BRITISH GEOLOGICAL SURVEY
BGS OPERATIONS REPORT CR/01/230

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BGS Atlantic Margin Project
Rockdrilling, Vibrocoring and Gravity Coring
from RRS "James Clark Ross"

By
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Appendix 2 with D. Smith, N. Campbell and Eileen Gillespie

Geographical index
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Rockdrilling, Vibrocoring and Gravity Coring

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Table of Contents

Introduction

The British Geological Survey were awarded survey time from NERC on board the RRS "James Clark Ross" a Polar Class Survey vessel owned and operated by the British Antarctic Survey (BAS).
This report details the work done on the designated BAS Cruise **JR64, BGS Atlantic Margin Project Cruise, JR/01/02.**
The area of work was in the Eastern Atlantic along the Hebrides Terrace and out towards Rockall and beyond. (**See Figure 1**). Due to an extended mobilisation and limited extension options only part of the planned survey programme was carried out this year in the time available.

BGS provided the **Equipment Systems** detailed in **Appendix 1.** They were mobilised on board the vessel at the Cammell Laird shipyard at Hebburn on the river Tyne. Following this mobilisation and a check of launch and recovery procedures for operating the rockdrill the BGS personnel left the vessel as it had to undergo emergency repairs for a propeller noise prior to going to sea. BGS re-joined in Leith, Scotland following a drydocking of the ship there and completed the final shake-down of equipment on passage to the first survey location.

Figure 1 shows the **Location Map of Sites Occupied** and **Figure 2** the **Layout of Survey Equipment on the After Deck. Table 1** gives a **Summary of Core Collected**. **Appendix 1** contains **Coring Equipment details, Appendix 2** contains **Operational Details for Rockdrill and Vibrocore Sites** and **Appendix 3** contains a **Summary Daily Log of the BGS Operations.**

BGS Personnel taking part in the operation were as follows:-
A. Skinner BGS Team Leader, winch operator, deck assistance
N. Campbell - Mechanical Engineer, rockdrill operations, i/c night shift
D. Smith - Electronic Engineer, rockdrill operations
E. Gillespie – Winch Operator, deck and laboratory assistance
J. Glendinning, A. Henderson – deck and laboratory assistance
R. Gatliff, P. Kempton – geologists: on board curation and interpretation.

The BGS team operated on 2x12hr shifts covering all operations required on each shift.

C. Morri from the Dunstaffinage Marine Laboratory, Oban, Scotland sailed as student geologist. M. Mackey and O. Cadhla of the Coastal Resources Centre in Ireland sailed as Cetacean and Bird Observers.

The RRS "James Clark Ross" was under the command of Captain J. Burgan.

Clearances

BGS applied for clearances through the Logistics Office at the British Antarctic Survey. John Hall at BAS arranged these and informed both the Master and A. Skinner that clearances had been obtained subject to certain information being passed to the shore, as appropriate. For most of the survey period this involved daily reporting to Flag Officer Submarines with a forward look of the next 24 hour work period. Captain Burgan sent this information each morning after consultation with Bob Gatliff, the night geologist who had assessed the previous day's results and prepared a forward plan for the next period of work based on this.

Mobilisation

Mobilisation took place at the Cammell Laird Shipyard, Hebburn, on the river Tyne south of Newcastle over the period from Wednesday 25th July to Saturday 28th July. During this time the ship was also trying to arrange for rectification of a propeller noise, initially using divers and then by arranging a drydocking. Drydocking was arranged for 4th August on the Tyne and therefore BGS personnel left the vessel on Sunday 29th July as there was little else they could do until the vessel was ready for sea. Subsequently drydocking proved not to be possible in the Tyne and, on Saturday 4th August the vessel was towed to Leith, Scotland for a drydocking there. This was effected on the evening of Sunday 5th August and the repair completed by the morning of Monday 6th August when the dock was re-flooded and the ship removed to the bunkering quay. At 1732hrs on the 6th August the vessel departed Leith with all systems operational and the final set-up of the BGS equipment was done on passage to the first site.

The BGS mobilisation went according to plan and the large and useable aft deck area of the "James Clark Ross" allowed parallel siting of the rockdrill/vibrocorer and gravity corer systems together with their associated control cabins and core removal equipment (See **Figure 2**). All spares and other items were stored in the scientific hold or the ample laboratory and workshop spaces available.

Electrical Power for all deck and overside operations was supplied from the ship's power plant via switched and fused distribution boxes in the ship's supply and the BGS containers. All subsea power was taken and used via a BGS transformer and a 'clean' 240V single phase supply was fed directly into the deck containers for use in the computer system. The vessel also connected the rockdrill control container into the ship's telephone system and both coring containers into the ship's fire detection and alarm system.

Demobilisation

Demobilisation was effected in two stages. The vessel had a tight schedule to maintain with committments already entered into regarding the International Festival of the Sea (IFOS) at Portsmouth.
Upon arrival in Portsmouth all BGS equipment was re-arranged with some being stowed in the forward hold or below decks in the scientific hold. Some core samples were unloaded but the remainder were left on for demobilisation in Grimsby with all of the equipment.

Upon arrival in Grimsby the BGS drilling rig was dismantled and put ashore together with all of the other equipment not required for later work in the Antarctic. Additional equipment was put on for that work at the same time.

BGS Coring Equipment

Rockdrill/Vibrocorer

The BGS 5m rockdrill with the option of vibrocoring by interchange of barrels and selection of different computer controlled functions was the main sampling tool used for the programme. This rockdrill had been extensively modified over the previous winter months and the full specification of the equipment is shown in **Appendix 1**.
Deployment was over the stern of the vessel using the ships 'A' frame and the BGS combined power hoist umbilical cable winch system. Winch and 'A' frame or stern Gantry were controlled from the UIC room overlooking the aft deck from one deck up with both operators working in

visual and oral contact and radio communication to Bridge and main deck. All drill functions were PC controlled and a monitor display allowed the operator to observe progress and make variations to the coring parameters. A digital log of seabed operations was recorded at each site and graphed examples can be found in **Appendix 2**.

In rockdrilling mode the tool collects a core of 49mm diameter inside a steel liner from which it is then extracted upon recovery and stored in separated boxed trays. During the coring process the bit weight can be varied between zero and 1000kg, speed of rotation can be varied between 0-600 RPM and either one or two flush pumps can be used. Penetration and oil pressure graphs are the most useful for interpretation of the drilling but there is a variety of sensors fitted, including pitch and roll to check for stability of the frame on the seabed and all can be displayed/interrogated during the operation. A seabed-looking echo-sounder was fitted on this new version of the drill and allowed for a more controlled landing on the seabed as from 20m above seabed until landing increments of 10cm change in line out were recorded. The inclinometers then indicated whether the landing angle was suitable for attempting to drill on or, as happens on occasion, the seafloor is too steep and the rig falls over. A remote display of the drill operating console, situated beside the winch allowed the winch operator to be more in control of this operation than was possible before.

A seabed-looking camera was also fitted to the rig and a snapshot of the seabed was taken before drilling. This assisted in identifying the nature of the seabed and gave an impression of the likely success or failure of a drilling attempt. Pebbles and cobbles are still the main problem to be overcome when drilling from the seabed and the camera allowed for a more rational approach to continuing to drill or to stopping, clearing a blocked bit and re-trying or moving to another location. The camera position was moved around during this cruise to ascertain best position for future work.

In vibrocoring mode the tool can collect up to 5m of soft sediment core of variable lithology in a in a steel core barrel with plastic liner tube, stainless steel core catcher and carbon steel cutting shoe. A neoprene 'O' ring seals the annular space between liner and core barrel.

The polycarbonate liner is used for sample storage after cutting into suitable lengths and capping, taping and waxing each length. This reduction in length from the full 6m of the vibrocorer only mode is due to the necessary precaution of avoiding the vibration head striking the rotary kelly on the base of the frame. During the vibrocoring process a 6 tonne vibration force is delivered to the core cutting shoe and upon full penetration or refusal to go further (as seen on the operator display) the vibration is switched off. The barrel is then retrieved back into the frame of the unit at a controlled speed before the corer leaves the seabed.

For both of these coring systems a minimum of four persons are required to lift a corebarrrel from the rig to the core bench.

Gravity Coring System

The gravity corer comprises a heavy (250-1000kg) lead weight shrouded in steel and containing non-return valves to avoid sample washout. Samples are obtained by gravity impact and collected in a steel core barrel with plastic liner tube, stainless steel core catcher and carbon steel cutting shoe. A neoprene 'O' ring seals the annular space between liner and core barrel.

The system for deployment and recovery of the corer comprises a steel trough and catcher system plumbed by a block on an 'A' frame which allows powered and free fall deployment of the corer assembly and powered recovery via an umbilical and winch. Various combinations of winch/umbilical/cradle are possible depending on the circumstances of deployment and for this cruise a 6m core barrel assembly with one tonne headweight was deployed using a Kevlar Cable on the BGS gravity coring winch.

The system is deployed via a controlled launch from the shute and a controlled and metered descent to just above the seabed when it is steadied and then allowed to free fall to seabed impact and beyond

without restriction. Tension is then taken on the winch umbilical and the corer pulled out from the seabed and retrieved back to the surface where it is re-docked in the handling trough. In general this is a two person operation with direct visual contact between them. but radio communication and TV can also be used.
During deployment the vessel was held by dynamic positioning and although the handling shute has an opening catcher the cable always stayed well within the .25m radius of movement allowable without the cable hitting the sides or restraints on the shute.
Because 6m core barrels were being used with a short shute the aft port Effer crane was used to handle the full core barrel upon recovery.
On deck the core barrel is removed to the core bench where the liner with core is extruded. A minimum of four persons are required to lift the 6m core barrel to the core bench upon recovery.

Core Curation
Rockdrill Cores
Once the core barrel is removed to the core bench the core bit and reamer are removed from the bottom end and the water swivel assembly from the top end of the outer core barrel. The inner core barrel is then removed and laid on the bench. Using a suitable pusher and valve system water is then pumped into the inner core barrel from the top and the core extruded at the bottom into sections of labelled plastic guttering. After cleaning and examination the core is stored in cardboard boxes with polystyrene spacers to identify any areas subsampled and to secure gaps in the packing prior to transportation.
Vibrocores and Gravity Cores
On the core bench the liner complete with core is extruded from the core barrel and laid out along the bench. The liner is then marked with an orientation line, sectioned into maximum one metre long lengths, sub-sampled if required, and capped with a yellow cap on the top and a black cap on the base of each section. The caps are taped on and then sealed with wax when all sub-sampling has been completed. Labelling is always as required by the client. Once the wax is dry and if this is required the core may be split longitudinally for laboratory examination and when this is complete it should be sealed in layflat tubing and stored in cardboard boxes labelled with identical marking to that of the core inside.
All split cores should have a cardboard divider placed between the split sections when boxing them.

Conclusions

Despite the vessel delays shortening the planned duration of the cruise it was very productive and exciting new data was obtained. (See Frontispiece). Many of the originally planned sites were successfully occupied due to an extremely efficient vessel and crew plus good weather and reliable equipment. Downtime was minimal and the efficiency of the new rockdrill control system and upgraded hydraulics significantly cut down overburden drilling problems while at the same time core recovery and drilling rates were higher than was possible in earlier cruises.
Deck handling and deployment of all equipment was straightforward and used methods developed for earlier cruises on this vessel. The high calibre deck crew who were always available and participated fully in all aspects of the work further enhanced the already good working practices on board this vessel. The positioning and station keeping was excellent and did much to contribute to the minimum maintenance required on the seabed equipment. A downward-looking echosounder, sited on the base of the drill, allowed for a softer landing than was previously

possible in most circumstances and allowed an assessment of heave and a more controlled landing in others.

The rockdrill upgrades performed to full specification and have proved both robust and reliable thereby significantly improving the drill capability for international science cruises in the future. The addition of a ‘near real time’ seabed camera facility to monitor the area on and around the landing area of the drill is also a significant assistance to interpretation of the liklihood of drilling success.
Once again the RRS “James Clark Ross” has proved to be a superb platform to work on and from and even away from its Polar Environment the high standards which BGS have come to enjoy on this vessel were maintained to the full.

Table 1 – Summary of Cores Collected

Date	Sample Site No.	Equip. Type	BGS plan No.	TD (m)	Rec. (m)	Water Depth (m)	Rock Type
07/08/01	58-08/227	DR	JD20	0.38	0.04	66	Granitic gneiss
	58-08/228	DR	JD20	1.32	0.98	66	Granitic gneiss
08/08/01	58-08/229	DR	JD16	0.99	0.99	105	Seafloor deposit (metamorphic rock pebbles)
	58-08/230	DR	JD19	2.04	1.33	64	Amphibole garnet gneiss
	57-09/530	DR	JD13	3.06	0.67	118	Surficial seafloor deposit (mixed lithology)
	57-09/531	DR	JD12	3.90	0.60	137	Surficial seafloor deposit (metamorphic clasts)
	57-09/532	DR	JD11	1.91	0.57	118	Surficial seafloor deposit (metamorphic clasts)
09/08/01	57-09/533	DR	JD9	2.60	0.48	129	Surficial seafloor deposit (metamorphic clasts)
	57-09/534	DR	JD15	1.33	0.09	99	Biotite gneiss
	57-09/535	DR	JD15	1.02	0.09	99	Biotite gneiss
	57-09/536	DR	JD10	0.50	0.23	120	Biotite hornblende gneiss
	57-09/537	DR	JD10	2.90	2.49	118	Biotite hornblende & granitic gneiss
	56-08/920	DR	JD7	1.26	1.08	73	Biotite hornblende gneiss
	56-08/921	DR	JD6	0.90	0.78	82	Biotite gneiss (K-feld porphyroclasts)
10/08/01	56-08/922	DR	JD8	0.92	0.00	80	No recovery
	56-08/923	DR	JD8	1.52	0.20	80	Surficial seafloor deposit (metamorphic clasts)
	56-09/383	DR	JD3	0.34	0.00	74	No recovery
	56-09/384	DR	JD3	1.80	1.27	74	Amphibolite
	56-08/924	DR	JD4	1.69	1.13	56	Amphibolite & granitic gneiss
	56-08/925	DR	JD5	1.80	0.40	93	Surficial seafloor deposit (mixed lithology)
	56-08/926	DR	JD5	2.10	0.18	93	Surficial seafloor deposit (mixed lithology)
	56-09/385	DR	JD1	1.33	0.20	101	Granitic biotite gneiss
	56-09/386	DR	JD1	1.70	1.18	101	Granitic biotite gneiss
11/09/01	56-09/387	DR	JD2	0.50	0.13	114	Biotite gneiss
	56-09/388	DR	JD2	0.83	0.21	114	Biotite gneiss
	56-10/248	VE	RH4	2.43	2.43	657	Dark grey mud
	56-10/249	CS	RH4	4.33	4.33	657	Dark grey mud
	56-10/249	VE	RH4	4.20	4.20	657	Dark grey mud
	56-10/250	VE	RH5	4.36	4.36	737	Dark greenish grey mud
	56-10/250	CS	RH5	3.84	3.84	737	Dark greenish grey mud
	56-10/251	VE	RH3	4.00	4.00	776	Sandy dark greyish brown mud
	56-10/251	CS	RH3	2.77	2.77	776	Sandy dark greyish brown mud
	56-10/252	VE	RH2	4.48	4.48	717	Dark greyish brown sandy mud

Table 1 – Summary of Cores Collected (continued)

Date	Sample Site No.	Equip. Type	BGS plan No.	TD (m)	Rec. (m)	Water Depth (m)	Rock Type
11/09/01	56-10/252	CS	RH2	3.38	3.38	717	Dark greyish brown sandy mud
	56-10/253	VE	RH1	4.30	4.30	591	Sand overlying mud
	56-10/253	CS	RH1	0.10	0.10	591	Almost no recovery - two attempts
	56-10/254	VE	RH6	4.39	4.39	644	Sand overlying mud
	56-10/255	VE	RH6	4.79	4.79	644	Sand overlying mud
	57-12/41	DR	K158	4.03	1.14	667	Carbonates with Mn crusts
	57-12/42	DR	K159	1.78	0.00	745	No recovery
13/08/01	58-12/9	CS	CM7	6.00	3.35	1935	Greyish brown clay
	57-14/57	DR	K121	1.33	0.48	150	Surficial seafloor deposit (aphyric basalt)
	57-14/58	DR	K46	2.61	1.81	121	Grey and white gneiss
	57-14/59	DR	K118	0.96	0.13	116m	Plagioclase phyric basalt
	57-14/60	DR	K118	1.03	0.31	116m	Plagioclase phyric basalt
	57-14/61	DR	K119	0.00	0.00	128m	No recovery
14/08/01	57-15/14	DR	K123	0.95	0.00	250	No recovery
	57-15/15	DR	K123	1.28	0.59	250	Aphyric basalt
	57-15/16	DR	K148	4.86	0.58	262	Surficial seafloor deposit (basaltic clasts)
15/08/01	57-15/17	DR	K49	1.39	0.10	201	Surficial seafloor deposit (basaltic clasts)
	57-15/18	DR	K125	1.25	0.45	190	Surficial seafloor deposit (mixed lithology)
	57-15/19	DR	K127	1.01	0.18	167	Surficial seafloor deposit (basaltic clasts)
	57-15/20	DR	K127	1.30	0.17	167	Surficial seafloor deposit (basaltic clasts)
	57-15/21	DR	K130	1.30	0.50	186	Surficial seafloor deposit (basaltic clasts)
	57-15/22	DR	K116	1.18	0.27	179	Surficial seafloor deposit (basaltic clasts)
	57-15/23	DR	K132	1.33	0.36	214	Surficial seafloor deposit (basaltic clasts)
	57-15/24	DR	K133	0.89	0.23	183	Surficial seafloor deposit (basaltic clasts)
	57-15/25	DR	K115	1.48	0.25	197	Surficial seafloor deposit (basaltic clasts)
16/08/01	57-15/26	DR	K134	0.77	0.12	219	Surficial seafloor deposit (metamorphic clasts)
	56-15/13	DR	K138	4.86	1.00	189	Sand and gravel (shell & meta' rock fragments)
	56-15/14	DR	K137	1.79	0.73	185	Surficial seafloor deposit (ig. & meta. pebbles)

	56-15/15	DR	K136	3.90	0.26	186	Sand and gravel (shell, basalt & meta' clasts)

Table 1 – Summary of Cores Collected (continued)

Date	Sample Site No.	Equip. Type	BGS plan No.	TD (m)	Rec. (m)	Water Depth (m)	Rock Type
16/08/01	56-15/16	VE	K136	0.62	0.02	186	Dark greenish grey sand
	56-15/17	DR	K111	2.20	0.22	195	Surficial seafloor deposit (metamorphic clasts)
	56-15/18	DR	K112	4.52	4.21	182	Hornblende ± biotite gneiss
	56-15/19	DR	K140	1.40	0.40	238	Surficial seafloor deposit (metamorphic clasts)
17/08/01	57-16/16	DR	K141	4.88	0.48	602	Chalk
	57-16/17	VE	K141	3.48	3.48	602	Sand and mud
	57-16/18	VE	K142	3.19	2.71	670	Foraminiferal sand and mud
	57-17/5	DR	K156	4.64	4.40	963	Dolomite-cemented volcanic breccia + chalk
	57-17/6	DR	K145	4.88	3.10	891	Dolomite-cemented volcanic breccia
	57-17/7	DR	K109	3.51	1.68	810	Thin limestone/Mn crust above tuffaceous
18/08/01	57-17/8	DR	K144	4.11	3.81	691	Limestones and thick volcanic conglomerates
	57-17/9	DR	K143	4.16	0.94	936	Volcanic conglomerates and some calcarenite
	56-16/32	DR	S1	2.15	0.12	178	Surficial seafloor deposit (metamorphic clasts)
	56-16/33	DR	S1	1.83	0.46	178	Biotite/hornblende gneiss
	56-16/34	DR	S3	1.20	0.46	187	Biotite/garnet gneiss
	56-15/20	DR	S2	1.61	0.37	181	Surficial seafloor deposit (metamorphic clasts)
	56-15/21	DR	S2	1.13	0.32	181	Surficial seafloor deposit (metamorphic clasts)
19/08/01	56-15/22	DR	S4	1.98	0.31	181	Surficial seafloor deposit (metamorphic clasts)
	56-15/23	DR	S6	1.35	0.24	182	Surficial seafloor deposit (metamorphic clasts)
	56-15/24	DR	S6	1.38	0.17	183	Surficial seafloor deposit (metamorphic clasts)
	57-16/19	VE	K147	3.31	3.07	666	White carbonate ooze, seabed Fe-Mn crust

Appendix 1

BGS Coring Equipment Details

Gravity Coring system
Rockdrill and Vibrocoring system

BGS Gravity Corer System

Technical Specifications

Corer System Specifications

Steel, open chute launching frame with integral 'A' Frame which fits as a unit over the side or stern of the vessel. Winch on the head of the chute allows for controlled deployment and recovery of the gravity corer during launch and recovery. Deployment and recovery to seabed is via a dedicated free-fall winch. A 5000m Kevlar Cable allows deployment in most water depths envisaged for normal scientific work with some spare capacity.

Overall Dimensions : 'A' Frame 4.2m high with 2.5m span at extremities of feet. Corer chute is 6.0m in length overall.

Weight in Air : 3.5 tonnes (excluding corer).

Core Barrel : Steel, 102mm O.D. with 83mm I.D. Polycarbonate liner

Core Size: 83mm retained in plastic liner

Core Bit Type: Hardened steel cutting shoe

Power Requirements: 380/415VAC, 3 phase, 50Hz, 16A supply (for deployment and recovery winch & hydraulics)

Operational Requirements

Stable platform with good position keeping. For longer cores an adjacent Hiab crane is useful to assist with barrel handling. Deck space to store and deploy system plus small control cabin (max. 8' x 6'6" x 6'6" high), 7m x 1.2m x 1m high core bench and sundry spares and consumables including 6m long liner tubes.

BGS Gravity Coring Freefall Umbilical Winch

This unit allows operations with the BGS gravity coring system in water depths to at least 3500m (deepest operations to date) via a 5000m Kevlar Cable capability. A special high speed sheave, also supplied by BGS is required for the cable to allow rapid deployment without sheave or cable wear.

Winch/Power Pack Specifications and Requirements

The winch is electro-hydraulically operated from its own power pack and can be operated from a local control on the power pack or by a remote control box. A meter showing line out and line speed is fitted at both locations.

Winch base dimension: 2.9m x 2.5m x 1.9m high

Winch weight: 10 tonnes

Power Pack base dimension: 2.4m x 0.85m x 1.9m high

Power Pack weight: 2.17 tonnes

Power Requirements: 380/415VAC, 3 phase, 50 Hz. 60KVA minimum @ 415V

Above Portable 'A' Frame, Launch Chute and launch/recovery winch
Below left Freefall Deployment Winch with 5000m Kevlar Cable
Below right Deck Layout, Container Workshop, Core Bench, Coring System

BGS Seabed Rockdrill and Vibrocorer System

Technical specifications

Rockdrill Specifications

Steel, open structure frame with electro-hydraulic power pack, flush pumps, vibrator motor and seabed microprocessor control capable of coring rock formations to a depth of 5m below seabed in up to 2000m of water. 3.0m and 5.0m seabed penetration versions are available.
Overall Dimensions : 7.7m high with 5.5m span at extremities of feet (5.0m version)
Weight in Air : 3.5 tonnes
Core Barrel : BGS Hex steel outer core barrel with steel inner barrel
Core Size: 50mm
Core Bit Types: T.C., Surface and Impregnated Diamond
Core Bit R.P.M.: 0-600, infinitely variable
Power Requirements: 30kVa, 380/415VAC, 3 phase, 50Hz

Vibrocoring Mode Option

By interchange of core barrels and a different processor-controlled operation the same unit is enabled to operate as a soft sediment/non cohesive sediment sampler capable of coring up to 5m below seabed in up to 2000m of water.
Core Barrel : Steel, 102mm O.D. with 83mm I.D. Polycarbonate liner
Core Size: 83mm retained in plastic liner
Core Bit Type: Hardened steel cutting shoe

Operational Requirements

Stable platform with good position keeping (D.P. or moorings) together with an 'A' frame or Crane with at least 10 tonnes SWL. For shallow water operations (up to 350m in good conditions) separate power and hoist cables can be used. If deeper, or in high current or sea states, a winch with combined signal/power/hoist cable is required. It can be provided by BGS. Deck space to store and deploy rig, 8' x 6'6" x 6'6" high control cabin, 7m x 1.2m x 1m high core bench and sundry spares and consumables including 6m long liner tubes.

BGS Combined Signal/Power/Hoist Umbilical Winch

This unit allows operations with the seabed Rockdrill/vibrocorer in water depths to 2000m without recourse to additional cables. A special sheave, also supplied by BGS is required for the cable. An additional 1m of headroom is required in the deployment system to allow for this.
Winch/Power Pack Specifications and Requirements
The winch is electro-hydraulically operated from its own power pack and can be operated from a local control on the power pack or by a remote control box. A line meter showing metres out and line speed is fitted at both locations.
Winch base dimension: 3m x 3.2m x 2.2m high
Winch weight: 17 tonnes
Power Pack base dimension: 2m x 1m x 1.7m high
Power Pack weight: 2 tonnes
Power Requirements: 415VAC, 3 phase, 100A

Left
Core Barrel installation and removal position

Middle
Sequence of launch or recovery positions
for Rockdrill/Vibrocorer

Bottom Left
Power pack for BGS Umbilical Winch

Bottom Right BGS Umbilical Winch

Appendix 2

Operational Details – Rockdrill and Vibrocore Sites

Notes on the Rockdrill and Vibrocorer Monitoring Graphs and Photographs

The graphs have been derived from data logged when the equipment is being monitored for its operational status while at the seabed. As this is a new system various methods of data collection and presentation were attempted for this cruise. No screening of data has taken place and this data is primarily a tool for the engineer to use when operating the drill and monitoring its progress. Ultimately, with experience and correct presentation, these graphs will be able to contribute useable 'measurement while drilling' information for geological interpretation.

The photographs are snapshots of the landing area when the drill reaches seabed and give an indication of the type of material likely to be drilled. It is not a photograph of the area into which the coring bit will penetrate.

When viewing the Graphs the following factors must be taken into account:

Rockdrill

1. The graphs shows penetration in centimetres, oil pressure in psi and rotation of the drillstring per minute, all against time in minutes.

2. If the drill stalls out and has to be reset then the elapsed time for the graphs will reverts to zero although the graph may continue its display. Similarly the penetration shown in the screen box box represents that of the last reading when the screen is captured.

3. The scaling of the sensors is not fully calibrated. The figures displayed are influenced by their degree of sensitivity, increment of recording and the environment in which they are operating.

4. The penetrometer measuring length of core barrel drilled into seabed is similarly influenced but added to this are aberrations caused by the acoustic properties of the environment. These may mask the signal or give a false one and the trend of the curve is more important that any actual value along it.

5. If the angle of inclination of the drill is more than a few degrees then the weight on bit may be less effective. The rig will tip over on the seabed if the angle of tilt exceeds about 40 degrees and is unsafe to operate at angles greater than 25 degrees. Drilling efficiency will be lessened on steep angles of slope but this cannot be quantified at this stage.

6. Various types of core bits were carried for the project and the one used at each site is recorded. Good success was obtained with impregnated diamond bits for the first time ever and this is attributed to a more efficient drill allowing their use within correct drilling parameters.

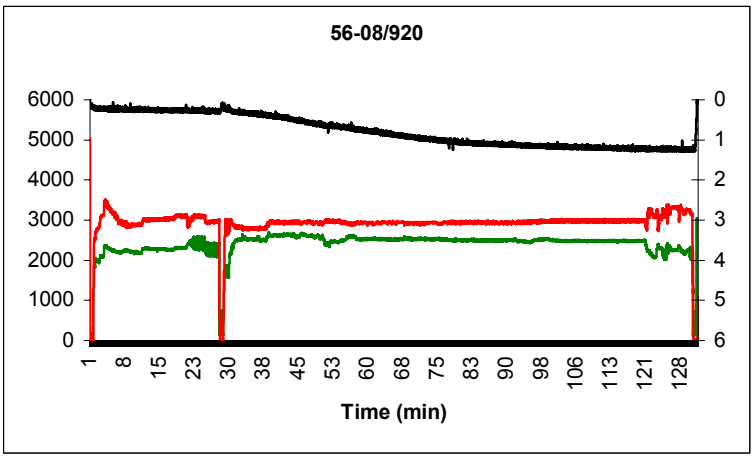
Vibrocorer

7. The vibrocorer penetration gives a guide to core recovery. If the material is soft the recovery should match, or may slightly exceed, the penetration. If the material is granular it may compact and give less apparent recovery. Additionally core may be lost through catcher inversion, or lack of retention, upon recovery. There is no RPM graph in vibration mode and the oil pressure relates to winch retraction only.

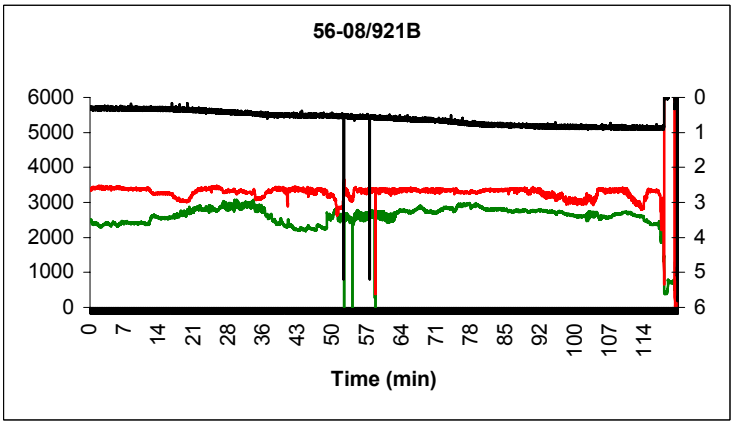
Gravity Corer

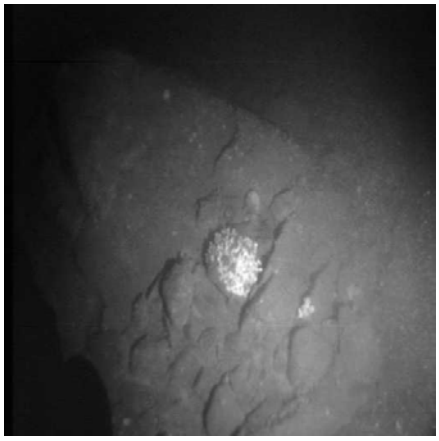
The gravity corer is not instrumented at the seabed interface and there are no operational logs

associated with it.

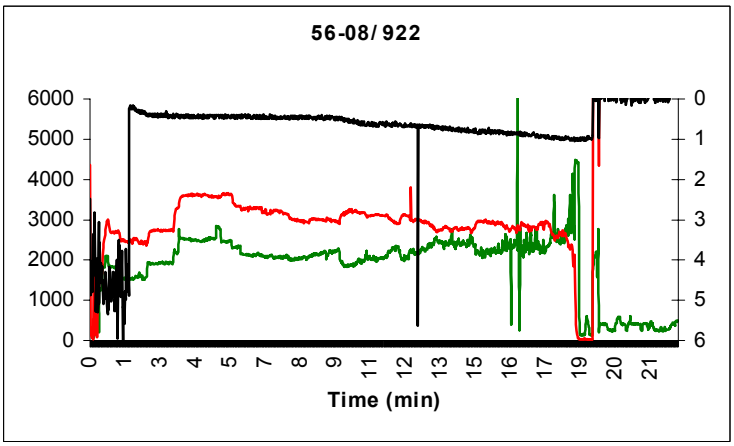


Deployed drill at site **56-08 920**, water depth 85m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a rock platform with a step and a 12 degree slope according to the drill. Commenced coring at 1620hrs and completed at 1731hrs having penetrated 1.28m. with 1.08m. of good core recovered.

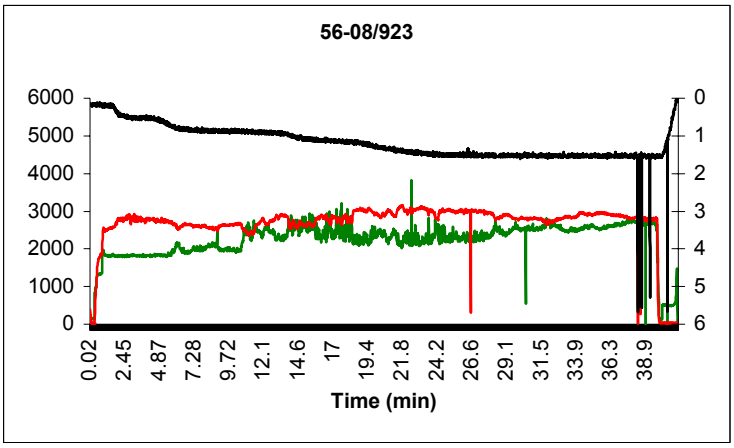




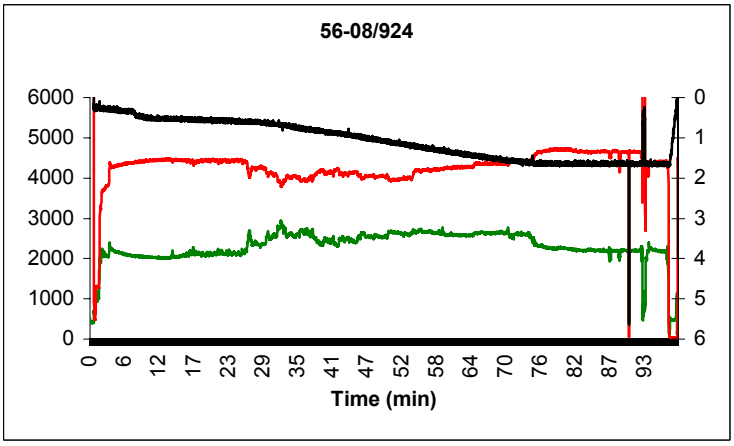
Deployed drill at site **56-08 921**, water depth 82m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment veneer over probable rock with some boulders. Commenced coring at 2049hrs and completed at 2300hrs having penetrated 0.90m. with 0.78m. of good core recovered.

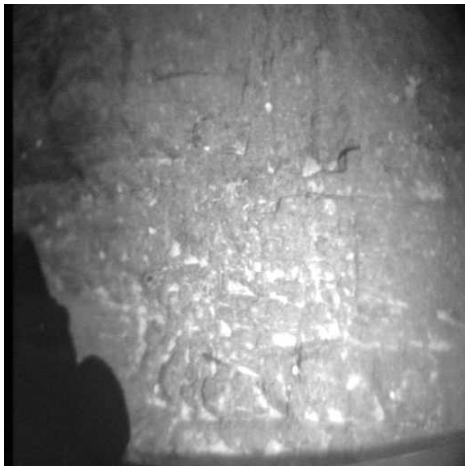


Deployed drill at site **56-08 922**, water depth 78m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a flat seabed. Commenced coring at 1126hrs and completed at 0142hrs having penetrated 0.82m with no recovery.

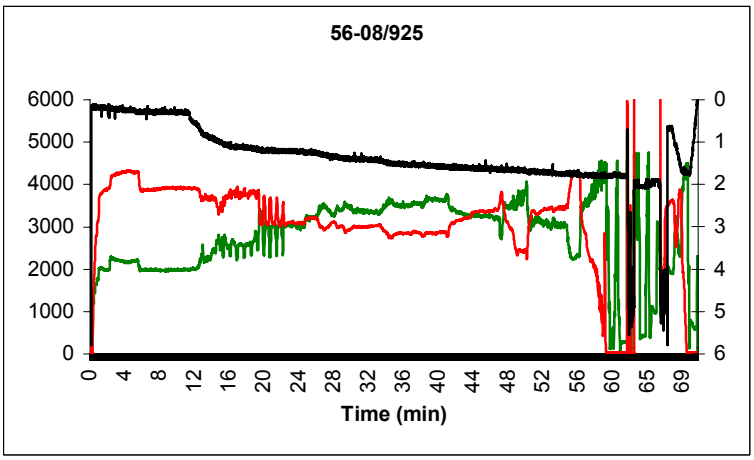


Deployed drill at site **56-08 923**, water depth 78m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a flat seabed. Commenced coring at 0255hrs and completed at 0335hrs having penetrated 1.52m. Only pebbles were obtained in the core barrel.

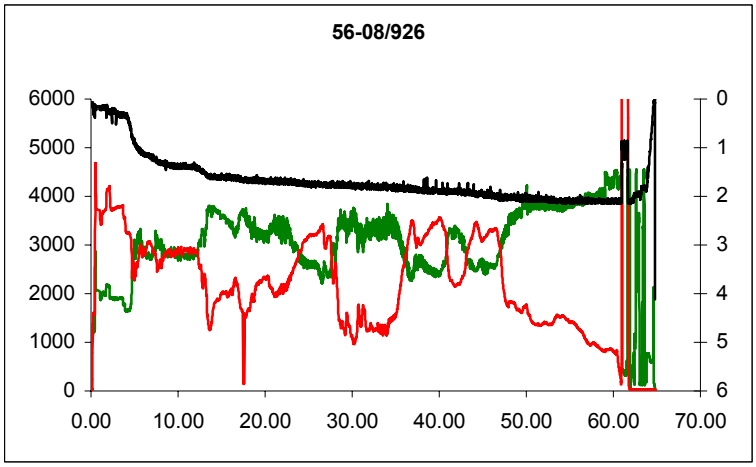


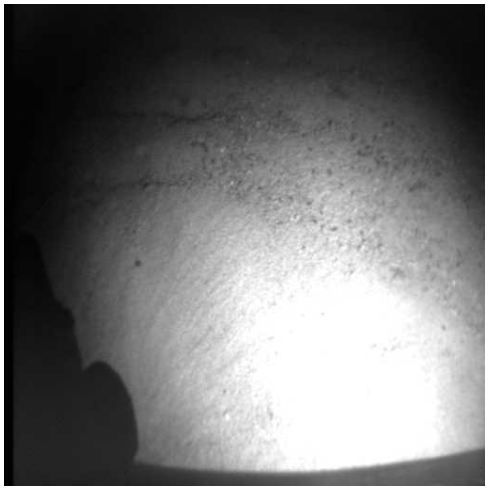


Deployed drill at site **56-08 924**, water depth 76m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated rock on seabed and drill inclination of 18 degrees. Commenced coring at 1238hrs and completed at 1416hrs having penetrated 1.69m. with 1.13m. of good core recovered.

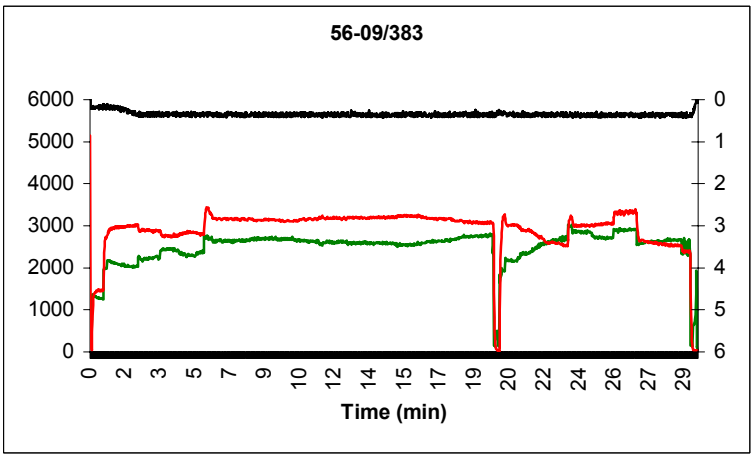


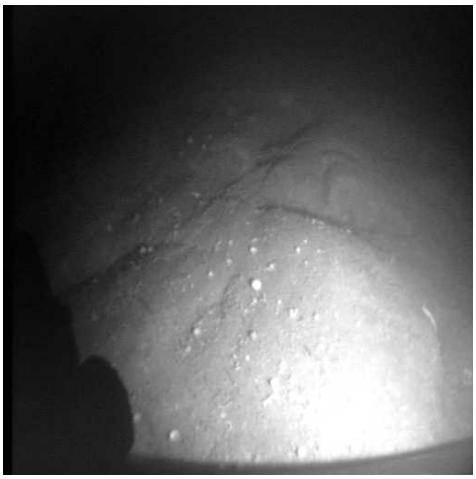
Deployed drill at site **56-08 925**, water depth 101m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed, possibly a sandwave. Commenced coring at 1604hrs and completed at 1720hrs having penetrated 1.80m then stalled. Only pebbles and shells recovered with a very polished core barrel.



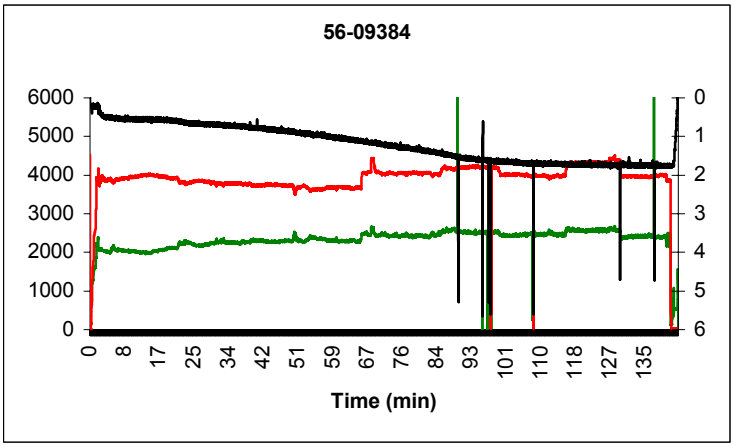


Deployed drill at site **56-08 926**, water depth 101m. Surface set stepped profile diamond bit, grade 60/80spc. Seabed photo indicated possible sandwaves at seabed. Commenced coring at 1822hrs and completed at 1930hrs. Penetration 2.10m. Superficial deposits of mixed lithology obtained.

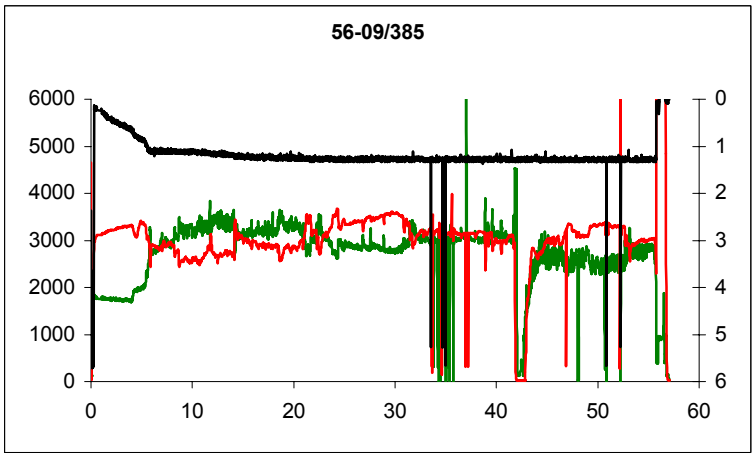


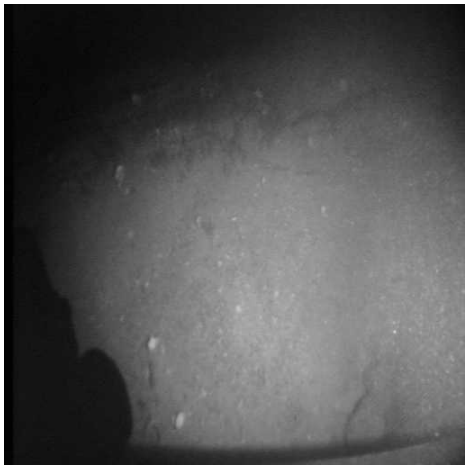


Deployed drill at site **56-09 383**, water depth 76m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a rock platform. Commenced coring at 0615hrs and completed at 0637hrs having penetrated 0.34m and made no further progress. No core recovered.

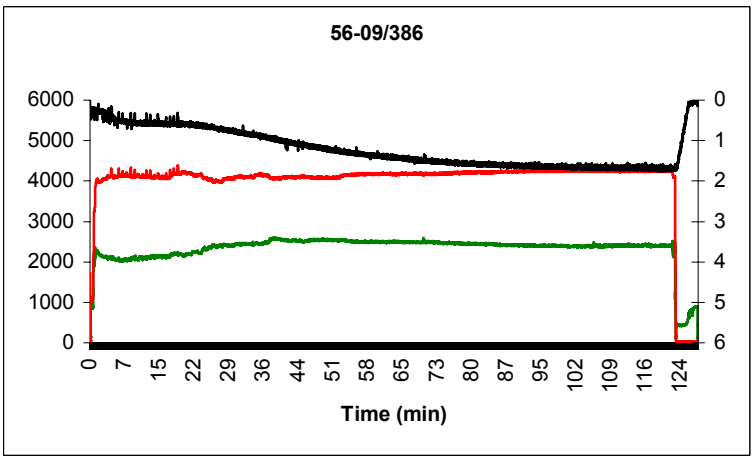


Deployed drill at site **56-09 384**, water depth 76m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a rock outcrop with a fracture. Commenced coring at 0720hrs and completed at 0934hrs having penetrated 1.80m. with 1.27m. of good core recovered.

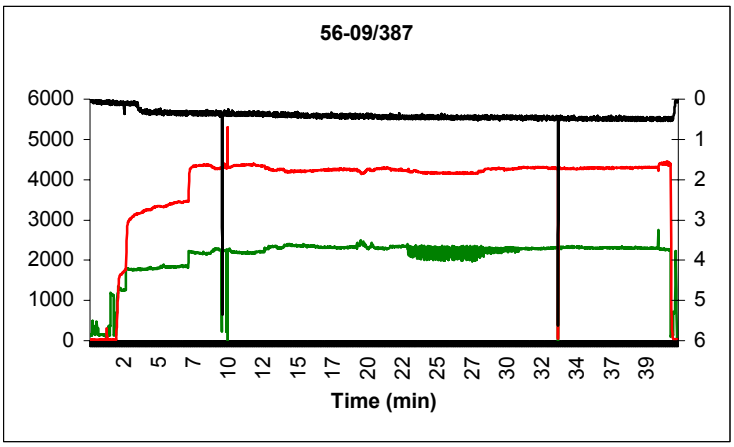


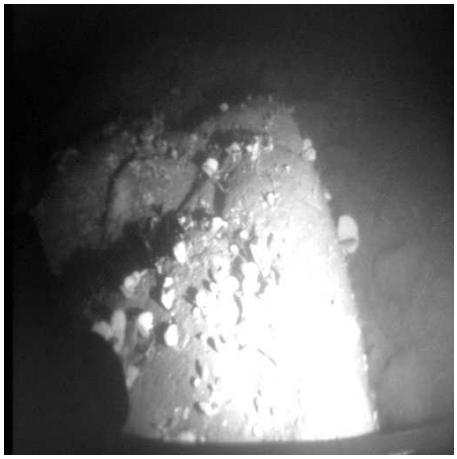


Deployed drill at site **56-09 385**, water depth 100m. Surface set stepped profile diamond bit, grade 60/80spc. Seabed photo indicated sediment cover with shells and possible pebbles/cobbles. Commenced coring at 2128hrs and completed at 2223hrs having penetrated 1.33m. and stalled. Retracting did not restart. 0.2m. of core recovered.

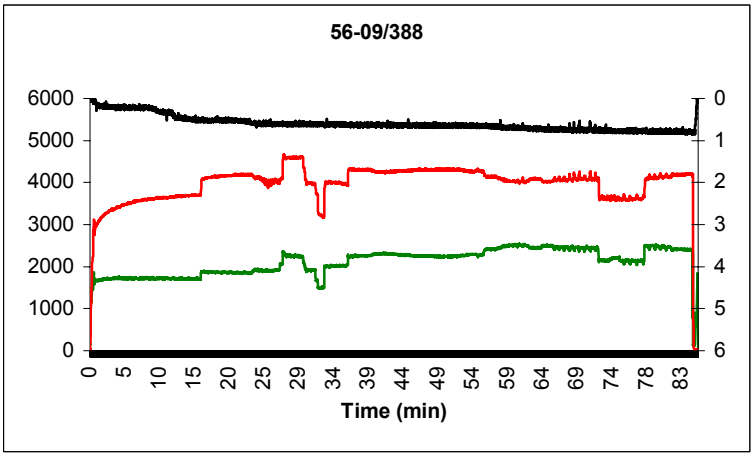


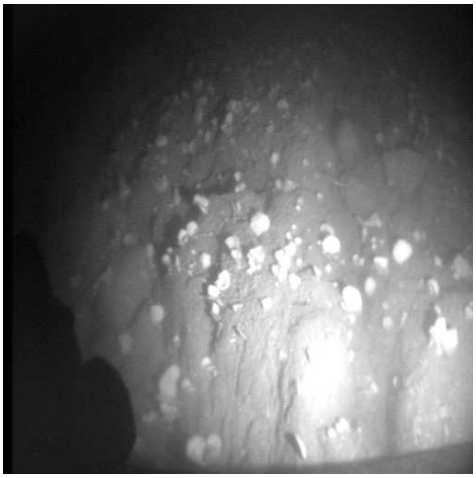
Deployed drill at site **56-09 386**, water depth 101m. Impregnated diamond bit, grade 9 matrix. Same location as previous coring attempt. Seabed photo indicated a sediment cover possibly covering some boulders. Commenced coring at 2251hrs and completed at 0057hrs having penetrated 1.70m. and recovered 1.18m of good core.



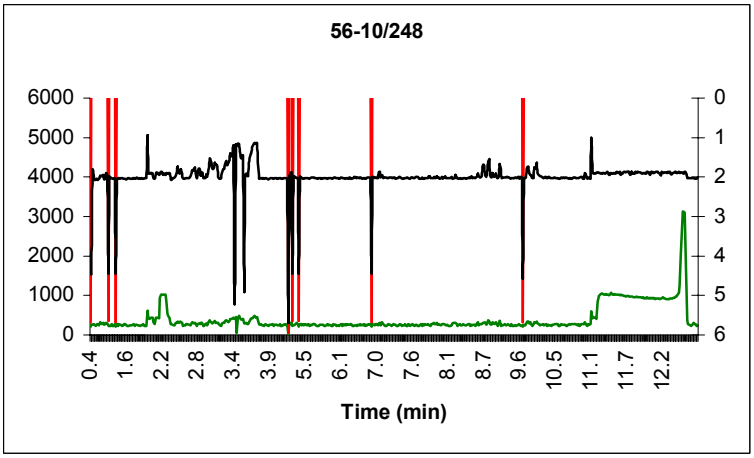


Deployed drill at site **56-09 387**, water depth 80m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a boulder strewn seabed with thin sediment cover and ?living molluscs. Commenced coring at 0315hrs and completed at 0353hrs having penetrated 0.5m. and obtained 0.13m. of core.



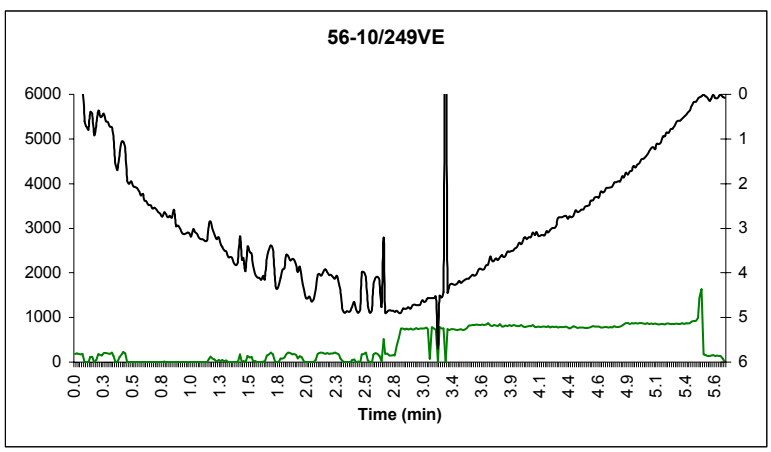


Deployed drill at site **56-09 388**, water depth 88m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated sediment cover and boulders with ?living molluscs. Commenced coring at 0419hrs and completed at 0544hrs having penetrated 0.83m. 0.21m. of core recovered.

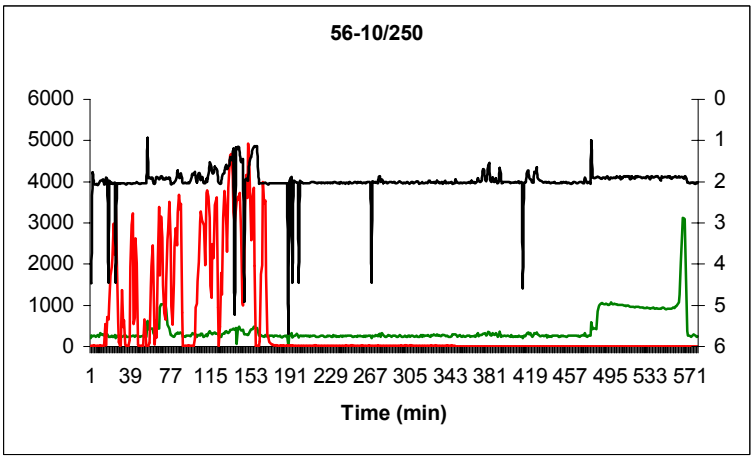


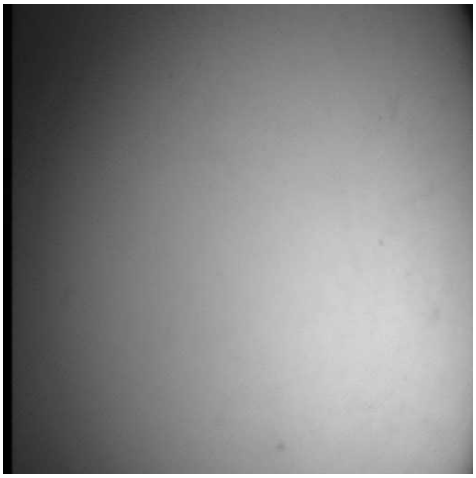
Deployed vibrocorer at site **56-10 248**, water depth 650m. Seabed photo indicated a sediment and pebble covered seabed. Commenced coring at 1132hrs but unable to vibrate. Under self-weight

penetration recover 2.43m. of sediment. Retrieve rig to deck for repairs to a broken motor lead and remove sample collected by gravity when freefall valve was opened.

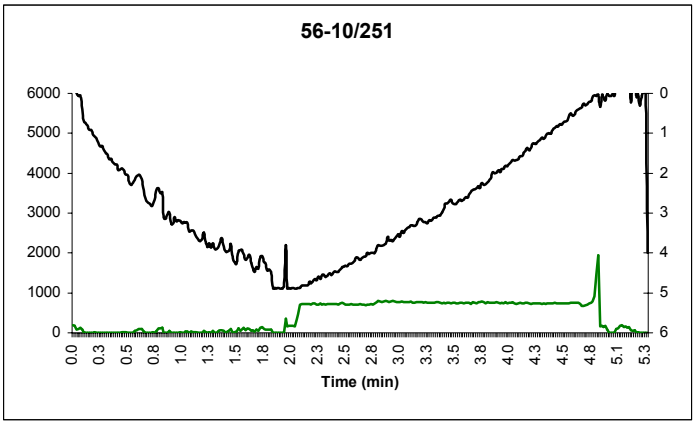


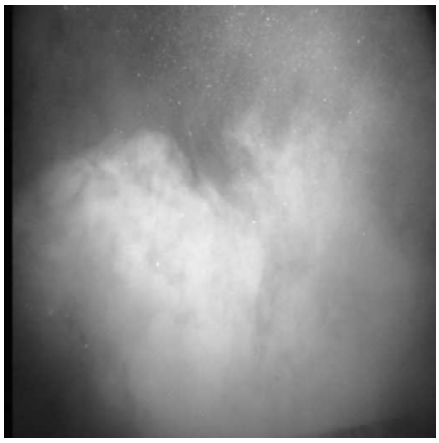
Deployed vibrocorer at site **56-10 249**, water depth 655m. Seabed photo indicated a sediment and pebble covered seabed. Commenced coring at 1538hrs and completed at 1542hrs having penetrated and recovered 4.2m. of sediment.
Gravity core then taken at the same location with 4.33m core length obtained.



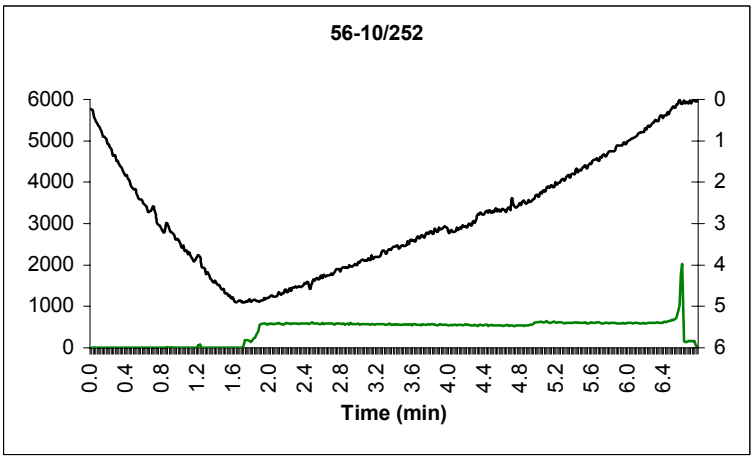


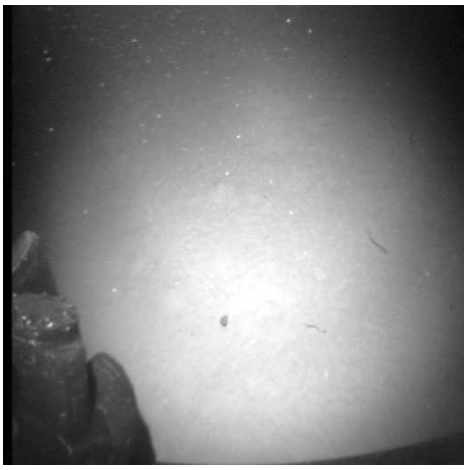
Deployed vibrocorer at site **56-10 250**, water depth 735m. Seabed photo indicated a sediment and pebble covered seabed. Commenced coring at 1720hrs and completed at 1724hrs having penetrated and recovered 4.36m. of sediment.
Gravity core then taken at the same location with 3.84m. core length obtained.



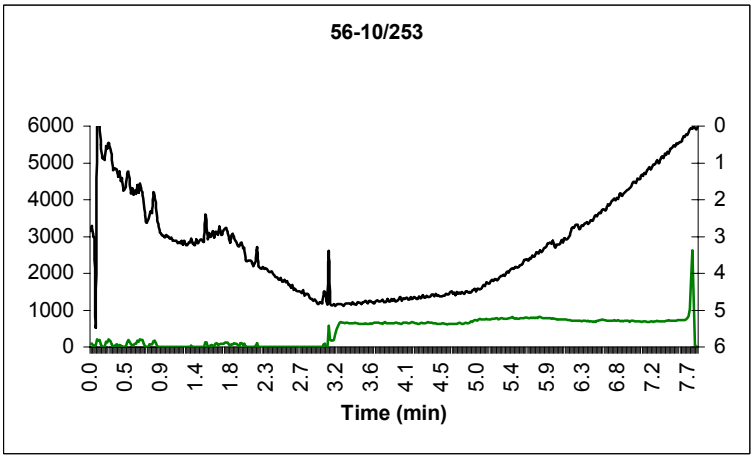


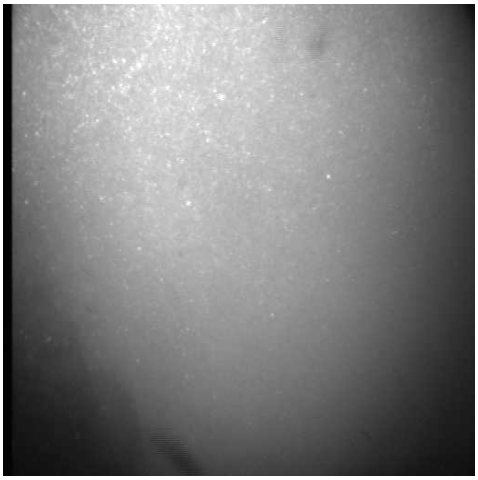
Deployed vibrocorer at site **56-10 251**, water depth 777m. Seabed photo indicated a sediment covered seabed. Commenced coring at 2008hrs and completed at 2010hrs having penetrated and recovered 4.0m. of sediment.
Gravity core then taken at the same location with 2.77m. core length recovered.





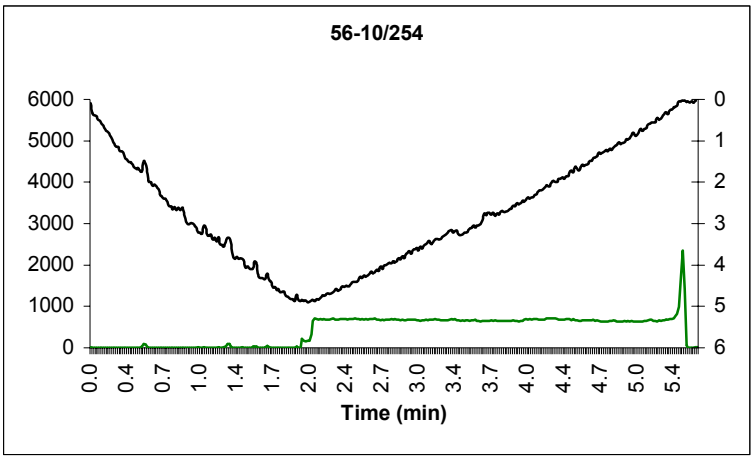
Deployed vibrocorer at site **56-10 252**, water depth 724m. Seabed photo indicated a sediment covered seabed. Commenced coring at 2305hrs and completed at 2307hrs having penetrated and recovered 4.48m. of sediment.
Gravity core then taken at the same location with 3.38m core length recovered.

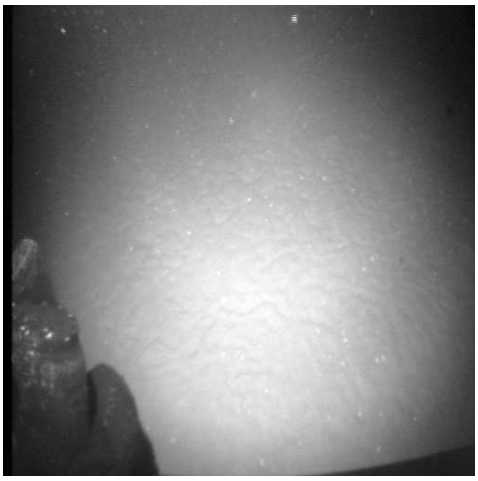




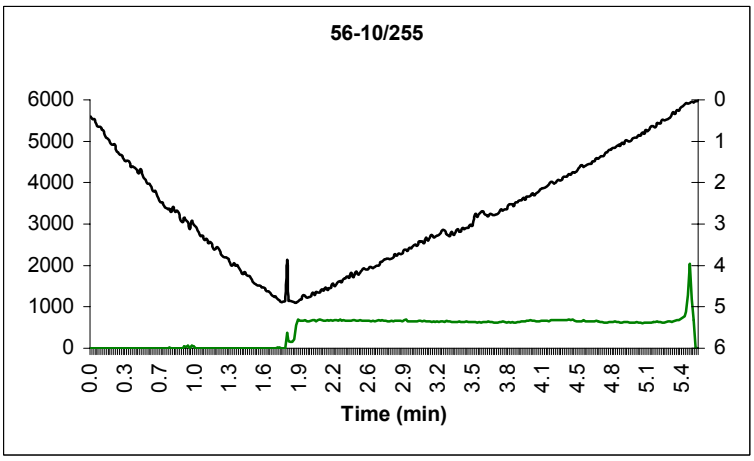
Deployed vibrocorer at site **56-10 253**, water depth 592m. Seabed photo indicated a sediment covered seabed. Commenced coring at 0229hrs and completed at 0236hrs having penetrated and recovered 4.3m. of sediment.

Gravity core then taken at the same location but achieved only 0.1m penetration.

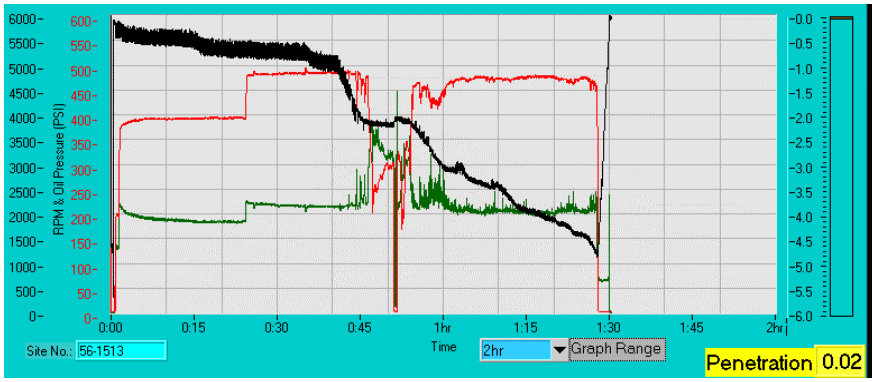




Deployed vibrocorer at site **56-10 254**, water depth 644m. Seabed photo indicated a sediment covered seabed. Commenced coring at 0557hrs and completed at 0559hrs having penetrated and recovered 4.39m. of sediment.
Gravity core not taken at the same location as seabed photo indicated a likely poor result based on last location photo and results.

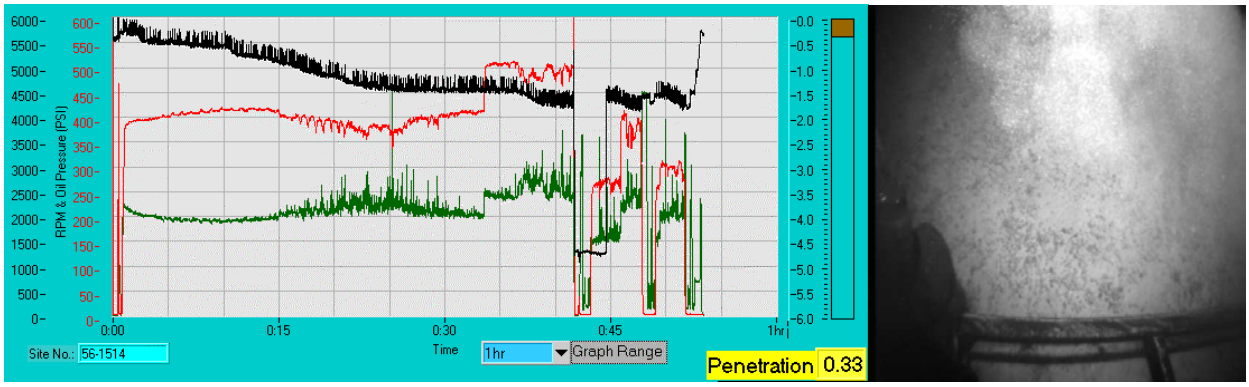


Deployed vibrocorer at site **56-10 255**, water depth 644m. in lieu of gravity core. Seabed photo indicated a sediment covered seabed. Commenced coring at 0704hrs and completed at 0706hrs having penetrated and recovered 4.79m. of sediments.

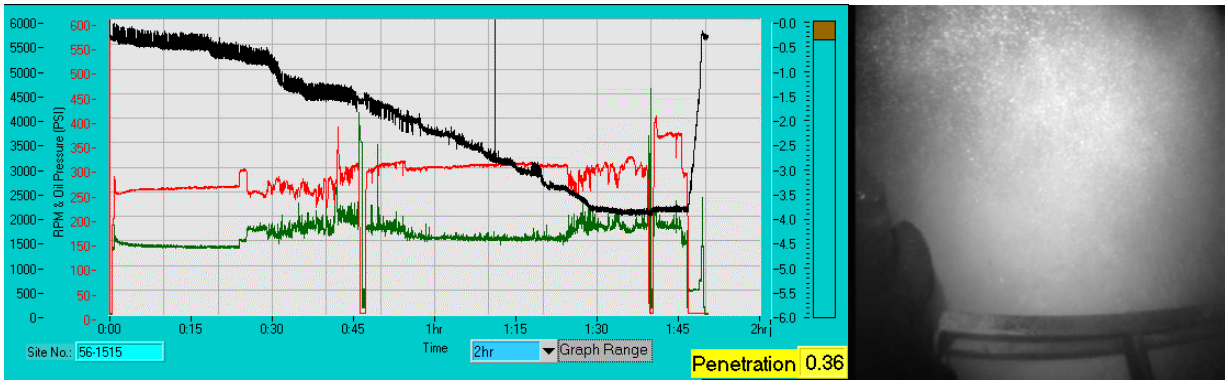


Deployed drill at site **56-15 13**, water depth 185m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a soft or muddy seabed as there was a sediment suspension

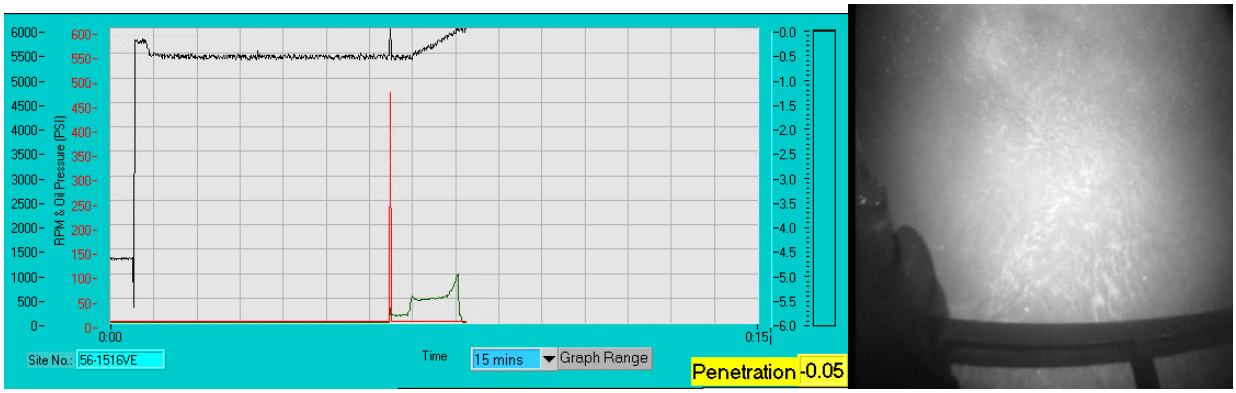
cloud caused by landing the rig. Commenced coring at 0446hrs and completed at 0613hrs having penetrated 4.86m. 1.0m. of sand and gravel deposits were recovered. Penetration shown on graph has reset.



Deployed drill at site **56-15 14**, water depth 185m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cover with pebbles.
Commenced coring at 0812hrs and completed at 0905hrs having penetrated 1.79m. with stalling at times. 0.73m. of superficial deposits were recovered.

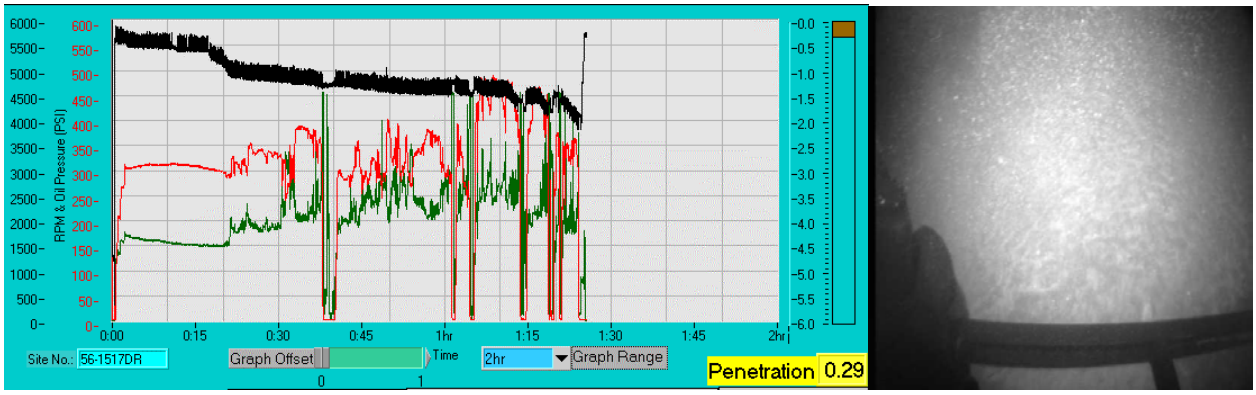


Deployed drill at site **56-15 15**, water depth 186m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cover with pebbles.
Commenced coring at 1057hrs and completed at 1245hrs having penetrated 3.90m.
0.26m. of superficial deposits were recovered.

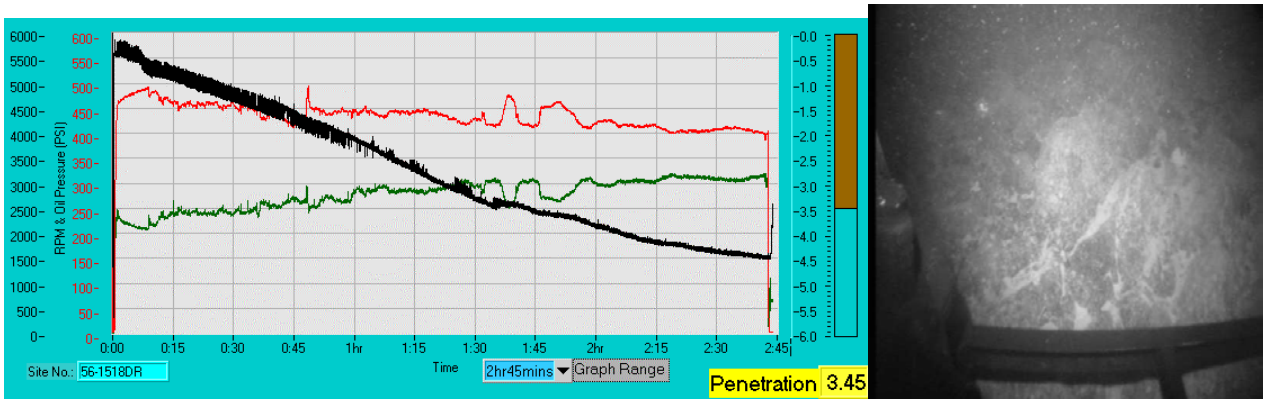


Deployed vibrocorer at site **56-15 16**, water depth 186m. Same location as previous drill site to see if material is sediment/soft. Seabed photo indicated it was probably sandy. Commenced

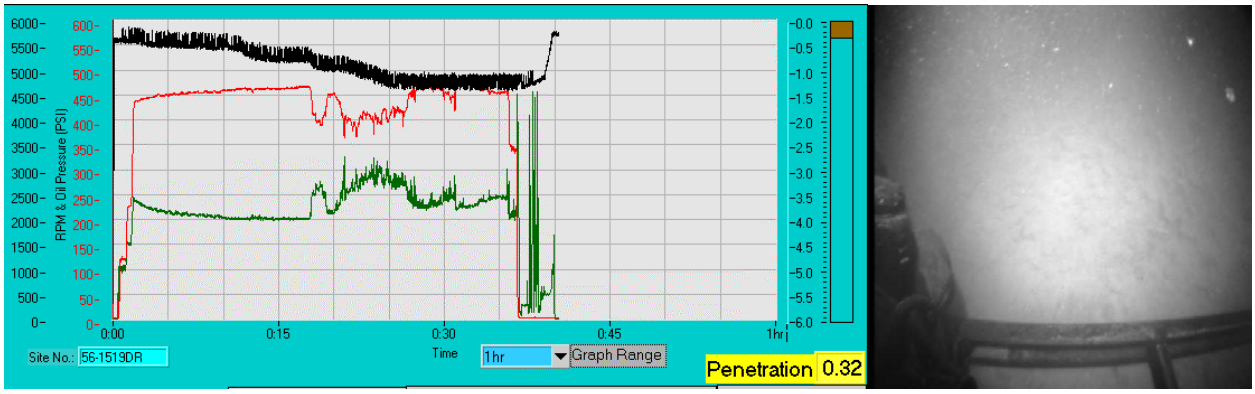
coring at 1329hrs and completed at 1335hrs having made no penetration and no core recovered. Sand grains on shoe and liner/catcher.



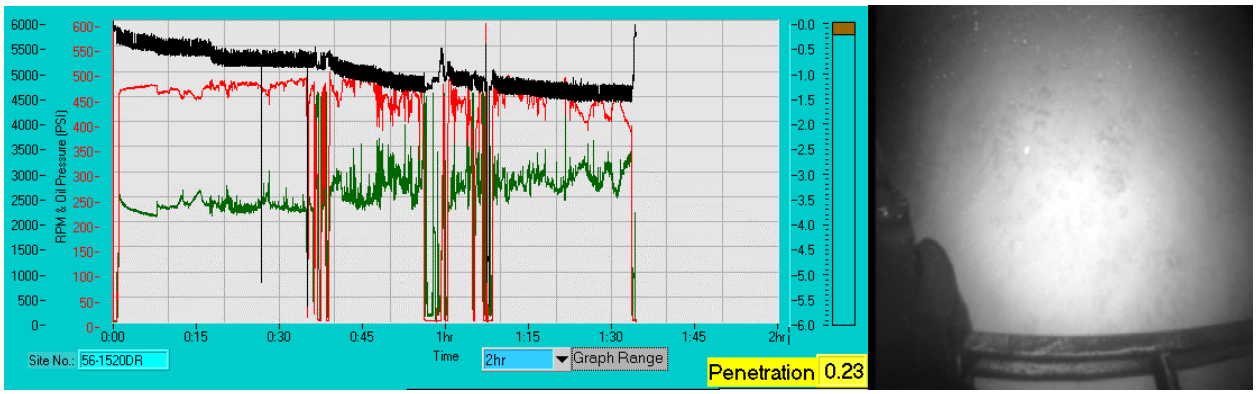
Deployed drill at site **56-15 17**, water depth 197m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a ?gravelly seabed. Commenced coring at 1552hrs and completed at 1725hrs having penetrated 2.2m.with frequent stalling towards the end. Only 0.22m. of pebbles were recovered and the bit was totally worn out.



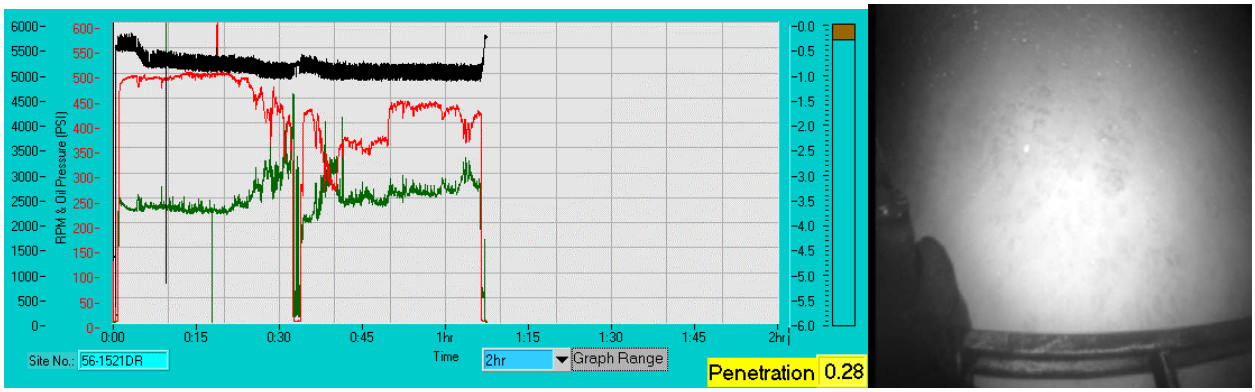
Deployed drill at site **56-15 18**, water depth 182m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a rock outcrop and the drill was lying at a ten degree inclination. Commenced coring at 1824hrs and completed at 2004hrs having penetrated 4.52m. 4.21m of excellent core was recovered.



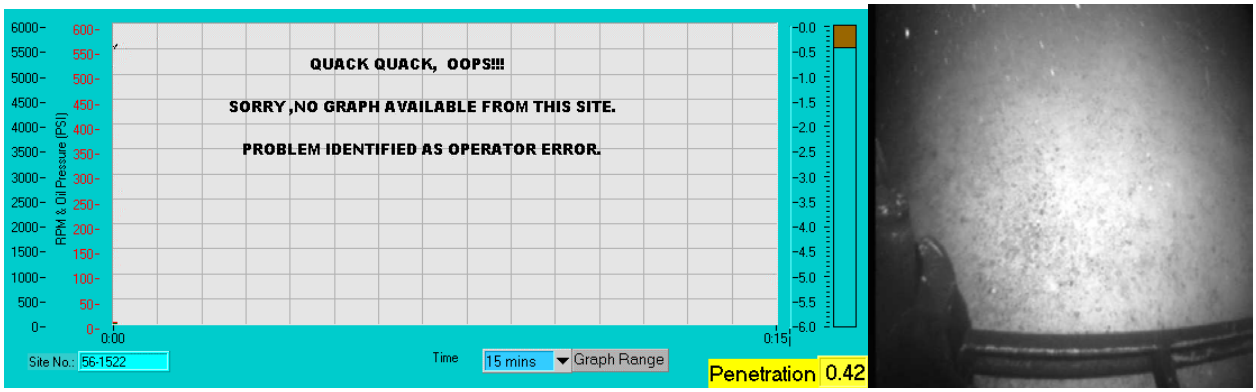
Deployed drill at site **56-15 19**, water depth 238m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a ?sandy seabed. Commenced coring at 2315hrs and completed at 2353hrs having penetrated 1.4m. 0.4m of superficial deposits obtained.



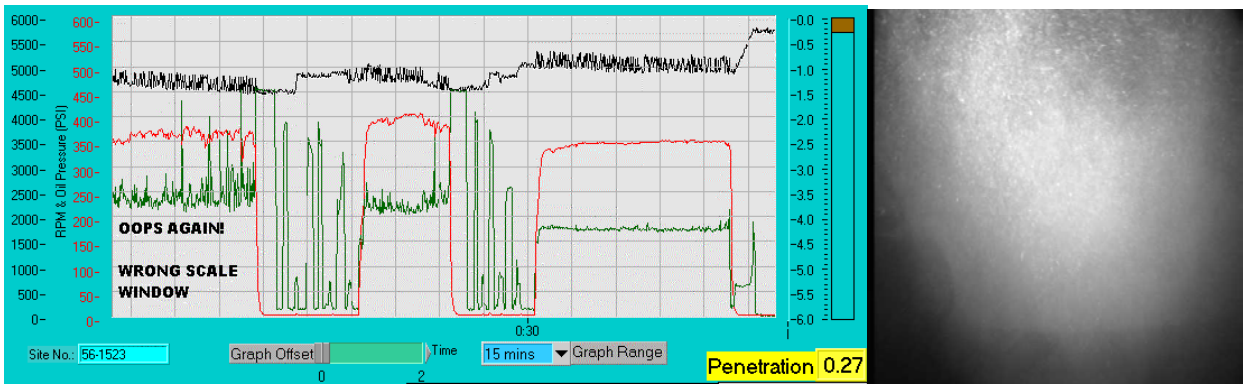
Deployed drill at site **56-15 20**, water depth 181m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy and pebbly seabed. Commenced coring at 2126hrs and completed at 2300hrs having penetrated 1.61m. Stopped due to no further penetration. Recovered 0.37m. of pebbles.



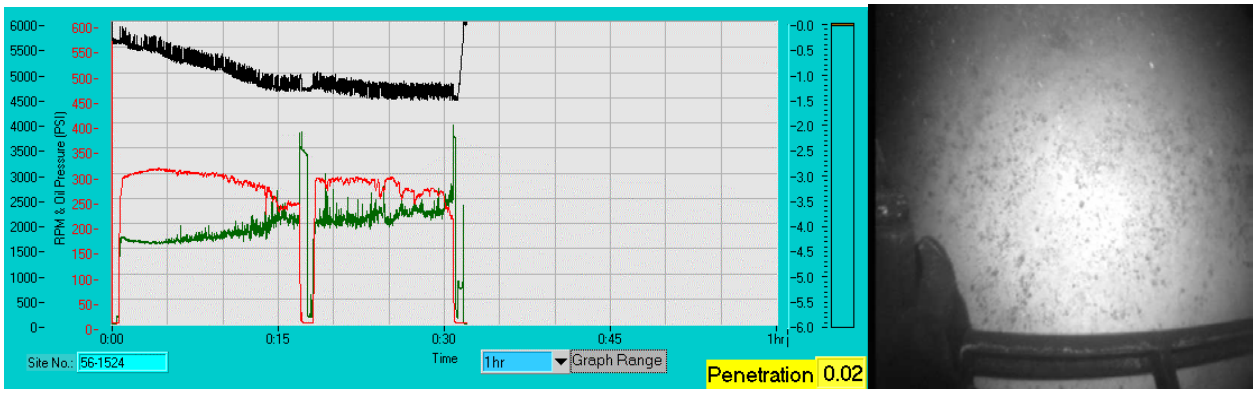
Deployed drill at site **56-15 21**, at same location, water depth 181m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy and pebbly seabed. Commenced coring at 2338hrs and completed at 0044hrs having penetrated 1.13m. Stopped due to no further penetration. Recovered 0.32m. of pebbles.



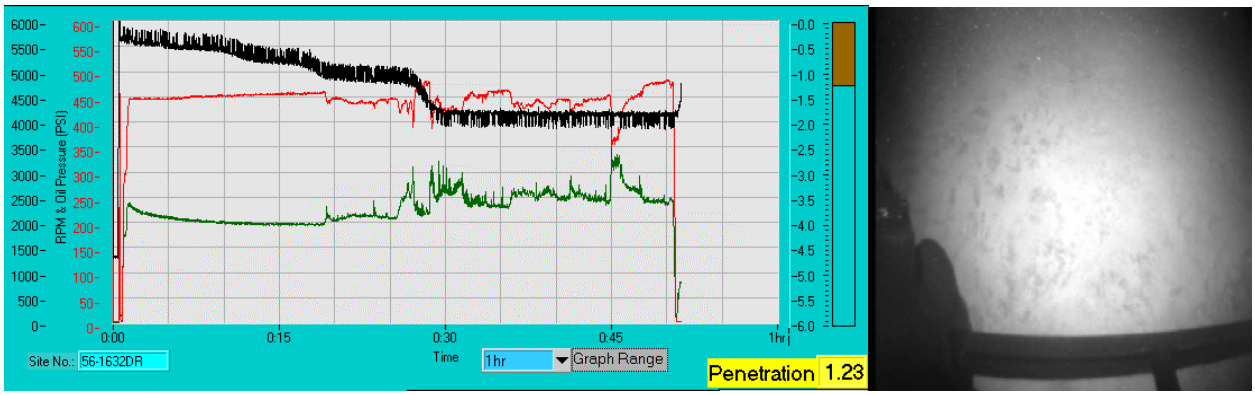
Deployed drill at site **56-15 22**, water depth 181m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered, pebbly and cobbly seabed. Commenced coring at 0225hrs and completed at 0335hrs having penetrated 1.98m. with stalling then stopped due to no further penetration. Recovered 0.31m. of pebbles.



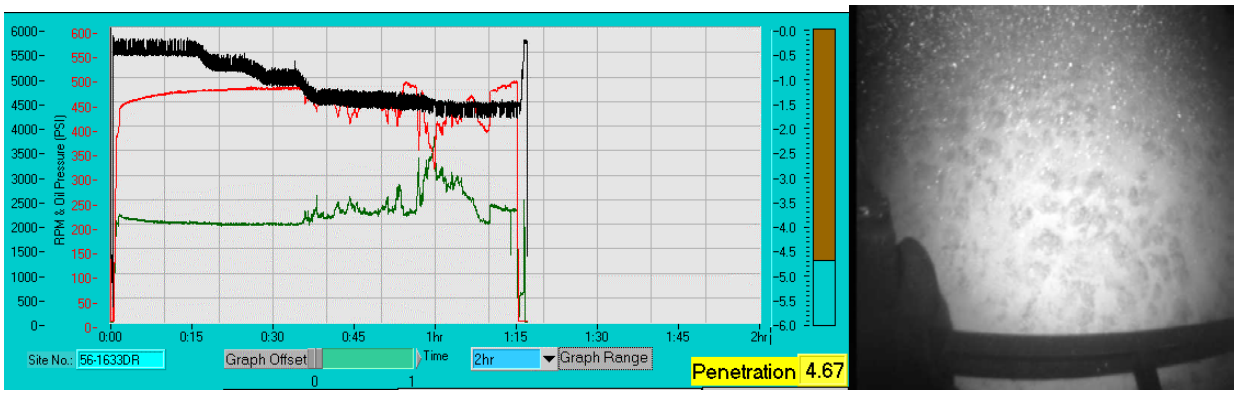
Deployed drill at site **56-15 23**, water depth 182m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered seabed clouded by the rig landing. Commenced coring at 0502hrs and completed at 0537hrs having penetrated 1.35m. with stalling then stopped due to no further penetration. Recovered 0.24m. of pebbles.



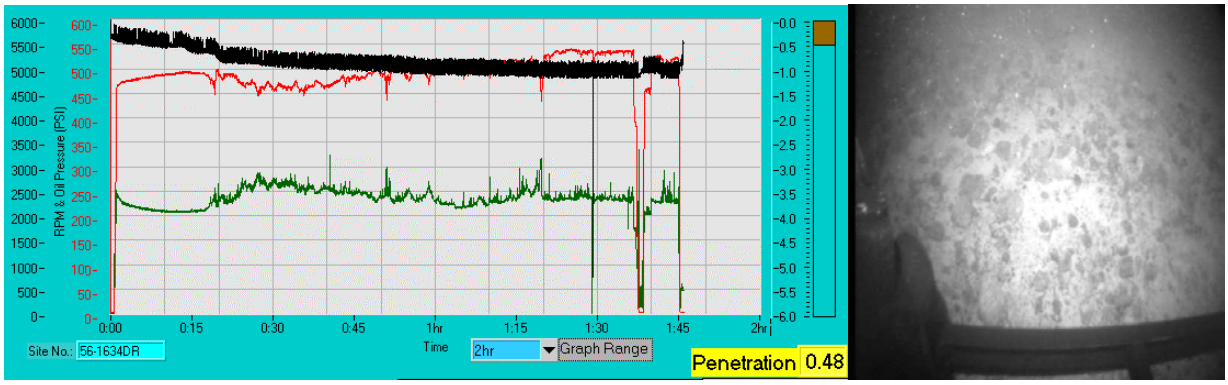
Deployed drill at site **56-15 24**, water depth 192m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment covered pebbly seabed. Commenced coring at 0615hrs and completed at 0646hrs having penetrated 1.38m. with stalling then stopped due to no further penetration. Recovered 0.17m. of pebbles.



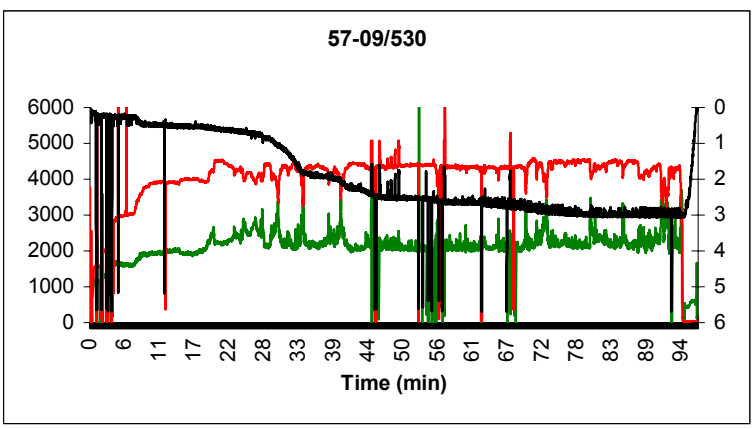
Deployed drill at site **56-16 32**, water depth 176m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed with ?rock outcrop or boulders. Commenced coring at 1304hrs and completed at 1354hrs having penetrated 2.15m.and then stopped. 0.12m. of pebbles and a rock core retrieved, rock may have been in situ as large pull-out required to break it.



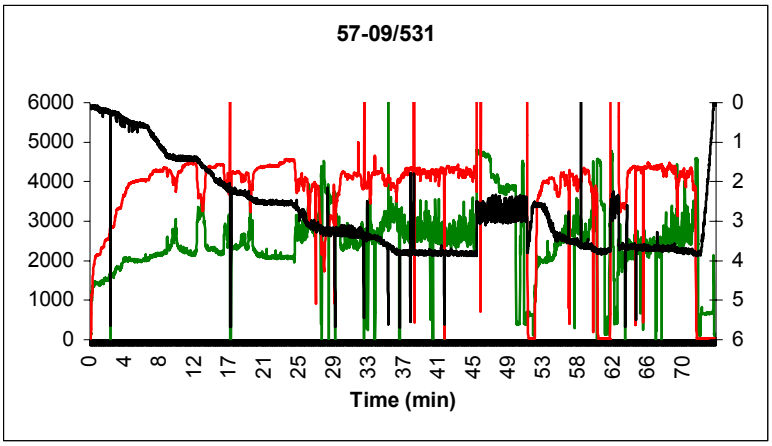
Deployed drill at site **56-16 33** in same location as previous core, water depth 176m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed strewn with boulders. Commenced coring at 1441hrs and completed at 1545hrs having penetrated 1.83m.then stopped . Recovered 0.46m. of pebbles and core.



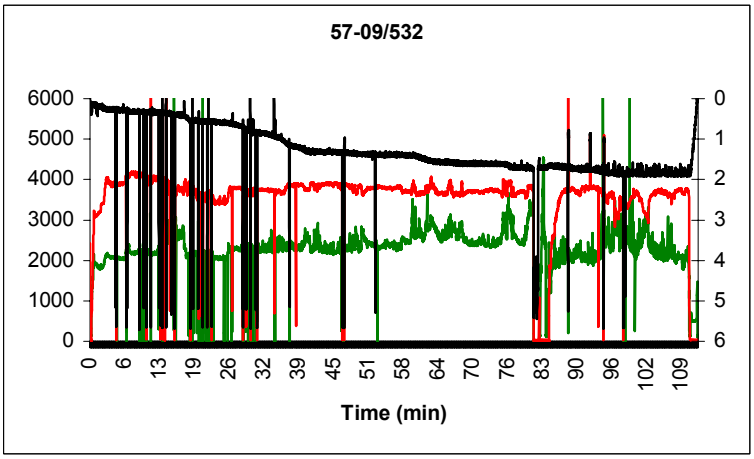
Deployed drill at site **56-16 34**, water depth 187m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a bouldery and pebbly seabed. Commenced coring at 1714hrs and completed at 1858hrs having penetrated 1.2m. then stopped due to no further penetration. Recovered 0.46m.of cemented sediment, pebbles and core.

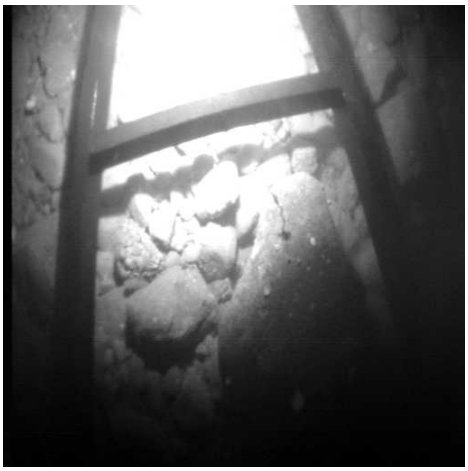


Deployed drill at site **57-09 530**, water depth 18m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a boulder and pebble strewn seabed. Commenced coring at 1330hrs and completed site at 1504hrs having made 3.05m penetration at varying speeds. Only pebbles and cored boulders were recovered.

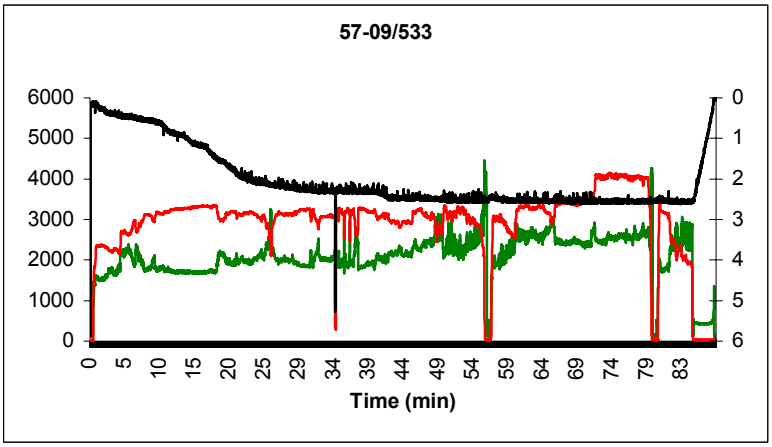


Deployed drill at site **57-09 531,** water depth 137m. Impregnated diamond bit with grade 8 matrix. Seabed photo indicated a boulder and pebble strewn seabed with sediment cover stirred up by the rig landing. Coring commenced at 1708hrs and was completed at 1820hrs after 3.89m penetration. The rig stalled out and was retracted and restarted but the base of the hole could not be regained. The recovery was pebbles, cored boulders and sand.

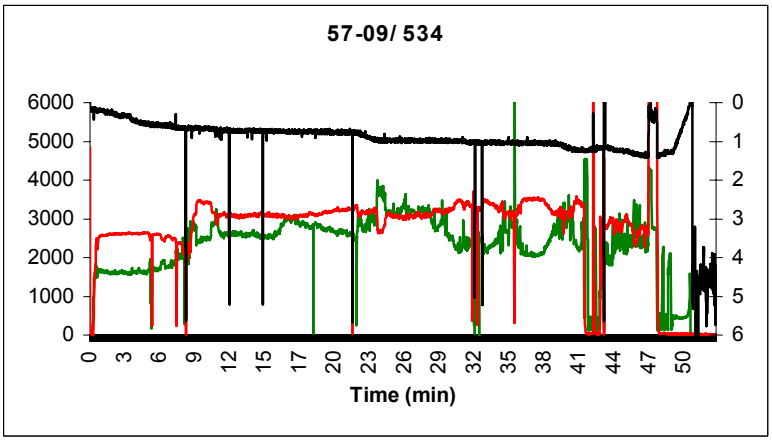




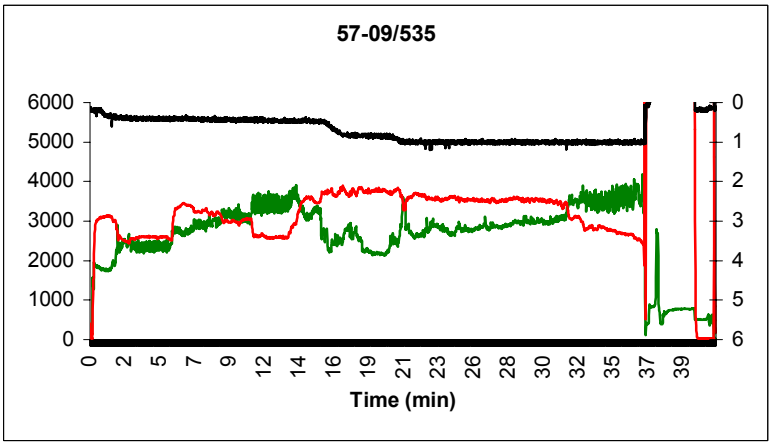
Deployed drill at site **57-09 532**, water depth 110m. Impregnated diamond bit with grade 8 matrix. Seabed photo indicated a boulder strewn seabed with some boulders in view up to 0.5m axis. There may be rock pavement between. Coring commenced at 1957hrs and was completed at 2107hrs after 1.91m penetration. Recovery was pebbles and cored pebbles.



Deployed drill at site **57-09 533**, water depth 129m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated boulders and sediment cover at the seabed. Commenced coring at 0027hrs and completed at 0152hrs having penetrated 2.56m. Recovery was all pebbles or cored pebbles.

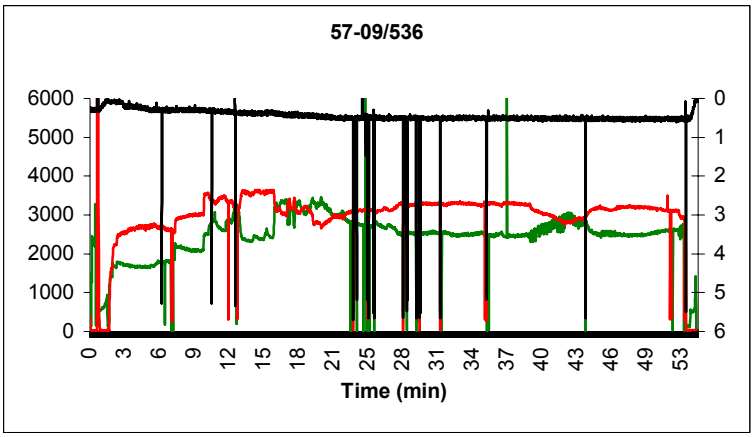


Deployed drill at site **57-09 534**, water depth 99m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a flat, boulder-strewn seabed. Commenced coring at 0449hrs and completed at 0541hrs having penetrated 1.33m with stalling and bit blocking. Recovery was 0.09m of probable core below pebbles.

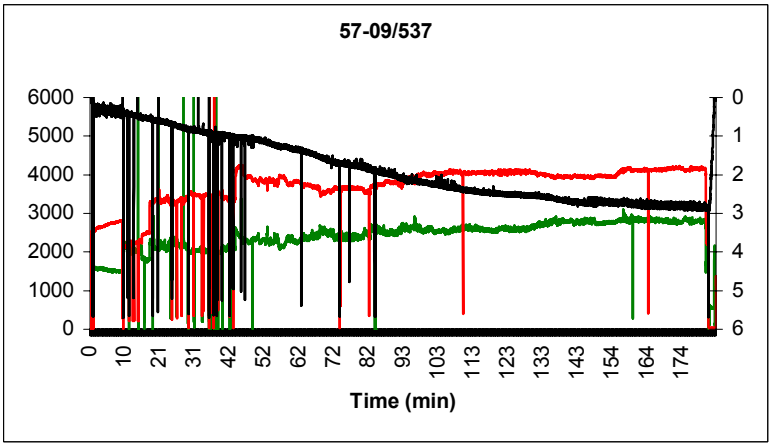


Deployed drill at site **57-09 535**, water depth 99m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a rocky seabed, possibly rock with fractures. Commenced coring at

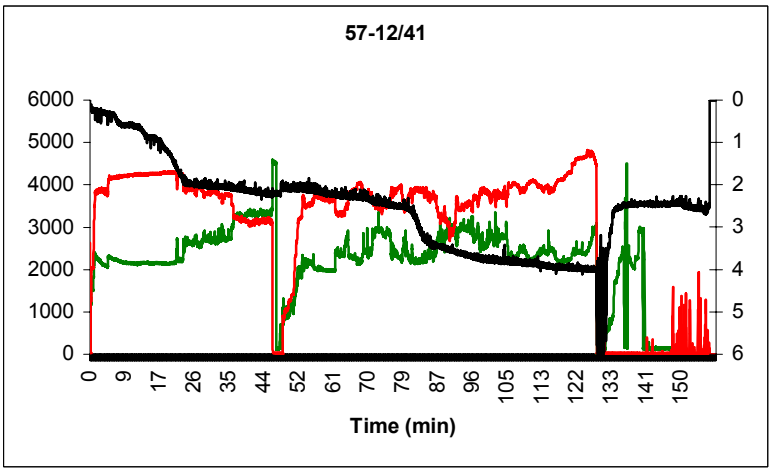
0620hrs and completed at 0658hrs having penetrated 1.02m. Recovery of 0.09m of possible core.

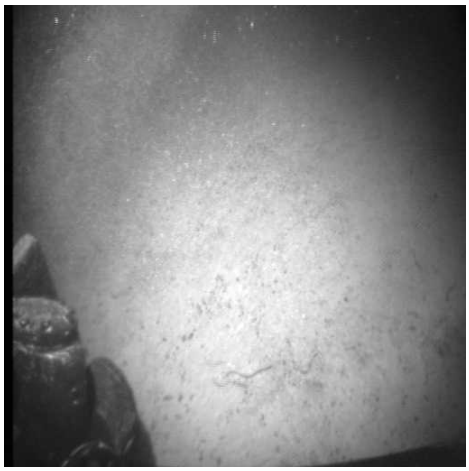


Deployed drill at site **57-09 536**, water depth 120m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a smooth seabed which the drill indicated was at 11 degrees angle. Commenced coring at 0851hrs and completed at 0945hrs having penetrated 0.50m. and recovered 0.23m of good core.

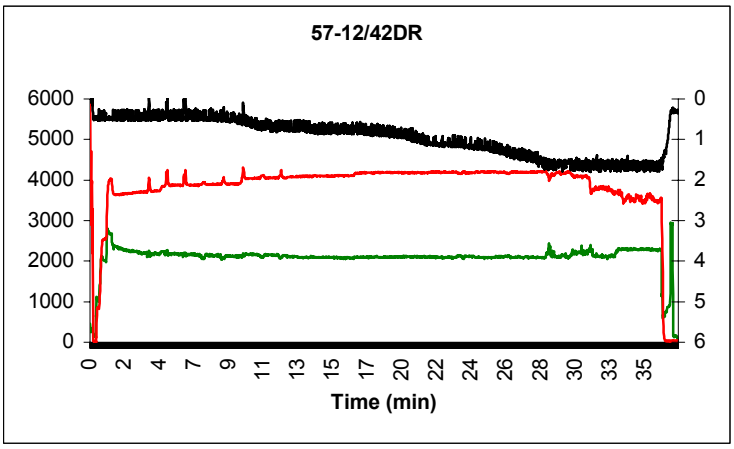


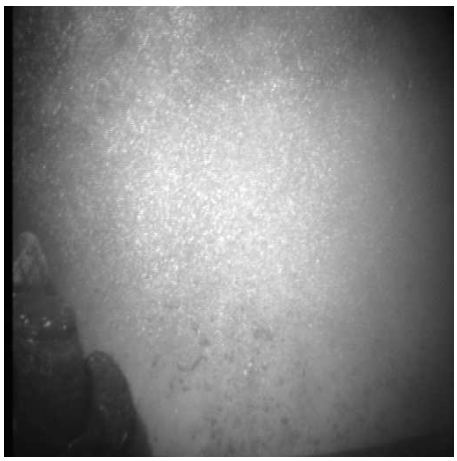
Deployed drill at site **57-09 537**, water depth 119m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a rock platform which the drill indicated was at a slope of 22 degrees. Commenced coring at 1108hrs and completed at 0408hrs having penetrated 2.90m. and recovered 2.49m. of good core.



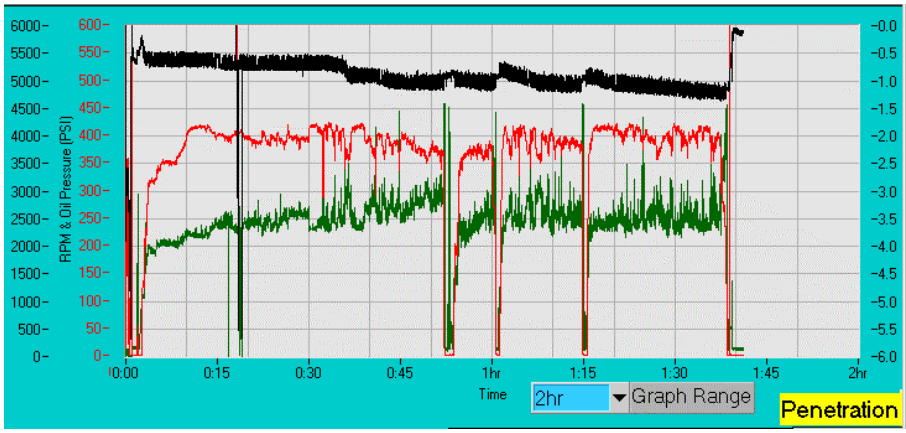


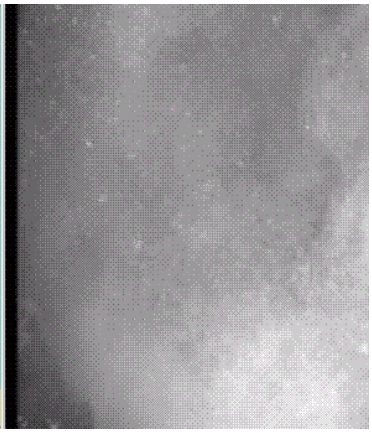
Deployed drill at site **57-12 41**, water depth 670m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 1502hrs and completed at 1709hrs having penetrated 4.03m and stalled. Unable to restart drill and also unable to retract out of seabed. Release core barrel to base and lift frame – frame clear of seabed but barrel still stuck. Keep strain on winch and use swell to ease free over a period of time. Recover to deck with retraction wire broken and bit and reamer broken off but 1.14m. of core still in core barrel. Core indicates high liklihood of jamming in loose, abrasive sediments.



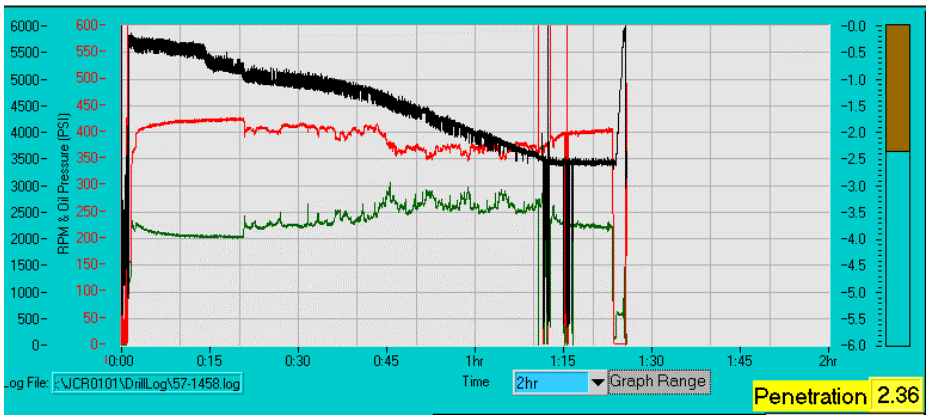


Deployed drill at site **57-12 42**, water depth 740m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 2232hrs and completed at 2308hrs having penetrated 1.78m. All the time closely observing the flushing to ensure no blocking. However no core was recovered.



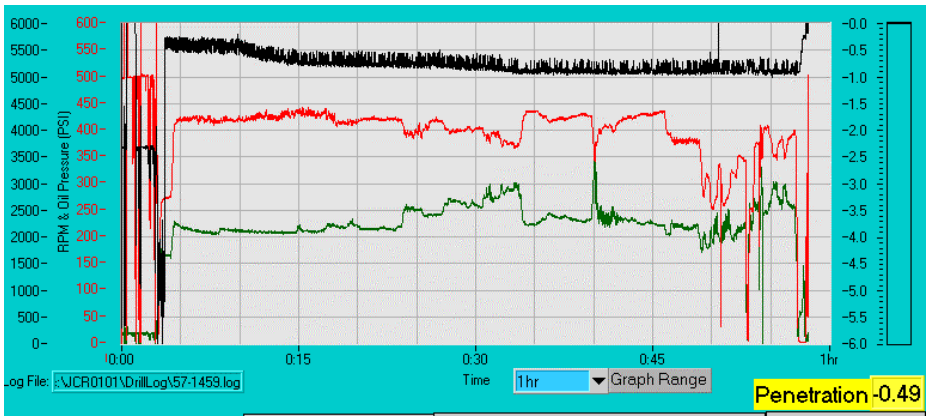


Deployed drill at site **57-14 57**, water depth 142m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment covered seabed. Commenced coring at 1219hrs and completed at 1357hrs having penetrated 1.33m with a lot of stalling. 0.48m of cored pebbles of the same type recovered.



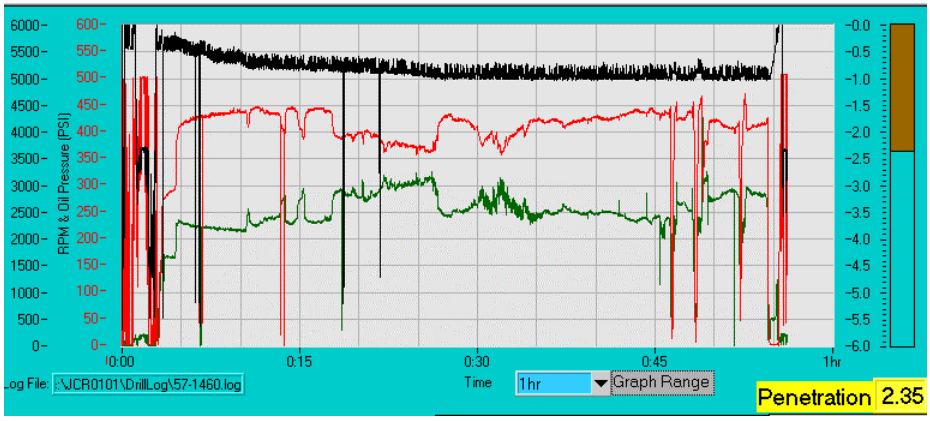
No Photo

Deployed drill at site **57-14 58**, water depth 122m. Impregnated diamond bit, grade 8. No seabed photo available. Commenced coring at 1558hrs and completed at 1722hrs having penetrated 2.61m. and obtained 1.81m of excellent core.



No Photo

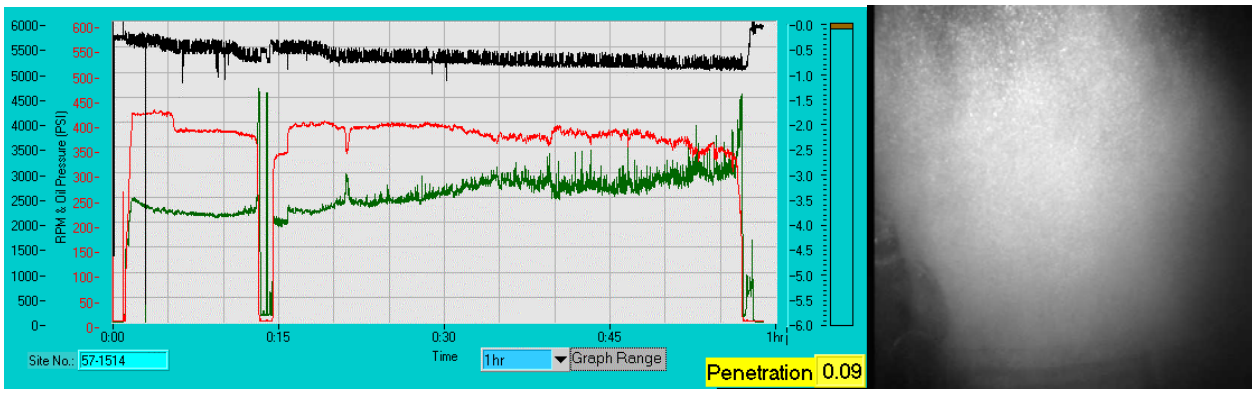
Deployed drill at site **57-14 59**, water depth 114m. Impregnated diamond bit, grade 8 matrix. No seabed photo available. Commenced coring at 1926hrs and completed at 2016hrs having penetrated 0.96m. and obtained 0.13m. of core.



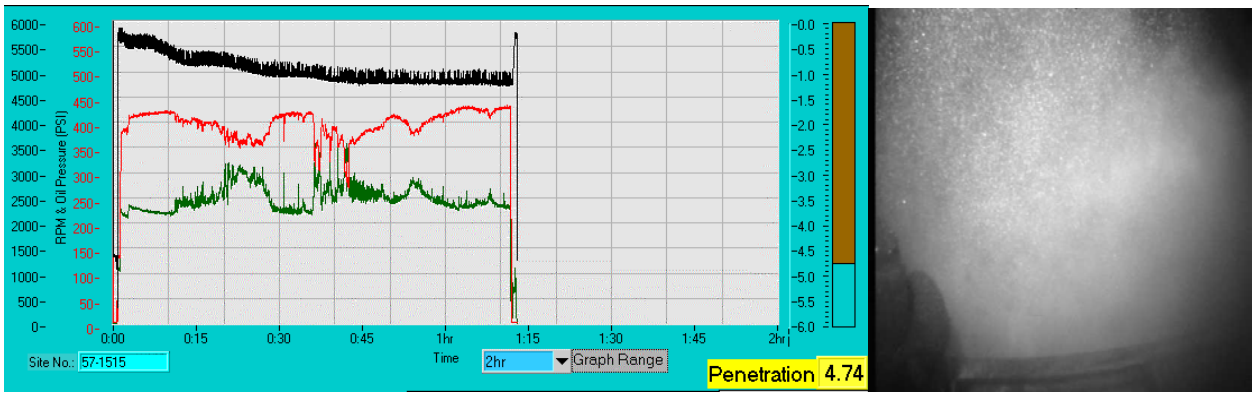
No Photo

Deployed drill at site **57-14 60**, water depth 114m. Impregnated diamond bit, grade 8 matrix. No seabed photo at this site which has the same location as the previous attempt. Commenced coring at 2055hrs and completed at 2147hrs having penetrated 1.03m. This time obtained a good core 0.31m. in length.

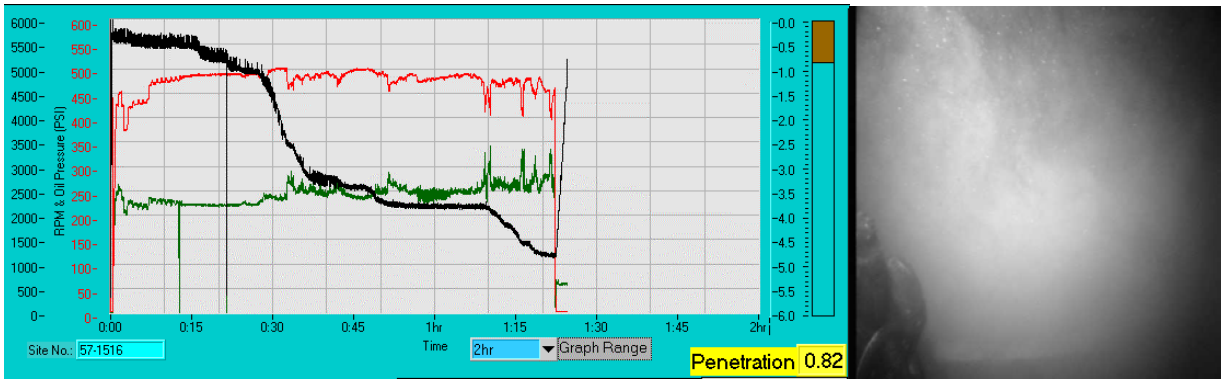
Deployed drill at site **57-14 61**, water depth 128m. Impregnated diamond bit, grade 9 matrix. No seabed photo and rig on 25-30 degree incline after two aborted landing attempts - One resulted in rig falling over). Commenced coring at 2335hrs and completed at 2340hrs as unable to start the rig which may be damaged so retrieve to deck for inspection. No Photo, Graph or Core recovered.



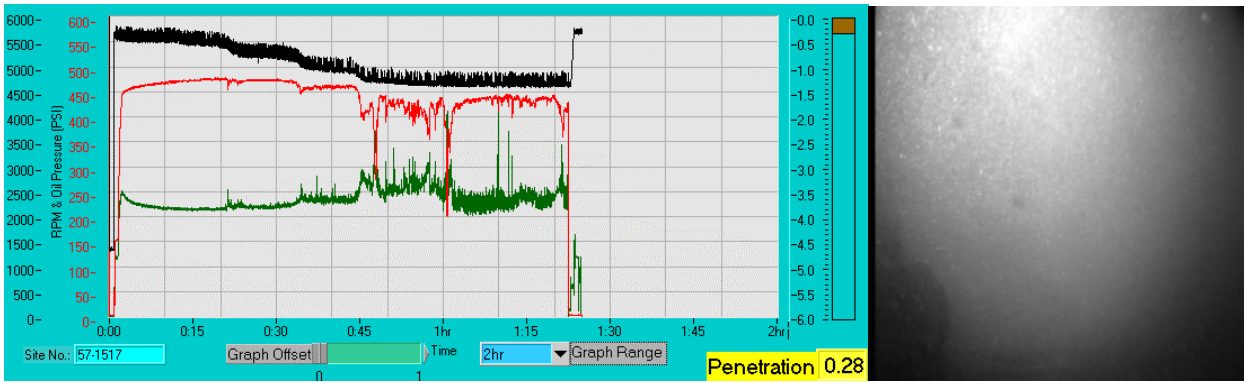
Deployed drill at site **57-15 14**, water depth 250m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a smooth and probably sandy seabed. Commenced coring at 1545hrs and completed at 1656hrs having penetrated 0.95m. No recovery corebarrel bent. This may be due to damage at previous site as the bend was inside the kelly. Replace core barrel for retry at same site.



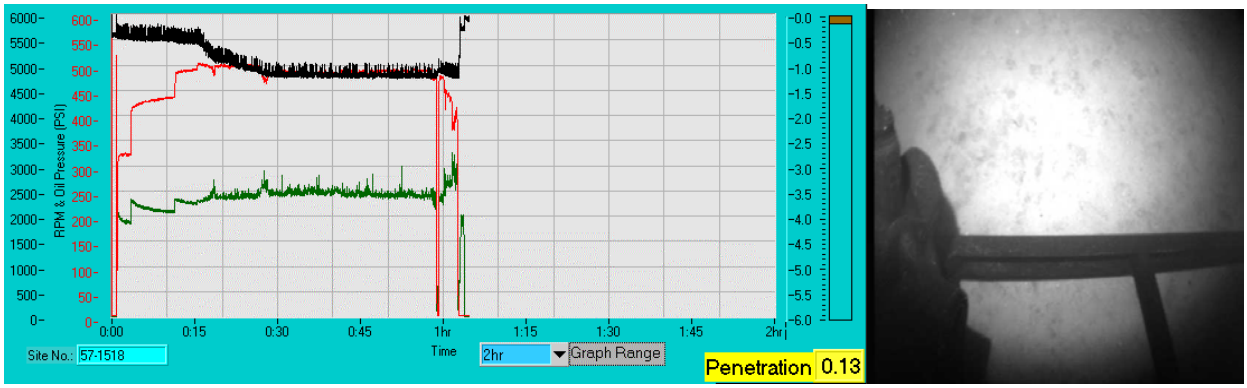
Deployed drill at site **57-15 15**, water depth 250m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a smooth and probably sandy seabed - reassuring since it is at the same location as the previous drilling attempt. Coring commenced at 1754hrs and completed at 1905hrs having penetrated 1.28m. 0.59m. recovered comprising some pebbles and then fractured core.



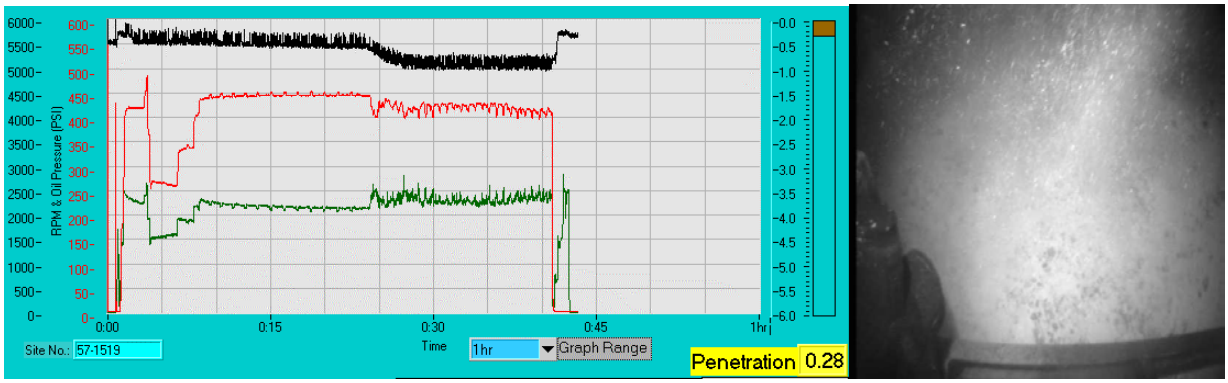
Deployed drill at site **57-15 16**, water depth 265m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a soft sediment seabed disturbed by the rig landing. Commenced coring at 2041hrs and completed at 2202hrs with 4.86m. penetration. 0.58m of superficial deposits were recovered.



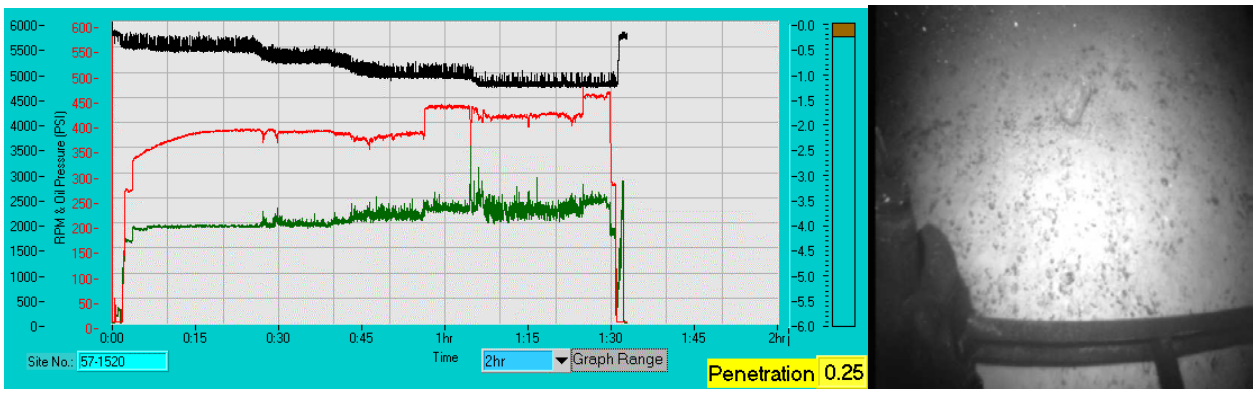
Deployed drill at site **57-15 17**, water depth 200m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a soft sediment seabed disturbed by the rig landing.
Commenced coring at 0003hrs and completed at 0125hrs having penetrated 1.39m.
0.1m. of seabed deposits were recovered.



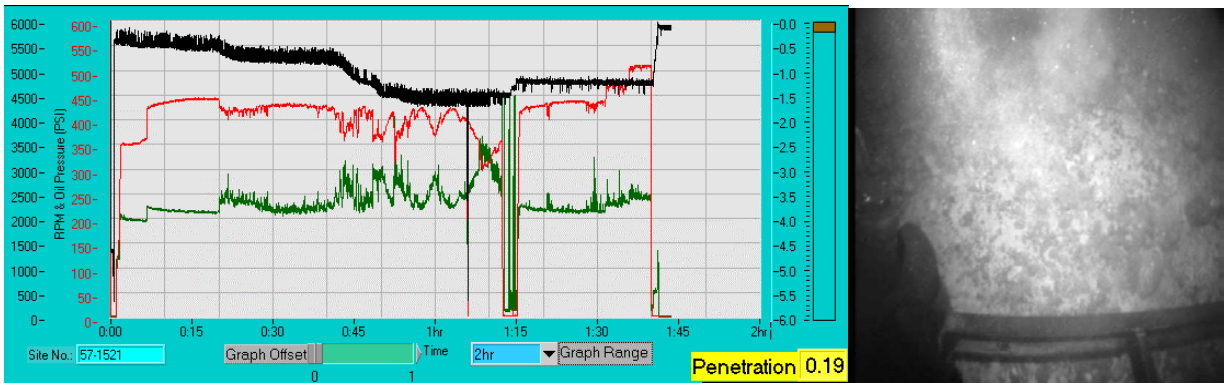
Deployed drill at site **57-15 18**, water depth 191m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a mottled ?gravelly seabed.
Commenced coring at 0352hrs and completed at 0455hrs having penetrated 1.25m.
0.45m. of superficial deposits were recovered.



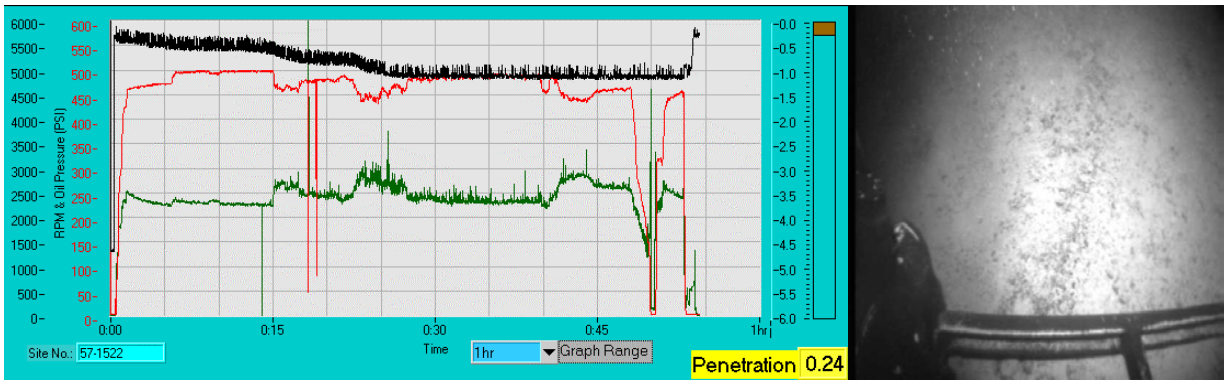
Deployed drill at site **57-15 19**, water depth 167m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy bottom with sediment plume caused by rig landing. Commenced coring at 0622hrs and completed at 0704hrs having penetrated 1.01m. 0.18m. of superficial deposits were recovered.



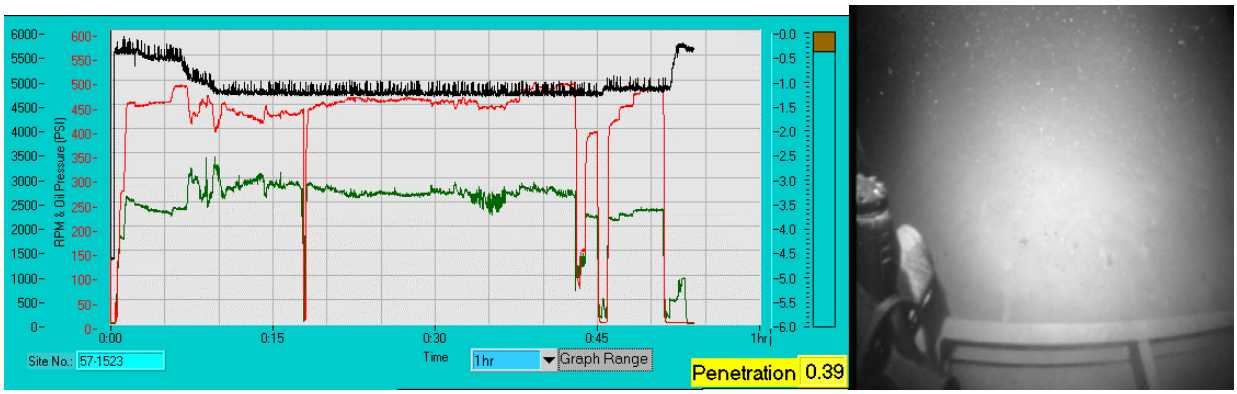
Deployed drill at site **57-15 20**, water depth 167m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a pebbly seabed. Commenced coring at 0740hrs and completed at 0910hrs having penetrated 1.3m. Only 0.17m. of pebbles recovered.



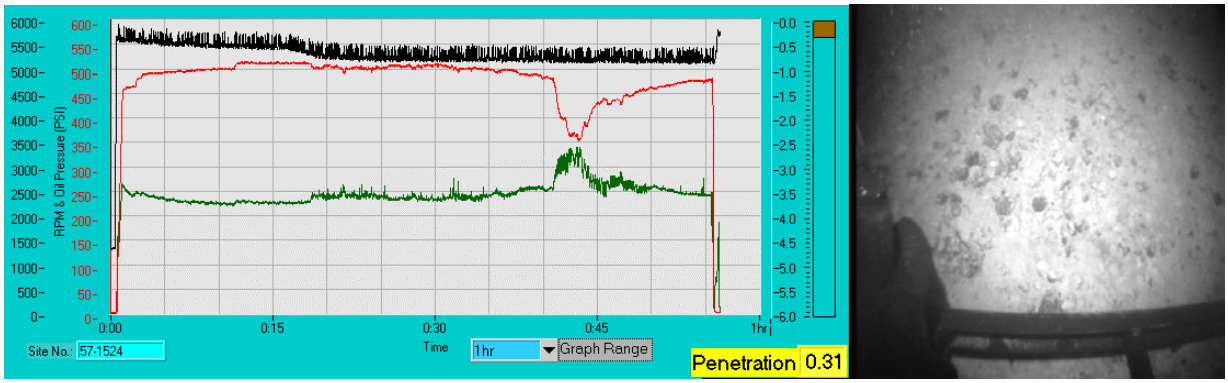
Deployed drill at site **57-15 21**, water depth 178m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a boulder seabed with some fine sediment cover also. Commenced coring at 1120hrs and completed at 1258hrs having penetrated 1.3m. Only 0.5m. of pebbles recovered.



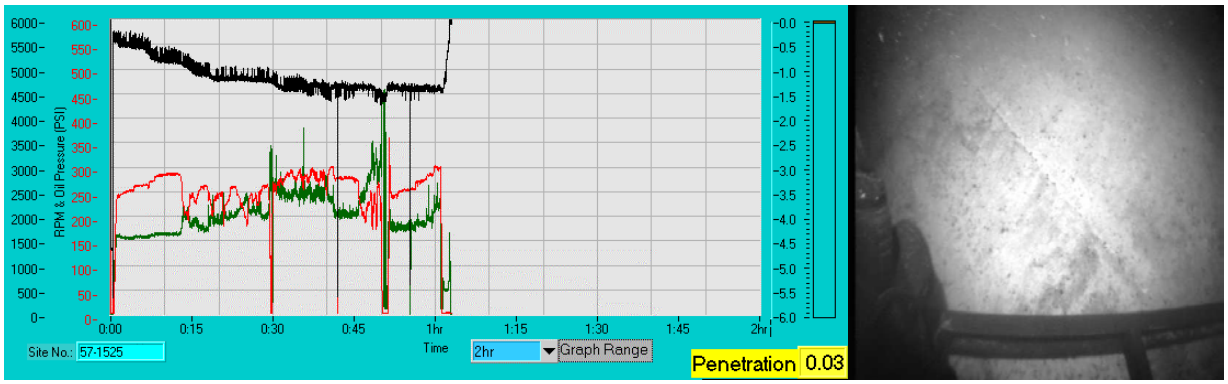
Deployed drill at site **57-15 22**, water depth 178m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a gravelly seabed. Commenced coring at 1441hrs and completed at 1533hrs having penetrated 1.18m. Only 0.27m. of pebbles recovered.



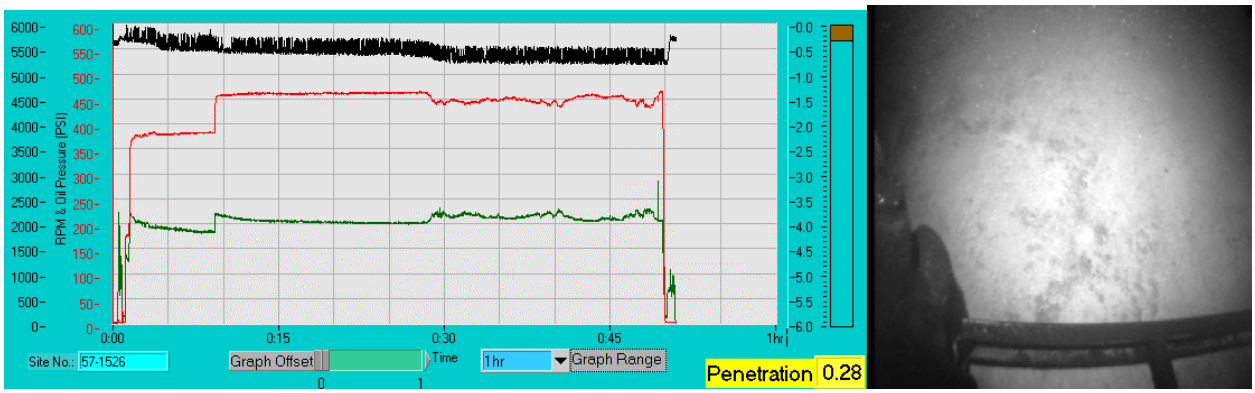
Deployed drill at site **57-15 23**, water depth 214m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed with ?gravel and clouding due to sediment plume as rig was landed. Commenced coring at 1739hrs and completed at 1821hrs having penetrated 1.33m. Only 0.36m. of pebbles recovered.



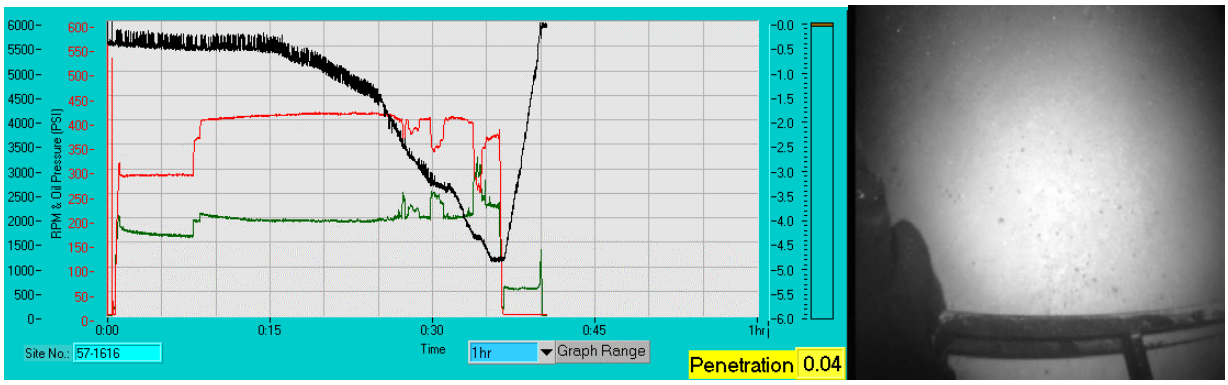
Deployed drill at site **57-15 24**, water depth 183m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered seabed with pebbles and cobbles. Commenced coring at 2023hrs and completed at 2118hrs having penetrated 0.89m. Only 0.23m. of pebbles recovered.



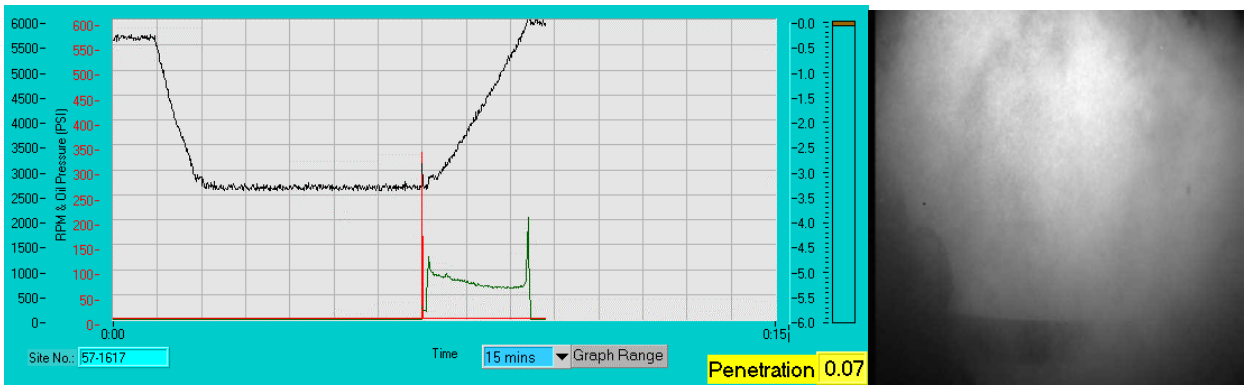
Deployed drill at site **57-15 25**, water depth 196m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a ?scour in sediment or a fracture if rock. Commenced coring at 2244hrs and completed at 2345hrs having penetrated 1.48m.with stalling at times. Recovery was 0.25m. of pebbles.



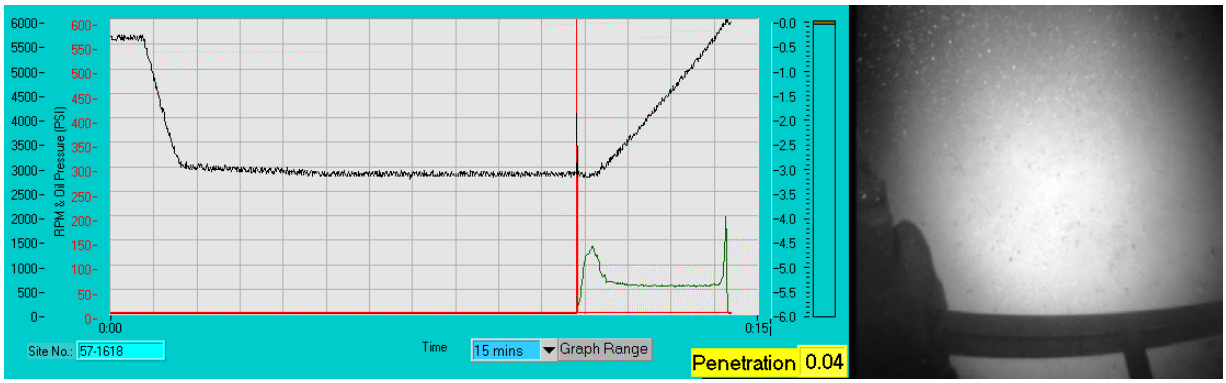
Deployed drill at site **57-15 26**, water depth 219m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cover with pebbles and cobbles. Commenced coring at 0200hrs and completed at 0249hrs having penetrated 0.77m. Only 0.12m. of pebbles recovered.



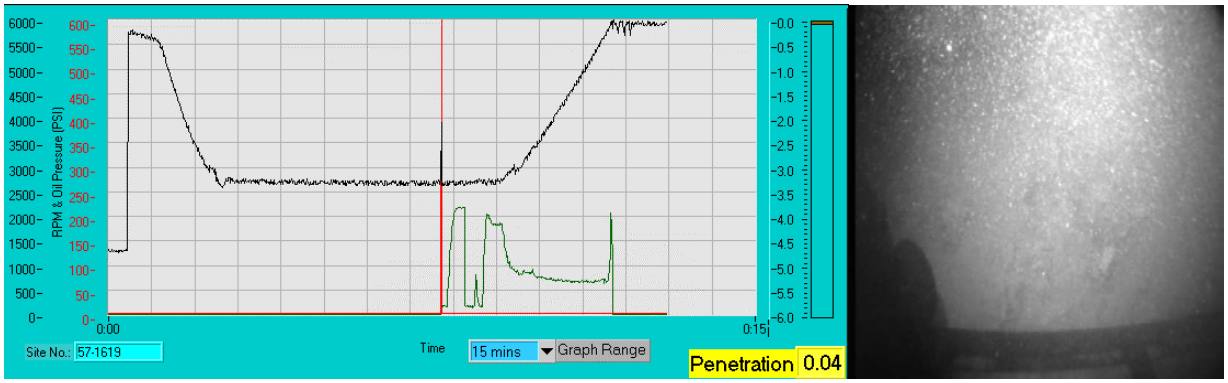
Deployed drill at site **57-16 16**, water depth 601m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered pebbly seabed. Commenced coring at 0216hrs and completed at 0252hrs having penetrated 4.88m. Obtained 0.48m. of core.



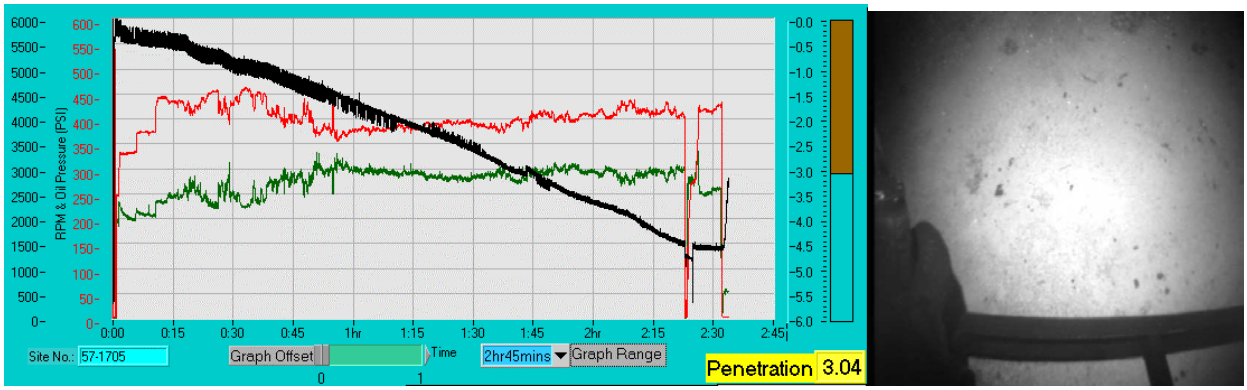
Deployed vibrocorer at site **57-16 17**, at same location, water depth 601m. Seabed photo indicated a sediment cover disturbed by the rig landing. Commenced coring at 0407hrs and completed at 0414hrs having penetrated and recovered 3.48m. of sediment over rock.



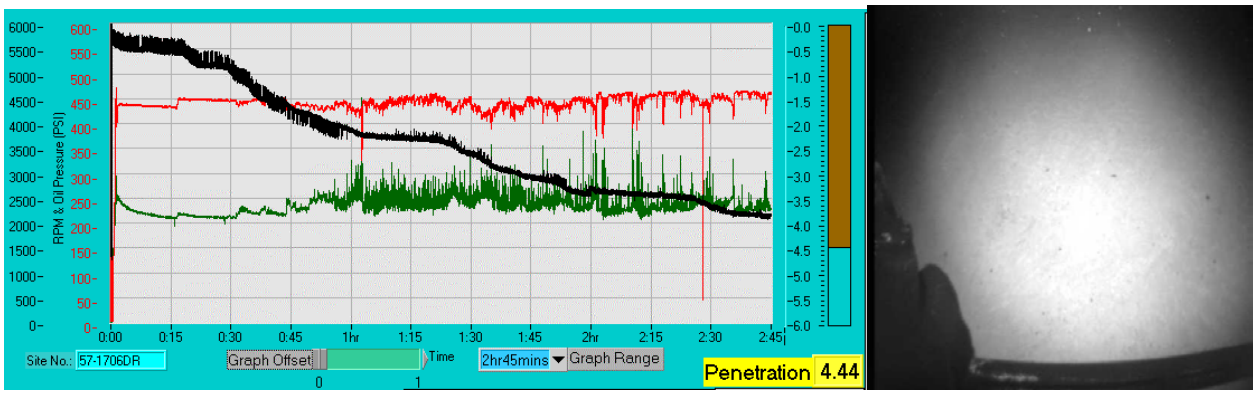
Deployed vibrocorer at site **57-16 18**, water depth 670m. Seabed photo indicated a sediment cover disturbed by the rig landing. Commenced coring at 0550hrs and completed at 0600hrs having penetrated 3.19m. Recovered 2.71m. of core and lost some due to inverted catchers.



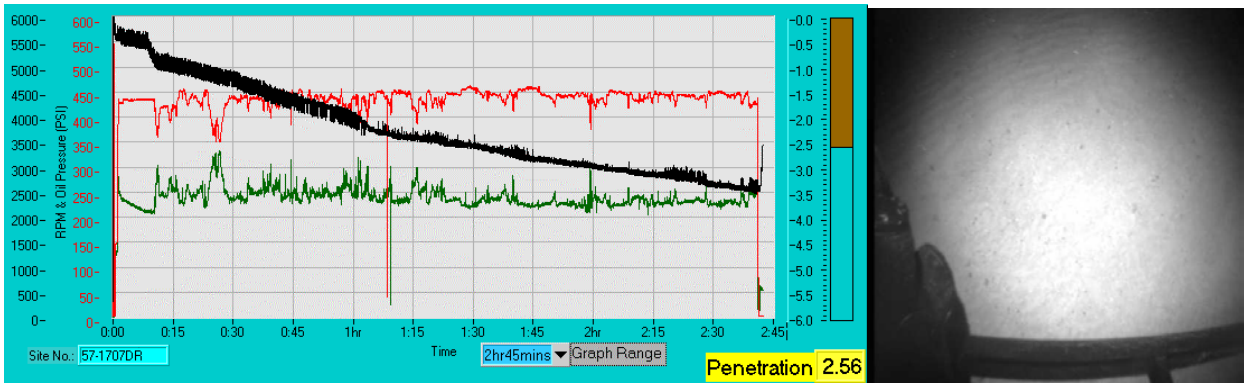
Deployed vibrocorer at site **57-16 19**, water depth 666m. Seabed photo indicated a sediment covered pebbly seabed. Commenced coring at 1017hrs and completed at 1029hrs having penetrated 3.31m. Very strong retraction force required for pull-out and 3.07m. of good soft rock core obtained above an inverted catcher.



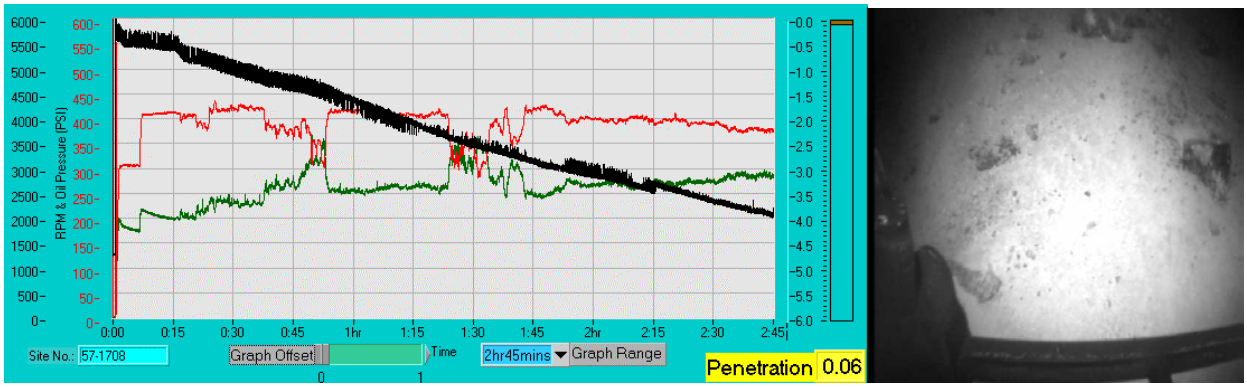
Deployed drill at site **57-17 5**, water depth 961m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed with some pebbles. Trouble finding seabed due to site being on a pinnacle. Rig lying at 12 degrees while drilling. Commenced coring at 1050hrs and completed at 1357hrs having penetrated 4.64m. Recovered 4.4m. of good core.



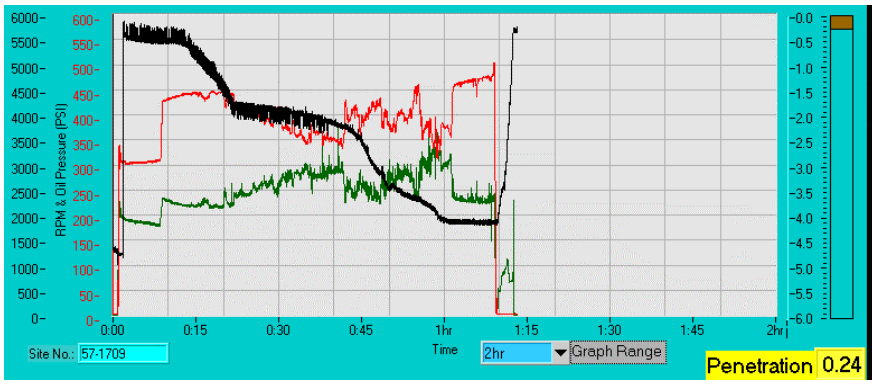
Deployed drill at site **57-17 6**, water depth 924m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed. Commenced coring at 1523hrs and completed at 1844hrs having penetrated 4.88m.with fast penetration at the end. 3.1m. of good but undercut core recovered.

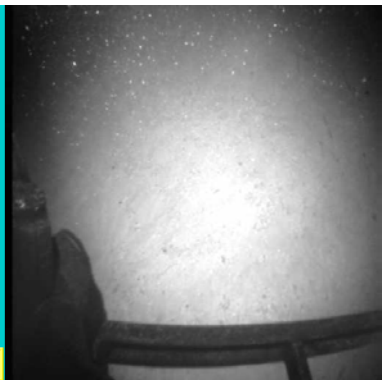


Deployed drill at site **57-17 7**, water depth 809m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed. Commenced coring at 2048hrs and completed at 2329hrs having penetrated 3.51m. 1.68m of core recovered.

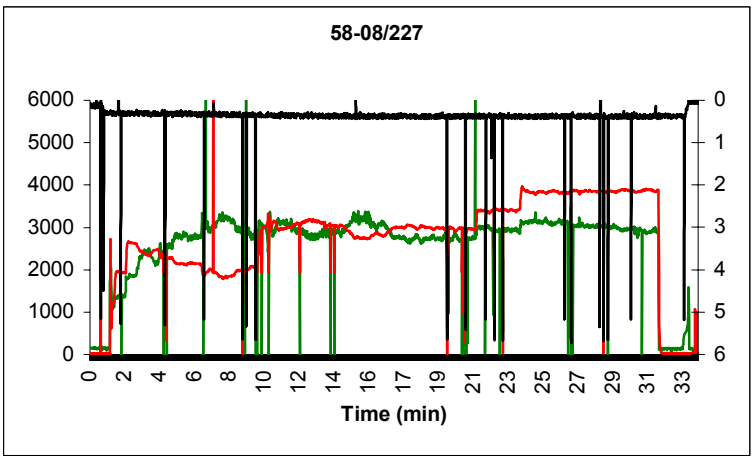


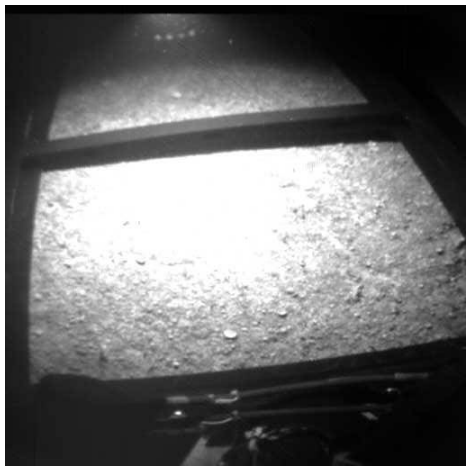
Deployed drill at site **57-17 8**, water depth 691m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed with some ?rock outcrop and some boulders. Commenced coring at 0123hrs and completed at 0423hrs having penetrated 4.11m. 3.81m. of core recovered.



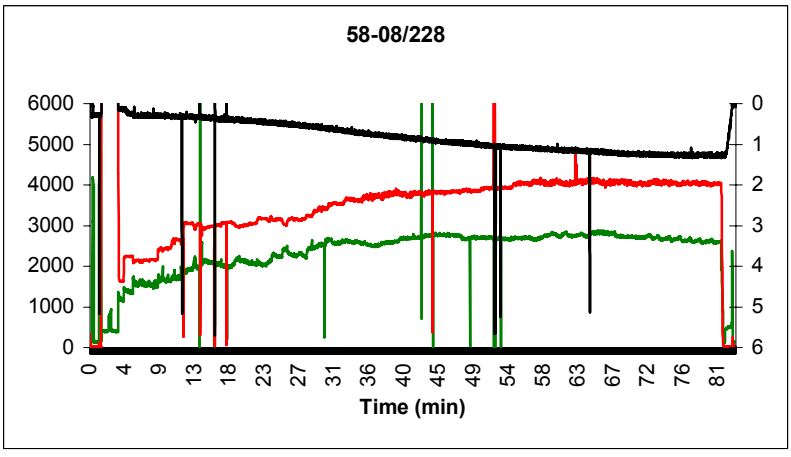


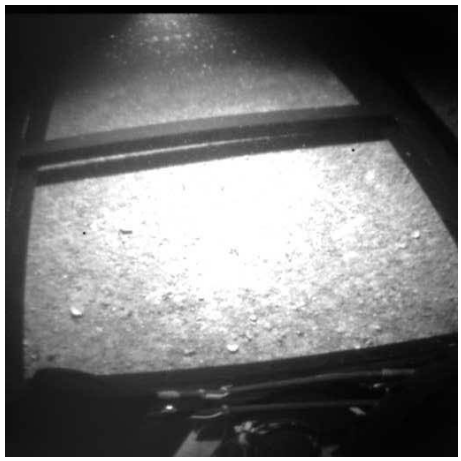
Deployed drill at site **57-17 9**, water depth 926m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered seabed. Commenced coring at 0550hrs and completed at 0700hrs having penetrated 4.16m. 0.94m of core recovered.



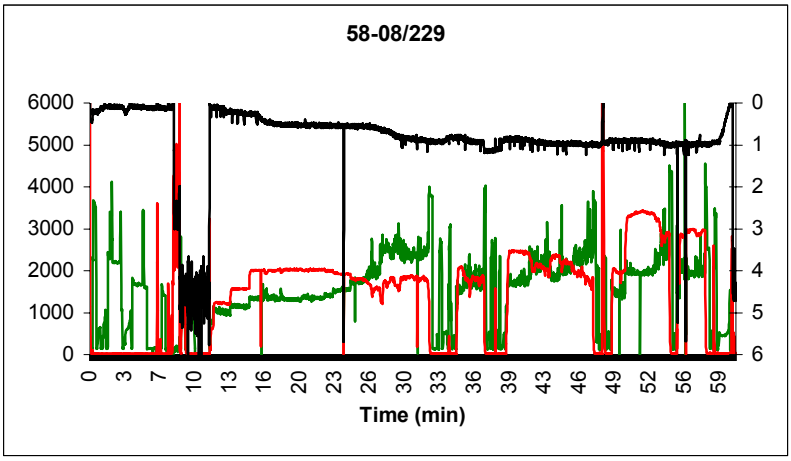


Deployed drill at site **58-08 227**, water depth 66m. Surface set stepped profile diamond bit 60/80 spc. Seabed photo indicated a rock platform. Commenced coring at 1845hrs and completed at 1915hrs having penetrated 0.38m. Single piece of core which may have been a pebble in core barrel.

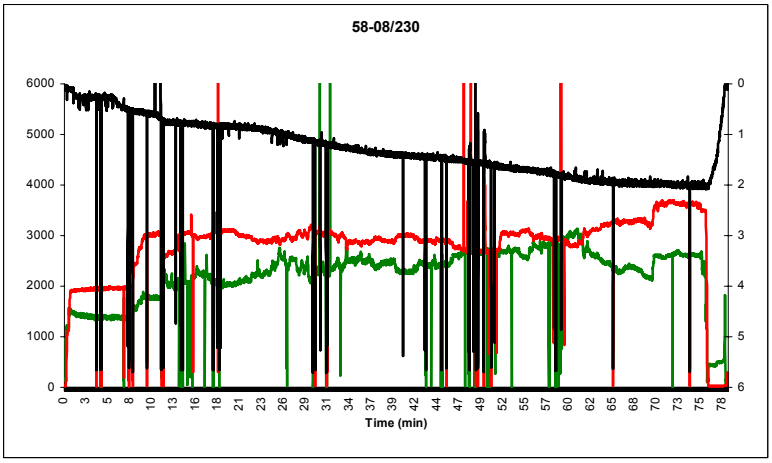




Deployed drill at site **58-08 228** – same location for a second try, this time using an impregnated diamond bit grade 8 matrix. Seabed photo indicated a rock platform. Commenced coring at 2200hrs and completed at 2321hrs having penetrated 1.32m. Excellent rock core 0.98m long obtained in very hard material.



Deployed drill at site **58-08 229**, water depth 105m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a boulder field. Commenced coring at 0440hrs and completed at 0510hrs having penetrated 0.99m. Some pebbles recovered.



Deployed drill at site **58-08 230**, water depth 64m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated rock outcrop and some pebbles/boulders at seabed. Commenced coring at 0814hrs and completed site at 0928hrs having penetrated 2.04m and obtained 1.33m of good fractured rock core.

Deployed gravity corer at site **58-12 9**, water depth 1935m. Penetration 6m into seabed and 3.35m. of sediment core recovered. No Graph or Photo.

Appendix 3

Summary Daily Log of Operations

Note: All times are Local Ship's Time

Daily Log of BGS Operations – Cruise JR02/01

Wednesday 25th July
Arrive at "RRS James Clark Ross" at Cammell Laird shipyard, Hebburn, River Tyne. BGS consigned equipment already being unloaded onto quayside. Unable to place equipment directly onto vessel as divers are underneath it inspecting the propeller area for a possible fouling – nothing definite found.
Commence loading onto vessel at 1600hrs and complete for day at 1800hrs with all equipment excluding the rockdrill umbilical winch on board but not fastened in position.
A. Skinner, J. Glendinning, S. Henderson and E. Gillespie, all BGS, join vessel.

Safety Induction Briefing given by Cammell Laird for dockside working.

Thursday 26th July
Move ship along berth in morning to allow shore crane better access to load and position rockdrill umbilical winch. Place winch on board and fasten in position.
Commence stowing equipment spares and consumables in scientific hold, workshop and laboratory areas. Position gravity coring winch, gravity core shute and 'A' frame and fasten in position.
Position winch power packs, 6m core bench and fasten in position. Run all hydraulic hoses and electrical cabling.
Vessel engineers confirm that there is still a problem with the propeller as evidenced by a noise when rotating. Investigation of this continues.

Friday 27th July
BGS lorry arrives in morning with rockdrill, control container and spares container plus equipment palettes. Commence unloading onto vessel and quay. Build up rockdrill on quay using shore crane then place on pontoon beside ship for lifting on board and positioning outboard by the ships crane. Last of BGS equipment arrives early pm on contractor lorry and unloaded directly onto vessel.
N. Campbell and D. Smith, BGS, C. Mori, SAMS, join vessel.

Saturday 28th July
Complete BGS mobilisation. Fill and vent hydraulics on drill and complete a full function wet test of drilling rig. All functions working. All cables tidied and fastened and all laboratory and workshop equipment and stores secured.
Vessel requires to be drydocked to investigate propeller area and this is unlikely to be possible before 2/3 August so arrange for BGS personnel to leave vessel in interim and put others joining on hold in the meantime.

Sunday 29th July
Move rockdrill inboard of vessel and secure. All BGS personnel leave vessel.

Monday 30th July
No activity regarding JCR

Tuesday 31st July

D. Smith BGS returns to vessel to complete drill software/hardware tasks and report on drydock progress – still no confirmation of drydocking and vessel has not moved from berth in shipyard which is due to close today as the yard is in receivership.

Wednesday 1st August

No progress on JCR drydocking.

Thursday 2nd August

No progress on JCR drydocking in Tyne. Captain Burgan advised that drydocking may have to be in Southampton after BGS/IFOS and that divers may be used to effect a temporary repair in the meantime but nothing has been set up for this.

After receiving this report from the vessel and obtaining no impression of urgency at BAS HQ in ascertaining just what A&P were going to do and when, A. Skinner realised that the time was fast approaching when BGS would have to withdraw from their scientific programme as the vessel charter time could not be extended to compensate for the delay. He contacted a company in Leith at 2100hrs with regard to a drydocking there and was told that a dock could possibly be available, enquiries would be made and that he would receive a full status by 1000hrs tomorrow (Friday).

Friday 3rd August

A. Skinner received a phone call from D. Vanston, Dales Engineering Leith at 0830hrs stating that a drydock could be made available up to Tuesday 7th August but no later. Confirmation of requirement would have to be given by noon today to ensure that this timing could be met and that the barge going into dock could be delayed. Gave Dales details of vessel, BAS contacts and direct JCR contacts – Dales said that they would contact A&P as Skinner wished them to be aware that the matter may be taken out of their hands.

Skinner then phoned J. Pye at BAS HQ and advised him that a drydock was available in Leith, that it was the same one as had been advised over a week ago and that it was being held until noon today pending their go-ahead for the work. J. Pye said that he would contact A&P and make them aware of the facility. I re-iterated the timing required for a decision and hoped that BAS would be able to directly intervene and take up the offer and secure the possibility of continuing the BGS programme.

Skinner also contacted Captain Burgan on the JCR to keep him advised of his intervention with BAS HQ.

Skinner advised by BAS, J. Pye, at noon that arrangements for drydocking in Leith were underway, that there were problems in obtaining a tug for the tow to Leith but A&P were investigating. Skinner contacted three (UK) tug suppliers who confirmed this scarcity but one had a tug returning from Norway available on Saturday am. He then contacted A&P with the tug details and found that they had already begun negotiations with the company for this tug.

Finally Skinner contacted Dales to confirm that arrangements were in hand and that they had the relevant docking details and plans, BAS HQ to ensure that all arrangements for leaving the Tyne and arriving in the Forth were in hand (This confirmed by J. Barnes). He also contacted the Captain and D. Smith BGS just in case they had not been kept abreast of developments.

Saturday 4th August

D. Smith (BGS) leaves JCR in Tyne prior to it sailing.

Sunday 5th August

Vessel arrived in Leith in p.m. and commenced drydocking operation immediately. Overnight working to complete inspection and repair. It was found that the propeller guard had been dented against the propeller shaft and this in turn caused the misalignment and knocking noise heard.

Monday 6th August
Leith then passage to Pentland Firth, wind variable sea slight.
Repairs completed to dent in propeller guard and preparations for re-flooding dock underway by 0800hrs. Vessel then taken from dock to bunkering quay for fuelling and ballast water. Departed Leith at 1700hrs for survey area.

Tuesday 7th August
Passage Pentland Firth – Hebrides Terrace, wind NE3, sea slight.
Sailing to survey location throughout morning and afternoon. Safety Briefing and Boat Drill in morning. Arrived in survey area 1800hrs and set up for coring. Line out metering problem on BGS umbilical winch delayed deployment until a replacement meter was installed.
Deployed drill at site **58-08 227**, water depth 66m. Surface set stepped profile diamond bit 60/80 spc. Seabed photo indicated a rock platform.
Commenced coring at 1845hrs and completed at 1915hrs having penetrated 0.38m. Single piece of core which may have been a pebble in core barrel.
Deployed drill at site **58-08 228** – same location for a second try, this time using an impregnated diamond bit grade 8 matrix. Seabed photo indicated a rock platform.
Commenced coring at 2200hrs and completed at 2321hrs having penetrated 1.32m. Excellent rock core 0.98m long obtained in very hard material.

Wednesday 8th August
Hebrides Terrace, wind NNE3, sea slight.
Deployed drill at site **58-08 229**, water depth 105m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a boulder field.
Commenced coring at 0440hrs and completed at 0510hrs having penetrated 0.99m. Some pebbles recovered.
Deployed drill at site **58-08 230**, water depth 64m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated rock outcrop and some pebbles/boulders at seabed.
Commenced coring at 0814hrs and completed site at 0928hrs having penetrated 2.04m and obtained 1.33m of good fractured rock core.
Deployed drill at site **57-09 530**, water depth 18m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a boulder and pebble strewn seabed.
Commenced coring at 1330hrs and completed site at 1504hrs having made 3.05m penetration at varying speeds. Only pebbles and cored boulders were recovered.
Deployed drill at site **57-09 531,** water depth 137m. Impregnated diamond bit with grade 8 matrix. Seabed photo indicated a boulder and pebble strewn seabed with sediment cover stirred up by the rig landing.
Coring commenced at 1708hrs and was completed at 1820hrs after 3.89m penetration. The rig stalled out and was retracted and restarted but the base of the hole could not be regained. The recovery was pebbles, cored boulders and sand.
Deployed drill at site **57-09 532**, water depth 110m. Impregnated diamond bit with grade 8 matrix. Seabed photo indicated a boulder strewn seabed with some boulders in view up to 0.5m axis. There may be rock pavement between.
Coring commenced at 1957hrs and was completed at 2107hrs after 1.91m penetration. Recovery was pebbles and cored pebbles.

Thursday 9th August
Hebrides Terrace, wind NNW4, sea slight.

Deployed drill at site **57-09 533**, water depth 129m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated boulders and sediment cover a the seabed.
Commenced coring at 0027hrs and completed at 0152hrs having penetrated 2.56m. Recovery was all pebbles or cored pebbles.
Deployed drill at site **57-09 534**, water depth 99m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a flat, boulder-strewn seabed.
Commenced coring at 0449hrs and completed at 0541hrs having penetrated 1.33m with stalling and bit blocking. Recovery was 0.09m of probable core below pebbles.
Deployed drill at site **57-09 535**, water depth 99m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a rocky seabed, possibly rock with fractures.
Commenced coring at 0620hrs and completed at 0658hrs having penetrated 1.02m.
Recovery of 0.09m of possible core.
Deployed drill at site **57-09 536**, water depth 120m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a smooth seabed which the drill indicated was at 11 degrees angle.
Commenced coring at 0851hrs and completed at 0945hrs having penetrated 0.50m. and recovered 0.23m of good core.
Deployed drill at site **57-09 537**, water depth 119m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a rock platform which the drill indicated was at a slope of 22 degrees.
Commenced coring at 1108hrs and completed at 0408hrs having penetrated 2.90m. and recovered 2.49m. of good core.
Deployed drill at site **56-08 920**, water depth 85m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a rock platform with a step and a 12 degree slope according to the drill.
Commenced coring at 1620hrs and completed at 1731hrs having penetrated 1.28m. with 1.08m. of good core recovered.
Deployed drill at site **56-08 921**, water depth 82m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a sediment veneer over probable rock with some boulders.
Commenced coring at 2049hrs and completed at 2300hrs having penetrated 0.90m. with 0.78m. of good core recovered.

Friday 10th August
Hebrides Terrace, wind SSW6, sea moderate.
Deployed drill at site **56-08 922**, water depth 78m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a flat seabed.
Commenced coring at 1126hrs and completed at 0142hrs having penetrated 0.82m with no recovery.
Deployed drill at site **56-08 923**, water depth 78m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a flat seabed.
Commenced coring at 0255hrs and completed at 0335hrs having penetrated 1.52m. Only pebbles were obtained in the core barrel.
Deployed drill at site **56-09 383**, water depth 76m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a rock platform.
Commenced coring at 0615hrs and completed at 0637hrs having penetrated 0.34m and made no further progress. No core recovered.
Deployed drill at site **56-09 384**, water depth 76m. Impregnated diamond bit, grade 8 matrix.
Seabed photo indicated a rock outcrop with a fracture.
Commenced coring at 0720hrs and completed at 0934hrs having penetrated 1.80m. with 1.27m. of good core recovered.
Deployed drill at site **56-08 924**, water depth 76m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated rock on seabed and drill inclination of 18 degrees.

Commenced coring at 1238hrs and completed at 1416hrs having penetrated 1.69m. with 1.13m. of good core recovered.
Deployed drill at site **56-08 925**, water depth 101m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed, possibly a sandwave.
Commenced coring at 1604hrs and completed at 1720hrs having penetrated 1.80m then stalled. Only pebbles and shells recovered with a very polished core barrel.
Deployed drill at site **56-08 926**, water depth 101m. Surface set stepped profile diamond bit, grade 60/80spc. Seabed photo indicated possible sandwaves at seabed.
Commenced coring at 1822hrs and completed at 1930hrs having penetrated 2.10m. Only superficial seabed deposits of mixed lithology obtained.
Deployed drill at site **56-09 385**, water depth 100m. Surface set stepped profile diamond bit, grade 60/80spc. Seabed photo indicated sediment cover with shells and possible pebbles/cobbles.
Commenced coring at 2128hrs and completed at 2223hrs having penetrated 1.33m. and stalled. Retracting did not restart. 0.2m. of core recovered.
Deployed drill at site **56-09 386**, water depth 101m. Impregnated diamond bit, grade 9 matrix. Same location as previous coring attempt. Seabed photo indicated a sediment cover possibly covering some boulders.
Commenced coring at 2251hrs and completed at 0057hrs having penetrated 1.70m. and recovered 1.18m of good core.

Saturday 11th August
Hebrides Terrace – Barra Fan, wind W2, sea slight.
Deployed drill at site **56-09 387**, water depth 80m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a boulder strewn seabed with thin sediment cover and ?living molluscs.
Commenced coring at 0315hrs and completed at 0353hrs having penetrated 0.5m. and obtained 0.13m. of core.
Deployed drill at site **56-09 388**, water depth 88m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated sediment cover and boulders with ?living molluscs.
Commenced coring at 0419hrs and completed at 0544hrs having penetrated 0.83m.
0.21m. of core recovered.
Deployed vibrocorer at site **56-10 248**, water depth 650m. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 1132hrs but unable to vibrate. Penetrate and recover 2.43m. of sediment. Retrieve rig to deck for repairs to a broken motor lead and remove sample collected by gravity when freefall valve was opened
Deployed vibrocorer at site **56-10 249**, water depth 655m. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 1538hrs and completed at 1542hrs having penetrated and recovered 4.2m. of sediment.
Gravity core then taken at the same location with 4.33m core length obtained.
Deployed vibrocorer at site **56-10 250**, water depth 735m. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 1720hrs and completed at 1724hrs having penetrated and recovered 4.36m. of sediment.
Gravity core then taken at the same location with 3.84m. core length obtained.
Deployed vibrocorer at site **56-10 251**, water depth 777m. Seabed photo indicated a sediment covered seabed.
Commenced coring at 2008hrs and completed at 2010hrs having penetrated and recovered 4.0m. of sediment.

Gravity core then taken at the same location with 2.77m. core length recovered.
Deployed vibrocorer at site **56-10 252**, water depth 724m. Seabed photo indicated a sediment covered seabed.
Commenced coring at 2305hrs and completed at 2307hrs having penetrated and recovered 4.48m. of sediment.
Gravity core then taken at the same location with 3.38m core length recovered.

Sunday 12th August
Barra Fan - Anton Dohrn Area, wind WSW3, sea moderate-slight
Deployed vibrocorer at site **56-10 253**, water depth 592m. Seabed photo indicated a sediment covered seabed.
Commenced coring at 0229hrs and completed at 0236hrs having penetrated and recovered 4.3m. of sediment.
Gravity core then taken at the same location but achieved only 0.1m penetration.
Deployed vibrocorer at site **56-10 254**, water depth 644m. Seabed photo indicated a sediment covered seabed.
Commenced coring at 0557hrs and completed at 0559hrs having penetrated and recovered 4.39m. of sediment.
Gravity core not taken at the same location as seabed photo indicated a likely poor result based on last location photo and results.
Deployed vibrocorer at site **56-10 255**, water depth 644m. in lieu of gravity core. Seabed photo indicated a sediment covered seabed.
Commenced coring at 0704hrs and completed at 0706hrs having penetrated and recovered 4.79m. of sediments.
Deployed drill at site **57-12 41**, water depth 670m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 1502hrs and completed at 1709hrs having penetrated 4.03m and stalled. Unable to restart drill and also unable to retract out of seabed. Release core barrel to base and lift frame – frame clear of seabed but barrel still stuck. Keep strain on winch and use swell to ease free over a period of time. Recover to deck with retraction wire broken and bit and reamer broken off but 1.14m. of core still in core barrel. Core indicates high indication of jamming in loose, abrasive sediments.
Replace retraction wire and core barrel assembly.
Deployed drill at site **57-12 42**, water depth 740m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment and pebble covered seabed.
Commenced coring at 2232hrs and completed at 2308hrs having penetrated 1.78m. All the time closely observing the flushing to ensure no blocking. However no core was recovered.

Captain reports that a mayday has been received and that we are likely to be the closest vessel. Secure aft deck for passage and await instructions from Stornoway Coastguard. Subsequently asked to attend to casualty which is a Scottish Fishing Boat 'Aurelia' which is taking on water and flooding with engine stopped.
Make all speed to last known position.

Monday 13th August
North of Anton Dohrn, wind SW5, sea moderate.
Sailing Northwards to rendevous with 'Aurelia'. Fishery protection vessel 'Norna' also in attendance and arrived first and dealt with casualty. Fishing Vessel Aurelia with five persons on board sank in position 57deg. 52.88min. N. 011deg. 01.86min. W. All rescued from liferaft by

seaboat from 'Norna' and transferred to coastguard helicopter from Stornoway after medical assessment in what was a very slick operation in fog and moderate sea conditions.

Revised coring site plan in light of new position after standing down from Mayday as some sites were closer than those originally planned.

Deployed gravity corer at site **58-12 9**, water depth 1935m. Penetration 6m into seabed and 3.35m. of sediment core recovered.
Deployed drill at site **57-14 57**, water depth 142m. Impregnated diamond bit, grade 8 matrix. Seabed photo indicated a sediment covered seabed.
Commenced coring at 1219hrs and completed at 1357hrs having penetrated 1.33m with a lot of stalling. 0.48m of cored pebbles of the same type recovered.
Deployed drill at site **57-14 58**, water depth 122m. Impregnated diamond bit, grade 8. No seabed photo available.
Commenced coring at 1558hrs and completed at 1722hrs having penetrated 2.61m. and obtained 1.81m of excellent core.
Camera light failed to function and on recovery find the lead disconnected and the plug shorted. Probably a fuse inside the subsea electronics bottle has blown. Debate the possibility of moving the rig inboard for repairs but postpone for further checks and move to next site in the meantime.

Camera not functioning on replacement cable. Internal fuse or relay in subsea computer bottle failed. Weather not good for moving rig inboard for repairs so go on next site without camera. Fax Forecast indicates a high pressure system coming in tomorrow when we will also be in deeper water so that may be the best time to effect an inboard lift for repair.

Deployed drill at site **57-14 59**, water depth 114m. Impregnated diamond bit, grade 8 matrix. No seabed photo available.
Commenced coring at 1926hrs and completed at 2016hrs having penetrated 0.96m. and obtained 0.13m. of core.
Deployed drill at site **57-14 60**, water depth 114m. Impregnated diamond bit, grade 8 matrix. No seabed photo at this site which has the same location as the previous attempt.
Commenced coring at 2055hrs and completed at 2147hrs having penetrated 1.03m. This time obtained a good core 0.31m. in length.
Deployed drill at site **57-14 61**, water depth 128m. Impregnated diamond bit, grade 9 matrix. No seabed photo and rig on 25-30 degree incline despite two attempts to land in better place. (One attempt resulted in rig falling over).
Commenced coring at 2335hrs and completed at 2340hrs having been unable to start the rig. It appears that the rig may be damaged so retrieve to deck for inspection. No core recovered.

Tuesday 14th August
Rockall Area, wind WSW6, sea moderate-heavy.
Retrieved rig to deck and assessed situation. Ascertain that there is a problem in energising the hydraulic valve which rotates the kelly. This requires the rig to be brought inboard for repairs and with the heavy swell running this has to wait until daylight to be attempted. Prepare ropes, slings etc. and likely spares and await daylight.
Commence lifting inboard at 0700hrs and completed and secured by 0730hrs. Remove subsea computer innards on end flanges to workshop for examination and repair. Complete all repairs and workshop tests by 1230hrs and refit to rig and re-test. Then move rig outboard and re-secure in launch position. Re-locate to next site as have been running with the sea to effect lift in

calmest conditions possible. Sea state 5-7 in morning reducing 4-6 in afternoon but still with heavy swell.
Deployed drill at site **57-15 14**, water depth 250m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a smooth and probably sandy seabed.
Commenced coring at 1545hrs and completed at 1656hrs having penetrated 0.95m. No recovery and a bent corebarrel which may have been a function of the previous evening's bashing on the seabed as the bend was inside the kelly. Replace core barrel for retry at the same site.
Deployed drill at site **57-15 15**, water depth 250m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a smooth and probably sandy seabed which is reassuring since it is at the same location as the previous drilling attempt.
Coring commenced at 1754hrs and completed at 1905hrs having penetrated 1.28m.
0.59m. comprising some pebbles and then fractured core was recovered.
Deployed drill at site **57-15 16**, water depth 265m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a soft sediment seabed disturbed by the rig landing.
Commenced coring at 2041hrs and completed at 2202hrs having penetrated 4.86m.
0.58m of superficial deposits were recovered.

Wednesday 15th August
WestSouthWest of Rockall, wind SSW 4, sea moderate.
Deployed drill at site **57-15 17**, water depth 200m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a soft sediment seabed disturbed by the rig landing.
Commenced coring at 0003hrs and completed at 0125hrs having penetrated 1.39m.
0.1m. of seabed deposits were recovered.
Deployed drill at site **57-15 18**, water depth 191m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a mottled ?gravelly seabed.
Commenced coring at 0352hrs and completed at 0455hrs having penetrated 1.25m.
0.45m. of superficial deposits were recovered.
Deployed drill at site **57-15 19**, water depth 167m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy bottom with sediment plume caused by rig landing.
Commenced coring at 0622hrs and completed at 0704hrs having penetrated 1.01m.
0.18m. of superficial deposits were recovered.
Deployed drill at site **57-15 20**, water depth 167m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a pebbly seabed.
Commenced coring at 0740hrs and completed at 0910hrs having penetrated 1.3m. Only 0.17m. of pebbles recovered.
Deployed drill at site **57-15 21**, water depth 178m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a boulder seabed with some fine sediment cover also.
Commenced coring at 1120hrs and completed at 1258hrs having penetrated 1.3m.
Only 0.5m. of pebbles recovered.
Deployed drill at site **57-15 22**, water depth 178m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a gravelly seabed.
Commenced coring at 1441hrs and completed at 1533hrs having penetrated 1.18m.
Only 0.27m. of pebbles recovered.
Deployed drill at site **57-15 23**, water depth 214m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy seabed with ?gravel and clouding due to sediment plume as rig was landed.
Commenced coring at 1739hrs and completed at 1821hrs having penetrated 1.33m.
Only 0.36m. of pebbles recovered.

Deployed drill at site **57-15 24**, water depth 183m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sediment covered seabed with pebbles and cobbles.
Commenced coring at 2023hrs and completed at 2118hrs having penetrated 0.89m.
Only 0.23m. of pebbles recovered.
Deployed drill at site **57-15 25**, water depth 196m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a ?scour in sediment or a fracture if rock.
Commenced coring at 2244hrs and completed at 2345hrs having penetrated 1.48m.with stalling at times. Recovery was 0.25m. of pebbles.

Thursday 16th August
West of Rockal, wind NNW4, sea slight.
Deployed drill at site **57-15 26**, water depth 219m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cover with pebbles and cobbles.
Commenced coring at 0200hrs and completed at 0249hrs having penetrated 0.77m.
Only 0.12m. of pebbles recovered.
Deployed drill at site **56-15 13**, water depth 185m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cloud caused by landing the rig.
Commenced coring at 0446hrs and completed at 0613hrs having penetrated 4.86m.
1.0m. of sand and gravel deposits were recovered.
Deployed drill at site **56-15 14**, water depth 185m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cover with pebbles.
Commenced coring at 0812hrs and completed at 0905hrs having penetrated 1.79m. with stalling at times. 0.73m. of superficial deposits were recovered.
Deployed drill at site **56-15 15**, water depth 186m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment cover with pebbles.
Commenced coring at 1057hrs and completed at 1245hrs having penetrated 3.90m.
0.26m. of superficial deposits were recovered.
Deployed vibrocorer at site **56-15 16**, water depth 186m. Same location as previous drill site to see if material is sediment/soft. Seabed photo indicated it was probably sandy.
Commenced coring at 1329hrs and completed at 1335hrs having made no penetration and no core recovered. Sand grains on shoe and liner/catcher.
Deployed drill at site **56-15 17**, water depth 197m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a ?gravelly seabed.
Commenced coring at 1552hrs and completed at 1725hrs having penetrated 2.2m.with frequent stalling towards the end. Only 0.22m. of pebbles were recovered and the bit was totally worn out.
Deployed drill at site **56-15 18**, water depth 182m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a rock outcrop and the drill was lying at a ten degree inclination.
Commenced coring at 1824hrs and completed at 2004hrs having penetrated 4.52m. 4.21m of excellent core was recovered.
Deployed drill at site **56-15 19**, water depth 238m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a ?sandy seabed.
Commenced coring at 2315hrs and completed at 2353hrs having penetrated 1.4m.
And obtained 0.4m of superficial deposits.

Friday 17th August
West of Rockall, wind S 2, sea slight.
Deployed drill at site **57-16 16**, water depth 601m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sediment covered pebbly seabed.

Commenced coring at 0216hrs and completed at 0252hrs having penetrated 4.88m. Obtained 0.48m. of core.
Deployed vibrocorer at site **57-16 17**, at same location, water depth 601m. Seabed photo indicated a sediment cover disturbed by the rig landing.
Commenced coring at 0407hrs and completed at 0414hrs having penetrated and recovered 3.48m. of sediment over rock.
Deployed vibrocorer at site **57-16 18**, water depth 670m. Seabed photo indicated a sediment cover disturbed by the rig landing.
Commenced coring at 0550hrs and completed at 0600hrs having penetrated 3.19m.
Recovered 2.71m. of core and lost some due to inverted catchers.
Deployed drill at site **57-17 5**, water depth 961m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy seabed with some pebbles. Trouble finding seabed due to site being on a pinnacle. Rig lying at 12 degrees while drilling.
Commenced coring at 1050hrs and completed at 1357hrs having penetrated 4.64m. Recovered 4.4m. of good core.
Deployed drill at site **57-17 6**, water depth 924m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy seabed.
Commenced coring at 1523hrs and completed at 1844hrs having penetrated 4.88m.with fast penetration at the end. 3.1m. of good but undercut core recovered.
Deployed drill at site **57-17 7**, water depth 809m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy seabed.
Commenced coring at 2048hrs and completed at 2329hrs having penetrated 3.51m.
1.68m of core recovered.

Saturday 18th August
SouthWest of Rockall, wind S 4, sea slight.
Deployed drill at site **57-17 8**, water depth 691m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy seabed with some ?rock outcrop and some boulders.
Commenced coring at 0123hrs and completed at 0423hrs having penetrated 4.11m.
3.81m. of core recovered.
Deployed drill at site **57-17 9**, water depth 926m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sediment covered seabed.
Commenced coring at 0550hrs and completed at 0700hrs having penetrated 4.16m.
0.94m of core recovered.
Deployed drill at site **56-16 32**, water depth 176m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy seabed with ?rock outcrop or boulders.
Commenced coring at 1304hrs and completed at 1354hrs having penetrated 2.15m.and then stopped. 0.12m. of pebbles and a rock core retrieved, rock may have been in situ as large pull-out required to break it.
Deployed drill at site **56-16 33** in same location as previous core, water depth 176m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy seabed strewn with boulders.
Commenced coring at 1441hrs and completed at 1545hrs having penetrated 1.83m.then stopped .
Recovered 0.46m. of pebbles and core.
Deployed drill at site **56-16 34**, water depth 187m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a bouldery and pebbly seabed.
Commenced coring at 1714hrs and completed at 1858hrs having penetrated 1.2m. then stopped due to no further penetration. Recovered 0.46m.of cemented sediment, pebbles and core.
Deployed drill at site **56-15 20**, water depth 181m. Impregnated diamond bit, grade 9 matrix.
Seabed photo indicated a sandy and pebbly seabed.

Commenced coring at 2126hrs and completed at 2300hrs having penetrated 1.61m. then stopped due to no further penetration. Recovered 0.37m. of pebbles.
Deployed drill at site **56-15 21**, at same location, water depth 181m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sandy and pebbly seabed.
Commenced coring at 2338hrs and completed at 0044hrs having penetrated 1.13m. then stopped due to no further penetration. Recovered 0.32m. of pebbles.

Sunday 19th August.
S. and W of Rockall, Wind WSW 4, slight sea, moderate swell.
Completed core site described above.
Deployed drill at site **56-15 22**, water depth 181m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered, pebbly and cobbly seabed.
Commenced coring at 0225hrs and completed at 0335hrs having penetrated 1.98m. with stalling then stopped due to no further penetration. Recovered 0.31m. of pebbles.
Deployed drill at site **56-15 23**, water depth 182m. Impregnated diamond bit, grade 9 matrix. Seabed photo indicated a sediment covered seabed clouded by the rig landing.
Commenced coring at 0502hrs and completed at 0537hrs having penetrated 1.35m. with stalling then stopped due to no further penetration. Recovered 0.24m. of pebbles.
Deployed drill at site **56-15 24**, water depth 192m. Surface set stepped profile diamond bit, 60/80spc. Seabed photo indicated a sediment covered pebbly seabed.
Commenced coring at 0615hrs and completed at 0646hrs having penetrated 1.38m. with stalling then stopped due to no further penetration. Recovered 0.17m. of pebbles.
Deployed vibrocorer at site **57-16 19**, water depth 666m. Seabed photo indicated a sediment covered pebbly seabed.
Commenced coring at 1017hrs and completed at 1029hrs having penetrated 3.31m. Very strong retraction force required for pull-out and 3.07m. of good soft rock core obtained above an inverted catcher.

Commenced Passage to Portsmouth, begin de-rigging equipment for demobilisation.

Monday 20th August
Off Skellys (SW Ireland) at midday. Wind SSW 5, moderate sea and swell.
On Passage to Portsmouth. Continue dismantling equipment and packing laboratory equipment, cores etc. Re arranging equipment for return or staying on board for next operation in Antarctic.
Fire and Boat drill carried out at 1030hrs.

Tuesday 21st August
S. and W of Rockall, Wind WSW 4, slight sea, moderate swell.
On passage to Portsmouth. Catching up on paperwork and all shipping documents for ending this cruise and preparing for JR71 in the Antarctic.

Wednesday 22nd August
Pick up Pilot in southampton Water at 0800hrs.
Commence re-arranging of BGS equipment for IFOS.
Some BGS cores picked up from vessel by arranged vehicle.
P. Kempton, M. Mackey, O. Cadhla, C. Morri leave vessel.

Thursday 23rd August

Remaining BGS personnel leave vessel. Cruise completed except for demobilisation which will be completed in Grimsby after IFOS.

Saturday 25th August/ Sunday 26th August

Neil Campbell and James Glendinning return to vessel which had relocated to Grimsby with additional vehicle from D.N. Clarkson. Additional equipment taken south for JR71 cruise and stored beside vessel for later loading. All existing rockdrill and gravity coring equipment removed and returned to Edinburgh. Umbilical winch left on for next vibrocoring phase. Demobilisation completed 1100hrs Sunday.