORE LOG 1:48 SCALE

Contractor: Baker Hughes
Core #: 4
Formation: Blue Fish
Core Interval: From: 1938 m To: 1960.5 m
Cut: 22.5 m **Recovered:** 21.5 m
Bit type: BHC 409C
Size: 216 mm
Coring Time: 7.75 hrs





no flor, mod strmg milky cut

1946.8 SH.. dk gy, fis, firm to hd, sl silic, mod carb, polished surfaces pos slickensides, tr calcite frac coating, no vis stn, med brn flor, slow to mod strmg milky cut

1948.3 SH.. dk gy, firm to hd, sl silic, mod carb, sl mmica, fis, num fos molds, no stn, med brn flor, mod strmg milky cut.

1950 SH.. dk gy, firm to hd, fis, plty, tr calcite filled micro frac, some ls lenses in the sh, no vis stn, no flor, slow to mod strmg milky cut.

1951.5 SH.. dk gy, firm to hd, sl silic, fis, sl carb, tr py cubes, com fos molds, no stn, no flor, slow to mod strmg milky cut.

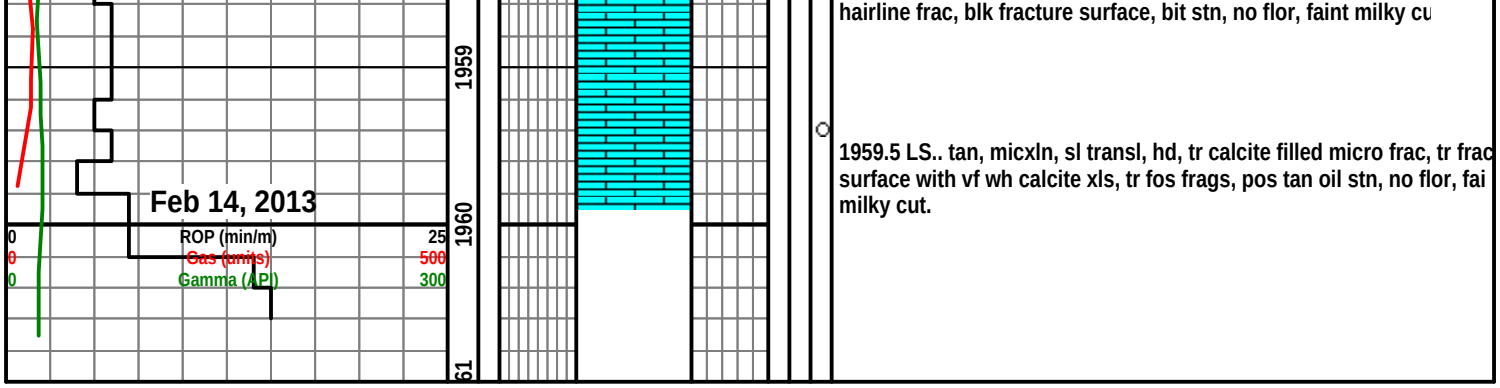
1953 SH.. dk gy, firm to hd, sl silic, sl carb, calc beds, com fos molds no stn, no flor, slow to mod strmg milky cut.

1954.5 SH.. dk gy, firm to hd, fis, sl silic, sl carb, no stn, pos wk flor, slow to mod strmg milky cut.

1956 SH.. dk gy, firm, fis, sl silic, sl carb, micxln calc beds of fos frags, no stn, no flor, slow to mod strmg milky cut.

1957.5 LS.. tan, lt brn, vf to f xln, sl transl, dense, faint fos frags, rr spec soft bit, tr soft bit in vugs, tr pp vug por, 2-3% por, spty yel flor, faint milky cut.

1958.5 LS.. med gy, gy-brn, micxln, sl transl, hd, one calcite filled



hairline frac, blk fracture surface, bit stn, no flor, faint milky cu

1959.5 LS.. tan, micxln, sl transl, hd, tr calcite filled micro frac, tr frac surface with vf wh calcite xls, tr fos frags, pos tan oil stn, no flor, fai milky cut.

Scale 1:240 (5"=100') Metric

Well Name:	MGM - Shell East MacKay I-78		
Location:	Unit I, Section 78, Grid 64 50 125 30		
Licence Number:	1202	Region:	NWT mainland
Spud Date:	Jan 17, 2013	Drilling Completed:	Feb 15, 2013
Surface Coordinates:	Lat 64°47'42.1" N; Long 125°43'19.1" W		
Bottom Hole Coordinates	Lat 64°47'42.1" N; Long 125°43'19.1" W		
Ground Elevation (m):	155.0	K.B. Elevation (m):	161.2
Logged Interval (m):	0 To: 2001	Total Depth (m):	2001
Formation:	Total Depth in Hume Formation		
Type of Drilling Fluid:	Gel chem		

OPERATOR

Company:	MGM Energy Corp.
Address:	4100, 350 - 7th Avenue SW Calgary, Alberta T2P 3N9

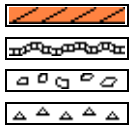
GEOLOGIST

Name:	Dave Prior
Company:	RPS Energy
Address:	1400, 800 - 5th Avenue SW Calgary, AB Canada T2P 3T6

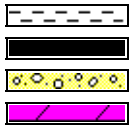
Cores

Cut core from 1820 to 1874 m in three runs, cut 1938 to 1960 m in one run.
Core logs appended below.

ROCK TYPES

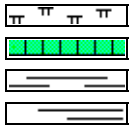


Anhy
Bent
Brec
Cht

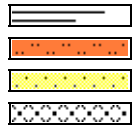


Clyst
Coal
Congl
Dol

Gyp
Igne
Lmst
Meta



Mrlst
Salt
Shale
Shcol



Shgy
Sltst
Ss
Till

ACCESSORIES

MINERAL

Anhy
Arggrn
Arg
Bent
Bit
Brecfrag
Calc
Carb
Chtdk
Chtlt
Dol
Feldspar
Ferrpel
Ferr
Glau

Gyp
Hvymin
Kaol
Marl
Minxl
Nodule
Phos
Pyr
Salt
Sandy
Silt
Sil
Sulphur
Tuff

FOSSIL

Algae
Amph
Belm
Bioclst
Brach
Bryozoa
Cephal
Coral
Crin
Echin
Fish
Foram
Fossil
Gastro
Oolite

Ostra
Pelec
Pellet
Pisolite
Plant
Strom

STRINGER

Anhy
Arg
Bent
Coal
Dol
Gyp
Ls
Mrst

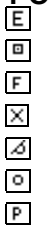
Sltstrg
Ssstrg

TEXTURE

Boundst
Chalky
Cryxln
Earthy
Finexln
Grainst
Lithogr
Microxln
Mudst
Packst
Wackest

OTHER SYMBOLS

POROSITY



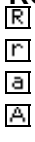
Earthy
Fenest
Fracture
Inter
Moldic
Organic
Pinpoint

Vuggy

SORTING

Well
Moderate
Poor

ROUNDING



Rounded
Subrnd
Subang
Angular

OIL SHOW

Even

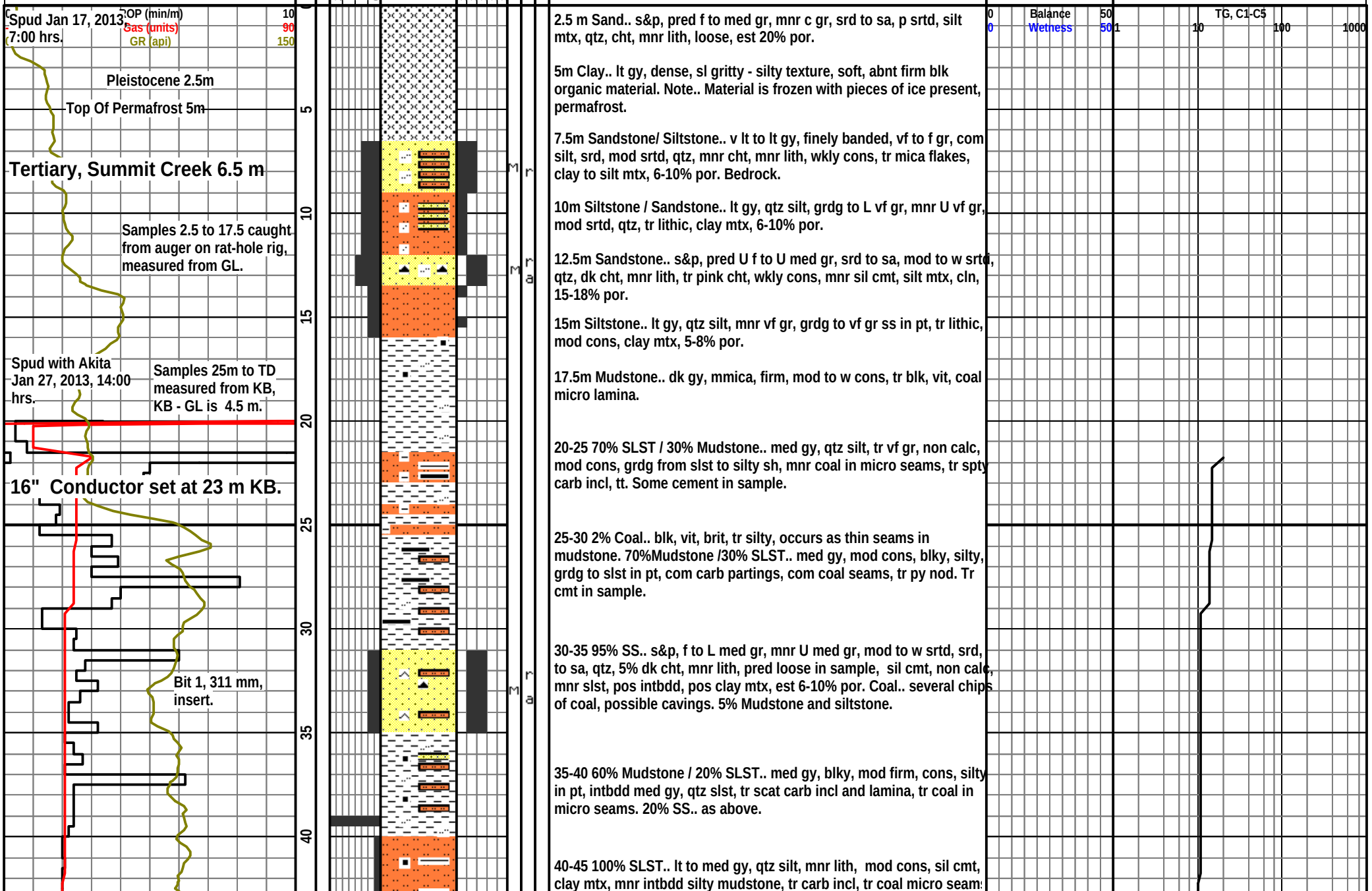
Spotted
Ques
Dead

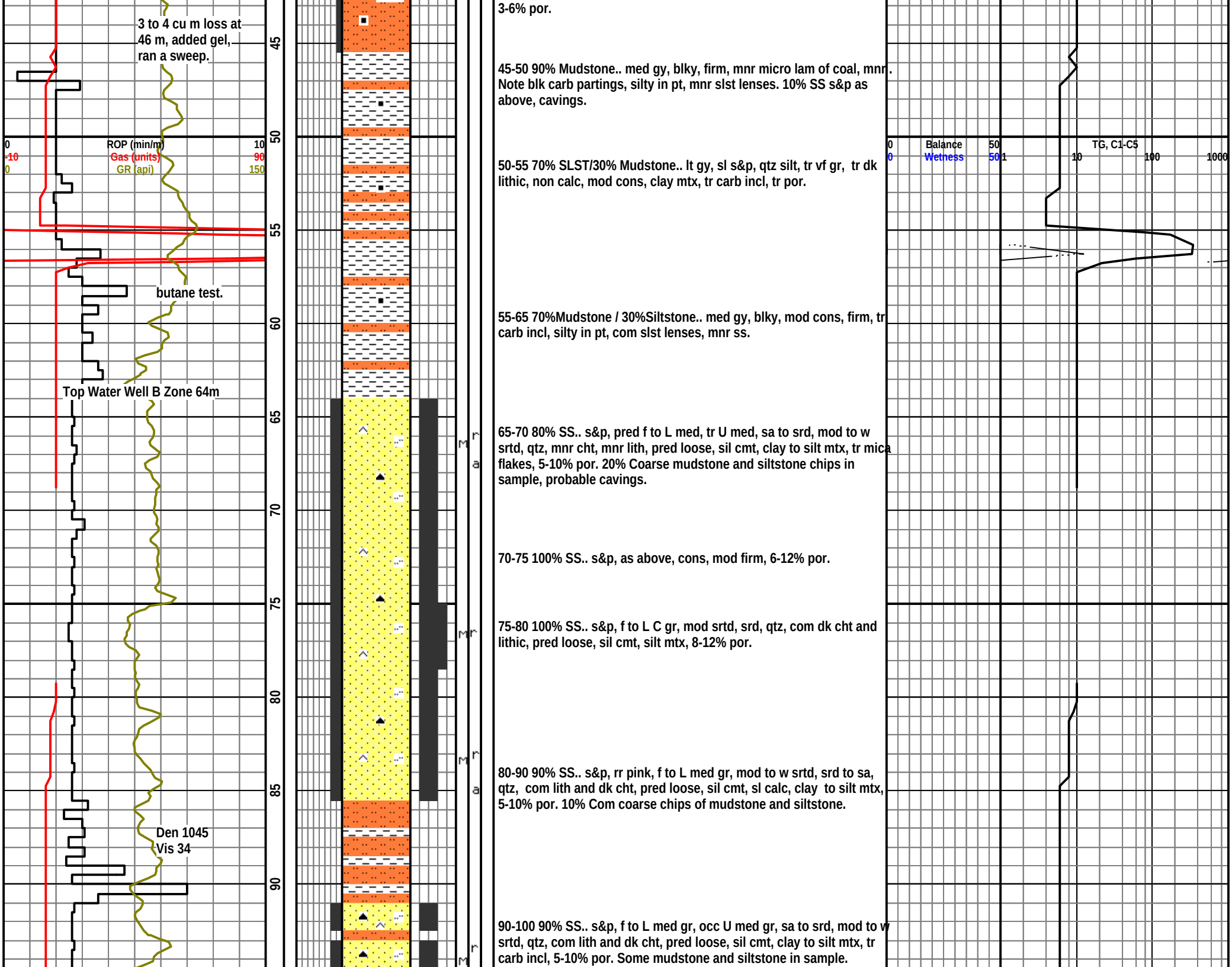
INTERVAL

Core
Dst

EVENT

Isotube
Rft
Sidewall


Curve Track 1
ROP (min/m)
Gas (units)
GR (api)
Depth
Porosity Type
Porosity
24%
18%
12%
6%
Lithology
Grain Size
1/16 mm
1/8 mm
1/4 mm
1/2 mm
1 mm
Sorting
Rounding
Oil Shows
Geological Descriptions
Balance/Wetness
Balance
Wetness
Chromatograph
TG (Units)
C1 (units)
C2 (units)
C3 (units)
C4 (units)
C5 (units)
ROP (min/m) 10
Gas (units) 90
GR (api) 150
Balance 0 50
Wetness 0 50
TG, C1-C5 1 10 100 1000
Spud Jan 17, 2013, 7:00 hrs.
Pleistocene 2.5m
Top Of Permafrost 5m
Tertiary, Summit Creek 6.5 m
Samples 2.5 to 17.5 caught from auger on rat-hole rig, measured from GL.
Spud with Akita Jan 27, 2013, 14:00 hrs.
Samples 25m to TD measured from KB, KB - GL is 4.5 m.
16" Conductor set at 23 m KB.
Bit 1, 311 mm, insert.
0
5
10
15
20
25
30
35
40
2.5 m Sand.. s&p, pred f to med gr, mnr c gr, srd to sa, p srtd, silt mtx, qtz, cht, mnr lith, loose, est 20% por.
5m Clay.. lt gy, dense, sl gritty - silty texture, soft, abnt firm blk organic material. Note.. Material is frozen with pieces of ice present, permafrost.
7.5m Sandstone/ Siltstone.. v lt to lt gy, finely banded, vf to f gr, com silt, srd, mod srtd, qtz, mnr cht, mnr lith, wkly cons, tr mica flakes, clay to silt mtx, 6-10% por. Bedrock.
10m Siltstone / Sandstone.. lt gy, qtz silt, grdg to L vf gr, mnr U vf gr, mod srtd, qtz, tr lithic, clay mtx, 6-10% por.
12.5m Sandstone.. s&p, pred U f to U med gr, srd to sa, mod to w srtd, qtz, dk cht, mnr lith, tr pink cht, wkly cons, mnr sil cmt, silt mtx, cln, 15-18% por.
15m Siltstone.. lt gy, qtz silt, mnr vf gr, grdg to vf gr ss in pt, tr lithic, mod cons, clay mtx, 5-8% por.
17.5m Mudstone.. dk gy, mmica, firm, mod to w cons, tr blk, vit, coal micro lamina.
20-25 70% SLST / 30% Mudstone.. med gy, qtz silt, tr vf gr, non calc, mod cons, grdg from slst to silty sh, mnr coal in micro seams, tr spty carb incl, tt. Some cement in sample.
25-30 2% Coal.. blk, vit, brit, tr silty, occurs as thin seams in mudstone. 70%Mudstone /30% SLST.. med gy, mod cons, blky, silty, grdg to slst in pt, com carb partings, com coal seams, tr py nod. Tr cmt in sample.
30-35 95% SS.. s&p, f to L med gr, mnr U med gr, mod to w srtd, srd, to sa, qtz, 5% dk cht, mnr lith, pred loose in sample, sil cmt, non calc, mnr slst, pos intbdd, pos clay mtx, est 6-10% por. Coal.. several chips of coal, possible cavings. 5% Mudstone and siltstone.
35-40 60% Mudstone / 20% SLST.. med gy, blky, mod firm, cons, silty in pt, intbdd med gy, qtz slst, tr scat carb incl and lamina, tr coal in micro seams. 20% SS.. as above.
40-45 100% SLST.. lt to med gy, qtz silt, mnr lith, mod cons, sil cmt, clay mtx, mnr intbdd silty mudstone, tr carb incl, tr coal micro seam



3-6% por.

45-50 90% Mudstone.. med gy, blky, firm, mnr micro lam of coal, mnr. Note blk carb partings, silty in pt, mnr slst lenses. 10% SS s&p as above, cavings.

50-55 70% SLST/30% Mudstone.. lt gy, sl s&p, qtz silt, tr vf gr, tr dk lithic, non calc, mod cons, clay mtx, tr carb incl, tr por.

55-65 70%Mudstone / 30%Siltstone.. med gy, blky, mod cons, firm, tr carb incl, silty in pt, com slst lenses, mnr ss.

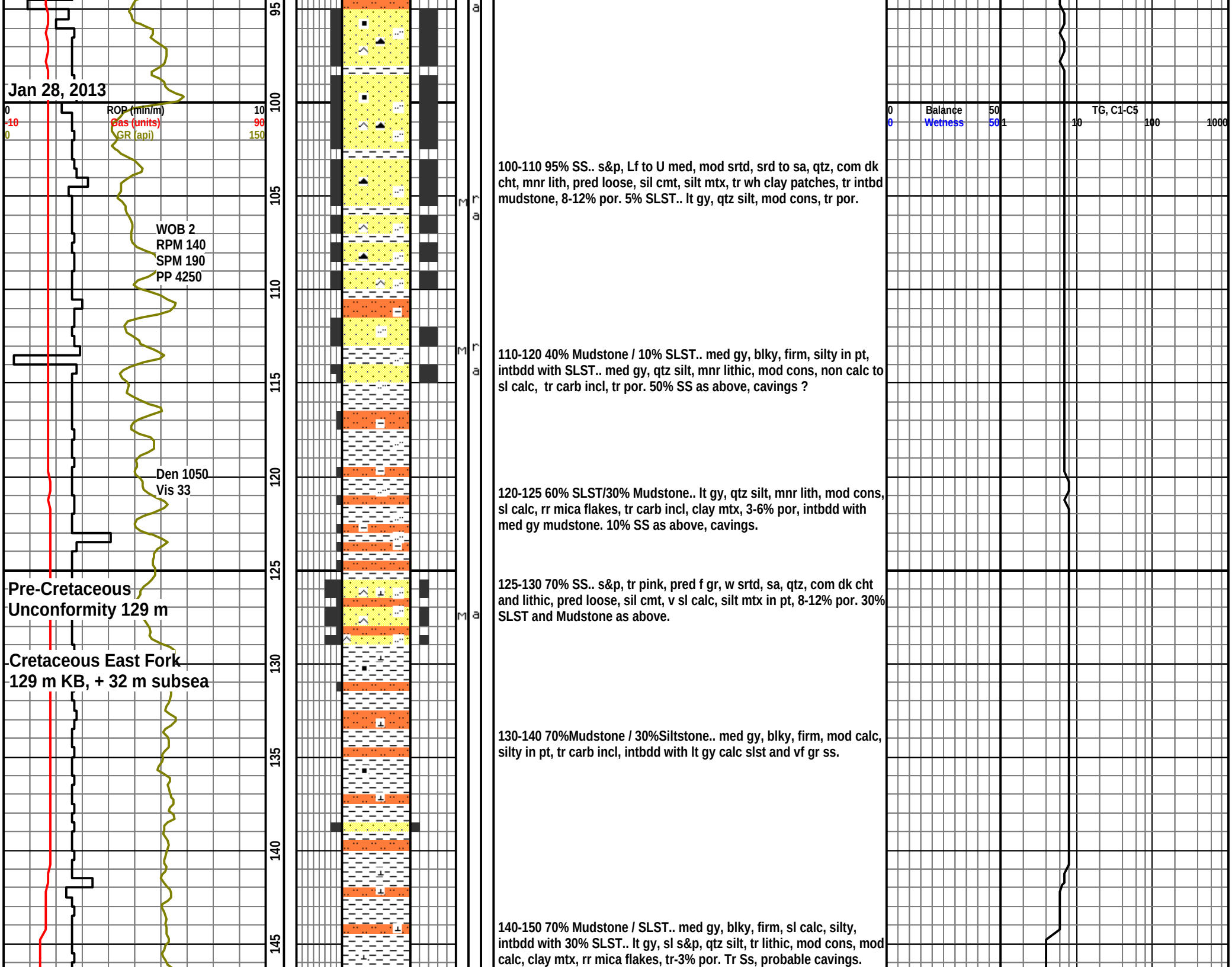
65-70 80% SS.. s&p, pred f to L med, tr U med, sa to srd, mod to w srtd, qtz, mnr cht, mnr lith, pred loose, sil cmt, clay to silt mtx, tr mica flakes, 5-10% por. 20% Coarse mudstone and siltstone chips in sample, probable cavings.

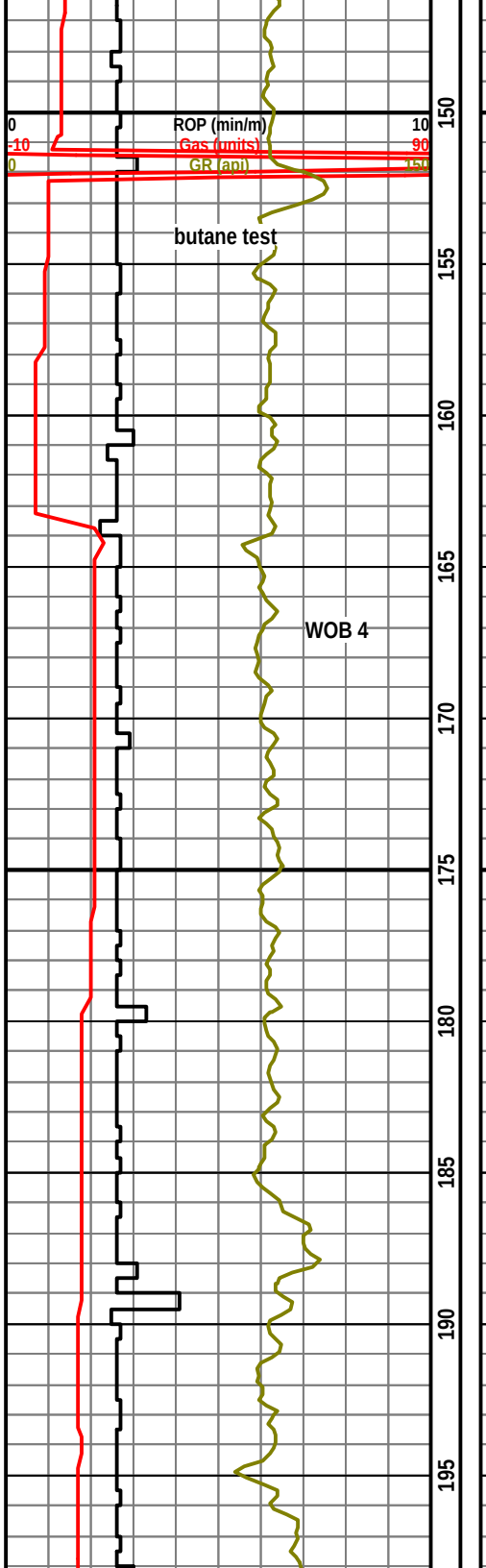
70-75 100% SS.. s&p, as above, cons, mod firm, 6-12% por.

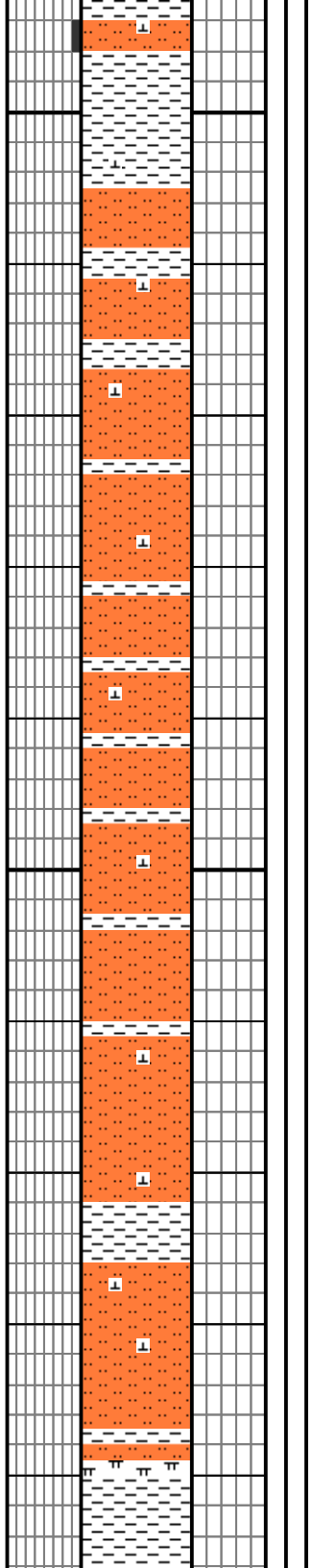
75-80 100% SS.. s&p, f to L C gr, mod srtd, srd, qtz, com dk cht and lithic, pred loose, sil cmt, silt mtx, 8-12% por.

80-90 90% SS.. s&p, rr pink, f to L med gr, mod to w srtd, srd to sa, qtz, com lith and dk cht, pred loose, sil cmt, sl calc, clay to silt mtx, 5-10% por. 10% Com coarse chips of mudstone and siltstone.

90-100 90% SS.. s&p, f to L med gr, occ U med gr, sa to srd, mod to w srtd, qtz, com lith and dk cht, pred loose, sil cmt, clay to silt mtx, tr carb incl, 5-10% por. Some mudstone and siltstone in sample.


Jan 28, 2013
0
ROP (min/m)
10
-10
Gas (units)
90
0
GR (api)
150
WOB 2
RPM 140
SPM 190
PP 4250
Den 1050
Vis 33
Pre-Cretaceous
Unconformity 129 m
Cretaceous East Fork
129 m KB, + 32 m subsea
95
100
105
110
115
120
125
130
135
140
145
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000
100-110 95% SS.. s&p, Lf to U med, mod srtd, srd to sa, qtz, com dk cht, mnr lith, pred loose, sil cmt, silt mtx, tr wh clay patches, tr intbd mudstone, 8-12% por. 5% SLST.. lt gy, qtz silt, mod cons, tr por.
110-120 40% Mudstone / 10% SLST.. med gy, blky, firm, silty in pt, intbdd with SLST.. med gy, qtz silt, mnr lithic, mod cons, non calc to sl calc, tr carb incl, tr por. 50% SS as above, cavings ?
120-125 60% SLST/30% Mudstone.. lt gy, qtz silt, mnr lith, mod cons, sl calc, rr mica flakes, tr carb incl, clay mtx, 3-6% por, intbdd with med gy mudstone. 10% SS as above, cavings.
125-130 70% SS.. s&p, tr pink, pred f gr, w srtd, sa, qtz, com dk cht and lithic, pred loose, sil cmt, v sl calc, silt mtx in pt, 8-12% por. 30% SLST and Mudstone as above.
130-140 70%Mudstone / 30%Siltstone.. med gy, blky, firm, mod calc, silty in pt, tr carb incl, intbdd with lt gy calc slst and vf gr ss.
140-150 70% Mudstone / SLST.. med gy, blky, firm, sl calc, silty, intbdd with 30% SLST.. lt gy, sl s&p, qtz silt, tr lithic, mod cons, mod calc, clay mtx, rr mica flakes, tr-3% por. Tr Ss, probable cavings.





150-155 70% Mudstone.. med gy, blky, firm, silty, intbdd with slst, mod calc. 30% SLST.. lt gy, mod cons, calc cmt, clay mtx, tr por. SS.. one chip, s&p, tr pink, vf to f gr, mod to w srtd, sa to srd, qtz, com lith and cht, calc, 5-8% por.

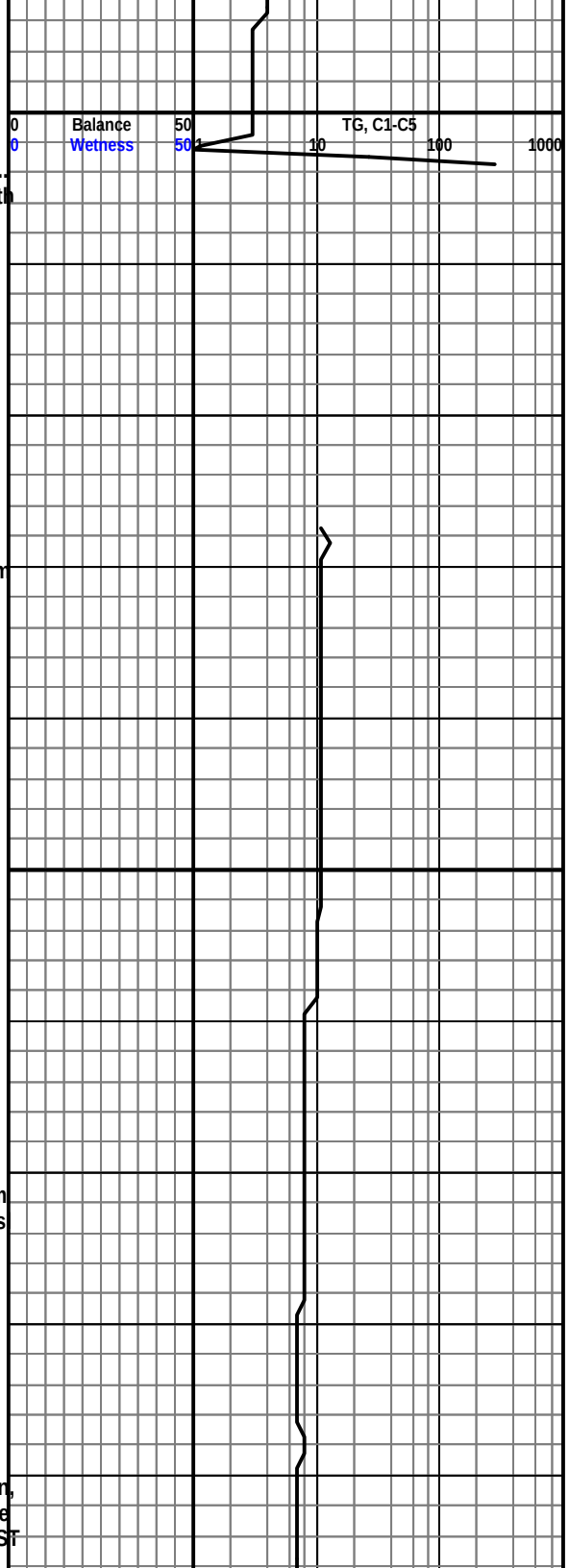
155-160 100% SLST.. lt to med gy, qtz silt, mnr lithic, rr mica flakes, clay mtx, mod calc, grdg to silty mudstone in part, local mudstone beds, tr por.

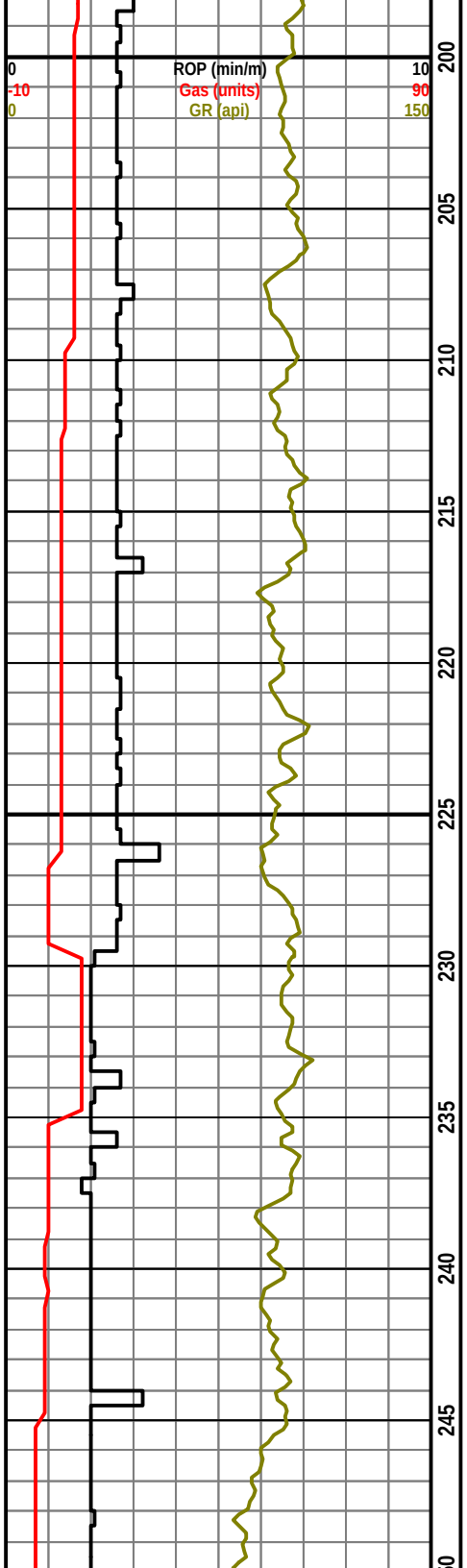
160-170 100% SLST.. med gy, qtz silt, mnr lithic, mod to w cons, firm to brittle, clay mtx, rr to tr carb incl, sl to mod calc, some intbdd mudstone, tr to 3% por,

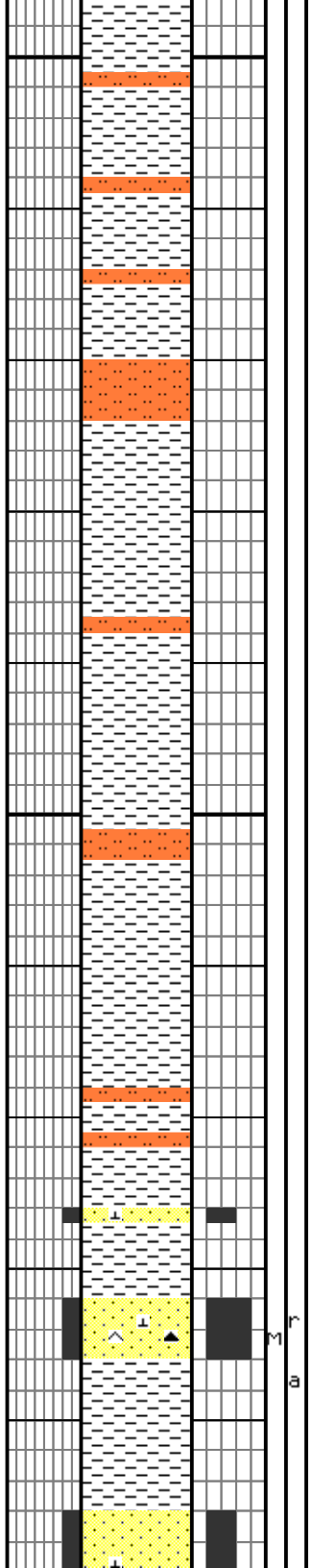
170-180 100% SLST.. as above, com intbdd mudstone, tr vf to f ss.

180-195 100% SLST.. lt to med gy, sl s&p, qtz silt, mnr lith, grdg from near clay size to near vf gr, com microscopic wh patches of clay ?, s to mod calc, mnr intbdd silty mudstone, tr to 6% por.

195-200 5%, Marlstone.. med gy-gn, crpxln, locally grading to micxln, earthy, hd, brittle, mnr clay residue after HCl, less reactive and more clay content in pt, tr local rounded mudstone inclusions, tt. 95% SLST as above







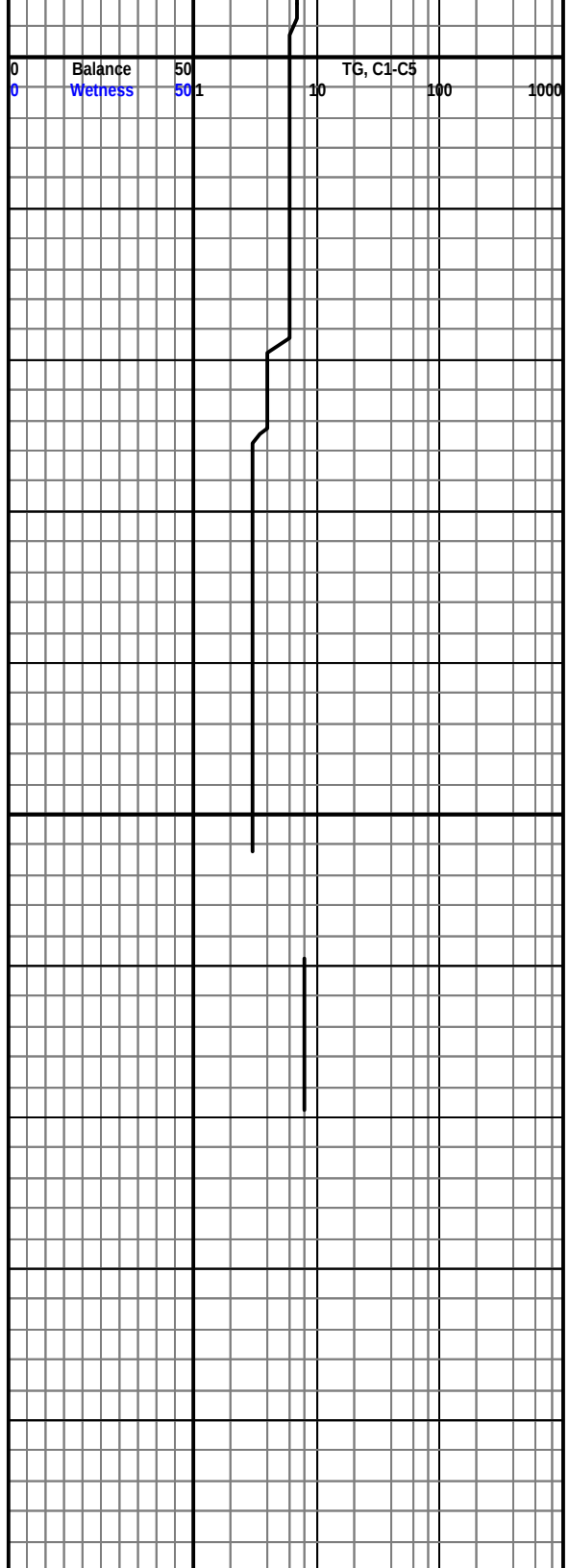
200-210 70% Mudstone.. med to dk gy, sl mmica, firm. 30% SLST.. med gy, sl s&p, as above.

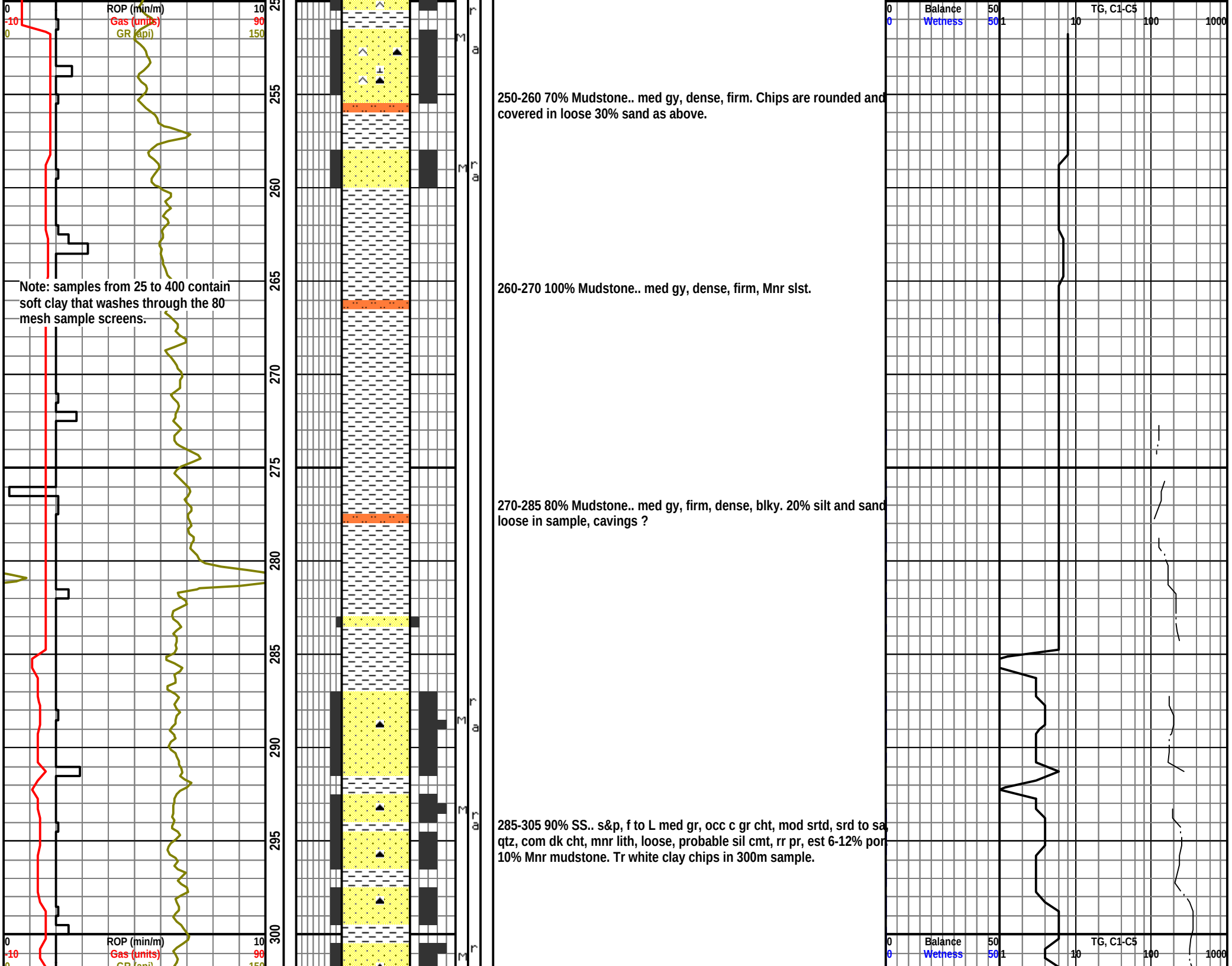
210-220 50% Mudstone.. med gy, rounded chips, firm, sl brit. 50% SLST.. med gy, firm, brit, clay mtx, tr por. Mixed lithologies and sawdust, from a hole sweep.

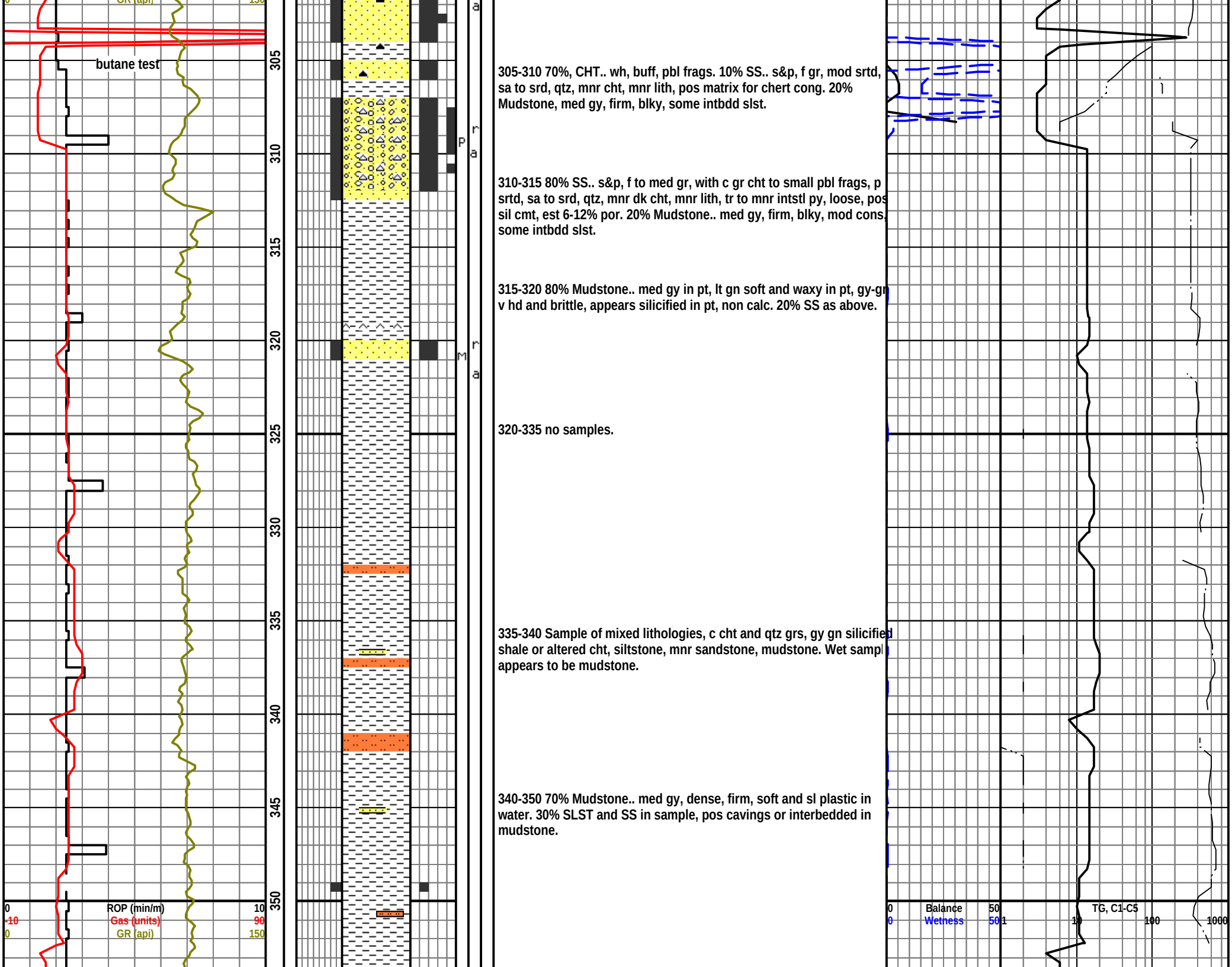
220-230 75% Mudstone.. med gy, firm, blky, sl mmica. 25% SLST.. med gy, mod cons, qtz, mnr lith, clay mtx, tr to 3% por. Higher vis mud producing some clay balls.

230-240 75%Mudstone.. med gy, blky, firm. 25% SLST.. med gy, qtz silt, firm, blky, tr por. Tr ss.

240-250 70% SS.. s&p, f to L med gr, mod to w srtd, srd to sa, qtz, com dk cht, tr py, pred loose, sil cmt, mod calc, est 6-12% por. 30% mudstone.




0
ROP (min/m)
10
-10
Gas (units)
90
0
GR (api)
150
Balance
Wetness
50
1
10
100
1000
TG, C1-C5
250
255
260
265
270
275
280
285
290
295
300
Note: samples from 25 to 400 contain soft clay that washes through the 80 mesh sample screens.
250-260 70% Mudstone.. med gy, dense, firm. Chips are rounded and covered in loose 30% sand as above.
260-270 100% Mudstone.. med gy, dense, firm, Mnr slst.
270-285 80% Mudstone.. med gy, firm, dense, blky. 20% silt and sand loose in sample, cavings ?
285-305 90% SS.. s&p, f to L med gr, occ c gr cht, mod srtd, srd to sa, qtz, com dk cht, mnr lith, loose, probable sil cmt, rr pr, est 6-12% por, 10% Mnr mudstone. Tr white clay chips in 300m sample.



305-310 70%, CHT.. wh, buff, pbl frags. 10% SS.. s&p, f gr, mod srtd, sa to srd, qtz, mnr cht, mnr lith, pos matrix for chert cong. 20% Mudstone, med gy, firm, blky, some intbdd slst.

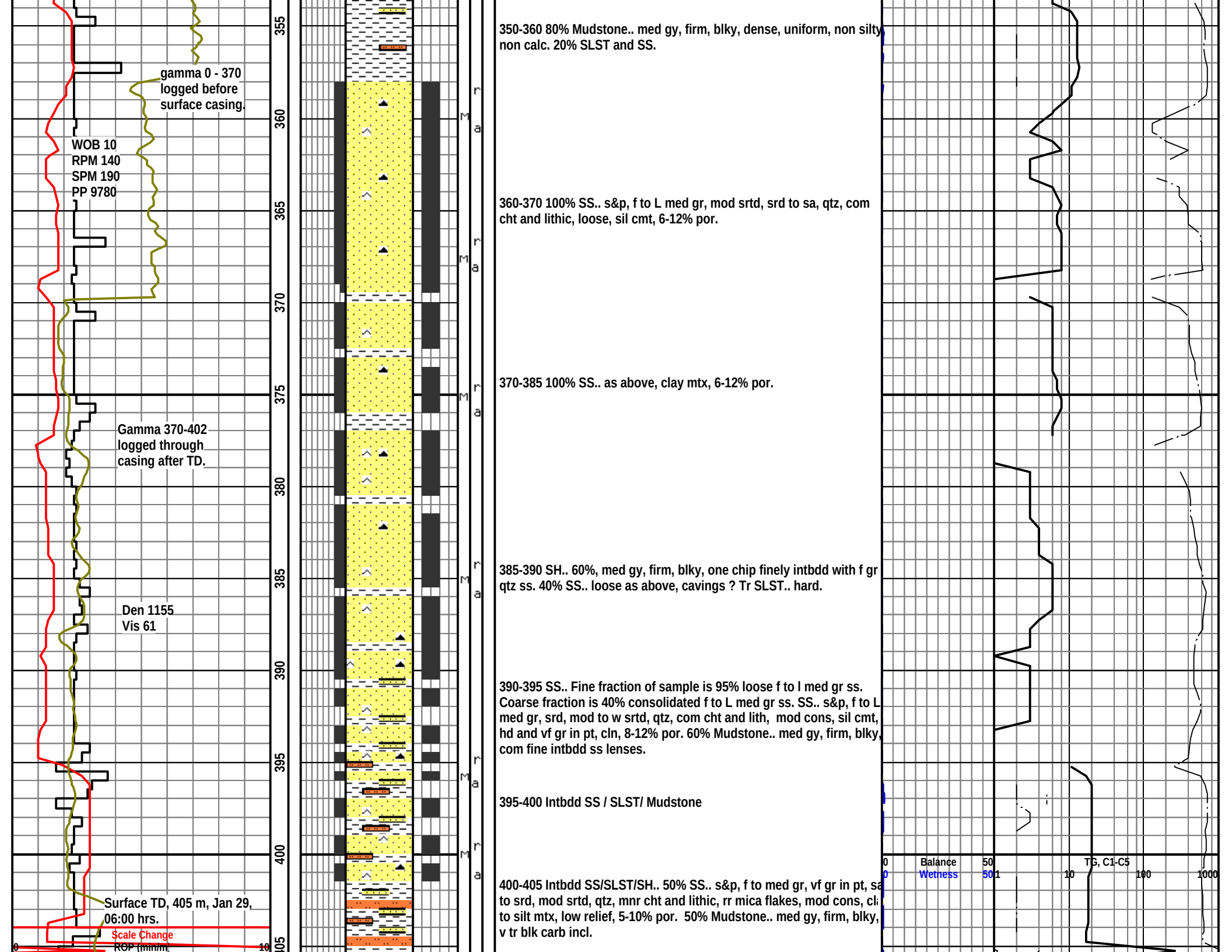
310-315 80% SS.. s&p, f to med gr, with c gr cht to small pbl frags, p srtd, sa to srd, qtz, mnr dk cht, mnr lith, tr to mnr intstl py, loose, pos sil cmt, est 6-12% por. 20% Mudstone.. med gy, firm, blky, mod cons, some intbdd slst.

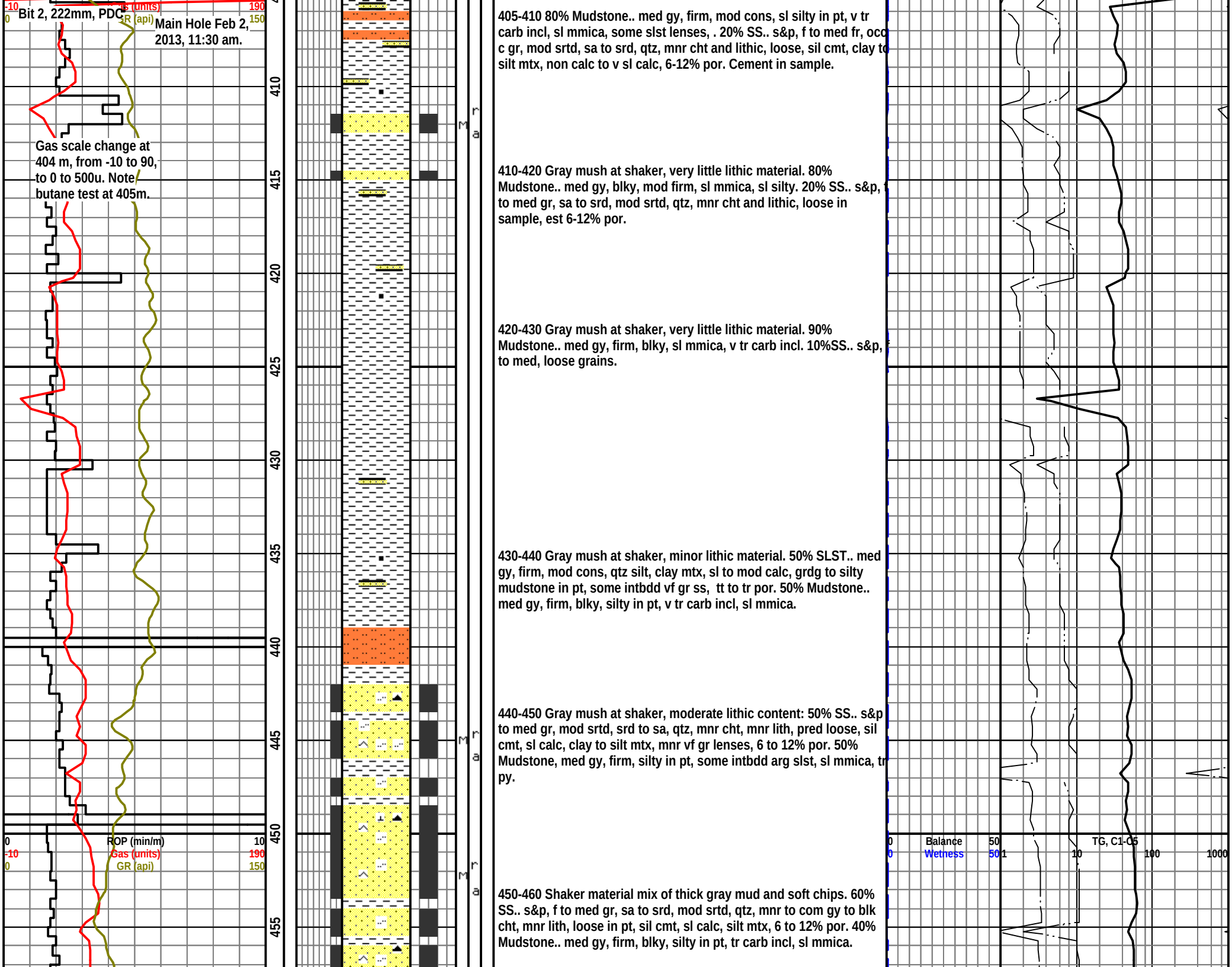
315-320 80% Mudstone.. med gy in pt, lt gn soft and waxy in pt, gy-gn v hd and brittle, appears silicified in pt, non calc. 20% SS as above.

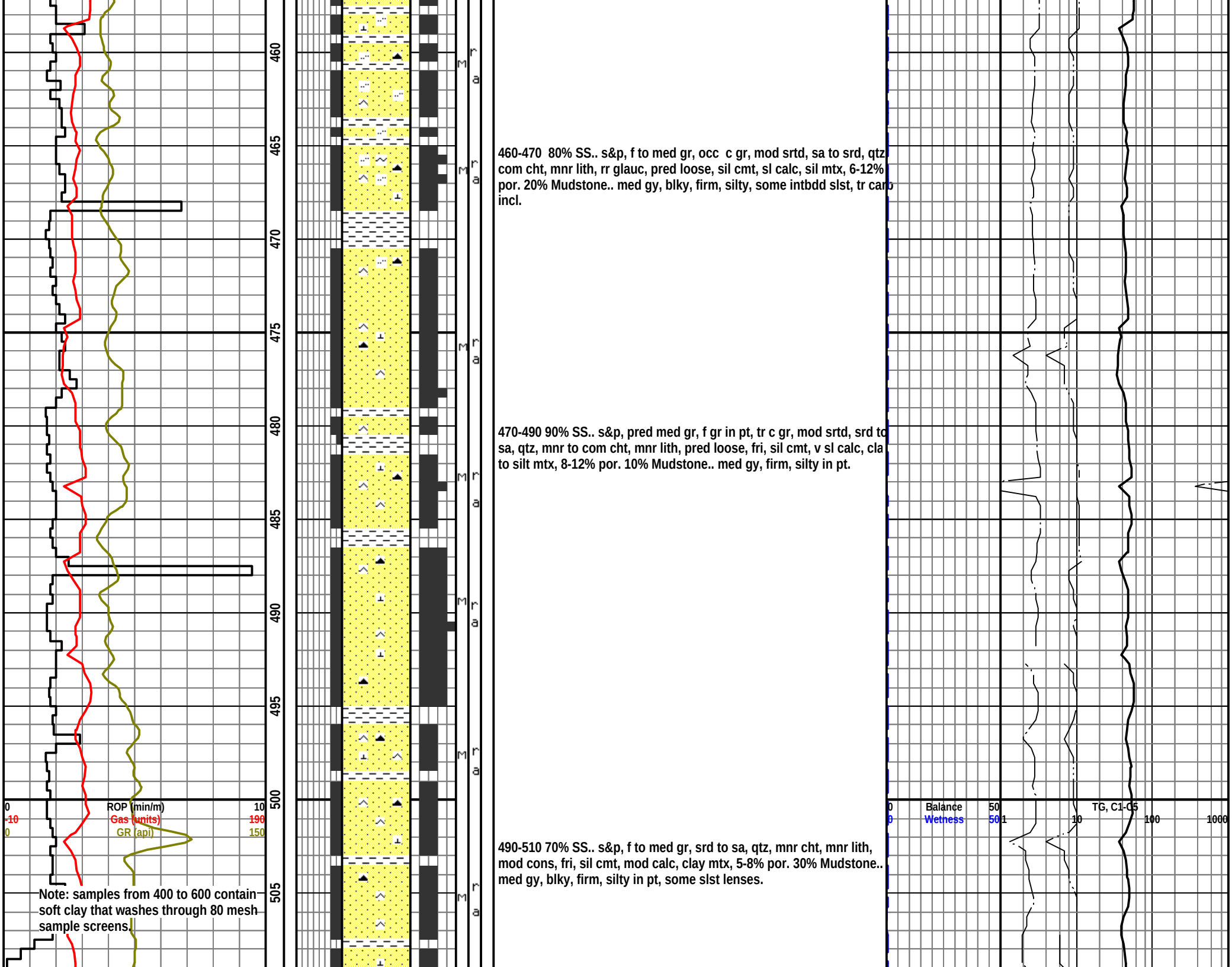
320-335 no samples.

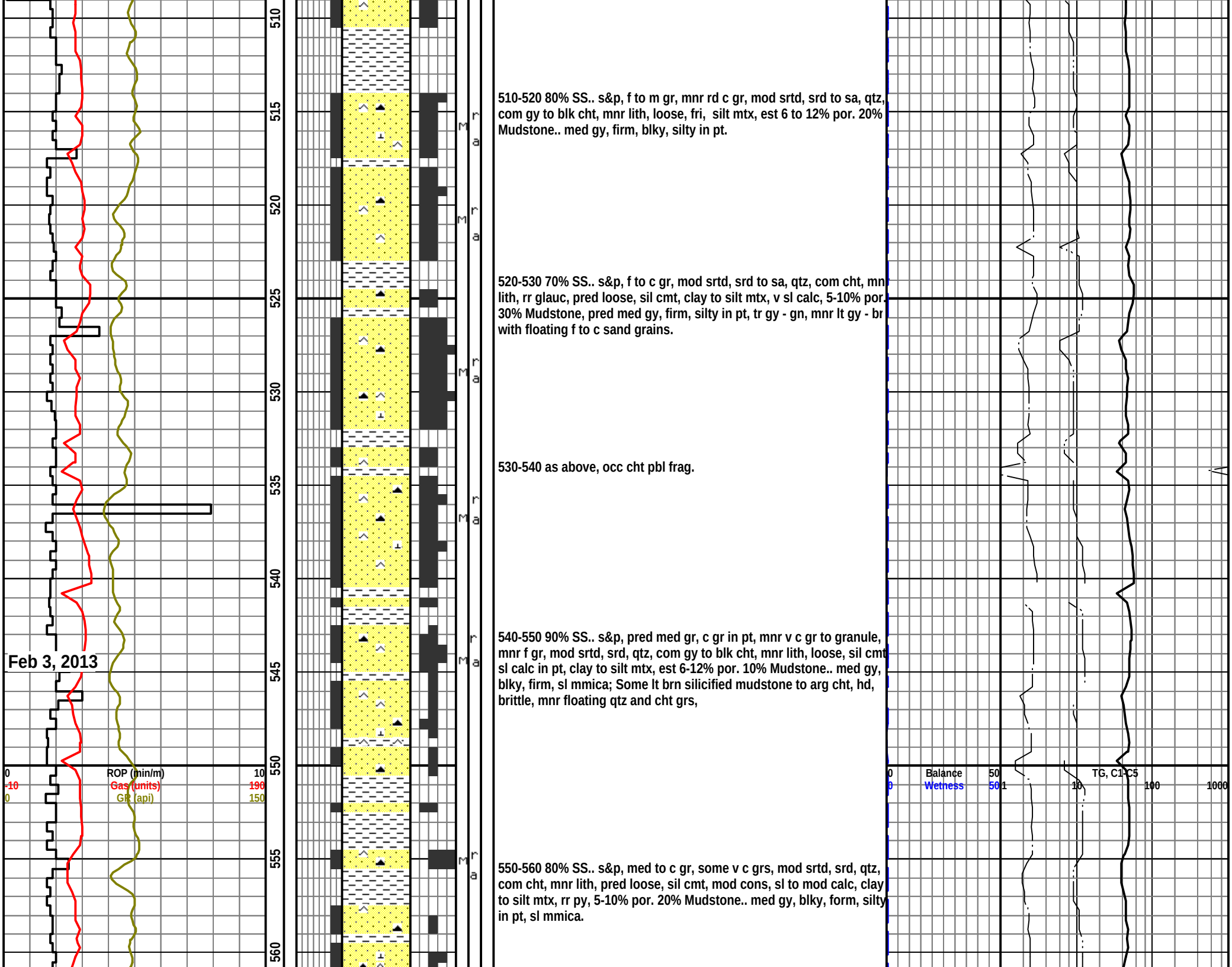
335-340 Sample of mixed lithologies, c cht and qtz grs, gy gn silicified shale or altered cht, siltstone, mnr sandstone, mudstone. Wet sampl appears to be mudstone.

340-350 70% Mudstone.. med gy, dense, firm, soft and sl plastic in water. 30% SLST and SS in sample, pos cavings or interbedded in mudstone.


gamma 0 - 370 logged before surface casing.
WOB 10
RPM 140
SPM 190
PP 9780
Gamma 370-402 logged through casing after TD.
Den 1155
Vis 61
Surface TD, 405 m, Jan 29, 06:00 hrs.
Scale Change
ROP (min/m)
0
10
355
360
365
370
375
380
385
390
395
400
405
350-360 80% Mudstone.. med gy, firm, blky, dense, uniform, non silty non calc. 20% SLST and SS.
360-370 100% SS.. s&p, f to L med gr, mod srtd, srd to sa, qtz, com cht and lithic, loose, sil cmt, 6-12% por.
370-385 100% SS.. as above, clay mtx, 6-12% por.
385-390 SH.. 60%, med gy, firm, blky, one chip finely intbdd with f gr qtz ss. 40% SS.. loose as above, cavings ? Tr SLST.. hard.
390-395 SS.. Fine fraction of sample is 95% loose f to l med gr ss. Coarse fraction is 40% consolidated f to L med gr ss. SS.. s&p, f to L med gr, srd, mod to w srtd, qtz, com cht and lith, mod cons, sil cmt, hd and vf gr in pt, cln, 8-12% por. 60% Mudstone.. med gy, firm, blky, com fine intbdd ss lenses.
395-400 Intbdd SS / SLST/ Mudstone
400-405 Intbdd SS/SLST/SH.. 50% SS.. s&p, f to med gr, vf gr in pt, sa to srd, mod srtd, qtz, mnr cht and lithic, rr mica flakes, mod cons, cl to silt mtx, low relief, 5-10% por. 50% Mudstone.. med gy, firm, blky, v tr blk carb incl.
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5


Bit 2, 222mm, PDC
Main Hole Feb 2, 2013, 11:30 am.
Gas scale change at 404 m, from -10 to 90, to 0 to 500u. Note butane test at 405m.
405-410 80% Mudstone.. med gy, firm, mod cons, sl silty in pt, v tr carb incl, sl mmica, some slst lenses, . 20% SS.. s&p, f to med fr, occ c gr, mod srtd, sa to srd, qtz, mnr cht and lithic, loose, sil cmt, clay to silt mtx, non calc to v sl calc, 6-12% por. Cement in sample.
410-420 Gray mush at shaker, very little lithic material. 80% Mudstone.. med gy, blky, mod firm, sl mmica, sl silty. 20% SS.. s&p, f to med gr, sa to srd, mod srtd, qtz, mnr cht and lithic, loose in sample, est 6-12% por.
420-430 Gray mush at shaker, very little lithic material. 90% Mudstone.. med gy, firm, blky, sl mmica, v tr carb incl. 10%SS.. s&p, f to med, loose grains.
430-440 Gray mush at shaker, minor lithic material. 50% SLST.. med gy, firm, mod cons, qtz silt, clay mtx, sl to mod calc, grdg to silty mudstone in pt, some intbdd vf gr ss, tt to tr por. 50% Mudstone.. med gy, firm, blky, silty in pt, v tr carb incl, sl mmica.
440-450 Gray mush at shaker, moderate lithic content: 50% SS.. s&p to med gr, mod srtd, srd to sa, qtz, mnr cht, mnr lith, pred loose, sil cmt, sl calc, clay to silt mtx, mnr vf gr lenses, 6 to 12% por. 50% Mudstone, med gy, firm, silty in pt, some intbdd arg slst, sl mmica, tr py.
450-460 Shaker material mix of thick gray mud and soft chips. 60% SS.. s&p, f to med gr, sa to srd, mod srtd, qtz, mnr to com gy to blk cht, mnr lith, loose in pt, sil cmt, sl calc, silt mtx, 6 to 12% por. 40% Mudstone.. med gy, firm, blky, silty in pt, tr carb incl, sl mmica.
-10
0
Gas (units)
GR (api)
190
150
ROP (min/m)
10
Balance
50
Wetness
TG, C1-C5
1
10
100
1000
405
410
415
420
425
430
435
440
445
450
455


460
465
470
475
480
485
490
495
500
505
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5
Note: samples from 400 to 600 contain soft clay that washes through 80 mesh sample screens.
460-470 80% SS.. s&p, f to med gr, occ c gr, mod srtd, sa to srd, qtz com cht, mnr lith, rr glauc, pred loose, sil cmt, sl calc, sil mtx, 6-12% por. 20% Mudstone.. med gy, blky, firm, silty, some intbdd slst, tr carb incl.
470-490 90% SS.. s&p, pred med gr, f gr in pt, tr c gr, mod srtd, srd to sa, qtz, mnr to com cht, mnr lith, pred loose, fri, sil cmt, v sl calc, cla to silt mtx, 8-12% por. 10% Mudstone.. med gy, firm, silty in pt.
490-510 70% SS.. s&p, f to med gr, srd to sa, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, mod calc, clay mtx, 5-8% por. 30% Mudstone.. med gy, blky, firm, silty in pt, some slst lenses.



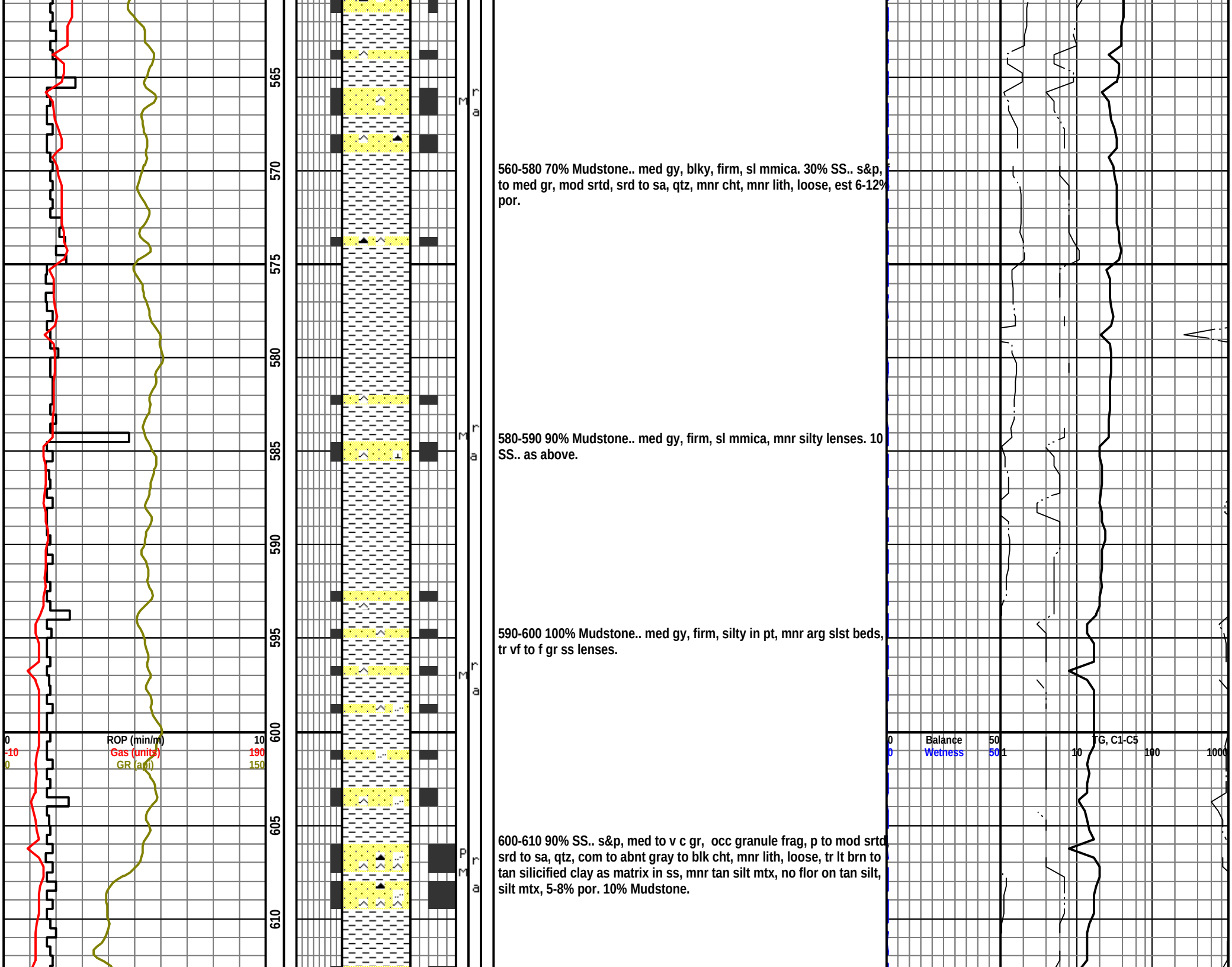
510-520 80% SS.. s&p, f to m gr, mnr rd c gr, mod srtd, srd to sa, qtz, com gy to blk cht, mnr lith, loose, fri, silt mtx, est 6 to 12% por. 20% Mudstone.. med gy, firm, blky, silty in pt.

520-530 70% SS.. s&p, f to c gr, mod srtd, srd to sa, qtz, com cht, mnr lith, rr glauc, pred loose, sil cmt, clay to silt mtx, v sl calc, 5-10% por. 30% Mudstone, pred med gy, firm, silty in pt, tr gy - gn, mnr lt gy - br with floating f to c sand grains.

530-540 as above, occ cht pbl frag.

540-550 90% SS.. s&p, pred med gr, c gr in pt, mnr v c gr to granule, mnr f gr, mod srtd, srd, qtz, com gy to blk cht, mnr lith, loose, sil cmt sl calc in pt, clay to silt mtx, est 6-12% por. 10% Mudstone.. med gy, blky, firm, sl mmica; Some lt brn silicified mudstone to arg cht, hd, brittle, mnr floating qtz and cht grs,

550-560 80% SS.. s&p, med to c gr, some v c grs, mod srtd, srd, qtz, com cht, mnr lith, pred loose, sil cmt, mod cons, sl to mod calc, clay to silt mtx, rr py, 5-10% por. 20% Mudstone.. med gy, blky, form, silty in pt, sl mmica.

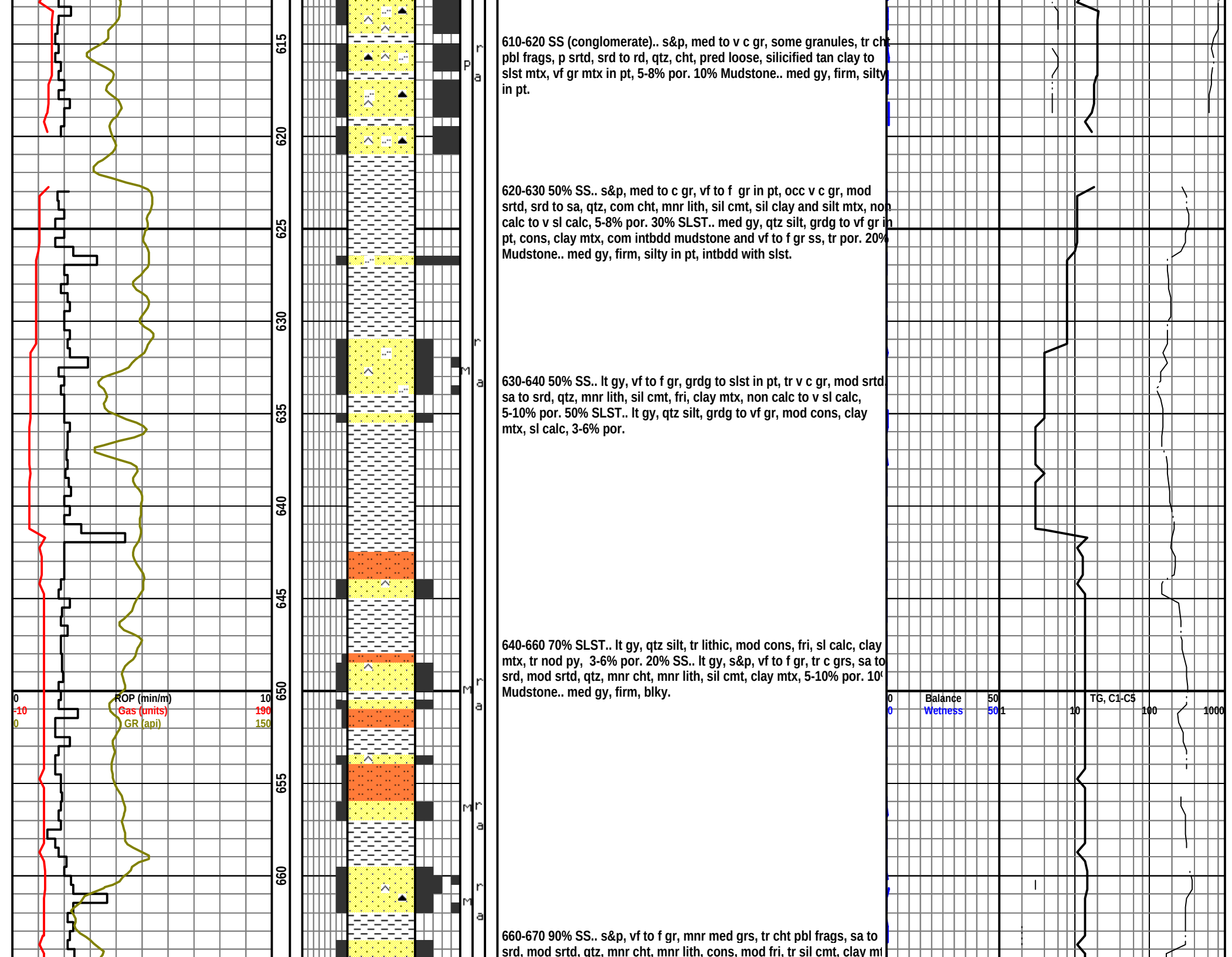


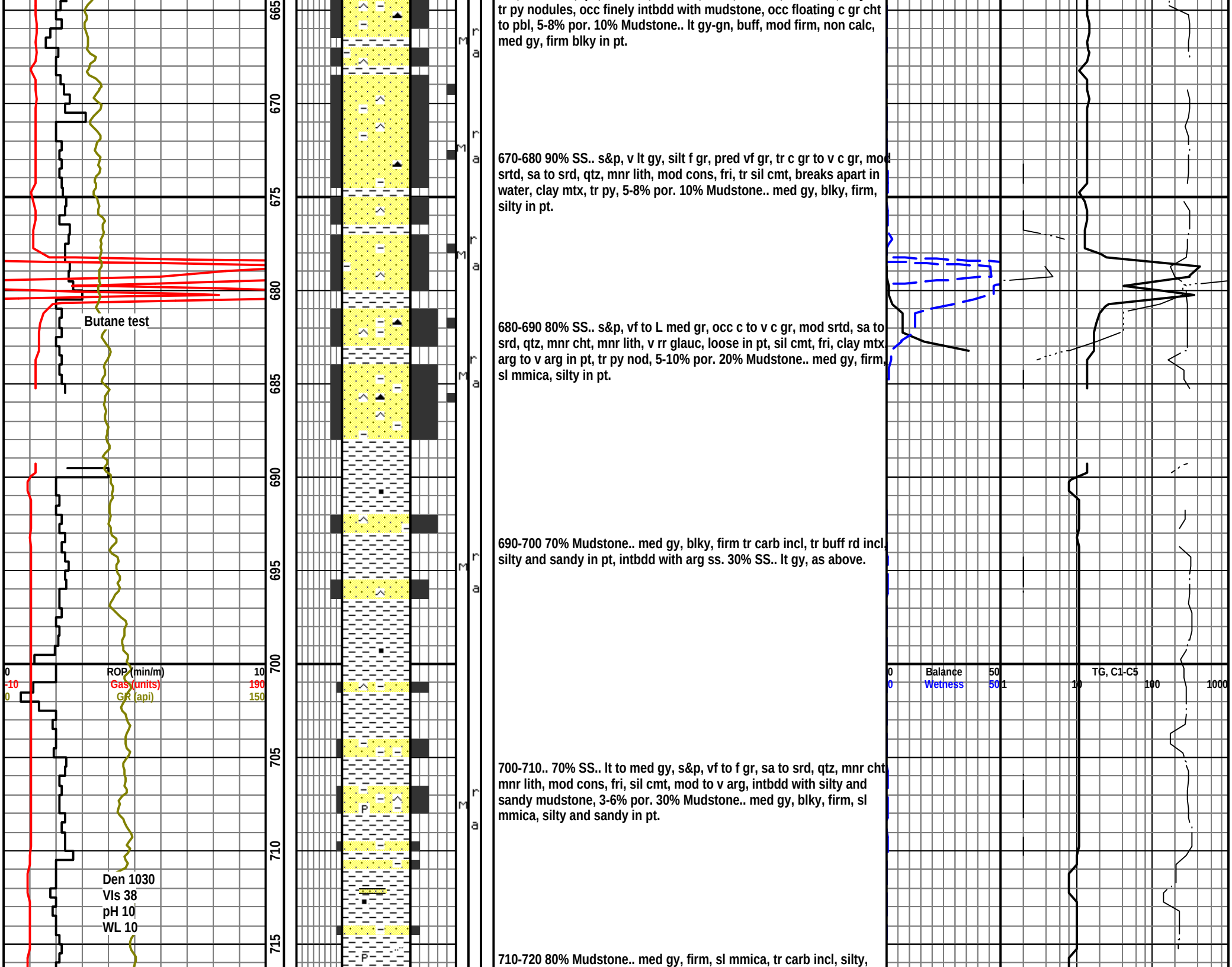
560-580 70% Mudstone.. med gy, blky, firm, sl mmica. 30% SS.. s&p, f to med gr, mod srtd, srd to sa, qtz, mnr cht, mnr lith, loose, est 6-12% por.

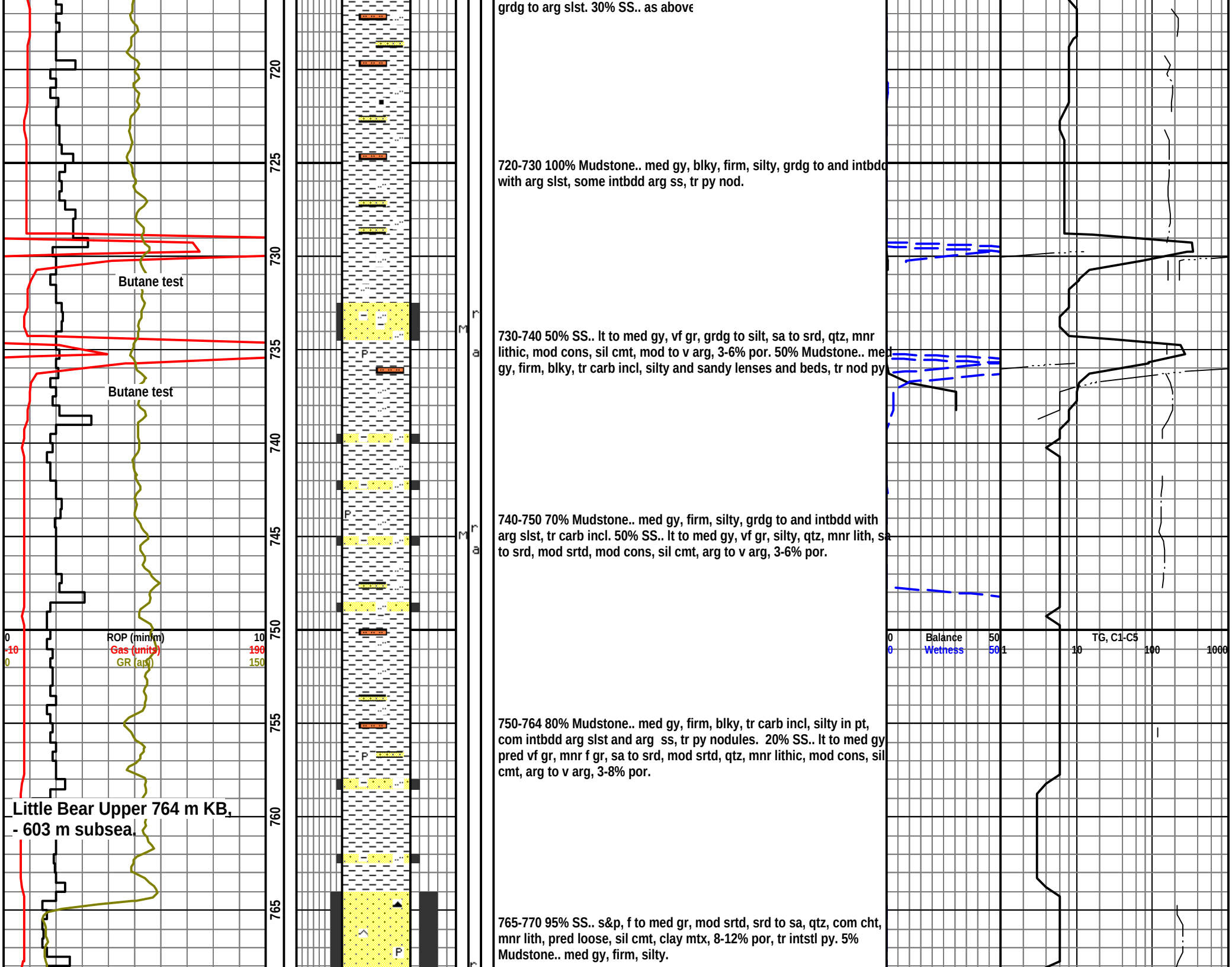
580-590 90% Mudstone.. med gy, firm, sl mmica, mnr silty lenses. 10 SS.. as above.

590-600 100% Mudstone.. med gy, firm, silty in pt, mnr arg slst beds, tr vf to f gr ss lenses.

600-610 90% SS.. s&p, med to v c gr, occ granule frag, p to mod srtd, srd to sa, qtz, com to abnt gray to blk cht, mnr lith, loose, tr lt brn to tan silicified clay as matrix in ss, mnr tan silt mtx, no flor on tan silt, silt mtx, 5-8% por. 10% Mudstone.


0
-10
0
ROP (min/m)
Gas (units)
GR (api)
10
190
150
615
620
625
630
635
640
645
650
655
660
610-620 SS (conglomerate).. s&p, med to v c gr, some granules, tr cht pbl frags, p srtd, srd to rd, qtz, cht, pred loose, silicified tan clay to slst mtx, vf gr mtx in pt, 5-8% por. 10% Mudstone.. med gy, firm, silty in pt.
620-630 50% SS.. s&p, med to c gr, vf to f gr in pt, occ v c gr, mod srtd, srd to sa, qtz, com cht, mnr lith, sil cmt, sil clay and silt mtx, non calc to v sl calc, 5-8% por. 30% SLST.. med gy, qtz silt, grdg to vf gr in pt, cons, clay mtx, com intbdd mudstone and vf to f gr ss, tr por. 20% Mudstone.. med gy, firm, silty in pt, intbdd with slst.
630-640 50% SS.. lt gy, vf to f gr, grdg to slst in pt, tr v c gr, mod srtd, sa to srd, qtz, mnr lith, sil cmt, fri, clay mtx, non calc to v sl calc, 5-10% por. 50% SLST.. lt gy, qtz silt, grdg to vf gr, mod cons, clay mtx, sl calc, 3-6% por.
640-660 70% SLST.. lt gy, qtz silt, tr lithic, mod cons, fri, sl calc, clay mtx, tr nod py, 3-6% por. 20% SS.. lt gy, s&p, vf to f gr, tr c grs, sa to srd, mod srtd, qtz, mnr cht, mnr lith, sil cmt, clay mtx, 5-10% por. 10% Mudstone.. med gy, firm, blky.
660-670 90% SS.. s&p, vf to f gr, mnr med grs, tr cht pbl frags, sa to srd, mod srtd, qtz, mnr cht, mnr lith, cons, mod fri, tr sil cmt, clay mt
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5


665
670
675
680
685
690
695
700
705
710
715
Butane test
Den 1030
Vis 38
pH 10
WL 10
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5
tr py nodules, occ finely intbdd with mudstone, occ floating c gr cht to pbl, 5-8% por. 10% Mudstone.. lt gy-gn, buff, mod firm, non calc, med gy, firm blky in pt.
670-680 90% SS.. s&p, v lt gy, silt f gr, pred vf gr, tr c gr to v c gr, mod srtd, sa to srd, qtz, mnr lith, mod cons, fri, tr sil cmt, breaks apart in water, clay mtx, tr py, 5-8% por. 10% Mudstone.. med gy, blky, firm, silty in pt.
680-690 80% SS.. s&p, vf to L med gr, occ c to v c gr, mod srtd, sa to srd, qtz, mnr cht, mnr lith, v rr glauc, loose in pt, sil cmt, fri, clay mtx, arg to v arg in pt, tr py nod, 5-10% por. 20% Mudstone.. med gy, firm, sl mmica, silty in pt.
690-700 70% Mudstone.. med gy, blky, firm tr carb incl, tr buff rd incl, silty and sandy in pt, intbdd with arg ss. 30% SS.. lt gy, as above.
700-710.. 70% SS.. lt to med gy, s&p, vf to f gr, sa to srd, qtz, mnr cht mnr lith, mod cons, fri, sil cmt, mod to v arg, intbdd with silty and sandy mudstone, 3-6% por. 30% Mudstone.. med gy, blky, firm, sl mmica, silty and sandy in pt.
710-720 80% Mudstone.. med gy, firm, sl mmica, tr carb incl, silty,



grdg to arg slst. 30% SS.. as above

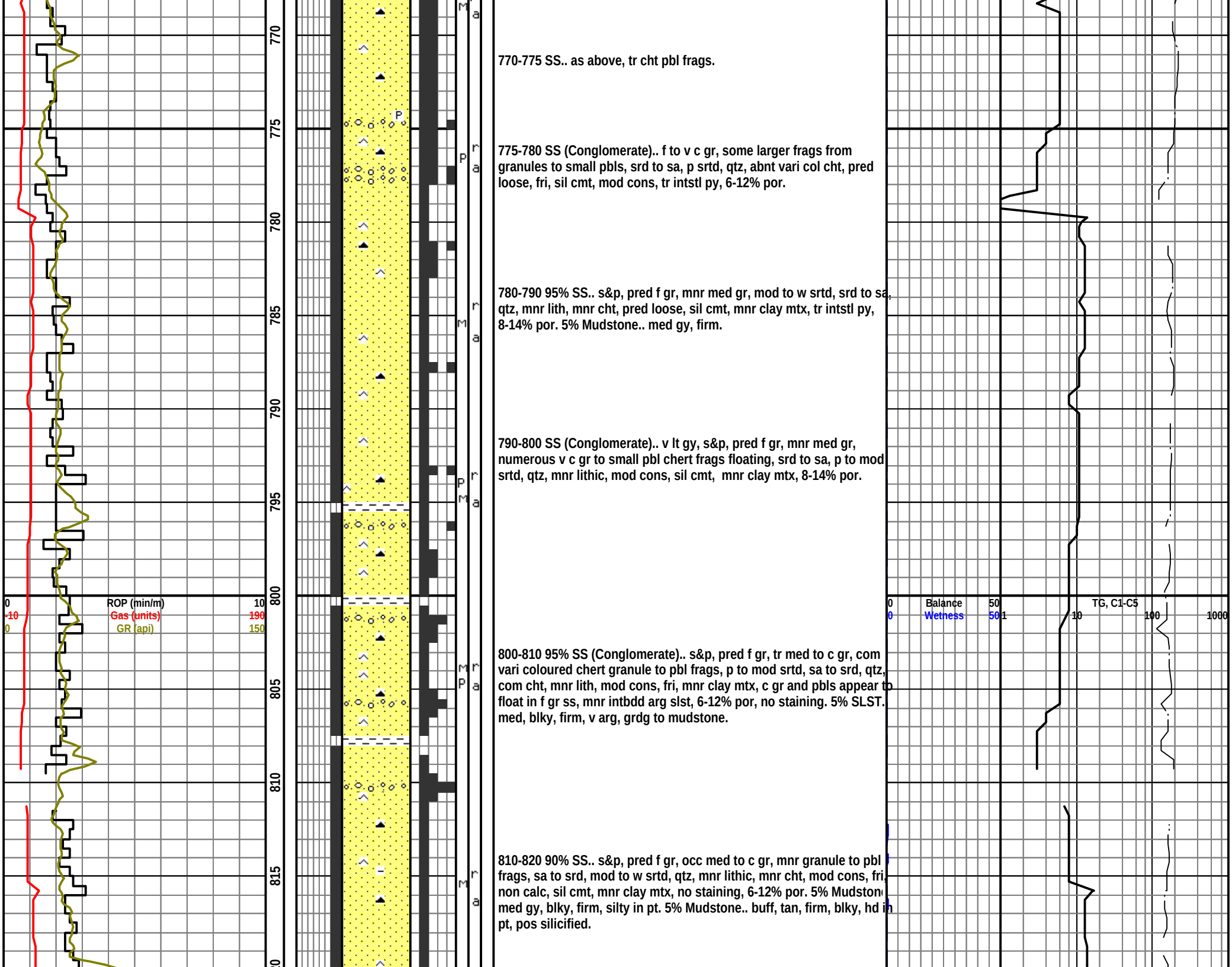
720-730 100% Mudstone.. med gy, blky, firm, silty, grdg to and intbdd with arg slst, some intbdd arg ss, tr py nod.

730-740 50% SS.. lt to med gy, vf gr, grdg to silt, sa to srd, qtz, mnr lithic, mod cons, sil cmt, mod to v arg, 3-6% por. 50% Mudstone.. med gy, firm, blky, tr carb incl, silty and sandy lenses and beds, tr nod py

740-750 70% Mudstone.. med gy, firm, silty, grdg to and intbdd with arg slst, tr carb incl. 50% SS.. lt to med gy, vf gr, silty, qtz, mnr lith, sa to srd, mod srtd, mod cons, sil cmt, arg to v arg, 3-6% por.

750-764 80% Mudstone.. med gy, firm, blky, tr carb incl, silty in pt, com intbdd arg slst and arg ss, tr py nodules. 20% SS.. lt to med gy pred vf gr, mnr f gr, sa to srd, mod srtd, qtz, mnr lithic, mod cons, sil cmt, arg to v arg, 3-8% por.

765-770 95% SS.. s&p, f to med gr, mod srtd, srd to sa, qtz, com cht, mnr lith, pred loose, sil cmt, clay mtx, 8-12% por, tr intstl py. 5% Mudstone.. med gy, firm, silty.



770-775 SS.. as above, tr cht pbl frags.

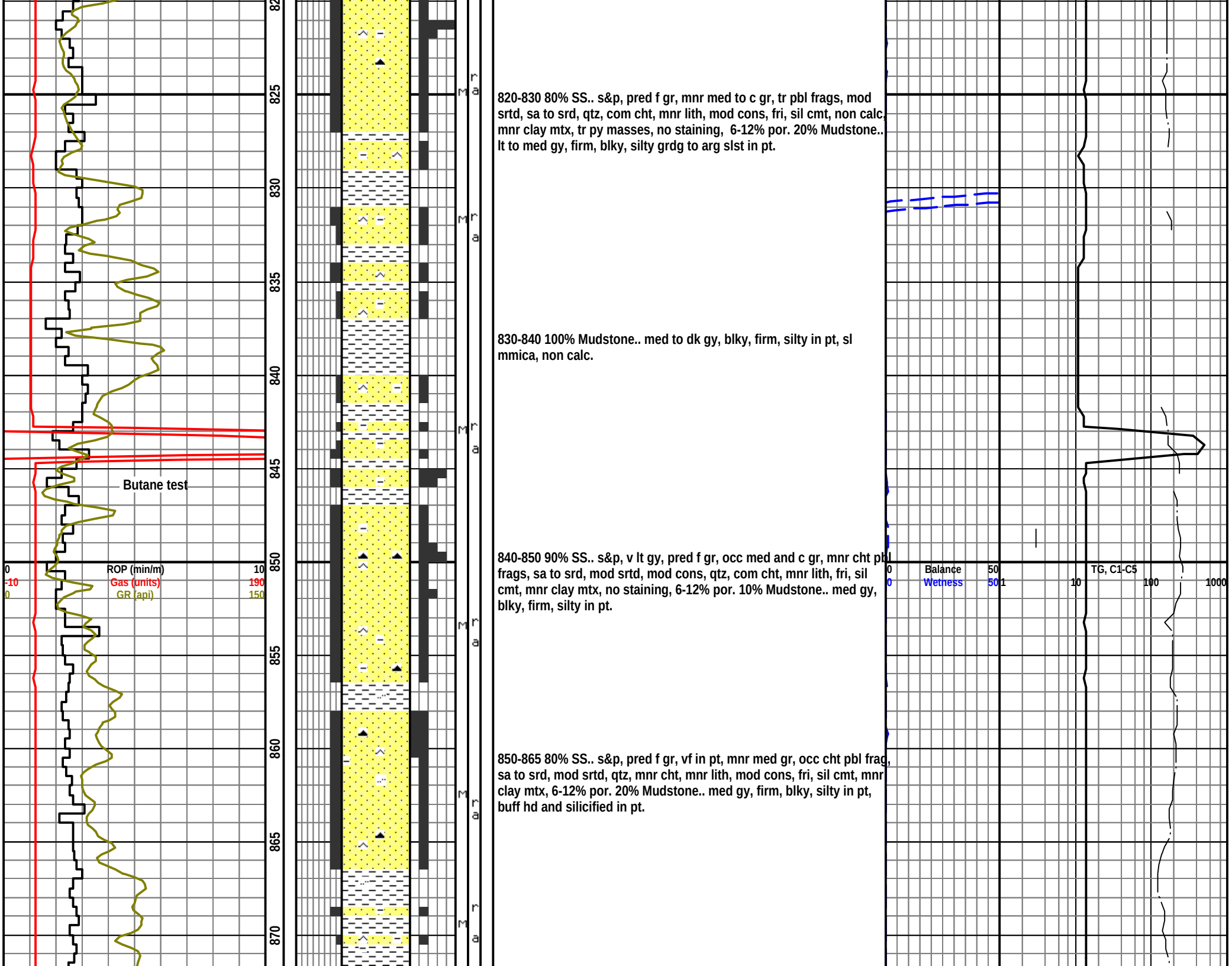
775-780 SS (Conglomerate).. f to v c gr, some larger frags from granules to small pbls, srd to sa, p srtd, qtz, abnt vari col cht, pred loose, fri, sil cmt, mod cons, tr intstl py, 6-12% por.

780-790 95% SS.. s&p, pred f gr, mnr med gr, mod to w srtd, srd to sa, qtz, mnr lith, mnr cht, pred loose, sil cmt, mnr clay mtx, tr intstl py, 8-14% por. 5% Mudstone.. med gy, firm.

790-800 SS (Conglomerate).. v lt gy, s&p, pred f gr, mnr med gr, numerous v c gr to small pbl chert frags floating, srd to sa, p to mod srtd, qtz, mnr lithic, mod cons, sil cmt, mnr clay mtx, 8-14% por.

800-810 95% SS (Conglomerate).. s&p, pred f gr, tr med to c gr, com vari coloured chert granule to pbl frags, p to mod srtd, sa to srd, qtz, com cht, mnr lith, mod cons, fri, mnr clay mtx, c gr and pbls appear to float in f gr ss, mnr intbdd arg slst, 6-12% por, no staining. 5% SLST. med, blky, firm, v arg, grdg to mudstone.

810-820 90% SS.. s&p, pred f gr, occ med to c gr, mnr granule to pbl frags, sa to srd, mod to w srtd, qtz, mnr lithic, mnr cht, mod cons, fri, non calc, sil cmt, mnr clay mtx, no staining, 6-12% por. 5% Mudstone med gy, blky, firm, silty in pt. 5% Mudstone.. buff, tan, firm, blky, hd in pt, pos silicified.

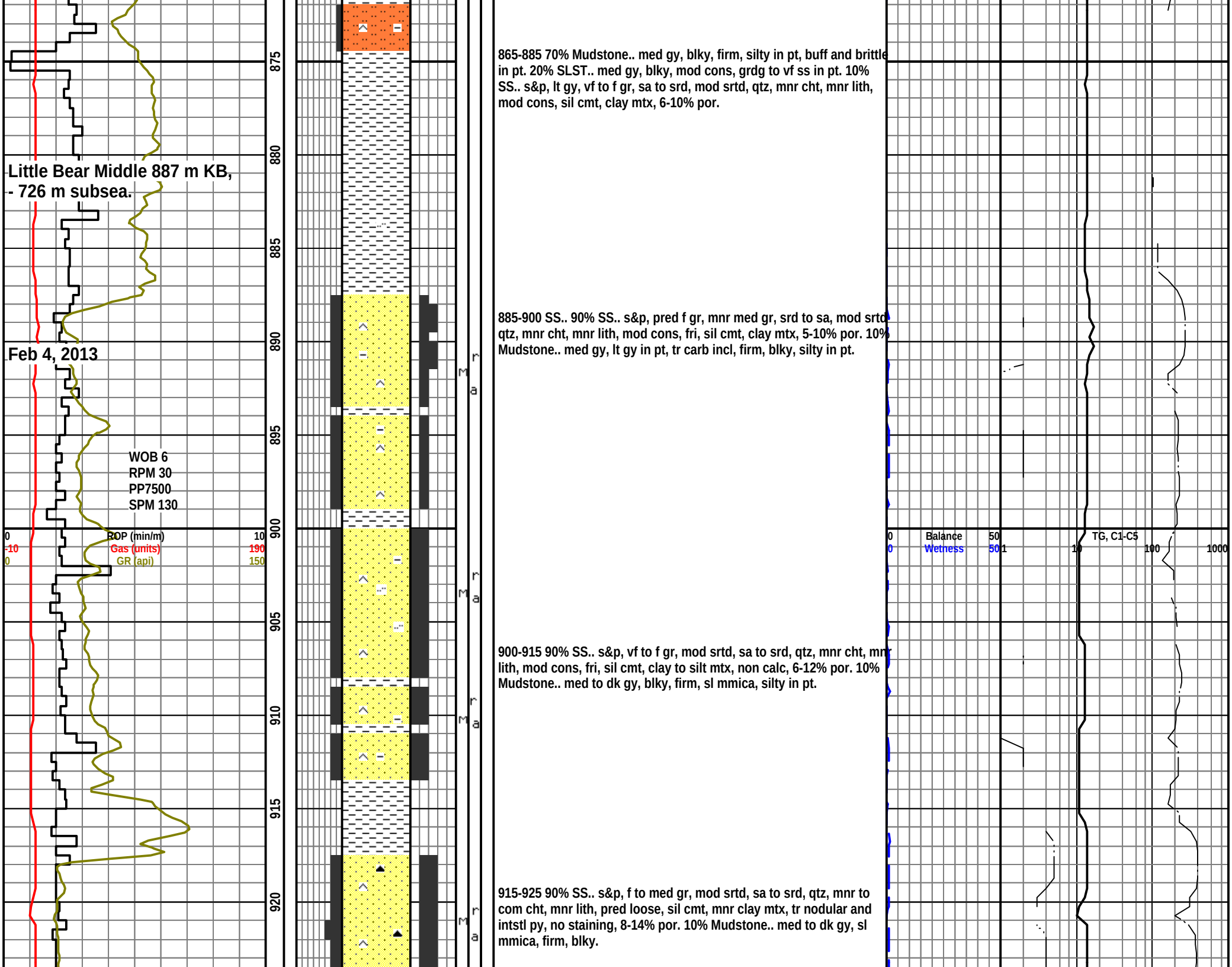


820-830 80% SS.. s&p, pred f gr, mnr med to c gr, tr pbl frags, mod srtd, sa to srd, qtz, com cht, mnr lith, mod cons, fri, sil cmt, non calc, mnr clay mtx, tr py masses, no staining, 6-12% por. 20% Mudstone.. lt to med gy, firm, blky, silty grdg to arg slst in pt.

830-840 100% Mudstone.. med to dk gy, blky, firm, silty in pt, sl mmica, non calc.

840-850 90% SS.. s&p, v lt gy, pred f gr, occ med and c gr, mnr cht pbl frags, sa to srd, mod srtd, mod cons, qtz, com cht, mnr lith, fri, sil cmt, mnr clay mtx, no staining, 6-12% por. 10% Mudstone.. med gy, blky, firm, silty in pt.

850-865 80% SS.. s&p, pred f gr, vf in pt, mnr med gr, occ cht pbl frag, sa to srd, mod srtd, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, mnr clay mtx, 6-12% por. 20% Mudstone.. med gy, firm, blky, silty in pt, buff hd and silicified in pt.

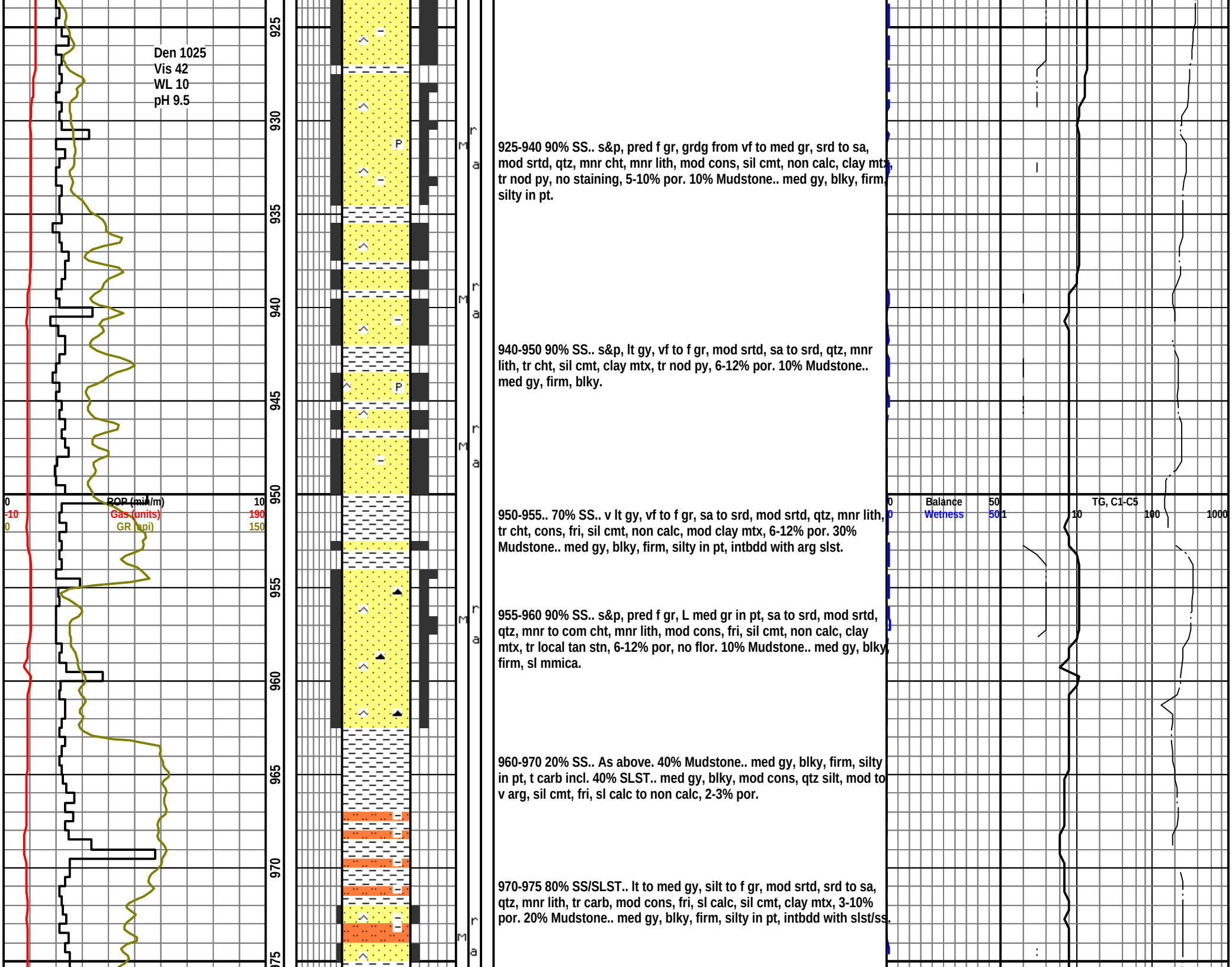


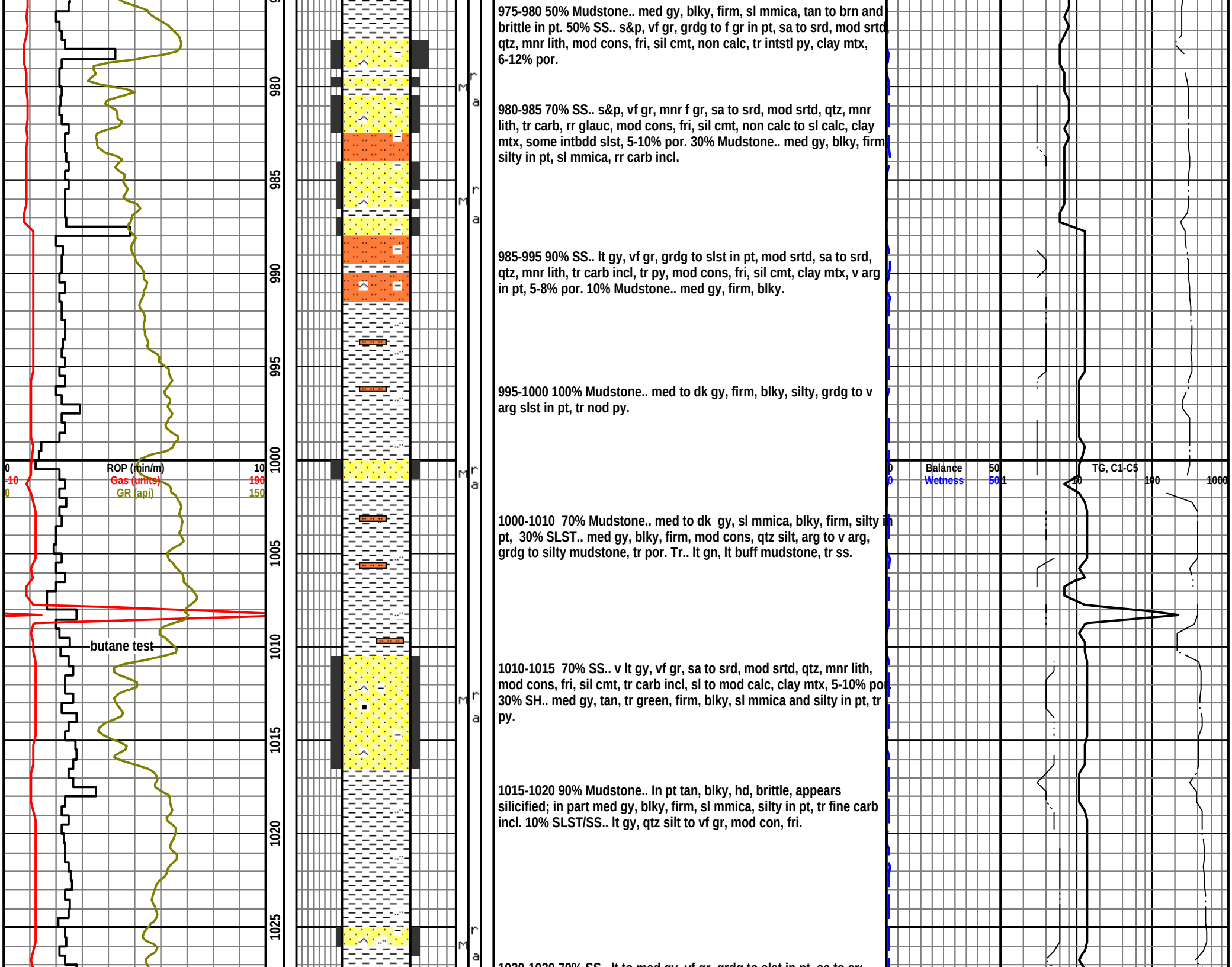
865-885 70% Mudstone.. med gy, blky, firm, silty in pt, buff and brittle in pt. 20% SLST.. med gy, blky, mod cons, grdg to vf ss in pt. 10% SS.. s&p, lt gy, vf to f gr, sa to srd, mod srtd, qtz, mnr cht, mnr lith, mod cons, sil cmt, clay mtx, 6-10% por.

885-900 SS.. 90% SS.. s&p, pred f gr, mnr med gr, srd to sa, mod srtd, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, clay mtx, 5-10% por. 10% Mudstone.. med gy, lt gy in pt, tr carb incl, firm, blky, silty in pt.

900-915 90% SS.. s&p, vf to f gr, mod srtd, sa to srd, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, clay to silt mtx, non calc, 6-12% por. 10% Mudstone.. med to dk gy, blky, firm, sl mmica, silty in pt.

915-925 90% SS.. s&p, f to med gr, mod srtd, sa to srd, qtz, mnr to com cht, mnr lith, pred loose, sil cmt, mnr clay mtx, tr nodular and intstl py, no staining, 8-14% por. 10% Mudstone.. med to dk gy, sl mmica, firm, blky.


Den 1025
Vis 42
WL 10
pH 9.5
925
930
935
940
945
950
955
960
965
970
975
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000
925-940 90% SS.. s&p, pred f gr, grdg from vf to med gr, srd to sa, mod srtd, qtz, mnr cht, mnr lith, mod cons, sil cmt, non calc, clay mtx, tr nod py, no staining, 5-10% por. 10% Mudstone.. med gy, blky, firm, silty in pt.
940-950 90% SS.. s&p, lt gy, vf to f gr, mod srtd, sa to srd, qtz, mnr lith, tr cht, sil cmt, clay mtx, tr nod py, 6-12% por. 10% Mudstone.. med gy, firm, blky.
950-955.. 70% SS.. v lt gy, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr cht, cons, fri, sil cmt, non calc, mod clay mtx, 6-12% por. 30% Mudstone.. med gy, blky, firm, silty in pt, intbdd with arg slst.
955-960 90% SS.. s&p, pred f gr, L med gr in pt, sa to srd, mod srtd, qtz, mnr to com cht, mnr lith, mod cons, fri, sil cmt, non calc, clay mtx, tr local tan stn, 6-12% por, no flor. 10% Mudstone.. med gy, blky, firm, sl mmica.
960-970 20% SS.. As above. 40% Mudstone.. med gy, blky, firm, silty in pt, t carb incl. 40% SLST.. med gy, blky, mod cons, qtz silt, mod to v arg, sil cmt, fri, sl calc to non calc, 2-3% por.
970-975 80% SS/SLST.. lt to med gy, silt to f gr, mod srtd, srd to sa, qtz, mnr lith, tr carb, mod cons, fri, sl calc, sil cmt, clay mtx, 3-10% por. 20% Mudstone.. med gy, blky, firm, silty in pt, intbdd with slst/ss.



975-980 50% Mudstone.. med gy, blky, firm, sl mmica, tan to brn and brittle in pt. 50% SS.. s&p, vf gr, grdg to f gr in pt, sa to srd, mod srtd, qtz, mnr lith, mod cons, fri, sil cmt, non calc, tr intstl py, clay mtx, 6-12% por.

980-985 70% SS.. s&p, vf gr, mnr f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, rr glauc, mod cons, fri, sil cmt, non calc to sl calc, clay mtx, some intbdd slst, 5-10% por. 30% Mudstone.. med gy, blky, firm silty in pt, sl mmica, rr carb incl.

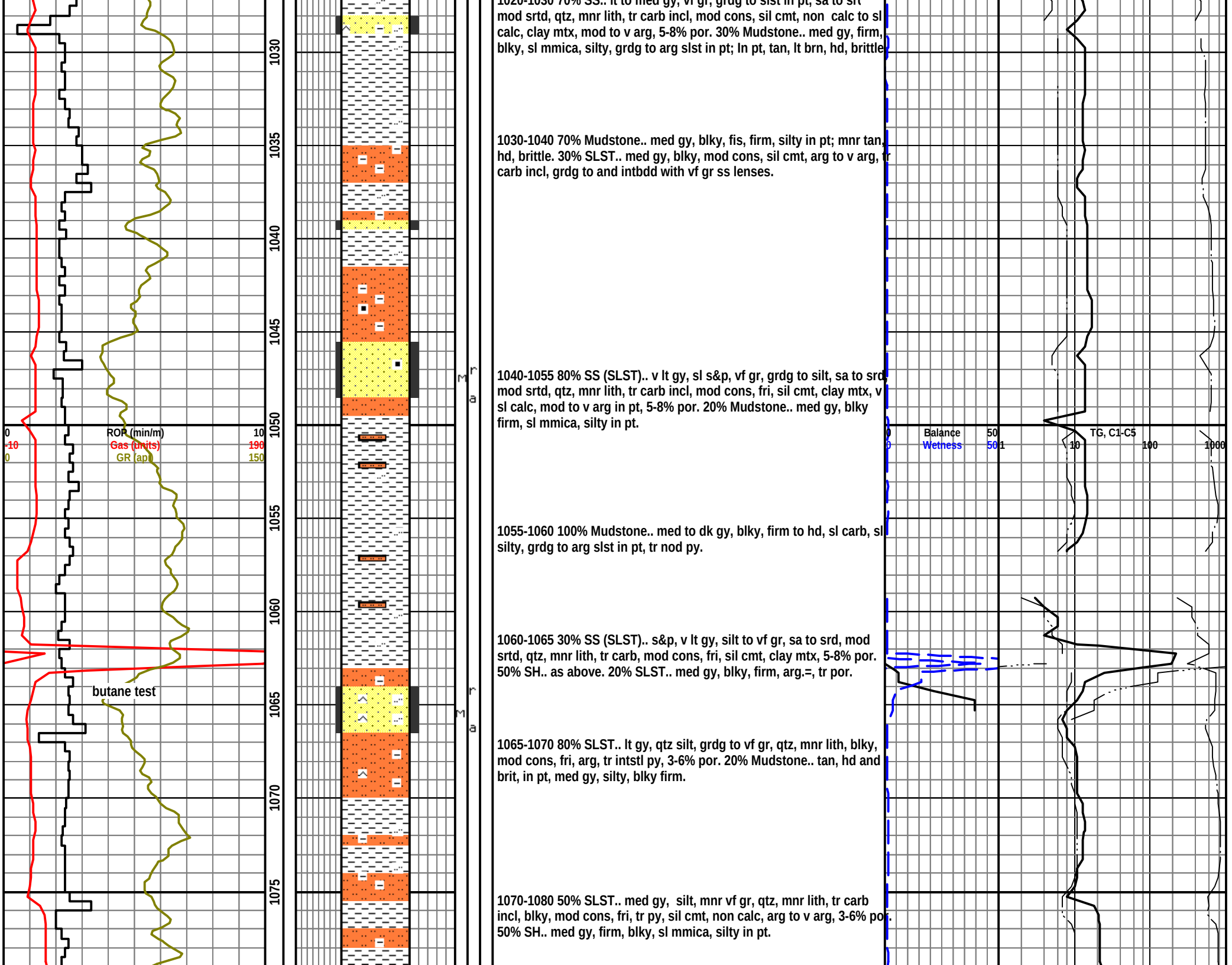
985-995 90% SS.. lt gy, vf gr, grdg to slst in pt, mod srtd, sa to srd, qtz, mnr lith, tr carb incl, tr py, mod cons, fri, sil cmt, clay mtx, v arg in pt, 5-8% por. 10% Mudstone.. med gy, firm, blky.

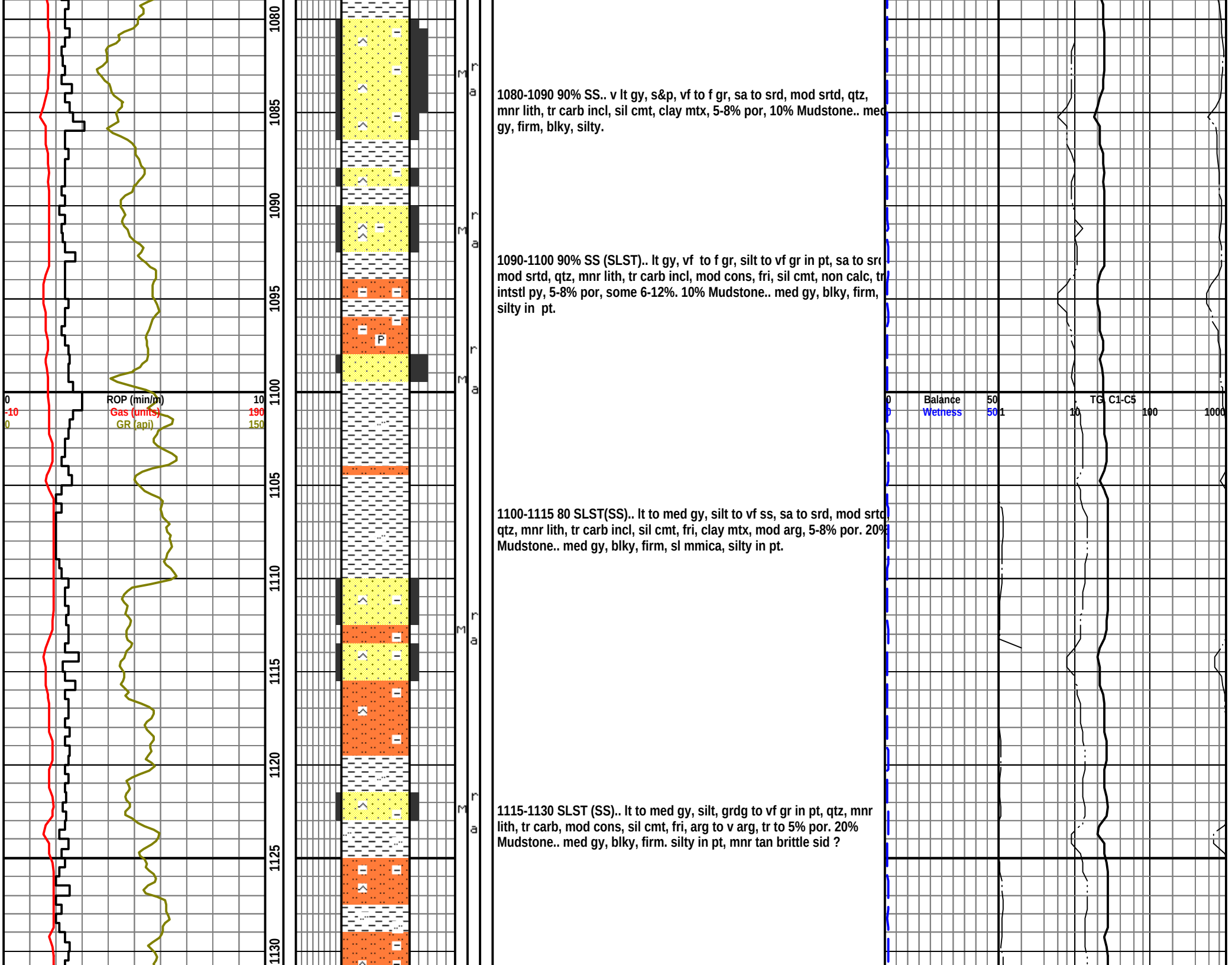
995-1000 100% Mudstone.. med to dk gy, firm, blky, silty, grdg to v arg slst in pt, tr nod py.

1000-1010 70% Mudstone.. med to dk gy, sl mmica, blky, firm, silty in pt, 30% SLST.. med gy, blky, firm, mod cons, qtz silt, arg to v arg, grdg to silty mudstone, tr por. Tr.. lt gn, lt buff mudstone, tr ss.

1010-1015 70% SS.. v lt gy, vf gr, sa to srd, mod srtd, qtz, mnr lith, mod cons, fri, sil cmt, tr carb incl, sl to mod calc, clay mtx, 5-10% por. 30% SH.. med gy, tan, tr green, firm, blky, sl mmica and silty in pt, tr py.

1015-1020 90% Mudstone.. In pt tan, blky, hd, brittle, appears silicified; in part med gy, blky, firm, sl mmica, silty in pt, tr fine carb incl. 10% SLST/SS.. lt gy, qtz silt to vf gr, mod con, fri.


1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
butane test
Balance
50
Wetness
50
1
TG, C1-C5
10
100
1000
1020-1030 70% SS.. lt to med gy, vf gr, grdg to slst in pt, sa to srd mod srtd, qtz, mnr lith, tr carb incl, mod cons, sil cmt, non calc to sl calc, clay mtx, mod to v arg, 5-8% por. 30% Mudstone.. med gy, firm, blky, sl mmica, silty, grdg to arg slst in pt; ln pt, tan, lt brn, hd, brittle
1030-1040 70% Mudstone.. med gy, blky, fis, firm, silty in pt; mnr tan, hd, brittle. 30% SLST.. med gy, blky, mod cons, sil cmt, arg to v arg, tr carb incl, grdg to and intbdd with vf gr ss lenses.
1040-1055 80% SS (SLST).. v lt gy, sl s&p, vf gr, grdg to silt, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, mod cons, fri, sil cmt, clay mtx, v sl calc, mod to v arg in pt, 5-8% por. 20% Mudstone.. med gy, blky firm, sl mmica, silty in pt.
1055-1060 100% Mudstone.. med to dk gy, blky, firm to hd, sl carb, sl silty, grdg to arg slst in pt, tr nod py.
1060-1065 30% SS (SLST).. s&p, v lt gy, silt to vf gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, mod cons, fri, sil cmt, clay mtx, 5-8% por. 50% SH.. as above. 20% SLST.. med gy, blky, firm, arg.=, tr por.
1065-1070 80% SLST.. lt gy, qtz silt, grdg to vf gr, qtz, mnr lith, blky, mod cons, fri, arg, tr intstl py, 3-6% por. 20% Mudstone.. tan, hd and brit, in pt, med gy, silty, blky firm.
1070-1080 50% SLST.. med gy, silt, mnr vf gr, qtz, mnr lith, tr carb incl, blky, mod cons, fri, tr py, sil cmt, non calc, arg to v arg, 3-6% por. 50% SH.. med gy, firm, blky, sl mmica, silty in pt.

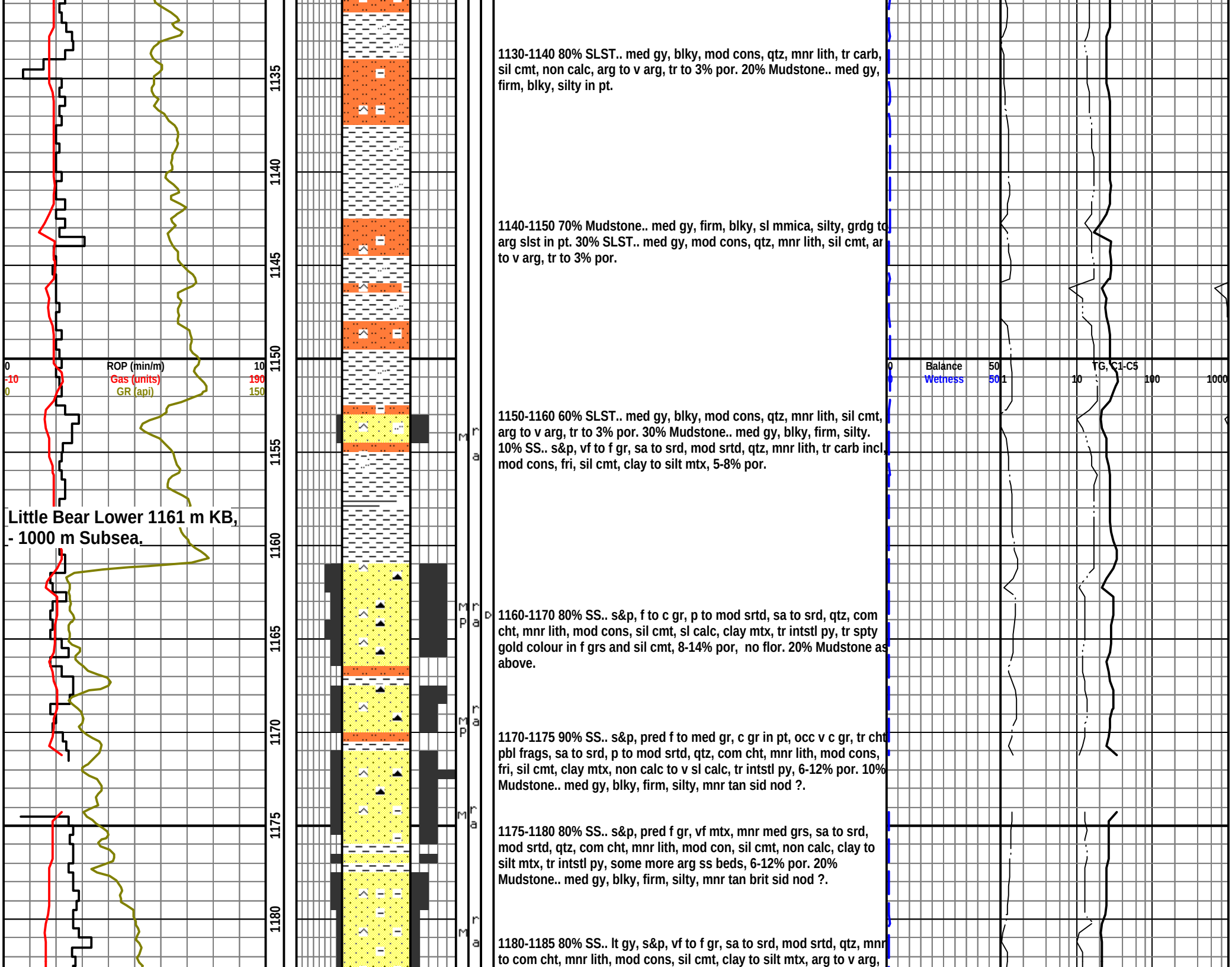


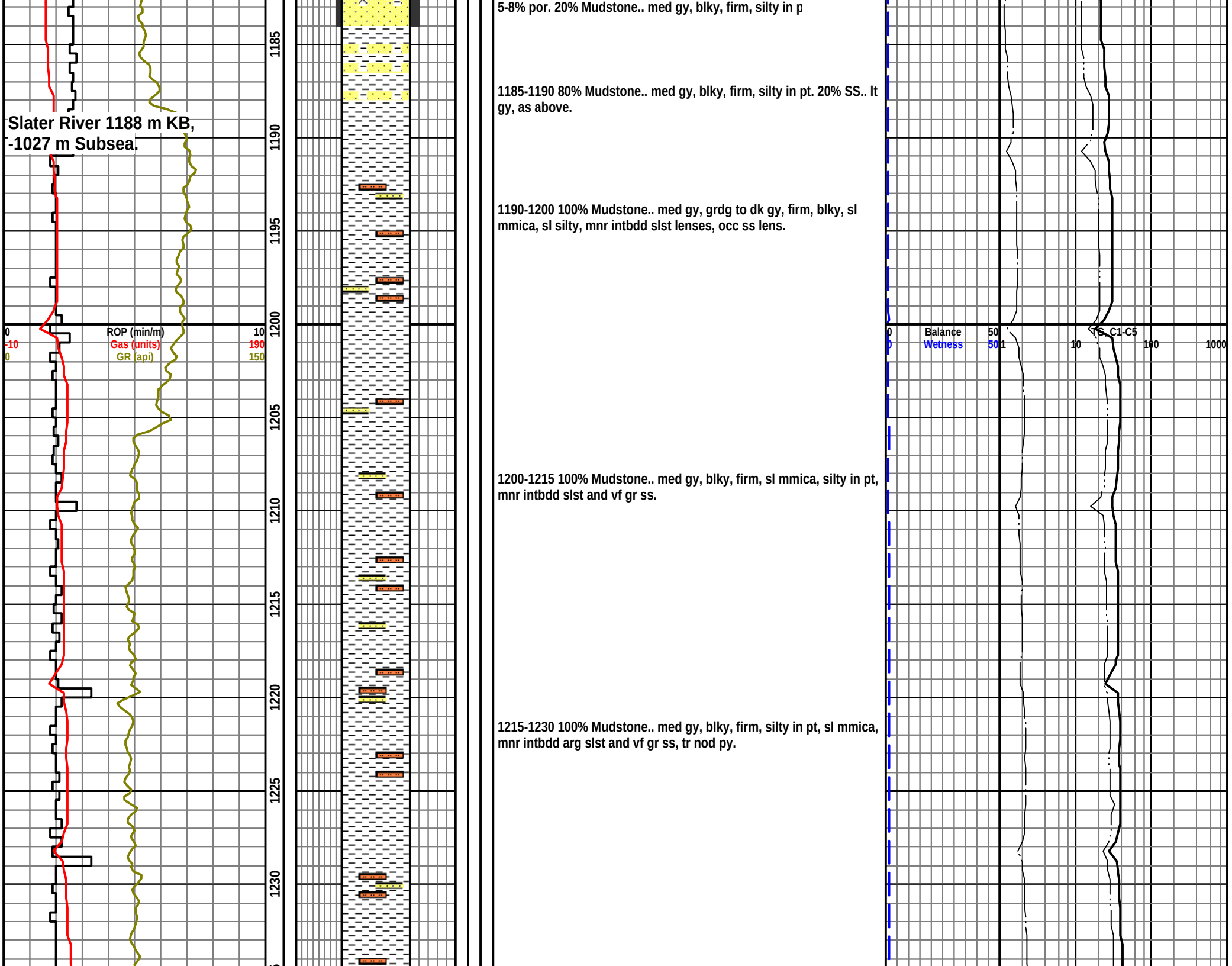
1080-1090 90% SS.. v lt gy, s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, sil cmt, clay mtx, 5-8% por, 10% Mudstone.. med gy, firm, blky, silty.

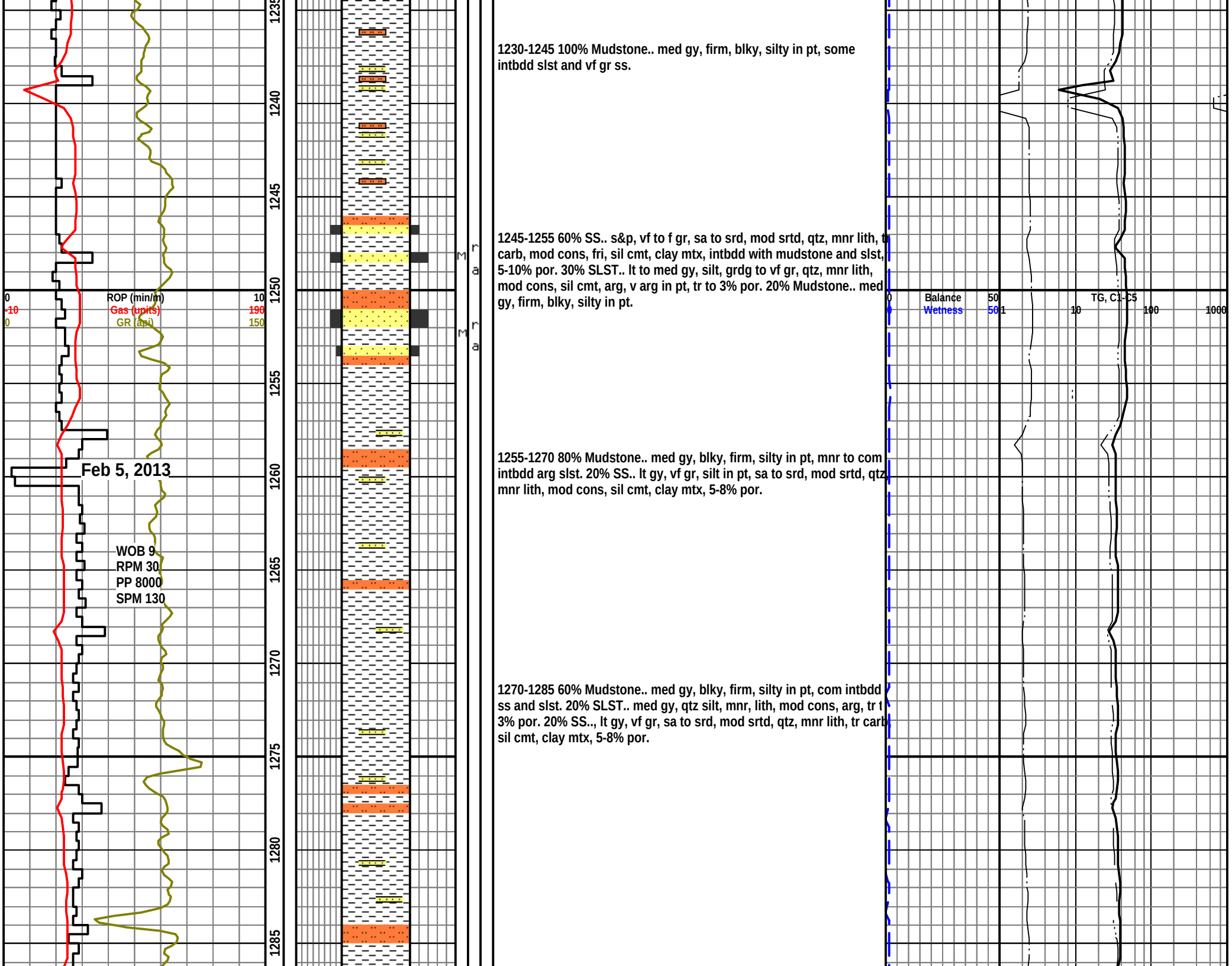
1090-1100 90% SS (SLST).. lt gy, vf to f gr, silt to vf gr in pt, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, mod cons, fri, sil cmt, non calc, tr intstl py, 5-8% por, some 6-12%. 10% Mudstone.. med gy, blky, firm, silty in pt.

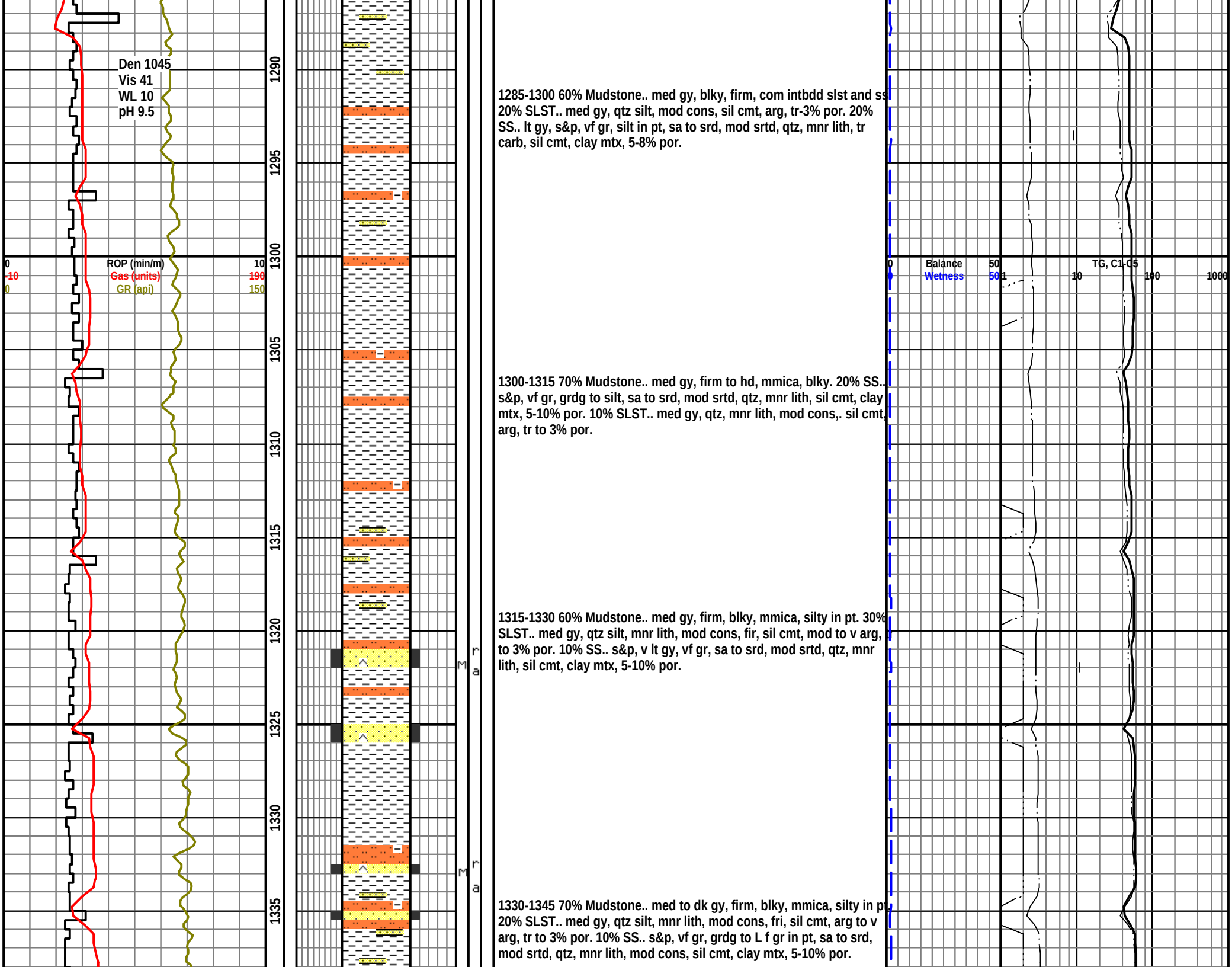
1100-1115 80 SLST(SS).. lt to med gy, silt to vf ss, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, sil cmt, fri, clay mtx, mod arg, 5-8% por. 20% Mudstone.. med gy, blky, firm, sl mmica, silty in pt.

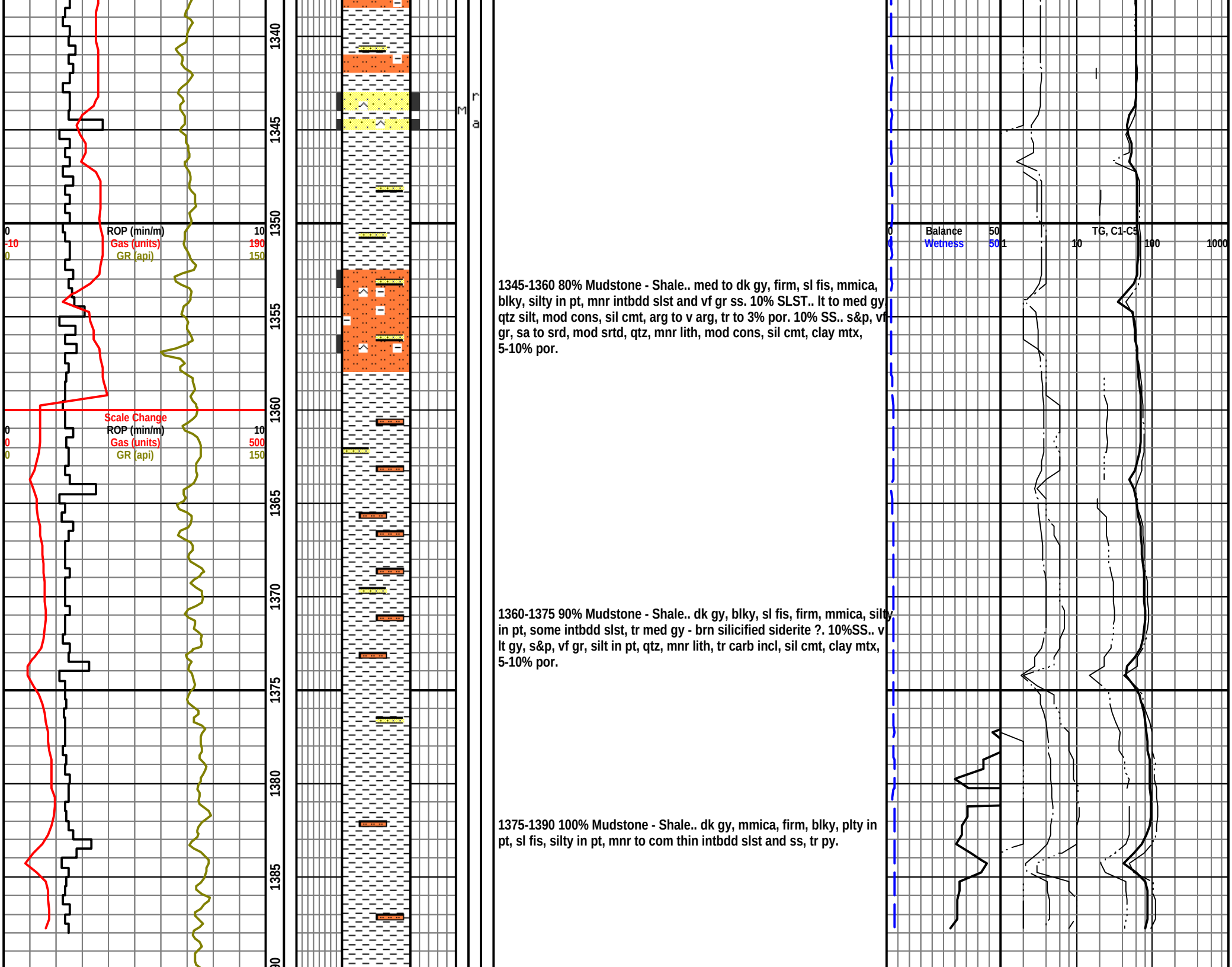
1115-1130 SLST (SS).. lt to med gy, silt, grdg to vf gr in pt, qtz, mnr lith, tr carb, mod cons, sil cmt, fri, arg to v arg, tr to 5% por. 20% Mudstone.. med gy, blky, firm. silty in pt, mnr tan brittle sid ?


0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
Little Bear Lower 1161 m KB,
- 1000 m Subsea.
0
Balance
50
TG, C1-C5
0
Wetness
50
1
10
100
1000
1130-1140 80% SLST.. med gy, blky, mod cons, qtz, mnr lith, tr carb, sil cmt, non calc, arg to v arg, tr to 3% por. 20% Mudstone.. med gy, firm, blky, silty in pt.
1140-1150 70% Mudstone.. med gy, firm, blky, sl mmica, silty, grdg to arg slst in pt. 30% SLST.. med gy, mod cons, qtz, mnr lith, sil cmt, ar to v arg, tr to 3% por.
1150-1160 60% SLST.. med gy, blky, mod cons, qtz, mnr lith, sil cmt, arg to v arg, tr to 3% por. 30% Mudstone.. med gy, blky, firm, silty. 10% SS.. s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, mod cons, fri, sil cmt, clay to silt mtx, 5-8% por.
1160-1170 80% SS.. s&p, f to c gr, p to mod srtd, sa to srd, qtz, com cht, mnr lith, mod cons, sil cmt, sl calc, clay mtx, tr intstl py, tr spty gold colour in f grs and sil cmt, 8-14% por, no flor. 20% Mudstone as above.
1170-1175 90% SS.. s&p, pred f to med gr, c gr in pt, occ v c gr, tr cht pbl frags, sa to srd, p to mod srtd, qtz, com cht, mnr lith, mod cons, fri, sil cmt, clay mtx, non calc to v sl calc, tr intstl py, 6-12% por. 10% Mudstone.. med gy, blky, firm, silty, mnr tan sid nod ?.
1175-1180 80% SS.. s&p, pred f gr, vf mtx, mnr med grs, sa to srd, mod srtd, qtz, com cht, mnr lith, mod con, sil cmt, non calc, clay to silt mtx, tr intstl py, some more arg ss beds, 6-12% por. 20% Mudstone.. med gy, blky, firm, silty, mnr tan brit sid nod ?.
1180-1185 80% SS.. lt gy, s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr to com cht, mnr lith, mod cons, sil cmt, clay to silt mtx, arg to v arg,


Slater River 1188 m KB,
-1027 m Subsea.
0
-10
0
ROP (min/m)
Gas (units)
GR (api)
10
190
150
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
5-8% por. 20% Mudstone.. med gy, blky, firm, silty in p
1185-1190 80% Mudstone.. med gy, blky, firm, silty in pt. 20% SS.. lt gy, as above.
1190-1200 100% Mudstone.. med gy, grdg to dk gy, firm, blky, sl mmica, sl silty, mnr intbdd slst lenses, occ ss lens.
1200-1215 100% Mudstone.. med gy, blky, firm, sl mmica, silty in pt, mnr intbdd slst and vf gr ss.
1215-1230 100% Mudstone.. med gy, blky, firm, silty in pt, sl mmica, mnr intbdd arg slst and vf gr ss, tr nod py.
0
Balance
50
0
Wetness
50
TG, C1-C5
1
10
100
1000


0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
Feb 5, 2013
WOB 9
RPM 30
PP 8000
SPM 130
1230
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
Mar
Mar
1230-1245 100% Mudstone.. med gy, firm, blky, silty in pt, some intbdd slst and vf gr ss.
1245-1255 60% SS.. s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, mod cons, fri, sil cmt, clay mtx, intbdd with mudstone and slst, 5-10% por. 30% SLST.. lt to med gy, silt, grdg to vf gr, qtz, mnr lith, mod cons, sil cmt, arg, v arg in pt, tr to 3% por. 20% Mudstone.. med gy, firm, blky, silty in pt.
1255-1270 80% Mudstone.. med gy, blky, firm, silty in pt, mnr to com intbdd arg slst. 20% SS.. lt gy, vf gr, silt in pt, sa to srd, mod srtd, qtz, mnr lith, mod cons, sil cmt, clay mtx, 5-8% por.
1270-1285 60% Mudstone.. med gy, blky, firm, silty in pt, com intbdd ss and slst. 20% SLST.. med gy, qtz silt, mnr, lith, mod cons, arg, tr t 3% por. 20% SS.., lt gy, vf gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, sil cmt, clay mtx, 5-8% por.
0
Balance
50
TG, C1-C5
0
Wetness
50
1
10
100
1000

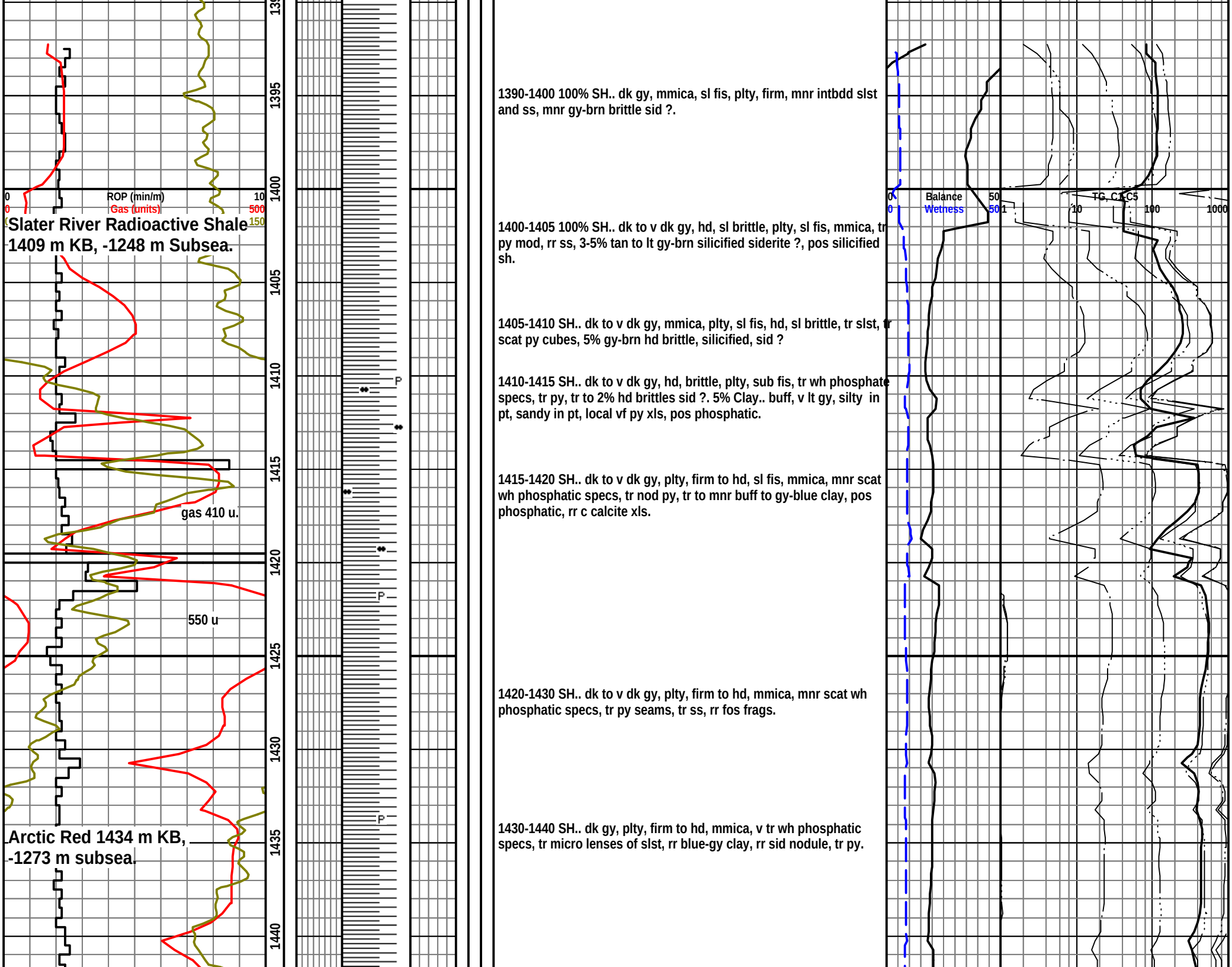

Den 1045
Vis 41
WL 10
pH 9.5
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5
1285-1300 60% Mudstone.. med gy, blky, firm, com intbdd slst and ss 20% SLST.. med gy, qtz silt, mod cons, sil cmt, arg, tr-3% por. 20% SS.. lt gy, s&p, vf gr, silt in pt, sa to srd, mod srtd, qtz, mnr lith, tr carb, sil cmt, clay mtx, 5-8% por.
1300-1315 70% Mudstone.. med gy, firm to hd, mmica, blky. 20% SS.. s&p, vf gr, grdg to silt, sa to srd, mod srtd, qtz, mnr lith, sil cmt, clay mtx, 5-10% por. 10% SLST.. med gy, qtz, mnr lith, mod cons,. sil cmt, arg, tr to 3% por.
1315-1330 60% Mudstone.. med gy, firm, blky, mmica, silty in pt. 30% SLST.. med gy, qtz silt, mnr lith, mod cons, fir, sil cmt, mod to v arg, tr to 3% por. 10% SS.. s&p, v lt gy, vf gr, sa to srd, mod srtd, qtz, mnr lith, sil cmt, clay mtx, 5-10% por.
1330-1345 70% Mudstone.. med to dk gy, firm, blky, mmica, silty in pt 20% SLST.. med gy, qtz silt, mnr lith, mod cons, fri, sil cmt, arg to v arg, tr to 3% por. 10% SS.. s&p, vf gr, grdg to L f gr in pt, sa to srd, mod srtd, qtz, mnr lith, mod cons, sil cmt, clay mtx, 5-10% por.



1345-1360 80% Mudstone - Shale.. med to dk gy, firm, sl fis, mmica, blky, silty in pt, mnr intbdd slst and vf gr ss. 10% SLST.. lt to med gy qtz silt, mod cons, sil cmt, arg to v arg, tr to 3% por. 10% SS.. s&p, vf gr, sa to srd, mod srtd, qtz, mnr lith, mod cons, sil cmt, clay mtx, 5-10% por.

1360-1375 90% Mudstone - Shale.. dk gy, blky, sl fis, firm, mmica, silty in pt, some intbdd slst, tr med gy - brn silicified siderite ?. 10%SS.. v lt gy, s&p, vf gr, silt in pt, qtz, mnr lith, tr carb incl, sil cmt, clay mtx, 5-10% por.

1375-1390 100% Mudstone - Shale.. dk gy, mmica, firm, blky, plty in pt, sl fis, silty in pt, mnr to com thin intbdd slst and ss, tr py.



1390-1400 100% SH.. dk gy, mmica, sl fis, plty, firm, mnr intbdd slst and ss, mnr gy-brn brittle sid ?.

1400-1405 100% SH.. dk to v dk gy, hd, sl brittle, plty, sl fis, mmica, tr py mod, rr ss, 3-5% tan to lt gy-brn silicified siderite ?, pos silicified sh.

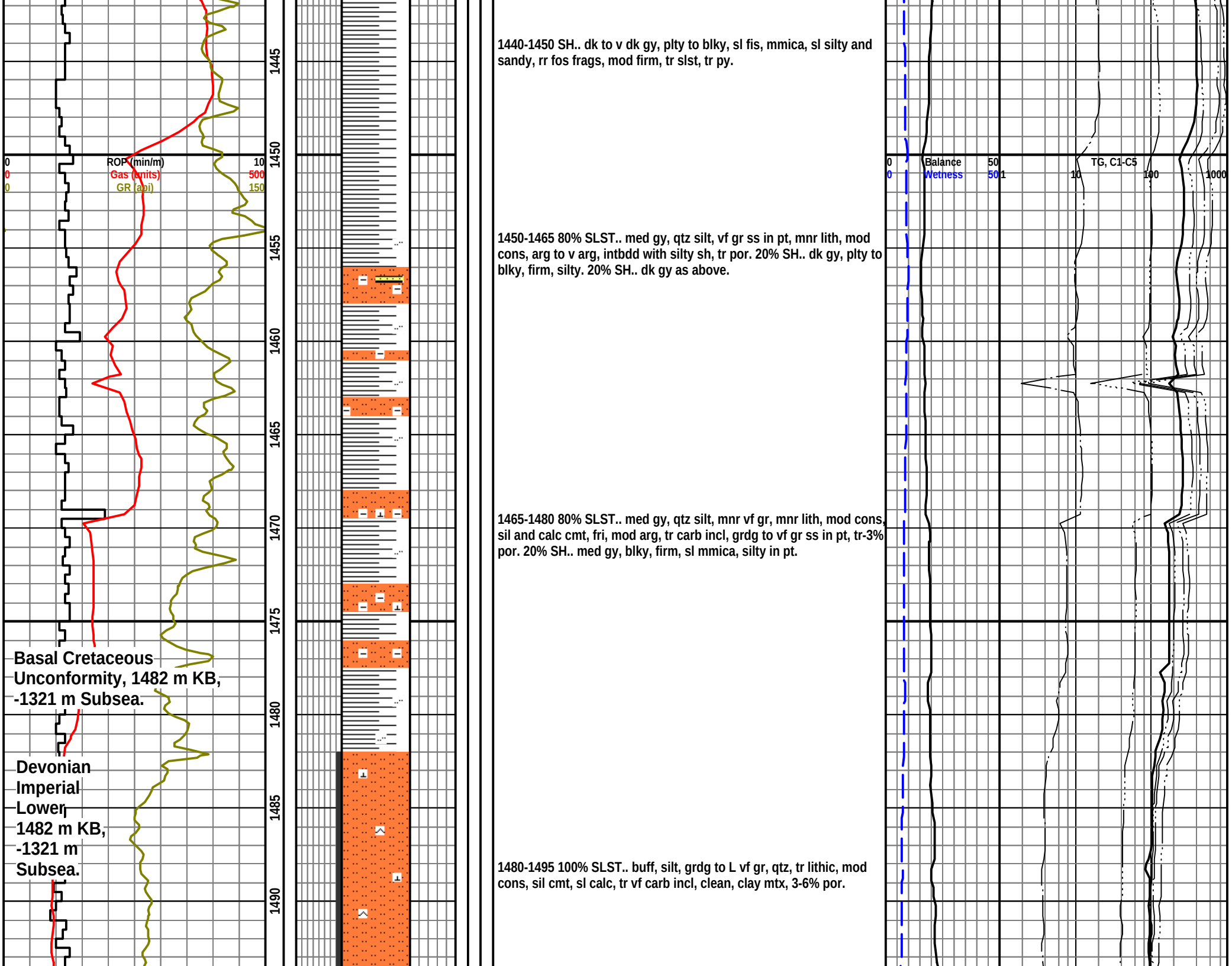
1405-1410 SH.. dk to v dk gy, mmica, plty, sl fis, hd, sl brittle, tr slst, tr scat py cubes, 5% gy-brn hd brittle, silicified, sid ?

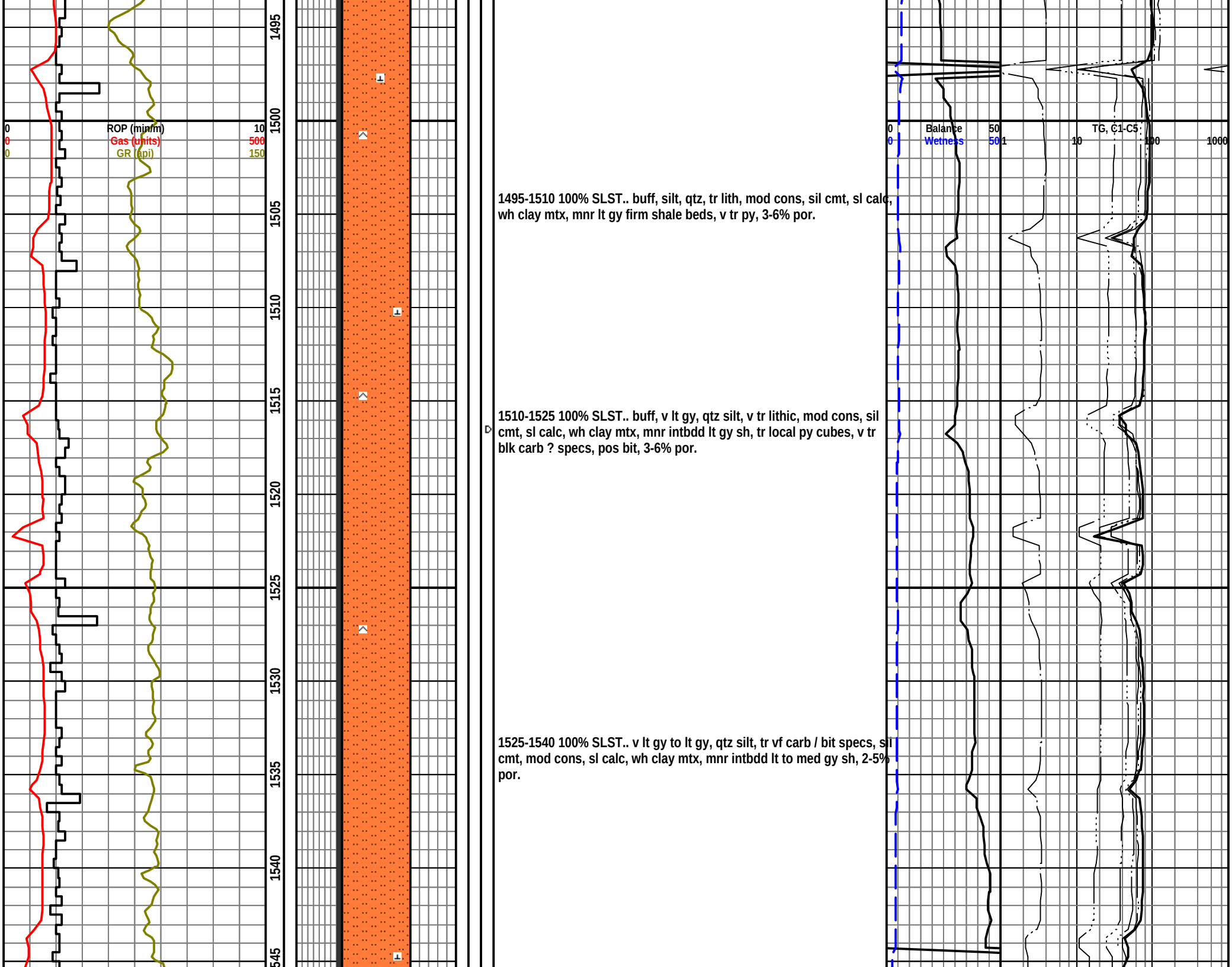
1410-1415 SH.. dk to v dk gy, hd, brittle, plty, sub fis, tr wh phosphate specs, tr py, tr to 2% hd brittles sid ?. 5% Clay.. buff, v lt gy, silty in pt, sandy in pt, local vf py xls, pos phosphatic.

1415-1420 SH.. dk to v dk gy, plty, firm to hd, sl fis, mmica, mnr scat wh phosphatic specs, tr nod py, tr to mnr buff to gy-blue clay, pos phosphatic, rr c calcite xls.

1420-1430 SH.. dk to v dk gy, plty, firm to hd, mmica, mnr scat wh phosphatic specs, tr py seams, tr ss, rr fos frags.

1430-1440 SH.. dk gy, plty, firm to hd, mmica, v tr wh phosphatic specs, tr micro lenses of slst, rr blue-gy clay, rr sid nodule, tr py.

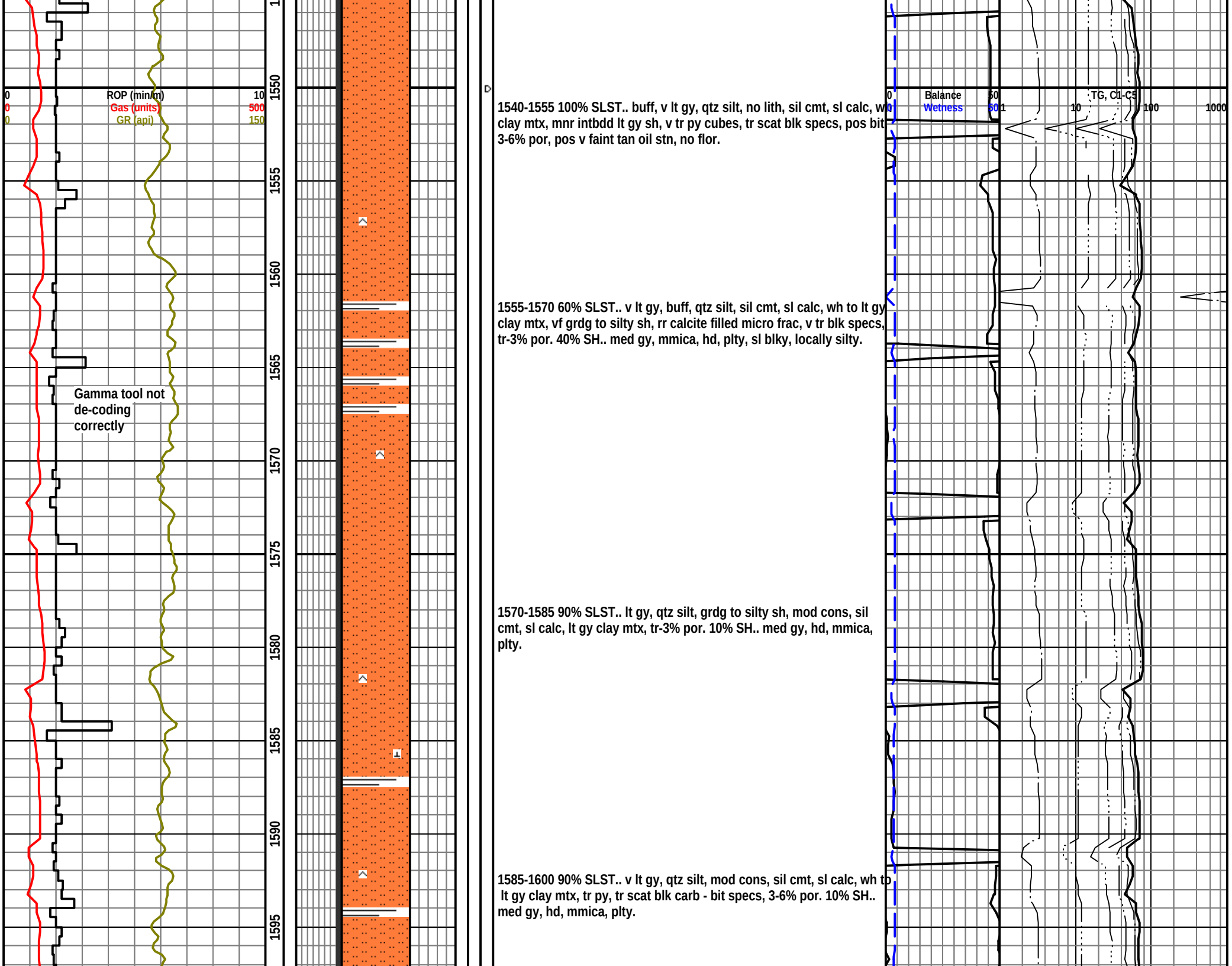

0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
Basal Cretaceous Unconformity, 1482 m KB, -1321 m Subsea.
Devonian Imperial Lower, 1482 m KB, -1321 m Subsea.
1440-1450 SH.. dk to v dk gy, plty to blky, sl fis, mmica, sl silty and sandy, rr fos frags, mod firm, tr slst, tr py.
1450-1465 80% SLST.. med gy, qtz silt, vf gr ss in pt, mnr lith, mod cons, arg to v arg, intbdd with silty sh, tr por. 20% SH.. dk gy, plty to blky, firm, silty. 20% SH.. dk gy as above.
1465-1480 80% SLST.. med gy, qtz silt, mnr vf gr, mnr lith, mod cons, sil and calc cmt, fri, mod arg, tr carb incl, grdg to vf gr ss in pt, tr-3% por. 20% SH.. med gy, blky, firm, sl mmica, silty in pt.
1480-1495 100% SLST.. buff, silt, grdg to L vf gr, qtz, tr lithic, mod cons, sil cmt, sl calc, tr vf carb incl, clean, clay mtx, 3-6% por.
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000



1495-1510 100% SLST.. buff, silt, qtz, tr lith, mod cons, sil cmt, sl calc, wh clay mtx, mnr lt gy firm shale beds, v tr py, 3-6% por.

1510-1525 100% SLST.. buff, v lt gy, qtz silt, v tr lithic, mod cons, sil cmt, sl calc, wh clay mtx, mnr intbdd lt gy sh, tr local py cubes, v tr blk carb ? specs, pos bit, 3-6% por.

1525-1540 100% SLST.. v lt gy to lt gy, qtz silt, tr vf carb / bit specs, sil cmt, mod cons, sl calc, wh clay mtx, mnr intbdd lt to med gy sh, 2-5% por.

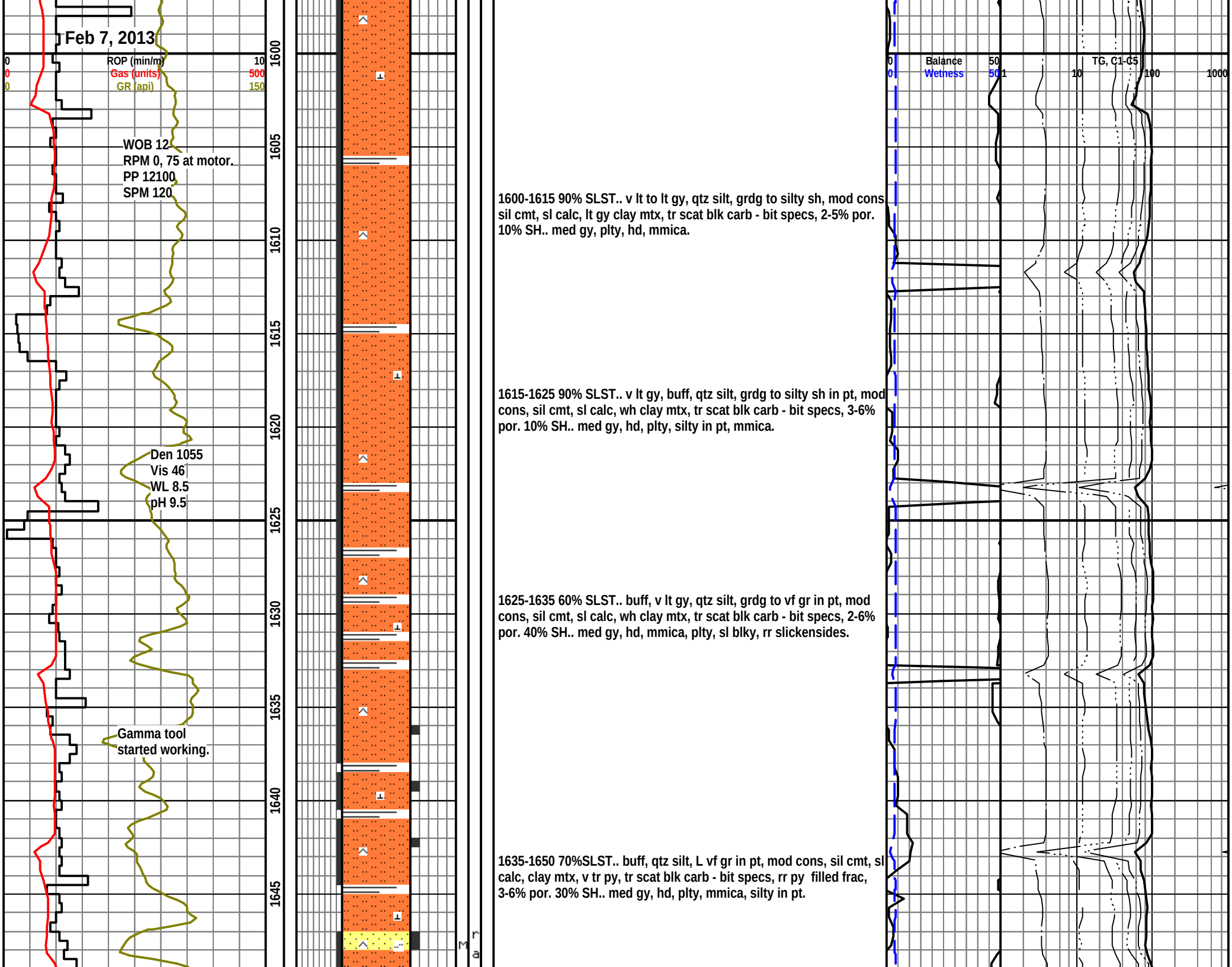


1540-1555 100% SLST.. buff, v lt gy, qtz silt, no lith, sil cmt, sl calc, wh clay mtx, mnr intbdd lt gy sh, v tr py cubes, tr scat blk specs, pos bit 3-6% por, pos v faint tan oil stn, no flor.

1555-1570 60% SLST.. v lt gy, buff, qtz silt, sil cmt, sl calc, wh to lt gy clay mtx, vf grdg to silty sh, rr calcite filled micro frac, v tr blk specs, tr-3% por. 40% SH.. med gy, mmica, hd, plty, sl blky, locally silty.

1570-1585 90% SLST.. lt gy, qtz silt, grdg to silty sh, mod cons, sil cmt, sl calc, lt gy clay mtx, tr-3% por. 10% SH.. med gy, hd, mmica, plty.

1585-1600 90% SLST.. v lt gy, qtz silt, mod cons, sil cmt, sl calc, wh to lt gy clay mtx, tr py, tr scat blk carb - bit specs, 3-6% por. 10% SH.. med gy, hd, mmica, plty.

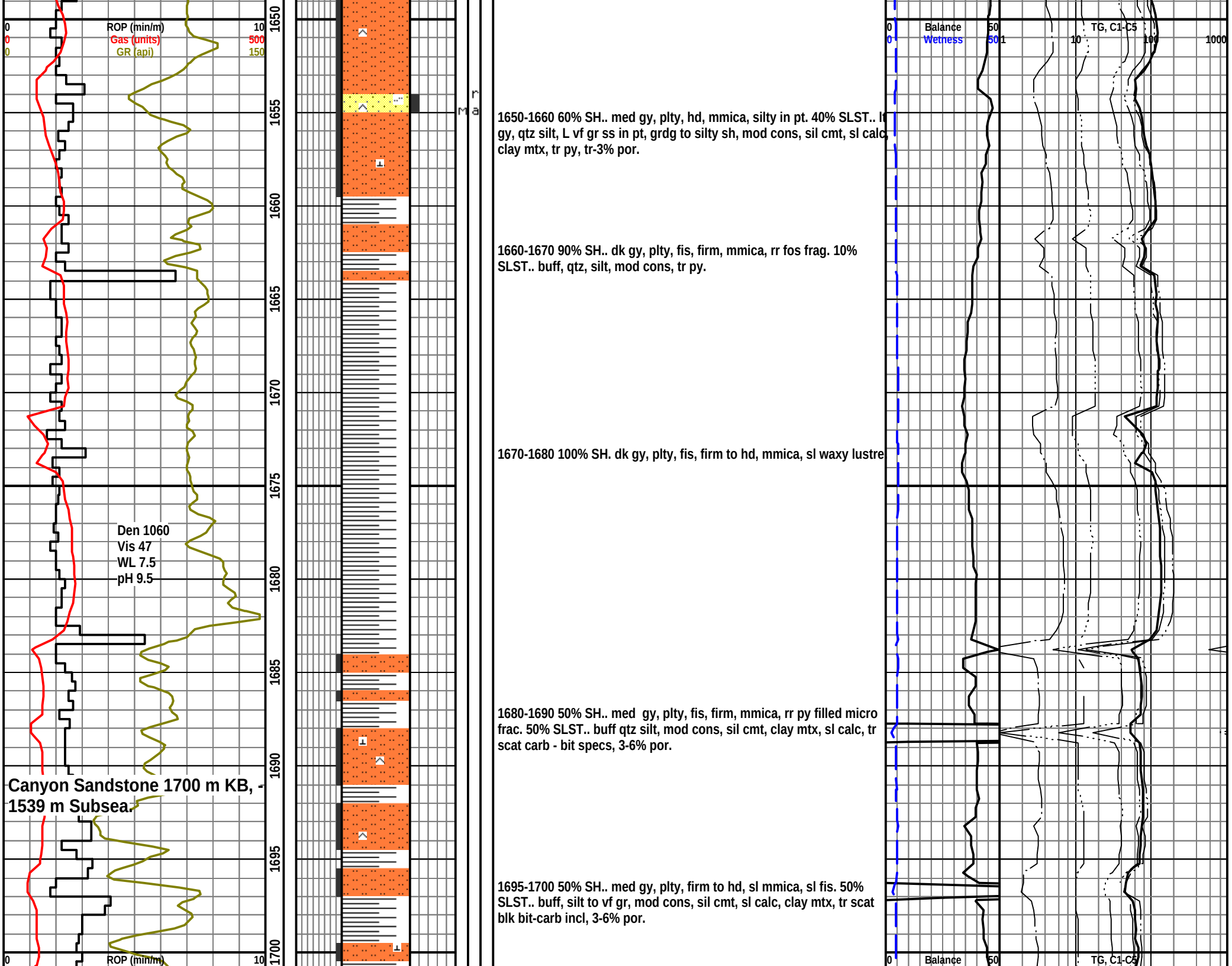


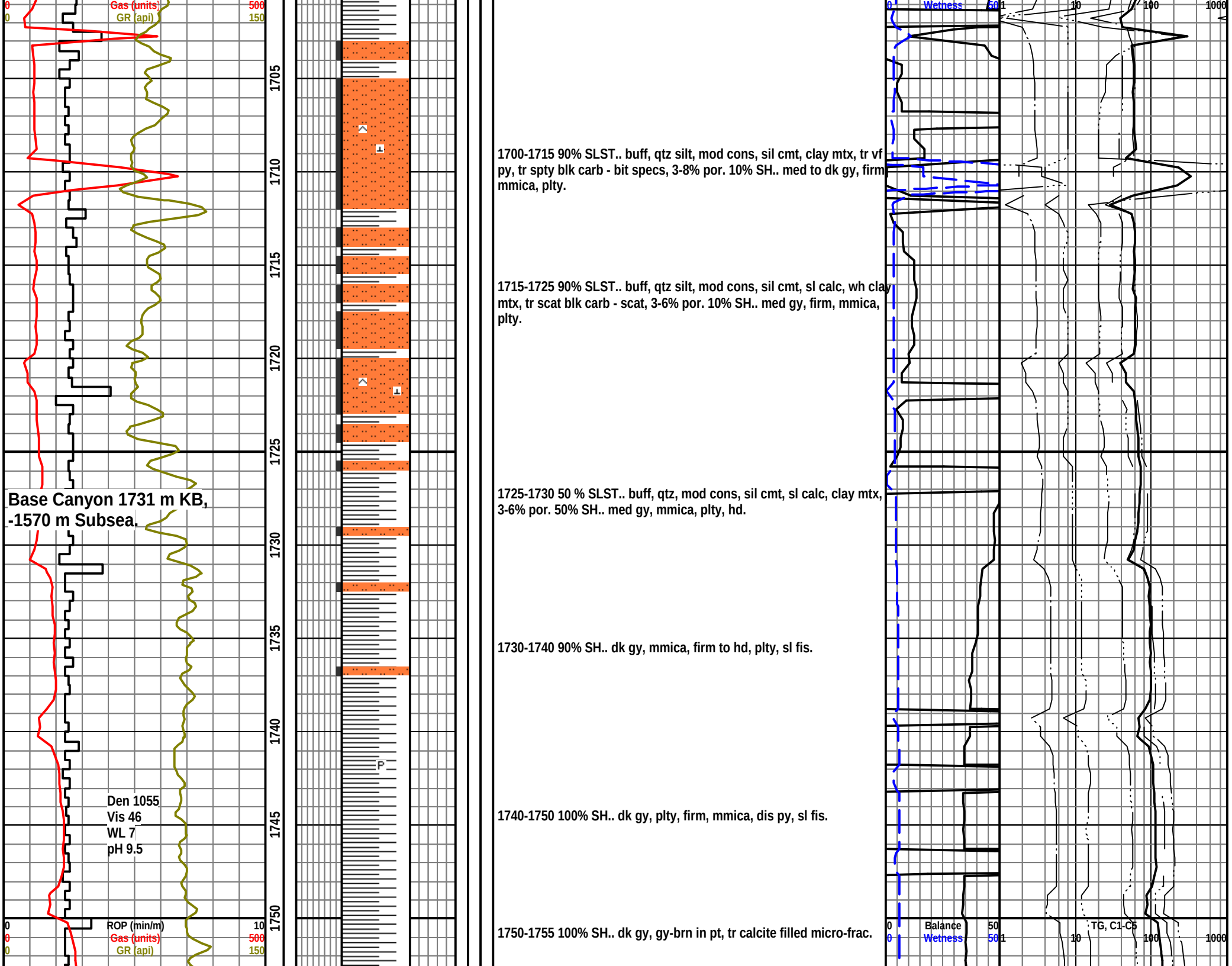
1600-1615 90% SLST.. v lt to lt gy, qtz silt, grdg to silty sh, mod cons sil cmt, sl calc, lt gy clay mtx, tr scat blk carb - bit specs, 2-5% por. 10% SH.. med gy, plty, hd, mmica.

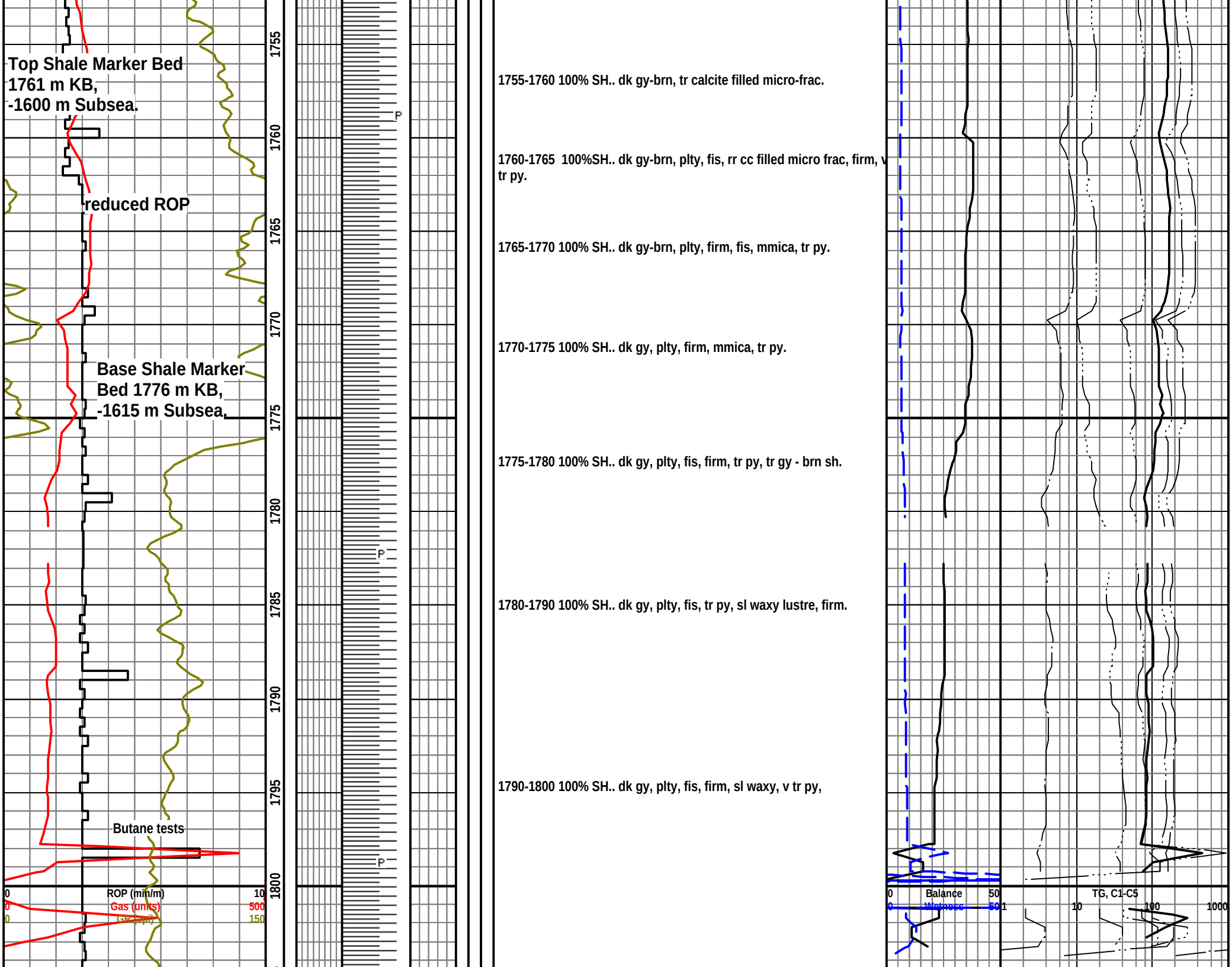
1615-1625 90% SLST.. v lt gy, buff, qtz silt, grdg to silty sh in pt, mod cons, sil cmt, sl calc, wh clay mtx, tr scat blk carb - bit specs, 3-6% por. 10% SH.. med gy, hd, plty, silty in pt, mmica.

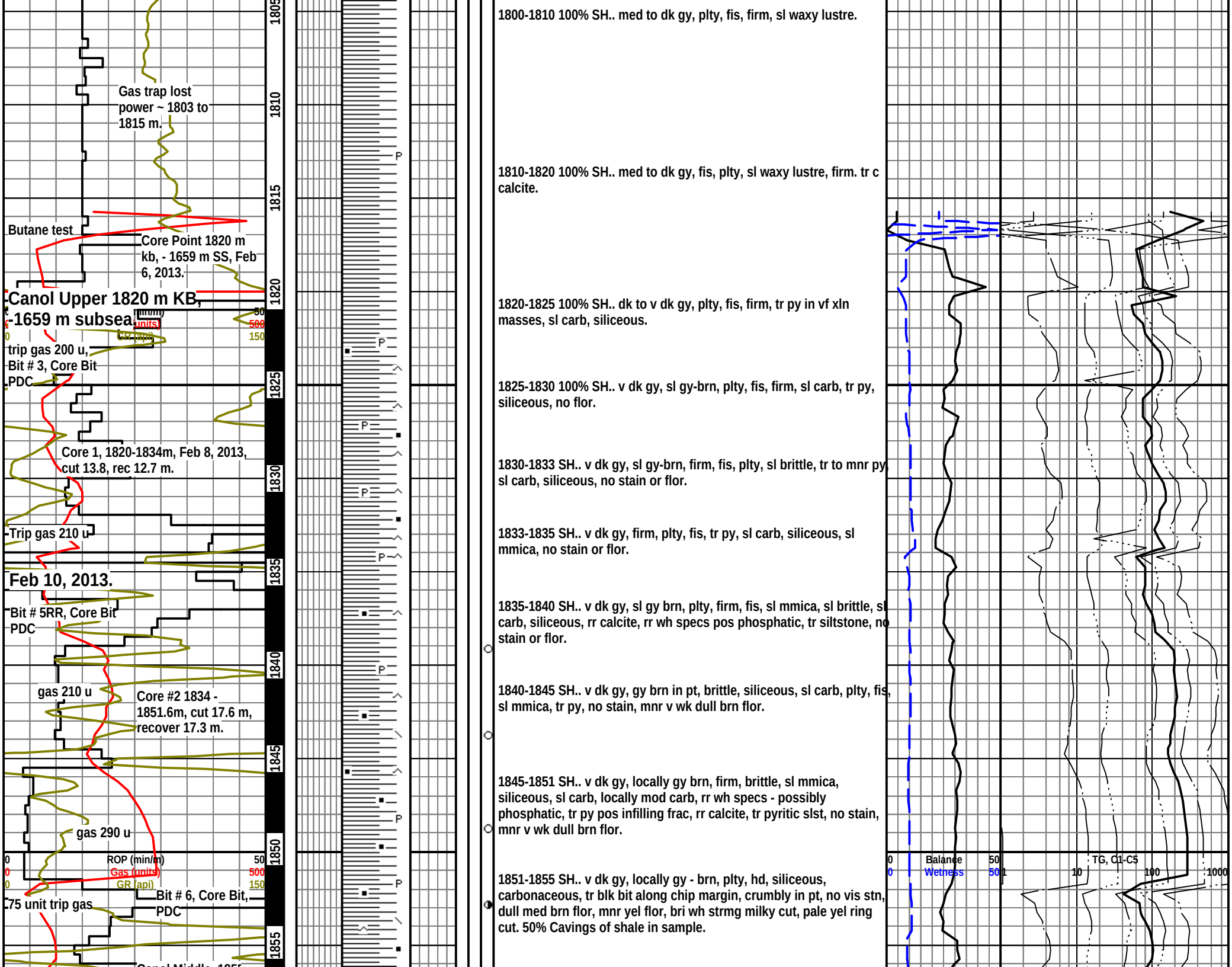
1625-1635 60% SLST.. buff, v lt gy, qtz silt, grdg to vf gr in pt, mod cons, sil cmt, sl calc, wh clay mtx, tr scat blk carb - bit specs, 2-6% por. 40% SH.. med gy, hd, mmica, plty, sl blky, rr slickensides.

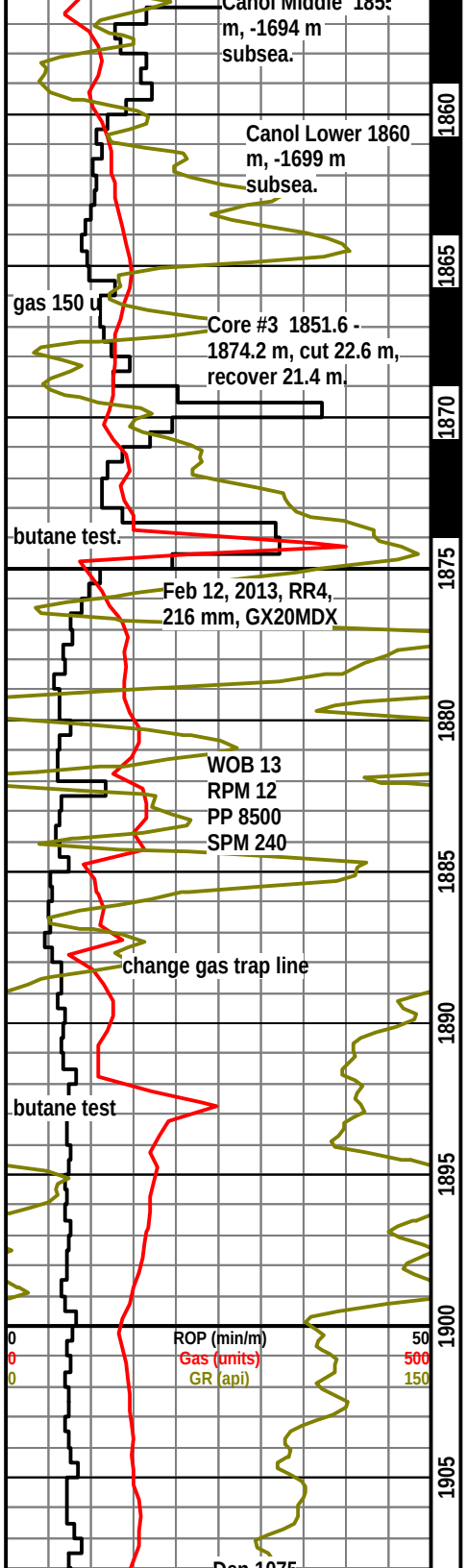
1635-1650 70%SLST.. buff, qtz silt, L vf gr in pt, mod cons, sil cmt, sl calc, clay mtx, v tr py, tr scat blk carb - bit specs, rr py filled frac, 3-6% por. 30% SH.. med gy, hd, plty, mmica, silty in pt.

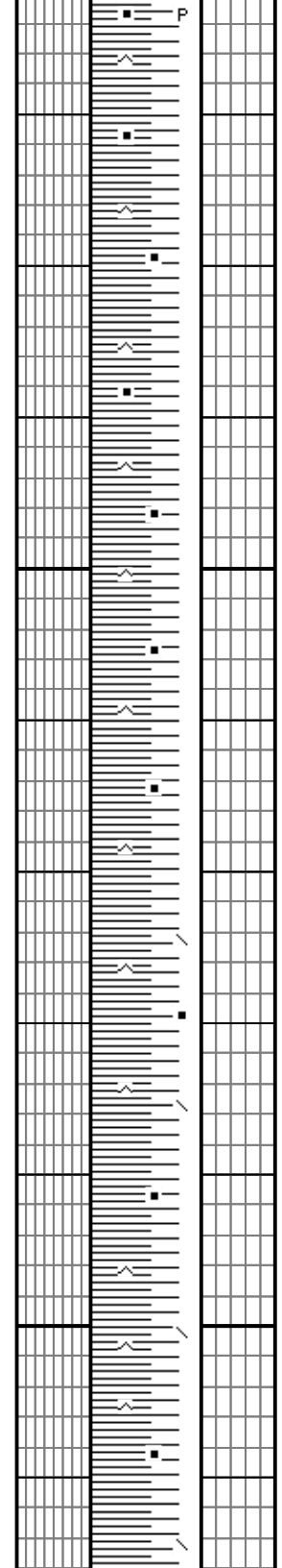

0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
Den 1060
Vis 47
WL 7.5
pH 9.5
Canyon Sandstone 1700 m KB, -1539 m Subsea.
0
ROP (min/m)
10
1650-1660 60% SH.. med gy, plty, hd, mmica, silty in pt. 40% SLST.. lt gy, qtz silt, L vf gr ss in pt, grdg to silty sh, mod cons, sil cmt, sl calc, clay mtx, tr py, tr-3% por.
1660-1670 90% SH.. dk gy, plty, fis, firm, mmica, rr fos frag. 10% SLST.. buff, qtz, silt, mod cons, tr py.
1670-1680 100% SH. dk gy, plty, fis, firm to hd, mmica, sl waxy lustre
1680-1690 50% SH.. med gy, plty, fis, firm, mmica, rr py filled micro frac. 50% SLST.. buff qtz silt, mod cons, sil cmt, clay mtx, sl calc, tr scat carb - bit specs, 3-6% por.
1695-1700 50% SH.. med gy, plty, firm to hd, sl mmica, sl fis. 50% SLST.. buff, silt to vf gr, mod cons, sil cmt, sl calc, clay mtx, tr scat blk bit-carb incl, 3-6% por.
0
Balance
50
TG, C1-C5
0
Wetness
50
1
10
100
1000
0
Balance
50
TG, C1-C5


0
Gas (units)
500
0
GR (api)
150
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
Base Canyon 1731 m KB,
-1570 m Subsea.
Den 1055
Vis 46
WL 7
pH 9.5
0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1700-1715 90% SLST.. buff, qtz silt, mod cons, sil cmt, clay mtx, tr vf py, tr spty blk carb - bit specs, 3-8% por. 10% SH.. med to dk gy, firm, mmica, plty.
1715-1725 90% SLST.. buff, qtz silt, mod cons, sil cmt, sl calc, wh clay mtx, tr scat blk carb - scat, 3-6% por. 10% SH.. med gy, firm, mmica, plty.
1725-1730 50 % SLST.. buff, qtz, mod cons, sil cmt, sl calc, clay mtx, 3-6% por. 50% SH.. med gy, mmica, plty, hd.
1730-1740 90% SH.. dk gy, mmica, firm to hd, plty, sl fis.
1740-1750 100% SH.. dk gy, plty, firm, mmica, dis py, sl fis.
1750-1755 100% SH.. dk gy, gy-brn in pt, tr calcite filled micro-frac.
0
Wetness
50
1
10
100
1000
0
Balance
50
0
Wetness
50
1
10
TG, C1-C5
100
1000


Top Shale Marker Bed
1761 m KB,
-1600 m Subsea.
reduced ROP
Base Shale Marker
Bed 1776 m KB,
-1615 m Subsea.
Butane tests
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
P
P
P
0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1755-1760 100% SH.. dk gy-brn, tr calcite filled micro-frac.
1760-1765 100%SH.. dk gy-brn, plty, fis, rr cc filled micro frac, firm, v
tr py.
1765-1770 100% SH.. dk gy-brn, plty, firm, fis, mmica, tr py.
1770-1775 100% SH.. dk gy, plty, firm, mmica, tr py.
1775-1780 100% SH.. dk gy, plty, fis, firm, tr py, tr gy - brn sh.
1780-1790 100% SH.. dk gy, plty, fis, tr py, sl waxy lustre, firm.
1790-1800 100% SH.. dk gy, plty, fis, firm, sl waxy, v tr py,
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000


1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
Gas trap lost power ~ 1803 to 1815 m.
Butane test
Core Point 1820 m kb, - 1659 m SS, Feb 6, 2013.
Canol Upper 1820 m KB, -1659 m subsea
ROP (min/m)
Gas (units)
GR (api)
trip gas 200 u,
Bit # 3, Core Bit
PDC
Core 1, 1820-1834m, Feb 8, 2013, cut 13.8, rec 12.7 m.
Trip gas 210 u
Feb 10, 2013.
Bit # 5RR, Core Bit
PDC
gas 210 u
Core #2 1834 - 1851.6m, cut 17.6 m, recover 17.3 m.
gas 290 u
75 unit trip gas
Bit # 6, Core Bit,
PDC
1800-1810 100% SH.. med to dk gy, plty, fis, firm, sl waxy lustre.
1810-1820 100% SH.. med to dk gy, fis, plty, sl waxy lustre, firm. tr c calcite.
1820-1825 100% SH.. dk to v dk gy, plty, fis, firm, tr py in vf xln masses, sl carb, siliceous.
1825-1830 100% SH.. v dk gy, sl gy-brn, plty, fis, firm, sl carb, tr py, siliceous, no flor.
1830-1833 SH.. v dk gy, sl gy-brn, firm, fis, plty, sl brittle, tr to mnr py, sl carb, siliceous, no stain or flor.
1833-1835 SH.. v dk gy, firm, plty, fis, tr py, sl carb, siliceous, sl mmica, no stain or flor.
1835-1840 SH.. v dk gy, sl gy brn, plty, firm, fis, sl mmica, sl brittle, sl carb, siliceous, rr calcite, rr wh specs pos phosphatic, tr siltstone, no stain or flor.
1840-1845 SH.. v dk gy, gy brn in pt, brittle, siliceous, sl carb, plty, fis, sl mmica, tr py, no stain, mnr v wk dull brn flor.
1845-1851 SH.. v dk gy, locally gy brn, firm, brittle, sl mmica, siliceous, sl carb, locally mod carb, rr wh specs - possibly phosphatic, tr py pos infilling frac, rr calcite, tr pyritic slst, no stain, mnr v wk dull brn flor.
1851-1855 SH.. v dk gy, locally gy - brn, plty, hd, siliceous, carbonaceous, tr blk bit along chip margin, crumbly in pt, no vis stn, dull med brn flor, mnr yel flor, bri wh strmg milky cut, pale yel ring cut. 50% Cavings of shale in sample.
Balance
Wetness
TG, C1-C5





1855-1860 SH.. v dk gy to gyish brn, hd, brittle, siliceous, carbonaceous, tr py frac infil, sub plty, sl crumbly, tr carb slst, rr calcite, no vis stn, dull brn to locally yellow flor, fast strmg bri milky cut, dk yel ring cut.

1860-1865 SH.. v dk gy to gyish brn, plty, hd, siliceous, carbonaceous, crumbly in pt, tr calcite frac infil, no vis stn, dull brn to medium brn flor, bri wh strmg cut.

1865-1870 SH.. dk brnish gy, v dk gy, sub plty, fis, mod siliceous, firm, tr py, tr calcite fracture fill, rr blk dry bit chip, no vis stn, spty med brn flor, bri wh strmg milky cut.

1870-1872 SH.. v dk gy, mnr gy brn, hd, brittle, plty, sub plty in pt, siliceous, sl carb, tr slst , tr calcite frac infil, no vis stn, spty dull brn flor, bri wh milky cut.

1872-1880 after trip, SH.. v dk gy, brnish gy in pt, mmica, hd, brit, sili tr calcite lined frac surfaces, carb, no vis stn, spty dull brn flor, wk strmg milky cut.

1880-1885 SH.. v dk gy, mmica, hd, silic, carb, num calcite filled hairline frac, no vis stn, spty to even med brn cut, mod strmg milky cut, med yel ring cut.

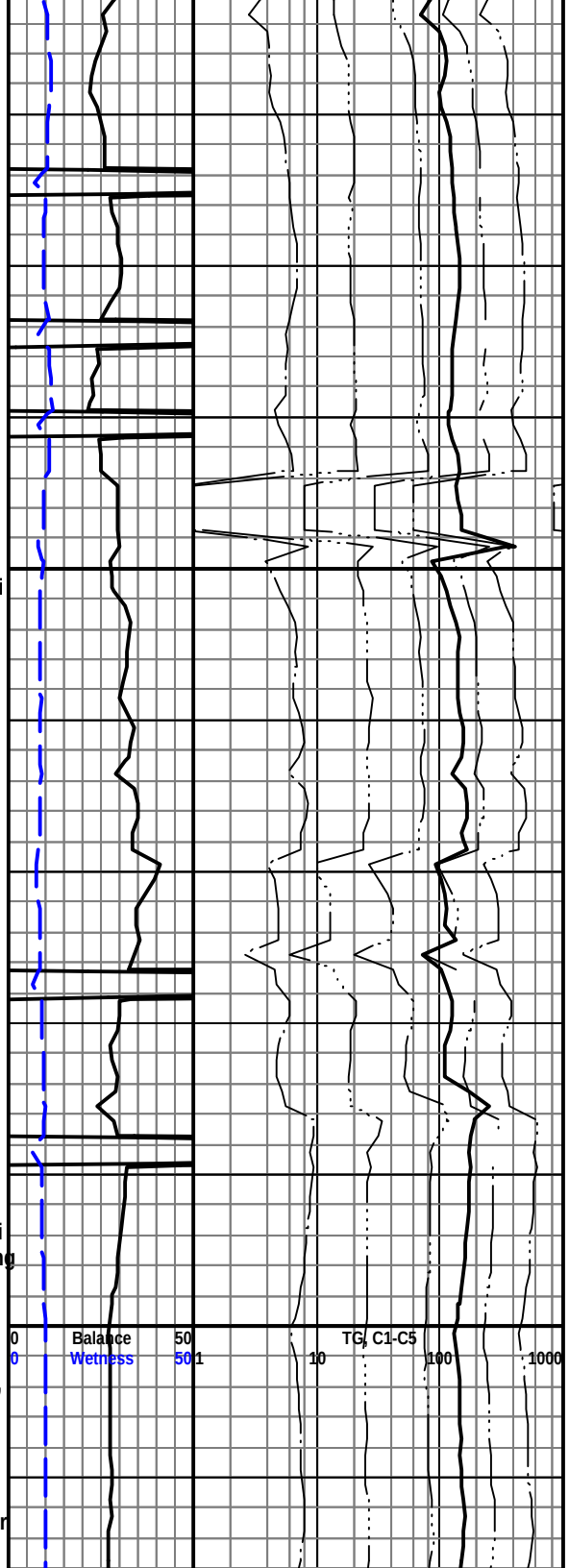
1885-1890 SH.. v dk gy, brnish gy in pt, mmica, hd, brit, silic, carb - bit, tr calcite lined frac, tr py, no vis stn, spty to even med brn flor, slow milky strmg cut, med yel ring cut.

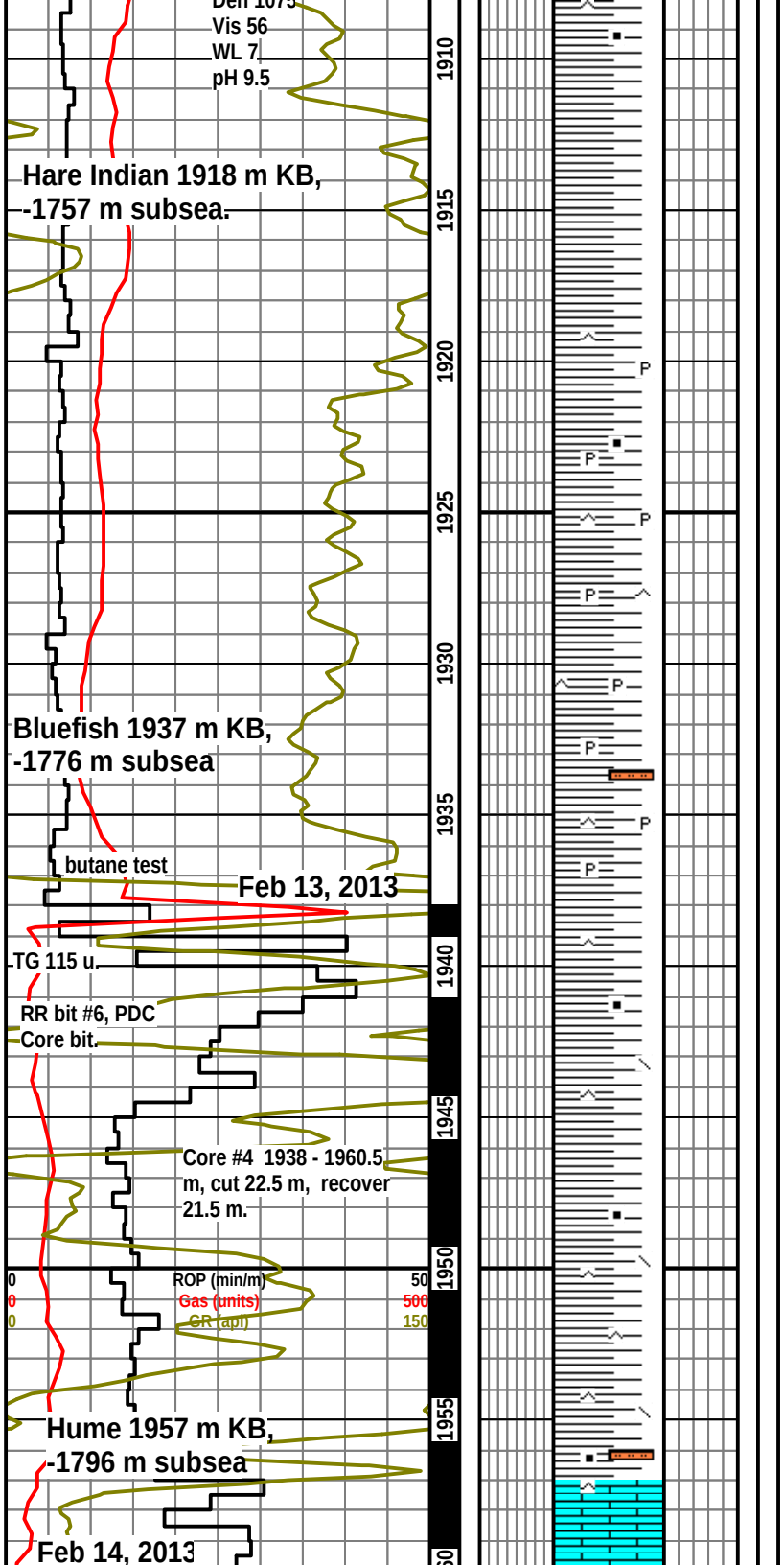
1890-1895 SH.. v dk gy, brnish gy, mmica, hd, brit, silic, carb - bit, tr calcite filled hairline to v narrow frac, tr micxln py masses, sl bit appearance in pt, no vis stn, mod milky strmg cut, med yel ring cut.

1895-1900 SH.. v dk gy, brnish gy, mmica, hd, silic, carb - bit, tr calci lined frac, tr pyritic slst, no vis stn, mod strmg milky cut, med yel ring cut.

1900-1905 SH.. v dk gy, brnish gy, mmica, hd, brit, silic, carb - bit, some calcite filled micro frac, tr f to med clr calc xls on frac surface, tr py, bituminous appearance in pt, no vis oil stn, v wk brn flor, mod milky strmg cut, yel ring cut.

1905-1910 SH.. v dk gy, brnish gy, hd, silic, mmica, carb - bit, tr py, tr calcite filled micro frac, sl bit, no vis oil stn, even dull brn flor, mod





milky strmg cut, yel ring cut

1910-1920 no samples.

1920-1925 SH.. v dk gy, mnr brnish gy, mmica, hd, silic, carb, tr py chips , tr calcite filled micro frac, no vis stn, even to spty med brn flor, slow milky strmg cut.

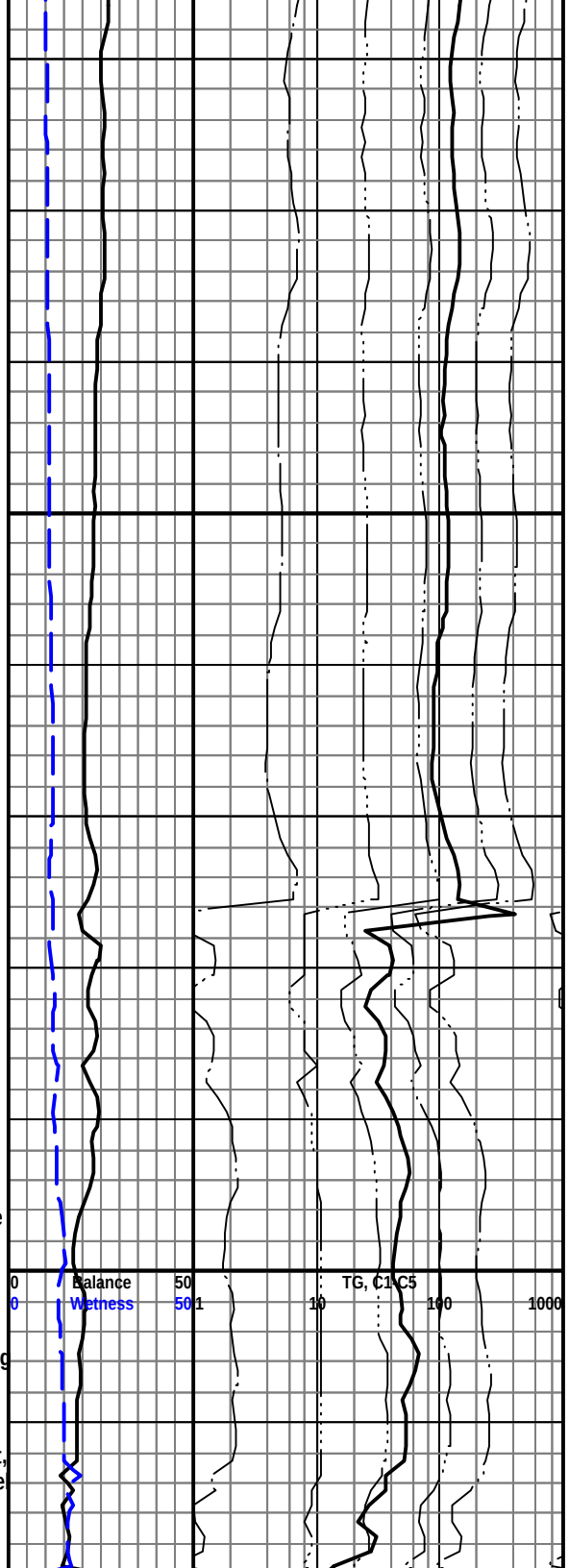
1925-1930 SH.. v dk gy, hd, silic, mmica, tr py chips. silic, sl carb, rr calcite frac infil, no vis stn, even to spty med brn flor, v slow strmg milky cut.

1930-1938 SH.. v dk gy, mmica, hd, siliceous, sl carb, tr py chips, tr slst, no stn, even to spty med brn flor, slow milky strmg cut.

1938-1940 after trip, SH.. dk gy., mmica, firm., plty, fis, mod silic, sl carb, rr calcite fracture infil tr py, tr slst.

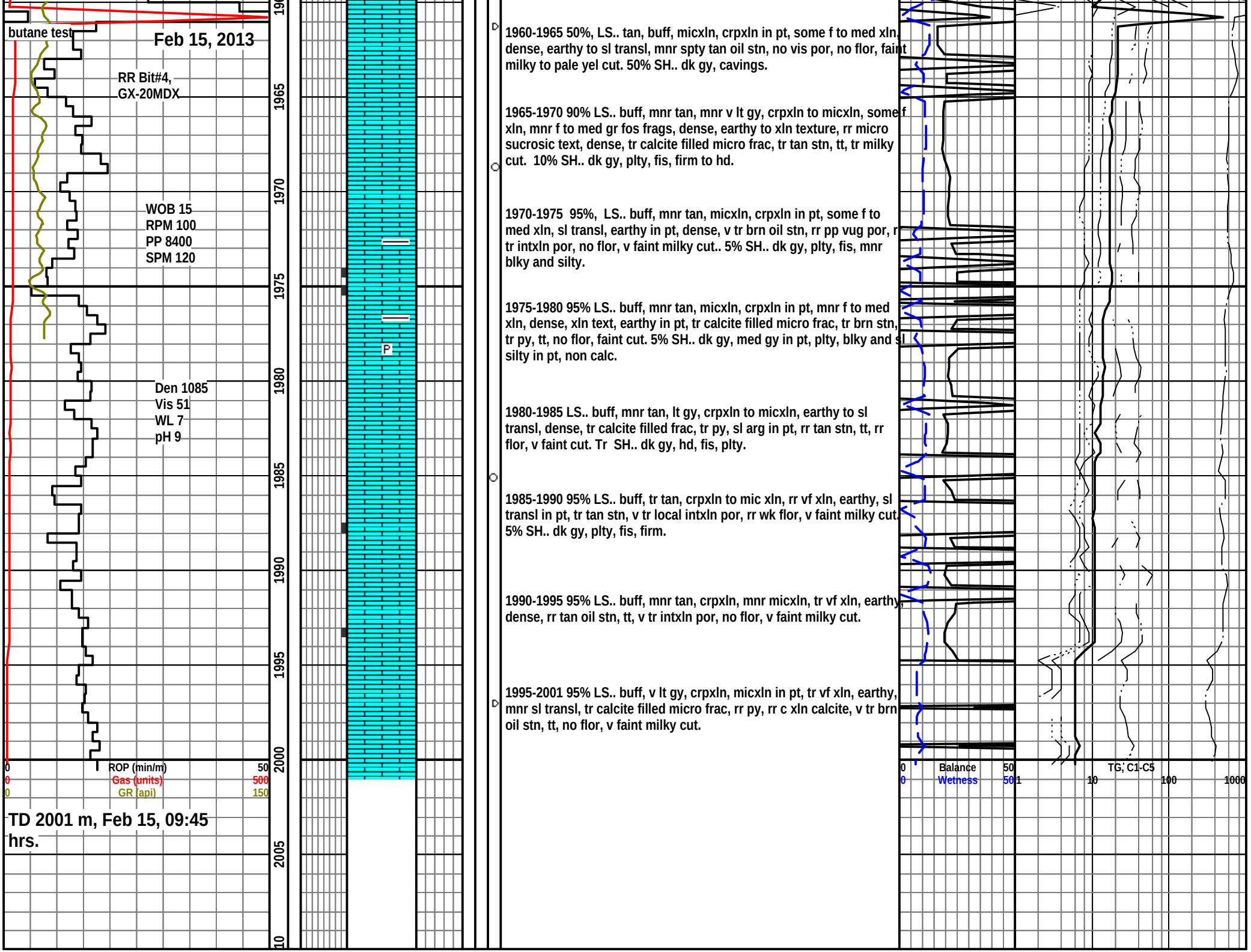
1940-1945 SH.. dk gy, mmica, firm, plty, fis, sl silic, sl carb, tr wh calcite frac infil, tr lt gy, crpxln calcareous chips, tr py, no vis stn, even to spty dull brn flor, slow milky strmg cut, yel ring cut.

1945-1950 SH.. v dk gy, plty, fis, hd, silic, carb, several calcite filled micro frac, com lt gy crpxln calcite, no vis stn, dull brn flor, slow strmg milky cut. Note.. the lt gy calcareous chips are bitumen staine and are occasionally contain clean wh calcite filled micro fracs.



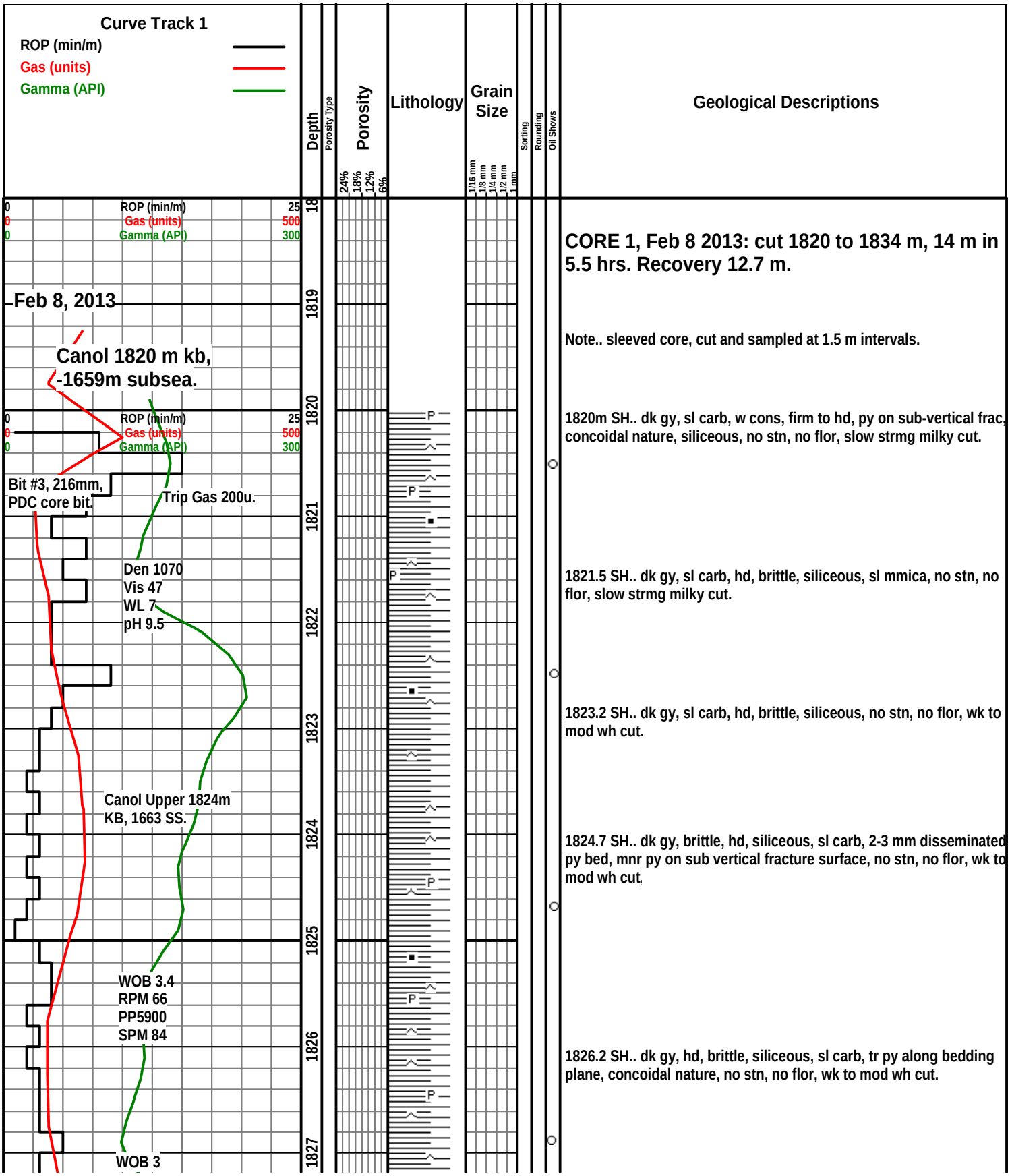
1950-1955 SH.. v dk gy, sl gy - brn, firm to hd, silic, carb, plty, fis, tr py, tr lt gy calc chips, dull med brn flor, mod strmg milky cut, yel ring cut.

1955-1960 SH.. v dk gy, gy brn, plty, fis, hd, sl mmica, silic, carb - bit, tr lt gy calc chips, tr wh sl oil stained slst, no vis stn, dull brn flor, ye flor in slst, mod strmg cut.


butane test
Feb 15, 2013
RR Bit#4,
GX-20MDX
WOB 15
RPM 100
PP 8400
SPM 120
Den 1085
Vis 51
WL 7
pH 9
P
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
0
ROP (min/m)
50
0
Gas (units)
500
0
GR (api)
150
TD 2001 m, Feb 15, 09:45 hrs.
1960-1965 50%, LS.. tan, buff, micxln, crpxln in pt, some f to med xln, dense, earthy to sl transl, mnr spty tan oil stn, no vis por, no flor, faint milky to pale yel cut. 50% SH.. dk gy, cavings.
1965-1970 90% LS.. buff, mnr tan, mnr v lt gy, crpxln to micxln, some f xln, mnr f to med gr fos frags, dense, earthy to xln texture, rr micro sucrosic text, dense, tr calcite filled micro frac, tr tan stn, tt, tr milky cut. 10% SH.. dk gy, plty, fis, firm to hd.
1970-1975 95%, LS.. buff, mnr tan, micxln, crpxln in pt, some f to med xln, sl transl, earthy in pt, dense, v tr brn oil stn, rr pp vug por, r tr intxln por, no flor, v faint milky cut.. 5% SH.. dk gy, plty, fis, mnr blky and silty.
1975-1980 95% LS.. buff, mnr tan, micxln, crpxln in pt, mnr f to med xln, dense, xln text, earthy in pt, tr calcite filled micro frac, tr brn stn, tr py, tt, no flor, faint cut. 5% SH.. dk gy, med gy in pt, plty, blky and sl silty in pt, non calc.
1980-1985 LS.. buff, mnr tan, lt gy, crpxln to micxln, earthy to sl transl, dense, tr calcite filled frac, tr py, sl arg in pt, rr tan stn, tt, rr flor, v faint cut. Tr SH.. dk gy, hd, fis, plty.
1985-1990 95% LS.. buff, tr tan, crpxln to mic xln, rr vf xln, earthy, sl transl in pt, tr tan stn, v tr local intxln por, rr wk flor, v faint milky cut. 5% SH.. dk gy, plty, fis, firm.
1990-1995 95% LS.. buff, mnr tan, crpxln, mnr micxln, tr vf xln, earthy, dense, rr tan oil stn, tt, v tr intxln por, no flor, v faint milky cut.
1995-2001 95% LS.. buff, v lt gy, crpxln, micxln in pt, tr vf xln, earthy, mnr sl transl, tr calcite filled micro frac, rr py, rr c xln calcite, v tr brn oil stn, tt, no flor, v faint milky cut.
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000

CORE LOG 1:48 SCALE

Contractor: Baker Hughes
Core #: 1,2,3
Formation: Canol
Core Interval: From: 1820 m To: 1874.2 m
Cut: 54.2 m **Recovered:** 51.4 m
Bit type: PDC
Size: 216 mm
Coring Time: 17.5 hrs



CORE 1, Feb 8 2013: cut 1820 to 1834 m, 14 m in 5.5 hrs. Recovery 12.7 m.

Note.. sleeved core, cut and sampled at 1.5 m intervals.

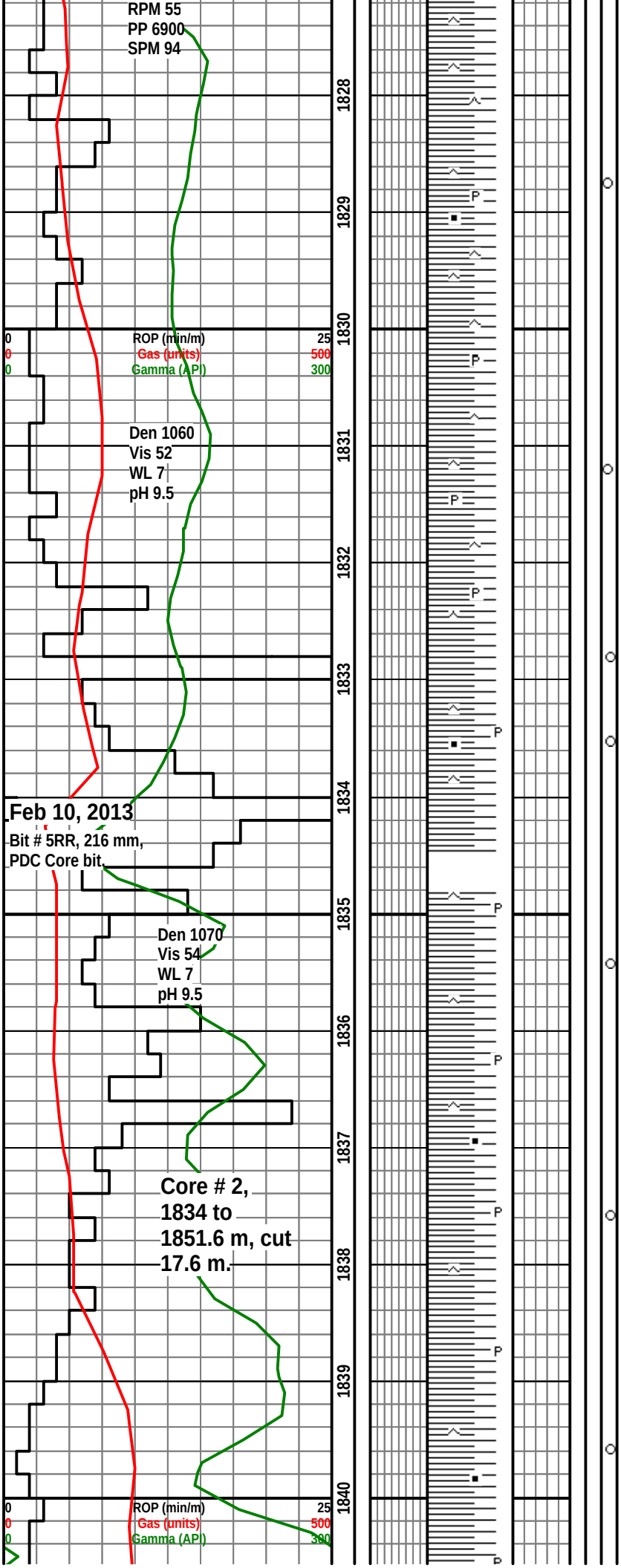
1820m SH.. dk gy, sl carb, w cons, firm to hd, py on sub-vertical frac, concoidal nature, siliceous, no stn, no flor, slow strmg milky cut.

1821.5 SH.. dk gy, sl carb, hd, brittle, siliceous, sl mmica, no stn, no flor, slow strmg milky cut.

1823.2 SH.. dk gy, sl carb, hd, brittle, siliceous, no stn, no flor, wk to mod wh cut.

1824.7 SH.. dk gy, brittle, hd, siliceous, sl carb, 2-3 mm disseminated py bed, mnr py on sub vertical fracture surface, no stn, no flor, wk to mod wh cut.

1826.2 SH.. dk gy, hd, brittle, siliceous, sl carb, tr py along bedding plane, concoidal nature, no stn, no flor, wk to mod wh cut.



1827.7 SH.. dk gy, hd, brittle, siliceous, sl carb, concoidal nature, v sl mmica, no stn, no flor, wk to mod wh cut.

1829.2 SH.. dk gy, hd, brittle, siliceous, sl carb, concoidal nature, tr py, no stn, no flor, wk milky strmg cut.

1830.7 SH.. dk gy, sl brn gy, hd, brittle, siliceous, sl carb, scat py on fracture plane, no flor, no stn, wk to mod milky cut.

1832.2 SH.. dk gy, sl brn, hd, brittle, siliceous, sl carb, concoidal frac no flor, no stn, mod milky cut.

1832.7 SH.. dk gy, sl brn, hd, brittle, siliceous, sl carb, scat dis, py, no flor, no stn, mod milky cut.

No Core 1832.7 to 1834 m, core shoe jammed with rubble chips.

CORE 2, Feb 10 2013: cut 1834 to 1851.6 m, 17.6 m in 5.75 hrs. Recovery 17.3 m

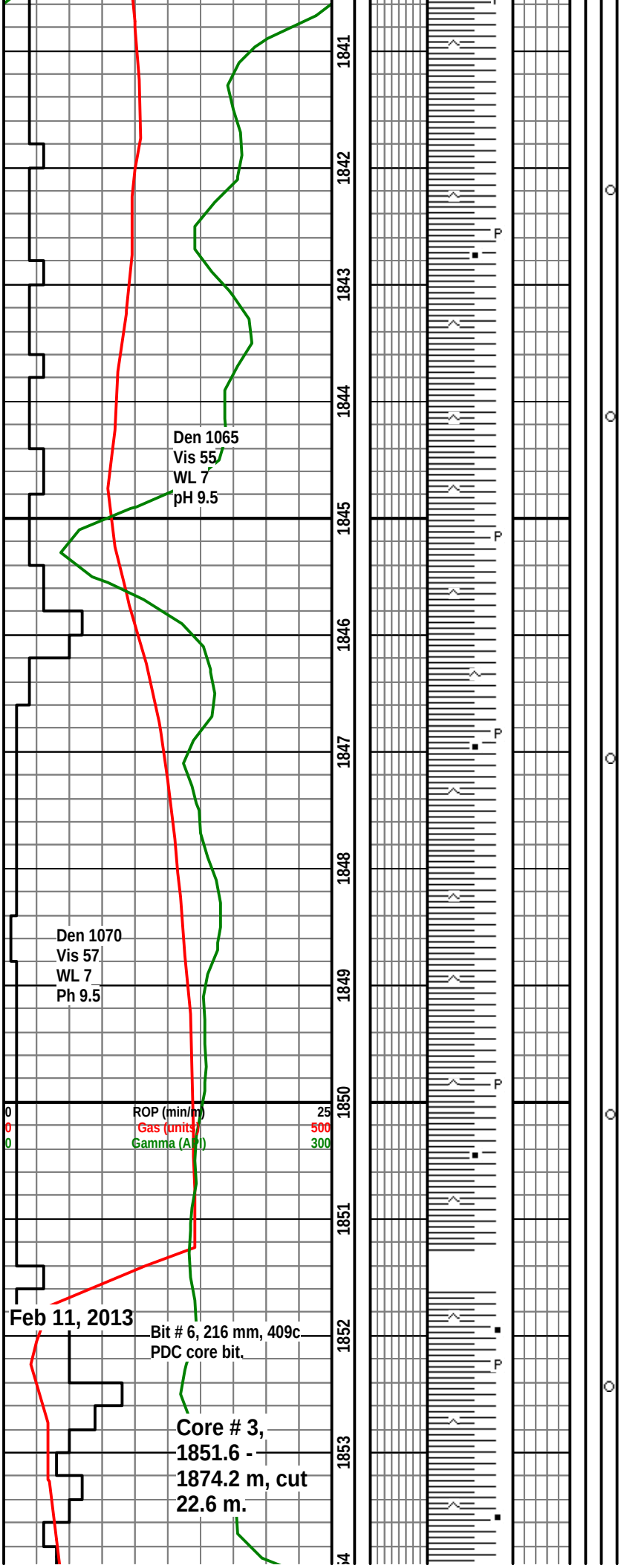
1834 SH.. dk gy, sl mmica, hd, brittle, siliceous, sl carb, tr scat py, no stain, no flor, slow mod wh cut.

1835.5 SH.. dk gy, sl mmica, hd, brittle, siliceous, com scat py needles, sl carb, no stn, no flor, strong wh cu

1837 SH.. dk gy, sl mmica, hd, brittle, siliceous, tr scat py needles, , sl carb, tr bit replacing micro fossils, tr moldic por, no stain, strong fast wh cut, sulfur odour.

1838.5 SH.. dk gy, brittle, siliceous, sl carb, tr dis py, fis, plty, sl sulfur odour, no stain, no flor, strong milky cut.

1840 SH.. dk gy, hd, sl mmica, sl carb, siliceous, py in a 2-3mm bed, no stain, no flor, strong milky cut, sulfur odou



1841.7 SH.. dk gy, hd, platy, fis, siliceous, tr calcite on vertical fracture surface, sl carb, tr scat py, no staining, dull brn flor, slow wh strmg cut, wk sulfur odour.

1843.2 SH.. dk gy, plty, fis, hd, siliceous, sl carb, tr py, no staining, dull brn flor, slow milky cut

1844.7 H.. dk gy, mmica, hd, siliceous, plty, sl carb, no staining, dull brn flor, slow milky cut.

1846.2 SH.. dk gy, hd, siliceous, platy, com scat micro py, no stain, dull brn flor, mod milky cut, sulfur odour.

1847.7 SH.. dk gy, hd, siliceous, sl mmica, no stain, dull brn flor, slow milky cut, sulfur odour

Note.. the milky cut dries to a pale yellow ring cut.

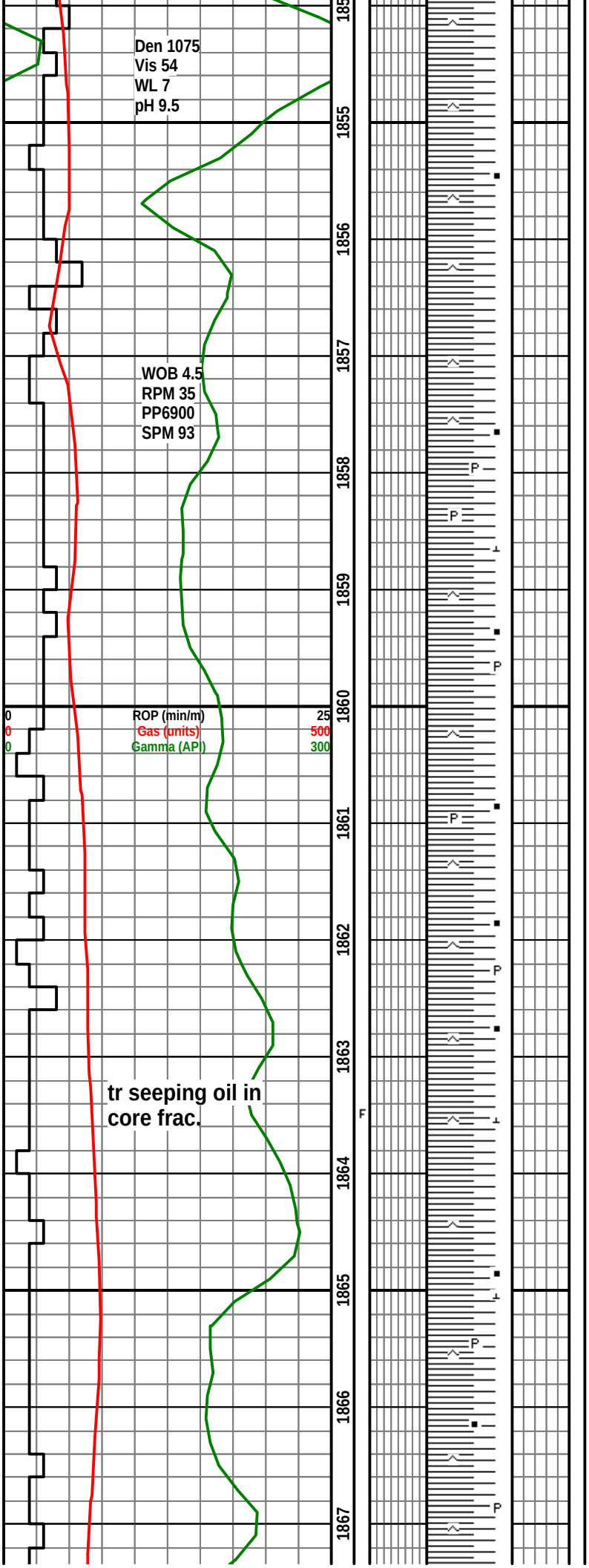
1849.2 SH.. dk gy, hd, siliceous, sl mmica, tr calcite on vertical frac surfaces, no stain, dull brn flor, mod to strong wh milky cut,

1850.7 SH.. dk gy, mmica, hd, siliceous, sl carb, tr py, tr py replacing a fossil, no stain, dull brn flor, mod milky cut, mod sulfur odour.

1851.3 SH.. dk gy, mmica, hd, siliceous, sl carb, pos slickensides, local rugose bedding surface - pos pressure solution, microscopic scat py, no staining, dull brn flor, mod to strong wh cut, wk sulfur odour.

CORE 3, Feb 11 2013: cut 1851.6 - 1874.2 m, 22.6 m in 6.75 hrs. Recovery 21.4 m

1853.1 SH.. dk gy, hd, brittle, siliceous, sl carb, micro scat py, no vis stn, wk dull brn flor, wk sulfur odour, bri wh strmg cut.



1854.3 SH.. dk gy, sl mmica, hd, brittle, siliceous, sl carb, no vis stn, dull dk brn flor, no sulfur odor, bri wh strmg cut.

1855.8 SH.. dk gy, hd, siliceous, sl carb, mmica, no vis stn, med brn flor, no sulfur odour, bri wh strmg cut.

Note.. white cut dries to a pale yellow ring cut.

1857.3 SH.. dk gy, hd, brittle, sl mmica, siliceous, sl carb, no vis stn, dull brn flor, no sulfur odor, bri wh strmg cut.

1858.8 SH.. dk gy, hd, sl mmica, siliceous, sl carb, calcite coating on sub vertical frac, calcite +/- dol on horiz bedding surfaces, tr vf gran py in v thin horiz beds, no vis stn, dull brn flor, wk sulfur odour, bri wh strmg cut.

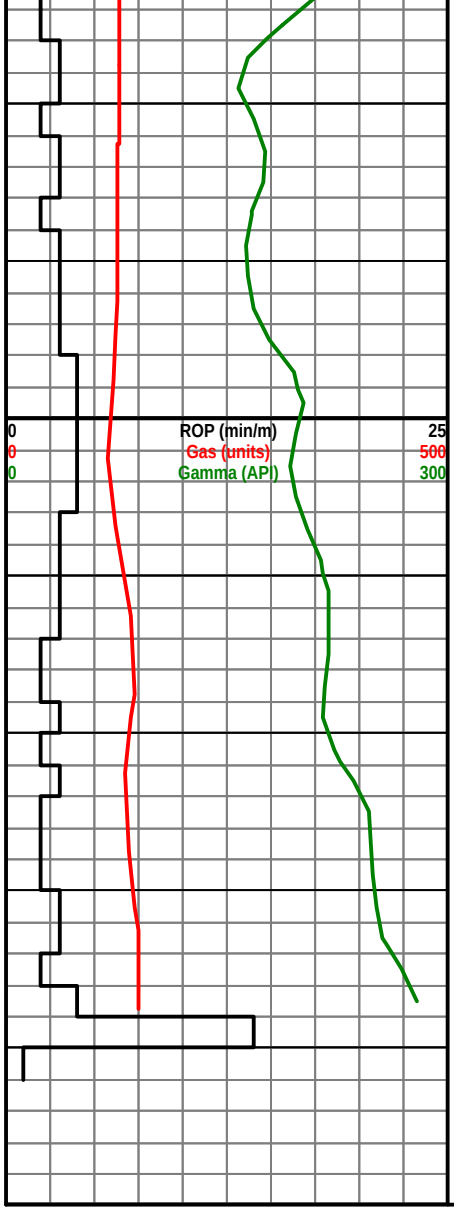
1860.3 SH.. dk gy, hd, siliceous, concoidal frac, sl carb, mnr thin bedding parallel py seams, no vis stn, even med brn flor, wk sulfur odour, bri wh strmg cut.

1861.8 SH.. dk gy, hd, siliceous, mmica, abnt vf dis py. sl carb, no vis stn, dull brn flor, wk sulfur odour, bri wh strmg cut.

1863.4 SH.. dk gy, hd, siliceous, sl carb, sl mmica, f xln calcite on sub vertical frac, tr bleeding oil on a tight frac, oil has a dk yel flor, no vis stn on sh, even med brn flor, no sulfur odour, bri wh strmg cut.

1864.9 SH.. dk gy, hd, siliceous, siliceous, sl carb, com vf dis py, one sub vertical calcite lined hairline frac, dull brn flor, wk sulfur odour, bri wh strmg cut.

1866.4 SH.. dk gy, hd, siliceous, concoidal frac, one calcite lined hairline frac, mnr dis py, dull brn flor, wk sulfur odour, bri wh strmg cut.



1867.9 SH.. dk gy, hd, siliceous, concoidal frac, sl carb, com vf dis py, no vis staining, wk dull brn flor, sl sulfur odour, bri wh milky strmg cut.

1869.4 SH.. dk gy, hd, siliceous, sl carb, com micro dis py, tr calcite along pos sub vertical frac, no vis stn, possible dull brn flor, wk sulfur odour, slow bri wh strmg milky cut.

1870.9 SH.. dk gy, hd, siliceous, sl carb, mnr micro scat py, one vertical hairline frac no calcite coating possibly mechanically fractured, no vis stn, slow strmg milky cut.

1872.4 SH.. dk gy, hd, siliceous, sl carb, sl mmica, mnr scat micro py, no vis stn, dull dk brn flor, slow strmg milky cut.

1873 SH.. dk gy, hd, siliceous, sl carb, no vis stn, pos wk dull brn flor, no flor, no sulfur odour, slow strmg milky cut.

Scale 1:240 (5"=100') Metric

Well Name:	MGM - Shell East MacKay I-78		
Location:	Unit I, Section 78, Grid 64 50 125 30		
Licence Number:	1202	Region:	NWT mainland
Spud Date:	Jan 17, 2013	Drilling Completed:	Feb 15, 2013
Surface Coordinates:	Lat 64°47'42.1" N; Long 125°43'19.1" W		
Bottom Hole Coordinates	Lat 64°47'42.1" N; Long 125°43'19.1" W		
Ground Elevation (m):	155.0	K.B. Elevation (m):	161.2
Logged Interval (m):	0 To: 2001	Total Depth (m):	2001
Formation:	Total Depth in Hume Formation		
Type of Drilling Fluid:	Gel chem		

OPERATOR

Company:	MGM Energy Corp.
Address:	4100, 350 - 7th Avenue SW Calgary, Alberta T2P 3N9

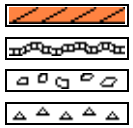
GEOLOGIST

Name:	Dave Prior
Company:	RPS Energy
Address:	1400, 800 - 5th Avenue SW Calgary, AB Canada T2P 3T6

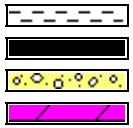
Cores

Cut core from 1820 to 1874 m in three runs, cut 1938 to 1960 m in one run.
Core logs appended below.

ROCK TYPES

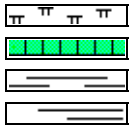


Anhy
Bent
Brec
Cht

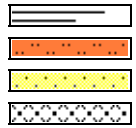


Clyst
Coal
Congl
Dol

Gyp
Igne
Lmst
Meta



Mrlst
Salt
Shale
Shcol



Shgy
Sltst
Ss
Till

ACCESSORIES

MINERAL

Anhy
Arggrn
Arg
Bent
Bit
Brecfrag
Calc
Carb
Chtdk
Chtlt
Dol
Feldspar
Ferrpel
Ferr
Glau

Gyp
Hvymin
Kaol
Marl
Minxl
Nodule
Phos
Pyr
Salt
Sandy
Silt
Sil
Sulphur
Tuff

FOSSIL

Algae
Amph
Belm
Bioclst
Brach
Bryozoa
Cephal
Coral
Crin
Echin
Fish
Foram
Fossil
Gastro
Oolite

Ostra
Pelec
Pellet
Pisolite
Plant
Strom

STRINGER

Anhy
Arg
Bent
Coal
Dol
Gyp
Ls
Mrst

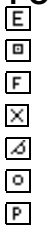
Sltstrg
Ssstrg

TEXTURE

Boundst
Chalky
Cryxln
Earthy
Finexln
Grainst
Lithogr
Microxln
Mudst
Packst
Wackest

OTHER SYMBOLS

POROSITY



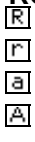
Earthy
Fenest
Fracture
Inter
Moldic
Organic
Pinpoint

Vuggy

SORTING

Well
Moderate
Poor

ROUNDING



Rounded
Subrnd
Subang
Angular

OIL SHOW

Even

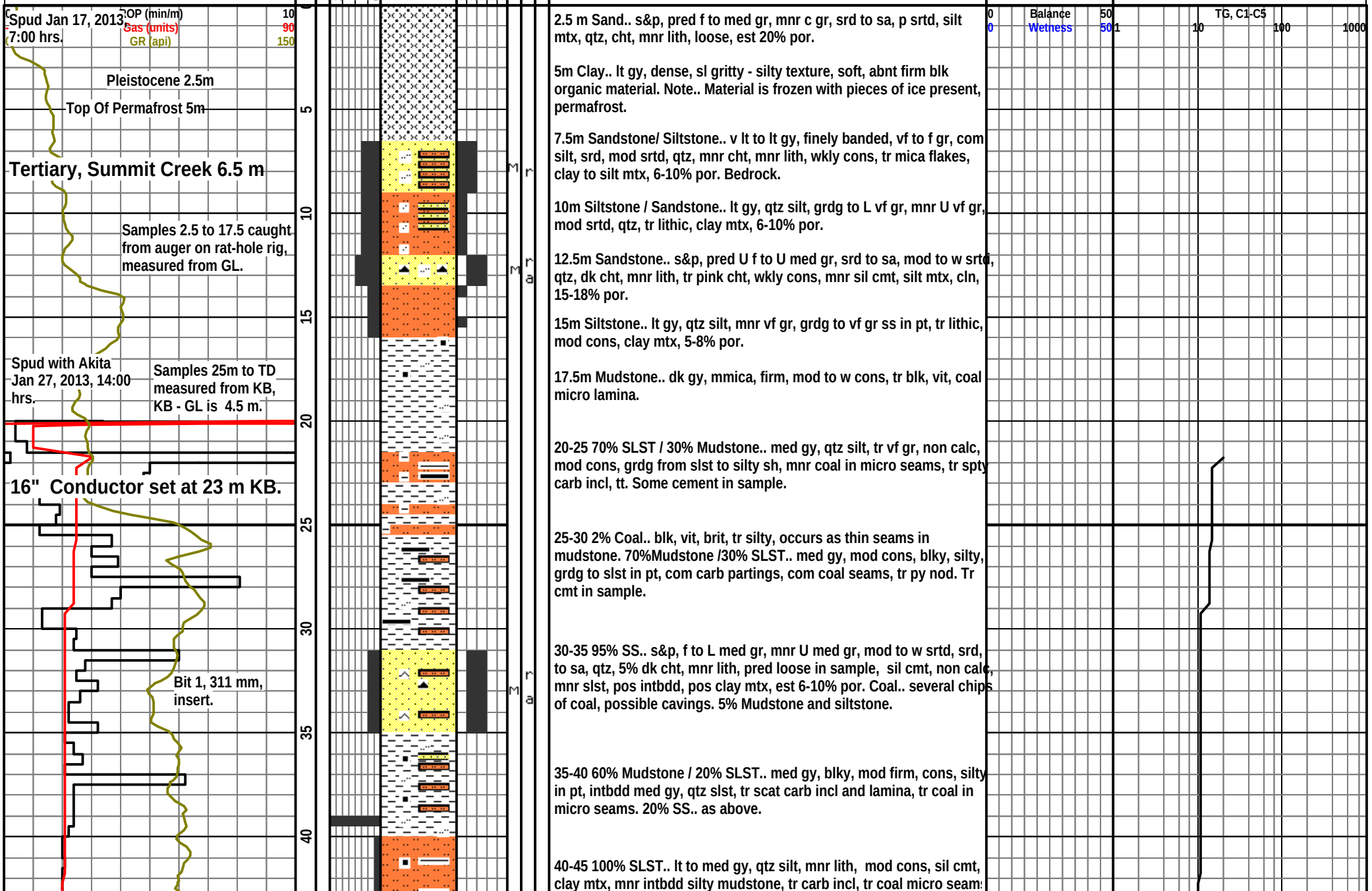
Spotted
Ques
Dead

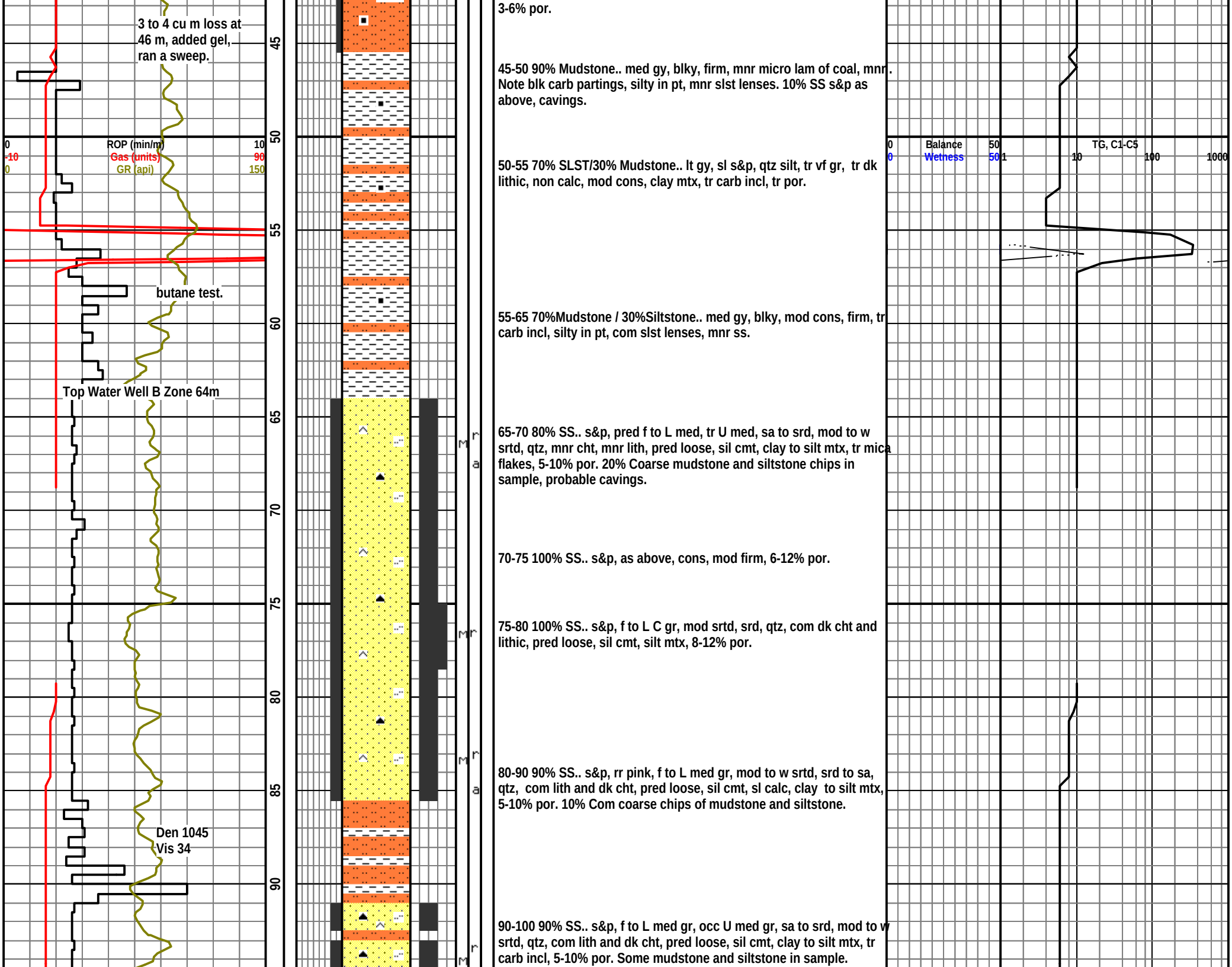
INTERVAL

Core
Dst

EVENT

Isotube
Rft
Sidewall


Curve Track 1
ROP (min/m)
Gas (units)
GR (api)
Depth
Porosity Type
Porosity
24%
18%
12%
6%
Lithology
Grain Size
1/16 mm
1/8 mm
1/4 mm
1/2 mm
1 mm
Sorting
Rounding
Oil Shows
Geological Descriptions
Balance/Wetness
Balance
Wetness
Chromatograph
TG (Units)
C1 (units)
C2 (units)
C3 (units)
C4 (units)
C5 (units)
ROP (min/m) 10
Gas (units) 90
GR (api) 150
Balance 0 50
Wetness 0 50
TG, C1-C5 1 10 100 1000
Spud Jan 17, 2013, 7:00 hrs.
Pleistocene 2.5m
Top Of Permafrost 5m
Tertiary, Summit Creek 6.5 m
Samples 2.5 to 17.5 caught from auger on rat-hole rig, measured from GL.
Spud with Akita Jan 27, 2013, 14:00 hrs.
Samples 25m to TD measured from KB, KB - GL is 4.5 m.
16" Conductor set at 23 m KB.
Bit 1, 311 mm, insert.
0
5
10
15
20
25
30
35
40
2.5 m Sand.. s&p, pred f to med gr, mnr c gr, srd to sa, p srtd, silt mtx, qtz, cht, mnr lith, loose, est 20% por.
5m Clay.. lt gy, dense, sl gritty - silty texture, soft, abnt firm blk organic material. Note.. Material is frozen with pieces of ice present, permafrost.
7.5m Sandstone/ Siltstone.. v lt to lt gy, finely banded, vf to f gr, com silt, srd, mod srtd, qtz, mnr cht, mnr lith, wkly cons, tr mica flakes, clay to silt mtx, 6-10% por. Bedrock.
10m Siltstone / Sandstone.. lt gy, qtz silt, grdg to L vf gr, mnr U vf gr, mod srtd, qtz, tr lithic, clay mtx, 6-10% por.
12.5m Sandstone.. s&p, pred U f to U med gr, srd to sa, mod to w srtd, qtz, dk cht, mnr lith, tr pink cht, wkly cons, mnr sil cmt, silt mtx, cln, 15-18% por.
15m Siltstone.. lt gy, qtz silt, mnr vf gr, grdg to vf gr ss in pt, tr lithic, mod cons, clay mtx, 5-8% por.
17.5m Mudstone.. dk gy, mmica, firm, mod to w cons, tr blk, vit, coal micro lamina.
20-25 70% SLST / 30% Mudstone.. med gy, qtz silt, tr vf gr, non calc, mod cons, grdg from slst to silty sh, mnr coal in micro seams, tr spty carb incl, tt. Some cement in sample.
25-30 2% Coal.. blk, vit, brit, tr silty, occurs as thin seams in mudstone. 70%Mudstone /30% SLST.. med gy, mod cons, blky, silty, grdg to slst in pt, com carb partings, com coal seams, tr py nod. Tr cmt in sample.
30-35 95% SS.. s&p, f to L med gr, mnr U med gr, mod to w srtd, srd, to sa, qtz, 5% dk cht, mnr lith, pred loose in sample, sil cmt, non calc, mnr slst, pos intbdd, pos clay mtx, est 6-10% por. Coal.. several chips of coal, possible cavings. 5% Mudstone and siltstone.
35-40 60% Mudstone / 20% SLST.. med gy, blky, mod firm, cons, silty in pt, intbdd med gy, qtz slst, tr scat carb incl and lamina, tr coal in micro seams. 20% SS.. as above.
40-45 100% SLST.. lt to med gy, qtz silt, mnr lith, mod cons, sil cmt, clay mtx, mnr intbdd silty mudstone, tr carb incl, tr coal micro seam



3-6% por.

45-50 90% Mudstone.. med gy, blky, firm, mnr micro lam of coal, mnr. Note blk carb partings, silty in pt, mnr slst lenses. 10% SS s&p as above, cavings.

50-55 70% SLST/30% Mudstone.. lt gy, sl s&p, qtz silt, tr vf gr, tr dk lithic, non calc, mod cons, clay mtx, tr carb incl, tr por.

55-65 70%Mudstone / 30%Siltstone.. med gy, blky, mod cons, firm, tr carb incl, silty in pt, com slst lenses, mnr ss.

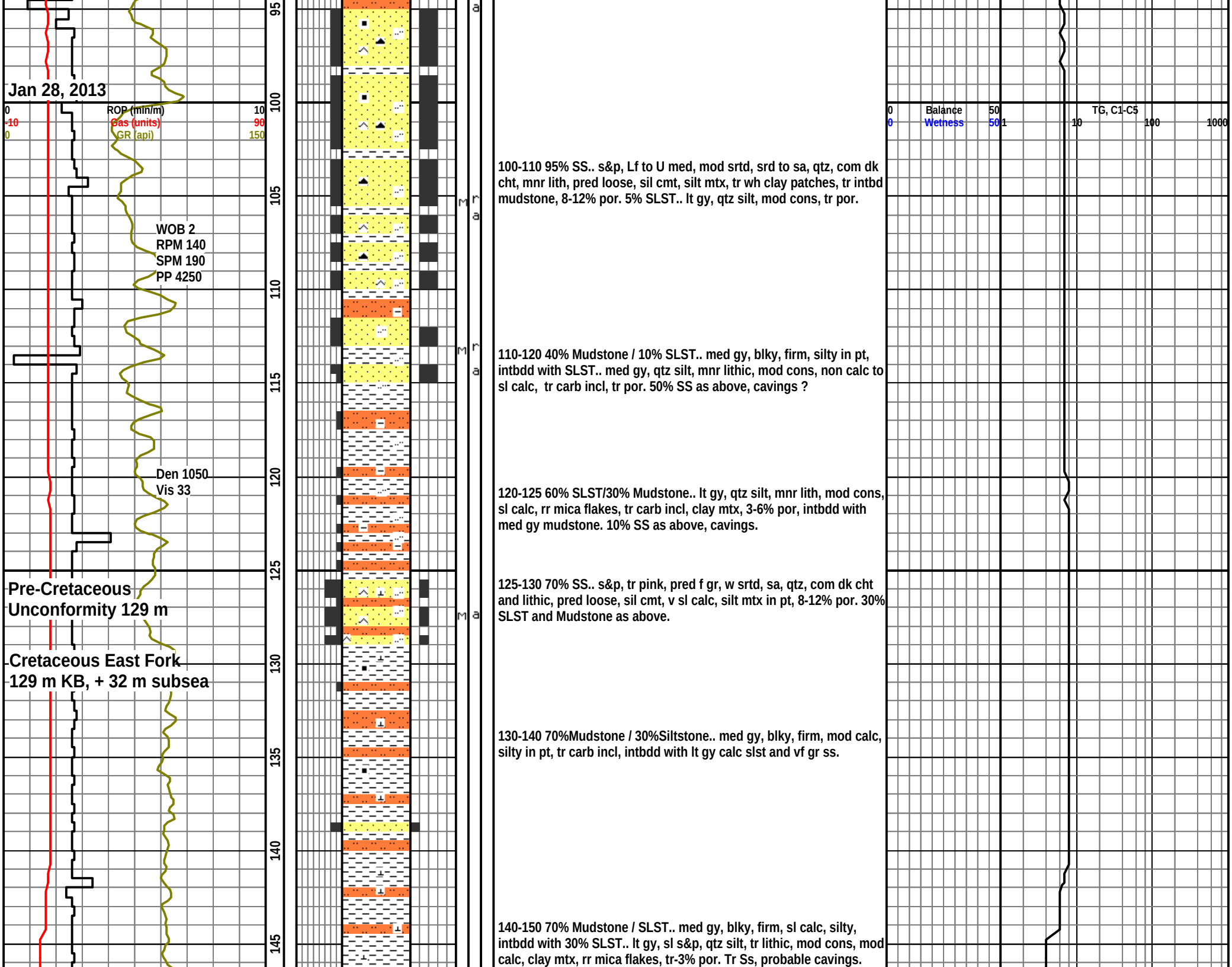
65-70 80% SS.. s&p, pred f to L med, tr U med, sa to srd, mod to w srtd, qtz, mnr cht, mnr lith, pred loose, sil cmt, clay to silt mtx, tr mica flakes, 5-10% por. 20% Coarse mudstone and siltstone chips in sample, probable cavings.

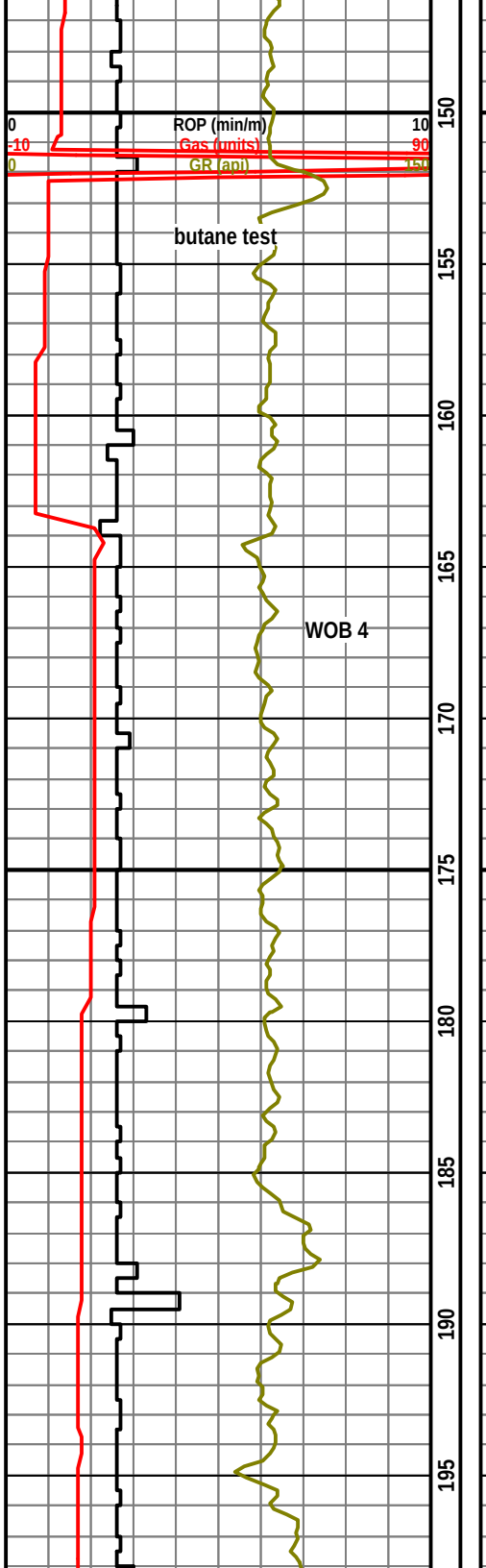
70-75 100% SS.. s&p, as above, cons, mod firm, 6-12% por.

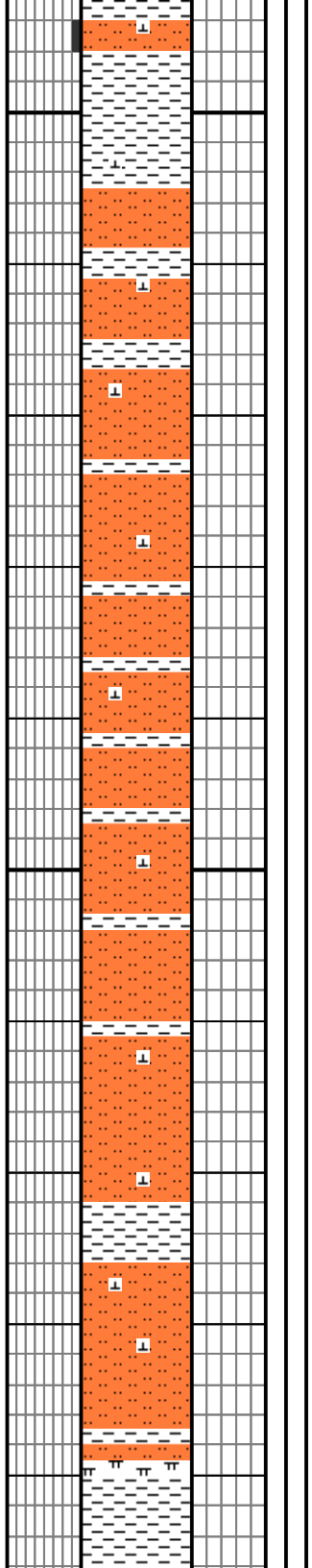
75-80 100% SS.. s&p, f to L C gr, mod srtd, srd, qtz, com dk cht and lithic, pred loose, sil cmt, silt mtx, 8-12% por.

80-90 90% SS.. s&p, rr pink, f to L med gr, mod to w srtd, srd to sa, qtz, com lith and dk cht, pred loose, sil cmt, sl calc, clay to silt mtx, 5-10% por. 10% Com coarse chips of mudstone and siltstone.

90-100 90% SS.. s&p, f to L med gr, occ U med gr, sa to srd, mod to w srtd, qtz, com lith and dk cht, pred loose, sil cmt, clay to silt mtx, tr carb incl, 5-10% por. Some mudstone and siltstone in sample.


Jan 28, 2013
0
ROP (min/m)
10
-10
Gas (units)
90
0
GR (api)
150
WOB 2
RPM 140
SPM 190
PP 4250
Den 1050
Vis 33
Pre-Cretaceous
Unconformity 129 m
Cretaceous East Fork
129 m KB, + 32 m subsea
95
100
105
110
115
120
125
130
135
140
145
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000
100-110 95% SS.. s&p, Lf to U med, mod srtd, srd to sa, qtz, com dk cht, mnr lith, pred loose, sil cmt, silt mtx, tr wh clay patches, tr intbd mudstone, 8-12% por. 5% SLST.. lt gy, qtz silt, mod cons, tr por.
110-120 40% Mudstone / 10% SLST.. med gy, blky, firm, silty in pt, intbdd with SLST.. med gy, qtz silt, mnr lithic, mod cons, non calc to sl calc, tr carb incl, tr por. 50% SS as above, cavings ?
120-125 60% SLST/30% Mudstone.. lt gy, qtz silt, mnr lith, mod cons, sl calc, rr mica flakes, tr carb incl, clay mtx, 3-6% por, intbdd with med gy mudstone. 10% SS as above, cavings.
125-130 70% SS.. s&p, tr pink, pred f gr, w srtd, sa, qtz, com dk cht and lithic, pred loose, sil cmt, v sl calc, silt mtx in pt, 8-12% por. 30% SLST and Mudstone as above.
130-140 70%Mudstone / 30%Siltstone.. med gy, blky, firm, mod calc, silty in pt, tr carb incl, intbdd with lt gy calc slst and vf gr ss.
140-150 70% Mudstone / SLST.. med gy, blky, firm, sl calc, silty, intbdd with 30% SLST.. lt gy, sl s&p, qtz silt, tr lithic, mod cons, mod calc, clay mtx, rr mica flakes, tr-3% por. Tr Ss, probable cavings.





150-155 70% Mudstone.. med gy, blky, firm, silty, intbdd with slst, mod calc. 30% SLST.. lt gy, mod cons, calc cmt, clay mtx, tr por. SS.. one chip, s&p, tr pink, vf to f gr, mod to w srtd, sa to srd, qtz, com lith and cht, calc, 5-8% por.

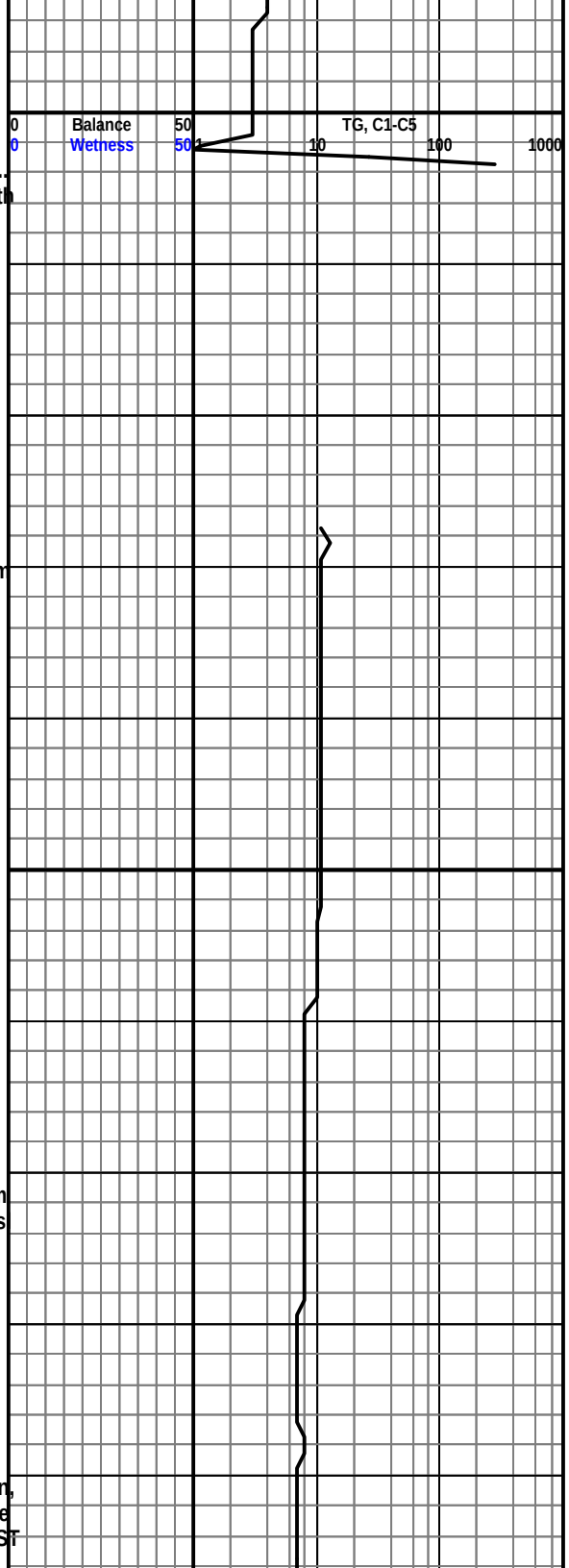
155-160 100% SLST.. lt to med gy, qtz silt, mnr lithic, rr mica flakes, clay mtx, mod calc, grdg to silty mudstone in part, local mudstone beds, tr por.

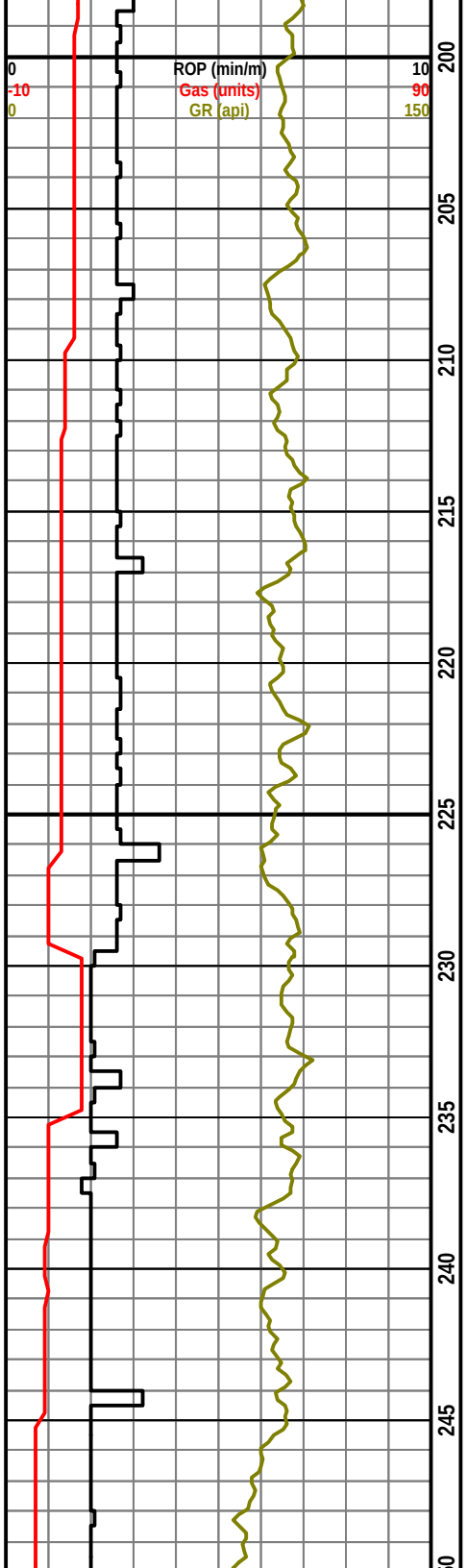
160-170 100% SLST.. med gy, qtz silt, mnr lithic, mod to w cons, firm to brittle, clay mtx, rr to tr carb incl, sl to mod calc, some intbdd mudstone, tr to 3% por,

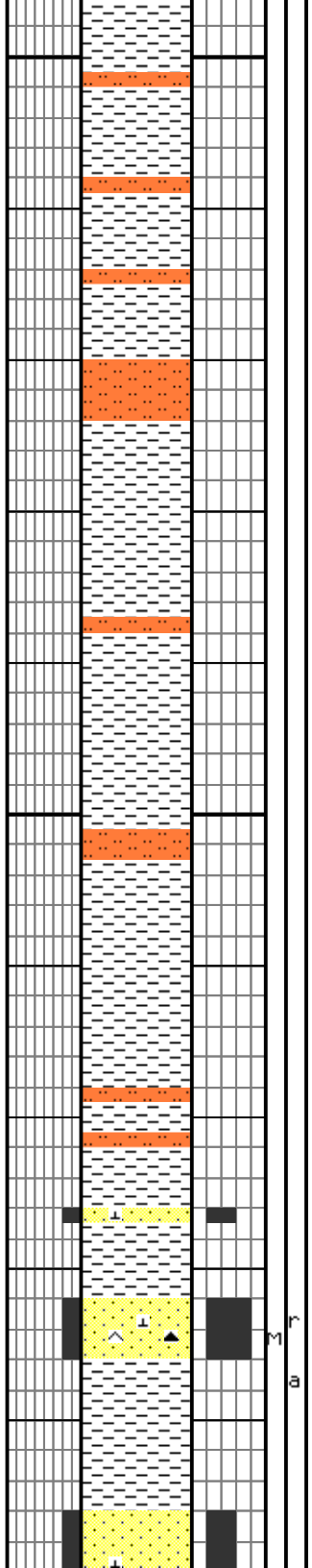
170-180 100% SLST.. as above, com intbdd mudstone, tr vf to f ss.

180-195 100% SLST.. lt to med gy, sl s&p, qtz silt, mnr lith, grdg from near clay size to near vf gr, com microscopic wh patches of clay ?, s to mod calc, mnr intbdd silty mudstone, tr to 6% por.

195-200 5%, Marlstone.. med gy-gn, crpxln, locally grading to micxln, earthy, hd, brittle, mnr clay residue after HCl, less reactive and more clay content in pt, tr local rounded mudstone inclusions, tt. 95% SLST as above







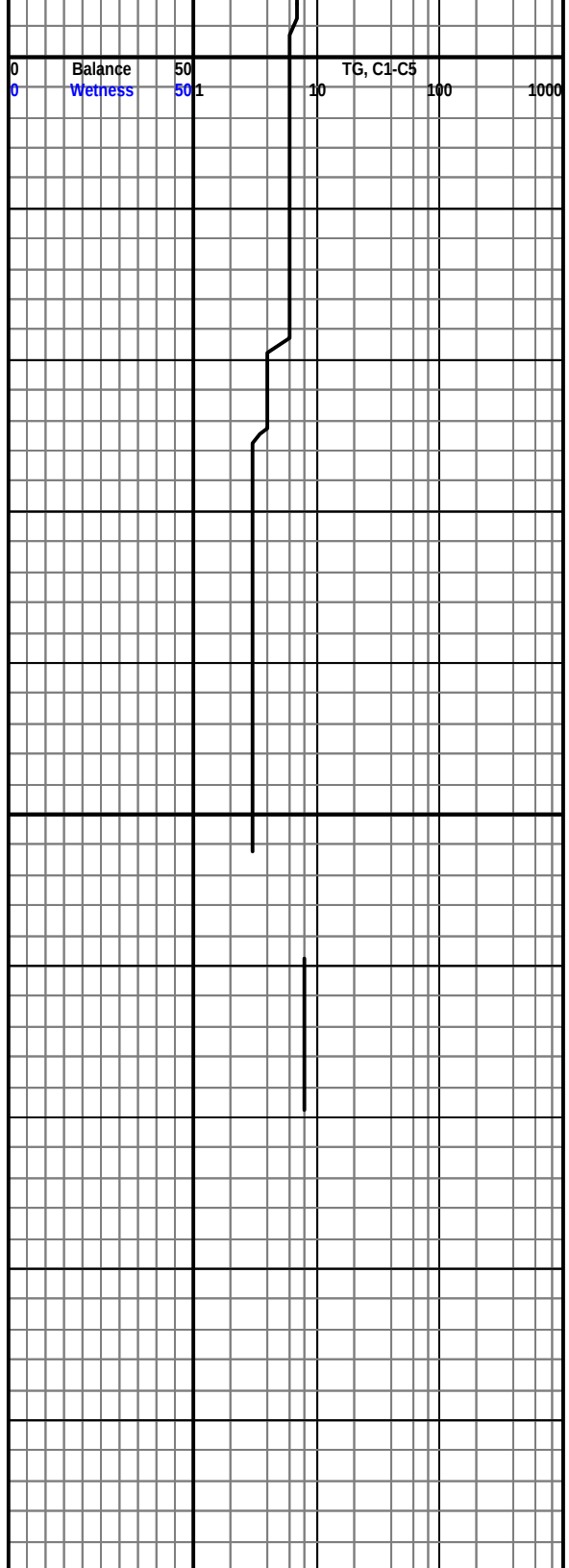
200-210 70% Mudstone.. med to dk gy, sl mmica, firm. 30% SLST.. med gy, sl s&p, as above.

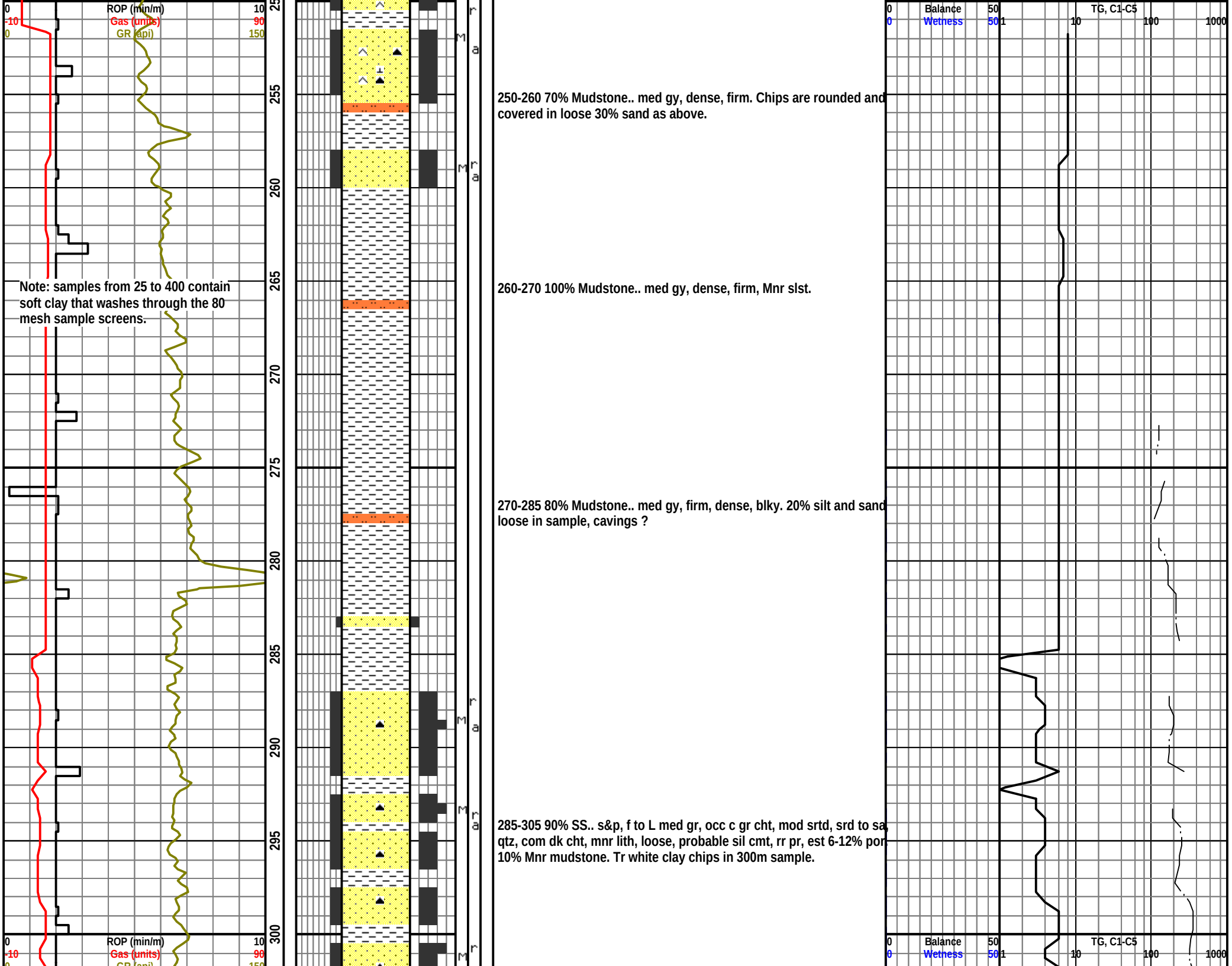
210-220 50% Mudstone.. med gy, rounded chips, firm, sl brit. 50% SLST.. med gy, firm, brit, clay mtx, tr por. Mixed lithologies and sawdust, from a hole sweep.

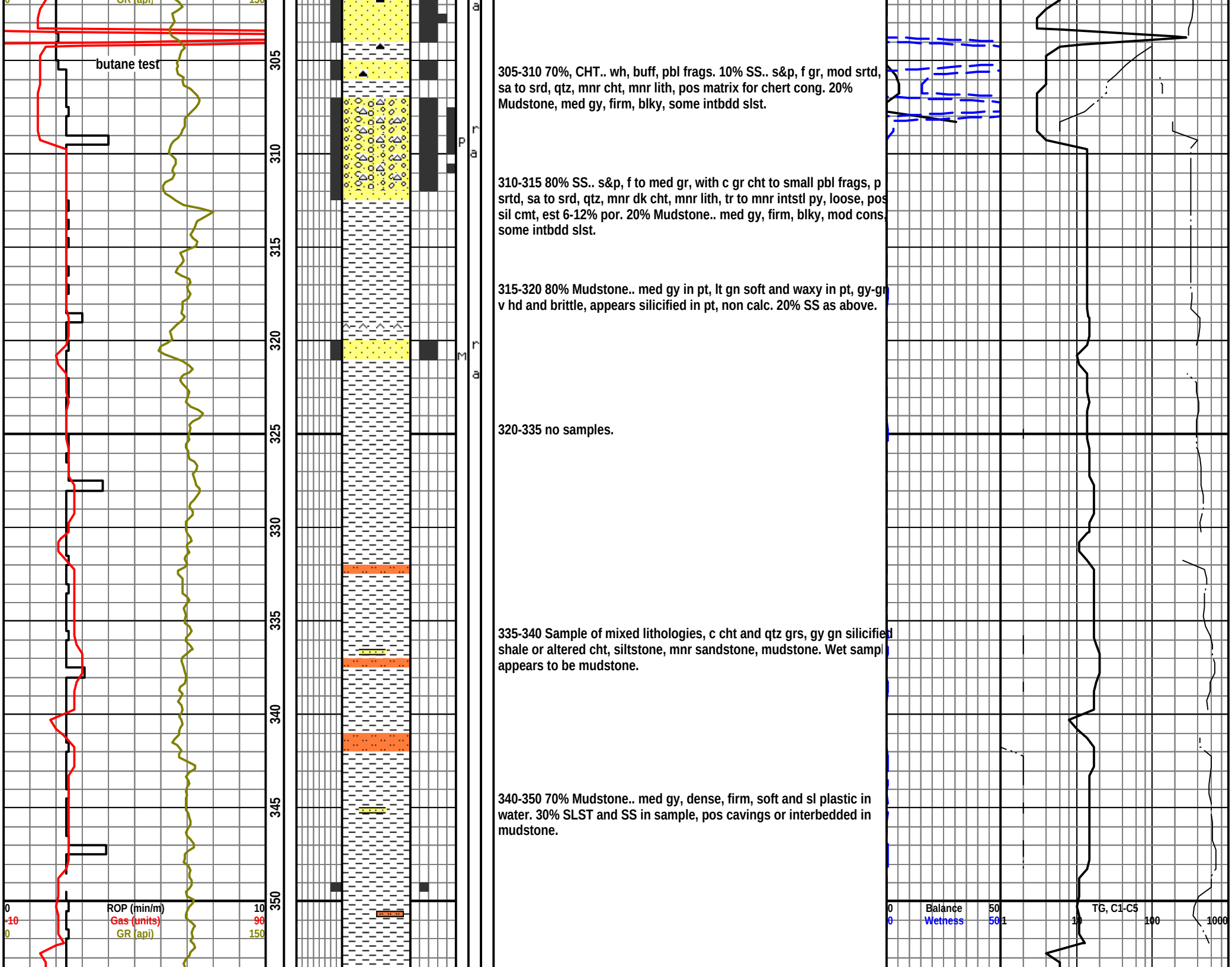
220-230 75% Mudstone.. med gy, firm, blky, sl mmica. 25% SLST.. med gy, mod cons, qtz, mnr lith, clay mtx, tr to 3% por. Higher vis mud producing some clay balls.

230-240 75%Mudstone.. med gy, blky, firm. 25% SLST.. med gy, qtz silt, firm, blky, tr por. Tr ss.

240-250 70% SS.. s&p, f to L med gr, mod to w srtd, srd to sa, qtz, com dk cht, tr py, pred loose, sil cmt, mod calc, est 6-12% por. 30% mudstone.




0
ROP (min/m)
10
-10
Gas (units)
90
0
GR (api)
150
Balance
Wetness
50
1
10
100
1000
TG, C1-C5
250
255
260
265
270
275
280
285
290
295
300
Note: samples from 25 to 400 contain soft clay that washes through the 80 mesh sample screens.
250-260 70% Mudstone.. med gy, dense, firm. Chips are rounded and covered in loose 30% sand as above.
260-270 100% Mudstone.. med gy, dense, firm, Mnr slst.
270-285 80% Mudstone.. med gy, firm, dense, blky. 20% silt and sand loose in sample, cavings ?
285-305 90% SS.. s&p, f to L med gr, occ c gr cht, mod srtd, srd to sa, qtz, com dk cht, mnr lith, loose, probable sil cmt, rr pr, est 6-12% por, 10% Mnr mudstone. Tr white clay chips in 300m sample.



305-310 70%, CHT.. wh, buff, pbl frags. 10% SS.. s&p, f gr, mod srtd, sa to srd, qtz, mnr cht, mnr lith, pos matrix for chert cong. 20% Mudstone, med gy, firm, blky, some intbdd slst.

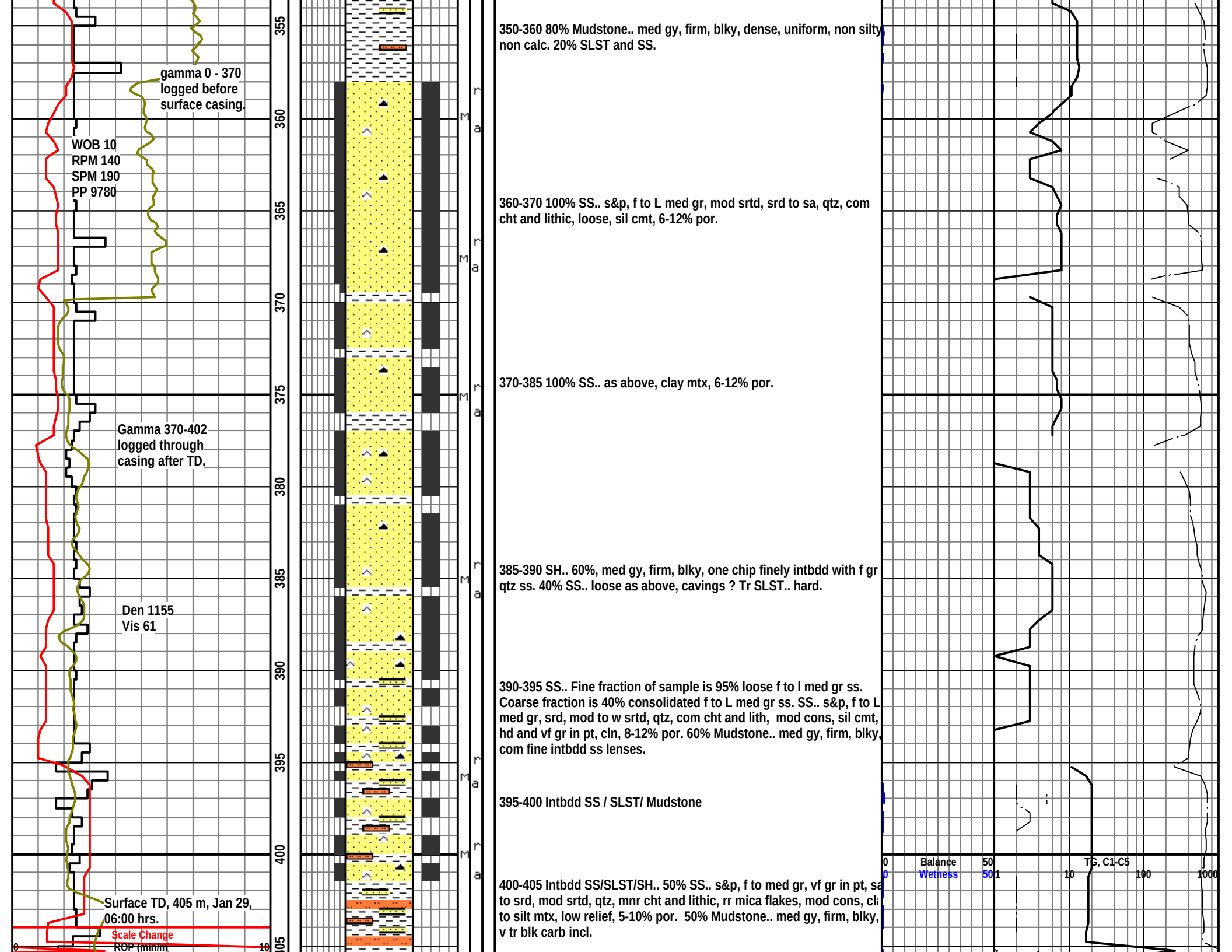
310-315 80% SS.. s&p, f to med gr, with c gr cht to small pbl frags, p srtd, sa to srd, qtz, mnr dk cht, mnr lith, tr to mnr intstl py, loose, pos sil cmt, est 6-12% por. 20% Mudstone.. med gy, firm, blky, mod cons, some intbdd slst.

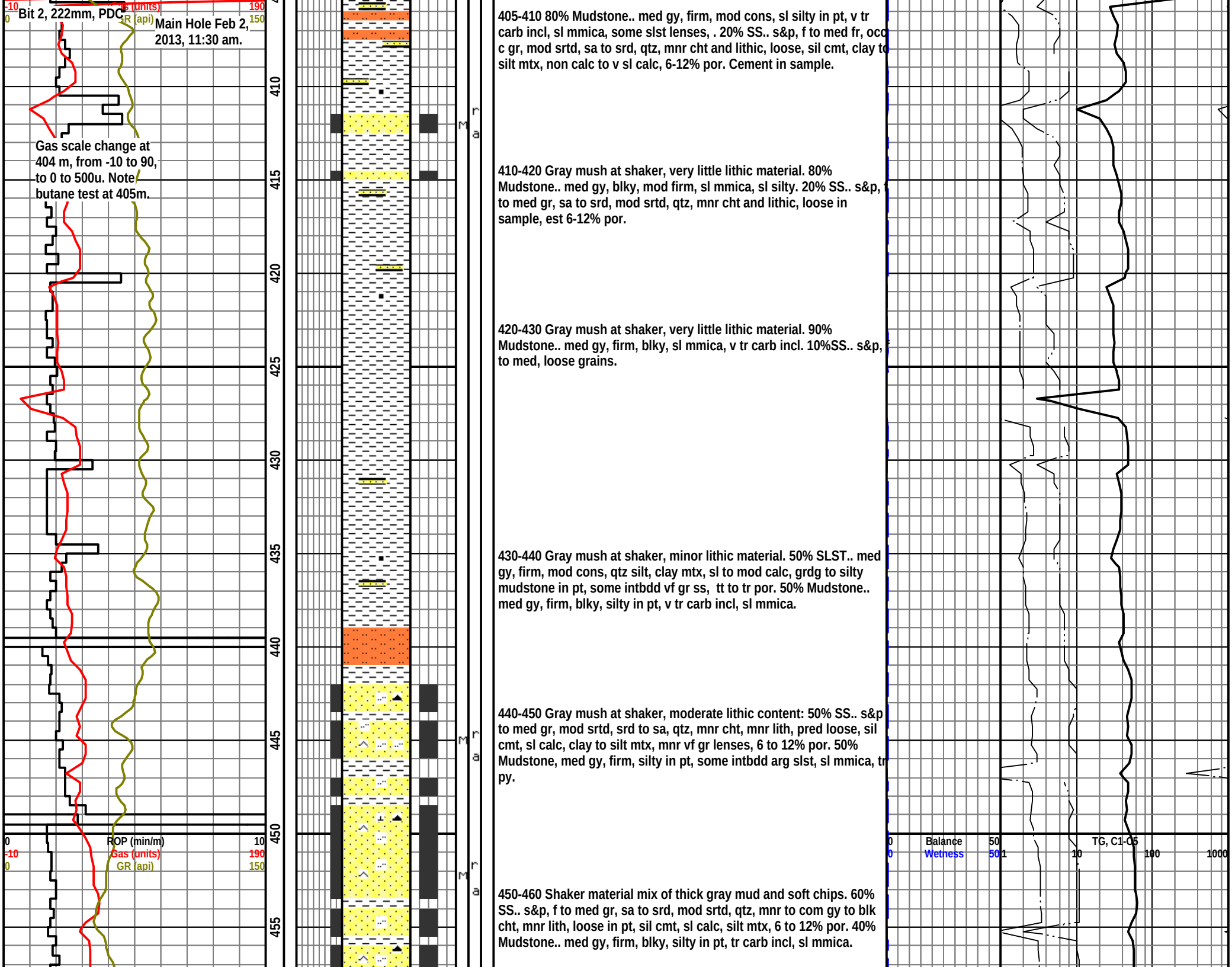
315-320 80% Mudstone.. med gy in pt, lt gn soft and waxy in pt, gy-gn v hd and brittle, appears silicified in pt, non calc. 20% SS as above.

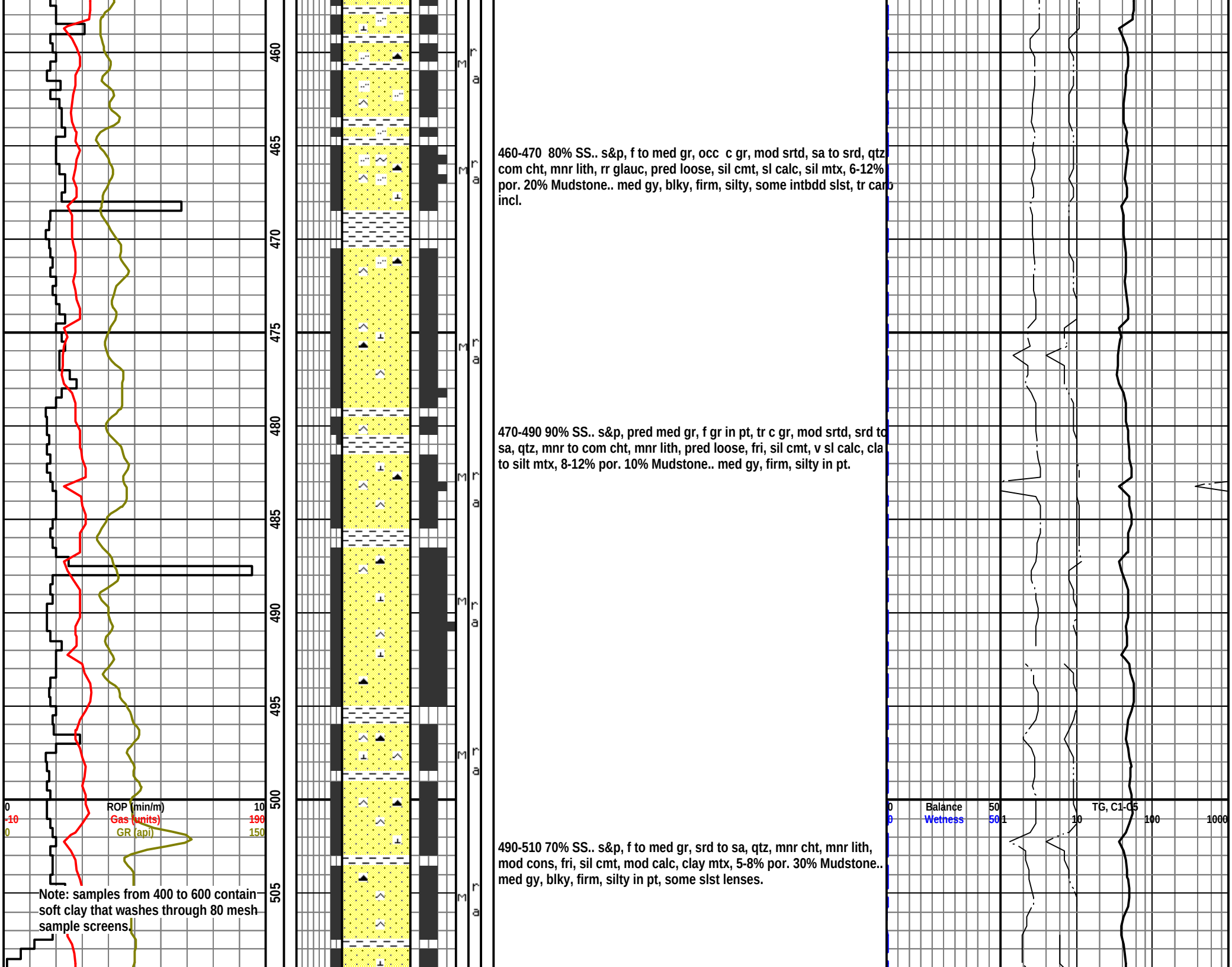
320-335 no samples.

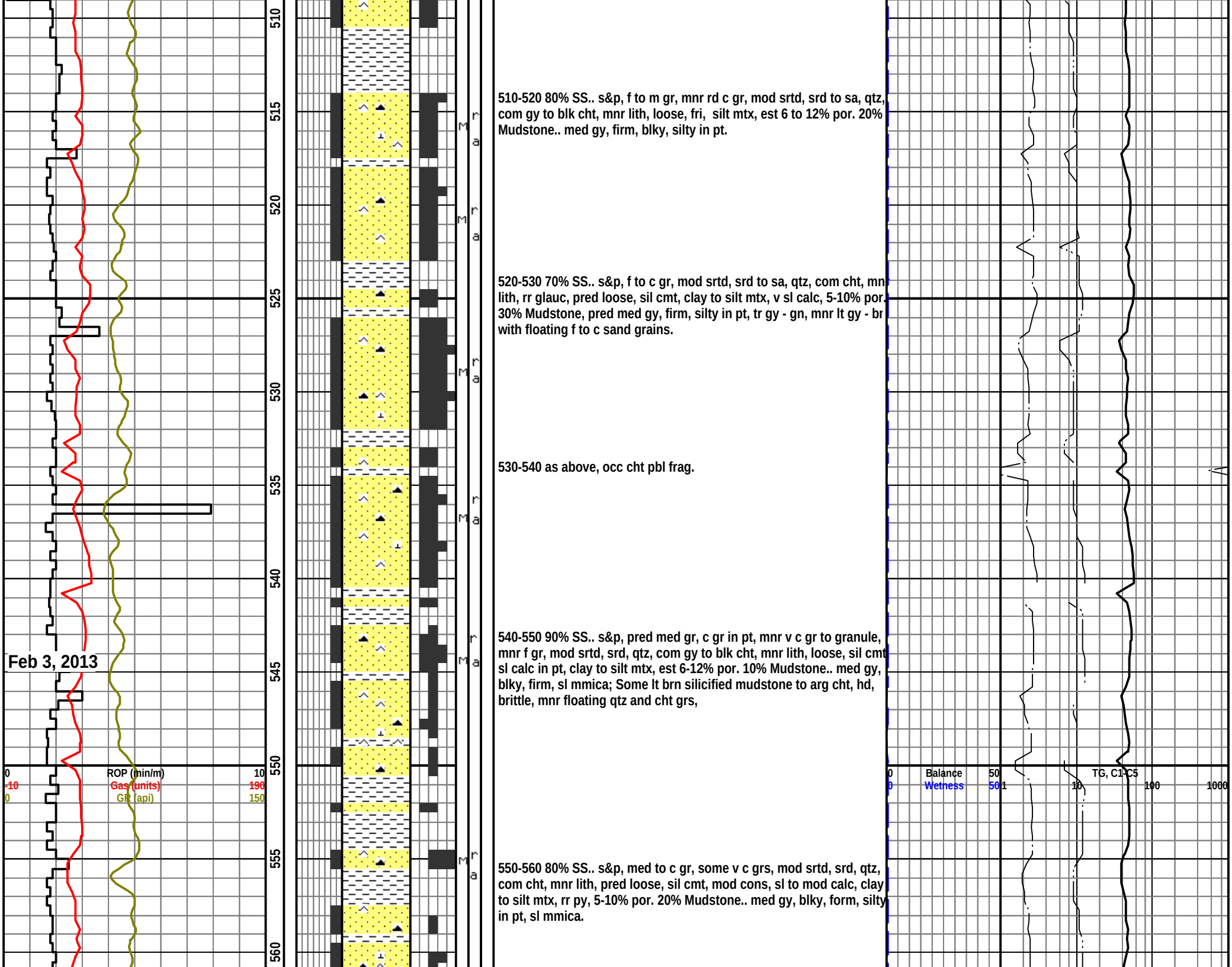
335-340 Sample of mixed lithologies, c cht and qtz grs, gy gn silicified shale or altered cht, siltstone, mnr sandstone, mudstone. Wet sampl appears to be mudstone.

340-350 70% Mudstone.. med gy, dense, firm, soft and sl plastic in water. 30% SLST and SS in sample, pos cavings or interbedded in mudstone.


gamma 0 - 370 logged before surface casing.
WOB 10
RPM 140
SPM 190
PP 9780
Gamma 370-402 logged through casing after TD.
Den 1155
Vis 61
Surface TD, 405 m, Jan 29, 06:00 hrs.
Scale Change
ROP (min/m)
0
10
355
360
365
370
375
380
385
390
395
400
405
350-360 80% Mudstone.. med gy, firm, blky, dense, uniform, non silty non calc. 20% SLST and SS.
360-370 100% SS.. s&p, f to L med gr, mod srtd, srd to sa, qtz, com cht and lithic, loose, sil cmt, 6-12% por.
370-385 100% SS.. as above, clay mtx, 6-12% por.
385-390 SH.. 60%, med gy, firm, blky, one chip finely intbdd with f gr qtz ss. 40% SS.. loose as above, cavings ? Tr SLST.. hard.
390-395 SS.. Fine fraction of sample is 95% loose f to l med gr ss. Coarse fraction is 40% consolidated f to L med gr ss. SS.. s&p, f to L med gr, srd, mod to w srtd, qtz, com cht and lith, mod cons, sil cmt, hd and vf gr in pt, cln, 8-12% por. 60% Mudstone.. med gy, firm, blky, com fine intbdd ss lenses.
395-400 Intbdd SS / SLST/ Mudstone
400-405 Intbdd SS/SLST/SH.. 50% SS.. s&p, f to med gr, vf gr in pt, sa to srd, mod srtd, qtz, mnr cht and lithic, rr mica flakes, mod cons, cl to silt mtx, low relief, 5-10% por. 50% Mudstone.. med gy, firm, blky, v tr blk carb incl.
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5


Bit 2, 222mm, PDC
Main Hole Feb 2, 2013, 11:30 am.
Gas scale change at 404 m, from -10 to 90, to 0 to 500u. Note butane test at 405m.
405-410 80% Mudstone.. med gy, firm, mod cons, sl silty in pt, v tr carb incl, sl mmica, some slst lenses, . 20% SS.. s&p, f to med fr, occ c gr, mod srtd, sa to srd, qtz, mnr cht and lithic, loose, sil cmt, clay to silt mtx, non calc to v sl calc, 6-12% por. Cement in sample.
410-420 Gray mush at shaker, very little lithic material. 80% Mudstone.. med gy, blky, mod firm, sl mmica, sl silty. 20% SS.. s&p, f to med gr, sa to srd, mod srtd, qtz, mnr cht and lithic, loose in sample, est 6-12% por.
420-430 Gray mush at shaker, very little lithic material. 90% Mudstone.. med gy, firm, blky, sl mmica, v tr carb incl. 10%SS.. s&p, f to med, loose grains.
430-440 Gray mush at shaker, minor lithic material. 50% SLST.. med gy, firm, mod cons, qtz silt, clay mtx, sl to mod calc, grdg to silty mudstone in pt, some intbdd vf gr ss, tt to tr por. 50% Mudstone.. med gy, firm, blky, silty in pt, v tr carb incl, sl mmica.
440-450 Gray mush at shaker, moderate lithic content: 50% SS.. s&p to med gr, mod srtd, srd to sa, qtz, mnr cht, mnr lith, pred loose, sil cmt, sl calc, clay to silt mtx, mnr vf gr lenses, 6 to 12% por. 50% Mudstone, med gy, firm, silty in pt, some intbdd arg slst, sl mmica, tr py.
450-460 Shaker material mix of thick gray mud and soft chips. 60% SS.. s&p, f to med gr, sa to srd, mod srtd, qtz, mnr to com gy to blk cht, mnr lith, loose in pt, sil cmt, sl calc, silt mtx, 6 to 12% por. 40% Mudstone.. med gy, firm, blky, silty in pt, tr carb incl, sl mmica.
-10
0
Gas (units)
GR (api)
190
150
ROP (min/m)
10
Balance
50
Wetness
TG, C1-C5
1
10
100
1000
405
410
415
420
425
430
435
440
445
450
455


460
465
470
475
480
485
490
495
500
505
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5
Note: samples from 400 to 600 contain soft clay that washes through 80 mesh sample screens.
460-470 80% SS.. s&p, f to med gr, occ c gr, mod srtd, sa to srd, qtz com cht, mnr lith, rr glauc, pred loose, sil cmt, sl calc, sil mtx, 6-12% por. 20% Mudstone.. med gy, blky, firm, silty, some intbdd slst, tr carb incl.
470-490 90% SS.. s&p, pred med gr, f gr in pt, tr c gr, mod srtd, srd to sa, qtz, mnr to com cht, mnr lith, pred loose, fri, sil cmt, v sl calc, cla to silt mtx, 8-12% por. 10% Mudstone.. med gy, firm, silty in pt.
490-510 70% SS.. s&p, f to med gr, srd to sa, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, mod calc, clay mtx, 5-8% por. 30% Mudstone.. med gy, blky, firm, silty in pt, some slst lenses.



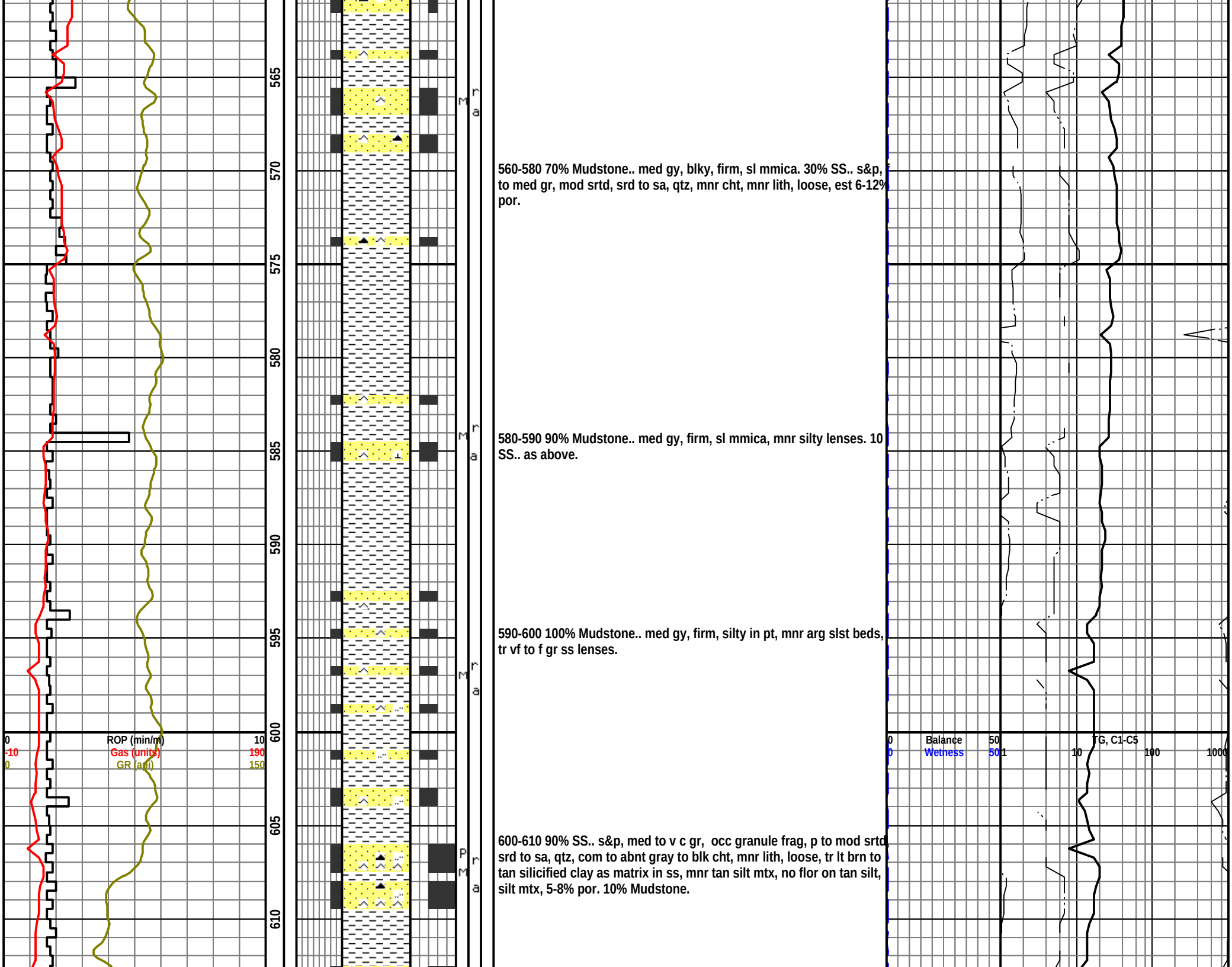
510-520 80% SS.. s&p, f to m gr, mnr rd c gr, mod srtd, srd to sa, qtz, com gy to blk cht, mnr lith, loose, fri, silt mtx, est 6 to 12% por. 20% Mudstone.. med gy, firm, blky, silty in pt.

520-530 70% SS.. s&p, f to c gr, mod srtd, srd to sa, qtz, com cht, mnr lith, rr glauc, pred loose, sil cmt, clay to silt mtx, v sl calc, 5-10% por. 30% Mudstone, pred med gy, firm, silty in pt, tr gy - gn, mnr lt gy - br with floating f to c sand grains.

530-540 as above, occ cht pbl frag.

540-550 90% SS.. s&p, pred med gr, c gr in pt, mnr v c gr to granule, mnr f gr, mod srtd, srd, qtz, com gy to blk cht, mnr lith, loose, sil cmt sl calc in pt, clay to silt mtx, est 6-12% por. 10% Mudstone.. med gy, blky, firm, sl mmica; Some lt brn silicified mudstone to arg cht, hd, brittle, mnr floating qtz and cht grs,

550-560 80% SS.. s&p, med to c gr, some v c grs, mod srtd, srd, qtz, com cht, mnr lith, pred loose, sil cmt, mod cons, sl to mod calc, clay to silt mtx, rr py, 5-10% por. 20% Mudstone.. med gy, blky, form, silty in pt, sl mmica.

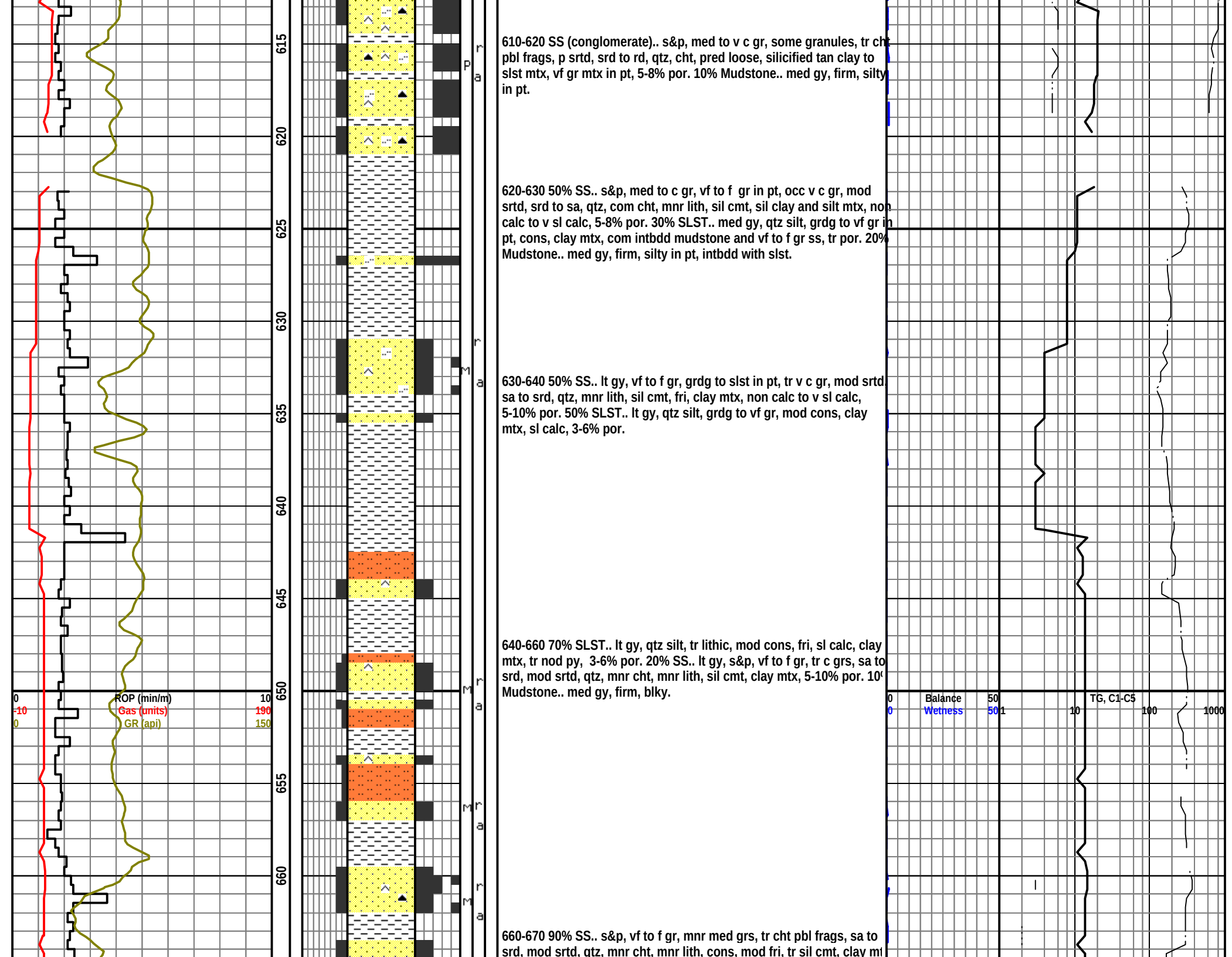


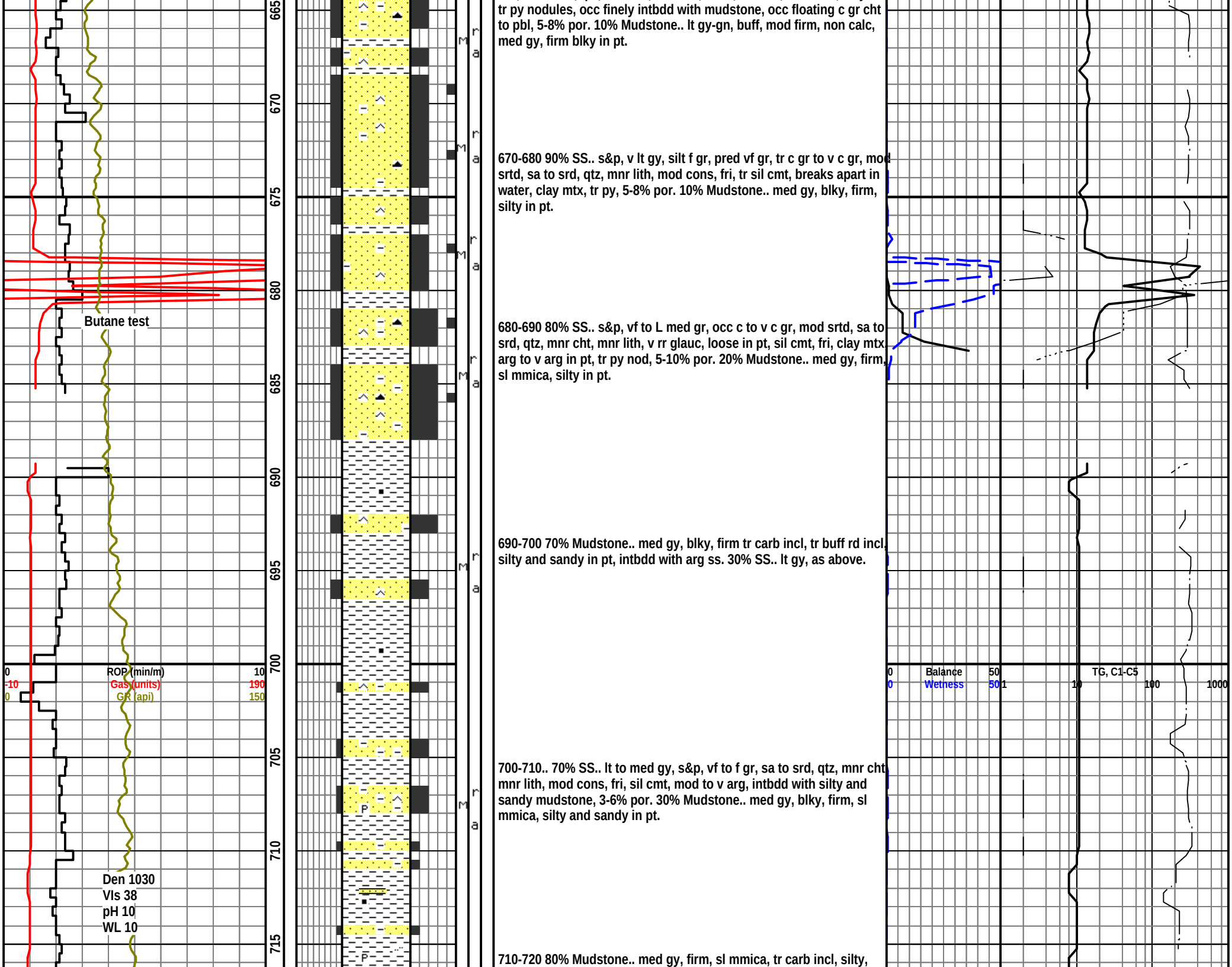
560-580 70% Mudstone.. med gy, blky, firm, sl mmica. 30% SS.. s&p, f to med gr, mod srtd, srd to sa, qtz, mnr cht, mnr lith, loose, est 6-12% por.

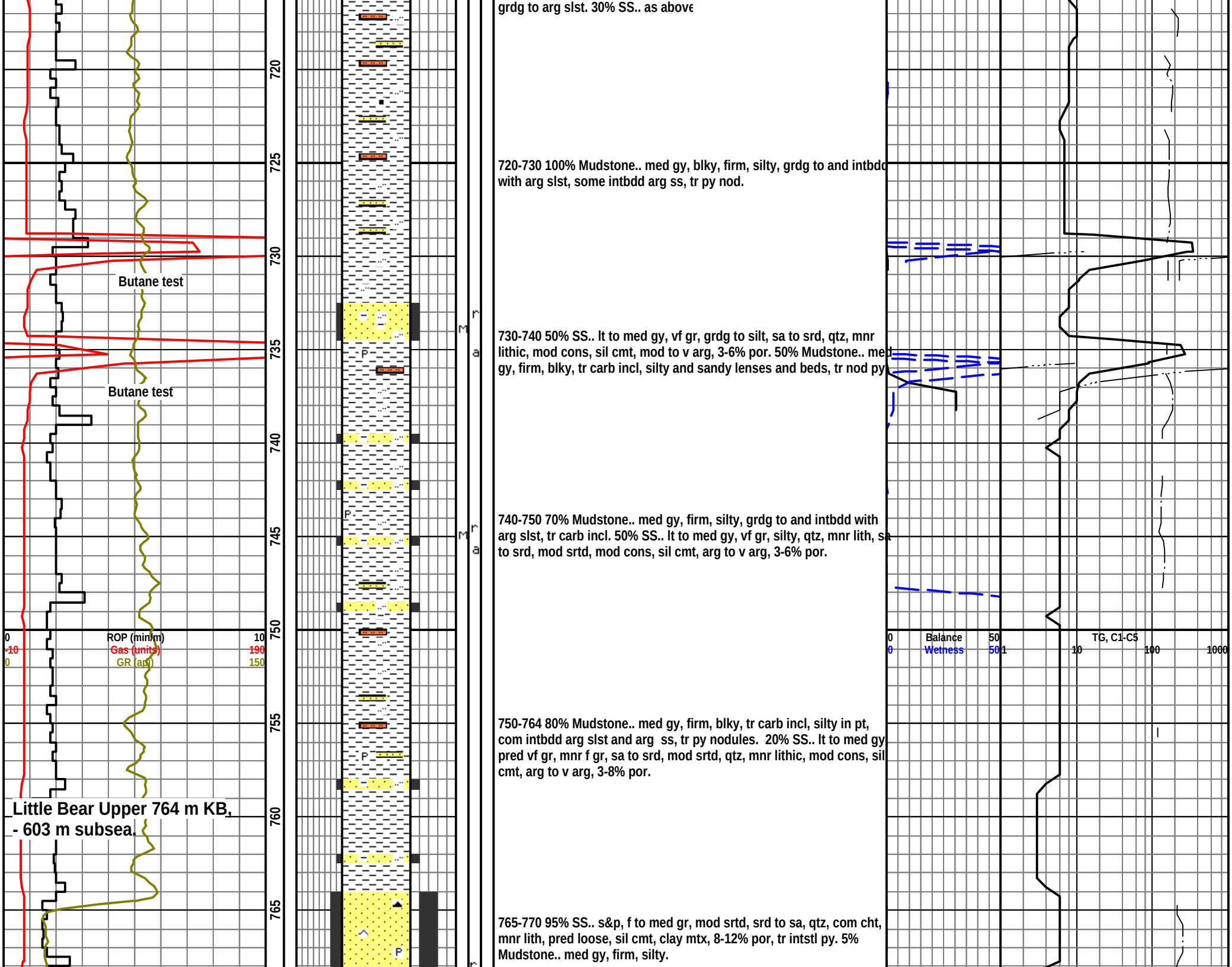
580-590 90% Mudstone.. med gy, firm, sl mmica, mnr silty lenses. 10 SS.. as above.

590-600 100% Mudstone.. med gy, firm, silty in pt, mnr arg slst beds, tr vf to f gr ss lenses.

600-610 90% SS.. s&p, med to v c gr, occ granule frag, p to mod srtd, srd to sa, qtz, com to abnt gray to blk cht, mnr lith, loose, tr lt brn to tan silicified clay as matrix in ss, mnr tan silt mtx, no flor on tan silt, silt mtx, 5-8% por. 10% Mudstone.


0
-10
0
ROP (min/m)
Gas (units)
GR (api)
10
190
150
615
620
625
630
635
640
645
650
655
660
610-620 SS (conglomerate).. s&p, med to v c gr, some granules, tr cht pbl frags, p srtd, srd to rd, qtz, cht, pred loose, silicified tan clay to slst mtx, vf gr mtx in pt, 5-8% por. 10% Mudstone.. med gy, firm, silty in pt.
620-630 50% SS.. s&p, med to c gr, vf to f gr in pt, occ v c gr, mod srtd, srd to sa, qtz, com cht, mnr lith, sil cmt, sil clay and silt mtx, non calc to v sl calc, 5-8% por. 30% SLST.. med gy, qtz silt, grdg to vf gr in pt, cons, clay mtx, com intbdd mudstone and vf to f gr ss, tr por. 20% Mudstone.. med gy, firm, silty in pt, intbdd with slst.
630-640 50% SS.. lt gy, vf to f gr, grdg to slst in pt, tr v c gr, mod srtd, sa to srd, qtz, mnr lith, sil cmt, fri, clay mtx, non calc to v sl calc, 5-10% por. 50% SLST.. lt gy, qtz silt, grdg to vf gr, mod cons, clay mtx, sl calc, 3-6% por.
640-660 70% SLST.. lt gy, qtz silt, tr lithic, mod cons, fri, sl calc, clay mtx, tr nod py, 3-6% por. 20% SS.. lt gy, s&p, vf to f gr, tr c grs, sa to srd, mod srtd, qtz, mnr cht, mnr lith, sil cmt, clay mtx, 5-10% por. 10% Mudstone.. med gy, firm, blky.
660-670 90% SS.. s&p, vf to f gr, mnr med grs, tr cht pbl frags, sa to srd, mod srtd, qtz, mnr cht, mnr lith, cons, mod fri, tr sil cmt, clay mt
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5


665
670
675
680
685
690
695
700
705
710
715
Butane test
Den 1030
Vis 38
pH 10
WL 10
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5
tr py nodules, occ finely intbdd with mudstone, occ floating c gr cht to pbl, 5-8% por. 10% Mudstone.. lt gy-gn, buff, mod firm, non calc, med gy, firm blky in pt.
670-680 90% SS.. s&p, v lt gy, silt f gr, pred vf gr, tr c gr to v c gr, mod srtd, sa to srd, qtz, mnr lith, mod cons, fri, tr sil cmt, breaks apart in water, clay mtx, tr py, 5-8% por. 10% Mudstone.. med gy, blky, firm, silty in pt.
680-690 80% SS.. s&p, vf to L med gr, occ c to v c gr, mod srtd, sa to srd, qtz, mnr cht, mnr lith, v rr glauc, loose in pt, sil cmt, fri, clay mtx, arg to v arg in pt, tr py nod, 5-10% por. 20% Mudstone.. med gy, firm, sl mmica, silty in pt.
690-700 70% Mudstone.. med gy, blky, firm tr carb incl, tr buff rd incl, silty and sandy in pt, intbdd with arg ss. 30% SS.. lt gy, as above.
700-710.. 70% SS.. lt to med gy, s&p, vf to f gr, sa to srd, qtz, mnr cht mnr lith, mod cons, fri, sil cmt, mod to v arg, intbdd with silty and sandy mudstone, 3-6% por. 30% Mudstone.. med gy, blky, firm, sl mmica, silty and sandy in pt.
710-720 80% Mudstone.. med gy, firm, sl mmica, tr carb incl, silty,



grdg to arg slst. 30% SS.. as above

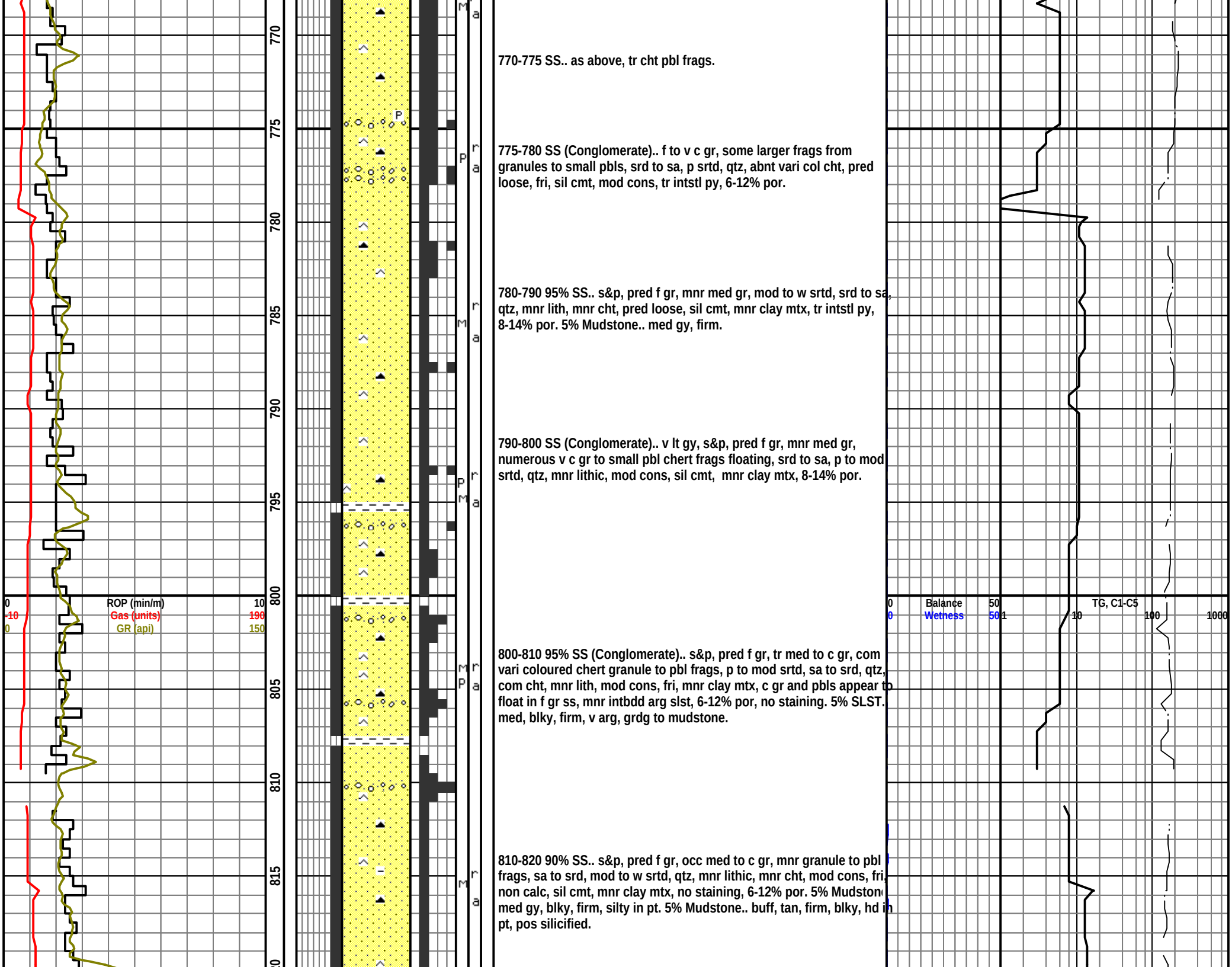
720-730 100% Mudstone.. med gy, blky, firm, silty, grdg to and intbdd with arg slst, some intbdd arg ss, tr py nod.

730-740 50% SS.. lt to med gy, vf gr, grdg to silt, sa to srd, qtz, mnr lithic, mod cons, sil cmt, mod to v arg, 3-6% por. 50% Mudstone.. med gy, firm, blky, tr carb incl, silty and sandy lenses and beds, tr nod py

740-750 70% Mudstone.. med gy, firm, silty, grdg to and intbdd with arg slst, tr carb incl. 50% SS.. lt to med gy, vf gr, silty, qtz, mnr lith, sa to srd, mod srtd, mod cons, sil cmt, arg to v arg, 3-6% por.

750-764 80% Mudstone.. med gy, firm, blky, tr carb incl, silty in pt, com intbdd arg slst and arg ss, tr py nodules. 20% SS.. lt to med gy pred vf gr, mnr f gr, sa to srd, mod srtd, qtz, mnr lithic, mod cons, sil cmt, arg to v arg, 3-8% por.

765-770 95% SS.. s&p, f to med gr, mod srtd, srd to sa, qtz, com cht, mnr lith, pred loose, sil cmt, clay mtx, 8-12% por, tr intstl py. 5% Mudstone.. med gy, firm, silty.



770-775 SS.. as above, tr cht pbl frags.

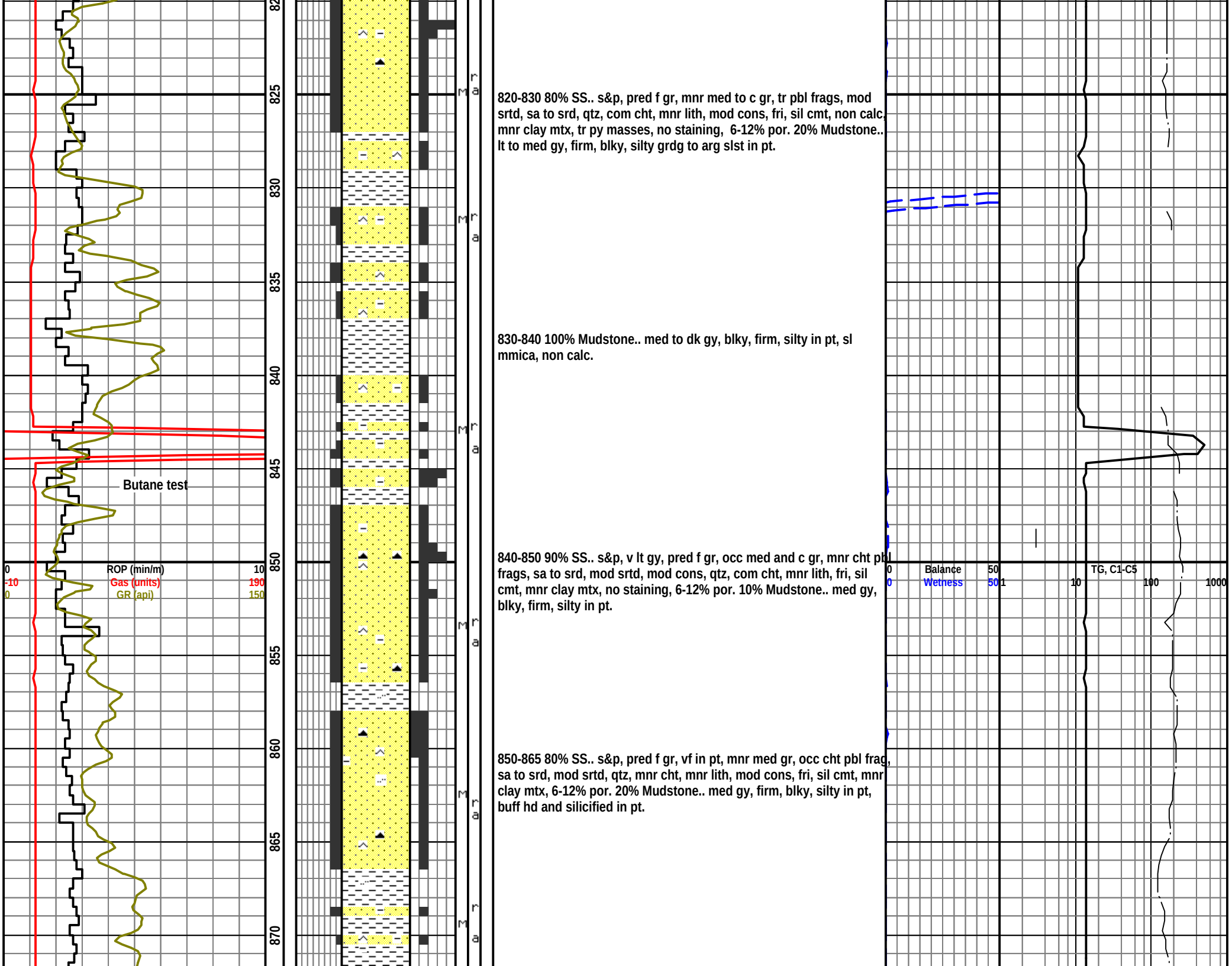
775-780 SS (Conglomerate).. f to v c gr, some larger frags from granules to small pbls, srd to sa, p srtd, qtz, abnt vari col cht, pred loose, fri, sil cmt, mod cons, tr intstl py, 6-12% por.

780-790 95% SS.. s&p, pred f gr, mnr med gr, mod to w srtd, srd to sa, qtz, mnr lith, mnr cht, pred loose, sil cmt, mnr clay mtx, tr intstl py, 8-14% por. 5% Mudstone.. med gy, firm.

790-800 SS (Conglomerate).. v lt gy, s&p, pred f gr, mnr med gr, numerous v c gr to small pbl chert frags floating, srd to sa, p to mod srtd, qtz, mnr lithic, mod cons, sil cmt, mnr clay mtx, 8-14% por.

800-810 95% SS (Conglomerate).. s&p, pred f gr, tr med to c gr, com vari coloured chert granule to pbl frags, p to mod srtd, sa to srd, qtz, com cht, mnr lith, mod cons, fri, mnr clay mtx, c gr and pbls appear to float in f gr ss, mnr intbdd arg slst, 6-12% por, no staining. 5% SLST. med, blky, firm, v arg, grdg to mudstone.

810-820 90% SS.. s&p, pred f gr, occ med to c gr, mnr granule to pbl frags, sa to srd, mod to w srtd, qtz, mnr lithic, mnr cht, mod cons, fri, non calc, sil cmt, mnr clay mtx, no staining, 6-12% por. 5% Mudstone med gy, blky, firm, silty in pt. 5% Mudstone.. buff, tan, firm, blky, hd in pt, pos silicified.

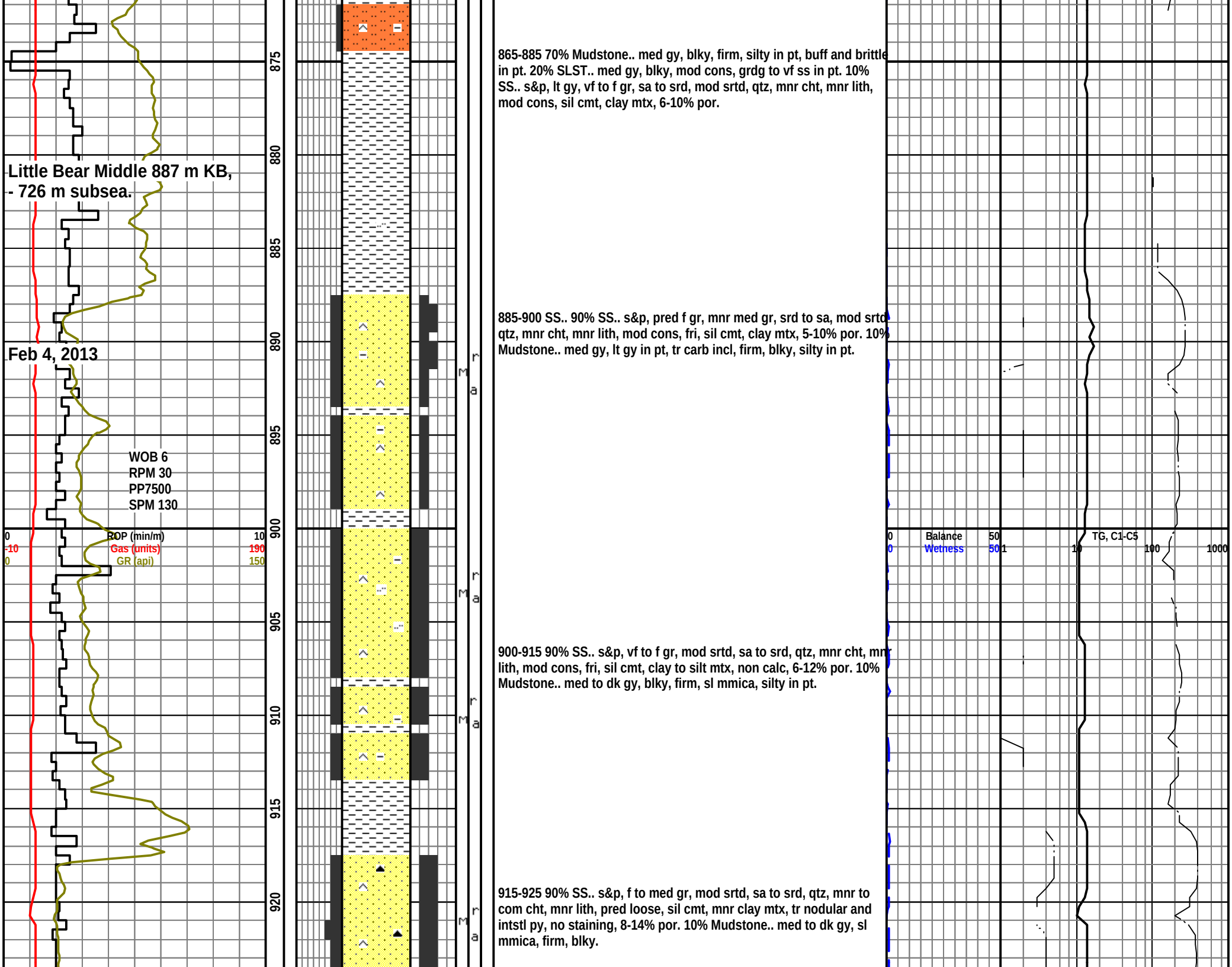


820-830 80% SS.. s&p, pred f gr, mnr med to c gr, tr pbl frags, mod srtd, sa to srd, qtz, com cht, mnr lith, mod cons, fri, sil cmt, non calc, mnr clay mtx, tr py masses, no staining, 6-12% por. 20% Mudstone.. lt to med gy, firm, blky, silty grdg to arg slst in pt.

830-840 100% Mudstone.. med to dk gy, blky, firm, silty in pt, sl mmica, non calc.

840-850 90% SS.. s&p, v lt gy, pred f gr, occ med and c gr, mnr cht pbl frags, sa to srd, mod srtd, mod cons, qtz, com cht, mnr lith, fri, sil cmt, mnr clay mtx, no staining, 6-12% por. 10% Mudstone.. med gy, blky, firm, silty in pt.

850-865 80% SS.. s&p, pred f gr, vf in pt, mnr med gr, occ cht pbl frag, sa to srd, mod srtd, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, mnr clay mtx, 6-12% por. 20% Mudstone.. med gy, firm, blky, silty in pt, buff hd and silicified in pt.

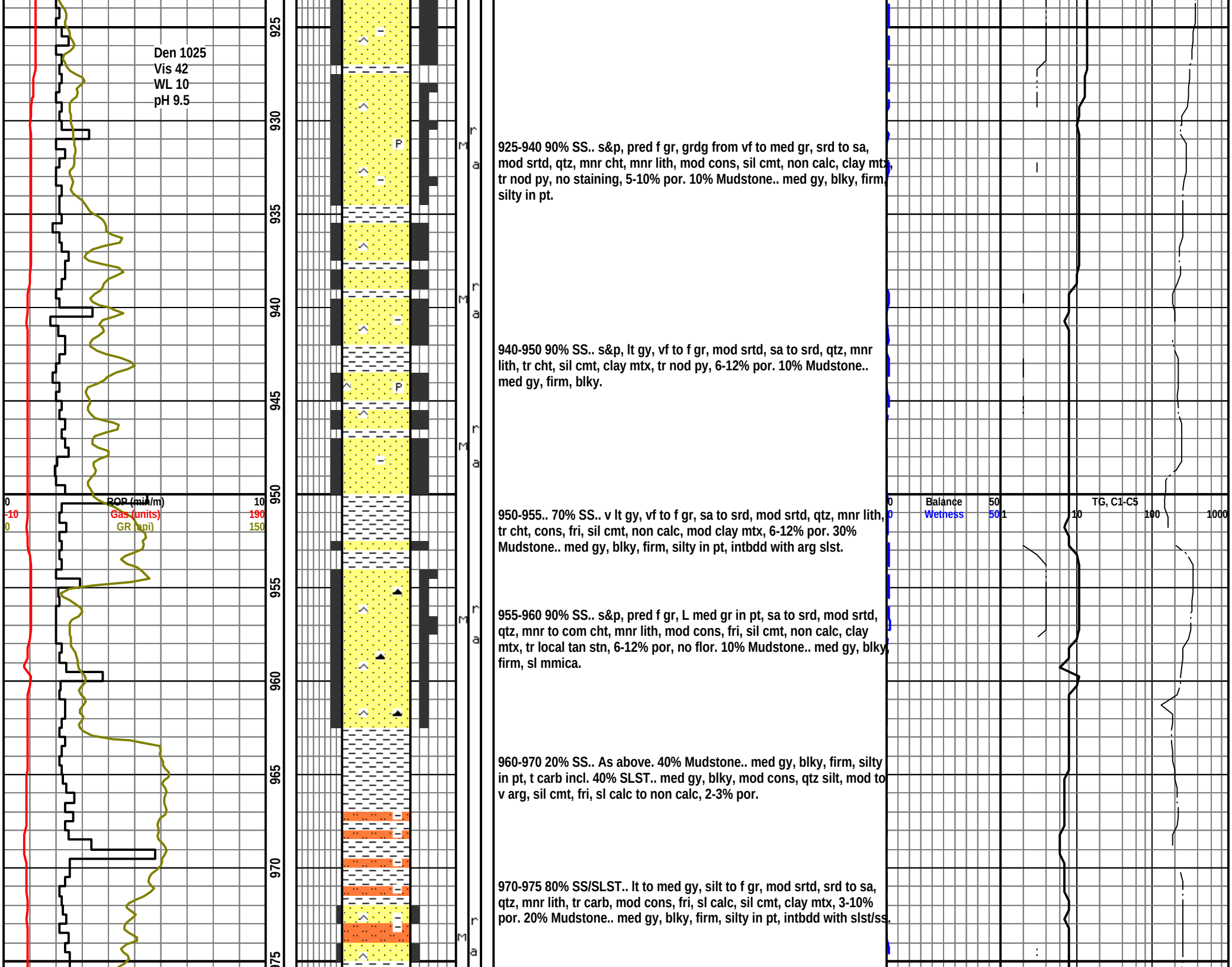


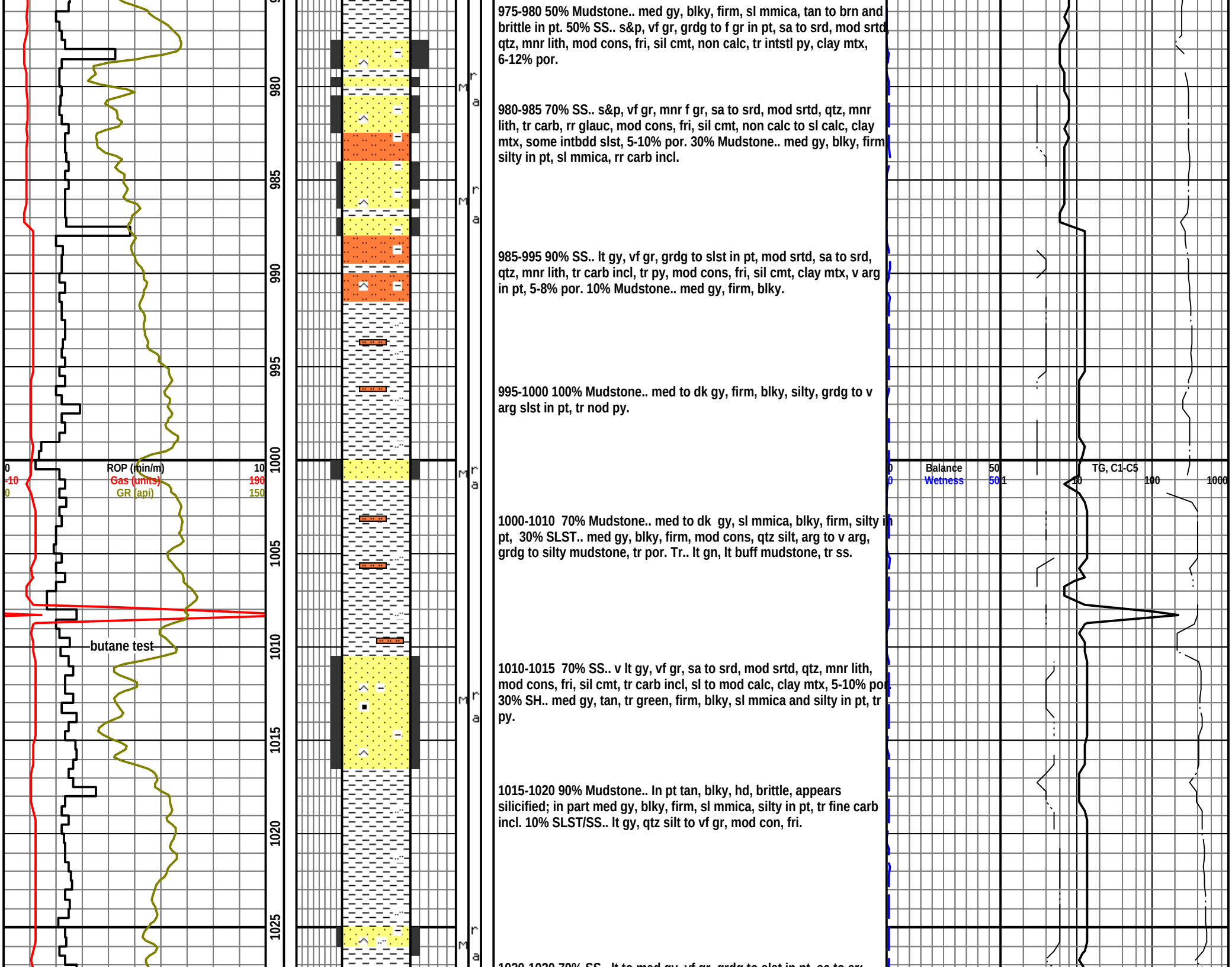
865-885 70% Mudstone.. med gy, blky, firm, silty in pt, buff and brittle in pt. 20% SLST.. med gy, blky, mod cons, grdg to vf ss in pt. 10% SS.. s&p, lt gy, vf to f gr, sa to srd, mod srtd, qtz, mnr cht, mnr lith, mod cons, sil cmt, clay mtx, 6-10% por.

885-900 SS.. 90% SS.. s&p, pred f gr, mnr med gr, srd to sa, mod srtd, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, clay mtx, 5-10% por. 10% Mudstone.. med gy, lt gy in pt, tr carb incl, firm, blky, silty in pt.

900-915 90% SS.. s&p, vf to f gr, mod srtd, sa to srd, qtz, mnr cht, mnr lith, mod cons, fri, sil cmt, clay to silt mtx, non calc, 6-12% por. 10% Mudstone.. med to dk gy, blky, firm, sl mmica, silty in pt.

915-925 90% SS.. s&p, f to med gr, mod srtd, sa to srd, qtz, mnr to com cht, mnr lith, pred loose, sil cmt, mnr clay mtx, tr nodular and intstl py, no staining, 8-14% por. 10% Mudstone.. med to dk gy, sl mmica, firm, blky.


Den 1025
Vis 42
WL 10
pH 9.5
925
930
935
940
945
950
955
960
965
970
975
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000
925-940 90% SS.. s&p, pred f gr, grdg from vf to med gr, srd to sa, mod srtd, qtz, mnr cht, mnr lith, mod cons, sil cmt, non calc, clay mtx, tr nod py, no staining, 5-10% por. 10% Mudstone.. med gy, blky, firm, silty in pt.
940-950 90% SS.. s&p, lt gy, vf to f gr, mod srtd, sa to srd, qtz, mnr lith, tr cht, sil cmt, clay mtx, tr nod py, 6-12% por. 10% Mudstone.. med gy, firm, blky.
950-955.. 70% SS.. v lt gy, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr cht, cons, fri, sil cmt, non calc, mod clay mtx, 6-12% por. 30% Mudstone.. med gy, blky, firm, silty in pt, intbdd with arg slst.
955-960 90% SS.. s&p, pred f gr, L med gr in pt, sa to srd, mod srtd, qtz, mnr to com cht, mnr lith, mod cons, fri, sil cmt, non calc, clay mtx, tr local tan stn, 6-12% por, no flor. 10% Mudstone.. med gy, blky, firm, sl mmica.
960-970 20% SS.. As above. 40% Mudstone.. med gy, blky, firm, silty in pt, t carb incl. 40% SLST.. med gy, blky, mod cons, qtz silt, mod to v arg, sil cmt, fri, sl calc to non calc, 2-3% por.
970-975 80% SS/SLST.. lt to med gy, silt to f gr, mod srtd, srd to sa, qtz, mnr lith, tr carb, mod cons, fri, sl calc, sil cmt, clay mtx, 3-10% por. 20% Mudstone.. med gy, blky, firm, silty in pt, intbdd with slst/ss.



975-980 50% Mudstone.. med gy, blky, firm, sl mmica, tan to brn and brittle in pt. 50% SS.. s&p, vf gr, grdg to f gr in pt, sa to srd, mod srtd, qtz, mnr lith, mod cons, fri, sil cmt, non calc, tr intstl py, clay mtx, 6-12% por.

980-985 70% SS.. s&p, vf gr, mnr f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, rr glauc, mod cons, fri, sil cmt, non calc to sl calc, clay mtx, some intbdd slst, 5-10% por. 30% Mudstone.. med gy, blky, firm silty in pt, sl mmica, rr carb incl.

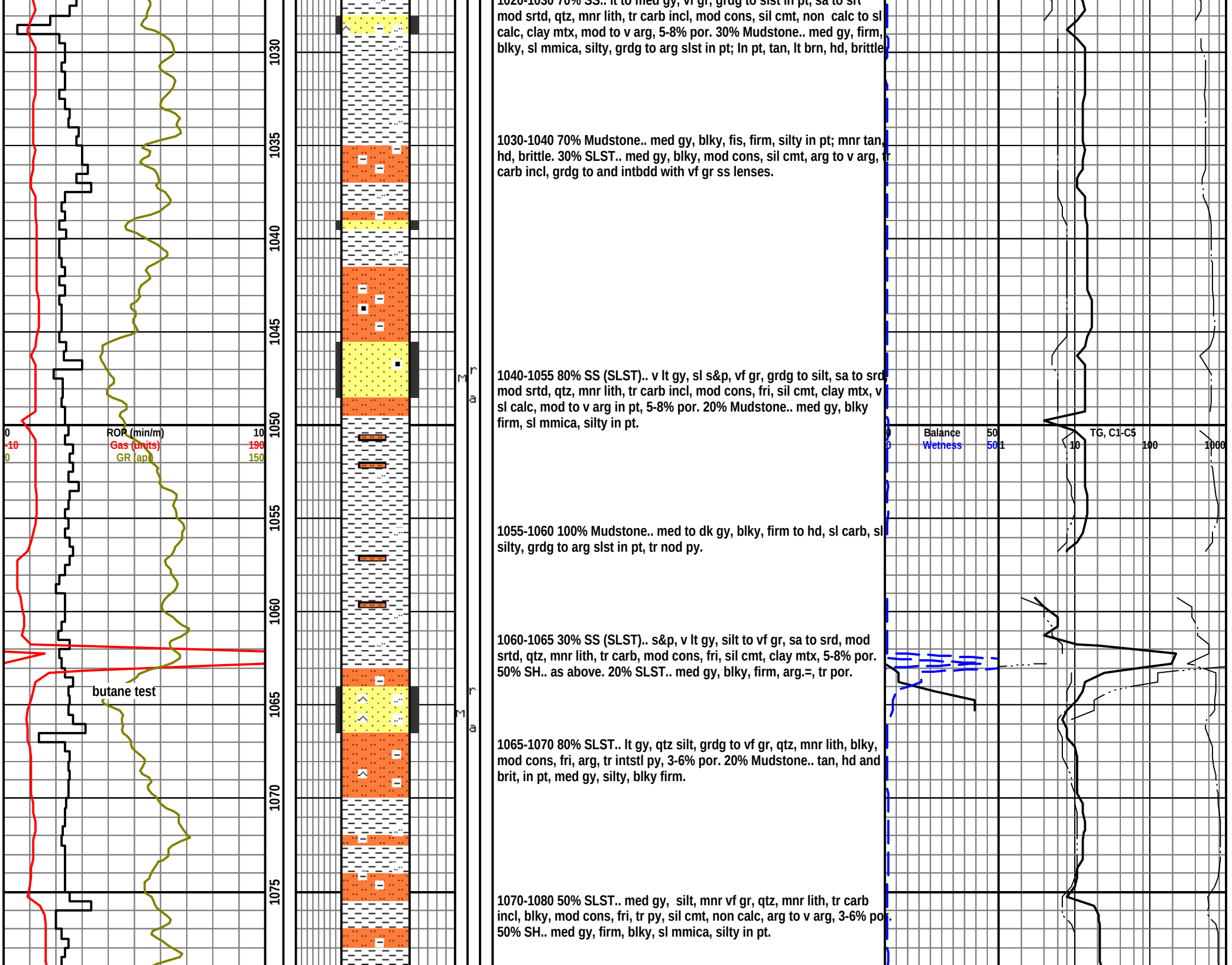
985-995 90% SS.. lt gy, vf gr, grdg to slst in pt, mod srtd, sa to srd, qtz, mnr lith, tr carb incl, tr py, mod cons, fri, sil cmt, clay mtx, v arg in pt, 5-8% por. 10% Mudstone.. med gy, firm, blky.

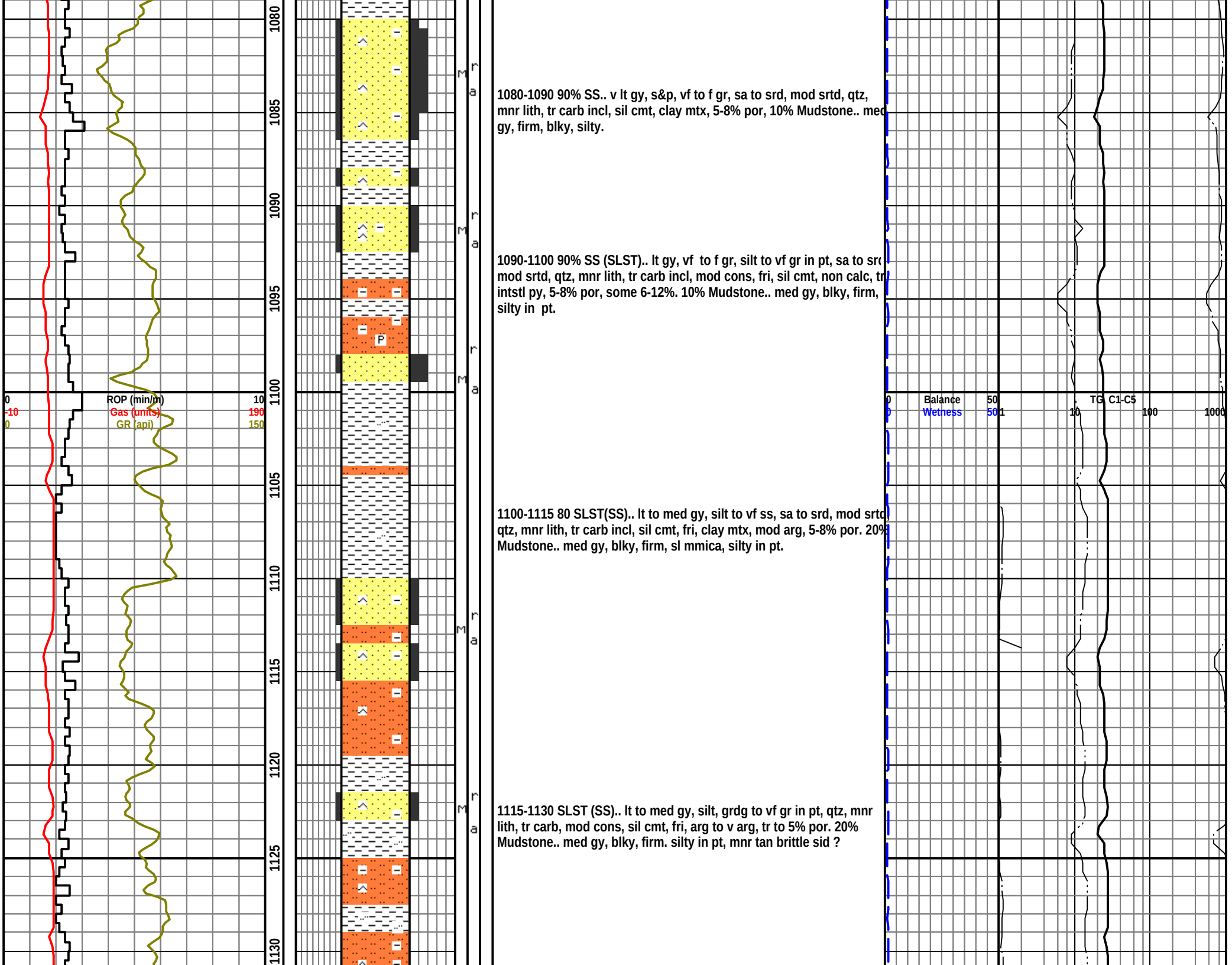
995-1000 100% Mudstone.. med to dk gy, firm, blky, silty, grdg to v arg slst in pt, tr nod py.

1000-1010 70% Mudstone.. med to dk gy, sl mmica, blky, firm, silty in pt, 30% SLST.. med gy, blky, firm, mod cons, qtz silt, arg to v arg, grdg to silty mudstone, tr por. Tr.. lt gn, lt buff mudstone, tr ss.

1010-1015 70% SS.. v lt gy, vf gr, sa to srd, mod srtd, qtz, mnr lith, mod cons, fri, sil cmt, tr carb incl, sl to mod calc, clay mtx, 5-10% por. 30% SH.. med gy, tan, tr green, firm, blky, sl mmica and silty in pt, tr py.

1015-1020 90% Mudstone.. In pt tan, blky, hd, brittle, appears silicified; in part med gy, blky, firm, sl mmica, silty in pt, tr fine carb incl. 10% SLST/SS.. lt gy, qtz silt to vf gr, mod con, fri.


1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
butane test
Balance
50
Wetness
50
1
TG, C1-C5
10
100
1000
1020-1030 70% SS.. lt to med gy, vf gr, grdg to slst in pt, sa to srd mod srtd, qtz, mnr lith, tr carb incl, mod cons, sil cmt, non calc to sl calc, clay mtx, mod to v arg, 5-8% por. 30% Mudstone.. med gy, firm, blky, sl mmica, silty, grdg to arg slst in pt; ln pt, tan, lt brn, hd, brittle
1030-1040 70% Mudstone.. med gy, blky, fis, firm, silty in pt; mnr tan, hd, brittle. 30% SLST.. med gy, blky, mod cons, sil cmt, arg to v arg, tr carb incl, grdg to and intbdd with vf gr ss lenses.
1040-1055 80% SS (SLST).. v lt gy, sl s&p, vf gr, grdg to silt, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, mod cons, fri, sil cmt, clay mtx, v sl calc, mod to v arg in pt, 5-8% por. 20% Mudstone.. med gy, blky firm, sl mmica, silty in pt.
1055-1060 100% Mudstone.. med to dk gy, blky, firm to hd, sl carb, sl silty, grdg to arg slst in pt, tr nod py.
1060-1065 30% SS (SLST).. s&p, v lt gy, silt to vf gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, mod cons, fri, sil cmt, clay mtx, 5-8% por. 50% SH.. as above. 20% SLST.. med gy, blky, firm, arg.=, tr por.
1065-1070 80% SLST.. lt gy, qtz silt, grdg to vf gr, qtz, mnr lith, blky, mod cons, fri, arg, tr intstl py, 3-6% por. 20% Mudstone.. tan, hd and brit, in pt, med gy, silty, blky firm.
1070-1080 50% SLST.. med gy, silt, mnr vf gr, qtz, mnr lith, tr carb incl, blky, mod cons, fri, tr py, sil cmt, non calc, arg to v arg, 3-6% por. 50% SH.. med gy, firm, blky, sl mmica, silty in pt.

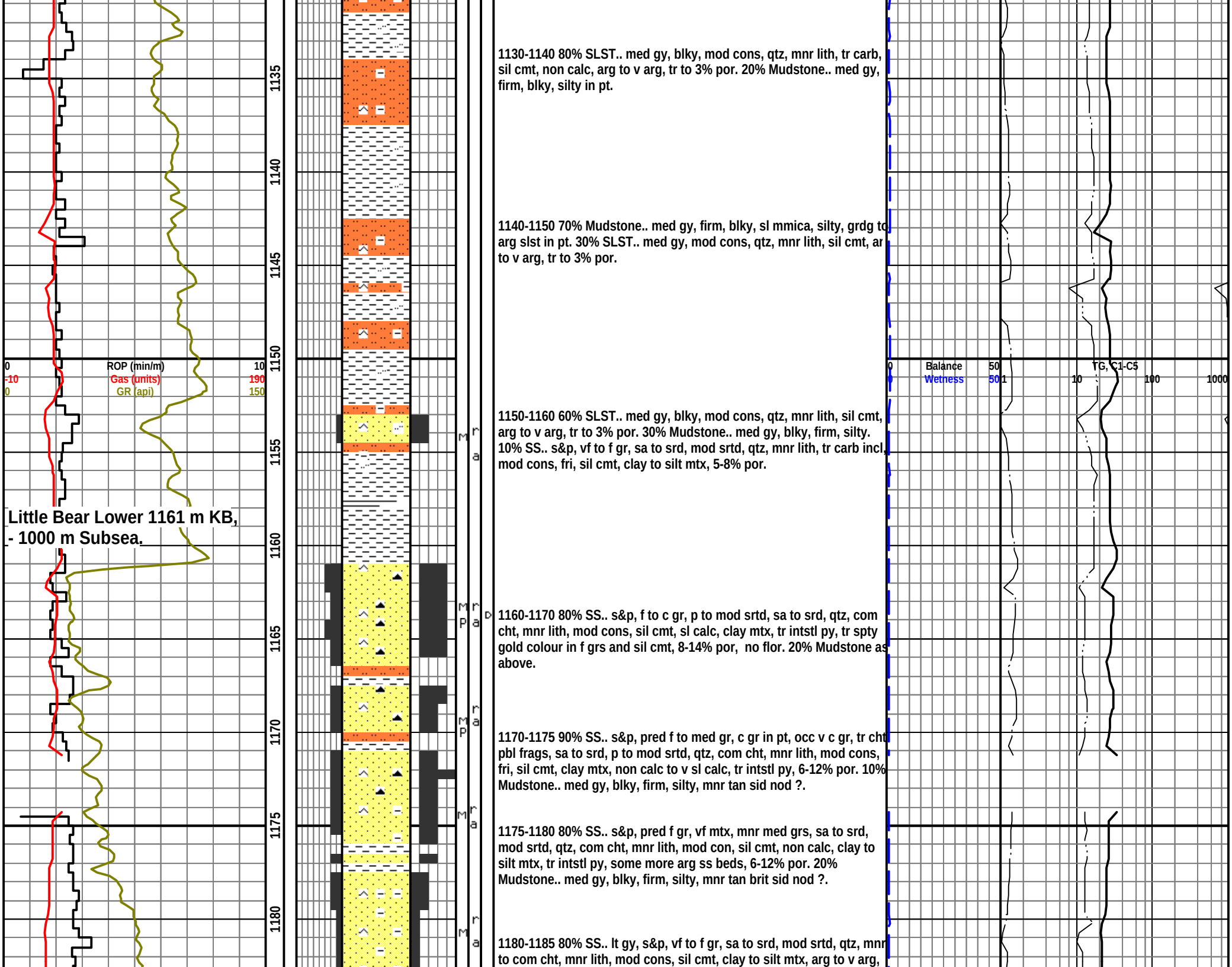


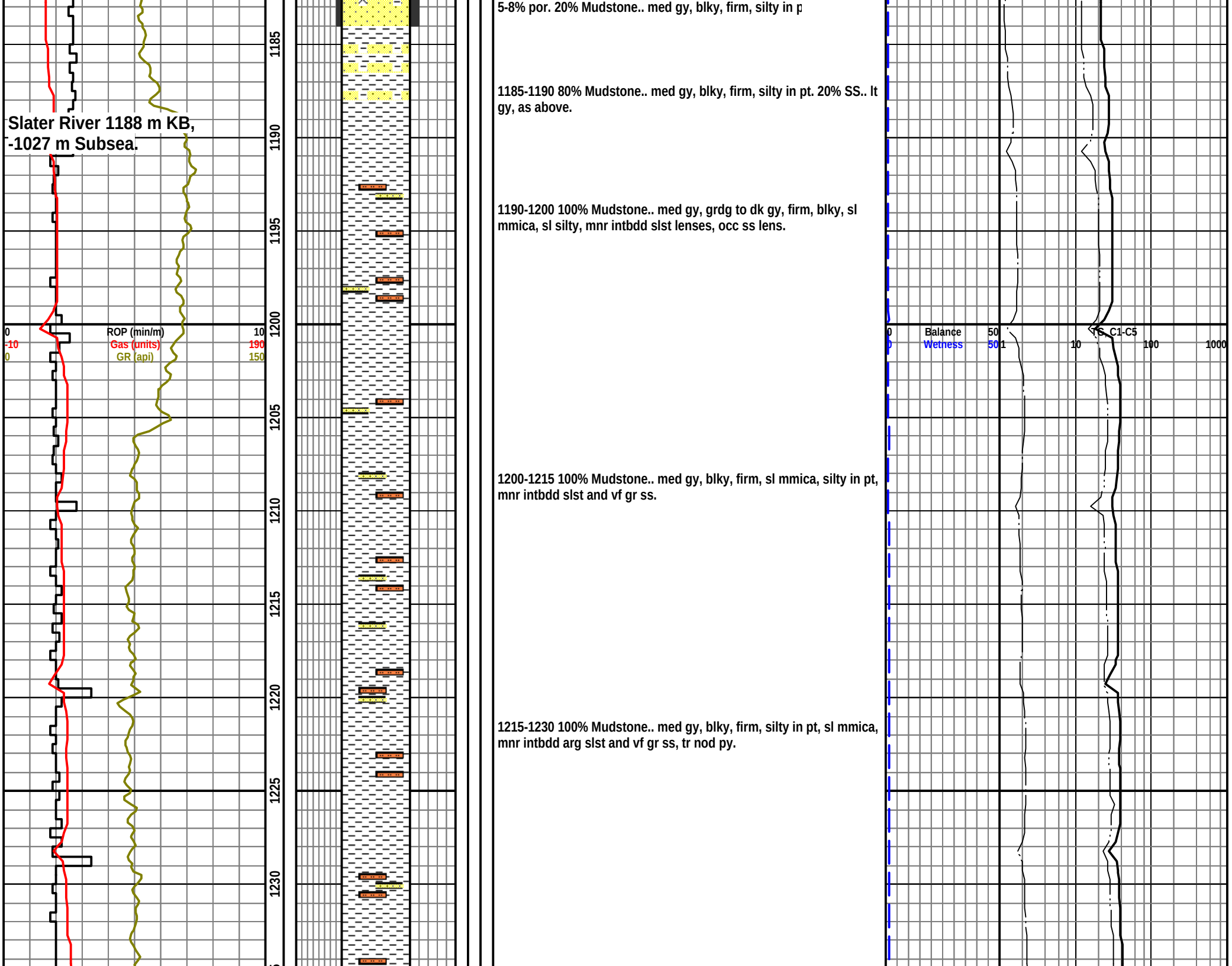
1080-1090 90% SS.. v lt gy, s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, sil cmt, clay mtx, 5-8% por, 10% Mudstone.. med gy, firm, blky, silty.

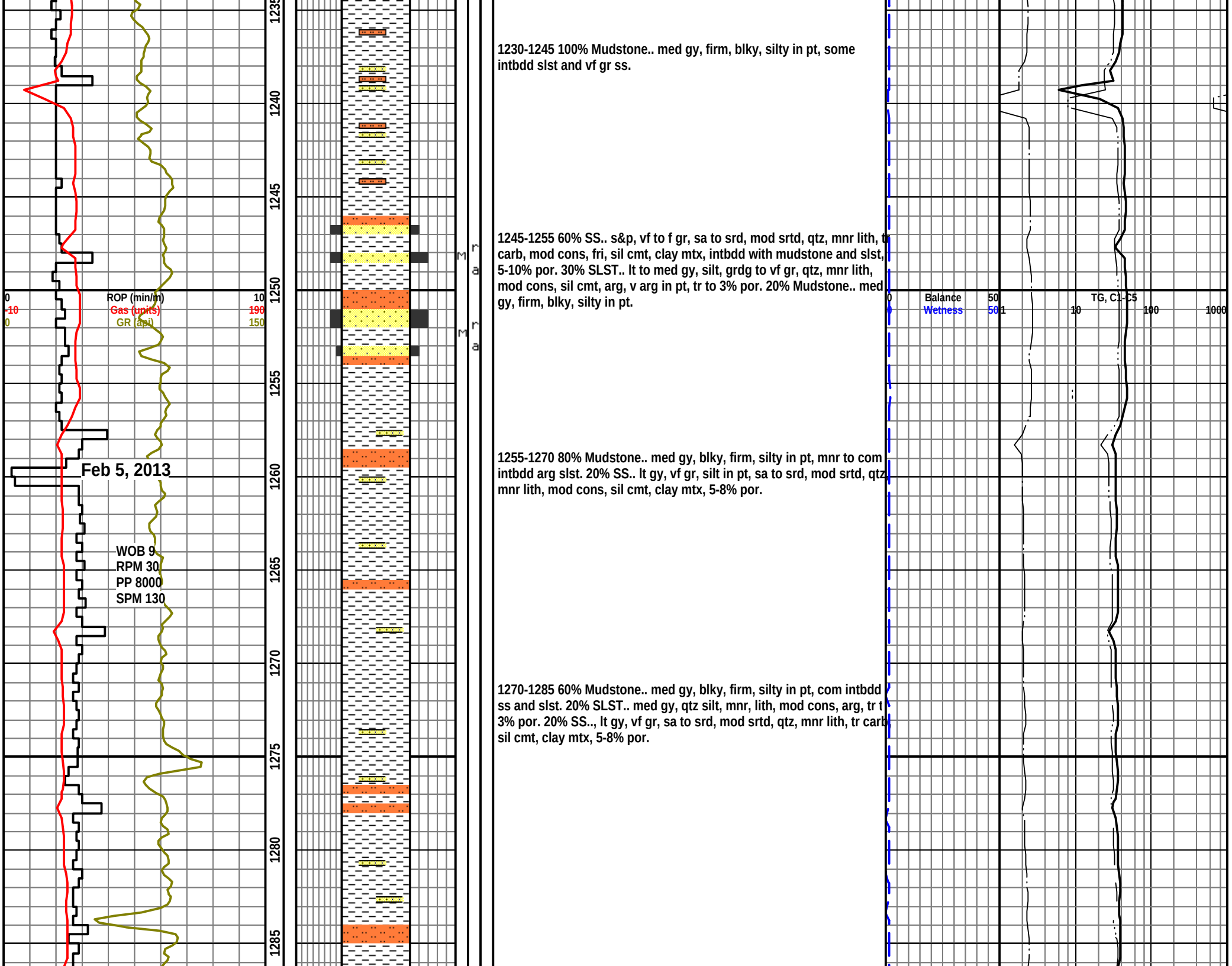
1090-1100 90% SS (SLST).. lt gy, vf to f gr, silt to vf gr in pt, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, mod cons, fri, sil cmt, non calc, tr intstl py, 5-8% por, some 6-12%. 10% Mudstone.. med gy, blky, firm, silty in pt.

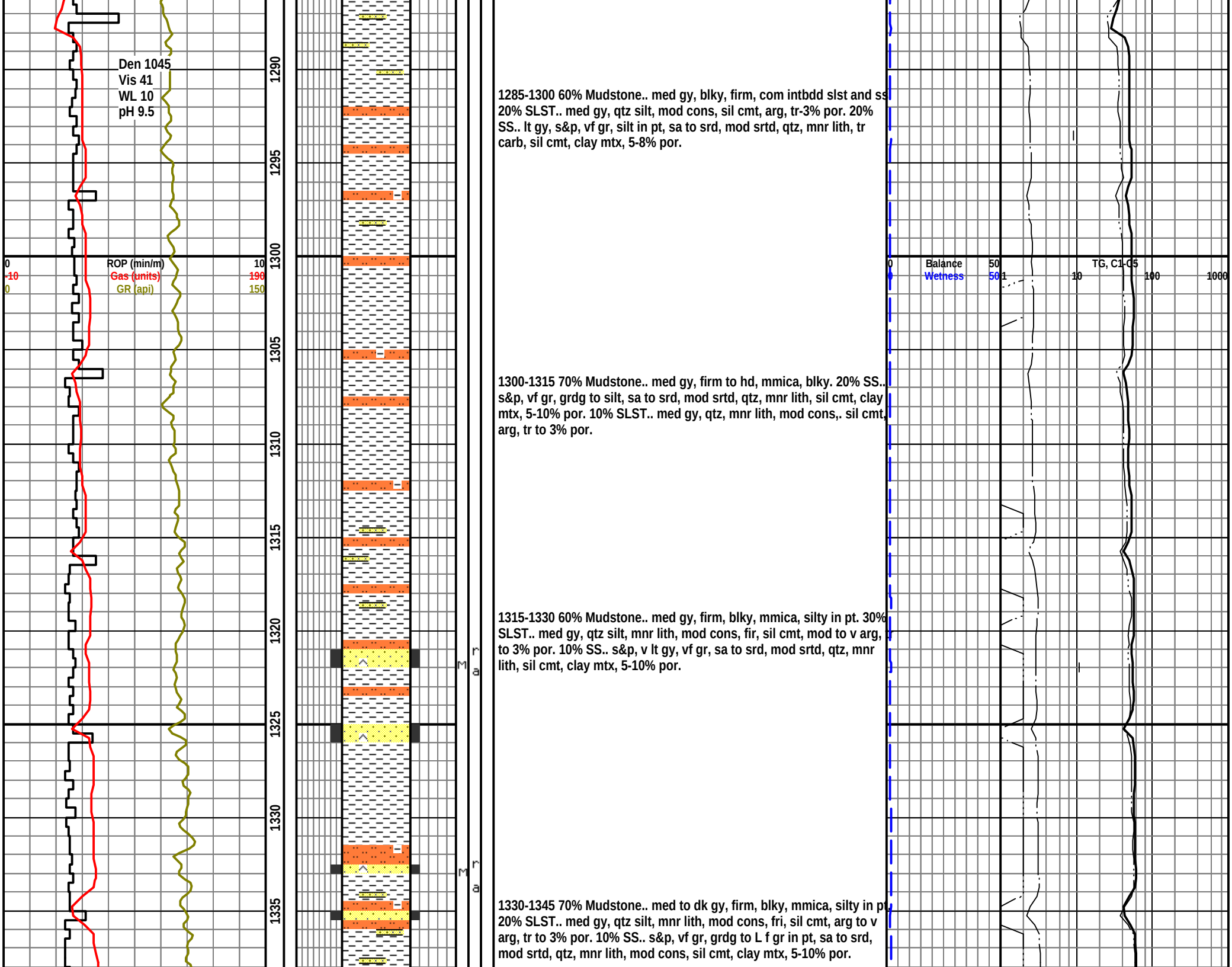
1100-1115 80 SLST(SS).. lt to med gy, silt to vf ss, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, sil cmt, fri, clay mtx, mod arg, 5-8% por. 20% Mudstone.. med gy, blky, firm, sl mmica, silty in pt.

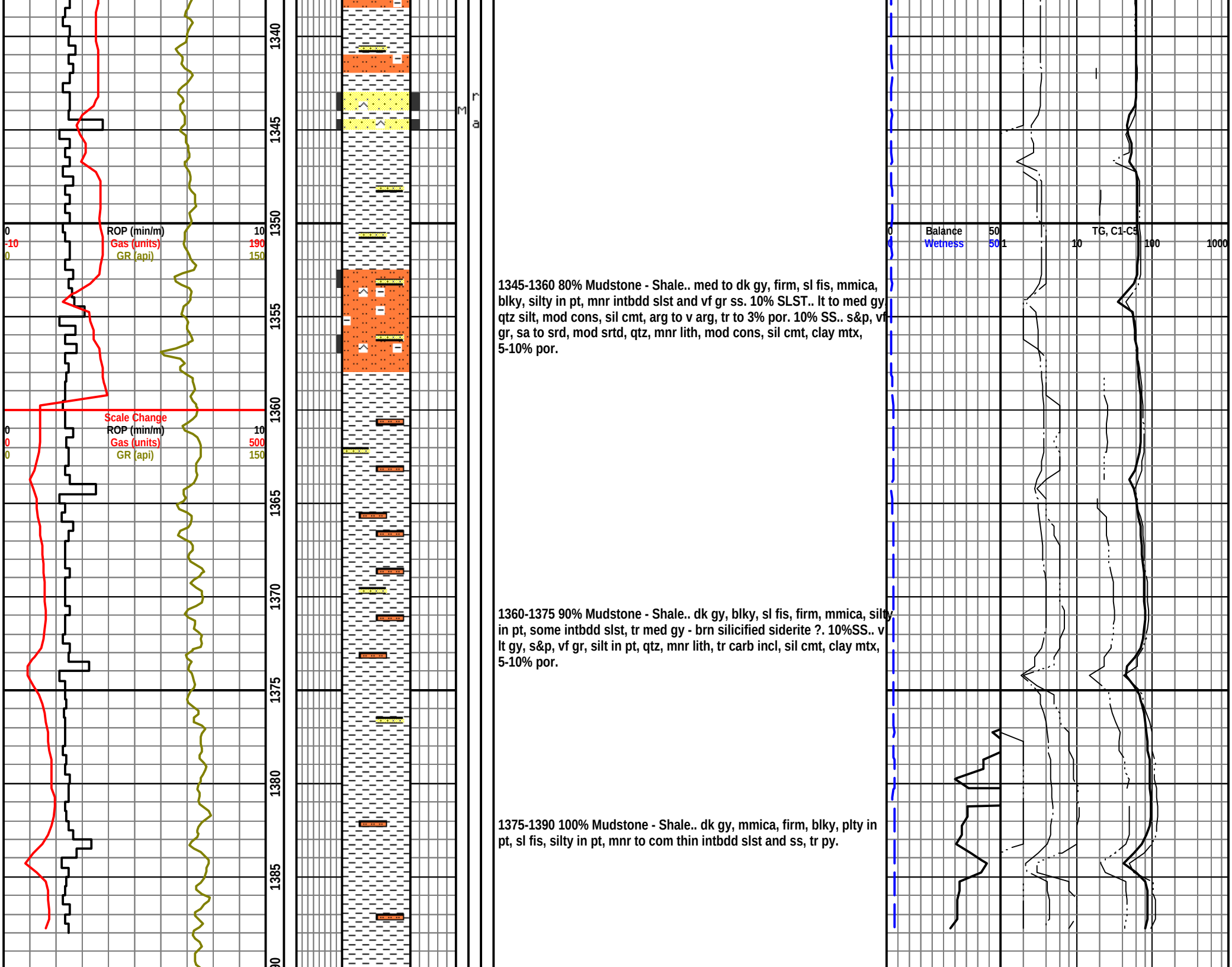
1115-1130 SLST (SS).. lt to med gy, silt, grdg to vf gr in pt, qtz, mnr lith, tr carb, mod cons, sil cmt, fri, arg to v arg, tr to 5% por. 20% Mudstone.. med gy, blky, firm. silty in pt, mnr tan brittle sid ?


0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
Little Bear Lower 1161 m KB,
- 1000 m Subsea.
0
Balance
50
TG, C1-C5
0
Wetness
50
1
10
100
1000
1130-1140 80% SLST.. med gy, blky, mod cons, qtz, mnr lith, tr carb, sil cmt, non calc, arg to v arg, tr to 3% por. 20% Mudstone.. med gy, firm, blky, silty in pt.
1140-1150 70% Mudstone.. med gy, firm, blky, sl mmica, silty, grdg to arg slst in pt. 30% SLST.. med gy, mod cons, qtz, mnr lith, sil cmt, ar to v arg, tr to 3% por.
1150-1160 60% SLST.. med gy, blky, mod cons, qtz, mnr lith, sil cmt, arg to v arg, tr to 3% por. 30% Mudstone.. med gy, blky, firm, silty. 10% SS.. s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb incl, mod cons, fri, sil cmt, clay to silt mtx, 5-8% por.
1160-1170 80% SS.. s&p, f to c gr, p to mod srtd, sa to srd, qtz, com cht, mnr lith, mod cons, sil cmt, sl calc, clay mtx, tr intstl py, tr spty gold colour in f grs and sil cmt, 8-14% por, no flor. 20% Mudstone as above.
1170-1175 90% SS.. s&p, pred f to med gr, c gr in pt, occ v c gr, tr cht pbl frags, sa to srd, p to mod srtd, qtz, com cht, mnr lith, mod cons, fri, sil cmt, clay mtx, non calc to v sl calc, tr intstl py, 6-12% por. 10% Mudstone.. med gy, blky, firm, silty, mnr tan sid nod ?.
1175-1180 80% SS.. s&p, pred f gr, vf mtx, mnr med grs, sa to srd, mod srtd, qtz, com cht, mnr lith, mod con, sil cmt, non calc, clay to silt mtx, tr intstl py, some more arg ss beds, 6-12% por. 20% Mudstone.. med gy, blky, firm, silty, mnr tan brit sid nod ?.
1180-1185 80% SS.. lt gy, s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr to com cht, mnr lith, mod cons, sil cmt, clay to silt mtx, arg to v arg,


Slater River 1188 m KB,
-1027 m Subsea.
0
-10
0
ROP (min/m)
Gas (units)
GR (api)
10
190
150
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
5-8% por. 20% Mudstone.. med gy, blky, firm, silty in p
1185-1190 80% Mudstone.. med gy, blky, firm, silty in pt. 20% SS.. lt gy, as above.
1190-1200 100% Mudstone.. med gy, grdg to dk gy, firm, blky, sl mmica, sl silty, mnr intbdd slst lenses, occ ss lens.
1200-1215 100% Mudstone.. med gy, blky, firm, sl mmica, silty in pt, mnr intbdd slst and vf gr ss.
1215-1230 100% Mudstone.. med gy, blky, firm, silty in pt, sl mmica, mnr intbdd arg slst and vf gr ss, tr nod py.
0
Balance
50
0
Wetness
50
TG, C1-C5
1
10
100
1000


0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
Feb 5, 2013
WOB 9
RPM 30
PP 8000
SPM 130
1230
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
Mar
Mar
1230-1245 100% Mudstone.. med gy, firm, blky, silty in pt, some intbdd slst and vf gr ss.
1245-1255 60% SS.. s&p, vf to f gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, mod cons, fri, sil cmt, clay mtx, intbdd with mudstone and slst, 5-10% por. 30% SLST.. lt to med gy, silt, grdg to vf gr, qtz, mnr lith, mod cons, sil cmt, arg, v arg in pt, tr to 3% por. 20% Mudstone.. med gy, firm, blky, silty in pt.
1255-1270 80% Mudstone.. med gy, blky, firm, silty in pt, mnr to com intbdd arg slst. 20% SS.. lt gy, vf gr, silt in pt, sa to srd, mod srtd, qtz, mnr lith, mod cons, sil cmt, clay mtx, 5-8% por.
1270-1285 60% Mudstone.. med gy, blky, firm, silty in pt, com intbdd ss and slst. 20% SLST.. med gy, qtz silt, mnr, lith, mod cons, arg, tr t 3% por. 20% SS.., lt gy, vf gr, sa to srd, mod srtd, qtz, mnr lith, tr carb, sil cmt, clay mtx, 5-8% por.
0
Balance
50
TG, C1-C5
0
Wetness
50
1
10
100
1000

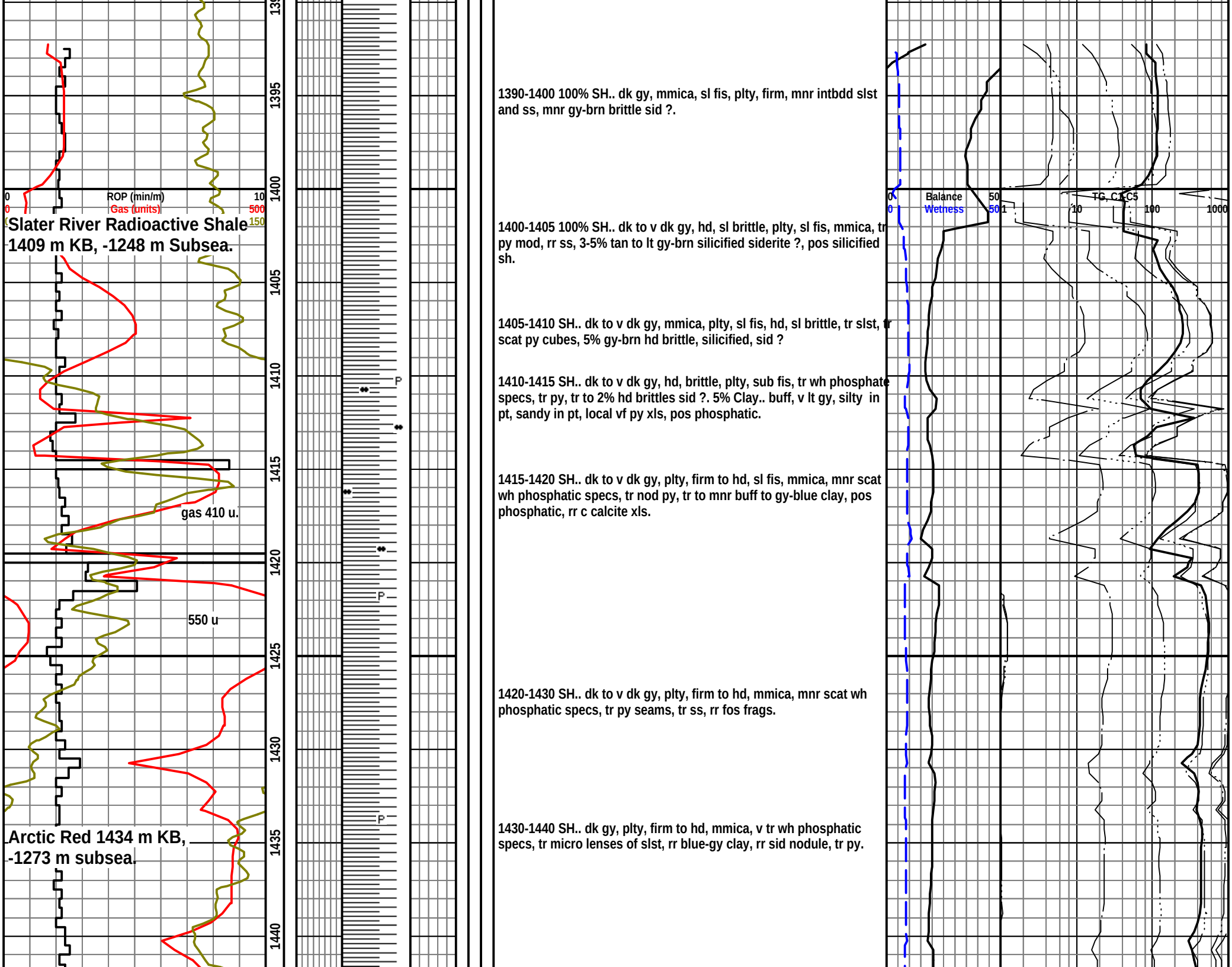

Den 1045
Vis 41
WL 10
pH 9.5
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
0
ROP (min/m)
10
-10
Gas (units)
190
0
GR (api)
150
0
Balance
50
0
Wetness
50
1
10
100
1000
TG, C1-C5
1285-1300 60% Mudstone.. med gy, blky, firm, com intbdd slst and ss 20% SLST.. med gy, qtz silt, mod cons, sil cmt, arg, tr-3% por. 20% SS.. lt gy, s&p, vf gr, silt in pt, sa to srd, mod srtd, qtz, mnr lith, tr carb, sil cmt, clay mtx, 5-8% por.
1300-1315 70% Mudstone.. med gy, firm to hd, mmica, blky. 20% SS.. s&p, vf gr, grdg to silt, sa to srd, mod srtd, qtz, mnr lith, sil cmt, clay mtx, 5-10% por. 10% SLST.. med gy, qtz, mnr lith, mod cons,. sil cmt, arg, tr to 3% por.
1315-1330 60% Mudstone.. med gy, firm, blky, mmica, silty in pt. 30% SLST.. med gy, qtz silt, mnr lith, mod cons, fir, sil cmt, mod to v arg, tr to 3% por. 10% SS.. s&p, v lt gy, vf gr, sa to srd, mod srtd, qtz, mnr lith, sil cmt, clay mtx, 5-10% por.
1330-1345 70% Mudstone.. med to dk gy, firm, blky, mmica, silty in pt 20% SLST.. med gy, qtz silt, mnr lith, mod cons, fri, sil cmt, arg to v arg, tr to 3% por. 10% SS.. s&p, vf gr, grdg to L f gr in pt, sa to srd, mod srtd, qtz, mnr lith, mod cons, sil cmt, clay mtx, 5-10% por.



1345-1360 80% Mudstone - Shale.. med to dk gy, firm, sl fis, mmica, blky, silty in pt, mnr intbdd slst and vf gr ss. 10% SLST.. lt to med gy qtz silt, mod cons, sil cmt, arg to v arg, tr to 3% por. 10% SS.. s&p, vf gr, sa to srd, mod srtd, qtz, mnr lith, mod cons, sil cmt, clay mtx, 5-10% por.

1360-1375 90% Mudstone - Shale.. dk gy, blky, sl fis, firm, mmica, silty in pt, some intbdd slst, tr med gy - brn silicified siderite ?. 10%SS.. v lt gy, s&p, vf gr, silt in pt, qtz, mnr lith, tr carb incl, sil cmt, clay mtx, 5-10% por.

1375-1390 100% Mudstone - Shale.. dk gy, mmica, firm, blky, plty in pt, sl fis, silty in pt, mnr to com thin intbdd slst and ss, tr py.



1390-1400 100% SH.. dk gy, mmica, sl fis, plty, firm, mnr intbdd slst and ss, mnr gy-brn brittle sid ?.

1400-1405 100% SH.. dk to v dk gy, hd, sl brittle, plty, sl fis, mmica, tr py mod, rr ss, 3-5% tan to lt gy-brn silicified siderite ?, pos silicified sh.

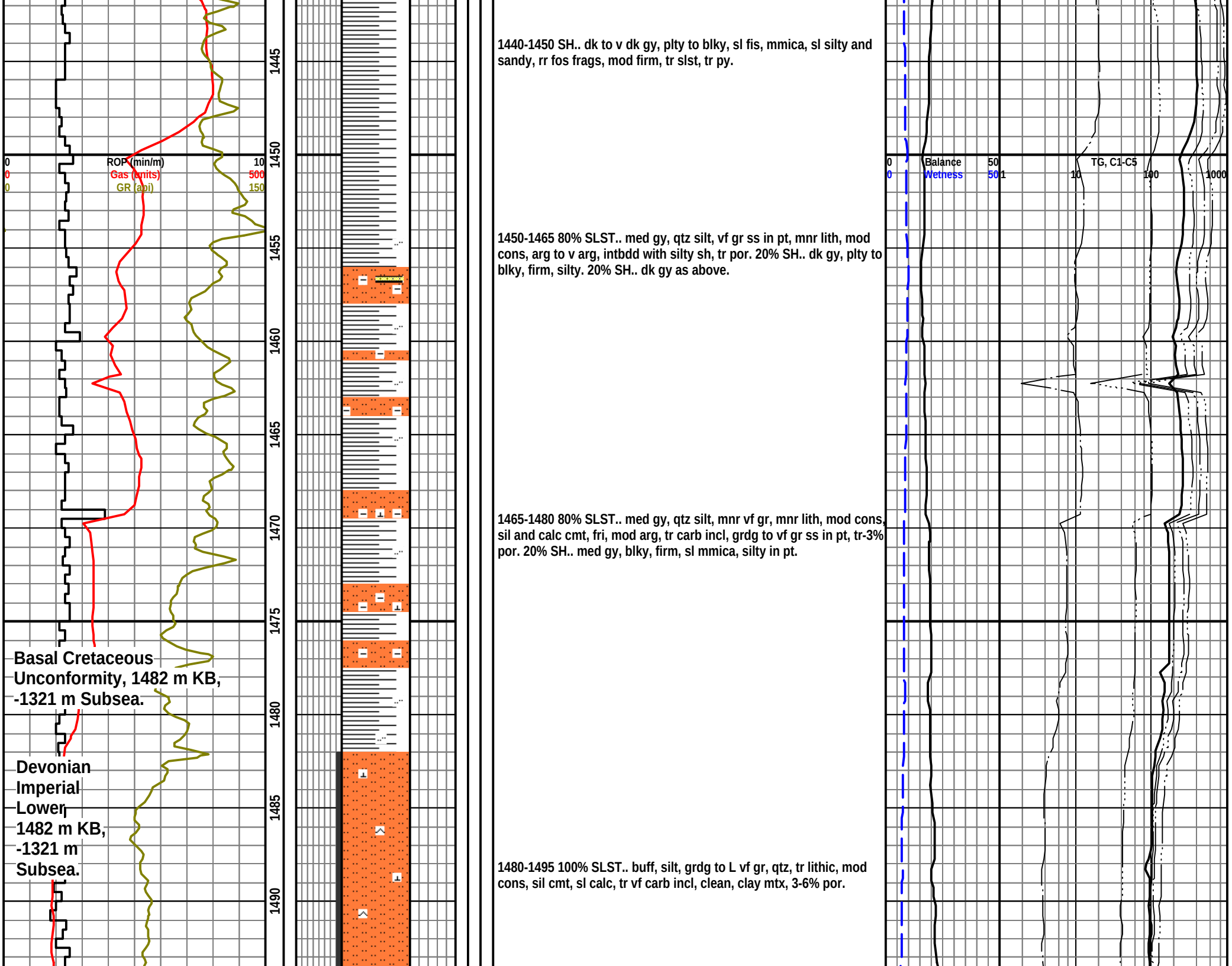
1405-1410 SH.. dk to v dk gy, mmica, plty, sl fis, hd, sl brittle, tr slst, tr scat py cubes, 5% gy-brn hd brittle, silicified, sid ?

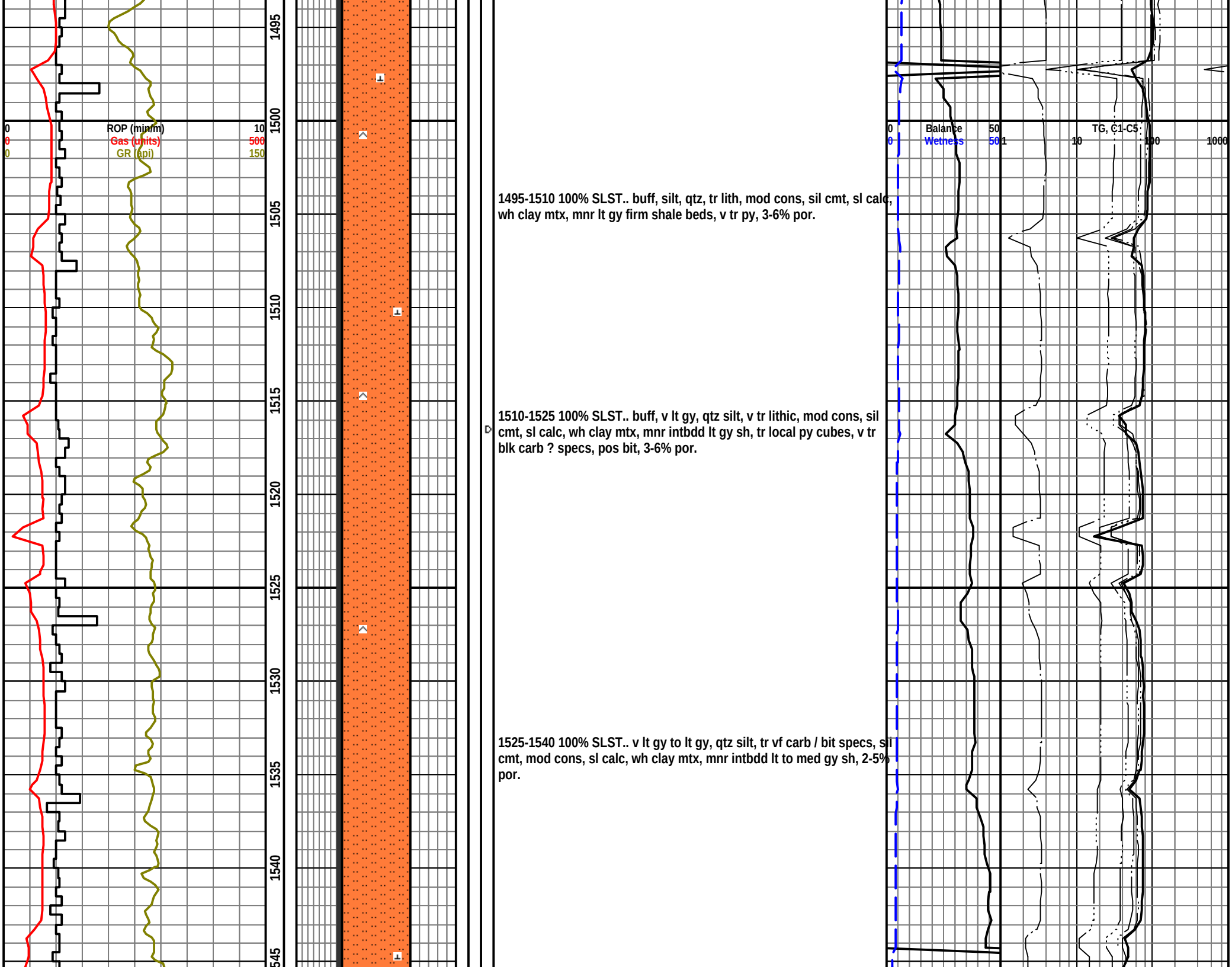
1410-1415 SH.. dk to v dk gy, hd, brittle, plty, sub fis, tr wh phosphate specs, tr py, tr to 2% hd brittles sid ?. 5% Clay.. buff, v lt gy, silty in pt, sandy in pt, local vf py xls, pos phosphatic.

1415-1420 SH.. dk to v dk gy, plty, firm to hd, sl fis, mmica, mnr scat wh phosphatic specs, tr nod py, tr to mnr buff to gy-blue clay, pos phosphatic, rr c calcite xls.

1420-1430 SH.. dk to v dk gy, plty, firm to hd, mmica, mnr scat wh phosphatic specs, tr py seams, tr ss, rr fos frags.

1430-1440 SH.. dk gy, plty, firm to hd, mmica, v tr wh phosphatic specs, tr micro lenses of slst, rr blue-gy clay, rr sid nodule, tr py.

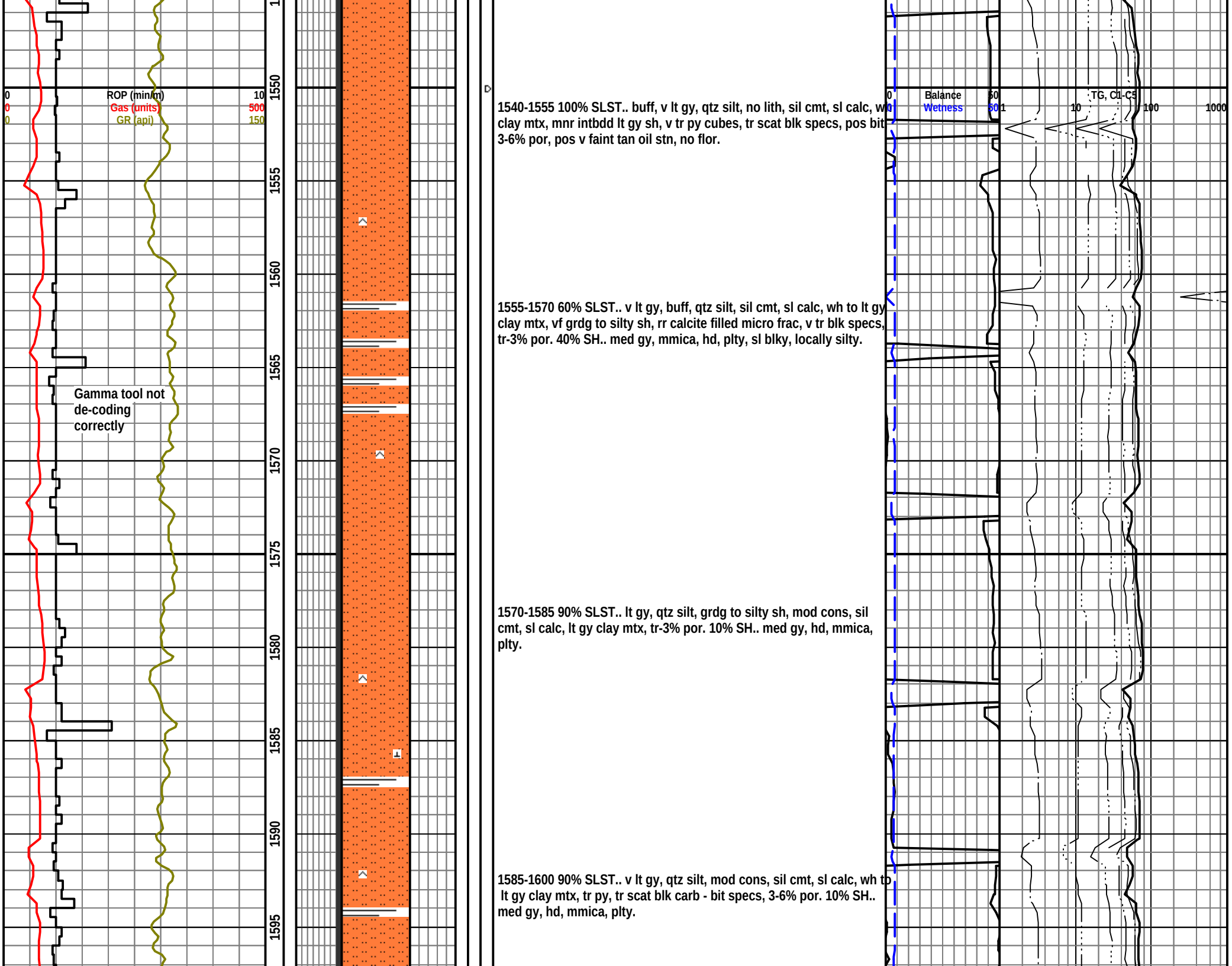

0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
Basal Cretaceous Unconformity, 1482 m KB, -1321 m Subsea.
Devonian Imperial Lower, 1482 m KB, -1321 m Subsea.
1440-1450 SH.. dk to v dk gy, plty to blky, sl fis, mmica, sl silty and sandy, rr fos frags, mod firm, tr slst, tr py.
1450-1465 80% SLST.. med gy, qtz silt, vf gr ss in pt, mnr lith, mod cons, arg to v arg, intbdd with silty sh, tr por. 20% SH.. dk gy, plty to blky, firm, silty. 20% SH.. dk gy as above.
1465-1480 80% SLST.. med gy, qtz silt, mnr vf gr, mnr lith, mod cons, sil and calc cmt, fri, mod arg, tr carb incl, grdg to vf gr ss in pt, tr-3% por. 20% SH.. med gy, blky, firm, sl mmica, silty in pt.
1480-1495 100% SLST.. buff, silt, grdg to L vf gr, qtz, tr lithic, mod cons, sil cmt, sl calc, tr vf carb incl, clean, clay mtx, 3-6% por.
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000



1495-1510 100% SLST.. buff, silt, qtz, tr lith, mod cons, sil cmt, sl calc, wh clay mtx, mnr lt gy firm shale beds, v tr py, 3-6% por.

1510-1525 100% SLST.. buff, v lt gy, qtz silt, v tr lithic, mod cons, sil cmt, sl calc, wh clay mtx, mnr intbdd lt gy sh, tr local py cubes, v tr blk carb ? specs, pos bit, 3-6% por.

1525-1540 100% SLST.. v lt gy to lt gy, qtz silt, tr vf carb / bit specs, sil cmt, mod cons, sl calc, wh clay mtx, mnr intbdd lt to med gy sh, 2-5% por.

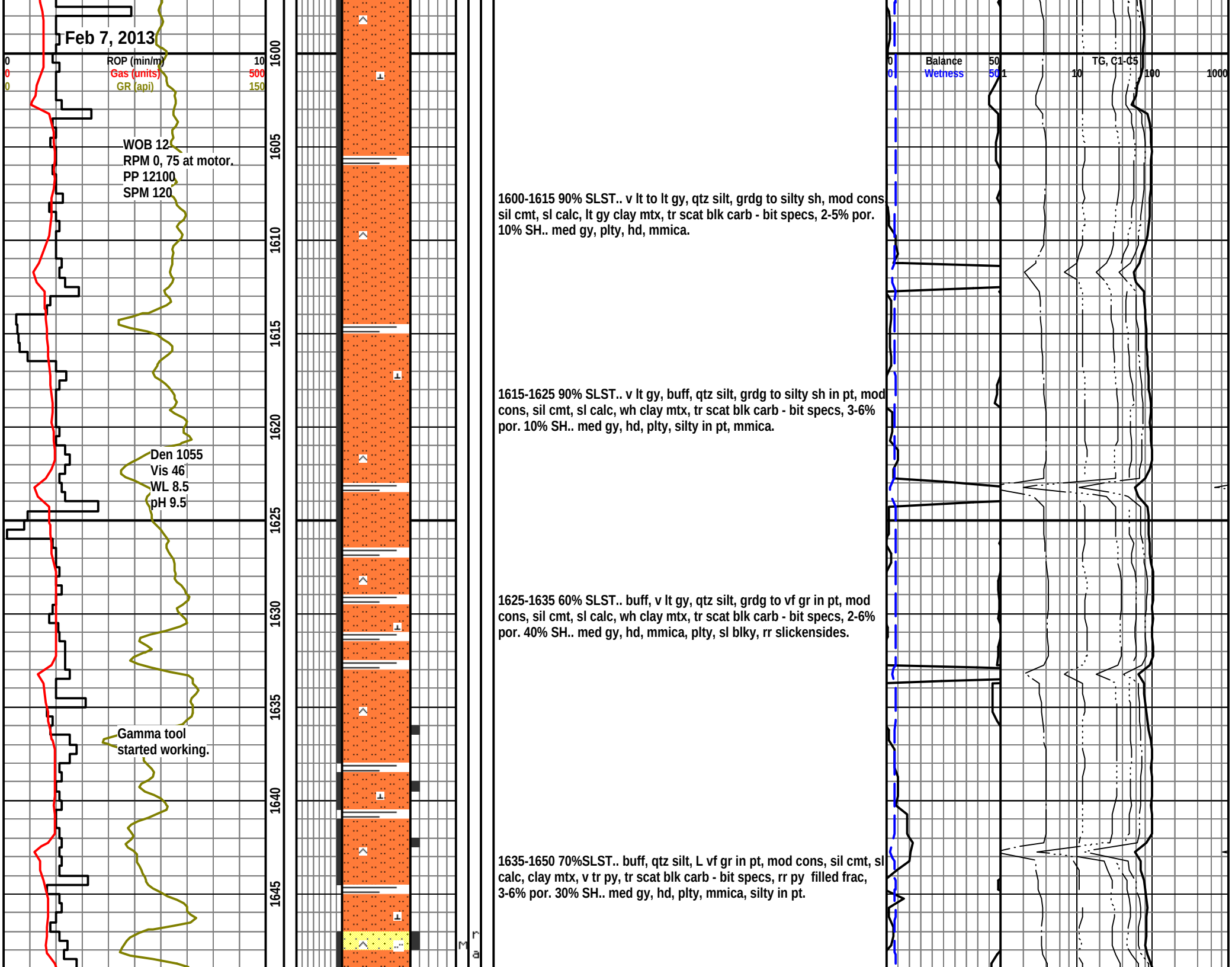


1540-1555 100% SLST.. buff, v lt gy, qtz silt, no lith, sil cmt, sl calc, wh clay mtx, mnr intbdd lt gy sh, v tr py cubes, tr scat blk specs, pos bit 3-6% por, pos v faint tan oil stn, no flor.

1555-1570 60% SLST.. v lt gy, buff, qtz silt, sil cmt, sl calc, wh to lt gy clay mtx, vf grdg to silty sh, rr calcite filled micro frac, v tr blk specs, tr-3% por. 40% SH.. med gy, mmica, hd, plty, sl blky, locally silty.

1570-1585 90% SLST.. lt gy, qtz silt, grdg to silty sh, mod cons, sil cmt, sl calc, lt gy clay mtx, tr-3% por. 10% SH.. med gy, hd, mmica, plty.

1585-1600 90% SLST.. v lt gy, qtz silt, mod cons, sil cmt, sl calc, wh to lt gy clay mtx, tr py, tr scat blk carb - bit specs, 3-6% por. 10% SH.. med gy, hd, mmica, plty.

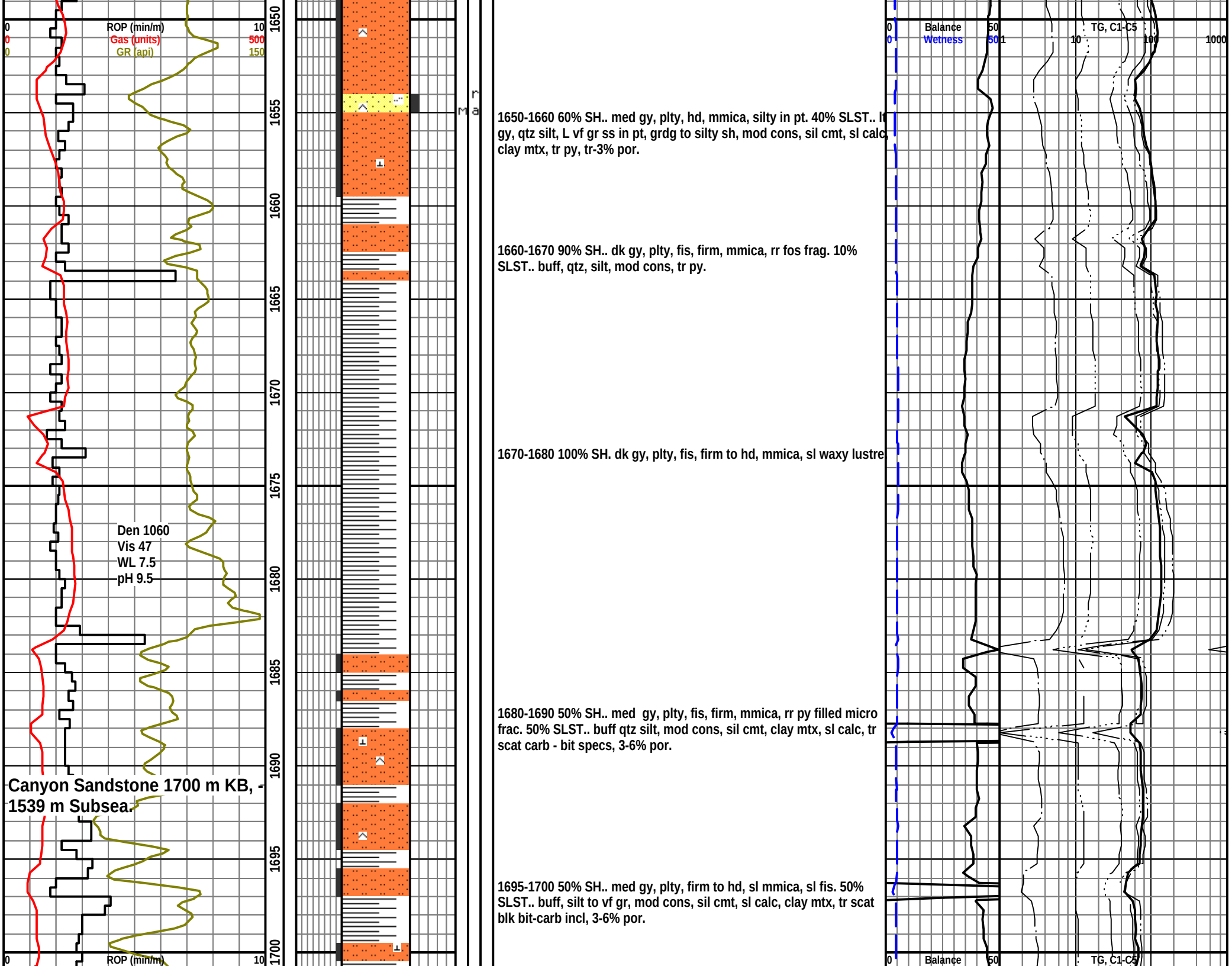


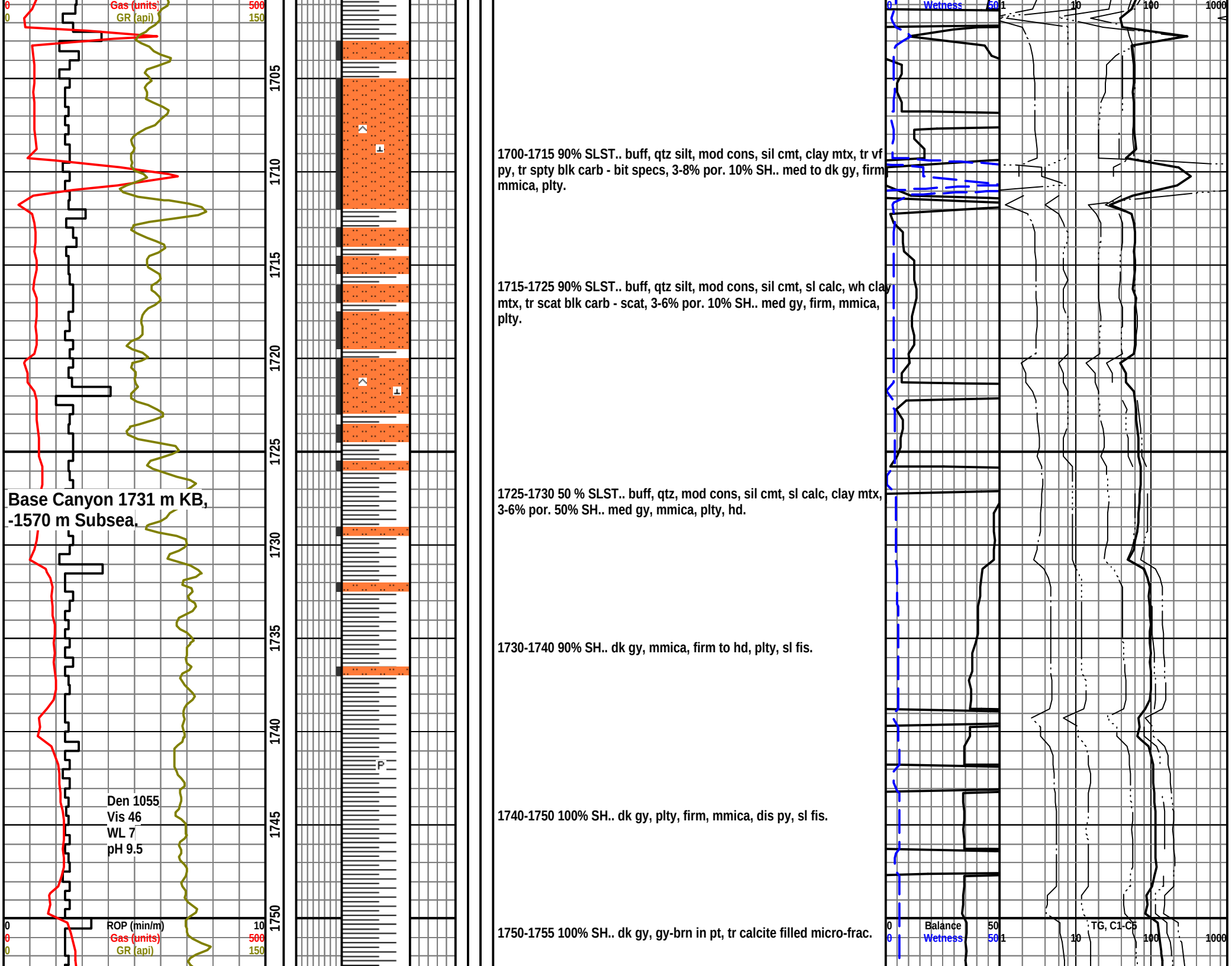
1600-1615 90% SLST.. v lt to lt gy, qtz silt, grdg to silty sh, mod cons sil cmt, sl calc, lt gy clay mtx, tr scat blk carb - bit specs, 2-5% por. 10% SH.. med gy, plty, hd, mmica.

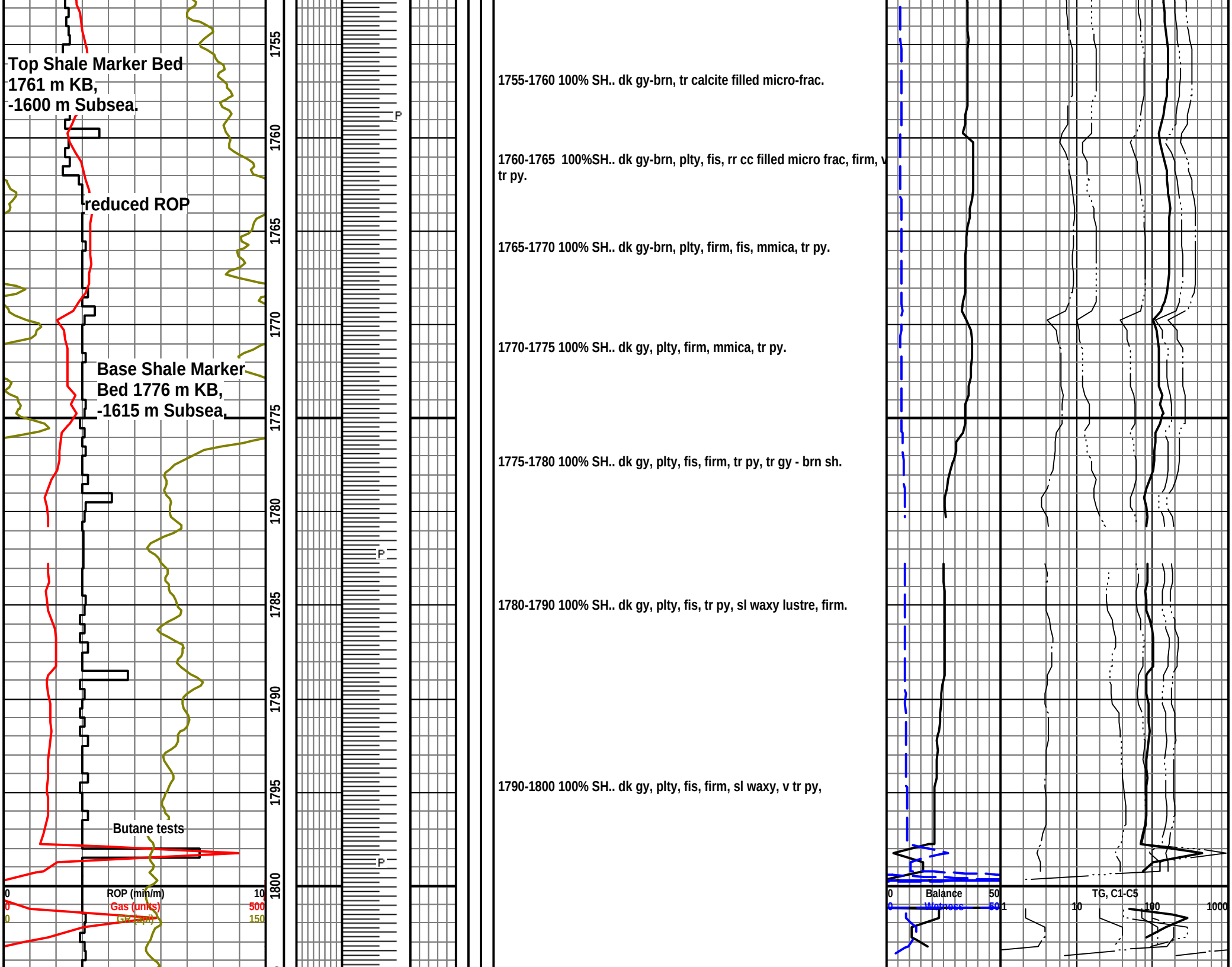
1615-1625 90% SLST.. v lt gy, buff, qtz silt, grdg to silty sh in pt, mod cons, sil cmt, sl calc, wh clay mtx, tr scat blk carb - bit specs, 3-6% por. 10% SH.. med gy, hd, plty, silty in pt, mmica.

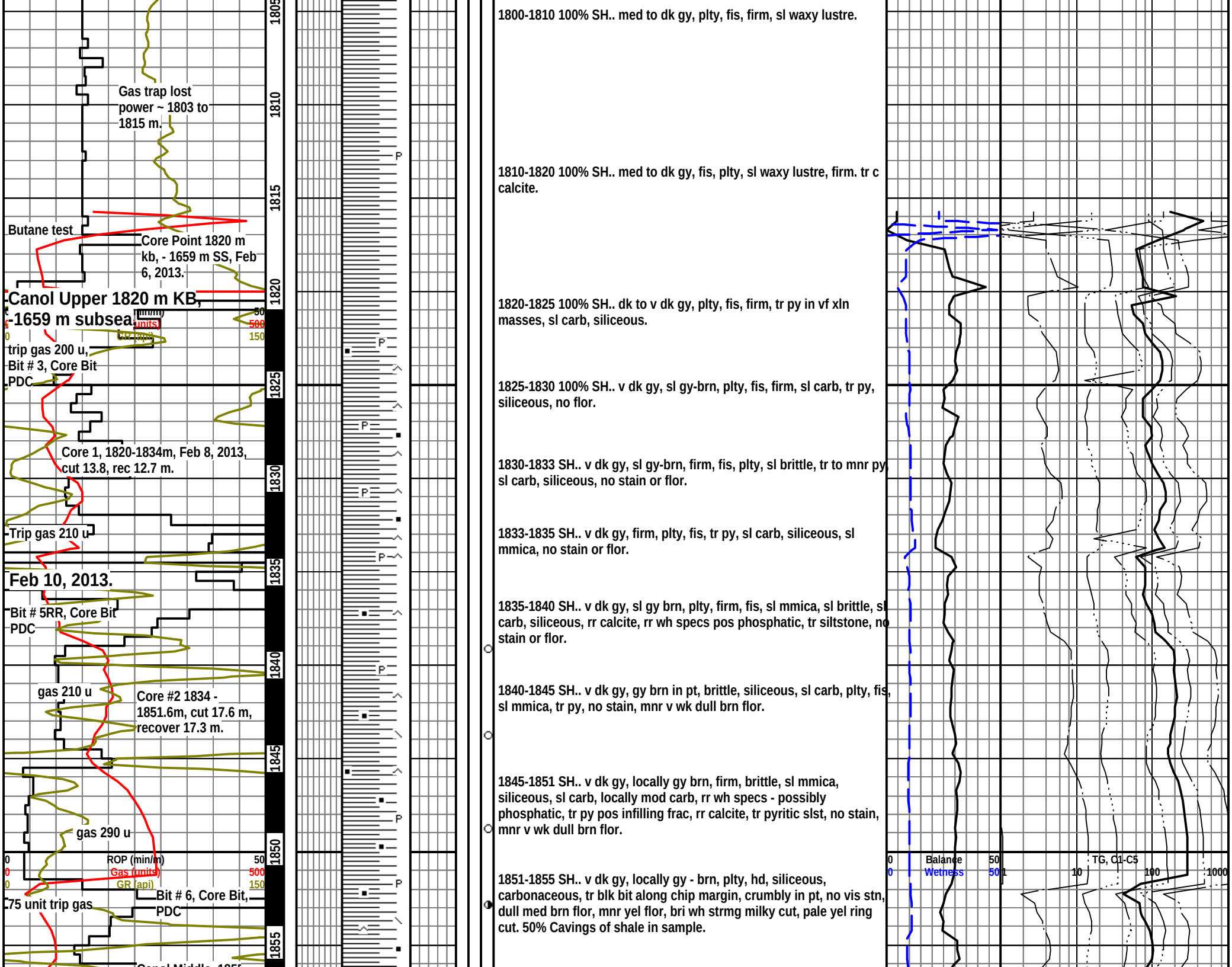
1625-1635 60% SLST.. buff, v lt gy, qtz silt, grdg to vf gr in pt, mod cons, sil cmt, sl calc, wh clay mtx, tr scat blk carb - bit specs, 2-6% por. 40% SH.. med gy, hd, mmica, plty, sl blky, rr slickensides.

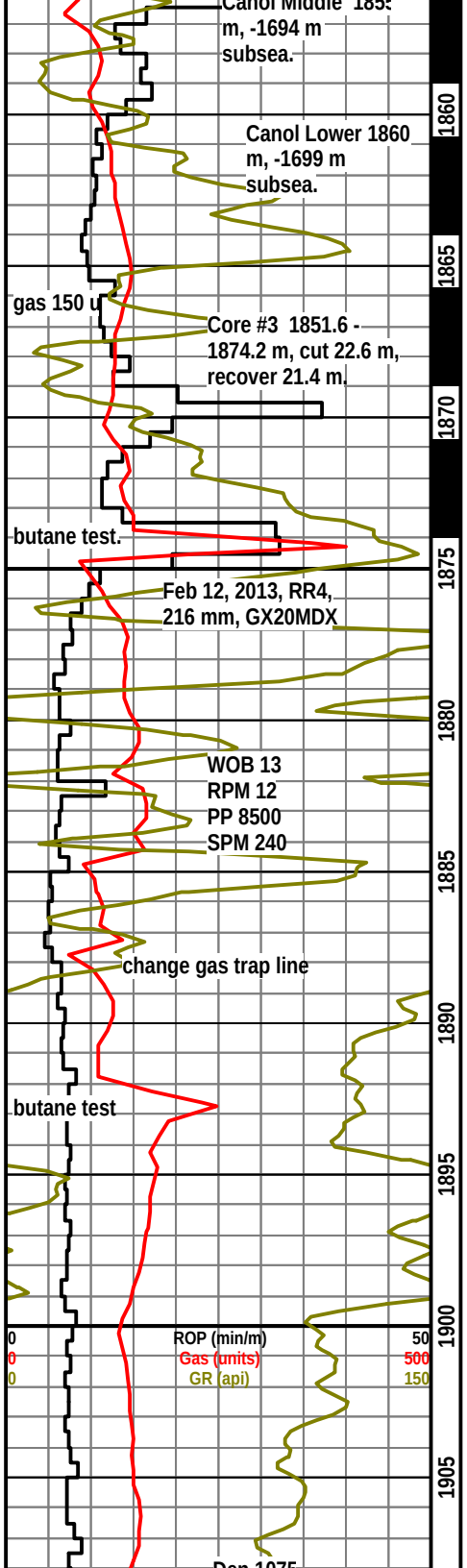
1635-1650 70%SLST.. buff, qtz silt, L vf gr in pt, mod cons, sil cmt, sl calc, clay mtx, v tr py, tr scat blk carb - bit specs, rr py filled frac, 3-6% por. 30% SH.. med gy, hd, plty, mmica, silty in pt.

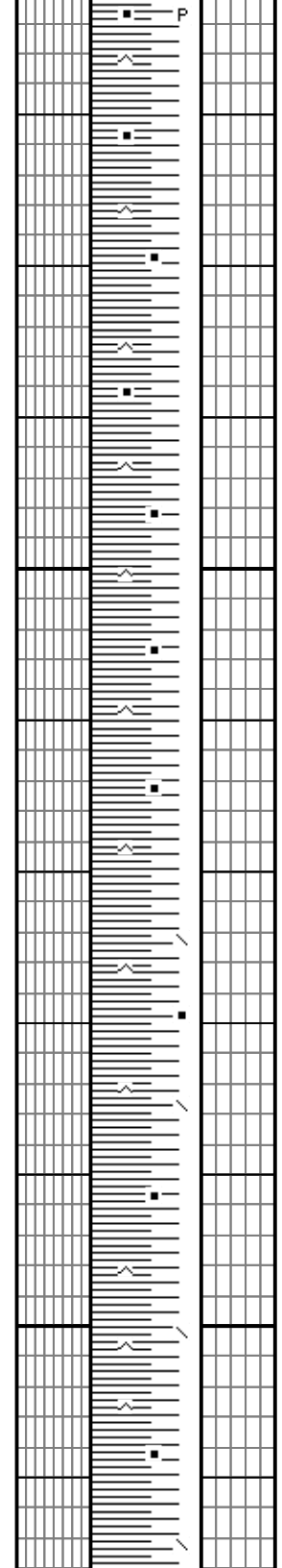

0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
Den 1060
Vis 47
WL 7.5
pH 9.5
Canyon Sandstone 1700 m KB, -1539 m Subsea.
0
ROP (min/m)
10
1650-1660 60% SH.. med gy, plty, hd, mmica, silty in pt. 40% SLST.. lt gy, qtz silt, L vf gr ss in pt, grdg to silty sh, mod cons, sil cmt, sl calc, clay mtx, tr py, tr-3% por.
1660-1670 90% SH.. dk gy, plty, fis, firm, mmica, rr fos frag. 10% SLST.. buff, qtz, silt, mod cons, tr py.
1670-1680 100% SH. dk gy, plty, fis, firm to hd, mmica, sl waxy lustre
1680-1690 50% SH.. med gy, plty, fis, firm, mmica, rr py filled micro frac. 50% SLST.. buff qtz silt, mod cons, sil cmt, clay mtx, sl calc, tr scat carb - bit specs, 3-6% por.
1695-1700 50% SH.. med gy, plty, firm to hd, sl mmica, sl fis. 50% SLST.. buff, silt to vf gr, mod cons, sil cmt, sl calc, clay mtx, tr scat blk bit-carb incl, 3-6% por.
0
Balance
50
TG, C1-C5
0
Wetness
50
1
10
100
1000
0
Balance
50
TG, C1-C5


0
Gas (units)
500
0
GR (api)
150
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
Base Canyon 1731 m KB,
-1570 m Subsea.
Den 1055
Vis 46
WL 7
pH 9.5
0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1700-1715 90% SLST.. buff, qtz silt, mod cons, sil cmt, clay mtx, tr vf py, tr spty blk carb - bit specs, 3-8% por. 10% SH.. med to dk gy, firm, mmica, plty.
1715-1725 90% SLST.. buff, qtz silt, mod cons, sil cmt, sl calc, wh clay mtx, tr scat blk carb - scat, 3-6% por. 10% SH.. med gy, firm, mmica, plty.
1725-1730 50 % SLST.. buff, qtz, mod cons, sil cmt, sl calc, clay mtx, 3-6% por. 50% SH.. med gy, mmica, plty, hd.
1730-1740 90% SH.. dk gy, mmica, firm to hd, plty, sl fis.
1740-1750 100% SH.. dk gy, plty, firm, mmica, dis py, sl fis.
1750-1755 100% SH.. dk gy, gy-brn in pt, tr calcite filled micro-frac.
0
Wetness
50
1
10
100
1000
0
Balance
50
0
Wetness
50
1
10
TG, C1-C5
100
1000


Top Shale Marker Bed
1761 m KB,
-1600 m Subsea.
reduced ROP
Base Shale Marker
Bed 1776 m KB,
-1615 m Subsea.
Butane tests
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
P
P
P
0
ROP (min/m)
10
0
Gas (units)
500
0
GR (api)
150
1755-1760 100% SH.. dk gy-brn, tr calcite filled micro-frac.
1760-1765 100%SH.. dk gy-brn, plty, fis, rr cc filled micro frac, firm, v
tr py.
1765-1770 100% SH.. dk gy-brn, plty, firm, fis, mmica, tr py.
1770-1775 100% SH.. dk gy, plty, firm, mmica, tr py.
1775-1780 100% SH.. dk gy, plty, fis, firm, tr py, tr gy - brn sh.
1780-1790 100% SH.. dk gy, plty, fis, tr py, sl waxy lustre, firm.
1790-1800 100% SH.. dk gy, plty, fis, firm, sl waxy, v tr py,
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000


1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
Gas trap lost power ~ 1803 to 1815 m.
Butane test
Core Point 1820 m kb, - 1659 m SS, Feb 6, 2013.
Canol Upper 1820 m KB, -1659 m subsea
ROP (min/m)
Gas (units)
GR (api)
trip gas 200 u,
Bit # 3, Core Bit
PDC
Core 1, 1820-1834m, Feb 8, 2013, cut 13.8, rec 12.7 m.
Trip gas 210 u
Feb 10, 2013.
Bit # 5RR, Core Bit
PDC
gas 210 u
Core #2 1834 - 1851.6m, cut 17.6 m, recover 17.3 m.
gas 290 u
75 unit trip gas
Bit # 6, Core Bit,
PDC
1800-1810 100% SH.. med to dk gy, plty, fis, firm, sl waxy lustre.
1810-1820 100% SH.. med to dk gy, fis, plty, sl waxy lustre, firm. tr c calcite.
1820-1825 100% SH.. dk to v dk gy, plty, fis, firm, tr py in vf xln masses, sl carb, siliceous.
1825-1830 100% SH.. v dk gy, sl gy-brn, plty, fis, firm, sl carb, tr py, siliceous, no flor.
1830-1833 SH.. v dk gy, sl gy-brn, firm, fis, plty, sl brittle, tr to mnr py, sl carb, siliceous, no stain or flor.
1833-1835 SH.. v dk gy, firm, plty, fis, tr py, sl carb, siliceous, sl mmica, no stain or flor.
1835-1840 SH.. v dk gy, sl gy brn, plty, firm, fis, sl mmica, sl brittle, sl carb, siliceous, rr calcite, rr wh specs pos phosphatic, tr siltstone, no stain or flor.
1840-1845 SH.. v dk gy, gy brn in pt, brittle, siliceous, sl carb, plty, fis, sl mmica, tr py, no stain, mnr v wk dull brn flor.
1845-1851 SH.. v dk gy, locally gy brn, firm, brittle, sl mmica, siliceous, sl carb, locally mod carb, rr wh specs - possibly phosphatic, tr py pos infilling frac, rr calcite, tr pyritic slst, no stain, mnr v wk dull brn flor.
1851-1855 SH.. v dk gy, locally gy - brn, plty, hd, siliceous, carbonaceous, tr blk bit along chip margin, crumbly in pt, no vis stn, dull med brn flor, mnr yel flor, bri wh strmg milky cut, pale yel ring cut. 50% Cavings of shale in sample.
Balance
Wetness
TG, C1-C5





1855-1860 SH.. v dk gy to gyish brn, hd, brittle, siliceous, carbonaceous, tr py frac infil, sub plty, sl crumbly, tr carb slst, rr calcite, no vis stn, dull brn to locally yellow flor, fast strmg bri milky cut, dk yel ring cut.

1860-1865 SH.. v dk gy to gyish brn, plty, hd, siliceous, carbonaceous, crumbly in pt, tr calcite frac infil, no vis stn, dull brn to medium brn flor, bri wh strmg cut.

1865-1870 SH.. dk brnish gy, v dk gy, sub plty, fis, mod siliceous, firm, tr py, tr calcite fracture fill, rr blk dry bit chip, no vis stn, spty med brn flor, bri wh strmg milky cut.

1870-1872 SH.. v dk gy, mnr gy brn, hd, brittle, plty, sub plty in pt, siliceous, sl carb, tr slst , tr calcite frac infil, no vis stn, spty dull brn flor, bri wh milky cut.

1872-1880 after trip, SH.. v dk gy, brnish gy in pt, mmica, hd, brit, sili tr calcite lined frac surfaces, carb, no vis stn, spty dull brn flor, wk strmg milky cut.

1880-1885 SH.. v dk gy, mmica, hd, silic, carb, num calcite filled hairline frac, no vis stn, spty to even med brn cut, mod strmg milky cut, med yel ring cut.

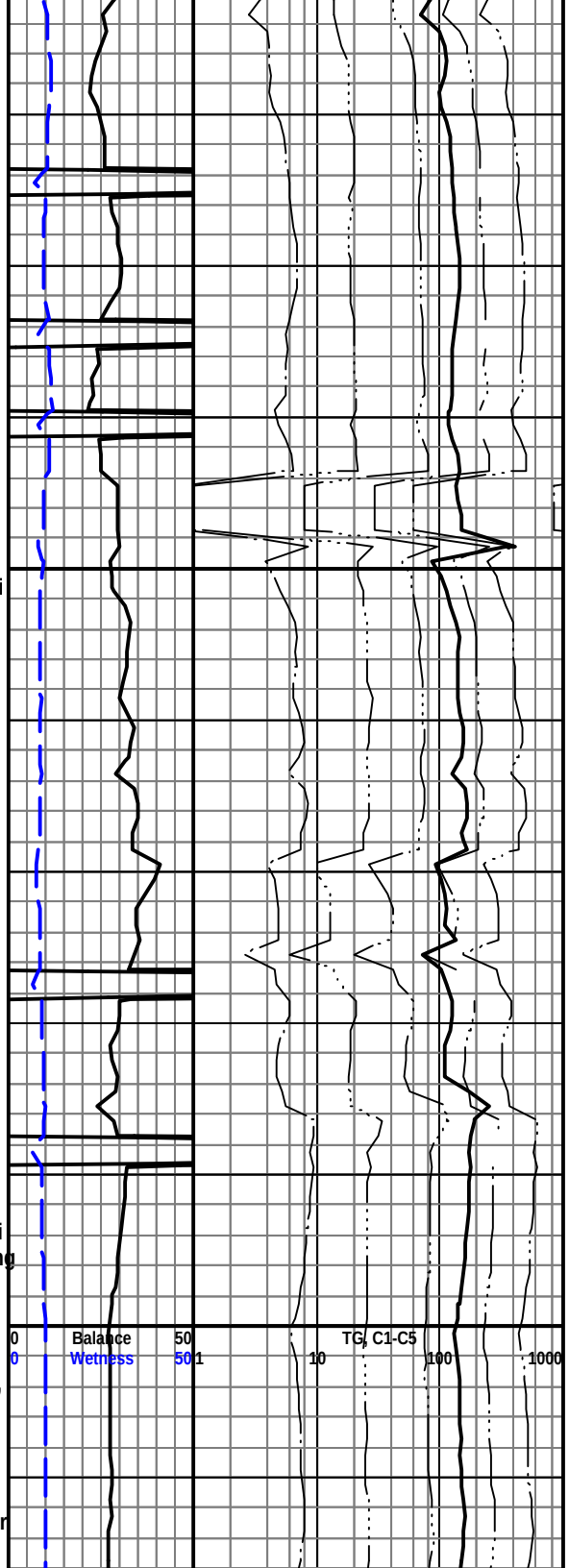
1885-1890 SH.. v dk gy, brnish gy in pt, mmica, hd, brit, silic, carb - bit, tr calcite lined frac, tr py, no vis stn, spty to even med brn flor, slow milky strmg cut, med yel ring cut.

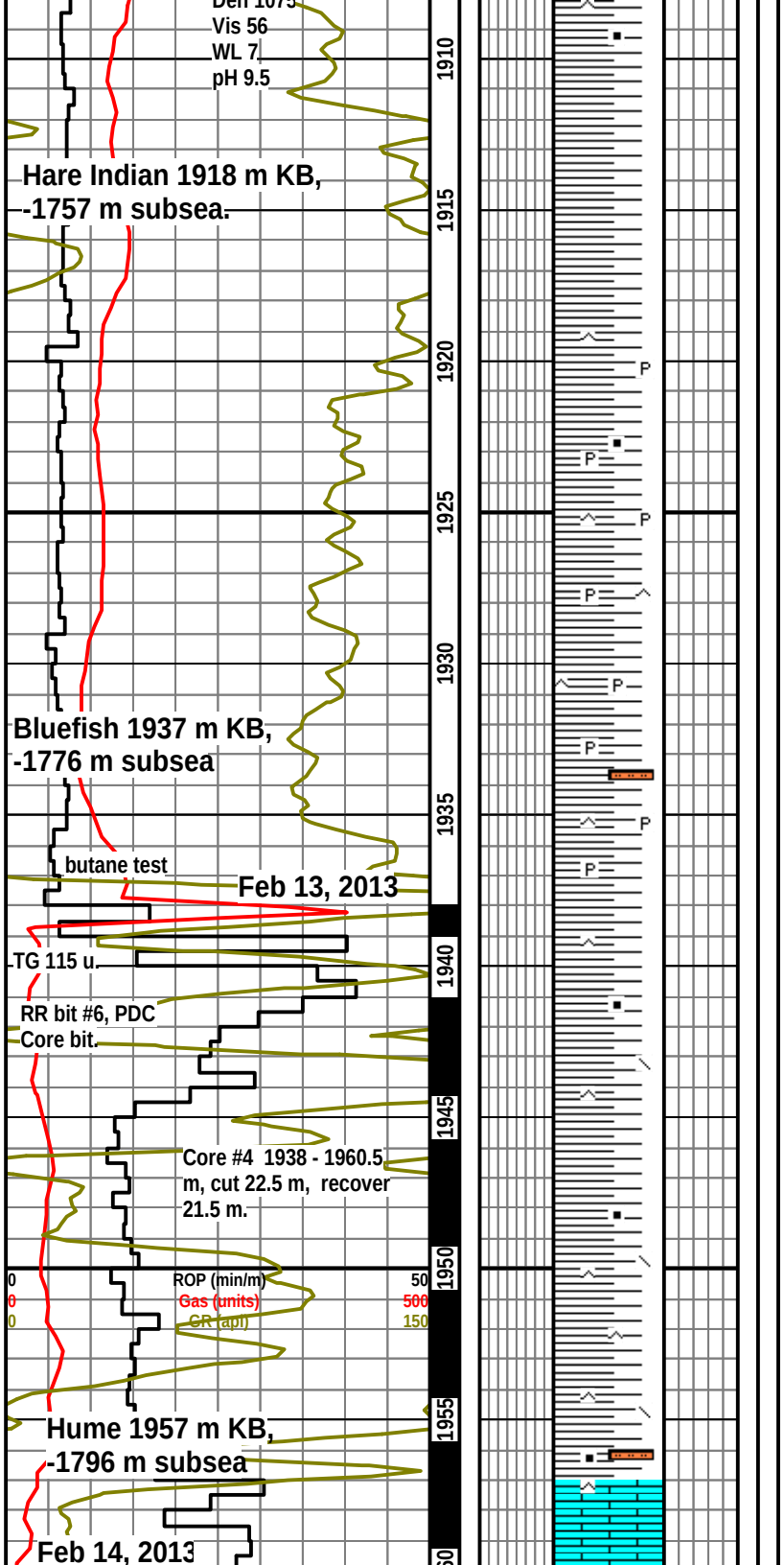
1890-1895 SH.. v dk gy, brnish gy, mmica, hd, brit, silic, carb - bit, tr calcite filled hairline to v narrow frac, tr micxln py masses, sl bit appearance in pt, no vis stn, mod milky strmg cut, med yel ring cut.

1895-1900 SH.. v dk gy, brnish gy, mmica, hd, silic, carb - bit, tr calci lined frac, tr pyritic slst, no vis stn, mod strmg milky cut, med yel ring cut.

1900-1905 SH.. v dk gy, brnish gy, mmica, hd, brit, silic, carb - bit, some calcite filled micro frac, tr f to med clr calc xls on frac surface, tr py, bituminous appearance in pt, no vis oil stn, v wk brn flor, mod milky strmg cut, yel ring cut.

1905-1910 SH.. v dk gy, brnish gy, hd, silic, mmica, carb - bit, tr py, tr calcite filled micro frac, sl bit, no vis oil stn, even dull brn flor, mod





milky strmg cut, yel ring cut

1910-1920 no samples.

1920-1925 SH.. v dk gy, mnr brnish gy, mmica, hd, silic, carb, tr py chips , tr calcite filled micro frac, no vis stn, even to spty med brn flor, slow milky strmg cut.

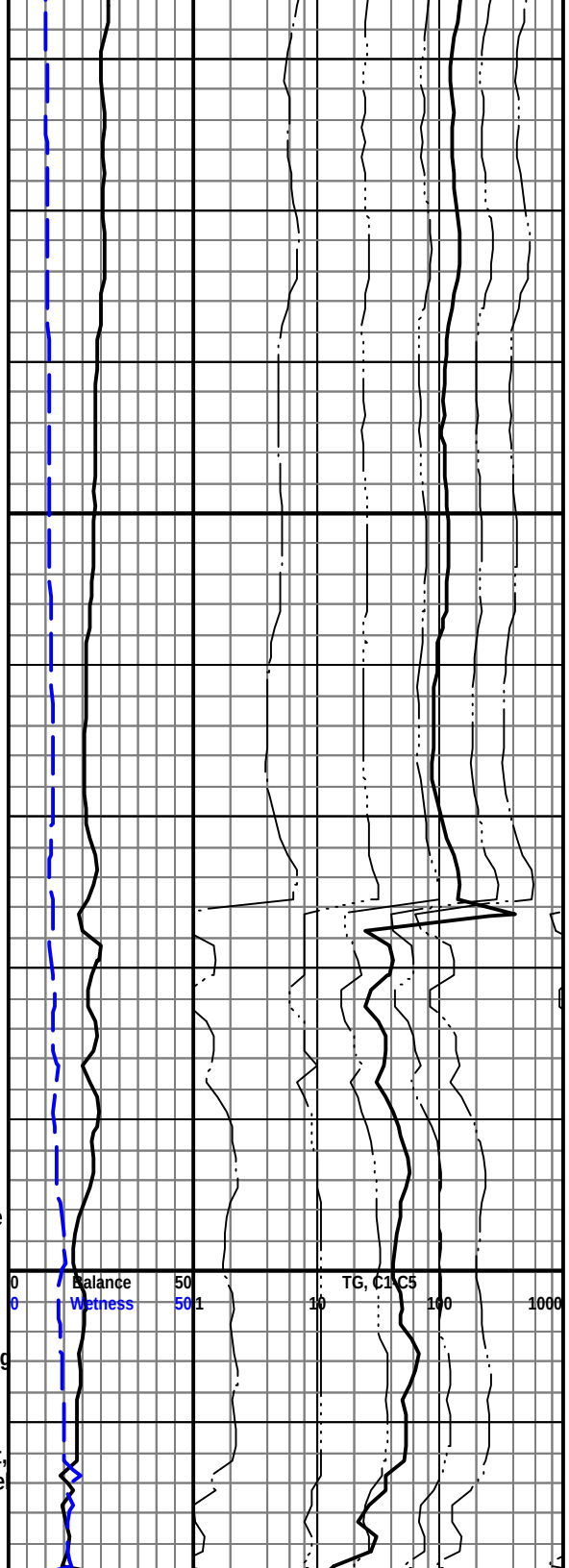
1925-1930 SH.. v dk gy, hd, silic, mmica, tr py chips. silic, sl carb, rr calcite frac infil, no vis stn, even to spty med brn flor, v slow strmg milky cut.

1930-1938 SH.. v dk gy, mmica, hd, siliceous, sl carb, tr py chips, tr slst, no stn, even to spty med brn flor, slow milky strmg cut.

1938-1940 after trip, SH.. dk gy., mmica, firm., plty, fis, mod silic, sl carb, rr calcite fracture infil tr py, tr slst.

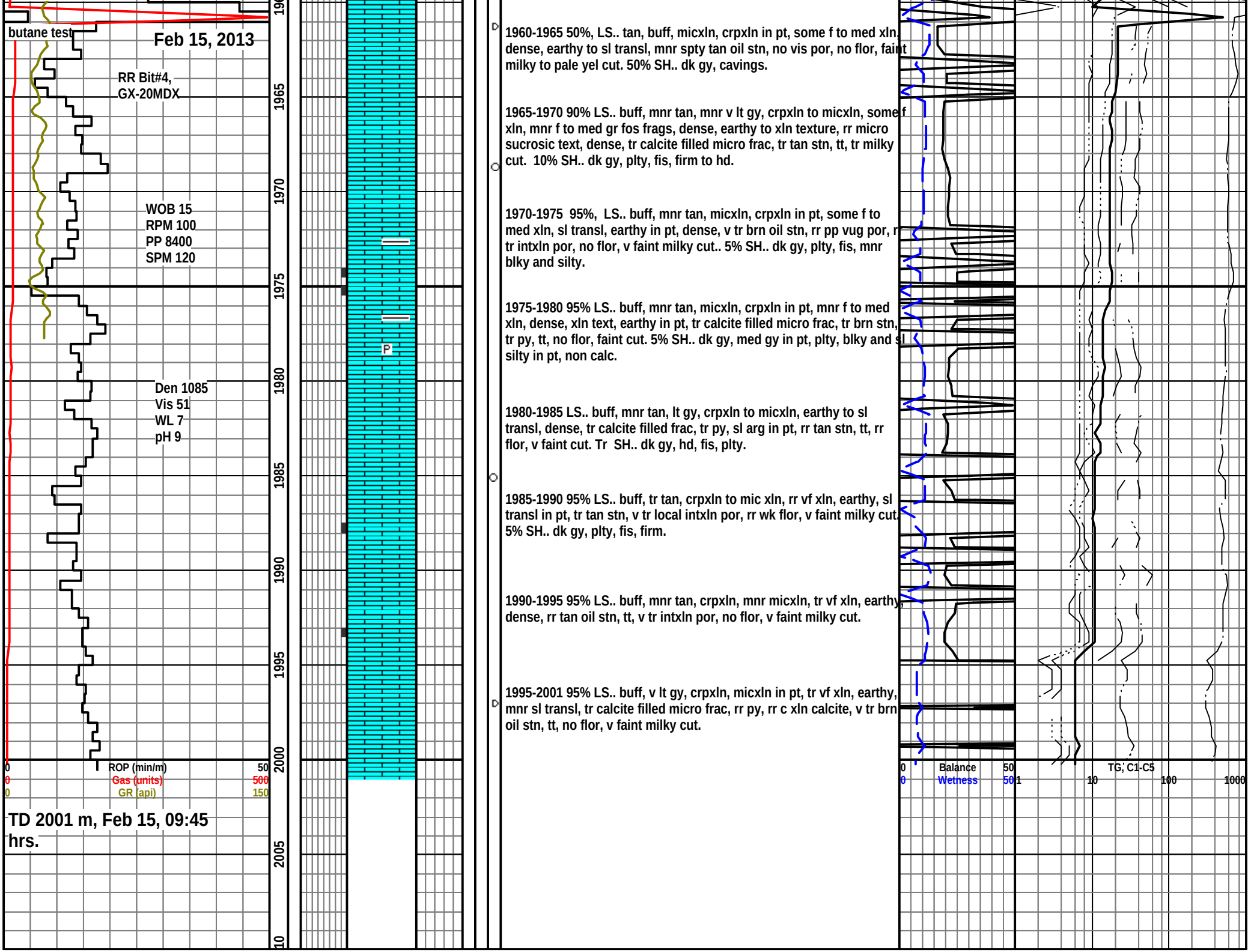
1940-1945 SH.. dk gy, mmica, firm, plty, fis, sl silic, sl carb, tr wh calcite frac infil, tr lt gy, crpxln calcareous chips, tr py, no vis stn, even to spty dull brn flor, slow milky strmg cut, yel ring cut.

1945-1950 SH.. v dk gy, plty, fis, hd, silic, carb, several calcite filled micro frac, com lt gy crpxln calcite, no vis stn, dull brn flor, slow strmg milky cut. Note.. the lt gy calcareous chips are bitumen staine and are occasionally contain clean wh calcite filled micro fracs.



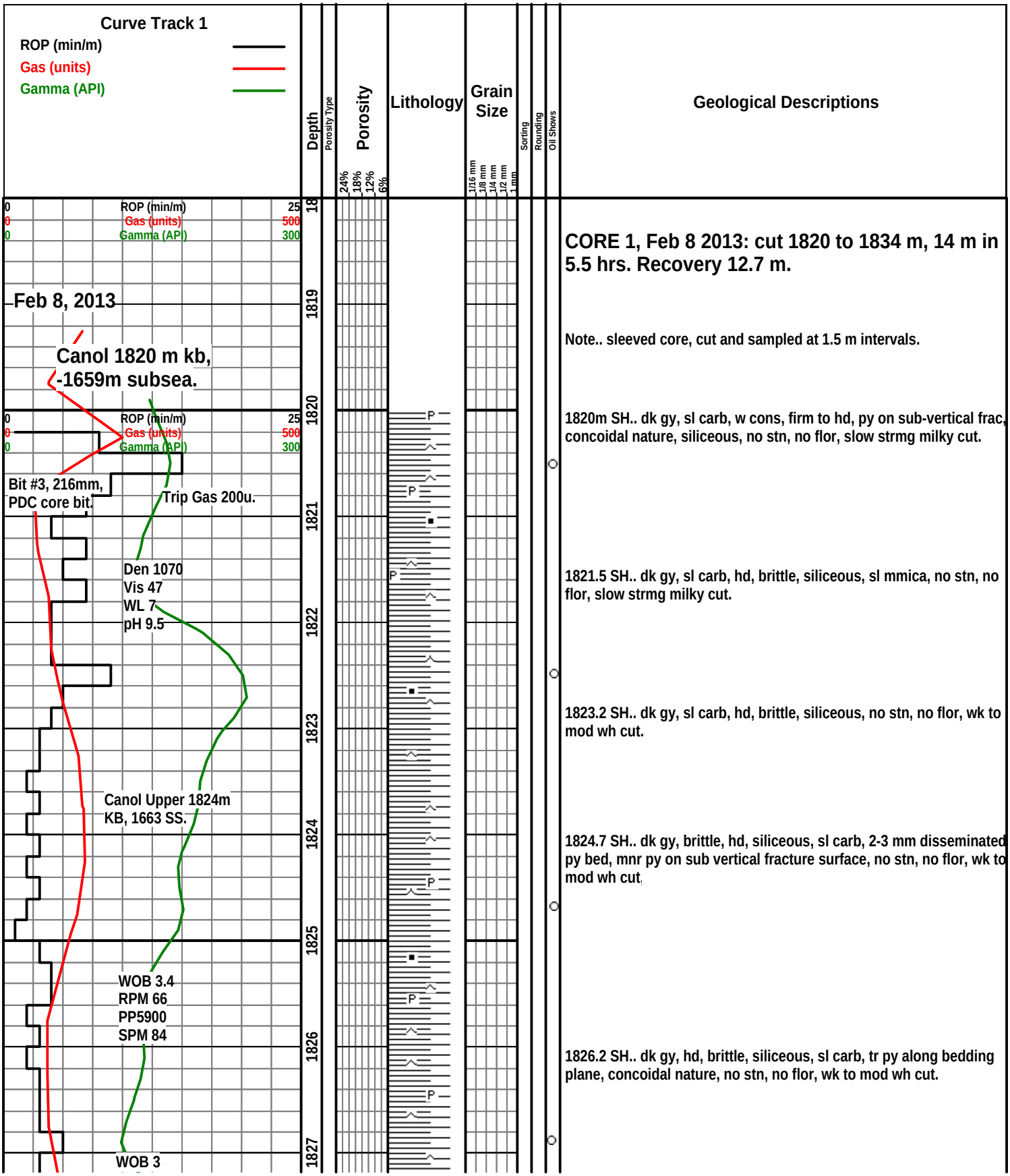
1950-1955 SH.. v dk gy, sl gy - brn, firm to hd, silic, carb, plty, fis, tr py, tr lt gy calc chips, dull med brn flor, mod strmg milky cut, yel ring cut.

1955-1960 SH.. v dk gy, gy brn, plty, fis, hd, sl mmica, silic, carb - bit, tr lt gy calc chips, tr wh sl oil stained slst, no vis stn, dull brn flor, ye flor in slst, mod strmg cut.


butane test
Feb 15, 2013
RR Bit#4,
GX-20MDX
WOB 15
RPM 100
PP 8400
SPM 120
Den 1085
Vis 51
WL 7
pH 9
P
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
0
ROP (min/m)
50
0
Gas (units)
500
0
GR (api)
150
TD 2001 m, Feb 15, 09:45 hrs.
1960-1965 50%, LS.. tan, buff, micxln, crpxln in pt, some f to med xln, dense, earthy to sl transl, mnr spty tan oil stn, no vis por, no flor, faint milky to pale yel cut. 50% SH.. dk gy, cavings.
1965-1970 90% LS.. buff, mnr tan, mnr v lt gy, crpxln to micxln, some f xln, mnr f to med gr fos frags, dense, earthy to xln texture, rr micro sucrosic text, dense, tr calcite filled micro frac, tr tan stn, tt, tr milky cut. 10% SH.. dk gy, plty, fis, firm to hd.
1970-1975 95%, LS.. buff, mnr tan, micxln, crpxln in pt, some f to med xln, sl transl, earthy in pt, dense, v tr brn oil stn, rr pp vug por, r tr intxln por, no flor, v faint milky cut.. 5% SH.. dk gy, plty, fis, mnr blky and silty.
1975-1980 95% LS.. buff, mnr tan, micxln, crpxln in pt, mnr f to med xln, dense, xln text, earthy in pt, tr calcite filled micro frac, tr brn stn, tr py, tt, no flor, faint cut. 5% SH.. dk gy, med gy in pt, plty, blky and sl silty in pt, non calc.
1980-1985 LS.. buff, mnr tan, lt gy, crpxln to micxln, earthy to sl transl, dense, tr calcite filled frac, tr py, sl arg in pt, rr tan stn, tt, rr flor, v faint cut. Tr SH.. dk gy, hd, fis, plty.
1985-1990 95% LS.. buff, tr tan, crpxln to mic xln, rr vf xln, earthy, sl transl in pt, tr tan stn, v tr local intxln por, rr wk flor, v faint milky cut. 5% SH.. dk gy, plty, fis, firm.
1990-1995 95% LS.. buff, mnr tan, crpxln, mnr micxln, tr vf xln, earthy, dense, rr tan oil stn, tt, v tr intxln por, no flor, v faint milky cut.
1995-2001 95% LS.. buff, v lt gy, crpxln, micxln in pt, tr vf xln, earthy, mnr sl transl, tr calcite filled micro frac, rr py, rr c xln calcite, v tr brn oil stn, tt, no flor, v faint milky cut.
0
Balance
50
0
Wetness
50
1
TG, C1-C5
10
100
1000

CORE LOG 1:48 SCALE

Contractor: Baker Hughes
Core #: 1,2,3
Formation: Canol
Core Interval: From: 1820 m To: 1874.2 m
Cut: 54.2 m **Recovered:** 51.4 m
Bit type: PDC
Size: 216 mm
Coring Time: 17.5 hrs



CORE 1, Feb 8 2013: cut 1820 to 1834 m, 14 m in 5.5 hrs. Recovery 12.7 m.

Note.. sleeved core, cut and sampled at 1.5 m intervals.

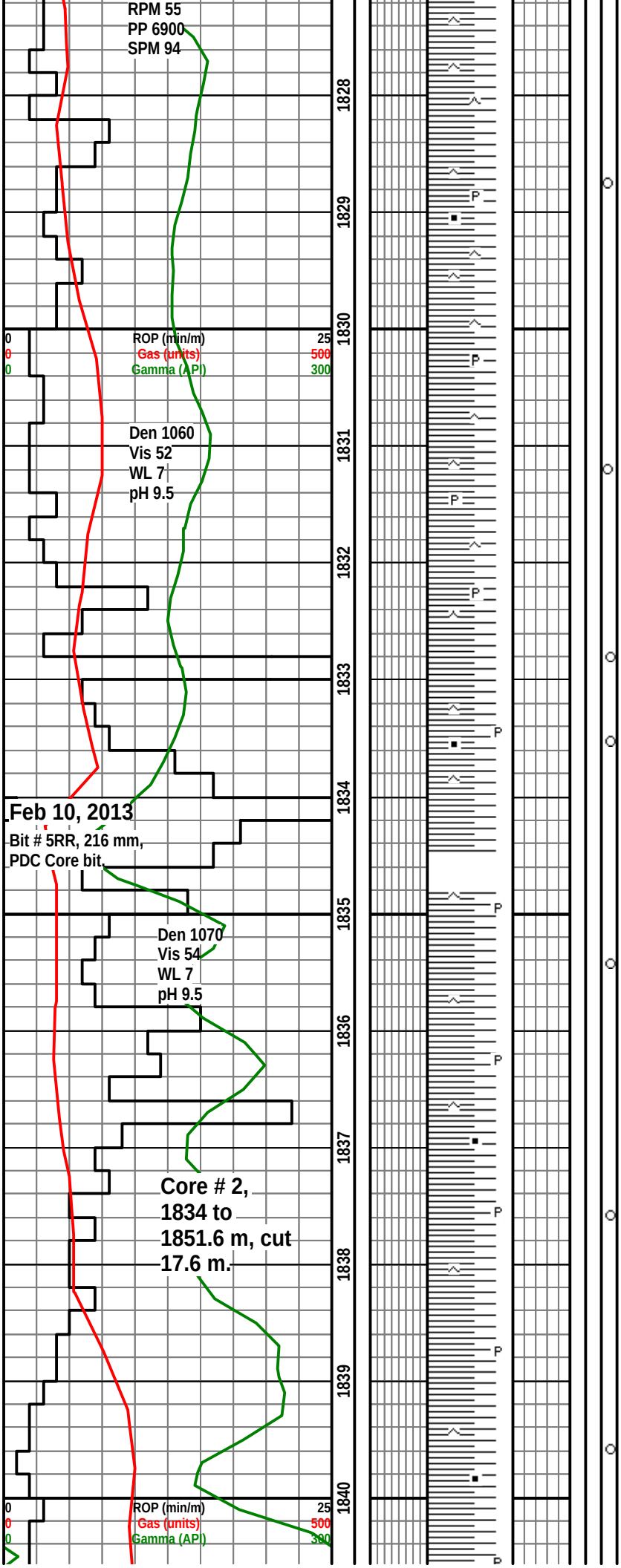
1820m SH.. dk gy, sl carb, w cons, firm to hd, py on sub-vertical frac, concoidal nature, siliceous, no stn, no flor, slow strmg milky cut.

1821.5 SH.. dk gy, sl carb, hd, brittle, siliceous, sl mmica, no stn, no flor, slow strmg milky cut.

1823.2 SH.. dk gy, sl carb, hd, brittle, siliceous, no stn, no flor, wk to mod wh cut.

1824.7 SH.. dk gy, brittle, hd, siliceous, sl carb, 2-3 mm disseminated py bed, mnr py on sub vertical fracture surface, no stn, no flor, wk to mod wh cut.

1826.2 SH.. dk gy, hd, brittle, siliceous, sl carb, tr py along bedding plane, concoidal nature, no stn, no flor, wk to mod wh cut.



1827.7 SH.. dk gy, hd, brittle, siliceous, sl carb, concoidal nature, v sl mmica, no stn, no flor, wk to mod wh cut.

1829.2 SH.. dk gy, hd, brittle, siliceous, sl carb, concoidal nature, tr py, no stn, no flor, wk milky strmg cut.

1830.7 SH.. dk gy, sl brn gy, hd, brittle, siliceous, sl carb, scat py on fracture plane, no flor, no stn, wk to mod milky cut.

1832.2 SH.. dk gy, sl brn, hd, brittle, siliceous, sl carb, concoidal frac no flor, no stn, mod milky cut.

1832.7 SH.. dk gy, sl brn, hd, brittle, siliceous, sl carb, scat dis, py, no flor, no stn, mod milky cut.

No Core 1832.7 to 1834 m, core shoe jammed with rubble chips.

CORE 2, Feb 10 2013: cut 1834 to 1851.6 m, 17.6 m in 5.75 hrs. Recovery 17.3 m

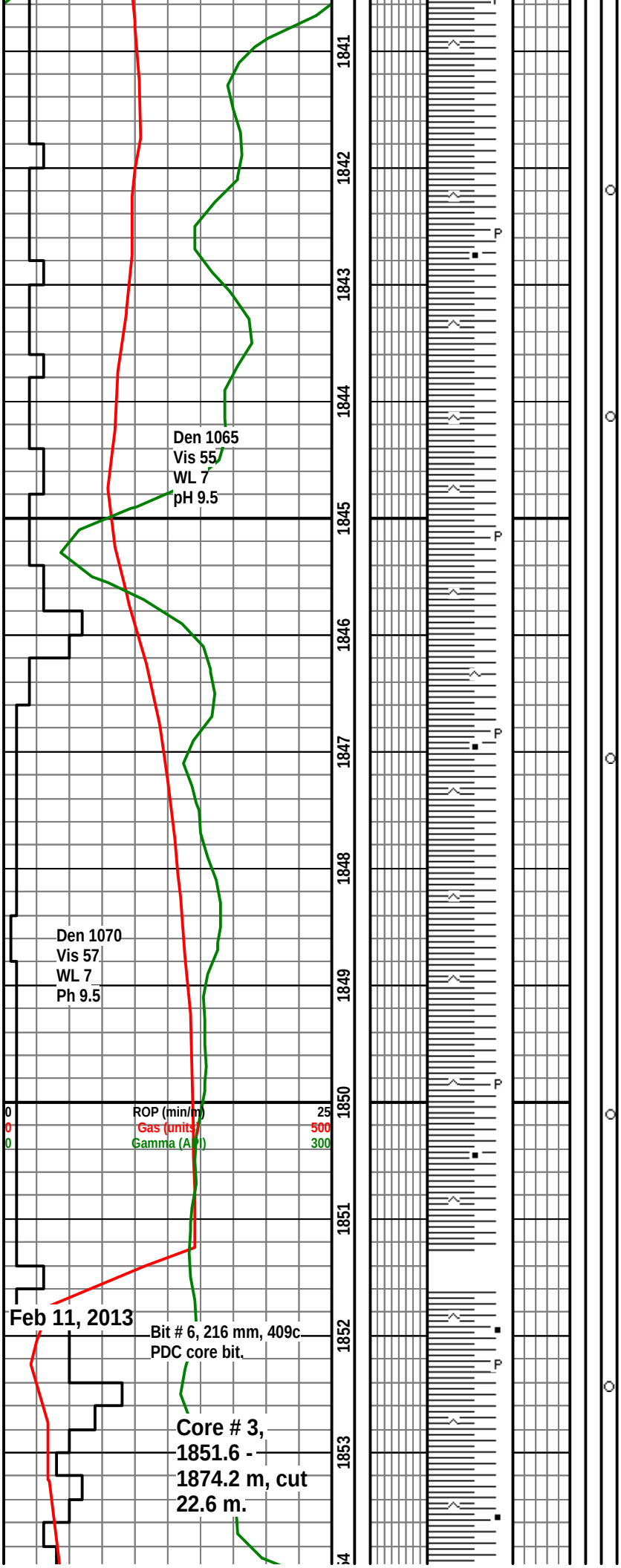
1834 SH.. dk gy, sl mmica, hd, brittle, siliceous, sl carb, tr scat py, no stain, no flor, slow mod wh cut.

1835.5 SH.. dk gy, sl mmica, hd, brittle, siliceous, com scat py needles, sl carb, no stn, no flor, strong wh cu

1837 SH.. dk gy, sl mmica, hd, brittle, siliceous, tr scat py needles, , sl carb, tr bit replacing micro fossils, tr moldic por, no stain, strong fast wh cut, sulfur odour.

1838.5 SH.. dk gy, brittle, siliceous, sl carb, tr dis py, fis, plty, sl sulfur odour, no stain, no flor, strong milky cut.

1840 SH.. dk gy, hd, sl mmica, sl carb, siliceous, py in a 2-3mm bed, no stain, no flor, strong milky cut, sulfur odou



1841.7 SH.. dk gy, hd, platy, fis, siliceous, tr calcite on vertical fracture surface, sl carb, tr scat py, no staining, dull brn flor, slow wh strmg cut, wk sulfur odour.

1843.2 SH.. dk gy, plty, fis, hd, siliceous, sl carb, tr py, no staining, dull brn flor, slow milky cut

1844.7 H.. dk gy, mmica, hd, siliceous, plty, sl carb, no staining, dull brn flor, slow milky cut.

1846.2 SH.. dk gy, hd, siliceous, platy, com scat micro py, no stain, dull brn flor, mod milky cut, sulfur odour.

1847.7 SH.. dk gy, hd, siliceous, sl mmica, no stain, dull brn flor, slow milky cut, sulfur odour

Note.. the milky cut dries to a pale yellow ring cut.

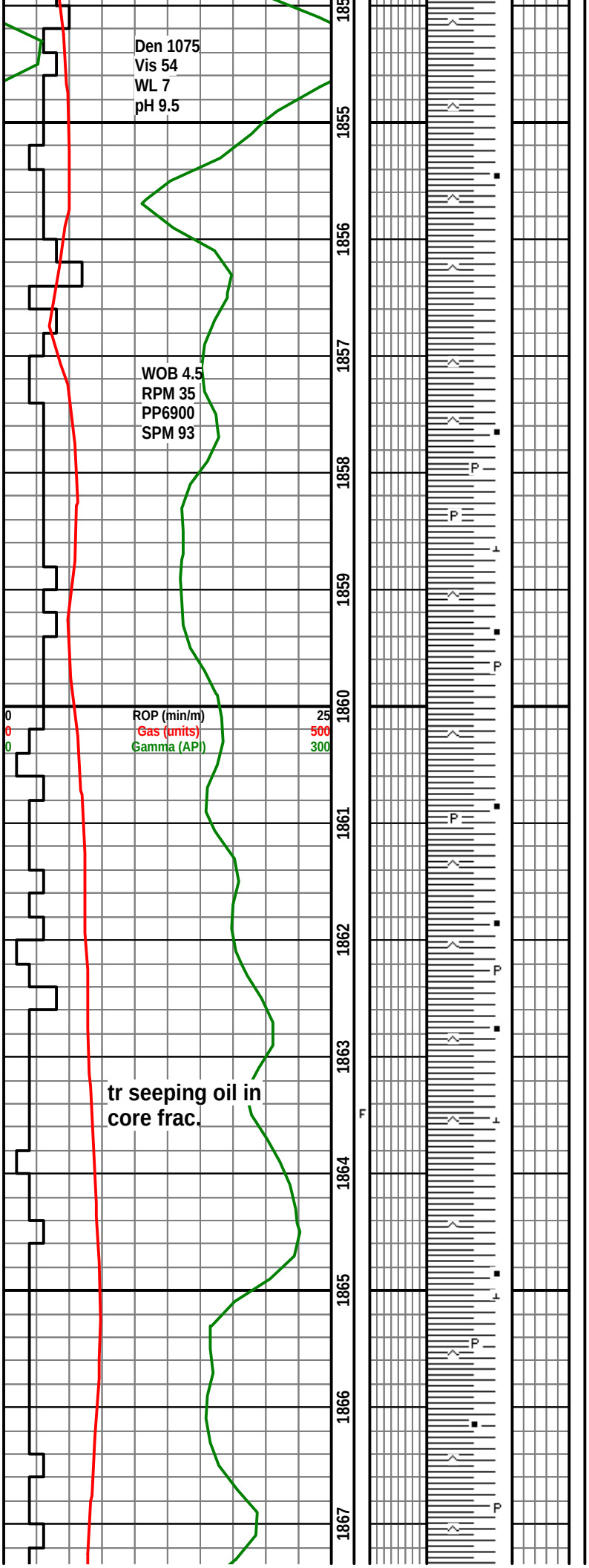
1849.2 SH.. dk gy, hd, siliceous, sl mmica, tr calcite on vertical frac surfaces, no stain, dull brn flor, mod to strong wh milky cut,

1850.7 SH.. dk gy, mmica, hd, siliceous, sl carb, tr py, tr py replacing a fossil, no stain, dull brn flor, mod milky cut, mod sulfur odour.

1851.3 SH.. dk gy, mmica, hd, siliceous, sl carb, pos slickensides, local rugose bedding surface - pos pressure solution, microscopic scat py, no staining, dull brn flor, mod to strong wh cut, wk sulfur odour.

CORE 3, Feb 11 2013: cut 1851.6 - 1874.2 m, 22.6 m in 6.75 hrs. Recovery 21.4 m

1853.1 SH.. dk gy, hd, brittle, siliceous, sl carb, micro scat py, no vis stn, wk dull brn flor, wk sulfur odour, bri wh strmg cut.



1854.3 SH.. dk gy, sl mmica, hd, brittle, siliceous, sl carb, no vis stn, dull dk brn flor, no sulfur odor, bri wh strmg cut.

1855.8 SH.. dk gy, hd, siliceous, sl carb, mmica, no vis stn, med brn flor, no sulfur odour, bri wh strmg cut.

Note.. white cut dries to a pale yellow ring cut.

1857.3 SH.. dk gy, hd, brittle, sl mmica, siliceous, sl carb, no vis stn, dull brn flor, no sulfur odor, bri wh strmg cut.

1858.8 SH.. dk gy, hd, sl mmica, siliceous, sl carb, calcite coating on sub vertical frac, calcite +/- dol on horiz bedding surfaces, tr vf gran py in v thin horiz beds, no vis stn, dull brn flor, wk sulfur odour, bri wh strmg cut.

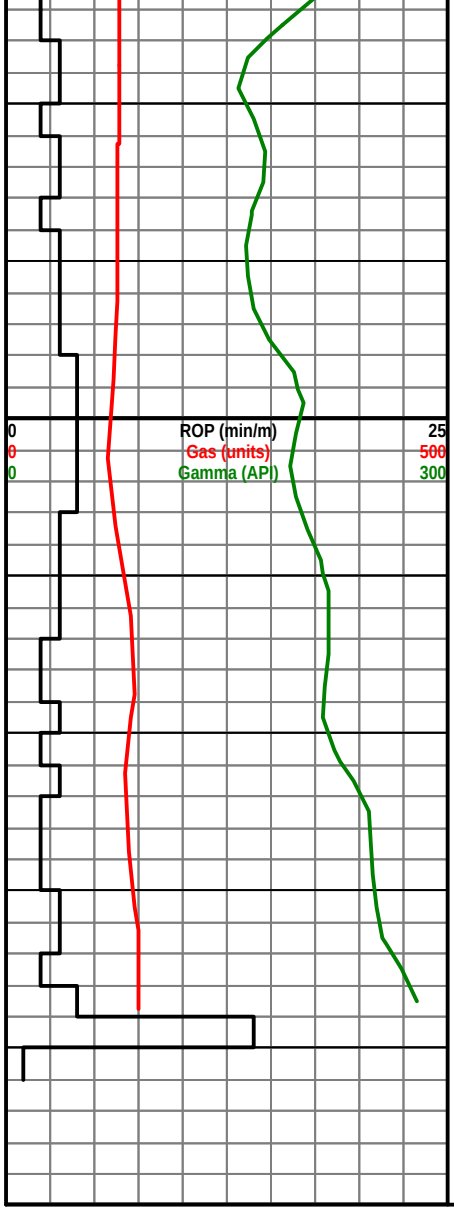
1860.3 SH.. dk gy, hd, siliceous, concoidal frac, sl carb, mnr thin bedding parallel py seams, no vis stn, even med brn flor, wk sulfur odour, bri wh strmg cut.

1861.8 SH.. dk gy, hd, siliceous, mmica, abnt vf dis py. sl carb, no vis stn, dull brn flor, wk sulfur odour, bri wh strmg cut.

1863.4 SH.. dk gy, hd, siliceous, sl carb, sl mmica, f xln calcite on sub vertical frac, tr bleeding oil on a tight frac, oil has a dk yel flor, no vis stn on sh, even med brn flor, no sulfur odour, bri wh strmg cut.

1864.9 SH.. dk gy, hd, siliceous, siliceous, sl carb, com vf dis py, one sub vertical calcite lined hairline frac, dull brn flor, wk sulfur odour, bri wh strmg cut.

1866.4 SH.. dk gy, hd, siliceous, concoidal frac, one calcite lined hairline frac, mnr dis py, dull brn flor, wk sulfur odour, bri wh strmg cut.



1867.9 SH.. dk gy, hd, siliceous, concoidal frac, sl carb, com vf dis py, no vis staining, wk dull brn flor, sl sulfur odour, bri wh milky strmg cut.

1869.4 SH.. dk gy, hd, siliceous, sl carb, com micro dis py, tr calcite along pos sub vertical frac, no vis stn, possible dull brn flor, wk sulfur odour, slow bri wh strmg milky cut.

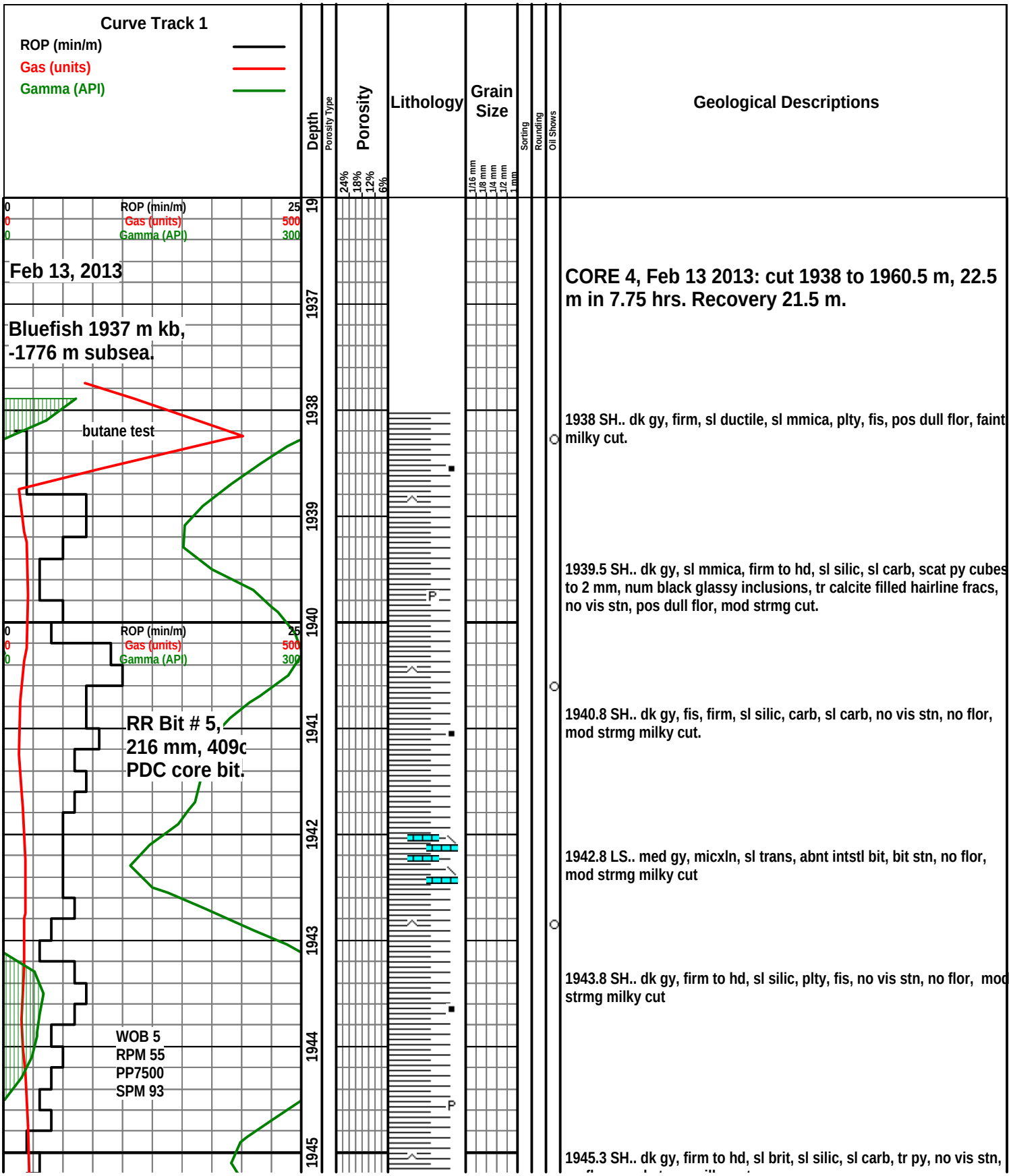
1870.9 SH.. dk gy, hd, siliceous, sl carb, mnr micro scat py, one vertical hairline frac no calcite coating possibly mechanically fractured, no vis stn, slow strmg milky cut.

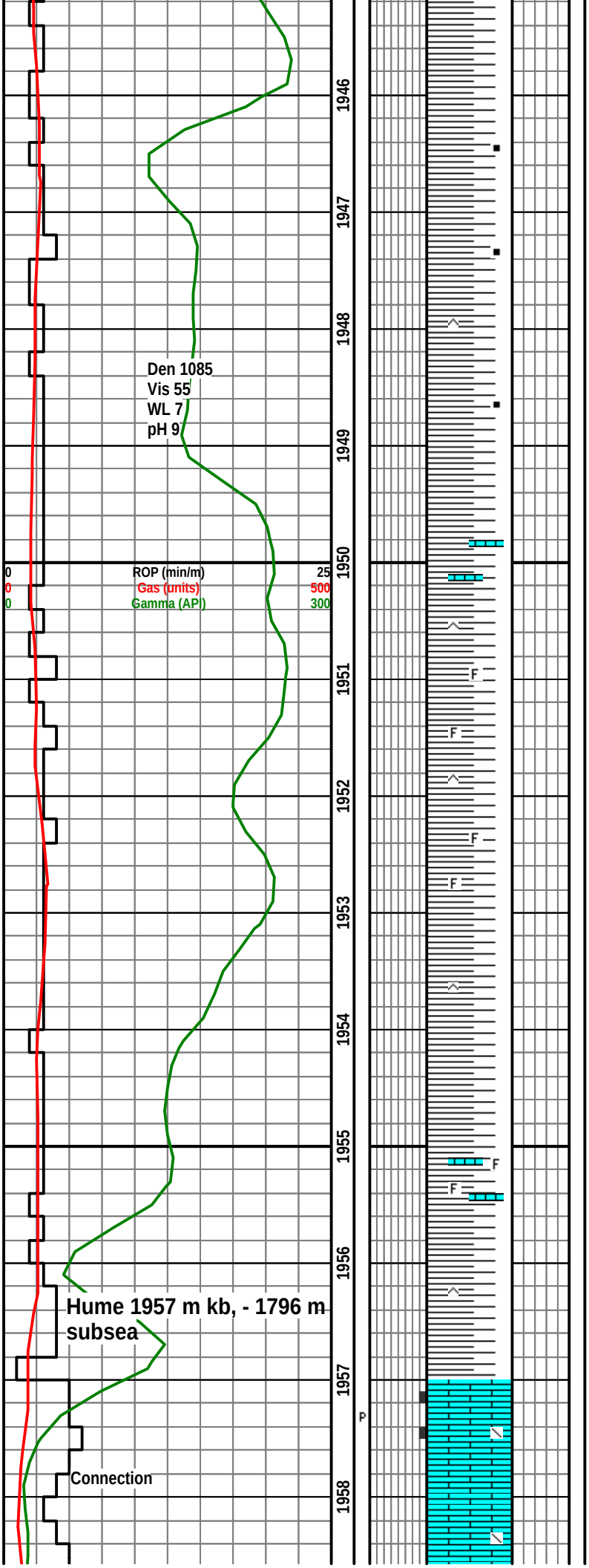
1872.4 SH.. dk gy, hd, siliceous, sl carb, sl mmica, mnr scat micro py, no vis stn, dull dk brn flor, slow strmg milky cut.

1873 SH.. dk gy, hd, siliceous, sl carb, no vis stn, pos wk dull brn flor, no flor, no sulfur odour, slow strmg milky cut.

CORE LOG 1:48 SCALE

Contractor: Baker Hughes
Core #: 4
Formation: Blue Fish
Core Interval: From: 1938 m To: 1960.5 m
Cut: 22.5 m **Recovered:** 21.5 m
Bit type: BHC 409C
Size: 216 mm
Coring Time: 7.75 hrs





no flor, mod strmg milky cut

1946.8 SH.. dk gy, fis, firm to hd, sl silic, mod carb, polished surfaces pos slickensides, tr calcite frac coating, no vis stn, med brn flor, slow to mod strmg milky cut

1948.3 SH.. dk gy, firm to hd, sl silic, mod carb, sl mmica, fis, num fos molds, no stn, med brn flor, mod strmg milky cut.

1950 SH.. dk gy, firm to hd, fis, plty, tr calcite filled micro frac, some ls lenses in the sh, no vis stn, no flor, slow to mod strmg milky cut.

1951.5 SH.. dk gy, firm to hd, sl silic, fis, sl carb, tr py cubes, com fos molds, no stn, no flor, slow to mod strmg milky cut.

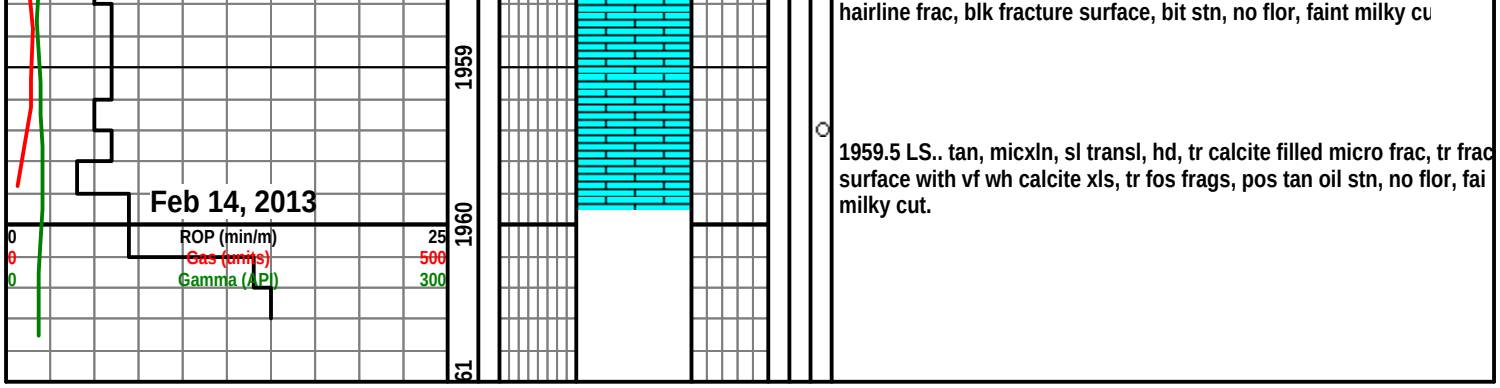
1953 SH.. dk gy, firm to hd, sl silic, sl carb, calc beds, com fos molds no stn, no flor, slow to mod strmg milky cut.

1954.5 SH.. dk gy, firm to hd, fis, sl silic, sl carb, no stn, pos wk flor, slow to mod strmg milky cut.

1956 SH.. dk gy, firm, fis, sl silic, sl carb, micxln calc beds of fos frags, no stn, no flor, slow to mod strmg milky cut.

1957.5 LS.. tan, lt brn, vf to f xln, sl transl, dense, faint fos frags, rr spec soft bit, tr soft bit in vugs, tr pp vug por, 2-3% por, spty yel flor, faint milky cut.

1958.5 LS.. med gy, gy-brn, micxln, sl transl, hd, one calcite filled



hairline frac, blk fracture surface, bit stn, no flor, faint milky cu

1959.5 LS.. tan, micxln, sl transl, hd, tr calcite filled micro frac, tr frac surface with vf wh calcite xls, tr fos frags, pos tan oil stn, no flor, fai milky cut.

RPS ENERGY CANADA LTD. (RPS)

TERMS

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MGM_SHELL East Mackay I-78 GW-OO1

Samples from water well rig drilling with air, and mist.

5m, (15') Clay.. light gray, dense, firm, slightly ductile, weak laminated, possible claystone. Sample is dry pieces of clay to approx 1 cm. Probably weakly consolidated mud stone.

9m, (30') Clay, Silt.. light gray, slightly salt and pepper, weak laminated grained clay, finely interbedded with silt, occasional rounded grains to L very fine grained size, moderately consolidated, possible claystone / siltstone. Sample is dry pieces of clay and silt to 2 cm, probably very wkly consolidated mudstone and siltstone.

14m (45') Sand, salt and pepper, fine to L coarse grained, quartz and chert, poor sorted, subangular to subrounded, silt and clay matrix, very friable, unconsolidated in sample, grains coated with clay and silt, estimated 10 to 15% porosity.. Sample is dry

18m (60') Mudstone.. light gray, firm, moderately consolidated, slightly micromicaceous, no laminations. Sample chips muddy and coated with fine to coarse quartz and chert grains, similar to above.

23m (75') Mudstone, Coal.. medium gray, moderately consolidated, firm, slightly micromicaceous, minor carbonaceous inclusion, very faint wavy bedding, 5% Coal.. black, brittle, vitreous, Sample is dry,

27 m (90') Mudstone, Siltstone.. Med gray, Sample has wet clay with patches of siltstone.

32m (105') Mudstone.. Med gray, firm, moderately consolidated, scattered white flecks, no bedding to possible weak bedding. Sample is chips of claystone in a wet clay.

37m (120') Mudstone.. medium to dark gray, firm, slightly micromicaceous, moderately consolidated, very slightly gritty, trace carbonaceous inclusion. Sample is a wet clay with chips.

41m (135) Mudstone.. medium gray, dense, firm, moderately consolidated, trace carbonaceous inclusion, slightly micromicaceous, Sample is chips of claystone in a muddy clay.

46m (150') Mudstone.. medium gray, firm, dense, slightly bedded, slightly micromicaceous. Sample is muddy clay with claystone chips.

50m (165') Mudstone.. medium gray, firm, dense, slightly gritty, slightly micromicaceous, Sample of muddy clay with chips of claystone.

55m (180') Siltstone.. very light gray, slightly salt and pepper, quartz silt, trace L very fine grained, minor dark lithic, moderately consolidated, clean to trace clay matrix, trace mica flakes, trace porosity. Sample is silty and muddy with abundant siltstone chips.

59m (195') Sandstone, Siltstone .. salt and pepper, light gray, very fine to coarse grained, poor sorted, subangular to subrounded, quartz, chert, moderately consolidated, poor porosity. Siltstone, very light gray, quartz silt, trace lithic, trace carbonaceous inclusions, moderately consolidated, trace porosity. Muddy sample.

64m (210') Sandstone.. very light gray, salt and pepper, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, trace chert, minor lithographic, moderately consolidated, silt matrix, trace mica flakes, poor porosity. Sample wet, slightly muddy.

69m (225') Mudstone / Siltstone.. light gray, firm to hard, platy, appears siliceous, smooth to gritty texture, grading to siltstone. Wet sample, slightly muddy.

73m(240') Sandstone.. salt and pepper, fine to very coarse grained, poor sorted, subrounded, quartz, light to dark chert, trace orange chert, well consolidated, silica cement, trace porosity. Wet sample.

78m (255') Sandstone.. salt and pepper, U very fine to U fine grained, moderately to well sorted, subrounded to subangular, quartz, minor dark lithic, trace chert, poor to moderately consolidated, friable, some interbedded siltstone, trace to poor porosity. Wet sample.

82m (270') Mix of sandstone, siltstone and mudstone

87m(285') Mix of Sandstone, Siltstone and Claystone. Sandstone.. salt and pepper, very fine to fine grained, subrounded to subangular, moderately to well sorted, quartz, minor lithographic, trace chert, moderately to well consolidated, silica cement, some white clay matrix, silt matrix, rare mica flakes, poor porosity. Siltstone.. very light gray, quartz, rare mica, trace very fine grained quartz, moderately to well consolidated, silica cement, trace porosity. Mudstone.. medium gray, slightly micromicaceous, firm, dense, possible interbedded with sandstone and siltstone. Trace coal, rare CHERT, black, coarse grained, rounded, cavings ?

92m (300') mix of lithologies, predominant Sandstone and Siltstone, as above.

96m (315') Sandstone.. salt and pepper, very fine to fine grained, moderately to well sorted, subrounded to subangular, quartz, minor lithographic, trace chert, rare mica, silica cement, moderately consolidated, friable, silt matrix, possible clay in matrix, poor porosity. Some siltstone and claystone in sample.

101m (330') Mix of sandstone, Siltstone and Mudstone.

105m (345') Mix of uphole lithologies. Sandstone.. salt and pepper, L very fine to L fine grained, minor fine grained, moderately to well sorted, subangular to subrounded, quartz, minor lithic, trace chert, moderately to well consolidated, silica cement, silt matrix, poor porosity. Siltstone.. very light gray, well consolidated, quartz silt, silica cement, clay matrix in part, porosity. Mudstone.. medium gray, dense, firm, very slightly micromicaceous, siliceous, trace carbonaceous inclusions.

110m (360') Mix of lithologies, as above.

114m (375') Mudstone / Siltstone.. medium gray, firm, dense, slightly micromicaceous, siliceous, interbedded with very light gray, quartz siltstone. Sandstone.. salt and pepper, very fine to fine grained, subangular to subrounded, moderately sorted, quartz, minor lithic, trace chert, moderately to well consolidated, friable, silt matrix, poor porosity.

119m (390') Mudstone interbedded with siltstone and sandstone as above.

122m (400') Mudstone interbedded with siltstone and sandstone.

MGM_SHELL East Mackay I-78 GW-OO2

Samples from water well rig drilling with water.

5m (15') Clay.. light gray, moderately firm, moderately consolidated, dense, trace carbonaceous inclusion, very slightly micromicaceous. Probably mudstone. Sample is dry as the first 25 ft were air drilled. Samples of clay pieces to 3 cm.

9m (30') Siltstone.. very light gray, quartz silt, trace lithic, moderately to well consolidated, very slightly calcareous, some interbedded sandstone, trace porosity. Sandstone.. salt and pepper, very fine to fine grained, subrounded, moderately sorted, quartz, minor dark chert, trace lithographic, moderately consolidated, silica cement, silt matrix, minor clay, poor porosity.

14m (45') Mudstone / Siltstone, Mudstone.. medium gray, firm, trace carbonaceous inclusion, soft in sample. Siltstone.. very light gray, quartz silt, trace L very fine grained, firm, slightly consolidated, trace porosity. Sample is a dried mud of clay and silt.

18m (60') Mudstone / Siltstone, Mudstone.. medium gray, firm, micromicaceous, moderately consolidated. Siltstone.. light gray, slightly salt and pepper, quartz, minor lithic, firm, moderately consolidated, slightly argillaceous, non calcareous, trace porosity. Sample chips better consolidated than above.

23m (75') Minor COAL.. black, brittle, vitreous. Mudstone.. medium gray, minor dark gray, firm, locally finely layered, rare coal inclusion.

27m (90') Mudstone / Siltstone, Mudstone.. medium gray, firm, weak consolidated, trace wispy carbonaceous inclusion, gritty texture in part. Siltstone.. light gray, quartz silt, minor lithographic, weak consolidated, clay matrix, trace porosity.

32m (105') Siltstone.. light gray, slightly salt and pepper, quartz silt, trace very fine grained, trace lithic, common black carbonaceous wisps and surfaces, clay matrix, moderately to well consolidated, trace porosity.

37m (120') Mudstone.. medium gray, firm, moderately to well consolidated, trace carbonaceous inclusion, slightly micromicaceous, possible faint irregular bedding. Siltstone.. light gray, quartz silt, firm, moderately to well consolidated, silica cement, clay matrix, tight to trace porosity.

41m (135') Mudstone.. medium gray, dense, moderately consolidated, firm, trace carbonaceous inclusion, slightly micromicaceous.

46m (150') Mudstone.. medium gray, firm, moderately consolidated, slightly micromicaceous, slightly gritty, grading to siltstone in part.

50m (165') Siltstone.. light gray, slightly salt and pepper, quartz silt, minor lithic, trace very fine grained, moderately consolidated, silica cement, clay matrix, tight to trace porosity. Mudstone.. medium gray, dense, moderately to well consolidated, slightly micromicaceous.

55m (180') Sandstone.. predominant fine grained, trace L medium grained, some very fine grained, subrounded to subangular, moderately sorted, quartz, minor lithic, rare chert, slightly calcareous, weak consolidated, very friable, clay matrix, crumbles in water. Possible reconstituted chips of loose sand and clay.

59m (195') Sandstone.. salt and pepper, fine grained, minor L medium grained, moderately to well sorted, subrounded, quartz, dark chert, loose, very friable, no evidence of cement, silt matrix, estimated 12 to 15% porosity.

64m (210') Sandstone.. salt and pepper, very fine to fine grained, subrounded to subangular, moderately sorted, quartz, minor lithic, trace chert, loose in sample, silt matrix, 12 to 15%.

69m (225') Sandstone.. salt and pepper, fine to L medium grained, subrounded, quartz, dark chert, loose in sample, silt matrix, estimated 12 to 15% porosity. Mudstone.. medium gray, firm, weakly laminated. Sample is predominantly loose sand similar to 65m, possible cavings.

73m (240') Sandstone.. salt and pepper, very fine to fine grained, grading to siltstone in part, subrounded moderately consolidated, quartz, minor lithic, loose, silt matrix, possible clay matrix, 10 to 12% porosity.

78, (255') Sandstone.. salt and pepper, very fine to fine grained, subrounded, occasional rounded, moderately to well subrounded, quartz, minor lithic, trace chert, loose grains, silt matrix, possible clay matrix, 10 to 12% porosity.

81m (267') Sandstone/ Siltstone.. salt and pepper, silt to fine grained, subrounded, moderately sorted, quartz, minor lithic, loose in sample, possible clay matrix, 8 to 12% porosity.

Samples collected at the shaker

MGM_SHELL East Mackay I-78 GW-OO3

Samples from water well rig drilling with water.

no sample at 5 m.

9m (30') Mudstone.. medium gray, slightly micromicaceous, moderately firm, dense, no evidence of bedding, slightly silty.

14m (45') Siltstone.. very light gray, slightly salt and pepper, quartz silt, minor lithic, moderately consolidated, clay matrix, trace porosity. Mudstone.. medium gray, dense, firm. Congl/SANDSTONE.. salt and pepper, fine to pebble size, very poor sorted, subrounded to rounded, quartz, dark chert pebbles, loose, estimated porosity 12 to 18%, possibly uphole gravel contaminating the sample.

18m (60') SANDSTONE.. salt and pepper, fine to medium grained, moderately sorted, subrounded, quartz, chert, minor lithic, loose, silt matrix, 10 to 15% porosity.

23m (75') Mudstone.. medium gray, dense, firm, moderately consolidated, silty in part, common siltstone lenses, minor carbonaceous inclusion.

27m (90) Sandstone.. salt and pepper, very fine to fine grained, moderately sorted, subrounded to subangular, quartz, chert, minor lithographic, weak to moderately consolidated, silt matrix, silica cement, non calcareous, trace mica flakes, 8 to 10% porosity. Siltstone.. very light gray, slightly salt and pepper, quartz silt, minor very fine grained, moderately consolidated, silica cement, clay matrix, trace porosity. Minor mudstone.

32m (105') Siltstone.. light gray, salt and pepper, quartz silt, trace lithic, moderately consolidated, silica cement, clay matrix, minor very fine to fine grained sandstone lenses, poor porosity, Mudstone.. medium gray, slightly micromicaceous, firm, moderately consolidated.

37m (120') Mudstone.. medium gray, firm, dense, slightly micromicaceous, trace carbonaceous inclusion, trace silt. Siltstone.. very light gray, as above.

41m (135') predominantly mudstone, as above, some Siltstone.

46m (150') Mudstone.. medium gray, firm, moderately consolidated, slightly micromicaceous, slightly silty, gritty texture, trace carbonaceous inc. Minor, siltstone.

50m, (165') Mudstone.. medium gray, dense, firm, slightly micromicaceous, rare carbonaceous inclusion, slightly silty in part, minor siltstone.

55m (180) Sandstone.. salt and pepper, very fine to fine grained, subrounded, to subangular, moderately sorted, quartz, lithic, minor chert, silica cement, silt matrix, mica flakes, 6 to 10% porosity. Mudstone.. medium gray, micromicaceous, firm, moderately consolidated.

59m (195) Sandstone.. salt and pepper, very fine to fine grained, moderately sorted, subrounded to subangular, quartz, minor lithic, minor chert, loose, silt matrix, possible clay matrix, 6 to 8% porosity. Mudstone.. medium gray, firm, moderately consolidated, trace carbonaceous inclusion, slightly micromicaceous.

64m (210') Sandstone.. salt and pepper, very fine to fine grained, subrounded, moderately sorted, quartz, minor chert, minor lithographic, quartz silt matrix, silica cement, moderately consolidated, moderately clean, 6 to 10% porosity.

69m (225') Sandstone, salt and pepper, very fine to fine grained, as above. Mudstone.. medium gray, slightly micromicaceous, firm, moderately consolidated. Siltstone.. very light gray, quartz, silt, trace lithic, firm, moderately consolidated, silica cement, possible clay matrix, trace to poor porosity.

73m (240') Sandstone.. salt and pepper, very fine to fine grained, moderately sorted, subrounded, to subangular, quartz, minor lithographic, trace chert, moderately consolidated, friable, silica cement, silt matrix, trace mica flakes, 5 to 8% porosity. Mudstone.. medium gray, very slightly micromicaceous, firm, moderately consolidated.

78m (255') Sandstone.. salt and pepper, very fine to fine grained, moderately sorted, subrounded, quartz, minor chert, minor lithographic, trace pink chert, moderately consolidated, friable, silica cement, silt matrix, trace mica flakes, 8 to 12% porosity.

82m (270') Sandstone, as above.

85m (280') Sandstone.. salt and pepper, very fine to fine grained, as above.
Mudstone.. medium gray, firm, moderately consolidated, dense.

Samples 10 to 50 m caught at shaker, samples 55 to TD caught at top of casing.

DAILY DRILLING SUMMARY

MGM - Shell East MacKay I - 78
3.00179E+15

Date	24:00 hrs Depth	Progress	Drilling Hours	ROP (m/hr)	Mud Properties Density	Vis	WL	pH	Operations Summary
12 Jan									Complete water testing well #1
13 Jan									Drill water testing well to TD at 267 ft. Run gamma, resistivity, caliper, temperature and sonic logs.
14 Jan									Complete water well 2 with casing and grout, move to third location, drill to ~ 20 ft and set 9 5/8 surface casing. Note, no samples, water drilling and vacuuming the returns.
15 Jan									Drill to ~ 210 ft.
16 Jan									Drill water testing well no 3 to TD at 280 ft. Run gamma, temperature and resistivity logs.
17 Jan									Complete water well 3 with 4" casing, and grout, drain boiler, pumps etc. Spud Rathole at 07:00 hrs, drill to 18 m from GL, sample and describe at 2.5 m intervals.
18 Jan									Finish packing up water drilling rig, crew and geologist fly to Edmonton. Winter road closed, delaying arrival of Akita drilling rig.