CAGE - Centre for Arctic Gas Hydrate Environment and Climate Report Series, Volume 5 (2017)

To be cited as: Andreassen, K. (2023). CAGE17-5 Cruise Report: Marine Geophysical Cruise to the Yermak Plateau and western Svalbard continental margin. CAGE - Centre for Arctic Gas Hydrate Environment and Climate Report Series, Volume 5. https://doi.org/10.7557/cage.6946
Additional info at: https://septentrio.uit.no/index.php/cage/database

ISSN: 2703-9625
Publisher: Septentrio Academic Publishing Tromsø Norway

CRUISE REPORT

CAGE 17-5

Marine Geophysical Cruise to the Yermak Plateau and western Svalbard continental margin

R/V Helmer Hanssen 28. September – 09. October 2017

Chief Scientist: Karin Andreassen
Captain: Hans Hansen

Centre for Gas Hydrate, Environment and Climate (CAGE)
Department of Geosciences
UiT – The Arctic University of Norway

Report Outline

page

1. Scientific objectives

The cruise was a part of the Centre of Excellence for Gas Hydrate, Environment and Climate (CAGE) at UiT - The Arctic University of Norway.

The cruise had the following scientific objectives:

- Geomorphic mapping of seafloor features at the Yermak Plateau, as far north as possible aiming at identifying ice flow orientations.
- Improve the seismic stratigraphy along the western Svalbard continental margin, using the ODP holes 910C and 912A of the Yermak Plateau and the ODP hole 986 west of Svalbard.
- Investigate fluid-flow features related to gas hydrate bearing sediments.

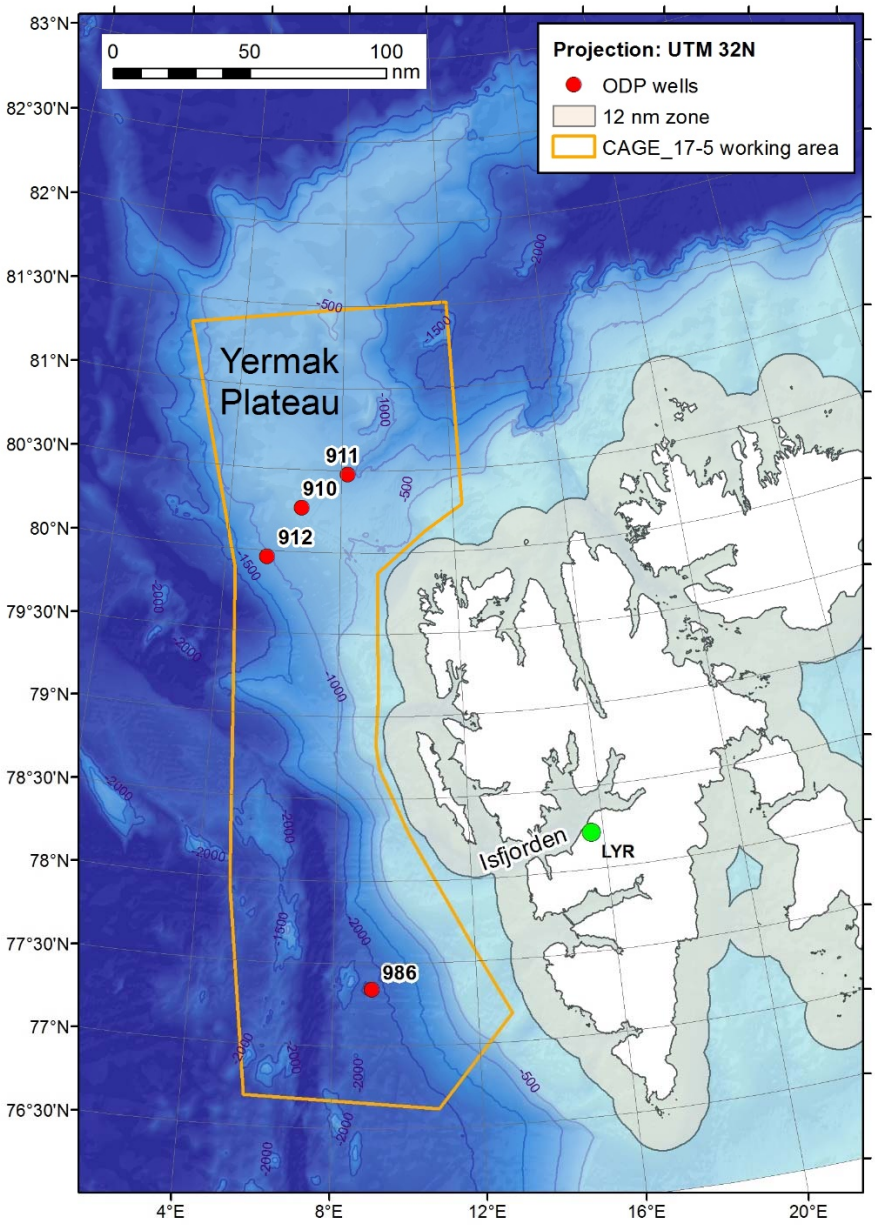

Figure 1. Map showing the overall working areas for cruise CAGE17-5: Yermak Plateau and western Svalbard continental margin.

2. Cruise participants

Karin Andreassen	Chief scientist	Sh1
Henry Patton	Researcher	Sh1
Sunil Vadakkepuliyambatta	Researcher	Sh2
Malin Waage	PhD (seismics)	Sh1
Kate Alyse Waghorn	PhD (seismics)	Sh2
Pavel Serov	PhD (Gas analysis)	Sh1
Espen Valberg	PhD (seismics)	Sh2
Lene Loug Hansen	Ms student	Sh2
Bjørn Runar Olsen	Engineer	
Truls Holm	Engineer	

Shift 1: 08:00-20.00. Shift 2: 20:00-08:00
Bjørn Runar Olsen: 08:00-16:00; 20:00-00:00
Truls Holm: 16:00-20:00; 00:00-08:00

Cruise shifts started 28. September at 20:00, stopped 08. October at 20:00

Departure from Longyearbyen 28.09 kl 00:00, transit to Yermak Plateau: ca 20 hrs.

3. Equipment used

3.1 Subbottom Profiler (Chirp)

A X-STAR Full Spectrum Sonar is a versatile wideband FM sub-bottom profiler that generates cross-sectional images of the seabed and collects digital normal incidence reflection data over many frequency ranges. X-STAR transmits an FM pulse that is linearly swept over a full spectrum frequency range (also called “chirp pulse”).

The chirp system comprises of a hull-mounted 4 x 4 transducer array operated at an energy level of 4 kW and at a shot rate of 1 s. The signal lasts 40 ms, starts at 1.5 kHz and end at 9 kHz. The system can operate in up to 8000 m of water. The penetration depth depends on the sediment type/thickness, it can be up to 80 m in soft clay.

During this cruise, we imaged the morphology of the ocean floor and its shallow sub-bottom sedimentary layers and structures using the subbottom profiler along all lines.

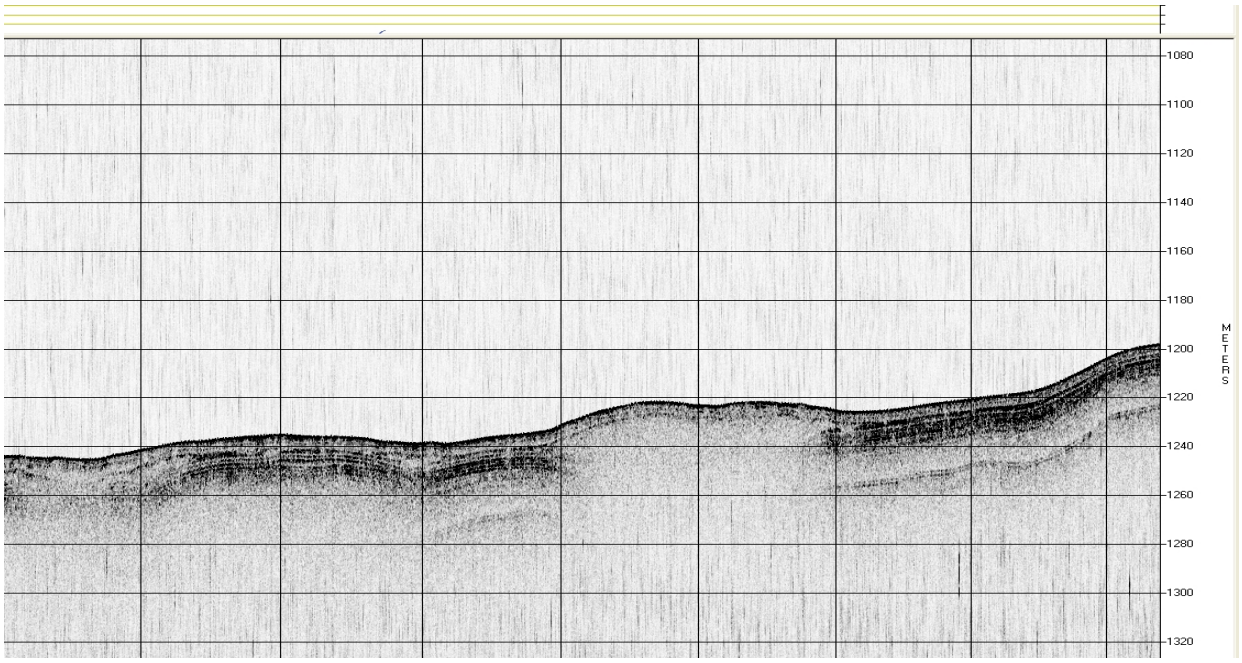

Figure 2. A typical sub-bottom profile during the survey.

3.2 Multibeam Echosounder

In the hull of R/V Helmer Hansen a Kongsberg Simrad EM 302 multi-beam echo sounder has been installed. The multi-beam system measures the two-way travel time that a sound wave initiated by a transmitter needs to reach the sea floor and come back. These waves have a frequency of 30 kHz, which is too high to penetrate the seafloor sediments, but gives a high resolution for a bathymetric map. It also scans the water column for acoustic anomalies which helps to detect gas seepage from the seafloor. The water velocity for bottom-depth calculation was estimated from CTD sensor measurements. A beam angle of 60/60 was used for the survey with 432 beams on each side.

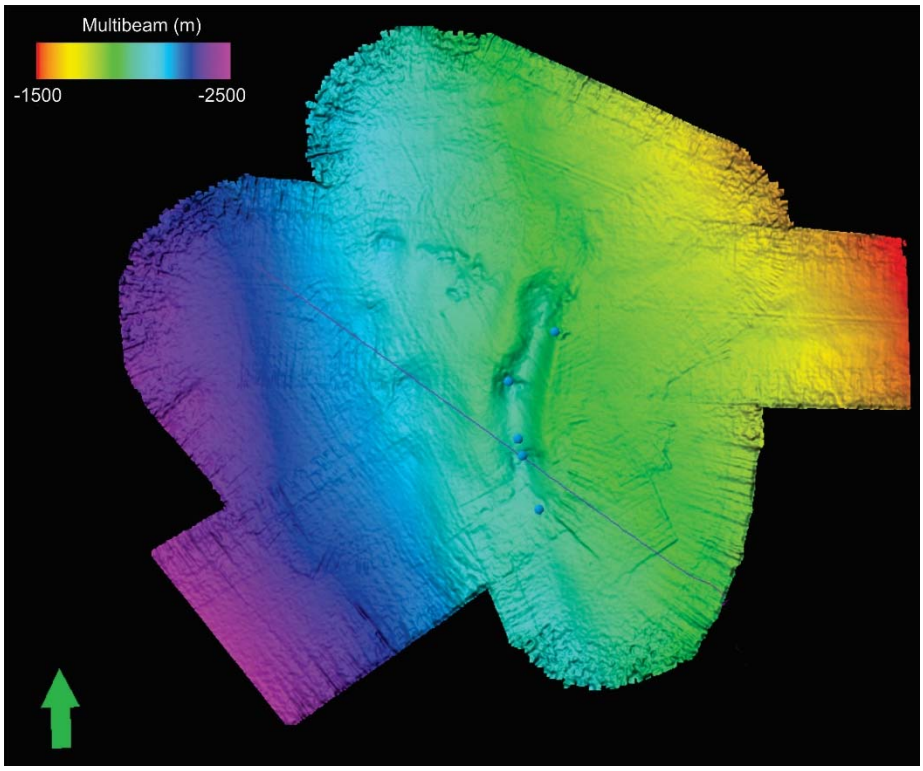

Figure 3. Multibeam bathymetry of the continental margin west of Prins Karls Forland.

3.3 CTD

CTD (Conductivity, Temperature, Depth) sensors measure the physical properties of seawater. In addition to measuring the conductivity, temperature and pressure (from which depth is calculated), the CTD sensors measure or calculate salinity of seawater, density, sound velocity, turbidity, fluorescence/chlorophyll, and oxygen content. Furthermore, the CTD deck unit can trigger closing of Niskin bottles at discrete depths. Water samples may be taken from the Niskin bottles for further analysis.

R/V Helmer Hanssen uses SBE 911plus CTD for producing vertical profiles of seawater properties. A winch is used to lower the CTD system into the water. The SBE 911plus CTD can measure physical properties of the seawater from up to eight auxiliary sensors, in marine or fresh-water environments at depths up to 6000 meters. However, the winch wire length limits CTD measurements to approximately 3200 meters. The CTD sensors record data at a rate of 24 samples per second. The 911plus system uses the modular SBE 3plus temperature sensor, SBE 4C conductivity sensor, SBE 5T submersible pump, and TC duct. The submersible pump pumps water along the sensor to measure the conductivity. The TC duct makes sure that temperature and conductivity are measured on the same parcel of water.

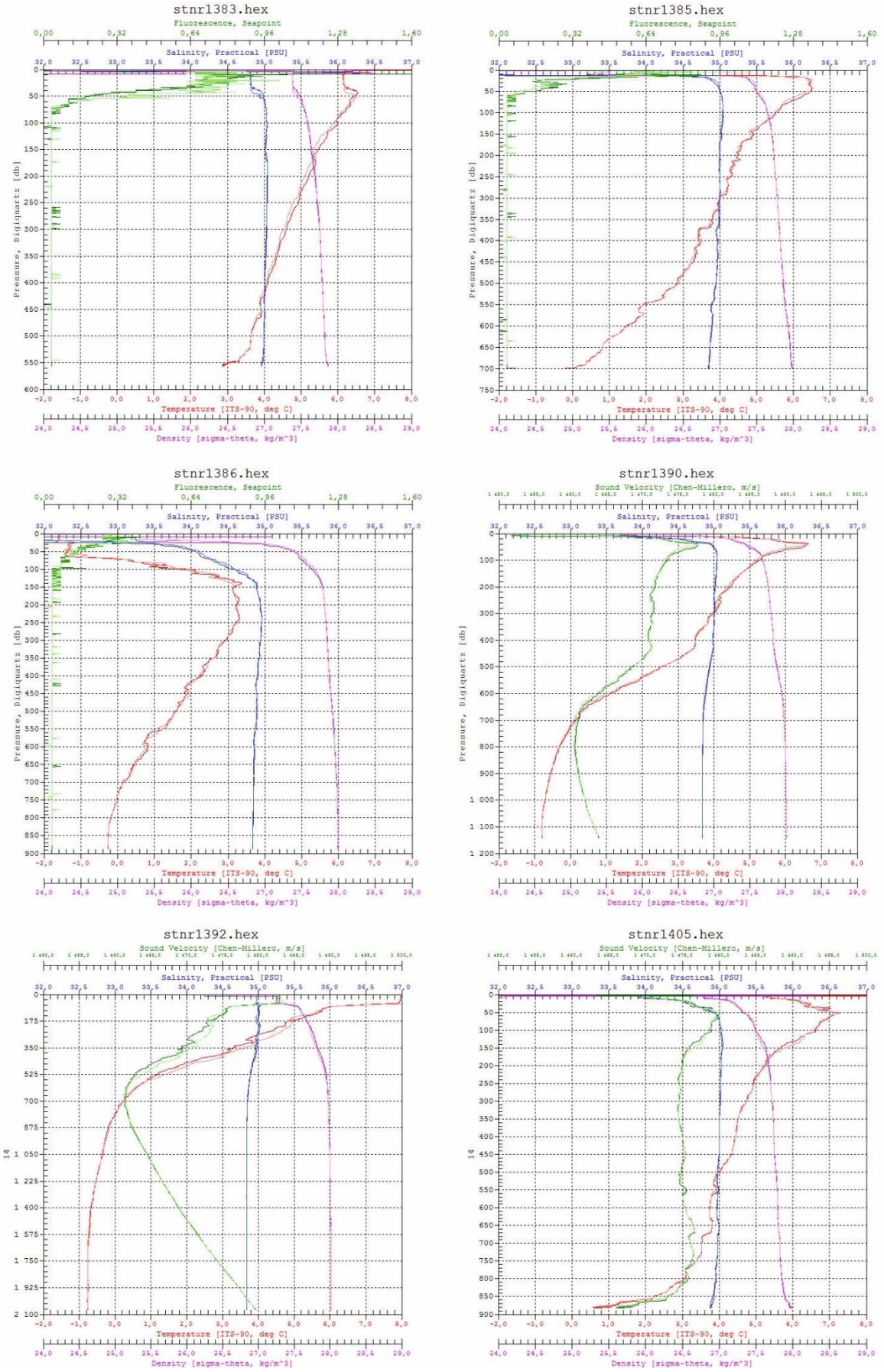

Figure 4. CTD profiles from the cruise, locations and indicated in Figures 14, 16, 18.

3.4 2D Reflection Seismic

Source: During 2D seismic acquisition, two mini GI (Generator-Injector) air guns are used as the seismic source. Mini GI airguns are especially suited for high resolution surveys. The air gun generates seismic waves by releasing compressed air into the water. A compressor supplies air at a pressure of 170 bar to the air gun. Shooting rate, sampling rate and other acquisition parameters for each line is listed in the line-log.

Streamer: The streamer used during 2D data acquisition is 100 m long with 32 channels separated by 3.125 m. The streamer is composed of four 25 m long P-Cable Sections.

Operation: The streamer is towed behind the ship at a distance of 68 m from an arm at ~13 m from the centre of the boat. The air gun is towed at a distance of 33 m behind the ships at a depth of approximately 2 mbsl. See Fig. 5 for geometry of the survey.

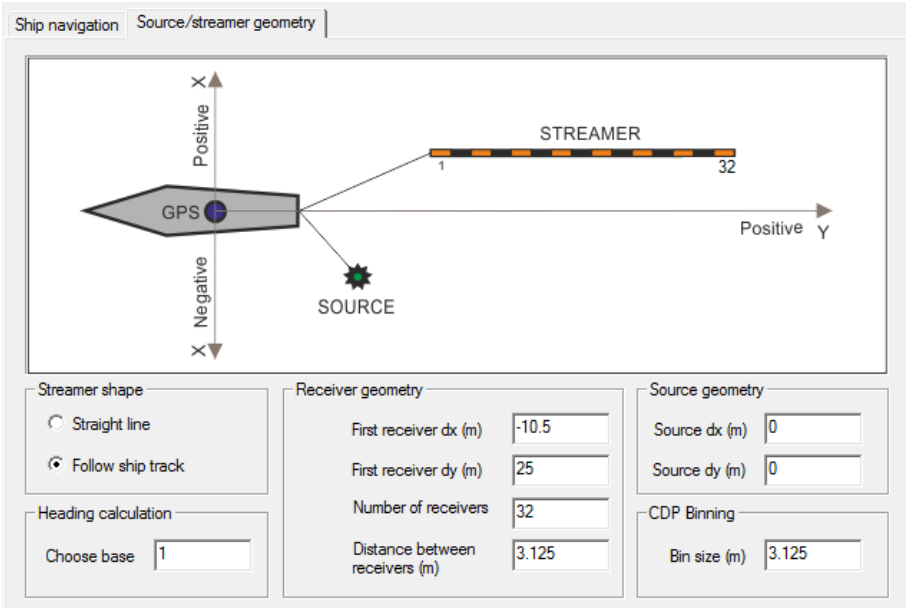

Figure 5. Geometry of the 2D seismic survey during CAGE17-5 cruise. The gun position is used as a reference point for streamer geometry calculation.

A total of 20 seismic lines were acquired on the Yermark Plateau and along the West Svalbard Margin, two of these were re-shooting segments of two lines that had gaps in them. Another line had to be reshot as one of the guns was shooting a few milliseconds out of sync

3.4.1 Ship-Board Processing

On-board data processing used Radex Pro software. Seg-y files were imported to Petrel for quality control. On board processing included:

1. *Navigation Files:* Seatrack GPS positioning from the gun raft and stern of the ship is used. These are checked for gaps and interpolated if necessary
2. *Read SegD Files into RadEx Pro*
3. *Geometry assignment*
4. *CDP Binning (3.125 x 3.125 m bin size)*
5. *Filtering: Simple Bandpass filtering (normally 10-20-350-450 Hz) and F-K filter and Burst Noise Removal where that was necessary*
6. *If necessary: SharpSeis Deghost*
7. *Amplitude Correction (Time raised to power of 1-2 and trace equalization)*
8. *NMO Correction to water velocity*
9. *Stacking*
10. *Migration using the Post Stack Kirchhoff Migration method*
11. *Seg-y Output*

Processing examples

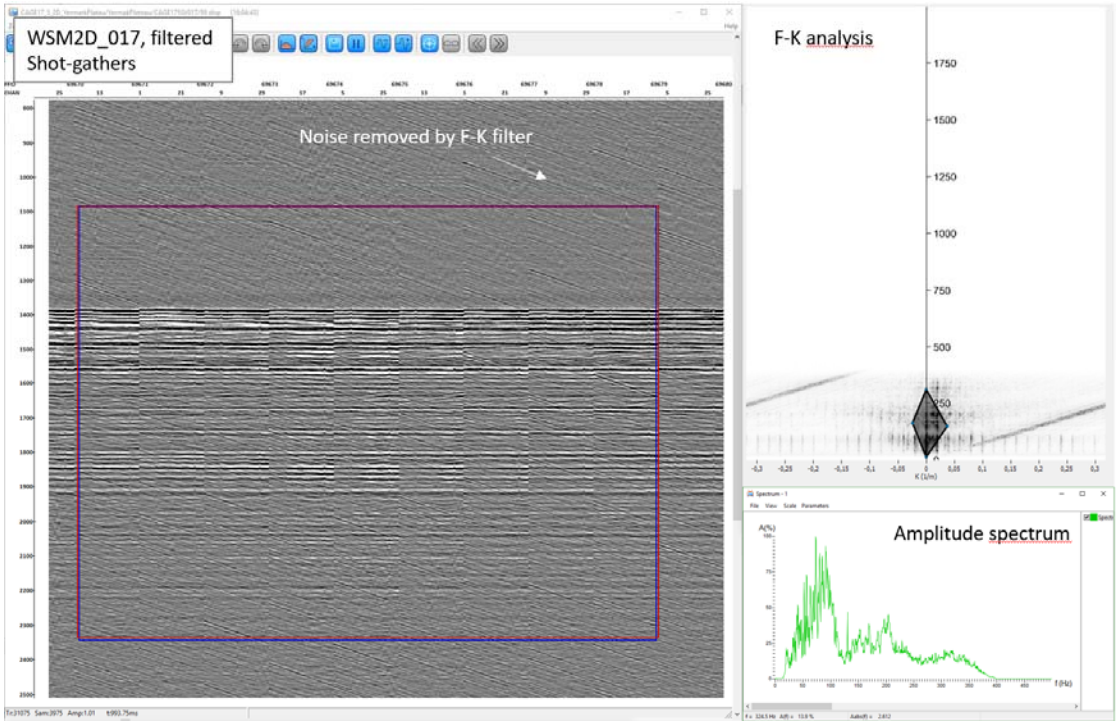

Figure 6. Western Svalbard Margin Cage 17-5_017 shot gathers.

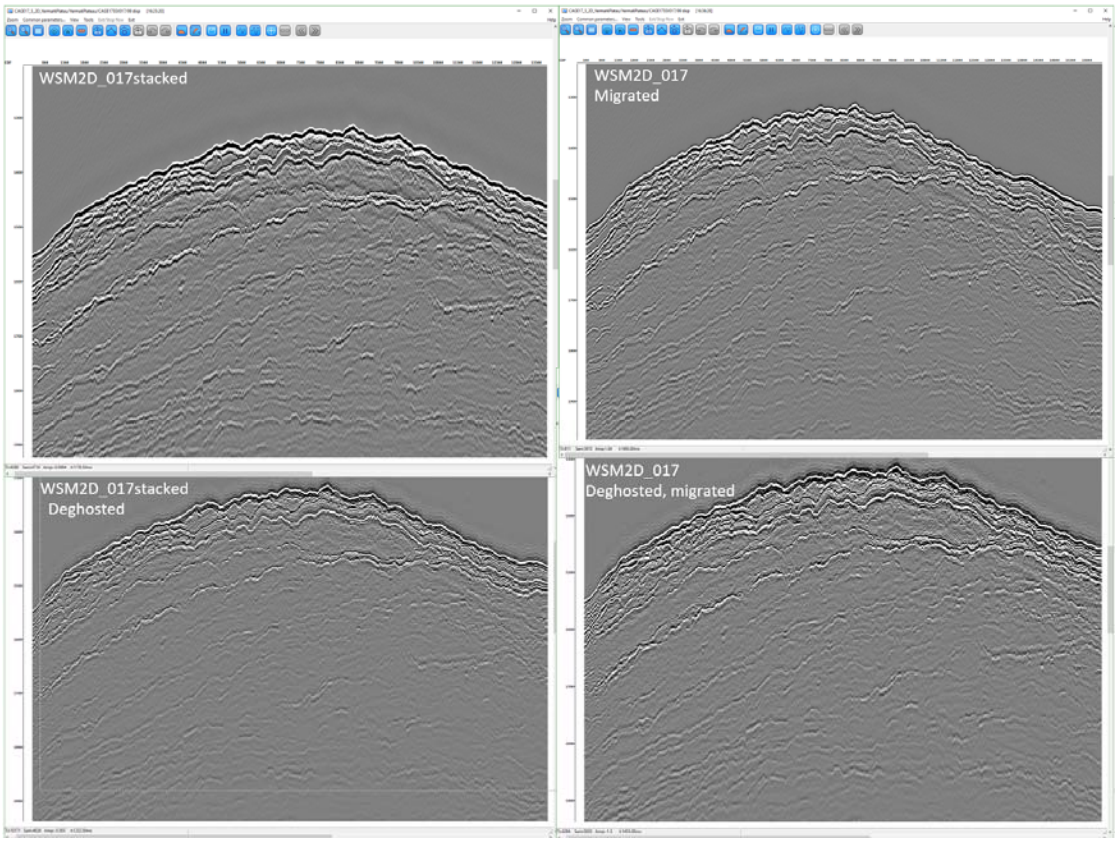

Figure 7. Western Svalbard Margin Cage 17-5_017 processing

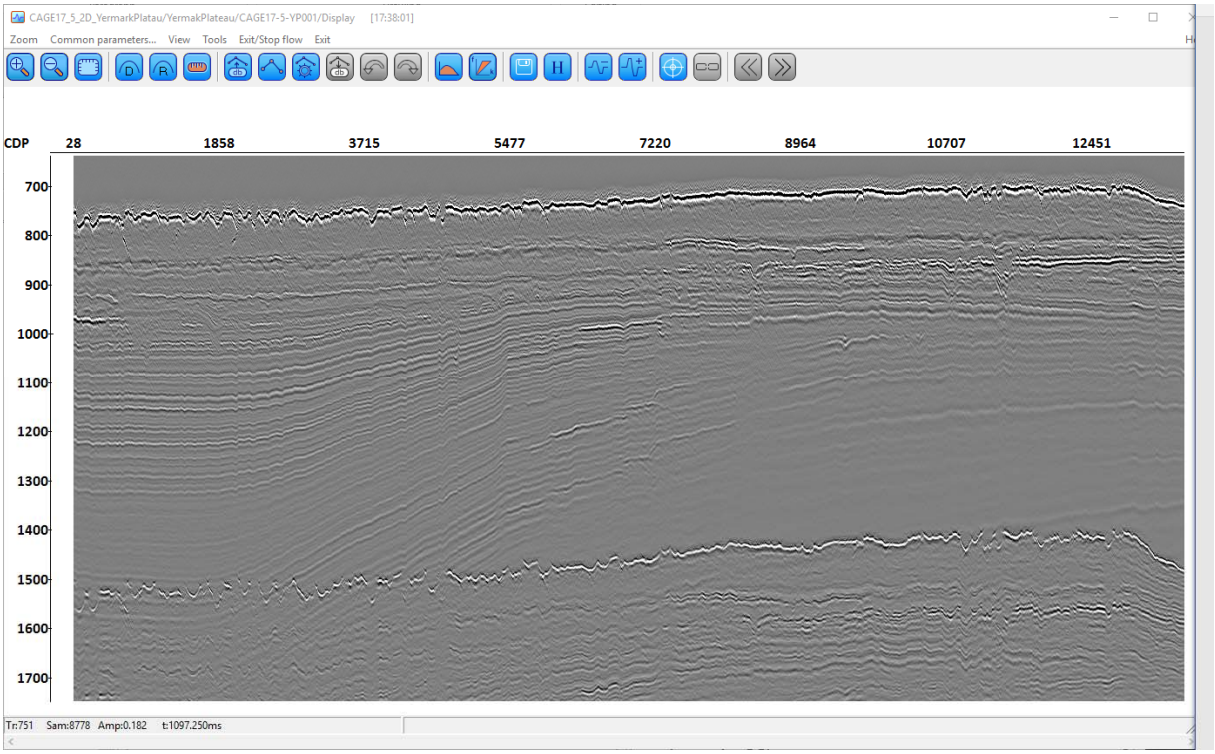

Figure 8. Western Svalbard Margin Cage 17-5_YP2D_001 (migrated).

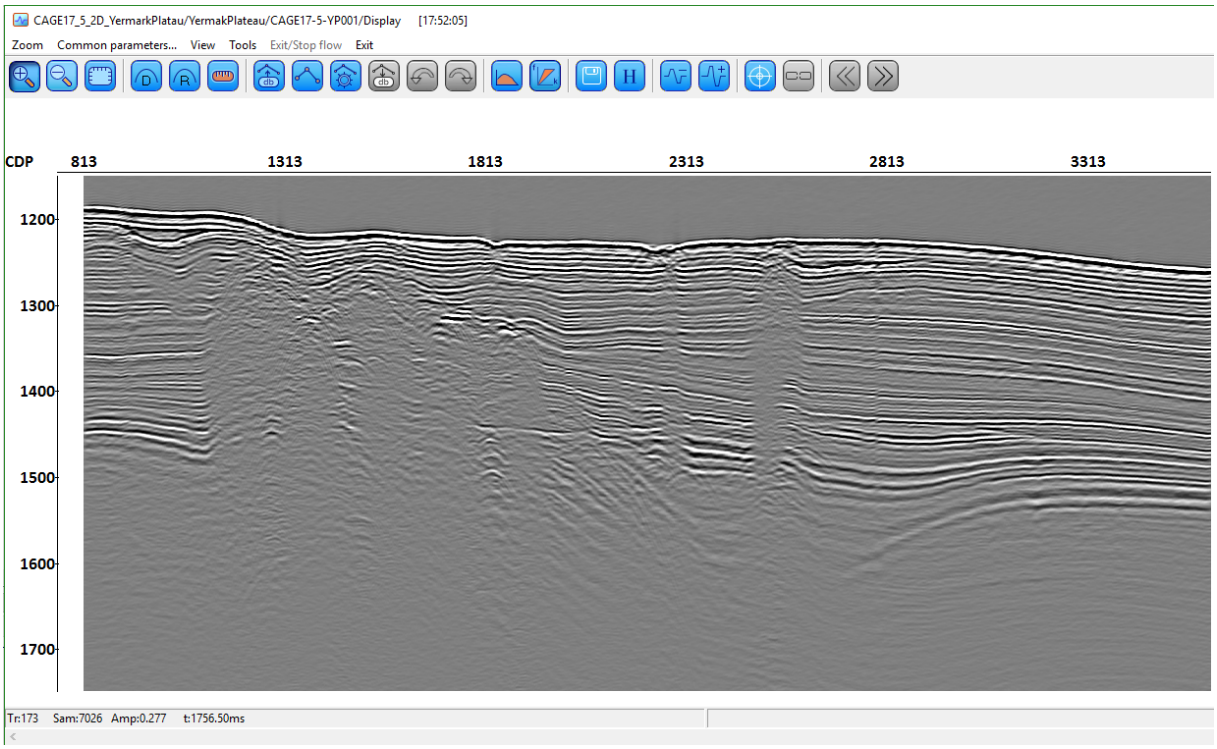

Figure 9. Western Svalbard Margin Cage 17-5_WSM2D_010 (migrated).

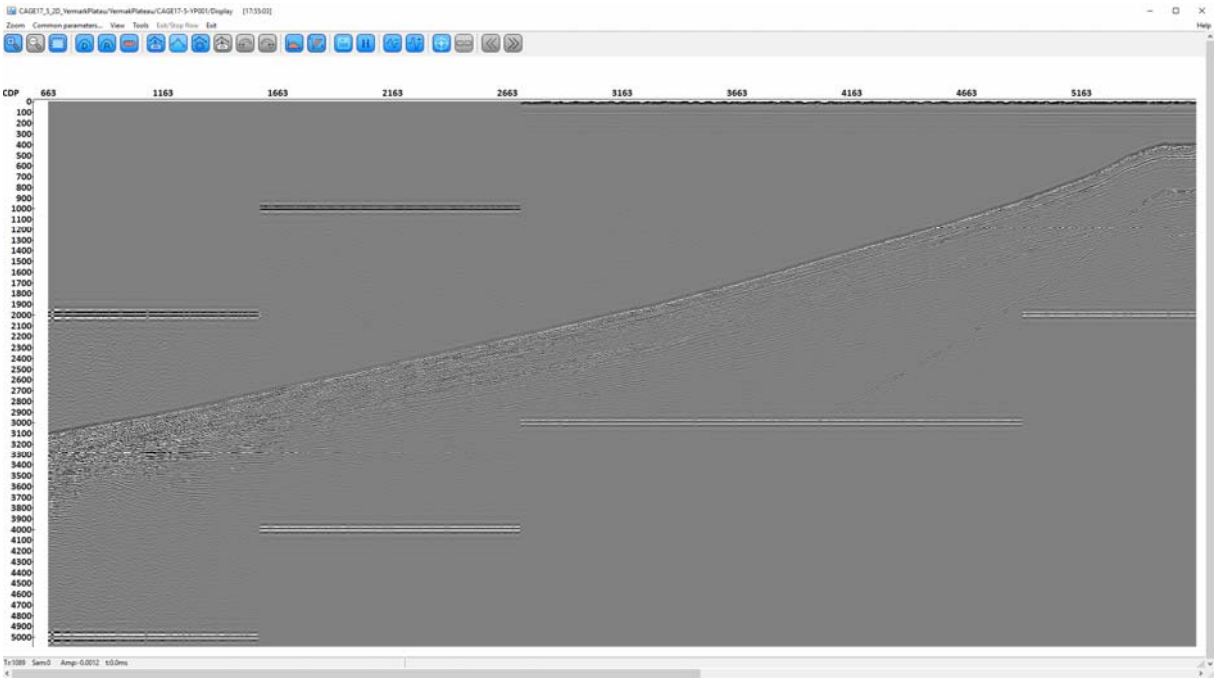

Figure 10. Western Svalbard Margin Cage 17-5_WSM2D_013 (migrated).

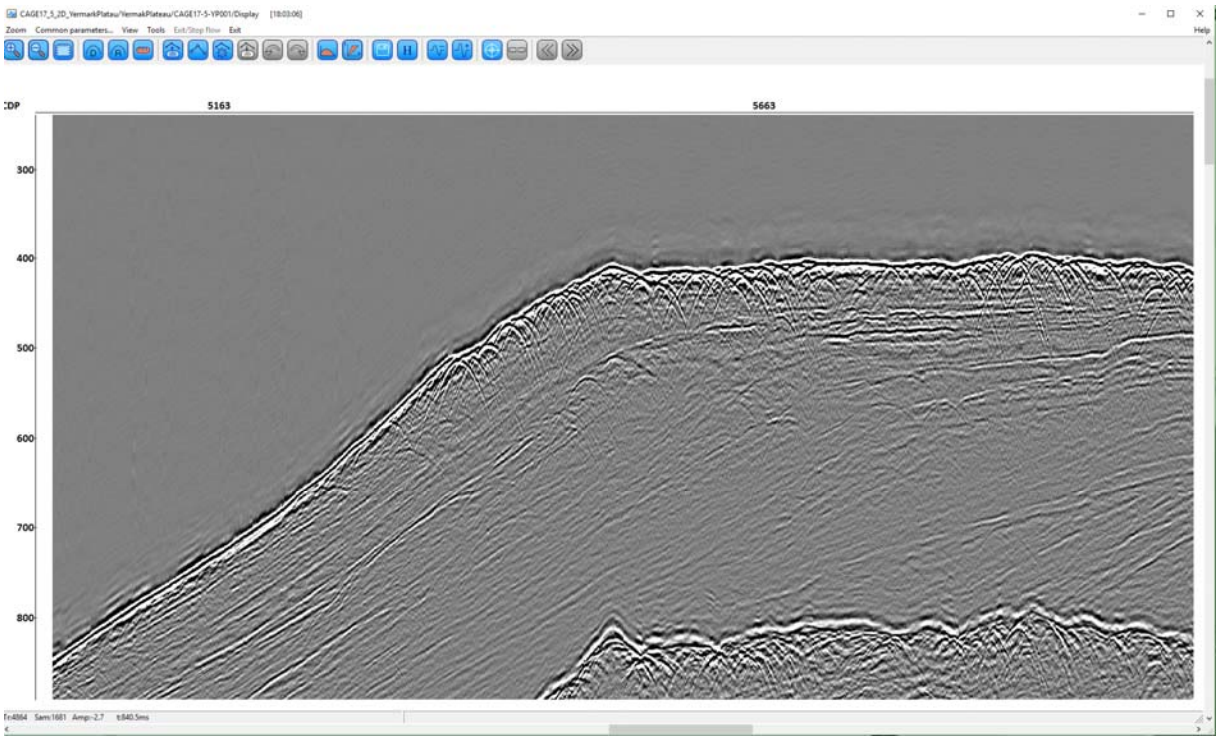

Figure 11. Western Svalbard Margin Cage 17-5_WSM2D_013: stacked and debubbled using demultiple.

Acquisition related issues

Seatrack crashed from time-to-time and then it is important that the computer is restarted (on/off button) as quick as possible to prevent losing navigation data. For the python script to work after this has happened, timestamps need to be added on the navigation spreadsheet. The error is located by (-) that appears after the problem. This data must also be deleted.

We experienced missing data at three lines, one line of 18 minutes, one of 8 min and one of 1 min; in the first two cases, the missing sections of the lines had to be reshot. The missing data was related to a GeoEEL software error, whereby the software was unable to automatically detect the shot trigger. Another line had to be reshot as one of the guns was shooting a few milliseconds out of sync. This problem leads to repeated reflections on the data and thus severe notches on the amplitude spectra (Fig. 12). After this occurred we started testing the shooting array before starting the line to check synchronization.

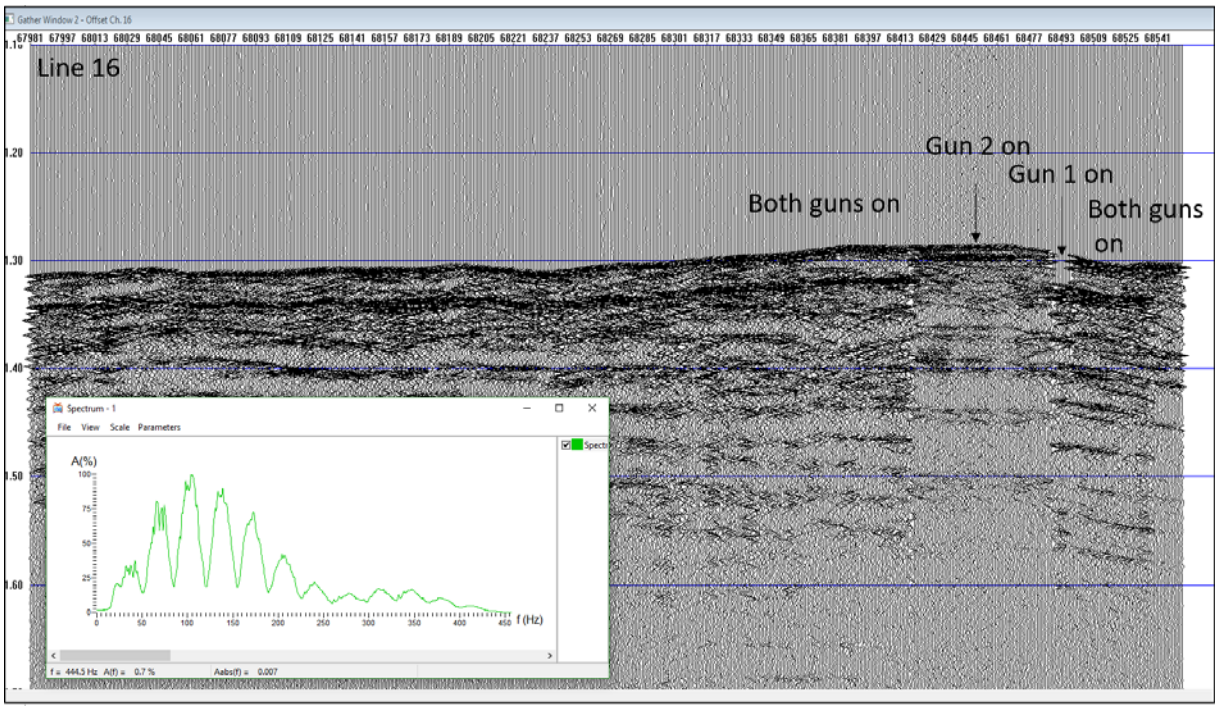

Figure 12. Western Svalbard Margin seismic line Cage 17-5_WSM2D_016 showing problem with unsyncronized airguns.

Other gun related issues included GPS battery losing charge, falling off, hydrophone failures and gun-chain breakages. Extra nuts, new screws and tape made them more robust, however it reflects the importance of making sure everything sits tight etc.

3.5 Single Beam Echo sounder

Single beam echo sounders are common among all types of ships. Their primary purpose is to estimate the depth of the seafloor. In a single beam echo sounder, the transducer projects a sound pulse through water in a controlled direction and the reflected wave is received. The depth is calculated from the travel time of the sound pulse. R/V Helmer Hanssen has a keel-mounted Simrad EK 60 single beam echo sounder with transducers at three different frequencies, 18 KHz, 38 KHz and 120 KHz. The 18 KHz transducer can be used for depths up to 10 km whereas 38 KHz and 120 KHz can only be used for depths up to 2 km and 500m respectively.

3.6 Sediment coring

Five sediment cores were taken with a gravity corer. Upon recovery of cores 1-4, the plastic linear containing a sediment core was cut into 1m long sections. Shortly after the sections were split half, opened and subsampled in laboratory. Both, sampled and an "archive" halves were sealed with plastic and stored horizontally in a cooling room at 4

°C temperature. One additional gravity core (CAGE 17-5_1415GC) sampled for geotechnical analyses was not opened. The plastic linear containing the core was sliced in 1 m long sections. The sections were capped, sealed, labeled and stored horizontally in a cooling room.

3.7 Gas from gas hydrate samples

Core CAGE 17-5_1401GC contained massive gas hydrate from 0.7-1.2 m below seafloor. Samples of interstitial gas were taken according to the conventional headspace sample preparation procedure. 5ml of bulk sediment was taken from a core with a plastic cut-off syringe and placed into 20 ml headspace glass vials containing 5 ml of 1-molar solution of NaOH and two glass beads. NaOH solution is meant to prevent microbial methane degradation in the sample. The vials were capped with rubber ThermoScientific septums, sealed with aluminum crimp caps and shaken for 2 minutes for equilibrating gas concentrations in sediment-solution mixture and the headspace air. The vials are stored vertically in upside-down position in a cooling room at 4 °C.

Samples of gas from gas hydrate were taken in the same 20 ml vials. ~1-5 ml of gas hydrate with minor admixture of sediment material were placed in the vials with and without preliminary added NaOH solution. The vials were capped with rubber septums and pierced with syringe needles to purge some gas from dissociating hydrate and avoid pressure increase in a vial (Fig. 13). The needles were removed immediately after the bubble release terminated. Analogous, to sediment headspace samples, the vials with hydrate gas were crimped and stored vertically in upside-down position in a cooling room. Samples taken are listed in Table 1.

Figure 13. 20 ml chromatographic vials with hydrate gas samples. Photo by Henry Patton.

Table 1. List of gas samples from bottom sediments and gas hydrates offshore of Prins Karls Forland

cruise	station	type	interval, cm	sample type
CAGE 17-5	1401	GC	0-2	sediment headspace
CAGE 17-5	1401	GC	18-20	sediment headspace
CAGE 17-5	1401	GC	38-40	sediment headspace
CAGE 17-5	1401	GC	78-80	sediment headspace
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	85-100	gas from hydrate
CAGE 17-5	1401	GC	100-102	sediment headspace
CAGE 17-5	1401	GC	150-152	sediment headspace
CAGE 17-5	1401	GC	200-202	sediment headspace
CAGE 17-5	1401	GC	250-252	sediment headspace
CAGE 17-5	1401	GC	293-295	sediment headspace
CAGE 17-5	1402	GC	0-2	sediment headspace
CAGE 17-5	1402	GC	50-52	sediment headspace
CAGE 17-5	1402	GC	100-102	sediment headspace
CAGE 17-5	1402	GC	150-152	sediment headspace
CAGE 17-5	1403	GC	0-2	sediment headspace
CAGE 17-5	1403	GC	50-52	sediment headspace
CAGE 17-5	1403	GC	100-102	sediment headspace
CAGE 17-5	1403	GC	150-152	sediment headspace
CAGE 17-5	1403	GC	200-202	sediment headspace
CAGE 17-5	1403	GC	250-252	sediment headspace
CAGE 17-5	1403	GC	300-302	sediment headspace
CAGE 17-5	1403	GC	350-352	sediment headspace
CAGE 17-5	1404	GC	0-2	sediment headspace
CAGE 17-5	1404	GC	50-52	sediment headspace
CAGE 17-5	1404	GC	100-102	sediment headspace
CAGE 17-5	1404	GC	100-102	sediment headspace
CAGE 17-5	1404	GC	150-152	sediment headspace
CAGE 17-5	1404	GC	200-202	sediment headspace
CAGE 17-5	1404	GC	250-252	sediment headspace
CAGE 17-5	1404	GC	300-302	sediment headspace
CAGE 17-5	1404	GC	250-352	sediment headspace

4. Study areas and ship tracks

4.1. Yermak Plateau

Three 2D seismic profiles were acquired in this area to aid stratigraphic correlation with Yermak ODP drill-sites (Fig. 14) as well as for seismic facies interpretation. Multibeam bathymetry was acquired as far north as possible with the ice conditions. The seafloor shows several glacio-geomorphological features such as iceberg ploughmarks and mega-scale glacial lineations.

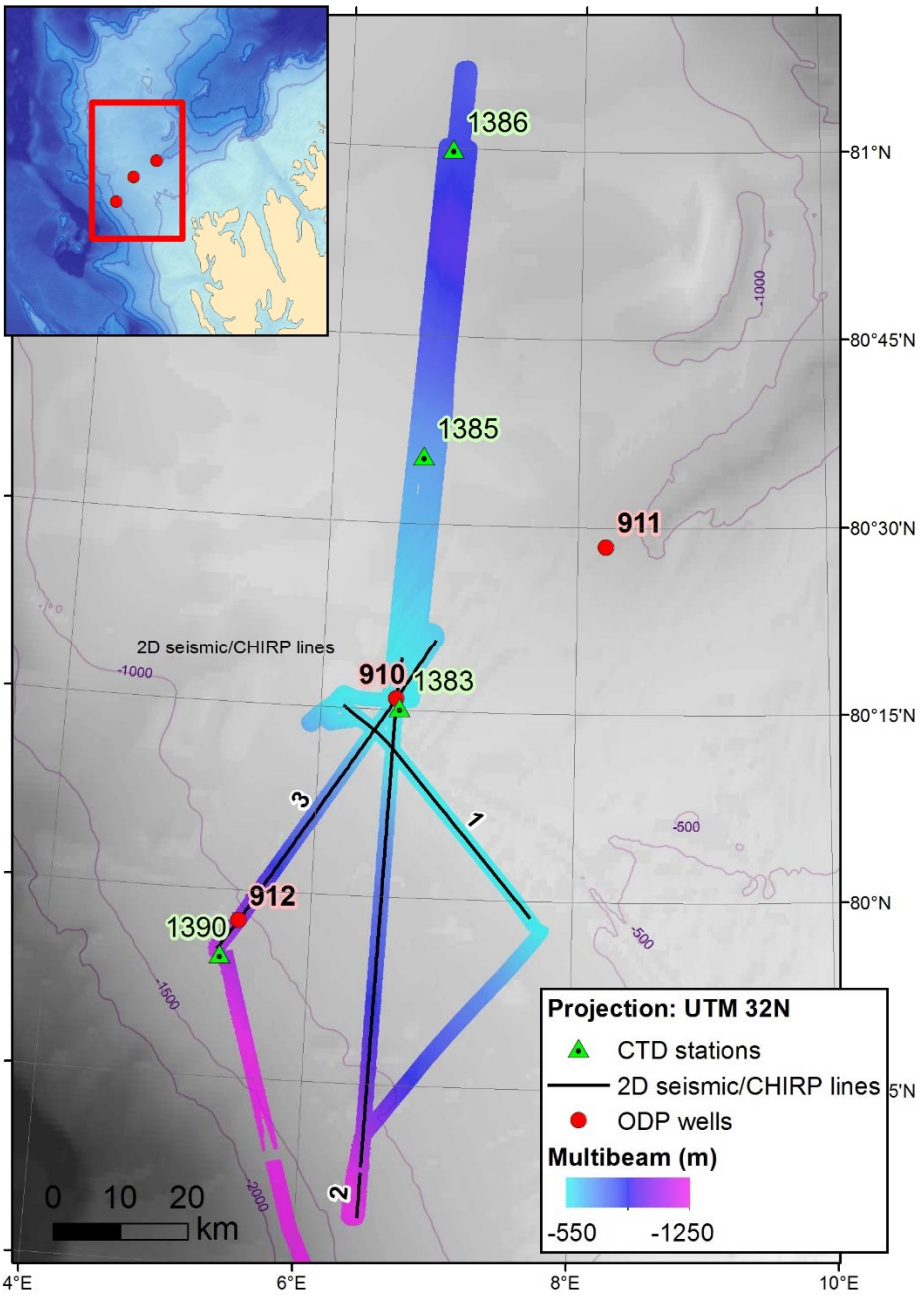

Figure 14. Map shoring location of multibeam bathymetry, seismic and CTDs acquired at the Yermak Plateau.

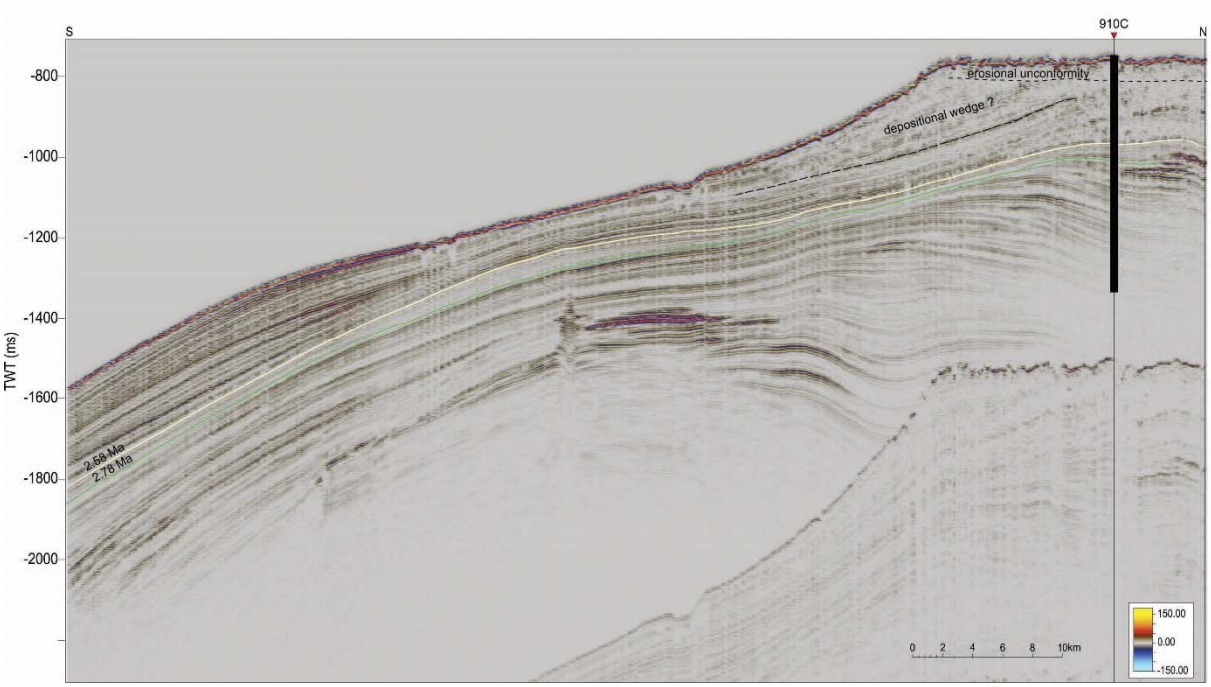

Figure 15. Seismic section from profile CAGE 17-5_02 on the Yermak Plateau.

4.2 Western Svalbard continental margin.

The seismic lines were acquired along the western Svalbard continental margin to help update the seismic correlation between the ODP well 986 and the wells on the Yermak Plateau. These lines fill in gaps and improve lines that have been acquired on previous cruises.

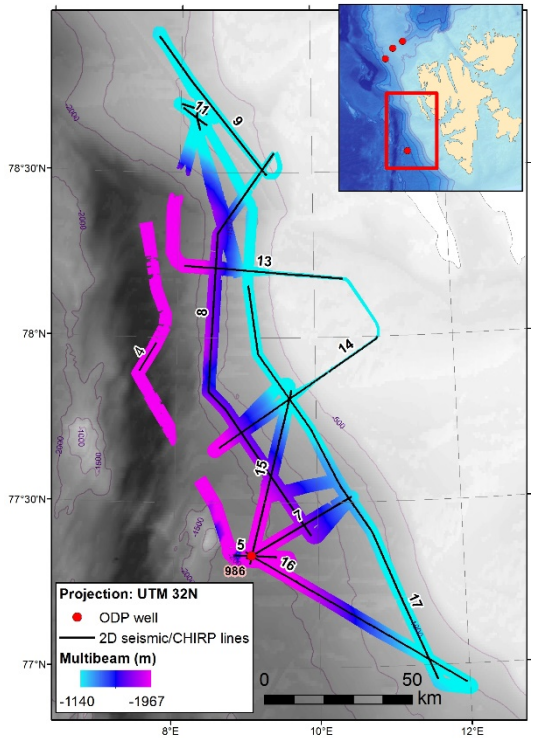

Figure 16. Map showing seismic profiles acquired for updating the seismic stratigraphyalong the western Svalbard continental margin.

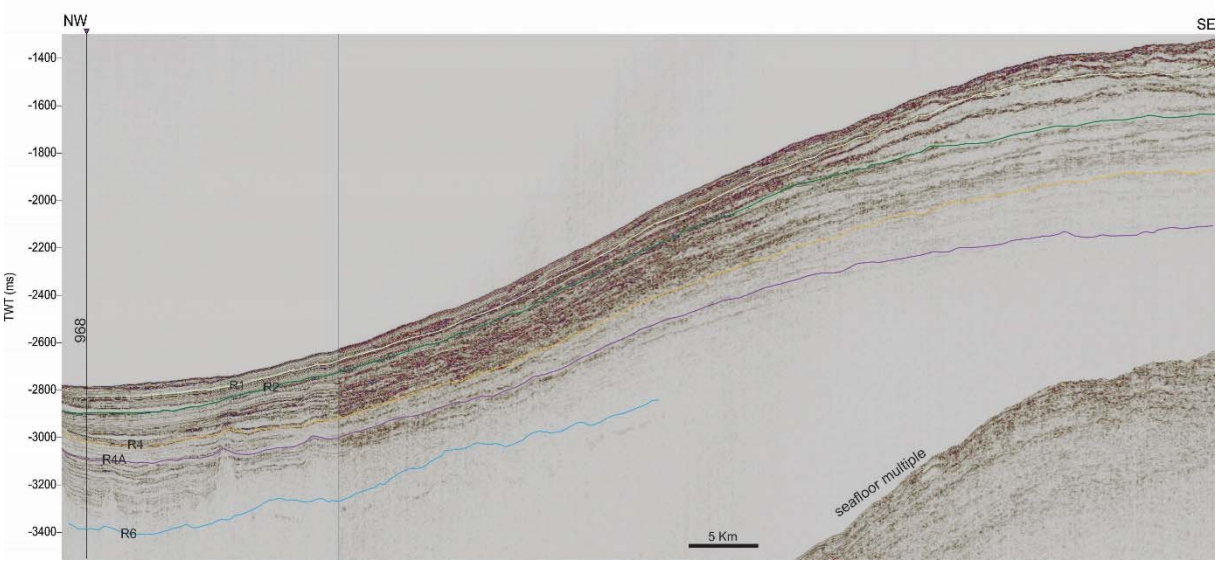

Figure 17. Seismic line Cage17-5-016 for correlation with ODP borehole 986, see Figure 16 for location.

4.3. Gas hydrates offshore of Prins Karls Forland.

Three 2D seismic profiles, chirp and multibeam bathmetry were acquired west of Prins Karls Forland where the seafloor exhibits an elongated depression in an area revealing vertical fluid-flow expressions on seismic profiles. Hydrate samples had been recovered from this area during a 2008 expedition (Fisher et al., 2011, and we chose to core this same location (Fig. 18; GC 1404). Based on evaluation of chirp and multibeam data acquired together with seismic lines from the area, we chose five core locations (Figs. 18-20; Tables 1 and 2).

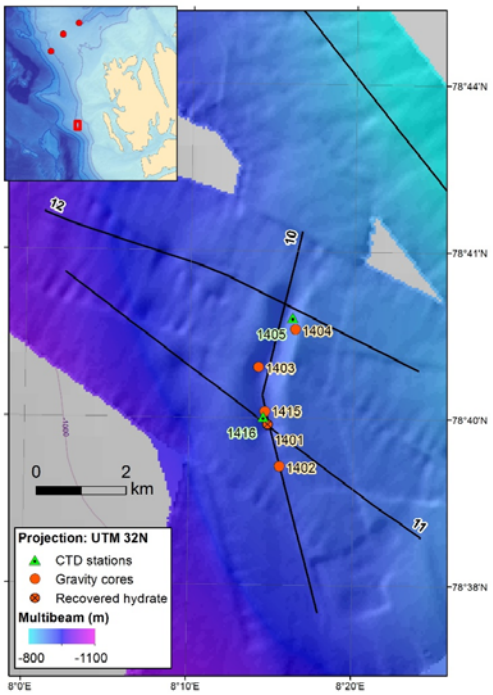

Figure 18. Map showing overview of gravety cores and lines of seismic data, chirp profiles and multibeam bathymetry offshore of Prins Karls Forland.

St. Nr.	Lat	Long	Date	Time (UTC)	Penetration (cm)
1401	78 39.928	8 14.794	04.10.17	14:04	295, with ca 50 cm of massive hydrates from c.0.70-1.20 m
1402	78 39.428	8 15.537	04.10.17	14:59	162
1403	78 40.616	8 14.205	04.10.17	16:21	342
1404	78 41.069	8 16.423	04.10.17	17:20	372
1415	78 40.084	8 14.606	08.10.17	12:47	339

Table 2. Information of the gravity cores taken offshore of Prins Karls Forland.

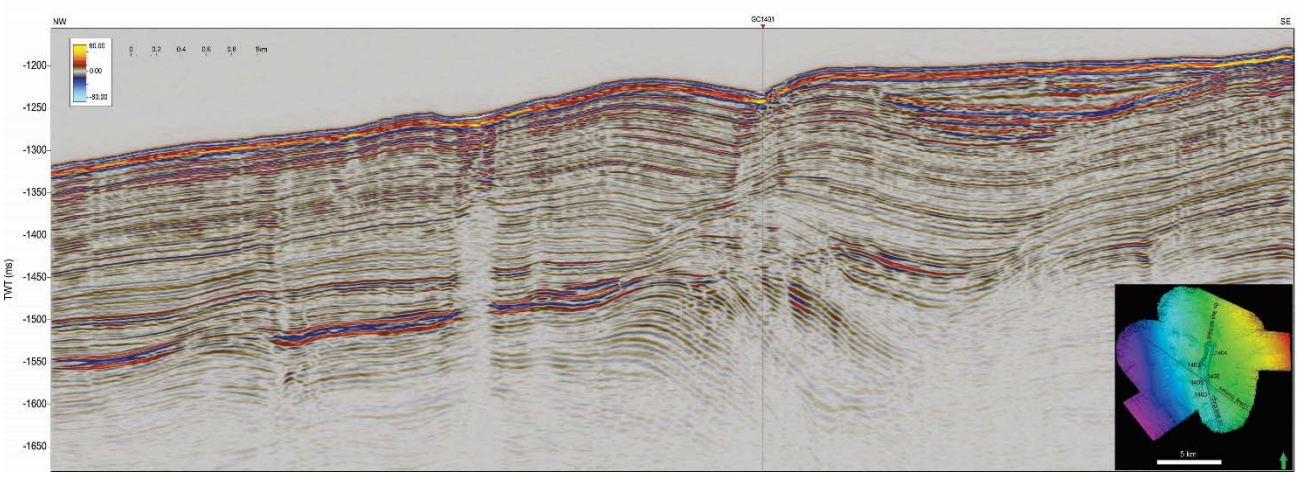

Figure 19. Seismic profile Cage 17-5_011 across sediment core Cage 17-5_1401GC that contained massive gas hydrate.

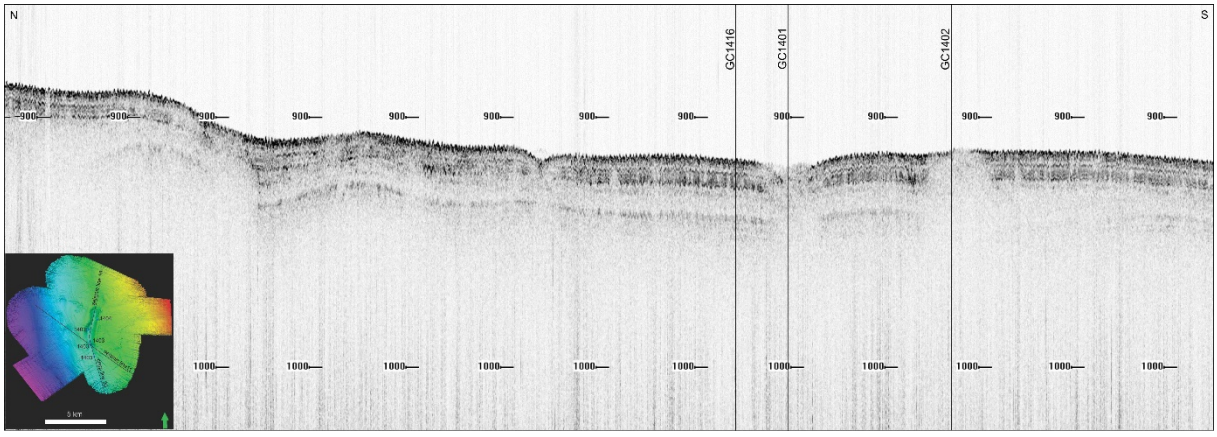

Figure 20. Chirp profile 030 (same location as seismic line 010) chowing GC location Cage 17-5_1401GC, which contained massive gas hydrate.

Four of the cores were split onboard whereas one (GC1415) was kept intact for geotechnical measurements. One of the cores (GC1401) contained a ca 50 cm section of massive hydrate (Fig. 21). The seismic data from the area showed multiple vertical gas chimneys, which seemed to pierce the contourite deposits. A clear bottom-simulating reflector (BSR) was observed near and across these fluid-flow features (Fig. 19). No active gas seepages in the water column were observed in the area.

Figure 21. Gas hydrate bearing sediments of gravity core Cage17-5_1401GC.

5. Logs

Event log CAGE_17-5

Date	Time	Event
27/9	1000	Depart Longyearbyen, heading for Yermak Plateau. Multibeam
28/9		Start chirp
28/9	16:55	Start multibeam survey of the plateau ridge northwards towards the sea ice. Rough weather conditions 2-3 m wave height.
30/09	02:15	Multibeam survey stopped. Moving towards the YP2D_1_ 2D seismic line
30/09	04:00	2D seismic deployed
01/10	12:24	Transit south from Yermak Plateau to Knipovich Ridge
2/10	03:47	Line over donut features on Knipovich Ridge
02/10	12:00	Test lines with miniGI and GI guns west of Isfjorden
02/10	20:43	Long seismic line west of Svalbard following the shelf break
4/10	07:21	Begin 2D seismic survey west of Prins Karls Forland across linear trough
4/10	14:04	Begin gravity core sampling northwards through the trough. Gas hydrate recovered in the first core 1401GC.
4/10	18:32	Transit to Isfjorden fan
4/10	22:42	Begin 2D seismic survey of the Isfjorden TMF
5/10	09:32	Ship engine failure during station 1407 (seismic line 14) meant the seismic equipment had to be brought in abruptly.
5/10	11:39	Seismic line 14 resumed.
6/10	03:52	Started seismic line northwards adjacent to shelf break. Broke off midway to repeat lines around Isfjorden TMF.
7/10	04:56	Repeated line 15 and part of line 16 around ODP 986 due to poor data quality acquisition previously.
7/10	21:19	Resume surveying shelf edge transect (line 17)
8/10	10:42	Transit back to Knipovich Ridge to collect a gravity core without hydrate for sediment property analyses.
8/10	13:57	Transit south to fill in a gap along line 17 (section 20) on Isfjorden TMF.
8/10	20:49	Start transit to Longyearbyen.

Station log summary CAGE_17-5

Site	Line no	Activity	Line Id	Date	Start Time (UTC)	Start Shot	Latitude	Longitude	End Time (UTC)	End Shot	Latitude (end)	Longitude (end)	Equipment
				2017									
YP	1383	CTD		9/28	16:10		80 15.186	6 37.240					CTD
YP	1384	EM302		9/28	16:55		80 15.903	6 35.562					Chirp,EM302
YP	1385	CTD		9/28	19:38		80 35.417	6 44.179					CTD
YP	1386	CTD		9/28	23:44		80 59.850	6 52.547					CTD
YP		EM302		9/29	1:06		81 06.379	6 57.946					Chirp,EM302
YP		EM302		9/29	3:30		80 52.346	6 53.880					Chirp,EM302
YP		EM302		9/29	4:00		80 51.051	6 53.327	11:01		80 15.64	6 39.38	Chirp,EM302
YP		EM302		9/29	11:05		80 15.37	6 35.60	17:35		81 00.11	6 53.02	Chirp,EM302
YP		EM302		9/29	17:47		80 59.91	7 01.19	2:20		80 15.763	6 42.649	Chirp,EM302
YP	1387	2D_Seis	1	9/30	7:51	1290	80 15.109	6 10.981	13:10	5113	79 58.103	7 42.747	2D,Chirp,EM302
YP	1388	2D_Seis	2	9/30	17:36	5397	79 34.791	6 27.520	3:03	12184	80 19.306	6 37.355	2D,Chirp,EM302
YP	1389	2D_Seis	3	10/1	3:55	12185	80 20.624	6 52.751	11:20	17491	79 55.165	5 02.810	2D,Chirp,EM302
YP	1390	CTD		10/1	11:38		79 54.773	5 19.761	12:24		79 54.773	5 19.761	CTD
KR	1391	2D_Seis	4	10/2	3:47	17611	77 59.017	7 41.848	5:06	18286	77 53.834	7 27.685	2D,Chirp,EM302
WSM	1392	CTD		10/2	9:31		77 22.011	8 45.803	10:52		77 23.117	8 48.100	CTD
WSM	1393	2D_Seis	5	10/2	12:00	18667	77 20.5099	8 50.0632	13:39	19855	77 20.1688	9 26.1255	2D,Chirp,EM302
WSM	1394	2D_Seis	6	10/2	16:03	20041	77 20.466	9 00.327	17:51	21359	77 20.076	9 33.131	2D,Chirp,EM302
WSM	1395	2D_Seis	7	10/2	20:43	21581	77 20.043	9 01.617	1:40	25177	77 30.995	10 28.542	2D,Chirp,EM302
WSM	1396	2D_Seis	8	10/3	3:58	25178	77 24.120	9 53.946	20:28	37061	78 33.557	9 25.413	2D,Chirp,EM302
WSM	1397	2D_Seis	9	10/3	21:57	37062	78 29.617	9 18.332	5:00	42133	78 54.597	7 38.727	2D,Chirp,EM302
PKF	1398	2D_Seis	10	10/4	7:21	42267	78 42.801	8 17.453	8:40	43137	78 37.55	8 18.126	2D,Chirp,EM302
PKF	1399	2D_Seis	11	10/4	9:12	43138	78 38.654	8 23.886	10:26	44035	78 41.823	8 01.542	2D,Chirp,EM302
PKF	1400	2D_Seis	12	10/4	10:53	44036	78 42.406	8 01.455					2D,Chirp,EM302
PKF	1401	GC		10/4	14:04		78 39.927	8 14.794	14:04				GC

PKF	1402	GC		10/4	14:59		78 39.428	8 15.537	14:59				GC
PKF	1403	GC		10/4	16:21		78 40.616	8 14.205	16:21				GC
PKF	1404	GC		10/4	17:20		78 41.069	8 16.423	17:20				GC
PKF	1405	CTD		10/4	17:59		78 41.205	8 16.260	18:32		78 41.283	8 15.458	CTD
WSM	1406	2D_Seis	13	10/4	22:42	45222	78 13.066	8 05.602	4:56	49511	78 10.564	10 26.169	2D,Chirp,EM302
WSM	1407	2D_Seis	14a	10/5	7:04	49794	77 59.893	10 54.389	9:32	51571	77 53.638	19 10.587	2D,Chirp,EM302
WSM	1408	2D_Seis	14b	10/5	11:39	51635	77 54.047	10.13.432	16:59	55493	77 39.945	8 36.470	2D,Chirp,EM302
WSM	1409	2D_Seis	15	10/5	19:00	55647	77 50.407	9 38.641	3:02	60588	77 18.897	9 03.326	2D,Chirp,EM302
WSM	1410	2D_Seis	16	10/6	3:52	60589	77 21.177	8 59.868	16:05	68417	76 56.556	11 58.903	2D,Chirp,EM302
WSM	1411	2D_Seis	17	10/6	17:52	68655	76 57.139	11 34.867	2:44	75047	77 33.210	10 18.495	2D,Chirp,EM302
WSM	1412	2D_Seis	18	10/7	4:56	75137	77 29.767	9 14.996	7:13	76765	77 18.844	9 03.267	2D,Chirp,EM302
WSM	1413	2D_Seis	19	10/7	8:51	76859	77 15.822	9 40.708	16:51	82610	76 56.666	11 58.187	2D,Chirp,EM302
WSM	1414	2D_Seis	20	10/7	21:19	82754	77 29.207	10 30.394	10:42	92265	78 27.012	8 55.680	2D,Chirp,EM302
WSM	1415	GC		10/8	12:47		78 40.084	8 14.606					GC
WSM	1416	CTD		10/8	13:14		78 40.017	8 14.517	13:57		78 40.513	8 10.908	CTD
WSM	1417	2D_Seis	21	10/8	20:18	92351	77 55.02	9 17.46	20:49	92723	77.570	9 10.5	2D,Chirp,EM302

Seismic Line Log Summary CAGE_17-5

Site	Station	Line Id	Date	Time UTC	Start Shot	Lat	Long	End Time UTC	End Shot	Lat (end)	Long (end)	Equip.	Shot Rate (s)	Notes
YP	1387	1	9/30	7:51	1290	80.252	6.183	13:10	5113	79.968	7.712	2 mini GI at 15/15 and 30/30, 170 bar	5	Rec Length 2 s, shooting rate 5 s, sample rate 0.125 ms no delay recorded. Seatemp: 6-6.8, Airtemp: 5, wind:13-8 m/s, waveheight: 1.25. Average water velocity: 1472,9 m/s 09.30(UTC) GPS on the canon does not work (needs battery change). hydrophone is lost on the gun2. A lot of noise on channel 1. Also 9, 17 & 25. One hydrophone is lost. Some episodic noise in the first 10 channels.
YP	1388	2	9/30	17:36	5397	79.580	6.459	3:03	12184	80.322	6.623	2 mini GI at 15/15 and 30/30, 170 bar	5	Sample rate changed to 0.250 ms, recording length now at 3s. Shot rate still 5 s. No delay.. No GPGGA string detected, therefore all shots are recorded in CEST not UTC. WInd speed about 10 m/s, wave height about 1m. Stopped acquisition at 5914 to fix serial string. From 5915 shots are in UTC time stamp.From shot 7012, nav is logged in the geoeel computer. Nav lost due to seatrack system crash at 01:17:24 UTC. System rebooted at 01:54:36 UTC
YP	1389	3	9/1	3:55	12185	80.344	6.879	11:19	17491	79.919	5.047	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temp: 6.3, Air temp:7, WindSpeed: 10.7 m/s. Sample rate changed to 0.125ms, recording length 2 s.Nav lost due to seatrack system crash at 04:38:14 UTC. System rebooted at 04:44:58 UTC. Seatrack crush 06:36 UTC. System rebooted at 06:39:06 UTC. On shot 14639 delay set to to 0.048 sec. On shot 14679 shot rate set to 6s. Shot rate returned to 5sec on shot 14727 - unable to enter a delay. Seatrack crashed and rebooted at 07:46 UTC.
KR	1391	4	10/2	3:47	17611	77.984	7.697	5:06	18286	77.897	7.461	2 mini GI at 15/15 and 30/30, 170 bar	7	Seismic profile over 'donut' features on the Knipovich Ridge. Water temp: 6.5, Air temp:6.6, WindSpeed: 8.6m/s. Sample rate 0.5ms, recording length 6 s. seatrack crash at about shot 18095

WSM	1393	5	10/2	12:00	18667	77.342	8.834	13:39	19855	77.336	9.435	2 mini GI at 15/15 and 30/30, 170 bar	5	ODP986 test line with miniGI guns. Water temp: 7.9, Air temp:5.8, WindSpeed: 14.6 m/s. Sample rate 0.250ms, recording length 4 s. 18891 shot (14:15) - the start of reasonable data. 19159 shot - at ODP986 site.
WSM	1394	6	10/2	16:03	20041	77.341	9.005	17:51	21359	77.335	9.552	1 GI 45 at 155 bar	5	ODP986 test line with GI guns. Water temp: 8.2, Air temp:6, WindSpeed: 10.4 m/s. Sample rate 0.250ms, recording length 4 s.
WSM	1395	7	10/2	20:43	21581	77.334	9.027	1:40	25177	77.517	10.476	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 8.2 degrees celsius. Wind speed is about 11 m/s. sample rate is 0.250 ms and rec length 4s. Wave heights around 2m. Seatrack crashed at 23:38. Seatrack crashed at 01:01.
WSM	1396	8	10/3	3:58	25178	77.402	9.899	20:28	37061	78.559	9.424	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 7.7 degrees celsius. Wind speed is about 2.8 m/s. sample rate is 0.250 ms and rec length 4s. Seatrack crashed at 06:45. Seatrack started recording again at 06:47:49. Line CAGE_17_5_SV_2D_008a is finished at 29973 shot. Line CAGE_17_5_SV_2D_008b started at shot 29974. Seatrack crashed at 14:34:38. CAGE_17_5_SV_2D_008b ended at shot 34312.CAGE_17_5_SV_2D_008c start at shot 34313. Seatrack crashed 18:01:21, 18:23:20
WSM	1397	9	10/3	21:57	37062	78.494	9.306	5:00	42133	78.910	7.645	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 5.2 degrees celsius. Wind speed is about 4.6 m/s. sample rate is 0.250 ms and rec length 3s. Seatrack crashed 23:06:58. 23:28:29. 04:02:13
WSM	1398	10	10/4	7:21	42267	78.713	8.291	8:40	43137	78.626	8.302	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 5.6 degrees celsius. Wind speed is about 8.63 m/s. Wave height 2.5 m. sample rate is 0.250 ms and rec length 3s. Seatrack crashed 08:22. Seatrack started recording at 42939 sp.
WSM	1399	11	10/4	9:12	43138	78.644	8.398	10:26	44035	78.697	8.026	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 5.3 degrees celsius. Wind speed is about 8 m/s. Wave height 2.5 m. sample rate is 0.125 ms and rec length 2s.
WSM	1400	12	10/4	10:53	44036	78.707	8.024	12:10	44952	78.669	8.477	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 5.8 degrees celsius. Wind speed is about 9 m/s. Wave height 1.5-2.5 m. sample rate is 0.125 ms and rec length 2s.

WSM	1406	13	10/4	22:42	45222	78.218	8.093	4:56	49511	78.176	10.436	2 mini GI at 15/15 and 30/30, 170 bar	5 - 6	Water temperature is 6 degrees celsius. Wind speed is about 11 m/s. Wave height 1.5-2.5 m. sample rate is 0.500 ms and rec length 3s with 2s delay. From shot 45618 recording delay is 1 sec.From shot 46119 no recording delay. From shot 46187, shot interval is 5 sec. Sea track crashed at 00:19:37, 00:57:33,01:59:19.From shot 47305, recording length is 2 sec
WSM	1407	14a	10/5	7:04	49794	77.998	10.906	9:32	51571	77.894	19.176	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temperature is 7 degrees celsius. Wind speed is about 8 m/s. Wave height 1.5-2.5 m. sample rate is 0.500 ms and rec length 2s. Seatrack crashed at 07:09:37. 07:15:06 (49926sp) gun 1 is turned off for a test. At 49957sp gun 1 is on. acquisition stopped at 51571sp due to ships engine problem. gun and streamer are out.
WSM	1408	14b	10/5	11:39	51635	77.901	10.224	16:59	55493	77.666	8.608	2 mini GI at 15/15 and 30/30, 170 bar	5	Continue line 14. Water temperature is 7.5 degrees celcius. Wind speed is about 7.8 m/s. Wave height 1.5-2.5 m. Line 14B start. From 51722 - good data. Delay added then removed at shot c. 52340. At shot 52714 at 12:53:39 Seatrak crashed. 0.5 s delay added at shot 52773. 0.5s delay added at shot 52998 (total 1s). 0.5s delay added at shot 53575 (total 1.5s). Seatrack rebooted at 14:53. 0.5s delay added at shot 54346 (total 2s)
WSM	1409	15	10/5	19:00	55647	77.840	9.644	3:02	60588	77.315	9.055	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temp: 8.2, Air temp: 3.1, WindSpeed: 6 m/s. Sample rate: 0.50ms, recording length 3 s. @56665 delay of 1s added. Seatrack crashed @23:59:51 Missing trigger time shots 59865-598870.
WSM	1410	16	10/6	3:52	60589	77.353	8.998	16:05	68417	76.943	11.982	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temp: 8, Air temp: 2.4 WindSpeed: 10 m/s. Sample rate: 0.250ms, recording length 3 s with 1 sec delay. Seatrack crash at 04:48. 063396 at 07:45 seatrak crashed. Battery fallen off position on gun at shot 63530 (07:57 UTC). Retrieve gun. acquisition continued at shot 63531 (09:17:28 UTC). No fire gun 1 error. seatrack crash at 63656sp. Seatrack crashed at 63823 sp. Seatrack crached 66810 and 67074. At 67396 delayed set to zero. 67598 seatrack crash.

WSM	1411	17	10/6	17:52	68655	76.952	11.581	2:44	75047	77.554	10.308	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temp: 8, Air temp: 1.8 WindSpeed: 5.2 m/s. Sample rate: 0.250ms, recording length 3s, delay is 0.5. Until 68700 sp gun 1 trigger problems.Seatrack crashed at 19:48:47,21:55:57,21:57:39,22:18:15,02:11:06. From shot 70347, no delay. shots 73025,73146,73530 delayed gun fire
WSM	143	18	10/7	4:56	75137	77.496	9.250	7:13	76765	77.314	9.054	2 mini GI at 15/15 and 30/30, 170 bar	5	Repeat of line 15. Water temp: 7.6, Air temp: 2.9 WindSpeed: 3.4 m/s. Sample rate: 0.500ms, recording length 4s. Channel 30 is noisy
WSM	1413	19	10/7	8:51	76859	77.264	9.678	16:51	82610	76.944	11.970	2 mini GI at 15/15 and 30/30, 170 bar	5	Repeat of line 16. Water temp: 7.8, Air temp: 2.8 WindSpeed: 3.3 m/s. Sample rate: 0.250ms, recording length 3s, delay 1s. 76765sp - 76859sp testing guns separately and simultaneously. Seatrack crash at 79941.
WSM	1414	20	10/7	21:19	82754	77.487	10.507	10:42	92265	78.450	8.928	2 mini GI at 15/15 and 30/30, 170 bar	5	Water temp: 7.8, Air temp: 3.6 WindSpeed: 6 m/s. Sample rate: 0.250ms, recording length 3s. 87732 Serial string not detected. Next shot delayed by 06:21 minutes. Line 20A ends at 87731. Line 20B starts from 87733. From 88179-88187 only one gun firing (test). At 09:00 UTC the wind speed is 13 m/s. 92188 seatrack crash.
WSM	1417	21	10/8	20:18	92351	77.917	9.291	20:49	92723	77.950	9.175	2 mini GI at 15/15 and 30/30, 170 bar	5	Repeating part of line 20 to fill in the gap. Water temp: 7.5, Air temp: 4.1 WindSpeed: 3 m/s. Sample rate: 0.250ms, recording length 3s.