Appendix A.5.1.5

Phase 3 Contract 2

N6 Galway City Transport Project Phase 3 Ground Investigation Contract 2,

October 2015 to January 2016

A.5.1.5

R15-16

N6 Galway City Transport Project

Phase 3 Ground Investigation

Contract No. 2 - Factual Report

Galway County Council

Prepared by BRG Ltd. on behalf of Priority Drilling Ltd.

Dave Blaney

Project Number: **R15/16**

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BRG Ltd. Galway County Council

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R15/16
N6 Galway City Transport Project - Phase 3 Ground Investigation
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Dave Blaney P.Geo
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Contents

List of Figures

Appendices

1. Purpose and Scope of Works

Galway County Council, on its own behalf and on behalf of Galway City Council, are committed to developing a solution to the existing transportation issues in Galway City and its environs, which are having a negative impact upon the local, regional and national road network. As part of this work it is necessary to undertake ground investigation works prior to the commencement of detailed design work.

The Menlo region, within and to the immediate west of Lackagh Quarry, has been selected as a possible route for the N6 road development (Figure 1).

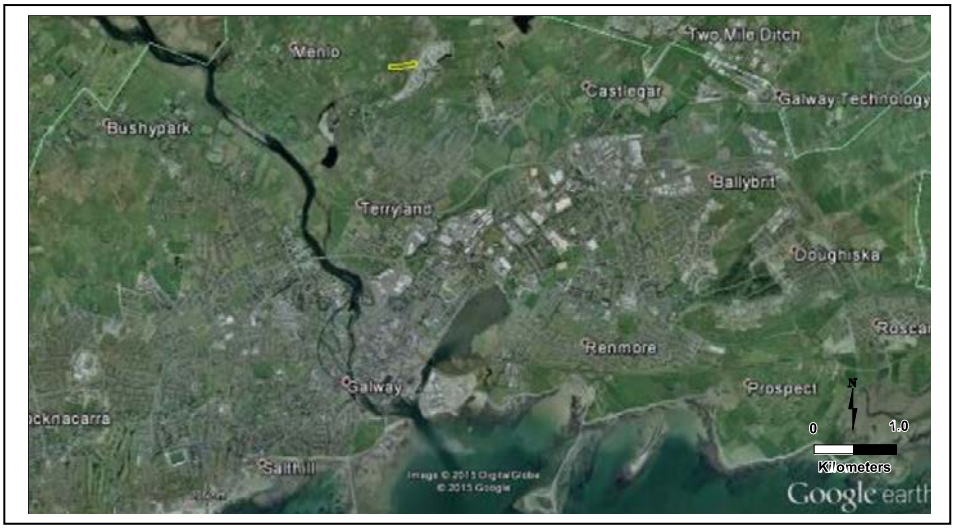

Figure 1: Lackagh Quarry Ground Investigation Site - Yellow Polygon (Google 2015)

The site consists of a non-active quarry with associated derelict buildings, plant, structures and poor quality agricultural land used for the grazing of cattle (Figure 2).

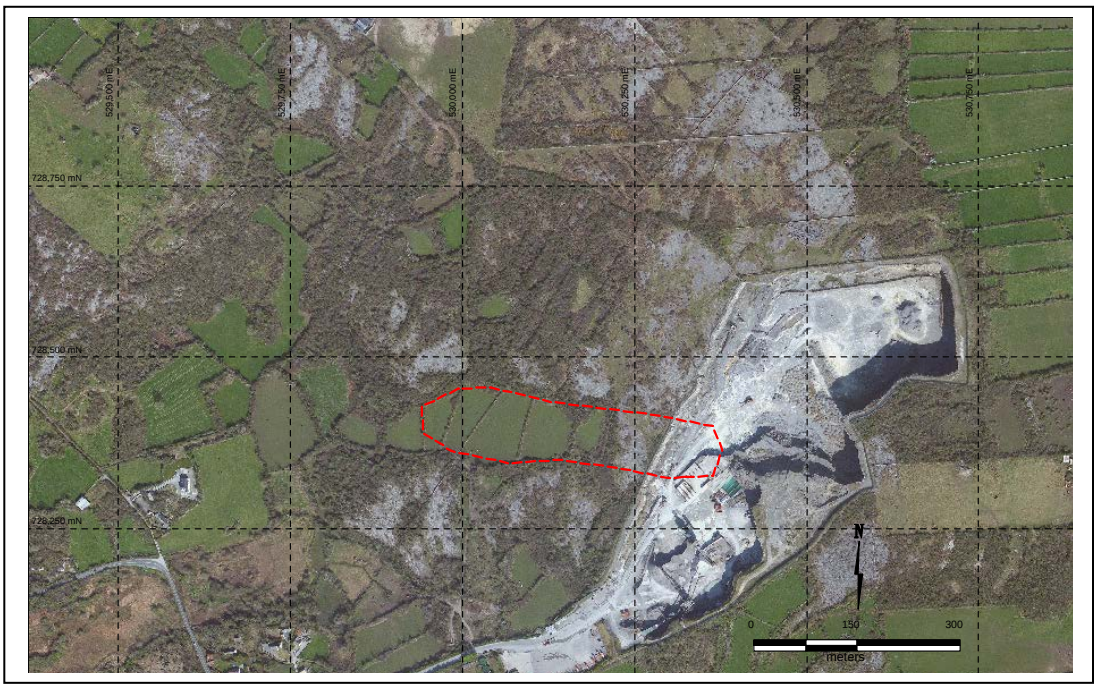

Figure 2: Site Area - Dashed Red Line

This area is in an environmentally sensitive region, with the Lough Corrib cSAC Annex 1 habitat (candidate Special Area of Conservation) located immediately west and north of the Lackagh Quarry site (Figure 3).

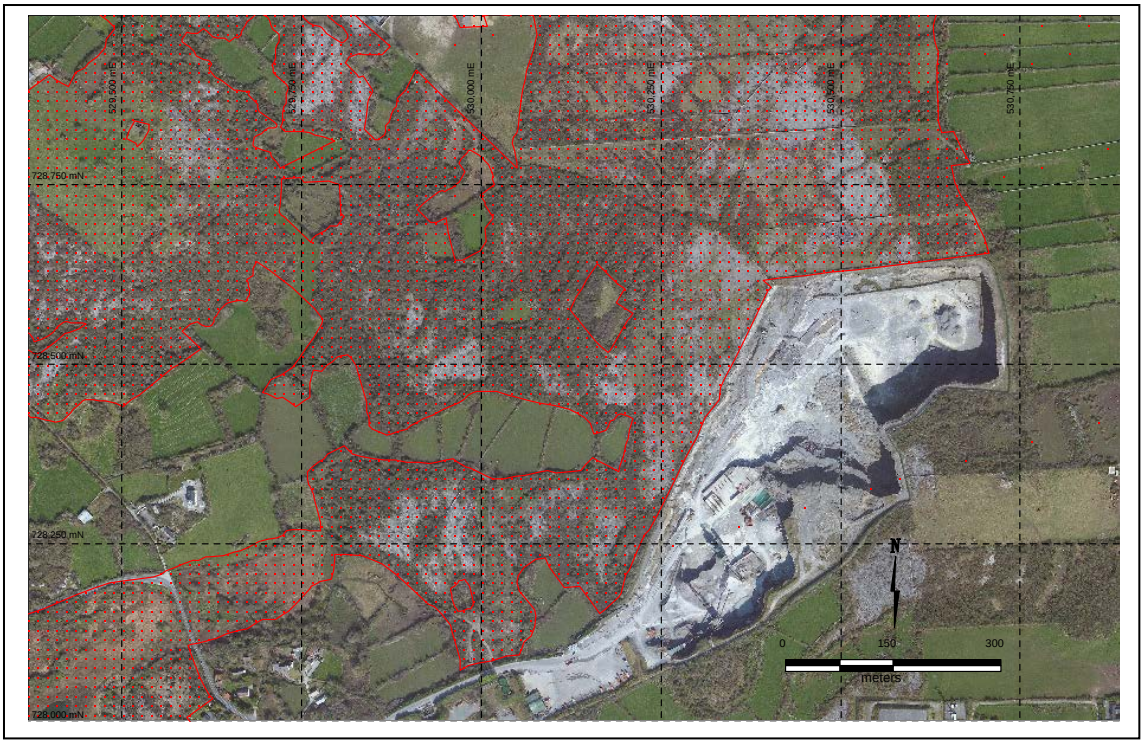

Figure 3: SAC Location (Red Hashed Area) (NPWS 2015)

The objective of the ground investigation is as follows:

- Characterise the nature of the rockmass for tunnel design;
- Characterise the hydrogeology for tunnel design and the existing groundwater conditions;
- Indentify any existing karst features and potential for karstic conditions with the rockmass
- Carryout in-situ and laboratory testing to provide geotechnical and hydrogeological parameters for tunnel design

In order to accomplish the stated objectives the following ground investigation was proposed:

- 1 No. Sub-horizontal rotary core drillhole along the proposed tunnel alignment for a length of approximately 300m
- 3 No. Vertical Rotary core drillholes to depths of 32.5m, 35.0m and 40.0m
- 3 No. Monitoring Installations (piezometers) with raised steel covers
- Geotechnical Laboratory Testing

- Downhole Geophysics
- Surface Geophysics
- Factual Reporting

2. Geological Setting and Ground Conditions

The site is underlain by Lower Carboniferous (Visean) Limestone located approximately 2km to the northeast of the contact with the Galway granitic intrusive complex (Figure 4). There is little published data for this region and Geological Survey of Ireland (GSI) 1:100,000 scale Bedrock Map series record this area as Undifferentiated Visean Shelf Limestones.

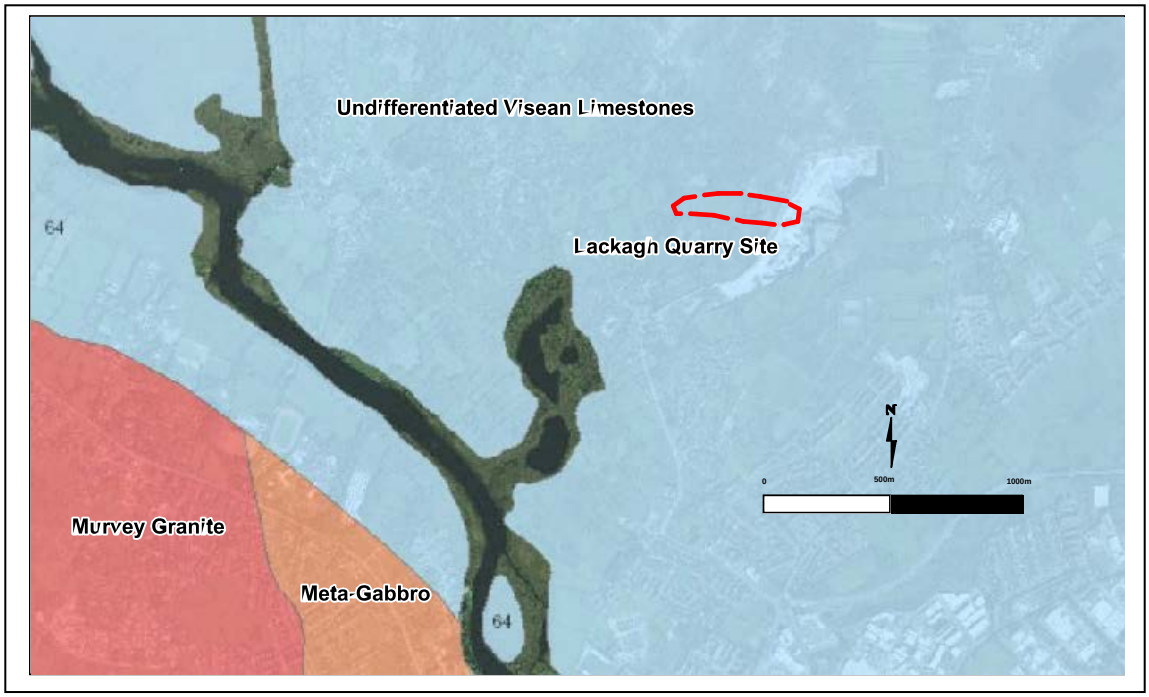

Figure 4: Simplified Geology Map of the Menlo Region (GSI 1:100,000 series)

The bedrock geology is dominated by light grey / grey, massively bedded, fine to medium grained pellety to weakly oolitic grainstones. Discrete, metric scale, beds of dark grey / black limestones are developed within the sequence. The black limestone beds are dominated by synsedimentary breccias with intraclastic clasts of grainstone supported in a black fine grained micritic matrix, this was only intersected by one of the ground investigation boreholes. There is evidence of burrowing and the brecciation may have been caused by bioturbation. Minor bioclastic debris is disseminated throughout, dominated by unrecognisable small shell fragments. Locally occurring coarse bioclastic fragments consist of thick shelled brachiopods and solitary corals. The fauna and well sorted nature of the rock are indicative of a shallow water, relatively high energy depositional environment. Thin (centimetric scale), horizons of grey / green to black mudstone form semi-continuous marker horizons within the geological sequence. The mudstone horizons (often known as clay wayboards) can be weakly tuffaceous, often containing a significant proportion of finely disseminated pyrite. The pyrite in these thin bands oxidises strongly and is responsible for the surficial iron staining present on parts of the lower benches at Lackagh Quarry.

The unconsolidated Quaternary geology of this region has been proven by the recent drilling to be much more complex than originally anticipated. A deep buried channel / trough is located to the west orientated along an east-west axis. Unconsolidated material deposited within this feature ranges from lacustrine, laminated (possibly varved) dark brown, organic clays to sands / gravels of a possibly fluviatile origin, all overlain by very stiff, glacial boulder clays.

Extensive areas of limestone pavement are developed to the north and west of the quarry site and there are numerous glacial erratics scattered throughout, many of which are granitic.

3. Ground Investigations

3.1 Setting Out / Surveying

Drawings and coordinates were provided by ARUP and were used to locate and position each borehole and geophysical station. The drillhole collar locations were positioned using a Trimble GeoExplorer 6000 RTK GPS system corrected to a differential base station through a phone modem link. Locations were measured relative to Irish Transverse Mercator.

The low angle borehole, BH01, was set out using the Trimble GeoExplorer 6000 RTK GPS system. The hole / working platform was orientated using a prismatic compass, accurate to +/- 0.5^{o}. The rig was then set up using a Reflex TN14 Gyrocompass to measure the exact dip and azimuth of the hole before coring commenced.

Downhole surveying of drillhole BH01 was carried out at 3m intervals using a Reflex EZ-TRAC digital downhole survey instrument. Owing to ground conditions (cavities and localised broken ground from 186m) the hole could only be surveyed from 175m back to surface. A core orientation tool had been used throughout the drilling that provided information about the dip of the hole, the driller noted no significant variation in dip from 175m. Refer to Appendix I for all surveying data.

3.2 Ground Geophysical Surveying

Ground geophysical surveying was specified for the Lackagh Quarry Ground Investigation. BRG Ltd were sub-contracted by Priority Drilling Ltd. to carry out the surveying. The geophysical surveys consisted of 2D Electrical Resistivity Tomography (ERT) and Microgravity across an initial area of roughly 300x30m, this area was subsequently extended to define the lateral and depth extent of a zone of deep overburden. The surveys were designed to test for subsurface heterogeneity and bedrock depths in advance of follow up rotary core drilling. Information on potential karst features were of particular interest to the client.

Microgravity data was acquired with measured sites along the centre line and 15m either side of the proposed tunnel section. These lines were measured with nominal station spacing of 10m, with gaps where scrub hawthorn was too thick. Extra stations were measured within the quarry on the first bench at 5-10m intervals. Measurements were taken using a Lacoste & Romberg model G gravity meter. Instrument drift was monitored by returning to a locally established base station at hourly intervals.

Stations were topographically surveyed using a Trimble GeoExplorer 6000 RTK GPS system corrected through phone modem link for both the ERT and the gravity surveys. The drift corrected gravity data was corrected for elevation, latitude, and reduced to Bouguer 2.67g/cm^{3} to allow for local average rock densities. It was then gridded and exported for display and interpretation in the MapInfo GIS system (Figure 5).

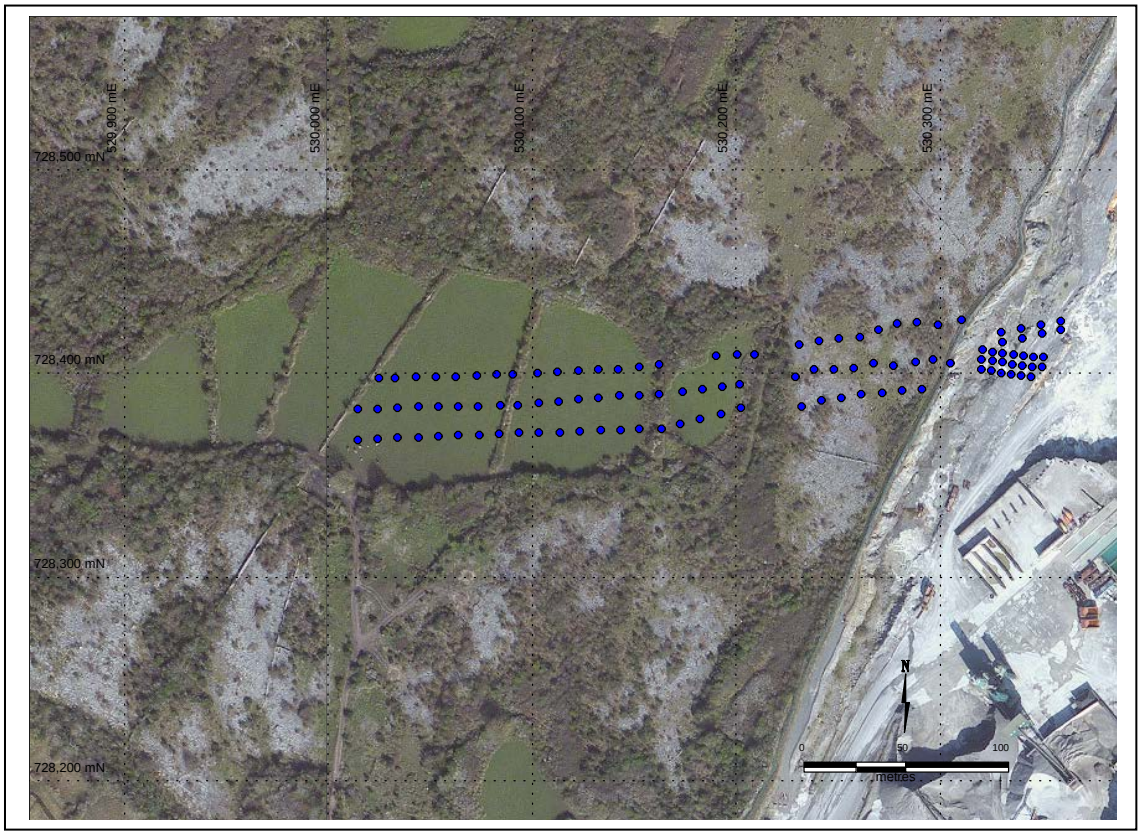

Figure 5: Microgravity Station Locations

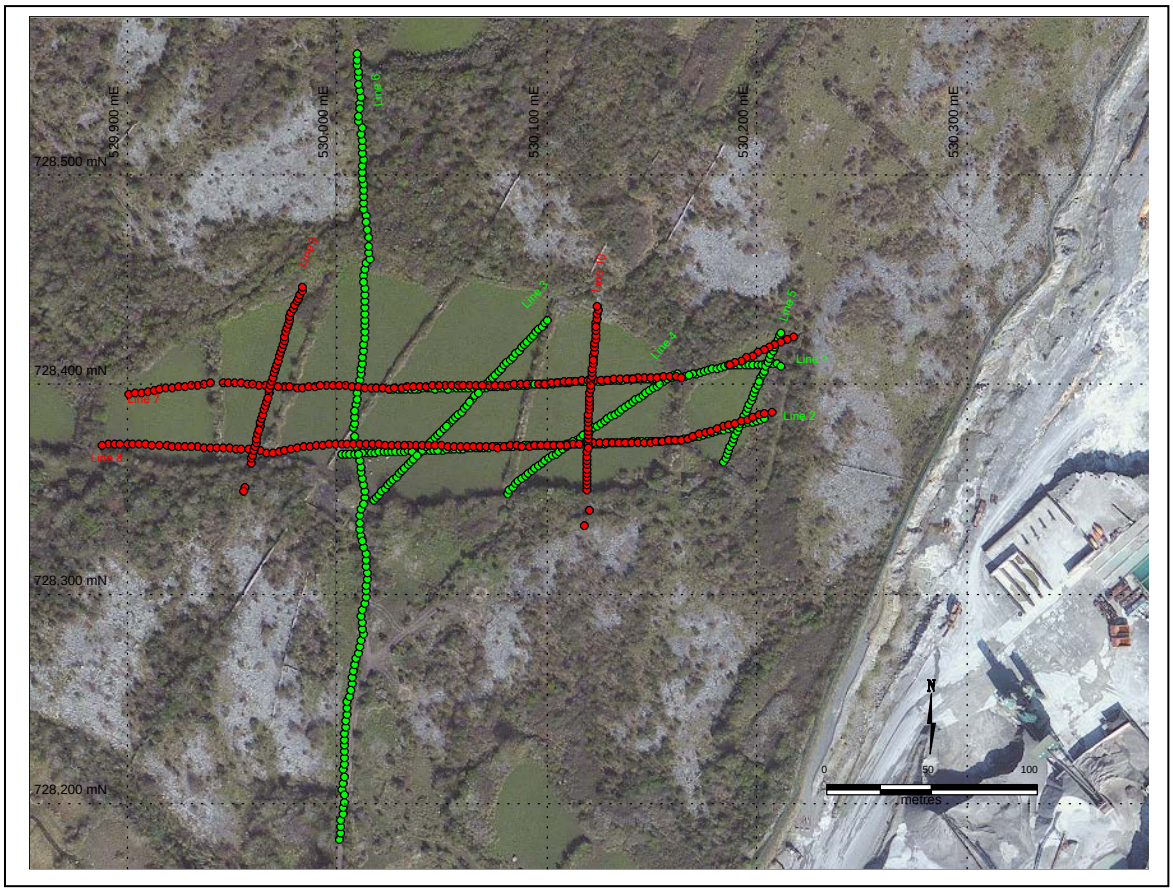

Figure 6: 2D Electrical Resistivity Tomography (ERT) Line / Station Locations

The depth mapping potential with the ERT is limited by the length of each spread. The variability of line lengths meant that the ERT surveying was capable of surveying to a minimum depth of 22m bgl on Line 5 to a maximum depth of 60m bgl on Line 6. Equipment used was an Allied Associates Tigre system which has the potential for up to 128 electrode takeouts. 2m station spacing was initially used to get the required detail along the chosen lines, with 3m intervals on the long lines (6, 7 & 8). Data was measured using a Wenner array, controlled by an Imager2006 programme with a laptop computer. Saved data was inverted using the Geotomo Res2Dinv programme and exported as an image file displaying a cross section of the inverted Resistivities with elevation data. The resultant resistivity sections were subsequently interpreted and an interpreted geological model developed.

Resistivity sections from the 2D ERT and the microgravity data show a marked contrast from high resistivity bedrock in the east with a sharp contact into very low resistivity zones to the west. The western region has a low gravity response coincident with the low resistivity. The base of the initial ERT lines did not penetrate below 30m, however, the low resistivity zone developed to the west suggests that this area was dominated by a significant deep overburden feature. Subsequent 2D ERT surveying, particularly line 6 defined a channel / basin shaped feature developed along a roughly east - west axis with sharp contacts to the north and south. The northern side of the feature seems to be step down into the core of the channel, which is roughly coincident with BH03. The surface geophysical report is appended as Appendix V.

3.3 Rotary Borehole Investigation

Five rotary boreholes were drilled during this phase of the investigation. Four vertical and one low angle borehole drilled from the quarry floor (Figures 5 & 6).

DHID	East	North	Elevation	Dip	Azimuth	Length (m)
BH01	530370.592	728426.557	16.712	-11.5^{o}	268.3^{o}	276.7
BH03	530023.824	728382.566	26.256	-90^{o}	360^{o}	109.9
BH04	530150.783	728400.125	32.167	-90^{o}	360^{o}	35
BH05	530186.649	728378.105	34.138	-90^{o}	360^{o}	40.3
BH06	530125.143	728383.081	30.799	-90^{o}	360^{o}	45

Table 1: Borehole Collar Locations

3.3.1 Low Angle Drilling (HQ Core)

The low angle borehole, BH01, was drilled using a Dura Lite rig producing HQ diameter core (63.5mm). This borehole was drilled using a 3m hexagonal core barrel in order to minimise droop and deflection away from the planned section. The borehole was collared at an azimuth of 268.3^{o} N_{mag} and a dip of -11.5^{o} to the horizontal. BH01 was located within the boundary of the quarry and was designed to drill into the quarry face. The hole was located at the base of the lower bench and rig

was stepped back approximately 6m from the quarry face. The face was scaled back before the rig was moved onto site using an excavator to remove loose, unstable rock material that was at risk of collapse. A concrete plinth was constructed between the borehole collar and the quarry face to support the rods whilst drilling and accordingly the first 6m cored from BH01 consists of concrete.

BH01 was drilled to a final depth of 276.7m. It was scheduled to drill to approximately 300m. However, poor quality and unconsolidated / cavernous ground intersected from 272.4m to the end of hole at 276.7m meant that the hole could not be continued.

After drilling was completed borehole BH01 was sealed at a depth of 175m using a Vann Ruth plug and was then backfilled with a cement / bentonite grout from 175m back to surface. The cavities in the lower part of the hole (175.0 - 276.7m) contributed to localised unstable ground conditions and it was considered a significant possibility that they may act as conduits to draw the cement / bentonite grout away from the hole, therefore, a plug was installed at 175m to seal the lower part of the hole.

3.3.2 Vertical Drilling (PQ Core)

The vertical boreholes (BH03, BH04, BH05 & BH06) were all drilled using a top drive Hang Seng drilling rig producing PQ diameter drill core (85mm). The holes were collared along the line of the proposed tunnel route to the west of the quarry. BH03 was scheduled to drill to a depth of 32.5m, however, it drilled through a deep overburden feature with very challenging, poorly consolidated ground, intersecting rock at a depth of 104.95m and stopping at a depth of 109.9m. The hole was cored to 85.55m in PQ and subsequently cased to 85m with PW casing. It was then open hole drilled using a HQ tricone until competent ground was intersected at 104.95m and continued to the end of hole with HQ core. Due to the instability of hole BH03 the planned piezometer could not be installed or the downhole geophysical survey carried out. It was backfilled with a cement / bentonite grout upon completion.

BH04 and BH05 were drilled to scheduled depths and intersected the expected geological succession of shallow overburden overlying competent, massively bedded limestones. Piezometers were installed in both of these holes. BH06 was an additional hole added to the ground investigation to test a zone of transition from competent to poorly consolidated rock / overburden that had been detected by the ground geophysical survey. This hole was drilled to a final depth of 45m in unconsolidated clay, sand and gravel it was backfilled with a cement grout from the end of hole back to a depth of 11.0m. A stand pipe was installed in the top of the hole.

The core from the rotary drilling was logged in accordance with the BS5930:1999 specification. A detailed geological description of the rock was generated and a

quantitative description of the fracture state of the rock core was provided for each borehole, including:

- Total Core Recovery (TCR)
- Solid Core Recovery (SCR)
- Fracture Index (FI)
- Fracture Number (FNo.)
- Rock Quality Designation (RQD)

The logs were generated using HoleBase AGS software (Hard copies - Appendix II).

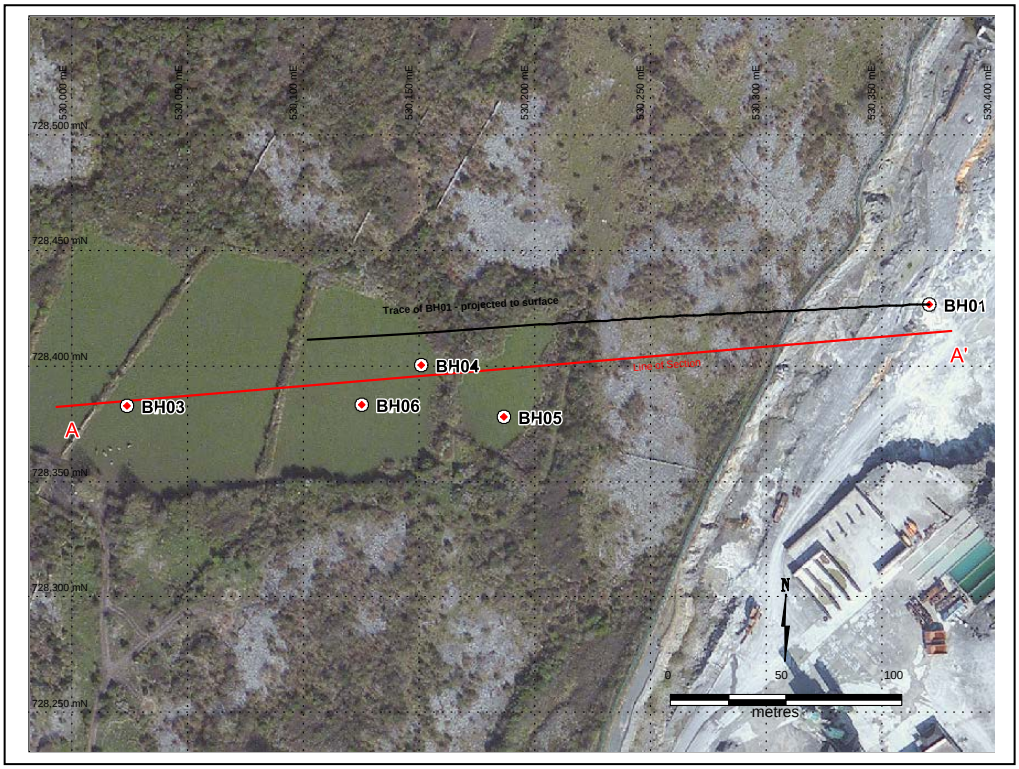

Figure 7: Borehole Collar Locations, Traces and Line of Section

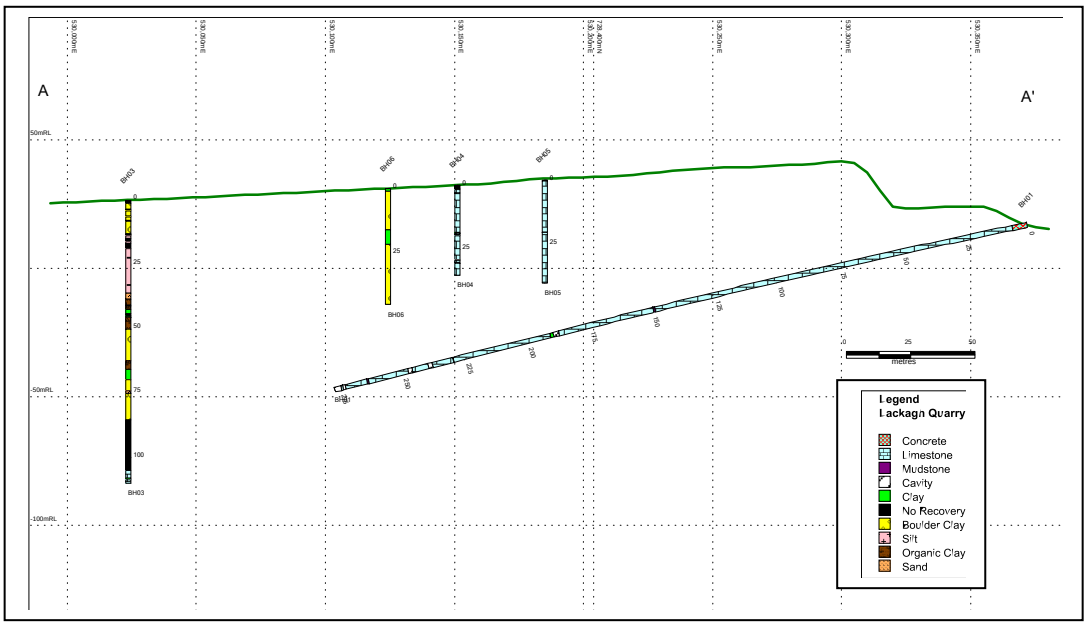

Figure 8: A - A' Drill Section (looking North) through the Lackagh Quarry GI Site

3.4 Discontinuity Logging

Discontinuity logging of rock cores was carried out using the ARUP "Rock Core Discontinuity Log" template for holes BH01, BH04 and BH05. The following headings were used:

- Orientation
- Spacing
- Roughness
- Weathering
- Infilling
- Number of Discontinuity Sets

The core from BH01 was orientated using a core orientation system mounted on the core barrel. and the discontinuities were measured relative to the invert of the core (NB: downhole direction is 180^{o} up hole is 0^{o}).

See Appendix III for the discontinuity logs.

3.5 Piezometer Installations

Three piezometers were installed in the vertical boreholes located to the west of the quarry. They were installed in boreholes BH04, BH05 and BH06. A summary of the installation design can be seen in Tables 2 - 4.

From (m)	To (m)	Installation
0.00	28.00	Blank 19mm PVC Pipe
28.00	34.00	Slotted 19mm PVC Pipe
34.00		End Cap
0.00	21.00	Cement Grout
21.00	23.00	Bentonite Pellets
23.00	24.00	Sand
24.00	34.00	Pea Gravel
34.00	35.00	Gravel Base

Table 2: BH04 Piezometer Installation Details

From (m)	To (m)	Installation
0.00	33.00	Blank 19mm PVC Pipe
33.00	39.00	Slotted 19mm PVC Pipe
39.00		End Cap
0.00	19.00	Cement Grout
19.00	23.00	Bentonite Pellets
23.00	24.00	Sand
24.00	39.00	Pea Gravel
39.00	40.30	Gravel Base

Table 3: BH05 Piezometer Installation Details

From (m)	To (m)	Installation
0.00	4.00	Blank 19mm PVC Pipe
4.00	10.00	Slotted 19mm PVC Pipe
10.00		End Cap
0.00	1.00	Cement Grout
1.00	2.00	Bentonite Pellets
2.00	3.00	Sand
3.00	11.00	Pea Gravel
11.00	45.00	Cement Grout

Table 4: BH06 Piezometer Installation Details

3.6 Borehole Geophysical Surveying

Ground geophysical surveying was specified for the Lackagh Quarry Ground Investigation. European Geophysical Services Ltd were sub-contracted by Priority Drilling Ltd. to carry out this surveying. It was originally intended to survey three boreholes, however, the poor ground conditions encountered in BH03 meant that only BH04 and BH05 were surveyed.

The geophysical surveys consisted of:

- Optical Televiewer
- Acoustic Televiewer
- Fluid Temperature and Conductivity, Natural Gamma Calliper
- Impeller Flowmeter
- Focused Resistivity
- Full Wave Sonic Velocity
- Pumped Temperature and Conductivity

Report attached as Appendix VI

3.7 Rock / Soil / Water - Laboratory Testing

Core samples were taken from the rock / soil recovered during the drilling operations and forwarded to two accredited laboratories for a testing. The Celtest Laboratory near Bangor in North Wales was selected to carry out the rock testing. The Priority Geotechnical Soil testing Laboratory was selected to carry out the soil testing.

Test	BH01 (No.)	BH04 (No.)	BH05 (No.)	Total Number of Tests
Deformability in Uniaxial Compression	10	5	5	20
Indirect Tensile Strength by Brazilian Test	3	1	1	5
Natural Water Content	40	10	9	59
Oxidisable Sulphate	5	1	1	7
pH Value	5	1	1	7
Point Load	58	25	25	108
Porosity / Density using Saturation & Buoyancy	15	2	3	20
Porosity / Density using Saturation & Calliper	15	2	3	20
Thin Section Petrography	2	1	1	4
Total Sulphur	6	1	1	8
Uniaxial Compressive Strength	36	10	10	56
Total	**195**	**59**	**60**	**314**

Table 5: Scheduled Rock Tests

Test	BH03 (No.)	BH06 (No.)	Total Number of Tests
Atterberg Limits	9	3	12
Moisture Content	19	3	22
Oedometer	4	3	7
Organic Matter Content	9	3	12
Particle Size Distribution	9	0	9
pH Value	5	0	5
Triaxial Test (Unconsolidated / Undrained)	5	3	8
Total	**60**	**15**	**75**

Table 6: Scheduled Soil Tests

A suite of aggregate tests had been scheduled in the Bill of Quantities, including:

- Slake Durability Index
- Los Angeles Coefficient
- Aggregate Crushing Value
- Ten Percent Fines
- Aggregate Impact Value
- Aggregate Abrasion Value
- Polished Stone Value
- Aggregate Frost Heave

The volume of material required to carry out these tests was excessive (e.g. the Aggregate Frost Heave test needs a minimum of 75kg of rock) and would have taken the bulk of the available drill core. Given the relatively homogenous nature of the limestone intersected it was agreed that a representative bulk sample would be acquired from the quarry and sent for the specified aggregate testing. Accordingly, a

composite, 275kg, representative sample was obtained from the quarry and sent to Celtest.

Water samples were obtained from the piezometers in boreholes BH04, BH05 and BH06 and sent to the IAS Laboratory in Bagenalstown, Co Carlow for testing for major cations and anions.

Test results are summarised in Tables 7 - 10 certificates are attached as Appendix VII

Location ID	Sample ID	Depth Top	Depth Base	Test	Result
BH01	**48861**	6.70	6.80	Moisture Content	**1.20%**
BH01	**48862**	10.36	10.46	Point Load	**79.3MPa**
BH01	**48863**	10.46	10.69	Uniaxial Compressive Strength	**97MPa**
BH01	**48864**	10.69	10.76	Point Load	**78MPa**
BH01	**48865**	10.89	10.97	Porosity / Density using Saturation and Buoyancy	**0.5 / 2.63**
BH01	**48866**	10.97	11.07	Porosity / Density using Saturation and Calliper	**0.47/2.69**
BH01	**48867**	11.57	11.94	Deformability in Uniaxial Compression	**99.8MPa**
BH01	**48868**	13.26	13.35	Moisture Content	**1.60%**
BH01	**48869**	13.35	13.45	Point Load	**82.9MPa**
BH01	**48870**	13.45	13.70	Uniaxial Compressive Strength	**59MPa**
BH01	**48871**	13.70	13.80	Point Load	**71.9MPa**
BH01	**48872**	16.30	16.40	Point Load	**67.7MPa**
BH01	**48873**	16.40	16.66	Uniaxial Compressive Strength	**73MPa**
BH01	**48874**	16.66	16.80	Point Load	**76.5MPa**
BH01	**48875**	22.40	22.50	Porosity / Density using Saturation and Calliper	**0.58/2.65**
BH01	**48876**	22.50	22.60	Porosity / Density using Saturation and Buoyancy	**1.2 / 2.70**
BH01	**48877**	26.20	26.36	Point Load	**47.1MPa**
BH01	**48878**	26.36	26.61	Uniaxial Compressive Strength	**100MPa**
BH01	**48879**	26.61	26.70	Point Load	**60.5MPa**
BH01	**48880**	27.85	28.15	Deformability in Uniaxial Compression	**112.4MPa**
BH01	**48881**	32.65	32.72	Moisture Content	**1.40%**
BH01	**48882**	34.44	34.48	Point Load	**88.8MPa**
BH01	**48883**	34.48	34.73	Uniaxial Compressive Strength	**69MPa**
BH01	**48884**	34.73	34.83	Point Load	**62.2MPa**
BH01	**48885**	44.35	44.40	Porosity / Density using Saturation and Calliper	**0.54/2.70**
BH01	**48886**	44.45	44.54	Point Load	**84.8MPa**
BH01	**48887**	44.54	44.79	Uniaxial Compressive Strength	**83MPa**
BH01	**48888**	44.79	44.90	Point Load	**53.0MPa**

BH01	**48889**	45.65	45.74	Porosity / Density using Saturation and Buoyancy	**0.5/2.68**
BH01	**48890**	48.90	49.16	Deformability in Uniaxial Compression	**187.5MPa**
BH01	**48891**	53.80	53.93	Total Sulphur	**<0.1%**
BH01	**48892**	55.30	55.40	Oxidisable Sulphate	**<0.01%**
BH01	**48893**	55.84	55.92	pH Value	**9.1**
BH01	**48894**	56.50	56.60	Point Load	**64.4MPa**
BH01	**48895**	56.60	56.85	Uniaxial Compressive Strength	**138MPa**
BH01	**48896**	56.85	56.93	Point Load	**63.9MPa**
BH01	**48897**	57.30	57.40	Moisture Content	**1.10%**
BH01	**48898**	61.65	61.75	Moisture Content	**1.20%**
BH01	**48899**	62.76	62.86	Point Load	**83.4MPa**
BH01	**48900**	62.86	63.05	Uniaxial Compressive Strength	**65MPa**
BH01	**50857**	63.05	63.16	Point Load	**49.6MPa**
BH01	**50858**	64.20	64.50	Indirect Tensile Strength by Brazilian Test	**7.8MPa**
BH01	**50859**	65.40	65.50	Total Sulphur	**<0.1%**
BH01	**50860**	65.66	65.75	Porosity / Density using Saturation and Buoyancy	**0.2/2.72**
BH01	**50861**	65.75	65.92	Porosity / Density using Saturation and Calliper	**0.64/2.69**
BH01	**50862**	66.00	66.10	Point Load	**69.6MPa**
BH01	**50863**	66.10	66.34	Uniaxial Compressive Strength	**104MPa**
BH01	**50864**	66.34	66.45	Point Load	**62.6MPa**
BH01	**50865**	67.07	67.20	Moisture Content	**1.10%**
BH01	**50866**	67.20	67.28	Porosity / Density using Saturation and Calliper	**0.57/2.71**
BH01	**50867**	68.50	68.59	Porosity / Density using Saturation and Buoyancy	**0.2/2.63**
BH01	**50868**	70.10	70.20	Moisture Content	**1.30%**
BH01	**50869**	72.10	72.30	Deformability in Uniaxial Compression	**136.3MPa**
BH01	**50870**	73.03	73.10	Moisture Content	**1.60%**
BH01	**50871**	76.00	76.09	Moisture Content	**1.20%**
BH01	**50872**	79.10	79.18	Point Load	**51.8MPa**
BH01	**50873**	79.18	79.40	Uniaxial Compressive Strength	**62MPa**
BH01	**50874**	79.40	79.52	Point Load	**48.0MPa**
BH01	**50875**	80.04	80.12	Moisture Content	**1.20%**
BH01	**50876**	81.70	81.78	Moisture Content	**1.60%**
BH01	**50877**	87.50	87.57	Moisture Content	**1.80%**
BH01	**50878**	39.70	39.80	Moisture Content	**1.30%**
BH01	**50879**	91.10	91.20	Total Sulphur	**<0.1%**
BH01	**50880**	91.34	91.42	Porosity / Density using Saturation and Calliper	**0.49/2.71**
BH01	**50881**	91.42	91.51	Porosity / Density using Saturation and Buoyancy	**1.0/2.70**
BH01	**50882**	91.63	91.71	Moisture Content	**1.80%**
BH01	**50883**	92.35	92.47	Point Load	**73.3MPa**
BH01	**50884**	92.47	92.70	Uniaxial Compressive Strength	**76MPa**

BH01	**50885**	92.70	92.79	Point Load	**71.1**
BH01	**50886**	93.00	93.10	Moisture Content	**1.50%**
BH01	**50887**	94.90	94.96	Oxidisable Sulphate	**<0.01%**
BH01	**50888**	94.96	95.05	pH Value	**9.2**
BH01	**50889**	97.34	97.43	Moisture Content	**1.30%**
BH01	**50890**	97.95	98.23	Deformability in Uniaxial Compression	**110.0MPa**
BH01	**50891**	101.36	101.45	Moisture Content	**1.60%**
BH01	**50892**	102.90	103.20	Indirect Tensile Strength by Brazilian Test	**12.6MPa**
BH01	**50893**	108.15	108.22	Point Load	**61.2MPa**
BH01	**50894**	108.22	108.51	Uniaxial Compressive Strength	**107MPa**
BH01	**50895**	108.51	108.62	Point Load	**70.2MPa**
BH01	**50896**	108.62	108.70	Moisture Content	**1.20%**
BH01	**50897**	110.27	110.37	Porosity / Density using Saturation and Calliper	**0.57/2.69**
BH01	**50898**	110.37	110.45	Porosity / Density using Saturation and Buoyancy	**0.7/2.59**
BH01	**50899**	113.00	113.08	Thin Section - Petrology	
BH01	**50900**	113.12	113.19	Moisture Content	**1.50%**
BH01	**50901**	115.89	116.05	Point Load	**52.5MPa**
BH01	**50902**	116.05	116.29	Uniaxial Compressive Strength	**104MPa**
BH01	**50903**	116.29	116.39	Point Load	**62.2MPa**
BH01	**50904**	118.82	118.88	Moisture Content	**1.90%**
BH01	**50905**	123.44	123.55	Moisture Content	**2.20%**
BH01	**50906**	125.90	126.00	Moisture Content	**1.30%**
BH01	**50907**	126.80	126.90	Moisture Content	**2.50%**
BH01	**50908**	128.80	128.89	Point Load	**80.8MPa**
BH01	**50909**	128.89	129.14	Uniaxial Compressive Strength	**79MPa**
BH01	**50910**	129.14	129.21	Point Load	**84.0MPa**
BH01	**50911**	131.12	131.17	Moisture Content	**2.60%**
BH01	**50912**	131.60	131.70	Moisture Content	**1.20%**
BH01	**50913**	132.65	132.62	Moisture Content	**1.80%**
BH01	**50914**	133.21	133.32	Point Load	**69.2MPa**
BH01	**50915**	133.32	133.54	Uniaxial Compressive Strength	**110MPa**
BH01	**50916**	133.54	133.63	Point Load	**61.8MPa**
BH01	**50917**	134.35	134.44	Moisture Content	**1.10%**
BH01	**50918**	137.06	137.20	Porosity / Density using Saturation and Calliper	**0.76/2.81**
BH01	**50919**	37.20	137.30	Porosity / Density using Saturation and Buoyancy	**0.3/2.63**
BH01	**50920**	138.60	138.72	pH Value	**9.2**
BH01	**50921**	140.00	140.20	Deformability in Uniaxial Compression	**58.7MPa**
BH01	**50922**	142.81	142.91	Moisture Content	**1.30%**
BH01	**50923**	146.20	146.30	Point Load	**55.0MPa**
BH01	**50924**	146.30	146.52	Uniaxial Compressive Strength	**100MPa**
BH01	**50925**	146.52	146.61	Point Load	**62.6MPa**
BH01	**50926**	148.97	149.05	Thin Section - Petrology	

BH01	**50927**	150.29	150.37	Porosity / Density using Saturation and Calliper	**0.61/2.75**
BH01	**50928**	151.67	151.75	Porosity / Density using Saturation and Buoyancy	**0.7/2.67**
BH01	**50929**	152.97	153.04	Total Sulphur	**<0.1%**
BH01	**50930**	153.20	153.30	Oxidisable Sulphate	**<0.01%**
BH01	**50931**	154.60	154.68	Moisture Content	**1.40%**
BH01	**50932**	155.20	155.28	Moisture Content	**1.70%**
BH01	**50933**	156.33	156.44	Point Load	**42.0MPa**
BH01	**50934**	156.44	156.68	Uniaxial Compressive Strength	**86MPa**
BH01	**50935**	156.68	156.76	Point Load	**47.3MPa**
BH01	**50936**	163.49	163.56	Moisture Content	**2.50%**
BH01	**50937**	165.17	165.25	Point Load	**77.7MPa**
BH01	**50938**	165.25	165.49	Uniaxial Compressive Strength	**83MPa**
BH01	**50939**	165.49	165.58	Point Load	**64.6MPa**
BH01	**50940**	166.00	166.10	Moisture Content	**1.30%**
BH01	**50941**	172.96	173.07	Porosity / Density using Saturation and Calliper	**0.49/2.68**
BH01	**50942**	173.07	173.20	Porosity / Density using Saturation and Buoyancy	**0.4/2.72**
BH01	**50943**	174.47	174.69	Uniaxial Compressive Strength	**76MPa**
BH01	**50944**	175.18	175.26	Point Load	**58.6MPa**
BH01	**50945**	175.26	175.50	Uniaxial Compressive Strength	**86MPa**
BH01	**50946**	175.50	175.59	Point Load	**58.6MPa**
BH01	**50947**	176.00	176.10	Moisture Content	**1.20%**
BH01	**50948**	180.24	180.50	Indirect Tensile Strength by Brazilian Test	**14.6MPa**
BH01	**50949**	182.12	182.20	pH Value	**9.3**
BH01	**50950**	183.17	183.40	Deformability in Uniaxial Compression	**118.6MPa**
BH01	**50951**	183.90	184.02	Point Load	**48.8MPa**
BH01	**50952**	184.02	184.25	Uniaxial Compressive Strength	**97MPa**
BH01	**50953**	184.25	184.34	Point Load	**70.1MPa**
BH01	**50954**	196.19	186.25	Moisture Content	**1.80%**
BH01	**50955**	193.60	193.68	Total Sulphur	**<0.1%**
BH01	**50956**	194.13	194.20	Porosity / Density using Saturation and Calliper	**0.54/2.69**
BH01	**50957**	194.60	194.67	Point Load	**48.0MPa**
BH01	**50958**	194.67	194.90	Uniaxial Compressive Strength	**114MPa**
BH01	**50959**	194.90	194.99	Point Load	**57.6MPa**
BH01	**50960**	195.77	195.86	Porosity / Density using Saturation and Buoyancy	**0.5/2.71**
BH01	**50961**	201.47	201.55	Oxidisable Sulphate	**<0.01%**
BH01	**50962**	204.62	204.70	Point Load	**83.6MPa**
BH01	**50963**	204.70	204.95	Uniaxial Compressive Strength	**132MPa**
BH01	**50964**	204.95	205.02	Point Load	**60.5**
BH01	**50965**	209.65	209.72	Moisture Content	**1.70%**
BH01	**50966**	210.18	210.30	Porosity / Density using Saturation and Calliper	**0.65/2.69**

BH01	**50967**	210.30	210.40	Porosity / Density using Saturation and Buoyancy	**0.3/2.85**
BH01	**50968**	210.57	210.82	Uniaxial Compressive Strength	**111MPa**
BH01	**50969**	211.10	211.20	Moisture Content	**1.40%**
BH01	**50970**	211.77	211.85	Point Load	**56.2MPa**
BH01	**50971**	211.85	212.10	Uniaxial Compressive Strength	**52MPa**
BH01	**50972**	212.10	212.20	Point Load	**68.7MPa**
BH01	**50973**	212.33	212.58	Deformability in Uniaxial Compression	**104.7MPa**
BH01	**50974**	213.80	213.90	pH Value	**9.1**
BH01	**50975**	218.20	218.28	Moisture Content	**1.50%**
BH01	**50976**	222.52	222.62	Moisture Content	**1.00%**
BH01	**50977**	223.70	223.80	Porosity / Density using Saturation and Calliper	**0.56/2.75**
BH01	**50978**	224.08	224.20	Porosity / Density using Saturation and Buoyancy	**0.3/2.63**
BH01	**50979**	225.65	225.74	Point Load	**80.3MPa**
BH01	**50980**	225.74	225.95	Uniaxial Compressive Strength	**77MPa**
BH01	**50981**	225.95	226.03	Point Load	**72.3MPa**
BH01	**50982**	228.16	228.24	Porosity / Density using Saturation and Calliper	**0.64/2.70**
BH01	**50983**	228.24	228.32	Porosity / Density using Saturation and Buoyancy	**0.4/2.65**
BH01	**50984**	230.13	230.20	Moisture Content	**2.00%**
BH01	**50985**	231.65	231.78	Point Load	**53.0MPa**
BH01	**50986**	231.78	232.00	Uniaxial Compressive Strength	**111MPa**
BH01	**50987**	232.00	232.10	Point Load	**74.6MPa**
BH01	**50988**	232.46	232.60	Deformability in Uniaxial Compression	**69.6MPa**
BH01	**50989**	235.04	235.10	Moisture Content	**1.30%**
BH01	**50990**	235.64	235.73	Total Sulphur	**<0.1%**
BH01	**50991**	236.73	237.03	Uniaxial Compressive Strength	**80MPa**
BH01	**50992**	237.17	237.43	Uniaxial Compressive Strength	**76MPa**
BH01	**50993**	242.82	242.92	Point Load	**53.8MPa**
BH01	**50994**	242.92	243.14	Uniaxial Compressive Strength	**118MPa**
BH01	**50995**	243.14	243.23	Point Load	**64.6MPa**
BH01	**50996**	250.30	250.56	Deformability in Uniaxial Compression	**56.4MPa**
BH01	**50997**	251.81	251.95	Point Load	**52.5MPa**
BH01	**50998**	251.95	252.22	Uniaxial Compressive Strength	**121MPa**
BH01	**50999**	252.22	252.32	Point Load	**61.4MPa**
BH01	**51000**	253.30	253.38	Oxidisable Sulphate	**<0.01%**
BH01	**51001**	259.72	259.82	Point Load	**64.1MPa**
BH01	**51002**	259.82	260.06	Uniaxial Compressive Strength	**143MPa**
BH01	**51003**	260.06	260.18	Point Load	**44.9MPa**
BH01	**51004**	262.43	262.63	Uniaxial Compressive Strength	**66MPa**
BH01	**51005**	262.63	262.73	Point Load	**67.7MPa**
BH01	**51006**	264.80	164.93	Point Load	**48.5MPa**
BH01	**51007**	264.93	264.15	Uniaxial Compressive Strength	**83MPa**
BH01	**51008**	265.15	265.25	Porosity / Density using Saturation and Calliper	**0.63/2.65**

BH01	**51009**	265.25	265.38	Porosity / Density using Saturation and Buoyancy	**0.5/2.64**
BH01	**51010**	268.30	268.40	Uniaxial Compressive Strength	**90MPa**
BH01	**51011**	271.70	271.90	Uniaxial Compressive Strength	**91MPa**

Table 7: Summary of Rock Test Results in BH01.

Location ID	Sample ID	Depth Top	Depth Base	Test	Certificate
BH03	**48801**	4.15	4.42	Triaxial - Unconsolidated / Undrained	x
BH03	**48802**	13.65	13.73	Moisture Content	x
BH03	**48803**	13.73	13.85	Atterberg Limits	x
BH03	**48804**	14.90	15.00	Particle Size Distribution	x
BH03	**48805**	19.00	19.10	Particle Size Distribution	x
BH03	**48806**	19.10	19.20	Atterberg Limits	x
BH03	**48807**	19.25	19.30	Moisture Content	x
BH03	**48808**	19.90	20.00	Moisture Content	x
BH03	**48809**	20.95	21.05	pH	x
BH03	**48810**	21.30	21.40	Moisture Content	x
BH03	**48811**	25.50	25.60	Particle Size Distribution	x
BH03	**48812**	25.80	25.90	Particle Size Distribution	x
BH03	**48813**	26.50	26.60	Particle Size Distribution	x
BH03	**48814**	26.70	26.80	Particle Size Distribution	x
BH03	**48815**	27.20	27.25	pH	x
BH03	**48816**	27.45	27.55	Atterberg Limits	x
BH03	**48817**	27.55	27.65	Particle Size Distribution	x
BH03	**48818**	30.25	30.33	Particle Size Distribution	x
BH03	**48819**	31.20	31.30	Moisture Content	x
BH03	**48822**	33.95	34.03	Moisture Content	x
BH03	**48824**	36.70	36.80	Particle Size Distribution	x
BH03	**48825**	38.60	38.70	Moisture Content	x
BH03	**48826**	38.95	39.05	Organic Matter Content	x
BH03	**48827**	39.25	39.30	Atterberg Limits	x
BH03	**48828**	39.45	39.55	Organic Matter Content	x
BH03	**48829**	39.80	39.83	Moisture Content	x
BH03	**48830**	40.65	40.77	Atterberg Limits	x
BH03	**48831**	41.20	41.25	pH	x
BH03	**48832**	41.30	41.50	Oedometer	x
BH03	**48833**	41.85	42.08	Triaxial - Unconsolidated / Undrained	x
BH03	**48834**	42.30	42.35	Moisture Content	x
BH03	**48835**	42.35	42.40	Organic Matter Content	x
BH03	**48836**	42.65	42.97	Triaxial - Unconsolidated / Undrained	x
BH03	**48837**	42.97	43.30	Oedometer	x
BH03	**48838**	44.05	44.20	Oedometer	x
BH03	**48839**	46.20	46.27	Organic Matter Content	x
BH03	**48840**	46.27	46.59	Triaxial - Unconsolidated / Undrained	x
BH03	**48841**	47.00	47.10	pH	x

BH03	**48842**	47.20	47.27	Moisture Content	x
BH03	**48843**	47.45	47.55	Organic Matter Content	x
BH03	**48844**	47.85	48.02	Oedometer	x
BH03	**48845**	48.20	48.30	Atterberg Limits	x
BH03	**48846**	48.45	48.70	Triaxial - Unconsolidated / Undrained	x
BH03	**48847**	49.00	49.10	Organic Matter Content	x
BH03	**48848**	49.30	49.40	Moisture Content	x
BH03	**48849**	63.15	63.22	Organic Matter Content	x
BH03	**48850**	63.38	63.43	pH	x
BH03	**48851**	63.50	63.55	Moisture Content	x
BH03	**48852**	63.90	63.95	Organic Matter Content	x
BH03	**48853**	64.30	64.35	Moisture Content	x
BH03	**48854**	64.90	64.95	Organic Matter Content	x
BH03	**48855**	65.50	65.60	Moisture Content	x
BH03	**48856**	66.95	67.05	Moisture Content	x
BH03	**48857**	68.40	68.45	Moisture Content	x
BH03	**48858**	70.40	70.50	Moisture Content	x
BH03	**48859**	70.75	70.85	Moisture Content	x
BH03	**48860**	71.60	71.70	Moisture Content	x
BH06	**50742**	5.25	5.50	Triaxial - Unconsolidated / Undrained	x
BH06	**50744**	16.20	16.50	Oedometer	x
BH06	**50745**	16.60	16.70	Moisture Content	x
BH06	**50746**	16.70	16.80	Atterberg Limits	x
BH06	**50747**	17.13	17.20	Organic Matter Content	x
BH06	**50748**	18.00	18.25	Triaxial - Unconsolidated / Undrained	x
BH06	**50749**	18.25	18.35	Moisture Content	x
BH06	**50750**	18.65	18.75	Atterberg Limits	x
BH06	**50851**	18.95	19.05	Organic Matter Content	x
BH06	**50852**	19.70	19.95	Oedometer	x
BH06	**50853**	20.00	20.25	Oedometer	x
BH06	**50854**	21.45	21.52	Moisture Content	x
BH06	**50855**	21.52	21.60	Atterberg Limits	x
BH06	**50856**	21.75	21.80	Organic Matter Content	x

Table 8: Summary of Soil Test Results in BH03 & BH06.

Location ID	Sample ID	Depth Top	Depth Base	Test	Result
BH04	**48901**	3.5	3.55	Moisture Content	**0.20%**
BH04	**48902**	5.4	5.48	Moisture Content	**0.60%**
BH04	**48903**	8.06	8.36	Deformability in Uniaxial Compression	**119.9MPa**
BH04	**48904**	9.3	9.36	Moisture Content	**0.30%**
BH04	**48905**	10.63	10.88	Deformability in Uniaxial Compression	**41.6MPa**
BH04	**48906**	11.77	11.83	Moisture Content	**0.20%**
BH04	**48907**	12.62	12.75	Point Load	**59.2MPa**
BH04	**48908**	12.85	13.1	Uniaxial Compressive Strength	**76MPa**
BH04	**48909**	13.1	13.25	Point Load	**52.7MPa**

BH04	**48910**	14.4	14.63	Deformability in Uniaxial Compression	**62.0MPa**
BH04	**48911**	14.63	14.74	Point Load	**49.2MPa**
BH04	**48912**	14.74	14.97	Uniaxial Compressive Strength	**86MPa**
BH04	**48913**	14.97	15.13	Point Load	**60.1MPa**
BH04	**48914**	11.77	11.83	Porosity / Density using Saturation and Calliper & Porosity / Density using Saturation and Buoyancy	**0.2/2.72**
BH04	**48915**	17.74	17.86	Point Load	**60.2MPa**
BH04	**48917**	18.12	18.2	Point Load	**56.5MPa**
BH04	**48918**	19.2	19.32	Point Load	**36.5MPa**
BH04	**48919**	20.05	20.12	Thin Section / Petrography	
BH04	**48920**	20.12	20.22	Point Load	**73.9MPa**
BH04	**48921**	20.22	20.5	Uniaxial Compressive Strength	**55MPa**
BH04	**48922**	20.8	20.85	Moisture Content	**0.40%**
BH04	**48923**	21.2	21.3	Point Load	**68.4MPa**
BH04	**48924**	21.8	21.9	Moisture Content	**1%**
BH04	**48925**	22.2	22.31	Point Load	**90.2MPa**
BH04	**48926**	22.6	22.78	Point Load	**60.1MPa**
BH04	**48927**	22.78	23.06	Uniaxial Compressive Strength	**53MPa**
BH04	**48928**	23.1	23.2	Point Load	**64.6MPa**
BH04	**48929**	21.8	21.9	Porosity / Density using Saturation and Calliper & Porosity / Density using Saturation and Buoyancy	**0.4/2.69**
BH04	**48930**	23.7	23.8	Point Load	**77.7MPa**
BH04	**48931**	23.8	24.1	Uniaxial Compressive Strength	**111MPa**
BH04	**48932**	24.17	24.28	Point Load	**74MPa**
BH04	**48933**	24.28	24.52	Uniaxial Compressive Strength	**91MPa**
BH04	**48934**	25.08	25.19	Point Load	**77.5MPa**
BH04	**48935**	25.19	25.41	Deformability in Uniaxial Compression	**64.1MPa**
BH04	**48936**	28.27	28.4	Porosity / Density using Saturation and Calliper	**0.5/2.65**
BH04	**48937**	27.91	28	Point Load	**89.4MPa**
BH04	**48938**	28.27	28.4	Moisture Content	**0.10%**
BH04	**48939**	28.4	28.44	Point Load	**68.3MPa**
BH04	**48941**	29.38	29.54	Indirect Tensile Strength by Brazilian Test	**5.97MPa**
BH04	**48943**	29.86	29.94	Point Load	**92MPa**
BH04	**48949**	30.93	30.03	Point Load	**76.6MPa**
BH04	**48950**	31.03	31.3	Uniaxial Compressive Strength	**76MPa**
BH04	**48951**	31.3	31.4	Point Load	**67.8MPa**
BH04	**48954**	31.66	31.7	Total Sulphur	**<0.1%**
BH04	**48955**	31.76	31.84	Point Load	**59.6MPa**
BH04	**48956**	31.84	31.93	Oxidisable Sulphur	**0.04**
BH04	**48957**	31.93	32.15	Uniaxial Compressive Strength	**78MPa**
BH04	**48958**	32.15	32.26	Point Load	**55.4MPa**
BH04	**48959**	32.26	32.35	pH	**9.3**
BH04	**48962**	32.5	32.57	Point Load	**78.8MPa**
BH04	**48963**	32.57	32.85	Uniaxial Compressive Strength	**92MPa**
BH04	**48964**	32.85	32.96	Point Load	**65.5MPa**

BH04	**48965**	33.12	33.16	Moisture Content	**0.10%**
BH04	**48966**	33.2	33.48	Deformability in Uniaxial Compression	**66.5MPa**
BH04	**48967**	33.48	33.6	Point Load	**49.9MPa**
BH04	**48968**	32.35	32.43	Porosity / Density using Saturation and Buoyancy	**0.4/2.69**
BH04	**48969**	34.56	34.59	Moisture Content	**0.30%**
BH04	**48970**	34.96	35	Moisture Content	**0.20%**
BH05	**48971**	0.65	0.73	Moisture Content	**0.30%**
BH05	**48972**	0.98	1.04	Moisture Content	**0.10%**
BH05	**48973**	1.41	1.5	Moisture Content	**0.10%**
BH05	**48974**	2.62	2.67	Porosity / Density using Saturation and Calliper	**0.4/2.68**
BH05	**48975**	2.8	2.96	Point Load	**27.8Mpa**
BH05	**48976**	1.41	1.5	Porosity / Density using Saturation and Buoyancy	**0.3/2.65**
BH05	**48977**	7.73	7.84	Point Load	**63MPa**
BH05	**48978**	8.1	8.25	Point Load	**43.8MPa**
BH05	**48979**	8.54	8.66	Point Load	**62MPa**
BH05	**48980**	8.9	8.96	Moisture Content	**0.10%**
BH05	**48981**	9.46	9.57	Point Load	**91.5MPa**
BH05	**48982**	9.57	9.77	Uniaxial Compressive Strength	**91MPa**
BH05	**48983**	9.77	9.92	Point Load	**55.4MPa**
BH05	**48984**	10.2	10.26	Point Load	**101.0MPa**
BH05	**48985**	11.3	11.45	Point Load	**43.1MPa**
BH05	**48986**	11.45	11.72	Uniaxial Compressive Strength	**86MPa**
BH05	**48987**	11.72	11.83	Point Load	**77.2MPa**
BH05	**48988**	12.92	13.07	Moisture Content	**0.30%**
BH05	**48989**	13.5	13.6	Point Load	**141.1MPa**
BH05	**48990**	13.7	13.81	Point Load	**67.3MPa**
BH05	**48991**	13.81	14.07	Uniaxial Compressive Strength	**94MPa**
BH05	**48992**	14.07	14.15	Point Load	**84.4MPa**
BH05	**48993**	14.27	14.4	Point Load	**74.0MPa**
BH05	**48994**	14.65	14.89	Uniaxial Compressive Strength	**72MPa**
BH05	**48995**	15.43	15.55	Point Load	**81.8MPa**
BH05	**48996**	15.95	16.22	Deformability in Uniaxial Compression	**57.0MPa**
BH05	**48997**	16.45	16.55	Point Load	**67.3MPa**
BH05	**48998**	16.87	17.19	Uniaxial Compressive Strength	**77MPa**
BH05	**48999**	17.97	18.06	Porosity / Density using Saturation and Buoyancy	**0.3/2.69**
BH05	**50701**	19.7	19.92	Indirect Tensile Strength by Brazilian Test	**3.39MPa**
BH05	**50702**	28.85	28.95	Porosity / Density using Saturation and Calliper	**0.4/2.69**
BH05	**50703**	22.07	22.21	Point Load	**54.3MPa**
BH05	**50704**	22.9	23	Point Load	**87.3MPa**
BH05	**50705**	23.94	24.05	Point Load	**67.2MPa**
BH05	**50706**	24.05	24.3	Deformability in Uniaxial Compression	**44.9MPa**
BH05	**50707**	24.73	24.85	Point Load	**66.4MPa**
BH05	**50708**	25.2	25.4	Deformability in Uniaxial Compression	**22.6MPa**

BH05	**50709**	26	26.12	Point Load	**76.4MPa**
BH05	**50710**	26.12	26.35	Deformability in Uniaxial Compression	**66.3MPa**
BH05	**50711**	27.68	27.88	Uniaxial Compressive Strength	**79MPa**
BH05	**50712**	28.75	28.85	Moisture Content	**0.10%**
BH05	**50715**	29.09	29.18	Total Sulphur	**<0.1**
BH05	**50716**	29.18	29.3	Oxidisable Sulphur	**<0.01**
BH05	**50717**	29.3	29.4	pH	**9.2**
BH05	**50718**	30.3	30.4	Moisture Content	**0.40%**
BH05	**50721**	30.88	30.92	Moisture Content	**0.30%**
BH05	**50725**	32.44	32.54	Point Load	**76.8MPa**
BH05	**50726**	32.54	32.6	Moisture Content	**0.20%**
BH05	**50727**	32.83	32.92	Point Load	**66.7MPa**
BH05	**50728**	32.92	33	Thin Section / Petrography	
BH05	**50729**	33	33.26	Uniaxial Compressive Strength	**116MPa**
BH05	**50730**	33.22	33.26	Porosity / Density using Saturation and Calliper	**0.6/2.69**
BH05	**50731**	33.5	33.7	Uniaxial Compressive Strength	**51MPa**
BH05	**50733**	33.92	33.16	Uniaxial Compressive Strength	**54MPa**
BH05	**50735**	34.5	34.7	Porosity / Density using Saturation and Buoyancy	**0.4/2.68**
BH05	**50736**	37.4	37.5	Point Load	**80.7MPa**
BH05	**50737**	37.5	37.82	Uniaxial Compressive Strength	**131MPa**
BH05	**50738**	37.82	37.92	Point Load	**77.2MPa**
BH05	**50740**	37.92	38.08	Point Load	**52.3MPa**

Table 9: Summary of Rock Test Results in BH04 & BH05

Sample	Test	Result
Bulk Sample	Aggregate Crushing Value	**23%**
Bulk Sample	Aggregate Impact Value	**17%**
Bulk Sample	Aggregate Abrasion Value	**12**
Bulk Sample	Polished Stone Value	**38**
Bulk Sample	Slake Durability	**99.40%**
Bulk Sample	Los Angeles Coefficient	**28**
Bulk Sample	Soundness by Magnesium Sulphate	**1**
Bulk Sample	10% Fines	**150kN**
Bulk Sample	Frost Heave	**3.3mm**

Table 10: Summary of Rock Test Results in Bulk Sample

3.8 In Situ Water Testing

Water samples were obtained from boreholes BH04, BH05 and BH06 and tested for pH, Temperature, Conductivity and Dissolved O_2. Three water samples were obtained and the pH, Temperature, Conductivity and dissolved O_2 data was acquired using a Watterra Pump with each borehole purged for at least 30 minutes. This work was carried out by Ronan Doyle of Ronan Doyle Monitoring Solutions, Ballinrobe County Mayo.

Borehole	pH	Temperature (^{o}C)	Conductivity (µS)	Dissolved O_2 (mg/l)
BH04	7.47	10.5	295	0.21
BH05	7.77	10.5	420	0.8
BH06	12.53	9.8	6187	0.8

Table 11: In Situ Water Testing Results

3.9 Permeability Testing

Falling Head and Packer Testing was carried out on boreholes BH04 and BH05. The ground conditions intersected in boreholes BH03 and BH06 was considered too unstable for permeability testing.

A falling head test was carried out in BH04 on the 5th of January 2016. The rods were removed from the hole and the water level in the borehole was recorded at 17.88m bgl before the test commenced. Initially a volume of 130 litres was pumped into the hole, upon cessation of pumping the water level recovered almost immediately (i.e. faster than the dip meter could be lowered into the hole). A second test was subsequently carried out and 500 litres were pumped into the hole and same rapid recovery to 17.88m bgl was observed.

Falling head tests were carried out in BH05 on the 7th of January 2016. The rods were removed from the hole and the water level in this borehole was recorded at 19.45m bgl before commencement of the test. Initially a volume of 215 litres was pumped into the hole and the hole recovered back to 19.42m bgl and had stabilised after 40 minutes. A second test using a greater volume of water was carried out and 1000 litres of water was pumped into the hole. This test had proceeded almost to conclusion when the water level rose slightly (c.1.0cm) and a obstruction could be felt in the hole. The driller ran the rods back into the hole to assist with the piezometer installation and found that there was clay in the hole from 19.3 to 20.8m. The Falling Head test data is presented in Appendix XI.

Packer testing was carried out in boreholes BH04 and BH05 on the 18th of December 2015 and the 6th of January 2016 respectively. Set up details are presented in Table 12 and the results in Appendix X.

Borehole	Top (m)	Bottom (m)	Midpoint (m)
BH04	18	20	19
BH04	21	23	22
BH04	24	26	25
BH04	28	30	29
BH05	36	38	37
BH05	30	32	31
BH05	24	27	25.5
BH05	20	23	21.5

Table 12: Packer Test Installation Details

The Packer Tests carried out at 28-30m and 21-23m in BH04 suffered from loss of water pressure due to cavities / fractures. For both of these tests only one stage could be measured. All of the scheduled packer tests were carried out in BH05.

It was noted that the water pressure recovery once pumping had ceased was instantaneous in all of the test intervals.

3.10 Water level Measurements

Throughout the ground investigation water level measurements were taken from all of the vertical drillholes, both during and after drilling. It should be noted that owing to ground instability and the need to keep holes open for the ground geophysical surveying, the bulk of the readings from boreholes BH03 and BH04 were taken when the holes were cased with PW steel casing, which extended from surface to the base of the hole.

APPENDIX I

Hole	East	North	Elevation
BH1	530370.592	728426.557	16.712
BH3	530023.824	728382.566	26.256
BH4	530150.783	728400.125	32.167
BH5	530186.649	728378.105	34.138
BH6	530125.143	728383.081	30.799

Survey name	Station	East	North	Elevation	Dip	Azimuth	Tool–	Gravity	Mag.Str.	Mag.Dip	Mag.X	Mag.Y	Mag.Z	Roll Angle	Mag.T/face	DLS
*	Metres	Metres	Metres	Metres	Degrees	Degrees	Centigrade	G	nT	Degrees	nT	nT	nT	Degrees	Degrees	deg./30m
BH-1	1	0	0	0	-11.5	268.3	11	1.000147	48955	67.9	18396	0	45367	90	292.4	0
BH-1	4	-2.94	-0.09	-0.6	-11.5	268.1	11	1.00047	48954	67.9	18424	0	45355	90	292.4	1.9
BH-1	7	-5.88	-0.18	-1.2	-11.5	268.4	11	1.000677	48946	67.9	18415	0	45350	89.7	292.1	2.3
BH-1	10	-8.81	-0.28	-1.8	-11.7	267.9	11	1.00063	49023	67.9	18436	0	45424	89	291.5	5.4
BH-1	13	-11.75	-0.39	-2.41	-11.7	267.9	11	1.001172	49022	67.9	18468	0	45410	88.4	290.9	0.4
BH-1	16	-14.68	-0.5	-3.02	-11.8	267.6	11	1.000628	49027	67.9	18422	0	45434	88.4	290.8	3
BH-1	19	-17.62	-0.62	-3.63	-11.9	267.5	11	1.00041	49014	67.9	18451	0	45408	88.2	290.7	0.9
BH-1	22	-20.54	-0.81	-4.27	-12.6	265.4	11	1.002129	49028	68.5	17966	0	45618	89.2	291	22.5
BH-1	25	-23.47	-0.99	-4.91	-12.1	267.2	11	1.000351	49037	67.9	18457	0	45431	88.7	291.1	19
BH-1	28	-26.4	-1.13	-5.54	-12.2	267.3	11	1.000495	49044	67.9	18458	0	45438	88.4	290.8	1.2
BH-1	31	-29.33	-1.28	-6.18	-12.4	267.1	11	1.000687	49069	67.9	18452	0	45467	88.5	290.9	3.2
BH-1	34	-32.25	-1.43	-6.83	-12.6	266.9	11	1.000132	49044	67.9	18419	0	45454	88.4	290.8	2.8
BH-1	37	-35.18	-1.58	-7.48	-12.6	267.1	11	1.000742	49065	67.9	18458	0	45460	88.3	290.7	2.2
BH-1	40	-38.1	-1.73	-8.13	-12.6	267.1	11	1.000358	49075	67.9	18479	0	45463	88.3	290.8	0.4
BH-1	43	-41.02	-1.88	-8.79	-12.6	267.1	11	1.000171	49057	67.9	18429	0	45464	88.5	290.9	0.6
BH-1	46	-43.95	-2.02	-9.44	-12.5	267.3	11	1.000035	49054	67.9	18466	0	45446	88.8	291.3	2
BH-1	49	-46.87	-2.17	-10.09	-12.7	267	11	1.000317	49034	67.9	18438	0	45435	89.4	291.8	2.7
BH-1	52	-49.8	-2.32	-10.75	-12.7	267.1	11	1.000291	49062	68	18415	0	45475	89.7	292.1	0.4
BH-1	55	-52.72	-2.47	-11.41	-12.7	266.9	11	1.000127	49043	67.9	18450	0	45440	90.4	292.9	2
BH-1	58	-55.64	-2.61	-12.06	-12.5	267.8	11	0.99969	49044	67.6	18658	0	45356	90.8	293.6	9.5
BH-1	61	-58.57	-2.74	-12.72	-12.8	267.1	11	1.000477	49098	67.9	18474	0	45490	92.3	294.8	8
BH-1	64	-61.49	-2.89	-13.38	-12.8	267	11	1.00001	49037	67.9	18460	0	45430	93.1	295.6	0.4
BH-1	67	-64.41	-3.04	-14.05	-12.9	266.9	11	1.000212	49044	67.9	18458	0	45438	93.5	296	1.5
BH-1	70	-67.33	-3.2	-14.72	-12.9	267	11	1.0002	49029	67.9	18458	0	45422	94.5	297	1.4
BH-1	73	-70.25	-3.35	-15.39	-12.9	266.9	11	1.000355	49071	67.9	18437	0	45476	94.9	297.4	1.7
BH-1	76	-73.17	-3.51	-16.06	-12.9	267	11	1.000287	49068	67.8	18512	0	45442	95.4	297.9	1.8
BH-1	79	-76.11	-3.53	-16.68	-10.9	272	11	0.992033	49037	67.9	18432	0	45441	95.8	298.3	52.4

Survey name	Station	East	North	Elevation	Dip	Azimuth	Tool–	Gravity	Mag.Str.	Mag.Dip	Mag.X	Mag.Y	Mag.Z	Roll Angle	Mag.T/face	DLS
*	Metres	Metres	Metres	Metres	Degrees	Degrees	Centigrade	G	nT	Degrees	nT	nT	nT	Degrees	Degrees	deg./30m
BH-1	82	-79.04	-3.56	-17.3	-13	266.9	11	1.000459	49018	67.9	18469	0	45406	96.3	298.8	53.7
BH-1	85	-81.96	-3.72	-17.98	-13.2	266.6	11	1.000487	49052	67.9	18490	0	45434	96.5	299.1	3.2
BH-1	88	-84.87	-3.89	-18.66	-13.1	266.8	11	1.000296	49038	67.9	18437	0	45440	96.8	299.2	1.2
BH-1	91	-87.79	-4.06	-19.34	-13.1	266.8	11	1.000282	49031	67.9	18455	0	45426	96.8	299.3	0.7
BH-1	94	-90.71	-4.22	-20.03	-13.1	266.7	11	1.000122	49080	67.9	18447	0	45482	97.2	299.7	1
BH-1	97	-93.62	-4.39	-20.71	-13.2	266.7	11	1.000303	49066	67.9	18470	0	45457	97.6	300.1	0.6
BH-1	100	-96.54	-4.55	-21.4	-13.2	266.7	11	1.000268	49068	67.8	18503	0	45445	97.5	300.1	0.5
BH-1	103	-99.47	-4.63	-22.05	-11.8	270.2	11	0.995246	49056	68.6	17887	0	45678	98.2	300	37
BH-1	106	-102.39	-4.71	-22.7	-13.3	266.7	11	1.00031	49060	67.9	18480	0	45446	97.7	300.2	37.4
BH-1	109	-105.31	-4.88	-23.39	-13.3	266.6	11	1.000017	49021	67.9	18429	0	45425	97.8	300.3	0.7
BH-1	112	-108.22	-5.05	-24.08	-13.4	266.5	11	1.000223	49056	67.9	18482	0	45442	98	300.5	1.5
BH-1	115	-111.13	-5.22	-24.78	-13.4	266.7	11	1.000889	49063	67.9	18460	0	45457	98	300.5	1.4
BH-1	118	-114.05	-5.4	-25.48	-13.5	266.5	11	1.000317	49027	67.9	18468	0	45416	98.3	300.8	2.1
BH-1	121	-116.96	-5.58	-26.18	-13.4	266.6	11	1.000141	49042	67.9	18448	0	45440	98.3	300.8	1.2
BH-1	124	-119.87	-5.75	-26.88	-13.5	266.5	11	1.000272	49046	67.9	18477	0	45433	98.3	300.9	0.9
BH-1	127	-122.78	-5.93	-27.58	-13.5	266.5	11	0.99995	49034	67.9	18473	0	45422	98.3	300.8	0.6
BH-1	130	-125.69	-6.11	-28.28	-13.6	266.4	11	1.000699	49079	67.9	18430	0	45487	98.2	300.7	0.8
BH-1	133	-128.6	-6.29	-28.99	-13.6	266.6	11	1.00039	49055	67.9	18443	0	45456	98.2	300.8	1.6
BH-1	136	-131.51	-6.47	-29.7	-13.7	266.3	11	0.999701	49064	67.9	18444	0	45466	98	300.5	2.8
BH-1	139	-134.42	-6.65	-30.41	-13.7	266.4	11	1.000129	49052	67.9	18462	0	45445	98.2	300.7	0.9
BH-1	142	-137.33	-6.83	-31.12	-13.8	266.4	11	1.000614	49054	67.9	18477	0	45441	98.7	301.3	0.9
BH-1	145	-140.24	-7.02	-31.83	-13.8	266.3	11	1.000523	49075	67.9	18474	0	45465	98.7	301.2	0.7
BH-1	148	-143.14	-7.21	-32.55	-13.8	266.3	11	1.000394	49034	67.9	18471	0	45422	98.9	301.5	0.6

Survey name	Station	East	North	Elevation	Dip	Azimuth	Tool–	Gravity	Mag.Str.	Mag.Dip	Mag.X	Mag.Y	Mag.Z	Roll Angle	Mag.T/face	DLS
*	Metres	Metres	Metres	Metres	Degrees	Degrees	Centigrade	G	nT	Degrees	nT	nT	nT	Degrees	Degrees	deg./30m
BH-1	151	-146.05	-7.39	-33.26	-13.8	266.4	11	1.000164	49043	67.9	18474	0	45430	98.9	301.5	1.5
BH-1	154	-148.96	-7.57	-33.98	-13.9	266.4	11	1.000365	49066	67.9	18451	0	45464	99.1	301.6	1
BH-1	157	-151.87	-7.76	-34.7	-13.9	266.3	11	1.000252	49055	67.8	18506	0	45430	99.2	301.8	1
BH-1	160	-154.77	-7.95	-35.43	-14	266.2	11	0.999691	49068	67.9	18477	0	45456	99.2	301.7	0.6
BH-1	163	-157.68	-8.14	-36.15	-14	266.3	11	1.001008	49040	67.9	18411	0	45453	99.3	301.8	0.5
BH-1	166	-160.58	-8.33	-36.88	-14	266.2	11	0.999912	49061	67.9	18462	0	45455	100.3	302.8	0.6
BH-1	169	-163.48	-8.52	-37.6	-14	266.3	11	1.00026	49044	67.9	18480	0	45430	100.3	302.9	1.2
BH-1	172	-166.39	-8.71	-38.33	-14.1	266.4	11	1.000443	49080	67.9	18462	0	45476	100.3	302.8	0.4
BH-1	175	-169.29	-8.89	-39.06	-14.1	266.2	11	0.999983	49089	67.9	18458	0	45487	100.3	302.8	1.5

APPENDIX II

Rotary Core Log

Borehole No. **BH01**

Sheet 1 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		0.00 - 5.60								Concrete Plinth
		5.60 - 6.30	14	100	60	41	5.60	11.11		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. (Core invert not marked)
		6.30 - 7.52	3	100	100	100	6.30	10.41		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Sub-vertical stylolites, occasional coarse shelled bioclast (Brachiopod)
		7.52 - 10.15	6	100	89	81	7.52	9.19		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Occasional fine grained scattered bioclasts, minor stylolites

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 2 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							10.15	6.56		
		10.15 - 11.10	2	88	88	88				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Very occasional fine grained bioclast
							11.10	5.61		
		11.10 - 12.66	5	100	44	38				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. pellety / slightly oolitic texture
							12.66	4.05		
		12.66 - 14.20	2	100	100	96				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. pellety / slightly oolitic intervals with small rounded bioclasts
							14.20	2.51		
		14.20 - 14.58	18	100	29	29				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Intersecting conjugate joints
							14.58	2.13		
		14.58 - 15.46	2	100	100	100				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Minor white calcite fill along joint
							15.46	1.25		
		15.46 - 15.86	15	100	25	0				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. White calcite fill and weak oxidation along steeply dipping joint surface
							15.86	0.85		
		15.86 - 17.04	2	100	100	100				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. pellety / slightly oolitic texture, minor thick shelled brachiopods
							17.04	-0.33		
		17.04 - 21.07	3	97	87	86				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Slightly pellety scattered fine bioclastic debris with occasional coarse shelled brachiopod fragment

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 3 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							21.07	-4.36		
		21.07 - 21.60	23	100	53	40				Strong. fresh, grey / pale grey, fine to medium grained, massive LIMESTONE. minor bioclastic debris and white calcite veinlets, basal 10cm is rubble
		21.60 - 22.75	3	100	100	100	21.60	-4.89		Strong. fresh, grey / pale grey, fine to medium grained, massive LIMESTONE. Occasional coarse shelled brachiopod fragments
		22.75 - 24.34	4	100	78	65	22.75	-6.04		Strong. fresh, grey / pale grey, fine to medium grained, massive LIMESTONE. Thin, discontinuous white/pink dolomite veinlets dipping at 45'. Minor scattered fine grained bioclasts and very fine stylolites
		24.34 - 24.73	15	92	0	0	24.34	-7.63		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Cavity developed with weak oxidation and pitting / dissolution on contacts
		24.73 - 31.68	2	100	100	100	24.73	-8.02		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. with hairline white calcite veinlets dipping at 50 - 70'. Minor scattered poorly sorted bioclastic debris. Fine sub-vertical stylolites

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 4 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		31.68 - 33.22	7	100	77	55	31.68	-14.97		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. fine sub-vertical stylolites. 31.78m calcite filled vugs locally developed
		33.22 - 37.10	2	100	97	95	33.22	-16.51		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Small scattered bioclasts, very rare coarse shell and coral fragment. Minor fine stylolites
		37.10 - 38.70	6	100	59	51	37.10	-20.39		Strong. fresh, brownish pale grey, fine to medium grained, massive LIMESTONE. Fine grained scattered bioclastic debris, minor very fine stylolites
		38.70 - 40.45	2	100	100	100	38.70	-21.99		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Very minor scattered bioclastic debris, minor orange limonitic staining along a joint surface at 39.35m

Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 5 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							40.45	-23.74		
		40.45 - 43.30	3	100	90	88				Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Minor bioclastic debris, and fine stylolites
		43.30 - 44.30	6	90	9	0	43.30	-26.59		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Fine vuggy texture and faint stylolites
		44.30 - 52.98	6	100	96	91	44.30	-27.59		Strong. fresh, light grey, fine to medium grained, massive LIMESTONE. Scattered bioclastic debris, fragments of coarse shelled brachiopods or solitary corals. locally developed fine vuggy texture (49.1 - 49.55m). White calcite veinlets dip 90', azimuth 020' to core invert

41 42 43 44 45 46 47 48 49 50

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 6 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		52.98 - 53.74	9	97	37	13	52.98	-36.27		Strong. fresh, light grey, fine to medium grained, massive LIMESTONE. Minor fine stylolites
		53.74 - 56.10	3	94	94	90	53.74	-37.03		Strong. fresh, light grey, fine to medium grained, massive LIMESTONE. Very rare small bioclastic fragments, fine stylolites
		56.10 - 58.60	3	100	96	92	56.10	-39.39		Strong. fresh, grey, medium grained, massive LIMESTONE. Pellety texture with scattered small bioclastic fragments and faint stylolites.
							58.60	-41.89		Strong. fresh, light grey, fine to medium grained, massive LIMESTONE. Minor bioclastic debris, and fine stylolites

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 7 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		58.60 - 61.47	3	100	99	99				
							61.47	-44.76		
		61.47 - 62.25	10	100	55	47				Strong. fresh, light grey, fine to medium grained, massive LIMESTONE. Fine vuggy texture, 61.94m a 1cm thick white calcite vein dipping at 80' azimuth 185' to core invert
							62.25	-45.54		
		62.25 - 63.73	1	100	100	100				Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Occasional fine stylolite
							63.73	-47.02		
		63.73 - 64.22	10	94	69	61				Strong. fresh, grey/light grey, fine to medium grained, massive LIMESTONE. Minor bioclastic debris, and fine stylolites. Some coarse vugs (6mm wide) irregular shaped with orange/brown limonitic infill
							64.22	-47.51		
		64.22 - 67.85	3	100	100	100				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Incipient pellety texture , scatted bioclastic debris, and faint stylolites
							67.88	-51.17		
		67.85 - 68.78	9	92	77	60				Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Minor bioclastic debris, and fine stylolites

Continued on next sheet

61 62 63 64 65 66 67 68 69 70

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 8 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		68.78 - 72.31	3	98	96	96				
		72.31 - 73.39	6	100	30	19	72.31	-55.60		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Minor bioclastic debris, and fine stylolites. Axial parallel jointing
		73.39 - 75.70	3	100	94	94	73.39	-56.68		Strong. fresh, pale grey, fine grained, massive LIMESTONE. Minor fine stylolites
		75.70 - 76.37	12	96	67	16	75.70	-58.99		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE.
		76.37 - 77.60	2	100	100	95	76.37	-59.66		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Fine stylolites
		77.60 - 78.20	20	100	12	0	77.60	-60.89		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. 77.85m 1cm thick white calcite vein, 78.16m 1cm thick white orange calcite vein (Fe stains)
							78.20	-61.49		Strong. fresh, pale grey, fine grained, massive LIMESTONE. Numerous stylolites

Continued on next sheet

71 72 73 74 75 76 77 78 79 80

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 9 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		78.20 - 86.15	3	99	99	98				
							86.15	-69.44		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Occasional stylolites and fine grained bioclastic debris. 87.06m - 1cm thick white calcite vein
		86.15 - 88.77	2	100	96	96				
							88.77	-72.06		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. 90.09m - 2cm thick white calcite vein. Locally developed fine vuggy texture
		88.77 - 90.30	7	100	49	23				

81 82 83 84 85 86 87 88 89 90

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 10 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							90.30	-73.59		
		90.30 - 95.95	2	100	99	98				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Minor faint stylolites
							95.95	-79.24		
		95.95 - 100.33	3	99	94	89				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. small scattered bioclasts with some large (7cm dia.) coarse shelled brachiopods

91 92 93 94 95 96 97 98 99 100

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 11 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							100.33	-83.62		
		100.33 - 102.74	6	97	85	71				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Scattered small partially oxidised vugs. 101.4 & 101.43m 1cm thick white calcite veins dip 90' Azimuth 360'
							102.74	-86.03		
		102.74 - 105.90	3	100	99	99				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Fine bioclastic debris scattered throughout
							105.90	-89.19		
		105.90 - 108.60	2	100	100	99				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Thin (c.1mm), randomly orientated white / brown calcite veinlets over top 40cm. scattered fine bioclastic debris and fine stylolites
							108.60	-91.89		
										Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Occasional scattered fine bioclastic debris and fine stylolites . Minor white calcite veining dipping at 85' to 180'

101 102 103 104 105 106 107 108 109 110

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 12 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		108.60 - 111.55	5	100	98	86				
							111.55	-94.84		Strong. fresh, grey, fine grained, massive LIMESTONE. Fine black stylolites
		111.55 - 113.73	1	100	100	100				
							113.73	-97.02		
		113.73 - 114.33	3	100	0	0				Strong. fresh, grey, fine grained, massive LIMESTONE. Fine grained bioclastic debris. Axial parallel jointing
							114.33	-97.62		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Disseminated very fine grained bioclastic debris
		114.33 - 119.52	1	100	100	98				
							119.52	-102.81		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Faint pellety texture, etched stylolites and scattered small vugs, often

111 112 113 114 115 116 117 118 119 120

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 13 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		119.52 - 127.29	4	100	95	87				weakly oxidised. Disseminated fine grained bioclastic debris
		127.29 - 128.75	6	99	97	82	127.29	-110.58		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Incipient mottled texture and scattered fine bioclastic debris.
							128.75	-112.04		Strong. fresh, dark grey, fine to medium grained, massive LIMESTONE. Wispy black argillaceous partings. Scattered fine bioclastic debris with some coarse shelled brachiopods / gastropods. thick black stylolites with argillic infill. Occasional white calcite veinlet

121 122 123 124 125 126 127 128 129 130

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 14 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		128.75 - 134.90	1	100	97	97				
		134.90 - 136.05	4	84	84	84	134.90	-118.19		Strong. fresh, dark grey, fine to medium grained, massive LIMESTONE. Wispy black argillaceous partings. Scattered fine bioclastic debris with some coarse shelled brachiopods.
		136.05 - 137.52	3	100	100	95	136.05	-119.34		Strong. fresh, dark grey, fine to medium grained, massive LIMESTONE. Weak intraclastic breccia texture minor stylolites and black argillic partings
		137.52 - 141.84	2	100	100	100	137.52	-120.81		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Small scattered bioclasts, incipient intraclastic breccia texture locally developed minor discontinuous white calcite veinlets

131 132 133 134 135 136 137 138 139 140

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 15 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		141.84 - 142.93	3	100	100	100	141.84	-125.13		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Small scattered bioclasts, incipient bioturbated / burrowed texture
		142.93 - 143.70	0	100	100	100	142.93	-126.22		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE.. Pellety / almost oolitic texture
		143.70 - 148.30	1	100	100	100	143.70	-126.99		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Intraclastic breccia texture sub-rounded clasts 0.5 - 2.0cm dia. possibly related to bioturbation / burrowing. Minor stylolites and a very rare bioclast
		148.30 - 148.90	10	100	0	0	148.30	-131.59		Core is crosscut by a 2cm thick band of weak / very weak, fresh, fine grained Black MUDSTONE. Soft / Friable texture, locally altered to clay dip 32' to 060'
							148.90	-132.19		Strong. fresh, dark grey / black, fine to medium grained, massive LIMESTONE. Intraclastic breccia texture poorly sorted, very irregular / angular clasts of fine grained limestone (micrite) in a black / dark grey locally argillaceous matrix. Intensity of brecciation decreasing with depth

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 16 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		148.90 - 154.60	2	100	99	97				
		154.60 - 161.75	1	100	100	71	154.60	-137.89		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Stylolites locally up to 3mm thick. Minor bioclastic debris. Locally developed incipient intraclastic breccia / bioturbation textures

151 152 153 154 155 156 157 158 159 160

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 17 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							161.75	-145.04		
		161.75 - 166.30	1	100	100	98				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Locally developed pellety / oolitic texture. Scattered bioclastic debris
							166.30	-149.59		
		166.30 - 168.90	1	100	100	99				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Numerous coarse bioclasts and white calcite infilling small voids
							168.90	-152.19		
										Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Slight pellety texture. Scattered fine to medium grained bioclasts

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 18 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		168.90 - 172.00	1	100	100	100				
							172.00	-155.29		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE.
		172.00 - 175.65	2	100	100	99				
							175.65	-158.94		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Scattered coarse shelled brachiopods
		175.65 - 177.00	1	100	100	100				
							177.00	-160.29		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Minor stylolites, some up to 2mm thick. Scattered fine bioclastic debris
		177.00 - 182.50	1	100	100	100				

171 172 173 174 175 176 177 178 179 180

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 19 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							182.50	-165.79		
		182.50 - 186.80	1	100	100	99				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Locally developed incipient intraclastic breccia texture. Fine stylolites and minor bioclasts
							186.80	-170.09		
		186.80 - 189.00	0	0	0	0				Cavity - No recovery. Pitting / dissolution textures and slight brown oxidation on contacts
							189.00	-172.29		
		189.00 - 190.30		100	0	0				Soft to firm, light brown, fine grained sandy CLAY. Some tabular / angular clasts of light brown oxidised mudstone within the clay

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 20 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
			0				190.30	-173.59		
		190.30 - 191.20	0	100	100	100				Strong. fresh, grey, fine to medium grained, massive LIMESTONE.
		191.20 - 192.85	8	100	64	41	191.20	-174.49		Strong. fresh, grey / dark grey, fine to medium grained, massive LIMESTONE.
		192.85 - 195.70	1	100	100	100	192.85	-176.14		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Light brown sandy clay coating joint surfaces
		195.70 - 198.70	1	100	100	100	195.70	-178.99		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Scattered coarse shelled brachiopods
							198.70	-181.99		Strong. fresh, light grey / grey, fine to medium grained, massive LIMESTONE. Occasional coarse shelled brachiopod, locally developed incipient intraclastic breccia texture

191 192 193 194 195 196 197 198 199 200

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 21 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		198.70 - 203.00	2	91	91	91				
		203.00 - 203.90	9	94	94	56	203.00	-186.29		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Minor coarse shelled brachiopods. Joints coated with light brown fine sandy clay
		203.90 - 207.50	1	100	98	98	203.90	-187.19		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Scattered coarse shelled brachiopods
							207.50	-190.79		Strong. fresh, grey, fine to medium grained, massive LIMESTONE.

201 202 203 204 205 206 207 208 209 210

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 22 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		207.50 - 214.50	1	100	100	99				
		214.50 - 216.90	2	100	90	90	214.50	-197.79		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. disseminated bioclastic debris
		216.90 - 217.60	3	100	100	100	216.90	-200.19		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Slightly vuggy with minor oxidation focused upon vugs
		217.60 - 221.55	4	97	87	78	217.60	-200.89		Strong. fresh, light grey / grey, fine to medium grained, massive LIMESTONE.

211 212 213 214 215 216 217 218 219 220

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 23 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							221.55	-204.84		
		221.55 - 223.55	5	100	98	96				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Minor oxidation and light brown clay localised along joints and along some stylolites
							223.55	-206.84		
		223.55 - 226.55	3	97	84	81				Strong. fresh, pale grey/ grey, medium grained, massive LIMESTONE. Distinct pellety texture, fine grained bioclastic debris. 226.4 - 226.5 evidence of oxidation, dissolution (pitting) along a shallowly dipping joint plane
							226.55	-209.84		
		226.55 - 229.10	3	100	97	95				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. slight dissolution and oxidation focused on some joint surfaces
		229.10 - 229.20	0	0	0	0	229.10	-212.39		Cavity infilled with light brown soft / firm sticky clay
							229.20	-212.49		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Slight discolouration and oxidation along some joint surfaces

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 24 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		229.20 - 231.10	4	95	91	86	231.10	-214.39		
		231.10 - 233.20	1	100	98	95				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE.
		233.20 - 234.15	11	91	79	45	233.20	-216.49		Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Joints and fractures infilled with light brown fine / medium grained sand. 232.78 2cm white calcite vein
		234.15 - 237.55	6	99	80	70	234.15	-217.44		Strong. fresh, grey, fine to medium grained, massive LIMESTONE. Locally developed fine vuggy texture. 236.6m joint with intense bright orange Fe Staining.
		237.55 - 239.20	0	0	0	0	237.55	-220.84		CAVITY - coarse grained yellow sand and angular gravel with some light brown silt. Recover 30 - 35%
							239.20	-222.49		Strong. fresh, light grey / grey, fine to medium grained, massive LIMESTONE. Locally developed coarse vuggy texture - vugs up to 5mm dia.

231 232 233 234 235 236 237 238 239 240

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 25 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		239.20 - 241.40	6	50	19	13				
							241.40	-224.69		
		241.40 - 243.90	4	100	97	95				Strong. fresh, pale grey, fine to medium grained, massive LIMESTONE. Scattered poorly sorted bioclastic debris. Fine grained orange brown sand coating joint surfaces
							243.90	-227.19		
		243.90 - 245.58	7	85	36	29				Strong. slightly weathered, pale grey, fine to medium grained, massive LIMESTONE. 243.9-244.35m axial parallel discontinuity with black argillaceous lamina. Orange brown clayey sand coating joint surfaces
							245.58	-228.87		
		245.58 - 247.25	0	0	0	0				CAVITY - 5% recovery of yellow brown fine to medium grained sand
							247.25	-230.54		
		247.25 - 248.37	4	100	61	38				Strong. fresh, pale grey / grey, mottled, fine to medium grained, massive LIMESTONE. Fine vuggy texture with minor oxidation / Fe staining localised within the vugs. Some axial parallel jointing
							248.37	-231.66		
		248.37 - 250.20	3	100	97	93				Strong. fresh, dark grey, medium grained, massive LIMESTONE. Poorly sorted bioclastic debris

241 242 243 244 245 246 247 248 249 250

Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 26 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							250.20	-233.49		Strong. fresh, dark grey, medium grained, massive LIMESTONE. Poorly sorted bioclastic debris. Discontinuous randomly orientated white calcite veinlets
		250.20 - 253.00	2	100	98	98				
							253.00	-236.29		Strong. fresh, grey, medium grained, massive LIMESTONE. Scattered poorly sorted bioclastic debris. Incipient intraclastic breccia texture
		253.00 - 255.50	2	100	92	92				
		255.50 - 255.90	7	100	0	0	255.50	-238.79		Strong. grey LIMESTONE cross cut by cavity / dissolution zone bright orange staining and dissolution textures on cavity contact
		255.90 - 256.90	4	100	60	60	255.90	-239.19		Strong. fresh, grey, medium grained, massive LIMESTONE. Scattered bioclastic debris
		256.90 - 257.35	22	78	0	0	256.90	-240.19		Moderately strong, black, fine to medium grained LIMESTONE - black argillite rich zones - Rubble poorly sorted fragments with some polished surfaces.
		257.35 - 259.40	3	100	68	68	257.35	-240.64		Moderately strong. black / dark grey, fine to medium grained, massive LIMESTONE. Intraclastic breccia, irregular poorly sorted limestone clasts in a black argillite rich matrix
		259.40 - 259.50	0	100	0	0	259.40	-242.69		Strong. fresh, dark grey, medium grained, massive LIMESTONE.
										Continued on next sheet

Remarks

AGS

Rotary Core Log

Borehole No. **BH01**

Sheet 27 of 28

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530370.59 - 728426.56	Hole Type RC
Location: Galway		Level: 16.71	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		259.50 - 263.10	3	100	90	87				
		263.10 - 263.70	3	58	0	0	263.10 263.70	-246.39 -246.99		Weak, black / grey MUDSTONE, running sub-parallel to core axis band is 2 - 3cm thick and partially altered to clay. The contact with the limestone shows evidence of oxidation / Fe staining
		263.70 - 266.40	2	100	100	100				Strong. fresh, grey / pale grey, medium grained, massive LIMESTONE. Mottled and evidence of bioturbation / burrowing. 265.4 - 265.46 fracture zone with rubble and coarse brown sand
		266.40 - 267.10	17	100	40	40	266.40	-249.69		Strong. fresh, grey / pale grey, medium grained, massive LIMESTONE. Mottled and evidence of bioturbation / burrowing. Core is coated with coarse brown sand
		267.10 - 267.70	2	100	100	100	267.10 267.70	-250.39 -250.99		Strong. fresh, grey / pale grey, medium grained, massive LIMESTONE. Mottled and evidence of bioturbation / burrowing.
		267.70 - 270.30	6	100	55	52				Strong. fresh, grey / dark grey, medium grained, massive LIMESTONE. Occasional stylolitic and axial parallel joint

261 262 263 264 265 266 267 268 269 270

Continued on next sheet

Remarks

Rotary Core Log

Borehole No. **BH01**

Sheet 28 of 28

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530370.59 - 728426.56	Hole Type RC
Location:	Galway		Level:	16.71	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 21/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							270.30	-253.59		
		270.30 - 272.40	1	100	100	100				Strong. fresh, grey / dark grey, medium grained, massive LIMESTONE.
							272.40	-255.69		
		272.40 - 273.40	0	0	0	0				CAVITY no recovery
							273.40	-256.69		
		273.40 - 274.16	5	79	39	20				Strong. fresh, very pale grey, medium grained, massive LIMESTONE. Probably a boulder within cavity / unconsolidated sediments
							274.16	-257.45		
		274.16 - 276.70	0	8	0	0				CAVITY - unconsolidated ground only 10% medium to coarse limestone cobbles and some gravel recovered
							276.70	-259.99		End of borehole at 276.70 m

271 272 273 274 275 276 277 278 279 280

Remarks

AGS

Rotary Core Log

Borehole No. **BH03**

Sheet 1 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
										No Recovery
							1.20	25.06		Very soft, light brown, sandy CLAY with minor angular gravel
							1.45	24.81		Rubble of sub-angular to sub-rounded grey Limestone fragments and minor creamy coloured calcite. Lumps of soft light grey/brown clay. (Recovery 0.35m)
							2.70	23.56		Stiff, grey brown, sandy CLAY, occasional sub angular gravel and cobbles of dark grey limestone
							3.00	23.26		Coarse cobbles of dark grey limestone with firm / stiff grey brown sandy clay
							3.20	23.06		Coarse COBBLES with gravel. Sub-angular to sub-rounded grey / dark grey limestone with minor pink (tonalitic) granite
							3.55	22.71		Core loss
		4.15 - 4.42	C				4.00	22.26		Stiff / very stiff, light grey/brown sandy CLAY with minor (10 - 15%) scattered angular limestone gravel
							4.85	21.41		Stiff / very stiff, light grey/brown sandy CLAY with angular limestone gravel & cobbles
							6.00	20.26		Core loss
							6.55	19.71		Stiff / very stiff, light grey/brown sandy CLAY with angular limestone gravel, cobbles and occasional boulders
							6.85	19.41		Stiff / very stiff, grey / brown sandy CLAY with (12 - 20%) angular limestone gravel and occasional sub-rounded cobbles
							7.65	18.61		Core loss
							8.05	18.21		Loose angular GRAVEL with cobbles. Coated with stiff sandy clay
							8.25	18.01		Stiff / very stiff, light grey / brown, sandy CLAY, 205 sub-angular / sub-rounded gravel and occasional sub-rounded cobble and small boulder
										Continued on next sheet

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 2 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							11.55	14.71		Stiff / very stiff, light grey / brown, sandy CLAY, 205 sub-angular / sub-rounded gravel and occasional sub-angular cobbles and small boulder
							12.94	13.32		Soft, dark chocolate brown CLAY
							12.98	13.28		Core Loss
		13.65 - 13.73	D				13.65	12.61		Soft / very soft, greenish grey, fine sandy SILT (recovery 0.5m)
		13.73 - 13.85	D							
		14.90 - 15.00	D				14.75	11.51		Core Loss
							16.15	10.11		Soft / firm, grey / green SILT
							16.45	9.81		Soft / very soft, grey brown SILT with very thin clay laminae (Mobilised and coating surface by drilling additive)
							16.85	9.41		Core loss
							18.60	7.66		Soft / very soft, grey SILT
		19.00 - 19.10	D							
		19.10 - 19.20	D							
		19.25 - 19.30	D				19.25	7.01		Soft / firm, grey SILT, locally developed faint brown laminae (smearing of clay surface)
		19.90 - 20.00	D							

Continued on next sheet

Remarks

All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 3 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		20.95 - 21.05	D							
		21.30 - 21.40	D							
							21.70	4.56		Very soft / soft, grey SILT (Recovery 50%)
							23.00	3.26		Soft / firm, grey SILT (Recovery 60%)
							25.20	1.06		Soft / very soft, grey SILT (Recovery 90%)
		25.50 - 25.60	D							
		25.80 - 25.90	D							
		26.50 - 26.60	D							
		26.70 - 26.80	D							
		27.20 - 27.25	D							
		27.45 - 27.55	D							
		27.55 - 27.65	D				27.50	-1.24		Firm grey SILT with centimetric scale horizontal banding
							28.45	-2.19		Soft, grey SILT (recovery 60%)
							30.00	-3.74		

Continued on next sheet

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 4 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		30.25 - 30.33	D							Soft / firm grey SILT
		31.20 - 31.30	D							
		31.35 - 31.45	D							
							31.73	-5.47		Firm, grey / brown SILT
							32.40	-6.14		Soft, grey SILT
		33.70 - 33.80	D							
		33.95 - 34.03	D							
							34.60	-8.34		Soft / Firm, light grey SILT. Minor fine grained sand
		36.05 - 36.15	D				36.05	-9.79		Loose / medium dense, light grey / brown, silty SAND (recovery 30%)
		36.70 - 36.80	D							
							38.38	-12.12		Firm, dark chocolate brown organic CLAY, Small fibres bottom 0.5m of core coated with fine grained grey sand
		38.60 - 38.70	D							
		38.95 - 39.05	D							
		39.25 - 39.30	D							
		39.45 - 39.55	D							
		39.80 - 39.83	D							

Continued on next sheet

31 32 33 34 35 36 37 38 39 40

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 5 of 11

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530023.82 - 728382.57	Hole Type RC
Location: Galway		Level: 26.26	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		40.65 - 40.77	D				40.65	-14.39		Loose / medium dense, grey, fine to medium grained SAND (recovery 60%)
							41.00	-14.74		Firm grey / brown, organic CLAY, minor dark brown banding 0.5 - 1cm thick
		41.20 - 41.25	D							
		41.30 - 41.50	C							
		41.85 - 42.08	C				41.80	-15.54		Stiff / very stiff, dark brown, organic CLAY. Basal 4cm laminated - light / dark brown millimetric scale laminae
		42.30 - 42.35	D							
		42.35 - 42.40	D				42.40	-16.14		Firm / stiff, dark brown grey, CLAY
		42.65 - 42.97	C							
		42.97 - 43.30	C							
							43.25	-16.99		Soft to firm light grey CLAY
		44.05 - 44.20	C							
							44.20	-17.94		Core Loss
							44.85	-18.59		Firm, dark grey brown CLAY
							45.24	-18.98		Soft, grey SILT
							45.30	-19.04		Very Stiff, Dark brown / grey, organic CLAY
		46.20 - 46.27	D							
		46.27 - 46.59	C							
		47.00 - 47.10	D							
		47.20 - 47.27	D							
		47.45 - 47.55	D							
		47.85 - 48.02	C							
		48.20 - 48.30	D							
		48.45 - 48.70	C							
		49.00 - 49.10	D							
		49.30 - 49.40	D							
							50.00	-23.74		

Continued on next sheet

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 6 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							50.35	-24.09		Firm grey CLAY, with cobbles of strong pale grey limestone rounded to sub-angular
										Soft, light greyish brown, cobbly CLAY, cobbles of pale grey limestone, comprise 50% of material
							51.30	-25.04		Boulder of pale grey massive limestone, stylolitic with stylolites rotated to sub-vertical orientation
							52.56	-26.30		Soft / firm, brownish grey gravelly CLAY, angular gravel (10 - 20%), sub-rounded coarse cobbles / small boulders (30 - 40%) of light grey massive limestone. (recovery 80%)
							56.40	-30.14		Sub-rounded COBBLES with coarse gravel - coated by soft light grey clay
							57.15	-30.89		Soft / firm Pale grey CLAY with angular cobbles of grey limestone (recovery 40%)
							57.85	-31.59		Soft grey brown CLAY with angular gravel and cobbles (Recovery 40%)
										Continued on next sheet

51 52 53 54 55 56 57 58 59 60

Remarks
All angles measured relative to core normal

AGS

Rotary Core Log

Borehole No. **BH03**

Sheet 7 of 11

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530023.82 - 728382.57	Hole Type RC
Location: Galway		Level: 26.26	Scale 1:50
Client: Galway County Council		Dates: 13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							60.55	-34.29		BOULDER of strong, pale grey, fine to medium grained Limestone
							62.20	-35.94		Soft to firm grey brown cobbly CLAY - cobbles of angular limestone
							62.52	-36.26		Stiff brown, organic CLAY
		63.15 - 63.22	D							
		63.38 - 63.43	D							
		63.50 - 63.55	D							
		63.90 - 63.95	D							
		64.30 - 64.35	D				64.05	-37.79		Loose / medium dense, brown / grey, medium grained SAND
		64.90 - 64.95	D				64.11	-37.85		Firm / stiff, brown / dark brown, organic CLAY, Finely laminated (0.5 - 1.5mm laminae) light / dark brown. Occasional small white clay flecks / blebs. Millimetric to centimetric scale bands of fine to medium grained sand, locally developed grading - coarsening down
		65.50 - 65.60	D							
							65.78	-39.52		Stiff pale grey CLAY
							65.85	-39.59		Firm / stiff, brownish grey, finely laminated CLAY with sub-rounded cobbles of grey limestone, locally friable and broken up in situ
							66.48	-40.22		Firm grey, fine sandy CLAY, with 10% angular gravel
		66.95 - 67.05	D				66.85	-40.59		Firm, pale creamy grey, fine grained sandy CLAY (recovery 80%)
		68.40 - 68.45	D				67.65	-41.39		Firm, grey / creamy grey fine sandy CLAY laminated and banded texture with small clasts of creamy white, soft weather limestone
							69.15	-42.89		BOULDER of strong, fresh pale grey, fine grained Limestone
							69.89	-43.63		

Continued on next sheet

Remarks

All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 8 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		70.40 - 70.50	D							Firm, dark brown / grey, laminated CLAY, with boulders of light grey limestone
		70.75 - 70.85	D							
							72.98	-46.72		Soft / firm, grey / brown fine sandy CLAY with angular fine to medium grained limestone gravel and cobbles
							73.95	-47.69		Loose. light grey / brown medium grained SAND, with bands of soft brown clay (Recovery 50%)
							75.00	-48.74		BOULDER of strong, fresh, pale grey Limestone
							76.14	-49.88		Firm dark brown organic CLAY, minor coarse grained gravel
							76.35	-50.09		Soft dark brown organic CLAY - very light / low density
							76.42	-50.16		Soft light brown / grey, gravelly CLAY, 50 -60% coarse angular gravel and occasional cobbles, poor recovery of clay but all cobbles / gravel have a clay coating
							79.10	-52.84		BOULDER of strong light grey limestone
							79.54	-53.28		Soft / firm grey brown sandy CLAY, with sub-angular limestone gravel / cobbles
										Continued on next sheet

71 72 73 74 75 76 77 78 79 80

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 9 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							80.10	-53.84		Loose coarse gravelly COBBLES of light grey limestone. evidence of reworking by the bit
							85.55	-59.29		Tricone drilling - Open hole drilling - no recovery

81 82 83 84 85 86 87 88 89 90

Continued on next sheet

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No.
BH03
Sheet 10 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring			Depth (m)	Level (m)	Legend	Stratum Description
				TCR	SCR	RQD				

91
92
93
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96
97
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99
100

Continued on next sheet

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH03**

Sheet 11 of 11

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530023.82 - 728382.57	Hole Type RC
Location:	Galway		Level:	26.26	Scale 1:50
Client:	Galway County Council		Dates:	13/11/2015 - 09/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							104.95	-78.69		Strong, grey, fine to medium grained, massive LIMESTONE. Discontinuous white calcite veining dipping at 55 - 65' and up to 1cm thick., scatter bioclast debris.
							107.10	-80.84		Rubble of gravel sized pale grey Limestone fragments
		107.50 - 108.16	7	90	52	52	107.50	-81.24		Strong, fresh pale grey, fine grained, massive LIMESTONE. Scattered bioclastic debris, stylolitic thin argillite partings
							108.16	-81.90		Soft, dark brown CLAY, with cobbles of angular / sub-angular limestone
		108.60 - 109.90		100	100	100	108.60	-82.34		Strong, fresh, grey medium grained, massive LIMESTONE. Scattered fine bioclastic debris. 109.4m small calcite filled void with cubic crystals of purple fluorite
							109.90	-83.64		End of borehole at 109.90 m

101 102 103 104 105 106 107 108 109 110

Remarks
All angles measured relative to core normal

Rotary Core Log

Borehole No. **BH04**

Sheet 1 of 7

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530150.78 - 728400.13	Hole Type RC
Location:	Galway		Level:	32.17	Scale 1:25
Client:	Galway County Council		Dates:	11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		0.00 - 1.20		0	0	0				No Recovery sandy gravelly soil
		1.20 - 1.35		100	0	0	1.20	30.97		Mid brown, soft CLAY, with fine to medium grained, angular, limestone gravel
		1.35 - 1.50		100	0	0	1.35	30.82		Light grey to pale brown soft CLAY
		1.50 - 2.84		37	0	0	1.50	30.67		Rubble comprising - Strong, Slightly weathered pale grey fine to medium grained LIMESTONE
		2.84 - 3.36		87	13	0	2.84	29.33		Strong, fresh, pale grey to brownish grey, fine to medium grained LIMESTONE
		3.36 - 4.00		100	0	0	3.36	28.81		Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Broken in chaotic angular fragments clasts ranging in size from 0.5cm to 10cm across in a matrix of firm to stiff brown / grey clay between fragments and in bands up to 10cm thick.
		4.00 - 4.20	25	100	0	0	4.00	28.17		Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. two fracture sets, 1. dipping at 25' Planar / Rough, 2. Dipping at 85', Planar / Rough coated with grey / brown clay.
		4.20 - 4.45		100	0	0	4.20	27.97		A rubble of Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE.
		4.45 - 4.90	9	100	24	24	4.45	27.72		Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Two fracture sets, 1. dipping at 15 -30' Planar to slightly undulating / Rough, infilled with grey /brown grey stiff clay with fine grained sand, 2. Dipping at 65', Planar / Rough
							4.90	27.27		

Continued on next sheet

1 2 3 4 5

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH04**

Sheet 2 of 7

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530150.78 - 728400.13	Hole Type RC
Location: Galway		Level: 32.17	Scale 1:25
Client: Galway County Council		Dates: 11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		4.90 - 5.95	10	100	10	10				Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Etched, sub-horizontal stylolites. Two fracture sets, 1. Closely spaced, dipping at 15-25' Planar to slightly undulating / Rough, coated with light brown / grey clay and fine sand, 2. Dipping at 70 - 90', Planar -undulating/ Rough coated with grey / brown clay and fine grained sand.
							5.95	26.22		
		5.95 - 6.20		88	0	0				Rubble of Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Fragments angular and 1 - 7cm across.
							6.20	25.97		
		6.20 - 7.30	8	100	0	0				Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE.. Slightly etched stylolites. two fracture sets, 1. dipping at 5 - 20' Planar / Rough,, grey clay infill 2. Dipping at 70 - 90', Planar - undulating / Rough coated with grey / brown clay.
							7.30	24.87		
		7.30 - 7.53	2	100	100	70				Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. One fracture set, dipping at 10' Planar / Rough,
							7.53	24.64		
		7.53 - 7.80	7	100	0	0				Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Sub-horizontal stylolites. 3 - 10cm apart. One fracture set dipping at 70 - 90' Undulating / Rough, brown clay fill - aperture width up to 2mm..
							7.80	24.37		
		7.80 - 8.60	3	100	93	93				Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Sub horizontal, well developed stylolites two fracture sets, 1. dipping at 5 - 10' Planar / Rough, 2. Dipping at 45', Planar / Rough no infill
							8.60	23.57		
		8.60 - 11.36	5	100	13	13				Strong, fresh, pale grey / brown, fine to medium grained massive LIMESTONE. Sub horizontal stylolites 10-20cm apart. Locally developed, sub -vertical white calcite veinlets at 9.7m. Three fracture sets, 1. dipping at 10 - 25' Undulating to Planar / Rough, locally developed light brown clay and fine grained sand, 2. Dipping at 70 - 90, Planar / Rough coated / infilled with with grey / brown clay. 3. Locally developed (between 9.4 - 97m), dipping at 85' Planar / Rough controlled by hairline white calcite veinlets

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH04**

Sheet 3 of 7

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530150.78 - 728400.13	Hole Type RC
Location:	Galway		Level:	32.17	Scale 1:25
Client:	Galway County Council		Dates:	11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							11.36	20.81		
		11.36 - 12.50	8	100	72	66				Strong, fresh, grey, fine to medium grained massive LIMESTONE. two fracture sets, 1. dipping at 5-15' Planar / Rough, locally developed thin clay light brown coating, 2. Dipping at 55', Planar / Rough coated with white grey calcite.
							12.50	19.67		
		12.50 - 15.86	1	100	100	100				Strong, fresh, grey / pale grey, fine to medium grained massive LIMESTONE. Sub horizontal stylolites., minor fine bioclastic debris. One fracture set dipping at 10' Planar / Rough.

11 12 13 14 15

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH04**

Sheet 4 of 7

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530150.78 - 728400.13	Hole Type RC
Location:	Galway		Level:	32.17	Scale 1:25
Client:	Galway County Council		Dates:	11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							15.86	16.31		
		15.86 - 17.74	6	100	41	41				Strong, fresh, grey, slightly mottled, fine to medium grained, massive LIMESTONE. Two fracture sets, 1. dipping at 10-25' undulating / Rough, Grey/brown to orange-brown clay coating fracture surfaces. and locally infilling fractures - aperture up to 2mm thick. 2. Dipping at 60 - 70', Planar / Rough very minor clay coating.
		17.74 - 18.40	0	100	100	100	17.74	14.43		Strong, fresh, pale grey / grey, slightly mottled, fine to medium grained, massive LIMESTONE. 5mm wide calcite vein dipping at 85'.
		18.40 - 18.50		100	0	0	18.40	13.77		Very soft, dark bluish grey CLAY
		18.50 - 18.60		100	0	0	18.50	13.67		
		18.60 - 19.36	1	100	100	100	18.60	13.57		Medium strength, fresh, faintly laminated, black MUDSTONE. Disseminated, sub mm to mm scale blebs of crystalline pyrite. Basal contact has a wavy / undulating nature. Strong, fresh, grey / dark grey, fine to medium grained, massive LIMESTONE. Faint brecciated intraclastic texture. - very irregular shaped angular, centimetric scale clasts in a dark grey fine grained matrix. Chaotic network of shaley stylolitic partings - incipient randomly orientated fracturing. One fracture set. dipping at 5' Planar / Rough, no infill
		19.36 - 19.55		79	0	0	19.36	12.81		Dark grey, soft CLAY with friable angular / tabular grey limestone fragments 2 - 5mm across
		19.55 - 19.95	18	100	58	40	19.55	12.62		Strong, fresh, grey / dark grey, slightly mottled, fine to medium grained, massive LIMESTONE. Brecciated texture, angular / irregularly shaped intraclasts 0.5 - 3cm across, in a dark grey fine grained matrix (micrite), clasts are matrix
							19.95	12.22		

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH04**

Sheet 5 of 7

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530150.78 - 728400.13	Hole Type RC
Location: Galway		Level: 32.17	Scale 1:25
Client: Galway County Council		Dates: 11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		19.95 - 20.78	0	100	100	100				supported. One fracture set, dipping at 40-45' Planar / Rough, minor grey/brown clay. Strong, fresh, grey, slightly mottled, fine to medium grained, massive LIMESTONE. Brecciated texture, sub-angular, irregular shaped, intraclasts in a dark grey fine grained matrix. Minor bioclastic debris.
		20.78 - 21.64	2	100	100	100	20.78	11.39		Strong, fresh, grey, fine to medium grained, massive LIMESTONE. Incipient breccia texture. Sub-horizontal stylolites 10 - 15cm apart, minor scattered bioclasts. One fracture set dipping at 25' Planar / Rough, no infill (rubbly)
		21.64 - 22.60	9	96	57	57	21.64	10.53		Strong, fresh, grey / pale grey, slightly mottled, fine to medium grained, massive LIMESTONE. Sub-horizontal stylolites and very small discontinuous white calcite veins. Three fracture sets, 1. dipping at 5-10' Planar to slightly stepped / Rough,. 2. Dipping at 30 - 40', Planar / Rough, 3. Dipping at 70 - 75' Planar / Rough minor orange brown clay particulary over top 20cm. .
		22.60 - 26.50	2	100	100	99	22.60	9.57		Strong, fresh, pale grey / brownish grey, fine to medium grained, massive LIMESTONE. Scattered small bioclasts and an occasional larger (2- 3cm) coral fragment. Sub-horizontal stylolites 20 - 30cm apart. One fracture set dipping at 5-10' Planar / Rough, minor pale brown sandy clay coating.

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH04**

Sheet 6 of 7

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530150.78 - 728400.13	Hole Type RC
Location:	Galway		Level:	32.17	Scale 1:25
Client:	Galway County Council		Dates:	11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		26.50 - 27.20	9	100	46	20	26.50	5.67		Strong, fresh, pale grey / brownish grey, fine to medium grained, massive LIMESTONE. Two fracture sets, 1. dipping at 5-10 Planar / Rough, no infill. 2. Dipping at 55-60', Planar / Rough, very minor yellowish brown clay coating.
		27.20 - 28.95	4	100	87	78	27.20	4.97		Strong, fresh, pale grey, fine to medium grained, massive LIMESTONE. Two fracture sets, 1. closely / medium spaced, dipping at 5-10' Planar / Rough, Grey/brown to orange-brown clay coating fracture surfaces. and locally infilling fractures - aperture up to 2mm thick. 2. Dipping at 45", Planar / Rough
		28.95 - 29.32		0	0	0	28.95	3.22		CAVITY. Contacts display evidence of dissolution, pitting etc... thin coatings of yellowish brown clay
		29.32 - 30.20	3	100	100	100	29.32	2.85		Strong, fresh, pale grey, fine to medium grained, massive LIMESTONE. Sub-horizontal stylolites 10 - 20cm apart. One fracture set, 1. Closely spaced, dipping at 0-5' Planar / Rough,

Continued on next sheet

26 27 28 29 30

Remarks
All angles measured relative to short core axis

AGS

Rotary Core Log

Borehole No. **BH04**

Sheet 7 of 7

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530150.78 - 728400.13	Hole Type RC
Location:	Galway		Level:	32.17	Scale 1:25
Client:	Galway County Council		Dates:	11/11/2015 - 12/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							30.20	1.97		
		30.20 - 30.40		100	0	0				Very soft light brown / grey CLAY with a band of pale brown sand 5cm thick at top. Cavity Fill?
							30.40	1.77		
		30.40 - 33.72	2	100	100	98				Strong, fresh, pale grey, fine to medium grained, massive LIMESTONE. Sub-horizontal stylolites. One fracture sets dipping at 5-20' Planar / Rough, Medium spaced.
		33.72 - 34.30	7	100	0	0	33.72	-1.55		Strong, fresh, pale grey, fine to medium grained, massive LIMESTONE. Sub-horizontal stylolites. Two fracture sets 1. dipping at 5-10' Planar / Rough, no infill. 2. dipping at 75-85', Planar / Rough.
		34.30 - 35.00	1	100	100	100	34.20	-2.03		Strong, fresh, pale grey, fine to medium grained, massive LIMESTONE. Minor sub-horizontal stylolites. One fracture sets dipping at 250' Planar to undulating / Rough, no infill.
							35.00	-2.83		End of borehole at 35.00 m

31 32 33 34 35

Remarks
All angles measured relative to short core axis

AGS

Rotary Core Log

Borehole No. **BH05**

Sheet 1 of 9

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530186.65 - 728378.11	Hole Type RC
Location: Galway		Level: 34.14	Scale 1:25
Client: Galway County Council		Dates: 06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							0.40	33.74		Overburden minor cobbles recovered
		0.40 - 0.95	13	100	0	0	0.95	33.19		Strong, pale grey, medium grained, massive LIMESTONE. Joint set dipping at 5 - 10' Planar / Rough, no infill. Joint set dipping at 85 - 90' Planar / Rough, grey calcite coating joint surface
		0.95 - 1.17	0	100	100	100	1.17	32.97		Strong, pale grey, medium grained, massive pellety LIMESTONE
		1.17 - 1.50	12	100	0	0	1.50	32.64		Strong, pale grey, medium grained, massive LIMESTONE. Joints dipping at 5 - 10' Planar - slightly undulating / Rough,, very close to closely spaced,
		1.50 - 2.30	11	100	0	0	2.30	31.84		Strong pale grey / grey, medium grained, massive LIMESTONE. Joints dipping at 5 - 10' Planar / Rough. Set of two conjugate joints dipping at 85 - 90' with strike angle between sets of 110 / 70' Planar to Slightly undulating / Rough
		2.30 - 3.27	11	100	32	32	3.27	30.87		Strong, pale grey, fine to medium grained, slightly bioclastic, massive LIMESTONE. Minor stylolites, Very closely to closely spaced fractures dipping at 5 - 15', Planar to slightly undulating / Rough.
		3.27 - 5.80	8	99	0	0				Strong, grey / pale grey, medium grained, pellety, massive LIMESTONE. closely spaced fracture dipping at 5 - 15', Planar to slightly undulating / Rough. Fracture set dipping at 85' planar / rough
										Continued on next sheet

1 2 3 4 5

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH05**

Sheet 2 of 9

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530186.65 - 728378.11	Hole Type RC
Location:	Galway		Level:	34.14	Scale 1:25
Client:	Galway County Council		Dates:	06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							5.80	28.34		
		5.80 - 8.00	6	100	0	0				Strong, pale grey, medium grained, pellety, massive LIMESTONE. fine grained scattered bioclastic debris, Sub horizontal stylolites. Very closely to closely spaced fractures dipping at 5 - 20', Planar to slightly undulating / Rough, minor fine grained grey sand infill. Axial parallel conjugate jointing dipping at 85 - 90' striking 120 / 60 relative to each other. minor clay coating
		8.00 - 8.68	1	91	91	91	8.00	26.14		Strong, pale grey, medium grained, massive LIMESTONE. fine grained scattered bioclastic debris, Sub horizontal stylolites.
		8.68 - 9.50	11	100	88	37	8.68	25.46		Strong, pale grey, fine grained, massive LIMESTONE. Sub horizontal stylolites. Fractures dipping at 5 - 10', Planar / Rough, Fractures dipping at 45' Planar - slightly undulating / Rough
		9.50 - 10.25	0	100	100	100	9.50	24.64		Strong, pale grey, fine grained, massive LIMESTONE. fine, sub horizontal stylolites, spaced 5 - 10cm.

Continued on next sheet

6 7 8 9 10

Remarks
All angles measured relative to short core axis

AGS

Rotary Core Log

Borehole No. **BH05**

Sheet 3 of 9

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530186.65 - 728378.11	Hole Type RC
Location: Galway		Level: 34.14	Scale 1:25
Client: Galway County Council		Dates: 06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							10.25	23.89		
		10.25 - 11.34	13	100	0	0				Strong, pale grey, fine grained, massive LIMESTONE. Sub horizontal stylolites. Three fractures sets 1. dipping at 5 - 10', Planar / Rough, no infill; 2. dipping at 45 - 50' planar to slightly undulating / Rough, fine sand coating fracture surfaces. 3. dipping at 85 - 90', Planar to slightly undulating / Rough cross-cutting the other fracture sets.
							11.34	22.80		
		11.34 - 12.62	3	100	100	78				Strong, pale grey, fine to medium grained, massive LIMESTONE. Sub horizontal stylolites. Two fracture sets 1. dipping at 5 - 10', Planar to slightly undulating / Rough, 2. dipping at 85 - 90', Planar / Rough very minor iron staining.
							12.62	21.52		
		12.62 - 13.27	15	100	0	0				Strong, pale grey / grey, fine / medium grained, massive LIMESTONE. Two fractures sets 1. Close to very closely spaced dipping at 5 - 20', Planar / Rough; 2. dipping at 70 - 80', Planar / Rough
							13.27	20.87		
		13.27 - 15.04	4	100	100	96				Strong, grey, fine / medium grained, massive LIMESTONE. Very small scattered bioclasts, Occasional sub-horizontal stylolites. Small elongate calcite filled "Birdseyes", elongate sub vertical long axis 5 - 10mm long and 0.5mm wide. Two fracture sets 1. Medium spaced dipping at 5 - 15', Planar / Rough; 2. Widely spaced, dipping at 55', Planar / Rough

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH05**

Sheet 4 of 9

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530186.65 - 728378.11	Hole Type RC
Location: Galway		Level: 34.14	Scale 1:25
Client: Galway County Council		Dates: 06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							15.04	19.10		
		15.04 - 15.44	18	100	100	0				Strong, grey, fine / medium grained, massive LIMESTONE. Very small scattered bioclasts and a large 1cm dia. gastropod , Occasional sub-horizontal stylolites. Two fracture sets 1. Closely to very closely spaced dipping at 5 - 15', Planar / Rough; 2. Dipping at 85', Planar to slightly undulating / Rough
							15.44	18.70		
		15.44 - 16.82	2		100	100				Strong, grey, fine / medium grained, massive LIMESTONE. Occasional sub-horizontal stylolites. Faint intraclasts centimetric scale. One fracture set dipping at 10', Planar / Rough;
							16.82	17.32		
		16.82 - 18.40	8	100	100	63				Strong, grey, fine / medium grained, massive LIMESTONE. Fine grained scattered bioclastic debris. Locally developed intraclasts, clasts are rounded to sub-rounded 1 - 2cm in dia. Two fracture sets 1. Medium spaced dipping at 10 - 15', Planar / Rough, minor associated rubble; 2. Sub-vertical - undulating dipping at 80 - 90', Planar / Rough
							18.40	15.74		
		18.40 - 19.26	7	100	95	60				Strong, grey, fine grained, massive LIMESTONE. Thin band of coarse brachiopod shells at 18.82m. Two fracture sets 1. Medium spaced, dipping at 10', Planar / Rough, minor light brown clay coating the fracture surfaces; 2. Dipping at 80-85', Planar / Rough associated with thin white calcite veinlets
							19.26	14.88		
		19.26 - 19.95	3	100	100	100				Strong, pale grey, fine / medium grained, massive, pellety LIMESTONE. Fine scattered bioclasts, Occasional sub-horizontal stylolites. Fracture set dipping at 5 - 10', Planar / Rough, no infill.
							19.95	14.19		

Continued on next sheet

16 17 18 19 20

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH05**

Sheet 5 of 9

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530186.65 - 728378.11	Hole Type RC
Location: Galway		Level: 34.14	Scale 1:25
Client: Galway County Council		Dates: 06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		19.95 - 20.20	24	100	60	0				Strong, grey, fine / medium grained, massive LIMESTONE. Two fracture sets 1. Closely spaced dipping at 5 - 10', Planar / Rough; 2. Dipping at 45', Planar / Rough light brown clay infill, up to 2mm thick.
		20.20 - 20.30	0	0	0	0	20.20	13.94		Core loss
		20.30 - 20.45	0	100	100	100	20.30	13.84		Very stiff, light brown / orange brown CLAY. Finely laminated.
		20.45 - 20.75	20	100	0	0	20.45	13.69		Strong, grey, fine / medium grained, massive LIMESTONE. Small black millimetric scale blebs- burrowing? Three fracture sets 1. Very closely spaced, dipping at 5', Planar / Rough; 2. Dipping at 80', Planar / Rough with white calcite coating fracture surfaces. 3. dipping at 70', undulating / rough crosscut by set 2.
		20.75 - 21.50	9	100	35	24	20.75	13.39		Strong, grey pale grey mottled, fine / medium grained, massive, pellety LIMESTONE. Intraclastic texture sub-angular to sub-rounded clasts 1 - 2cm dia. in a darker grey fine grained matrix. Two fracture sets 1. Dipping at 10 - 15', Planar / Rough; 2. Dipping at 60', Planar to undulating / Rough, fracture surfaces coated with light brown clay
		21.50 - 22.40	4	100	94	94	21.50	12.64		Strong, grey, medium grained, massive LIMESTONE. Very small scattered bioclasts with occasional coarse brachiopods. Minor sub-horizontal stylolites. Two fracture sets 1. Medium spaced dipping at 10', Planar / Rough; 2. Medium spaced, dipping at 35', Planar / Rough
		22.40 - 23.73	5	100	16	16	22.40	11.74		Strong, pale grey, fine / medium grained, massive LIMESTONE. Occasional sub-horizontal stylolites with minor oxidation. Thin hairline, steeply dipping white calcite veinlets. Two fracture sets 1. Medium spaced dipping at 5 - 10', Planar / Rough; 2. Dipping at 80-85', Planar / Rough, light brown clay coating fracture surfaces, locally developed fracture infill up to 1mm thick
		23.73 - 25.55	2	100	93	93	23.73	10.41		Strong, grey / grey brown, fine / medium grained, massive LIMESTONE. Occasional faint, sub-horizontal stylolites. Minor scatter fine bioclastic debris. Two fracture sets 1. Medium spaced dipping at 5 - 10', Planar / Rough; 2. Dipping at 60', Planar / Rough

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH05**

Sheet 6 of 9

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530186.65 - 728378.11	Hole Type RC
Location:	Galway		Level:	34.14	Scale 1:25
Client:	Galway County Council		Dates:	06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		25.55 - 25.85	13	100	80	80	25.55	8.59		Strong, grey / brownish grey, fine / medium grained, massive LIMESTONE. Very small scattered bioclasts, Two fracture sets 1. dipping at 10 - 20', Planar / Rough; 2. Dipping at 50', Planar / Rough no infill
		25.85 - 26.60	3	100	91	91	25.85	8.29		Strong, grey, fine / medium grained, massive LIMESTONE. Slightly oxidised sub-horizontal stylolites. Fracture set dipping at 5 - 10', Planar / Rough; no infill
		26.60 - 27.65	9	100	37	37	26.60	7.54		Strong, pale grey / brownish grey, fine / medium grained, massive LIMESTONE. Occasional thick shelled bioclasts - brachiopod, Three fracture sets 1. Dipping at 10 - 20', Planar / Rough; 2. Close spaced, dipping at 55 - 60', Planar / Rough; 3. Dipping at 85', Planar / Rough minor white calcite coating fracture surfaces
		27.65 - 28.03	3	100	100	100	27.65	6.49		Strong, pale grey / brownish grey, fine / medium grained, massive LIMESTONE. Occasional sub-horizontal stylolites. Fracture set dipping at 5 ', Planar / Rough, no infill
							28.03	6.11		Strong, pale grey / brownish grey, fine / medium grained, massive LIMESTONE. Three fracture sets 1. Close spaced dipping at 5 - 20', Planar / Rough; 2. Widely spaced, dipping at 40-50', Planar / Rough, at 31.7m light brown clay infill 1mm thick; 3. Axial parallel - 90', crosscuts all the other fracture sets. Planar / rough with a thin coating of white calcite.

Continued on next sheet

Remarks

All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH05**

Sheet 7 of 9

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530186.65 - 728378.11	Hole Type RC
Location:	Galway		Level:	34.14	Scale 1:25
Client:	Galway County Council		Dates:	06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		28.03 - 32.03	3	100	0	0				
		32.03 - 34.72	4	100	100	97	32.03	2.11		Strong, pale grey / brownish grey, fine / medium grained, massive LIMESTONE. Occasional sub-horizontal stylolites. One fracture set, close to Medium spaced, dipping at 5 - 20', Planar / Rough, no infill.
							34.72	-0.58		Strong, grey . brownish grey, fine / medium grained, massive LIMESTONE. Very small scattered bioclasts, and a rare thick shelled

Continued on next sheet

31 32 33 34 35

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH05**

Sheet 8 of 9

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530186.65 - 728378.11	Hole Type RC
Location:	Galway		Level:	34.14	Scale 1:25
Client:	Galway County Council		Dates:	06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
		34.72 - 37.20	6	100	4	4				brachiopod . Occasional sub-horizontal stylolites. Three fracture sets 1. Close spaced dipping at 10 - 20', Planar / Rough; 2. Very widely spaced, dipping at 35-40', Planar / Rough; 3. 75 - 85' Undulating / rough, fracture surface coated with light brown clay. Crosscuts other fracture sets
		37.20 - 38.00	0	100	100	100	37.20	-3.06		Strong, grey / pale grey, fine / medium grained, massive LIMESTONE.
		38.00 - 40.00		100	0	0	38.00	-3.86		Strong, pale grey, fine to medium grained, massive LIMESTONE. Occasional stylolites, two fracture sets. 1. dipping at 5', planar / rough , 2. dipping at 85-90' Planar / rough coated and partially infilled by light brown clay

36 37 38 39 40

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No.
BH05
Sheet 9 of 9

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530186.65 - 728378.11	Hole Type RC
Location:	Galway		Level:	34.14	Scale 1:25
Client:	Galway County Council		Dates:	06/11/2015 - 10/11/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							40.30	-6.16		End of borehole at 40.30 m

41
42
43
44
45

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH06**

Sheet 1 of 5

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530125.14 - 728383.08	Hole Type RC
Location:	Galway		Level:	30.80	Scale 1:50
Client:	Galway County Council		Dates:	10/12/2015 - 18/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							0.10	30.70		TOPSOIL Soft, pale grey, sandy CLAY (Recovery 35%)
							1.05	29.75		Loose grey to dark grey cobbly BOULDERS of bioclastic limestone, minor pale grey sandy clay
							1.50	29.30		Firm, light yellowish brown, sandy CLAY, coarse grained sub-angular cobbles of dark grey limestone and occasional granite cobble (recovery 45%)
							3.10	27.70		Very stiff , light yellowish brown sandy CLAY with coarse gravel / cobbles and occasional boulders of sub-rounded to sub-angular limestone with minor granite
		5.25 - 5.50	C							
							7.91 7.96	22.89 22.84		Firm / stiff light grey CLAY Very stiff, light brown sandy CLAY with minor light orange oxidation spots / patches. Coarse gravel / cobbles and occasional boulders of sub-rounded to sub-angular limestone with minor granite
		9.95 - 10.20	C							

Continued on next sheet

Remarks

All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH06**

Sheet 2 of 5

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530125.14 - 728383.08	Hole Type RC
Location:	Galway		Level:	30.80	Scale 1:50
Client:	Galway County Council		Dates:	10/12/2015 - 18/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							15.20	15.60		Loose, medium grained angular clayey GRAVEL with small cobbles all coarse fragments coated with sticky, soft, dark grey clay
							15.93	14.87		Very Stiff dark grey / brown CLAY
		16.20 - 16.50	C							
		16.60 - 16.70	D							
		16.70 - 16.80	D							
		17.13 - 17.20	D							
		18.00 - 18.25	C				18.00	12.80		Very Stiff grey CLAY
		18.25 - 18.35	D							
		18.65 - 18.75	D							
		18.95 - 19.05	D							
		19.70 - 19.95	C							
		20.00 - 20.25	C							

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH06**

Sheet 3 of 5

Project Name: Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords: 530125.14 - 728383.08	Hole Type RC
Location: Galway		Level: 30.80	Scale 1:50
Client: Galway County Council		Dates: 10/12/2015 - 18/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							21.20	9.60		Firm grey CLAY
		21.45 - 21.52	D				21.48	9.32		Firm / Stiff finely laminated dark brown / brown CLAY
		21.52 - 21.60	D				21.82	8.98		Firm, dark brown CLAY with 60% tabular angular gravel
							21.92	8.88		Firm grey fine sandy CLAY with angular limestone gravel and some coarse cobbles and small boulders
							22.60	8.20		Very soft, light grey sandy CLAY with rounded gravel
							22.84	7.96		Soft, grey sandy CLAY angular gravel / cobbles
							23.30	7.50		Firm / Stiff grey sandy CLAY with sub-angular / angular matrix supported coarse gravel and cobbles
							23.60	7.20		Soft, grey, sandy CLAY with medium / coarse grained, angular gravel and an occasional boulder (25cm dia.
							25.50	5.30		Soft / firm grey / green sandy CLAY with sub angular cobbles and boulders. Some of the clay is washed out and is just coated the cobbles and boulders
							26.65	4.15		Stiff / very stiff, light grey CLAY occasional boulder of pale grey limestone
							27.30	3.50		Loose, grey / dark grey cobbly GRAVEL with occasional boulders of limestone coated with very soft brownish grey clay

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH06**

Sheet 4 of 5

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530125.14 - 728383.08	Hole Type RC
Location:	Galway		Level:	30.80	Scale 1:50
Client:	Galway County Council		Dates:	10/12/2015 - 18/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							30.85	-0.05		Soft / very soft, pale grey / greenish grey bouldery CLAY, cobbles and coarse gravel, clay washed out and just left coating fragments in some areas.
							33.20	-2.40		Firm greenish grey (Khaki) CLAY with angular coarse cobbles of pale grey limestone
							33.50	-2.70		Firm, greenish grey gravelly CLAY, gavel composed of dark grey limestone
							33.70	-2.90		Pale grey, medium grained, fresh, massively bedded limestone BOULDER Broken up along a series of fractures - undulating rough dipping at 70-80' and planar rough dipping at 50-60'. Minor grey clay coating joint surfaces.
							34.70	-3.90		Loose sub-angular COBBLES coated with soft pale grey clay
							35.10	-4.30		Soft greenish grey sandy, gravelly CLAY with angular cobbles and small boulders of pale grey / occasionally black limestone
							39.10	-8.30		Loose sub-angular COBBLES of very dark grey limestone (Recovery 30%)

Continued on next sheet

Remarks
All angles measured relative to short core axis

Rotary Core Log

Borehole No. **BH06**

Sheet 5 of 5

Project Name:	Lackagh Quarry Preliminary Ground Investigation	Project No. Lackagh Quarry	Co-ords:	530125.14 - 728383.08	Hole Type RC
Location:	Galway		Level:	30.80	Scale 1:50
Client:	Galway County Council		Dates:	10/12/2015 - 18/12/2015	Logged By Dave Blaney

Well	Water Strikes	Depth (m)	Type / FI	Coring TCR	Coring SCR	Coring RQD	Depth (m)	Level (m)	Legend	Stratum Description
							40.60	-9.80		Loose, coarse gravelly COBBLES, angular to sub-angular with some coated by greenish grey clay occasional small boulder
							44.40	-13.60		BOULDER of strong, fresh, fine / medium grained, massively bedded Limestone. 44.8m a joint filled with soft, dark grey clay, 2cm thick (Possibly bedrock)
							45.00	-14.20		End of borehole at 45.00 m

41 42 43 44 45 46 47 48 49 50

Remarks
All angles measured relative to short core axis

APPENDIX III

			PROJECT NAM Lackagh Quarry																							REPORT NO:					
			CLIENT: Galway County Council																							HOLE NO:	BH-01				
			ENGINEER: ARUP																							LOGGED BY:	Dave Blaney				
				Roughness										Aperture					Filling					Weathering									
Depth of Discontinuity (m BGL)	Azimuth	Dip	Non Intact? (NI)	Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	No	Sl	Mod	High	Comp		Hole Azimuth	Hole Dip	True Azimuth	True Dip
				R	Sm	St	R	Sm	St	R	Sm	St		>10 mm	2.5-10	0.5-2.5	0.1-0.5	<0.1														
5.80		45					X									X								X					No Invert marked	268	-11.5		
5.95		10								X						X								X					No Invert marked	268	-11.5		
6.10		20								X						X								X					No Invert marked	268	-11.5		
6.18		25	X							X						X								X					No Invert marked	268	-11.5		
6.30		65	X							X						X								X					No Invert marked	268	-11.5		
6.90	180	85								X						X								X						268	-11.5		
7.08	190	60								X						X								X						268	-11.5		
7.52	165	65								X						X								X						268	-11.5		
7.58	165	65								X						X								X						268	-11.5		
7.66	230	70								X						X								X						268	-11.5		
7.90	180	55					X									X								X						268	-11.5		
8.35	285	90								X						X								X						268	-11.5		
8.55	210	75								X						X								X						268	-11.5		
8.72	135	72								X						X								X						268	-11.5		
8.83	60	82								X						X								X						268	-11.5		
8.85	150	90					X									X								X						268	-11.5		
9.35	195	78								X						X								X						268	-11.5		
9.67	215	90								X						X								X						268	-11.5		
9.81	130	62								X						X								X						268	-11.5		
9.90	335	82								X						X								X						268	-11.5		
10.17	330	90								X						X								X						268	-11.7		
10.20	180	90					X									X								X						268	-11.7		
10.71	10	90								X						X								X						268	-11.7		
10.90	5	82								X						X								X						268	-11.7		
11.42	0	75								X						X								X						268	-11.7		
11.44	115	74								X						X									X				Slight Fe Staining	268	-11.7		
11.54	200	40	X							X						X								X						268	-11.7		
11.92	145	45								X						X								X						268	-11.7		
11.97	180	85								X						X								X						268	-11.7		
12.20	285	45					X									X								X						268	-11.7		
12.35	350	50	X							X						X								X						268	-11.7		
12.47	100	65								X						X								X						268	-11.7		
13.02	150	60								X						X								X						268	-11.7		
13.33	220	60								X						X						x		X					Partial coating of white calcite	268	-11.7		
13.43	350	75								X						X								X						268	-11.7		
14.32	25	72								X						X								X						268	-11.7		
14.36	120	85								X						X								X						268	-11.7		
14.39	185	62								X						X								X						268	-11.7		
14.42	30	80								X						X								X						268	-11.7		
14.45	120	80								X						X								X						268	-11.7		
14.52	140	65								X						X						X	X	X					Minor white calcite and smears of pale brown clay	268	-11.7		
14.56	50	80								X						X			X					X						268	-11.7		
14.70	170	80								X						X						X			X				White clacite and small patches of Fe Staining	268	-11.7		
15.27	165	80								X						X						X		X					Very Minor white calcite	268	-11.7		
15.47	170	80								X						X						X		X						268	-11.7		
15.58	130	72								X						X						X	X	X					White clacite and minor clay smears	268	-11.7		
15.63	355	50								X						X			X					X						268	-11.7		
15.68	75	90								X						X			X					X						268	-11.7		
15.76	135	85								X						X			X					X						268	-11.7		
15.83	195	60								X						X							X	X					Minor light brown clay	268	-11.7		
16.33	170	85								X						X			X					X						268	-11.8		
17.05	180	85								X						X			X					X						268	-11.8		

17.64	25	84	X							X						X			X				X						268	-11.8		
17.76	30	80								X						X						X	X	X				Minor smear of light brown clay	268	-11.8		
18.06	270	20								X						X			X					X					268	-11.8		
18.12	185	85	X							X						X			X					X					268	-11.8		
18.59	35	75								X						X						X		X				Minor light grey calcite	268	-11.8		
19.48	145	80								X						X			X					X					268	-11.9		
20.07	40	70								X						X			X					X					268	-11.9		
20.26	135	90								X						X			X					X					268	-11.9		
20.57	225	65								X						X			X					X					268	-11.9		
21.10	120	90	X							X						X			X					X					268	-11.9		
21.14	220	60								X						X			X					X					268	-11.9		
21.20	170	90								X						X						X	X	X				Minor smear of light brown clay	268	-11.9		
21.33	310	70								X						X			X					X					268	-11.9		
21.38	315	70								X						X			X					X					268	-11.9		
21.41	230	75	X							X						X			X					X					268	-11.9		
21.58	230	70								X						X			X					X					268	-11.9		
22.34	5	90								X						X			X					X					268	-11.9		
22.48	30	60								X						X			X					X					268	-11.9		
22.73	170	48								X						X			X					X					268	-11.9		
22.96	290	52		X												X			X					X					268	-11.9		
23.03	20	60								X						X						X		X				Creamy white calcite coating	268	-11.9		
23.56	220	65								X						X			X					X					268	-11.9		
23.86	320	65					X									X						X			X			Pale grey calcite / minor grey clay and very slight Fe staining	268	-11.9		
24.26	20	80								X						X			X					X					268	-11.9		
24.35	140	70								X						X							X		X			Minor clay / localised dark brown Fe staining	268	-11.9		
24.73	125	90								X						X						X							268	-11.9		
24.94	130	90								X						X			X					X					268	-11.9		
26.18	185	85								X						X			X					X					267	-12.1		
27.35	0	85								X						X			X					X					267	-12.1		
27.48	30	80								X						X			X					X					267	-12.1		
27.84	195	80								X						X			X					X					267	-12.1		
28.16	175	85								X						X			X					X					267	-12.2		
28.74	5	80		X												X			X					X					267	-12.2		
31.02	15	90								X						X						X		X				White / Grey calcite deposited on fracture surface	267	-12.4		
31.25	320	85		X												X			X					X					267	-12.4		
31.34	0	50								X						X			X					X					267	-12.4		
31.66	195	75								X						X			X					X					267	-12.4		
31.73	10	60	X							X						X			X					X					267	-12.4		
31.76	10	85										X			X								X	X				Creamy white calcite vein, 4mm thick weak striae	267	-12.4		
31.82	20	70		X											X				X					X					267	-12.4		
32.01	50	90								X						X			X					X					267	-12.4		
32.08	330	50								X						X			X					X					267	-12.4		
32.64	145	65								X						X			X					X					267	-12.4		
32.90	20	90								X						X			X					X					267	-12.4		
32.97	315	62								X						X			X					X					267	-12.4		
33.11	30	35								X						X			X					X					267	-12.4		
33.20	310	80								X						X			X					X					267	-12.4		
33.70	310	70	X							X						X			X					X					267	-12.4		
34.05	60	75								X						X			X					X				Minor white calcite coating fracture surface	267	-12.6		
35.04	0	90								X						X			X					X					267	-12.6		
35.35	10	72		X												X			X					X					267	-12.6		
35.48	335	78								X						X			X					X					267	-12.6		
36.43	175	85								X						X			X					X					267	-12.6		
36.88	235	90								X						X			X					X					267	-12.6		
36.95	235	90								X						X			X					X					267	-12.6		
37.23	195	15					X									X			X					X					267	-12.6		
37.31	225	65								X						X			X					X					267	-12.6		
37.51	215	70								X						X			X					X					267	-12.6		
38.13	175	88								X						X			X					X					267	-12.6		
38.20	230	22		X												X			X					X					267	-12.6		
38.30	305	75								X						X			X					X					267	-12.6		
38.50	5	15								X						X			X					X					267	-12.6		

39.35	180	45							X						X				X					X				Minor orange Fe staining	267	-12.6		
40.53	160	40							X						X			X					X					267	-12.6		
40.80	0	90							X						X			X					X					267	-12.6		
41.03	50	88							X						X			X					X					267	-12.6		
41.20	315	90							X						X								X					267	-12.6		
41.67	180	10					X								X			X			X		X				Traces of white calcite	267	-12.6		
41.97	30	30							X						X			X					X					267	-12.6		
42.52	0	90							X						X			X					X					267	-12.6		
43.28	225	62							X						X			X					X					267	-12.5		
43.40	170	10							X						X			X					X					267	-12.5		
43.70	75	60							X						X			X					X					267	-12.5		
43.90	285	80							X						X			X					X					267	-12.5		
44.02	15	48							X						X			X					X					267	-12.5		
44.22	170	40							X						X			X					X					267	-12.5		
44.47	30	50							X						X			X					X					267	-12.5		
44.52	30	50							X						X			X					X					267	-12.5		
45.16	15	50							X						X			X					X					267	-12.5		
45.30	180	75							X				X						X		X			X				White calcite, minor Fe staining	267	-12.5		
45.47	30	55							X						X			X					X					267	-12.5		
45.62	30	70							X						X			X					X					267	-12.5		
45.70	25	55							X						X				X					X				Slight Fe staining	267	-12.5		
45.88	175	42							X						X						X		X					Discontinuous coating of white calcite	267	-12.5		
46.06	0	75							X						X			X					X					267	-12.7		
46.88	310	75							X						X			X					X					267	-12.7		
47.20	120	80							X						X							X	X					Minor brown clay	267	-12.7		
47.50	15	80							X						X			X					X					267	-12.7		
47.75	320	80					X								X						X		X					Partial coating of white calcite	267	-12.7		
47.88	310	75							X						X						X		X					Partial coating of white calcite	267	-12.7		
48.34	240	80							X						X			X					X					267	-12.7		
49.08	175	75							X						X			X					X					267	-12.7		
49.54	45	84							X						X			X					X					267	-12.7		
49.70	225	58							X						X			X					X					267	-12.7		
50.28	0	90							X						X			X					X					267	-12.7		
50.77	160	45							X						X			X					X					267	-12.7		
51.04	175	90							X						X			X					X					267	-12.7		
51.52	140	50							X						X			X					X					267	-12.7		
51.60	120	65							X						X			X					X					267	-12.7		
51.65	120	70							X						X			X					X					267	-12.7		
51.75	125	65							X						X			X					X					267	-12.7		
51.84	145	80							X						X			X					X					267	-12.7		
52.14	140	62							X						X			X					X					267	-12.7		
25.23	140	60							X						X			X					X					267	-12.7		
52.70	45	85							X						X			X					X					267	-12.7		
53.07	310	65	X						X						X			X					X					267	-12.7		
53.27	345	30							X						X			X					X					267	-12.7		
53.35	0	90							X						X			X					X					267	-12.7		
53.43	0	90							X						X			X					X					267	-12.7		
53.48	80	85	X				X								X			X					X					267	-12.7		
52.52	355	85							X						X			X					X					267	-12.7		
53.56	285	75	X				X								X			X					X					267	-12.7		
53.80	5	90							X						X			X					X					267	-12.7		
53.94	0	90							X						X			X					X					267	-12.7		
54.70	170	85							X						X			X					X					267	-12.7		
55.34	20	85							X						X			X					X					267	-12.7		
55.44	20	85							X						X			X					X					267	-12.7		
55.73	355	90							X						X			X					X					267	-12.7		
56.14	30	44					X								X			X					X					267	-12.7		
56.61	320	85							X						X			X					X					267	-12.7		
57.28	320	85							X						X			X					X					267	-12.7		
57.75	55	80	X						X						X			X					X					267	-12.7		
58.20	175	50					X								X			X					X				Curved / Arcuate joint surface	267	-12.7		
58.31	345	50							X						X			X					X					267	-12.7		

58.48	0	80							X						X			X					X					Possible drillers break	267	-12.7		
58.80	5	90									X				X			X					X					Triae due to intersecting stylolite	267	-12.7		
59.47	355	90							X						X			X					X						267	-12.7		
59.63	160	85							X						X			X					X						267	-12.7		
59.83	170	80					X								X			X					X					Curved / Arcuate joint surface	267	-12.7		
60.00	5	90							X						X			X					X						267	-12.7		
61.02	180	80							X						X			X					X						267	-12.8		
61.47	140	70							X						X						X		X					Trace grey calcite	267	-12.8		
61.80	90	85	X				X								X			X					X						267	-12.8		
61.85	200	65					X								X				X					X				Partial orange / brown Fe staining	267	-12.8		
62.02	20	80					X								X			X					X					Very Rough joint surface	267	-12.8		
62.17	50	60							X						X			X					X						267	-12.8		
62.58	145	60							X						X						X		X					Light grey calcite coating	267	-12.8		
63.77	40	50							X						X			X					X						267	-12.8		
63.97	200	42							X						X			X					X						267	-12.8		
64.06	30	65							X						X			X					X						267	-12.8		
64.20	210	50							X						X			X					X						267	-12.8		
64.50	345	50							X						X			X					X						267	-12.8		
64.98	180	85							X						X			X					X						267	-12.8		
65.72	130	75							X						X			X					X						267	-12.8		
65.88	130	80							X						X			X					X						267	-12.8		
66.97	50	80							X						X			X					X						267	-12.8		
66.99	50	78							X						X			X					X						267	-12.8		
67.20	175	78							X						X			X					X						267	-12.9		
67.60	220	80							X						X			X					X						267	-12.9		
67.70	45	90							X						X			X					X						267	-12.9		
67.90	60	72	X						X						X			X					X						267	-12.9		
68.38	350	90							X						X			X					X						267	-12.9		
68.60	355	90							X						X			X					X						267	-12.9		
68.66	350	90							X						X			X					X						267	-12.9		
68.73	0	90							X						X						X		X					Calcite vein 1mm thick	267	-12.9		
68.78	0	80							X						X						X		X					Calcite vein	267	-12.9		
68.90	170	75							X						X			X					X					Very irregular	267	-12.9		
69.25	355	90							X						X			X					X						267	-12.9		
69.66	20	75							X						X			X					X						267	-12.9		
69.93	325	85	X						X						X			X					X						267	-12.9		
69.98	140	75							X						X			X					X						267	-12.9		
70.13	10	80							X						X			X					X						267	-12.9		
70.27	15	80							X						X			X					X						267	-12.9		
70.60	5	80									X				X			X					X					Slickensides, plunging at 25' to 270'	267	-12.9		
71.43	355	80					X								X			X					X					Curved Arcuate Joint	267	-12.9		
71.90	50	82							X						X			X					X						267	-12.9		
72.34	310	80							X						X			X					X						267	-12.9		
72.45	50	30							X						X				X					X				Slight pale orange Fe staining	267	-12.9		
72.50	135	45	X						X						X			X					X						267	-12.9		
72.80	0	90							X						X			X					X						267	-12.9		
73.20	295	30							X						X			X					X						267	-12.9		
73.74	35	72							X						X			X					X						267	-12.9		
73.98	75	65		X											X			X					X					very small mm scale steps	267	-12.9		
74.50	350	78									X				X						X		X					White grey calcite vein, sub-horizontal striae	267	-12.9		
74.60	80	75					X										X	X					X						267	-12.9		
74.73	195	72							X						X			X					X					Very rough texture - almost stepped	267	-12.9		
75.14	5	80							X						X			X					X						267	-12.9		
75.27	150	55							X						X			X					X						267	-12.9		
75.50	170	85									X				X			X					X					Faint stating	267	-12.9		
75.80	20	75	X						X						X			X					X						267	-12.9		
75.92	30	65							X						X			X					X						267	-12.9		
76.09	25	70							X						X			X					X						267	-12.9		
76.19	165	60							X						X			X					X						267	-12.9		
76.39	50	50	X				X								X			X					X						267	-12.9		
76.72	200	70							X						X			X					X						267	-12.9		
77.10	325	70							X						X			X					X						267	-12.9		

77.17	205	85							X						X			X					X						267	-12.9		
77.63	305	55	X						X						X			X					X						267	-12.9		
77.67	65	80	X						X						X			X					X						267	-12.9		
77.80	110	85	X						X						X			X					X						267	-12.9		
77.86	20	75							X						X			X					X						267	-12.9		
77.93	335	90					X								X				X					X					urved / Arcuate fracture, Minor Fe staining	267	-12.9		
78.02	50	90							X						X			X					X						267	-12.9		
78.06	155	90	X						X						X			X					X						267	-12.9		
78.13	180	90	X						X						X			X					X						267	-12.9		
78.18	160	85	X						X						X			X					X						267	-12.9		
78.37	180	90	X						X						X			X					X						267	-12.9		
79.93	140	90	X				X								X			X					X						267	-12.9		
80.07	140	70		X											X			X					X						267	-12.9		
80.16	180	90							X						X			X					X						267	-12.9		
80.65	45	65							X						X						X		X					Thin coating of grey calcite	267	-12.9		
80.94	310	85							X						X			X					X						267	-12.9		
81.15	40	74							X						X			X					X						267	-12.9		
81.20	300	90							X						X			X					X						267	-12.9		
81.66	5	78									X				X				X					X					weak, sub-horizontal striae - Minor Fe staining	267	-12.9		
81.85	340	38							X						X			X					X						267	-12.9		
82.26	320	60					X								X			X					X						267	-13.1		
82.36	145	72									X				X			X					X					Striae formed by intersection offracture with stylolite	267	-13.1		
82.59	220	68									X				X			X					X						267	-13.1		
82.80	220	64					X								X			X					X					Curved / arcuate	267	-13.1		
83.12	320	58							X						X			X					X						267	-13.1		
83.40	355	44							X						X			X					X						267	-13.1		
83.53	335	84					X								X			X					X						267	-13.1		
84.00	0	90							X						X			X					X						267	-13.1		
84.25	10	88									X				X			X					X					Striae from intersection of stylolites	267	-13.1		
85.05	170	80							X						X			X					X					Curved / Arcuate joint surface	267	-13.1		
85.32	170	82							X						X				X		X			X				White / orange Fe stained clacite	267	-13.1		
86.10	310	54							X						X			X					X						267	-13.1		
86.38	220	50							X						X			X					X						267	-13.1		
86.62	350	38							X						X			X					X						267	-13.1		
86.96	350	52							X						X			X					X						267	-13.1		
87.47	205	58							X						X			X					X						267	-13.1		
87.53	285	70	X						X						X			X					X						267	-13.1		
88.14	10	88							X						X			X					X						267	-13.1		
88.77	0	90							X						X			X					X						267	-13.1		
88.82	90	78					X								X			X					X					Curved / Arcuate	267	-13.1		
88.99	0	42				X									X			X					X					Partially striated	267	-13.1		
89.13	340	42							X						X			X					X						267	-13.1		
89.35	210	52							X						X			X					X						267	-13.1		
89.44	70	82					X								X			X					X					Curved / Arcuate	267	-13.1		
89.64	10	78							X						X			X					X						267	-13.1		
89.75	100	86	X				X								X			X					X					Curved / Arcuate	267	-13.1		
90.00	80	84					X								X			X					X						267	-13.1		
90.30	100	84					X										X				X		X					Grey calcite	267	-13.1		
90.85	330	82								X					X			X					X					smooth	267	-13.1		
91.18	350	90							X						X			X					X						267	-13.1		
91.48	220	82							X						X			X					X						267	-13.1		
91.58	0	90							X						X			X					X						267	-13.1		
91.83	355	90							X						X			X					X						267	-13.1		
91.96	160	84							X						X			X					X						267	-13.1		
92.71	345	78							X						X			X					X						267	-13.1		
93.14	165	88							X						X						X		X					Partially coated with white calcite	267	-13.1		
93.97	320	82							X						X			X					X						267	-13.1		
94.75	350	70							X						X			X					X						267	-13.2		
95.00	10	78							X						X						X		X					Partially coated with white calcite	267	-13.2		
95.32	355	80							X						X			X					X						267	-13.2		
95.98	340	76	X	X											X			X					X						267	-13.2		
96.02	350	78							X						X			X					X						267	-13.2		

96.13	15	90		X											X			X					X						267	-13.2		
96.84	5	90					X								X			X					X					Curved / Arcuate	267	-13.2		
97.44	180	48								X					X			X					X						267	-13.2		
97.53	195	86								X					X							X			X				Joint infilled with 5mm white calcite veinlet minor Fe stain	267	-13.2		
98.92	225	74								X						X			X					X						267	-13.2		
98.37	320	48								X						X			X					X						267	-13.2		
98.92	5	90								X						X			X					X						267	-13.2		
99.35	225	58								X						X						X		X					Partially coated with grey calcite	267	-13.2		
99.40	185	80								X						X			X					X						267	-13.2		
99.70	185	36								X						X				X					X				Trace Fe staining	267	-13.2		
100.08	355	40								X						X			X					X						267	-13.2		
100.45	340	46								X						X			X					X						267	-13.2		
100.60	320	70		X												X			X					X					Very rough / irregular - pitted surface	267	-13.2		
100.65	195	56								X						X			X					X						267	-13.2		
100.74	215	62								X						X			X					X						267	-13.2		
100.85	140	62		X												X				X				X					Minor Fe Staining	267	-13.2		
100.91	210	70								X						X			X					X						267	-13.2		
101.16	345	36								X						X						X		X					Trace grey calcite	267	-13.2		
101.70	310	42								X						X			X					X					Very rough - almost stepped	267	-13.2		
101.43	350	90								X				X								X			X				Coarsely crystalline white calcite vein - Fe staining	267	-13.2		
101.65	170	72								X						X			X						X				Minor Fe staining	267	-13.2		
102.27	0	38								X						X			X					X						267	-13.2		
102.50	0	90	X						X							X				X					X				Stiae with locallised Fe Staining	267	-13.2		
102.55	180	18	X							X						X			X					X						267	-13.2		
103.48	340	80	X							X						X			X					X						267	-13.2		
103.87	355	86								X						X			X					X						267	-13.2		
103.92	330	76	X							X						X			X					X						267	-13.2		
103.95	210	62	X							X						X			X					X						267	-13.2		
104.15	150	38								X						X			X					X						267	-13.2		
104.78	350	74								X						X			X					X						267	-13.2		
105.42	350	88								X						X			X					X						267	-13.2		
105.54	345	85								X						X			X					X						267	-13.2		
105.70	0	90								X						X			X					X						267	-13.2		
106.13	185	50								X						X			X					X						267	-13.3		
106.30	150	62								X						X			X					X						267	-13.3		
107.10	5	50								X						X			X					X						267	-13.3		
107.35	10	48								X						X						X		X					Trace Fe staining -minor light brown clay	267	-13.3		
107.84	180	88								X						X			X					X						267	-13.3		
108.61	180	44								X						X			X					X						267	-13.3		
108.80	40	70								X						X								X						267	-13.3		
108.92	305	84								X						X						X		X					Slightly oxidised calcite	267	-13.3		
108.98	320	90								X						X			X					X						267	-13.3		
109.40	320	90								X						X			X					X						267	-13.3		
109.17	140	84								X						X			X					X						267	-13.3		
108.36	150	70								X						X			X					X						267	-13.3		
109.42	140	88								X						X			X					X						267	-13.3		
109.54	115	86	X	X												X			X					X						267	-13.3		
109.60	320	78								X						X			X					X						267	-13.3		
109.91	310	90								X						X						X		X						267	-13.3		
110.25	300	74								X						X			X					X						267	-13.3		
110.95	315	52								X						X						X		X						267	-13.3		
111.09	325	78								X						X			X					X						267	-13.3		
111.30	60	86								X						X						X		X						267	-13.3		
112.40	325	82		X												X			X					X						267	-13.4		
113.52	30	54		X												X						X		X						267	-13.4		
114.00	0	8	X				X									X			X					X						267	-13.4		
115.30	335	84								X						X			X					X						267	-13.4		
117.92	215	88								X						X			X					X						267	-13.4		
118.32	330	82								X						X			X					X						267	-13.5		
118.74	330	80								X						X			X					X						267	-13.5		
119.15	20	55	X				X									X			X					X						267	-13.5		
119.38	5	90								X						X			X					X						267	-13.5		

119.52	230	56							X						X			X					X						267	-13.5		
119.66	235	70							X						X								X						267	-13.5		
120.15	50	24					X								X			X			X		X						267	-13.5		
120.68	10	90					X								X			X					X						267	-13.5		
120.95	5	84							X						X			X					X						267	-13.5		
121.40	135	90							X						X			X					X						267	-13.5		
121.58	140	62	X						X						X				X					X						267	-13.5		
122.10	135	70		X											X				X					X						267	-13.5		
122.40	340	84							X					X							X			X						267	-13.5		
122.58	150	70					X								X			X					X						267	-13.5		
122.64	140	70		X											X			X					X						267	-13.5		
122.80	50	70					X								X						X		X						267	-13.5		
123.00	115	78					X								X			X					X						267	-13.5		
123.05	115	74					X								X			x						X					267	-13.5		
123.28	140	74					X								X			X					X						267	-13.5		
123.38	20	68							X						X						X		X						267	-13.5		
123.44	320	80					X								X			X					X						267	-13.5		
123.52	160	60		X											X			X						X					267	-13.5		
123.60	325	40							X						X			X					X						267	-13.5		
124.12	15	76							X						X						X		X						267	-13.5		
124.42	130	78							X						X						X		X						267	-13.5		
125.05	50	90					X								X			X					X						267	-13.5		
125.28	25	64					X								X			X					X						267	-13.5		
125.62	320	90							X						X			X					X						267	-13.5		
126.10	240	80	X						X						X			X						X					267	-13.5		
126.25	150	58					X								X			X					X						267	-13.5		
126.72	235	72							X						X			X					X						267	-13.5		
126.83	325	64							X						X			X					X						267	-13.5		
126.87	325	64							X						X			X					X						267	-13.5		
126.93	325	76							X								X	X					X						267	-13.5		
127.05	200	80					X								X			X					X						267	-13.5		
127.54	150	68					X								X			X					X						267	-13.5		
127.61	320	70					X								X			X					X						267	-13.5		
127.67	315	82					X								X			X					X						267	-13.5		
127.80	220	74							X						X			X					X						267	-13.5		
127.91			X						X						X			X					X						267	-13.5		
128.36	195	52							X						X			X					X						267	-13.5		
128.41	165	62							X						X			X					X						267	-13.5		
128.48	150	62							X						X			X					X						267	-13.5		
129.60	195	62					X								X			X					X						267	-13.5		
129.83	20	60		X											X			X					X						267	-13.5		
130.25	205	42								X					X						X		X						266	-13.6		
130.30	80	80						X							X						X		X						266	-13.6		
130.62	170	84							X						X			X					X						266	-13.6		
131.47	160	48							X						X			X					X						266	-13.6		
131.60	80	80	X				X								X						X		X						266	-13.6		
131.71	350	70							X						X			X					X						266	-13.6		
132.14	340	86							X							X					X		X						266	-13.6		
133.45	210	48							X						X			X					X						266	-13.6		
134.73	160	62					X								X			X					X						266	-13.6		
134.90	340	80							X				X								X		X						266	-13.6		
135.38	185	40							X						X			X					X						266	-13.6		
135.57	180	90					X								X			X					X						266	-13.6		
136.47	180	32							X						X			X					X						266	-13.7		
136.72	175	32							X						X			X					X						266	-13.7		
137.10	340	86							X						X			X					X						266	-13.7		
137.70	10	82							X						X			X					X						266	-13.7		
138.39	320	90							X						X			X					X						266	-13.7		
139.60	25	86							X						X			X					X						266	-13.7		
140.65	150	62					X								X			X					X						266	-13.7		
140.90	190	54							X						X			X					X						266	-13.7		
141.02	190	68							X						X			X					X						266	-13.7		

141.40	5	86							X						X			X					X						266	-13.7		
142.05	10	90							X						X			X					X						266	-13.7		
142.60	40	46		X											X			X					X						266	-13.8		
142.79	150	72							X							X		X					X						266	-13.8		
142.86	130	80							X						X			X					X						266	-13.8		
144.36	150	68							X						X			X					X						266	-13.8		
145.45	155	62							X						X			X					X						266	-13.8		
145.57	140	58							X						X			X					X						266	-13.8		
145.80	130	66							X						X			X					X						266	-13.8		
148.30			X																									148.3 148.5m NI / Broken & Friable core	266	-13.8		
149.10	350	86							X						X			X					X						266	-13.8		
149.77	155	70	X	X											X			X					X						266	-13.8		
150.44	160	76							X						X			X					X						266	-13.8		
150.84	30	70		X											X			X					X						266	-13.8		
150.88	140	90							X						X			X					X						266	-13.8		
150.93	320	80		X											X			X					X						266	-13.8		
151.20	310	72		X											X			X					X						266	-13.8		
151.60	150	82							X						X			X					X						266	-13.8		
152.09	10	90							X						X			X					X						266	-13.8		
152.56	165	60		X											X							X	X					Very rough / pitted / evidence of dissolution, Black argillite	266	-13.8		
152.94	20	84		X											X			X					X					Very rough / pitted / evidence of dissolution, Black argillite	266	-13.8		
153.35	15	90							X						X			X					X						266	-13.8		
153.70	140	74		X											X			X					X					Very rough / pitted / evidence of dissolution, Black argillite	266	-13.8		
154.30	350	90							X						X			X					X						266	-13.9		
154.80	355	60							X						X			X					X						266	-13.9		
154.90	355	60							X						X			X					X						266	-13.9		
155.12	340	60							X						X			X					X						266	-13.9		
155.90	340	82		X											X			X					X					Very Rough	266	-13.9		
156.30	350	90							X						X			X					X						266	-13.9		
157.15	5	86							X						X			X					X						266	-13.9		
159.45	5	90							X						X			X					X						266	-13.9		
159.60	120	86							X						X			X					X						266	-13.9		
162.05	5	82							X						X			X					X						266	-14		
163.48	325	88							X						X			X					X						266	-14		
163.57	330	86							X						X			X					X						266	-14		
163.97	15	90					X								X			X					X						266	-14		
164.08	5	90					X								X			X					X						266	-14		
164.55	180	44							X						X			X					X						266	-14		
165.00	325	86							X						X			X					X						266	-14		
167.00	60	74							X						X			X					X						266	-14		
167.68	135	90							X						X			X					X						266	-14		
168.64	140	80							X						X			X					X						266	-14		
168.69	140	82							X						X			X					X						266	-14		
171.07	60	78							X						X						X		X					Minor grey calcite	266	-14		
171.30	310	80							X						X			X					X						266	-14		
171.66	315	80							X						X			X					X						266	-14		
172.15	60	90							X						X						X		X					Minor grey calcite	266	-14.1		
172.56	315	90							X						X			X					X						266	-14.1		
173.00	320	74							X						X			X					X						266	-14.1		
173.40	325	76		X											X			X					X						266	-14.1		
173.44	330	76							X						X			X					X						266	-14.1		
174.05	320	76							X						X			X					X						266	-14.1		
174.86	330	82							X						X			X					X						266	-14.1		
176.52	310	70							X						X			X					X						266	-14.1		
177.10	180	18					X								X			X					X						266	-14.1		
179.77	0	90							X						X			X					X						266	-14.1		
180.17	350	84							X						X			X					X						266	-14.1		
180.75	330	86							X						X			X					X						266	-14.1		
182.53	45	86							X						X			X					X						266	-14.1		
182.97	115	76							X						X			X					X						266	-14.1		
183.95	230	76							X						X			X					X						266	-14.1		
185.83	50	68							X						X			X					X						266	-14.1		

186.17	180	88							X						X			X					X						266	-14.1		
186.24	180	85							X						X			X					X						266	-14.1		
186.53	40	80							X						X			X					X						266	-14.1		
191.20	335	90	X						X						X							X	X					Light brown sandy clay coating joints	266	-14.1		
191.64	40	72	X						X						X							X	X					Light brown sandy clay coating joints	266	-14.1		
191.72	40	72	X						X						X							X	X					Light brown sandy clay coating joints	266	-14.1		
191.90	340	52							X						X							X	X					Light brown sandy clay coating joints	266	-14.1		
192.21	350	38	X						X						X							X	X					Light brown sandy clay coating joints	266	-14.1		
192.50	140	48							X						X			X					X						266	-14.1		
192.70	330	80	X						X						X						X	X	X					White calcite & Light brown sandy clay	266	-14.1		
192.82	5	78							X						X			X					X						266	-14.1		
193.50	5	78							X						X			X					X						266	-14.1		
194.80	20	70							X						X			X					X						266	-14.1		
196.30	5	78							X						X			X					X						266	-14.1		
196.74	340	70							X						X			X					X						266	-14.1		
199.10	180	90							X						X			X					X						266	-14.1		
199.45	20	50							X						X						X		X					Wjite grey calcite	266	-14.1		
199.52	140	68							X						X			X					X						266	-14.1		
199.97	5	90							X						X			X					X						266	-14.1		
200.95	250	42	X					X							X				X					X				Slight Fe staining	266	-14.1		
203.00	345	38							X						X							X	X					Light brown, fine grained sand infill	266	-14.1		
203.21	340	54							X						X			X					X						266	-14.1		
203.24	340	56							X						X			X					X						266	-14.1		
203.32	345	50							X						X			X					X						266	-14.1		
203.64	340	70							X						X			X					X						266	-14.1		
203.69	345	62							X						X						X	X	X						266	-14.1		
203.87	145	54							X						X							X		X				Light brown grey clay coating, minor Fe staining	266	-14.1		
205.40	5	90							X						X			X					X						266	-14.1		
205.68	140	42							X						X			X					X						266	-14.1		
205.93	130	68							X						X			X					X						266	-14.1		
206.68	195	62		X											X				X					X				Slight Fe Staining	266	-14.1		
207.02	10	90							X						X			X					X						266	-14.1		
207.25	345	40		X											X			X					X						266	-14.1		
207.60	350	90							X						X			X					X						266	-14.1		
209.30	0	90							X						X			X					X						266	-14.1		
210.15	170	76							X						X			X					X						266	-14.1		
210.94	0	90							X						X			X					X						266	-14.1		
212.94	20	78							X						X			X					X						266	-14.1		
213.00	145	90							X						X							X		X				Brown grey clay coating, minor Fe staining	266	-14.1		
213.80	20	72							X						X			X					X						266	-14.1		
214.65	215	38							X						X			X					X						266	-14.1		
215.00	210	36							X						X			X					X						266	-14.1		
216.05	15	62		X											X						X		X					White calcite	266	-14.1		
216.80	30	70							X						X						X		X					Minor white calcite	266	-14.1		
216.90	135	74							X						X			X					X						266	-14.1		
217.10	340	88		X											X			X					X						266	-14.1		
217.33	330	90		X											X			X					X						266	-14.1		
217.92	330	82	X						X						X			X					X						266	-14.1		
217.94	40	78	X						X						X			X					X						266	-14.1		
218.04	330	82		X											X				X					X				slight oxidation	266	-14.1		
218.36	310	78							X						X				X					X				slight oxidation	266	-14.1		
218.37	310	76							X						X			X						X				slight oxidation	266	-14.1		
218.56	210	82							X						X			X					X						266	-14.1		
218.92	310	90							X						X			X						X				slight oxidation	266	-14.1		
219.70	320	86							X						X			X						X				slight oxidation	266	-14.1		
219.74	330	90							X						X			X						X				slight oxidation	266	-14.1		
219.77	330	90	X						X						X			X					X						266	-14.1		
220.44	240	42					X								X			X					X						266	-14.1		
220.58	310	90							X						X			X					X						266	-14.1		
220.74	45	78	X						X						X						X		X					Trace white calcite	266	-14.1		
221.61	120	46		X											X				X					X				Leached / pitted - slight Fe staining	266	-14.1		
221.90	20	60							X						X				X					X				Very light Fe staining	266	-14.1		

222.05	25	52							X					X							X		X					White calcite veining	266	-14.1		
223.34	15	58							X						X			X					X						266	-14.1		
222.55	160	70							X						X							X	X					Trace light brown clay smearing	266	-14.1		
222.65	20	58							X						X						X		X					White calcite	266	-14.1		
223.00	135	76							X						X							X	X					Minor yellow brown clay coating	266	-14.1		
223.05	140	78							X						X							X	X					Minor yellow brown clay coating	266	-14.1		
223.65	120	42							X						X			X					X						266	-14.1		
224.00	30	82							X						X						X		X					Coarse crystalline calcite	266	-14.1		
224.50	60	52							X						X			X					X						266	-14.1		
224.71	145	62							X						X			X					X						266	-14.1		
225.00	120	58							X						X							X	X					Trace light brown clay	266	-14.1		
225.45	170	36							X						X			X					X						266	-14.1		
226.35	220	40					X								X							X			X			Intensely oxidised, pitted - dissolution	266	-14.1		
226.62	140	62							X				X					X						X				Fe staining / minor clay	266	-14.1		
226.74	150	70							X						X				X					X				Slightly leached / dissolution	266	-14.1		
227.84	150	72							X						X				X					X				Slightly leached / dissolution	266	-14.1		
227.92	140	80							X						X				X					X				Slightly leached / dissolution	266	-14.1		
227.95	210	60	X	X											X			X					X						266	-14.1		
228.55	45	86							X						X			X					X						266	-14.1		
228.75	30	90							X						X			X					X						266	-14.1		
229.00	50	80							X				X										X		X			Clay filled cavity 10cm wide	266	-14.1		
229.10	50	80							X				X										X		X			Clay filled cavity 10cm wide	266	-14.1		
229.90	145	42							X						X								X	X				Minor grey brown clay	266	-14.1		
230.20	310	82							X						X								X		X			Slightly leached with grey / brown clay	266	-14.1		
230.36	310	90							X						X								X		X			Slightly leached with grey / brown clay	266	-14.1		
230.60	230	76	X												X										X			Axial parallel / broken int angular elongate fragments	266	-14.1		
230.93	310	90							X						X								X		X			Slightly leached grey sandy clay coating	266	-14.1		
231.10	35	72							X						X								X		X			Slightly leached grey clay coating	266	-14.1		
232.10	160	82							X						X			X						X					266	-14.1		
232.17	145	66							X						X			X						X					266	-14.1		
232.22	170	53							X						X			X						X					266	-14.1		
232.80	345	88								X					X						X		X					White calcite vein, vertical striae	266	-14.1		
233.20	55	68	X						X						X							X	X					Coarse brown grey sand	266	-14.1		
233.34	210	70							X						X			X					X						266	-14.1		
233.40	340	58	X						X					X								X	X					fine grained briwn / grey sand	266	-14.1		
233.56	50	82							X						X							X	X					Minor sand coating	266	-14.1		
233.70	310	82					X								X							X	X					Minor sand coating	266	-14.1		
233.90	180	88	X				X								X							X	X					Minor sand coating	266	-14.1		
134.10	180	86	X				X								X							X	X					Minor sand coating	266	-14.1		
234.36	160	70							X						X							X	X					Minor clayey sand	266	-14.1		
234.48	345	42					X								X			X					X					Curved / arcuate joint plane	266	-14.1		
234.96	160	64	X				X								X							X	X					Trace clay	266	-14.1		
235.03	350	78	X						X						X			X					X						266	-14.1		
235.08	0	60	X						X						X			X					X						266	-14.1		
235.19	150	72	X						X						X			X					X						266	-14.1		
235.26	180	50	X	X											X			X					X						266	-14.1		
235.31	155	48		X											X							X	X					Light brown clay coating	266	-14.1		
235.65	230	32							X						X			X					X						266	-14.1		
235.80	175	64							X						X							X	X					Soft grey brown clay	266	-14.1		
235.87	140	75					X								X							X	X					Soft grey brown clay	266	-14.1		
236.20	70	64	X						X						X							X	X					Minor grey clay	266	-14.1		
236.30	50	78	X						X						X							X	X					Minor grey clay	266	-14.1		
236.37	320	54	X						X						X							X	X					Minor grey clay	266	-14.1		
236.48	60	78		X											X			X					X						266	-14.1		
236.60	20	38							X					X								X				X		Fine sand infill & bright orange Fe staining	266	-14.1		
237.18	20	36							X						X			X					X						266	-14.1		
237.55	110	64							X						X							X						Upper contact of a cavity	266	-14.1		
239.25		45	X						X						X						X	X	X					No Invert marked	266	-14.1		
239.86		90		X											X			X					X					No Invert marked	266	-14.1		
240.00			X																				X					240.0 - 240.2m Rubble recovered	266	-14.1		
241.20		15							X						X				X					X				No Invert marked - Slight oxidation	266	-14.1		
241.55	220	42							X						X				X					X				Slight Oxidation	266	-14.1		

242.15	150	90							X						X				X				X					Slight Oxidation, fine sand	266	-14.1		
242.45	35	52							X						X				X				X					Slight Oxidation	266	-14.1		
242.70	320	88							X						X							X	X					Yellow brown clay coating joint surface	266	-14.1		
242.80	330	90							X						X							X	X					Yellow brown clay coating joint surface	266	-14.1		
243.50	20	90							X						X			X					X						266	-14.1		
243.53	20	84							X						X							X		X				Slightly oxidised with brown clay coating	266	-14.1		
243.55	20	86							X						X							X		X				Slightly oxidised with brown clay coating	266	-14.1		
243.74	175	44							X						X							X		X				Slightly oxidised with brown clay and fine sand coating	266	-14.1		
244.30	0	10					X								X						X			X				Black argillite caoting , undulating and axial paraleel	266	-14.1		
244.76	50	66							X						X			X							X			Bright orange oxidation	266	-14.1		
245.35	10	10							X						X							X		X				Orange brown sand coating surface, leached contact	266	-14.1		
247.70	0	28							X						X			X					X						266	-14.1		
247.90	95	78					X								X				X					X				Slight oxidation	266	-14.1		
248.05	310	30							X						X				X					X				Slight oxidation	266	-14.1		
249.00	315	90							X						X							X		X				Orange brown sandy clay coating	266	-14.1		
249.05	320	90	X						X						X			X					X						266	-14.1		
249.54	355	70							X						X							X	X						266	-14.1		
250.90	25	78					X								X							X	X					Orange brown fine grained sand	266	-14.1		
252.60	345	52	X						X						X							X	X					coarse yellow brown sand infill	266	-14.1		
253.15	145	82							X						X			X					X						266	-14.1		
254.11	0	90							X						X			X					X						266	-14.1		
254.70	140	48							X						X			X					X						266	-14.1		
254.94	160	78							X						X				X					X				Weak Fe staining	266	-14.1		
255.30	40	72	X	X											X				X					X				Weak Fe staining	266	-14.1		
255.33	230	80							X						X							X	X					Minor Orange brown clay	266	-14.1		
255.93		60	X						X						X			X						X				No Invert Marked	266	-14.1		
256.10		75					X								X							X	X					No Invert Marked - Curved / Arcuate	266	-14.1		
256.57		45							X						X			X					X					No Invert Marked	266	-14.1		
256.60		45							X						X			X					X					No Invert Marked	266	-14.1		
256.70		45							X						X			X					X					No Invert Marked	266	-14.1		
257.00		20	X					X							X			X					X					No Invert Marked - Polished	266	-14.1		
257.60		90	X					X							X			X					X					No Invert Marked - Polished and undulating	266	-14.1		
257.90		90	X					X							X			X					X					No Invert Marked	266	-14.1		
258.50		45							X						X			X					X					No Invert Marked	266	-14.1		
258.70		30							X						X							X	X					No Invert Marked - minor sand	266	-14.1		
259.05		85						X							X			X					X					No Invert Marked - slightly polished	266	-14.1		
260.23	155	78							X						X			X					X						266	-14.1		
260.51	150	70							X						X			X					X						266	-14.1		
260.70	40	90							X						X							X	X					Minor clay	266	-14.1		
260.80	280	38	X				X								X			X					X						266	-14.1		
260.84	150	78							X						X			X					X						266	-14.1		
261.30	170	62							X						X					X			X					Coarse sand	266	-14.1		
261.42	170	56							X						X			X					X						266	-14.1		
262.94	340	86							X						X			X					X						266	-14.1		
263.15	195	80							X						X			X					X						266	-14.1		
263.45	165	18					X								X				X						X				266	-14.1		
263.95	340	84							X						X			X					X						266	-14.1		
264.20	340	74							X						X			X					X						266	-14.1		
265.07	310	84	X						X						X				X					X				Slightly oxidsed	266	-14.1		
265.48	210	66							X				X							X				X				Coarse sand infill / ribble	266	-14.1		
266.09	210	70							X						X			X					X						266	-14.1		
266.35	305	72							X						X			X					X						266	-14.1		
266.44		55							X						X					X			X					No Invert Marked - Coarse sand	266	-14.1		
266.62		75							X						X					X			X					No Invert Marked - Coarse brown sand	266	-14.1		
267.05	50	72							X						X			X					X						266	-14.1		
267.15	40	662							X						X					X	X		X					Grey calcite & coarse brown sand	266	-14.1		
267.75	250	18							X						X					X			X					Minor Sand	266	-14.1		
267.96		60							X						X			X					X					No Invert Marked	266	-14.1		
268.04		65							X						X			X					X					No Invert Marked	266	-14.1		
268.50			X												X								X					268.5 - 268.65m Coarse Rubble	266	-14.1		
268.65		45							X						X			X					X					No Invert Marked	266	-14.1		
268.79		45							X						X			X					X					No Invert Marked	266	-14.1		

269.00		85	X						X						X			X				X					No Invert Marked - Conjugate Jointing	266	-14.1		
269.00		75					X								X			X				X					No Invert Marked - Conjugate Jointing	266	-14.1		
269.52	140	76							X						X			X				X						266	-14.1		
269.75	90	48							X						X			X				X						266	-14.1		
270.15	310	30							X						X			X				X						266	-14.1		
271.54	180	82							X						X			X				X						266	-14.1		

		PROJECT NAME Lackagh Quarry																									REPORT NO:	
		CLIENT: Glaway County Council																									HOLE NO:	BH-04
		ENGINEER: ARUP																									LOGGED BY:	Dave Blaney
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	No	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
5.30	20								x						x							x	x					Grey brown soft clay
5.40	20								x						x							x	x					Grey brown soft clay
5.60	50								x						x							x	x					Grey brown soft clay
5.70	80					x									x							x	x					Grey brown soft clay
6.35	10					x									x							x	x					Grey brown soft clay
6.40	90								x							x						x	x					Minor clay smeared on fracture surface
6.70	90								x							x						x	x					Minor clay smeared on fracture surface
6.50	15					x									x			x					x					
6.68	35					x									x			x					x					
6.95	85								x						x							x	x					Minor br/gy clay smeared on fracture surface
7.02	5								x						x			x					x					
7.37	15								x						x			x					x					
7.54	15								x						x			x					x					
7.73	75					x									x			x					x					
7.75	80					x									x							x	x					Stiff / Firm br/gy clay 1mm aperture
7.86	10								x						x			x					x					
8.20	10					x									x			x					x					
8.70	70					x									x			x					x					
8.90	80					x									x							x	x					Firm gy/br clay 2mm aperture
8.95	5					x									x							x	x					Minor gy/br clay smearing fract. Surface
9.05	80					x									x							x	x					Firm gy/br clay 1mm aperture
9.10	10					x									x							x	x					
9.16	80					x									x							x	x					
9.24	55					x									x			x					x					
9.72	85					x									x							x	x					
9.33	85					x									x							x	x					
9.40	50					x									x			x					x					
9.50	85								x						x							x	x					Minor light grey clay smearing
10.00	80					x									x							x	x					Minor light grey clay smearing
10.50	80					x									x							x	x					Locallised small smears of light grey clay
10.87	5								x						x			x					x					
11.06	80					x									x			x					x					
11.30	60					x									x			x					x					
11.60	45								x						x			x					x					

		PROJECT NAME Lackagh Quarry																								REPORT NO:	
		CLIENT: Glaway County Council																								HOLE NO:	BH-04
		ENGINEER: ARUP																								LOGGED BY:	Dave Blaney
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	No	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
11.63	5	x							x						x			x					x					
11.79	45								x						x			x					x					
11.80	5	x							x						x			x					x					
11.97	15					x									x			x					x					
12.50	60								x						x						x		x					White / grey calcite coating
12.51	15								x						x			x					x					
12.92	15					x									x			x					x					
14.40	10					x									x			x					x					
15.14	10					x									x			x					x					
15.90	70								x						x							x	x					Minor light grey clay smearing fract. Surface
16.38	10					x								x				x						x				Minor etching / pitting on fract. Surface
16.55	70					x									x			x					x					
16.77	5					x									x			x					x					
17.05	10					x									x			x					x					Strongly undulating - 30mm amplitude
17.40	10					x								x								x	x					Orange / brown clay infill
17.50	80					x									x							x		x				Minor clay and locallised Fe. staining
17.60	45	x							x						x			x					x					
17.65	70	x							x						x			x					x					
18.77	10								x						x			x					x					
19.93	25					x							x					x					x					
20.98	10								x						x			x					x					
21.85	60					x									x			x					x					
22.05	20					x								x				x					x					
22.15	40								x						x			x					x					
22.35	10								x						x			x					x					
23.10	10								x						x			x						x				Slight Fe Staining
23.13	0								x						x			x					x					
23.62	5								x						x			x					x					
24.17	20								x						x			x					x					
24.98	5					x									x			x					x					
25.16	10					x								x				x						x				Slight Fe Staining
25.58	10								x						x			x					x					
25.80	10								x						x			x					x					

		PROJECT NAME Lackagh Quarry																									REPORT NO:	
		CLIENT: Glaway County Council																									HOLE NO:	BH-04
		ENGINEER: ARUP																									LOGGED BY:	Dave Blaney
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	No	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
26.52	5					x									x			x					x					
26.70	75								x						x							x	x					Fine smear of light brown clay
26.72	20	x							x						x			x					x					
26.96	5					x									x			x					x					
27.06	60	x							x						x			x					x					
27.09	15	x							x						x			x					x					
27.13	10	x							x						x			x					x					
27.18	60	x							x						x			x					x					
27.53	5								x						x			x					x					
27.84	5					x									x			x					x					
27.87	5								x						x			x					x					
27.98	5								x						x			x					x					
28.25	5								x						x							x	x					Trace light grey clay coating
28.55	50								x						x			x					x					
28.90						x							x									x		x				37cm wide void - minor clay / slight oxidat.
29.77	5								x						x			x					x					
29.94	5								x						x			x					x					
30.10	5								x						x			x					x					
30.63	15					x									x							x	x					Minor light brown clay smearing
30.69	5								x						x							x	x					Minor light brown clay smearing
30.92	10					x									x			x					x					
31.43	10					x									x							x	x					Minor light brown clay smearing
31.60	5					x									x							x	x					Minor light brown clay smearing
32.47	20								x						x			x					x					
32.90	5								x						x			x					x					
33.94	10	x							x						x			x					x					
34.00	85								x						x			x					x					
34.04	10	x							x						x			x					x					
34.30	10	x							x						x			x					x					
34.52	75								x						x			x					x					
34.57	15	x							x						x			x					x					
34.96	15								x						x			x					x					

		PROJECT NAME Lackagh Quarry																									REPORT NO:	
		CLIENT: Galway County Council																									HOLE NO:	BH-05
		ENGINEER: ARUP																									LOGGED BY:	Dave Blaney
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	X	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
0.52	5	X				X									X			X					X					
0.60	5					X									X			X					X					
0.63	85								X						X						X		X					White / brown crystalline calcite
0.63	85								X						X			X					X					
0.68	5					X									X			X					X					
0.75	5	X							X						X			X					X					
0.84	5	X							X						X			X					X					
0.90	5								X						X			X					X					
1.31	15								X						X							X	X					Pale brown clay smearing fract. Surface
1.37	10	X				X									X							X	X					Pale brown clay smearing fract. Surface
1.40	10	X				X									X							X	X					Pale brown clay smearing fract. Surface
1.50	85	X							X						X							X	X					Pale brown clay smearing fract. Surface
1.66	5					X									X							X	X					Pale brown clay smearing fract. Surface
1.83	85	X							X						X			X					X					
2.13	10								X						X			X					X					
2.22	20		X												X			X					X					
2.42	5								X						X			X					X					
2.47	10								X						X			X					X					
2.57	10								X						X			X					X					
2.64	5								X						X			X					X					
2.70	10								X						X			X					X					
2.77	20					X									X			X					X					
2.82	5								X						X			X					X					
2.99	15								X						X			X					X					
3.07	10					X									X			X					X					
3.20	10								X						X			X					X					
3.27	20								X						X			X					X					
3.50	85					X									X			X					X					Minor fine gr. Sand coating fract. Surface
3.45	15	X				X									X			X					X					
3.62	20	X				X			X						X			X					X					
4.02	15								X						X			X					X					
4.10	85								X						X							X			X			Fine sandy clay coating & weak Fe staining
4.10	85								X						X							X			X			Joints are sub-parallel c.2-3cm apart
4.16	5								X						X			X					X					

		PROJECT NAME Lackagh Quarry																									REPORT NO:	
		CLIENT: Galway County Council																									HOLE NO:	BH-05
		ENGINEER: ARUP																									LOGGED BY:	Dave Blaney
			Roughness										Aperture					Filling					Weathering					
			Stepped			Undulating			Planar																			
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	R	Sm	St	R	Sm	St	R	Sm	St	Other	V Open >10mm	Open 2.5-10	Mod Open 0.5-2.5	Tight 0.1-0.5	V Tight <0.1	Clean	Staining	% Soil	% Mineral	Clay	X	Sl	Mod	High	Comp	Comments
4.25	5	X							X						X			X					X					
4.50	5	X							X						X			X					X					
4.73	5	X							X						X			X					X					
4.60	85								X						X							X			X			Fine sandy clay coating & weak Fe staining
4.60	85								X						X							X			X			Fine sandy clay coating & weak Fe staining. Joints are parallel and 2cm apart
4.74	5	X							X						X			X					X					
4.83	5	X							X						X			X					X					
3.85-8.0	85-90								X						X						X	X			X			Fine sandy clay coating & Fe staining. Fracture is are axial parallel and continue for 4.15m. From 6.5m white calcite deposited on fracture surface. 7.0-7.65m firm brown/grey clay infill - aparture up to 4mm wide
4.97	5	X							X						X			X					X					
5.07	10	X							X						X							X	X					Minor clay coating fracture surface
5.13	20	X							X						X							X	X					Minor clay coating fracture surface
5.20	75	X							X						X			X					X					Conjugate with vertical joint
5.16	10	X							X						X			X					X					
5.61	20	X				X									X			X					X					
5.73	10	X							X						X			X					X					
5.80	5	X							X						X			X					X					
5.97	5	X							X						X			X					X					
6.10	85	X	X												X							X	X					Conjugate with vertical fracture strike 120 / 60'
6.26	5	X							X						X			X					X					
6.38	10	X							X						X							X	X					Light brown clay
6.48	5	X							X						X			X					X					
6.60	5	X							X						X			X					X					
6.74	5	X							X						X			X					X					
6.78	5	X							X						X			X					X					
6.88	15	X				X									X			X					X					
6.91	10	X				X									X			X					X					
7.13	5	X							X						X			X					X					
7.37	5	X							X						X			X					X					
7.57	10	X							X						X			X					X					
7.74	15								X						X			X					X					
8.64	0								X						X				X					X				Orange brown Fe staining
8.68	50								X						X				X					X				Orange brown Fe staining
8.73	50								X						X				X					X				Orange brown Fe staining

		PROJECT NAME Lackagh Quarry																									REPORT NO:	
		CLIENT: Galway County Council																									HOLE NO:	BH-05
		ENGINEER: ARUP																									LOGGED BY:	Dave Blaney
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	X	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
8.92	45		X												X				X					X				Orange brown Fe staining
9.20	45								X						X							X		X				Orange brown Fe staining
9.35	60		X												X				X					X				Orange brown Fe staining, light brown clay smearing
10.25	5								X						X			X					X					
10.4 - 11.3	85								X						X						X	X		X				Axial parallel fracture, minor calcite and orange brown clay coating fracture surface
10.50	5								X						X			X					X					
11.20	50					X									X						X	X	X					Light grey calcite and minor brown clay coating fracture surface
11.30	5								X						X			X					X					
11.90	5		X												X						X		X					Fracture devoped along stylolite, black argillite lining
11.95	80	X							X						X			X						X				Minor Fe staining
12.05	15					X									X			X					X					
12.42	10		X												X						X		X					Fracture devoped along stylolite, black argillite lining
12.60	55								X						X			X					X					
12.6 - 13.4	85								X						X				X					X				Minor Fe staining
12.78	0	X							X						X							X	X					Minor light brown clay
12.84	5	X							X						X							X	X					Minor light brown clay
13.02	5	X							X						X			X					X					
13.26	5	X							X						X			X					X					
13.52	20								X						X			X					X					
13.82	5								X						X			X					X					
14.39	30								X						X							X	X					Sand/clay coating, minor Fe staining
14.72	55								X						X			X					X					
15.00	30								X						X			X					X					
15.15	15		X												X						X		X					Fracture devoped along stylolite, black argillite lining
15.20	85	X				X									X			X					X					
15.33	85	X				X									X			X					X					
15.40	20					X									X							X	X					Minor brown clay
15.55	10		X												X						X		X					Fracture devoped along stylolite, black argillite lining
16.59	10					X									X			X					X					
16.86	10								X						X							X		X				Minor light brown clay, some pitting & weak oxidation of fracture surface
16.90	30								X						X							X		X				Minor light brown clay, some pitting & weak oxidation of fracture surface

		PROJECT NAME Lackagh Quarry																								REPORT NO:	
		CLIENT: Galway County Council																								HOLE NO:	BH-05
		ENGINEER: ARUP																								LOGGED BY:	Dave Blaney
Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	X	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
17.20	10								X						X							X	X					Grey/brown clay coating fract. Surface
17.25	85	X				X									X							X	X					Minor grey / brown clay
17.40	45					X									X							X	X					Minor grey/brown clay coating fract. Surface
17.78	5					X									X							X	X					Undulating - amplitude 2cm, brown clay infill
18.03	15		X												X							X	X					Minor clay
18.30	15					X									X			X					X					
18.50	85	X							X						X						X		X					Minor white calcite
18.60	20								X						X							X	X					Orange/brown clay smeared on fract surface
18.80	10								X						X							X	X					Orange/brown clay smeared on fract surface
18.90	85								X						X						X		X					Minor white calcite
18.97	10					X									X			X					X					
19.20	20					X									X							X	X					Orange/brown clay infill
19.60	5								X						X			X					X					
19.98	45	X							X						X							X	X					Orange/brown clay infill, aperture up to 2mm thick
20.00	45	X							X						X							X	X					Orange/brown clay infill, aperture up to 2mm thick
20.04	45								X						X			X					X					
20.12	10								X						X			X					X					
20.60	85								X						X			X					X					
20.60	75					X									X							X	X					Orange/brown clay coating fract. Surface
20.52	10								X						X			X					X					
20.73	20	X	X												X							X	X					Very rough - Orange/brown clay coating fract. Surface
20.87	35	X	X												X							X	X					Very rough - Orange/brown clay coating fract. Surface
20.97	50					X									X							X	X					Orange/brown clay coating fract. Surface
21.23	55					X									X							X	X					Brown sandy clay coating
21.35	55					X									X							X	X					Brown sandy clay coating
21.42	55					X							X									X	X					Joint aperture is >10mm infilled with orange brown clay
21.86	30	X							X						X			X					X					
21.90	20								X						X			X					X					
22.05	45								X						X			X					X					

		PROJECT NAME Lackagh Quarry																						REPORT NO:	
		CLIENT: Galway County Council																						HOLE NO:	BH-05
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Depth of Discontinuity (m BGL)	Orient.to Short Core Axis	Non Intact? (NI)	Roughness										Aperture					Filling					Weathering					Comments
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	X	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
22.10	5								X						X			X					X					
22.45	85	X							X						X							X		X				Clay coating fract surface minor Fe staining
22.92	10	X							X						X							X	X					Clay coating fract surface
23.40	70								X						X							X	X					Light brown clay over basal 30cm
23.60	5	X							X						X			X					X					
23.72	10								X						X						X		X					Minor light grey calcite
24.40	60								X						X			X					X					
24.50	0								X						X			X					X					
25.04	0								X						X			X					X					
25.52	45								X						X						X		X					Minor light grey calcite
25.82	25					X									X			X					X					
26.37	5								X						X			X					X					
26.61	5								X						X			X					X					
26.70	80	X							X						X				X				X					Minor Fe staining
27.10	85								X						X						X		X					Minor white calcite
27.14	20	X	X												X			X					X					
27.27	55								X						X			X					X					
27.62	55		X												X			X					X					
27.88	0								X						X			X					X					
28.05	5	X							X						X			X					X					
28.12	60	X							X						X			X					X					
28.16	5	X				X									X			X					X					
28.25	90								X						X						X		X					Minor white calcite veining
28.40	55	X							X						X			X					X					
28.1 - 32.35	85-90								X						X						X		X					Axial parallel fracture, surfaces partially coated with white calcite
28.81	15	X							X						X			X					X					
28.90	20	X							X						X			X					X					
29.05	30	X							X						X			X					X					
29.35	10	X							X						X			X					X					
29.40	60	X							X						X			X					X					
30.00	5	X							X						X			X					X					
30.30	40	X							X						X			X					X					
30.38	10	X				X									X			X					X					
30.50	10	X							X						X			X					X					

		PROJECT NAME Lackagh Quarry																								REPORT NO:	
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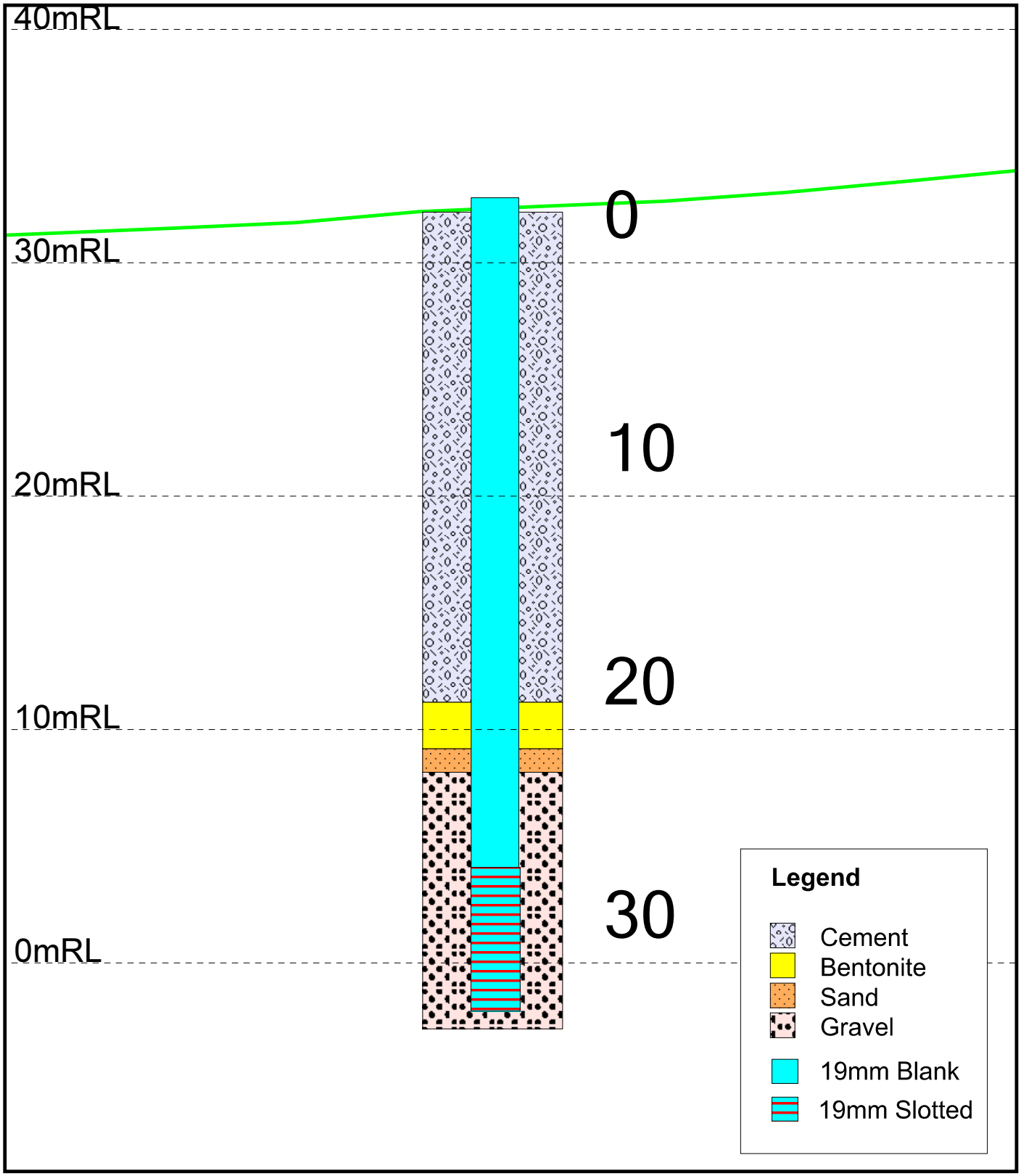
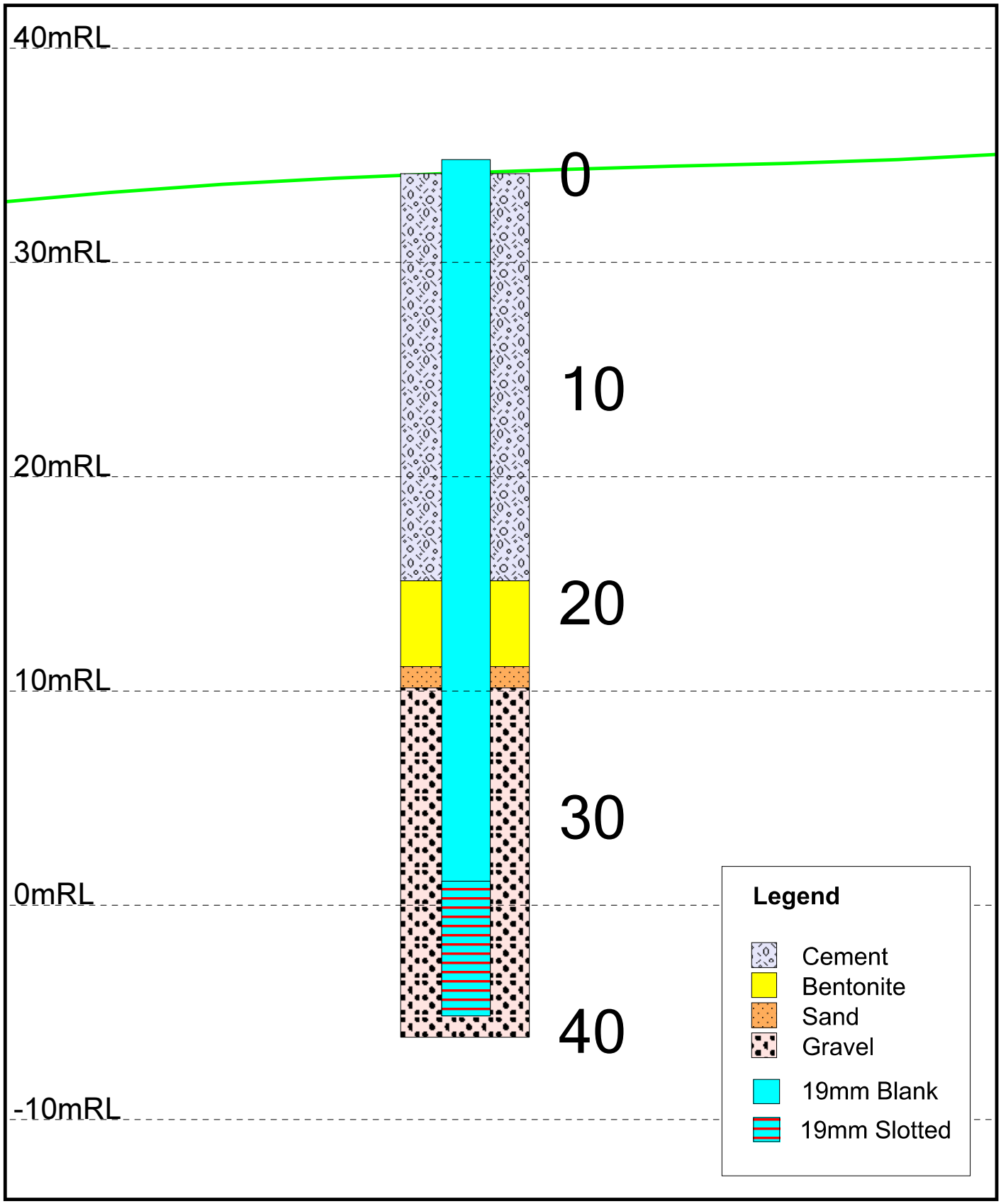
			Stepped			Undulating			Planar			Other	V Open	Open	Mod Open	Tight	V Tight	Clean	Staining	% Soil	% Mineral	Clay	X	Sl	Mod	High	Comp	
			R	Sm	St	R	Sm	St	R	Sm	St		>10mm	2.5-10	0.5-2.5	0.1-0.5	<0.1											
30.78	10	X							X						X			X					X					
30.90	35	X							X						X			X					X					
31.30	50	X							X						X				X					X				
31.60	70	X							X						X				X					X				
31.90	45	X							X						X			X					X					
32.07	35								X						X			X					X					
32.24	5								X						X			X					X					
32.85	15								X						X			X					X					
32.91	20								X						X			X					X					
33.30	5								X						X			X					X					
33.55	5								X						X			X					X					
33.80	5								X						X			X					X					
33.94	10					X									X			X					X					
34.55	10								X						X			X					X					
34.73	45								X						X			X					X					
34.9 - 37.2	85					X									X				X			X		X				Locally stepped aspect, trace clay coating surfaces, slight Fe staining over top 1.5m
34.90	20								X						X			X					X					
35.00	45	X							X						X			X					X					
35.23	20	X		X											X			X					X					
35.37	10	X							X						X			X					X					
35.54	15	X							X						X			X					X					
35.63	10								X						X			X					X					
35.73	10								X						X			X					X					
36.10	5	X							X						X							X		X				Minor clay, slight Fe Staining
36.40	20	X							X						X			X					X					
36.47	10								X						X			X					X					
36.88	45	X							X						X			X					X					
37.20	30					X									X							X	X					Traces of orange brown clay
38.05	10								X						X			X					X					
37.95 - 40.0	85					X									X							X		X				Minor clay smearing surfaces and locallised Fe staining
38.64	10	X							X						X			X					X					
39.64	10	X							X						X			X					X					
39.75	55	X							X						X			X					X					
39.90	65	X							X						X			X					X					

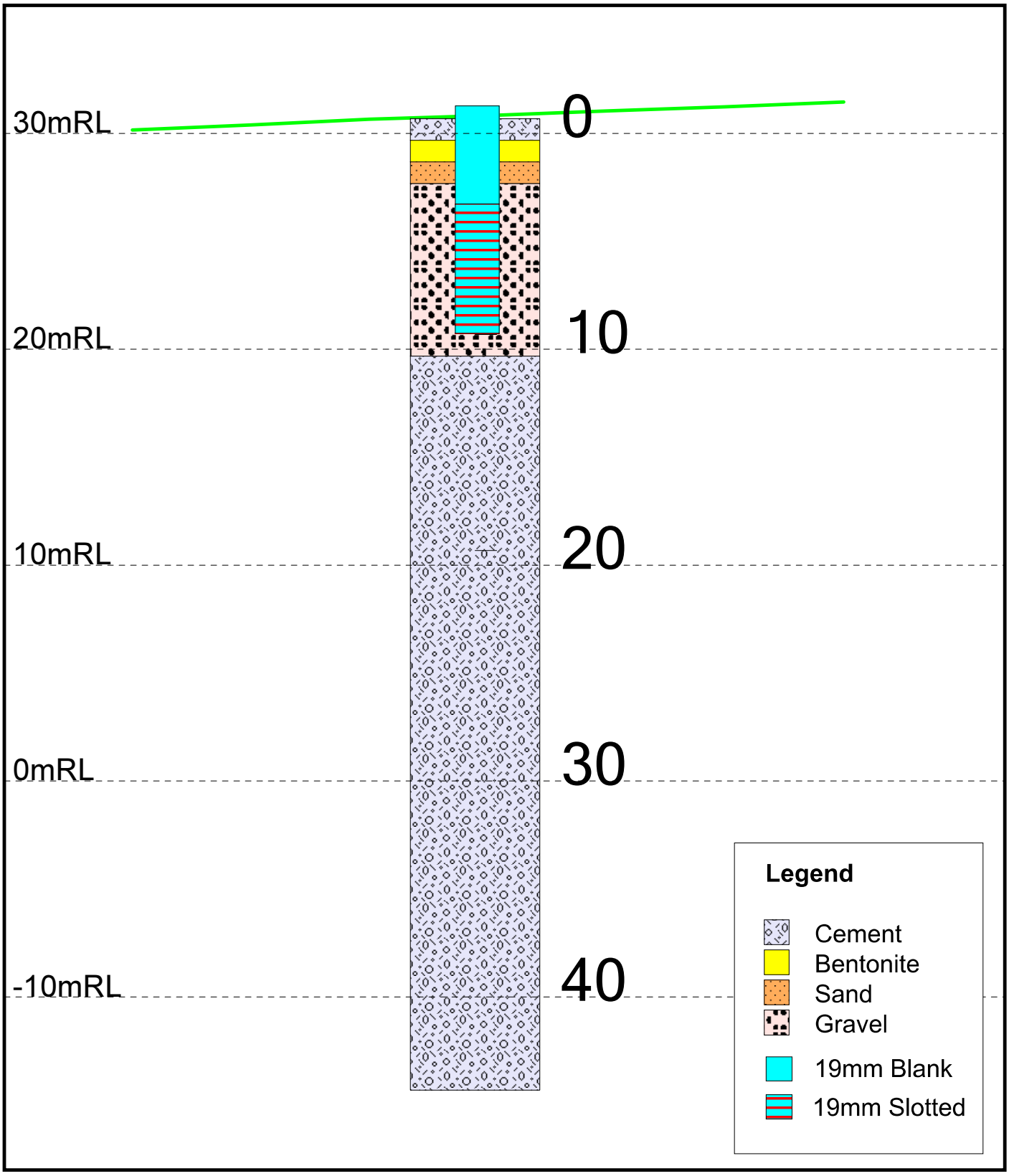
APPENDIX IV



Piezometer Installation BH04



Piezometer Installation BH05



Piezometer Installation BH06

APPENDIX V

R13/16

Report on Geophysical Surveys completed at Lackagh Quarry Co. Galway for Arup

Graham Reid P.Geo.

Project Number: **R13/16**
Author(s): Graham Reid P.Geo,
BRG Ltd. Arup
Date of Report: January 2016

Private & Confidential

THE DATA PRESENTED IN THIS REPORT WAS ACQUIRED FROM GEOPHYSICAL NON-INVASIVE TECHNIQUES CARRIED OUT AT SURFACE. INTERPRETATIONS ARE DERIVED FROM A COMBINATION OF GROUND CONDITIONS, TYPICAL GEOPHYSICAL RESPONSES AND THE KNOWLEDGE/EXPERIENCE OF THE AUTHOR. BRG LTD HAS COMPILED AND INTERPRETED THE DATA TO BEST INDUSTRY STANDARDS AND WITH ALL REASONABLE SKILL AND DILIGENCE IN RELATION TO THE TECHNIQUES AND RESOURCES APPLIED IN AGREEMENT WITH THE CLIENT. ANY FUTURE USE OF THIS REPORT SHOULD TAKE ITS INTERPRETIVE NATURE INTO CONSIDERATION.

Report Number	Author	Checked By	Version	Date
R13/16	Graham Reid P. Geo	Dave Blaney P. Geo	V1	18/01/2016
Signed				

R13/16

Report on Geophysical Surveys at Lackagh, Co. Galway

Graham Reid, January 2016

Contents

List of Figures

1. Executive Summary

BRG Ltd completed geophysical surveys in an area to the west of the abandoned Lackagh Quarry, Menlo, Co. Galway as part of the Priority Drilling Ltd preliminary site investigation for the proposed new road alignment through this area. The geophysical surveys consisted of 2D Electrical Resistivity Tomography (ERT) and Microgravity across an initial area of roughly 300*30m, subsequently extended to better define the extent of a deep weathering/karst zone.

The surveys were designed to test for subsurface details and bedrock depths in advance of follow up rotary core drilling. Information on potential karst features were of particular interest to the client. The bedrock exposed in the quarry and outcropping to the west consists of strong, thickly bedded Visean limestones dipping gently to the south-west. A thin Tuff band is reputed to control a local aquifer, with more thinly bedded limestones and thin shaley bands developed beneath.

Outcrop to the west of the quarry consists of well-developed limestone pavement extending c,80-100m to the west, which gives way to grass fields across the remainder of the survey area.

Resistivity sections from the 2D ERT and gravity data show a marked contrast from high resistivity bedrock in the east with a sharp contact into very low resistivity zones to the west. The western region has a low gravity response coincident with the low resistivity. The base of the initial ERT lines did not penetrate below 30m in the west suggesting that this area could be a deep overburden/weathered zone, possibly a karst filled sinkhole or more shaley unit.

The work was completed over three separate periods:

- 6 day period from 27th October to 3rd November 2015.
- 1 day, 25th November
- 3 days, 13-15th January

2. Introduction

BRG was hired by Priority drilling Ltd. to acquire 2D ERT and microgravity data along a planned potential route for the new Galway ring road located to the west of Lackagh Quarry.

The Quarry is located to the north of Galway city with easy access off the Coolagh Road. The quarry is abandoned and fenced off and site access was organised through Sean Ross of Arup. The work was completed mainly across fields and limestone pavement to the west of the quarry and outside the quarry footprint. A rough track running from inside the quarry bounds allowing access into the fields. Loose cattle including a bull were running free within the fields and surrounding scrub, however these were fenced out of the fields when ERT lines were being acquired. A minor microgravity grid was also added on the first bench within the quarry over the area where the proposed horizontal borehole was drilled.

Figure 1: Aerial Photograph Site Location Map

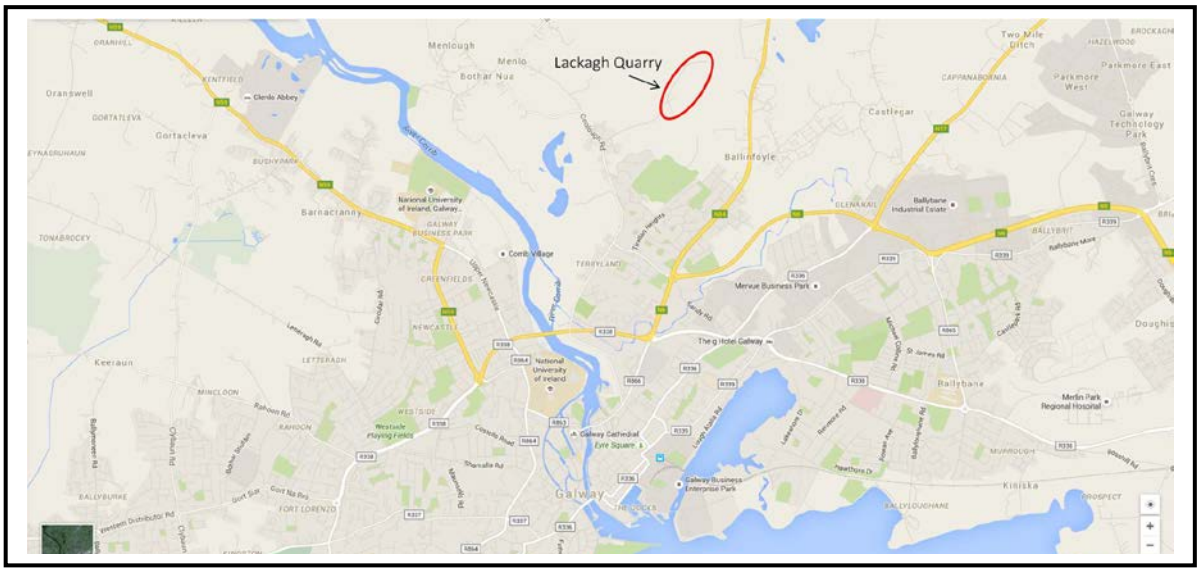


Figure 2: Location Map

2.1 Survey Objectives

1) Acquire 2D Resistivity and Microgravity data across the specified region within and proximal to the Lackagh Quarry site.

2) Generate Maps and sections showing the geophysical characteristics of the site and generate interpretative maps and sections of the overburden/bedrock model over the chosen areas.

3) Outline potential areas for future intrusive investigations (in particular to assist with locating follow up rotary drilling)

3. Geological setting

The mapped geology from the Geological Survey of Ireland (1:100,000) shows the site to be underlain by undifferentiated Visean limestones / shaley limestones. The rocks are well exposed within the quarry and to the west as outcropping weathered limestone pavement. These limestones are massive, thickly bedded micritic / grainstone units, generally strong and dipping to the southwest. Overburden appears to be mostly clay and gravels and most likely glacially derived soils (the site walk over noted rounded granite boulders scattered across the limestone pavement, these are probably glacial erratics). A pronounced Tuff band clearly exposed in the quarry underlies the massive limestones and is thought to control a local aquifer. It also appears to host minor sulphides (pyrite) with iron staining developed on the surface of the underlying, slightly argillaceous, limestones.

4. Survey Equipment and methodology

The geophysical surveys were chosen to provide detailed overburden/bedrock profiles along the chosen lines (ERT) and to identify any significant anomalous zones that could be a result of faults/fractures or karst development (ERT and Microgravity).

The depth mapping potential with the ERT is limited by the length of each spread so that individual spreads were capable of surveying to from 22m b.g.l. in Line 5 to a maximum of 60m b.g.l. with Line 6. Equipment consisted of an Allied Associates Tigre system which has the potential for up to 128 electrode takeouts. 2m station spacing was initially used to get the required detail along the chosen lines, with 3m intervals on the long lines (6, 7 & 8). Data was measured using a Wenner array, controlled by an Imager2006 programme with a laptop computer. Saved data was inverted using the Geotomo Res2Dinv programme and exported as an image file displaying a cross section of the inverted Resistivities with elevation data. The resultant resistivity sections were subsequently interpreted and an interpreted geological model developed.

Microgravity data was acquired with measured sites along the centre line and 15m either side of the proposed tunnel section. These lines were measured with nominal station spacing of 10m, with gaps where scrub hawthorn was too thick. Extra stations were measured within the quarry on the first bench at 5-10m intervals. Measurement was taken using a Lacoste & Romberg model G gravity meter. Instrument drift was monitored by returning to a locally established base station at hourly intervals.

Stations were topographically surveyed using a Trimble GeoExplorer 6000 RTK GPS system corrected through phone modem link for both the ERT and the gravity surveys. The drift corrected gravity data was corrected for elevation, latitude, and reduced to Bouguer 2.67g/cm^3 to allow for local average rock densities. It was then gridded and exported for display and interpretation in the MapInfo GIS system.

All points were surveyed in Irish Transverse Mercator (ITM) projection.

5. Discussion of Results (Figures 3-16)

The 2D ERT data defines a marked contrast between the resistive massive limestones to the east and exposed within the quarry and a narrow, deep, conductive response that was detected to the west. This contact is clearly seen on lines 1 (at station 114) & 2 (station 134) where it is shown as steep westerly dipping feature. Lines 3 & 4 are almost entirely mapping the lower resistivity unit which is greater than 14m deep. This conductive zone could represent a combination of thicker overburden and underlying weathered bedrock. Line 5 was surveyed entirely on the edge of the

outcropping limestone pavement and displays a thin conductive overburden layer over resistive bedrock.

Line 6 was extended N-S perpendicular to the long axis of the fields with the aim of mapping the edges of the deep overburden feature – this line was surveyed while BH3 was still in progress, with the inversion model shows the hole located within a significant deep overburden (low resistivity) feature. The southern contact of the deep overburden feature is mapped as being sub-vertical with the overburden depth increasing from <1.0m to >55.0m within a few meters. The northern side of the deep overburden feature exhibits a steeped nature with a rapid shallowing at station 210 to a depth of c.35m bgl, and the northern edge seen at station 275 where the overburden depth shallows rapidly.

Lines 7 & 8 were surveyed along similar locations to 2 & 1 respectively; however they were surveyed at 3m electrode spacing and extended to the west. Line 7 exhibits a strange higher resistivity shallow zone to the west of station 96 with lower resistivity below – this most likely reflects the line location proximal to the southern contact of the deep overburden feature resulting in the inversion model displaying some “edge” effects.

Lines 9 & 10 were also designed to map the edges of the deep overburden feature, and this has been successfully achieved along the southern contact and only partially successful in the north (where thick hawthorn bush in an environmentally sensitive area restricted access to extend the lines). These lines were surveyed using a 2m electrode spacing.

The microgravity data shows the same general scenario as the resistivity data. Higher density and more coherent limestones in the east give way to a lower density zone to the west with an irregular sinuous contact between the two. Measurements on the bench within the quarry give the same relatively high density limestone situation as seen at the area underlain by limestone pavement. However, the lower gravity readings located in zones along the edges of the quarry faces are interpreted as the effect of terrain factors

The geophysical interpretation (Figure 16) is derived from a combination of both the Microgravity and 2D ERT methods. This outlines the contact zone at about 530,130E between shallow limestones to the east and deeper overburden/weathered zone to the west. The original ERT lines and microgravity provided limited definition of the contact zones and these have been refined by the extended 3m interval lines. The rotary drilling has shown that the ERT models correlate well with the underlying geology. The mapped low resistivity zone closely follows the field outline. Completed drillholes have been located on the model sections, with those annotated as “offset”

projected from up to 10m away onto the sections (N.B. there is some slight discrepancy between the plotted holes and the modelled section inversion as the holes have been extrapolated from up to 10m off line)

The unusual nature of these grass fields and where they sit within the surrounding limestone pavement would also support the possibility that they reflect the surface expression of an infilled topographic feature such as a slot canyon.

ERT Line Locations

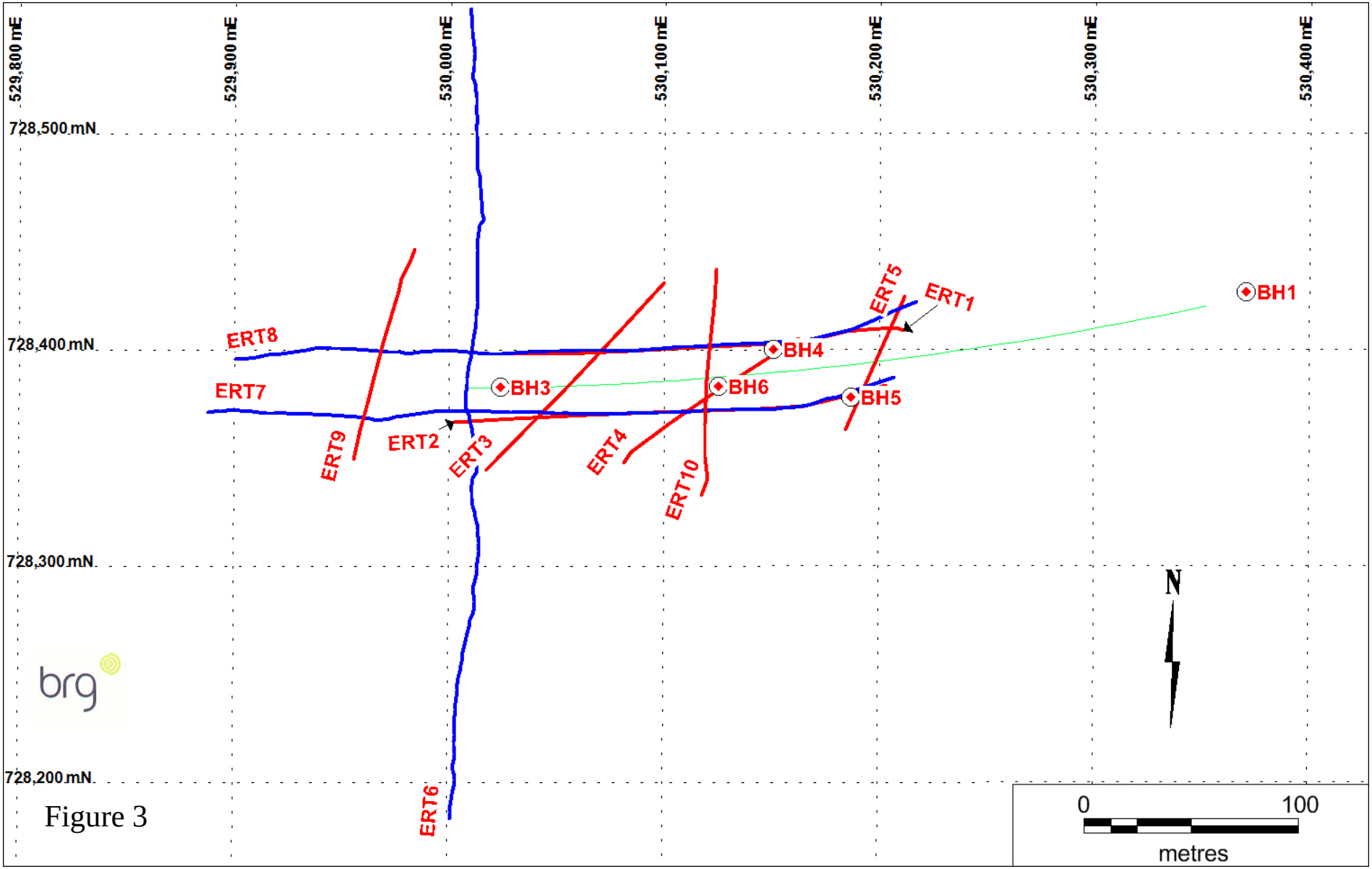


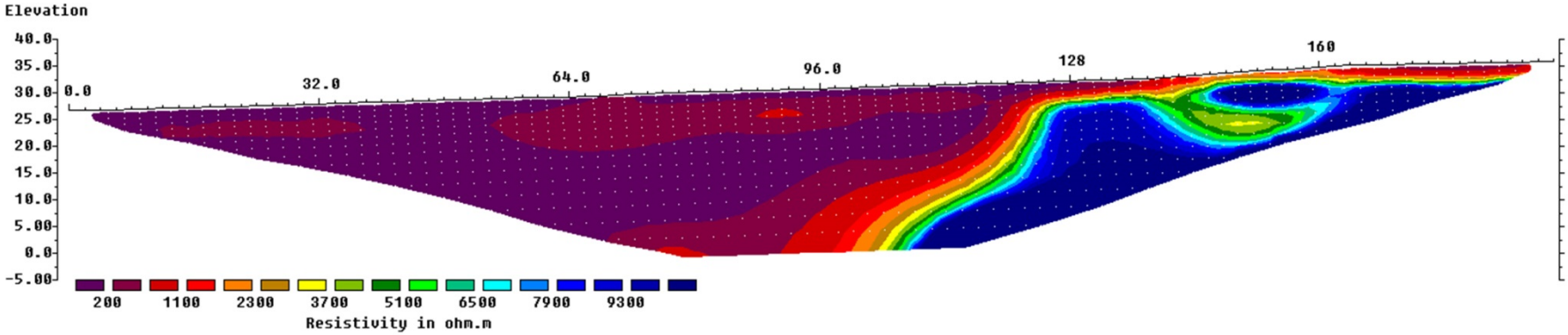
Figure 3

Resistivity – ERT Line 1

2m Electrode Takeouts

West

East



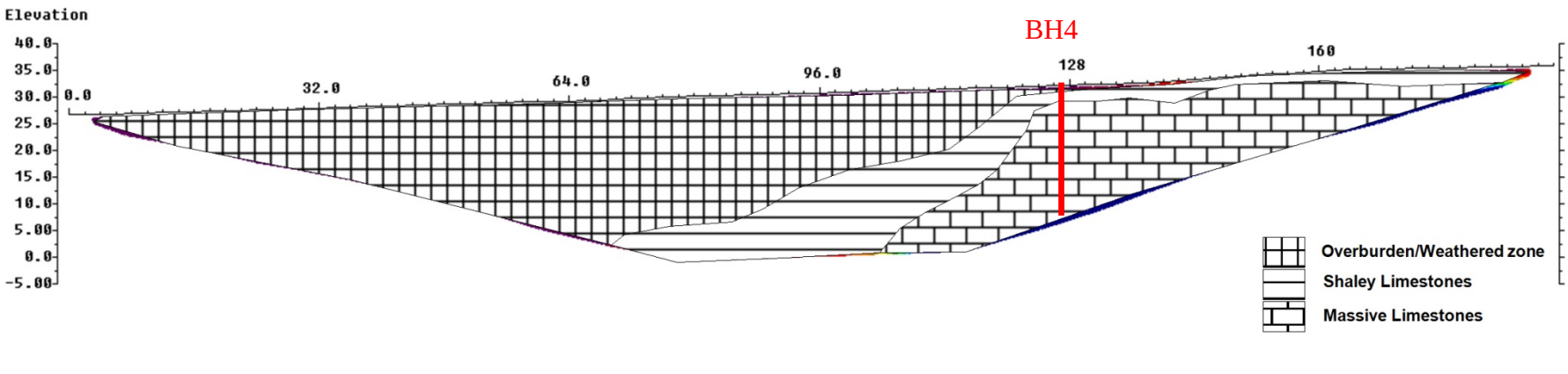


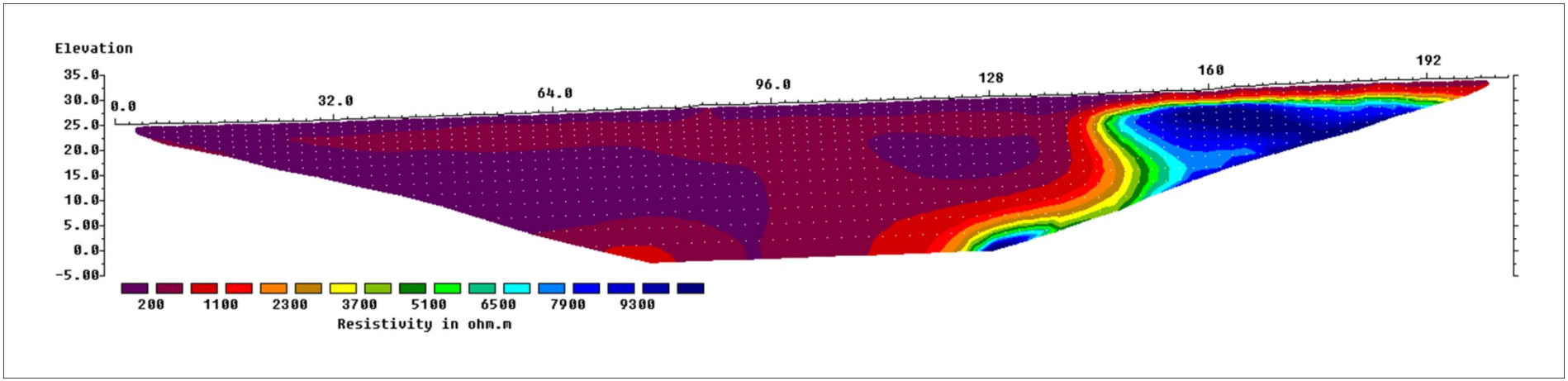
Figure 4

Resistivity – ERT Line 2

West

2m Electrode Takeouts

East



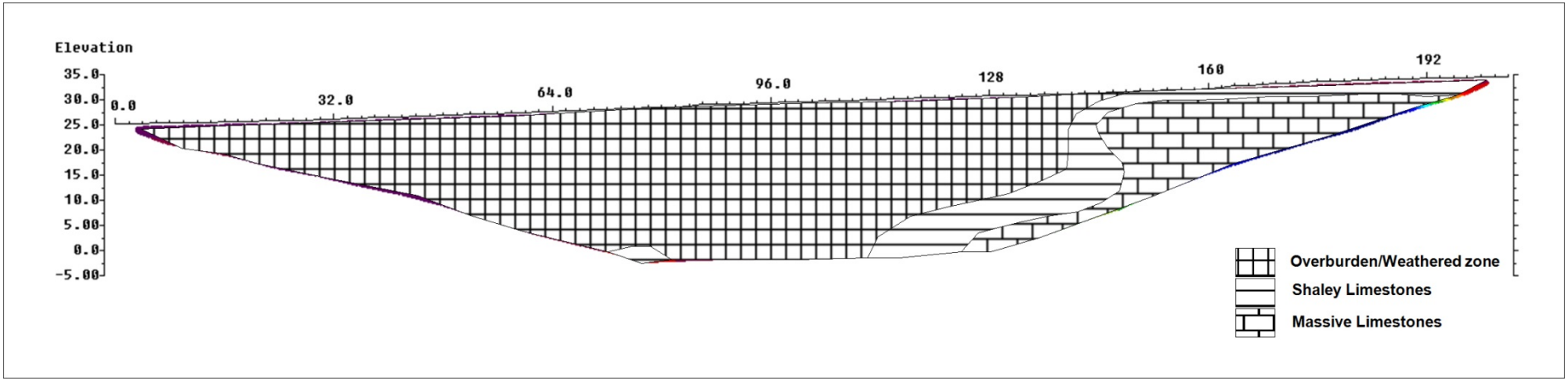


Figure 5

Resistivity – ERT Line 3

SW

2m Electrode Takeouts

NE

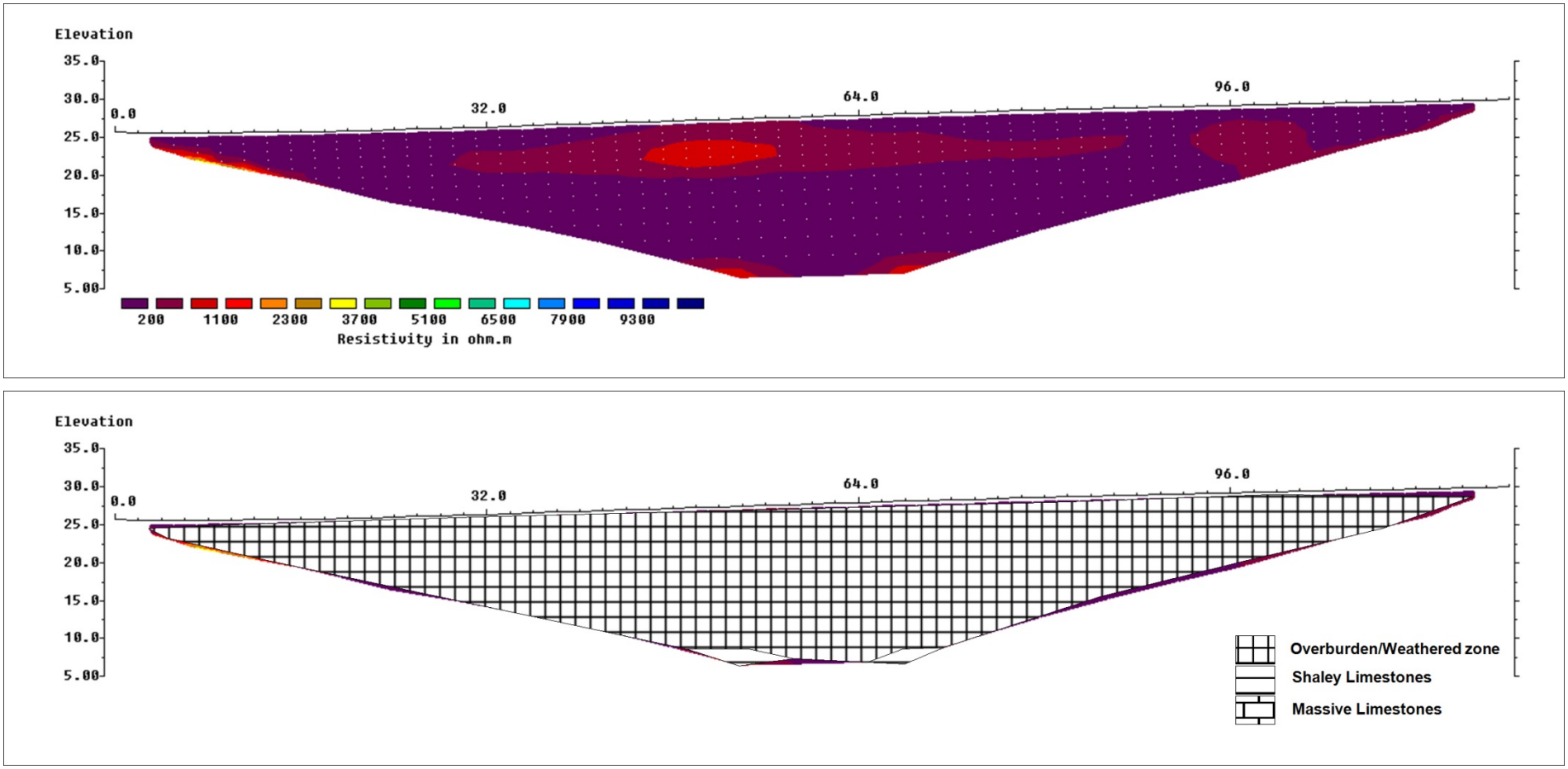


Figure 6

Resistivity – ERT Line 4

SW

2m Electrode Takeouts

NE

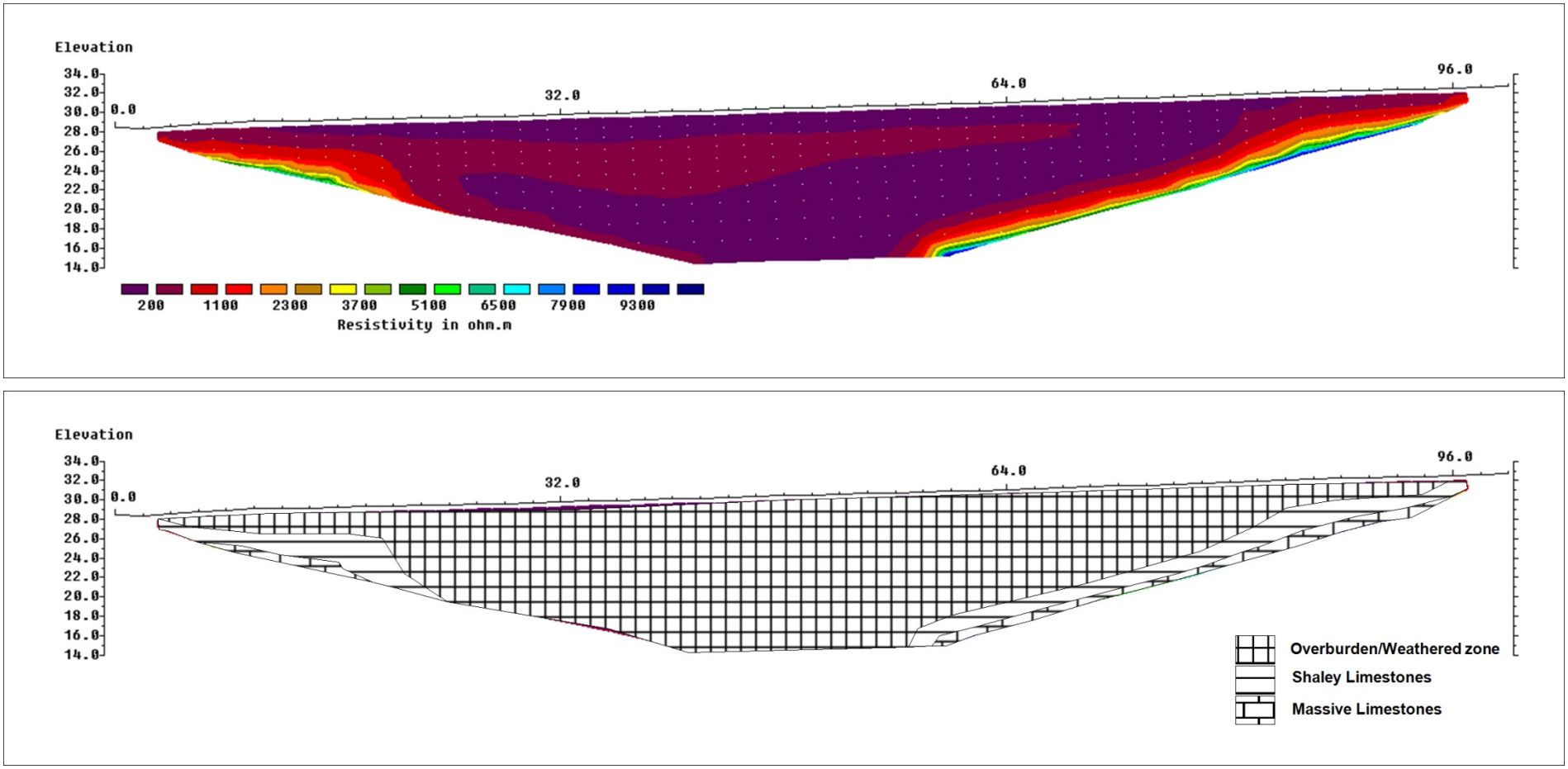


Figure 7

Resistivity – ERT Line 5

SW

2m Electrode Takeouts

NE

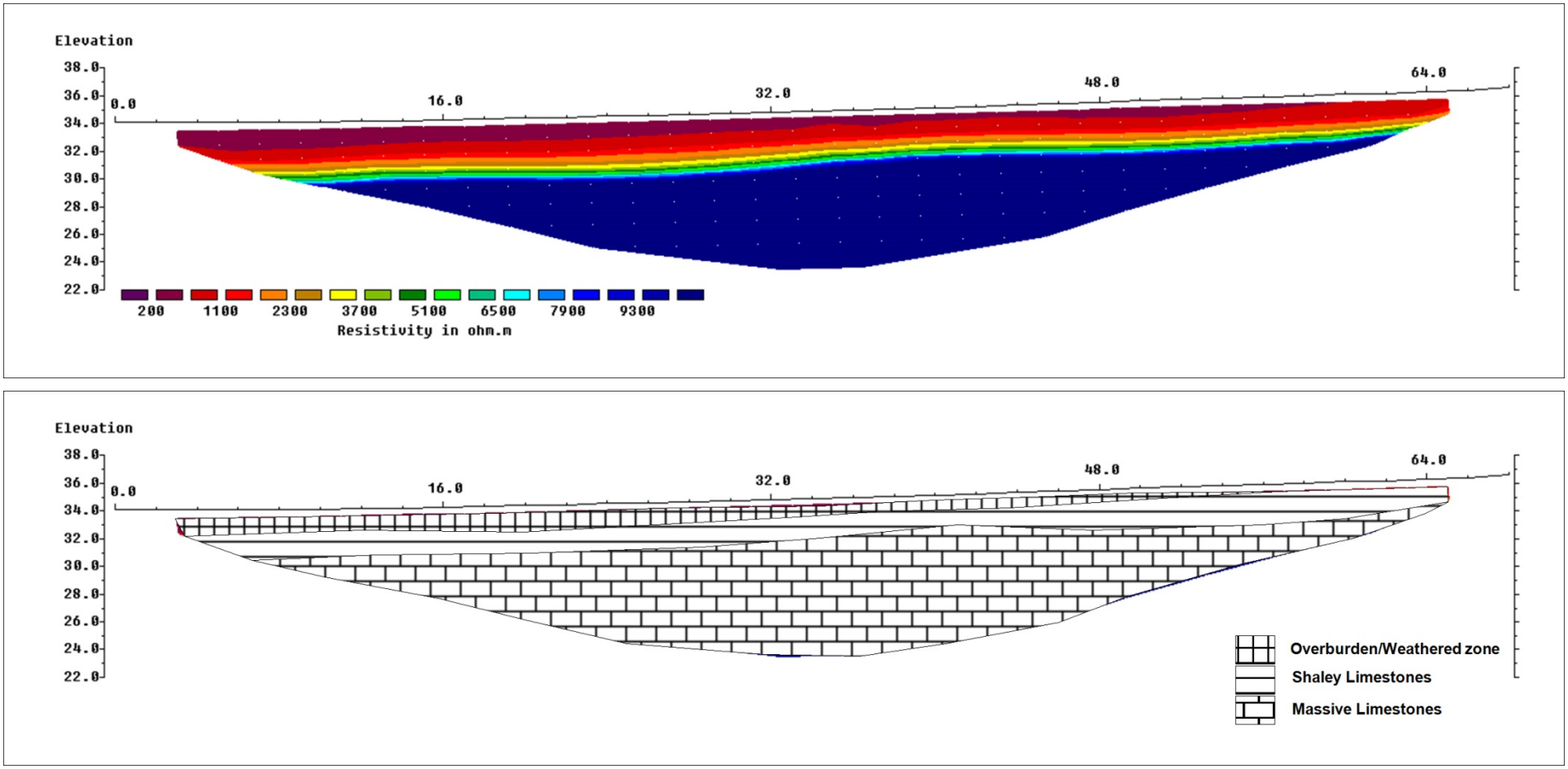


Figure 8

Resistivity – ERT Line 6

S

3m Electrode Takeouts

N

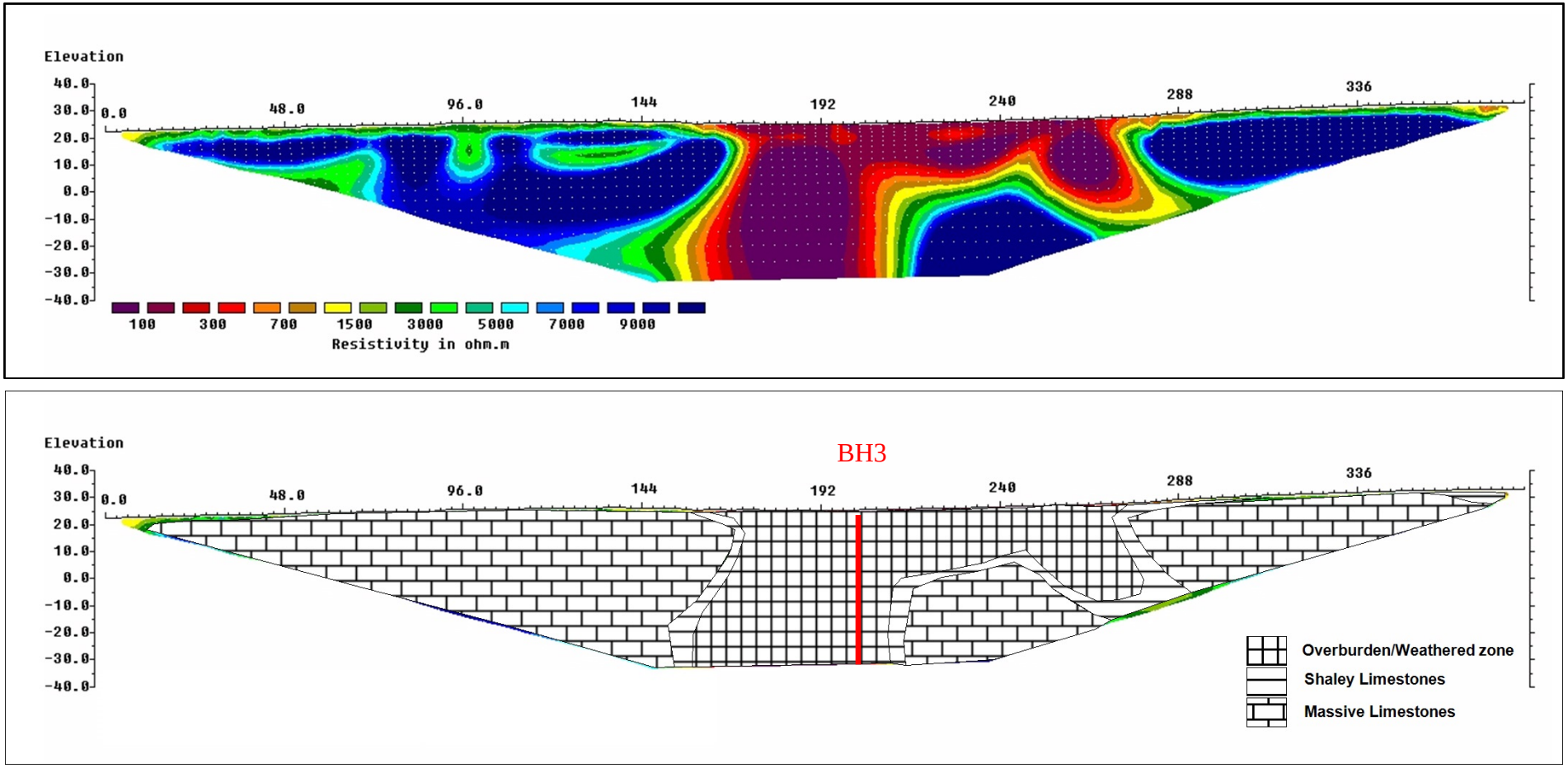


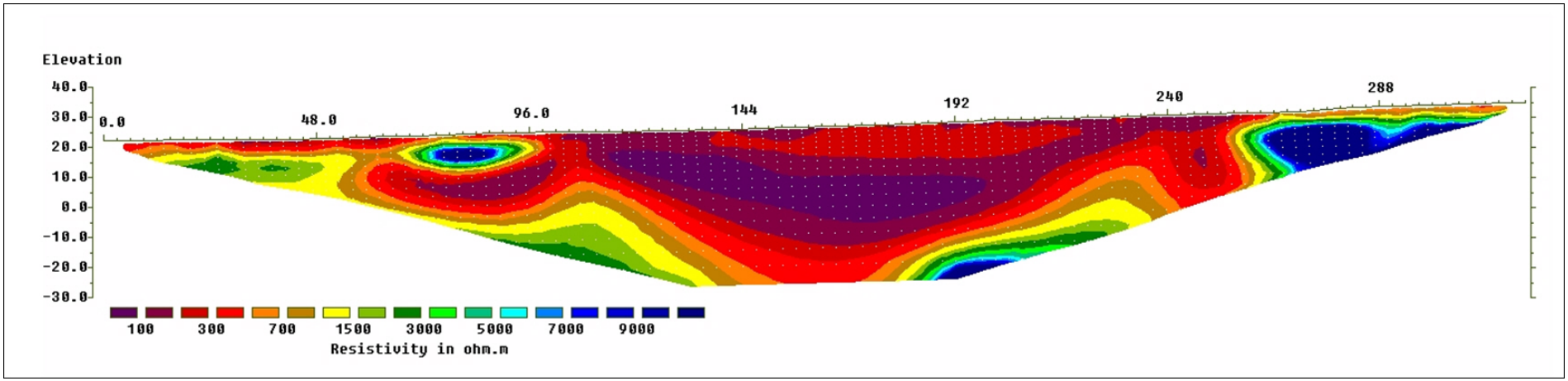
Figure 9

Resistivity – ERT Line 7

W

3m Electrode Takeouts

E



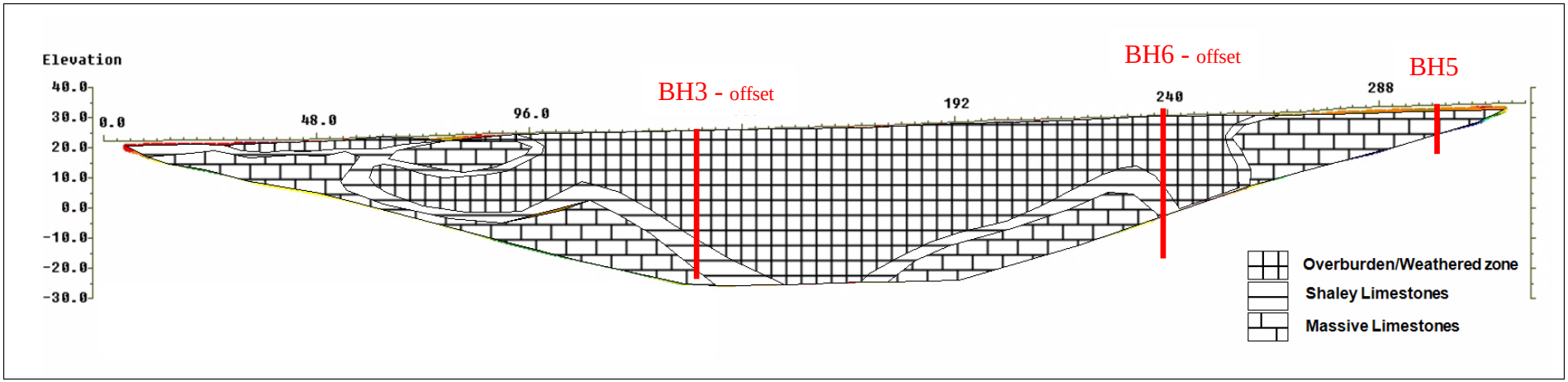


Figure 10

Resistivity – ERT Line 8

W

3m Electrode Takeouts

E

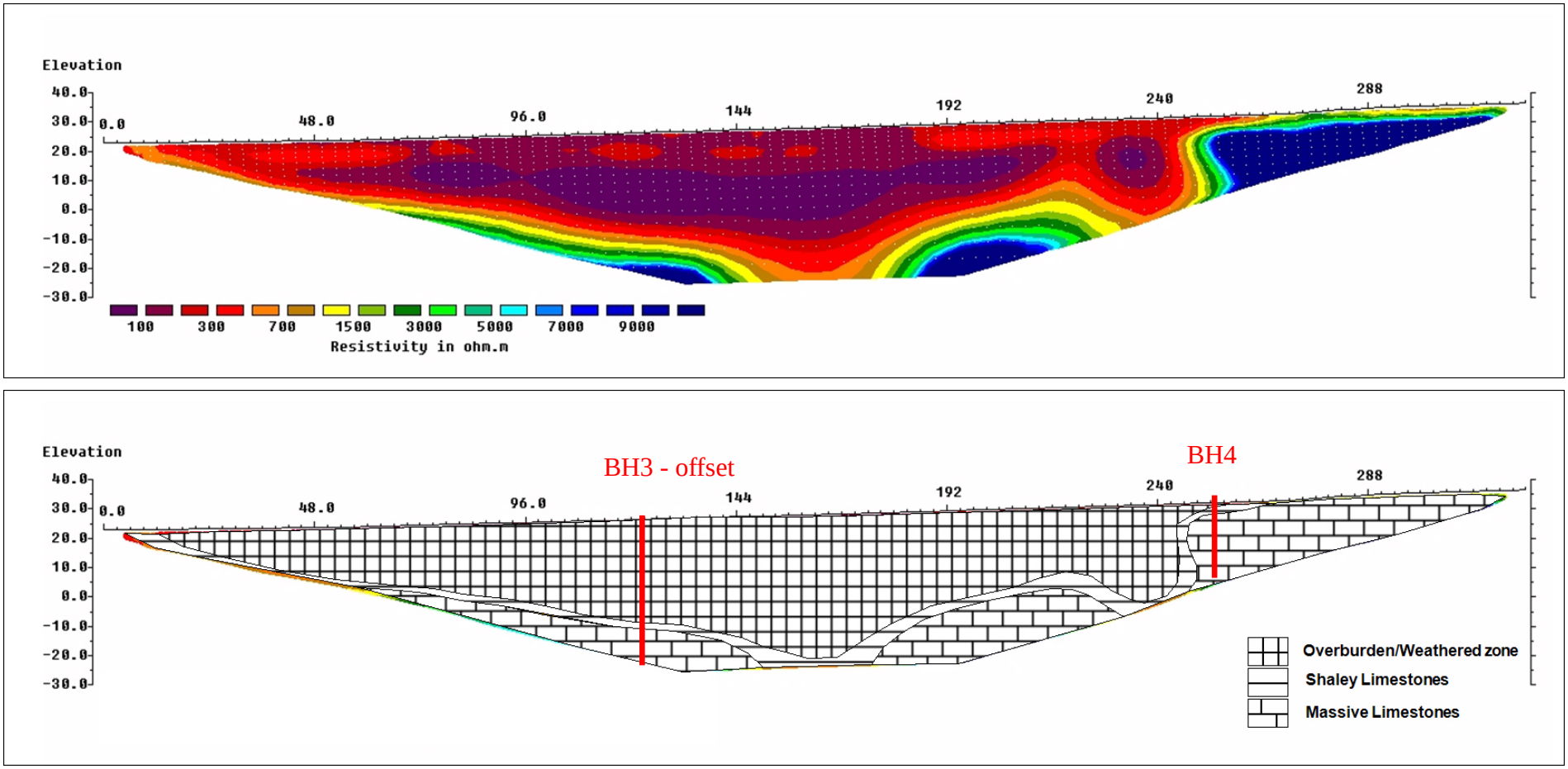


Figure 11

Resistivity – ERT Line 9

S

2m Electrode Takeouts

N

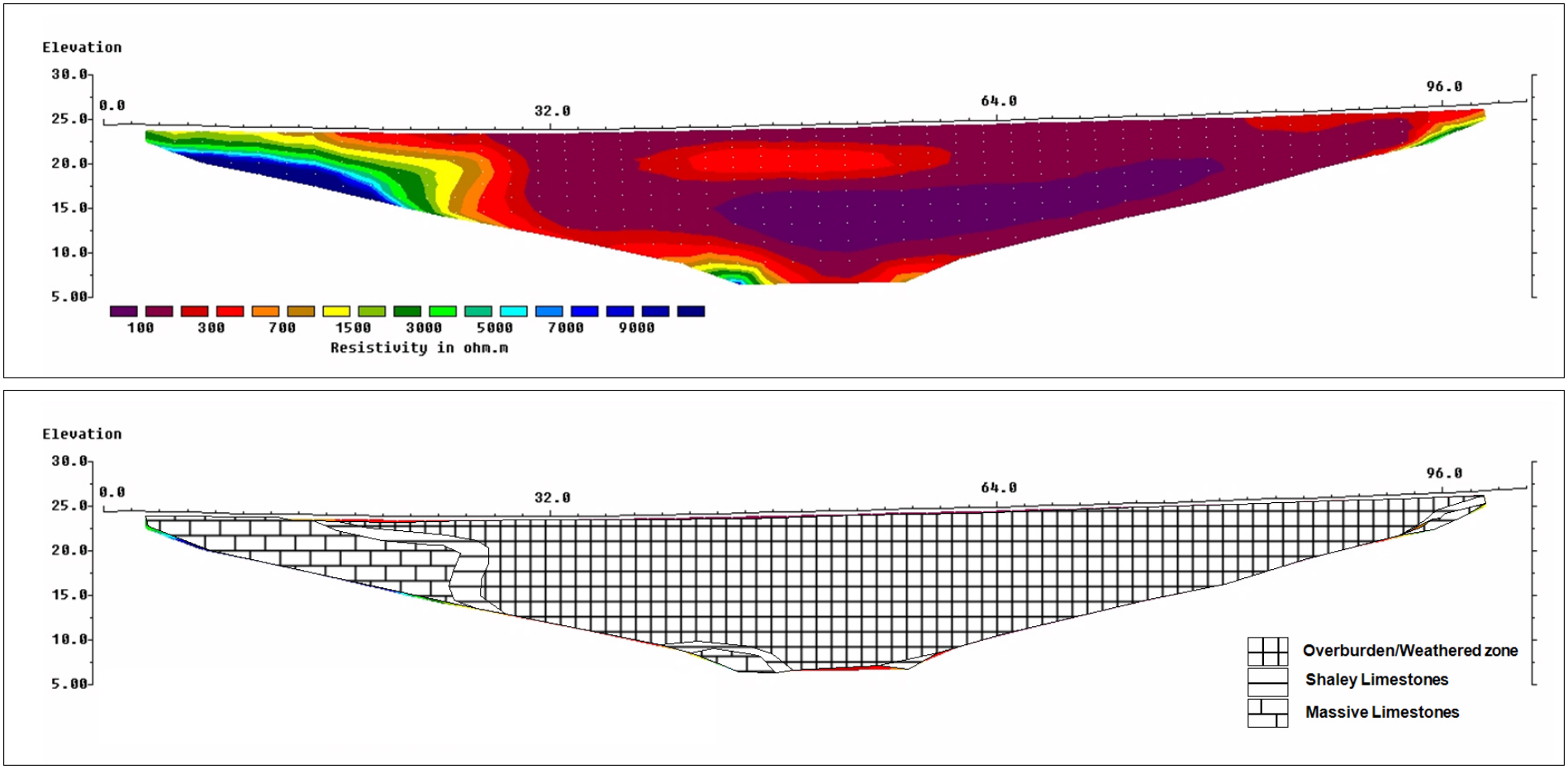


Figure 12

Resistivity – ERT Line 10

S

2m Electrode Takeouts

N

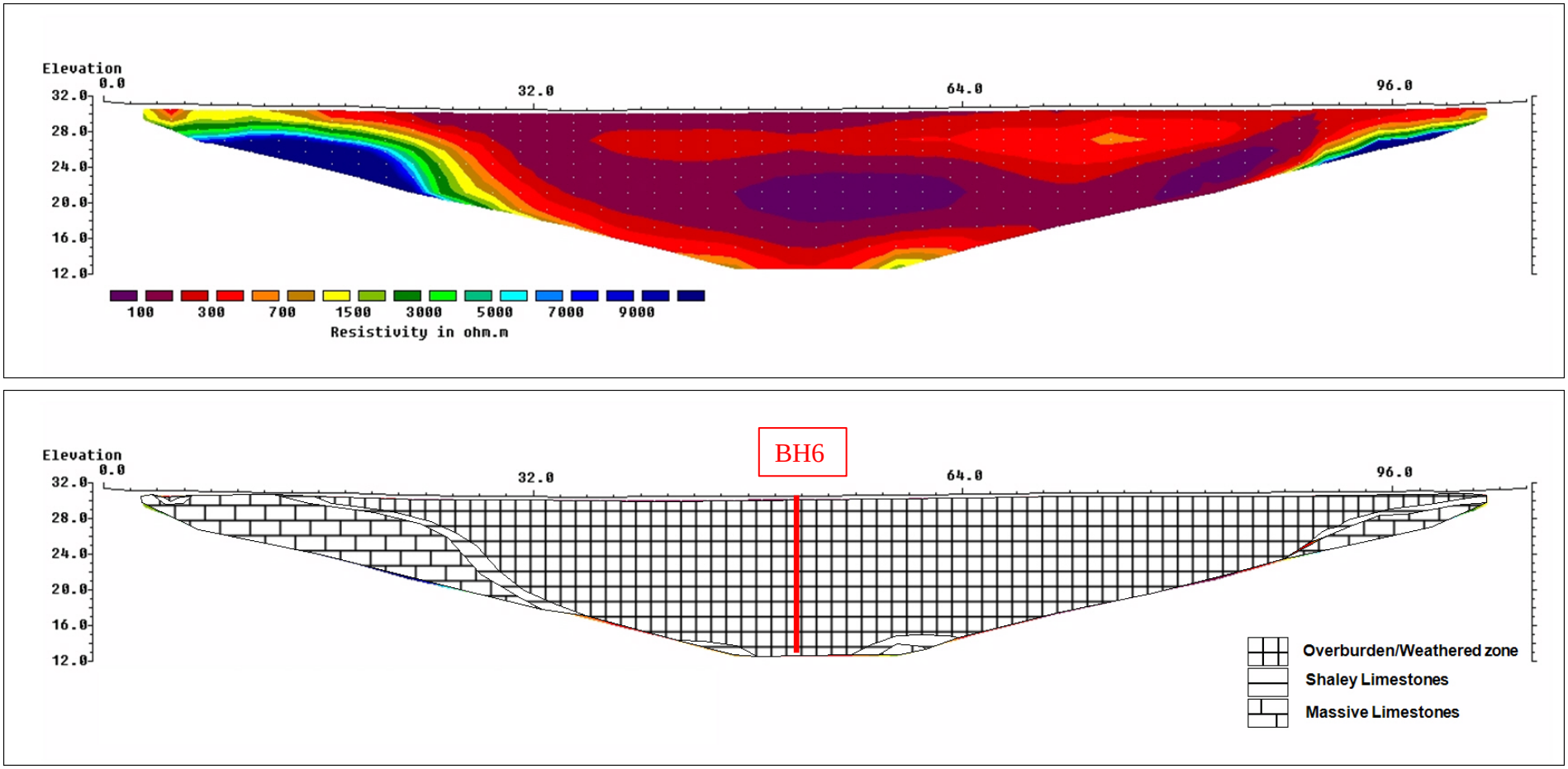


Figure 13

Microgravity Station Location Map

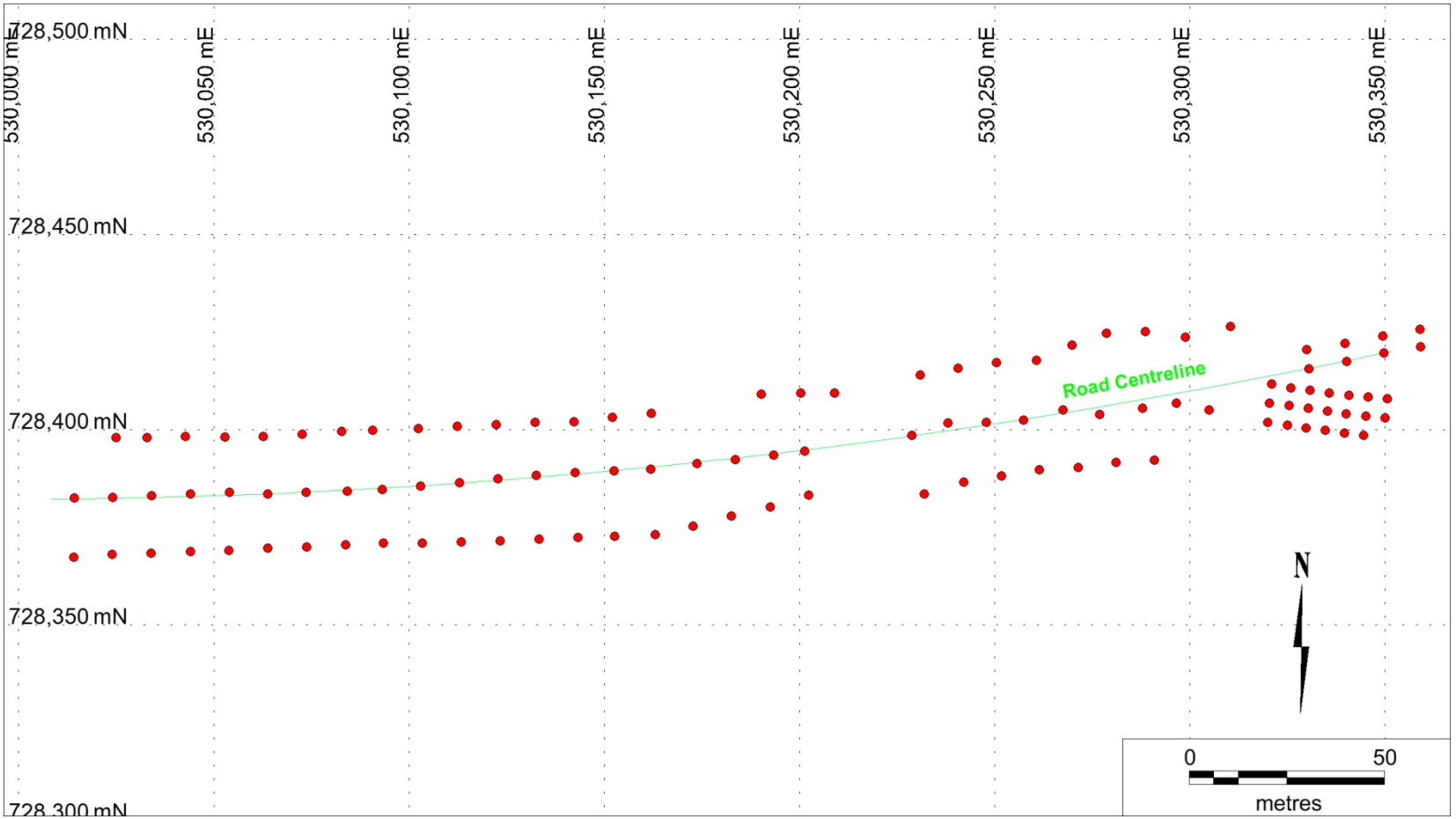


Figure 14

Microgravity Bouguer Gravity Map

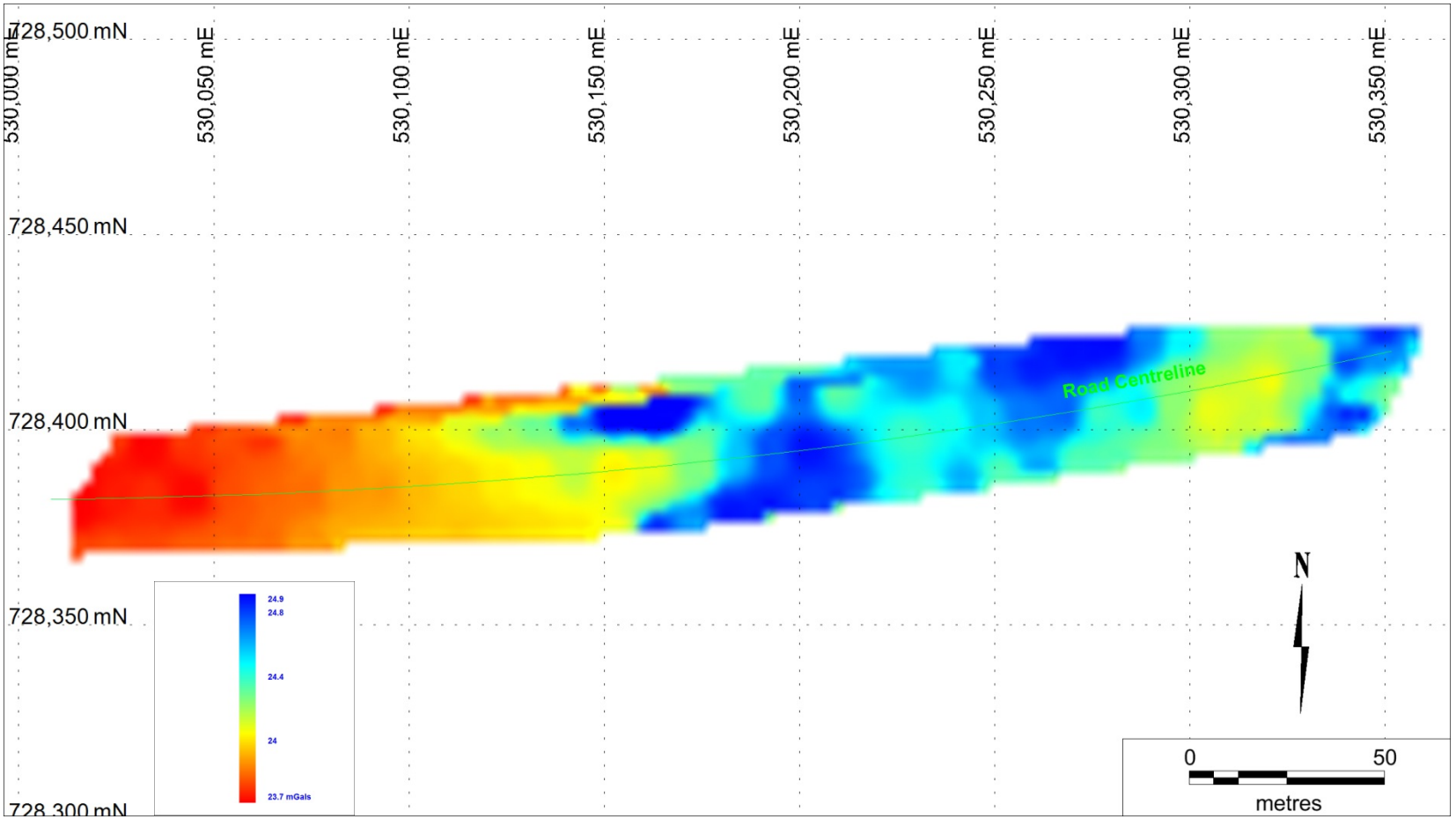


Figure 15

Geophysical Interpretation Map

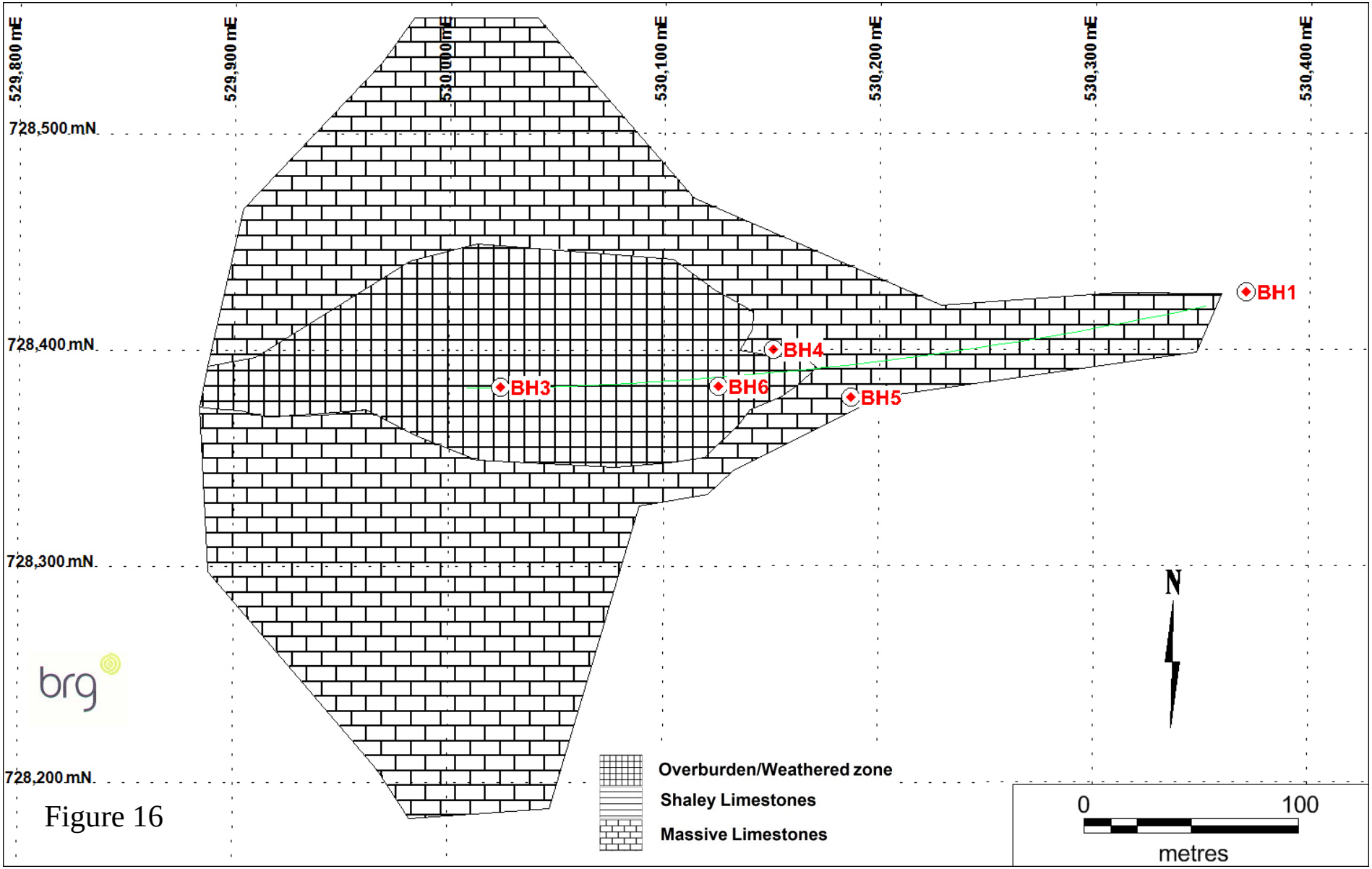


Figure 16

APPENDIX VI

EUROPEAN GEOPHYSICAL SERVICES

REPORT ON THE

GEOPHYSICAL LOGGING

OF TWO BOREHOLES

AT

LACKAGH QUARRY

Prepared For:

Priority Drilling Ltd.
Killimor, Ballinasloe,
Co. Galway, Ireland

PRIORITY DRILLING

JAN 2016/PRIO1502_ rpt/IRL

	Name	Date
Logged by:	Rhys Powell	8/9.12.15
Report by:	Rhys Powell	4.1.16
Checked by:	James Whitford	6.1.15

European Geophysical Services Ltd
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CONTENTS

LIST OF FIGURES

1.0 INTRODUCTION

At the request of Priority Drilling Ltd., borehole imaging and geophysical logging was carried out in two boreholes at Lackagh Quarry, Co. Galway, Ireland.

The work was carried out by European Geophysical Services on the 8th and 9th of December 2015.

The following logs were run:-

BH	Logs	From (m)	To (m)
4	Optical Imager, Acoustic Imager	3.1	34.0
4	Fluid Temperature and Conductivity, Natural Gamma, Caliper	3.1	34.2
4	Impeller Flowmeter	16.0	33.7
4	Focused Resistivity	15.5	34.0
4	Full Wave Sonic	15.5	34.0
4	Pumped Temperature and Conductivity	18.8	34.2

BH	Logs	From (m)	To (m)
5	Optical Imager, Acoustic Imager	1.0	39.9
5	Fluid Temperature and Conductivity, Natural Gamma, Caliper	1.0	40.0
5	Impeller Flowmeter	17.6	40.0
5	Focused Resistivity	17.6	40.0
5	Full Wave Sonic	17.6	40.0
5	Pumped Temperature and Conductivity	24.1	40.0

2.0 THE GEOPHYSICAL LOGGING METHODS

The Equipment and Field Procedure

A fully digital logging system with a 600m capacity motorised winch mounted in a Land Rover was used.

All logging data was recorded digitally for reprocessing and archiving purposes.

With the exception of the fluid logs, all logs were run from the bottom of the boreholes upward.

The optical imager survey was carried out first to avoid the disturbance of the fluid by the geophysical logs which may affect water clarity.

Fluid Temperature (T)

There is a natural geothermal gradient of increasing temperature with depth. This gradient varies with the thermal conductivity of the geological formation and is modified by water flowing in, out or vertically though the borehole.

This log is used to determine any flow pattern within the borehole and to identify flow zones.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

Fluid Conductivity (EC or EC25)

The electrical conductivity (EC) of the water is related to its salinity and dissolved solids and is therefore a measure of the quality of the borehole water. The shape of the log trace can indicate zones of inflow.

Using data from the temperature log the electrical conductivity is corrected to 25°C (EC25).

This log is used to identify different zones of water quality.

Differential logs are produced over a one metre spacing, these are an interpretative aid to detect gradient changes.

2.0 THE GEOPHYSICAL LOGGING METHODS

Optical Borehole Imager (Optical)

A precision-machined prism and CCD camera assembly permits a high definition video image of the borehole wall to be captured in a variety of horizontal and vertical resolutions. The resulting image is digitised in the sonde for transmission to the surface acquisition system.

The image is then orientated to Magnetic North and displayed as an unwrapped image log. This enables a detailed structural interpretation to be made if required.

For the best results the optical imager should be run above the water level or in clean, clear fluid. The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is recorded on the way down the borehole to limit disturbance to the clarity of the water in the borehole by the logging tool.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage

Acoustic Borehole Imager (Amplitude and Travel Time)

This tool scans the borehole wall through 360 degrees and records the acoustic reflection of the resulting signal in terms of amplitude and transit time (the travel time from the tool to the borehole wall). This technique requires a fluid filled borehole with a minimum of suspended solids, polymers or muds within the fluid column.

This sensitive technique responds to small diameter changes, rugosity and the acoustic nature of the borehole wall. It is primarily used for detecting fractures and other discontinuities. The resultant images are orientated (to magnetic North) 0° through 90°, 180° and 270° back to 0°.
The logging tool is centralised during data acquisition by two sets of bow springs. The bow springs are adjusted to a variety of borehole diameters prior to acquisition. The image is viewed on the way down the borehole to allow fine tuning of the acquisition parameters. The settings are then adjusted and the image recorded on the way up the borehole which ensures a constant line speed during acquisition.

Images and associated data are viewed in real time during the data acquisition.

The orientation system employs a flux gate magnetometer and therefore the recorded data within approximately one metre of magnetic steel casing is un-orientated. This is corrected manually during the post-processing stage

2.0 THE GEOPHYSICAL LOGGING METHODS

Impeller Flowmeter (FV)

This log is used to determine any flow pattern within the borehole and identify flow zones. The tool uses an impeller and is normally run at a constant logging speed against the anticipated flow for the best response. The data is corrected for logging speed and a fluid velocity (FV) log is produced.

Caliper (Cal)

This tool measures the mean diameter of the borehole. It is used to check the integrity of the borehole lining, and where the borehole is unlined to identify zones of washout, breakout or fissures.

Natural Gamma (Gam)

The tool measures the naturally occurring gamma radiation found in rocks and sediments. It is mainly used to detect the clays that contain potassium K^{40}, though the U^{238} series of elements and the Th^{232} series of elements also emit gamma radiation.

The higher the concentration of these clay minerals the greater the responses on the natural gamma log.

Focused Resistivity Log (Res Deep and Res Shallow)

The Focused Resistivity tool uses Guard Electrodes to focus the current into the formation. This gives excellent vertical resolution and good penetration, especially in highly conductive borehole fluids where a Normal Resistivity Sonde would not be as effective.

The tool has two electrode spacing’s to allow a deep and shallow depth of investigation.

The response of this log is a function of porosity, type of formation / mineralogy and its pore water quality. These logs aid in the identification of strata and quality of the pore water.

2.0 THE GEOPHYSICAL LOGGING METHODS

Full Wave Sonic (VDL)

This tool has been specially designed to provide a full wave form recording of sonic signals and uses fixed spaced transmitter – receivers.
The received signals are digitised at a fast sampling rate with high resolution. Data may be sampled at typically 5cm or 10cm intervals dependant upon resolution required.

The data is processed for P wave velocity (or transit time) and amplitude.

This tool can only be used in fluid filled unlined boreholes.

3.0 SITE DETAILS

Site:
Lackagh Quarry

Irish Grid Ref: M 30240 28372

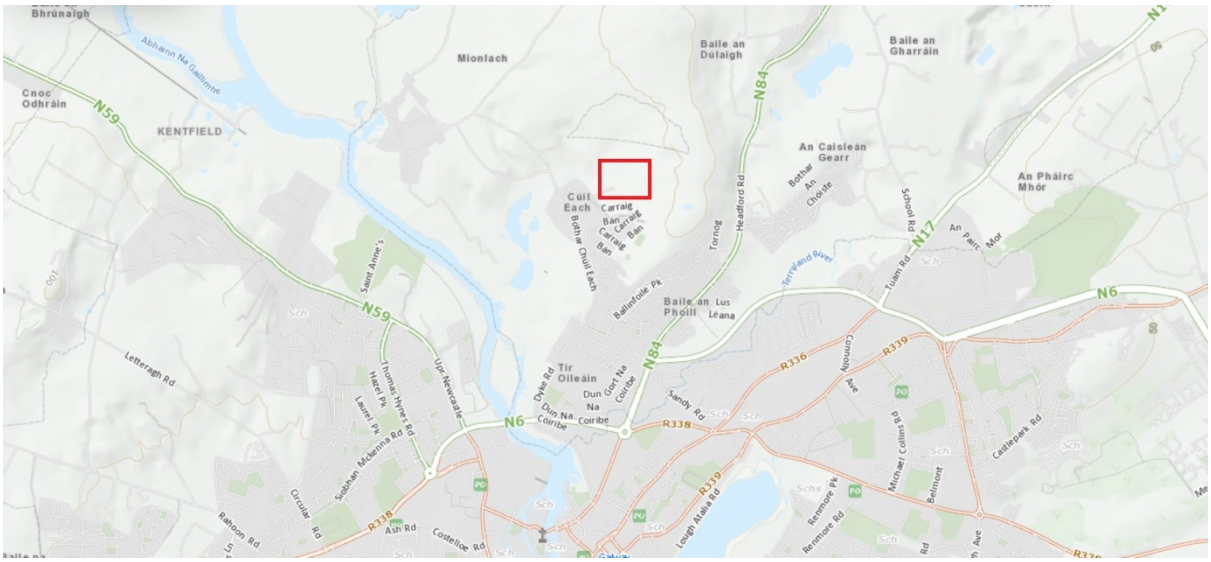


Figure 3.1 Location map showing location highlighted by red circle.
© 2014 Ordnance Survey Ireland.

Figure 3.2 Aerial image showing approximate borehole locations. © Google 2016.

4.0 PROCESSING AND PRESENTATION OF RESULTS

Detailed logs of the imager data have been produced at a vertical scale of 1:10. Composite geophysical logs have been produced at 1:50. Full Wave Sonic results are presented separately at 1:50 with Imager, Natural Gamma and Caliper data to aid interpretation.

Constructional details and information on each borehole are given in the headers of each log.

All images have been referenced to Magnetic North.

The borehole's azimuth and tilt are plotted alongside the images.

The image of the borehole wall is presented in an unwrapped form with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structural features and discontinuities have been picked from the images in the form of colour coded sinusoidal projections - see Appendix 1 for details. This 'Discontinuities' log is also presented with a horizontal scale marked 0° - North, through 90° - East, 180° - South, 270° - West, back to North.

Structure picking is not a definitive analysis of all the features within a borehole. Only the discontinuities that have a linear dip and direction are 'picked' and used in the analysis of the discontinuities. Features that do not have a regular sinusoidal shape do not have a linear dip and direction, 'best fit' picking of these features is done if approximately 80% coverage of the sinusoid can be achieved. Below this percentage the inaccuracy of the picking is too great and if included in any structural analysis may adversely skew the results. Vughs, solution holes, and angular break outs are examples of features not picked.

The apparent azimuth and apparent dip (i.e. relative to the borehole's azimuth and tilt) of the discontinuities are calculated using the diameter of the borehole and the geometric parameters of the sinusoids overlaid on the discontinuities. The final processing stage is to correct these apparent values to true azimuth (in relation to Magnetic North) and true dip (from horizontal) by correcting for the borehole's azimuth and tilt.

The final results are presented as a 'tadpole' plot (Discontinuities - True°). The horizontal position of the tadpole's head gives the defect's true dip angle and its tail points in the direction of the defect's azimuth. These logs are presented with a horizontal scale in degrees. By convention the top of the page is North (Magnetic) and the right hand edge of the paper is East.

The true structural data has been presented in digital format as an excel file (xls).

5.0 BOREHOLE LOGGING CONSTRAINTS

- **Vehicle access restrictions**
  Poor ground conditions, soft ground access to borehole locations

- **Tool access restrictions**
  None

- **Borehole conditions / risk to equipment**
  Drill rods left in boreholes prior to logging to prevent collapse. Highly fractured rock below casing in BH4.

- **Lack of fluid filled column / cloudy fluid**
  Optical and Acoustic run in both boreholes due to cloudy water. Boreholes pumped dry during pumped TC logging, not possible to run pumped flowmeter.

- **Time constraint**
  None

- **Borehole construction / casing**
  BH4 not cased deep enough – loose rock below casing. No casing in BH5.

Appendix 1

Discontinuity Classification.

Discontinuity	Colour	Classification Parameters
Major Fracture or Fissure	Blue	An open break in the formation, that is **continuous** across the entire image.
Minor Fracture or Fissure	Turquoise	A thin or closed break in the formation, that is **continuous or discontinuous** across the image.
Vein	Green	That may be **continuous or discontinuous** across the entire image.
Fabric	Red	Defines a feature generally metamorphic, igneous or sedimentary in origin that may be **continuous or discontinuous** across the image, such as bedding and cross-bedding, schistosity or gneissosity.
Intrusions	Purple	Intrusive features such as dykes and sills, generally **continuous** across the image
Unknown	Black	Faint features which **can not** be classified.

Appendix 2

Geophysical Logs

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Priority Drilling**

Borehole: **BH4**

Log Type: ***Composite***

Location: **Lackagh Quarry** Area: **Co. Galway** Grid Ref: Elevation:

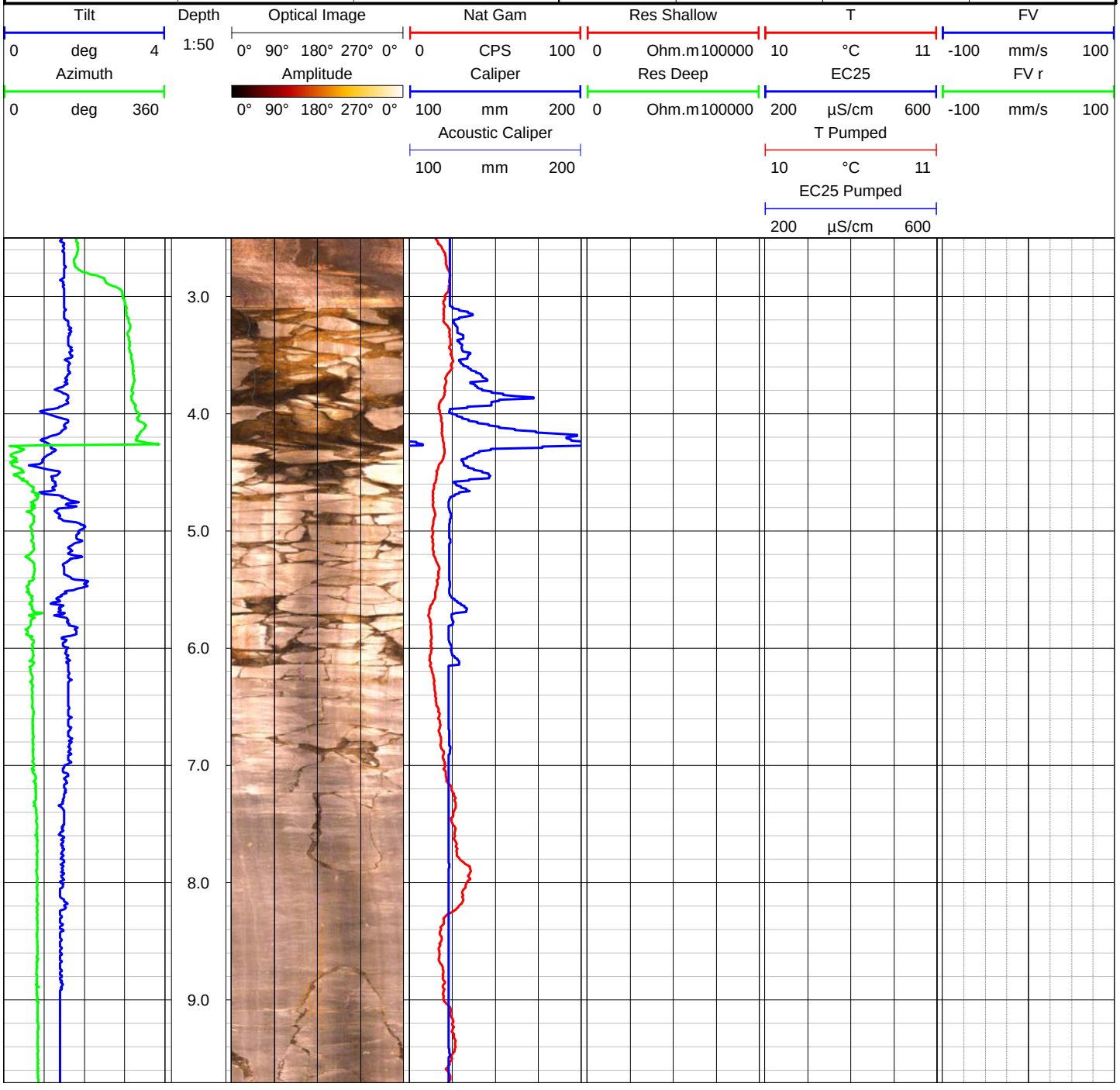
Drilled Depth: (m)	**35**	Date:	**8.12.15 / 9.12.15**
Logged Depth: (m)	**34.1**	Recorded By:	**Rhys Powell**
Logging Datum:	**Ground Level**	Remarks:	Rods pulled immediately before logging.
Logged Interval: (m)	**3.1 - 34.1**		
Fluid Level: (m)	**14.6 / 15.5**	**Ref:**	

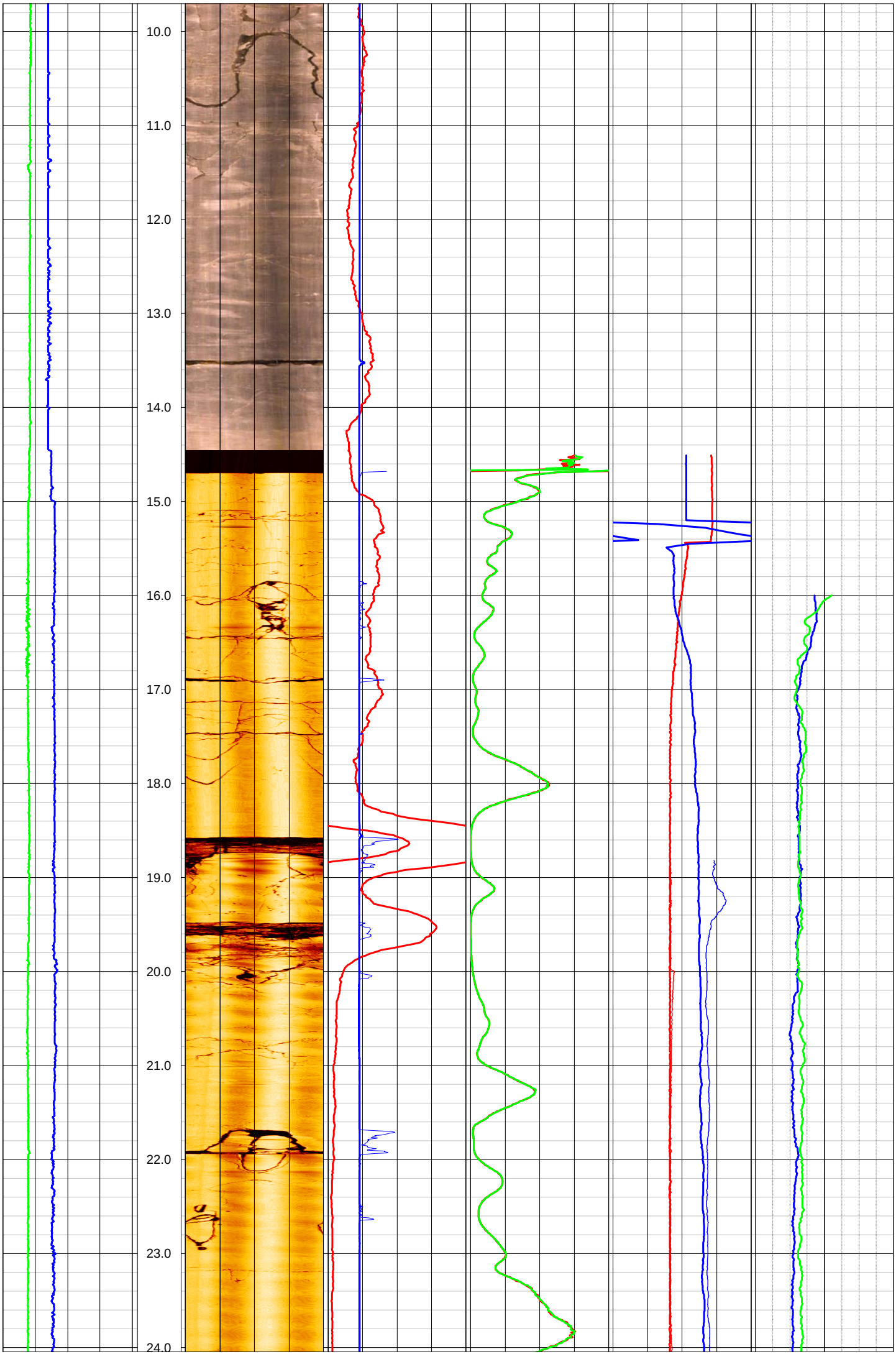
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
122	**0.1**	**35**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**0.0**	**3.1**

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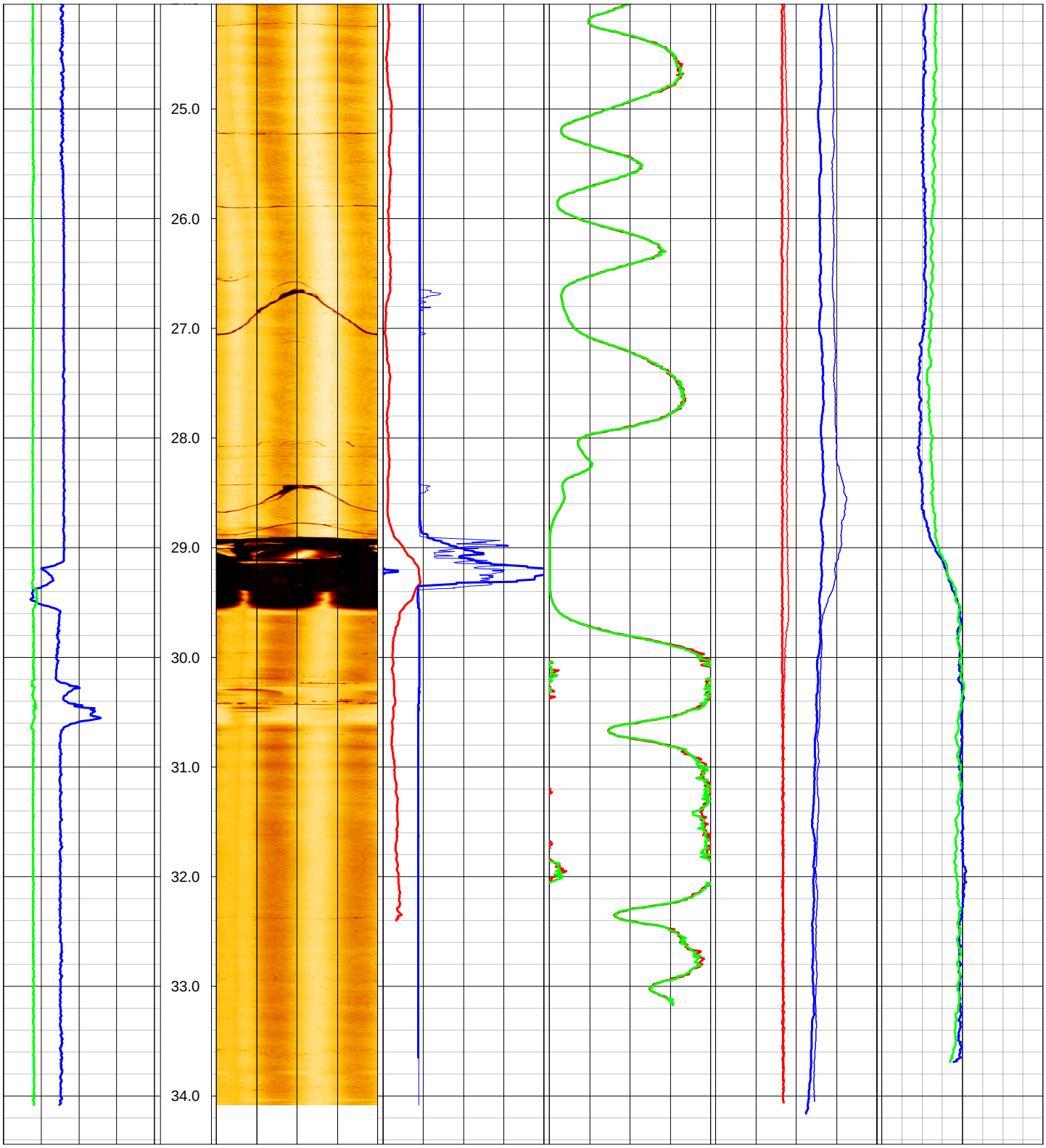
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34.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Priority Drilling**

Borehole: **BH4**

Log Type: ***Image***

Location: **Lackagh Quarry** Area: **Co. Galway** Grid Ref: Elevation:

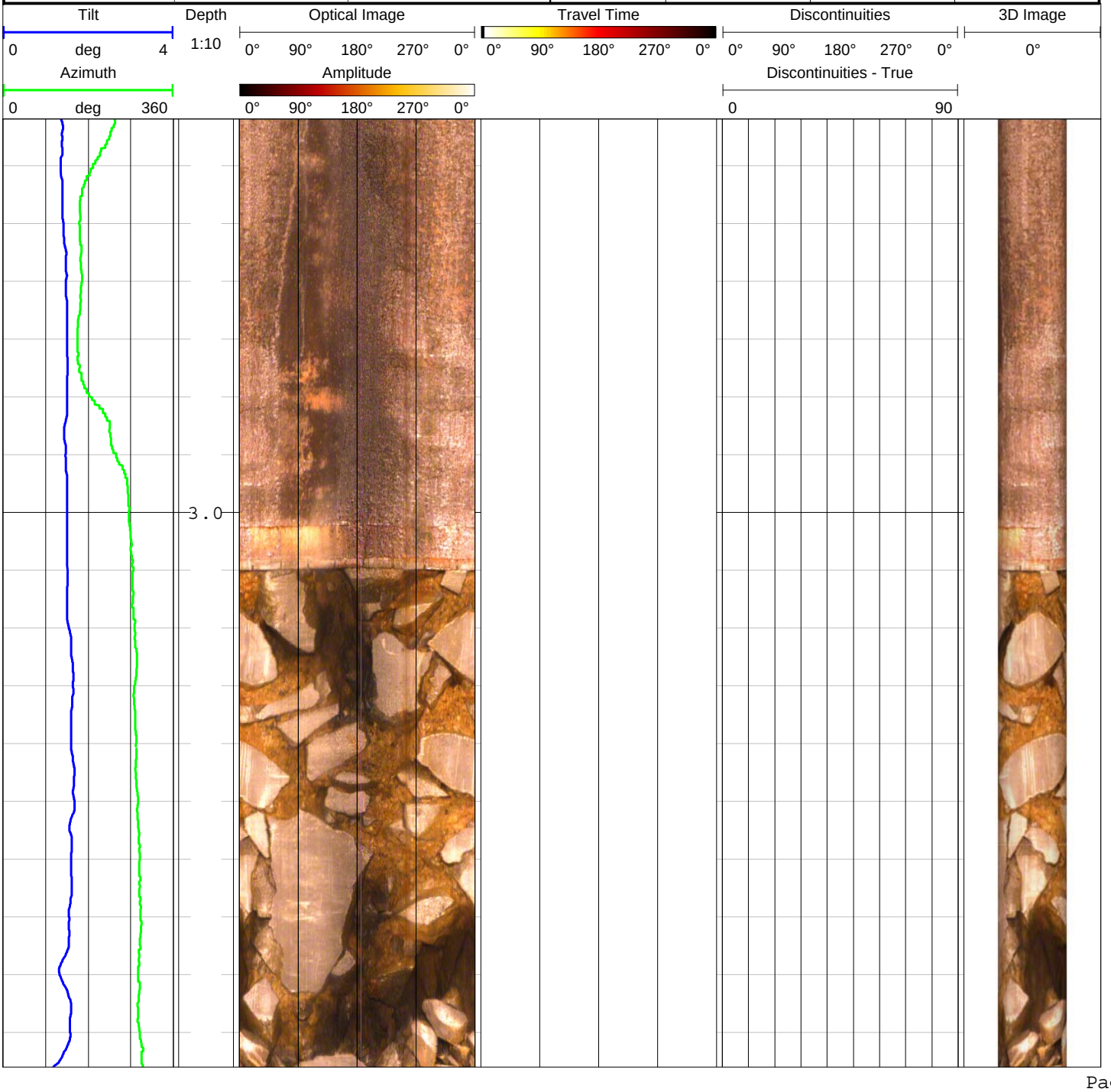
Drilled Depth: (m)	**35**	Date:	**8.12.15**
Logged Depth: (m)	**34.0**	Recorded By:	**Rhys Powell**
Logging Datum:	**Ground Level**	Remarks:	Rods pulled immediately before logging.
Logged Interval: (m)	**3.1 - 34.0**		
Fluid Level: (m)	**14.6**	**Ref:**	

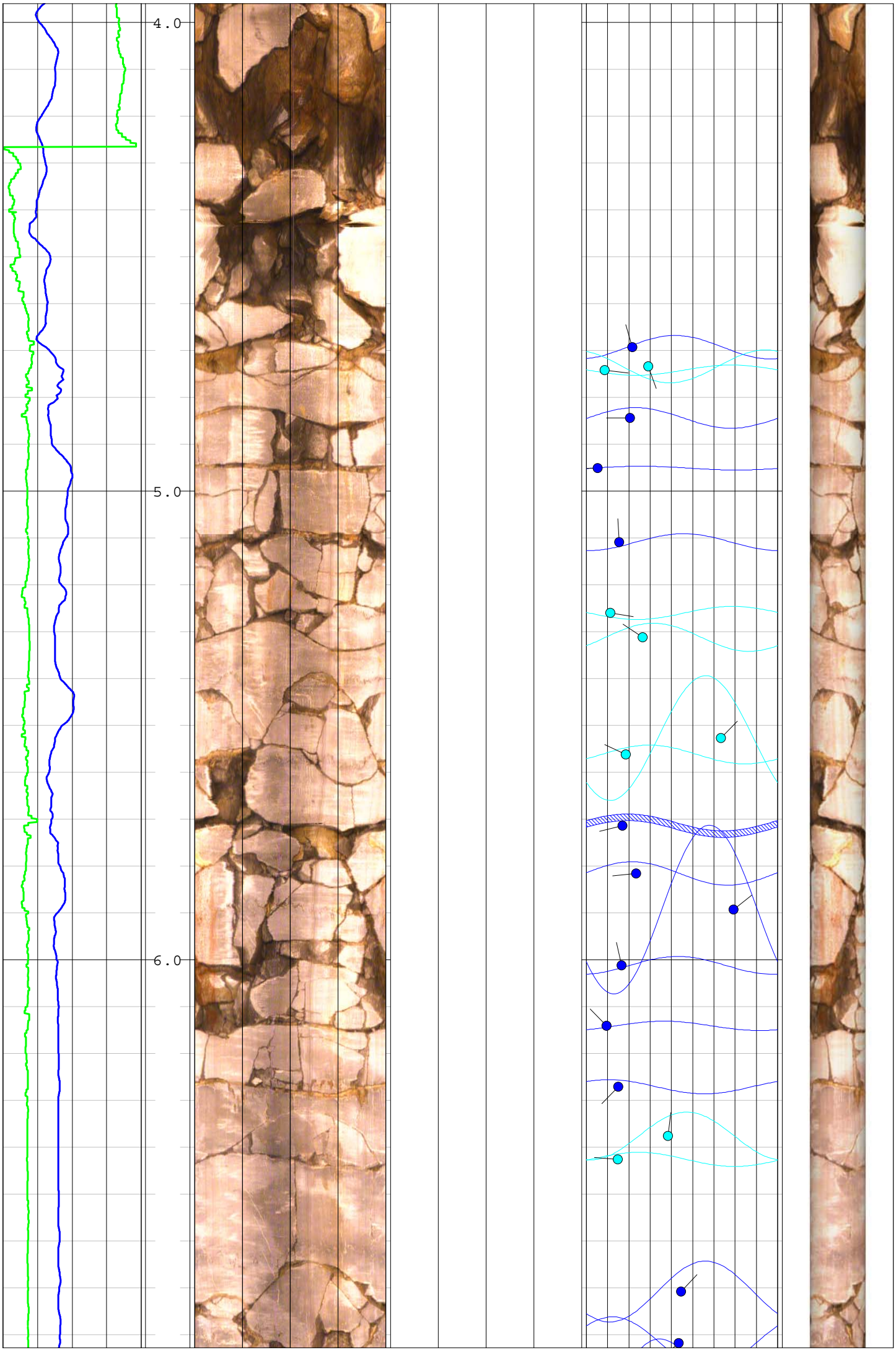
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
PQ	**0.1**	**35**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**0.0**	**3.1**

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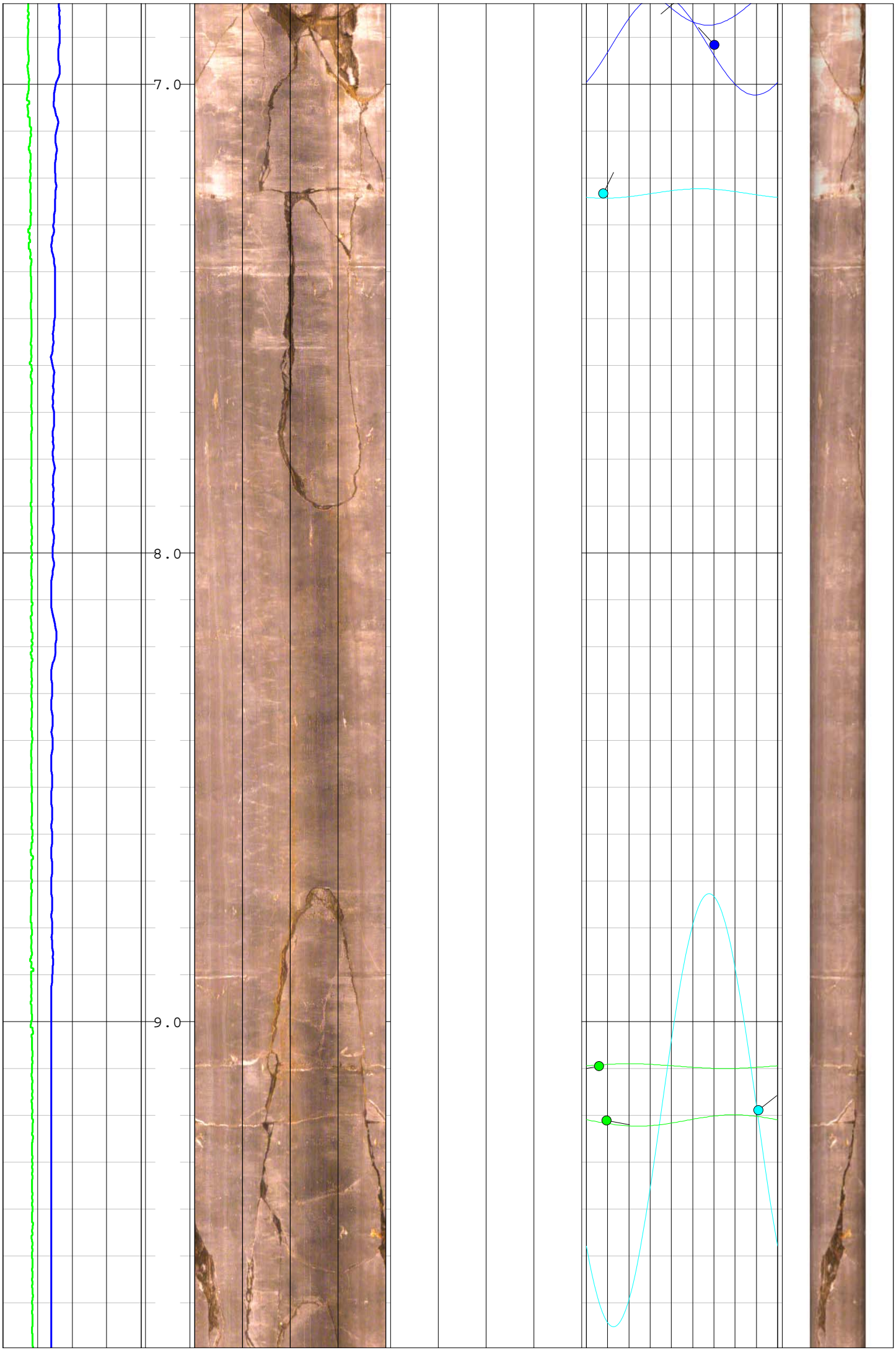
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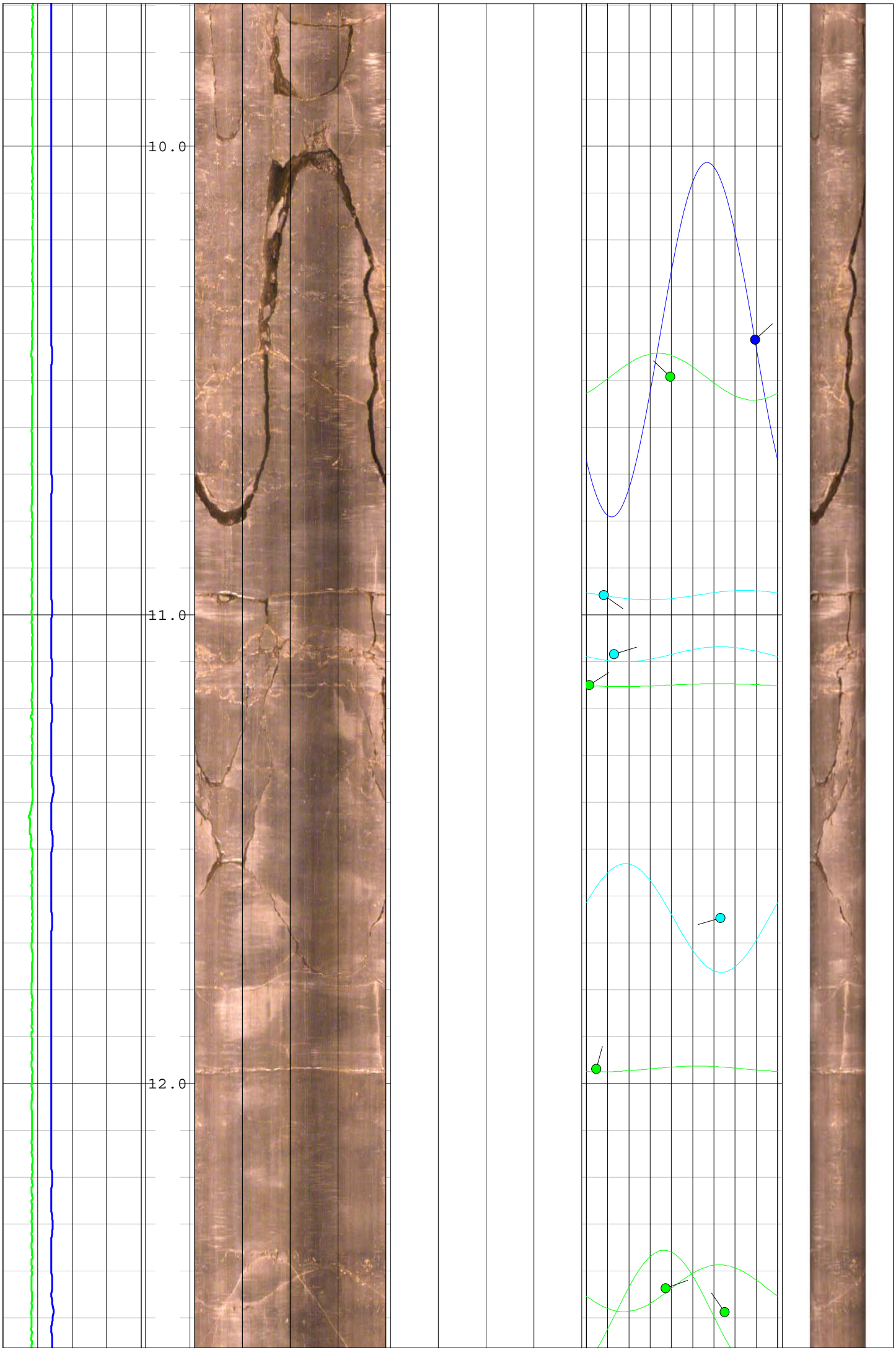
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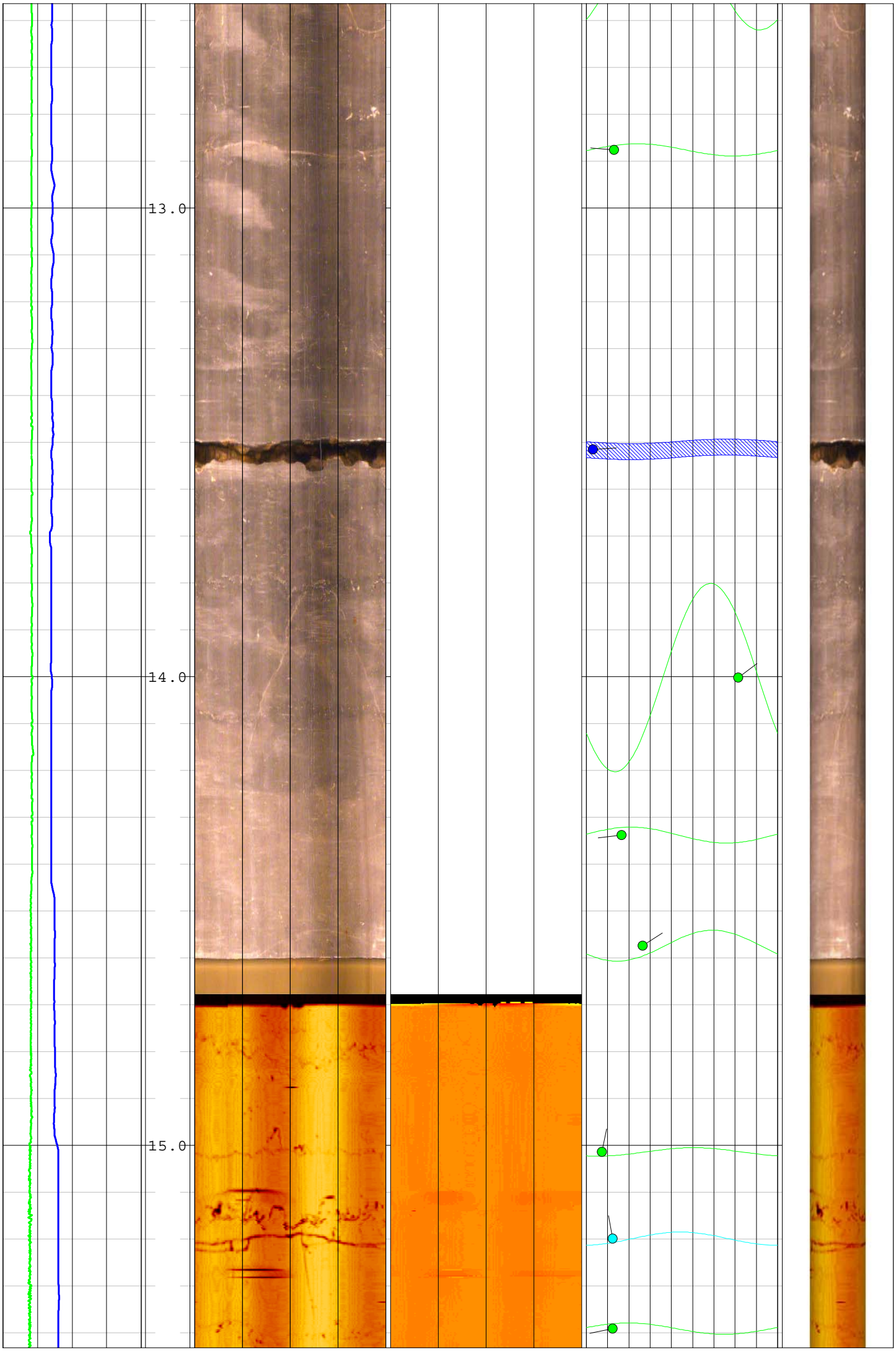
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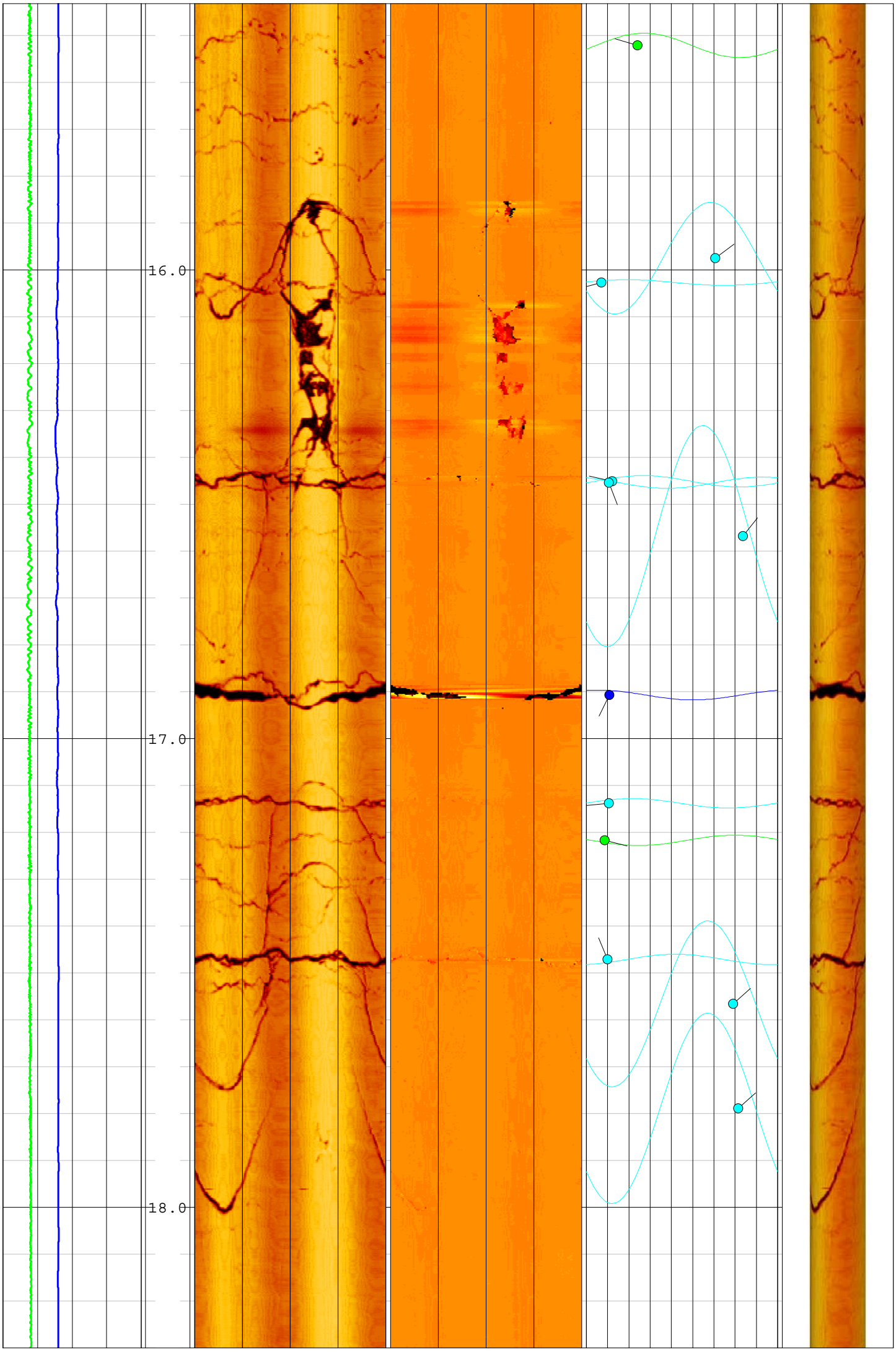
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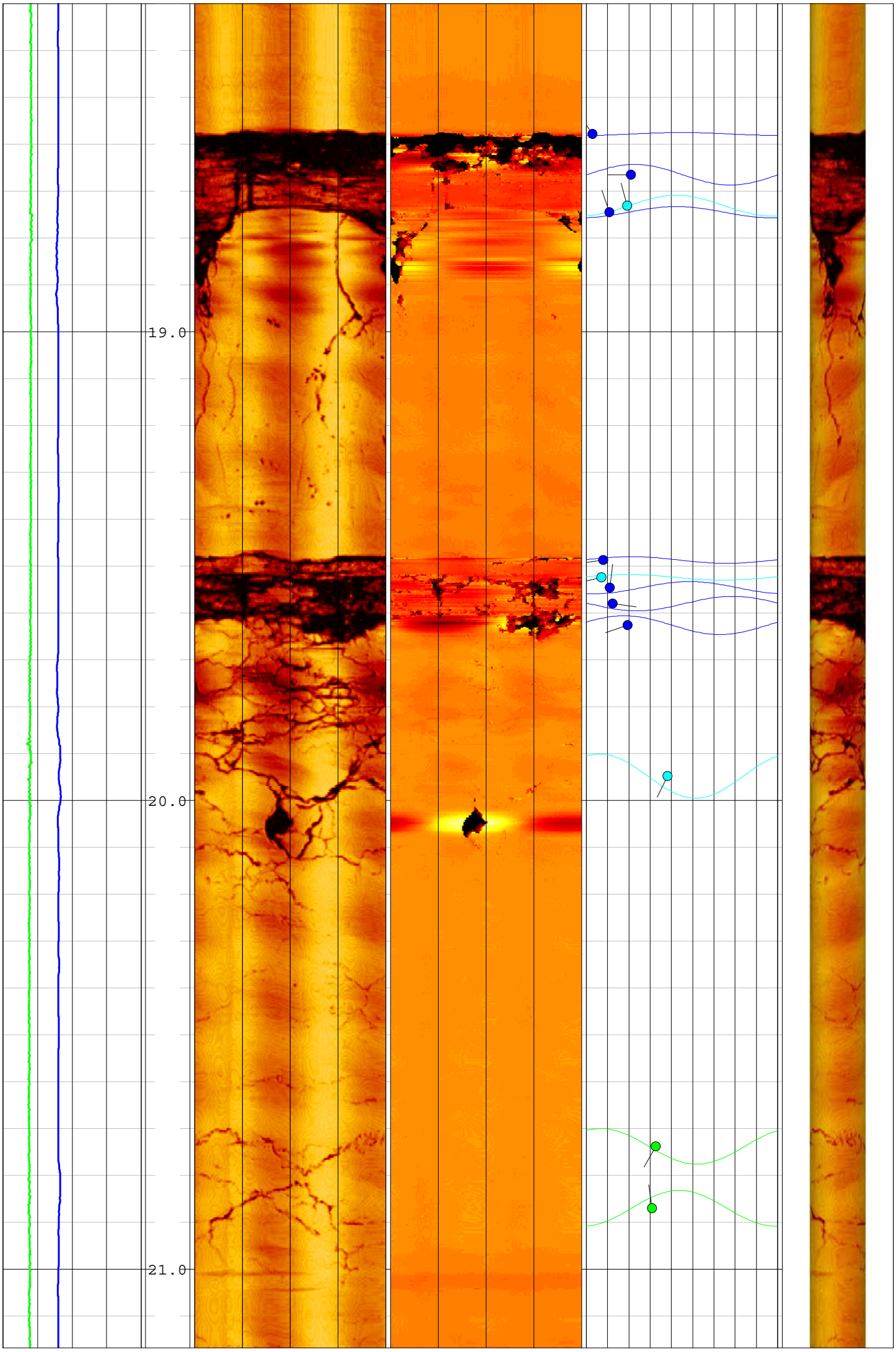
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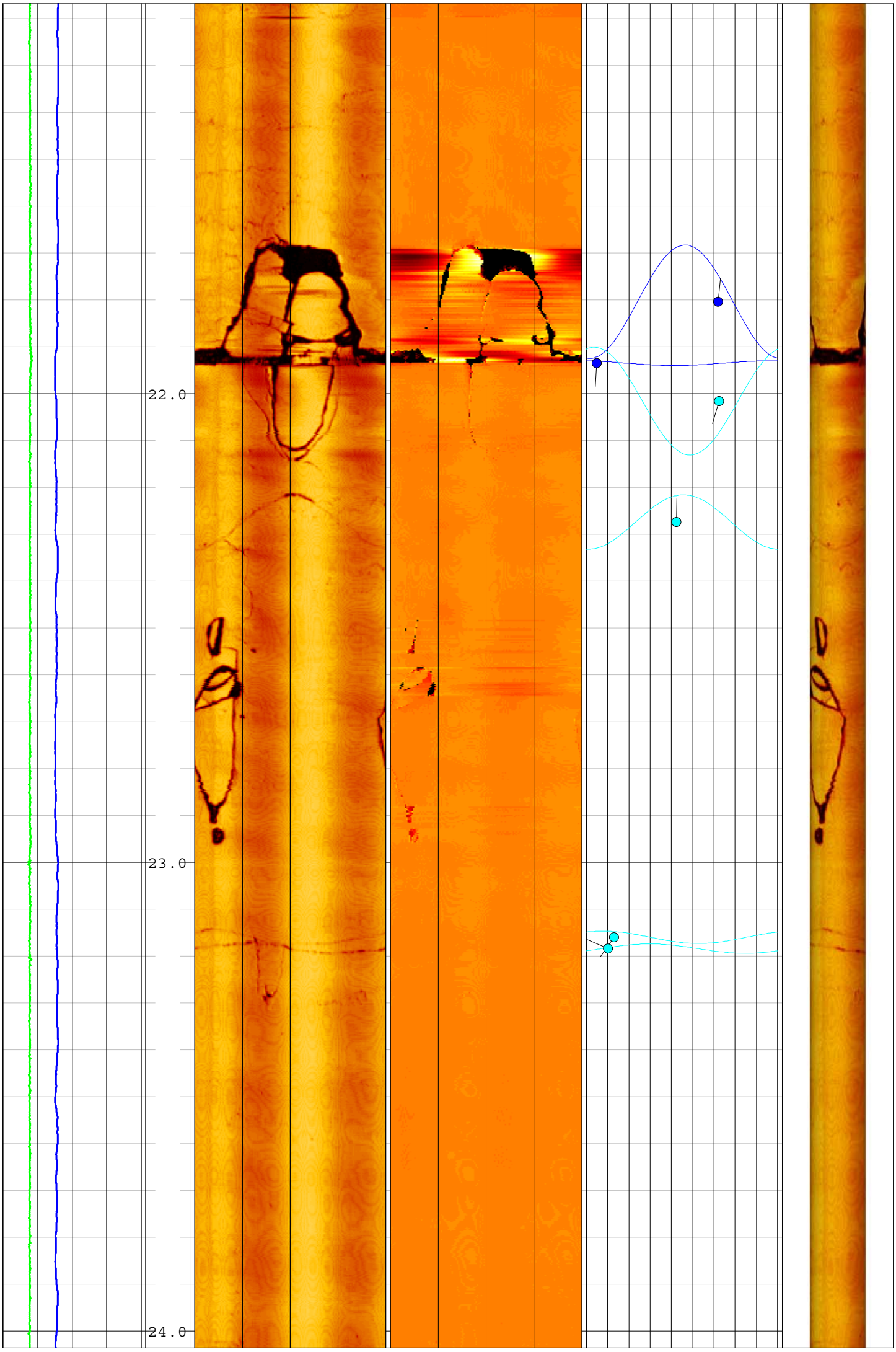
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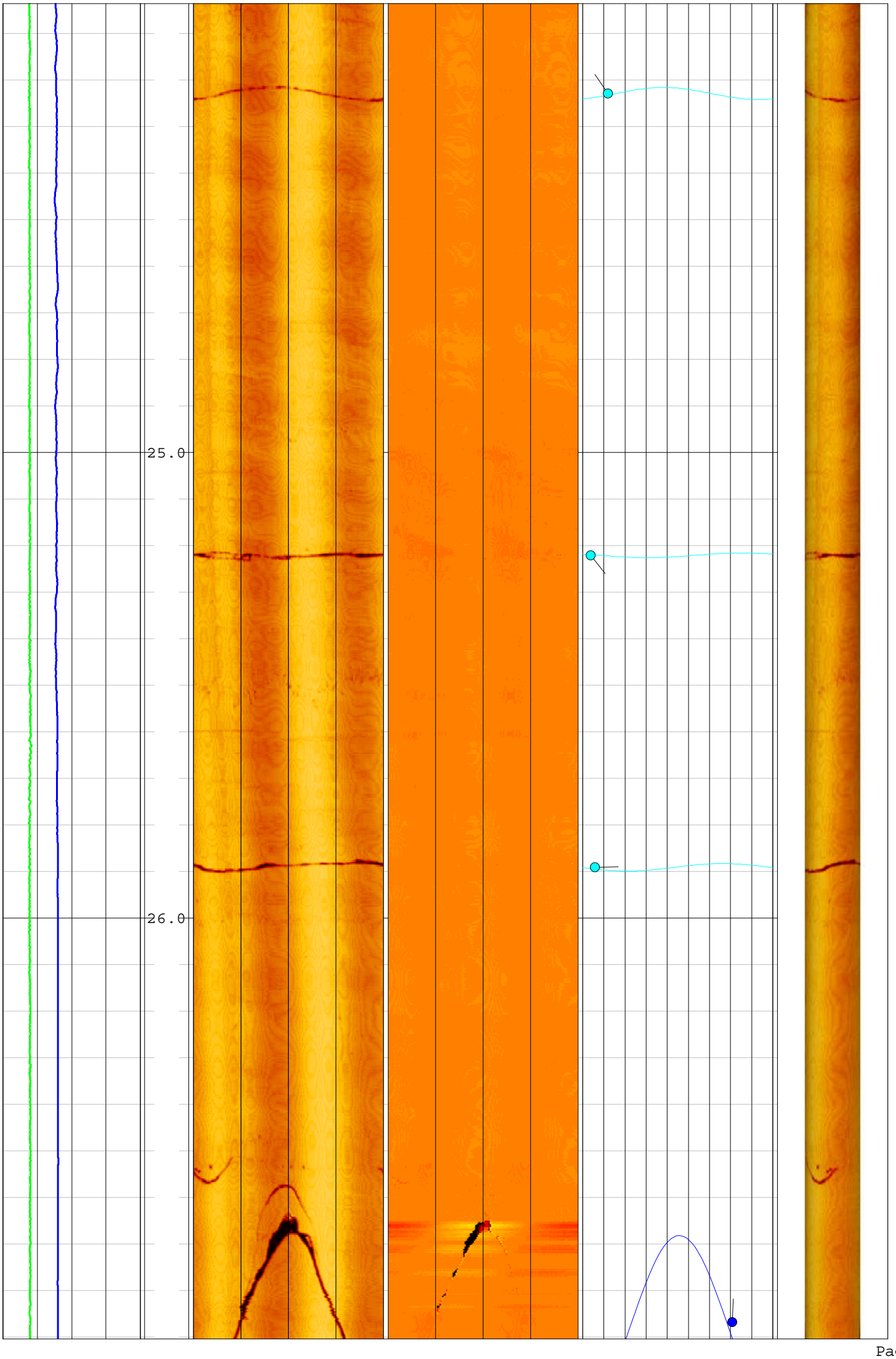
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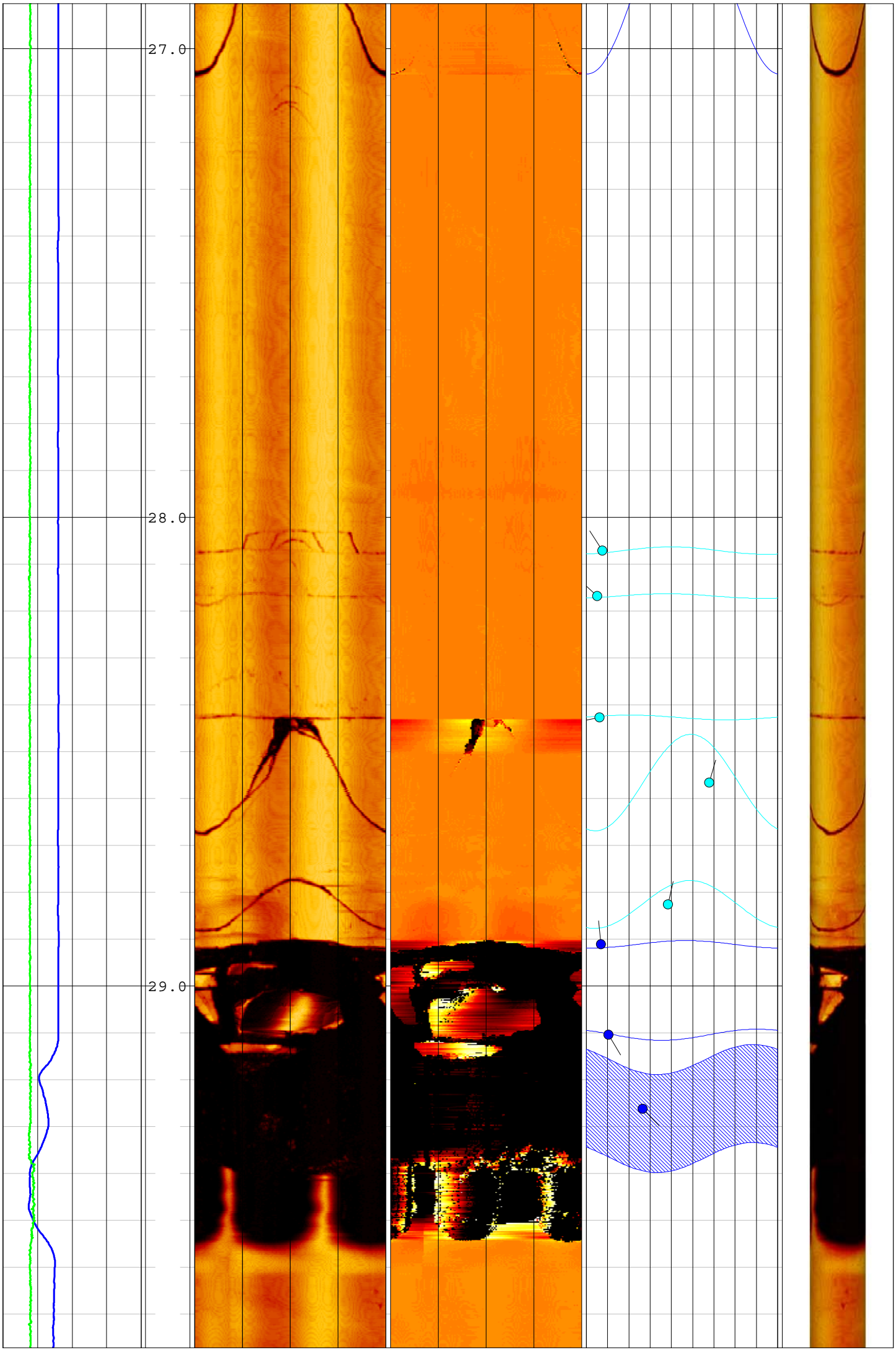
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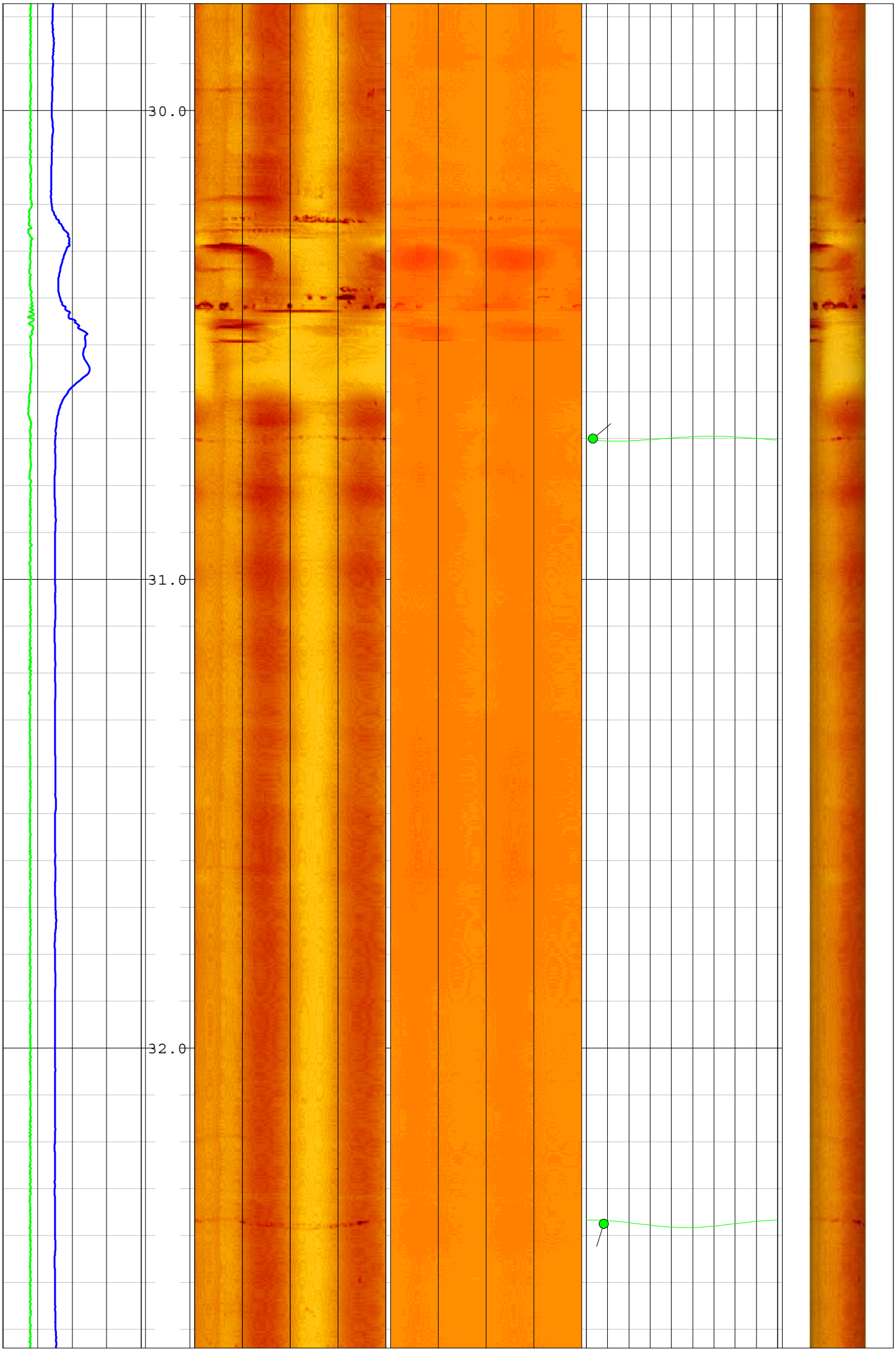
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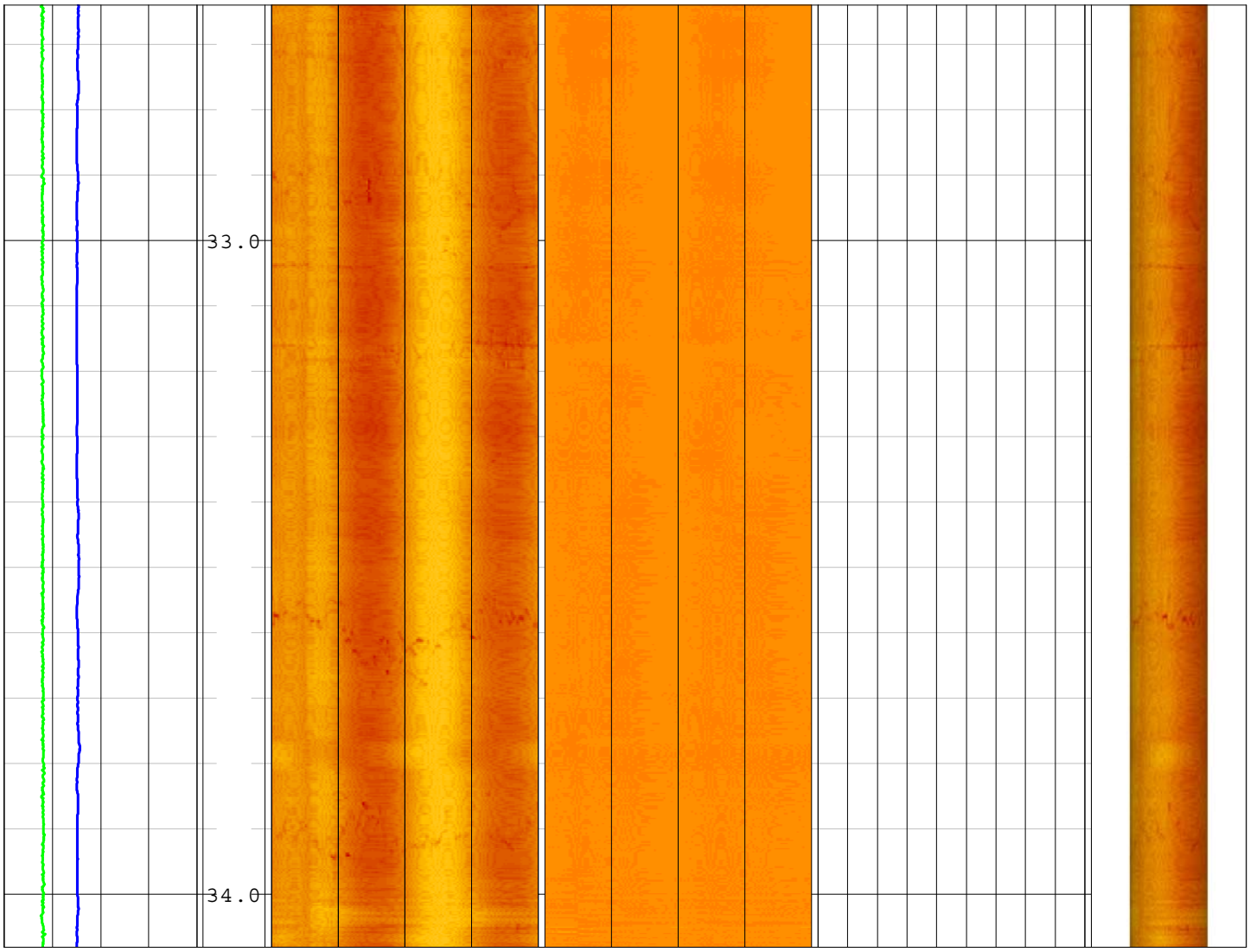

33.0
34.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Priority Drilling**

Borehole: **BH4**

Log Type: ***Full Wave Sonic***

Location: **Lackagh Quarry** Area: **Co. Galway** Grid Ref: Elevation:

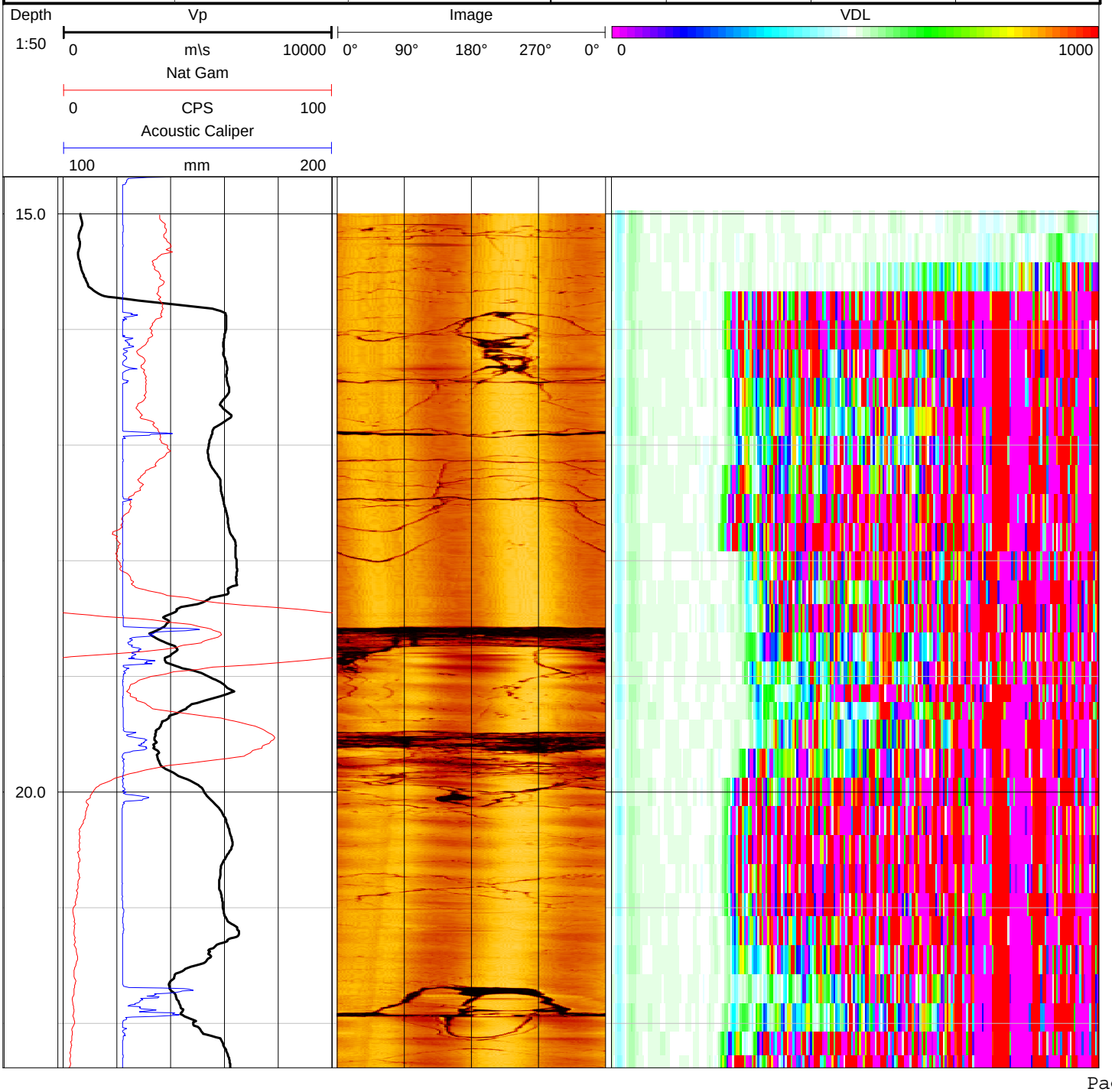
Drilled Depth: (m)	**35**	Date:	**9.12.15**
Logged Depth: (m)	**33.5**	Recorded By:	**Rhys Powell**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**16.0 - 33.5**		
Fluid Level: (m)	**16.0**	**Ref:**	

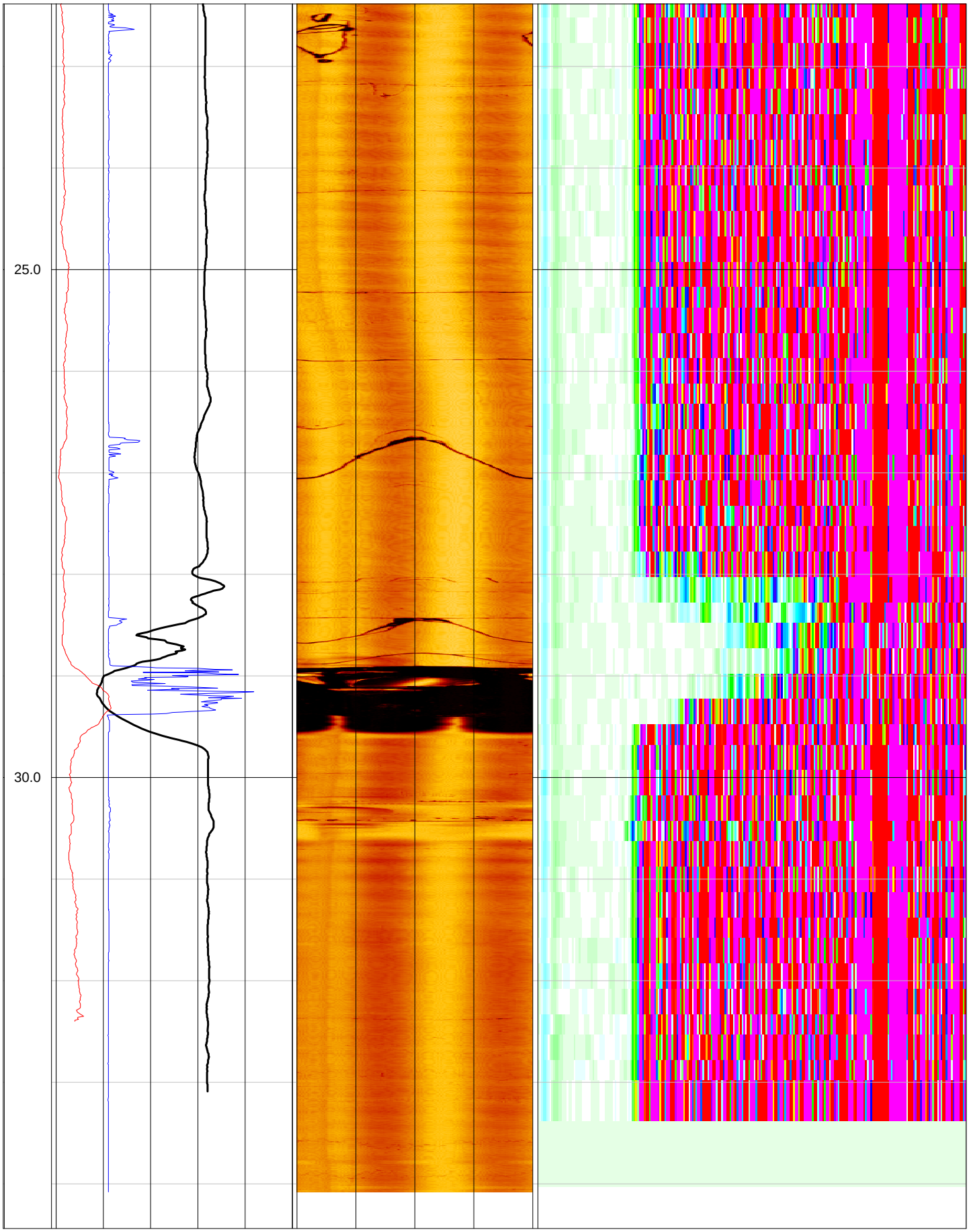
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
122	**0.0**	**35**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
Steel	**130**	**0.0**	**3.1**

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EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Priority Drilling**

Borehole: **BH5**

Log Type: ***Composite***

Location: **Lackagh Quarry** Area: **Co. Galway** Grid Ref: Elevation:

Drilled Depth: (m)	**40.3**	Date:	**8.12.15**
Logged Depth: (m)	**40.1**	Recorded By:	**Rhys Powell**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**1.0 - 40.1**		
Fluid Level: (m)	**17.6**	**Ref:**	

BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
PQ	**0.0**	**40.3**

CASING RECORD

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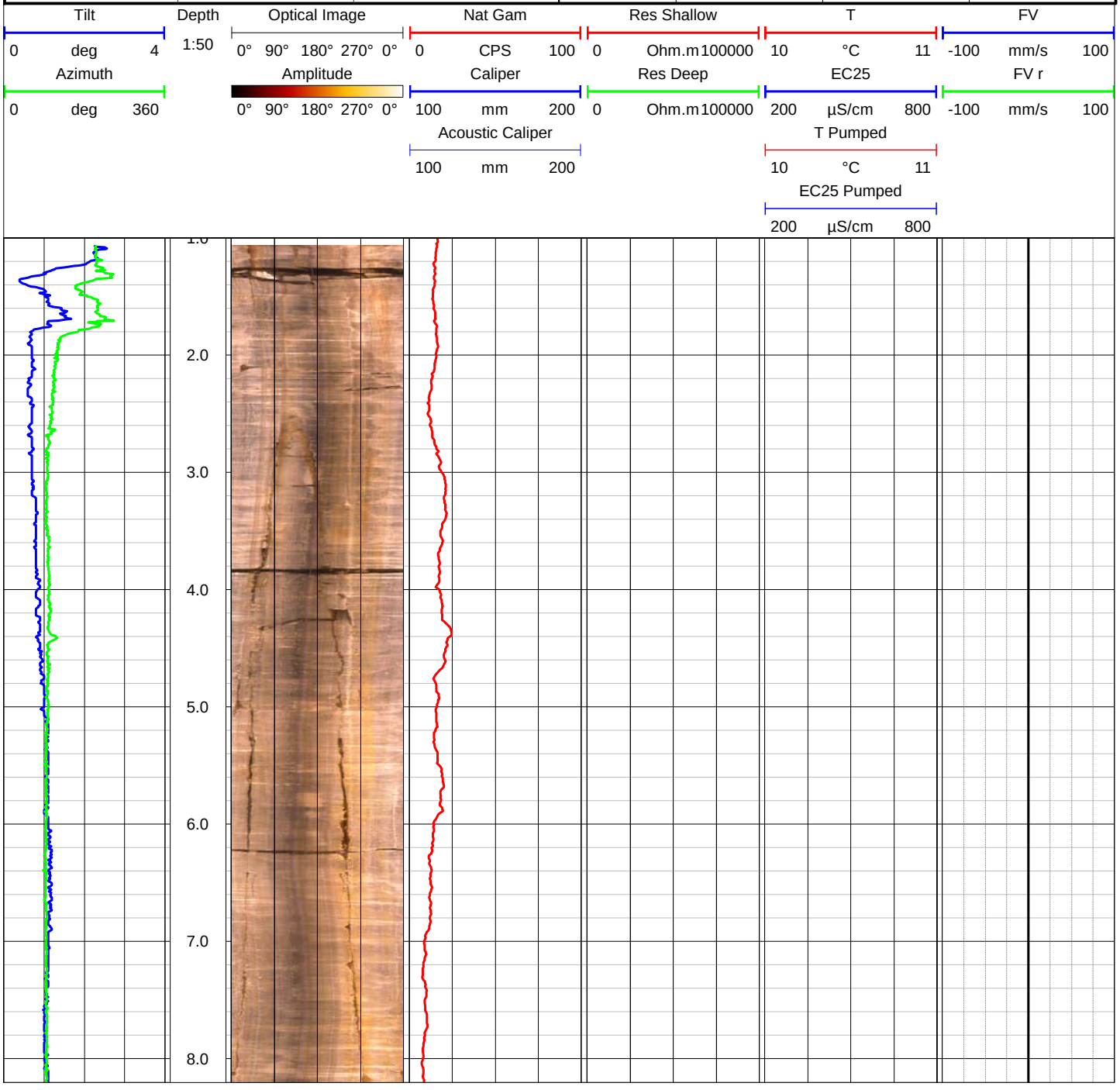

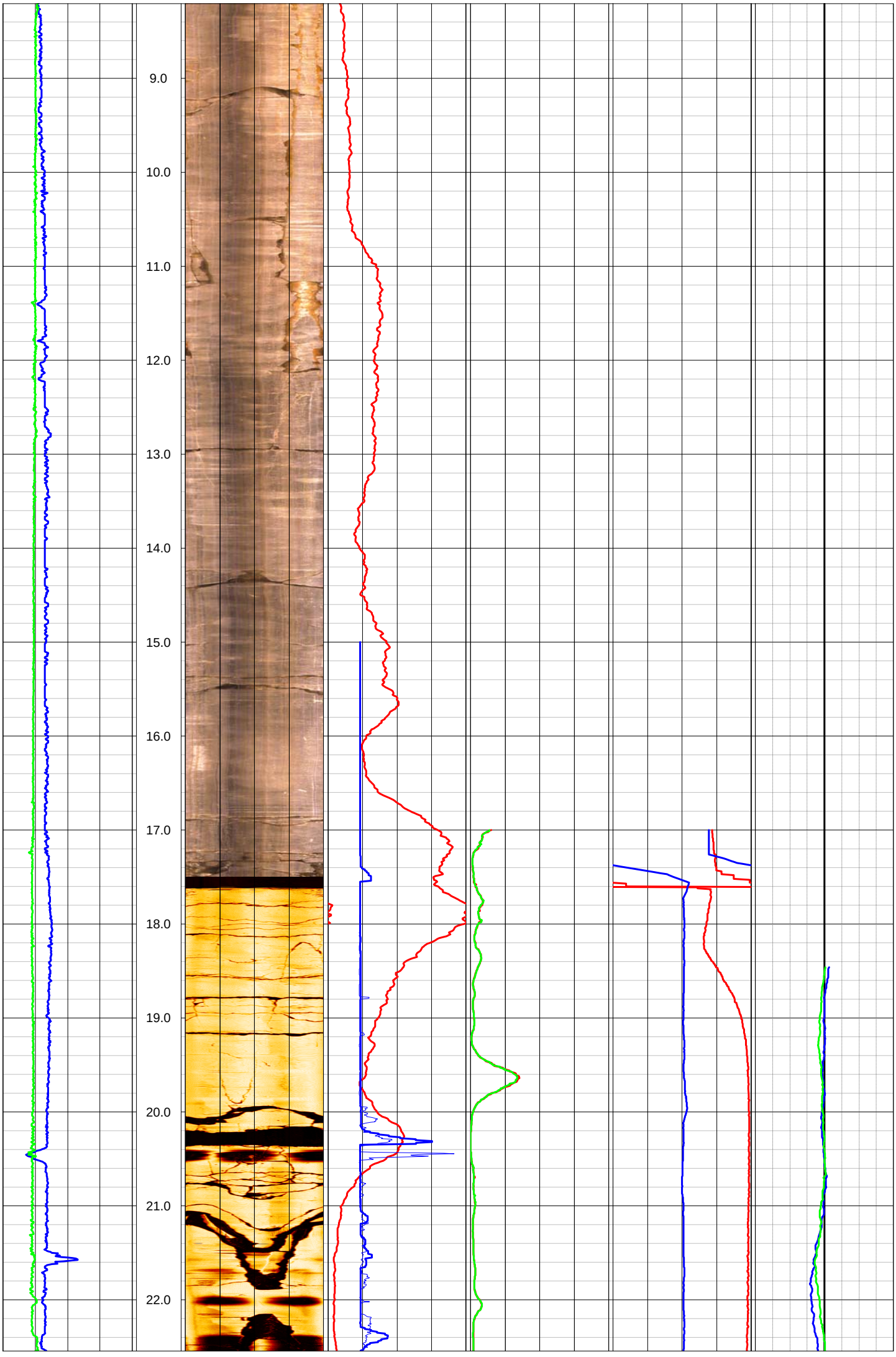
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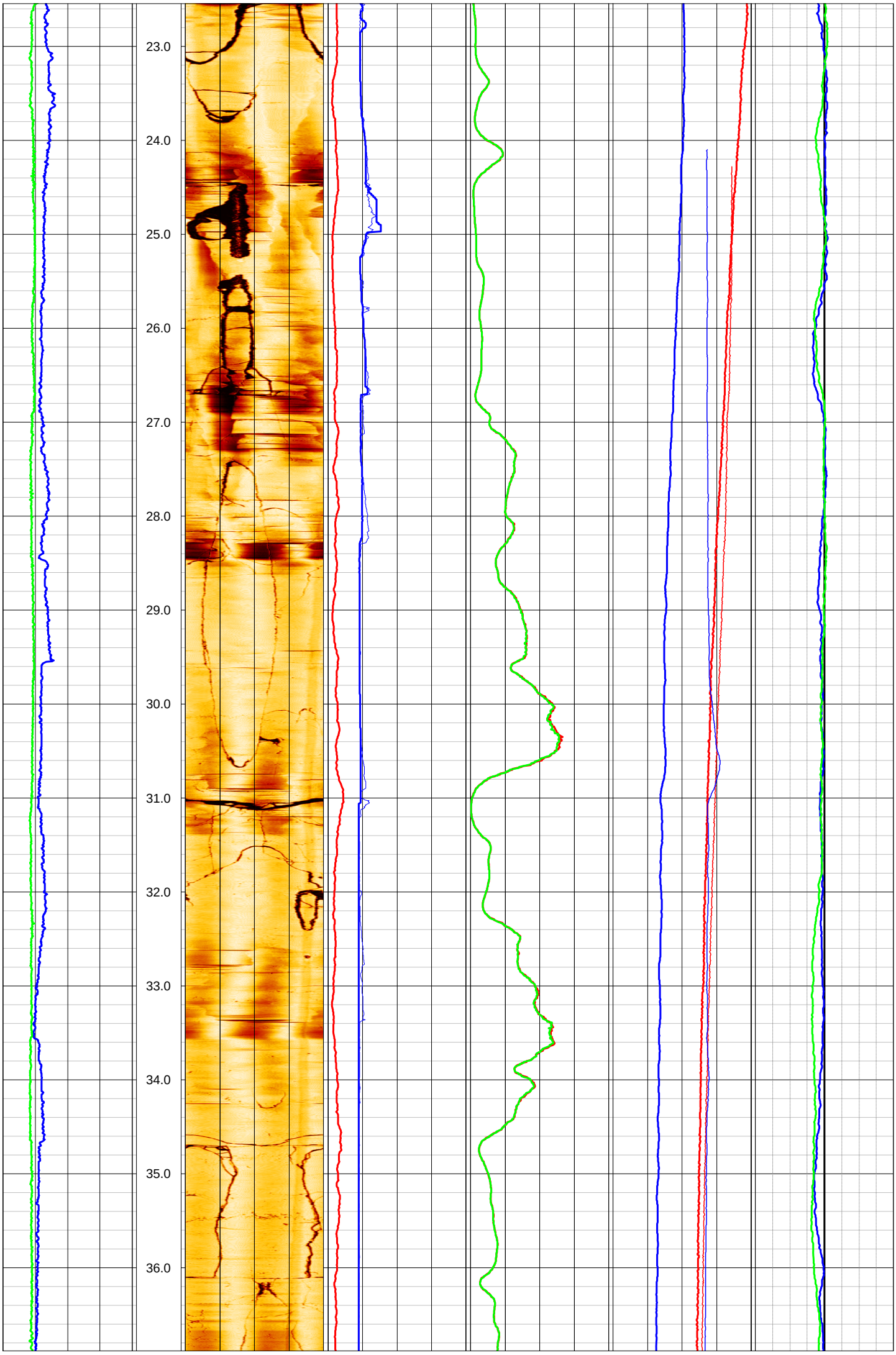
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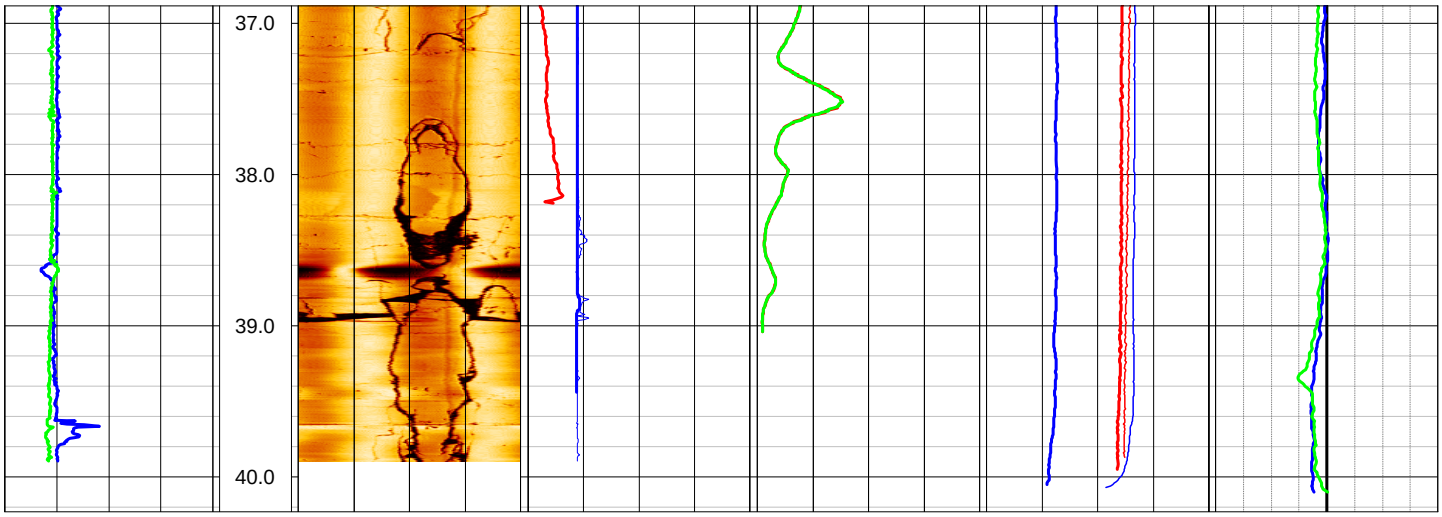
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38.0
39.0
40.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Priority Drilling**

Borehole: **BH5**

Log Type: ***Image***

Location: **Lackagh Quarry** Area: **Co. Galway** Grid Ref: Elevation:

Drilled Depth: (m)	**40.3**	Date:	**8.12.15**
Logged Depth: (m)	**39.9**	Recorded By:	**Rhys Powell**
Logging Datum:	**Ground Level**	Remarks:	Rods pulled immediately before logging.
Logged Interval: (m)	**1.0 - 39.9**		
Fluid Level: (m)	**17.9**	**Ref:**	

BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
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CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
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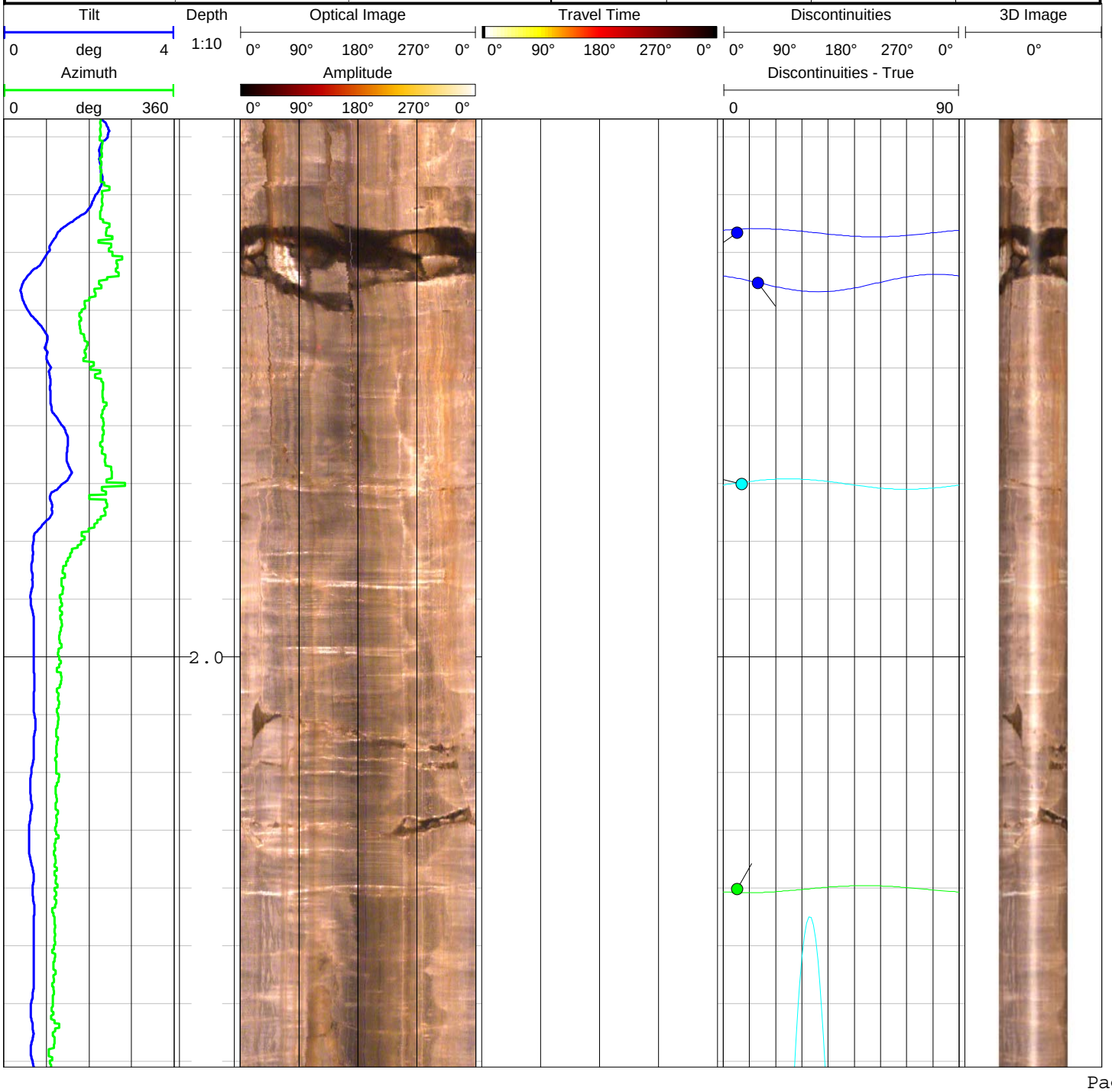

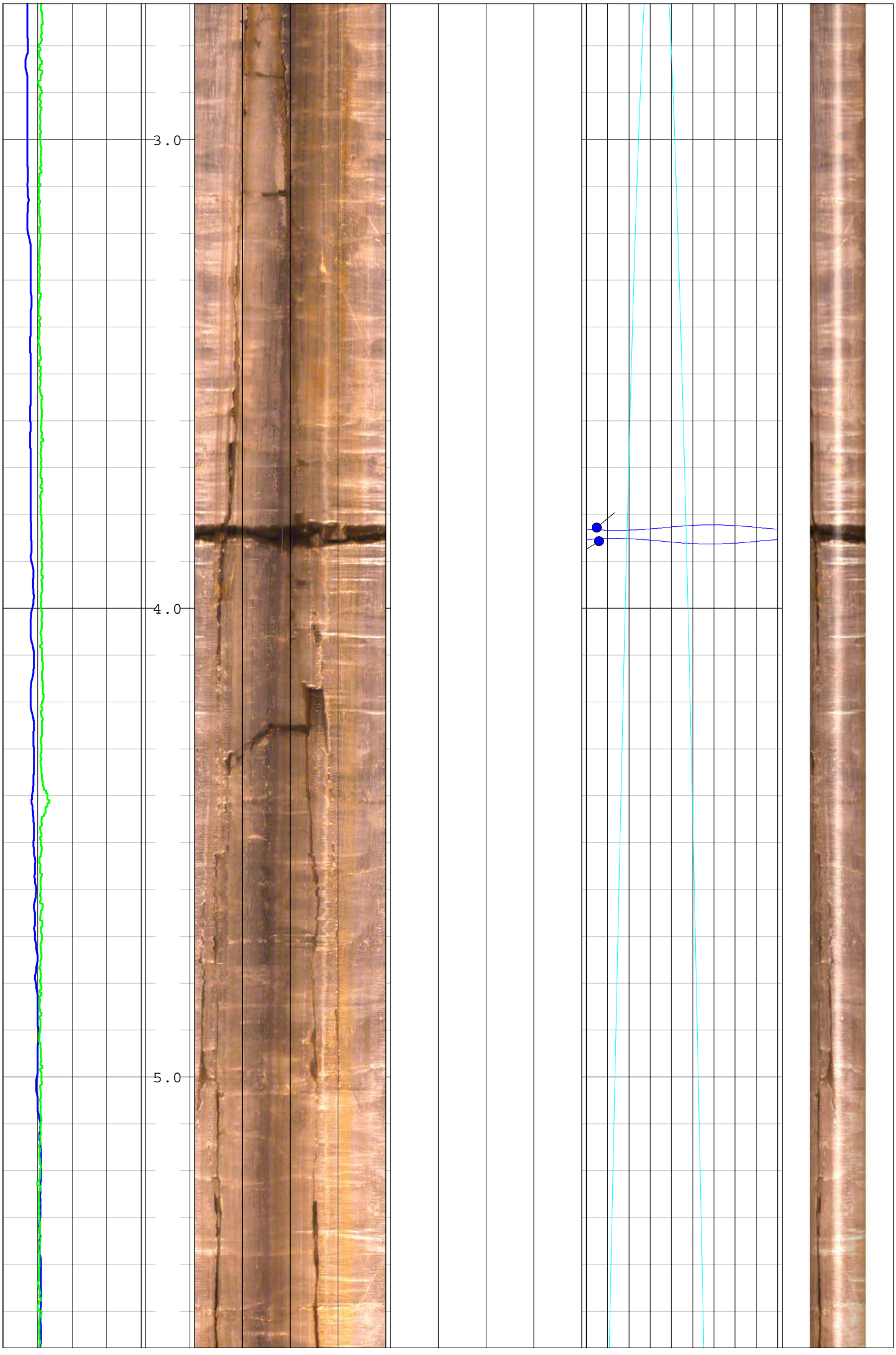
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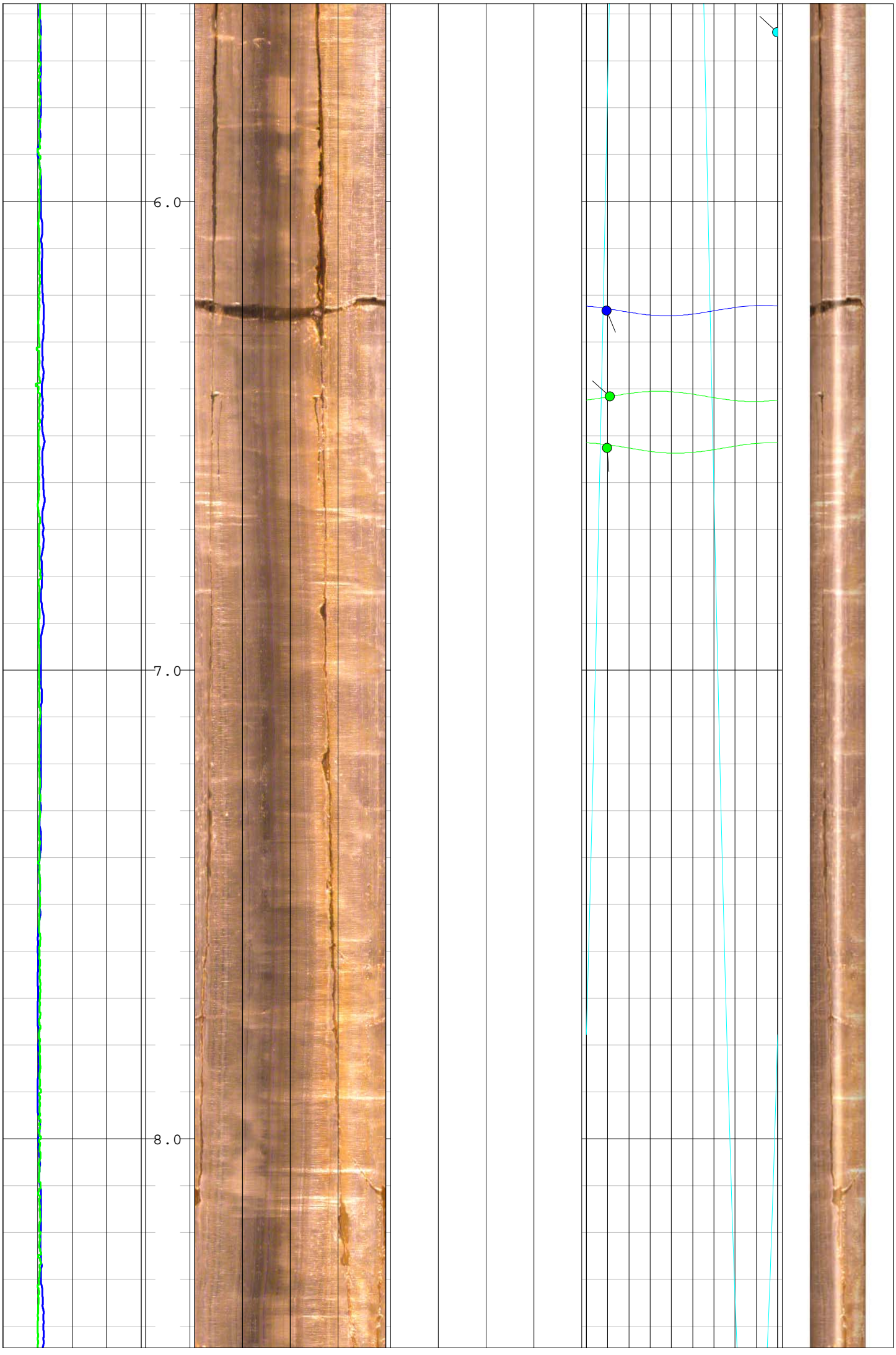
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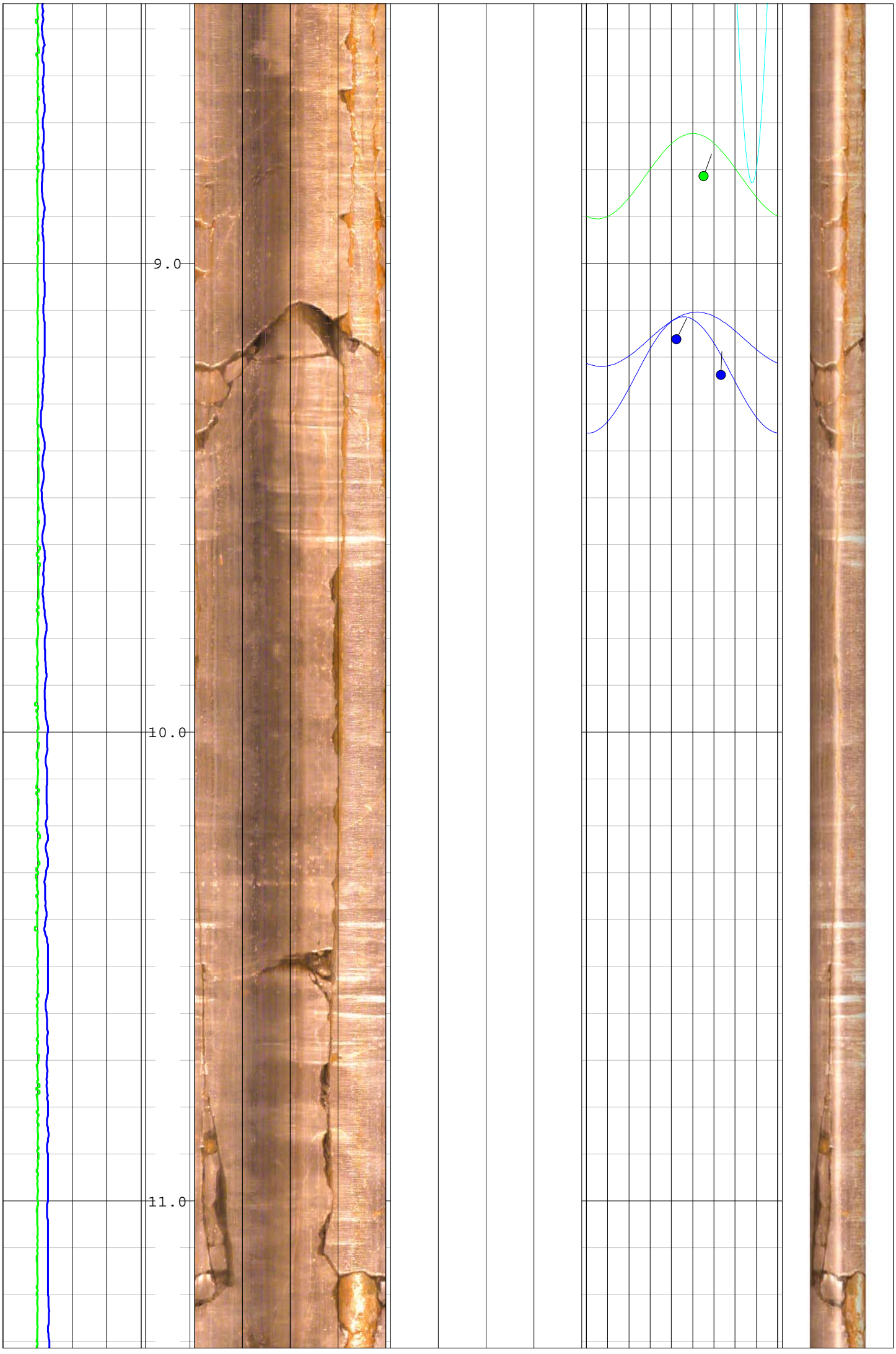
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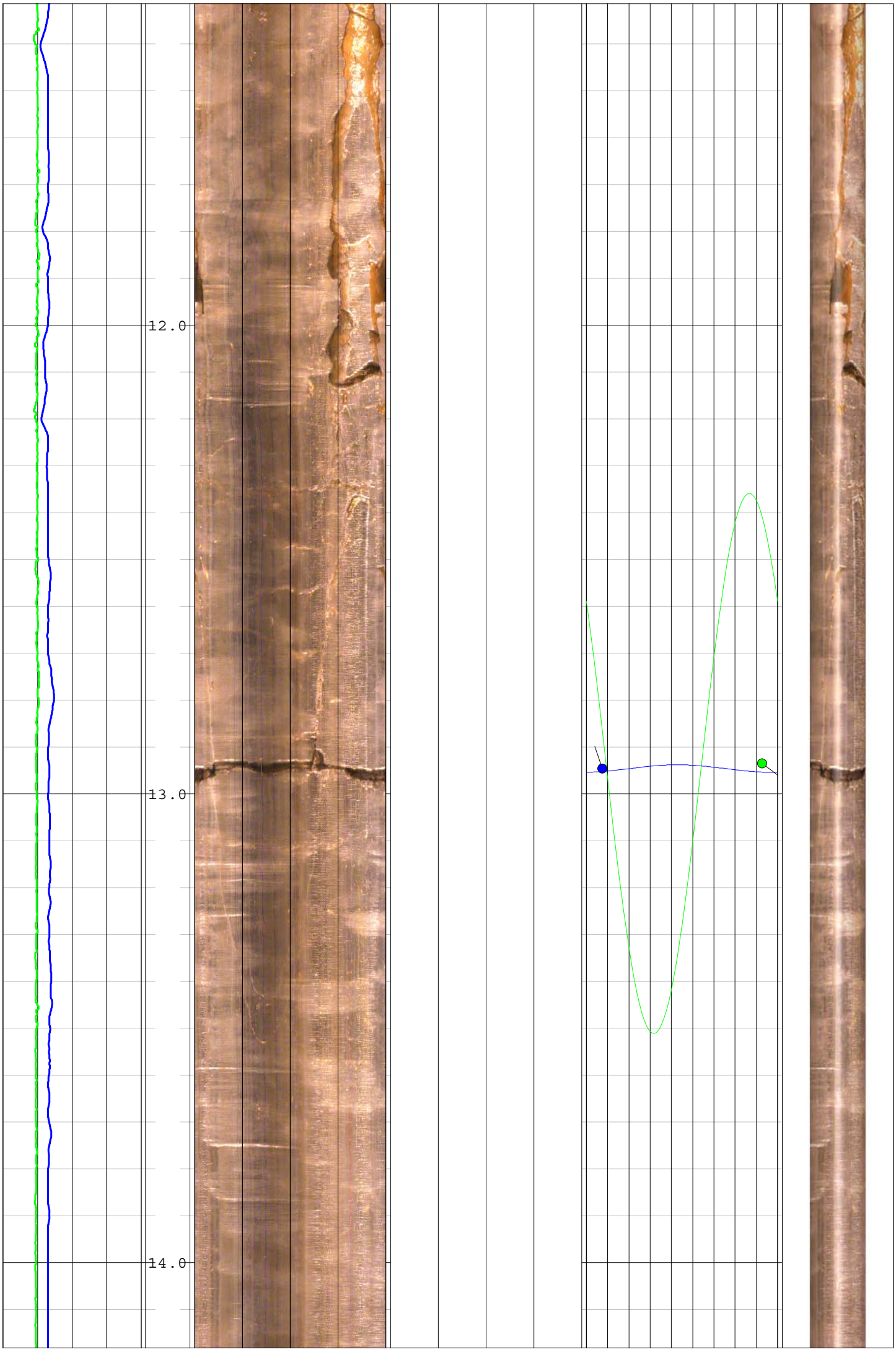
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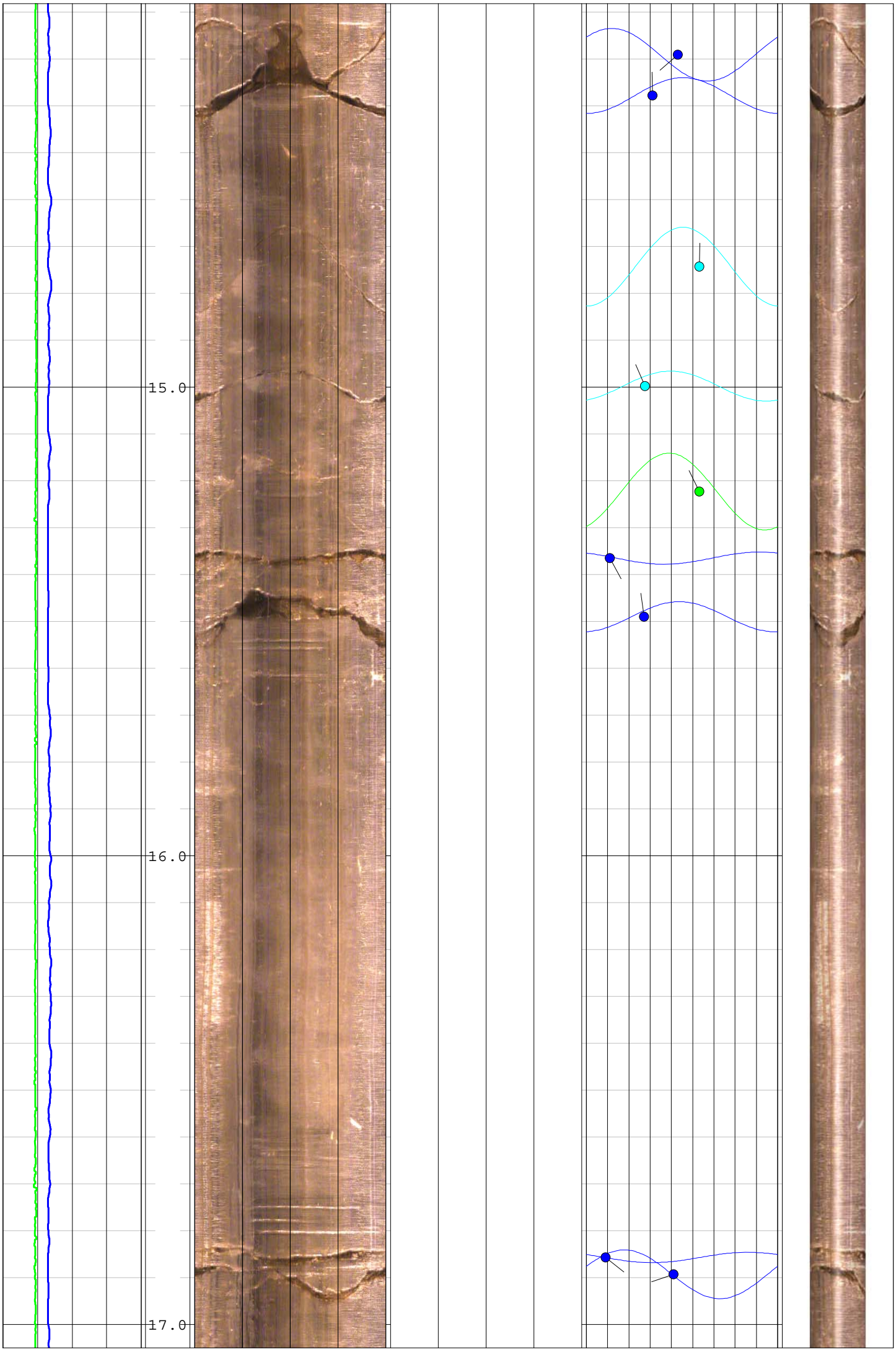
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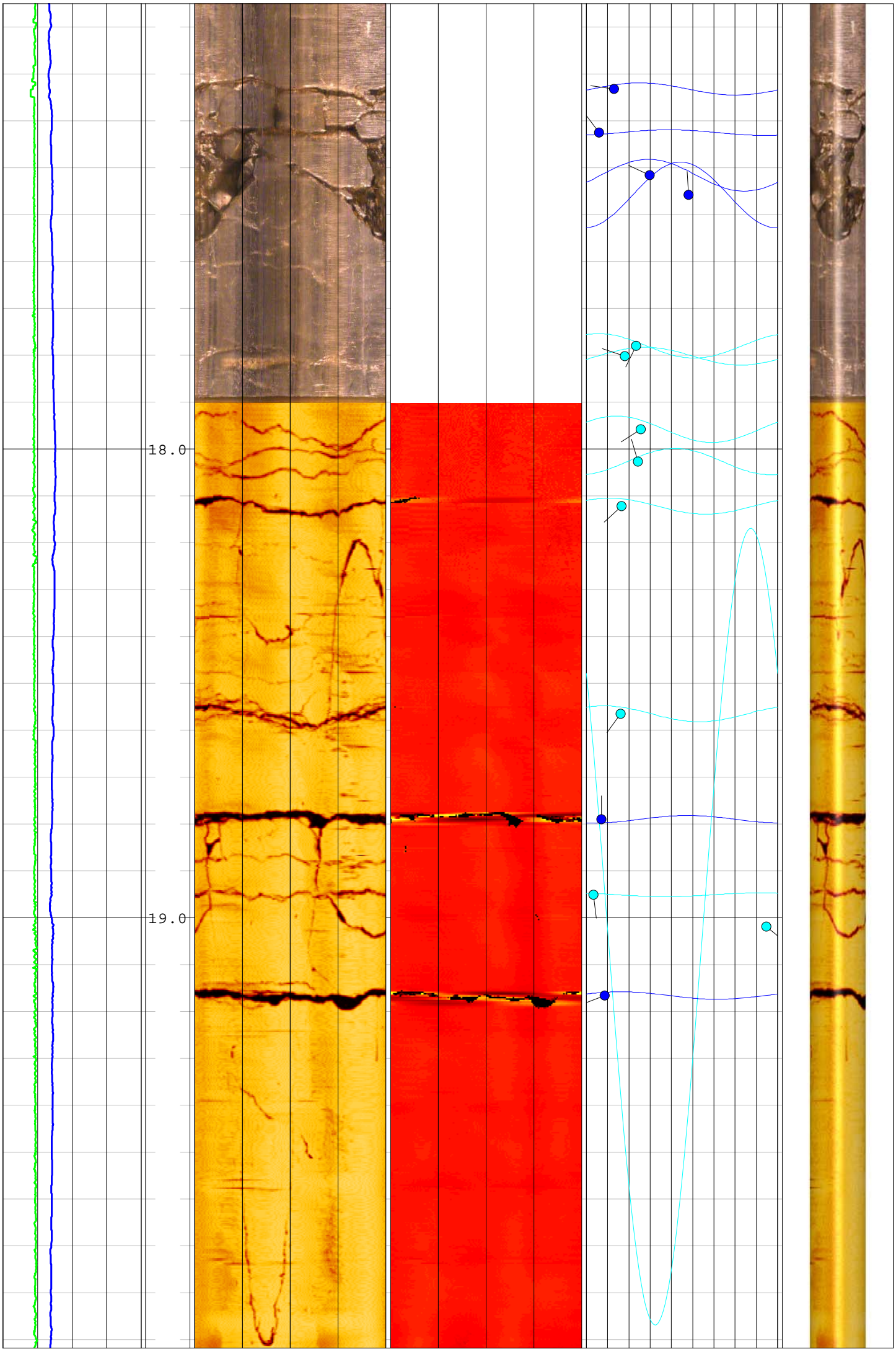
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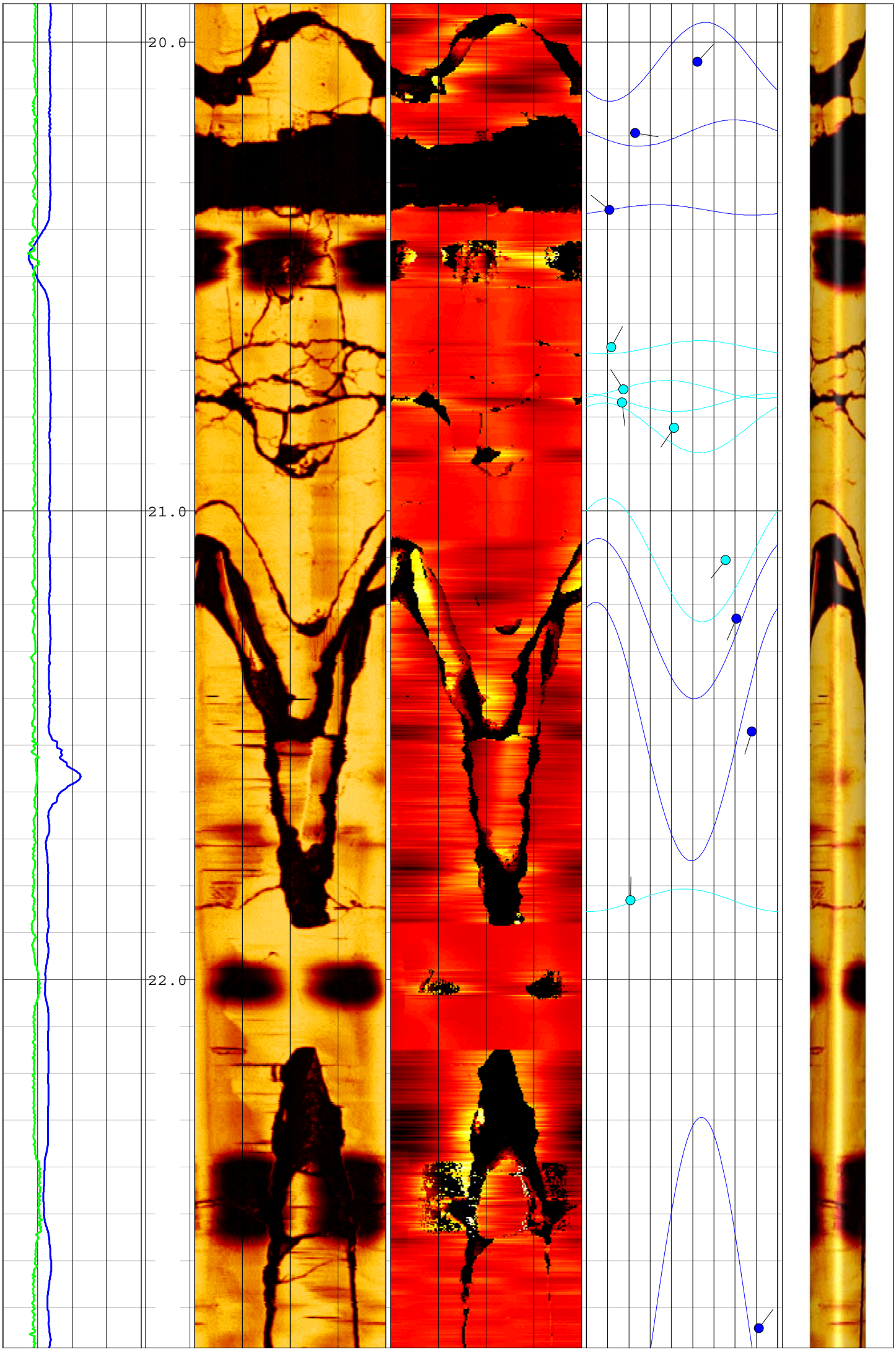
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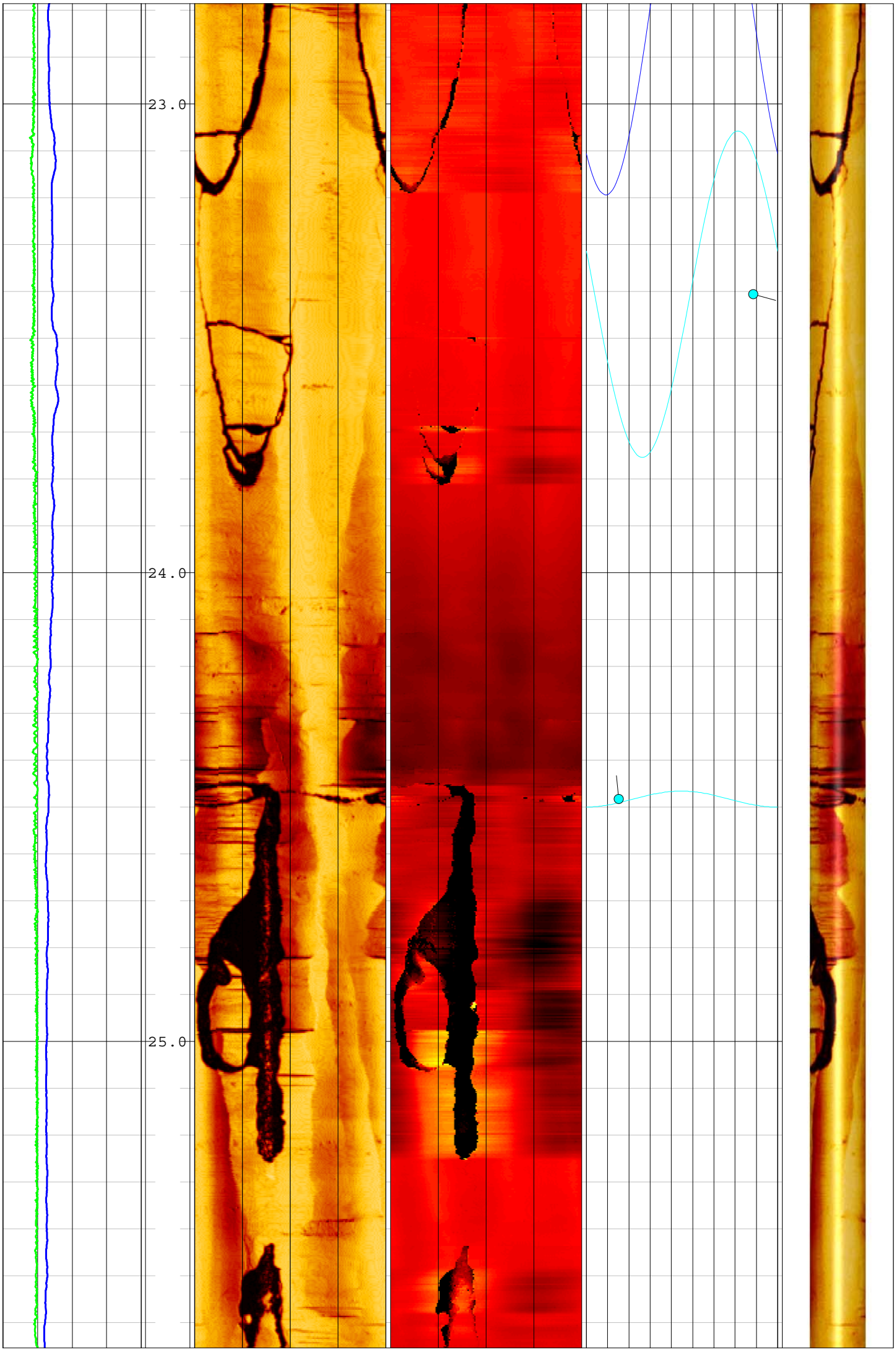
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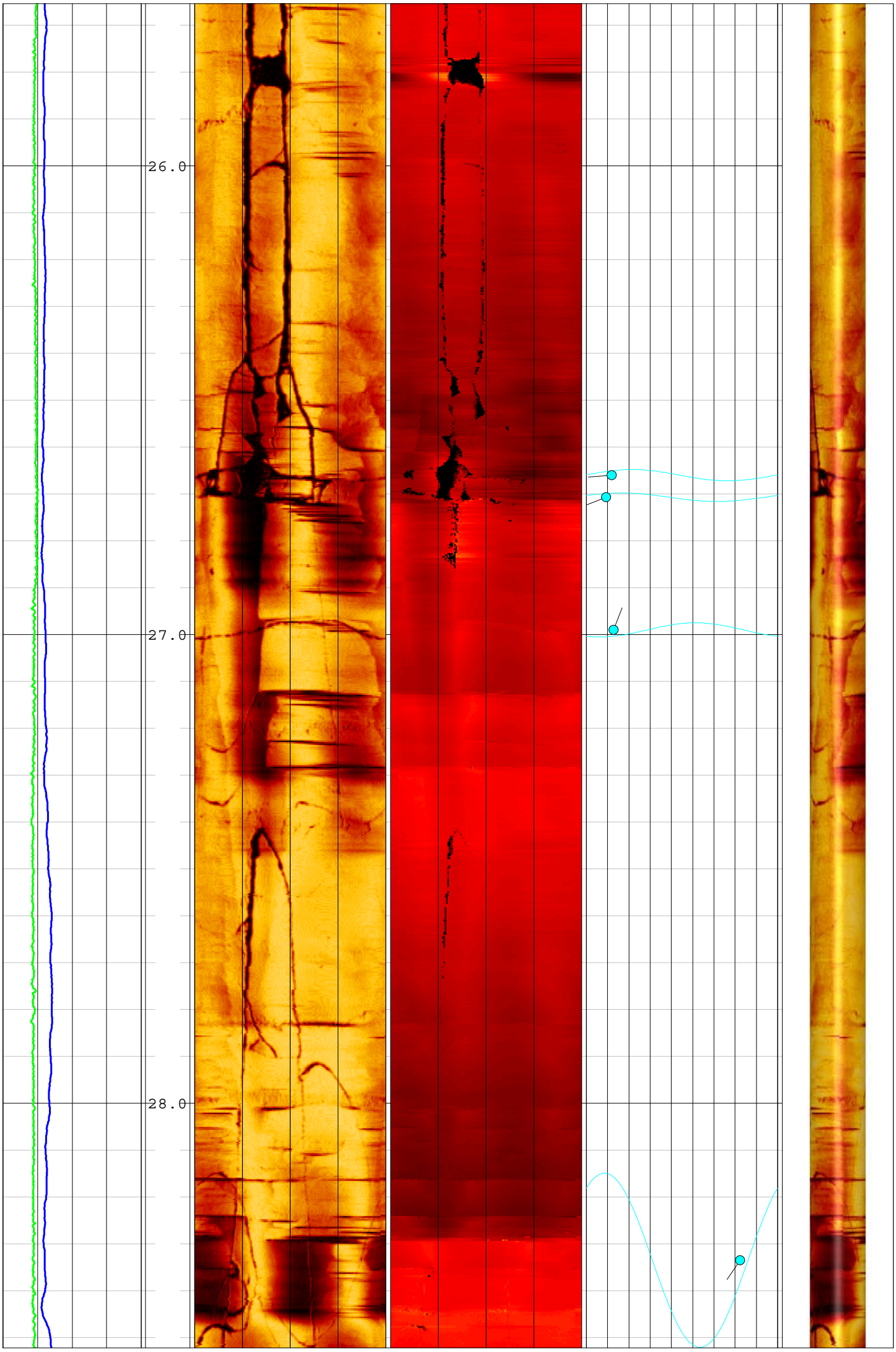
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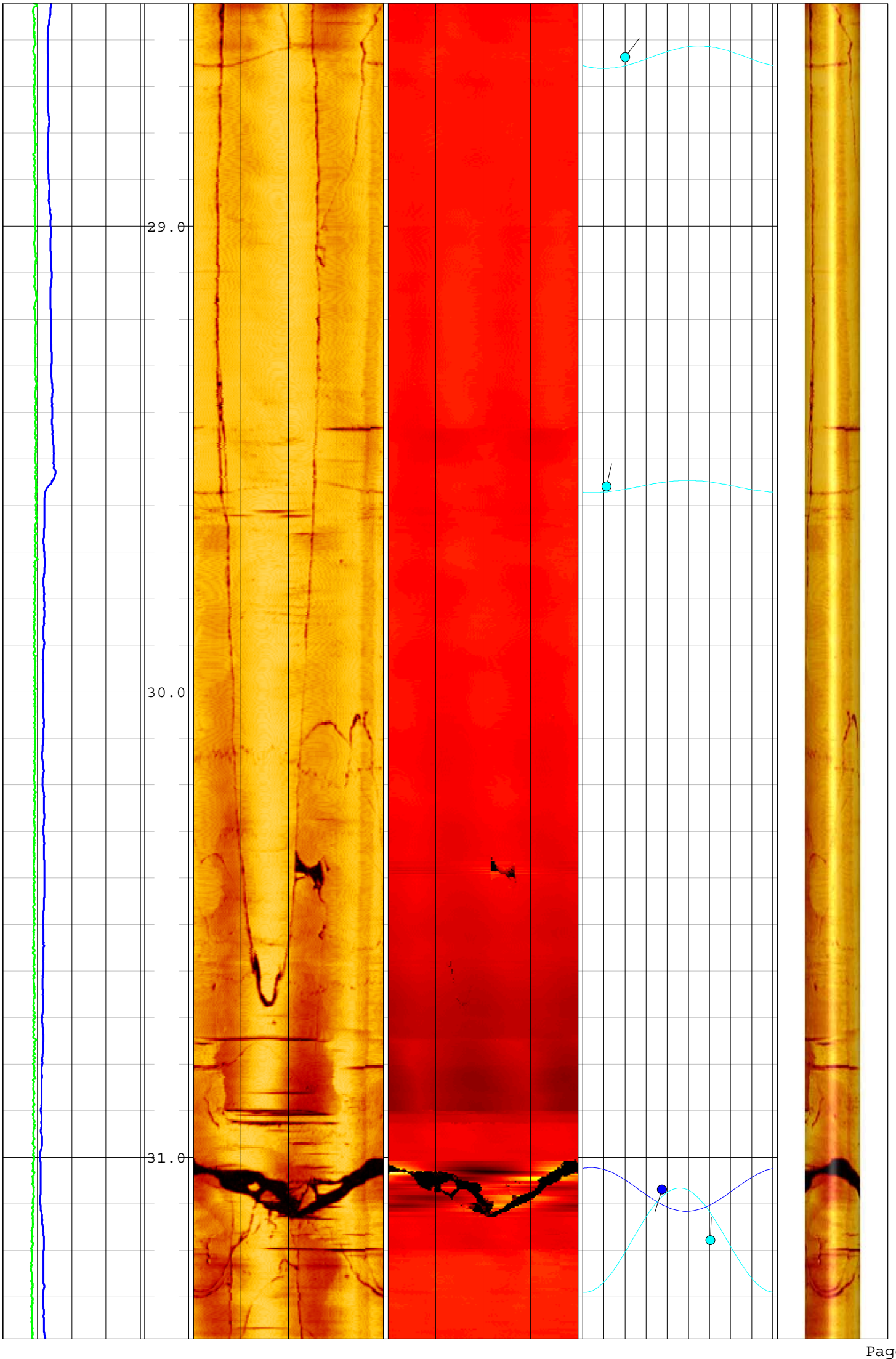
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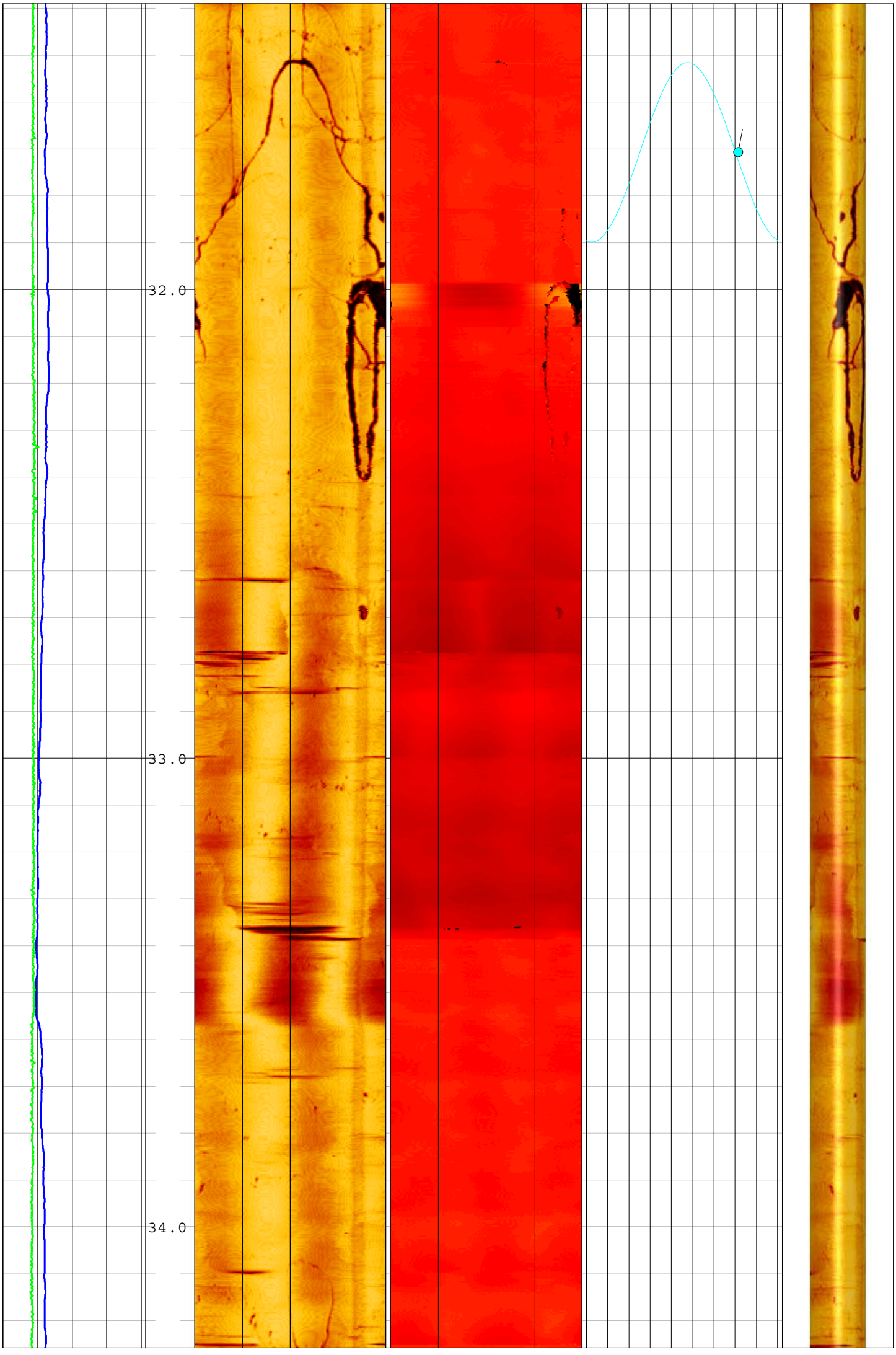
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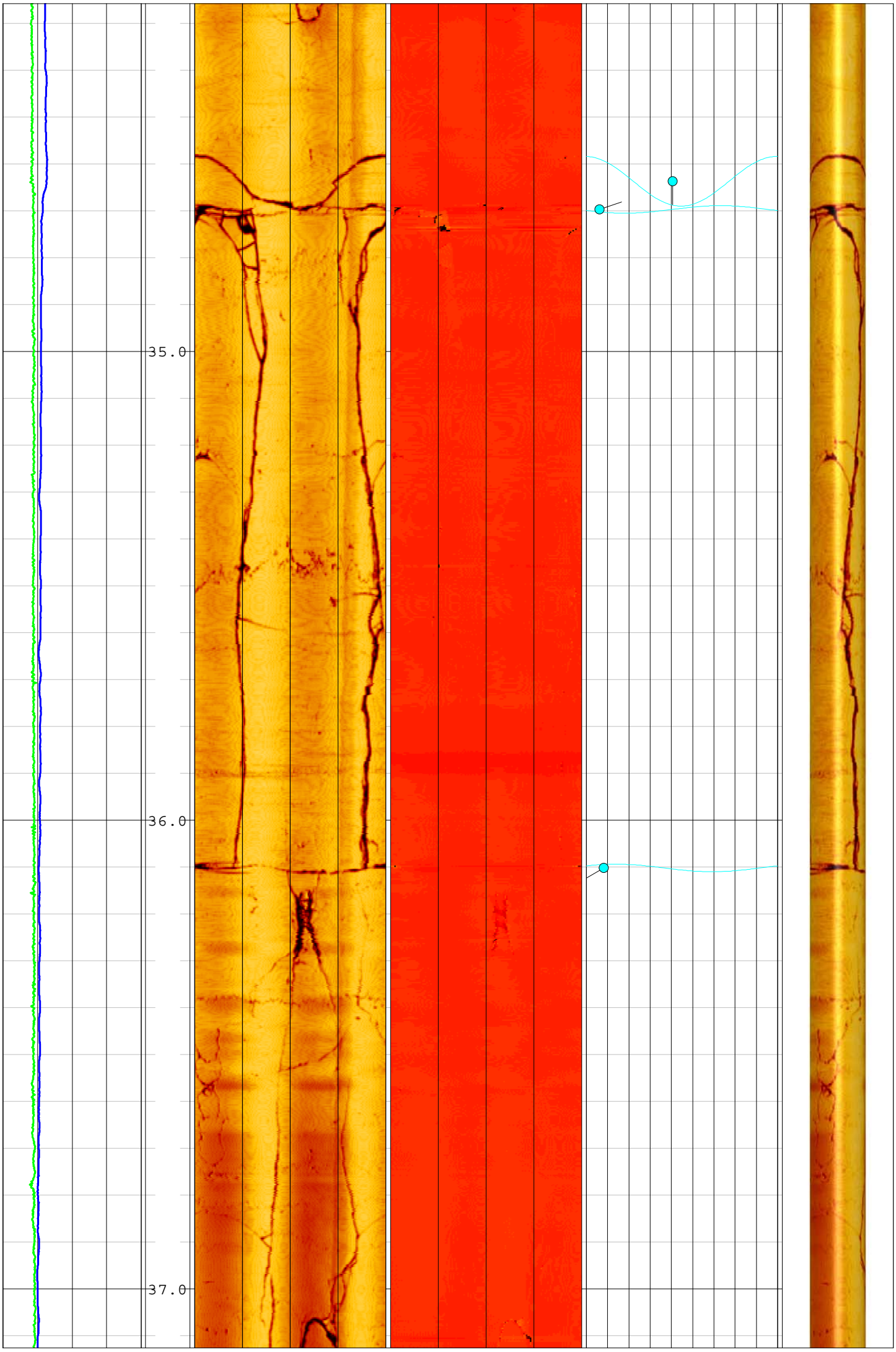
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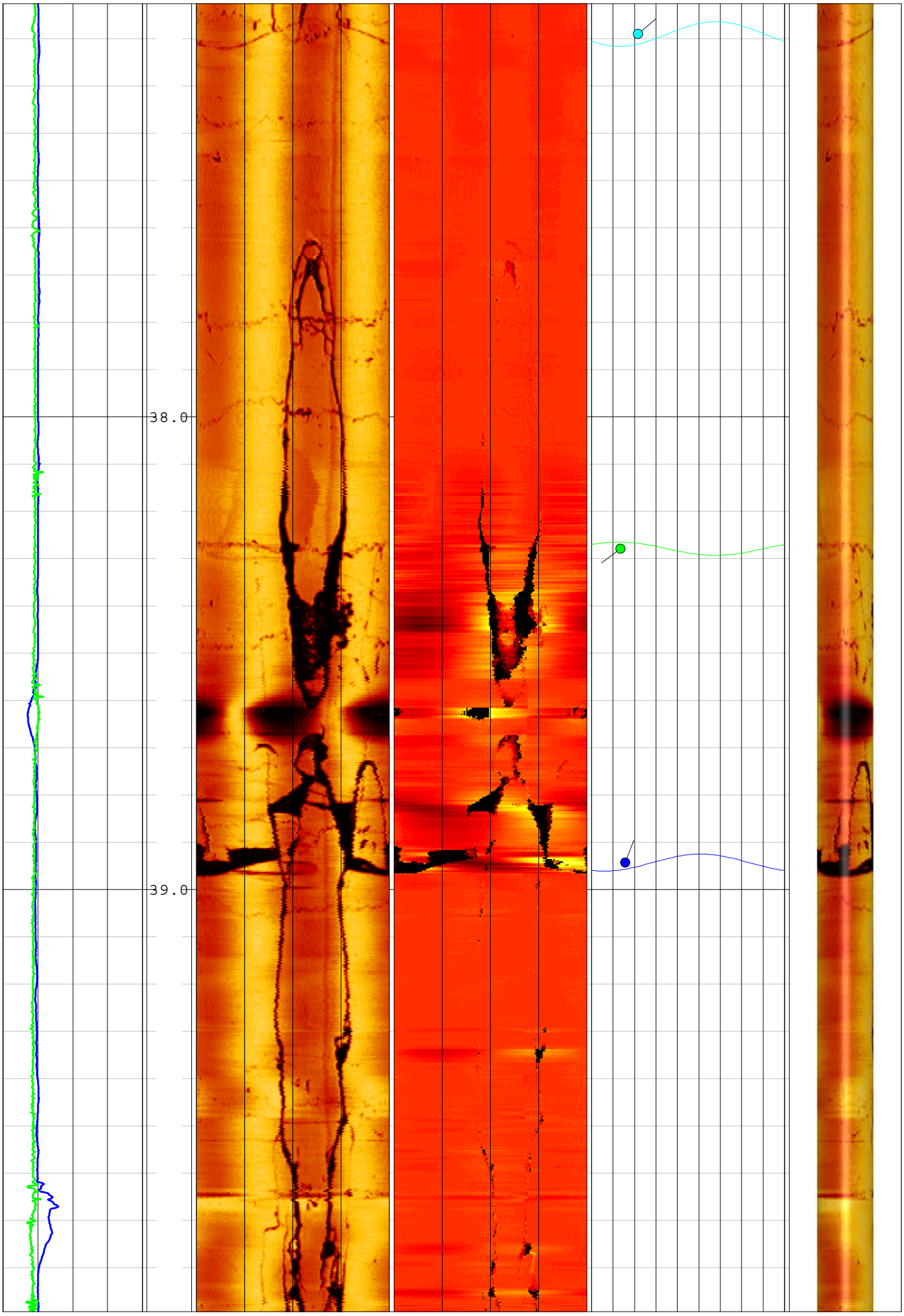
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39.0

EUROPEAN GEOPHYSICAL SERVICES LTD

Client: **Priority Drilling**

Borehole: **BH5**

Log Type: ***Full Wave Sonic***

Location: **Lackagh Quarry** Area: **Co. Galway** Grid Ref: Elevation:

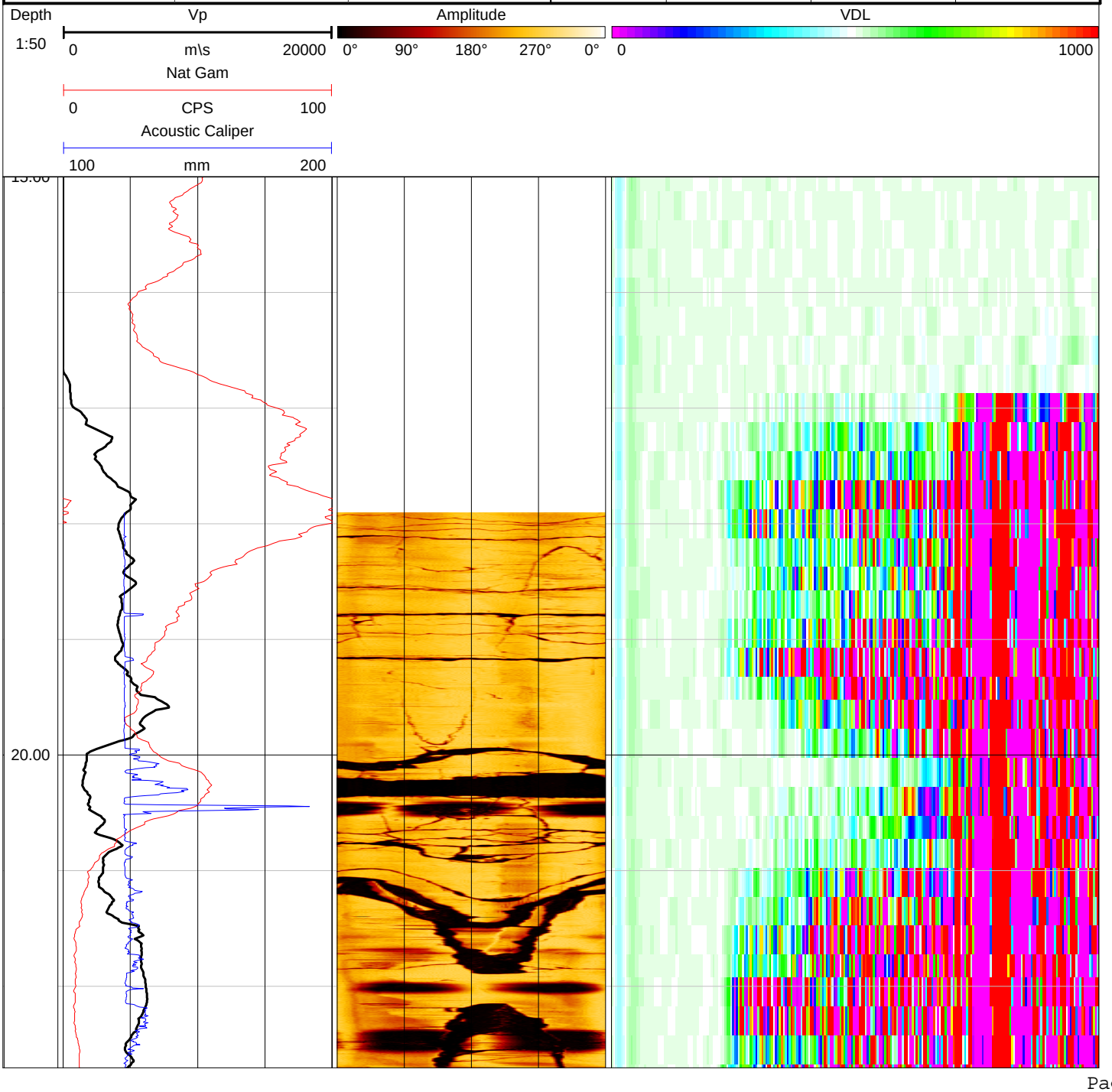
Drilled Depth: (m)	**40.3**	Date:	**8.12.15**
Logged Depth: (m)	**39.2**	Recorded By:	**Rhys Powell**
Logging Datum:	**Ground Level**	Remarks:	
Logged Interval: (m)	**16.9 - 39.2**		
Fluid Level: (m)	**16.9**	**Ref:**	

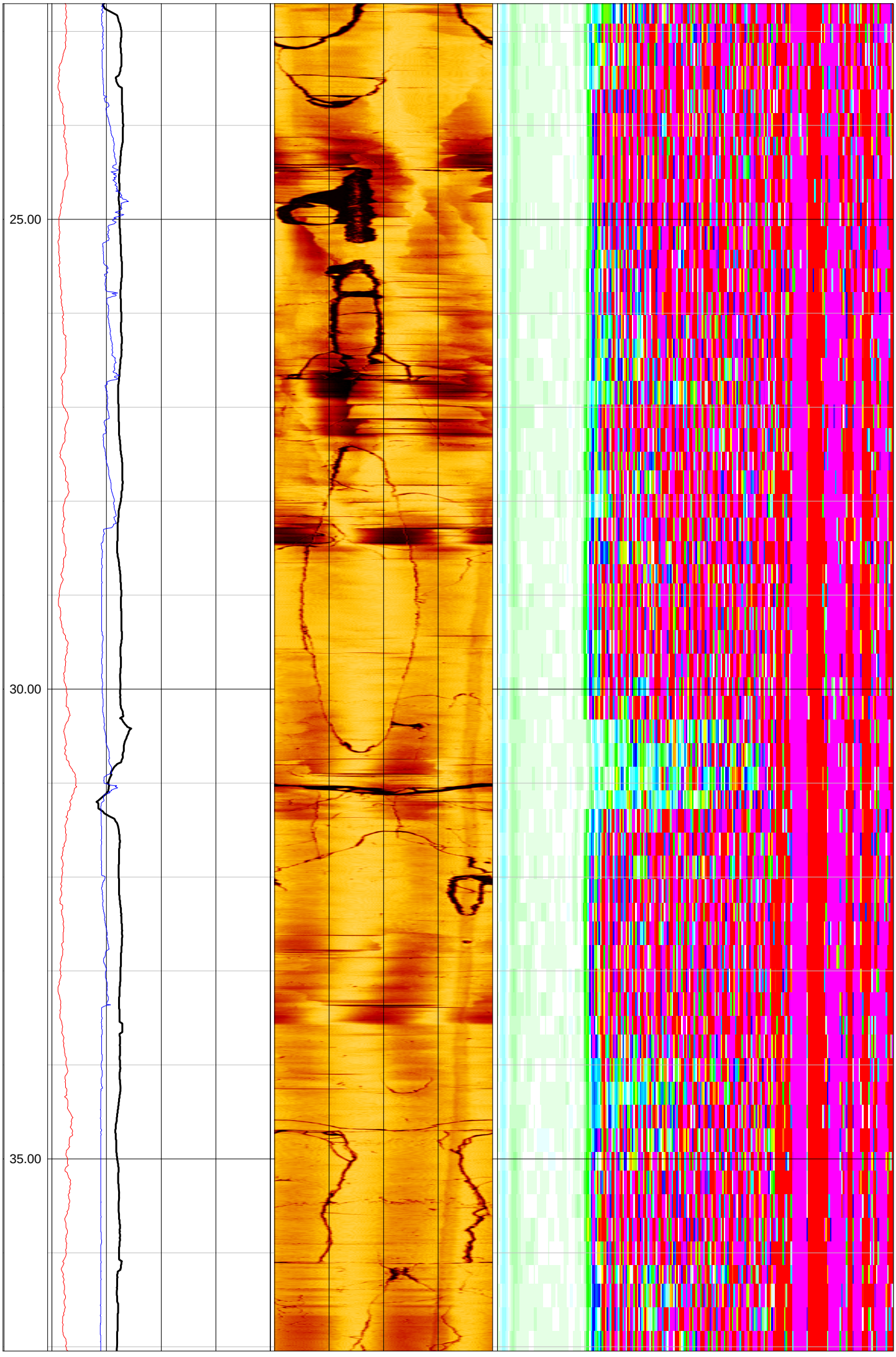
BOREHOLE RECORD

Bit: (mm)	From: (m)	To: (m)
122	**0.0**	**40.3**

CASING RECORD

Type	Size: (mm)	From: (m)	To: (m)
None			

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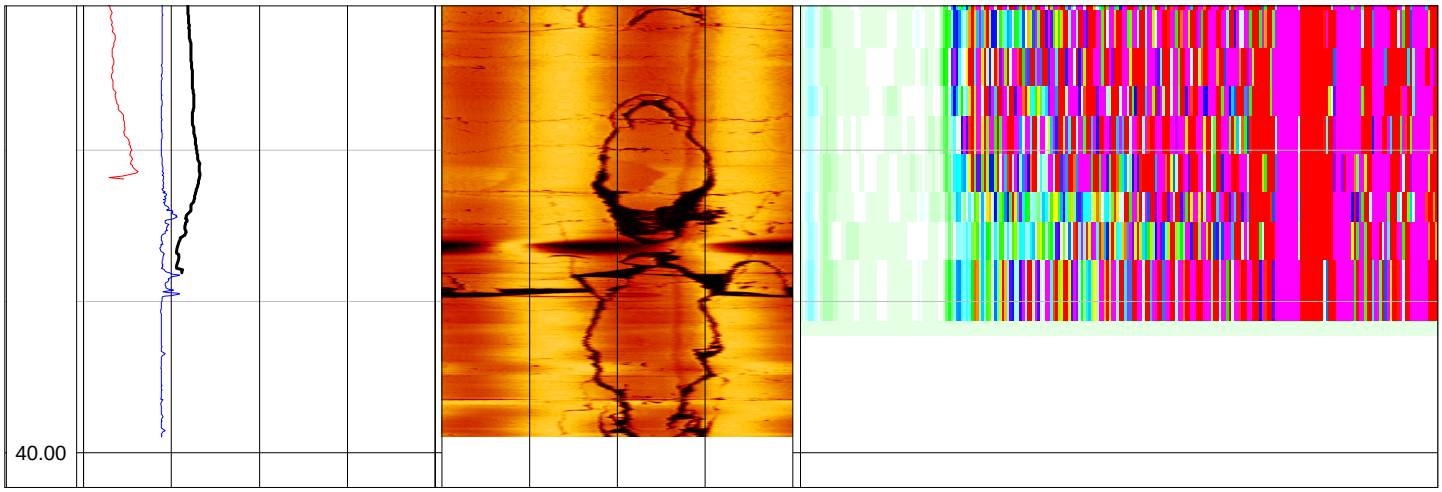
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APPENDIX VII

10% Fines

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Priority Construction Ltd
162 Clontarf Road

Dublin 3
Ireland
VAT No: 9D53971I

Contract: Lackagh Quarry

Date: 29 February 2016
Test Report Ref: STR 448031

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Ten Per Cent Fines Value (TFV) of aggregate sample 10mm and greater in accordance with **BS 812: Part 111: 1990.**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S56595**
Client Ref. No:	**Bulk Sample**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**18/01/2016**
Date of Start of Test:	**21/02/2016**
Sampling Location:	**Unknown**
Name of Source:	**Lackagh Quarry**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Aggregate**
Target Specification	**N/A**

RESULTS:

Ten per cent fines value (DRY) = 150 kN

Comments

Has the "as received material" been altered by crushing in the laboratory: **Yes**

Report to nearest 10kN for forces of 100kN or more report to nearest 5kN for forces less than 100kN.

Certificate Prepared by:-
Mathew Sayer
Assistant Laboratory Manager

Approved by: -
Eric Goulden
Technical Manager

Aggregate Abrasion Value

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Priority Construction Ltd
162 Clontarf Road

Dublin 3
Ireland
VAT No: 9D53971I

Contract: Lackagh Quarry

Date: 29 February 2016
Test Report Ref: STR 448026

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Aggregate Abrasion Value (AAV) of aggregate sample, in accordance with **BS EN 1097-8 : 2009 Annex A**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S56595**
Client Ref. No:	**Bulk Sample**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**18/01/2016**
Date of Start of Test:	**23/02/2016**
Sampling Location:	**Unknown**
Name of Source:	**Lackagh Quarry**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Aggregate**
Target Specification:	**N/A**

RESULTS:

Aggregate Abrasion Value (Test 1) = 12.1 (three significant figures)
Aggregate Abrasion Value (Test 2) = 12.4 (three significant figures)

Mean Aggregate Abrasion Value = 12 (two significant figures)

Comments

None

Certificate Prepared by:-
Mathew Sayer
Assistant Laboratory Manager

Approved by: -
Eric Goulden
Technical Manager

Aggregate Crushing Value

Priority Construction Ltd
162 Clontarf Road

Dublin 3
Ireland
VAT No: 9D53971I

Contract: Lackagh Quarry

Date: 29 February 2016
Test Report Ref: STR 448024

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Aggregate Crushing Value (ACV) of aggregate sample, in accordance with **BS 812: Part 110: 1990.**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S56595**
Client Ref. No:	**Bulk Sample**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**18/01/2016**
Date of Start of Test:	**20/02/2016**
Sampling Location:	**Unknown**
Name of Source:	**Lackagh Quarry**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Aggregate**
Target Specification:	**N/A**

RESULTS:

Aggregate Crushing Value (%) = 23 (nearest whole number)

Comments

None

Certificate Prepared by:-

Mathew Sayer
Assistant Laboratory Manager

Approved by: -

Eric Goulden
Technical Manager

Aggregate Impact Value

celtest
INDEPENDENT MATERIALS TESTING I DIAMOND DRILLING & SAWING

Priority Construction Ltd
162 Clontarf Road

Dublin 3
Ireland
VAT No: 9D53971I

Contract: Lackagh Quarry

Date: 29 February 2016
Test Report Ref: STR 448025

LABORATORY TEST REPORT

TEST REQUIREMENTS: To determine the Aggregate Impact Value (AIV) of aggregate sample – DRY, in accordance with **BS 812: Part 112: 1990.**

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S56595**
Client Ref. No:	**Bulk Sample**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**18/01/2016**
Date of Start of Test:	**21/02/2016**
Sampling Location:	**Unknown**
Name of Source:	**Lackagh Quarry**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Material Description:	**Aggregate**
Target Specification:	**N/A**

RESULTS:

Aggregate Impact Value (DRY) (%) = 17 (nearest whole number)

Comments

If the AIV is greater than 30 then, the results should be treated with caution.
No departure from specified procedure.

Certificate Prepared by:-
Mathew Sayer
Assistant Laboratory Manager

Approved by: -
Eric Goulden
Technical Manager

Deformability in Uniaxial Compression and Brazil Tests

Priority Construction Ltd
162 Clontarf Road
Dublin 3
Ireland
REP. Of Ireland.
VAT No: 9D53971I

Date: 15th February 2016
Test Report Ref. STR: 443020

LABORATORY TEST REPORT

TEST REQUIREMENTS: Unconfined compressive strength, elastic moduli & indiect tensile strength by Brazil.

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S56158**
Client Ref. No:	**Various**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**8/12/2016**
Date of Start of Test.:	**15/12/2015**
Sampling Location:	**Various**
Name of Source:	**Lackagh Quarry SI**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Aggregate Type and Nominal Size:	**Core**
Target Specification:	**N/A**

COMMENTS/ DEPARTURE FROM SPECIFIED PROCEDURE

The work was carried out by our competent, sub contracted laboratory.

RESULTS

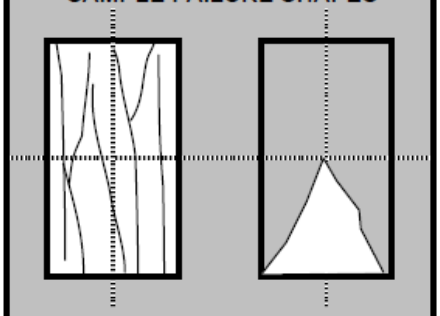
( ) E. R. Goulden
Technical Manager
Approved Signatories

( ) E. N. Jones
Soils Laboratory Manager

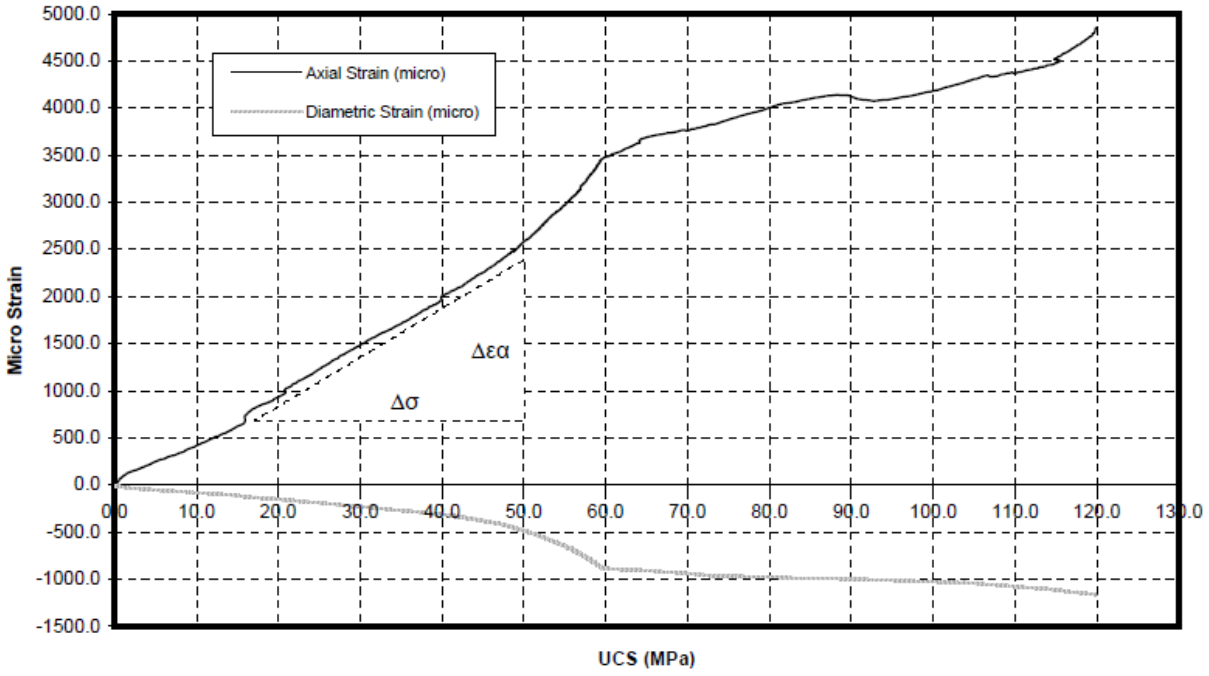
(✓) N Dumbarton
Assistant Laboratory Manager

BOREHOLE		BH04
CORE RUN		48903
DEPTH		8.06-8.36
SAMPLE DIAMETER	mm	82.22
SAMPLE HEIGHT	mm	186.15
WATER CONTENT	%	0.0
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	14.21
DATE OF TESTING		24/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	18.60
POISSON'S RATIO *v*		0.20
UNCONFINED COMPRESSIVE STRENGTH	MPa	119.9

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves

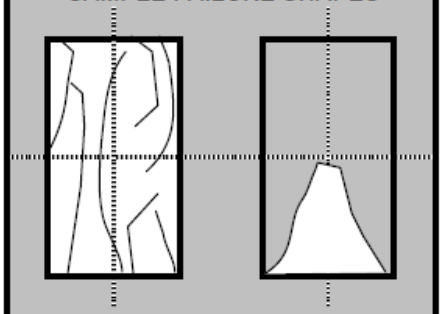


Test Notes:

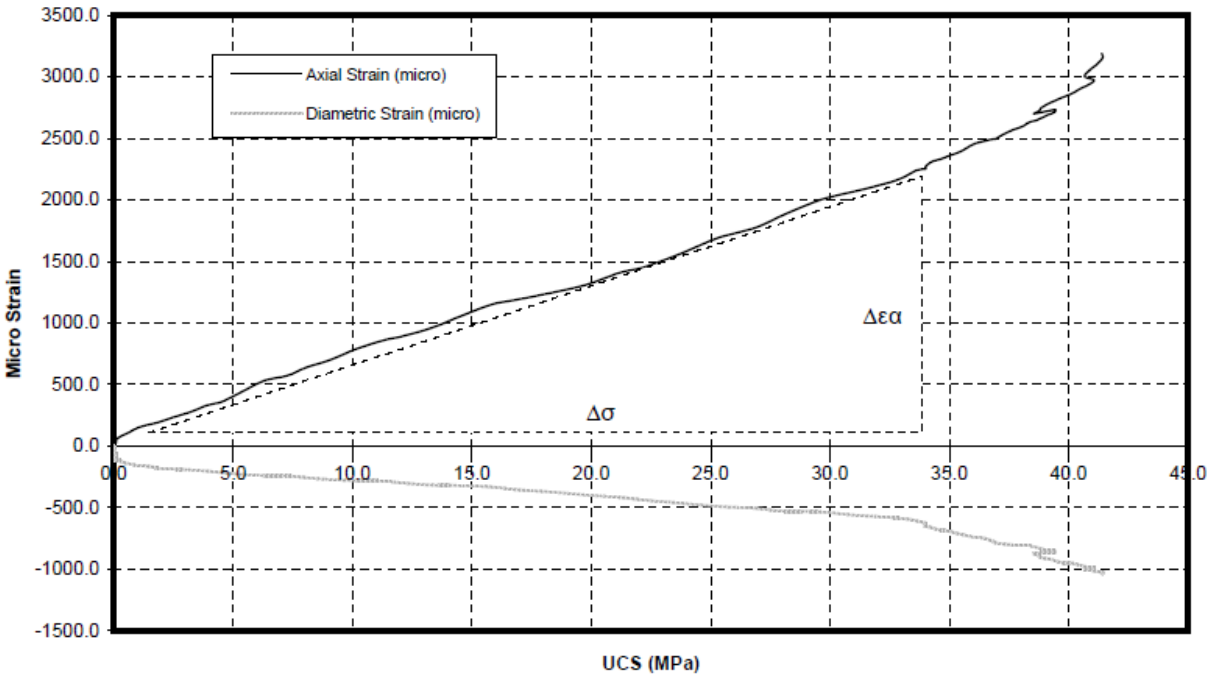
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 16.6MPa and 50.1MPa

BOREHOLE		BH04
CORE RUN		48905
DEPTH		10.63-10.88
SAMPLE DIAMETER	mm	82.11
SAMPLE HEIGHT	mm	197.38
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.6
TEST DURATION	mm.sec	6.4
DATE OF TESTING		25/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	15.57
POISSON'S RATIO *v*		0.22
UNCONFINED COMPRESSIVE STRENGTH	MPa	41.6

SAMPLE FAILURE SHAPES



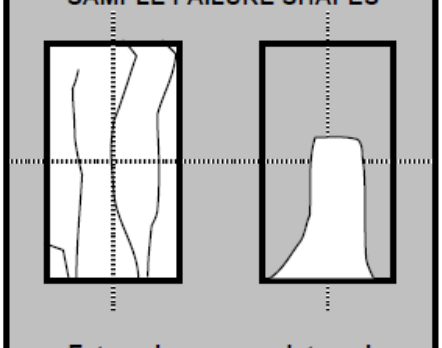
Axial & Diametric Stress / Strain Curves



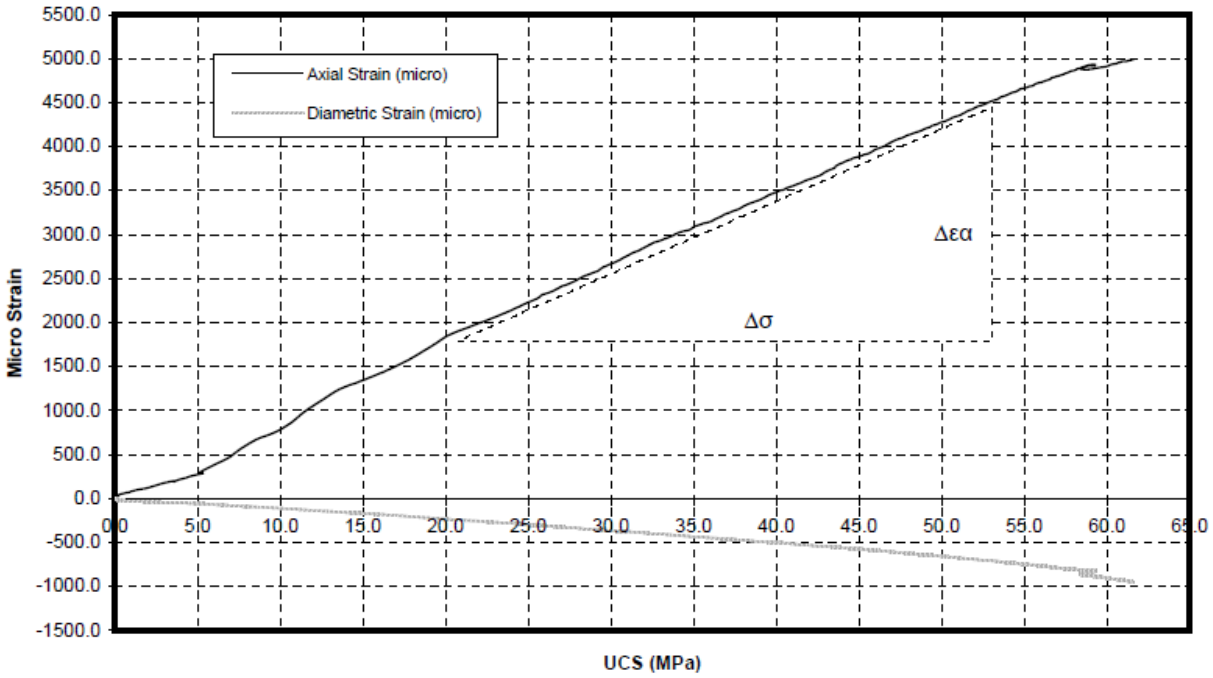
Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 1MPa and 34MPa

BOREHOLE		BH04
CORE RUN		48910
DEPTH		14.40-14.63
SAMPLE DIAMETER	mm	82.43
SAMPLE HEIGHT	mm	186.76
WATER CONTENT	%	0.2
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.8
TEST DURATION	mm.sec	6.52
DATE OF TESTING		25/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	12.33
POISSON'S RATIO *v*		0.18
UNCONFINED COMPRESSIVE STRENGTH	MPa	62.0

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves

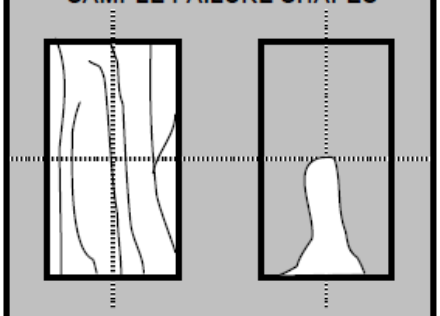


Test Notes:

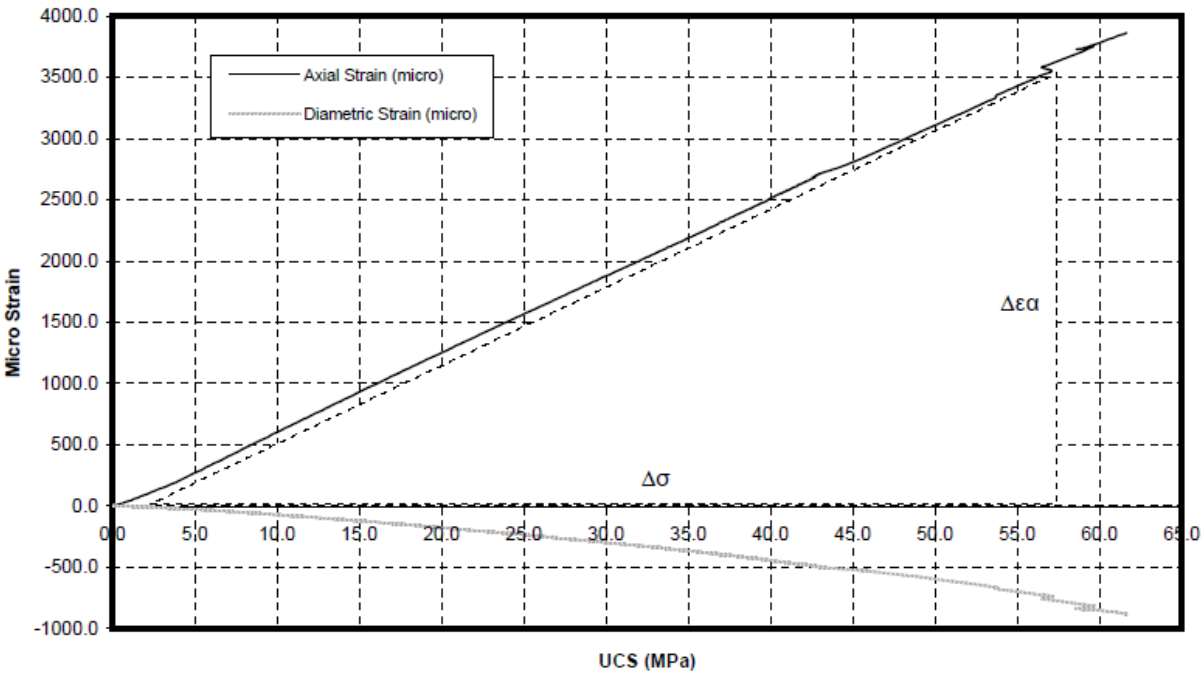
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 20.2MPa and 52.9MPa

BOREHOLE		BH04
CORE RUN		48935
DEPTH		25.19-25.41
SAMPLE DIAMETER	mm	81.94
SAMPLE HEIGHT	mm	186.81
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	8.34
DATE OF TESTING		25/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	15.68
POISSON'S RATIO *v*		0.20
UNCONFINED COMPRESSIVE STRENGTH	MPa	64.1

SAMPLE FAILURE SHAPES



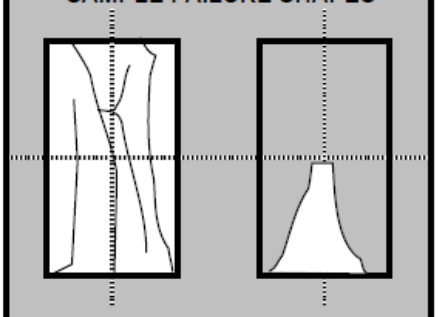
Axial & Diametric Stress / Strain Curves



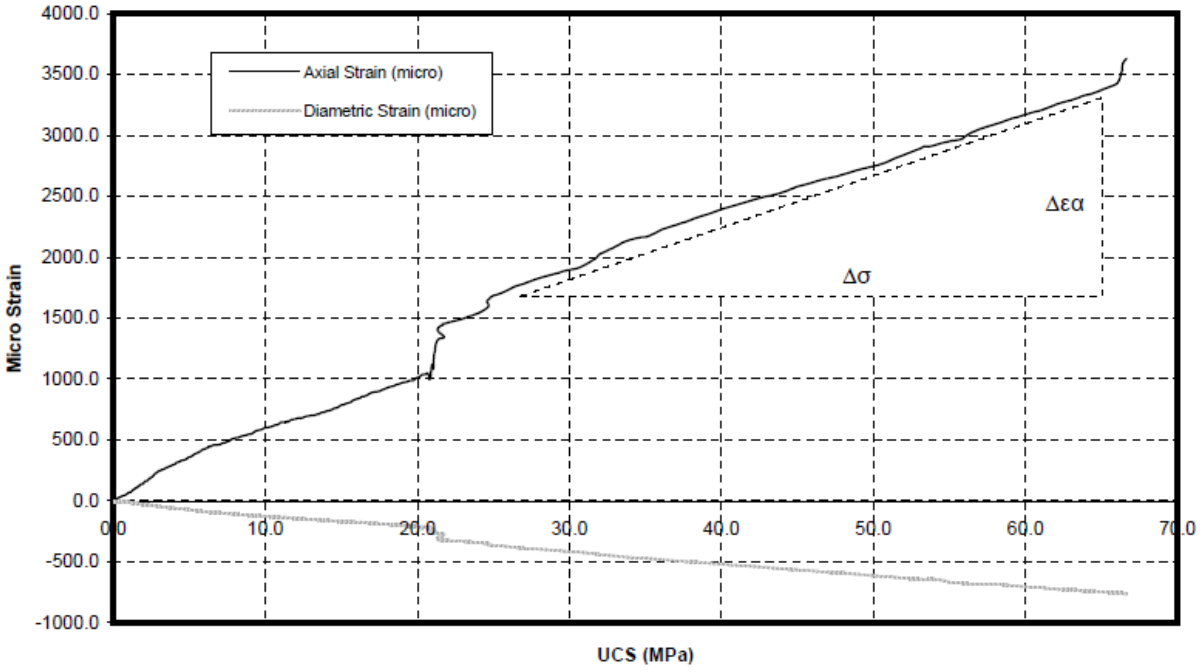
Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 2MPa and 57.5MPa

BOREHOLE		BH04
CORE RUN		48966
DEPTH		33.20-33.48
SAMPLE DIAMETER	mm	82.14
SAMPLE HEIGHT	mm	184.83
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	1.1
TEST DURATION	mm.sec	5.11
DATE OF TESTING		25/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	23.77
POISSON'S RATIO *v*		0.23
UNCONFINED COMPRESSIVE STRENGTH	MPa	66.5

SAMPLE FAILURE SHAPES



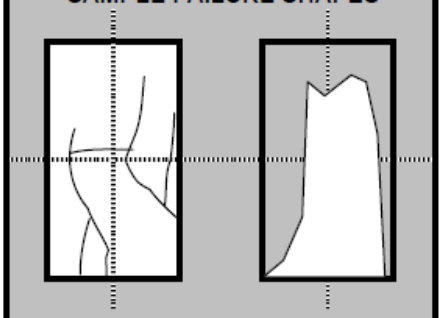
Axial & Diametric Stress / Strain Curves



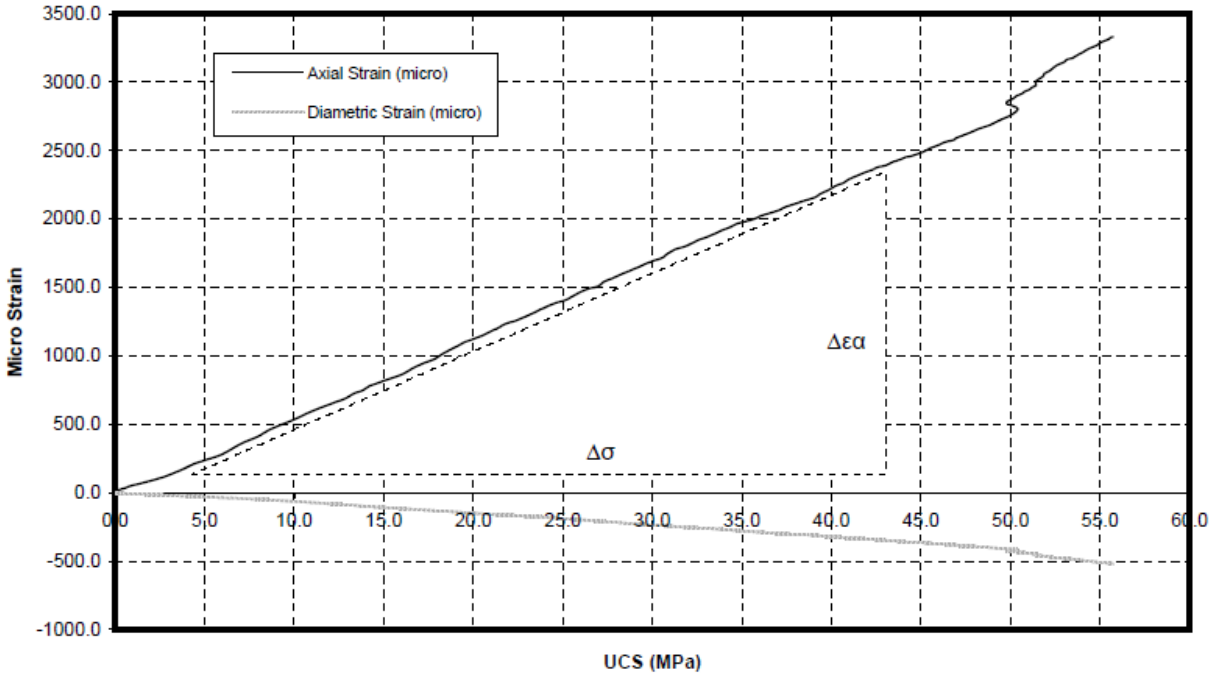
Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 25.9MPa and 65.1MPa

BOREHOLE		BH05
CORE RUN		48996
DEPTH		15.95-16.22
SAMPLE DIAMETER	mm	82.33
SAMPLE HEIGHT	mm	187.90
WATER CONTENT	%	0.2
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.5
TEST DURATION	mm.sec	9.58
DATE OF TESTING		21/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	17.68
POISSON'S RATIO *v*		0.15
UNCONFINED COMPRESSIVE STRENGTH	MPa	57.0

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves



Test Notes:

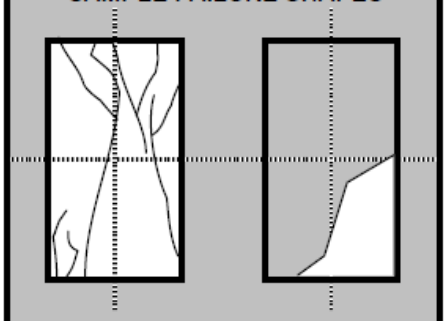
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve

Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve

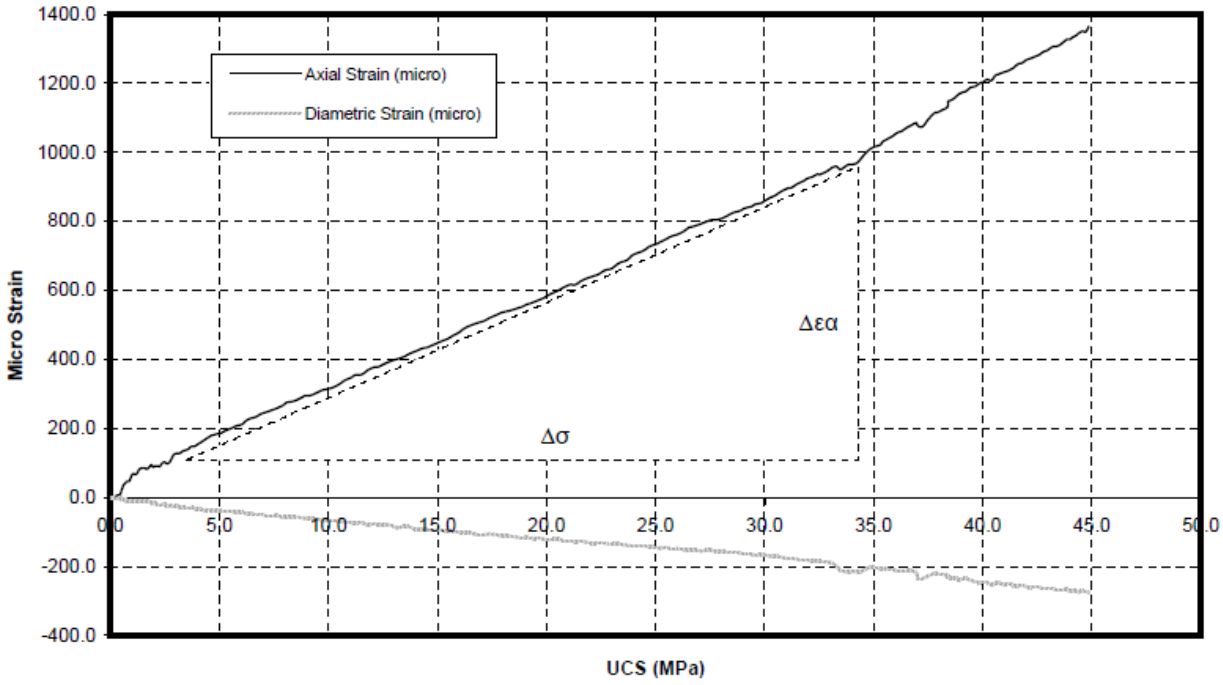
Young's modulus and poisson's ratio calculated between stress levels of 3.6MPa and 43MPa

BOREHOLE		BH05
CORE RUN		50706
DEPTH		24.05-24.30
SAMPLE DIAMETER	mm	81.06
SAMPLE HEIGHT	mm	187.95
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	5.38
DATE OF TESTING		24/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	36.97
POISSON'S RATIO *v*		0.20
UNCONFINED COMPRESSIVE STRENGTH	MPa	44.9

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves

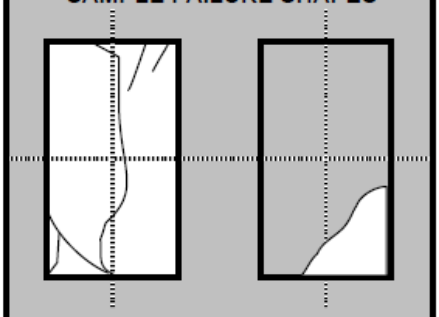


Test Notes:

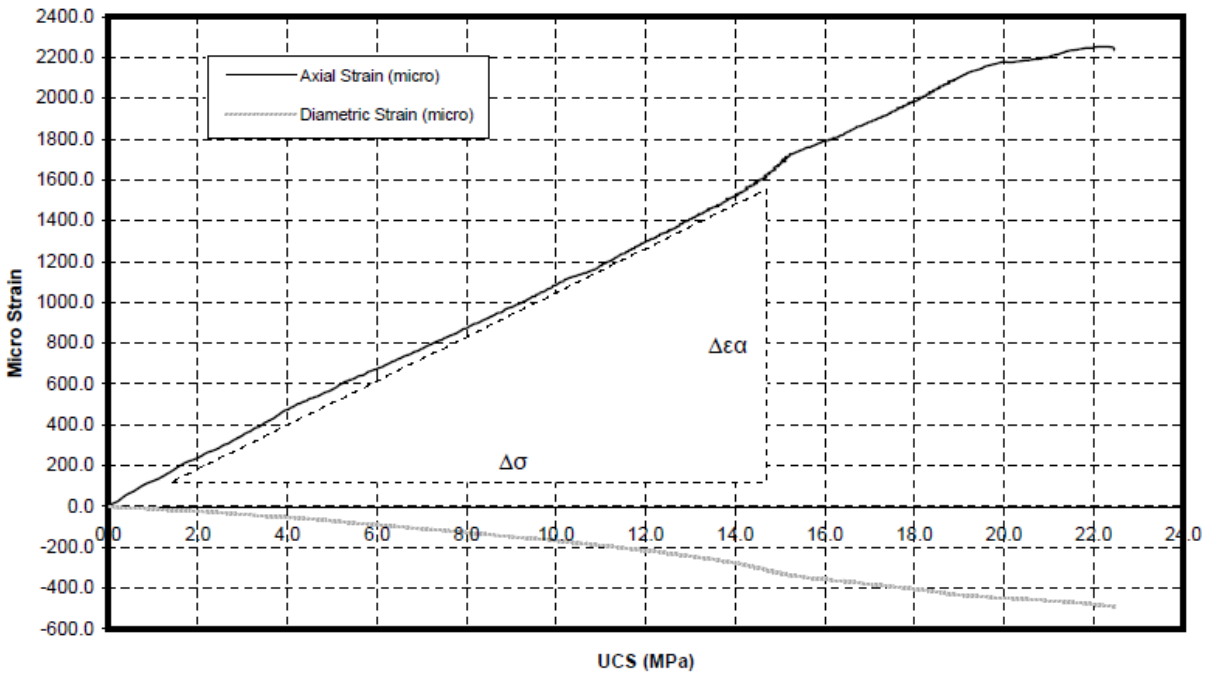
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 3.1MPa and 34.3MPa

BOREHOLE		BH05
CORE RUN		50708
DEPTH		25.20-25.40
SAMPLE DIAMETER	mm	82.08
SAMPLE HEIGHT	mm	190.12
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.6
TEST DURATION	mm.sec	3.21
DATE OF TESTING		25/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	9.10
POISSON'S RATIO *v*		0.21
UNCONFINED COMPRESSIVE STRENGTH	MPa	22.6

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves



Test Notes:

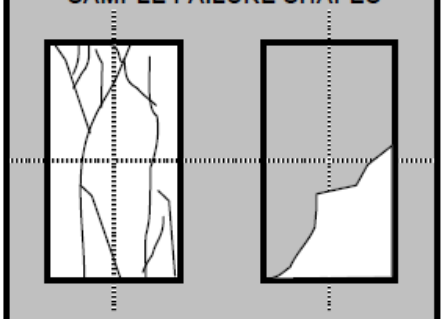
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve

Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve

Young's modulus and poisson's ratio calculated between stress levels of 1.2MPa and 14.8MPa

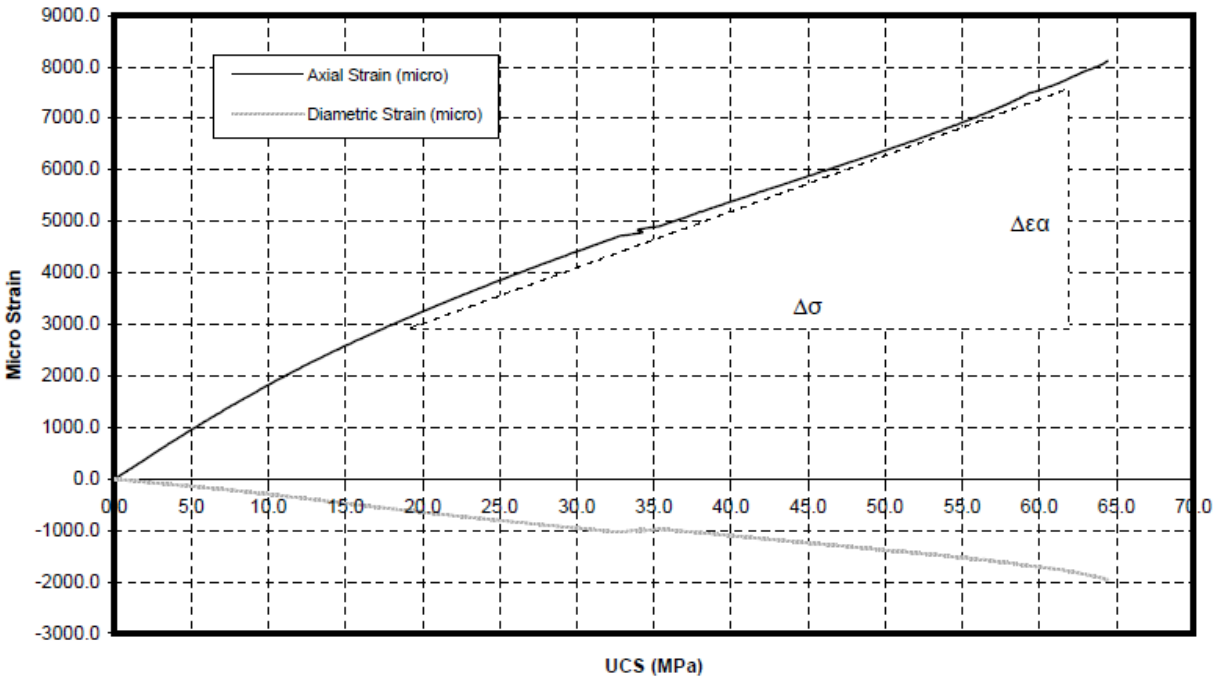
BOREHOLE		BH05
CORE RUN		50710
DEPTH		26.12-26.35
SAMPLE DIAMETER	mm	79.70
SAMPLE HEIGHT	mm	181.09
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.8
TEST DURATION	mm.sec	7.14
DATE OF TESTING		24/01/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	9.18
POISSON'S RATIO *v*		0.24
UNCONFINED COMPRESSIVE STRENGTH	MPa	66.3

SAMPLE FAILURE SHAPES



External Internal

Axial & Diametric Stress / Strain Curves

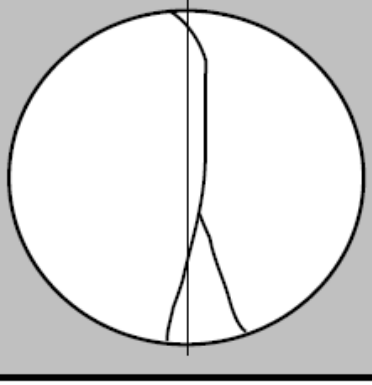


Test Notes:

Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 18.8MPa and 62.4MPa

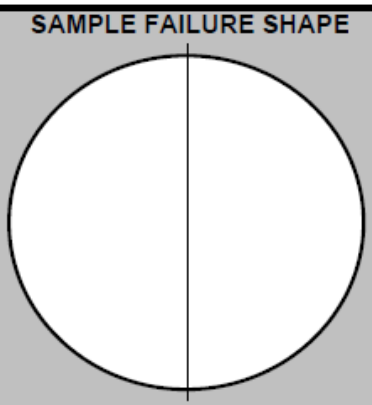
BOREHOLE		BH04
CORE RUN		48941
DEPTH		29.38-29.54
SAMPLE DIAMETER	mm	82.10
SAMPLE THICKNESS	mm	38.53
WATER CONTENT	%	0.1
DEGREE OF SATURATION	%	N/A
STRESS RATE	kN/s	1.90
TEST DURATION	secs	16
DATE OF TESTING		21-Jan-16
LOAD FRAME USED		Impact
ORIENTATION OF LOADING		Diam
TENSILE STRENGTH	MPa	5.97

SAMPLE FAILURE SHAPE



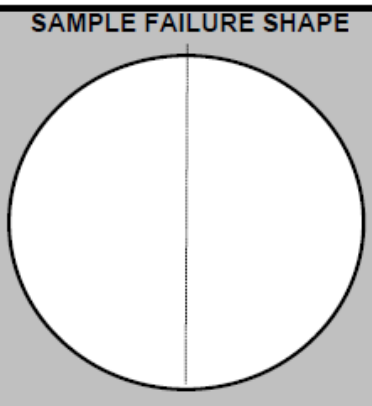
BOREHOLE		
CORE RUN		
DEPTH		
SAMPLE DIAMETER	mm	
SAMPLE THICKNESS	mm	
WATER CONTENT	%	
DEGREE OF SATURATION	%	
STRESS RATE	kN/s	
TEST DURATION	secs	
DATE OF TESTING		
LOAD FRAME USED		
ORIENTATION OF LOADING		
TENSILE STRENGTH	MPa	

SAMPLE FAILURE SHAPE



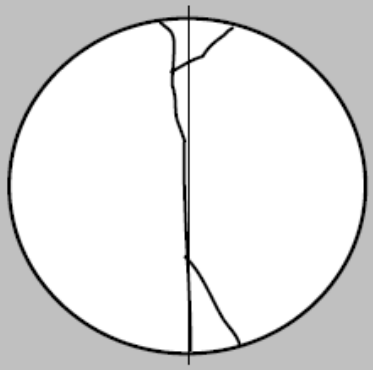
BOREHOLE		
CORE RUN		
DEPTH		
SAMPLE DIAMETER	mm	
SAMPLE THICKNESS	mm	
WATER CONTENT	%	
DEGREE OF SATURATION	%	
STRESS RATE	kN/s	
TEST DURATION	secs	
DATE OF TESTING		
LOAD FRAME USED		
ORIENTATION OF LOADING		
TENSILE STRENGTH	MPa	

SAMPLE FAILURE SHAPE



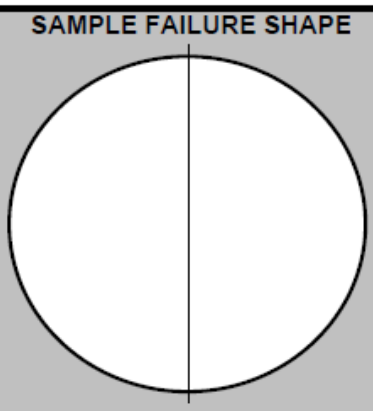
BOREHOLE		BH05
CORE RUN		50701
DEPTH		19.70-19.92
SAMPLE DIAMETER	mm	82.24
SAMPLE THICKNESS	mm	41.12
WATER CONTENT	%	0.2
DEGREE OF SATURATION	%	N/A
STRESS RATE	kN/s	0.80
TEST DURATION	secs	22
DATE OF TESTING		21-Jan-16
LOAD FRAME USED		Impact
ORIENTATION OF LOADING		Diam
TENSILE STRENGTH	MPa	3.39

SAMPLE FAILURE SHAPE



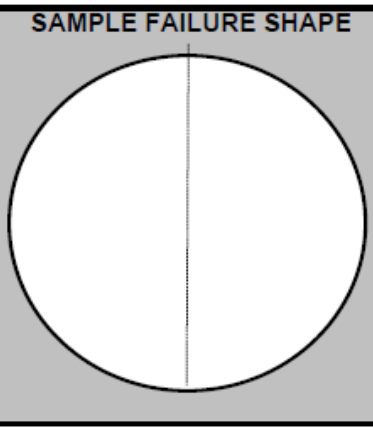
BOREHOLE		
CORE RUN		
DEPTH		
SAMPLE DIAMETER	mm	
SAMPLE THICKNESS	mm	
WATER CONTENT	%	
DEGREE OF SATURATION	%	
STRESS RATE	kN/s	
TEST DURATION	secs	
DATE OF TESTING		
LOAD FRAME USED		
ORIENTATION OF LOADING		
TENSILE STRENGTH	MPa	

SAMPLE FAILURE SHAPE



BOREHOLE		
CORE RUN		
DEPTH		
SAMPLE DIAMETER	mm	
SAMPLE THICKNESS	mm	
WATER CONTENT	%	
DEGREE OF SATURATION	%	
STRESS RATE	kN/s	
TEST DURATION	secs	
DATE OF TESTING		
LOAD FRAME USED		
ORIENTATION OF LOADING		
TENSILE STRENGTH	MPa	

SAMPLE FAILURE SHAPE



Priority Drilling Ltd.
Killimor
Ballinasloe
Co Galway
Ireland
8D23036i

Date: 29th March 2016
Test Report Ref. STR: 447866

LABORATORY TEST REPORT

TEST REQUIREMENTS: Unconfined compressive strength, elastic moduli & indirect tensile strength by Brazil.

SAMPLE DETAILS:

Certificate of sampling received:	**No**
Laboratory Ref. No:	**S56595**
Client Ref. No:	**Various**
Date and Time of Sampling:	**Unknown**
Date of Receipt at Lab:	**18/01/2016**
Date of Start of Test.:	**18/03/2016**
Sampling Location:	**Various**
Name of Source:	**Lackagh Quarry**
Method of Sampling:	**Unknown**
Sampled By:	**Client**
Aggregate Type and Nominal Size:	**Rock Testing**
Target Specification:	**N/A**

COMMENTS/ DEPARTURE FROM SPECIFIED PROCEDURE

The work was carried out by our competent, sub contracted laboratory.

RESULTS

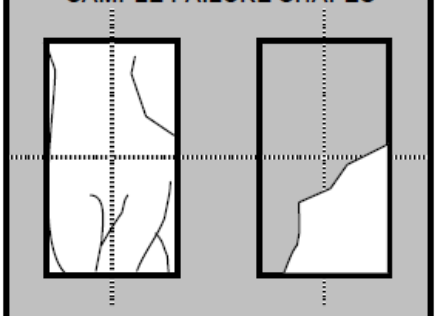
( ) E. R. Goulden
Technical Manager
Approved Signatories

( ) E. N. Jones
Soils Laboratory Manager

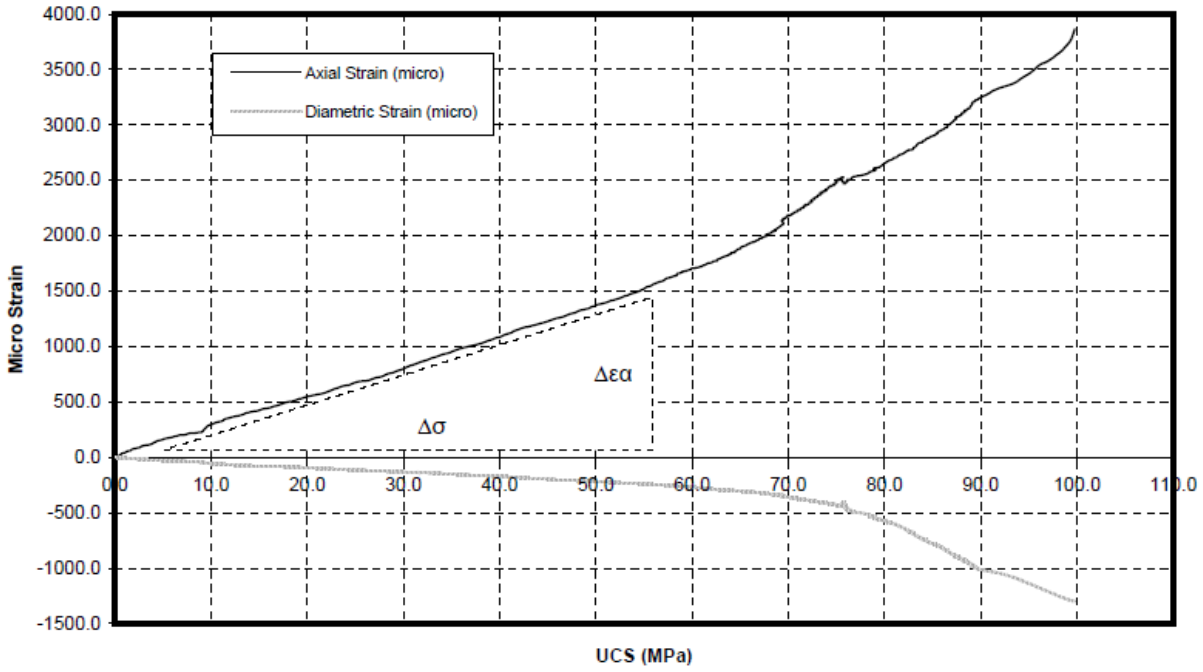
(✓) N Dumbarton
Assistant Laboratory Manager

BOREHOLE		BH01
CORE RUN		48867
DEPTH		11.57-11.94
SAMPLE DIAMETER	mm	61.08
SAMPLE HEIGHT	mm	137.42
WATER CONTENT	%	0.2
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.6
TEST DURATION	mm.sec	8.18
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	36.46
POISSON'S RATIO *v*		0.15
UNCONFINED COMPRESSIVE STRENGTH	MPa	99.8

SAMPLE FAILURE SHAPES



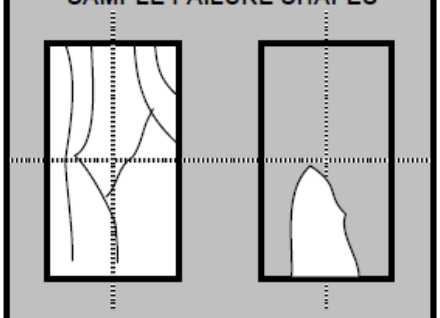
Axial & Diametric Stress / Strain Curves



Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 4.4MPa and 56MPa

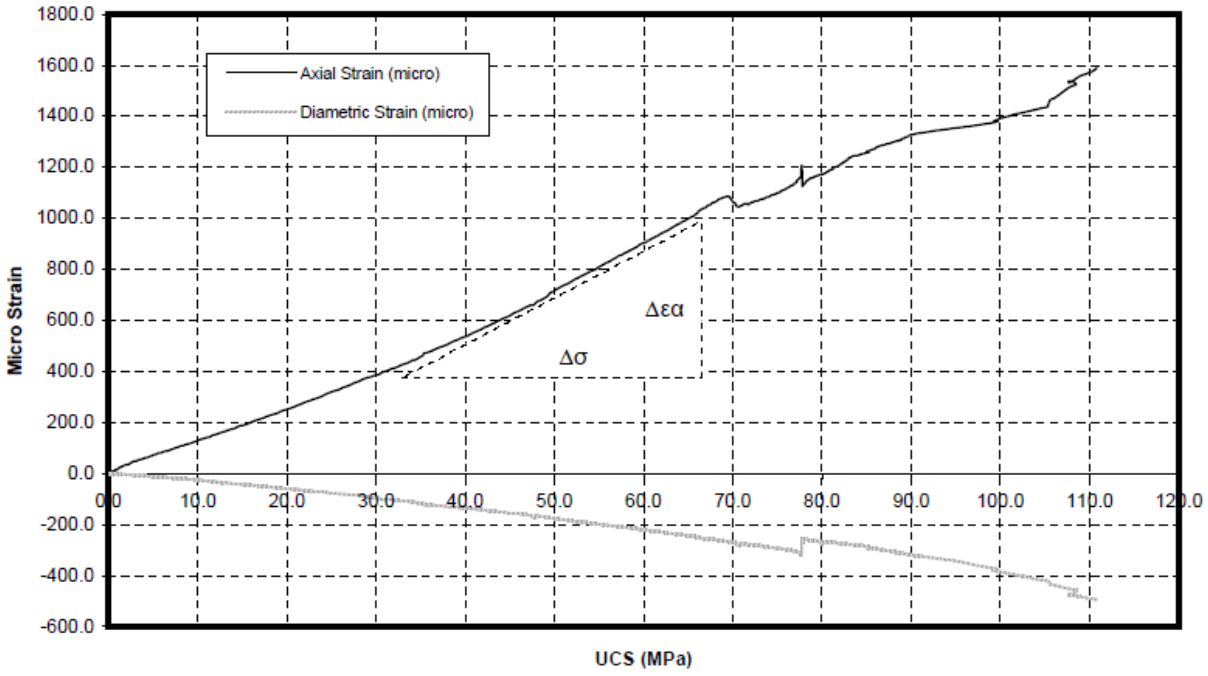
BOREHOLE		BH01
CORE RUN		48880
DEPTH		27.85-28.15
SAMPLE DIAMETER	mm	61.32
SAMPLE HEIGHT	mm	135.90
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	8.18
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	55.37
POISSON'S RATIO *v*		0.23
UNCONFINED COMPRESSIVE STRENGTH	MPa	112.4

SAMPLE FAILURE SHAPES



External Internal

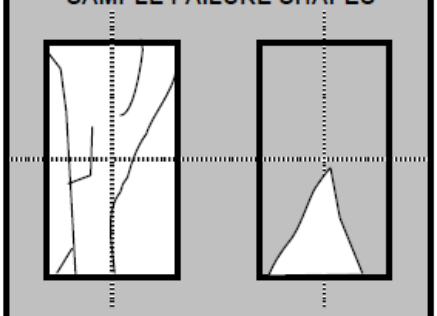
Axial & Diametric Stress / Strain Curves



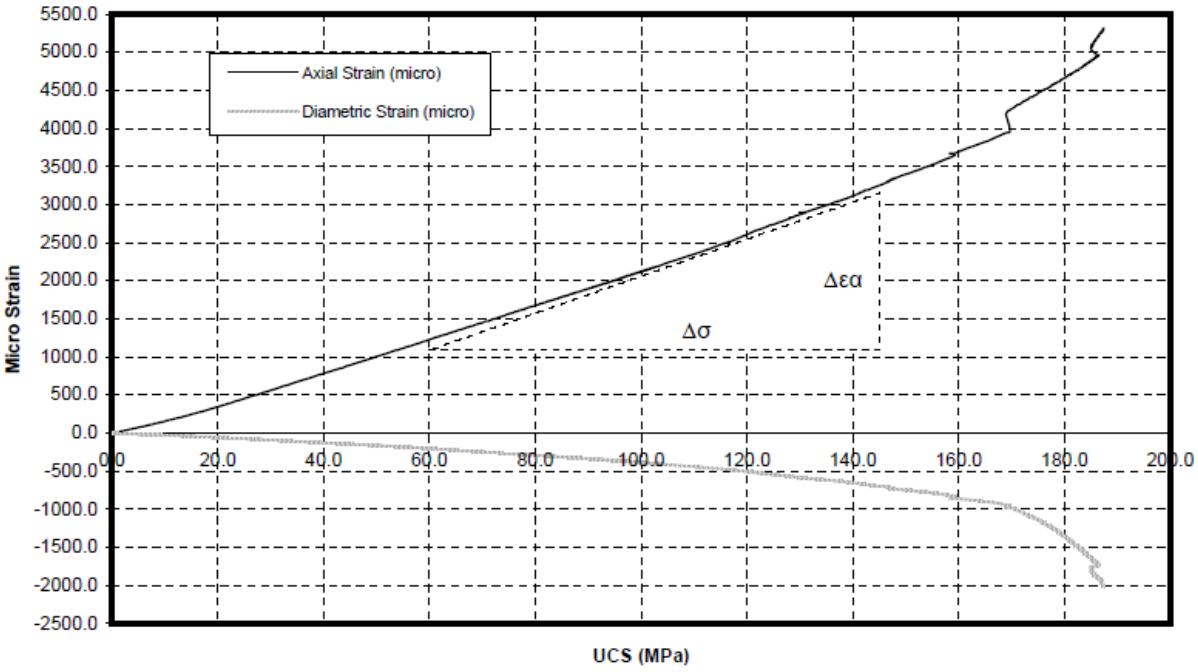
Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 32MPa and 66.7MPa

BOREHOLE		BH01
CORE RUN		48890
DEPTH		48.90-49.16
SAMPLE DIAMETER	mm	61.11
SAMPLE HEIGHT	mm	136.32
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	12.58
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	42.01
POISSON'S RATIO *v*		0.24
UNCONFINED COMPRESSIVE STRENGTH	MPa	187.5

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves

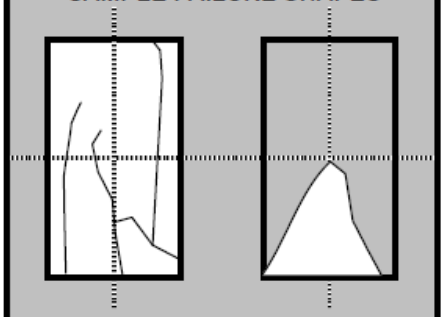


Test Notes:

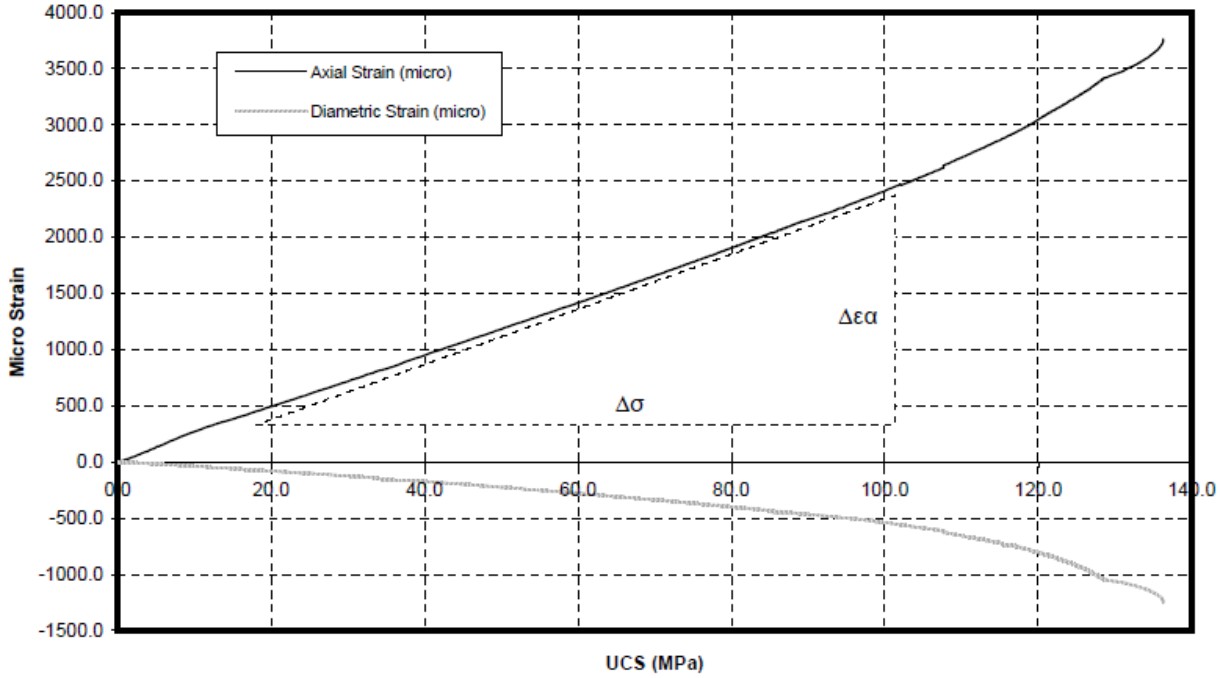
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 58.6MPa and 145.9MPa

BOREHOLE		BH01
CORE RUN		50869
DEPTH		72.10-72.30
SAMPLE DIAMETER	mm	60.91
SAMPLE HEIGHT	mm	134.09
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.6
TEST DURATION	mm.sec	10.36
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	41.60
POISSON'S RATIO *v*		0.24
UNCONFINED COMPRESSIVE STRENGTH	MPa	136.3

SAMPLE FAILURE SHAPES



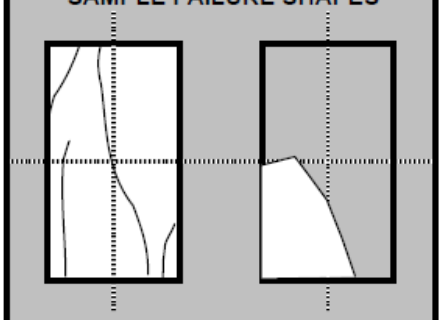
Axial & Diametric Stress / Strain Curves



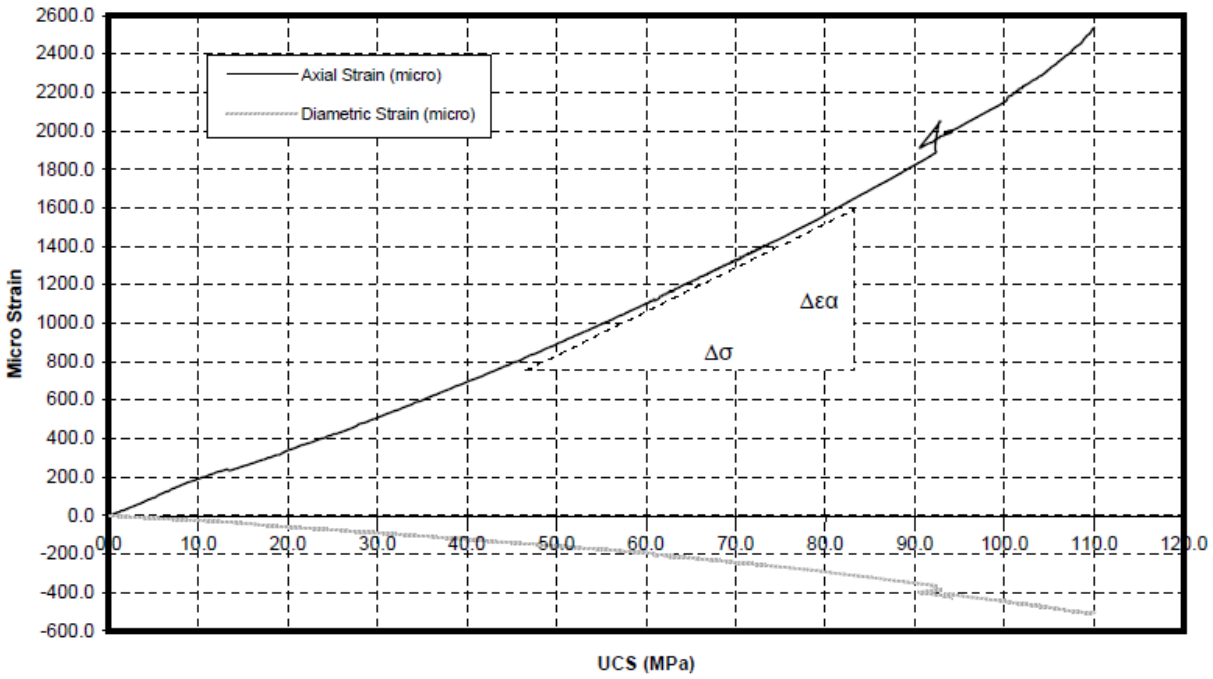
Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 16.8MPa and 102.1MPa

BOREHOLE		BH01
CORE RUN		50890
DEPTH		97.95-98.23
SAMPLE DIAMETER	mm	61.07
SAMPLE HEIGHT	mm	135.52
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	7.5
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	44.43
POISSON'S RATIO *v*		0.20
UNCONFINED COMPRESSIVE STRENGTH	MPa	110.0

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves

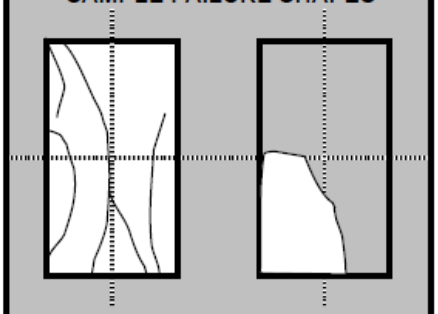


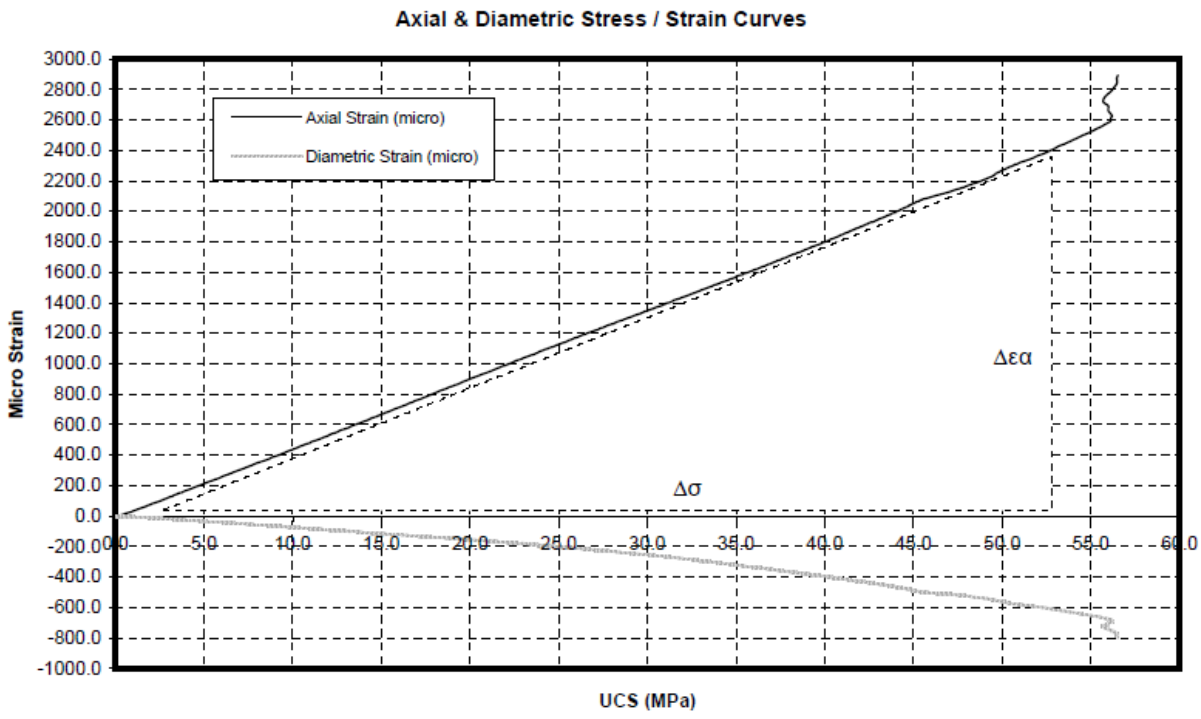
Test Notes:

Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 45.6MPa and 83.4MPa

BOREHOLE		BH01
CORE RUN		50921
DEPTH		140.00-140.20
SAMPLE DIAMETER	mm	61.10
SAMPLE HEIGHT	mm	135.31
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	4.05
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	21.81
POISSON'S RATIO *v*		0.25
UNCONFINED COMPRESSIVE STRENGTH	MPa	58.7

SAMPLE FAILURE SHAPES



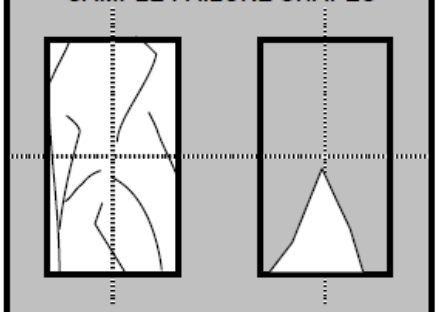


Test Notes:

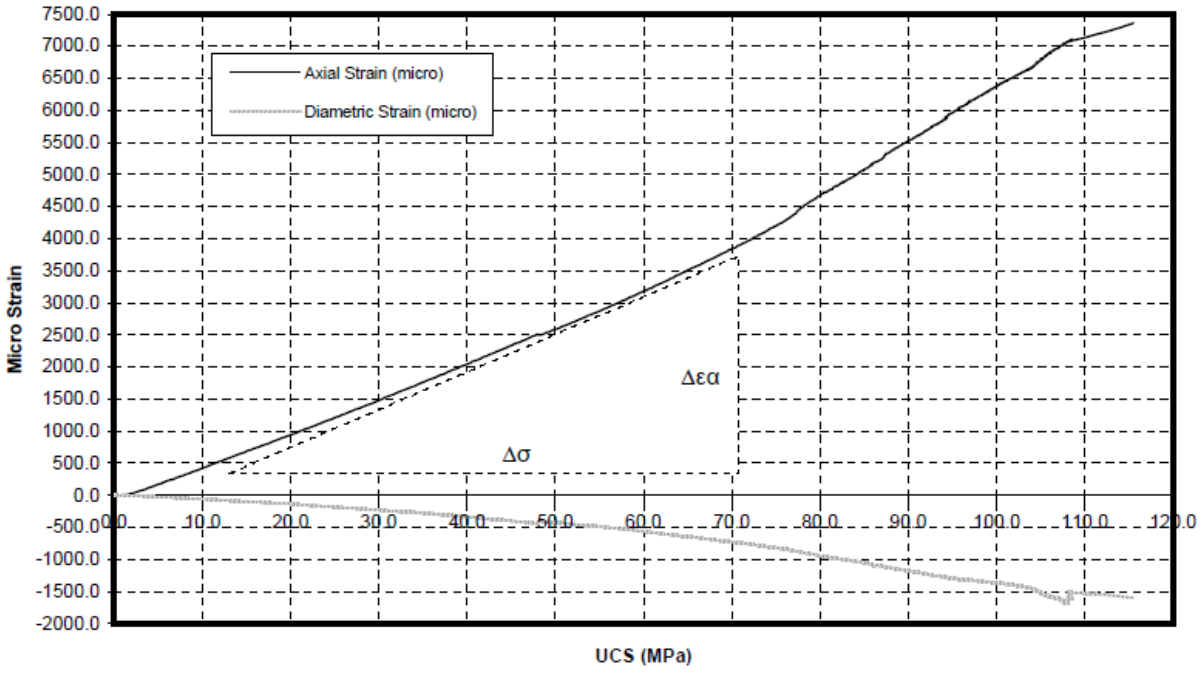
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 2.3MPa and 53MPa

BOREHOLE		BH01
CORE RUN		50950
DEPTH		183.17-183.40
SAMPLE DIAMETER	mm	61.20
SAMPLE HEIGHT	mm	136.93
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.9
TEST DURATION	mm.sec	6.55
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	17.44
POISSON'S RATIO *v*		0.20
UNCONFINED COMPRESSIVE STRENGTH	MPa	118.6

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves



Test Notes:

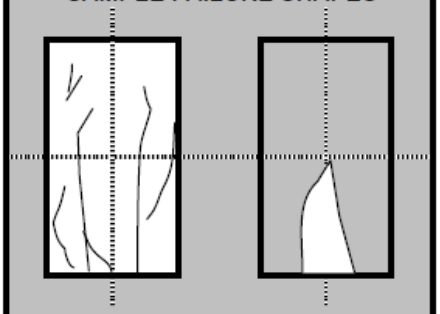
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve

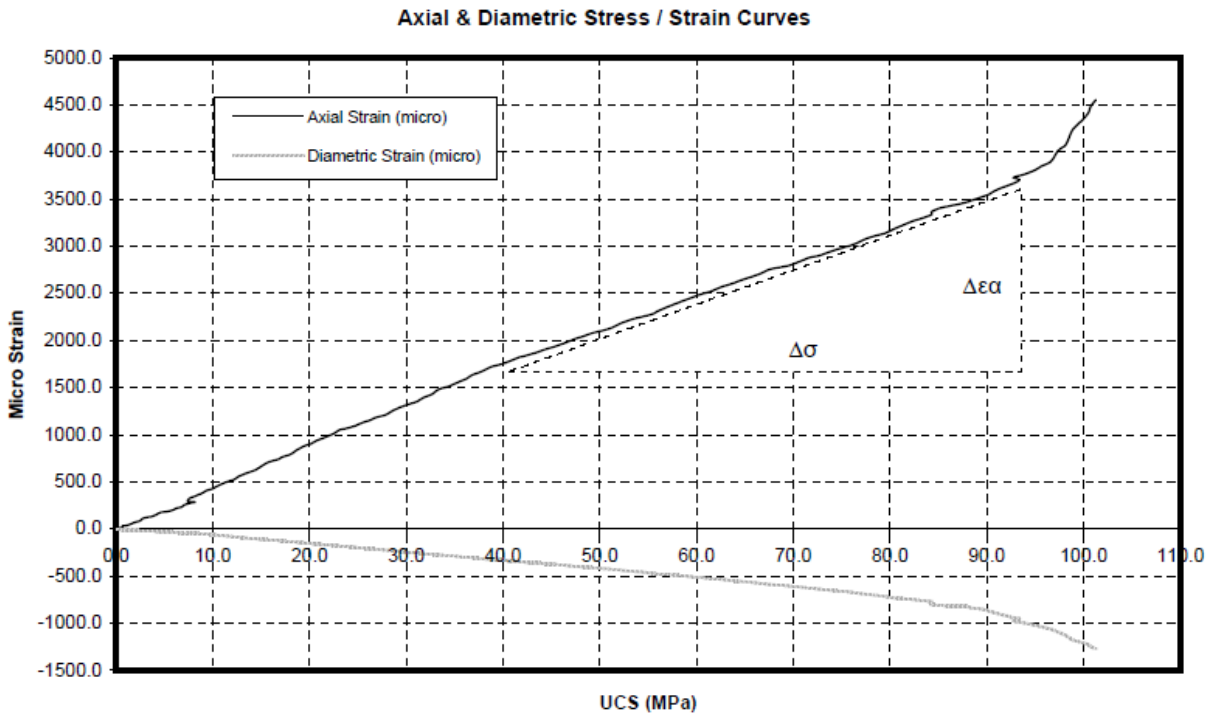
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve

Young's modulus and poisson's ratio calculated between stress levels of 12.4MPa and 70.7MPa

BOREHOLE		BH01
CORE RUN		50973
DEPTH		212.33-212.58
SAMPLE DIAMETER	mm	61.08
SAMPLE HEIGHT	mm	136.48
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	7.33
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	26.89
POISSON'S RATIO *v*		0.31
UNCONFINED COMPRESSIVE STRENGTH	MPa	104.7

SAMPLE FAILURE SHAPES



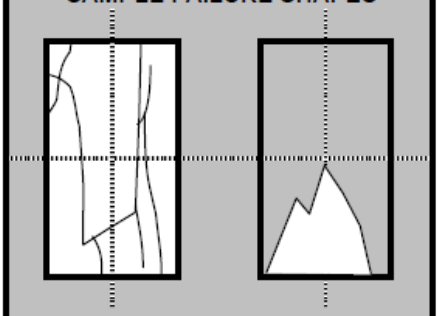


Test Notes:

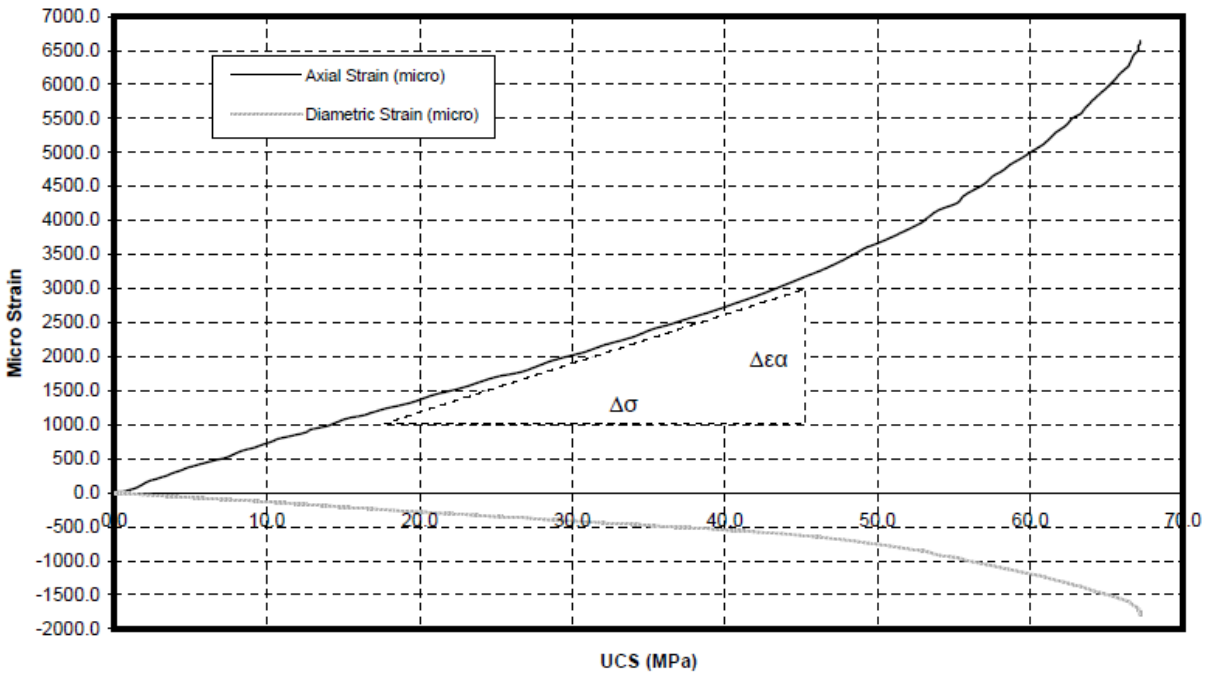
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 39.7MPa and 93.4MPa

BOREHOLE		BH01
CORE RUN		50988
DEPTH		232.46-232.60
SAMPLE DIAMETER	mm	60.90
SAMPLE HEIGHT	mm	125.20
WATER CONTENT	%	0.2
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.4
TEST DURATION	mm.sec	8.19
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	14.17
POISSON'S RATIO *v*		0.19
UNCONFINED COMPRESSIVE STRENGTH	MPa	69.6

SAMPLE FAILURE SHAPES



Axial & Diametric Stress / Strain Curves

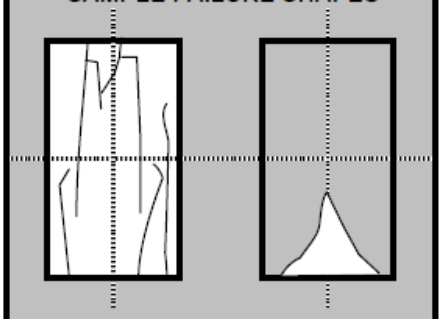


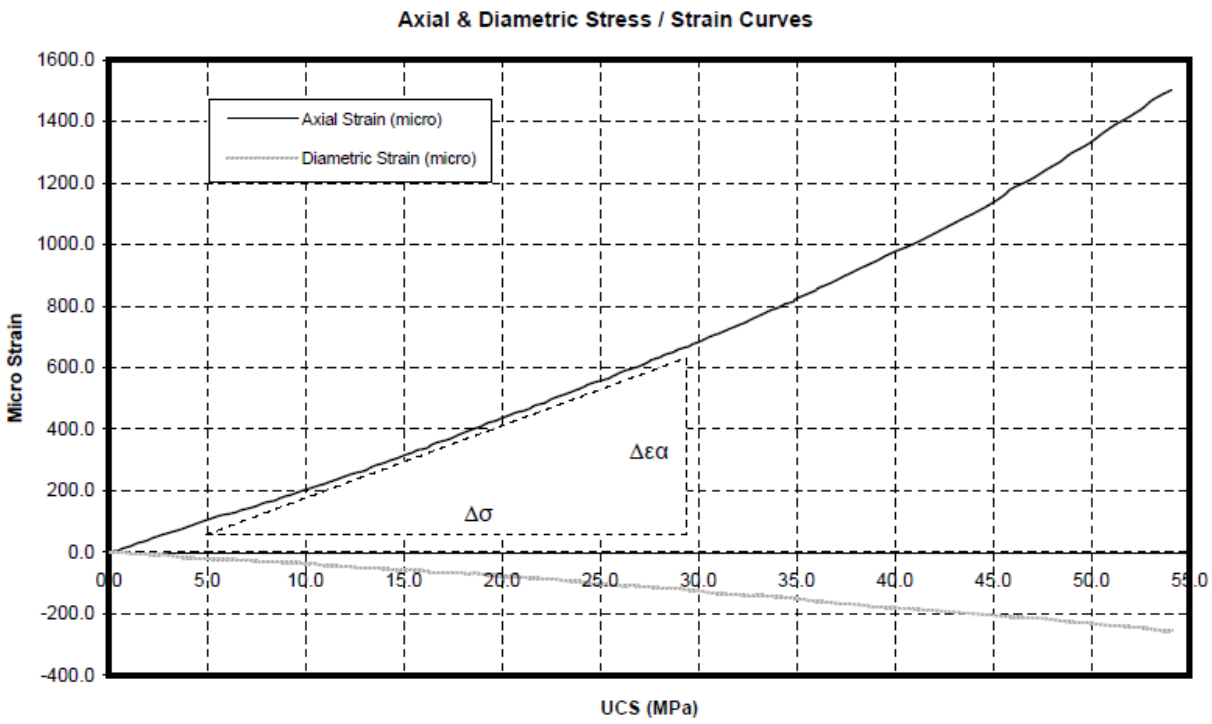
Test Notes:

Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 16.8MPa and 45.4MPa

BOREHOLE		BH01
CORE RUN		50996
DEPTH		250.30-250.56
SAMPLE DIAMETER	mm	60.88
SAMPLE HEIGHT	mm	126.80
WATER CONTENT	%	0.1
TEST CONDITION		As Received
RATE OF LOADING	kN/s	0.7
TEST DURATION	mm.sec	4.17
DATE OF TESTING		22/03/2016
LOAD FRAME USED		2000kN
LOAD DIRECTION WITH RESPECT TO LITHOLOGY		Perpendicular
YOUNG'S MODULUS *E* (AVERAGE)	GPa	43.34
POISSON'S RATIO *v*		0.18
UNCONFINED COMPRESSIVE STRENGTH	MPa	56.4

SAMPLE FAILURE SHAPES

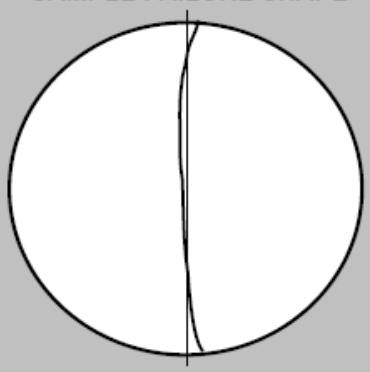




Test Notes:
Method of Young's modulus determination - Average Modulus of Linear Portion of Axial Stress-Strain Curve
Method of Poisson's ratio determination - slope of axial curve / slope of lateral curve
Young's modulus and poisson's ratio calculated between stress levels of 5MPa and 29MPa

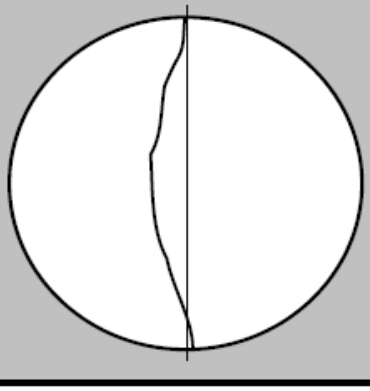
BOREHOLE		BH01
CORE RUN		50858
DEPTH		64.20-64.50
SAMPLE DIAMETER	mm	60.97
SAMPLE THICKNESS	mm	30.76
WATER CONTENT	%	0.3
DEGREE OF SATURATION	%	N/A
STRESS RATE	kN/s	1.10
TEST DURATION	secs	20
DATE OF TESTING		21-Mar-16
LOAD FRAME USED		2000kN
ORIENTATION OF LOADING		Diam
TENSILE STRENGTH	MPa	7.80

SAMPLE FAILURE SHAPE



BOREHOLE		BH01
CORE RUN		50892
DEPTH		102.90-103.20
SAMPLE DIAMETER	mm	61.19
SAMPLE THICKNESS	mm	30.52
WATER CONTENT	%	0.1
DEGREE OF SATURATION	%	N/A
STRESS RATE	kN/s	1.50
TEST DURATION	secs	24
DATE OF TESTING		21-Mar-16
LOAD FRAME USED		2000kN
ORIENTATION OF LOADING		Diam
TENSILE STRENGTH	MPa	12.60

SAMPLE FAILURE SHAPE



BOREHOLE		BH01
CORE RUN		50948
DEPTH		180.24-180.50
SAMPLE DIAMETER	mm	61.51
SAMPLE THICKNESS	mm	30.46
WATER CONTENT	%	3.9
DEGREE OF SATURATION	%	N/A
STRESS RATE	kN/s	1.7
TEST DURATION	secs	26
DATE OF TESTING		21-Mar-16
LOAD FRAME USED		2000kN
ORIENTATION OF LOADING		Diam
TENSILE STRENGTH	MPa	14.60

SAMPLE FAILURE SHAPE