

**Natural Gamma Ray
Rate Of Penetration**



1 : 240

| | |
|----------------|---|
| County | : Barber |
| Field | : Arrowhead |
| Location | : Lat: 37° 2' 5.26" North Long: 98° 24' 44.15" West |
| Well | : Schupbach 3510 #4-1H |
| Company | : Shell Exploration and Productio |
| Rig | : Nabors 180 |
| LOCATION | Company : Shell Exploration and Productio Rig : Nabors 180 Well : Schupbach 3510 #4-1H Field : Arrowhead County : Barber API Number : 15007238530100 |
| Latitude | : 37° 2' 5.26" North |
| Longitude | : 98° 24' 44.15" West |
| UTM Easting | = 2,025,611.78 ft |
| UTM Northing | = 134,054.97 ft |
| Other Services | Directional Services |

| | | | |
|------------------------|----------------|---------------|-----------------------|
| Permanent Datum | : Ground Level | Elevation | : 1309.00 ft |
| Log Measured From | : Drill Floor | 23.80 ft | Above Permanent Datum |
| Drilling Measured From | : Drill Floor | MD LOG | |

| | | | |
|----------------|---------------|-----------|--------------------|
| Depth Logged | : 83.00 ft | To | 9,880.00 ft |
| Date Logged | : 17-Aug-12 | To | 20-Sep-12 |
| Total Depth MD | : 9,880.00 ft | TVD | : 4,794.26 ft |
| Spud Date | : 18-Aug-12 | Plot Type | : Final |
| | | Plot Date | : 20-Sep-12 |
| | | Unit No. | : PP#40 |
| | | Job No. | : OK-XX-0009504797 |

| Run No. | Borehole Record (MD) | | Run No. | Borehole Record (MD) | |
|---------|----------------------|-------------|---------|----------------------|---------|
| | Size | From To | | Size | From To |
| 0100 | 12.250 in | 83.00 ft | | | |
| 0200 | 8.750 in | 800.00 ft | | | |
| 0300 | 8.750 in | 4,318.00 ft | | | |
| 0400 | 6.125 in | 5,216.00 ft | | | |
| 0500 | 6.125 in | 6,191.00 ft | | | |
| 0600 | 6.125 in | 6,714.00 ft | | | |
| 0700 | 6.125 in | 7,788.00 ft | | | |

WELL INFORMATION

| MWD Run Number | 200 | 300 | 400 | 500 | 600 |
|----------------------------------|-----------------|------------------|------------------|------------------|------------------|
| Date run completed | 05-Sep-12 | 08-Sep-12 | 12-Sep-12 | 14-Sep-12 | 16-Sep-12 |
| Rig Bit Number | 0200 | 0300 | 0400 | 0500 | 0600 |
| Bit Size (in) | 8.750 | 8.750 | 6.125 | 6.125 | 6.125 |
| Tool Nominal OD (in) | 8.000 | 6.750 | 4.750 | 4.750 | 4.750 |
| Log Start Depth (MD, ft) | 800.00 | 4,318.00 | 5,216.00 | 6,191.00 | 6,714.00 |
| Log End Depth (MD, ft) | 4,318.00 | 5,216.00 | 6,191.00 | 6,714.00 | 7,788.00 |
| Drill or Wipe | Drill | Drill | Drill | Drill | Drill |
| Drill/Wipe Start Date and Time | 02-Sep-12 09:13 | 05-Sep-12 13:11 | 10-Sep-12 04:45 | 12-Sep-12 08:44 | 14-Sep-12 01:35 |
| Drill/Wipe End Date and Time | 05-Sep-12 06:00 | 08-Sep-12 11:32 | 12-Sep-12 08:31 | 14-Sep-12 09:44 | 16-Sep-12 12:30 |
| Min Inc (deg) @ Depth (MD, ft) | .03 @ 2,883.00 | 6.89 @ 4,273.00 | 89.60 @ 6,010.00 | 89.38 @ 6,485.00 | 89.66 @ 7,434.00 |
| Max Inc (deg) @ Depth (MD, ft) | 4.59 @ 804.00 | 86.28 @ 5,159.00 | 91.67 @ 5,725.00 | 90.62 @ 6,295.00 | 91.48 @ 7,244.00 |
| Bit TFA(in2) / Bit Type | .66 / PDC | .45 / PDC | .55 / PDC | .55 / PDC | .52 / PDC |
| Flow Rate (gpm) | 550.00 | 400.00 | 297.00 | 297.00 | 299.00 |
| Max AV (fpm) / CV (fpm) @ MWD | 286.0 / 322.0 | 332.0 / 420.0 | 479.0 / 520.0 | 484.0 / 520.0 | 484.0 / 520.0 |
| Fluid Type | Fresh Water Gel | Fresh Water Gel | Fresh Water Gel | Fresh Water Gel | Fresh Water Gel |
| Density (ppg) / Viscosity (spqt) | 9.10 / 55.00 | 9.10 / 60.00 | 8.40 / 27.00 | 8.40 / 27.00 | 8.40 / 28.00 |
| Filtrate CL (ppm) | 22,000.00 | 20,500.00 | 2,600.00 | 2,500.00 | 28,000.00 |
| pH / Fluid Loss (mptm) | 11.20 / 0 | 11.20 / 0 | 11.20 / 5 | 11.20 / 0 | 11.20 / 5 |
| PV (cP) / YP (lhf2) | 18 / 18.00 | 25 / 18.00 | 1 / 1.00 | 1 / 1.00 | 1 / 1.00 |
| % Solids / % Sand | 4.50 / 1.00 | 7.90 / 1.00 | 1.00 / 0.75 | 1.00 / 1.00 | 1.00 / 0.75 |
| % Oil / Oil:Water Ratio | N/A / N/A | N/A / N/A | N/A / N/A | N/A / N/A | N/A / N/A |
| Rm @ Measured Temp (degF) | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A |
| Rmf @ Measured Temp (degF) | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A |

| | | | | | |
|-------------------------------|--------------|--------------|--------------|--------------|--------------|
| Rmc @ Measured Temp (degF) | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A |
| Max Tool Temp (degF) / Source | 144.54 / PCM | 139.96 / PCM | 133.20 / PCM | 133.20 / PCM | 130.96 / PCM |
| Rm @ Max Tool Temp (degF) | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A | N/A @ N/A |
| Lead MWD Engineer | Fred Martin | Fred Martin | Fred Martin | Fred Martin | Fred Martin |
| Customer Representative | Jack Everett | Jack Everett | John Dyer | Jack Everett | Jack Everett |

SENSOR INFORMATION

Directional Sensor Information

| | | | | | |
|------------------------|----------|----------|----------|----------|----------|
| Tool Type | PCDC | PCDC | PCDC | PCDC | PCDC |
| Distance From Bit (ft) | 60.16 | 54.22 | 50.29 | 51.20 | 51.24 |
| Software Version | 6.21 | 6.21 | 6.21 | 6.21 | 6.21 |
| Sub Serial Number | 11149805 | 11149805 | 11130241 | 11130241 | 11130421 |
| Sonde Serial Number | 400471 | 400261 | 400261 | 400471 | 400261 |
| Sensor ID Number | N/A | N/A | N/A | N/A | N/A |
| Toolface Offset (deg) | 39.40 | 358.40 | 234.52 | 101.36 | 38.01 |

Gamma Ray Sensor Information

| | | | | | |
|------------------------------|----------|----------|----------|----------|----------|
| Tool Type | PCG | PCG | PCG | PCG | PCG |
| Distance From Bit (ft) | 55.06 | 49.12 | 45.19 | 46.10 | 46.14 |
| Recorded Sample Period (sec) | 20 | 15 | 15 | 15 | 15 |
| Software Version | 8.15 | 8.15 | 8.15 | 8.15 | 8.15 |
| Sub Serial Number | 11149805 | 11149805 | 11130241 | 11130241 | 11130241 |
| Insert/Sonde Serial Number | 11293316 | 11293340 | 11293340 | 11293316 | 11293340 |

Pulser Controller Sensor Information

| | | | | | |
|---------------------------|----------|----------|----------|----------|----------|
| Tool Type | PCM | PCM | PCM | PCM | PCM |
| Software Version | 5.28 | 5.28 | 5.28 | 5.28 | 5.28 |
| PIC Software Version | 1.40 | 1.40 | 1.40 | 1.40 | 1.40 |
| Sub/HOC Serial Number | 11149805 | 11149805 | 11130241 | 11130241 | 11130241 |
| Insert/Probe/Module SN | 11400905 | 10868851 | 10868851 | 11400905 | 10868851 |
| Battery Serial Number | N/A | N/A | N/A | N/A | N/A |
| Valve Insert SN | N/A | N/A | N/A | N/A | N/A |
| DC Insert Serial Number | N/A | N/A | N/A | N/A | N/A |
| Choke Size (32nd) | N/A | N/A | N/A | N/A | N/A |
| Driver Current (amps) | N/A | N/A | N/A | N/A | N/A |
| Driver SMI Current (amps) | N/A | N/A | N/A | N/A | N/A |
| Boot Strap Version | 4,130.00 | 4,130.00 | 4,130.00 | 4,130.00 | 4,130.00 |

WELL INFORMATION

| | | | | |
|--------------------------------|------------------|--|--|--|
| MWD Run Number | 700 | | | |
| Date run completed | 20-Sep-12 | | | |
| Rig Bit Number | 0700 | | | |
| Bit Size (in) | 6.125 | | | |
| Tool Nominal OD (in) | 4.750 | | | |
| Log Start Depth (MD, ft) | 7,788.00 | | | |
| Log End Depth (MD, ft) | 9,880.00 | | | |
| Drill or Wipe | Drill | | | |
| Drill/Wipe Start Date and Time | 16-Sep-12 21:13 | | | |
| Drill/Wipe End Date and Time | 19-Sep-12 12:42 | | | |
| Min Inc (deg) @ Depth (MD, ft) | 88.37 @ 8,099.00 | | | |
| Max Inc (deg) @ Depth (MD, ft) | 91.97 @ 8,288.00 | | | |
| Bit TFA(in2) / Bit Type | .64 / PDC | | | |
| Flow Rate (gpm) | 300.00 | | | |
| Max AV (fpm) / CV (fpm) @ MWD | 490.0 / 498.0 | | | |
| Fluid Type | Fresh Water Gel | | | |

| | | | | |
|----------------------------------|--------------|--|--|--|
| Density (ppg) / Viscosity (spqt) | 8.40 / 30.00 | | | |
| Filtrate CL (ppm) | 2,700.00 | | | |
| pH / Fluid Loss (mptm) | 11.20 / 5 | | | |
| PV (cP) / YP (lhf2) | 1 / 2.00 | | | |
| % Solids / % Sand | 1.00 / 1.00 | | | |
| % Oil / Oil:Water Ratio | N/A / N/A | | | |
| Rm @ Measured Temp (degF) | N/A @ N/A | | | |
| Rmf @ Measured Temp (degF) | N/A @ N/A | | | |
| Rmc @ Measured Temp (degF) | N/A @ N/A | | | |
| Max Tool Temp (degF) / Source | 142.25 / PCM | | | |
| Rm @ Max Tool Temp (degF) | N/A @ N/A | | | |
| Lead MWD Engineer | Fred Martin | | | |
| Customer Representative | John Dyer | | | |

SENSOR INFORMATION

Directional Sensor Information

| | | | | |
|------------------------|----------|--|--|--|
| Tool Type | PCDC | | | |
| Distance From Bit (ft) | 57.17 | | | |
| Software Version | 6.21 | | | |
| Sub Serial Number | 11130241 | | | |
| Sonde Serial Number | 400471 | | | |
| Sensor ID Number | N/A | | | |
| Toolface Offset (deg) | 248.19 | | | |

Gamma Ray Sensor Information

| | | | | |
|------------------------------|----------|--|--|--|
| Tool Type | PCG | | | |
| Distance From Bit (ft) | 52.07 | | | |
| Recorded Sample Period (sec) | 15 | | | |
| Software Version | 8.15 | | | |
| Sub Serial Number | 11130241 | | | |
| Insert/Sonde Serial Number | 11293316 | | | |

Pulser Controller Sensor Information

| | | | | |
|---------------------------|----------|--|--|--|
| Tool Type | PCM | | | |
| Software Version | 5.28 | | | |
| PIC Software Version | 1.40 | | | |
| Sub/HOC Serial Number | 11130241 | | | |
| Insert/Probe/Module SN | 11400905 | | | |
| Battery Serial Number | N/A | | | |
| Valve Insert SN | N/A | | | |
| DC Insert Serial Number | N/A | | | |
| Choke Size (32nd) | N/A | | | |
| Driver Current (amps) | N/A | | | |
| Driver SMI Current (amps) | N/A | | | |
| Boot Strap Version | 4,130.00 | | | |

REMARKS

1. All depths are calibrated to the driller's pipe tally and are measured from the rotary table.

2. No depth corrections have been made for pipe stretch or compression.

3. All data presented is recorded (memory data) unless otherwise stated.

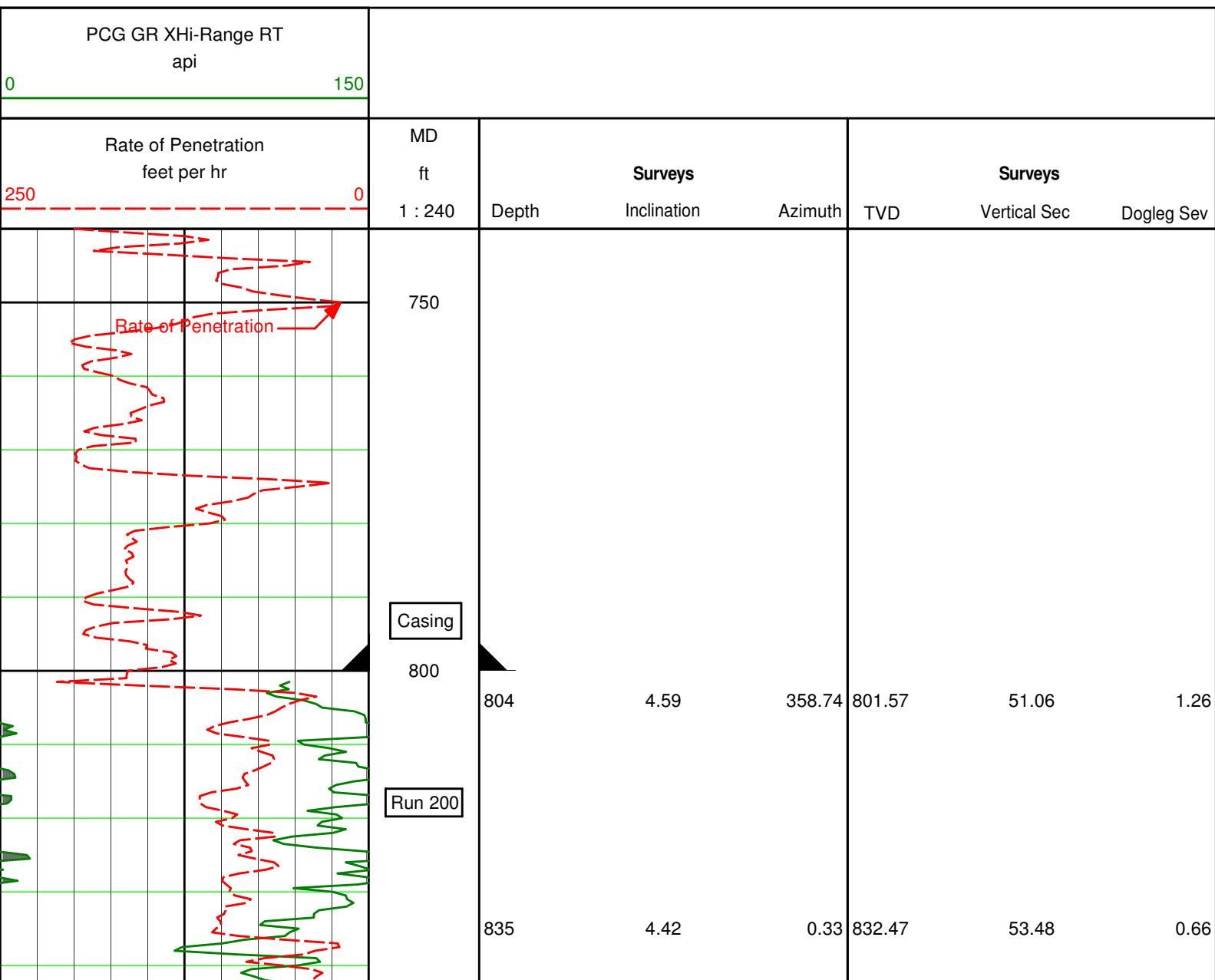
4. The following smoothing parameters have been applied to the data:

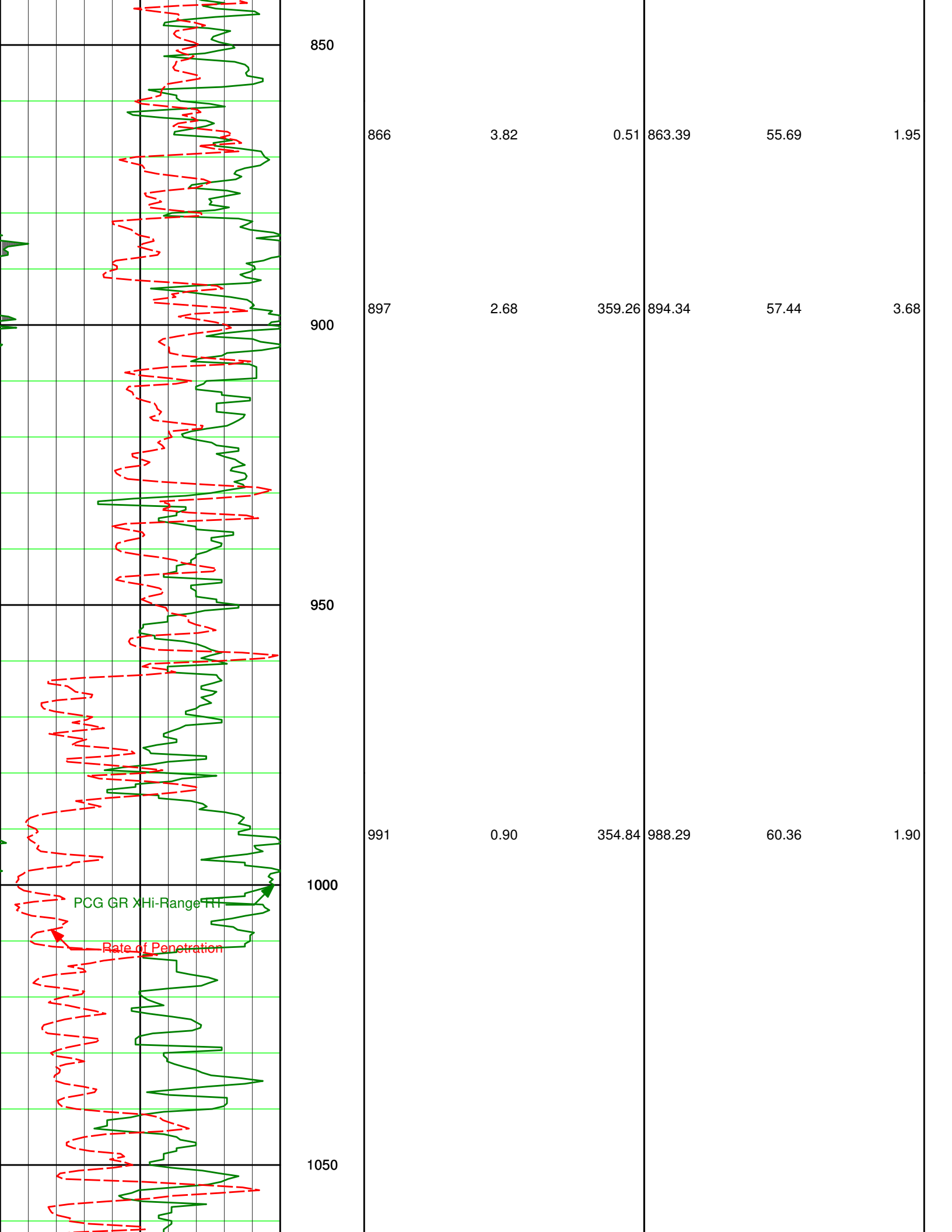
- ROP: 1.0 ft interval, 3.0 ft coercion distance.
- GAMMA: 0.5 ft interval, 0.6 ft coercion distance.

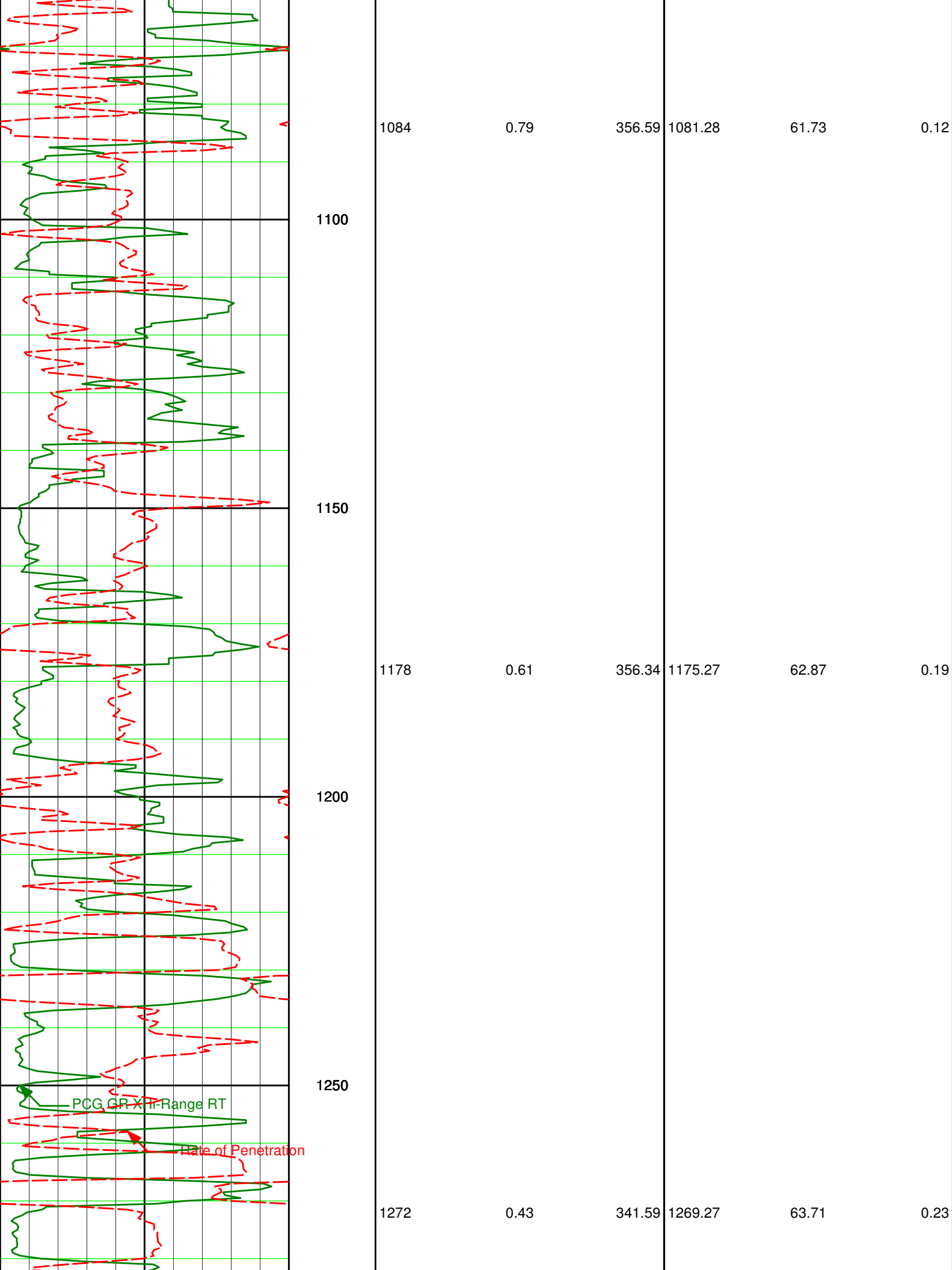
5. Run 100 was directional only.

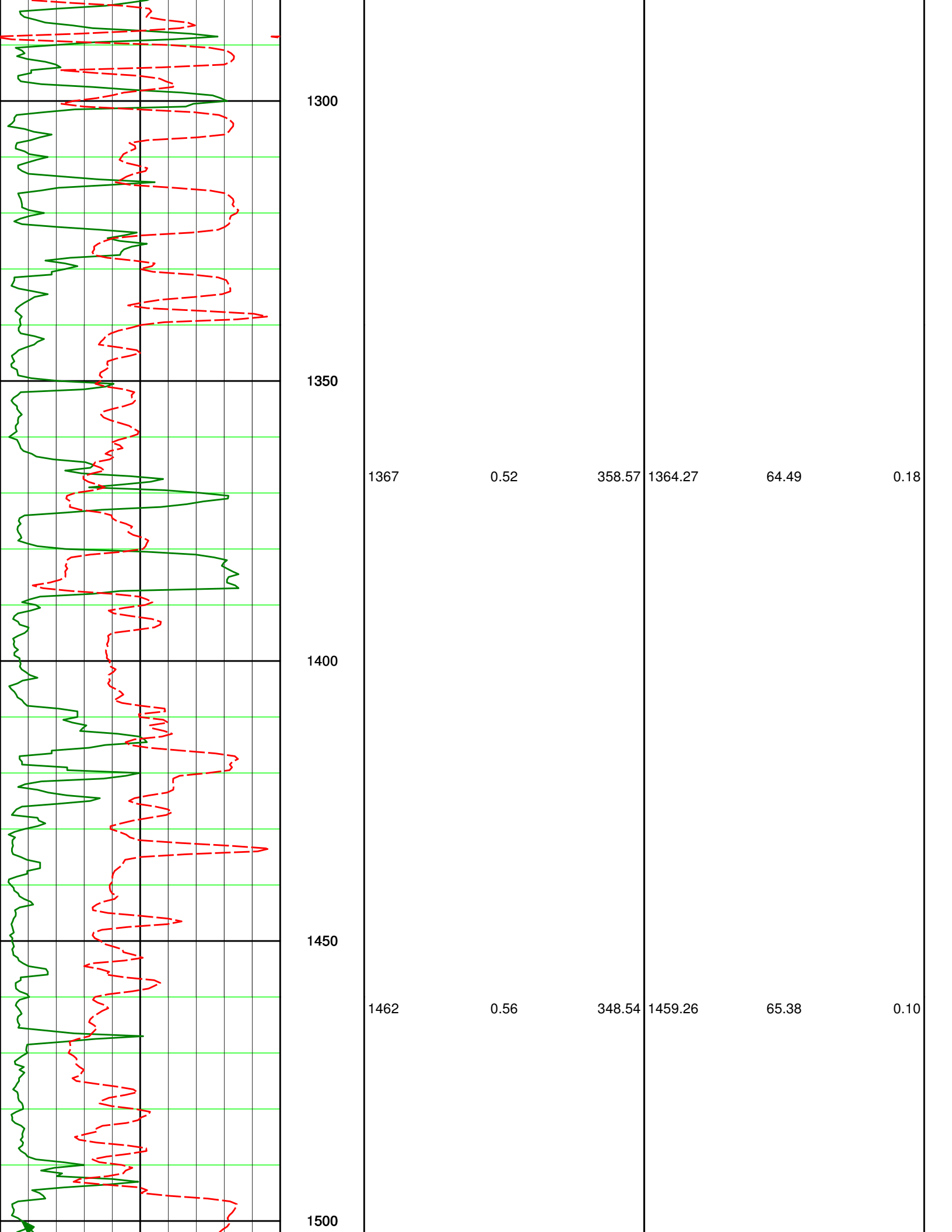
WARRANTY

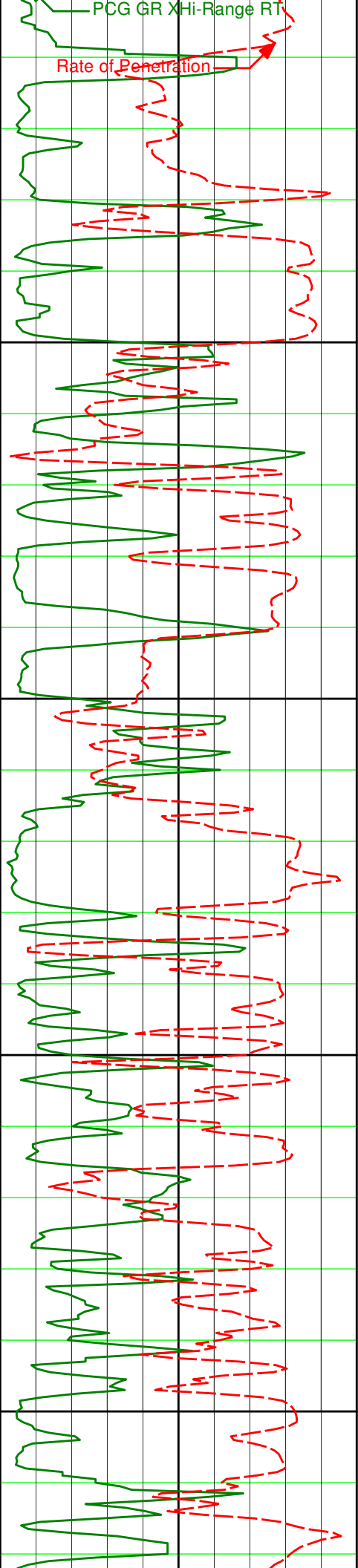
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1550

1557

0.41

356.69

1554.26

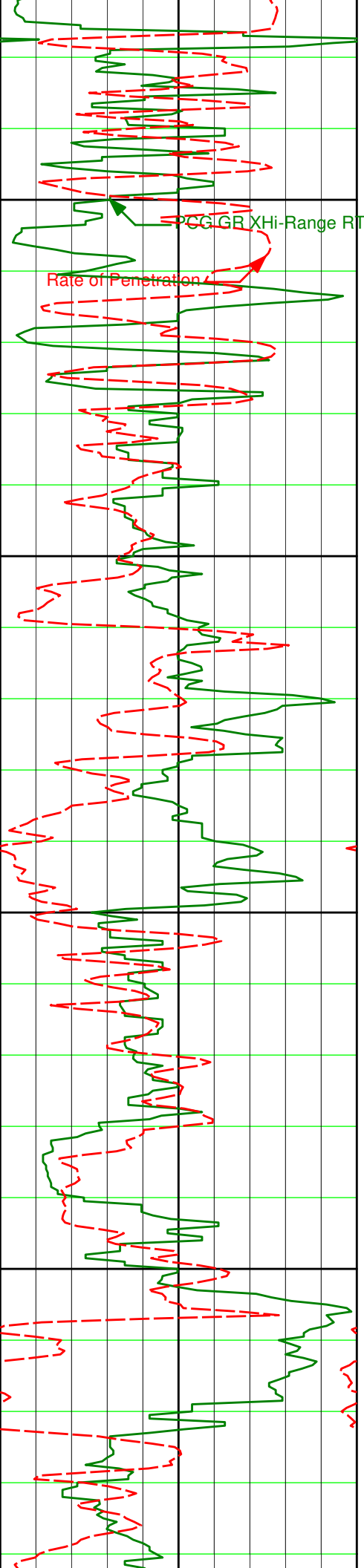
66.18

0.17

1600

1650

1700



1746 0.53 354.07 1743.25 67.74 0.06

1750

PCG:GRXHi-Range RT

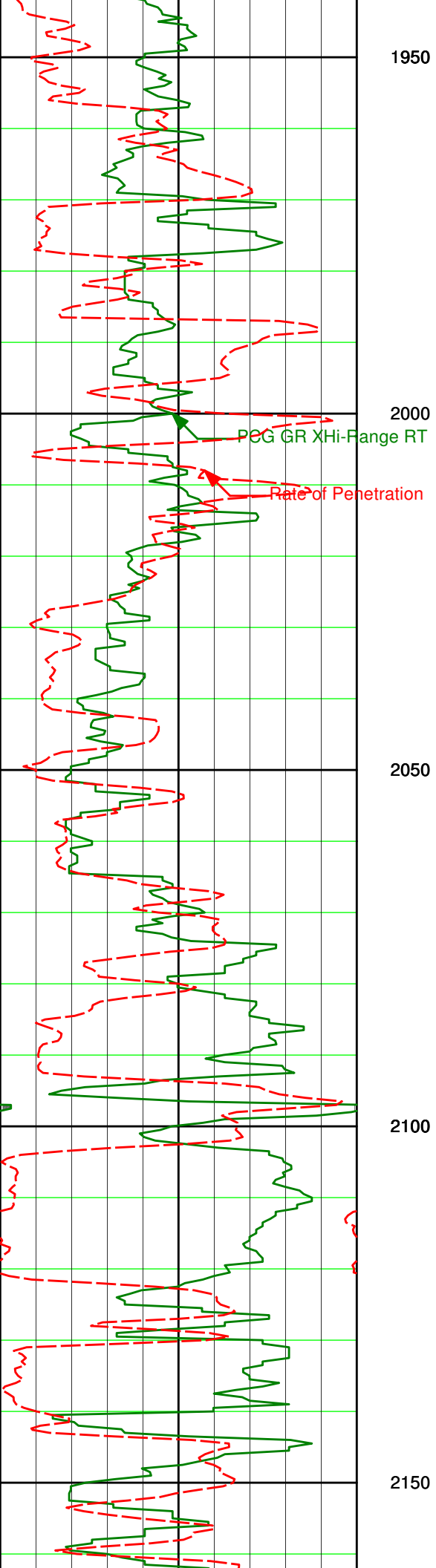
Rate of Penetration

1800

1850

1900

1936 0.56 342.18 1933.25 69.53 0.06



2126

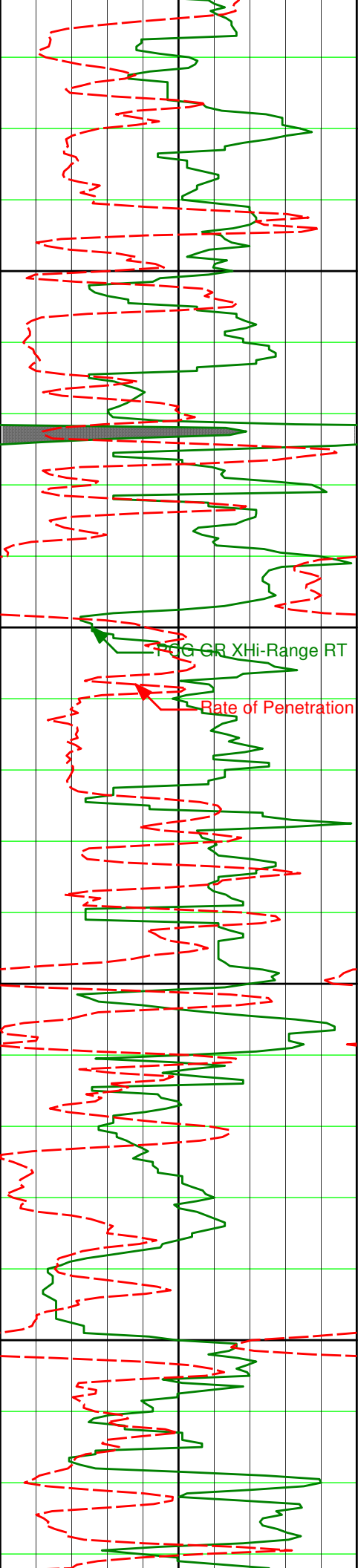
0.18

22.00

2123.24

70.71

0.23



2200

2250

2300

2350

LOG GR XHi-Range RT

Rate of Penetration

2315

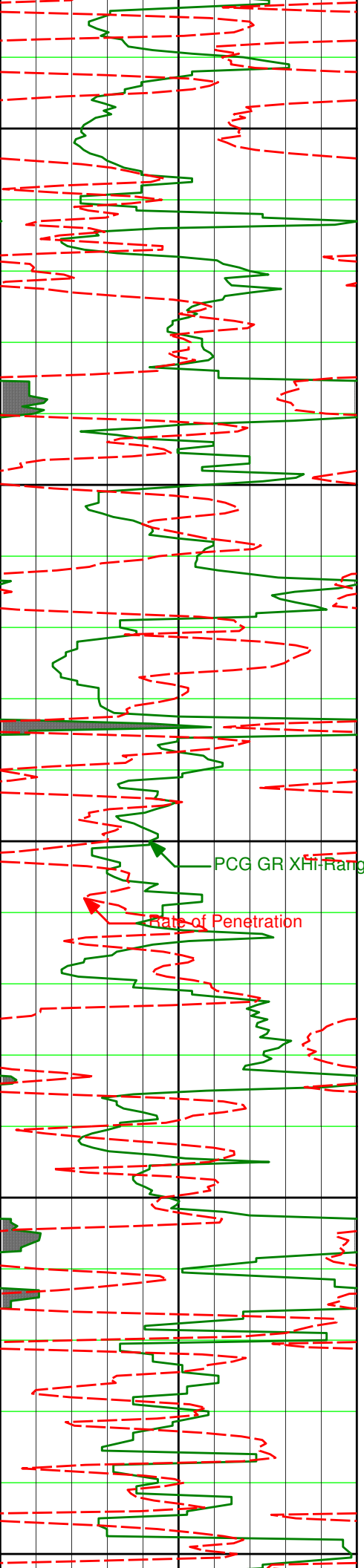
0.65

313.71

2312.24

71.79

0.32



2400

2450

2500

2550

2600

2505

0.44

324.80

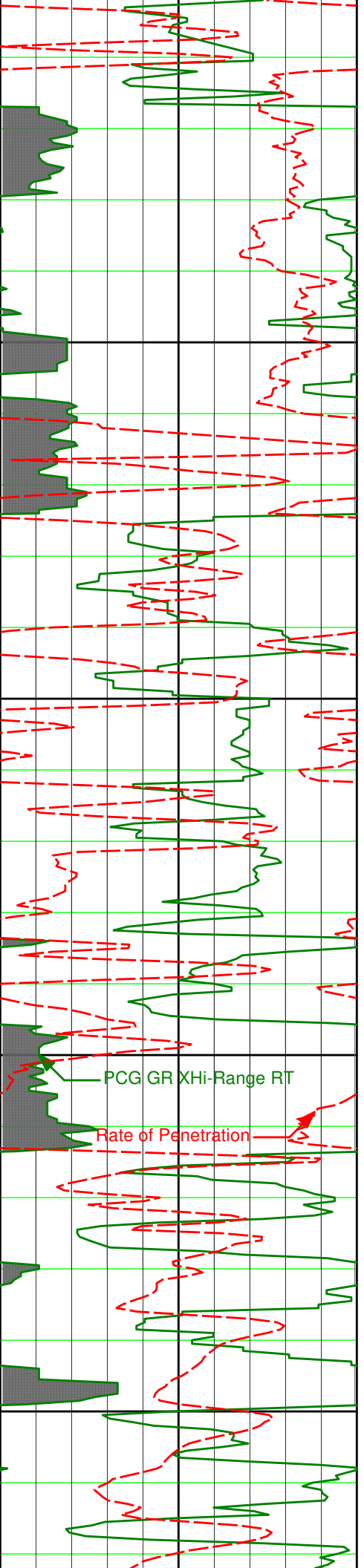
2502.23

73.26

0.12

PCG GR XFI-Range RT

Rate of Penetration



2650

2700

2750

2800

2694

0.34

334.23

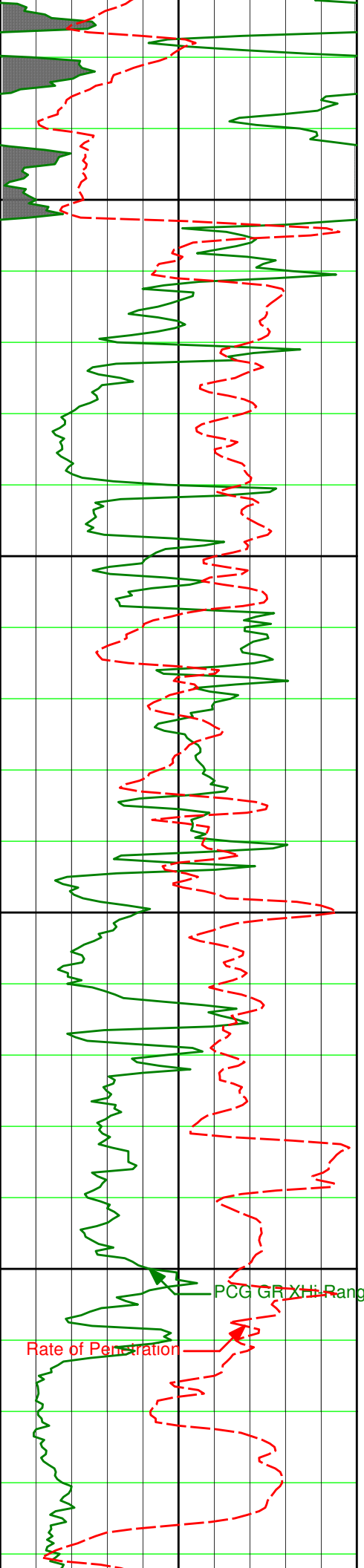
2691.22

74.43

0.06

PCG GR XHi-Range RT

Rate of Penetration



2850

2883

0.03

108.38

2880.22

74.95

0.19

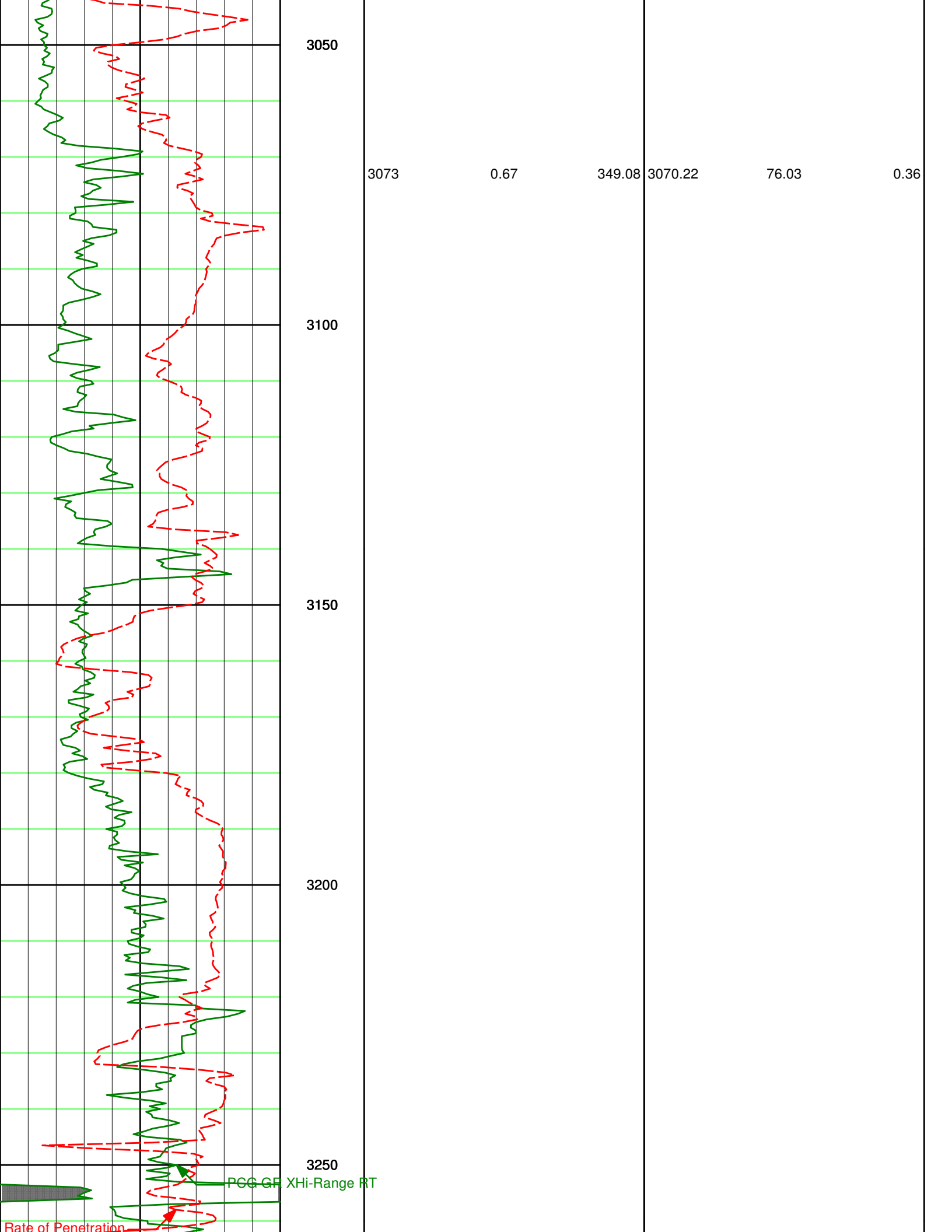
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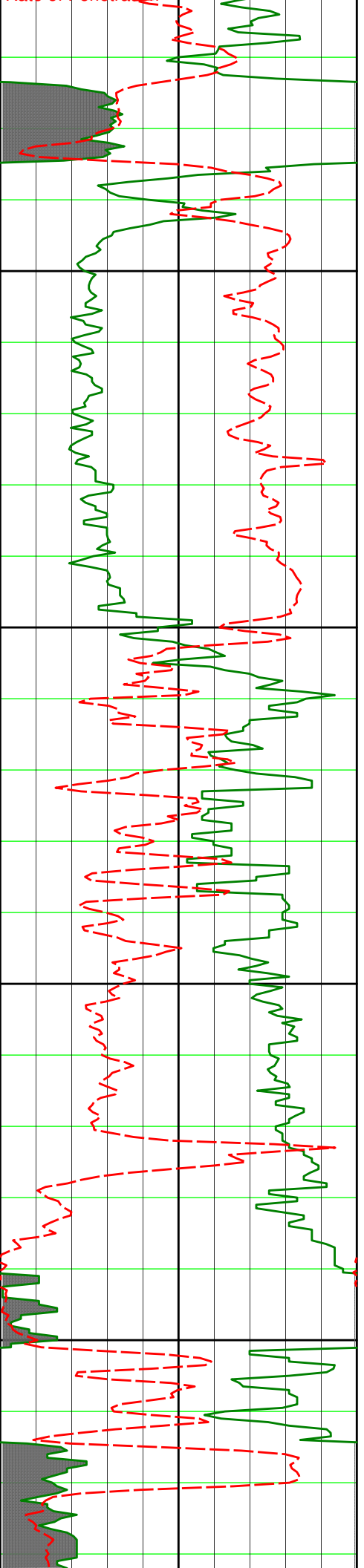
2950

3000

PCG GR(X)H Range RT

Rate of Penetration





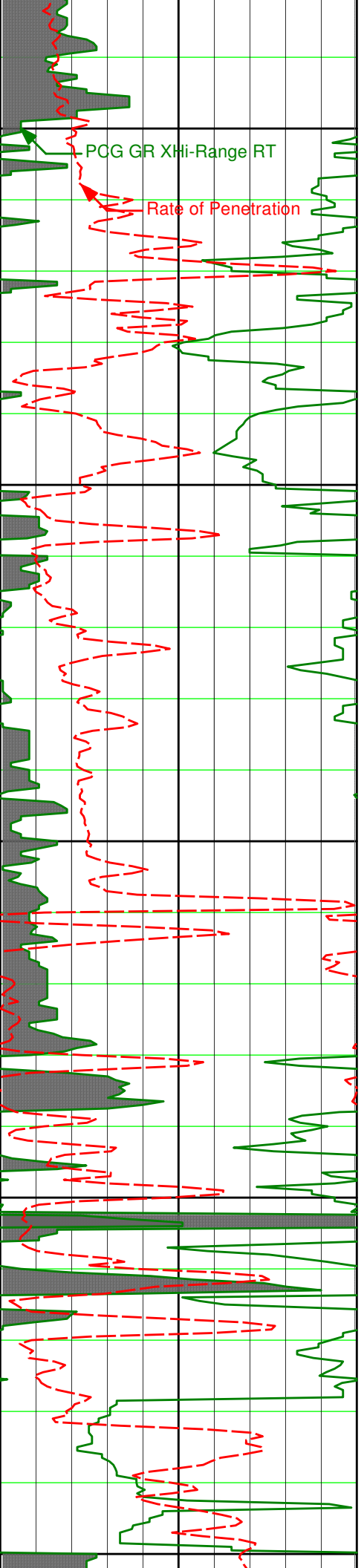
3300

3350

3400

3450

| | | | | | |
|------|------|--------|---------|-------|------|
| 3263 | 0.83 | 337.32 | 3260.20 | 78.46 | 0.12 |
| 3452 | 0.57 | 13.07 | 3449.19 | 80.66 | 0.26 |



3500

PCG GR XHi-Range RT

Rate of Penetration

3550

3600

3642

0.50

347.24

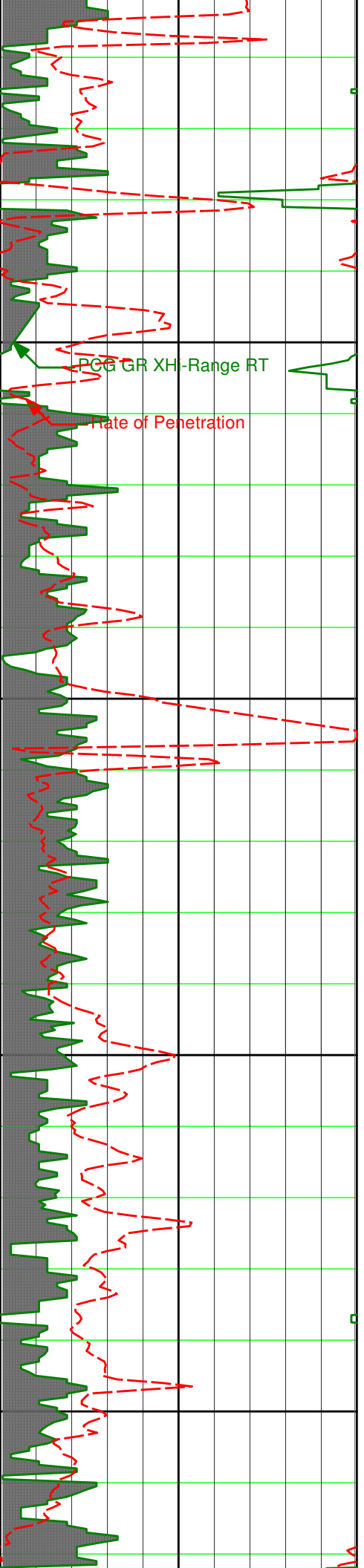
3639.18

82.37

0.13

3650

3700



3750

PGG GR XHI-Range RT

Rate of Penetration

3800

3832

0.31

332.57

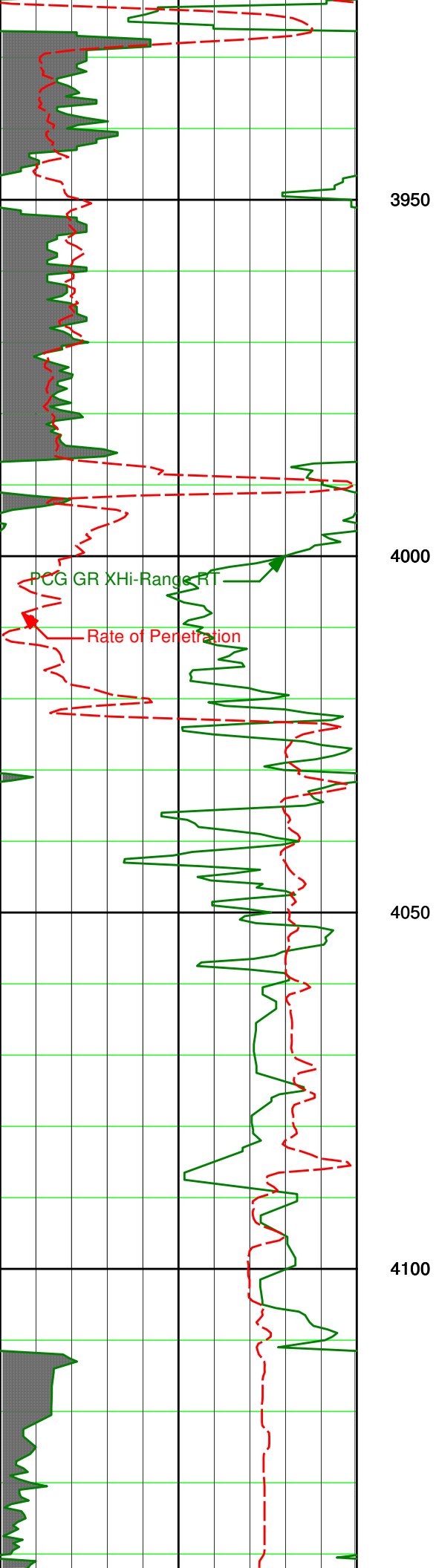
3829.18

83.68

0.11

3850

3900



4022

0.22

306.56

4019.17

84.42

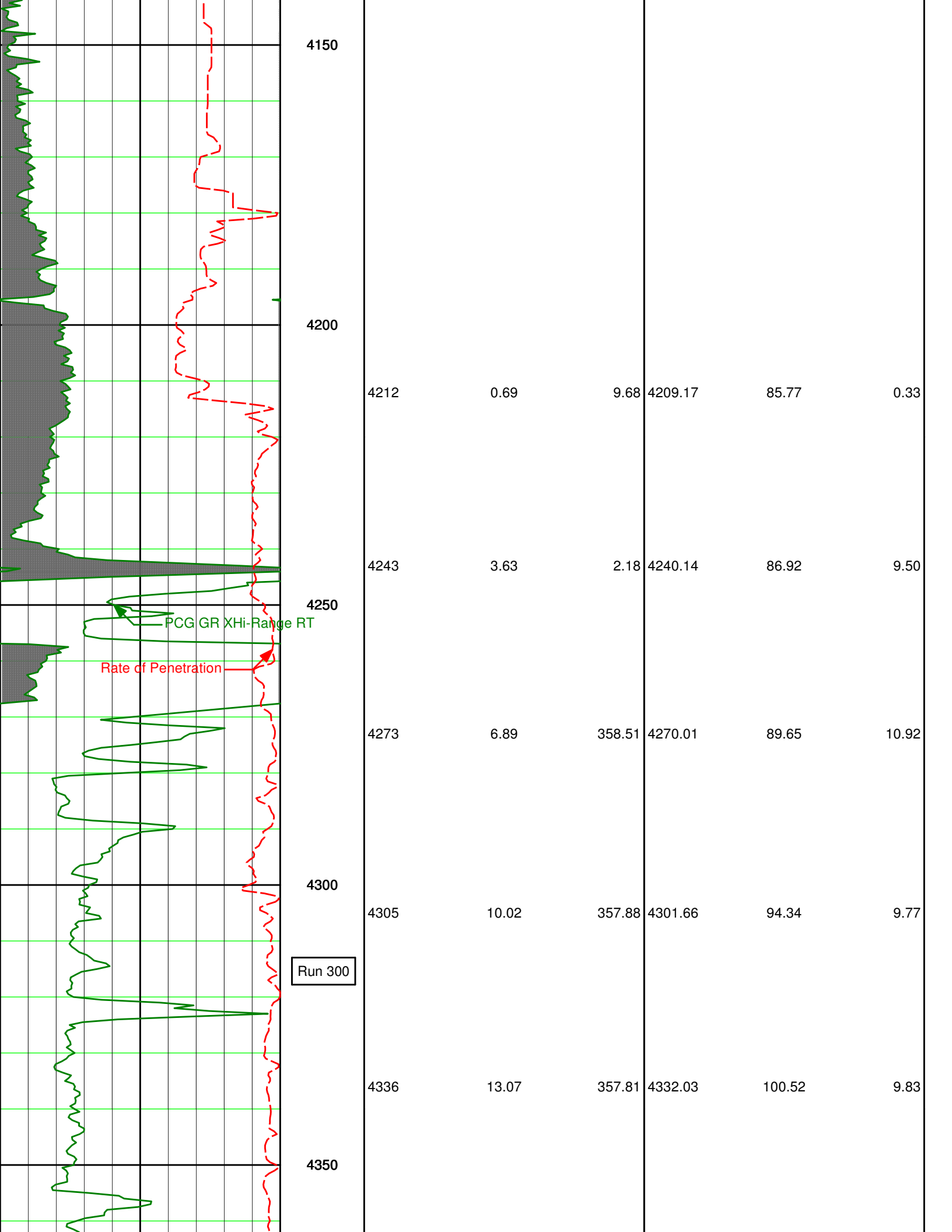
0.08

3950

4000

4050

4100



4150

4200

4212

0.69

9.68

4209.17

85.77

0.33

4243

3.63

2.18

4240.14

86.92

9.50

4250

PCG GR XHi-Range RT

Rate of Penetration

4273

6.89

358.51

4270.01

89.65

10.92

4300

Run 300

4305

10.02

357.88

4301.66

94.34

9.77

4336

13.07

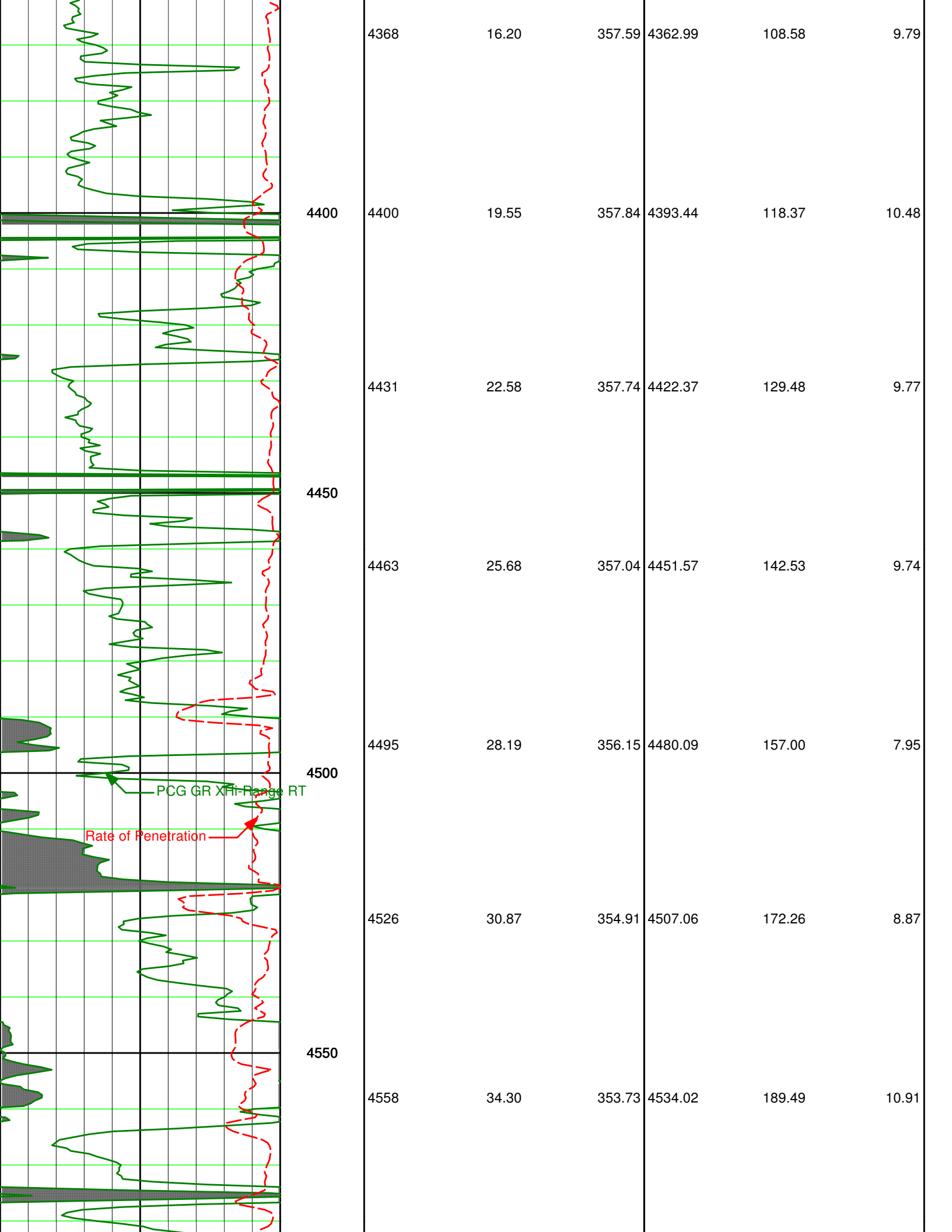
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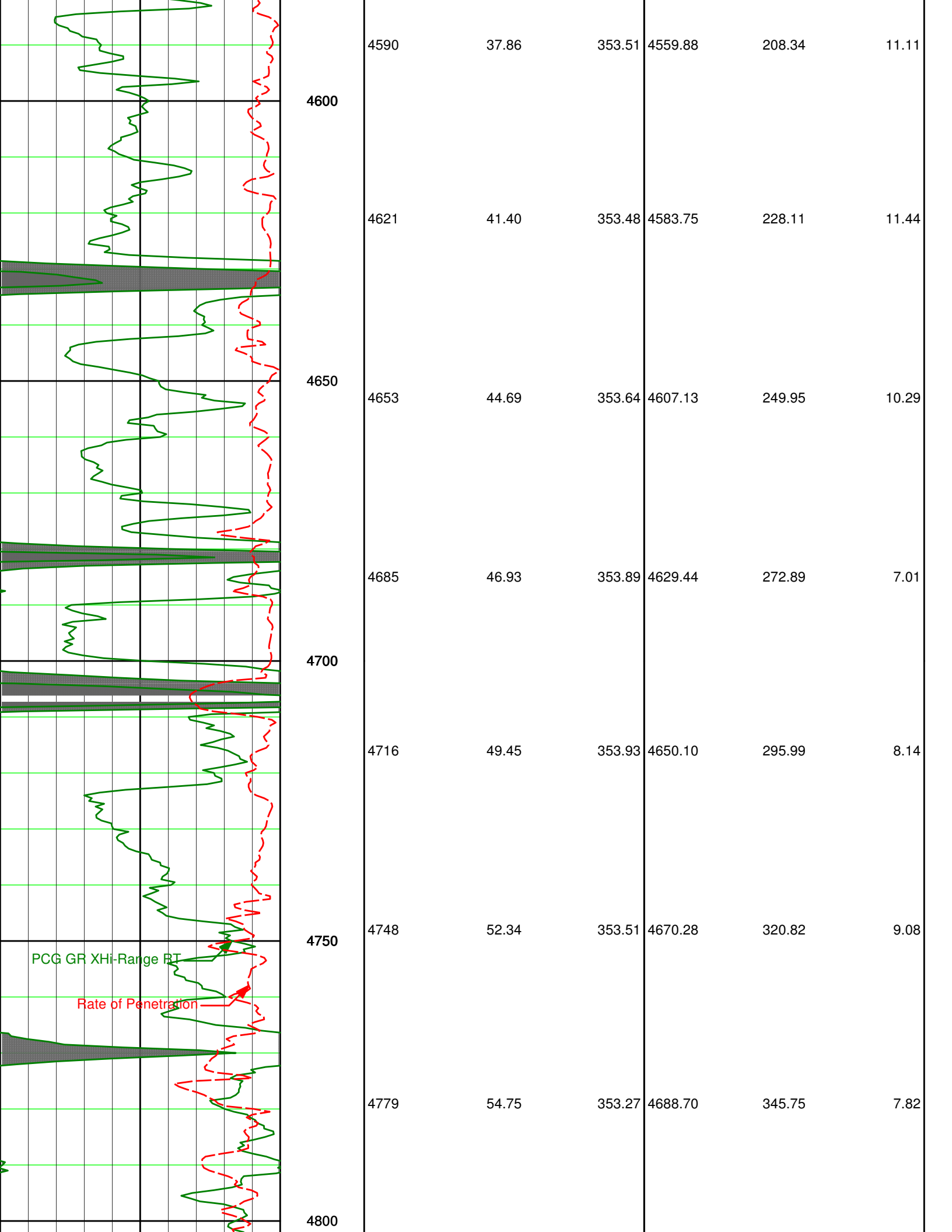
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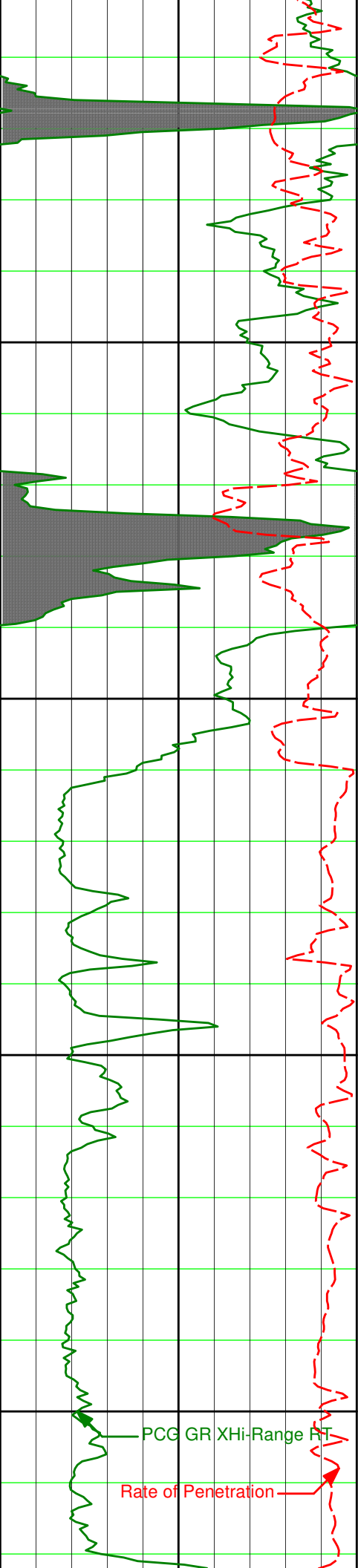
100.52

9.83

4350



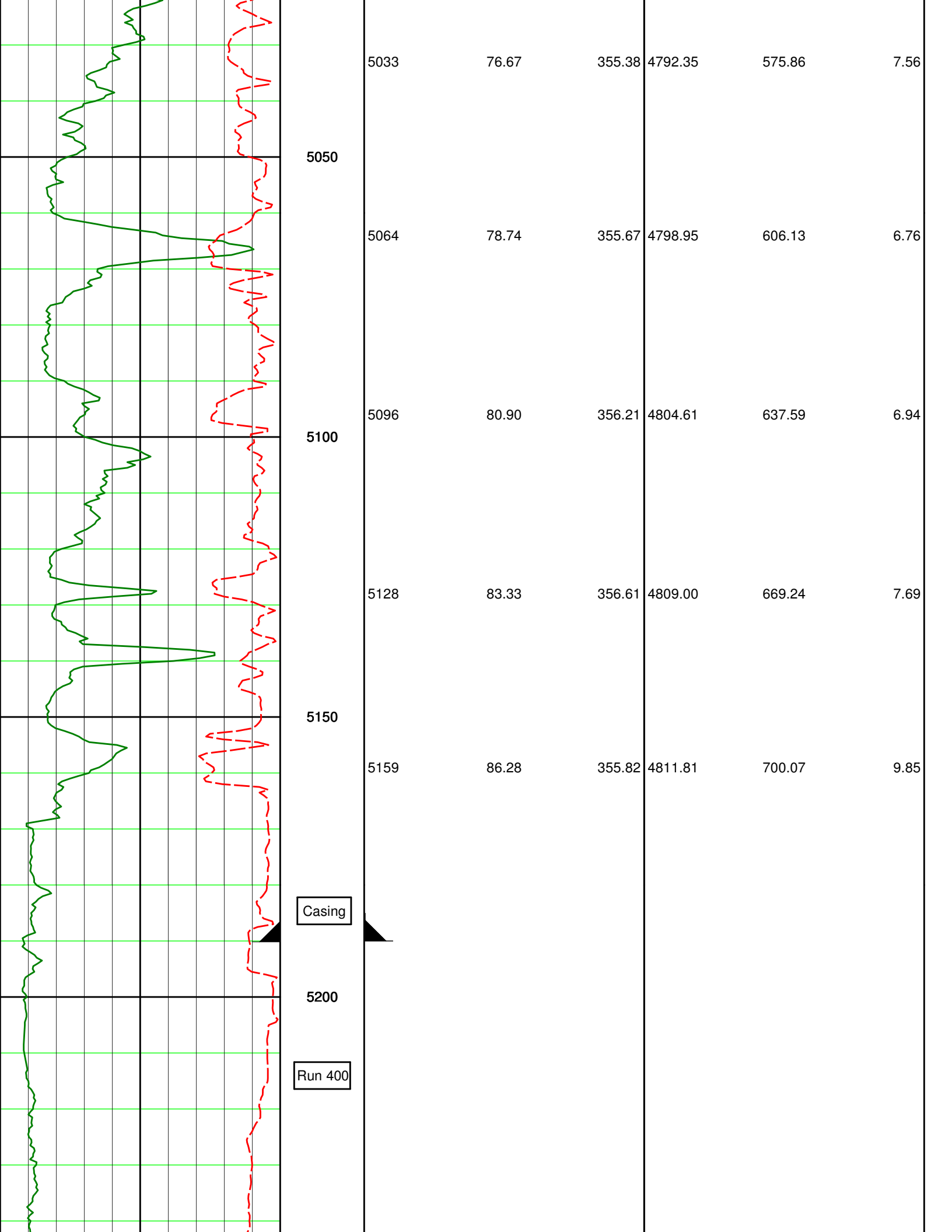


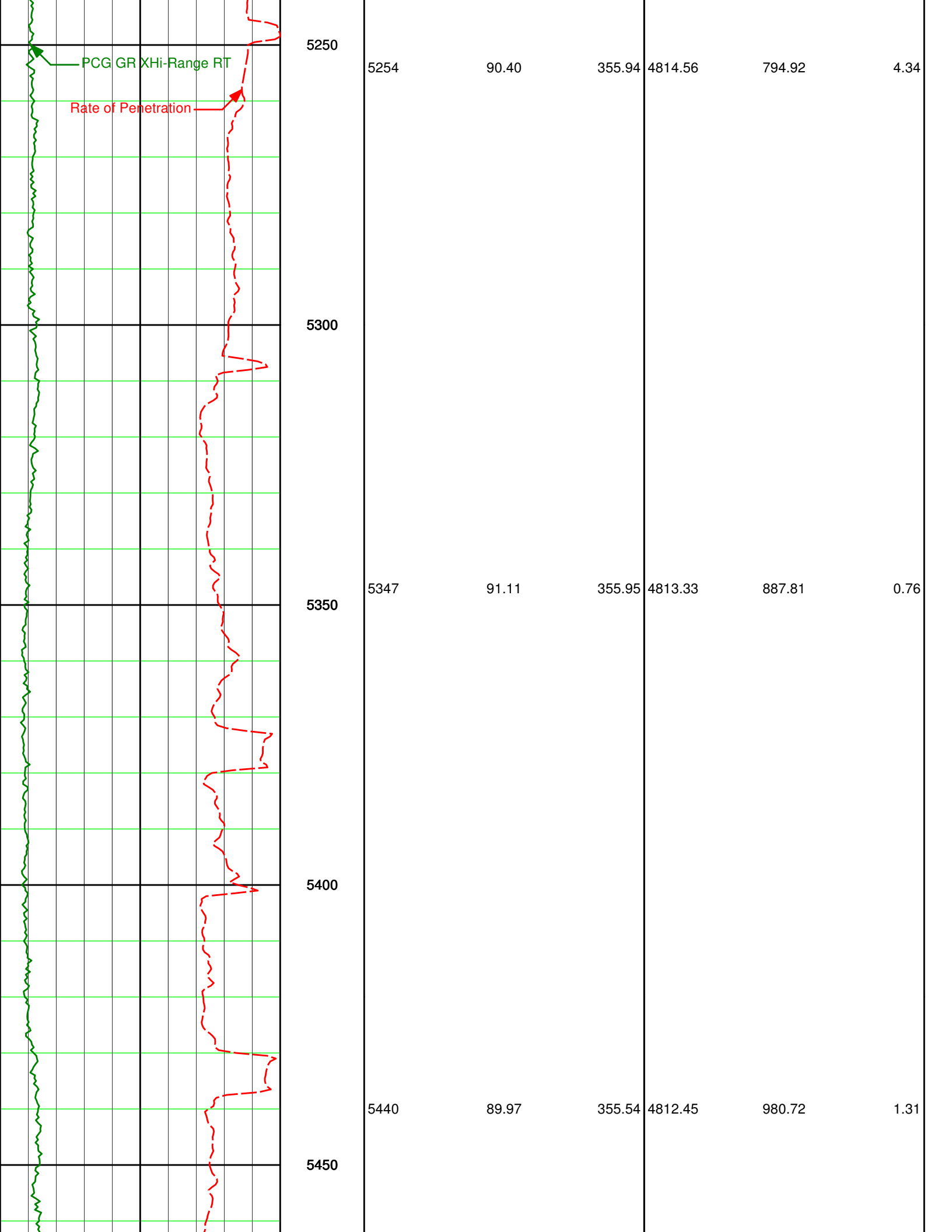


| | | | | | | |
|------|------|-------|--------|---------|--------|------|
| | 4811 | 57.48 | 353.82 | 4706.54 | 372.32 | 8.62 |
| | 4843 | 60.63 | 353.91 | 4722.99 | 399.76 | 9.85 |
| 4850 | | | | | | |
| | 4874 | 62.57 | 354.20 | 4737.74 | 427.02 | 6.30 |
| | 4906 | 65.38 | 354.56 | 4751.78 | 455.77 | 8.84 |
| 4900 | | | | | | |
| | 4938 | 68.50 | 354.08 | 4764.31 | 485.20 | 9.85 |
| 4950 | | | | | | |
| | 4969 | 71.41 | 353.99 | 4774.93 | 514.32 | 9.39 |
| | 5001 | 74.37 | 354.59 | 4784.35 | 544.90 | 9.42 |
| 5000 | | | | | | |

PCG GR XHi-Range RT

Rate of Penetration





PCG GR XHi-Range RT

Rate of Penetration

5250

5254

90.40

355.94

4814.56

794.92

4.34

5300

5350

5347

91.11

355.95

4813.33

887.81

0.76

5400

5450

5440

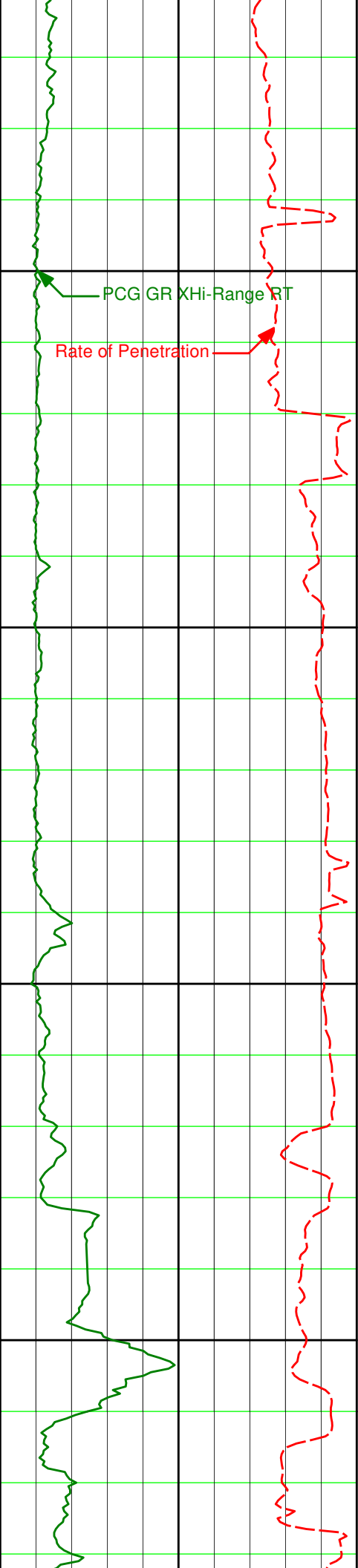
89.97

355.54

4812.45

980.72

1.31



5500

PCG GR XHi-Range RT

Rate of Penetration

5535

91.11

354.32

4811.56

1075.68

1.75

5550

5600

5630

91.87

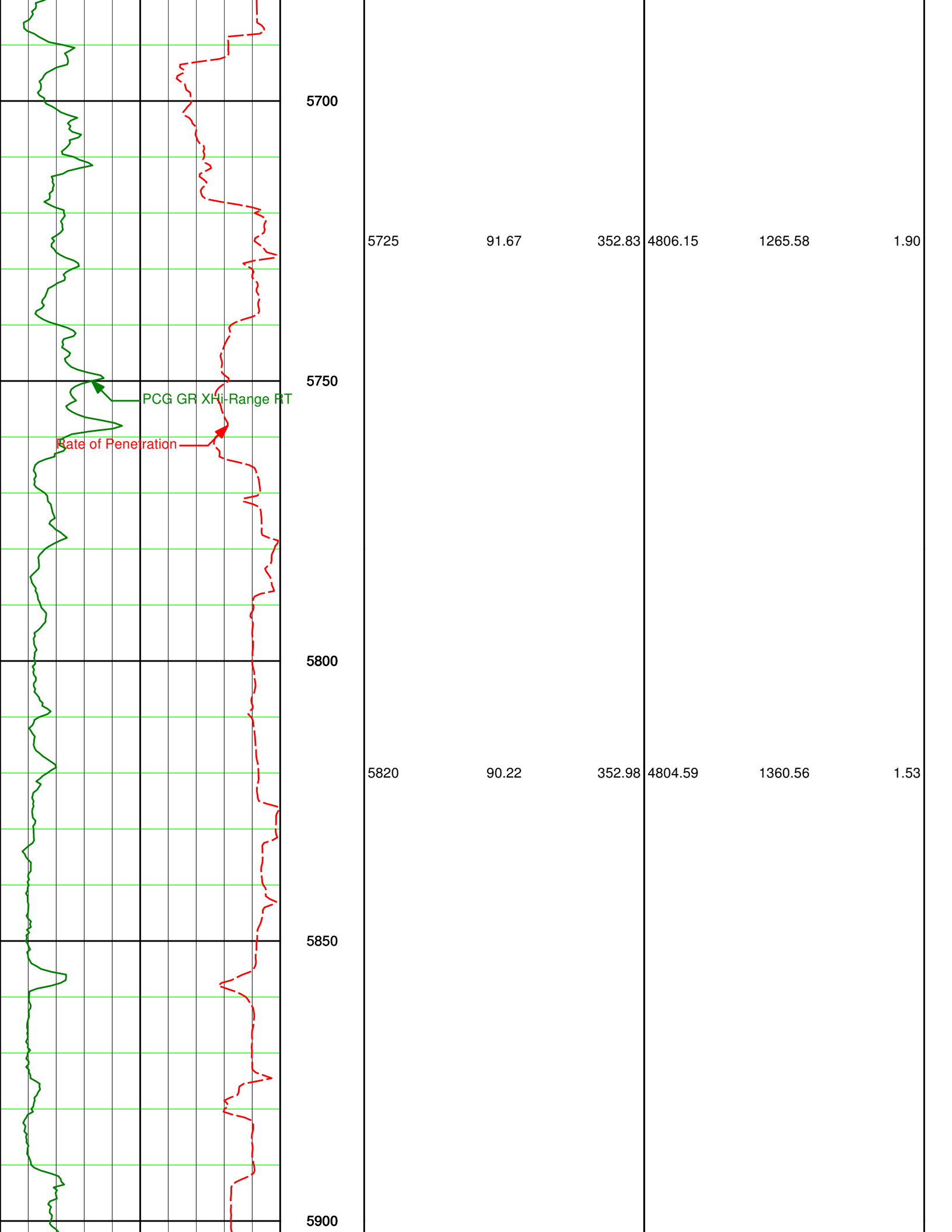
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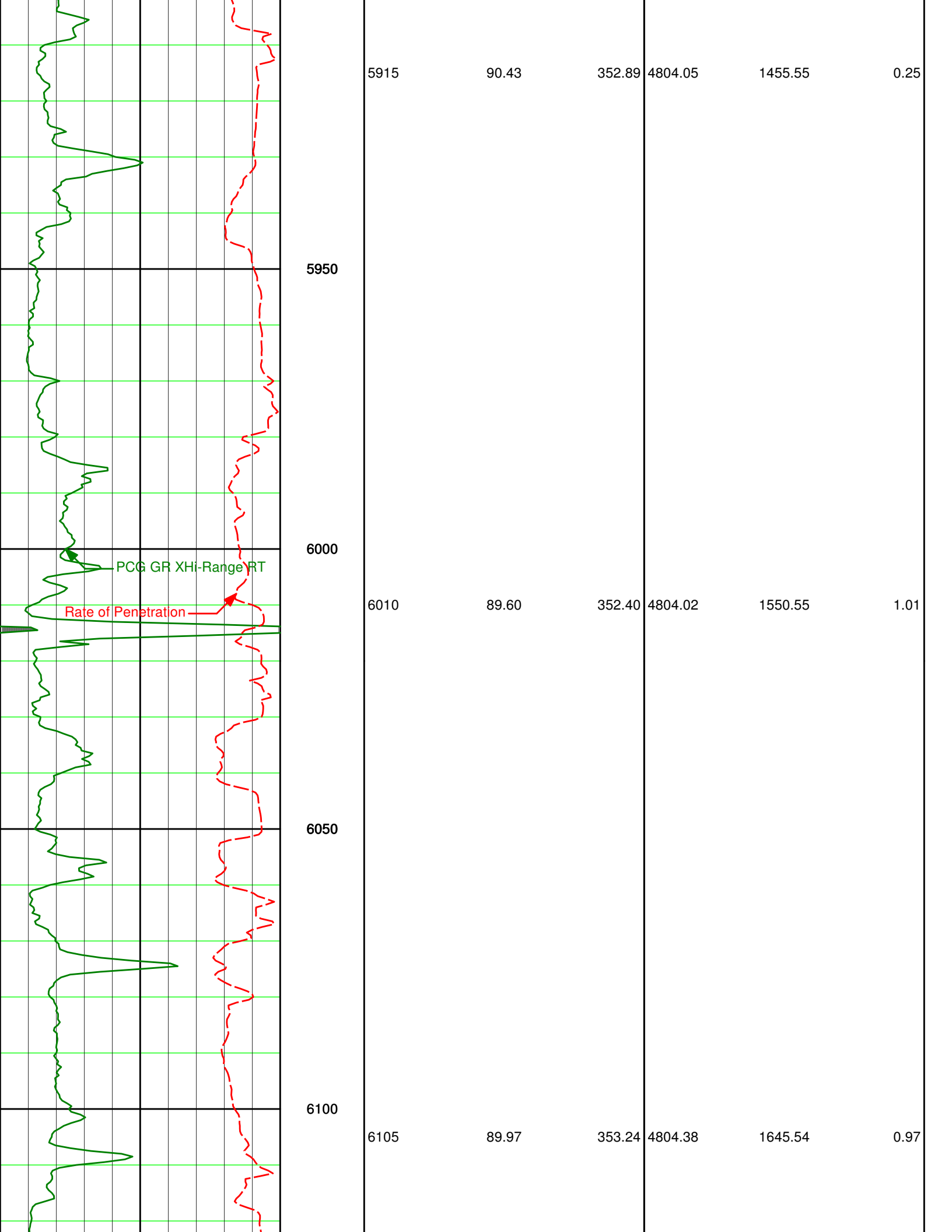
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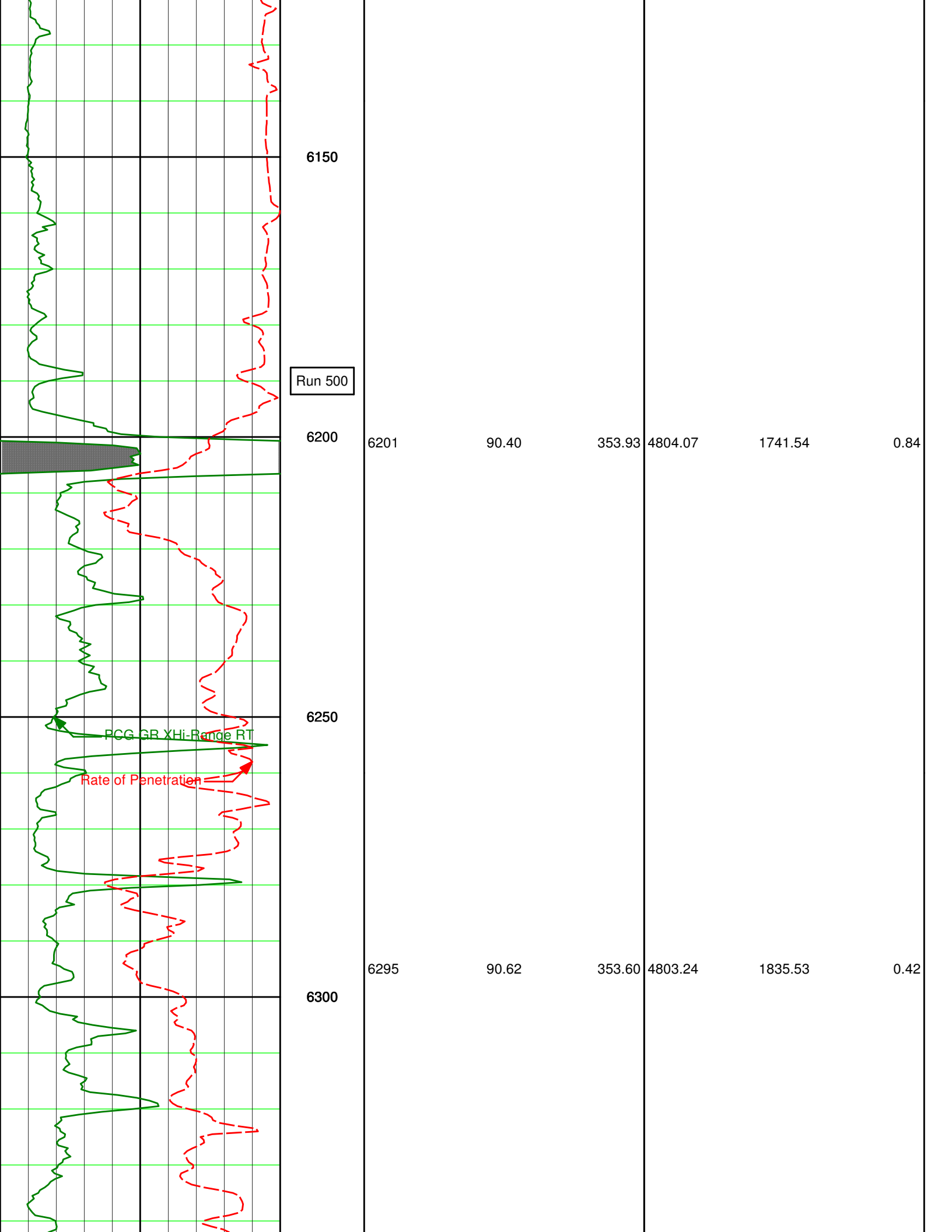
1170.63

0.86

5650







6150

Run 500

6200

6201

90.40

353.93

4804.07

1741.54

0.84

6250

PCG GR XHi-Range RT

Rate of Penetration

6300

6295

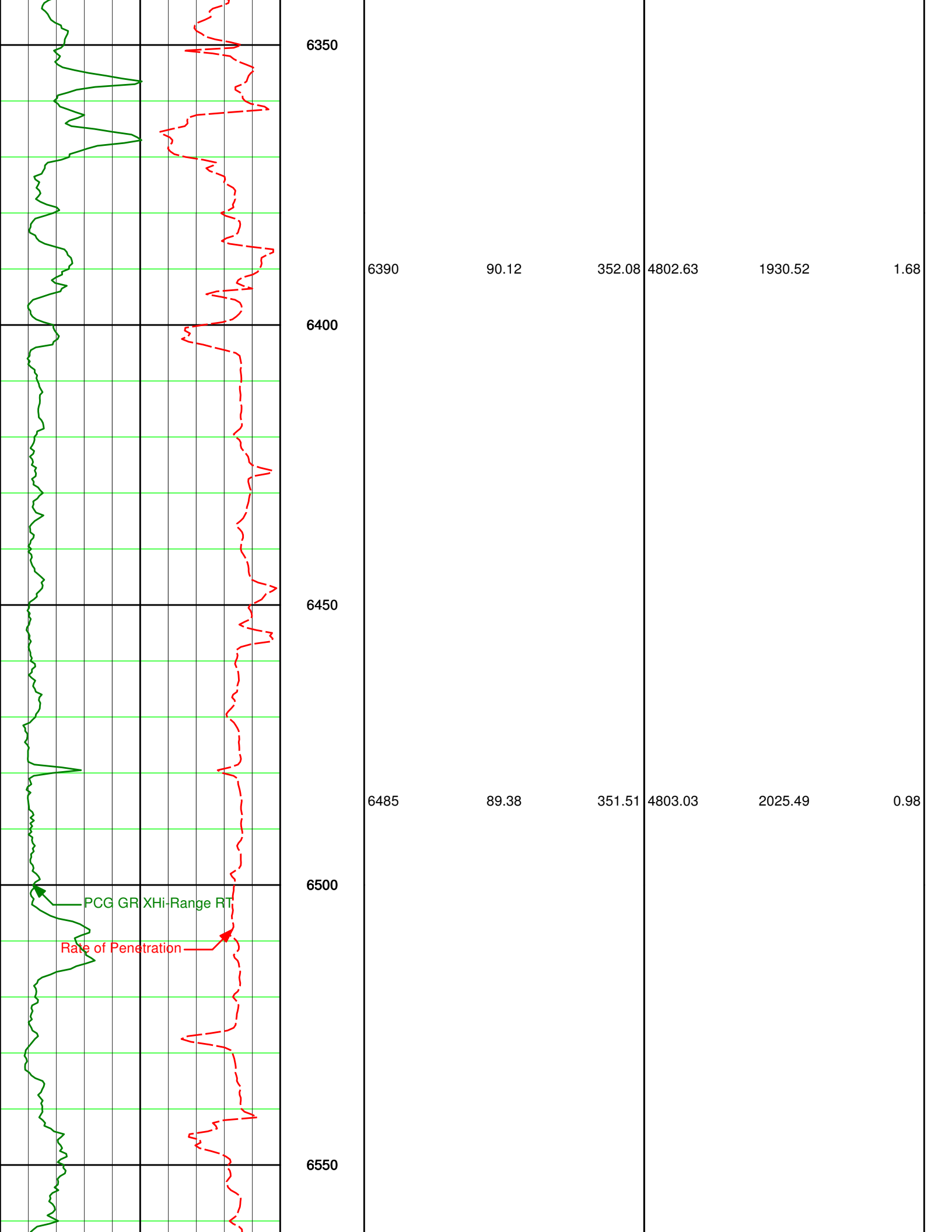
90.62

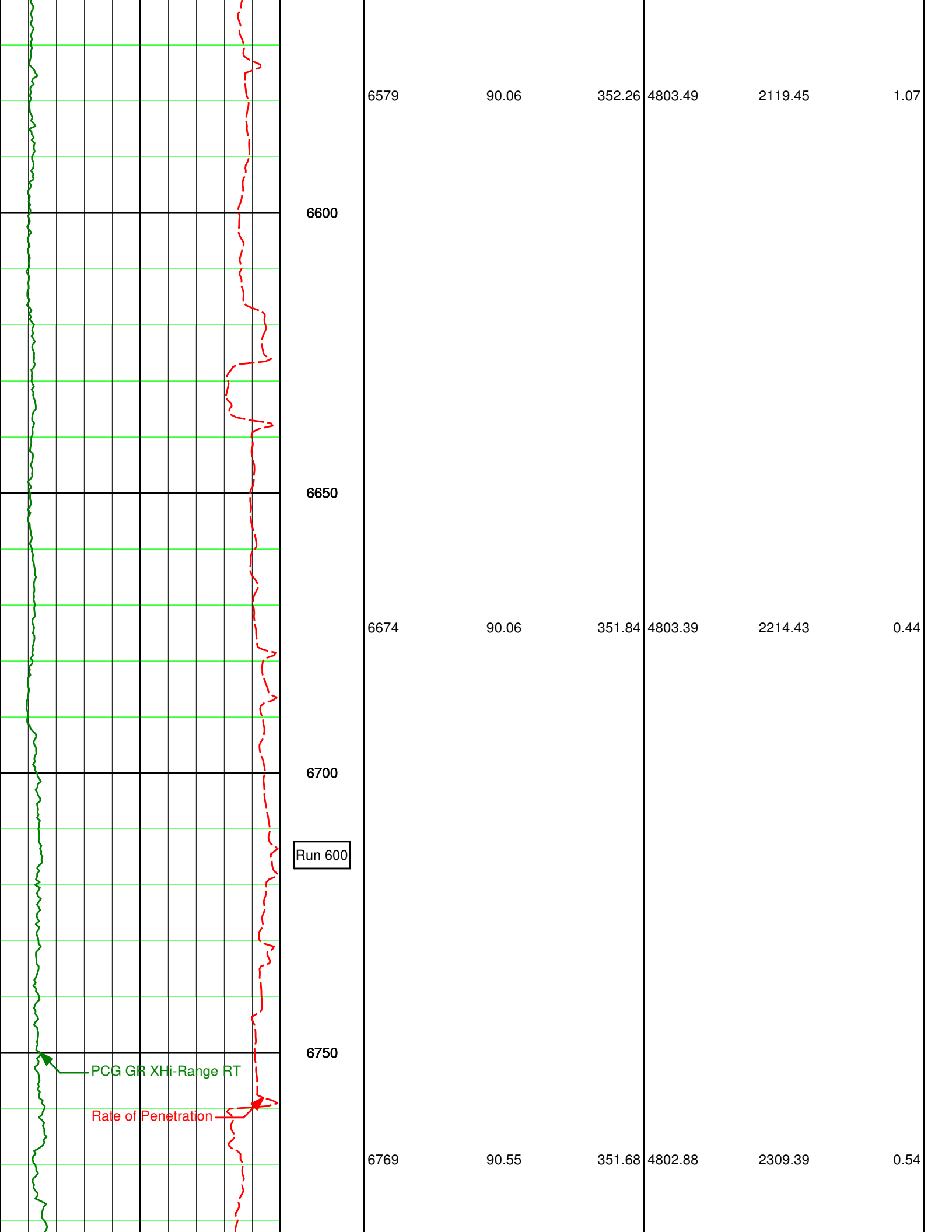
353.60

4803.24

1835.53

0.42





6579

90.06

352.26

4803.49

2119.45

1.07

6600

6650

6674

90.06

351.84

4803.39

2214.43

0.44

6700

Run 600

6750

PCG GR XHi-Range RT

Rate of Penetration

6769

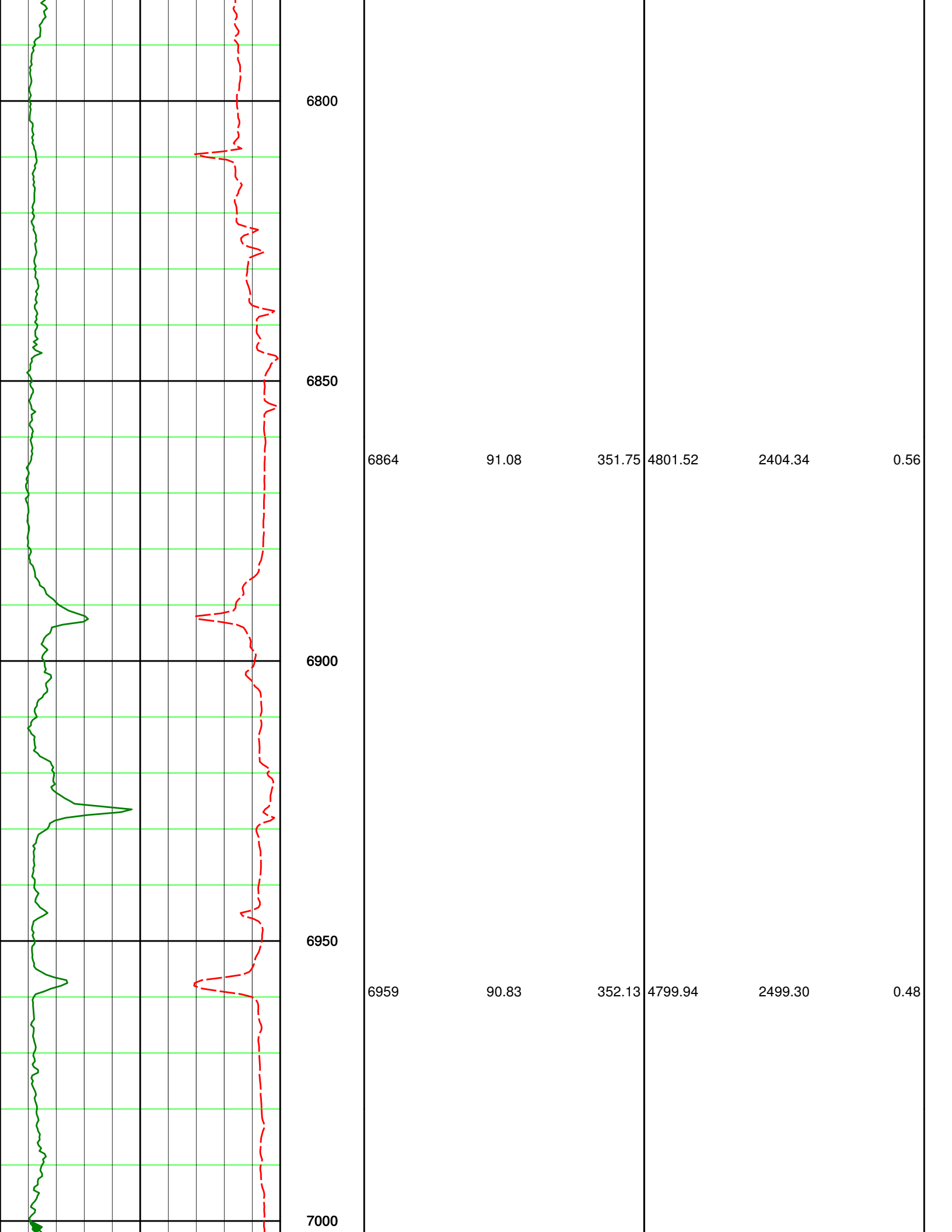
90.55

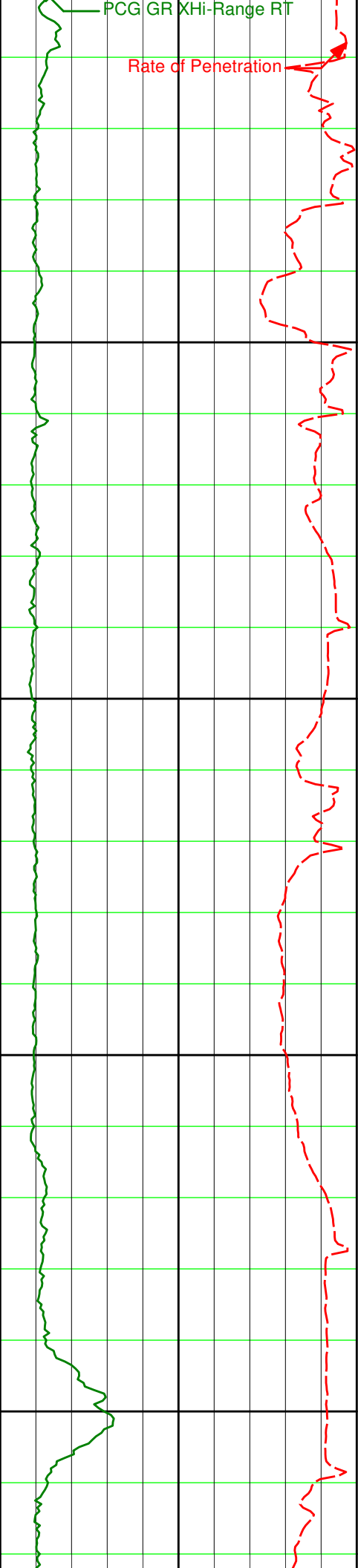
351.68

4802.88

2309.39

0.54





Rate of Penetration

7050

7054

90.18

353.88

4799.10

2594.29

1.97

7100

7150

7149

90.00

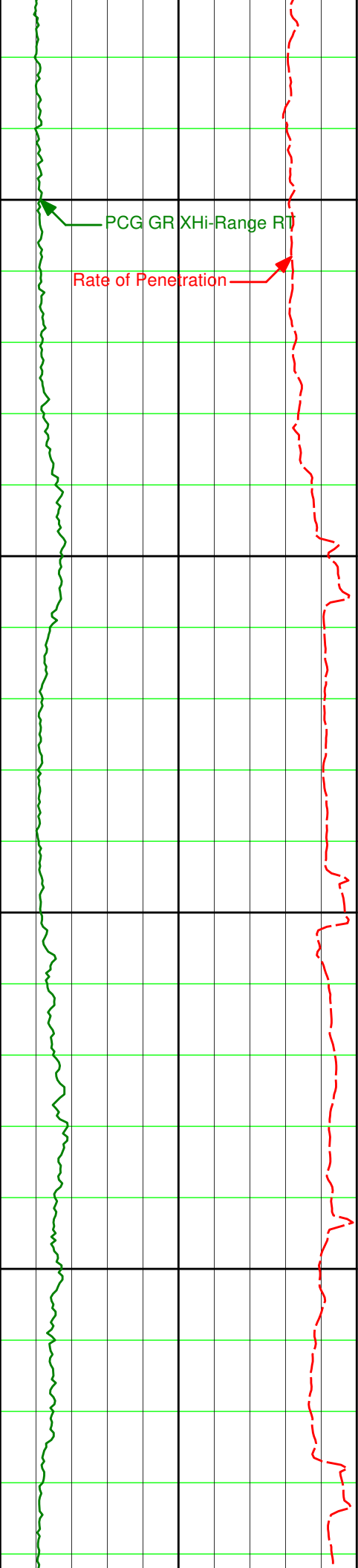
354.35

4798.95

2689.28

0.53

7200



| | | | | | |
|------|-------|--------|---------|---------|------|
| 7244 | 91.48 | 354.82 | 4797.72 | 2784.25 | 1.64 |
|------|-------|--------|---------|---------|------|

7250

PCG GR XHi-Range RT

Rate of Penetration

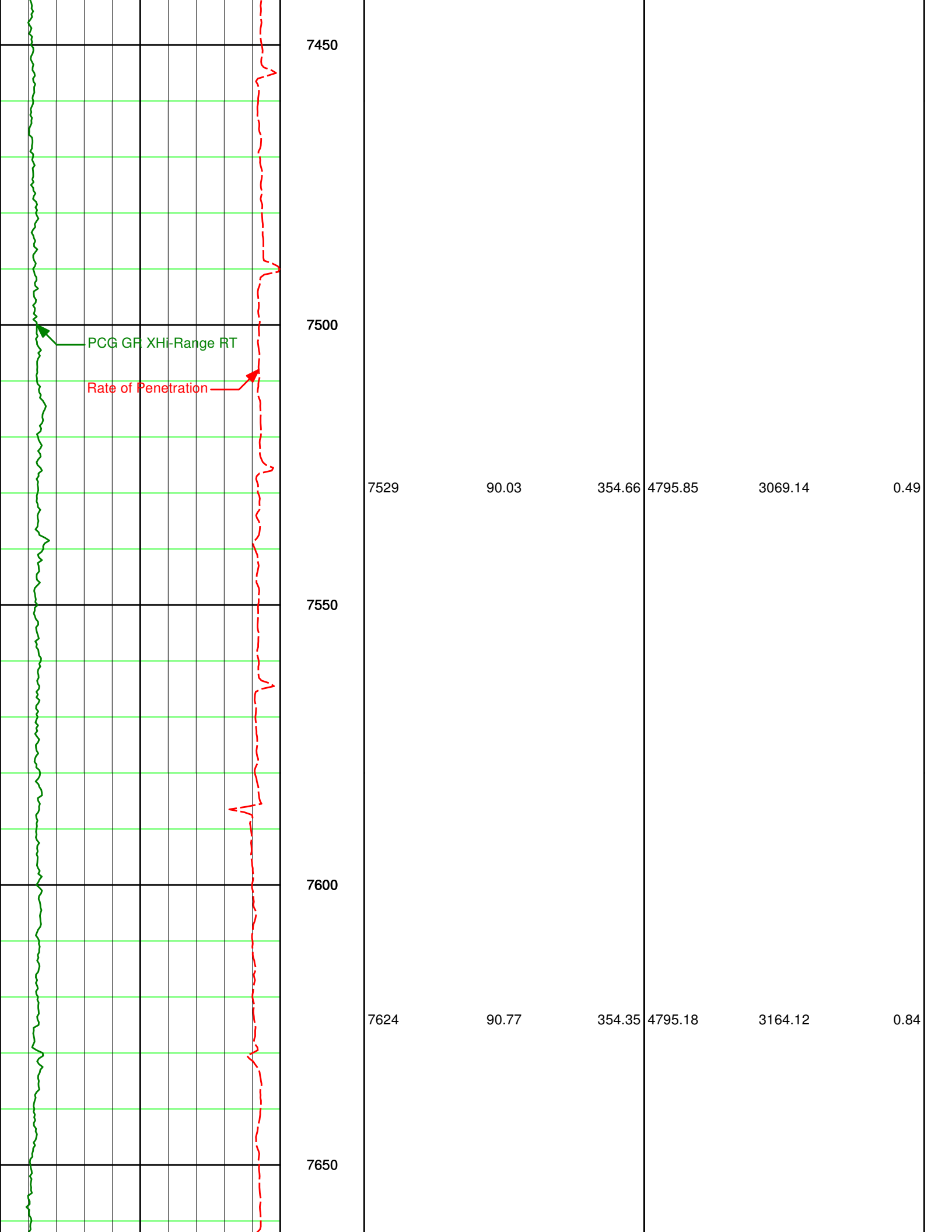
7300

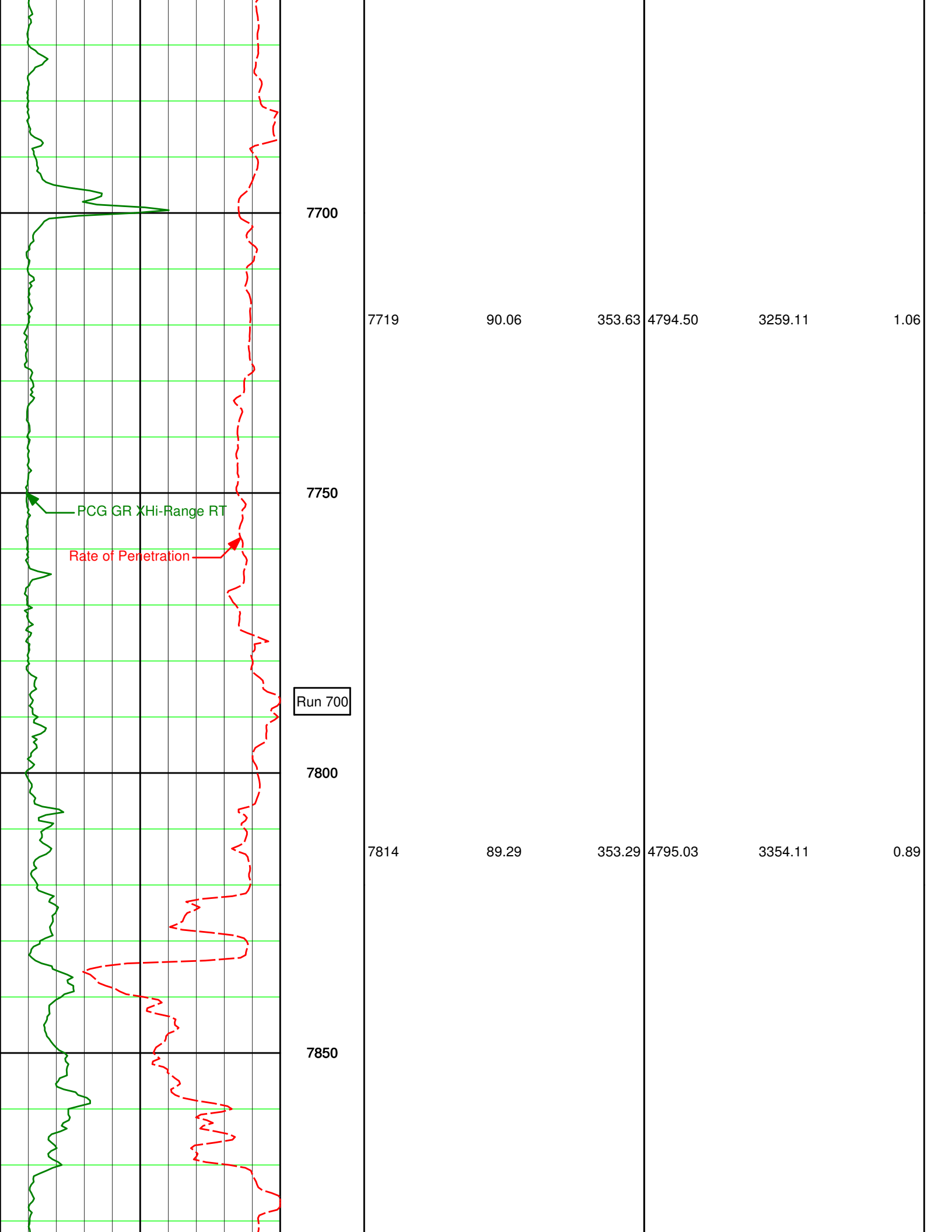
| | | | | | |
|------|-------|--------|---------|---------|------|
| 7339 | 90.71 | 355.07 | 4795.90 | 2879.20 | 0.86 |
|------|-------|--------|---------|---------|------|

7350

7400

| | | | | | |
|------|-------|--------|---------|---------|------|
| 7434 | 89.66 | 354.37 | 4795.59 | 2974.17 | 1.33 |
|------|-------|--------|---------|---------|------|





7700

7719

90.06

353.63

4794.50

3259.11

1.06

7750

Run 700

7800

7814

89.29

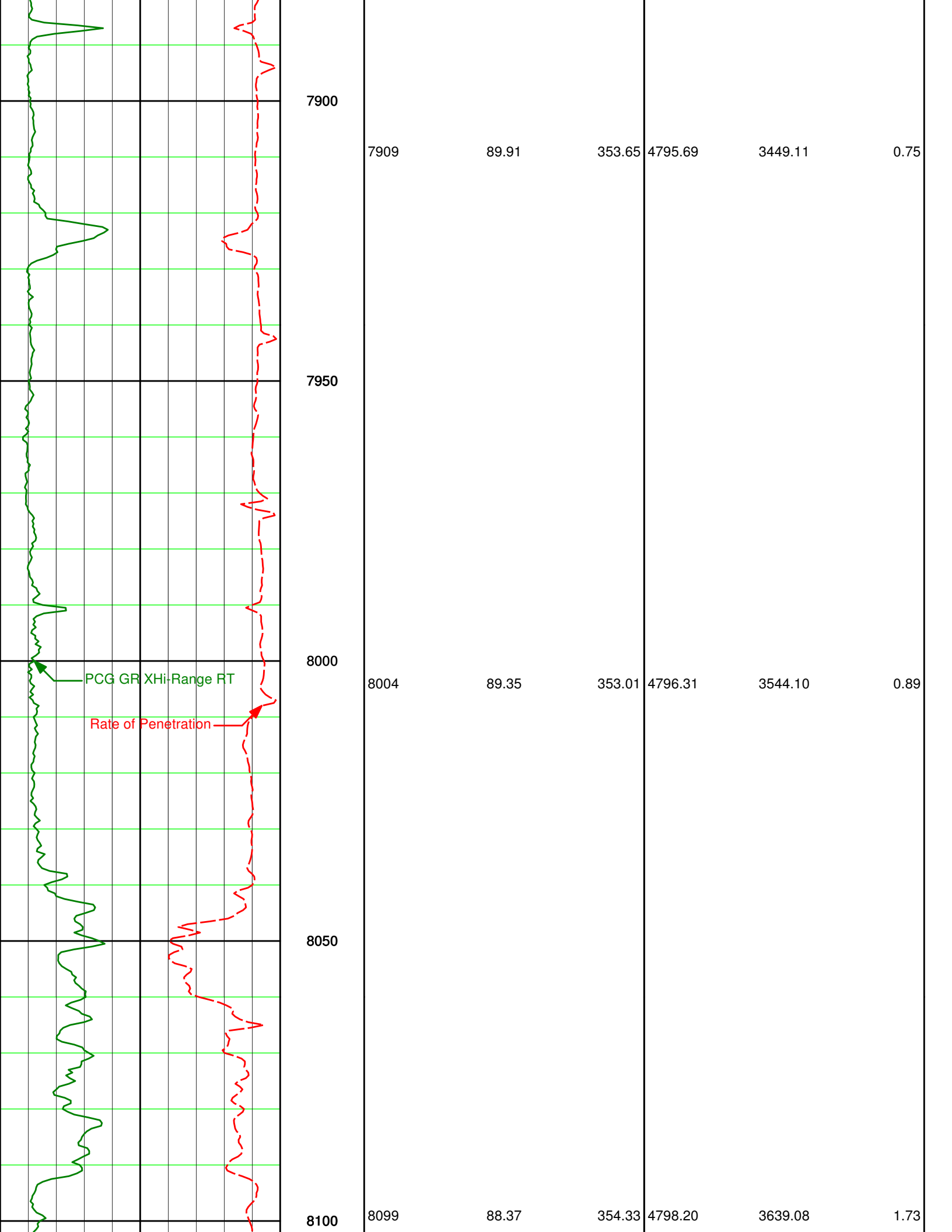
353.29

4795.03

3354.11

0.89

7850



7900

7909

89.91

353.65

4795.69

3449.11

0.75

7950

8000

8004

89.35

353.01

4796.31

3544.10

0.89

8050

8100

8099

88.37

354.33

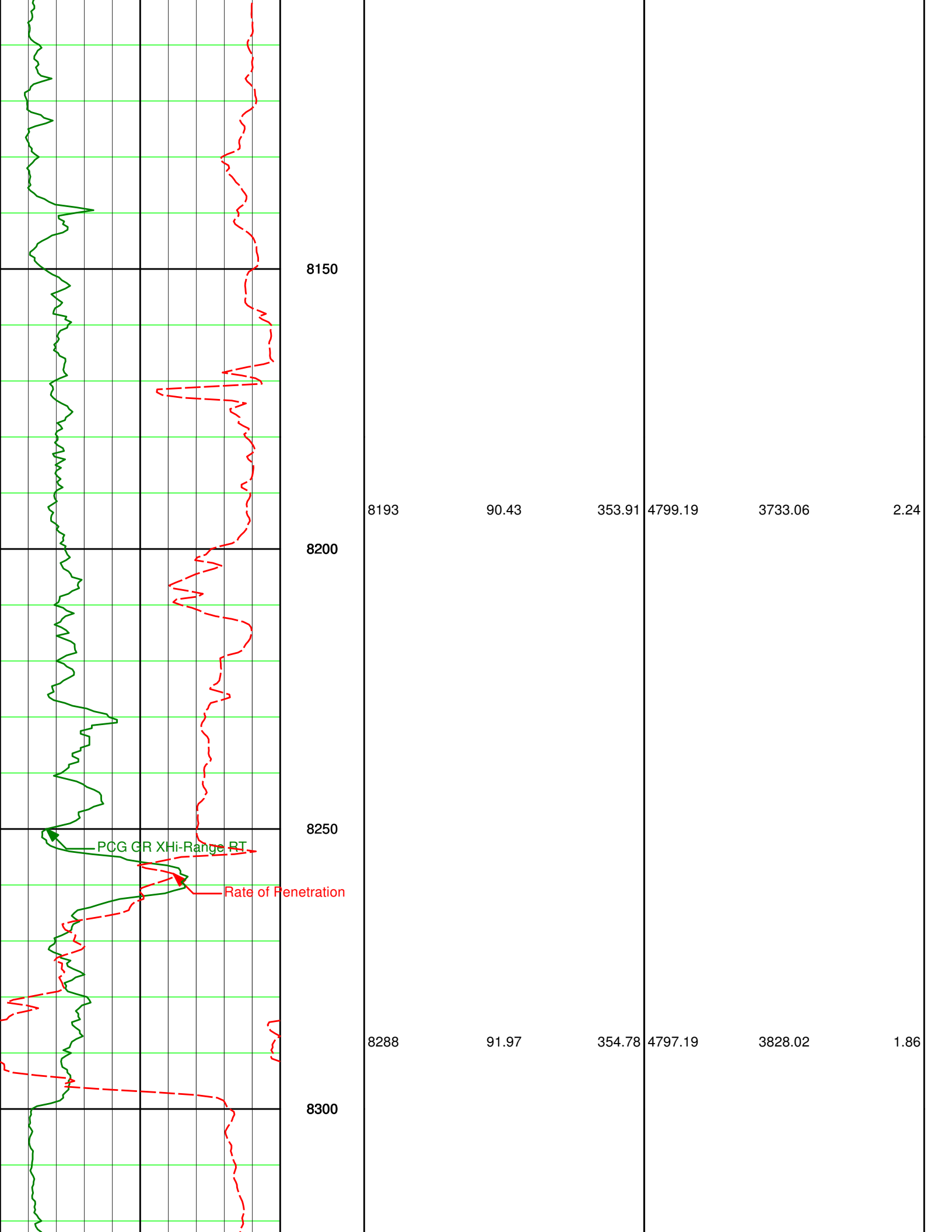
4798.20

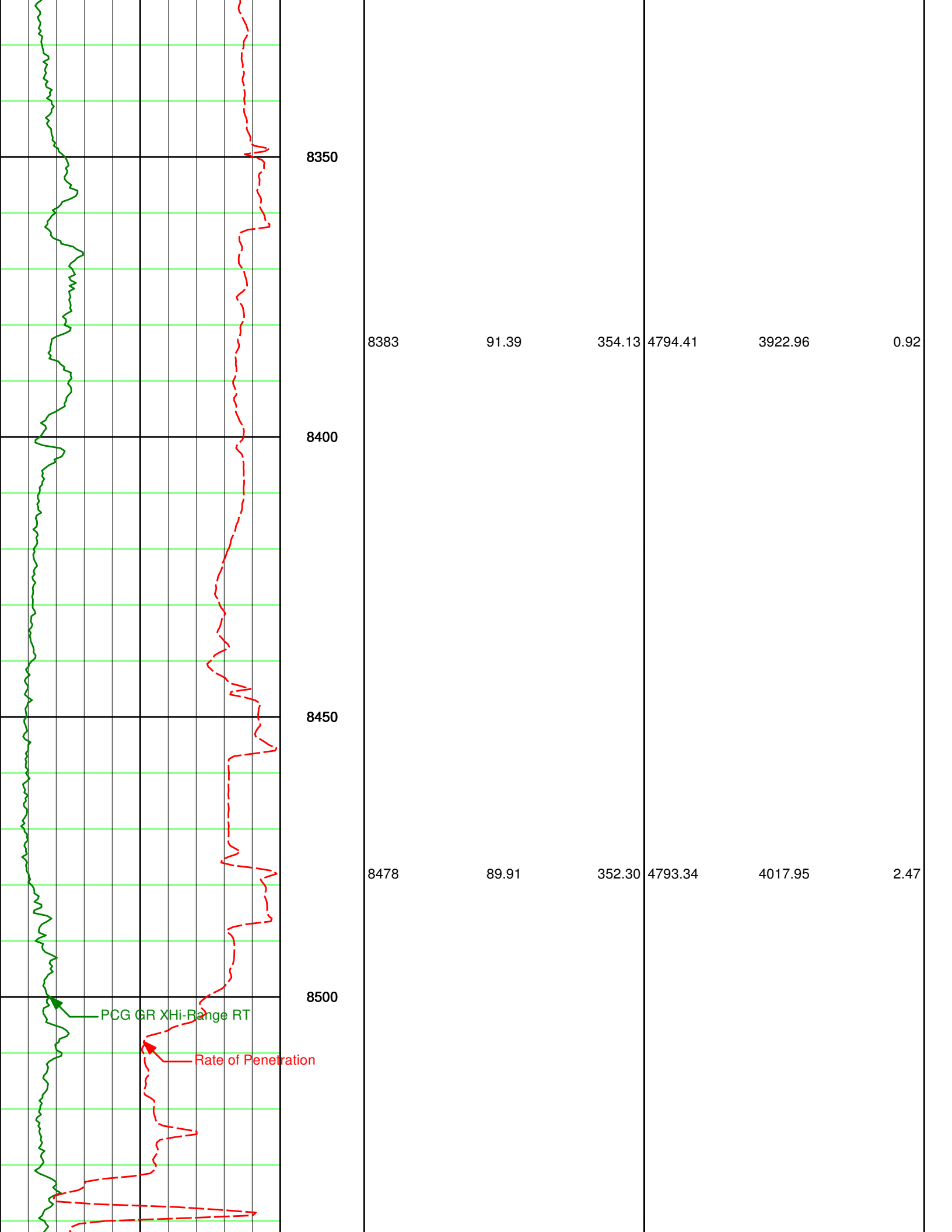
3639.08

1.73

PCG GR XHi-Range RT

Rate of Penetration





8350

8383

91.39

354.13

4794.41

3922.96

0.92

8400

8450

8478

89.91

352.30

4793.34

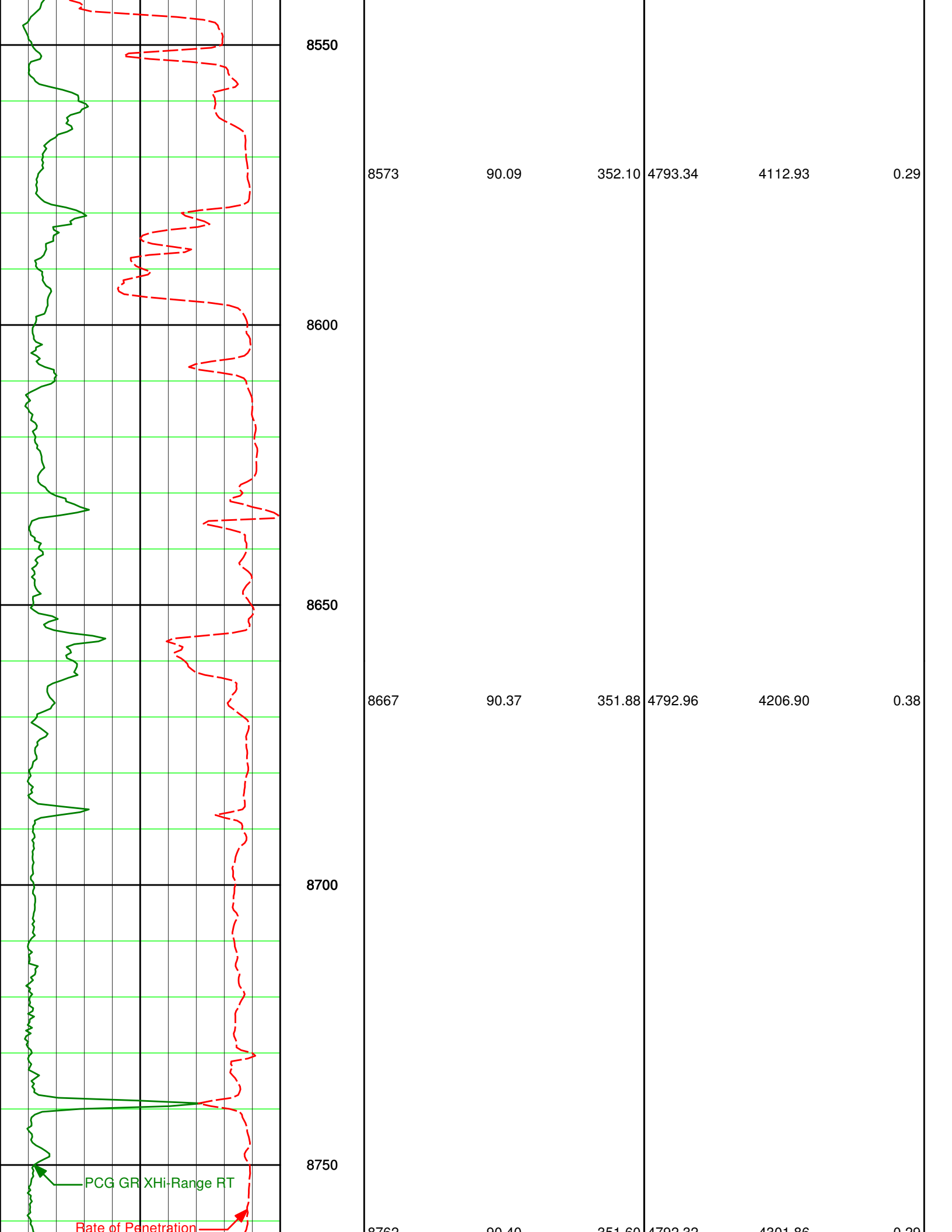
4017.95

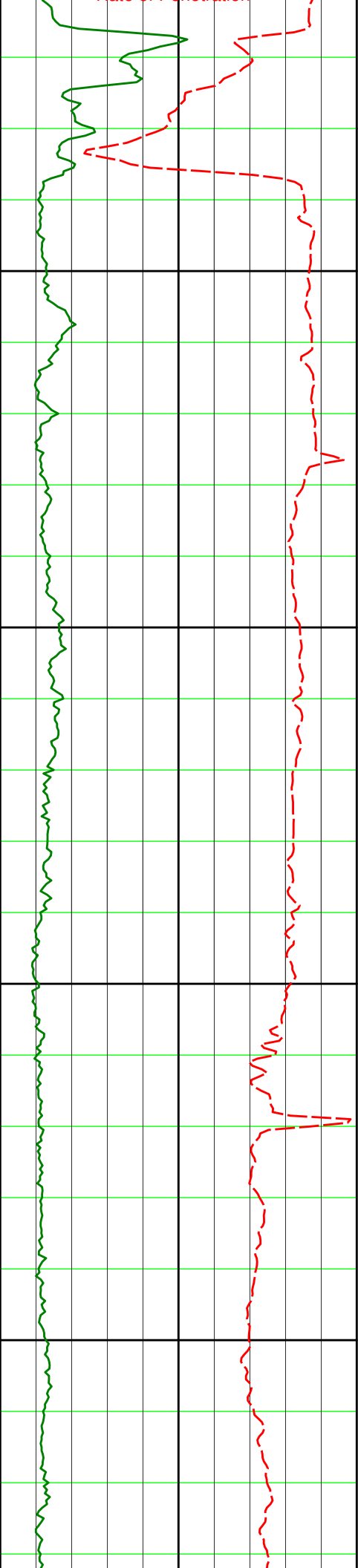
2.47

8500

PCG GR XHi-Range RT

Rate of Penetration





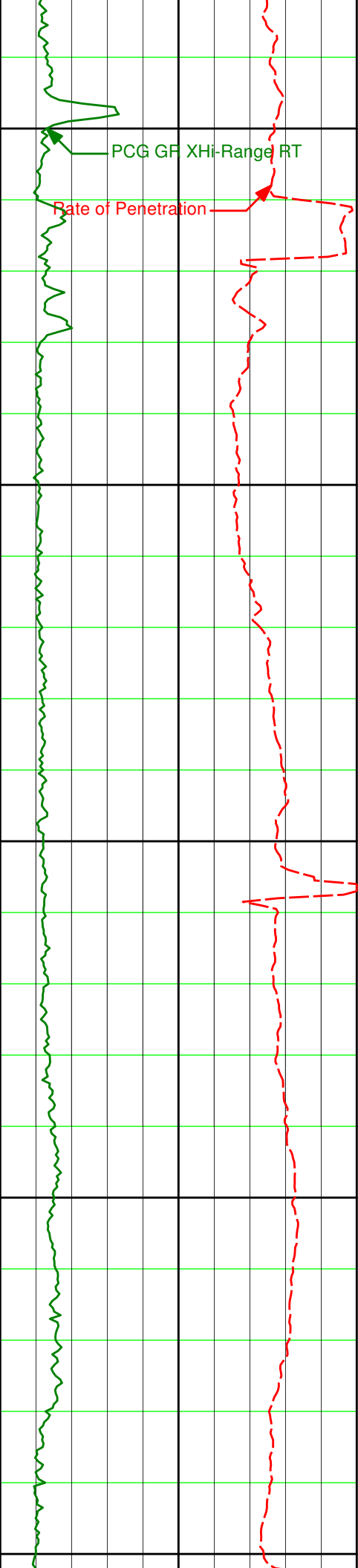
8800

8850

8900

8950

| | | | | | |
|------|-------|--------|---------|---------|------|
| 8762 | 90.40 | 351.60 | 4792.32 | 4301.86 | 0.29 |
| 8857 | 90.12 | 351.74 | 4791.89 | 4396.82 | 0.33 |
| 8952 | 89.10 | 351.17 | 4792.53 | 4491.77 | 1.23 |



9000

PCG GF XHi-Range RT

Rate of Penetration

9050

9047

89.97

352.05

4793.30

4586.72

1.30

9100

9150

9142

90.74

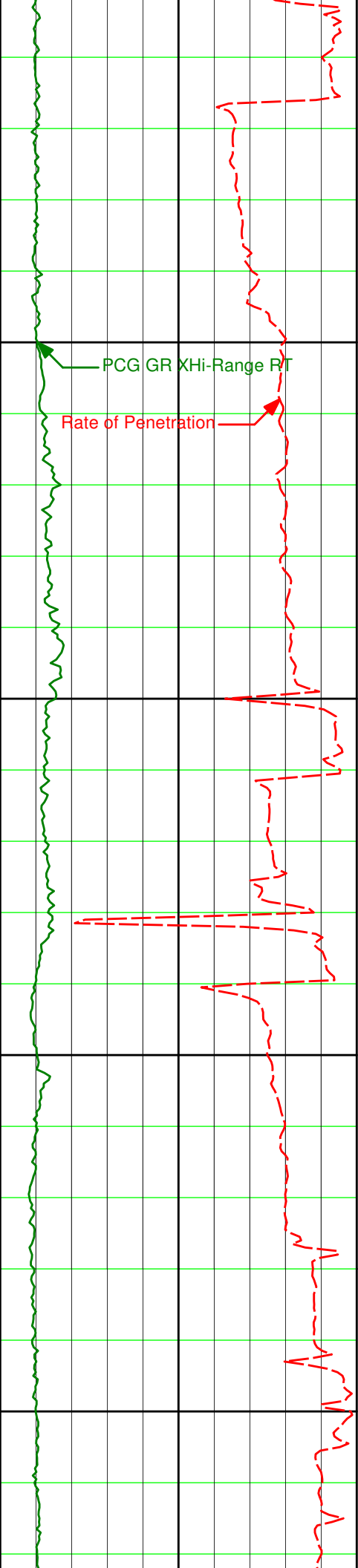
352.25

4792.71

4681.70

0.84

9200



9237
 9250
 9300
 9332
 9350
 9400

9237
 9332

91.29
 87.96

354.06
 352.72

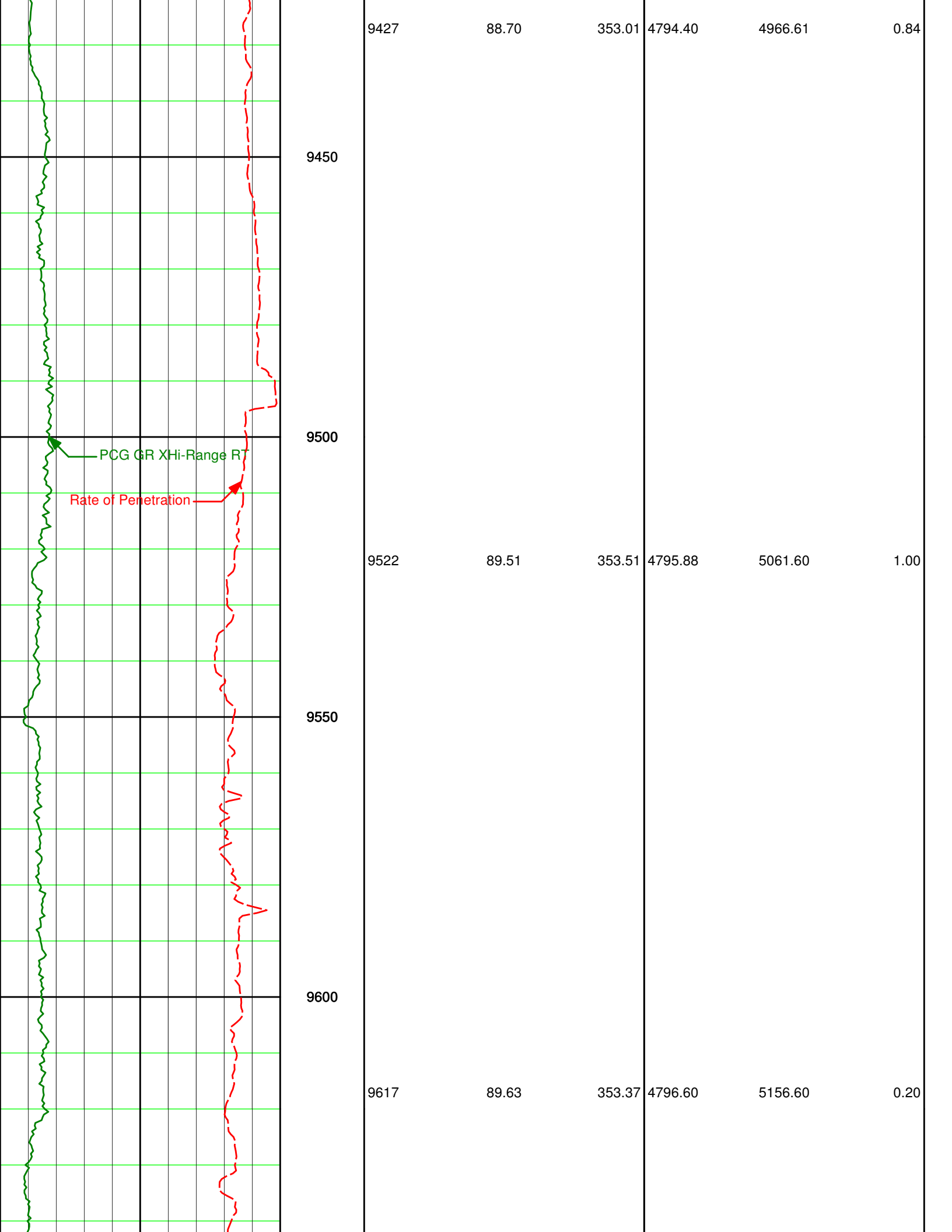
4791.02
 4791.64

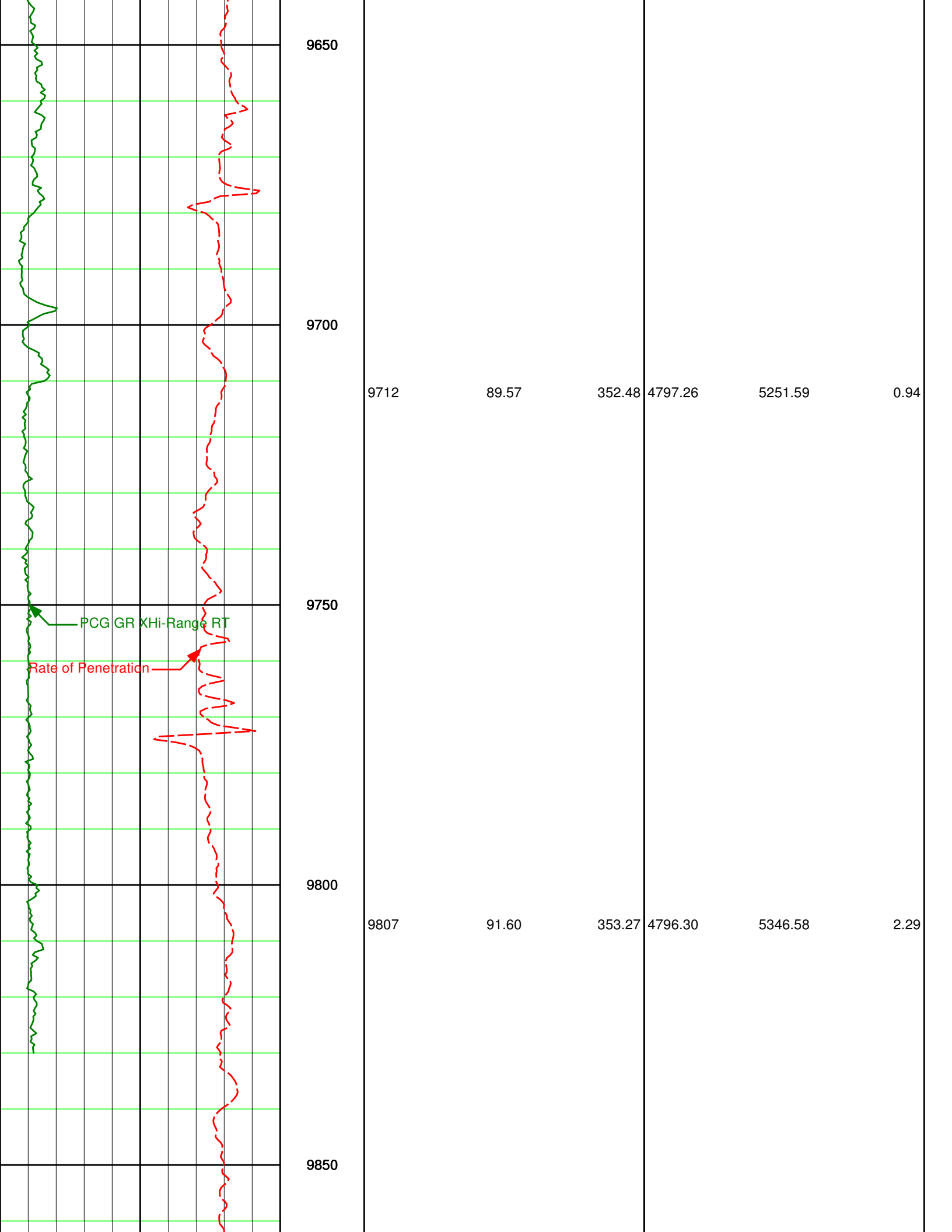
4776.68
 4871.66

1.99
 3.78

PCG GR XHi-Range RT

Rate of Penetration





9650

9700

9750

9800

9850

9712

89.57

352.48

4797.26

5251.59

0.94

9807

91.60

353.27

4796.30

5346.58

2.29

PCG GR XHi-Range RT

Rate of Penetration

| | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|---|-------------------------------------|---------|-------------|---------|---------|--------------|------------|
| | | | | | | | | | <div style="border: 1px solid black; padding: 2px; display: inline-block;">TD</div> | 9880 | 91.60 | 353.27 | 4794.26 | 5419.55 | 0.00 | |
| | | | | | | | | | | Final Survey is a Projection to Bit | | | | | | |
| | | | | | | | | | | 9900 | | | | | | |
| Rate of Penetration feet per hr | | | | | | | | | | MD | Surveys | | | Surveys | | |
| <div style="border-top: 1px dashed red; border-bottom: 1px dashed red; height: 2px;"> 250 0 </div> | | | | | | | | | | ft | Depth | Inclination | Azimuth | TVD | Vertical Sec | Dogleg Sev |
| PCG GR XHi-Range RT api | | | | | | | | | | 1 : 240 | | | | | | |
| <div style="border-top: 1px solid green; border-bottom: 1px solid green; height: 2px;"> 0 150 </div> | | | | | | | | | | | | | | | | |



HALLIBURTON

DIRECTIONAL SURVEY REPORT

Shell Exploration and Productio
Schubach 3510 #4-1H
Arrowhead
Barber KS
USA

OK-XX-0009504797

Surveys from 0' MD to 9,880' are provided by Halliburton Sperry Drilling Services.
Final Survey is a projection to the bit.

| Measured Depth (feet) | Inclination (degrees) | Direction (degrees) | Vertical Depth (feet) | Latitude (feet) | Departure (feet) | Vertical Section (feet) | Dogleg (deg/100ft) |
|-----------------------------|--------------------------|------------------------|-----------------------------|--------------------|---------------------|-------------------------------|-----------------------|
| 0.00 | 0.00 | 0.00 | 0.00 | 0.00 N | 0.00 E | 0.00 | TIE-IN |
| 80.00 | 0.31 | 239.54 | 80.00 | 0.11 S | 0.19 W | -0.09 | 0.39 |
| 142.00 | 0.51 | 111.31 | 142.00 | 0.29 S | 0.07 W | -0.28 | 1.20 |
| 172.00 | 0.64 | 87.19 | 172.00 | 0.33 S | 0.22 E | -0.36 | 0.92 |
| 202.00 | 0.86 | 43.88 | 201.99 | 0.16 S | 0.54 E | -0.23 | 1.97 |
| 234.00 | 1.41 | 21.30 | 233.99 | 0.38 N | 0.85 E | 0.28 | 2.19 |
| 269.00 | 2.25 | 2.08 | 268.97 | 1.47 N | 1.03 E | 1.34 | 2.93 |
| 300.00 | 3.38 | 358.41 | 299.93 | 2.99 N | 1.03 E | 2.85 | 3.69 |
| 331.00 | 4.33 | 353.54 | 330.86 | 5.06 N | 0.87 E | 4.93 | 3.25 |
| 362.00 | 4.92 | 352.41 | 361.76 | 7.55 N | 0.57 E | 7.43 | 1.93 |
| 394.00 | 5.30 | 351.83 | 393.63 | 10.37 N | 0.17 E | 10.28 | 1.19 |
| 425.00 | 5.84 | 348.62 | 424.49 | 13.33 N | 0.34 W | 13.28 | 1.99 |
| 456.00 | 6.31 | 345.58 | 455.31 | 16.53 N | 1.08 W | 16.54 | 1.86 |
| 488.00 | 6.39 | 345.19 | 487.12 | 19.96 N | 1.97 W | 20.05 | 0.27 |
| 519.00 | 6.43 | 344.50 | 517.92 | 23.30 N | 2.87 W | 23.47 | 0.29 |
| 613.00 | 5.78 | 351.18 | 611.39 | 33.05 N | 5.01 W | 33.41 | 1.02 |
| 706.00 | 5.42 | 351.34 | 703.95 | 42.02 N | 6.39 W | 42.48 | 0.40 |
| 733.00 | 5.25 | 351.70 | 730.83 | 44.50 N | 6.76 W | 44.99 | 0.64 |
| 804.00 | 4.59 | 358.74 | 801.57 | 50.55 N | 7.29 W | 51.06 | 1.26 |
| 835.00 | 4.42 | 0.33 | 832.47 | 52.99 N | 7.31 W | 53.48 | 0.66 |
| 866.00 | 3.82 | 0.51 | 863.39 | 55.22 N | 7.29 W | 55.69 | 1.95 |
| 897.00 | 2.68 | 359.26 | 894.34 | 56.98 N | 7.29 W | 57.44 | 3.68 |

| | | | | | | | |
|----------------|--------------|---------------|----------------|------------------|-----------------|----------------|--------------|
| 991.00 | 0.90 | 354.84 | 988.29 | 59.91 N | 7.39 W | 60.36 | 1.90 |
| 1084.00 | 0.79 | 356.59 | 1081.28 | 61.27 N | 7.49 W | 61.73 | 0.12 |
| 1178.00 | 0.61 | 356.34 | 1175.27 | 62.41 N | 7.56 W | 62.87 | 0.19 |
| 1272.00 | 0.43 | 341.59 | 1269.27 | 63.24 N | 7.70 W | 63.71 | 0.23 |
| 1367.00 | 0.52 | 358.57 | 1364.27 | 64.01 N | 7.83 W | 64.49 | 0.18 |
| 1462.00 | 0.56 | 348.54 | 1459.26 | 64.90 N | 7.93 W | 65.38 | 0.10 |
| 1557.00 | 0.41 | 356.69 | 1554.26 | 65.69 N | 8.04 W | 66.18 | 0.17 |
| 1746.00 | 0.53 | 354.07 | 1743.25 | 67.25 N | 8.17 W | 67.74 | 0.06 |
| 1936.00 | 0.56 | 342.18 | 1933.25 | 69.01 N | 8.55 W | 69.53 | 0.06 |
| 2126.00 | 0.18 | 22.00 | 2123.24 | 70.17 N | 8.72 W | 70.71 | 0.23 |
| 2315.00 | 0.65 | 313.71 | 2312.24 | 71.19 N | 9.38 W | 71.79 | 0.32 |
| 2505.00 | 0.44 | 324.80 | 2502.23 | 72.53 N | 10.58 W | 73.26 | 0.12 |
| 2694.00 | 0.34 | 334.23 | 2691.22 | 73.63 N | 11.25 W | 74.43 | 0.06 |
| 2883.00 | 0.03 | 108.38 | 2880.22 | 74.12 N | 11.45 W | 74.95 | 0.19 |
| 3073.00 | 0.67 | 349.08 | 3070.22 | 75.19 N | 11.61 W | 76.03 | 0.36 |
| 3263.00 | 0.83 | 337.32 | 3260.20 | 77.55 N | 12.35 W | 78.46 | 0.12 |
| 3452.00 | 0.57 | 13.07 | 3449.19 | 79.73 N | 12.66 W | 80.66 | 0.26 |
| 3642.00 | 0.50 | 347.24 | 3639.18 | 81.46 N | 12.63 W | 82.37 | 0.13 |
| 3832.00 | 0.31 | 332.57 | 3829.18 | 82.73 N | 13.05 W | 83.68 | 0.11 |
| 4022.00 | 0.22 | 306.56 | 4019.17 | 83.40 N | 13.59 W | 84.42 | 0.08 |
| 4212.00 | 0.69 | 9.68 | 4209.17 | 84.76 N | 13.69 W | 85.77 | 0.33 |
| 4243.00 | 3.63 | 2.18 | 4240.14 | 85.92 N | 13.62 W | 86.92 | 9.50 |
| 4273.00 | 6.89 | 358.51 | 4270.01 | 88.67 N | 13.64 W | 89.65 | 10.92 |
| 4305.00 | 10.02 | 357.88 | 4301.66 | 93.37 N | 13.79 W | 94.34 | 9.77 |
| 4336.00 | 13.07 | 357.81 | 4332.03 | 99.57 N | 14.02 W | 100.52 | 9.83 |
| 4368.00 | 16.20 | 357.59 | 4362.99 | 107.65 N | 14.35 W | 108.58 | 9.79 |
| 4400.00 | 19.55 | 357.84 | 4393.44 | 117.46 N | 14.74 W | 118.37 | 10.48 |
| 4431.00 | 22.58 | 357.74 | 4422.37 | 128.59 N | 15.17 W | 129.48 | 9.77 |
| 4463.00 | 25.68 | 357.04 | 4451.57 | 141.65 N | 15.77 W | 142.53 | 9.74 |
| 4495.00 | 28.19 | 356.15 | 4480.09 | 156.12 N | 16.63 W | 157.00 | 7.95 |
| 4526.00 | 30.87 | 354.91 | 4507.06 | 171.35 N | 17.83 W | 172.26 | 8.87 |
| 4558.00 | 34.30 | 353.73 | 4534.02 | 188.50 N | 19.54 W | 189.49 | 10.91 |
| 4590.00 | 37.86 | 353.51 | 4559.88 | 207.22 N | 21.64 W | 208.34 | 11.11 |
| 4621.00 | 41.40 | 353.48 | 4583.75 | 226.87 N | 23.88 W | 228.11 | 11.44 |
| 4653.00 | 44.69 | 353.64 | 4607.13 | 248.57 N | 26.33 W | 249.95 | 10.29 |
| 4685.00 | 46.93 | 353.89 | 4629.44 | 271.38 N | 28.82 W | 272.89 | 7.01 |
| 4716.00 | 49.45 | 353.93 | 4650.10 | 294.35 N | 31.27 W | 295.99 | 8.14 |
| 4748.00 | 52.34 | 353.51 | 4670.28 | 319.03 N | 33.99 W | 320.82 | 9.08 |
| 4779.00 | 54.75 | 353.27 | 4688.70 | 343.80 N | 36.86 W | 345.75 | 7.82 |
| 4811.00 | 57.48 | 353.82 | 4706.54 | 370.19 N | 39.85 W | 372.32 | 8.62 |
| 4843.00 | 60.63 | 353.91 | 4722.99 | 397.48 N | 42.78 W | 399.76 | 9.85 |
| 4874.00 | 62.57 | 354.20 | 4737.74 | 424.60 N | 45.60 W | 427.02 | 6.30 |
| 4906.00 | 65.38 | 354.56 | 4751.78 | 453.21 N | 48.42 W | 455.77 | 8.84 |
| 4938.00 | 68.50 | 354.08 | 4764.31 | 482.51 N | 51.33 W | 485.20 | 9.85 |
| 4969.00 | 71.41 | 353.99 | 4774.93 | 511.47 N | 54.36 W | 514.32 | 9.39 |
| 5001.00 | 74.37 | 354.59 | 4784.35 | 541.90 N | 57.40 W | 544.90 | 9.42 |
| 5033.00 | 76.67 | 355.38 | 4792.35 | 572.76 N | 60.11 W | 575.86 | 7.56 |
| 5064.00 | 78.74 | 355.67 | 4798.95 | 602.95 N | 62.47 W | 606.13 | 6.76 |
| 5096.00 | 80.90 | 356.21 | 4804.61 | 634.37 N | 64.70 W | 637.59 | 6.94 |
| 5128.00 | 83.33 | 356.61 | 4809.00 | 666.00 N | 66.68 W | 669.24 | 7.69 |
| 5159.00 | 86.28 | 355.82 | 4811.81 | 696.80 N | 68.72 W | 700.07 | 9.85 |
| 5254.00 | 90.40 | 355.94 | 4814.56 | 791.50 N | 75.54 W | 794.92 | 4.34 |
| 5347.00 | 91.11 | 355.95 | 4813.33 | 884.26 N | 82.11 W | 887.81 | 0.76 |
| 5440.00 | 89.97 | 355.54 | 4812.45 | 976.99 N | 89.01 W | 980.72 | 1.31 |
| 5535.00 | 91.11 | 354.32 | 4811.56 | 1071.61 N | 97.40 W | 1075.68 | 1.75 |
| 5630.00 | 91.87 | 354.62 | 4809.08 | 1166.14 N | 106.55 W | 1170.63 | 0.86 |
| 5725.00 | 91.67 | 352.83 | 4806.15 | 1260.52 N | 116.92 W | 1265.58 | 1.90 |
| 5820.00 | 90.22 | 352.98 | 4804.59 | 1354.78 N | 128.65 W | 1360.56 | 1.53 |
| 5915.00 | 90.43 | 352.89 | 4804.05 | 1449.06 N | 140.34 W | 1455.55 | 0.25 |
| 6010.00 | 89.60 | 352.40 | 4804.02 | 1543.27 N | 152.50 W | 1550.55 | 1.01 |
| 6105.00 | 89.97 | 353.24 | 4804.38 | 1637.53 N | 164.37 W | 1645.54 | 0.97 |
| 6201.00 | 90.40 | 353.93 | 4804.07 | 1732.93 N | 175.09 W | 1741.54 | 0.84 |
| 6295.00 | 90.62 | 353.60 | 4803.24 | 1826.37 N | 185.30 W | 1835.53 | 0.42 |
| 6390.00 | 90.12 | 352.08 | 4802.63 | 1920.62 N | 197.15 W | 1930.52 | 1.68 |
| 6485.00 | 89.38 | 351.51 | 4803.03 | 2014.65 N | 210.70 W | 2025.49 | 0.98 |
| 6579.00 | 90.06 | 352.26 | 4803.49 | 2107.70 N | 223.97 W | 2119.45 | 1.07 |
| 6674.00 | 90.06 | 351.84 | 4803.39 | 2201.79 N | 237.12 W | 2214.43 | 0.44 |
| 6769.00 | 90.55 | 351.68 | 4802.88 | 2295.81 N | 250.73 W | 2309.39 | 0.54 |
| 6864.00 | 91.08 | 351.75 | 4801.52 | 2389.80 N | 264.42 W | 2404.34 | 0.56 |
| 6959.00 | 90.83 | 352.13 | 4799.94 | 2483.85 N | 277.74 W | 2499.30 | 0.48 |
| 7054.00 | 90.18 | 353.88 | 4799.10 | 2578.14 N | 289.32 W | 2594.29 | 1.97 |

| | | | | | | | |
|---------|-------|--------|---------|-----------|----------|---------|------|
| 7149.00 | 90.00 | 354.35 | 4798.95 | 2672.64 N | 299.06 W | 2689.28 | 0.53 |
| 7244.00 | 91.48 | 354.82 | 4797.72 | 2767.20 N | 308.02 W | 2784.25 | 1.64 |
| 7339.00 | 90.71 | 355.07 | 4795.90 | 2861.81 N | 316.39 W | 2879.20 | 0.86 |
| 7434.00 | 89.66 | 354.37 | 4795.59 | 2956.41 N | 325.13 W | 2974.17 | 1.33 |
| 7529.00 | 90.03 | 354.66 | 4795.85 | 3050.97 N | 334.21 W | 3069.14 | 0.49 |
| 7624.00 | 90.77 | 354.35 | 4795.18 | 3145.53 N | 343.31 W | 3164.12 | 0.84 |
| 7719.00 | 90.06 | 353.63 | 4794.50 | 3240.01 N | 353.26 W | 3259.11 | 1.06 |
| 7814.00 | 89.29 | 353.29 | 4795.03 | 3334.39 N | 364.08 W | 3354.11 | 0.89 |
| 7909.00 | 89.91 | 353.65 | 4795.69 | 3428.77 N | 374.88 W | 3449.11 | 0.75 |
| 8004.00 | 89.35 | 353.01 | 4796.31 | 3523.12 N | 385.91 W | 3544.10 | 0.89 |
| 8099.00 | 88.37 | 354.33 | 4798.20 | 3617.52 N | 396.38 W | 3639.08 | 1.73 |
| 8193.00 | 90.43 | 353.91 | 4799.19 | 3711.02 N | 406.01 W | 3733.06 | 2.24 |
| 8288.00 | 91.97 | 354.78 | 4797.19 | 3805.53 N | 415.37 W | 3828.02 | 1.86 |
| 8383.00 | 91.39 | 354.13 | 4794.41 | 3900.04 N | 424.55 W | 3922.96 | 0.92 |
| 8478.00 | 89.91 | 352.30 | 4793.34 | 3994.36 N | 435.77 W | 4017.95 | 2.47 |
| 8573.00 | 90.09 | 352.10 | 4793.34 | 4088.49 N | 448.66 W | 4112.93 | 0.29 |
| 8667.00 | 90.37 | 351.88 | 4792.96 | 4181.57 N | 461.75 W | 4206.90 | 0.38 |
| 8762.00 | 90.40 | 351.60 | 4792.32 | 4275.58 N | 475.40 W | 4301.86 | 0.29 |
| 8857.00 | 90.12 | 351.74 | 4791.89 | 4369.58 N | 489.17 W | 4396.82 | 0.33 |
| 8952.00 | 89.10 | 351.17 | 4792.53 | 4463.52 N | 503.29 W | 4491.77 | 1.23 |
| 9047.00 | 89.97 | 352.05 | 4793.30 | 4557.50 N | 517.15 W | 4586.72 | 1.30 |
| 9142.00 | 90.74 | 352.25 | 4792.71 | 4651.60 N | 530.12 W | 4681.70 | 0.84 |
| 9237.00 | 91.29 | 354.06 | 4791.02 | 4745.91 N | 541.45 W | 4776.68 | 1.99 |
| 9332.00 | 87.96 | 352.72 | 4791.64 | 4840.26 N | 552.39 W | 4871.66 | 3.78 |
| 9427.00 | 88.70 | 353.01 | 4794.40 | 4934.48 N | 564.19 W | 4966.61 | 0.84 |
| 9522.00 | 89.51 | 353.51 | 4795.88 | 5028.81 N | 575.34 W | 5061.60 | 1.00 |
| 9617.00 | 89.63 | 353.37 | 4796.60 | 5123.19 N | 586.19 W | 5156.60 | 0.20 |
| 9712.00 | 89.57 | 352.48 | 4797.26 | 5217.46 N | 597.88 W | 5251.59 | 0.94 |
| 9807.00 | 91.60 | 353.27 | 4796.30 | 5311.72 N | 609.66 W | 5346.58 | 2.29 |
| 9880.00 | 91.60 | 353.27 | 4794.26 | 5384.18 N | 618.21 W | 5419.55 | 0.00 |

CALCULATION BASED ON MINIMUM CURVATURE METHOD

**SURVEY COORDINATES RELATIVE TO WELL SYSTEM REFERENCE POINT
TVD VALUES GIVEN RELATIVE TO DRILLING MEASUREMENT POINT**

**VERTICAL SECTION RELATIVE TO WELL HEAD
VERTICAL SECTION IS COMPUTED ALONG A DIRECTION OF 353.34 DEGREES (TRUE)
A TOTAL CORRECTION OF 4.88 DEG FROM MAGNETIC NORTH TO TRUE NORTH HAS BEEN APPLIED**

**HORIZONTAL DISPLACEMENT IS RELATIVE TO THE WELL HEAD.
HORIZONTAL DISPLACEMENT(CLOSURE) AT 9880.00 FEET
IS 5419.56 FEET ALONG 353.45 DEGREES (TRUE)**

Final Survey is a projection to the bit.