ALKOR-Berichte

Baltic Sea Geophysical Student Field Trip

Cruise No. AL542

14.08.2020 – 21.08.2020,
Kiel (Germany) – Kiel (Germany)
GPF19-1_92

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Preface

Cruise AL542 was carried out as a marine geophysical field course for ‘Physics of the Earth System’ bachelor students at Kiel University. One task of the student course was writing the cruise report. Hence some parts of the report may not appear in a typical way. We decided to only moderately modify the student’s report in an editorial manner to leave the student’s achievements as visible as possible. (Sebastian Krastel, Jens Schneider von Deimling, Philipp Held, Kai-Frederik Lenz).

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1 Cruise Summary

1.1 Summary in English

The cruise AL542 took place in the Western Baltic Sea in the period 14. – 21.08.2020. The cruise was carried out as a marine geophysical field course of Kiel University. Starting and ending point of the cruise was Kiel. One stopover in Kiel took place during the cruise due to an exchange of parts of the scientific party (18.08.2020). The main aim of the cruise was to introduce marine geophysical acquisition to the students including hands-on experience in collecting marine geophysical data. This approach also included a first processing and interpretation of the data as well as the presentation of the first results.

The main survey area of the first leg of the cruise AL 542 was the Bay of Mecklenburg. In the eastern part of the bay seismic and acoustic data were collected with the aim to identify historical coastlines and buried glacial structures. Further, the central part of the bay was mapped with the multibeam echosounder to find the Blinkerhügel, a small mound with reported accumulation of manganese nodules, investigated in 2002 by Hlawatsch et al. The Blinkerhügel was clearly identified as an outcropping ground moraine. Seafloor samples at eight locations were collected with a grab from the area of the Blinkerhügel. At one location stones with manganese crusts were successfully retrieved.

The four survey areas of the second leg of the cruise were Mittelgrund, Noer and Damp which are located in the Eckernförde Bay and an area near Fehmarn which is located in the northwest of the island in the Fehmarn Sund. In the region Mittelgrund in the Eckernförde Bay a well-known, developing pockmark field was surveyed with hydroacoustic and seismic methods. Furthermore, a known pockmark near Noer was surveyed with hydroacoustic methods. From the third survey area Damp Laminaria agitate algae have been reported. The aim in this area was to check, if it is possible to detect the algae with the hydroacoustic systems. Additionally, some video transects and seafloor samples were gathered for ground truthing in this region. In the survey area near Fehmarn a dynamic dune field was surveyed with hydroacoustic methods. This dune field is surveyed every year to document changes in the submarine environment.

1.2 Zusammenfassung

Die Ausfahrt AL542 fand im Zeitraum vom 14. bis 21.08.2020 in der westlichen Ostsee statt. Die Fahrt wurde als marines geophysikalisches Feldtraining der Universität Kiel durchgeführt. Start- und Endpunkt der Fahrt war Kiel. Ein Zwischenstopp in Kiel fand zum Austausch von Teilen der wissenschaftlichen Besatzung am 18.08.2020 statt. Das Hauptziel der Ausfahrt war den Studierenden marine geophysikalische Kenntnisse zu vermitteln und ihnen praktische Erfahrungen im Sammeln mariner geophysikalischer Daten zu ermöglichen. Dies beinhaltet auch eine erste Verarbeitung und Interpretation der Daten sowie die Präsentation der ersten Ergebnisse.

Das Hauptuntersuchungsgebiet des ersten Fahrtabschnittes war die Mecklenburger Bucht. Im östlichen Teil der Bucht wurden seismische und akustische Daten gesammelt um historische Küstenlinien und glaziale Strukturen zu untersuchen. Darüber hinaus wurde der zentrale Teil der Bucht mit dem Fächerecholot kartiert, um den Blinkerhügel zu finden. An diesem kleinen Hügel wurden Ansammlung von Manganknollen von Hlawatsch et al. (2002) gefunden. Der

Blinkerhügel wurde eindeutig als ausbeißende Grundmoräne identifiziert. An acht Stellen wurden mit einem Greifer aus dem Gebiet des Blinkerhügels Proben entnommen. An einer Stelle wurden Steine mit Mangankrusten erfolgreich geborgen.

Die vier Untersuchungsgebiete des zweiten Fahrtabschnitts waren Mittelgrund, Noer und Damp, die in der Eckernförder Bucht liegen, und ein Gebiet bei Fehmarn, das im Nordwesten der Insel im Fehmarn Sund liegt. In der Region Mittelgrund in der Eckernförder Bucht wurde ein bekanntes, sich entwickelndes Pockmark-Feld mit hydroakustischen und seismischen Methoden vermessen. Weiterhin wurde ein bekanntes Pockmark bei Noer mit hydroakustischen Methoden vermessen. Im dritten Untersuchungsgebiet kommen Laminaria-Algen vor. Es sollte geprüft werden, ob diese Algen mit den hydroakustischen Systemen kartiert werden können. Zusätzlich wurden in dieser Region einige Video-Transekte und Proben vom Meeresboden gesammelt. Im Untersuchungsgebiet bei Fehmarn wurde ein dynamisches Dünenfeld mit hydroakustischen Methoden vermessen. Dieses Dünenfeld wird jedes Jahr vermessen, um Veränderungen zu dokumentieren.

2 Participants

2.1 Principal Investigators

Name	Institution
Krastel, Sebastian, Prof. Dr.	CAU

2.2 Scientific Party

Name	Discipline	Institution	Leg
Sebastian Krastel, Prof. Dr.	Seismic/Chief Scientist	CAU	1 & 2
Jens Schneider v.D., Dr.	Hydroacoustics	CAU	2
Philipp Held, Dr.	Hydroacoustics	CAU	1
Kai-Frederik Lenz	Seismic	CAU	1 & 2
Noemi Schulze Glanert	Bachelor Student	CAU	1
Alexander Schmitz	Bachelor Student	CAU	1
Viktoria Thamm	Bachelor Student	CAU	1
Mette Lea Baumann	Bachelor Student	CAU	2
Martje Hänsch	Bachelor Student	CAU	2
Philipp Tabelow	Master Student	CAU	2
Kimberly Wordtmann	Bachelor Student	CAU	2

2.3 Participating Institutions

CAU Christian-Albrechts-Universität zu Kiel

3 Research Program

3.1 Description of the Work Area

Ice-load induced tectonics

Neotectonic activity in the Baltic Sea was investigated (among others) by Hansen et al. (2005; 2007), Hübscher et al. (2010) and Al Hseinat and Hübscher (2017). A review of the results is beyond the scope of this report. Here, we focus on deformation driven by ice-load induced tectonics (e.g., Al Hseinat and Hübscher, 2014; 2016). A good example is the Kossau tunnel valley in the southeastern Bay of Kiel (Al Hseinat and Hübscher, 2014). The Kossau tunnel valley strikes almost south to north and is 1200 – 1800 m wide and up to 200 m deep. A near-vertical fault with an apparent dip angle of $> 80^\circ$ and an associated anticline intersect and deform the post-Permian succession directly beneath the Kossau tunnel valley. Al Hseinat and Hübscher (2014) explain the origin of the fault–anticline assemblage as a consequence of ice-load induced tectonics above an inherited and deep-rooted sub-salt fault that is related to the Glückstadt Graben. Near-surface faulting weakened the upper strata and facilitated erosion, which led to the formation of the Kossau tunnel valley. Consequently, the formation and evolution of the Kossau tunnel valley results from the interplay of ice-load induced tectonics and subglacial melt-water erosion.

Shallow gas and free gas ebullition

Significant release of methane gas bubbles from Holocene organic rich and gas bearing mud into the water column was anticipated for the Baltic Sea to occur. Very comprehensive international research campaigns were conducted especially in the Eckernförde Bay (CBBL, METROL, BALTIC GAS, SFB 95), but significant free gas release could hardly be verified (Orsi et al., 1996; Richardson and Bryant, 1996; Schmale et al., 2010). From a cruise in 2014, thousands of individual gas bubble ebullitions being released from the Holocene mud have been reported to occur all over the place in the Eckernförde Bay (Schneider von Deimling et al., 2015; Lohrberg et al., 2017)

Seismic stratigraphy and sediment dynamics in the Fehmarn Belt

The near surface sediments in the Fehmarn Belt have been affected by the last ice ages. The seafloor consists of sediments that cover the basal till and were deposited during various transgression/regression phases of the Baltic Sea. Seafloor sediment grain sizes have been mapped out by Kaufhold (1995). Organic rich Holocene mud often represents the top layer in the channels and basins hosting free gas in large areas.

Sediment transport dynamics within the Fehmarn Belt are highly dependent on the hydrographic current regime. About 70% of the entire Baltic inflow and outflow water exchange passes the Fehmarn Belt (Lass et al., 1987). Typically, surface water flows toward northwest and bottom water toward southeast, but reversals of these flow directions are common (Mittelstaedt et al., 2008). In the southern area of the Fehmarn Belt, there are various current monitoring stations (Klein, 1998; Jakobsen and Trébuchet, 2000; Mittelstaedt et al., 2008; FEHY, 2013). Under normal conditions, near-bottom flow velocities > 60 cm/s are observed in less than 1% of the measurement time (FEHY, 2013) with median flow velocities < 20 cm/s. Maxima with > 100

cm/s can be achieved during inflow events in the various Belts of the Baltic Sea (Jakobsen, 1995; Sellschopp et al., 2006). Inflow events are assumed to control the sediment dynamics in the various Baltic Sea belts (Werner and Newton, 1975).

A subaqueous dune field exists in the Fehmarn Belt (Western Baltic Sea) in water depths of 11-24 m. It was described in detail by Feldens et al. (2014) and re-analyzed by Hagemann (2017). The dune field lies parallel to the Belt and is approximately 9 km long in east-west and 2 km wide in north-south direction. It is divided into a southern terrace in water depths of 11-18 m and a northern terrace in water depths of 18-24 m. The dune crests run perpendicular to the Belt's cross-section with lee sides to the east. The mean dune heights range from 2 m on the shallower southern terrace to 0.6 m on the deeper northern terrace. The wavelengths decrease from 90 m in the central southern part to 30 m in the deeper northern part. Since 2015 the Fehmarn Belt is re-surveyed by means of this kind of student cruises on a yearly basis. Therefore, a unique dataset is being acquired to better understand individual dune formation, the dune field sediment dynamics, and to quantify the bulk sediment mass transport.

3.2 Aims of the Cruise

The cruises serve as marine geophysical field lectures being integral part of the geophysical Bachelor and the Master programs offered by Kiel University. The field trip is designed to let the students gain practical experience with state-of-the-art marine geophysical methods and to sharpen the senses for exciting scientific tasks to be solved. The training includes on board survey planning, acquisition, processing, and interpretation of the data. Students are trained on a variety of geophysical methods including 2D seismics, multibeam echo sounding, subbottom profiling, and calibrated water column hydroacoustics. The geophysical measurements are supplemented by geological ground-truthing, video imaging, and oceanographic data acquisition. Next to the technical challenges of getting used to various geophysical methods and the workflow at sea, the students work on small scientific projects based on data collected during the cruises.

Students learn how to image, analyse, and interpret seismo-acoustic records. They investigate deeper geological structures to better understand links between deep structures and recent geology, morphology, and (neo-)tectonics by seismo-acoustic methods. Subbottom data will be acquired to resolve small-scale features near the seabed surface and respective sedimentary settings will be discussed.

Shallow gas accumulations and gas bubble transport from the sediment into the water column will be mapped using hydroacoustic methods. The morphology of the seafloor is investigated by modern multi-beam mapping in order to establish possible connections to the subsurface and regional geology, thus enabling a better understanding of sediment dynamics. Thanks to calibrated fish finders and multibeam sounders, we will work with absolute sound pressure levels; this is also be used for sophisticated habitat mapping. Students investigate whether and to what extent benthic life effects the acoustic backscattering strength of the seafloor (vegetation, macrobenthos, shallow gas). To validate the acoustic findings, grab and core samples are taken complemented by video imaging.

3.3 Agenda of the Cruise

The main survey area of the first leg of the cruise AL 542 was the Bay of Mecklenburg (Fig. 3.3.1). In the eastern part of the bay seismic and acoustic data were collected with the aim to identify historical coastlines and buried glacial structures. Further, the central part of the bay was mapped with the multibeam echosounder to characterize the Blinkerhügel, a small mound with reported accumulation of manganese nodules, investigated in 2002 by Hlawatsch et al.

Fig. 3.3.1 Position of tracks, seismic profiles, SES profiles and grabs taken in the Bay of Mecklenburg.

The four survey areas of the second leg of the cruise were Mittelgrund, Noer and Damp (all located in the Eckernförde Bay) and an area near Fehmarn located in the northwest of the island in the Fehmarn Sund. In the region Mittelgrund in the Eckernförde Bay a well-known, developing pockmark field was surveyed with hydroacoustic and seismic methods (Fig. 3.3.2).

Furthermore, a known pockmark field near Noer was surveyed with hydroacoustic methods. *Laminaria agitate* algae have been reported from the Damp survey area. The aim in this area was to check, if it is possible to detect the algae with the hydroacoustic systems. Additionally, some video transects and seafloor samples were gathered for ground truthing in this region. In the survey area near Fehmarn a dynamic dune field was surveyed with hydroacoustic methods. This dune field is surveyed every year to document changes in the submarine environment. A map of the track and all stations of the cruise AL542 is plotted in figure 3.3.3.

Fig. 3.3.2 Zoom-In to the survey area Eckernförde Bay. In the middle of the Eckernförde Bay there is the region Mittelgrund. On the map one can see the profile lines where measurements were taken with the NORBIT Multibeam and the INNOMAR. Red dots mark CTD measurements and blue dots mark locations where grab samples have been taken

Fig. 3.3.3 A map of the AL542 track to Mecklenburg Bay, Eckernförde Bay, Fehmarn and Damp (thin line). The thick line shows the seismic profiles that were acquired in the survey areas. CTD measurements were taken for each bathymetric survey, marked by a red dot. The blue dots mark the respective locations where grab samples were taken.

4 Narrative of the Cruise

On **Friday the 14th** of August the RV ALKOR left its home port Kiel at 9 am with three senior scientists and three undergraduate students on board. Beside functioning as a geophysical student field trip, the cruise aimed to conduct several measurements in the Baltic Sea as preliminary study for future projects as well as contribution to ongoing research. During transit to the Mecklenburg Bay, the scientific equipment was prepared and put into operation. Especially the motion reference unit of the multibeam echosounder system had to be calibrated by driving several features of eight. In the evening the first destination in the Mecklenburg Bay was reached. There, seismic and acoustic data was collected with the aim to later identify historical coastlines and glacial structures. Also, a conductivity, temperature and depth (CTD) measurement was performed, probing depth dependent sound speed to allow for correct raytracing of the travel path in the water column.

The survey lasted until the evening of **Saturday the 15th** without major issues. After hauling the streamer and seismic source inboard, the RV ALKOR continued its track a few nautical miles eastward in the Mecklenburg Bay. Using the multibeam echosounder, with again a CTD measurement to consider depth dependent sound speed, the next objective was to find the Blinkerhügel, a small mound with reported accumulation of manganese nodules, investigated in 2002 by Hlawatsch et al. Since records of this time are rather inaccurate, a fairly large track was surveyed at night. The Blinkerhügel was clearly identified as up to 3 m morphological high representing a ground moraine.

During daytime **Sunday the 16th** the seismic source, a micro airgun, was exchanged with counterparts of different chamber volume, driven by various operation modes and parameters to study seismic penetration performance in gassy sediments. Further description on this specific track can be found in section 5.1. Unfortunately, initial data acquisition problems with a streamer segment lead to a small delay in the schedule. Nonetheless the measurements successfully began and continued without further complications.

In the following night to **Monday the 17th** the survey for imaging glacial structures was continued in the western part of the bay. After finishing this track, the seismic system was hauled back inboard at noon to return to the Blinkerhügel. There, eight seafloor samples were collected with a grab. The samples have been classified with respect to homogeneity, grain size, colour and natural gas content, according to the smell. Some rocks with manganese caps were sampled. These rocks were cleaned and stored for further analysis ashore. Later on, the RV ALKOR began its transit back to the Kiel port. On this course the opportunity was used to fill missing echosounder data from some previous tracks and to map a supposed pockmark in the Mecklenburg Bay. Near surface gas is coming very close to the sea floor at this location but no depression was found in the multibeam data. Later the night the multibeam echosounder was also deactivated for the transit.

On **Tuesday the 18th** the RV ALKOR berthed at its home port KIEL GEOMAR at half past 7, thereby ending the first leg of the cruise. At 09:00 am the five new members of the scientific staff for leg 2, consisting of one senior scientist and four students, boarded the R/V ALKOR. Two senior scientists from the first leg stayed onboard. No additional scientific equipment has been boarded. The second leg started from the Geomar pier in Kiel 09:30 am. From Kiel the ALKOR headed towards the region Mittelgrund in the Eckernförde Bay (survey area 1). After the arrival in this first survey area, a CTD profile was taken. Afterwards the NORBIT Multibeam

System was lowered in the moonpool and the measurement of the seven east-west profiles across the well-known pockmark field in the Eckernförde Bay started. The Multibeam profiles were finished at 03:30 pm and another CTD measurement was taken to detect possible changes in the sound velocity profile. Afterwards, the same profiles that were measured with the NORBIT at first, were measured with the INNOMAR sediment echosounder. The data were not collected together because there is some cross talk between the systems and we wanted to acquire data with the best possible quality. Some additional profiles were collected with the NORBIT multibeam system in order to close data gaps from the previous multibeam survey. At 06:12 pm the ship headed towards Fehmarn (survey area 2) and the INNOMAR kept measuring during the transit. For the transit the NORBIT system was pulled up out of the water, to allow a higher vessel speed. At 09:00 pm the ship arrived at the survey area in the northwest of Fehmarn and a CTD profile was taken. Afterwards multibeam and sediment echosounder measurements were conducted along the pre-defined profile lines across a dune field in this area. At 11:10 pm of the 18th of August, the NORBIT multibeam system stopped working because it had no GPS signal. The computer program was restarted and the measurements could be continued.

On the **19th of August** the NORBIT Multibeam measurements and the INNOMAR sediment echosounder measurements across the dune field continued until 08:20 am. After the completion of the profiles in survey area 2 a CTD measurement was taken and the ship headed towards Eckernförde Bay again.

The ship arrived in the Eckernförde Bay (pockmarks Mittelgrund) shortly before 12:00 am and a short seismic survey across the pockmark area was conducted. The first seismic measurements started at 12:30 am and 5 profiles were taken. For the first 3 profiles the source was a MicroGI with a chamber volume of 0.1 l. For the other 2 profiles the source was a standard GI with decreased volume (0.7 l). In the first case the air pressure was 140 bar. Because of the limitations of the used compressor the pressure had to be decreased to 120 bar to fill the bigger volume of the standard GI. The shot interval was increased from 4 seconds to 8 seconds. The seismic measurements were completed at 5 pm and the ship headed to survey area 3 in the Eckernförde Bay near Noer, where a CTD profile was taken at 05:50 pm. Starting at 06:06 pm, 9 profiles were taken with the NORBIT Multibeam, which constantly collected data, and the INNOMAR sediment echosounder. The last profile was completed at 08:35 pm and another CTD profile was taken. To get a higher resolution of the Mittelgrund area bathymetry, it was surveyed again after a 15 minute transit. This time the opening angle was decreased by 30° to 120°. That reduces the swath width. The last profile was complete at 10:55 pm. The INNOMAR sediment echosounder was turned off and the opening angle was increased back to 150°. Afterwards the ship headed towards survey area Damp (survey area 4). Laminaria algae have been reported in this area and we wanted to check, if we can detect them with the hydroacoustic systems.

At 12:45 am on the **20th August** a CTD profile was taken. At 01:15 am the ship arrived at the start of the first profile and multibeam measurements were taken along the profile lines. A second CTD Profile was taken at 04:35 am at the northern end of the fifth profile. Afterwards we continued measuring the profiles with NORBIT multibeam.

At 05:30 am the ship speed was changed from 3kn to 4kn. The multibeam was used to find locations for grab samples. In total 4 sampling locations were chosen based on their backscatter. Two have been chosen because of their relatively low backscatter, one because of the relatively high backscatter and one based on the backscatter that could be caused by vegetation. For a test

of the interference between the INNOMAR and the NORBIT system, the INNOMAR was turned on and off three times during the rest of the measurements in the Damp area. Later on this day a Rumohrlot sampling was planned. Therefore, an area with a big layer of silt is needed, so it can penetrate the ground and the material will stay in the plastic tube which is open to the lower end. At 07:00 am the search for this area started with the transition beginning in the middle of the last profile of the Damp area. For this purpose, the INNOMAR system was used. We found an area with a low backscatter (BS), which indicates a silty material. To decide at which location a Rumohrlot sample should be taken, the data were plotted and a location was selected. In the meantime, a NORBIT profile was taken. This profile went back from the possible Rumohrlot location and crossed the foundation of one of the dismantled Schwedeneck rigs, which is connected to a buried pipeline, which is clearly visible in the backscatter data. At 08:26 am a CTD profile was taken. To reference, whether the locations for the grab sampling are interesting enough and to gather additional information about the Damp area, some video tracks were acquired. After a short test of the GoPro a first video track was recorded, starting at 09:00 am. Two further tracks were filmed at other locations within the area. At 10:40 am, during the third track, an error with the SD card occurred. After some fixes, the camera started to work again and the video track was finished at 11:04 am. The grab sampling started at 11:06 am. Not all of the 14 grab samples were successful. Some of them were empty or just contained one piece of rock. At 02:34 pm the grab was used to take three sediment samples in the area, as well as a Rumohrlot core sample, which was taken at 03:00 pm. During the night we surveyed a reference line in the Eckernförde bay with the EK60. This reference line is surveyed every year to get long-time measurements. Therefore, the vessel traveled with a speed of 3 kn between two points continuously.

At the morning of the **21st August**, the ship headed back to Kiel. At 08:00 am the ship reached the GEOMAR eastshore pier and the cruise ended at 09:15 am.

5 Preliminary Results

5.1 2D reflection Seismic

(N. Schulze Glanert, A. Schmitz, V. Thamm)

The deployed seismic measurement system consisted of a streamer and an airgun as sound source (Fig. 5.1.1). The overall dimension was laid-out for reflection seismic only. At first a micro GI-Gun with a pressure around 140 bar was used, which was triggered externally every 4 seconds. It was later exchanged by both a normal and a mini GI-Gun with reduced volume respectively, the operation parameters also varied (see table 5.1.1 below).

Fig. 5.1.1 Left: Streamer segments on board with red float. Right: Preparation of the seismic source.

Table 5.1.1 Configuration of the seismic source

Source	Shot interval [s]	Injector Delay [ms]	Pressure [bar]	Chamber Volume [l]	Profile-/ Surveynr.
MicroGI	4	25	140	0,1	S100
MiniGI/Re	7	25	140	0,2	P201
MiniGI/Re	4	25	100	0,2	P202
G Gun	7	-	110-130	0,4	P203
MicroGI	3	20	80	0,1	P204
MicroGI	3	20	140	0,1	P205
MicroGI	4	20	140	0,1	P206-P219 P301-P303
Mini G	5	-	140	0,2	P220
Mini GI	6	25	80	0,2	P221
GI Gun	10	30	120	0,7	P304,P305

The streamer setup consisted of four active sections with eight channels at 1.5625 m spacing each and a vibration isolation section. Each connection module included an AD converter (ADC). For the AD converters, connecting the streamers, a sampling rate of 250 μ s was used. The whole build was terminated by a towing cable with a length of 19.94 m fixed at the ALKOR rear end. A digital repeater on board functions as a signal amplifier. The streamer's waterside end was held in position by a float. The overall cable length summed up to 80,08 m. A detailed map of the deck can be found below (Fig. 5.1.2 to Fig 5.1.4). To ensure the best compromise between data quality and survey speed the average ship velocity was set to 4 kn.

Fig. 5.1.2 Deck geometries for Micro GI Airgun streamer configuration for 2D reflection seismic.

Fig. 5.1.3 Deck geometries for Mini GI Airgun streamer configuration for 2D reflection seismic.

Fig. 5.1.4 Deck geometries for GI Airgun streamer configuration for 2D reflection seismic

Some first results of the seismic data are presented to give a short overview. In figure 5.1.5 the first prominent reflection shows the seafloor and clearly beneath it on the left side a thick reflector indicates free gas with following decreasing acoustic signal and resulting lighter reflections below. Multiple reflections from the reflector start at around 70 ms. Between them

reflectors coming from the right can be seen. On the right side a fault system is reaching down from 50 ms. Further down some reflectors can be seen (e.g. yellow lines). Figure 5.1.6 shows the seismic profile 105. On the right side the reflector at 50 ms is falling down to the left where it is intermitted by some fault systems at 1000 m and 1600 m offset. At 90 ms on the right side a multiple cuts through the true reflector coming up from 140 ms (yellow line). The data shown in figure 5.1.7 reveals a deeper view of figure 5.1.6. More reflectors of deeper layers are visible e.g. at 380 ms and 440 ms (yellow lines). Their amplitudes are much lower as the reflectors above, cause the acoustic energy is decreasing from previous reflections of layers. The reflectors are continuous and start to intermit more between 0 m and 600 m offset. A multiple reflection of the reflectors at 140 ms can be found at depths of 200 ms and below.

Fig. 5.1.5 Seismic data of profile 104: Two dominant reflectors are indicated by a yellow line. Important features such as natural gas or a fault are also marked.

Fig. 5.1.6 Seismic data of profile 105: several reflectors can be seen e.g. at 140 ms and beneath a multiple reflection 360 ms.

Fig. 5.1.7 Seismic data of profile 105: A deeper view shows further reflectors and multiple reflections

5.2 INNOMAR Sediment Echosounder (SES)

(N. Schulze Glanert, A. Schmitz, V. Thamm)

Another instrument used to image marine sediments during the survey was the parametric sediment echosounder INNOMAR SES 2000-Medium, mounted stationary at the hull of RV ALKOR. It works by combining two close frequencies of around 100 kHz to form a considerably lower frequency in the range of 4 kHz to 15 kHz which is able to penetrate the ground to depth up to 20 m, depending on the ground composition. Simultaneously the small footprint size allows high resolution measurements. Different low frequencies (4 kHz, 8 kHz, 10 kHz and 15 kHz) were used on profile tracks which were measured more than once. Single measured profile tracks were recorded with a 6 kHz frequency.

In figure 5.2.1 the SES data allows differentiation of sediment structures (right), hard rock and glacial till (left). The seafloor begins at 0.01 s TWT and the multiples start at 0.02 s. On the right-side sediment is deposited. The ground penetration is lower on the left-side. Sediment accumulation can only occur below a certain depth when the whirl up of particles due to wave energy is outweighed by the sedimentation rate.

Fig. 5.2.1 SES data

The profile in figure 5.2.2 shows a continuous sediment layer in the first few milliseconds below the seafloor. Below this layer an unconformity can be found due to former glacial erosion of the ground.

Fig. 5.2.2 SES data, profile 105

The sediment echosounder data in figure 5.2.3 show a usual sediment deposition at the top. At the left side natural gas results in an absorption sound energy and is the reason why the signal cannot travel any deeper. The signal loss already begins above the white part in the noisy area. On the right side a strong reflector is visible and beneath it.

Fig. 5.2.3 SES data, profile 104

5.3 NORBIT Multibeam

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

One of the instruments that we used was a NORBIT STX prototype wideband Multibeam Echosounder System (MBES). This instrument forms directional acoustic signals and sends them like a fan to the ground. In total there are 512 beams, each with a small opening angle of around 1° , depending on the operation frequency adjustable between 200 kHz and 700 kHz. The STX MBES prototype was developed by NORBIT in the BONUS ECOMAP project and was acoustically calibrated for 200 kHz and 400 kHz in a test tank with copper spheres to obtain absolute backscattering strength values.

The instrument was lowered through the moonpool of RV ALKOR and rested there most of the time during the cruise, except during steaming (Fig. 5.3.1 and 5.3.2). The approximate depth under the water line is 4.5 m but may change given the draft and squat of the vessel.

Fig. 5.3.1 Picture of the NORBIT multibeam over the moonpool

Fig 5.3.2 Picture of the NORBIT multibeam upside-down on the ship

The curved receiver and the cylindrical transmitter are perpendicular to each other forming a mills cross. The signals are transmitted in a fan-like shape which is perpendicular to the ship's direction.

The swath opening angle can be adjusted on the fly, but it only affects the receive beam pattern. Most of the time we chose an angle of 150° in water depth down to 30 m. Only for measurements in the Mittelgrund area the opening angle was reduced once to 120° . The data were acquired with a centre frequency of 400 kHz and a bandwidth of 80 kHz. The frequency modulated pulses were thus ranging between 360 kHz and 440 kHz. The acoustic signals are scattered and reflected from the seafloor. The instrument receives scattered and reflected signals. Next to the transducers there is an online sound velocity probe (AML). With the knowledge of the sound velocity and knowledge of the time offset the beam directions can be formed accordingly. The multibeam system holds an Applanix Wavemaster motion sensor. It registers very accurately the ship's motion, because the orientation of the transmitted and received signals changes a lot by every motion of the ship. With the motion sensor the ship's motion can be calculated back from the received signals. The motion sensor in the sonar head is tightly connected to the topside electronics and with a dual GPS antenna on the ship's deck. Therefore,

the collected data can be merged with the ship's location. To correct GPS errors we received RTK correction by courtesy of Axionet GmbH via the ships internet connection for the actual position and time. With this technique changes in water level can also be corrected.

All data were recorded with the NORBIT WBMS GUI and gridded bathymetry and backscatter were visualized online with the novel NORBIT DCT software. No sound velocity profiles could be loaded and all the recorded .s7k files need to be raytraced afterwards. With the mentioned parameters and a water depth between 12 m and 25 m we get a theoretical range resolution of about 0.9 cm at the ground, were the INS system showed accuracy of 2-3 cm in position and 2-3 cm in height.

With the multibeam technique there is a systematic pattern in the measurements of the backscatter and reflection. Perpendicular sound incidence on the seabed will show systematically higher reflection, compared to slanted sound inclination toward outer beams resulting in the well-known angular range behavior. In the pictures below (Fig. 5.3.3 and Fig. 5.3.4) light colors stand for high backscatter. Angular range behavior has not been compensated yet.

Fig. 5.3.3 Backscatter picture in the NORBIT WBMS GUI program while recording

Fig. 5.3.4 Backscatter data shown in a map with the ship's current position

5.3.1 Data example sand dunes

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

From measurements of previous years, it is known that there are sand dunes on the seabed surface west of the island Fehmarn (Fig. 5.3.5). We made measurements with the NORBIT Multibeam to observe these sand dunes and to see if they changed or moved in the last year. In the picture (Fig. 5.3.5) one can see the profile lines with this year's measurements. The length of one profile line is about 5 km. In the Northwest of the survey area one can see the structures of a wave field of the sand dunes. The extension of the wave field is about 2 km in length. In this area are about 20 dunes, so on average the dunes are spaced every 100 m.

Fig. 5.3.5 Multibeam data from Northwest of Fehmarn showing water depth, sand dunes in the top left, the colors stand for: red: 6m, orange: 10m, green: 15m, light blue: 20m, deep blue: 25m, dark blue: 30m

5.3.2 Data example Blinkerhügel

(N. Schulze Glanert, A. Schmitz, V. Thamm)

Here the results of bathymetry (figure 5.3.6) and side scan sonar (5.3.7) in the vicinity of the Blinkerhügel are shown. The latter is clearly visible as the eastern elevation represented by red colour. White areas represent missing data due to navigation inaccuracies or shadow casting of the sound beam. Next to the Blinkerhügel another submarine elongated hill is present. The parallel running elevations in the map occur at the overlap of two tracks and are a pure systematic error. The backscatter signal strength of the side scan sonar gives information about the seafloor roughness, where higher values imply higher roughness. It is notable that the areas of higher signal in the plot show a sharp edge. This can happen because of rapid bathymetry changes when the high frequency signal is strongly non-linearly attenuated with depth. The seafloor features of the Blinkerhügel range from rather uniform (south east) sectors to areas with a rich distribution of rocks and smaller objects (north west) where the location of Mangan nodules is supposed.

Fig. 5.3.6 Bathymetry map around the Blinkerhügel. Red colour indicates higher elevation, while green to blue displays lower.

Fig. 5.3.7 Multibeam backscatter strength around the Blinkerhügel. Yellow areas indicate strong backscatter intensity which are usually shallower than their surroundings.

5.4 CTD

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

For the correct processing of the acoustic data refraction effects in the water column needs to be considered. Therefore, it is important to know the acoustic speed in the water column. The sound velocity in the water depends on the temperature, depth and salinity.

It is assumed that the sound velocity changes in the vertical and it can be presented as a sound velocity profile (SVP, Fig. 5.4.1). Vertical sound velocity profiles were taken with an AML MINOS-X system (Fig. 5.4.2) combining conductivity, temperature, depth (CTD) and in situ sound velocity measurements. It can be used for depths up to 1000 m. In general, the probe was used at the beginning of the first MBES profile of an area and at the end of the last profile. So, both measurements can be used to process the data of the respective area. Overall, we conducted 13 sound velocity profiles. The atmospheric pressure was automatically subtracted from the measured pressure. The pressure values are displayed in decibars (dBar) and is equal to the water depth. Afterwards all of these measured values can be used for further processing.

Fig 5.4.1 A line chart of temperature and salinity of the different water layers.

Fig. 5.4.2 CTD probe AML Minos X.

The data example (Fig. 5.4.1 and Fig 5.4.3) is shown in two diagrams. This CTD profile was measured on August 19th at 05:50 pm in Eckernförde Bay after the seismic measurements were completed. Figure 5.4.1 shows salinity and temperature over depth. Both measurement curves are almost constant in the first 7 m, indicating a well-mixed upper layer. The temperature, which starts with a value of around 22 °C, drops in the 7 m area to around 19.5 °C. As the depth progresses, the curve changes in steps. A small but clearly visible change in temperature can be seen at a depth of about 10 m. The temperature rises minimally and drops a few centimeters later to around 19° C and fluctuates by a maximum of 0.3° C for 3 m. A similar step can be seen at a depth of about 12 m. From about 13 m depth the temperature begins to drop more rapidly. From about 17 m the temperature decreases most until it reaches its minimum of about 13.5 °C at 22 m depth.

As already mentioned, the first change in the curve is visible for all values at a depth of 7 m. Up to this depth the salinity of the water has a value of about 14.7 PSU (Practical Salinity Units) and remains relatively constant. In the area of the 7 m the value increases to about 15.5 PSU and rises successively with increasing depth. From a depth of around 20 m, the value increases more strongly until it reaches its maximum of around 20 PSU at a depth of around 22 m.

Figure 5.4.3 shows the different values of the sound velocity (x axis) in meters per second (m/s) of the water layers in relation to the water depth in meters (y axis). The first measured value of the sound velocity profile is 1505.71 m/s. As already recognized in the values of diagram A, also in this diagram the values remain almost constant up to a depth of 7 m. In the area of about 7 m the sound velocity decreases to about 1500 m/s, which is clearly visible in the curve. Up to a depth of around 19 m, the sound velocity drops to around 1490 m/s with a few step-like fluctuations. These steps are mainly visible in the depths of 10 m and about 12 m and are characterized by a slight increase and afterwards by a stronger decrease of the sound velocity. From a depth of 19 m, the sound velocity decreases more strongly and reaches its minimum at 1485.45 m/s at a depth of around 22 m.

Fig 5.4.3 A line chart of the sound velocities of the different water layers (SVP).

5.5 Grab and Rumohrlot

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

To take sediment samples of the seafloor surface, a grab (Fig 5.5.1) and a Rumohr-Lot (Fig. 5.5.2) were used. They were deployed with the winch from the deck into the water. The samples were brought back on deck and examined by hand for different parameters. All grab samples and the Rumohrlot sample are listed with their locations, time and water depth in chapter 7.3. The grab enables the sampling of the surface and the underlying sediments to a depth of about 30 cm. The disadvantage of this method is, that the sediment can get disturbed while taking the sample back on deck, but it can give an overview over the material at the sample location.

Fig 5.5.1 The grab on the deck

To take nearly undisturbed sediment samples of the surface and the first decimeters of the sediment, a Rumohrlot was used (Fig. 5.5.2). This sample method is based on gravity. The Rumohrlot has two weight plates on top of a PVC tube, where the down facing edge is sharpened for a better penetration into the seafloor. When the tube reaches the seafloor, it sinks into the sediment. The lower end of the tube is open while it gets pulled out and transported back on the deck. In case of sediment with a high amount of sand, this open end is a problem because the sediment likely falls out of the tube while it is lifted. Therefore, the Rumohrlot is used to take samples of cohesive material. In this case, the location for the sample was chosen, to examine the transition from a mostly clastic material with a grain size between fine sand and gravel and some larger stones, to an area with layers of Silt and organic rich sediments.

Fig. 5.5.2 Empty Rumohrlot (left) and full (right)

5.5.1 Samples from the Blinkerhügel

(N. Schulze Glanert, A. Schmitz, V. Thamm)

The map shows the stations where sediments were grabbed (Fig. 5.5.3). Start was station AL542_8 and the last one AL542_15. At the first station manganese nodules were found. At the other stations different sediments were seen. Some of them were well sorted and some more inhomogeneous. Also, the grains were different, we saw fine-grained and coarse-grained sediment. In the map, the red areas show sediments with a higher backscatter amplitude, what indicates shallower water, a rougher sea floor or both. Samples taken at stations which appear dark in the map above only contain homogenous silt. The yellow structures were the sides of the swaths of the sonar. The resolution there is lower than the red coloured places between the yellow stripes which are the middle of the swath.

Fig. 5.5.3 Position of grab taken in the Bay of Mecklenburg.

Beside other stones a few manganese nodules were found (Fig 5.5.4). Especially nodules grown in a ring like shape around a mother stone. The older the bigger they are.

Fig. 5.5.4 Latitude: 54°10.987, Longitude: 011°23.972, Station: AL542_8

Fig. 5.5.5 Latitude: 54°11.033, Longitude: 011°24.246, Station: AL542_9

This sediment was fine and poorly sorted (Fig. 5.5.5). Neither stones nor other bigger parts were found in this sample.

5.5.2 Samples from Damp

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

The samples were evaluated by the criteria color, H₂S smell, animals that are living in the sediment like worms, mussels, vegetation, grain size, roundness, sorting. These samples contain important information that can be used for ground truthing and to compare the backscatter from the multibeam data with the actual conditions on the sea floor. The locations where the samples were taken are shown on a map of the region in figure 5.5.15 and figure 5.5.13 shows a closer view to the southern part of the area, to enable a better differentiation between the individual locations. The background shows the backscatter in the area, that was recorded with the NORBIT system.

Fig. 5.5.12 Map of the backscatter in the Damp region with the sample locations.

Fig. 5.5.13 Closer view on the sample locations in the southern Damp area.

ALS42_34_1 (Fig. 5.5.14): The material at the top of the sample is brown, while the material starting at around 2 cm is getting grey. The smell is neutral and no vegetation is present. One worm and some seashell are scattered on the surface and in the sample. The grain size varies between fine and coarse sand and some small gravel so the material is not well sorted. The grains are round and sharp edged as well. The backscatter in the sample area was high, what matches the sand to gravel sized grains at the surface.

Fig. 5.5.14 AL542_34_1.

AL542_34_2 (Fig. 5.5.15): The second grab sample did only contain a small amount of grey sediment grains with a grain size within the fine sand fraction. Additionally, some stones that were covered with the algae *Coccotylus truncatus* on top had been picked up by the grab. Within these algae, animals like mussels, sponges and sea urchins seems to live or sought shelter. The backscatter was low. Regarding the stones in this area, a high backscatter would be anticipated but the vegetation on the stones possibly absorbs some of the signal, so the backscatter gets reduced.

Fig. 5.5.15 AL542_34_2. Stones overgrown by *Coccotylus truncatus*

Rumohrlot: AL542_42 (Fig 5.5.26 and 5.5.27): The sediment column within the rumohrlot tube had a height of 76 cm. From 0 – 10 cm mud with a very high water content forms the upper seafloor. Between 18 and 22 cm laid a small band of dark grey material, that seemed to be very fine grained with many seashells. Starting at 29 cm an area that was colored in a slightly brighter grey. It extended downwards to a depth of 34 cm. It contained no visible shells. Between 34 and 56 cm the material looks like the material between 10 and 29 cm but contained no seashell. At 56 cm down to the end of the core at 76 cm the material looked stiffer and was colored in a brighter grey. The BS at this location was very low. This matches with the muddy, very fine grained

material at the surface of the sample. Apart from the mentioned layer with seashell no other evidences of living or dead animals were visible.

Fig 5.5.26 The Rumohrlot sample in the PVC tube.

Fig 5.5.27 Sketch of the structure of the Rumohrlot sample with layer thickness [cm].

5.6 EK60 Split Beam

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

The EK60 is a fishery echosounder, which is optimized for the water column and not for the sediments below the sea floor. The instrument transmits signals in four channels with frequencies of 38 kHz, 70 kHz, 120 kHz and 200 kHz. These signals are reflected and scattered at boundary surfaces with acoustic impedance (product of density and sound velocity) contrast to the surrounding water. The EK60 is able to provide not only water depth, but also information from acoustic targets in the water column such as fish or density layers. The EK60 was switched off during measurements with the Innomar echosounder, because the EK60 signal disturbs the signal recorded by the Innomar echosounder.

5.7 GoPro Camera

(M. Baumann, M. Hänsch, P. Tabelow, K. Wordtmann)

An underwater camera was used to obtain more precise information about the seafloor, the sediments and possible flora and fauna. A waterproof GoPro Hero 8 action camera were used, which is able to connect to a smartphone via Wi-Fi. To enable this connection underwater, a cable was attached to the camera and the smartphone, which transfer the Wi-Fi signal. In addition, the camera was placed in a waterproof housing to be able to use it at greater depths. It also was attached to a rope, which was additionally weighted down with a metallic weight to prevent buoyancy. Afterwards the images can also be used to evaluate and interpret the measurement data.

Figure 5.7.1 shows an underwater image from the measuring area in front of Damp. Multibeam measurements were previously taken in this area and the resulting data (the backscatter) was used to select a location where additional information about the seabed would be helpful.

Through the video recordings some information about the sea bed could be collected. It is a badly sorted material. Additionally, large stones became visible, which were almost completely covered by vegetation. Also, some marine life, like mussels, starfish and some fish could be discovered. This additional information can be used to evaluate and interpret the measurement data of the multibeam.

Figure 5.7.2 shows an underwater image of the Blinkerhügel in the measuring area of the Mecklenburg Bay. Through the image some large stones became visible. Also, in this area the stones were covered by vegetation and a lot of marine life, like starfish and shells, became visible.

Fig. 5.7.1 An image of the video recordings from the measuring area in Damp.

Fig. 5.7.2 An image of underwater recordings of the Blinkerhügel in Mecklenburg Bay.

6 Ship's Meteorological Station

There was no meteorologist on board during the cruise.

7 Station List AL542

7.1 Overall Station List

Activity - Device Operation	Timestamp	Device	Action	Latitude	Longitude
AL542_1-1	2020-08-14 12:31:44	SES2000	profile start	54° 17,810' N	011° 19,168' E
AL542_1-1	2020-08-14 13:26:17	SES2000	alter course	54° 18,201' N	011° 07,023' E
AL542_1-1	2020-08-14 14:23:39	SES2000	profile end	54° 11,738' N	011° 13,339' E
AL542_2-1	2020-08-14 14:29:02	CTD	in the water	54° 11,703' N	011° 13,564' E
AL542_2-1	2020-08-14 14:31:39	CTD	on deck	54° 11,718' N	011° 13,523' E
AL542_3-1	2020-08-14 16:17:54	Seismic Source	Airgun in water	54° 11,653' N	011° 13,522' E
AL542_3-1	2020-08-15 15:51:44	Seismic Source	Airgun on deck	54° 07,960' N	011° 12,730' E
AL542_3-2	2020-08-14 16:20:37	Seismic Towed Receiver	Streamer in water	54° 11,656' N	011° 13,668' E
AL542_3-2	2020-08-15 15:54:00	Seismic Towed Receiver	Streamer on deck	54° 07,984' N	011° 12,844' E
AL542_3-3	2020-08-14 17:29:02	Seismic Source	profile start	54° 11,317' N	011° 19,242' E
AL542_3-3	2020-08-14 18:31:41	Seismic Source	profile end	54° 08,371' N	011° 23,094' E

AL542_3-3	2020-08-14 18:43:09	Seismic Source	profile start	54° 08,299' N	011° 23,114' E
AL542_3-3	2020-08-14 20:42:18	Seismic Source	profile end	54° 15,718' N	011° 23,595' E
AL542_3-3	2020-08-14 20:44:56	Seismic Source	profile start	54° 15,872' N	011° 23,663' E
AL542_3-3	2020-08-14 22:01:35	Seismic Source	profile end	54° 17,772' N	011° 31,390' E
AL542_3-3	2020-08-14 22:01:59	Seismic Source	profile start	54° 17,747' N	011° 31,400' E
AL542_3-3	2020-08-14 22:49:36	Seismic Source	profile end	54° 14,621' N	011° 32,852' E
AL542_3-3	2020-08-14 22:53:43	Seismic Source	profile start	54° 14,396' N	011° 32,669' E
AL542_3-3	2020-08-15 00:35:11	Seismic Source	profile end	54° 12,185' N	011° 21,692' E
AL542_3-3	2020-08-15 00:35:56	Seismic Source	profile start	54° 12,169' N	011° 21,614' E
AL542_3-3	2020-08-15 01:51:11	Seismic Source	profile end	54° 11,727' N	011° 13,199' E
AL542_3-3	2020-08-15 01:57:51	Seismic Source	profile start	54° 11,857' N	011° 12,637' E
AL542_3-3	2020-08-15 03:18:34	Seismic Source	profile end	54° 16,491' N	011° 08,147' E
AL542_3-3	2020-08-15 03:28:41	Seismic Source	profile start	54° 16,262' N	011° 07,737' E
AL542_3-3	2020-08-15 04:52:42	Seismic Source	profile end	54° 11,451' N	011° 12,519' E
AL542_3-3	2020-08-15 05:00:37	Seismic Source	profile start	54° 11,426' N	011° 11,985' E
AL542_3-3	2020-08-15 06:16:18	Seismic Source	profile end	54° 15,609' N	011° 07,453' E
AL542_3-3	2020-08-15 06:20:36	Seismic Source	profile start	54° 15,392' N	011° 07,367' E
AL542_3-3	2020-08-15 07:35:49	Seismic Source	profile end	54° 11,120' N	011° 11,659' E
AL542_3-3	2020-08-15 07:41:22	Seismic Source	profile start	54° 11,054' N	011° 11,184' E
AL542_3-3	2020-08-15 08:43:38	Seismic Source	profile end	54° 14,748' N	011° 07,643' E
AL542_3-3	2020-08-15 08:52:01	Seismic Source	profile start	54° 14,669' N	011° 07,145' E
AL542_3-3	2020-08-15 10:01:09	Seismic Source	profile end	54° 10,624' N	011° 11,149' E
AL542_3-3	2020-08-15 10:09:30	Seismic Source	profile start	54° 10,568' N	011° 10,680' E
AL542_3-3	2020-08-15 11:08:44	Seismic Source	profile end	54° 13,951' N	011° 07,325' E
AL542_3-3	2020-08-15 11:33:21	Seismic Source	profile start	54° 13,578' N	011° 07,133' E
AL542_3-3	2020-08-15 12:53:01	Seismic Source	profile end	54° 09,004' N	011° 11,974' E

AL542_3-3	2020-08-15 13:06:39	Seismic Source	profile start	54° 08,457' N	011° 11,253' E
AL542_3-3	2020-08-15 14:14:46	Seismic Source	profile end	54° 12,459' N	011° 07,253' E
AL542_3-3	2020-08-15 14:23:10	Seismic Source	profile start	54° 12,696' N	011° 07,510' E
AL542_3-3	2020-08-15 15:44:34	Seismic Source	profile end	54° 07,998' N	011° 12,240' E
AL542_4-1	2020-08-15 17:30:11	CTD	in the water	54° 10,147' N	011° 24,923' E
AL542_4-1	2020-08-15 17:34:01	CTD	on deck	54° 10,145' N	011° 24,927' E
AL542_5-1	2020-08-15 18:17:22	MB	profile start	54° 10,215' N	011° 25,049' E
AL542_5-1	2020-08-16 08:30:25	MB	profile end	54° 11,243' N	011° 24,798' E
AL542_6-1	2020-08-16 08:31:57	Seismic Towed Receiver	Streamer in water	54° 11,293' N	011° 24,762' E
AL542_6-1	2020-08-16 09:25:04	Seismic Towed Receiver	Streamer on deck	54° 14,170' N	011° 23,789' E
AL542_6-1	2020-08-16 11:17:48	Seismic Towed Receiver	Streamer in water	54° 15,808' N	011° 23,175' E
AL542_6-1	2020-08-16 11:33:23	Seismic Towed Receiver	Streamer on deck	54° 16,153' N	011° 24,638' E
AL542_6-1	2020-08-16 12:10:26	Seismic Towed Receiver	Streamer in water	54° 15,757' N	011° 23,387' E
AL542_6-1	2020-08-17 11:15:33	Seismic Towed Receiver	Streamer on deck	54° 15,828' N	011° 24,296' E
AL542_7-1	2020-08-16 08:36:31	Seismic Source	Airgun in water	54° 11,436' N	011° 24,681' E
AL542_7-1	2020-08-16 12:16:58	Seismic Source	profile start	54° 15,889' N	011° 23,742' E
AL542_7-1	2020-08-16 13:24:10	Seismic Source	profile end	54° 17,605' N	011° 30,219' E
AL542_7-1	2020-08-16 13:37:24	Seismic Source	profile start	54° 17,659' N	011° 30,080' E
AL542_7-1	2020-08-16 14:39:06	Seismic Source	profile end	54° 15,841' N	011° 23,542' E
AL542_7-1	2020-08-16 14:42:54	Seismic Source	Airgun on deck	54° 15,757' N	011° 23,195' E
AL542_7-1	2020-08-16 15:10:31	Seismic Source	Airgun in water	54° 15,803' N	011° 23,330' E
AL542_7-1	2020-08-16 15:14:50	Seismic Source	profile start	54° 15,881' N	011° 23,627' E
AL542_7-1	2020-08-16 16:15:02	Seismic Source	profile end	54° 17,554' N	011° 29,978' E
AL542_7-1	2020-08-16 16:24:10	Seismic Source	Airgun on deck	54° 17,671' N	011° 30,533' E
AL542_7-1	2020-08-16 16:44:26	Seismic	Airgun in	54° 17,893' N	011° 30,819' E

		Source	water		
AL542_7-1	2020-08-16 16:52:07	Seismic Source	profile start	54° 17,617' N	011° 30,190' E
AL542_7-1	2020-08-16 16:57:03	Seismic Source	profile end	54° 17,464' N	011° 29,646' E
AL542_7-1	2020-08-16 17:01:59	Seismic Source	profile start	54° 17,327' N	011° 29,128' E
AL542_7-1	2020-08-16 17:48:40	Seismic Source	profile end	54° 15,994' N	011° 24,050' E
AL542_7-1	2020-08-16 17:49:29	Seismic Source	profile start	54° 15,969' N	011° 23,955' E
AL542_7-1	2020-08-16 20:37:25	Seismic Source	profile end	54° 21,508' N	011° 13,465' E
AL542_7-1	2020-08-16 20:49:28	Seismic Source	profile start	54° 21,452' N	011° 12,501' E
AL542_7-1	2020-08-16 21:16:32	Seismic Source	profile end	54° 19,676' N	011° 13,236' E
AL542_7-1	2020-08-16 21:21:25	Seismic Source	profile start	54° 19,402' N	011° 13,053' E
AL542_7-1	2020-08-16 22:05:03	Seismic Source	profile end	54° 18,827' N	011° 08,107' E
AL542_7-1	2020-08-16 22:05:24	Seismic Source	profile start	54° 18,814' N	011° 08,081' E
AL542_7-1	2020-08-16 22:23:23	Seismic Source	profile end	54° 17,687' N	011° 08,471' E
AL542_7-1	2020-08-16 22:42:19	Seismic Source	profile start	54° 17,660' N	011° 10,028' E
AL542_7-1	2020-08-16 23:26:01	Seismic Source	profile end	54° 20,465' N	011° 08,706' E
AL542_7-1	2020-08-16 23:37:59	Seismic Source	profile start	54° 20,404' N	011° 07,986' E
AL542_7-1	2020-08-17 00:20:26	Seismic Source	profile end	54° 17,639' N	011° 09,163' E
AL542_7-1	2020-08-17 00:44:40	Seismic Source	profile start	54° 17,567' N	011° 11,544' E
AL542_7-1	2020-08-17 01:30:00	Seismic Source	profile end	54° 20,496' N	011° 10,147' E
AL542_7-1	2020-08-17 01:39:16	Seismic Source	profile start	54° 20,286' N	011° 09,570' E
AL542_7-1	2020-08-17 02:19:52	Seismic Source	profile end	54° 17,616' N	011° 10,633' E
AL542_7-1	2020-08-17 02:44:09	Seismic Source	profile start	54° 17,579' N	011° 12,958' E
AL542_7-1	2020-08-17 03:35:15	Seismic Source	profile end	54° 20,934' N	011° 11,447' E
AL542_7-1	2020-08-17 03:46:01	Seismic Source	profile start	54° 20,785' N	011° 10,726' E
AL542_7-1	2020-08-17 04:35:05	Seismic Source	profile end	54° 17,544' N	011° 12,199' E
AL542_7-1	2020-08-17 04:52:34	Seismic Source	profile start	54° 17,373' N	011° 13,647' E
AL542_7-1	2020-08-17 06:01:40	Seismic	profile end	54° 21,872' N	011° 11,556' E

		Source			
AL542_7-1	2020-08-17 06:12:11	Seismic Source	profile start	54° 21,700' N	011° 11,067' E
AL542_7-1	2020-08-17 06:44:50	Seismic Source	profile end	54° 19,617' N	011° 11,795' E
AL542_7-1	2020-08-17 06:45:05	Seismic Source	profile start	54° 19,601' N	011° 11,802' E
AL542_7-1	2020-08-17 07:52:23	Seismic Source	profile end	54° 17,271' N	011° 18,207' E
AL542_7-1	2020-08-17 07:56:52	Seismic Source	Airgun on deck	54° 17,169' N	011° 18,495' E
AL542_7-1	2020-08-17 08:22:54	Seismic Source	Airgun in water	54° 16,712' N	011° 19,867' E
AL542_7-1	2020-08-17 08:26:54	Seismic Source	profile start	54° 16,635' N	011° 20,124' E
AL542_7-1	2020-08-17 10:02:37	Seismic Source	profile end	54° 17,569' N	011° 30,086' E
AL542_7-1	2020-08-17 10:15:17	Seismic Source	profile start	54° 17,542' N	011° 29,915' E
AL542_7-1	2020-08-17 11:06:27	Seismic Source	profile end	54° 16,161' N	011° 24,640' E
AL542_7-1	2020-08-17 11:11:46	Seismic Source	Airgun on deck	54° 15,928' N	011° 24,395' E
AL542_7-1	2020-08-17 11:15:56	Seismic Source	Streamer on deck	54° 15,820' N	011° 24,287' E
AL542_8-1	2020-08-17 12:14:04	Grab	in the water	54° 10,986' N	011° 23,974' E
AL542_8-1	2020-08-17 12:15:56	Grab	on deck	54° 10,982' N	011° 23,982' E
AL542_8-2	2020-08-17 12:24:41	Grab	in the water	54° 10,963' N	011° 24,001' E
AL542_8-2	2020-08-17 12:26:37	Grab	on deck	54° 10,962' N	011° 24,008' E
AL542_8-3	2020-08-17 12:29:20	Grab	in the water	54° 10,969' N	011° 24,016' E
AL542_8-3	2020-08-17 12:35:36	Grab	on deck	54° 10,966' N	011° 24,007' E
AL542_9-1	2020-08-17 12:43:30	Grab	in the water	54° 11,032' N	011° 24,246' E
AL542_9-1	2020-08-17 12:45:38	Grab	on deck	54° 11,036' N	011° 24,251' E
AL542_10-1	2020-08-17 13:08:29	Grab	in the water	54° 10,788' N	011° 24,740' E
AL542_10-1	2020-08-17 13:11:00	Grab	on deck	54° 10,782' N	011° 24,748' E
AL542_11-1	2020-08-17 13:26:26	Grab	in the water	54° 10,603' N	011° 23,744' E
AL542_11-1	2020-08-17 13:28:56	Grab	on deck	54° 10,609' N	011° 23,738' E
AL542_11-2	2020-08-17 13:31:45	Grab	in the water	54° 10,603' N	011° 23,732' E
AL542_11-2	2020-08-17 13:33:45	Grab	on deck	54° 10,598' N	011° 23,737' E
AL542_12-1	2020-08-17 13:42:46	Grab	in the water	54° 10,736' N	011° 23,901' E
AL542_12-1	2020-08-17 13:44:49	Grab	on deck	54° 10,732' N	011° 23,905' E
AL542_13-1	2020-08-17 13:56:04	Grab	in the water	54° 10,736' N	011° 23,339' E
AL542_13-1	2020-08-17 13:58:05	Grab	on deck	54° 10,736' N	011° 23,351' E
AL542_14-1	2020-08-17 14:23:04	Grab	in the water	54° 10,900' N	011° 23,841' E
AL542_14-1	2020-08-17 14:25:03	Grab	on deck	54° 10,902' N	011° 23,834' E
AL542_15-1	2020-08-17 14:55:04	Grab	in the water	54° 10,497' N	011° 21,935' E
AL542_15-1	2020-08-17 14:56:43	Grab	on deck	54° 10,500' N	011° 21,937' E
AL542_15-2	2020-08-17 14:58:29	Grab	in the water	54° 10,503' N	011° 21,930' E
AL542_15-2	2020-08-17 15:00:10	Grab	on deck	54° 10,505' N	011° 21,921' E

AL542_16-1	2020-08-17 15:22:31	SES2000	profile start	54° 10,543' N	011° 22,422' E
AL542_16-1	2020-08-17 17:11:32	SES2000	profile end	54° 10,948' N	011° 22,867' E
AL542_16-1	2020-08-17 17:28:33	SES2000	profile start	54° 12,051' N	011° 22,177' E
AL542_16-1	2020-08-17 20:53:09	SES2000	profile end	54° 12,482' N	011° 21,809' E
AL542_16-2	2020-08-17 16:44:20	CTD	in the water	54° 11,290' N	011° 24,750' E
AL542_16-2	2020-08-17 16:46:23	CTD	on deck	54° 11,297' N	011° 24,744' E
AL542_17-1	2020-08-18 10:10:28	CTD	in the water	54° 30,058' N	010° 01,137' E
AL542_17-1	2020-08-18 10:15:17	CTD	on deck	54° 30,059' N	010° 01,194' E
AL542_18-1	2020-08-18 10:35:41	MB	profile start	54° 29,703' N	010° 00,463' E
AL542_18-1	2020-08-18 10:59:22	MB	profile end	54° 29,697' N	010° 02,620' E
AL542_18-1	2020-08-18 11:05:18	MB	profile start	54° 29,775' N	010° 02,693' E
AL542_18-1	2020-08-18 11:30:19	MB	profile end	54° 29,774' N	010° 00,521' E
AL542_18-1	2020-08-18 11:36:36	MB	profile start	54° 29,842' N	010° 00,538' E
AL542_18-1	2020-08-18 12:01:03	MB	profile end	54° 29,837' N	010° 02,625' E
AL542_18-1	2020-08-18 12:09:53	MB	profile start	54° 29,993' N	010° 02,604' E
AL542_18-1	2020-08-18 12:35:31	MB	profile end	54° 29,991' N	010° 00,417' E
AL542_18-1	2020-08-18 12:41:22	MB	profile start	54° 29,919' N	010° 00,524' E
AL542_18-1	2020-08-18 13:03:52	MB	profile end	54° 29,915' N	010° 02,638' E
AL542_18-1	2020-08-18 13:12:59	MB	profile start	54° 30,066' N	010° 02,580' E
AL542_18-1	2020-08-18 13:37:59	MB	profile end	54° 30,065' N	010° 00,420' E
AL542_18-1	2020-08-18 13:42:51	MB	profile start	54° 30,143' N	010° 00,455' E
AL542_18-1	2020-08-18 14:06:41	MB	profile end	54° 30,134' N	010° 02,660' E
AL542_19-1	2020-08-18 14:13:01	CTD	in the water	54° 30,065' N	010° 02,867' E
AL542_19-1	2020-08-18 14:17:31	CTD	on deck	54° 30,049' N	010° 02,888' E
AL542_20-1	2020-08-18 14:24:32	MB	profile start	54° 30,128' N	010° 02,614' E
AL542_20-1	2020-08-18 14:50:19	MB	profile end	54° 30,137' N	010° 00,423' E
AL542_20-1	2020-08-18 14:55:49	MB	profile start	54° 30,051' N	010° 00,495' E
AL542_20-1	2020-08-18 15:20:57	MB	profile end	54° 30,056' N	010° 02,617' E
AL542_20-1	2020-08-18 15:26:13	MB	profile start	54° 29,988' N	010° 02,638' E
AL542_20-1	2020-08-18 18:00:57	MB	profile end	54° 29,731' N	010° 02,240' E
AL542_21-1	2020-08-18 21:04:54	MB	in the water	54° 34,873' N	010° 57,763' E
AL542_21-1	2020-08-18 21:25:01	MB	profile start	54° 34,955' N	010° 58,741' E
AL542_21-1	2020-08-18 22:54:56	MB	profile end	54° 33,090' N	011° 08,360' E
AL542_21-1	2020-08-18 23:07:38	MB	profile start	54° 33,145' N	011° 08,276' E
AL542_21-1	2020-08-19 00:20:28	MB	profile end	54° 33,684' N	011° 04,668' E
AL542_21-1	2020-08-19 00:24:01	MB	profile start	54° 33,632' N	011° 04,968' E
AL542_21-1	2020-08-19 00:55:22	MB	profile end	54° 33,180' N	011° 08,270' E
AL542_21-1	2020-08-19 00:58:21	MB	profile start	54° 33,162' N	011° 08,488' E
AL542_21-1	2020-08-19 01:36:28	MB	profile end	54° 33,700' N	011° 04,655' E
AL542_21-1	2020-08-19 01:42:04	MB	profile start	54° 33,735' N	011° 04,614' E
AL542_21-1	2020-08-19 02:03:06	MB	profile end	54° 33,343' N	011° 06,924' E
AL542_21-1	2020-08-19 02:07:40	MB	profile start	54° 33,369' N	011° 07,084' E
AL542_21-1	2020-08-19 02:33:34	MB	profile end	54° 33,746' N	011° 04,689' E
AL542_21-1	2020-08-19 02:38:21	MB	profile start	54° 33,800' N	011° 04,547' E
AL542_21-1	2020-08-19 03:15:41	MB	profile end	54° 33,235' N	011° 08,328' E
AL542_21-1	2020-08-19 03:21:12	MB	profile start	54° 33,228' N	011° 08,544' E
AL542_21-1	2020-08-19 03:58:41	MB	profile end	54° 33,812' N	011° 04,635' E

AL542_21-1	2020-08-19 04:09:22	MB	profile end	54° 33,800' N	011° 04,422' E
AL542_21-1	2020-08-19 04:25:43	MB	profile start	54° 33,816' N	011° 04,571' E
AL542_21-1	2020-08-19 05:17:46	MB	profile end	54° 33,863' N	011° 04,364' E
AL542_21-2	2020-08-18 21:12:24	CTD	in the water	54° 34,951' N	010° 58,411' E
AL542_21-2	2020-08-18 21:14:31	CTD	on deck	54° 34,954' N	010° 58,420' E
AL542_21-3	2020-08-19 05:30:17	MB	profile start	54° 33,764' N	011° 05,346' E
AL542_21-3	2020-08-19 05:59:40	MB	profile end	54° 33,272' N	011° 08,598' E
AL542_21-3	2020-08-19 06:06:20	MB	profile start	54° 33,314' N	011° 08,799' E
AL542_21-3	2020-08-19 06:50:04	MB	profile end	54° 33,904' N	011° 04,506' E
AL542_21-3	2020-08-19 06:57:53	MB	profile start	54° 33,872' N	011° 04,917' E
AL542_21-3	2020-08-19 07:17:31	MB	profile end	54° 33,484' N	011° 07,049' E
AL542_21-3	2020-08-19 07:20:44	MB	profile start	54° 33,528' N	011° 07,126' E
AL542_21-3	2020-08-19 07:47:23	MB	profile end	54° 34,116' N	011° 04,634' E
AL542_21-3	2020-08-19 07:53:51	MB	profile start	54° 34,054' N	011° 04,746' E
AL542_21-3	2020-08-19 08:15:02	MB	profile end	54° 33,549' N	011° 06,934' E
AL542_22-1	2020-08-19 08:19:31	CTD	in the water	54° 33,592' N	011° 07,057' E
AL542_22-1	2020-08-19 08:23:44	CTD	on deck	54° 33,586' N	011° 07,058' E
AL542_23-1	2020-08-19 12:06:33	Seismic Towed Receiver	Streamer in water	54° 29,873' N	010° 06,168' E
AL542_23-1	2020-08-19 17:09:01	Seismic Towed Receiver	Streamer on deck	54° 31,378' N	010° 02,352' E
AL542_24-1	2020-08-19 12:09:54	Seismic Source	Airgun in water	54° 29,872' N	010° 05,955' E
AL542_24-1	2020-08-19 12:15:56	Seismic Source	profile start	54° 29,841' N	010° 05,524' E
AL542_24-1	2020-08-19 13:14:01	Seismic Source	profile end	54° 29,864' N	009° 58,917' E
AL542_24-1	2020-08-19 13:54:17	Seismic Source	profile start	54° 29,410' N	010° 01,749' E
AL542_24-1	2020-08-19 14:19:09	Seismic Source	profile end	54° 31,084' N	010° 01,764' E
AL542_24-1	2020-08-19 14:21:52	Seismic Source	Airgun on deck	54° 31,252' N	010° 01,696' E
AL542_24-1	2020-08-19 14:54:04	Seismic Source	Airgun in water	54° 30,768' N	010° 04,189' E
AL542_24-1	2020-08-19 15:12:58	Seismic Source	profile start	54° 29,840' N	010° 03,693' E
AL542_24-1	2020-08-19 15:52:35	Seismic Source	profile end	54° 29,866' N	009° 59,087' E
AL542_24-1	2020-08-19 16:32:23	Seismic Source	profile start	54° 29,376' N	010° 01,790' E
AL542_24-1	2020-08-19 16:56:50	Seismic Source	profile end	54° 31,059' N	010° 01,757' E
AL542_24-1	2020-08-19 17:04:56	Seismic Source	Airgun on deck	54° 31,312' N	010° 02,151' E
AL542_25-1	2020-08-19 17:49:21	CTD	in the water	54° 29,095' N	010° 00,487' E
AL542_25-1	2020-08-19 17:52:01	CTD	on deck	54° 29,101' N	010° 00,493' E
AL542_26-1	2020-08-19 18:06:01	MB	profile start	54° 28,639' N	010° 00,439' E

AL542_26-1	2020-08-19 20:28:42	MB	profile end	54° 29,158' N	010° 01,463' E
AL542_27-1	2020-08-19 20:30:58	CTD	in the water	54° 29,205' N	010° 01,500' E
AL542_27-1	2020-08-19 20:32:53	CTD	on deck	54° 29,212' N	010° 01,493' E
AL542_28-1	2020-08-19 20:52:31	MB	profile start	54° 29,742' N	010° 00,353' E
AL542_28-1	2020-08-19 23:53:21	MB	profile end	54° 30,104' N	010° 00,438' E
AL542_28-2	2020-08-19 21:50:43	CTD	in the water	54° 29,891' N	010° 01,399' E
AL542_28-2	2020-08-19 21:53:35	CTD	on deck	54° 29,904' N	010° 01,407' E
AL542_29-1	2020-08-20 00:50:38	CTD	in the water	54° 33,240' N	010° 03,209' E
AL542_29-1	2020-08-20 00:53:44	CTD	on deck	54° 33,253' N	010° 03,210' E
AL542_30-2	2020-08-20 04:36:11	CTD	in the water	54° 35,194' N	010° 03,173' E
AL542_30-2	2020-08-20 04:37:34	CTD	on deck	54° 35,210' N	010° 03,171' E
AL542_30-1	2020-08-20 07:00:02	MB	profile end	54° 35,248' N	010° 03,347' E
AL542_30-1	2020-08-20 08:18:31	MB	profile end	54° 33,686' N	010° 03,207' E
AL542_31-1	2020-08-20 08:25:09	CTD	in the water	54° 33,650' N	010° 03,098' E
AL542_31-1	2020-08-20 08:26:43	CTD	on deck	54° 33,654' N	010° 03,104' E
AL542_32-1	2020-08-20 08:46:05	CTD	in the water	54° 33,732' N	010° 03,263' E
AL542_32-1	2020-08-20 09:23:53	CTD	on deck	54° 33,603' N	010° 03,154' E
AL542_33-1	2020-08-20 10:27:05	CTD	in the water	54° 33,324' N	010° 03,320' E
AL542_33-1	2020-08-20 11:02:43	CTD	on deck	54° 33,301' N	010° 03,286' E
AL542_34-1	2020-08-20 11:06:23	Grab	in the water	54° 33,302' N	010° 03,326' E
AL542_34-1	2020-08-20 11:10:00	Grab	on deck	54° 33,325' N	010° 03,384' E
AL542_34-1	2020-08-20 11:20:55	Grab	in the water	54° 33,336' N	010° 03,311' E
AL542_34-1	2020-08-20 11:22:30	Grab	on deck	54° 33,334' N	010° 03,338' E
AL542_34-1	2020-08-20 11:31:29	Grab	in the water	54° 33,335' N	010° 03,270' E
AL542_34-1	2020-08-20 11:33:37	Grab	on deck	54° 33,338' N	010° 03,252' E
AL542_34-1	2020-08-20 11:45:58	Grab	on deck	54° 33,332' N	010° 03,268' E
AL542_35-1	2020-08-20 11:42:26	Grab	in the water	54° 33,335' N	010° 03,262' E
AL542_35-1	2020-08-20 11:46:54	Grab	on deck	54° 33,332' N	010° 03,292' E
AL542_36-1	2020-08-20 12:22:46	Grab	in the water	54° 34,750' N	010° 03,257' E
AL542_36-1	2020-08-20 12:24:27	Grab	on deck	54° 34,755' N	010° 03,256' E
AL542_36-2	2020-08-20 12:25:22	Grab	in the water	54° 34,756' N	010° 03,259' E
AL542_36-2	2020-08-20 12:27:28	Grab	on deck	54° 34,755' N	010° 03,269' E
AL542_37-1	2020-08-20 12:47:52	Grab	in the water	54° 34,340' N	010° 03,145' E
AL542_37-1	2020-08-20 12:49:15	Grab	on deck	54° 34,341' N	010° 03,137' E
AL542_38-1	2020-08-20 13:25:55	Grab	in the water	54° 34,265' N	010° 03,251' E
AL542_38-1	2020-08-20 13:27:08	Grab	on deck	54° 34,259' N	010° 03,252' E
AL542_39-1	2020-08-20 14:02:12	Grab	in the water	54° 33,698' N	010° 03,169' E
AL542_39-1	2020-08-20 14:03:40	Grab	on deck	54° 33,696' N	010° 03,165' E
AL542_39-2	2020-08-20 14:04:11	Grab	in the water	54° 33,696' N	010° 03,163' E
AL542_39-2	2020-08-20 14:05:08	Grab	on deck	54° 33,694' N	010° 03,160' E
AL542_39-3	2020-08-20 14:13:09	Grab	in the water	54° 33,677' N	010° 03,183' E
AL542_39-3	2020-08-20 14:13:21	Grab	on deck	54° 33,676' N	010° 03,183' E
AL542_40-1	2020-08-20 14:33:32	Grab	in the water	54° 33,529' N	010° 05,259' E
AL542_40-1	2020-08-20 14:35:24	Grab	on deck	54° 33,528' N	010° 05,265' E
AL542_41-1	2020-08-20 14:45:37	Grab	in the water	54° 33,305' N	010° 05,851' E
AL542_41-1	2020-08-20 14:47:40	Grab	on deck	54° 33,301' N	010° 05,850' E
AL542_42-1	2020-08-20 14:57:32	Rumohr-Lot	in the water	54° 33,170' N	010° 06,245' E

AL542_42-1	2020-08-20 14:59:54	Rumohr-Lot	on deck	54° 33,165' N	010° 06,253' E
AL542_42-2	2020-08-20 15:16:04	CTD	in the water	54° 33,124' N	010° 06,261' E
AL542_42-2	2020-08-20 15:19:56	CTD	on deck	54° 33,133' N	010° 06,289' E
AL542_43-1	2020-08-20 15:59:09	MB	profile start	54° 34,868' N	010° 10,375' E
AL542_43-1	2020-08-20 17:22:54	MB	profile end	54° 34,786' N	010° 10,455' E
AL542_43-2	2020-08-20 16:39:42	CTD	in the water	54° 34,806' N	010° 10,635' E
AL542_43-2	2020-08-20 16:42:57	CTD	on deck	54° 34,804' N	010° 10,621' E
AL542_43-3	2020-08-20 17:27:05	SES2000	profile start	54° 34,824' N	010° 10,377' E
AL542_43-3	2020-08-20 18:36:17	SES2000	profile end	54° 34,829' N	010° 10,613' E
AL542_44-1	2020-08-20 19:18:31	SES2000	profile start	54° 34,512' N	010° 15,296' E
AL542_44-1	2020-08-21 00:36:45	SES2000	profile end	54° 27,958' N	009° 51,524' E
AL542_44-1	2020-08-21 00:36:57	SES2000	profile start	54° 27,959' N	009° 51,510' E
AL542_44-1	2020-08-21 03:39:52	SES2000	profile end	54° 31,489' N	010° 04,600' E

7.2 Profile Station List

Profil-Nr.	Date	Time Start	Time End	Latitude Start	Longitude Start	Latitude End	Longitude End	Geometrics	Geometrics
								FFN Start	FFN End
AL542		UTC	UTC	xx° xx.x'	xx° xx.x'	xx° xx.x'	xx° xx.x'	FFN Start	FFN End
P101	14.08.2020	17:03	17:25	54°11.540	011°16.741	54°11.381	011°19.087	1344	1866
P102	14.08.2020	17:25	18:37	54°11.381	011°19.087	54°08.08	011°23.24	1866	2790
P103	14.08.2020	18:37	20:43	54°08.08	011°23.24	54°15.955	011°23.62	2790	4730
P104	14.08.2020	20:43	22:01	54°15.955	011°23.62	54°17.72	011°31.41	4730	5837
P105	14.08.2020	22:01	22:49	54°17.72	011°31.41	54°14.59	011°32.86	5837	6560
P106	14.08.2020	22:49	0:36	54°14.59	011°32.86	54°12.15	011°21.51	6560	8160
P107	15.08.2020	0:36	1:52	54°12.15	011°21.51	54°11.71	011°13.00	8160	9318
P108	15.08.2020	1:52	3:20	54°11.71	011°13.00	54°16.57	011°08.04	9318	10618
P109	15.08.2020	3:28	4:50	54°16.19	011°07.78	54°11.560	011°12.41	10761	11978
P110	15.08.2020	5:00	6:13	54°11.43	011°11.97	54°15.62	011°07.69	12127	13211
P111	15.08.2020	6:21	7:33	54°15.37	011°07.42	54°11.26	011°11.67	13225	14299
P112	15.08.2020	7:41	8:40	54°11.07	011°11.16	54°14.67	011°07.70	14300	15174
P113	15.08.2020	8:50	10:01	54°15.63	011°07.18	54°10.58	011°11.19	15199	16211
P114	15.08.2020	10:01	11:08	54°10.58	011°11.19	54°13.94	011°07.28	16211	17124
P115	15.08.2020	11:34	12:57	54°13.52	011°07.21	54°08.70	011°11.94	17125	18313
P116	15.08.2020	12:57	14:14	54°08.70	011°11.94	54°12.51	011°07.19	18314	19457
P117	15.08.2020	14:22	15:44	54°12.69	011°07.52	54°07.97	011°12.27	19578	20816
P201	16.08.2020	12:16	13:23	54°15.88	011°23.75	54°17.61	011°30.25	21012	21709
P202	16.08.2020	13:36	14:39	54°17.65	011°30.05	54°15.80	011°23.38	21710	22658
P203	16.08.2020	15:13	16:15	54°15.87	011°23.59	54°17.58	011°30.09	22659	23183
P204	16.08.2020	16:51	17:49	54°17.65	011°30.27	54°15.96	011°23.86	23190	24379
P205	16.08.2020	17:49	18:57	54°15.96	011°23.86	54°15.03	011°16.15	24379	25761
P206	16.08.2020	19:01	20:37	54°15.19	011°15.75	54°21.56	011°13.44	25762	27194
P207	16.08.2020	20:48	21:16	54°21.45	011°12.50	54°19.62	011°13.26	27195	27612
P208	16.08.2020	21:21	22:04	54°19.38	011°12.90	54°18.82	011°08.09	27613	28234
P209	16.08.2020	22:08	22:24	54°18.63	011°08.09	54°17.62	011°08.50	28235	28465
P210	16.08.2020	22:41	23:26	54°17.59	011°10.07	54°20.43	011°08.67	28466	29153
P211	16.08.2020	23:37	0:21	54°20.45	011°07.97	54°17.49	011°09.26	29154	29821
P212	17.08.2020	0:40	1:30	54°17.54	011°11.55	54°20.55	011°10.11	29822	30495
P213	17.08.2020	1:39	2:20	54°20.22	011°09.57	54°17.57	011°10.65	30496	31113
P214	17.08.2020	2:22	2:39	54°17.44	011°10.95	54°17.38	011°12.87	31147	31403

P215	17.08.2020	3:00	3:33	54°17.54	011°12.97	54°20.88	011°11.47	31406	32164
P216	17.08.2020	3:45	4:35	54°20.84	011°10.71	54°17.50	011°12.21	32168	32912
P217	17.08.2020	4:52	6:00	54°17.36	011°13.64	54°21.87	011°11.55	32912	33930
P218	17.08.2020	6:10	6:45	54°21.72	011°11.06	54°19.41	011°11.83	33931	34454
P219	17.08.2020	6:49	7:50	54°19.40	011°12.12	54°17.32	011°18.10	34512	35433
P220	17.08.2020	8:56	10:02	54°15.99	011°23.27	54°17.56	011°30.08	35517	36285
P221	17.08.2020	10:13	11:05	54°17.06	011°30.06	54°16.13	011°24.57	36286	36854
P301	19.08.2020	12:33	13:14	54°29.82	010°03.47	54°29.86	009°58.81	37000	37642
P302	19.08.2020	13:14	13:55	54°29.86	009°58.81	54°29.52	010°01.77	37642	38266
P303	19.08.2020	13:55	14:18	54°29.52	010°01.77	54°31.08	010°01.76	38266	38615
P304	19.08.2020	15:17	15:47	54°29.82	010°03.06	54°29.86	009°59.60	38616	38795
P305	19.08.2020	16:30	16:56	54°29.24	010°01.75	54°31.06	010°01.76	38796	38954

7.3 Sample Station List

Sample number	Longitude	Latitude	Time [UTC]	Depth [m]
AL542_8	011°23.972	54° 10.987	12:13	19.3
AL542_9	011°24.246	54° 11.033	12:43	21.6
AL542_10	011°24.740	54° 10.788	13:08	21.8
AL542_11	011°23.451	54° 10.605	13:27	21.6
AL542_12	011°23.901	54° 10.736	13:42	21.7
AL542_13	011°23.340	54° 10.735	13:56	22.1
AL542_14	011°23.840	54° 10.900	14:23	21.6
AL542_15	011°21.934	54° 10.497	14:50	19.3
AL542_34_1	010°03.335	54° 33.304	11:16	13.5
AL542_34_2	010°03.314	54° 33.336	11:21	12.8
AL542_34_3	010°03.268	54° 33.336	11:31	12.3
AL542_34_4	010°03.260	54° 33.335	11:42	12.3
AL542_35	010°03.274	54° 33.331	11:46	12.5
AL542_36_1	010°03.253	54° 34.751	12:23	10.6
AL542_36_2	010°03.266	54° 34.754	12:26	10.5
AL542_37	010°03.143	54° 34.342	12:48	11.1
AL542_38	010°03.250	54° 34.263	13:26	11.7
AL542_39_1	010°03.166	54° 33.697	14:02	11.1
AL542_39_2	010°03.159	54° 33.693	14:05	11.1
AL542_39_3	010°03.186	54° 33.677	14:12	11.2
AL542_40	010°05.894	54° 33.528	14:34	23.9
AL542_41	010°05.851	54° 33.303	14:46	28.1
AL542_42	010°06.250	54°33.170	14:58	25.7

8 Data and Sample Storage and Availability

All data and samples collected during the cruise will be stored and archived at Kiel University. Contact person is Sebastian Krastel (Sebastian.krastel@ifg.uni-kiel.de).

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11 Appendices

11.1 Selected Pictures of Samples

Fig. 11.1.1 Latitude: 54°10.788, Longitude: 011°24.740, Station: AL542_10

Fig. 11.1.2 Latitude: 54°10.605, Longitude: 011°23.451, Station: AL542_11

Fig. 11.1.3 Latitude: 54°10.736, Longitude: 011°23.901, Station: AL542_12

Fig. 11.1.4 Latitude: 54°10.735, Longitude: 011°23.340, Station: AL542_13

Fig. 11.1.5 Latitude: 54°10.900, Longitude: 011°23.840, Station: AL542_14

Fig. 11.1.6 Latitude: 54°10.497, Longitude: 011°21.934, Station: AL542_15

AL542_34_3 (Fig 11.1.7): The material is brown-grey and does not smell like H₂S. The grain size varies from fine sand to coarse sand and the sorting is medium. No vegetation, animals or seashell were present. The roundness of the grains varies from nearly round to sharp edged. The backscatter was high and correlates to the material in the grab.

Fig 11.1.7 AL542_34_3

AL542_34_4: This sample contained only one stone without any vegetation or animals.
 AL542_35 (Fig 11.1.8): The sediment surface was light brown and after 2 cm the material color changed into a light grey. The sediment consisted of fine to medium sand and was well sorted. No vegetation was found within the sample but one living red worm was visible. The location was in a high backscatter area, what corresponds to the found surface material.

Fig 11.1.8 AL542_35

AL542_36_1 (Fig 11.1.9): The backscatter in the sample area was high, but the grab contained only sea stars and algae, so the sediment on the seafloor couldn't be examined. Regarding the backscatter it was probably at least fine sand or coarser. The grab could be landed with the edges on some stones, so that it closed above the seafloor. The algae could be one of some which are scattered around the area or a small path with vegetation, that is too small to be seen clearly in the backscatter with the used resolution.

Fig 11.1.9 AL542_36_1

AL542_36_2: The grab was completely empty at this location. The region was characterized by high and low backscatter. The fact, that the sample was empty, could be caused by stones on the ground that prevented the grab from closing with sediment inside.

AL542_37 (Fig 11.1.10): The material on the surface was brown and grey and the grain size varied from medium sand to stones, while the material was bad sorted. Some mussels and seashell were distributed within the sample. The high backscatter matches the found material at the surface.

Fig 11.1.10 AL542_37

AL542_38 (Fig 11.1.11): The top of the sample was covered with brown material with grain sizes between medium sand and gravel. After roughly 2 cm stiff fine material filled the grab. In this layer seashell and mussels occurred. The grain size of this material was within the silt fraction. In this region, clay lenses occur so it was not clear, whether it was a layer of clay or just a clay lens.

Fig 11.1.11 AL542_38

AL542_39_1 (Fig 11.1.12): This sample position was located just at the border of high and low backscatter, so it is not exactly clear, in which of these the sample has been taken. The grab only lifted up one boulder with a small amount of algae on top, so it would correlate to the high backscatter. Or it could be one of a few stones in the low backscatter area.

Fig 11.1.12 AL542_39_1

AL542_39_2 (Fig 11.1.13): The Top of the sample surface is brown. Beginning at a depth of about 1 mm the sediment turned grey. The grain size varies from medium sand to gravel. The grains are slightly rounded and the sediment is badly sorted. Some seashell was dispersed within the sediment volume. The sample location was between high and low backscatter. Considering the sample surface this sample would produce a high backscatter.

Fig 11.1.13 AL542_39_2

AL542_39_3 (Fig 11.1.14): The third sample at this location consisted of only one boulder (diameter around 25 cm). On top of the boulder were some algae with a sea urchin. Although a boulder usually would cause a high backscatter, this sample is from an area with low backscatter. The algae on the top of the stones could absorb some amount of the signal so the backscatter gets lower.

Fig 11.1.14 AL542_39_3

AL542_40 (Fig 11.1.15): The sediment on top of the sample was soft and black. The black color results from a high amount of rotten organic matter. It had a strong smell of H₂S. Within the sample the material was grey and very fine and cohesive. It could have been a clay lens. The backscatter at this location was very low, what matches the found surface material.

Fig 11.1.15 AL542_40

AL542_41 (Fig 11.1.16): The material on the top of the sample was very soft. Its color was black, what was caused by a high amount of rotten organic matter. Like the previous sample it had a strong H₂S smell. The dark color reached further down into the seafloor and started to turn into grey. The material at the bottom was cohesive and could belong to a clay lens like they can appear in this region. The low backscatter at this location corresponds to the taken sample.

Fig 11.1.16 AL542_41

11.2 Seismic Acquisition Protocol

Time	Latitude	Longitude	Course	Heading	Speed O.G.	Depth	Source	Shot interval	Leakage	FFN	Injector Delay	Gun-Pressure	Remarks
UTC	xx° xx.xxx'	xx° xx.xxx'	[°]	[°]	[kn]	[m]		[s]			[ms]	[bar]	
Friday, 14.08.2020													
S100													
17:03	54°11.540	011°16.741	96	91	3.0	21	MicroG	3	2	8	1344	25	140 SOL P101
17:20	54°11.450	011°18.294	97	93	3.0	21	MicroG	4	2	9	1704	25	Changed shotinterval to 4 sec
17:25	54°11.381	011°19.087	116	110	3.1	22	MicroG	4	2	10	1866	25	140 EOL P101, SOL P102
17:39	54°11.068	011°19.664	137	128	3.4	22	MicroG	4	2	10	1988	25	140 Streamerlänge geändert wegen Befestigung
17:47	54°10.503	011°20.410	143	133	3.5	23	MicroG	4	2	10	2159	25	140 Shut down air gun to calibrate
	54°10.057	011°20.982	144	135	3.5	23	MicroG	4	2	10	2175	25	140 Reenable air gun
18:09	54°09.434	011°21.787	143	138	3.6	24	MicroG	4	2	11	2378	25	140 Serial string not detected, interrupted navigation for some minutes
18:37	54°08.08	011°23.24	345	256	3.4	22	MicroG	4	2	11	2790	25	140 EOL P102, SOL P103, Nav input changed
18:56	54°09.149	011°23.205	3	3	3.7	28	MicroG	4	2	11	3079	25	140
19:16	54°10.276	011°23.270	3	7	3.4	23	MicroG	4	2	11	3363	25	140
19:36	54°11.549	011°23.351	358	5	3.8	23	MicroG	4	2	11	3683	25	140
19:55	54°12.76	011°23.43	2	5	3.8	22	MicroG	4	2	11	3985	25	140
20:15	54°13.99	011°23.51	2	3	4.0	22	MicroG	4	2	11	4257	25	140
20:38	54°15.46	011°23.57	3	7	3.9	22	MicroG	4	2	11	4606	25	140
20:43	54°15.955	011°23.62	62	64	3.8	22	MicroG	4	2	11	4730	25	140 EOL P103, SOL P104
21:05	54°16.44	011°25.71	67	71	3.8	22	MicroG	4	2	11	5009	25	140
21:26	54°16.98	011°27.81	65	65	4.0	23	MicroG	4	2	11	5318	25	130
21:46	54°17.53	011°29.95	66	63	4.0	29	MicroG	4	2	11	5713	25	140
22:01	54°17.72	011°31.41	172	164	4.4	29	MicroG	4	2	11	5837	25	140 EOL P104, SOL P105
22:26	54°16.09	011°32.16	165	161	4.1	24	MicroG	4	2	11	6227	25	140
22:49	54°14.59	011°32.86	170	188	4.0	30	MicroG	4	2	11	6560	25	140 EOL P105, SOL P106
23:11	54°13.94	011°30.50	250	246	4.1	24	MicroG	4	2	11	6911	25	140
23:30	54°13.56	011°28.56	253	245	3.8	23	MicroG	4	2	11	7183	25	140
23:50	54°13.13	011°26.43	249	244	4.0	22	MicroG	4	2	11	7479	25	140
Saturday, 15.08.2020													
0:10	54°12.65	11°24.21	250	254	4.0	22	MicroG	4	2	11	7792	25	140
0:31	54°12.27	011°22.07	249	248	4.0	22	MicroG	4	2	11	8094	25	140
0:36	54°12.15	011°21.51	253	251	4.0	22	MicroG	4	2	11	8160	25	140 EOL P106, SOL P107
1:01	54°12.00	011°18.79	264	261	3.9	21	MicroG	4	2	11	8545	25	130
1:20	54°11.89	011°16.71	266	265	3.9	21	MicroG	4	2	11	8829	25	130
1:40	54°11.77	011°14.199	266	266	4.1	21	MicroG	4	2	11	9156	25	130
1:52	54°11.71	011°13.00	276	294	3.4	20	MicroG	4	2	11	9318	25	130 EOL P107, SOL P108
2:10	54°12.499	011°12.009	329	330	4.6	17	MicroG	4	2	11	9573	25	130
2:30	54°13.737	011°10.829	332	339	3.9	14	MicroG	4	2	11	9883	25	130
2:50	54°14.874	011°09.726	331	330	4.0	13	MicroG	4	2	11	10183	25	140
3:10	54°16.05	011°08.56	329	331	4.0	11	MicroG	4	2	11	10483	25	140
3:20	54°16.57	011°08.04	328	329	3.5	11	MicroG	4	2	11	10618	25	140 EOL P108,
3:28	54°16.19	011°07.78	154	150	5.0	13	MicroG	4	2	11	10761	25	140 SOL P109
3:48	54°15.06	011°08.89	151	149	4.0	25	MicroG	4	2	11	11044	25	140
4:10	54°13.78	011°10.17	149	147	3.9	13	MicroG	4	2	11	11381	25	130
4:32	54°12.59	011°11.37	147	143	3.8	15	MicroG	4	2	11	11711	25	140
4:50	54°11.560	011°12.41	148	142	4.0	20	MicroG	4	2	11	11978	25	130 EOL P109
5:00	54°11.43	011°11.97	334	339	3.7	20	MicroG	4	2	11	12127	25	140 SOL P110

5:20	54°12.64	011°10.81	329	327	3.9	16	MicroGI	4	2	11.0	12435	25	130	
5:40	54°13.66	011°09.77	329	326	3.9	12	MicroGI	4	2	12.0	12707	25	140	
6:00	54°14.98	011°08.44	329	327	4.1	15	MicroGI	4	2	12.0	13056	25	130	
6:13	54°15.62	011°07.69	286	280	3.7	13	MicroGI	4	2	12.0	13211	25	0	EOL P110, Ausschalten der Kanone während des Drehens zum neuen Profil
6:21	54°15.37	011°07.42	144	141	3.6	10	MicroGI	4	2	12.0	13225	25	140	SOL P111
6:40	54°14.23	011°08.66	149	149	4.0	10	MicroGI	4	2	12.0	13530	25	150	
7:05	54°12.57	011°10.33	150	148	4.0	15	MicroGI	4	2	12.0	13960	25	150	
7:23	54°11.77	011°11.14	149	145	4.0	18	MicroGI	4	2	12.0	14170	25	150	
7:33	54°11.26	011°11.67	155	169	4.0	20	MicroGI	4	2	12.0	14299	25	0	EOL P111 Kurve, Airgun aus
7:41	54°11.07	011°11.16	338	338	4.0	20	MicroGI	4	2	12.0	14300	25	150	SOL P112 Neues Profil
8:06	54°12.60	011°09.78	339	327	4.1	14	MicroGI	4	2	11.0	14639	25	140	
8:20	54°13.49	011°08.90	330	327	4.0	11	MicroGI	4	2	11.0	14869	25	140	
8:40	54°14.67	011°07.70	330	329	4.1	15	MicroGI	4	2	11.0	15174	25	0	EOL P112 Kurve, Airgun aus
8:50	54°15.63	011°07.18	156	154	4.4	15	MicroGI	4	2	11.0	15199	25	140	SOL P113 Neues Profil
9:00	54°14.06	011°07.71	149	148	4.1	16	MicroGI	4	2	11.0	15339	25	140	
9:20	54°12.92	011°08.83	149	147	4.0	12	MicroGI	4	2	11.0	15620	25	140	
9:40	54°11.74	011°10.02	150	147	4.0	16	MicroGI	4	2	11.0	15931	25	130	
10:01	54°10.58	011°11.19	149	147	4.1	20	MicroGI	4	2	11.0	16211	25		EOL P113, SOL P114, Kurve Airgun aus
10:24	54°11.49	011°09.74	332	331	3.9	16	MicroGI	4	2	11.0	16474	25	140	
10:41	54°12.46	011°08.77	330	329	4.0	13	MicroGI	4	2	11.0	16746	25	140	
11:00	54°13.47	011°07.74	333	332	3.9	15	MicroGI	4	2	11.0	17013	25	140	
11:08	54°13.94	011°07.28	343	351	3.8	13	MicroGI	4	2	11.0	17124	25	140	EOL P114, Kurve Airgun aus
11:34	54°13.52	011°07.21	144	141	4.1	12	MicroGI	4	2	11.0	17125	25	140	SOL P115
11:55	54°12.31	011°08.49	148	144	4.0	15	MicroGI	4	2	11.0	17465	25	140	
12:20	54°10.92	011°09.88	148	143	4.0	19	MicroGI	4	2	11.0	17816	25	140	
12:40	54°09.75	011°11.08	144	137	3.8	21	MicroGI	4	2	11.0	18120	25	140	
12:57	54°08.70	011°11.94	216	213	4.2	22	MicroGI	4	2	11.0	18313	25	140	EOL P115, SOL P116
13:25	54°09.56	011°10.114	328	332	4.1	21	MicroGI	4	2	11.0	18739	25	140	
13:42	54°10.64	011°09.09	330	333	4.1	19	MicroGI	4	2	11.0	19010	25	140	
14:00	54°11.74	011°08.00	329	331	3.9	16	MicroGI	4	2	11.0	19283	25	140	
14:14	54°12.45	011°07.24	330	335	4.0	12	MicroGI	4	2	11.0	19457	25	140	EOL P116, SOL P117
14:34	54°12.02	011°08.23	149	144	4.0	15	MicroGI	4	2	11.0	19782	25	140	
14:50	54°11.08	011°09.17	150	144	4.0	16	MicroGI	4	2	11.0	20028	25	140	
14:52	54°09.86	011°10.40	148	141	4.2	21	MicroGI	4	2	11.0	20347	25	140	
15:20	54°09.43	011°10.83	150	142	4.0	21	MicroGI	4	2	11.0	20455	25	140	
15:44	54°07.97	011°12.27	144	133	4.0	23	MicroGI	4	2	11.0	20816	25	140	EOL P117, EOS100, Material an Deck
Sunday, 16.08.2020														
S200														
12:16	54°15.88	011°23.75	59	60	3.0	21	MiniGI/R	7	2	4.0	21012	25	140	SOL P201, Mini GI 025 l in True GI Mode
12:20	54°15.97	011°24.03	64	64	3.5	21	MiniGI/R	6	2	5.0	21024	25	140	
12:22	54°16.04	011°24.29	64	63	3.7	21	MiniGI/R	5	2	5.0	21054	25	140	
12:40	54°16.51	011°26.01	678	71	3.7	22	MiniGI/R	5	2	9.0	21279	25	140	
12:44								7			21314			Shooting rate changed to 6 s
13:00	54°17.02	011°27.99	65	69	3.7	24	MiniGI/R	7	2	11.0	21491	25	140	
13:23	54°17.61	011°30.25	68	70	3.9	24	MiniGI/R	7	2	11.0	21709	25	140	EOL P201
13:36	54°17.65	011°30.05	235	225	4.2	23	MiniGI/R	4	2	11.0	21710	25	100	SOL P202; Mini GI 0.25l, True GI, low pressure
13:56	54°17.02	011°27.96	246	238	4.2	23	MiniGI/R	4	2	12.0	22019	25	100	
14:18	54°16.39	011°25.52	245	234	4.0	22	MiniGI/R	4	2	12.0	22373	25	100	
14:39	54°15.80	011°23.38	245	243	3.5	22	MiniGI/R	4	2	12.0	22658			EOL P202; Kanone aus, retracted MiniGI
15:13	54°15.87	011°23.59	66	67	3.4	22	GI Gun	9	2	12.0	22659	0	110	SOL P203, GI Gun mit Reducer 0.7l, only Generator

15:16	54°15.94	011°23.85	65	66	4.0	22	GI Gun	8	2	12.0	22680	0	110	Shooting rate changed to 8 s
15:19	54°16.03	011°24.19	64	66	4.1	22	GI Gun	7	2	12.0	22703	0	110	Shooting rate changed to 7 s
15:43	54°16.70	011°26.78	65	68	4.2	22	GI Gun	7	2	12.0	22920	0	120	
16:00	54°17.20	011°28.68	67	70	4.1	23	GI Gun	7	2	12.0	23061	0	130	
16:15	54°17.58	011°30.09	65	68	3.8	24	GI Gun	7	2	12.0	23183	0	130	EOL P203
16:51	54°17.65	011°30.27	238	228	4.3	24	MicroGI	3	2	12.0	23190	20	80	SOL P204, Micro GI 80 bar
17:10	54°17.09	011°28.20	246	236	4.2	23	MicroGI	3	2	12.0	23603	20	80	
17:32	54°16.46	011°25.82	247	237	4.0	22	MicroGI	3	2	12	24045	20	80	
17:49	54°15.96	011°23.86	250	240	4.3	22	MicroGI	3	2	12	24379	20	140	EOL P204, SOL P205, Micro GI Normal
18:07	54°15.65	011°21.82	260	255	4.0	21	MicroGI	3	2	12	24767	20	120	
18:27	54°15.40	011°19.48	261	254	4.0	21	MicroGI	3	2	12	25171	20	120	
18:50	54°15.12	011°16.89	257	251	4.0	21	MicroGI	3	2	12	25623	20	110	
18:57	54°15.03	011°16.15	260	260	4.1	21	MicroGI	3	2	12	25761	20		EOL P205
19:01	54°15.19	011°15.75	352	353	4.3	21	MicroGI	4	2	12	25762	20	120	SOL P206
19:21	54°16.46	011°15.29	347	349	4.0	16	MicroGI	4	2	12	26060	20	140	
19:40	54°17.73	011°14.82	349	355	4.0	15	MicroGI	4	2	12	26347	20	140	
20:01	54°19.11	011°14.32	348	353	4.3	19	MicroGI	4	2	12	26559	20	140	
20:28	54°20.98	011°13.65	346	347	4.2	16	MicroGI	4	2	12	27076	20	140	
20:37	54°21.56	011°13.44	345	339	4.0	15	MicroGI	4	2	12	27194	20		EOL P206
20:48	54°21.45	011°12.50	172	165	4.2	14	MicroGI	4	2	12	27195	20	140	SOL P207
21:06	54°20.31	011°12.94	166	160	4.0	17	MicroGI	4	2	12	27467	20	140	
21:16	54°19.62	011°13.26	169	166	4.2	18	MicroGI	4	2	12	27612	20	140	EOL P207
21:21	54°19.38	011°12.90	255	248	4.3	18	MicroGI	4	2	12	27613	20	140	SOL P208
21:41	54°19.11	011°10.70	259	253	4.0	15	MicroGI	4	2	13	27915	20	140	
22:00	54°18.89	011°08.57	260	255	4.0	12	MicroGI	4	2	13	28200	20	140	
22:04	54°18.82	011°08.09	230	246	3.8	13	MicroGI	4	2	13	28234	20	140	EOL P208
22:08	54°18.63	011°08.09	163	158	3.9	12	MicroGI	4	2	13	28235	20	140	SOL P209
22:24	54°17.62	011°08.50	158	146	3.8	12	MicroGI	4	2	13	28465	20	140	EOL P209
22:41	54°17.59	011°10.07	345	337	4.3	11	MicroGI	4	2	13	28466	20	140	SOL P210
23:03	54°19.08	011°09.29	345	344	4.0	13	MicroGI	4	2	12	28824	20	140	
23:24	54°20.37	011°08.74	345	344	4.0	10	MicroGI	4	2	13	29127	20	140	
23:26	54°20.53	011°08.67	345	344	4.0	10	MicroGI	4	2	13	29153	20	140	EOL P210
23:37	54°20.45	011°07.97	177	164	3.8	11	MicroGI	4	2	13	29154	20	140	SOL P211
Monday, 17.08.2020														
0:01	54°18.86	011°08.63	167	163	4.0	11	MicroGI	4	2	13	29533	20	140	
0:21	54°17.49	011°09.26	139	127	3.6	10	MicroGI	4	2	13	29821	20	140	EOL P211
0:40	54°17.54	011°11.55	341	344	4.4	12	MicroGI	4	2	13	29822	20	140	SOL P212
1:00	54°18.63	011°10.97	344	344	4.2	15	MicroGI	4	2	12	30073	20	140	
1:20	54°19.86	011°10.41	345	345	4.0	14	MicroGI	4	2	12	30559	20	140	
1:30	54°20.55	011°10.11	333	324	3.8	11	MicroGI	4	2	12	30495	20	140	EOL P212
1:39	54°20.22	011°09.57	177	175	4.3	13	MicroGI	4	2	12	30496	20	140	SOL P213

2:00	54°18.91	011°10.06	164	161	3.9	14	MicroGI	4	2	12	30812	20	140	
2:20	54°17.57	011°10.65	164	157	4.1	11	MicroGI	4	2	12	31113	20	130	EOL P213
2:20	54°17.44	011°10.95	97	92	3.9	11	MicroGI	4	2	12	31147	20	130	SOL P214
2:39	54°17.38	011°12.87	61	51	3.8	12	MicroGI	4	2	12	31403	20	130	EOL P214
2:43	54°17.54	011°12.97	344	339	3.8	13	MicroGI	4	2	12	31406	20	130	SOL P215
3:00	54°18.70	011°12.42	344	344	4.0	17	MicroGI	4	2	12	31670	20	140	
3:20	54°19.99	011°11.87	346	347	4.2	17	MicroGI	4	2	12	31964	20	130	
3:33	54°20.88	011°11.47	345	354	4.0	11	MicroGI	4	2	12	32164	20	130	EOL P215
3:45	54°20.84	011°10.71	173	165	4.0	11	MicroGI	4	2	12	32168	20	130	SOL P216
4:05	54°19.56	011°11.26	165	162	4.1	14	MicroGI	4	2	12	32457	20	140	
4:25	54°18.30	011°11.84	166	160	4.2	15	MicroGI	4	2	12	32739	20	140	
4:35	54°17.50	011°12.21	166	158	4.1	11	MicroGI	4	2	12	32912	20	140	EOL 216
4:52	54°17.36	011°13.64	348	343	4.4	12	MicroGI	4	2	12	32912	20	140	SOL 217
5:12	54°18.65	011°13.03	345	346	4.1	18	MicroGI	4	2	12	33197	20	140	
5:30	54°19.95	011°12.43	345	346	3.9	17	MicroGI	4	2	12	33497	20	140	
5:48	54°21.01	011°11.95	344	345	4.0	13	MicroGI	4	2	12	33743	20	140	
6:00	54°21.87	011°11.55	344	345	4.0	12	MicroGI	4	2	12	33930	20		EOL P217
6:10	54°21.72	011°11.06	182	175	3.7	12	MicroGI	4	2	12	33931	20	140	SOL P218
6:33	54°20.27	011°11.55	167	161	3.9	15	MicroGI	4	2	12	34284	20	140	
6:45	54°19.41	011°11.83	153	142	3.6	16	MicroGI	4	2	12	34454	20	140	EOL P218
6:49	54°19.40	011°12.12	121	116	3.8	17	MicroGI	4	2	12	34512	20	140	SOL P219
7:09	54°18.69	011°14.16	119	117	4.1	19	MicroGI	4	2	12	34820	20	140	
7:29	54°18.06	011°16.04	121	123	4.0	20	MicroGI	4	2	12	35107	20	140	
7:50	54°17.32	011°18.10	122	122	4.0	21	MicroGI	4	2	12	35433	20	140	EOL P219
7:53	54°17.22	011°18.33	121	120							35438			15 ohne Geode
8:29	54°16.552	011°20.40	118	119	4.1	21	MniGI	6	2	12	35471	0	140	Start of recording
8:56	54°15.99	011°23.27	100	100	3.8	21	MniGI	6	2	12	35517	0	140	SOL P220, Mini GI 0.5 l, only generator
9:00	54°15.95	011°23.68	99	94	3.8	21	MniGI	5	2	12	35560	0	140	
9:20	54°16.43	011°25.78	67	70	4.0	22	MniGI	5	2	12	35800	0	140	Viele GPS Aussetzer, evtl. falsche Zeiten in der Aufnahme
9:39	54°16.95	011°27.75	66	67	4.0	23	MniGI	5	2	12	36025	0	140	
10:02	54°17.56	011°30.08	72	72	4.1	23	MniGI	5	2	12	36285	0	140	EOL P220
10:13	54°17.06	011°30.06	232	230	4.5	23	MniGI	5	2	12	36286	25	100	SOL P221
10:37	54°16.91	011°27.53	246	241	4.1	14	MniGI	6	2	13	36565	25	80	shotinterval changed to 6s
10:57	54°16.36	011°25.34	247	238	3.5	21	MniGI	6	2	13	36793	25	80	
11:05	54°16.137	011°24.57	230	209	3.9	22	MniGI	6	2	13	36854	25	80	EOL P221, SOS 200
Wednesday 19.08.2020														
S300														
12:33	54°29.820	010°03.47	270	267	4.0	23	MicroGI	4	2	23	37000	20	140	SOL P301
13:03	54°29.841	010°00.51	273	271	4.0	25	MicroGI	4	2	20	37513	20	140	
13:14	54°29.86	009°58.81	268	260	4.0	26	MicroGI	4	2	19	37642	20	140	EOL P301, SOL P302
13:35	54°29.17	009°59.96	105	101	4.0	24	MicroGI	4	2	19	37957	20	140	
13:55	54°29.52	010°01.77	3	9	4.1	23	MicroGI	4	2	19	38266	20	140	EOL P302, SOL P303
14:18	54°31.081	010°01.765	359	3	4.0	28	MicroGI	4	2	18	38615	20	140	EOL P303, MicroGI wurde rausgenommen
15:17	54°29.82	010°03.06	269	265	4.1	23	GI	8	2	18	38616	30	120	SOL P304, deployed GI Gun 0.7 l True GI mode
15:19	54°29.82	010°02.84	269	264	4.1	24	GI	9	2	18	38627	30	120	changed shotinterval to 9s
15:22	54°29.82	010°02.55	269	269	4.0	23	GI	10	2	18	38640	30	120	changed shotinterval to 10s
15:43	54°29.84	010°00.11	274	271	4.1	25	GI	10	2	18	38785	30	100	
15:47	54°29.86	009°59.60	272	269	4.3	26	GI	10	2	18	38795	30	100	EOL P304
16:30	54°29.24	010°01.75	17	17	4.4	23	GI	10	2	18	38796	30	120	SOL P305
16:50	54°30.575	010°01.77	359	2	4.2	25	GI	10	2	18	38917	30	120	
16:56	54°31.06	010°01.76	359	0	4.2	28	GI	10	2	18	38954	30	120	EOL P305 EOS 300