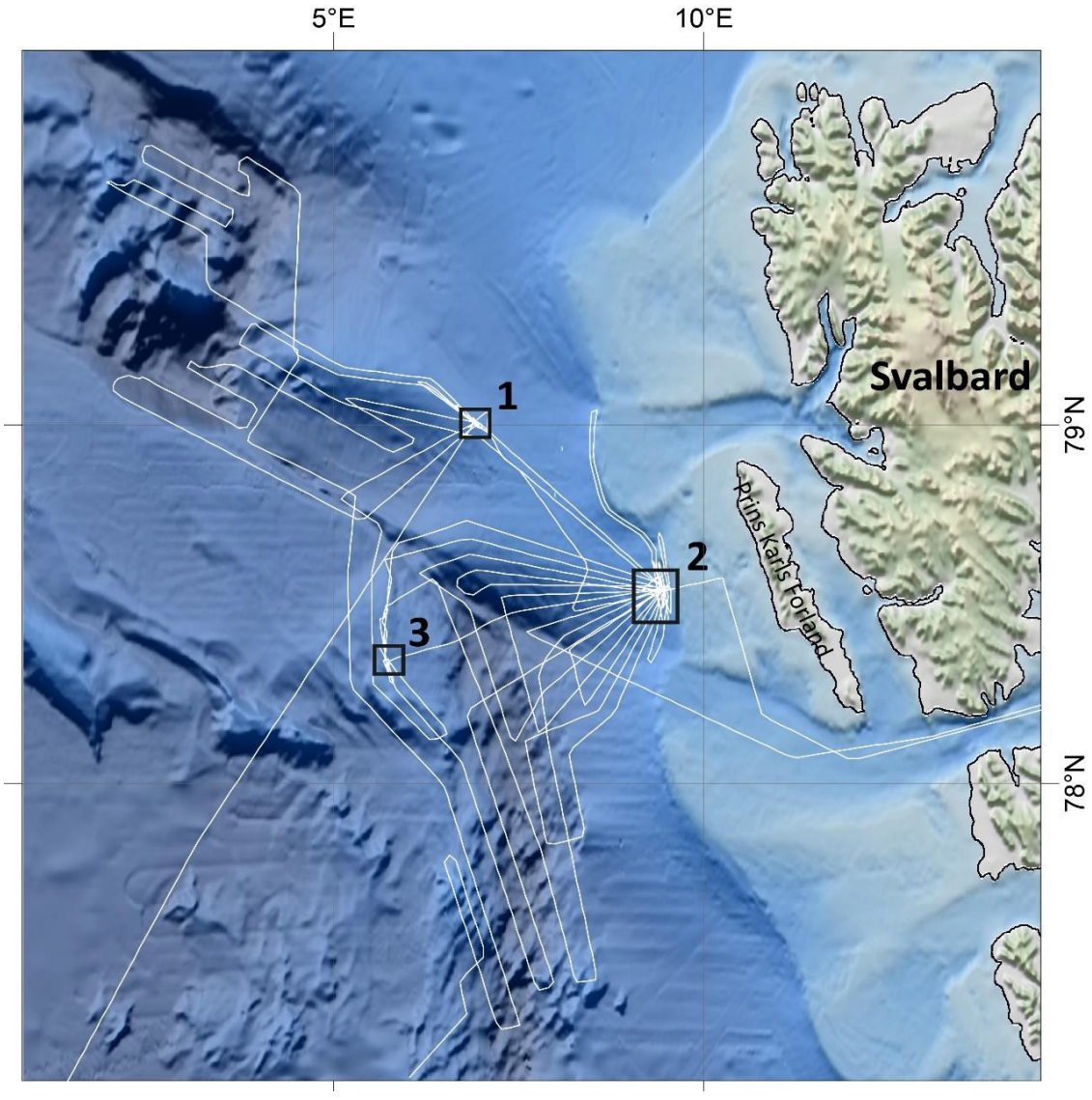
Prof. Dr. Gerhard Bohrmann
MARUM – Center for Marine Environmental Sciences
and Department of Geosciences
Klagenfurter Str.
28359 Bremen – GERMANY
Tel. +49 421-218-65050
Email: gbohrmann@marum.de

Short Cruise Report
R/V MARIA S. MERIAN – MSM57
Reykjavik- Longyearbyen – Reykjavik
July 29 – September 7, 2016
Chief Scientist: Gerhard Bohrmann
Captain: Björn Maaß



Track lines of MARIA S. MERIAN Cruise MSM57 with stations in three areas: 1 = Vestnesa Ridge, 2 = upper continental margin of Svalbard, 3 = Svyatorgo Ridge.

Objectives

The main objective of the cruise was to investigate gas hydrate systems and their dynamics at the continental margin of Svalbard. Gas hydrates have been documented by geophysical methods and by direct sampling in sediments of the margin. Samples have been retrieved from Vestnesa Ridge an elongated sediment drift at the lower part of the continental margin. Along the crest of Vestnesa Ridge well defined chimney structures within a well-stratified sediment sequence and distinct pockmarks with active gas seepage were found. Based on seismic 3D data three drillings with MeBo were planned inside and outside of the chimney structures in order to understand the distribution of gas hydrates. Further drillings were planned at the uppermost part of the continental slope offshore Prins Karls Forland. Above the gas hydrate stability zone around 400m water depth various methane emission sites were detected as acoustic plumes in echosounder recordings. One explanation interprets the methane emissions from hydrate decomposition due to a potential increase in water temperature of 1° C during the last 30 years. Such an increase of bottom water from 2°C to 3° C would cause a downward movement of the upper boundary of the gas hydrate stability of 38 m. Up to now no methane hydrates have been sampled in such shallow water depth off Svalbard and the hydrate melting hyothesis is highly questionable. In order to understand the hydrate dynamics of this depth interval between 300 – 500 m water depth five drill sites were planned to drill using the mobile drilling system MeBo. Chemical, physical and geological analyses of the drilled sediments should allow to understand the hydrate distribution in the cores and to define the phase boundary more precisely. Gravity core sampling and heat flow measurements were planned to support the MeBo drillings.

Cruise Narrative

Research Vessel MARIA S. MERIAN sailed on Friday, 29 July 2016 at 1 p. m. local time from bunker pier of Icelandic port Reykjavik for a transit of four days to our research area at the western continental slope of Spitsbergen. Before, R/V MARIA S. MERIAN berthed at Ægisgarður Pier for an exchange of scientific crew and equipment of the cruises MSM56 and 57. For MSM57 the MARUM seafloor drill rig MeBo70 and many additional, mostly geological sampling devices were taken on board. In total eight 20’ containers were discharged in addition to one 40’ container by boatswain and crew. Especially the complex installation of MeBo70 prolonged the berthing time to four, instead of the usual three days.

Having left Reykjavik, MARIA S. MERIAN steamed along Iceland’s west side, under coast protection, northwards across the Denmark Strait during Saturday, 30 July, crossed the active rift zone of Kolbeinsey Ridge and arrived, on Sunday, 31 July at the Iceland Plateau, where we started to record data from the hydro-acoustic systems PARASOUND and the Multi-beam EM122. The vessel followed the direction of the Kolbeinsey Ridge to the north and crossed the Jan Mayen Fracture Zone west of the Island Jan Mayen. The vessel steamed on Monday, 1 August, through the Greenland Sea and crossed the Greenland Fracture on Tuesday, 2 August. We crossed the Molloy Transform Fault, which actively separates the Knipovich Ridge from the Molloy Ridge Area.

After we reached Vestnesa Ridge, our target area for the first leg, on Tuesday, we started at 16:25 with a gravity corer at the potential MeBo drill site to recover a 577 cm sediment core (GC-1) of hemipelagic mud away from the pockmarks and gas chimneys in the seabed. On Wednesday, 3 August at 04:15 MeBo (MeBo 123), the seafloor drill rig, was deployed for the first time during the cruise within the Lunde Pockmark at a location of relative flat seafloor. Unfortunately, MeBo stopped drilling after 3 hours due to technical problems. Instead of Mebo

drilling activities we took 2 gravity cores; one at the MeBo station to recover the uppermost meters of sediment which are difficult to sample by Mebo drilling. We recovered a 7.65 m-long core showing the uppermost sediment sequence in a very good quality. The second gravity GC-3 sampled the sediment sequence again at the background station away from the pockmarks. The following four-hour mapping activity covered the entire elongated 3D-seismic box of UiT, whereas the profiles extended the NW and the SE rim of the box.

The presence of acoustic anomalies in the water column was recorded and the analysis of the data showed us the distribution of gas emission sites in relation to the pockmarks. A second T-lance profiling with eight individual stations on Vestnesa Ridge followed until the morning of Thursday, 4 August, when Mebo (Mebo124) was launched at the same position in the Lunde Pockmark as before. Due to the break of the Kernfänger, drilling had to stop and the drill rig had to recovered from the seafloor. Instead we took two gravity cores in the Lunde Pockmark to sample hydrates. For locations we were guided by the micro-bathymetry map recently taken by the UiT and we could define the sampled sites by very small-scaled morphological features. Gravity core GC-4 sampled 535 cm of the hemipelagic sediments and gravity core GC-5 recovered a 60 cm sequence with gas hydrates. After the Kernfänger was repaired, the seafloor drill rig (MeBo125) was deployed at the same position in the Lunde Pockmark as the two drilling attempts before.

MeBo drilled over night until 06:00 on Friday, 5 August and drilling had to be stopped because a core barrel was cramped in the drill rod and it was not possible to pull it out with the wire-line system. The system drilled down to 22.90 mbsf and recovered 906 cm of core material. The chance that the Mebo had be rigged for the next drill site was taken for ten more T-lance measurements predominantly within the Lunde Pockmark. A further gravity core (GC-6) sampled hydrate in a small pit of 30 m in diameter in the Lunde Pockmark, before the MeBo was deployed at the background station where we wanted to core the sediment sequence as deep as possible.

The position for drilling was selected clearly away from the gas chimneys and a distinct fault in the deeper sediment sequence imaged by the 3D seismic data of UiT. Drilling was performed from Friday afternoon during Saturday, 6 August until Sunday, 7 August late morning. The drilling was the deepest one up to now during this cruise, with a total penetration of 62.50 m and cored 26,42 m sediments. After drilling we deployed the temperature lance (TL05-1) to measure a 4.5 m temperature profile just at the same position as the MeBo drill site. Further 5 temperature lance measurements were taken within or outside pockmarks (TL06-1 to -5) and MeBo (MeBo 127) started to drill a new site at Lunde pockmark, where high amplitude reflectors are seen close to the surface. Drilling had to change from push coring to rotary coring around 5.75 mbsf, where massive carbonates have been sampled. Due to technical problems the drilling had to be stopped much earlier at a drilling depth of 13.90 m. The deepest core was the autoclave tool core barrel (MDP) developed within the collaborative project SUGAR. The MDP was deployed three times during the drilling on Vestnesa Ridge. In all cases the formation pressure was kept by the tool that allowed a selective degassing and quantification of the gas amount in the formation. Unfortunately, one of the autoclave tools did not sample sediment; however, the other two autoclave deployments were more successful. MeBo 127 core total length of 3.52 m. Beside an autoclave core barrel (MDP) the borehole assembly was plugged at the end with a MeBoCORK (Circulation Obviation Retrofit Kit).

After the drilling activity on Monday, 8 August we took a gravity core (GC-7) at Lomvi Pockmark in the northeast pit and sampled gas hydrate. Unfortunately, the core barrel was bent and we had to take a second core at the same position. T-lance profiling (TL-7) was than performed during night inside and outside of Lomvi Pockmark. We recovered 16 temperature profiles until the morning of Tuesday, 9 August. A gravity core (GC-8) was taken in a small crater observed in the micro-bathymetry map and recovered gas hydrate as well at the base of the core. A second gravity core

(GC-9) was taken at the T-lance station TL02-5, where anomalies in conductivity have been found and comparisons with the lithology are planned. On Tuesday, 9 August the wind speed increased during late afternoon and the weather forecast predicted a sea state of Beaufort 7. We therefore decided to leave the area of Vestnesa Ridge and moved to the west to map the northern part of the Molloy Ridge area. Although this area is only 60nm away from Vestnesa Ridge, the weather was much better, due to extended ice fields.

Wednesday afternoon, 10 August, we moved back to Vestnesa Ridge, where the weather had calmed down as well and we were able to continue with MeBo drilling (MeBo 128) at the seep site of Lunde Pockmark. The drill hole was at the same spot as MeBo 127 and should expand the knowledge on lithology with depth. Unfortunately, due to technical problems the drilling had to be stopped at 10.75 mbsf. An extensive profiling of the T-lance at 16 stations (TL08) followed northwest of the Lunde Pockmark and covered at least two more pockmarks that showed no activity by gas venting. Higher heat flux values were determined inside the pockmarks, and it appears that the higher heat flow values are not correlated to the gas-emission activity of the pockmarks. The T-lance program was finished on Thursday morning, 11 August and we took two gravity cores in small pits at Lomvi Pockmark. Both cores (GC-11 and GC-12) sampled only a short sequence of sediments with distinct gas hydrate layers, which most probably stopped deeper penetration of the corer. During the last station of Leg 1 we deployed a sonar at the seafloor, close to the CORK position. The sonar will scan the water column and gas emissions during regular time intervals and will become recovered by ROV at the same time, when the data of the MeBoCORK will be downloaded.

On Thursday, RV MARIA S. MERIAN started steaming to Longyearbyen. During the transit we performed seafloor mapping across Vestnesa Ridge and the continental slope, west of Svalbard. During the night we reached the Isfjord, and berthed in the morning of Friday, 12 August at the coal mine pier of Longyearbyen directly at the airport. 14 scientists and 4 crew members were exchanged prior to Leg 2 of this cruise. Despite the rainy weather, many of us enjoyed the time to walk on land. RV MARIA S. MERIAN left the coal mine pier on Saturday morning, 13 August during sunny weather and continued mapping for the rest of the day and the night. After the crew-change in Longyearbyen we started our research studies at the western continental slope off Svalbard. Due to rough sea state we shifted the beginning of MeBo drilling (MeBo 129-1) to the evening. The location of the drill site in 405 m water depth was selected to drill into the glacigenic sediments at the slope of Spitzbergen and to penetrate a strong high amplitude reflector in 34-38 mbsf. The MeBo did two drill sites during the same deployment (MeBo129-1 and 129-2) which lasted from Sunday evening to Tuesday morning, 16 August 2016. The first drill hole sampled sediments down to 12.39 m and the second hole recovered sediments down to 22.98 mbsf.

Yet, the overall low wind speed and small sea state enabled us to conduct all station work safely. Only Tuesday, 16 August, sea state was too high to deploy MeBo, so we started an alternate science program to study the nearby Svyatogor Ridge, located west of the well-known Knipovich Rift. Using the heat-probe we conducted temperature measurements at 16 stations overnight along three short transects across the ridge crest.

These measurements showed that the pockmarks are characterized by much higher heat flow compared to the regions outside these structures. Although we did not find any gas flares using the vessel's acoustic imaging tools, the increased heat flow is an indication of advection of warmer fluids from depths. Back at the shallow continental margin offshore Prins Karls Forland we took gravity core GC-13 during Wednesday, 17 August and started drilling a MeBo Site 130 close to MeBo 129 at 405 m water depth. Due to technical problems, we had to stop drilling at the early morning of Thursday, 18 August, and we took gravity core GC-14 at the same location. The following drilling at the position in 405 m water depth started at 08:00 on Friday morning 19 August reached a drilling

depth of 20.30 mbsf. MeBo drill Sites 133 and 134 continued drilling until Sunday, 21 August at the shallowest area at 340 m beyond the accumulation of recent gas seeps. Overnight mapping of the seafloor brought us back to the deepest drill site at 445 m water depth on Monday morning, 22 August. Between MeBo drilling sites 135 and 136 until Wednesday morning, 24 August, mapping and gravity core GC-17 defined the station program.

After a short mapping survey, MeBo was again deployed Wednesday evening to start a new drill site in 340 m water depth, well outside the methane hydrate stability zone. Drilling lasted until Thursday morning 25 August reaching a depth of 22m. The cores revealed an interesting sequence of glacial deposits. Due to the bad weather conditions, we started our sampling program on Svyatogor Ridge on Friday 26 August. We first deployed the temperature lance along the northern portion of the ridge to investigate a series of pockmarks. A total of 13 stations (TL-10) were completed. A gravity core (GC-18) was then taken within a pockmark that had shown the highest heat-flow value above the regional background trend. After an additional short mapping survey, we reached Vestnesa Ridge and started drill site 138 at the seep site within Lunde Pockmark in 1200 m of water on Saturday 27 August. At this drill site we reached a total depth of nearly 24m yielding sediment sequence rich in methane hydrates and carbonate precipitates. Seafloor mapping to the west brought us on Sunday, 28 August to the Molloy Deep, where sea ice coverage hindered us to map the westernmost part of the nodal deep. Steaming back to Vestnesa Ridge to the East we took a gas hydrate-rich core (GC-19) at a seep site of Lunde pockmark on Monday morning 29 August.

Gas hydrate specimen were stored in liquid nitrogen and will be used for structural analysis in laboratories at home. We reached at the same day the upper margin offshore Prins Karls Forland and drilled a third drill hole at 391 m water depth. This drilling was finished at the evening of Tuesday, 30 August at 26.15 mbsf. The over-night mapping brought us to Svyatogor Ridge, where we took two gravity cores (GC-20 and GC-21) and a T-lance profile (TL-11) of nine stations on Wednesday, 31 August. During the following Thursday, 1 September, we started to drill another site just below the methane hydrate stability zone in 402 m water depth and 4 km to the north of our main seismic profile. We were guided by a high-frequency seismic profile acquired by our French colleagues with the SYSIF deep-towed seismic tool. A bright spot reflection in around 30mbsf, which was interpreted as gas-charged layer was one of the targets. We drilled until Friday morning, 2 September down to 33.30m and could confirm the presence of free gas in this horizon. Gravity corer GC-22 followed afterwards and was the last station work performed during this cruise. Seafloor mapping for more than 26 hours was used to fill some gaps in the bathymetry maps and to extend the Knipovich Ridge data to the western rim of the rift valley. R/V MARIA S. MERIAN started its transit back to Reykjavik on Saturday, 3 September and reached the harbor on Wednesday 7 September, where Cruise MSM57 ended.

Acknowledgements

R/V MARIA S. MERIAN cruise MSM57 to Vestnesa Ridge and the upper continental margin off Svalbard planned, coordinated and carried out by MARUM “Center for Marine Environmental Sciences” at the University of Bremen in cooperation with CAGE, the excellence cluster and “Centre for Arctic Gas Hydrate, Environment and Climate” of the University of Tromsø and the GEOMAR, Helmholtz-Zentrum für Ozeanforschung, Kiel. The cruise was financed by the German Research Foundation (DFG) and funds from CAGE and Statoil. 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, Björn Maaß and his crew for their continued contribution to a pleasant and professional atmosphere aboard R/V MARIA S. MERIAN.

Cruise participants

Name	Affiliation	Name	Affiliation
Ahrlich, Frauke	MARUM	Meckel, Sebastian	MARUM
Bergenthal, Markus	MARUM	Meyer-Schack, Birgit	MARUM
Bohrmann, Gerhard	FB5	Noorlander, Kees	MARUM
Bünz, Stefan	CAGE-UiT,	Panieri, Giuliana	CAGE-Uit
Düßmann, Ralf	MARUM	Pape, Thomas	FB5
Ferreira, Christian	FB5	Reuter, Michael	MARUM
Freudenthal, Tim	MARUM	Riedel, Michael	MARUM
Fröhlich, Siefke	MARUM	Rosiak, Uwe	MARUM
Hamann, Kristin	GEOMAR	Schmidt, Christopher	GEOMAR
Hong, Wei Li	CAGE-UiT	Schmidt, Werner	MARUM
Hsu, Chieh Wei (Jeff)	FB5	Seiter, Christian	MARUM
Johnson, Joel	UoNH	Spagnoli, Giovanni	Bauer
Kaszemeik, Kai	MARUM	Stachowski, Adrian	MARUM
Kausche,Arne	MARUM	Stange, Nikolas	FB5
Klein, Thorsten	MARUM	Wallmann, Klaus	GEOMAR
Lange, Mirko	FB5	Wintersteller, Paul	FB5
Lepland, Aivo	CAGE-UiT	Wunsch, David	Corsyde
Malnati, Janice	FB5	Yao, Haoyi	CAGE-UiT

MARUM Center for Marine and Environmental Sciences, DFG Research Center and Cluster of Excellence, University of Bremen, Postfach 330440, 28334 Bremen, **Germany**

FB5 Department of Geosciences, University of Bremen, Geo Building, Klagenfurter Str. 28359 Bremen, **Germany**

CAGE-UiT Centre for Arctic Gas Hydrate, Environment and Climate**,** Naturfagbygget, Dramsveien 201, 9010 Tromsø, **Norway**

GEOMAR Helmholtz-Zentrum für Ozeanforschung Kiel, Düsternbrooker Weg20/Wischhofstr. 1-3 ,24105 Kiel/24148 Kiel, **Germany**

Corsyde Corsyde International GmbH & CO. KG, Reuchlinstr. 10-11, 10553 Berlin, **Germany**

UoNH University of New Hamsphire, Department of Earth Sciences, James Hall, 56 College Road, Durham, NH 03824, U.S.A.

Bauer BAUER Maschinen GmbH, BAUER Str. 1, 86529 Schrobenhausen, **Germany**

List of stations

Date 2016 (UTC)	MSM57 St. No.	Instrument	GeoB St. No.	Location	Latitude N	Longitude E
02.08.2016	613-1	GC-1	21601-1	Lunde Pockmark	79°00.504'	6°54.637'
02.08.2016	614-1	TL01	21602-1	outside Pockm.	79°01.036'	6°53.737'
02.08.2016	615-1	TL02-1	21603-1	outside Pockm.	79°00.577'	6°53.936'
02.08.2016	615-2	TL02-2	21603-2	outside Pockm.	79°00.528'	6°54.151'
02.08.2016	615-3	TL02-3	21603-3	Lunde Pockmark	79°00.502'	6°54.614'
02.08.2016	615-4	TL02-4	21603-4	outside Pockm.	79°00.397'	6°54.864'
03.08.2016	615-5	TL02-5	21603-5	outside Pockm.	79°00.339'	6°55.170'
03.08.2016	615-6	TL02-6	21603-6	Lomvi Pockmark	79°00.277'	6°55.538'
03.08.2016	615-7	TL02-7	21603-7	Lomvi Pockmark	79°00.219'	6°55.610'
03.08.2016	615-8	TL02-8	21603-8	Lomvi Pockmark	79°00.180'	6°55.778'
03.08.2016	616-1	MeBo123	21604-1	Lunde Pockmark	79°00.503'	6°54.625'
03.08.2016	617-1	GC-2	21605-1	Lunde Pockmark	79°00.506'	6°54.613'
03.08.2016	618-1	GC-3	21606-1	Reference Station	78°59.806'	6°57.808'
03.08.2016	619-1	TL03-1	21607-1	outside Pockm.	79°00.014'	6°56.901'
03.08.2016	619-2	TL03-2	21607-2	outside Pockm.	79°00.070'	6°56.562'
03.08.2016	619-3	TL03-3	21607-3	outside Pockm.	78°59.993'	6°55.651'
03.08.2016	619-4	TL03-4	21607-4	Lomvi Pockmark	79°00.114'	6°55.674'
04.08.2016	619-5	TL03-5	21607-5	Lomvi Pockmark	79°00.148'	6°56.008'
04.08.2016	619-6	TL03-6	21607-6	outside Pockm.	79°00.216'	6°56.146'
04.08.2016	619-7	TL03-7	21607-7	outside Pockm.	79°00.311'	6°56.895'
04.08.2016	619-8	TL03-8	21607-8	outside Pockm.	79°00.372'	6°57.138'
04.08.2016	620-1	MeBo124	21608-1	Lunde Pockmark	79°00.502'	6°54.615'
04.08.2016	621-1	GC-4	21609-1	Lunde Pockmark	79°00.413'	6°54.269'
04.08.2016	621-2	GC-5	21609-2	Lunde Pockmark	79°00.403'	6°54.253'
04.08.2016	622-1	MeBo125	21610-1	Lunde Pockmark	79°00.503'	6°54.621'
05.08.2016	623-1	TL04-1	21611-1	Lunde Pockmark	79°00.570'	6°55.025'
05.08.2016	623-2	TL04-2	21611-2	outside Pockm.	79°00.497'	6°54.433'
05.08.2016	623-3	TL04-3	21611-3	Lunde Pockmark	79°00.474'	6°54.590'
05.08.2016	623-4	TL04-4	21611-4	Lunde Pockmark	79°00.445'	6°54.607'
05.08.2016	623-5	TL04-5	21611-5	Lunde Pockmark	79°00.446'	6°54.280'
05.08.2016	623-6	TL04-6	21611-6	Lunde Pockmark	79°00.424'	6°53.896'
05.08.2016	623-7	TL04-7	21611-7	outside Pockm.	79°00.442'	6°53.645'
05.08.2016	623-8	TL04-8	21611-8	Lunde Pockmark	79°00.493'	6°53.929'
05.08.2016	623-9	TL04-9	21611-9	Lunde Pockmark	79°00.483'	6°53.306'
05.08.2016	623-10	TL04-10	21611-10	Lunde Pockmark	79°00.380'	6°54.602'
05.08.2016	624-1	GC-6	21612-1	Lunde Pockmark	79°00.4266'	6°54.673'
05.08.2016	625-1	MeBo126	21613-1	Background	78°59.806'	6°57.808'
07.08.2016	626-1	TL05-1	21614-1	MeBo126 site	78°59.806'	6°57.808'
07.08.2016	627-1	TL06-1	21615-1	NW Vestnesa Ridge	79°06.966'	6°08.728'
07.08.2016	627-2	TL06-2	21615-2	NW Vestnesa Ridge	79°06.933'	6°09.690'
07.08.2016	627-3	TL06-3	21615-3	NW Vestnesa Ridge	79°06.895'	6°10.720'

07.08.2016	627-4	TL06-4	21615-4	NW Vestnesa Ridge	79°06.854'	6°11.847'
07.08.2016	627-5	TL06-5	21615-5	NW Vestnesa Ridge	79°06.806'	6°12.832'
07.08.2016	628-1	MeBo127	21616-1	Lunde Pockmark	79°00.418'	6°54.245'
08.08.2016	629-1	GC-7	21617-1	Lunde Pockmark	79°00.205'	6°55.867'
08.08.2016	629-2	GC-8	21617-2	Lunde Pockmark	79°00.201'	6°55.870'
08.08.2016	630-1	TL07-1	21618-1	Lunde & NoName Pockm.	79°00.421'	6°54.245'
08.08.2016	630-2	TL07-2	21618-2	Lunde & NoName Pockm.	79°00.416'	6°54.248'
09.08.2016	630-3	TL07-3	21618-3	Lunde & NoName Pockm.	79°00.407'	6°54.231'
09.08.2016	630-4	TL07-4	21618-4	Lunde & NoName Pockm.	79°00.393'	6°54.191'
09.08.2016	630-5	TL07-5	21618-5	Lunde & NoName Pockm.	79'00.379'	6°54.158'
09.08.2016	630-6	TL07-6	21618-6	Lunde & NoName Pockm.	79°00.346'	6°54.094'
09.08.2016	630-7	TL07-7	21618-7	Lunde & NoName Pockm.	79°00.316'	6°54.074'
09.08.2016	630-8	TL07-8	21618-8	Lunde & NoName Pockm.	79°00.277'	6°54.725'
09.08.2016	630-9	TL07-9	21618-9	Lunde & NoName Pockm.	79°00.344'	6°54.666'
09.08.2016	630-10	TL07-10	21618-10	Lunde & NoName Pockm.	79°00.361'	6°54.574'
09.08.2016	630-11	TL07-11	21618-11	Lunde & NoName Pockm.	79°00.407'	6°54.593'
09.08.2016	630-12	TL07-12	21618-12	Lunde & NoName Pockm.	79°00.435'	6°54.532'
09.08.2016	630-13	TL07-13	21618-13	Lunde & NoName Pockm.	79°00.475'	6°54.524'
09.08.2016	630-14	TL07-14	21618-14	Lunde & NoName Pockm.	79°00.496'	6°54.351'
09.08.2016	630-15	TL07-15	21618-15	Lunde & NoName Pockm.	79°00.610'	6°53.736'
09.08.2016	630-16	TL07-16	21618-16	Lunde & NoName Pockm.	79°00.674'	6°53.356'
09.08.2016	631-1	GC-9	21619-1	Lunde Pockmark	79°00.427'	6°54.677'
09.08.2016	632-1	GC-10	21620-1	at TL02-5 site	79°00.339'	6°55.170'
10.08.2016	633-1	MeBo128	21621-1	Lunde Pockmark	79°00.430'	6°54.255'
10.08.2016	634-1	TL08-1	21622-1	NoName Pockmark	79°01.087'	6°49.855'
11.08.2016	634-2	TL08-2	21622-2	NoName Pockmark	79°01.155'	6°50.041'
11.08.2016	634-3	TL08-3	21622-3	NoName Pockmark	79°01.098'	6°50.481'
11.08.2016	634-4	TL08-4	21622-4	NoName Pockmark	79°01.074'	6°50.637'
11.08.2016	634-5	TL08-5	21622-5	NoName Pockmark	79°01.059'	6°50.949'
11.08.2016	634-6	TL08-6	21622-6	NoName Pockmark	79°01.038'	6°51.129'
11.08.2016	634-7	TL08-7	21622-7	NoName Pockmark	79°00.985'	6°51.258'
11.08.2016	634-8	TL08-8	21622-8	NoName Pockmark	79°00.944'	6°51.492'
11.08.2016	634-9	TL08-9	21622-9	NoName Pockmark	79°00.875'	6°51.533'
11.08.2016	634-10	TL08-10	21622-10	NoName Pockmark	79°00.855'	6°51.802'
11.08.2016	634-11	TL08-11	21622-11	NoName Pockmark	79°00.828'	6°52.223'
11.08.2016	634-12	TL08-12	21622-12	NoName Pockmark	79°00.744'	6°53.085'
11.08.2016	634-13	TL08-13	21622-13	NoName Pockmark	79°00.696'	6°53.176'
11.08.2016	634-14	TL08-14	21622-14	NoName Pockmark	79°00.592'	6°54.294'
11.08.2016	634-15	TL08-15	21622-15	NoName Pockmark	79°00.599'	6°54.700'
11.08.2016	634-16	TL08-16	21622-16	NoName Pockmark	79°00.558'	6°54.821'
11.08.2016	635-1	GC-11	21623-1	Lomvi Pockmark	79°00.212'	6°55.950'
11.08.2016	636-1	GC-12	21624-1	Lomvi Pockmark	79°00.171'	6°55.498'
11.08.2016	637-1	S-CORK	21625-1	Lunde Pockmark	79°00.380'	6°54.297'
14.08.2016	638-1	MeBo129-1	21626-1	Cont.-Margin Site 1	78°33.212'	09°27.070'

15.08.2016	638-2	MeBo129-2	21626-2	Cont.-Margin Site 1	78°33.212'	09°27.070'
16.08.2016	639-1	SVP-1	21627-1	Cont. Margin	78°38.06'	05°41.92'
16.08.2016	640-1	SVP-2	21628-1	North of Svyatogor Ridge	78°38.06'	05°41.92'
16.08.2016	641-1	TL09-1	21629-1	Svyatogor Ridge	78°21.206'	05°40.542'
16.08.2016	641-2	TL09-2	21629-2	Svyatogor Ridge	78°21.258'	05°41.440'
16.08.2016	641-3	TL09-3	21629-3	Svyatogor Ridge	78°21.324'	05°42.134'
16.08.2016	641-4	TL09-4	21629-4	Svyatogor Ridge	78°21.337'	05°42.479'
17.08.2016	641-5	TL09-5	21629-5	Svyatogor Ridge	78°21.372'	05°43.434'
17.08.2016	641-6	TL09-6	21629-6	Svyatogor Ridge	78°21.439'	05°44.178'
17.08.2016	641-7	TL09-7	21629-7	Svyatogor Ridge	78°21.120'	05°44.916'
17.08.2016	641-8	TL09-8	21629-8	Svyatogor Ridge	78°20.813'	05°45.382'
17.08.2016	641-9	TL09-9	21629-9	Svyatogor Ridge	78°20.709'	05°44.346'
17.08.2016	641-10	TL09-10	21629-10	Svyatogor Ridge	78°20.600'	05°43.473'
17.08.2016	641-11	TL09-11	21629-11	Svyatogor Ridge	78°20.473'	05°42.270'
17.08.2016	641-12	TL09-12	21629-12	Svyatogor Ridge	78°20.318'	05°42.559'
17.08.2016	641-13	TL09-13	21629-13	Svyatogor Ridge	78°20.039'	05°42.882'
17.08.2016	641-14	TL09-14	21629-14	Svyatogor Ridge	78°20.130'	05°43.649'
17.08.2016	641-15	TL09-15	21629-15	Svyatogor Ridge	78°20.249'	05°44.380'
17.08.2016	641-16	TL09-16	21629-16	Svyatogor Ridge	78°20.387'	05°45.147'
17.08.2016	642-1	GC-13	21630-1	Cont. -Margin	78°33.241'	09°23.344'
17.08.2016	643-1	MeBo130	21631-1	Cont.-Margin Site 4	78°33.236'	09°27.337'
18.08.2016	643-2	GC-14	21631-2	Cont.-Margin Site 4	78°33.237'	09°27.336'
18.08.2016	643-3	MeBo131	21631-3	Cont.-Margin Site 4	78°33.236'	09°27.337'
19.08.2016	643-4	MeBo132	21631-4	Cont.-Margin Site 4	78°33.236'	09°27.337'
20.08.2016	643-5	GC-15	21631-5	Cont.-Margin Site 4	78°33.236'	09°27.337'
20.08.2016	644-1	MeBo133	21632-1	Cont.-Margin Site 5	78°33.132'	09°29.6527'
20.08.2016	644-2	MeBo134	21632-2	Cont.-Margin Site 5	78°33.132'	09°29.6527'
22.08.2016	645-1	MeBo135	21633-1	Cont.-Margin Site 3	78°32.9347'	09°22.7898'
23.08.2016	645-2	GC-16	21633-2	Cont.-Margin Site 3	78°32.938'	09°22.786'
23.08.2016	645-3	MeBo136	21633-3	Cont.-Margin Site 3	78°32.9347'	09°22.7898'
25.08.2016	646-1	MeBo137	21634-1	Cont.-Margin Site 6	78°33.5851'	09°32.5283'
25.08.2016	646-2	GC-17	21634-2	Cont.-Margin Site 6	78°33.589'	09°32.528'
26.08.2016	647-1	TL10-1	21635-1	Svyatogor Ridge	78°30.243'	05°42.676'
26.08.2016	647-2	TL10-2	21635-2	Svyatogor Ridge	78°29.871'	05°43.316'
26.08.2016	647-3	TL10-3	21635-3	Svyatogor Ridge	78°29.553'	05°43.603'
26.08.2016	647-4	TL10-4	21635-4	Svyatogor Ridge	78°29.438'	05°42.955'
26.08.2016	647-5	TL10-5	21635-5	Svyatogor Ridge	78°29.343'	05°43.442'
26.08.2016	647-6	TL10-6	21635-6	Svyatogor Ridge	78°29.271'	05°43.086'
26.08.2016	647-7	TL10-7	21635-7	Svyatogor Ridge	78°29.150'	05°43.669'
26.08.2016	647-8	TL10-8	21635-8	Svyatogor Ridge	78°29.051'	05°42.085'
26.08.2016	647-9	TL10-9	21635-9	Svyatogor Ridge	78°28.863'	05°41.432'
26.08.2016	647-10	TL10-10	21635-10	Svyatogor Ridge	78°28.810'	05°41.771'
26.08.2016	647-11	TL10-11	21635-11	Svyatogor Ridge	78°28.658'	05°41.900'
26.08.2016	647-12	TL10-12	21635-12	Svyatogor Ridge	78°28.510'	05°41.949'
26.08.2016	647-13	TL10-13	21635-13	Svyatogor Ridge	78°28.406'	05°40.368'

26.08.2016	648-1	GC-18	21636-1	Svyatogor Ridge	78°21.322'	05°42.129'
27.08.2016	649-1	MeBo138	21637-1	Lunde Pockmark	79°00.426'	06°54.246'
29.08.2016	650-1	GC-19	21638-1	Lunde Pockmark	79°00.424'	06°54.678'
29.08.2016	651-1	MeBo139	21639-1	Cont.-Margin Site 5	78°33.132'	09°29.6527'
31.08.2016	652-1	GC-20	21640-1	Svyatogor Ridge	78°21.303'	05°42.309'
31.08.2016	653-1	GC-21	21641-1	Svyatogor Ridge	78°21.659'	05°41.594'
31.08.2016	654-1	TL11-1	21642-1	Svyatogor Ridge	78°23.515'	05°37.316'
31.08.2016	654-2	TL11-2	21642-2	Svyatogor Ridge	78°23.509'	05°38.699'
31.08.2016	654-3	TL11-3	21642-3	Svyatogor Ridge	78°23.514'	05°39.323'
31.08.2016	654-4	TL11-4	21642-4	Svyatogor Ridge	78°23.514'	05°40.459'
31.08.2016	654-5	TL11-5	21642-5	Svyatogor Ridge	78°23.506'	05°41.844'
31.08.2016	654-6	TL11-6	21642-6	Svyatogor Ridge	78°23.720'	05°41.546'
31.08.2016	654-7	TL11-7	21642-7	Svyatogor Ridge	78°23.951'	05°41.285'
31.08.2016	654-8	TL11-8	21642-8	Svyatogor Ridge	78°24.191'	05°41.185'
31.08.2016	654-9	TL11-9	21642-9	Svyatogor Ridge	78°24.415'	05°41.041'
01.09.2016	655-1	MeBo140	21643-1	Cont.-Margin Site 7	78°35.288'	09°23.963'
02.09.2016	656-1	GC-22	21644-1	Cont.-Margin Site 5	78°33.132'	09°29.6527'

Gravity cores (GC): 22

MeBo drill sites: 19 total (7 at Vestnesa Ridge, 12 at the upper continental margin Svalbard)

1 CORK station

T-lance deployments: 11 (110 spot measurements)

Sound velocity probe (SVP): 2

Mapping with EM122 and PARASOUND: 3,520 nautical miles