# WELL COMPLETION REPORT

# NORTH WIRRAH-1

VOLUME 2
## INTERPRETIVE DATA

GIPPSLAND BASIN
VICTORIA

**ESSO AUSTRALIA PTY LTD**

*Compiled by Stephen Jones and Sheryl Sazenis*
*March 2006*

WELL COMPLETION RPEORT
**NORTH WIRRAH-1**

# VOLUME 2:

# INTEPRETATIVE DATA

WELL COMPLETION RPEORT
**NORTH WIRRAH -1**

# VOLUME 2:

# INTEPRETATIVE DATA (cont'd)

# I. WELL INDEX SHEET

## WELL & RIG DATA

**WELL NAME:** North Wirrah– 1
**OPERATOR:** Esso Australia Resources Pty Ltd
**CLASSIFICATION:** Wildcat

| SURFACE LOCATION | | | | | | GENERAL | |
|---|---|---|---|---|---|---|---|
| **LATITUDE** | | **LONGITUDE** | | **UTM CO-ORDS** | | **Rig Name:** | Ensco 102 |
| DEG: | 38 | DEG: | 147 | NORTH: | 5773600.38 | **Basin:** | Gippsland Basin |
| MIN: | 10 | MIN: | 50 | EAST: | 573486.30 | **Status:** | Plugged and Abandoned Well |
| SEC: | 57.094S | SEC: | 20.674E | Geodetic Datum:<br>Zone / Meridian : | GDA 94(GRS80)<br>Zone 55, South | | |

| | | | |
|---|---|---|---|
| **Rig on location:** | 10:10 hours, 3 September 2005 | **Total Depth (Driller):** | 2678mRT |
| **Spudded Well:** | 14:30 hours, 4 September 2005 | **Total Depth (Logger):** | 2504mRT |
| **TD Reached:** | 01:30 hours, 18 September 2005 | **RT to Sea level:** | 39.2m |
| **Rig Released:** | 10:00 hours, 25 September 2005 | **RT to Seafloor:** | 90.2m |
| **Trap Style:** | Structural trap | **Datum:** | MSL |
| | | **Seismic:** | G01 |

**Cuttings Samples:**

| Hole Size (inch) | Hole TD (m) | Casing Size (inch) | Shoe Depth (m) | | Abandonment Plugs | |
|---|---|---|---|---|---|---|
| 26” | 160 | 20” | 155.28 | | 1 | 1970-1490 |
| 12.25” | 888 | 9.625” | 884 | | 2 | 914-764 |
| 8.5” | 2678 | | | | 3 | 205-105 |
| | | | | | | |

### NORTH WIRRAH –1 FORMATION TOPS

| Age | Formation | Measured Depth (mRT) | Depth (mTVD) | Depth (mSS) |
|---|---|---|---|---|
| MIOCENE-OLIGOCENE | Lakes Entrance Formation | 1364.0 | -1364.0 | -1324.8 |
| OLIGOCENE-EOCENE | Latrobe Group (TOL) | 1536.6 | -1536.6 | -1497.4 |
| EOCENE | Top Coarse Clastics (N-150) | 1556.0 | -1556.0 | -1516.8 |
| EOCENE | Top N. asperus coal | 1627.2 | -1627.2 | -1588.0 |
| EOCENE | Top P. asperopolus coal | 1702.1 | -1702.1 | -1662.9 |
| EOCENE | Top P-100 sand | 1722.5 | -1722.5 | -1683.3 |
| EOCENE | Top M. diversus coal | 1870.5 | -1870.5 | -1831.3 |
| EOCENE | Top M-1 sand | 1891.0 | -1891.0 | -1851.8 |
| EOCENE | Top L-440 sand | 2200.0 | -2200.0 | -2160.8 |
| PALEOCENE | Top Lower balmei volcanics | 2216.3 | -2216.3 | -2177.1 |
| PALEOCENE | Base Lower balmei volcanics | 2314.0 | -2314.0 | -2274.8 |
| PALEOCENE | Top L-450 reservoir | 2314.0 | -2314.0 | -2274.8 |
| CRETACEOUS | K/T Boundary | 2439.2 | -2439.2 | -2400.0 |
| CRETACEOUS | Top T-sands | 2449.7 | -2449.7 | -2410.5 |
| CRETACEOUS | Top T.lilliei | 2593.2 | -2593.2 | -2553.9 |
| | Total Depth | 2678.0 | -2678.0 | -2638.7 |

# I. WELL INDEX SHEET (cont'd)

| LWD LOGS | | | |
|---|---|---|---|
| **Suite / Run** | **Type of Log** | **Interval (mRT)** | **BHT °C / Time since circ.(Hrs)** |
| 1/1 | GVR6/ADN6 | 888 - 2678 | 35.25 hr/ 46.27°C |
| | | | |

| WIRELINE LOGS | | | |
|---|---|---|---|
| **Suite / Run** | **Type of Log** | **Interval (mRT)** | **BHT °C / Time since circ.(Hrs)** |
| 1/1 | DSI-HNGS-LEHQT | 2501-882 | 12.25 hr/ 103.3°C |
| 1/2 | VSP-GR (Checkshots) | 2500-762 | 21.0 hr/ 104.4°C |

# II. INTRODUCTION

The North Wirrah-1 well was drilled as a wildcat exploration well in 52.8 metres of water, within the VIC/L2 licence area of the Gippsland Basin (Figure 1).

The well spudded on the 4th September 2005 and a TD of 2678m MD (2638.7m TVDss) was reached on the 18th September 2005. The well was plugged and abandoned and the rig was released on the 25th September 2005.

The North Wirrah-1 well tested a fault dependent structural trap predicted to contain hydrocarbons at three levels, located northeast of the Wirrah Field. The primary target consisted of Lower *L. balmei* Latrobe Group reservoirs top sealed by volcanics. Secondary targets consisted of reservoir section in the Upper *L. balmei* and *F. longus* aged section.

The key risk for the shallower *L. balmei* targets was expected to be fault seal while the key risks for the deeper *F. longus* target were also expected to be fault seal with an additional reservoir quality risk.

# III. SUMMARY OF WELL RESULTS

North Wirrah-1 intersected a 36m residual hydrocarbon column (2314-1350mMD) within the primary L-450 reservoir objective with up to 100% shows and elevated gas readings up to C5. This zone also includes a thin 1.3m net oil zone with average effective porosity of 21% and average effective water saturation of 33%, located within a heavily cemented sand section, possibly protecting it from the trap breaching mechanism. Hydrocarbon shows and petrophysical analysis indicates the presence of relict hydrocarbon zones in the upper reservoir section immediately beneath the *L. balmei* volcanics and above the thin live oil sand. Significant mud gas shows up to C5 and cuttings shows combined with a calculated effective residual oil saturation of 12% over the interval (2314-1346.6mMD) indicate the presence of a relict oil column.

The North Wirrah-1 well was positioned to drill 30m off the crest in order to maximise the probability of the well intersecting oil legs beneath potential gas caps, as predicted pre-drill. Results of the well indicate that the North Wirrah Prospect bounding fault had sealed a substantial column of hydrocarbon that was subsequently breached. The mechanism and timing of breaching is not well understood, most-likely being related to post-hydrocarbon entrapment fault reactivation.

# III. SUMMARY OF WELL RESULTS (cont'd)

The shallower L-440 secondary objective immediately above the volcanics also encountered significant shows indicating the presence of another potential relict hydrocarbon column at this level.

The deeper *F. longus* secondary objective had limited reservoir quality rock preserved due to a pervasive secondary cementation overprint. No significant shows were encountered over this interval.

The stratigraphy intersected by the North Wirrah-1 well is summarised in Figure 2. A comparison of prognosed versus actual formation tops is summarised in Table 1.

# IV. GEOLOGICAL DISCUSSION

*OVERVIEW*

The majority of large Gippsland Basin hydrocarbon fields are Latrobe Group closures sealed by overlying marine shales of the Lakes Entrance Formation. Some large intra-Latrobe Group fields are also present such as the Tuna T and Turrum L reservoirs which are sealed by coastal plain shales. The main accumulation anticipated in North Wirrah-1 was below the Intra-Latrobe L. *balmei* volcanic. Sub-volcanic L. *balmei* hydrocarbons are encountered in the Moonfish Field, West Moonfish-1, Emperor-1, Whiting-1 and Wirrah-1.
Within the greater Wirrah, Barracouta, Whiting and Snapper area there are several small to medium intra-Latrobe Group hydrocarbon accumulations sealed by coastal plain shales and from each of these fields (excl. Wirrah) oil has been produced from the upper-Latrobe Group (*N. asperus - L. balmei*).

The North Wirrah-1 well was drilled to test hydrocarbon potential at several levels within a fault dependent closure mapped northeast of the Wirrah field.

*REGIONAL SETTING*

The initial formation of the Gippsland Basin was associated with rifting and subsidence that extended along the southern margins of Australia during the Jurassic to Early Cretaceous. During this period, deposition of predominantly volcanic clastic successions occurred in alluvial and fluvial environments, in NE trending en-echelon graben systems (Otway and Strzelecki Groups). A phase of structuring and localised uplift of the Strzelecki Group occurred around 100-95Ma.

A renewed phase of Late Cretaceous (approximately 90 Ma) rifting coincided with the onset of Tasman seafloor spreading to the east of Tasmania. This resulted in the rapid development of extensional basins in the Gippsland area with active extensional faults oriented WNW/ESE (oblique to the earlier extensional event). A thick (overall coarsening-up) succession was deposited in these tectonically active depocentres (Golden Beach Group and Emperor Subgroup). Initial rift deposition included marine and lacustrine shales in distal parts of the basin, while deltaic successions and alluvial fans developed along basin margins. The rift fill succession gradually evolved into a fluvial-dominated system. As the northward migrating Tasman spreading centre passed by the Gippsland Basin around 85-80Ma, the eruption of mafic volcanics and emplacement of related intrusions occurred across the Gippsland basin.

The active rift phase in the Gippsland Basin ceased at approximately 80 Ma, as the Tasman Rift proceeded to migrate further north towards Queensland. From this time onwards, the Gippsland Basin essentially evolved into a failed arm of the Tasman rift system. The Latrobe Group was deposited in this sag phase basin setting with fault controlled subsidence continuing until the Late Paleocene. Most of the Latrobe Group was deposited in a non-marine setting behind a NE-SW trending beach-barrier complex. During the Early Eocene, the Tuna/Flounder Channel eroded into the underlying Latrobe Group sediments and filled with predominantly marine to marginal marine sediments of the Flounder Formation. As sedimentation rates declined across the basin the strandline moved to the northwest depositing a thin time-transgressive unit of glauconitic green sands (Gurnard Formation) over a wide area including the Tuna/Flounder Channel. The top of the Gurnard Formation forms the Top of Latrobe Group. In the Middle Eocene, another major channelling event, the Marlin Channel, occurred to the west of the Kipper area and partially filled with distal marine sediment of the Turrum Formation. Erosion associated with these channelling events and the top of Latrobe unconformity resulted in the formation of many of the hydrocarbon traps in the basin.

The end of the Latrobe Group is marked by deposition of marl and calcareous claystone of the Lakes Entrance Formation in response to continued marine transgression during the Oligocene. Prograding limestone and calcareous siltstone wedges of the Gippsland Limestone resulted in the formation of the present day shelf.

Compressional events in the late Eocene to mid Miocene caused selective inversion of faults around the basin and the establishment of the major ENE-WSW anticlinal trends in the basin

*STRATIGRAPHY*

The prognosed stratigraphy of the North Wirrah-1 well was based on adjacent well control (Wirrah-1, Wirrah-2 and Wirrah-3) and regional seismic correlations.

A summary of the actual stratigraphic section intersected is shown in Figure 2. The well penetrated the expected thick sequence of limestones and marls of the Gippsland Limestone, also encountering a Miocene Sandstone within the Gippsland Limestone as predicted. This was followed by Marls and claystones of the Lakes Entrance Formation. The Top of the Latrobe Group was intersected 4.4m deep to prognosis. The Latrobe Group *P. asperopolus* to *L. balmei* section above the Lower *L. balmei* volcanics consists of marginal marine to fluvial deposits including bay head deltas, tidal and fluvial channels, coals and floodplain shales. The Top of Lower *L. balmei* volcanics was penetrated 3.9m shallow to prediction, however the thickness of 97.7m was greater than anticipated from offset wells, resulting in the primary objective Top of L-450 Reservoir intersected 64.8m deep to prognosis. The sub-volcanic reservoir section consists of *L. balmei* aged fluvial-deltaic deposits. The net to gross within the primary objective is 43% with an average effective porosity of 17% with a strong cementation overprint. The remainder of the Latrobe Group (*L. balmei to T. lilliei*) consists of marginal marine to fluvial deposits.

The deeper secondary objective in the *F. longus* section had limited reservoir quality preserved due to a pervasive secondary cementation overprint which is anomalous in the Wirrah area. The K/T boundary came in as predicted at -2400mTVDss.

*STRUCTURE*

The trap at the North Wirrah prospect is bounded to the north by the Rosedale Fault which also bounds the Moonfish and Wirrah discoveries. The Rosedale fault accommodates growth of the Golden Beach and Intra-Latrobe section separating the northern terrace from the central deep. The Wirrah field is bounded by two *en echelon* east-west trending faults. On the enclosed structure maps and structural cross-section (Enclosures 1 - 4) the North Wirrah fault is referred to as **(f1),** the Rosedale fault is referred to as **(f2)** and the main Wirrah fault is referred to as **(f3)**. These faults separate the southern Wirrah-3 fault block from the central Wirrah-1 fault block and the Wirrah field from the North Wirrah fault block. North Wirrah is bounded to the west by the Rosedale fault which is inverted by late Eocene-Miocene NW-SE trending compression. This compression created the major ENE-WSW anticlinal trend over the North Wirrah prospect and Wirrah field. The North Wirrah-1 well drilled the North Wirrah fault block, north of the **(f1)** fault.

At the level of the *L. balmei* reservoir beneath the *L. balmei* volcanics the inversion has resulted in a large fault dependent closure. North Wirrah-1 was positioned to drill 30m off the crest in order to maximise the probability of the well intersecting oil legs beneath potential gas caps, as predicted pre-drill. The observation of a 36m residual hydrocarbon column, coupled with the well location some 30m off-crest implies an original column height in excess of 66m. From analysis of fault juxtaposition it is believed that the **(f1)** fault sealed with the assistance of anomalous fault seal other than juxtaposition at some stage post hydrocarbon migration. It is postulated that this fault has been subsequently breached, at a sub-seismic level, breaching the trap integrity. The reservoired hydrocarbons have likely cross-fault leaked at this time and may have ultimately migrated to the top seal at the N-150 level in the Wirrah field.

The North Wirrah-1 well has also drilled a deeper *F. longus* section of the same fault dependent North Wirrah fault block. Unlike the primary objective, there was no evidence of residual hydrocarbons throughout the *F. longus* section. Overall the depositional net-to-gross is high, however limited reservoir quality sands are preserved due to pervasive cementation throughout the interval.

## *HYDROCARBON DISTRIBUTION*

North Wirrah-1 intersected a 36m residual hydrocarbon column (2314-1350mMD) within the primary L-450 reservoir objective with up to 100% cuttings shows indicated and elevated gas readings up to C5. This zone also includes a thin 1.3m net oil zone with average effective porosity of 21% and average effective water saturation of 33% within a heavily cemented sand (Refer to Figure 1, Formation Evaluation Log Interpretation Report, Appendix 1). Hydrocarbon shows and petrophysical analysis indicates the presence of relict hydrocarbon zones in the upper reservoir section immediately beneath the *L. balmei* volcanics and above the live oil sand. Significant mud gas up to C5 and cuttings shows combined with a calculated effective residual oil saturation of 12% over the interval (2314-1346.6mMD) confirms the presence of a relict oil column.. The observation of a 36m residual hydrocarbon column, coupled with the well location some 30m off-crest implies an original total column height in excess of 66m. Results of the well indicate that the North Wirrah Prospect bounding fault had sealed a substantial column of hydrocarbon that was subsequently breached. The mechanism and timing of breaching is not well understood, most likely being related to post-hydrocarbon entrapment fault reactivation.

The secondary L-440 target also had significant mud gas and cuttings shows, which may also represent a relict column over the interval 2200-2210 mMD.

The deeper *F. longus* secondary objective had limited reservoir quality rock preserved due to a pervasive secondary cementation overprint which is anomalous in the Wirrah area. No significant shows were observed over this interval.

*GEOPHYSICAL DATA*

The North Wirrah prospect was partially identified on the 1984 Wirrah 3D seismic data, however it was not until subsequent interpretation on the G01A 3D seismic survey that the North Wirrah fault block was interpreted to be isolated from the Wirrah field. The seismic data quality of the G01A survey exhibits improved multiple suppression and signal-to-noise ratio compared to the previous 1984 Wirrah survey. The final migrated full stack product (quadrature phase) from the G01 data processing was used for the interpretation. Seismic data quality of the Tertiary upper Latrobe Group is good with little ambiguity in the correlations. The seismic data quality at the deeper Cretaceous level is adequate to map the structural form, but is not adequate to directly map the distribution of potential volcanics or the sedimentary section beneath.

Four wells (Wirrah-1, Wirrah-2, Wirrah-3 and Harlequin-1) were tied to the seismic data using synthetic seismograms generated in Geoframe Synthetics which provided the main tie points for the seismic horizon interpretation.

A synthetic seismogram was created in IESX using good quality log and VSP/checkshot data and is displayed in Enclosure 5.

*TIME INTERPRETATION*

Time interpretation of horizons and faults was undertaken using Voxelgeo. A 3D geologic model incorporating interpreted horizons and fault framework was built in TWT within Petrel to QC the interpretation. This required some slight modifications and quality control in order to build an internally consistent geologic framework model.

*DEPTH CONVERSION*

The North Wirrah area appears to be located in a region of relatively low lateral velocity gradients. A base of high velocity channel event was mapped, however there appears to be no direct relationship between channel isochron and Vrms velocities from seismic.

High density seismic velocities (50m x 50m) were used to build a velocity cube for the area. Average velocities were then extracted from the velocity volume at each time horizon. The extracted Vavg map for each horizon was smoothed in Geodepth using an 1800m x 1800m LOWESS filter. A raw depth map was then created for each horizon with a conversion factor applied using a multiplicative factor derived from well control. An additive depth mistie map was created for each surface and applied to produce a final depth map tied to well control. Most well ties were within +/- 15 m with larger misties of up to 20 m for the deepest surface at the TopTsands.

The Top of Latrobe Group and intra-Latrobe surfaces were intersected close to prediction. The Top of Lower *L. balmei* Volcanics was penetrated 3.9m shallow to prediction, however the thickness of 97.7m was greater than predicted resulting in the Base *L. balmei* Volcanics being intersected 64.8m deep to prognosis. The post-drill synthetic tie produced indicates the Base *L. balmei* Volcanics pick is a cycle lower than picked pre-drill from tie into the Moonfish area (Enclosure 5). The greater thickness allows resolution of a discernible top and base of Volcanics rather than a single cycle event below or close to peak tuning as seen in Wirrah-1 and the Moonfish area.

The deeper horizons have lower confidence seismic velocities as the primary reflections become weaker and interbed multiples from the coals affect the seismic response. Depth Conversion was not considered a risk pre-drill.

The K/T pick came in as predicted at -2400mTVDss.

# North Wirrah-1

# Formation / Zone Tops

## Predicted vs Actual

| Formation / Zone | | TVDss Actual (m) | TVDss Predicted (m) | Differenc e | MDRT Actual (m) |
|---|---|---|---|---|---|
| Top Gippsland Limestone | | 52.8 | 51 | +1.8 | 92.0 |
| Top Miocene Sandstone | | 730.8 | 721 | +9.8 | 770.0 |
| Base Miocene Sandstone | | 790.8 | 790 | +0.8 | 830.0 |
| Top Lakes Entrance Formation | | 1324.8 | 1327 | -2.2 | 1364.0 |
| Top Latrobe Group | | 1497.4 | 1493 | +4.4 | 1536.6 |
| Top N-150 Sand (TCC) | | 1516.7 | 1525 | -8.3 | 1556 |
| Top N. asperus Coals | | 1587.9 | 1585 | +2.9 | 1627.2 |
| Top P. asperopolus Coal | | 1662.9 | 1655 | +7.9 | 1702.1 |
| Top P-100 Sand | | 1683.3 | 1671 | +12.3 | 1722.5 |
| Top M. diversus Coal | | 1831.3 | 1817 | +14.3 | 1870.5 |
| Top M1 Sand | | 1851.8 | 1832 | +19.8 | 1891.0 |
| Top L-440 Reservoir | | 2160.8 | 2122 | +39.8 | 2200.0 |
| Top Lower L. balmei Volcanics | | 2177.1 | 2181 | -3.9 | 2216.3 |
| Base Lower L. balmei Volcanics | | 2274.8 | 2210 | +64.8 | 2314.0 |
| Top L-450 Reservoir | | 2274.8 | 2210 | +64.8 | 2314.0 |
| K/T | | 2400.0 | 2400 | 0.0 | 2439.2 |
| Top T-sand Reservoir** | | 2410.5 | 2442 | -31.5 | 2449.7 |
| Top F. longus Volcanic | | Absent | 2542 | - | - |
| Top T. lilliei | | 2553.9 | 2673 | -119.1 | 2593.2 |

* Primary Objective
** Secondary Objectives

# TABLE 1

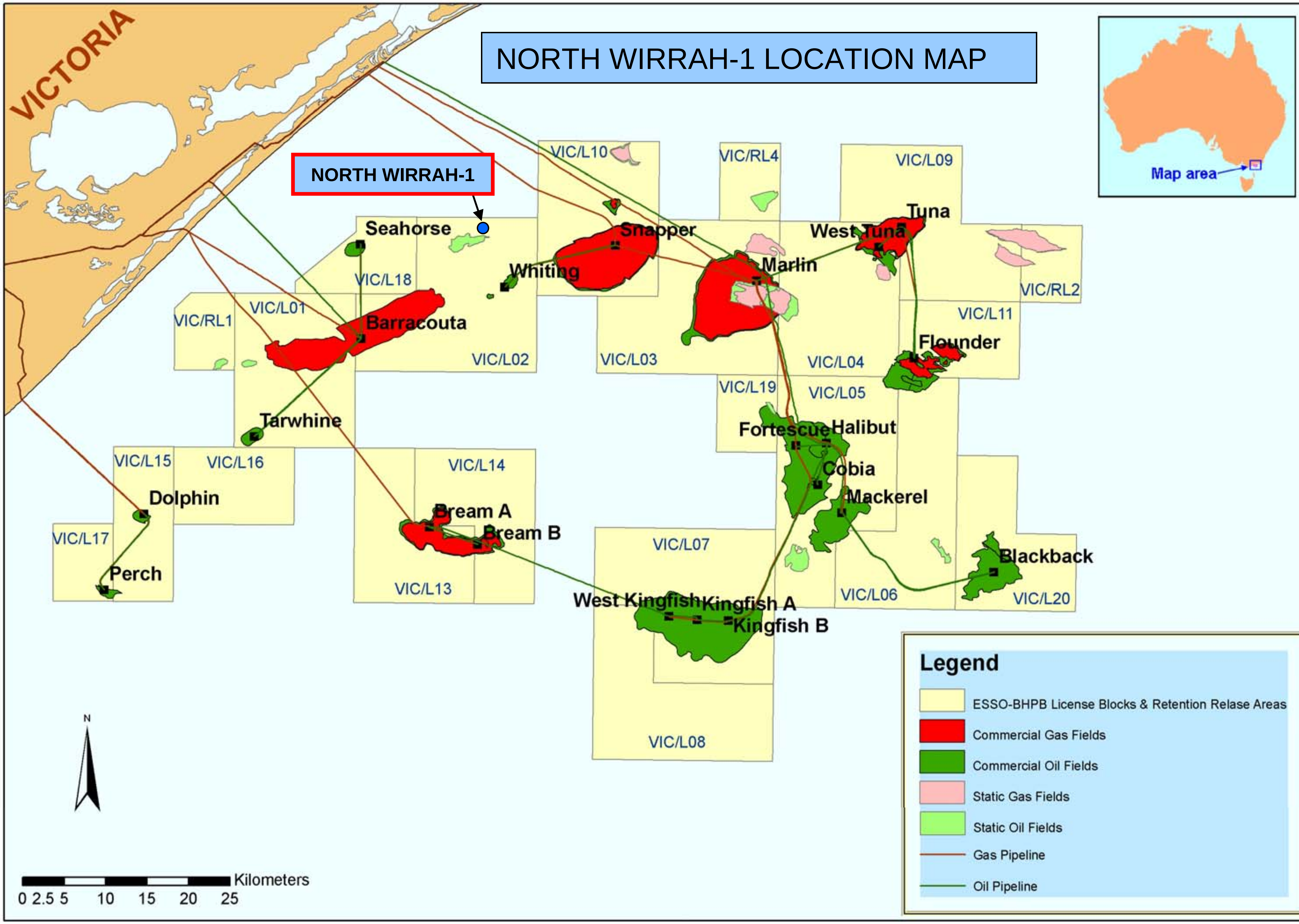
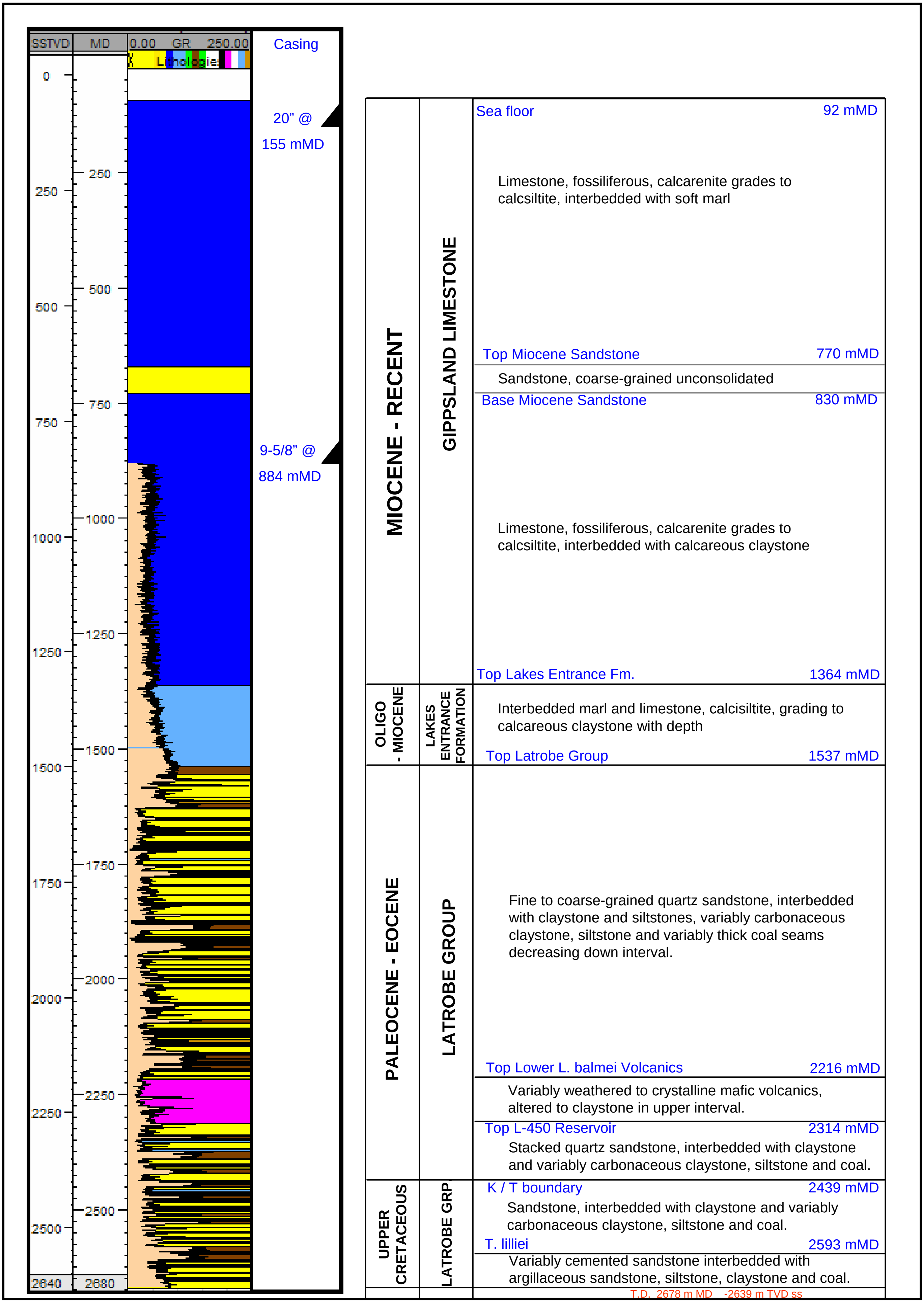

NORTH WIRRAH-1 LOCATION MAP
VICTORIA
NORTH WIRRAH-1
Map area
Seahorse
Snapper
Whiting
Marlin
West Tuna
Tuna
Barracouta
Flounder
Tarwhine
Fortescue
Halibut
Cobia
Mackerel
Dolphin
Perch
Bream A
Bream B
Blackback
West Kingfish
Kingfish A
Kingfish B
VIC/L10
VIC/RL4
VIC/L09
VIC/RL2
VIC/L11
VIC/L18
VIC/L01
VIC/RL1
VIC/L02
VIC/L03
VIC/L04
VIC/L19
VIC/L05
VIC/L15
VIC/L16
VIC/L14
VIC/L17
VIC/L13
VIC/L07
VIC/L06
VIC/L20
VIC/L08
Legend
ESSO-BHPB License Blocks & Retention Relase Areas
Commercial Gas Fields
Commercial Oil Fields
Static Gas Fields
Static Oil Fields
Gas Pipeline
Oil Pipeline
N
Kilometers
0 2.5 5 10 15 20 25

FIGURE 1

# Figure 2 North Wirrah -1 Stratigraphic Column



# ATTACHMENT 1

# COMPOSITE WELL LOG

ESSO AUSTRALIA RESOURCES LTD.

# WELL COMPLETION LOG Scale - 1:200

# NORTH WIRRAH -1

**Gippsland Basin, Victoria**
**Concession: VIC/ L2**

| | | |
|---|---|---|
| **POST-DRILL** (surface) **LOCATION:** | Latitude: | 38º 10' 57.094" S |
| | Longitude: | 147º 50' 20.674" E |
| | AMG X: | 573486.30 mE |
| | AMG Y: | 5773600.38 mN |
| | Datum: | GDA94 (GRS80) |
| | Projection: | MGA/ UTM Zone 55 (S) |
| **ELEVATION:** | G.L.: | -52.80 m |
| | R.T.: | 39.2 m |
| | Water Depth: | 52.80 m |
| **DATES:** | Spudded: | 04/09/2005 |
| | Rig Released: | 25/09/2005 |
| | I.P. Established: | Plugged & Abandoned |
| | *(Initial production)* | |

| | |
|---|---|
| **COMPILED BY:** | Sheryl Sazenis |
| **DRAFTED BY:** | Arnaldo Ribeiro |
| **DRILLED BY:** | ENSCO 102 |
| **TOTAL DEPTH:** | 2678m MDRT |
| **PLUGGED BACK T.D.:** | 125m MDRT |
| **CLASSIFICATION:** | Wildcat |
| **STATUS:** | Plugged & Abandoned |

**SERVICE COMPANIES:**

| | |
|---|---|
| DRILLING CONTRACTOR: | Ensco Asia Pacific |
| MWD: | Schlumberger Anadrill |
| GYRO SURVEYING: | Not Run |
| CORING: | No cores cut |
| WIRELINE LOGGING: | Schlumberger |
| CEMENTING: | Dowell Schlumberger |
| CASING: | Weatherford Australia |
| PRODUCTION TESTING: | Not tested |
| ROV: | Global Offshore ROV |
| MUD LOGGING: | Geoservices |
| PRESSURE RECORDING: | Not tested |
| WELL VELOCITY SURVEY: | Schlumberger |
| MUD ENGINEERING: | Baroid Australia |
| LINER: | No Liner |

## LEGEND

2.7m NOS
Ø = 17%
Sw = 32%

LOG ANALYSIS DATA
NS - Net Sand
NOS - Net Oil Sand
NGS - Net Gas Sand
Sw - Water Saturation

*No Rec.*
CORE
*Rec.*

PERFORATED INTERVAL

PLUG

MUD DATA
Ø - Porosity
Snd - Sand
MW - Mud Weight
FV - Funnel Velocity
PV - Plastic Velocity
YP - Yield Point
Gel - Gel Strength
pH - Acidity/Alkalinity
WL - Water Loss
Cl - Chloride
Ca - Calcium
Sol - Solids
H2O - Water
Oil -Oil

SST — RECOVERED SIDE WALL CORE LITHOLOGY
SST - Sandstone CLST - Claystone
SLST - Siltstone LMST - Limestone
MST - Mudstone ML - Marl
SH - Shale COAL - Coal

SIDE WALL CORE - NO RECOVERY

FIT

P2/11 MDT/RFT PRETEST RUN/SEAT NUMBER

S11/2 MDT/RFT SAMPLE RUN/SAMPLE NUMBER

P2/40 MDT VERTICAL/HORIZONTAL PERMEABILITY TEST

PACKER

BRIDGE PLUG

SHOW OR STAIN

HYDROCARBON CUT

FLUORESCENCE

GAS SHOW

OIL PRODUCTIVE

GAS PRODUCTIVE

INTERPRETED OIL PRODUCTION

INTERPRETED GAS PRODUCTION

INTERPRETED WATER PRODUCTION

WATER PRODUCTIVE

CONDENSATE PRODUCTION

INTEPRETED CONDENSATE BEARING

DSTG DST WITH GAS RECOVERED

DSTO DST WITH OIL RECOVERED

SURVEY POINT

13-3/8" CASING SHOE

MUD

## LITHOLOGICAL SYMBOLS

Sandstone

Dolomite

Mica

Pelecypods

| | | | |
|---|---|---|---|
| Siltstone | Marl | Chert | Echinoids |
| Mudstone | Anhydrite | Carbonaceous Matter | Fish Remains |
| Claystone | Volcanics | Calcareous | Plant Remains |
| Shale | Basement | Glauconite | Spores |
| Coal | Granule | Corals | Leaves |
| Limestone | Oolites | Bryozoans | Foram |
| Micritic Limestone | Dolomitic | Brachiopods | Fossils |
| Grain Limestone | | Gastropods | |
| Skeletal Limestone | Pyrite | Cephalopods | |

## LOGGING AND SURVEYING

| LWD/MWD | Interval (mMDRT) | Survey | Interval (mMDRT) |
|---|---|---|---|
| GVR6/ADN6 | 888 – 2678m | Anderdrift | 56.6 – 2644.58 |
| **Log Suite #1** | | | |
| **RUN #1** HNGS/DSI | 2501m - 882m<br>2400m - 2310m Repeat Section | | |
| **RUN #2** VSP (Checkshots) | 2500m - 762m<br>1580m – 1555m Repeat Section | | |

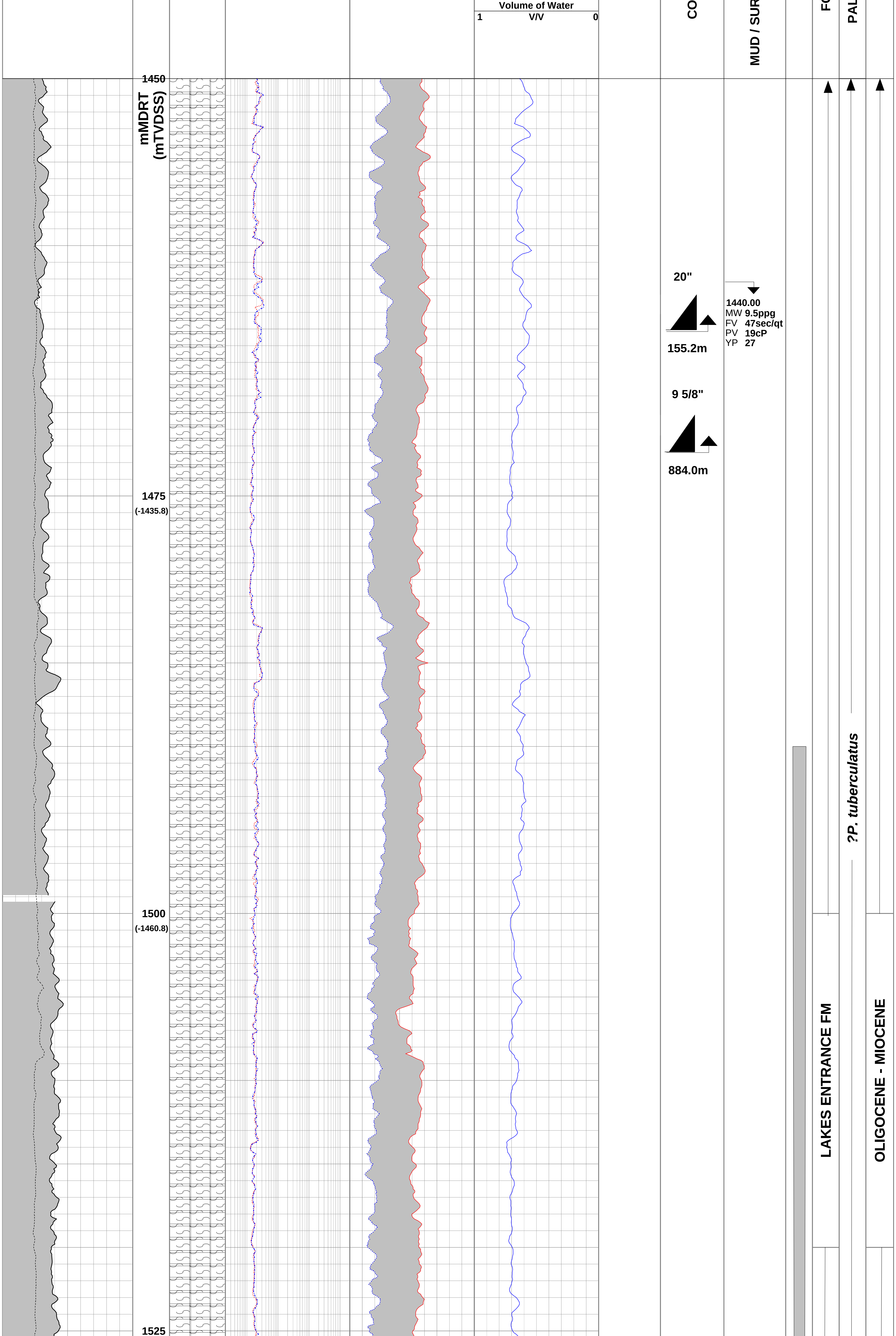
## WELL DATA

| | | | | |
|---|---|---|---|---|
| Date | 11-Sept-05/14-Sept-05 | 11-Sept-05/18-Sept-05 | 19th September 2005 | 19th September 2005 |
| Run | LWD#1 | LWD#2 | Run 1 | Run 2 |
| Log | GVR6/PowerPulse/ADN6 | GVR6/PowerPulse/ADN6 | HNGS-DSI | VSI (Checkshots) |
| Depth Driller | 1508 m MDRT | 2678 m MDRT | 2678m | 2678m |
| Depth Logger | 1508m MDRT | 2678m MDRT | 2504m (HUD) | 2504m (HUD) |
| Bottom Log Interval | 1498m MDRT | 2678m MDRT | 2501m | 2500m |
| Top Log Interval | 888m MDRT | 1498m MDRT | 882m | 762m |
| Casing Driller | 884m MDRT | 884m MDRT | 884 | 884m |
| Casing Logger | ---- | ---- | 882m | 882m |
| Casing Size | 9 5/8" (244mm) | 9 5/8" (244mm) | 9 5/8" (244mm) | 9 5/8" (244m) |
| Casing Weight | 47.0ppf | 47.0ppf | 47lb | 47lb |
| Bit Size | 8 1/2" (216mm) | 8 1/2" (216mm) | 8 1/2" (216mm) | 8 1/2" (216mm) |
| Type of Fluid in Hole | KCl/PHPA/GLYCOL | KCl/PHPA/GLYCOL | KCL/PHPA/polymer/glycol | KCL/PHPA/polymer/glycol |
| Density | 8.5 ppg | 9.5 ppg | 10.5 ppg (1.26 sg) | 10.5 ppg (1.26 sg) |
| Rm @ Measured Temp. | 0.13 ohms @ 22.3 deg C | 0.07 ohms @ 23.7 deg C | 0.08 ohms @ 27.6 deg C | 0.08 ohms @ 27.6 deg C |
| Rmf @ Measured Temp. | 0.11 ohms @ 22.2 deg C | 0.08 ohms @ 23.5 deg C | 0.06 ohms @ 27.6 deg C | 0.06 ohms @ 27.6 deg C |
| Rmc @ Measured Temp. | 0.19 ohms at 22.3 deg C | 0.14 ohms at 24.2 deg C | 0.14 ohms @ 28 deg C | 0.14 ohms @ 28 deg C |
| Max. Recorded Temp. | 57 deg C | 92 deg C | 103.3 deg C | 104.4 deg C |
| Equipment / Location | Sale | Sale | Schlumberger/Sale | Schlumberger/Sale |
| Recorded By | J. Dolan/R Burns/M. Y. Tan | J. Dolan/R Burns/M. Y. Tan | Ron Clarke/Dimitri Molokov | Ron Clarke / Dimitri Molokov |
| Witnessed By | G O'Neill/S. Duff | G O'Neill/S. Duff | Stuart Duff/Greg O'Neill | Stuart Duff / Greg O'Neill |

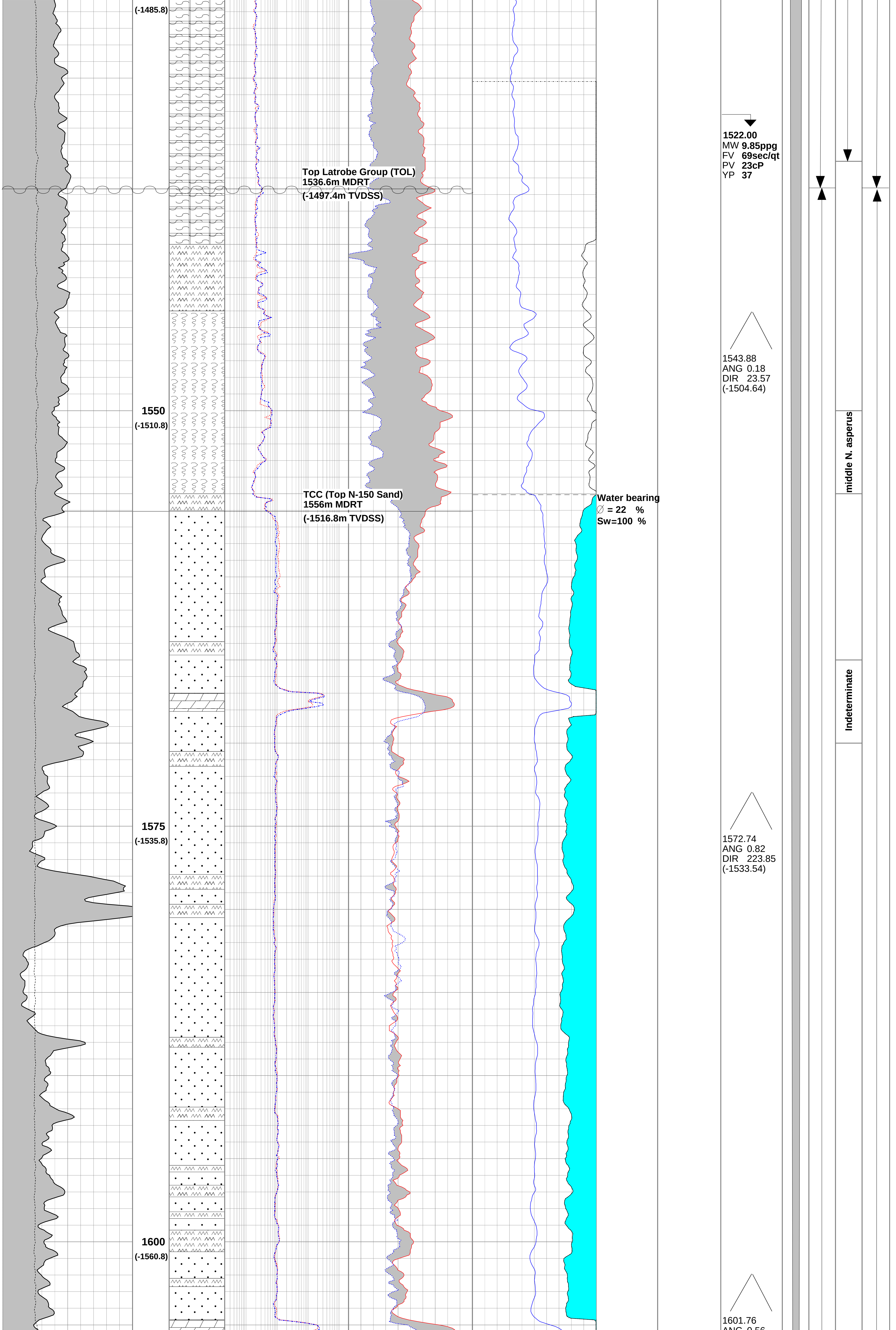
| CORES | | | PERFORATIONS | | |
|---|---|---|---|---|---|
| **From (mMDRT)** | **To (mMDRT)** | **Rec %** | **From (mMDRT)** | **To (mMDRT)** | **Shots/ft** |
| | | | | | |
| No cores were cut | --- | | No perforations | | |
| | | | | | |
| | | | | | |

| CASING | | | | PLUGS | | |
|---|---|---|---|---|---|---|
| **Size** | **Set @ (mMDRT)** | **Sx Cmt** | **Formation** | **From (mMDRT)** | **To (mMDRT)** | **Sx Cmt** |
| | | | | | | |
| 20" | 155.2 | 957 | Gippsland Limestone | (1)1970 | 1490 | 549 |
| 9.625" | 884 | 465 | Gippsland Limestone | (2) 914 | 764 | 170 |
| | | | | (3) 205 | 105 | 329 |
| | | | | | | |

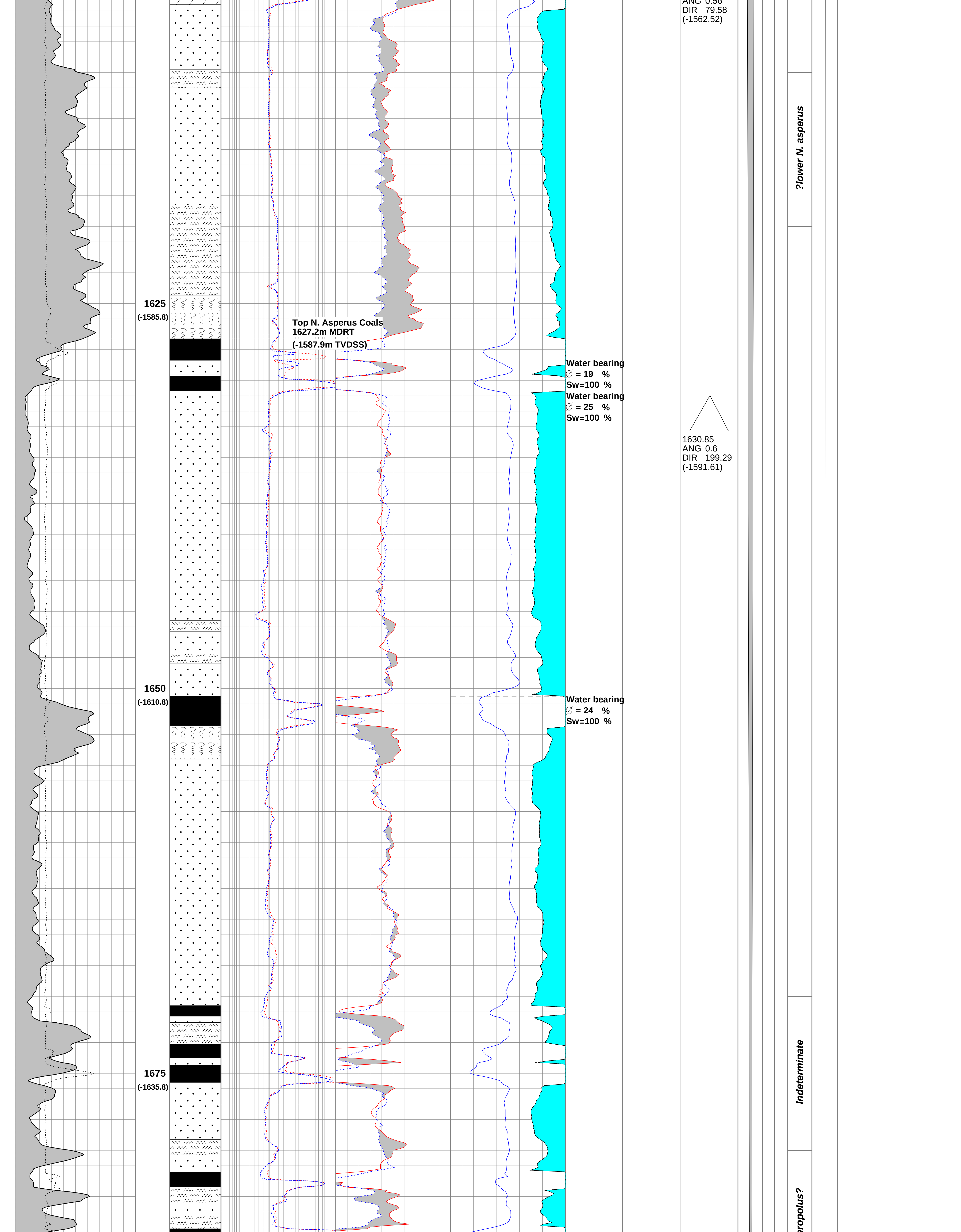
| Caliper / Gamma Ray | DEPTH | LITHOLOGY | Deep Resistivity / Medium Resistivity | RHOB / Neutron Porosity | Delta-T / Effective Porosity | TEST | MPLETION | VEY DATA | PLUGS | ORMATION | YNOLOGY | AGE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Caliper 6 IN 16 | | | Deep Resistivity 0.2 OHMM 2000 | RHOB 1.85 G/C3 2.85 | Delta-T 500 US/M 100 | | | | | | | |
| Gamma Ray 0 GAPI 200 | | | Medium Resistivity 0.2 OHMM 2000 | Neutron Porosity 0.45 V/V -0.15 | Effective Porosity 1 V/V 0 | | | | | | | |

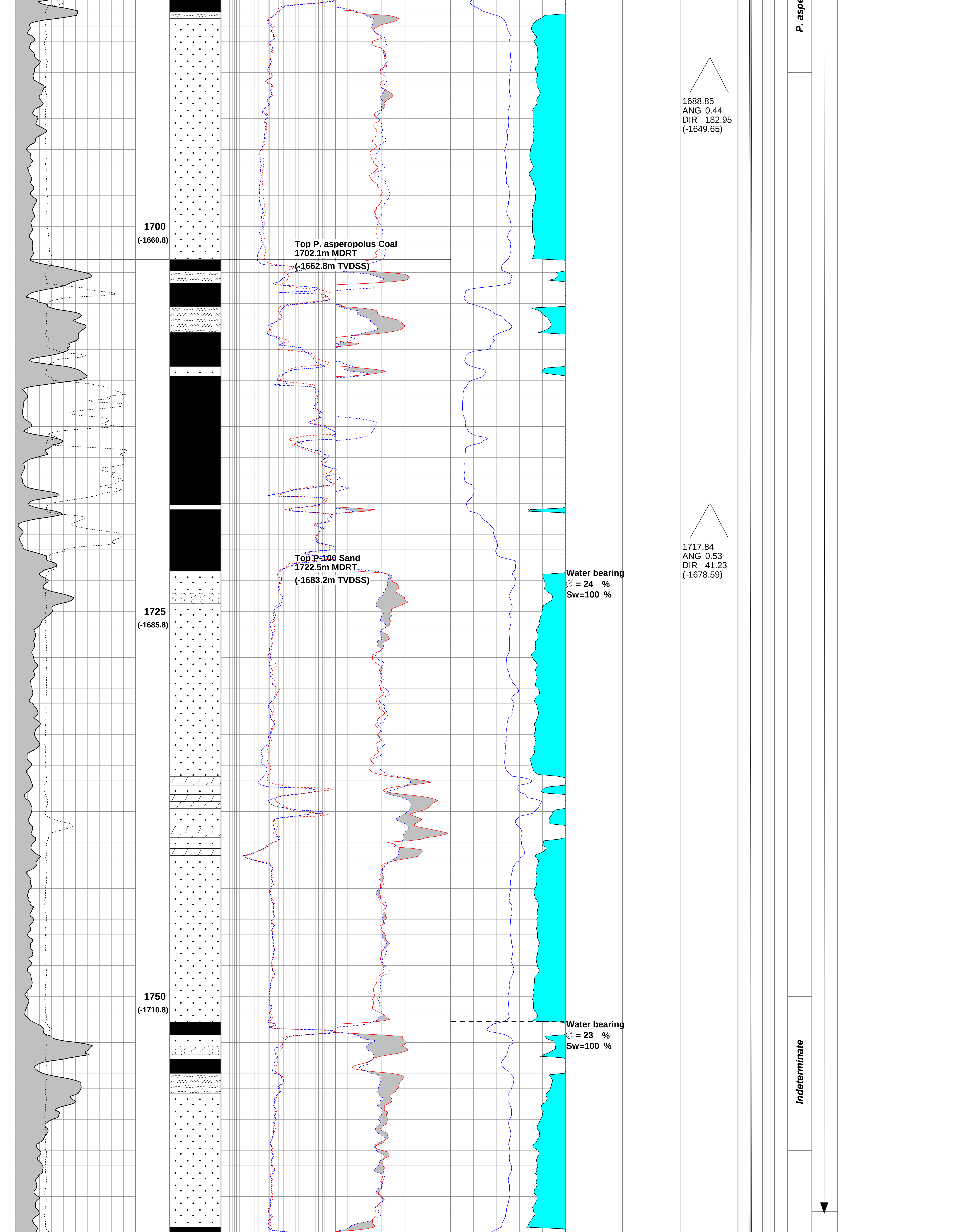


Volume of Water
1
V/V
0
CO
MUD / SUR
FO
PAL
mMDRT
(mTVDSS)
1450
1475
(-1435.8)
1500
(-1460.8)
1525
20"
155.2m
9 5/8"
884.0m
1440.00
MW 9.5ppg
FV 47sec/qt
PV 19cP
YP 27
?P. tuberculatus
LAKES ENTRANCE FM
OLIGOCENE - MIOCENE

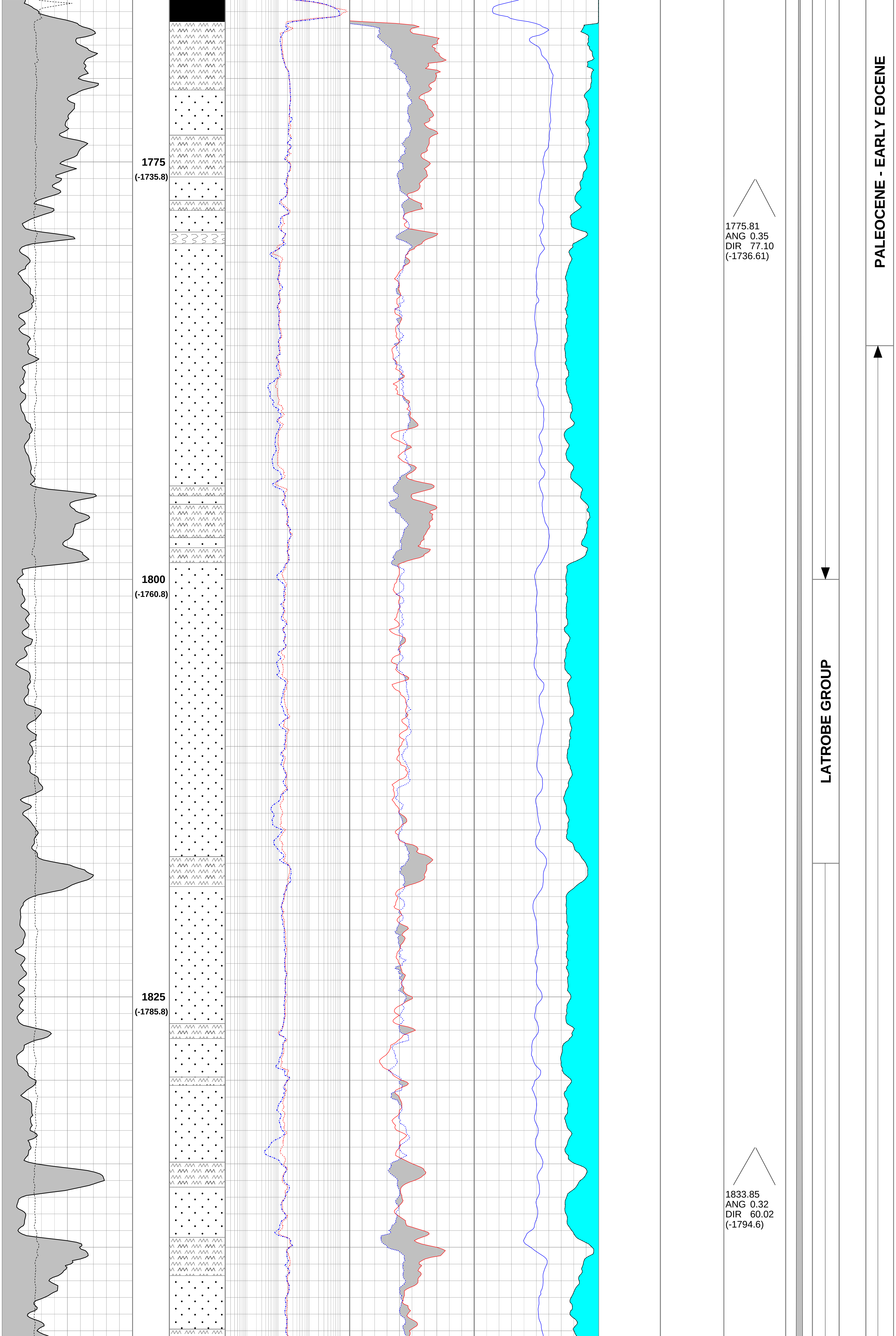


(-1485.8)
Top Latrobe Group (TOL)
1536.6m MDRT
(-1497.4m TVDSS)
1550
(-1510.8)
TCC (Top N-150 Sand)
1556m MDRT
(-1516.8m TVDSS)
Water bearing
∅ = 22 %
Sw=100 %
1575
(-1535.8)
1600
(-1560.8)
1522.00
MW 9.85ppg
FV 69sec/qt
PV 23cP
YP 37
1543.88
ANG 0.18
DIR 23.57
(-1504.64)
1572.74
ANG 0.82
DIR 223.85
(-1533.54)
1601.76
middle N. asperus
Indeterminate

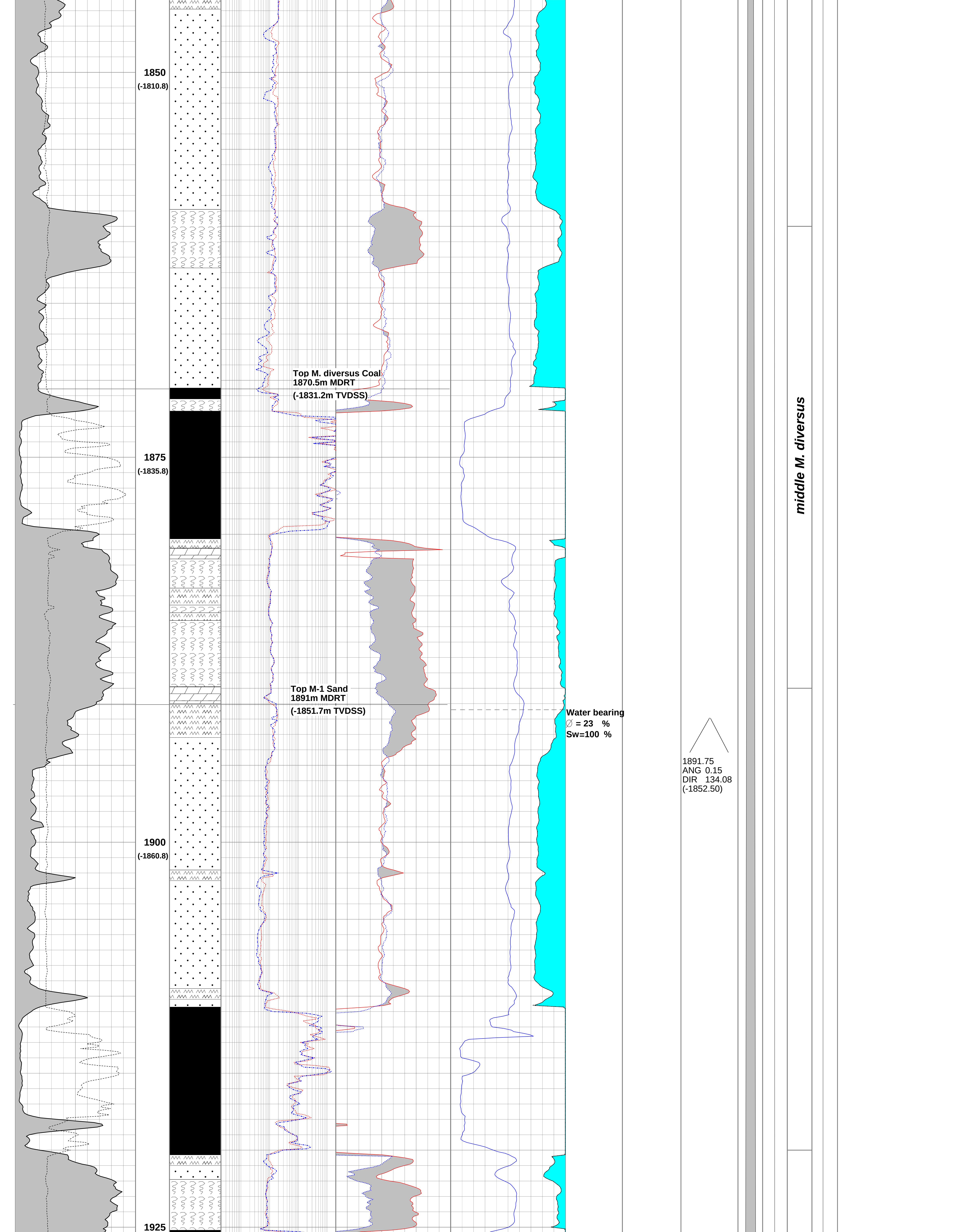

ANG 0.56
DIR 79.58
(-1562.52)
?lower N. asperus
1625
(-1585.8)
Top N. Asperus Coals
1627.2m MDRT
(-1587.9m TVDSS)
Water bearing
∅ = 19 %
Sw=100 %
Water bearing
∅ = 25 %
Sw=100 %
1630.85
ANG 0.6
DIR 199.29
(-1591.61)
1650
(-1610.8)
Water bearing
∅ = 24 %
Sw=100 %
Indeterminate
1675
(-1635.8)

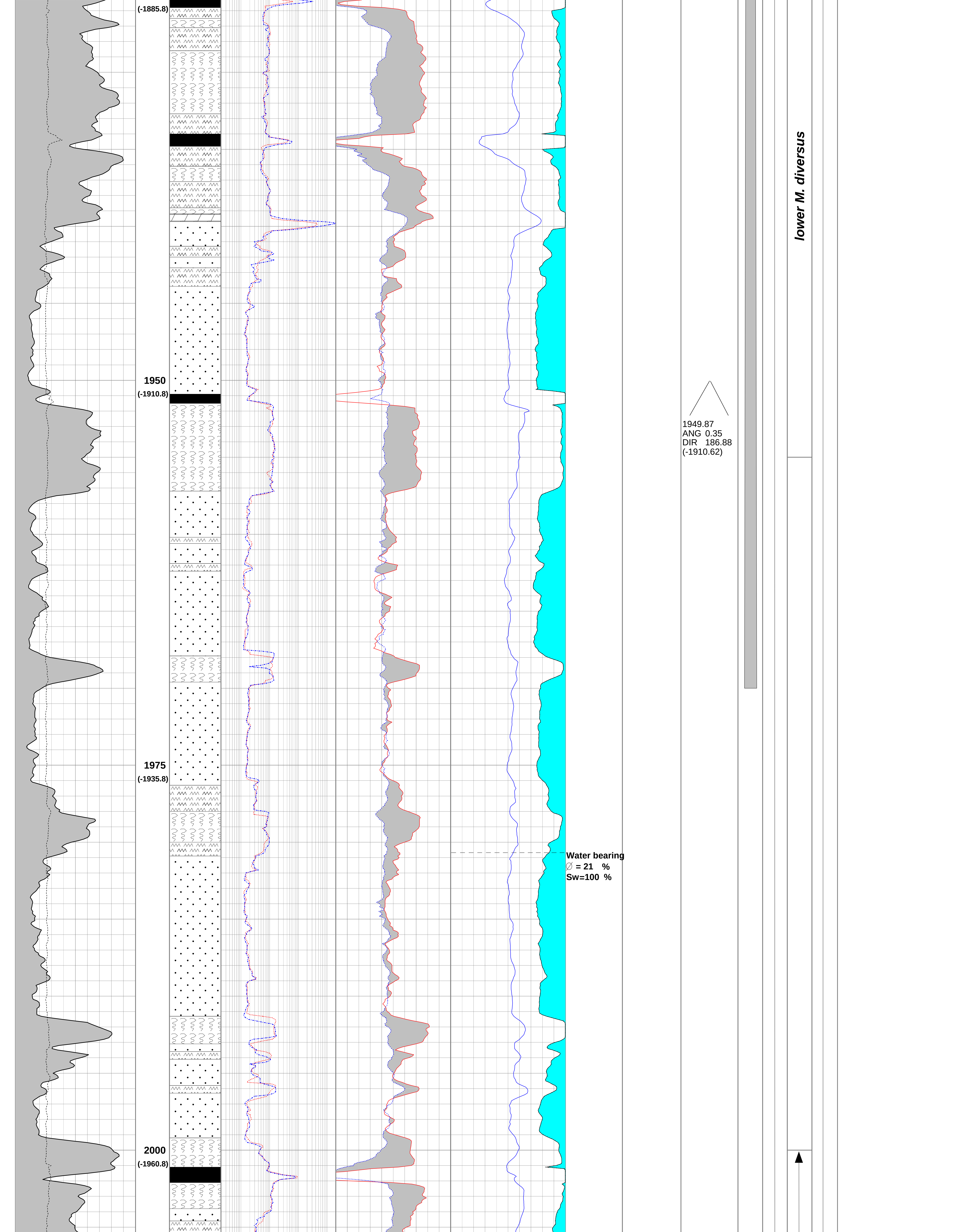


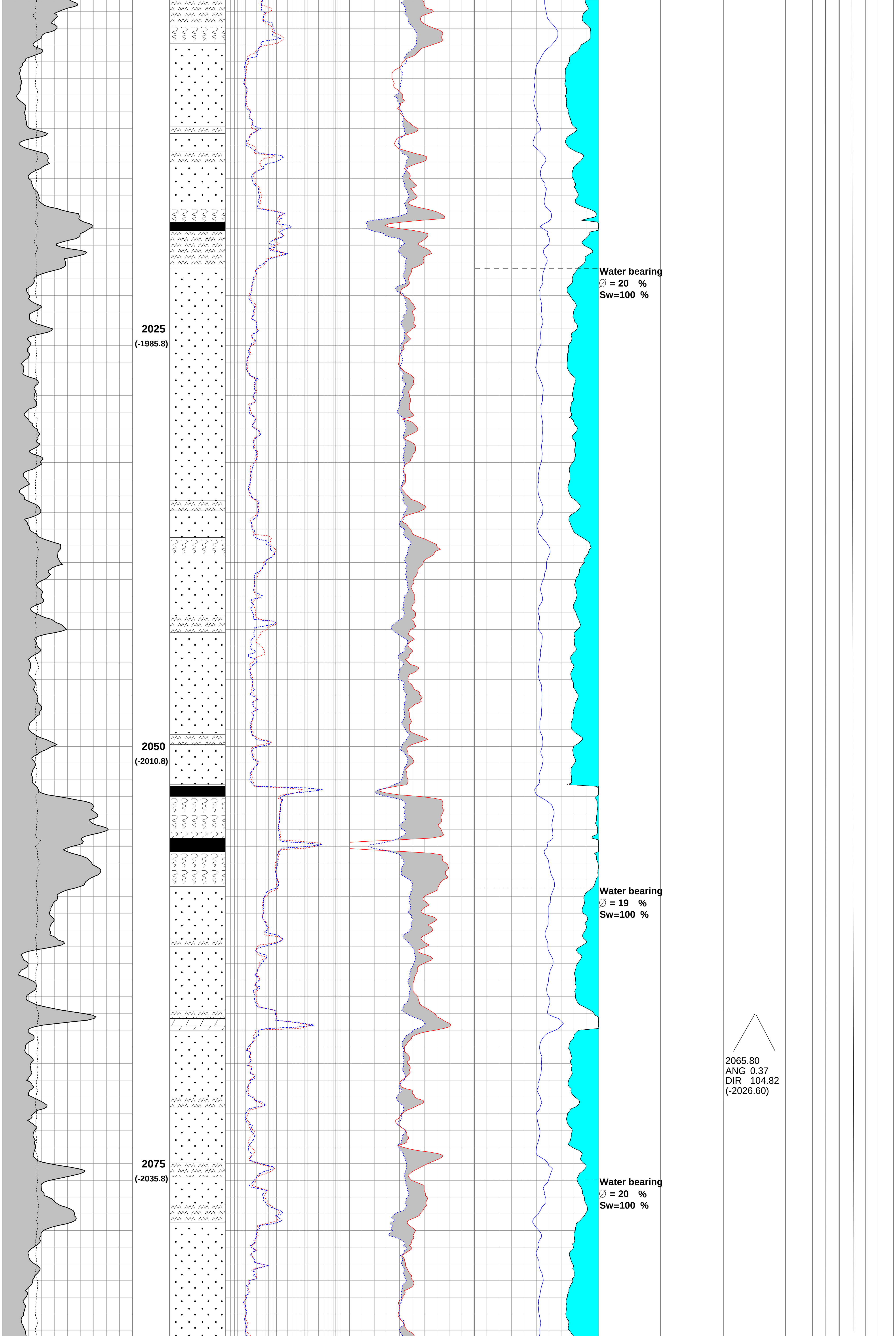
1700
(-1660.8)
Top P. asperopolus Coal
1702.1m MDRT
(-1662.8m TVDSS)
Top P-100 Sand
1722.5m MDRT
(-1683.2m TVDSS)
1725
(-1685.8)
1750
(-1710.8)
Water bearing
∅ = 24 %
Sw=100 %
Water bearing
∅ = 23 %
Sw=100 %
1688.85
ANG 0.44
DIR 182.95
(-1649.65)
1717.84
ANG 0.53
DIR 41.23
(-1678.59)
P. aspe
Indeterminate



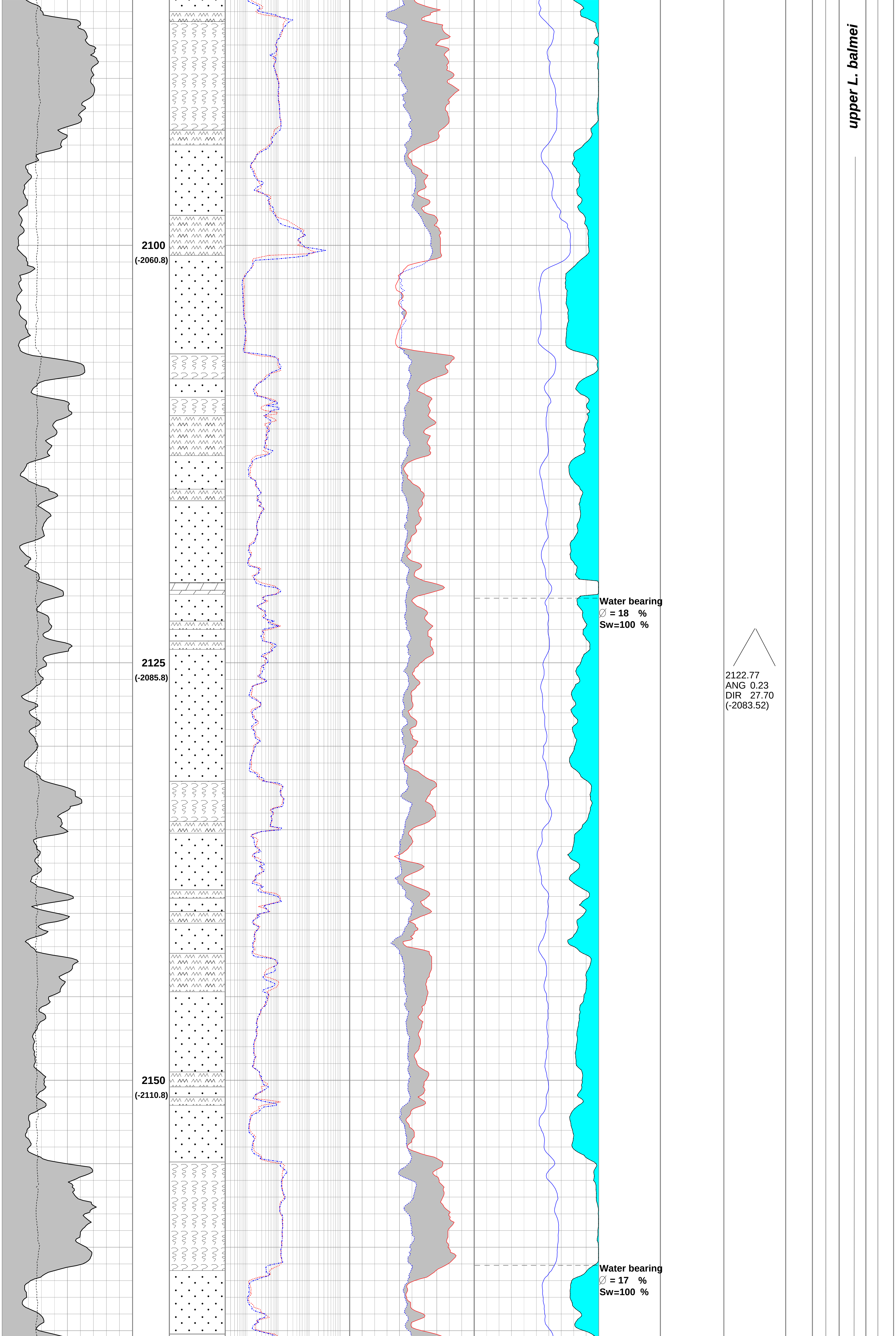
1775
(-1735.8)
1800
(-1760.8)
1825
(-1785.8)
1775.81
ANG 0.35
DIR 77.10
(-1736.61)
1833.85
ANG 0.32
DIR 60.02
(-1794.6)
LATROBE GROUP
PALEOCENE - EARLY EOCENE

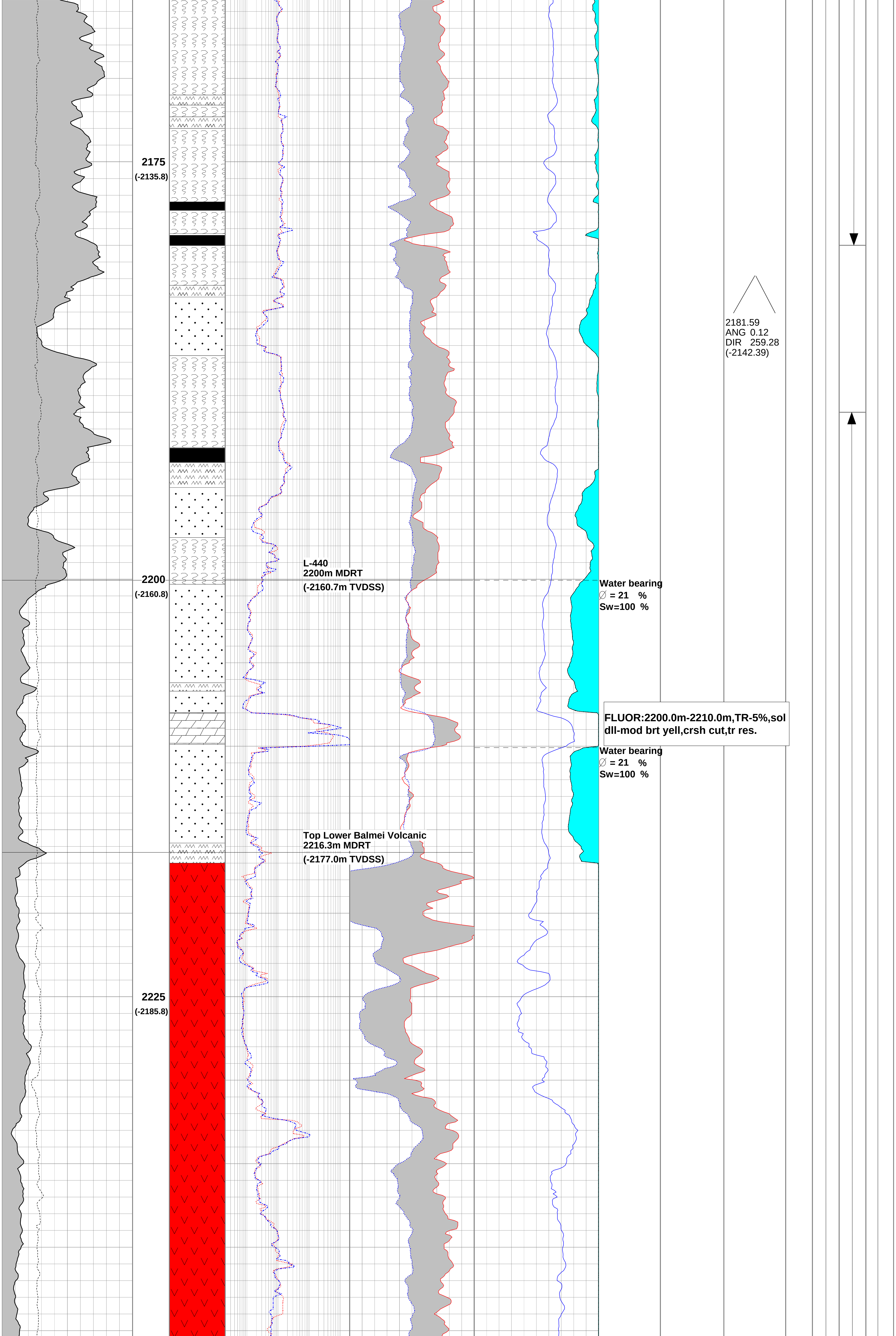

1850
(-1810.8)
1875
(-1835.8)
1900
(-1860.8)
1925
Top M. diversus Coal
1870.5m MDRT
(-1831.2m TVDSS)
Top M-1 Sand
1891m MDRT
(-1851.7m TVDSS)
Water bearing
Ø = 23 %
Sw=100 %
1891.75
ANG 0.15
DIR 134.08
(-1852.50)
middle M. diversus

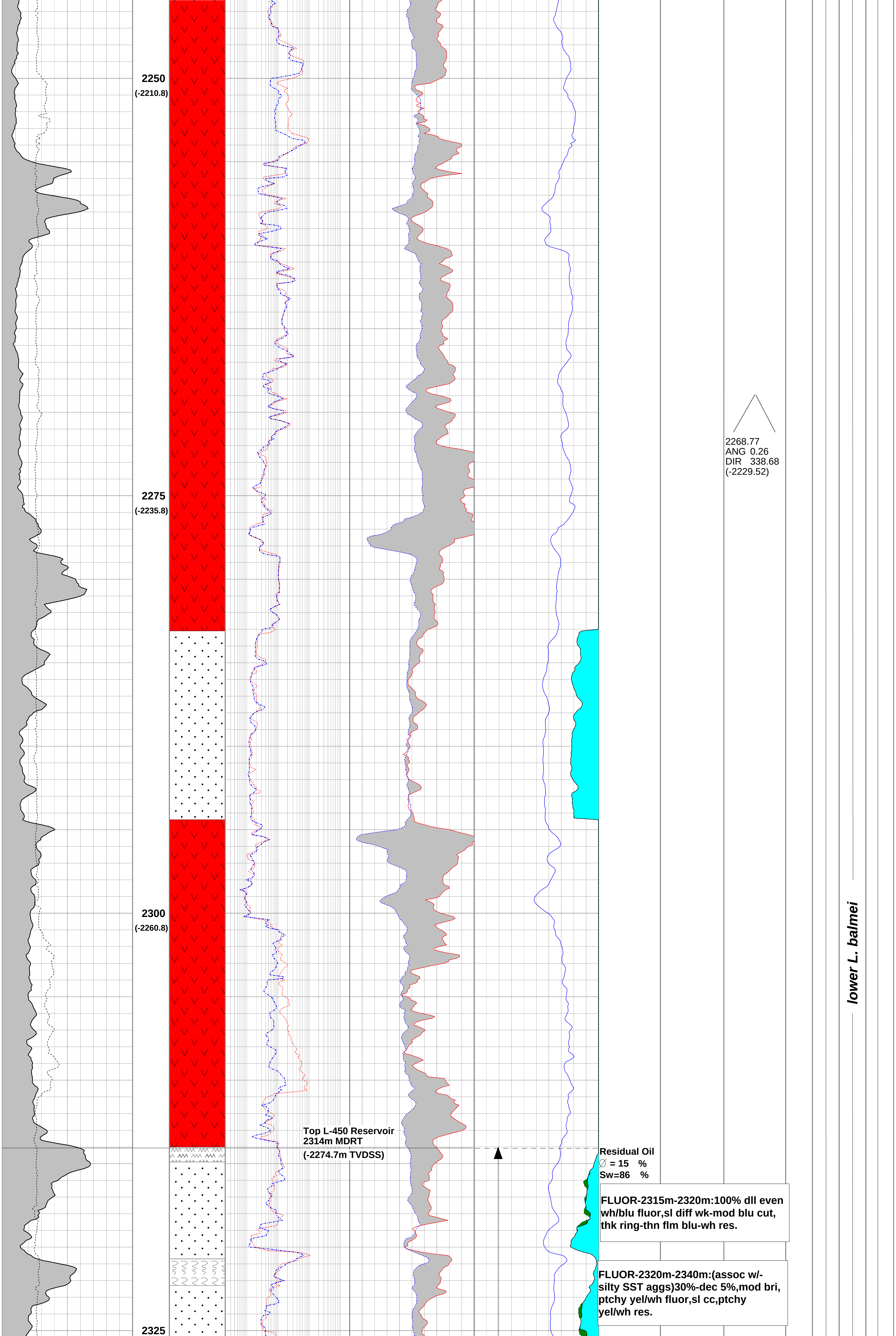

(-1885.8)
1950
(-1910.8)
1949.87
ANG 0.35
DIR 186.88
(-1910.62)
1975
(-1935.8)
Water bearing
∅ = 21 %
Sw=100 %
2000
(-1960.8)
lower M. diversus



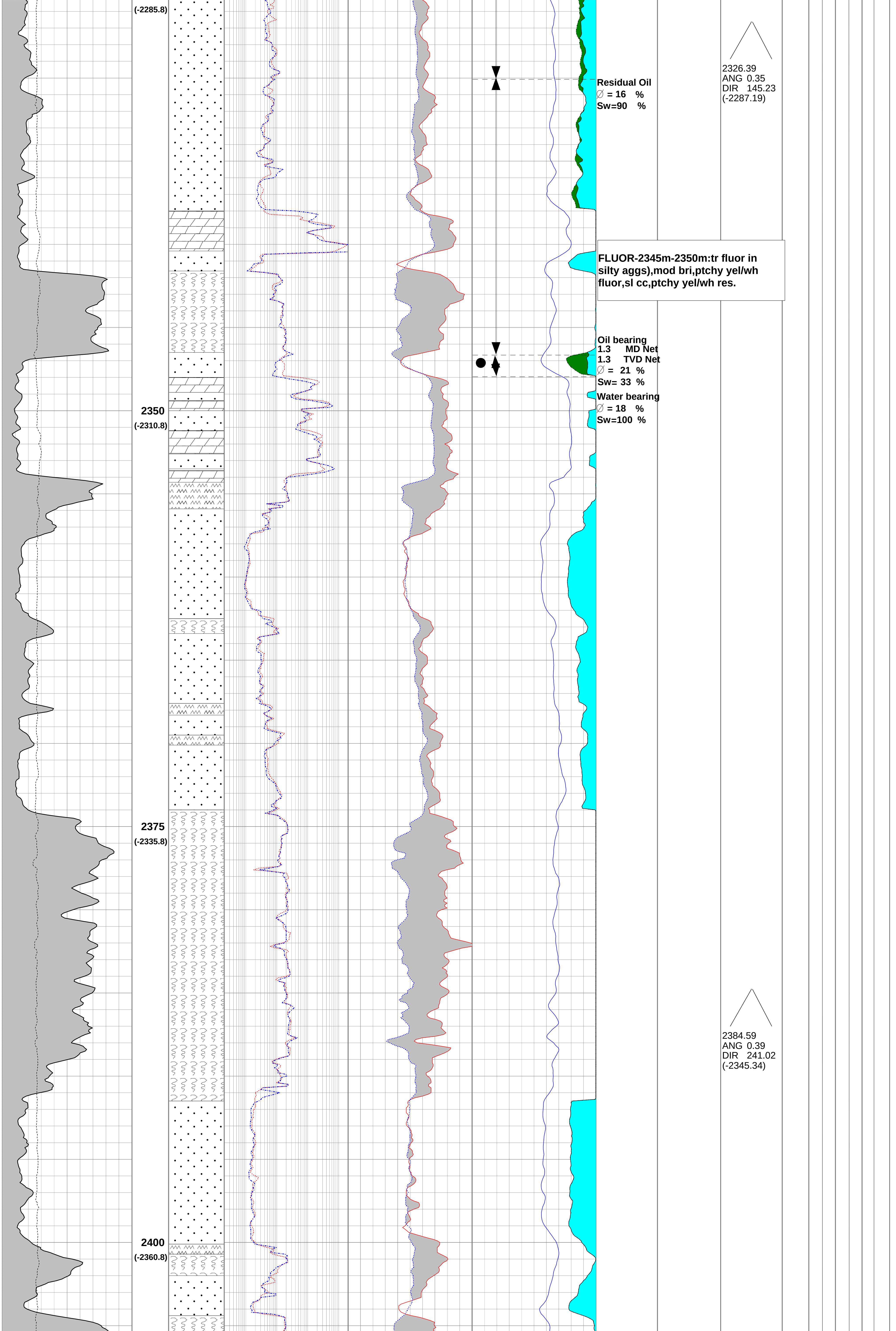
2025
(-1985.8)
Water bearing
∅ = 20 %
Sw=100 %
2050
(-2010.8)
Water bearing
∅ = 19 %
Sw=100 %
2065.80
ANG 0.37
DIR 104.82
(-2026.60)
2075
(-2035.8)
Water bearing
∅ = 20 %
Sw=100 %


upper L. balmei
2100
(-2060.8)
Water bearing
∅ = 18 %
Sw=100 %
2122.77
ANG 0.23
DIR 27.70
(-2083.52)
2125
(-2085.8)
2150
(-2110.8)
Water bearing
∅ = 17 %
Sw=100 %

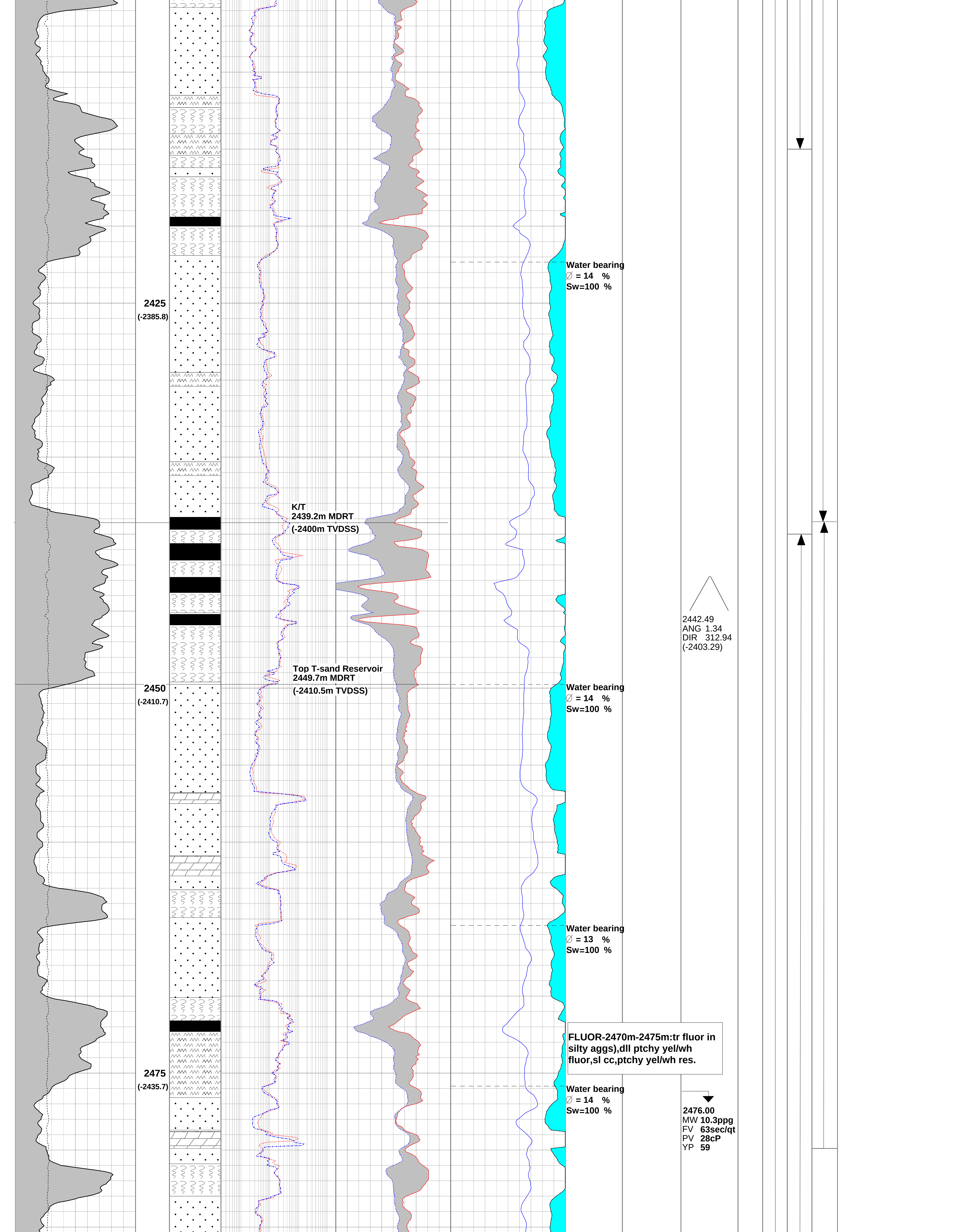

2175
(-2135.8)
2181.59
ANG 0.12
DIR 259.28
(-2142.39)
L-440
2200m MDRT
(-2160.7m TVDSS)
2200
(-2160.8)
Water bearing
∅ = 21 %
Sw=100 %
FLUOR:2200.0m-2210.0m,TR-5%,sol
dll-mod brt yell,crsh cut,tr res.
Water bearing
∅ = 21 %
Sw=100 %
Top Lower Balmei Volcanic
2216.3m MDRT
(-2177.0m TVDSS)
2225
(-2185.8)



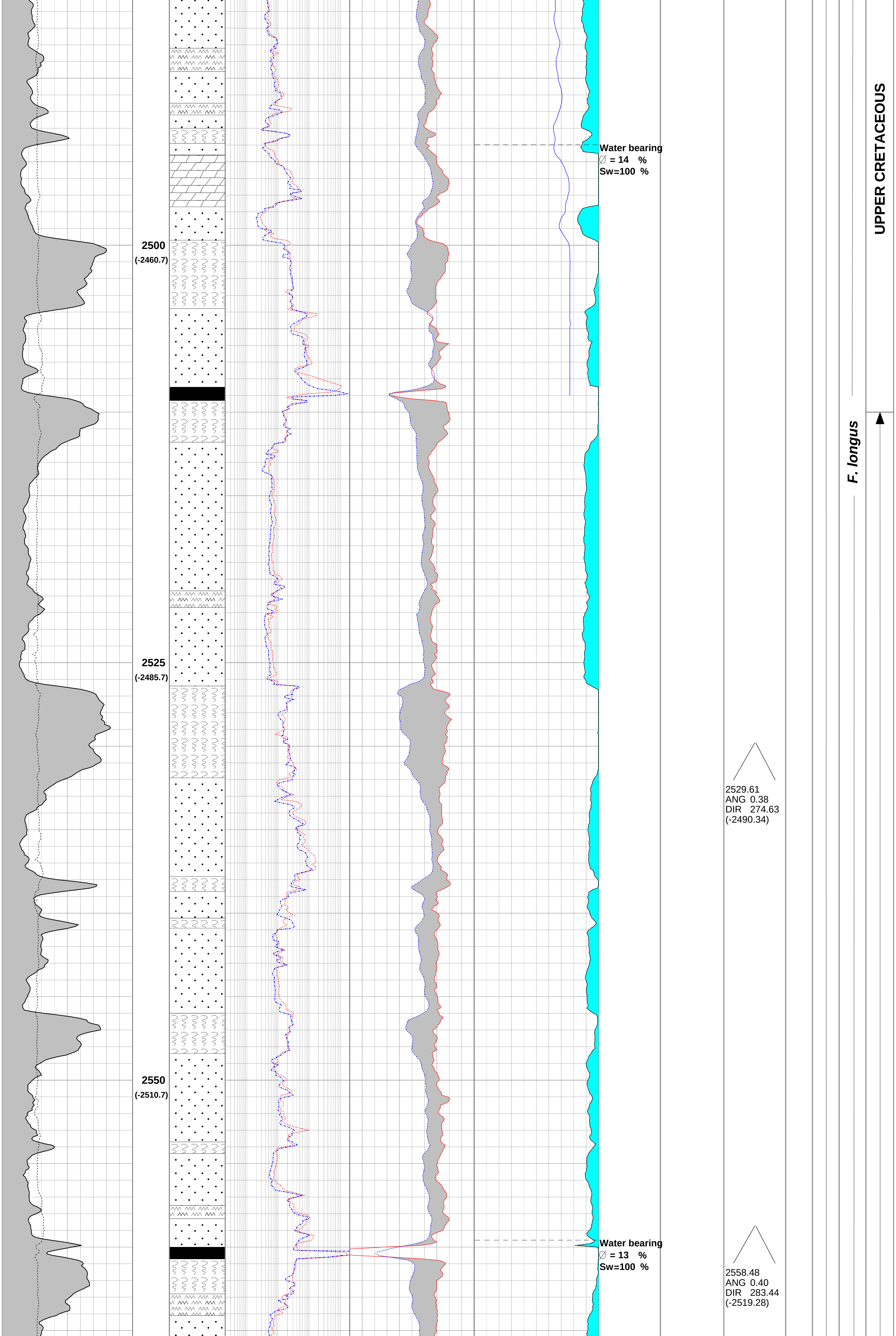
2250
(-2210.8)
2268.77
ANG 0.26
DIR 338.68
(-2229.52)
2275
(-2235.8)
2300
(-2260.8)
lower L. balmei
Top L-450 Reservoir
2314m MDRT
(-2274.7m TVDSS)
Residual Oil
∅ = 15 %
Sw=86 %
FLUOR-2315m-2320m:100% dll even wh/blu fluor,sl diff wk-mod blu cut, thk ring-thn flm blu-wh res.
FLUOR-2320m-2340m:(assoc w/-silty SST aggs)30%-dec 5%,mod bri, ptchy yel/wh fluor,sl cc,ptchy yel/wh res.
2325

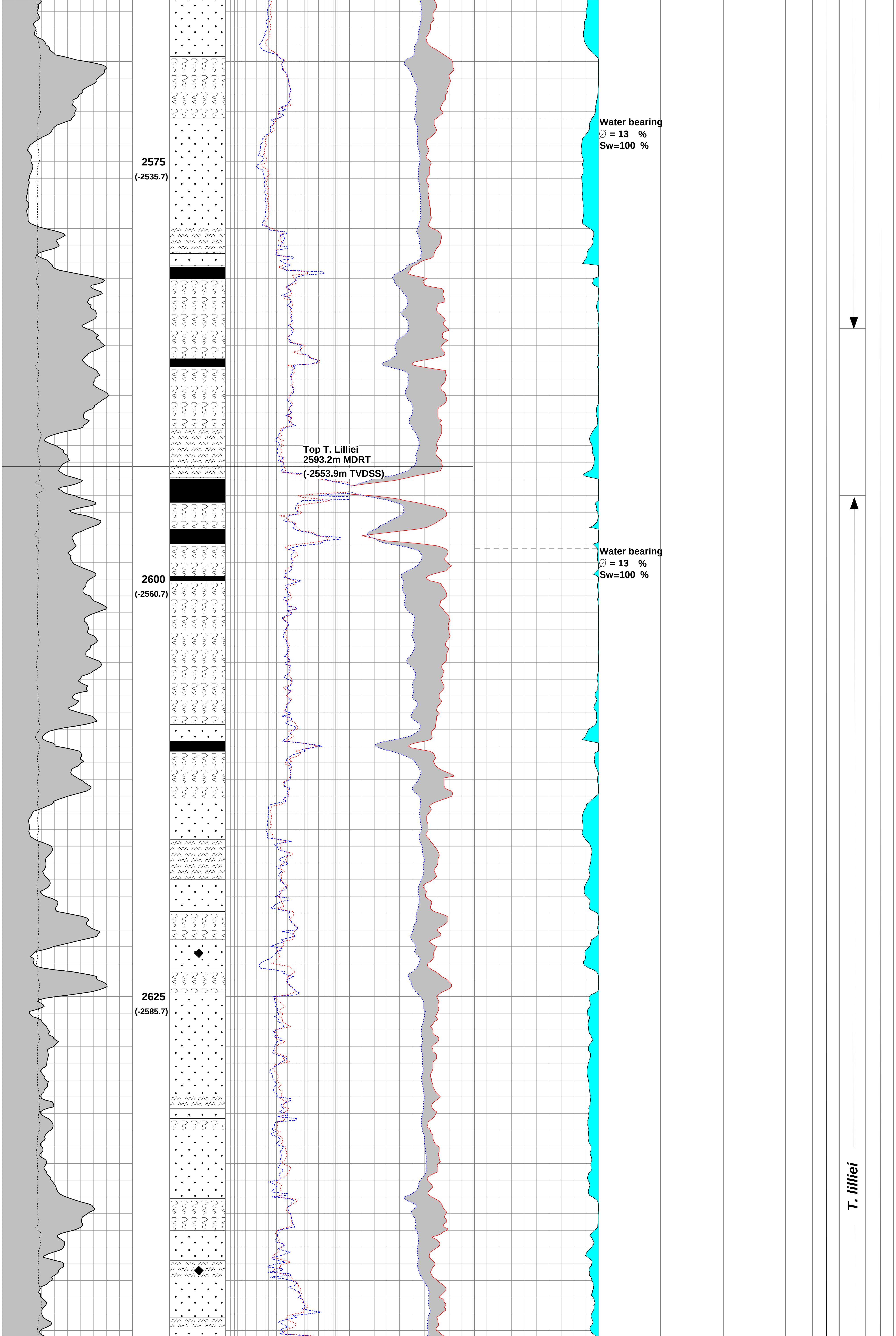


(-2285.8)
Residual Oil
∅ = 16 %
Sw=90 %
2326.39
ANG 0.35
DIR 145.23
(-2287.19)
FLUOR-2345m-2350m:tr fluor in silty aggs),mod bri,ptchy yel/wh fluor,sl cc,ptchy yel/wh res.
Oil bearing
1.3 MD Net
1.3 TVD Net
∅ = 21 %
Sw= 33 %
Water bearing
∅ = 18 %
Sw=100 %
2350
(-2310.8)
2375
(-2335.8)
2384.59
ANG 0.39
DIR 241.02
(-2345.34)
2400
(-2360.8)

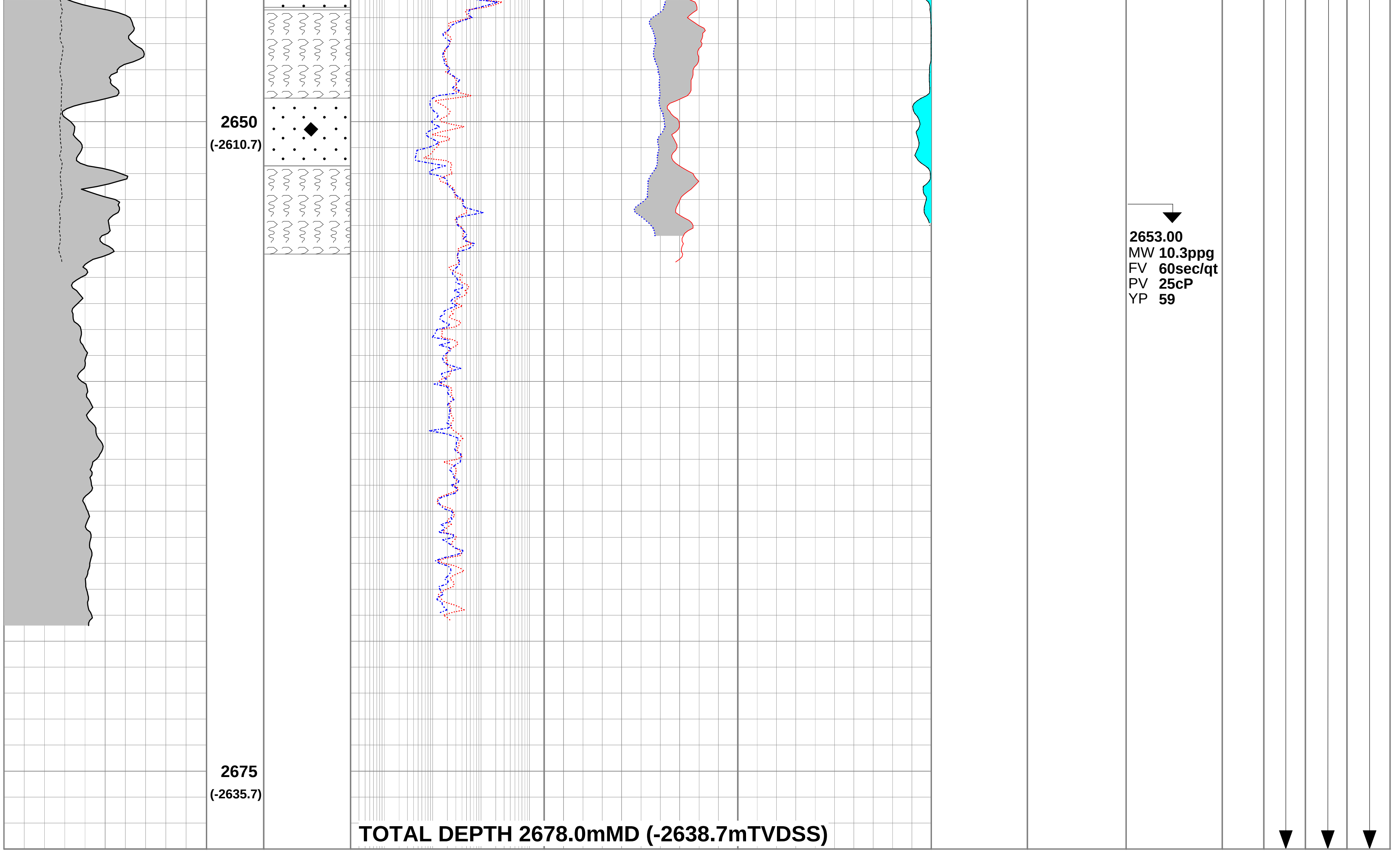


2425
(-2385.8)
Water bearing
∅ = 14 %
Sw=100 %
K/T
2439.2m MDRT
(-2400m TVDSS)
2442.49
ANG 1.34
DIR 312.94
(-2403.29)
Top T-sand Reservoir
2449.7m MDRT
(-2410.5m TVDSS)
2450
(-2410.7)
Water bearing
∅ = 14 %
Sw=100 %
Water bearing
∅ = 13 %
Sw=100 %
FLUOR-2470m-2475m:tr fluor in silty aggs),dll ptchy yel/wh fluor,sl cc,ptchy yel/wh res.
2475
(-2435.7)
Water bearing
∅ = 14 %
Sw=100 %
2476.00
MW 10.3ppg
FV 63sec/qt
PV 28cP
YP 59


2500
(-2460.7)
2525
(-2485.7)
2550
(-2510.7)
Water bearing
∅ = 14 %
Sw=100 %
Water bearing
∅ = 13 %
Sw=100 %
2529.61
ANG 0.38
DIR 274.63
(-2490.34)
2558.48
ANG 0.40
DIR 283.44
(-2519.28)
F. longus
UPPER CRETACEOUS



Water bearing
∅ = 13 %
Sw=100 %
2575
(-2535.7)
Top T. Lilliei
2593.2m MDRT
(-2553.9m TVDSS)
Water bearing
∅ = 13 %
Sw=100 %
2600
(-2560.7)
2625
(-2585.7)
T. lilliei




| | |
|---|---|
| GR_RAB | RAB Gamma Ray |
| DCAV | Density Caliper |
| RES_BS | Shallow Button Resistivity |
| RES_BM | Medium Button Resistivity |
| RES_BD | Deep Button Resistivity |
| RES_RING | Ring Resistivity |
| ROBB | Bulk Desnity Bottom |
| TNPH | Thermal Neutron Porosity |
| PIGN | Effective Porosity |
| VUWA | Bulk Volume of Water |

Plugged and Abandoned
25 September 2005

# APPENDIX 1

# FORMATION EVALUATION
# LOG INTERPRETATION
# REPORT

# Esso Australia Pty Ltd.

**Exploration Department**

**North Wirrah 1**
**Formation Evaluation**
**Log Interpretation Report**

**Petrophysicist:  P J Tarabbia**
**Jan 2006**

# North Wirrah 1 Log Interpretation

North Wirrah 1 was drilled to test a fault dependent structural trap NE of the Wirrah Field. The North Wirrah 1 well was designed to target the L-450 reservoir sands below the *Lower L. balmei* volcanics with secondary targets in the *L. balmei* and *T. longus* reservoirs.

The well was spudded on the 4th Sept 2005. The 8½" hole was drilled to a total depth of 2678mMDRT (2677.9mTVDRT). North Wirrah 1 plugged and abandoned on the 20th Sept 2005.

Schlumberger LWD and wireline logs have been analysed for porosity, water saturation and net pay over the interval 1530-2650 mMDRT.

#Note: All depths quoted in this report are logged mMDRT unless otherwise specified.

## DATA

Data from the following logging surveys were used in the interpretation:

| Survey/Log | Company | Top (m MDRT) | Hole size (inches) | Bottom (m MDRT) |
|---|---|---|---|---|
| GVR/ADN6: GR_RAB-ROBB-TNPH-RES_RING-ROP5-ECD-ATMP-DCAV-RES_BS-RES_BD-PERA-DRHO | Anadrill | 888 | 8 ½ | 2670 |
| HNGS/DSI: DTCO-DT4P-DT4S-DTSM-HBHK-HFK-HSGR-HTHO-HTPR-HTUR-HUPR-HURA | Schlumberger | 92 | 8 ½ | 2504 (HUD) |

**Deviation**

Vertical well.

**Mud Data**

| | | |
|---|---|---|
| Mud Type : | KCl/Glycol/PHPA | |
| Mud Weight: | 8.5-9.5 ppg (While-drilling) | |
| Mud Weight: | 10.5 ppg (Wireline) | |
| RT: | 39.2m | |
| | While-drilling | Wireline |
| Rm: | 0.07 @ 23.7 $^0$C | 0.08 @ 27.6 $^0$C |
| Rmf: | 0.08 @ 23.5 $^0$C | 0.06 @ 27.6 $^0$C |
| Rmc: | 0.14 @ 24.2 $^0$C | 0.14 @ 28 $^0$C |
| BHT: | 104 $^0$C @2504m | |

**Hole Size**

888 – 2678 mMDRT 8½ inches

**Data Acquisition & Log Quality**

No problems were encountered in the acquisition of the LWD logs and the data quality of all the LWD logs is acceptable. The DSI/HNGS wireline logging run did not go past 2504m. Sonic data required slight depth shifting to match the LWD density-neutron.

### Data Processing

The DTCO curve was depth aligned to match the character of the LWD curves. All coal zones were manually picked and a coal flag (flag_coal) was created. Igneous zones and dolomite cemented zones were identified and manually picked from the logs.

In addition, temperature (temp) and hydrocarbon flag (flag_rhoh) curves were also generated. All the new curves were used as inputs for the final petrophysical interpretation.

## INTERPRETATION

### Logs Used

The primary logs used in the interpretation were RES_RING (deep resistivity), GR_RAB (borehole corrected gamma ray), ROBB (Bottom bulk density) and TNPH (environmentally corrected thermal neutron porosity).

### Formation Water Salinity

$R_{wa}$ analysis using a = 1, m = 2 and n = 2 indicates clean water sands have varying apparent formation water salinity from 3000 to 30,000 ppm NaCl equivalent. Salinity variations were the major driver for the zone intervals defined in Elan.

### Hydrocarbon Type Identification

### L450A and L450B

Fluorescence is described on the mudlog across this section of the reservoir.

### L450C

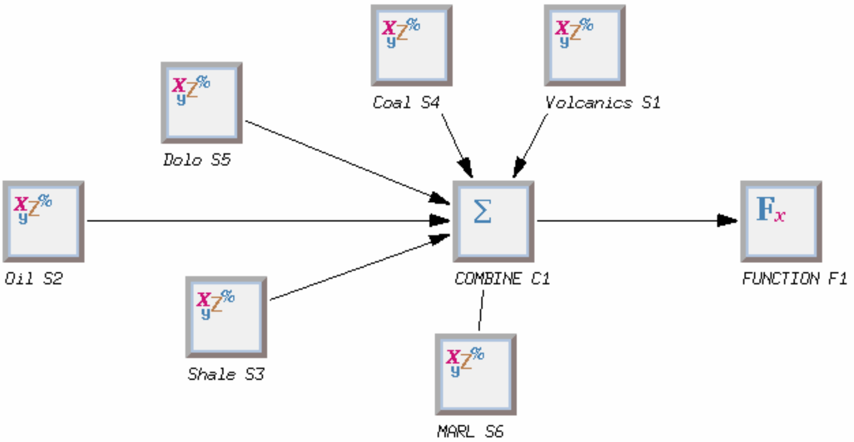
The lack of density-neutron cross-over in the L450C sand indicates the hydrocarbon type is most likely oil. Despite the thin nature of the logged oil interval and its occurrence within a cemented sandstone unit, the LKO is interpreted to be at 2347.9m (oil on rock). Fluorescence is described on the mudlog across this section of the reservoir.

**Shale Volume, Porosity and Water Saturation**

Schlumberger's Geoframe ELAN+ module was used to determine mineral volumes, total porosity, effective porosity and effective saturation.  The details of the models are illustrated in the figures and tables below.

## ELAN+ MODEL

**ELAN Processes**




**ELAN Input Channels**

| Name | Curve |
|---|---|
| Temp_CH | TEMP |
| RHOB_IFAC_CH | IFRH |
| NPHI_IFAC_CH | INPH |
| RHOB_CH | ROBB |
| DT_CH | DTCO |
| NPHI_CH | TNPH |
| PRB1_CH | RHOH |
| PRB2_CH | FLAG_VOLC |
| PRB3_CH | DOLO |
| PRB4_CH | FLAG_COAL |
| PRB5_CH | FLAG_MARL |

**ELAN Global Parameters**

| | |
|---|---|
| Reference Index | MD |
| Processing Interval | 1530(m) To 2654.4(m) |
| Sampling Rate | 0.3281(m) |
| Uncertainty Channel | FALSE |
| Clay Input | DRY |
| Special Fluids | Water |

**ELAN Zone Definition**

| Name | Bottom To Top |
|---|---|
| ZONE5 | 2654.4(m) To 2380(m) |
| ZONE4 | 2380.0(m) To 1940(m) |
| ZONE3 | 1940.0(m) To 1890(m) |
| ZONE2 | 1890.0(m) To 1790(m) |
| ZONE1 | 1790.0(m) To 1530(m) |

**ELAN Process Definiton**

---

Process SOLVE2 "Oil"
Equations RHOB NPHI CUDC_DWA GR CT3
Volumes QUAR ORTH ILLI XWAT UWAT XOIL UOIL
User Constraints constraint(maxDolmite, DOLO<0)
Constraint Zones Bottom Top
UNDEFINED 2654.3999(m ) 1530.0999(m )

Constraints Applied
UNDEFINED - IrreducibleXWater
UNDEFINED - IrreducibleUWater
UNDEFINED - WaterBaseMud_SXO_gt_SW

---

Process SOLVE3 "Shale"
Equations RHOB CUDC_DWA GR
Volumes QUAR ILLI XWAT UWAT

Constraint Zones Bottom Top
UNDEFINED 2654.3999(m ) 1530.0999(m )

---

Process SOLVE4 "Coal"
Equations RHOB
Volumes COAL

Constraint Zones Bottom Top
UNDEFINED 2654.3999(m ) 1530.0999(m )

---

Process SOLVE5 "Dolo"
Equations RHOB
Volumes DOLO

Constraint Zones Bottom Top
UNDEFINED 2654.3999(m ) 1530.0999(m )

---

Process SOLVE1 "Volcanics"
Equations RHOB
Volumes IGNE

Constraint Zones Bottom Top
UNDEFINED 2654.3999(m ) 1530.0999(m )

---

Process SOLVE6 "MARL"
Equations RHOB
Volumes CARB

Constraint Zones Bottom Top
UNDEFINED 2654.3999(m ) 1530.0999(m )

---

Process COMBINE 1 "COMBINE"
Order SOL.2 SOL.3 SOL.4 SOL.5 SOL.1 SOL.6
Combine Method
"Nth Wirrah " 8708.6611 (m ) Internal Average
Probability Functions
probability(SOL.6, PRB5_CH)
probability(SOL.5, PRB3_CH)
probability(SOL.4, PRB4_CH)
probability(SOL.1, PRB2_CH)
prob3 = linear(ILLI_VOL.SOL.3, 0.3, 0, 0.5, 1)
probability(SOL.3, prob3)
prob2 = if (PRB1_CH <=0.7, 1, 0)
probability(SOL.2, prob2)

**ELAN Process Definiton (Con't)**

---

Process FUNCTION 1 "FUNCTION"
Outputs VCL SWT SUWI PIGN PHIT
User-defined Function/n swt_cmp=(UWAT_VOL + XBWA_VOL)/(UWAT_VOL + XBWA_VOL + UOIL_VOL)
output(SWT, swt_cmp)

---

**ELAN Model Constraints**

---

Model 2: Constraint Zones
Name Boundary Temperature
UNDEFINED 8708.6611 -999.25
constraints
UNDEFINED - IrreducibleXWater
UNDEFINED - IrreducibleUWater
UNDEFINED - WaterBaseMud_SXO_gt_SW
Model 3: Constraint Zones
Name Boundary Temperature
UNDEFINED 8708.6611 -999.25
constraints
Model 4: Constraint Zones
Name Boundary Temperature
UNDEFINED 8708.6611 -999.25
constraints
Model 5: Constraint Zones
Name Boundary Temperature
UNDEFINED 8708.6611 -999.25
constraints
Model 1: Constraint Zones
Name Boundary Temperature
UNDEFINED 8708.6611 -999.25
constraints
Model 6: Constraint Zones
Name Boundary Temperature
UNDEFINED 8708.6611 -999.25
Constraints

---

**ELAN Different Parameters**

| Parameters | ZONE5 | ZONE4 | ZONE3 | ZONE2 |
|---|---|---|---|---|
| ********************* | ********* | ********* | ********* | ********* |
| RHOB_UWAT (g/cm3 ) | 0.972 | 0.979 | 0.972 | 0.970 |
| CXDC_XWAT (mS/m ) | 20.038 | 18.005 | 14.732 | 14.364 |
| CXDC_XBWA (mS/m ) | 11.445 | 10.296 | 8.427 | 8.214 |
| CUDC_UWAT (mS/m ) | 12.000 | 13.460 | 2.180 | 0.770 |
| CUDC_UBWA (mS/m ) | 3.166 | 2.848 | 2.331 | 2.272 |
| WCLP_ILLI (m3/m3 ) | 0.138 | 0.136 | 0.133 | 0.133 |
| RW (ohm.m ) | 0.482 | 0.389 | 2.052 | 5.677 |
| CUDC_UNC_ZP (mS/m ) | 0.052 | 0.055 | 0.022 | 0.013 |

| Parameters | ZONE1 |
|---|---|
| ********************* | ********* |
| RHOB_UWAT (g/cm3 ) | 0.973 |
| CXDC_XWAT (mS/m ) | 13.631 |
| CXDC_XBWA (mS/m ) | 7.789 |
| CUDC_UWAT (mS/m ) | 1.200 |
| CUDC_UBWA (mS/m ) | 2.155 |
| WCLP_ILLI (m3/m3 ) | 0.132 |
| RW (ohm.m ) | 3.462 |
| CUDC_UNC_ZP (mS/m ) | 0.016 |

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**ELAN Probability Expressions**

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probability(SOL.6, PRB5_CH)
probability(SOL.5, PRB3_CH)
probability(SOL.4, PRB4_CH)
probability(SOL.1, PRB2_CH)
prob3 = linear(ILLI_VOL.SOL.3, 0.3, 0, 0.5, 1)
probability(SOL.3, prob3)
prob2 = if (PRB1_CH <=0.7, 1, 0)
probability(SOL.2, prob2)

---

**ELAN Same Parameters**

| Parameter | Value | Parameter | Value |
|---|---|---|---|
| RHOB_QUAR | 2.650(g/cm3 ) | RHOB_CALC | 2.710(g/cm3 ) |
| RHOB_DOLO | 2.847(g/cm3 ) | RHOB_ORTH | 2.570(g/cm3 ) |
| RHOB_ILLI | 2.780(g/cm3 ) | RHOB_KAOL | 2.620(g/cm3 ) |
| RHOB_CARB | 2.710(g/cm3 ) | RHOB_COAL | 1.200(g/cm3 ) |
| RHOB_IGNE | 3.000(g/cm3 ) | RHOB_XWAT | 1.074(g/cm3 ) |
| RHOB_XOIL | 0.700(g/cm3 ) | RHOB_UOIL | 0.700(g/cm3 ) |
| RHOB_XGAS | -0.006(g/cm3 ) | RHOB_UGAS | -0.006(g/cm3 ) |
| RHOB_XBWA | 1.000(g/cm3 ) | NPHI_QUAR | -0.059(m3/m3 ) |
| NPHI_CALC | 0.000(m3/m3 ) | NPHI_DOLO | 0.032(m3/m3 ) |
| NPHI_ORTH | -0.010(m3/m3 ) | NPHI_ILLI | 0.247(m3/m3 ) |
| NPHI_KAOL | 0.450(m3/m3 ) | NPHI_CARB | 0.000(m3/m3 ) |
| NPHI_COAL | 0.450(m3/m3 ) | NPHI_IGNE | 0.000(m3/m3 ) |
| NPHI_XWAT | 1.000(m3/m3 ) | NPHI_UWAT | 1.000(m3/m3 ) |
| NPHI_XOIL | 1.000(m3/m3 ) | NPHI_UOIL | 1.000(m3/m3 ) |
| NPHI_XGAS | 0.090(m3/m3 ) | NPHI_UGAS | 0.090(m3/m3 ) |
| NPHI_XBWA | 1.000(m3/m3 ) | DT_QUAR | 55.500(us/m ) |
| DT_CALC | 47.800(us/m ) | DT_DOLO | 43.500(us/m ) |
| DT_ORTH | 60.000(us/m ) | DT_ILLI | 60.000(us/m ) |
| DT_KAOL | 91.318(us/m ) | DT_CARB | -999.250(us/m ) |
| DT_COAL | 121.920(us/m) | DT_IGNE | 16.916(us/m ) |
| DT_XWAT | 0.000(us/m ) | DT_UWAT | 220.000(us/m ) |
| DT_XOIL | 0.000(us/m ) | DT_UOIL | 240.000(us/m ) |
| DT_XGAS | 0.000(us/m ) | DT_UGAS | 289.865(us/m ) |
| DT_XBWA | 189.000(us/m) | U_QUAR | 5.000( ) |
| U_CALC | 14.100( ) | U_DOLO | 9.100( ) |
| U_ILLI | 9.900( ) | U_KAOL | 5.100( ) |
| U_COAL | 1.000( ) | U_XWAT | 0.692( ) |
| U_UWAT | 0.000( ) | U_XOIL | 0.136( ) |
| U_UOIL | 0.000( ) | U_XGAS | 0.012( ) |
| U_UGAS | 0.000( ) | U_XBWA | 0.398( ) |
| CXDC_ILLI | -999.25(mS/m) | CXDC_KAOL | -999.250(mS/m ) |
| CUDC_ILLI | -999.25(mS/m) | CUDC_KAOL | -999.250(mS/m ) |
| GR_QUAR | 40.000(gAPI ) | GR_CALC | 11.000(gAPI ) |
| GR_DOLO | 3.000(gAPI ) | GR_ORTH | 200.000(gAPI ) |
| GR_ILLI | 235.000(gAPI ) | GR_KAOL | 98.000(gAPI ) |
| GR_CARB | 20.000(gAPI ) | GR_COAL | 40.000(gAPI ) |
| GR_IGNE | 40.000(gAPI ) | GR_XWAT | 0.000(gAPI ) |
| GR_UWAT | 0.000(gAPI ) | GR_XOIL | 0.000(gAPI ) |
| GR_UOIL | 0.000(gAPI ) | GR_XGAS | 0.000(gAPI ) |
| GR_UGAS | 0.000(gAPI ) | GR_XBWA | 0.000(gAPI ) |

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**ELAN Same Parameters (Con’t)**

| | | | |
|---|---|---|---|
| CT1_QUAR | 0.000( ) | CT1_CALC | 0.000( ) |
| CT1_DOLO | 0.000( ) | CT1_ORTH | 0.000( ) |
| CT1_ILLI | 0.000( ) | CT1_KAOL | 0.000( ) |
| CT1_CARB | 0.000( ) | CT1_COAL | 0.000( ) |
| CT1_IGNE | 0.000( ) | CT1_XOIL | 1.000( ) |
| CT1_UOIL | -0.100( ) | CT1_XGAS | 1.000( ) |
| CT1_UGAS | 0.000( ) | CT1_XBWA | 0.000( ) |
| CT2_QUAR | 0.000( ) | CT2_CALC | 0.000( ) |
| CT2_DOLO | 0.000( ) | CT2_ORTH | 0.000( ) |
| CT2_ILLI | 0.000( ) | CT2_KAOL | 0.000( ) |
| CT2_COAL | 0.000( ) | CT2_IGNE | 0.000( ) |
| CT2_XWAT | 0.000( ) | CT2_UWAT | 0.000( ) |
| CT2_XOIL | 0.000( ) | CT2_UOIL | 0.000( ) |
| CT2_XGAS | 1.000( ) | CT2_UGAS | -0.500( ) |
| CT2_XBWA | 0.000( ) | CT3_QUAR | -0.100( ) |
| CT3_CALC | 0.000( ) | CT3_DOLO | 0.000( ) |
| CT3_ORTH | 1.000( ) | CT3_ILLI | 0.000( ) |
| CT3_KAOL | 0.000( ) | CT3_CARB | 0.000( ) |
| CT3_COAL | 0.000( ) | CT3_IGNE | 0.000( ) |
| CT3_XWAT | 0.000( ) | CT3_UWAT | 0.000( ) |
| CT3_XOIL | 0.000( ) | CT3_UOIL | 0.000( ) |
| CT3_XGAS | 0.000( ) | CT3_UGAS | 0.000( ) |
| CT3_XBWA | 0.000( ) | ARHOB_ILLI | 2.780(g/cm3 ) |
| ARHOB_KAOL | 2.620(g/cm3 ) | WCLP_KAOL | 0.061(m3/m3 ) |
| CBWA_ILLI | -999.25(mS/m) | CBWA_KAOL | -999.250(mS/m ) |
| CECA_ILLI | 0.200(meq/g ) | CECA_KAOL | 0.090(meq/g ) |
| RMF | 0.160(ohm.m ) | MST | 61.880(degC ) |
| RWT | -999.250(degC) | SALIN_ISOL | -999.250(ppk ) |
| SALIN_PARA | -999.250(ppk ) | SALIN_XWAT | 12.924(ppk ) |
| SALIN_UWAT | 30.000(ppk ) | SALIN_XIWA | -999.250(ppk ) |
| SALIN_UIWA | -999.250(ppk ) | SALIN_XOIL | 0.000(ppk ) |
| SALIN_UOIL | 0.000(ppk ) | SALIN_XGAS | 0.000(ppk ) |
| SALIN_UGAS | 0.000(ppk ) | SALIN_XSFL | -999.250(ppk ) |
| SALIN_USFL | -999.250(ppk ) | CT1_ZP | 0.000( ) |
| CT2_ZP | 0.000( ) | CT3_ZP | 0.000( ) |
| RHOB_UNC_ZP | 0.027(g/cm3 ) | NPHI_UNC_ZP | 0.015(m3/m3 ) |
| DT_UNC_ZP | 2.250(us/m ) | U_UNC_ZP | 0.225( ) |
| CXDC_UNC_ZP | 0.072(mS/m ) | GR_UNC_ZP | 2.250(gAPI ) |
| CT1_UNC_ZP | 0.015( ) | CT2_UNC_ZP | 0.015( ) |
| CT3_UNC_ZP | 0.015( ) | VOLS_UNC_ZP | 0.015(m3/m3 ) |
| RHOB_UNC_WM | 1.000( ) | NPHI_UNC_WM | 1.000( ) |
| DT_UNC_WM | 0.300( ) | U_UNC_WM | 0.400( ) |
| CXDC_UNC_WM | 0.500( ) | CUDC_UNC_WM | 0.700( ) |
| GR_UNC_WM | 0.300( ) | CT1_UNC_WM | 0.200( ) |
| CT2_UNC_WM | 0.200( ) | CT3_UNC_WM | 0.900( ) |
| VOLS_UNC_WM | 1.000( ) | RHOB_IFAC_ZP | 0.800( ) |
| NPHI_IFAC_ZP | 0.800( ) | A_ZP | 1.000( ) |
| N_ZP | 2.000( ) | C_DWA | 0.000( ) |
| M_DWA | 2.000( ) | BVIRR | 0.010(m3/m3 ) |

## RESULTS AND DISCUSSION

The top sand of the L450C reservoir unit is oil bearing (Fig 1). Fluorescence and an elevated C5 response were observed across this sand on the mudlog. A total of 1.3m of net pay sand is present. The sand has an average effective porosity of 21% and average effective water saturation of 33%.

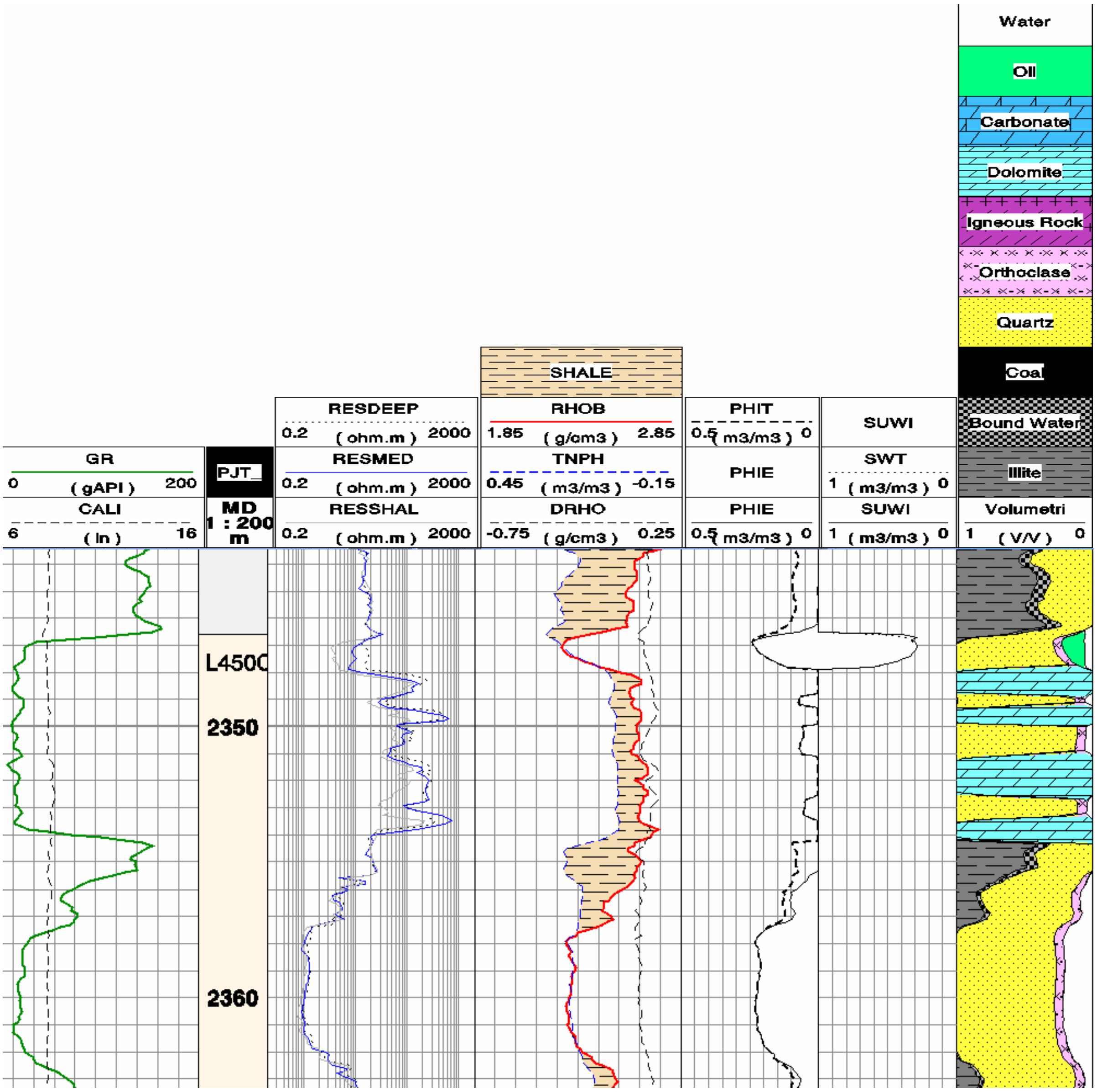



Figure 1. L450C reservoir interval sands.

The L450A and the L450B reservoirs are interpreted to contain a residual oil column (Fig 2). The L450A sand has and average porosity of 15% and a residual oil saturation of 14%. The L450B sand has an average porosity of 16% and a residual oil saturation of 10%.

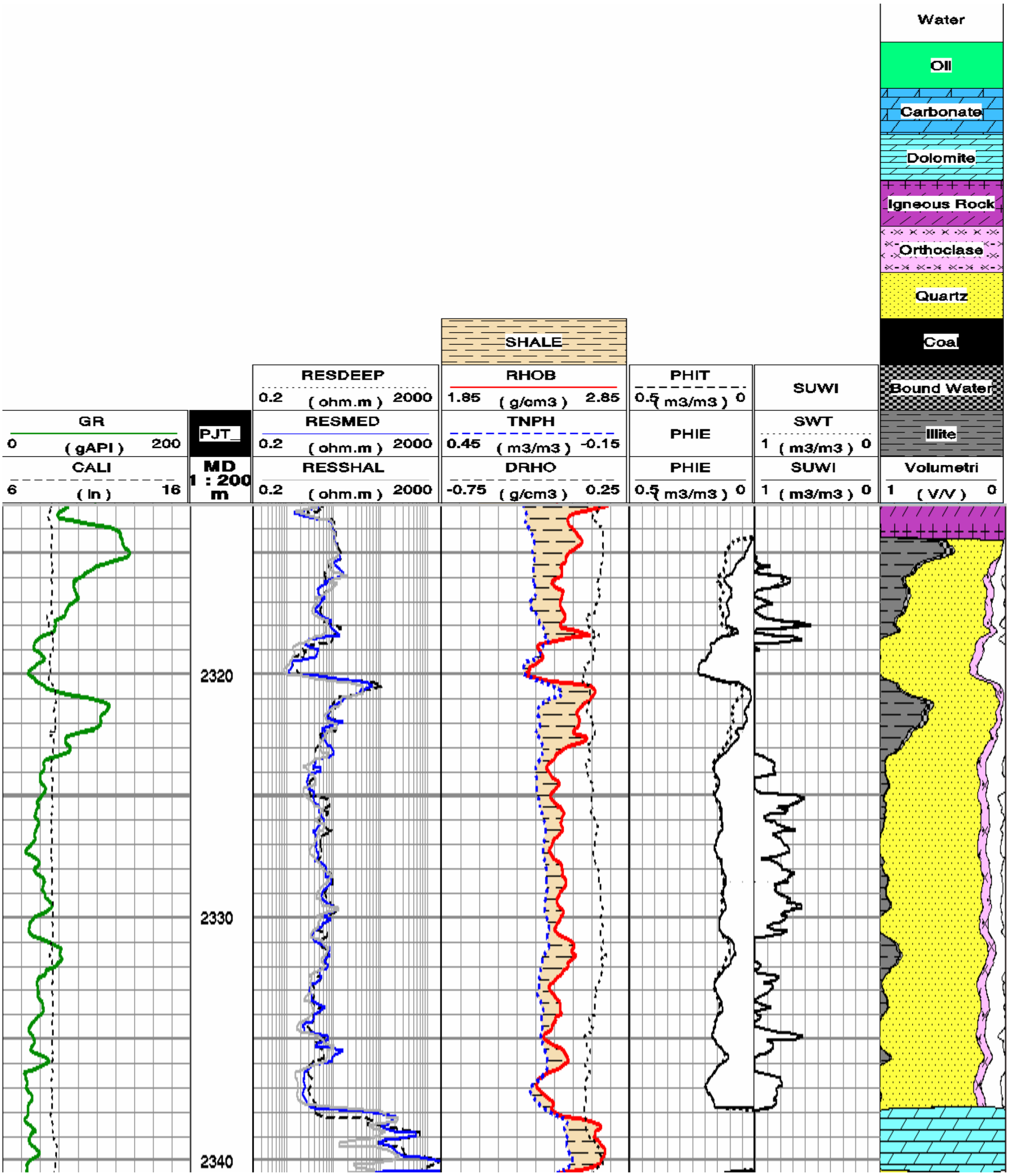



Figure 2. Residual oil in the L450A and L450B reservoir units.

# North Wirrah-1

Petrophysical Summary  1540 - 2656.3m MD

Depth Reference:MDKB

Mean VCL, Mean PHIE (or PIGN), Mean SWE (or SUWI) is based on a PHIE or PIGN cutoff of 0.12

| Zone | Top Depth mMD | Bottom Depth mMD | Gross Thickness mMD | Net/Gross | Mean VCL | Mean PHIE | Mean SWE | | Comments | Net Pay Thickness mMD |
|---|---|---|---|---|---|---|---|---|---|---|
| TOL | 1540.07 | 1555 | 15.0 | 0.00 | 0.43 | 0.00 | | | | |
| N150 | 1555 | 1628.63 | 73.6 | 0.83 | 0.24 | 0.22 | 1.00 | | Water bearing | |
| N190 | 1628.63 | 1630.78 | 2.2 | 0.26 | 0.09 | 0.19 | 1.00 | | Water bearing | |
| N191 | 1630.78 | 1650.49 | 19.7 | 1.00 | 0.01 | 0.25 | 1.00 | | Water bearing | |
| N192 | 1650.49 | 1702.33 | 51.8 | 0.83 | 0.07 | 0.24 | 1.00 | | Water bearing | |
| P1 | 1722.27 | 1751.58 | 29.3 | 0.88 | 0.01 | 0.24 | 1.00 | | Water bearing | |
| Psands | 1751.58 | 1765 | 13.5 | 0.79 | 0.11 | 0.23 | 1.00 | | Water bearing | |
| M1 | 1891.34 | 1910.77 | 19.4 | 0.86 | 0.03 | 0.23 | 1.00 | | Water bearing | |
| M2 | 1980.62 | 2018.27 | 37.7 | 0.70 | 0.06 | 0.21 | 1.00 | | Water bearing | |
| L420 | 2021.32 | 2058.43 | 37.1 | 0.80 | 0.07 | 0.20 | 1.00 | | Water bearing | |
| L405 | 2058.43 | 2075.85 | 17.4 | 0.74 | 0.07 | 0.19 | 1.00 | | Water bearing | |
| L410 | 2075.85 | 2121.07 | 45.2 | 0.62 | 0.07 | 0.20 | 1.00 | | Water bearing | |
| L430 | 2121.07 | 2161.03 | 40.0 | 0.63 | 0.10 | 0.18 | 1.00 | | Water bearing | |
| L435 | 2161.03 | 2200 | 39.0 | 0.18 | 0.07 | 0.17 | 1.00 | | Water bearing | |
| L440 | 2200 | 2210.02 | 10.0 | 0.79 | 0.02 | 0.21 | 1.00 | | Water bearing | |
| L445 | 2210.02 | 2283 | 73.0 | 0.09 | 0.02 | 0.21 | 1.00 | | Water bearing | |
| L450A | 2314.03 | 2330.02 | 16.0 | 0.49 | 0.03 | 0.15 | 0.86 | | Residual Oil | |
| L450B | 2330.02 | 2346.6 | 16.6 | 0.42 | 0.02 | 0.16 | 0.90 | | Residual Oil | |
| L450C Oil | 2346.6 | 2347.9 | 1.3 | 0.82 | 0.02 | 0.21 | 0.33 | | Oil bearing | 1.3 |
| **LKO at 2347.9mMD** | | | | | | | | | | |
| L450C | 2347.9 | 2374.4 | 26.5 | 0.39 | 0.02 | 0.18 | 1.00 | | Water bearing | |
| Lsands | 2422.27 | 2449.71 | 27.4 | 0.30 | 0.01 | 0.14 | 1.00 | | Water bearing | |
| T550 | 2449.71 | 2462.74 | 13.0 | 0.52 | 0.03 | 0.14 | 1.00 | | Water bearing | |
| T551 | 2465.36 | 2470.16 | 4.9 | 0.70 | 0.03 | 0.13 | 1.00 | | Water bearing | |
| T560 | 2475.79 | 2493.93 | 18.2 | 0.34 | 0.05 | 0.14 | 1.00 | | Water bearing | |
| T560B | 2493.93 | 2531.49 | 37.6 | 0.08 | 0.03 | 0.14 | 1.00 | | Water bearing | |
| T560C | 2531.49 | 2548.84 | 17.4 | 0.00 | | 0.00 | | | | |
| T560D | 2548.84 | 2559.53 | 10.7 | 0.00 | | 0.00 | | | | |
| T560 | 2559.53 | 2572.39 | 12.9 | 0.04 | 0.12 | 0.13 | 1.00 | | Water bearing | |
| T570 | 2572.39 | 2581.66 | 9.3 | 0.56 | 0.03 | 0.13 | 1.00 | | Water bearing | |
| T580 | 2590.71 | 2593.56 | 2.9 | 0.00 | | 0.00 | | | | |
| T581 | 2598.09 | 2656.33 | 58.2 | 0.03 | 0.05 | 0.13 | 1.00 | | Water bearing | |

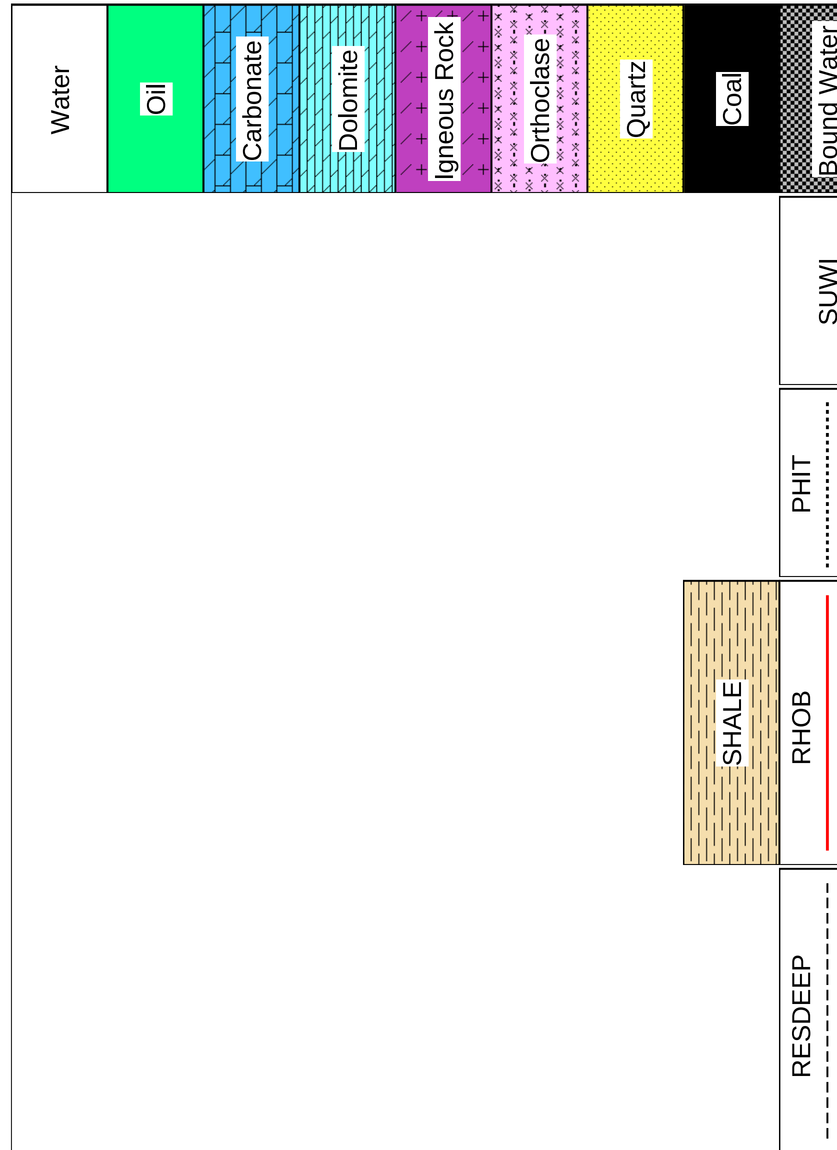
# NORTH WIRRAH–1

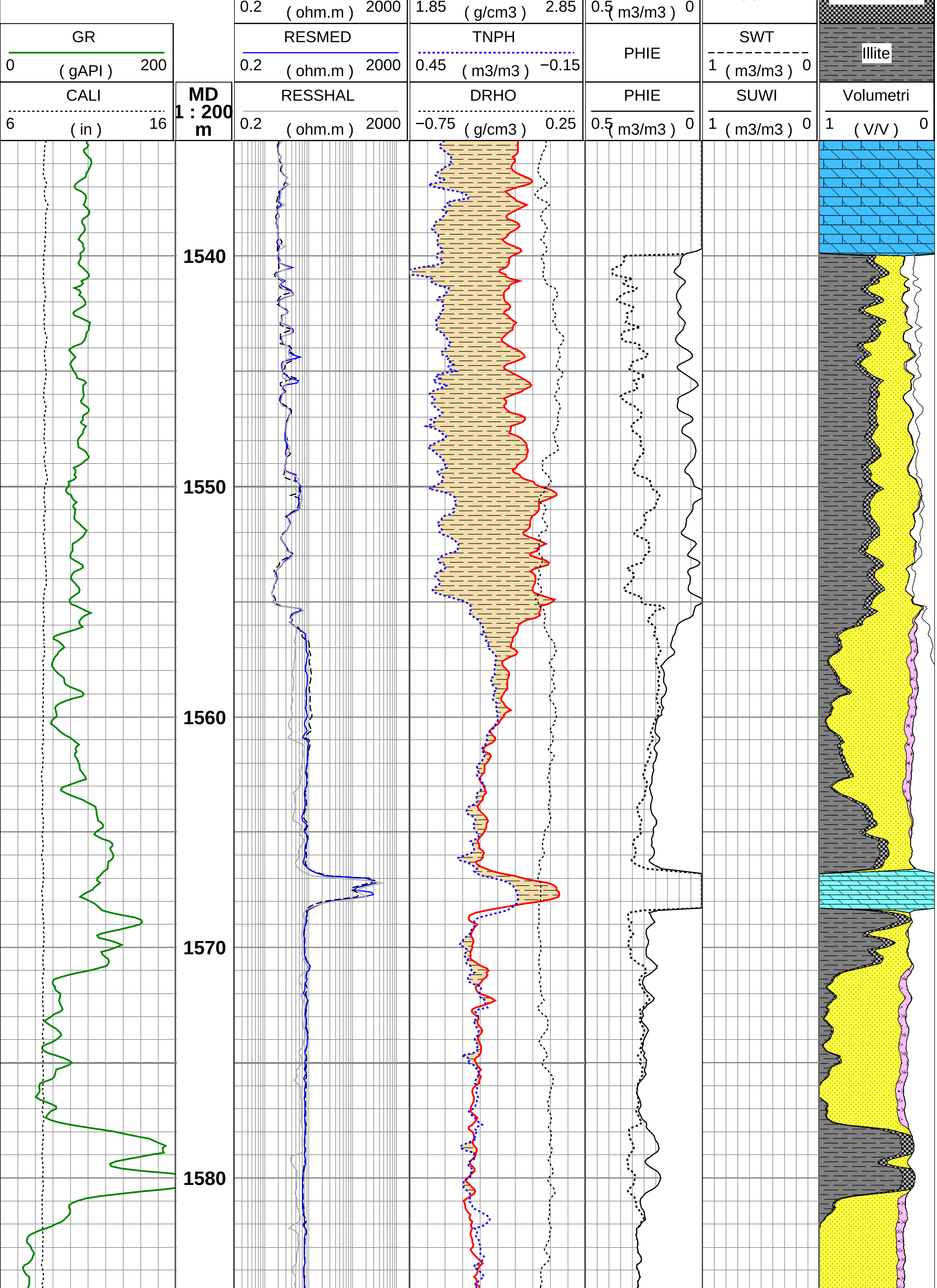
## Petrophysical Analysis

## 1:200 MD

| | |
|---|---|
| COMPANY: | Esso Australia Pty. Ltd. |
| WELL: | NORTH WIRRAH–1 |
| FIELD: | WIRRAH |
| STATE: | P&A |
| COUNTRY: | AUSTRALIA |
| PETROPHYSICIST: | PAUL TARABBIA |

| | | |
|---|---|---|
| Date Logged: | 11/9/05–19/9/05 | Date of analysis: Jan 2006 |
| Well Location: | VIC/L2 | |
| Elevations: | K.B. 39.2m | D.F. 39.2m |
| Latitude: | 38 10’57.1 | RT to seabed. 92m |
| Longitude: | 147 50’20.7 | |





0.2 ( ohm.m ) 2000
1.85 ( g/cm3 ) 2.85
0.5 ( m3/m3 ) 0
GR
0 ( gAPI ) 200
RESMED
0.2 ( ohm.m ) 2000
TNPH
0.45 ( m3/m3 ) −0.15
PHIE
SWT
1 ( m3/m3 ) 0
Illite
CALI
6 ( in ) 16
MD
1 : 200
m
RESSHAL
0.2 ( ohm.m ) 2000
DRHO
−0.75 ( g/cm3 ) 0.25
PHIE
0.5 ( m3/m3 ) 0
SUWI
1 ( m3/m3 ) 0
Volumetri
1 ( V/V ) 0
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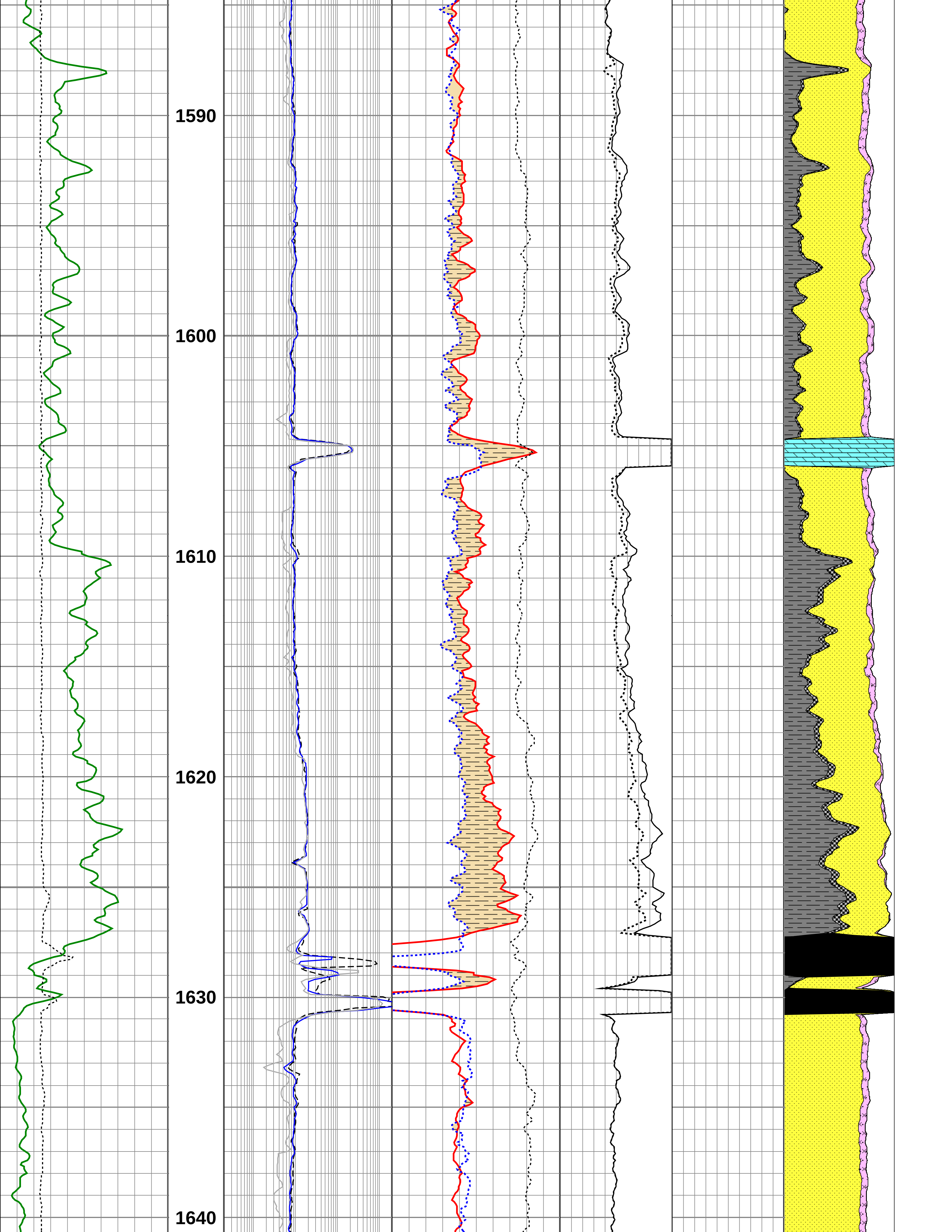
1560
1570
1580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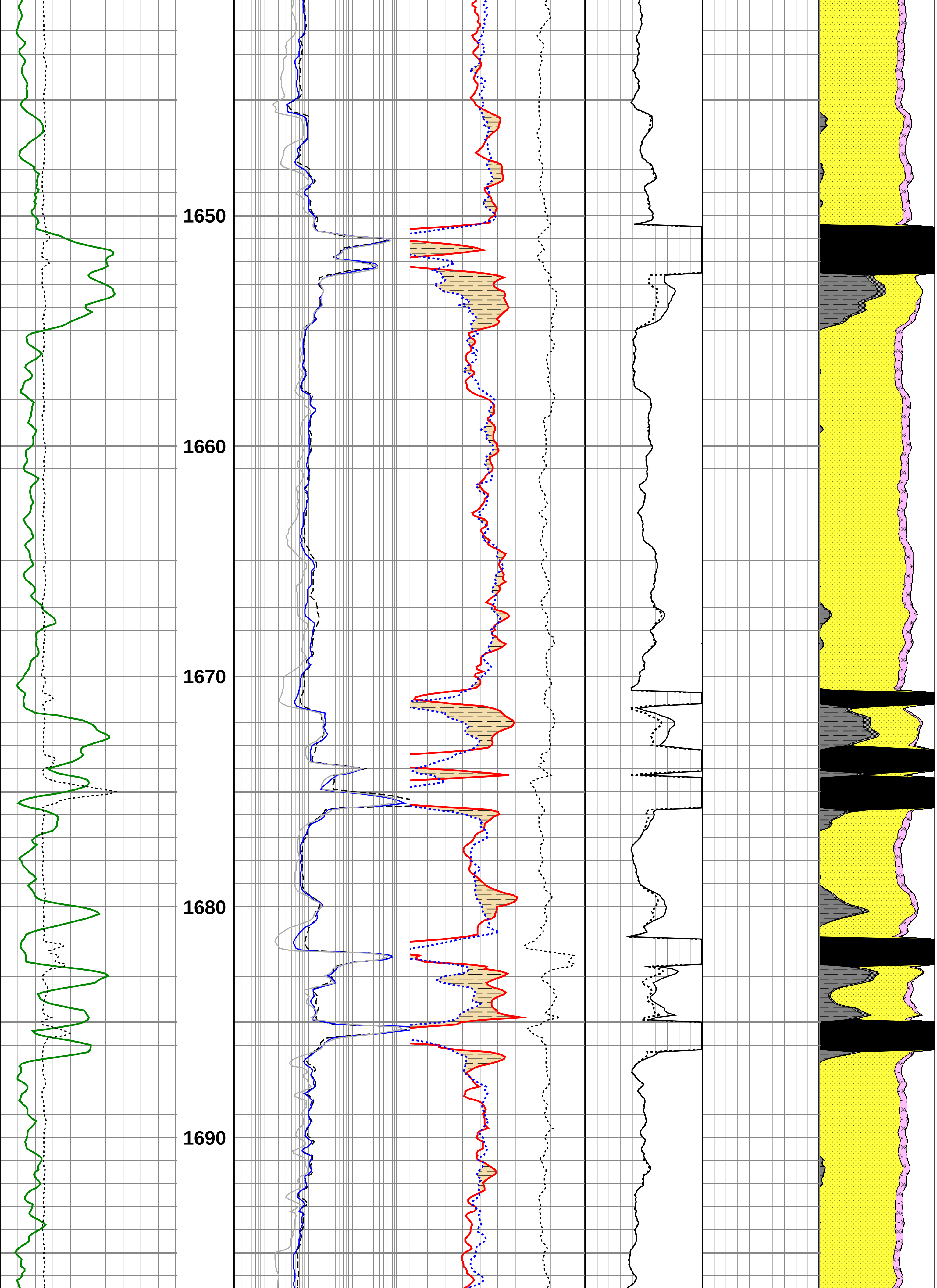
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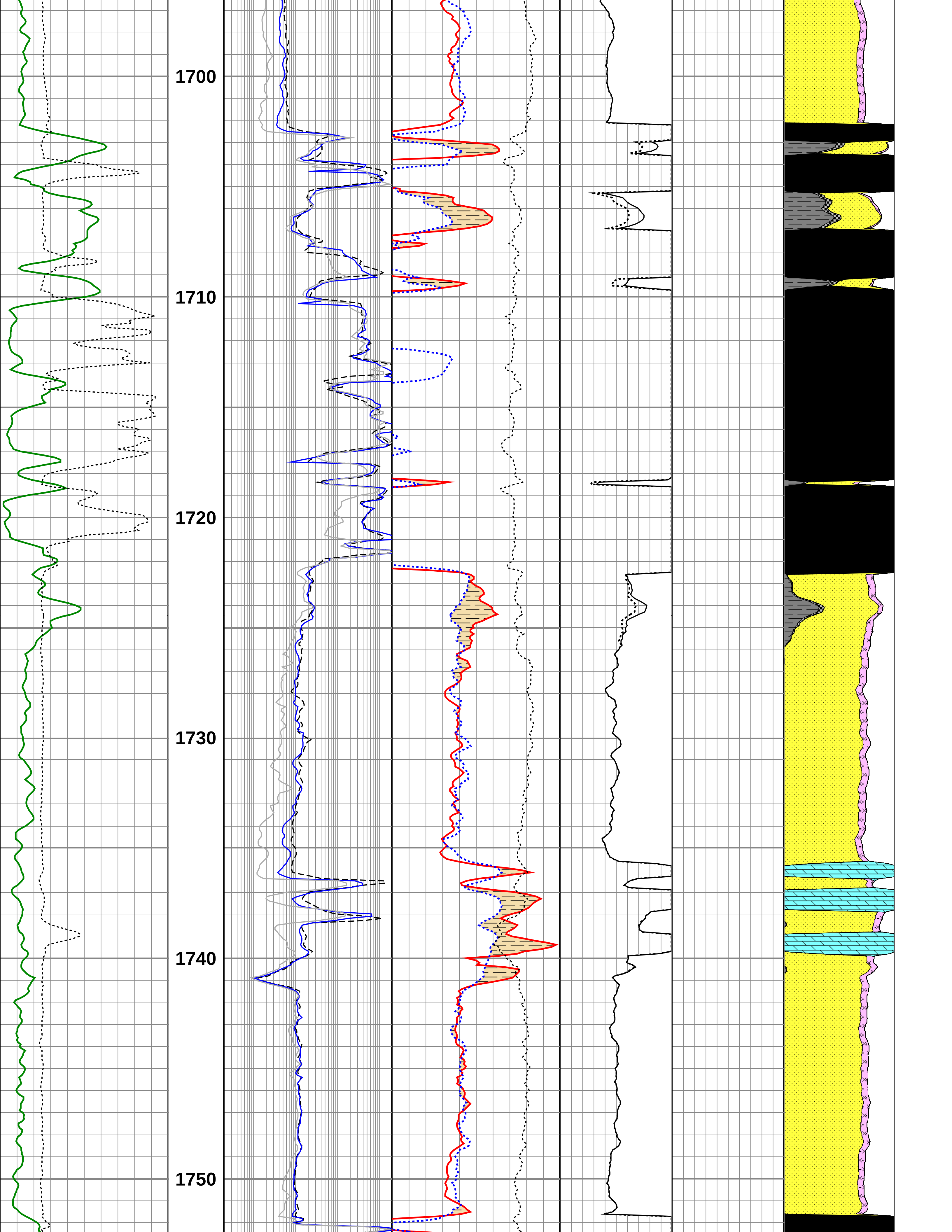
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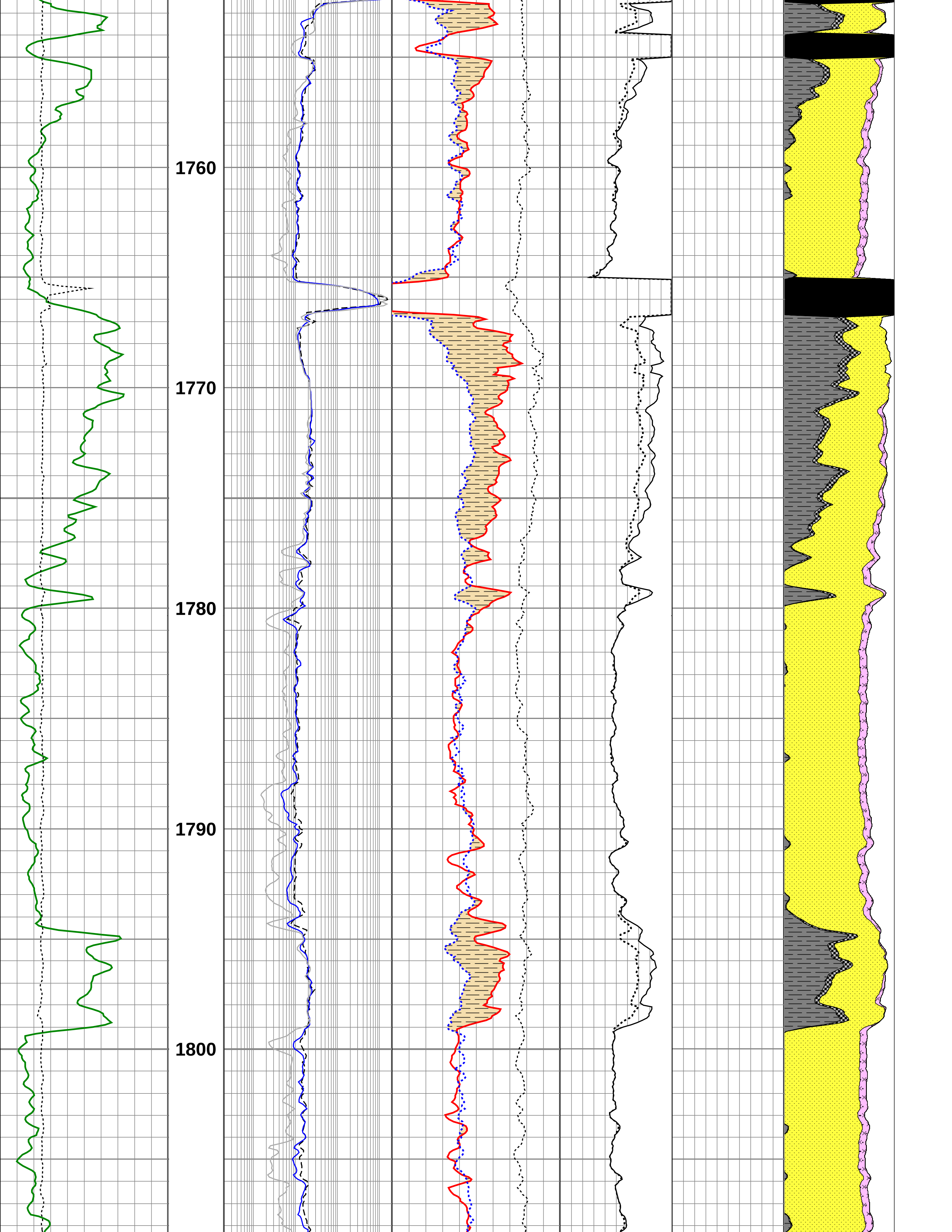
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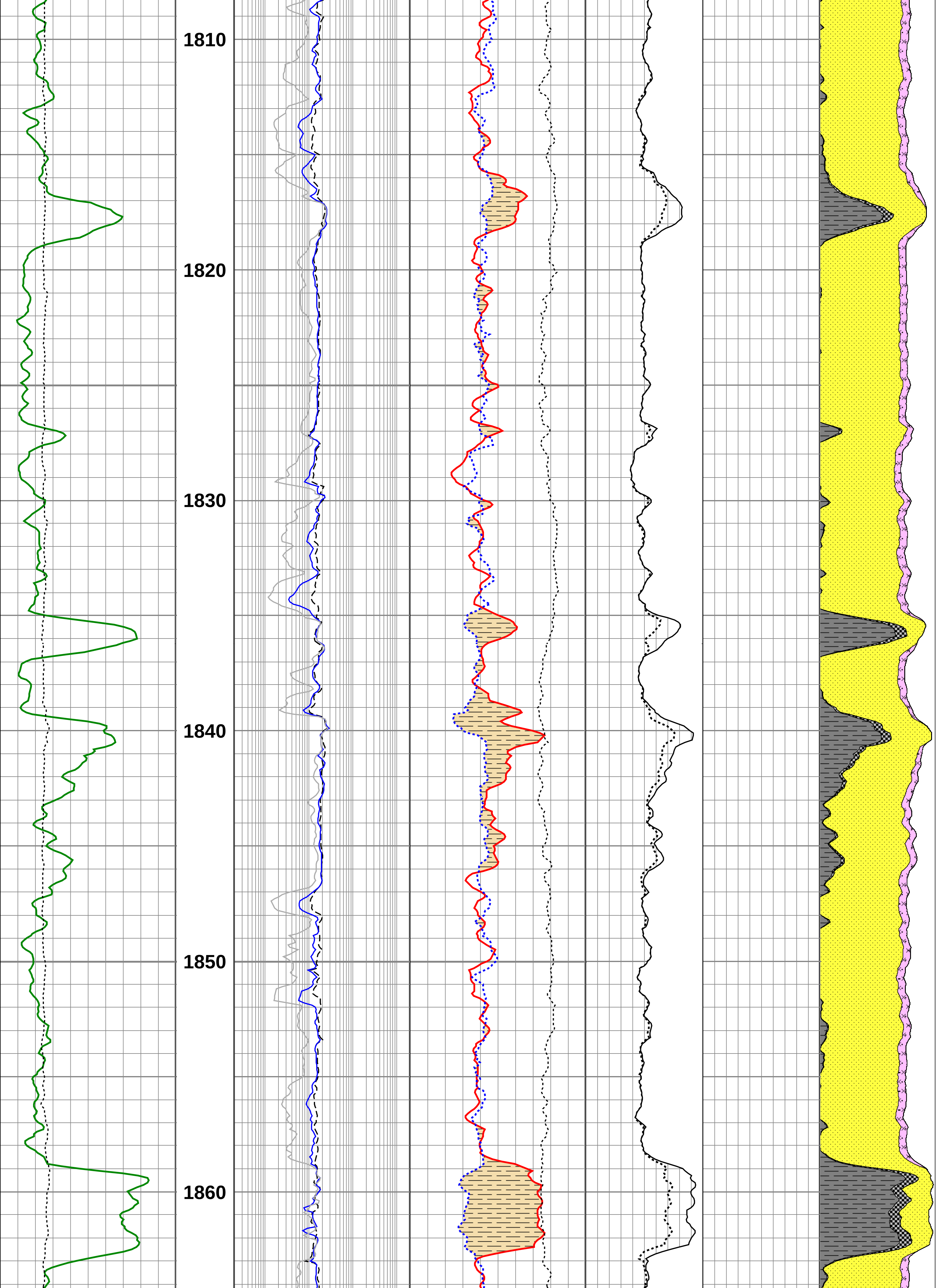
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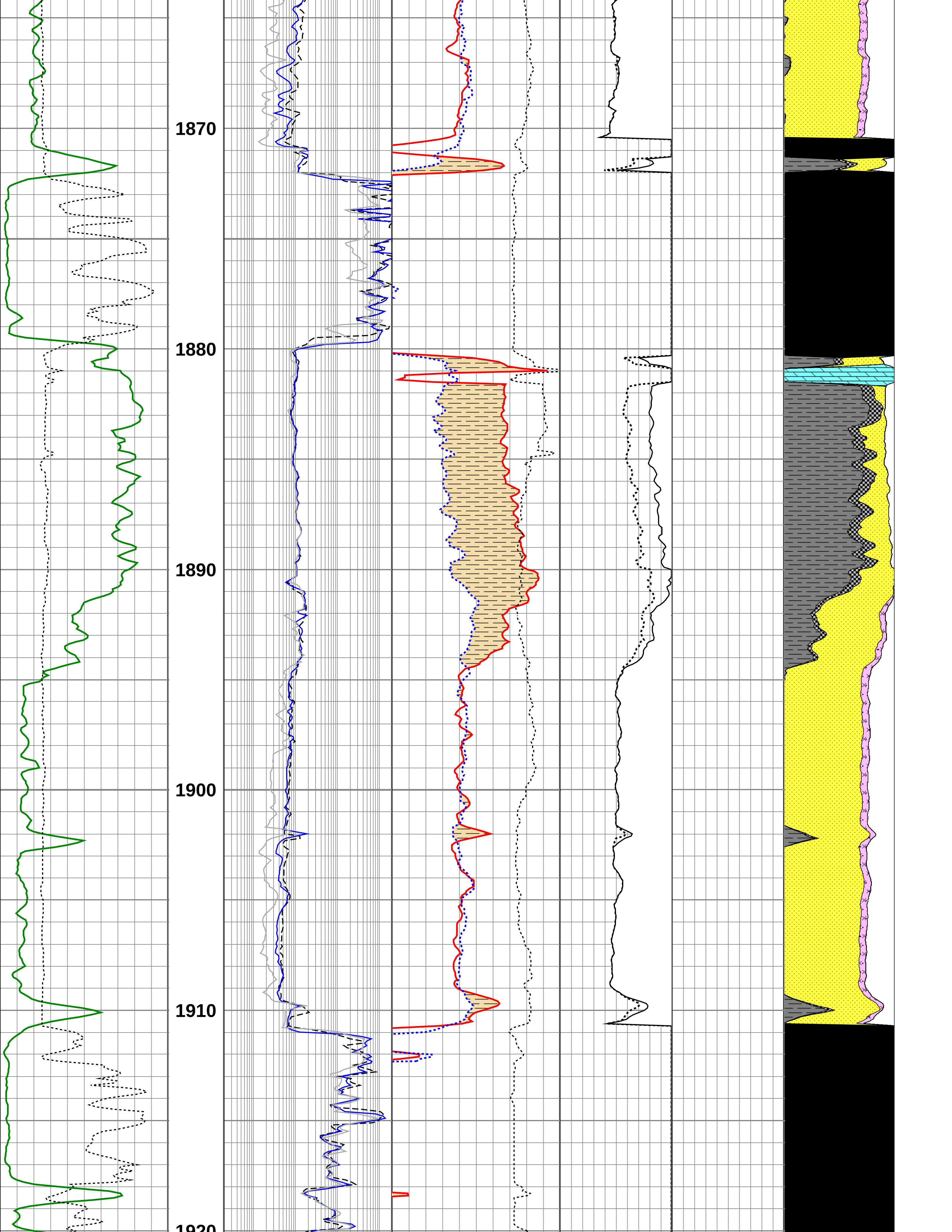
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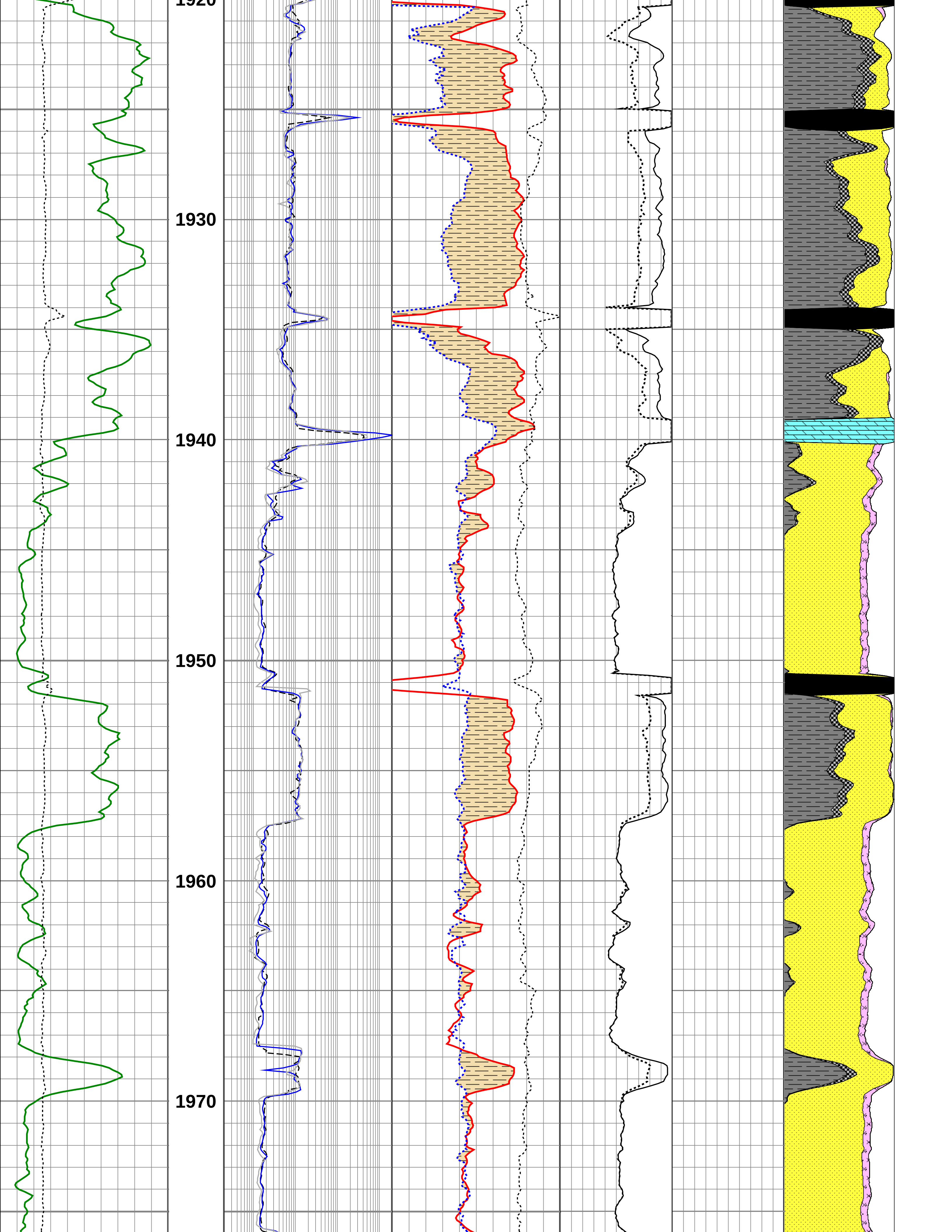
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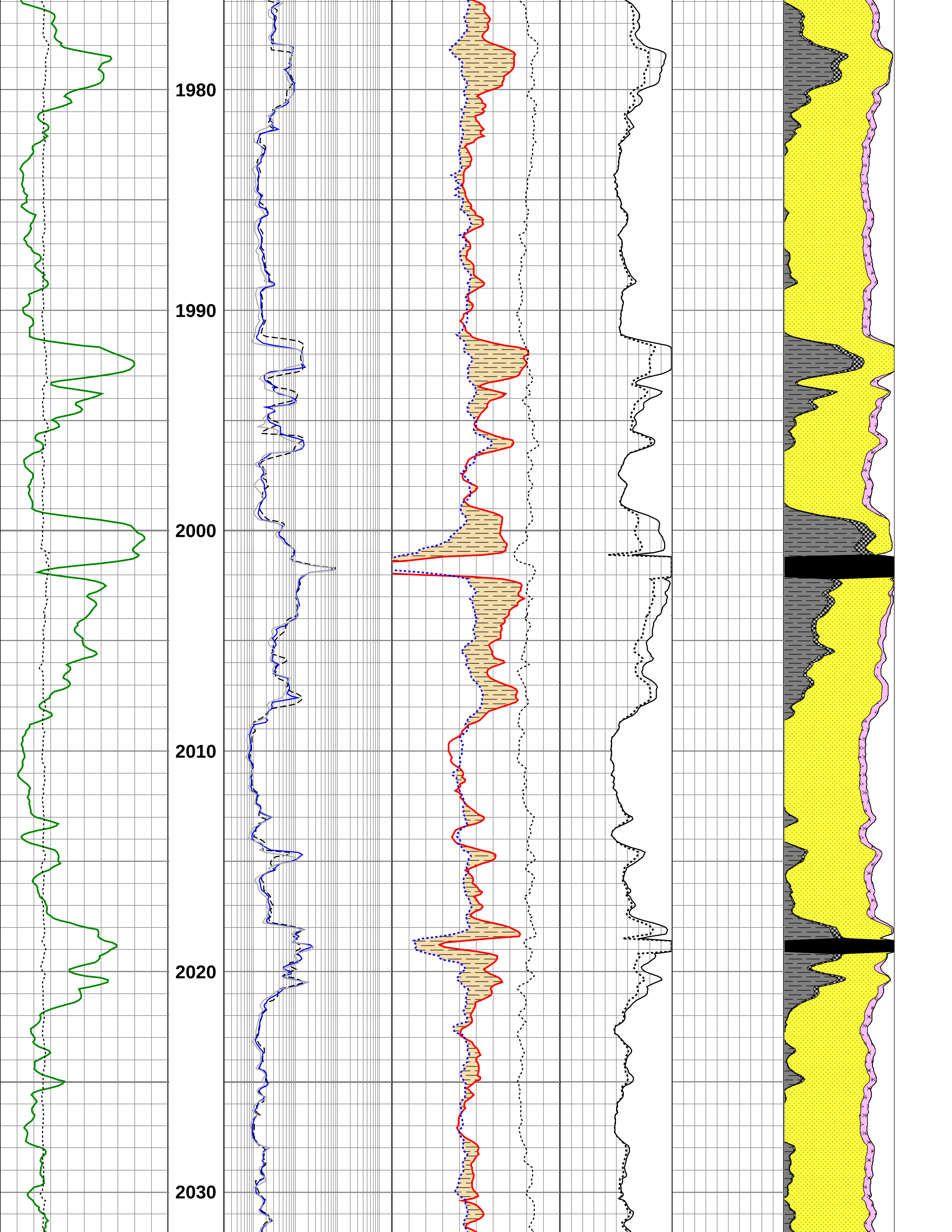
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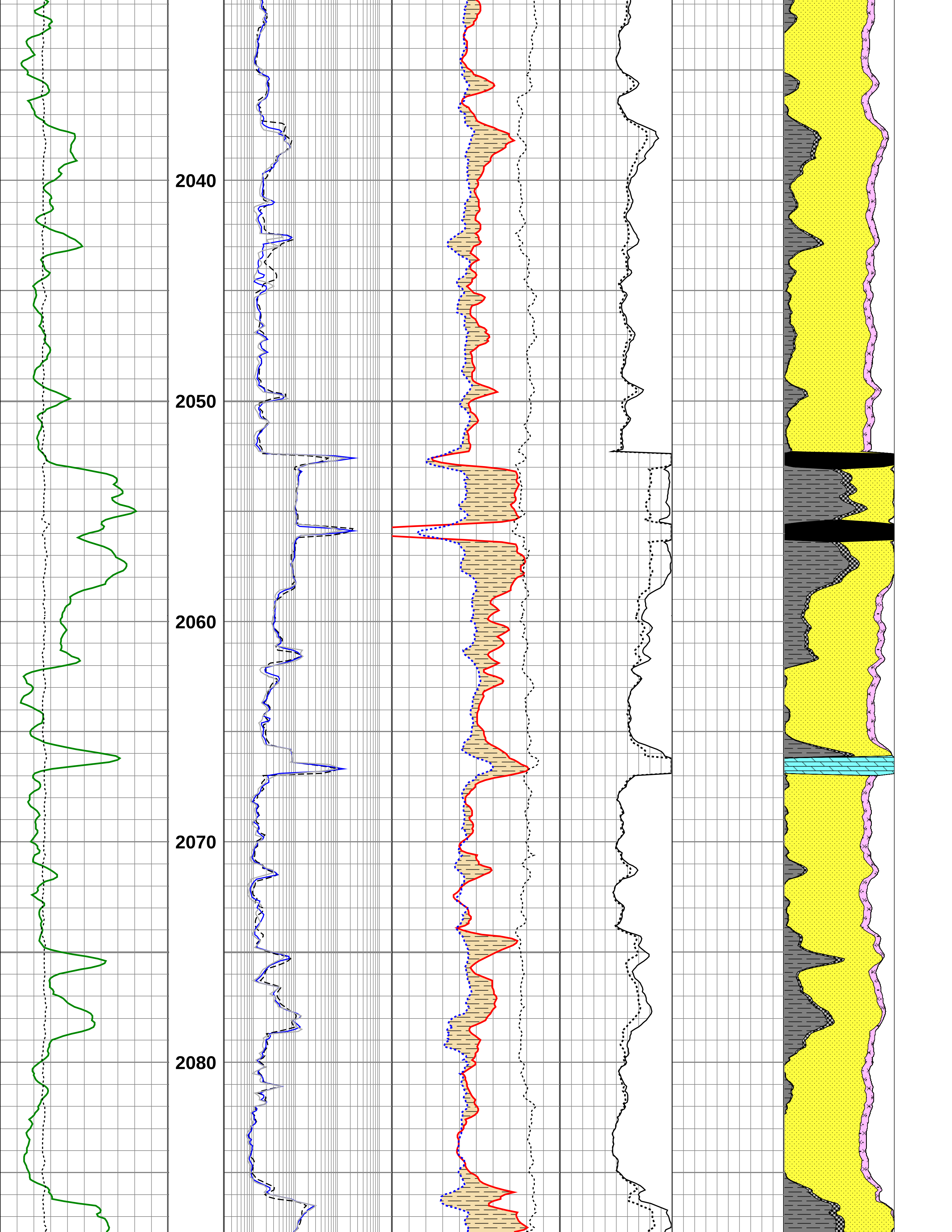
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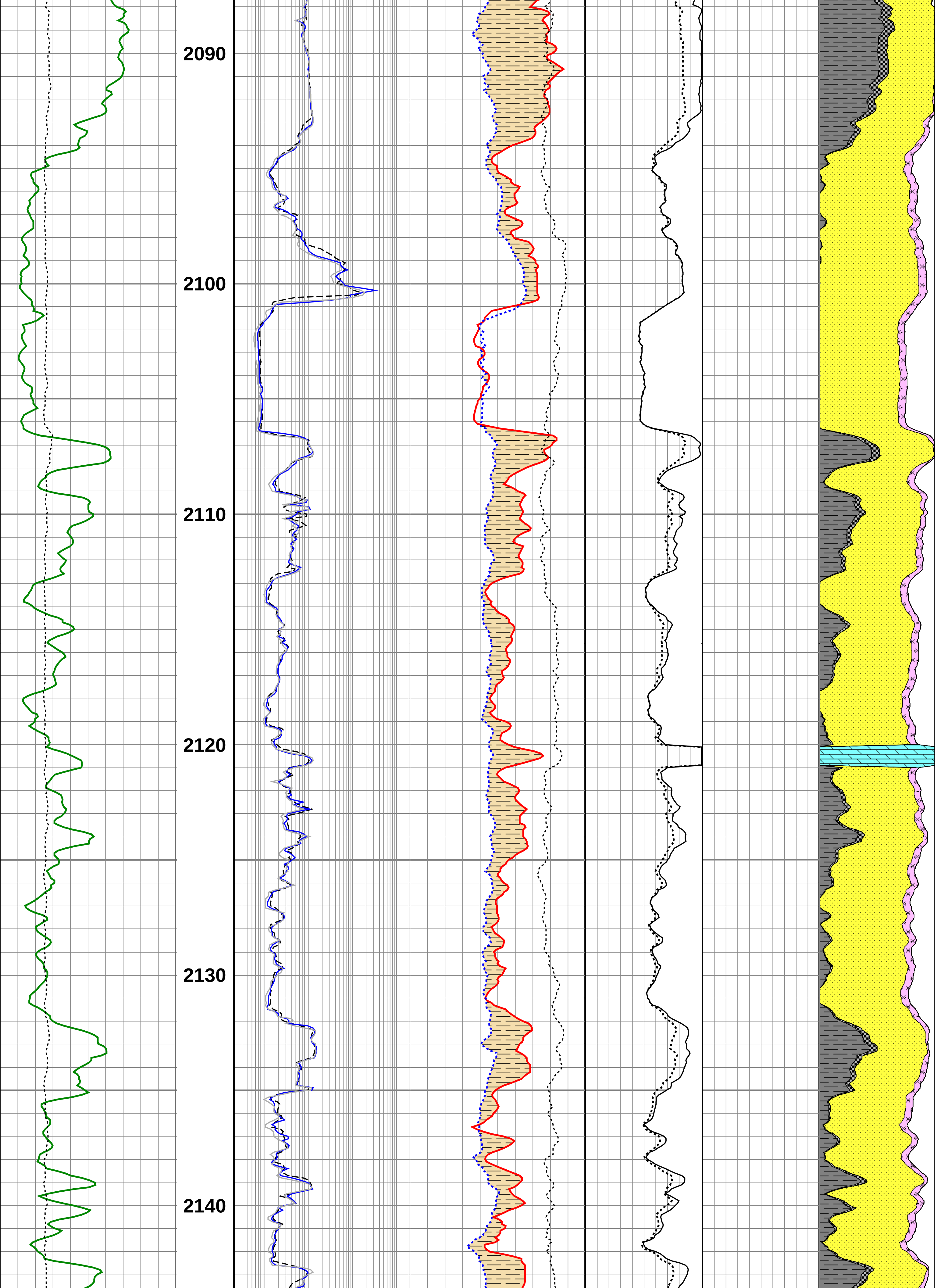
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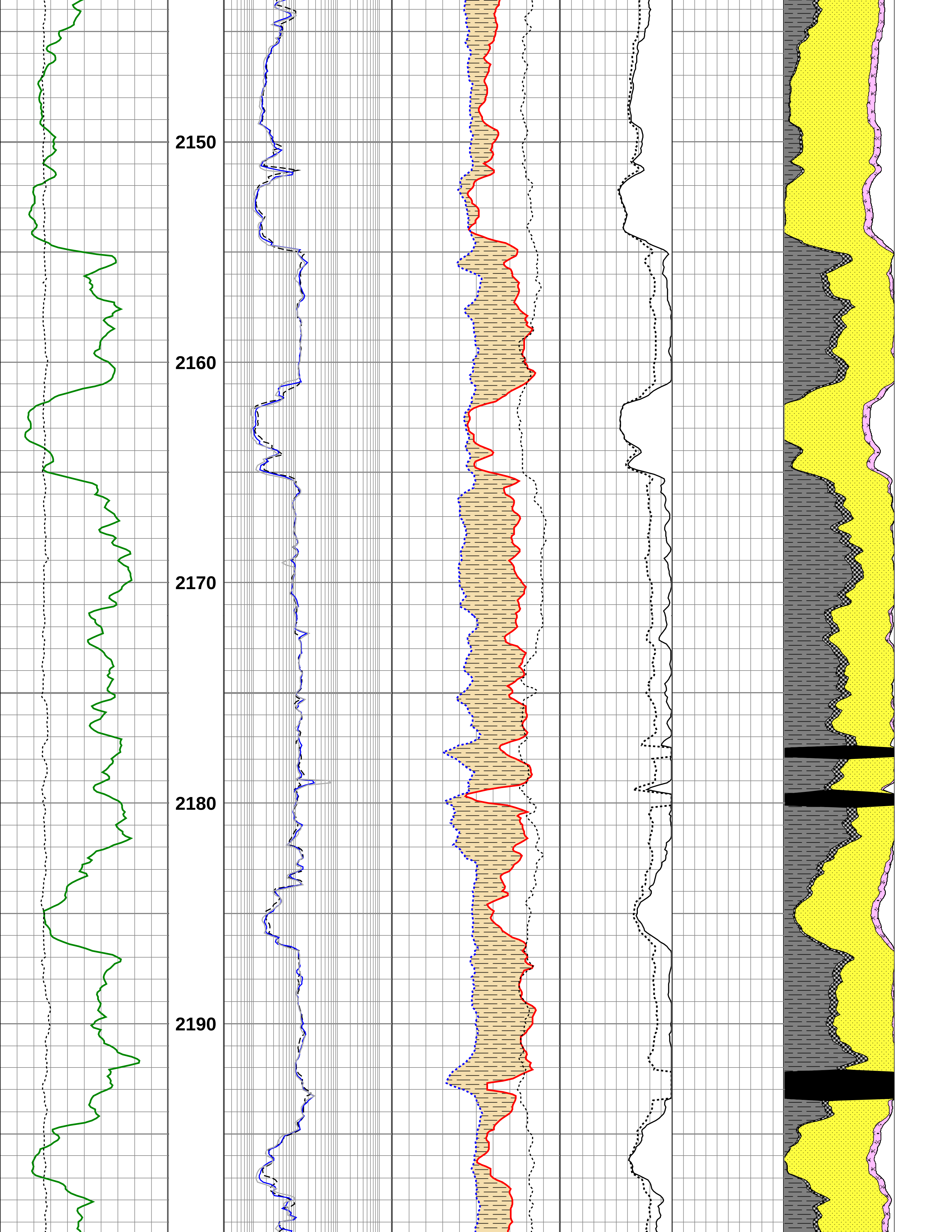
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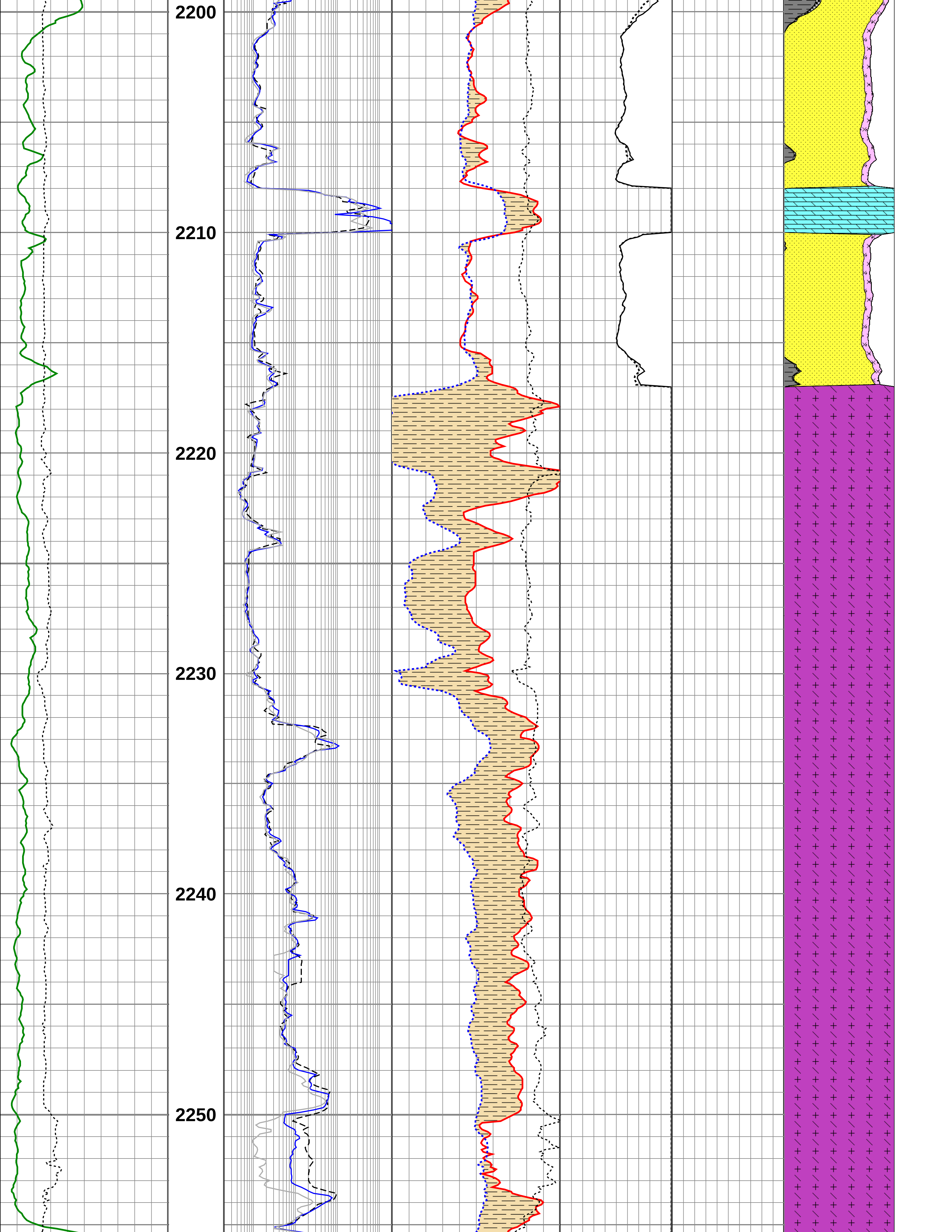

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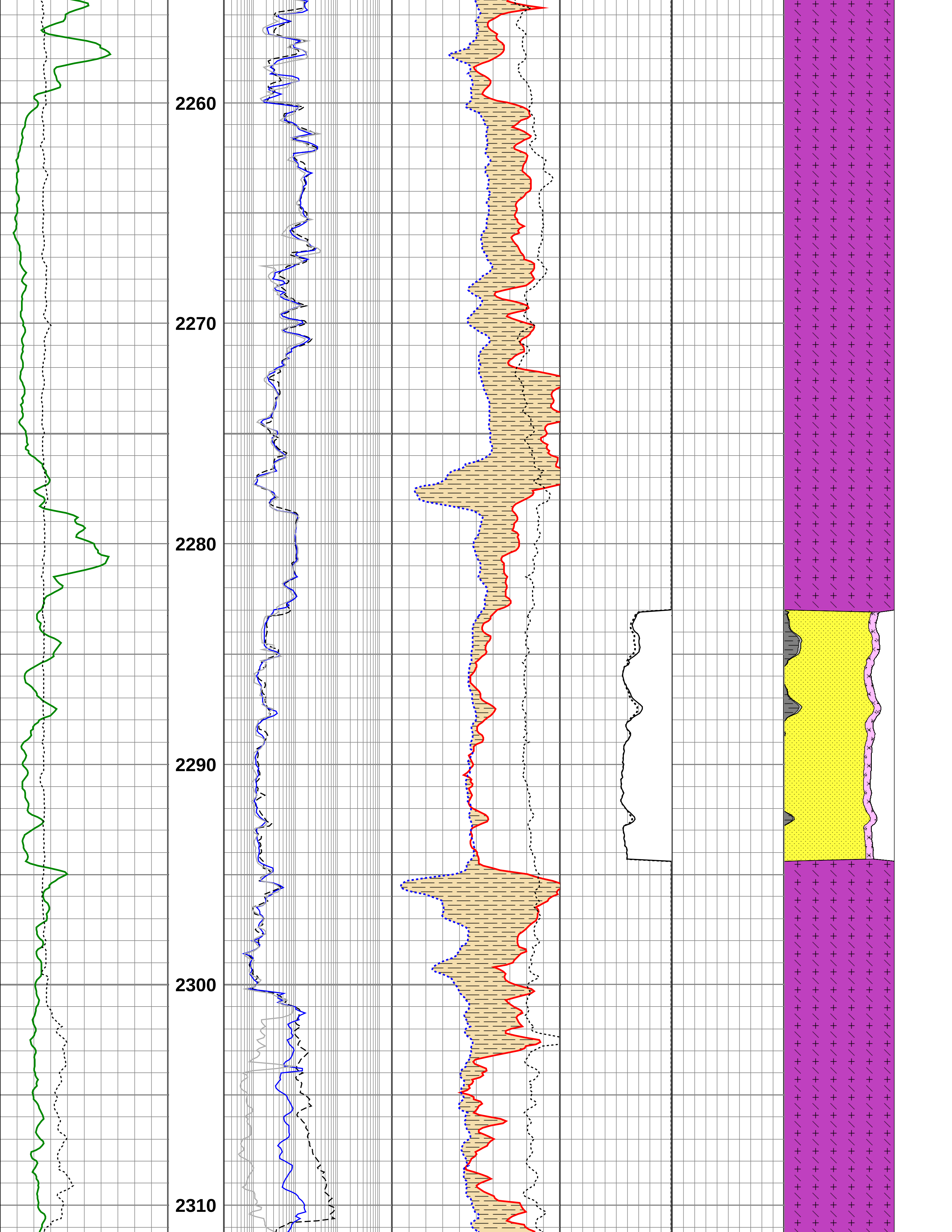
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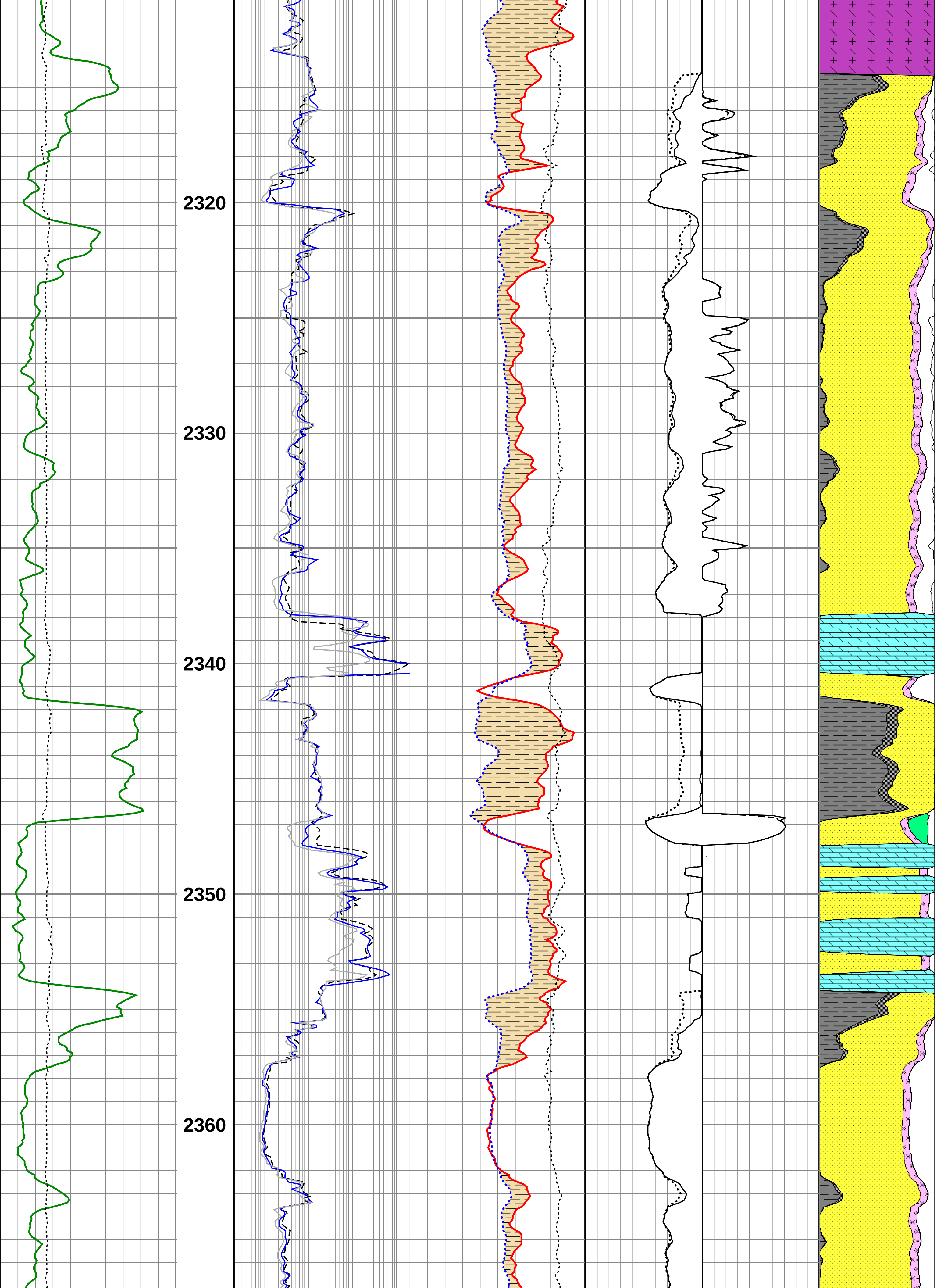
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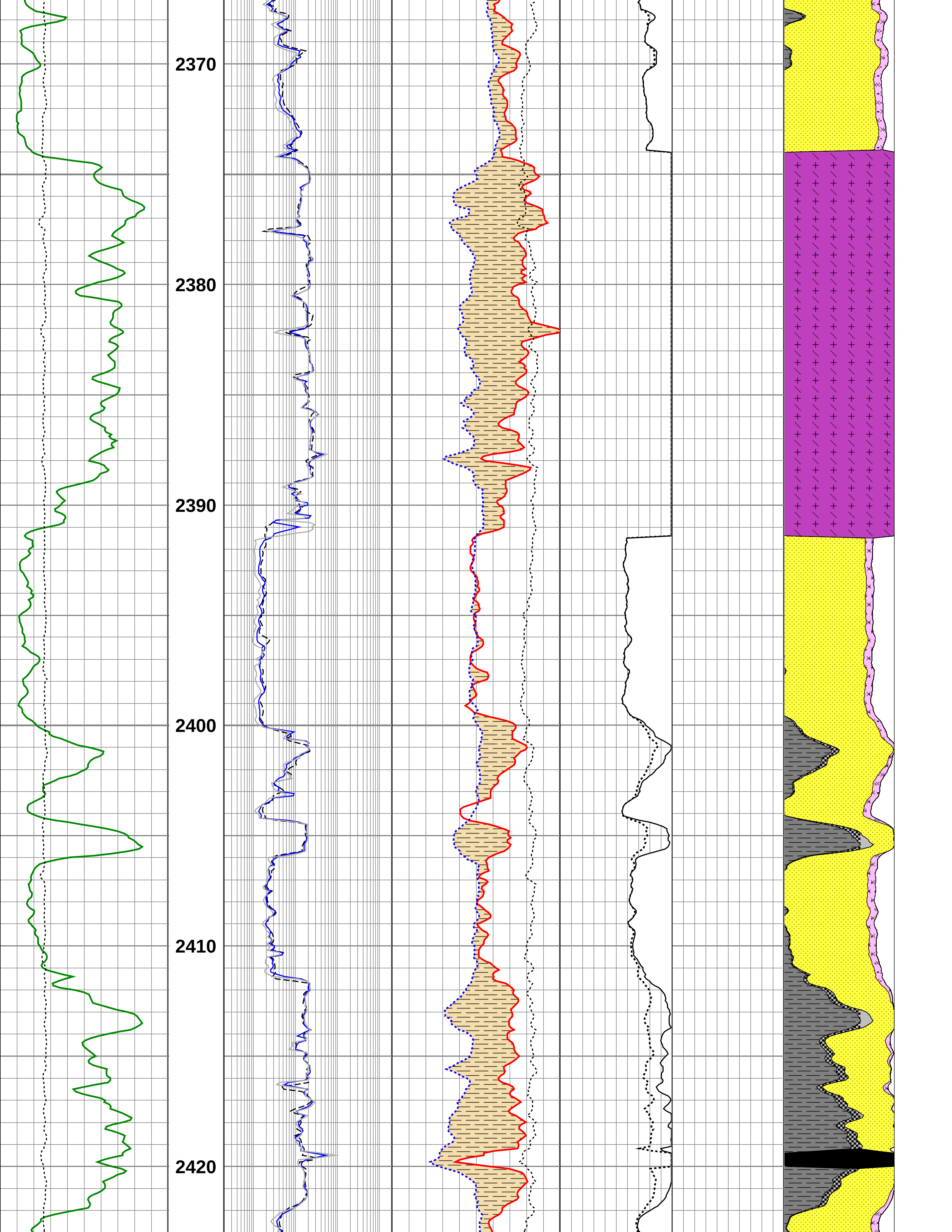

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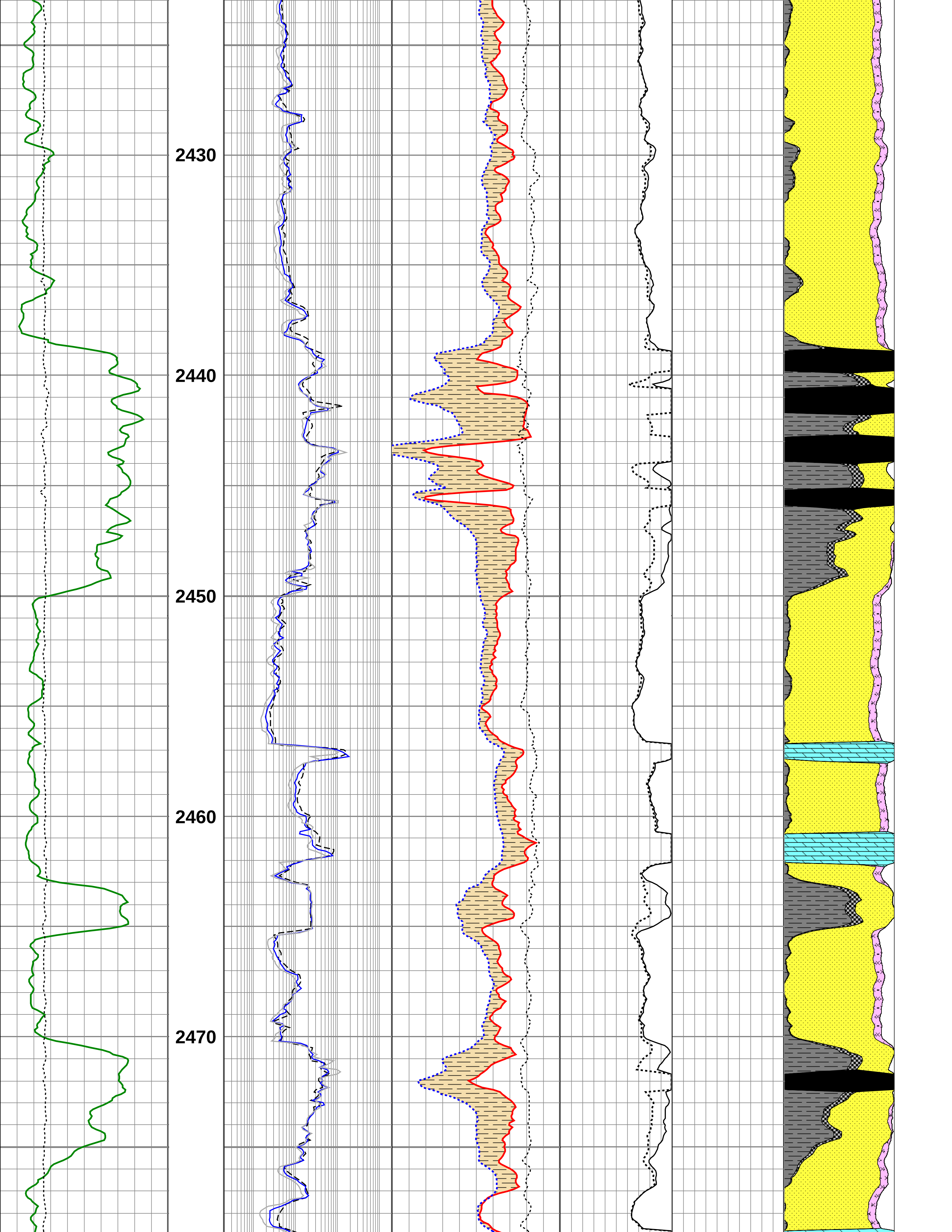
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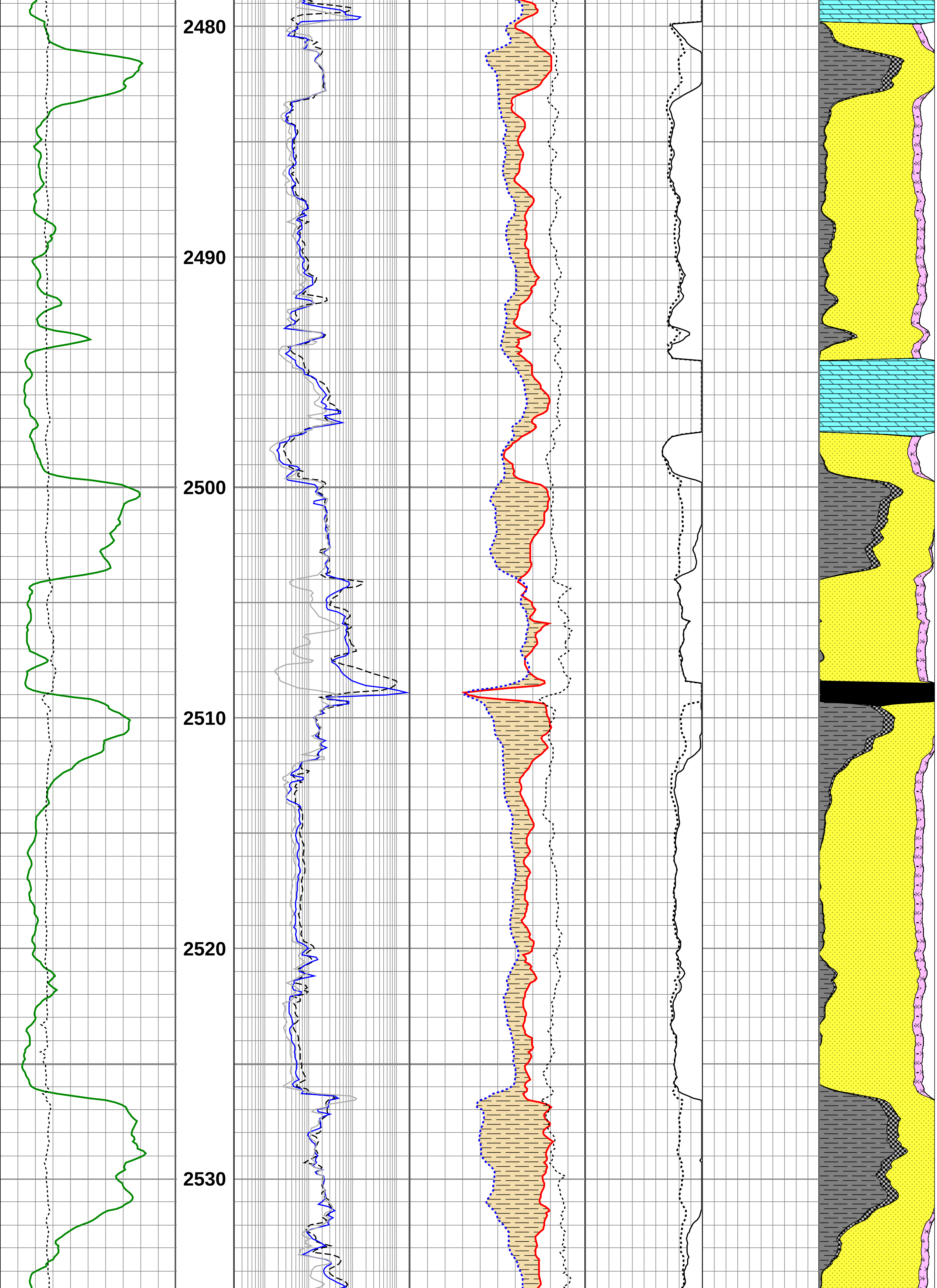
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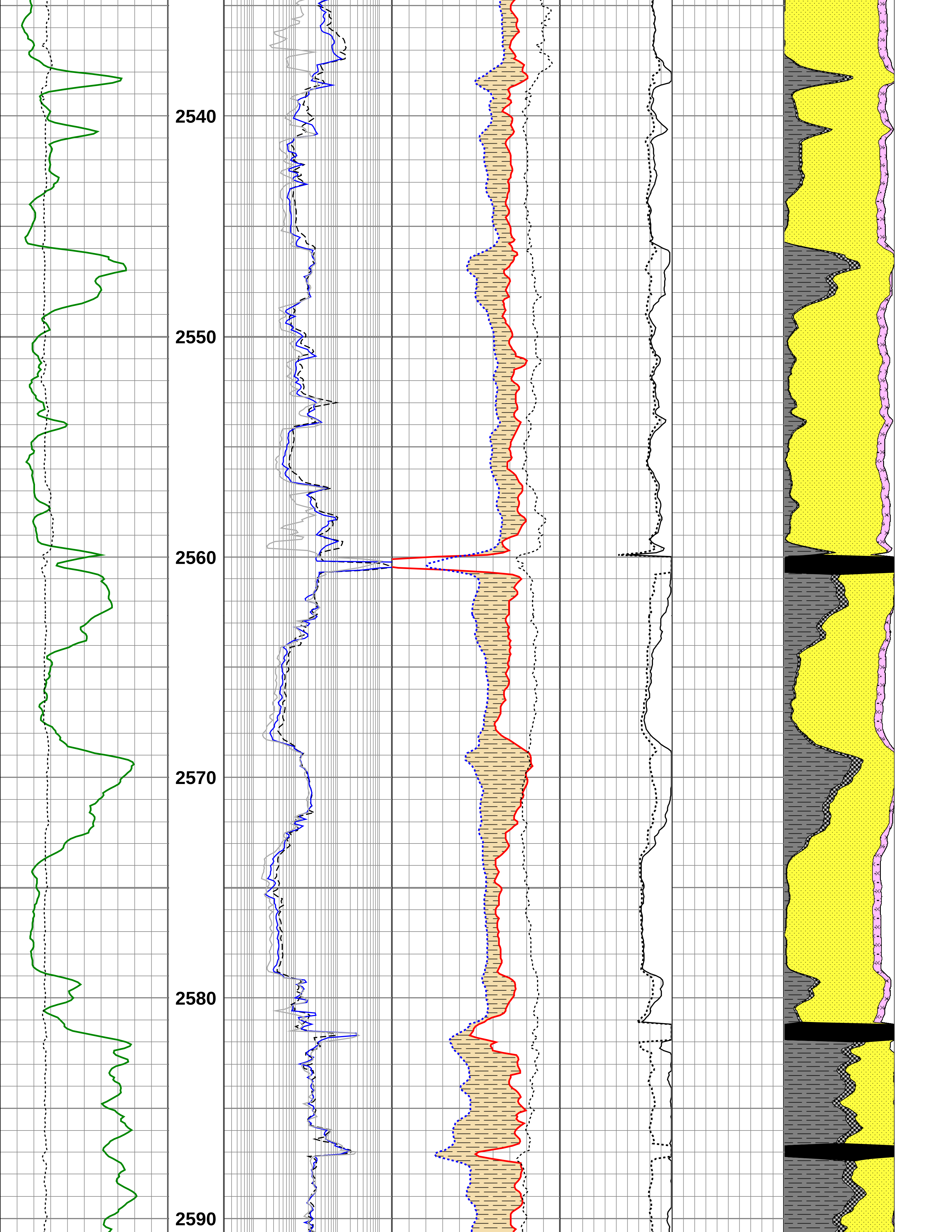

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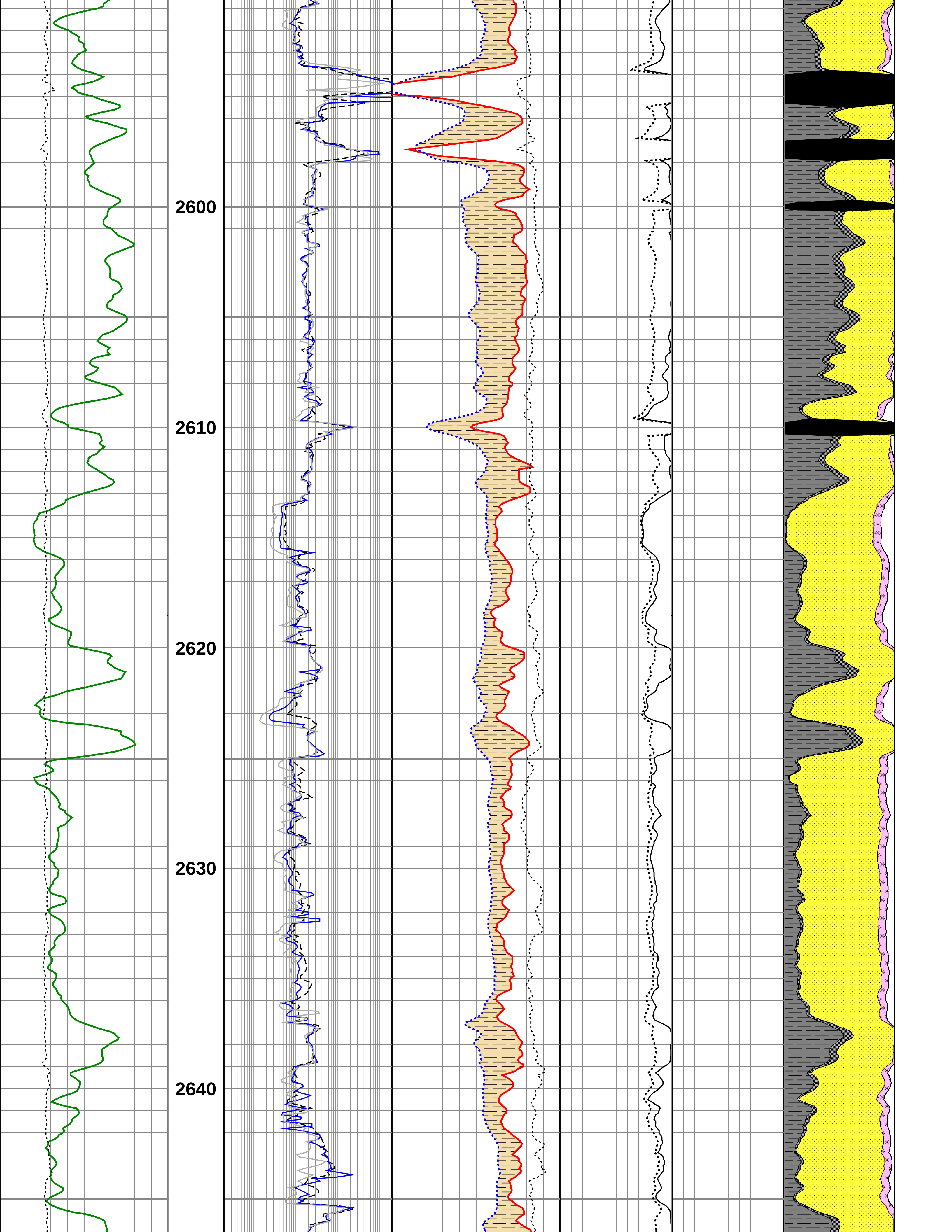
2560
2570
2580
2590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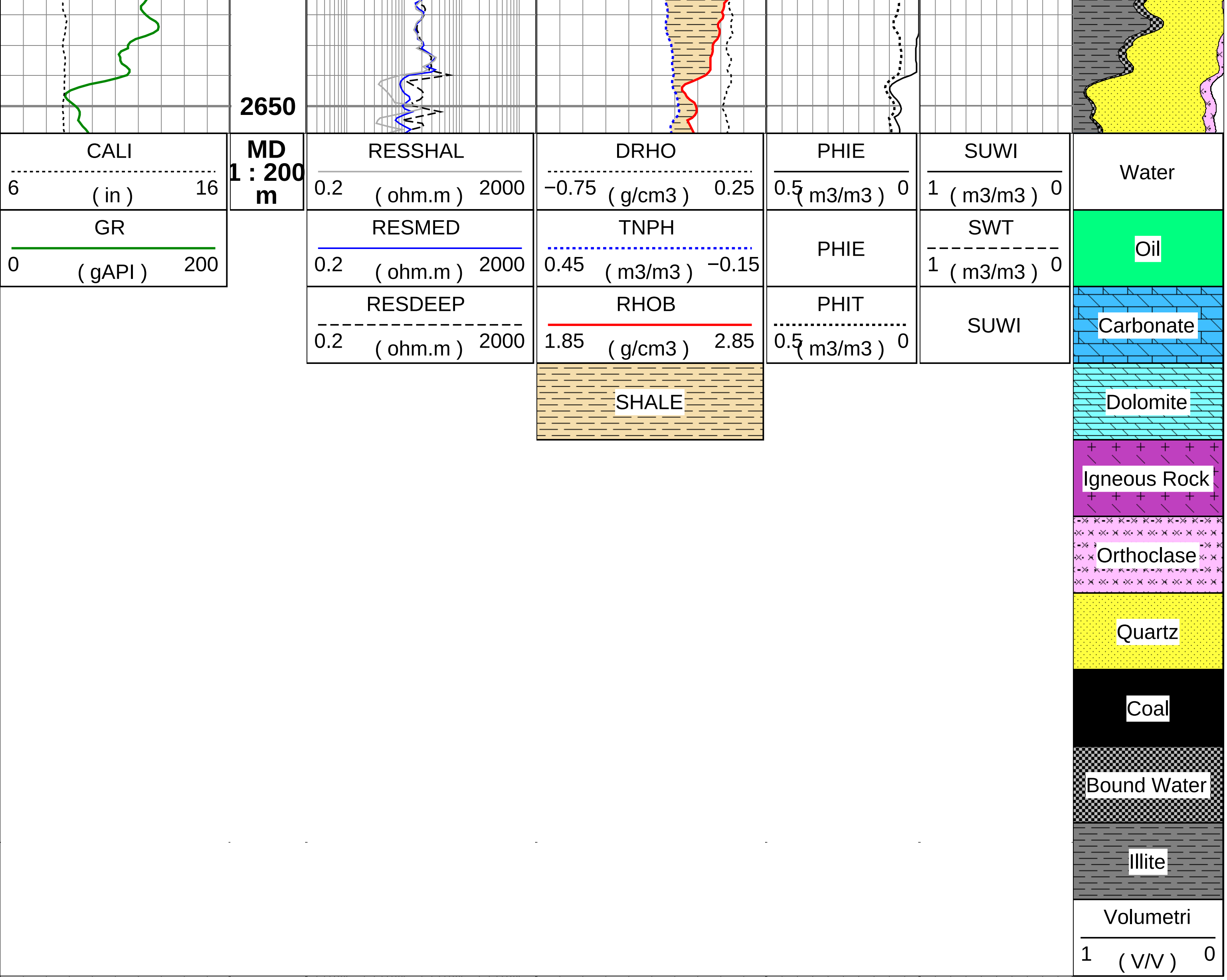
2610
2620
2630
2640



2650
CALI
6 ( in ) 16
GR
0 ( gAPI ) 200
MD
1 : 200
m
RESSHAL
0.2 ( ohm.m ) 2000
RESMED
0.2 ( ohm.m ) 2000
RESDEEP
0.2 ( ohm.m ) 2000
DRHO
−0.75 ( g/cm3 ) 0.25
TNPH
0.45 ( m3/m3 ) −0.15
RHOB
1.85 ( g/cm3 ) 2.85
SHALE
PHIE
0.5 ( m3/m3 ) 0
PHIE
PHIT
0.5 ( m3/m3 ) 0
SUWI
1 ( m3/m3 ) 0
SWT
1 ( m3/m3 ) 0
SUWI
Water
Oil
Carbonate
Dolomite
Igneous Rock
Orthoclase
Quartz
Coal
Bound Water
Illite
Volumetri
1 ( V/V ) 0

# APPENDIX 2

# PALYNOLOGY ANALYSIS

# PALYNOLOGY OF

# NORTH WIRRAH-1

## GIPPSLAND BASIN, AUSTRALIA


**by**

**ROGER MORGAN**



**Prepared for**
**ESSO AUSTRALIA LTD**

**February, 2006**

REF: GIP.NORTH WIRRAH-1 REPORT

PALYNOLOGY OF

NORTH WIRRAH-1

GIPPSLAND BASIN, AUSTRALIA

**CONTENTS** **PAGE**

# 1 SUMMARY

Data quality is very poor due to poor palynomorph yields which may be caused by the mud additive Barablock. If Barablock is to be used in the future, swcs may be required to get good palynology data.

1450/80 m (cutts) – 1530/35 m (cutts) : ?*P. tuberculatus* Zone : Oligocene-Miocene : ?nearshore marine : immature

1550/55 m (cutts) : middle *N. asperus* Zone : Late Eocene : shelfal marine : immature

1570 m (cutts) : Extremely lean of palynomorphs and Indeterminate

1620 m (cutts) : ?lower *N. asperus* Zone : ?Middle Eocene : marine : immature

1670/80 m (cutts) : Extremely lean of palynomorphs and Indeterminate

1680/90 m (cutts) : *P. asperopolus* – upper *M. diversus* Zones : Early Eocene : ?non-marine : immature

1750/60 m (cutts) – 1770/80 m (cutts) : Extremely lean of palynomorphs and Indeterminate

1860/70 m (cutts) – 1880/90 m (cutts) : middle *M. diversus* Zone : Early Eocene : ?non-marine : immature

1920/30 m (cutts) – 1950/55 m (cutts) : lower *M. diversus* Zone : Early Eocene : ?non-marine : immature

2000/10 m (cutts) – 2170/80 m (cutts) : upper *L. balmei* Zone : Paleocene : ?non-marine : marginally mature for oil, immature for gas/condensate

2190/2200 m (cutts) – 2410/15 m (cutts) : lower *L. balmei* Zone : Paleocene : ?non-marine : marginally mature for oil, immature for gas/condensate

2440/45 m (cutts) – 2580/85 m (cutts) : *F. longus* Zone (and M. druggii Zone 2440/45 m) : Maastrichtian : marginally marine (2440/45 m) to ?non-marine : marginally mature for oil, immature for gas/condensate

2595/6000 m (cutts) – 2675/78 m (cutts) : *T. lilliei* Zone : Maastrichtian-Campanian : ?non-marine : early mature for oil, marginally mature for gas/condensate

## 2 INTRODUCTION

The **North Wirrah-1** well was processed by Corelabs in Perth and studied by Roger Morgan in Maitland, South Australia. The original preparations yielded abundant inertinite and very few palynomorphs. Enquiries suggested that the drilling additive Barablock might be responsible for preventing clean preparations. Corelabs assured me that Konrad Weiss had been consulted during initial preparations, and had been unable to improve quality. Batches of samples were reprocessed at Corelabs in an attempt to improve results. Techniques tried included (a) crushing samples before processing, (b) solvent wash then crushing and (c) rigwash wash and crushing. None of these produced significantly better results.

The Tertiary zonation is that of Partridge (1976 and pers. Comm.) as shown in Figure 1.

The overall Cretaceous zone framework is that of Helby, Morgan and Partridge (1987) and subdivisions of these zones are shown in Figure 2 from Morgan (2004).

Palaeoenvironmental assessments are based on specimen counts of 100 specimens where possible, also providing a percentage content of all species. Criteria for the palaeo-environmental subdivisions are given on Table 1. In running text, rare = <1-3%, frequent = 4-10%, common = 11-30%, abundant = 31-50% and superabundant = 51-100%.

Confidence ratings include the factor of sample type, and distinctiveness of the fossil event, according to the scheme shown on Table 1. This is the STRATDAT scheme used by Esso.

Maturity data were generated in the form of Spore Colour Index, and are plotted on Figure 3 Maturity Profile : North Wirrah-1. The oil and gas windows follow the general concensus of geochemical literature. The oil window corresponds to spore colours of light-mid brown (Staplin Spore Colour Index of 2.7) to dark brown (3.6) equal to vitrinite reflectance values of 0.6% to 1.3%. Geochemists argue variations on kerogen type, basin type and basin history. The maturity data is thus open to reinterpretation using the basic colour observations as reworked. However, the range of interpretation philosophies is not great, and probably would not move the oil window by more than 200 m.

# TABLE 1

## SUMMARY OF PALYNOLOGICAL DATA : NORTH WIRRAH-1

| DEPTH (m) | SAMPLE TYPE | MICROFOSSIL YIELD | PERCENTAGE | | | | DIVERSITY *1 | | SPORE-POLLEN ZONE | CR *2 | ENVIRONMENT *3 | ORGANIC MATURITY (TA1) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | MICROPLANKTON | | | SPORE-POLLEN- | SALINE MICROPLANKTON | SPORE-POLLEN | | | | |
| | | | DINOFLAG | SPINY AC. | FRESH ALGAE | | | | | | | |
| 1450/80 | CUTTS | EX LOW | 5 | 0 | 0 | 95 | EX LOW | MODERATE | ?P. TUBERCULATUS | D4 | NEARSHORE MARINE | 2.0 |
| 1505/10 | CUTTS | VERY LOW | 29 | 3 | 10 | 67 | MODERATE | MODERATE | ?P. TUBERCULATUS | D4 | NEARSHORE MARINE | 2.0 |
| 1530/35 | CUTTS | LOW | 8 | 1 | 3 | 88 | LOW | HIGH | ?P. TUBERCULATUS | D3 | NEARSHORE MARINE | 2.0 |
| 1550/55 | CUTTS | LOW | 45 | 1 | 0 | 54 | MODERATE | MODERATE | N. ASPERUS, MIDDLE | D1 | SHELFAL MARINE | 2.0 |
| 1565/70 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | INDETERMINATE | D | INDETERMINATE | 2.0 |
| 1610/20 | CUTTS | EX LOW | - | - | - | - | EX LOW | LOW | N. ASPERUS, ?LOWER | D3 | MARINE | 2.1 |
| 1670/80 | CUTTS | EX LOW | 4 | 0 | 4 | 92 | EX LOW | MODERATE | INDETERMINATE | D | MARINE | 2.1 |
| 1680/90 | CUTTS | EX LOW | 0 | 0 | 4 | 96 | NIL | HIGH | P. ASPEROPOLUS – UPPER M. DIVERSUS | D3 | ?NON-MARINE | 2.1 |
| 1750/60 | CUTTS | EX LOW | - | - | - | - | NIL | MODERATE | INDETERMINATE | D | ?NON-MARINE | 2.1 |
| 1770/80 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | INDETERMINATE | D | ?NON-MARINE | 2.2 |
| 1860/70 | CUTTS | EX LOW | 0 | 0 | 4 | 96 | NIL | MODERATE | M. DIVERSUS, MIDDLE | D2 | ?NON-MARINE | 2.2 |
| 1880/90 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | M. DIVERSUS, MIDDLE | D2 | ?NON-MARINE | 2.2 |
| 1920/30 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | M. DIVERSUS, LOWER | D2 | ?NON-MARINE | 2.2 |
| 1950/55 | CUTTS | LOW | (3) | 0 | 0 | 97 | (EX LOW) | MODERATE | M. DIVERSUS, LOWER | D2 | ?NON-MARINE | 2.2 |
| 2000/10 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | L. BALMEI, UPPER | D2 | ?NON-MARINE | 2.3 |
| 2050/60 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | INDETERMINATE | D | ?NON-MARINE | 2.3 |
| 2080/90 | CUTTS | NEAR BARREN | - | - | - | - | NIL | EX LOW | INDETERMINATE | D | ?NON-MARINE | 2.3 |
| 2150/60 | CUTTS | NEAR BARREN | - | - | - | - | NIL | EX LOW | INDETERMINATE | D | ?NON-MARINE | 2.3 |
| 2170/80 | CUTTS | LOW | 0 | 0 | 7 | 93 | NIL | HIGH | L. BALMEI, UPPER | D2 | NON-MARINE | 2.4 |
| 2190/2200 | CUTTS | MODERATE | 0 | 0 | 4 | 96 | NIL | MODERATE | L. BALMEI, LOWER | D2 | NON-MARINE | 2.4 |
| 2255/60 | CUTTS | EX LOW | - | - | - | - | NIL | EX LOW | INDETERMINATE | D | ?NON-MARINE | 2.4 |
| 2275/80 | CUTTS | EX LOW | (2) | 0 | 0 | 98 | (EX LOW) | MODERATE | L. BALMEI | D3 | ?NON-MARINE | 3.4 |
| 2315/20 | CUTTS | EX LOW | - | - | - | - | NIL | EX LOW | INDETERMINATE | D | ?NON-MARINE | 2.5 |
| 2340/45 | CUTTS | EX LOW | - | - | - | - | NIL | MODERATE | INDETERMINATE | D | ?NON-MARINE | 2.5 |
| 2375/80 | CUTTS | BARREN | - | - | - | - | - | - | INDETERMINATE | D | INDETERMINATE | - |
| 2410/15 | CUTTS | EX LOW | 0 | 0 | 0 | 100 | NIL | HIGH | L. BALMEI, LOWER | D2 | NON-MARINE | 2.5 |
| 2440/45 | CUTTS | VERY LOW | 1 | 0 | 0 | 99 | EX LOW | HIGH | F. LONGUS, UPPER | D2 | MARGINALLY MARINE | 2.6 |
| 2465/70 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | INDETERMINATE | D | ?NON-MARINE | 2.6 |
| 2495/2500 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | F. LONGUS, UPPER | D2 | ?NON-MARINE | 2.6 |
| 2525/30 | CUTTS | NEAR BARREN | - | - | - | - | NIL | LOW | INDETERMINATE | D | ?NON-MARINE | 2.6 |
| 2560/65 | CUTTS | EX LOW | - | - | - | - | NIL | MODERATE | F. LONGUS | D3 | ?NON-MARINE | 2.7 |
| 2580/85 | CUTTS | EX LOW | 0 | 0 | 0 | 100 | NIL | MODERATE | INDETERMINATE | D | ?NON-MARINE | 2.7 |
| 2595/2600 | CUTTS | EX LOW | 0 | 0 | 0 | 100 | NIL | MODERATE | T. LILLIEI | D3 | ?NON-MARINE | 2.8 |
| 2600/05 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | T. LILLIEI | D3 | ?NON-MARINE | 2.8 |
| 2620/25 | CUTTS | EX LOW | - | - | - | - | NIL | LOW | T. LILLIEI | D3 | ?NON-MARINE | 2.8 |
| 2635/40 | CUTTS | BARREN | - | - | - | - | NIL | EX LOW | INDETERMINATE | D | INDETERMINATE | - |
| 2645/50 | CUTTS | NEAR BARREN | - | - | - | - | NIL | EX LOW | INDETERMINATE | D | ?NON-MARINE | 2.8 |
| 2655/60 | CUTTS | BARREN | - | - | - | - | NIL | NIL | INDETERMINATE | D | INDETERMINATE | - |
| 2665/70 | CUTTS | EX LOW | - | - | - | - | NIL | MODERATE | T. LILLIEI | D3 | ?NON-MARINE | 2.9 |
| 2675/78 | CUTTS | EX LOW | 0 | 0 | 4 | 96 | NIL | MODERATE | T. LILLIEI | D3 | ?NON-MARINE | 2.9 |

| *1 DIVERSITY | |
|---|---|
| V HIGH | 30+ SPECIES |
| HIGH | 20-29 SPECIES |
| MOD | 10-19 SPECIES |
| LOW | 5-9 SPECIES |
| EX LOW | 1-4 SPECIES |

| *2 CONFIDENCE RATINGS | |
|---|---|
| A = Core<br>Bp = Sidewall core (percussion) | 1 = Excellent Confidence<br>High diversity with key species |
| Br = Sidewall core (rotary/mechanical)<br>C = Coal cuttings | 2 = Good Confidence<br>Moderate diversity with key species |
| D = Ditch cuttings<br>E = Junk basket | 3 = Fair Confidence<br>Low diversity with key species |
| F = Miscellaneous/unknown<br>G = Outcrop | 4 = Poor Confidence<br>Moderate to high diversity without key species |
| | 5 = Very Low Confidence<br>Low diversity without key species |

| *3 ENVIRONMENTS | DINOFLAGELLATE CONTENT% | DINOFLAGELLATE DIVERSITY | FRESHWATER ALGAE CONTENT% |
|---|---|---|---|
| OFFSHORE MARINE | 67 to 100 | VERY HIGH | LOW |
| SHELFAL MARINE | 34 to 66 | HIGH | “ |
| NEARSHORE MARINE | 11 to 33 | MODERATE | “ |
| VERY NEARSHORE MARINE | 5 to 10 | MODERATE-LOW | “ |
| MARGINAL MARINE | <1 to 4 | LOW-VERY LOW | “ |
| BRACKISH | 0, SPINY ACRITARCHS ONLY | EXTREMELY LOW | “ |
| NON-MARINE (UNDIFF) | 0, NO SPINY ACRITARCHS | NIL | LOW |
| NON-MARINE (LACUSTRINE) | 0, NO SPINY ACRITARCHS | NIL | MODERATE 10%+ |

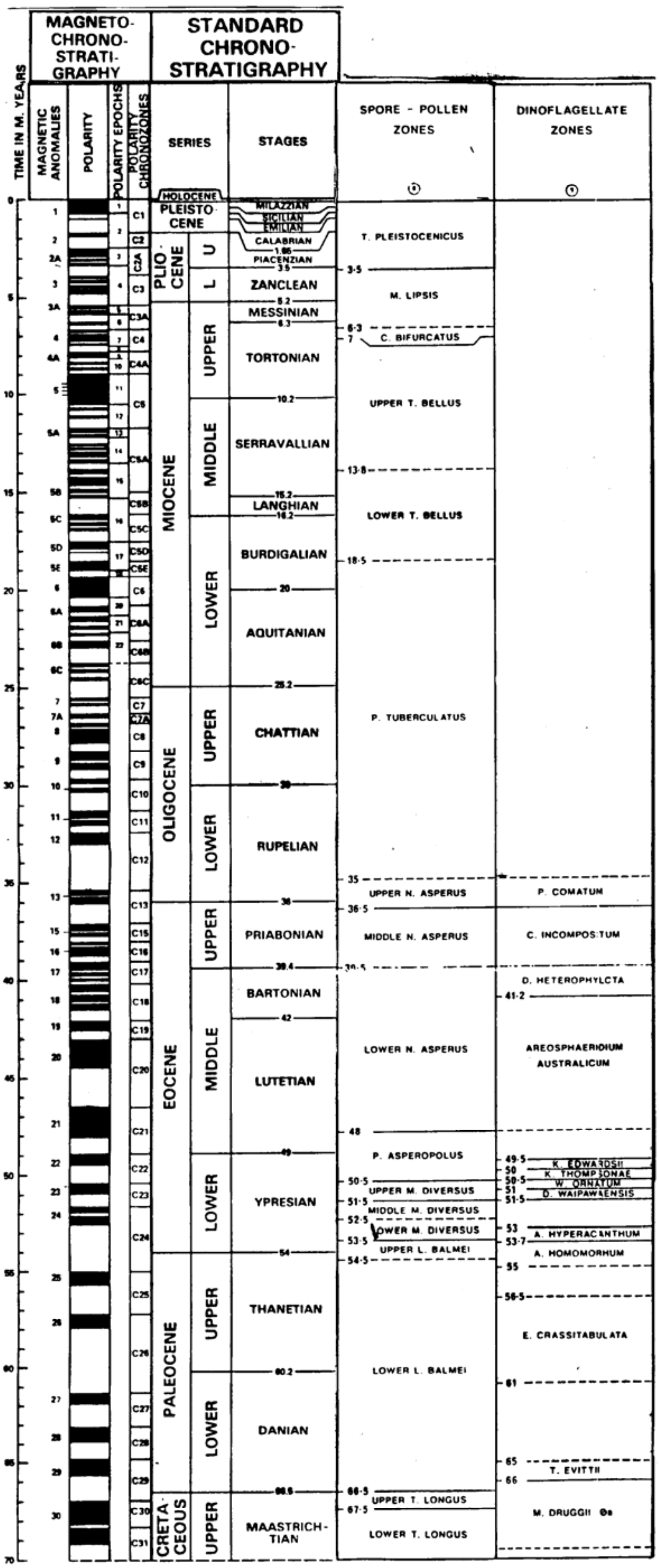


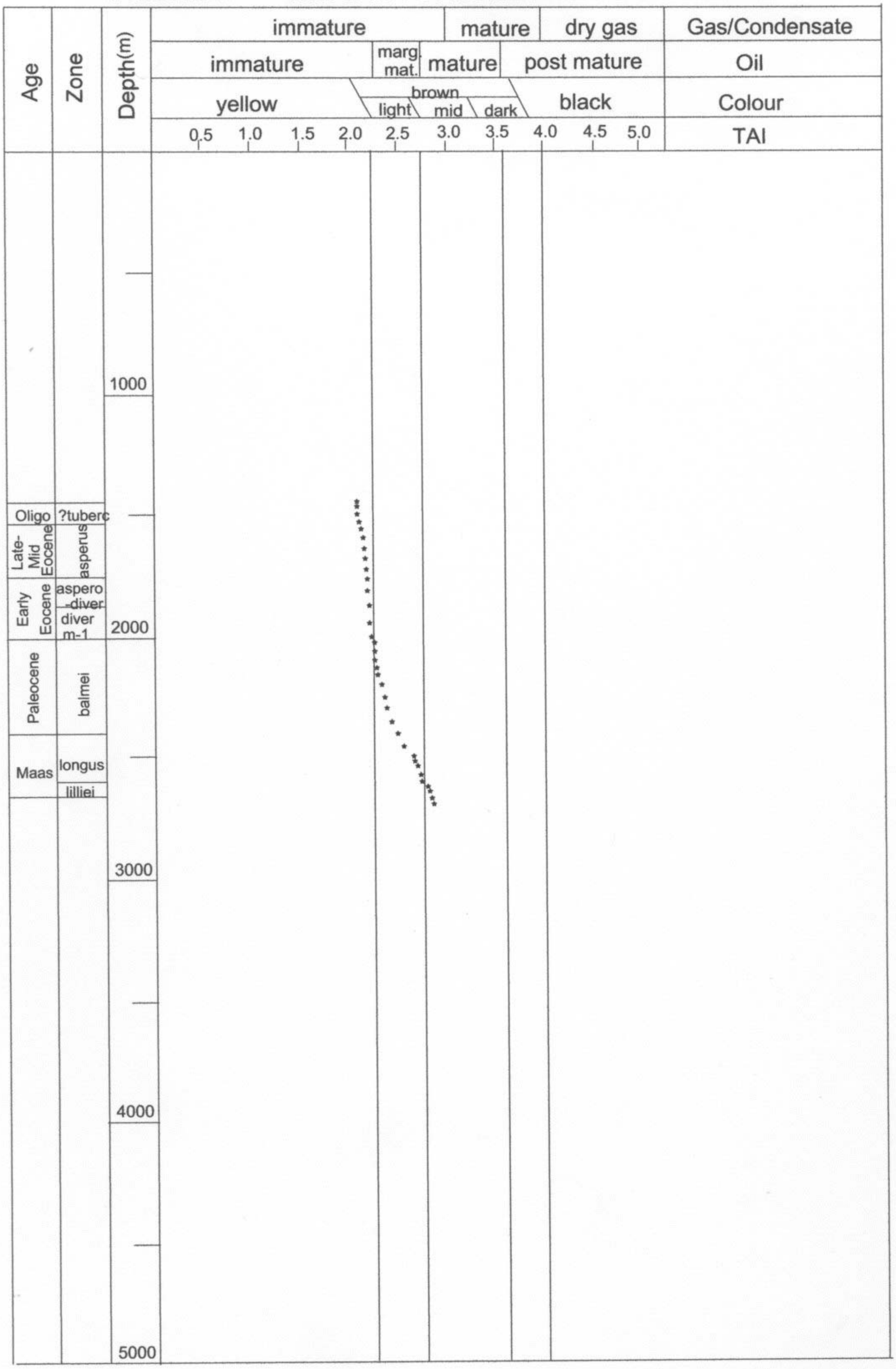

**FIGURE 1** **TERTIARY ZONATION SCHEME (Partridge 1976 and pers. comm. using time scale of Haq et al)**

| | SPORE-POLLEN EVENTS | SPORE-POLLEN SUBZONES | | | DINOFLAGELLATE EVENTS | DINOFLAGEL-LATE SUBZONES | DINOFLAGELLATE SUBZONE (SENSU PARTRIDGE) |
|---|---|---|---|---|---|---|---|
| | base *P. grandis* * | Upper *L. balmei* | | | | *A. hyperacanthum* | |
| | top *I. "antipoda"* | | c | | | | |
| | top frequent *A. obscurus* | | b | | top *E. crassitabulata* | *E. crassitabulata* | |
| | base frequent *A. obscurus* | Lower *L. balmei* | | | base *E. crassitabulata* | | |
| | base common *L. balmei* | | | | | | |
| | base *I. "antipoda"* | | a | | top *T. evittii* | *T. evittii* | |
| | top consistent *G. rudata* | | | | base *T. evittii* | | |
| | top *T. confessus* * | | | | top *M. conorata* | *M. druggii* | |
| | top *T. verrucosus* | | c | | base *M. conorata* | | |
| | top *T. sectilis, T. lilliei, F. longus* | | | | | | |
| | top frequent *G. rudata* | Upper *F. longus* | | | | | |
| | top common *A. obscurus* | | b | | | | |
| | base common *A. obscurus* | | | | | | |
| | base *G. rudata* > *N. endurus* | | a | | | | |
| | base *S. puncatus* | | | | | | |
| | top common *N. endurus* * | | c | | | | |
| | base common *G. rudata* ** | | | | | | |
| | | | b | | | | |
| | top *T. "megasectilis"* ** | Lower *F. longus* | | | | | |
| | base *T. "megasectilis"* | | a | | | | |
| 1. | base *F. longus* * | | | | | | |
| 2. | base *T. verrucosus* * | | | | | | |
| 3. | base *T. waipawaensis* | | b | | | | |
| 4. | top *F. sabulosus* | | | | | | |
| 5. | more consistent *F. sabulosus* ** | | | | | | |
| | | Upper *T. lilliei* | | 6. | consistent dinoflagellates * | | |
| | | | a | 7. | freq/common dinoflagellates | | |
| | | | | 8. | top *I. marshallii* | Upper *I. marshallii* | |
| | | | | 9. | base *C. bretonica* | | |
| 10. | *N. endurus* influx * | | c | | | | |
| | | | | 11. | top common *I. marshallii* * | | |
| 12. | top consist/frequent *F. sabulosus* ** | | b | | | Middle *I. marshallii* | *V. spinulosa* |
| | | Lower *T. lilliei* | | 13. | base common *I. marshallii* * | | |
| 14. | top *G. rudata* increase ** | | | | | | |
| | | | a | 15. | base *I. marshallii* | | |
| 16. | base *B. sectilis* * | | | | | Lower *I. marshallii* | |
| 17. | base *T. lilliei* * | | | | | | |
| | | | | 18. | base *V. spinulosa* | | |
| | | | b | 19. | top frequent *I. variabile* | | |
| | | | | 20. | top *T. suspectum* * | Upper *I. variabile* | |
| 21. | top frequent *F. sabulosus* ** | Upper *N. senectus* | | | | | |
| | | | | 22. | top common *I. variabile* * | Middle *I. variabile* | |
| | | | a | 23. | top *Nelsoniella* spp. * | | *T. suspectum* |
| | | | | 24. | top frequent *Chatangiella* spp. | | |
| 25. | base *G. rudata* * | | | | | Lower *I. variabile* | |
| 26. | base frequent *Nothofagidites* ** | | c | | | | |
| 27. | base frequent *F. sabulosus* ** | | b | | | | |
| | | Lower *N. senectus* | | 28. | top common *C. arvensis* * | *C. arvensis* | *C. arvensis* |
| | | | a | 29. | base common *C. arvensis* * | | |
| 30. | base consist *Nothofagidites* * | | | | | | |
| 31. | base *F. sabulosus* | | | | | *I. ponticum* | *I. ponticum* |
| | | | | 32. | top common *I. ponticum* | | |
| | | Upper *T. apoxyexinus* | | 33. | base *T. suspectum* | | |
| | | | | 34. | top common *C. porosa* * | *C. porosa* | *C. porosa* |
| | | | | 35. | base common *C. porosa* | | |
| 36. | base frequent *Proteacidites* * | | | | | | |
| | base *T. gillii** | lower *T. apoxyexinus* | | | | | |
| 37. | base *C. ohaiensis, Proteacidites*spp. | | | | | | |

**FIGURE 2 DETAILED SUBZONATION SUMMARY (MORGAN 2003)**

**Single Asterisk * shows defining event for upper/lower subzone**
**Double Asterisk ** shows defining event for a/b/c sub-subzones**

FIGURE 3 MATURITY PROFILE : NORTH WIRRAH-1



# 3 PALYNOSTRATIGRAPHY

## 3.1 1450/80 m (cutts) – 1530/35 m (cutts) : ?*P. tuberculatus* Zone

Poor palynomorph yields have reduced precision. Slides contain mostly inertinite. Assignment is tentative on the absence of younger markers, and deepest *Cyatheacidites tectifera, Foveotriletes crater* and *Proteacidites tuberculatus* at the base, and on the associated frequent *Operculodinium* spp. Amongst the spore-pollen, common are *Falcisporites similis, Dilwynites granulatus* and *Nothofagidites emarcidus* with frequent *Cyathidites minor, Haloragacidites harrisii, Microcachryidites antarcticus, Phyllocladidites mawsonii* and *Vitreisporites pallidus*. Rare elements include *C. tectifera, F. crater, Nothofagidites deminutus, Nothofagidites falcata* and *P. tuberculatus*.

Dinoflagellates are minor and of low to moderate diversity. Common are *Operculodinium* spp. with rare *Cerebrocysta* sp., *Deflandrea phosphoritica, Eisenackia ornata, Hystrichokolpoma eisenackii, Impletosphaeridium* sp. I and *Systematophora placacantha*.

Nearshore environments are suggested by minor quantities of marine dinoflagellates with dominant terrestrial spores and pollen. However, in these poor yielding samples, this may not be an accurate assessment.

Colourless spore colours indicate immaturity for hydrocarbons.

## 3.2 1550/55 m (cutts) : middle *N. asperus* Zone

Poor palynomorph yields have reduced precision. Slides contain abundant amorphous sapropel suggesting oil based mud or a similar processing problem. Assignment is indicated by the dinoflagellates including *Vozzhennikovia extensa* and *Eisenackia ornata*.

Amongst the spores and pollen, frequent are *Cyathidites* spp., *Haloragacidites harrisii, N. deminutus* and *N. emarcidus* with rare *Lygistepollenites florinii, Myrtaceidites parvus, Nothofagidites flemingii* and *N. falcata*.

Dinoflagellates are dominant with abundant *Spiniferites ramosus* and common *Operculodinium* spp. Rare elements include *E. ornata*, *Impletosphaeridium* sp. I, *Lingulodinium machaerophorum*, *Phthanoperidinium comatum, S. placacantha* and *V. extensa.*

Shelfal marine environments are indicated by subequal quantities of marine dinoflagellates and terrestrial spores and pollen.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.3 1570 m (cutts) : Indeterminate

This sample is totally dominated by abundant inertinite with very few identifiable palynomorphs and lacking key markers. Rare taxa are all longranging and include *Cyathidites australis*, *H. harrisii*, *P. mawsonii* and *Verrucosisporites kopukuensis*. No dinoflagellates were seen.

Environments may be non-marine as no dinoflagellates were seen. However, too few palynomorphs were seen to be confident.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.4 1620 m (cutts) : ?lower *N. asperus* Zone

This sample is also totally dominated by inertinite with very few palynomorphs. However, the dinoflagellate *D. phosphoritica* without younger markers suggests the lower *N. asperus* Zone or younger. Spores and pollen are longranging and include *D. granulatus*, *H. harrisii* and *L. florinii*. The only dinoflagellate seen was *D. phosphoritica*.

Marine environments are suggested by the single dinoflagellate, but it could be caved. Too few palynomorphs were seen to be confident.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.5 1670/80 m (cutts) : Indeterminate

This sample is totally dominated by inertinite and sapropel with few identifiable palynomorphs. Spores and pollen present are rare and longranging and include frequent *D. granulatus* and *H. harrisii* with rare *Cyathidites* spp., *L. florinii, N. emarcidus* and *N. deminutus*. A single dinoflagellate is not age diagnostic and might be caved.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.6 1690/90 m (cutts) : *P. asperopolus* – upper *M. diversus* Zones

This sample is dominated by inertinite with few identifiable palynomorphs. However, assignment to this interval is indicated by common *H. harrisii* at the top and oldest *Proteacidites pachypolus* at the base. The sample could be from anywhere within the interval. Common are *F. similis* and *H. harrisii* with frequent *Osmundacidites wellmanii*. Rare elements include *Malvacipollis subtilis, N. flemingii, P. mawsonii, P. pachypolus* and *V. kopukuensis*. No dinoflagelaltes were seen.

Environments appear to be non-marine, in the absence of saline markers. However, too few palynomorphs have been seen to be definitive.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.7 1750/60 m (cutts) – 1770/80 m (cutts) : Indeterminate

Inertinite totally dominates these samples with very few longranging palynomorphs. Rare elements include *D. granulatus, H. harrisii, N. flemingii* and *P. mawsonii*. No dinoflagellates were seen.

Non-marine environments are suggested by the absence of saline markers, but really too few palynomorphs have been seen to be definitive.

### 3.8 1860/70 m (cutts) – 1880/90 m (cutts) : middle *M. diversus* Zone

Inertinite continues to dominate these assemblages, but some age significant pollen were seen. Assignment is indicated by oldest *Proteacidites ornatus*, and *Proteacidites tuberculiformis* without younger markers. Frequent are *Cyathidites* spp. and *H. harrisii*. Rare elements include *Intratriporopollenites notabilis, M. subtilis, Proteacidites leightonii, P. ornatus* and *P. tuberculiformis*. No dinoflagellates were seen.

Non-marine environments are suggested by the absence of saline markers. However, too few palynomorphs have been seen to be definitive.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.9 1920/30 m (cutts) – 1950/55 m (cutts) : lower *M. diversus* Zone

Inertinite and mineral dominate these assemblages with some age significant taxa seen. Assignment is indicated by *Proteacidites grandis* without older or younger markers considered in place. A single *P. ornatus* at 1950/55 m is considered caved. Common are *Cyathidites* spp. and *Proteacidites* spp. with frequent *F. similis* and *P. mawsonii*. Rare elements include *H. harrisii*, *P. grandis* and *V. kopukuensis*. The only dinoflagellate seen is *Cerebrocysta* sp., considered caved from the Oligocene above.

Non-marine environments are most likely, as the only saline markers are considered caved. However, too few palynomorphs have been seen to be definitive.

Yellow spore colours indicate immaturity for hydrocarbons.

### 3.10 2000/10 m (cutts) – 2170/80 m (cutts) : upper *L. balmei* Zone

Palynomorph yields vary wildly. Most samples in this interval continue to be dominated by inertinite with few (but sufficient) age diagnostic spores and pollen. In stark contrast a single sample (2170/80 m) yielded abundant and diverse spores and pollen.

Assignment is indicated by youngest *Lygistepollenites balmei* at the top, and the absence of older markers at the base. At 2170/80 m in the diverse assemblage, common are *Gleicheniidites* spp., *L. balmei*, *P. mawsonii* and *V. pallidus* with frequent *C. minor* and *F. similis*. Rare elements include *Gambierina rudata*, *Nothofagidites endurus*, *Periporopollenites polyoratus* and *Stereisporites punctatus*. No dinoflagellates were seen.

Non-marine environments are suggested by the absence of saline markers. However, only in 2170/80 m have sufficient palynomorphs been seen to be confident.

Light brown spore colours indicate marginal maturity for oil, but immaturity for gas/condensate.

### 3.11 2190/2200 m (cutts) – 2410/15 m (cutts) : lower *L. balmei* Zone

Again, palynomorph yields vary wildly, with the best samples at 2190/2200 m, 2275/80 m, 2410/15 m. The other samples are totally dominated by inertinite with few recognisable palynomorphs. In the richer samples, common are *C. minor*, *F. similis*, *L. balmei* and *P. mawsonii* with frequent *Gleicheniidites* spp., *Proteacidites* spp. and at 2415.20 m, *Tetracolporites verrucosus*. Rare elements include *Australopollis obscurus, G. rudata, N. senectus, T. punctatus* and *T. verrucosus*. Very minor younger caving include *P. tuberculiformis, P. grandis* and *P. ornatus*. No dinoflagellates were seen.

Non-marine environments are suggested by the absence of saline markers. However, only at 2190/200, 2275/80 and 2410/15 m have sufficient palynomorphs been seen to be confident.

Light brown spore colours indicate marginal maturity for oil, but immaturity for gas/condensate.

### 3.12 2440/45 m (cutts) – 2580/85 m (cutts) : *F. longus* Zone

Inertinite dominates these assemblages, with amorphous sapropel common at 2440/45 m and 2560/65 m. The richest assemblages are at 2440/45 m and 2480/85 m. Assignment is on youngest *Tricolpites confessus*, *Manumiella conorata* and downhole influx of *G. rudata* at the top, and oldest *T. verrucosus* (2495/500) and the absence of older markers. Oldest *S. punctatus* at 2495/500 m suggests the base of upper *F. longus* Zone, with 2425/30 m – 2480/85 m assigned to the lower *F. longus* Zone. In the rich assemblages, common are *Cyathidites* spp. and *Proteacidites* spp. with frequent *F. similis* and *G. rudata.* Rare elements include *C. ohaiensis, N. endurus, T. verrucosus* and *T. confessus*.

A single *M. conorata* at 2440/45 m indicates the *M. druggii* Dinoflagellate Zone.

Environments appear to be non-marine except marginally marine at 2440/45 m. However, too few palynomorphs were seen in many samples to be reliable.

Light to mid brown spore colours indicate marginal maturity for oil, but immaturity for gas/condensate.

### 3.13 2595/600 m (cutts) – 2675/78 m (cutts) : *T. lilliei* Zone

Inertinite dominates these assemblages, with few identifiable palynomorphs. Assignment is suggested by youngest *Forcipites sabulosus* at the top, and the absence of older markers at the base. However, confidence is low in these poor assemblages. The richest samples are at 2595/6000 m and 2675/78 m, but neither acheive a 100 specimen count despite repeated processing trying different techniques. In the richest assemblages, common is *F. similis* and *Proteacidites* spp. with frequent *Dictyophyllidites* spp., *M. antarcticus* and *N. endurus*. Rare elements include *F. sabulosus, G. rudata* and *T. confessus*. Minor younger caving includes *L. balmei*, *P. pachypolus* and *P. grandis*.

A single dinoflagellates (*S. ramosus*) was seen at 2675/78 m but it is considered caved. Non-marine environments are therefore considered most likely throughout, although too few palynomorphs have been seen in many samples to be definitive.

Mid brown spore colours indicate early maturity for oil but immaturity for gas/condensate.

# 4 REFERENCES

Helby, R.J, Morgan, R.P and Partridge, A D (1987) A Palynological Zonation of the Australian Mesozoic *In* Studies in Australian Mesozic Palynology *Assoc. Australas. Palaeontols. Mem. 4, 1-94*

Morgan, R.P. (2004) Palynology of the bottomhole of Conger-1, Gippsland Basin, Australia *unpubl. rept.* for Esso Australia

Partridge, A.D. (1976) The geological expression of Eustacy in the early Tertiary of the Gippsland Basin APEA J

**Well Name : North Wirrah-1**

Operator :

Interval : 1460m - 2698m

Scale : 1:5000

Chart date: 09 March 2006

Palynological Data Chart : INTERPRETIVE DATA

% Abundance histogram : Highest occurrence

Roger Morgan

# North Wirrah-1

Morgan Palaeo Associates
Maitland, South Australia

Enclosure 1

**Sampling**

Cutting

Core

Sidewall core

**Text Keys**

*1 P. asperopolus - M. diversus, upper

*2 % within discipline (40mm=100%)

*3 In-Situ occurrences

# APPENDIX 3

# VELOCITY SURVEY REPORT

# Q-Borehole Survey Report

Schlumberger

| | |
|---|---|
| Survey type: | Checkshot Survey |
| Company: | Esso Australia Pty Ltd |
| Well: | North Wirrah-1 |
| Field: | North Wirrah |
| Country: | Australia |
| Run: | 2 |
| Date: | 19-Sep-2005 |

Recorded by: T.Hopper/R.Clark/D.Molokhov

Witnessed by: G.O'Neil/S.Duff

# Report Contents

## Introduction

A borehole seismic survey was recorded in Suite 1 Run 2 in the vertical (max. 1.34 deg deviation) offshore exploration well North Wirrah-1 on 19 of September 2005. This survey included Rig Source checkshot measurements from 763 M MD RT to 2504 M MD RT. The data were acquired using 1 shuttle VSIT-C (directly connected to the cartridge using AH-244 adaptor) downhole tool.

A Parallel G-Gun cluster (2 x 150 cu. inch G-GUN) was deployed from the Rig ENSCO 102 with an azimuth of 90 degrees with reference to North. The offset of gun was fixed 45 M from the wellhead. The guns were submerged from a buoy to 3 M below water surface. 2 hydrophones were deployed 5 M below the center of the gun cluster.

WSI-A WSAM-B module were used for acquisition. Guns were tuned using time break sensors.

## Survey Results

Total acquisition time for the survey was recorded as 5 hours 15 minutes from rig up to full rig down. The operational time for the survey was 3 hrs 45 mins.

Data quality generally for the checkshot survey considered to be good throughout the survey; data was recorded from 763 m to 2504 MD at the levels assigned by the customer. At least 3 good repeatable shots were recorded at each checkshot level.
Gamma Ray Log was recorded (up log) while before the main checkshot survey. Depth offset 3 meters deeper was observed. The depth offset was applied before the survey.

The tide level used “zero” for the static correction. Static correction of transit time does not use water tide level in this report.

## Well Information

| | |
|---|---|
| **Company** | **Esso Australia Pty Ltd** |
| **Well** | **North Wirrah-1** |
| **Field** | **North Wirrah** |
| **Country** | Australia |
| **State** | Victoria |
| **Logging Date** | 19-Sep-2005 |
| **Run Number** | 2 |
| **Service Order** | |
| **Well Head (Latitude)** | 38 10' 57.074" S |
| **Well Head (Longitude)** | 147 50' 20.683" E |
| **Well Head (X Coordinate)** | 573486.5 UTM |
| **Well Head (Y Coordinate)** | 5773601.0 UTM |
| **Total Depth - Driller** | 2678.0 m |
| **Total Depth - Logger** | 2504.0 m |
| **Maximum Hole Deviation** | 1.3 deg |
| **Azimuth of Maximum Deviation** | |
| **Program Version** | 13C0-300 |
| **Bit Size** | 8.500 in |
| **Recorded by** | T.Hopper/R.Clark/D.Molokhov |
| **Witnessed by** | G.O'Neil/S.Duff |

## Elevation Information

| | |
|---|---|
| **Permanent Datum** | Mean Sea Level |
| **Elevation Permanent Datum** | 0.0 m |
| **Above Permanent Datum** | 39.2 m |
| **Drilling Measured From** | R.T. |
| **Derrick Floor** | 39.2 m |
| **Ground Level** | -52.8 m |
| **Kelly Bush** | 39.2 m |
| **Log Measured From** | R.T. |
| **Elevation Log Zero** | 39.2 m |

## Depth Corrected Information

| | |
|---|---|
| **Water Velocity** | 1524.0 m/s |
| **Seismic Reference Datum** | 0.0 m |

## Remarks

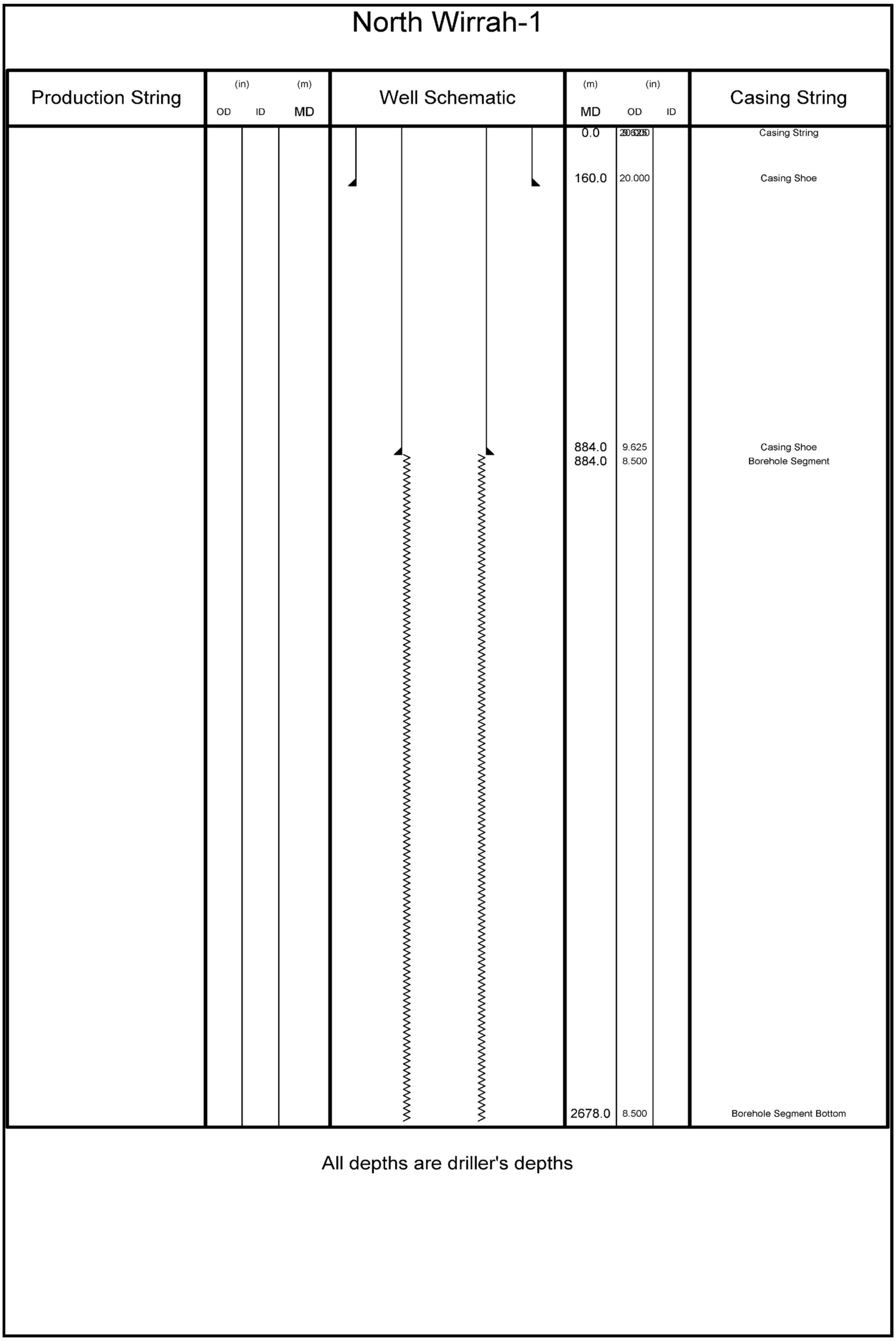
Checkshot survey recorded at the levels chosen by the customer.

Driller's depth not tagged due to hole conditions. Deepest depth reached 2504 M.

Maximum temperature 103 deg was recorded by three thermometers in LEH-QT head.

Additional mud properties: PV 26.0 cP @ 49degC, YP 51lbs/100ft^2, Gells 10/19/26 lbs/100ft^2
HTHP 10.6ml/30mins @ 121degC, Cake 1/2 32nd in, Corr solid 6.9%, Sand 02.%, MBT 6 ppb,
ALK mud 0.23 Pm, ALK Filt 0.14/0.8 Pf/Mf, Chlorides 49500 mg/L, Total hardness 280 mg/L
Glycol 3.6%, KCL 9%, PHPA 1.4 ppb, sulphide residual 180 mg/L, Barite 5.6%.
Casing Grade: L-80; Casing Weight: 47 lb/ft.

# Well Sketch





Schlumberger

# Well Inclinometry List

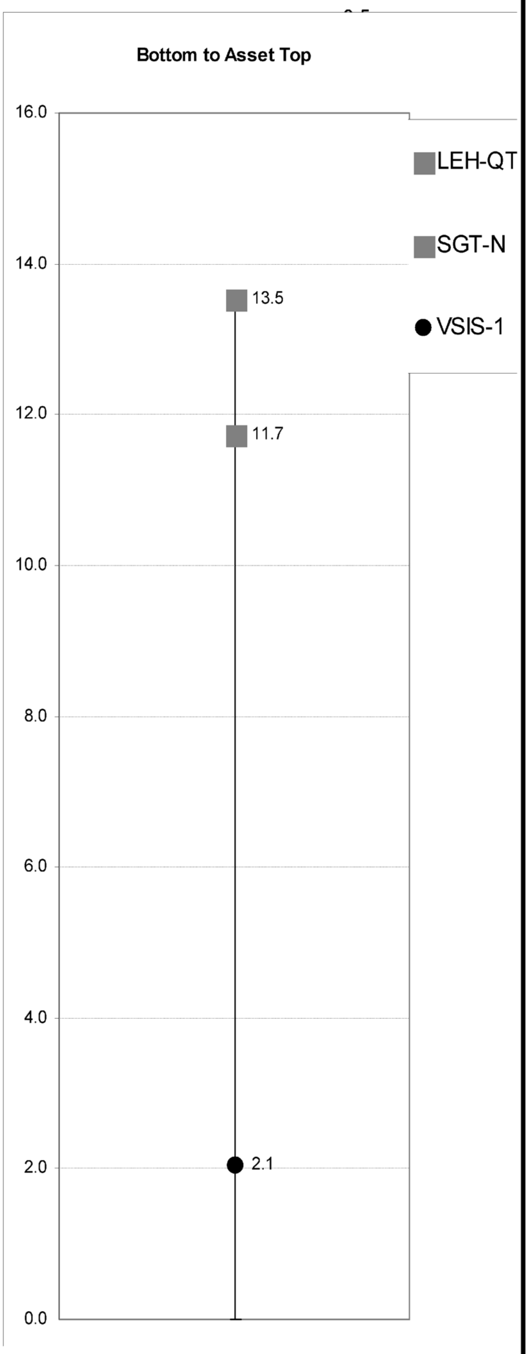
Meas. Tie Depth 0 m
True Vert. Tie Depth 0 m

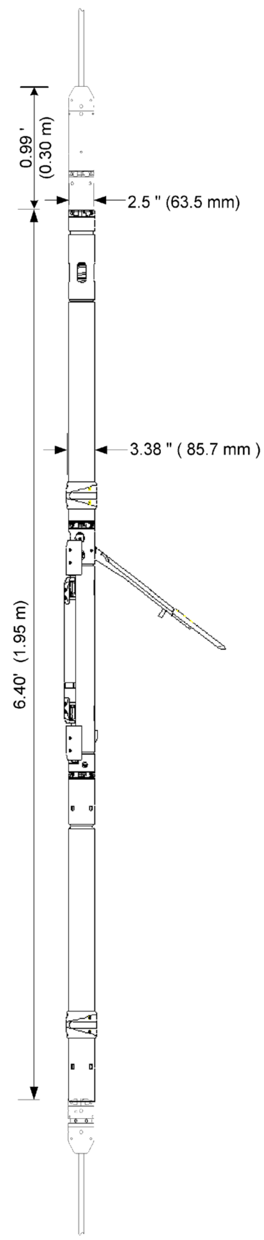
| Measured Depth | Deviation | Azimuth | True Vertical Depth |
|---|---|---|---|
| (m) | (deg) | (deg) | (m) |
| 0 | 0 | 42.4 | |
| 56.6 | 0.32 | 42.4 | 56.6 |
| 86 | 0.4 | 58.77 | 86 |
| 116 | 0.16 | 49.65 | 116 |
| 146 | 0.22 | 140.89 | 146 |
| 176 | 0.2 | 143.8 | 176 |
| 206 | 0.29 | 131.05 | 206 |
| 236 | 0.2 | 133.86 | 236 |
| 266 | 0.16 | 125.76 | 266 |
| 296 | 0.18 | 137.36 | 296 |
| 326 | 0.23 | 161.17 | 326 |
| 356 | 0.19 | 163.93 | 356 |
| 386 | 0.25 | 157.87 | 386 |
| 416 | 0.57 | 139.71 | 416 |
| 446 | 0.74 | 141.47 | 445.99 |
| 476 | 0.74 | 172.45 | 475.99 |
| 506 | 0.56 | 207.56 | 505.99 |
| 536 | 0.65 | 297.54 | 535.99 |
| 566 | 1.02 | 289.46 | 565.98 |
| 596 | 0.83 | 277.69 | 595.98 |
| 626 | 0.67 | 273.3 | 625.98 |
| 656 | 0.6 | 266.84 | 655.98 |
| 686 | 0.61 | 241.78 | 685.97 |
| 716 | 0.45 | 250.69 | 715.97 |
| 746 | 0.57 | 256.13 | 745.97 |
| 776 | 0.48 | 231.83 | 775.97 |
| 806 | 0.45 | 200.43 | 805.97 |
| 836 | 0.54 | 203.88 | 835.97 |
| 862 | 0.48 | 210.12 | 861.97 |
| 893.68 | 0.54 | 245.83 | 893.65 |
| 903.56 | 0.58 | 248.38 | 903.53 |
| 932.7 | 0.44 | 234.88 | 932.66 |
| 990.76 | 0.26 | 175.81 | 990.72 |
| 1019.54 | 0.54 | 193.35 | 1019.5 |
| 1077.81 | 0.29 | 221.48 | 1077.77 |
| 1106.72 | 0.64 | 350.02 | 1106.68 |
| 1135.67 | 0.46 | 115.12 | 1135.63 |
| 1164.4 | 0.42 | 197.79 | 1164.36 |
| 1193.4 | 0.56 | 294.34 | 1193.36 |
| 1222.23 | 0.52 | 28.54 | 1222.19 |
| 1251.36 | 0.39 | 119.27 | 1251.32 |
| 1280.3 | 0.08 | 24.79 | 1280.25 |
| 1309.52 | 0.33 | 150.56 | 1309.47 |
| 1338.44 | 0.08 | 121.48 | 1338.39 |

| | | | |
|---|---|---|---|
| 1367.65 | 0.04 | 86.18 | 1367.6 |
| 1396.59 | 0.14 | 13.59 | 1396.54 |
| 1425.61 | 0.09 | 247.14 | 1425.56 |
| 1454.63 | 0.09 | 239.09 | 1454.58 |
| 1483.6 | 0.09 | 326.47 | 1483.55 |
| 1514.78 | 0.1 | 321.13 | 1514.73 |
| 1543.88 | 0.18 | 23.57 | 1543.83 |
| 1572.78 | 0.82 | 223.85 | 1572.73 |
| 1601.76 | 0.56 | 79.58 | 1601.71 |
| 1630.85 | 0.6 | 199.29 | 1630.8 |
| 1659.81 | 0.43 | 51.27 | 1659.76 |
| 1688.9 | 0.44 | 182.95 | 1688.85 |
| 1717.84 | 0.53 | 41.23 | 1717.79 |
| 1747 | 0.28 | 169.79 | 1746.95 |
| 1775.86 | 0.35 | 77.1 | 1775.81 |
| 1805.05 | 0.55 | 290.44 | 1804.99 |
| 1833.85 | 0.32 | 60.02 | 1833.79 |
| 1862.83 | 0.15 | 246.3 | 1862.77 |
| 1891.75 | 0.15 | 134.08 | 1891.69 |
| 1920.75 | 0.17 | 272.78 | 1920.69 |
| 1949.87 | 0.35 | 186.88 | 1949.81 |
| 1978.84 | 0.26 | 160.55 | 1978.78 |
| 2007.56 | 0.14 | 204.19 | 2007.5 |
| 2037 | 0.39 | 15.84 | 2036.94 |
| 2065.85 | 0.37 | 104.82 | 2065.79 |
| 2094.68 | 0.27 | 193.57 | 2094.62 |
| 2122.77 | 0.23 | 27.7 | 2122.71 |
| 2152.72 | 0.24 | 123.57 | 2152.66 |
| 2181.64 | 0.12 | 259.28 | 2181.58 |
| 2210.42 | 0.35 | 284.9 | 2210.36 |
| 2268.77 | 0.26 | 338.68 | 2268.71 |
| 2297.54 | 0.37 | 75.8 | 2297.48 |
| 2326.44 | 0.35 | 145.23 | 2326.38 |
| 2355.51 | 0.3 | 319.01 | 2355.45 |
| 2384.59 | 0.39 | 241.02 | 2384.53 |
| 2413.62 | 0.87 | 2.44 | 2413.55 |
| 2442.55 | 1.34 | 312.94 | 2442.48 |
| 2471.71 | 0.99 | 325 | 2471.63 |
| 2500.45 | 0.06 | 8.13 | 2500.37 |
| 2529.61 | 0.38 | 274.63 | 2529.53 |
| 2558.55 | 0.4 | 283.44 | 2558.47 |
| 2587.37 | 0.4 | 333.57 | 2587.29 |
| 2616.44 | 0.18 | 272.94 | 2616.36 |
| 2644.58 | 0.03 | 300.03 | 2644.5 |
| 2678 | 0.06 | 123.22 | 2677.92 |

# Tool Sketch

| | meter |
|---|---|
| LEH-QT | 0.89 |
| DTC-H | 0.91 |
| HGNS-B | 2.87 |
| AH199 | 0.31 |
| VSPC-BA | 3.22 |
| VSCC-BB | 3.18 |
| AH-244 | 0.11 |
| VSIS-1 | 1.95 |
| VSIA | 0.10 |
| **TOTAL** | **13.54** |



## Downhole Equipment Information

| | |
|---|---|
| **Tool Type** | VSIT |
| **Surface Equipment** | WASM-AB #838, WSI-A #966 |
| **Combined Tool** | DTC-H #8715, HGNS-H #3747, AH-199 #31722 |
| **Number of Shuttles** | 1 |
| **Nominal Receiver Spacing** | N/A |
| **Gimbaled (Y/N)** | No |
| **Downhole Geophone Type** | GAC-D 3-axis orthogonal |
| **Sensitivity** | 0.5 V/G 3% |
| **Natural Frequency** | 20 Hz |
| **Damping Factor** | N/A |
| **DC Resistance** | 1500 Ohms 3% @25 degC |
| **Measurement Specification** | |
| **Dynamic range** | > 105 dB at 36 dB |
| **Distortion** | < -90 dB |
| **Analog Low-Cut filter** | 0.3 Hz, -6 dB/Oct |
| **Digital Low-Cut filter** | None |
| **DC Offset removal** | Averaging by surface software |
| **Digital High-Cut filter** | Linear phase at down hole |
| **Pass band ripple** | +- 0.01 dB |
| **Stop band attenuation** | < -130 dB |
| **Bandwidth** | 80% of Nyquist frequency |
| **Test Signal harmonic distortion** | < -110 dB |
| **Tool SN** | |
| **VSPC-BA** | 8074 |
| **VSCC-BB** | 8074 |
| **AH-244** | 8071 |
| **Receiver #1 (VSIS-CA)** | 8312 |
| **VSIA** | 8086 |

**Remarks**

**VSI run with one shuttle directly connected to the cartridge with AH-244 adaptor.**

| DATE | Time Start | Time Taken Hr : min | OPERATION |
|---|---|---|---|
| 19-Sep-05 | 09:45 | 00:45 | Rig Up VSI |
| | 10:30 | 00:10 | Surface Check VSI |
| | 10:40 | 00:35 | RIH in hole to 763 M |
| | 11:15 | 01:00 | VSI at 763 M, perform checkshot for system check |
| | 12:15 | 00:15 | VSI at TD, commence GR correlation |
| | 12:30 | 00:05 | GR correlation completed run back to TD |
| | 12:35 | 00:55 | VSI at TD commence Checkshots |
| | 13:30 | 00:45 | VSI at 763 M, POOH |
| | 14:15 | 00:45 | VSI at surface, commence rig down of VSI |
| | 15:00 | | Rig down completed well released |
| | | **5:15** | **HRS –TOTAL OPERATING TIME** |

## General Information

| | |
|---|---|
| **Survey Type** | Zero Offset VSP |
| **Surface Recording Length** | 1000.0 ms |
| **Suface Sampling Rate** | 1.0 ms |
| **Downhole Recording Length** | 5000.0 ms |
| **Downhole Sampling Rate** | 1.0 ms |
| **Top of Survey** | 762.9 m |
| **Bottom of Survey** | 2500.0 m |
| **Number of Shots** | 69 |
| **Number of Downhole Traces** | 69 |
| **Number of Downhole Traces used for Processing** | 44 |

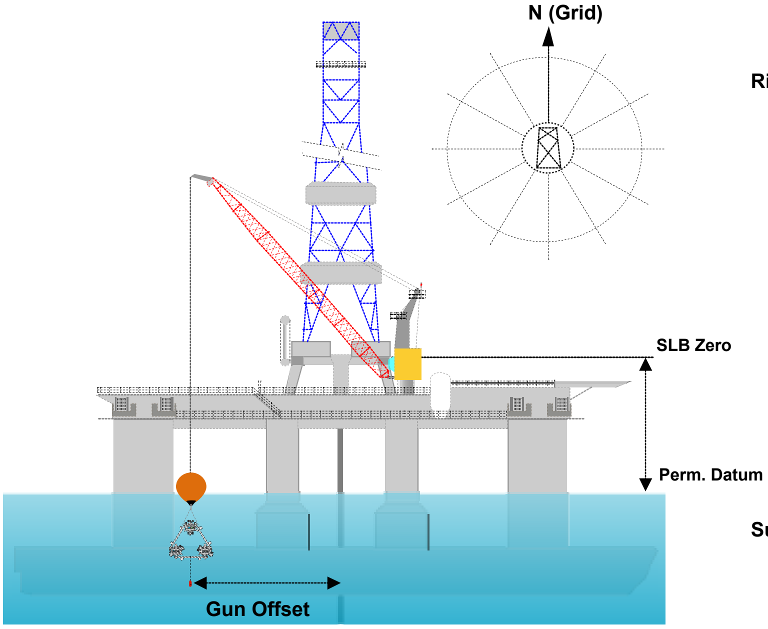
# Borehole Seismic Source Information

**Engineer:** R.Clark/D.Molokhov
**Well Name:** North Wirrah-1 **Date:** 19-Sep-2005
**Rig:** ENSCO 102

**<Geometrical Coordinates>** **Longitude:** 147 50' 20.683" E **Latitude:** 38 10' 57.074" S
**<UTM Coordinates>** **Easting:** 573,486.52 M **Northing:** 5,773,600.98 M

**Permanent Datum:** MSL
**Log Measured From:** DF **Elev.** 39.2 **Unit :** m

**SRD (Seismic Reference Datum):** MSL **Elev.** 0.0 **from SLB zero:** 39.2 (SRDS)
**Water Depth:** 52.8




**RIG Heading:** 135.0 deg
**Rig Crane used:** ✔ Port side ☐ Starboard side
**Rig Crane azimuth** (from Rig Heading): 90.0 deg

**Gun Azimuth (Grid North):** 90.0 deg (GAZI)

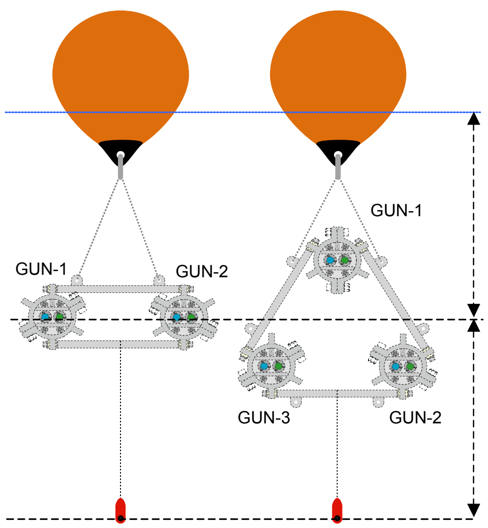
**Hy1 Azimuth (Grid North):** 90.0 deg
**Hy2 Azimuth (Grid North):** 90.0 deg
**Hy3 Azimuth (Grid North):** deg

**Gun Offset:** 45.0 (GOFF)

**Hydrophone-1 Offset:** 45.0
**Hydrophone-2 Offset:** 45.0
**Hydrophone-3 Offset:**

**Surface Velocity:** 1524 m/s (SVEL)

**Cluster Gun Type:**
✔ **WSGC-P90** ☐ **WSGC-T90**




**Gun Type:**
✔ **WSG-G150** **(G-Gun 150cu.inch)**
☐ **WSG-G250** **(G-Gun 250cu.inch)**

**GUN-1 sn:** 371663
**GUN-2 sn:** 371646
**GUN-3 sn:**

**Gun Depth from Local Tide** 3.0
**Gun Depth from SLB** 42.2 (GDSZ)

**Hydrophone 1 Type:** MP-24L3 (10Hz)
**Hydrophone 2 Type:** MP-24L3 (10Hz)
**Hydrophone 3 Type:** none

| | | |
|---|---|---|
| **Hy 1 Depth from Gun** 5.0 | **Hy 1 Depth from LT** 8.0 | **Hy 1 Depth from SLB zero** 47.2 |
| **Hy 2 Depth from Gun** 5.0 | **Hy 2 Depth from LT** 8.0 | **Hy 2 Depth from SLB zero** 47.2 |
| **Hy 3 Depth from Gun** | **Hy 3 Depth from LT** | **Hy 3 Depth from SLB zero** |

**Air Gun Firing Pressure:** 1800 psi **Accumulator Pressure (Inlet pressure):** 4000 psi

**Source of Air supply:** N2 Gas Bottle Racks
**Air Controller (Regulator) Type:** WAP-SS01 **sn:** VEA001

## Sea Condition

**Sea Condition:** Slight **Wave Height:** 0.6
**Low Tide Level:** -0.6 **at** 04:00 19/Sep/05 **Main survey started at** 12:00 19/Sep/05
**High Tide Level:** 0.5 **at** 22:00 19/Sep/05 **ended at** 13:00 19/Sep/05
**Tide Table available:** ✔ **Yes** ☐ **No**

## HSE

**Safe Distance:** 6.3

**Observation of Marine Mammals**
**Marine Mammals sighted in 30 minutes before the survey** ☐ **Yes** ✔ **No**
**Soft-Start implemented:** ✔ **Yes** ☐ **No**

# Borehole Seismic Gun Tuning Information

## Surface Sensor Channels / Gun Controller

**WSAM (WSI)** sn: WSAM:838 / WSI:966

| | Gun No | TB | Hy No | SSPS |
|---|---|---|---|---|
| S1 (WSI-SS2) | 1 | ✔ | 1 | ✔ |
| S2 (WSI-SS3) | | ☐ | | ☐ |
| S3 (WSI-SS4) | | ☐ | | ☐ |
| S4 (WSI-SS5) | | ☐ | | ☐ |
| S5 (WSI-SS6) | | ☐ | | ☐ |
| S6 (WSI-SS7) | 2 | ✔ | 2 | ☐ |

**TGS-8** sn: RL:000000 SL:000000

| | Gun No | TB | Hy No |
|---|---|---|---|
| Ch1 | | ☐ | |
| Ch2 | | ☐ | |
| Ch3 | | ☐ | |
| Ch4 | | ☐ | |
| Ch5 | | ☐ | |
| Ch6 | | ☐ | |
| Sig | | | |
| Aux1 Sig | | | |
| Aux2 Sig | | | |

| | | |
|---|---|---|
| P1 | ☐ Depth S. | ☐ Pres. S. |
| P2 | ☐ Depth S. | ☐ Pres. S. |
| P3 | ☐ Depth S. | ☐ Pres. S. |
| P4 | ☐ Depth S. | ☐ Pres. S. |

## Cluster Gun Tuning / Quality Control

**Tuning Sensor used**
- ✔ Time Break Sensor
- ☐ Hydrophone

| WSI | Gun No | Gun Delay(ms) |
|---|---|---|
| FS1 | 1 | 32.0 |
| FS2 | 2 | 31.0 |
| FS3 | | 0.0 |

| TGS-8 | Gun No | Gun Delay(ms) | Threshold(v) |
|---|---|---|---|
| Ch1 | | 0.0 | 0.5 |
| Ch2 | | 0.0 | 0.5 |
| Ch3 | | 0.0 | 0.5 |
| Ch4 | | 0.0 | 0.0 |
| Ch5 | | 0.0 | 0.0 |
| Ch6 | | 0.0 | 0.0 |

### ClusterTuning (Break Time of Tuning Sensors)

| | FS1 / Ch 1 | FS2 / Ch 2 | FS3 / Ch |
|---|---|---|---|
| Shot-1 | 43.1 | 43.3 | 0.0 |
| Shot-2 | 42.4 | 43.2 | 0.0 |
| Shot-3 | 42.4 | 43.2 | 0.0 |
| Shot-4 | 43.2 | 43.0 | 0.0 |
| Shot-5 | 43.0 | 43.3 | 0.0 |
| Shot-6 | 42.9 | 43.3 | 0.0 |
| Shot-7 | 43.0 | 43.3 | 0.0 |
| Average | 42.9 | 43.3 | 0.0 |

### Quality Check Surface Signals / Filling Time (air Regulator)

| | S1 Time Break / PP | S2 TT(ms) / PP | S3 TT(ms) / PP | S4 TT(ms) / PP | S5 TT(ms) / PP | S6 TT(ms) / PP | Filling Time (sec) |
|---|---|---|---|---|---|---|---|
| Shot-1 | 45.1 / 30955 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 44.9 / 27199 | 10 |
| Shot-2 | 45.2 / 29473 | 0.0 / 0 | 1.0 / 0 | 0.0 / 0 | 0.0 / 0 | 45.0 / 26261 | 10 |
| Shot-3 | 45.2 / 30080 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 45.0 / 27047 | 10 |
| Shot-4 | 45.2 / 28834 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 45.0 / 26631 | 10 |
| Shot-5 | 45.2 / 29935 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 0.0 / 0 | 45.0 / 26794 | 10 |

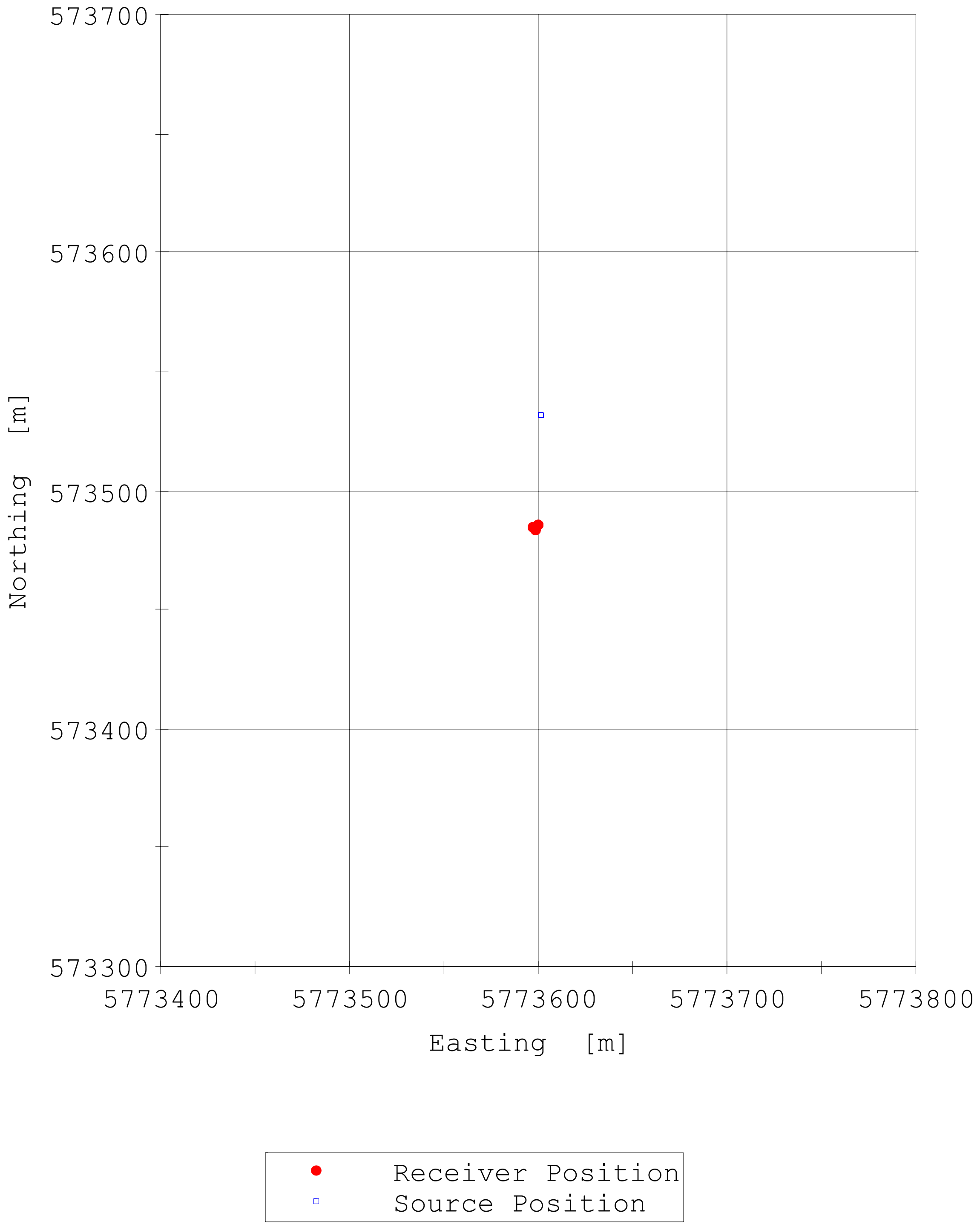
# Other Logs Information

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Sonic Log:** | DSI (P&S-UD) | **Interval:** | **from** | 2,504.0 | **to** | 725.0 | **Date:** | 19/Sep/05 |
| **Density Log:** | <service name> | **Interval:** | **from** | 0.0 | **to** | 0.0 | **Date:** | dd/MMM/yy |

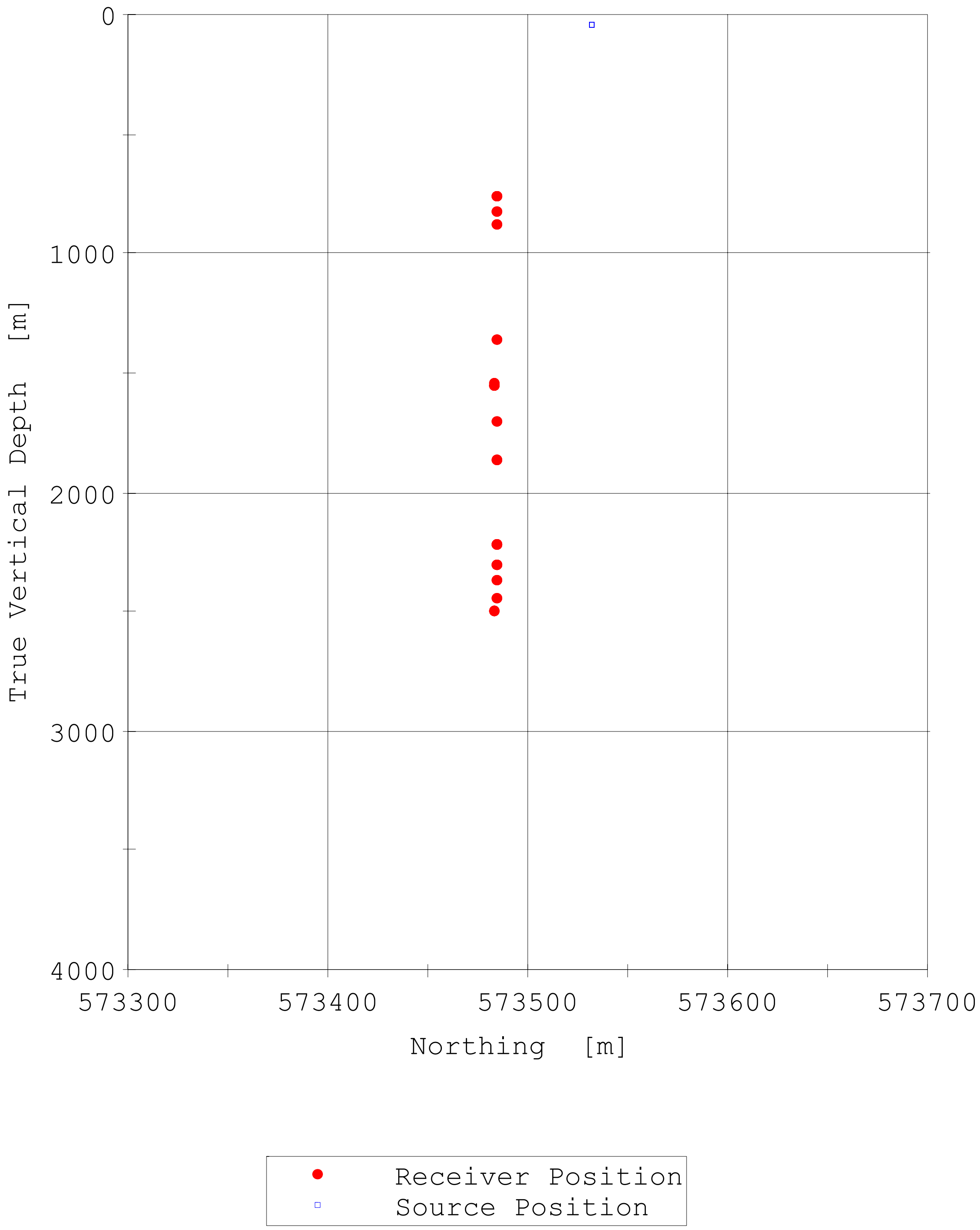
**Remarks**

Ports 2 and 7 of WSI-A 966 module used for tuning the guns with time brake sensors. After tuning being completed, the sensors were unplugged and hydrophones were connected to the same ports. Five quality check surface signals were made with hydrophones at ports 2 and 7.

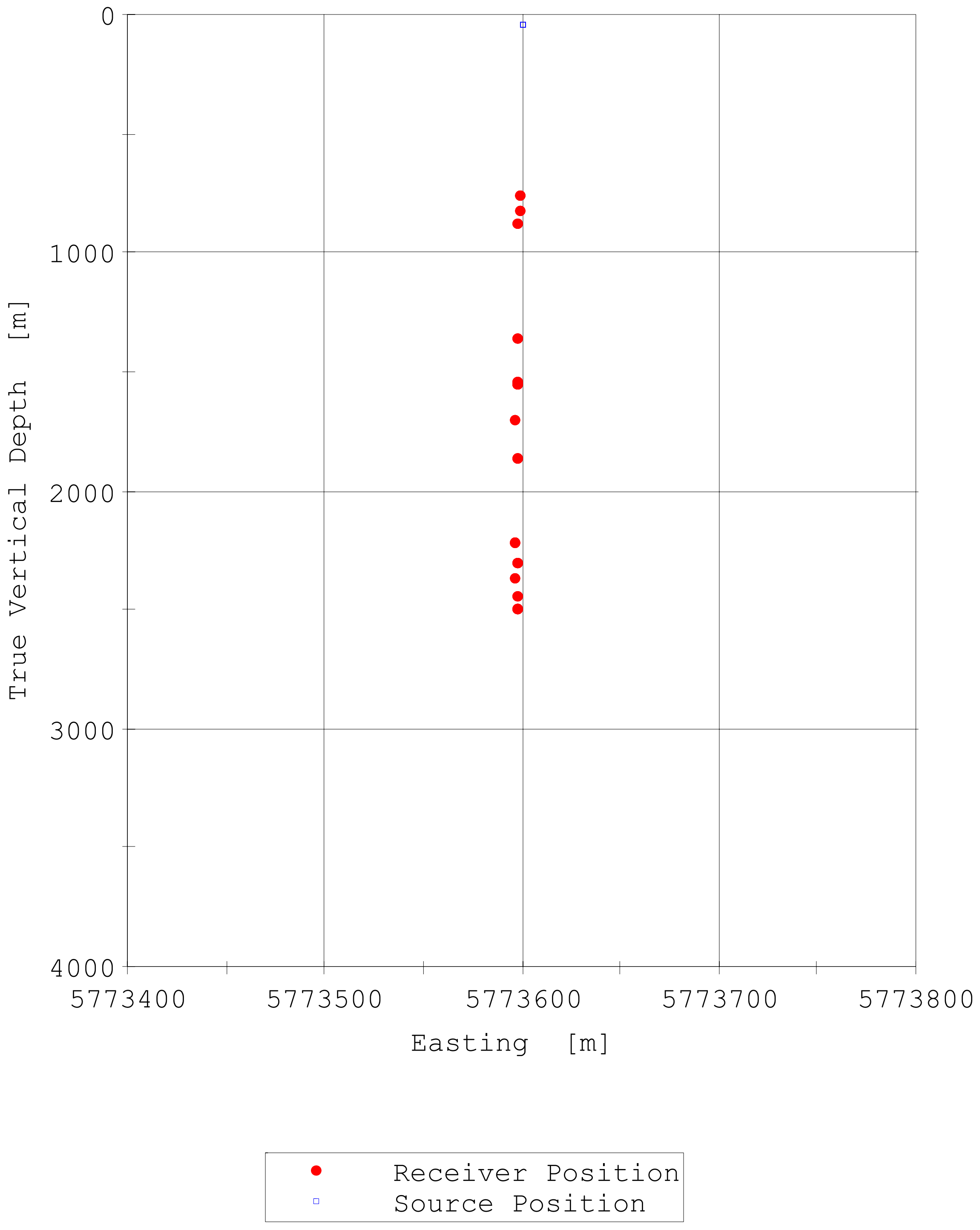
Geometry Infomation Page (X-Y)



## Geometry Infomation Page (X-Z)



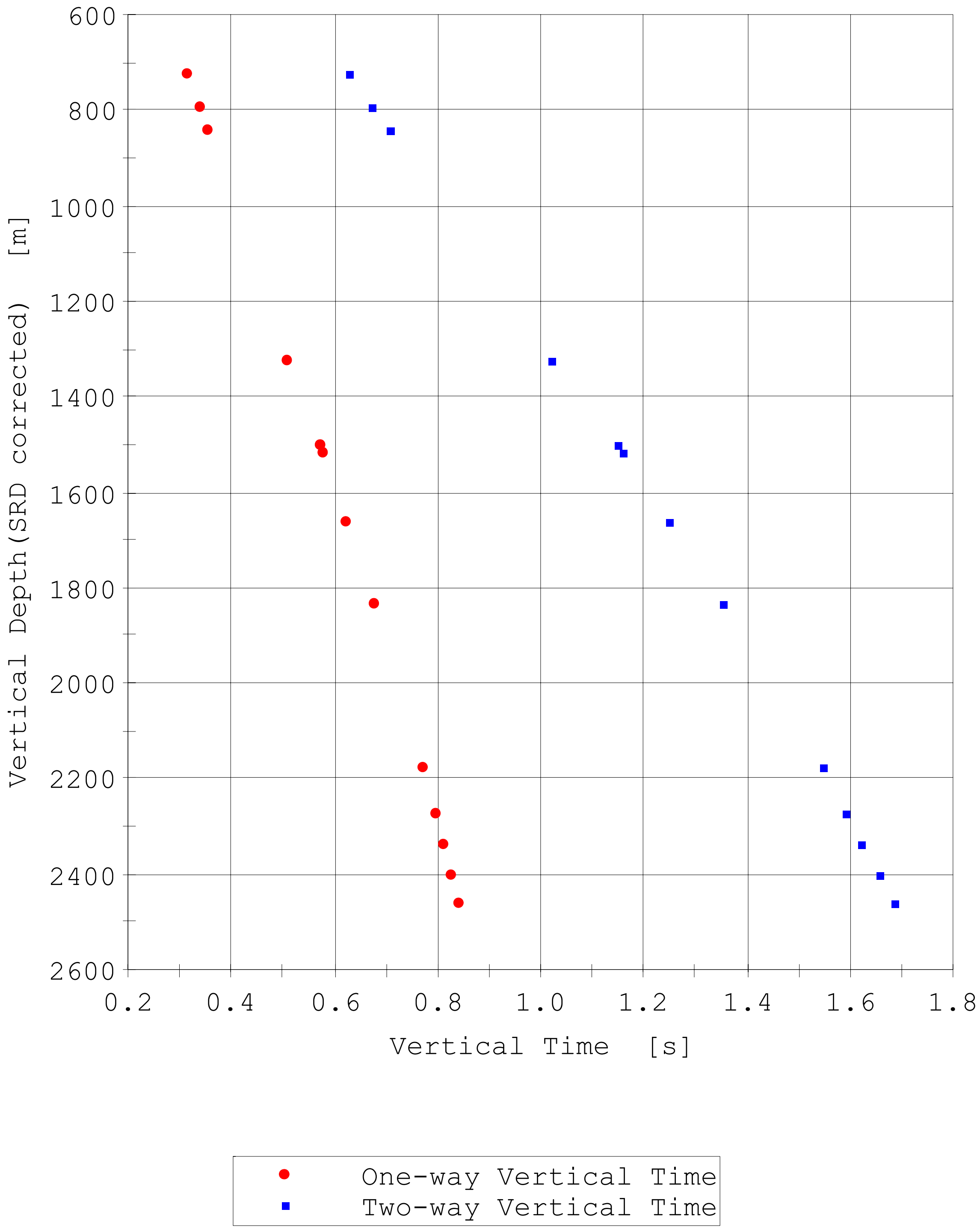
# Geometry Infomation Page (Y-Z)






Schlumberger

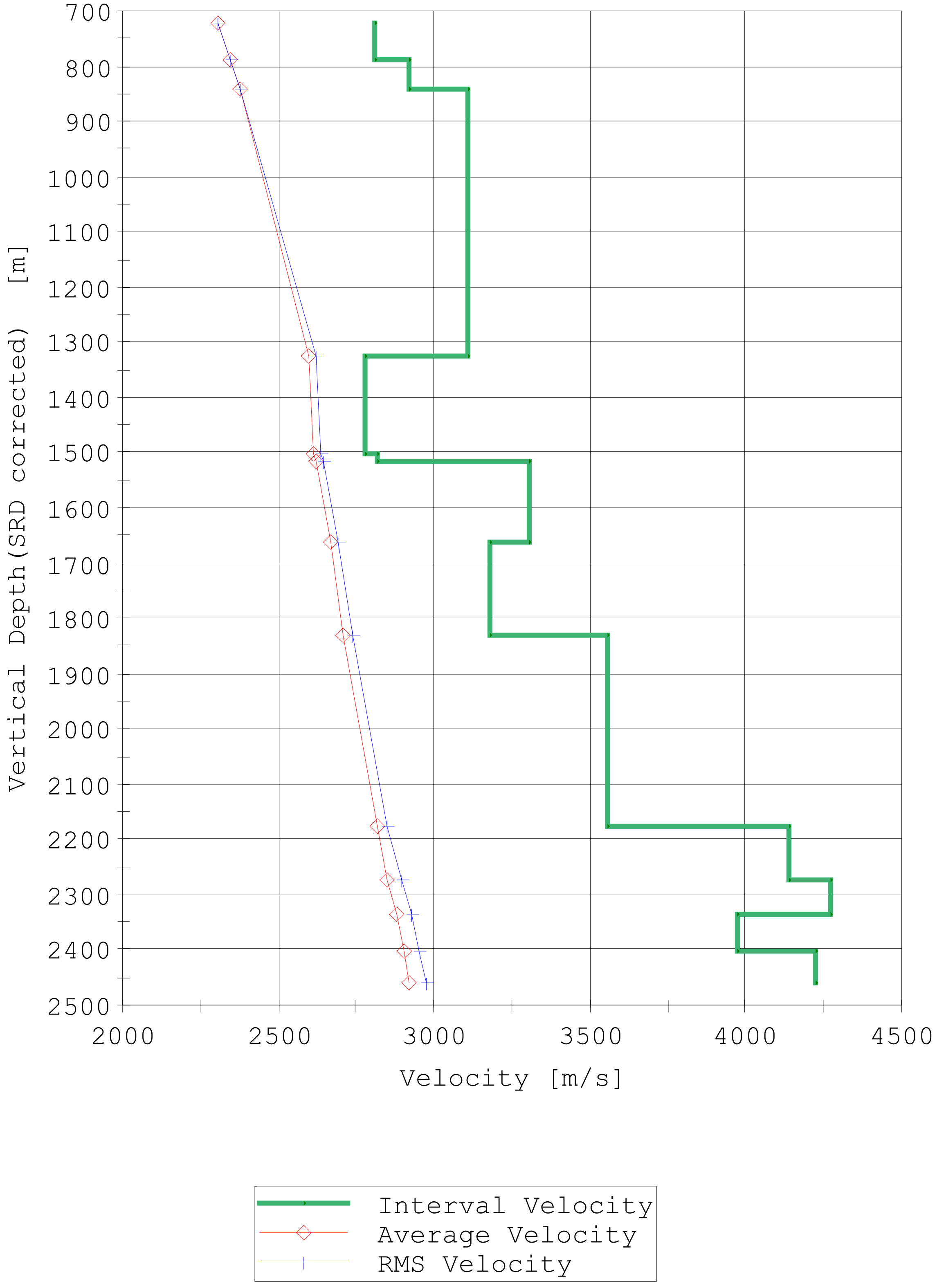
# Time Depth Plot Page






Schlumberger

Velocity Plot Page



## Stack Summary Listing (1/1) from VSI_004_A_geo_wavefield_z.ldf

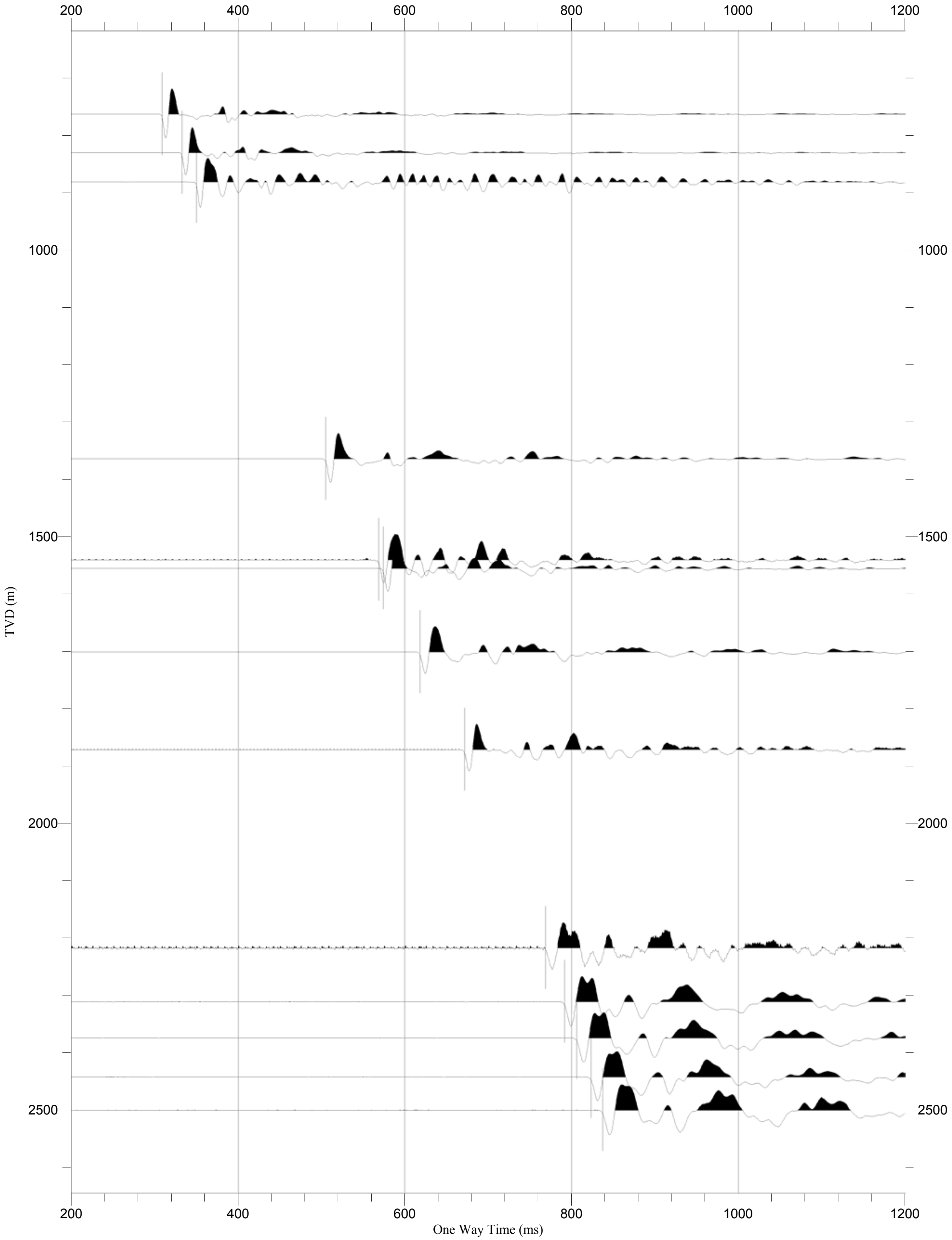
| Stack Number ACQUISITION_ SHOT_ NUMBER | Measured Depth [m] CABLE_ LENGTH | True Vertical Depth [m] RECEIVER_ CORRECTION_ Z | Measured Time [s] TRANSIT_ TIME | One-way Vertical Time [s] TRANSIT_ TIME_SRD | Two-way Vertical Time [s] TRANSIT_ TIME_ INITIAL | Interval Velocity [m/s] VELOCITY_ 1 | Average Velocity [m/s] VELOCITY_ 2 | RMS Velocity [m/s] VELOCITY_ 3 |
|---|---|---|---|---|---|---|---|---|
| | 0 | 0 | 0 | 0 | 0 | | | |
| | | | | | | 2309.8 | | |
| 16 | 762.9 | 723.7 | 0.3087 | 0.3133 | 0.6267 | | 2309.8 | 2309.8 |
| | | | | | | 2809.7 | | |
| 15 | 830.0 | 790.8 | 0.3325 | 0.3372 | 0.6744 | | 2345.1 | 2348.6 |
| | | | | | | 2920.5 | | |
| 14 | 880.9 | 841.7 | 0.3499 | 0.3546 | 0.7093 | | 2373.4 | 2380.0 |
| | | | | | | 3106.1 | | |
| 13 | 1364.0 | 1324.7 | 0.5052 | 0.5101 | 1.0203 | | 2596.8 | 2622.7 |
| | | | | | | 2776.2 | | |
| 12 | 1540.0 | 1500.7 | 0.5686 | 0.5735 | 1.1471 | | 2616.6 | 2640.1 |
| | | | | | | 2814.4 | | |
| 11 | 1555.0 | 1515.7 | 0.5739 | 0.5789 | 1.1578 | | 2618.4 | 2641.8 |
| | | | | | | 3308.9 | | |
| 10 | 1701.0 | 1661.7 | 0.6180 | 0.6230 | 1.2460 | | 2667.3 | 2694.5 |
| | | | | | | 3177.1 | | |
| 9 | 1871.0 | 1831.8 | 0.6715 | 0.6765 | 1.3530 | | 2707.7 | 2735.7 |
| | | | | | | 3553.5 | | |
| 8 | 2217.0 | 2177.7 | 0.7688 | 0.7739 | 1.5477 | | 2814.1 | 2851.5 |
| | | | | | | 4138.3 | | |
| 7 | 2311.0 | 2271.7 | 0.7915 | 0.7966 | 1.5932 | | 2851.8 | 2896.2 |
| | | | | | | 4269.7 | | |
| 6 | 2374.0 | 2334.7 | 0.8063 | 0.8113 | 1.6227 | | 2877.6 | 2926.9 |
| | | | | | | 3969.4 | | |
| 5 | 2442.0 | 2402.7 | 0.8234 | 0.8285 | 1.6569 | | 2900.2 | 2952.2 |
| | | | | | | 4228.1 | | |
| 4 | 2500.0 | 2460.7 | 0.8371 | 0.8422 | 1.6844 | | 2921.8 | 2977.4 |
| | | | | | | | | |

## Shot Summary Listing (1/1)

| Measured Depth [m] | Tool Number | Stack Number | Relative Bearing [deg] | Caliper [in] | Anchoring force [kg] | Shot number |
|---|---|---|---|---|---|---|
| 762.9 | 1 | 16 | 10.0 | 9.6 | 749.6 | 83, 84, 85, 86 |
| 830.0 | 1 | 15 | 10.0 | 9.5 | 726.1 | 79, 80, 81, 82 |
| 880.9 | 1 | 14 | 8.3 | 11.6 | 712.4 | 76, 77, 78 |
| 1364.0 | 1 | 13 | 2.3 | 9.7 | 814.3 | 73, 74, 75 |
| 1540.0 | 1 | 12 | -11.7 | 10.8 | 756.7 | 70, 71, 72 |
| 1555.0 | 1 | 11 | -7.5 | 9.9 | 774.9 | 67, 68, 69 |
| 1701.0 | 1 | 10 | 5.0 | 10.3 | 778.3 | 64, 65, 66 |
| 1871.0 | 1 | 9 | -6.2 | 9.8 | 743.6 | 61, 62, 63 |
| 2217.0 | 1 | 8 | -10.9 | 9.9 | 739.6 | 53, 56, 58, 60 |
| 2311.0 | 1 | 7 | -22.2 | 9.6 | 712.7 | 50, 51, 52 |
| 2374.0 | 1 | 6 | 10.5 | 9.5 | 718.2 | 47, 48, 49 |
| 2442.0 | 1 | 5 | 9.0 | 9.5 | 701.9 | 44, 45, 46 |
| 2500.0 | 1 | 4 | -15.6 | 9.3 | 717.8 | 39, 40, 41, 42, 43 |

# Field Processing Report

| Raw Stack (Z) | Normalization Trace by Trace (31%)<br>Polarity Normal<br>One Way Time (ms)<br>Scaling 15.2 cm/sec, 1/9570 | |
|---|---|---|





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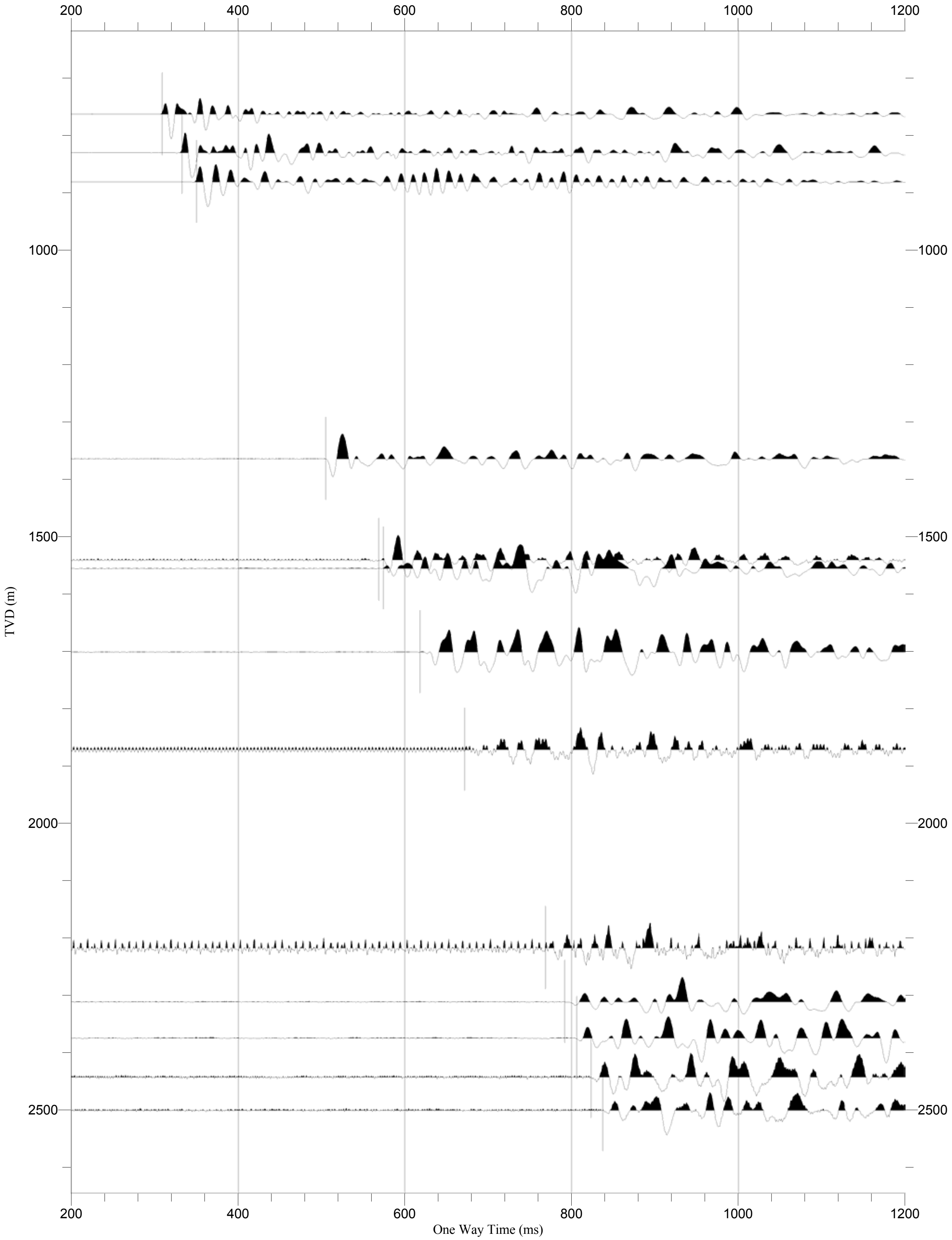
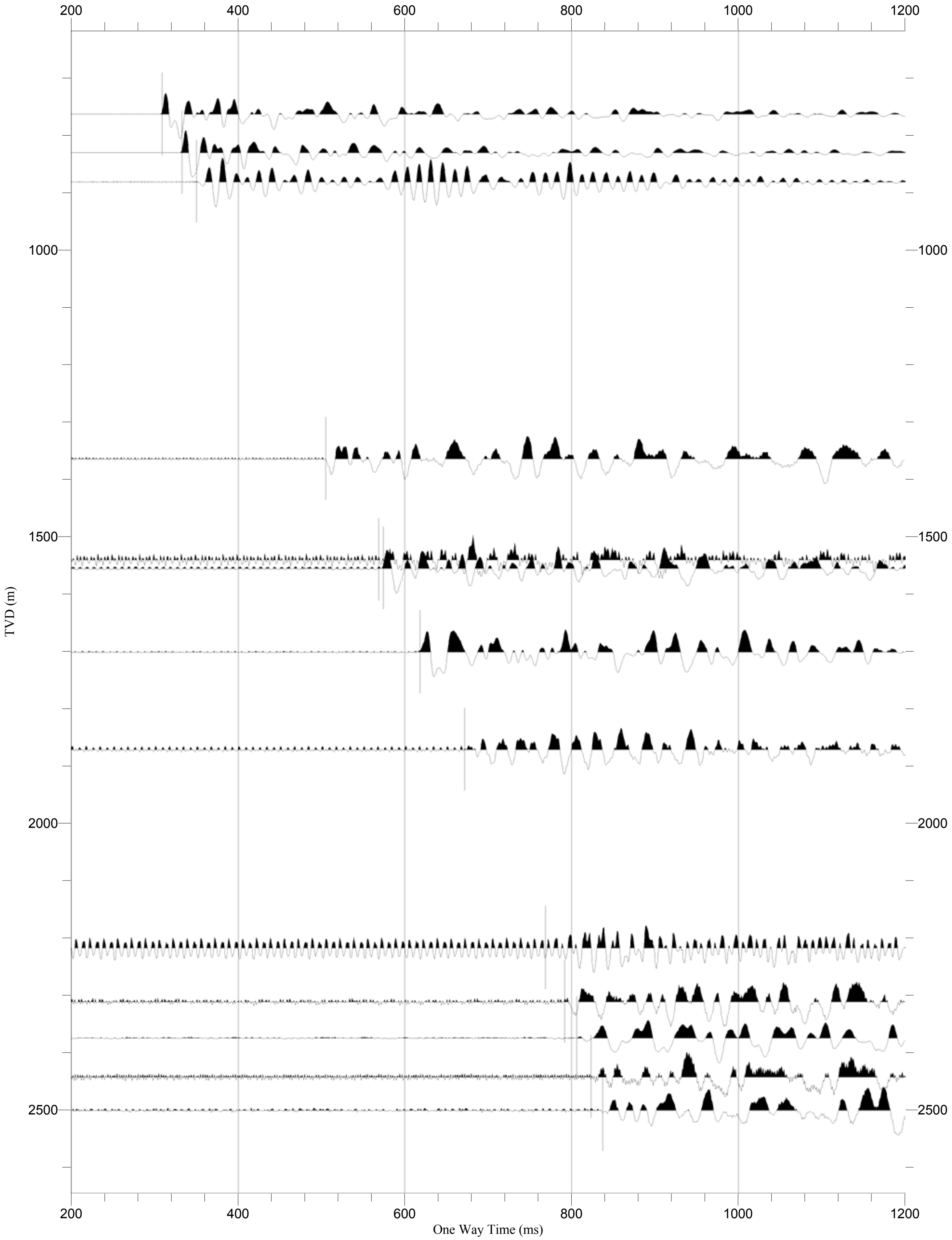
| Raw Stack (X) | Normalization Trace by Trace (30%)<br>Polarity Normal<br>One Way Time (ms)<br>Scaling 15.2 cm/sec, 1/9570 | |
|---|---|---|



| | |
|---|---|
| Raw Stack (Y) | Normalization Trace by Trace (30%)<br>Polarity Normal<br>One Way Time (ms)<br>Scaling 15.2 cm/sec, 1/9570 |



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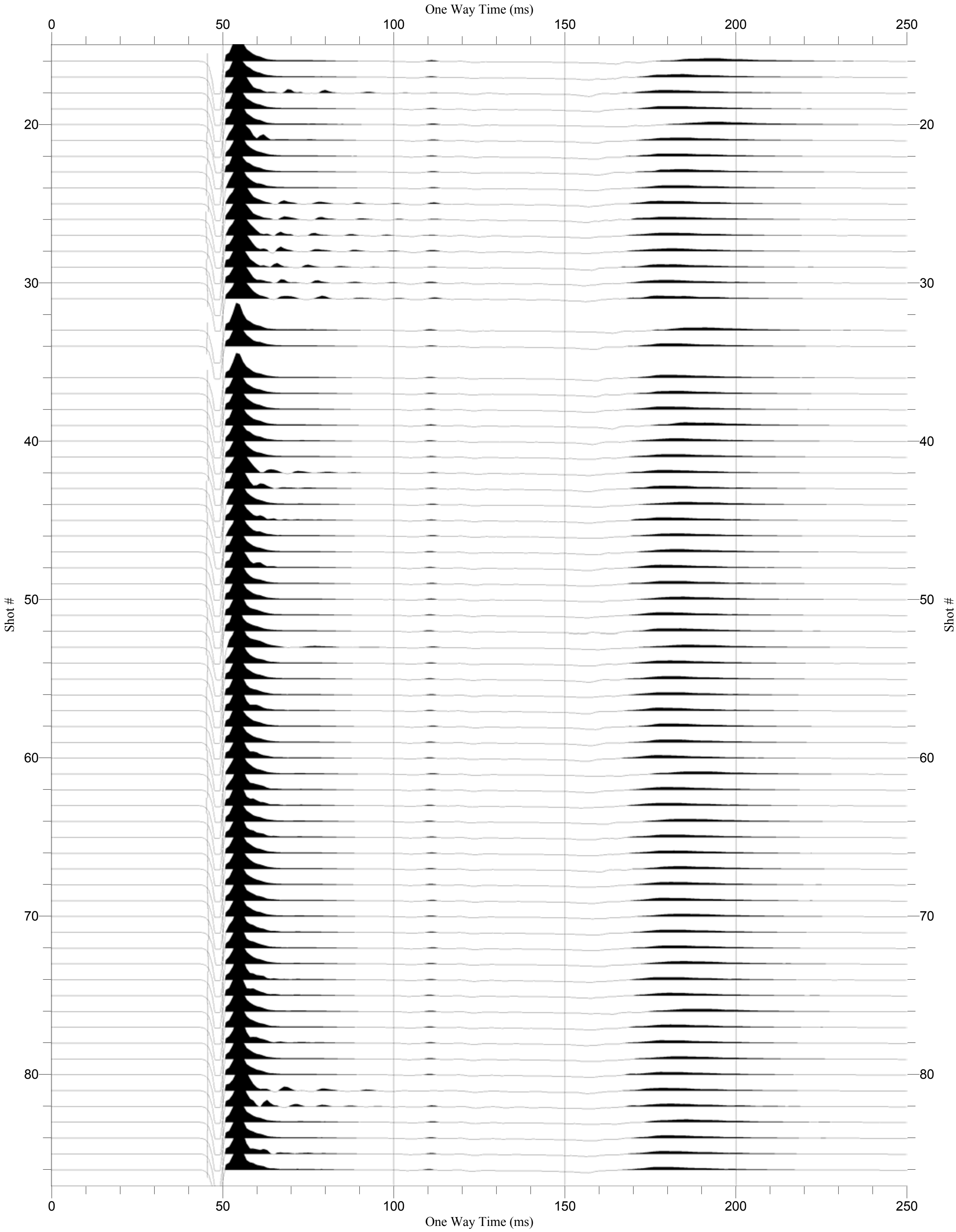
# Source Signature QC Report

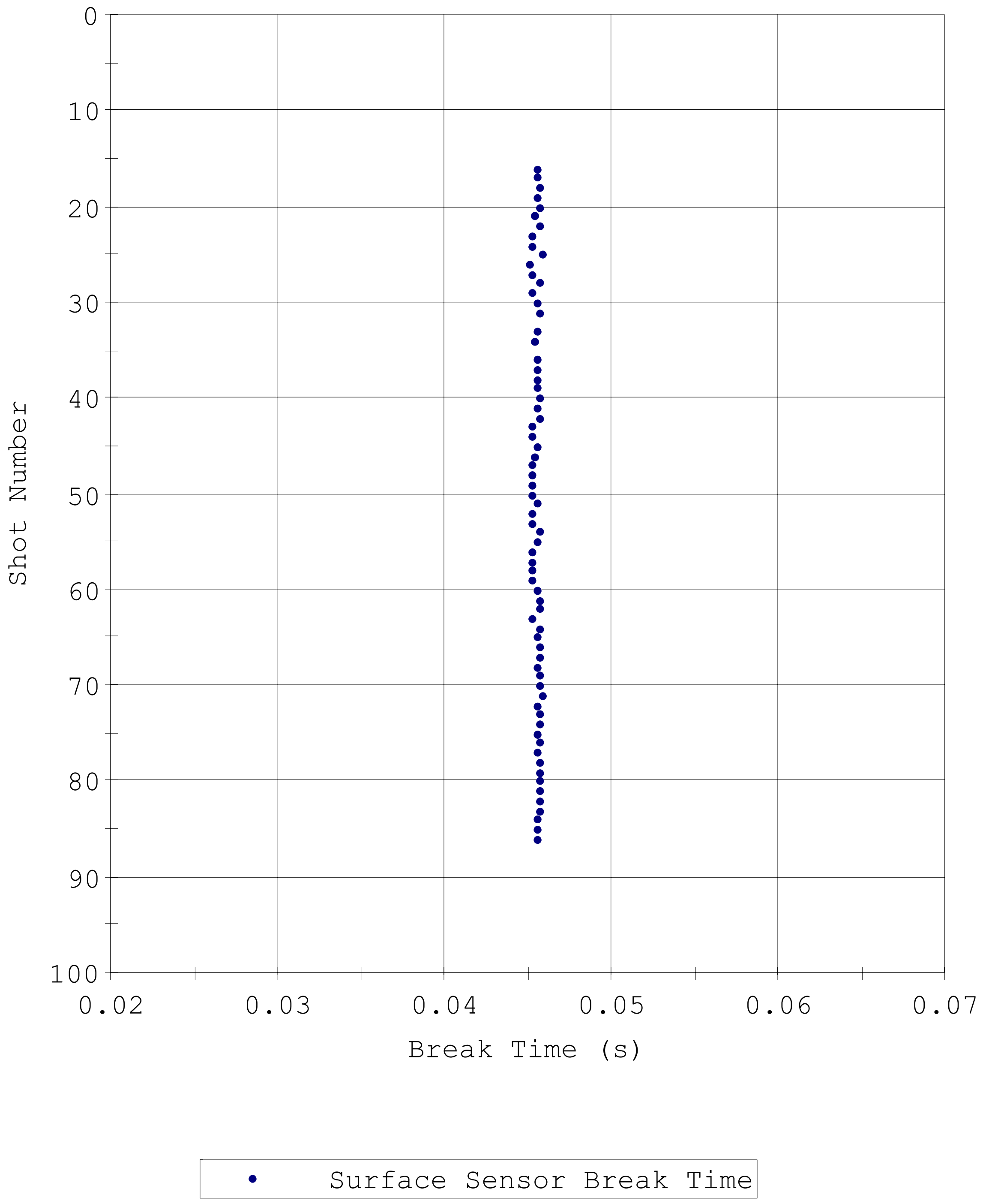
| | |
|---|---|
| Source Sensor Signature | Normalization Largest Trace in Gather (300%)<br>Polarity Normal<br>One Way Time (ms)<br>Scaling 63.47 cm/sec, 0.29/cm |



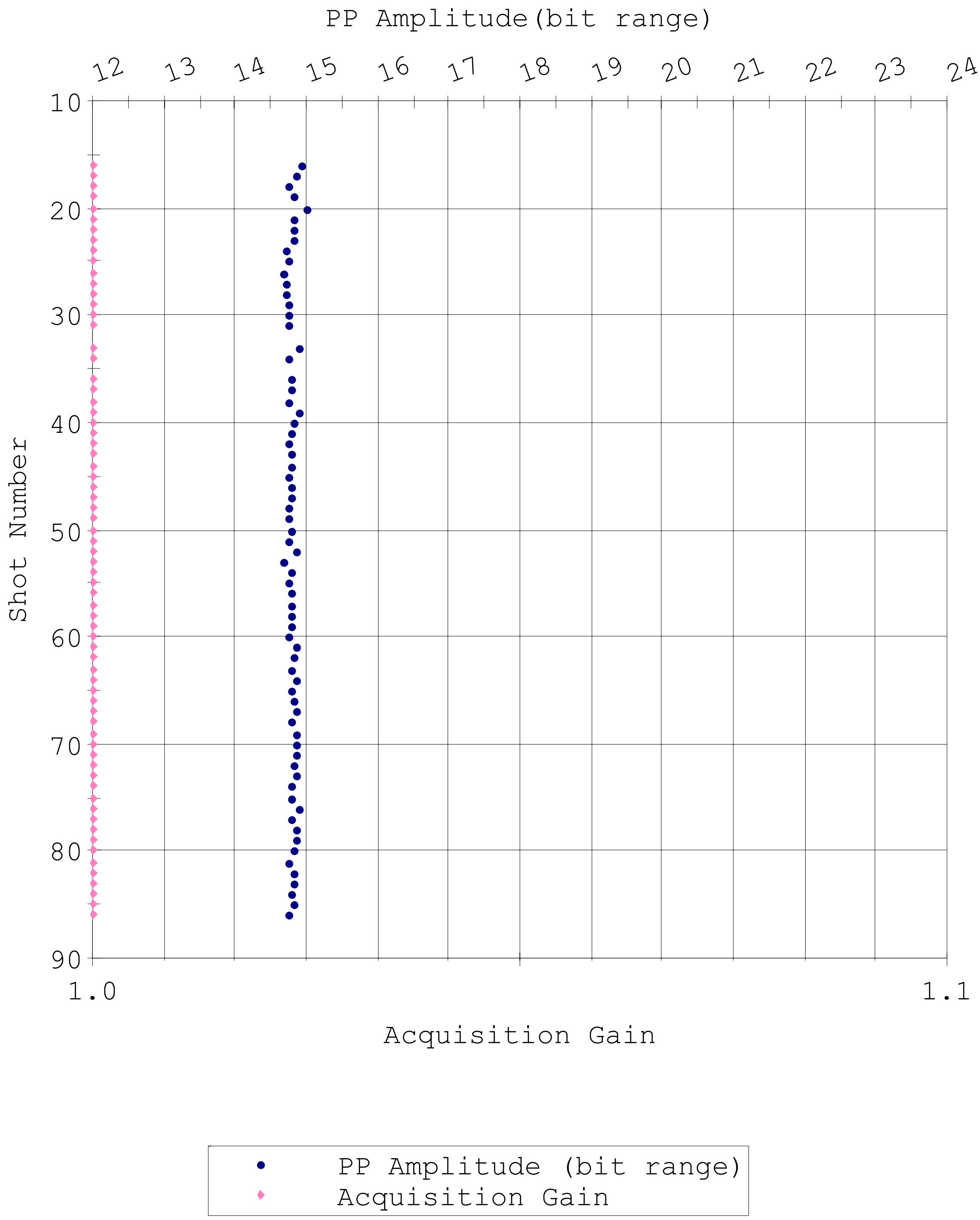


Schlumberger

# Surface Sensor QC Plot Page



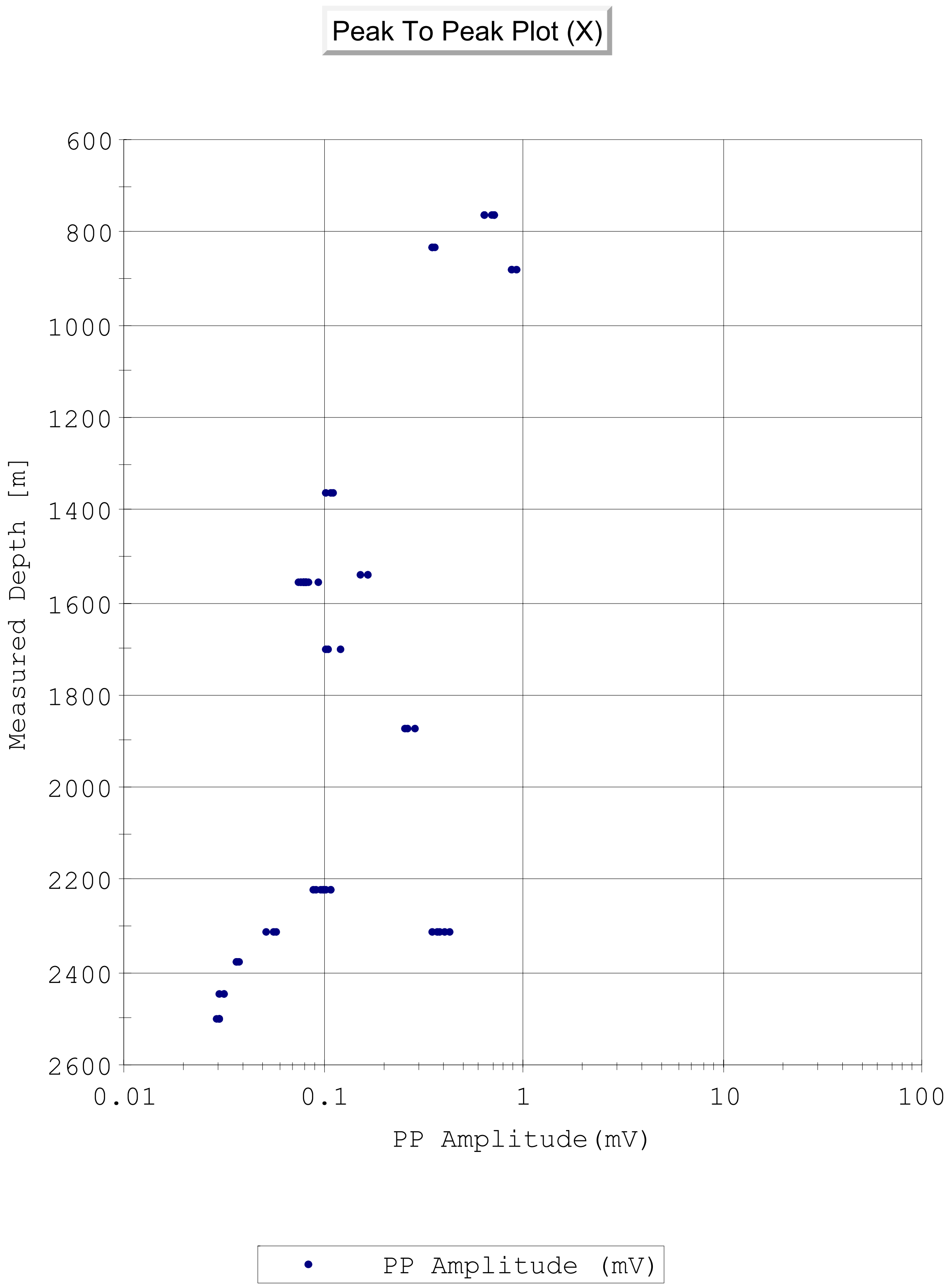
# Amplitude QC Plot (Surface)

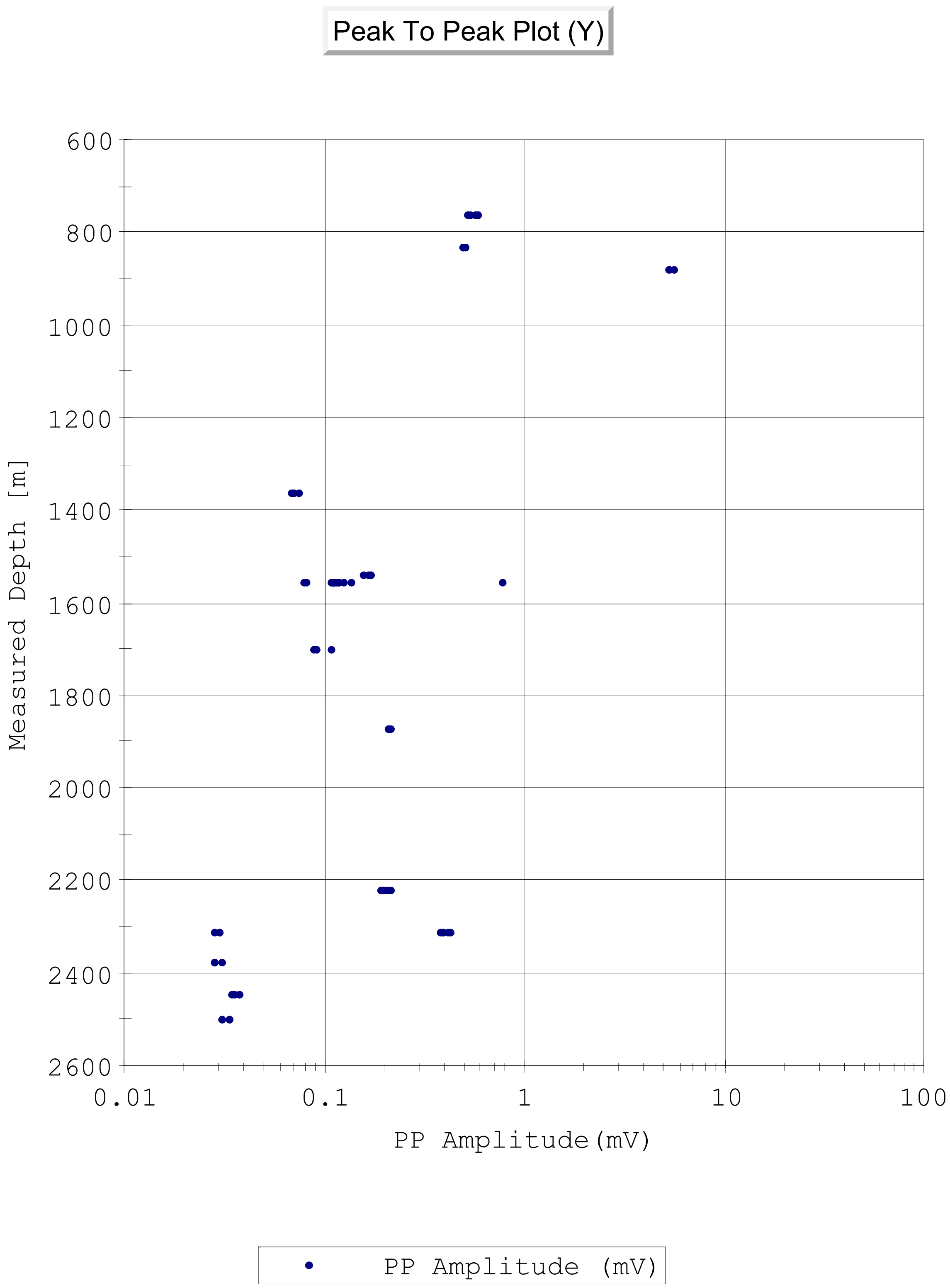





Schlumberger

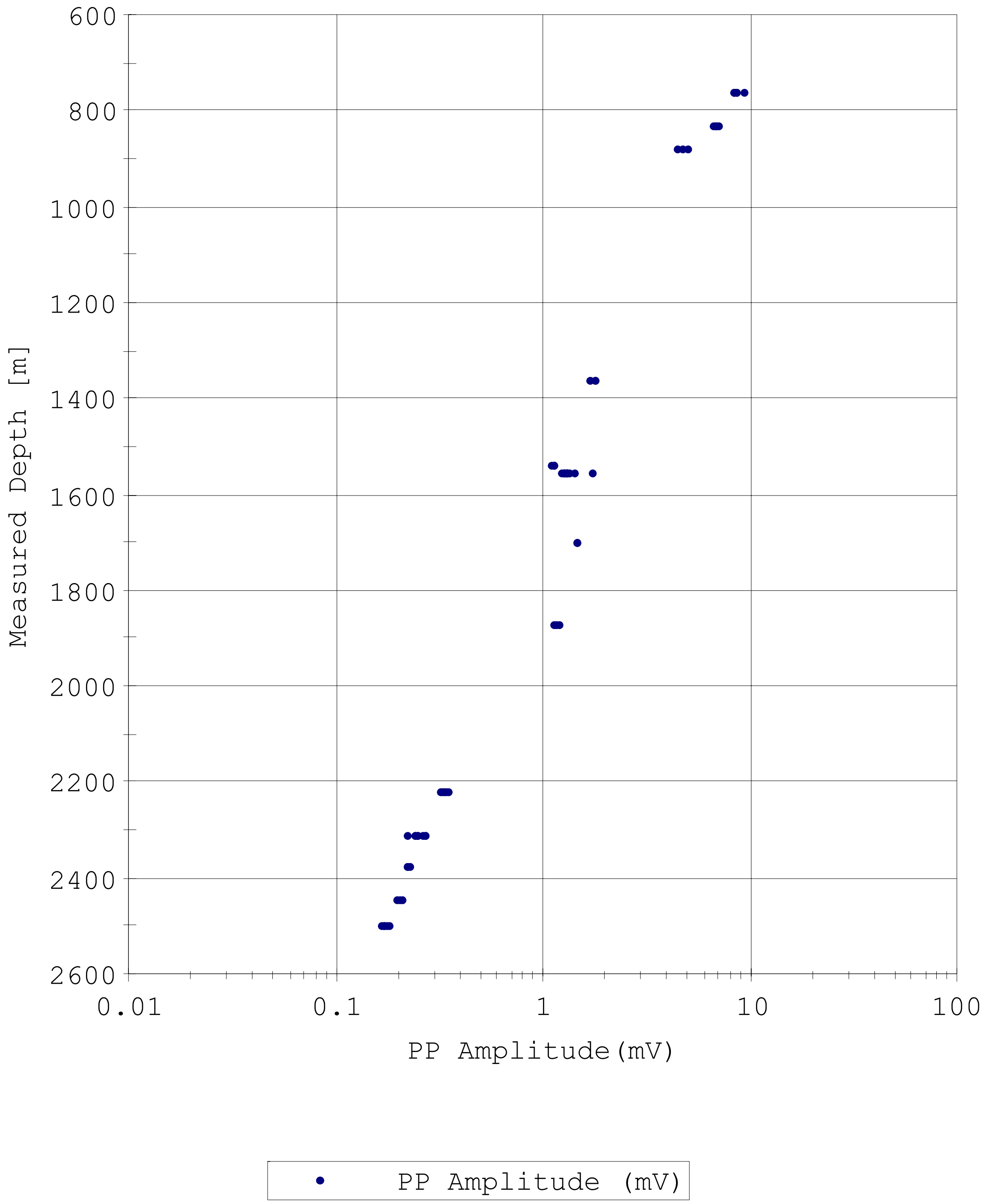
# Amplitude QC Report


Peak To Peak Plot (X)
Measured Depth [m]
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
0.01
0.1
1
10
100
PP Amplitude(mV)
PP Amplitude (mV)



Peak To Peak Plot (Y)
600
800
1000
1200
1400
1600
1800
2000
2200
2400
2600
Measured Depth [m]
0.01
0.1
1
10
100
PP Amplitude(mV)
PP Amplitude (mV)

# Peak To Peak Plot (Z)



# Shot and Observer Report

## Observer's Note (1/2)

| Well depth [m] | Time | Shot Type | Shot# | Stack# | Source | Remarks |
|---|---|---|---|---|---|---|
| 762.9 | 10:35:54 | ENLO | 1 | | | |
| 762.9 | 10:36:18 | ENHI | 2 | | | |
| 762.9 | 10:36:27 | ETHD | 3 | | | |
| 762.9 | 10:36:41 | DRNG | 4 | | | |
| 762.9 | 10:36:55 | GA02 | 5 | | | |
| 762.9 | 10:37:04 | GA04 | 6 | | | |
| 762.9 | 10:37:14 | GA08 | 7 | | | |
| 762.9 | 10:37:24 | GA16 | 8 | | | |
| 762.9 | 10:37:34 | GA32 | 9 | | | |
| 762.9 | 10:37:48 | XTLK | 10 | | | |
| 762.9 | 10:38:07 | XTLK | 11 | | | |
| 762.9 | 10:38:25 | XTLK | 12 | | | |
| 762.9 | 10:38:43 | EIMP | 13 | | | |
| 762.9 | 10:41:05 | BKGD | 14 | | | |
| 762.9 | 10:42:46 | SHOT | 16 | 1 | A | |
| 762.9 | 10:44:44 | SHOT | 17 | 1 | A | |
| 762.9 | 10:44:54 | SHOT | 18 | 1 | A | |
| 762.9 | 10:46:47 | SHOT | 19 | 1 | A | |
| 1555.0 | 11:23:33 | SHOT | 20 | 2 | A | |
| 1555.0 | 11:23:51 | SHOT | 21 | 2 | A | |
| 1555.0 | 11:25:21 | SHOT | 22 | 2 | A | |
| 1555.0 | 11:26:37 | SHOT | 23 | 2 | A | |
| 1555.0 | 11:27:04 | SHOT | 24 | 2 | A | |
| 1555.0 | 11:27:14 | SHOT | 25 | 2 | A | |
| 1555.0 | 11:27:24 | SHOT | 26 | 2 | A | |
| 1555.0 | 11:27:34 | SHOT | 27 | 2 | A | |
| 1555.0 | 11:27:44 | SHOT | 28 | 2 | A | |
| 1555.0 | 11:27:54 | SHOT | 29 | 2 | A | |
| 1555.0 | 11:28:04 | SHOT | 30 | 2 | A | |
| 1555.0 | 11:28:14 | SHOT | 31 | 2 | A | |
| 2311.0 | 11:50:58 | SHOT | 33 | 3 | A | |
| 2311.0 | 11:51:30 | SHOT | 34 | 3 | A | |
| 2311.0 | 11:52:05 | SHAK | 35 | | | |
| 2311.0 | 11:52:40 | SHOT | 36 | 3 | A | |
| 2311.0 | 11:53:58 | SHOT | 37 | 3 | A | |
| 2311.0 | 11:55:01 | SHOT | 38 | 3 | A | |
| 2500.0 | 12:11:44 | SHOT | 39 | 4 | A | |
| 2500.0 | 12:12:31 | SHOT | 40 | 4 | A | |
| 2500.0 | 12:13:13 | SHOT | 41 | 4 | A | |
| 2500.0 | 12:13:28 | SHOT | 42 | 4 | A | |
| 2500.0 | 12:13:46 | SHOT | 43 | 4 | A | |
| 2442.0 | 12:20:31 | SHOT | 44 | 5 | A | |
| 2442.0 | 12:20:56 | SHOT | 45 | 5 | A | |
| 2442.0 | 12:21:27 | SHOT | 46 | 5 | A | |
| 2374.0 | 12:27:01 | SHOT | 47 | 6 | A | |
| 2374.0 | 12:27:24 | SHOT | 48 | 6 | A | |
| 2374.0 | 12:27:53 | SHOT | 49 | 6 | A | |
| 2311.0 | 12:32:27 | SHOT | 50 | 7 | A | |
| 2311.0 | 12:32:52 | SHOT | 51 | 7 | A | |
| 2311.0 | 12:33:19 | SHOT | 52 | 7 | A | |
| 2217.0 | 12:39:21 | SHOT | 53 | 8 | A | |
| 2217.0 | 12:39:57 | SHOT | 54 | 8 | A | |
| 2217.0 | 12:40:35 | SHOT | 55 | 8 | A | |
| 2217.0 | 12:41:00 | SHOT | 56 | 8 | A | |
| 2217.0 | 12:41:21 | SHOT | 57 | 8 | A | |
| 2217.0 | 12:42:03 | SHOT | 58 | 8 | A | |
| 2217.0 | 12:42:44 | SHOT | 59 | 8 | A | |
| 2217.0 | 12:43:05 | SHOT | 60 | 8 | A | |
| 1871.0 | 12:58:23 | SHOT | 61 | 9 | A | |

## Observer's Note (2/2)

| Well depth [m] | Time | Shot Type | Shot# | Stack# | Source | Remarks |
|---|---|---|---|---|---|---|
| 1871.0 | 12:58:48 | SHOT | 62 | 9 | A | |
| 1871.0 | 12:59:09 | SHOT | 63 | 9 | A | |
| 1701.0 | 13:08:50 | SHOT | 64 | 10 | A | |
| 1701.0 | 13:09:13 | SHOT | 65 | 10 | A | |
| 1701.0 | 13:10:08 | SHOT | 66 | 10 | A | |
| 1555.0 | 13:18:02 | SHOT | 67 | 11 | A | |
| 1555.0 | 13:18:41 | SHOT | 68 | 11 | A | |
| 1555.0 | 13:19:13 | SHOT | 69 | 11 | A | |
| 1540.0 | 13:23:18 | SHOT | 70 | 12 | A | |
| 1540.0 | 13:23:41 | SHOT | 71 | 12 | A | |
| 1540.0 | 13:24:03 | SHOT | 72 | 12 | A | |
| 1364.0 | 13:33:04 | SHOT | 73 | 13 | A | |
| 1364.0 | 13:33:26 | SHOT | 74 | 13 | A | |
| 1364.0 | 13:33:48 | SHOT | 75 | 13 | A | |
| 880.9 | 13:53:20 | SHOT | 76 | 14 | A | |
| 880.9 | 13:54:05 | SHOT | 77 | 14 | A | |
| 880.9 | 13:54:28 | SHOT | 78 | 14 | A | |
| 830.0 | 13:59:27 | SHOT | 79 | 15 | A | |
| 830.0 | 14:00:07 | SHOT | 80 | 15 | A | |
| 830.0 | 14:00:18 | SHOT | 81 | 15 | A | |
| 830.0 | 14:00:32 | SHOT | 82 | 15 | A | |
| 762.9 | 14:05:24 | SHOT | 83 | 16 | A | |
| 762.9 | 14:06:02 | SHOT | 84 | 16 | A | |
| 762.9 | 14:06:20 | SHOT | 85 | 16 | A | |
| 762.9 | 14:06:55 | SHOT | 86 | 16 | A | |

# GR Correlation Report

| Company: | Well: |
|---|---|

# Output DLIS Files

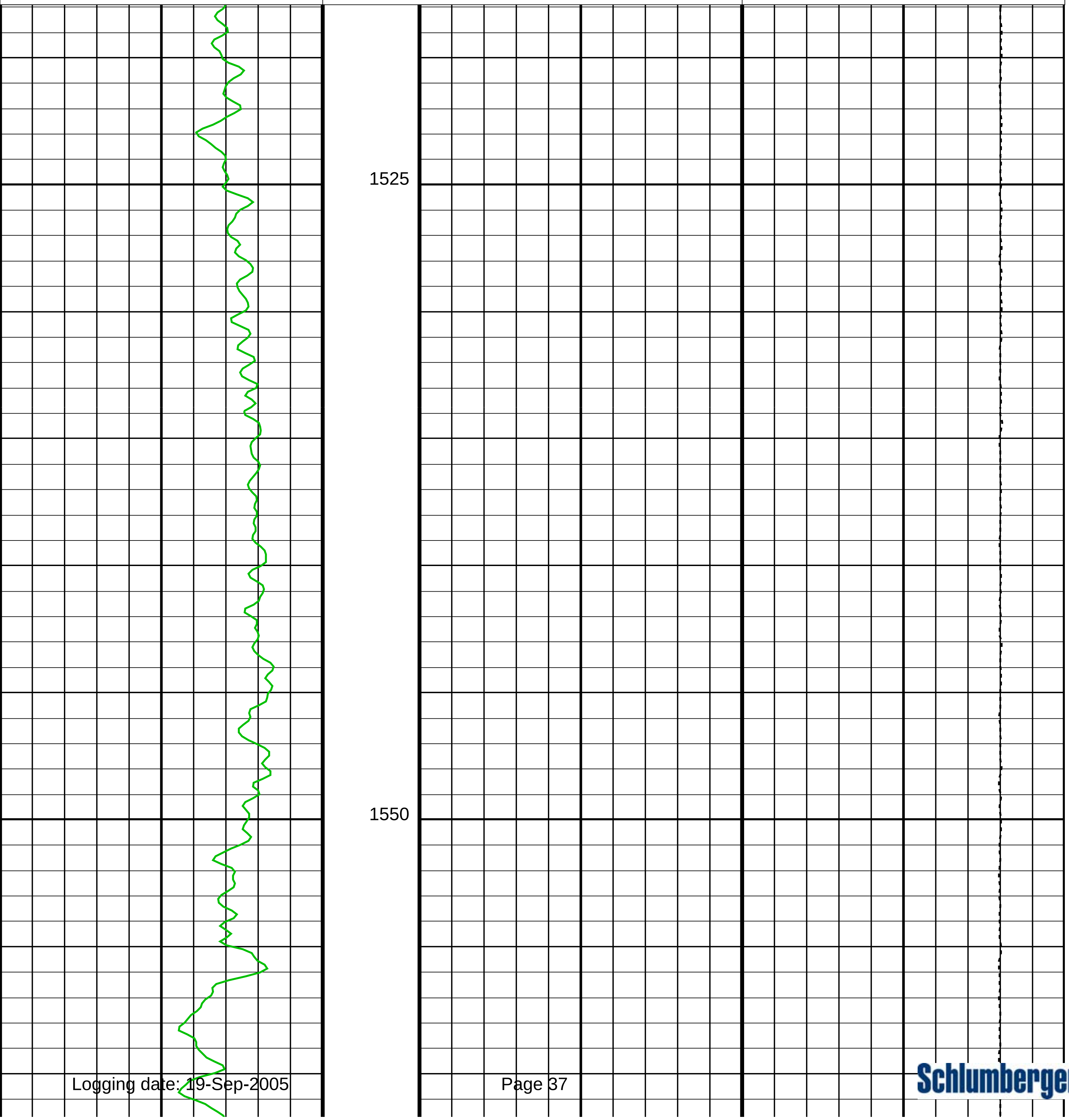
| DEFAULT | VSIT_TLD_MCFL_CNL_041LUP | FN:50 | PRODUCER | 19−Sep−2005 11:08 | 1598.7 M | 1517.9 M |
|---|---|---|---|---|---|---|

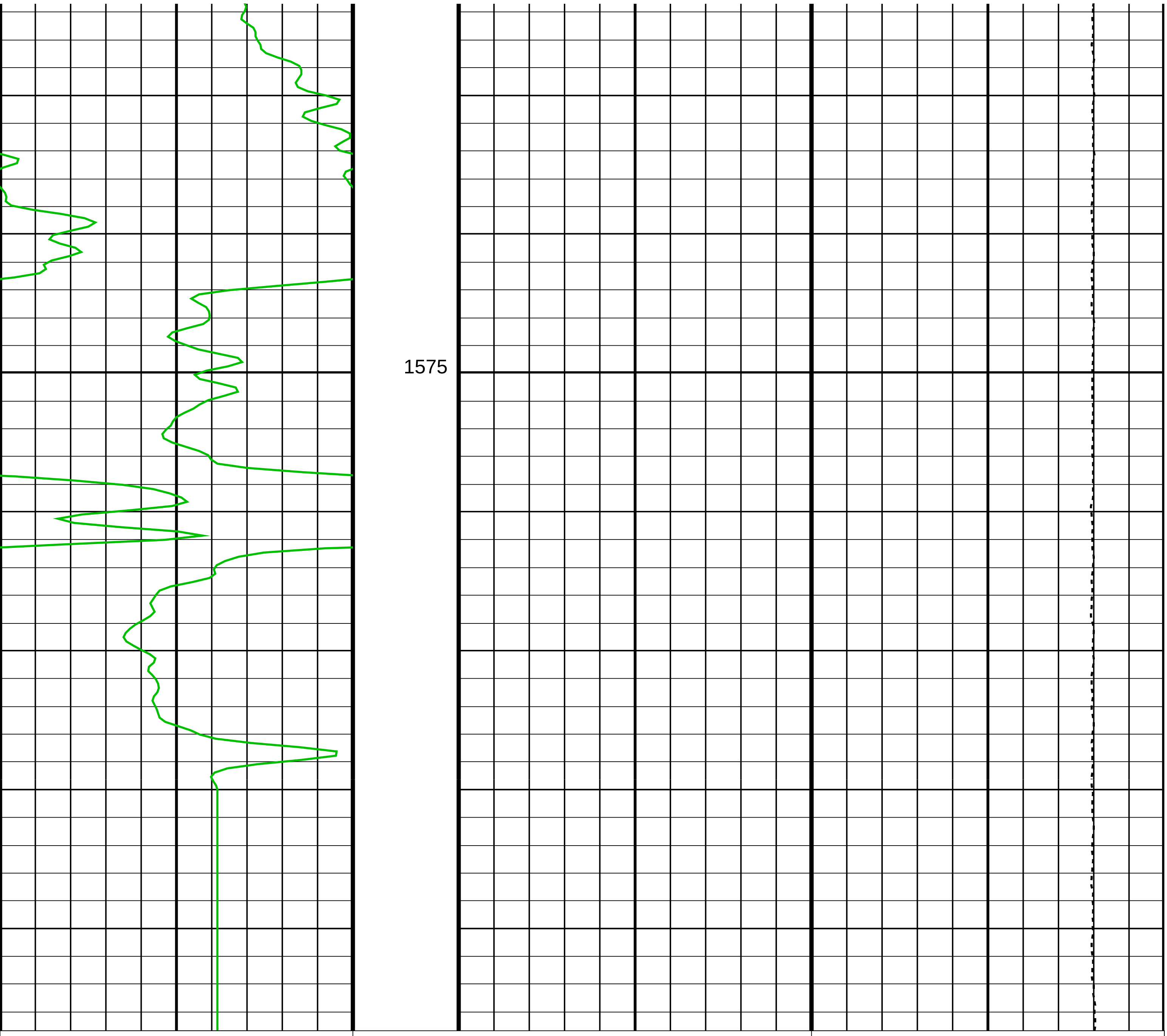
## OP System Version: 13C0−300

MCM

| | | | |
|---|---|---|---|
| VSIT−C | SKK−2724−VSI | HILTH−FTB | SRPC−2788−HILT |
| DTC−H | 13C0−300 | | |

| Gamma Ray (GR) | | Tension (TENS) |
|---|---|---|
| 0 (GAPI) 150 | | 10000 (LBF) 0 |






| Gamma Ray (GR) | | Tension (TENS) |
|---|---|---|
| 0 (GAPI) 150 | | 10000 (LBF) 0 |

**Format: CORRELATION** **Vertical Scale: 1:200** **Graphics File Created: 19−Sep−2005 11:08**

## OP System Version: 13C0−300

**MCM**

| | | | |
|---|---|---|---|
| **VSIT−C** | **SKK−2724−VSI** | **HILTH−FTB** | **SRPC−2788−HILT** |
| **DTC−H** | **13C0−300** | | |

## Output DLIS Files

| | | | | |
|---|---|---|---|---|
| **DEFAULT** | **VSIT_TLD_MCFL_CNL_041LUP** | **FN:50** | **PRODUCER** | **19−Sep−2005 11:08** |

# Tidal Water Level Report

EQUALLY SPACED PREDICTIONS FOR North Wirrah-1
LATITUDE=-38 11    LONGITUDE= 147 50    TIME ZONE = EST    DT =1 HOUR

HOURS AFTER MIDNIGHT

| DATE | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01:09:2005 | -.39 | -.55 | -.64 | -.62 | -.50 | -.28 | -.03 | .17 | .26 | .25 | .18 | .05 | -.10 | -.20 | -.21 | -.12 | .05 | .25 | .45 | .59 | .61 | .49 | .29 | .03 |
| 02:09:2005 | -.23 | -.44 | -.57 | -.60 | -.53 | -.36 | -.14 | .06 | .20 | .23 | .18 | .08 | -.05 | -.17 | -.22 | -.17 | -.04 | .13 | .32 | .49 | .58 | .54 | .37 | .16 |
| 03:09:2005 | -.07 | -.29 | -.46 | -.53 | -.51 | -.39 | -.21 | -.03 | .12 | .20 | .19 | .11 | -.01 | -.12 | -.20 | -.20 | -.12 | .02 | .19 | .35 | .48 | .51 | .41 | .24 |
| 04:09:2005 | .05 | -.14 | -.32 | -.43 | -.45 | -.38 | -.24 | -.09 | .05 | .16 | .19 | .14 | .04 | -.06 | -.14 | -.18 | -.16 | -.08 | .05 | .20 | .33 | .40 | .38 | .27 |
| 05:09:2005 | .13 | -.02 | -.18 | -.32 | -.37 | -.33 | -.24 | -.12 | .00 | .11 | .19 | .18 | .10 | .01 | -.07 | -.13 | -.16 | -.14 | -.07 | .05 | .17 | .26 | .29 | .25 |
| 06:09:2005 | .17 | .06 | -.06 | -.19 | -.27 | -.28 | -.22 | -.14 | -.04 | .07 | .16 | .20 | .16 | .08 | .01 | -.05 | -.11 | -.15 | -.14 | -.08 | .02 | .10 | .15 | .17 |
| 07:09:2005 | .15 | .10 | .02 | -.07 | -.16 | -.20 | -.18 | -.14 | -.07 | .03 | .13 | .19 | .20 | .16 | .10 | .05 | -.03 | -.12 | -.17 | -.17 | -.12 | -.06 | -.00 | .05 |
| 08:09:2005 | .08 | .09 | .07 | .02 | -.04 | -.10 | -.12 | -.11 | -.08 | -.01 | .09 | .17 | .21 | .22 | .19 | .15 | .07 | -.05 | -.16 | -.22 | -.22 | -.20 | -.16 | -.10 |
| 09:09:2005 | -.03 | .03 | .07 | .08 | .06 | .02 | -.04 | -.07 | -.06 | -.03 | .05 | .13 | .20 | .25 | .27 | .25 | .18 | .07 | -.09 | -.22 | -.29 | -.32 | -.32 | -.28 |
| 10:09:2005 | -.19 | -.08 | .01 | .08 | .13 | .13 | .07 | .01 | -.03 | -.03 | .01 | .08 | .17 | .25 | .32 | .35 | .31 | .21 | .04 | -.14 | -.30 | -.40 | -.45 | -.44 |
| 11:09:2005 | -.37 | -.24 | -.10 | .03 | .14 | .20 | .18 | .10 | .01 | -.02 | -.01 | .03 | .10 | .21 | .33 | .43 | .45 | .37 | .22 | .01 | -.22 | -.41 | -.53 | -.58 |
| 12:09:2005 | -.55 | -.43 | -.27 | -.08 | .09 | .22 | .26 | .20 | .09 | -.00 | -.04 | -.04 | .01 | .12 | .28 | .44 | .54 | .54 | .43 | .23 | -.03 | -.31 | -.53 | -.65 |
| 13:09:2005 | -.68 | -.61 | -.46 | -.24 | -.01 | .19 | .30 | .29 | .19 | .05 | -.05 | -.10 | -.10 | -.02 | .15 | .37 | .56 | .65 | .61 | .47 | .23 | -.10 | -.41 | -.63 |
| 14:09:2005 | -.74 | -.75 | -.65 | -.44 | -.17 | .10 | .29 | .35 | .29 | .15 | -.01 | -.13 | -.19 | -.17 | -.03 | .20 | .45 | .65 | .73 | .68 | .49 | .19 | -.18 | -.50 |
| 15:09:2005 | -.71 | -.80 | -.78 | -.63 | -.36 | -.05 | .22 | .37 | .37 | .27 | .10 | -.09 | -.23 | -.28 | -.21 | -.02 | .25 | .52 | .71 | .78 | .70 | .46 | .12 | -.26 |
| 16:09:2005 | -.57 | -.76 | -.83 | -.77 | -.56 | -.24 | .08 | .31 | .41 | .38 | .24 | .03 | -.18 | -.32 | -.33 | -.23 | -.01 | .27 | .55 | .74 | .78 | .65 | .39 | .05 |
| 17:09:2005 | -.31 | -.60 | -.77 | -.80 | -.69 | -.43 | -.10 | .19 | .37 | .43 | .36 | .19 | -.04 | -.25 | -.36 | -.35 | -.22 | -.00 | .27 | .54 | .70 | .70 | .55 | .30 |
| 18:09:2005 | -.01 | -.34 | -.59 | -.72 | -.70 | -.54 | -.28 | .01 | .26 | .41 | .42 | .31 | .13 | -.09 | -.28 | -.37 | -.35 | -.23 | -.02 | .24 | .47 | .59 | .56 | .43 |
| 19:09:2005 | .23 | -.04 | -.32 | -.52 | -.59 | -.53 | -.37 | -.14 | .11 | .31 | .41 | .37 | .25 | .09 | -.11 | -.27 | -.36 | -.35 | -.25 | -.07 | .14 | .32 | .41 | .40 |
| 20:09:2005 | .32 | .18 | -.03 | -.24 | -.37 | -.40 | -.34 | -.21 | -.03 | .18 | .33 | .37 | .32 | .22 | .08 | -.09 | -.25 | -.35 | -.37 | -.30 | -.17 | -.01 | .13 | .22 |
| 21:09:2005 | .25 | .24 | .17 | .03 | -.11 | -.19 | -.20 | -.17 | -.08 | .06 | .22 | .31 | .33 | .28 | .22 | .11 | -.07 | -.24 | -.35 | -.39 | -.37 | -.30 | -.18 | -.05 |
| 22:09:2005 | .07 | .15 | .20 | .19 | .12 | .03 | -.03 | -.06 | -.06 | .00 | .11 | .22 | .28 | .30 | .29 | .25 | .14 | -.05 | -.24 | -.36 | -.43 | -.46 | -.43 | -.33 |
| 23:09:2005 | -.18 | -.03 | .11 | .21 | .25 | .22 | .14 | .07 | .01 | -.00 | .04 | .11 | .19 | .26 | .31 | .33 | .30 | .16 | -.05 | -.24 | -.38 | -.50 | -.56 | -.53 |
| 24:09:2005 | -.41 | -.23 | -.05 | .12 | .26 | .32 | .27 | .18 | .09 | .02 | -.00 | .02 | .09 | .19 | .29 | .36 | .38 | .32 | .16 | -.06 | -.26 | -.43 | -.56 | -.61 |
| 25:09:2005 | -.56 | -.41 | -.21 | -.00 | .19 | .33 | .35 | .27 | .15 | .05 | -.02 | -.04 | -.01 | .08 | .22 | .35 | .41 | .41 | .32 | .13 | -.11 | -.33 | -.50 | -.61 |
| 26:09:2005 | -.62 | -.53 | -.35 | -.13 | .10 | .28 | .37 | .33 | .21 | .08 | -.02 | -.08 | -.09 | -.02 | .13 | .30 | .42 | .45 | .41 | .28 | .06 | -.20 | -.41 | -.56 |
| 27:09:2005 | -.62 | -.59 | -.46 | -.25 | -.00 | .21 | .34 | .35 | .26 | .12 | -.01 | -.10 | -.14 | -.10 | .03 | .21 | .38 | .47 | .47 | .38 | .20 | -.06 | -.31 | -.49 |
| 28:09:2005 | -.58 | -.60 | -.52 | -.35 | -.11 | .13 | .29 | .34 | .29 | .16 | .02 | -.10 | -.17 | -.16 | -.05 | .12 | .31 | .45 | .50 | .45 | .31 | .08 | -.18 | -.40 |
| 29:09:2005 | -.53 | -.58 | -.55 | -.42 | -.21 | .04 | .23 | .31 | .29 | .20 | .06 | -.08 | -.18 | -.20 | -.13 | .03 | .22 | .39 | .50 | .50 | .40 | .21 | -.04 | -.29 |
| 30:09:2005 | -.45 | -.54 | -.54 | -.46 | -.28 | -.05 | .16 | .28 | .29 | .22 | .10 | -.05 | -.18 | -.24 | -.20 | -.07 | .10 | .28 | .43 | .50 | .46 | .31 | .09 | -.14 |

NOTES: - Datum is Mean Sea Level (0.93 metres above LAT).
- Units are metres.
- Strictly astronomical tides. No allowance has been made for meteorological effects.

TABLE 2(a): PREDICTED TIDAL HEIGHTS AT NORTH WIRRAH-1, SEPTEMBER - 2005

# VSI Tool Evaluation Test Report

# VSI Seismic Evaluation Report

## ELECTRICAL NOISE LOW TEST

**2005/09/19 10:35:54**

**Shot No: 1** **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| DC Offset | 1 | X | -25.2968 | milli V | -100.0000 | 100.0000 | PASS |
| RMS Noise Level | 1 | X | 0.1260 | micro V | - | 0.5000 | PASS |
| Noise Peak | 1 | X | 0.5151 | micro V | - | 2.0000 | PASS |
| DC Offset | 1 | Y | -25.4057 | milli V | -100.0000 | 100.0000 | PASS |
| RMS Noise Level | 1 | Y | 0.1238 | micro V | - | 0.5000 | PASS |
| Noise Peak | 1 | Y | 0.4690 | micro V | - | 2.0000 | PASS |
| DC Offset | 1 | Z | -25.3261 | milli V | -100.0000 | 100.0000 | PASS |
| RMS Noise Level | 1 | Z | 0.1335 | micro V | - | 0.5000 | PASS |
| Noise Peak | 1 | Z | 0.5067 | micro V | - | 2.0000 | PASS |

## ELECTRICAL NOISE HIGH TEST

**2005/09/19 10:36:18**

**Shot No: 2** **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| DC Offset | 1 | X | -24.9646 | milli V | -100.0000 | 100.0000 | PASS |
| RMS Noise Level | 1 | X | 0.1256 | micro V | - | 0.5000 | PASS |
| Noise Peak | 1 | X | 0.4304 | micro V | - | 2.0000 | PASS |
| DC Offset | 1 | Y | -25.3325 | milli V | -100.0000 | 100.0000 | PASS |
| RMS Noise Level | 1 | Y | 0.1248 | micro V | - | 0.5000 | PASS |
| Noise Peak | 1 | Y | 0.4678 | micro V | - | 2.0000 | PASS |
| DC Offset | 1 | Z | -24.9572 | milli V | -100.0000 | 100.0000 | PASS |
| RMS Noise Level | 1 | Z | 0.1315 | micro V | - | 0.5000 | PASS |
| Noise Peak | 1 | Z | 0.4978 | micro V | - | 2.0000 | PASS |

## ELECTRICAL DISTORTION TEST

**2005/09/19 10:36:27**

**Shot No: 3** **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Total Harmonic Distortion | 1 | X | -103.5693 | dB | - | -90.0000 | PASS |
| Total Harmonic Distortion | 1 | Y | -102.5657 | dB | - | -90.0000 | PASS |
| Total Harmonic Distortion | 1 | Z | -104.9164 | dB | - | -90.0000 | PASS |

## SYSTEM DYNAMIC RANGE TEST

**2005/09/19 10:36:41**

**Shot No: 4** **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| System Dynamic Range | 1 | X | 107.2640 | dB | 103.0000 | - | PASS |
| System Dynamic Range | 1 | Y | 107.5153 | dB | 103.0000 | - | PASS |
| System Dynamic Range | 1 | Z | 107.4490 | dB | 103.0000 | - | PASS |

## AMPLIFIER GAIN 2 TEST

**2005/09/19 10:36:55**

**Shot No: 5** **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Gain Accuracy | 1 | X | 0.1572 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | X | 0.0000 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Y | 0.1467 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Y | 0.0000 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Z | 0.1541 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Z | 0.0000 | dB | -0.5000 | 0.5000 | PASS |

## AMPLIFIER GAIN 4 TEST

**2005/09/19 10:37:04**

**Shot No: 6** **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Gain Accuracy | 1 | X | 0.1544 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | X | 0.0028 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Y | 0.1440 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Y | 0.0027 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Z | 0.1533 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Z | 0.0008 | dB | -0.5000 | 0.5000 | PASS |

**AMPLIFIER GAIN 8 TEST**

**2005/09/19 10:37:14**

**Shot No: 7** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Gain Accuracy | 1 | X | 0.1537 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | X | 0.0035 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Y | 0.1436 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Y | 0.0031 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Z | 0.1525 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Z | 0.0016 | dB | -0.5000 | 0.5000 | PASS |

**AMPLIFIER GAIN 16 TEST**

**2005/09/19 10:37:24**

**Shot No: 8** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Gain Accuracy | 1 | X | 0.1498 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | X | 0.0074 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Y | 0.1387 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Y | 0.0079 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Z | 0.1499 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Z | 0.0043 | dB | -0.5000 | 0.5000 | PASS |

**AMPLIFIER GAIN 32 TEST**

**2005/09/19 10:37:34**

**Shot No: 9** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Gain Accuracy | 1 | X | 0.1529 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | X | 0.0043 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Y | 0.1410 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Y | 0.0057 | dB | -0.5000 | 0.5000 | PASS |
| Gain Accuracy | 1 | Z | 0.1513 | dB | -0.5000 | 0.5000 | PASS |
| Gain Step Accuracy | 1 | Z | 0.0028 | dB | -0.5000 | 0.5000 | PASS |

**CROSS TALK X TEST**

**2005/09/19 10:37:48**

**Shot No: 10** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Cross Talk X-Y | 1 | - | -100.0763 | dB | - | -90.0000 | PASS |
| Cross Talk X-Z | 1 | - | -98.0485 | dB | - | -90.0000 | PASS |

**CROSS TALK Y TEST**

**2005/09/19 10:38:07**

**Shot No: 11** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Cross Talk Y-Z | 1 | - | -97.5111 | dB | - | -90.0000 | PASS |
| Cross Talk Y-X | 1 | - | -99.2740 | dB | - | -90.0000 | PASS |

**CROSS TALK Z TEST**

**2005/09/19 10:38:25**

**Shot No: 12** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Cross Talk Z-X | 1 | - | -96.8713 | dB | - | -90.0000 | PASS |
| Cross Talk Z-Y | 1 | - | -96.4059 | dB | - | -90.0000 | PASS |

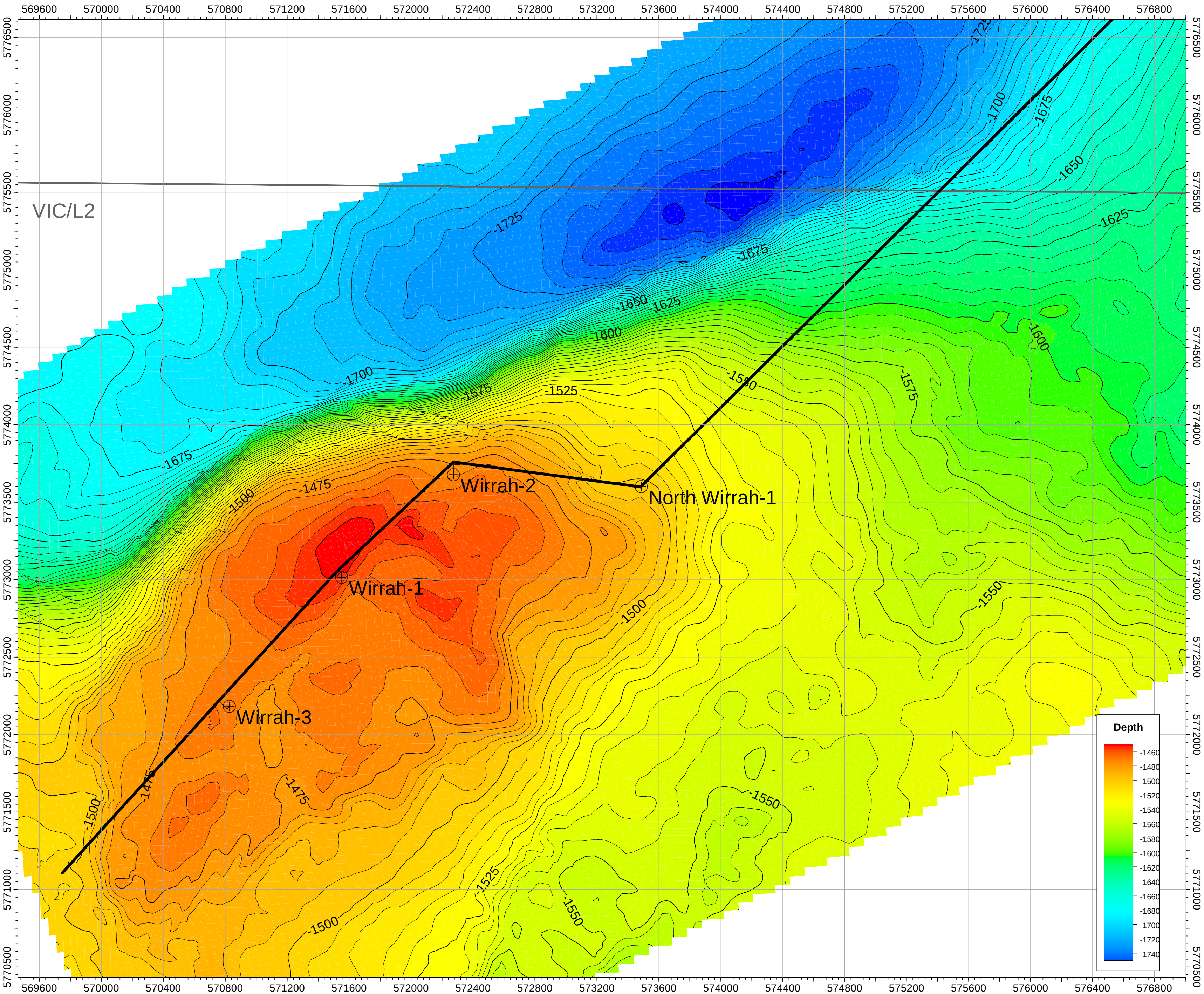
**IMPULSE RESPONSE TEST**

**2005/09/19 10:38:43**

**Shot No: 13** | **Station Depth: 762.92 m**

| Evaluation Item | Shuttle | Channel | Value | Unit | Lower Limit | Upper Limit | Result |
|---|---|---|---|---|---|---|---|
| Amplitude (0.3Hz) | 1 | X | -1.6805 | dB | -5.0000 | - | PASS |
| Amplitude (400Hz) | 1 | X | -3.5759 | dB | -5.0000 | - | PASS |
| Impulse Amplitude | 1 | X | 574.2287 | milli V | - | - | - |
| Phase Diff. at 0.3Hz from X1 | 1 | X | 0.0000 | degree | - | - | - |
| Amplitude (0.3Hz) | 1 | Y | -1.6108 | dB | -5.0000 | - | PASS |
| Amplitude (400Hz) | 1 | Y | -3.5740 | dB | -5.0000 | - | PASS |
| Impulse Amplitude | 1 | Y | 573.5751 | milli V | - | - | - |
| Phase Diff. at 0.3Hz from X1 | 1 | Y | -0.6855 | degree | - | - | - |
| Amplitude (0.3Hz) | 1 | Z | -1.5896 | dB | -5.0000 | - | PASS |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Amplitude (400Hz) | 1 | Z | -3.5742 | dB | -5.0000 | - | PASS |
| Impulse Amplitude | 1 | Z | 573.8167 | milli V | - | - | - |
| Phase Diff. at 0.3Hz from X1 | 1 | Z | -0.9408 | degree | - | - | - |




# North Wirrah-1
# Depth Structure Map
# Top Latrobe Group
# Esso Australia
# Enclosure 1

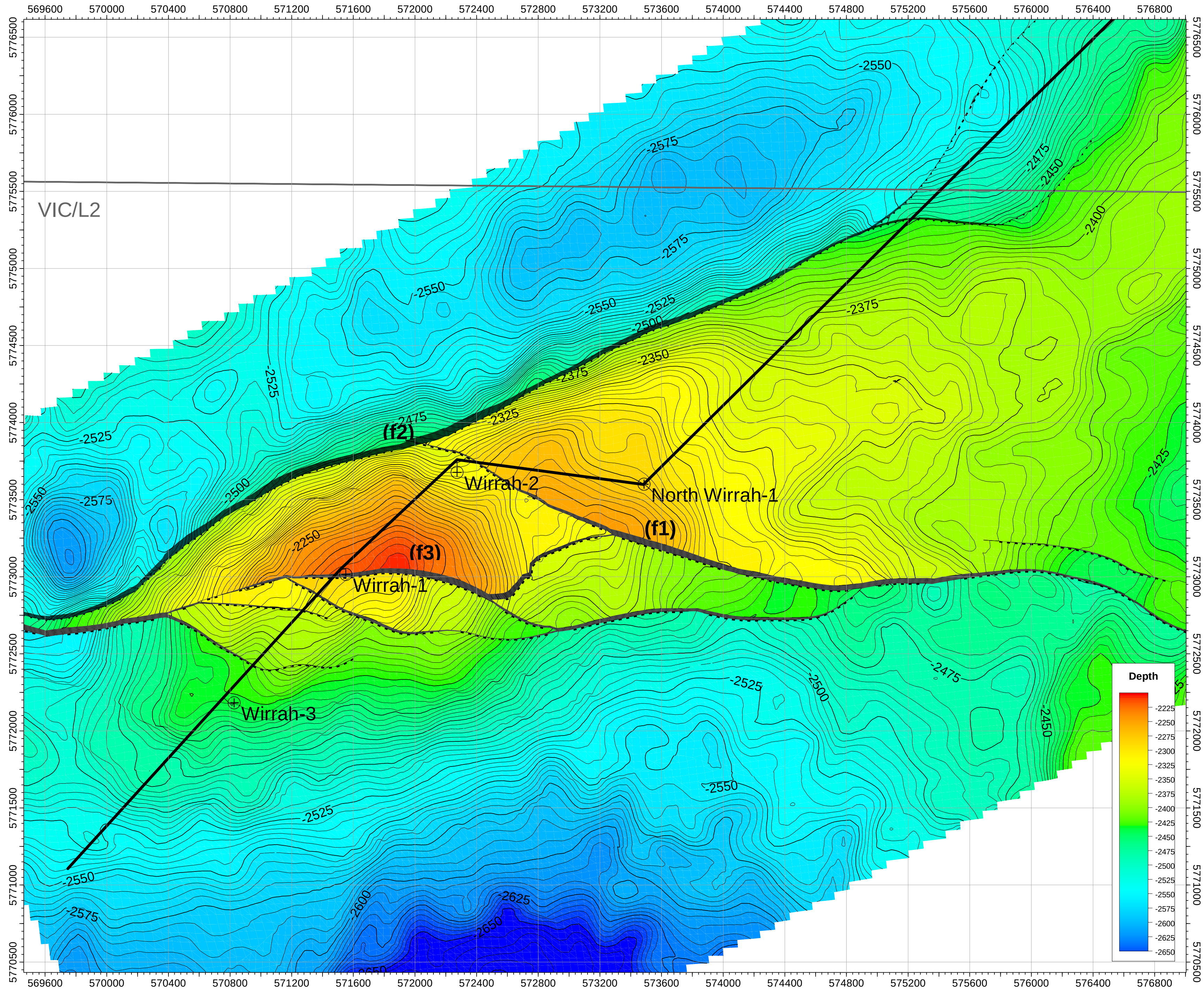
0 250 500 750 1000m

1:25000

## Map

| | |
|---|---|
| *Country* AUSTRALIA | *Contour inc* 5 |
| *Block* VIC L2 | *User name* sajones |
| *Project* North Wirrah-1 | *Date* 03/09/2006 |
| *Horizon Name* Top Latrobe Group | *Signature* Stephen Jones |
| *Scale* 1:25000 | |

ExxonMobil




# North Wirrah-1 Depth Structure Map Base L. balmei Volcanics / Top L-450 Reservoir Esso Australia Enclosure 2

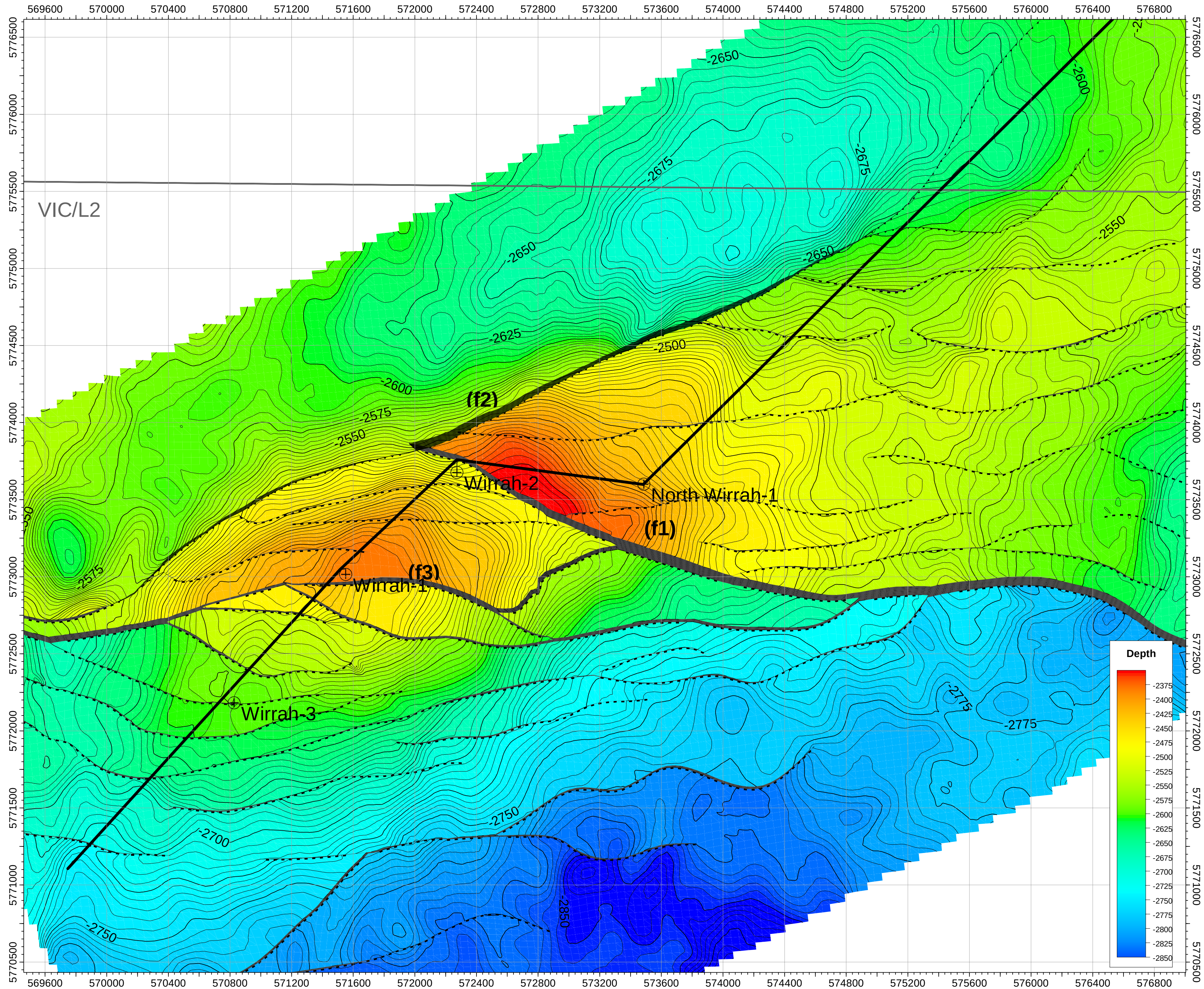
0 250 500 750 1000m

1:25000

## Map

| Country | Contour inc |
|---|---|
| AUSTRALIA | 5 |
| **Block** | **User name** |
| VIC L2 | sajones |
| **Project** | **Date** |
| North Wirrah-1 | 03/09/2006 |
| **Horizon Name** | **Signature** |
| Base L. Balmei Volcanics | Stephen Jones |
| **Scale** | |
| 1:25000 | |

ExxonMobil




# North Wirrah-1
# Depth Structure Map
# Top T-sands
# Esso Australia
# Enclosure 3

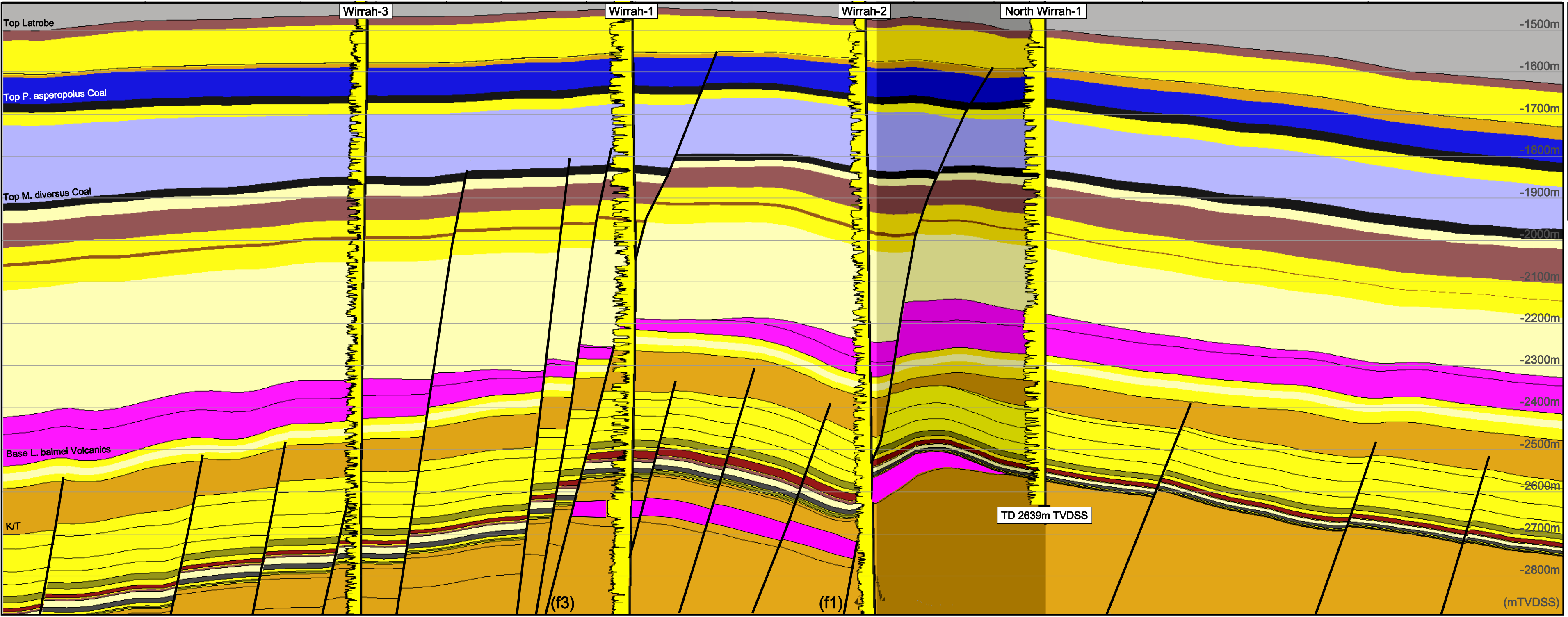
0 250 500 750 1000m

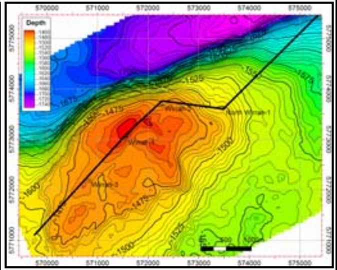
1:25000

## Map

| | |
|---|---|
| *Country* AUSTRALIA | *Contour inc* 5 |
| *Block* VIC L2 | *User name* sajones |
| *Project* North Wirrah-1 | *Date* 03/09/2006 |
| *Horizon Name* Top Tsands | *Signature* Stephen Jones |
| *Scale* 1:25000 | |

ExxonMobil



Top Latrobe
Depth Structure Map
Cross-section Location

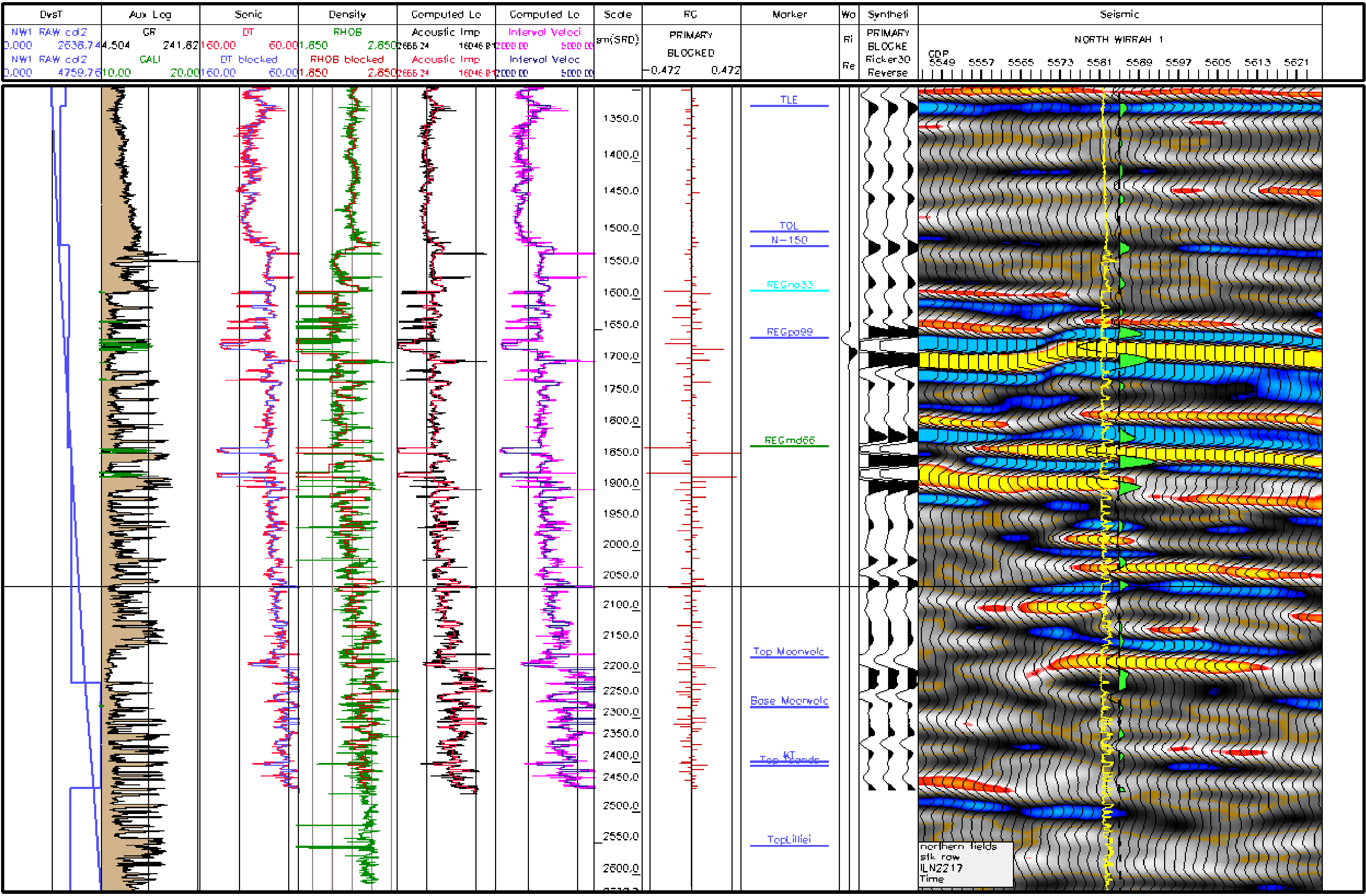
**North Wirrah-1**
**Structural Cross-Section**
**Esso Australia**

Enclosure 4

S A Jones 07/03/2006

# North Wirrah-1 Synthetic Seismogram

Enclosure 5




ExxonMobil