TotalEnergies E&P Namibia

Environmental Baseline Survey: Block 2913B

Environmental Baseline and Habitat Assessment Survey Report

Dates of Survey:

Phase 1 (Block 2913B - Venus-2): 26.07.2022 – 09.08.2022
Phase 2 (Block 2913B & Venus-1X): 07.09.2022 – 30.09.2022

Prepared By:
Benthic Solutions Limited
Unit A Greengates Way
Hoveton
Norfolk
United Kingdom

Survey Supported By:
Creocean
128 ave de Fès
34080 Montpellier
France

Client:
TotalEnergies E&P Namibia
55 Ausspannplatz
Rehoboth Rd
Windhoek
Namibia

Document Ref.	Revision	Date	Author	Review	Approved
BSL2202_TEEPNA _B2913B_EBS-HAS	00	03/03/2023	L. Warburton; A. Wilson	P. Collins	L. Bostock
BSL2202_TEEPNA _B2913B_EBS-HAS	01	25/07/2023	L. Warburton; A. Wilson	L. Bostock	L. Bostock
BSL2202_TEEPNA _B2913B_EBS-HAS	02	04/09/2023	L. Warburton; A. Wilson	L. Bostock	L. Bostock
BSL2202_TEEPNA _B2913B_EBS-HAS	03	07/09/2023	L. Warburton; A. Wilson	L. Bostock	L. Bostock

Table of Contents

Figures

Tables

Table of Abbreviations

Abbreviation	Meaning	Abbreviation	Meaning
$\mu g.l^{-1}$	Micrograms per litre	MSL	Mean Sea Level
AAIW	Antarctic Intermediate Water	mV	Millivolts
Al	Aluminium (element)	NADW	North Atlantic Deep Water
AMBI	Marine Biotic Index	NB	Niskin Bottle
ANZECC	Australian and New Zealand Environment and Conservation Council	NDIR	Non-Dispersive Infra-Red
AQA	Analytical Quality Assurance	Ni	Nickel (element)
AQC	Analytical Quality Control	NIMPA	Namibian Islands Marine Protected Area
AR	Aqua Regia	NMBAQC	Northeast Atlantic Marine Biological Association Quality Control scheme
As	Arsenic (element)	nMDS	Non-metric Multi-Dimensional Scaling
B2913B	Licence Block 2913B	NO_2	Nitrite
Ba	Barium (element)	NO_3	Nitrate
BC	Box Core	NPD	Naphthalene, Phenanthrene and Dibenzothiophene
BCI	Biotic Coefficient Index	NQEp	Provisional Environmental Quality Standards
BCLME	Benguela Current Large Marine Ecosystem	NTU	Nephelometric Turbidity Units
Be	Beryllium (element)	OMZ	Oxygen Minimum Zone
BSL	Benthic Solutions Limited	OSPAR	Convention for the Protection of the Marine Environment of the North-East Atlantic
BTEX	Benzene, Toluene, Ethyl benzene and Xylene	P/B	Petrogenic / Biogenic
CBD	Convention on Biological Diversity	PAH	Polycyclic Aromatic Hydrocarbon
Cd	Cadmium (element)	PAHMSW	Polycyclic Aromatic Hydrocarbon Mass Spectrometry Sea Water
CFU	Colony Forming Unit	PAM	Passive Acoustic Monitoring
CLUSTER	Hierarchical Agglomerative Clustering	Pb	Lead (element)
CM	Central Meridian	PCA	Principle Component Analysis
Co	Cobalt (element)	PCR	Polymerase Chain Reaction
CPI	Carbon Preference Index	PEP	Project Execution Plan
Cr	Chromium (element)	pH	Potential of Hydrogen
CSA	CSA Ocean Sciences	PN	Plankton Net
CTD	Conductivity, Temperature, Depth	PO_4	Orthophosphate
Cu	Copper (element)	ppm	Parts per million
CV	Coefficient of Variation	Pr	Pristane
d/w	Dry weight	Pr/Ph	Pristane Phytane ratio
DBT	Dibenzothiophene	PRIMER	Plymouth Routines in Multivariate Ecological Research software
DCM	Dichloromethane	PSA	Particle Size Analysis
DNA	Deoxyribonucleic Acid	PSD	Particle Size Distribution
DO	Dissolved Oxygen	PSU	Practical Salinity Unit
DTM	Digital Terrain Model	PSV	Platform Supply Vessel
DVV	Double Van Veen	PT	Plankton Trawl
E&P	Exploration and Production	PWL	Proposed Well Location
EBS	Environmental Baseline Study	Redox	Reduction-Oxidation
EBSA	Ecologically or Biologically Significant Marine Areas	RELATE	Relationship Testing
EBUS	Eastern Boundary Upwelling System	SACFOR	Superabundant, Abundant, Common, Frequent, Occasional and Rare Abundance Scale
eDNA	Environmental Deoxyribonucleic Acid	SASSW	South Atlantic and Subtropical Surface Waters

Abbreviation	Meaning	Abbreviation	Meaning
EPOS	Environmental Post Operations Survey	Sb	Antimony (element)
ERL	Effects Range Low	SD	Standard Deviation
ERM	Effects Range Median	SE	Southeast
ESACW	Eastern South Atlantic Central Water	Se	Selenium (element)
EUNIS	European Nature Information Service	SHE	Standard Hydrogen Electrode
FAV	Final Acute Value	SIMPER	Similarity Percentages Analysis
FCV	Final Chronic Value	SIMPROF	Similarity Profiling Analysis
Fe	Iron (element)	Sn	Tin (element)
FWL	Final Well Location	SOP	Standard Operating Procedure
GC	Gas Chromatography	STR	Subsea Technology & Rentals
GC-FID	Gas Chromatography - Flame Ionization Detector	SWL	Sampled Well Location
GC-MS	Gas Chromatography – Mass Spectrometry	TC	Total Carbon
GPS	Geographical Positioning System	TEEPNA	Total Energies Exploration & Production Namibia
H_2S	Hydrogen Sulphide	THC	Total Hydrocarbon Content
HC	Hydrocarbon	Ti	Titanium (element)
HD	High Definition	TIC	Total Inorganic Carbon
Hg	Mercury (element)	TOC	Total Organic Carbon
HM	Heavy Metals	TOM	Total Organic Matter
ICP-AES	Inductively Coupled Plasma - Atomic Emission Spectroscopy	TPH	Total Petroleum Hydrocarbon
ICP-MS	Inductively Coupled Plasma – Mass Spectrometry	TPHFID	Total Petroleum Hydrocarbon Flame Ionization
ICP-OES	Inductively Coupled Plasma – Optical Emission Spectroscopy	TSS	Total Suspended Solids
IMS	Industrial Methylated Spirit	UCM	Unresolved Complex Mixture
IOE	Index of Organic Enrichment	UK	United Kingdom
IR	Infra-Red	UKAS	United Kingdom Accreditation Service
KONENS	Method of colorimetry analysis	USEPA	United States Environmental Protection Agency
LARS	Launch and Recovery System	UTC	Coordinated Universal Time
Lebensspuren	Biologically formed sedimentary structure, e.g. animal tracks and burrows	UTM	Universal Transverse Mercator
Li	Lithium (element)	UV	Ultra-violet
LME	Large Marine Ecosystem	UVP	Underwater Video Profiler
LoD	Limit Of Detection	V	Vanadium (element)
LOI	Loss On Ignition	VIS	Visible Spectrum Light
LoQ	Limit of Quantification	VOCHSAS	Volatile Organic Compounds in Soil by Headspace GC-MS
MARBEC	Centre of Marine Biodiversity, Exploitation and Conservation	WAS	Wilson Auto-siever
MDS	Multi-Dimensional Scaling	WGS84	World Geodetic System 1984
ME6211	Cerianthid anemones and burrowing megafauna in Atlantic mid bathyal mud	Zn	Zinc (element)
$mg.kg^{-1}$	Milligrams per kilogram		
MG62	Atlantic Abyssal Mud		
MG62	Atlantic Abyssal Mud		
MMO	Marine Mammal Observer		
Mn	Manganese (element)		
Mo	Molybdenum (element)		

Executive Summary

A localised environmental baseline and habitat assessment survey was conducted for TotalEnergies E&P Namibia (TEEPNA) within Block 2913B, approximately 270km offshore Namibia. Environmental operations were carried out by Benthic Solutions Limited (BSL) between the 26th of July and the 9th of August 2022 aboard the *PSV Shepard Tide* during the Venus-2 phase 1 and between the 7th and 30th of September 2022 aboard the *PSV Bourbon Evolution* during the Venus-1X and wider Block survey phase 2. **Note that post-survey operations the Venus-2 well was officially renamed Venus-1A, but for continuity between the survey and reporting phases of this project the well is referred to as Venus-2.**

There is limited knowledge pertaining to Block 2913B with the deep waters of Namibia virtually unexplored. This study aimed to provide an understanding of the conditions of the Block's deep water bathyal plains by characterising the physico-chemistry properties of the sediment and the habitats present.

Block 2913B covers an approximate surface area of 8,215km^2 with a water depth ranging from approximately 2,500m to over 3,200m below sea level. The Venus-2 proposed well location (PWL) is situated in a water depth of 2,970m. Environmental sampling involved the acquisition of physico-chemical and macrofauna samples using a Grey-O'Hara 0.25m^2 box corer at 20 stations at the Venus-2 PWL area and a further 54 stations distributed across the Block. Seabed video footage was obtained using a combination of live-feed and non-live feed pressure camera systems to provide HD quality footage at 12 stations. Seawater samples were collected at a total of eight stations (two during phase 1 and six during phase 2 of the survey), from three depths relating to near seabed, mid-water and surface using Niskin bottles. Full seawater profiles were completed using the multiparameter Valeport MIDAS to the full water depth at each of the five stations to assess the water quality across the survey area. **Note that eight sediment stations, 1 water station and two video transects were associated to the Venus-1X final well location (FWL) and have been excluded from this analysis and reported in the separate EPOS report.**

Particle size analysis revealed sediments within the Block to be exclusively dominated by fines, with the majority of stations classified as 'Sandy Mud' on the Folk classification scale. The camera footage acquired confirmed the seafloor to be a generally uniform fines dominated soft-bottom habitat.

Total organic carbon (TOC), total organic matter (TOM), nitrogen and phosphorous were low throughout the survey area. Similarly, total hydrocarbon content (THC), saturate alkanes and polycyclic aromatic hydrocarbons (PAH) were low and indicative of a pristine deep-sea environment. Gas chromatogram inspection revealed some partially unresolved complex mixtures present, likely as a result of regional influences. There were no distinct drilling fluid signatures in the GC-traces. TOC, TOM and hydrocarbon results were very slightly higher at stations comprising the cruciform sampling surrounding the Venus-2 PWL, but this reflects the sample analysis of phase 1 and phase 2 occurring in different periods of the laboratory schedule. Apart from this, there was no clear geographic or depth related pattern in hydrocarbon values throughout Block 2913B. Sediment BTEX were below their respective Limit of detections.

Concentrations of most metals remained at low concentrations throughout the Block. Where almost all metals were found to be below reference values, with only nickel was above the ANZECC sediment quality guideline value (SQGV) and OSPAR effect range low (ERL) at some stations. Barium and barium by fusion were consistently low throughout the Block.

A total of 2,534 individuals were recorded from the 66 samples analysed, of which 88 annelid species accounted for 54.1% of the total number of individuals. Shannon-Wiener Diversity Index values indicating 'good' diversity across the Block. Multivariate analysis split the dataset into four significantly different macrofaunal groupings at a Bray-Curtis similarity slice of 25%. However, all clusters were considered to reflect typical background communities for deep-sea sediments, with differences thought to reflect natural patchiness in the distribution of benthic faunal communities or differences in grab retention, as opposed to the influence of notable physical or chemical gradients. Aerobic heterotrophic microorganisms were present in high quantities across the Block, while hydrocarbon degrading microorganisms were recorded in variable quantities from below the limit of detection to over 11,000NPP.g^{-1} at six stations.

The water column profiles within Block 2913B indicated a thermocline in the surface water mass (South Atlantic and Subtropical Surface Waters), before showing typical properties for Eastern South Atlantic Central Water (ESACW) to around 700m depth, then transitioning through of Antarctic Intermediate Water (AAIW) to 1000m into North Atlantic Deep water (NADW) to the seabed. All chemicals analysed in the water samples, including nutrients, were low and at expected natural levels, revealing an homogeneous and uncontaminated seawater environment.

Chlorophyll-*a* and phaeopigments were low in the two samples analysed in Block 2913B. Phytoplankton numbers were moderate, where the assemblages were mainly dominated by diatoms followed by dinoflagellates. The zooplankton trawls were dominant by copepods.

The seabed across the Block was deemed to include one level three EUNIS habitat type: MG62 'Atlantic abyssal mud'. Surface sediments across the survey area were heavily reworked by bioturbation ('Lebensspuren') with evidence of crustacean and polychaete burrows, urchin tracks and Hemichordata (possibly *Tergivelum cinnabarinum*) feeding spirals. Although no benthic habitat legislation was directly applicable to Namibian waters, a precautionary approach was taken and a single potentially sensitive habitat, 'Seapen and burrowing megafauna communities', was identified as potentially forming isolated patches within the survey area. This habitat is listed by one or more International Conventions, European Directives or UK Legislation, which can be used as a good indicator of the sensitive habitats present. Nevertheless, no megafauna was observed interacting with the burrows in the acquired footage, and these areas are not thought to be of conservation interest in Namibian waters, where this habitat does not appear to be particularly rare or at risk from anthropogenic impact.

1 Introduction

1.1 Project Information

Client:	TotalEnergies E&P Namibia
Service:	Block 2913B Localised Environmental Baseline Survey
Contractor:	Benthic Solutions Limited (BSL)
Contractor Reference:	2202
Survey Area:	Namibia: Block 2913B
Survey Type:	Preliminary Environmental Baseline and Habitat Assessment Survey Report
Survey Period:	Phase 1 (Block 2913B & Venus-2): 26.07.2022-09.08.2022 Phase 2 (Block 2913B & Venus-1X): 07.09.2022-30.09.2022
Survey Vessel:	Phase 1 (Block 2913B & Venus-2): PSV *Shepherd Tide* Phase 2 (Block 2913B & Venus-1X): PSV *Bourbon Evolution 807*
Survey Equipment:	1 x 0.5m^2 Box Core, 1 x 0.25m^2 Box Core, 1 x DVV Grabs, 2 x *Wilson* Auto-siever, 3 x Pressure Cameras, 2 x Live Feed Cameras, 2 x CTD Multiprofilers, 6 x 10L Niskin Bottles, 1 x eDNA Pump, 1 x Bongo Plankton Net System (Phytoplankton and Zooplankton), 1 x Chl-α pump, 1 x NORM meter, 2x PAM systems (Vanishing Point), 1 x Launch and Recovery System (LARS), 1 x RAPP Winch, 1 x MARE Winch, 1 x ORE Winch
Client Project Manager:	Saviour Ufot (saviour.ufot@totalenergies.com) Marie-Line Pagnoux (marie-line.pagnoux@external.totalenergies.com)
Contractor Project Manager:	Cécile Bertin (cecile.bertin@benthicsolutions.com)

1.2 Project Overview

TotalEnergies E&P Namibia (hereinafter referred to as TEEPNA) contracted Benthic Solution Limited (BSL) to conduct an Environmental Baseline Study (EBS) located in Namibian waters on Block 2913B (Figure 1.1). Licence Block 2913B (B2913B) was surveyed in two operational phases, with phase 1 focussed on the Venus-2 (also known as Venus-1A) proposed well location (PWL) and completed between the 26th July and the 9th August 2022 aboard the PSV *Shepherd Tide.* Phase 2 survey operations were carried out aboard the supply vessel (SV) *Bourbon Evolution 807* between the 7th September and the 30th September 2022. Phase 2 environmental operations were conducted through different priority areas and revisited eight pre-drill stations of the Venus-1X well area to gather information on the physico-chemical and biological environment post drilling operations (BSL, 2019 and 2023c).

This report will focus on the habitat investigation, ground-truthing and environmental baseline assessment conducted across Block 2913B, including the development area containing the Venus-2 PWL as well as wider priority and secondary areas. The results and interpretation of the Venus-1X post-drill survey (8 stations) is reported separately in the subsequent environmental post operations survey report (BSL, 2023c).

Block 2913B covers an approximate surface area of 8,215km^2 with a water depth ranging from approximately 2,500m to over 3,200m below sea level. The Venus-1X final drilled well (FWL) is situated in a water depth of 2,970m located 4m west from the initial proposed Venus-1X well location (PWL). The Venus-2 PWL is also situated in a water depth of 2,900m. The proposed and final drilled well locations for both Venus-2 and Venus-1X are presented in Table 1.1, along with the sampled proposed well location (SPWL) and the sampled final well location (SFWL).

Environmental seabed, water column sampling and video assessments were conducted across B2913B to provide a regional understanding of the different habitats encountered. Sampling stations at the Venus-2 PWL will act as a reference point for future monitoring.

Data was acquired through sampling of the seabed using a 0.25m^2 box corer due to soft depositional sediments present. Seawater samples were taken from three key layers within the water column using Niskin bottles. Seabed video footage was obtained using a combination of live-feed and non-live feed pressure camera systems to provide HD quality footage (Appendix XVI – Seabed Photographs from Transects).

Table 1.1 Proposed, Final and Sampled Well Locations in Block 2913B

Geodetics: WGS84 UTM 33S			
Well	**Easting (m)**	**Northing (m)**	**Depth (m)**
Venus-1X PWL (2018)	331 857	6 737 905	2,970
Venus-1X SPWL (2018)	331 843	6 737 915	2,964
Venus-1X FWL (2021)	331 854	6 737 902	2,970
Venus-1X SFWL (2022)	331 901	6 737 835	2,963
Venus 2 PWL (2022)	326 890	6 749 285	2,900
Venus-2 SPWL (2022)	326 897	6 749 287	2,900

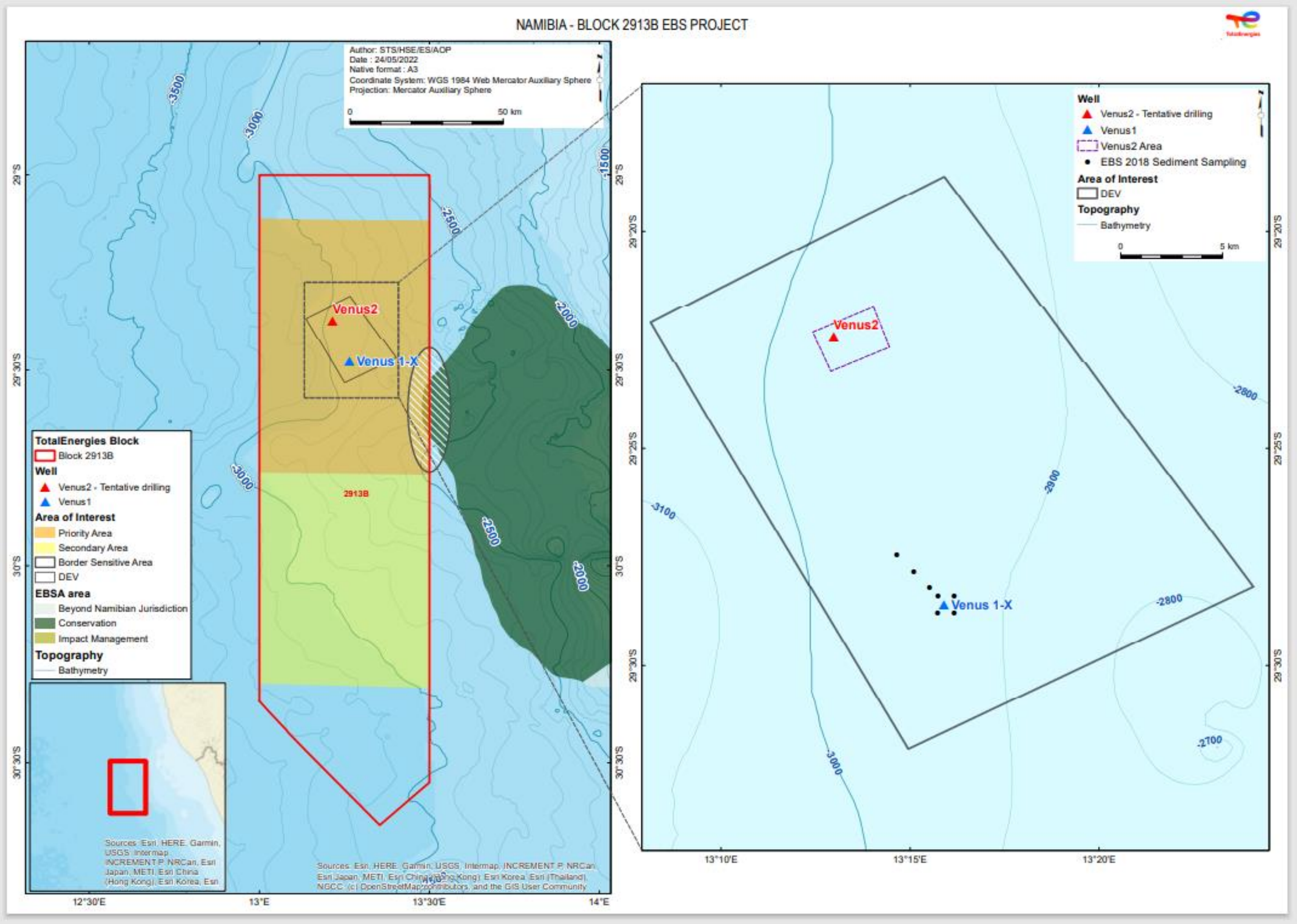


Figure 1.1 Licence Block 2913B - Offshore Namibia

1.3 Scope of Work

The survey included characterisation of the benthos and water column physico-chemistry and biology, as well as, monitoring of anthropogenic activity (i.e. vessel traffic) and opportunistic observations of marine megafauna by marine mammal observations (MMO) and passive acoustic monitoring (PAM), to provide an understanding of the baseline conditions prior to commencing further drilling and development activities.

The main objectives for surveying within Block 2913B were to:

- Acquire baseline data of sediment and water column physico-chemical characteristics;
- Identify and assess any existing pollutants within the sediment and the water column, in particular, those related to oil and gas activities, before new operations;
- Identify sensitive habitats or species susceptible to disturbance from drilling related activities;
- Establish an understanding of the natural variation in environmental conditions against which the environmental impact of future oil and gas operations can be assessed.

1.4 Reporting Structure

The following reports will be provided by BSL and Creocean, relating to the operations within Blocks 2912 and 2913B conducted offshore Namibia:

Table 1.2 Multiblock Survey Reporting Structure – Namibia

Report Volume.	Block	Report title	Provided by	Citation
Field Reports				
1	2913B	Environmental Baseline Survey: Block 2913B: Phase 1, Venus-2. Field Report	BSL	BSL, 2022a
2	2913B	Environmental Baseline Survey: Block 2913B: Phase 2, Regional and Venus-1X. Field Report	BSL	BSL, 2022b
3	2912	Environmental Baseline Survey: Block 2912: Field Report	BSL	BSL, 2022c
Marine Mammals Reports				
4	2913B	Environmental Baseline Survey: Block 2913B: Marine Mammal Observation Monitoring Report	BSL	BSL, 2022d
5	2912	Environmental Baseline Survey: Block 2912: Regional. Marine Mammal Observation Monitoring Report	BSL	BSL, 2022e
Environmental Reports				
6	**2913B**	**Environmental Baseline Survey: Block 2913B: Final Environmental Baseline and Habitat Assessment Survey (this report)**	**BSL**	**BSL, 2023a**
7	2913B	Environmental Baseline Survey: Block 2913B: Final environmental DNA Report	BSL	BSL, 2023b
8	2913B	Environmental Post-Operations Survey: Block 2913B: Venus-1X: Final EPOS	BSL	BSL, 2023c
9	2912	Environmental Baseline Survey: Block 2912: Final Environmental Baseline and Habitat Assessment Survey	Creocean	Creocean, 2023a
10	2912	Environmental Baseline Survey: Block 2912: Final environmental DNA Report	BSL	BSL, 2023d

1.5 Background Information and Reference Levels

1.5.1 *Background Information Relating to Offshore Namibia*

Before sampling commenced within Block 2913B, a bibliographic study of the regional area was produced by BSL for the Venus-1X PWL area (BSL, 2019), in conjunction with the 'Marine Spatial Planning' report published by the Ministry of Fisheries and Marine Resources (MFMR) (2021). The documents included an in-depth overview of the current literature for the offshore Namibia region, characterising the environment and identifying areas of specific concern and sensitivity in the regional area. A summary of its findings for Block 2913B is provided below.

1.5.1.1 *Ecologically or Biologically Significant Marine Areas*

The Convention on Biological Diversity (CBD) aims to address the conservation of open ocean and deep-sea ecosystems using the concept of Ecologically or Biologically Significant Marine Areas (EBSAs). The parties to the CBD, in 2008, agreed to adopt the scientific criteria for identifying EBSAs that allows for management and conservation to be prioritised within areas that are key for the long-term conservation of ecosystems (CBD, 2008). Although, the criteria for defining EBSAs are broad with differing levels of importance and EBSAs do not necessarily imply that a management response is required, they provide useful information for further marine protection measures (Clark *et al.*, 2014).

Namibia has seven internally recognised EBSAs that were designated to submarine ridges, continental margin, canyons, escarpments and seamounts (Nelson Mandela University, 2022). These features in conjunction with cold deep-water upwelling cells support the life histories of key species through increased productivity in these areas. The nearby EBSAs to B2913B are tabulated in Table 1.3 and illustrated in Figure 1.2.

Table 1.3 Namibian EBSAs

EBSA	Distance from Block 2913B	Description
Orange Cone	250km northeast	The coastal area includes ten threatened ecosystem types: two Critically Endangered, four Endangered and four Vulnerable types. The marine environment experiences slow and weak wind speeds, making it potentially favourable for the reproduction of pelagic species
Walvis Ridge Namibia	854km north	The Walvis Ridge Namibia EBSA encompasses a series of seamounts, which provide increased habitat heterogeneity that could potentially support a relatively high biological diversity.
Orange Seamount and Canyon Complex	Adjacent to the Block	The EBSA comprises a range of threatened and endangered shelf and shelf edge habitats that are in relatively natural/pristine condition.
Namibe	1,268km north	The presence of shelf-incising canyons and seamounts in the EBSA footprint area contributes to elevated productivity that provides foraging habitats for a range of species.

EBSA	Distance from Block 2913B	Description
Namin Flyway	553km northeast	The sheltered bays and shallow waters lead to increased water temperatures and hence higher productivity. A weak upwelling cell is present off Walvis Bay which further contributes to the productivity of the EBSA.
Cape Fria	1,100km north	The continental shelf within the EBSA narrows and produces an upwelling cell that enhances local productivity and provides foraging grounds for a range of species

1.5.1.2 *Marine Protected Areas*

The Namibian Islands Marine Protected Area (MPA) is Africa's second largest proclaimed MPA and the only designated MPA in Namibian waters (Figure 1.2). Situated along the southwestern coast of Namibia, the MPA covers a surface area of 10,000km^2 and is located 231km northeast of Block 2913B. Since its proclamation, no formal management plan has been implemented, placing the MPA and its ecosystems at risk (Blue Marine Foundation, 2023).

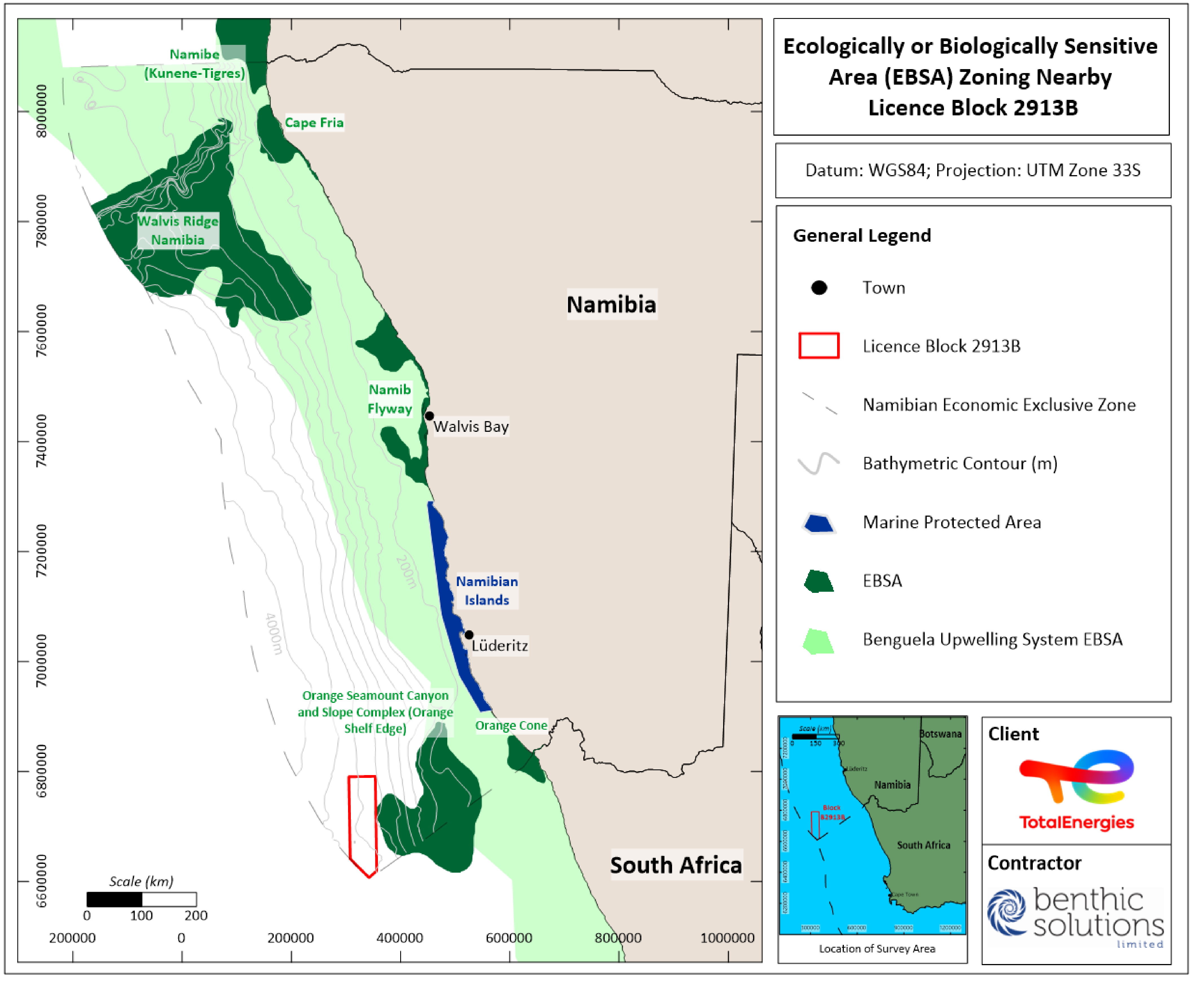


Figure 1.2 Ecologically or Biologically Sensitive Areas and Marine Protected Areas in Proximity to Block 2913B

1.5.1.3 *Large Marine Ecosystems*

Block 2913B is situated within the Benguela coastal upwelling system, which is one of the most biologically productive regions of the world ocean and subsequently has been established as a Large Marine Ecosystem (LME) that is jointly managed by the states of Angola, Namibia and South Africa (Emeis *et al*., 2004). The Benguela Current Large Marine Ecosystem (BCLME) is one of the world's four major Eastern Boundary Upwelling Systems (EBUS) and is located in the SE Atlantic east of the 0° meridian, between 14°S and 37°S. Wind-driven coastal upwelling of nutrients fuels high productivity and the northern Benguela upwelling is typically driven by equatorward, south-easterly winds, while south Benguela upwelling is more discrete and pulsed. In addition to commercial fisheries, the BCLME also provides ecosystem goods and services from offshore oil and gas production, coastal and marine diamond mining, coastal tourism, shipping and marine aquaculture estimated to be worth between US$ 54.3 billion and US$ 269 billion (Finke *et al*., 2020).

1.5.1.4 *Geography and Geological Features*

The **continental shelf off southern Namibia is variable in width and is characterised by well defined shelf breaks, a shallow outer shelf and an aerofoil-shaped submarine 'Recent River Delta' on the inner shelf, along with shallow canyons, escarpments, eroded plateaus and sedimentary basins** (BSL, 2018). Other topographical features of interest in the region, but outside of the Block include Orange Bank, an area that shallows to 160m, Child's Bank situated approximately 150km offshore and the Tripp Seamount situated 300km offshore (SLR Environmental Consulting, 2020).

The **surface geology of the inner shelf is underlain by Precambrian bedrock**, while the **middle and outer continental shelf areas are composed of Cretaceous and Tertiary**. The continental slope, seaward of the shelf break, has a smooth seafloor, underlain by calcareous deposition, which was primarily deposited by historic Orange River discharge. **Erosion of the continental shelf has resulted in a generally thin unconsolidated sediment layer of approximately 1m thick**. Sediments become finer seaward towards deeper water, changing from sand dominated to clay dominated sediments, with muddy sand and sandy mud expected within the deep waters of Block 2913B (SLR Environmental Consulting, 2020).

1.5.1.5 *Wind, Waves and Tides*

Namibia is subject to predominantly **southerly, south-westerly and south-easterly winds**. Winds are one of the main physical drivers of the nearshore Benguela region and generate consistent south-westerly swells, which contribute to the northward-flowing longshore currents. As a consequence, physical processed are characterised by the average seasonal wind patterns. The prevailing winds in the Benguela region are controlled by the South Atlantic subtropical anticyclone (a high-pressure area), which undergoes seasonal variation (RPS, 2020). The strongest winds occur during summer from southeast to southwest and are strongly dominated by south-southeasterlies, while the winter winds are south to south-easterly, but are dominated by north-westerlies. The combination of the southerly and south-easterly winds drive the upwelling of nutrient-rich bottom waters and results in high biological production (SLR Environmental Consulting, 2020). The total wave climate in deeper waters will most often be dominated by long period swell waves. Strong winds and large waves are possible throughout the year, but most severe in the winter months (RPS, 2020).

A majority of the west coast of southern Africa is classified as exposed and is influenced by predominantly **wind driven south-westerly swells**. The wave climate of offshore Namibia shows seasonal variation, with winter periods (from June to August) showing maximum wave heights that exceed 10m, while the wave heights in summer are typically 2m (RPS, 2020, SLR Environmental Consulting, 2020).

The tidal regime of Namibia **is semi-diurnal**, with two high tides and two low tides during a tidal day, occurring almost synchronously along the coast. Tides range between 0.6m on the neap tidal cycle and 1.5m on the spring tide (SLR Environmental Consulting, 2020).

1.5.1.6 *Water Currents*

The south African West Coast is **strongly influenced by the Benguela Current** and current velocities on the continental shelf range between 10 to 30cm/s, with localised flows, associated with eddies, reaching current speeds in excess of 50 cm/s. On the western side of the Benguela Current, the water flow is more transient and is characterised by large eddies that are shed from the Agulhas Current. The flows are predominantly wind-forced, barotropic and fluctuate between poleward and equatorward flow (SLR Environmental Consulting, 2020).

1.5.2 *Pre-Drill Survey at Venus-1X in Block 2913B*

In 2018, BSL carried out a pre-drill EBS surrounding Venus-1X PWL at a total of eight seabed sampling stations and three water sampling locations (at three depths) that were arranged in a cruciform around the Venus-1X well location at 500m, 1km, 2km and 3km intervals. **Particle size analysis revealed a homogeneous sandy mud environment dominated by silt with a variable sand content and an absence of gravel.** There was no apparent spatial distribution to the sediment classification with changing water depth, however, the sediments from stations sampled at relatively deeper water depths showed a subtle shift in mean particle size from medium silt (0.010mm to 1.012mm) to fine and very fine silt (0.007mm to 0.009mm) (BSL, 2019).

Hydrocarbon levels (as total extractable hydrocarbons; THC) were considered low across the pre-drill Venus-1X survey area (mean 1.64mg.kg^{-1}±1.3SD) and were reflective of uncontaminated west African sediments. In addition, all analysed polycyclic aromatic hydrocarbons (PAH) were low (<1µg.kg^{-1}) and indicative of a natural seabed environment. Heavy and trace metal concentrations were low and consistent with natural baseline conditions, with no discernible trend present and the variability in metals was attributed to particle size, organic content, and mineralogy (BSL, 2019).

The hydrographic profiles obtained during the Venus-1X pre-drill survey were considered typical of offshore open ocean environments, with a relatively well-mixed body of water in the first 50m and a weak thermocline present down to a depth of 670m due to the consistent zone of mixing (BSL, 2019).

Drop-down HD video attached to the box cores surveyed surrounding the Venus-1X PWL revealed sediment consisting of predominantly fine or muddy material with variable sand content. Conspicuous fauna visible across the pre-drill Venus-1X survey area was limited and consisted primarily of foraminifera, with the impoverished infauna dominated by Annelida and Mollusca (BSL, 2019).

1.5.3 *Reference Levels and Sources*

A number of reference levels are used in this report to aid with the interpretation of the survey results, placing the current data in the context of typically background levels or concentrations deemed to show evidence of contamination.

1.5.3.1 *Sediments*

ANZECC/ARMCANZ

In order to characterise contamination in sediments, sediment quality guidelines (SQGs) adopted by the Australian and New Zealand Environment and Conservative Council (ANZECC) and the Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) will be used in this report (Simpson *et al.,* 2013). The application of SQGs involves a tiered, decision-tree approach. Following this framework, the total concentrations of contaminants are compared to SQG values. For metals, the sediment quality guideline values' (SQGVs) and SQG-High values are largely unchanged and remain based on the effects range low (ERL) and effects range median (ERM) values (see below). For organics, threshold effects level (TEL) and probable effects level (PEL) values are now used. If the contaminant concentrations exceed the SQGVs, further investigations are initiated to determine whether there is indeed an environmental risk associated with the exceedance by assessing the contaminant bioavailability.

ERL & ERM

In order to assign a level of context for toxicity, an approach used by Long *et al.* (1995), to characterise contamination in sediments will be used in this report. 'Effect range low' (ERL) levels were defined as concentration of metals at which adverse effects were reported in 10% of the data reviewed, whilst 'effect range median' (ERM) levels were defined as the concentrations at which 50% of studies reported harmful effects. The ERLs and ERMs will be used to evaluate the ecological significance of heavy and trace metal concentrations within the survey area.

EQS

Environmental quality standards (EQS) concerning the presence in surface of certain substances or groups of substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment. Standards are in line with the strategy and objectives of the EUs Framework Directive (Directive 2000/60/EC).

OSPAR Total Hydrocarbon Content

The OSPAR total hydrocarbon content (THC) threshold has been adopted by OSPAR countries as the no-effect level from cuttings derived hydrocarbons on benthic organisms. Based on the benthic amphipod (e.g. *Corophium volutator*) biomarkers for oil pollution, the study indicated that the critical tissue residue (the highest tissue concentration at which no significant mortality was observed) was approximately 900 $mg.kg^{-1}$ in sediment containing 31 to 48 $mg.kg^{-1}$ of cuttings derived hydrocarbons. As such, the study deduced a no-effect residue concentration in the region of 50$mg.kg^{-1}$ dry weight. THC in sediments below 50$mg.kg^{-1}$ are considered to be outside of the chemical impact zone of a cuttings pile (OSPAR, 2009).

EGASPIN

Environmental Guidelines and Standards for the Petroleum Industry In Nigeria (EGASPIN) provides reference thresholds for the THC content of soils and marine sediments (Department of Petroleum Resources, 2002). The target value indicates the soil/sediment quality required for the full restoration of the soils/sediments functionality for human, animal and plant life. The intervention value is the upper threshold whereby the quality for which the functionality of soil/ sediments for human, animal and plant life are, or threatened with being seriously impaired. Concentrations in excess of the intervention values correspond to serious contamination.

French Circular N1 & N2

Quality thresholds concerning substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment. The N1 threshold is considered the lower limit whereby, concentrations within sediment of a substance below the N1 threshold is considered non-toxic and concentrations above the N1 threshold is considered sediment requiring ecotoxicological investigations. The N2 threshold is considered the upper limit whereby, concentrations within sediment of a substance below the N2 threshold is considered toxic. Standards are in line with the strategy and objectives of the French Circular Directive (Directive 9/08/2006).

Index of Organic Enrichment (Alzieu, 2003)

The index of organic enrichment (IOE) is calculated from individual scores for total organic carbon (TOC), total nitrogen and total phosphorous, which, added together, gives the overall IOE, ranging from zero to eleven (Table 1.4), with a maximum of four being recorded from total organic carbon and total nitrogen and a maximum of three being recorded from total phosphorus. The values will not be reported in the data tables, instead their organic enrichment will be presented to aid in the interpretation.

Table 1.4 Reference Values for Calculating the Index of Organic Enrichment

Individual Index Score	Total Organic Carbon (% M/M)	Total Nitrogen (% d/w)	Total Phosphorous (mg.kg^{-1} d/w)
0	<0.6	<0.6	<500
1	0.6 – 2.3	0.6 – 1.2	500 – 800
2	2.4 – 4.0	1.2 – 2.4	800 – 1,200
3	4.1 – 5.8	2.4 – 3.6	>1,200
4	>5.8	>3.6	
Index of Organic Enrichment (IOE) (Alzieu, 2003)		**Organic Enrichment**	
0		None	
1-3		Weak	
4-6		Medium	
>6		Strong	

1.5.3.2 *Seawaters*

CCME

The Canadian Council of Ministers of the Environment (CCME, 2001) produced water quality guidelines as broadly protective tools to support the functioning of healthy aquatic ecosystems. Based on field research programmes the long-term concentrations of water pH and dissolved oxygen for a healthy ecosystem has been developed.

EQS

Environmental quality standards (EQS) concerning the presence in surface of certain substances or groups of substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment. Standards are in line with the strategy and objectives of the EUs Water Framework Directive (Directive 2000/60/EC).

NOAA CCC and CMC

National Oceanic and Atmospheric Administration (NOAA) developed screening quick reference tables to help evaluate potential risks from contaminated water, sediment, or soil. The criterion continuous concentration (CCC) is an estimate of the highest concentration of a material in the water column to which an aquatic community can be exposed indefinitely without resulting in unacceptable effect. The criterion maximum concentration (CMC) is an estimate of the highest concentration of a material in the water column to which an aquatic community can be exposed briefly without resulting in an unactable effect (Buchman, 2008).

French Circular N1 & N2

Quality thresholds concerning substances identified as priority pollutants because of the significant risk they pose to or via the aquatic environment. The N1 threshold is considered the lower limit whereby, concentrations within the aquatic environment of a substance below the N1 threshold is considered non-toxic and concentrations above the N1 threshold requires ecotoxicological investigations. The N2 threshold is considered the upper limit whereby, concentrations within the aquatic environment of a substance below the N2 threshold is considered toxic. Standards are in line with the strategy and objectives of the French Circular Directive (Directive 9/08/2006).

European References for Nutrients in Seawater

This defines the "European References for Nutrients in Seawater" which built on the Decrees of 25 January 2010 and 27 July 2015; however, these decrees were only based on the monitoring of the DIN (Dissolved Inorganic Nitrogen). These updated standards are based on the previous indicator concentrations (Total Nitrogen, nitrates and orthophosphates) and compare them to the previous Water framework Directive (ruling of 27 July 2015, amending the ruling of January 25, 2010) (Table 1.5).

Table 1.5 Provisional European References for Nutrients in Seawater

<table>
<tr><th>Threshold</th><th>Dissolved Organic Carbon ($mg.l^{-1}$)</th><th>Total Nitrogen ($mg.l^{-1}$)</th><th>Nitrate (NO_3) ($mg.l^{-1}$)</th><th>Nitrite (NO_2) ($mg.l^{-1}$)</th><th>Orthophosphate (PO_4) ($mg.l^{-1}$)</th></tr>
<tr><td>Very good</td><td>≤ 5</td><td>≤ 0.7</td><td>≤10</td><td rowspan="2"><0.3</td><td>≤0.03</td></tr>
<tr><td>Good</td><td><7</td><td>0.7-1.05</td><td>50</td><td>0.03-0.1</td></tr>
<tr><td>Medium</td><td><10</td><td>1.05-1.4</td><td>-</td><td rowspan="3">>0.3</td><td>0.1-0.14</td></tr>
<tr><td>Poor</td><td><15</td><td>1.4-1.68</td><td>-</td><td>0.14-0.38</td></tr>
<tr><td>Bad</td><td>> 15</td><td>>1.68</td><td>-</td><td>>0.38</td></tr>
</table>

2 Field Survey Programme and Analytical Methods

2.1 Geodetic Parameters

The geodetic parameters used are provided below in Table 2.1.

Table 2.1 Geodetic Parameters

Required Datum	
GPS Datum	World Geodetic System 1984 (WGS84) EPSG Code:32744
Semi-major Axis (a)	6378137.000m
Inverse Flattening (1/f)	298.257223563
Projection Parameters	
Grid Projection	Universal Transverse Mercator
Projection Name	UTM Zone 33 South
Central Meridian & Scale Factor at C.M.	15° East & 0.9996
False Easting & False Northing	500 000m & 10000000m

2.2 Environmental Ground-truthing and Sampling

BSL, supported by Creocean, designed a survey strategy combining video transects, water sampling and sediment sampling, to provide a comprehensive understanding of the regional seabed based on the investigation targets selection rationale provided by TEEPNA (Figure 2.1). Any sampling locations within the subsea cable 2km exclusion zone were moved accordingly. The sampling strategy was approved by the client prior to the start of the survey and was outlined in the project execution plan (Internal Doc reference code: 220906 2202.02_BSL_TEEPNA-TEEPSA Multiblock Regional EBS_PEP_01) and Block 2913B/2912 specific addendum (Internal Doc reference code: 220915 2202.02_BSL_TEEPNA-TEEPSA PEP - Addendum#1).

The survey field operations are detailed in Appendix I – Field Operations and Survey Methods, with grab sampling logs and deck observations provided in Appendix IX – Deck Log Observations, camera transect logs in Appendix X – Camera Transect Log Sheets and box core video logs in Appendix XI – Box Corer Video Log Sheets.

2.2.1 *Sediment Sampling*

During phase 1 (Venus-2), a total of 19, out of the 23 originally planned cruciform stations, were sampled using a Grey-O'Hara 0.25m^2 box corer as soft mud-dominated sediments were encountered (Table 2.2). Similarly, **during phase 2 (Venus-1X and the wider Block) a total of 55 grab sample locations, out of the 61 originally planned, were sampled using a Grey-O'Hara 0.25m^2** (Table 2.2). Of the 55 grab sample locations in phase 2, eight targeted the 2018 historic cruciform stations at Venus-1X to acquire data on the sediment physico-chemistry and biology post-drilling operations (BSL, 2023c). In addition, grab samples were taken at 2,000m SE of the Venus-2 PWL to complete the 19 stations from phase 1 scope. Amendments to the scope, based on TEEPNA comments, were made in the field based on the time constraints faced as a result of periods of unworkable weather. One Grey-

O'Hara 0.25m^2 box corer deployment was required at each station to collect sufficient material for macrofauna and physico-chemistry sub-sampling.

All benthic sampling stations acquired underwent the following sampling/sub-sampling:

- 1 x 0.1m^2 macro-invertebrate replicate samples processed over a 500µm aperture sieve;
- 1x 0.1m^2 physico-chemical replicate, subsampled for particle size distribution (PSD) at a single surface depth of 5cm; total organic carbon (TOC), total organic matter (TOM), moisture, heavy and trace metals (HM), hydrocarbons (HC, including total petroleum hydrocarbons (TPH), saturated hydrocarbons and polycyclic aromatic hydrocarbons (PAH)), nutrients (total nitrogen as N and total phosphorous), BTEX, microbiology and eDNA at a single surface depth of 0-2cm.

2.2.2 *Seawater Sampling*

During **phase 1, two seawater sampling stations were conducted at the Venus-2 PWL, one at 250m southeast of the PWL (but which was classed as the Venus-2 well centre) and one 10km to the northeast of the PWL** using 10L Niskins and a multiparameter Valeport MIDAS CTD+ water quality profiler. Similarly, **during phase 2, water sampling was carried out at six stations** using 10L Niskins and CTD profiler. Only seven of the total water stations are included in this report as the station for the Venus-1X well is discussed in the separate EPOS report (BSL, 2023c). Seawater samples were obtained at three depths relating to near seabed, mid-water, and surface with each Niskin triggered by daisy-chained messengers. Sub-samples were extracted from the Niskin bottles using a specialist tap fitting, taking care to prevent contact between the tap and the sample containers to avoid the potential for contamination.

Full seawater quality profiles were completed to the full water depth at each of the eight locations (one being for Venus-1X EPOS) to assess the water quality across the survey area. For this, the multiparameter probe was fitted with sensors for conductivity (salinity), temperature, pressure (depth), dissolved oxygen (DO), pH, redox and turbidity.

Zooplankton samples were collected using a 200µm mesh and phytoplankton organisms through a 50µm mesh fitted to a bongo plankton net. The zooplankton and phytoplankton were sampled from 100m vertical tows with a sampling rate of approximately 0.5m per second.

In addition, eDNA samples were acquired at the three water depths (near seabed, mid-water, and surface) at all eight stations (one being for Venus-1X EPOS and the rest across the wider region of Block 2913B). The samples were processed with specialised water eDNA kits provided by Applied Genomics and the filters were bagged and refrigerated for subsequent analyses (Appendix I – Field Operations and Survey Methods). Approximately 2L of seawater was filtered at each depth level to ensure sufficient eDNA material was retained within the 0.45µm filters for analyses. The results and interpretation of the water and sediment eDNA samples are discussed in the separate Block 2913B eDNA report (BSL, 2023b).

Table 2.2 Summary of EBS Data Acquisition for Laboratory Analysis

Geodetics: WGS84 UTM 33S									
Station	Area	Target Easting (m)	Target Northing (m)	Fix Easting (m)	Fix Northing (m)	Distance from target coordinate (m)	Fix Depth (m)	Sampling	Sample Analyses
Phase 1									
0m Venus-2 SPWL	Development Area (P1)	326 890	6 749 285	326 897	6 749 287	7	2,900	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
250m_SE	Development Area (P1)	327 067	6 749 108	327 057	6 749 121	16	2,900	BC	Sed PC, Fauna, Sed eDNA
500m_SE	Development Area (P1)	327 244	6 748 931	327 211	6 748 948	37	2,900	BC	Sed PC, Fauna, Sed eDNA
1000m_SE	Development Area (P1)	327 597	6 748 578	327 591	6 748 566	13	2,900	BC	Sed PC, Fauna, Sed eDNA
3000m_SE	Development Area (P1)	329 011	6 747 164	-	-	-	-	-	-
10,000m_SE	Development Area (P1)	333 961	6 742 214	-	-	-	-	-	-
250m_NW	Development Area (P1)	326 713	6 749 462	326 735	6 749 451	24	2,900	BC	Sed PC, Fauna, Sed eDNA
500m_NW	Development Area (P1)	326 536	6 749 639	326 523	6 749 636	14	2,900	BC	Sed PC, Fauna, Sed eDNA
1000m_NW	Development Area (P1)	326 183	6 749 992	326 175	6 749 980	14	2,900	BC	Sed PC, Fauna, Sed eDNA
1500m_NW	Development Area (P1)	325 829	6 750 346	325 824	6 750 350	7	2,900	BC	Sed PC, Fauna, Sed eDNA
2000m_NW	Development Area (P1)	325 476	6 750 699	325 471	6 750 700	5	2,900	BC	Sed PC, Fauna, Sed eDNA
3000m_NW	Development Area (P1)	324 769	6 751 406	324 767	6 751 400	6	2,900	BC	Sed PC, Fauna, Sed eDNA
5000m_NW	Development Area (P1)	323 354	6 752 821	-	-	-	-	-	-
250m_NE	Development Area (P1)	327 067	6 749 462	327 062	6 749 473	12	2,900	BC	Sed PC, Fauna, Sed eDNA
500m_NE	Development Area (P1)	327 244	6 749 639	327 217	6 749 640	27	2,900	BC	Sed PC, Fauna, Sed eDNA
1000m_NE	Development Area (P1)	327 597	6 749 992	327 603	6 750 011	20	2,900	BC	Sed PC, Fauna, Sed eDNA
2000m_NE	Development Area (P1)	328 304	6 750 699	328 281	6 750 697	23	2,900	BC	Sed PC, Fauna, Sed eDNA
10,000m_NE	Development Area (P1)	333 961	6 756 356	333 983	6 756 362	23	2,900	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
250m_SW	Development Area (P1)	326 713	6 749 108	326 741	6 749 091	33	2,900	BC	Sed PC, Fauna, Sed eDNA
500m_SW	Development Area (P1)	326 536	6 748 931	326 511	6 748 931	26	2,900	BC	Sed PC, Fauna, Sed eDNA
1000m_SW	Development Area (P1)	326 183	6 748 578	326 177	6 748 572	9	2,900	BC	Sed PC, Fauna, Sed eDNA
2000m_SW	Development Area (P1)	325 476	6 747 871	325 503	6 747 857	31	2,900	BC	Sed PC, Fauna, Sed eDNA

Geodetics: WGS84 UTM 33S									
Station	Area	Target Easting (m)	Target Northing (m)	Fix Easting (m)	Fix Northing (m)	Distance from target coordinate (m)	Fix Depth (m)	Sampling	Sample Analyses
Phase 2									
Venus-1X SFWL	Priority Area (P2)	331 884	6 737 841	331 901	6 737 835	18	2,963	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
500m_NE	Priority Area (P2)	332 218	6 738 297	332 241	6 738 304	24	2,958	BC	Sed PC, Fauna, Sed eDNA
500m_NW	Priority Area (P2)	331 516	6 738 280	331 539	6 738 275	24	2,965	BC	Sed PC, Fauna, Sed eDNA
500m_SE	Priority Area (P2)	332 217	6 737 568	332 238	6 737 569	21	2,961	BC	Sed PC, Fauna, Sed eDNA
500m_SW	Priority Area (P2)	331 504	6 737 556	331 503	6 737 564	8	2,970	BC	Sed PC, Fauna, Sed eDNA
1km_NW	Priority Area (P2)	331 155	6 738 645	331 140	6 738 636	17	2,976	BC	Sed PC, Fauna, Sed eDNA
2km_NW	Priority Area (P2)	330 464	6 739 333	330 454	6 739 335	10	2,991	BC	Sed PC, Fauna, Sed eDNA
3km_NW	Priority Area (P2)	329 727	6 740 043	329 720	6 740 045	7	2,999	BC	Sed PC, Fauna, Sed eDNA
2000m_SE*	Priority Area (P2)	328 304	6 747 871	328 336	6 747 892	38	2,900	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_01	Development Area	326 822	6 753 743	323 580	6 748 151	17	2,964	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_02	Development Area (P1)	323 591	6 748 152	323 580	6 748 151	11	3,025	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_03	Development Area (P1)	331 982	6 752 435	331 970	6 752 408	30	2,916	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_04	Development Area (P1)	324 797	6 744 705	324 815	6 744 720	23	3,051	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_05	Development Area (P1)	327 644	6 746 158	327 657	6 746 161	13	3,028	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_06	Development Area (P1)	330 842	6 747 789	330 825	6 747 793	17	3,002	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_07	Development Area (P1)	334 069	6 749 436	334 068	6 749 431	5	2,978	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_08	Development Area (P1)	326 298	6 741 538	326 286	6 741 553	19	3,032	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_09	Development Area (P1)	329 583	6 743 189	329 584	6 743 183	6	3,019	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_10	Development Area (P1)	332 842	6 744 826	332 850	6 744 806	22	3,003	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_11	Development Area (P1)	336 129	6 746 477	336 159	6 746 461	34	2,977	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_12	Development Area (P1)	328 246	6 738 447	328 237	6 738 454	11	3,025	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_13	Development Area (P1)	334 916	6 741 752	334 921	6 741 768	17	2,976	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_14	Development Area (P1)	338 263	6 743 411	338 286	6 743 415	23	2,954	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_15	Development Area (P1)	330 098	6 735 508	330 086	6 735 516	14	3,013	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_16	Development Area (P1)	336 923	6 738 780	336 934	6 738 763	20	2,903	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_17	Development Area (P1)	340 344	6 740 420	340 362	6 740 399	28	2,879	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_18	Priority Area (P2)	308 023	6 774 725	-	-		-	-	-
B2913B_ENV_19	Priority Area (P2)	320 551	6 775 726	320 565	6 775 745	24	2,943	BC	Sed PC, Fauna, Sed eDNA

Geodetics: WGS84 UTM 33S									
Station	Area	Target Easting (m)	Target Northing (m)	Fix Easting (m)	Fix Northing (m)	Distance from target coordinate (m)	Fix Depth (m)	Sampling	Sample Analyses
B2913B_ENV_20	Priority Area (P2)	334 260	6 774 802	334 251	6 774 852	51	2,810	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_21	Priority Area (P2)	349 998	6 775 520	350 031	6 775 501	38	2,625	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
B2913B_ENV_22	Priority Area (P2)	311 419	6 766 029	-	-		-	-	-
B2913B_ENV_23	Priority Area (P2)	323 903	6 766 030	323 896	6 766 027	8	2,996	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_24	Priority Area (P2)	336 527	6 766 031	336 501	6 766 031	26	2,849	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_25	Priority Area (P2)	348 963	6 766 032	348 964	6 765 993	39	2,593	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_26	Priority Area (P2)	311 667	6 753 919	-	-		-	-	-
B2913B_ENV_27	Priority Area (P2)	336 095	6 752 024	336 095	6 752 017	7	2,857	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_28	Priority Area (P2)	346 779	6 750 597	346 740	6 750 620	45	2,737	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_29	Priority Area (P2)	310 562	6 741 903	310 568	6 741 935	33	3,117	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_30	Priority Area (P2)	349 383	6 741 920	349 392	6 741 929	13	2,793	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_31	Priority Area (P2)	312 158	6 729 933	312 146	6 729 958	28	3,164	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_32	Priority Area (P2)	324 681	6 729 934	-	-		-	-	-
B2913B_ENV_33	Priority Area (P2)	337 266	6 729 934	337 288	6 729 920	26	2,953	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_34	Priority Area (P2)	353 219	6 727 832	353 242	6 727 804	36	2,743	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_35	Priority Area (P2)	354 266	6 722 620	354 266	6 722 610	10	2,661	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
B2913B_ENV_36	Priority Area (P2)	312 404	6 717 922	312 453	6 717 887	60	2,878	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
B2913B_ENV_37	Priority Area (P2)	324 939	6 717 923	-	-		-	-	-
B2913B_ENV_38	Priority Area (P2)	337 512	6 717 924	337 512	6 717 939	15	2,790	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_39	Priority Area (P2)	351 949	6 716 039	351 953	6 716 030	10	2,538	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_40	Priority Area (P2)	347 574	6 714 380	347 571	6 714 393	13	2,613	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_41	Secondary Area (P3)	319 576	6 704 817	319 598	6 704 851	40	2,873	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_42	Secondary Area (P3)	331 797	6 704 825	-	-		-	-	-
B2913B_ENV_43	Secondary Area (P3)	344 443	6 704 833	344 428	6 704 859	30	2,715	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_44	Secondary Area (P3)	319 648	6 689 685	319 644	6 689 713	28	2,957	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_45	Secondary Area (P3)	330 172	6 689 705	330 173	6 689 722	17	2,830	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
B2913B_ENV_46	Secondary Area (P3)	344 547	6 689 702	344 513	6 689 675	43	2,735	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_47	Secondary Area (P3)	319 726	6 673 495	319 706	6 673 475	28	3,012	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_48	Secondary Area (P3)	332 100	6 673 503	332 063	6 673 487	40	2,963	BC	Sed PC, Fauna, Sed eDNA

Geodetics: WGS84 UTM 33S									
Station	Area	Target Easting (m)	Target Northing (m)	Fix Easting (m)	Fix Northing (m)	Distance from target coordinate (m)	Fix Depth (m)	Sampling	Sample Analyses
B2913B_ENV_49	Secondary Area (P3)	351 001	6 675 362	351 001	6 675 343	19	2,846	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_50	Secondary Area (P3)	316 361	6 654 382	316 402	6 654 385	41	3,116	BC, NB, CTD, PN	Sed PC, Fauna, Sed eDNA, Water, Water eDNA
B2913B_ENV_51	Secondary Area (P3)	332 253	6 656 831	332 282	6 656 861	42	3,032	BC	Sed PC, Fauna, Sed eDNA
B2913B_ENV_52	Secondary Area (P3)	344 182	6 656 823	344 249	6 656 815	67	2,960	BC	Sed PC, Fauna, Sed eDNA

Notes:
Sampling Type: BC = Box Core; NB = water sampler "Niskin Bottle"; CTD = water quality profiler (conductivity, temperature, depth, dissolved oxygen, pH and turbidity); PN = water sampler "Plankton Nets"
Sample Analyses: PC = Physico-chemistry; Fauna processed over 500µm sieve
'-' = Samples removed from the scope of work due to the proximity of seabed infrastructure
Grey value = distance greater than 2% water depth
**Sample associated to the Venus-2 PWL campaign (phase 1) but acquired during survey phase 2*
Beige = Venus-1X sampling station with results and interpretation discussed in the EPOS report (BSL, 2023c)

2.2.3 *Underwater Video/Camera Acquisition*

During phase 1, due to survey time constraints and increasing weather patterns occurring towards the end of the survey, only a **single attempt for a towed underwater video transect** was undertaken travelling over the seabed within **500m of the Venus-2 PWL**.

During phase 2, camera transects ranging between **345m to 1,412m in length** were conducted at **9 sampling stations as part of the Block 2913B area of interest (including Venus-2 PWL) scope** for the acquisition of video and stills data to investigate changes in potential sensitive habitats as part of the EBS scope of work (Table 2.3). **Two sampling stations (B2913B_CAM_10 and B2913B_CAM_11) as part of the Venus-1X EPOS scope were also acquired for video and stills data to assess for any seabed changes post-drilling (BSL, 2023c)**. Live-feed footage was provided from the STR Seabug towed camera system via the sonar cable on the RAPP winch and at >3,000m water depths non-live-feed was provided by a towed pressure camera system. The live-feed STR system provided SD, stills and HD of the seabed, while the non-live-feed system provided only HD footage with screenshots providing the still images required.

A pressure camera was fixed on the box corer to obtain high-definition video footage at 63 sediment stations during sampling (no video acquired at station 500m_NW, B2913B_ENV_24 and B2913B_ENV_28) ; see Appendix XI – Box Corer Video Log Sheets). Details of the camera specifications are provided in Appendix I – Field Operations and Survey Methods.

Table 2.3 Summary of Environmental Camera Transects

Geodetics: WGS84 UTM 33S										
Transect		Date	Time	Easting (m)	Northing (m)	Water Depth (m)	Distance travelled (m)	Minutes of Video	Camera System (Front view)	Camera System (Side view)
Phase 1										
0m-Venus-2	SOL	06/08/2022	19:26	327 371	6 748 792	2,970	1,458	01:24	Pressure Camera	Pressure Camera
	EOL		20:53	326 355	6 749 839	2,970				
Phase 2										
B2913B_CAM_03	SOL	29/09/2022	18:52	326 713	6 749 086	3,008	516	01:56	Pressure Camera	Pressure Camera
	EOL		20:49	327 048	6 749 479	3,002				
B2913B_CAM_04	SOL	29/09/2022	23:39	326 672	6 749 487	3,002	561	01:47	Pressure Camera	Pressure Camera
	EOL		01:27	327 067	6 749 089	3,006				
B2913B_CAM_05	SOL	30/09/2022	04:26	332 379	6 751 455	2,928	582	01:56	Pressure Camera	Pressure Camera
	EOL		06:23	332 342	6 750 874	2,966				
B2913B_CAM_06	SOL	30/09/2022	09:21	339 064	6 752 554	2,335	538	01:55	Pressure Camera	Pressure Camera
	EOL		11:17	339 566	6 752 361	2,732				
B2913B_CAM_10	SOL	29/09/2022	13:42	332 155	6 737 934	2,942	467	01:46	Pressure Camera	Pressure Camera
	EOL		15:28	331 894	6 737 547	2,957				
B2913B_CAM_11	SOL	29/09/2022	08:10	331 858	6 738 301	2,958	576	01:57	MOD 4.3 (Time Lapse)	Pressure Camera
	EOL		10:07	332 236	6 737 866	2,707				
B2913B_CAM_14	SOL	29/09/2022	02:17	353 208	6 728 057	2,635	497	01:25	MOD 4.3 (Time Lapse)	Pressure Camera
	EOL		03:42	353 283	6 727 566	2,749				
B2913B_CAM_15	SOL	28/09/2022	19:35	354 343	6 723 099	2,711	523	02:19	MOD 4.3 (Time Lapse)	Pressure Camera
	EOL		21:54	354 241	6 722 586	2,665				
B2913B_CAM_17	SOL	28/09/2022	11:05	336 094	6 714 750	2,701	1,412	04:19	MOD 4.3 (Time Lapse)	Pressure Camera
	EOL		15:24	337 496	6 714 918	2,737				
B2913B_CAM_18	SOL	28/09/2022	06:11	344 961	6 706 663	2,685	345	00:38	Seabug (Live Feed)	Pressure Camera
	EOL		06:50	344 631	6 706 763	2,561				
B2913B_CAM_20	SOL	27/09/2022	20:56	332 655	6 656 382	3,028	1,131	01:37	Seabug (Live Feed)	Pressure Camera
	EOL		22:34	331 879	6 657 205	3,023				

Beige = Venus-1X sampling station with results and interpretation discussed in the EPOS report (BSL, 2023c)

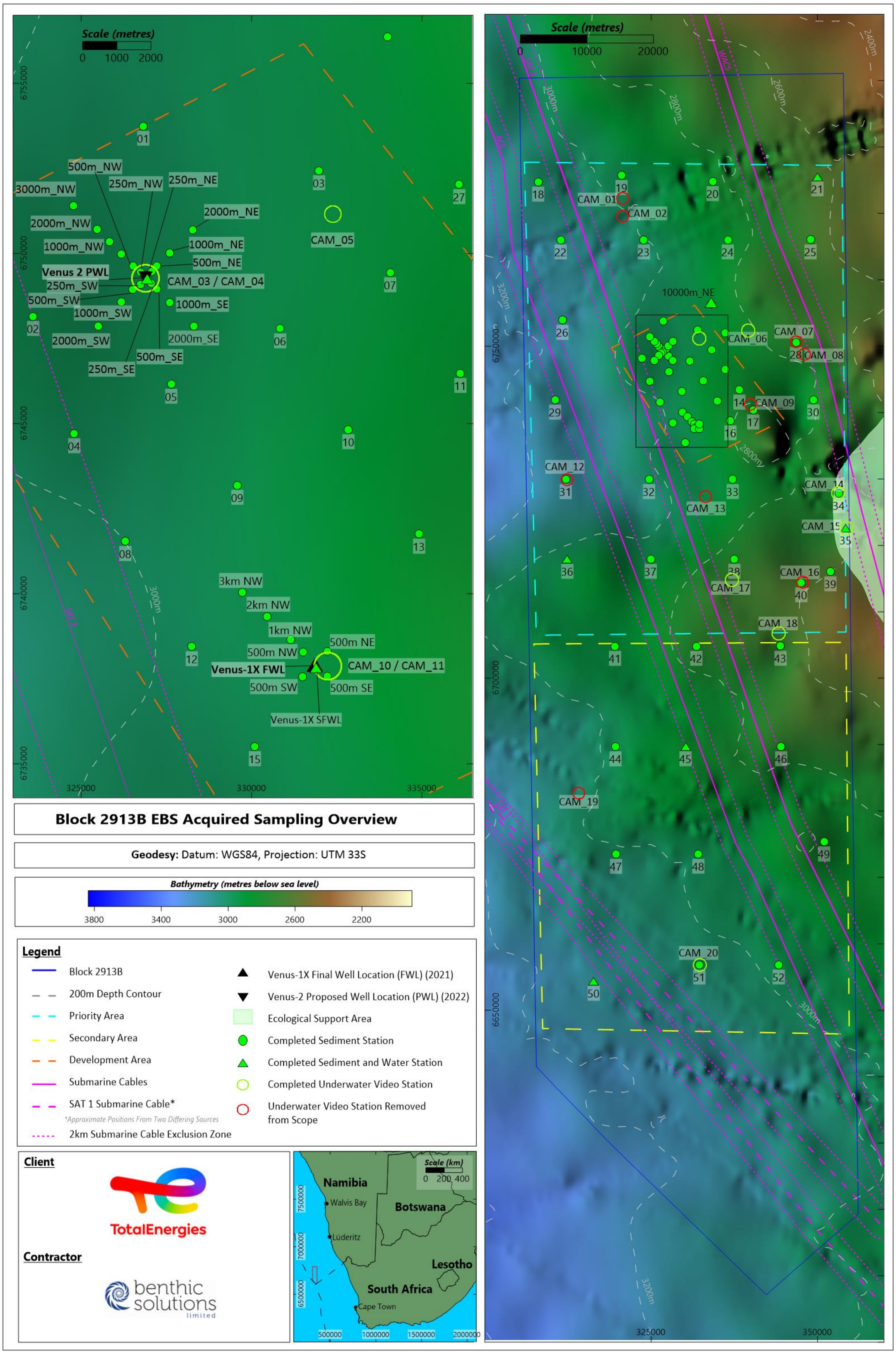


Figure 2.1 Block2913B Sampling Strategy

2.3 Sample Analyses

The recovered sediment and water samples were correctly stored prior to demobilisation and transportation of the material to the analytical laboratories. This involved the freezing or chilling of all physico-chemical samples upon recovery and transporting them back to the UK and France to be forwarded to the analysing laboratory (Table 2.4). This material was analysed at the laboratories detailed in Table 2.4, with the certificate accreditation for the chemistry scope presented in Appendix XVIII –Certification of Laboratories).

Table 2.4 Sample Analysis Laboratories

Sample Analysis	Survey Phase	Laboratory
Sediment chemistry	1 & 2	Socotec, UK
Sediment particle size analysis	1 & 2	BSL, UK
Sediment microbiology	1 & 2	Eurofins, France
Sediment macrofauna	1 & 2	BSL, UK
Sediment and water eDNA	1 & 2	AGL, UK
Water chemistry	1	Socotec, UK
	2	LPL and CEDRE, France
Water plankton	1*	PIQv, France
Water chlorophyll	1	Eurofins, France
	2	Marbec, France

Notes:
**Acquired water plankton samples from survey phase 2 lost during sample delivery to laboratory; no analysis performed*

The analytical methods and limits of detection (LoD) or limits of quantification (LoQ) used in the two surveys are summarised below in Table 2.5, Table 2.6 and Table 2.7. Water sample analyses have two LoDs/LoQs due to the use of different laboratories across the two survey phases. Further details for specific analytical methodologies are provided in Appendix II – Data Presentation, Laboratory and Statistical Analyses.

Table 2.5 Summary of Phase 1 Water Sample Analyses and Methodology (mainly Socotec)

Laboratory Analyses	Methods	US EPA / OSPAR	Limit of Detection / Quantification
Total suspended solids	Determination of Suspended Solids in waters by gravimetry. BS 2690:1981:Part 120, WSLM10	EPA 160.2 / BS2690 Part 121 (1981)	$5 mg.l^{-1}$
Total organic carbon (TOC)	Instrumental analysis using acid/persulphate digestion and nondispersive IR detection, WSLM13	EPA 9060A / BS EN 1484:1997	$0.2 mg.l^{-1}$
Nitrite	Automated discrete colorimetric analysis, KONENS	EPA 353.2 / ISO 6777:1984	$0.2 mg.l^{-1}$
Nitrate	Automated discrete colorimetric analysis, KONENS	EPA 353.2 / ISO 6777:1984	$0.01 mg.l^{-1}$
Orthophosphate	Automated discrete colorimetric analysis, KONENS. Calculation of Orthophosphate as PO4 from Phosphate as P.	EPA 353.2 / ISO 6777:1984	$0.03 mg.l^{-1}$
Total Nitrogen as N/Nitrogen Kjedhal	Determination of Total Nitrogen, peroxodisulphate digestion, colorimetric quantitation using 2,6-dimethylphenol.	EPA 351.2 / ISO 5663:1984	$1.0 mg.l^{-1}$
Metals Analysis by Aqua Regia Digest	Method using ICPMS, ICP-AES	EPA 6020B / ISO 17025:2017	$0.0001 – 0.1 mg.l^{-1}$
Total petroleum hydrocarbons (TPH)	Solvent extraction and clean up followed by GC-FID analysis, TPHFID	EPA 8015 / ISO 16703:2004	$1 \mu g.l^{-1}$

Laboratory Analyses	Methods	US EPA / OSPAR	Limit of Detection / Quantification
Aliphatic hydrocarbons	Solvent extraction and clean up followed by GC-FID analysis; TPHFID	EPA 8015 / ISO 16703:2004	-
Polycyclic aromatic hydrocarbons (PAH) - 16 USEPA	Solvent extraction and clean up followed by GC-MS analysis; PAHMSW	EPA 8270 / ISO 28540:2011	0.001mg.l^{-1}
BTEX (Benzene, Ethyl Benzene, Toluene, O,M,P-Xylenes)	Determination of Volatile Organic Compounds by Headspace GCMS	EPA 3810 / ISO 17943:2016	0.001 - 0.003mg.l^{-1}
Chlorophyll-*a* and Phaeopigments	Spectrophotometry (UV/VIS)	UV-VIS Spectrophotometer	6 - 7µg.l^{-1}
Total heterotrophic microorganisms	Numeration - NPP	-	0.3 UFC/ml
Hydrocarbon adapted microorganisms	Numeration - NPP	-	
Phytoplankton	Riffled count (trawl) and identification	-	N/A
Zooplankton	Riffled count (trawl) and identification	-	N/A

Table 2.6 Summary of Phase 2 Water Sample Analyses and Methodology (mainly Le Cedre/LPL)

Laboratory Analyses	Method	US EPA/ OSPAR	Limit of Detection / Quantification
Total Organic Carbon (TOC)	Combustion /IR	EPA 9060A / BS EN 1484:1997	0.2 mg/l
Total Suspended Solids (TSS)	Gravimetry NF EN 872	EPA 160.2 / BS2690 Part 121 (1981)	2 mg/l
Nitrates (NO3-)	Continuous flow	EPA 353.2 / ISO 6777:1984	0.02 mg/l
Nitrites (NO2)	Continuous flow	EPA 353.2 / ISO 6777:1984	0.01 mg/l
Orthophosphates (PO43-)	Continuous flow	EPA 353.2 / ISO 6777:1984	0.02 mg/l
Total Nitrogen as N/Nitrogen Kjedhal	Spectrophotometry	EPA 351.2 / ISO 5663:1984	0.02 mg/l
Aliphatic hydrocarbons >C5 – C35	GC/MS Internal method	EPA 8015 / ISO 16703:2004	10 µg/l
Aromatic hydrocarbons >C6 – C35			10 µg/l
Total aliphatic hydrocarbons			230 µg/l
Total aromatic hydrocarbons			170 µg/l
Total aliphatic and aromatic hydrocarbons			400 µg/l
BTEX (Benzene, Ethyl Benzene, Toluene, O, M, P-Xylenes)	GC/MS	EPA 3810 / ISO 17943:2016	1 µg/l
PAH (x16 PAHs)	GC/MS	EPA 8270 / ISO 28540:2011	0.005 µg/l
Metals Analysis	EPA 6020B	EPA 6020B / ISO 17025:2017	0.015 – 10 µg/l
Total heterotrophic microorganisms	Internal Method	-	0.300 UFC/ml
Hydrocarbon adapted microorganisms	Internal Method	-	10,000 UFC/ml
Chlorophyll-*a* and Phaeopigments	Spectrophotometry (UV/VIS)	UV-VIS Spectrophotometer	N/A
Zooplankton	ECOTAXA Imagery, ZooScan	200 µm	N/A
Phytoplankton	ECOTAXA Imagery, FlowCAM	50 µm	N/A

Table 2.7 Summary of Phase 1 and 2 Sediment Sample Analyses and Methodology

Laboratory Analyses	Methods	US EPA / OSPAR	Limit of Detection / Quantification
Full Particle Size Analysis (sieve and laser diffraction)	Diffraction laser and physical sieve	ISO 17892-1:2014	0.02µm to 2000µm
Moisture Content	Documented in-house method, oven drying @ 105°C, No TMSS	EPA 9060A / ISO 10694:1995	0.20%
Total Organic Matter by LOI	Determination of loss on ignition at 450°C by gravimetry.	EPA 9060A / ISO 10694:1995	0.2%m/m
Total Organic Carbon	Documented in-house method with carbonate removal and sulphurous acid digestion and high temperature combustion at 1600°C/NDIR, WSLM59	ISO 13878:1998	0.02%m/m
Total Nitrogen as N	Documented in-house method using Konelab discrete analyser, No AMMAR	ISO 11464 & ISO 11466	0.05%
Total Phosphorous	Documented in-house method using aqua regia extraction and ICP-OES, ICP-SOIL	ISO 11464 & ISO 11466	4mg.kg^{-1}
Metals Analysis by Aqua Regia Digest	Method using aqua regia extraction and ICP-MS and ICP-MSS and ICP-OES, ICP-SOIL	EPA 7081	0.01 - 36mg.kg^{-1}
Ba by Fusion	Fusion	EPA 418.1	100mg.kg^{-1}
Total Petroleum Hydrocarbons (TPH)	Method using marine specification by GC-FID, TPHFIDUS	EPA 418.1	1µg.kg^{-1}
Aliphatic hydrocarbons	Method using marine specification by GC-FID, TPHFIDUS	ISO 17892-1:2014	1µg.kg^{-1}
PAHs (16 USEPA)	Method using DTI specification by GC-MS (SIM), PAH-SED	EPA 8100 / ISO 13859:2014	1µg.kg^{-1}
BTEX (Benzene, Ethyl Benzene, Toluene, O, M, P-Xylenes)	Method using headspace GC-MS, VOCHSAS	EPA 5021A / ISO 16558-1:2015	1 - 5µg.kg^{-1}
Total heterotrophic microorganisms	Numeration - CFU	-	500NPP/g
Hydrocarbon adapted microorganisms	Numeration - CFU	-	5NPP/g
Macroinvertebrate analysis (500µm)	Identification and abundance	-	1 ind/0.1m^2
	Biomass	-	0.0001g

3 Environmental Baseline Survey Results and Discussion

3.1 Bathymetry and Seabed Features

Bathymetry for the region was derived from both broadscale low-resolution data and 3D seismic data acquisition that was provided by the client prior to the survey. Block 2913B is located approximately 270km off the south coast of Namibia and **water depths ranged between 2,500m to over 3,200m below sea level**. Despite the relatively minimal change in water depth with an **average slope gradient of 0.6% across the survey area,** a relatively steep slope with a gradient of 2.7% was located 1km NW of Venus-1X (Figure 2.1).

3.2 Sediment Reduction-Oxidation (Redox) Potential, pH and Naturally occurring Radioactive Material (NORM)

Readings for redox and pH were taken for each sediment sample, the results of which can be found in Table 3.1.

The **temperature ranged from 3.1°C to 11.7°C at measurement depth 1cm, and 1.3°C to 9.5°C at the 10cm measurement depth**.

The pH ranged from 5.5 to 9.4 at measurement depth 1cm, and 4.4 and 8.2 at the 10cm measurement depth. **Most samples where either natural (pH 7-7.9) or slightly acidic (4.4-6.9) with a smaller proportion (18% of samples) classed as alkaline (pH >7.9).**

The observed redox was then standardised to 10°C and normalised to the standard hydrogen electrode (SHE) by adding 214mV, the results of which are displayed in Table 3.1.**The redox normalised to SHE was variable throughout Block 2193B**. The **surficial redox measurements (1cm depth) ranged from 365mV to 852mV, whilst the measurements taken at 10cm depth ranged from 348mV to 708mV**.

Both measurement depths display **well oxygenated sediment** at most stations. The most reduced surficial sediment was found at B2913B_ENV_16 with a score of 365mV. Interestingly, the most reduced sediment at 10cm depth was not at the same station and was found at 500m_NW with a score of 348mV. Neither of these redox values are particularly low or cause for a concern when considering microbial-mediated redox processes have been known to decrease the redox potential to a level as low as −300mV (Søndergaard, 2009). Thus, the slightly lower values seen at both of these stations are likely to be a reflection of small-scale variability in the seabed sediment composition and redox potential. There was no clear trend in sediment oxygenation within the Block. In general, sites with a higher fines content appeared to be slightly less oxygenated than sites with a lower fines content, however the least oxygenated sites did not have the highest fines content as a rule. Again, it is likely that this is a result of small-scale variability in the seabed.

Table 3.1 Summary of the Temperature, pH and Redox Normalised Results

Station	Water Depth (m)	1cm Penetration				10cm Penetration			
		Observed Redox (mV)	Observed Temperature (°C)	Redox Normalised to SHE* (mV)	pH	Observed Redox (mV)	Observed Temperature (°C)	Redox Normalised to SHE* (mV)	pH
0m Venus-2 SPWL	2,900	280	9.4	494	8.0	195	4.7	409	8.0
250m_SE	2,900	213	8.4	427	8.1	187	4.2	401	6.7
500m_SE	2,900	157	8.7	371	8.1	138	4.1	352	8.1
1000m_SE	2,900	174	8.1	388	8.0	193	5.7	407	6.6
2000m_SE	2,900	166	11.7	380	7.5	270	6.5	484	7.6
250m_NW	2,900	240	8.9	454	8.1	209	4.7	423	8.0
500m_NW	2,900	181	9.3	395	8.2	134	4.9	348	8.1
1000m_NW	2,900	252	6.0	466	7.9	167	5.3	381	7.9
1500m_NW	2,900	232	7.6	446	6.8	240	3.7	454	6.6
2000m_NW	2,900	214	8.8	428	6.1	224	5.2	438	6.9
3000m_NW	2,900	245	8.3	459	8.1	212	4.1	426	8.0
250m_NE	2,900	222	8.9	436	6.5	189	4.9	403	6.4
500m_NE	2,900	245	8.5	459	7.8	216	4.6	430	7.8
1000m_NE	2,900	189	8.3	403	7.0	135	4.9	349	6.9
2000m_NE	2,900	207	9.5	421	7.0	209	4.2	423	6.2
10000m_NE	2,900	638	10.0	852	8.0	494	5.5	708	7.8
250m_SW	2,900	250	6.7	464	8.2	255	4.3	469	8.2
500m_SW	2,900	217	8.5	431	8.1	154	4.9	368	8.1
1000m_SW	2,900	303	9.7	517	6.4	192	4.9	406	6.3
2000m_SW	2,900	215	9.0	429	6.8	229	4.5	443	6.4
B2913B_ENV_01	2,964	245	5.1	459	6.1	269	3.4	483	5.7
B2913B_ENV_02	3,025	174	7.2	389	7.6	175	4.2	389	7.6
B2913B_ENV_03	2,916	244	8.5	458	6.3	250	7.9	464	6.2
B2913B_ENV_04	3,051	267	9.7	481	6.4	180	8.1	394	8.1
B2913B_ENV_05	3,028	190	8.6	405	7.6	176	7.5	391	7.7
B2913B_ENV_06	3,002	153	7.3	367	7.8	159	5.7	373	7.9
B2913B_ENV_07	2,978	165	4.7	379	7.9	156	3.8	370	8.2
B2913B_ENV_08	3,032	203	3.1	417	7.3	202	1.3	416	7.3
B2913B_ENV_09	3,019	181	6.7	395	7.6	200	5.6	414	7.0
B2913B_ENV_10	3,003	236	6.2	451	6.8	231	5.6	445	7.1
B2913B_ENV_11	2,977	155	7.4	369	7.6	222	3.5	436	7.4.
B2913B_ENV_12	3,025	180	5.7	394	6.8	150	4.0	364	6.7
B2913B_ENV_13	2,976	190	8.4	404	7.1	175	5.2	389	6.8
B2913B_ENV_14	2,954	243	9.0	457	7.3	253	6.4	467	7.1

Station	Water Depth (m)	1cm Penetration				10cm Penetration			
		Observed Redox (mV)	Observed Temperature (°C)	Redox Normalised to SHE* (mV)	pH	Observed Redox (mV)	Observed Temperature (°C)	Redox Normalised to SHE* (mV)	pH
B2913B_ENV_15	3,013	-	-	-	-	-	-	-	-
B2913B_ENV_16	2,903	151	7.0	365	6.7	220	5.0	434	4.4
B2913B_ENV_17	2,879	288	7.1	502	6.0	320	4.0	534	5.4
B2913B_ENV_19	2,943	322	7.1	536	6.6	314	6.2	528	6.4
B2913B_ENV_20	2,810	247	8.2	461	6.9	263	5.2	477	6.8
B2913B_ENV_21	2,625	312	6.9	526	7.0	292	4.6	506	7.0
B2913B_ENV_23	2,996	308	10.0	522	7.8	271	7.0	485	7.7
B2913B_ENV_24	2,849	153	6.4	367	9.4	138	4.0	352	8.0
B2913B_ENV_25	2,593	267	7.7	481	7.2	294	5.0	508	7.2
B2913B_ENV_27	2,857	347	7.4	561	6.4	422	4.2	636	5.4
B2913B_ENV_28	2,737	284	9.6	498	6.7	386	9.5	600	5.3
B2913B_ENV_29	3,117	282	7.7	496	8.1	244	6.2	458	8.0
B2913B_ENV_30	2,793	246	9.0	460	7.0	243	4.2	457	6.8
B2913B_ENV_31	3,164	266	7.9	480	7.9	236	7.1	450	7.8
B2913B_ENV_33	2,953	258	5.7	472	7.8	190	4.2	404	7.7
B2913B_ENV_34	2,743	185	6.0	399	7.5	170	4.4	384	7.5
B2913B_ENV_35	2,661	173	8.3	387	7.7	140	7.6	354	7.6
B2913B_ENV_36	2,878	248	7.1	462	7.7	220	4.9	434	7.3
B2913B_ENV_38	2,790	278	9.9	492	7.3	182	5.7	396	6.9
B2913B_ENV_39	2,538	224	7.1	438	7.6	200	5.6	414	7.6
B2913B_ENV_40	2,613	278	7.9	492	7.6	237	5.6	451	7.5
B2913B_ENV_41	2,873	395	7.6	609	5.5	296	4.9	510	6.7
B2913B_ENV_43	2,715	154	8.6	368	7.5	150	4.5	364	7.4
B2913B_ENV_44	2,957	322	8.7	536	5.9	296	5.1	510	6.3
B2913B_ENV_45	2,830	274	6.8	488	6.9	-	-	-	6.4
B2913B_ENV_46	2,735	352	7.7	566	7.4	296	4.4	510	7.4
B2913B_ENV_47	3,012	262	7.9	476	7.3	231	6.4	445	7.2
B2913B_ENV_48	2,963	189	8.1	403	7.6	167	6.7	381	7.6
B2913B_ENV_49	2,846	180	6.6	394	7.4	147	4.5	361	7.4
B2913B_ENV_50	3,116	207	10.7	421	8.0	197	5.7	411	7.8
B2913B_ENV_51	3,032	282	7.7	496	5.9	206	5.7	420	6.7
B2913B_ENV_52	2,960	289	7.0	503	6.8	268	4.8	482	6.8

Notes:
**Redox potential standardised to SHE (10°C)*
'-' No reading acquired due to malfunction in probe.

NORM is present in very low concentrations in the Earth's crust and is bought to the surface through human activities such as oil and gas exploration and mining. NORM can also form in the oil and gas industry due to the precipitation of minerals (e.g. barium, calcium, strontium and radium sulfates), as scale, on the outside of tubulars and/or casing, due to changes in temperature and pressure of fluids injected into reservoirs. NORM background levels are established on the vessel by taking a reading before each sample at different locations on the vessel. No γ readings were taken at 26 stations in the survey area due to a probe malfunction. **All station had Alpha and Beta measurements which differed by <3 CPS from their respective sample background levels indicating no contamination** (Table 3.2). **Gamma measurements were above the background levels by more than 3 counts per second (CPS) at 30 stations indicating a slight NORM presence** (Table 3.2). **However, one sample (10,000m_NE) was >20 CPS above its background level and therefore could be considered as containing naturally occurring radioactive particles.**

Table 3.2 Summary of the NORM Results (CPS)

Stations	αβ Background	αβ	γ Background	γ
0m Venus 2 SPWL	0.25	0.25	1.00	7.00
250m_SE	0.60	0.60	7.00	8.00
500m_SE	0.35	0.35	2.50	6.00
1000m_SE	0.39	0.79	1.39	7.03
2000m_SE	0.38	0.69	1.44	5.73
250m_NW	0.35	0.38	3.00	6.00
500m_NW	0.63	0.69	2.43	6.69
1000m_NW	0.40	0.60	1.00	9.00
2000m_NW	0.23	0.29	9.57	17.09
3000m_NW	0.40	0.40	1.50	8.00
250m_NE	0.35	0.40	3.00	8.00
500m_NE	0.46	0.33	6.03	6.19
1000m_NE	0.33	0.76	13.87	11.23
2000m_NE	0.29	0.46	1.96	5.89
10,000m_NE	0.29	0.43	1.93	24.34
250m_SW	3.00	0.30	0.40	7.00
500m_SW	0.33	0.39	7.00	17.00
1000m_SW	0.30	0.40	1.50	7.00
1500m_NW	0.39	0.89	1.26	5.23
2000m_SW	0.20	0.30	1.50	8.50
B2913B_ENV_01	0.29	0.69	1.26	4.26
B2913B_ENV_02	0.26	0.39	1.71	5.83
B2913B_ENV_03	0.36	0.56	1.63	5.16
B2913B_ENV_04	0.33	0.56	8.59	5.13
B2913B_ENV_05	0.21	0.49	1.83	4.99
B2913B_ENV_06	0.41	0.36	1.29	6.89
B2913B_ENV_07	0.33	0.43	1.09	4.73
B2913B_ENV_08	0.43	0.34	5.86	5.43
B2913B_ENV_09	0.53	0.89	1.66	6.09
B2913B_ENV_10	0.39	0.29	18.97	27.64
B2913B_ENV_11	0.41	0.53	11.72	12.10
B2913B_ENV_12	0.29	0.43	1.09	5.96
B2913B_ENV_13	0.26	0.39	1.56	7.03
B2913B_ENV_14	0.21	0.56	3.74	7.13
B2913B_ENV_15	0.26	0.39	2.86	5.93
B2913B_ENV_16	0.19	0.43	1.43	5.23
B2913B_ENV_17	0.36	0.46	1.19	5.89
B2913B_ENV_19	0.48	0.43	-	-
B2913B_ENV_20	0.46	0.39	-	-
B2913B_ENV_21	0.16	0.43	-	-
B2913B_ENV_23	0.26	0.43	-	-
B2913B_ENV_24	0.29	0.73	-	-
B2913B_ENV_25	0.33	0.46	-	-
B2913B_ENV_27	0.33	0.83	1.56	5.73

Stations	αβ Background	αβ	γ Background	γ
B2913B_ENV_28	0.23	0.49	1.51	5.73
B2913B_ENV_29	0.34	0.63	-	-
B2913B_ENV_30	0.43	0.66	3.50	5.89
B2913B_ENV_31	0.36	0.73	-	-
B2913B_ENV_33	0.49	0.76	-	-
B2913B_ENV_34	0.46	0.86	-	-
B2913B_ENV_35	0.39	0.83	-	-
B2913B_ENV_36	0.39	0.43	-	-
B2913B_ENV_38	0.43	0.53	-	-
B2913B_ENV_39	0.38	0.53	-	-
B2913B_ENV_40	0.29	0.39	-	-
B2913B_ENV_41	0.28	0.69	-	-
B2913B_ENV_43	0.49	0.56	-	-
B2913B_ENV_44	0.46	0.39	-	-
B2913B_ENV_45	0.29	0.53	-	-
B2913B_ENV_46	0.13	0.63	-	-
B2913B_ENV_47	0.38	0.49	-	-
B2913B_ENV_48	0.19	0.43	-	-
B2913B_ENV_49	0.46	0.63	-	-
B2913B_ENV_50	0.26	0.73	-	-
B2913B_ENV_51	0.60	0.43	-	-
B2913B_ENV_52	0.19	0.39	-	-

Notes:
'-' No reading acquired due to malfunction in probe.

3.3 Particle Size Distribution (PSD)

The particle size interpretation of sediments from the Block 2913B survey area was based on observations from seabed photography and from the **analytical results acquired from the sediments at 66 stations** (Figure 2.1). Material for particle size analysis (PSA) was recovered from the **surface 5cm of the grab sampler** (box corer and double grab) and analysed by BSL upon return of the samples to Norfolk, UK. Refer to Appendix II – Data Presentation, Laboratory and Statistical Analyses for the laboratory methods employed.

The sediment characteristics for each station are listed in Table 3.3 and individual particle size distribution plots are presented in Appendix III – Particle Size Distribution.

3.3.1 *General Description*

All grab samples were described as light brownish grey (Munsell colour: 10YR 6/2) soft mud. The results of particle size were also consistent, with sediments **dominated by fines** (mean: 78.1%±6.1SD), a **moderate proportion of sands** (mean: 21.9%±6.1SD) and negligible gravel (mean: 0.1%±0.4SD; Table 3.3).

The results of particle size analyses revealed a **homogeneous sediment type across the survey area**. Considering there is low variation in depth and seabed features, homogeneity is expected. All stations sampled within Block 2913B were dominated by fines, with a low sands content, and a negligible gravel content. This consistent sediment composition is clearly illustrated in Figure 3.1 to Figure 3.3.

Fines were high across the Block with all but two stations recording >75% of silts/clays in the sediment obtained (Figure 3.1). The lower proportion of fines recorded at station B2913B_ENV_36 (56.1%) was related to an increased sand content (Table 3.3). The low coefficient of variation for the fines fraction (7.72%) provides further evidence for the homogeneity of sediments. **Shallow geology likely influenced the high fines content**; deck logs indicated consolidated clay underlying surficial sediment throughout the Block. The sedimentary relationship between the **highest proportion of fines and lowest proportion of sands was supported by a positive correlation** between the two parameters (ρ(66)=0.-989, p<0.001).

The highest **proportion of sands** was recorded at the same station, B2913B_ENV_36 (43.9%) (Table 3.3) as the highest proportion of fines; the proportion of sands at this station was substantially higher than others (mean: 21.9%±6.1SD). Figure 3.1 and Figure 3.2 illustrate the geographic location of this site and, although it is in the western extent of the Block other stations with similar geographic characteristics do not display the same sediment composition. Small-scale variability in the seabed is likely to have caused this station to display such a difference to the rest of the stations sampled.

Gravel content was negligible throughout Block 2913B and the Venus-2 PWL survey area, as indicated by the high coefficient of variation (570.4%). The highest proportion of gravel was recorded at B2913B_ENV_43 (2.72%, Table 3.3, Figure 3.3.). This station was situated in an area of seabed similar to the majority of stations and station B2913B_ENV_41 was situated directly parallel and due west of station B2913B_ENV_43 and did not see a similar composition, thus the higher proportion of gravel was likely due to the small-scale variability at the seabed.

The Folk (1954) and Wentworth (1922) sediment classifications for each station are listed in Table 3.3. The Wentworth classification assigns a single sediment class based on the mean particle size and is appropriate for well sorted modal sediments. The Folk classification provides a more representative description for poorly sorted sediments, encompassing a range of particle sizes as it takes into account the relative proportions of mud (<63µm), sand (63µm-2mm) and gravel (>2mm) fractions. For the purposes of this study, the modified Folk classification produced by the British Geological Survey was used (Long, 2006).

The samples collected within the survey area were represented by three Folk classifications including 'Mud, 'Sandy Mud', and 'Slightly Gravelly Sandy Mud'. Most stations sampled were classified as 'Sandy Mud' (61 out of 66). Four of the remaining five stations were classified as 'Mud', and station B2913B_ENV_43 was classified as 'Slightly Gravelly Sandy Mud' (Table 3.3). **The Wentworth classification scale identified four sediment classifications, ranging from 'Very Fine Silt' to 'Coarse Silt'**. The sediments across the Block were poorly sorted to varying degrees, with stations predominantly being classified as 'Very Poorly Sorted' (95% of the stations) and 'Poorly sorted' (5% of the stations; Table 3.3).

Table 3.3 Sediment Particle Size Characteristics

Station	Depth (m)	Mean Particle Size (mm)	Mean Particle Size (Phi)	Wentworth Classification	Sorting Coefficient	Sorting Classification	Fines (%)	Sands (%)	Gravel (%)	Modified Folk Scale
0m Venus-2 SPWL	2,900	0.01	6.18	Fine Silt	2.36	Very Poorly Sorted	79.3	20.6	0.0	Sandy Mud
250m_SE	2,900	0.01	6.28	Fine Silt	2.28	Very Poorly Sorted	81.7	18.2	0.0	Sandy Mud
500m_SE	2,900	0.01	6.45	Fine Silt	2.30	Very Poorly Sorted	83.3	16.7	0.0	Sandy Mud
1000m_SE	2,900	0.01	6.18	Fine Silt	2.51	Very Poorly Sorted	77.9	22.1	0.0	Sandy Mud
2000m_SE	2,900	0.02	5.98	Medium Silt	2.50	Very Poorly Sorted	76.3	23.7	0.0	Sandy Mud
250m_NW	2,900	0.01	6.12	Fine Silt	2.56	Very Poorly Sorted	76.7	23.3	0.0	Sandy Mud
500m_NW	2,900	0.01	6.21	Fine Silt	2.41	Very Poorly Sorted	79.7	20.3	0.0	Sandy Mud
1000m_NW	2,900	0.01	6.79	Fine Silt	2.06	Very Poorly Sorted	89.7	10.3	0.0	Sandy Mud
1500m_NW	2,900	0.02	5.91	Medium Silt	2.46	Very Poorly Sorted	75.1	24.9	0.0	Sandy Mud
2000m_NW	2,900	0.01	6.23	Fine Silt	2.44	Very Poorly Sorted	78.9	21.1	0.0	Sandy Mud
3000m_NW	2,900	0.01	6.98	Fine Silt	1.87	Poorly Sorted	93.5	6.5	0.0	Mud
250m_NE	2,900	0.01	6.75	Fine Silt	2.16	Very Poorly Sorted	87.8	12.2	0.0	Sandy Mud
500m_NE	2,900	0.01	7.14	V. Fine Silt	2.05	Very Poorly Sorted	92.3	7.7	0.0	Mud
1000m_NE	2,900	0.01	6.30	Fine Silt	2.25	Very Poorly Sorted	82.5	17.5	0.0	Sandy Mud
2000m_NE	2,900	0.01	6.34	Fine Silt	2.53	Very Poorly Sorted	79.3	20.6	0.0	Sandy Mud
10000m_NE	2,900	0.01	6.38	Fine Silt	2.43	Very Poorly Sorted	80.7	19.3	0.0	Sandy Mud
250m_SW	2,900	0.01	6.07	Fine Silt	2.41	Very Poorly Sorted	78.2	21.8	0.0	Sandy Mud
500m_SW	2,900	0.01	6.30	Fine Silt	2.24	Very Poorly Sorted	82.0	18.0	0.0	Sandy Mud
1000m_SW	2,900	0.01	6.64	Fine Silt	2.41	Very Poorly Sorted	83.6	16.4	0.0	Sandy Mud
2000m_SW	2,900	0.01	6.38	Fine Silt	2.36	Very Poorly Sorted	81.8	18.2	0.0	Sandy Mud
B2913B_ENV_01	2,964	0.01	6.15	Fine Silt	2.39	Very Poorly Sorted	79.5	20.5	0.0	Sandy Mud
B2913B_ENV_02	3,025	0.01	6.26	Fine Silt	2.39	Very Poorly Sorted	80.3	19.7	0.0	Sandy Mud
B2913B_ENV_03	2,916	0.01	6.44	Fine Silt	2.47	Very Poorly Sorted	81.8	18.2	0.0	Sandy Mud
B2913B_ENV_04	3,051	0.01	6.18	Fine Silt	2.53	Very Poorly Sorted	78.0	22.0	0.0	Sandy Mud
B2913B_ENV_05	3,028	0.01	6.15	Fine Silt	2.51	Very Poorly Sorted	77.9	22.1	0.0	Sandy Mud
B2913B_ENV_06	3,002	0.02	6.04	Fine Silt	2.50	Very Poorly Sorted	77.4	22.6	0.0	Sandy Mud
B2913B_ENV_07	2,978	0.01	6.21	Fine Silt	2.50	Very Poorly Sorted	79.3	20.7	0.0	Sandy Mud
B2913B_ENV_08	3,032	0.02	5.99	Medium Silt	2.53	Very Poorly Sorted	76.0	24.0	0.0	Sandy Mud
B2913B_ENV_09	3,019	0.01	6.30	Fine Silt	2.41	Very Poorly Sorted	81.0	19.0	0.0	Sandy Mud
B2913B_ENV_10	3,003	0.01	6.18	Fine Silt	2.19	Very Poorly Sorted	82.1	17.9	0.0	Sandy Mud
B2913B_ENV_11	2,977	0.01	6.20	Fine Silt	2.24	Very Poorly Sorted	81.7	17.9	0.5	Sandy Mud
B2913B_ENV_12	3,025	0.01	6.18	Fine Silt	2.55	Very Poorly Sorted	77.6	22.5	0.0	Sandy Mud
B2913B_ENV_13	2,976	0.01	6.32	Fine Silt	2.46	Very Poorly Sorted	81.2	18.8	0.0	Sandy Mud
B2913B_ENV_14	2,954	0.01	6.39	Fine Silt	2.41	Very Poorly Sorted	81.5	18.5	0.0	Sandy Mud
B2913B_ENV_15	3,013	0.01	6.25	Fine Silt	2.34	Very Poorly Sorted	80.7	19.3	0.0	Sandy Mud
B2913B_ENV_16	2,903	0.01	6.12	Fine Silt	2.56	Very Poorly Sorted	76.8	23.2	0.0	Sandy Mud
B2913B_ENV_17	2,879	0.02	5.91	Medium Silt	2.68	Very Poorly Sorted	72.9	27.1	0.0	Sandy Mud
B2913B_ENV_19	2,943	0.01	6.17	Fine Silt	2.42	Very Poorly Sorted	79.5	20.5	0.0	Sandy Mud
B2913B_ENV_20	2,810	0.02	5.99	Medium Silt	2.49	Very Poorly Sorted	76.4	23.6	0.0	Sandy Mud
B2913B_ENV_21	2,625	0.01	6.17	Fine Silt	2.49	Very Poorly Sorted	78.5	21.5	0.0	Sandy Mud
B2913B_ENV_23	2,996	0.01	6.11	Fine Silt	2.63	Very Poorly Sorted	75.9	24.1	0.0	Sandy Mud
B2913B_ENV_24	2,849	0.01	6.12	Fine Silt	2.38	Very Poorly Sorted	79.3	20.7	0.0	Sandy Mud
B2913B_ENV_25	2,593	0.01	6.10	Fine Silt	2.49	Very Poorly Sorted	78.6	21.4	0.0	Sandy Mud
B2913B_ENV_27	2,857	0.02	5.95	Medium Silt	2.35	Very Poorly Sorted	77.7	22.3	0.0	Sandy Mud
B2913B_ENV_28	2,737	0.01	6.16	Fine Silt	2.47	Very Poorly Sorted	79.6	20.4	0.0	Sandy Mud
B2913B_ENV_29	3,117	0.01	6.19	Fine Silt	2.48	Very Poorly Sorted	79.2	20.8	0.0	Sandy Mud
B2913B_ENV_30	2,793	0.01	7.21	V. Fine Silt	1.71	Poorly Sorted	96.8	3.2	0.0	Mud
B2913B_ENV_31	3,164	0.01	6.49	Fine Silt	2.20	Very Poorly Sorted	84.9	15.1	0.0	Sandy Mud
B2913B_ENV_33	2,953	0.02	6.03	Fine Silt	2.41	Very Poorly Sorted	78.0	22.0	0.0	Sandy Mud
B2913B_ENV_34	2,743	0.02	5.97	Medium Silt	2.54	Very Poorly Sorted	76.2	23.8	0.0	Sandy Mud
B2913B_ENV_35	2,661	0.02	5.80	Medium Silt	2.57	Very Poorly Sorted	73.7	26.3	0.0	Sandy Mud
B2913B_ENV_36	2,878	0.03	4.91	Coarse Silt	2.78	Very Poorly Sorted	56.1	43.9	0.0	Sandy Mud
B2913B_ENV_38	2,790	0.01	7.22	V. Fine Silt	1.60	Poorly Sorted	97.8	2.2	0.0	Mud
B2913B_ENV_39	2,538	0.02	5.98	Medium Silt	2.54	Very Poorly Sorted	76.3	23.7	0.0	Sandy Mud
B2913B_ENV_40	2,613	0.02	5.98	Medium Silt	2.53	Very Poorly Sorted	75.5	24.5	0.0	Sandy Mud
B2913B_ENV_41	2,873	0.01	6.41	Fine Silt	2.28	Very Poorly Sorted	83.1	16.9	0.0	Sandy Mud
B2913B_ENV_43	2,715	0.01	6.06	Fine Silt	2.50	Very Poorly Sorted	77.1	20.1	2.7	Slightly Gravelly Sandy
B2913B_ENV_44	2,957	0.02	5.96	Medium Silt	2.71	Very Poorly Sorted	73.8	26.2	0.0	Sandy Mud
B2913B_ENV_45	2,830	0.02	5.97	Medium Silt	2.50	Very Poorly Sorted	76.9	23.1	0.0	Sandy Mud
B2913B_ENV_46	2,735	0.02	5.61	Medium Silt	2.70	Very Poorly Sorted	68.4	31.6	0.0	Sandy Mud
B2913B_ENV_47	3,012	0.02	5.98	Medium Silt	2.62	Very Poorly Sorted	73.0	27.0	0.0	Sandy Mud
B2913B_ENV_48	2,963	0.02	5.79	Medium Silt	2.65	Very Poorly Sorted	72.6	27.4	0.0	Sandy Mud
B2913B_ENV_49	2,846	0.01	6.11	Fine Silt	2.32	Very Poorly Sorted	79.2	20.7	0.1	Sandy Mud
B2913B_ENV_50	3,116	0.02	5.89	Medium Silt	2.56	Very Poorly Sorted	73.6	26.4	0.0	Sandy Mud
B2913B_ENV_51	3,032	0.02	5.89	Medium Silt	2.63	Very Poorly Sorted	74.0	26.0	0.0	Sandy Mud
B2913B_ENV_52	2,960	0.02	5.94	Medium Silt	2.57	Very Poorly Sorted	74.7	25.3	0.0	Sandy Mud
Mean		**0.01**	**6.12**	**Fine Silt**	**2.41**	**Very Poorly Sorted**	**78.1**	**21.9**	**0.1**	**Sandy Mud**
Standard Deviation		**0.00**	**0.34**	**NC**	**0.21**	**NC**	**6.1**	**6.1**	**0.4**	**NC**
Variance (%)		**24.8**	**5.6**	**NC**	**8.7**	**NC**	**7.8**	**27.8**	**570.4**	**NC**
Minimum		**0.01**	**4.91**	**NC**	**1.60**	**NC**	**56.1**	**2.2**	**0.0**	**NC**
Maximum		**0.03**	**7.22**	**NC**	**2.78**	**NC**	**97.8**	**43.9**	**2.7**	**NC**

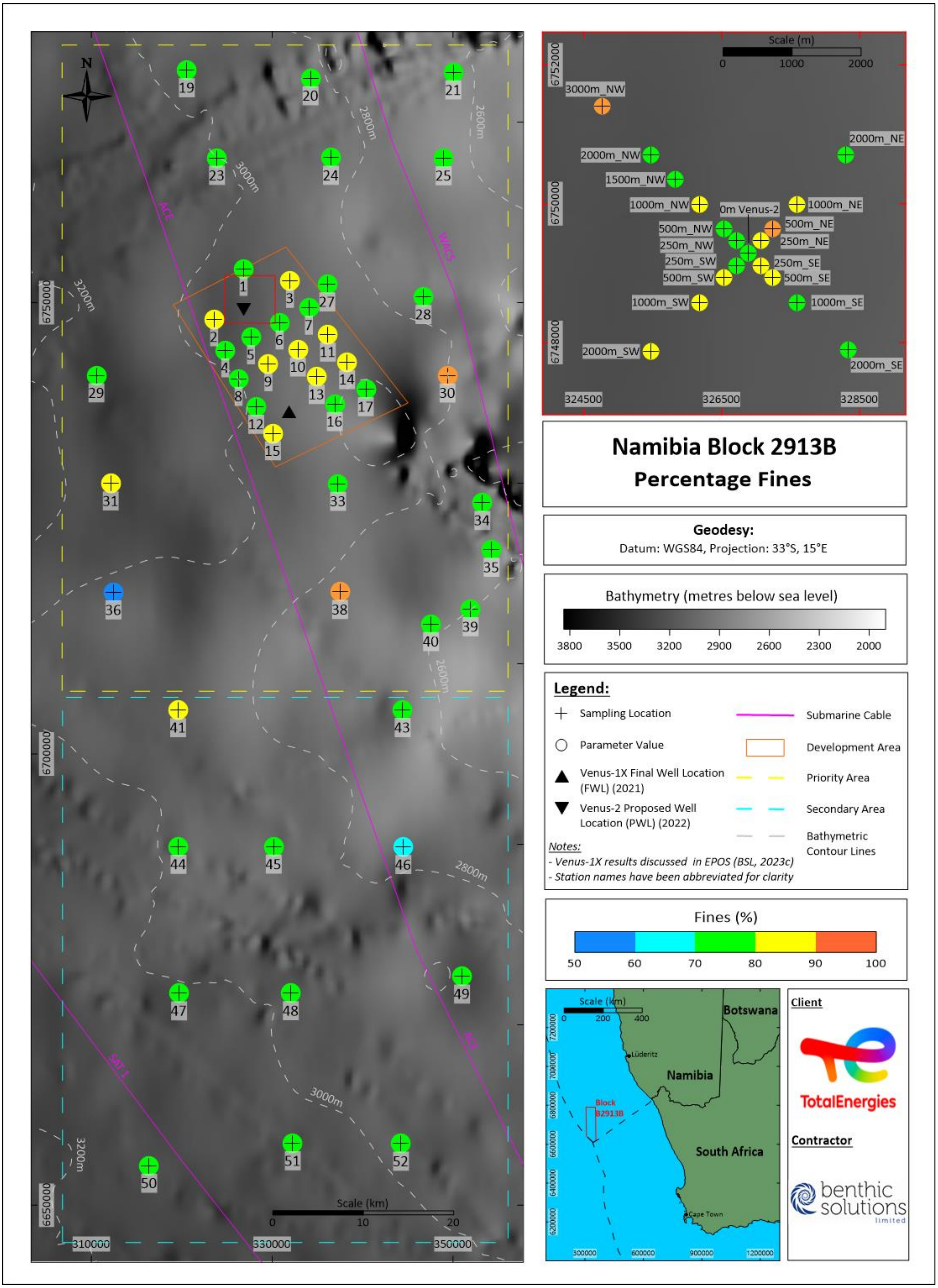


Figure 3.1 Percentage of Fines

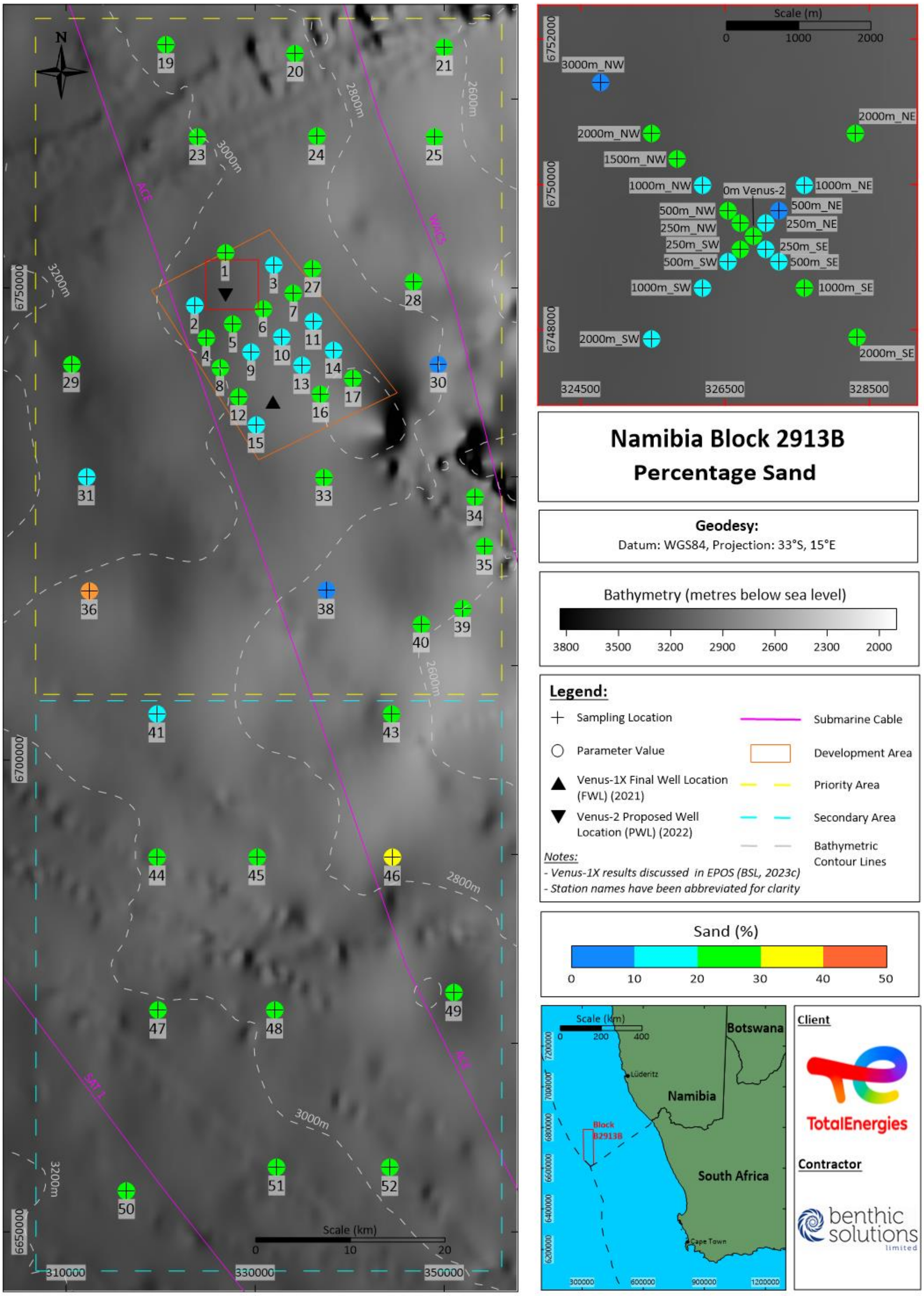


Figure 3.2 Percentage of Sand

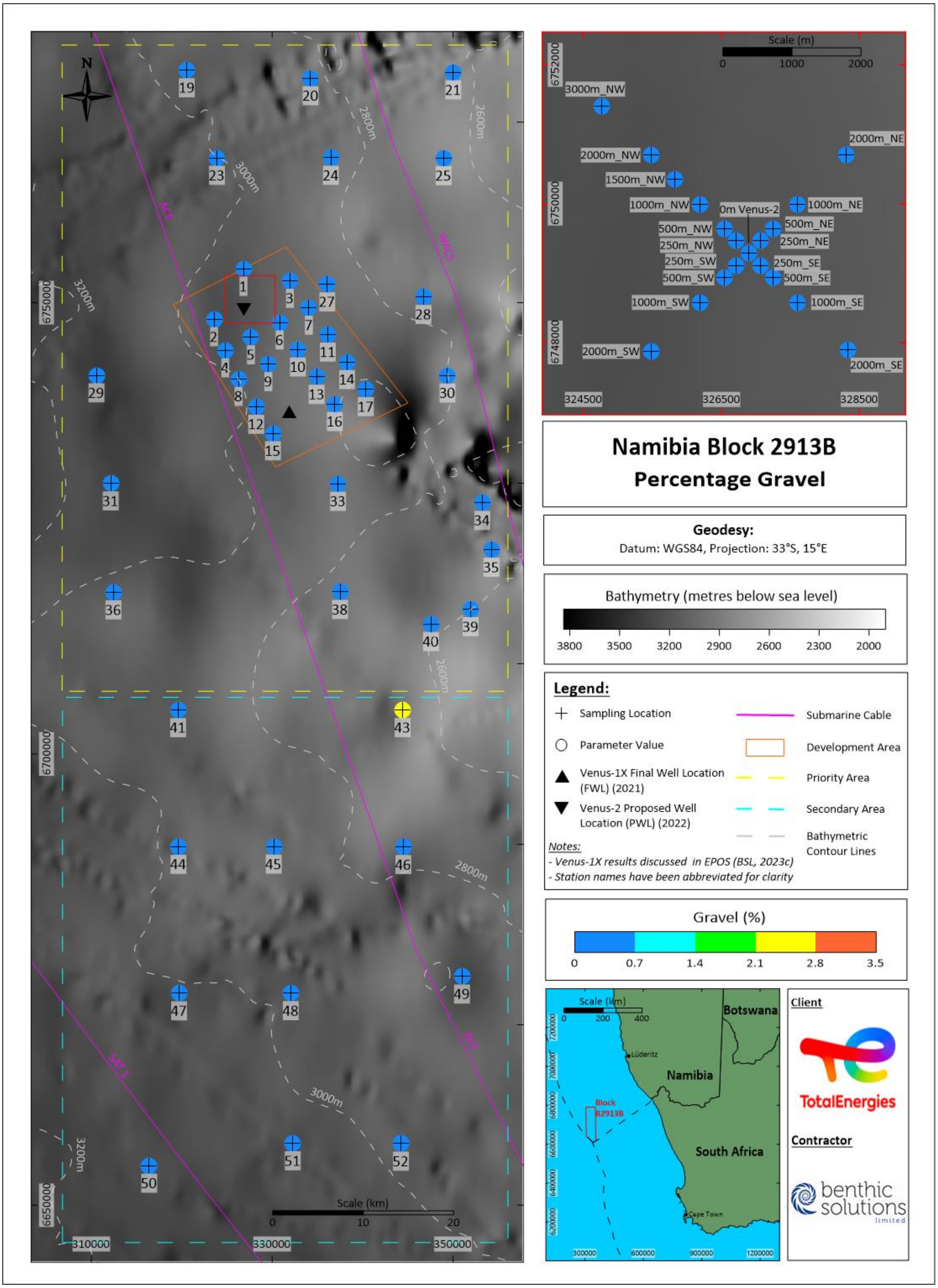


Figure 3.3 Percentage of Gravel

3.3.2 *Multivariate Analysis*

The particle size distribution of the 66 sediment samples were subjected to further detailed investigation by multivariate analysis using Plymouth Routines in Multivariate Ecological Research software (PRIMER V7; Clarke and Warwick, 1994) to elucidate any spatial trends within the data.

A similarity dendrogram was generated by hierarchical agglomerative clustering (CLUSTER) using the particle size (phi) to illustrate the similarities/dissimilarities between stations using the Euclidean Distance dissimilarity measure. Similarity profiling analysis (SIMPROF) of the inter-station similarities/dissimilarities initially indicated the presence of many statistically different groups ($p<0.05$; 23 clusters), differentiated by black branches in the dendrogram, showing the heterogeneity of the dataset. However, this was thought to have over-differentiated the dataset and a **'slice' was overlain at a Euclidean Distance of 7 to group the stations at a higher level more relevant for interpretation** (Figure 3.4). The slice separated the survey dataset into four main cluster groups, as described below:

- **Cluster '*a*': The largest cluster contained 58 stations which were all fines dominated** and ranged from 72.6% at B2913B_ENV_48 to 97.8% at B2913B_ENV_38. These stations recorded lower but variable proportions of sand (15.1% to 27.4%) and negligible gravel (<2.3%). Almost all stations were **classified as 'Sandy Mud'**, with station B2913B_ENV_43 being classified as 'Slightly Gravelly Sandy Mud' on the modified Folk scale.
- **Cluster '*b*'**: The second cluster consisted of **three stations**, two of which were in the wider Block (B2913B_ENV_30 and B2913B_ENV_38), and the other of which was situated in the Venus-2 PWL cruciform (3000m_NW). These stations were all **classified as 'Mud'** on the Folk scale, and all had lower sorting coefficients than average.
- **Cluster '*c*': This cluster contained four stations, all of which were in the Venus-2 SPWL cruciform (1000m_NW, 250m_NE, 500m_NE, 1000m_SW).** These sediment samples all had a slightly higher mean particle size (phi) than the rest of the stations sampled, and hence were very slightly siltier in their composition, reflected by being categorised as a combination of '**Fine Silt' and 'Very Fine Silt'** on the Wentworth Classification Scale.
- **Cluster '*d*'**: This cluster is made up of **one station**, B2913B_ENV_36. Although this station is classed as 'Sandy Mud' on the modified Folk Scale, this station has approximately double the proportion of sands than other stations and is hence also the only station **classed as 'Coarse Silt**' on the Wentworth Classification Scale.

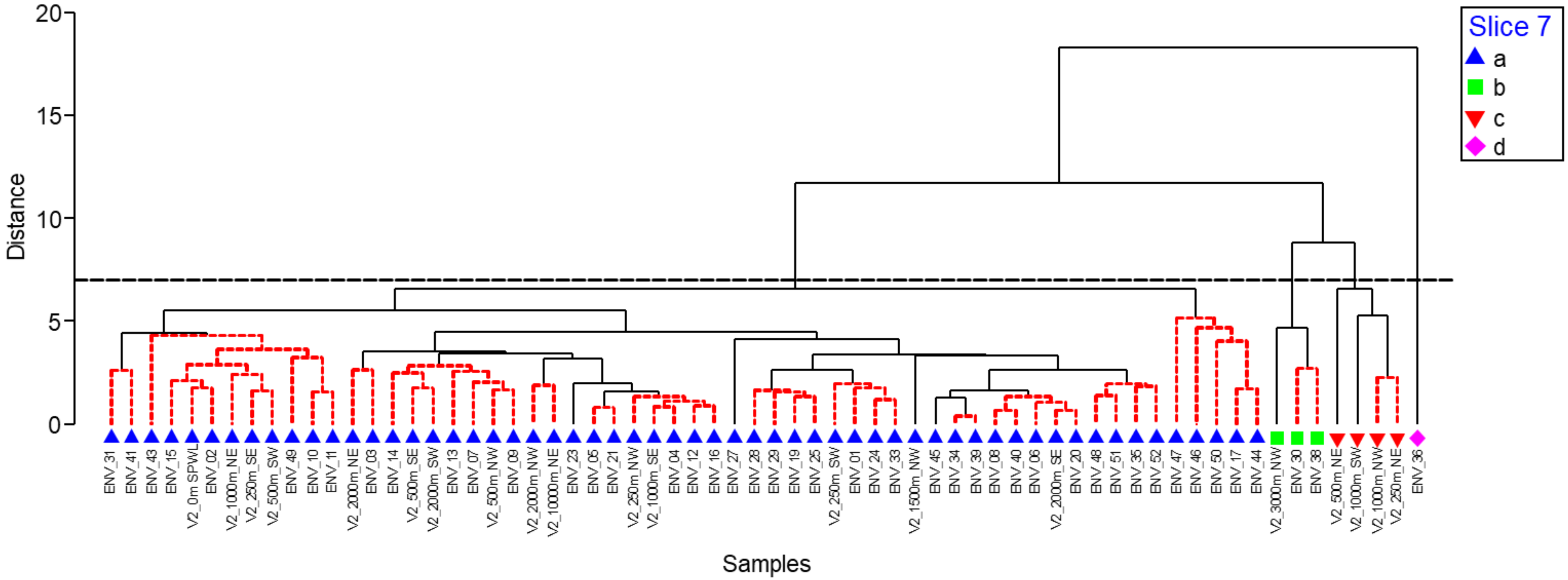


Figure 3.4 Particle Size Analysis Similarity Dendrogram (Station Names Abbreviated for Clarity)

A principal component analysis (PCA) was carried out on the whole phi sieve fraction data for each station (Figure 3.5). The resultant PCA plot shows the interrelatedness of each station, in terms of PSD, by plotting each station against the two principal component axes (PC1 and PC2) which best describe the variability in sediment composition across the survey area. The direction and magnitude of variation in each whole phi sediment class is illustrated by the superimposition of eigenvectors over the PCA plot, shown by the orientation and length of the blue arrows labelled with relevant phi fraction.

The PCA plot illustrates that **cluster *'a'* was the cluster with the highest number of stations. Stations in this cluster were composed of silt, fine silts and very fine silts (phi 7 to 9).** Cluster *'d'* was most influenced by sands and fine sands (phi 2 to 3). Differences between clusters *'b'* and *'c'* were driven by the proportion of fine and very fine silt; cluster *'b'* is situated further away from the central point of the PCA plot compared to cluster *'c'*, demonstrating it has a higher proportion of fine and very fine silt.

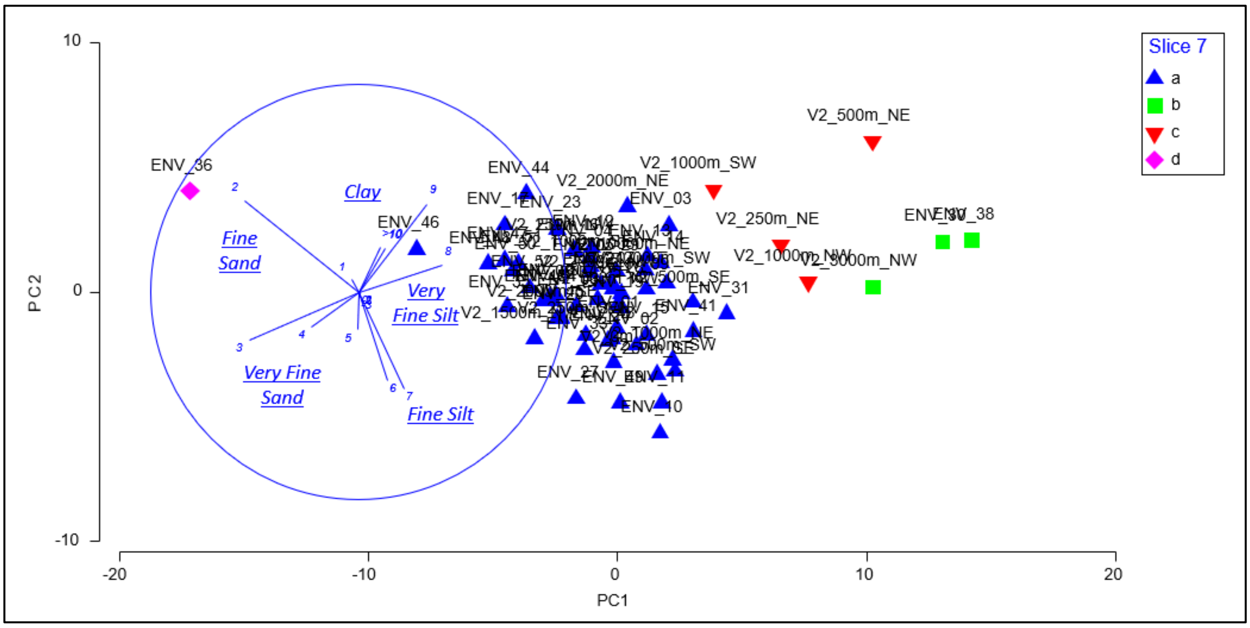


Figure 3.5 Principal Component Analysis of Particle Size Analysis

A comparison of the full particle size distribution dataset using Wentworth (1922) size categories split into the four clusters described above is shown in Figure 3.6 along with example seabed and grab sample photographs. The plot illustrates the **subtle heterogeneity of the Block 2913B seabed** with different clusters demonstrating peaks in the different phi size fractions. **All four clusters had a peak in the fine to very fine silt fraction (phi 7 to 9)** with this most prominent in clusters '*a*', '*b*' and '*c*'. Cluster *'d'* and *'c'* had a bimodal distribution with the prominent peak in the fine sand to very fine sand fraction (phi 2 to 3). The geographical distribution of clusters is displayed over bathymetry data in Figure 3.7.

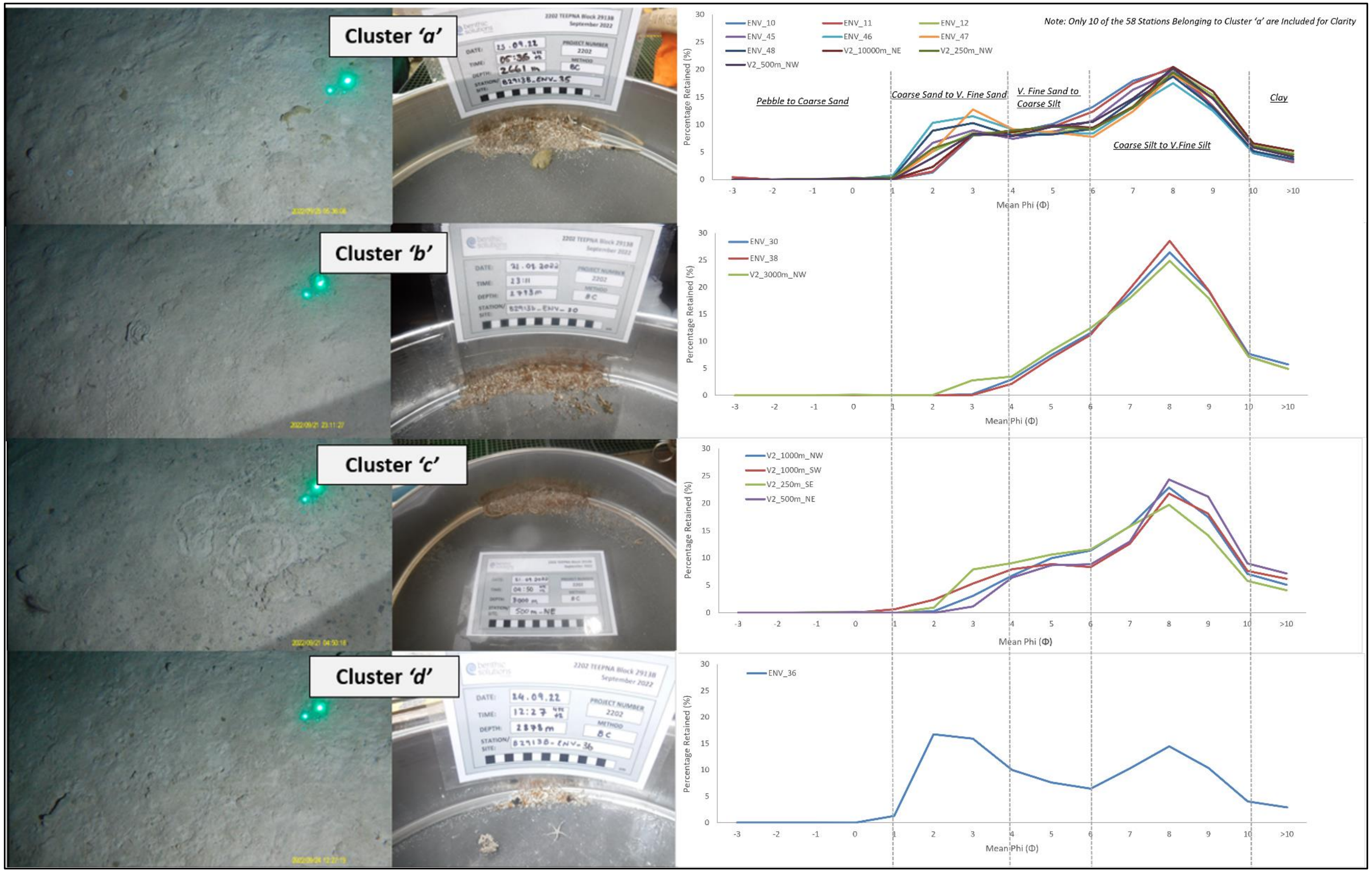


Figure 3.6 Particle Size Distribution for the Different Clusters 'a', 'b', 'c', and 'd'

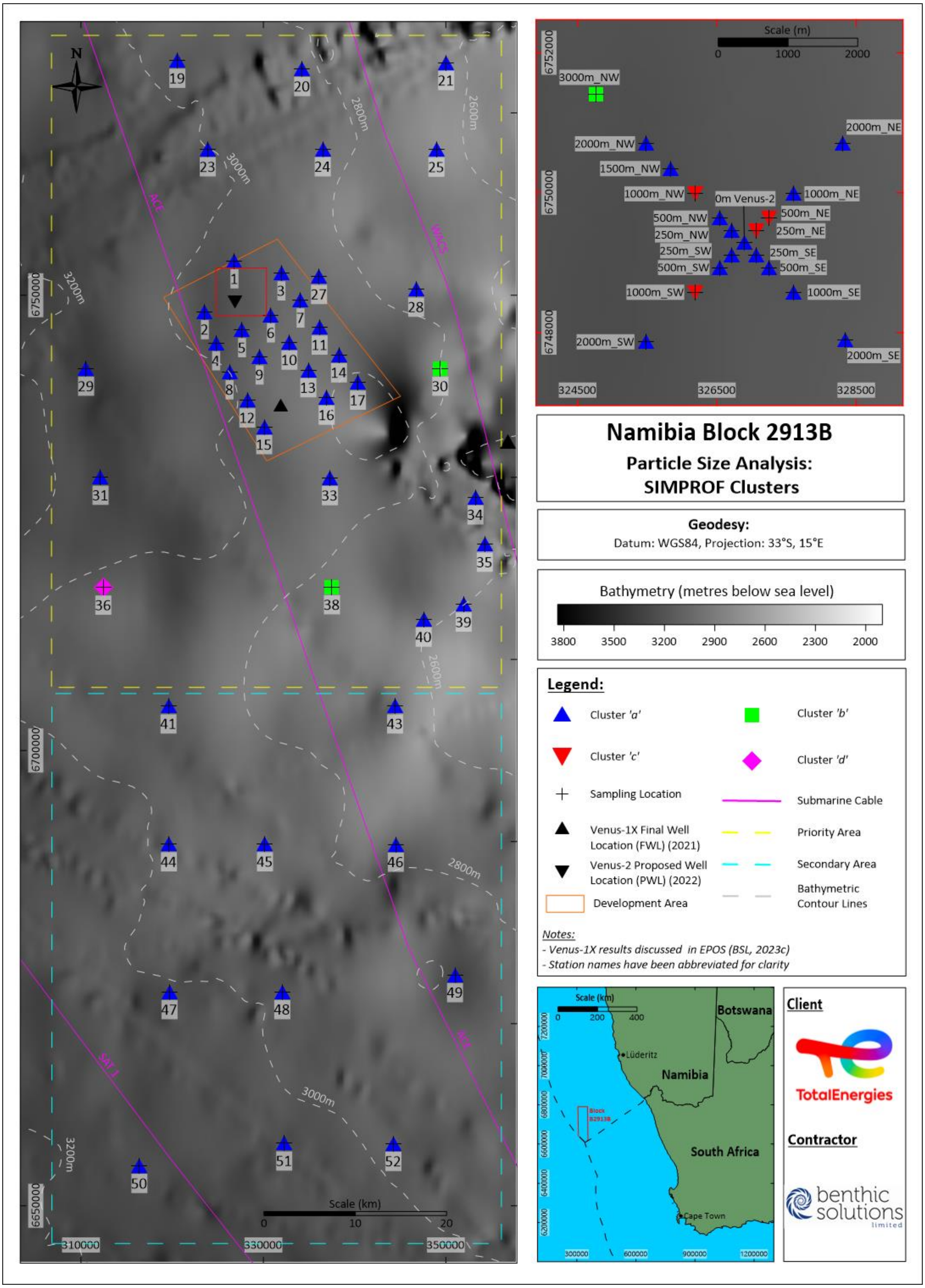


Figure 3.7 PSD Multivariate Clusters

3.4 Total Organic Matter/Carbon, Moisture Content, Nutrients and Index of Enrichment

Sediments were analysed for moisture content, total organic carbon (TOC), total organic matter (TOM), total nitrogen and total phosphorous, with reference levels presented in Table 3.4. The results in Table 3.4 and the spatial distribution of TOC presented in Figure 3.8. **TOC represents the proportion of biological material and organic detritus within the substrates** and is determined by sulphurous acid extraction and combustion at 1,600°C**.** This acid extraction and combustion determination of organic carbon is less susceptible to the interference sometimes recorded using crude combustion techniques, such as analysing total organic matter through loss on ignition (LOI) at 450°C by gravimetry.

TOM content displayed little variation across the Block and was considered generally low, ranging from 3.3% at 500m_NW to 7.7% at 2000m_SW. The TOM at station 2000m_SW was noteworthy in that it was slightly higher than all other stations (mean 4.2% ± 14.0). This slight increase is likely due to small scale variability in seabed sediments. **The proportion of TOM found in stations surrounding the Venus 2 SPWL was slightly higher when compared to the wider Block**; the mean average TOM from the phase 1 acquired stations was 4.4%, whilst the mean average for the sampling sites in the wider Block was 4.1%. There were no relationships between TOM and sediment characteristics.

The **TOC results were considered low throughout the survey area (mean 0.53%±0.13SD) and followed a similar pattern to TOM in which proportions of TOC were very slightly higher in the stations surrounding the Venus 2 PWL.** TOC in surface sediments is an important source of food for benthic fauna (Snelgrove & Butman, 1994), although an overabundance may lead to reductions in species richness and abundance due to oxygen depletion. Increases in TOC may also reflect increases in both physical factors (i.e. fines) and common co-varying environmental factors through greater sorption on increased sediment surface areas (Thompson and Lowe, 2004). **A significant positive relationship between fines and TOC was observed (ϱ(66)=0.379, *p*>0.01), likely due to flux and settlement of organic material to the seabed.** Furthermore, there was a significant negative relationship between depth and TOC (ϱ(65)=0.-573, *p*>0.001) which is again likely due to the flux of organic material through the water column. As would be expected, TOC was lowest at sites with a higher sand content. **TOC levels in the Block 2913B survey area are expected to reflect inputs of both autochthonous and allochthonous material.** Primary production in phytoplankton represents an important component of TOC, especially considering the high rate of primary productivity in the Benguela upwelling system, and during summer blooming periods. Additionally, it is anticipated that the allochthonous material from the surrounding area has also influenced the Block 2913B TOC results.

Moisture content was consistent and ranged from 45.7% at station 500m_SE to 59.1% at station 1500m_NW. Interestingly there were no relationships between moisture content and sediment characteristics or depth. It would be expected to see a negative relationship between moisture content and depth as deeper sites with a higher proportion of fines usually display a higher moisture content, but this is not the case in this region.

The nutrient (nitrogen and phosphorus) content of the seabed sediment samples is presented below in Table 3.4. **Phosphorus levels displayed a low amount of variation across the survey area, ranging**

from 194mg.kg^{-1} at B2913B_ENV_47 to 370mg.kg^{-1} at B2913B_ENV_25 (mean 298.4mg.kg^{-1}±33SD). Nitrogen was also consistent across the Block with low levels recorded at all stations, highest at B2913B_ENV_25 (0.08%) and below the LoD (<0.05%) at stations B2913B_ENV_23 and B2913B_ENV_29 (mean 0.06% ±0.007SD). These low levels of nitrogen and phosphorus can be expected in deep waters as there is minimal sunlight penetration found within the lower bathyal zone.

Organic enrichment is the proportion of decomposing organic matter in sediments and can be calculated from the levels of TOC, nitrogen and phosphorus, defined in relation to reference levels proposed by Alzieu (2003). The individual scores for TOC, total nitrogen and total phosphorous are then added together to give an overall **index of organic enrichment (IOE) ranging from zero to eleven**, with associated organic enrichment interpretation (Table 3.4). **Approximately a third (30%) of the stations sampled achieved an IOE score of 1 whilst the rest achieved scores of 0, denoting weak levels of organic enrichment** within the survey area, which is expected for deep sea environment. It is worth noting that the subtle difference in the organic results likely reflects the sample analysis of phase 1 and phase 2 samples occurring in different periods of the laboratory schedule. Despite the minor variation in the data, all results were low and close to the LOD of the laboratory instrument with no indication of any contamination within the survey area.

Table 3.4 Sediment Moisture, Organic Carbon/ Matter, Nutrients and Index of Enrichment

Station	Depth (m)	Total Organic Matter (%)	Total Organic Carbon (% M/M)	Moisture Content (%)	Total Phosphorus ($mg.kg^{-1}$)	Total Nitrogen (%)	Index of Organic Enrichment*
0m Venus-2 SPWL	2,900	4.9	0.65	55.6	313	0.06	1
250m_SE	2,900	4.3	0.70	57.2	291	0.06	1
500m_SE	2,900	4.5	0.58	45.7	302	0.05	0
1000m_SE	2,900	4.3	0.73	51.8	325	0.06	1
2000m_SE	2,900	4.1	0.42	55.2	316	0.06	0
250m_NW	2,900	4.3	0.71	55.0	330	0.06	1
500m_NW	2,900	3.3	0.68	54.5	317	0.05	1
1000m_NW	2,900	3.9	0.63	54.4	302	0.05	1
1500m_NW	2,900	4.3	0.74	59.1	297	0.06	1
2000m_NW	2,900	4.1	0.75	55.7	308	0.05	1
3000m_NW	2,900	4.0	0.73	53.2	296	0.05	1
250m_NE	2,900	4.1	0.71	54.6	314	0.06	1
500m_NE	2,900	4.1	0.71	55.0	311	0.06	1
1000m_NE	2,900	4.2	0.72	50.7	319	0.06	1
2000m_NE	2,900	4.0	0.68	49.3	299	0.05	1
10000m_NE	2,900	4.4	0.67	53.3	317	0.07	1
250m_SW	2,900	4.5	0.74	55.9	324	0.07	1
500m_SW	2,900	4.5	0.81	53.6	323	0.06	1
1000m_SW	2,900	4.2	0.67	55.0	306	0.06	1
2000m_SW	2,900	7.7	0.66	52.9	290	0.06	1
B2913B_ENV_01	2,964	4.3	0.47	55.0	291	0.07	0
B2913B_ENV_02	3,025	4.0	0.19	54.1	316	0.06	0
B2913B_ENV_03	2,916	4.3	0.43	54.7	301	0.06	0
B2913B_ENV_04	3,051	4.2	0.39	54.0	292	0.06	0
B2913B_ENV_05	3,028	4.2	0.38	54.5	299	0.06	0
B2913B_ENV_06	3,002	4.3	0.40	54.2	311	0.05	0
B2913B_ENV_07	2,978	4.6	0.45	54.1	323	0.07	0
B2913B_ENV_08	3,032	4.3	0.42	49.4	298	0.06	0
B2913B_ENV_09	3,019	4.5	0.42	57.9	317	0.07	0
B2913B_ENV_10	3,003	4.4	0.42	55.0	286	0.06	0
B2913B_ENV_11	2,977	3.8	0.56	54.2	303	0.06	0
B2913B_ENV_12	3,025	3.6	0.50	56.5	218	0.06	0
B2913B_ENV_13	2,976	3.8	0.45	56.1	292	0.06	0
B2913B_ENV_14	2,954	3.7	0.49	54.3	319	0.06	0
B2913B_ENV_15	3,013	3.7	0.51	56.3	307	0.05	0
B2913B_ENV_16	2,903	3.7	0.50	47.7	290	0.06	0
B2913B_ENV_17	2,879	3.7	0.49	57.1	301	0.06	0
B2913B_ENV_19	2,943	4.1	0.50	52.3	322	0.06	0
B2913B_ENV_20	2,810	4.1	0.59	55.6	332	0.07	0
B2913B_ENV_21	2,625	4.2	0.57	52.8	366	0.07	0
B2913B_ENV_23	2,996	3.7	0.45	53.2	278	<0.05	0
B2913B_ENV_24	2,849	4.0	0.52	54.7	336	0.06	0
B2913B_ENV_25	2,593	4.8	0.75	52.4	370	0.08	0

Station	Depth (m)	Total Organic Matter (%)	Total Organic Carbon (% M/M)	Moisture Content (%)	Total Phosphorus (mg.kg^{-1})	Total Nitrogen (%)	Index of Organic Enrichment*
B2913B_ENV_27	2,857	3.8	0.55	52.2	320	0.07	0
B2913B_ENV_28	2,737	3.7	0.51	53.1	335	0.07	0
B2913B_ENV_29	3,117	3.9	0.41	48.3	296	<0.05	0
B2913B_ENV_30	2,793	3.7	0.53	58.0	341	0.07	0
B2913B_ENV_31	3,164	3.4	0.42	57.0	292	0.05	0
B2913B_ENV_33	2,953	3.8	0.52	56.1	319	0.06	0
B2913B_ENV_34	2,743	4.4	0.49	55.3	301	0.07	0
B2913B_ENV_35	2,661	4.0	0.45	54.7	323	0.06	0
B2913B_ENV_36	2,878	3.5	0.33	54.5	207	0.05	1
B2913B_ENV_38	2,790	4.0	0.41	54.5	279	0.06	0
B2913B_ENV_39	2,538	4.3	0.47	55.0	259	0.07	0
B2913B_ENV_40	2,613	5.8	0.46	54.1	297	0.07	0
B2913B_ENV_41	2,873	4.1	0.44	55.6	240	0.06	0
B2913B_ENV_43	2,715	4.5	0.48	55.7	311	0.07	0
B2913B_ENV_44	2,957	4.0	0.39	53.8	235	0.05	0
B2913B_ENV_45	2,830	4.2	0.47	53.1	226	0.05	0
B2913B_ENV_46	2,735	4.3	0.41	54.3	249	0.05	0
B2913B_ENV_47	3,012	4.1	0.40	57.0	194	0.06	0
B2913B_ENV_48	2,963	4.3	0.44	55.4	289	0.06	0
B2913B_ENV_49	2,846	4.6	0.47	57.1	285	0.06	0
B2913B_ENV_50	3,116	4.0	0.38	56.3	262	0.05	0
B2913B_ENV_51	3,032	4.3	0.39	57.1	291	0.05	0
B2913B_ENV_52	2,960	4.4	0.43	54.3	294	0.05	0
Mean		**4.2**	**0.53**	**54.3**	**298.7**	**0.06**	-
Standard Deviation		**0.59**	**0.13**	**2.4**	**33.0**	**0.007**	-
Variance (%)		**14.0**	**25.0**	**4.5**	**11.1**	**12.3**	-
Minimum		**3.3**	**0.19**	**45.7**	**194**	**0.05**	-
Maximum		**7.7**	**0.81**	**59.1**	**370**	**0.08**	-
Reference Levels							
Alzieu (2003) Index of Enrichment: None			<0.6	-	<500	<0.6	-
Alzieu (2003) Index of Enrichment: Weak			0.6-2.3	-	500-800	0.6-1.2	-
Alzieu (2003) Index of Enrichment: Medium			2.4-4.0	-	800-1200	1.2-2.4	-
Alzieu (2003) Index of Enrichment: Strong			4.1-5.8	-	>1200	2.4-3.6	-
Alzieu (2003) Index of Enrichment: Strong			>5.8	-	-	>3.6	-

Notes:
**Scores for the index of organic enrichment are colour shaded according to the associated level of organic enrichment, as proposed by Alzieu (2003): 0 = None (N), 1-3 = Weak (W), 4-6 = Medium (M), >6 = Strong (S).*

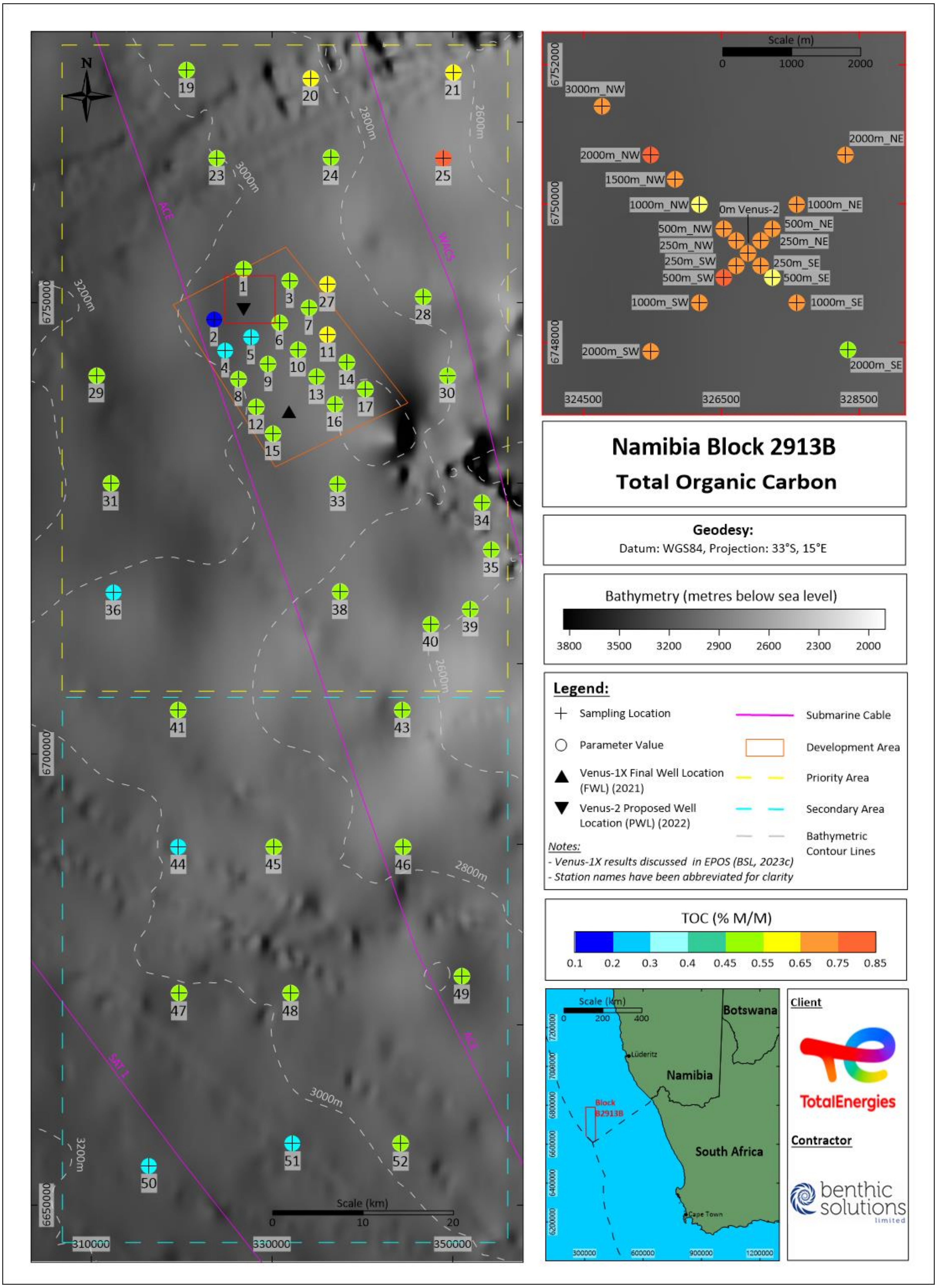


Figure 3.8 Total Organic Carbon

3.5 Sediment Hydrocarbons

Results for hydrocarbon analyses are summarised and tabulated as total hydrocarbon content (THC), total polycyclic aromatic hydrocarbons (PAHs), and total n-alkane and homologue ratios in Table 3.5; the mean, standard deviation (SD), coefficient of variance (CV), maximum and minimum has been calculated. Two examples of gas chromatograms can be seen in Figure 3.11 and Figure 3.12 (0m Venus-2 and B2913B_ENV_25) with the remainder presented in Appendix V – GC FID Traces (Saturates). Chromatograms (GC-FID) are labelled with every second n-alkane, the isoprenoid hydrocarbons, pristane and phytane, along with the internal standards hepta-methylnonane (A), deuterated hexadecane (B) and 1-chlorooctadecane (C).

3.5.1 *Total Hydrocarbon Concentrations*

The total hydrocarbon concentrations (THC) of the sediments, measured by integration of all non-polarised components within the GC trace, displayed **low variability ranging from 0.66mg.kg^{-1} at station B2913B_ENV_02 to 7.77mg.kg^{-1} at 2000m_SW** (Figure 3.9; Table 3.5). The THC recorded at station 2000m_SW was higher than THC across the Block (mean 2.08mg.kg^{-1}±1.46SD) with no clear reasoning as to why this is the case, it is likely due to small-scale variability in the seabed through Block 2913B. **THC was very slightly higher at stations comprising the cruciform sampling surrounding the Venus-2 PWL.** It is worth noting that the subtle difference in the THC results likely reflects the sample analysis of phase 1 and phase 2 samples occurring in different periods of the laboratory schedule. Despite the minor variation in the data, all results were low and close to the LOD of the laboratory instrument with no indication of any contamination within the survey area. **Apart from this, there was no clear geographic or depth related pattern in THC values throughout Block 2913B.**

Fines and sands were both significantly correlated with THC; the proportion of fines and THC displayed a positive correlation ($\varrho(66)=0.379$, $p>0.05$), whilst the proportion of sands and THC displayed a negative correlation ($\varrho(66)=-0.284$, $p>0.05$). Typically, **where sand is dominant, contaminants such as THC are less likely to be retained in the substrate (i.e. a sink) than in areas where fine sediments are prolific due to the reduced potential for sorption onto the grains**, explaining both correlations seen. THC was negatively correlated with depth throughout Block 2913B ($\varrho(66)=-0.266$, $p>0.05$), which is expected when considering sediments at deeper stations were slightly higher in their proportions of fines.

The low variability and low THC values recorded are indicative of natural THC levels in a non-industrialised deep-sea environment.

Table 3.5 Sediment Hydrocarbon Concentrations

Station	Depth (m)	THC (mg.kg-1)	Total n-alkanes (µg.kg-1)	Carbon Preference Index (CPI)	Pristane / Phytane Ratio	Petrogenic / Biogenic Ratio	Proportion of Alkanes (%)	Total PAHs (µg.kg-1)	NPD (µg.kg-1)	NPD (%)
0m Venus-2 SPWL	2,900	5.73	91	3.22	-	0.00	1.58	0.00	0.00	-
250m_SE	2,900	4.36	86	9.84	-	0.00	1.98	0.00	0.00	-
500m_SE	2,900	2.05	117	4.18	-	0.00	5.72	0.00	0.00	-
1000m_SE	2,900	4.18	251	2.59	-	0.00	6.00	0.00	0.00	-
2000m_SE	2,900	1.37	138	2.40	-	0.00	10.1	0.00	0.00	-
250m_NW	2,900	5.05	297	3.71	-	0.00	5.88	0.00	0.00	-
500m_NW	2,900	4.47	309	3.07	-	0.00	6.91	0.00	0.00	-
1000m_NW	2,900	3.60	241	4.65	-	0.00	6.68	0.00	0.00	-
1500m_NW	2,900	4.09	305	4.48	-	0.00	7.47	6.79	6.79	100
2000m_NW	2,900	3.41	237	3.76	-	0.00	6.96	2.71	2.71	100
3000m_NW	2,900	3.03	238	4.59	-	0.00	7.85	2.35	2.35	100
250m_NE	2,900	2.86	315	3.56	-	0.00	11.01	1.14	1.14	100
500m_NE	2,900	2.68	214	4.45	-	0.00	7.97	0.00	0.00	-
1000m_NE	2,900	2.94	262	4.24	-	0.00	8.91	0.00	0.00	-
2000m_NE	2,900	3.54	246	3.23	-	0.00	6.94	0.00	0.00	-
10000m_NE	2,900	2.47	201	4.65	-	0.00	8.16	0.00	0.00	-
250m_SW	2,900	4.14	270	4.26	-	0.00	6.51	1.00	1.00	100
500m_SW	2,900	5.08	328	2.88	-	0.00	6.45	0.00	0.00	-
1000m_SW	2,900	4.61	216	3.81	-	0.00	4.69	0.00	0.00	-
2000m_SW	2,900	7.77	277	2.82	-	0.00	3.56	0.00	0.00	-
B2913B_ENV_01	2,964	0.73	117	3.39	-	0.02	16.1	0.00	0.00	-
B2913B_ENV_02	3,025	0.66	82.8	4.29	-	0.00	12.6	0.00	0.00	-
B2913B_ENV_03	2,916	1.07	88.6	2.86	-	0.00	8.31	0.00	0.00	-
B2913B_ENV_04	3,051	1.97	360	1.42	-	0.01	18.3	0.00	0.00	-
B2913B_ENV_05	3,028	1.61	254	1.63	-	0.03	15.8	0.00	0.00	-
B2913B_ENV_06	3,002	1.25	108	2.82	-	0.03	8.68	0.00	0.00	-
B2913B_ENV_07	2,978	1.88	172	2.39	-	0.08	9.13	0.00	0.00	-
B2913B_ENV_08	3,032	1.77	163	2.32	-	0.06	9.19	0.00	0.00	-

Station	Depth (m)	THC (mg.kg-1)	Total n-alkanes (µg.kg-1)	Carbon Preference Index (CPI)	Pristane / Phytane Ratio	Petrogenic / Biogenic Ratio	Proportion of Alkanes (%)	Total PAHs (µg.kg-1)	NPD (µg.kg-1)	NPD (%)
B2913B_ENV_09	3,019	2.10	147	2.42	-	0.07	7.01	0.00	0.00	-
B2913B_ENV_10	3,003	0.98	121	2.92	-	0.04	12.4	0.00	0.00	-
B2913B_ENV_11	2,977	1.82	267	1.72	-	0.01	14.7	0.00	0.00	-
B2913B_ENV_12	3,025	2.27	150	2.38	-	0.16	6.64	0.00	0.00	-
B2913B_ENV_13	2,976	1.20	140	2.93	-	0.02	11.7	0.00	0.00	0-
B2913B_ENV_14	2,954	0.92	105	3.93	-	0.00	11.5	0.00	0.00	-
B2913B_ENV_15	3,013	1.60	116	3.51	-	0.00	7.27	0.00	0.00	-
B2913B_ENV_16	2,903	0.87	109	3.73	-	0.00	12.4	0.00	0.00	-
B2913B_ENV_17	2,879	1.25	150	2.40	-	0.01	12.0	0.00	0.00	-
B2913B_ENV_19	2,943	0.83	107	3.94	-	0.00	12.9	0.00	0.00	-
B2913B_ENV_20	2,810	1.46	145	2.33	-	0.00	9.95	0.00	0.00	-
B2913B_ENV_21	2,625	1.76	190	2.38	-	0.03	10.8	0.00	0.00	-
B2913B_ENV_23	2,996	0.76	98.9	3.67	-	0.00	13.0	0.00	0.00	-
B2913B_ENV_24	2,849	1.41	142	2.96	-	0.01	10.1	0.00	0.00	-
B2913B_ENV_25	2,593	1.13	177	2.08	-	0.00	15.7	0.00	0.00	-
B2913B_ENV_27	2,857	1.32	118	3.81	-	0.02	8.89	0.00	0.00	-
B2913B_ENV_28	2,737	1.58	147	2.67	-	0.01	9.29	0.00	0.00	-
B2913B_ENV_29	3,117	0.91	107	2.51	-	0.01	11.7	0.00	0.00	-
B2913B_ENV_30	2,793	1.57	179	2.30	-	0.03	11.4	7.22	1.60	22.1
B2913B_ENV_31	3,164	1.44	145	2.67	-	0.00	10.0	0.00	0.00	-
B2913B_ENV_33	2,953	1.21	108	2.91	-	0.00	8.90	0.00	0.00	-
B2913B_ENV_34	2,743	2.10	146	1.92	-	0.00	6.97	0.00	0.00	-
B2913B_ENV_35	2,661	1.32	122	2.60	-	0.00	9.23	0.00	0.00	-
B2913B_ENV_36	2,878	0.97	109	2.18	-	0.00	11.1	0.00	0.00	-
B2913B_ENV_38	2,790	0.77	107	2.84	-	0.00	13.9	0.00	0.00	-
B2913B_ENV_39	2,538	1.57	142	2.92	-	0.04	9.03	0.00	0.00	-
B2913B_ENV_40	2,613	1.66	147	2.69	-	0.00	8.85	0.00	0.00	-
B2913B_ENV_41	2,873	1.34	119	2.47	-	0.00	8.91	0.00	0.00	-
B2913B_ENV_43	2,715	1.03	112	2.99	-	0.00	10.8	4.53	1.55	34.3
B2913B_ENV_44	2,957	0.74	92.8	2.95	-	0.00	12.6	0.00	0.00	-

Station	Depth (m)	THC (mg.kg-1)	Total n-alkanes (µg.kg-1)	Carbon Preference Index (CPI)	Pristane / Phytane Ratio	Petrogenic / Biogenic Ratio	Proportion of Alkanes (%)	Total PAHs (µg.kg-1)	NPD (µg.kg-1)	NPD (%)
B2913B_ENV_45	2,830	0.97	102	2.19	-	0.00	10.5	0.00	0.00	-
B2913B_ENV_46	2,735	0.93	111	2.60	-	0.00	11.9	0.00	0.00	-
B2913B_ENV_47	3,012	0.99	111	2.69	-	0.00	11.2	0.00	0.00	-
B2913B_ENV_48	2,963	1.05	100	2.86	-	0.00	9.54	0.00	0.00	-
B2913B_ENV_49	2,846	1.15	96.8	2.39	-	0.00	8.43	0.00	0.00	-
B2913B_ENV_50	3,116	1.51	118	2.81	-	0.04	7.83	0.00	0.00	-
B2913B_ENV_51	3,032	1.28	141	2.41	-	0.00	11.1	0.00	0.00	-
B2913B_ENV_52	2,960	1.40	117	2.35	-	0.00	8.37	0.00	0.00	-
Mean		**2.08**	**166**	**3.11**	**-**	**0.01**	**9.52**	**0.39**	**0.26**	**79.5**
Standard Deviation		**1.46**	**72.4**	**1.15**	**-**	**0.03**	**3.18**	**1.38**	**0.98**	**35.2**
Variance (%)		**69.9**	**43.7**	**37.0**	**-**	**231.5**	**33.5**	**353.9**	**375.3**	**44.3**
Minimum		**0.66**	**82.8**	**1.42**	**-**	**0.00**	**1.58**	**0.00**	**0.00**	**22.1**
Maximum		**7.77**	**360**	**9.84**	**-**	**0.16**	**18.3**	**7.22**	**6.79**	**100**
Reference Values										
OSPAR (2009) THC Threshold		50	-	-	-	-	-	-	-	-
EGASPIN (2002) Target Value		50	-	-	-	-	-	-	-	-
EGASPIN (2002) Intervention Value		5000	-	-	-	-	-	-	-	-

Notes:
'-' = Not calculable due to phytane concentration <LOD

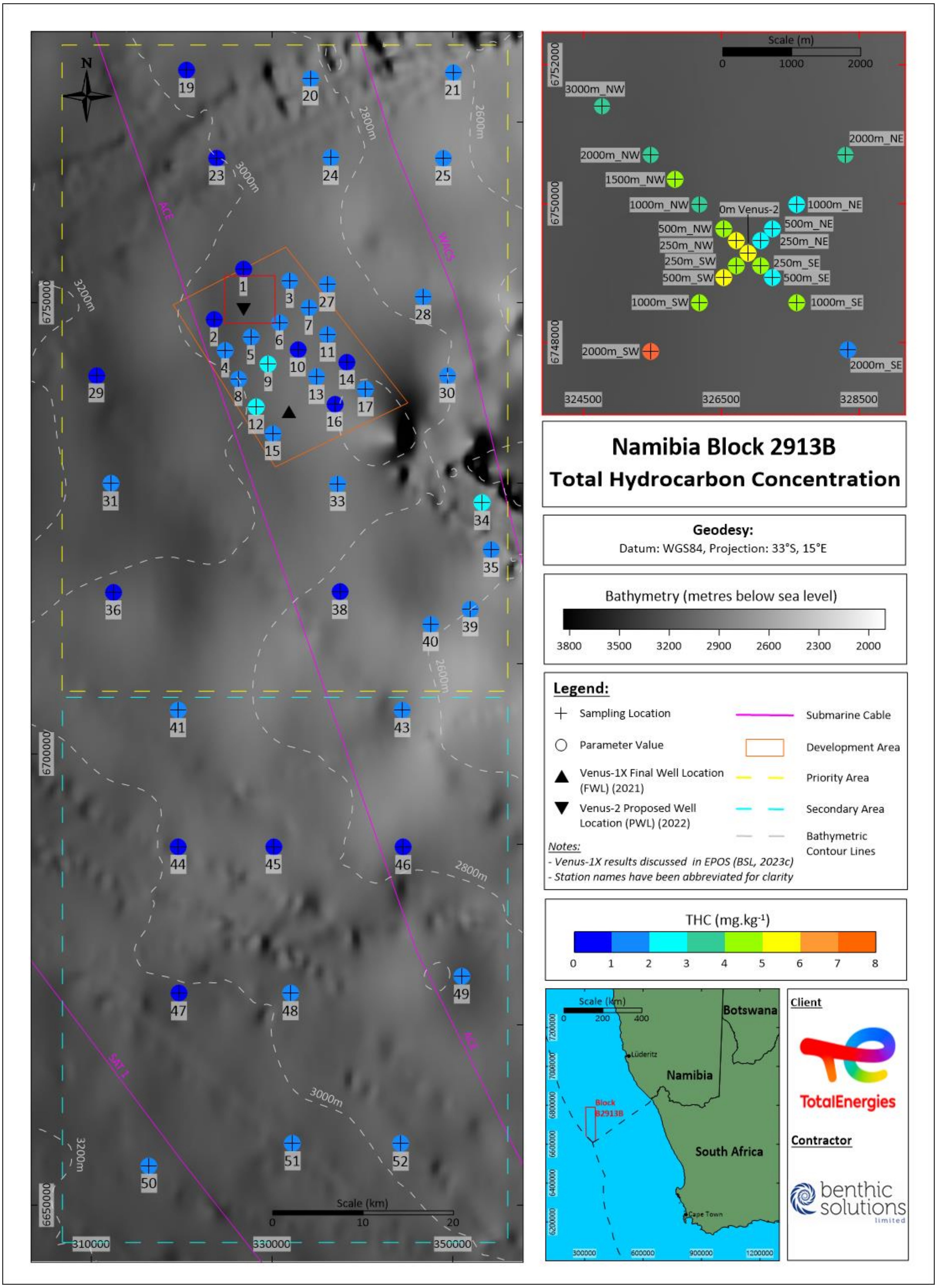


Figure 3.9 Total Hydrocarbon Concentration

3.5.2 *Saturate/Aliphatic Hydrocarbons*

All sampling stations were analysed for n-alkanes using gas chromatography with flame ionisation detection (GC-FID). The results are summarised in Table 3.5 and are individually listed in Appendix IV – Total Aliphatic Concentrations by Station, which gives a breakdown of consecutive n-alkane content from nC_{10} through to nC_{37}, together with the isoprenoid hydrocarbons Pristane (Pr) and Phytane (Ph).

The total n-alkane concentrations were relatively low across much of the Block, ranging from 82.8µg.kg^{-1} at station B2913B_ENV_02 to 360µg.kg^{-1} at station B2913B_ENV_04 (mean 166µg.kg^{-1}±72.4SD). Similar to THC, total n-alkane concentrations were slightly higher in the sampling cruciform surrounding the Venus-2 PWL (Figure 3.10). It is worth noting that the subtle difference in the total n-alkane results likely reflects the sample analysis of phase 1 and phase 2 samples occurring in different periods of the laboratory schedule. Despite the minor variation in the data, all results were low and close to the LOD of the laboratory instrument with **no indication of any contamination within the survey area. Apart from this, there was no clear geographic or depth related pattern in total n-alkane values throughout Block 2913B**. **These concentrations are as would be expected for deep-sea marine sediments** and suggest a generally non-depositional regime for organics from the surface waters and allochthonous sources (such as river runoff and terrestrial sources). As expected, the total n-alkane concentrations were positively correlated with TOC (ϼ(66)=-0.532, p>0.01).

Inspection of the individual gas chromatograms at all stations (Figure 3.11, Figure 3.12 and Appendix V – GC FID Traces (Saturates)) revealed **evidence of mixed hydrocarbons between nC_{22} and nC_{36} at all stations**. These may reflect a combination of regional influences from terrestrial runoff and shipping activity (e.g. weathered greases, fuel oils lubricants or waxes). **These heavier and partially unresolved complex mixtures (UCM) may also correspond to an input of terrigenous plant materials which typically comprise the long-chain, odd carbon-numbered n-alkanes** (nC_{25}-nC_{33}; Eglinton *et al.,* 1962). Furthermore, some **small peaks evident in the nC_{20} range may also be indicative of marine organic matter through autochthonous planktonic and algal contributions** (Peters and Moldowan, 1993). Peaks indicative of Pristane (nC_{17}-nC_{18}) are present on gas chromatograms B2913B_ENV_01, B2913B_ENV_48, and B2913B_ENV_51 which can be attributed to a higher proportion of phyto-detritus incorporated into the sediment.

Small peaks at ~5.62, ~6.83, ~15.9 & ~17.2 minutes, present at the majority of stations, are thought to be lab introduced during the extraction of sediments and were removed from the analysis and interpretation of the alkanes (Figure 3.11).

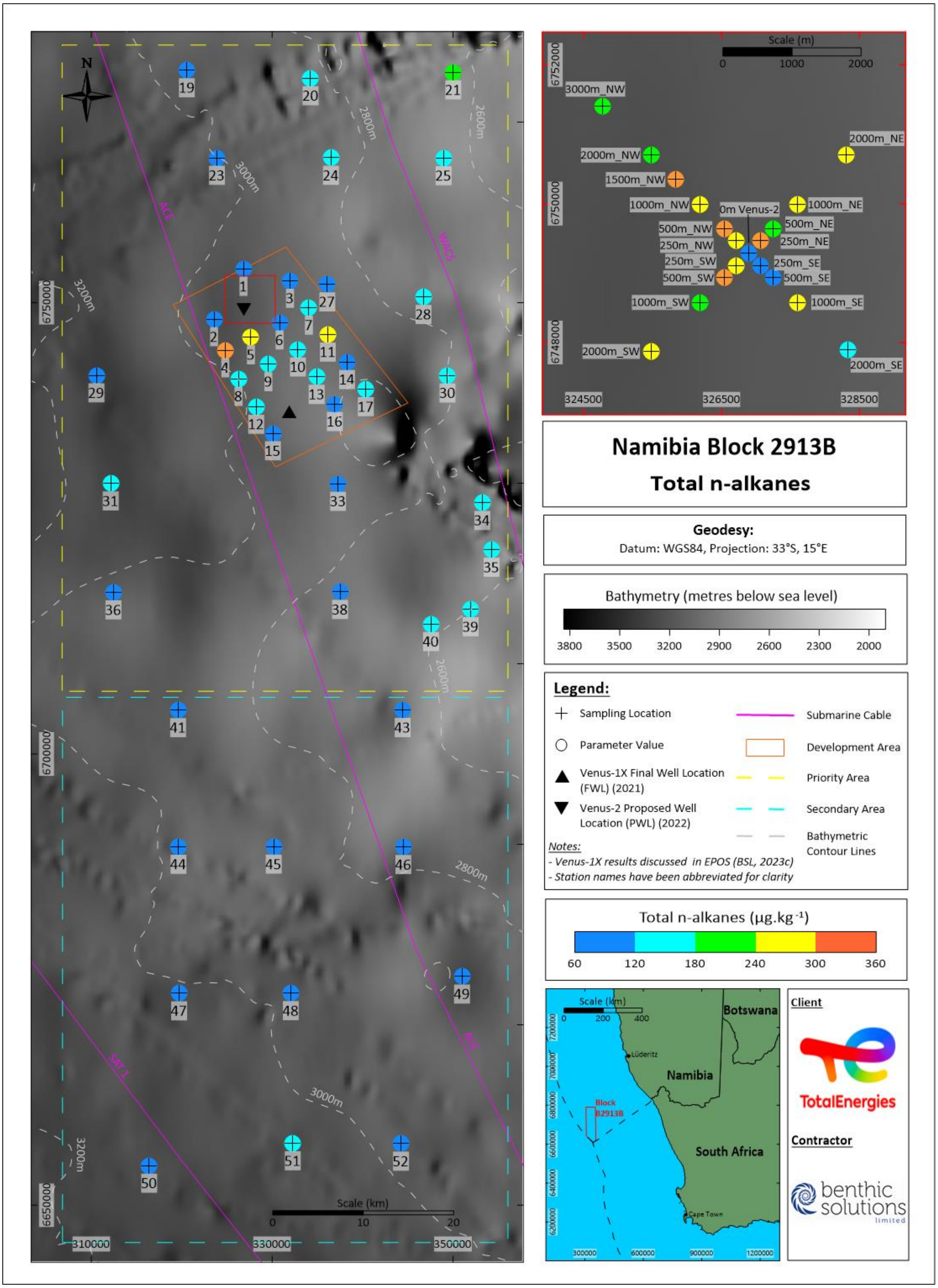


Figure 3.10 Total Saturate Alkanes

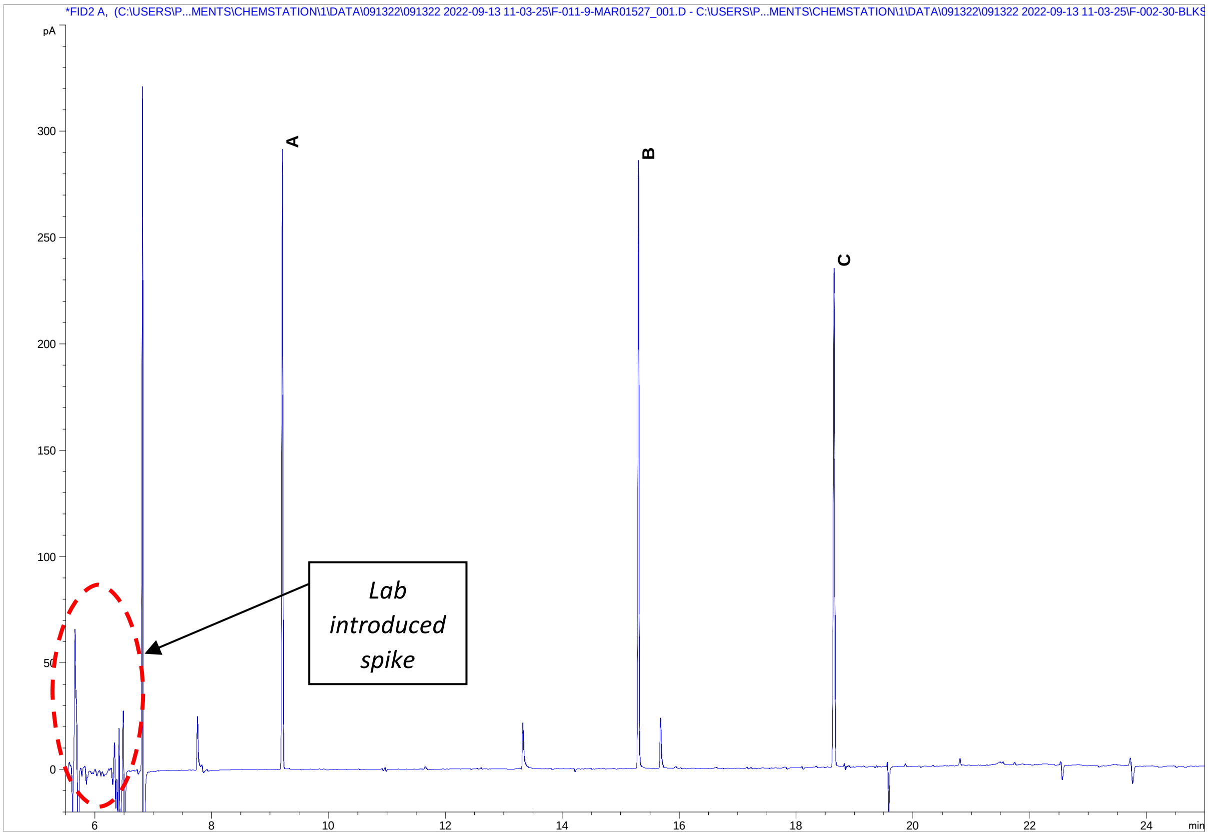


Figure 3.11 Gas Chromatogram Signature for Station 0m Venus-2

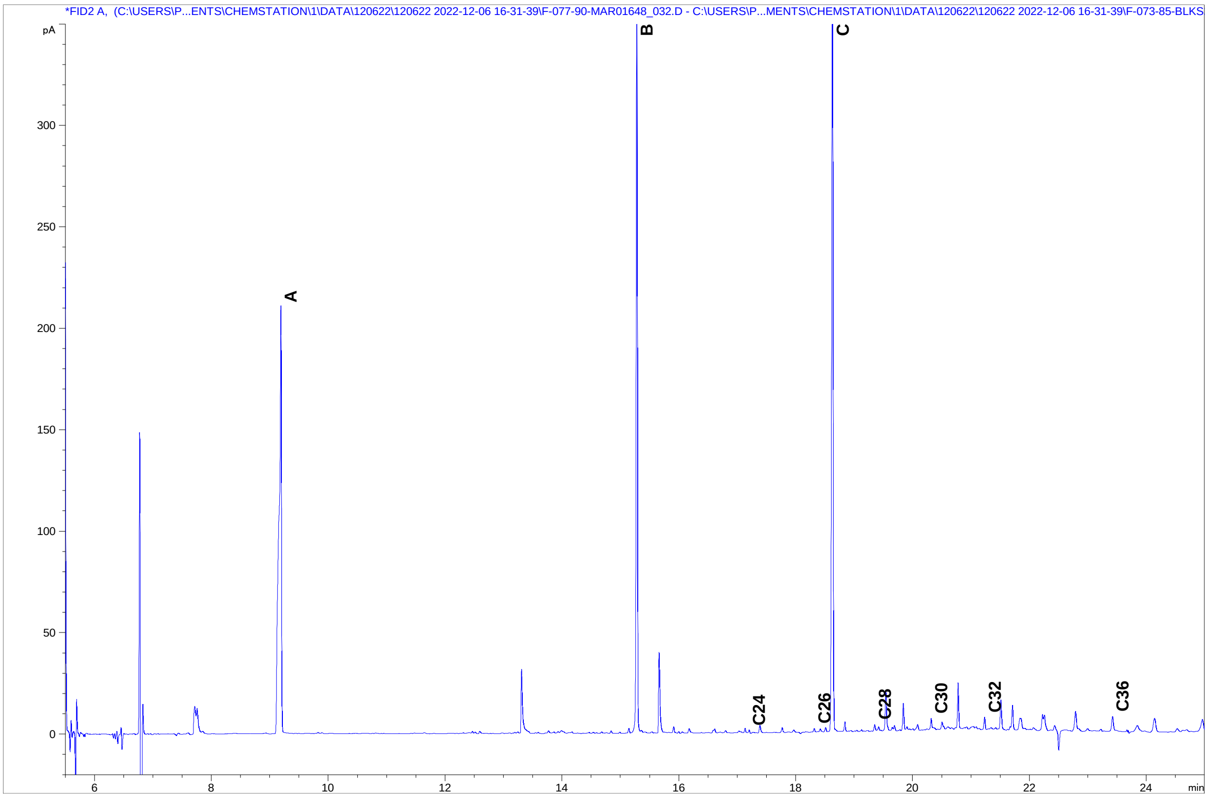


Figure 3.12 Gas Chromatogram Signature for Station B2913B_ENV_25

3.5.2.1 *Carbon Preference Index (CPI)*

The carbon preference index (CPI) is associated with the preference of biogenic n-alkanes (i.e. that of a preference for odd-carbon numbered homologues, particularly around nC_{27-33}; Sleeter *et al*., 1980), derived from fatty acids, alcohols, esters and land plant waxes. **The CPI for the full saturate range** (nC_{10} to nC_{37}; Appendix IV; Table 3.5) **was low, ranging from 1.42 at B2913B_ENV_04 to 9.84 at 250m_SE.** The CPI recorded at 250m_SE is unusually high when compared to the rest of the Block (mean: 3.11 SD±1.15) and is likely higher than the rest due to having values of 0 of below the limit of detection for even numbered short chain alkanes. Similar to patterns in TOC and THC, CPI values were slightly higher in the cruciform sampling area surrounding the Venus-2 PWL which likely reflects the sample analysis of phase 1 and phase 2 samples occurring in different periods of the laboratory schedule.

3.5.2.2 *Petrogenic/Biogenic (or P/B) Ratio*

The P/B ratio compares the lighter, more petrogenic aliphatics (nC_{10-20}) with the heavier, and more biogenic aliphatics (nC_{21-37}). Results were calculated for all stations and ratios varied from 0.00 to 0.16 (mean 0.01±0.03SD), indicating all stations were influenced by biogenic aliphatic compounds with no indication of hydrocarbon contamination (Table 3.5).

3.5.2.3 *Pristane/Phytane Ratio*

Pristane and phytane are both isoprenoid alkanes commonly found as constituents within crude oils (Berthou and Friocourt, 1981). However, in biogenic environments, only pristane is commonly found in the marine environment as it is naturally biosynthesised and a product of phytol moiety of chlorophyll. Phytane is generally absent or only present at low levels in uncontaminated natural systems (Blumer and Snyder, 1965). A presence of both isoprenoids at similar levels is typically taken as an indication of petroleum contamination.

The pristane/phytane **ratios at all stations were incalculable due to the absence of phytane** (<1µg.kg^{-1}) with a **relative dominance of pristane** across all stations, which was to be **expected for ambient background conditions. Given the incalculable Pr/Ph ratios, it should also be noted that the pristane/phytane ratios can often be difficult to interpret due to their erratic nature** induced by the variability of phytoplankton numbers (Blumer and Synder, 1965), and should be used mainly to substantiate other interpretations.

3.5.3 *Polycyclic Aromatic Hydrocarbons*

3.5.3.1 *Non-normalised Polycyclic Aromatic Hydrocarbons*

Polycyclic aromatic hydrocarbons were analysed at each station using gas chromatography-mass spectrometry (GC-MS). Results of the single ion current (SIC) analyses are summarised in Table 3.5 with concentrations of individual parent compounds and their alkyl derivatives shown in Appendix VI – Polycyclic Aromatic Hydrocarbon Concentrations. The concentrations of 19 PAH priority pollutants listed by US Environmental Protection Agency (EPA) are listed in Appendix VII – Polycyclic Aromatic Hydrocarbon Concentrations: EPA PAHs. The EPA 19 are used globally in assessment of contamination relating to both environmental and human health studies.

PAHs and their alkyl derivatives have been recorded in a wide range of marine sediments (Laflamme and Hites, 1978) with the majority of compounds produced from what is thought to be pyrolytic sources. These include the combustion of organic material such as forest fires (Youngblood and Blumer, 1975), the burning of fossil fuels and, in the case of offshore oil fields, flare stacks. The resulting PAHs, rich in the heavier weight 4-6 ring aromatics, are normally transported to the sediments via atmospheric fallout or river runoff. Another PAH source is petroleum hydrocarbon, often associated with localised drilling activities. These are rich in the lighter, more volatile 2 and 3 ring PAHs (NPD; naphthalene (128), phenanthrene, anthracene (178) and dibenzothiophene (DBT) with their alkyl derivatives.

Total PAH concentrations (2-6 compounds) were consistently low across much of the survey area (Figure 3.13) and ranged from 0µg.kg^{-1} to 7.22µg.kg^{-1}. The majority (89%) of sampling stations recorded 0µg.kg^{-1} total PAHs, only 7 of the 66 sampled sites recorded values above this. Station B2913B_ENV_30 had the highest PAH concentration, recording a value of 7.22µg.kg^{-1}, the lowest value was recorded at station 250m_NE at 1.14µg.kg^{-1}. **Total PAH was very slightly higher at stations comprising the cruciform sampling surrounding the Venus-2 PWL.** It is worth noting that the subtle difference in the total PAH results likely reflects the sample analysis of phase 1 and phase 2 samples occurring in different periods of the laboratory schedule. Despite the minor variation in the data, all results are still considered low. **Apart from this, there was no clear geographic or depth related pattern in total PAH values throughout Block 2913B. PAH concentrations are thought to represent natural background levels for Namibian offshore waters.**

The lighter, more volatile NPD fraction (2 and 3 ring aromatics) followed a similar pattern with 89% of sampling stations recording 0µg.kg^{-1}. Where NPD fractions were found, they ranged from 1.14µg.kg^{-1} at station 250m_NE to 7.22µg.kg^{-1} at station B2913B_ENV_30. NPD PAH accounted for on average 79.5%±35.2SD of the total PAHs, indicative of sediments with a high petrogenic influence. As expected, both total PAHs and the NPD fraction of PAHs were positively correlated with TOC content ($\varrho(66)=0.378$, $p>0.05$ for both parameters).

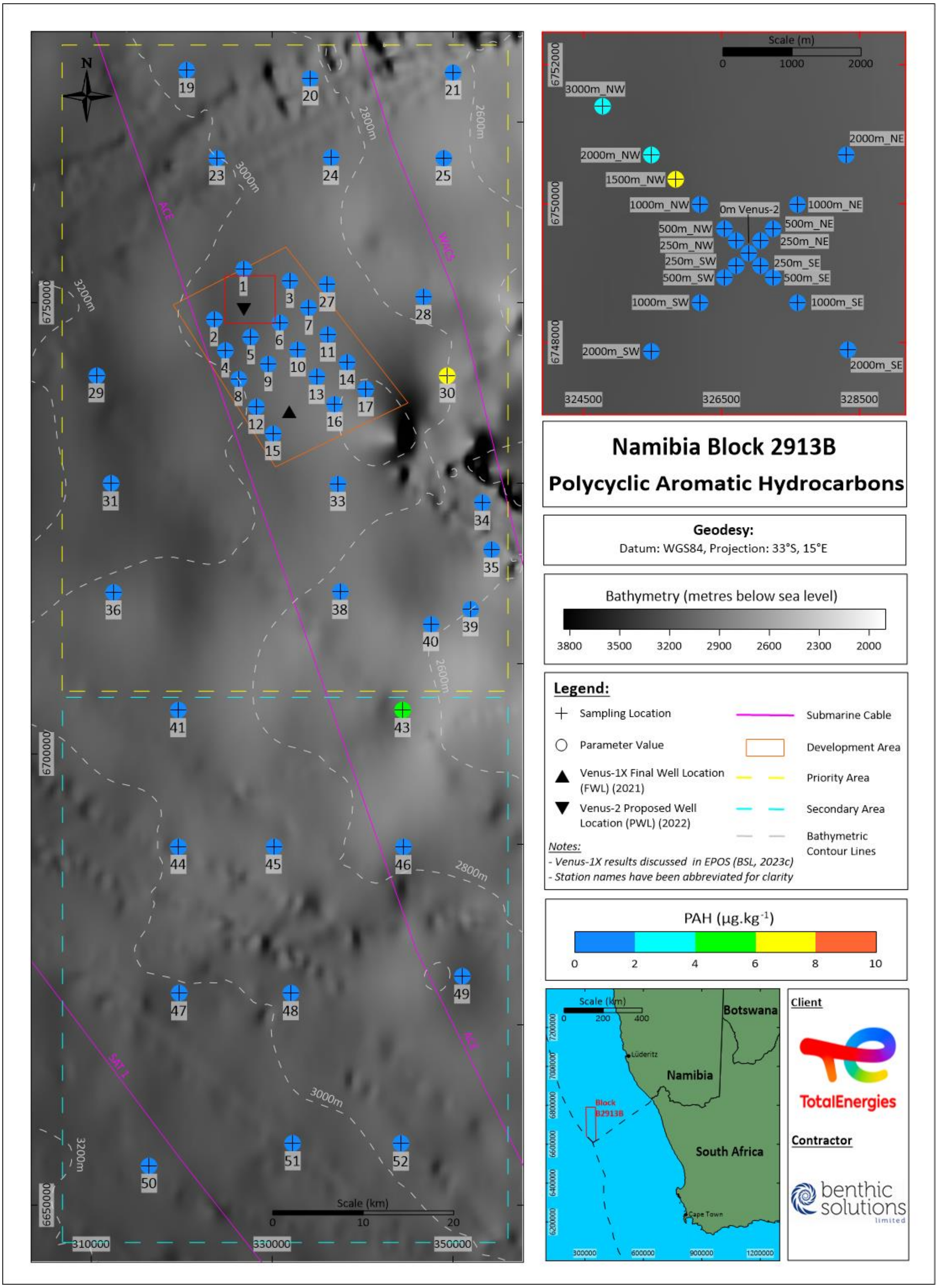


Figure 3.13 Polycyclic Aromatic Hydrocarbons

3.5.3.2 *Normalised Polycyclic Aromatic Hydrocarbons*

It is recognised that many organic contaminants are hydrophobic and bind strongly to the organic carbon in sediments (Thompson and Lowe, 2004). To account for the preferential partitioning of these contaminants to organic matter, organic contaminants such as total PAHs can be normalised to 1% TOC content of the sediment at each station (see Figure II.I in Appendix II – Data Presentation, Laboratory and Statistical Analyses; Simpson *et al.,* 2013). Total PAH concentration normalised to 1% TOC content are displayed in Table 3.7, along with the normalised sediment quality guideline value (SQGV) threshold. Normalised concentrations below the SQGV are considered 'low risk', indicating the contaminant poses little risk of adverse biological effects (Simpson *et al.,* 2013). **The normalised total PAH values for stations within Block 2913B indicate all results below the SQGV and the upper threshold of SQGV-High indicating the contaminant is of 'low risk' with negligible effects to marine life in the survey area.**

Table 3.6 Normalised Total Polycyclic Aromatic Hydrocarbons

Station	Depth (m)	Normalised Total PAH (μg.kg^{-1})
0m Venus-2 SPWL	2,900	0
250m_SE	2,900	0
500m_SE	2,900	0
1000m_SE	2,900	0
2000m_SE	2,900	0
250m_NW	2,900	0
500m_NW	2,900	0
1000m_NW	2,900	0
1500m_NW	2,900	9.18
2000m_NW	2,900	3.61
3000m_NW	2,900	3.22
250m_NE	2,900	1.61
500m_NE	2,900	0
1000m_NE	2,900	0
2000m_NE	2,900	0
10000m_NE	2,900	0
250m_SW	2,900	1.35
500m_SW	2,900	0
1000m_SW	2,900	0
2000m_SW	2,900	0
B2913B_ENV_01	2,964	0
B2913B_ENV_02	3,025	0
B2913B_ENV_03	2,916	0
B2913B_ENV_04	3,051	0
B2913B_ENV_05	3,028	0
B2913B_ENV_06	3,002	0
B2913B_ENV_07	2,978	0
B2913B_ENV_08	3,032	0
B2913B_ENV_09	3,019	0
B2913B_ENV_10	3,003	0
B2913B_ENV_11	2,977	0

Station	Depth (m)	Normalised Total PAH (µg.kg^{-1})
B2913B_ENV_12	3,025	0
B2913B_ENV_13	2,976	0
B2913B_ENV_14	2,954	0
B2913B_ENV_15	3,013	0
B2913B_ENV_16	2,903	0
B2913B_ENV_17	2,879	0
B2913B_ENV_19	2,943	0
B2913B_ENV_20	2,810	0
B2913B_ENV_21	2,625	0
B2913B_ENV_23	2,996	0
B2913B_ENV_24	2,849	0
B2913B_ENV_25	2,593	0
B2913B_ENV_27	2,857	0
B2913B_ENV_28	2,737	0
B2913B_ENV_29	3,117	0
B2913B_ENV_30	2,793	13.62
B2913B_ENV_31	3,164	0
B2913B_ENV_33	2,953	0
B2913B_ENV_34	2,743	0
B2913B_ENV_35	2,661	0
B2913B_ENV_36	2,878	0
B2913B_ENV_38	2,790	0
B2913B_ENV_39	2,538	0
B2913B_ENV_40	2,613	0
B2913B_ENV_41	2,873	0
B2913B_ENV_43	2,715	9.43
B2913B_ENV_44	2,957	0
B2913B_ENV_45	2,830	0
B2913B_ENV_46	2,735	0
B2913B_ENV_47	3,012	0
B2913B_ENV_48	2,963	0
B2913B_ENV_49	2,846	0
B2913B_ENV_50	3,116	0
B2913B_ENV_51	3,032	0
B2913B_ENV_52	2,960	0
Reference Values		
AZNECC/ARMCANZ SQGV (Simpson *et al.,* 2013)		10,000
AZNECC/ARMCANZ SQGV-High (Simpson *et al.,* 2013)		50,000

3.5.4 *BTEX - Monocyclic Aromatic Hydrocarbons*

Benzene, Toluene, Ethylbenzene and Xylene (BTEX) isomers can be biodegraded in the absence of oxygen by a wide range of organisms. These also can pose a significant health risk in contaminated environments and encourage the growth of hydrocarbon-degrading anaerobes (Chakraborty and Coates, 2004). **Results for BTEX within the current survey are provided within Appendix VIII, where the full suite of results for mono-aromatic hydrocarbons were below their respective LoDs.**

3.6 Heavy and Trace Metal Concentrations

Results for heavy and trace metal analysis are given in Table 3.7. All of the 21 heavy and trace metals analysed (Al, As, Ba, Be, Cd, Co, Cr, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Sb, Se, Sn, Ti, V and Zn) underwent full strength aqua regia digestion and extraction for partial sediment metals, with barium also analysed by fusion technique to provide more reliable quantification in the presence of barite. The spatial variability in the concentrations of several metals is shown in Figure 3.14 to Figure 3.20.

The question of bioavailability of metals to marine organisms is a complex one, as sediment granulometry and the interface between water and sediment all affect the bioavailability and subsequent toxicity. Therefore, even if a metal is found in higher concentrations it does not necessarily follow that this will have a detrimental effect on the environment if present in an insoluble state. Historically, several extraction techniques have been applied to metal analysis, with the most common applying to an HF/perchloric extraction for total metals, and a weaker nitric or aqua regia extraction. The latter techniques have shown close correlation to metal burdens in the tissues of benthic organisms (Luoma and Davies, 1983; Bryan and Langston, 1992). However, the way bioavailability is reflected by the extent to which a particular metal digests is not well understood, and research is ongoing.

Metals occur naturally in the marine environment and are widely distributed in both dissolved and sedimentary forms. Some are essential to marine life while others may be toxic to numerous organisms (Paez-Osuna and Ruiz-Fernandez, 1995). Rivers, coastal discharges, and the atmosphere are the principal modes of entry for most metals into the marine environment (Schaule and Patterson, 1983), with anthropogenic inputs occurring primarily as components of industrial and municipal wastes. Metals most characteristic of offshore contamination of marine sediments are barium (Ba), chromium (Cr), lead (Pb) and zinc (Zn; Neff, 2005), although these may vary greatly dependent upon the constituents used.

Trace metal contaminants in the marine environment tend to form associations with the non-residual phases of mineral matter, such as iron (Fe) and manganese oxides and hydroxides, metal sulphides, organics and carbonates (speciation; Tessier *et al*., 1979). Metals associated with these non-residual phases are prone to various environmental interactions and transformations (physical, chemical and biological), potentially increasing their biological availability (Tessier *et al*., 1979). Residual trace metals (mainly primary and secondary minerals) are defined as those which are part of the silicate matrix of the sediment and that are located mainly in the lattice structures of the component minerals. Residual metals are less likely to be released from these lattices into solution in normal environmental conditions (Tessier *et al*., 1979).

Metals are generally not harmful to organisms at concentrations normally found in marine sediments and some, like zinc, may be essential for normal metabolism although can become toxic above a critical threshold. In order to assign a level of context for toxicity, an approach used by Long, *et al*. (1995) to characterize contamination in sediments will be used here. These researchers reviewed field and laboratory studies and identified nine metals that were observed to have ecological or biological effects on organisms. They defined “effect range low” (ERL) values as the lowest concentration of a metal that produced adverse effects in 10% of the data reviewed, whilst “effect range median” (ERM) values designate the level at which half of the studies reported harmful effects. Consequently, metal concentrations recorded below the ERL value are not expected to elicit adverse effects, while levels above the ERM value are likely to be toxic to some marine life.

Of particular relevance to the offshore oil and gas industry are metals associated with drilling related discharges. These can contain substantial amounts of barium sulphate (barites) as a weighting agent (NRC, 1983) and barium is frequently used to detect the deposition of drilling fluids around offshore installations (Chow and Snyder, 1980; Gettleson and Laird, 1980; Trocine and Trefry, 1983). The majority of barium is typically insoluble in the form of a non-toxic sulphate (Gerrard *et al*., 1999); this metal is rarely of toxicological concern to the marine fauna. Solid barites are often discharged during the drilling process and also contain measurable concentrations of heavy metals as impurities, including chromium, copper, lead, vanadium and zinc (NRC, 1983). Other heavy metals, either as impurities or additives are also present in other mud components.

For this survey, natural barium levels were considered to be low and indicative of a non-industrialised deep-sea habitat, ranging from 278mg.kg^{-1} at B2913B_ENV_36 to 695mg.kg^{-1} at station 3000m_NW (Figure 3.14). A significant positive relationship between fines and natural barium was observed (ϱ(66)=0.536, p>0.001). Most stations in the northern area of the Block had slightly higher natural barium levels than those positioned in the southern extent of the Block (Figure 3.14). Furthermore, when barium was measured by fusion technique, which more effectively quantifies barium in the barite form used in drilling muds, concentrations were recorded following a similar pattern to that of natural barium. Barium by fusion concentrations were higher in the development area of the Block ranging from 800mg.kg^{-1} to 1,000mg.kg^{-1} (Figure 3.15). **Although barium by fusion concentrations were highest there, the values were not indicative of drilling activity and reflect small-scale variability in the seabed**.

Heavy and trace metal concentrations showed limited variation across the survey area, which is unsurprising given the similar depths encountered through the Block. Almost all metal concentrations were recorded below their respective ERL values (where applicable), with selenium and tin also below the LoD for all stations within the Block 2913B survey area. **Most metals associated with drilling related barite discharges (arsenic, chromium, nickel, vanadium, zinc and iron) were low throughout the survey area**, even with higher concentrations of natural barium and barium by fusion observed at stations within the development area.

Nickel was the only metal to exceed its respective ERL of 20.9mg.kg^{-1} (OSPAR 2014) and SQGV of 21.0mg.kg^{-1} (ANZECC 2013) at 83% of stations sampled, however all concentrations were well below the ERM value of 51.6mg.kg^{-1} and ranged from 12.2mg.kg^{-1} at B2913B_ENV_50 to 35.3mg.kg^{-1} at station B2913B_ENV_21 (Figure 3.16). Previous surveys in Block 2913B have also highlighted elevated nickel concentrations above the ERL, suggesting that **background concentrations of nickel in Namibian waters are slightly higher than other sediments** (BSL, 2018).

Chromium levels were found to be consistent throughout the survey area ranging from 8.9mg.kg^{-1} at station B2913B_ENV_36 to 21.2mg.kg^{-1} at station B2913B_ENV_21 (mean 14.0±2.6SD)(Figure 3.17). Arsenic and chromium were significantly positively correlated (ϱ(66)=0.431, p>0.001). Values were

below reference levels throughout the Block, indicating chromium levels in Namibian offshore waters are low.

Copper concentrations were also low through the survey area and were consistently below all reference levels, thought to reflect background Copper concentrations offshore Namibia. Concentrations ranged from 18.2mg.kg^{-1} at station B2913B_ENV_12 to 30.1mg.kg^{-1} B2913B_ENV_21, displaying no geographic or bathymetric trend in their variation (Figure 3.18).

Lead is a non-biodegradable metal that can affect development and recruitment of marine invertebrates such as annelids, cnidarians and echinoderms (Botté *et al.,* 2022). **In Block 2913B, lead concentrations were very low ranging from 1.6mg.kg^{-1} at B2913B_ENV_12 to 5.6mg.kg^{-1} at B2913B_ENV_10 (mean 2.4mg.kg^{-1}±0.05SD)** (Figure 3.19).

Zinc, which is essential for normal metabolism is another trace metal present in offshore sediments and was found to be consistent in its low concentration along with other trace metals (Figure 3.20). **Zinc concentrations ranged from 16.5mg.kg^{-1} at station B2913B_ENV_12 to 58.8mg.kg^{-1} at station 250m_NW.** Zinc was significantly positively correlated with the proportion of fines ($\varrho(66)=0.403$, $p>0.001$) and significantly negatively correlated with the proportion of sands ($\varrho(66)=-0.486$, $p>0.001$).

The crustal metal aluminium ranged from 3,500mg.kg^{-1} at B2913B_ENV_36 to 8,090mg.kg^{-1} at stations B2913B_ENV_25 and 30 (mean 6,535mg.kg^{-1}±1,119SD) (Figure 3.21). Higher **aluminium levels tend to occur naturally in sediment with high silicate content, as observed in Block 2913B**, thus explaining the moderate concentrations recorded throughout the survey area. **Iron,** which **is also naturally abundant in marine sediments,** varied between 2,750mg.kg^{-1} at B2913B_ENV_47 to 6,150mg.kg^{-1} at B2913B_ENV_25 (mean 4,867mg.kg^{-1}±768 SD) (Figure 3.22).

The physical nature of the sediment (a high sedimentary fines content) had a clear effect on heavy metal concentrations, with significant relationships recorded between the proportion of fines and most of the metals analysed. Five of the metals analysed (arsenic, chromium, cobalt, manganese and nickel) were recorded as highest at station B2913B_ENV_21, which had a high fines content (78.5%).

Table 3.7 Sediment Total Heavy and Trace Metal Concentrations

Station	Depth (m)	Aluminium (Al) (mg.kg^{-1})	Antimony (Sb) (mg.kg^{-1})	Arsenic (As) (mg.kg^{-1})	Barium (Ba) (mg.kg^{-1})	Barium By Fusion (mg.kg^{-1})	Beryllium (Be) (mg.kg^{-1})	Cadmium (Cd) (mg.kg^{-1})	Chromium (Cr) (mg.kg^{-1})	Cobalt (Co) (mg.kg^{-1})	Copper (Cu) (mg.kg^{-1})	Iron (Fe) (mg.kg^{-1})	Lead (Pb) (mg.kg^{-1})	Lithium (Li) (mg.kg^{-1})	Manganese (Mn) (mg.kg^{-1})	Mercury (Hg) (mg.kg^{-1})	Molybdenum (Mb) (mg.kg^{-1})	Nickel (Ni) (mg.kg^{-1})	Selenium (mg.kg^{-1}) (Se)	Tin (Sn) (mg.kg^{-1})	Titanium (Ti) (mg.kg^{-1})	Vanadium (V) (mg.kg^{-1})	Zinc (Zn) (mg.kg^{-1})
0m Venus-2 SPWL	2,900	6,340	<0.1	0.8	656	800	<0.10	0.2	13.3	4.5	24.8	5,000	2.3	17.6	547	0.05	0.5	24.7	<1.0	<0.5	97.7	13.8	25.8
250m_SE	2,900	6,220	<0.1	0.6	485	800	<0.10	<0.04	12.2	3.9	22.6	4,680	2.4	16.6	471	0.05	0.5	22.4	<1.0	<0.5	109	11.8	31.4
500m_SE	2,900	6,530	0.1	1.1	665	800	<0.10	0.1	13.4	4.5	25.4	4,990	2.2	18.3	649	0.05	0.7	28.8	<1.0	<0.5	101	13.0	33.4
1000m_SE	2,900	6,990	0.1	1.3	488	800	0.1	0.1	13.6	4.2	24.4	5,390	2.4	19.0	526	0.09	0.5	23.0	<1.0	<0.5	109	13.8	29.5
2000m_SE	2,900	7,550	<0.1	1.6	637	800	0.3	0.2	18.4	5.3	28.6	5,400	3.4	17.6	702	0.03	0.6	31.6	<1.0	<0.5	130	16.6	26.9
250m_NW	2,900	6,550	0.1	1.0	617	800	<0.10	0.1	13.8	4.5	26.0	5,010	2.5	17.8	561	0.06	1.0	25.1	<1.0	<0.5	111	12.9	58.8
500m_NW	2,900	7,340	0.1	1.0	671	900	<0.10	0.1	14.3	4.6	28.8	5,530	2.4	19.3	560	0.06	0.7	26.0	<1.0	<0.5	128	13.0	35.1
1000m_NW	2,900	6,470	0.2	1.5	655	900	<0.10	<0.04	13.1	4.6	24.8	5,020	2.4	18.0	550	0.05	0.8	24.9	<1.0	<0.5	98.8	12.7	30.3
1500m_NW	2,900	6,630	<0.1	0.9	620	800	<0.10	<0.04	12.6	3.8	22.9	4,910	2.2	17.6	508	0.05	0.6	22.5	<1.0	<0.5	109	12.4	24.3
2000m_NW	2,900	6,520	0.1	1.2	613	800	<0.10	<0.04	13.0	4.4	24.5	5,090	2.3	18.0	512	0.05	0.6	23.1	<1.0	<0.5	101	13.3	35.6
3000m_NW	2,900	6,700	0.1	1.3	695	1000	<0.10	<0.04	12.9	4.1	22.5	5,180	2.1	18.1	542	0.06	0.8	24.0	<1.0	<0.5	102	13.0	23.8
250m_NE	2,900	6,490	0.1	1.2	607	800	<0.10	0.3	13.5	4.5	24.7	5,100	2.6	17.9	520	0.08	0.6	23.0	<1.0	<0.5	103	13.3	32.7
500m_NE	2,900	6,710	<0.1	1.2	674	800	0.1	0.2	13.6	4.5	24.7	5,170	2.3	18.3	528	0.06	0.8	23.1	<1.0	<0.5	104	14.0	28.2
1000m_NE	2,900	6,780	<0.1	1.2	661	900	<0.10	0.2	13.7	4.5	25.3	5,130	2.4	18.4	537	0.06	0.5	23.8	<1.0	<0.5	105	14.2	27.0
2000m_NE	2,900	6,860	<0.1	1.0	695	900	<0.10	0.1	13.6	4.5	24.8	5,310	2.4	18.8	580	0.05	0.6	25.9	<1.0	<0.5	111	13.2	26.0
10000m_NE	2,900	7,020	<0.1	1.6	669	800	<0.10	0.3	14.3	4.0	23.9	5,380	2.3	18.9	512	0.06	0.5	22.7	<1.0	<0.5	113	14.2	25.2
250m_SW	2,900	6,590	0.1	1.5	666	900	<0.10	0.4	13.4	4.4	25.0	5,030	4.4	18.1	509	0.06	0.6	22.2	<1.0	<0.5	99.5	14.2	25.8
500m_SW	2,900	6,730	0.1	1.4	682	800	<0.10	0.2	13.4	4.5	25.1	5,180	2.5	18.3	516	0.06	0.6	22.9	<1.0	<0.5	104	13.7	35.2
1000m_SW	2,900	6,610	<0.1	1.7	695	800	<0.10	0.2	12.4	4.2	23.8	5,160	2.5	18.5	553	0.05	0.7	24.0	<1.0	<0.5	104	12.5	27.8
2000m_SW	2,900	6,630	<0.1	1.1	668	900	<0.10	0.4	12.9	4.4	24.7	5,120	2.2	18.3	574	0.05	0.7	24.8	<1.0	<0.5	106	12.9	27.4
B2913B_ENV_01	2,964	6,010	<0.1	2.4	444	700	0.2	0.2	15.2	4.5	25.7	5,310	2.5	14.6	481	0.02	<0.5	26.0	<1.0	<0.5	103	13.6	26.8
B2913B_ENV_02	3,025	7,550	<0.1	1.4	650	700	0.3	0.4	17.3	5.1	28.7	5,430	2.6	18.0	681	0.03	0.5	30.7	<1.0	<0.5	131	15.5	25.6
B2913B_ENV_03	2,916	7,330	<0.1	0.9	635	800	0.2	0.3	15.6	4.2	25.6	5,280	2.5	17.2	492	0.02	<0.5	25.0	<1.0	<0.5	129	13.6	25.0
B2913B_ENV_04	3,051	7,150	<0.1	0.5	656	800	0.2	0.3	11.7	3.6	21.2	5,120	2.1	16.9	532	0.02	<0.5	24.0	<1.0	<0.5	126	11.4	20.2
B2913B_ENV_05	3,028	7,280	<0.1	0.7	639	800	0.2	0.3	14.2	4.3	25.3	5,230	2.3	17.3	673	0.02	0.6	29.6	<1.0	<0.5	129	12.9	23.0

Station	Depth (m)	Aluminium (Al) (mg.kg^{-1})	Antimony (Sb) (mg.kg^{-1})	Arsenic (As) (mg.kg^{-1})	Barium (Ba) (mg.kg^{-1})	Barium By Fusion (mg.kg^{-1})	Beryllium (Be) (mg.kg^{-1})	Cadmium (Cd) (mg.kg^{-1})	Chromium (Cr) (mg.kg^{-1})	Cobalt (Co) (mg.kg^{-1})	Copper (Cu) (mg.kg^{-1})	Iron (Fe) (mg.kg^{-1})	Lead (Pb) (mg.kg^{-1})	Lithium (Li) (mg.kg^{-1})	Manganese (Mn) (mg.kg^{-1})	Mercury (Hg) (mg.kg^{-1})	Molybdenum (Mb) (mg.kg^{-1})	Nickel (Ni) (mg.kg^{-1})	Selenium (mg.kg^{-1}) (Se)	Tin (Sn) (mg.kg^{-1})	Titanium (Ti) (mg.kg^{-1})	Vanadium (V) (mg.kg^{-1})	Zinc (Zn) (mg.kg^{-1})
B2913B_ENV_06	3,002	7,710	<0.1	1.3	634	400	0.3	0.4	17.0	4.9	28.5	5,410	2.7	17.8	664	0.03	0.5	30.2	<1.0	<0.5	134	15.0	25.3
B2913B_ENV_07	2,978	7,440	<0.1	1.3	660	800	0.3	0.3	15.1	4.1	24.3	5,440	2.5	17.4	510	0.03	<0.5	23.6	<1.0	<0.5	129	13.8	22.5
B2913B_ENV_08	3,032	6,960	<0.1	1.0	488	800	0.3	0.4	13.4	3.9	23.4	4,890	2.3	16.2	523	0.03	<0.5	24.8	<1.0	<0.5	121	13.4	23.0
B2913B_ENV_09	3,019	7,550	<0.1	1.1	650	800	0.3	0.4	16.3	4.5	25.1	5,420	2.6	17.6	590	0.03	<0.5	27.7	<1.0	<0.5	132	15.1	24.7
B2913B_ENV_10	3,003	6,560	<0.1	0.8	466	800	0.3	0.4	15.3	4.3	25.5	4,680	5.6	15.2	604	0.03	0.5	28.2	<1.0	<0.5	116	14.2	24.5
B2913B_ENV_11	2,977	7,060	0.1	1.3	492	900	0.3	0.2	16.1	4.3	25.8	5,100	2.5	16.4	622	0.05	0.5	29.0	<1.0	<0.5	124	14.3	23.9
B2913B_ENV_12	3,025	3,990	<0.1	1.5	373	800	0.3	0.1	9.2	3.0	18.2	3,120	1.6	10.0	381	0.01	<0.5	18.5	<1.0	<0.5	65.3	9.3	16.5
B2913B_ENV_13	2,976	6,180	<0.1	1.9	607	800	0.3	0.2	14.3	4.4	25.5	4,770	2.3	15.3	648	0.03	0.5	31.3	<1.0	<0.5	112	12.5	24.6
B2913B_ENV_14	2,954	7,790	<0.1	1.7	670	800	0.3	0.2	16.2	4.4	25.4	5,660	2.3	18.2	634	0.02	0.5	28.9	<1.0	<0.5	137	13.9	24.6
B2913B_ENV_15	3,013	7,140	<0.1	2.2	634	800	0.3	0.2	16.7	4.7	27.0	5,180	2.5	16.9	563	0.03	0.5	28.3	<1.0	<0.5	121	14.9	25.3
B2913B_ENV_16	2,903	6,690	<0.1	1.7	490	800	0.3	0.1	13.6	3.7	22.0	4,960	2.0	16.1	460	0.02	<0.5	22.8	<1.0	<0.5	117	12.0	20.5
B2913B_ENV_17	2,879	7,130	<0.1	1.6	475	700	0.3	0.2	15.2	4.1	23.4	5,190	2.1	16.8	526	0.02	<0.5	25.9	<1.0	<0.5	127	13.8	23.2
B2913B_ENV_19	2,943	7,260	<0.1	1.9	649	800	0.3	0.2	17.8	4.7	27.2	5,390	2.6	17.0	516	0.03	<0.5	25.6	<1.0	<0.5	125	16.1	25.1
B2913B_ENV_20	2,810	7,530	<0.1	1.9	665	800	0.3	0.2	15.3	3.8	23.2	5,580	2.1	17.6	419	0.02	<0.5	21.4	<1.0	<0.5	129	13.2	21.6
B2913B_ENV_21	2,625	7,630	<0.1	2.5	671	800	0.3	0.2	21.2	6.4	30.1	6,140	2.9	19.4	853	0.03	0.7	35.3	<1.0	<0.5	130	17.7	30.0
B2913B_ENV_23	2,996	6,590	<0.1	1.8	480	800	0.3	0.1	15.3	4.3	25.4	4,810	2.2	15.4	514	0.03	<0.5	27.8	<1.0	<0.5	117	13.1	26.2
B2913B_ENV_24	2,849	7,850	<0.1	2.2	668	800	0.2	0.2	17.6	4.4	26.8	5,820	2.5	18.9	566	0.04	<0.5	28.0	<1.0	<0.5	134	16.2	24.8
B2913B_ENV_25	2,593	8,090	<0.1	2.2	646	800	0.1	0.2	19.4	5.4	27.1	6,150	2.7	19.6	670	0.03	0.5	29.9	<1.0	<0.5	141	16.7	28.6
B2913B_ENV_27	2,857	6,700	<0.1	2.0	488	800	0.2	0.1	14.1	3.9	23.0	5,120	2.2	16.3	450	0.03	<0.5	22.0	<1.0	<0.5	108	12.8	21.6
B2913B_ENV_28	2,737	7,440	<0.1	2.2	481	700	0.2	0.3	16.8	4.5	25.8	5,570	2.8	17.9	565	0.04	<0.5	28.6	<1.0	<0.5	131	15.0	29.4
B2913B_ENV_29	3,117	7,100	<0.1	1.8	641	700	0.1	0.2	15.1	4.5	26.0	4,940	2.4	16.6	489	0.03	<0.5	24.9	<1.0	<0.5	120	13.5	26.5
B2913B_ENV_30	2,793	8,090	<0.1	2.1	643	700	0.2	0.3	18.4	5.2	26.6	5,950	2.5	19.2	743	0.02	0.5	32.1	<1.0	<0.5	143	16.0	26.0
B2913B_ENV_31	3,164	6,860	<0.1	2.1	635	700	0.2	0.2	14.9	4.2	25.0	4,810	2.3	15.9	446	0.02	<0.5	22.1	<1.0	<0.5	114	13.0	22.3
B2913B_ENV_33	2,953	7,400	<0.1	2.1	673	700	0.2	0.3	16.7	4.9	26.9	5,260	2.5	17.6	721	0.02	0.5	32.3	<1.0	<0.5	120	15.3	25.7
B2913B_ENV_34	2,743	6,670	<0.1	2.3	450	600	0.2	0.2	16.0	4.6	24.5	5,000	2.3	15.9	699	0.02	0.5	29.6	<1.0	<0.5	118	14.6	24.6
B2913B_ENV_35	2,661	7,150	0.1	0.8	447	700	0.3	0.3	18.6	4.7	26.1	5,330	3.0	17.9	423	0.03	<0.5	26.8	<1.0	<0.5	126	15.7	30.8
B2913B_ENV_36	2,878	3,500	<0.1	0.9	278	500	0.2	0.6	8.9	4.0	19.3	2,780	2.0	10.0	369	0.04	<0.5	17.6	<1.0	<0.5	48.9	10.2	18.4

Station	Depth (m)	Aluminium (Al) (mg.kg^{-1})	Antimony (Sb) (mg.kg^{-1})	Arsenic (As) (mg.kg^{-1})	Barium (Ba) (mg.kg^{-1})	Barium By Fusion (mg.kg^{-1})	Beryllium (Be) (mg.kg^{-1})	Cadmium (Cd) (mg.kg^{-1})	Chromium (Cr) (mg.kg^{-1})	Cobalt (Co) (mg.kg^{-1})	Copper (Cu) (mg.kg^{-1})	Iron (Fe) (mg.kg^{-1})	Lead (Pb) (mg.kg^{-1})	Lithium (Li) (mg.kg^{-1})	Manganese (Mn) (mg.kg^{-1})	Mercury (Hg) (mg.kg^{-1})	Molybdenum (Mb) (mg.kg^{-1})	Nickel (Ni) (mg.kg^{-1})	Selenium (mg.kg^{-1}) (Se)	Tin (Sn) (mg.kg^{-1})	Titanium (Ti) (mg.kg^{-1})	Vanadium (V) (mg.kg^{-1})	Zinc (Zn) (mg.kg^{-1})
B2913B_ENV_38	2,790	4,920	0.1	1.0	430	700	0.1	0.6	12.8	4.2	23.3	4,080	2.2	13.5	621	0.04	0.5	27.4	<1.0	<0.5	71.4	12.9	23.2
B2913B_ENV_39	2,538	4,820	0.2	1.0	382	700	0.1	0.7	12.6	4.5	21.9	4,130	2.5	13.5	560	0.04	<0.5	24.1	<1.0	<0.5	69.9	12.7	25.1
B2913B_ENV_40	2,613	4,900	<0.1	1.2	405	700	0.2	0.6	13.8	5.5	23.2	4,150	2.7	13.9	604	0.04	<0.5	25.5	<1.0	<0.5	78.4	13.8	24.5
B2913B_ENV_41	2,873	4,080	<0.1	1.2	349	700	0.2	0.6	10.1	3.7	20.6	3,120	2.6	10.7	347	0.03	<0.5	16.1	<1.0	<0.5	62.4	11.7	22.5
B2913B_ENV_43	2,715	4,620	0.2	1.6	417	700	0.2	0.6	12.2	4.7	23.6	3,850	2.6	12.7	676	0.04	0.5	27.2	<1.0	<0.5	71.6	13.4	25.2
B2913B_ENV_44	2,957	4,730	<0.1	1.3	415	600	0.2	0.6	11.0	3.9	21.1	3,640	2.1	12.2	368	0.08	<0.5	16.5	<1.0	<0.5	73.1	12.0	19.4
B2913B_ENV_45	2,830	4,380	<0.1	1.4	391	600	0.2	0.6	10.2	3.6	21.0	3,370	2.0	11.3	375	0.04	<0.5	17.7	<1.0	<0.5	69.8	11.7	17.7
B2913B_ENV_46	2,735	3,660	<0.1	1.5	319	600	0.1	0.5	9.1	3.5	21.0	2,930	2.0	10.0	407	0.04	<0.5	20.0	<1.0	<0.5	58.2	10.7	20.9
B2913B_ENV_47	3,012	3,770	<0.1	1.4	310	600	0.2	0.1	9.1	3.7	22.3	2,750	2.5	9.8	371	0.06	<0.5	19.2	<1.0	<0.5	55.9	10.7	22.9
B2913B_ENV_48	2,963	7,250	<0.1	1.1	453	700	0.3	0.2	11.2	3.4	18.4	4,560	1.9	15.6	322	<0.01	<0.5	15.7	<1.0	<0.5	125	11.8	19.0
B2913B_ENV_49	2,846	6,540	<0.1	1.5	437	800	0.3	0.3	12.1	3.5	19.3	4,410	2.1	14.6	390	0.01	<0.5	18.4	<1.0	<0.5	115	12.1	21.4
B2913B_ENV_50	3,116	6,400	<0.1	1.2	424	700	0.3	0.3	11.6	3.6	22.2	4,110	1.9	14.2	262	<0.01	<0.5	12.2	<1.0	<0.5	112	11.9	18.4
B2913B_ENV_51	3,032	6,780	<0.1	1.3	464	600	0.3	0.3	13.1	4.2	22.5	4,530	2.1	15.4	397	0.02	<0.5	19.0	<1.0	<0.5	115	13.5	20.4
B2913B_ENV_52	2,960	6,810	<0.1	1.5	457	700	0.3	0.2	11.0	3.5	18.6	4,520	1.8	15.3	329	<0.01	<0.5	15.7	<1.0	<0.5	114	11.4	25.5
Mean		**6,535**	-	**1.4**	**555**	**759**	**0.2**	**0.3**	**14.1**	**4.3**	**24.2**	**4,867**	**2.4**	**16.4**	**530**	**0.04**	**0.6**	**24.5**	-	-	**109**	**13.4**	**25.7**
Standard Deviation		**1,119**	-	**0.5**	**119**	**101**	**0.1**	**0.2**	**2.6**	**0.6**	**2.6**	**768**	**0.5**	**2.5**	**114**	**0.02**	**0.1**	**4.6**	-	-	**23**	**1.6**	**5.8**
Variance (%)		**17**	-	**32.8**	**21**	**13**	**28.5**	**54.9**	**18.3**	**12.9**	**10.6**	**16**	**22.5**	**15.6**	**22**	**45.1**	**20.7**	**18.8**	-	-	**21**	**11.9**	**22.7**
Minimum		**3,500**	**0.1**	**0.5**	**278**	**400**	**0.1**	**0.0**	**8.9**	**3.0**	**18.2**	**2,750**	**1.6**	**9.8**	**262**	**0.01**	**0.5**	**12.2**	-	-	**48.9**	**9.3**	**16.5**
Maximum		**8,090**	**0.2**	**2.5**	**695**	**1,000**	**0.3**	**0.7**	**21.2**	**6.4**	**30.1**	**6,150**	**5.6**	**19.6**	**853**	**0.09**	**1.0**	**35.3**	-	-	**143**	**17.7**	**58.8**
Reference Values																							
French Circular N1		-	-	25	-	-	-	1.2	90	-	45	-	100	-	-	0.4	-	37	-	-	-	-	276
French Circular N2		-	-	50	-	-	-	2.4	180	-	90	-	200	-	-	0.8	-	74	-	-	-	-	552
OSPAR (2014) ERL		-	-	8.2	-	-	-	1.2	81	-	34	-	46.7	-	-	0.15	-	20.9	-	-	-	-	150
NOAA (2008) ERM		-	-	70	-	-	-	9.6	370	-	270	-	218	-	-	0.71	-	51.6	-	-	-	-	410
ANZECC/ARMCANZ SQGV		-	-	20	-	-	-	1.5	80	-	65	-	50	-	-	0.15	-	21	-	-	-	-	200
ANZECC/ARMCANZ SQGV-High		-	-	70	-	-	-	10	370	-	270	-	220	-	-	1	-	52	-	-	-	-	410

Notes: Light green cell = above N1 level, Dark green cell = above N2 level; Light red cell = above ERL level, Dark red cell = above ERM level, Light purple cell = above SQGV level, Dark purple cell = above SQGV-High level
'NC' = Not calculable due to data being below limits of detection

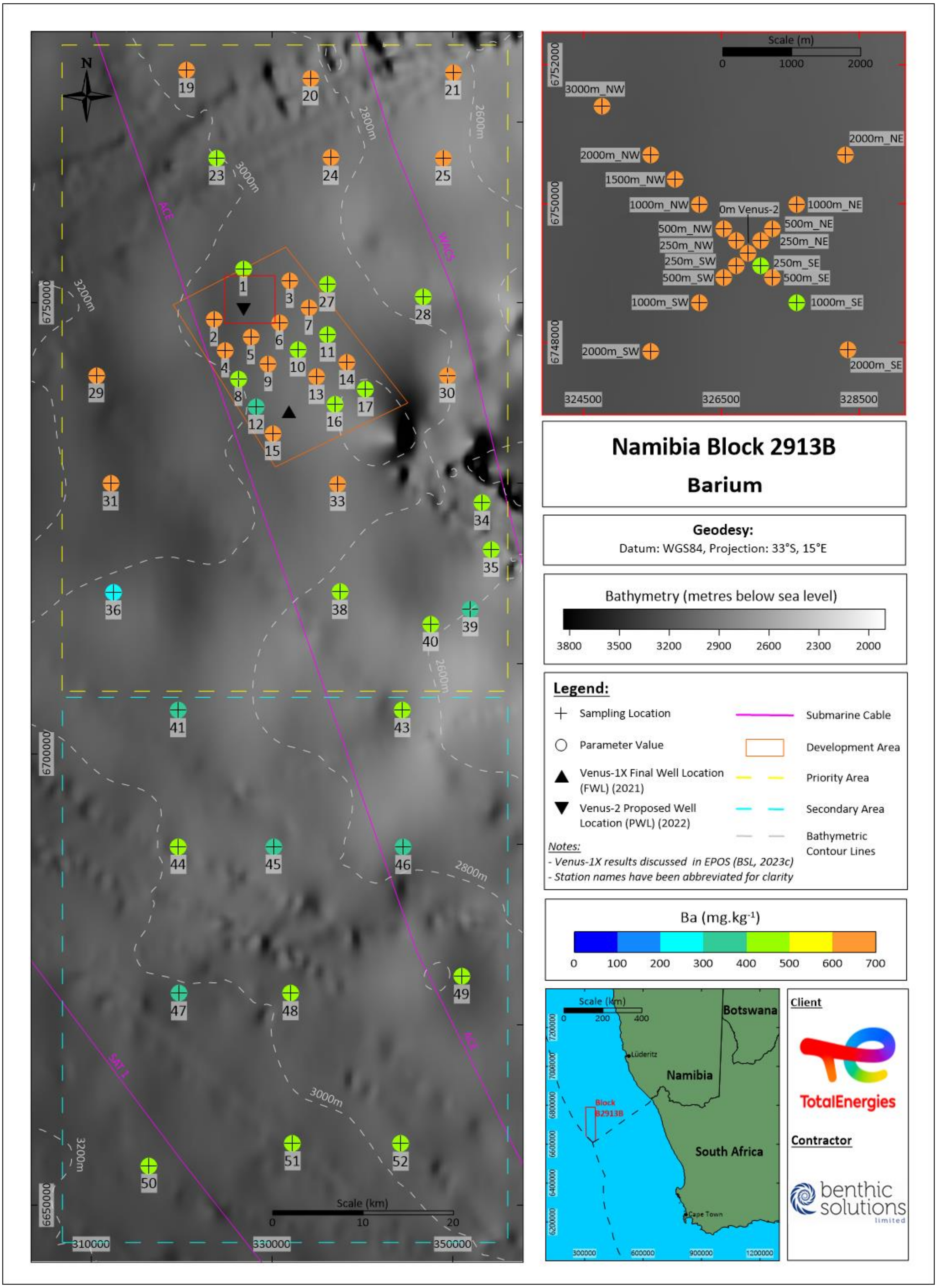


Figure 3.14 Concentrations of Barium

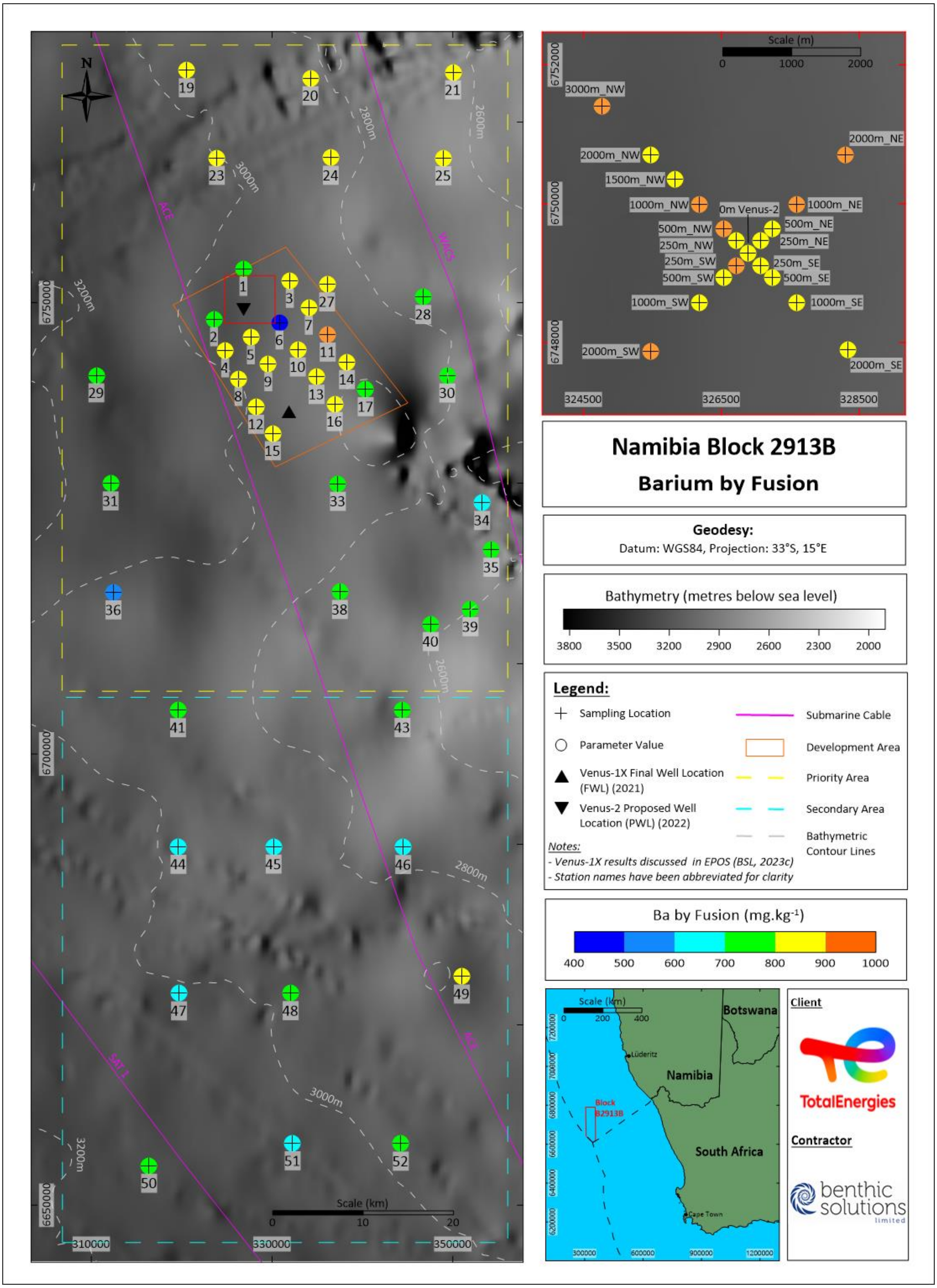


Figure 3.15 Concentration of Barium by Fusion

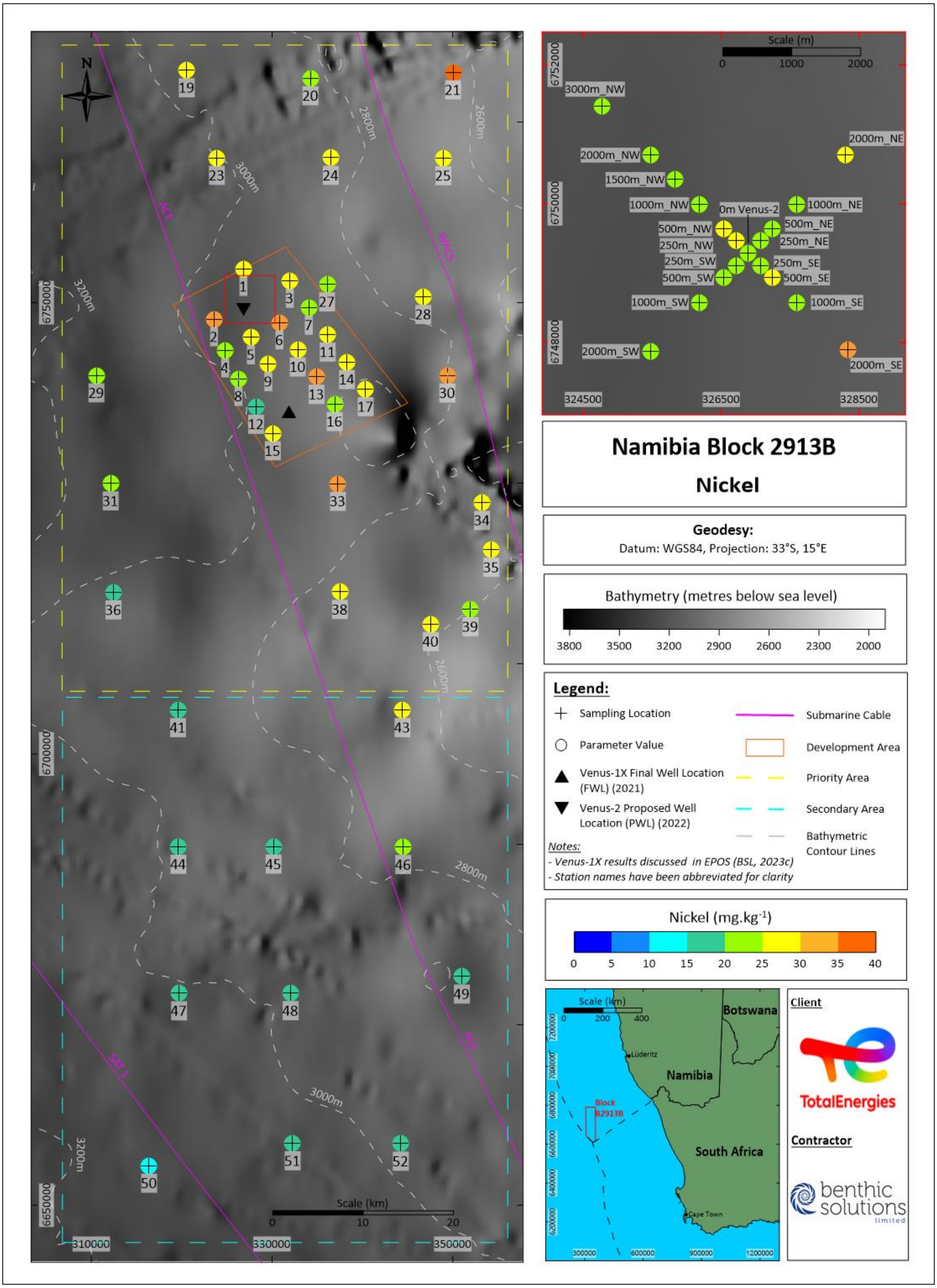


Figure 3.16 Concentration of Nickel

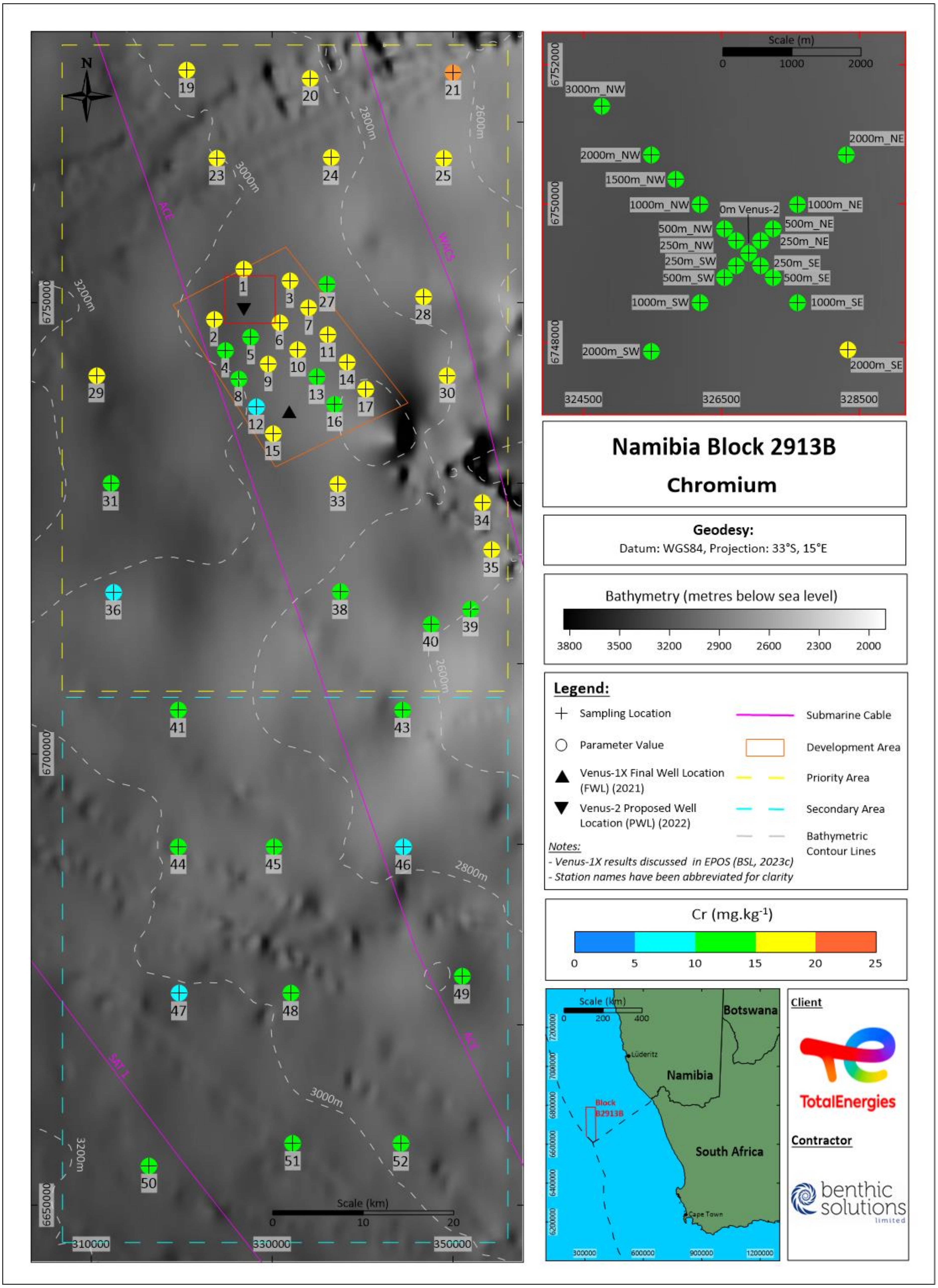


Figure 3.17 Concentrations of Chromium

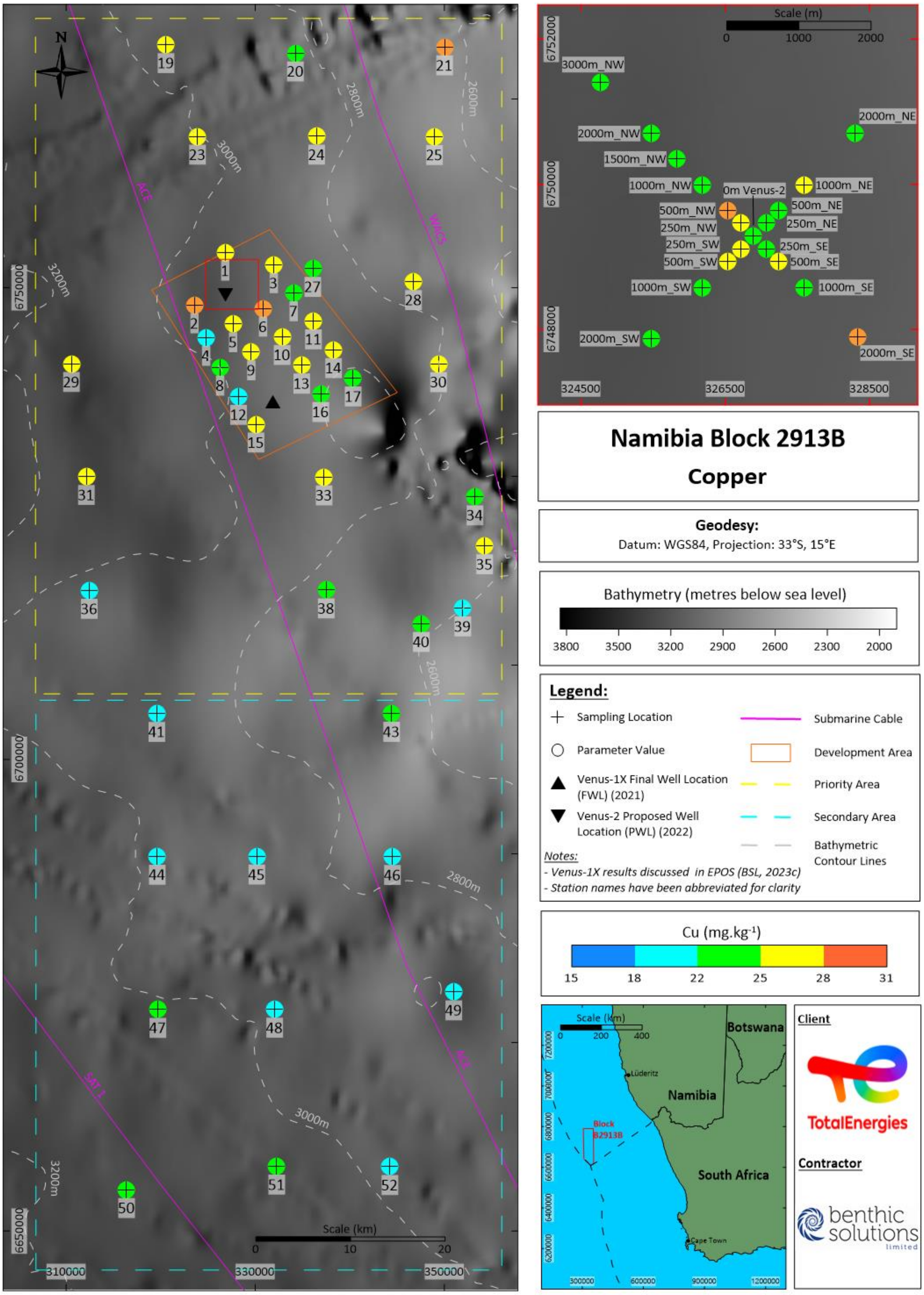


Figure 3.18 Concentration of Copper

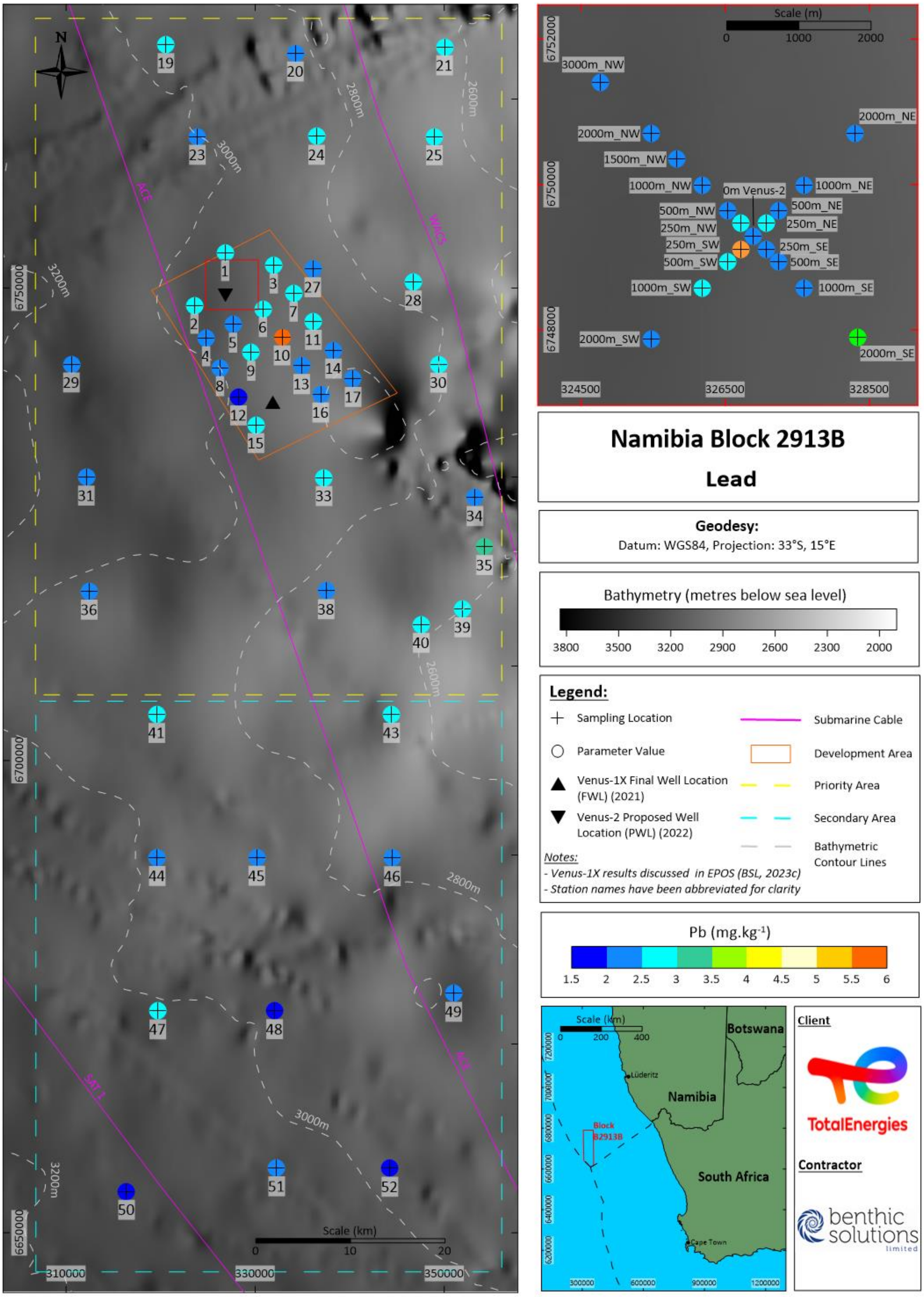


Figure 3.19 Concentrations of Lead

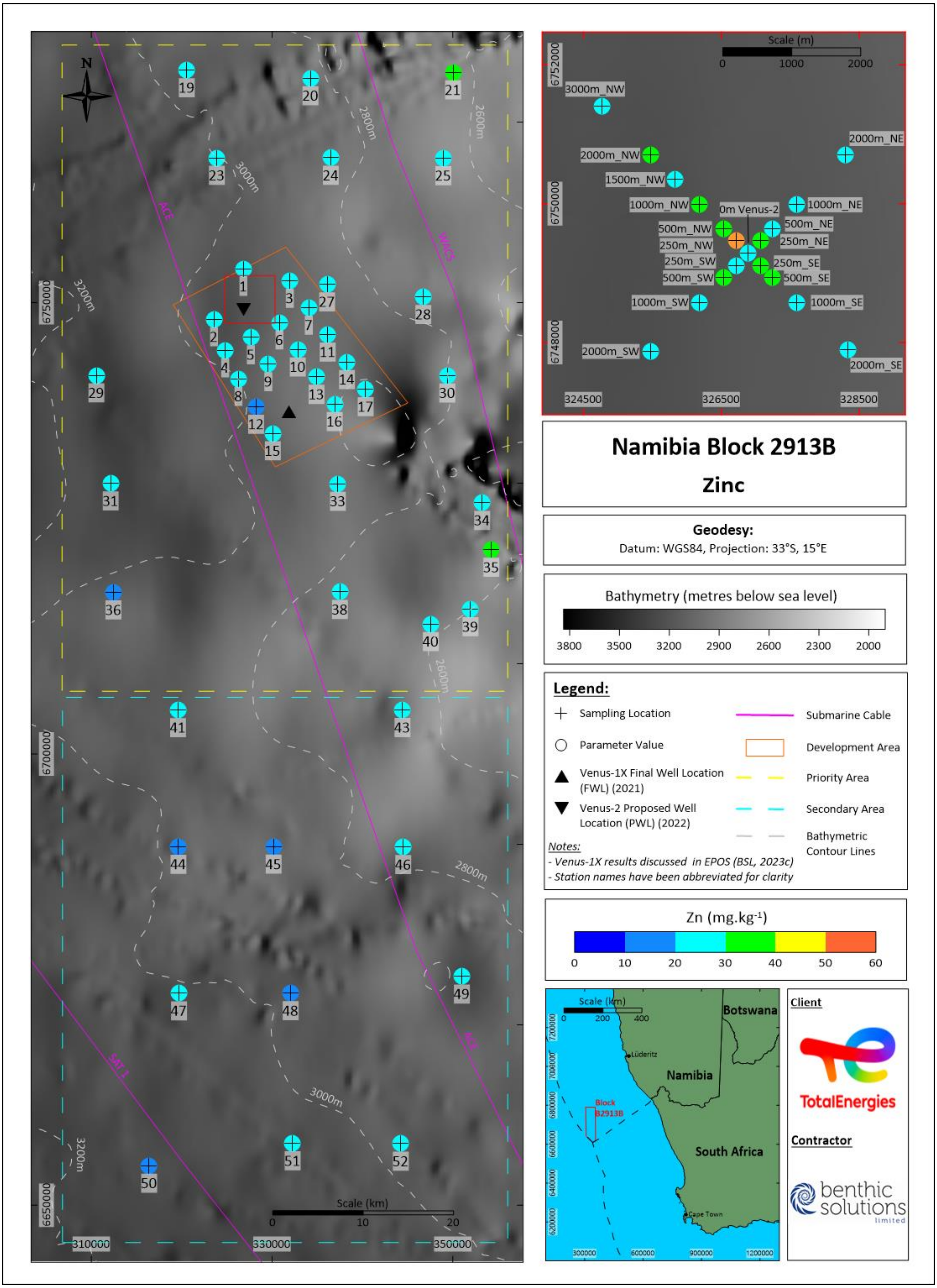


Figure 3.20 Concentrations of Zinc

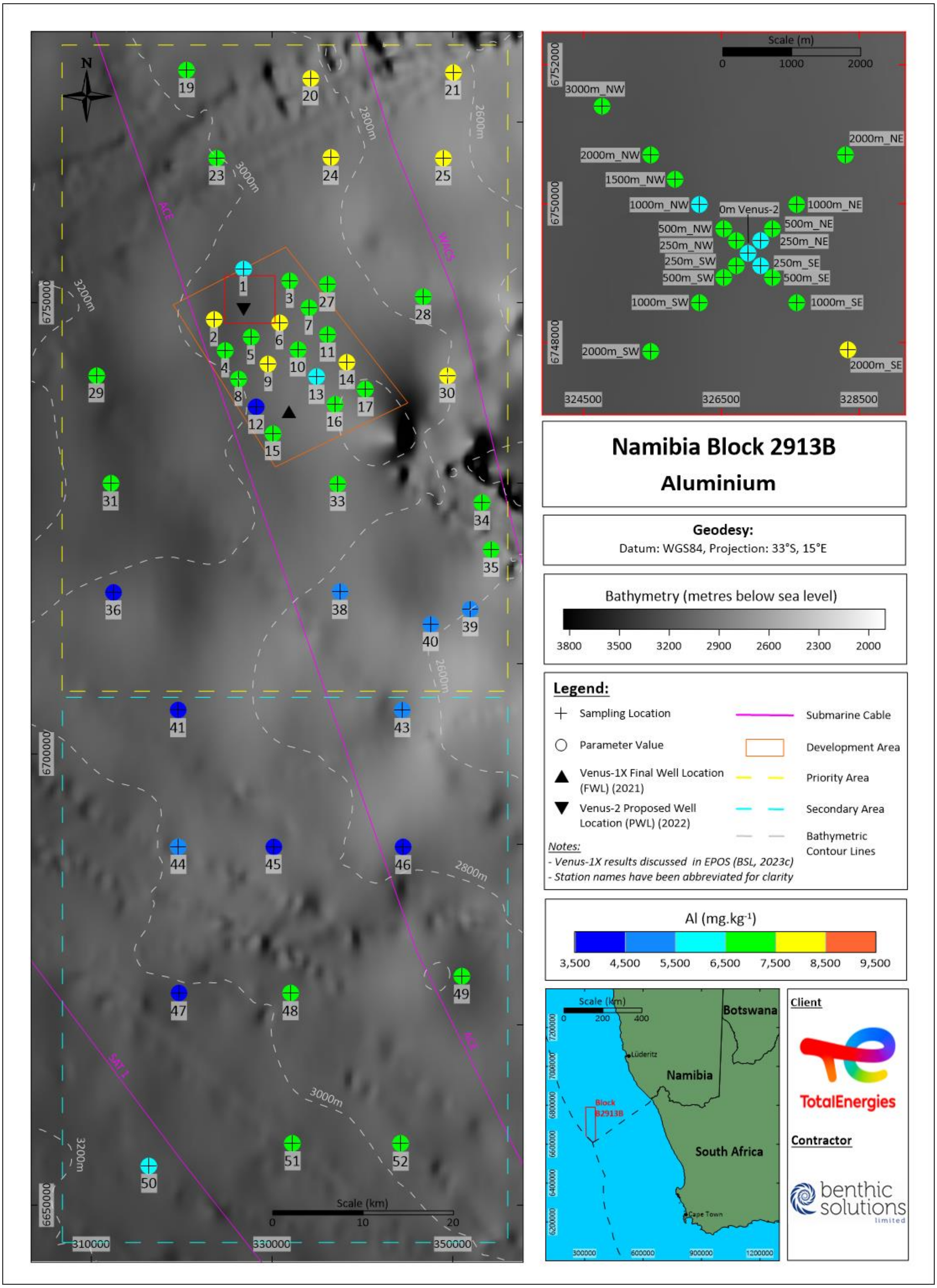


Figure 3.21 Concentrations of Aluminium

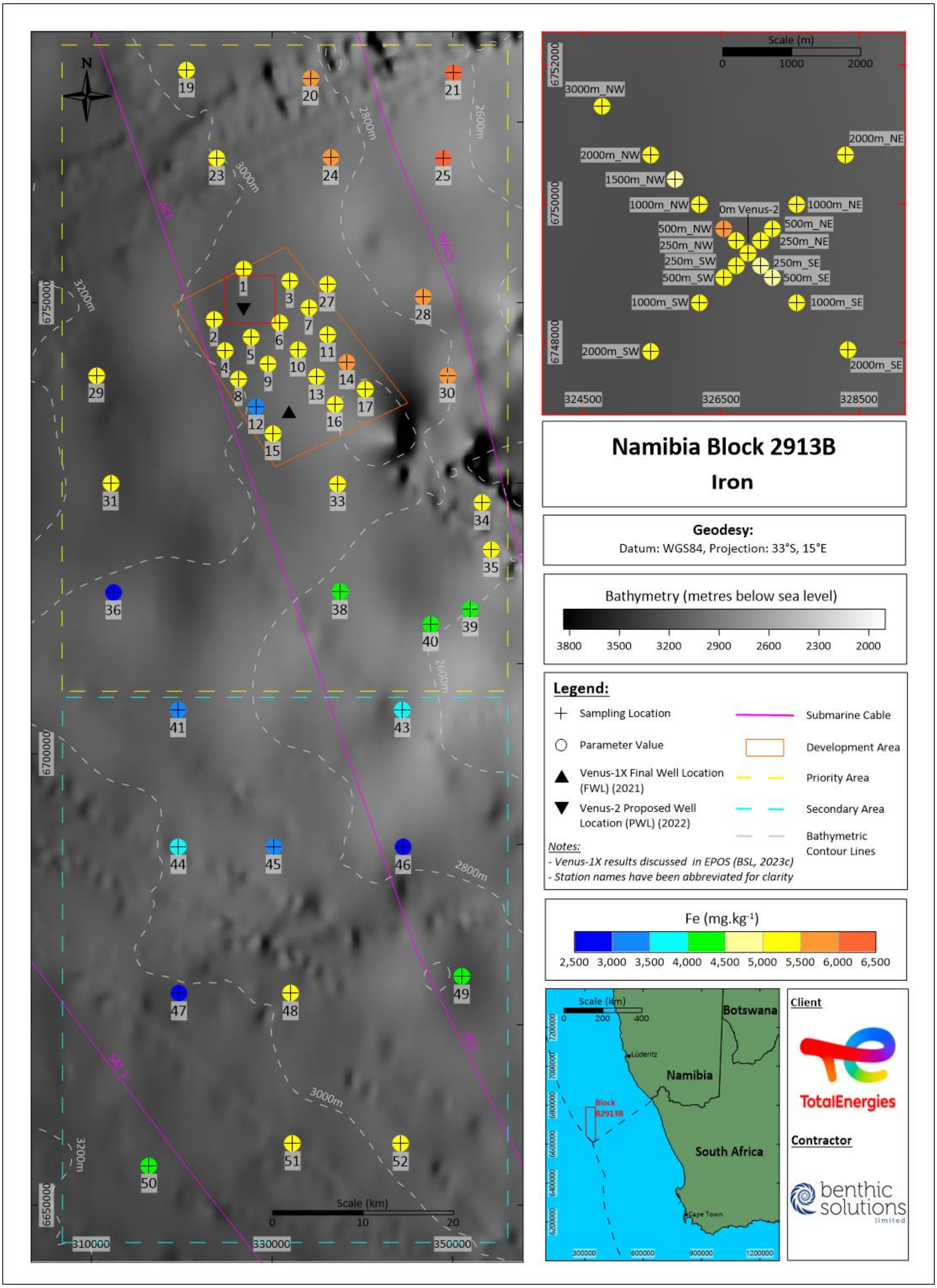


Figure 3.22 Concentrations of Iron

3.7 Sediment Biology

3.7.1 *Microbiology Analysis*

Sediment samples were collected from the surface at each of the 66 stations within Block 2913B for microbiology testing. Specifically, of heterotrophic microorganisms (yeast, fungi, bacteria) and oil-degrading microorganisms (yeast, fungi, bacteria). Results are presented Table 3.8.

The deep-sea sediments represent a significant long-term sink for microbiological activity with around 75% of the integrated bacterial biomass from surface waters to deep-sea sediments found in the top 10cm of sediment (Lochte, 1992). The bacteria in oceanic and coastal sediments constitute around 76% (ca. 3.8×10^{30}) of all global benthic bacteria with around 13% being found in the upper 10cm of deep-sea sediments (Deming, 1992; Whitman, 1998).

The deep-sea benthic boundary layer and sediment–water interface is generally characterised by low temperatures and a limited food supply from detritus or particulate organic matter sinking down from the richer productive surface layer, often in a seasonal cycle. The respiration in the sediment-water interface is dominated by bacteria (Pfannkuche, 1993), which play a major role in the decomposition of organic material on the deep-sea bed, making up at least 13–30% of the total biological consumption of organic carbon (Rowe and Deming 1985). Bacteria, which contribute the greatest biomass, will be influenced by many physical and biological parameters found at the sediments and seawater interface.

Studies into microbial communities in oil-contaminated seawaters and sediments have identified two proteobacteria which are known to degrade alkanes and aromatic hydrocarbons: *Alcanivorax* and *Cycloclasticus*, respectively (Harayama *et al*., 2004).

Aerobic heterotrophic microorganisms (yeast, fungi, bacteria) were present in high quantities ranging from 25,000NPP.g^{-1} at two stations (B2913B_ENV_27 and 48) to over 11 x 10^{6}NPP.g^{-1} at 25 stations. Hydrocarbon degrading microorganisms (yeast, fungi, bacteria) were recorded in quantities under the LOD of 50NPP.g^{-1} at six stations up to over 11,000NPP.g^{-1} at six stations (Table 3.8). **The results reflect the natural temporal differences in microorganism numbers across Block 2913B.**

Table 3.8 Sediment Microbiology (NPP/g)

Station	Depth (m)	Aerobic Heterotrophic Microorganisms	Hydrocarbon Degrading Microorganisms
0m Venus-2 SPWL	2,900	>11,000,000	25,000
250m_SE	2,900	7,000,000	1,300
500m_SE	2,900	2,500,000	130
1000m_SE	2,900	1,300,000	60
2000m_SE	2,900	7,000,000	250
250m_NW	2,900	7,000,000	60
500m_NW	2,900	2,500,000	600
1000m_NW	2,900	>11000,000	<50
1500m_NW	2,900	>11000,000	<50
2000m_NW	2,900	>11000,000	<50
3000m_NW	2,900	>11,000,000	2,500
250m_NE	2,900	>11,000,000	60
500m_NE	2,900	>11,000,000	<50
1000m_NE	2,900	7,000,000	250
2000m_NE	2,900	>11,000,000	600
10000m_NE	2,900	>11,000,000	60
250m_SW	2,900	>11,000,000	13,000
500m_SW	2,900	>11,000,000	2,500
1000m_SW	2,900	>11,000,000	1,300
2000m_SW	2,900	>11,000,000	600
B2913B_ENV_01	2,964	2,500,000	250
B2913B_ENV_02	3,025	2,500,000	250
B2913B_ENV_03	2,916	>11,000,000	60
B2913B_ENV_04	3,051	>11,000,000	600
B2913B_ENV_05	3,028	>11,000,000	250
B2913B_ENV_06	3,002	>11,000,000	2500
B2913B_ENV_07	2,978	>11,000,000	250
B2913B_ENV_08	3,032	>11,000,000	250
B2913B_ENV_09	3,019	7,000,000	600
B2913B_ENV_10	3,003	600,000	>11,000
B2913B_ENV_11	2,977	7,000,000	1,300
B2913B_ENV_12	3,025	2,500,000	250
B2913B_ENV_13	2,976	>11,000,000	<50
B2913B_ENV_14	2,954	>11,000,000	250
B2913B_ENV_15	3,013	7,000,000	250
B2913B_ENV_16	2,903	2,500,000	250
B2913B_ENV_17	2,879	2,500,000	<50
B2913B_ENV_19	2,943	250,000	250
B2913B_ENV_20	2,810	7,000,000	250
B2913B_ENV_21	2,625	600,000	250
B2913B_ENV_23	2,996	7,000,000	250
B2913B_ENV_24	2,849	7,000,000	600
B2913B_ENV_25	2,593	250,000	2,500
B2913B_ENV_27	2,857	2,5000	250
B2913B_ENV_28	2,737	>11,000,000	600

Station	Depth (m)	Aerobic Heterotrophic Microorganisms	Hydrocarbon Degrading Microorganisms
B2913B_ENV_29	3,117	2,500,000	2,500
B2913B_ENV_30	2,793	>11,000,000	7,000
B2913B_ENV_31	3,164	>11,000,000	250
B2913B_ENV_33	2,953	2,500,000	2,500
B2913B_ENV_34	2,743	600,000	250
B2913B_ENV_35	2,661	>11,000,000	7,000
B2913B_ENV_36	2,878	2,500,000	250
B2913B_ENV_38	2,790	7,000,000	2,500
B2913B_ENV_39	2,538	2,500,000	250
B2913B_ENV_40	2,613	2,500,000	>11,000
B2913B_ENV_41	2,873	2,500,000	250
B2913B_ENV_43	2,715	600,000	250
B2913B_ENV_44	2,957	2,500,000	1,300
B2913B_ENV_45	2,830	2,500,000	7,000
B2913B_ENV_46	2,735	2,500,000	200
B2913B_ENV_47	3,012	2,500,000	>11,000
B2913B_ENV_48	2,963	2,5000	>11,000
B2913B_ENV_49	2,846	250,000	200
B2913B_ENV_50	3,116	7,000,000	>11,000
B2913B_ENV_51	3,032	2,500,000	>11,000
B2913B_ENV_52	2,960	2,500,000	2,500

3.7.2 *Macrofauna Analysis*

Macrofaunal analysis was conducted on 66 single replicate samples obtained around the Venus-2 PWL and within the wider Block 2913B survey area. As discussed previously, the sediment composition across the survey area was largely homogeneous with a dominance of fines, moderate proportions of sand and negligible gravel.

For the purpose of this assessment epifaunal species have been separated into **two categories: solitary epifauna and colonial epifauna**. Solitary epifauna include specimens that, although epifaunal in nature, are recorded in low counts. As such solitary epifauna are often considered to be less ecologically important components of the marine benthos; **for this survey they consisted of solitary Cnidaria individuals**. Colonial epifauna are inclusive of encrusting epifauna which are generally recorded in high counts or as presence/absence. **For this survey they include colonial Bryozoa, Cnidaria and Porifera.** Within these analyses colonial epifauna have been omitted as they are often not possible to enumerate and therefore only assessed on a presence/absence basis; however, due to the importance of colonial epifauna at stations containing coarse sediments, the richness of this component of the macrobenthos is discussed separately in Section 3.7.2.3. It should be noted that the foraminifera, usually described as solitary infauna, were included as colonial epifauna as the aggregations were difficult to enumerate and were presented as presence and absence data.

Subsequent macrofaunal taxonomy of all recovered fauna identified a **total of 2,534 individuals (infauna and solitary epifauna) from the 66 samples analysed**. Faunal data for each sample are listed in Appendix XII – Macrofauna and Biomass Species Lists, whilst univariate analyses are summarised by station in Table 3.9.

Of the **198 taxa recorded 191 were infaunal**, consisting of **88 annelid species** accounting for 54.1% of the total individuals. The **arthropods were represented by 48 species** (10.4% of the total individuals), **molluscs by 36 species** (31.3% of the total individuals) and **echinoderms by ten species** (1.4% of the total individuals). **All other groups (including Cnidaria, Nemertea, Nematoda and Chordata) were represented by six species,** accounting for 2.6% of the total individuals. **Solitary epifauna was represented by three species of Cnidaria** which represented 0.1% of the total individuals.

With the exception of species that have been intentionally grouped into higher taxonomic levels (e.g. Nematoda, Nemertea etc.), **the majority of adult specimens were identified to genus level or lower (~85%).** A total of **nine juvenile species** were recorded within the current survey area, of which Echinodermata were the most abundant (27 individuals). It was not possible to ascribe these specimens to a particular species at this stage in their lifecycle, and as such have been usually grouped to order level. Juveniles are often excluded from community analyses due to their high mortality prior to reaching maturity and difficulties in distinguishing species of the same genus. Consequently, they tend to induce a recruitment spike at certain times of the year due to rapid settlement and colonisation but are essentially an ephemeral part of the population masking the underlying trends within the mature adults. These specimens have therefore been excluded from univariate and multivariate analyses but have been listed separately in Appendix XII – Macrofauna and Biomass Species Lists.

Nematoda have been included in macrofauna analysis, as they can often serve as indicators of organic enrichment. However, as Nematoda vary in size, the estimates of its abundance may not be entirely accurate, with some likely to have passed through the 500µm sieve during macrofauna sample processing.

Example images of taxa found during the survey are provided in Figure 3.23.

Figure 3.23 Macrofauna Photoplate

3.7.2.1 *Univariate Analyses*

The primary and univariate parameters for all stations are listed in Table 3.9 and represented in Figure 3.24 to Figure 3.26, for abundance, species richness and Simpson's Diversity. **A single macrofauna replicate (0.1m^2) was analysed for each of the 66 sampling stations.**

Numbers of individuals were variable across the survey area and ranged between seven individuals per 0.1m^2 at stations B2913B_ENV_23 and B2913B_ENV_36 to 79 individuals per 0.1m^2 at station 1500m_NW, with this variation reflected in the moderate to high coefficient of variation (33.7%) (mean 38±13SD). **Number of species was also variable** and ranged from five species at station B2913B_ENV_23 to 39 species at station 1500m_NW (mean 19±6SD). Two stations (B2913B_ENV_23 and B2913B_ENV_36) displayed lower numbers of species and individuals relative to the rest of the sampling stations which may relate to the slightly lower grab sample retention at these two sites (Appendix IX – Deck Log Observations).

Margalef's Index, a measure of species richness, showed a similar pattern to the number of species and individuals, with station B2913B_ENV_23 (2.06) displaying the lowest species richness and station 1500m_NW the highest (8.70). **According to the thresholds outlined in Dauvin *et al*. (2012), the mean Shannon-Wiener Diversity Index values observed across the survey area indicate 'good' diversity** (mean: 3.75±0.53SD). The lowest diversity was still classed as 'moderate' diversity and observed at station B2913B_ENV_23 (2.13), while the highest was recorded at station 1500m_NW (4.88) indicating 'high' diversity. Pielou's Equitability followed a different pattern, with station B2913B_ENV_13 having the lowest evenness (0.777) and the highest at station B2913B_ENV_23 (0.976). **Simpson's Diversity was high and similar** across sampling stations as evidenced by a low coefficient of variation (5.3%) (mean 0.919±0.042).

No obvious spatial patterns for the aforementioned indices were apparent in Block 2913B as emphasised in Figure 3.24 to Figure 3.26.

Table 3.9 Univariate Faunal Parameters by Station (per 0.1m²)

Sample	Depth (m)	Number of Species per Sample (S)	Number of Individuals	Richness (Margalef)	Evenness (Pielou's Evenness)	Simpson's Diversity (1-Lambda')	Shannon-Wiener Diversity
0m Venus-2 SPWL	2,900	15	40	3.80	0.833	0.876	3.25
250m_SE	2,900	20	39	5.19	0.909	0.938	3.93
500m_SE	2,900	11	27	3.03	0.852	0.863	2.95
1000m_SE	2,900	24	54	5.77	0.894	0.935	4.10
2000m_SE	2,900	30	68	6.87	0.886	0.945	4.35
250m_NW	2,900	22	46	5.49	0.882	0.922	3.94
500m_NW	2,900	20	44	5.02	0.919	0.941	3.97
1000m_NW	2,900	15	38	3.85	0.822	0.862	3.21
1500m_NW	2,900	39	79	8.70	0.924	0.966	4.88
2000m_NW	2,900	27	49	6.68	0.935	0.963	4.44
3000m_NW	2,900	28	51	6.87	0.939	0.966	4.51
250m_NE	2,900	25	46	6.27	0.851	0.905	3.95
500m_NE	2,900	25	48	6.20	0.918	0.953	4.26
1000m_NE	2,900	22	49	5.40	0.871	0.917	3.88
2000m_NE	2,900	15	25	4.35	0.882	0.897	3.44
10000m_NE	2,900	22	52	5.32	0.834	0.887	3.72
250m_SW	2,900	23	65	5.27	0.887	0.930	4.01
500m_SW	2,900	16	30	4.41	0.907	0.924	3.63
1000m_SW	2,900	21	48	5.17	0.875	0.919	3.84
2000m_SW	2,900	20	44	5.02	0.882	0.917	3.81
B2913B_ENV_01	2,964	18	36	4.74	0.874	0.911	3.65
B2913B_ENV_02	3,025	19	41	4.85	0.848	0.893	3.60
B2913B_ENV_03	2,916	14	20	4.34	0.930	0.937	3.54
B2913B_ENV_04	3,051	18	38	4.67	0.911	0.930	3.80
B2913B_ENV_05	3,028	19	34	5.10	0.922	0.945	3.92
B2913B_ENV_06	3,002	19	33	5.15	0.914	0.938	3.88
B2913B_ENV_07	2,978	16	26	4.60	0.922	0.939	3.69
B2913B_ENV_08	3,032	20	36	5.30	0.897	0.925	3.88
B2913B_ENV_09	3,019	12	22	3.56	0.895	0.900	3.21
B2913B_ENV_10	3,003	28	43	7.18	0.934	0.965	4.49
B2913B_ENV_11	2,977	23	38	6.05	0.921	0.950	4.17
B2913B_ENV_12	3,025	30	58	7.14	0.913	0.956	4.48
B2913B_ENV_13	2,976	13	31	3.49	0.777	0.804	2.88
B2913B_ENV_14	2,954	14	27	3.94	0.856	0.883	3.26
B2913B_ENV_15	3,013	24	43	6.12	0.929	0.957	4.26
B2913B_ENV_16	2,903	16	26	4.60	0.944	0.951	3.78
B2913B_ENV_17	2,879	21	44	5.29	0.929	0.947	4.08
B2913B_ENV_19	2,943	23	39	6.01	0.936	0.958	4.23
B2913B_ENV_20	2,810	25	50	6.14	0.904	0.947	4.20
B2913B_ENV_21	2,625	13	38	3.30	0.842	0.865	3.11
B2913B_ENV_23	2,996	5	7	2.06	0.917	0.857	2.13
B2913B_ENV_24	2,849	20	32	5.48	0.941	0.958	4.07

Sample	Depth (m)	Number of Species per Sample (S)	Number of Individuals	Richness (Margalef)	Evenness (Pielou's Evenness)	Simpson's Diversity (1-Lambda')	Shannon-Wiener Diversity
B2913B_ENV_25	2,593	19	38	4.95	0.904	0.928	3.84
B2913B_ENV_27	2,857	19	30	5.29	0.933	0.952	3.96
B2913B_ENV_28	2,737	15	21	4.60	0.944	0.952	3.69
B2913B_ENV_29	3,117	18	31	4.95	0.944	0.955	3.94
B2913B_ENV_30	2,793	15	29	4.16	0.908	0.926	3.55
B2913B_ENV_31	3,164	23	55	5.49	0.790	0.869	3.57
B2913B_ENV_33	2,953	15	34	3.97	0.900	0.918	3.52
B2913B_ENV_34	2,743	25	33	6.86	0.972	0.981	4.51
B2913B_ENV_35	2,661	14	38	3.57	0.868	0.895	3.30
B2913B_ENV_36	2,878	6	7	2.57	0.976	0.952	2.52
B2913B_ENV_38	2,790	8	18	2.42	0.879	0.856	2.64
B2913B_ENV_39	2,538	20	30	5.59	0.970	0.972	4.19
B2913B_ENV_40	2,613	24	34	6.52	0.949	0.968	4.35
B2913B_ENV_41	2,873	23	43	5.85	0.903	0.940	4.08
B2913B_ENV_43	2,715	21	34	5.67	0.942	0.959	4.14
B2913B_ENV_44	2,957	11	25	3.11	0.832	0.840	2.88
B2913B_ENV_45	2,830	15	30	4.12	0.814	0.837	3.18
B2913B_ENV_46	2,735	15	23	4.47	0.941	0.949	3.68
B2913B_ENV_47	3,012	20	47	4.94	0.900	0.928	3.89
B2913B_ENV_48	2,963	20	52	4.81	0.796	0.864	3.44
B2913B_ENV_49	2,846	25	46	6.27	0.884	0.931	4.10
B2913B_ENV_50	3,116	24	50	5.88	0.859	0.911	3.94
B2913B_ENV_51	3,032	16	40	4.07	0.828	0.859	3.31
B2913B_ENV_52	2,960	12	42	2.94	0.777	0.800	2.79
Mean		**19**	**38**	**5.01**	**0.893**	**0.919**	**3.75**
Standard Deviation		**6**	**13**	**1.26**	**0.047**	**0.042**	**0.53**
Variance (%)		**30.8**	**33.7**	**25.2**	**5.3**	**4.5**	**14.2**
Minimum		**5**	**7**	**2.06**	**0.777**	**0.800**	**2.13**
Maximum		**39**	**79**	**8.70**	**0.976**	**0.981**	**4.88**

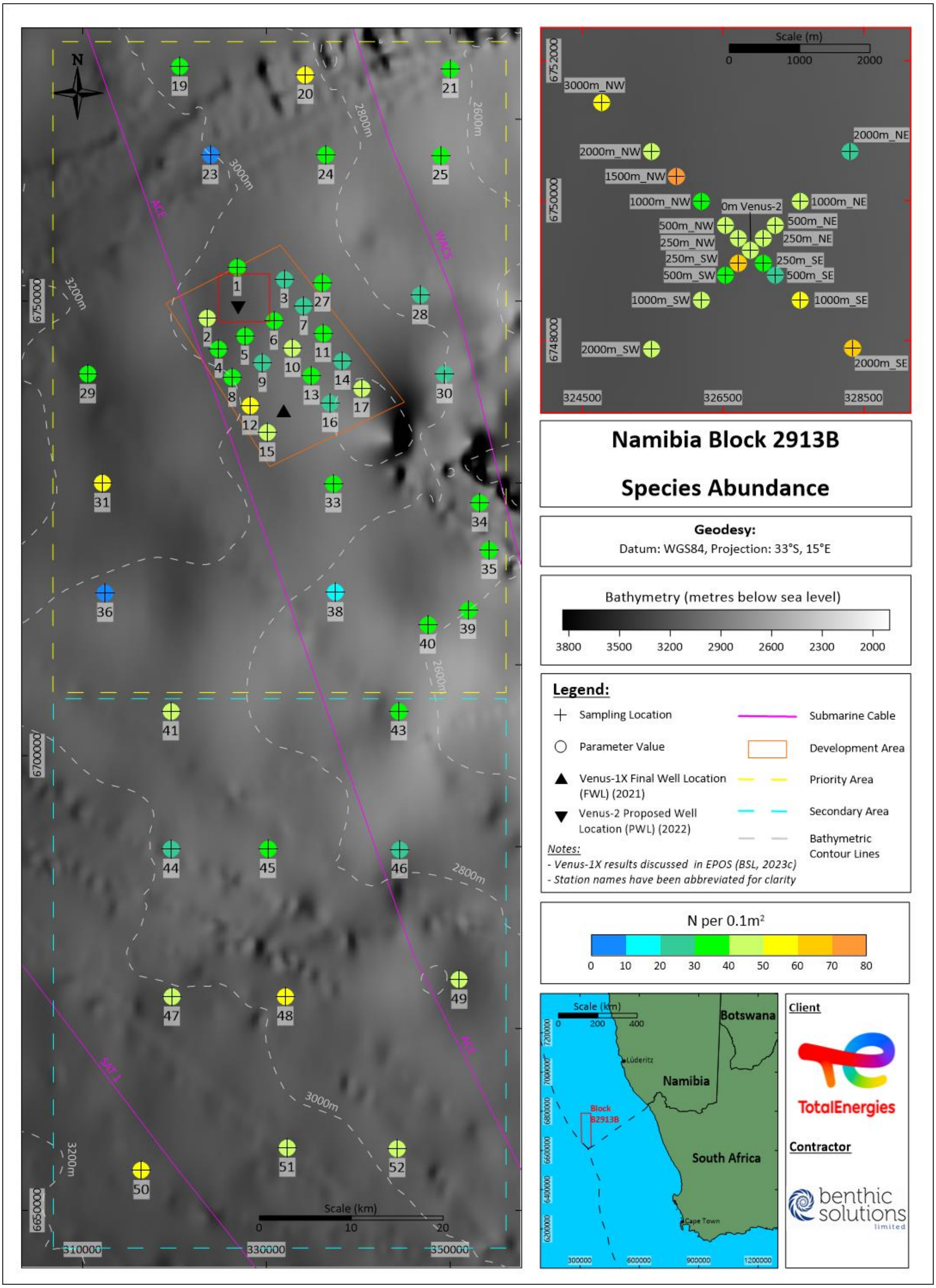


Figure 3.24 Macrofauna - Faunal Abundance (0.1m²)

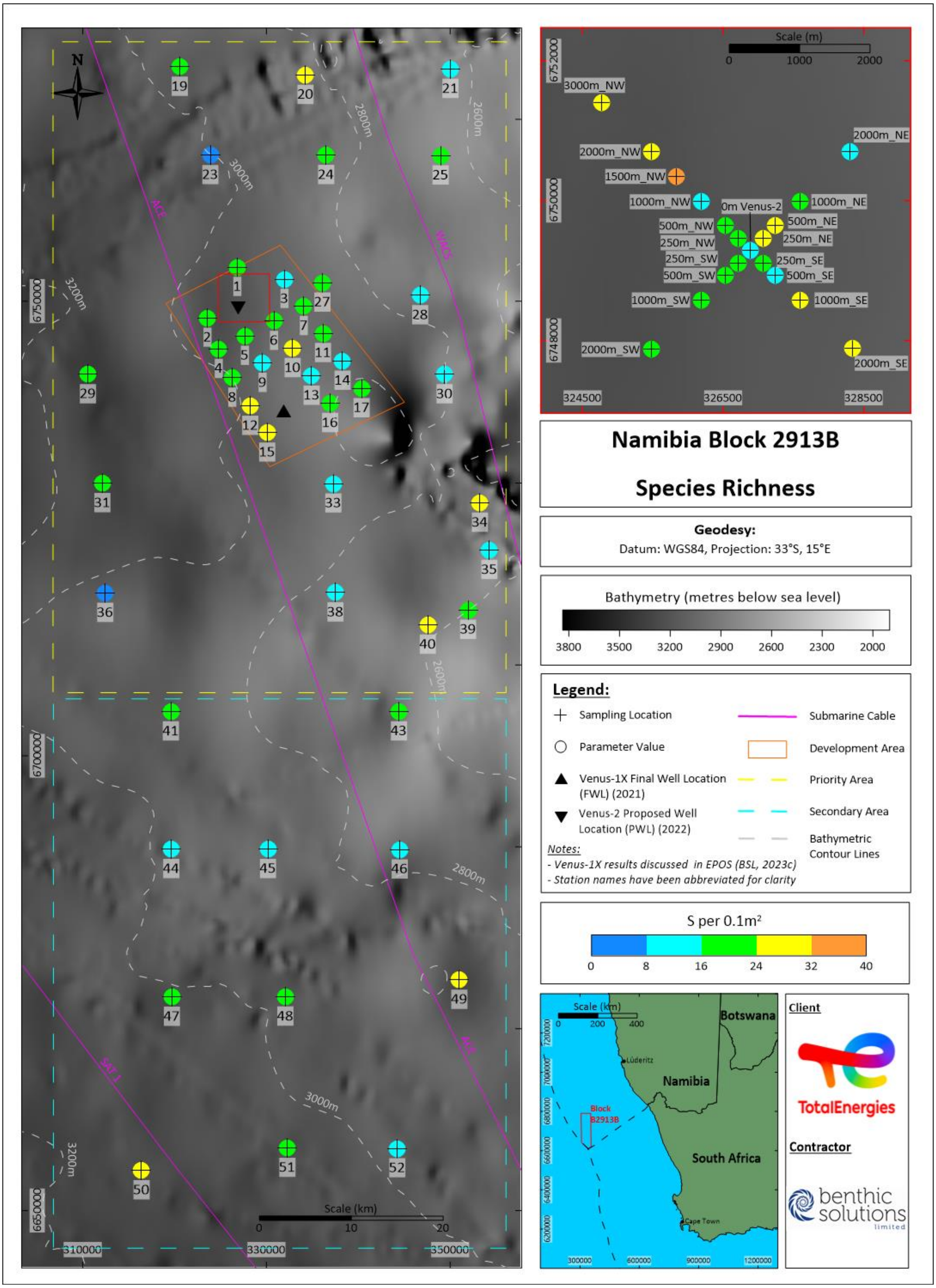


Figure 3.25 Macrofauna – Species Richness (0.1m²)

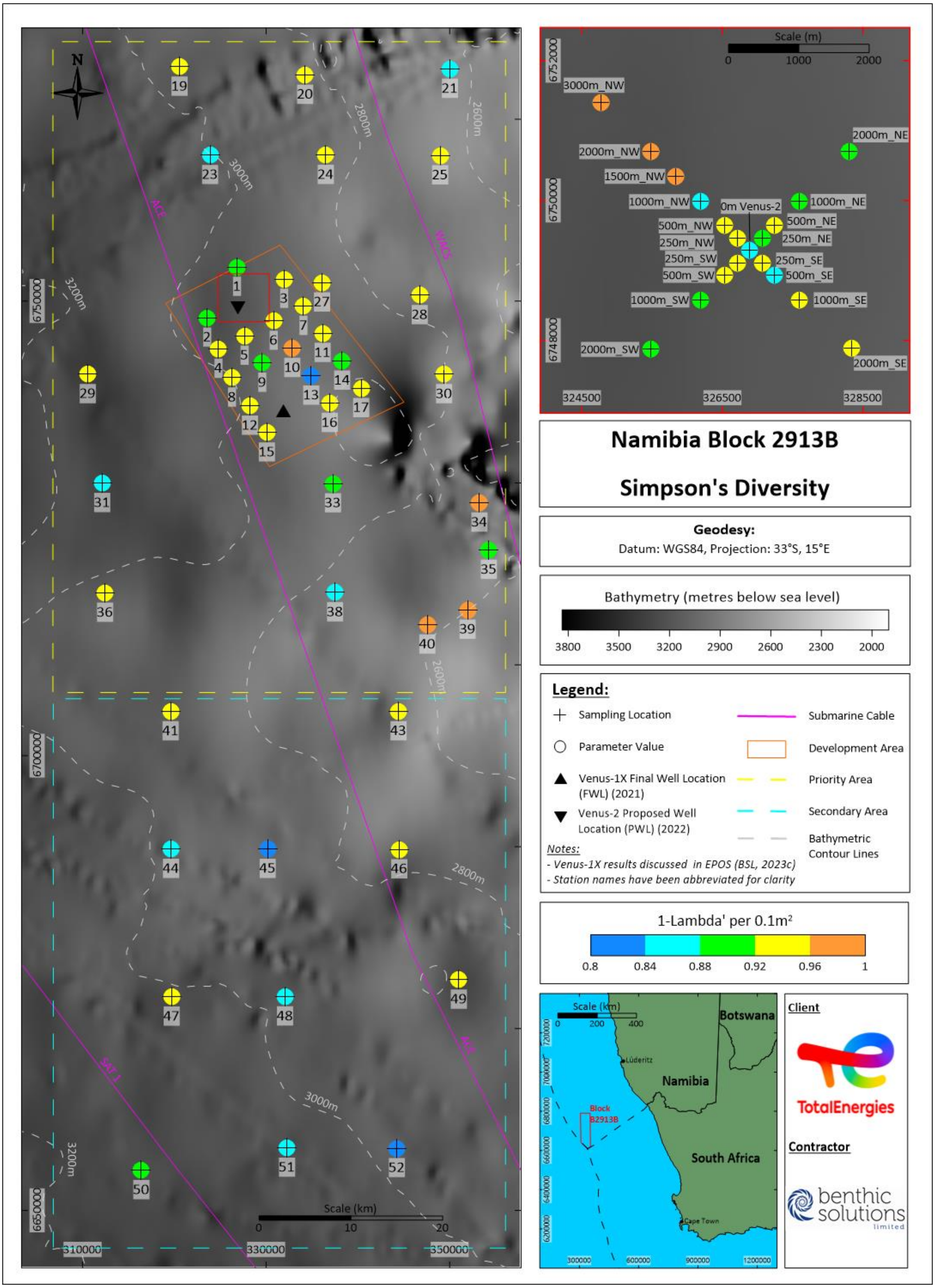


Figure 3.26 Macrofauna – Simpson's Diversity (1-Lambda'; 0.1m^2)

3.7.2.2 *Multivariate Analyses*

To provide a more thorough examination of the macrofaunal community, multivariate analysis was performed upon the station data using Plymouth Routines in Multivariate Ecological Research V7 software (PRIMER; Clarke *et al.,* 2014) to illustrate data trends. Unlike univariate or derived diversity indices, multivariate analyses preserve the identity of the different species by assigning a similarity or dissimilarity between the samples based on differences in the abundances of constituent species. All data were square-root transformed prior to analysis to down-weight the influence of any overriding species dominance between sample similarities/dissimilarities.

3.7.2.2.1 Hierarchical Agglomerative Clustering – Group Average Method

A similarity dendrogram was created using hierarchical agglomerative clustering (CLUSTER) and is presented for all stations in Figure 3.27. **SIMPROF analysis highlighted the presence of nine significantly different (*p*<0.05) clusters** comprising one or more stations (0.1m^2) which were differentiated by black branches on the dendrogram. However, this was **thought to have over differentiated the dataset** and in order to aid interpretation of the data, **a slice was overlaid at a 25% Bray-Curtis** similarity level to highlight key ecological variation evident within the dataset. This slice subsequently **separated the macrofauna into four clusters.** Intra-cluster samples displayed Bray Curtis similarities of between 30% to 41%. Further interpretation of these four clusters is provided in Table 3.10.

Table 3.10 Summary of SIMPROF Station Groupings

SIMPROF Group	Similarity (%)	Stations	Interpretation
'a'	40.3	All other stations	This cluster **comprised 94% of the sampling stations** and is therefore represents the **predominant macrofaunal community** present within Block 2913B. Stations within this cluster displayed the **highest species richness and abundance and moderate to high levels of diversity**. The polychaete, *Spiophanes similis* and the mollusc, *Yoldiella insculpta* were particularly abundant.
'b'	30.3	B2913B_ENV_16 B2913B_ENV_23	**Species richness, abundance and diversity was lower** compared to cluster *'a'* which may relate to the slightly lower grab sample retention at station B2913B_ENV_23, resulting in an appearance of an impoverished community. The cluster also had the presence of the polychaete, *Spiophanes similis*, albeit in a lower abundance compared to cluster '*a*'.
'c'	-	B2913B_ENV_28	This cluster was comprised of a single station B2913B_ENV_28 located to the east of the Venus-2 PWL development area, which displayed **a lower species richness and abundance** compared to cluster '*a*', but higher than the average for cluster '*b*'. **Echinoderms were completely absent from this cluster** which likely contributed to its differentiation to cluster groups *'a', 'b'* and '*c*' where they were present.
'd'	-	B2913B_ENV_36	This cluster consisted exclusively of station B2913B_ENV_36 located in the southwestern extent of the priority area in Block 2913B. This station was **characterised by a higher proportion of sands (43.9%)** compared to the rest of the Block and the **brittlestar, Ophiomyxidae sp., was exclusively found at this station** likely relating to the higher sand content. A **lower species richness and abundance**, similar to station B2913B_ENV_23 in cluster '*b*', was recorded which may relate to the slightly lower grab sample retention at this station resulting in an appearance of an impoverished community.

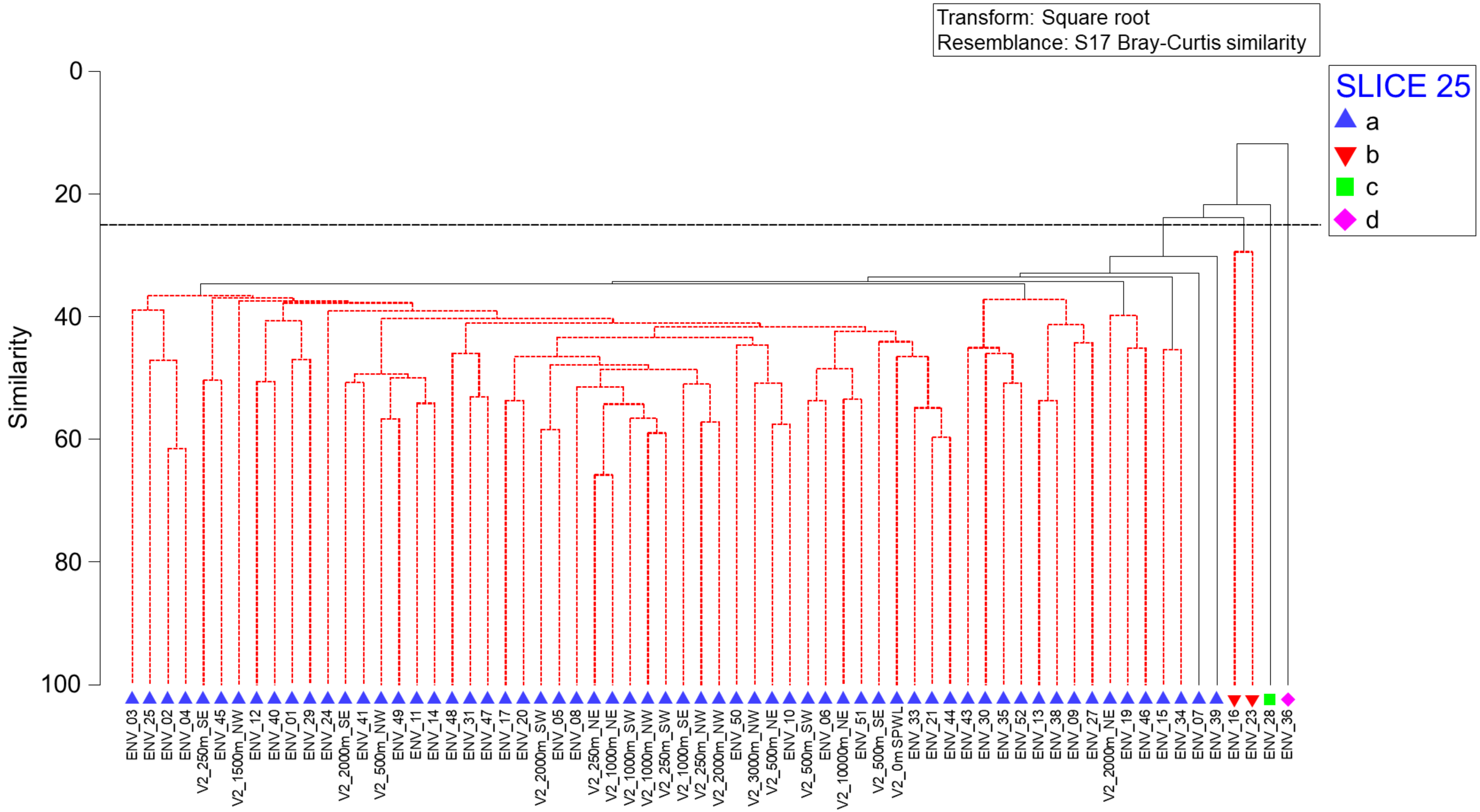


Figure 3.27 Dendrogram of Macrofaunal Stations (0.1m^2) (Station Names Abbreviated for Clarity)

3.7.2.2.2 *Non-metric Multi-dimensional Scaling (MDS) Ordination*

Similarities in the macrofaunal communities recorded across the survey area are presented in Figure 3.28 by station, as a 2-dimensional non-metric multi-dimensional scaling (nMDS) ordination. The nMDS plot reveals an ordination of the data that should be treated with a degree of caution due to the moderately high stress level of 0.28. Despite this, the plotted stations were consistent to the clusters identified in the dendrogram (Figure 3.27), whereby cluster '*a*' is tightly ordinated in the centre of the plot indicative of the main macrofaunal community present. The other three clusters are ordinated around cluster '*a*' showing variation to one and other reflective of the lower species abundance and richness present.

Despite the identification of four separate SIMPROF groups, **all clusters were considered to reflect typical background communities for deep-sea sediments, with differences thought to reflect natural patchiness in the distribution of benthic faunal communities or differences in grab retention, as opposed to the influence of notable physical or chemical gradients.** The geographical distribution of multivariate clusters is provided in Figure 3.29. From this, it is evident that **there are no obvious spatial patterns that can explain the differences in macrofaunal communities highlighted by the multivariate analysis.**

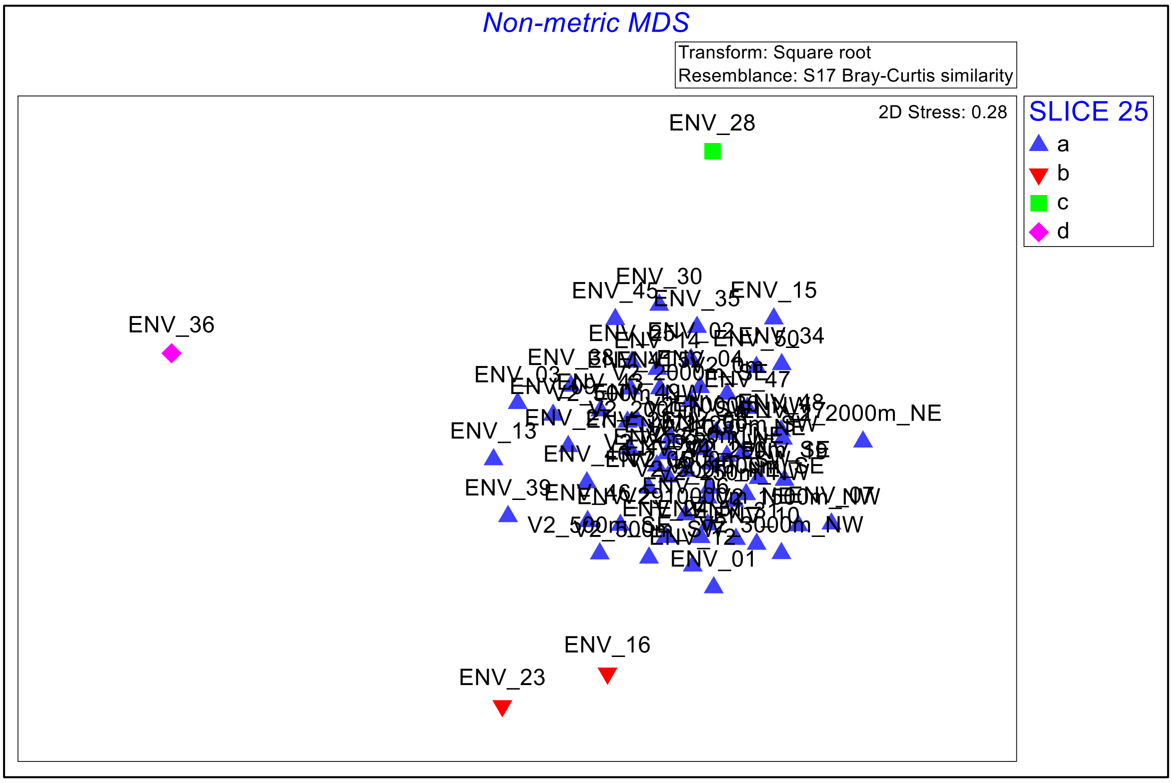


Figure 3.28 nMDS Ordination Plot of Macrofaunal Stations (0.1m²)

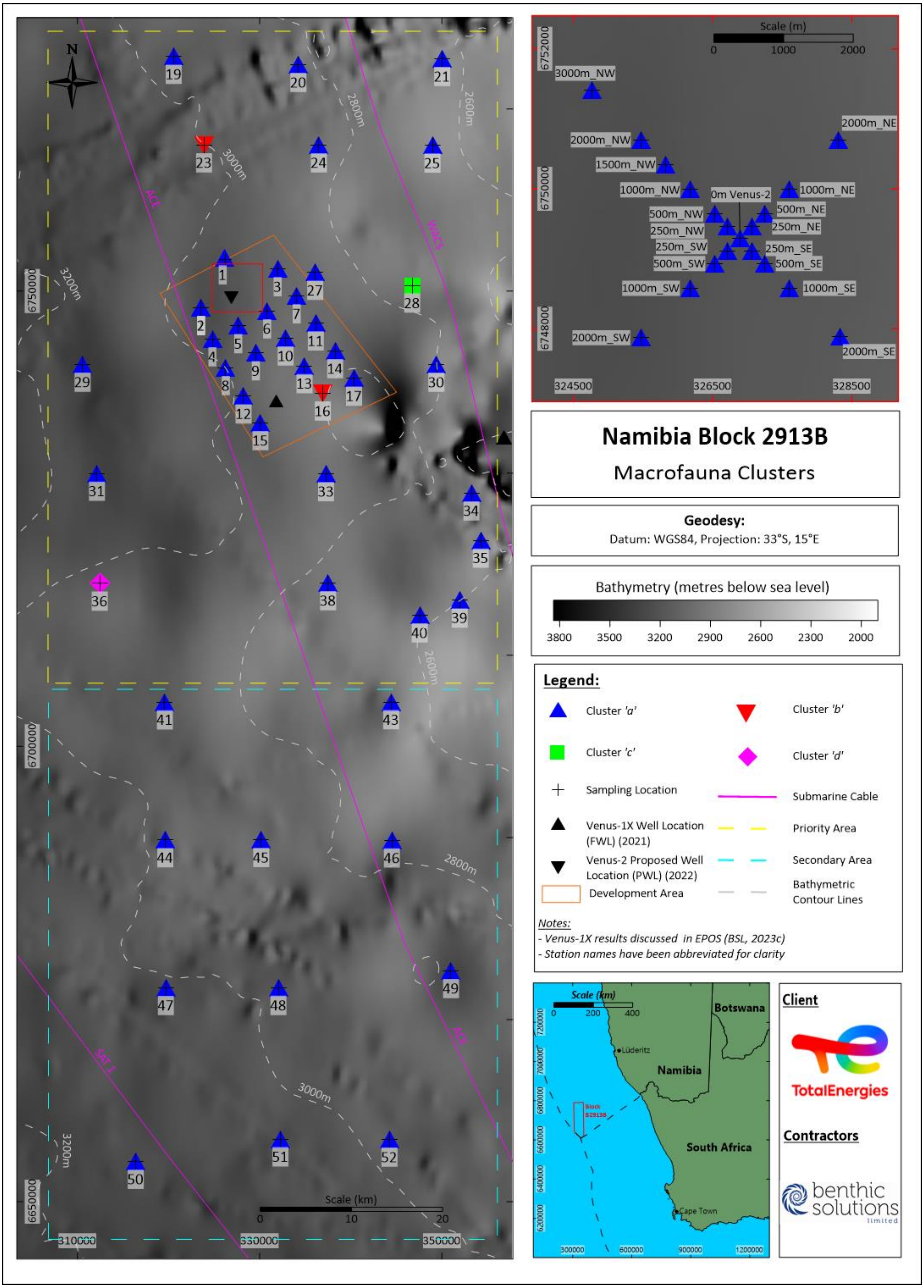


Figure 3.29 Multivariate Macrofauna Cluster Distribution Over Bathymetry

3.7.2.2.3 Correlation with Environmental Variables

To assess whether the observed differences in community composition were a result of any relationships between the biological community and environmental parameters, such as sediment composition or the concentrations of metals or hydrocarbons, a series of RELATE tests (correlation tests) were performed (Table 3.11).

Table 3.11 RELATE Results for Environmental Variables

Relate Tests	Water Depth	Sediment Phi	Nutrients	Hydrocarbons	Heavy Metals
	p = 0.02 ϱ = 0.149	*p* = >0.05 ϱ = 0.056	*p* = >0.05 ϱ = 0.056	*p* = >0.05 ϱ = -0.112	*p* = 0.04 ϱ = 0.128

Light grey cell = 0.05 significance

The **RELATE test between the macrofauna and heavy metal similarity matrices were significant** (ϱ=0.128, $p<0.05$), indicating a significant correlation between the datasets. In order to visualise this relationship, a PCA was carried out on the heavy metals, which were overlain with the clusters identified from the macrofauna dataset (Figure 3.30). The PCA plot **indicated that the varying concentrations of iron and aluminium were principally responsible for the differences in the macrofaunal community** across the Block 2913B survey area. **Both metals are abundant elements in marine sedimentary systems and their varying concentrations within the survey area likely to reflect natural associations due to the speciation properties of the metals as opposed to a shared point source of contamination**.

A significant correlation between **water depth** and macrofauna was also identified by the RELATE test (ϱ=0.149, $p<0.05$). However, given stations in a similar water depth, for example B2913B_ENV_28 (2,737m) and B2913B_30 (2,793m) was assigned to different macrofaunal clusters, '*c*' and '*a*' respectively, the result suggests that the macrofaunal hierarchical structuring is less influenced by the water depth across the Block. It is important to note that a number of physical and chemical variables will naturally co-correlate with depth making any interpretation of this correlation difficult and of limited use.

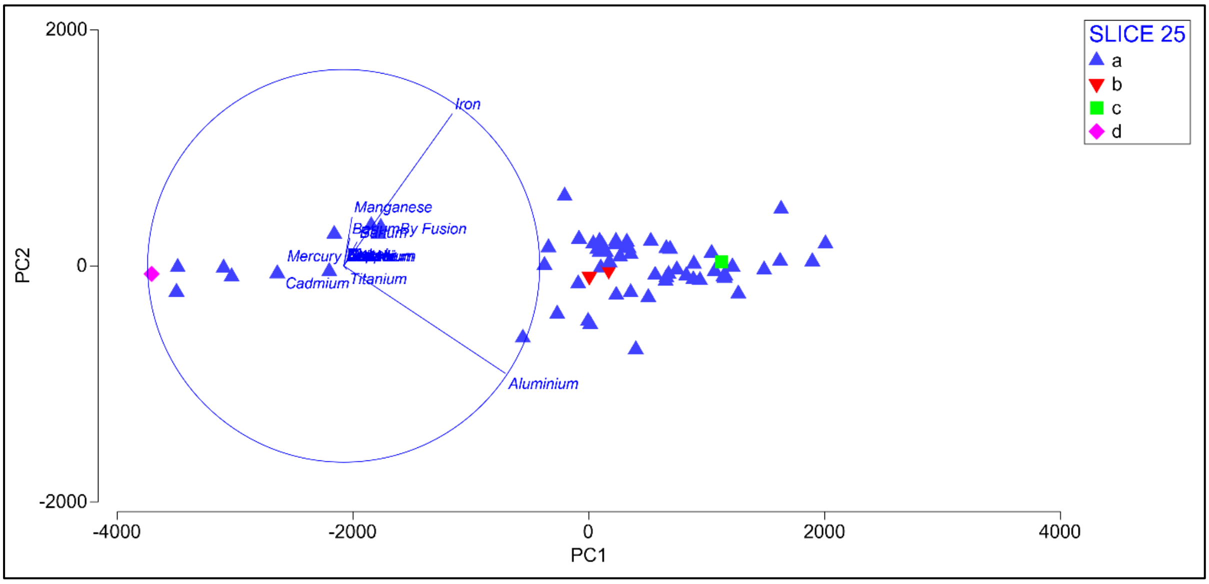


Figure 3.30 Principal Component Analysis of Heavy Metals with Macrofaunal Clusters

3.7.2.2.4 Inter-cluster Variation in Community Composition

To investigate the differing macrofaunal communities described by the identified multivariate clusters, a plot of species abundance versus number of species per sample was created (Figure 3.31).

From this, it is clear that the relationship between the two variables was in part responsible for the separation of clusters, with cluster '*d*' plotted in the bottom left displaying low species richness and abundance, while clusters '*a*' and '*c*' grouped centrally. However, cluster '*b*' stations were split, with B2913B_ENV_23 displaying low species abundance and richness, while station B2913B_ENV_16 displayed a similar number of species and number of individuals to those of the predominant cluster '*a*'.

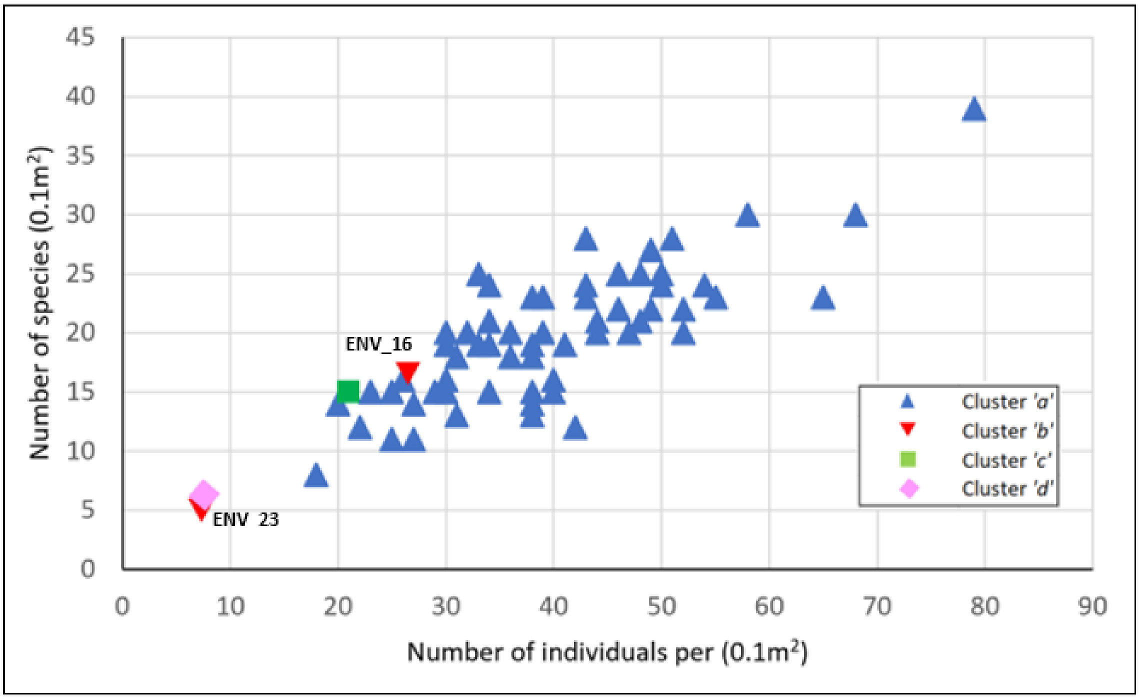


Figure 3.31 Number of Species vs. Number of Individuals per Station (0.1m^2)

Differences in the relative phyletic composition of macrofaunal communities were explored by plotting the average percentage contribution of major phyla to the overall number of individuals and number of species within each cluster (Figure 3.32 and Figure 3.33).

The results highlighted the general similarity of the macrofaunal communities, with a dominance of Annelida which contributed >53% at all clusters, **which is expected for deep-sea soft sediments** (Bonifácio et al., 2021, Herring, 2010, Rex and Etter, 2010). **Cluster '*a*' (31.7%) and '*c*' (23.8%) had the highest proportions of molluscs** with lower abundances in clusters '*b*' (12.1%) and '*d*' (14.3%). There was a **small variation in the abundance of Crustacea** across Block 2913B, with the highest proportions recorded in cluster '*c*' and '*d*' (14.3% each). **The absence of echinoderms in cluster '*c*' contributed to its differentiation from other clusters** where echinoderms abundance ranged between 1.3% and 14.3% of the community. **Cluster '*a*' likely separated from all other clusters due to the contribution of "other" species (Cnidaria, Nemertea, Nematoda, and Chordata) which were absent in all other clusters. Colonial epifauna was present only in clusters '*b*'** (3.0%) and '*c*' (4.8%).

In terms of the contribution of phyla to numbers of species, the clusters showed a similar pattern to the number of individuals, **suggesting that the differing species abundances and richness contributions of phyla were both important for the separation of the clusters. Annelida was the dominant phylum in all four clusters** and accounted for 44.5%, 61.1%, 60.0% and 50.0% at each respective cluster. Cluster '*a*' contained seven species of colonial epifauna which was absent in all other clusters.

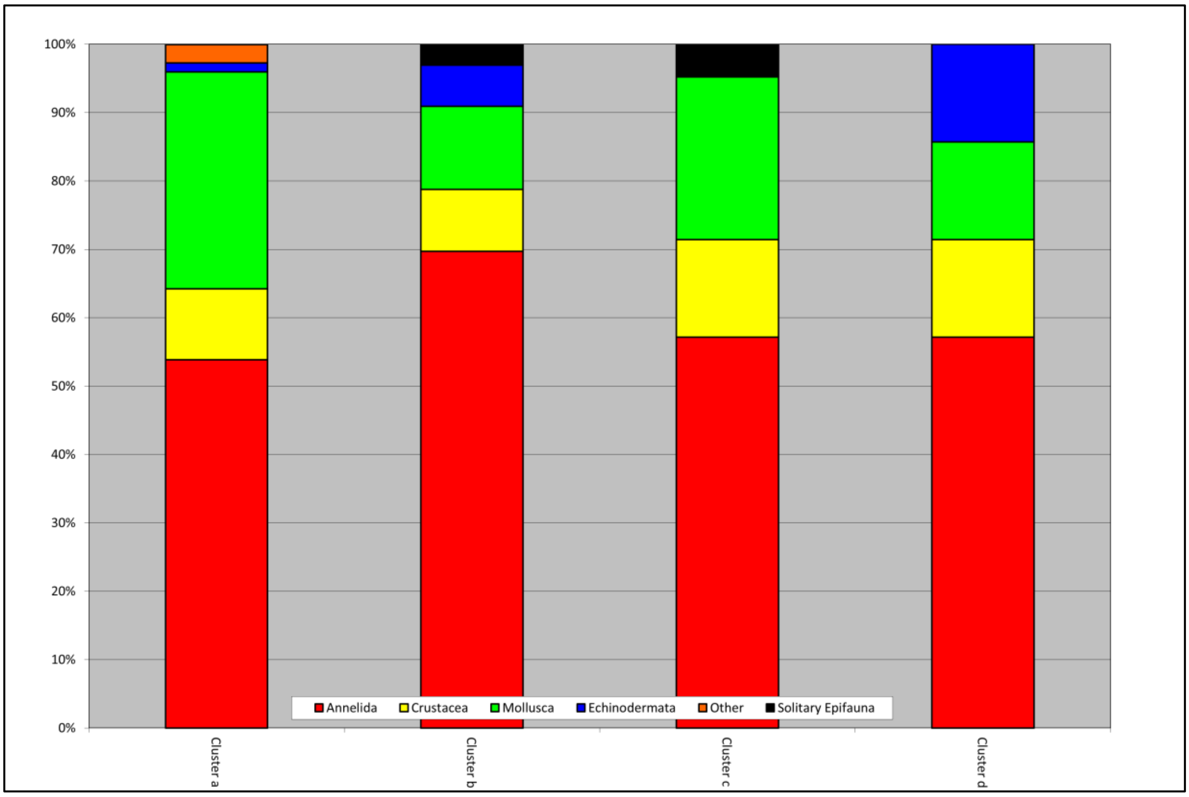


Figure 3.32 Average Contribution of Each Phylum to Total Faunal Abundance for Each Cluster

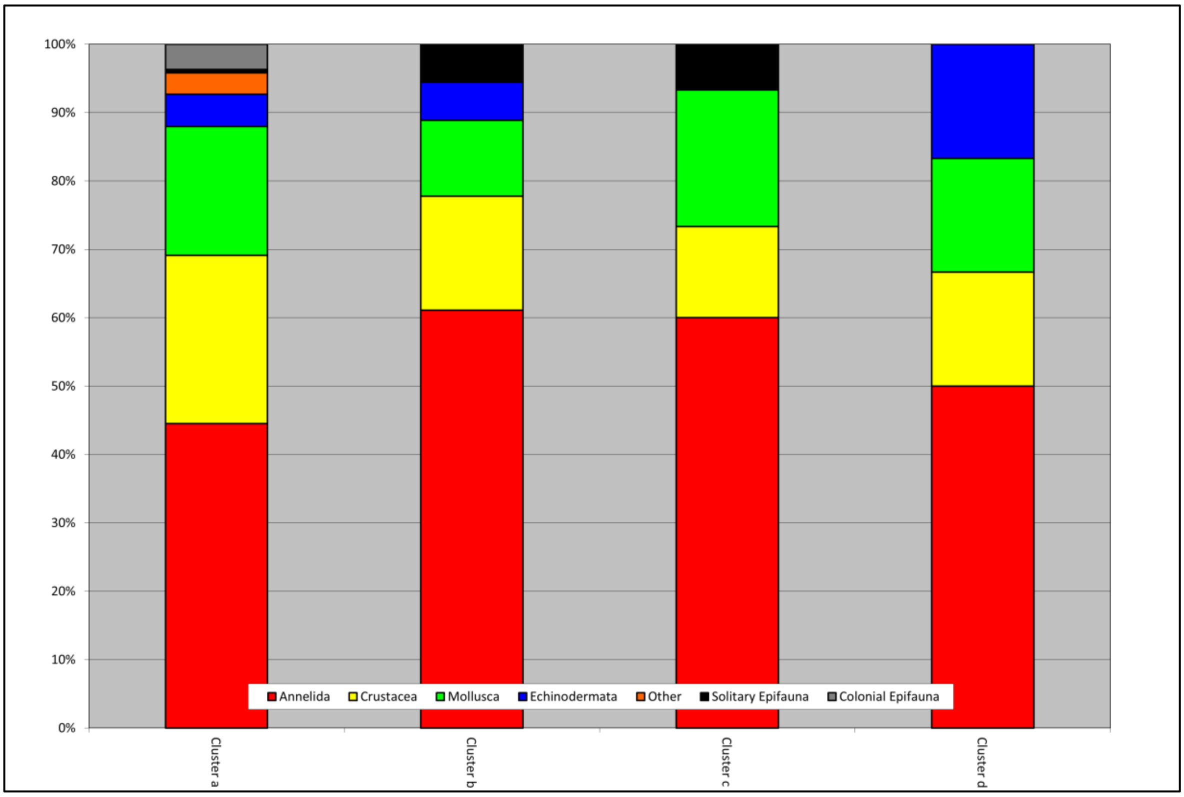


Figure 3.33 Average Contribution of Each Phylum to Total Number of Species for Each Cluster

Table 3.12 provides further information on the ecological parameters driving the separation of macrofaunal clusters across the Venus-2 and wider Block 2913B survey areas. The contribution of different ecological groups (EG) was calculated using the **Marine Biotic Index (AMBI)** developed by Borja *et al*. (2000) and is displayed for each of the identified clusters in Figure 3.34.

This revealed that **cluster '*a*'** was **dominated by sensitive species (EG I) and indifferent species (EG II)** which together accounted for 54.9% of taxa, with **first (EG V) and second (EG IV) order opportunistic species, which are used as pollution indicator in AMBI, making up the lowest proportion of species in cluster '*a*' (11.4%).** Cluster '*b*' had a lower proportion of sensitive (EG I) and indifferent species (EG II) (25%) and a higher proportion of disturbance tolerant species (EG III) (45.9%) and pollution indicator species (EG IV and V; 29.2%). Cluster '*c*' had a similar contribution of EG I and EG II species to cluster '*a*' but had an absence of EG V species. Cluster '*d*', comprised of the denuded station B2913B_ENV_36 community, displayed a comparable proportion of sensitive species to the other clusters (33.3%) with the remainder comprised of tolerant species (EG III); further supporting the likelihood that the low number of species and abundance at this sampling station was due to lower grab retention as opposed to localised sources of contamination.

Furthermore, the **AMBI Biotic Coefficient Index (BCI)** was developed to determine the impacts and the quality status in soft-bottom marine benthic communities but is now broadly used along European coastlines to aid in determining the level of pollution within an environment (WFD-UKTAG, 2014). The system operates between 0 and 7, with lower numbers corresponding to higher or good ecological status (WFD-UKTAG, 2014). Despite the presence of pollution indicating species and opportunistic feeders across clusters '*a*', '*b*' and '*c*', **all clusters scored <3.3 indicative of at minimum "Good" ecological status. A "Good" ecological status indicates slightly reduced species richness and diversity where most of the sensitive taxa of the type-specific communities are present** (WFD-UKTAG, 2014). Subsequently, **the conformance of the ecological status across all clusters indicates that the differentiation of the macrofaunal clusters is unlikely to be due to localised areas of pollution and instead is likely to reflect differences in grab retention or natural spatial variation in the distribution of benthic macrofauna.** It should be noted that the AMBI biotic Coefficient is designed for shallow water European coastal sediments and may not be applicable for the deep water sediments of offshore Namibia, as 3-57% of the collected species per station could not be assigned an AMBI ecological group, therefore, the current interpretation of the AMBI scores for each cluster should be treated with a degree of scepticism.

A comparison of the infaunal versus epifaunal richness within each cluster is provided in Table 3.12. **All clusters were dominated by infaunal taxa,** which was unsurprising given the limited availability of hard substrate for epifaunal colonisation. The dominance of infauna was also evidenced by high infauna/epifauna ratios across all clusters.

Table 3.12 Overview of AMBI Ecological Groups per SIMPROF Clusters

SIMPROF Cluster	EG I Contribution (%)		EGI II Contribution (%)		EG III Contribution (%)		EG IV Contribution (%)		EG V Contribution (%)		AMBI BCI Score		Infauna Richness (%)		Epifauna Richness (%)		Infauna / Epifauna Ratio	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
a	24	69.4	0	28	13	60	0	12	0	25	1.0 (H)	3.1 (G)	87.5	100	0	12.5	0	27
b	16.7	8.3	0	8.3	41.7	16.7	0	16.7	16.7	25	3.0 (G)	3.1 (G)	93.8	100	0	6.3	0	15
c	-	35.7	-	14.3	-	21.4	-	28.6	-	0	-	2.1 (G)	-	93.3	-	6.7	-	14
d	-	33.3	-	0	-	66.7	-	0	-	0	-	2.0 (G)	-	100	-	0	-	0

Notes:
'-' = Clusters 'c' and 'd' contain a single station so only a max value is
AMBI BCI:
0.0 ≤ 1.2 = High status
1.2 ≤ 3.3 = Good status
3.3 ≤ 4.3 = Moderate status
4.3 ≤ 5.5 = Poor status
5.5 ≤ 7.0 = Bad status

AMBI Group	Feeding Method
Group I	Disturbance sensitive species
Group II	Disturbance indifferent species
Group III	Disturbance tolerant species
Group IV	Second order opportunistic species
Group V	First order opportunistic taxa

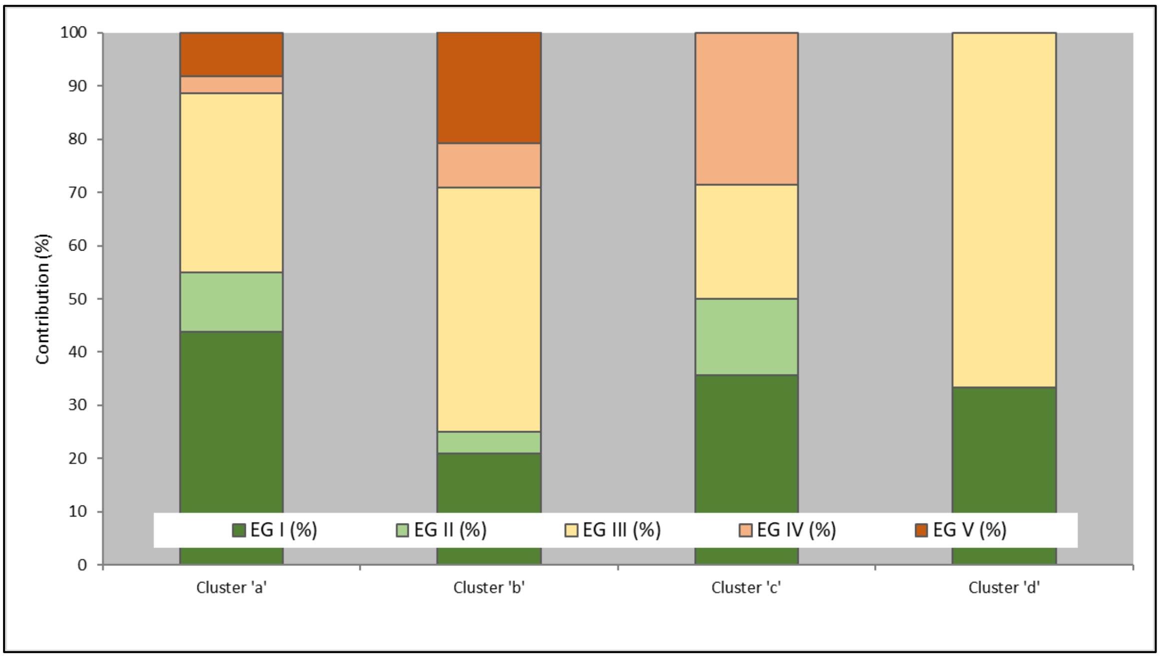


Figure 3.34 AMBI Ecological Groups I-V Average Percentage Contribution

To determine the species driving the differences between the four SIMPROF clusters identified from the data, Table 3.13 presents the top ten characterising species in each cluster together with their percentage contribution to the overall similarity within the cluster whereas, Table 3.14 shows the top five species responsible for differences between clusters.

Clusters *'a'*, *'b'* and *'d'* were characterised by the polychaete *Spiophanes similis* which was most abundant in cluster '*a*' contributing the most to the community (31%) and was contributed less to the communities in cluster '*d*' (29%) and cluster '*b*' (20%). Clusters '*a*' and '*b*' were most similar sharing three species within the top ten characterising taxa; *Mastobranchus* sp., *Spiophanes similis* and *Pristigloma nitens*. Cluster '*c*' was characterised by three species *Aphelochaeta* sp., *Thyasira obsolete*, and *Macrostylis* sp. which together accounted for 43% of the community present.

A review of the 5 taxa most responsible for differentiating the four clusters (Table 3.14), included several taxa previously highlighted as characteristic of several clusters, suggesting that some differentiation was due to variability in the abundance of consistently dominant taxa. The absence of the bivalve *Yoldiella insculpta* and a lower average abundance of the annelid worm *Spiophanes similis* within cluster '*b*' stations were the main contributors to differentiation with the predominant macrofaunal community (cluster '*a*') accounting for 27.2% dissimilarity. Similarly, the lower abundances of the aforementioned species within cluster '*c*' in combination with the higher average abundance of the polychaete *Aphelochaeta* sp. were the main drivers for differentiation between cluster '*c*' and '*a*' (29.6% dissimilarity). Cluster '*d*' was primarily differentiated from cluster '*a*' due to the absence of *Yoldiella insculpta* and *Pristigloma nitens* in the former and a higher abundance of *Spiophanes similis* in the latter accounting for 38.3% of the dissimilarity between the two communities.

Overall, in the absence of any notable physical or chemical gradients that may explain the differentiation of the macrofaunal clusters identified, it is most likely that these compositional differences can be attributed to a combination of natural spatial variation.

Table 3.13 Top 10 Species Abundances for Clusters 'a', 'b', 'c' and 'd'

Top 10 Species	Cluster *'a'* Average similarity: 40.5%			Cluster *'b'* Average similarity: 30.3%			Cluster *'c'* (less than two samples)*		Cluster *'d'* (less than two samples)*	
	Species	Average Abundance	Contribution (%)	Species	Average Abundance	Contribution (%)	Species	Contribution (%)	Species	Contribution (%)
1	*Spiophanes similis*	6.9	31	*Mastobranchus* sp.	3.5	60	*Aphelochaeta* sp.	19	*Spiophanes similis*	29
2	*Yoldiella insculpta*	6.4	30	*Spiophanes similis*	1.5	20	*Thyasira obsoleta*	14	*Anobothrus* sp.	14
3	*Pristigloma nitens*	2.6	10	*Pristigloma nitens*	1.5	20	*Macrostylis* sp.	10	Maldanidae sp.	14
4	*Mastobranchus* sp.	2.2	7	-	-	-	**	-	*Chelator* sp.	14

Top 10 Species	Cluster 'a' Average similarity: 40.5%			Cluster 'b' Average similarity: 30.3%			Cluster 'c' (less than two samples)*		Cluster 'd' (less than two samples)*	
	Species	Average Abundance	Contribution (%)	Species	Average Abundance	Contribution (%)	Species	Contribution (%)	Species	Contribution (%)
5	*Glycera lapidum*	0.7	2	-	-	-	**	-	*Iphinopsis alba*	14
6	*Prionospio* sp.	0.9	2	-	-	-	**	-	Ophiomyxidae sp.	14
7	*Aricidea (Acmira) simplex*	0.9	2	-	-	-	**	-	-	-
8	*Lysippe* sp.	0.8	1.5	-	-	-	**	-	-	-
9	*Nucula atacellana*	0.8	1.3	-	-	-	**	-	-	-
10	Nematoda	0.7	1.3	-	-	-	**	-	-	-

* *Less than two samples within the cluster*
** *More than seven taxa of the same abundance present.*
Blue shading = sharded taxa across 3 clusters   Orange shading = shared taxa across 2 clusters

Table 3.14 Dissimilarity Percentages (SIMPER) for Clusters 'a', 'b', 'c' and 'd'

	Cluster 'a'		Cluster 'b'		Cluster 'c'	
Cluster 'd'	Average dissimilarity 89.12%		Average dissimilarity 86.80 %		Average dissimilarity 92.86%	
	Yoldiella insculpta	15.4	*Mastobranchus* sp.	19.3	*Aphelochaeta* sp.	14.3
	Spiophanes similis	11.6	*Pristigloma nitens*	7.6	*Thyasira obsoleta*	10.7
	Pristigloma nitens	6.2	*Lysippe* sp.	7.0	*Macrostylis* sp.	7.1
	Mastobranchus sp.	5.2	*Anobothrus* sp.	5.9	Virgulariidae sp.	3.6
	Ophiomyxidae sp.	2.5	Maldanidae sp.	5.9	Echiura sp.	3.6
Cluster 'a'			Average dissimilarity 79.00%		Average dissimilarity 83.66%	
			Yoldiella insculpta	14.7	*Spiophanes similis*	11.4
			Spiophanes similis	12.5	*Yoldiella insculpta*	10.4
			Mastobranchus sp.	4.4	Aphelochaeta sp.	7.8
			Lysippe sp.	4.2	*Thyasira obsoleta*	5.2
			Pristigloma nitens	3.9	*Pristigloma nitens*	5.0
Cluster 'b'					Average dissimilarity 82.22%	
					Aphelochaeta sp.	12.6
					Thyasira obsoleta	10.4
					Mastobranchus sp.	8.2
					Macrostylis sp.	6.9
					Lysippe sp.	5.2
Cluster 'c'						

3.7.2.3 *Epifaunal and Other Biological Groups*

A **total of 16 stations from the 66 obtained within the Block 2913B survey area recorded the presence of colonial epifauna** that were not statistically assessed within the infauna data analysis, as they were tabulated on a presence/absence basis. Due to the presence/absence scale to which epifaunal species were identified, for the purpose of this chart and to highlight the epifaunal richness, where epifaunal species were recorded as present this was given the numerical value of "1" to represent the colony. The distribution of epifaunal assemblages across the survey area is represented in Figure 3.35. The analysis indicated that infauna was dominant across the survey area, with colonial epifauna making up a small part of the community at stations in cluster '*a*'. Infaunal and epifaunal specie are listed separately in Appendix XII – Macrofauna and Biomass Species Lists.

Throughout the stations, seven taxa were epifaunal which belonged to the phyla Cnidaria, Bryozoa and Porifera. Bryozoa were represented by four taxa: Bugulidae, *Notoplites*, Ctenostomatida, Crisiidae. Cnidaria were represented by Epizoanthidae and Anthoathecata.

Due to the nature of the sediment, the opportunities for epifaunal attachment surfaces were minimal to non-existent which is consistent with the lack of epifaunal diversity. The homogeneity of the sediment across all stations reflects the dominance of infauna taxa, as expected with sandy mud sediment. In which infauna thrive below the surface layer, the lack of a substrate for attachment for epifaunal species makes it extremely difficult to establish themselves.

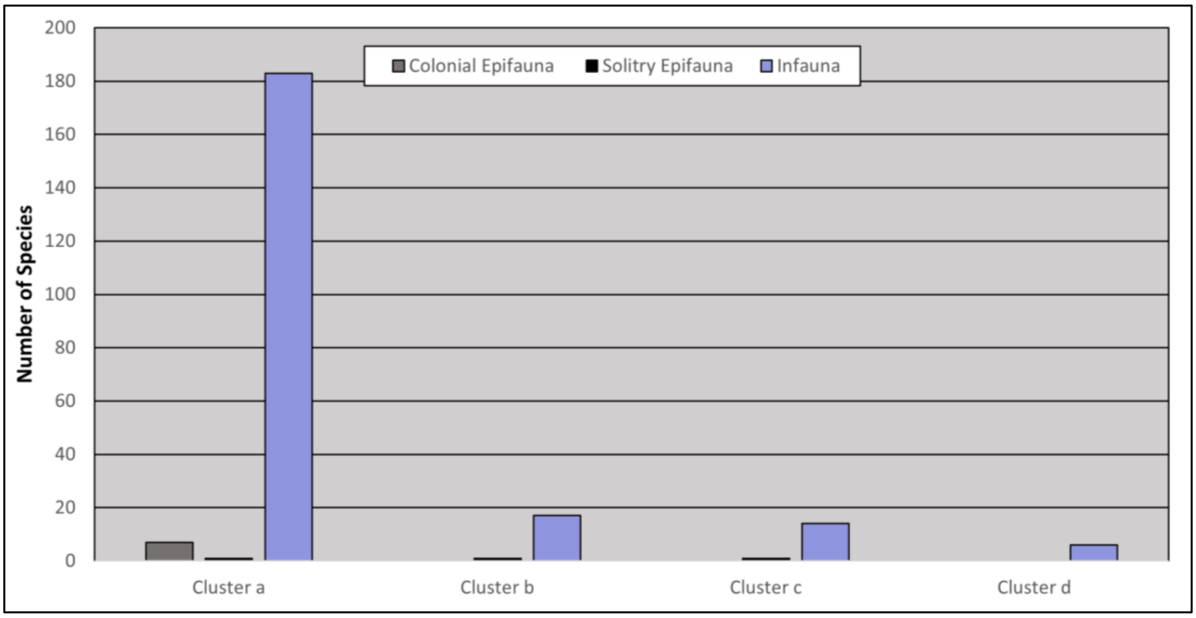


Figure 3.35 Epifaunal Versus Infaunal Richness

3.7.2.4 *Biomass*

Biomass allows another viewpoint into the community structure of the benthos, providing additional information that may indicate potential organic enrichment and pollution. The biomass (blotted wet weight) of the macrofauna for the Block 2913B survey area is displayed by phyla in Table 3.15 and by taxa in Appendix XII – Macrofauna and Biomass Species Lists.

The **total biomass across the survey area, was estimated to be 186.806g/m^2**, with the **majority comprised of Annelida,** which accounted for 129.751g/m^2 (69.5%) of the total biomass. Similar to infaunal abundance, **the dominance of Annelida biomass is to be expected with deep-sea soft mud dominated habitats** (Bonifácio et al., 2021, Herring, 2010, Rex and Etter, 2010). The next major contributor was the Echinodermata which accounted for 38.926g/m^2 (20.8%), followed by Arthropoda which accounted 10.762g/m^2 (5.8%) and Cnidaria (5.029g/m^2 (2.7%)). The lowest biomass contributors were Mollusca, Nemertea, Nematoda and a single individual Chordata with a combined biomass of 2.338g/m^2 (1.3%).

Figure 3.36 outlines the relative contributions of phyla to total biomass for each of the identified clusters. From this it is evident that the contributions of differing phyla to total biomass varied significantly between clusters; **however, these differences are likely explained by the disproportionate effect of larger taxa in clusters '*b*' '*c*' and '*d*'.** For instance, the high contribution of Cnidaria within cluster '*b*' is because of the presence of one individual (*Anthoptilum* sp.) that accounted for 92% of the total Cnidaria biomass across all clusters. Similarly, the presence of *Jakobia* sp. within cluster '*c*' accounted for 94% of the annelid biomass within this cluster and 32% of the total biomass of Annelida across all clusters. Finally, the presence of a single echinoderm (Ophiomyxidae sp.) accounted for 63% of the total biomass of cluster '*d*'.

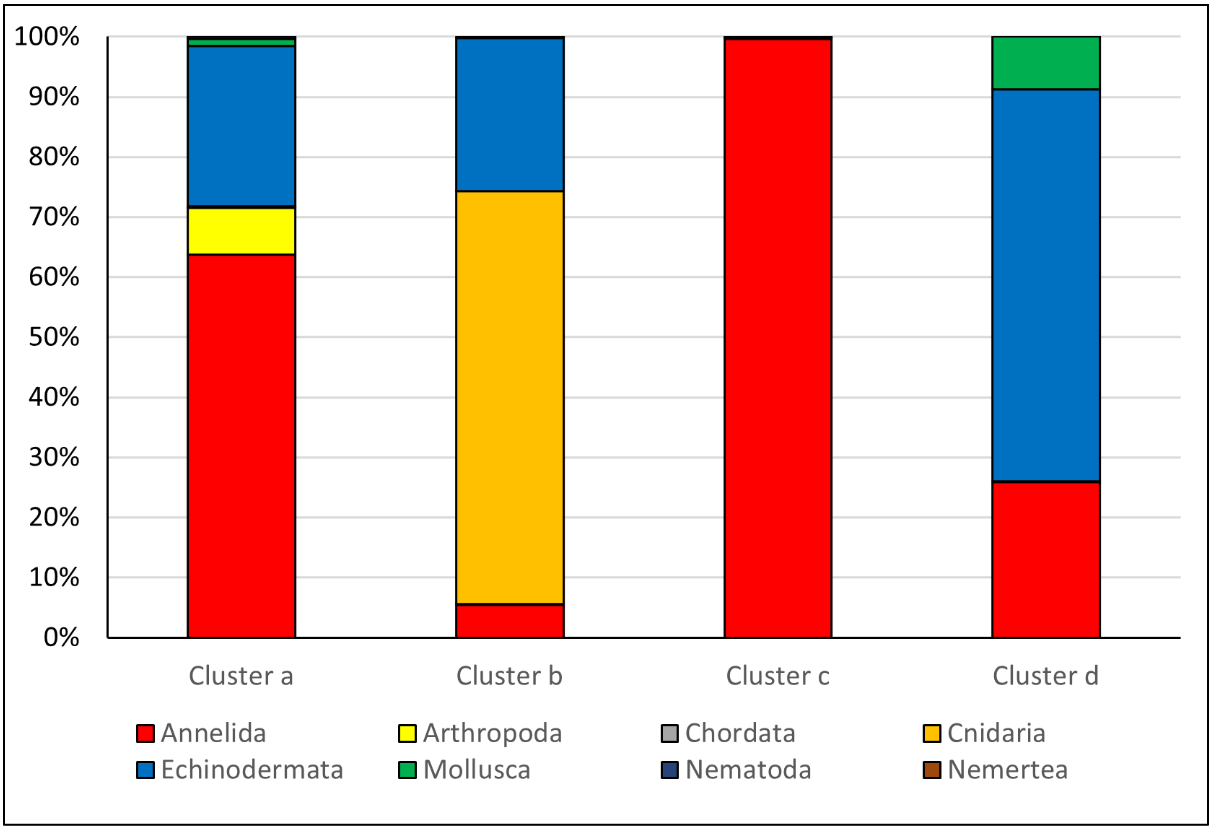


Figure 3.36 Proportion of Biomass by Phyla for Each Cluster

3.7.2.5 *General Sediment Biology Conclusion*

Based on the above interpretation of the macrofaunal dataset acquired during the current EBS in Block 2913B, the differences in macrofaunal assemblages are due to natural variation in species abundance and richness. The **macrofauna community is considered to have good to high diversity with no obvious spatial patterns** that can explain the differences in diversity indices or macrofaunal communities highlighted by the multivariate analysis in Block 2913B. There is **no indication of contamination** in the biological data assessed.

Table 3.15 Blotted Wet Weight Biomass (0.0001g) of Major Groups Within Block 2913B Survey Area

Station	Depth (m)	Annelida	Arthropoda	Chordata	Cnidaria	Echinodermata	Mollusca	Nematoda	Nemertea	Total
0m_Venus-2	2,900	0.0527	0.0143	-	0.0206	0	0	-	-	**0.0876**
250m_SE	2,900	0.0268	0.0081	-	0	0	0.0018	-	-	**0.0367**
500m_SE	2,900	0.0228	0.0001	-	0	0	0	0.0001	-	**0.023**
1000m_SE	2,900	0.0254	0.002		0	0.0015	0	-	-	**0.0289**
2000m_SE	2,900	0.1226	0.0057		0	0	0.0056	0.0001	-	**0.134**
250m_NW	2,900	0.0811	0.0091		0	0	0	0.0001	0.0036	**0.0939**
500m_NW	2,900	0.124	0.8149		0	0.0006	0	-	-	**0.9395**
1000m_NW	2,900	0.0775	0.0002	-	0	0.0096	0	-	-	**0.0873**
1500m_NW	2,900	0.0351	0.0184	-	0.0078	0.0093	0.0064	-	0.0001	**0.0771**
2000m_NW	2,900	0.0389	0.0078	-	0	0.0192	0.0022	0.0001	0.0025	**0.0707**
3000m_NW	2,900	0.1431	0.0081	-	0	0.0019	0.0003	0.0011	0.0001	**0.1546**
250m_NE	2,900	0.0234	0.0004	-	0	0.0087	0	-	-	**0.0325**
500m_NE	2,900	0.0516	0.0063	-	0	0.0055	0	0.0001	-	**0.0635**
1000m_NE	2,900	0.0632	0.0032	-	0	0.0017	0	-	-	**0.0681**
2000m_NE	2,900	0.0097	0	-	0	0	0	-	-	**0.0097**
10000m_NE	2,900	0.1935	0.0015		0	0.1631	0.001	-	-	**0.3591**
250m_SW	2,900	0.0201	0.0013	-	0	0	0.0001	0.0001	0.0015	**0.0231**
500m_SW	2,900	0.0682	0.0016	-	0	0	0	-	-	**0.0698**
1000m_SW	2,900	0.0723	0.0038	-	0	0	0.0022	0.0001	-	**0.0784**
2000m_SW	2,900	0.0644	0.0046	-	0	0	0.0001	0.0001	-	**0.0692**
B2913B_ENV_01	2,964	0.1674	0.0049	-	0	0	0.0021	-	-	**0.1744**
B2913B_ENV_02	3,025	0.0694	0.0011	-	0	0	0	0.0001	0.0001	**0.0707**
B2913B_ENV_03	2,916	0.6041	0	-	0	0	0.001	-	-	**0.6051**

Station	Depth (m)	Annelida	Arthropoda	Chordata	Cnidaria	Echinodermata	Mollusca	Nematoda	Nemertea	Total
B2913B_ENV_04	3,051	0.0268	0.002	-	0	0	0.0004	0.0001	-	**0.0293**
B2913B_ENV_05	3,028	3.842	0.0048	-	0	0.0097	0.0064	0.0001	-	**3.863**
B2913B_ENV_06	3,002	0.0162	0	-	0	0	0.0016	-	-	**0.0178**
B2913B_ENV_07	2,978	0.0116	0	-	0.0001	0	0.0046	-	-	**0.0163**
B2913B_ENV_08	3,032	0.0493	0.0045	-	0	0	0.0001	-	-	**0.0539**
B2913B_ENV_09	3,019	0.0203	0.0002	-	0	0.0048	0	0.0001	-	**0.0254**
B2913B_ENV_10	3,003	0.0889	0.0012	-	0	0	0.0101	0.0004	0.0001	**0.1007**
B2913B_ENV_11	2,977	0.1871	0.0044	-	0	0	0.004	-	-	**0.1955**
B2913B_ENV_12	3,025	0.0193	0.0013	0.0034	0	0.0142	0.0095	0.0001	-	**0.0478**
B2913B_ENV_13	2,976	0.1268	0.0065	-	0	0	0.0002	-	-	**0.1335**
B2913B_ENV_14	2,954	0.1828	0.0102	-	0	0.0163	0	-	-	**0.2093**
B2913B_ENV_15	3,013	0.0844	0.004	-	0	0	0.0001	-	0.0017	**0.0902**
B2913B_ENV_16	2,903	0.0294	0.0013	-	0.4624	0.1719	0.001	-	-	**0.666**
B2913B_ENV_17	2,879	0.0619	0.0006	-	0	0	0	-	-	**0.0625**
B2913B_ENV_19	2,943	0.0487	0.005	-	0	0	0	-	0.0002	**0.0539**
B2913B_ENV_20	2,810	0.3355	0.0127	-	0	0.0001	0.0002	-	0.0025	**0.351**
B2913B_ENV_21	2,625	0.168	0.0053	-	0	0	0	0.0038		**0.1771**
B2913B_ENV_23	2,996	0.0072	0.0001	-	0	0	0	-	-	**0.0073**
B2913B_ENV_24	2,849	0.0442	0.0005	-	0	0.0001	0.0684	-	-	**0.1132**
B2913B_ENV_25	2,593	0.0426	0.003		0	0.0082	0.0001	0.0001	-	**0.054**
B2913B_ENV_27	2,857	0.1381	0.0003	-	0.0011	0.0694	0.0013	0.0001	-	**0.2103**
B2913B_ENV_28	2,737	4.1141	0.0002	-	0.0038	0.0044	0.0059	-	-	**4.1284**
B2913B_ENV_29	3,117	0.0095	0.0016	-	0	0	0.0001	0.0001	-	**0.0113**
B2913B_ENV_30	2,793	0.0179	0.0027	-	0	0.0094	0.0001	-	-	**0.0301**

Station	Depth (m)	Annelida	Arthropoda	Chordata	Cnidaria	Echinodermata	Mollusca	Nematoda	Nemertea	Total
B2913B_ENV_31	3,164	0.0461	0.0072	-	0	0.0002	0.0044	-	-	**0.0579**
B2913B_ENV_33	2,953	0.0626	0	-	0	0.0001	0	-	-	**0.0627**
B2913B_ENV_34	2,743	0.2164	0.0089	-	0	0	0	-	-	**0.2253**
B2913B_ENV_35	2,661	0.0203	0.0003	-	0	0.2963	0.0001	-	-	**0.317**
B2913B_ENV_36	2,878	0.0176	0.0001	-	0	0.0443	0.0059	-	-	**0.0679**
B2913B_ENV_38	2,790	0.1256	0.0096	-	0	0	0	-	-	**0.1352**
B2913B_ENV_39	2,538	0.0182	0.0336	-	0	1.0407	0	0.0001	-	**1.0926**
B2913B_ENV_40	2,613	0.0474	0.0023	-	0	1.6774	0.0009	0.0001	-	**1.7281**
B2913B_ENV_41	2,873	0.0305	0.0007	-	0	0.0893	0.0001	0.0001	-	**0.1207**
B2913B_ENV_43	2,715	0.1078	0.0023	-	0	0.0074	0.0032	-	-	**0.1207**
B2913B_ENV_44	2,957	0.0093	0.0005	-	0	0	0.0043	0.0001	0.0092	**0.0234**
B2913B_ENV_45	2,830	0.0507	0.0006	-	0	0	0.0274	-	-	**0.0787**
B2913B_ENV_46	2,735	0.0198	0.0121	-	0.007	0	0	0.0001	0.0139	**0.0529**
B2913B_ENV_47	3,012	0.0191	0.0009	-	0	0	0.0002	-	-	**0.0202**
B2913B_ENV_48	2,963	0.1005	0.0003		0.0001	0.0919	0	-	-	**0.1928**
B2913B_ENV_49	2,846	0.1211	0.0015	-	0	0.0898	0	-	-	**0.2124**
B2913B_ENV_50	3,116	0.0372	0.0018	-	0	0	0.0003	0.0001	0.0036	**0.043**
B2913B_ENV_51	3,032	0.0512	0.0001	-	0	0.0201	0.0001	-	-	**0.0715**
B2913B_ENV_52	2,960	0.0438	0.0036	-	0	0.0055	0	-	-	**0.0529**
Total Biomass (g/0.1m²) by group		**12.9751**	**1.0762**	**0.0034**	**0.5029**	**3.8926**	**0.1838**	**0.0075**	**0.0391**	**18.6806**
Proportional Contribution (%)		**69.5**	**5.8**	**0.0**	**2.7**	**20.8**	**1.0**	**0.0**	**0.2**	**-**
Biomass (g/m²) by group		**129.751**	**10.762**	**0.034**	**5.029**	**38.926**	**1.838**	**0.075**	**0.391**	**186.806**

'-' Taxa not present

3.8 Water Quality and Biology

3.8.1 *Water Column Profiling*

The structure of the water column was surveyed using a multi-parameter seawater profiler across the Block. The profiler was fitted with sensors for conductivity (salinity), temperature, pressure (depth), dissolved oxygen, pH, turbidity, redox . Eight seawater profiles were acquired during the sampling campaign within Block 2913B; one of which is not included in this report as it was taken over the Venus-1X FWL and is reported in the separate EPOS report (BSL, 2023c). During data collection the profiler was fitted to dyneema rope during deployments, delivering a downcast and upcast profile of the water column. The data extremes are summarised in Table 3.16 with the full water profile upcasts illustrated in Figure 3.37.

The temperature profiles show the upper ~100m of the water column to be thermally well mixed with temperatures of approximately 15.5°C at all sampling sites. The water column temperature rapidly declined through the thermocline layer from 100m to 600m depth; though all stations showed similar rates of temperature decline, station B2913B_ENV_45 saw the most extreme. Temperature decline continued, albeit at a considerably slower rate, to around 1000m depth where temperatures at all sampling sites began to stabilise at approximately 3°C. **A minimum temperature of 1.9°C was reached at approximately 2,300m depth. Although the region was under the influence of a La Niña event, there were no abnormalities in sea surface temperatures.**

Salinity slightly varied in the first 100m of water ranging from 35.5 PSU at station 250m_SE to 35.4 PSU at B2913B_ENV_45. As expected, considering their relationship and influence on one another, **the halocline followed a very similar profile to the thermocline as salinity rapidly declined between 100m and 600m depth to the minimum salinity recorded, 34.4 PSU.** From this point in the water column, salinity gradually increased to 35 PSU at 2000m where it stabilised and remained constant to the seabed. The increase in salinity in deeper waters is indicative of the presence of different water masses.

The water column showed evidence of four separate water masses, which were consistent with the expected surface, central, intermediate and deep-water masses of offshore Namibia (Hanz *et al.,* 2019). **Within the first 100m, a well oxygenated layer of water was observed with temperature and salinity values indicative of South Atlantic and Subtropical Surface Waters** (SASSW) (temperature range from 14°C to 20°C, salinity range from 34 to 36 PSU). This water mass is a mixture of sun-warmed upwelled water, and water stemming from the Agulhas Current (Hutchings *et al.,* 2009). **From 100m, temperature and salinity properties within the water column transitioned through to those characteristic of Eastern South Atlantic Central Water** (ESACW), 200m to 700m depth marks the core of ESACW (Stramma and England, 1999). ESACW is characterised by a slightly lower core salinity range of 34.5 to 35.5 PSU and temperature range of 6°C to 14°C (Liu and Tanhua, 2019), both of these data ranges are seen in Figure 3.44. **The influence of Antarctic Intermediate Water (AAIW) can be seen at around 700m depth where water becomes slightly fresher and continues to decline in temperature**. At the base of the AAIW, **beyond approximately 1000m, the water column is influenced by the cool mass of the North Atlantic Deep Waters (NADW); characteristics of this water mass include a deep**

salinity maximum as seen by the slightly increased salinity in the survey area, and a relatively high dissolved oxygen content given its depth (Valentine, Lutjeharms and Brundrit, 1993).

The dissolved oxygen (DO) profile showed the top ~100m of the water column to remain relatively stable with a relatively sharp decrease from this point from ~93% DO to 78% DO at around 100m, after which reduction in dissolved oxygen became more gradual to a minimum of ~40% DO at around 900m and remained stable with depth. **At around 1,400m DO began to increase again, reaching a deep maximum at ~47% DO at 2,000m** depth before gradually decreasing to 38% DO at 3,000m.

Table 3.16 Seawater Profile Extremities for Block 2913B

Station	Extreme	Conductivity ($mS.cm^{-1}$)	Salinity (PSU)	pH (mV)	Redox (mV)	Density Anomaly ($kg.m^{-3}$)	Temperature (°C)	Dissolved Oxygen (% Saturation)	Turbidity (NTU)
10000m_NE	Min	32.3	34.4	7.7	29.2	1,026	2.5	37.9	0.1
	Max	44.1	35.5	8.1	76.0	1,041	15.8	99.9	0.4
250m_SE	Min	32.2	34.4	7.7	53.7	1,026	2.5	35.8	1.4
	Max	44.0	35.4	8.1	92.5	1,041	15.7	99.9	0.1
B2913_ENV_21	Min	32.2	34.4	7.8	142.4	1,026	2.6	39.2	0.1
	Max	44.2	35.5	8.3	190.3	1,039	15.8	97.9	1.0
B2913_ENV_35	Min	32.2	34.4	7.8	256.4	1,026	2.6	39.3	0.1
	Max	44.1	35.5	8.2	301.6	1,040	15.6	97.6	0.6
B2913_ENV_36	Min	32.2	34.3	7.8	183.5	1,026	3.3	40.6	0.1
	Max	44.5	35.6	8.3	273.8	1,033	16.0	98.9	2.0
B2913B_ENV_45	Min	31.9	34.2	7.8	155.7	1025	1.9	33.9	0.1
	Max	49.1	35.7	8.2	259.7	1042	20.5	97.7	0.8
B2913_ENV_50	Min	32.2	34.4	7.8	119.6	1,026	2.5	38.3	0.1
	Max	44.6	35.6	8.2	179.6	1,041	16.0	97.6	0.8
Reference Values									
CCME (1987) Marine Water Quality Guideline		-	-	7.0-8.7	-	-	-	-	-
CCME (1999) Marine Water Quality Guideline*		-	-	-	-	-	-	8	-

Notes:
**CCME (1999) Dissolved Oxygen reference value provided as $8mg.l^{-1}$ as the absence of salinity and temperature prevented conversion to percentage (%) saturation.*

The pH profile showed a consistent pattern across all sampling stations. Interestingly, the two stations in the Venus-2 cruciform (250m_SE and 10000m_NE) displayed consistently lower pH values than all other stations sampled by approximately 0.1. The profiles for these stations show the same shape profile as stations in the wider Block region, hence it is likely that this difference is not due to differences in water, but more likely due to the Venus-2 sampling being carried out in a separate earlier phase of the wider EBS study. This difference may reflect a minor temporal change in seawater characteristics or alternatively a change in calibration or other technical discrepancy. **Through the water column pH remained relatively constant in the well-mixed surface 100m (pH 8.1 and 8.2), followed by a sharp decrease at 100m depth. pH then continued to decrease gradually through the water column, reaching minimum values of pH 7.75 at approximately 800m remaining stable to**

900m. At a depth of 900m pH began to gradually increase to 2,000m, where it then remained stable at pH ~7.8 and ~7.9 to the seabed.

Turbidity is measure of the amount of cloudiness or haziness in sea water caused by individual particles too small to be seen without magnification. **Turbidity remained low throughout with occasional increases through spot readings of suspended material, along with a slight increase in background turbidity in the surface 100m.** This is indicative of wave driven turbidity and planktonic activity in the upper mixed zone, considering the Southwest African Margin is a major upwelling system, planktonic activity resulting in higher turbidity is unsurprising. Turbidity remained constant at approximately 0.2 NTU through the water column from 100m depth to the seabed.

Redox (mV) profiles differed at each sampling station, though every station displayed a lower redox potential in the surface waters, and higher potentials at the seabed. **The lowest oxidation reduction potentials were seen at station 250m_NE (40mV to 80mV, and the highest were seen at station B2913B_ENV_35 (260mV to 300mV).** Oxidation reduction potential values (mV) correspond to different biochemical reactions; at station 250m_NE where the lowest redox values are seen, there could be either denitrification, biological phosphorus removal or carbonaceous biochemical oxygen demand (cBOD) degradation with free molecular oxygen occurring, or a combination of the three reactions (YSI, 2023). Where the highest value was seen at station B2913B_ENV_35, nitrification was likely taking place (YSI, 2023).

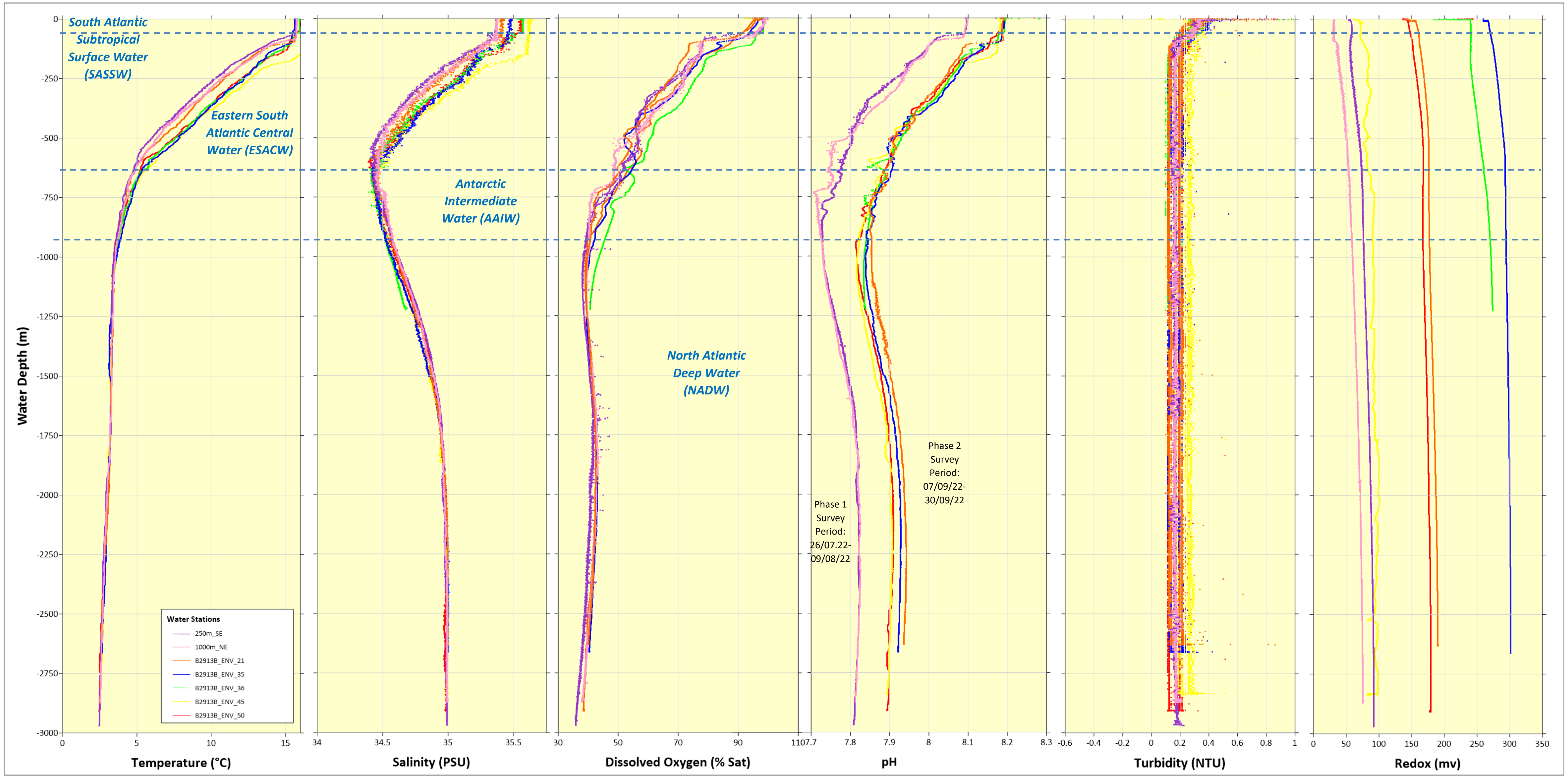


Figure 3.37 CTD Profiles for Block 2913B

3.8.2 *Water Chemistry*

Due to seawater samples undergoing analysis in different laboratories, there are some differences in parameters analysed, and in the lowest detection limits. Water samples from the phase 1 were analysed separately (Socotec) to the phase 2 stations (Le Cedre/LPL) with the different limits of detections tabulated in Table 2.5 and Table 2.6. Results from the seawater analysis are summarised in Table 3.17.

Total hydrocarbon content (THC) were low and mostly below the LOD or LOQ, with the exception of the middle sample at stations B2913B_ENV_36 (178.1µg.l^{-1}) and B913B_ENV_50 (417.2µg.l^{-1}) (Table 3.17). Both stations are far from any developed wells and it is unsure the reason for the higher concentration present compared to the rest of the water sampling points. **Total alkanes were either below LOD or could not be determined but are assumed to be low. PAH concentrations were low throughout** and ranged significantly from 0.012µg.l^{-1} at station B2913B_ENV_35_BOT to 0.482µg.l^{-1} at station B2913B_ENV_45_SUR. Moreover, the **concentrations of benzene, toluene, ethyl-benzene and xylene (BTEX) samples were all below the LOD (**Appendix VIII – BTEX Monocyclic Aromatic Hydrocarbons**).**

All heavy metals were recorded in low concentrations, either below or only marginally above their respective LODs, in all seawater samples collected in Block 2913B. No samples exceeded their respective NOAA (2008) CMC, CCC or EQS reference value (Table 3.17).

Orthophosphate (PO_4) ranged from below the LoD (<0.02mg.l^{-1}) to 0.222mg.l^{-1} at B2913B_ENV_50_SUR and B2913B_ENV_35_MID). Nitrite was below the LoD (<0.01mg.l^{-1}) in all samples, while nitrate varied from below the limit of detection (<0.1mg.l^{-1}) to 3.96mg.l^{-1} at B2913B_ENV_36_MID. Levels of nitrite, nitrate and orthophosphate were further evaluated against French **"Provisional Environmental Quality Standards (NQEp)"** to evaluate whether they represent waters in 'good condition'. **The results indicated that nitrite and nitrate concentrations were in 'very good condition'** for all samples from the Block 2913B survey area. **Orthophosphate results were more variable with a range of 'very good', 'good', 'medium' and 'poor' conditions achieved.**

Total suspended solids (TSS) were variable but low, ranging from <5 to 62mg.l^{-1} at 10000m_NE_SUR, with no obvious pattern of distribution either geographically or with depth. Total organic carbon (TOC) was also low throughout the survey area ranging from 0.58mg.l^{-1} at station 10000m_NE_BOT to 32.5mg.l^{-1} at station B2913B_ENV_35_MID.

All Alpha and Beta measurements were taken differed by <3 CPS from their respective sample background levels indicating no contamination (Table 3.17). Gamma measurements were above the background levels by more than 3 CPS at just one sample (B2913B_ENV_21_BOT) indicating a slight NORM presence in the water sample, but at a level which **not class as radioactive** (Table 3.17).

Overall, **the survey revealed a homogeneous and uncontaminated offshore seawater environment with a relatively low level of organic nutrients**.

Table 3.17 Seawater Chemistry Results

Parameter	250m_SE_SUR	250m_SE_MID	250m_SE_BOT	10000m_NE_SUR	10000m_NE_MID	10000m_NE_BOT	B2913B_ENV_21-SUR	B2913B_ENV_21-MID	B2913B_ENV_21-BOT	B2913B_ENV_35_SUR	B2913B_ENV_35_MID	B2913B_ENV_35_BOT	B2913B_ENV_36_SUR	B2913B_ENV_36_MID	B2913B_ENV_36_BOT	B2913B_ENV_45_SUR	B2913B_ENV_45_MID	B2913B_ENV_45_BOT	B2913B_ENV_50_SUR	B2913B_ENV_50_MID	B2913B_ENV_50_BOT	Reference Values		
																						Environmental Quality Standards (EQSs) (1999)	NOAA (2008) CCC	NOAA (2008) CMC
Total Organic Carbon (mg.l⁻¹)																								
TOC	0.94	1.13	0.78	0.78	0.65	0.58	26.5	26.1	26.5	31.3	32.5	30.6	26.7	25.7	26.4	30.6	26.1	27.1	25.7	26.9	26.8	-	-	-
Hydrocarbons (µg.l⁻¹)																								
THC	8.96	7.93	5.95	4.86	17.3	7.96	<27.4	<27.4	<27.4	<27.4	<27.4	<27.4	<91.4	178.1	<27.4	<27.4	<27.4	<27.4	<27.4	417.2	<27.4	-	-	-
Total Alkanes	<28	<28	<28	<28	<28	<28	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	nd**	-	-	-
Total PAHs	<34	<34	<34	<34	<34	<34	0.167	0.091	0.287	0.172	0.024	0.012	0.037	0.013	0.026	0.482	0.072	0.016	0.336	0.245	0.053	-	-	-
Benzene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	-	-	-
Toluene	<1	<1	<1	<1	<1	<1	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0	-	-	-
Ethylbenzene	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	-	-	-
M,p-xylene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	-	-	-
o-xylene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	-	-	-
Total Heavy and Trace Metals (µg.l⁻¹)																								
Aluminium (Al)	0.1	0	0	0	<0.10*	<0.10*	0.0463	0.0472	0.0387	<0.01*	<0.01*	<0.01*	0.0364	0.0408	0.04	0.0319	0.026	0.0317	0.0116	0.0163	0.0287	-	-	-
Antimony (Sb)	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	-	-	-
Arsenic (As)	0.001	0.001	0.002	0.001	0.001	0.001	0.00151	0.00183	0.0016	0.00186	0.0018	0.00134	0.00197	0.00205	0.00221	0.00199	0.00173	0.00198	0.00183	0.00153	0.00209	0.025	0.036	0.069
Barium (Ba)	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	0.00544	0.00889	10.0102	0.00538	0.00895	0.00922	0.00567	0.00915	0.0103	0.00493	0.00862	0.00963	0.00475	0.00772	0.0091	-	0.2	1
Beryllium (Be)	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	<0.00008*	0.1	1.5	-
Cadmium (Cd)	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	0.00007	0.00011	0.00015	0.0001	0.00015	0.0001	<0.00005*	0.00014	0.00018	0.00006	0.00031	0.00012	0.00013	0.00031	0.00013	0.0025	0.0088	0.04
Chromium (Cr)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001*	0.00126	0.00207	0.00118	0.00117	0.00174	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.00159	0.00143	<0.001*	0.00101	-	-	-
Cobalt (Co)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	-	-	-
Copper (Cu)	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.00222	<0.001*	<0.001*	0.00542	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	-	0.0031	0.0048
Iron (Fe)	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	<0.01*	0.0112	0.0165	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	-	-	-
Lead (Pb)	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	0.000805	0.000567	0.000997	<0.0005*	<0.0005	0.000763	<0.0005*	<0.0005*	<0.0005*	0.000553	0.00292	<0.0005*	<0.0005*	0.000798	<0.0005*	-	0.0081	0.21
Lithium (Li)	0.18	0.17	0.16	0.16	0.15	0.14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese (Mn)	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	-	0.1	-
Mercury (Hg)	<0.0001*	<0.0001*	<0.0001*	<0.0001*	<0.0001*	<0.0001*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	<0.000015*	0.0003	0.00094	0.0018
Molybdenum (Mo)	0.01	0.01	0.011	0.01	0.01	0.01	0.0098	0.0099	0.0101	0.00971	0.0101	0.00983	0.011	0.01	0.0108	0.0101	0.00944	0.00974	0.00936	0.00938	0.00927	0.023	-	-
Nickel (Ni)	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	-	0.0082	0.074
Selenium (Se)	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	<0.01*	0.071	0.29	-
Silver (Ag)	-	-	-	-	-	-	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	-	-	-
Thallium (Tl)	-	-	-	-	-	-	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	<0.0004*	-	-	-
Tin (Sn)	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	<0.002*	-	-	-

Parameter	250m_SE_SUR	250m_SE_MID	250m_SE_BOT	10000m_NE_SUR	10000m_NE_MID	10000m_NE_BOT	B2913B_ENV_21-SUR	B2913B_ENV_21-MID	B2913B_ENV_21-BOT	B2913B_ENV_35_SUR	B2913B_ENV_35_MID	B2913B_ENV_35_BOT	B2913B_ENV_36_SUR	B2913B_ENV_36_MID	B2913B_ENV_36_BOT	B2913B_ENV_45_SUR	B2913B_ENV_45_MID	B2913B_ENV_45_BOT	B2913B_ENV_50_SUR	B2913B_ENV_50_MID	B2913B_ENV_50_BOT	Reference Values		
																						Environmental Quality Standards (EQSs) (1999)	NOAA (2008) CCC	NOAA (2008) CMC
Titanium (Ti)	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	<0.10*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium (V)	0.001	0.002	0.002	0.002	0.002	0.002	<0.002*	<0.002*	0.00212	<0.002*	<0.002*	<0.002*	0.00214	0.00212	<0.002*	0.00211	0.00209	<0.002*	<0.002*	<0.002*	<0.002*	0.1	0.05	0
Zinc (Zn)	0.006	0.034	0.009	0.008	0.008	0.008	0.0213	0.0155	0.0298	0.0116	0.00682	0.00415	0.0269	0.0193	0.00483	0.00721	0.00846	0.0283	0.0108	0.0081	0.00497	-	0.081	0.09
Nutrients and Suspended Solids (mg.l^{-1})																								
Nitrite as N	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01 (VG)*	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	<0.01* (VG)	-	-	-
Nitrate as N	0.40 (VG)	0.3 (VG)	0.30 (VG)	0.20 (VG)	0.60 (VG)	<0.2 (VG)	0.995 (VG)	4.2 (VG)	6.76 (VG)	0.295 (VG)	2.17 (VG)	1.27 (VG)	1.19 (VG)	3.96 (VG)	1.51 (VG)	<0.1* (VG)	2.69 (VG)	1.45 (VG)	0.77 (VG)	2.08 (VG)	2.13 (VG)	-	-	-
Orthophosphate as PO_4	<0.03* (VG)	<0.03* (V)G	<0.03* (VG)	<0.03* (VG)	<0.03* (VG)	<0.03* (VG)	0.025 (VG)	0.134 (M)	0.196 (M)	0.025 (VG)	0.222 (P)	0.134 (M)	0.027 (VG)	0.193 (M)	0.14 (M)	0.024 (VG)	0.214 (P)	0.158 (M)	<0.02* (VG)	0.183 (M)	0.149 (M)	-	-	-
Total Nitrogen	5 (B)	5 (B)	6 (B)	4 (B)	3 (B)	4 (B)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Suspended Solids	6	<5*	41	62	52	32	2.5	<2*	3.8	9.1	21	26	7.4	6.7	6.6	10	6.3	11	8.6	7.6	7.7	-	-	-
NORM (counts per second)																								
αβ Background	***	***	***	***	***	***	0.34	0.43	0.31	0.39	0.39	0.39	0.43	0.43	0.43	0.39	0.49	0.49	0.26	0.26	0.26	-	-	-
αβ	***	***	***	***	***	***	0.38	0.65	0.83	0.46	0.36	0.46	0.46	0.36	0.36	0.59	0.29	0.39	-	0.39	0.26	-	-	-
γ Background	***	***	***	***	***	***	1.76	1.48	2.80	***	***	***	***	***	***	***	***	***	***	***	***	-	-	-
γ	***	***	***	***	***	***	2.22	2.25	15.96	***	***	***	***	***	***	***	***	***	***	***	***	-	-	-

Notes:

'' = parameter below equipment limit of detection*

'-' no data for this parameter due to differences in lab analysis.

Total PAHs from stations 250_SE & 10000m_NE included the sum of 19 different PAHS, whereas the rest of the stations in this report include the sum of 51 individual PAHs

Scores for the index of Environmental Quality Standards (NQEp): VG = Very Good; G = Good; M- = Medium, P = Poor, B = Bad.

*nd** = not determined*

**** = no NORM reading for this type of analysis due to probe error*

3.8.3 *Water Biology*

3.8.3.1 *Chlorophyll-a and Phaeopigments*

Chlorophyll is a photosynthetic pigment found in phytoplankton and can be measured to give an indication of marine productivity and nutrient enrichment. There are four types of chlorophyll; chlorophyll-*a* found in all algae and cyanobacteria, chlorophyll-*b* found in green algae, chlorophyll-*c* found in diatoms, dinoflagellates and brown algae and chlorophyll-*d* found only in red algae. It should be noted that the oceanic environment sampled in this campaign is likely to be subject to influence from nutrient enrichment through upwelling by the Benguela Current Upwelling System. Phaeophytin is a product from the breakdown of chlorophyll (Lorenzen, 1967).

Chlorophyll-*a*, chlorophyll-*b*, chlorophyll-*c* and phaeopigment levels were analysed from filtered Niskin bottle samples and were low across all samples, with phaeopigments recorded to be 0µg.l^{-1} at every sampling site (Table 3.19). **Chlorophyll-*a* was generally highest in the surface samples where it ranged from 0.4µg.l^{-1} at station B2913B_ENV_50_SUR to 0.00µg.l^{-1} at both 250m_SE_BOT and 10000m_NE_BOT.** At stations 0m Venus-2_BOT and 10000m_NE_BOT chlorophyll-*a* was at its highest concentration in the bottom water samples at 0.19µg.l^{-1} and 0.57µg.l^{-1} respectively. **Chlorophyll-*b* was recorded to be 0µg.l^{-1} throughout the survey site and chlorophyll-*c* was highest at B2913B_ENV_36_BOT at 2µg.l^{-1}.**

Table 3.18 Chlorophyll-a and Phaeopigments

Station	Depth (m)	Parameter (µg.l^{-1})			
		Chlorophyll-*a*	Chlorophyll-*b*	Chlorophyll-*c*	Phaeopigment
250m_SE_SUR	5	0.00	-	-	0
250m_SE_MID	1,000	0.09	-	-	0
250m_SE_BOT	2,900	0.19	-	-	0
10000m_NE_SUR	5	0.00	-	-	0
10000m_NE_MID	1,000	0.00	-	-	0
10000m_NE_BOT	2,900	0.57	-	-	0
B2913B_ENV_21_SUR	5	0.56	0	0	0
B2913B_ENV_21-MID	1,000	0.00	0	0	0
B2913B_ENV_21-BOT	2,628	0.00	0	1	0
B2913B_ENV_36_SUR	5	0.36	0	0	0
B2913B_ENV_36_MID	2,877	0.00	0	0	0
B2913B_ENV_36_BOT	3,164	0.00	n.d.	2	0
B2913B_ENV_35_SUR	5	0.29	0	0	0
B2913B_ENV_35_MID	1,000	0.00	0	0	0
B2913B_ENV_35_BOT	2,652	0.00	0	0	0
B2913B_ENV_45_SUR	5	0.33	0	0	0
B2913B_ENV_45_MID	1,000	0.00	0	0	0
B2913B_ENV_45_BOT	2,750	0.00	0	1	0
B2913B_ENV_50_SUR	5	0.40	0	0	0
B2913B_ENV_50_MID	1,000	0.00	0	0	0
B2913B_ENV_50_BOT	3,100	0.00	0	0	0

3.8.3.2 *Phytoplankton*

Phytoplankton taxonomy was carried out on samples acquired through horizontal phytoplankton trawls of varying length. The trawl at station 250m_SE was 350m long, whilst the trawl at station 10000m_NE was 270m long. Although plankton samples were collected for all seven water stations, both phytoplankton and zooplankton samples for the regional sampling phase 2 of Block 2913B (B2913B_ENV_21_SUR, B2913B_ENV_36_SUR, B2913B_ENV_35_SUR, B2913B_ENV_45_SUR, and B2913B_ENV_50_SUR) were lost during the transit from the vessel to the laboratory in France. Due to the loss of the plankton data at these five stations, underwater video profiler (UVP) profiles conducted in the same general area in 2015 by Creocean have been utilised as a regional reference. The results are discussed in Section 3.8.3.4.

Recovered phytoplankton samples included five main groups (diatoms, dinoflagellates, silicoflagellates, cyanobacteria and prasinophyte) with a total of 5,060,352 cells across the two samples analysed from Block 2913B. The vertical trawls were acquired for analysis using a 50µm mesh phytoplankton net.

All species are provided in Appendix XIII – Phytoplankton Species List, whilst primary variables and derived univariate analyses are summarised by station in Table 3.19. The two samples (250m_SE and 10000m_NE) **were dominated by diatoms (>55% contribution).** Other groups encountered contributed significantly less in comparison; **silicoflagellates contributed 6.28% at 250m_SE and 7.05% at 10000m_N, while dinoflagellates contributed 4.3% and 16% at _SE and 10000m_N respectively. Both phytoplankton samples had high abundances of the diatom genus *Thalassionema* spp., as well as *Pseudo-nitzschia* spp.** Some *Pseudo-nitzschia* species, under certain conditions, can produce a harmful algal bloom neurotoxin called domoic acid; this can cause amnesic shellfish poisoning which can not only affect humans but other marine life too. Similarly, both phytoplankton samples had high abundances of the dinoflagellate *Gonyaulax* spp., particularly at station 10000m_NE where 160,445 individuals were found. *Gonyaulax* are red dinoflagellates and secrete a poisonous toxin known as 'saxitoxin' which causes paralysis in humans, as well as causes red tides. Dinoflagellates *Pyrocystis fusiformis* and *Pyrocystis lunula* were found at station 10000m_NE, both of which are known to produce bioluminescence.

The primary variables and derived univariate diversity indices for the phytoplankton species assemblage are displayed in Table 3.20. Example images of phytoplankton found within the survey area are provided in Figure 3.39.

Table 3.19 Percentage Contribution of Phytoplankton Groups

Station	Phytoplankton Group (%)				
	Diatoms	Dinoflagellates	Silicoflagellate	Cyanobacteria	Prasinophyte
250m_SE	88.3	4.30	6.28	1.11	0.00
10,000m_NE	56.3	16.0	7.05	20.5	0.19
Mean	**72.3**	**10.1**	**6.67**	**10.8**	**0.10**
Standard Deviation	**22.7**	**8.25**	**0.54**	**13.7**	**0.13**
Variance (%)	**31.4**	**81.4**	**8.1**	**127.0**	**141.4**

Table 3.20 Primary and Univariate Diversities for Phytoplankton per 31.8m^3 Filtered Sample

Station	Number of Species (S)	Number of Cells (N)	Richness (Margalef)	Evenness (Pielou's Evenness)	Shannon-Wiener Diversity	Simpson's Diversity (1-Lambda')
250m_SE	21	3,529,350	1.33	0.706	3.10	0.838
10000m_NE	26	1,531,001	1.76	0.668	3.14	0.827
Mean	**24**	**2,530,176**	**1.54**	**0.687**	**3.12**	**0.832**
Standard Deviation	**4**	**1,413,046**	**0.30**	**0.027**	**0.03**	**0.007**
Variance (%)	**15.0**	**55.8**	**19.7**	**3.9**	**0.9**	**0.9**

A total of 28 species from 16 taxonomic families were recorded in the two water stations analysed in Block 2913B water samples, with Bacillariales representing on average 34.07% of the phytoplankton captured, followed by Thalassionematales (21.99%), Oscillatoriales (10.88%), and Gonyaulacales (8.25%) (Table 3.21).

Diatoms and dinoflagellates were the most dominant major taxonomic groups in both water samples. Diatoms comprised 88.3% and 56.3% of all taxa identified at 250m_SE and 10000m_NE respectively, the majority of which was driven by the presence of *Fragilariopsis doliolus, Pseudo-nitzschia* and *Rhizosolenia bergonii* at 250m_SE and by the presence of *Thalassionema* at 10000m_NE. Dinoflagellates comprised 4.3% and 16% of all taxa identified at 250m_SE and 10000m_NE respectively, of which 250m_SE was dominated by *Dictyocha*, while 10000m_NE was characterised by *Trichodesmium* and *Gonyaulax.* The relative proportions of each phylum are displayed in Figure 3.38 with example images of the dominant taxa presented in Figure 3.39.

Table 3.21 Percentage Contribution of Phytoplankton Within Block 2913B

Taxonomic Groups	Diatoms									Dinoflagellates				Silicoflagellate	Cyanobacteria	Prasinophyte
	Asterolamprales	Chaetocerotanae incertae sedis	Corethrales	Bacillariales	Leptocylindrales/ Rhizosoleniales	Naviculales	Thalassionematales	Thalassiosirales	Rhizosoleniales	Dinophysiales	Gonyaulacales	Peridiniales	Pyrocystales	Dictyochales	Oscillatoriales	Halosphaerales
250m_SE	0.17	2.49	1.50	51.20	0.00	0.00	11.64	3.99	3.99	0.33	3.65	0.33	0.00	6.31	1.11	0.00
10,000m_NE	0.19	2.68	0.00	16.95	0.38	0.19	32.34	2.68	0.59	0.57	12.84	1.53	1.11	7.09	20.65	0.19
Mean	**0.18**	**2.59**	**0.75**	**34.07**	**0.19**	**0.10**	**21.99**	**3.34**	**2.29**	**0.45**	**8.25**	**0.93**	**0.55**	**6.70**	**10.88**	**0.10**
Standard Deviation	**0.02**	**0.13**	**1.06**	**24.22**	**0.27**	**0.14**	**14.63**	**0.92**	**2.40**	**0.17**	**6.49**	**0.85**	**0.78**	**0.55**	**13.82**	**0.14**
Variance (%)	**10.1**	**5.2**	**141.4**	**71.1**	**141.4**	**141.4**	**66.6**	**27.7**	**104.7**	**37.8**	**78.8**	**91.0**	**141.4**	**8.2**	**127.0**	**141.4**

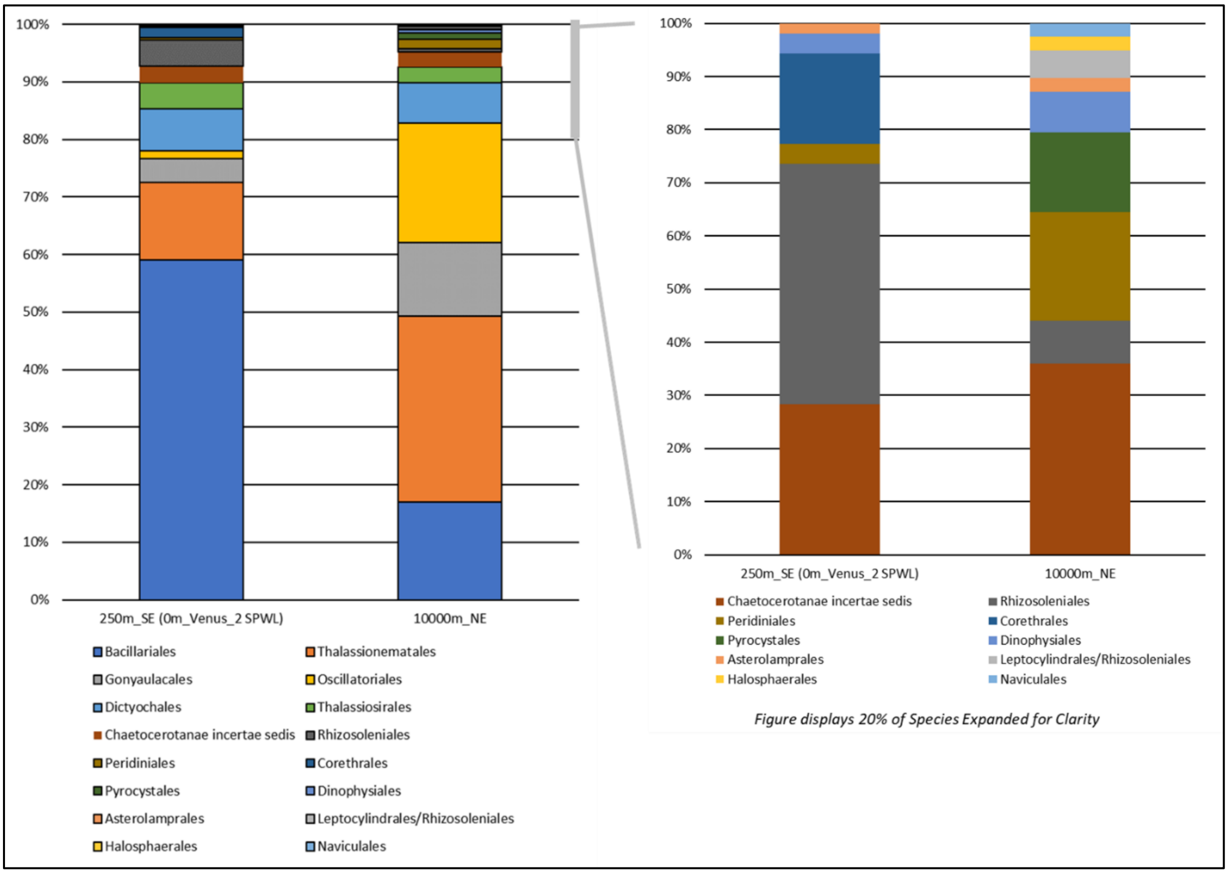


Figure 3.38 Relative Proportions of Phytoplankton Phylum Recorded in Block 2913B

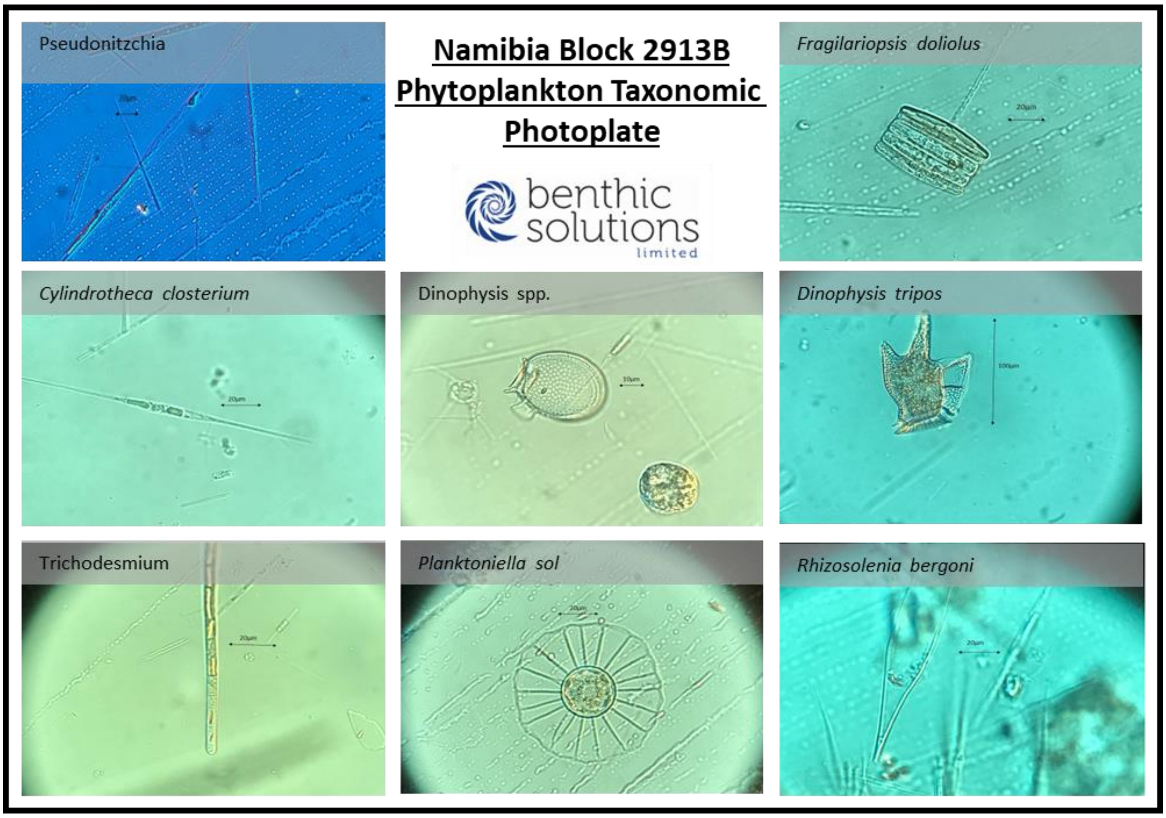


Figure 3.39 Example Images of Phytoplankton Species Encountered Within Block 2913B

3.8.3.3 *Zooplankton*

A vertical zooplankton trawl was carried out from 100m water depth to the surface at seven locations within the Block 2913B survey area. The vertical trawls were acquired for analysis using a 325µm mesh zooplankton net, which sampled 15.9m^3 of seawater. As for Phytoplankton, zooplankton samples for the regional sampling phase 2 of Block 2913B (B2913B_ENV_21_SUR, B2913B_ENV_36_SUR, B2913B_ENV_35_SUR, B2913B_ENV_45_SUR, and B2913B_ENV_50_SUR) were lost during the transit from the vessel to the laboratory in France. Due to the loss of the plankton data at these five stations, underwater video profiler (UVP) profiles conducted in the same general area in 2015 by Creocean have been utilised as a regional reference. The results are discussed in Section 3.8.3.4.

The primary and derived diversity indices for the zooplankton community from the two water samples collected during phase 1 are included in Table 3.22. This revealed a diverse community with 6,343 individuals recorded across the two samples within Block 2913B. **Zooplankton species were relatively consistent across the stations, with an average of 52 species per trawl recorded (±4SD)**. Number of cells was more variable, ranging from 2,208 at station 10000m_NE to 4,135 at station 250m_SE, with no obvious pattern of distribution.

Table 3.22 Univariate Parameters for Block 2913B Zooplankton Trawls

Station	Number of Species (S)	Number of Cells (N)	Richness (Margalef)	Evenness (Pielou's Evenness)	Shannon-Wiener Diversity	Simpson's Diversity (1-Lambda')
250m_SE	55	4135	6.48	0.555	3.21	0.772
10000m_NE	49	2208	6.23	0.748	4.20	0.919
Mean	**52**	**3172**	**6.36**	**0.651**	**3.70**	**0.846**
Standard Deviation	**4**	**1363**	**0.18**	**0.136**	**0.70**	**0.103**
Variance (%)	**8.2**	**43.0**	**2.8**	**20.9**	**18.9**	**12.2**

A total of 67 species from nine phyla were recorded in the two Block 2913B water samples, with Arthropoda representing on average 93.4% of the zooplankton captured, followed by Chaetognatha (3.45%) and Mollusca (1.2%) (Table 3.23).

Table 3.23 Percentage Contribution of Zooplankton Within Block 2913B

Taxonomic Groups	Arthropoda								Chaetognatha		Echinodermata	Mollusca				Annelida		Ctenophora	Hydrozoa		Retaria	Chordata			Ichthyoplankton
	Copepoda			Thecostraca	Malacostraca								Gastropoda			Polychaeta							Thaliacea		
	Copepoda Calanoida	Copepoda Cyclopoida	Copepoda Harpacticoida	Scalpellomorpha	Decapoda	Euphausiacea	Amphipoda	Ostracoda	Chaetognatha	Aphragmophora	Asteroidea	Bivalvia	Littorinimorpha	Pteropoda	Gastropoda	Phyllodocida	Polychaeta		Siphonophorae	Hydrozoa	Foraminifera	Appendicularia	Doliolida	Salpida	
250m_SE	88.7	1.4	0.0	0.0	0.0	2.2	0.7	1.1	3.5	0.1	0.0	0.1	0.0	0.9	0.1	0.1	0.1	0.0	0.4	0.0	0.4	0.2	0.2	0.0	0.0
10,000m_NE	78.0	8.4	0.4	0.1	0.0	1.8	0.4	3.6	3.2	0.1	0.0	0.0	0.0	1.3	0.0	0.4	0.2	0.0	1.7	0.1	0.0	0.1	0.0	0.0	0.0
Mean	**83.3**	**4.9**	**0.2**	**0.1**	**0.0**	**2.0**	**0.6**	**2.4**	**3.3**	**0.1**	**0.0**	**0.0**	**0.0**	**1.1**	**0.0**	**0.2**	**0.1**	**0.0**	**1.1**	**0.0**	**0.2**	**0.1**	**0.1**	**0.0**	**0.0**
Standard Deviation	**7.6**	**4.9**	**0.3**	**0.1**	**0.0**	**0.3**	**0.2**	**1.7**	**0.2**	**0.1**	**0.0**	**0.1**	**0.0**	**0.3**	**0.0**	**0.2**	**0.1**	**0.0**	**0.9**	**0.1**	**0.3**	**0.1**	**0.1**	**0.0**	**0.0**
Variance (%)	**9.1**	**100.5**	**141.4**	**141.4**	**41.9**	**14.5**	**33.9**	**73.3**	**5.9**	**66.2**	**141.4**	**141.4**	**41.9**	**26.5**	**5.9**	**93.6**	**81.0**	**141.4**	**87.6**	**141.4**	**141.4**	**52.3**	**141.4**	**41.9**	**41.9**

Copepods were overwhelmingly dominant amongst the Arthropoda, comprising 95.7% at 250m_SE and 93.6% at 10000m_NE of this phylum at both stations. Copepoda were comprised of 36 species of which 84.9% of the species were Calanoida. The Calanoida is an order of copepods, dominant in the plankton in many parts of the world's oceans, making up 55% to 95% of plankton samples. They are therefore important in many food webs, taking in energy from phytoplankton and algae and 'repackaging' it for consumption by higher trophic level predators. Many commercial fish are dependent on calanoid copepods for diet in either their larval or adult forms. Baleen whales such as bowhead whales, sei whales, right whales and fin whales eat calanoid copepods as an important food source.

The relative proportions of each phylum are displayed in Figure 3.40. A single juvenile fish was recorded in the samples collected, as well as good examples of a salp, and other zooplankton species (Figure 3.41).

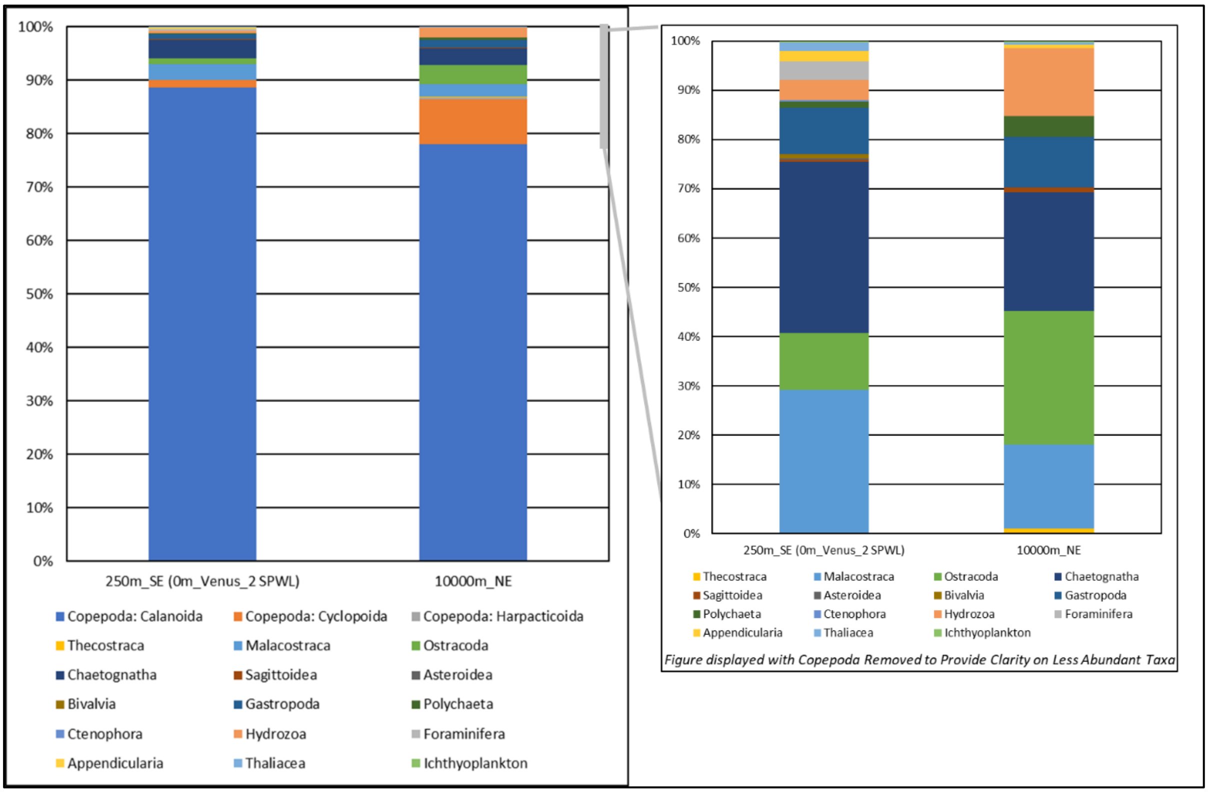


Figure 3.40 Relative Proportions of the Zooplankton Phylum recorded in Block 2913B

Figure 3.41 Example of Zooplankton Species Encountered Within Block 2913B

3.8.3.4 *Underwater Video Profiler*

The following text has been adapted from the Block 2912 environmental baseline report (Creocean, 2023a).

Profiles were performed at six stations between the 20th and 22nd December 2015 along an offshore-coast gradient in the same area as Block 2912 and 2913B, to assess the plankton diversity in the area. However, station S_1310, was of particular interest given its deep profile and proximity to Block 2912/2913B (Figure 3.42). Data were provided by the data owner Rainer Kiko from GEOMAR.

The UVP is an underwater video profiler that consists of a camera with its lens facing downward to take pictures of any particle, living or dead, passing in front of the lens and between two LEDs that illuminate a body of water of approximatively 1 L. A UVP profile is usually done during the descent of the camera, from the surface to the bottom of the water column. A UVP profile records the distribution of organisms ranging from 64 to 55mm in size range (Kiko *et al.* 2022) within the water column and yields an estimate of the biovolume of plankton based on image analysis. Note that abundances estimated from UVP images are derived from a smaller water volume compared to those caught in a net.

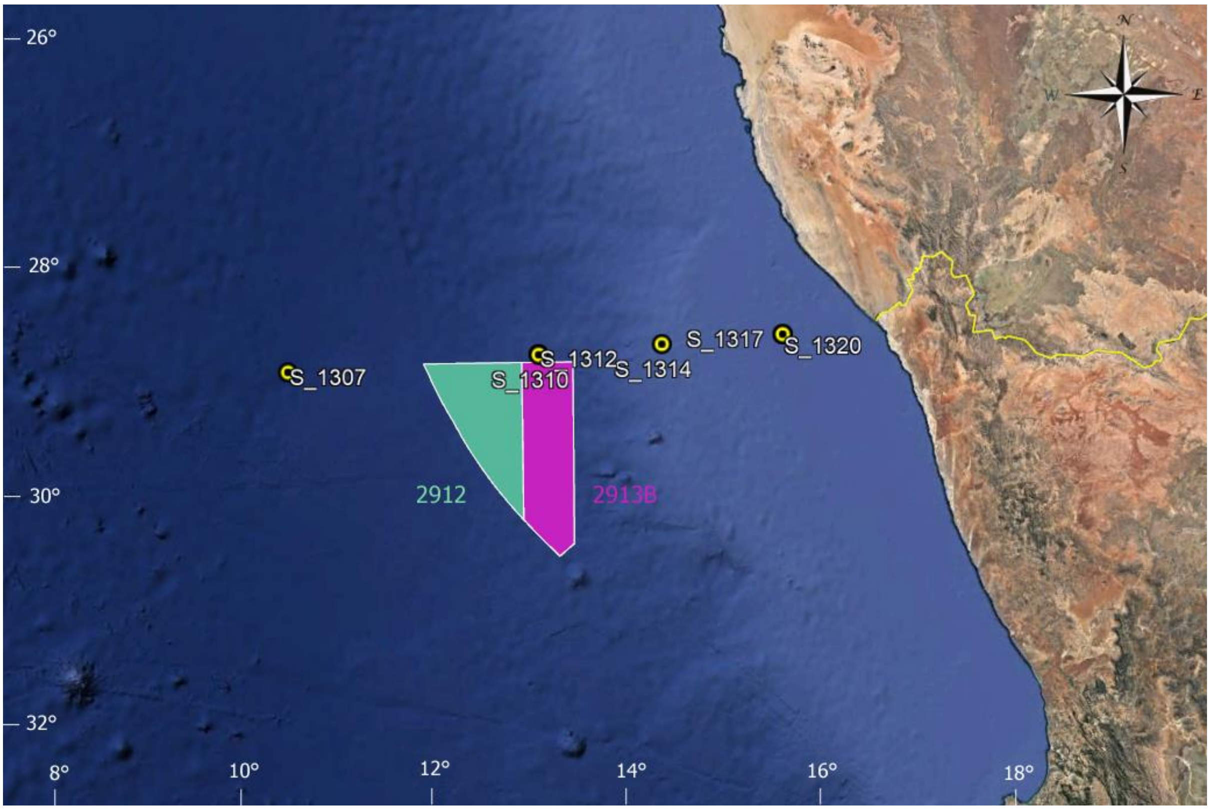


Figure 3.42 Location of UVP Stations (Source: Creocean, 2023a)

3.8.3.4.1 Phytoplankton and Protists Community

The phytoplankton community determined from the 2015 UVP data was characterised by filamentous cyanobacteria of the genus *Trichodesmium,* which also characterised the phytoplankton community at station 10000m_NE in the current study. Protists of the Rhizaria infrakingdom, which can be microalgal symbionts, were also very abundant. In particular, Phaeodaria, Acantharea, Foraminifera, and Polycystinea were observed at the different stations.

Trichodesmium were observed in nearly all stations with an abundance of 3.38 cells m^{-3} at station S_1310. At station S_1310, the protist community was characterized by high abundances of Phaedoria that represented 41% of the protist abundance at this station. Phaeodaria were distributed throughout the water column down to 2125 m, though the highest abundances were found around 400-500 m depth. Foraminifera represented 20% of the abundance of protists at S_1310 and were found higher in the water column reaching down to a 425 m water depth. Finally, the Polycystinea represented only a small fraction of the protists abundance at S_1310 station (3%), but the specimen was observed in deep water at 1,375 m.

Trichodesmium biovolumes were low compared to their abundances, with biovolumes varying from 1.50 to 2.82 mm3 m^{-3}. At station S_1310, Foraminifera represented 85% of the protists biovolume, however, further analyses of the data showed that this very large biovolume was mainly due to one specimen observed at 425m depth that bore particularly larges spicules.

Overall, the phytoplankton community in both surveys were primarily composed of diatoms.

3.8.3.4.2 Zooplankton Community

The zooplankton community identified using the UVP profiles was composed of multiple groups belonging to the crustacean subphylum including mostly copepods, Eumalacostraca, amphipods and ostracods, similar to the results for stations 250m_SE and 10000m_NE. A wide variety of gelatinous zooplankton also characterized the different stations investigated, such as Hydrozoa, Siphonophorae, Trachymedusae, Chaetognatha and Appendicularia.

Total zooplankton abundance was much lower at the offshore UVP stations (S_1307, S_1310, S_1312, S_1314) with around 20 individuals m^{-3} compared with stations near the coast (S_1317 and S_1320) that had approximatively 100 individuals m^{-3} in total. Despite this difference, all stations were dominated in term of abundance by copepods that represented 23% to 36 % of the zooplankton abundance at the offshore stations, and 54% to 56% of the zooplankton abundance at the coastal stations. Copepods were in much higher abundances in the current study (250m_SE and 10000m_NE), where copepods contributed to on average 83.3% of the zooplankton community. The analysis of the S_1310 station revealed that copepods represented most of the zooplankton abundance (36%), followed by Amphipoda (13%), and Eumalacostraca (11%). As described above for offshore stations in general, Chaetognatha also represented a large part of the zooplankton community abundance (11%). At S_1310, crustaceans appeared to be evenly distributed throughout the water column and down to 2625m depth. In comparison, gelatinous plankton such as Chaetognatha, Hydrozoa and Trachymedusae were observed higher in the water column and down to a 1,625m water depth

Zooplankton biovolumes were not proportional to the abundances described above as the difference between offshore and coast stations was less evident. S_1317 located near the coast had particularly large biovolumes of 886.79 mm3 m^{-3} while the other stations had total zooplankton biovolumes ranging from 192.68 to 386.61 mm3 m^{-3}. In general, Amphipoda and Eumalacostraca had the highest biovolumes representing 22% to 46 % and 5% to 49 % of the total zooplankton biovolume, respectively. Despite high abundances, gelatinous zooplankton represented a smaller fraction of the zooplankton biovolume, from 1% to 10 % for Chaetognatha for instance. The only exception to this trend was recoded at station S_1310 as it was characterised by large biovolumes of Eumalacostracan, Amphipoda, Siphonophorae and Chaetognatha, representing respectively 28%, 22%, 20%, and 10 %

of the zooplankton biovolume. The distribution pattern of zooplankton biovolumes followed the distribution of abundances in general although the largest specimens of Chaetognatha were observed at relatively the same depth, ranging from 800 to 1,000m.

Overall, zooplankton communities were fairly similar between the 2015 UVP study and the current survey but copepods were much more abundant in the current survey, which may relate to seasonal recruitment phase for the taxa.

3.8.3.5 *Microbiology*

Seawater samples were collected at three depths from seven locations across Block 2913B for microbiology testing, specifically aerobic heterotrophic microorganisms (yeast, fungi, bacteria) and hydrocarbon-degrading microorganisms (yeast, fungi, bacteria).

Bacteria in unpolluted seawater are generally considered scarce; contributing factors to this may include the lack of requisite nutrients, presence of bacteriophages, consumption of bacteria by protozoa and other predators, competition with other microorganisms, adsorption of bacteria and sedimentation, and destruction by sunlight (Waksman and Hotchkiss, 1937; Carlucci and Pramer, 1959). Seawater is considered to contain 0.2 to 2.0ppm of suspended particulate which bacteria may adsorb to and settle out of the water column to the seabed (Carlucci and Pramer, 1959). This process may lead to an accumulation of bacteria in the sediments rather than the water column (Carlucci and Pramer, 1959).

Studies into microbial communities in oil-contaminated seawater have identified two proteobacteria which are known to degrade alkanes and aromatic hydrocarbons: *Alcanivorax* and *Cycloclasticus* respectively (Harayama *et al.*, 2004). This study however did not identify individual species, but instead looked at the presence of microorganism groups. A summary of microorganism counts from water samples are listed in Table 3.24.

Table 3.24 Water Microbiology

Station	Depth (m)	Bacteria	
		Aerobic heterotrophic microorgansims (cfu.ml^{-1})	Hydrocarbon degrading microorgansims (cfu.ml^{-1})
250m_SE_SUR	5	25000	<5
250m_SE_MID	1000	60000	<5
250m_SE_BOT	2900	250000	<5
10000m_NE_SUR	5	60000	<5
10000m_NE_MID	1000	25000	<5
10000m_NE_BOT	2900	60000	13
B2913B_ENV_21_SUR	5	1500	<0.31
B2913B_ENV_21-MID	1000	1800	930
B2913B_ENV_21-BOT	2628	860	<0.31
B2913B_ENV_35_SUR	5	430	5800
B2913B_ENV_35_MID	1000	150	190

Station	Depth (m)	Bacteria	
		Aerobic heterotrophic microorgansims (cfu.ml^{-1})	Hydrocarbon degrading microorgansims (cfu.ml^{-1})
B2913B_ENV_35_BOT	2652	<0,31	2200
B2913B_ENV_36_SUR	5	2000	4.3
B2913B_ENV_36_MID	2877	2100	93
B2913B_ENV_36_BOT	3164	1600	0.92
B2913B_ENV_45_SUR	5	570	<0.31
B2913B_ENV_45_MID	1000	260	150
B2913B_ENV_45_BOT	2750	37	<0.31
B2913B_ENV_50_SUR	5	92	0.92
B2913B_ENV_50_MID	1000	1200	2.3
B2913B_ENV_50_BOT	3100	360	<0.31

Aerobic heterotrophic microorganisms were present in highly variable quantities with no discernible pattern of distribution. Quantities ranged from 37cfu.ml^{-1} at the bottom water sample of B2913B_ENV_45 up to 250,000cfu.ml^{-1} in the bottom water sample at station 250m_SE_BOT. **Hydrocarbon degrading microorganisms were recorded at all stations and were equally as variable in their quantities and distribution**. The highest concentration in hydrocarbon degrading microorganisms was seen in the surface water sample at station B2913B_ENV_35 (5800cfu.ml^{-1}); this value being considerably higher than the majority of concentrations recorded. The station is far from any developed wells and it is unsure the reason for the higher concentration present compared to the rest of the water sampling points.

3.9 Environmental Habitats

In addition to the laboratory analysis and interpretation of benthic samples, video and camera ground-truthing were acquired using both live-feed and non-live-feed towed camera systems along 10 transects within the wider Block 2913B area. In addition, two transects at the Venus-1X FWL were analysed with results discussed in the Venus-1X EPOS report (BSL, 2023c). Drop-down HD pressure camera footage was also acquired at 63 box core stations across Block 2913B (no video acquired at station 500m_NW, B2913B_ENV_24 and B2913B_ENV_28; see Appendix XI – Box Corer Video Log Sheets).

3.9.1 *Block 2913B General Habitat Characterisation*

Grab samples and camera data revealed **a single broad habitat type present across the Block 2913B survey area**. Subtle variations in surface sediments were observed across the overarching mud-dominated habitat, but these were not pronounced enough for a separate habitat delineation. **Conspicuous fauna across Block 2913B showed relatively high epifaunal diversity for a homogeneous abyssal mud-dominated habitat, with a total of 25 epifaunal species recorded.**

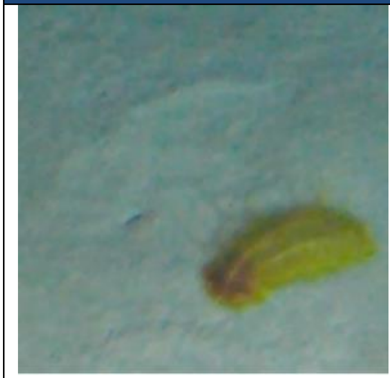
Mobile Arthropoda were widespread across the Block and included incidences of shrimp (Caridae sp.), hermit crabs (Paguridae sp.) with associated anemones along with an unidentified species of white crab (Crustacea). Other mobile fauna included a variety of Echinodermata, such as starfish (Asteroidea sp.), brittle stars (Ophiuridae sp.), sea urchins (*Hygrosoma* sp. And Echinidae sp.), sea cucumbers (*Benthodytes* sp.; Holothuridae sp.) and sea pigs (*Scotoplanes* sp.). Mobile Chordata species such as eel-shaped fishes (Halosauridae sp.), rat-tails (Macrouridae sp.), tripod fishes (Ipnopidae sp.), cusk-eels (Ophidiidae sp.) and larvacean houses (*Appendicularia* sp.) were also present.

Sessile epifauna also showed a relatively high diversity with an abundance of Anthozoa such as venus fly trap anemones (*Actinoscyphia aurelia*), seapens (Pennatulacea sp. And *Umbellula* sp.), sea whips (Gorgonacea sp.), unidentified sea anemones (Actinaria sp.) and unidentified Cnidaria. Xenophyophores, a clade of foraminiferans, were also ubiquitous across the 2913B survey area; however, given their growth form, it was impossible to identify which colonies were alive. Additionally, relatively rare occurrences of swimming Annelida, acorn worms (Hemichordata; possibly *Tergivelum cinnabarinum*), acorn barnacles (Scalpellomorpha sp.) were observed across the survey area. The most notable species across Block 2913B were unidentified tube-building annelids, which formed dense aggregations across camera transects B2913B_CAM_05 (NE of the Development area (P1)), B2913B_CAM_15 and B2913B_CAM_17 (SE of the Priority area (P2)).

Example seabed images of macrofauna within the B2913B survey area are presented in Figure 3.43, with specific locations described above displayed in Figure 3.45. Furthermore, example seabed and sample images from transects are provided in Appendix XVI – Seabed Photographs from Transects.

The Block 2913B habitats assigned during this survey campaign corresponded relatively well with previous surveys within Block 2913B. For example, the 2018 BSL environmental baseline and habitat assessment survey (EBS/HAS) also identified homogeneous mud-dominated habitats across the Block.

Conspicuous Fauna		
 Hermit crab and anemone (Paguridae sp. And Actinaria sp.)	 Unidentified crab (Crustacea sp.)	 Shrimp (Caridea sp.)
 Starfish (Asteroidea sp.)	 Brittle star (Ophiuroidea sp.)	 Starfish (Asteroidea sp.)
 Sea cucumber *Benthodytes* sp.	 Sea cucumber *Benthodytes* sp.	 Sea cucumber (Holothuroidea sp.)

Conspicuous Fauna		
 Sea cucumber (Holothuroidea sp.)	 Sea pig (*Scotoplanes* sp.)	 Tripod fish (Ipnopidae sp.)
 Tripod fish (Ipnopidae sp.)	 Cusk eel (Ophidiidae sp.)	 Rat tail (Macrouridae sp.)
 Eel-like fish (Halosauridae sp.)	 Anemone (Actinaria sp.)	 Anemone (Actinaria sp.)

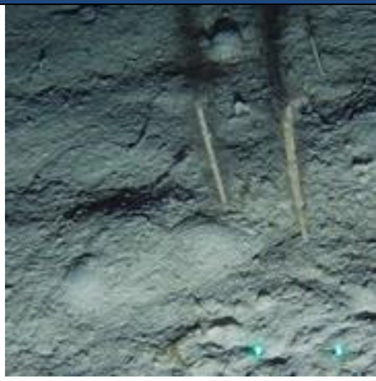
Conspicuous Fauna		
 Sea pen (Umbellula sp.)	 Annelid tube (Annelida sp.)	 Sea whip (Gorgonacea sp.)
 Cnidaria	 Acorn worm (Hemichordata sp. Possibly *Tergivelum cinnabarinum*)	 Acorn worm (Hemichordata sp.)
 Acorn barnacle (Scalpellomorpha sp.)	 Xenophyophores	 Larvacean house (posibily *Appendicularia* sp.)

Figure 3.43 Example Images of Conspicuous Fauna

3.9.2 *Block 2913B EUNIS Habitat Characterisation*

The broad-scale habitat encountered across Block 2913B was defined as **MG62 'Atlantic abyssal mud'** (Table 3.25). Evidence of '**Lebensspuren', bioturbation and burrowing megafauna communities were ubiquitously present across the survey area** and surface 'green gelatinous mucous ', which could not be attributed to any specific organism(s), was present across the northern and central extents of the priority area.

Table 3.25 Summarised Habitats Within the Survey Area

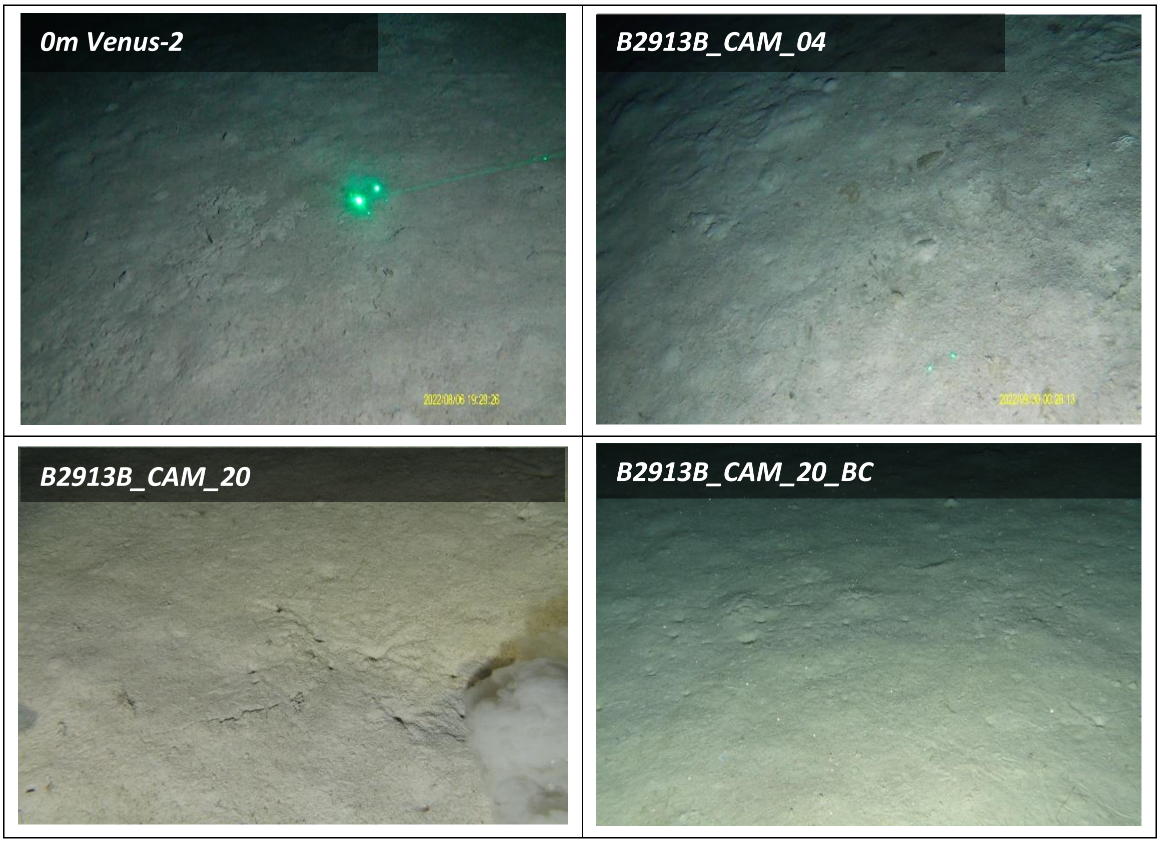
Designated Habitat	EUNIS Classification 2012	EUNIS Classification 2019	Depth within Block 2913B (m)	Designation Justification
Atlantic abyssal mud	A6.5	MG62	2,500 to 3,200	EUNIS classification, PSA and macrofauna return and video footage/captured stills. Relatively diverse infaunal community, dominated by polychaetes with sparse epifauna which include mobile species such as hermit crabs and sessile species such as glass sponges, sea pens and soft corals. Burrowing fauna are also likely to be present.
Habitat assignment following infauna analysis				
Cerianthid anemones and burrowing megafauna in Atlantic mid bathyal mud	A6.5	ME6211	2,500 to 3,200m	Habitat classification following review of infaunal analysis. Biotope characterised by burrowing anemones (Cerianthidae), unidentified hydroids (Hydrozoa) and unidentified tube worms (Sabellidae) on bioturbated mud with phytodetritus. Potentially large burrows supporting associated unknown megafauna, rare occurrence of seapens and stalked sponges (Hyalonema). A sum of 21 individuals from these characterising species were found; one *Virgularia mirabilis*, one Cerianthidae individual and 19 Sabellidae individuals.

All stations surveyed across Block 2913B were represented by the habitat 'Atlantic abyssal mud' (EUNIS: MG62). The surface sediments across the survey area were heavily reworked by **bioturbation ('Lebensspuren')** with evidence of crustacean and polychaete burrows, urchin tracks and Hemichordata (possibly *Tergivelum cinnabarinum*) feeding spirals. The variable burrow density observed will be further discussed in Section 3.9.3. The presence of this habitat within the survey area is unsurprising given the Namibian continental shelf is dominated by high-productivity upwelling areas where benthic habitats are often characterised by large areas of diatomaceous ooze, fed by the sedimentation of excess surface production (SLR Environmental Consulting, 2017). Atlantic abyssal mud habitats are described by EUNIS as "*Deep-sea mud sediments have a diverse infaunal community dominated by polychaetes. Epifauna tends to be sparse, mobile species, but aggregations of erect fauna such as glass sponges, sea pens and soft corals can occur*".

The relatively diverse faunal assemblages described above Section 3.9.1, in conjunction with 2,500m and 3,200m water depth range and mud-dominated sediments indicate conformance towards the **level three EUNIS habitat classification MG62 describing 'Atlantic abyssal mud'**. Example images of the 'MG62 'Atlantic abyssal mud' habitat classification is provided in Figure 3.44.

However, aggregations of unidentified tube-building annelids could indicate some conformance to the ME6211 'Cerianthid anemones and burrowing megafauna in Atlantic mid bathyal mud' habitat. On review of the infaunal data set, there were 21 individuals of key characterising species of the 'Cerianthid anemones and burrowing megafauna in Atlantic mid bathyal mud' habitat found in the survey area; one *Virgularia mirabilis,* one Cerianthidae individual and 19 Sabellidae individuals. Therefore we can confidently assign the ME6211 'Cerianthid anemones and burrowing megafauna in Atlantic mid bathyal mud' habitat as another broadscale habitat found in Block 2913B.

The extent of the broad-scale mud-dominated habitat within Block 2913B is presented in Figure 3.45 and is **based upon both visual observation and grab sample particle size analysis**. It is important to note that where imagery of the seafloor was not directly obtained, in the absence of side scan sonar data, the extent of the habitat has been described based on the bathymetric similarity. **Therefore, the extension of the mud habitat through extrapolation obtained by the camera footage is provided as a guide and may not be a true representation of the extent of the sea floor habitat present.**



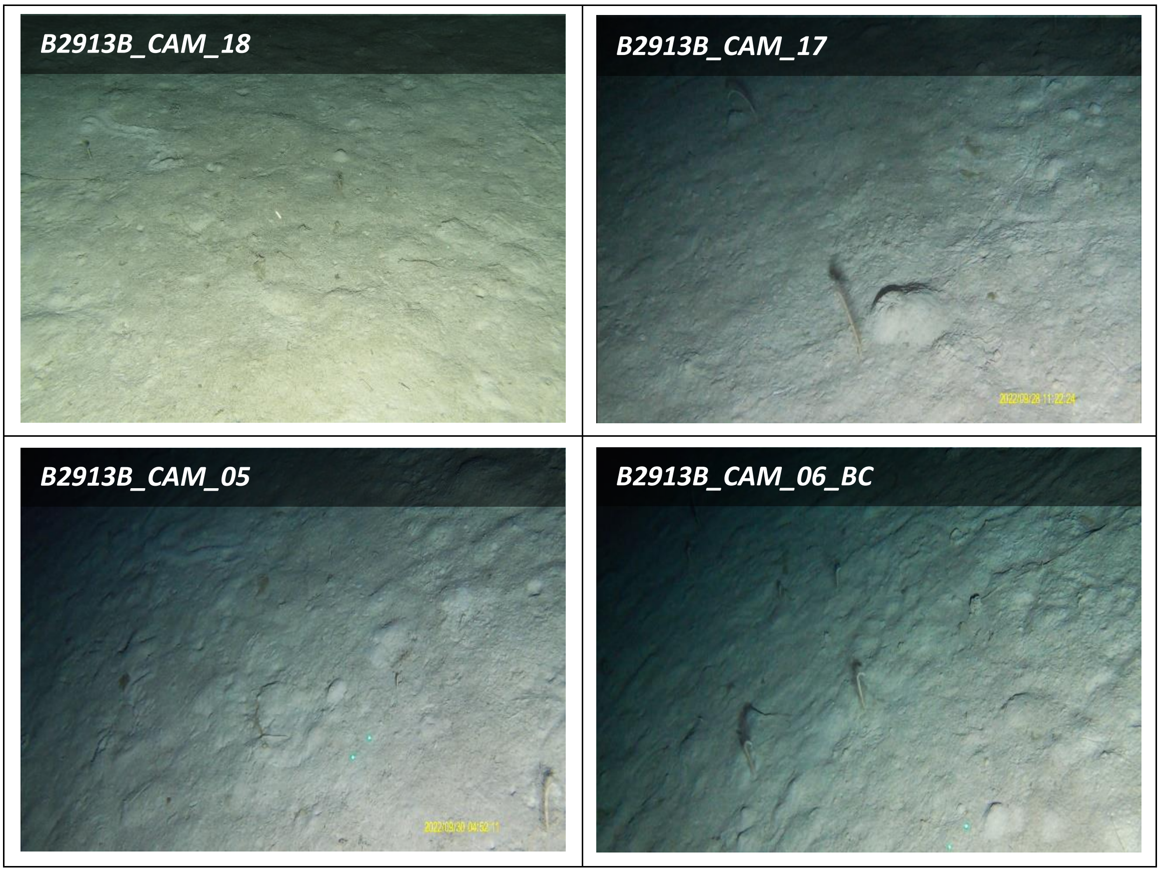


Figure 3.44 Example Images of MG62 Atlantic Abyssal Mud

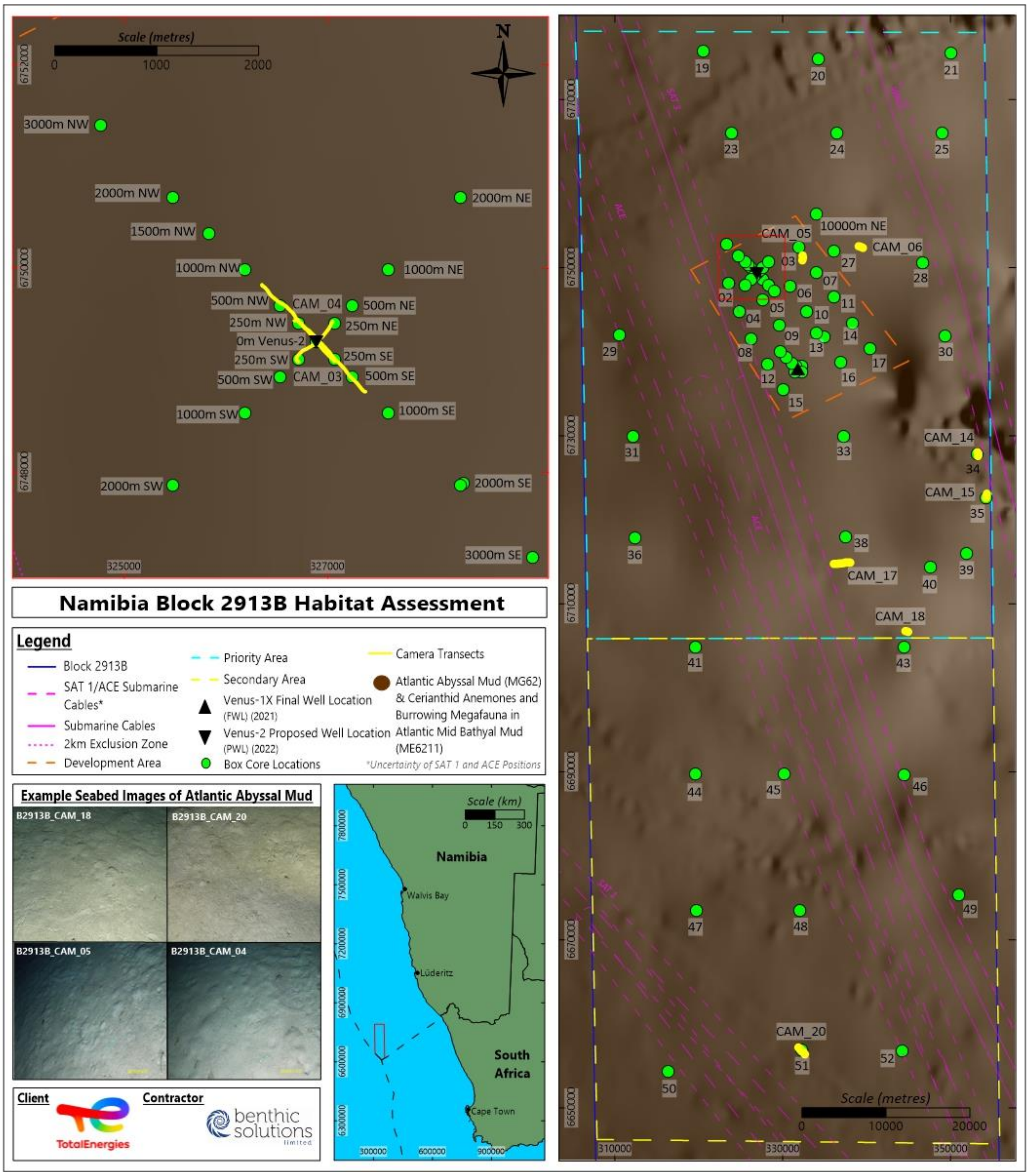


Figure 3.45 Environmental Habitats Within Block 2913B

3.9.3 *Potentially Sensitive Habitats and Species*

3.9.3.1 *Overview of Potential Habitat Sensitivities*

A review of potentially sensitive habitats present within Block 2913B has been carried out based on survey observations, including box core drop down HD video footage and towed Seabug HD camera footage.

Although habitat legislation relevant to the identified abyssal mud habitat type is listed by one or more International Conventions and European directives, these are **not directly applicable to Namibian waters.** Therefore, assessments of video footage below can be used as an indicator of the presence and potential importance of a habitat within the Block 2913B survey area, although these are only described as 'sensitive' by those conventions and directives listed above.

During the environmental survey 2022 campaigns undertaken in Block 2913B, the following potentially environmentally sensitive habitat was identified:

- Sea pen and burrowing megafauna communities.

This habitat is listed in the OSPAR (Oslo and Paris Conventions for the protection of the marine environment in the North-East Atlantic) "List of Threatened and/or Declining Species and Habitats" and is currently considered under threat and/or decline in all OSPAR areas of the Northeast Atlantic where it occurs (OSAPR, 2008). Although such legislation concerning the "Sea pen and burrowing megafauna communities" habitat is not directly applicable to Namibian waters and may prove not to be of similar conservation interest offshore Namibia, it has been highlighted in this report to form the basis of an overall **precautionary approach** to habitat assessment and classification.

3.9.3.2 *Burrow Assessment (Sea pen and Burrowing Megafauna Communities)*

The key determinant for the classification of 'Seapen and Burrowing Megafauna Communities' is the presence of burrowing species or burrows at a SACFOR density of at least 'frequent' (Table 3.26). However, application of the SACFOR scale is dependent on the size of the fauna being assessed. While no megafauna were specifically observed interacting with the burrows in the acquired footage, upon review of the faunal data available, it is likely several crustacean species are responsible for creating the observed burrows, including shrimp which were recovered at several stations. Although no burrowing macrofauna were observed interacting with these burrows, other species previously observed in Namibian waters such as *Upogebia capensis* create similar burrows and have an average body length between 3-15cm (Holthuis, 1991), supporting the decision to use this size class in the SACFOR assessment.

Table 3.26 SACFOR Abundance Scale

Cover (%)	Crust/ Meadow	Massive/ Turf	<1cm	1-3cm	3-15cm	>15cm	Density	
>80%	S		S				>1/0.001m^2 (1x1 cm)	>10,000/m^2
40-79%	A	S	A	S			1-9/0.001m^2	1000-9999/m^2
20-39%	C	A	C	A	S		1-9 / 0.01m^2 (10 x 10 cm)	100-999/m^2
10-19%	F	C	F	C	A	S	1-9 / 0.1m^2	10-99/m^2
5-9%	O	F	O	F	C	A	1-9/m^2	1-9/m^2
1-5% or density	R	O	R	O	F	C	1-9 / 10m^2 (3.16 x 3.16m)	0.1 to 0.9/m^2
<1% or density		R		R	O	F	1-9 / 100m^2 (10 x 10m)	0.01/m^2
					R	O	1-9 / 1000m^2 (31.6 x 31.6m)	-
						R	<1/1000m^2	-

Key

S	A	C	F	O	R
Super-abundant	Abundant	Common	Frequent	Occasional	Rare

Evidence of burrowing megafauna was observed on the video footage along every transect across the survey area. Based on the operational limits of deploying camera systems below 3,000m water depth a non-live-feed HD video camera was deployed. This deployment strategy was successful in collecting adequate data to inform a habitat assessment; however, not all the footage could be used to confidently assess burrow density. **Camera transect B2913B_CAM_03, located near Venus-2 PWL, had the highest visual abundance of burrows and a relatively continuous view of the seabed, which enabled a representative burrow assessment for the Block 2913B survey area to be conducted**.

Screenshots of the B2913B_CAM_03 HD video transect footage were taken when the camera system touched the seabed and resulted in 76 still images, providing a representative dataset for estimating the spatial variability in burrow densities across the survey area The estimated density of 3-15 cm burrows, which was the focus of the assessment based on the unlikeliness that any observed organism below 3cm would create or inhabit them, ranged between **0.00 ind/m^2 and 36.11 ind/m^2** (see Appendix XV – Burrow Density Assessment for more details), with an **average burrow density of 2.61 ind/m^2** recorded along the entire transect. The estimated densities therefore ranged from **'absent' to 'abundant' based on the SACFOR abundance scale,** with the **average density indicative of a 'common' burrow abundance.**

The SACFOR abundances of burrows across the transect, indicate some conformance to the 'Seapen and burrowing megafauna communities' sensitive habitat; however, an average 'frequent' burrow density (0.1 to 0.9/m^2) is required for conclusive characterisation. Although a single transect was analysed, similar sediment appeared throughout all transects and **therefore, it is likely that seapen and burrowing megafauna habitats are present within the overarching MG62 'Atlantic abyssal mud' habitat**.

However, no literature on the protected status of burrowing megafauna in Namibia offshore waters was found during analysis, and therefore **these areas are not thought to be of conservation interest in Namibian waters, where this habitat does not appear to be particularly rare or at risk from anthropogenic impact.**

4 Conclusion

Block 2913B covers an approximate **surface area of 8,215km^2** with **a water depth ranging from approximately 2,500m to over 3,200m below sea level**. The **Venus-2 proposed well location (PWL) is situated in a water depth of 2,970m.**

The results of the particle size analysis revealed **homogeneous sediments across the Block** which is to be expected given the low variation in water depth and seabed features. All stations were **dominated by fines with most classified as 'Sandy Mud' on the Folk classification scale**.

Total organic carbon (TOC), total organic matter (TOM), nitrogen and phosphorous were considered low throughout the survey area. TOC and TOM in the sediments were slightly higher surrounding the Venus-2 PWL but was still indicative of a pristine deep-sea environment. The subtle difference in the organic results likely reflects the sample analysis of phase 1 and phase 2 occurring in different periods of the laboratory schedule. Despite the minor variation in the data, all results were low and close to the LOD of the laboratory instrument with **no indication of any contamination within the survey area.**

Total hydrocarbon concentrations (THC) in sediment were considered low across the Block reflecting natural background levels and no anthropogenic impact. Total n-alkanes were also considered relatively low and indicative of a pristine deep-sea environment. Gas chromatogram inspection revealed some partially unresolved complex mixtures present, likely as a result of regional influences such as riverine/terrestrial run-off or shipping activity in the area. **There were no distinct drilling fluid signatures in the GC-traces. Total PAHs were low** throughout the survey area. THC, n-alkanes and PAH concentrations were very slightly higher at stations comprising the cruciform sampling surrounding the Venus-2 PWL, but this reflects the sample analysis of phase 1 and phase 2 occurring in different periods of the laboratory schedule. **Apart from this, there was no clear geographic or depth related pattern in hydrocarbon values throughout Block 2913B. Sediment BTEX were below their respective Limit of detections.**

Concentrations of most metals in sediment remained at background levels. Most elements were recorded at or below the low 'effect range' levels, with nickel being the only metal recorded in concentrations that exceeded its respective effect range low. Despite this, all values were below the effect range medium value. **The physical nature of the sediment (a high sedimentary fines content) had a clear effect on heavy metal concentrations, with significant relationships recorded between the proportion of fines and most of the metals analysed, indicating a natural spatial variation across the survey area.**

Species richness and faunal abundance was variable across the survey area, reflecting the homogeneous sandy mud sediment present. A total of 2,534 individuals were recorded, of which 88 annelid species accounted for 54.1% of the total number of individuals. **Average Shannon-Wiener Diversity Index values indicating 'good' diversity across the Block. There was no obvious spatial patten for diversity across the Block.** Further analysis using multivariate statistics identified four significantly different macrofaunal groupings within the survey area at a Bray-Curtis similarity slice of 25%. The first cluster comprised most of the sampling stations with high levels of species richness, abundance and diversity; while the other three clusters contained a total of four stations which had lower species richness, abundance and diversity. **However, all clusters were considered to reflect typical background communities for deep-sea sediments, with differences thought to reflect natural patchiness in the distribution of benthic faunal communities or differences in grab retention, as opposed to the influence of notable physical or chemical gradients.** Aerobic heterotrophic microorganisms were present in high quantities across the Block, while hydrocarbon degrading microorganisms were recorded in variable quantities from below the limit of detection to over 11,000NPP.g^{-1} at six stations.

Water column profiles within the survey area revealed the presence of **four vertically-arranged water masses** consisting of **South Atlantic and Subtropical Surface Waters** where a thermocline was present, **Eastern South Atlantic Central Water**, followed by **Antarctic Intermediate Water** where the salinity minimum was recorded, and lastly water characteristic of the **North Atlantic Deep Waters** was documented below 1,000m. The majority of the metals and all of the phenols were either below the limit of detection or present at very low concentrations, **indicating no water column contamination across the Block.**

Nutrients within the water samples were relatively low across the survey area, with nitrite and nitrate concentration considered to be 'in very good condition' for all samples. **Orthophosphate results were more variable with a range of 'very good', 'good', 'medium' and 'poor' conditions achieved.** Despite chlorophyll-*a* and phaeopigments being in low concentration in the two samples analysed in Block 2913B, phytoplankton numbers were moderate, where the assemblages were mainly dominated by diatoms followed by dinoflagellates. The zooplankton were diverse, with a total of 67 species from nine different taxonomic groups identified from the two vertical trawls from Block 2913B, with over 85% represented by copepods.

A single broad habitat was encountered across the entire extent of the survey area at all stations sampled and was defined as **MG62 'Atlantic abyssal mud'.** Conspicuous fauna across Block 2913B showed relatively **high epifaunal diversity for a homogeneous abyssal mud-dominated habitat, with a total of 25 epifaunal species recorded.** Surface sediments across the survey area were heavily reworked by **bioturbation ('Lebensspuren')** with evidence of crustacean and polychaete burrows, urchin tracks and Hemichordata (possibly *Tergivelum cinnabarinum*) feeding spirals.

A single OSPAR classified sensitive habitat, 'Seapen and burrowing megafauna communities', was identified as potentially occurring within the survey area. Evidence of burrowing megafauna was observed on the video footage along every transect across the survey area. Based on the operational limits of deploying camera systems below 3,000m water depth a non-live-feed HD video camera was deployed. This deployment strategy was successful in collecting adequate data to inform a habitat assessment; however, not all the footage could be used to confidently assess burrow density. **Therefore, camera transect B2913B_CAM_03, located near Venus-2 PWL, which had the highest visual abundance of burrows and a relatively continuous view of the seabed, was used to provide a representative burrow assessment for the Block 2913B survey area.**

The estimated densities ranged from **'absent' to 'abundant' based on the SACFOR abundance scale,** with the **average density indicative of a 'common' burrow abundance. As such, the** SACFOR abundances of burrows across the transect does indicate some conformance to the 'Seapen and burrowing megafauna communities' sensitive habitat; however, an average 'frequent' burrow density (0.1 to 0.9/m^2) is required for conclusive characterisation. Although a single transect was analysed, similar sediment appeared throughout all transects and **therefore, it is likely that seapen and burrowing megafauna habitats are present within the overarching MG62 'Atlantic abyssal mud' habitat**. However, no literature on the protected status of burrowing megafauna in Namibia offshore waters was found during analysis, and therefore **these areas are not thought to be of conservation interest in Namibian waters, where this habitat does not appear to be particularly rare or at risk from anthropogenic impact.**

5 References

Alzieu, C., 2003. Bioévaluation de la Qualité Environnementale des Sédiments Portuaires et des Zones D'immersion. IFREMER.

Berthou F, Friocourt MP. 1981. Gas chromatographic separation of diastereoisomeric isoprenoids as molecular markers of oil pollution. Chromatography. 219: 393–402

Billington, N., & Hebert, P. D., 1991. Mitochondrial DNA diversity in fishes and its implications for introductions. Canadian Journal of Fisheries and Aquatic Sciences, 48(S1), pp.80-94.

Blue Marine Foundation. 2023. Namibia MPA. Available from: https://www.bluemarinefoundation.com/projects/namibia/. [Accessed: June 2023].

Blumer, M. and Snyder, W.D., 1965. Isoprenoid Hydrocarbons in Recent Sediments: Presence of Pristane and Probable Absence of Phytane. Science 150(3703):1588-1589.

Botté, A., Seguin, C., Nehrgang, J., Zaidi, M., Guery, J., Leignel, V. 2022. Lead in the Marine Environment: Concentrations and Effects on Invertebrates. Ecotoxicology. 31, pp. 194-207.

Bray, J.R. and Curtis, J.T. 1957. An ordination of the upland forest communities of Southern Wisconsin. Ecol. Monogr., 27, pp.325-349.

Brooks, J. P., D. J. Edwards, M. D. Harwich, M. C. Rivera, J. M. Fettweis, Serrano, M.G., Reris, R.A., Sheth, N.U., Huang, B., Girerd, P. and Strauss, J.F., 2015. The truth about metagenomics: quantifying and counteracting bias in 16S rRNA studies. BMC Microbiology 15.1, p.66.

Bonifácio, P., Neal, L., & Menot, L. 2021. Diversity of Deep-Sea Scale-Worms (Annelida, Polynoidae) in the Clarion-Clipperton Fracture Zone. Frontiers in Marine Science, 8, 656899.

Borja, A., Franco, J., Pe´rez, V. 2000. A marine biotic index to establish the ecological quality of soft-bottom benthos within European estuarine and coastal environments. Mar. Poll. Bull. 40, 1100–1114

BSL, 2018. Environmental Baseline Survey: West Africa – Namibia Block 2913B.Unpublished report produced for Total E&P.

BSL, 2019. 1841 Volume 2: Environmental Baseline Survey and Habitat Assessment Report. Unpublished report produced for Total E&P.

BSL, 2022a. Environmental Baseline Survey: Block 2913B: Phase 1, Venus-2. Field Report. Unpublished report produced for Total E&P.

BSL, 2022b. Environmental Baseline Survey: Block 2913B: Phase 2, Regional and Venus-1X. Field Report. Unpublished produced for Total E&P.

BSL, 2022c. Environmental Baseline Survey: Block 2912. Field Report. Unpublished produced for Unpublished produced for Total E&P.

BSL, 2022d. Environmental Baseline Survey: Block 2913B: Phase 1, Venus-2. Marine Mammal Observation Monitoring Report.

BSL, 2022e. Environmental Baseline Survey: Block 2912: Regional. Marine Mammal Observation Monitoring Report.

BSL, 2023a. Environmental Baseline Survey: Block 2913B: Final Environmental Baseline and Habitat Assessment Survey (this report).

BSL, 2023b. Environmental Baseline Survey: Block 2913B: Final environmental DNA Report.

BSL, 2023c. Environmental Post-Operations Survey: Block 2913B: Venus-1X: Final Environmental Post-Operations Survey. Unpublished report produced for Total E&P.

BSL, 2023d. Environmental Baseline Survey: Block 2912: Final environmental DNA Report

Buchman, M. F. 2008. NOAA Quick Screening Reference Tables. NOAA OR&R Report 08-1 Seattle WA, Office of Response and Restoration Division, National Atmospheric and Oceanic Administration (2008): 34 pages.

Callahan, B. J., 2019. "I think it is right to think of the sequence variants as haplotypes in the population of that species." Personal Communication via eMail.

Callahan, B. J., McMurdie, P. J., Rosen, M. J., Han, A. W., Johnson, A. J. A. and Holmes, S. P., 2016. DADA2: high-resolution sample inference from Illumina amplicon data. Nature methods, 13(7), pp.581.

Carlucci, A.F. and Pramer, D., 1959. Factors Affecting the Survival of Bacteria in Seawater. Applied Microbiology, 7(6):388-392.

CBD, 2008. Decision adopted by the Conference Of the Parties to the Convention on Biological Diversity at its ninth meeting ix/20. *Marine and coastal biodiversity*, 1-12.

Chamberlain, S., 2017. rgbif: Interface to the Global 'Biodiversity' Information Facility 'API'. R package version 2.2.0.

Chow, T. J. and Snyder, C. G., 1980. Barium in the Marine Environment: A Potential Indicator of Drilling Contamination. In Symposium Proceedings: Research on environmental fate and effects of drilling fluids and cuttings. Lake Buena Vista, Florida, 2, pp.23-736

Clark, M. R., Rowden, A. A., Schlacher, T. A., Guinotte, J., Dunstan, P. K., Williams, A., Tsuchida, S. 2014. Identifying Ecologically or Biologically Significant Areas (EBSA): a systematic method and its application to seamounts in the South Pacific Ocean. Ocean & coastal management, 91, 65-79.

Clarke, K. & Gorley, R. N., 2006. Primer v6: User Manual/Tutorial.

Clarke, K.R. and Warwick, R.M., 1994. Similarity-based Testing for Community Pattern: the 2-way Layout With no Replication. Mar. Biol., 118:167-17.

Codling, I.D., Ashley, S.J., 1992. Development of a biotic index for the assessment of pollution status of marine benthic communities. Final report to SNIFFER and NRA. NR 3102/1.

Colquhoun, D., 2019. The false positive risk: a proposal concerning what to do About p-values. The American Statistician, 73(sup1), pp.192-201.

Creocean, 2023a. Environmental Baseline Survey: Block 2912: Final Environmental Baseline and Habitat Assessment Survey.

Clarke, K.R., Gorley, R.N., Somerfield, P.J., Warwick, R.M. 2014. Change in marine communities: an approach to statistical analysis and interpretation, 3rd edition. PRIMER-E: Plymouth

Dauvin, J.C., Alizier, S., Rolet, C., Bakalem, A., Bellan, G., Gomez Gesteira, J.L., Grimes, S., De-la-Ossa-Carretero, J.A. and Del-Pilar-Ruso, Y., 2012. Response of different benthic indices to diverse human pressures. *Ecological Indicators*, 12, pp. 143–153.

Deming, J.W. and Yager P.L., 1992. Natural bacterial assemblages in deep-sea sediments: Towards a global view. In: Deep-Sea Food Chains and the Global Carbon Cycle (Rowe G.T. Pariente V. Eds.), pp. 11–27. Kluwer Academic Publishers

Department of Petroleum Resources (DPR). 2002. EGASPIN soil/sediment target and intervention values for Mineral oil (or TPH). Environmental guidelines and standards for The Petroleum Industry in Nigeria. 2: 1-415.

Dos Santos, H.F., Cury, J.C., Do Carmo, F.L., Dos Santos, A.L., Tiedje, J., Van Elsas, J.D., Rosado, A.S. and Peixoto, R.S., 2011. Mangrove Bacterial Diversity and the Impact of Oil Contamination revealed by Pyrosequencing: Bacterial Proxies for Oil Pollution. PloS one, 6(3), p.e16943.

Eglinton, G., Gonzalez, A.G., Hamilton, R.J. and Raphael, R.A., 1962. Hydrocarbon Constituents of the Wax Coatings of Plant Leaves; a Taxonomic Survey. Phytochem., 1:89-102.

Emeis, K. C., Brüchert, V., Currie, B., Endler, R., Ferdelman, T., Kiessling, A., Vogt, T. 2004. Shallow gas in shelf sediments of the Namibian coastal upwelling ecosystem. *Continental Shelf Research*, *24*(6), 627-642.

EUNIS, 2019. EUNIS habitat classification 2019. Available from: https://www.eea.europa.eu/data-and-maps/data/eunis-habitat-classification. [Accessed: July 2021].

EUs Framework Directive (Directive 2000/60/EC)**.**

EU European References for Nutrients in Seawater, Decrees of 25 January 2010 and 27 July 2015.

Finke, G., Gee, K., Gxaba, T., Sorgenfrei, R., Russo, V., Pinto, D., Nsingi, K. K. 2020. Marine spatial planning in the Benguela Current Large Marine Ecosystem. Environmental Development, 36, 100569.

Folk, R.L., 1954. The Distinction Between Grain Size and Mineral Composition in Sedimentary Rock Nomenclature. Journal of Geology, 62(4):344-349.

French Circular Directive (Directive 9/08/2006).

Geller, J., Meyer, C., Parker, M. and Hawk, H., 2013. Redesign of PCR primers for mitochondrial cytochrome c oxidase subunit I for marine invertebrates and application in all-taxa biotic surveys. Molecular ecology resources, 13(5), pp.851-861.

Gettleson, D. A. and Laird, C. E., 1980. Benthic Barium Levels in the Vicinity of Six Drill Sites on the Gulf of Mexico. In Symposium Proceedings: Research on Environmental Fate and Effects of Drilling Fluids and Cuttings. Lake Buena Vista, Florida, 1:739-785.

Hanz, U., Wienberg, C., Hebbeln, D., Duineveld, G., Lavaleye, M., Juva, M., Dullo, W., Freiwald, A., Tamborrino, L., Reichart, G., Flögel, S., and Mienis, F., 2019. Environmental factors influencing benthic communities in the oxygen minimum zones on the Angolan and Namibian margins. Biogeosciences, 16, 4337–4356.

Harayama, S., Kasai, Y. and Hara, A., 2004. Microbial Communities in Oil-contaminated Seawater. Current opinion in biotechnology,15(3):205-214.

Herring P. 2010. The Biology of the Deep Ocean. Oxford University Press, Oxford, 314 pp

Holness S., Kirkman S., Samaai T., Wolf T., Sink K., Majiedt P., Nsiangango S., Kainge P., Kilongo K., Kathena J., Harris L., Lagabrielle E., Kirchner C., Chalmers R., Lombard M. (2014). Spatial Biodiversity Assessment and Spatial Management, including Marine Protected Areas. Final report for the Benguela Current Commission project BEH 09-01.

Holthuis, L.B., 1991 FAO Species Catalogue. Vol. 13. Marine lobsters of the world. An annotated and illustrated catalogue of species of interest to fisheries known to date. FAO Fish. Synop. 125(13):292p.

Hutchings, L., Van der Lingen, C., Shannon, L., Crawford, R., Verheye, H., Bartholomae, C., Van der Plas, A., Louw, D., Kreiner, A., and Ostrowski, M. 2009. The Benguela Current: An ecosystem of four components, *Progress in Oceanography*, 83, 15–32.

Irving, R., 2009. The identification of the main characteristics of stony reef habitats under the Habitats Directive: Summary report of an inter-agency workshop 26–27 March 2008, JNCC Report No. 432, JNCC, Peterborough, ISSN 0963-8091.

Kiko R, Picheral M, Antoine D, *et al* 2022. A global marine particle size distribution dataset obtained with the Underwater Vision Profiler 5. Earth Syst Sci Data 14:4315–4337. https://doi.org/10.5194/essd-14-4315-2022.

King, N.J., Bailey, D.M., Priede, I.G. and Browman, H.I., 2007. Role of scavengers in marine ecosystems. Mar. Ecol. Prog. Ser., 350, pp.175-178.

Klindworth, A., Pruesse, E., Schweer, T., Peplies, J., Quast, C., Horn, M. and Glöckner, F., 2012. Evaluation of general 16S ribosomal RNA gene PCR primers for classical and next-generation sequencing-based diversity studies. *Nucleic Acids Research*, 41(1), pp.e1-e1.

Kowalska, J.B., Mazurek, R., Gąsiorek, M. and Zaleski, T., 2018. Pollution Indices as Useful Tools for the Comprehensive Evaluation of the Degree of Soil Contamination–A review. Environmental Geochemistry and Health, 40(6):2395-2420.

Laflamme, R.E. and Hites, R.A., 1978. The Global Distribution of Polycyclic Aromatic Hydrocarbons in Recent Sediments. Geochim. Cosmochim. Acta, 42(3):289-303.

Lamb, P. D., Hunter, E., Pinnegar, J. K., Creer, S., Davies, R. G. and Taylor, M. I., 2019. How quantitative is metabarcoding: A meta-analytical approach. Molecular ecology, 28(2), pp.420-430.

Lenihan, H.S. and Oliver, J.S., 1995. Anthropogenic and natural disturbances to marine benthic communities in Antarctica. Ecological Applications, pp.311-326.

Leray, M., Knowlton, N., Ho, S. L., Nguyen, B. N. and Machida, R. J., 2019. GenBank is a reliable resource for 21st century biodiversity research. Proceedings of the National Academy of Sciences, 116(45), pp.22651-22656.

Liu, M., Tanhua, T., 2019. Characteristics of Water Masses in the Atlantic Ocean based on GLODAPv2 data. Ocean Science Discussions.

Lochte, K., 1992. Bacterial Standing Stock and Consumption of Organic Carbon in the Benthic Boundary Layer of the Abyssal North Atlantic. In: Deep-Sea Food Chains and the Global Carbon Cycle (Rowe G.T. Pariente V. Eds.). 360, pp.1-10.

Long, D. 2006. BGS Detailed Explanation of Seabed Sediment Modified Folk Classification. pp. 7.

Long, E. R., MacDonald, D. D., Smith, S. L. and Calder, F. D., 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuary sediments. Environmental Management, 19(1):81-97.

Lorenzen, C.J., 1967. Determination of Chlorophyll and Phaeo-pigments: Spectrophotometric equations. Limnology and Oceanography, 12(2):343-346.

Lugo, A.E., 1999. Mangrove Forests: a Tough System to Invade but an Easy One to Rehabilitate. Marine Pollution Bulletin, 37(8-12), pp.427-430.

Luoma, S. N. and Davies J. A., 1983. Requirements for Modelling Trace Metal Portioning in Oxidised Estuarine Sediments. Marine Chemistry, 12:pp.159-181.

Magurran, A., 1988. *Ecological diversity and its measurement*. London: Croom Helm.

Ministry of Fisheries and Marine Resources (MFMR), 2021. Current Status Report: Knowledge Baseline for Marine Spatial Planning in Namibia. Second Edition. MFMR, Windhoek: Namibia.

Murali, A., Bhargava, A. and Wright, E. S., 2018. IDTAXA: a novel approach for accurate taxonomic classification of microbiome sequences. Microbiome, 6(1), pp.140.

National Research Council (NRC), 1983. Drilling Discharges in the Marine Environment. National Academy Press, Washington DC. pp.180.

Neff, J. M., 2005. Bioaccumulation in marine organisms. Effects of contaminants from oil well produced water. Elsevier, Oxford, UK.

Nelson Mandela University, 2022. Namibian EBSA Status Assessment & Management Available from: https://cmr.mandela.ac.za/Research-Projects/EBSA-Portal/Namibia/Namibian-EBSA-Status-Assessment-Management. [Accessed: 07/12/2022].

OSPAR, 2008. OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic. OSPAR List of Threatened and/or Declining Species and Habitats (Reference Number: 2008-6, Replaces agreement 2004-6).

OSPAR, 2009. Implementation report on Recommendation 2006/5 on a management regime for offshore cutting piles, pp. 24..

Paez-Osuna, F., and Ruiz-Fernandez, C., 1995. Comparative Bioaccumulation of Trace Metals in *Penaeus stylirostris* in Estuarine and Coastal Environments. Estuarine, Coastal and Shelf Science, 40(1):35-44.

Paez-Osuna, F., and Ruiz-Fernandez, C., 1995. Comparative Bioaccumulation of Trace Metals in *Penaeus stylirostris* in Estuarine and Coastal Environments. Estuarine, Coastal and Shelf Science, 40(1):35-44.

Peters, K. E., Walters, C. C. and Moldowan, J. M., 2005. The Biomarker Guide: Biomarkers and Isotopes in the Environment and Human History. Vol.1. Cambridge University Press, 471

Peters, K.E., and Moldowan, J.M., 1993. The Biomarker Guide. Prentice Hall, Englewood Cliffs, NJ.

Pfannkuche, O., 1993. Benthic Response to the Sedimentation of Particulate Organic Matter at the BIOTRANS Station, 47°N, 20°W. Deep-Sea Res. II, 40(1):135–149.

R Core Team, 2020. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. URL: https://www.R-project.org/.

Rex, M.A and Etter, R.J., 2010. Deep-Sea Biodiversity: Pattern and Scale. Harvard University Press, 354 pp.

Ricciardi, A. and Bourget, E., 1998. Weight-to-weight Conversion Factors for Marine Benthic Macroinvertebrates. Marine Ecology Progress Series, 163:245-251.

RPS. 2020. Metocean Design Criteria Study – Namibia – 2913B. Prepared for Total and P Namibia B.V. Doc Ref: MMC03586.000 100-CN-REP-1900. 658 pp.

Sayers, E. W., Cavanaugh, M., Clark, K., Ostell, J., Pruitt, K. D. and Karsch-Mizrachi, I., 2018. GenBank. Nucleic acids research, 47(D1), D94-D99.

Schaule, B. K. and Patterson, C. C., 1983. Perturbations of the Natural Lead Depth Profile in the Sargasso Sea by Industrial Lead. In: Trace Metals in Seawater. Plenum Press, New York. pp.487-503.

Sink KJ, Attwood CG, Lombard AT, Grantham H, Leslie R, Samaai T, Kerwath S, Majiedt P, Fairweather T, Hutchings L, van der Lingen C, Atkinson LJ, Wilkinson S, Holness S, Wolf T. 2011. Spatial planning to identify focus areas for offshore biodiversity protection in South Africa. Unpublished Report. Cape Town: South African National Biodiversity Institute.

Simpson SL, Batley GB and Chariton AA (2013). Revision of the ANZECC/ARMCANZ Sediment Quality Guidelines. CSIRO Land and Water Science Report 08/07. CSIRO Land and Water.

SLR Environmental Consulting, 2020. Proposed 3D Seismic Survey in Licence Blocks 2912 and 2913B, Orange Basin, Namibia. Final Environmental Impact Assessment Report and Environmental & Social Management Plan. Prepared for Total and P Namibia B.V. Doc Ref: 733.20071.00002. 882 pp.

Snelgrove, P.V.R. and Butman, C.A., 1994. Animal-Sediment Relationships Revisited: Cause versus Effect. Oceanography and Marine Biology: An Annual Review, 32, 111-177.

Søndergaard, M., 2009. Redox Potential. 10.1016/B978-012370626-3.00115-0.

Stramma, L., England, M., 1999. On the water masses and mean circulation of the South Atlantic Ocean. Journal of Geophysical Research: Oceans. 104, 20863-20883.

Tessier, A., Campbell, P. G. C. and Bisson, M., 1979. Sequential Extraction Procedure for the Speciation of Particulate Trace Metals. Analytical Chemistry, 51(7):844-851.

Thompson, B. and Lowe, S. H., 2004. Assessment of macrobenthos response to sediment contamination in the San Francisco Estuary, California, USA. Environmental toxicology and chemistry, 23 9, 2178-87 .

Trocine, R. P. and Trefry, J. H., 1983. Particulate Metal Tracers of Petroleum Drilling Mud Dispersion in the Marine Environment. Environmental Science & Technology, 17(9):507-512.

Tsuji, S., Miya, M., Ushio, M., Sato, H., Minamoto, T. and Yamanaka, H., 2018. Evaluating intraspecific diversity of a fish population using environmental DNA: An approach to distinguish true haplotypes from erroneous sequences. bioRxiv, pp.429993.

Valentine, H.R., Lutjeharms, J.R.E. and Brundrit, G.B., 1993. The Water Masses and Volumetry of the Southern Agulhas Current Region. Deep Sea Research Part I: Oceanographic Research Papers, 40(6):1285-1305.

Varol, M., 2011. Assessment of Heavy Metal Contamination in Sediments of the Tigris River (Turkey) Using Pollution Indices and Multivariate Statistical Techniques. Journal of Hazardous Materials, 195:355-364.

Veiga, M.M., 1997. Introducing New Technologies for Abatement of Global Mercury Pollution, phase II: Latin America. Report to UNIDO, Vancouver, Canada, 70 p

Waksman, S.A. and Hotchkiss, M., 1937. On the Oxidation of Organic Matter in Marine Sediments by Bacteria. Journal of Marine Research, 1(2):101-118.

Warwick, R., & Clarke, K., 1991. A Comparison of some methods for analysing changes in benthic community structure. *Journal of the Marine Biological Association of the United Kingdom, 71*(1), 225-244. doi:10.1017/S0025315400037528

Wentworth, C K., 1922, A Scale of Grade and Class Terms for Clastic Sediments. The Journal of Geology, 30(5):377-392.

WFD-UKTAG, 2014. UKTAG Transitional and Coastal Water Assessment Method, Benthic Invertebrate Fauna, Infaunal Quality Index. pp.22.

Whitman, W.B., Coleman, D.C. and Wiebe, W.J., 1998. Prokaryotes: the Unseen Majority. Proceedings of the National Academy of Sciences, 95(12):6578-6583.

WHSRN, 2019. Bigi Pan. Available online at: https://whsrn.org/whsrn_sites/bigi-pan/ [Accessed 30/03/2021]

Youngblood, W.W. and Blumer, M., 1975. Polycyclic Aromatic Hydrocarbons in the Environment: Homologues Series in Soils and Recent Marine Sediments. Geochimica et Cosmochimica Acta, 39(9):1303-1314.

YSI, A Xylem Brand, 2023. ORP / Redox. Available online at: https://www.ysi.com/parameters/orp-redox [Accessed 23/01/23].

6 Appendices

Appendix I – Field Operations and Survey Methods

Appendix I presents a summary of the different methods employed during the two different field operation phases. For additional information, please refer to the **Environmental Field Reports** (BSL, 2022a and b).

221104 BSL2202_TEEPNA_B29   221220 BSL2202_TEEPNA_B29

Environmental Sampling

Details of the sampling equipment used during the survey are provided in the table below:

Benthic Survey	Equipment
Seabed Sampling	1 x 0.25m² Box Core (Gray O'Hara Box Core) 1 x DVV Grabs (2x 0.1m) 1 x 0.5m² Mega Box Core (backup) 1 x BSL Underway sampler 3 x BSL High-Definition self-contained cameras (BSL Pressure Cams) 2 x Live Feed Cameras (STR Seabug and BSL MOD 4)
Benthic processing	2 x standard deck cameras 1 x NORM meter 2 x Redox probes 1 x Munsell chart Sub-sampling kit 2 x *Wilson* auto-siever with 2 x 500µm mesh sieve
Consumables	Glass jars, double-lined ziplock bags used for frozen storage of chemistry samples, 250ml, 500ml bottles and 1L, 3L and 5L buckets for macrofaunal samples.
Water Quality and Chemistry	**Equipment**
Seawater Sampling	6 x 10L Niskin bottles (including contingency) 2 x CTD Multiprofilers (Midas Valeport with DO, pH and turbidity sensors) 2 x Zooplankton Net (200 µm) +flowmeter 2 x Phytoplankton Net (50 µm) + flowmeter
Seawater processing	1 x Chlorophyll pump 1 x eDNA pump 2 x 50µm sieves for phytoplankton 2 x 200 µm sieves for zooplankton
Consumables	1 litre, 500ml, 250ml plastic bottles and 1 litre, 500ml, 40ml glass bottles/vials, eDNA filters and NAP for fixing samples and cool boxes
Surface Deployment	**Equipment**
Surface Deployment	1 x fast deep-water winch with Dyneema rope (MARE winch) 1 x deep-water camera winch with sonar/coax cable (Rapp Winch) 1x deep-water water sampling winch with 6mm Dyneema rope (ORE winch) 1 x LARS (A-frame)
Positioning	**Equipment**
Positioning	2 x Complete positioning system (USBL and surface navigation systems) comprising: • 2 x Sonardyne Ranger 2 USBL system with an over-the-side deployed pole • 2 x Sonardyne Compatt 6 and 2 x WSM transponder 3000M and charger • 2 x C-Nav3050 GNSS System and band Antenna • 2 x Inertial Labs MRU • 2 x TSS Meridian Surveyor Gyro

Seabed Photography and Video

Seabed video footage for the regional Block 2913B EBS was acquired along the 10 transects using an STR Seabug towed camera system with a BSL HD pressure camera attached and a non-live-feed HD pressure camera system. These systems were mounted with a BSL camera sledge and were operated via a sonar cable (live-feed) and Dyneema fitted (non-live-feed) winches. The live-feed system provided an SD/targeting video to the surface and recorded HD video footage at the seabed, while the non-live-feed provided HD video. Full camera specifications can be found in the table below:

STR Seabug Camera System

STR Seabug Underwater Camera Specifications

Standard Features	Comment
Live-feed	
Image Resolution	5 to 24 megapixel
Light Sensitivity Setting	ISO 60-1600 Auto/Manual Selected
Sensor Type	1 / 1.8" format high-density CCD sensor
Light source	4 x 1000 lumen controllable LED lamps
Typical settings	Aperture priority at F8, Shutter speed typically 1/125th second, Auto flash mode (TTL)
Framing Video Used	320 Line / 50 Hz PAL
Control System	SES Multiport DTS
Manufacturer	STR
Other sensors	Depth sensor and compass
HD Camera	1080p video recording at 30fps (i.e., 2mp), with a capacity to internally store 5 hours of video
Non-live-feed	
HD Camera	1080p video recording at 30fps (i.e., 2mp), with a capacity to internally store 5 hours of video

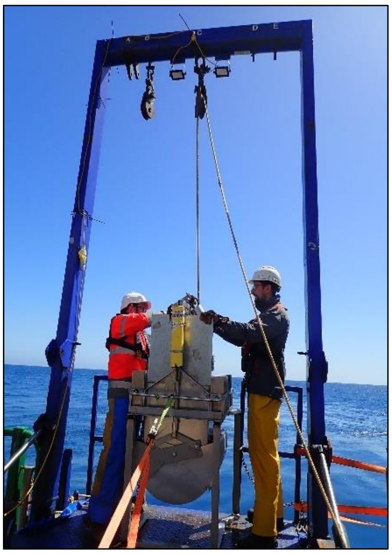
Once at the seabed, the live-feed camera was moved along the length of the transect at between 0.5 and 1.0 knots, while the non-live feed camera was moved along the seabed at a slower rate of 0.25 to 0.5 knots to ensure the camera would remain on the seabed. During live-feed camera operations, still images were captured and stored digitally on the camera's internal memory card. Live video footage, overlaid with time, position and site details, was viewed in real-time and recorded directly onto storage media. Photographs were uploaded instantly to the surface control unit for continuous review. Photographs were of high quality (6 megapixels, reduced from 24mp for faster upload speed) and can be used for detailed analysis. Data were downloaded at the end of each shift and backed up onto hard drives. Screenshots (still images) were taken post-hoc once the camera system had been recovered to the deck and the HD video footage downloaded. In addition, a BSL HD pressure camera was fixed on the box corer to obtain high-definition video footage at all the sediment stations during sampling.

A deep water mini HD camera system was used attached to either the sampler during operations to obtain a snapshot of the seabed at each station. The system comprised a 2MP, pressure-activated HD video camera which was set up to commence recording upon approach to the seabed, thus recording the instant the box corer makes contact with the substrate. The unit is supplied with its 1000-lumen LED light supply.

BSL Pressure Camera

Grab Sampling

Seabed sampling was carried out with a 0.25m^2 Gray O'Hara box corer at all stations in the survey area. The box corer was designed to maintain an undisturbed sediment sample by minimising the bow wave effect and sample washout. All subsamples for benthos and physico-chemical analysis were taken from a single successful deployment.



0.25m^2 Gray O'Hara Box Corer

The BSL Double Grab (a Double Van Veen Grab) was designed and built by BSL for operations in soft sediments, compacted sands and shallow clays. This grab would, therefore, act as a backup sampler to the primary box corer if sandier substrates were encountered. This device consists of two 0.1m^2 samplers set into a ballasted frame, reducing the time required to obtain multiple replicates at a single station.

Retained sediment samples were subject to quality control on recovery and were retained in the following circumstances:

- Water above the sample was undisturbed;
- Bucket closure complete (no sediment washout);
- Sampler was retrieved upright;
- Inspection/access doors had closed properly;
- No disruption of sample;
- No hagfish (*Myxine glutinosa*) and/or mucus coagulants.

Key observations from samples included colour, sediment classification, layering (including redox discontinuity layers), smell (including the presence of H_2S), obvious fauna, evidence of bioturbation and anthropogenic debris.

Sample Processing

Sediment

Field processing including sub-sampling of physico-chemical parameters was conducted on board by BSL's scientists. The following was retrieved from the surface sediments for later analysis:

- Hydrocarbons (total petroleum hydrocarbons, saturated hydrocarbons, polycyclic aromatic hydrocarbons; stored in a pre-washed foil-capped glass jar);
- BTEX (stored in a pre-washed foil-capped glass jar);
- Total Organic Matter (TOM), Total Organic Carbon (TOC) and moisture content; Heavy & trace Metals (HM); Nitrogen and Phosphorus (stored in doubled lined ziplock plastic bag);
- Particle size distribution (stored in doubled lined ziplock plastic bag);
- One spare sample (stored in double lined ziplock plastic bag);
- Heterotrophic and hydrocarbon-adapted microorganisms (stored in small plastic bags);
- eDNA 4 x 25ml (stored in double-lined ziplock plastic bags).
- A single 0.1m^2 fauna sample for macrofaunal analysis (0.1m^2 sub-sample from box corer to approximately 10cm.

Sample preservation was undertaken using standard techniques. All physico-chemical samples were stored in appropriate containers (i.e. glass for hydrocarbons, and plastics for metals, TOC, TOM and PSA) and immediately frozen and stored (< -18°C) for later transportation (frozen) to the laboratory upon demobilisation. Microbiology samples (heterotrophic and hydrocarbon adapted) and eDNA samples fixed with NAP solution were kept refrigerated (<4°C) in the field and during transportation. Faunal samples were processed onsite using a *Wilson* Auto-siever (WAS) through a 500µm sieve. Faunal samples were fixed and stained in 5% buffered formalin and a vital stain (Rose Bengal) for storage and transportation. All biological samples were double-labelled, with internal tags.

Water

A full suite of water samples were also recovered from the surface, mid-depth and near-seabed at eight locations throughout the survey area. Operations were combined with other sampling dives to reduce the ship time required for acquisition. All water samples were collected using Niskin bottles and were triggered using a messenger weight.

Seawater samples will be analysed for the following parameters:

- eDNA (seawater filtered and fixed with NAP - refrigerated);
- Total Organic Carbon (stored in 125ml bottles with 0.5ml of H2SO4 59% – refrigerated);
- Hydrocarbons (polycyclic aromatic hydrocarbons, alkanes; stored in 1L amber glass – frozen);
- Suspended matter and Kjeldhal nitrogen (stored in 500ml bottles – refrigerated);
- Nutrients (nitrate, nitrite, orthophosphates; stored in 100ml bottles – refrigerated);
- Trace metals (stored in 125ml bottles with 1ml of HNO3 65 % - refrigerated);
- Mercury (stored in 100ml glass bottles with 1ml of HCl – refrigerated);

- Bacteria (total aerobic flora for 7 days and aerobic flora adapted to hydrocarbons over 7 days; stored in 250ml bottle – refrigerated);
- Phytoplankton (sieved over 50µm mesh; stored with 2ml of Lugol's iodine; stored in 250ml plastic bottles);
- Zooplankton (sieve over 200 µm mesh; stored in 5 % Formalin; stored in 250ml plastic bottles);
- Chlorophyll-α (2L of filtered seawater on 47 mm filter – frozen).

All physico-chemistry samples were stored in appropriate containers (i.e. glass bottles for hydrocarbons and BTEX; plastic bottles for total suspended solids; specialised eDNA filter cartridge for eDNA and filter paper in foil-lined bags for chlorophyll and phaeopigments) and were retained in a freezer (-18°C) whilst on the vessel.

A multi-parameter CTD profiler was used at all six water stations to record the physico-chemical parameters of the water column. A zooplankton and phytoplankton net was used to conduct a vertical trawl from 100m (where possible) to the surface at all six water stations (as plankton migrates within this band).

Appendix II – Data Presentation, Laboratory and Statistical Analyses

Environmental Data Presentation using Contouring Software

To aid in the interpretation and presentation of the environmental information acquired for this report, both hydrographic and environmental variables were processed using contouring and 3D surface mapping software (Surfer v19). This software allows a digital terrain model (DTM), or grid, to be interpolated from irregularly spaced geographical information (XYZ data) using a kriging interpolation algorithm. When large quantities of data are interpreted (such as in swathe bathymetry), the level of interpolation is limited only to small spaces in between the data points. However, when processing environmental variables, a diagrammatic circle has been used to colour illustrate the parameter level at each relevant site (the size of this circle is diagrammatically determined to be colour coded based on the scale of the Figures presented in Section 2). It should be remembered that this is done for presentation purposes only and that these data values are “not representative” for the whole of the geographical area covered by the circle. No interpolation is required in this instance except where these circles overlap due to the scaling of the figure.

Particle Size Distribution

The samples recovered from each site were analysed by BSL which is accredited under the Northeast Atlantic Marine Biological Association Quality Control scheme (NMBAQC) for PSA analysis.

The sample was homogenised and split into a small sub-sample for laser diffraction and the remaining material was passed through stainless steel sieves with mesh apertures of 8000µm, 4000µm, 2000µm and 1000µm. In most cases, almost the entire sample would pass through the sieve stack, but any material retained on the sieve, such as small shells, shell fragments and stones were removed and the weight was recorded.

The smaller sub-sample was wet screened through a 1000µm sieve and determined using a Malvern Mastersizer 2000 particle sizer according to Standard Operating Procedures (SOP). The results obtained by a laser sizer have been previously validated by comparison with independent assessment by wet sieving (Hart, 1996). The range of sieve sizes, together with their Wentworth classifications are given in Table II. For additional quality control, all datasets were run through the Mastersizer in triplicate and the variations in sediment distributions were assessed to be within the 95% percentile.

The separate assessments of the fractions above and below 1000µm were combined using a computer programme. This followed a manual input of the sieve results for fractions 16-8mm, 8-4mm, 4-2mm and 2-1mm fractions and the electronic data captured by the Mastersizer below 1000µm.

This method defines the particle size distributions in terms of Phi mean, median, fraction percentages (i.e. coarse sediments, sands and fines), sorting (mixture of sediment sizes) and skewness (weighting of sediment fractions above and below the mean sediment size; Folk 1954).

Formulae and classifications for particle calculations made are given overleaf:

- **Graphic Mean (M)** - a very valuable measure of average particle size in Phi units (Folk & Ward, 1957).

$$M = \frac{\text{ø}16 + \text{ø}50 + \text{ø}84}{3}$$

Where *M = The graphic mean particle size in Phi*
ø = the Phi size of the 16th, 50th and 84th percentile of the sample

Table II.I: Phi and Sieve Apertures with Wentworth and Folk Classifications

Microns (µm)		Phi (Φ)		Sediment Description	
Aperture	Sediment Retained	Aperture	Sediment Retained		
4000	≥ 4000	-2	-2 < -1	Pebble	Gravel
2000	2000 < 4000	-1	-1 < -0.5	Granule	
1400	1400 <2000	-0.5	-0.5 < 0	Very Coarse Sand	Sands
1000	1000 < 1400	0	0 < 0.5		
710	710 <1000	0.5	0.5 < 1	Coarse Sand	
500	500 < 710	1	1 <1.5		
355	355 < 500	1.5	1.5 < 2	Medium Sand	
250	250 < 355	2	2 < 2.5		
180	180 < 250	2.5	2.5 < 3	Fine Sand	
125	125 < 180	3	3 < 3.5		
90	90 < 125	3.5	3.5 < 4	Very Fine Sand	
63	63 <90	4	4 < 4.5		
44	44 < 63	4.5	4.5 < 5	Coarse Silt	Fines (Silts)
31.5	31.5 < 44	5	5 < 5.5		
22	22 < 31.5	5.5	5.5 < 6	Medium Silt	
15.6	15.6 < 22	6	6 < 6.5		
11	11 < 15.6	6.5	6.5 < 7	Fine Silt	
7.8	7.8 < 11	7	7 < 7.5		
5.5	5.5 < 7.8	7.5	7.5 < 8	Very Fine Silt	
3.9	3.9 < 5.5	8	8 < 9		
2	2 < 3.9	9	9 <10	Clay	Fines (Clays)
1	1 < 2	10	≥ 10		

- **Sorting (D)** – the inclusive graphic standard deviation of the sample is a measure of the degree of sorting (Table II.II).

$$D = \frac{\text{ø}84 + \text{ø}16}{4} + \frac{\text{ø}95 + \text{ø}5}{6.6}$$

where *D = the inclusive graphic standard deviation*
ø = the Phi size of the 84th, 16th, 95th and 5th percentile of the sample

Table II.II: Sorting Classifications

Sorting Coefficient (Graphical Standard Deviation)	Sorting Classifications
0.00 < 0.35	Very well sorted
0.35 < 0.50	Well sorted
0.50 < 0.71	Moderately well sorted
0.71 < 1.00	Moderately sorted
1.00 < 2.00	Poorly sorted
2.00 < 4.00	Very poorly sorted
4.00 +	Extremely poorly sorted

- **Skewness (S)** – the degree of asymmetry of a frequency or cumulative curve (Table II.III).

$$S = \frac{\phi 84 + \phi 16 - (\phi 50)}{2(\phi 84 - \phi 16)} + \frac{\phi 95 + \phi 5 - 2(\phi 50)}{2(\phi 95 - \phi 5)}$$

where *S = the skewness of the sample*
ø = the Phi size of the 84th, 16th, 50th, 95th and 5th percentile of the sample

Table II.III: Skewness Classifications

Skewness Coefficient	Mathematical Skewness	Graphical Skewness
+1.00 > +0.30	Strongly positive	Strongly coarse skewed
+0.30 > +0.10	Positive	Coarse skewed
+0.10 > -0.10	Near symmetrical	Symmetrical
-0.10 > -0.30	Negative	Fine skewed
-0.30 > -1.00	Strongly negative	Strongly fine skewed

- **Graphic Kurtosis (K) –** The degree of peakedness or departure from the 'normal' frequency or cumulative curve (Table II.IV).

$$K = \frac{\phi 95 - \phi 5}{2.44(\phi 75 - \phi 25)}$$

Where *K = Kurtosis*
ø = the Phi size of the 95th, 5th, 75th and 25th percentile of the sample

***Table II.IV:* Kurtosis Classifications**

Kurtosis Coefficient	Kurtosis Classification	Graphical Meaning
0.41 < 0.67	Very Platykurtic	Flat-peaked; the ends are better sorted than the centre
0.67 < 0.90	Platykurtic	
0.90 < 1.10	Mesokurtic	Normal; bell shaped curve
1.11 < 1.50	Leptokurtic	Curves are excessively peaked; the centre is better sorted than the ends.
1.50 < 3.00	Very Leptokurtic	
3.00 +	Extremely Leptokurtic	

Sediment Multivariate Analyses

Similarity Matrices and Hierarchical Agglomerative Clustering (CLUSTER)

A similarity matrix is used to compare every individual sample station with each other. The coefficient used in this process is based on Euclidean distance considered to be the most suitable for environmental data. These are subsequently assigned into groups according to their level of similarity and clustered together based upon a Group Average Method into a dendrogram of similarity.

Similarity Profiling (SIMPROF)

Analyses data for significant clusters that show evidence of a multivariate pattern in data that are a priori unstructured, i.e. single samples from each site. The test works by comparing samples which have been ranked and ordered by resemblance against an expected profile which is obtained by permuting random variables across the set of samples, a mean of 1000 permutations is taken to produce an expected result for null structure with rare and common species displaying the same pattern. If the actual data deviates outside the 95% limits of the expected profile then there is evidence for significant structure and vice versa. The 'significant structure' is well represented on a dendrogram which will also show the clusters containing that lack significant differentiation (null structure), (Clarke & Gorley, 2006).

Principal Component Analyses (PCA)

This analysis is used to reduce the number of variables of larger data sets to smaller ones while still preserving as much information as possible. The PCA looks for patterns in the data and detects similarities or correlations between variables and brings out the strongest pattern in the data set which can then be further explored.

Sediment Chemistry

Total Organic Carbon (TOC) and Total Organic Matter (TOM)

Organic matter and carbon contents sediments were analysed using a combination of tests. These include Total Carbon (TC), analysed using a known weight of dried soil and combusted at 1600°C and the amount of Carbon determined by Infra-Red detection, Total Organic Matter by loss on ignition (TOM; see below) and Total Organic Carbon (TOC; see below). In addition to the standard accreditation as outlined below, additional analytical quality control (AQC), is carried out with every batch where a soil of known value is determined (every batch of 15 samples or part thereof). Blank determinations are also carried out routinely where required.

Total Inorganic Carbon (TIC) is determined by calculation: TC –TOC = TIC

TOC was analysed using an Eltra combustion method. This method is used for total carbon analysis of dried, crushed rock powder and environmental soil samples. The samples are previously treated with 10% HCl to remove inorganic carbon (Carbonates) before washing to remove residual acids and further dried.

The Carbon Analyser heats the sample in a flow of oxygen and any carbon present is converted to carbon dioxide which is measured by infra-red absorption. The percentage carbon is then calculated with respect to the original sample weight. The range for the method is 0.01% - 100%.

TOM was analysed using 1g of air dried and ground sample (<200µm) placed in a crucible and dried in an oven at 50±2.5°C until constant weight was achieved. The final sample weight was recorded to the nearest 0.01% and the sample was allowed to cool in a desiccator. The sample was then placed in a muffle furnace and heated to 440±25°C for four hours. The crucible was removed from the furnace and allowed to cool to room temperature in a desiccator. Thereafter, the crucible was reweighed and the percentage loss on ignition calculated. This test is reported to 0.01% and is accredited under the UKAS scheme.

Hydrocarbon Concentrations (Total Hydrocarbon Concentrations and Aliphatics)

General Precautions

High purity solvents were used throughout the analyses. Solvent purity was assessed by evaporating an appropriate volume to 1ml and analysing the concentrate by GC for general hydrocarbons, target n-alkanes and aromatics. All glassware and extraction sundries were cleaned prior to use by thorough rinsing with hydrocarbon-free deionised water followed by two rinses with dichloromethane. All glassware was heated in a high temperature oven at 450°C for 6 hours.

Extraction Procedure for Hydrocarbons

Each analytical sample (15±0.1g) was spiked with an internal standard solution containing the following components: aliphatics - heptamethylnonane, 1-chlorooctadecane and squalane. The sample was then wet vortex extracted using three successive aliquots of DCM/Methanol. The extracts were combined and water partitioned to remove the methanol and any excess water from the sample.

Solvent extracts were chemically dried and then reduced to approximately 1ml using a Kuderna Danish evaporator with micro Snyder.

Column Fractionation for Aliphatic and Aromatic Fractions

The concentrated extract was transferred to a pre-conditioned flash chromatography column containing approximately 1g of activated Silica gel. The compounds were eluted with 3ml of Pentane/DCM (2:1). An aliquot of the extract was then taken and analysed for total hydrocarbon (THC) content and individual n-alkanes by large volume injection GC-FID.

Quality Control Samples

The following quality control samples were prepared with the batches of sediment samples:

- A method blank comprising 15±0.1g of baked anhydrous sodium sulphate (organic free).
- A matrix matched standard sample consisting of 15±0.1g baked sand spiked with Florida mix.
- A sample duplicate - any one sample from the batch, dependent upon available sample mass, analysed in duplicate.

Hydrocarbon Analysis

Analysis of total hydrocarbons and aliphatics was performed by using an Agilent 6890 with an FID detector. Appropriate column and GC conditions were used to provide sufficient chromatographic separation of all analytes and the required sensitivity.

Carbon Preference Index

The carbon preference index is calculated as follows:

$$CPI = \frac{\text{odd homologues } (nC_{11} \text{ to } nC_{35})}{\text{even homologues } (nC_{10} \text{ to } nC_{34})}$$

Petrogenic/Biogenic (or P/B) Ratio

The Petrogenic/Biogenic Ratio is calculated as follows:

$$P/B \text{ Ratio} = \frac{P = \text{sum of } nC_{10} \text{ to } nC_{20}}{B = \text{sum of } nC_{21} \text{ to } nC_{35}}$$

Calibration and Calculation

GC techniques require the use of internal standards in order to obtain quantitative results. The technique requires addition of non-naturally occurring compounds to the sample, allowing correction for varying recovery.

Target analytes concentrations were calculated by comparison with the nearest eluting internal standards. A relative response factor was applied to correct the data for the differing responses of target analytes and internal standards. Response factors were established prior to running samples, from solutions containing USEPA(16) PAHs + Dibenzothiophene for the GCMS, Florida mix (even n-Alkanes nC_{10}-nC_{40}) for individual GCFID targets and a Diesel/Mineral Oil mix for total oil determination.

The mean detection limits used for the sediment total hydrocarbons and n-alkanes were:

1. n-alkane - 1ng.g^{-1} (ppb)
2. Total Hydrocarbons - 100ng.g^{-1} (ppb)

Heavy and Trace Metal Concentrations

Sediment samples were homogenised and a 50g portion of each sample was air dried at room temperature. Each sample was then ground down to a fine powder (<100µm) by hand using a metal free mortar and pestle. A clean sand sample was hand ground prior to preparation of the field samples as a blank.

Sample Digestion Procedure

Easily Leachable (Half strength Aqua Regia Extraction – Al, As, Ba, Be, Cd, Cr, Co, Cu, Fe, Hg, Li, Mn, Mo, Ni, Pb, Sb, Se, Sn, Ti, V, Zn)

Approximately 1g of the sediment samples were accurately weighed out and transferred to a beaker and wet with approximately 20ml of distilled water. Hydrochloric acid (6ml) and nitric acids (2ml) were added, and the covered sample left to digest for 4 hours in a steam bath.

After digestion, the samples were filtered through a Whatman 542 filter paper into a 100ml standard flask. The watch-glass and beaker were rinsed thoroughly, transferring the washings to the filter paper. The filter paper was rinsed until the volume was approximately 90ml. The filter funnel was rinsed into the flask and then the flask was made up to volume and mixed well. The filtrate was then analysed by ICP-OES and/or ICP-MS.

The minimum reporting values are given in Table II.V for aqua regia digestion.

Table II.V: Heavy Metals – Minimum Reporting Value (MRV)

Analyte	Unit	ICP	ICP-OES
Al	$mg.kg^{-1}$	10	-
As	$mg.kg^{-1}$	0.3	-
Ba	$mg.kg^{-1}$	0.5	-
Ba (by fusion)	$mg.kg^{-1}$	-	5
Be	$mg.kg^{-1}$	0.1	-
Cd	$mg.kg^{-1}$	0.1	-
Cr	$mg.kg^{-1}$	0.5	-
Co	$mg.kg^{-1}$	0.1	-
Cu	$mg.kg^{-1}$	0.5	-
Fe	$mg.kg^{-1}$	36	-
Hg	$mg.kg^{-1}$	0.5	-
Li	$mg.kg^{-1}$	2	-
Mn	$mg.kg^{-1}$	1	-
Mo	$mg.kg^{-1}$	0.5	-
Ni	$mg.kg^{-1}$	0.5	-
Pb	$mg.kg^{-1}$	0.5	-
Sb	$mg.kg^{-1}$	0.1	-
Se	$mg.kg^{-1}$	0.5	-
Sn	$mg.kg^{-1}$	0.5	-
Ti	$mg.kg^{-1}$	6	-
V	$mg.kg^{-1}$	0.6	-
Zn	$mg.kg^{-1}$	3	-

Barium by Fusion Analysis

In order to achieve complete dissolution of the insoluble barium sulphates, additional analysis using a lithium fusion method was undertaken. Sediments were dried at 90°C in evaporating basins for 8 hours and were disaggregated in a mortar and pestle, followed by sieving through a 60µm-mesh sieve. The powdered samples thus obtained were fused with excess sodium carbonate. After fusion, the mixtures were dissolved in dilute nitric acid and the solutions analysed by ICP-OES using the standard instrument operating conditions. The method is validated using a certified reference material (CRM).

Analytical Methodology

Inductively Coupled Plasma Optical Emission Spectrometry

The instrument is calibrated using dilutions of the 1ml (=10mg) spectroscopic solutions. The final calibration solutions are matrix matched with the relevant acids. The calibration line consists of five standards.

Inductively Coupled Plasma- Mass Spectrometry

The instrument is calibrated using dilutions of the 1ml (=10mg) spectroscopic solutions. The calibration line consists of seven standards.

The analytes are scaled against internal standards to take account of changes in plasma conditions as a result of matrix differences for standards and samples. The internal standards have a similar mass and ionisation properties to the target metals.

Normalisation

Normalisation is a procedure used to correct concentrations for the influence of the natural variability in sediment composition (i.e. grain size, organic matter and mineralogy). Natural and anthropogenic contaminants tend to show a much higher affinity to fine particulate matter compared to coarse due to the increased adsorption capacity of organic matter and clay minerals. In sites where there is variability in grain size between stations, effects of sources of contamination will at least partly be obscured by grain size differences.

Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC / ARMCANZ)

The ANZECC and ARMCANZ framework is a tiered, decision-tree approach to assess contaminated sediments against a set of sediment quality guideline values (SQGV) to establish the level of risk on the biological community (Simpson *et al.,* 2013; Figure II.I). The SQGVs are tabulated in Table II.VIII. If the contaminant concentrations exceed the SQGVs, further investigation is recommended to determine whether there is indeed an environment risk associated with the exceedance

Table II.VIII Sediment Quality Guideline Values (Simpsons et al., 2013)

Contaminant	SQGV	SQGV-High
Antimony (mg/kg)	2.0	25.0
Cadmium (mg/kg)	1.5	10.0
Chromium (mg/kg)	80.0	370.0
Copper (mg/kg)	65.0	270.0
Lead (mg/kg)	50.0	220.0
Mercury (mg/kg)	0.15	1.00
Nickel (mg/kg)	21.0	52.0
Silver (mg/kg)	1.0	4.0
Zinc (mg/kg)	200.0	410.0
Arsenic (mg/kg)	20.0	70.0
Tributyltin (µg/kg)	9.0	70.0
Total PAHs (µg/kg)	10,000	50,000
Total DDT (µg/kg)	1.2	5.0
Total PCBs (µg/kg)	34.0	280.0
Total Petroleum Hydrocarbons (TPHs) (mg/kg)	280.0	550.0

For metals, if the SQGV is exceeded by the results of the total metals analysis, the metals should be compared to background concentrations in reference sediments of comparable grain size from appropriate sites (Figure II.I part a). Exceedance of the SQGV is acceptable if it is below the background concentration. Note that for most anthropogenic organic contaminants, the background concentrations should be zero, but for metals it is possible for background concentrations to significantly exceed trigger values. If the SQGV is exceeded, and above the background concentration, the next step in the case of metal contaminants is to look at a dilute acid extractable metal concentration (AEM, by 30 min 1 M HCl extraction) which provides a useful measure of the potentially bioavailable metals (Figure II.I part a). Non-available forms of metals in sediments might include mineralised metals that require strong acid dissolution, as achieved by total particulate metal (TPM) measurements (also referred to as total recoverable metals). For many assessments, AEM measurements may be a useful starting point in the decision tree, rather than TPM determinations. However, for some metal phases that are sparing soluble in 1 M HCl (e.g. sulfide phases of Ag, Cu, Hg) and metals associated with organic polymers that may degrade over time (e.g. antifouling paints, tyre rubber), the measurement of TPM allows the potential future transformation of these metals into more bioavailable forms to be adequately considered.). In some jurisdictions, TPM measurements are deemed necessary for comparison with historical data trends. The contaminants whose concentrations exceed SQGVs following consideration of contaminant bioavailability are termed contaminants of potential concern (COPCs). The contaminants whose concentrations exceed SQGVs following consideration of contaminant bioavailability are termed contaminants of potential concern (COPCs). If the SQGV is still exceeded, the third step involves the more explicit consideration of the bioavailable contaminant fraction (Figure II.I part a). For metals that form insoluble sulfides, amorphous iron sulfide (FeS) measured as so-called acid-volatile sulfides (AVS), is an important metal-binding phase that reduces metal bioavailability. Measurements of metal concentrations in the pore waters and elutriates also provides valuable information on metal bioavailability.

Many organic contaminants are hydrophobic and bind strongly to the organic carbon in sediments. To account for the preferential partitioning of these contaminants to organic matter, organic contaminants and their SQGVs are normalised to the total organic carbon (TOC) concentration of the sediment (i.e. normalised to 1% TOC) ((Figure II.I part b). This normalisation should only be applied for TOC concentrations between 0.2 and 10% (Simpsons *et al.*, 2013).

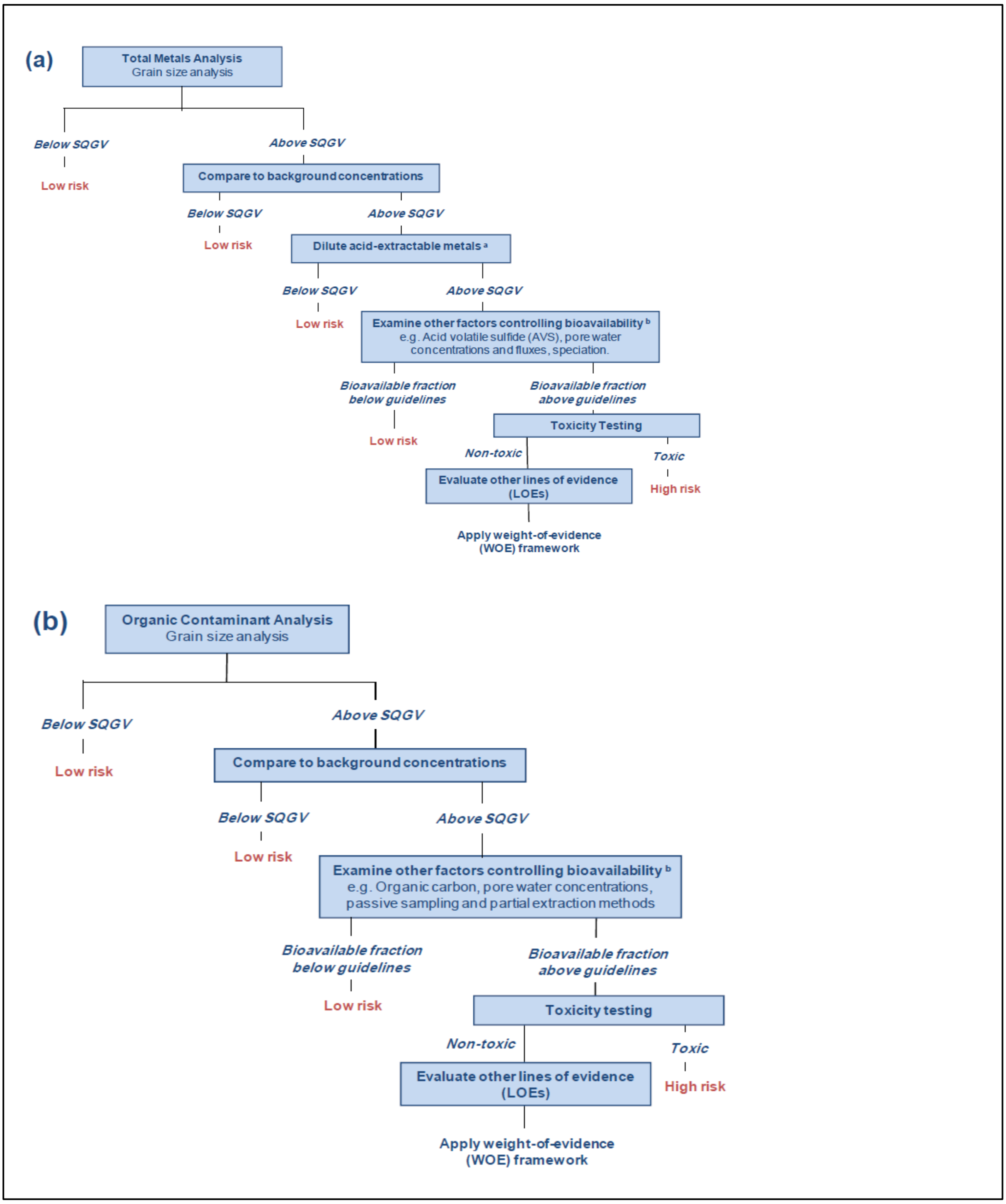


Figure II.I -Tiered framework for Assessment of Contaminated Sediments for (a) Metals and (b) Organics

Water Chemistry: Phase 1

Analytical Methodology

Inductively Coupled Plasma- Mass Spectrometry

Samples are firstly pumped from the sample tube through a pneumatic nebuliser which converts the solution into an aerosol suspended in argon gas. This aerosol passes through a glass spray chamber and into the torch assembly. Here, the sample passes into argon plasma. The molecules are atomised then ionised losing electrons in the plasma. The positively charged ions that are produced in the plasma are extracted into the vacuum system, via a pair of interface "cones". Electrostatic lenses keep the ions focused in a compact "ion beam" as they pass through the vacuum system to the final chamber, where the mass spectrometer (MS) and detector are housed.

Calibration

This method is calibrated with every run and incorporates a 7-point calibration (including blank) using matrix matched standards sourced from traceable material.

The calibration range extends up to 80µg.l^{-1} for most analytes. Any samples that are over-range are diluted with matrix matched solution and re-run.

Quality Control

This method is statistically controlled using both Process and Instrument Quality Control samples. Both are sourced independently from the solutions used to calibrate the method. Instrument and Process Blank solutions are also run at regular intervals (with each batch) to monitor potential sources of contamination.

Table II.IX Phase 1 Water Analysis Methods

Paramter	Socotec Laboratory Method
Total Organic Carbon (TOC)	Total organic carbon is measured instrumentally using an acid persulphate oxidation technique after initial removal of inorganic carbon. This methodology is preferred to catalytic combustion methods as it involves direct measurement of the analyte of interest. The measurable range of organic carbon in waters using this method is 0.1 - 20 mg/l carbon with a resolution of 0.2mg/l carbon. This range maybe extended by dilution of the sample. The instrument operates on the following principle. An aliquot of the sample is acidified with phosphoric acid and purged with nitrogen at 100°C to remove inorganic carbon. The acidified and purged sample is then reacted with potassium persulphate solution to oxidise the organic carbon present to carbon dioxide. This is purged from the reaction mixture and measured by a non-dispersive infra-red detector. The concentration of organic carbon is calculated from the volume of sample taken and the mass of carbon dioxide liberated by the oxidation.
Hydrocarbon Analysis	Internal standard solutions and surrogate were added to approximately 200ml water samples and extracted using DCM. The solvent extract was then reduced to approximately 1ml using a Kuderna Danish evaporator. Please refer to Appendix II for further details relating to the calibration and calculation of the hydrocarbon analyses.

Paramter	Socotec Laboratory Method
Total Polycyclic Aromatic Hydrocarbons (Total PAH):	Internal standard solutions and surrogate were added to approximately 200ml water samples and extracted using DCM. The solvent extract was then reduced to approximately 1ml using a Kuderna Danish evaporator. The final PAH samples were injected into a gas chromatograph (GC) equipped with a mass selective detector (MS). Concentrations were determined by referencing individual quantified mass peak areas for each target compound to the appropriate internal standard quantified mass peak area and the relative response factor calculated from the applicable continuing calibration check standard.
Total Metals by ICPMS (Nitric Acid Extractable Metals – As, Sb, Al, Ba, Be, Cd, Cr, Co, Cu, Fe, Pb, Mn, Hg, Mo, Ni, Se, Si, Ag, TI, Sn, V, Zn)	An aliquot of the water sample was acidified with concentrated nitric acid and boiled on a hot plate for 15 to 20 minutes before the extract was filtered through a 0.45µm filter and filled up with deionised water. The samples were then placed in a tube and analysed using the ICP-MS.
Sample Preparation (Mercury)	An aliquot of the As Received water sample is acidified with concentrated Nitric acid and gold (solution). The extract is filtered through a 0.45um filter. The sample is then placed in a tube and presented to the ICP-MS for analysis.
Total Nitrogen	An aliquot of sample is placed into a dry reaction tube together with reagents A (sodium hydroxide) and B (dipotassium perodoxisulphate, sodium tetraborate and sodium metaborate solution) and placed in a heating Block at 100°C for 1 hour. The reaction tube is then allowed to cool before adding reagent C (sodium azide and sodium sulphite solution) and inverting the tube. A pipette is used to transfer 0.5ml of the reacted sample into the test cuvette together with reagent D (propanol). After 15 minutes the cuvette is tested for direct colorimetric analysis using a spectrophotometer.
Nitrate	Nitrate was determined by subtracting the concentration of nitrite from the concentration of total oxidised nitrogen.
Nitrite	Nitrite ions were determined by diazotisation with sulphanilamide and coupling with N (1 naphthyl) ethylenediamine dihydrochloride. The absorbance of light by the coloured azo dye was measured at 540nm and was proportional to the concentration of nitrite in the samples.
Orthophosphate	Orthophosphate reacts with ammonium molybdate and antimony potassium tartrate under acidic conditions to form a complex which, when reduced with ascorbic acid, produces an intense blue colour. The absorbance of light by this species is measured at 880nm and is proportional to the concentration of orthophosphate in the sample. The result is reported as Phosphorous (P) but can be calculated back to Orthophosphate (PO4) by multiplying the 'Phosphate as P' result by 3.066 (the ratio between the molecular mass of PO4 and P).
Total Suspended Solids	Approximately 100ml of the well-mixed water samples were filtered through a weighed standard glass fibre filter and subsequently dried at 105°-110° before being re-weighed. The increased filter weight represented the weight of the total suspended solids which was then divided by the volume of water filtered in order to present the results as mg/litre.
Chlorophyll-a and Phaeophytin	Solvent extraction of the pigments was achieved using methanol which is particularly useful as it is superior to acetone. The concentration of chlorophyll 'a' was determined by spectrophotometric evaluation of the extract by carrying out absorbance measurements at 665nm for the analysis of chlorophyll 'a' and at 750nm for 'background turbidity'. Phaeophytin was analysed through acidification of the sample, which denatured and converted chlorophyll to chlorophyllide which is unpigmented. A re-run of the absorbance measurement revealed phaeophytin concentrations.

Water Chemistry: Phase 2

Water samples analysis includes:

- Redox potential (aboard the vessel).
- Suspended matter
- Total Organic Carbon.
- Nutrients: Kjeldahl nitrogen nitrate. nitrite. orthophosphates.
- Trace metals
- Mercury.
- Bacteria: total aerobic flora for 7 days and aerobic flora adapted to hydrocarbons over 7 days.
- Hydrocarbons: polycyclic aromatic hydrocarbons and alkanes.

Table II.X Phase 2 Water Analysis Methods

Water Parameter	Method
Total Suspended Solids (TSS)	Gravimetry NF EN 872
Total Organic Carbon (TOC)	Combustion /IR
Nitrates (NO3-)	Continuous flow
Nitrites (NO2)	Continuous flow
Orthophosphates (PO43-)	Continuous flow
Total Nitrogen	Spectrophotometry
Silver (Ag)	EPA 6020B
Aluminium (Al)	EPA 6020B
Arsenic (As)	EPA 6020B
Barium (Ba)	EPA 6020B
Beryllium (Be)	EPA 6020B
Cadmium (Cd)	EPA 6020B
Cobalt (Co)	EPA 6020B
Chromium (Cr)	EPA 6020B
Copper (Cu)	EPA 6020B
Iron (Fe)	EPA 6020B
Mercury (Hg)	EPA 6020B
Manganese (Mn)	EPA 6020B
Molybdenum (Mo)	EPA 6020B
Nickel (Ni)	EPA 6020B
Lead (Pb)	EPA 6020B
Antimony (Sb)	EPA 6020B
Selenium (Se)	EPA 6020B
Tin (Sn)	EPA 6020B
Thallium (Tl)	EPA 6020B
Zinc (Zn)	EPA 6020B
Vanadium (V)	EPA 6020B
Aliphatic hydrocarbons >C5 – C6	GC/MS Internal method
Aliphatic hydrocarbons >C6 - C8	GC/MS Internal method
Aliphatic hydrocarbons >C8 - C10	GC/MS Internal method
Aliphatic hydrocarbons >C10 - C12	GC/MS Internal method
Aliphatic hydrocarbons >C12 - C16	GC/MS Internal method
Aliphatic hydrocarbons >C16 - C21	GC/MS Internal method
Aliphatic hydrocarbons >C21 - C35	GC/MS Internal method
Aromatic hydrocarbons >C6-C8	GC/MS Internal method

Water Parameter	Method
Aromatic hydrocarbons >C8 - C10	GC/MS Internal method
Aromatic hydrocarbons >C10 - C12	GC/MS Internal method
Aromatic hydrocarbons >C12 - C16	GC/MS Internal method
Aromatic hydrocarbons >C16 – C21	GC/MS Internal method
Aromatic hydrocarbons >C21 - C35	GC/MS Internal method
Total aliphatic hydrocarbons	GC/MS Internal method
Total aromatic hydrocarbons	GC/MS Internal method
Total aliphatic and aromatic hydrocarbons	GC/MS Internal method
Benzene	GC/MS
Ethylbenzene	GC/MS
o-Xylene	GC/MS
Toluene	GC/MS
Xylene (meta-. para-)	GC/MS
PAH (x16 PAHs)	GC/MS
Total heterotrophic microorganisms	INTERNAL METHOD
Hydrocarbon adapted microorganisms	INTERNAL METHOD

Macro-invertebrate Analysis

Methodology

All macrofaunal determination was carried out inhouse by the BSL specialist taxonomist team. The BSL specialist taxonomist team are comprised of three senior individuals who possess a wealth of experience in macrofaunal identification in temperate deep-water environments.

Benthic sediment samples were thoroughly washed with freshwater on a 500µm sieve to remove traces of formalin, placed in gridded, white trays and then hand sorted by eye followed by binocular microscope, to remove all fauna. Sorted organisms were preserved in 70% IMS and 5% glycerol. Where possible, all organisms were identified to species level according to appropriate keys for the region. Colonial and encrusting organisms were recorded by presence alone and, where colonies could be identified as a single example, these were also recorded, although these datasets have not been considered in the overall statistical analysis of the material. The presence of anthropogenic components was also recorded where relevant.

All taxa were distinguished to species level and identified to at least family level where possible, and many of the species that could not be fully identified were separated putatively. Nomenclature for species names were allocated either when identity was confirmed, allocated as “cf.” when apparently identifying to a known species but confirmation was not possible (for example, incomplete specimens or descriptions), or allocated as “aff.” when close to but distinct from a described species. The terms “indet.” refers to being unable to identify to a lower taxon and “juv” as a juvenile of that species, genus or family.

Quality Assurance

BSL is committed to total quality control from the start of a project to its completion. All samples taken or received by the company were given a unique identification number. All analytical methods were carried out according to recognised standards for marine analyses. All taxonomic staff are fully qualified to post-doctorate level. Documentation is maintained that indicates the stage of analysis that each sample has reached. A full reference collection of all specimens has been retained for further clarification of putative species groups where/if required. BSL is a participant in the NMBAQC quality assurance scheme.

Digital datasets are kept for all sites in the form of excel spreadsheets (by sample and by station) on BSL's archive computer. This system is duplicated onto a second archive drive in case of electronic failure. These datasets will be stored in this way for a minimum of 3 years, or transferred to storage disk (data CD or DVD).

Biological Data Standardisation and Analyses

In accordance with OSPAR Commission (2004) guidelines, all species falling into juvenile, colonial, planktonic of meiofaunal taxa are excluded from the full analyses within the dataset (this is discussed further within the core of the report text). This helps to reduce the variability of data undertaken during different periods within the year, or where minor changes may occur or where some groups may only be included in a non-quantitative fashion, such as presence/absence. Certain taxa, such as the Nematoda, normally associated with meiofauna, were included where individuals greater than 10mm were recorded. The following primary and univariate parameters were calculated for each all data by stations and sample (Table II.VI).

In addition to univariate methods of analysis, data for both sample replicates and stations were analysed using multivariate techniques. These serve to reduce complex species-site data to a form that is visually interpretable. A multivariate analysis was based on transformed data (square root) to detect any improved relationships when effects of dominance were reduced. The basis for multivariate analyses was based upon the software PRIMER (Plymouth Routines In Multivariate Ecological Research).

Similarity Matrices and Hierarchical Agglomerative Clustering (CLUSTER)

A similarity matrix is used to compare every individual sample replicate and/or stations with each other. The coefficient used in this process is based upon Bray Curtis (Bray and Curtis, 1957), considered to be the most suitable for community data. These are subsequently assigned into groups of replicates and/or stations according to their level of similarity and clustered together based upon a Group Average Method into a dendrogram of similarity.

Table II.VI - Primary and Univariate Parameter Calculations

Variable	Parameter	Formula	Description
Total Species	S	Number of species recorded	Species richness
Total Individuals	N	Number of individuals recorded	Sample abundance
Shannon-Wiener Index	H(s)	$$H(s) = -\sum_{i=1}^{s}(Pi)(log_2 Pi)$$ where s = number of species & Pi = proportion of total sample belonging to *i*th species.	Diversity: using both richness and equitability, recorded in log 2.
Simpsons Diversity	1-Lambda	$$Lambda = \sum\left(\frac{ni(ni-1)}{N(N-1)}\right)$$ where ni = number of individuals in the *i*th species & N = total number of individuals	Evenness, related to dominance of most common species (Simpson, 1949)
Pielou's Equitability	J	$$J = \frac{H(s)}{(\log S)}$$ where s = number of species & H(s) = Shannon-Wiener diversity index.	Evenness or distribution between species (Pielou, 1969)

Non-metric Multidimensional Scaling (nMDS)

nMDS is currently widely used in the analysis of spatial and temporal change in benthic communities (e.g. Warwick and Clarke, 1991). The recorded observations from data were exposed to computation of triangular matrices of similarities between all pairs of samples. The similarity of every pair of sites was computed using the Bray-Curtis index on transformed data. Clustering was by a hierarchical agglomerative method using group average sorting, and the results are presented as a dendrogram and as a two-dimensional ordination plot. The degree of distortion involved in producing an ordination gives an indication of the adequacy of the nMDS representation and is recorded as a stress value as outlined in Table II.VII.

Table II.VII - Inference From nMDS Stress Values

nMDS Stress	Adequacy of Representation for Two-Dimensional Plot
≤0.05	Excellent representation with no prospect of misinterpretation.
>0.05 to 0.1	Good ordination with no real prospect of a misleading interpretation.
>0.1 to 0.2	Potentially useful 2-d plot, though for values at the upper end of this range too much reliance should not be placed on plot detail; superimposition of clusters should be undertaken to verify conclusions.
>0.2 to 0.3	Ordination should be treated with scepticism. Clusters may be superimposed to verify conclusions, but ordinations with stress values >2.5 should be discarded. A 3-d ordination may be more appropriate.
>0.3	Ordination is unreliable with points close to being arbitrarily placed in the 2-d plot. A 3-d ordination should be examined.

Similarity Percentages Analysis (SIMPER)

The nMDS clustering program is used to analyse differences between sites. SIMPER enables those species responsible for differences to be identified by examining the contribution of individual species to the similarity measure.

$S^{*}_{1} = S_{obs} + (a^2/2b)$

$\mathbf{S_{obs}}$ is the number of species observed

a is the number of species observed just once
b is the number of species observed just twice

Relationship Testing (RELATE)

A non-parametric Mantel test that looks at the relationship between 2 matrices (often biotic and environmental). This shows the degree of seriation, an alternative to cluster analysis, which looks for a sequential pattern in community change. The test computes Spearman's rank correlation coefficient (ρ) between the corresponding elements of each pair of matrices to produce a correlation statistic present between the two datasets, the significance of the correlation determined by a permutation procedure (Clarke and Gorley, 2006).

Analysis of Similarity (ANOSIM)

Non-parametric, multivariate test often used in community ecology that calculates Bray-Curtis coefficient (for biological data) or Euclidean distance (for environmental data) based on permutations of ranked data. It produces an R value which is an effect level on a scale of 0-1; R=1 where all differences between sites are greater than any differences within site, R=0 when there is no separation between groups. P value (<5%) is the likelihood of arriving at that R value by chance, this significance value is determined by a permutation procedure (Clarke and Gorley, 2006).

Similarity Profile (SIMPROF)

Analyses data for significant clusters that show evidence of a multivariate pattern in data that are a priori unstructured, i.e. single samples from each site, this differs from the ANOSIM tests which permutes data based on a grouping factor such as 'site' or 'year'. The test works by comparing samples which have been ranked and ordered by resemblance against an expected profile which is obtained by permuting random species (variables) across the set of samples, a mean of 1000 permutations is taken to produce an expected result for null structure with rare and common species displaying the same pattern. If the actual data deviates outside the 95% limits of the expected profile, then there is evidence for significant structure and vice versa. The 'significant structure' is well represented on a dendrogram which will also show the clusters containing that lack significant differentiation (null structure; Clarke and Gorley, 2006).

References

Bray, J.R. and Curtis, J.T. 1957. An ordination of the upland forest communities of Southern Wisconsin. Ecol. Monogr., 27, pp.325-349.

Clarke, K. & Gorley, R. N., 2006. Primer v6: User Manual/Tutorial.

Folk, R.L., 1954. The distinction between grain size and mineral composition in sedimentary rock nomenclature. Journal of Geology 62, pp.344-349.

Folk, R.L. and Ward, W.C., 1957. Brazos River Bar: A Study in the Significance of Grain Size Parameters. Journal of Sedimentary Research, 27, pp.3-26.

Hart, B., 1996. Ecological Monitoring Unit – Confirmation of the reproducibility of the Malvern Mastersizer Microplus Laser Sizer and comparison of its output with the Malvern 3600E sizer. Brixham Environmental Laboratory report BL2806/B.

Hurlbert, S.H., 1971. The non-concept of species diversity: a critique and alternative parameters. Ecology, 52(4), pp.577-586.

Appendix III – Particle Size Distribution

Appendix III - Particle Size Distribution_1 of

Appendix III - Particle Size Distribution_2 of

Modified Folk Classification

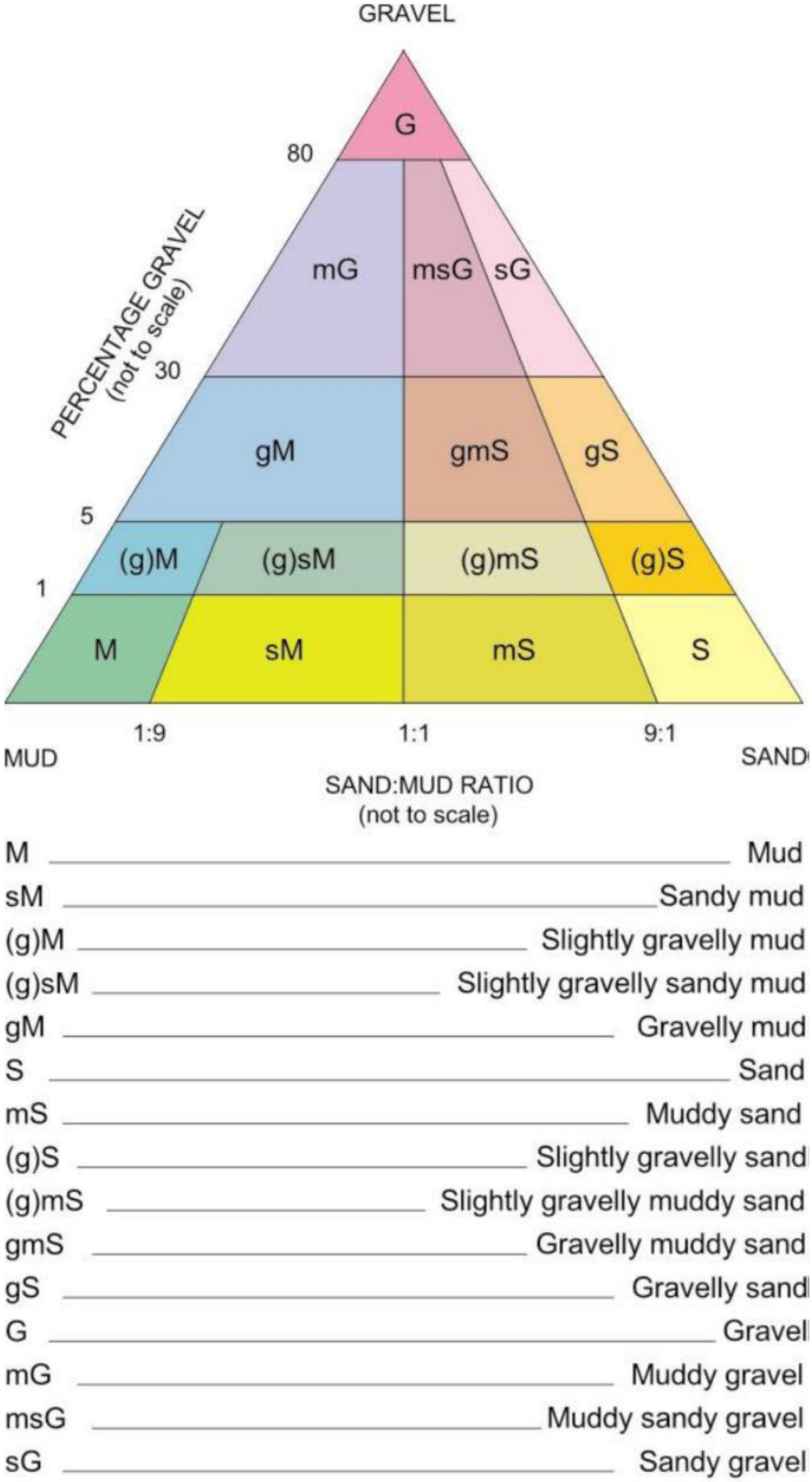


Figure III.I: Folk Classification Triangle (1954)

Appendix IV – Total Aliphatic Concentrations by Station

Sediment Samples

Table IV.I: Total Aliphatic Concentrations (μg.kg^{-1}) for Sampling Stations through Block 2913B

Station	0m Venus-2	250m_SE	500m_SE	1000m_SE	2000m_SE	250m_NW	500m_NW	1000m_NW	1500m_NW	2000m_NW	3000m_NW
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC15	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC17	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pristane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC18	<1	<1	<1	<1	1.49	<1	<1	<1	<1	<1	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	<1	<1	<1	1.8	<1	<1	<1	<1	<1	<1
nC20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC21	<1	<1	<1	<1	2.26	<1	<1	<1	<1	<1	<1
nC22	<1	<1	<1	3.70	1.98	5.13	<1	<1	<1	<1	<1
nC23	<1	5.96	6.14	4.23	2.9	5.08	5.69	4.44	5.98	4.60	5.10
nC24	<1	<1	<1	5.14	3.74	7.08	5.86	<1	<1	8.16	3.86
nC25	<1	<1	<1	4.98	3.9	11.7	6.54	7.94	12.4	7.62	5.91
nC26	<1	<1	5.22	4.88	3.7	7.50	6.40	6.85	7.63	7.31	6.35
nC27	12.8	12.6	38.7	7.20	9.0	13.2	9.01	13.8	12.4	8.91	8.68
nC28	7.68	<1	5.79	5.20	10.08	6.37	7.79	5.78	8.14	5.60	4.74
nC29	11.4	15.5	12.0	35.9	21.4	38.2	37.5	35.8	45.1	35.4	35.5
nC30	7.13	7.97	6.23	13.8	6.89	10.4	12.2	9.74	14.9	9.71	9.56
nC31	30.8	28.8	25.5	73.5	34.1	84.7	77.7	81.2	86.7	69.2	72.5
nC32	6.66	<1	5.42	5.44	4.29	8.19	10.1	6.75	8.01	4.88	6.60
nC33	14.3	15.6	12.3	35.0	13.50	43.8	39.7	38.8	42.1	32.3	33.6
nC34	<1	<1	<1	27.3	6.5	8.25	10.8	6.04	5.40	8.58	5.42
nC35	<1	<1	<1	20.4	3.7	28.2	30.0	8.32	28.5	18.4	19.6
nC36	<1	<1	<1	4.56	2.0	10.1	22.8	7.43	11.64	5.60	6.00
nC37	<1	<1	<1	<1	5.0	9.03	27.0	8.01	16.4	11.0	14.3
Total Oil	**5,734**	**4,360**	**2,052**	**4,184**	**1,366**	**5,049**	**4,469**	**3,604**	**4,086**	**3,411**	**3,028**
Total n-alkanes	**91**	**86**	**117**	**251**	**138**	**297**	**309**	**241**	**305**	**237**	**238**

Station	250m_NE	500m_NE	1000m_NE	2000m_NE	10000m_NE	250m_SW	500m_SW	1000m_SW	2000m_SW	B2913B_ENV_01
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC15	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC17	<1	<1	<1	<1	<1	<1	<1	<1	<1	2
Pristane	<1	<1	<1	<1	<1	<1	<1	<1	<1	1
nC18	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC21	<1	<1	<1	<1	<1	<1	<1	<1	4.17	2.3
nC22	<1	<1	4.58	4.08	3.61	<1	5.21	<1	5.96	<1
nC23	5.83	4.67	3.56	5.55	3.52	5.86	4.41	4.62	10.4	2.9
nC24	4.80	7.71	7.42	9.51	<1	7.29	10.5	6.61	14.1	1.6
nC25	9.27	6.26	9.99	11.6	<1	11.3	15.5	10.3	13.2	4.4
nC26	7.19	6.34	6.68	7.59	5.40	6.88	9.52	6.94	11.8	2.7
nC27	10.6	7.66	9.51	8.91	7.60	8.90	12.8	14.0	11.5	7.2
nC28	8.05	5.68	6.84	9.91	5.01	4.72	6.84	5.19	9.19	4.3
nC29	39.5	34.1	37.6	32.3	30.3	38.2	44.2	35.2	39.3	21.1
nC30	11.4	7.68	10.5	7.02	7.85	10.2	11.2	10.7	9.52	4.5
nC31	89.4	71.4	84.5	77.4	70.2	80.8	94.9	64.0	75.3	31.4
nC32	11.3	<1	6.55	5.33	4.87	6.17	5.74	5.78	5.53	4.3
nC33	45.9	34.7	40.5	35.8	33.7	37.0	37.0	29.2	36.0	12.3
nC34	12.1	8.19	7.35	9.54	5.97	8.49	27.8	4.70	9.82	6.02
nC35	23.7	15.5	12.0	10.4	15.1	22.8	23.1	13.9	9.16	3.0
nC36	14.1	3.55	<1	5.12	2.91	7.59	7.59	4.98	6.50	3.27
nC37	21.7	<1	14.2	6.01	5.43	13.9	11.3	<1	5.07	3.49
Total Oil	**2,862**	**2,679**	**2,938**	**3,543**	**2,468**	**4,144**	**5,080**	**4,611**	**7,771**	**727**
Total n-alkanes	**315**	**214**	**262**	**246**	**201**	**270**	**328**	**216**	**277**	**117**

Station	B2913B_ENV_02	B2913B_ENV_03	B2913B_ENV_04	B2913B_ENV_05	B2913B_ENV_06	B2913B_ENV_07	B2913B_ENV_08	B2913B_ENV_09	B2913B_ENV_10	B2913B_ENV_11
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	<1	<1	<1	2.4	2.2	<1	3.15	2.36	<1	<1
nC15	<1	<1	<1	<1	<1	<1	1.45	1.82	<1	<1
nC16	<1	<1	<1	<1	<1	5.03	1.87	1.95	<1	<1
nC17	<1	<1	1.4	1.82	1.5	2.54	2.39	3.04	2.04	2.21
Pristane	<1	<1	1.3	1.13	<1	<1	<1	1.46	1.03	<1
nC18	<1	<1	1.0	1.34	<1	1.23	1.02	<1	1.04	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	<1	<1	1.50	<1	2.28	<1	<1	1.46	<1
nC20	<1	<1	1.19	1.0	<1	1.90	<1	<1	<1	<1
nC21	<1	1.4	2.42	2.93	<1	1.72	1.26	1.77	1.45	2.90
nC22	<1	<1	4.67	3.34	<1	1.72	1.03	<1	<1	3.88
nC23	3.0	1.7	13.09	10.23	2.2	3.91	3.00	2.95	2.57	11.39
nC24	1.57	1.87	23.12	19.31	3.22	4.10	3.64	4.12	1.44	17.67
nC25	4.1	3.9	31.87	24.20	4.4	7.16	6.25	5.81	5.00	26.50
nC26	2.4	2.7	36.34	24.72	3.01	6.00	5.32	3.85	3.15	27.20
nC27	6.1	6.0	39.1	26.7	7.1	11.3	11.23	8.5	7.63	30.60
nC28	2.2	3.2	32.20	20.29	4.17	7.12	7.48	5.15	4.74	22.38
nC29	14.3	14.1	41.0	31.2	19	28.3	25.9	25.8	18.5	35.4
nC30	3.8	3.67	22.3	13.31	6.1	9.1	9.3	11.06	5.71	15.0
nC31	25.7	23.5	44.9	35.0	28.2	40.2	37.6	34.5	29.6	37.0
nC32	2.4	4.2	12.48	5.3	2.9	4.71	6.5	6.39	4.26	5.98
nC33	10.3	9.4	16.8	15.4	10.5	13.92	16.48	16.16	12.87	13.30
nC34	2.0	4.1	8.45	2.9	5.06	4.42	5.5	4.69	5.39	3.42
nC35	1.7	2.3	11.3	3.4	3.3	5.3	3.4	3.98	4.20	5.18
nC36	1.3	3.2	7.44	2.7	1.8	5.32	4.27	3.49	5.2	2.66
nC37	1.97	3.41	9.26	5.25	3.9	4.35	4.94	<1	4.96	4.13
Total Oil	**659**	**1,066**	**1,974**	**1,614**	**1,250**	**1,879**	**1,773**	**2,103**	**978**	**1,818**
Total n-alkanes	**83**	**89**	**360**	**254**	**108**	**172**	**163**	**147**	**121**	**267**

Station	B2913B_ENV_12	B2913B_ENV_13	B2913B_ENV_14	B2913B_ENV_15	B2913B_ENV_16	B2913B_ENV_17	B2913B_ENV_19	B2913B_ENV_20	B2913B_ENV_21	B2913B_ENV_23
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	7.12	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC15	7.61	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC16	3.59	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC17	2.49	2.17	<1	<1	<1	2.0	<1	<1	1.75	<1
Pristane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC18	<1	<1	<1	<1	<1	<1	<1	<1	1.13	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	<1	<1	<1	<1	<1	<1	<1	1.91	<1
nC20	<1	<1	<1	<1	<1	<1	<1	<1	1.19	<1
nC21	1.62	1.33	1.24	<1	<1	2.01	<1	2.34	2.97	1.69
nC22	<1	1.36	<1	<1	<1	2.01	<1	1.50	1.72	<1
nC23	3.10	3.41	2.85	2.4	2.9	4.39	3.33	4.10	4.15	1.54
nC24	1.41	1.86	<1	<1	3.00	5.02	1.75	3.82	12.29	1.79
nC25	7.09	6.68	5.62	4.68	4.5	8.9	4.62	6.13	6.95	4.08
nC26	5.29	5.27	4.34	2.95	2.86	7.68	2.85	4.96	5.37	2.77
nC27	12.29	10.50	8.5	7.9	7.6	11.2	7.2	9.45	10.27	6.78
nC28	6.03	6.92	4.81	4.77	3.32	7.1	4.00	7.34	6.08	4.64
nC29	21.5	23.43	18.19	19.4	17.6	23	20.3	25.0	32.7	17.29
nC30	12.20	8.0	4.5	6.26	4.3	6.3	4.7	6.7	7.85	4.95
nC31	32.1	35.6	31.5	33.1	34.3	32.5	31.6	35.0	46.4	31.50
nC32	3.32	5.5	3.16	4.76	3.28	5.12	2.51	7.52	6.06	3.03
nC33	11.95	14.5	11.87	13.3	13.15	12.3	11.42	17.00	19.38	10.86
nC34	3.67	3.42	2.39	3.37	3.7	6.3	3.8	10.2	8.9	2.93
nC35	3.36	3.1	2.2	5.1	1.9	3.1	3.5	2.49	4.62	1.90
nC36	1.87	3.28	2.19	3.70	2.5	4.47	2.0	1.53	5.74	1.03
nC37	2.80	3.65	2.17	4.66	3.62	6.45	3.42	<1	2.96	2.03
Total Oil	**2,267**	**1,197**	**919**	**1,601**	**873**	**1,251**	**830**	**1,460**	**1,764**	**762.93**
Total n-alkanes	**150**	**140**	**105**	**116**	**109**	**150**	**107**	**145**	**190**	**98.86**

Station	B2913B_ENV_24	B2913B_ENV_25	B2913B_ENV_27	B2913B_ENV_28	B2913B_ENV_29	B2913B_ENV_30	B2913B_ENV_31	B2913B_ENV_33	B2913B_ENV_34	B2913B_ENV_35
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC15	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC17	2.04	<1	1.90	1.68	1.27	1.81	<1	<1	<1	<1
Pristane	<1	<1	<1	1.12	<1	<1	<1	<1	<1	<1
nC18	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	<1	<1	<1	<1	3.19	<1	<1	<1	<1
nC20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC21	<1	<1	3.35	<1	1.22	5.65	<1	2.52	2.71	<1
nC22	<1	<1	<1	1.53	1.53	1.48	<1	1.35	1.82	<1
nC23	2.97	2.93	3.47	2.38	2.86	3.64	3.35	2.30	3.90	3.62
nC24	1.91	1.84	3.95	2.64	4.1	2.28	5.36	3.71	11.89	2.74
nC25	4.99	4.28	4.35	5.28	3.81	5.37	5.58	4.43	5.35	4.30
nC26	3.08	2.64	2.10	3.48	2.42	4.09	4.23	2.92	3.73	2.86
nC27	7.79	7.33	6.82	8.50	6.2	9.12	9.82	6.33	7.90	6.96
nC28	5.35	5.49	3.40	6.07	4.3	8.19	6.65	3.08	5.82	5.08
nC29	27.7	21.5	24.4	25.7	17	28.4	25.7	18.54	21.60	21.8
nC30	7.42	8.1	6.07	9.58	7.3	10.78	8.49	6.49	6.97	9.18
nC31	39.8	35.3	31.3	37.25	27	37.3	37.4	27.76	35.6	34.34
nC32	6.8	9.4	3.79	7.35	4.30	9.8	6.15	3.83	6.07	4.97
nC33	10.78	19.51	11.20	16.41	11.6	18.1	16.65	13.35	16.44	14.42
nC34	6.42	13.95	2.42	6.00	4.0	15.80	5.94	5.07	12.54	7.93
nC35	6.76	19.8	3.49	3.63	1.8	4.63	3.44	2.06	2.58	2.41
nC36	4.82	16.05	2.72	3.31	2.37	1.86	2.62	1.13	1.23	1.04
nC37	3.06	9.16	2.91	6.00	3.71	7.69	3.34	3.04	<1	<1
Total Oil	**1,406**	**1,126**	**1,323**	**1,580**	**912**	**1,570**	**1,444**	**1,213**	**2,097**	**1,318**
Total n-alkanes	**142**	**177**	**118**	**147**	**107**	**179**	**144.8**	**107.9**	**146.1**	**121.6**

Station	B2913B_ENV_36	B2913B_ENV_38	B2913B_ENV_39	B2913B_ENV_40	B2913B_ENV_41	B2913B_ENV_43	B2913B_ENV_44	B2913B_ENV_45	B2913B_ENV_46	B2913B_ENV_47
nC10	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC14	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC15	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC16	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC17	<1	<1	1.68	<1	<1	<1	<1	<1	<1	<1
Pristane	<1	<1	1.16	<1	<1	<1	<1	<1	<1	<1
nC18	<1	<1	1.18	<1	<1	<1	<1	<1	<1	<1
Phytane	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC19	<1	<1	2.17	<1	<1	<1	<1	<1	<1	<1
nC20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
nC21	<1	<1	2.93	2.74	<1	3	<1	<1	<1	1.49
nC22	<1	<1	1.60	1.89	<1	<1	<1	1.73	<1	1.29
nC23	2.88	3.30	3.88	2.60	3.77	3	2.10	3.37	3.94	2.11
nC24	3.89	3.69	2.46	3.51	1.93	2	2.74	6.49	2.84	1.95
nC25	4.17	5.07	4.15	5.43	4.41	5	4.12	4.01	4.59	4.19
nC26	2.84	2.38	4.34	4.13	2.89	3	2.73	2.62	3.18	3.20
nC27	6.34	6.23	8.27	9.32	6.77	6.9	6.24	6.33	7.15	7.33
nC28	4.65	4.29	5.92	5.87	4.61	4.3	4.21	3.66	5.37	5.00
nC29	17.3	16.8	29.1	28.53	21.1	20	17.22	16.02	19.66	21.97
nC30	5.75	5.20	8.80	8.75	7.24	6	5.03	5.10	6.33	7.49
nC31	28.8	28.8	35.8	37.9	28.8	30	26.37	26.32	28.80	29.41
nC32	5.44	4.61	5.23	5.59	7.29	3.7	3.86	3.88	4.68	4.40
nC33	12.81	11.72	13.65	15.48	16.01	12.1	11.29	11.88	13.61	10.81
nC34	5.29	3.91	5.09	8.49	8.30	6.0	3.39	6.42	6.71	4.12
nC35	2.20	1.88	3.91	5.36	4.08	3.0	1.97	1.93	2.43	3.42
nC36	6.23	3.69	1.54	1.70	2.23	3.1	1.53	2.05	1.72	2.52
nC37	<1	5.03	<1	<1	<1	<1	<1	<1	<1	<1
Total Oil	**974**	**768**	**1,569**	**1,664**	**1,341**	**1,030**	**739.19**	**967.95**	**931.30**	**991.45**
Total n-alkanes	**108.6**	**106.6**	**141.7**	**147.3**	**119**	**112**	**92.80**	**101.81**	**111.02**	**110.71**

Station	B2913B_ENV_48	B2913B_ENV_49	B2913B_ENV_50	B2913B_ENV_51	B2913B_ENV_52
nC10	<1	<1	<1	<1	<1
nC11	<1	<1	<1	<1	<1
nC12	<1	<1	<1	<1	<1
nC13	<1	<1	<1	<1	<1
nC14	<1	<1	<1	<1	<1
nC15	<1	<1	2.75	<1	<1
nC16	<1	<1	<1	<1	<1
nC17	<1	<1	1.86	<1	<1
Pristane	<1	<1	1.51	<1	<1
nC18	<1	<1	<1	<1	<1
Phytane	<1	<1	<1	<1	<1
nC19	<1	<1	<1	<1	<1
nC20	<1	<1	<1	<1	<1
nC21	1.41	1.95	2.21	2.21	1.29
nC22	1.34	1.69	1.49	1.97	1.43
nC23	1.82	2.06	2.08	3.35	2.53
nC24	1.62	2.77	3.19	2.51	3.74
nC25	3.57	3.02	4.12	4.70	4.39
nC26	2.96	3.33	3.29	4.9	3.62
nC27	6.82	6.50	7.53	8.89	8.81
nC28	4.45	4.46	5.11	5.91	4.66
nC29	19.14	17.55	21.17	24.23	21.63
nC30	7.55	7.73	8.15	11.02	9.32
nC31	29.39	25.16	28.80	35.57	32.98
nC32	4.26	4.03	4.56	6.53	5.98
nC33	9.91	10.07	12.48	15.81	8.40
nC34	2.20	1.99	2.54	4.59	4.55
nC35	2.35	1.99	3.00	3.37	2.13
nC36	1.67	2.53	2.72	3.96	1.59
nC37	<1	<1	1.16	1.61	<1
Total Oil	**1052.80**	**1148.69**	**1510.65**	**1275.04**	**1,398.2**
Total n-alkanes	**100.47**	**96.83**	**118.23**	**141.19**	**117.06**

Water Samples

Table IV.II: Total Aliphatic Concentrations (µg.l-1) at Block 2913B

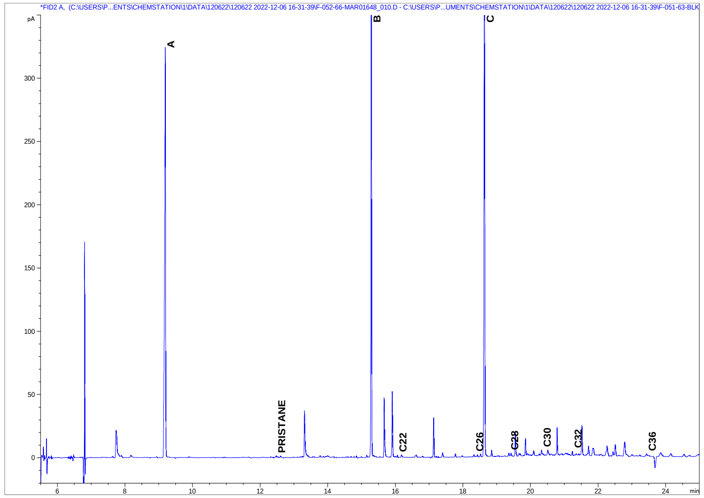
Station	250m_SE_SUR	250m_SE_MID	250m_SE_BOT	10000m_NE_TOP	10000m_NE_MID	10000m_NE_BOT	B2913B_ENV_21_SUR	B2913B_ENV_21_MID	B2913B_ENV_21_BOT
nC10	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC11	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC12	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC13	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC14	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC15	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC16	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC17	<1	<1	<1	<1	<1	<1	ND	ND	ND
Pristane	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC18	<1	<1	<1	<1	<1	<1	ND	ND	ND
Phytane	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC19	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC20	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC21	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC22	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC23	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC24	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC25	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC26	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC27	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC28	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC29	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC30	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC31	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC32	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC33	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC34	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC35	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC36	<1	<1	<1	<1	<1	<1	ND	ND	ND
nC37	<1	<1	<1	<1	<1	<1	ND	ND	ND
Total Oil	**8.96**	**7.93**	**5.95**	**4.86**	**17.3**	**7.96**	**<27.4**	**<27.4**	**<27.4**
Total n-alkanes	**<28**	**<28**	**<28**	**<28**	**<28**	**<28**	-	-	-

Station	B2913B_ENV_35_SUR	B2913B_ENV_35_MID	B2913B_ENV_35_BOT	B2913B_ENV_36_SUR	B2913B_ENV_36_MID	B2913B_ENV_36_BOT	B2913B_ENV_45_SUR	B2913B_ENV_45_MID	B2913B_ENV_45_BOT
nC10	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC11	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC12	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC13	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC14	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC15	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC16	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC17	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pristane	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC18	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phytane	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC19	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC20	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC21	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC22	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC23	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC24	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC25	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC26	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC27	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC28	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC29	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC30	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC31	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC32	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC33	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC34	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC35	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC36	ND	ND	ND	ND	ND	ND	ND	ND	ND
nC37	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Oil	**<27.4**	**<27.4**	**<27.4**	**<91.4**	**178.1**	**<27.4**	**<27.4**	**<27.4**	**<27.4**
Total n-alkanes	-	-	-	-	-	-	-	-	-

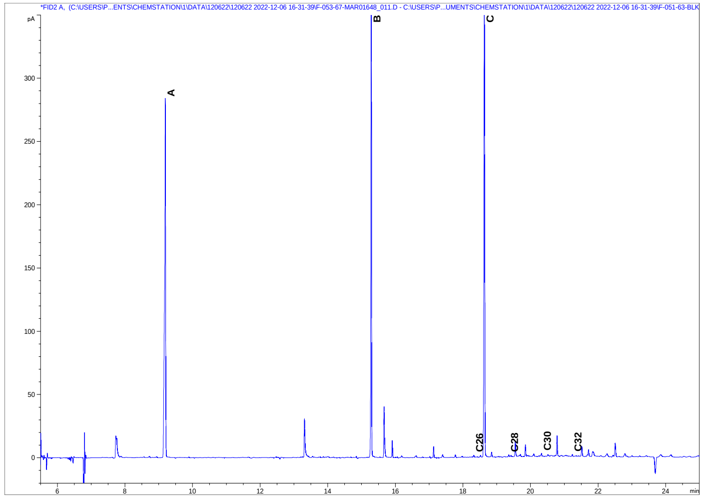
Station	B2913B_ENV_50_SUR	B2913B_ENV_50_MID	B2913B_ENV_50_BOT
nC10	ND	ND	ND
nC11	ND	ND	ND
nC12	ND	ND	ND
nC13	ND	ND	ND
nC14	ND	ND	ND
nC15	ND	ND	ND
nC16	ND	ND	ND
nC17	ND	ND	ND
Pristane	ND	ND	ND
nC18	ND	ND	ND
Phytane	ND	ND	ND
nC19	ND	ND	ND
nC20	ND	ND	ND
nC21	ND	ND	ND
nC22	ND	ND	ND
nC23	ND	ND	ND
nC24	ND	ND	ND
nC25	ND	ND	ND
nC26	ND	ND	ND
nC27	ND	ND	ND
nC28	ND	ND	ND
nC29	ND	ND	ND
nC30	ND	ND	ND
nC31	ND	ND	ND
nC32	ND	ND	ND
nC33	ND	ND	ND
nC34	ND	ND	ND
nC35	ND	ND	ND
nC36	ND	ND	ND
nC37	ND	ND	ND
Total Oil	**<27.4**	**417.2**	**<27.4**
Total n-alkanes	-	-	-

Appendix V – GC FID Traces (Saturates)

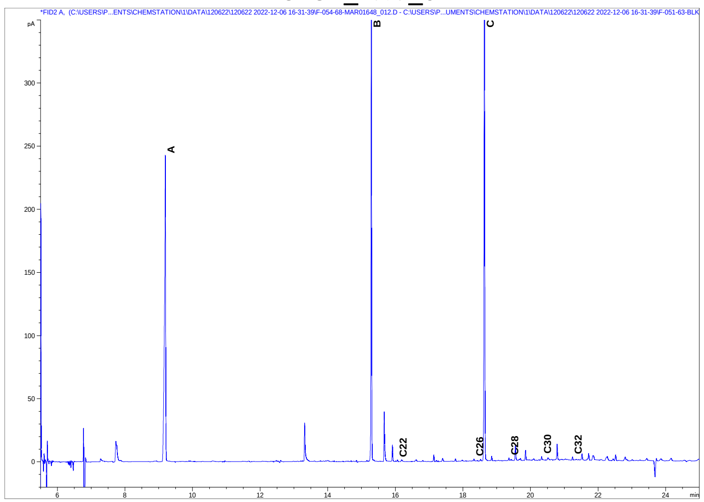
Sediment Stations



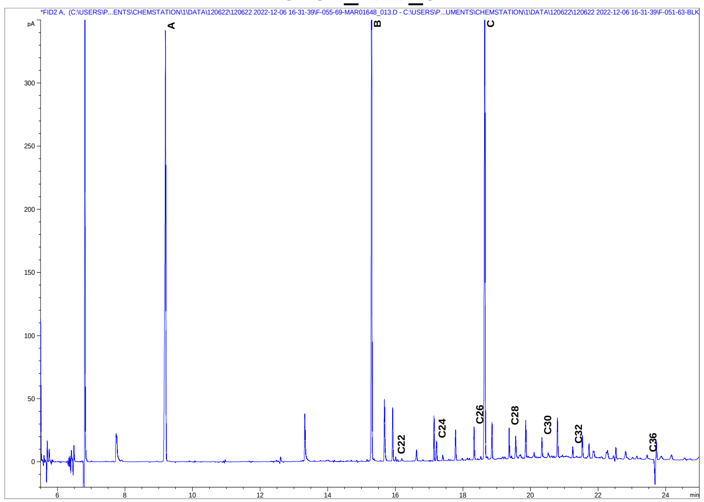
B2913B_ENV_01



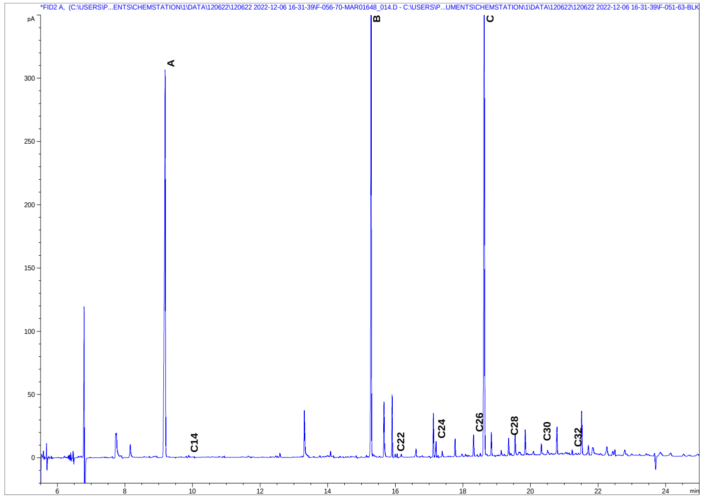
B2913B_ENV_02



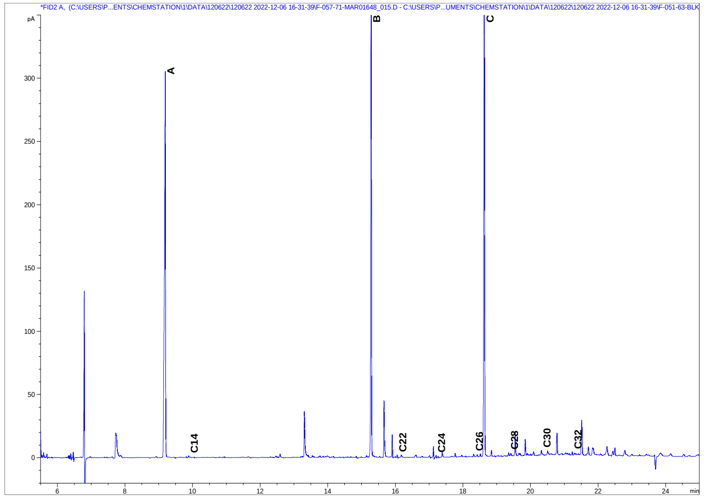
B2913B_ENV_03



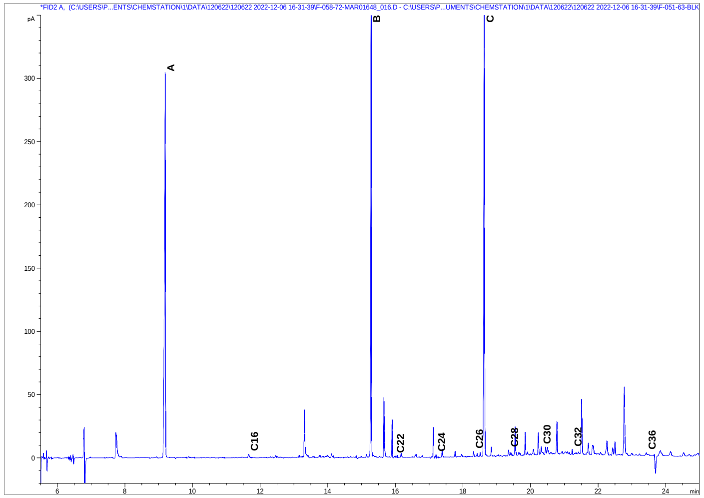
B2913B_ENV_04



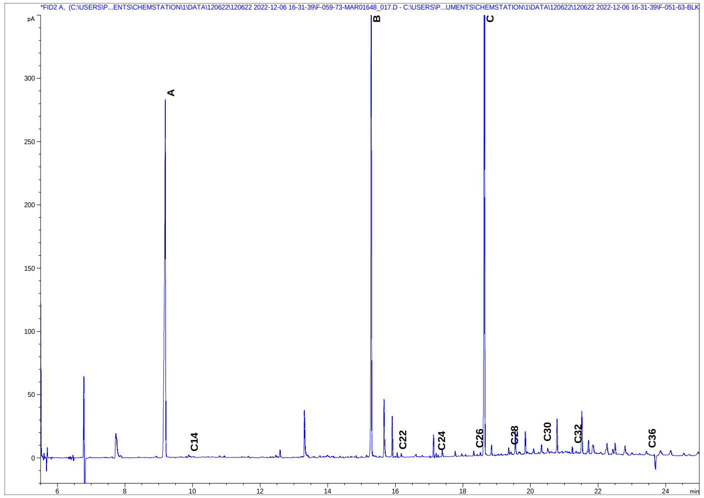
B2913B_ENV_05



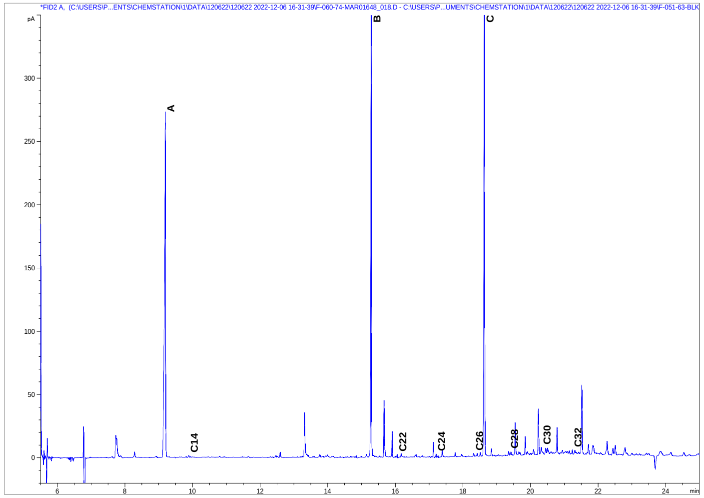
B2913B_ENV_06



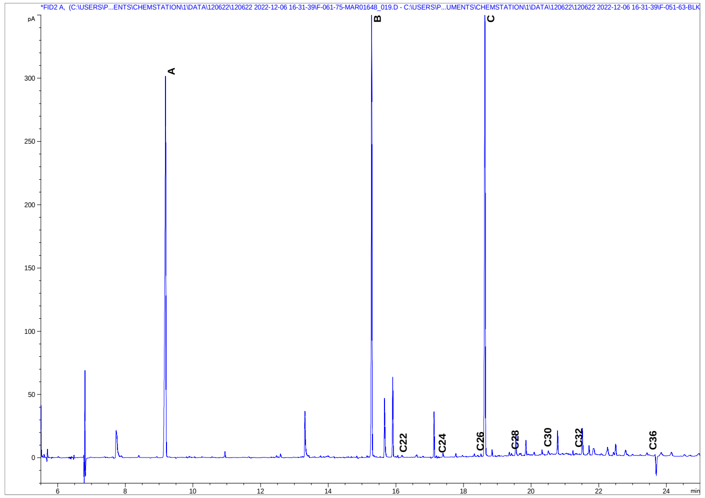
B2913B_ENV_07



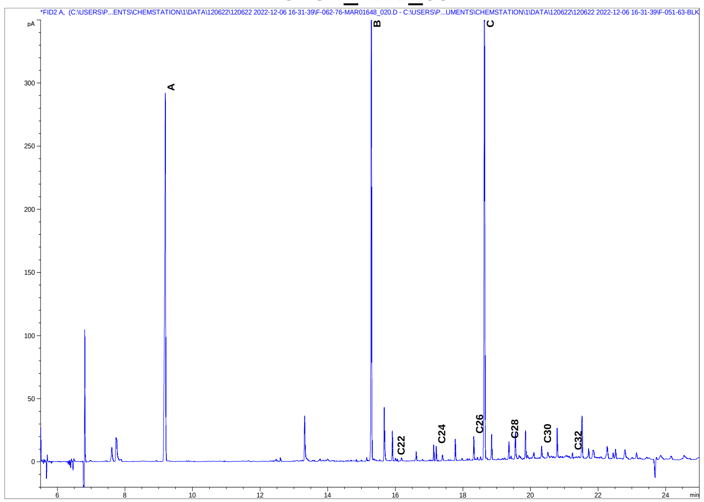
B2913B_ENV_08



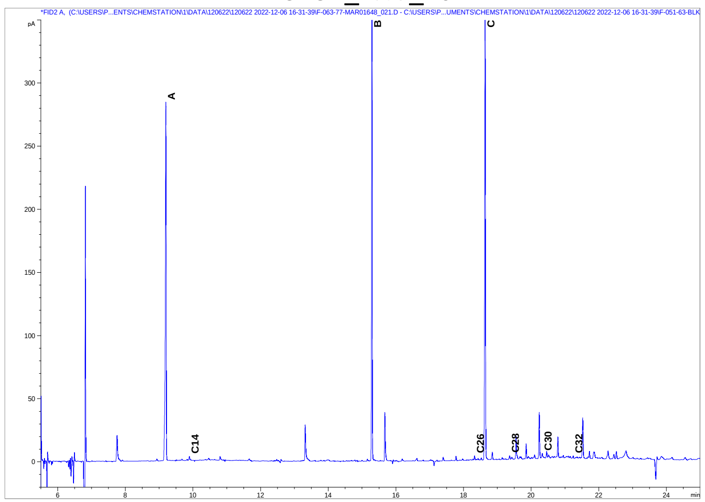
B2913B_ENV_09



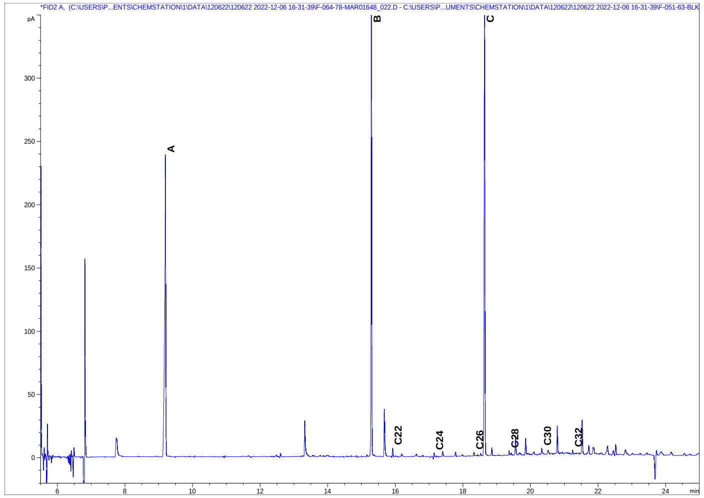
B2913B_ENV_10



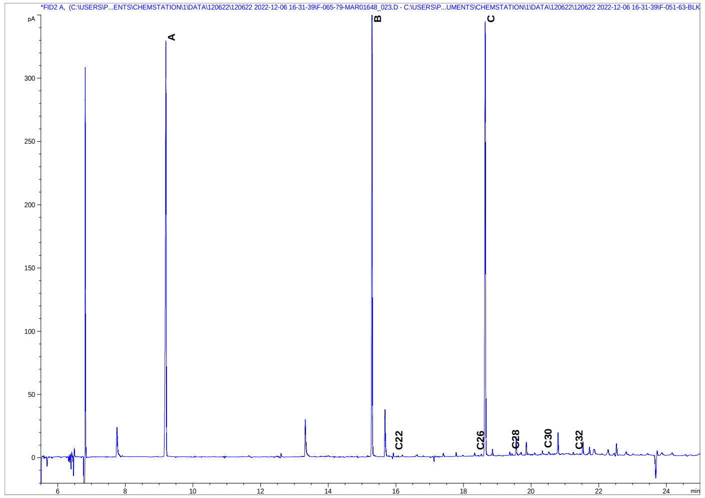
B2913B_ENV_11



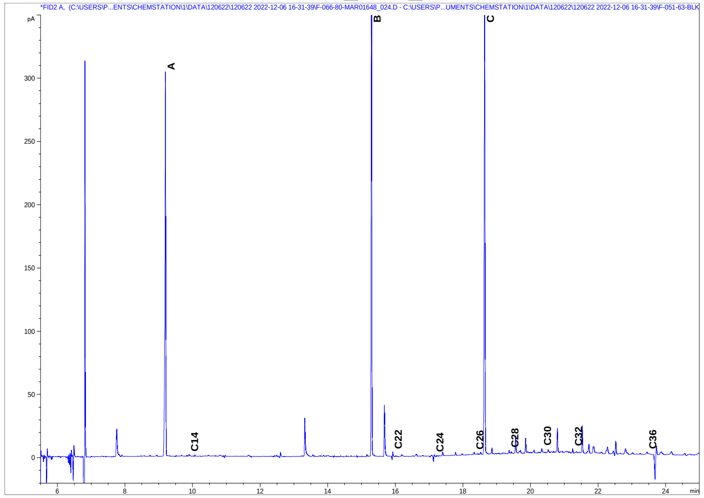
B2913B_ENV_12



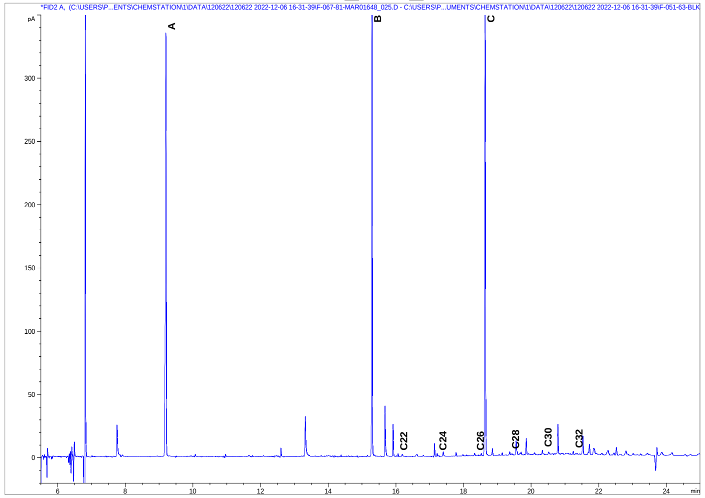
B2913B_ENV_13



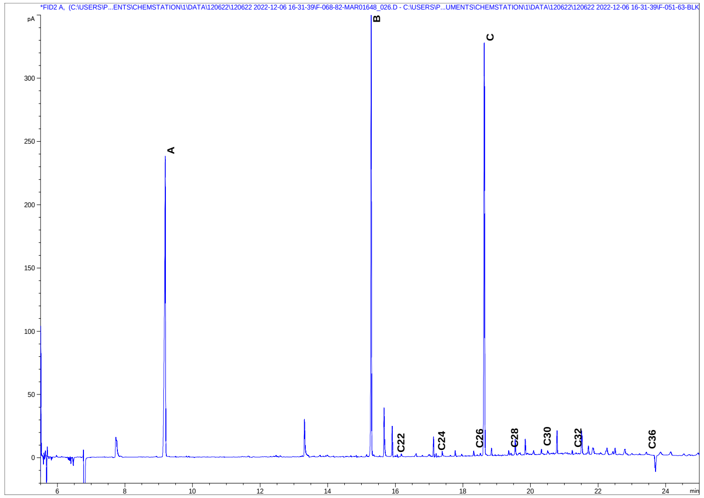
B2913B_ENV_14



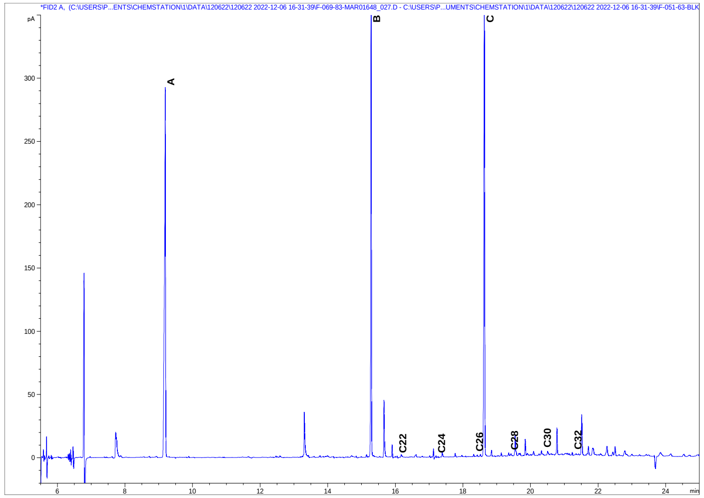
B2913B_ENV_15



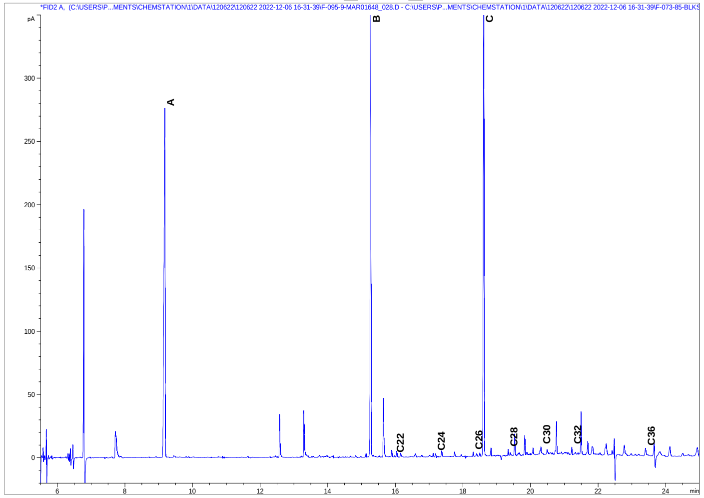
B2913B_ENV_16



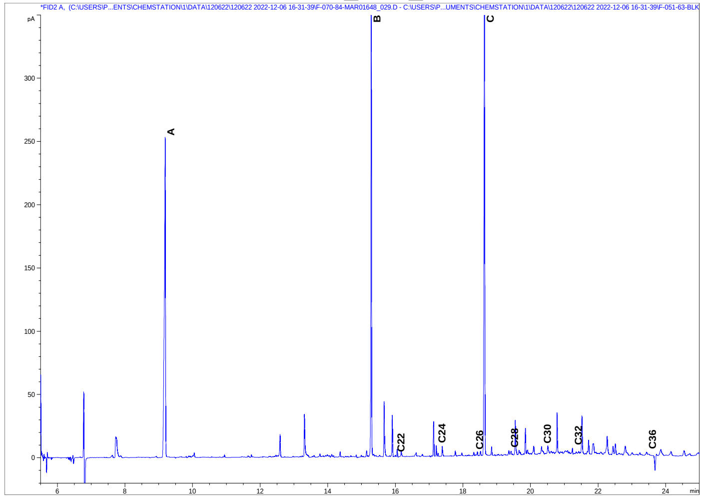
B2913B_ENV_17



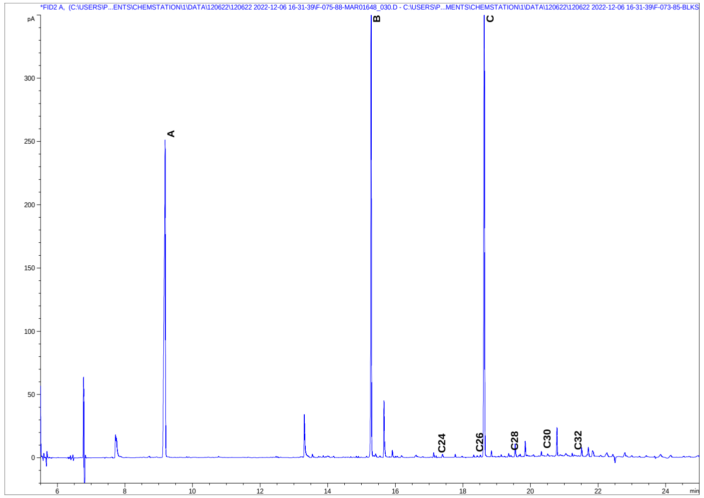
B2913B_ENV_19



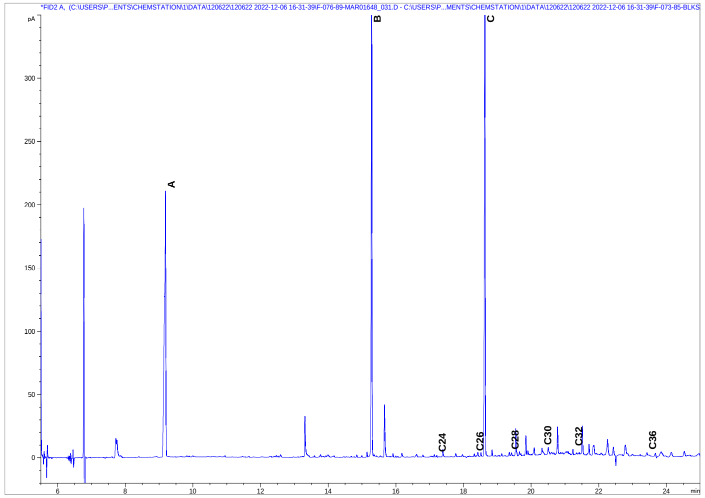
B2913B_ENV_20



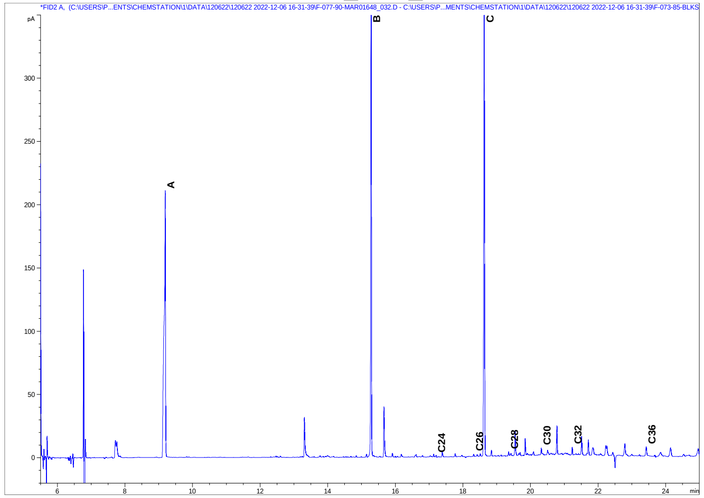
B2913B_ENV_21



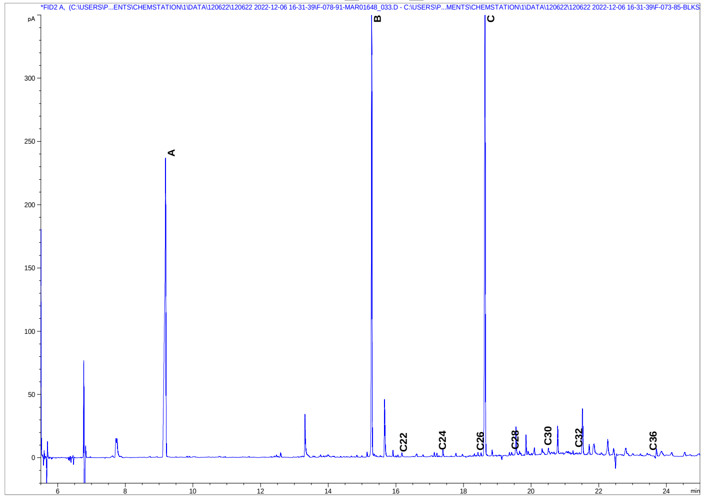
B2913B_ENV_23



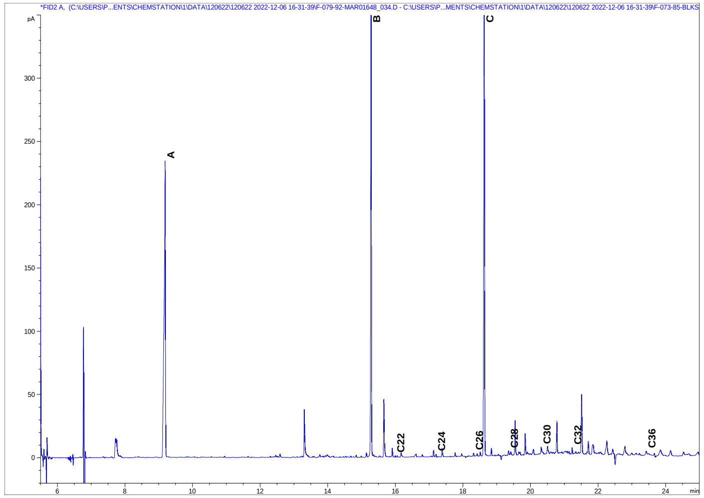
B2913B_ENV_24



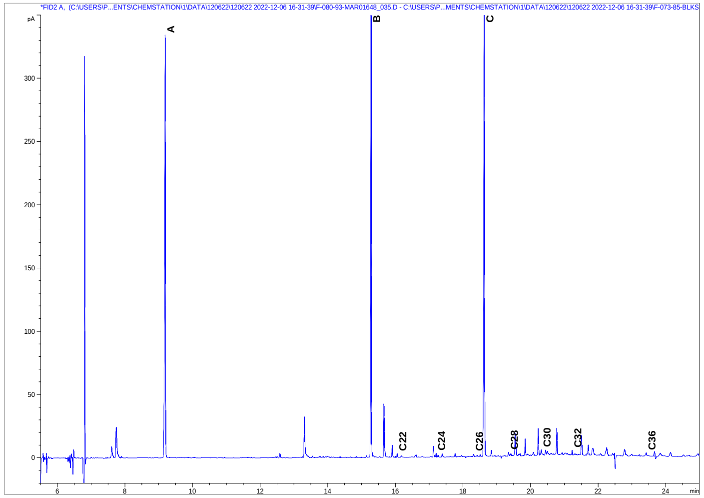
B2913B_ENV_25



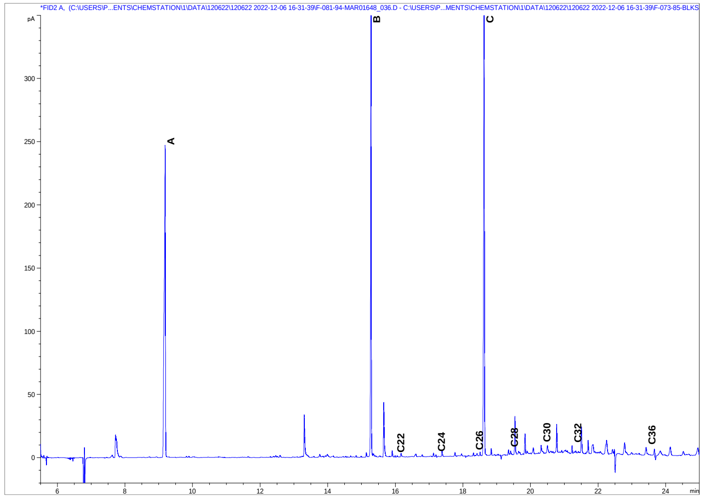
B2913B_ENV_27



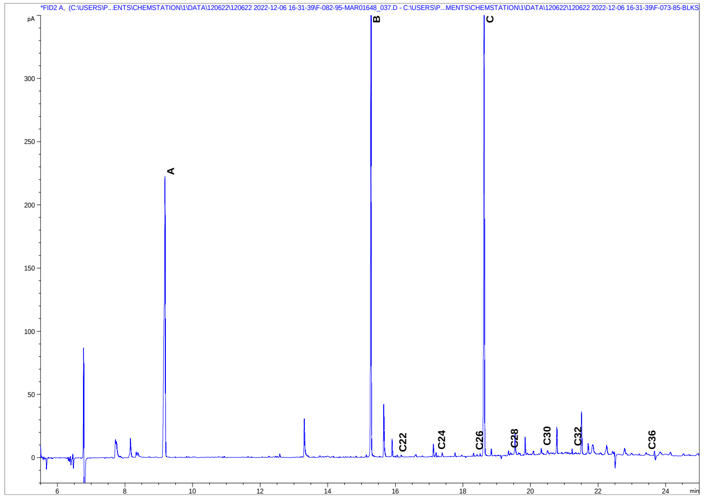
B2913B_ENV_28



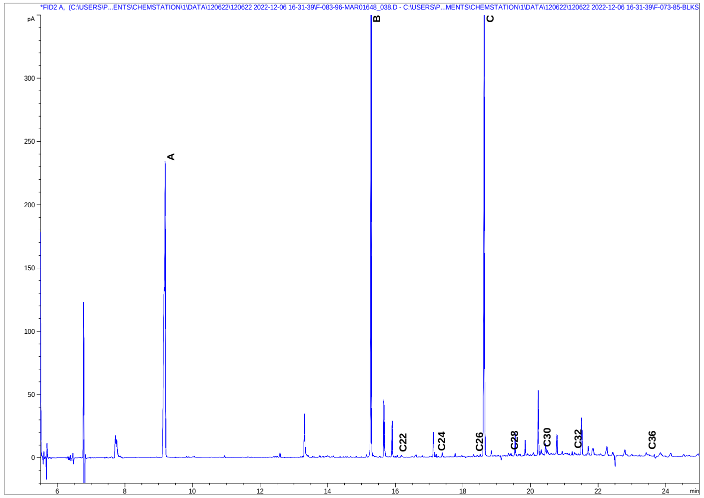
B2913B_ENV_29



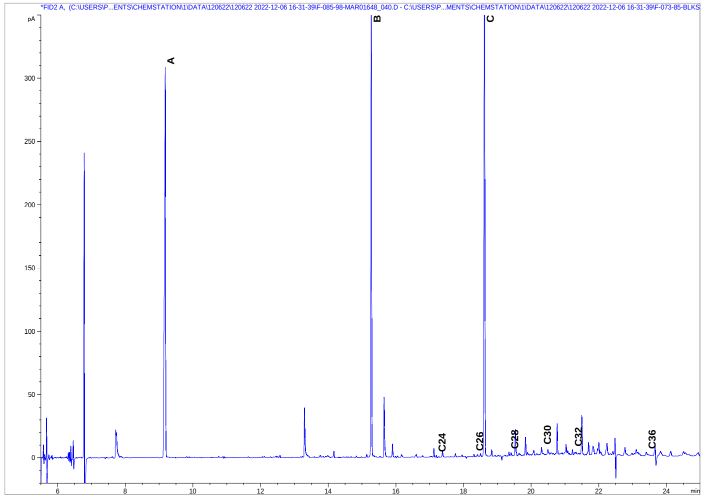
B2913B_ENV_30



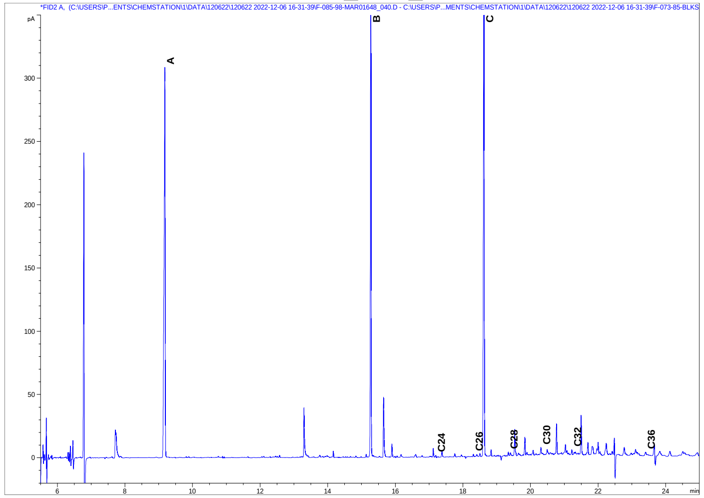
B2913B_ENV_31



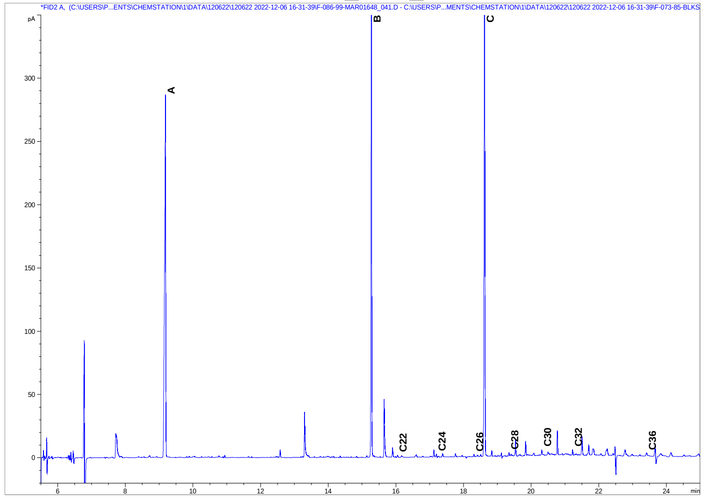
B2913B_ENV_33



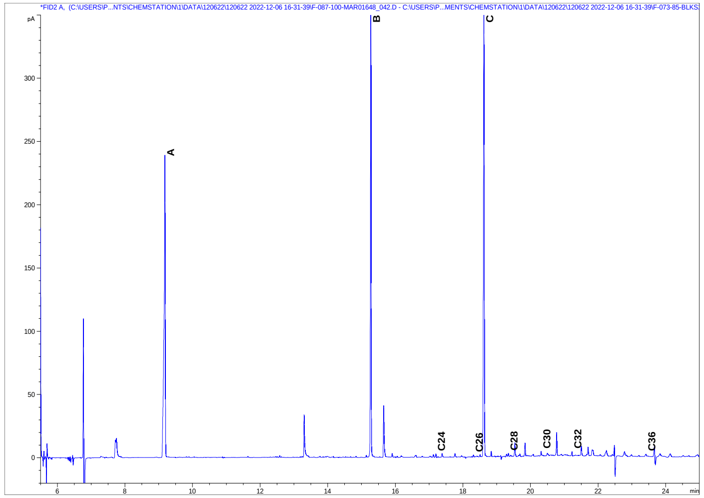
B2913B_ENV_34



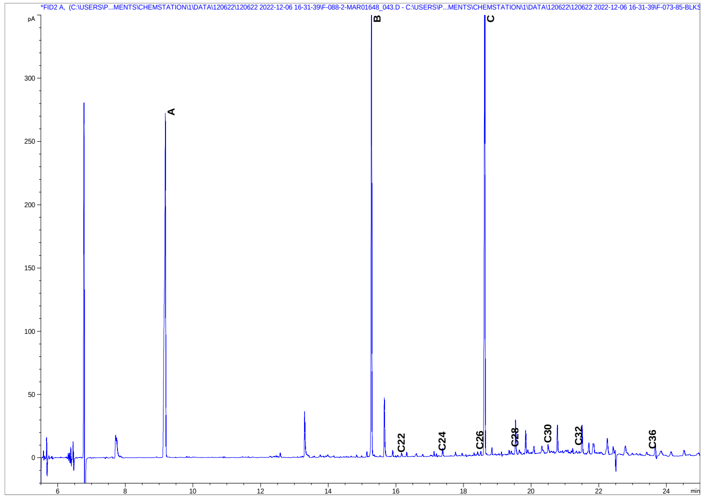
B2913B_ENV_35



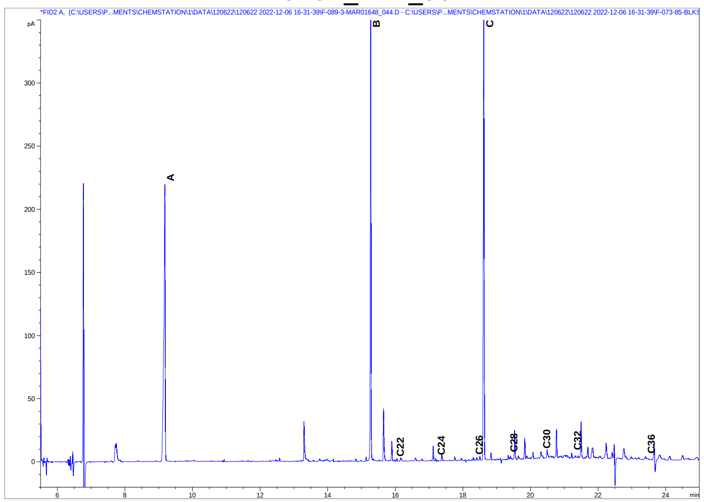
B2913B_ENV_36



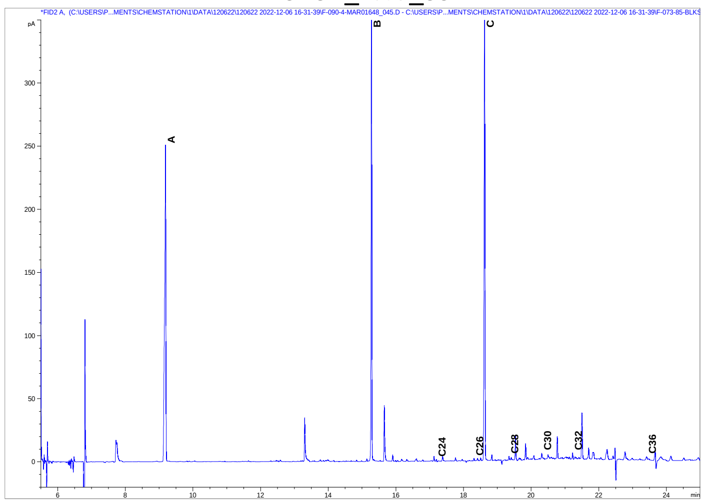
B2913B_ENV_38



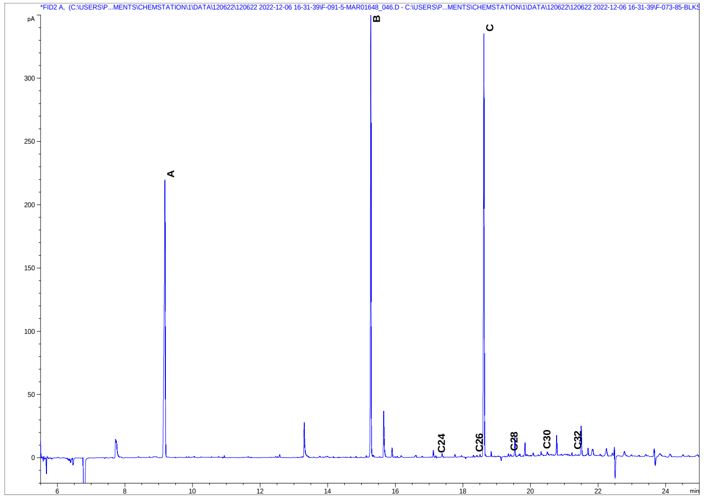
B2913B_ENV_39



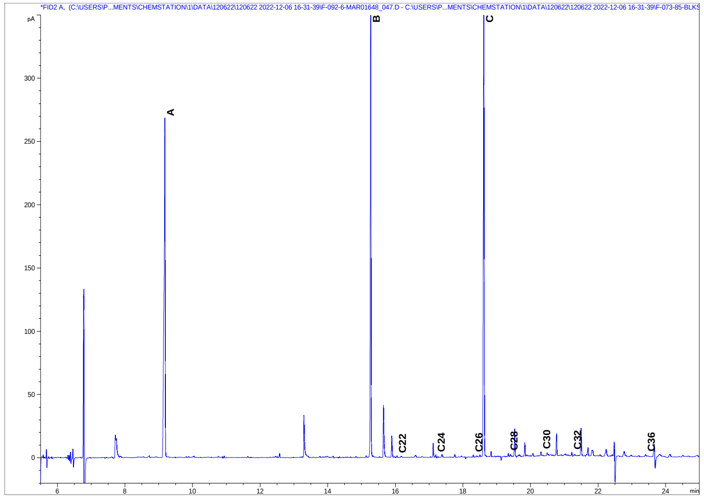
B2913B_ENV_40



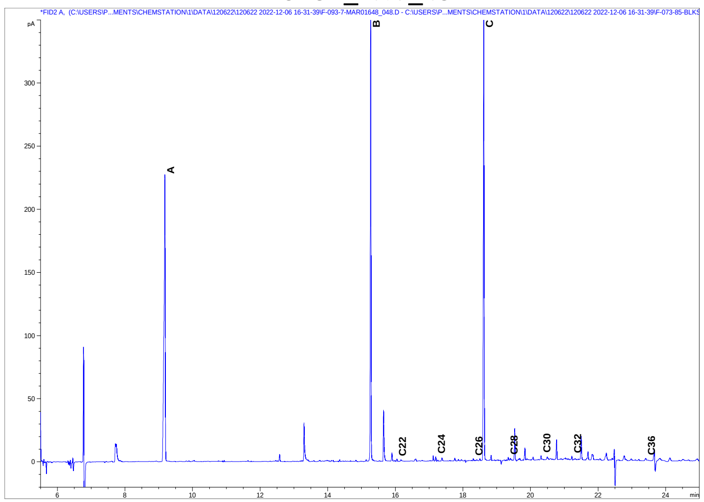
B2913B_ENV_41



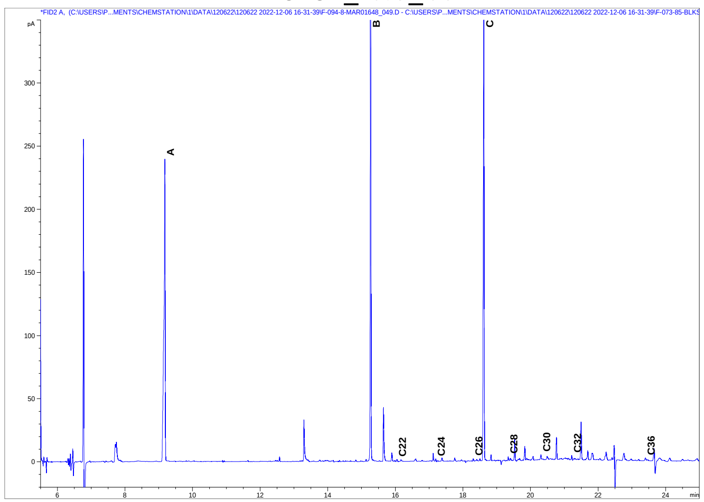
B2913B_ENV_43



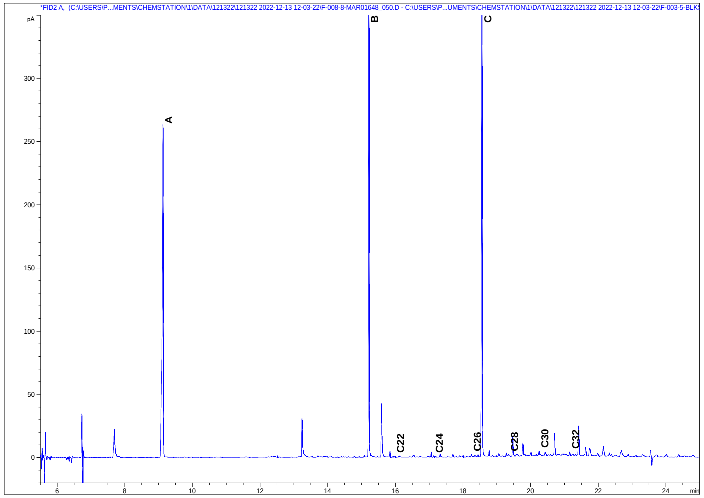
B2913B_ENV_44



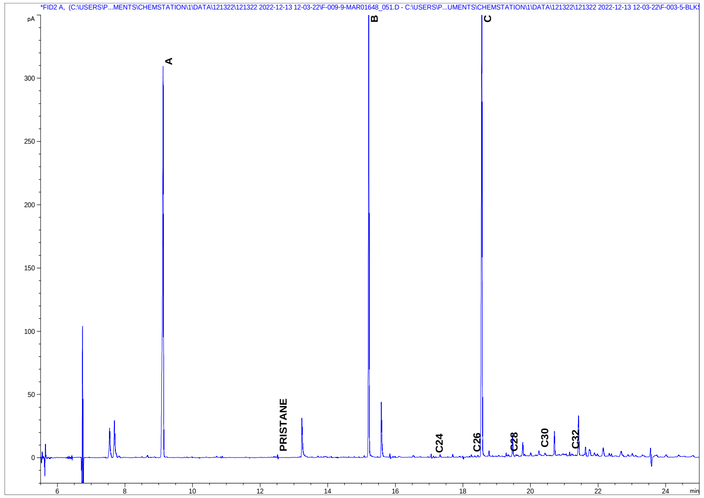
B2913B_ENV_45



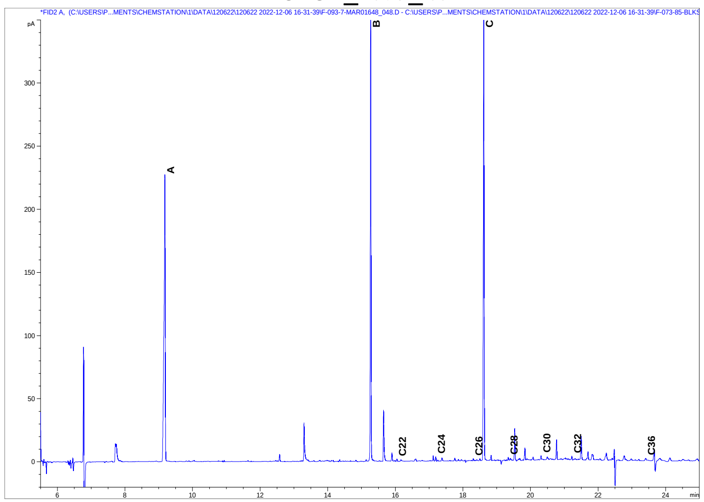
B2913B_ENV_46



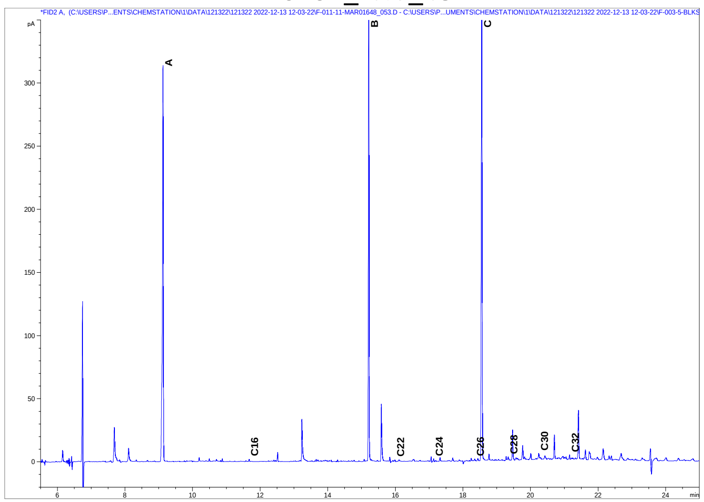
B2913B_ENV_47



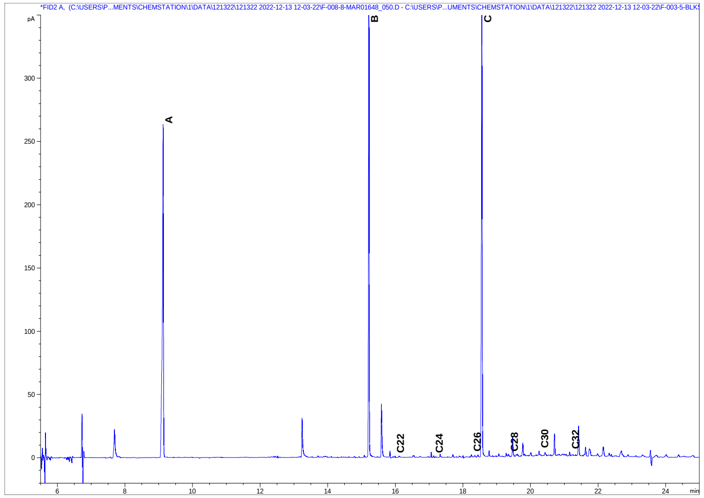
B2913B_ENV_48



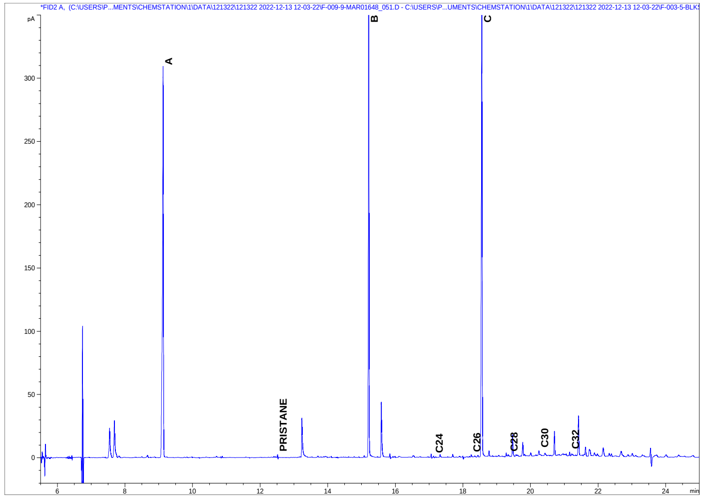
B2913B_ENV_49



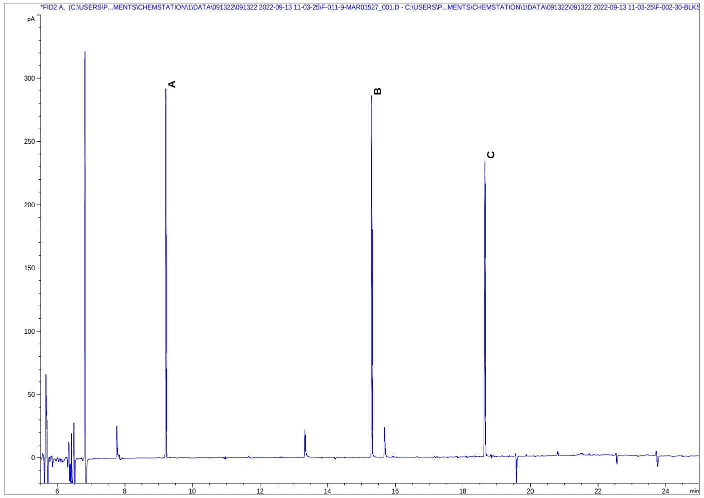
B2913B_ENV_50



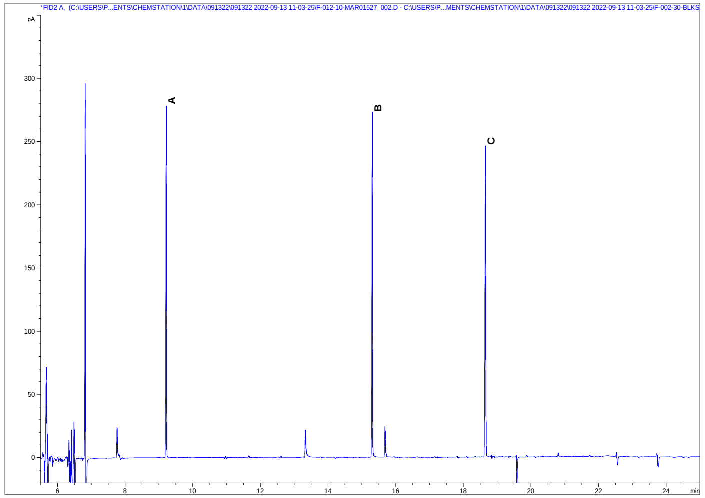
B2913B_ENV_51



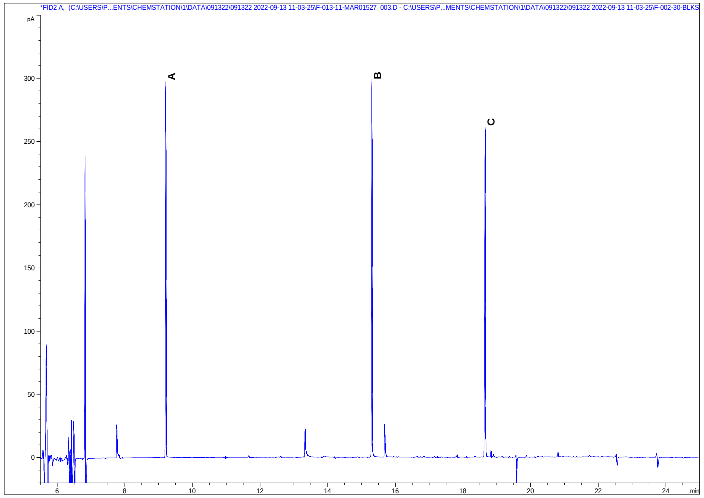
B2913B_ENV_52



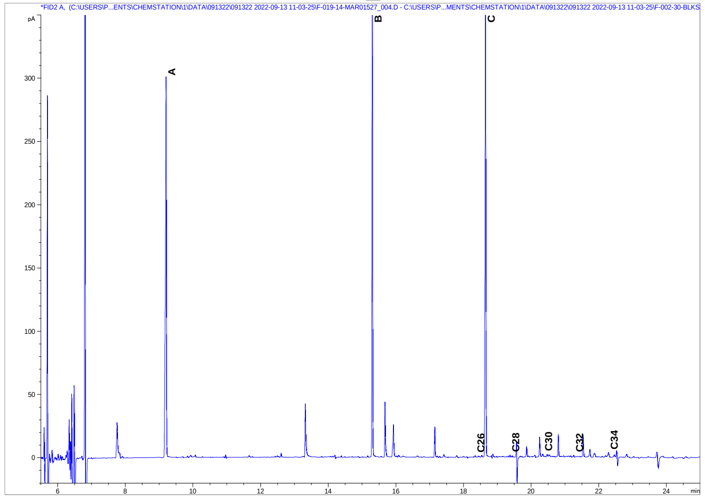
0m Venus-2



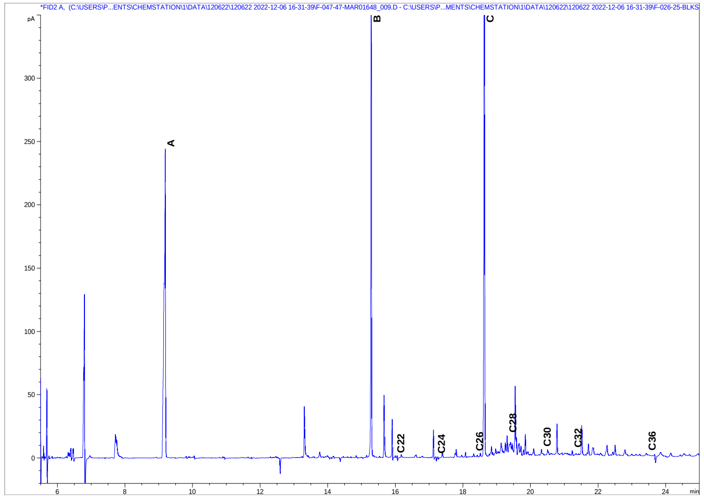
250m_SE



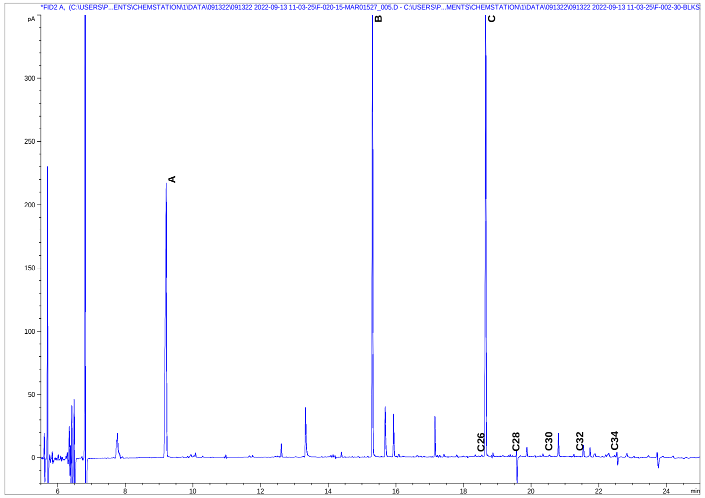
500m_SE



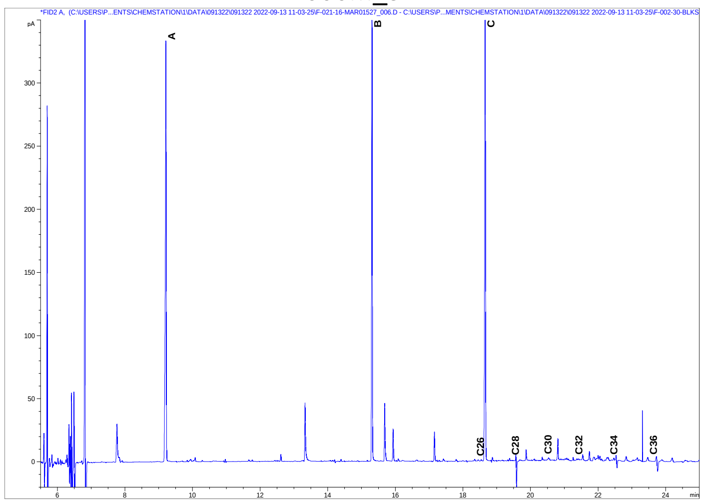
1000m_SE



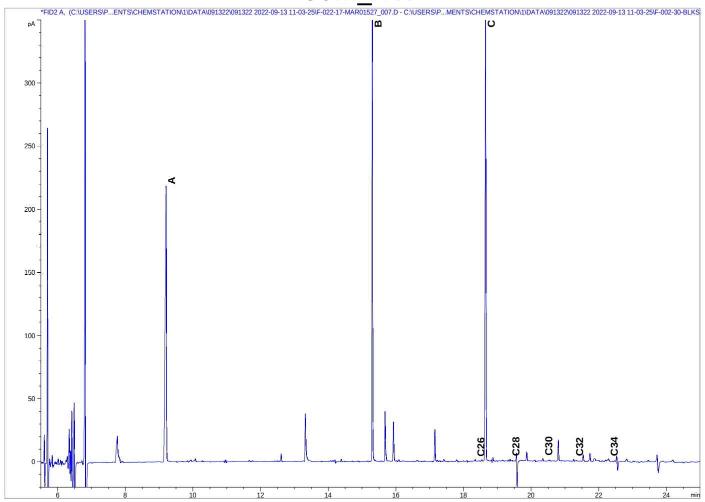
2000m_SE



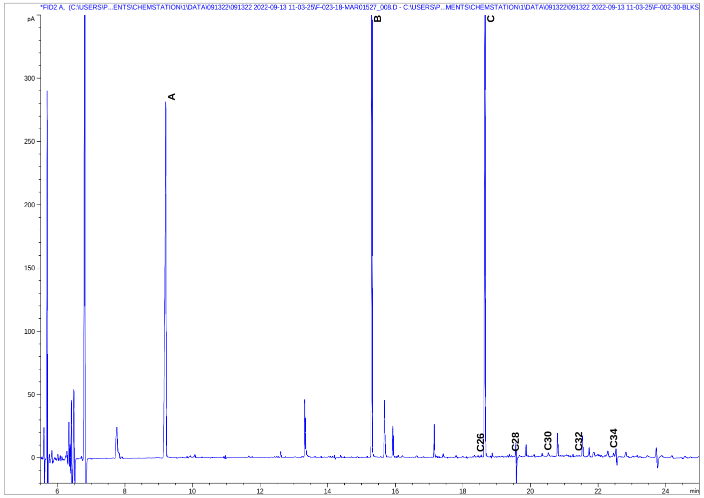
250m_NW



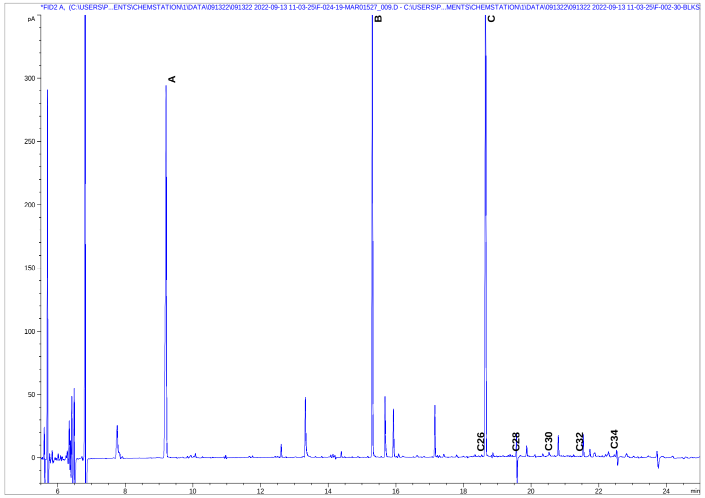
500m_NW



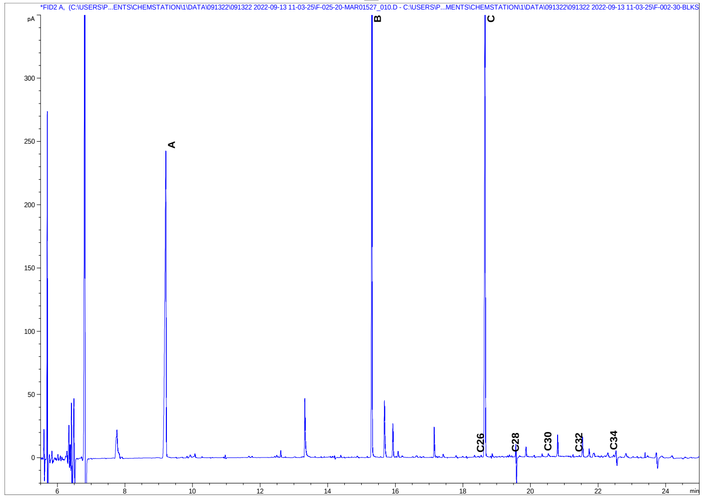
1000m_NW



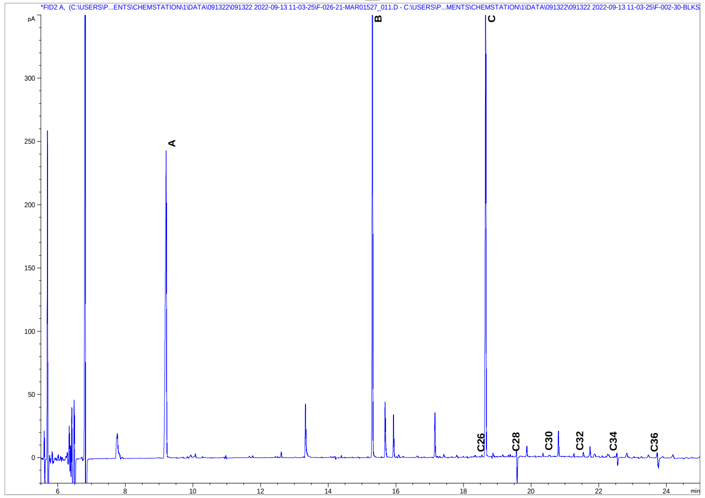
1500m_NW



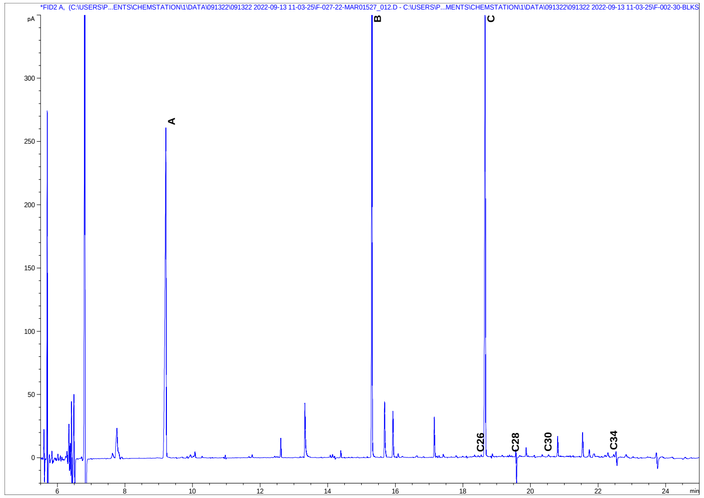
2000m_NW



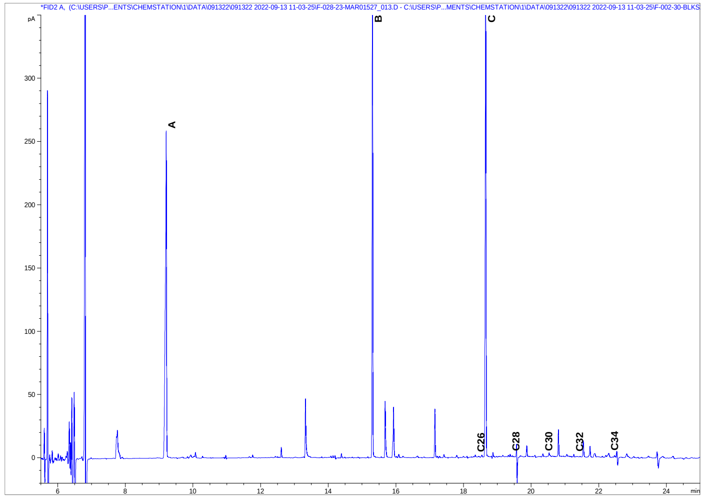
3000m_NW



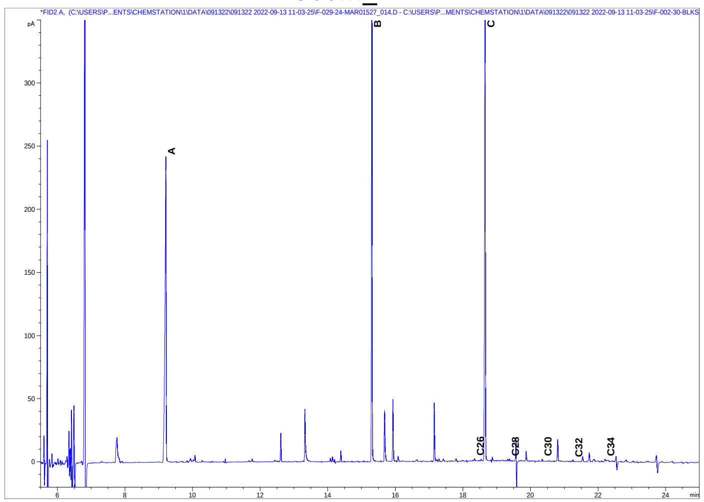
250m_NE



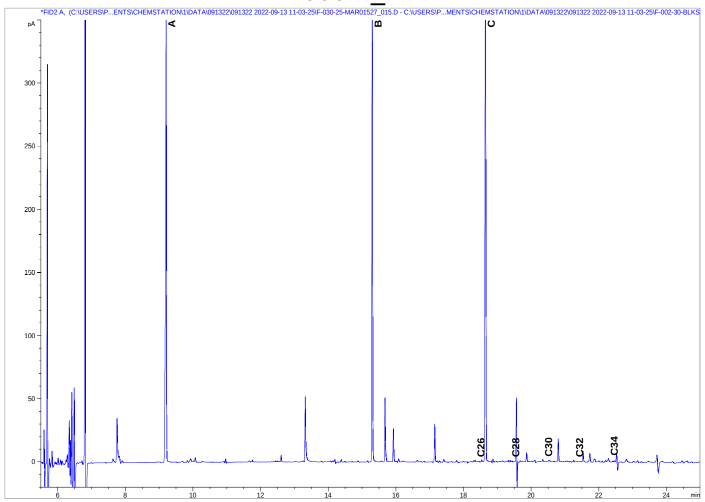
500m_NE



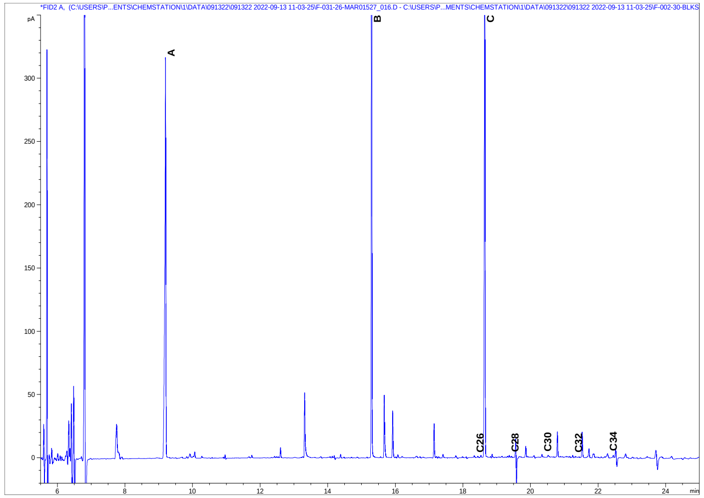
1000m_NE



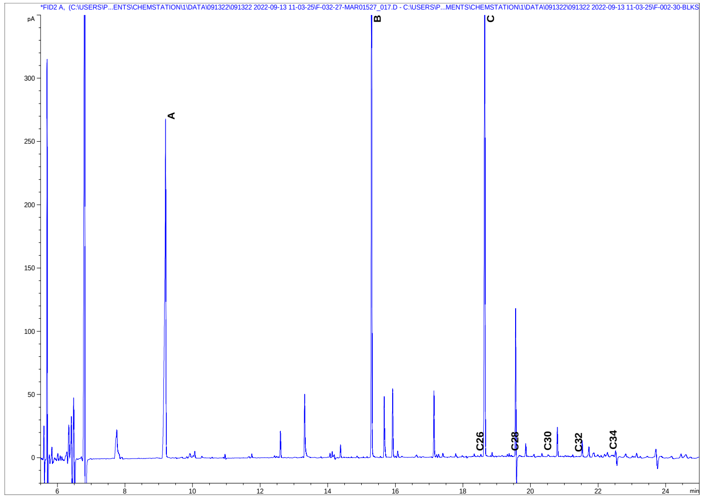
2000m_NE



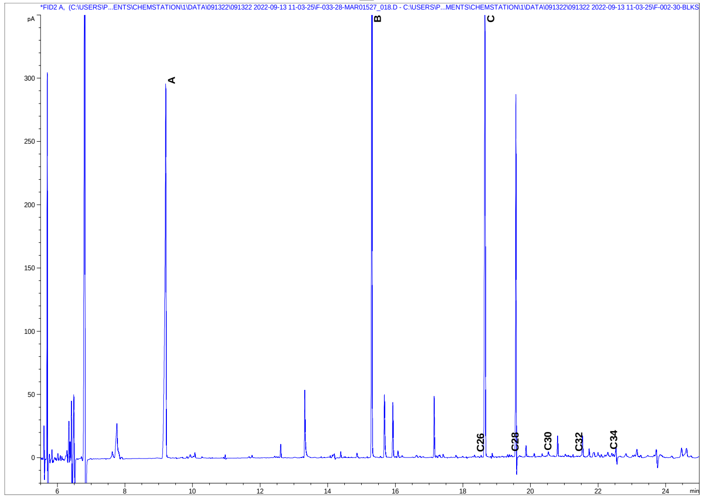
10000m_NE



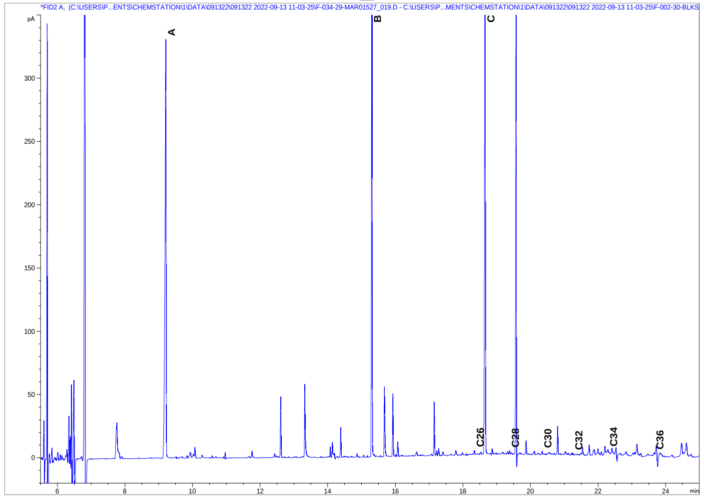
250m_SW



500m_SW

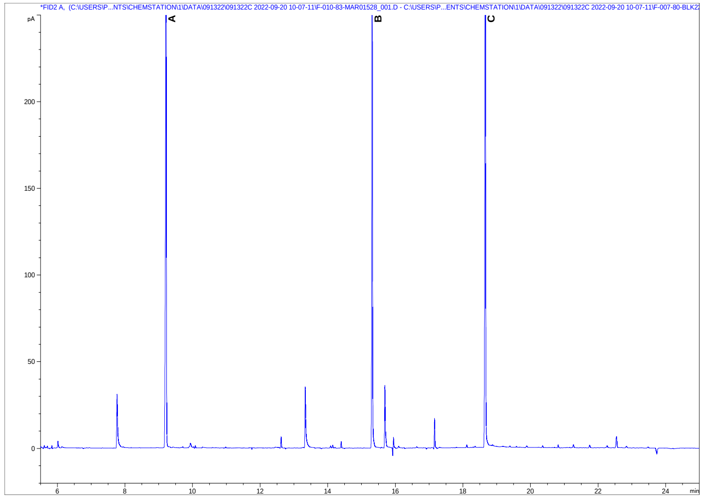


1000m_SW

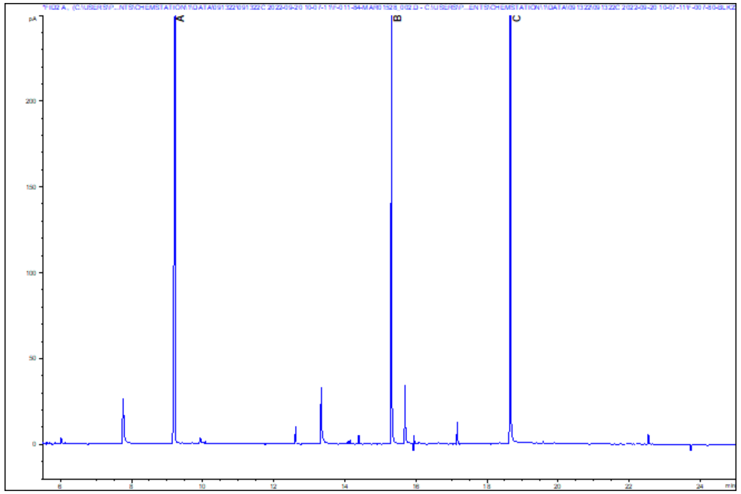


2000m_SW

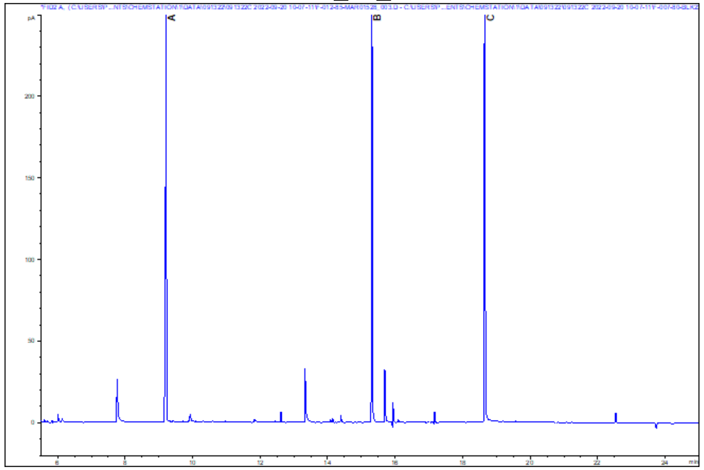
Water Stations



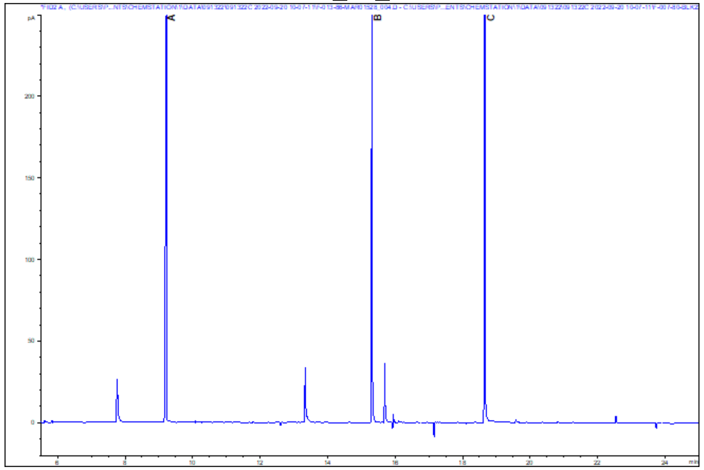
250m_SE_SUR



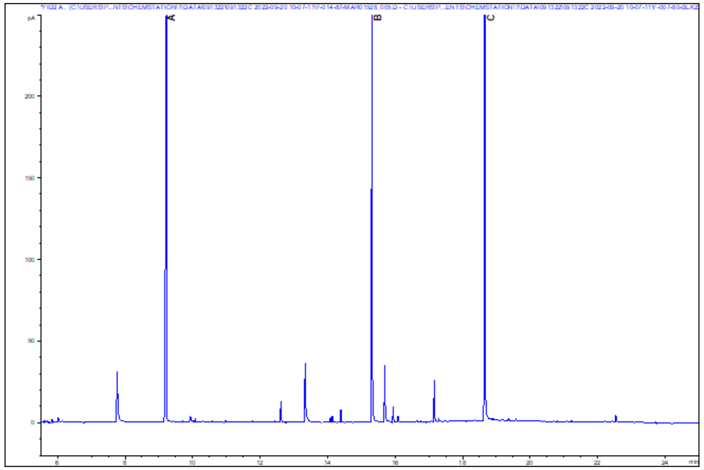
250m_SE_MID



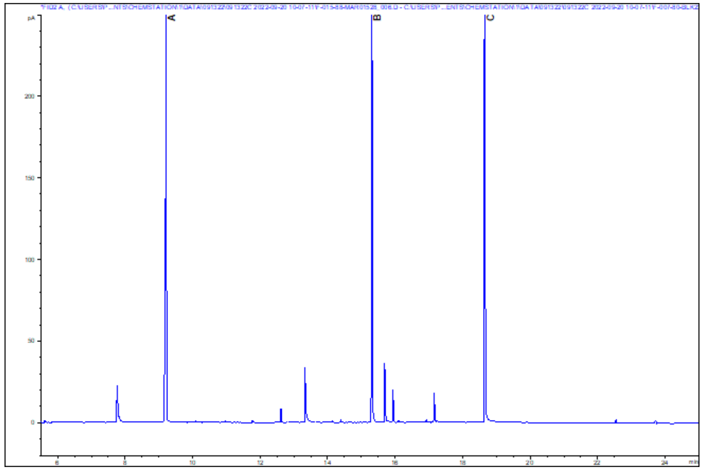
250m_SE_BOT



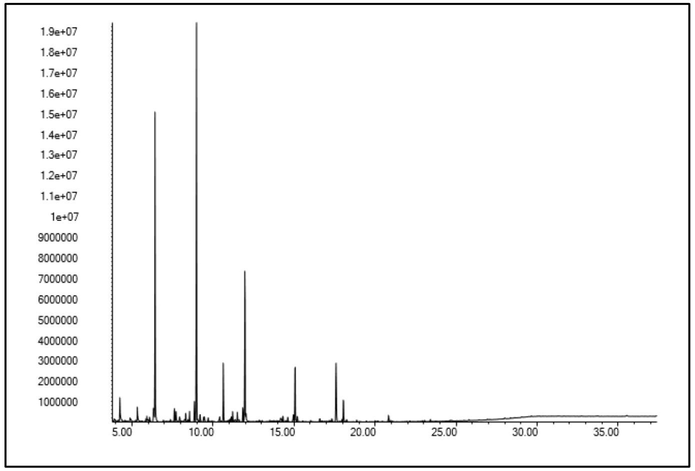
10000m_NE_SUR



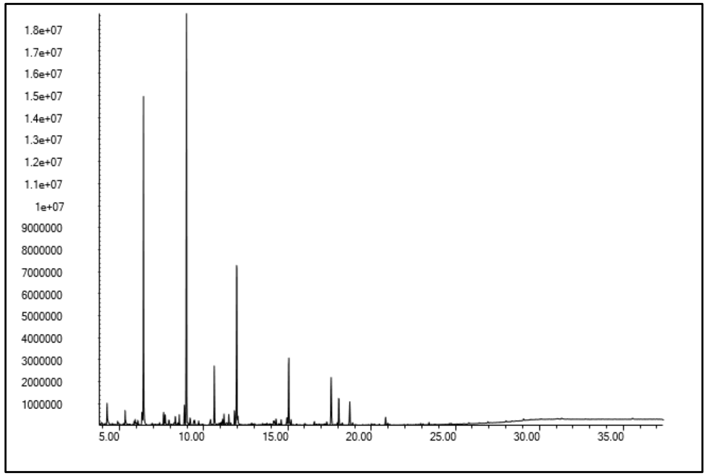
10000m_NE_MID



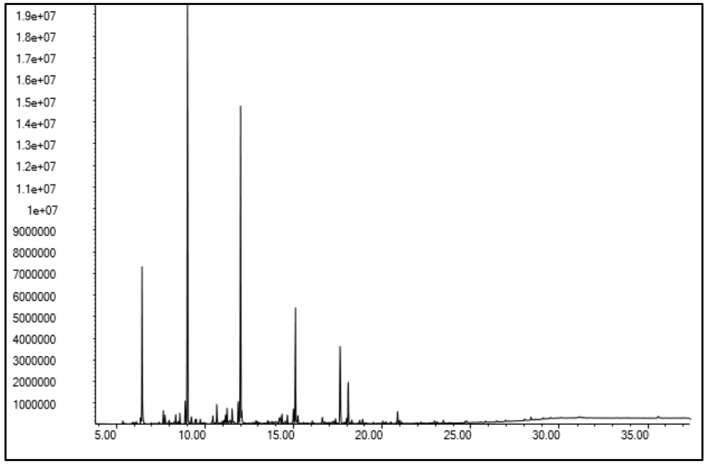
10000m_NE_BOT



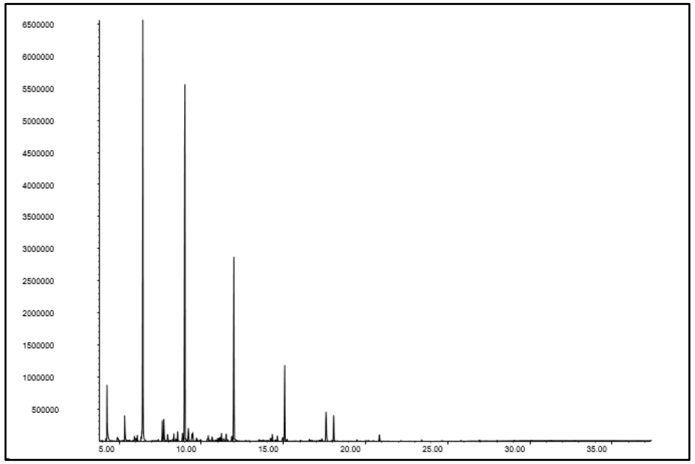
B2913B_ENV_21-SUR



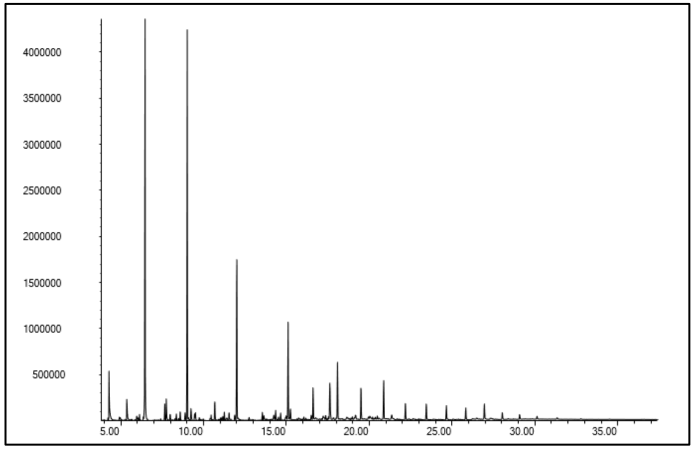
B2913B_ENV_21-MID



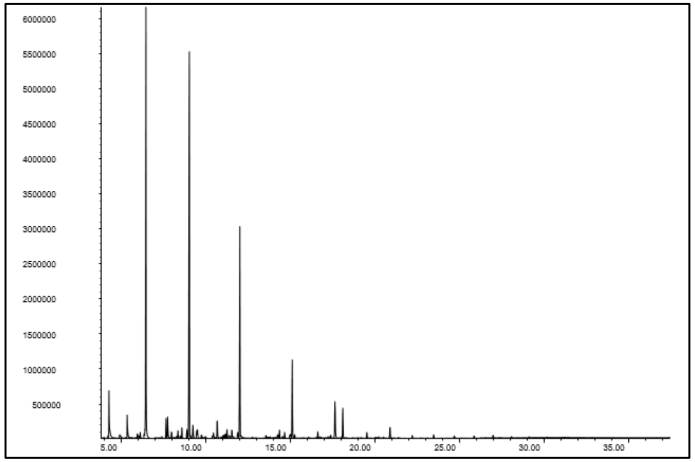
B2913B_ENV_21-BOT



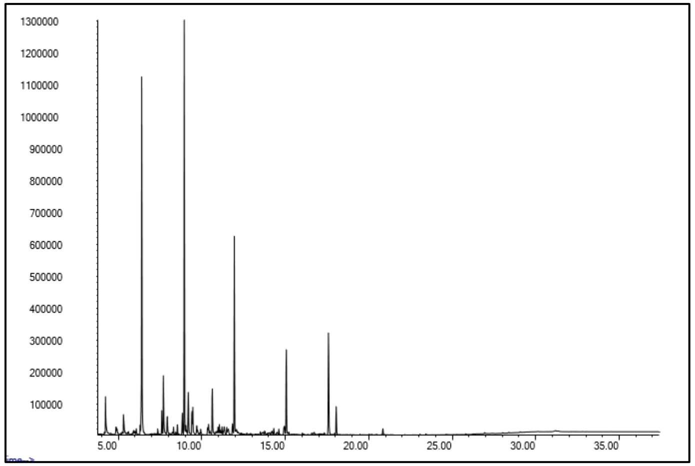
B2913B_ENV_36_SUR



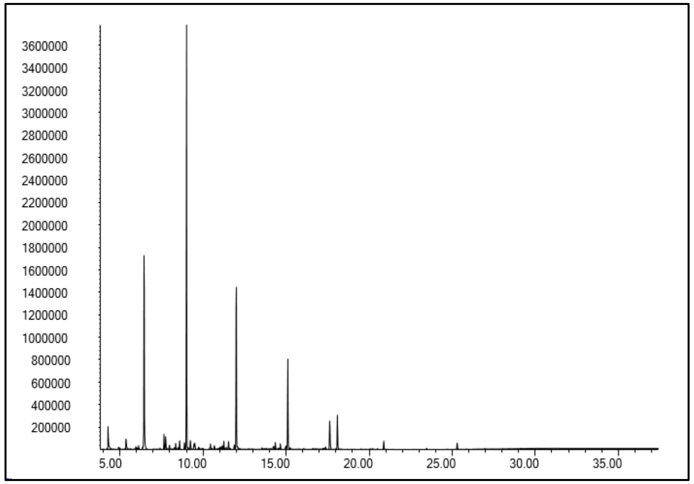
B2913B_ENV_36_MID



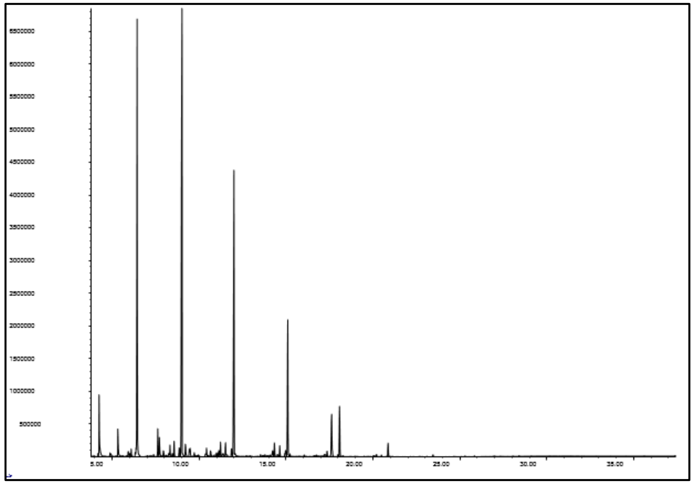
B2913B_ENV_36_BOT



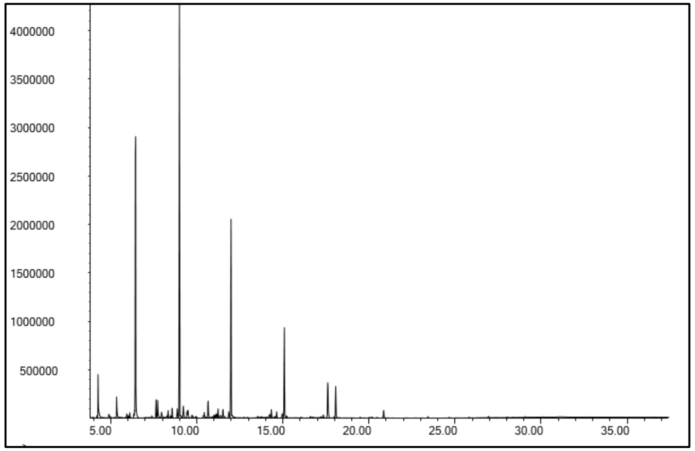
B2913B_ENV_35-SUR



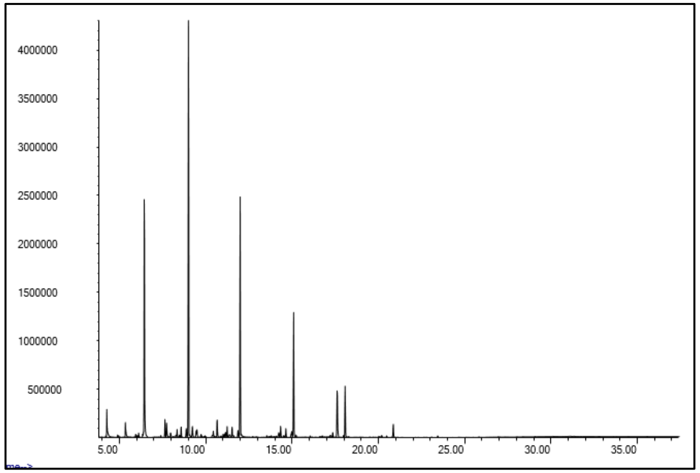
B2913B_ENV_35-MID



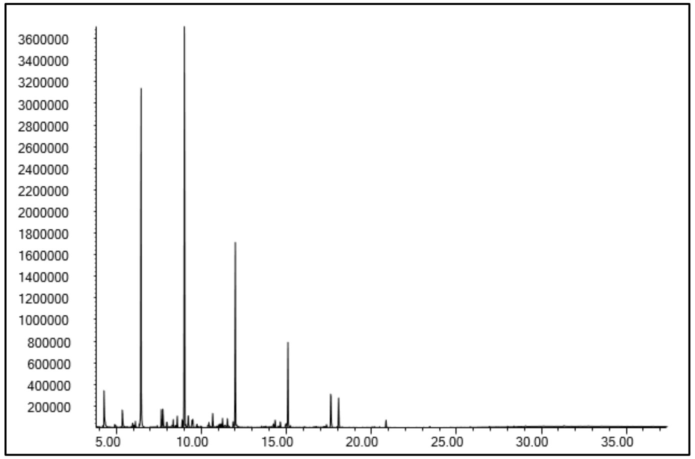
B2913B_ENV_35-BOT



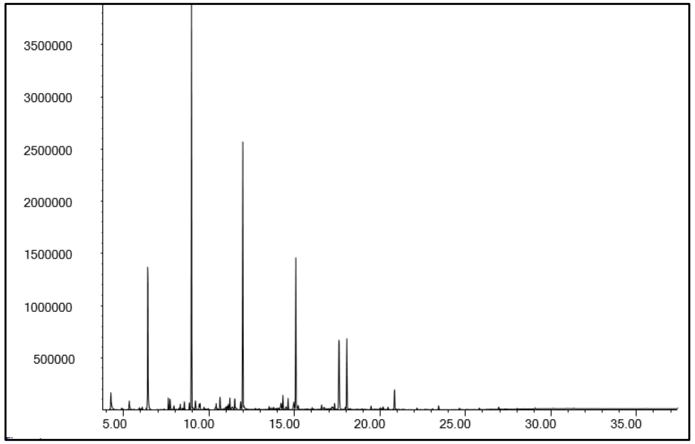
B2913B_ENV_45_SUR



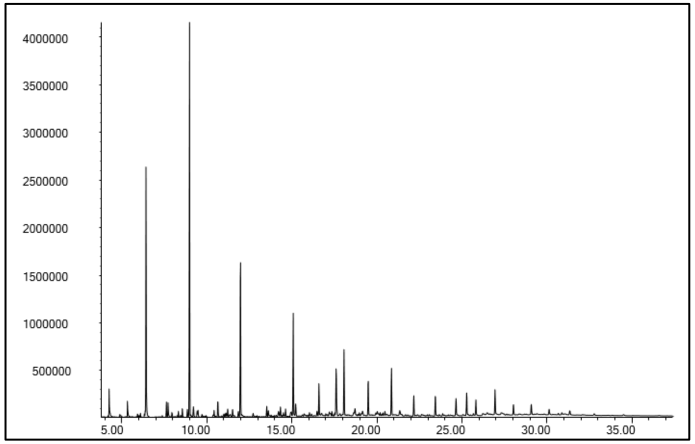
B2913B_ENV_45_MID



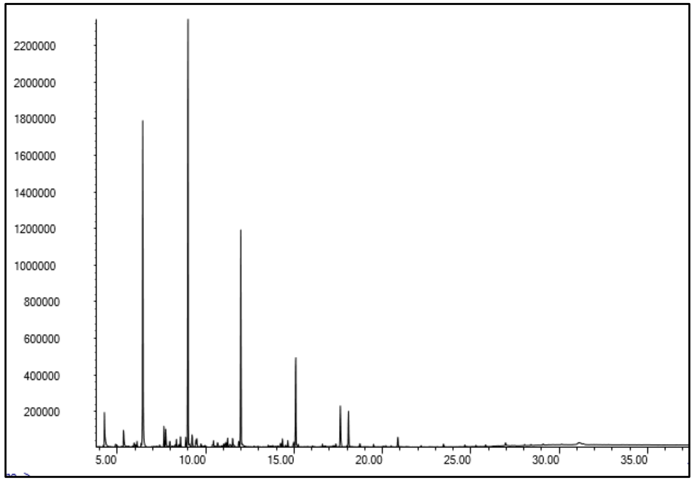
B2913B_ENV_45_BOT



B2913B_ENV_50_SUR



B2913B_ENV_50_MID



B2913B_ENV_50_BOT

Appendix VI – Polycyclic Aromatic Hydrocarbon Concentrations

Sediment Samples

Table VI.I: Polycyclic Aromatic Hydrocarbon Concentrations (µg.kg^{-1})

Station	0m Venus-2	250m_SE	500m_SE	1000m_SE	2000m_SE	250m_NW	500m_NW	1000m_NW	1500m_NW	2000m_NW	3000m_NW
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	1.05	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	1.65	1.34	1.03
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	2.31	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	0.00	0.00	0.0	0.0	0.0	0	0	0.0	5.0	1.3	1.0
Phenanthrene/Anthracene	0.00	0.00	0.0	0.0	0.0	0.00	0.0	0.00	1.78	1.38	1.33
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0.00	0.00	0.0	0.0	0.0	0.0	0	0.0	1.8	1.4	1.3
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1,Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0.00
Fluoranthene/Pyrene	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0.00
Benzoanthracene / Chrysene	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.0	0.00	0.00
Benzofluoranthenes / Benzopyrenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0.00	0.00	0.00	0.00	0.00	0.0	0	0.00	0.00	0.0	0.00
Aranthanthrenes / Indenopyrene / Benzoperylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum of all PAHs	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0**	**0.0**	**6.8**	**2.7**	**2.4**
Sum of NPD fraction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0**	**0**	**0.0**	**6.8**	**2.7**	**2.4**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	-	-	-	-	-	-

Station	250m_NE	500m_NE	1000m_NE	2000m_NE	10000m_NE	250m_SW	500m_SW	1000m_SW	2000m_SW	B2913B_ENV_01
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Naphthalenes	1.14	<1	<1	<1	<1	1.00	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	1.1	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0	0.0
Phenanthrene / Anthracene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0	0.0
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
Fluoranthene / Pyrene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0
Benzoanthracene / Chrysene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
Benzofluoranthenes / Benzopyrenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00
Aranthanthrenes / Indenopyrene / Benzoperylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum of all PAHs	**1.1**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**0**	**0**
Sum of NPD fraction	**1.1**	**0.0**	**0.0**	**0.0**	**0.0**	**1.0**	**0.0**	**0.0**	**0**	**0.0**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	-	-	-	-	-

Station	B2913B_ENV_02	B2913B_ENV_03	B2913B_ENV_04	B2913B_ENV_05	B2913B_ENV_06	B2913B_ENV_07	B2913B_ENV_08	B2913B_ENV_09	B2913B_ENV_10	B2913B_ENV_11
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	0.0	0.0	0.00	0.0	0.0	0.00	0.00	0.00	0.00	0.00
Phenanthrene / Anthracene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0.00	0.00	0.00
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluoranthene / Pyrene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0.0	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzoanthracene / Chrysene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Benzofluoranthenes / Benzopyrenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0.0	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
Aranthanthrenes / Indenopyrene / Benzoperylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum of all PAHs	**0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
Sum of NPD fraction	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	-	-	-	-	-

Station	B2913B_ENV_12	B2913B_ENV_13	B2913B_ENV_14	B2913B_ENV_15	B2913B_ENV_16	B2913B_ENV_17	B2913B_ENV_19	B2913B_ENV_20	B2913B_ENV_21	B2913B_ENV_23
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0
Phenanthrene / Anthracene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0.00	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.00	0
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Fluoranthene / Pyrene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0.00	0.00	0.00	0.00	0.0	0.0	0.00	0.00	0.00	0
Benzoanthracene / Chrysene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0
Benzofluoranthenes / Benzopyrenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0
Aranthanthrenes / Indenopyrene / Benzoperylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
Sum of all PAHs	**0.00**	**0.00**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	**0.00**	**0**
Sum of NPD fraction	**0.00**	**0.00**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.00**	**0.00**	**0**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	-	-	-	-	-

Station	B2913B_ENV_24	B2913B_ENV_25	B2913B_ENV_27	B2913B_ENV_28	B2913B_ENV_29	B2913B_ENV_30	B2913B_ENV_31	B2913B_ENV_33	B2913B_ENV_34	B2913B_ENV_35
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	0.00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00
Phenanthrene / Anthracene	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0.00	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	0.00
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fluoranthene / Pyrene	0.00	0.00	0.00	0.00	0.00	4.36	0.00	0.00	0.00	0.00
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0.00	0.00	0.00	0.00	0.00	4.36	0.00	0.00	0.00	0.00
Benzoanthracene / Chrysene	0.00	0.00	0.00	0.00	0.00	1.26	0.00	0.00	0.00	0.00
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0.00	0.00	0.00	0.00	0.00	1.26	0.00	0.00	0.00	0.00
Benzofluoranthenes / Benzopyrenes	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aranthanthrenes / Indenopyrene / Benzoperylene	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sum of all PAHs	0.00	0.0	0.00	0.00	0.00	7.2	0.00	0.00	0.00	0.00
Sum of NPD fraction	0.00	0.0	0.00	0.00	0.00	1.6	0.00	0.00	0.00	0.00
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	0.3	-	-	-	-

Station	B2913B_ENV_36	B2913B_ENV_38	B2913B_ENV_39	B2913B_ENV_40	B2913B_ENV_41	B2913B_ENV_43	B2913B_ENV_44	B2913B_ENV_45	B2913B_ENV_46	B2913B_ENV_47
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Naphthalenes	0.00	0.00	0.00	0.00	0.00	0	0	0	0	0
Phenanthrene / Anthracene	0.00	0.00	0.00	0.00	0.00	1.6	0	0	0	0
C1 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 178	0.00	0.00	0.00	0.00	0.00	2	0	0	0	0
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.0	0	0	0	0
Fluoranthene / Pyrene	0.00	0.00	0.00	0.00	0.00	2.97	0	0	0	0
C1 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 202	0.00	0.00	0.00	0.00	0.00	3.0	0	0	0	0
Benzoanthracene / Chrysene	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0
C1 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 228	0.00	0.00	0.00	0.00	0.00	0.0	0	0	0	0
Benzofluoranthenes / Benzopyrenes	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0
C1 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 252	0.00	0.00	0.00	0.00	0.00	0.0	0	0	0	0
Aranthanthrenes / Indenopyrene / Benzoperylene	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0
C1 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sum 276	0.00	0.00	0.00	0.00	0.00	0.00	0	0	0	0
Sum of all PAHs	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**5**	**0**	**0**	**0**	**0**
Sum of NPD fraction	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2**	**0**	**0**	**0**	**0**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	**0.52**	-	-	-	-

Station	B2913B_ENV_48	B2913B_ENV_49	B2913B_ENV_50	B2913B_ENV_51	B2913B_ENV_52
Naphthalene	<1	<1	<1	<1	<1
C1 Naphthalenes	<1	<1	<1	<1	<1
C2 Naphthalenes	<1	<1	<1	<1	<1
C3 Naphthalenes	<1	<1	<1	<1	<1
C4 Naphthalenes	<1	<1	<1	<1	<1
Sum Naphthalenes	0	0	0	0	0.00
Phenanthrene / Anthracene	0	0	0	0	0.00
C1 178	<1	<1	<1	<1	<1
C2 178	<1	<1	<1	<1	<1
C3 178	<1	<1	<1	<1	<1
Sum 178	0	0	0	0	0.00
Dibenzothiophene	<1	<1	<1	<1	<1
C1 Dibenzothiophenes	<1	<1	<1	<1	<1
C2 Dibenzothiophenes	<1	<1	<1	<1	<1
C3 Dibenzothiophenes	<1	<1	<1	<1	<1
Sum Dibenzothiophenes	0	0	0	0	0.00
Fluoranthene / Pyrene	0	0	0	0	0.00
C1 202	<1	<1	<1	<1	<1
C2 202	<1	<1	<1	<1	<1
C3 202	<1	<1	<1	<1	<1
Sum 202	0	0	0	0	0.00
Benzoanthracene / Chrysene	0	0	0	0	0.00
C1 228	<1	<1	<1	<1	<1
C2 228	<1	<1	<1	<1	<1
Sum 228	0	0	0	0	0.00
Benzofluoranthenes / Benzopyrenes	0	0	0	0	0.00
C1 252	<1	<1	<1	<1	<1
C2 252	<1	<1	<1	<1	<1
Sum 252	0	0	0	0	0.00
Aranthanthrenes / Indenopyrene / Benzoperylene	0	0	0	0	0.00
C1 276	<1	<1	<1	<1	<1
C2 276	<1	<1	<1	<1	<1
Sum 276	0	0	0	0	0.00
Sum of all PAHs	**0**	**0**	**0**	**0**	**0.00**
Sum of NPD fraction	**0**	**0**	**0**	**0**	**0.00**
NPD/4-6 Ring PAH Ratio	-	-	-	-	-

Water Samples

Table VI.I: Polycyclic Aromatic Hydrocarbon Concentrations (µg.l^{-1})

Station	250m_SE_SUR	250m_SE_MID	250m_SE_BOT	10000m_NE_SUR	10000m_NE_MID	10000m_NE_BOT	B2913B_ENV_21_SUR	B2913B_ENV_21_MID	B2913B_ENV_21_BOT
Naphthalene	<1	<1	<1	<1	<1	<1	17.6	18.7	36.2
C1 Naphthalenes	<1	<1	<1	<1	<1	<1	20.4	14.7	41.7
C2 Naphthalenes	<1	<1	<1	<1	<1	<1	23.5	16.1	79.1
C3 Naphthalenes	<1	<1	<1	<1	<1	<1	32.4	14.1	70.2
C4 Naphthalenes	<1	<1	<1	<1	<1	<1			
Sum Naphthalenes	<5	<5	<5	<5	<5	<5	93.95	63.61	227.20
Phenanthrene / Anthracene	<2	<2	<2	<2	<2	<2	-	-	-
C1 178	<1	<1	<1	<1	<1	<1	5.7	7.8	8.2
C2 178	<1	<1	<1	<1	<1	<1	<5.0	<5.0	5.5
C3 178	<1	<1	<1	<1	<1	<1	5.9	5.6	5.8
Sum 178	<5	<5	<5	<5	<5	<5	11.62	13.34	19.53
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5
C1 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5
C2 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5
C3 Dibenzothiophenes	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5
Sum Dibenzothiophenes	<4	<4	<4	<4	<4	<4	0.00	0.00	0.00
Fluoranthene / Pyrene	<2	<2	<2	<2	<2	<2	-	-	-
C1 202	<1	<1	<1	<1	<1	<1	1.3	1.2	1.5
C2 202	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5
C3 202	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5
Sum 202	<5	<5	<5	<5	<5	<5	3.99	1.22	1.51
Benzoanthracene / Chrysene	<2	<2	<2	<2	<2	<2	-	-	-
C1 228	<1	<1	<1	<1	<1	<1	-	-	-
C2 228	<1	<1	<1	<1	<1	<1	-	-	-
Sum 228	<4	<4	<4	<4	<4	<4	-	-	-
Benzofluoranthenes / Benzopyrenes	<4	<4	<4	<4	<4	<4	-	-	-
C1 252	<1	<1	<1	<1	<1	<1	-	-	-
C2 252	<1	<1	<1	<1	<1	<1	-	-	-
Sum 252	<6	<6	<6	<6	<6	<6	-	-	-
Aranthanthrenes / Indenopyrene / Benzoperylene	<3	<3	<3	<3	<3	<3	-	-	-
C1 276	<1	<1	<1	<1	<1	<1	-	-	-
C2 276	<1	<1	<1	<1	<1	<1	-	-	-
Sum 276	<5	<5	<5	<5	<5	<5	-	-	-
Sum of all PAHs	**<34**	**<34**	**<34**	**<34**	**<34**	**<34**	**166.90**	**91.13**	**287.27**
Sum of NPD fraction	**<14**	**<14**	**<14**	**<14**	**<14**	**<14**			
NPD/4-6 Ring PAH Ratio	-	-	-	-	-	-			

Station	B2913B_ENV_35_SUR	B2913B_ENV_35_MID	B2913B_ENV_35_BOT	B2913B_ENV_36_SUR	B2913B_ENV_36_MID	B2913B_ENV_36_BOT	B2913B_ENV_45_SUR	B2913B_ENV_45_MID	B2913B_ENV_45_BOT
Naphthalene	9.2	<1.5	<1.5	7.0	<1.5	<1.5	40.1	9.4	5.5
C1 Naphthalenes	6.1	<1.5	<1.5	<1.5	<1.5	<1.5	45.7	6.5	<1.5
C2 Naphthalenes	11.2	<1.5	<1.5	<1.5	<1.5	<1.5	114.9	9.9	<1.5
C3 Naphthalenes	<5.0	<1.5	<1.5	<1.5	<1.5	<1.5	155.8	13.6	<1.5
C4 Naphthalenes	-	-	-		-	-	-	-	-
Sum Naphthalenes	26.51	0.00	0.00	7.00	0.00	0.00	356.50	39.37	5.51
Phenanthrene / Anthracene	-	-	-	-	-	-	-	-	-
C1 178	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	10.9	<5.0	5.5
C2 178	15.3	<5.0	<5.0	<5.0	<5.0	<5.0	7.2	7.8	<5.0
C3 178	<5.0	6.5	<5.0	5.4	<1.5	<5.0	7.4	<LQ	5.1
Sum 178	20.32	6.49	0.00	5.42	0.00	0.00	25.43	7.75	10.64
Dibenzothiophene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
C1 Dibenzothiophenes	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
C2 Dibenzothiophenes	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
C3 Dibenzothiophenes	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Sum Dibenzothiophenes	0.00	0.00	0.00	0.00	0.00	0.00	5.47	0.00	0.00
Fluoranthene / Pyrene	-	-	-	-	-	-	-	-	-
C1 202	1.2	2.1	1.5	2.0	<1.5	<5.0	1.6	<1.5	<1.5
C2 202	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
C3 202	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Sum 202	1.20	2.07	1.48	1.95	0.00	0.00	3.82	1.16	0.00
Benzoanthracene / Chrysene	-	-	-	-	-	-	-	-	-
C1 228	-	-	-	-	-	-	-	-	-
C2 228	-	-	-	-	-	-	-	-	-
Sum 228	-	-	-	-	-	-	-	-	-
Benzofluoranthenes / Benzopyrenes	-	-	-	-	-	-	-	-	-
C1 252	-	-	-	-	-	-	-	-	-
C2 252	-	-	-	-	-	-	-	-	-
Sum 252	-	-	-	-	-	-	-	-	-
Aranthanthrenes / Indenopyrene / Benzoperylene	-	-	-	-	-	-	-	-	-
C1 276	-	-	-	-	-	-	-	-	-
C2 276	-	-	-	-	-	-	-	-	-
Sum 276	-	-	-	-	-	-	-	-	-
Sum of all PAHs	**171.76**	**24.26**	**12.29**	**37.08**	**12.83**	**26.17**	**481.71**	**71.82**	**16.15**
Sum of NPD fraction									
NPD/4-6 Ring PAH Ratio									

Station	B2913B_ENV_50_SUR	B2913B_ENV_50_MID	B2913B_ENV_50_BOT
Naphthalene	25.1	22.3	10.1
C1 Naphthalenes	14.7	27.0	8.5
C2 Naphthalenes	22.5	76.9	14.2
C3 Naphthalenes	11.7	51.0	<5.0
C4 Naphthalenes			
Sum Naphthalenes	74.07	177.26	32.90
Phenanthrene / Anthracene	-	-	-
C1 178	38.5	8.3	6.4
C2 178	27.5	5.6	<5.0
C3 178	19.9	<5.0	<5.0
Sum 178	85.90	13.86	6.36
Dibenzothiophene	<1.5	<1.5	<1.5
C1 Dibenzothiophenes	<5.0	<5.0	<1.5
C2 Dibenzothiophenes	<1.5	<5.0	<5.0
C3 Dibenzothiophenes	<1.5	<5.0	<1.5
Sum Dibenzothiophenes	0.00	0.00	0.00
Fluoranthene / Pyrene	-	-	-
C1 202	<1.5	<1.5	<1.5
C2 202	<1.5	<1.5	<1.5
C3 202	<1.5	<1.5	<1.5
Sum 202	0.00	1.02	0.00
Benzoanthracene / Chrysene	-	-	-
C1 228	-	-	-
C2 228	-	-	-
Sum 228	-	-	-
Benzofluoranthenes / Benzopyrenes	-	-	-
C1 252	-	-	-
C2 252	-	-	-
Sum 252	-	-	-
Aranthanthrenes / Indenopyrene / Benzoperylene	-	-	-
C1 276	-	-	-
C2 276	-	-	-
Sum 276	-	-	-
Sum of all PAHs	**336.34**	**244.52**	**52.53**
Sum of NPD fraction			
NPD/4-6 Ring PAH Ratio			

Appendix VII – Polycyclic Aromatic Hydrocarbon Concentrations: EPA PAHs

Sediment Samples

Table VII.I: Polycyclic Aromatic Hydrocarbon Concentrations: EPA PAH for Sediment Samples (µg.kg^{-1})

Station	0m Venus-2	250m_SE	500m_SE	1000m_SE	2000m_SE	250m_NW	500m_NW	1000m_NW	1500m_NW	2000m_NW	3000m_NW
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	1.05	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1	<1	<1	<1	1.78	1.38	1.33
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Station	250m_NE	500m_NE	1000m_NE	2000m_NE	10000m_NE	250m_SW	500m_SW	1000m_SW	2000m_SW	B2913B_ENV_01
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Station	B2913B_ENV_02	B2913B_ENV_03	B2913B_ENV_04	B2913B_ENV_05	B2913B_ENV_06	B2913B_ENV_07	B2913B_ENV_08	B2913B_ENV_09	B2913B_ENV_10	B2913B_ENV_11
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Station	B2913B_ENV_12	B2913B_EN87V_13	B2913B_ENV_14	B2913B_ENV_15	B2913B_ENV_16	B2913B_ENV_17	B2913B_ENV_19	B2913B_ENV_20	B2913B_ENV_21	B2913B_ENV_23
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Station	B2913B_ENV_24	B2913B_ENV_25	B2913B_ENV_27	B2913B_ENV_28	B2913B_ENV_29	B2913B_ENV_30	B2913B_ENV_31	B2913B_ENV_33	B2913B_ENV_34	B2913B_ENV_35
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluorene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1	1.60	<1	<1	<1	<1
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1	2.30	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1	2.07	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1	1.26	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Station	B2913B_ENV_36	B2913B_ENV_38	B2913B_ENV_39	B2913B_ENV_40	B2913B_ENV_41	B2913B_ENV_43	B2913B_ENV_44	B2913B_ENV_45	B2913B_ENV_46	B2913B_ENV_47
Naphthalene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1	<1	<1	1.30	<1	<1
Fluorene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1	1.55	<1	<1	<1	<1
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1	1.57	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1	1.40	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1

Station	B2913B_ENV_48	B2913B_ENV_49	B2913B_ENV_50	B2913B_ENV_51	B2913B_ENV_52
Naphthalene	<1	<1	<1	<1	<1
Acenaphthylene	<1	<1	<1	<1	<1
Acenaphthene	<1	<1	<1	<1	<1
Fluorene	<1	<1	<1	<1	<1
Phenanthrene	<1	<1	<1	<1	<1
Dibenzothiophene	<1	<1	<1	<1	<1
Anthracene	<1	<1	<1	<1	<1
Fluoranthene	<1	<1	<1	<1	<1
Pyrene	<1	<1	<1	<1	<1
Benzo[a]anthracene	<1	<1	<1	<1	<1
Chrysene	<1	<1	<1	<1	<1
Benzo[b]fluoranthene	<1	<1	<1	<1	<1
Benzo[k]fluoranthene	<1	<1	<1	<1	<1
Benzo[e]pyrene	<1	<1	<1	<1	<1
Benzo[a]pyrene	<1	<1	<1	<1	<1
Perylene	<1	<1	<1	<1	<1
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1
Benzo[ghi]perylene	<1	<1	<1	<1	<1

Water

Table VII.II: Polycyclic Aromatic Hydrocarbon Concentrations: EPA PAH for Block 2913B (µg.l⁻¹)

Station	250m_SE_SUR	250m_SE_MID	250m_SE_BOT	10000m_NE_SUR	10000m_NE_MID	10000m_NE_BOT	B2913B_ENV_21_SUR	B2913B_ENV_21_MID	B2913B_ENV_21_BOT	B2913B_ENV_36_SUR
Naphthalene	<1	<1	<1	<1	<1	<1	17.6	18.7	36.2	7.0
Acenaphthylene	<1	<1	<1	<1	<1	<1	<0.3	<0.3	<0.3	<0.3
Acenaphthene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Fluorene	<1	<1	<1	<1	<1	<1	5.9	<5	5.3	<1.5
Phenanthrene	<1	<1	<1	<1	<1	<1	<5	<1.5	<5	<1.5
Dibenzothiophene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Anthracene	<1	<1	<1	<1	<1	<1	<1.5	<0.3	<0.3	<0.3
Fluoranthene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Pyrene	<1	<1	<1	<1	<1	<1	2.7	<0.3	<0.3	<0.3
Benzo[a]anthracene	<1	<1	<1	<1	<1	<1	<1.5	<0.2	<0.2	<0.5
Chrysene	<1	<1	<1	<1	<1	<1	<0.3	<0.3	<0.3	<0.3
Benzo[b]fluoranthene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Benzo[k]fluoranthene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Benzo[e]pyrene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Benzo[a]pyrene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Perylene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Indeno[123,cd]pyrene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Dibenzo[a,h]anthracene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5
Benzo[ghi]perylene	<1	<1	<1	<1	<1	<1	<1.5	<1.5	<1.5	<1.5

Station	B2913B_ENV_36_MID	B2913B_ENV_36_BOT	B2913B_ENV_35_SUR	B2913B_ENV_35_MID	B2913B_ENV_35_BOT	B2913B_ENV_45_SUR	B2913B_ENV_45_MID	B2913B_ENV_45_BOT	B2913B_ENV_50_SUR	B2913B_ENV_50_MID	B2913B_ENV_50_BOT
Naphthalene	<1.5	<1.5	9.2	<1.5	<1.5	40.1	9.4	5.5	25.1	22.3	10.1
Acenaphthylene	<0.3	<1.0	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	1.8
Acenaphthene	<1.5	<1.5	<1.5	<1.5	<1.5	<5.0	<1.5	<1.5	<1.5	<1.5	<1.5
Fluorene	<1.5	<1.5	<5.0	<5.0	<1.5	12.1	<5.0	<1.5	<5	<5	<1.5
Phenanthrene	<1.5	<1.5	<5.0	<5.0	<1.5	11.6	<5.0	<1.5	<5	9.95	<1.5
Dibenzothiophene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Anthracene	<1.5	<1.5	<5.0	<1.5	<1.5	<5.0	<1.5	<1.5	<0.3	<0.3	<0.3
Fluoranthene	<1.5	<1.5	<5.0	<5.0	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Pyrene	<0.3	<0.3	<0.3	<0.3	<0.3	2.2	1.2	<0.3	<0.3	1.0	<0.3
Benzo[a]anthracene	<0.2	<0.5	<0.5	1.5	0.5	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Chrysene	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Benzo[b]fluoranthene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Benzo[k]fluoranthene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Benzo[e]pyrene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<LQ	<1.5	<1.5
Benzo[a]pyrene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<LQ	<1.5
Perylene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5
Indeno[123,cd]pyrene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<LQ	<1.5	<1.5
Dibenzo[a,h]anthracene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	5.1	<1.5	<1.5
Benzo[ghi]perylene	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	<1.5	5.5	<1.5	<1.5

Appendix VIII – BTEX Monocyclic Aromatic Hydrocarbons

Sediment Samples

Table VIII.I Monocyclic Aromatic Hydrocarbon Concentrations (µg.kg^{-1})

Station	Depth (m)	Benzene	Ethyl-Benzene	m/p-Xylenes	o-Xylene	Toluene
0m Venus-2 SPWL	2,900	<1	<2	<4	<2	<5
250m_SE	2,900	<1	<2	<4	<2	<5
500m_SE	2,900	<1	<2	<4	<2	<5
1000m_SE	2,900	<1	<2	<4	<2	<5
2000m_SE	2,900	<1	<2	<4	<2	<5
250m_NW	2,900	<1	<2	<4	<2	<5
500m_NW	2,900	<1	<2	<4	<2	<5
1000m_NW	2,900	<1	<2	<4	<2	<5
1500m_NW	2,900	<1	<2	<4	<2	<5
2000m_NW	2,900	<1	<2	<4	<2	<5
3000m_NW	2,900	<1	<2	<4	<2	<5
250m_NE	2,900	<1	<2	<4	<2	<5
500m_NE	2,900	<1	<2	<4	<2	<5
1000m_NE	2,900	<1	<2	<4	<2	<5
2000m_NE	2,900	<1	<2	<4	<2	<5
10000m_NE	2,900	<1	<2	<4	<2	<5
250m_SW	2,900	<1	<2	<4	<2	<5
500m_SW	2,900	<1	<2	<4	<2	<5
1000m_SW	2,900	<1	<2	<4	<2	<5
2000m_SW	2,900	<1	<2	<4	<2	<5
B2913B_ENV_01	2,964	<1	<2	<4	<2	<5
B2913B_ENV_02	3,025	<1	<2	<4	<2	<5
B2913B_ENV_03	2,916	<1	<2	<4	<2	<5
B2913B_ENV_04	3,051	<1	<2	<4	<2	<5
B2913B_ENV_05	3,028	<1	<2	<4	<2	<5
B2913B_ENV_06	3,002	<1	<2	<4	<2	<5
B2913B_ENV_07	2,978	<1	<2	<4	<2	<5
B2913B_ENV_08	3,032	<1	<2	<4	<2	<5
B2913B_ENV_09	3,019	<1	<2	<4	<2	<5
B2913B_ENV_10	3,003	<1	<2	<4	<2	<5
B2913B_ENV_11	2,977	<1	<2	<4	<2	<5
B2913B_ENV_12	3,025	<1	<2	<4	<2	<5
B2913B_ENV_13	2,976	<1	<2	<4	<2	<5
B2913B_ENV_14	2,954	<1	<2	<4	<2	<5
B2913B_ENV_15	3,013	<1	<2	<4	<2	<5
B2913B_ENV_16	2,903	<1	<2	<4	<2	<5
B2913B_ENV_17	2,879	<1	<2	<4	<2	<5
B2913B_ENV_19	2,943	<1	<2	<4	<2	<5

Station	Depth (m)	Benzene	Ethyl-Benzene	m/p-Xylenes	o-Xylene	Toluene
B2913B_ENV_20	2,810	<1	<2	<4	<2	<5
B2913B_ENV_21	2,625	<1	<2	<4	<2	<5
B2913B_ENV_23	2,996	<1	<2	<4	<2	<5
B2913B_ENV_24	2,849	<1	<2	<4	<2	<5
B2913B_ENV_25	2,593	<1	<2	<4	<2	<5
B2913B_ENV_27	2,857	<1	<2	<4	<2	<5
B2913B_ENV_28	2,737	<1	<2	<4	<2	<5
B2913B_ENV_29	3,117	<1	<2	<4	<2	<5
B2913B_ENV_30	2,793	<1	<2	<4	<2	<5
B2913B_ENV_31	3,164	<1	<2	<4	<2	<5
B2913B_ENV_33	2,953	<1	<2	<4	<2	<5
B2913B_ENV_34	2,743	<1	<2	<4	<2	<5
B2913B_ENV_35	2,661	<1	<2	<4	<2	<5
B2913B_ENV_36	2,878	<1	<2	<4	<2	<5
B2913B_ENV_38	2,790	<1	<2	<4	<2	<5
B2913B_ENV_39	2,538	<1	<2	<4	<2	<5
B2913B_ENV_40	2,613	<1	<2	<4	<2	<5
B2913B_ENV_41	2,873	<1	<2	<4	<2	<5
B2913B_ENV_43	2,715	<1	<2	<4	<2	<5
B2913B_ENV_44	2,957	<1	<2	<4	<2	<5
B2913B_ENV_45	2,830	<1	<2	<4	<2	<5
B2913B_ENV_46	2,735	<1	<2	<4	<2	<5
B2913B_ENV_47	3,012	<1	<2	<4	<2	<5
B2913B_ENV_48	2,963	<1	<2	<4	<2	<5
B2913B_ENV_49	2,846	<1	<2	<4	<2	<5
B2913B_ENV_50	3,116	<1	<2	<4	<2	<5
B2913B_ENV_51	3,032	<1	<2	<4	<2	<5
B2913B_ENV_52	2,960	<1	<2	<4	<2	<5

Water

Table VIII.I Monocyclic Aromatic Hydrocarbon Concentrations (µg.l^{-1})

Station	Benzene	Ethyl-Benzene	m/p-Xylenes	o-Xylene	Toluene
250m_SE_SUR	<1	<0.5	<1	<1	<1
250m_SE_MID	<1	<0.5	<1	<1	<1
250m_SE_BOT	<1	<0.5	<1	<1	<1
10000m_NE_SUR	<1	<0.5	<1	<1	<1
10000m_NE_MID	<1	<0.5	<1	<1	<1
10000m_NE_BOT	<1	<0.5	<1	<1	<1
B2913B_ENV_21-SUR	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_21-MID	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_21-BOT	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_35_SUR	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_35_MID	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_35_BOT	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_36_SUR	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_36_MID	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_36_BOT	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_45_SUR	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_45_MID	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_45_BOT	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_50_SUR	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_50_MID	<1.5	<1.5	<1.5	<1.5	<3
B2913B_ENV_50_BOT	<1.5	<1.5	<1.5	<1.5	<3

Appendix IX – Deck Log Observations

Phase 1

Geodetics: WGS84 UTM 33S											
Cast	Station Name	Water Depth (m)	Time (UTC+2)	Date	Volume Recovered (cm)	Sample Name	Fauna Container	Colour	Comments	Sediment Description	Conspicuous Fauna
1	250m_SE	2970	10:34	03.08.2022	-	CTD Profile	-	-	-	-	-
2	250m_SW	2970	13:12	03.08.2022	19	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay, bioturbation (burrows)	Foraminifera, worm tubes
3	250m_NW	2970	15:35	03.08.2022	25	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
4	250m_NE	2970	17:23	03.08.2022	20	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
5	250m_SE	2970	19:21	03.08.2022	21	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
6	500m_SE	2970	21:11	03.08.2022	23	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
7	500m_SW	2970	23:11	03.08.2022	-	-	-	-	Box core lid mechanism snagged - No Sample	Pale soft mud over consolidated clay	-
8	500m_SW	2970	00:56	04.08.2022	21	PC, eDNA, F1	250ml	7.5yr 7/8	Change in pressure cam due to flooding	Pale soft mud over consolidated clay	Foraminifera, worm tubes
9	500m_NW	2970	03:24	04.08.2022	20	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes, hermit crab
10	500m_NE	2970	15:41	04.08.2022	23	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
11	1000m_NE	2970	07:31	04.08.2022	21	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
12	1000m_SE	2970	09:25	04.08.2022	25	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
13	1000m_SW	2970	11:26	04.08.2022	21	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
14	1000m_NW	2970	13:24	04.08.2022	18	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes

Geodetics: WGS84 UTM 33S											
Cast	**Station Name**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Volume Recovered (cm)**	**Sample Name**	**Fauna Container**	**Colour**	**Comments**	**Sediment Description**	**Conspicuous Fauna**
15	0m Venus-2 SPWL	2970	15:49	04.08.2022	24	PC, eDNA, F1	250ml	7.5yr 7/8	Niskin failed to trigger, only able to obtain sediment sample	Pale soft mud over consolidated clay	Foraminifera, worm tubes
16	250m_SE	5-10 1000 2970	18:18 18:30 18:40	04.08.2022 04.08.2022 04.08.2022	-	Water	-	-	-	-	-
17	250m_SE	1000	19:42 19:43	04.08.2022	-	Zoop	500ml		100m Vertical Trawl	-	-
18	250m_SE	5	19:51 20:01	04.08.2022	-	Phyto	500ml		350m Horizontal Trawl	-	-
19	10000m_NE	1000	21:56 22:00	04.08.2022	-	Zoop	500ml		100m Vertical Trawl	-	-
20	10000m_NE	5	22:09 22:12	04.08.2022	-	Phyto	500ml		270m Horizontal Trawl	-	-
21	10000m_NE	5-10 1000 2970	23:24 23:30 23:44	04.08.2022 04.08.2022 04.08.2022	-	Water	-	-	-	-	-
22	10000m_NE	2970	01:38	05.08.2022	25	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes
23	2000m_NE	2970	05:40	05.08.2022	19	PC, eDNA, F1	250ml	7.5yr 7/8	-	Thin layer of pale soft mud over consolidated clay	Sea cucumber, Foraminifera, worm tubes
24	1500m_NW	2970	08:07	05.08.2022	19-22	NS	-	-	No/Eroded Sample - Not suitable to obtain Fauna sample due to wash out of surface sediments	-	-
25	1500m_NW	2970	09:38	05.08.2022	24	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay, bioturbation (burrows)	Foraminifera, worm tubes
26	2000m_NW	2970	11:23	05.08.2022	19.5	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay, bioturbation (burrows & worm casts)	Foraminifera, worm tubes
27	3000m_NW	2970	13:20	05.08.2022	25	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes

Geodetics: WGS84 UTM 33S											
Cast	Station Name	Water Depth (m)	Time (UTC+2)	Date	Volume Recovered (cm)	Sample Name	Fauna Container	Colour	Comments	Sediment Description	Conspicuous Fauna
28	2000m_SW	2970	15:56	05.08.2022	21	PC, eDNA, F1	250ml	7.5yr 7/8	-	Pale soft mud over consolidated clay	Foraminifera, worm tubes

Phase 2

Geodetics: WGS84 UTM 33S												
Cast#	Station Name	Sampler Used	Water Depth (m)	Time (UTC+2)	Date	Box Core Penetration (cm)	Sample Name	Container Type and Quantity	Comments	Colour	Sediment Description/ Stratification	Conspicuous Fauna/Comments
001	B2913B_ENV_21	Midas CTD+ Niskin	2628	14:34	16/09/2022	-	CTD Water - B	Full Suite	-	-	-	-
002	B2913B_ENV_21	Niskin	5	06:36	16/09/2022	-	Water - S	Full Suite	-	-	-	-
			1000	16:30			Water - M	Full Suite				
003	B2913B_ENV_21	Plankton nets	112	17:26	16/09/2022	-	N/S	N/S	Net tangled, failed deployment	-	-	-
004	B2913B_ENV_21	Plankton nets	112	17:53	16/09/2022	-	Zooplankton Phytoplankton	Full Suite	17:54:06 BOTT. 18:00:18 OUT. Duration: 06:12 Flow in: 121204. Flow out: 1213516. Max 112m	-	-	-
005	2000m_SE		2900	09:15	17/09/2022	49			-	10yr 6/2	Pale soft mud over consolidated clay	Polychaete tubes

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
		Gray O'Hara Box Core					PC eDNA F1	250ml				
006	B2913B_ENV_02	Gray O'Hara Box Core	2900	12:47	17/09/2022	49	PC eDNA F1	250ml	No Mb2 sample.	10yr 6/2	Pale soft mud over consolidated clay	
007	B2913B_ENV_01	Gray O'Hara Box Core	2900	15:55	17/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	
008	B2913B_ENV_03	Gray O'Hara Box Core	2900	18:26	17/09/2022	48	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Polychaete
009	B2913B_ENV_07	Gray O'Hara Box Core	2900	21:57	17/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	
010	B2913B_ENV_06	Gray O'Hara Box Core	3002	01:13	18/09/2022	51	PC eDNA F1	250ml	Small wave splashed over core while sampling	10yr 6/2	Pale soft mud over consolidated clay	Polychaete tubes

Geodetics: WGS84 UTM 33S												
Cast#	Station Name	Sampler Used	Water Depth (m)	Time (UTC+2)	Date	Box Core Penetration (cm)	Sample Name	Container Type and Quantity	Comments	Colour	Sediment Description/ Stratification	Conspicuous Fauna/Comments
011	B2913B_ENV_05	Gray O'Hara Box Core	3029	03:47	18/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Large worm (possible Sipunculid)
012	B2913B_ENV_04	Gray O'Hara Box Core	3021	06:18	18/09/2022	52	PC eDNA F1	250ml	Large wave filled core, washing out sample slightly. Samples still obtained but potential for anomalies in the data, meter readings obtained before wash out.	10yr 6/2	Pale soft mud over consolidated clay	
013	B2913B_ENV_08	Gray O'Hara Box Core	3032	18:08	19/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Polychaete tubes and Holothurians on camera
014	B2913B_ENV_09	Gray O'Hara Box Core	3019	20:57	19/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	
015	B2913B_ENV_10	Gray O'Hara Box Core	3003	23:56	19/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
016	B2913B_ENV_11	Gray O'Hara Box Core	2970	02:42	20/09/2022	50	PC eDNA F1	250ml	Changed redox probe. H2S smell in air and sample.	10yr 6/2	Pale soft mud over consolidated clay	
017	B2913B_ENV_14	Gray O'Hara Box Core	2955	05:17	20/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Polychaete tubes. Holothurian on camera footage
018	B2913B_ENV_13	Gray O'Hara Box Core	2976	07:47	20/09/2022	47	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Polychaete tubes
019	3km_NW	Gray O'Hara Box Core	2998	10:48	20/09/2022	47	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Polychaete, amphipod
020	2km_NW	Gray O'Hara Box Core	2995	13:23	20/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Spiral bioturbation on camera
021	1km_NW	Gray O'Hara Box Core	2976	15:27	20/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	-
022	500m_NW	Gray O'Hara Box Core	2965	17:31	20/09/2022	-	-	-	N/S due to snag of box core lid.	-	-	Starfish bioturbation on camera footage

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
023	500m_NW	Gray O'Hara Box Core	2965	18:53	20/09/2022	49	PC eDNA F1	250ml	-	10yr 6/2	Grey specks of potential drilling fluid on pale soft mud over consolidated clay	Foraminifera (Xenophyophores) in camera footage
024	Venus 1x SFWL	Midas CTD+ Niskin	2938	21:47	20/09/2022	-	Water - B	Full Suite	4L filtered for eDNA	-	-	-
025	Venus 1x SFWL	Niskin	1000	23:37	20/09/2022	-	Water - S	Full Suite	4L filtered for eDNA	-	-	-
026	Venus 1x SFWL	Plankton nets	114	00:29	21/09/2022	-	Zooplankton Phytoplankton	Full Suite	00:22:00 BOTT. 00:36:00 OUT. Duration: 06:20 Flow in: 123533. Flow out: 128085 Max 114m	-	-	-
027	Venus 1x SFWL	Gray O'Hara Box Core	2963	02:01	21/09/2022	48	PC eDNA F1	250ml	-	10yr 6/2	Grey specks of potential drilling fluid on pale soft mud over consolidated clay, more drilling fluid found in this sample compared to the samples at the stations 500m away.	-
028	500m_NE	Gray O'Hara Box Core	2958	04:50	21/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Grey specks of potential drilling fluid on pale soft mud over consolidated clay	Sea pen

Geodetics: WGS84 UTM 33S												
Cast#	Station Name	Sampler Used	Water Depth (m)	Time (UTC+2)	Date	Box Core Penetration (cm)	Sample Name	Container Type and Quantity	Comments	Colour	Sediment Description/ Stratification	Conspicuous Fauna/Comments
029	500m_SE	Gray O'Hara Box Core	2961	07:26	21/09/2022	49	PC eDNA F1	250ml	-	10yr 6/2	Grey specks of potential drilling fluid on pale soft mud over consolidated clay	Polychaetes
030	500m_SW	Gray O'Hara Box Core	2940	09:40	21/09/2022	51	PC eDNA F1	250ml x 2	-	10yr 6/2	Grey specks of potential drilling fluid on pale soft mud over consolidated clay	Holothurian on camera. Potential foraminifera (Xenophyophores) in F1, polychaetes.
031	B2913B_ENV_12	Gray O'Hara Box Core	3025	12:23	21/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	
032	B2913B_ENV_15	Gray O'Hara Box Core	3013	14:48	21/09/2022	50	PC eDNA F1	250ml	An issue with Redox and pH probe, recalibrated after station sampling	10yr 6/2	Pale soft mud over consolidated clay	
033	B2913B_ENV_16	Gray O'Hara Box Core	2903	17:31	21/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Sea pen(orange/ pink)
034	B2913B_ENV_17	Gray O'Hara Box Core	2879	20:11	21/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	

Geodetics: WGS84 UTM 33S												
Cast#	Station Name	Sampler Used	Water Depth (m)	Time (UTC+2)	Date	Box Core Penetration (cm)	Sample Name	Container Type and Quantity	Comments	Colour	Sediment Description/ Stratification	Conspicuous Fauna/Comments
035	B2913B_ENV_30	Gray O'Hara Box Core	2793	23:11	21/09/2022	50	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	
036	B2913B_ENV_28	Gray O'Hara Box Core	2737	02:00	22/09/2022	49	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Sea pens, Holothurian
037	B2913B_ENV_27	Gray O'Hara Box Core	2859	04:57	22/09/2022	51	PC eDNA F1	250ml	-	10yr 6/2	Pale soft mud over consolidated clay	Sea pens, Ophiuroidea
038	B2913B_ENV_29	Gray O'Hara Box Core	3117	08:55	22/09/2022	50	PC eDNA F1	250ml	No Gamma reading in remaining samples due to malfunction in probe.	10yr 6/2	Pale soft mud over consolidated clay	
039	B2913B_ENV_23	Gray O'Hara Box Core	2994	12:54	22/09/2022	50	PC eDNA F1	250ml	Possible wash out, minimal fauna, very sticky mud.	10yr 6/2	Pale soft mud over consolidated clay	
040	B2913B_ENV_24	Gray O'Hara Box Core	2849	15:44	22/09/2022	50	PC eDNA F1	250ml X 2	Foraminifera collected from PC side of sample (F2)	10yr 6/2	Pale soft mud over consolidated clay	Foraminifera, polychaete

Geodetics: WGS84 UTM 33S												
Cast#	Station Name	Sampler Used	Water Depth (m)	Time (UTC+2)	Date	Box Core Penetration (cm)	Sample Name	Container Type and Quantity	Comments	Colour	Sediment Description/ Stratification	Conspicuous Fauna/Comments
041	B2913B_ENV_25	Gray O'Hara Box Core	2593	18:44	22/09/2022	46	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	
042	B2913B_ENV_21	Gray O'Hara Box Core	2625	21:33	22/09/2022	49	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Burrow visible.
043	B2913B_ENV_20	Gray O'Hara Box Core	2810	00:53	23/09/2022	51	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Sea pens
044	B2913B_ENV_19	Gray O'Hara Box Core	2943	03:54	23/09/2022	50	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Sea pens, small burrows
045	B2913B_ENV_31	Gray O'Hara Box Core	3164	03:08	24/09/2022	51	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	
046	B2913B_ENV_31	Midas CTD+ Niskin	3164	03:08	24/09/2022	-	Water - B	Full Suite	4L filtered for eDNA	-	-	-
047	B2913B_ENV_36	Niskin	2877	08:07	24/09/2022	-	Water - S	Full Suite	4L filtered for eDNA	-	-	-
						-	Water - M	Full Suite	4L filtered for eDNA	-	-	-

Geodetics: WGS84 UTM 33S												
Cast#	Station Name	Sampler Used	Water Depth (m)	Time (UTC+2)	Date	Box Core Penetration (cm)	Sample Name	Container Type and Quantity	Comments	Colour	Sediment Description/ Stratification	Conspicuous Fauna/Comments
048	B2913B_ENV_36	Plankton Nets	116	11:02	24/09/2022	-	Zooplankton Phytoplankton	250ml 250ml	11:02 BOTT 11:14 OUT Duration: 12:00 Flow in: 128087. Flow out: 132855 Max 116m	-	-	-
049	B2913B_ENV_36	Gray O'Hara Box Core	2878	12:27	24/09/2022	48	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Ophiuroidea - white with a grey disc, small foraminifera
050	B2913B_ENV_33	Gray O'Hara Box Core	2953	17:56	24/09/2022	49	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Possible burrow
051	B2913B_ENV_34	Gray O'Hara Box Core	2743	21:50	24/09/2022	50	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Numerous sea pens
052	B2913B_ENV_35	Midas CTD+ Niskin	2652	01:36	25/09/2022	-	Water - B	Full Suite		-	-	-
053	B2913B_ENV_35	Midas CTD+ Niskin	5	02:58	25/09/2022	-	Water - S	Full Suite	4L filtered for eDNA	-	-	-
			1000	03:00		-	Water - M	Full Suite	4L filtered for eDNA	-	-	-

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
054	B2913B_ENV_35	Plankton Nets	119	04:17	25/09/2022	-	Phytoplankton	250ml	04:18 BOTT. 04:26 OUT. Duration: 08:06 Flow in: 132848 Flow out: 138200 Max 119m	-	-	-
							Zooplankton	250ml		-	-	-
055	B2913B_ENV_35	Gray O'Hara Box Core	2661	05:36	25/09/2022	42-50	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Very brittle flat sea urchin
056	B2913B_ENV_39	Gray O'Hara Box Core	2545	08:07	25/09/2022	50	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay with burrows and undulating mounds	Small round urchin, large pteropod
057	B2913B_ENV_40	Gray O'Hara Box Core	2613	10:17	25/09/2022	51	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay with small burrows and undulating mounds	
058	B2913B_ENV_38	Gray O'Hara Box Core	2790	12:45	25/09/2022	49	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Sea pens
059	B2913B_ENV_43	Gray O'Hara Box Core	2686	16:01	25/09/2022	48	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay with small black clumps	

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
060	B2913B_ENV_46	Gray O'Hara Box Core	2735	18:51	25/09/2022	50	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	
061	B2913B_ENV_49	Gray O'Hara Box Core	2896	21:57	25/09/2022	51	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	
062	B2913B_ENV_52	Gray O'Hara Box Core	2960	01:44	26/09/2022	51	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	
063	B2913B_ENV_51	Gray O'Hara Box Core	3032	05:44	26/09/2022	52	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	
064	B2913B_ENV_48	Gray O'Hara Box Core	2963	09:10	26/09/2022	51	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	2x Brittle stars, Foraminifera (Xenophyophores)
065	B2913B_ENV_45	Niskin	5	12:25	26/09/2022	-	Water - S	Full Suite	Approximately 4L filtered for eDNA	-	-	-

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
066	B2913B_ENV_45	Midas CTD+ Niskin	1000	14:08	26/09/2022	-	Water - M	Full Suite	Approximately 4L filtered for eDNA	-	-	-
			2750	13:57			Water - B	Full Suite	Approximately 4L filtered for eDNA	-	-	-
067	B2913B_ENV_45	Gray O'Hara Box Core	2830	20:12	26/09/2022	51	PC eDNA F1	250ml	Blurring of lasers in the video due to flooding	10yr 6/2	Pale soft mud over consolidated clay, with burrows	
068	B2913B_ENV_45	Plankton Nets	100	21:46	26/09/2022	-	Phytoplankton	250ml	21:42:00 BOTT. 21:48:26 OUT. Duration: 06:26 Flow in: 140555 Flow out: 143000 Max 100m	-	-	-
							Zooplankton	250ml				
069	B2913B_ENV_41	Gray O'Hara Box Core	2873	01:36	27/09/2022	51	PC eDNA F1	250ml	The blurring of lasers in the video due to flooding. Switched to new for the next deployment	10yr 6/2	Pale soft mud over consolidated clay	Brittle star and foraminifera (Xenophyophores)
070	B2913B_ENV_44	Gray O'Hara Box Core	2957	04:36	27/09/2022	52	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	Foraminifera (Xenophyophores)
071	B2913B_ENV_47	Gray O'Hara Box Core	3012	07:46	27/09/2022	50	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay, with small burrows	Brittle star and foraminifera (Xenophyophores)

Geodetics: WGS84 UTM 33S												
Cast#	**Station Name**	**Sampler Used**	**Water Depth (m)**	**Time (UTC+2)**	**Date**	**Box Core Penetration (cm)**	**Sample Name**	**Container Type and Quantity**	**Comments**	**Colour**	**Sediment Description/ Stratification**	**Conspicuous Fauna/Comments**
072	B2913B_ENV_50	Midas CTD+ Niskin	5	11:48	27/09/2022	-	Water - S		4L filtered for each eDNA			
			1000	11:56			Water - M					
			3100	12:14			Water - B					
073	B2913B_ENV_50	Plankton Nets	117	13:51	27/09/2022	-	Zooplankton Phytoplankton		13:51:00 BOTT. 13:57:30 OUT. Duration: 06:30 Flow in: 143000 Flow out: 149560 Max 117m			
074	B2913B_ENV_50	Gray O'Hara Box Core	3116	15:00	27/09/2022	52	PC eDNA F1	250ml		10yr 6/2	Pale soft mud over consolidated clay	White ringed discs

Appendix X – Camera Transect Log Sheets

Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgonidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
		Geodetics WGS84 UTM33S				Conspicuous fauna presence/absence																								
0m Venus-2	06/08/2022 20:29:26	327 371	6 748 792	1459	Bioturbated mud	P		P		P					P															
	06/08/2022 21:01:58	326 355	6 749 839																											
B2913B_CAM_03	29/09/2022 18:51:40	326 713	6 749 086	43	Bioturbated mud	P	P	P	P	P	P														P					
	29/09/2022 19:11:55	326 693	6 749 124																											
	29/09/2022 19:11:55	326 693	6 749 124	15	No visible seabed																									
	29/09/2022 19:17:24	326 708	6 749 127																											
	29/09/2022 19:17:24	326 708	6 749 127	490	Bioturbated mud	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P				P					P
	29/09/2022 20:51:31	327 048	6 749 479																											
B2913B_CAM_04	29/09/2022 23:38:27	326 672	6 749 487	25	Bioturbated mud		P						P	P				P							P					
	29/09/2022 23:56:45	326 677	6 749 512																											
	29/09/2022 23:56:45	326 677	6 749 512	36	No visible seabed																									

Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Conspicuous fauna presence/absence																								
		Geodetics WGS84 UTM33S				Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgonidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	30/09/2022 00:01:42	326 706	6 749 491																											
	30/09/2022 00:01:42	326 706	6 749 491	124	Bioturbated mud	P	P		P	P		P	P	P	P												P			P
	30/09/2022 00:25:00	326 794	6 749 403																											
	30/09/2022 00:25:00	326 794	6 749 403	21	No visible seabed																									
	30/09/2022 00:28:16	326 805	6 749 385																											
	30/09/2022 00:28:16	326 805	6 749 385	41	Bioturbated mud	P	P			P					P															
	30/09/2022 00:35:53	326 834	6 749 357																											
	30/09/2022 00:35:53	326 834	6 749 357	135	No visible seabed																									
	30/09/2022 00:51:54	326 917	6 749 250																											
	30/09/2022 00:51:54	326 917	6 749 250	36	Bioturbated mud													P		P										
	30/09/2022 00:59:53	326 935	6 749 219																											
	30/09/2022 00:59:53	326 935	6 749 219	88	No visible seabed																									

Geodetics WGS84 UTM33S																														
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Conspicuous fauna presence/absence																								
						Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgonidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	30/09/2022 01:09:27	327 004	6 749 165																											
	30/09/2022 01:09:27	327 004	6 749 165	98	Bioturbated mud	P	P	P	P	P			P	P	P	P	P			P										P
	30/09/2022 01:27:55	327 067	6 749 089																											
B2913B_CAM_05	30/09/2022 04:25:01	332 379	6 751 455	13	Bioturbated mud (high abundance of tube worms)				P										P		P				P					
	30/09/2022 04:29:34	332 374	6 751 443																											
	30/09/2022 04:29:34	332 374	6 751 443	4	No visible seabed																									
	30/09/2022 04:34:03	332 372	6 751 439																											
	30/09/2022 04:34:03	332 372	6 751 439	27	Bioturbated mud (high abundance of tube worms)	P				P		P							P	P	P				P					
	30/09/2022 04:46:26	332 368	6 751 412																											
	30/09/2022 04:46:26	332 368	6 751 412	26	No visible seabed																									
	30/09/2022 04:50:10	332 375	6 751 387																											
	30/09/2022 04:50:10	332 375	6 751 387	241		P			P	P				P		P		P		P	P	P	P		P					

Geodetics WGS84 UTM33S						Conspicuous fauna presence/absence																								
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgoniidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	30/09/2022 05:41:50	332 414	6 751 149		Bioturbated mud (high abundance of tube worms)																									
	30/09/2022 05:41:50	332 414	6 751 149	91	No visible seabed																									
	30/09/2022 05:52:56	332 389	6 751 062																											
	30/09/2022 05:52:56	332 389	6 751 062	3	Bioturbated mud (high abundance of tube worms)														P		P		P		P					
	30/09/2022 05:56:01	332 391	6 751 060																											
	30/09/2022 05:56:01	332 391	6 751 060	52	No visible seabed																									
	30/09/2022 06:01:22	332 384	6 751 008																											
	30/09/2022 06:01:22	332 384	6 751 008	4	Bioturbated mud (high abundance of tube worms)	P				P								P	P		P				P					
	30/09/2022 06:03:31	332 381	6 751 005																											
	30/09/2022 06:03:31	332 381	6 751 005	44	No visible seabed																									
	30/09/2022 06:08:25	332 367	6 750 964																											
	30/09/2022 06:08:25	332 367	6 750 964	7															P		P				P					

Geodetics WGS84 UTM33S																														
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Conspicuous fauna presence/absence																								
						Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgoniidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	30/09/2022 06:10:42	332 364	6 750 970		Bioturbated mud (high abundance of tube worms)																									
	30/09/2022 06:10:42	332 364	6 750 970	58	No visible seabed																									
	30/09/2022 06:18:07	332 363	6 750 913																											
	30/09/2022 06:18:07	332 363	6 750 913	13	Bioturbated mud (high abundance of tube worms)																P									
	30/09/2022 06:20:19	332 354	6 750 903																											
B2913B_CAM_06	30/09/2022 09:30:31	339 059	6 752 565	10	Bioturbated mud				P										P	P			P							
	30/09/2022 09:38:49	339 058	6 752 575																											
	30/09/2022 09:38:49	339 058	6 752 575	28	No visible seabed																									
	30/09/2022 09:47:33	339 083	6 752 562																											
	30/09/2022 09:47:33	339 083	6 752 562	7	Bioturbated mud														P				P							
	30/09/2022 09:52:02	339 089	6 752 563																											
	30/09/2022 09:52:02	339 089	6 752 563	35	No visible seabed																									

Geodetics WGS84 UTM33S																														
						Conspicuous fauna presence/absence																								
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgoniidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	30/09/2022 09:58:44	339 121	6 752 549																											
	30/09/2022 09:58:44	339 121	6 752 549	7	Bioturbated mud									P		P			P				P							
	30/09/2022 10:04:03	339 116	6 752 554																											
	30/09/2022 10:04:03	339 116	6 752 554	62	No visible seabed																									
	30/09/2022 10:09:46	339 172	6 752 528																											
	30/09/2022 10:09:46	339 172	6 752 528	39	Bioturbated mud	P				P		P						P	P				P							
	30/09/2022 10:18:04	339 211	6 752 522																											
	30/09/2022 10:18:04	339 211	6 752 522	27	No visible seabed																									
	30/09/2022 10:23:07	339 237	6 752 514																											
	30/09/2022 10:23:07	339 237	6 752 514	46	Bioturbated mud		P											P	P				P							
	30/09/2022 10:30:56	339 279	6 752 498																											
	30/09/2022 10:30:56	339 279	6 752 498	44	No visible seabed																									

Geodetics WGS84 UTM33S						Conspicuous fauna presence/absence																								
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgonidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	30/09/2022 10:36:35	339 316	6 752 474																											
	30/09/2022 10:36:35	339 316	6 752 474	123	Bioturbated mud	P				P									P				P	P			P			
	30/09/2022 10:55:28	339 431	6 752 429																											
	30/09/2022 10:55:28	339 431	6 752 429	46	No visible seabed																									
	30/09/2022 11:01:15	339 472	6 752 407																											
	30/09/2022 11:01:15	339 472	6 752 407	26	Bioturbated mud														P				P							
	30/09/2022 11:06:00	339 496	6 752 397																											
	30/09/2022 11:06:00	339 496	6 752 397	46	No visible seabed																									
	30/09/2022 11:12:07	339 536	6 752 374																											
	30/09/2022 11:12:07	339 536	6 752 374	36	Bioturbated mud									P					P				P							
	30/09/2022 11:15:09	339 568	6 752 357																											
B2913B_CAM_14	29/09/2022 02:20:40	353 215	6 728 036	57	bioturbated mud														P				P		P					

Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgoniidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
Geodetics WGS84 UTM33S						Conspicuous fauna presence/absence																								
	29/09/2022 02:33:41	353 246	6 727 988																											
	29/09/2022 02:33:41	353 246	6 727 988	424	bioturbated mud and increased abundance of tube worms	P	P	P		P		P		P	P		P	P	P				P	P	P	P				
	29/09/2022 03:43:33	353 283	6 727 566																											
B2913B_CAM_15	29/09/2022 19:30:34	354 343	6 723 099	14	Bioturbated mud														P								P			
	29/09/2022 19:47:31	354 347	6 723 085																											
	29/09/2022 19:47:31	354 347	6 723 085	19	No visible seabed																									
	29/09/2022 19:57:53	354 329	6 723 086																											
	29/09/2022 19:57:53	354 329	6 723 086	137	Bioturbated mud (high abundance of tube worms)	P	P		P			P		P			P	P	P		P	P	P		P	P		P	P	
	29/09/2022 20:36:07	354 320	6 722 949																											
	29/09/2022 20:36:07	354 320	6 722 949	27	No visible seabed																									
	29/09/2022 20:41:20	354 313	6 722 923																											
	29/09/2022 20:41:20	354 313	6 722 923	345		P	P		P	P				P	P		P	P	P		P	P	P	P	P	P				

Geodetics WGS84 UTM33S																														
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Conspicuous fauna presence/absence																								
						Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgoniidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	29/09/2022 21:55:15	354 241	6 722 586		Bioturbated mud (high abundance of tube worms)																									
B2913B_CAM_17	28/09/2022 11:05:29	336 094	6 714 750	16	Bioturbated mud (high abundance of tube worms)														P											
	28/09/2022 11:10:31	336 098	6 714 765																											
	28/09/2022 11:10:31	336 098	6 714 765	20	No visible seabed																									
	28/09/2022 11:19:05	336 117	6 714 769																											
	28/09/2022 11:19:05	336 117	6 714 769	10	Bioturbated mud (high abundance of tube worms)														P						P					
	28/09/2022 11:23:08	336 126	6 714 764																											
	28/09/2022 11:23:08	336 126	6 714 764	123	No visible seabed																									
	28/09/2022 11:45:18	336 249	6 714 763																											
	28/09/2022 11:45:18	336 249	6 714 763	16	Bioturbated mud (high abundance of tube worms)	P			P	P									P			P	P		P				P	P
	28/09/2022 12:58:30	336 263	6 714 770																											
	28/09/2022 12:58:30	336 263	6 714 770	734	No visible seabed																									

Geodetics WGS84 UTM33S																														
Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Conspicuous fauna presence/absence																								
						Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgonidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
	28/09/2022 13:36:15	336 997	6 714 788																											
	28/09/2022 13:36:15	336 997	6 714 788	20	Bioturbated mud (high abundance of tube worms)							P							P						P					
	28/09/2022 13:40:57	337 008	6 714 804																											
	28/09/2022 13:40:57	337 008	6 714 804	93	No visible seabed																									
	28/09/2022 14:02:47	337 101	6 714 812																											
	28/09/2022 14:02:47	337 101	6 714 812	34	Bioturbated mud (high abundance of tube worms)	P				P									P			P								
	28/09/2022 14:11:51	337 125	6 714 836																											
	28/09/2022 14:11:51	337 125	6 714836	127	No visible seabed																									
	28/09/2022 14:29:45	337 252	6 714854																											
	28/09/2022 14:29:45	337 252	6 714854	95	Bioturbated mud (high abundance of tube worms)	P			P	P		P		P					P		P	P			P					
	28/09/2022 14:52:40	337 340	6 714890																											

Station	Date & Time	Easting	Northing	Distance travelled (m)	Sediment type	Actiniaria	*Appendicularia* (Larvacean)	*Benthodytes*	Caridea	Paguridae	Actinoscyphia aurelia	Halosauridae	Asteroidea	Macrouridae	Holothuroidea	*Umbellula*	Ophiuroidea	Ipnopidae	Pennatulacea	*Hygrosoma*	Annelida	Ophidiidae	Gorgonidae	*Scotoplanes*	xenophyophores	Echinidae	Hemichordata	Scalpellomorpha	Crustacea	Cnidaria
		Geodetics WGS84 UTM33S				Conspicuous fauna presence/absence																								
B2913B_CAM_18	28/09/2022 06:10:48	344 961	6 706663	109	Bioturbated mud				P					P	P		P	P				P		P						
	28/09/2022 06:30:45	344 858	6 706700																											
B2913B_CAM_20	27/09/2022 20:57:05	332 647	6 656405	1105	Bioturbated mud	P		P	P	P		P	P	P	P	P	P	P	P			P			P	P	P			
	27/09/2022 22:33:40	331 873	6 657193																											

Appendix XI – Box Corer Video Log Sheets

Geodetics WGS84 UTM33S														
Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgoniidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
0m Venus-2 SPWL	04/08/2022 14:49:38 04/08/2022 14:50:09	326 890	6 749 285	Bioturbated mud										
250m_NE	03/08/2022 16:23:25 03/08/2022 16:23:45	327 067	6 749 462	Bioturbated mud										
250m_NW	03/08/2022 14:35:13 03/08/2022 14:35:30	326 713	6 749 462	Bioturbated mud										
250m_SE	03/08/2022 18:19:32 03/08/2022 19:19:48	327 067	6 749 108	Bioturbated mud										
250m_SW	03/08/2022 12:11:34 03/08/2022 12:11:53	326 713	6 749 108	Bioturbated mud										
500m_NE	04/08/2022 04:42:53 04/08/2022 04:43:14	327 244	6 749 639	Bioturbated mud										

Geodetics WGS84 UTM33S														
Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgoniidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
500m_NW (no video recorded)														
500m_SE	03/08/2022 20:09:52 03/08/2022 20:10:17	327 244	6 748 931	Bioturbated mud										
500m_SW	03/08/2022 22:10:15 03/08/2022 22:11:17	326 536	6 748 931	Bioturbated mud										P
1000m_NE	04/08/2022 06:32:20 04/08/2022 06:32:46	327 597	6 749 992	Bioturbated mud			P							
1000m_NW	04/08/2022 12:23:24 04/08/2022 12:23:48	326 183	6 749 992	Bioturbated mud	p									
1000m_SE	04/08/2022 08:25:23 04/08/2022 08:25:32	327 597	6 748 578	Bioturbated mud										
1000m_SW	04/08/2022 10:27:37 04/08/2022 10:28:05	326 183	6 748 578	Bioturbated mud										
1500m_NW	05/08/2022 08:38:38 05/08/2022 08:39:05	325 829	6 750 346	Bioturbated mud										
2000m_SW	05/08/2022 14:57:09 05/08/2022 14:57:22	325 476	6 747 871	Bioturbated mud										
2000m_NE	05/08/2022 04:39:59 05/08/2022 04:40:17	328 304	6 750 699	Bioturbated mud										

Geodetics WGS84 UTM33S														
Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgoniidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
2000m_NW	05/08/2022 10:22:43	325 476	6 750 699	Bioturbated mud										
	05/08/2022 10:25:26													
3000m_NW	05/08/2022 12:20:02	324 769	6 751 406	Bioturbated mud										
	05/08/2022 12:20:17													
10000m_NE	05/08/2022 00:37:48	333 961	6 756 356	Bioturbated mud	P								P	
	05/08/2022 00:38:20													
2000m_SE	17/09/2022 09:15:08	328 336	6 747 892	Bioturbated mud										
	17/09/2022 09:15:24													
B2913B_ENV_01	17/09/2022 15:54:53	323 580	6 748 151	Bioturbated mud				P						
	17/09/2022 15:55:36													
B2913B_ENV_02	17/09/2022 12:47:15	323 580	6 748 151	Bioturbated mud										
	17/09/2022 12:47:22													
B2913B_ENV_03	17/09/2022 18:25:32	331 970	6 752 408	Bioturbated mud		P	P							
	17/09/2022 18:25:53													
B2913B_ENV_04	18/09/2022 06:18:28	324 815	6 744 720	Bioturbated mud										
	18/09/2022 06:19:00													
B2913B_ENV_05	18/09/2022 03:47:29	327 657	6 746 161	Bioturbated mud										
	18/09/2022 03:47:49													

Geodetics WGS84 UTM33S														
Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgoniidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
B2913B_ENV_06	18/09/2022 01:13:08 18/09/2022 01:13:50	330 825	6 747 793	Bioturbated mud										P
B2913B_ENV_07	17/09/2022 21:56:38 17/09/2022 21:57:15	334 068	6 749 431	Bioturbated mud										P
B2913B_ENV_08	19/09/2022 18:07:55 19/09/2022 18:09:23	326 286	6 741 553	Bioturbated mud						P				
B2913B_ENV_09	19/09/2022 20:57:46 19/09/2022 20:58:24	329 584	6 743 183	Bioturbated mud										
B2913B_ENV_10	19/09/2022 23:55:55 19/09/2022 23:56:36	332 850	6 744 806	Bioturbated mud										
B2913B_ENV_11	20/09/2022 02:42:13 20/09/2022 02:42:39	336 159	6 746 461	Bioturbated mud										
B2913B_ENV_12	21/09/2022 12:23:11 21/09/2022 12:23:50	328 237	6 738 454	Bioturbated mud	P									
B2913B_ENV_13	21/09/2022 07:47:25 21/09/2022 07:47:48	334 921	6 741 768	Bioturbated mud										
B2913B_ENV_14	20/09/2022 05:16:54 20/09/2022 05:17:32	338 286	6 743 415	Bioturbated mud						P				
B2913B_ENV_15	21/09/2022 14:48:49 21/09/2022 14:49:18	330 086	6 735 516	Bioturbated mud										P
B2913B_ENV_16	21/09/2022 17:31:47 21/09/2022 17:32:08	336 934	6 738 763	Bioturbated mud										P

Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
		Geodetics WGS84 UTM33S												
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgonidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
B2913B_ENV_17	21/09/2022 20:11:21 21/09/2022 20:12:00	340 362	6 740 399	Bioturbated mud										P
B2913B_ENV_19	23/09/2022 03:54:07 23/09/2022 03:54:47	320 565	6 775 745	Bioturbated mud										P
B2913B_ENV_20	23/09/2022 00:53:51 23/09/2022 00:54:13	334 251	6 774 852	Bioturbated mud		P								
B2913B_ENV_21	22/09/2022 21:33:10 22/09/2022 21:33:52	350 031	6 775 501	Bioturbated mud		P								
B2913B_ENV_23	22/09/2022 12:54:08 22/09/2022 12:54:38	323 896	6 766 027	Bioturbated mud										
B2913B_ENV_24 (no video recorded)														
B2913B_ENV_25	22/09/2022 18:43:49 22/09/2022 18:44:02	348 964	6 765 993	Bioturbated mud		P								
B2913B_ENV_27	22/09/2022 04:57:31 22/09/2022 04:57:57	336 095	6 752 017	Bioturbated mud		P								
B2913B_ENV_28 (no video recorded)														
B2913B_ENV_29	22/09/2022 08:55:33 22/09/2022 08:55:57	310 568	6 741 935	Bioturbated mud										P
B2913B_ENV_30	21/09/2022 23:11:27 21/09/2022 23:12:03	349 392	6 741 929	Bioturbated mud										

Geodetics WGS84 UTM33S														
Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgoniidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
B2913B_ENV_31	24/09/2022 03:08:20 24/09/2022 03:09:02	312 146	6 729 958	Bioturbated mud										
B2913B_ENV_33	24/09/2022 17:56:10 24/09/2022 17:56:58	337 288	6 729 920	Bioturbated mud										
B2913B_ENV_34	24/09/2022 21:50:34 24/09/2022 21:51:23	353 242	6 727 804	Bioturbated mud		P					P			
B2913B_ENV_35	24/09/2022 05:36:08 24/09/2022 05:36:32	354 266	6 722 610	Bioturbated mud										
B2913B_ENV_36	24/09/2022 12:27:19 24/09/2022 12:27:40	312 453	6 717 887	Bioturbated mud						P				
B2913B_ENV_38	25/09/2022 12:45:21 25/09/2022 12:45:48	337 512	6 717 939	Bioturbated mud										
B2913B_ENV_39	25/09/2022 08:07:34 25/09/2022 08:07:58	351 953	6 716 030	Bioturbated mud			P		P					
B2913B_ENV_40	25/09/2022 10:17:23 25/09/2022 10:17:46	347 571	6 714 393	Bioturbated mud										
B2913B_ENV_41	27/09/2022 01:36:40 27/09/2022 01:37:15	319 598	6 704 851	Bioturbated mud										
B2913B_ENV_43	25/09/2022 16:01:16 25/09/2022 16:02:00	344 428	6 704 859	Bioturbated mud										
B2913B_ENV_44	27/09/2022 04:36:53 27/09/2022 04:37:20	319 644	6 689 713	Bioturbated mud										

Geodetics WGS84 UTM33S														
Station	Date & Time (Local)	Easting	Northing	Sediment type	Conspicuous fauna presence/absence									
					Actiniaria	Annelida	Asteroidea	Caridea	Gorgoniidae	Holothuroidea	Macrouridae	Ophiuroidea	Paguridae	Xenophyophores
B2913B_ENV_45	26/09/2022 20:12:15	330 173	6 689 722	Bioturbated mud										
	26/09/2022 20:13:10													
B2913B_ENV_46	25/09/2022 18:51:03	344 513	6 689 675	Bioturbated mud										
	25/09/2022 18:51:37													
B2913B_ENV_47	27/09/2022 07:46:37	319 706	6 673 475	Bioturbated mud								P		
	27/09/2022 07:47:18													
B2913B_ENV_48	26/09/2022 09:10:15	332 063	6 673 487	Bioturbated mud										
	26/09/2022 09:10:34													
B2913B_ENV_49	25/09/2022 21:57:39	351 001	6 675 343	Bioturbated mud						P				
	25/09/2022 21:58:29													
B2913B_ENV_50	27/09/2022 14:59:54	316 402	6 654 385	Bioturbated mud	P									
	27/09/2022 15:00:51													
B2913B_ENV_51	26/09/2022 05:44:52	332 282	6 656 861	Bioturbated mud										
	26/09/2022 05:45:29													
B2913B_ENV_52	26/09/2022 01:44:27	344 249	6 656 815	Bioturbated mud										
	26/09/2022 01:44:59													

Appendix XII – Macrofauna and Biomass Species Lists

Appendix XII - Macrofauna Infauna

Appendix XII - Macrofauna Epifaur

Appendix XII - Biomass List.pdf

Appendix XIII – Phytoplankton Species List

Appendix XIII -
Phytoplankton Spec

Appendix XIV – Zooplankton Species List

Appendix XIV -
Zooplankton Specie

Appendix XV – Burrow Density Assessment

Geodetics WGS84 UTM33S					
Still number	Date &Time	Easting	Northing	Burrow density (Ind/m²) (3-15 cm)	SACFOR abundance (3-15 cm)
B2913B_CAM_03					
01	29/09/2021 18:52:44	326 713	6 749 086	9.88	Common
02	29/09/2021 19:03:04	326 699	6 749 101	0.00	-
03	29/09/2021 19:05:44	326 698	6 749 097	0.62	Frequent
04	29/09/2021 19:06:04	326 697	6 749 103	0.31	Frequent
05	29/09/2021 19:07:14	326 690	6 749 103	0.00	-
06	29/09/2021 19:17:28	326 708	6 749 127	0.00	-
07	29/09/2021 19:21:06	326 706	6 749 146	27.01	Abundant
08	29/09/2021 19:22:01	326 715	6 749 145	0.00	-
09	29/09/2021 19:25:00	326 684	6 749 184	0.00	-
10	29/09/2021 19:27:17	326 754	6 749 173	22.22	Abundant
11	29/09/2021 19:28:17	326 726	6 749 170	0.69	Frequent
12	29/09/2021 19:29:24	326 740	6 749 167	0.00	-
13	29/09/2021 19:32:09	326 748	6 749 181	1.23	Common
14	29/09/2021 19:34:13	326 736	6 749 186	0.00	-
15	29/09/2021 19:38:45	326 778	6 749 208	0.08	Occasional
16	29/09/2021 19:39:08	326 774	6 749 210	1.23	Common
17	29/09/2021 19:39:31	326 781	6 749 208	3.78	Common
18	29/09/2021 19:40:55	326 796	6 749 208	0.00	-
19	29/09/2021 19:42:09	326 808	6 749 215	0.31	Frequent
20	29/09/2021 19:44:14	326 804	6 749 214	13.89	Abundant
21	29/09/2021 19:47:04	326 810	6 749 220	0.00	-
22	29/09/2021 19:47:55	326 820	6 749 220	0.62	Frequent
23	29/09/2021 19:49:30	326 831	6 749 227	0.31	Frequent
24	29/09/2021 19:50:08	326 823	6 749 217	0.31	Frequent
25	29/09/2021 19:50:51	326 834	6 749 231	0.00	-
26	29/09/2021 19:51:47	326 852	6 749 238	0.00	-
27	29/09/2021 19:53:11	326 840	6 749 230	0.00	-
28	29/09/2021 19:56:43	326 852	6 749 233	3.78	Common
29	29/09/2021 19:57:33	326 847	6 749 245	0.00	-
30	29/09/2021 19:58:28	326 850	6 749 241	0.00	-
31	29/09/2021 19:59:02	326 857	6 749 248	0.00	-
32	29/09/2021 19:59:56	326 861	6 749 243	0.31	Frequent
33	29/09/2021 20:00:10	326 857	6 749 242	2.78	Common
34	29/09/2021 20:00:42	326 871	6 749 244	2.78	Common
35	29/09/2021 20:01:31	326863	6 749 254	0.00	-
36	29/09/2021 20:02:01	326 867	6 749 256	36.11	Abundant
37	29/09/2021 20:03:18	326 878	6 749 260	0.00	-
38	29/09/2021 20:04:35	326 869	6 749 268	0.00	-
39	29/09/2021 20:05:29	326 887	6 749 263	0.00	-
40	29/09/2021 20:06:48	326 888	6 749 280	0.00	-
41	29/09/2021 20:07:41	326 896	6 749 278	0.00	-
42	29/09/2021 20:08:26	326 896	6 749 285	0.00	-
43	29/09/2021 20:09:40	326 903	6 749 281	0.00	-
44	29/09/2021 20:12:14	326 906	6 749 293	0.00	-
45	29/09/2021 20:13:11	326 925	6 749 288	0.00	-
46	29/09/2021 20:14:38	326 914	6 749 309	0.00	-
47	29/09/2021 20:15:36	326 928	6 749 309	0.00	-

Geodetics WGS84 UTM33S					
Still number	Date &Time	Easting	Northing	Burrow density (Ind/m²) (3-15 cm)	SACFOR abundance (3-15 cm)
48	29/09/2021 20:16:40	326 938	6 749 303	5.56	Common
49	29/09/2021 20:18:27	326 943	6 749 318	0.00	-
50	29/09/2021 20:19:37	326 958	6 749 333	0.00	-
51	29/09/2021 20:20:32	326 966	6 749 327	1.93	Common
52	29/09/2021 20:21:35	326 962	6 749 342	0.00	-
53	29/09/2021 20:22:29	326 967	6 749 348	3.70	Common
54	29/09/2021 20:23:41	326 967	6 749 351	3.86	Common
55	29/09/2021 20:24:32	326 981	6 749 354	0.00	-
56	29/09/2021 20:25:29	326 975	6 749 367	0.00	-
57	29/09/2021 20:26:25	326 977	6 749 357	2.78	Common
58	29/09/2021 20:27:53	326 988	6 749 380	0.62	Frequent
59	29/09/2021 20:28:39	326 995	6 749 393	0.00	-
60	29/09/2021 20:30:56	327 007	6 749 392	22.22	Abundant
61	29/09/2021 20:31:40	327 002	6 749 402	0	-
62	29/09/2021 20:32:43	327 008	6 749 405	0	-
63	29/09/2021 20:35:28	327 017	6 749 373	0	-
64	29/09/2021 20:37:37	327 023	6 749 403	5.56	Common
65	29/09/2021 20:38:40	327 017	6 749 415	22.69	Abundant
66	29/09/2021 20:39:33	327 012	6 749 426	0	-
67	29/09/2021 20:40:35	327 022	6 749 421	0	-
68	29/09/2021 20:41:29	327 028	6 749 434	0	-
69	29/09/2021 20:42:38	327 030	6 749 443	1.93	
70	29/09/2021 20:43:34	327 035	6 749 454	0	-
71	29/09/2021 20:46:41	327 043	6 749 454	3.78	Common
72	29/09/2021 20:47:43	327 052	6 749 463	0	-
73	29/09/2021 20:48:43	327 054	6 749 466	0	-
74	29/09/2021 20:49:42	327 054	6 749 477	2.78	Common
75	29/09/2021 20:50:45	N/A	N/A	0	-
76	29/09/2021 20:51:29	N/A	N/A	0	-

Appendix XVI – Seabed Photographs from Transects

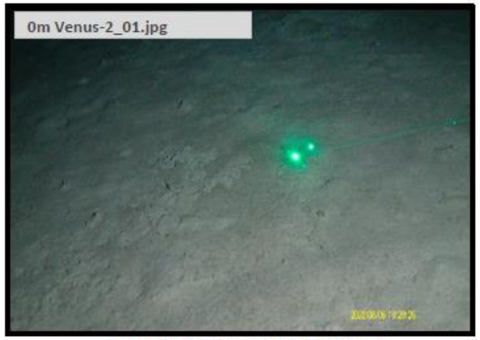


Photo Position: 327203 mE, 6748966 mN

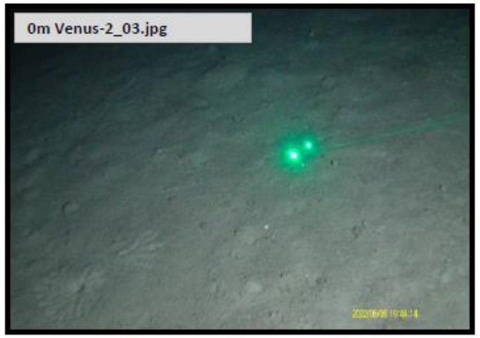


Photo Position: 326859 mE, 6749350 mN

Photo Position: 326550 mE, 6749655 mN

Habitat Summary Information: 0m Venus-2

Survey Area: Block 2913B

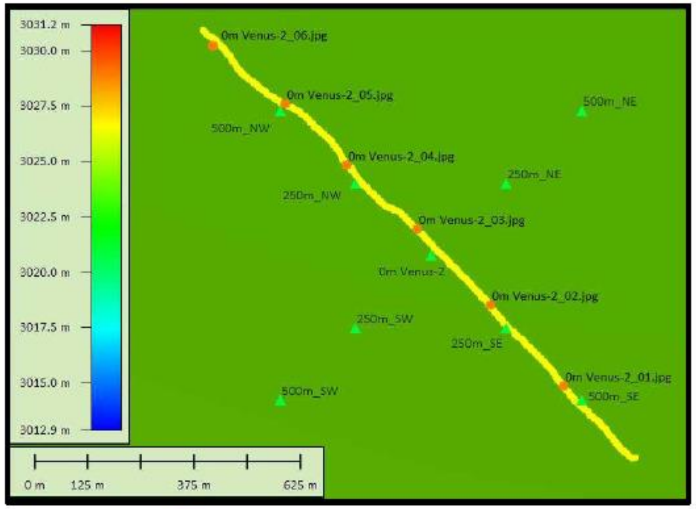
No. of Stills: 6 **Mins of Video: 84** **Track Length: 1458m** **Date: 06/08/2022**

Site Selection Criteria
Transect intersects Venus-2 PWL

Analogue Interpretation
Transect ground-truths an area of seabed at approximately 2,970m water depth

Sediment Description
Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna
Cnidaria: Actiniaria sp. Arthropoda: Paguridae sp. Echinodermata: Benthodytes sp., Holothuroidea sp.



Client: TotalEnergies

Contractor: benthic solutions limited

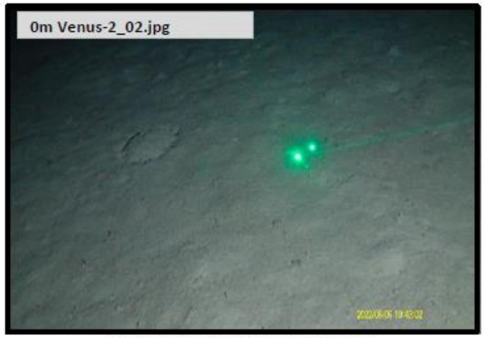


Photo Position: 327030 mE, 6749164 mN

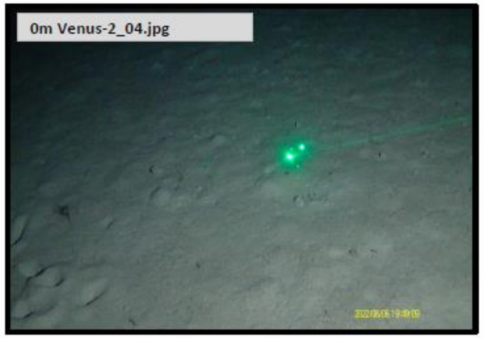


Photo Position: 326694 mE, 6749506 mN

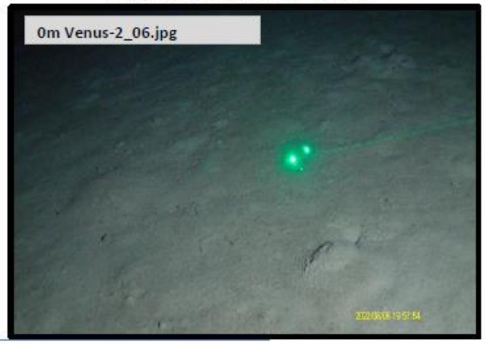


Photo Position: 326379 mE, 6749798 mN

Grab Location | Featured UW Image | UW Video Track

Geodetic Information: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

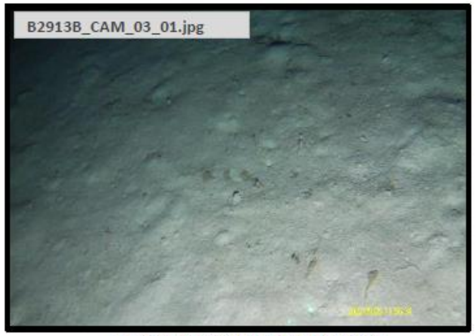


Photo Position: 326707 mE, 6749078 mN

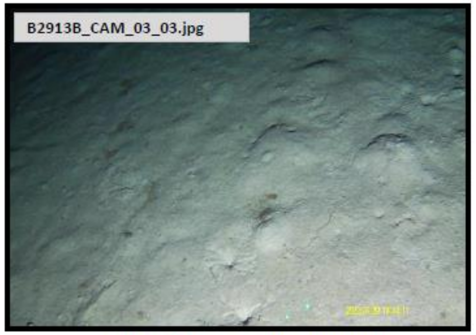


Photo Position: 326804 mE, 6749214 mN

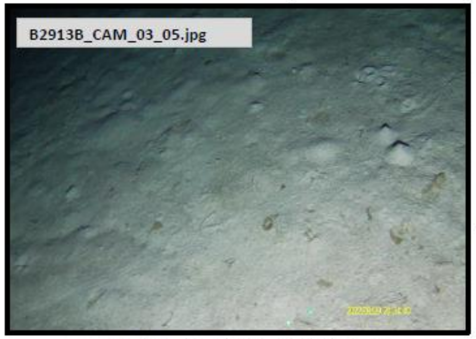


Photo Position: 327004 mE, 6749408 mN

Habitat Summary Information: B2913B_CAM_03

Survey Area: Block 2913B

No. of Stills: 6 **Mins of Video: 116** **Track Length: 516m** **Date: 29/09/2022**

Site Selection Criteria

Venus-2 PWL ground truthing SW-NE

Analogue Interpretation

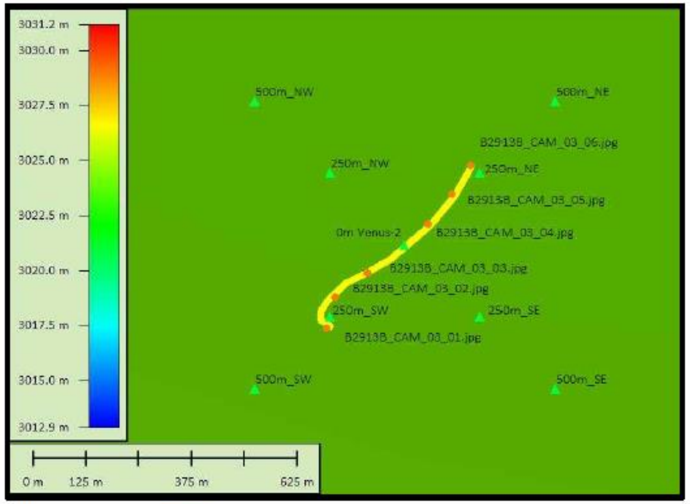
Transect ground-truths an area of seabed at approximately 3,008m to 3,002m water depth

Sediment Description

Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna

Cnidaria: Actiniaria sp., Cnidaria sp., *Umbellula* sp., Pennatulacea sp., *Actinoscyphia aurelia* . **Annelida:** Annelida sp. **Arthropoda:** Caridea sp., Paguridae sp. **Echinodermata:** Benthodytes sp., Asteroidea sp., Holothuroidea sp., Ophiuroidea sp., Hygrosoma sp. **Chordata:** Appendicularia sp., Halosauridae sp., Macrouridae sp., Ipnopidae sp. **Formanifera:** *Xenophyophores* sp.



Client: TotalEnergies

Contractor: benthic solutions limited

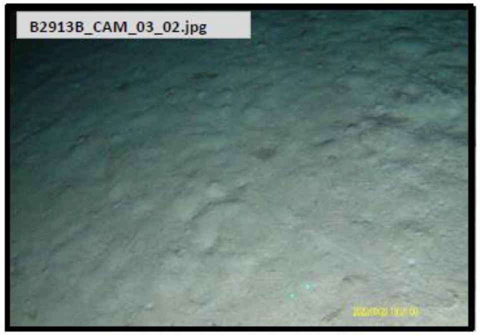


Photo Position: 326727 mE, 6749154 mN

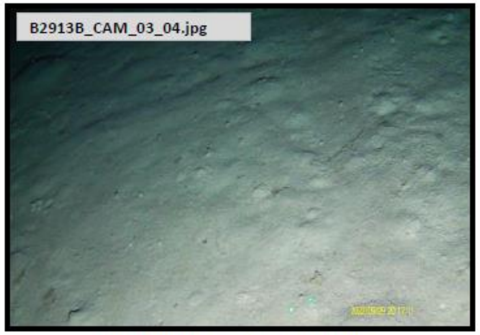


Photo Position: 326947 mE, 6749335 mN

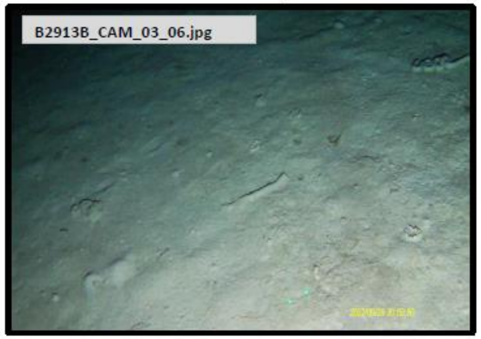


Photo Position: 327048 mE, 6749479 mN

Grab Location Featured UW Image UW Video Track

Geodetic Infomation: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

Photo Position: 326663 mE, 6749485 mN

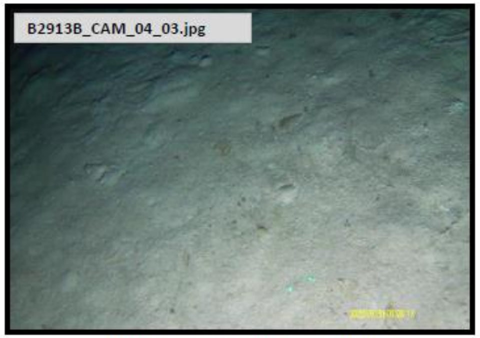


Photo Position: 326805 mE, 6749385 mN

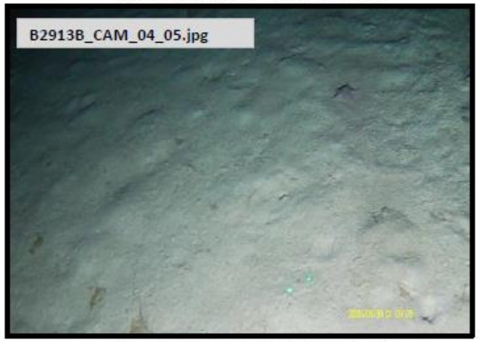


Photo Position: 327004 mE, 6749165 mN

Habitat Summary Information: B2913B_CAM_04

Survey Area: Block 2913B

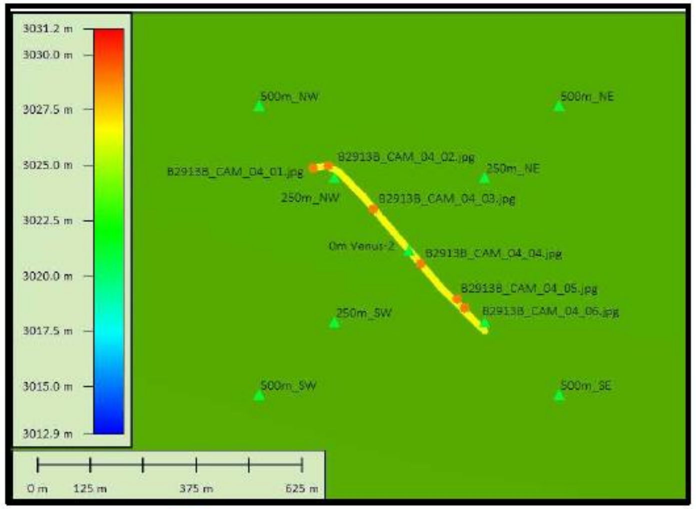
No. of Stills: 6 **Mins of Video: 107** **Track Length: 561m** **Date: 29/09/2022**

Site Selection Criteria
Venus-2 PWL ground truthing NW-SE

Analogue Interpretation
Transect ground-truths an area of seabed at approximately 3,006m to 3,002m water depth

Sediment Description
Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna
Cnidaria: Actiniaria sp., Cnidaria sp., *Umbellula* sp. **Annelida:** Annelida sp. **Arthropoda:** Caridea sp., Paguridae sp. **Echinodermata:** Benthodytes sp., Asteroidea sp., Holothuroidea sp., Ophiuroidea sp., Hygrosoma sp. **Chordata:** Appendicularia sp., Halosauridae sp., Macrouridae sp., Ipnopidae sp. **Formanifera:** *Xenophyophores* sp. **Hemichordata:** *Tergivelum cinnabarinum*



Client: TotalEnergies | Contractor: benthic solutions limited

Grab Location | Featured UW Image | UW Video Track

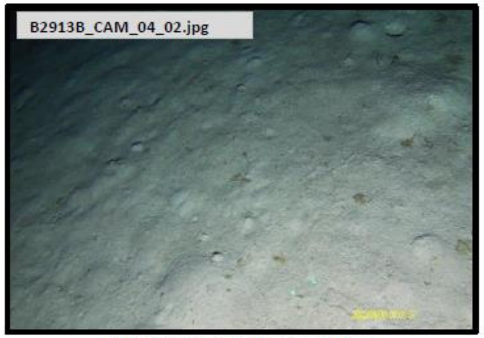


Photo Position: 326700 mE, 6749490 mN

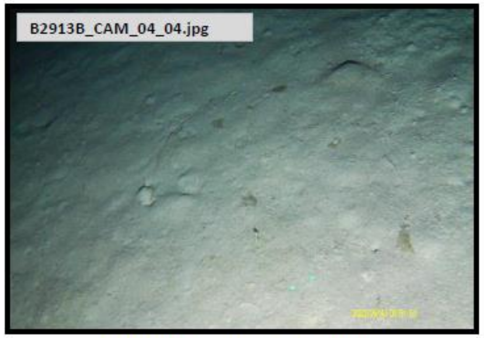


Photo Position: 326917 mE, 6749250 mN

Photo Position: 327021 mE, 6749143 mN

Geodetic Infomation: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

Photo Position: 332372 mE, 6751442 mN

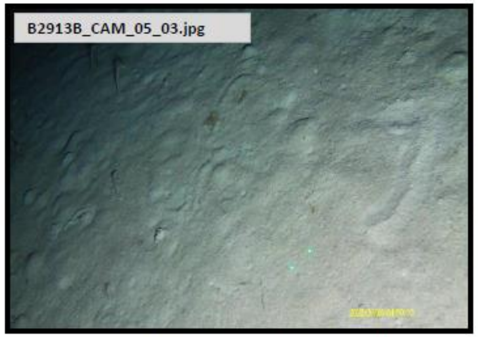


Photo Position: 332375 mE, 6751387 mN

Photo Position: 332405 mE, 6751288 mN

Habitat Summary Information: B2913B_CAM_05

Survey Area: Block 2913B

No. of Stills: 6 | **Mins of Video: 116** | **Track Length: 582m** | **Date: 30/09/2022**

Site Selection Criteria

Sharp transition of bathymetric change in the development area

Analogue Interpretation

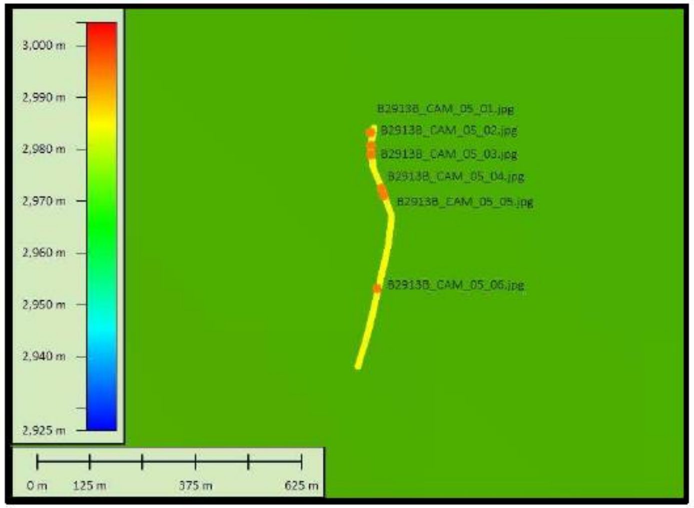
Transect ground-truths an area of seabed at approximately 2,928m to 2,966m water depth

Sediment Description

Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna

Cnidaria: Actiniaria sp., *Umbellula* sp., Pennatulacea sp., Gorgoniidae sp. **Annelida:** Annelida sp. **Arthropoda:** Caridea sp., Paguridae sp. **Echinodermata:** Hygrosoma sp. **Chordata:** Halosauridae sp., Macrouridae sp., Ipnopidae sp., Ophidiidae sp. **Formanifera:** *Xenophyophores* sp.



Client: TotalEnergies | Contractor: benthic solutions limited

Grab Location | Featured UW Image | UW Video Track

Geodetic Infomation: Datum: WGS84 | Projection: UTM | Zone: 33 S | Central Meridian: 15° East

Photo Position: 332374 mE, 6751409 mN

Photo Position: 332399 mE, 6751305 mN

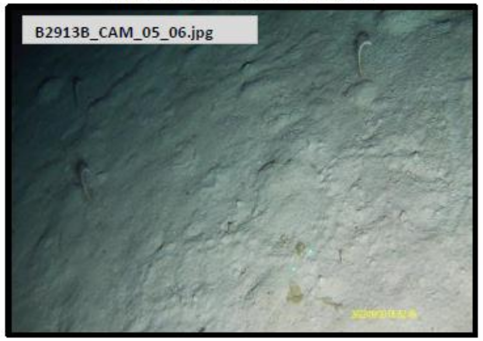


Photo Position: 332389 mE, 6751062 mN

Photo Position: 339059 mE, 6752565 mN

Habitat Summary Information: B2913B_CAM_06

Survey Area: Block 2913B

No. of Stills: 6 **Mins of Video: 115** **Track Length: 583m** **Date: 30/09/2022**

Site Selection Criteria
Small canyon feature

Analogue Interpretation
Transect ground-truths an area of seabed at approximately 2,335m to 2,732m water depth

Sediment Description
Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna
Cnidaria: Actiniaria sp. , Umbellula sp., Pennatulacea sp., Gorgoniidae sp. **Arthropoda:** Caridea sp., Paguridae sp. **Echinodermata:** Hygrosoma sp., Scotoplanes sp. **Chordata:** Appendicularia sp., Halosauridae sp., Macrouridae sp., Ipnopidae sp. **Hemichordata:** Tergivelum cinnabarinum

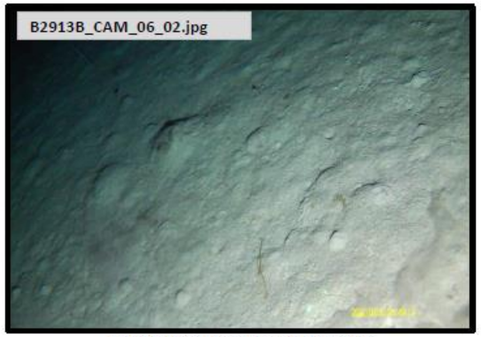


Photo Position: 339071 mE, 6752560 mN

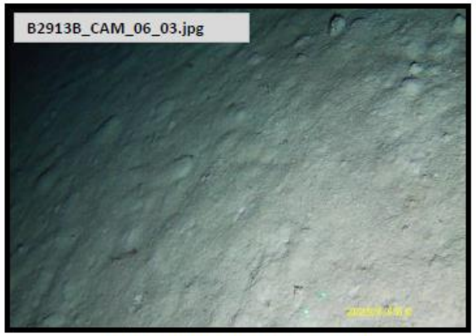


Photo Position: 339121 mE, 6752549 mN

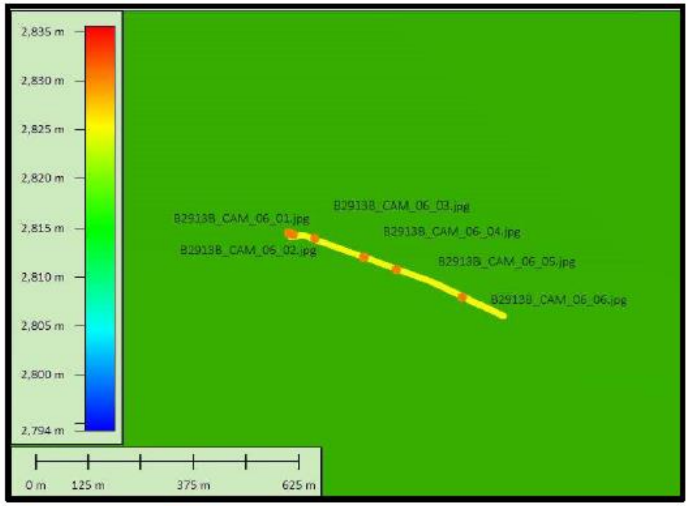


Photo Position: 339237 mE, 6752505 mN

Photo Position: 339316 mE, 6752474 mN

Client: TotalEnergies
Contractor: benthic solutions limited

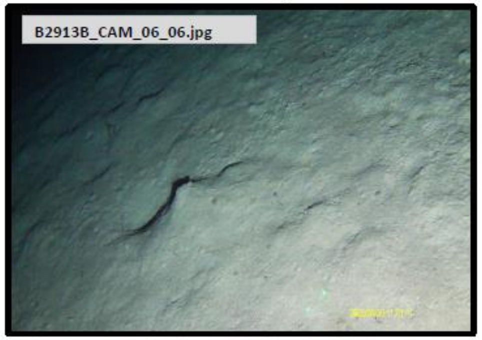


Photo Position: 339472 mE, 6752407 mN

Grab Location — Featured UW Image — UW Video Track

Geodetic Infomation: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

Photo Position: 353224 mE, 6728030 mN

Habitat Summary Information: B2913B_CAM_14

Survey Area: Block 2913B

No. of Stills: 6 **Mins of Video:** 85 **Track Length:** 497m **Date:** 29/09/2022

Site Selection Criteria

Ground-truthing the proposed protect area

Analogue Interpretation

Transect ground-truths an area of seabed at approximately 2,635m to 2,749m water depth

Sediment Description

Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna

Cnidaria: Actiniaria sp., Cnidaria sp., Pennatulacea sp. **Arthropoda:** Paguridae sp. **Echinodermata:** Benthodytes sp., Holothuroidea sp., Ophiuroidea sp., Scotoplanes sp., Echinidae sp. **Chordata:** Appendicularia sp., Halosauridae sp., Macrouridae sp., Ipnopidae sp. **Formanifera:** *Xenophyophores* sp.

Photo Position: 353262 mE, 6727951 mN

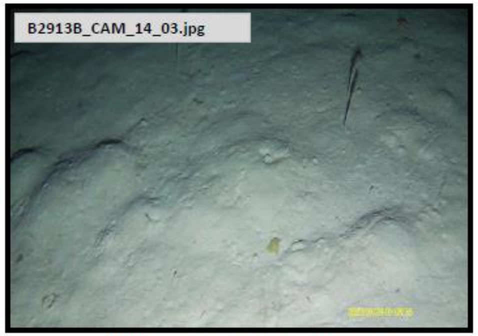
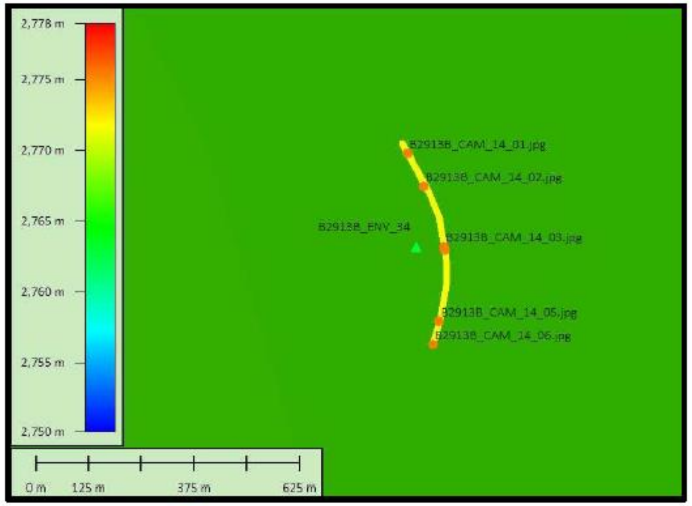


Photo Position: 353309 mE, 6727806 mN

Photo Position: 353311 mE, 6727796 mN



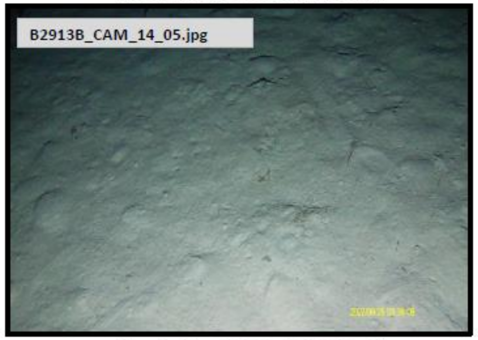


Photo Position: 353298 mE, 6727623 mN

Client

Contractor

Photo Position: 353283 mE, 6727566 mN

Grab Location Featured UW Image UW Video Track

Geodetic Infomation: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

Photo Position: 354343 mE, 6723099 mN

Photo Position: 354341 mE, 6723030 mN

Photo Position: 354268 mE, 6722797 mN

Habitat Summary Information: B2913B_CAM_15

Survey Area: Block 2913B

No. of Stills: 6 **Mins of Video: 139** **Track Length: 523m** **Date: 29/09/2022**

Site Selection Criteria

Ground-truthing the proposed protect area

Analogue Interpretation

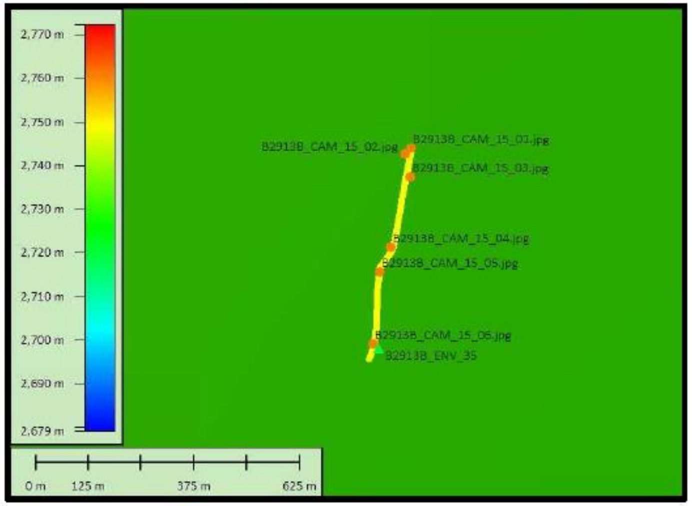
Transect ground-truths an area of seabed at approximately 2,665m to 2,711m water depth

Sediment Description

Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna

Cnidaria: Actiniaria sp. , Pennatulacea sp. **Annelida:** Annelida sp. **Arthropoda:** Caridea sp., Paguridae sp. **Echinodermata:** Benthodytes sp., Holothuroidea sp., Ophiuroidea sp.,Echinidae sp., Scalpellomorpha sp., Crustacea sp. **Chordata:** Appendicularia sp., Halosauridae sp., Macrouridae sp., Ipnopidae sp., Ophidiidae sp., Scotoplanes sp. **Formanifera:** *Xenophyophores* sp. **Hemichordata:** *Tergivelum cinnabarinum*



Client TotalEnergies

Contractor benthic solutions limited

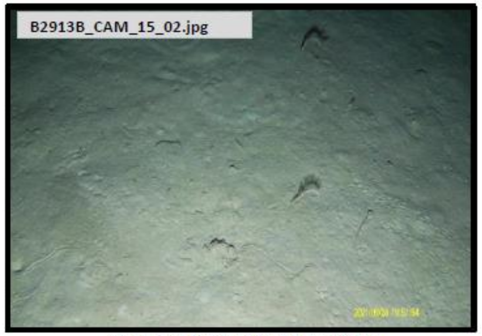


Photo Position: 354329 mE, 6723086 mN

Photo Position: 354296 mE, 6722857 mN

Photo Position: 354252 mE, 6722621 mN

Grab Location | Featured UW Image | UW Video Track

Geodetic Infomation: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

Habitat Summary Information: B2913B_CAM_17

Survey Area: Block 2913B

No. of Stills: 6 | **Mins of Video: 250** | **Track Length: 1412m** | **Date: 28/09/2022**

Site Selection Criteria

Sediment transportation valley

Analogue Interpretation

Transect ground-truths an area of seabed at approximately 2,701m to 2,737m water depth

Sediment Description

Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna

Cnidaria: Actiniaria sp., Cnidaria sp. , Pennatulacea sp., Gorgoniidae sp. **Annelida:** Annelida sp. **Arthropoda:** Caridea sp., Paguridae sp. **Chordata:** Halosauridae sp., Macrouridae sp., Ophidiidae sp. **Formanifera:** *Xenophyophores* sp.

Photo Position: 336098 mE, 6714736 mN

Photo Position: 336262 mE, 6714763 mN

Photo Position: 336356 mE, 6714756 mN

Photo Position: 336501 mE, 6714763 mN

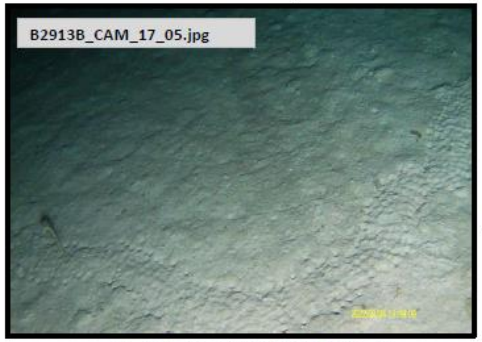


Photo Position: 337007 mE, 6714785 mN

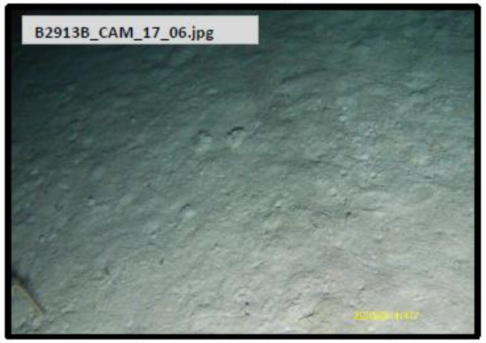
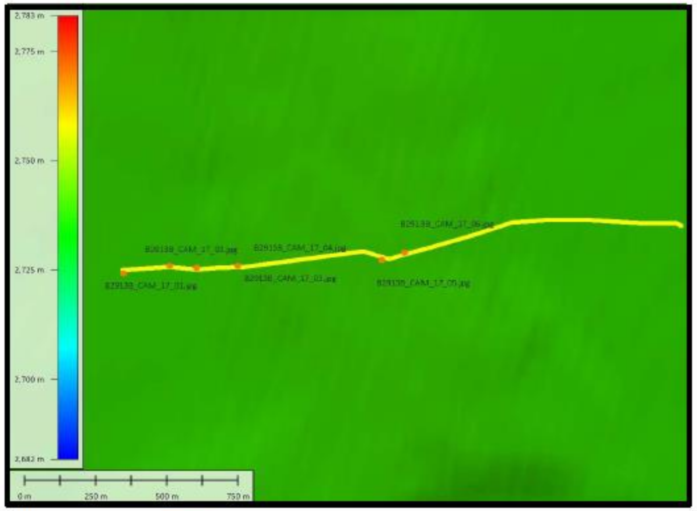


Photo Position: 337087 mE, 6714810 mN



Client: TotalEnergies

Contractor: benthic solutions limited

Grab Location | Featured UW Image | UW Video Track

Geodetic Infomation: Datum: WGS84 | Projection: UTM | Zone: 33 S | Central Meridian: 15° East

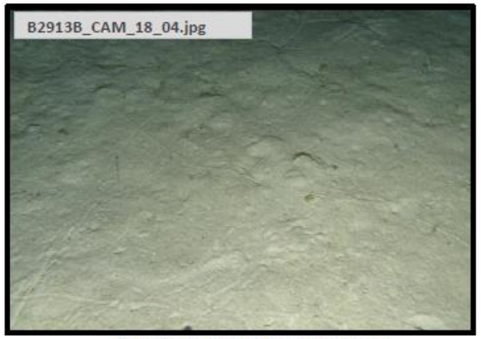


Photo Position: 344917 mE, 6706693 mN

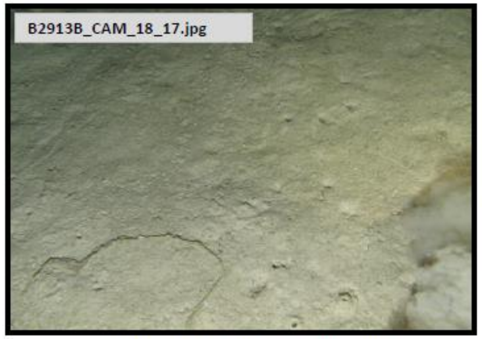


Photo Position: 344841 mE, 6706694 mN

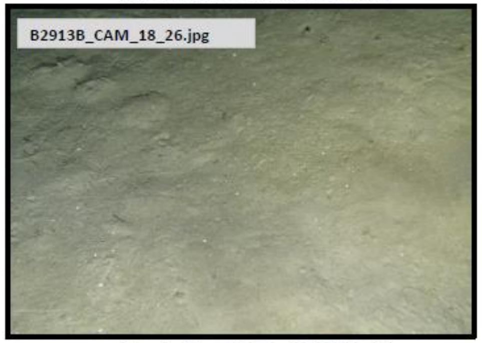


Photo Position: 344803 mE, 6706718 mN

Habitat Summary Information: B2913B_CAM_18

Survey Area: Block 2913B

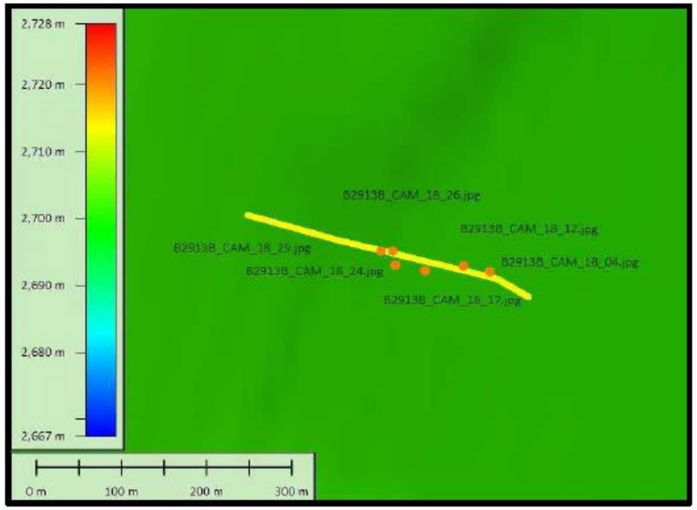
No. of Stills: 30 | **Mins of Video: 38** | **Track Length: 345m** | **Date: 28/09/2022**

Site Selection Criteria
Area of suspected slope failure and sediment transportation valley

Analogue Interpretation
Transect ground-truths an area of seabed at approximately 2,561m to 2,685m water depth

Sediment Description
Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna
Arthropoda: Caridea sp. **Echinodermata:** Holothuroidea sp., Ophiuroidea sp. **Chordata:** Macrouridae sp., Ipnopidae sp., Ophidiidae sp. **Formanifera:** *Xenophyophores* sp. **Hemichordata:** *Tergivelum cinnabarinum*



Client: TotalEnergies | Contractor: benthic solutions limited

Grab Location | Featured UW Image | UW Video Track

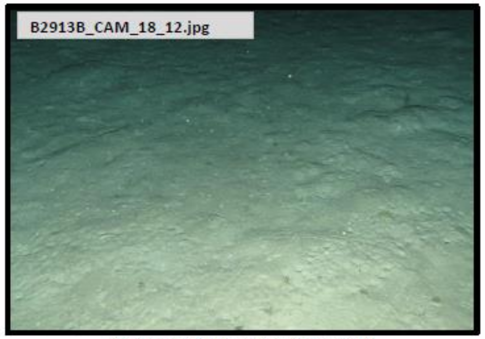


Photo Position: 344886 mE, 6706699 mN

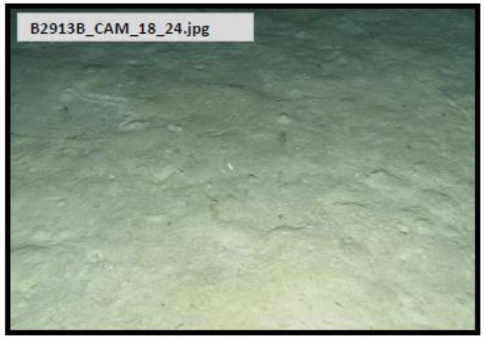


Photo Position: 344806 mE, 6706700 mN

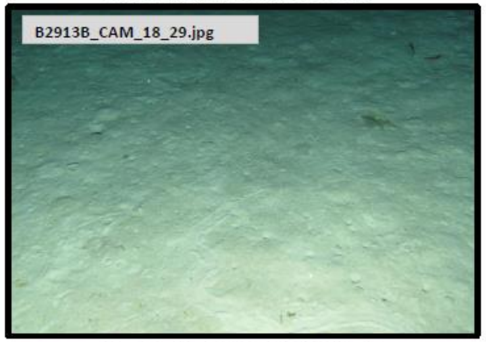


Photo Position: 344788 mE, 6706718 mN

Geodetic Infomation: Datum: WGS84 | Projection: UTM | Zone: 33 S | Central Meridian: 15° East

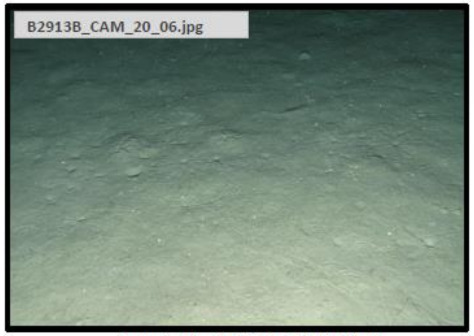


Photo Position: 332593 mE, 6656456 mN

Habitat Summary Information: B2913B_CAM_20

Survey Area: Block 2913B

No. of Stills: 82 **Mins of Video:** 97 **Track Length:** 1131m **Date:** 27/09/2022

Site Selection Criteria

Ground-truthing to the south of the survey area

Analogue Interpretation

Transect ground-truths an area of seabed at approximately 3,023m to 3,028m water depth

Sediment Description

Bioturbated unconsolidated mud with 'Lebensspuren' and burrows

Conspicuous Fauna

Cnidaria: Actiniaria sp., *Umbellula* sp., Pennatulacea sp. **Arthropoda:** Caridea sp., Paguridae sp. **Echinodermata:** Benthodytes sp., Asteroidea sp., Holothuridae sp., Ophiuroidea sp. **Chordata:** Appendicularia sp., Halosauridae sp., Macrouridae sp., Ipnopidae sp., Ophidiidae sp. **Formanifera:** *Xenophyophores* sp. **Hemichordata:** *Tergivelum cinnabarinum*

Photo Position: 332477 mE, 6656602 mN

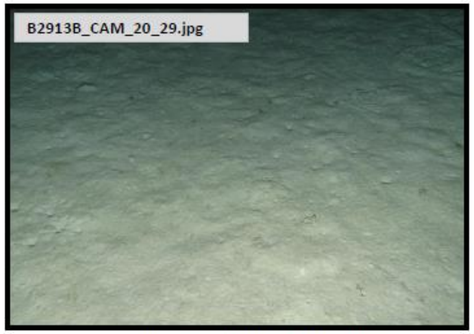


Photo Position: 332398 mE, 6656684 mN

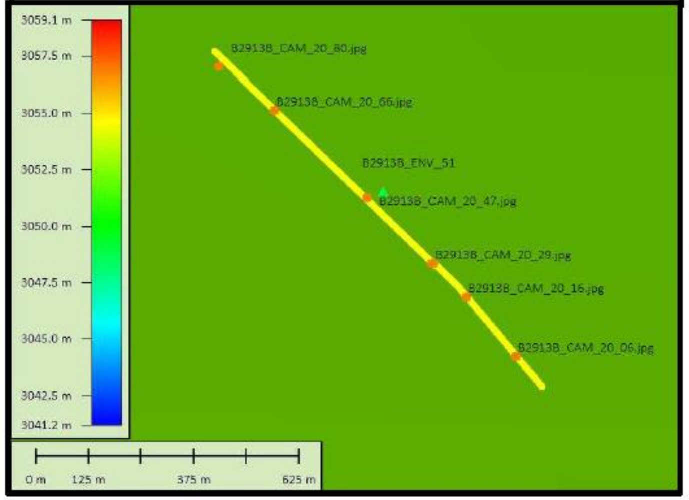


Photo Position: 332243 mE, 6656845 mN

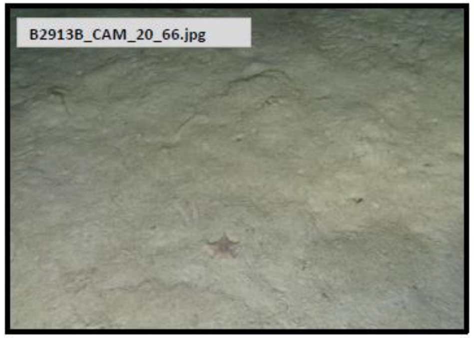


Photo Position: 332024 mE, 6657059 mN

Client: TotalEnergies

Contractor: benthic solutions limited

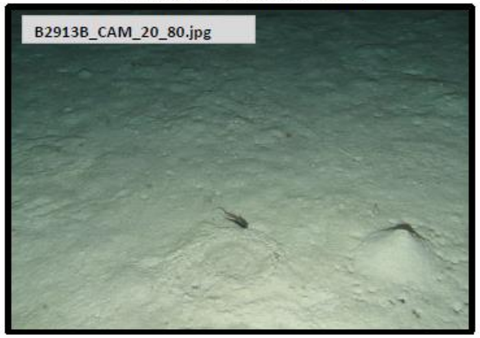


Photo Position: 331892 mE, 6657164 mN

Grab Location Featured UW Image UW Video Track

Geodetic Infomation: Datum: WGS84 Projection: UTM Zone: 33 S Central Meridian: 15° East

Appendix XVII – Spearman Correlations

Spearman's Correlation Coefficient (Two-tailed)	
Number of Data Points	66
p=0.05, 95% Significant	0.243
p=0.01, 99% Significant	0.316
p=0.001, 99.9% Significant	0.399

	Water Depth (m)	Mean (mm)	Sorting	Skewness	Kurtosis	% Fines	% Sands	% Gravel	Total Organic Carbon (% dwt)	Total Organic Matter (% w/w)	Moisture Content (%)	Total Oil (mg.kg-1)	Total n alkanes (ng.g-1)	Carbon Preference Index	P/B Ratio	Proportion of Alkanes (%)	Total PAHs (ng.g-1)	NPD PAHs (ng.g-1)
Water Depth (m)		0.002	0.137	-0.289	-0.062	-0.078	0.098	0.229	-0.573	-0.208	0.108	-0.266	-0.200	-0.136	0.359	0.271	-0.248	-0.246
Mean (mm)			0.755	-0.266	-0.854	-0.939	0.929	0.036	-0.345	0.093	0.105	-0.344	-0.257	-0.362	0.088	0.200	-0.132	-0.131
Sorting				-0.632	-0.822	-0.904	0.897	0.091	-0.424	0.005	-0.051	-0.293	-0.174	-0.380	0.059	0.201	-0.225	-0.225
Skewness					0.240	0.403	-0.398	-0.128	0.295	0.096	0.092	0.258	0.171	0.246	-0.145	-0.133	0.284	0.284
Kurtosis						0.935	-0.924	-0.067	0.260	-0.111	-0.109	0.128	0.144	0.242	0.061	-0.017	0.085	0.082
% Fines							-0.989	-0.058	0.379	-0.039	-0.075	0.301	0.216	0.365	-0.063	-0.174	0.131	0.130
% Sands								0.012	-0.377	0.032	0.055	-0.284	-0.205	-0.372	0.082	0.158	-0.181	-0.178
% Gravel									-0.201	0.013	0.076	-0.179	-0.169	-0.198	0.116	0.164	-0.173	-0.179
Total Organic Carbon (% dwt)										0.128	-0.098	0.667	0.532	0.451	-0.334	-0.533	0.373	0.378
Total Organic Matter (% w/w)											-0.042	0.272	0.101	-0.067	-0.102	-0.306	0.027	0.027
Moisture Content (%)												0.065	-0.078	-0.060	0.049	-0.148	0.272	0.267
Total Oil (mg.kg-1)													0.738	0.186	-0.071	-0.772	0.225	0.230
Total n alkanes (ng.g-1)														-0.040	0.117	-0.271	0.305	0.309
Carbon Preference Index															-0.388	-0.329	0.251	0.258
P/B Ratio																0.251	-0.123	-0.128
Proportion of Alkanes (%)																	-0.088	-0.094
Total PAHs (ng.g-1)																		1.000
NPD PAHs (ng.g-1)																		

	Antimony (AR-ICP)	Arsenic (AR-ICP)	Cadmium (AR-ICP)	Chromium (AR-ICP)	Cobalt (AR-ICP)	Copper (AR-ICP)	Lead (AR-ICP)	Manganese (AR-ICP)	Mercury (AR-ICP)	Molybdenum (AR-ICP)	Nickel (AR-ICP)	Vanadium (AR-ICP)	Zinc (AR-ICP)	Aluminium (AR-ICP)	Barium (AR-ICP)	Barium by fusion/XRF	Beryllium (AR-ICP)	Iron (AR-ICP)	Lithium (AR-ICP)	Titanium (AR-ICP)
Water Depth (m)	-0.355	-0.026	-0.062	0.065	-0.194	0.081	-0.130	-0.134	-0.385	-0.261	0.003	-0.063	-0.328	0.184	-0.017	-0.096	0.516	-0.075	-0.274	0.276
Mean (mm)	-0.190	0.038	0.151	-0.140	-0.190	-0.293	-0.171	-0.343	-0.186	-0.486	-0.252	-0.139	-0.396	-0.108	-0.547	-0.466	0.363	-0.289	-0.461	-0.010
Sorting	-0.205	-0.061	0.049	-0.209	-0.251	-0.335	-0.264	-0.323	-0.166	-0.461	-0.230	-0.278	-0.354	-0.106	-0.474	-0.427	0.347	-0.268	-0.391	-0.001
Skewness	0.253	-0.167	0.083	-0.046	0.138	0.084	0.133	0.134	0.296	0.364	0.030	0.093	0.209	-0.135	0.146	0.266	-0.407	0.004	0.162	-0.236
Kurtosis	0.099	0.164	-0.021	0.342	0.312	0.427	0.324	0.423	0.007	0.359	0.396	0.307	0.325	0.226	0.474	0.357	-0.207	0.366	0.392	0.160
% Fines	0.190	0.026	-0.075	0.212	0.244	0.359	0.261	0.364	0.166	0.476	0.282	0.237	0.403	0.133	0.536	0.459	-0.355	0.317	0.455	0.037
% Sands	-0.237	-0.033	0.053	-0.189	-0.263	-0.346	-0.276	-0.390	-0.179	-0.486	-0.294	-0.232	-0.400	-0.101	-0.505	-0.451	0.350	-0.281	-0.423	-0.010
% Gravel	-0.061	-0.040	-0.045	-0.105	-0.125	-0.077	0.132	-0.121	-0.123	-0.234	-0.072	-0.129	-0.199	-0.132	-0.244	-0.102	0.214	-0.241	-0.374	-0.032
Total Organic Carbon (% dwt)	0.379	0.101	-0.475	0.081	0.209	0.176	0.125	0.183	0.510	0.608	0.032	0.202	0.592	0.059	0.519	0.601	-0.635	0.345	0.652	-0.111
Total Organic Matter (% w/w)	0.039	-0.257	0.271	-0.163	0.028	-0.136	0.177	0.066	0.174	0.115	-0.098	0.064	0.131	-0.115	0.037	0.020	-0.170	-0.074	0.048	-0.137
Moisture Content (%)	-0.063	-0.014	0.058	-0.116	-0.099	-0.147	-0.018	-0.123	-0.224	-0.061	-0.119	-0.091	-0.173	-0.149	-0.236	-0.248	0.179	-0.208	-0.281	-0.042
Total Oil (mg.kg-1)	0.329	-0.313	-0.232	-0.128	0.074	0.012	0.058	0.161	0.503	0.596	-0.076	0.012	0.450	0.010	0.474	0.584	-0.572	0.188	0.536	-0.132
Total n alkanes (ng.g-1)	0.356	-0.141	-0.081	0.029	0.123	0.101	0.135	0.235	0.355	0.513	0.049	0.101	0.317	0.144	0.419	0.556	-0.409	0.300	0.521	0.014
Carbon Preference Index	0.247	-0.044	-0.272	-0.046	0.125	0.139	0.083	0.028	0.470	0.424	-0.023	0.013	0.396	-0.177	0.343	0.353	-0.518	0.051	0.298	-0.262
P/B Ratio	-0.200	0.086	0.107	0.284	0.028	0.173	0.162	0.213	-0.399	-0.230	0.301	0.179	-0.186	0.249	-0.073	-0.096	0.424	0.191	-0.097	0.363
Proportion of Alkanes (%)	-0.240	0.242	0.236	0.235	-0.003	0.094	0.019	0.047	-0.425	-0.414	0.226	0.092	-0.376	0.138	-0.285	-0.348	0.466	0.001	-0.329	0.262
Total PAHs (ng.g-1)	0.388	-0.023	0.227	-0.116	0.095	-0.046	0.105	0.079	0.252	0.344	-0.033	0.044	0.152	-0.105	0.082	0.172	-0.322	-0.001	0.175	-0.167
NPD PAHs (ng.g-1)	0.390	-0.029	0.227	-0.121	0.087	-0.050	0.099	0.072	0.259	0.348	-0.040	0.039	0.152	-0.108	0.086	0.179	-0.328	-0.003	0.176	-0.172
Antimony (AR-ICP)		-0.250	0.038	-0.124	0.228	0.088	0.199	0.170	0.506	0.449	0.070	-0.001	0.433	-0.210	0.044	0.321	-0.435	-0.040	0.194	-0.312
Arsenic (AR-ICP)			-0.281	0.431	0.243	0.285	0.104	0.145	-0.348	-0.134	0.249	0.348	0.030	0.261	0.109	-0.166	0.255	0.297	0.084	0.263
Cadmium (AR-ICP)				-0.191	-0.005	-0.224	0.160	0.013	-0.025	-0.232	-0.077	-0.025	-0.359	-0.175	-0.316	-0.320	0.116	-0.254	-0.327	-0.156
Chromium (AR-ICP)					0.695	0.859	0.578	0.588	-0.395	0.094	0.779	0.877	0.367	0.769	0.414	0.065	0.282	0.795	0.492	0.786
Cobalt (AR-ICP)						0.802	0.710	0.753	-0.019	0.433	0.779	0.760	0.633	0.394	0.365	0.090	-0.113	0.536	0.479	0.340
Copper (AR-ICP)							0.663	0.663	-0.106	0.384	0.819	0.789	0.623	0.614	0.517	0.211	-0.014	0.711	0.584	0.594
Lead (AR-ICP)								0.494	0.065	0.228	0.546	0.673	0.525	0.308	0.185	0.062	-0.072	0.436	0.331	0.279
Manganese (AR-ICP)									-0.066	0.561	0.904	0.611	0.438	0.415	0.449	0.218	-0.076	0.507	0.478	0.398
Mercury (AR-ICP)										0.488	-0.284	-0.155	0.418	-0.353	0.145	0.368	-0.768	-0.141	0.284	-0.515
Molybdenum (AR-ICP)											0.357	0.196	0.632	0.070	0.598	0.562	-0.588	0.292	0.636	-0.060
Nickel (AR-ICP)												0.699	0.437	0.511	0.354	0.104	0.114	0.579	0.400	0.559
Vanadium (AR-ICP)													0.441	0.682	0.441	0.089	0.129	0.739	0.557	0.616
Zinc (AR-ICP)														0.209	0.470	0.327	-0.522	0.464	0.680	0.109
Aluminium (AR-ICP)															0.589	0.139	0.332	0.857	0.628	0.929
Barium (AR-ICP)																0.608	-0.324	0.706	0.840	0.394
Barium by fusion/XRF																	-0.409	0.304	0.539	0.027
Beryllium (AR-ICP)																		0.037	-0.401	0.509
Iron (AR-ICP)																			0.806	0.747
Lithium (AR-ICP)																				0.443
Titanium (AR-ICP)																				

Appendix XVIII –Certification of Laboratories

Appendix XVIII Socotec Certification (	Appendix XVIII LPL Certification of Labora	Appendix XVIII Cedre Certification of Labora

Appendix XIX – Service Warranty

This report, with its associated works and services, has been designed solely to meet the requirements of the contract agreed with you, our client. If used in other circumstances, some or all of the results may not be valid and we can accept no liability for such use. Such circumstances include different or changed objectives, use by third parties, or changes to, for example, site conditions or legislation occurring after completion of the work. In case of doubt, please consult Benthic Solutions Limited. Please note that all charts, applicable should not be used for navigational purposes.