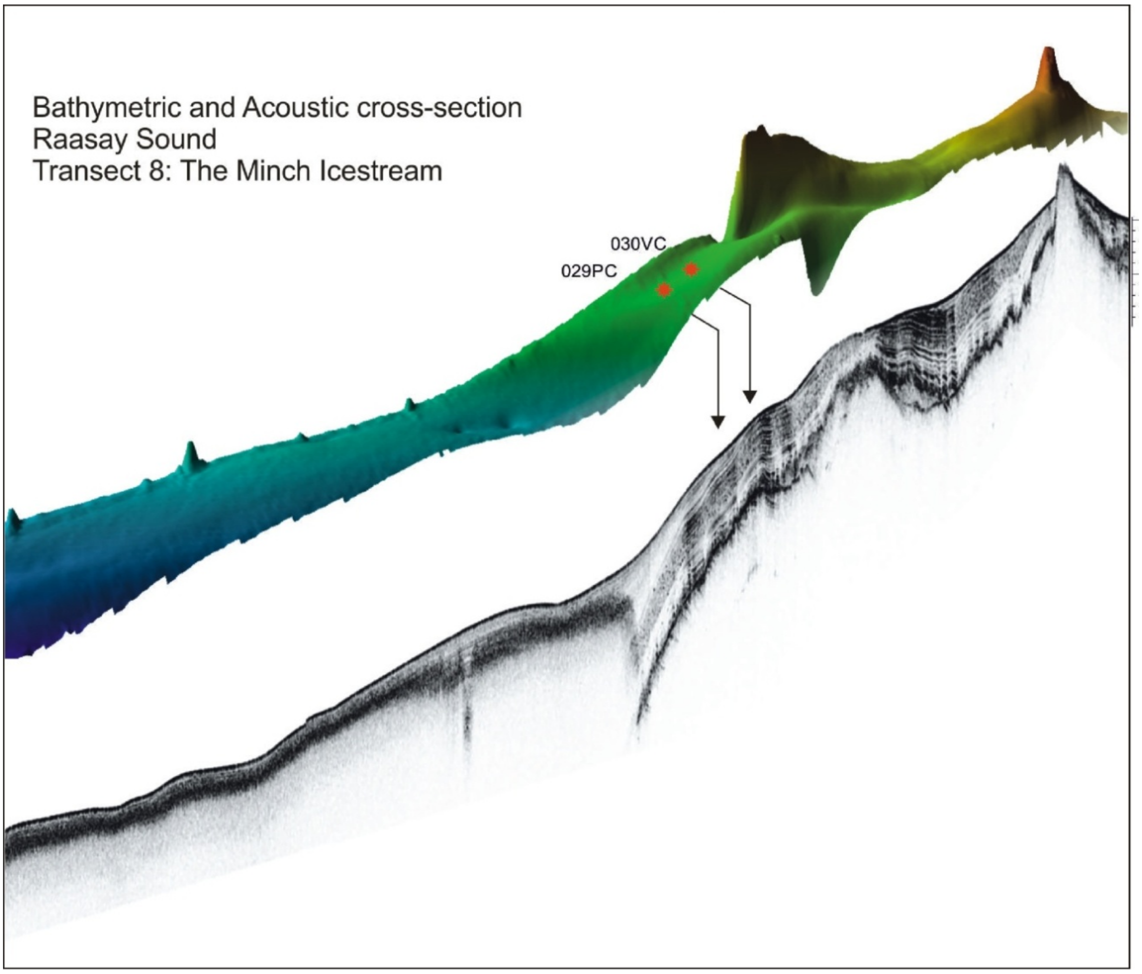
Cruise Report JC123 - RRS James Cook

'Britice-Chrono: constraining rates and styles of marine-influenced ice sheet retreat'

Colm O'Cofaigh (PSO, Department of Geography, Durham University) and the Scientific Party of JC123

July 3 – August 2, 2015


Bathymetric and Acoustic cross-section
Raasay Sound
Transect 8: The Minch Icestream
030VC
029PC

1.1 Acknowledgements

We thank the officers and crew of the RRS James Cook for their support and professionalism throughout cruise JC123. The work was funded by the UK Natural Environment Research Council.

1.2 Scientific Background, Aims and Achievements

Cruise JC123 was the second of two cruises on the UK research vessel the RRS James Cook related to the research project*"BRITICE-CHRONO: constraining rates and style of marine-influenced ice sheet decay"*. BRITICE-CHRONO is a five-year research project that brings together more than 40 researchers comprising glaciologists, marine and terrestrial Quaternary scientists and ice-sheet modellers. It involves researchers from eight UK universities, plus the British Geological Survey, British Antarctic Survey, NERC's radiocarbon facility and Scottish Universities Environmental Research Centre as well as project partners in Ireland, Italy, Sweden and Norway.

The underlying rationale behind BRITICE-CHRONO is concern about the retreat/stability of the marine-influenced West Antarctic and Greenland ice sheets, and consequent sea-level rise. It is imperative that we can predict the future rates of change of these large ice masses but our current ability to do so is limited and a weakness in climate science. Numerical ice sheet models – capable of making predictions have yet to be adequately tested against data on the pattern and timing of a shrinking ice sheet. Although recent work has constrained the pattern of retreat of the ice sheet that once covered Ireland and Britain (Clark et al., 2012, Quaternary Science Reviews), the *timing* of that retreat is inadequately constrained. BRITICE-CHRONO is a systematic and directed campaign to collect and date material to constrain the timing and rates of change of the British-Irish Ice Sheet (BIIS). Retreat of the BIIS will become the best constrained anywhere and be the benchmark against which predictive ice sheet models are improved and tested, thus contributing greatly to glaciology, climate and Quaternary science and the veracity of predictions of sea-level change.

The overall aim of the project is to provide the World's best reconstruction of the demise of a marine-based ice sheet and one that will be critical in developing and testing the next generation of ice sheet models. To achieve this we seek to answer the following research questions:

1. How do marine-based ice sheets deglaciate? By steady, stepped or catastrophic retreat, or partial 'float-off'?
2. What is the main driver(s) of retreat and what is the relative importance of climate change vs. sea level rise?
3. How is ice loss affected as the ice sheet margin crosses the marine-terrestrial transition? Once it back-steps onto land for how long does it stabilise, is it prone to quasi-stable oscillations?

4 What is the glaciological significance of ice rafted detritus (IRD)? This is fundamental for resolving the above because there is current uncertainty as to whether an IRD layer represents ice sheet margin advance or retreat.

5 Which ice sheet model implementations of iceberg calving, grounding line dynamics and ice stream mechanics are best suited for predicting ice sheet retreat?

The BIIS is ideal for such study because two-thirds of the ice sheet was marine-based, and drained by ice streams during its last major phase of expansion about 26,000-23,000 years ago, possibly with some fringing ice shelves, and it is thus a useful analogue for the West Antarctic Ice Sheet (WAIS). It was relatively small (~1/3 volume of WAIS) and therefore presents less demanding computational effort for modelling experiments and fieldwork accessibility compared to other ice sheets such as Greenland and Antarctic is straightforward. Furthermore there is a rapidly growing archive of marine geophysical data around the continental shelf, e.g., the datasets of the Irish National Seabed Survey and INFOMAR.

The focus of BRITICE-CHRONO is on retreat rates from marine-calving to terrestrial-melting margins and this requires that effort is split between these environments. The marine and terrestrial work is fully integrated and follows a common sampling strategy and procedure. Research effort is organised via a series of 8 transects from the continental shelf edge to a short distance (~30 km) onshore (Figure 1).

Cruise JC123 on the RRS James Cook in 2015 was the second BRITICE-CHRONO cruise. It focused on transects 1 (East Shetland), 2 (North Sea) and 8 (The Minch) (Figure 1).

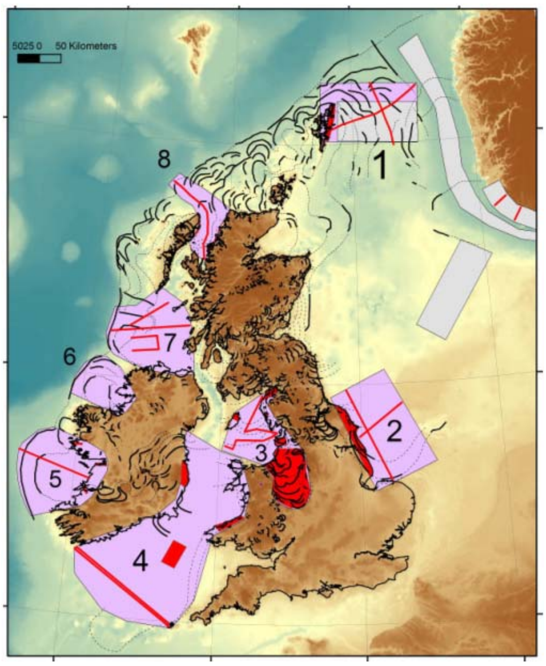


Figure 1. *BRITICE-CHRONO transects. Numbered transects in violet and which all stretch onshore for tens of kilometres (red). Black lines show the known ice sheet retreat pattern. Cruise JC123 focused on transects 1, 2 and 8.*

During JC123 we collected 7176 km of geophysical data using an EM710 multibeam echo sounder system and a Kongsberg SBP-120 sub-bottom profiler. These geophysical data were used to identify targets for coring. Coring utilised a British Geological Survey 6 m long vibrocorer system and NMFSS 9-15 m piston corer. One hundred and seventy nine cores were collected during the cruise. Survey transects and associated coring sites were planned by the scientific party based on previous available datasets including survey data collected by British Geological Survey. During the cruise each pre-planned transect was re-assessed using geophysical and multibeam investigations in order to verify and confirm previous interpretations, fine tune core locations or add new ones. Data collection during

JC123 began in the Minch (T8), then moved to the continental shelf west and east of the Shetlands (T1) and then progressed southwards down the North Sea to the southern Dogger Bank and the area offshore the Humber and the Wash (T2). In addition geophysical data and cores were also acquired on transit between these study areas. Maps showing geophysical data tracks and core locations are presented in Figures 2-6 below

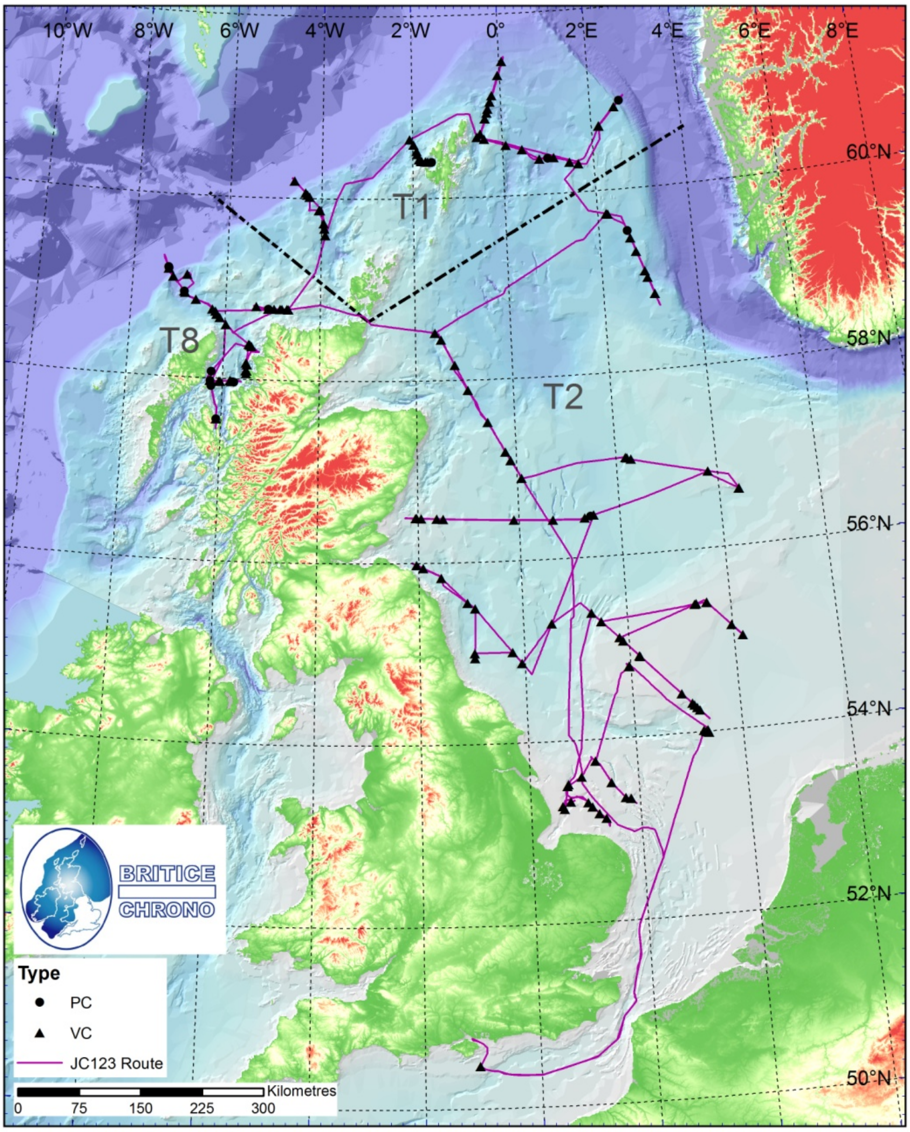


Figure 2. JC123 – Cruise track and core locations

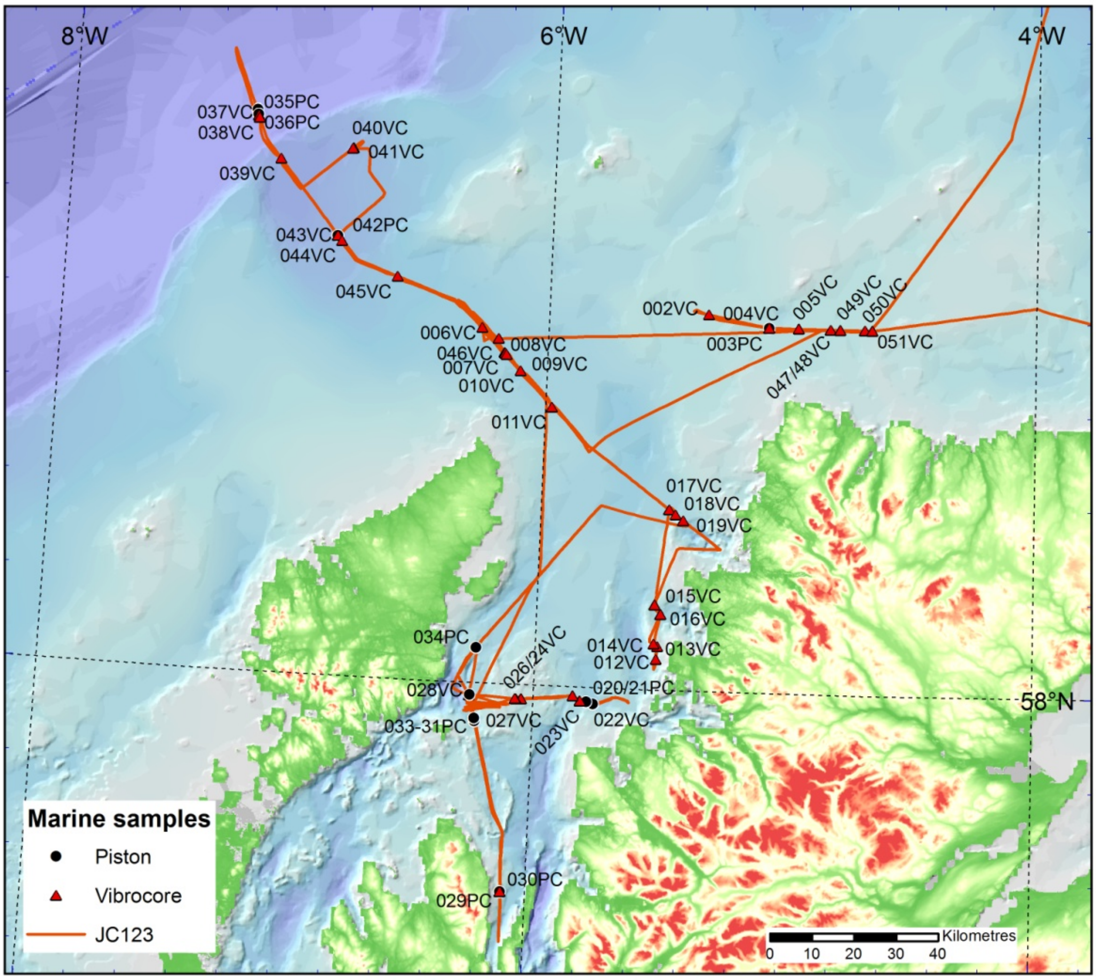


Figure 3. Cruise track and core locations in the Minch (T8) during JC123

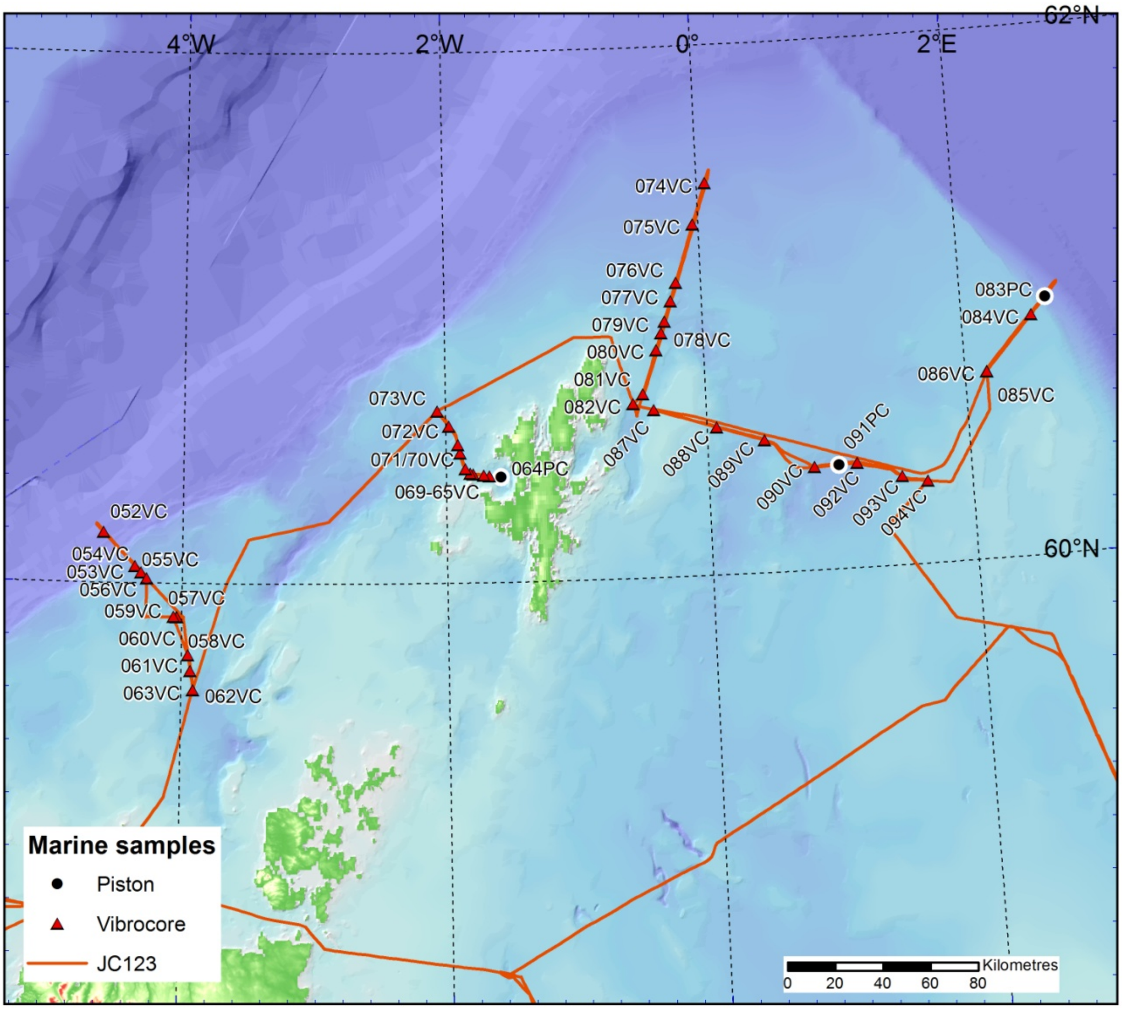


Figure 4. Cruise track and core locations east and west of Shetland (T1) during JC123

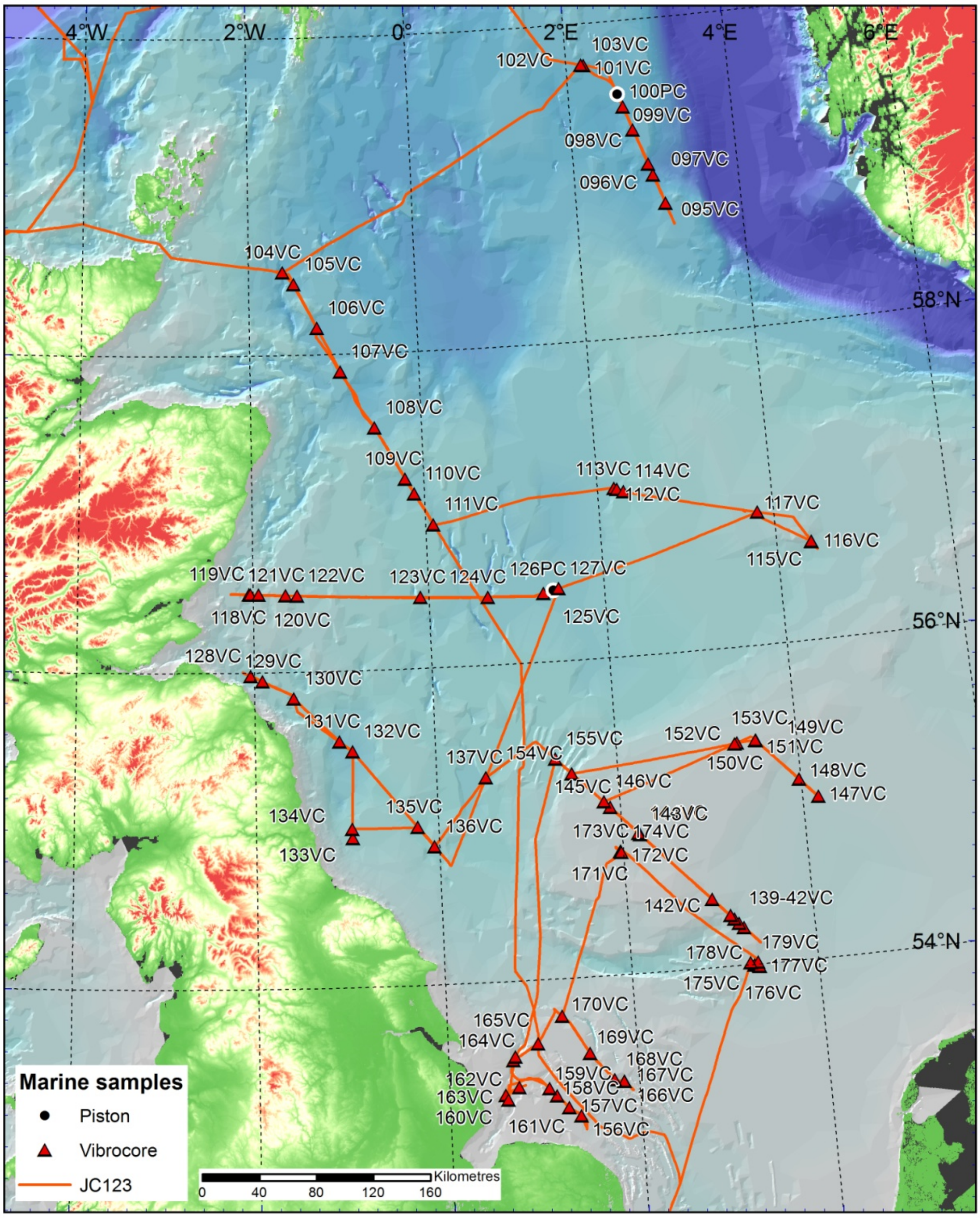


Figure 5. Cruise track and core locations in the North Sea (T2) during JC123

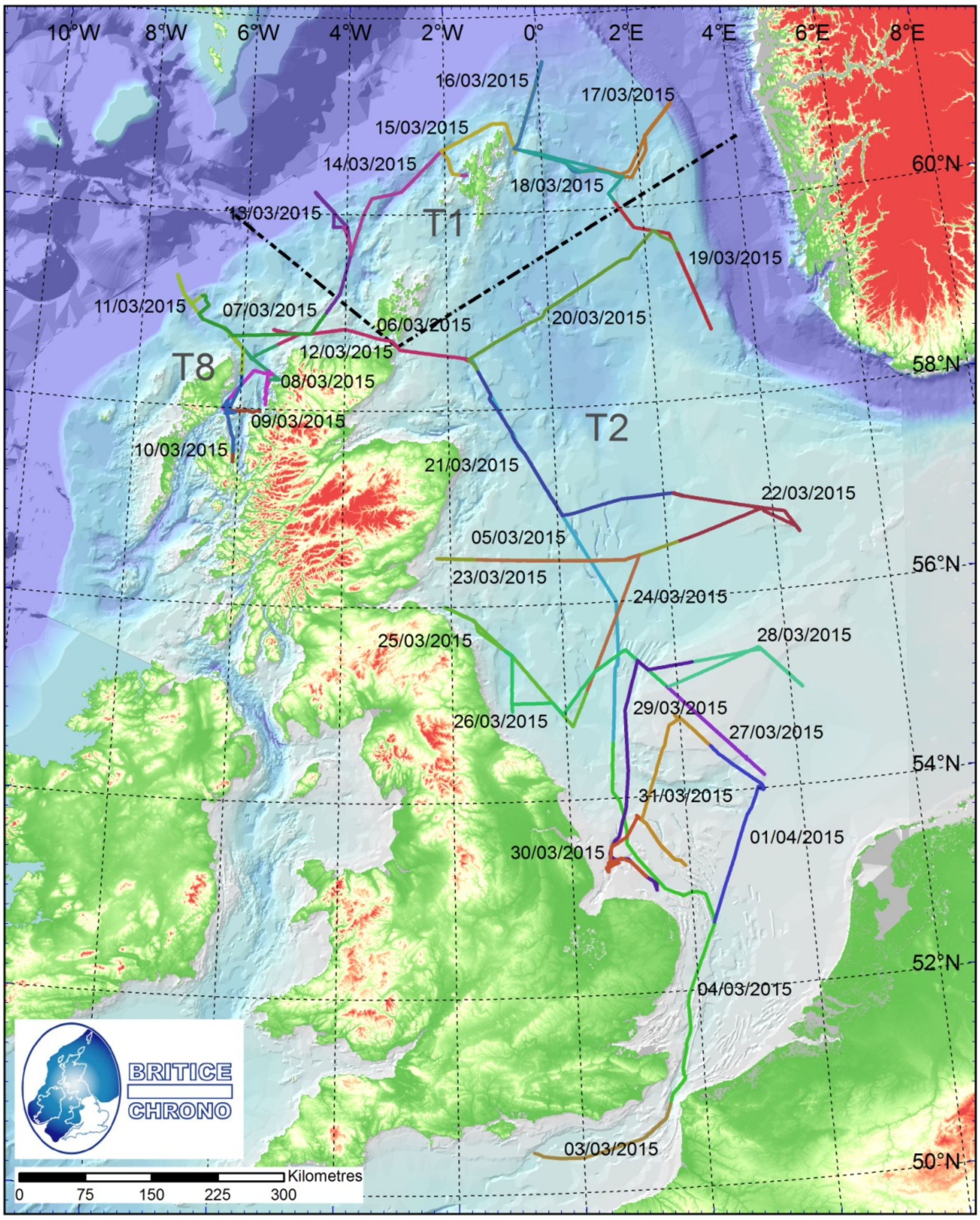


Figure 6. Cruise JC123 cruise track labelled by day

1.3 Cruise Participants

1	LEASK	JOHN ALAN	Master
2	ALVAREZ MUNOZ	PIERS	C/O
3	GRAVES	MALCOLM HAROLD	2/0
4	NORRISH	NICHOLAS	2/0
5	BRETT	ROBERT	Ch.Eng
6	KEMP	CHRISTOPHER	2/E
7	DOHERTY	NOEL	3/E
8	SLATER	GARY	3/E
9	DAMERELL	PAUL Darren	ETO
10	BULLIMORE	GRAHAM	PCO
11	MACDONALD	JOHN EWAN	CPOS
12	MACLEAN	ANDREW	CPOD
13	HOPLEY	JOHN	POD
14	MACHIN	NEIL	ERPO
15	WILCOX	SIMON	SG1A
16	VARGAS	SAMUEL HUGO DAY	SG1a
17	MILLAR	GERARD	SG1a
18	GIBSON	DAVID	SG1a
19	HAUGHTON	JOHN	H/Chef
20	LINK	WALTER JOHN	Chef
21	ROBINSON	PETER WAYNE	Stwd
22	PIPER	CARL	A/Stwd
23	DOIG	CALLUM	Cadet
24	HOLMES	ANDREW DAVID	Cadet
25	SHOTTON	LEE MICHAEL	Cadet
26	DAWKINS	SAMUEL	Cadet
27	O’COFAIGH	COLM	PI
28	MCGRATH	MARIAN	Scientist
29	GALES	JENNY ANNE	Scientist
30	SAHER	MARGOT HELEEN	Scientist
31	MELLET	CLAIRE LOUISE	Scientist
32	PHEASANT	IAIN JACK	Scientist
33	RICHARDSON	CONNOR DAVID	Scientist
34	TSILLIGANNIS	APOSTOLOS	Scientist
35	BRADWELL	TOM	Scientist
36	CALLARD	SARAH LOUISE	Scientist
37	CHIVERRELL	RICHARD	Scientist
38	CLARK	CHRISTOPHER	Scientist
39	DOVE	DAYTON WALKER	Scientist
40	GILLIES	ALAN	Scientist
41	GRIMOLDI	ELENA	Scientist
42	HOTHERSALL	JOSEPH LEO	Scientist
43	INGLE	ALEXANDER JOHN	Scientist
44	MONTES	MARIAN SANCHEZ	Sci
45	MORGAN	SALLY	Scientist
46	ROBERTS	DAVID HOWARD	Scientist
47	SYMES	LISA JANE	Scientist
48	TARLATI	SERENA	Scientist
49	EVANS	JEREMY MARSHALL	Technician
50	POOLE	BENJAMIN GEORGE	Tech

1.4 JC123 Cruise Narrative (Science)

Thursday July 2

Scientific party arrive at ship by 13.00-14.00 hours. Ship familiarisation and safety briefing from Purser at 16.00 hr. Science party meeting at 17.30 hr.

Friday July 3

Ship sailed at 09.00 hrs. Following MMO observations and a soft start geophysical data acquisition commenced at 11.00 hrs. A first vibrocore was collected SE of the Isle of Wight in 38 m of water at 12.00 hrs to test the vibrocorer. This was successful. We transited eastwards passing into French waters at 22.45 hrs whereupon geophysical data acquisition ceased. A full ship safety drill involving all of the science party was carried out at 16.15 hrs.

Saturday July 4

We crossed back into UK waters at 04.50 hrs and following an MMO observation watch and soft start we recommenced geophysical data acquisition. An SVP was collected for EM710 calibration purposes at 10.00 hrs. We continued the transit through the Dover Strait and northwards.

Sunday July 5

Continued northwards transit imaging impressive tunnel valleys with thick stratified infills on the sub-bottom profiler. An SVP was collected at 23.20 hrs. following which a short EM710 survey was run for calibration purposes.

Monday July 6

The calibration survey finished at 01.51 hrs and we transited through the Pentland Firth reaching maximum speed of 19 kts through the channel. At 10.00 we commenced a 20 mile survey from east to west directly north of Cape Wrath. We finished the survey by 13.18 hrs and then proceeded back east collecting a series of vibrocores and a piston core (002VC-005VC). Electrical problems with the vibrocorer forced a termination of the coring transect and we proceeded west to the shelf trough offshore of the mouth of the The Minch.

Tuesday July 7

We commenced a swath survey along the bathymetric trough leading from the outer Minch to the shelf edge. Deteriorating weather and vibrocorer repairs necessitated the termination of this survey line and we transited back south-west towards the Minch collecting 6 vibrocores (006VC-011VC). These cores had good recovery with 006VC and 010VC recovering 5.06 m and 5.37 m of sediment respectively. Upon completion of 011VC we commenced a SW swath survey line into the Northern Minch and then surveyed southwards to 58˚03.72’N 05 ˚30.78’W.

Wednesday July 8

We commenced a vibrocoring transect northwards back up the North Minch survey line collecting 8 vibrocores (012VC-019VC) en-route. Electrical problems with the vibrocore meant that we postponed collection of the last two cores selected from this survey line and at 18.24 hrs we re-commenced a swath survey southwards along the western side of the Minch before turning east and surveying across the central Minch.

Thursday July 9

We completed the Central Minch swath survey early on the morning of the 9th and commenced a coring transect from east to west back along the survey line collecting two piston cores (020PC-021PC) in 116 m and 105 m of water respectively and recovering 6.93 m and 8.69 m respectively at the eastern end of the survey line. This was followed by collection of 022VC which recovered 4.67 m of sediment in 83 m of water. A series of 6 vibrocores were then attempted with all recovering 0 m of sediment with the exception of the last 028VC at the western end of the survey line which collected a bag sample. At 6 pm we commenced a survey south into Raasay Sound imaging thick basin fills of stratified sediment on the sub-bottom profiler. We collected 029PC in 84 m water depth at 57˚33.465’N 06 ˚05.822’W in Raasay Sound, recovering 8.89 m of sediment. A test of the vibrocorer in the same basin fill at the same site only recovered a bag sample.

Friday July 10

We transited northwards out of Raasay Sound collecting a series of piston cores in the central Minch with good recovery of over 8 m in a probable glacimarine sediment fan (031PC-033PC). On-going problems with the vibrocorer prevented deployment and we proceeded north collecting piston core 034PC in 100 m of water east of Lewis. We remained on station for two hours following collection of this piston core for vibrocore repair and testing before transiting south and commencing a short multibeam and sub-bottom survey across the glacimarine fan in the central Minch. We broke off from this survey at 21.30 hrs and proceeded to head north and then NW towards the shelf edge.

Saturday July 11

We surveyed NW along the outer shelf trough, acros the shelf edge and down to about 800 m water depth on the slope. The sub-bottom profiler imaged thick sequences of stratified sediments on the slope and we collected two piston cores (035PC and 036PC). Following a re-termination of the vibrocorer umbilical overnight we collected two vibrocores on the upper slope (037VC and 038VC), both of which recovered over 4 m of sediment. We then proceeded SE back onto the outer shelf where we again deployed the vibrocorer recovering 4 m of sediment (039VC) before surveying to the NE and recovering 040VC in 175 m of water at the edge of a thick extensive basin fill of stratified sediments. This vibrcore recovered 6 m of sediment shortly after midnight with the base of the core containing stiff diamicton (till).

Sunday July 12

A second shorter core (041VC) was recovered from the edge of the stratified basin fill and again bottomed out in till although with overall shorter recovery (1.5 m). We proceeded SE and then SW to re-join the main trough where we deployed the piston corer (042PC). Recovery was poor, however, and so we then deployed the vibrocorer at the same site recovering 4.59 m of sediment (043VC). We completed the coring transect to the SE in the outer Minch shelf trough collecting 3 more vibrocores, again recovering till (044VC-046VC). Following this we transited directly west to the pick up our earlier survey line north of Cape Wrath and collected 5 vibrocores along the eastern section of this (047VC-051VC). This completed T8.

Monday July 13

We transited northeast overnight and commenced a T1 (Shetland Transect) survey across the Otter Bank Moraines, running a swath line north and then north-west onto the upper slope. Upon completion of the survey line we then began a coring transect on the upper slope and onto the shelf collecting 12 cores (052VC-058VC) across the shelf.

Tuesday July 14

We completed the core transect shortly before 08.00 hrs and then proceeded on a 90 mile transit to the north-east to the outer shelf north-west of St. Magnus's Bay on Shetland. A survey line into St. Magnus's Bay imaged a well-developed series of moraines. Clear conditions allowed fine views of the Shetlands. Piston core 064PC was collected in 160 m of water in St. Magnus Bay and recovered almost 6 m of sediment. This was followed by the collection of a vibrocore transect west out of the bay and then northwest across the shelf and a series of recessional moraines.

Wednesday July 15

We completed the coring transect to the north-west shortly before 11.00 hours with the collection of 073VC in 145 water depth and then proceeded to transit around Shetland to 60˚37.00'N 0˚32.00'W and then ran a survey line to the northeast across the shelf completing it about 01.30 hrs on the 16th.

Thursday July 16

Following completion of the swath survey we began a coring transect which continued to about 19.30 hrs (074VC-082VC). We then began a 120 mile survey line east into Norwegian waters and then north-east onto the outer shelf imaging a series of impressive moraines and grounding-zone wedges. Coring back from the outer shelf along this survey we recovered a piston core (083PC) and 3 vibrocores (084VC-086VC) before deteriorating weather forced the cessation of coring and we transited eastwards towards the Shetlands in rough seas (Force 7-8).

Friday July 17

Calmer conditions during the morning of the 17th allowed the resumption of coring and we transited west collecting 7 vibrocores and a piston core (087VC-094VC). The collection of 094VC concluded data collection on T1 (Shetland Transect).

Saturday July 18

We transited south and then commenced a long swath survey line to the south-east into Norwegian waters which continued overnight Saturday.

Sunday July 19

We continued a swath survey to the SE passing south of Bergen Bank into Norwegian waters. We then commenced a long coring transect back along this survey line collecting 5 vibrocores (095VC-099VC).

Monday July 20

We concluded the coring transect collecting a piston core (100PC) and 3 vibrocores (101-VC-103VC). 102VC only recovered 1.78 m of sand so 103VC was a redeployment at this site. At ~08.00 we commenced a 135 mile transit eastwards to the outer Moray Firth and then collected 8 vibrocores to the SE. 104VC-105VC were collected before midnight and recovered 2.07 m and 5.51 m of sediment respectively.

Tuesday July 21st

We finished the coring transect (106VC-111VC) shortly before 17.00 hrs and then commenced a transit east to the start of a survey line in the central North Sea at 57˚03.80’N 02˚11.40’E arriving at the start of the survey shortly before 23.00 hrs.

Wednesday July 22nd

We ran a survey to the ESE extending across the Great Fisher Bank and collecting a series of vibrocores 112VC-117VC. Upon completion of the coring we commenced a transit to the west at ~18.30 hrs.

Thursday July 23rd

We transited to 56˚ 25’N 01˚12’E where we took an SVP at 03.30 hrs and then commenced a 110 mile survey line running westwards towards the coastline and Bell Rock. The sub-bottom profiler imaged impressive bedrock structure as well as series of stratified basin fills towards the eastern end of the line and then a series of well-developed deltas as we moved progressively west. We finished the survey line about 18.00 hrs and then commenced a long coring transect back eastwards along the survey line recovering 118VC-121VC before midnight. Core recovery ranged from 0.75-4.2 m.

Friday July 24th

We continued coring collecting 122VC-127VC as well as 126PC along the transect to the east. Upon completion of 127VC at 15.35 hrs we transited SW direct towards 54˚ 45'N 00˚07'E and the start of the next SE-NW survey line.

Saturday July 25th

At 02.00 hrs we commenced a long survey from 54˚ 45'N 00˚07'E running north-west to 56˚ 00'N 02˚07'E offshore of the Forth. We imaged several grounding zone wedge/moraines on the northern half of the line. At ~15.50 hrs we commenced a vibrocore transect collecting 128VC-131VC with recovery of up to 5.58 m. 131VC was recovered in 109 m of water shortly before midnight..

Sunday July 26th

We continued the vibrocore transect to the SE collecting 132VC-136VC with good recovery of glacimarine sediment and probable till of up to 5.66 m. Upon completion of 136VC we then transited north-east collecting a final vibrocore (137VC, 5.59 m recovery) before continuing a transit to a waypoint at 55˚ 30.357'N 01˚06.634'E where we turned south-east to commence a survey line across Dogger Bank. We carried out an SVP at 19.40 hrs before re-commencing the survey line.

Monday July 27th

We finished the survey at about 08.00 hrs and then turned and commenced a long coring transect back northwest along the survey line collecting 138VC-146VC. Recovery ranged from 0.66-4.48 m in length. We completed 146VC just before midnight and then broke off from the coring transect to head east.

Tuesday July 28th

We transited east to 55˚26'N 03˚30'E and then turned southeast and surveyed for 35 miles to 55˚00'N 04˚12'E. We imaged possible lacustrine basin fills along this survey line. Upon completion of the survey line we then turned and collected 7 cores back along the survey line (147VC-153VC). Upon completion of the last core site we transited east along the north side of Dogger Bank.

Wednesday July 29th

We collected two vibrocores at the northern end of the Dogger Bank recovering 2.54 (154VC) and 6.05 m (155VC) respectively. Upon completion of the cores we then proceeded on a long transit west and then south to a position offshore of the mouth of Humber at 53˚23.190'N 0˚56.161'E at 17.00 hrs. We then commenced a 24 mile survey line to the southeast to 53˚02.844'N 1˚24.733'E where we turned and cored back northwest along the survey line collecting 156VC and 157VC.

Thursday July 30th

We completed the ‘Central Survey’ coring transect offshore of the Humber collecting 158VC and 159VC. We then moved west and completed a short survey (‘Western Survey’) to the west of, and across, ‘The Silverpit’ followed by recovery of 3 vibrocores 160VC-162VC. Upon completion of these vibrocores we transited north along the Silverpit collecting 163VC and 164VC and then headed north-east via 165VC and an SVP dip to 53˚48.012’N 01˚09.491’E arriving at 20.20 hrs. We then commenced a swath survey to the south-east.

Friday July 31st

We completed the swath survey at 02.51 hrs and then proceed back to the north-west along the survey line collecting 5 vibrocores en-route (166VC-170VC). Upon completion of 169VC we then commenced a 60 mile transit to the northeast onto Dogger Bank. We commenced a short survey of a delta followed by four vibrocores (171VC-174VC) with good recovery (4.7-5.56 m). Upon completion of 174VC at 20.48 hrs we commenced a transit to the SE

Saturday August 1st

We completed a transit to 54˚0.655N 03˚16.623’E where we carried out a short survey and collected 5 vibrocores (175VC-179VC). This completed core collection on JC123. Upon completion of the last vibrocore at 09.32 hrs we brought the vibrocorer back in-board and at 10.40 hrs commenced transit back to Southampton.

Sunday August 2nd

We passed the Seven Sisters at about 11.00 hrs en route to Southampton. We met the pilot at and proceeded up ‘The Narrows’ and were alongside on the NOC berth by 22.00 hrs.

2. Geophysical Operations

The RRS James Cook is equipped with 2 multibeam systems, an EM120 and an EM710 and an SBP120 sub-bottom profiler. The EM120 is a 12 khz system and it is the primary system for mapping purposes from 10 to 10.000 m. The device is hull mounted on a fixed installation and does not require regular calibrations. The system is interfaced with both its acquisition system (SIS) and OLEX for routine data acquisition. The EM710 is a 70-100 khz system and it is used for higher resolution mapping in shallower waters (5-1500 m). This second multibeam is installed on one of the 2 available ship drop keels and does require patch test calibrations every time the drop keel is lowered. The Kongsberg SBP120 Sub-bottom profiler is installed as an extension of the EM120 and it was used throughout the survey in order to image the sediment layers and buried glacially related features. A Sonardyne Ranger USBL system provided underwater positioning during coring operations. Each acoustic devise is interfaced with all the required ancillary sensors. Appanix POS-MV is used as primary positioning and motion sensor while Seapath200 is the secondary system. Both systems are interfaced with a CNAV3050 which provides the required DGPS corrections. The EM710 and SBP were run continuously throughout the cruise and only temporarily stopped during coring operations. The performance of both systems was very good. The EM120 was not used during JC123 due to the shallow water depths encountered on all transects.

Figure 7. Geophysical and hydrographic corner of the main lab. All scientific equipment including multibeam, sub-bottom profiler, navigation systems, Olex, USBL are rack mounted.

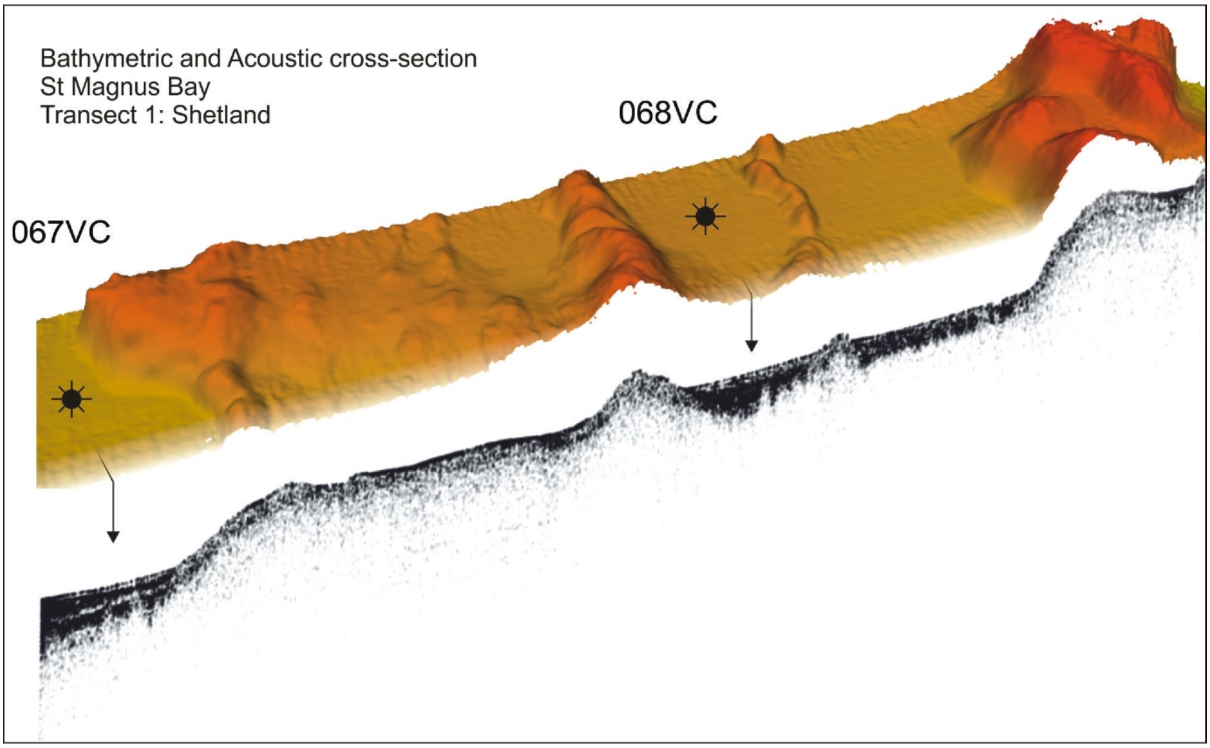


Figure 8. Example of EM710 multibeam and associated sub-bottom profile collected in St. Magnus Bay, Shetland during JC123

3. Coring

Coring operations on JC123 utilised a 6 m long BGS vibrocorer and a 9-15 m long NMFSS piston corer. Details of each core site are given in Tables 1 and 2 below.

3.1 BGS Vibrocorer

The BGS vibrocorer weighs approximately 5000kg, in the super-heavyweight class, and can be deployed to a water depth of 2000m. The system consists of a 6 m hollow tube of steel (e.g. barrel), which is driven into the seafloor by a 1 tonne vibrating pot at the top of the barrel. The instrument is held in a vertical upright position by a three legged metal frame that keeps it from tipping over on the seabed. Once deployed, the instrument can remain on the seabed for several hours if needed to penetrate the sediment using vibrations. Various sensors allow monitoring of the coring phase and the seabed resistance. The system also has a retracting engine which allows the core barrel to be retracted before recovering, reducing possible damage to the barrel. A team of 6 BGS technicians operated the instrument on a 24 hour operation. Recovery was generally good, depending on the nature of the substrate.

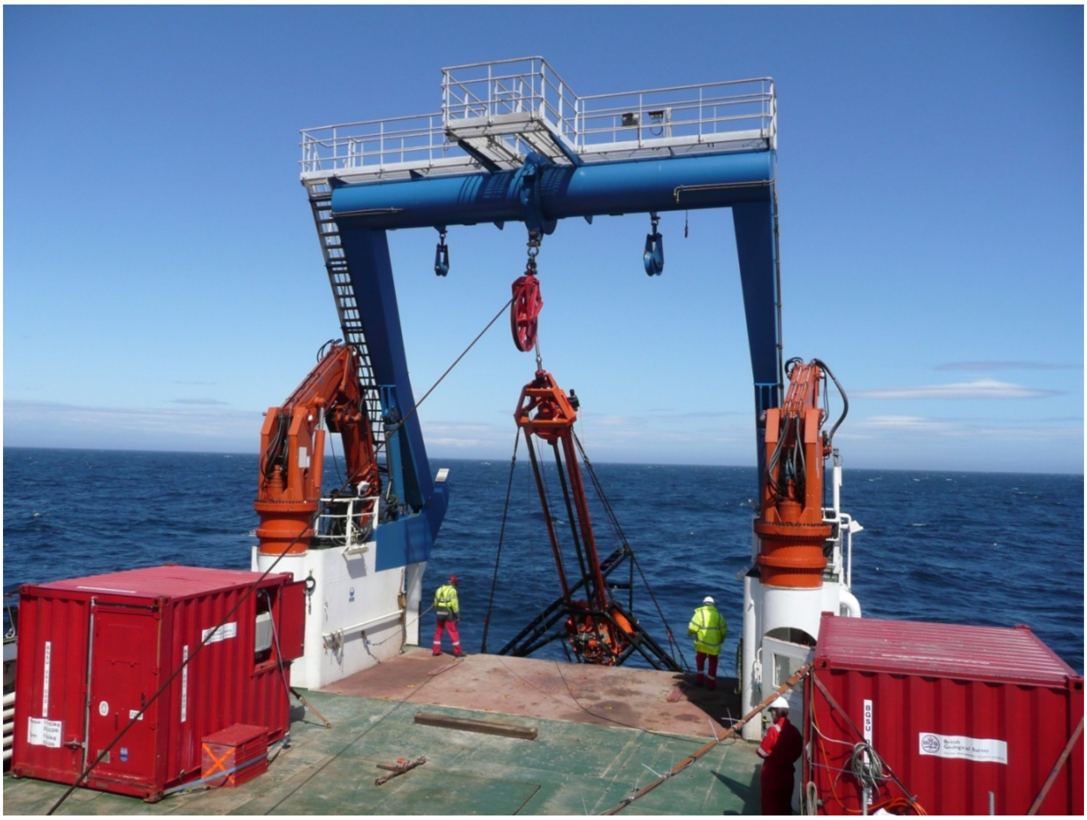


Figure 9. Deployment of the BGS vibrocorer, central North Sea, 21st August, 2015

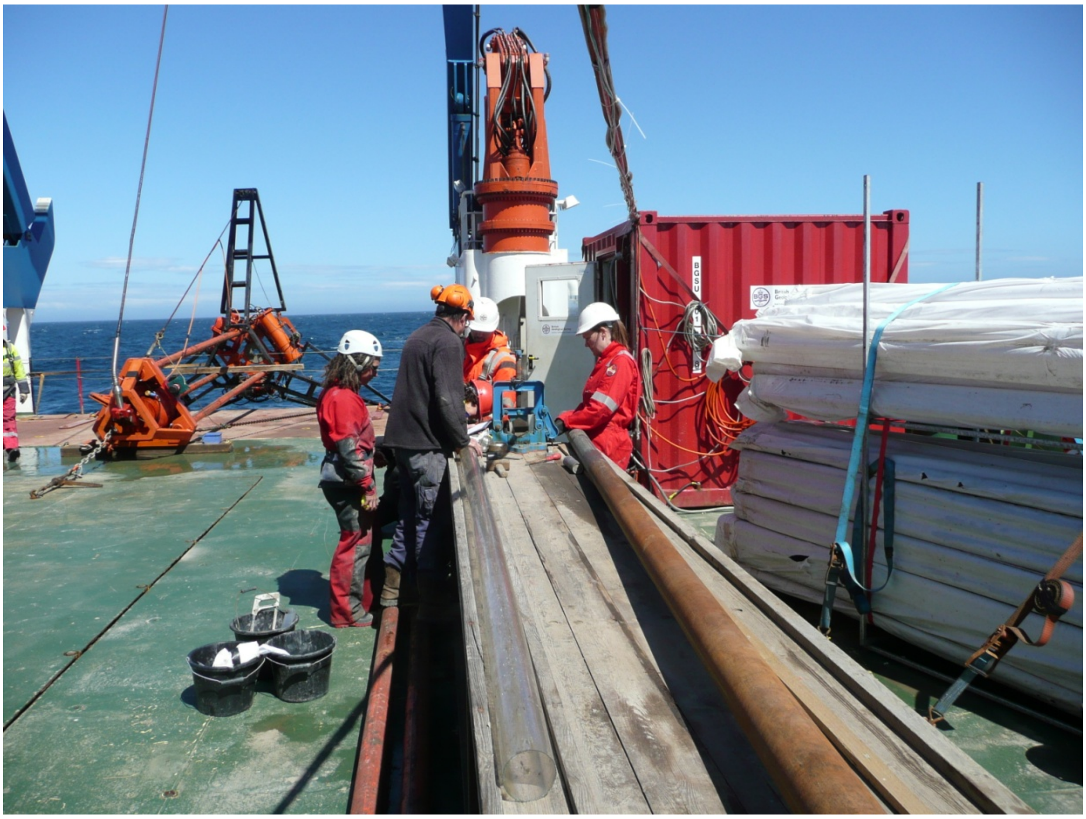


Figure 10. View of the aft deck with core bench and vibrocorer in the background.

3.2 NMFSS Piston corer

The RRS James Cook is equipped with a piston corer as part of the NERC equipment pool. The piston corer is normally launched using a Launch And Recovery System (LARS) from the starboard side and it is operated by the ship crew. During cruise JC123, a 9m, 12 m or 15 m barrel configuration was used. A set of additional infrastructure such as dedicated crane and core barrel holders are provided in order to facilitate the overall operation.

Figure 11. Deployment of NMFSS piston corer, North Sea.

3.3 Core analysis on-board ship during JC123

All vibrocores and piston cores recovered during JC123 were cut into 1 m long sections and were then run whole through a multi-sensor core (University of Leicester) to measure magnetic susceptibility, bulk density and p-wave velocity. They were then split and logged with information on sedimentary structures, colour, grain size, sorting, bedding contacts and macrofaunal content recorded. Measurement of sediment shear strength in kPa was recorded using a Torvane. Selected samples of marine carbonate (typically single or broken valves) were collected and stored for future submission for radiocarbon dating. From the southern North Sea selected core sections were also identified for OSL dating following the cruise.

Figure 11. View of the wet lab showing the door container lab with the multi-sensor core logger on the back right and the open door to the containerised core store on the left.

Table 1: Vibrocores (VC) and Piston Cores (PC) collected during cruise JC123 from transects T1 (East Shetland) and T8 (The Minch)						
Core	*Date of collection*	*Grid reference*	*Location*	*Water depth (m)*	*Recovery (m)*	*Comments*
001VC	3/7/2015 JD184	50° 27.970'N 1° 3.162'W	Solent	38	0	Test core
002VC	6/7/2015 JD187	58° 48.264'N 5° 20.845'W	Cape Wrath	89	2 (2 sections)	Outside moraine ridge extending W of Cape Wrath
003PC	6/7/2015 JD187	58° 46.800'N 5° 5.866'W	Cape Wrath	101	3.24 (4 sections)	In basin between N-S running moraine ridges
004VC	6/7/2016 JD187	58° 46.801'N 5° 5.842'W	Cape Wrath	102	4.13 (5 sections)	In basin between N-S running moraine ridges
005VC	6/7/2015 JD187	58° 46.803'N 4° 58.554'W	Cape Wrath	91	1.05 (2 sections)	Inside prominent N-S running moraine ridge
006VC	7/7/2015 JD188	58° 45.471'N 6° 16.491'W	Outer Minch	121	5.06 (6 sections)	Between large moraine ridges
007VC	7/7/2015 JD188	58° 42.398'N 6° 10.665'W	Outer Minch	120	2.82 (3 sections)	Inside large moraine ridge
008VC	7/7/2015 JD188	58° 42.302'N 6° 10.487'W	Outer Minch	120	2.82 (3 sections)	Inside large moraine ridge
009VC	7/7/2016 JD188	58° 42.117'N 6° 10.237'W	Outer Minch	121	4.38 (5 sections)	Inside large moraine ridge
010VC	7/7/2015 JD188	58° 40.174'N 6° 6.550'W	Outer Minch	124	5.37 (6 sections)	In basin between widely spaced moraine ridges
011VC	7/7/2016 JD188	58° 35.692'N 5° 58.539'W	Outer Minch	112	3.14 (4 sections)	In basin between widely spaced moraine ridges
012VC	8/7/2015 JD189	58° 03.916'N 5° 30.818'W	Inner Minch	70	2.63 (3 sections)	Between closely spaced nearshore moraine ridges
013VC	8/7/2015 JD189	58° 05.627'N 5° 30.520'W	Inner Minch	67	3.77 (4 sections)	Between closely spaced nearshore moraine ridges
014VC	8/7/2015 JD189	58° 05.932'N 5° 31.428'W	Inner Minch	52	1.73 (2 sections)	Between closely spaced nearshore moraine ridges
015VC	8/7/2015 JD189	58° 09.731'N 5° 30.080'W	Inner Minch	119	3.9 (4 sections)	Between closely spaced nearshore moraine ridges
016VC	8/7/2015 JD189	58° 10.927'N 5° 31.550'W	Inner Minch	102	5.59 (6 sections)	Outside prominent nearshore moraine ridge

017VC	8/7/2015 JD189	58° 23.162'N 5° 28.879'W	Inner Minch	118	5.07 (6 sections)	Outside prominent nearshore moraine ridge
018VC	8/7/2016 JD189	58° 22.261'N 5° 27.272'W	Inner Minch	113	5 (5 sections)	On flank of prominent nearshore moraine ridge
019VC	8/7/2015 JD189	58° 21.826'N 5° 25.417'W	Inner Minch	111	1.38 (2 sections)	Inside prominent nearshore moraine ridge
020PC	9/7/2015 JD190	57° 57.936'N 5° 45.553'W	Inner Minch	116	6.93 (8 sections)	In deep basin in East Minch
021PC	9/7/2015 JD190	57° 58.179'N 5° 47.135'W	Inner Minch	105	8.69 (9 sections)	In deep basin in East Minch
022VC	9/7/2016 JD190	57° 58.275'N 5° 48.621'W	Inner Minch	83	4.67 (5 sections)	On shallow bank in East Minch
023VC	9/7/2017 JD190	57° 58.885'N 5° 50.478'W	Inner Minch	95	0	No recovery
024VC	9/7/2016 JD190	57° 58.841'N 5° 50.458'W	Inner Minch	95	0	No recovery
025VC	9/7/2017 JD190	57° 58.231'N 6° 2.829'W	Inner Minch	64	0	No recovery
026VC	9/7/2015 JD190	57° 58.196'N 6° 4.128'W	Inner Minch	48	0	Only a bag sample
027VC	9/7/2015 JD190	57° 58.201'N 6° 4.384'W	Inner Minch	61	0	Only a bag sample
028VC	9/7/2015 JD190	57° 58.436'N 6° 15.436'W	Inner Minch	101	0	Only a bag sample
029PC	9/7/2015 JD190	57° 33.455'N 6° 5.809'W	Inner Minch	84	8.89 (10 sections)	In Sound of Raasay
030VC	9/7/2015 JD190	57° 33.458'N 6° 5.825'W	Inner Minch	84	0	No recovery
031PC	10/7/2015 JD191	57° 55.128'N 6° 13.793'W	Inner Minch	120	6.625 (7 sections)	In deep cross-Minch basin
032PC	10/7/2015 JD191	57° 55.512'N 6° 13.949'W	Inner Minch	118	7.215 (8 sections)	In deep cross-Minch basin
033PC	10/7/2015 JD191	57° 58.448'N 6° 15.310'W	Inner Minch	101	8.22 (9 sections)	On shallow bank just North of deep basin
034PC	10/7/2015 JD191	58° 04.536'N 6° 14.237'W	Inner Minch	100	6.445 (7 sections)	On top of topographic high in Main channel of Minch
035PC	11/7/2015 JD192	59° 11.731'N 7° 14.932'W	Outer Minch	525	6.33 (7 sections)	Beyond shelf break
036PC	11/7/2015 JD192	59° 11.156'N 7° 14.698'W	Outer Minch	491	5.01 (6 sections)	Beyond shelf break
037VC	11/7/2015 JD192	59° 10.958'N 7° 14.603'W	Outer Minch	484	4.15 (5 sections)	Beyond shelf break
038VC	11/7/2015	59° 10.686'N	Outer Minch	457	4.8	Beyond shelf break

	JD192	7° 14.391'W			(5 sections)	
039VC	11/7/2015 JD192	59° 05.633'N 7° 8.433'W	Outer Minch	183	4 (4 sections)	In outer basin leading to shelf break
040VC	11/7/2015 JD192	59° 07.530'N 6° 50.612'W	Outer Minch	175	6.06 (6 sections)	In outer basin leading to shelf break
041VC	12/7/2015 JD193	59° 07.470'N 6° 50.747'W	Outer Minch	175	1.01 (2 sections)	In outer basin leading to shelf break
042PC	12/7/2015 JD193	58° 56.230'N 6° 53.270'W	Outer Minch	171	0.47 (1 section)	In outer basin leading to shelf break
043VC	12/7/2015 JD193	58° 56.232'N 6° 53.274'W	Outer Minch	171	4.59 (5 sections)	In outer basin leading to shelf break
044VC	12/7/2015 JD193	58° 55.605'N 6° 52.141'W	Outer Minch	164	5.2 (6 sections)	In outer basin leading to shelf break
045VC	12/7/2015 JD193	58° 51.425'N 6° 37.983'W	Outer Minch	143	4.93 (5 sections)	In outer basin leading to shelf break
046VC	12/7/2015 JD193	58° 44.167'N 6° 12.319'W	Outer Minch	112	0.86 (1 section)	On flank of large moraine ridge
047VC	12/7/2015 JD193	58° 46.804'N 4° 50.719'W	Cape Wrath	88	0	No recovery
048VC	12/7/2015 JD193	58° 46.805'N 4° 50.715'W	Cape Wrath	89	3.66 (4 sections)	Between widely spaced N-S moraine ridges
049VC	12/7/2015 JD193	58° 46.801'N 4° 48.325'W	Cape Wrath	86	2.48 (3 sections)	Between widely spaced N-S moraine ridges
050VC	12/7/2015 JD193	58° 46.798'N 4° 42.289'W	Cape Wrath	82	1.52 (2 sections)	Between widely spaced N-S moraine ridges
051VC	12/7/2015 JD193	58° 46.806'N 4° 40.458'W	Cape Wrath	84	1.94 (2 sections)	Between widely spaced N-S moraine ridges
052VC	13/7/2015 JD194	60° 11.432'N 4° 35.947'W	Otter Bank	483	3.64 (4 sections)	Beyond shelf break
053VC	13/7/2015 JD194	60° 3.839'N 4° 21.410'W	Otter Bank	157	2.54 (3 sections)	On outer shelf
054VC	13/7/2015 JD194	60° 2.427'N 4° 18.687'W	Otter Bank	156	3.56 (4 sections)	On outer shelf
055VC	13/7/2015 JD194	60° 1.038'N 4° 16.048'W	Otter Bank	158	0	No recovery
056VC	13/7/2015 JD194	60° 1.037'N 4° 16.046'W	Otter Bank	158	4.8 (5 sections)	On outer shelf
057VC	13/7/2015 JD194	59° 52.436'N 4° 02.331'W	Otter Bank	136	1.99 (2 sections)	On flank of large moraine bank

058VC	13/7/2015 JD194	59° 52.434'N 4° 02.117'W	Otter Bank	138	2.03 (2 sections)	On flank of large moraine bank
059VC	14/7/2015 JD195	59° 52.428'N 4° 3.736'W	Otter Bank	124	4.02 (4 sections)	On flank of large moraine bank
060VC	14/7/2015 JD195	59° 43.855'N 3° 56.966'W	Otter Bank	116	2.42 (3 sections)	In small basin on flat
061VC	14/7/2015 JD195	59° 40.274'N 3° 55.948'W	Otter Bank	123	4.41 (5 sections)	In between closely spaced small moraine ridges
062VC	14/7/2015 JD195	59° 35.924'N 3° 54.701'W	Otter Bank	147	0.73 (1 section)	In between closely spaced small moraine ridges
063VC	14/7/2015 JD195	59° 35.896'N 3° 54.703'W	Otter Bank	147	0	No recovery
064PC	14/7/2015 JD195	60° 23.848'N 1° 34.952'W	W Shetland	160	5.92 (6 sections)	In deep part of St Magnus Bay
065VC	14/7/2015 JD195	60° 24.107'N 1° 40.365'W	W Shetland	100	2.62 (3 sections)	In between closely spaced small moraine ridges in St Magnus Bay
066VC	15/7/2015 JD196	60° 24.305'N 1° 42.915'W	W Shetland	102	0.49 (1 section)	In between closely spaced small moraine ridges in St Magnus Bay
067VC	15/7/2015 JD196	60° 24.626'N 1° 47.796'W	W Shetland	104	0.73 (1 section)	In between closely spaced small moraine ridges in St Magnus Bay
068VC	15/7/2015 JD196	60° 24.738'N 1° 49.023'W	W Shetland	101	0.82 (1 section)	In between closely spaced small moraine ridges in St Magnus Bay
069VC	15/7/2015 JD196	60° 25.806'N 1° 51.363'W	W Shetland	118	5.61 (6 sections)	In shallow part of broad basin leading out of St Magnus Bay
070VC	15/7/2015 JD196	60° 29.378'N 1° 53.659'W	W Shetland	123	3.53 (4 sections)	In small basin on edge of broad basin leading out of St Magnus Bay
071VC	15/7/2015 JD196	60° 31.295'N 1° 54.565'W	W Shetland	114	2.47 (3 sections)	In small basin in topographic high between large basins
072VC	15/7/2015 JD196	60° 35.495'N 1° 58.480'W	W Shetland	139	2.12 (3 sections)	In shallow part of broad basin on inner shelf
073VC	15/7/2015 JD196	60° 38.915'N 2° 3.911'W	W Shetland	145	4.21 (5 sections)	In SE edge of broad basin on mid shelf

074VC	16/7/2015 JD197	61° 28.733'N 0° 3.898'E	N Shetland	190	3.29 (4 sections)	In iceberg scoured plain on mid shelf
075VC	16/7/2015 JD197	61° 19.566'N 0° 2.561'W	N Shetland	175	3.28 (4 sections)	In iceberg scoured plain on mid shelf, just N of distal moraine ridge
076VC	16/7/2015 JD197	61° 6.478'N 0° 11.671'W	N Shetland	148	2.28 (3 sections)	In small basin on northen edge of moraine ridges on mid shelf
077VC	16/7/2015 JD197	61° 2.417'N 0° 14.462'W	N Shetland	146	1.42 (2 sections)	in wide basin between wide ridges
078VC	16/7/2015 JD197	60° 57.883'N 0° 17.624'W	N Shetland	157	4.2 (5 sections)	In small basin between small ridges
079VC	16/7/2015 JD197	60° 55.266'N 0° 19.415'W	N Shetland	155	3.1 (4 sections)	In small basin between small ridges
080VC	16/7/2015 JD197	60° 51.452'N 0° 21.998'W	N Shetland	139	2.54 (3 sections)	In small basin between large ridges
081VC	16/7/2015 JD197	60° 41.611'N 0° 28.828'W	E Shetland	123	1.12 (2 sections)	in saddle between two ridge tops on edge of central basin
082VC	16/7/2015 JD197	60° 2.39.484'N 0° 33.541'W	E Shetland	131	2.52 (3 sections)	In Unst basin
083PC	17/7/2015 JD198	60° 58.121'N 2° 39.518'E	E Shetland	200	7.8 (9 sections)	In Norwegian Channel
084VC	17/7/2015 JD198	60° 54.329'N 2° 32.481'E	E Shetland	127	1.63 (2 sections)	Near Norwegian Channel
085VC	17/7/2016 JD198	60° 42.396'N 2° 10.032'E	E Shetland	126	0.61 (1 section)	Mid shelf
086VC	17/7/2015 JD198	60° 42.298'N 2° 9.942'E	E Shetland	127	2.12 (3 sections)	Mid shelf
087VC	18/7/2015 JD199	60° 37.987'N 0° 24.112'W	E Shetland	134	2.25 (3 sections)	Near eastern flank of Unst Basin
088VC	18/7/2015 JD199	60° 33.440'N 0° 4.425'E	E Shetland	123	2.4 (3 sections)	Between N-S running moraine ridges
089VC	18/7/2015 JD199	60° 30.033'N 0° 25.941'E	E Shetland	147	1.53 (2 sections)	Between N-S running moraine ridges
090VC	18/7/2015 JD199	60° 23.339'N 0° 48.170'E	E Shetland	162	4.98 (5 sections)	Just inside distal moraine ridge
091PC	18/7/2015 JD199	60° 23.556'N 0° 59.418'E	E Shetland	158	2.19 (3 sections)	In broad basin between Unst basin and eastern ice grounding

						zone, middle shallow part
092VC	18/7/2015 JD199	60° 23.729'N 1° 7.655'E	E Shetland	152	5.96 (6 sections)	In broad basin between Unst basin and eastern ice grounding zone, eastern edge
093VC	18/7/2015 JD199	60° 20.102'N 1° 27.889'E	E Shetland	130	1.97 (2 sections)	On edge of eastern ice grounding zone
094VC	18/7/2015 JD199	60° 18.676'N 1° 39.449'E	E Shetland	109	1.96 (2 sections)	Inside eastern ice grounding zone

Table 2: Vibrocores (VC) and Piston Cores (PC) collected from transect T2 (North Sea) during cruise JC123						
Core	***Date of collection***	***Grid reference***	***Location***	***Water depth (m)***	***Recovery (m)***	***Comments***
095VC	19/7/2015 JD200	58°49.689'N 3°4.928E	Bergan bank	114	2.5 (3 Sections)	First core taken for T2
096VC	19/7/2015 JD200	59°0.665'N 2°57.688'E	Bergan bank (channel)	138.3	5.12 (6 Sections)	
097VC	19/7/20 JD200	59°4.999'N 2°54.799'E	Bergan bank (channel)	140	4.39 (5 Sections)	
098VC	19/7/2015 JD200	59°18.319'N 2°45.817'E	Viking Bank	116	1.7 (2 Sections)	
099VC	19/7/2015 JD200	59°27.325'N 2°39.895'E	Viking bank	123	2.91 (3 sections)	
100PC	20/7/2015 JD201	59°32.276'N 2°36.588'E	Viking Bank	125	4.78 (5 sections)	
101VC	20/7/2015 JD201	59°44.159'N 2°13.106'E	Viking Bank	117	2.38 (3 sections)	
102VC	20/7/2015 JD201	59°44.384'N 2°11.237'E	Viking Bank	118	1.78 (2 sections)	
103VC	20/7/2015 JD201	59°44.403'N 2°11.139'E	Viking Bank	117	2.24 (3 sections)	
104VC	20/7/2015 JD201	58°31.378'N 1°35.411'W	Offshore NE Scotland	114	4.20 (5 sections)	First core offshore northeast Scotland along a transect running south.
105VC	20/7/2015 JD201	58°26.887'N 1°27.633'E	Offshore NE Scotland	114	2.07 (3 Sections)	
106VC	21/7/2015 JD202	58°10.068'N 1°11.562'W	Offshore NE Scotland	116	5.51 (6 Sections)	
107VC	21/7/2015 JD202	57°53.289'N 0°55.885'W	Offshore NE Scotland	100	3.65 (4 Sections)	
108VC	21/7/2015 JD202	57°31.771'N 0°33.043'W	Offshore NE Scotland	102	3.57 (4 Sections)	
109VC	21/7/2015	57°11.917'N	Offshore NE	89	1.92	

	JD202	0°12.931'W	Scotland		(2 Sections)	
110VC	21/7/2015 JD202	57°06.218'N 0°07.064'W	Offshore NE Scotland	87	2.89 (3 Sections)	
111VC	21/7/2015 JD202	56°54.243'N 0°05.320'E	Offshore NE Scotland	89	5.05 (6 Sections)	
112VC	22/7/2015 JD203	57°03.772'N 2°11.474'E	West of Fisher Bank	91	3.41 (4 Sections)	First core on transect across Fisher Bank
113VC	22/7/2015 JD203	57°3.347'N 2°13.403'E	West of Fisher Bank	88	3.12 (4 Sections)	
114VC	22/7/2015 JD203	57°2.368'N 2°18.012'E	West of Fisher Bank	81	2.45 (3 Sections)	
115VC	22/7/2015 JD203	56°36.958'N 4°23.830'E	Fisher Bank	65	2.58 (2 Sections)	
116VC	22/7/2015 JD203	56°37.106'N 4°23.649'E	Fisher Bank	64	1.80 (2 Sections)	
117VC	22/7/2015 JD203	56°50.146'N 3°48.894'E	Fisher Bank	60.7	2.14 (3 Sections)	
118VC	23/7/2015 JD204	56°29.704'N 2°2.758'E	Firth of Forth	69.12	4.2 (5 Sections)	Transect across Devil Hole and Firth of Forth
119VC	23/7/2015 JD203	56°29.676'N 2°1.766'W	Firth of Forth	67.81	3.7 (4 Sections)	
J20VC	23/7/2015 JD203	56°29.561'N 1°56.287'W	Firth of Forth	48	0.75 (1 Sections)	
121VC	23/7/2015 JD203	56°29.139'N 1°37.785'W	Firth of Forth	57	2.8 (3 Sections)	
122VC	23/7/2015 JD203	56°28.923'N 1°29.967'E	Firth of Forth	62	1.19 (2 Sections)	
123VC	24/7/2015 JD204	56°26.904'N 0°05.883'E	Devils Hole	88	4.74 (5 Sections)	
124VC	24/7/2015 JD204	56°25.764'N 0°40.239'E	Devils Hole	87	1.65 (2 Sections)	
125VC	24/7/2015 JD204	56°25.959'N 1°18.219'E	Devils Hole	91	3.7 (4 Sections)	
126PC	24/7/2015 JD204	56°26.944'N 1°28.051'E	Devils Hole	91	0.9 (1 Section)	
127VC	24/7/2015 JD204	56°27.476'N 1°28.747'E	Devils Hole	97	3.34 (4 Sections)	
128VC	25/7/2015 JD205	55°58.798'N 2°2.414'W	Berwick to Blyth	74	4.49 (5 Sections)	First core taken between offshore Berwick to Bylth
129VC	25/7/2015 JD205	55°56.747'N 1°54.566'W	Berwick to Blyth	75.5	2.08 (3 Sections)	
130VC	25/7/2015 JD205	55°50.02'N 1°33.609'W	Berwick to Blyth	88.9	5.58 (6 Sections)	
131VC	25/7/2015 JD205	55°33.308'N 1°3.774'W	Berwick to Blyth	109	2.81 (3 Sections)	
132VC	25/7/2015	55°29.469'N	Berwick to	108	2.19	

	JD205	0°55.159'W	Blyth		(3 Sections)	
133VC	26/7/2015 JD206	54°56.661'N 0°56.725'W	Berwick to Blyth	77	4.46 (5 Sections)	
134VC	26/7/2015 JD206	55°00.037'N 0°56.921'W	Berwick to Blyth	83	4.52 (5 Sections)	
135VC	26/7/2015 JD206	54°59.961'N 0°13.798'W	Berwick to Blyth	90.6	5.66 (6 Sections)	
136VC	26/7/2015 JD206	54°52.414'N 0°3.289'W	Berwick to Blyth	91	4.10 (5 Sections)	
137VC	26/7/2015 JD206	55°17.598'N 0°32.520'W	Berwick to Blyth	80	5.69 (6 Sections)	
138VC	27/7/2015 JD207	54°14.250'N 3°14.014'E	Outer Silver Pit	41	3.06 (4 Sections)	First core in from Outer Silver Pit
139VC	27/7/2015 JD207	54°16.018'N 3°11.168'E	Outer Silver Pit	47	1.2 (2 Sections)	
140VC	27/7/2015 JD207	54°17.774'N 3°8.377'E	Outer Silver Pit	53	4.42 (5 Sections)	
141VC	27/7/2015 JD207	54°19.198'N 3°06.077'E	Outer Silver Pit	48	0.66 (1 Section)	
142VC	27/7/2015 JD207	54°25.933'N 2°55.075'E	Outer Silver Pit	33.7	2.88 (3 Sections)	
143VC	27/7/2015 JD207	54°52.4446N 2°11.6639E	Dogger Bank	24.4	2.53 (3 Sections)	First core on Dogger Bank
144VC	27/7/2015 JD207	54°53.0156N 2°10.7214E	Dogger Bank	25	0.8 (1 Section)	
145VC	27/7/2015 JD207	55°03.563'N 1°53.283'E	Dogger Bank	29	1.24 (2 Sections)	
146VC	27/7/2015 JD207	55°05.835'N 1°49.386'E	Dogger Bank	34	0.91 (1 section)	
147VC	28/7/2015 JD208	55°0.958'N 4°10.445'E	East end of Dogger Bank	48	3.59 (4 Sections)	
148VC	28/7/2015 JD208	55°08.206'N 3°58.739'E	East end of Dogger Bank	47	1.98 (2 Sections)	
149VC	28/7/2015 JD208	55°24.226'N 3°32.846'E	East end of Dogger Bank	33	0.96 (1 Section)	
150VC	28/7/2015 JD208	55°24.363'N 3°32.648'E	East end of Dogger Bank	33	1.77 (2 Sections)	
151VC	28/7/2015 JD208	55°24.341'N 3°32.599'E	East end of Dogger Bank	33	1.7 (2 Sections)	
152VC	28/7/2015 JD208	55°24.061'N 3°20.241'E	East end of Dogger Bank	32.3	1.02 (1 Section)	
153VC	28/7/2015 JD208	55°23.694'N 3°18.509'E	East end of Dogger Bank	32.2	1.98 (2 Section)	
154VC	29/7/2015 JD209	55°17.210'N 1°29.582'E	North Dogger Bank	61	2.45 (3 Sections)	
155VC	29/7/2015 JD209	55°23.171'N 1°19.192'E	North Dogger Bank	82	6.05 (6 Sections)	
156VC	29/7/2015 JD209	53°07.831'N 1°22.074'E	Humber	29	3.09 (4 Sections)	First core in the Humber area
157VC	29/7/2015	53°11.219'N	Humber	27	4.42	

	JD209	1°14.682’E			(5 Sections)	
158VC	30/7/2015 JD210	53°15.889’N 1°7.441’E	Humber	25	1.77 (2 Sections)	
159VC	30/7/2015 JD210	53°18.846’N 1°02.862’E	Humber	28	2.35 (3 Section)	
160VC	30/7/2015 JD210	53°19.747’N 0°43.808’E	Humber	24	1.87 (2 Sections)	
161VC	30/7/2015 JD210	53°17.113’N 0°35.063’E	Humber	21	2.34 (3 Sections)	
162VC	30/7/2015 JD210	53°15.265’N 0°36.683’E	Humber	19.9	2.70 (3 Sections)	
163VC	30/7/2015 JD210	53°30.160’N 0°41.055’E	Humber (in the Silver Pit)	88.5	No recovery	
164VC	30/7/2015 JD210	53°31.433’N 0°42.294’E	Humber (in the Silver Pit)	81.4	1.06 (2 Sections)	
165VC	30/7/2015 JD210	53°35.947’N 0°57.152’E	Humber	34.4	1.15 (2 Sections)	
166VC	31/7/2015 JD211	53°19.759’N 1°50.416’E	Humber	31	6.06 (6 Sections)	
167VC	31/7/2015 JD211	53°19.798’N 1°50.169’E	Humber	31	5.61 (6 Sections)	
168VC	31/7/2015 JD211	53°20.665’N 1°44.404’E	Humber	33	0.98 (1 Section)	
169VC	31/7/2015 JD211	53°31.124’N 1°29.819’E	Humber	32	2.3 (3 Sections)	
170VC	31/7/2015 JD211	53°45.831’N 1°13.491’E	Humber	33	1.01 (1 Section)	
171VC	31/7/2015 JD211	54°46.728’N 1°57.998’E	Dogger Bank	33.3	4.70 (5 Sections)	First core back on Dogger Bank
172VC	31/7/2015 JD211	54°46.638’N 1°58.147’E	Dogger Bank	32.4	5.56 (6 Sections)	
173VC	31/7/2015 JD211	54°46.549’N 1°58.267’E	Dogger Bank	32.2	5.09 (6 Sections)	
174VC	31/7/2015 JD211	54°46.301’N 1°58.601’E	Dogger Bank	34	3.42 (4 Sections)	
175VC	1/8/2015 JD212	53°59.746’N 3°18.739’E	Dogger Bank	43	3.36 (4 Sections)	
176VC	1/8/2015 JD212	53°59.331’N 3°21.841’E	Dogger Bank	45	2.85 (3 Sections)	
177VC	1/8/2015 JD212	53°59.128’N 3°21.883’E	Dogger Bank	44	3.17 (4 Sections)	
178VC	1/8/2015 JD212	54°0.829’N 3°21.081’E	Dogger Bank	43	2.67 (3 Sections)	
179VC	1/8/2015 JD212	54°0.757’N 3°16.305’E	Dogger Bank	40	2.62 (3 Sections)	

Appendix 4.1

JC123 NMFSS Ship Systems Computing Cruise Report

Cruise Overview

Britice Chrono

3rd Jul 15 – 04th Aug 15

All times given in this report are in UT.

Technician.

Andrew Moore, Lisa Symes (Science Systems Technicians) (nocs_nmfss_shipsys@noc.ac.uk)

Ship scientific computing systems.

Data was logged by the Techsas data acquisition system into NetCDF files. The format of the NetCDF files is given in the file NMFSS_NetCDF_Description_Cook_v2.docx. The instruments logged are given in JC123_Ship_fitted_information_sheet_JC.docx. Data was additionally logged into the RVS Level-C format, which is described in the NetCDF document.

Summary data was generated using the Near Real Time (NRT) software written for returning data to BODC. The summary data was produced from the NetCDF files logged by Techsas. The true wind speed and direction were calculated by the NRT software. Summary data are included at one minute intervals. The latitude and longitude are spot values at that time stamp. All other values have been averaged over one minute. The time stamp is the time at the start of the averaging period. If a data value is not available or valid at a time period then the data has been replaced by a fill value of 99999.0.

A second set of summary data has been generated from the level-C data giving 1 second resolution and 1 minute average data with fixed width fields. In the averaged data . The latitude and longitude are spot values at that time stamp. All other values have been averaged over one minute. The time stamp is the time at the start of the averaging period. If a data value is not available or valid at a time period then the data field is blank.

Techsas/Level-C Streams lost at 15 187 160053 to 15 187 164747

Position and attitude.

All GPS and attitude measurement systems were run throughout the cruise. The Seapath system is the vessel's primary GPS system, outputting the position of the ship's common reference point in the gravity meter room. The POSMV is the GPS that is repeated around the vessel and sent out to other systems.

'sb-att'(Level-C/Techsas) – gap between 15 208 111219 to 15 208 124147 (lost Seapath GPS)

Meteorology and Sea Surface monitoring package.

The Surfmet system was run throughout the cruise. Please see the separate BODC information sheet JC123_Surfmet_sensor_information_sheet.docx for details of the sensors used and the calibrations that need to be applied. The calibration sheets are included in the directory Ship_Systems\Met\SURFMET\calibrations. The non-toxic water supply was active from 12:00 04/07/2015 until XX:XX 01/08/15.

Data Loss:
14:30-14:45 - 21/07/15: Underway off for cleaning – unable to complete due to core-splitting requirement.
09:30-10:30 - 22/07/15: Cleaned fluorimeter and transmissometer

Kongsberg EA600 single beam echo sounder.

The EA600 single beam echo sounder was run throughout the cruise. It was used with a constant sound velocity of 1500 ms^{-1} throughout the water column to allow it to be corrected for sound velocity in post processing. As well as depths being logged to the Techsas and Level-C data loggers, files were saved as .BMP images and in raw Kongsberg format. The EA600 was not synchronised to the K-Sync synchronisation system.

Kongsberg EM120 and EM710 Multi-beam echo sounders.

The EM710 shallow water system was run throughout the cruise. The system requires calibration for each use as it is installed on the drop keel. These were chosen to be flush to the hull during the cruise, rather than fully deployed – which results in poorer multibeam data quality, but permits greater transit speeds.

A Calibration survey was planned and completed 05/07/2015. Prior to the start of the calibration an SV dip was completed (FILE25.000 below).

The survey lines 0100 to 0110 are applicable to the EM710 survey. A new vessel file was provided to the scientists (Roll=0.06, Pitch=-2.22, HDG=-3.57, Timing=0). The new vessel file is applied into Caris for post-processing of the multibeam data. No sensor settings were changed in SIS from the previous configuration.

The Sound Velocity Profiles section of this report describes the sound velocity profiles used during the cruise.

Sound Velocity Profiles.

The sound velocity profiles used in the EM710 multi-beam are shown below (also applied to USBL Ranger2 environment):

Date:	File No.	Time:	Position:	File Depth:	Swath Line
04072015	FILE21.000	10:28	52°39.800N 2°20.500	42m	
05072015	FILE25.000	23:24	58°30.759N 1°31.052W	104m	
14072015	FILE30.000	17:04	60°39.000N 2°04.000W	134m	[LINE:0397]
19072015	FILE33.000	17:15	59°00.652N 2°57.630E	132m	[LINE:0590]
23072015	FILE37.000	03:51	56°25.000N 1°12.000E	81m	[LINE:0728]
26072015	FILE39.000	20:57	55°23.114N 1°19.244E	72m	[LINE:0880]
30072015	FILE42.000	19:18	53°35.975N 0°57.142E	31m	[LINE:1046]

Reversions to previous SV profile files for EM710:
Time Applied: 15:47

31072015	FILE39.00	-	54°38.036N 1°45.582E	-	[LINE:1085]

S/N:22241 MIDAS SV Probe used for all profile acquisitions.

SBP120 Sub Bottom Profiler

The SBP120 Sub-bottom profiler and EPC thermal printer were run through out the cruise. All *seg (processed) and *.raw (raw) data was logged.

75 kHz and 150 kHz hull mounted ADCP systems.

N/A for cruise.

Gravity Meter.

No gravity meter was installed on the vessel for the cruise. The NetCDF and Level-C gravity files are empty streams.

WAMOS Wave Radar.

The WAMOS wave radar was run throughout the cruise. All data was logged and is included on the data disk (not PI copy as requested), but a summary of its output is given in the PARA*.ems files.

Appendix 4.2 - JC123 Sub-bottom Profiler (SB-120) Acquisition Parameters

James Cook (July 2015)

- Runtime Parameters:
  - Transmit Mode: Normal
  - Synchro: Fixed Rate
  - Ping Interval: 500 ms
  - Acquisition Delay: variable (typically ~20ms delay; 200ms window)
  - Pulse Form: Linear Chirp Up
  - Sweep Frequency: 2500-6500 Hz
  - Minimise Pulse shape: checked
  - Pulshe shape: 80%
  - Pulse length: 5ms
  - Source Power: variable (-5db (high-power) to -30 db low power) typically -10 or -20db.
  - Power ramping rate: 0.0
  - Beam width: Tx: Normal
  - Beam width: Rx: Normal
  - Number of beams: 1
  - Calculate Depth from depth: no-unticked
  - Automatic Slope correction: On
- Filters:
  - Filter: Enabled
    - Filter type: Matched
    - Corner Frequencies: Auto
    - Replica shaping: checked
  - Bottom tracker: Enabled
    - Show Master depth: checked
    - Window start (ms): 106
    - Window length: 20
    - Threshold %: 15
    - Auto-search: checked
  - Gain Correction
    - Enabled
    - Transmission loss: 0.0
  - Time-varying gain
    - Enabled
    - TVG control: Tracking
    - Offset: -2.0
    - Manually or digitally controlled…variable
      E.g Length ---- Slope

5	5.6
65	0.11
56.2	-0.3
  - Data Plotter: enabled
  - Processed Data Logger:
    - Enabled
    - Split raw files like seg files: checked
    - Path type: SEGY directory:
    - File close/append: 25
    - Max file size (mb): 200
    - Log selected beam only: unchecked
- Display
  - Echogram 1
    - Trace width: 1
    - Adjust to current window: checked
    - Adujust to current trace length: unchecked
    - Grid enabled: ms
    - Ping tick spacing: 200
    - Depth tick spacing 5ms or 6.25 ms (~5m)