DANMARKS OG GRØNLANDS GEOLOGISKE UNDERSØGELSE RAPPORT 2007/1

Multibeam and sidescan sonar survey in Kattegat Cruise Report

Habitat mapping of the Natura 2000 site 168: Læsø Trindel and Tønneberg Banke, Kattegat, Denmark

Jørgen O. Leth & Zyad Alhamdani

GEOLOGICAL SURVEY OF DENMARK AND GREENLAND
MINISTRY OF THE ENVIRONMENT

GEUS

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A research and development project between Skov- og Naturstyrelsen, Orbicon A/S and GEUS, 2005

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Indhold

1. Introduction

A survey has been conducted in the area of Læsø Trindel situated in the northern part of Kattegat, Denmark (figure 1). The aim of the field survey was to assess new tools for broad scale mapping and classification of marine habitats by combining acoustic methods with diver activities. The Natura 2000 site 168, Læsø Trindel and Tønneberg Banke was chosen as testing site due to the known presence of various Habitats Directive Annex 1 habitats (1110 Sandbanks, 1170 Reefs and 1180 Submarine structures made by leaking gases. See figure 2.

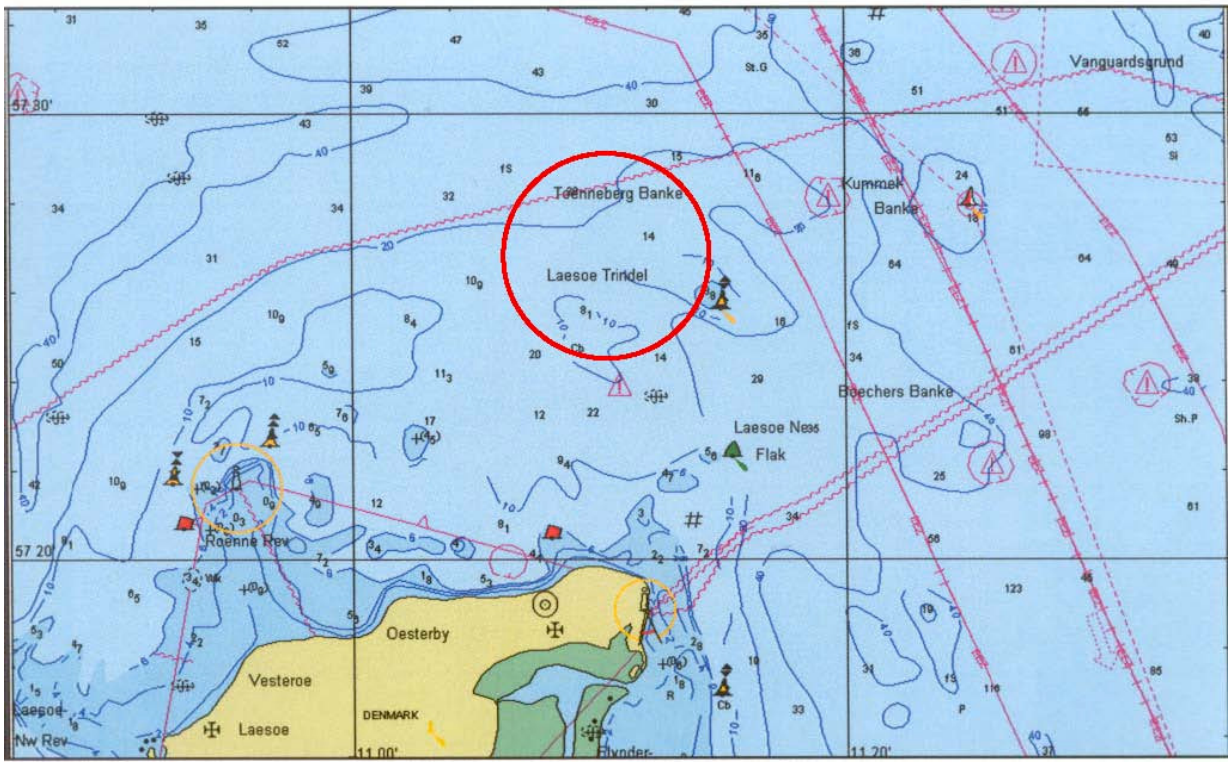

Figure 1. Location map of the Natura 2000 site 168, Læsø Trindel and Tønneberg Banke in the northern Kattegat, Denmark.

During the project, the applicability of the combined use of multibeam sonar and sidescan sonar systems has been tested as a tool for mapping of marine habitats. The project aims at providing evidence on the intercalibration of newly acquired acoustic data with other geological and biological information acquired from a dive survey within the Natura 2000 site. Initially the study area for acoustic surveying was delimited and the project partners fixed the order of priority. The acoustic survey was in performed September 2005 by The Geological Survey of Denmark and Greenland (GEUS).

Based on a preliminary interpretation of the acoustic data, features and sites for the subsequent ground truthing by diving were decided. Hedeselskabet A/S (now Orbicon) performed diving in October 2005. Dependent on the type of acoustic features and the state of the substrate GEUS suggested either paravane diving or point diving to be performed. I.e. objects or other pro-

nounced local features were inspected by point diving, while larger areas of specific types and change of substrate were inspected by paravane diving. The results of the ground truthing were subsequently integrated with the acoustic data set and the initial interpretation of the substratum was adjusted and extrapolated within the project area.

During the survey period, the study area was split into two sub-areas to ensure an acceptable set of acoustic data to be acquired in the available survey period in defiance of downtime due to bad weather or technical breakdowns. These sub-areas consist of a southwestern part, which has been affected by dredging, and a central part including the Læsø Trindel proper (see figure 10). Due to bad weather in two days the two sub-areas unfortunately were not connected by the survey. The present study has been concentrated on the central part of the Læsø Trindel.

The study was conducted partly to fulfil the obligations to the research and development contract 2005 between The Geological Survey of Denmark and Greenland (GEUS) and the Danish Forest and Nature Agency and partly to fulfil the Danish obligations to the EU BSR INTERREG IIIB project BALANCE.

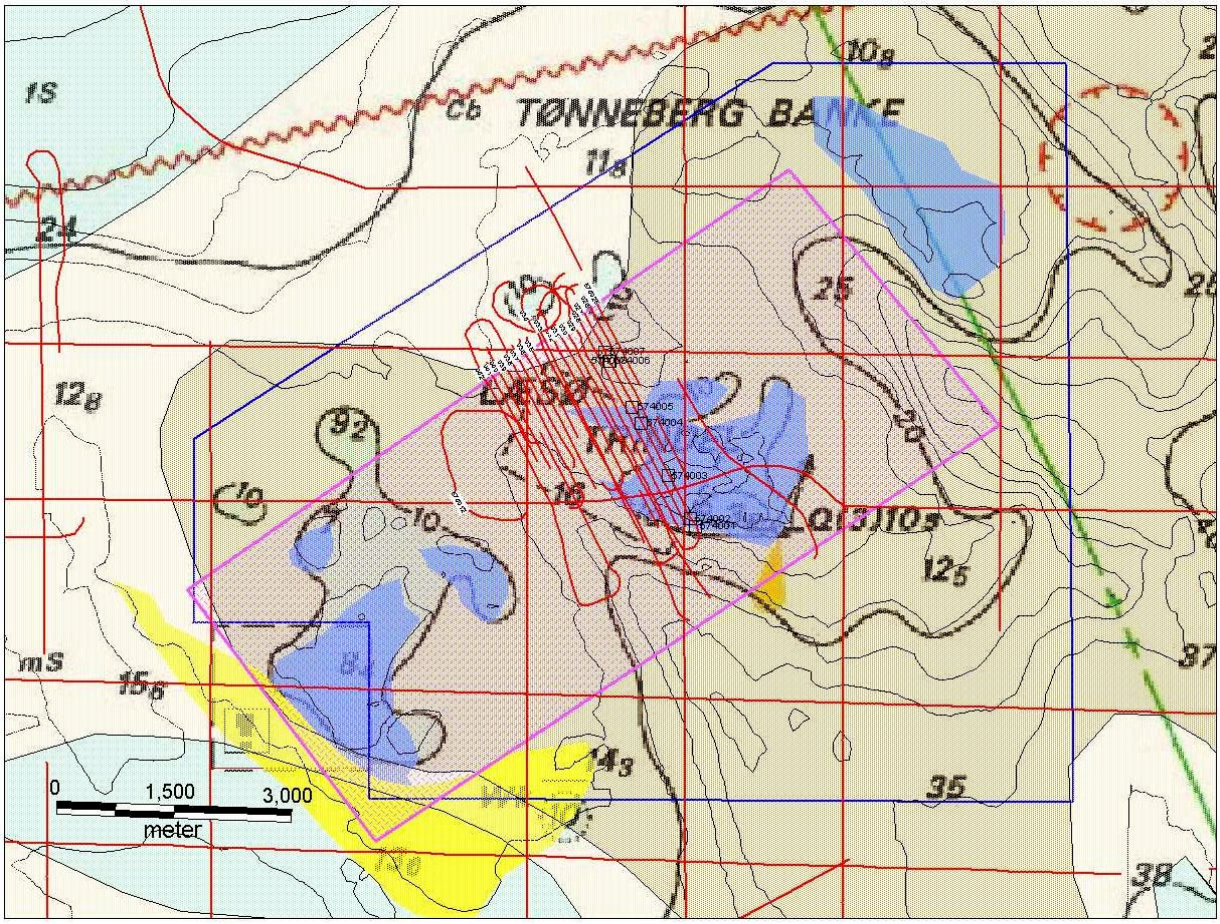

Figure 2. The Natura 2000 site 168, Læsø Trindel and Tønneberg Banke indicated by the blue box. The designated Habitats Directive Annex 1 habitats (1110 Sandbanks = yellow and 1170 Reefs = blue). Purple box marks the planned survey area. Red lines mark the existing geophysical survey lines.

2. Geological framework

The presence of Læsø Trindel stone reef and its variability is closely linked to the geological development of the area. The geology of the Læsø Trindel area is described as a vast accumulation of glacigenic deposits. The type and distribution of the coarse grained sediments giving rise to the stone reef indicates deposition and deformation in an ice marginal zone during the last glacial period. Based on the interpretation of seismic data deformation by thrusting and folding causes complex layering of the sediments. Furthermore, the morphology of the glacial surface is quite undulating with a relief of up to 10 m throughout the entire area (Larsen, 1996).

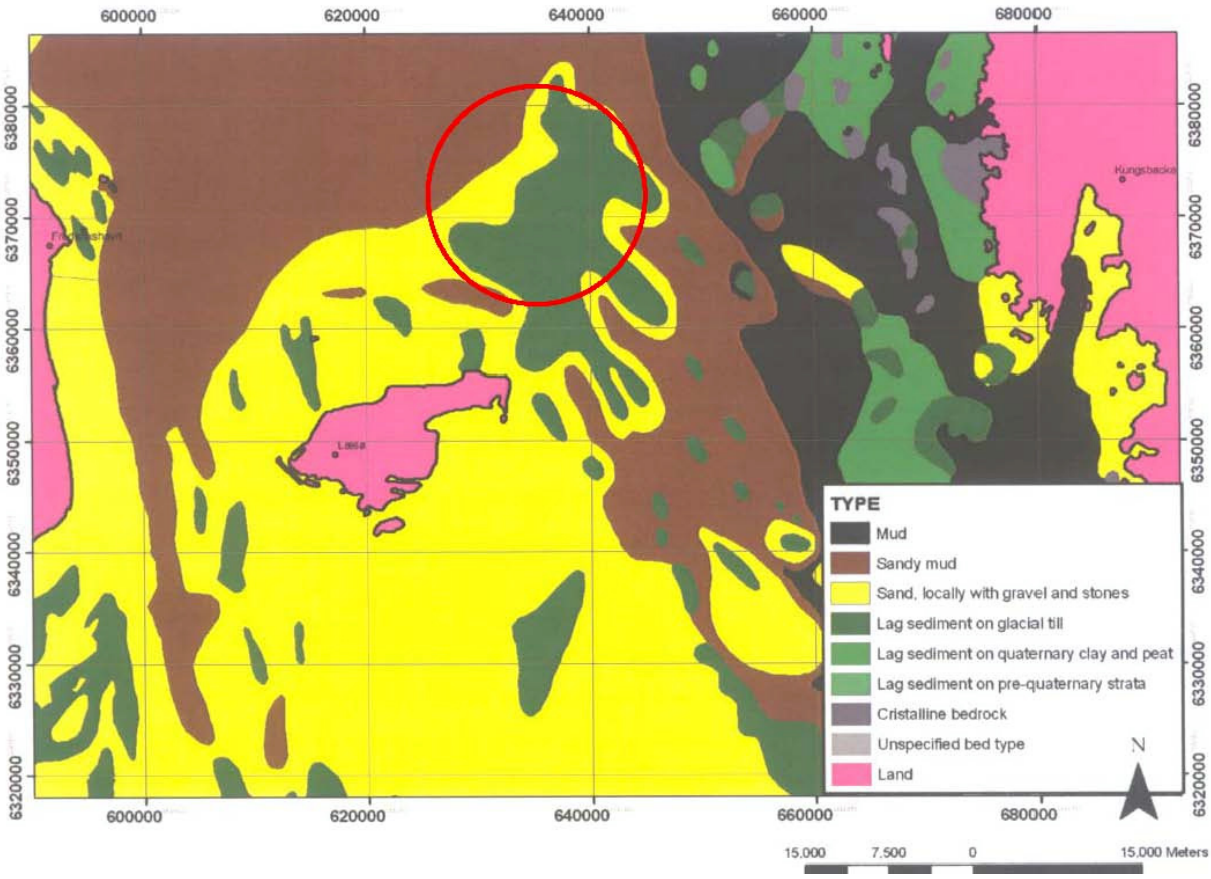

Figure 2. Seabed sediments surrounding the study area (red circle) north of the island of Læsø. From Hermansen and Jensen (2000).

At the Læsø Trindel proper, the supposed glacigenic formations outcrop with a high frequency of cobbles and boulder in the surface layers. In general, thin layers of reworked residual sandy and gravely sediments and marine postglacial sand cover the glacigenic deposits (Larsen, 1996). The detailed mapping of the morphology and the seabed sediment distribution, however, indicates a considerable variation of the stone coverage throughout the area. This expresses different depositional processes in the glacial or late glacial period, e.g. intense erosion, sub-glacial processes or deposition in front of the glacier during the late glacial period. More of these processes could explain the presence of cave-forming layers of cobbles and boulder. Moraine deposits have never

been recognised in the area, neither onshore nor offshore. The sub-surface of Læsø Trindel has recently been penetrated in boreholes (Skov- og Naturstyrelsen, 2006) indicating that late glacial clay - the so-called Yoldia Clay – is widespread in the area.
But some tectonic movements of Læsø have been documented, which most likely have influenced the distribution of sediments in the area. Aggregate extraction from the reef, especially by the removal of boulders by man, had a provable negative influence of the amount of stones present. In the surroundings to the Læsø Trindel the glacial surface submerge and the sediments there become dominated by late glacial marine clay and mud accumulated in the basins to the south and east of the Læsø Trindel.

A geological survey has been conducted by GEUS in 1996 with the aim of evaluate the marine sand and gravel resources in the Læsø Trindel area (see figure 2). Based on the interpretation of boomer, chirp and side scan sonar data combined with 8 sediment samples a map of the surface sediments has been constructed (figure 3). The eastern part of the 1996 survey area is covered by the present survey.

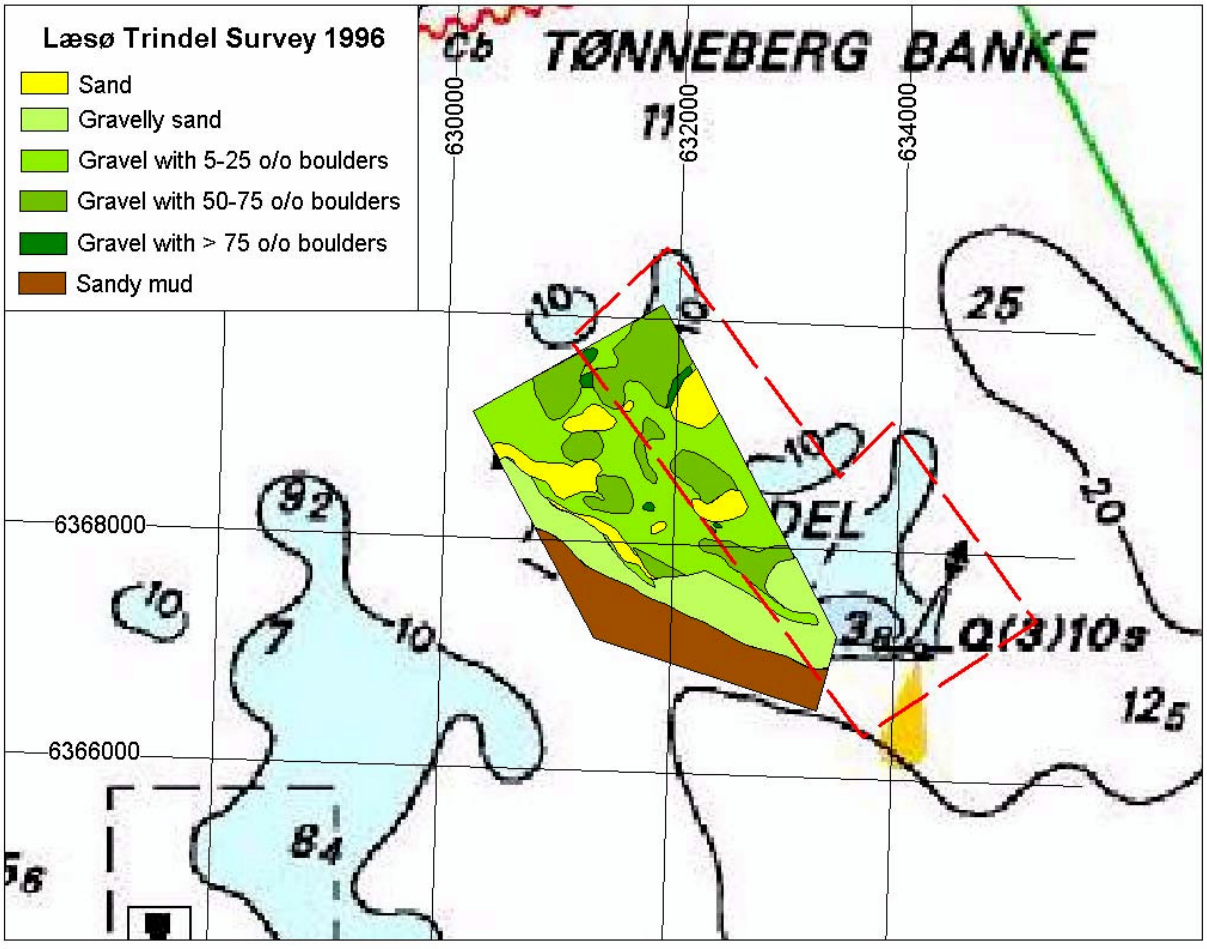

Figure 3. The sediment distribution and boulder coverage mapped based on GEUS 1996-data. The red box indicates the present study area. Coordinate system is UTM WGS84, zone 32).

2.1 Bathymetry

The bathymetry of northern Kattegat around the island of Læsø is very irregular with depths reaching 123 m only 12 km east of Læsø, whereas flat areas and reefs with shallow water depths less than 10 m extend in north-easterly and north-westerly direction like the shallow reef structures at the Læsø Trindel. According to the existing navigation chart, the shallowest part of Læsø Trindel reaches a minimum water depth of 3.8 m. The top of the Læsø Trindel plateau has an extension of app. 2x2 km with the water depth varying between 3.8 m and 10 m (figure 4).

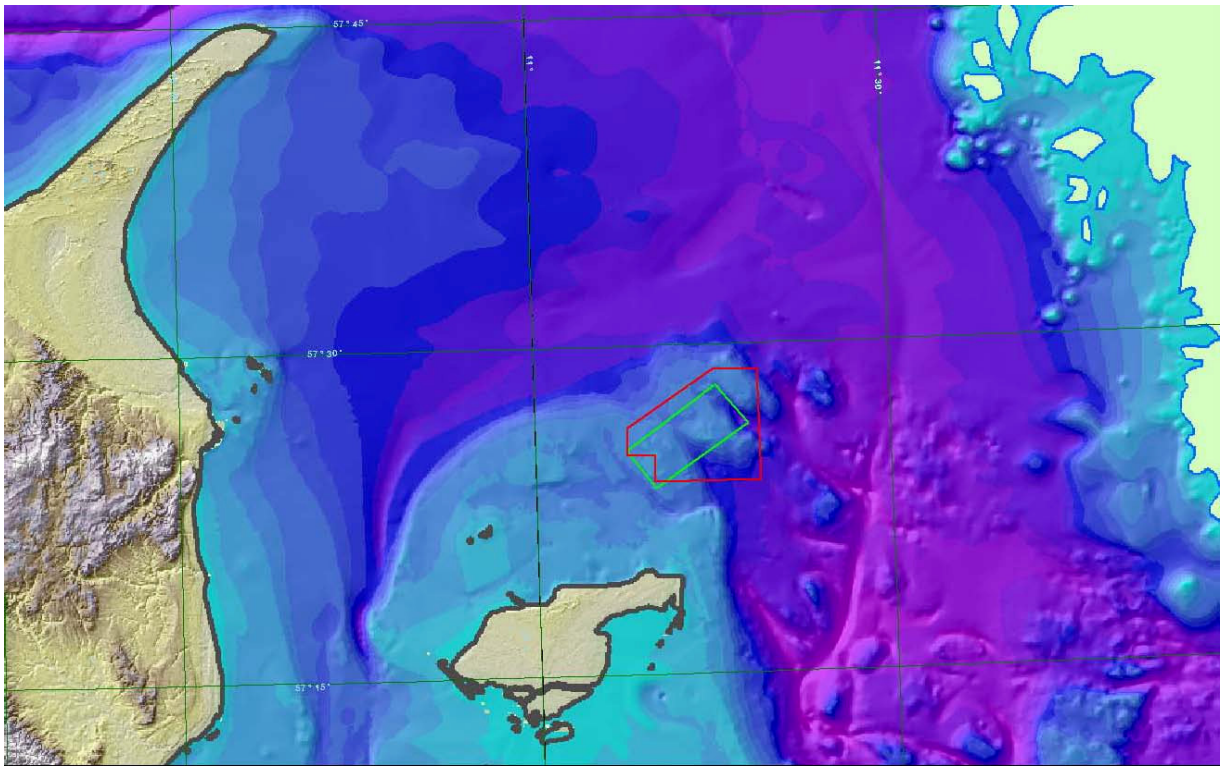

Figure 4. Bathymetric map of the northern Kattegat. The red box indicates The Natura 2000 site 168, Læsø Trindel and Tønneberg Banke. The green box indicates the planned survey area. Coordinate system is WGS84, zone 32.

2.2 Hydrography

The northern Kattegat is characterized by a transition area between the inflowing saline water of Skagerrak and the brackish outflowing water of the Baltic Sea. The mixing of these water masses is prominent north of Læsø in the so-called Kattegat – Skagerrak front. Despite the mixing process there is a permanent layering of the water column is present in the northern and the central part of Kattegat where saline dense water is found deeper than 12-15 m.

The prevailing directions of the currents are north and north-west. From modeling results, the maximum current speed has been established to be in the order of 1.0 m/s. The maximum tidal

induced current has been found to be in the order of 0.5 m/s. The maximum tidal amplitudes in the area are about 0.3 m. From modeling results (2 years hindcast) is has been established that the water level varies between +0.8 m and –0.6 m. With the prevailing wind directions from the north, north-west and south-east the impact on the area from wave action, however, is limited due to wave breaking at the edges i.e. the maximum wave height is found to be in the order of 4.5 m (ref. DHI modeling with a hindcast of 2 years).

3. The cruise and preparation and sea trials

3.1 Measurement and dimension control

The multibeam system has been purchased by GEUS and delivered by Kongsberg just before the onset of the present project. Prior to the survey the measurement and dimension control of the Kongsberg EM3000 Dual multibeam system, the MRU-5E, the Seapath 20, the DGPS and the deck level was performed at the vessel Line in the dock of Rødvig Harbour by Blom Maritime by assistance of representatives from Kongsberg Maritime and GEUS. The position of the sonar head and other measuring devices were carefully measured and referenced to a common datum and documented as part of the system integration and SAT (Sea Acceptance Test).

The dimension control report from Blom Maritime is attached in the appendix 1.

3.2 Calibration of the multibeam system

Kongsberg Maritime conducted the Sea Acceptance Test and calibration of the multibeam system in Copenhagen harbour and on the 3 days test cruises in Øresund with the participation of GEUS scientific and technical representatives.

A calibration procedure was followed to calibrate the two sonar heads for roll and pitch. The calibrating values were then stored in the instillation parameters file to be used later on in processing.

3.3 Shipboard scientific party

From GEUS the following personnel have been taken part in the data acquisition at Læsø Trindel:

Zyad Alhamdani, scientist Jørgen O. Leth, scientist Steen Lomholt, scientist Peter Trøst Jørgensen, electronic technician Egon Hansen, electronic technician

3.4 The cruise dairy

In the following table 1 the activities of the survey period is listed.

Date/time 2005	Activity
August, 22nd – 24rd	Measurement and dimension control of the multibeam system on-board the vessel Line by Blom Maritime at the dock of Rødvig Harbour.
August, 25th – 7th	Sea trials and calibration of the multibeam system in Øresund by Kongsberg and GEUS representatives.
August 28th – 29th	Line on transit from Copenhagen to Læsø. Arrival at Læsø 18:00.
August, 30th	Preparation and mobilisation at Østerby Harbour 07:00 – 15:00.
August, 31st	Dep. Østerby 07:45. Survey lines tr002 – tr011. Arrival at Østerby 19:00. No side scan sonar data.
September, 1st	Downtime at Østerby due to bad weather condition after attemped survey lines tr11 and tr12.
September, 2nd	Dep. Østerby 07:30. Survey lines tr014 – tr34. Arrival at Østerby 18:00. Change of GEUS crew. SLO leaves, AKZ and JOL arrive.
September, 3rd	Dep. Østerby 11:45. Awaiting the wind to decrease. Survey started 13:25. Survey lines tr36 – tr49. Arrival at Østerby 21:00.
September, 4th	Dep. Østerby 08:30. Survey lines tr50 – tr75. Arrival at Østerby 20:00.
September, 5th	Dep. Østerby 07:30. Survey lines tr76 – tr102. Arrival at Østerby 20:00.
September, 6th	Dep. Østerby 07:30. Survey lines tr103 – tr121. Arrival at Østerby 20:00. Exchange of technicians: PTJ leaves and EGH arrives.
September, 7th	Dep. Østerby 07:30. Survey lines tr122 – tr138. Arrival at Østerby 20:00.
September, 8th – 9th	Line on transit from Læsø to Copenhagen

Table 1. The full cruise dairy with the list of activities.

The logsheet of the survey listing the details of the data acquisition is attached in the appendix 2.

4. Survey methods

The methods used have been chosen to fulfil the aim of the project, an assessment of the combined use of marine acoustics and ground truthing by diving to classify and map marine habitats.

4.1 The acoustic survey systems

Two remote sensing instruments were deployed in this survey, namely: the multibeam sonar system (MBS) and the sidescan sonar system (SSS). Auxiliary systems like the navigation and positioning systems as well as the sound velocity profiler were also used in this survey.

4.1.1 The multibeam sonar system (MBS)

The used system is a high resolution Kongsberg EM3002D dual head seabed mapping system. Each head delivers a 1.5° beam for transmission and reception, where the swath coverage of the dual head system can reach up to 10 times the water depth. In the highdensity mode of operation each head acquires up to 254 soundings per ping. The operating frequencies are 293 and 307 kHz to avoid interference between the two heads. The operation range of the system is from 1m to 150m, which is also a function of salinity and temperature. The depth resolution is very high (~1cm), the across track measurement accuracy is a function of depth and the distance from nadir position, a nominal range resolution of 5 cm is reported (figure 5).

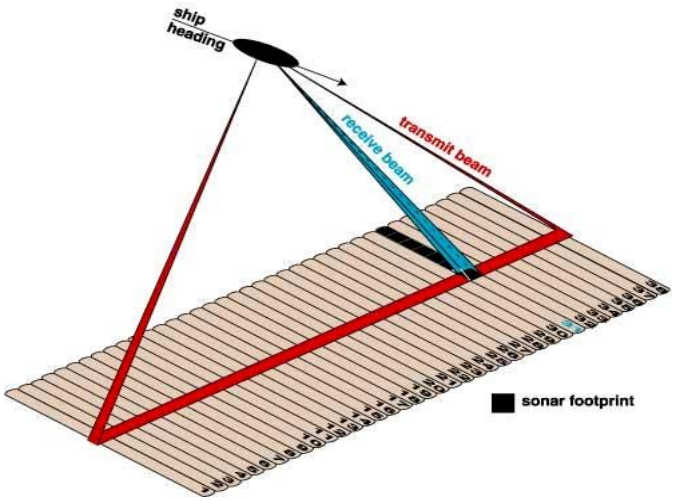

Figure 5. Schematic diagram of multibeam system operation.

Figure 6. The Kongsberg EM3002D pole mounted at the stern of the survey vessel Line with the Seatex Seapath 20 GPS compass mounted on top of the pole.

The Kongsberg's company engineers performed calibration in Copenhagen harbour and sea trials in the nearby Øresund (figure 6). The ship then transferred to Læsø with the MBS lifted out of the water for safety reasons. The MBS transmit across track fan shaped beam, which can be electronically stabilized for pitch, and the received beams are electronically stabilized for roll. The pitch, roll, heave, heading and the applied stabilization are all taken into account when calculating the sounding depths and positions.

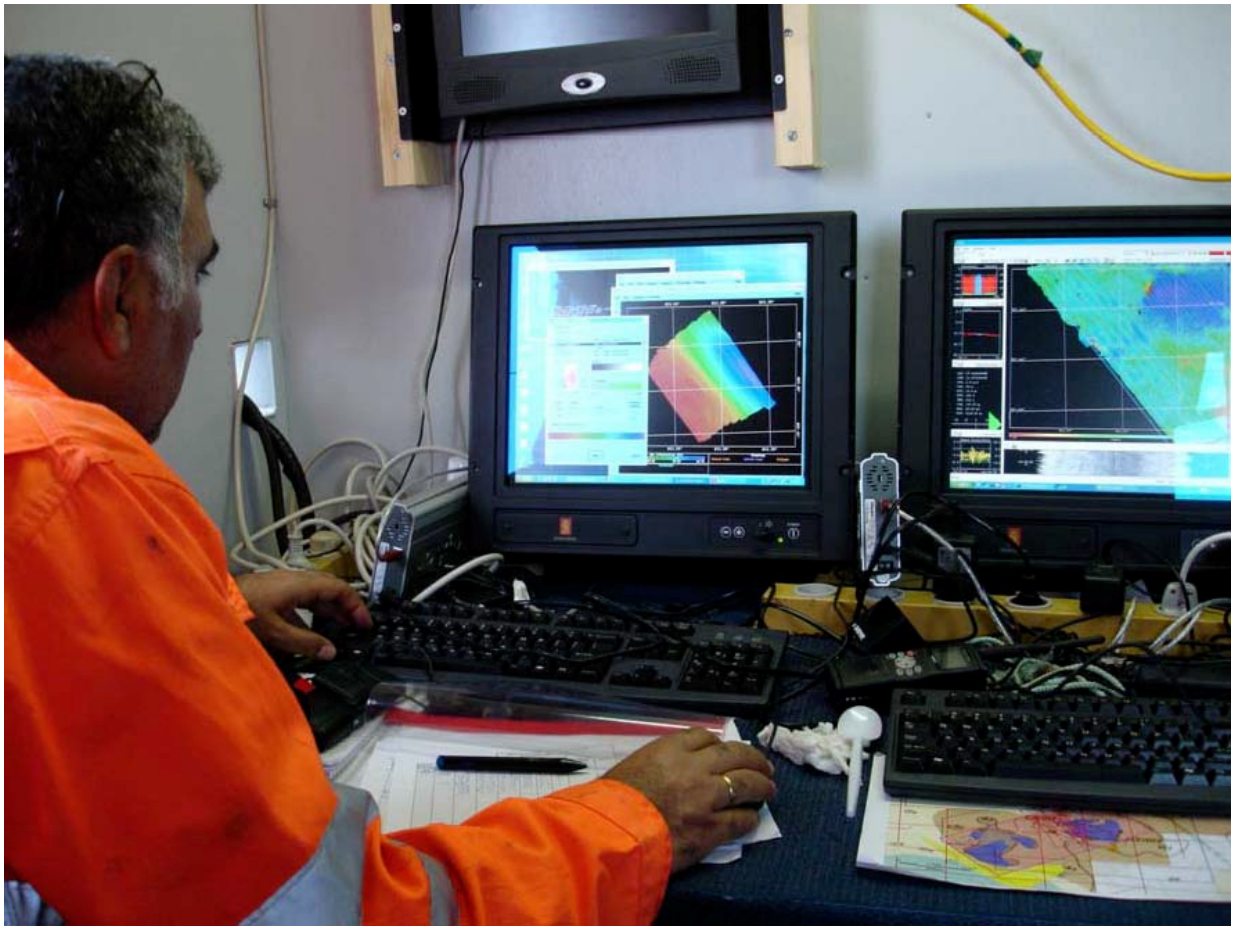

Figure 7. On-line multibeam data acquisition with the Kongsberg E3003D system at the Læsø Trindel.

4.1.2 The Side Scan Sonar (SSS)

The EdgeTech DF1000 dual frequency digital side scan sonar was towed behind the survey boat at a safe distance together with the hydrophone array. The system operates at two frequencies; 100 and 500 kHz corresponding to a standard and high-resolution operation respectively. The system generates a fan shape beam in the cross track direction with 50° beam width (figure 8). In the along track direction the beam width is 1.2° for the 100 kHz operation and 0.5° when the 500 kHz option is used. A nominal operating range of 200300m is reported and that depends on the type of the benthic sediments, and to a minor extent on temperature and salinity. A 12 knots maximum surveying speed is given in the manual, but a survey cruise of 6 knots was found to be

adequate for the survey in hand (figure 9). The resulting side scan picture is of high resolution and considered being very useful for seabed habitat mapping.

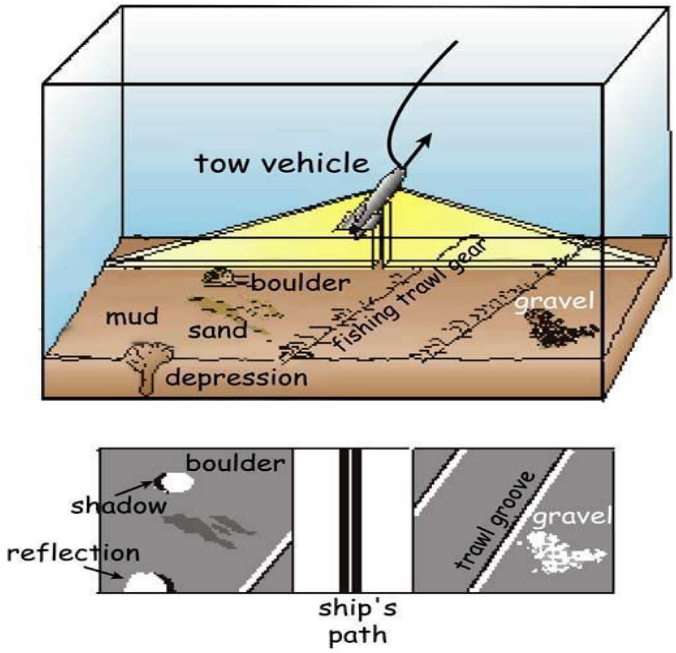

Figure 8. Schematic diagram of the sidescan sonar operation

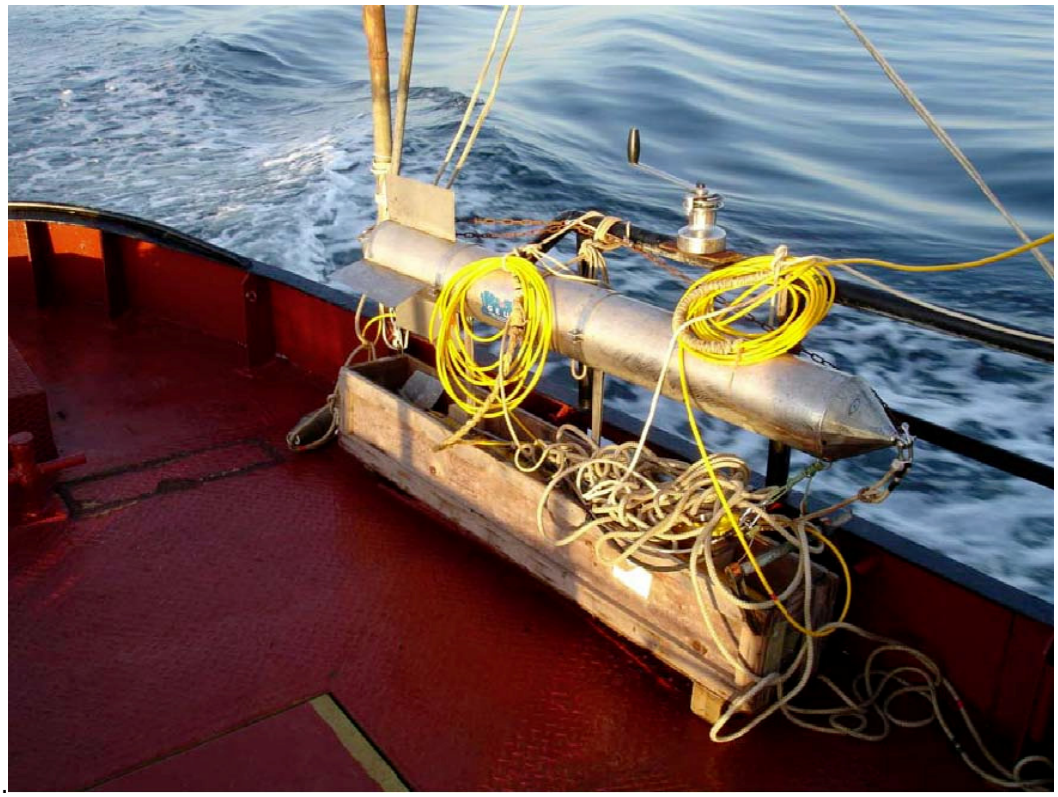

Figure 9. The EdgeTech DF-1000 sidescan sonar fish was stabilized for waves by the buoyancy of a 'torpedo' fixed to the fish ca. 40 cm above.

4.2 Navigation and positioning systems

4.2.1 Navigation system

The EIVA NaviPac integrated navigation and data acquisition software was used for navigation purposes. The software enables the time synchronising, survey planning of survey lines, navigation display as well as Helmsman display for survey boat navigation. The positioning devices and the motion sensors can be interfaced to the software.

4.2.2 The positioning systems and motion sensors

The positioning system used is Sagitta GPS a product of Thales Navigation. It consists of an antenna and a receiving unit with its corresponding software. This system provides a positioning accuracy of centimetres (depending on the operation mode). Kongsberg pro-vides the motion sensors as part of the purchasing deal of the multibeam system. It is the Seatext Motion Reference Unit MRU-5 for high accuracy measurements of pitch, roll, heave and yaw of the survey ship. It provides roll and pitch accuracy of 0.02° accuracy at ±5° amplitude. For heading accuracy the Seatex Seapath 20 GPS compass is used to achieve a heading accuracy of ~0.4° RMS.

4.2.3 The sound velocity profiler

This plays an important role in the accuracy of the depth measurement. The instrument measures Time-on-flight sound velocity with 0.03 m/s accuracy. The profiler is lowered down at the beginning and the end of the survey day. The SV Plus from Applied Microsystems was used in the survey and the acquired data was fed directly to the acquisition system for calibration. In addition, the Sound Velocity Smart Sensor was used to provide continuous sound velocity measurements at the vicinity of the sonar heads.

5. Data acquisition and processing

The data used in the project originates from the newly acquired acoustic data from the sidescan and the multibeam sonar systems and divers observations. Within the planned surveyed area data has been acquired by GEUS within two sub-areas (figure 10). The surveying of the Læsø Trindel area has been continued in the eastern direction with the purpose of covering the depth interval from about 3 to 35 m.

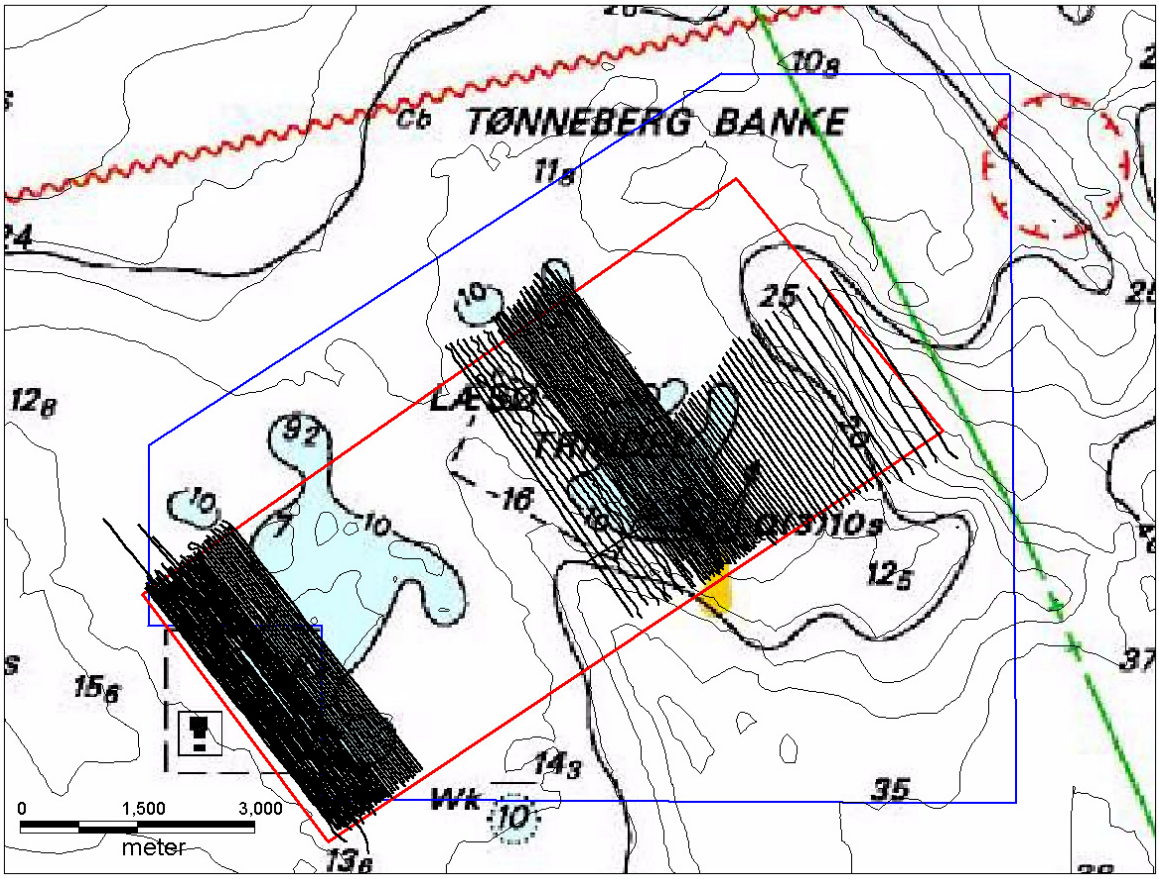

Figure 10. The Natura 2000 site 168, Læsø Trindel and Tønneberg Banke (blue box) with the survey area (red box) and the 2005-survey lines (dark lines) indicated. Note the two sub-areas of acquired survey lines.

5.1 The multibeam sonar system

Data was collected and stored using the Kongsberg SIS software. Return signal depth and amplitude was recorded for further processing as *.all files. All other information concerning the installation, calibration and navigation data were also stored in as well as the sound velocity profile taken during the survey. The raw data was then processed at GEUS by software from Kongsberg called Neptune, where all raw data converted to survey data, which then can be processed for

depth and backscattering data files. The data can be gridded and displayed in different format one can choose from the menu. The final processed and cleaned from outliers data can be exported into different format that suits many presentation programs.

The data has not been corrected for tidal or meteorological water level oscillations during the survey.

5.2 The side scan sonar system

The Triton Elics ISIS Sonar software was used for collecting side scan data. The data was recorded digitally in *.XTF format, also a hard copy was produced continuously during data acquisition. Important targets were noticed online and delineated for further inspection. The processing software is also the ISIS Suite where data was corrected for range and grey tone to enhance its quality for interpretation. The processed data was then build into a mosaic by the same software and displayed by another software, DelphMap, also from Triton Elics where it could be configured and merged and exported in different format acceptable by the current GIS software for presentation.

5.3 Ground truth diving

The subsequent ground truth diving performed by Hedeselskabet A/S in October took place at a series of positions decided by GEUS based on the preliminary interpretations of the acoustic data. The positions were chosen relevant to the aim of the project crossing areas of specific interest. The listed positions were sub-divided into point dive positions and paravane dive positions. Video and still camera were used as well as the observations of the experienced divers. The diving was conducted by two professional divers assisted by one diving assistant in agreement with the direction of the “Safety Diving” Handbook. Whenever the diver was submerged, he communicated with the ship via an underwater communication system ensuring the diver and the assistant on-board unlimited communication (The Dublex System).

By the point diving procedure the ship was anchored within a distance of a few metres from the chosen position. The primary task of point diving was to find the objects or substrate features pointed out by the geologist on the acoustic data, and to confirm if the interpretation was correct. Finally, the diver should document the substrate features by still photos and / or underwater digital video recordings.

By the paravane diving procedure the ship was anchored in an appropriate distance to the start position of the paravane track. After preparing himself, the diver submerged to the bottom waiting for the starting signal there. The paravane diving was conducted along predefined survey lines using the GPS system to ensure the exact position of the diver. The uncertainty was estimated to a few metres off the line. The survey speed of the paravane diver (2 – 4 km/t) was appropriate for the diver to register the overall substrate and biological features. Every paravane track was extended in both ends to ensure the total coverage of the suggested survey line. The diver communicated his observations directly to the onboard assistant who registered all information and data

from the diver directly on a laptop. The software “Paravane” was used linking the diver’s observation to a contemporary calculated actual position of the diver.

The parameters registered by the diver are: type of substrate (sediment type), degree of coverage (%) and the type of vegetation.

6. First results

6.1 Bathymetric map production

After performing the required processing on the Multibeam data, the data for Læsø Trindel were pooled and gridded together. The resulting sun illumination map was printed and it reveals a highly detailed manifestation of the seabed in the area under consideration. The depth of the seabed varies between 3.5m down to 42m approximately. The structures are very well pronounced in the map and places of stone reefs and flat sediment areas can be readily distinguished (figure 11). When zooming in, one can notice a “ripple shape” features along the outer beams of the survey lines; they have a depth difference of about 12-16cm from the surrounding area depth. This was reported to Kongsberg and subsequently GEUS has received a corrected version of the SIS software.

The scattered signal recorded by the multibeam system could also be used after mosaicing for seabed sediment discrimination. Due to the nature of the multibeam system beam pattern, the resulting scatter map will have a poorer resolution in comparison to the sidescan sonar results. This is very understandable, but in broad scale resolution, the two results are very similar.

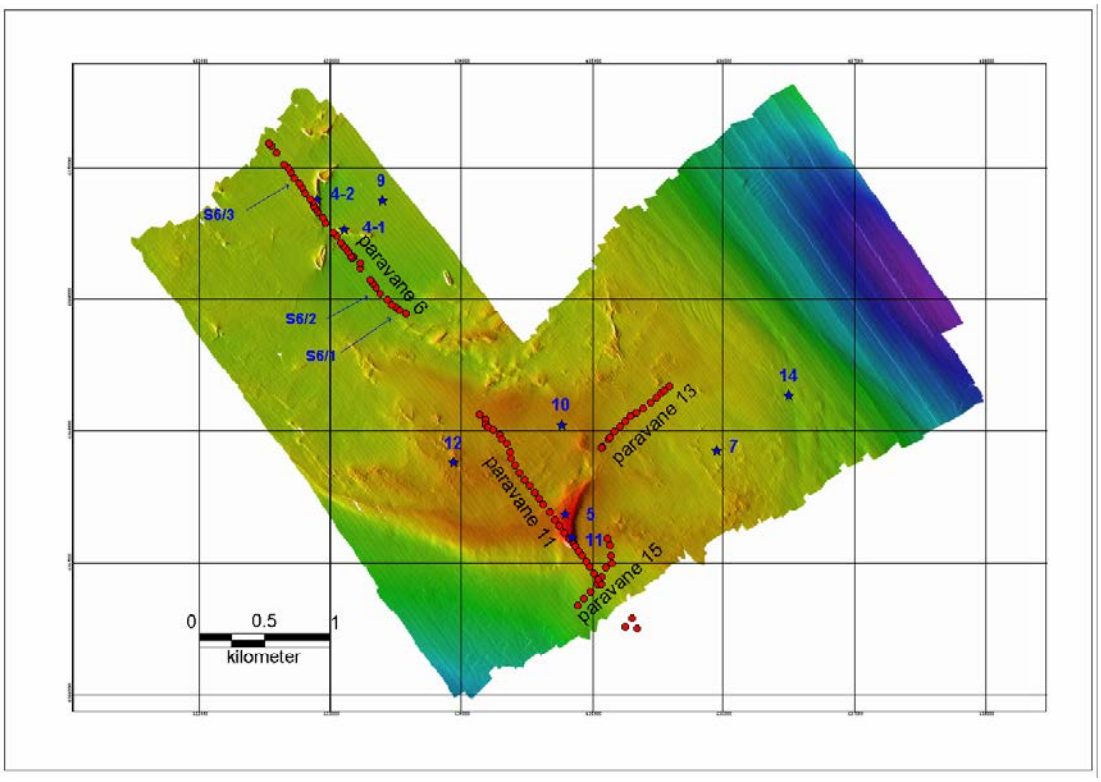

Figure 11. Bathymetric map of Læsø Trindel based on multibeam data showing the groundtruth positions (red dots the paravane tracks, arrows the position of the side scan photos; blue stars the point dive positions).

6.2 The backscattering results of the side scan sonar

The processed XTF files were mosaiced and merged in DelphMap so it can be geo-referenced and exported to MapInfo GIS software. The scattering map of the area was interpreted first according to the intensity of the scattered signal and its relation to the type of sediment (figure 12). Seabed areas were segmented accordingly.

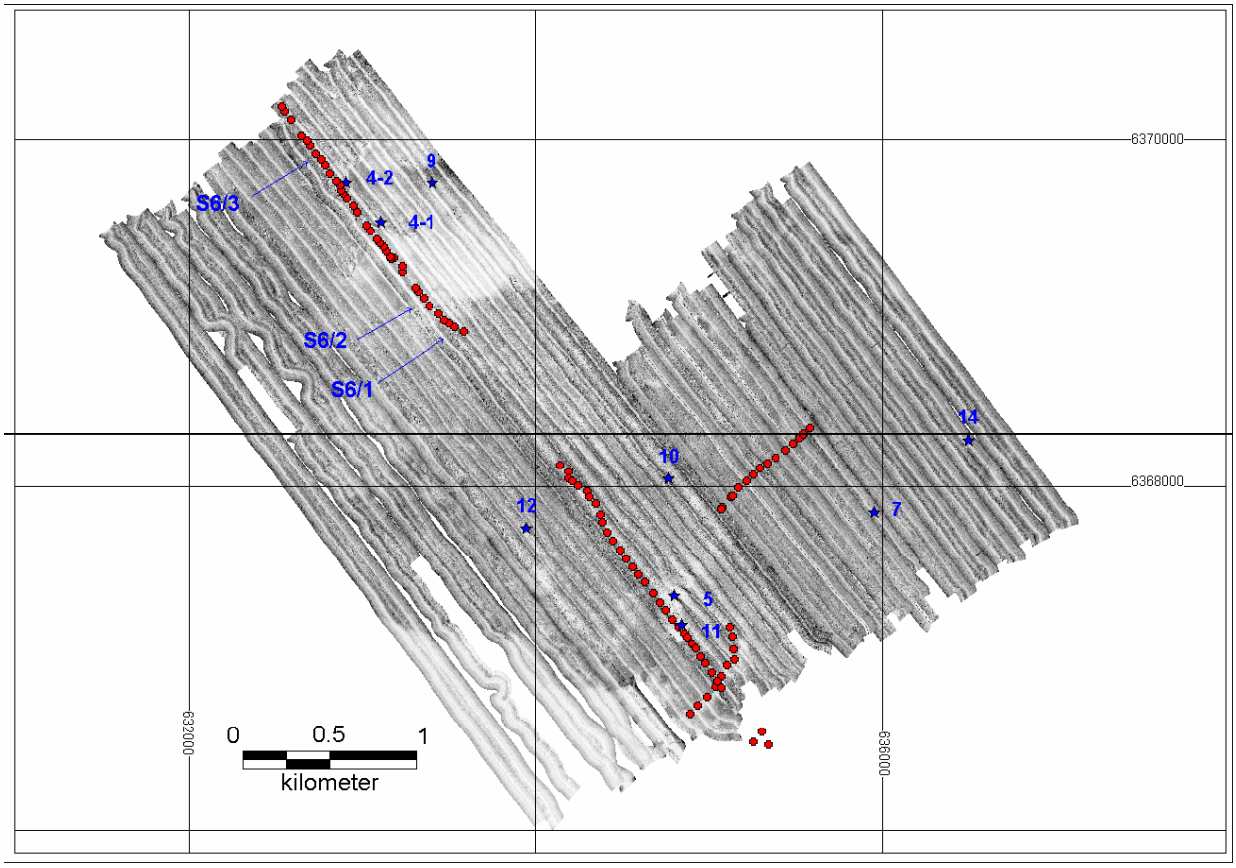

Figure 12. Backscattered signal of the surveyed area measured by the side scan sonar system. The ground truth positions are indicated (red dots indicate paravane tracks; blue arrows indicate the position of the paravane; blue stars the point dive positions).

7. Literature

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8. Appendices

Appendix 1. The dimension control report from Blom Maritime

Appendix 2. Survey logsheets

Appendix 3. Side scan sonar and the ground truthing examples

Appendix 4. List of 1996 sediment sieving results

Appendix 5. List of diving locations and ground truth samples

Appendix 1

The dimension control report from Blom Maritime

GEUS Danmarks og Grønlands Geologiske Undersøgelse v/Peter Trøst Jørgensen
Kvartærgeologisk Afdeling Øster Voldgade 10 DK-1350 København K

1350 København K

DERES REF.: VÅR REF.: DATO:

0504112-05001200 Stavanger, 25. august 2005

DIMENSJONSKONTROLL.
BÅTEN LINE.
EM3000 DUAL, MRU-5.E, SEAPATH 20 ANTENNE, SKIPS GPS ANTENNE, DEKKNIVÅ.
OPPMÅLT I RØDVIG, DANMARK, UKE 34 – 2005.

Vedlagt finner dere vår rapport som inneholder oppmålingsresultatene for temaene som er nevnt ovenfor.

Vi har ingen spesielle kommentarer til målingene.

Med vennlig hilsen for Blom Maritime AS

Odd Rune Olden

Vedl. Dimensjonskontroll rapport, dokument referanse nr. 0504112-05001199

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BLOM MARITIME
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Rapport

DOKUMENT TITTEL **DIMENSJONSKONTROLL. BÅTEN LINE. EM3000 DUAL, MRU-5.E, SEAPATH 20, SKIPS GPS, DEKKNIVÅ. OPPMÅLT I RØDVIG, DANMARK, UKE 34 - 2005**		DOKUMENT REFERANSE 0504112-05001199
KUNDE GEUS, Danmarks og Grønlands Geologiske Undersøgelse	BESTILLING NR.	SIDE 1 av 3

INNHOLDSFORTEGNELSE

1. INNLEDNING

Båten Line har fått et EM3000 Dual system montert på et bauspyd foran båten.
Systemet består av loddet(EM3000 Dual), med tilhørende bevegelsesensor(MRU-5.E) og
GPS antenne(Seapath 20).
Hensikten med oppmålingen på båten i Rødvig, Danmark, i uke 34 – 2005 var da å foreta
en innmåling og bestemmelse av følgende, som ble utført :
-Posisjon, heading, pitch og roll av EM3000 Dual.
-Posisjon, heading, pitch og roll av MRU-5.E for EM3000.
-Posisjon og heading av Seapath 20 antenne.
-Posisjon av skips GPS antenne.
-Spotsjekk av dekksnivå.

2. PERSONELL

Arbeidet ble utført av Senior Oppmålingsingeniør Odd Rune Olden fra Blom Maritime, med assistanse fra Kongsberg Maritime's og GEUS's representanter på stedet.

3. UTSTYR

Følgende utstyr ble benyttet: Leica TDM5005 Totalstasjon, serienr. 438009
Sertifikatet utgår: 13.01.06

Diverse mindre oppmålingsutstyr (prismer, måleband, vater etc.).

4. ARBEIDSBESKRIVELSE

Båten stod på land under oppmålingen.
Generelt ble alle posisjoner innmålt ved å måle vinkler og avstander fra Totalstasjonen
og til en mottakerprisme som ble plassert på det aktuelle punktet som ble innmålt.
For å se til alle punkt måtte Totalstasjonen settes opp to forskjellige steder.
For etter målingene å kunne beregne alle posisjoner inn i ett felles koordinatsystem ble

det målt til 8 felles referansepunkter på og rundt båten fra begge oppstillingene.

Det rettvinklete koordinat referanse systemet ble bestemt som følger :

-**Positiv X-akse peker forover og er paralell med båtens senterlinje (ligger 9mm på babord side av båtens senterlinje. Båtens senterlinje er definert som linjen gjennom senter rorstamme og senter kjøl ca. 2 meter bak baugen.)**

-Positiv Y-akse peker mot styrbord.

-Positiv Z-akse peker nedover.

-Nullpunktet(X=0,Y=0,Z=0) er i sensorpunktet i MRU'en.

-Referanseplanet er XZ-planet og YZ-planet paralellt med det vertikale bauspydet transducerne er montert på. (d.v.s bauspydet er vertikalt i systemet)

5. MÅLERESULTATER

Se de vedlagte skissene, side 1-7 i vedlegget.

6. KOMMENTARER

Da dette er en båt med mye spring i dekket, var det lite formålstjenlig å bruke dekket som en referanse for planet slik vi ofte gjør på skip med rett dekk.

Det var heller ikke råd å finne noen sikker vannlinje. Dette blant annet på grunn av at skroget var nymalt, men også av mangel på tegninger som viser basislinje og vannlinjeplan med forskjellige lastsituasjoner Det ble derfor bestemt av GEUS' representant på stedet at vi skulle bruke et vertikalt bauspyd som planreferanse. (Dette betyr at f.eks. senter topp bauspyd og senter bunn bauspyd har samme X og Y koordinater)

Ingen videre kommentarer til oppmålingen utover måleresultatene.

VEDLEGG 1

MÅLERESULTATER

EM3000, MRU, SEAPATH, SKIPS GPS, DEKKNIVÅ

Generelle notater

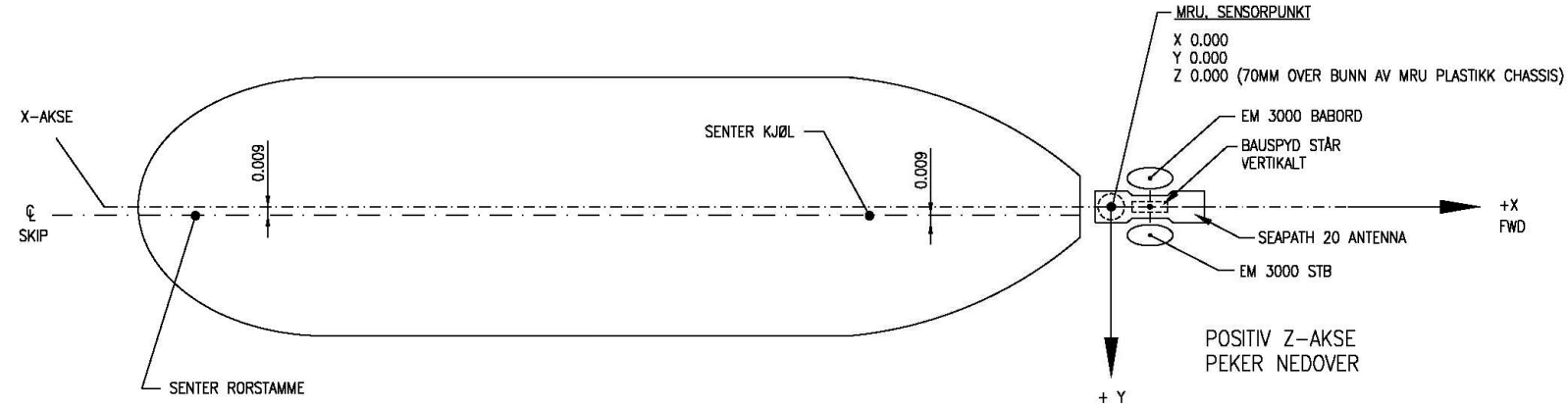
Generell målenøyaktighet er +/- 2mm.

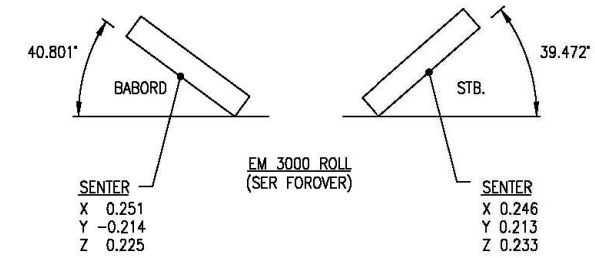
Antatt målenøyaktighet for heading, pitch, roll er +/- 0.025 grader.

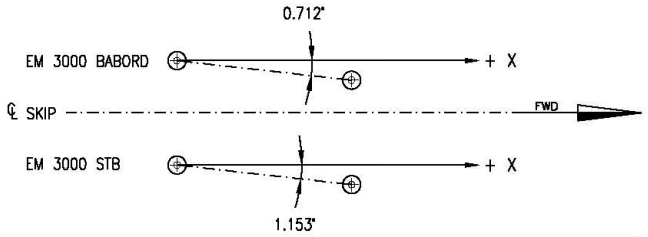
Alle mål i meter og 360 grader system.

Skissene er ikke i rett målestokk.

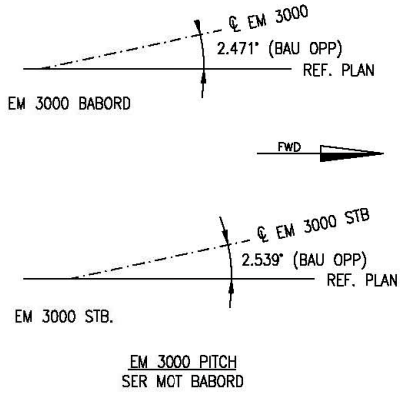
Dok. ID.: 05001199







EM 3000 HEADING
PLAN



EM 3000 PITCH
SER MOT BABORD

MERKNAD:
- ALLE MÅL I METER OG VINKLER I GRADER

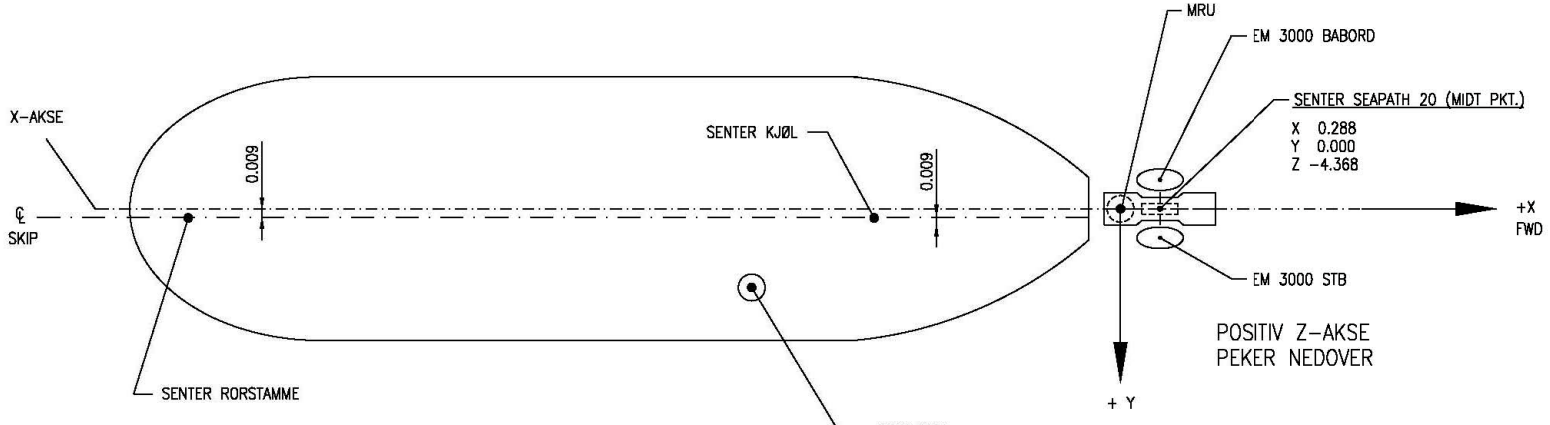
KOORDINAT REFERANSE SYSTEM:
- X-AKSE FOROVER, Y-AKSE STB, Z-AKSE NEDOVER
- NULLPUNKT I MRU
- XZ-PLANET OG YZ-PLANET ER PARALELL MED BAUSPYD

BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

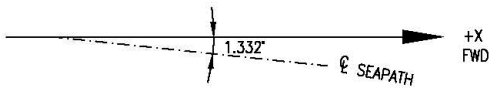
DIMENSJONSKONTROLL

KUNDE	DOKUMENT REFERANSE	SIDE
GEUS	0504112-05001199	1 av 7
PROSJEKT: LINE	KONTRAKT NR.	ORDRE NR.
STED: RØDVIK, DANMARK	REF. TEGNING NR.	REV.
TITTEL: EM 3000 DUAL		

REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV
0	FOR BRUK	05001199	0119901	31.08.05	TH	ORO	ORO	KA



SEAPATH 20
(SER OPP / STB)



HEADING SEAPATH 20
PLAN

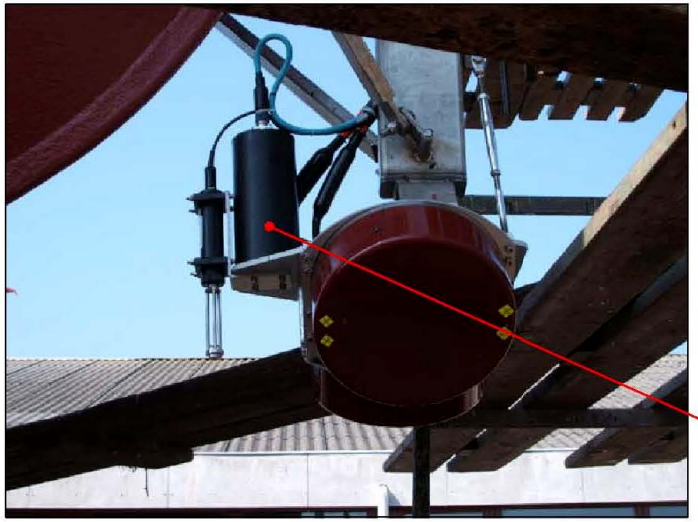
MERKNAD:
- ALLE MÅL I METER
- VINKLER I GRADER

BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

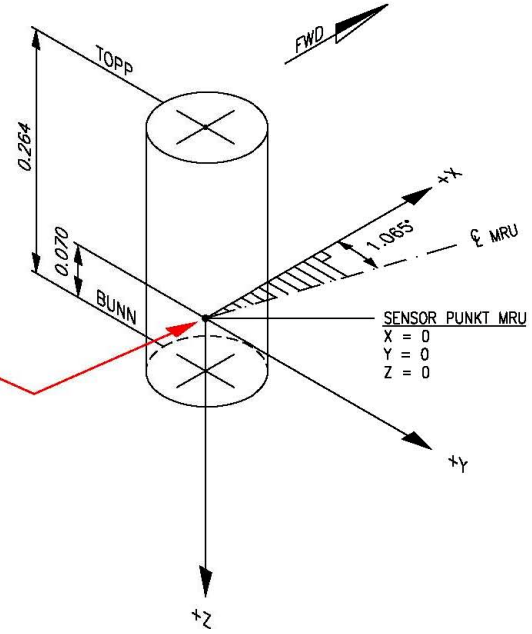
DIMENSJONSKONTROLL

KUNDE		DOKUMENT REFERANSE	SIDE
	GEUS	0504112-05001199	2 av 7
PROSJEKT		KONTRAKT NR.	ORDRE NR.
	LINE		
STED		REF. TEGNING NR.	REV.
	RØDVIK, DANMARK		
TITTEL			
	SEAPATH 20 OG SKIPS GPS		

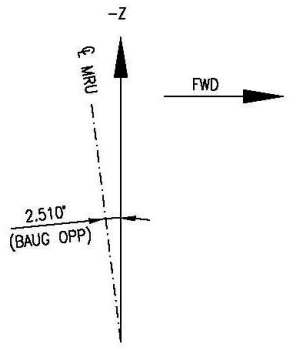
REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV
0	FOR BRUK	05001199	0119902	31.08.05	TH	ORO	ORO	KA



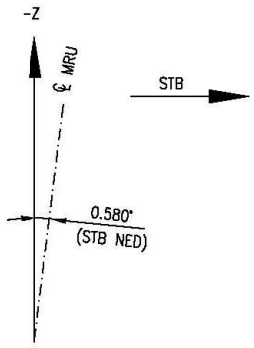
MRU-5.E
(SER MOT BABORD)



MRU-5.E HEADING



PITH
(SER MOT BABORD)



ROLL
(SER FOROVER)

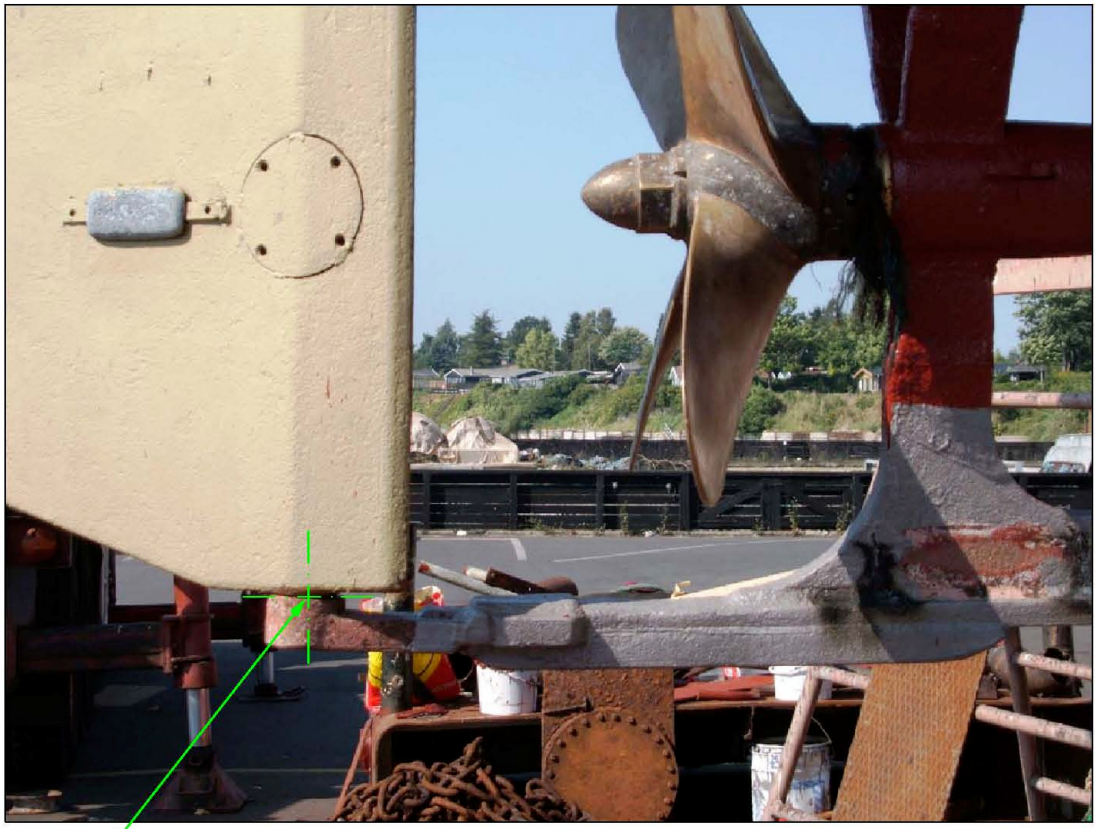
BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

DIMENSJONSKONTROLL

MERKNAD:
- ALLE MÅL I METER
- VINKLER I GRADER

REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV
0	FOR BRUK	05001199	0119903	31.08.05	TH	ORO	ORO	KA

KUNDE: GEUS	DOKUMENT REFERANSE: 0504112-05001199	SIDE: 3 av 7
PROSJEKT: LINE	KONTRAKT NR.	ORDRE NR.
STED: RØDVIK, DANMARK	REF. TEGNING NR.	REV.
TITTEL: MRU-5.E		



SENTER RORSTAMME
X −15.363
Y 0.009
Z 0.629 (ER CA. UNDERKANT KJØL)

MERKNAD:
- ALLE MÅL I METER
- X-AKSEN ER PARALELL MED SENTERLINJE BÅT OG LIGGER 9MM PÅ BABORD SIDE

BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

DIMENSJONSKONTROLL

KUNDE		DOKUMENT REFERANSE	SIDE
	GEUS	0504112-05001199	4 av 7
PROSJEKT		KONTRAKT NR.	ORDRE NR.
	LINE		
STED		REF. TEGNING NR.	REV.
	RØDVIK, DANMARK		
TITTEL			
	REFERANSE PÅ RORSTAMME		

REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV
0	FOR BRUK	05001199	0119904	31.08.05	TH	ORO	ORO	KA

TOPP DEKK
X −0.006
Y −0.250
Z −1.961 (TOPP LIST)

MERKNAD:
– ALLE MÅL I METER

BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

DIMENSJONSKONTROLL

0	FOR BRUK	05001199	0119905	31.08.05	TH	ORO	ORO	KA
REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV

KUNDE: GEUS	DOKUMENT REFERANSE: 0504112–05001199	SIDE: 5 av 7
PROSJEKT: LINE	KONTRAKT NR.	ORDRE NR.
STED: RØDVIK, DANMARK	REF. TEGNING NR.	REV.
TITTEL: DEKKNIVÅ BAUG		

TOPP DEKK
X −10.308
Y −1.931
Z −1.230 (TOPP LIST)

MERKNAD:
– ALLE MÅL I METER

BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

DIMENSJONSKONTROLL

0	FOR BRUK	05001199	0119906	31.08.05	TH	ORO	ORO	KA
REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV

KUNDE: GEUS	DOKUMENT REFERANSE: 0504112–05001199	SIDE: 6 av 7
PROSJEKT: LINE	KONTRAKT NR.	ORDRE NR.
STED: RØDVIK, DANMARK	REF. TEGNING NR.	REV.
TITTEL: DEKKNIVÅ BABORD SIDE		

TOPP LIST
X −10.395
Y 1.960
Z −1.248 (TOPP LIST)

MERKNAD:
– ALLE MÅL I METER

BLOM MARITIME
SUBSIDIARY OF THE BLOM GROUP

DIMENSJONSKONTROLL

0	FOR BRUK	05001199	0119907	31.08.05	TH	ORO	ORO	KA
REV. NR.	GRUNN FOR UTGIVELSE	DOK. NR.	ARKIV NR.	REV. DATO	TEGNET AV	UTFØRT AV	KONTR. AV	GODKJ. AV

KUNDE: GEUS		DOKUMENT REFERANSE: 0504112–05001199	SIDE: 7 av 7
PROSJEKT: LINE		KONTRAKT NR.	ORDRE NR.
STED: RØDVIK, DANMARK		REF. TEGNING NR.	REV.
TITTEL: DEKKNIVÅ STB SIDE			

Appendix 2 :

Survey Log Sheets

EM3002D Multibeam Echosounder Logsheet
Kvartærgeologisk afdeling

GEUS

Project #: FLU	Vessel: LINA	Location: LØSØ	Page #: 6
Pitch Offset:	Roll Offset:	Heading Offset:	Pos. Time Delay:	Roll Delay:

Date	Line ID	Line #	Start	End	Heading	Speed	Sea State	Ping Mode	Coverage	Yaw / Filter	Comments
7/9/05	Løsø Middle	SVP_1	12:30								SVP
		122	13:10	13:33	318	6.5 5.7	6-7			SSS is also operating	We are filling the gaps between the NE area & the SW area.
		123	13:41	14:10	150	4.7	"				
		124	14:15	14:37	320	6.4	"				
	126	+125	14:41	15:12	150	4.1	"				big beam
		127	15:16	15:25	320	6.1	"				short line
		128	15:28	15:36	167	4.2	"				this line is to fill the gap between 122 123
		129	15:42	15:45	302	4.2					This line to fill another gap before 122
		130	16:00	16:12	312	6.5	←				its a complementary line to Line 127.
	132 +	131	16:17	16:24	155	4.0	←	longer			line was cut because of bad surveying
	134 +	133	16:35	17:11	146	5	←	Longest line			back to the line to fill the gap — round
	136 +	135	17:13	17:34	325	6.6					many gaps double click → line 136 again
		137	17:39	18:06	150	5.3			last	Line	
x line		138	18:17	18:25	242	4.8				x line perpendicular towards SW	
		SVP_2									

Operator Name:
Date:

Time Utc+2

EM3002D Multibeam Echosounder Logsheet
Kvartærgeologisk afdeling

GEUS

Project #: FLU	Vessel: LINA	Location: Læsø Trindel	Page #: 5
Pitch Offset:	Roll Offset:	Heading Offset:	Pos. Time Delay:	Roll Delay:

Date	Line ID	Line #	Start	End	Heading	Speed	Sea State	Ping Mode	Coverage	Yaw / Filter	Comments
5/9/05	Continue from page (4)										
	Læsø NE	101	17:25	17:42	149	4.6	5		100%		
		102	17:43	17:54	312	6.4	5		"	last line in the survey	
	SVP		18:20							SVP profile (2).	
6/9/005	Back to the	NE side of the area to finish the						MB			
	SVP	in file	8:35							SVP	sss is also operating
	Læsø	103	9:37	9:48	314	6.7	5				
	Trim	104	9:51	10:08	149	4.2	5				
	NE	105	10:10	10:24	317	5.7	5				
		106	10:28	10:46	150	4.6	5				at 10:35 we had a GPS failure
		107	10:48	11:01	318	5.7	5				
		108	11:05	11:24	148	4.2	6				
		109	11:26	11:40	319	6	6				
		110	11:43	12:02	145	4.3	6				
		111	12:03	12:18	312	5.9	6				
		112	12:21	12:41	149	4.2	6				
		113	12:43	12:57	312	5.2	6				
		114+115	13:01	13:21	148	4.3	6				line 115 fault
		116	13:23	13:38	313	5.4	6				
		117	13:41	14:02	148	4.1	6				
		118	14:05	14:18	320	6.1	6				
		119	14:22	14:43	145	4.2	6				
		120	14:46	15:01	321	6.1	6				
		121	15:04	15:26	155	4.1	6				last line today

SVP 15:40 ~~SVP~~

Operator Name: mad
Date: 6/9

Time
UTC + 2

EM3002D Multibeam Echosounder Logsheet
Kvartærgeologisk afdeling

GEUS

Project #: FLU	Vessel: LINA	Location: Isesoe - Trindel	Page #: 4
Pitch Offset:	Roll Offset:	Heading Offset:	Pos. Time Delay:	Roll Delay:

Date	Line ID	Line #	Start	End	Heading	Speed	Sea State	Ping Mode	Coverage	Yaw / Filter	Comments
5/9/05											
	SVP test	-1	8:30								SVP Isese. 050905_1
	Isesø_Trin	~~9~~76	09:09	9:15	313	6.1	4 m/s		160%	All	Continue Yesterday's line towards SW
		77	9:16	9:24	146	5.3	5		5		line to cover the shallow structure
		78	9:26	9:48	320	6.2	4 m/s		6	With	back to normal surveying lines.
		79	9:49	10:16	147	4.8	4 m/s		11		
		80	10:17	10:39	317	6.2	4 m/s		5	SSS	
		81	10:40	11:07	147	4.2	5		5		
		82	11:09	11:30	318	6.1	4		5	profiler	
		83	11:40	12:07	147	5	4		5		
		84	12:09	12:29	318	6.5	4		5		
		85	12 31	13:01	148	4.8	4				
		86	13:04	13:22	318	7	4				
		87-88	13:23	13:54	146	4.3	4				
		89	13:56	14:15	314	6.7	4				
	91	+ 90	14:17	14:47	148	4.4	5			last line on the SW part of the area - Now we	
new area	Test NE	92	15:14	15:23	312	6.6	5			move to NE part	
		93	15:25	15:41	154	4.2	5				
		94	15:41	15:51	318	6.6	5				
		95	15:54	16:09	148	4.6	5				
		96	16:11	16:21	312	6.6	5				
		97	16:24	16:34	153	4.5	5				
		98	16:42	16:52	314	6.7	5				
		99	16:54	17:10	149	4.6	5				
		100	17:12	17:22	320	6.6	5				

Operator Name:
Date:

EM3002D Multibeam Echosounder Logsheet
Kvartærgeologisk afdeling

GEUS

Project #:	F&U	Vessel:	LINA	Location:	LAESØ Trindel	Page #:	3
Pitch Offset:		Roll Offset:		Heading Offset:		Pos. Time Delay:	Roll Delay:

Date	Line ID	Line #	Start	End	Heading	Speed	Sea State	Ping Mode	Coverage	~~Yaw+Filter~~	Comments
4/9/05			9:30							050904 (Filnr.)	SVP Begging of Survey
	LAESØ Trin	50	10:38	10:59	318	6.3	2 m/s		100%		SS Sonar is operating too. Big Stones in the bigging
		51	11:01	11:29	145	5.1	2m/s.		100%		
		52	11:31	11:54	319	6.6	2m/s		〃		
		53	11:55	12:26	147	4.9	2m/s		〃		
		54	12:28	12:48	318	6.7	2m/s		〃		
		55	12:49	13:21	147	4.8	2m/s		〃		
		56	13:22	13:44	318	6.6	2m/s		〃		
		57	13:44	14:17	148	4.5	3m/s				
		58	14:19	14:40	320	6.8	3				
		59_63	14:41	15:13	147	4.4	3				Line # is changed to 62 the 63
		64	15:15	15:35	318	6.9	3				15:18 - he made a swing which caused a gap it also created line 65 at the end.
		65_66	15:36	16:09	148	4.4	3				
		67	16:10	16:31	318	6.9	3				
		68_69	16:32	17:04	153	4.4	3				number changed again
		70	17:05	17:11	312	7.0	3		〃	short line	this is a middle line because of shallow water
		71	17:13	17:18	156	4.1	3		Coverage from the left and right hardside		This line is to fill the gaps in line 64
		72	17:19	17:28	342	4.	3		〃	〃	〃
		73	17:28	17:48	319	6.6	2				back to normal
		74+75	17:49	18:21	148	4.3	2				last line today. Change to 75
	SVP		18:36	at the end of the survey						There is a cliff between this morning and current SVP	SVP

Operator Name: Ingvar + Jørgen + Peter
Date: 4/9/2005

Tid: UTC + 2t

EM3002D Multibeam Echosounder Logsheet
Kvartærgeologisk afdeling

GEUS

Project #: 1950/FLU	Vessel: LINA	Location: LØSØ Trindad SW	Page #: 2
Pitch Offset:	Roll Offset:	Heading Offset:	Pos. Time Delay:	Roll Delay:

Date	Line ID	Line #	Start	End	Heading	Speed	Sea State	Ping Mode	Coverage	Yaw / Filter	Comments
9/2-05	Løsø-1	-28	12.29	12.51	320	6.0	3.5 m/s		100%		
"		-29	12.52	13.11	140	6.8	3 m/s		"		
		-30	13.12	13.35	320	5.8	"		"		
		-31	13.37	13.55	140	6.9	"				
		-32	13.56	14.19	320	5.7	"				
		-33	14.20	14.39	140	6.9	"				SVP - kl. 15[illegible]
		-34									Linie ind mod Hamn.
		35	does not exist								
9/3 05											SVP kl. 12:30
	Løsø-1	-36	13:25	13:45	328	6.1	9 m/s		100%		SSS was also operating.
		-37	13:49	14:16	147	6.1	9 m/s		100		Very large swells for the whole day
		-38	14:17	14:37	320	6.6	8 m/s		100%		heave ~ 2 m
		-39	14:39	15.07	147	4.9	8 m/s		100%		
		-40	15:08	15:28	317	6.4	7 m/s		100%		
		-41	15:30	15:58	148	4.8	7 m/s		"		
		-42	15:59	16.19	328	6.5	6 m/s		"		
		-43	16:20	16.48	148	4.8	6 m/s		"		
		-44	16:48	17:09	318	6	6 m/s		"		
		-45	17:11	17:37	149	5	6 m/s		"		
		-46	17:38	18:00	318	6.2	6 m/s		"		
		-47	18:01	18:27	147	5.2	6 m/s		"		
		-48	18:27	18:50	318	5.7	6 m/s		"		
		-49	18:51	19:17	145	5.4	7 m/s		"		last line today
											SVP kl 19:35

Operator Name:
Date:

Sonar Head 'ad.

2005.

Anvendt UTC + 2t. ref.

EM3002D Multibeam Echosounder Logsheet
Kvartærgeologisk afdeling

GEUS

Project #:		Vessel: LINE		Location: LÆSØ					Page #: 4	
Pitch Offset:		Roll Offset:		Heading Offset:			Pos. Time Delay:		Roll Delay:	
Date	Line ID	Line #	Start	End	Heading	Speed	Sea State	Ping Mode	Coverage	Yaw / Filter	Comments
31/08	Læsø_1	-1	10.47	11.11	320	5.6	3-5 m/s		100		SVP data kl. 930 ca. 20 m vand
—	—"—	-3	11.16	11.42	140	4.8	—		100		~ 555. data. ~
—	—	-4	11.44	12.08	321	5.3	—		100		
—	—	-5	12.12	12.37	140	5.2	—		100		
—	—	-6	12.38	—	320	5.3	—		100		linie Stoppet p.gr.a strømsvigt
—	—	-7	13.14	13.39	320	5.3	—		100		næste linie
		-8	13.49	14.17	140	5.4	4-6 m/s		100		(tidl. linie 6) startet langt ude.
		-9	14.18	14.45	320	5.3			100		
		-10	14.47		140	5.6			100		
01/09		-11					13 m/s				Test linie — På vej mod havn →
		-12	6.52								Test linie.
02/09		-14	6.52	7.14	320	6.2	6-8 m/s		100		SVP Data kl. 630 ca 20m vand
-		-15	7.14	7.35	140	6.2	—"—		—"—		
-		-16	7.37	7.58	320	6.4	—"—		—"—		
-		-17	8.00	8.19	140	6.6	—"—		—"—		Udfald på linie
-		-18	8.21	8.42	320	6.4	8 m/s		—"—		
-		-19	8.43	9.03	140	6.4	—"—		—"—		
-		-20	9.05	9.25	320	6.6	—"—		—"—		
-		-21	9.27	9.46	141	6.6	—"—		—"—		
-		-22	9.47	10.11	320	6.6	7 m/s		—"—		Forlænget p.gr.a "trossen"
-		-23	10.13	10.34	140	6.7	5 m/s		—		Helmsman o
-		-24	10.35	10.56	320	6.7	—		—		
-		-25	10.57	11.17	140	6.8	—		—		
-		-26	11.44	12.04	320	6.2	3-5 m/s	TAGE	—		Side Scan sat i vandet
		-27	12.07	12.28	140	6.7	—	—			

Operator Name:
Date:

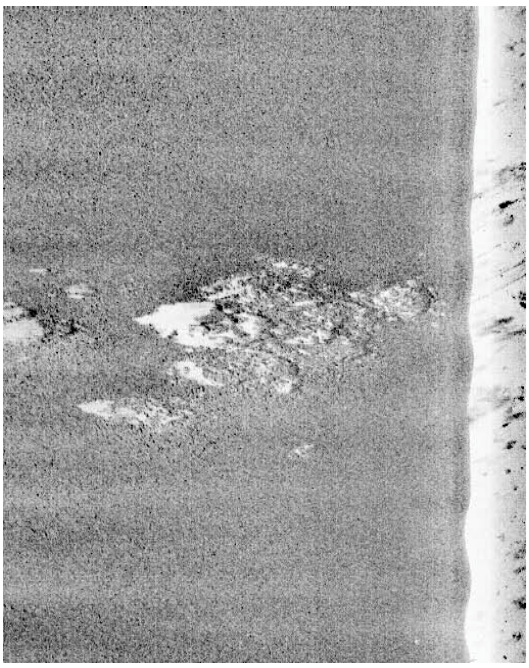
1158

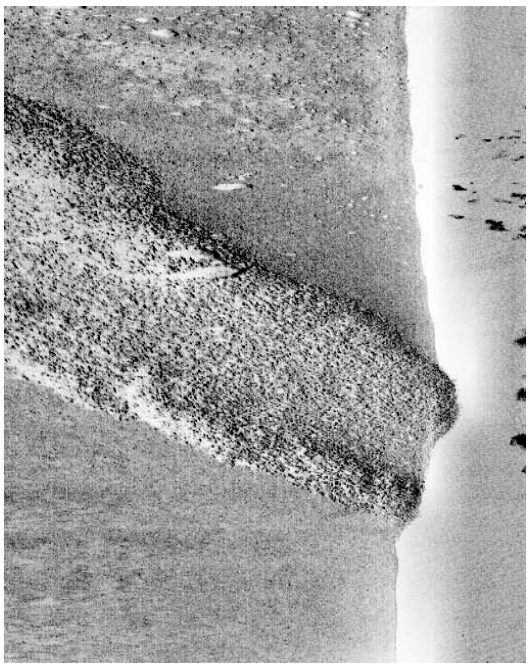
Appendix 3.

Side scan sonar and the ground truthing examples

The following presents some examples of sidescan/backscatter recordings and 2 photos taken by the diver. The examples represent a variety of substrate types and seabed features that are typical for the Læsø Trindel area. The numbers on each figure is the reference number for the divings found at figures 11 and 12.

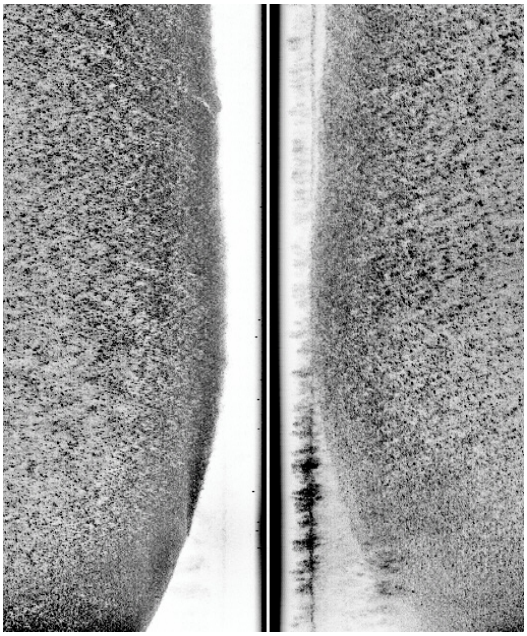
The dimension of the sidescan examples is approximately: Height 150 m and width 50 m.



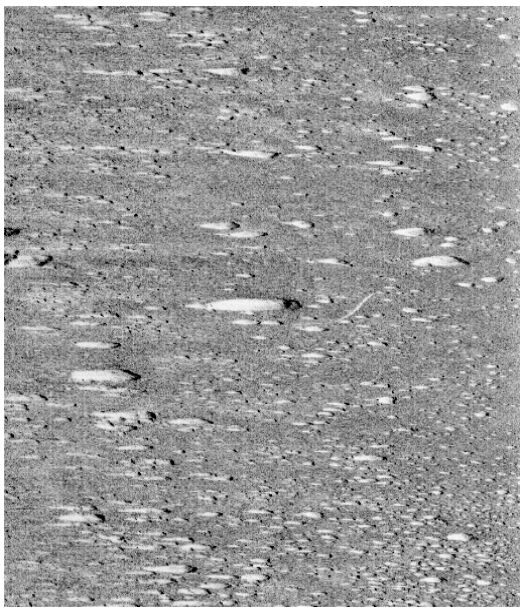


Point 14: Bubbling reef at the eastern part of the Trindel. A level sandy seabed surrounds these feautures of high reflectivity. The transition is sharp. Some topography within the feature is recognised by the shadows indicating a rough surface. These features are found scattered within an area of 600 times 200
m.

Point 4: Transition from a level featureless sandy seabed to a remarkable morphological bank-like structure of gravel and boulders rising 2-3 m above the surrounding seabed. On top of the bank individual boulders are found with a height of at least 3 m. The structure marks the transition from the sandy seabed (lower part of the picture) to a mixed seabed with high density of boulders (upper part of the picture). The structure, which can be traced several hundred metres into the nearby area, is a striking feature on the multibeam picture. More similar structures are seen throughout the area north of Læsø Trindel.



Point dive station 11. The top of Læsø Trindel. Acoustically the seabed type is characterised as mixed sediments dominated by gravel. No boulders have been identified possibly due to the fact that they are blurred by vegetation.



Paravane track 4: Mixed seabed of sand, gravel and a dense coverage of boulders Max. height of boulders is measured to 3-4 m. Dark grey nuances are probably due to presence of vegetation.

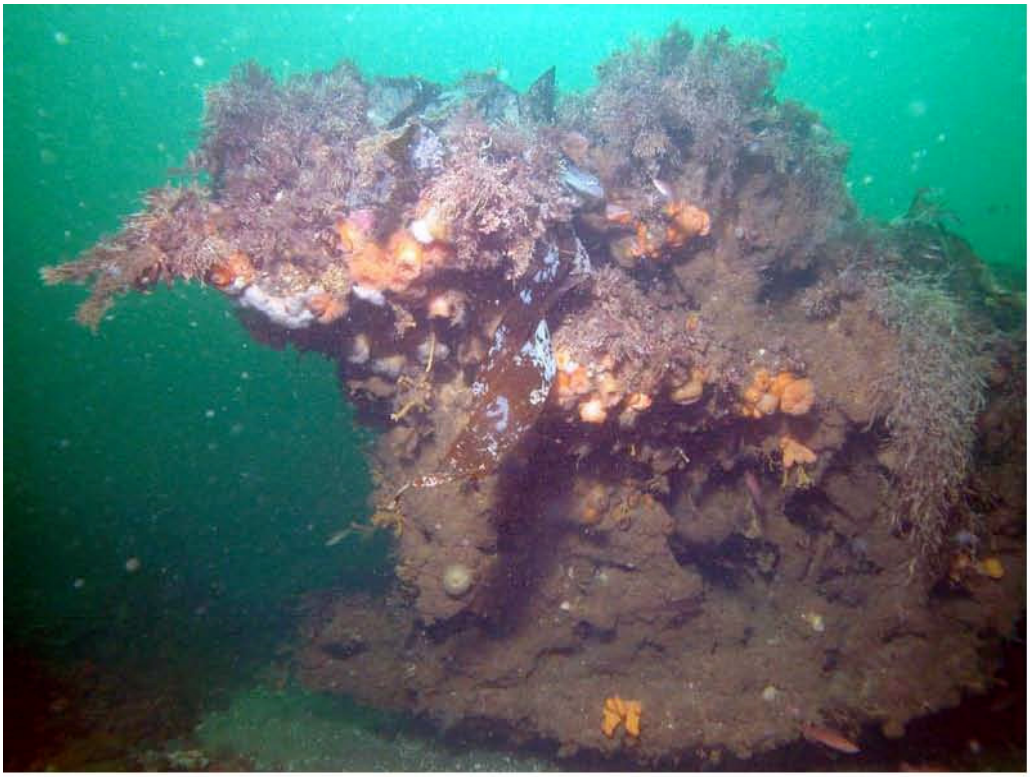


Photo 1: Subsea structure.of cemented sand with leaking gas at station 14.

Photo 2. Stonewall covered by a variety of vegetation at station 7.

Appendix 4

1996 sediment samples
Sieve analysis

SIGTEANALYSE.

Rekvirent: Birger Larsen
Lokalitet:
Boring:
Prøve nr: 574-008
Dybde (m): 105-110 cm.
Bem: Ikke slemmet.
Lab.nr: 960587
Dato: 29 November1996
Laborant: I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 138,04 g

Finsigtning.

	sigte mm	g	v%	% Sigterest akkumuleret v%
	16,000	0,00	0,00	0,00
	8,000	1,53	1,11	1,11
	4,000	8,00	5,80	6,91
	2,800	11,89	8,61	15,52
	2,000	14,55	10,54	26,06
	1,400	14,26	10,33	36,39
	1,000	14,92	10,81	47,20
	0,710	16,65	12,06	59,26
	0,500	23,89	17,31	76,57
	0,355	15,12	10,95	87,52
	0,250	12,45	9,02	96,54
	0,180	2,87	2,08	98,62
	0,125	0,85	0,62	99,24
	0,090	0,27	0,20	99,44
*	0,075	0,06	0,04	99,48
	0,063	0,04	0,03	99,51
	<0.063	0,69	0,49	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

	vægt%
Silt og ler .....<0.063mm:	0,49
Fin-sand .....>0.063mm-<0.200mm	1,48
Mellem-sand ..>0.200mm-<0.600mm	29,70
Grov-sand .... >0.600mm-<2.00mm	42,27
Grus ..... >2.00mm	26,06
Sum:	100,00

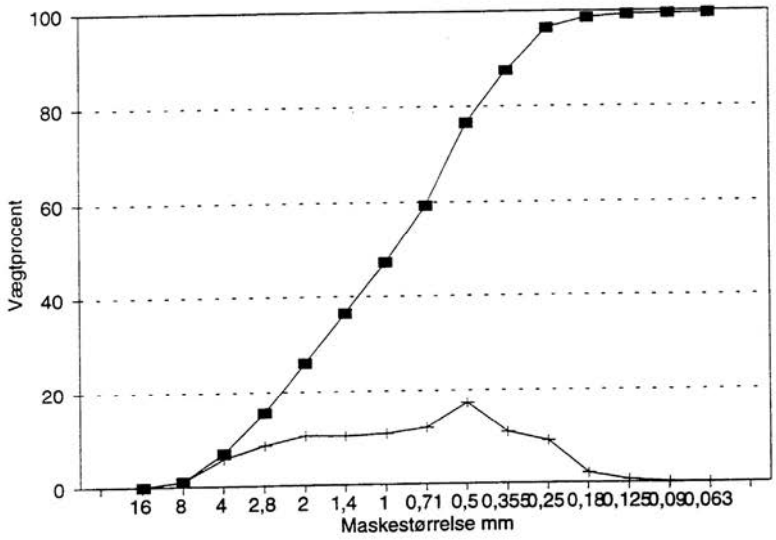
Beregninger.

25% fraktil	2,080
40% fraktil	1,266
Median	0,933
75% fraktil	0,519
90% fraktil	0,326
Middelkornstørrelse	1,177
Sorteringsgrad	2,002
Uensformighedstallet	3,883

NB: Fraktilerne fundet ved
LINÆR interpolation

0

Kornkurve (akkumuleret og pr. fraktion



SIGTEANALYSE.

Rekvirent: Birger Larsen
Lokalitet:
Boring:
Prøve nr: 574-008
Dybde (m): 90-100 cm.
Bem: Ikke slemmet.
Lab.nr: 960586
Dato: 29 November1996
Laborant: I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 162,87 g

Finsigtning.

	sigte mm	g	v%	% Sigterest akkumuleret v%
	16,000	0,00	0,00	0,00
	8,000	0,00	0,00	0,00
	4,000	1,21	0,74	0,74
	2,800	5,54	3,40	4,14
	2,000	4,18	2,57	6,71
	1,400	3,85	2,36	9,07
	1,000	6,17	3,79	12,86
	0,710	7,65	4,70	17,56
	0,500	16,50	10,13	27,69
	0,355	46,48	28,54	56,23
	0,250	54,25	33,31	89,54
	0,180	12,59	7,73	97,27
	0,125	3,12	1,92	99,19
	0,090	0,57	0,35	99,54
*	0,075	0,12	0,07	99,61
	0,063	0,07	0,04	99,65
	<0.063	0,57	0,35	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

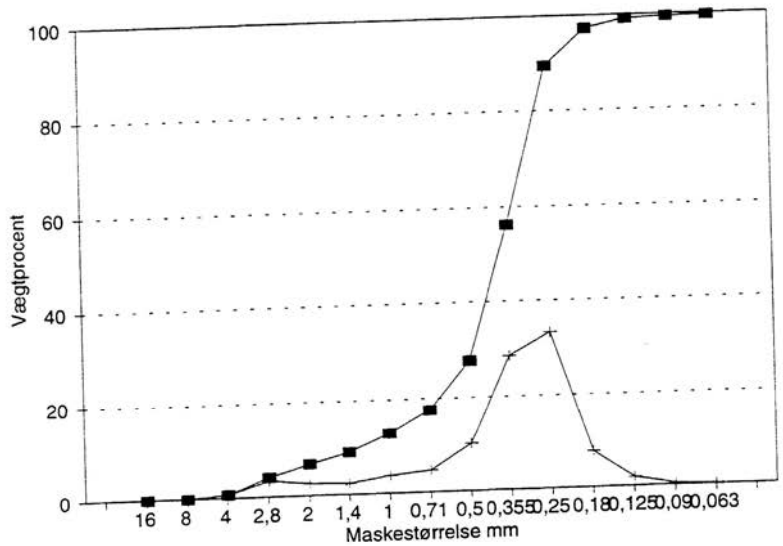
	vægt%
Silt og ler .....<0.063mm:	0,35
Fin-sand .....>0.063mm-<0.200mm	4,59
Mellem-sand ..>0.200mm-<0.600mm	72,20
Grov-sand .... >0.600mm-<2.00mm	16,16
Grus ..... >2.00mm	6,71
Sum:	100,00

Beregninger.

25% fraktil	0,556
40% fraktil	0,437
Median	0,387
75% fraktil	0,296
90% fraktil	0,246
Middelkornstørrelse	0,413
Sorteringsgrad	1,371
Uensformighedstallet	1,779

NB: Fraktilerne fundet ved LINÆR interpolation

Kornkurve (akkumuleret og pr. fraktion



SIGTEANALYSE.

Rekvirent:	Birger Larsen
Lokalitet:	
Boring:	
Prøve nr:	574-008
Dybde (m):	50-60 cm
Bem:	Ikke slemmet.
Lab.nr:	960585
Dato:	29 November1996
Laborant:	I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 103,97 g

Finsigtning.

	sigte mm	g	v%	% Sigterest akkumuleret v%
	16,000	0,00	0,00	0,00
	8,000	0,91	0,88	0,88
	4,000	0,21	0,20	1,08
	2,800	1,87	1,80	2,88
	2,000	6,04	5,81	8,69
	1,400	4,27	4,11	12,80
	1,000	5,87	5,65	18,45
	0,710	7,27	6,99	25,44
	0,500	12,04	11,58	37,02
	0,355	26,21	25,21	62,23
	0,250	30,08	28,93	91,16
	0,180	6,95	6,68	97,84
	0,125	1,65	1,59	99,43
	0,090	0,29	0,28	99,71
*	0,075	0,08	0,08	99,79
	0,063	0,04	0,04	99,83
	<0.063	0,19	0,17	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

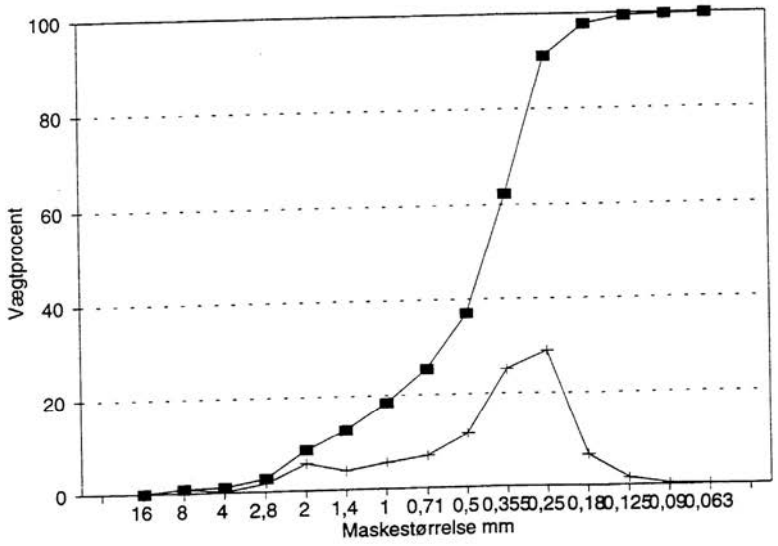
	vægt%
Silt og ler .....<0.063mm:	0,17
Fin-sand .....>0.063mm-<0.200mm	3,90
Mellem-sand ..>0.200mm-<0.600mm	64,43
Grov-sand .... >0.600mm-<2.00mm	22,82
Grus ..... >2.00mm	8,69
Sum:	100,00

Beregninger.

25% fraktil	0,728
40% fraktil	0,483
Median	0,425
75% fraktil	0,309
90% fraktil	0,254
Middelkornstørrelse	0,487
Sorteringsgrad	1,536
Uensformighedstallet	1,899

NB: Fraktilerne fundet ved LINÆR interpolation

Kornkurve (akkumuleret og pr. fraktion



SIGTEANALYSE.

Rekvirent: Birger Larsen
Lokalitet:
Boring:
Prøve nr: 574-008
Dybde (m): 0-10 cm
Bem: Ikke slemmet.
Lab.nr: 960584
Dato: 29 November1996
Laborant: I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 270,77 g

Finsigtning.

	sigte mm	g	v%	% Sigterest akkumuleret v%
	16,000	0,00	0,00	0,00
	8,000	0,00	0,00	0,00
	4,000	2,73	1,01	1,01
	2,800	11,31	4,18	5,19
	2,000	14,09	5,20	10,39
	1,400	9,37	3,46	13,85
	1,000	14,93	5,51	19,36
	0,710	16,09	5,94	25,30
	0,500	26,60	9,82	35,12
	0,355	55,15	20,37	55,49
	0,250	79,51	29,36	84,85
	0,180	27,86	10,29	95,14
	0,125	9,13	3,37	98,51
	0,090	1,83	0,68	99,19
*	0,075	0,55	0,20	99,39
	0,063	0,24	0,09	99,48
	<0.063	1,38	0,52	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

	vægt%
Silt og ler .....<0.063mm:	0,52
Fin-sand .....>0.063mm-<0.200mm	7,28
Mellem-sand ..>0.200mm-<0.600mm	61,76
Grov-sand .... >0.600mm-<2.00mm	20,05
Grus ..... >2.00mm	10,39
Sum:	100,00

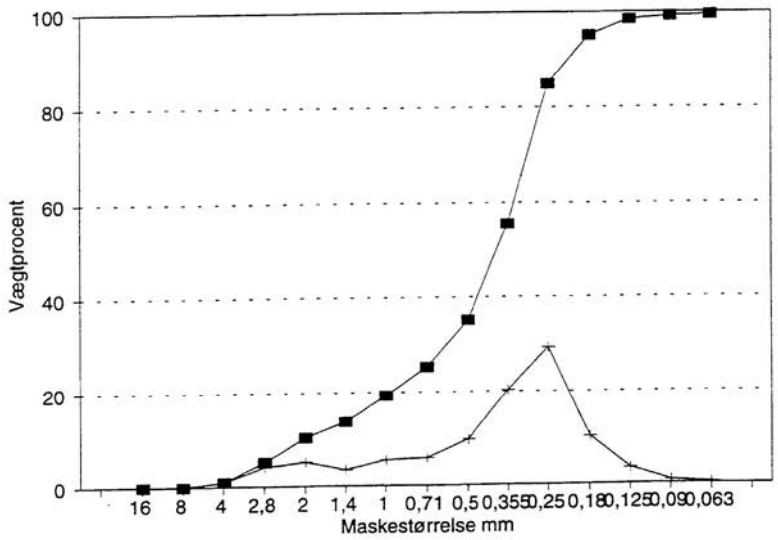
Beregninger.

25% fraktil	0,725
40% fraktil	0,465
Median	0,394
75% fraktil	0,285
90% fraktil	0,215
Middelkornstørrelse	0,468
Sorteringsgrad	1,594
Uensformighedstallet	2,164

NB: Fraktilerne fundet ved LINÆR interpolation

0

Kornkurve (akkumuleret og pr. fraktion



SIGTEANALYSE.

Rekvirent: Birger Larsen
Lokalitet:
Boring:
Prøve nr: 574-006 2 Grab.
Dybde (m):
Bem: Ikke slemmet.
Lab.nr: 960583
Dato: 29 November1996
Laborant: I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 100,88 g

Finsigtning.

	sigte mm	g	v%	% Sigterest akkumuleret v%
	16,000	0,00	0,00	0,00
	8,000	0,26	0,26	0,26
	4,000	1,27	1,26	1,52
	2,800	1,58	1,57	3,09
	2,000	1,40	1,39	4,48
	1,400	0,87	0,86	5,34
	1,000	1,64	1,63	6,97
	0,710	1,27	1,26	8,23
	0,500	8,94	8,86	17,09
	0,355	25,48	25,26	42,35
	0,250	46,47	46,06	88,41
	0,180	9,60	9,52	97,93
	0,125	1,56	1,55	99,48
	0,090	0,26	0,26	99,74
*	0,075	0,07	0,07	99,81
	0,063	0,02	0,02	99,83
	<0.063	0,19	0,17	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

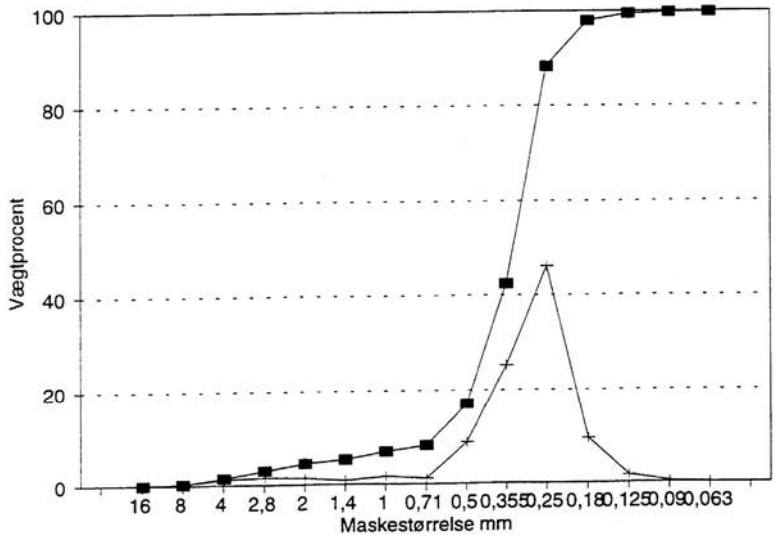
	vægt%
Silt og ler .....<0.063mm:	0,17
Fin-sand .....>0.063mm-<0.200mm	4,62
Mellem-sand ..>0.200mm-<0.600mm	82,34
Grov-sand .... >0.600mm-<2.00mm	8,39
Grus ..... >2.00mm	4,48
Sum:	100,00

Beregninger.

25% fraktil	0,455
40% fraktil	0,368
Median	0,338
75% fraktil	0,281
90% fraktil	0,238
Middelkornstørrelse	0,358
Sorteringsgrad	1,273
Uensformighedstallet	1,546

NB: Fraktilerne fundet ved
LINÆR interpolation

Kornkurve (akkumuleret og pr. fraktion



SIGTEANALYSE.

Rekvirent: Birger Larsen
Lokalitet:
Boring:
Prøve nr: 574-006 1
Dybde (m):
Bem: Ikke slemmet.
Lab.nr: 960582
Dato: 29 November1996
Laborant: I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 151,65 g

Finsigtning.

sigte mm	g	v%	% Sigterest akkumuleret v%
16,000	0,00	0,00	0,00
8,000	0,00	0,00	0,00
4,000	0,99	0,65	0,65
2,800	1,46	0,96	1,61
2,000	1,22	0,80	2,41
1,400	1,09	0,72	3,13
1,000	2,06	1,36	4,49
0,710	1,97	1,30	5,79
0,500	14,13	9,32	15,11
0,355	40,34	26,60	41,71
0,250	71,97	47,46	89,17
0,180	13,64	8,99	98,16
0,125	2,16	1,42	99,58
0,090	0,24	0,16	99,74
* 0,075	0,02	0,01	99,75
0,063	0,02	0,01	99,76
<0.063	0,34	0,24	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

	vægt%
Silt og ler .....<0.063mm:	0,24
Fin-sand .....>0.063mm-<0.200mm	4,17
Mellem-sand ..>0.200mm-<0.600mm	84,92
Grov-sand .... >0.600mm-<2.00mm	8,26
Grus ..... >2.00mm	2,41
Sum:	100,00

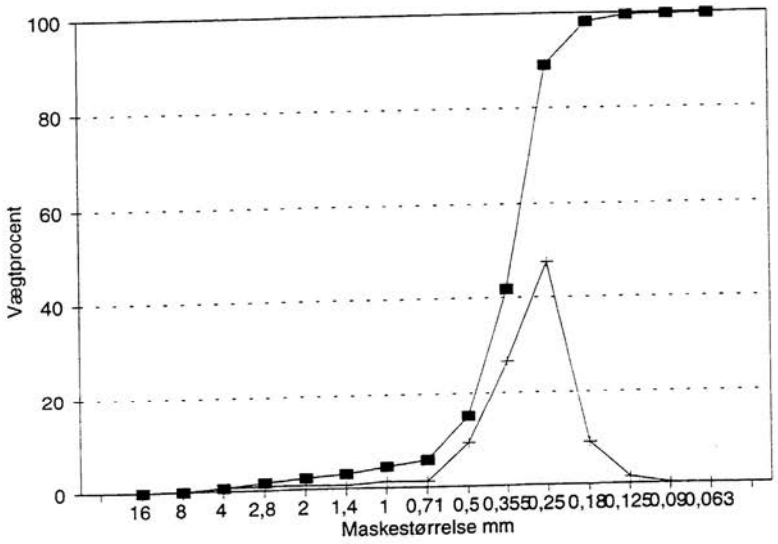
Beregninger.

25% fraktil	0,446
40% fraktil	0,364
Median	0,337
75% fraktil	0,281
90% fraktil	0,244
Middelkornstørrelse	0,355
Sorteringsgrad	1,259
Uensformighedstallet	1,496

NB: Fraktilerne fundet ved LINÆR interpolation

0

Kornkurve (akkumuleret og pr. fraktion



SIGTEANALYSE.

Rekvirent: Birger Larsen
Lokalitet:
Boring:
Prøve nr: 574-001
Dybde (m):
Bem: Ikke slemmet.
Lab.nr: 960581
Dato: 29 November1996
Laborant: I. Nørgaard

Danmarks Geologiske Undersøgelse
Thoravej 8, 2400 København NV.
TLF. 31106600
Sedimentlaboratoriet

Prøvens totalvægt: 131,53 g

Finsigtning.

	sigte mm	g	v%	% Sigterest akkumuleret v%
	16,000	0,00	0,00	0,00
	8,000	0,00	0,00	0,00
	4,000	4,91	3,73	3,73
	2,800	4,58	3,48	7,21
	2,000	3,65	2,78	9,99
	1,400	3,66	2,78	12,77
	1,000	5,10	3,88	16,65
	0,710	9,38	7,13	23,78
	0,500	18,96	14,41	38,19
	0,355	36,58	27,81	66,00
	0,250	36,79	27,97	93,97
	0,180	6,61	5,03	99,00
	0,125	0,60	0,46	99,46
	0,090	0,04	0,03	99,49
*	0,075	0,01	0,01	99,50
	0,063	0,01	0,01	99,51
	<0.063	0,65	0,49	100,00

*)NB: 0.075 mm sigten udprintes ikke på kurven.

Sigteprocenter.

	vægt%
Silt og ler .....<0.063mm:	0,49
Fin-sand .....>0.063mm-<0.200mm	1,95
Mellem-sand ..>0.200mm-<0.600mm	66,23
Grov-sand .... >0.600mm-<2.00mm	21,34
Grus ..... >2.00mm	9,99
Sum:	100,00

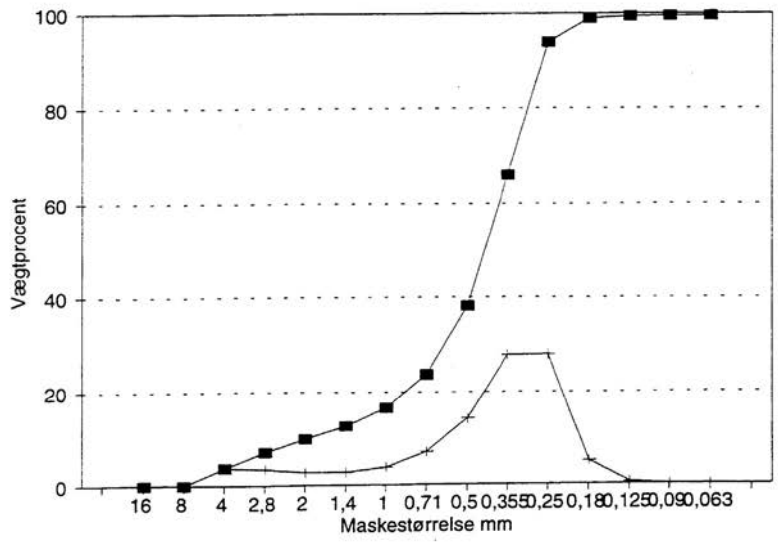
Beregninger.

25% fraktil	0,692
40% fraktil	0,491
Median	0,438
75% fraktil	0,321
90% fraktil	0,265
Middelkornstørrelse	0,484
Sorteringsgrad	1,468
Uensformighedstallet	1,852

NB: Fraktilerne fundet ved LINÆR interpolation

0

Kornkurve (akkumuleret og pr. fraktion



LÆSØ TRINDEL PRØVER 17 og 21 Maj 1996

574-001 Haps E: 634229 N: 6367355? 11 m (ressourceområdet)
SAND, groft, m mellemsand, let gruset og småstenet, lys gulligråt,. m skalstumper
I to mislykkede forsøg fik vi 1 sten på henholdsvis 5 og 10 cm.
Glødetab 1.17% Kalkindhold 21% Kornkurve i bilag 3.1

574-002 Grab E. 634167 N: 6367459 10 m (top af " strandvold")
4 forsøg. Tang og et par håndstore sten.
Ikke repræsentativ.

574-003 Grab E: 633868 N: 6367996 11 m (småsten facies på sidescan)
3 forsøg. Småsten og Grus, tynd rusthinde på korn. Form kantrundet (glacial?).
Næppe repræsentativ.

574- 004 Grab E: 633503 N:6368650 13 m (Sandområde).
SAND, mellem, m. groft sand og fint grus, få småsten. gullig gråt,skalstumper
Residualkarakter.

574- 005 Grab E: 6333380 N: 6368847 14.5 m (småstenet facies på side scan)
GRUS, grovsandet, m mellemsand, gulliggråt, mange rødalger og skalstumper.
Få klumper af gråt ler tyder på meget tyndt residual sediment.

574-006 Grab E: 633071 N: 6369428 18 m (Sandområde)
SAND, groft, m mellemsand, mange skalstumper, gulgrå (som smeltevandssand)
Meget stor Cyprina islandica.
2 prøver. Glødetab 0.7%-0.9 % Kalkindhold 9-11% Kornkurve i bilag 3.2 og 3.3.

574-007 Grab E: 633013 N: 6369543 12m (stenet område)
3 forsøg. Hård bund- kun et par sten og store tangplanter i grabben.
Prøven ikke repræsentativ.

574-008 Vibrocore E: E: 633080,3 N: 6369425.8 18 m (Sandområde)
0 - 104 cm SAND, mellem m grovsand, let fingruset mange skalstumper i top mindre nedefter, mørkt gulliggråt, der iltes til rust-grå.
0-10 cm Glødetab 1.1 % Kalkindhold 21 % Kornkurve bilag 3.4
50-60 cm Glødetab 1.0 % Kalkindhold 14% Kornkurve bilag 3.5
90-100 cm Glødetab 0.6 % Kalkindhold 7 % Kornkurve bilag 3.6
104- 115 cm SAND, grov- og mellemsand, gruset, ca 10 % skalstumper (Astarte,Dosinia,balaner)
105-110 cm Glødetab 0.7% Kalkindhold 13 % Kornkurve bilag 3.7
115-140 cm SKALGRUS, m grovsand, med spredte 1-2 cm gruskorn- enkelte med Fe-Mn belægning.
Prøven virker let leret (opblanding fra laget nedenfor). Postglacialt marint.
120-125 cm Glødetab 2.5 % Kalkindhold 44%
140- 164 cm Skalgruset fortsætter men iblandes ca 50% 5cm store skarpe brudstykker af LER
som beskrevet nedenfor. Prøven afspejler sandsynligvis leroverfladen gennemsat af mange gravegange fyldt med skalgrus.
164- 263 cm LER, fast, ret fedt, gulligråt som er en sekundær farve dannet ved iltning af mørk gråt ler som ses i de indre dele af lerklumperne. Leret selv synes stukturløst, men gennemsættes af stejltstående gravegange 1-2 cm i diameter og fyldt med skalgrus. En sådan gravegang kan følges fra 251-270 cm dvs ca 1 m under leroverfladen. Udfra foraminifer faunaen tolkes leret som Senglacialt Yoldialer.

Appendix 5

List of the paravane transects, point dive positions and the ground truth registrations

paravane 4+6																			
	Depth	Stone>3	Stone1_3	Stone2_1	Gravel	Sand	Algea%	Seaane-mone	Søpindsvin	Plants	Animals	Phys_cond	diveposN	diveposE	ship-posN	shipposE	dis-tance	accdist	
1	15.9	5	20	40	15	20	50	0	0	laminaria	0.5dødmands	clayey/sand	5726.581	1113.544	5726.596	1113.49	60.483	0	
2	16.4	5	10	40	20	25	40	0	0	laminaria	crabs	clayey/sand	5726.596	1113.49	5726.61	1113.462	37.748	60.483	
3	16.5	3	2	10	10	75	30	0	0	laminaria	søstjerner	sandbed	5726.61	1113.462	5726.619	1113.435	31.819	98.231	
4	16.6	3	1	5	2	89	30	0.1	0	laminaria	0.5søstjern	sandy/silty	5726.619	1113.435	5726.639	1113.401	50.069	130.05	
5	16.6	5	2	1	1	91	30	0	0	laminaria	taskekrabb	sandy/silty	5726.639	1113.401	5726.664	1113.348	70.758	180.119	
6	16.5	1	1	1	1	96	60	0.1	0	laminaria	fdødmandsh	sandy/silty	5726.664	1113.348	5726.688	1113.317	52.865	250.877	
7	17	0	0	1	0	99	100	0	0	laminaria	søstjerner	sandy	5726.688	1113.317	5726.708	1113.29	46.287	303.742	
8	17.1	0	0	0.1	0	99.9	100	0	0	lam på små	søstjerner	sandy	5726.708	1113.29	5726.72	1113.272	27.921	350.029	
9	17.1	0	0	0.1	0	99.9	100	0.1	0	lam på små	0.5søstjern	sandy	5726.72	1113.272	5726.728	1113.264	18.183	377.95	
10	17.1	0	0	0.1	0	99.9	100	0	0	laminaria	søstjerner	sandbed	5726.771	1113.197	5726.791	1113.198	36.883	499.713	
11	17.2	0	0	0.1	0	99.9	100	0	0	laminaria	søstjerner	sandbed	5726.791	1113.198	5726.818	1113.151	68.923	536.596	
12	17.4	0	0	0.1	0	99.9	100	0	0	lam. sac	søstj 0.5	sandbed	5726.818	1113.151	5726.813	1113.139	15.709	605.519	
13	17.3	0	0	0.1	0	99.9	100	0	0	lam. sac	søstj 0.5	sandbed	5726.813	1113.139	5726.82	1113.13	17.11	621.228	
14	17.3	0	0	1	0	99	100	0	0	lam sac	søstj0.5	sandbed	5726.82	1113.13	5726.837	1113.113	35.239	638.338	
15	17	0	0	0.1	0	99.9	100	0	0	lam sac på	fjæsinger.	sandbed	5726.837	1113.113	5726.853	1113.097	32.466	673.578	
16	16.8	0	0	0.1	0	99.9	100	0	0	lam sac på	fjæsinger.	sandbed	5726.853	1113.097	5726.864	1113.077	29.984	706.044	
17	16.5	0	0	0.1	0	99.9	100	0	0	lam sac på	fjæsinger.	sandbed	5726.864	1113.077	5726.877	1113.057	30.689	736.028	
18	16.4	0	0	0.1	0	99.9	100	0	0	lam sac på	søstj0.5	sandbed	5726.877	1113.057	5726.905	1113.024	61.465	766.717	
19	16.2	0	0	0.1	0	99.9	100	0	0	lam sac på	0	sandbed	5726.905	1113.024	5726.922	1113.003	37.377	828.182	
20	16.1	20	20	30	5	25	60	0	0	lam palme	søstj0.5	flocal boulder ree	5726.922	1113.003	5726.964	1112.949	95.423	865.559	
21	16.1	7	0	0	30	63	50	0	0	lam palme	0.5dødmands	sandy gravel	5726.964	1112.949	5726.985	1112.927	43.918	960.982	

22	16.2	10	5	1	2	82	60	0	0	lam og rød	dødmandshå	gravelly	5726.985	1112.927	5727.01	1112.893	57.315	1004.9
23	16.4	30	60	10	0	0	40	0	0	palmetangf	0	boulder reef	5727.01	1112.893	5727.023	1112.874	31.498	1062.216
24	10.9	30	60	10	0	0	60	0	0	.palmetang	0	boulder reef	5727.023	1112.874	5727.033	1112.864	20.096	1093.714
25	11	50	30	15	5	0	60	0	0	palmetang.	søstj0.5	boulder reef	5727.033	1112.864	5727.05	1112.856	32.784	1113.81
26	13.7	10	0	1	0	89	60	0	0	palmatang	taskekrabb	boulder reef	5727.05	1112.856	5727.062	1112.834	30.604	1146.594
27	14.2	10	1	0	2	87	50	0	0	kødblad. r	krabber	sandbed	5727.062	1112.834	5727.086	1112.801	55.472	1177.198
28	14.3	20	0	15	0	65	40	0	0	finger. pa	0	sandbed	5727.086	1112.801	5727.112	1112.777	54.065	1232.67
29	14.4	15	0	5	20	60	40	0	0	finger.pal	0	sandbed	5727.112	1112.777	5727.13	1112.754	40.834	1286.734
30	14.7	10	0	0	10	80	60	0	0.5	finger.pal	0	large boulders	5727.13	1112.754	5727.15	1112.721	48.502	1327.569
31	14.9	10	0	5	5	80	40	0	0	finger. pa	0	sand m	5727.15	1112.721	5727.177	1112.694	58.186	1376.07
32	14.9	15	0	0	10	75	50	0	0	lam sac.pa	søstj0.5	sand m	5727.177	1112.694	5727.192	1112.675	32.308	1434.256
33	15.1	5	5	0	5	85	50	0	0	lam sac. p	søstj0.5	sand m	5727.192	1112.675	5727.207	1112.647	39.727	1466.563
34	15.2	3	2	0	10	85	50	0	0	lam sac.kø	dødmandshå	sand m	5727.207	1112.647	5727.234	1112.62	56.339	1506.29
35	15.1	5	2	0	10	83	50	0.1	0	lam sac. p	0.5søstj.dø	rsand and boulde	5727.234	1112.62	5727.258	1112.59	54.138	1562.629
36	15.2	5	3	0	5	87	60	0	0	lam sac. p	dødmandshå	rsand and boulde	5727.258	1112.59	5727.284	1112.554	60.283	1616.767
37	15.3	15	0	0	10	75	60	0	0	lam sac. k	søstj0.5	rsand and boulde	5727.284	1112.554	5727.298	1112.535	32.074	1677.05
38	15.3	2	1	0	10	87	60	0	0	palme.kødb	søstj0.5	sand m	5727.298	1112.535	5727.317	1112.517	39.151	1709.124

paravane 11																		
	Depth	Stone>3	Stone1_3	Stone2_1	Gravel	Sand	Algea%	Seaanemo	Søpindsvin	Plants	Animals	Phys_cond	diveposN	diveposE	ship-posN	shipposE	dis-tance	ac-cdist
1	10.9	0	1	10	89	0	10	0	0	kel. palme	sea urchi 0	gravelbed	5726.137	1114.122	5726.125	1114.158	42.272	
2	10.8	0	1	10	89	0	10	0	0	kel. palme	sea urchi 0	gravelbed	5726.16	1114.075	5726.118	1114.121	89.996	206.2

3	11	0	0	5	70	25	5	0	0	0	0	sand m	5726.118	1114.121	5726.107	1114.14	28.371	296.2
4	11.1	0	1	1	70	28	5	0	0	kel. lam s	0	sand + gra	5726.107	1114.14	5726.093	1114.174	42.061	324.6
5	11.1	0	1	1	30	68	3	0	0	kel. palme	sea urchi 0	sand + gra	5726.093	1114.174	5726.079	1114.218	51.274	366.6
6	11.3	0	0	2	10	88	5	0	0	kel. lam s	sea urchi 0	sandbed	5726.074	1114.224	5726.057	1114.237	35.209	428
7	11.5	5	0	0	5	90	5	0	0	palme	0	few stones	5726.057	1114.237	5726.037	1114.272	50.495	463.6
8	11.6	5	5	20	70	0	60	0	0	palme	0	boulder ree	5726.037	1114.272	5726.001	1114.296	71.328	514.1
9	11.5	3	5	50	10	32	50	0	0	palme . kel	sea urchi 0	rest er sa	5726.001	1114.296	5725.976	1114.305	46.035	585.5
10	11.6	3	5	80	12	0	60	0	0	kel. palme	0	sand + gra	5725.976	1114.305	5725.945	1114.334	65.92	631.5
11	11.5	5	5	60	20	10	50	0	0	palme . kel	0	sandbed	5725.945	1114.334	5725.916	1114.365	60.386	697.4
12	11.3	5	10	60	20	5	60	0	0	palme . lam	0	SAND	5725.916	1114.365	5725.887	1114.403	66.221	757.8
13	11.5	5	5	70	10	10	70	0	0	kel. palme	0	SAND	5725.887	1114.403	5725.861	1114.437	59.401	824.0
14	11.5	2	2	40	30	26	50	0	0	palme .			5725.861	1114.437	5725.839	1114.464	48.194	883.4
15	11.6	10	1	60	25	4	40	0	0	palme . kel	sea urchi 0	SAND	5725.832	1114.474	5725.809	1114.504	52.658	947.8
16	11.8	5	5	50	20	20	40	0	0	palme . kel	0	SAND	5725.809	1114.504	5725.784	1114.539	57.841	1000.5
17	11.6	2	5	70	18	5	70	0	0	kel. palme	0	SAND	5725.784	1114.539	5725.75	1114.584	77.45	1058.3
18	9.6	5	10	60	20	5	60	0	0	kel. palme	sea urchi 0	SAND	5725.75	1114.584	5725.719	1114.623	68.863	1135.8
19	8.8	2	3	80	15	0	70	0	0	røde buske	0		5725.719	1114.623	5725.695	1114.655	55.281	1204.6
20	7.6	5	20	70	5	0	80	0	0	corda filu			5725.695	1114.655	5725.664	1114.692	67.779	1259.9
21	5.8	5	50	45	0	0	90	0	0	corda filu	sea urchi 0.1		5725.664	1114.692	5725.64	1114.727	56.865	1327.7
22	4.5	5	50	45	0	0	90	0	0	corda filu	sea urchi 0.1		5725.64	1114.727	5725.62	1114.755	47.069	1384.6
23	5.3	0	10	90	0	0	70	0	0	røde buske			5725.62	1114.755	5725.608	1114.772	27.475	1431.6
24	8.2	0	20	80	0	0	80	0	0	røde	sea	dense shel	5725.60	1114.77	5725.58	1114.79	44.302	1459.1

										buske	urchi 0		8	2	8	7		
25	11.4	1	20	70	9	0	80	0	0	kel. lam s		SAND	5725.588	1114.797	5725.571	1114.818	38.287	1503.4
26	11.6	0	5	90	5	0	60	0	0	kel. lam s			5725.571	1114.818	5725.545	1114.847	55.062	1541.7
27	12.3	0	10	70	10	10	70	0	0	kel.	sea urchi 0	SAND	5725.545	1114.847	5725.524	1114.871	45.825	1596.7
28	13	0	5	80	10	5	80	0	0	kel. lam s	sea urchi 0	SAND	5725.524	1114.871	5725.496	1114.905	61.912	1642
29	13.9	0	0	90	5	5	60	0	0	kel. palme	sea urchi 0	SAND	5725.496	1114.905	5725.469	1114.937	60.207	1704.5
30	14.7	0	5	30	0	65	15	0	0	lam sac. p		SAND	5725.469	1114.937	5725.448	1114.96	44.775	1764.7
31	14.9	0	1	3	0	96	5	0	0	lam sac. k		SAND	5725.448	1114.96	5725.43	1114.979	37.568	1809.5

Paravane 13																		
	Depth	Stone>3	Stone1_3	Stone2_1	Gravel	Sand	Algea%	Seaanemone	Søpindsvin	Plants	Animals	Phys_cond	diveposN	diveposE	shipposN	shipposE	distance	accdis
1	11.2	3	1	70	26	0	40	0	0	lam sac.pa	0.5seaurchi	sand below	5726.011	1114.998	5726.006	1114.993	12.011	
2	11.2	5	2	50	43	0	50	0	0	palmetang	0.5seaurchi	sand below	5726.006	1114.993	5726.042	1115.049	87.658	12.0
3	11.2	1	1	40	58	0	40	0	0	palmetang.			5726.042	1115.049	5726.046	1115.058	10.863	99.6
4	11.5	1	1	30	40	28	60	0	0	palme.kæll		sand reste	5726.046	1115.058	5726.07	1115.093	56.798	110.5
5	11.7	10	20	50	20	0	80	0	0	palme. kæl	0.5seaurchi		5726.07	1115.093	5726.092	1115.142	63.11	167
6	11.9	20	20	50	10	0	80	0	0	lam sac.pa	0.5seaurchi		5726.092	1115.142	5726.11	1115.181	52.167	230
7	12	15	15	50	20	0	70	0	0	palme.skul	0.5seaurchi	few stones	5726.11	1115.181	5726.13	1115.223	55.022	282.6
8	12.2	1	5	20	10	64	20	0	0	lam sac. p		sand reste	5726.13	1115.223	5726.143	1115.265	48.852	337.6
9	12.4	0	5	1	2	92	10	0	0	sac. kælli		sand m	5726.143	1115.265	5726.16	1115.319	63.059	386.4
10	12.4	3	2	10	10	75	20	0.5	0	palme. kæl	0.5seaurchi	sand reste	5726.16	1115.319	5726.184	1115.376	71.542	449
11	12.6	3	5	5	10	77	30	0	0	palme. kød	0.5seaurchi	SAND reste	5726.184	1115.376	5726.204	1115.424	60.964	521.0
12	13	1	2	5	5	87	10	0	0	kællinge.		sand reste	5726.204	1115.424	5726.22	1115.46	45.491	582.0
13	13.2	0	0.1	1	1	97.9	5	0	0			sand reste	5726.22	1115.46	5726.231	1115.484	31.786	627.5
14	13	3	2	5	2	88	10	0	0	sac. kælli		sand reste	5726.231	1115.484	5726.249	1115.522	50.081	659.3
15	13	0.1	2	1	20	76.9	2	0	0	sac. palme	0.5seaurchi	sand reste	5726.249	1115.522	5726.262	1115.572	55.939	709.4

Paravane 15																	
	Depth	Stone>3	Stone1_3	Stone2_1	Gravel	Sand	Algea%	Sea anem-one	Søpindsvin	Plants	Animals	Phys_cond	diveposN	diveposE	shipposN	shipposE	distan
1	15.9	0	1	40	20	39	15	0	0	Lam sac. k	seaurch 0	rest is sa	5725.306	1115.183	5725.264	1115.218	85.0
2	16.4	0	0	3	1	96	2	0	0	Lam sac.	seaurch 0	coarse sand	5725.264	1115.218	5725.274	1115.13	90.4
3	16.8	0	0	1	5	94	1	0	0	Lam sec	0	coarse sand	5725.274	1115.13	5725.367	1114.776	392.5
4	17.4	0	0	3	1	96	5	0	0	Lam sac. k	0	sand with e	5725.367	1114.776	5725.393	1114.822	66.2
5	16.7	0	0	3	2	95	3	0	0	Lam sac. k	0	Sand with s	5725.393	1114.822	5725.42	1114.874	72.5
6	15.9	0	0.1	3	0	96.9	5	0	0	Lam sac. p	0	sand m	5725.42	1114.874	5725.45	1114.928	77.7
7	15.1	0	0	5	0	95	5	0	0	Lam sac. k	0	sand m	5725.45	1114.928	5725.482	1114.959	66.3
8	14.6	0	0	7	0	93	5	0	0	Lam. sac.	0	sand m	5725.482	1114.959	5725.517	1114.997	74.7
9	14	0	1	8	2	89	10	0	0	Lam sac. p	seaurch 0	sand m	5725.517	1114.997	5725.534	1115.042	55
10	13.9	0	10	20	1	69	20	0.1	0	Lam sac. p	0	sand m	5725.534	1115.042	5725.566	1115.037	59.4
11	13.2	0	1	90	5	4	50	0	0	palme. ke	0	sand below	5725.566	1115.037	5725.608	1115.032	76.8
12	12.2	0	1	90	1	8	50	0	0	kel. Lam s	0	sand below	5725.608	1115.032	5725.636	1115.018	55.0
13	11.2	0	1	90	5	4	50	0	0	palme. kel	0	sand below	5725.636	1115.018	5725.672	1115.002	67.8