

ALKOR - Berichte

***CAU Kiel Institute of Geosciences:
Measuring Techniques in Shallow Water***

Cruise No. AL574

02.06.2022 – 13.06.2022

Kiel (Germany) – Kiel (Germany)

MScMarineMeasure



**Christian Winter, Marius Becker, Knut Krämer,
Participants of the Master Course MSc Marine Geosciences**

Prof. C. Winter, Coastal Geology and Sedimentology,
Institute of Geosciences
University, Kiel, Germany

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1 Cruise Summary

1.1 Summary

Cruise AL574 was a teaching course for students of the MSc Marine Geosciences and BSc Geowissenschaften at Christian-Albrechts-Universität Kiel. Students had hands-on experience on standard marine geoscientific research procedures on the expeditions from Kiel to the Kiel and Mecklenburg Bay, Western Baltic Sea.

The research program focussed on water column measurements and sedimentological observations of the seafloor and subseafloor structures. Work areas were located North and East of Fehmarn Island, in Mecklenburg Bay, and Kiel Bay. CTD profiles (plus density, oxygen) were taken. ADCP measurements (velocities) were carried out at different cross-sections. Different areas were mapped with multibeam echosounder (MBES) and sediment echosounder (SES). Grab samples and gravity cores were taken and described.

1.2 Zusammenfassung

Die Expedition AL574 war eine Lehrveranstaltung für Studenten des MSc Marine Geowissenschaften und des BSc Geowissenschaften der Christian-Albrechts-Universität zu Kiel. Auf den Fahrten von Kiel in die Kieler und Mecklenburger Bucht in der westlichen Ostsee konnten die Studenten praktische Erfahrungen mit Standardverfahren der geowissenschaftlichen Meeresforschung sammeln.

Auf dem Forschungsprogramm standen Wassersäulenmessungen und sedimentologische Beprobungen des Meeresbodens und des Untergrundes. Die Arbeitsgebiete befanden sich nördlich und östlich der Insel Fehmarn, in der Mecklenburger Bucht und der Kieler Bucht. Es wurden CTD-Profile (Dichte, Sauerstoff) aufgenommen. ADCP-Messungen (Geschwindigkeiten) wurden in verschiedenen Querprofilen durchgeführt. Verschiedene Bereiche wurden mit Fächerecholot und Sedimentecholot kartiert. Es wurden Oberflächenproben und Schwerelotkerne entnommen und beschrieben.

2 Participants

2.1 Principle Investigator

Name	Discipline	Institution
Prof. Dr. Winter, Christian.	Geosciences	CAU

2.2 Scientific Party

Name	Discipline	Institution
Dr. Becker, Marius	Lecturer, Geosciences	CAU
Dr. Krämer, Knut	Lecturer, Geosciences	CAU
Arenas, Carlos	Geosciences	CAU
Brown, Audrey	Geosciences	CAU
Enge, Anna	Geosciences	CAU
Felgendreher, Meret	Geosciences	CAU
Hartmann, Jacqueline	Geosciences	CAU
Moharana, Ardhendu	Geosciences	CAU
Oelkers, Lisa	Geosciences	CAU
Schneider, Jakob	Geosciences	CAU
Swain, Rakesh	Geosciences	CAU
Malliakas, Till	Geosciences	CAU
Vahrenkamp, Sarima	Geosciences	CAU
von Stebut, Laura	Geosciences	CAU
Waßmund, Leon	Geosciences	CAU
Prof. Dr. Winter, Christian	Lecturer, Geosciences	CAU

2.3 Participating Institutions

CAU Christian-Albrechts-Universität zu Kiel

3 Research Program

AL574 was a teaching course expedition for students of the MSc Marine Geosciences and BSc Geowissenschaften at Christian-Albrechts-Universität Kiel. The cruise was carried out in two legs, each 5 days, for MSc students and a day trip in between for BSc students.

3.1 Description of the Work Area

The cruise visited different working areas. All areas are located in the Western Baltic Sea. They are indicated in Fig. 3.1. In detail the following areas were visited:

- **Fehmarn North Dune field:** A well-known location for the study of the morphology and sedimentology of subaquatic compound dunes was revisited and mapped with multibeam echosounder (MBES) and sediment echosounder (SES). Grab samples for sedimentary analyses were taken along two bedforms.
- **Fehmarn Belt East bedforms:** For a continued study of small sea floor structures MBES and SES mapping was carried out, grab samples were taken, and one sediment core was taken by gravity coring.
- **Fehmarn Belt transects:** N-S transects (German waters only) across the Fehmarn Belt were sailed to measure stratification of the water column and possibly an exchange flow situation into and out of the Baltic Sea. ADCP velocities and CTD density profiles were derived.
- **Mecklenburg Bay transect:** To measure the stratification of the water column an ADCP velocity transect and CTD profiles were carried out across the Mecklenburg Bay.
- **Paleochannel Dana river and Øjet channel:** Areas were mapped by MBES to visualise meandering paleo river valleys in the Fehmarn West area.
- **Sagas Bank West** MBES and SES, gravity cores

3.2 Aims of the cruise

The aims of the cruise were to teach marine geoscientific methodology and operations (derive data and video images); to test procedures and the combination of different hydroacoustic instrumentation, and to derive data on the hydrodynamics and sedimentology of different sites in the Western Baltic Sea.

Investigations were based on different techniques. The following methodology was used:

- A multibeam echosounder (Norbit WBMS STX) was installed in the moonpool of the ship
- A 600 kHz RDI ADCP was installed in the moonpool of the ship
- A handheld Sea&Sun CTD 48M was used for water column temperature and conductivity measurements, also to calculate sound speed profiles for the correction of MBES data.
- For bed surface sampling a Van Veen sediment grab and a Shipek sediment sampler were used. These were combined with RTK positioning.

- A gravity corer was used, both with plastic foil liner for quick analysis and photography (for teaching) and with regular plastic liners, which were cut into 1 m sections and stored in D-tubes on board.
- An RTK GNSS system was installed on the A-frame above the wire for precise location of grab samples
- An underwater video camera was used to collect profiles for ground truthing

3.3 Agenda of the cruise

AL574 was a field exercise cruise in the framework of the Marine Geosciences Master course of Kiel University. The title of the course is "Shallow water measuring techniques" and it aims at teaching standard marine geoscientific methodology to student groups in short expeditions. Three lecturers and six students were on the first 5 day leg from Tuesday June 2nd to 6th. We visited different areas in the Western Baltic Sea for observations of the seafloor with multibeam and parametric echo sounder (SES), we deployed a camera system, measured water column properties with the ship CTD and water velocities with ADCP. Several grab samples and gravity cores were taken and analysed immediately (Fig. 3.2).

June 7th then was a day-trip with eleven students (BSc Geowissenschaften) to Kiel Bay. After a general briefing on the area and measuring devices, and ship security we approached a transect at Stoller Grund and showed how to use CTD, MBES, SES, and a Van Veen grab for sediment sampling.

The second leg of AL547 started on Wednesday, June 8th. Eight students (MSc Marine Geosciences and MSc Angewandte Geowissenschaften) boarded FS Alkor. The activities of the first leg were repeated for the second group of Master students (Fig 4.3).

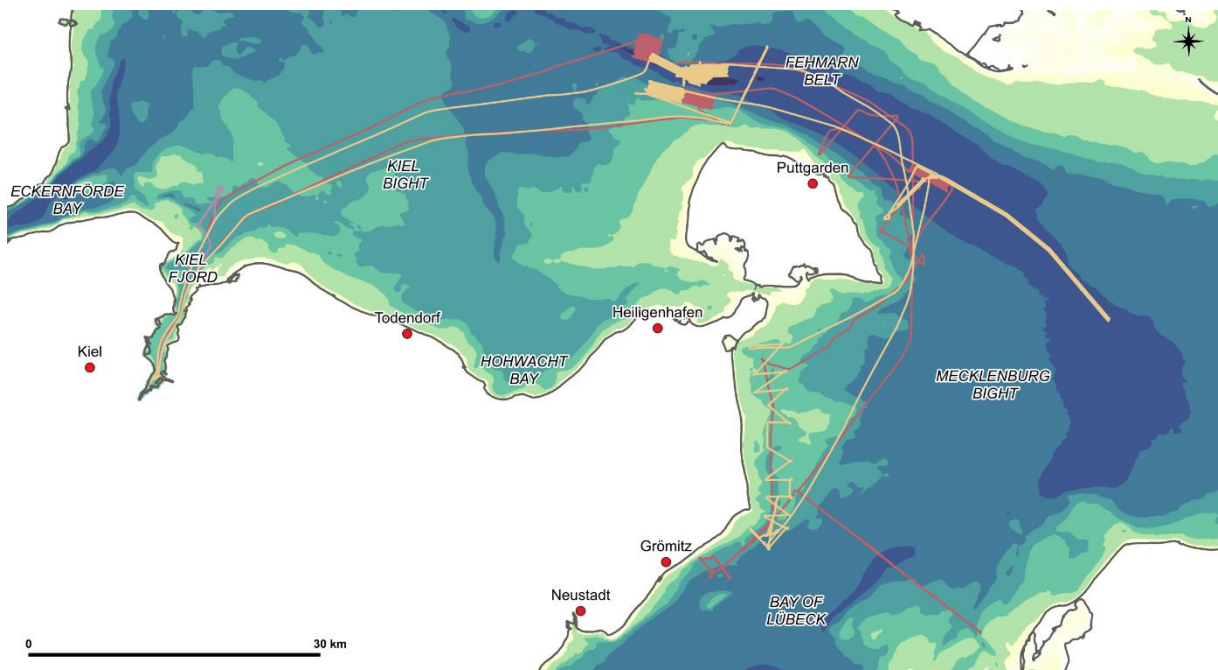
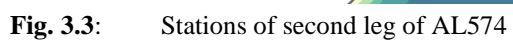
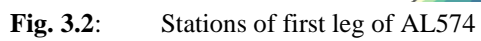


Fig. 3.1: Track chart of AL574. Legs are given in different colors: Leg 1 - red, Leg 2 – yellow, and day trip purple.



4 Narrative of the cruise

After set-up on the previous day, we left Kiel Westuferkai on Thursday 2.6.2022. Boarding at 8.00 was quick and the ship departed shortly after towards a S-N transect offshore the Western coast of Fehmarn. The transit time was spent with welcoming the students, setting up cabins, labs, and gear, safety instructions, a general introduction to the aims and contents of the course, and initial lectures on measuring devices.

The first activity was a S-N transect across the German part of the Fehmarn Belt. Water column physical properties were measured by 600 kHz ADCP in the moonpool (AL574_2-1, in the following only the station number is given) and later 11 CTD stations on the way back (3-13). CTD stations were operated by the students for training also on board communication. An interesting flow and transport situation was observed with a distinct surface water mass flowing towards the east, and a westward directed bottom water layer. Device operations, flow structure and the respective boundary conditions and drivers of that situation were discussed in the debriefing in the evening. After a short transit the night was dedicated to the mapping by MBES and SES (14) of the well-known Fehmarn dune field. This area features large bifurcating (dendritic) asymmetric dunes. Students were working in shifts, monitoring the operation of the devices.

In the morning of Friday 3.6.2022 the data was processed and the resulting map formed the basis for a joint discussion on bedform evolution and sedimentary properties. After a lecture and briefing, a sampling scheme for the day was developed and 18 sample positions were defined. An additional SES transect (16) for a profile showing the evolution of bedforms was mapped. Then 19 RTK positioned Van Veen grabs (17-35) allowed precise sampling of different locations along and across bedform patterns (trough, stoss side, lee side, crest). The samples were described in terms of sedimentology and discussed on the basis of the earlier measured bathymetric map. In the bedform field two video transects were recorded to further explore the seafloor sedimentology and habitats (36, 37). Visibility was good, some sea floor fauna (mainly in the troughs) and flora could be observed. The difference of bedform trough lag deposits and well sorted crests could be confirmed by the videos.

The ship then passed by the construction site of Fehmarn link, the Fehmarn Belt tunnel project. One excavator on a barge was active. After two more ADCP transects east and west of the site across the Fehmarn Belt, we continued with the mapping (39) of another kind of bedform field further east until after midnight. Numerous distinct seafloor features ('lunate bedforms') have a characteristic crescentic shape of about 30 m cross-sectional length, 100 m width and about one meter height.

After a discussion of last day's results, Saturday June 4 started with an overview lecture on Baltic Sea geology, and a briefing on the day's activities. Two box cores (another, preliminary box corer was taken at a wrong position was sampled, but not further analysed). The two boxes (trough 43, crest 44) were prepared, described, and analysed. Small amounts of samples (2 cm intervals) were taken for further analysis in the lab. Another ADCP / CTD transect (45, 46) across the Mecklenburg Bay provided insight in the local flow structure east and west of the Fehmarn tunnel building site. On the way to Mecklenburg Bay two video profiles showed different seafloor environments (dumping site 47, hard substrate 48) and respective habitats. Limited visibility

hindered in depth analysis of the videos. The day was discussed in an evening discussion and debriefing session.

Sunday June 5th started with a short lecture on gravity coring. A short parametric echo sounder transect (49) shore normal of the coast of Western Mecklenburg Bay revealed an interesting channel fill. The data was processed on the spot and three positions were defined for gravity coring. Three cores were taken (two additional tries 50, 51) resulted in very limited recovery and were abandoned). Two of them (52, 54; foil liners) were immediately opened, cut into halves, and analysed by the students. Another 4.77 m core (53) was taken in plastic liner, cut in 1 m pieces, and boxed in D-tubes for subsequent analysis in the lab. These cores show an interesting succession of sedimentary layers connected to the drainage and flooding events in the Baltic Sea postglacial development. The findings were discussed and compiled in a lecture on Baltic Sea geology. Another ADCP (55) / CTD (56-71) transect was measured across the Mecklenburg Bay (MB) for discussion of MB hydrodynamics. After a transit back to Fehmarn Belt again we mapped an area west of Øjet (72). This area features an ancient meandering channel and the river banks of which nowadays are in a water depth of about 26 m.

Monday June 6th. The data was processed on Monday, giving room for discussion for this feature. The river was then navigated along the former thalweg to derive information on riverbed structures in the subbottom. The river mouth deposits were sampled by gravity corer (77) with a core length of 2.77 m and it was also tried to get a core from a point bar deposit in the river meander bend; however with limited success (glacial till) and the core only resulted in a core catcher sample (78). The ship returned to Kiel (Westufer), and the student group left happy and tired after cleaning labs, cabins, and a debriefing session.

Tuesday June 7th was a day-trip with eleven students (BSc Geowissenschaften) to Kiel Bay. After a general briefing on the area and measuring devices, and ship security we approached a transect at Stoller Grund. This same transect was navigated twice back and forth: First with ADCP (79) to explain the flow structure at this transect. On the way back three CTD stations were performed in which the students were announcing the CTD operations (80-82). Again the same transect was measured with SES and MBES (83) based on which students decided on positions for groundtruthing the hydroacoustic information: Six Van Veen grab samples (84-89) were taken, and the students in groups of two described the sediments. The relation of the sediments to multibeam backscatter revealed a (not unexpected) distribution of fine sediments in the deeper parts of the Stoller Grund channel. In discussing this and general aspects of ship based research we ended the day. The ship returned to Kiel Westufer Kai and the students group debarked.

The second leg of AL547 started on Wednesday, 8.6.2022. Eight students (MSc Marine Geosciences and MSc Angewandte Geowissenschaften) boarded FS Alkor in the morning. The ship left for the first investigation towards the Western coast of Fehmarn. The transit time was spent with setting up cabins, labs, and gear, safety instructions, a general introduction to the aims and contents of the course, and initial lectures on measuring devices.

The first activity was a S-N transect across the German part of the Fehmarn Belt. Water column velocities were measured by ADCP in the moonpool (91) and later 10 CTD stations (92-101) on the way back revealed the density structure of the water column. CTD stations were operated by the students to train on board communications. A week later than the first transect different situation of flow and transport was observed with a distinct surface water mass flowing towards east, and a distinct layer of bottom water of very low velocities. At two stations two water samples

were collected from the bottom water and the surface waters for suspended matter filtering. A handheld CTD sound velocity profile was taken (102), and the afternoon and night was dedicated to the mapping by multibeam echo sounder (103) and SES subbottom profiler of a second section of the Fehmarn dune field, sporadically handheld CTD profiles (104-115) were taken for sound velocity profiles. Students were working in shifts, monitoring the operation of the devices.

In the early morning of Thursday 9.6.2022 also two explosion craters were mapped (116). Then the MBES data was processed and the resulting map formed the basis for a joint discussion on bedform evolution and sedimentary properties. After a lecture and briefing, a sampling scheme for the day was developed and 16 sample positions were defined along four transects (117-132). The first transect was along one of the sand ribbons leading to the dune field. The second transect was in the southern part of the dune field. We also selected a dune that bifurcated and placed sampling locations along a non-bifurcated dune and a bifurcated dune to see if there were lithological differences that led to dune bifurcation. Sample positions included dune crests and troughs. After sampling, students described the sedimentological properties of the samples and discussed on the basis of the earlier measured bathymetric map. In and next to the bedform field three video transects were carried out to further explore the seafloor sedimentology and habitats (133-135). These three profiles included also the detonation craters mapped earlier, the transition from ribbon like structures into the dune field and one transect across single dunes. Following this a debriefing and discussions about all our observations until that time took place. After a short transit we continued with sound velocity profiles (136, 138-141) and the mapping (137, 142) of the lunate bedform field in the Fehmarn Belt until after the early morning.

After a discussion of last day's results, Friday 10.6.2022 started with an overview lecture on the lunate bedform field and the data that had been recorded overnight. Students then established a plan to take box core samples of the crest and troughs of these bedforms. The first box core (144) went well however others failed (145). A 3 m gravity core attempted at the location (146) also failed. Then four grab samples along the lunate bedforms were taken (148-151). Additionally, an underwater camera system was used for observations on the seafloor (152). The students split into groups describing the box core, logging the grab samples, filtering the sediment to recover shell biomass. In the evening, a debriefing of the day followed by a lecture on the postglacial landscapes of the Baltic Sea. Through the rest of the evening and into the night additional 16 SES and MBES profiles were taken across a paleo channel West of Fehmarn (154), accompanied by two sound velocity profiles (153, 155).

Saturday 11.6.2022 started with a briefing about the previously collected SES and MBES profiles from the night before. Based on the collected data students selected four gravity core profile locations for the characterization of the subbottom sediments. The locations were selected at the lower and upper limits of the channel as well as two cores within the channel. The first core failed twice (156) because of too hard ground as confirmed by a grab sample (156-3) for information of the sediment in this location. Grab sample at other potential core locations (157,158) showed that here there was also a similar lithology to the first location which would have most likely resulted in another unsuccessful core. Two new core locations (159-2, 158-2) at the Southernmost profile had good recovery with foil liners. A third core was then taken with a plastic liner for later lab analyses (160). The first two foil cores were laid out at the back of the ship and sliced in halves. Two groups of four described the two cores for the rest of the afternoon.

Afterwards the results were discussed and presented. Dinner was followed by a briefing during which we discussed the cores and their relation to the late Pleistocene-Holocene setting of the Baltic Sea. After a transit, and after the discussion, an overnight collection of SES and ADCP profiles across the ancient Dana river started (162, 166) accompanied by sound velocity profiles (161, 163-165, 167-169).

Sunday June 12th started with a morning briefing to discuss the data of the previous night. Following the briefing different activities along two transects included ADCP measurements (170, 183) and casts with the CTD rosette across the channel, and collecting water samples of bottom water and surface water (171-184). Simultaneously, core 160-1 was cut in 1 m sections and split in halves. We categorised the core and took exemplary smear slides. After lunch, there was a short debriefing of the morning and then the cleaning of the labs and cabins. Back at Westufer pier the equipment was packed. The cruise finished with a joint meeting before departing the boat in the evening.

5 Preliminary Results

The following chapter is part of the learning experience of the MSc Marine Geosciences course. Students were asked to co-author the sections of the preliminary results sections. Only mild review was carried out, which explains the heterogeneity.

5.1 Sedimentology and morphology of the Fehmarn subaqueous dune field

(Brown & T. Malliakas, CAU Kiel)

On the second day of the Alkor cruise AL574, Leg 1, a part of the subaqueous Fehmarn dune field, located in the south-western Baltic Sea in the Fehmarn Belt was mapped.

5.1.1 Bathymetry

To obtain bathymetric data on the research area, the Fehmarn dune field was mapped using a Multibeam-Echosounder (MBES). The Norbit WBMS STX MBES, worked at a frequency of 400 kHz. Over the course of 12.25 hours an area of approximately 4 km² seafloor was measured. The water depth in that area ranged between 23 m at the deepest point and 14 m at the shallowest point. The post-processed bathymetric data showed an area with lower elevation in the shallower SW-part of the dune field, where the so-called sand-ribbons are located. NE of the sand-ribbons, the dune formation starts. The crests were observed to be aligned in a N-S directions, with the stoss sides of the dunes facing west, indicating a dominantly eastward directed flow-regime. In the shallower area, adjacent to the sand-ribbons, the heights of the dunes reach around 2-2.5 m. Both the heights and the distance between crests decreases towards the north.

5.1.2 Grab samples

To characterize the properties of the dune field sediments, sediment surface samples were collected from the seafloor using a Van-Veen Grab sampler. Based on the bathymetry data, 19 total sample sites were selected, which for our preliminary results have further been divided into 8 localities labelled A through H (Fig. 5.1).

Sampling locations were selected in order to observe potential facies differences across individual dunes, as well as throughout the entire dune field, in addition to the sand ribbons (locality A). Locality B occurs in the lower transition between older dunes and the sand ribbons. Locality C is from the northernmost part of the field where no dunes are found, and where the water depth was deepest (20 m). Locality D provides a transect of the youngest dunes in deeper water. Locality E samples were taken from where the dunes bifurcated. Locality F provides a single sample from a large area in between dunes, while locality G crosses a transect of a larger, older dune. Locality H was taken from the top transition to the sand ribbons in the eastern portion. Fig. 5.2 shows W-E dune field elevation profiles (NW-SE in the sand ribbon) of selected sampling areas showing the changes in dune dimensions from north to south. Dunes throughout the field remain asymmetric in structure. Individual dune heights from our sample locations within the dune field ranged from 0.9 m to 1.6 m and lengths from 30 m to 85 m. All dimensions increase following dune bifurcation. The very low H/L ratios between 0.02-0.03 show no N-S trend from the sample-only dataset.

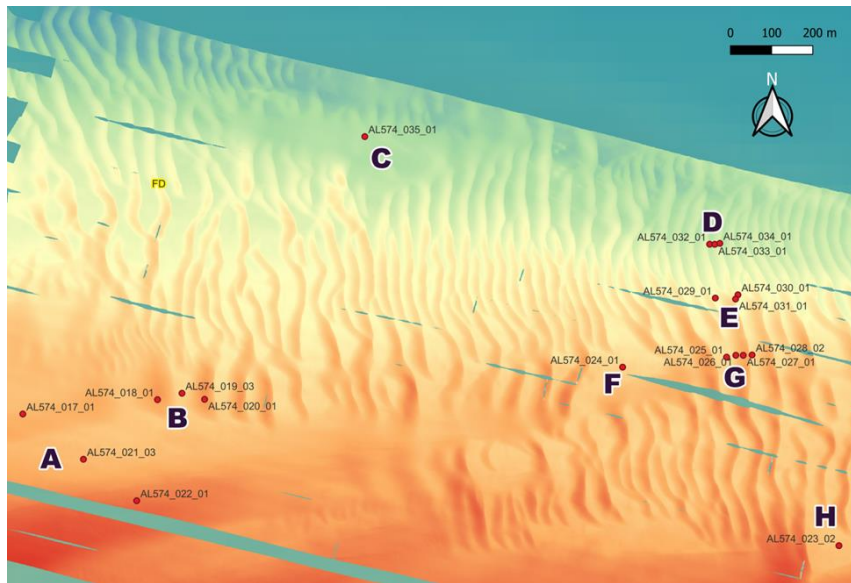


Fig. 5.1 Bathymetric map of the dunefield encompassing sampling localities. Depth scale ranges from 14 m (dark red) to 23 m (dark blue)

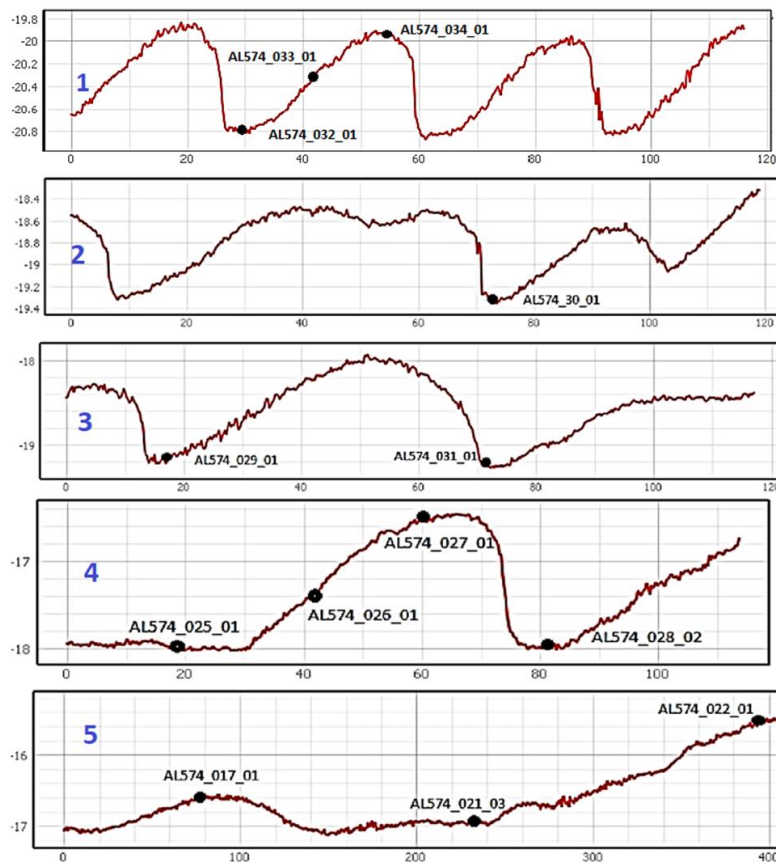


Fig. 5.2 Profiles of selected areas of dune field sampling arranged from N-S. All vertical and horizontal units are in meters. Profiles 1-4 were drawn from W-E, profile 5 from NW-SE. Profile 1 shows locality D (northeast), profiles 2 and 3 show locality E (bifurcation), profile 4 shows locality G (east), and profile 5 shows locality A (sand ribbons).

Overall sedimentary descriptions of the grab samples were performed in order to characterize potential patterns in sediment throughout the field (Table 5.1). Within individual dunes, samples from crests and stoss sides were found to be coarser grained than samples taken from troughs. Trough samples were also where cobbles were found, which in the cases of samples AL574_19-2, 21-3, 23-2, and 28-2, required multiple attempts to successfully capture samples due to the inability of the grab sampler to close. The northern portion of the dune field was the deepest part, and also overall finer-grained than counterparts from the southern portion of the field where the broad sand ribbons and larger transitional dunes were found. Samples from within the dune field (localities C, D, E, F and G) were more gray in color and contained more decayed organic material, and localities within troughs from this area were where H₂S could be detected.

Table 5.1 Table of the facies descriptions of the samples with the respective locations in respect to the morphology of the dune, the locality of the sample (see Fig. 5.1) and the water depth.

Facies Description	Samples	Sample Locations	Locality	Depth (m)
Medium to very coarse sand, gravel component, moderately sorted, H ₂ S absent, light brown	AL574_17-1	Sand ribbon (Crest)	A	16
	AL574_18-1	Crest	B	16
	AL574_20-1	Crest	B	16
	AL574_22-1	Sand Ribbon (Crest)	B	15
Medium to coarse sand, gravel component, containing cobbles, poorly sorted, H ₂ S absent, light brown	AL574_19-2	Trough	B	17
	AL574_21-3	Sand Ribbon (Trough)	A	16
Medium to coarse sand, containing cobbles, poor to moderately sorted, H ₂ S absent, gray-brown	AL574_23-2	Trough	H	17
	AL574_24-1	Trough	F	17
Very fine to medium sand, secondary silt, containing cobbles, poor to moderately sorted, H ₂ S present, gray-brown	AL574_25-1	Trough	G	18
	AL574_28-2	Trough	G	16
	AL574_31-1	Trough	E	18
	AL574_32-1	Trough	D	20
Medium to coarse sand, poor to moderately sorted, H ₂ S weak/absent, gray-brown	AL574_26-1	Stoss	G	18
	AL574_27-1	Crest	G	17
	AL574_33-1	Stoss	D	19
	AL574_34-1	Crest	D	20
	AL574_35-1	Northern field	C	20
Fine to medium sand, moderately sorted, H ₂ S absent, gray-brown	AL574_29-1	Trough	E	18
	AL574_30-1	Trough	E	18

5.1.3 Video profiles

To further investigate some of the properties of the seafloor in this research area, two routes were picked for video profiles. The camera used was a Vivotek IP 9191-HP heaved by the winch of the vessel. Both profiles had a length of approximately 270 m with the ship moving at a speed of around 0.4 knots towing the camera. The video recordings were live transmitted to the laboratory, where the research crew was able to adjust the length of the towing cable, in order to keep the camera in a sufficient height above the seafloor.

The first profile was located at the western part of the older dune formation, spanning over the length of three dunes (Fig. 5.3e) in depths between 16 m and 18 m. In the trough, larger rocks and exposed glacial till could be seen. These harder substrates allow for sessile organisms to settle in these areas, creating more diverse habitats, inhabited by algae, sponges, crabs, different kinds of mollusks, echinoderms, and some fish species (Fig. 5.3a). As the slope increased, the presence of plant material stopped abruptly. Also, the density of fauna decreased, with only some flatfish, starfish and shell fragments being visible. The sediment of the steep leeside of the dune became finer, as pebbles, rocks and boulders became absent (Fig. 5.3b). Between the crests and the leesides of the dunes, no real distinction in sedimentology or fauna and flora can be observed. On the stoss

side of the dunes, the seafloor looked similar to the crest and leeward side, however, smaller bedforms became more pronounced on the surface (Fig. 5.3d).

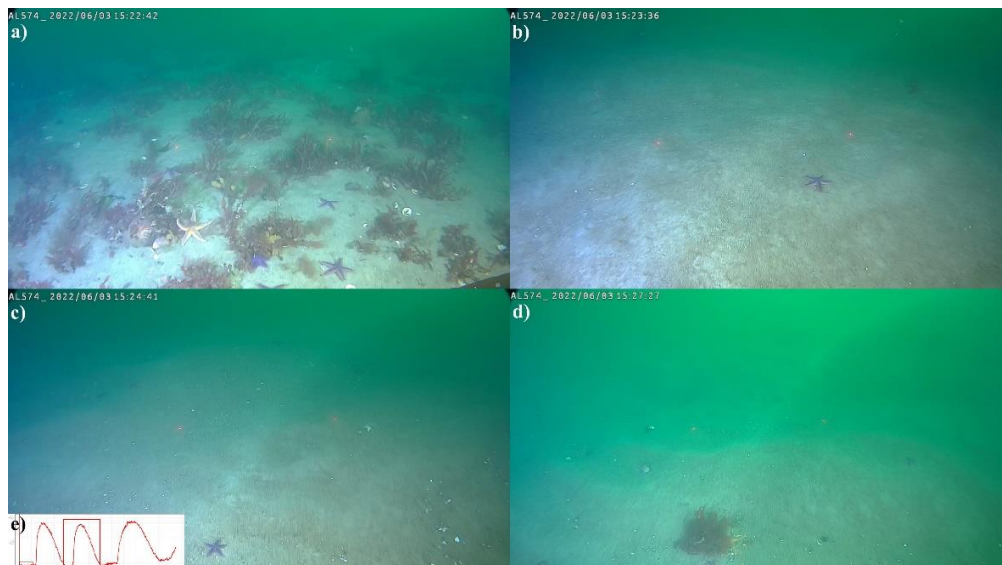


Fig. 5.3 Images taken from the video recordings, showing a) the seafloor of the trough, inhabited by various marine organisms, b) the barren leeward side, c) crest and d) windward side. e) shows the morphology of the filmed profile, with the red square indicating the dune where the pictures a-d were taken.

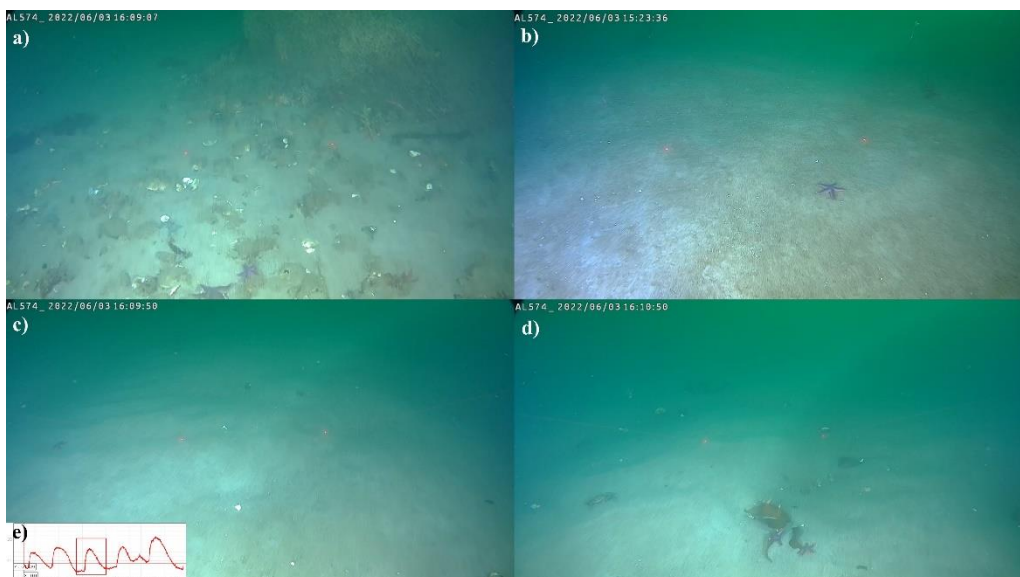


Fig. 5.4 Images from the videorecording of the second profile. a) the trough area with a benthic community and a large boulder on the top right corner, b) the leeward side, c) the crest and d) the windward side with secondary bedforms visible. e) shows the profile of the five dunes included in the video transect. The four pictures were taken at the dune, highlighted by the red box.

The second profile was located in the northern part of the dune field. Across the profile five dunes of the younger dune formation were recorded (Fig. 5.4e) in water depths between 20 m and 21.5 m. In contrast to the first profile, the dunes were smaller in elevation and distance to each other. Regarding the sedimentology and biological activity, the trends along the profiles were the same. The hard sediments of the trough, including a larger boulder (Fig. 5.4a), were active habitats

and secondary bedforms could be seen on the crest, becoming more prominent on the stoss side (Fig. 5.4c and 5.4d). In the morphological lows of these secondary bedforms, sporadic occurrence of biological activity was observed (Fig. 5.4d).

5.2 Sedimentology of the Fehmarn subaqueous dune field

(R. Kumar Swain & A. Sekhar Moharana, CAU Kiel)

On the second day of the Alkor cruise AL574, Leg 2, a second part of the subaqueous Fehmarn dune field, located in the south-western Baltic Sea in the Fehmarn Belt was mapped. This study describes the distribution of subaqueous dunes offshore Fehmarn Island between 13 m and 25 m water depth, based on Multibeam Echo-Sounder (MBES) bathymetry and grain size samples.

5.2.1 Methods

High-resolution bathymetric data were acquired using MBES (Multi-Beam Echo-Sounder), see 5.1.1 for a description of the set-up. For particle size distributions, 16 grab samples were taken using a Van Veen grab sampler (Fig. 5.5). The grain size distribution was described using a sediment sampling protocol log.

5.2.2 Results

The mapped dune field is located in water depths of 18-25 m. Dune heights range from 0.5 m to 2 m across the dune field with larger dunes of around 1.5 to 2 m height in the Central dune field. They have a length ranging between 39 to 50 m and are at 17-18 m water depth. Towards the North a decrease in the length of the dunes is observed, ranging between 19 to 22 m which dune height less than 0.5 m in water-depths of 20 to 23 m. This is where barchanoid dunes are observed (Fig 5.5).

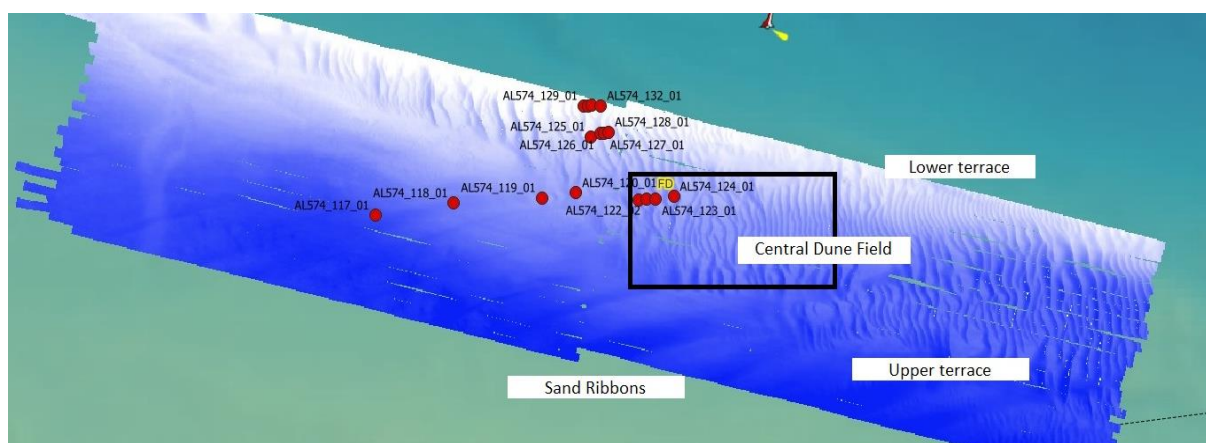


Fig. 5.5 Bathymetric data and sample locations at Fehmarn dune field

From the west a transition from sand ribbons into the dune field is observed. These sand ribbons are seen as elevated ridges at 13 to 20 m water depth with less than a meter in height and widths ranging from 50 m to several hundreds of meter as they protrude into the dune field from the SE.

From the 16 grab samples collected a subset was initially described (Table 5.2). In the sand ribbon area, the grab sample AL574_118_1 was taken at a water depth of 18 m, which showed a

poorly sorted courser-grained sand matrix with few large gravel particles. It had few shell fragments and an algal settlement on a hard substrate is seen. As we move into the dune field from NW, a much different matrix and sediment sorting are observed. In the central dune field, we start to see much finer gravels. A high abundance of life forms like bivalves, kelp and shell fragments were sampled from the trough area. Following the dunes to the northern end, they appear to be less wide and smaller, forming barchanoid dunes. The matrix here appears to be of clay and silt mixture in the trough whereas finer sand matrix in the crest.

Table 5.2 Bathymetric data and sample locations at Fehmarn dune field

Grab_sample	Water depth	Location on dune field	Main Matrix	Sorting	Secondary Component	Life form
AL574_118_1	18m	End of the transition zone	Coarse sand	Poor	Coarse gravels	Shell fragments & algal settlement
AL574_119_1	19m	Transition zone	Coarse sand	Moderately	Fine gravels	1 large bivalve & more shell fragments
AL574_123_1	19m	Crest in Central dune field	Coarse sand	Moderately	Fine gravels	1 large bivalve & no shell fragment
AL574_124_1	18m	Trough in Central dune field	Medium sand	Well sorted	Fine sand	Rich in life form.
AL574_129_1	23m	Trough in barchanoid dunes	Clay	Moderately	Silt	Rich in organic matter with strong smell
AL574_130_1	23m	Crest in barchanoid dunes	Medium sand	Well-sorted	Fine sand	No life form

5.3 The Fehmarn dune field as a habitat

(J. Schneider & L. von Stebut, CAU Kiel)

On 09.06.2022, the second day of the Alkor cruise AL574, Leg 2, a part of the subaqueous Fehmarn dune field, located in the south-western Baltic Sea in the Fehmarn Belt was studied (cf. 5.2, Fig. 5.5; Feldens et al., 2015). For this, a Multi-Beam Echo Sounder (MBES), Van Veen grab sampler, and video system was used. The topic of this section is the Fehmarn dune field as a sea-floor habitat. Thereby, relationships between sedimentology, geomorphology, and ecology are investigated to define features of the dune field as a habitat. After the description of the material and methods, the preliminary results are described and then interpreted and discussed.

5.3.1 Methods

MBES mapping was used to derive information on the Fehmarn dune field bathymetry. To derive information on the sedimentological parameters, the Van Veen grab sampler was operated. Afterward, the 16 sediment grab-samples AL574_117-1 – AL574_132-1 were analyzed regarding their grain size distribution (cf. 5.2.1) and organic matter contents.

Additionally a custom-made underwater video system with lights and parallel lasers was used to derive a video transect of the dune field. The utilized cameras were a Vivotek IP9191-HT and a GOPRO HERO 7 Black. Both cameras recorded in Full HD (1920x1080 px). The distance between two lasers was set to 50 cm to get a size reference. The positioning of the video system

was done via RTK GNSS on the A-frame. The offset due to the travel and the skew of the wire was measured from a photo from the side with 4.9° . With the water depth d , the resulting offset ('layback') was $l = \tan(4.9) \cdot d$. The synchronization was done via a photo of smartphone clock at the beginning of the videos. Afterward, the videos were analyzed regarding abundant species and the nature of the dune field as a habitat.

5.3.2 Results

Sediment samples from troughs express characteristic features of glacial till sediments, like a wide spectrum of grain sizes with clay, sand, and pebbles in varying ratios. The dunes themselves consist of medium-grained sands with fine-grained sand as a secondary component.

Observations from the video profile confirm and add to those from the grab-samples. Along with estimations of grain-size distributions, the grab-samples were investigated for organism content: Samples from the troughs included red algae (*Rhodomenia* sp.), bryozoa (*Flustra foliacea*), gastropods (*Buccinum undatum*), porifera, polychaeta, as well as shells and shell fragments of bivalves (*Arctica islandica*), sometimes covered by barnacles. The dune crest samples contained *Arctica islandica* shells and live individuals, *Buccinum undatum*, and a polychaete. Volume percentages of shell content were estimated for some samples from dune crests and ranged from 0.3 % (AL574_132-1) to 8 % (AL574_118-1). AL574_122-2, a sample from the trough had a shell content of approximately 30 %.

The video cameras were applied to examine a part of the dune field. The profile started on the stoss side of a dune ($54^\circ 35' 9,024''\text{N}$, $10^\circ 59' 59,8956''\text{E}$) and proceeded in eastern direction: The upper part and crest of the first dune appeared sparsely populated: Some partially buried shells of *Arctica islandica*, 2 individuals of *Asteria rubens*, a kelp species, and a juvenile flat fish could be observed in the field of view, while the camera was approaching the edge of the first dune. The lee side of the dune transitions into the first dune trough. Along the dune margin was a prominent patch of kelp. Porifera of the species *Haliclona oculata* occurred in close association. Motile species like fish (possibly *Ctenolabrus rupestris*) and *Asteria rubens* were also present.

The trough between the first and the second dune was the widest in the investigated area. It was characterized by a flat surface of rather fine-grained looking, compact sand and clay with variously sized pebbles, as well as a large density of shell fragments (Fig. 5.7, screenshots 2,5,8). Shells and shell fragments of *Arctica islandica* and *Buccina undatum* could be identified. Kelp occurs frequently and uses pebbles, stones, and shells to attach to with its holdfast. *Asteria rubens* are common and could sometimes be seen in a feeding position on bivalve shells. Starfish feed on bivalves by suffocating them, then opening the shell and everting their stomach inside the shell to digest it. This observation would indicate that live bivalves were also present in the troughs. Floating red algae and bryozoa (*Flustra foliacea*) could be seen, the latter often in association with kelp. Further species included a hermit crab (*Pagurus bernhardus*), *Carcinus maenas*, several flat fish (*Platichthys flesus*, *Pleuronectes platessa*), a ground-dwelling fish of the family Gobiidae, and a butterflyfish (*Pholis gunellus*).

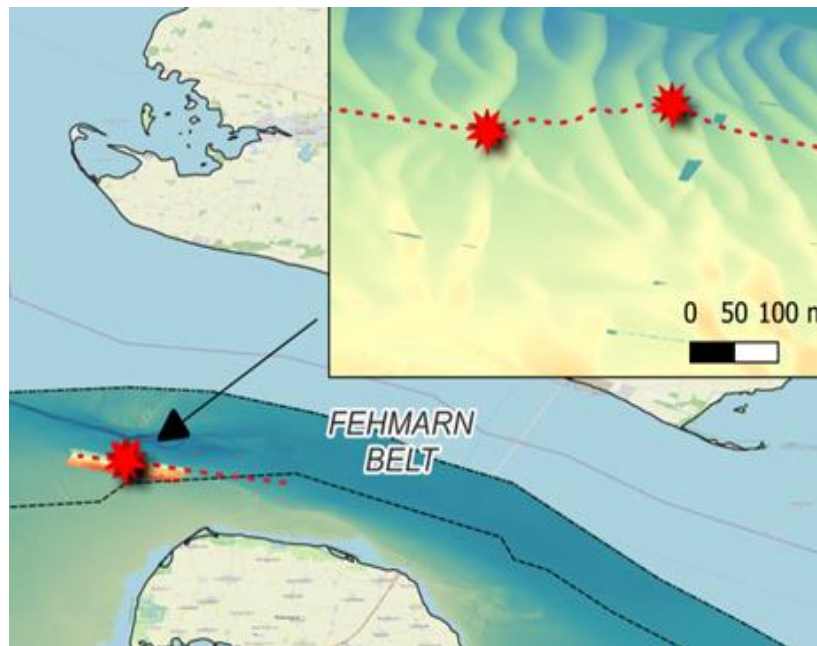


Fig. 5.6: Location of the research area in the south-western Baltic Sea in the Fehmarn Belt. The red stars indicate the start and end of a video profile transect in the Fehmarn dune field.

The population density decreased gradually across the stoss side of the second dune. Some kelp, shell fragments, *Asteria rubens* and a plaice (*Pleuronectes platessa*) could be seen. The stoss side of the dunes is covered by smaller ripples and shell fragments appear more frequently in the troughs between them (Fig. 5.7, screenshots 1,4,7).

At the edge of the second dune resided another patch of kelp in association with porifera. The second trough was very similar in character to the first one. Several flat fish, sea stars, kelp, and porifera could be seen between shells/shell fragments, pebbles, and stones. Another species of porifera (*Halichondria panicea*) could also be identified in this section of the profile. Two juvenile *Buccina undatum* were observed while they were preying or scavenging on a bivalve.

Moving up the stoss side of the third dune allowed for similar observations as on the first two dunes. Down at the leeward margin of the third dune was another patch of kelp. This one is the most pronounced of the three patches that were covered in the video profile (Fig. 5.7, screenshot 8). Large individuals of *Haliclona oculata* and a shell of not further identified small fish occurred in close proximity with the algae. The trough between the third and fourth dune was rather narrow but shared characteristics of the other troughs. The profile ended on top of the fourth dune. While the camera was lifted, the scarcity of organisms on the dune crests could be well seen. A detailed summary of surveyed organisms is listed in Table 5.3.

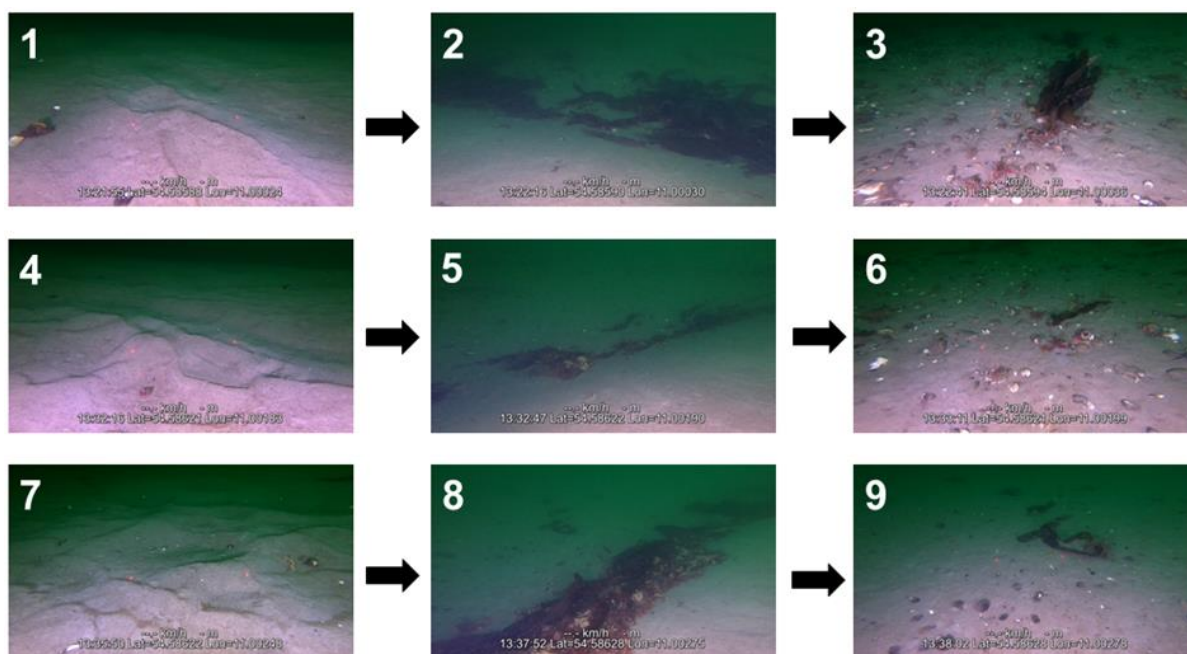


Fig. 5.7 The three distinct habitats we defined for the subaqueous Fehmarn dune field. Video profile screenshots 1, 4, 7 represent the dunes; 2, 5, 8 picture the dune margin (lee side); 3, 6, 9 show the troughs between the dunes. Arrows indicate the transition between the habitats.

Table 5.1: Observed faunal inventory from grab-samples and video profile observations.

Phylum	Species	Motility	Trophy/Feeding habit
Echinodermata	<i>Asteria rubens</i>	Motile (epibenthic), planktonic larval stage	Preys on benthic invertebrates
Mollusca	<i>Arctica islandica</i>	Sessile (endobenthic), planktonic larval stage	Filter feeding
	<i>Buccinum undatum</i>	Motile (epibenthic), planktonic larval stage	Preys, scavenges
Porifera	<i>Haliclona oculata</i>	Sessile (epibenthic) on soft and hard substrate	Filter feeding
	<i>Halichondria panicea</i>	Sessile (epibenthic) on hard substrate	Filter feeding
Bryozoa	<i>Flustra foliacea</i>	Sessile (epibenthic), here associated with kelp	Filter feeding
Chordata	<i>Platichthys flesus</i>	Motile (ground dwelling nekton)	Preys on benthic invertebrates
	<i>Pleuronectes platessa</i>	Motile (ground dwelling nekton)	Preys on benthic invertebrates
	<i>Pholis gunellus</i>	Motile (ground dwelling nekton)	Preys on benthic invertebrates
Crustacea	<i>Carcinus maenas</i>	motile (epibenthic), planktonic larval stage	Preys on benthic invertebrates
	<i>Pagurus bernhardus</i>	motile (epibenthic), planktonic larval stage	Filter feeding, scavenging

5.3.3 Discussion

The idea to further investigate the dune field with regard to its properties as a habitat arose from the observation of apparently distinct zones. We observed that the benthic community composition changed as a function of sedimentological and geomorphological parameters. By analyzing the video recording we could establish a zonation and confirm that features are consistent between the dunes. We divide the section of the dune field we investigated into 3 types of sub-habitats: The dune, the trough between two dunes, and the dune lee side:

The **dune** consists of medium-grained and coarse sand, it contains mussel shells and fragments. It is probable that living bivalves exist in this habitat. The species *Arctica islandica* are known to

bury in soft sediments where they are capable of anaerobic respiration (Taylor, 1976). It is also a filter feeder. The requirements for this lifestyle, soft substrate and moving water masses, are met in this habitat. Kelp requires a hard substrate like pebbles, rocks, or mollusk shells to attach to. Hard substrates occur on the dune, but in a much smaller density than in the troughs, which could be an explanation for the differences in kelp density between the two sub-habitats. Sand is transported up the dune-water-interface and seems to bury sessile organisms. Partially buried individuals of kelp were observed. Motile organisms like fish and starfish are likely to move between sub-habitats.

The **troughs** between the dunes are the result of a limited sediment supply for dune formation. The glacial till at the bottom of the dunes consists of a clay matrix with a random distribution of secondary grain size fractions. This forms a sub-habitat that is distinctly different from the dunes. Shell fragments and pebbles have accumulated between the dunes and form the basis for a diverse ecosystem. The highest diversity of species can be observed here. All major trophic levels can be observed, and several different predatory species be seen.

The **margin** on the lee side of the dunes is the most striking feature we observed. The properties of this defined space seem to induce an accumulation of macroalgae and sponges, forming a reef-like sub-habitat by providing shelter and feeding ground for several other species. A definitive explanation for this feature cannot be given from the available data, but assumptions can be made. We interpret the patches of kelp and porifera as a result of the dune's movement. While the dunes are migrating, they push back the immobile species from the dune troughs, consequently accumulating a mass of organisms on their edges.

5.3.4 Conclusion

The dune field exhibits very interesting features, both from a sedimentological as well as an ecological view. Our methods are sufficient to describe the features of the dune field with reasonable detail. However, a more sophisticated approach might help shed light on the exact processes that are responsible for the features we observed. Long-term observations of bottom currents and movement of the dunes, as well as investigations into the endobenthic community are required to provide a more complete picture of this habitat. We suggest that future expeditions look further into dune formation and take box-core samples in order to investigate the assemblage of endobenthic communities.

5.4 Hydrodynamics and Salt transport at the Fehmarn Belt, Leg 1

(J. Hartmann & C. Arenas, CAU Kiel)

On the first day of the first leg, a cross-section was sailed across the German part of the Fehmarn Belt (Fig. 5.8). Together with the Sound, the Belt Sea regulates the exchange of water masses between the Baltic and the North Sea as they are the narrowest constraints (Lass et al., 1987). The exchange of water is of major importance as the North Sea water induces oxygenated and saline water ventilating the deep basins of the Baltic Sea but occurs only occasionally in extended amounts (HELCOM, 1986). The exchange of water masses between the Baltic and the North Sea resembles an estuarine circulation (Meier et al., 2006) in which dense saline water enters the Baltic in depth whereas less dense water leaves the Baltic Sea in the near-surface layer. The brackish conditions in the Baltic result from the riverine input of freshwater and the minor contribution of

saline North Sea water (HELCOM, 1986). The mixing of both water masses is mostly hindered by the halocline leading to strong stratification (Meier et al., 2006). The inflow of North Sea water into the Baltic Sea is driven by two different forces. On the one hand, the salinity gradient between the North and Baltic Sea which is then referred to as baroclinic inflow, and on the other hand, caused by wind and air pressure changes, the barotropic inflow altering the sea level between the Kattegat and the western Baltic Sea. Baroclinic conditions predominate during summer whereas heavy storms cause increased barotropic inflows during autumn and winter (Lass et al., 1988).

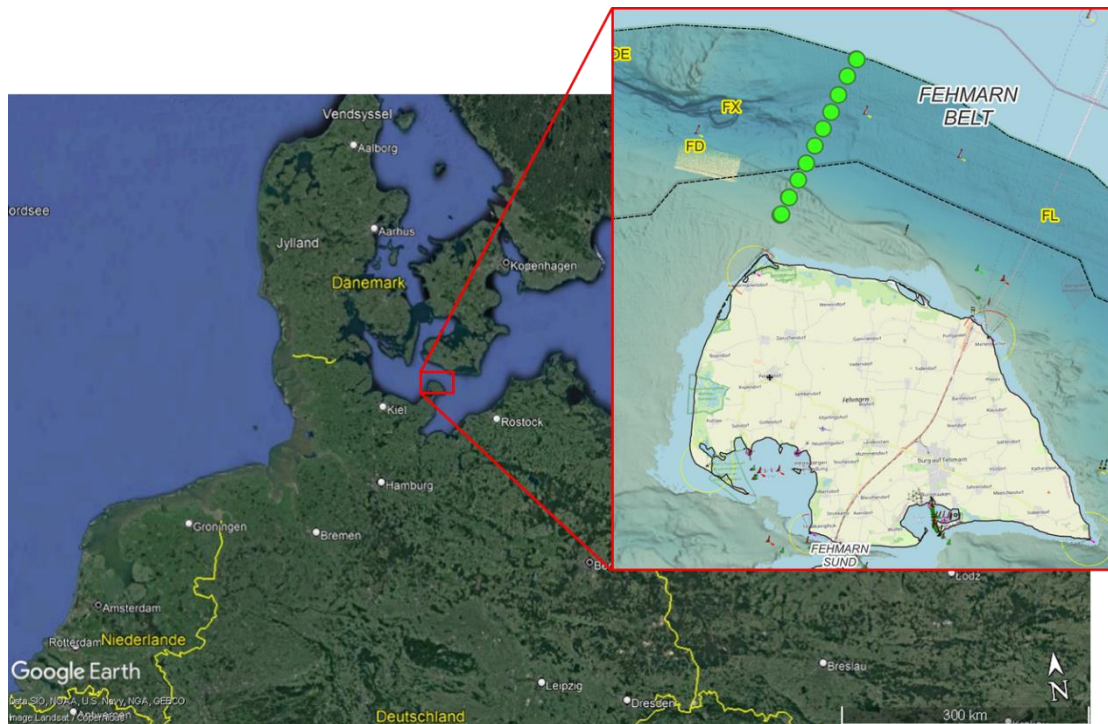


Fig. 5.8 Location of the research area in the western Belt Sea. The green dots in the right close-up indicate Conductivity, Temperature, Depth (CTD) sample locations across the Acoustic Doppler Current Profiler (ADCP) transect.

5.4.1 Methods

The ship's rosette CTD (Conductivity, Temperature, Depth) and a 600 kHz Acoustic Doppler Current Profiler (ADCP) have been applied along a transect crossing the Fehmarn Belt in width. The ADCP measures current velocities and directions throughout the water column and the CTD supplies measures of water column physical properties. First, the ADCP transect was recorded going from SW to NE followed by selected CTD stations across the transect on the way back.

5.4.2 Results

Based on water velocity direction and magnitude, three major units of the profile can be identified (Fig 5.9). ADCP profiles showing movement directed towards the South/Southeast with a comparably high velocity ($\sim 0.34 \text{ ms}^{-1}$) in the upper water column. These properties extend in depth towards the Southwest. Further down, water movement is directed towards the North/Northeast with low to medium velocity ($0.0 - 0.22 \text{ ms}^{-1}$). Here, the highest velocities occur in the center of the water body. In between this first and second unit the area of East/Northeast movement and low

velocities is interposed. At the bottom of the water column, water moves towards the South/Southwest with low velocity.

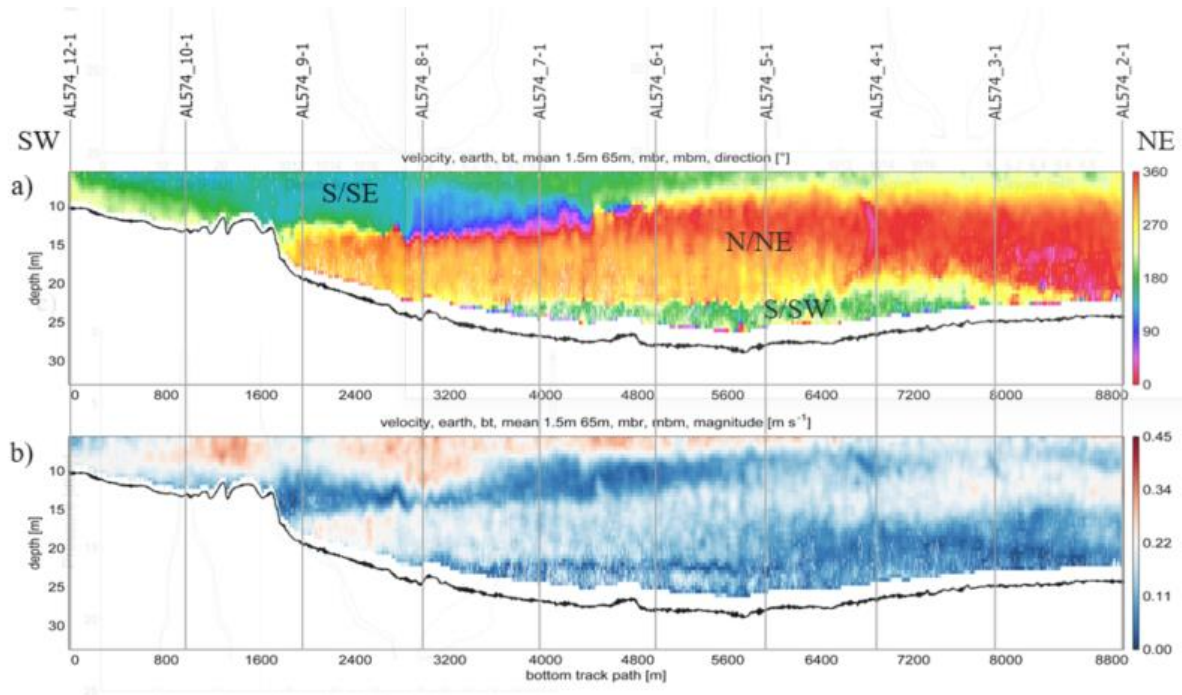


Fig. 5.9 Results from the Southwest/Northeast ADCP transect with a) direction of the water movement and b) velocity magnitudes throughout the water column in the Fehmarn Belt

Based on the ADCP transect chosen CTDs should encompass information about the three previously described water bodies. For the CTD profiles we focus on AL574_6-1 to AL574_9-1 (cf. Fig. 5.9). The upper layer of the water column reveals the highest temperature and lowest salinity and density. Its depth varies between 6-8 m depending on the CTD location (Fig. 5.10). Further down, temperature decreases whereas the salinity and density increase. AL574_8-1 reveals constant temperature, salinity, and density while AL574_7-1 and AL574_6-1 indicate an increase in those properties. AL574_8-1 shows an increase in salinity and density and a decrease in temperature at around 15 m which does not occur in AL574_6-1 and AL574_7-1. The next marked change occurs at around 20 m in all three profiles by decreasing temperature and increasing salinity and density.

5.4.3 Discussion

Based on the measurements we differentiated three units of the water column based on velocity and direction and changes in temperature, salinity and density: The uppermost water mass reveals the highest temperatures, lowest salinity, and thus density and flows to the South/Southeast. The water mass below, flowing to the North/Northeast, indicates lower temperature and higher salinity and thus density, whereas the lowest water mass is characterized by even lower temperatures and higher salinity and density (e.g. AL574_8-1) and moves towards the South/Southwest.

We found that water with low salinity flows towards the central Baltic Sea near the surface, and highly saline, cold water enters the Baltic Sea in depth. The intermediate water mass moves North/Northwest and thus toward the North Sea. Obviously this momentary state is more complex

than the earlier described long term exchange of water masses between the North and Baltic Sea as estuarine overturning circulation, with the surface outflow of brackish Baltic Seawater and inflow of saline North Sea water in depth (e.g. Meier et al., 2006). Compared to our observation, we found that only the movement of the lowest water mass matches the described estuarine circulation, whereas the surficial movement reveals opposed behavior. The intermediate water mass maintains the circulation by transporting water towards the North Sea.

As a possible explanation and referring to Lass et al. (1988), changes in salinity, as well as wind direction and speed, might have altered the exchange temporarily. With the surficial inflow of less saline water, we suggest that wind stress may have deflected the surface water towards the South/Southeast. This could imply that the intermediate water mass represents the normally occurring surficial outflow of brackish Baltic Sea water.

Additionally, we observed East/Northeast (blue-pinkish, Fig. 5.9) directed movement with only low velocity in between the first and second water mass. Here the CTD, also reveals constant temperature, salinity, and density (AL574_8-1) suggesting a mixing zone. It is worthy to mention that this interpreted mixing zone might be due to internal waves yielded by the differences in velocity and density between the water masses.

5.4.4 Conclusion and Outlook

Overall, we identified three water masses throughout the water column in the Baltic Sea. These water masses differ based on temperature, salinity, density, velocity, and direction. We expected the outflow of brackish Baltic Sea water to occur in the surface area but found the inflow of low saline water instead. This reversal might represent a temporary variation due to wind stress and rainfall events. For a more profound assessment of water mass exchange between the Baltic and the North Sea through the Belt Sea, temporarily extended measurements are required.

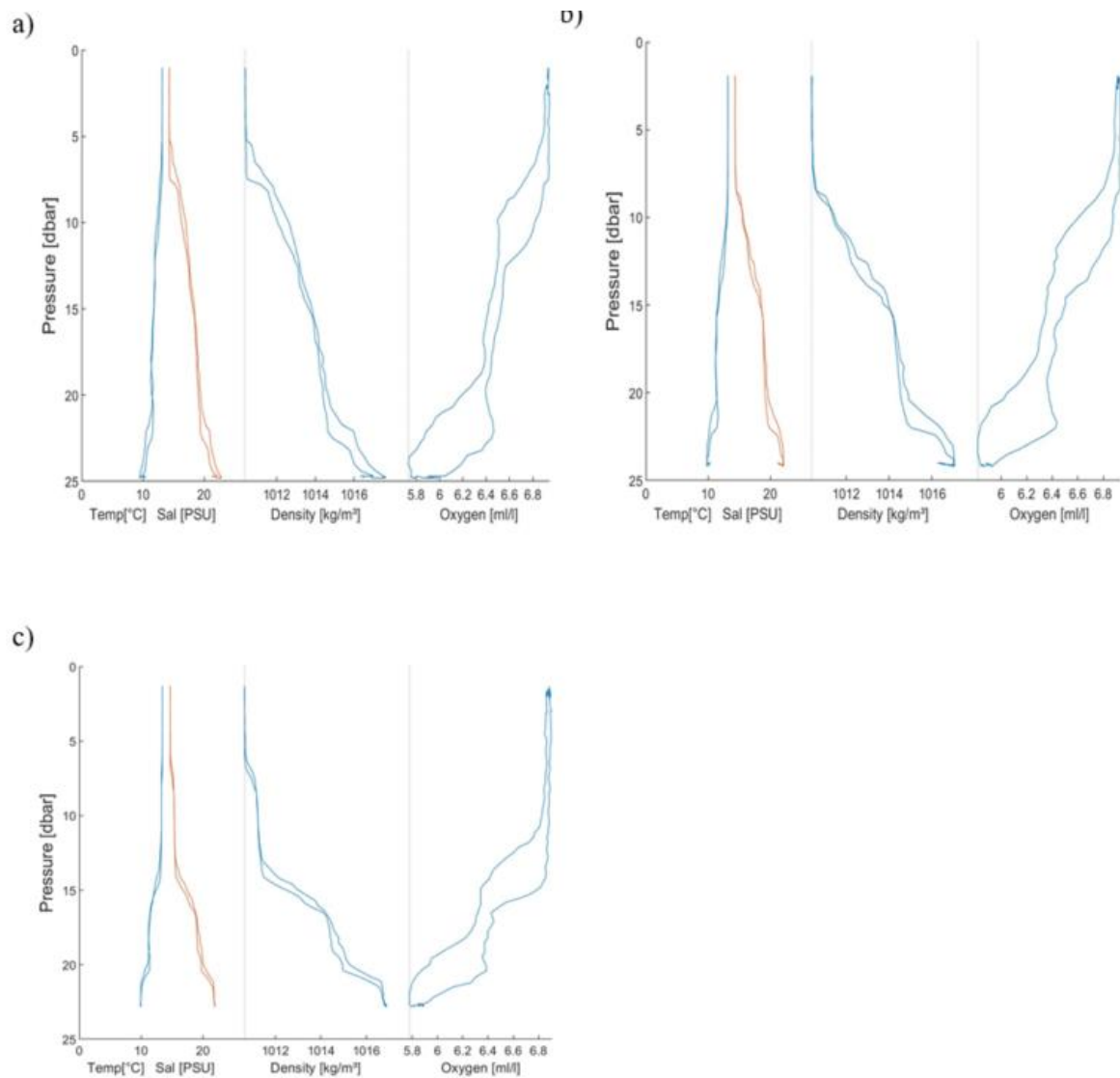


Fig. 5.10 Selected CTD profiles showing temperature, conductivity, salinity and density from a) AL574_6-1 b) AL574_7-1, and c) AL574_8-1.

5.5 Hydrodynamics and Salt transport at the Fehmarn Belt, Leg 2

(S. Vahrenkamp & A. Enge, CAU Kiel)

On both legs, an N-S transect was sailed across the German part of the Fehmarn Belt. An Acoustic Doppler Current Profiler (ADCP) was recording to derive current velocity profiles. This section reports on the cross-section measured on the second leg. When navigating back on the same track ten CTD Rosette profiles (92-1 to 101-1) were taken (Fig. 5.11).

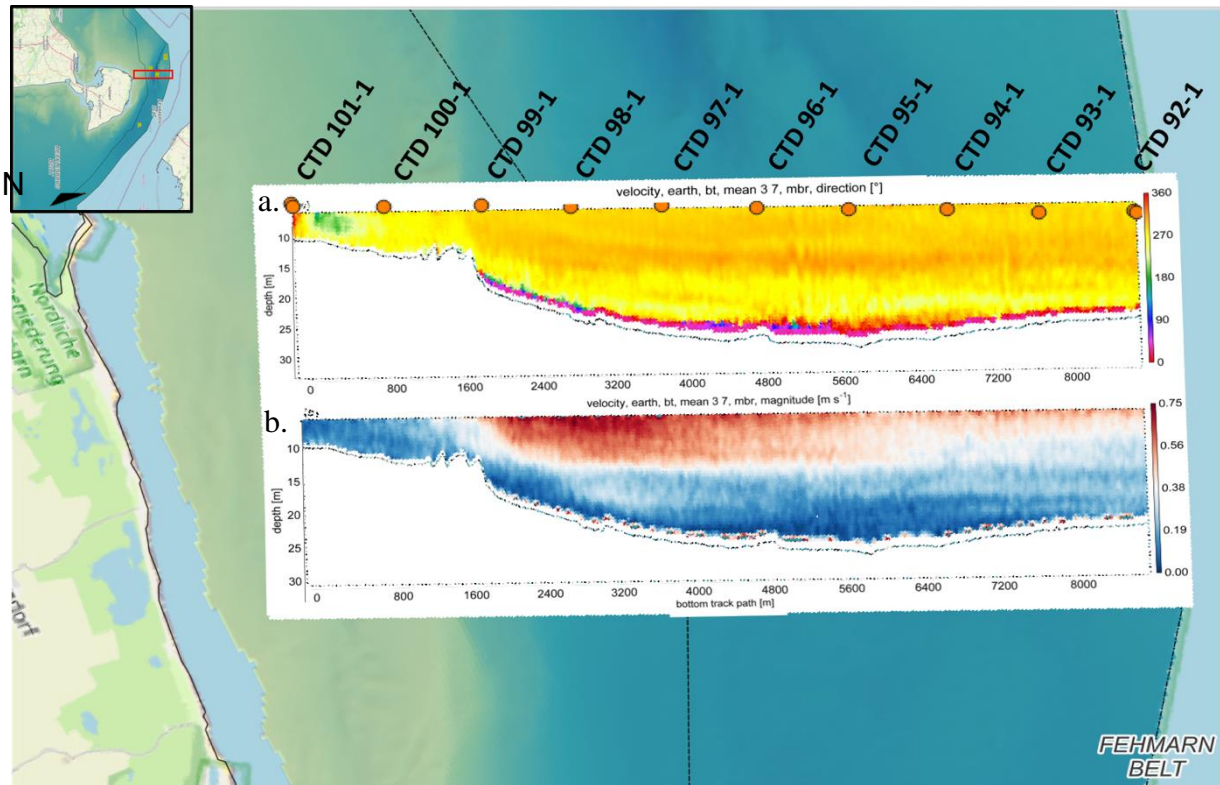


Fig. 5.11 ADCP profile of the second Leg a. showing direction [°] and b. magnitude of flow [m/s] with CTD Rosette measurements (CTD 92-1 to 101-1) indicated on the profile.

5.5.1 Methods

An Acoustic Doppler Current Profiler (ADCP) in the moon pool was used to measure the flow velocity and direction from the hull depth of about 5 m down to the seafloor. The data shown here is already processed including coordinate transformations and the recalculation of the flow velocity by subtracting the ships velocity along the track. For the coordinate transformation the data is first converted from an instrument coordinate system to a vessel coordinate system and then to an earth coordinate system.

The CTD measurements were carried out with the ship CTD rosette. The CTD data was processed manually in Matlab. In the following profiles the data is plotted for downcasts only.

5.5.2 Results

In the ADCP profiles the direction of the flow is displayed in earth coordinates. Values of 270° indicate a westward flow. Along the measured transect the flow in the Fehmarn Belt was unidirectional in a westward direction at this point in time. The magnitude of the flow velocity is displayed in m/s. Maximum values of velocity magnitude are found at the surface and at closer proximity to Fehmarn with a velocity magnitude of 0.75 m/s and a depth of approximately 15 m (at location CTD 97-1, 98-1). Lower values of velocity magnitude are seen in the deeper part of the Fehmarn Belt (CTD 92-1 to 95-1). With increasing depths the velocity magnitude decreases

until approaching zero at the seafloor along the whole track. In the very shallow areas, close to the coast of Fehmarn, the velocity magnitude is consistently low.

In the middle of the transect (4800 m to 5800 m) patterns interpreted as internal waves can be observed with an amplitude up to 4 m and a wavelength of ~200 m (Fig. 5.11, cf. section 5.4). The internal waves can be observed in the direction plot as part of a more northern directed flow indicated by a darker orange as well as in the velocity plot as a wave feature of velocity 0.38 m/s.

CTD data of temperature, salinity, depth, and oxygen are shown in Fig. 5.12. Specific layers can be addressed to separate water masses: The upper water column down to approximately 11 m can be identified as a warmer, fresher, and more oxygenated water mass with temperatures of 14 to 16 °C, salinity concentrations of 10 to 14 PSU and oxygen concentrations of 6.8 to 7 ml/l. Temperature and oxygen values are constant over this layer whereas salinity increases linearly with depth. From 11 m downwards temperature decreases until 17 m. This layer is identified as the Thermocline. Below the thermocline (17 m to 23 m), the temperature is almost constant between 10 to 11 °C which is named as the cold layer here. At depths greater than 23 m the temperature again decreases. In the salinity profile an increase in salinity is seen from the surface until 11 m, as previously described. From 11 to approximately 22.5 m salinity increases stronger from values of 14 to 22 PSU, so the layer is identified as the Halocline. At greater depths, salinity concentrations increase until 25 PSU. In the oxygen profile the layering is very similar to that of temperature with a rather constant oxygen concentration in the surface layer until 11 m (Epilimnion, 6.8 to 7 ml/l), a decrease from 11 to 17 m (Metalimnion) followed by another constant layer of low oxygen concentrations (Hypolimnion) and a strong decrease of oxygen in higher depths until reaching concentration of approximately 5 ml/l. The surface layer is probably well oxygenated.

From Fig. 5.11 internal wave patterns can be observed at a depth of 10 - 15 m at the location of 4400-5400 m. In Fig. 5.12 the corresponding CTD measurements are plotted to enable a comparison of the influence of internal waves on the stratification patterns. Comparing the CTD profile with the adjacent (6400-8600 m) measurements, the water column appears to have a lower gradient in the thermocline region (lower stratification) and a rather constant temperature in the cold layer, indicating mixing processes. In the salinity and oxygen profiles it is difficult to see a clear influence of internal waves.

In Fig. 5.13 the density profiles of the CTD measurements from 92-1 to 100-1 are shown. The density stratification is at first look similar across all profiles ranging from 1006 to 1009 kg/m³ in the upper 11 m and then increasing towards values of 1019 kg/m³ in depths of 20 to 25 m. The range in density from 1006 to 1019 kg/m³ places the water in the category of brackish water having a range from between 1000 kg/m³ (freshwater) to 1025 kg/m³ (salt water).

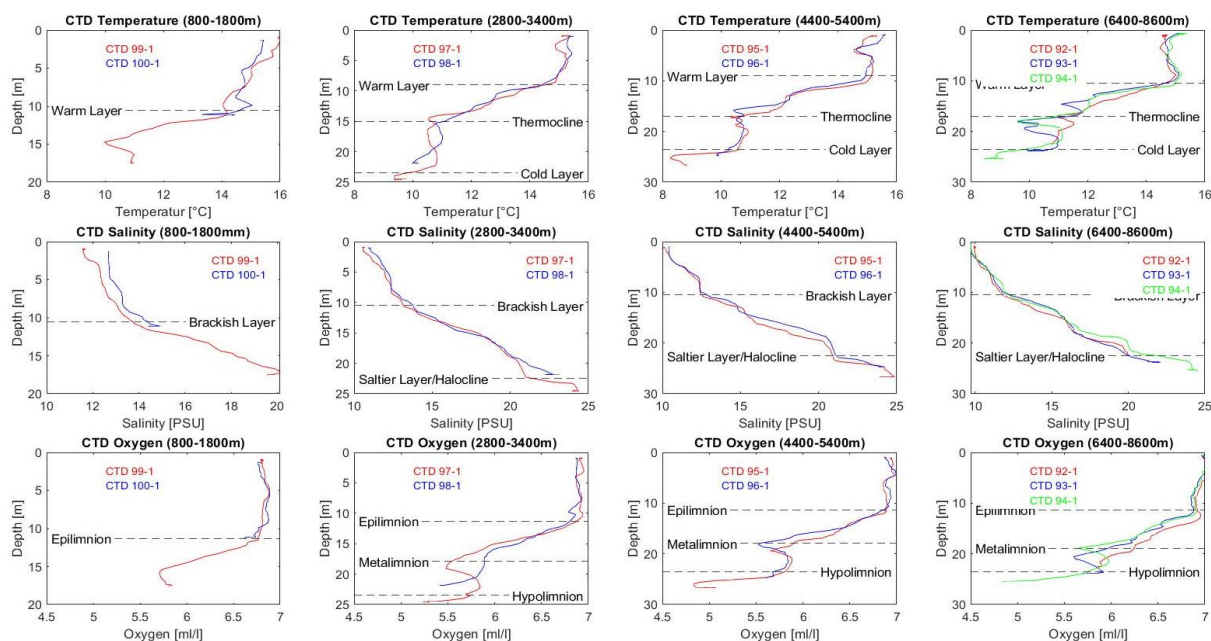


Fig. 5.12 Vertical profiles of temperature [°C], salinity [PSU] and oxygen [ml/l] from the CTD Rosette measurements along the ADCP track from 0-8600 m. The CTD profiles are grouped for specific features seen in the ADCP profiles: left: lower surface velocity, mid left: internal waves, mid right: higher surface velocity and right: shallow water

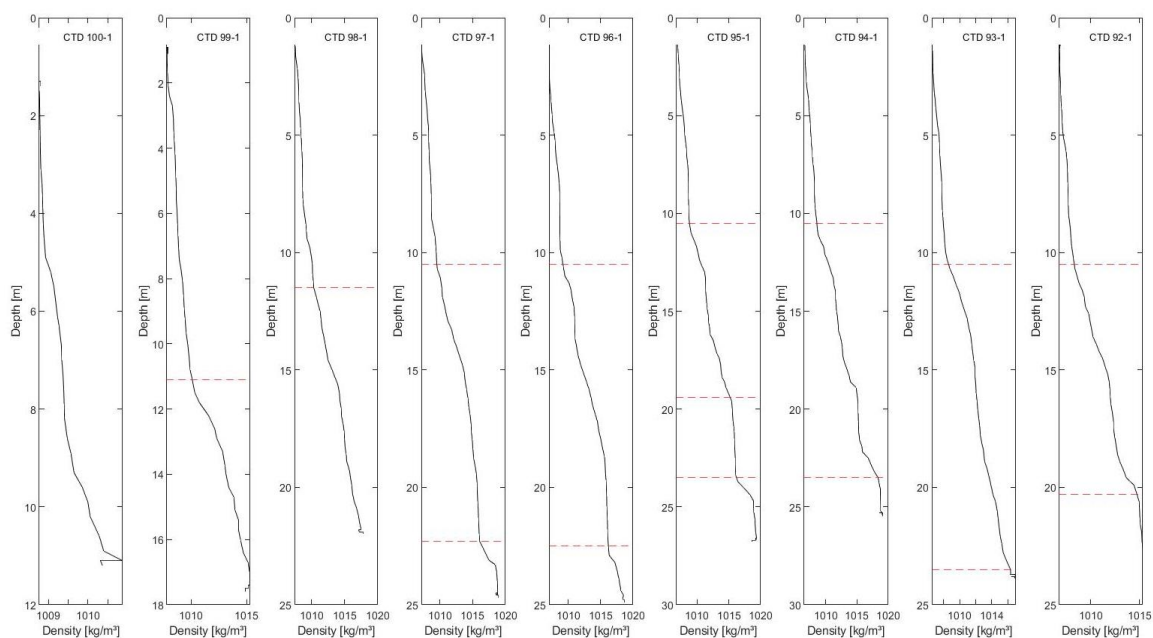


Fig. 5.13 Vertical profiles of density [kg/m³] from the CTD measurements along the ADCP transect. Changes in the density gradient (slope) are marked with a dotted line to underline some layering profiles

From the measured salinity concentrations of the CTD profiles [PSU] and the ADCP velocity profiles [m/s] the salinity transport at each CTD profile location is calculated (Fig. 5.14). The values between 20 and 30 m depth have to be considered critically because of some NaN values in the ADCP data and therefore do not result in “real” values (red area). Nevertheless, the results show that the transport decreases with increasing depth due to the decrease of velocity approaching the bottom.

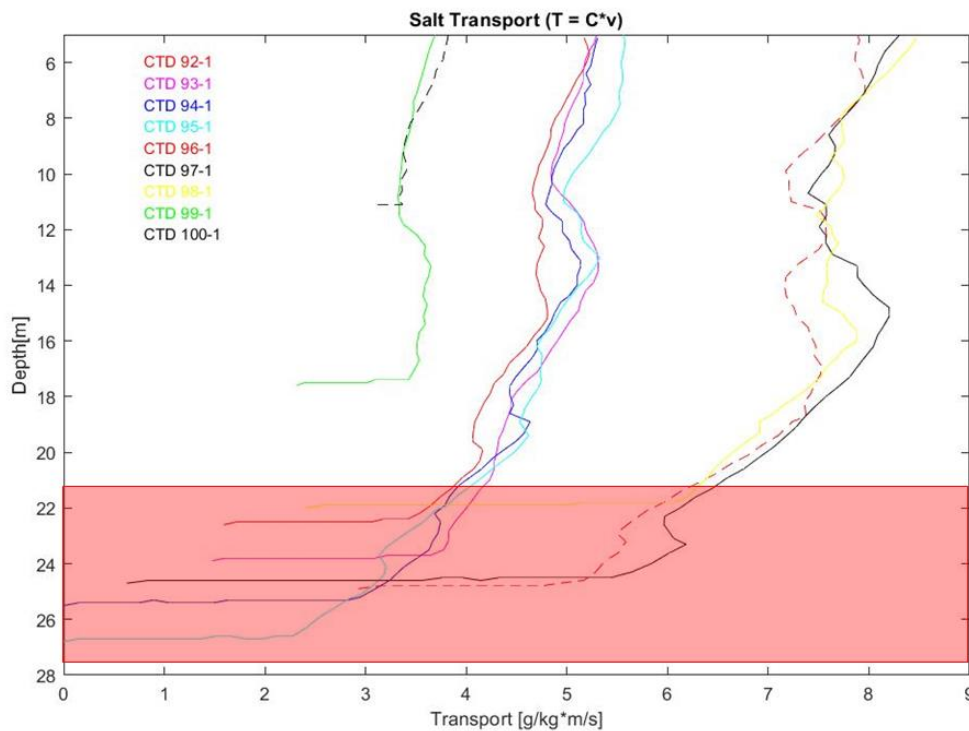


Fig. 5.14 Vertical profiles of calculated salt transport [PSU*m/s] along the ADCP track profile.

5.5.3 Discussion

The Baltic Sea is an enclosed sea, supplied with freshwater from river discharge and saline water from the North Sea. The water exchange between the Baltic and North Sea is limited by shallow and narrow connections in the western Baltic Sea. The inflow of seawater from the North Sea is driven by a complex interplay of meteorological and oceanographic dynamics covering pressure driven (barotropic) or salinity driven (baroclinic) exchange mechanisms (Mohrholz, 2018). The most significant inflow of salt water occurs during Major Baltic Inflow Events (MBIs) during which oxygenated North Sea water, which is vital for organisms and ecosystems, is transported into the Baltic Sea.

One of the two pathways of exchange between the Baltic Sea and the North Sea occurs at the Fehmarn Belt which is why it is an area of interest for studying exchange and mixing dynamics. As a simplified model it is expected that when saltier and colder water masses from the North Sea, which have a higher density, enter the Baltic Sea they will accumulate below the less saline, slightly warmer Baltic Sea water. This can result in a stratified water column or a well-mixed one when mixing processes due to wind or internal waves are present.

The unidirectional flow we see in our data does not initially match with the expected results which would be two water masses, a bottom one coming from the North Sea and moving in an

eastward direction and an overlaying water mass moving westward. However, when looking at the ADCP data of the first leg (Fig. 5.9) we observe a completely different, more expected setting. Those results show a much more complex profile with multi directional flow. The significant difference in flow regime and velocity magnitude between the two profiles one week apart highlights the complexity of this environment where water movement is dependent on varying external factors including local weather conditions, density differences between the Baltic and North Sea, pressure differences and temperature differences (Reissmann et al. 2009).

5.6 Gravity cores

(M. Felgendreher)

For an exemplary investigation of Western Baltic Sea postglacial history, sediment cores were taken in a sediment basin south of Fehmarn in the Mecklenburg Bay. The location of the two cores described here are shown on Fig 5.15.

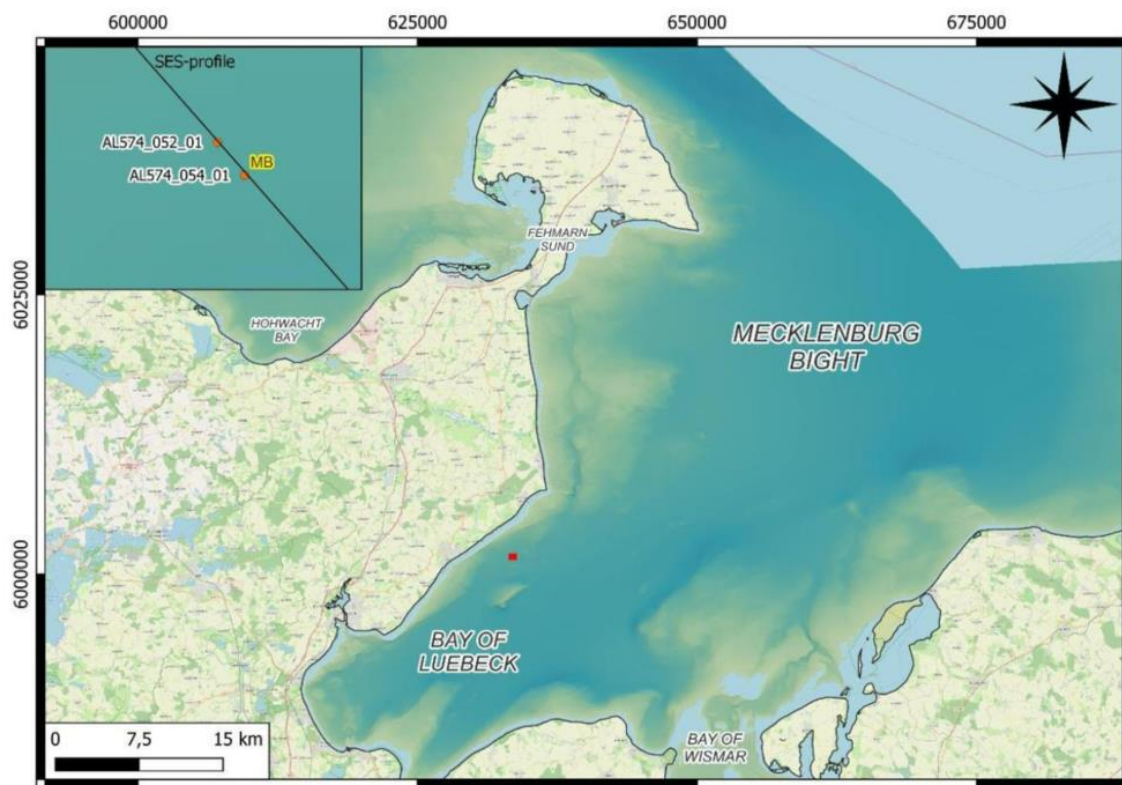


Fig. 5.15 Core locations in the Bay of Lübeck

The coring was carried out using a gravity corer of 5.5 m length and an attached weight of 800 kg and a foil liner for immediate access. To survey adequate coring locations, an Innomar SES 2000 echo sounder was used. In the SES profile, the base of the basin, several former small channels and the infill of the overall structure are observed (Fig. 5.16). Considering the length of the corer, two positions with the expected base material in less than 5 m depth below seafloor were chosen. The location of AL574_52 was selected to obtain sediments of a presumably younger channel infill, whereas AL574_54 was chosen to penetrate deeper into the base material, which

was expected to consist of glacial till. To investigate the postglacial history, the cores are briefly described with the focus on sediment composition and remains of organic material.

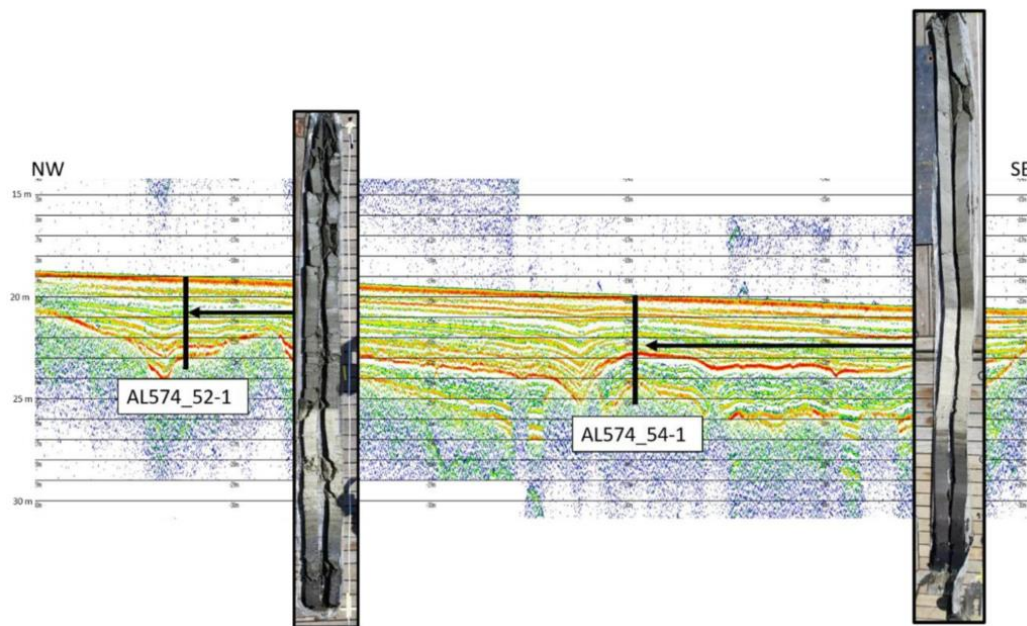


Fig. 5.16 Sediment cores AL574_52-1 and AL574_54-1 are shown with their positions on the SES-profile.

5.6.1 Gravity Core description

Here core AL574_54-1 is described (Fig. 5.17). It has a length of 5.25 m. The base part at 5.25 m depth is composed of grey clayey material in the base and core cutter. The grey material is overlain by 0.20 m of black sediments with remains of terrestrial plants such as roots and branches.

On top of the black layer, the cores show a high but decreasing content of plant material. The color changes from black to a lighter brownish grey material with a high clay and silt and a low carbonate content that increases upwards. A transition zone at about 4 m core depth leads to very fine, organic-rich beige material. This unit covers a thickness of around 70 cm. With the positive HCl-test the high carbonate content can be approved. The beige carbonate layer shows beige and orange laminations of some mm thickness. Also, remains of plants can be found. Very small mussel shells and gastropod housings were found throughout the layer.

A thin sand layer of 2 cm thickness with some shells at the bottom were deposited above the carbonate layer. The fine grains in the sand layer are very well sorted and rounded.

Olive green and brownish clay with silt can be described for the overlaying unit. It shows a fining upward sequence, a decrease in carbonate content and an increase in bioturbation. The unit is covered by a strongly bioturbated brown mud. Bioturbation and many burrow traces filled with grey sand are features in this layer.

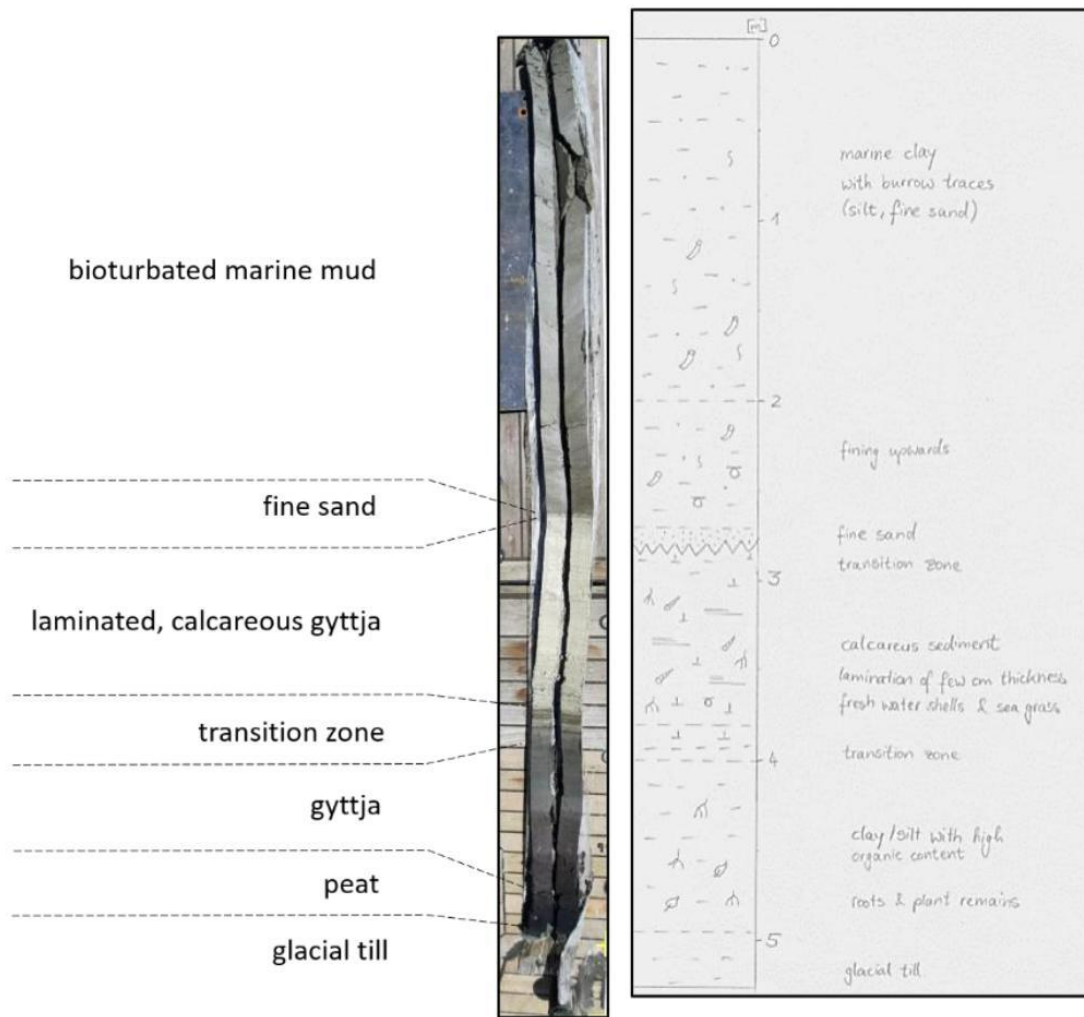


Fig. 5.17 Description and interpretation of the sediment core AL574_54-1

6 Station List AL574

Station No	Event Time	Gear	Depth (m)	Latitude	Longitude	Action
AL574_1-1	02.06.2022 10:18	ADCP	10	54° 33.197' N	011° 04.781' E	profile start
AL574_1-1	02.06.2022 11:16	ADCP	24	54° 37.361' N	011° 08.556' E	profile end
AL574_2-1	02.06.2022 11:24	CTD	24	54° 37.348' N	011° 08.582' E	in the water
AL574_2-1	02.06.2022 11:29	CTD	24	54° 37.335' N	011° 08.589' E	on deck
AL574_3-1	02.06.2022 11:42	CTD	25	54° 36.907' N	011° 08.105' E	in the water
AL574_3-1	02.06.2022 11:47	CTD	25	54° 36.870' N	011° 08.122' E	on deck
AL574_4-1	02.06.2022 12:02	CTD	27	54° 36.409' N	011° 07.672' E	in the water
AL574_4-1	02.06.2022 12:06	CTD	27	54° 36.395' N	011° 07.671' E	on deck
AL574_5-1	02.06.2022 12:16	CTD	28	54° 35.949' N	011° 07.301' E	in the water
AL574_5-1	02.06.2022 12:22	CTD	28	54° 35.938' N	011° 07.304' E	on deck
AL574_6-1	02.06.2022 12:36	CTD	26	54° 35.498' N	011° 06.910' E	in the water
AL574_6-1	02.06.2022 12:40	CTD	26	54° 35.485' N	011° 06.903' E	on deck
AL574_7-1	02.06.2022 12:49	CTD	26	54° 35.049' N	011° 06.508' E	in the water
AL574_7-1	02.06.2022 12:54	CTD	27	54° 35.050' N	011° 06.487' E	on deck
AL574_8-1	02.06.2022 13:03	CTD	24	54° 34.577' N	011° 06.087' E	in the water
AL574_8-1	02.06.2022 13:08	CTD	24	54° 34.572' N	011° 06.073' E	on deck
AL574_9-1	02.06.2022 13:17	CTD	19	54° 34.130' N	011° 05.673' E	in the water
AL574_9-1	02.06.2022 13:22	CTD	19	54° 34.131' N	011° 05.653' E	on deck
AL574_10-1	02.06.2022 13:31	CTD	13	54° 33.664' N	011° 05.222' E	in the water
AL574_10-1	02.06.2022 13:34	CTD	13	54° 33.665' N	011° 05.222' E	on deck
AL574_11-1	02.06.2022 13:36	CTD	13	54° 33.669' N	011° 05.231' E	in the water
AL574_11-1	02.06.2022 13:37	CTD	13	54° 33.667' N	011° 05.231' E	on deck
AL574_12-1	02.06.2022 13:46	CTD	10	54° 33.216' N	011° 04.852' E	in the water
AL574_12-1	02.06.2022 13:49	CTD	10	54° 33.213' N	011° 04.843' E	on deck
AL574_13-1	02.06.2022 16:29	CTD	22	54° 35.276' N	011° 00.005' E	in the water
AL574_13-1	02.06.2022 16:32	CTD	22	54° 35.268' N	011° 00.012' E	on deck
AL574_14-1	02.06.2022 16:46	Multibeam	22	54° 35.253' N	011° 00.180' E	profile start
AL574_14-1	03.06.2022 05:01	Multibeam	14	54° 34.572' N	010° 59.921' E	profile end
AL574_15-1	03.06.2022 05:07	CTD	14	54° 34.609' N	010° 59.815' E	in the water
AL574_15-1	03.06.2022 05:09	CTD	14	54° 34.613' N	010° 59.798' E	on deck
AL574_16-1	03.06.2022 05:13	SES2000	15	54° 34.676' N	010° 59.942' E	profile start
AL574_16-1	03.06.2022 05:25	SES2000	17	54° 34.746' N	011° 01.618' E	profile end
AL574_17-1	03.06.2022 07:57	Grab	16	54° 34.714' N	011° 00.177' E	in the water
AL574_17-1	03.06.2022 07:59	Grab	16	54° 34.710' N	011° 00.177' E	on deck
AL574_18-1	03.06.2022 08:10	Grab	16	54° 34.733' N	011° 00.476' E	in the water
AL574_18-1	03.06.2022 08:11	Grab	16	54° 34.728' N	011° 00.476' E	on deck
AL574_19-1	03.06.2022 08:17	Grab	17	54° 34.729' N	011° 00.534' E	in the water
AL574_19-1	03.06.2022 08:18	Grab	17	54° 34.726' N	011° 00.531' E	on deck
AL574_19-2	03.06.2022 08:22	Grab	16	54° 34.734' N	011° 00.532' E	in the water
AL574_19-2	03.06.2022 08:23	Grab	17	54° 34.736' N	011° 00.531' E	on deck
AL574_19-3	03.06.2022 08:27	Grab	17	54° 34.734' N	011° 00.533' E	in the water
AL574_19-3	03.06.2022 08:29	Grab	17	54° 34.732' N	011° 00.533' E	on deck
AL574_20-1	03.06.2022 08:35	Grab	16	54° 34.731' N	011° 00.588' E	in the water
AL574_20-1	03.06.2022 08:37	Grab	17	54° 34.728' N	011° 00.581' E	on deck
AL574_21-1	03.06.2022 08:44	Grab	16	54° 34.647' N	011° 00.309' E	in the water
AL574_21-1	03.06.2022 08:45	Grab	16	54° 34.649' N	011° 00.308' E	on deck
AL574_21-2	03.06.2022 08:49	Grab	16	54° 34.646' N	011° 00.313' E	in the water
AL574_21-2	03.06.2022 08:51	Grab	16	54° 34.644' N	011° 00.317' E	on deck
AL574_21-3	03.06.2022 08:53	Grab	16	54° 34.646' N	011° 00.310' E	in the water
AL574_21-3	03.06.2022 08:55	Grab	16	54° 34.651' N	011° 00.307' E	on deck
AL574_22-1	03.06.2022 09:01	Grab	15	54° 34.602' N	011° 00.429' E	in the water
AL574_22-1	03.06.2022 09:03	Grab	15	54° 34.601' N	011° 00.431' E	on deck
AL574_23-1	03.06.2022 09:18	Grab	17	54° 34.509' N	011° 01.998' E	in the water
AL574_23-1	03.06.2022 09:20	Grab	17	54° 34.512' N	011° 01.998' E	on deck
AL574_23-2	03.06.2022 09:22	Grab	17	54° 34.512' N	011° 02.001' E	in the water
AL574_23-2	03.06.2022 09:24	Grab	17	54° 34.508' N	011° 01.998' E	on deck
AL574_24-1	03.06.2022 10:03	Grab	17	54° 34.758' N	011° 01.538' E	in the water
AL574_24-1	03.06.2022 10:10	Grab	17	54° 34.750' N	011° 01.534' E	on deck

AL574_25-1	03.06.2022 10:22	Grab	18	54° 34.764' N	011° 01.760' E	in the water
AL574_25-1	03.06.2022 10:24	Grab	18	54° 34.769' N	011° 01.757' E	on deck
AL574_26-1	03.06.2022 10:32	Grab	18	54° 34.766' N	011° 01.780' E	in the water
AL574_26-1	03.06.2022 10:34	Grab	18	54° 34.766' N	011° 01.784' E	on deck
AL574_27-1	03.06.2022 10:43	Grab	17	54° 34.764' N	011° 01.798' E	in the water
AL574_27-1	03.06.2022 10:45	Grab	17	54° 34.766' N	011° 01.800' E	on deck
AL574_28-1	03.06.2022 10:51	Grab	16	54° 34.764' N	011° 01.819' E	in the water
AL574_28-1	03.06.2022 10:52	Grab	16	54° 34.765' N	011° 01.814' E	on deck
AL574_28-2	03.06.2022 11:00	Grab	16	54° 34.767' N	011° 01.815' E	in the water
AL574_28-2	03.06.2022 11:01	Grab	16	54° 34.769' N	011° 01.819' E	on deck
AL574_29-1	03.06.2022 11:12	Grab	18	54° 34.841' N	011° 01.738' E	in the water
AL574_29-1	03.06.2022 11:13	Grab	18	54° 34.840' N	011° 01.737' E	on deck
AL574_30-1	03.06.2022 11:16	Grab	18	54° 34.840' N	011° 01.770' E	in the water
AL574_30-1	03.06.2022 11:17	Grab	18	54° 34.840' N	011° 01.770' E	on deck
AL574_31-1	03.06.2022 11:21	Grab	18	54° 34.840' N	011° 01.789' E	in the water
AL574_31-1	03.06.2022 11:22	Grab	18	54° 34.838' N	011° 01.784' E	on deck
AL574_32-1	03.06.2022 11:31	Grab	20	54° 34.912' N	011° 01.729' E	in the water
AL574_32-1	03.06.2022 11:32	Grab	20	54° 34.913' N	011° 01.730' E	on deck
AL574_33-1	03.06.2022 11:38	Grab	19	54° 34.913' N	011° 01.740' E	in the water
AL574_33-1	03.06.2022 11:40	Grab	19	54° 34.912' N	011° 01.740' E	on deck
AL574_34-1	03.06.2022 11:45	Grab	20	54° 34.913' N	011° 01.750' E	in the water
AL574_34-1	03.06.2022 11:46	Grab	20	54° 34.913' N	011° 01.753' E	on deck
AL574_35-1	03.06.2022 12:00	Grab	20	54° 35.063' N	011° 00.964' E	in the water
AL574_35-1	03.06.2022 12:02	Grab	20	54° 35.062' N	011° 00.966' E	on deck
AL574_36-1	03.06.2022 13:03	Underwater Video System	17	54° 34.752' N	011° 00.788' E	in the water
AL574_36-1	03.06.2022 13:32	Underwater Video System	16	54° 34.731' N	011° 00.498' E	on deck
AL574_37-1	03.06.2022 13:56	Underwater Video System	20	54° 34.975' N	011° 01.583' E	in the water
AL574_37-1	03.06.2022 14:23	Underwater Video System	20	54° 35.016' N	011° 01.307' E	on deck
AL574_38-1	03.06.2022 17:12	CTD	28	54° 30.262' N	011° 21.599' E	in the water
AL574_38-1	03.06.2022 17:15	CTD	28	54° 30.257' N	011° 21.589' E	on deck
AL574_39-1	03.06.2022 17:25	Multibeam	28	54° 30.258' N	011° 21.822' E	profile start
AL574_39-1	03.06.2022 22:09	Multibeam	28	54° 29.513' N	011° 25.251' E	profile end
AL574_40-1	03.06.2022 18:28	CTD	28	54° 30.357' N	011° 21.748' E	in the water
AL574_40-1	03.06.2022 18:30	CTD	28	54° 30.358' N	011° 21.754' E	on deck
AL574_41-1	03.06.2022 19:33	CTD	28	54° 30.413' N	011° 21.833' E	in the water
AL574_41-1	03.06.2022 19:35	CTD	28	54° 30.418' N	011° 21.839' E	on deck
AL574_42-1	03.06.2022 20:39	CTD	29	54° 30.513' N	011° 21.919' E	in the water
AL574_42-1	03.06.2022 20:41	CTD	29	54° 30.519' N	011° 21.930' E	on deck
AL574_43-1	04.06.2022 08:00	Box Corer	27	54° 29.637' N	011° 24.434' E	in the water
AL574_43-1	04.06.2022 08:03	Box Corer	28	54° 29.636' N	011° 24.432' E	on deck
AL574_44-1	04.06.2022 08:33	Box Corer	28	54° 29.647' N	011° 24.404' E	in the water
AL574_44-1	04.06.2022 08:36	Box Corer	27	54° 29.645' N	011° 24.396' E	on deck
AL574_45-1	04.06.2022 09:36	ADCP	15	54° 30.206' N	011° 15.996' E	profile start
AL574_45-1	04.06.2022 10:27	ADCP	26	54° 33.207' N	011° 20.710' E	profile end
AL574_46-1	04.06.2022 10:53	ADCP	28	54° 33.726' N	011° 16.950' E	profile start
AL574_46-1	04.06.2022 11:35	ADCP	12	54° 31.373' N	011° 13.262' E	profile end
AL574_47-1	04.06.2022 12:58	Underwater Video System	19	54° 25.155' N	011° 22.802' E	in the water
AL574_47-1	04.06.2022 13:25	Underwater Video System	21	54° 25.289' N	011° 22.827' E	on deck
AL574_48-1	04.06.2022 13:39	Underwater Video System	21	54° 25.578' N	011° 22.790' E	in the water
AL574_48-1	04.06.2022 13:58	Underwater Video System	21	54° 25.650' N	011° 22.691' E	on deck
AL574_49-1	05.06.2022 06:28	SES2000	18	54° 09.167' N	011° 02.134' E	profile start
AL574_49-1	05.06.2022 06:49	SES2000	20	54° 08.117' N	011° 03.513' E	profile end
AL574_50-1	05.06.2022 07:55	Gravity Corer	19	54° 08.959' N	011° 02.390' E	in the water
AL574_50-1	05.06.2022 08:00	Gravity Corer	19	54° 08.960' N	011° 02.389' E	on deck
AL574_51-1	05.06.2022 08:23	Gravity Corer	19	54° 08.953' N	011° 02.394' E	in the water
AL574_51-1	05.06.2022 08:28	Gravity Corer	19	54° 08.953' N	011° 02.394' E	on deck

AL574_52-1	05.06.2022 08:46	Gravity Corer	19	54° 08.732' N	011° 02.684' E	in the water
AL574_52-1	05.06.2022 08:50	Gravity Corer	19	54° 08.733' N	011° 02.685' E	on deck
AL574_53-1	05.06.2022 10:02	Gravity Corer	19	54° 08.728' N	011° 02.679' E	in the water
AL574_53-1	05.06.2022 10:06	Gravity Corer	19	54° 08.728' N	011° 02.679' E	on deck
AL574_54-1	05.06.2022 10:24	Gravity Corer	20	54° 08.690' N	011° 02.741' E	in the water
AL574_54-1	05.06.2022 10:29	Gravity Corer	20	54° 08.689' N	011° 02.742' E	on deck
AL574_55-1	05.06.2022 11:26	ADCP	14	54° 12.747' N	011° 10.176' E	profile start
AL574_55-1	05.06.2022 13:42	ADCP	10	54° 04.612' N	011° 26.980' E	profile end
AL574_56-1	05.06.2022 13:48	CTD	10	54° 04.597' N	011° 26.985' E	in the water
AL574_56-1	05.06.2022 13:48	CTD	10	54° 04.603' N	011° 26.990' E	on deck
AL574_57-1	05.06.2022 13:59	CTD	17	54° 05.194' N	011° 25.733' E	in the water
AL574_57-1	05.06.2022 14:00	CTD	17	54° 05.195' N	011° 25.727' E	on deck
AL574_58-1	05.06.2022 14:11	CTD	15	54° 05.769' N	011° 24.557' E	in the water
AL574_58-1	05.06.2022 14:12	CTD	15	54° 05.765' N	011° 24.555' E	on deck
AL574_59-1	05.06.2022 14:23	CTD	17	54° 06.350' N	011° 23.377' E	in the water
AL574_59-1	05.06.2022 14:24	CTD	17	54° 06.349' N	011° 23.374' E	on deck
AL574_60-1	05.06.2022 14:36	CTD	17	54° 06.927' N	011° 22.176' E	in the water
AL574_60-1	05.06.2022 14:37	CTD	17	54° 06.922' N	011° 22.177' E	on deck
AL574_61-1	05.06.2022 14:48	CTD	19	54° 07.511' N	011° 20.985' E	in the water
AL574_61-1	05.06.2022 14:49	CTD	19	54° 07.509' N	011° 20.979' E	on deck
AL574_62-1	05.06.2022 15:01	CTD	21	54° 08.100' N	011° 19.746' E	in the water
AL574_62-1	05.06.2022 15:02	CTD	21	54° 08.092' N	011° 19.744' E	on deck
AL574_63-1	05.06.2022 15:13	CTD	26	54° 08.678' N	011° 18.593' E	in the water
AL574_63-1	05.06.2022 15:14	CTD	26	54° 08.670' N	011° 18.598' E	on deck
AL574_64-1	05.06.2022 15:25	CTD	24	54° 09.263' N	011° 17.336' E	in the water
AL574_64-1	05.06.2022 15:26	CTD	24	54° 09.255' N	011° 17.336' E	on deck
AL574_65-1	05.06.2022 15:37	CTD	22	54° 09.834' N	011° 16.190' E	in the water
AL574_65-1	05.06.2022 15:38	CTD	22	54° 09.830' N	011° 16.187' E	on deck
AL574_66-1	05.06.2022 15:39	CTD	22	54° 09.828' N	011° 16.194' E	in the water
AL574_66-1	05.06.2022 15:52	CTD	22	54° 10.451' N	011° 14.957' E	on deck
AL574_67-1	05.06.2022 16:04	CTD	21	54° 10.992' N	011° 13.806' E	in the water
AL574_67-1	05.06.2022 16:05	CTD	21	54° 10.991' N	011° 13.805' E	on deck
AL574_68-1	05.06.2022 16:18	CTD	20	54° 11.573' N	011° 12.611' E	in the water
AL574_68-1	05.06.2022 16:18	CTD	20	54° 11.575' N	011° 12.607' E	on deck
AL574_69-1	05.06.2022 16:31	CTD	16	54° 12.160' N	011° 11.391' E	in the water
AL574_69-1	05.06.2022 16:32	CTD	16	54° 12.163' N	011° 11.387' E	on deck
AL574_70-1	05.06.2022 16:45	CTD	14	54° 12.733' N	011° 10.193' E	in the water
AL574_70-1	05.06.2022 16:46	CTD	14	54° 12.736' N	011° 10.185' E	on deck
AL574_71-1	05.06.2022 20:10	CTD	35	54° 36.636' N	010° 58.157' E	in the water
AL574_71-1	05.06.2022 20:12	CTD	36	54° 36.653' N	010° 58.140' E	on deck
AL574_72-1	05.06.2022 20:23	Multibeam	32	54° 36.717' N	010° 57.748' E	profile start
AL574_72-1	06.06.2022 07:41	Multibeam	20	54° 38.302' N	010° 56.670' E	profile end
AL574_73-1	05.06.2022 21:37	CTD	29	54° 36.863' N	010° 57.949' E	in the water
AL574_73-1	05.06.2022 21:39	CTD	29	54° 36.861' N	010° 57.936' E	on deck
AL574_74-1	06.06.2022 05:11	CTD	21	54° 38.111' N	010° 56.296' E	in the water
AL574_74-1	06.06.2022 05:12	CTD	20	54° 38.122' N	010° 56.290' E	on deck
AL574_75-1	06.06.2022 07:46	CTD	20	54° 38.259' N	010° 56.535' E	in the water
AL574_75-1	06.06.2022 07:47	CTD	20	54° 38.259' N	010° 56.535' E	on deck
AL574_76-1	06.06.2022 07:47	Multibeam	20	54° 38.260' N	010° 56.535' E	profile start
AL574_76-1	06.06.2022 08:37	Multibeam	27	54° 36.978' N	010° 56.411' E	profile end
AL574_77-1	06.06.2022 09:04	Gravity Corer	27	54° 37.176' N	010° 56.730' E	in the water
AL574_77-1	06.06.2022 09:08	Gravity Corer	27	54° 37.191' N	010° 56.730' E	on deck
AL574_78-1	06.06.2022 10:17	Gravity Corer	21	54° 37.898' N	010° 56.769' E	in the water
AL574_78-1	06.06.2022 10:21	Gravity Corer	21	54° 37.900' N	010° 56.774' E	on deck
AL574_79-1	07.06.2022 07:26	ADCP	11	54° 28.246' N	010° 13.791' E	profile start
AL574_79-1	07.06.2022 07:56	ADCP	12	54° 30.254' N	010° 16.237' E	profile end
AL574_80-1	07.06.2022 08:07	CTD	13	54° 30.121' N	010° 16.052' E	in the water
AL574_80-1	07.06.2022 08:10	CTD	13	54° 30.107' N	010° 16.041' E	on deck
AL574_81-1	07.06.2022 08:29	CTD	18	54° 29.078' N	010° 14.762' E	in the water
AL574_81-1	07.06.2022 08:34	CTD	18	54° 29.073' N	010° 14.753' E	on deck
AL574_82-1	07.06.2022 08:55	CTD	11	54° 28.304' N	010° 13.854' E	in the water
AL574_82-1	07.06.2022 08:59	CTD	12	54° 28.315' N	010° 13.914' E	on deck
AL574_83-1	07.06.2022 09:03	ADCP	11	54° 28.283' N	010° 13.836' E	profile start
AL574_83-1	07.06.2022 09:32	ADCP	12	54° 30.231' N	010° 16.204' E	profile end
AL574_84-1	07.06.2022 10:53	Grab	11	54° 29.921' N	010° 15.771' E	in the water

AL574_84-1	07.06.2022 10:54	Grab	12	54° 29.920' N	010° 15.778' E	on deck
AL574_85-1	07.06.2022 10:58	Grab	13	54° 29.859' N	010° 15.748' E	in the water
AL574_85-1	07.06.2022 11:00	Grab	13	54° 29.857' N	010° 15.738' E	on deck
AL574_85-2	07.06.2022 11:01	Grab	13	54° 29.856' N	010° 15.736' E	in the water
AL574_85-2	07.06.2022 11:02	Grab	13	54° 29.856' N	010° 15.740' E	on deck
AL574_86-1	07.06.2022 11:17	Grab	12	54° 29.885' N	010° 15.753' E	in the water
AL574_86-1	07.06.2022 11:18	Grab	12	54° 29.884' N	010° 15.758' E	on deck
AL574_87-1	07.06.2022 11:34	Grab	18	54° 28.764' N	010° 14.428' E	in the water
AL574_87-1	07.06.2022 11:35	Grab	18	54° 28.762' N	010° 14.418' E	on deck
AL574_88-1	07.06.2022 11:41	Grab	18	54° 28.632' N	010° 14.256' E	in the water
AL574_88-1	07.06.2022 11:43	Grab	18	54° 28.629' N	010° 14.264' E	on deck
AL574_89-1	07.06.2022 11:49	Grab	18	54° 28.507' N	010° 14.122' E	in the water
AL574_89-1	07.06.2022 11:51	Grab	18	54° 28.505' N	010° 14.116' E	on deck
AL574_90-1	07.06.2022 11:59	ADCP	11	54° 28.288' N	010° 13.822' E	profile start
AL574_90-1	07.06.2022 12:29	ADCP	12	54° 30.248' N	010° 16.235' E	profile end
AL574_91-1	08.06.2022 10:04	ADCP	10	54° 33.195' N	011° 04.791' E	profile start
AL574_91-1	08.06.2022 11:07	ADCP	24	54° 37.372' N	011° 08.500' E	profile end
AL574_92-1	08.06.2022 11:09	CTD	24	54° 37.381' N	011° 08.520' E	in the water
AL574_92-1	08.06.2022 11:19	CTD	24	54° 37.359' N	011° 08.525' E	on deck
AL574_93-1	08.06.2022 11:29	CTD	25	54° 36.894' N	011° 08.095' E	in the water
AL574_93-1	08.06.2022 11:36	CTD	25	54° 36.893' N	011° 08.102' E	on deck
AL574_94-1	08.06.2022 11:47	CTD	27	54° 36.446' N	011° 07.676' E	in the water
AL574_94-1	08.06.2022 11:52	CTD	27	54° 36.434' N	011° 07.673' E	on deck
AL574_95-1	08.06.2022 12:02	CTD	29	54° 35.957' N	011° 07.246' E	in the water
AL574_95-1	08.06.2022 12:07	CTD	29	54° 35.957' N	011° 07.247' E	on deck
AL574_96-1	08.06.2022 12:15	CTD	27	54° 35.501' N	011° 06.834' E	in the water
AL574_96-1	08.06.2022 12:20	CTD	27	54° 35.512' N	011° 06.833' E	on deck
AL574_97-1	08.06.2022 12:28	CTD	26	54° 35.035' N	011° 06.407' E	in the water
AL574_97-1	08.06.2022 12:34	CTD	26	54° 35.048' N	011° 06.389' E	on deck
AL574_98-1	08.06.2022 12:42	CTD	24	54° 34.577' N	011° 06.027' E	in the water
AL574_98-1	08.06.2022 12:50	CTD	24	54° 34.597' N	011° 05.990' E	on deck
AL574_99-1	08.06.2022 12:59	CTD	19	54° 34.135' N	011° 05.625' E	in the water
AL574_99-1	08.06.2022 13:04	CTD	19	54° 34.138' N	011° 05.619' E	on deck
AL574_100-1	08.06.2022 13:12	CTD	13	54° 33.648' N	011° 05.218' E	in the water
AL574_100-1	08.06.2022 13:17	CTD	13	54° 33.646' N	011° 05.182' E	on deck
AL574_101-1	08.06.2022 13:25	CTD	10	54° 33.194' N	011° 04.829' E	in the water
AL574_101-1	08.06.2022 13:28	CTD	10	54° 33.191' N	011° 04.812' E	on deck
AL574_102-1	08.06.2022 14:15	CTD	16	54° 35.004' N	010° 57.082' E	in the water
AL574_102-1	08.06.2022 14:16	CTD	16	54° 35.006' N	010° 57.087' E	on deck
AL574_103-1	08.06.2022 14:48	Multibeam	15	54° 34.954' N	010° 57.170' E	profile start
AL574_103-1	09.06.2022 05:13	Multibeam	22	54° 35.714' N	010° 57.261' E	profile end
AL574_104-1	08.06.2022 17:05	CTD	15	54° 34.599' N	011° 00.078' E	in the water
AL574_104-1	08.06.2022 17:07	CTD	15	54° 34.604' N	011° 00.062' E	on deck
AL574_105-1	08.06.2022 18:04	CTD	16	54° 34.630' N	011° 00.081' E	in the water
AL574_105-1	08.06.2022 18:05	CTD	16	54° 34.633' N	011° 00.072' E	on deck
AL574_106-1	08.06.2022 19:14	CTD	16	54° 34.685' N	011° 00.044' E	in the water
AL574_106-1	08.06.2022 19:16	CTD	16	54° 34.689' N	011° 00.020' E	on deck
AL574_107-1	08.06.2022 20:23	CTD	17	54° 34.733' N	011° 00.096' E	in the water
AL574_107-1	08.06.2022 20:25	CTD	17	54° 34.739' N	011° 00.064' E	on deck
AL574_108-1	08.06.2022 21:29	CTD	17	54° 34.735' N	011° 00.219' E	in the water
AL574_108-1	08.06.2022 21:31	CTD	17	54° 34.740' N	011° 00.202' E	on deck
AL574_109-1	08.06.2022 22:31	CTD	17	54° 34.745' N	011° 00.424' E	in the water
AL574_109-1	08.06.2022 22:34	CTD	17	54° 34.759' N	011° 00.406' E	on deck
AL574_110-1	08.06.2022 23:35	CTD	18	54° 34.841' N	011° 00.359' E	in the water
AL574_110-1	08.06.2022 23:38	CTD	18	54° 34.843' N	011° 00.351' E	on deck
AL574_111-1	09.06.2022 00:39	CTD	18	54° 34.886' N	011° 00.346' E	in the water
AL574_111-1	09.06.2022 00:41	CTD	18	54° 34.888' N	011° 00.337' E	on deck
AL574_112-1	09.06.2022 01:42	CTD	18	54° 34.972' N	011° 00.291' E	in the water
AL574_112-1	09.06.2022 01:44	CTD	18	54° 34.979' N	011° 00.293' E	on deck
AL574_113-1	09.06.2022 02:46	CTD	19	54° 35.007' N	011° 00.307' E	in the water
AL574_113-1	09.06.2022 02:48	CTD	19	54° 35.002' N	011° 00.299' E	on deck
AL574_114-1	09.06.2022 03:44	CTD	19	54° 35.101' N	011° 00.270' E	in the water
AL574_114-1	09.06.2022 03:46	CTD	20	54° 35.106' N	011° 00.260' E	on deck

AL574_115-1	09.06.2022 04:41	CTD	21	54° 35.167' N	011° 00.303' E	in the water
AL574_115-1	09.06.2022 04:42	CTD	21	54° 35.169' N	011° 00.295' E	on deck
AL574_116-1	09.06.2022 05:26	Multibeam	18	54° 35.358' N	010° 57.424' E	profile start
AL574_116-1	09.06.2022 06:22	Multibeam	19	54° 35.346' N	010° 57.646' E	profile end
AL574_117-1	09.06.2022 07:33	Grab	16	54° 34.956' N	010° 58.899' E	in the water
AL574_117-1	09.06.2022 07:34	Grab	16	54° 34.960' N	010° 58.903' E	on deck
AL574_118-1	09.06.2022 07:44	Grab	18	54° 34.982' N	010° 59.320' E	in the water
AL574_118-1	09.06.2022 07:45	Grab	18	54° 34.986' N	010° 59.322' E	on deck
AL574_119-1	09.06.2022 07:55	Grab	19	54° 34.990' N	010° 59.789' E	in the water
AL574_119-1	09.06.2022 07:56	Grab	19	54° 34.992' N	010° 59.788' E	on deck
AL574_120-1	09.06.2022 08:03	Grab	19	54° 35.002' N	010° 59.972' E	in the water
AL574_120-1	09.06.2022 08:05	Grab	19	54° 35.002' N	010° 59.974' E	on deck
AL574_121-1	09.06.2022 08:11	Grab	19	54° 34.976' N	011° 00.302' E	in the water
AL574_121-1	09.06.2022 08:12	Grab	19	54° 34.976' N	011° 00.304' E	on deck
AL574_122-1	09.06.2022 08:16	Grab	19	54° 34.979' N	011° 00.342' E	in the water
AL574_122-1	09.06.2022 08:18	Grab	19	54° 34.981' N	011° 00.345' E	on deck
AL574_122-2	09.06.2022 08:26	Grab	19	54° 34.979' N	011° 00.344' E	in the water
AL574_122-2	09.06.2022 08:28	Grab	19	54° 34.981' N	011° 00.343' E	on deck
AL574_123-1	09.06.2022 08:34	Grab	19	54° 34.979' N	011° 00.392' E	in the water
AL574_123-1	09.06.2022 08:35	Grab	19	54° 34.979' N	011° 00.392' E	on deck
AL574_124-1	09.06.2022 08:40	Grab	18	54° 34.984' N	011° 00.491' E	in the water
AL574_124-1	09.06.2022 08:41	Grab	18	54° 34.984' N	011° 00.493' E	on deck
AL574_125-1	09.06.2022 08:53	Grab	21	54° 35.167' N	011° 00.054' E	in the water
AL574_125-1	09.06.2022 08:55	Grab	21	54° 35.167' N	011° 00.057' E	on deck
AL574_126-1	09.06.2022 10:09	Grab	21	54° 35.174' N	011° 00.108' E	in the water
AL574_126-1	09.06.2022 10:10	Grab	21	54° 35.174' N	011° 00.109' E	on deck
AL574_127-1	09.06.2022 10:15	Grab	21	54° 35.175' N	011° 00.126' E	in the water
AL574_127-1	09.06.2022 10:16	Grab	21	54° 35.174' N	011° 00.129' E	on deck
AL574_128-1	09.06.2022 10:23	Grab	21	54° 35.177' N	011° 00.155' E	in the water
AL574_128-1	09.06.2022 10:24	Grab	21	54° 35.179' N	011° 00.155' E	on deck
AL574_129-1	09.06.2022 10:38	Grab	22	54° 35.257' N	011° 00.027' E	in the water
AL574_129-1	09.06.2022 10:39	Grab	22	54° 35.258' N	011° 00.028' E	on deck
AL574_130-1	09.06.2022 10:44	Grab	23	54° 35.257' N	011° 00.048' E	in the water
AL574_130-1	09.06.2022 10:45	Grab	23	54° 35.254' N	011° 00.048' E	on deck
AL574_131-1	09.06.2022 10:51	Grab	23	54° 35.257' N	011° 00.066' E	in the water
AL574_131-1	09.06.2022 10:52	Grab	22	54° 35.259' N	011° 00.070' E	on deck
AL574_131-2	09.06.2022 10:54	Grab	22	54° 35.258' N	011° 00.071' E	in the water
AL574_131-2	09.06.2022 10:55	Grab	22	54° 35.256' N	011° 00.072' E	on deck
AL574_132-1	09.06.2022 11:01	Grab	23	54° 35.255' N	011° 00.115' E	in the water
AL574_132-1	09.06.2022 11:02	Grab	23	54° 35.256' N	011° 00.114' E	on deck
AL574_133-1	09.06.2022 12:01	Underwater Video System	19	54° 35.343' N	010° 57.754' E	in the water
AL574_133-1	09.06.2022 12:28	Underwater Video System	19	54° 35.360' N	010° 57.862' E	on deck
AL574_134-1	09.06.2022 12:44	Underwater Video System	20	54° 35.210' N	010° 59.106' E	in the water
AL574_134-1	09.06.2022 13:05	Underwater Video System	20	54° 35.251' N	010° 59.262' E	on deck
AL574_135-1	09.06.2022 13:16	Underwater Video System	21	54° 35.153' N	011° 00.005' E	in the water
AL574_135-1	09.06.2022 13:42	Underwater Video System	21	54° 35.178' N	011° 00.210' E	on deck
AL574_136-1	09.06.2022 15:16	CTD	28	54° 29.976' N	011° 24.495' E	in the water
AL574_136-1	09.06.2022 15:18	CTD	28	54° 29.978' N	011° 24.501' E	on deck
AL574_137-1	09.06.2022 15:23	Multibeam	28	54° 29.890' N	011° 24.992' E	profile start
AL574_137-1	10.06.2022 01:58	Multibeam	28	54° 30.518' N	011° 22.540' E	profile end
AL574_138-1	09.06.2022 17:53	CTD	25	54° 21.698' N	011° 40.228' E	in the water
AL574_138-1	09.06.2022 17:54	CTD	25	54° 21.703' N	011° 40.216' E	on deck
AL574_139-1	09.06.2022 20:29	CTD	28	54° 29.843' N	011° 24.823' E	in the water
AL574_139-1	09.06.2022 20:32	CTD	28	54° 29.845' N	011° 24.861' E	on deck
AL574_140-1	09.06.2022 23:07	CTD	25	54° 21.602' N	011° 40.177' E	in the water
AL574_140-1	09.06.2022 23:09	CTD	25	54° 21.600' N	011° 40.148' E	on deck
AL574_141-1	10.06.2022 02:03	CTD	29	54° 30.520' N	011° 22.357' E	in the water
AL574_141-1	10.06.2022 02:05	CTD	29	54° 30.519' N	011° 22.364' E	on deck
AL574_142-1	10.06.2022 04:50	Multibeam	19	54° 28.400' N	011° 20.722' E	profile start

AL574_142-1	10.06.2022 07:23	Multibeam	27	54° 29.930' N	011° 23.739' E	profile end
AL574_143-1	10.06.2022 05:14	CTD	27	54° 29.719' N	011° 23.176' E	in the water
AL574_143-1	10.06.2022 05:16	CTD	27	54° 29.718' N	011° 23.188' E	on deck
AL574_144-1	10.06.2022 07:30	Box Corer	27	54° 29.925' N	011° 24.047' E	in the water
AL574_144-1	10.06.2022 07:33	Box Corer	27	54° 29.919' N	011° 24.047' E	on deck
AL574_145-1	10.06.2022 07:51	Box Corer	27	54° 29.910' N	011° 24.109' E	in the water
AL574_145-1	10.06.2022 07:54	Box Corer	27	54° 29.909' N	011° 24.112' E	on deck
AL574_145-2	10.06.2022 08:09	Box Corer	27	54° 29.904' N	011° 24.107' E	in the water
AL574_145-2	10.06.2022 08:12	Box Corer	27	54° 29.907' N	011° 24.109' E	on deck
AL574_146-1	10.06.2022 08:35	Gravity Corer	27	54° 29.930' N	011° 24.050' E	in the water
AL574_146-1	10.06.2022 08:41	Gravity Corer	27	54° 29.943' N	011° 24.061' E	on deck
AL574_147-1	10.06.2022 09:23	Multibeam	28	54° 29.956' N	011° 23.870' E	profile start
AL574_147-1	10.06.2022 09:26	Multibeam	28	54° 29.881' N	011° 24.218' E	profile end
AL574_148-1	10.06.2022 09:58	Grab	28	54° 29.920' N	011° 24.000' E	in the water
AL574_148-1	10.06.2022 10:00	Grab	28	54° 29.920' N	011° 23.997' E	on deck
AL574_149-1	10.06.2022 10:05	Grab	28	54° 29.925' N	011° 24.022' E	in the water
AL574_149-1	10.06.2022 10:08	Grab	28	54° 29.927' N	011° 24.022' E	on deck
AL574_150-1	10.06.2022 10:22	Grab	28	54° 29.913' N	011° 24.024' E	in the water
AL574_150-1	10.06.2022 10:25	Grab	28	54° 29.923' N	011° 24.028' E	on deck
AL574_150-2	10.06.2022 10:34	Grab	28	54° 29.911' N	011° 24.021' E	in the water
AL574_150-2	10.06.2022 10:35	Grab	28	54° 29.912' N	011° 24.020' E	on deck
AL574_151-1	10.06.2022 10:55	Grab	28	54° 29.910' N	011° 24.044' E	in the water
AL574_151-1	10.06.2022 10:57	Grab	28	54° 29.911' N	011° 24.044' E	on deck
AL574_152-1	10.06.2022 11:19	Underwater Video System	28	54° 29.952' N	011° 23.914' E	in the water
AL574_152-1	10.06.2022 11:45	Underwater Video System	28	54° 29.906' N	011° 24.147' E	profile start
AL574_153-1	10.06.2022 13:32	CTD	11	54° 20.750' N	011° 06.098' E	in the water
AL574_153-1	10.06.2022 13:33	CTD	11	54° 20.750' N	011° 06.100' E	on deck
AL574_154-1	10.06.2022 13:41	SES2000	9	54° 20.875' N	011° 06.197' E	profile start
AL574_154-1	10.06.2022 20:27	SES2000	11	54° 10.730' N	011° 05.533' E	profile end
AL574_155-1	10.06.2022 20:41	CTD	19	54° 10.217' N	011° 06.437' E	in the water
AL574_155-1	10.06.2022 20:42	CTD	19	54° 10.215' N	011° 06.432' E	on deck
AL574_156-1	11.06.2022 07:55	Gravity Corer	19	54° 12.061' N	011° 07.968' E	in the water
AL574_156-1	11.06.2022 07:58	Gravity Corer	18	54° 12.065' N	011° 07.963' E	on deck
AL574_156-2	11.06.2022 08:13	Gravity Corer	18	54° 12.061' N	011° 07.967' E	in the water
AL574_156-2	11.06.2022 08:17	Gravity Corer	18	54° 12.065' N	011° 07.965' E	on deck
AL574_156-3	11.06.2022 08:25	Grab	18	54° 12.062' N	011° 07.970' E	in the water
AL574_156-3	11.06.2022 08:27	Grab	18	54° 12.062' N	011° 07.970' E	on deck
AL574_157-1	11.06.2022 08:48	Grab	17	54° 12.496' N	011° 08.325' E	in the water
AL574_157-1	11.06.2022 08:50	Grab	17	54° 12.495' N	011° 08.325' E	on deck
AL574_158-1	11.06.2022 09:49	Grab	20	54° 09.669' N	011° 07.231' E	in the water
AL574_158-1	11.06.2022 09:51	Grab	20	54° 09.666' N	011° 07.229' E	on deck
AL574_159-1	11.06.2022 10:04	Grab	20	54° 09.920' N	011° 06.819' E	in the water
AL574_159-1	11.06.2022 10:06	Grab	20	54° 09.923' N	011° 06.815' E	on deck
AL574_159-2	11.06.2022 10:19	Gravity Corer	20	54° 09.917' N	011° 06.822' E	in the water
AL574_159-2	11.06.2022 10:23	Gravity Corer	20	54° 09.905' N	011° 06.853' E	on deck
AL574_158-2	11.06.2022 10:43	Gravity Corer	20	54° 09.669' N	011° 07.228' E	in the water
AL574_158-2	11.06.2022 10:46	Gravity Corer	20	54° 09.679' N	011° 07.209' E	on deck
AL574_160-1	11.06.2022 11:08	Gravity Corer	20	54° 09.670' N	011° 07.232' E	in the water
AL574_160-1	11.06.2022 11:12	Gravity Corer	20	54° 09.668' N	011° 07.232' E	on deck
AL574_161-1	11.06.2022 15:08	CTD	25	54° 36.502' N	011° 04.109' E	in the water
AL574_161-1	11.06.2022 15:09	CTD	25	54° 36.493' N	011° 04.108' E	on deck
AL574_162-1	11.06.2022 15:22	Multibeam	22	54° 36.520' N	011° 02.669' E	profile start
AL574_162-1	12.06.2022 01:32	Multibeam	29	54° 35.553' N	011° 02.542' E	profile end
AL574_163-1	11.06.2022 19:55	CTD	36	54° 36.205' N	010° 59.983' E	in the water
AL574_163-1	11.06.2022 19:58	CTD	35	54° 36.191' N	010° 59.939' E	on deck
AL574_164-1	11.06.2022 22:59	CTD	26	54° 35.864' N	011° 04.670' E	in the water
AL574_164-1	11.06.2022 23:02	CTD	26	54° 35.867' N	011° 04.637' E	on deck
AL574_165-1	12.06.2022 01:35	CTD	29	54° 35.517' N	011° 02.613' E	in the water
AL574_165-1	12.06.2022 01:40	CTD	29	54° 35.515' N	011° 02.597' E	on deck
AL574_166-1	12.06.2022 01:59	Multibeam	25	54° 36.296' N	011° 00.473' E	profile start
AL574_166-1	12.06.2022 06:15	Multibeam	25	54° 35.435' N	011° 00.470' E	profile end
AL574_167-1	12.06.2022 02:25	CTD	26	54° 37.206' N	010° 57.523' E	in the water

AL574_167-1	12.06.2022 02:26	CTD	26	54° 37.208' N	010° 57.535' E	on deck
AL574_168-1	12.06.2022 03:51	CTD	37	54° 36.127' N	011° 00.518' E	in the water
AL574_168-1	12.06.2022 03:54	CTD	37	54° 36.121' N	011° 00.527' E	on deck
AL574_169-1	12.06.2022 06:25	CTD	24	54° 35.536' N	011° 00.526' E	in the water
AL574_169-1	12.06.2022 06:26	CTD	24	54° 35.530' N	011° 00.521' E	on deck
AL574_170-1	12.06.2022 06:30	ADCP	24	54° 35.518' N	011° 00.506' E	profile start
AL574_170-1	12.06.2022 06:46	ADCP	23	54° 36.373' N	011° 00.691' E	profile end
AL574_171-1	12.06.2022 06:53	CTD	25	54° 36.376' N	011° 00.702' E	in the water
AL574_171-1	12.06.2022 06:54	CTD	25	54° 36.369' N	011° 00.697' E	on deck
AL574_172-1	12.06.2022 07:01	CTD	40	54° 36.179' N	011° 00.639' E	in the water
AL574_172-1	12.06.2022 07:06	CTD	41	54° 36.167' N	011° 00.625' E	on deck
AL574_173-1	12.06.2022 07:07	CTD	40	54° 36.166' N	011° 00.630' E	in the water
AL574_173-1	12.06.2022 07:16	CTD	39	54° 36.156' N	011° 00.671' E	on deck
AL574_174-1	12.06.2022 07:25	CTD	34	54° 36.027' N	011° 00.668' E	in the water
AL574_174-1	12.06.2022 07:28	CTD	34	54° 36.021' N	011° 00.656' E	on deck
AL574_175-1	12.06.2022 07:29	CTD	34	54° 36.020' N	011° 00.656' E	in the water
AL574_175-1	12.06.2022 07:37	CTD	33	54° 36.011' N	011° 00.639' E	on deck
AL574_176-1	12.06.2022 07:53	CTD	34	54° 35.649' N	011° 02.068' E	in the water
AL574_176-1	12.06.2022 07:55	CTD	34	54° 35.655' N	011° 02.080' E	on deck
AL574_177-1	12.06.2022 07:56	CTD	34	54° 35.654' N	011° 02.083' E	in the water
AL574_177-1	12.06.2022 08:01	CTD	34	54° 35.634' N	011° 02.102' E	on deck
AL574_178-1	12.06.2022 08:10	CTD	34	54° 36.044' N	011° 02.028' E	in the water
AL574_178-1	12.06.2022 08:13	CTD	34	54° 36.041' N	011° 02.043' E	on deck
AL574_179-1	12.06.2022 08:14	CTD	35	54° 36.039' N	011° 02.049' E	in the water
AL574_179-1	12.06.2022 08:19	CTD	35	54° 36.031' N	011° 02.068' E	on deck
AL574_180-1	12.06.2022 08:27	CTD	35	54° 36.320' N	011° 02.067' E	in the water
AL574_180-1	12.06.2022 08:29	CTD	35	54° 36.316' N	011° 02.067' E	on deck
AL574_181-1	12.06.2022 08:30	CTD	35	54° 36.316' N	011° 02.069' E	in the water
AL574_181-1	12.06.2022 08:35	CTD	35	54° 36.303' N	011° 02.079' E	on deck
AL574_182-1	12.06.2022 08:44	CTD	22	54° 36.504' N	011° 02.095' E	in the water

7 Data and Sample Storage and Availability

Sediment samples and core material will be stored at Ifg CAU Kiel and is available for further analysis. Digital data is stored on the groups servers and will be subject to further analysis. After a moratorium period of 2 years (July 2024) the data is freely available upon request to Prof. Christian Winter.

8 Acknowledgements

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