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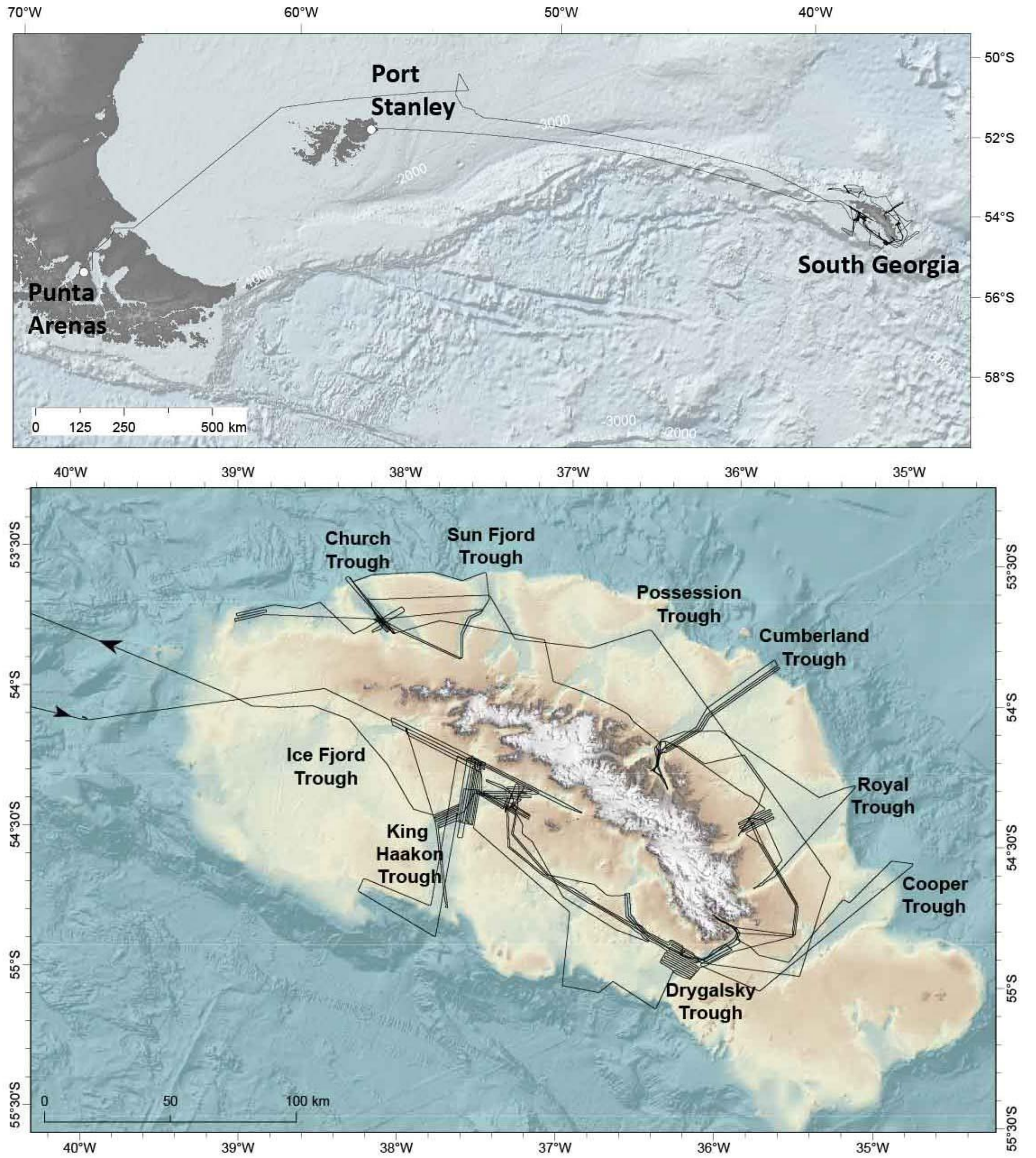
Short Cruise Report
R/V METEOR– M 134
Port Stanley – Punta Arenas
January 16 – February 17, 2017
Chief Scientist: Gerhard Bohrmann
Captain: Rainer Hammacher



Track lines of METEOR Cruise M134 from Port Stanley to Punta Arenas (above) and around South Georgia (below).

Objectives

The overarching goal of the proposed cruises was to increase our knowledge of fluid flow and gas emissions and its related processes in general and specifically in the area around South Georgia, where this phenomenon was newly discovered during R/V Polarstern cruise ANT-29/4 in March/April 2013. Besides the intense investigation of the gas emissions (occurrence, source, variability, quantity and fate), we were further interested if gas is stored in the shallow sediments in form of gas hydrates and how the seep sites are colonized. Moreover, the bio(-geo)-chemical processes in the sediments and in the water column have been planned to analyze to comprehensively understand the fluid flow system and the pathways of dissolved iron from the island to the open ocean.

Cruise Narrative

On Monday, **16 January** 2017, at 18:12 local time RV METEOR left the floating pontoon pier of Port Stanley Harbour for the three-day transit to the sub-Antarctic island of South Georgia, where the glacial shelf troughs will be the research targets. Prior to the departure of RV METEOR's 134th expedition, there has been port time at FIPASS-pier (Falkland Interim Port and Storage System), a floating platform in the natural harbour of Port Stanley that is formed by 7 permanently anchored, linked barges and connected to land by bridge. The 6 containers with our scientific equipment had been loaded in Cape Town at the start of the previous expedition M133, therefore only the scientific party changed in Port Stanley. Most of the 28 scientists, engineers, technicians and students from Germany, the US, the UK, France, Switzerland and Austria arrived in Port Stanley on **14 January** on the weekly plane from Santiago de Chile with stops at Punta Arenas, Chile and Rio Gallegos, Argentina before the plane landed at Mount Pleasant, the Royal Airforce airport on the Falkland Islands. The long flight time and the complicated connection from Europe are testiment to how remote the Falkland Islands are in the South Atlantic. So everybody was happy, after more than 2 days of travel, to board RV METEOR on 14 and 15 January. We used the short time in the harbour to set-up the laboratories, to mobilise the technical marine equipment on the work deck and to go for a last evening stroll ashore, where most of us walked to the close-by penguin beach called Gypsy Cove.

During our eastward bound transit from the Falkand Islands to South Georgia we left the Falkland Plateau on Tuesday, **17 January** and crossed the Falkland Trough, a deep trough separating the Falkand Plateau to the north from the North-Scotia-Ridge in the south. The narrow east-west ranging North-Scotia-Ridge forms the northern edge of the small Scotia Plate, which shifts away from the South American macro plate by left-lateral movement. Despite a push from behind by the West Wind Drift, the METEOR made just 10 knots in transit. Presumably the barnacle cover on the vessel's hull has grown over the last few months slowing the vessel down. The slightly lowered speed had a positive effect on the bathymetry and sedimentological surveys which we did around the clock during transit. On Wednesday, **18 January** we went passed the southern flank of a further elongated plateau called Shag Rocks, arriving at our planned work area of South Georgia on Thursday afternoon, **19 January**. The first CTD station was done there in 2,455 m water depth to determine the sound velocity profile and to sample the water column, before we sailed eastwards to the shelf edge of the South Georgian micro-continent. Having arrived at our work area on Friday, we started with mapping a 60 nautical mile long west-east running profile parallel to South Georgia's coastline.

The hydro-acoustic mapping profile, which first transects across the Ice Fjord Trough, then through the King Haakon Bay Trough and finally through the Jacobsen Trough, showed that methane emissions and flares were present in all three troughs. As such the new findings from the southern side of the island were in line with those previsouly discovered along the northern side demonstrating that we study a phenomenan general to the troughs of the region. King Haakon Bay is well known as Sir Ernest Shackleton landed here after crossing the Scotia Sea from Elephant Island aboard the open boat James Caird.

During the running of the hydro-acoustic mapping profile and in beautiful sunshine we were able to view the western part of the island with its snow-capped, jagged mountains reaching over 1,000 m in height and glaciers that flow from the high mountains to the coastline before calving into the sea. Many of us were facinated by this panoramic landscape and enjoyed the view despite the polar climate since our southbound crossing of the Polar Front. Of the three mapped troughs we swiftly decided to opt for the King Haakon Bay Trough as the one to sample. Comprehensive station work was carried out throughout Saturday **21 January** and Sunday **22**. CTD stations were used to sample the methane distribution in the water column, in addition to specific bottom water samples, multi-corer and gravity corer deployments. The MARUM-ROV (remote operating vehicle) SQUID 2,000 m undertook dives (ROV 20 and 21) on both days to the seafloor and collected results. During these days the weather was foggy, but despite wind speeds of 4-5 Beaufort felt relatively calm. Air and water temperatures were about 2.5°C, to which we have already adapted to for the work on deck.
Our two dives (ROV-20 and ROV-21) with ROV SQUID in 230 m depth of the King Haakon Trough turned out to be more difficult than expected due to easily disturbed surface sediments. The causes were less the movements of the diving robotic vehicle then the fast movements of local fish that made the waters murky and the diver operation challenging. A group of about 40 marbled rock cod swam in front of the camera-eyes of the ROV and stirred the sediments up. We had selected the diving locations based on the positions of flares that the vessels‘ hydroaccustic systems had detected. Unfortunately we were unable to find the emission sites of the gas bubbles by ROV because of the poor visibility. The forward looking sonar system of the ROV, which generally helps with the detection of flare origins on the seafloor, was unable to find the right target because of the signal overload in the water column. But chemical measurements throughout the watercolumn had shown clear signals of methane input from the sediments. To do this, the CTD with its 24 water samplers is placed into the water column on an almost daily basis and the collected water samples from 24 different depth are used for the anaylsis of different chemical parameters – including those to measure methane. The resulting methane concentration profiles are extended to the seafloor by the deployment of a bottom water sampler, and samples by multi- and gravity corer lengthening the methane profile into the seafloor. In general the background concentrations of methane in the ocean are about 1-2 nanomol/l, while in the area of gas emissions, concentrations of 20-50 nanomol/l are measureable. On the seafloor of King Haakon Trough concentrations of 300-400 nanomol/l were present.
On Monday, **23. January**, we looked in detail into the gas emmisions in the Ice Fjord Trough that we had detected the night before. After CTD-4, bottom water sampler (BWS-3) and gravity core (GC-3) dive ROV-22 was done in the Ice Fjord Trough. The ROV-team and scientists took over the rough wet lab of the vessel that is used as control centre during dives. Further scientists are in constant contact and support on the dives from the conference room through live video streaming and online voice communication with the scientists in the ROV control centre. The visibility on the seafloor in 250 m deopth of the Ice Fjord Trough was also heavily compromised but at least emitted gas bubble were seen at this location. Next to this a rich variety of benthic organisms were observed, like notothenoid fish (white blooded fish), filter feeding sea anemones, sun- and brittle stars as well as glass sponges, which are typical for the Southern Ocean, and now an then an octupus, just to name a few.

Based on forcasted worsening weather conditions we moved on Monday night (**23 January**) eastwards on the southern side of the island and continued our mapping survey on RV METEOR. On Tuesday, **24 January** we carried out station work in the Drygalski Fjord at the south-eastern tip of South Georgia. While the weather outside the fjord was challening with high winds and 4-5 m high waves, it was much calmer in the narrow fjord and all station work was possible. At time, strong katabatic winds coming down the over 2000 m high mountains and the Risting Glacier caused winds speeds of 8-10 Beaufort but large wave movements stayed away.

The Drygalski Fjord is not only of interest because of its historical connection to the 1st German Antarctic expedition (1901-1903) but also because of its geological structure as a shearing zone as these shearing zones are often used as emmission lanes for deep-based fluids. The methane emissions of these fjords could be caused by thermogenic methane, which either rise from depth along the deep disturbance lane or at one of the numerous parallel disturbance, and then emerges from the seafloor. Only when we're back on land can isotope analyses of the methane's carbon and oxygen can tell us if the source is biogenic or thermogenic methane that we sampled in Drygalski Fjord.

Following a promising good weather forecast by the on board DWD (German weather service) on Thursday **26. January**, we moved to Cumberland Bay East and ran a CTD profile (CTD-10 to CTD-14) from the inner fjord next to Nordenskjöld glacier to the outer end of the bay, abd took a gravity core at Grytviken flare. Crossing the Grytviken Flare we noticed that this gas emission site is still active. This gas emission site had been detected in 2013 by RV Polarstern and was named after the neighbouring, 1904 Norwegian founded whaling station Grytviken. The extremely pleasant weather and the fantastic scencery of high mount fantastic scenery with glaciers and calving icebergs called most of us on board of METEOR again and again out on deck during all breaks, just to enjoy the view.

On Friday, **27. January**, we started our survey and station work in the Church Trough area, where we had detected gas emissions in 380 m water depth. At this depth level and with sea temperatures of less than 2°C the methane hydrate stability zone is reached and methane should form in contact with water the solid structure methane hydrate. Gravity core GC-10 which we took on Sunday, 29 Januray confirmed very convincingly the presence of methane hydrates. With this gravity core it was possible for the first time to confirm undoubtly the existence of methane hydrates south of the Polar Front.

The exciting discovery of methane hydrates on the shelf of sub-Antarctic South Georgia on Sunday kept us very busy using all available equipment to document and quantify the solid hydrate connection of methane and water. Changes in the salinity concentration in the sediment cores, which were precisely measured by determining the chloride content, are direct responses to hydrate formation or dissolution. Similar to the formation of sea ice, hydrate formation enriches the sediments with salt. The measured chloride contents, elevated up to 45 mmol against seawater, are a good indicator for hydrate enrichment in the sediment. Methane hydrate dissolution happens during the corer extrusion and during the later work in the laboratory, methane evaporates and the hydrate water dilutes the pore water. It is this dilution that we measure via the chloride content of the pore water and can use for a quantification of methane hydrates. An alternative method to verify these pore water measurements is the quantification of methane with the autoclaved gravity corer DAPC-1. The DAPC collects a sediment core and seals and stores it gas-tight with the *in-situ* pressure of the seafloor. Methane is unable to evaporate during recovery of the equipment in the water column and is released on deck via a quantitative pressure valve. Despite the total volume of the DAPC being only 15 l, more than 50 l of methane were released during the dissolution of the gas hydrates, which is indicative of a methane concentration of about 10%. As this concentration is in

line with the estimates based on the chloride measurements, we will be able to contribute excellent new analyses from the South Georgian Church Trough to the world map of gas hydrate distribution.
On Monday, **30 January**, we finished the station work in the Church Trough with further deployments of gravity core, multicore, CTD and bottom water samples. On Monday night several shelf troughs were mapped by cross profiling in an eastward direction until on Tuesday morning arriving in a selected area of the Royal Trough, where sediment cores sampling was planned. Only a few miles before reaching the coring location however, we discovered an iceberg was slowly drifting on to our core location, blocking our way. We decided therefore to start the survey mapping of the Royal Bay, the landwards end of the Royal Trough, that we had planned for the early evening. When reaching the entrance of the bay we had to stop for a short while as very strong winds came down the Ross Glacier into the bay. Gusts of 11 Beaufort was too strong for us and therefore METEOR turned back to the gravity core location, which was now freed from the eastward drifting iceberg. Two gravity cores for microbiology and biochemistry, a CTD station, followed by a fine-scale mapping survey finished the day. The mapping of the seafloor overnight turned out to be difficult as we had to reduce the vessels speed to help retain the quality of data collected by the multibeam system in wind conditions of 9-10 Beaufort. As a result of the bad weather in the night we had a delayed arrival at Cumberland Bay delayed on Wednesday **1 February**. On entering into Cumberland Bay East, progress was slowed by several icebergs and growlers, and the weather changed rapidly. Wind- and wave actions decreased remarkably and the clouds moved away in favour of blue sky. Multiple water sampling (Fig. C) and sediment core collections as well as an ROV dive followed. At around 19:00 we had to abort the dive due to rising sea fog and an increasing row of growlers blocking the entrance to Cumberland Bay.
Following the over-night mapping of the Cumberland Trough to the shelf edge and back, Thursday, **2 February**, was perfect for land-based sampling with beautiful sunny weather conditions. In order to follow the iron intake into the ocean, which leads to phytoplankton blooms in the nutrient-rich waters of South Georgia, we took ground water spring samples and melt water samples in King Edward Cove. In parallel all scientists and crew had the possibility to visit the former whaling station at Grytviken which had been in used from 1904-1964. Grytviken, known as the starting point of several famous Antarctic expeditions, with its fur seals, elephant seals, penguins and seabirds as well as with its building remaining from the whaling industry past, was a big event for most of us. The museum and post office were open and the friendly chats with the few inhabitants in glowing sunshine were the perfect disruption to the daily work at sea.
The brilliant weather was also used on Friday, 3 February, for the final sampling of Cumberland Bay, and a dive with ROV SQUID at the Grytviken gas flare brought us satisfactory sediment, gas and water samples of the cold seep on the seafloor. We used the next night and Saturday for seafloor mapping surveys which brought us first to the east and later to the south of the island. Here the sun is also shining and a calm sea gives favourably conditions for our research tasks.
After finishing the comprehensive sampling and surveying of Cumberland Bay East in the third week, we steamed on the RV METEOR eastwards along the northern coastline of South Georgia, before circumnavigating the eastern end of the island and then heading westwards along the southern coast. During the night we had to keep a minimum distance of 10 nautical miles from the coast for safety reasons, in order to avoid ice bergs and growlers, which drift from the calving glaciers through the island's bays into the open water. As RV METEOR has not the right ice classification (only E2), encounters with ice are to be avoided at all costs. While steaming the multi-beam and sediment echo sounders are constantly running surveying the sea floor and the water column. The computer screens show not only patterns of various organisms like krill and fish swarms but also gas flares raising up from the sea floor; the later are our main targets and point us to the location for our dives

with the remotely operating vehicle (ROV). A 24 h watch system is run in the bathymetry lab. The most recent discoveries of the expedition are announced here and for our research expedition the bathymetry lab is the place on the vessel where science planning and command happens.
During our westward survey we discovered the most intensive flare in the water column on the hard rock ground about 11 km south of Paradise Beach and we called it Paradise Flare. But when we wanted to study these gas emissions in detail on Monday, **6 February**, a dive with ROV SQUID was impossible due to too much swell. We therefore steamed 60 miles to the west, as the weather forecast allowed us 2 days for station work at King Haakon Trough. In general, the weather conditions to the south of the island are worse than to the north caused by the influence of the strong West Wind Drift. We experience almost daily changes in the weather. We used these two days for a series of stations with CTD, bottom water sampler, gravity and multi-corers on the southern site of the island.
Two dives to sample the gas emissions at acoustically identified flare positions finished the program off, with dive 29 on Wednesday **8 February** being the highlight. As always during this expedition it was difficult at the start of the dive to find and sample the gas emission sites on the bottom of the trough as the bottom water was disturbed and murky, but in the end we were successful. The second part of the dive lead along a nearly 70 m high almost vertical wall, which marked the border of the trough. Everybody on board was fascinated by the extremely rich diversity of the benthic fauna, such as starfish, brittle stars, sponges, hard and soft corals, bryozoans, hydrozoans, … etc. The vertical wall with its overhanging rocks showed layered sedimentary rocks, which are used by the organisms as hard substrate. The trough runs in north-westerly direction and joins the southern wards leading part of the King Haakon Trough. Already during the bathymetry survey the steep flanks of this trough had been noticed as a clear left-lateral tectonic drift of the seafloor and is a structure in parallel to the Cooper Shear zone that is mapped on the island of South Georgia. During the glacial maximum this trough was used by an ice stream from the direction of Annenkov Island so we gave it the name Annenkov Trough (Fig. C1). While most shelf trough runs in radial directions away from the island, Annenkov Trough is completely differently orientated, which can only be explained by tectonic changes to the seafloor. Although the shelf morphology of South Georgia is in general characterised by glacier streams, the multibeam surveys with the echosounder also show details of active plate movements of the shelf base.
A series of 3 gravity cores sampled two unconfomities in the more recent sediment layers, which are very prominently present in the single beam PARASOUND records of King Haakon Trough (Fig. C1). Discordances are also present on the northern site of the island in the Royal Trough and are linked with changing current regimes during certain times in the glacial history. Whether the changes in the current systems on the South Georgian shelf carry a global signal or are different in different troughs will be revealed in the comparative analysis of these cores to those taken in the Royal Trough.
The last two days of station work on Wednesday, **8 February** and Thursday, **9 February** were used to collect missing samples in the Royal Trough and Drygalski Fjord. A planned last dive at Paradise Flare had unfortunately to be cancelled because of unsuitable weather conditions and the remaining time until Friday night was used for a further mapping survey of King Haakon Trough. The last week of our expedition involved the transit from South Georgia to Punta Arenas in Chile. Based on a weather forecast predicting bad weather for this leg of the expedition, we departed in good time on the weekend. The route was hard to calculate because of the strong winds of the West Wind Drift and the forecasted gale. While all station work had stopped, apart from the deployment of two XBTs to determine the sound velocity profile of the water column, the survey systems Parasound and multibeam echosounder were still running. Also the air and water measurements for CO_2 and

methane continued. The transit enabled us scientists time for more detailed analyses of the data and to finalised the chapters for the cruise report. The hydro-acoustic team was able to process all multibeam echo-sounder data and to produce a first overview map. A large part of the Parasound data, especially the water column data, had been processed. In total more than 1,600 locations with gas emissions were registered by the sounders. As we have mapped 8 of the shelf troughs almost along their entire length to the outer shelf edge with at least one line, we can prove that the gas emissions occur predominantly in the inner troughs of the island and only very occasional in the outer shelf areas. This distribution pattern we can see, not only based on the flares in the water column, but also the gas emissions also correlate clearly with gas pockets in the sediment which we can see in the sediment layer plots as 'blankening' zones.

On Monday, **13 February**, the vessel sailed at 06:18 UTC over a special coordinate: 52°S und 52°W. It does not happen often that a point is crossed were geographic latitude and longitude are equal. As is happened at 4:18 ship's time, only the people on the bridge and on watch in the hydro-acoustic lab noticed it. Next to the data analysis we used our daily science meetings this week to present and discuss results of the different working groups. Based on the unforeseen brilliant weather we were able to reach the entrance to the Strait of Magellan on Thursday, 16th February. The wide entrance to this passage is unusual with its flat land after our eyes got used to the high mountains of South Georgia. Several rigs of the petroleum industry remind us of our return to civilisation. For the transit to Punta Arenas we picked up a pilot at 19:00 on the **16 February**, who sailed with us for the last 110 nautical miles until we reach our anchorage, where the cruise finished at **17 February**. Most of us will depart the vessel on Sunday morning to catch an afternoon flight to Santiago. From Santiago we fly across the Atlantic and most of the scientists will arrive at home on Monday.

Acknowledgements

R/V METEOR cruise M134 to South Georgia was planned, coordinated and carried out by MARUM "Center for Marine Environmental Sciences" at the University of Bremen. The cruise was financed by the German Research Foundation (DFG). The shipping operator Reederei Briese Schiffahrts GmbH & Co KG provided technical support on the vessel. We would like to specially acknowledge the master of the vessel, Rainer Hammacher and his crew for their continued contribution to a pleasant and professional atmosphere aboard R/V METEOR. We also thank the government of South Georgia and the Sandwich Islands for support. Specifically, we are thankful to the Govt. Officer Pat Lurcock from King Edward Point for giving us advice for landing and visiting Grytviken. Many thanks to the staff of the Control Station German Research Vessels and to the Logistic Department of MARAUM.

Cruise participants

Name	**Discipline**	**Affiliation**
Aromokeye, Adeyemi David	Microbiology	FB2, Uni Bremen
Bihler, Viola	Hydroacoustics	MARUM
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Grahs, Maximilian	Hydroacoustics	MARUM
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Leymann, Tom	ROV pilot	MARUM
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Loher, Markus	Sediments	MARUM
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List of Stations

Date 2017	St. No.	Instrument	GeoB St. No.	Time (UTC) Begin	Latitude S	Longitude W	Water depth (m)
19.01.	109-1	CTD-1	22001-1	17:00	54°07.710	39°55.453	2419
19.01.	109-2	GOFLO-1	22001-2		54°07.710	39°55.453	2419

19.01.	109-3	GOFLO-2	22001-3	20:10	54°07.245	39°56.026	2451
21.01.	110-1	CTD-2	22002-1	5:57	54°17.238	37°31.302	231
21.01.	110-2	MUC-1	22002-2	7:13	54°17.245	37°17.328	230
21.01.	110-3	GC-1	22002-3	08:18	54°17.245	37°31.327	230
21.01.	111-1	ROV-20	22003-1		54°17.234	37°31.301	231
21.01.	112-1	BWS-1	22004-1	14:17	54°17.228	37°31.314	229
22.01.	113-1	CTD-3	22005-1	10:14	54°16.981	37°31.045	225
22.01.	114-3	GC-2	22006-1	11:13	54°17.231	37°31.287	228
22.01.	115-1	ROV-21	22007-1		54°16.986	37°31.067	225
22.01.	116-1	BWS-2	22008-1	19:45	54°17.000	37°31.060	227
23.01.	117-1	CTD-4	22009-1	09:53	54° 9.451	37°58.549	250
23.01.	117-2	GOFLO-3	22009-2	10:35	54° 9.459	37°58.571	251
23.01.	117-3	GC-3	22009-3	11:59	54° 9.458	37°58.581	250
23.01.	118-1	ROV-22	22010-1		54°10.101	37°56.648	243
23.01.	119-1	BWS-3	22011-1	20:24	54° 9.450	37°58.570	249
24.01.	120-1	CTD-5	22012-1		54°48.871	36°0.598	217
24.01.	120-2	MUC-2	22012-2	13:22	54°48.872	37° 0.602	217
24.01.	120-3	MUC-3	22012-3	13:57	54°48.873	36° 0.604	217
24.01.	120-4	BWS-4	22012-4	14:50	54°48.870	36° 0.600	218
24.01.	121-1	CTD-6	22013-1	17:29	54°51.270	35°54.659	319
25.01.	122-1	CTD-7	22014-1	10:38	54°52.659	35°54.743	285
25.01.	123-1	MUC-4	22015-1	12:14	54°51.269	35°54.667	318
25.01.	124-1	CTD-8	22016-1	13:48	54°49.430	35°58.213	70
25.01.	124-2	GC-4	22016-2	14:15	54°49.432	35°58.214	78
25.01.	125-1	GOFLO-4	22017-1	15:02	54°48.894	36° 0.609	217
25.01.	126-1	CTD-9	22018-1	16:05	54°48.279	36° 2.100	110
25.01.	126-2	GC-5	22018-2	16:30	54°48.277	36° 2.097	111
26.01.	127-1	CTD-10	22019-1	09:58	54°10.977	36°25.459	261
26.01.	128-1	CTD-11	22020-1	11:48	54°15.891	36°26.218	256
26.01.	129-1	CTD-12	22021-1	12:48	54°17.275	36°27.298	144
26.01.	130-1	CTD-13	22022-1	14:04	54°19.093	36°23.551	208
26.01.	131-1	CTD-14	22023-1	15:14	54°21.110	36°22.424	135
26.01.	132-1	GC-6	22024-1	17:24	54°15.885	36°26.225	254
27.01.	133-1	CTD-15	22025-1	09:53	53°46.194	38° 8.387	368
27.01.	133-2	GC-7	22025-2	10:45	53°46.198	38° 8.391	366
27.01.	134-1	ROV-23	22026-1		53°46.246	38°08.348	369
27.01.	135-1	CTD-16	22027-1	19:42	53°46.187	38° 8.422	368
28.01.	136-1	CTD-17	22028-1	10:15	53°46.198	38° 8.365	367
28.01.	136-2	GC-8	22028-2	11:16	53°46.201	38° 8.430	368
28.01.	136-3	GC-9	22028-3	12:49	53°46.180	38°08.420	368
28.01.	137-1	ROV-24	22029-1		53°46.208	38°08.378	368
28.01.	138-1	BWS-5	22030-1	22:18	53°46.206	38°08.418	368
29.01.	139-1	MUC-5	22031-1	10:15	53°46.209	38° 8.413	367
29.01.	140-1	GC-10	22032-1	11:09	53°46.199	38° 8.409	369
29.01.	140-2	DAPC-1	22032-2	12:41	53°46.197	38° 8.406	367
29.01.	141-1	ROV-25	22033-1		53°37.383	38°19.776	799
30.01.	142-1	CTD-18	22034-1	8:18	53°48.847	37°59.683	200
30.01.	142-3	MUC-6	22034-3	10:42	53°48.849	37°59.655	211
30.01.	142-4	BWS-7	22034-4	11:27	53°48.849	37°59.655	212
30.01.	143-1	DAPC-2	22035-1	13:28	53°46.190	38° 8.404	367
30.01.	144-1	GC-11	22036-1	15:01	53°47.454	38° 6.532	330
30.01.	145-1	GC-12	22037-1	16:56	53°44.705	38°10.666	378
30.01.	146-1	CTD-19	22038-1	18:53	53°42.032	38°13.175	345
30.01.	146-2	BWS-8	22038-2	20:05	53°42.032	38°13.180	345

31.01.	147-1	GC-13	22039-1	14:04	54°27.438	35°50.546	227
31.01.	147-2	GC-14	22039-2	15:11	54°27.444	35°50.526	227
31.01.	148-1	CTD-20	22040-1	16:41	54°27.685	35°51.138	222
01.02.	149-1	GOFLO-5	22041-1	9:45	54°21.110	36°22.440	136
01.02.	149-2	MUC-7	22041-2	10:24	54°21.106	36°22.439	136
01.02.	150-1	GOFLO-6	22042-1	11:42	54°17.279	36°27.682	146
01.02.	151-1	GC-15	22043-1	12:34	54°15.899	36°26.248	254
01.02.	152-1	ROV-26	22044-1		54°15.940	36°26.248	254
03.02.	153-1	GOFLO-7	22045-1	7:55	54°11.630	36°25.620	257
03.02.	154-1	MUC-8	22046-1	9:55	54°17.270	36°27.710	142
03.02.	156-1	ROV-27	22047-1		54°15.919	36°26.279	220
04.02.	157-1	CTD-21	22048-1	10:00	54°56.511	36°14.964	174
04.02.	157-2	BWS-9	22048-2	11:00	54°56.509	36°14.986	172
04.02.	157-3	MUC-9	22048-3	12:13	54°56.511	36°14.964	173
04.02.	157-4	MUC-10	22048-4	12:37	54°56.510	36°14.963	173
05.02.	158-1	CTD-22	22049-1	10:00	54°23.152	37°30.764	368
05.02.	158-2	BWS-10	22049-2	11:10	54°23.163	37°30.757	368
05.02.	158-3	GC-16	22049-3	12:29	54°23.165	37°30.758	359
05.02.	159-1	ROV-28	22050-1		54°23.147	37°30.773	363
05.02.	160-1	MUC-11	22051-1	20:11	54°23.152	37°30.765	358
06.02.	161-1	CTD-23	22052-1	11:21	54°56.510	36°14.964	172
06.02.	162-1	CTD-24	22053-1	13:05	54°56.512	36°14.954	172
07.02.	163-1	CTD-25	22054-1	8:01	54°26.156	37°21.083	260
07.02.	163-2	MUC-12	22054-2	9:07	54°26.169	37°21.094	256
07.02.	164-1	GC-17	22055-1	11:16	54°23.320	37°29.511	380
07.02.	165-1	GC-18	22056-1	17:44	54°23.003	37°14.142	259
07.02.	166-1	GC-19	22057-1	19:08	54°23.024	37°16.970	266
07.02.	167-1	GC-20	22058-1	20:31	54°23.043	37°19.388	268
07.02.	168-1	CTD-26	22059-1	21:58	54°25.048	37°18.621	211
08.02.	169-1	CTD-27	22060-1	08:05	54°26.156	37°21.083	260
08.02.	169-2	BWS-11	22060-2	09:15	54°26.165	37°21.094	260
08.02.	170-1	ROV-29	22061-1		54°26.157	37°21.053	262
09.02.	171-1	MUC-13	22062-1	04:11	54°27.454	35°50.668	226
09.02.	172-1	MUC-14	22063-1	05:05	54°27.695	35°51.142	223
09.02.	173-1	GOFLO-8	22064-1	09:58	54°51.250	35°54.600	319
09.02.	173-2	BWS-12	22064-2	11:00	54°51.266	35°54.650	318
09.02.	174-1	CTD-28	22065-1	13:02	54°49.422	35°58.200	65
09.02.	174-2	CTD-29	22065-2	13:30	54°49.663	35°58.462	71
09.02.	174-3	CTD-30	22065-3	14:07	54°49.263	35°58.153	84
09.02.	175-1	GC-21	22066-1	14:45	54°48.871	36° 0.616	217
09.02.	176-1	CTD-31	22067-1	16:20	54°47.555	36° 4.073	194
12.02.	177-1	XSV-1	22068-1	16:21	52°20.902	48°18.681	970
13.02.	178-1	XBT-1	22069-1	14:29	51°47.310	53°21.220	2001

ROV: 10 dives with ROV SQUID 2000
DAPC: 2 stations using the dynamic autoclave piston corer
GC: 21 stations gravity corer
MUC: 14 multicorer stations
CTD: 31 stations CTD with hydro-casts
BWS: 12 bottom water sampler stations
GOFLO: 8 stations GoFlo Sampler