

SURVEY REPORT

TNO IMARES

Date 12 October 2006

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**Environmental Description Habitat1180, B13 Block,
(18 – 28 September 2006)
Survey 06-06-10**

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1. Background

The Dogger Bank Area is indicated as an area of special interest because of its natural values. In the B-13 area leaking of natural shallow gasses occurs. Areas with natural gas seeps are placed under the Habitat Directive Annex I habitat type 1180 "Submarine structures made by leaking gases". In such areas aggregations of sandstone may occur due to carbonate cementing of sediment from microbial oxidation of gas emissions. These sandstone formations can form complex structures consisting of rocks or blocks, pavements and pillars up to 4 m high, sheltering a specific ecosystem.

The objective of the survey was to perform a habitat mapping survey in the B13-section of the Dutch Continental shelf, in order to identify the presence shallow gas and of indicators of the Marine Habitat 1180. Indicators are active seepage of gas and fluids, carbonate structures, pockmarks, sediment characteristics and associated characteristic organisms and habitat discriminators typical for this habitat.

The different remote sensing techniques included shallow seismic for bottom profiling, side scan sonar for seabed description, as well as ground truthing of the sea bed sediment using a suitable grab sampling technique (Hamon grab sampler).

2. Tailor-made Survey

2.1 Choice of sampling stations

Figure 1 shows the layout of the proposed set of seismic lines which was used for seismic survey in this study. The layout includes:

- full coverage of the B13 area
- reconnaissance tracks passing A12 and B10, to confirm the analysis that shallow gas is not present at these proposed drilling locations.
- reconnaissance tracks passing A18 and B16, to investigate the possible presence of natural gas seepage at these locations as the seismic data indicated migration of deeper gas into shallower strata.
- a track passing location B13 which follows an X-Star track that TNO made during the NASCENT project when gas seepages were identified at several locations.

2.2 Sampling and techniques

For the survey the ship “OMS Pollux” was used. A DGPS navigation system was installed for surveying the positioning of the ship. An offset was calculated for the positioning of the sonar and echo sounder systems, as well as of the positions of the sediment samples.

The Side Scan Sonar and Chirp echo sounder work was carried out by TNO Built Environment and Geosciences.

The sampling positions for grab samples were determined based upon the results of the seismic information. The positions were chosen as follows to enable a good description of the B13 area. Locations of interest were:

- a) locations where evidence was found of gas seepage in the water column. These locations were identified on the echo sounder and side scan sonar images (4 stations)
- b) areas representing different types of surface morphology. These areas were identified on the side scan sonar images (6 stations; 3 stations in areas of with only little or no morphological features and 3 stations in areas with clear bed forms).

At each sampling location station where gas seepage was identified five (replicate) samples were collected for macrofauna and sediment analysis. At each sampling station chosen to describe the surface morphology three (replicate) samples were collected for macrofauna and sediment analysis. The grab samples for macrofauna and sediment analysis were all taken with a Hamon grab (0.09 m²).

On deck a visual description was made of each sample. First a small subsample was taken from each grab sample for sediment analysis. After this the content of each of the replicates was washed through a sieve with 1 mm diameter. The material left behind on the sieve was collected separately for each sample into polyethylene containers and preserved with 4% buffered formaldehyde in seawater solution.

General information the sample position, water depth, time of sampling, weather conditions and allocation of samples was recorded by a surveyor/Shipman.

At all stations the positions of the 3-5 sub samples taken were within a range of circa 20 m meters at gas seep locations and within a range of 50 m at areas to describe the sea bed morphology. All samples contained at least the top 20 cm deep, some even 35 – 40 cm.

The actual positions of the sediment samples are shown in figure 2.

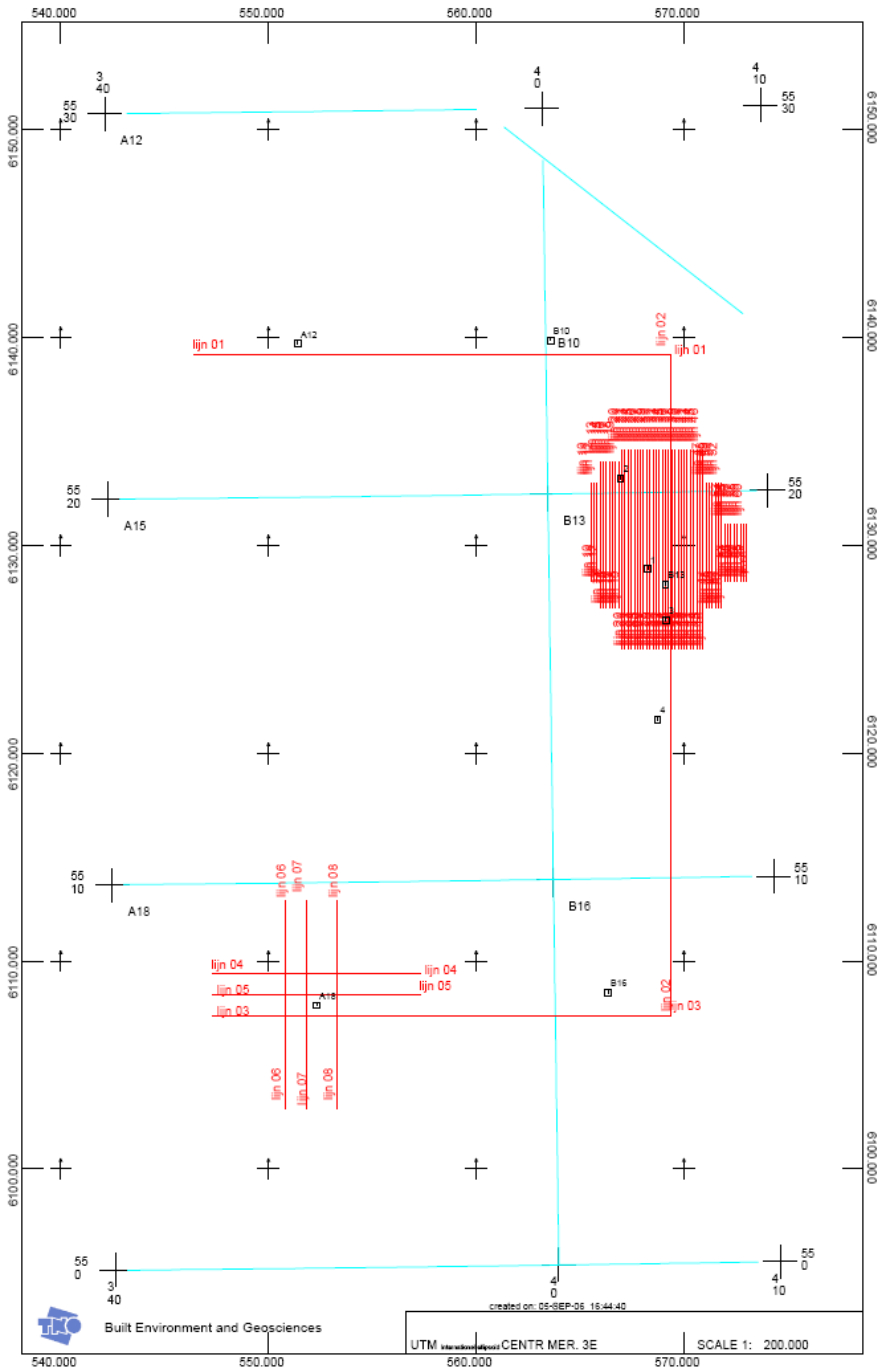


Figure 1. Overview of the positions of the seismic lines in the survey of the B13 block and some additional lines in the A block. Squares indicate the positions of former drill locations.

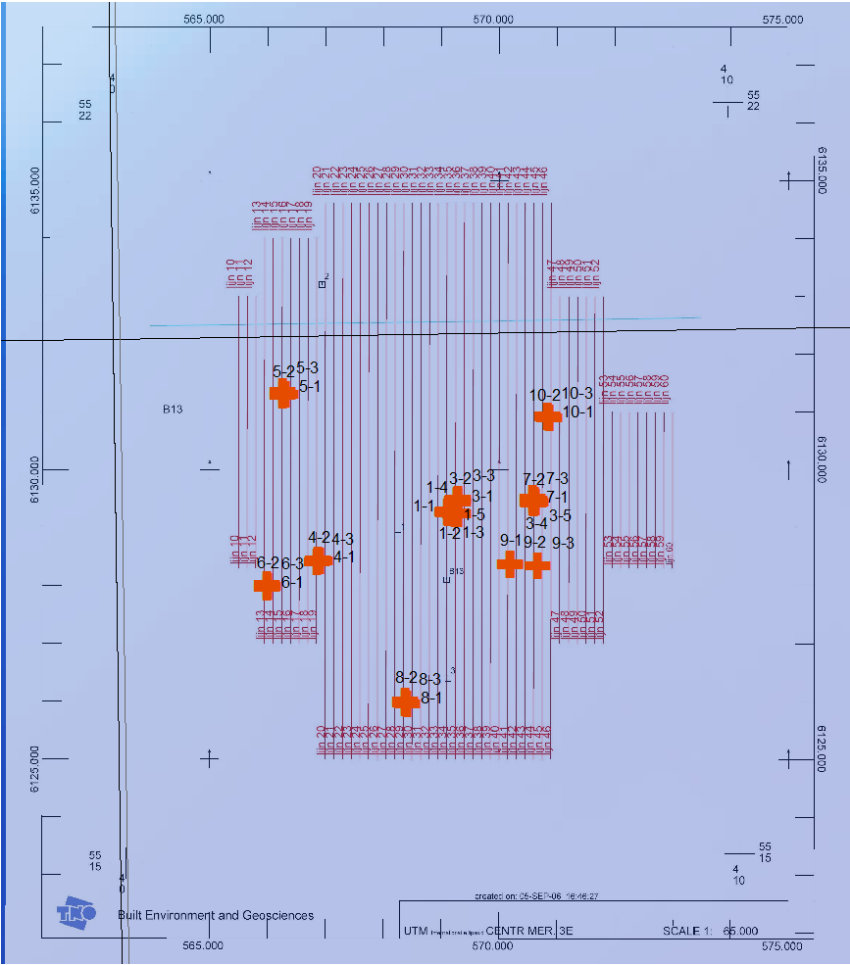


Figure 2. Overview of the sample positions at the B13 block

3. Measurements, decisions and on board observations

The program for shooting the seismic lines started with the lines in B13 block, beginning with the short lines in the east. After some technical problems and a weather forecast that was not promising, it was decided to give priority to shoot first the long lines in the centre of B13 block, passing the drilling positions. This in order to gather as much information of the centre part of the B13 block, as well as around the former drilling positions. If the weather should improve than the lines on either site would be filled in. The lines in A block were given lower priority.

It was decided to conduct the grab sampling after finishing the seismic work. As the crane was needed to position the Hamon grab on deck between the A-frame, the seismic work could not continue at the same time. This would mean inefficient use of time. By having this order of activities, also all information of the seismic work on possible locations of interest could be used in deciding the exact positions for the grab sampling.

The echo sounder was set out close to the ship over port side. To avoid collision/damage with the equipment and to increase efficient sailing time, each turn was made over port side. Lines were braided as, at each turn in the north one line was skipped and a second taken to the south. In the south a short turn was made to fill in the missed line.

From the sonar images it became clear that within the B13 the sea bed surface is not uniform. Overall depth was between 39 – 42 m. Areas with only little morphological features (e.g line 25?) alternate with areas with presumably small and some large ripples or megaripples. As the sonar fish is flying at a depth of about 20 m above the sea bed, the images tend to show more features at distances further away from the fish (the shading effect becomes stronger with relative small features).

The sonar images showed shallow gas accumulation at several locations. At 4 locations gas seepages was clearly visible in the water column and at several locations smaller gas seepages were found. During grab sampling at some locations, small air bubbles were seen at the surface.

After having finished also the remaining reconnaissance lines it was decided that along the lines no extra ground truthing samples were needed. No special features indicating Marine Habitat 1180 were seen and also the areas in which gas seepage was observed did not differ strongly from those at the B13 area.

Weather circumstances

Sea water temperature 16.5 °C
Air temperature 17 C, relative humidity 63%, Barometer 1008mBar, SE Wind 23.8 Knots
Average wind force between 2-7 Bf, During day sunny/ light cloudy, evening cloudy and some rain.
Wave height between 1 – 3 m;
Weather, mostly dry, light cloudy, some showers, sometimes sunny

4. Infrastructure and Equipment

Navigation, Meteorology, Bathymetry

Depth

sea temp ca 16 C

air temp

Ship heading

DGPS antenna CSI type CDA2 Receiver CSI type GBX Pro.

Side scan sonar CM 800 325 kHz

Chirp echo sounder Furuno full color Echosounder

Ground truthing equipment

Hamon grab 0.09 m²

1 mm sieve table with round holes, direct discharge of sediment thru a hose pipe

Remarks

Tuesday 19/9/06. A check of the 3.5 kHz echo sounder revealed that it did not work properly. It was replaced by a Chirp echo sounder which was brought from Utrecht to Cuxhaven, Germany.

5. Daily Reports

Monday 18th September 2006.

Mobilization in Den Helder at 8:00, departure for Denmark at 9.30 hrs., arrival at Faaborg (DK) 19.00 hrs. Start with mobilizing on the vessel 'OMS Pollux' and installing equipment. A safety check of the vessel and safety equipment was done. Company Safety Procedures and Environmental Protection Policy were found to be in order.

Departure from Faaborg at 22:30 hrs; transit to the Kiel Canal.

Tuesday 19th September.

During the day the equipment was tested and adjustments were made to the ship. During the afternoon problems were identified in the signal processing of the 3.5 kHz system. As the weather forecast for the B13 area was also not good (wave height up to 4m), it was decided not to continue sailing to the area but to have the system replaced during the time waiting for significant weather improvement. Port was made in Cuxhaven, Germany.

Wednesday 20th September.

A chirp sub-bottom profiler system arrived at Cuxhaven at 10:00 hrs as a replacement. This system was tested in the harbor during the day. Sail was set to the B13 area at 18:15 hrs.

The weather forecast shows low pressure area passing over the AB blocks, resulting in significant wave height, but expected to improve towards the weekend.

Thursday, 21st September.

Arrival at B13 area at 11:00 hrs. Equipment was prepared. Start sailing seismic lines at 13:00 hrs with side scan sonar and sub-bottom profiler at B13 area. Seismic survey will continue during evening.

Wind force up to 7, Wave heights average 2 -3 m with some larger ones; during the day some improvement.

Unfortunately the captain got seriously sick, the crew has taken up the tasks to continue the survey. E-mail communication by satellite is not running.

Friday, 22nd September.

Start seismic survey at 8:30 hrs. First line at 10:30 hrs. Weather is good, wave height ca. 2 m.

Thursday, 21st September.

Seismic survey was continued during evening. Finish survey at 23:00; Equipment on deck at 23:45 hrs.

Friday, 22nd September.

Start preparing equipment for seismic survey at 8:30 hrs.

Since Thursday a total of 23 seismic lines have been surveyed in the B14 block. At two locations the presence of gas seepage is clearly visible from the subbottom profiler signal. So far no clear evidence of pockmarks was found.

Seismic survey was finished at 22:30; Equipment on deck at 23:15 hrs.

Weather conditions are good, wave height ca. 2 m; the weather forecast for the next days is good.

Saturday, 23rd September.

Start preparing equipment for seismic survey at 8:30 hrs.

Check side scan sonar and echo sounder system. Start with sailing lines at 9.30.

Seismic survey was finished at 21:50; Equipment on deck at 22:15 hrs.

In total 11 lines were completed. All lines were in the B13 block.

Weather conditions are still good, wave height ca. 1,5 -2 m; and decreasing.

Sunday, 24th September.

Start preparing equipment for seismic survey at 8:30 hrs.

Check side scan sonar and echo sounder system. Start with sailing lines at 9.00.

In total 14 lines were completed, which round off all foreseen lines of the B13 block.

Seismic survey was ended at 23:00; Equipment on deck at 23:30 hrs.

Weather conditions continue to be good, wave height ca. 1,5 m;

Because of expected best weather conditions for Monday, we will start with the grab sampling to describe B13 - block at several stations. Finishing of remaining lines in A and B block is foreseen on Tuesday.

Monday, 25th September.

Start preparing equipment and installation for ground truthing at 8:30 hrs.

Start grab sampling at 9.00 hrs.

At 10 locations a total of 38 grabs were taken. All grabs were taken at the B13 block. Locations were selected on the basis of the side scan sonar images and echo sounder information.

Grab sampling was ended at 21.45 hrs; Demobilization of equipment and conservation of material was finished at 22.40 hrs.

Weather conditions were very good, wave height less than 1,5 m;

Finishing of remaining lines in A and B block is foreseen for tomorrow, Tuesday 26th.

Tuesday, 26th September.

Start preparing seismic equipment at 8:30 hrs. Start with first seismic line at 9.15 hrs. The lines 1 – 10 running in A and B block were sailed.

Seismic survey was finished at 23:00; Equipment on deck at 23:20 hrs.

All the lines that were scheduled for this cruise were completed. Transit to Esbjerg at 23:30 hrs

Weather conditions were good, wave height 1 – 1.5 m.

Thursday, 28th September.

Loading of equipment at 07:30 hrs. Transit to Den Helder. Arrival at Den Helder at 17:00 hrs. Demobilisation of equipment. The samples were securely stalled. End of field survey activities.

Appendix 1. List of Stations, coordinates and sample information

Date	Station nr.	sub sample	jar nr	Time	°N coordinates			°E coordinates			Depth	Weather & wave condition	Current °	Course °
					°N	min	sec	°E	min	sec				
250906	9	1	1	16.25	55	17	48.9	4	6	20.26	40.2	calm, cloudy, East 1- 2, wave height 1 - 1,5 m	90	180
250906	9	2	2	10.5	55	17	48.2	4	6	20.2	40.3	„	90	180
250906	9	3	3	11.22	55	17	47.2	4	6	47.72	40.2	„	90	180
250906	2	1	4	11.34	55	18	17.42	4	5	29.33	39.8	„	90	300
250906	2	2	5	12.51	55	18	17.01	4	5	28.37	40.1	„	86	243
250906	2	3	6	13.08	55	18	17.09	4	5	28.81	39.8	„	86	340
250906	2	4	7	13.38	55	18	17	4	5	29.9	39.9	„	80	100
250906	2	5	8	13.54	55	18	16.96	4	5	29.85	39.5	„	80	20
250906	2		NITG	14.08	55	18	17.01	4	5	27.83	39.7	„	114	310
250906	1	1	9	14.23	55	18	18.28	4	5	21.35	39.6	„	114	70
250906	1	2	10	14.32	55	18	18.47	4	5	20.3	39.7	„	258	80
250906	1	3	11	14.4	55	18	18.36	4	5	20.73	39.7	„	258	85
250906	1	4	12	14.52	55	18	18.99	4	5	21.16	39.6	„	258	70
250906	1	5	13	15.01	55	18	17.97	4	5	20.97	39.8	„	258	15
250906	4	1	14	15.24	55	17	52.16	4	3	14.13	39.3	„	268	70
250906	4	2	15	15.35	55	17	52.3	4	3	11.9	39.4	„	270	70
250906	4	3	16	15.44	55	17	51.3	4	3	11.44	39.5	„	270	40
250906	6	1	17	16.15	55	17	39.1	4	2	22.46	39.3	„	270	70
250906	6	2	18	16.24	55	17	38.24	4	2	22.62	39.6	„	268	70
250906	6	3	19	16.35	55	17	37.73	4	2	22.05	39.6	„	268	70
250906	5	1	20	17.05	55	19	25.22	4	2	42.95	39.2	„	270	90
250906	5	2	21	17.18	55	19	24.98	4	2	40.16	39.1	„	270	80
250906	5	3	22	17.28	55	19	27.2	4	2	39.84	39.2	„	270	60
250906	10	1	23	18.08	55	19	10.98	4	6	59.65	40	„	263	50
250906	10	2	24	18.16	55	19	9.72	4	7	1.5	40.1	„	263	50
250906	10	3	25	18.24	55	19	10.71	4	6	59.29	40.3	„	263	50
250906	10	4	26	18.48	55	18	23.8	4	5	29.78	40.2	„	260	80
250906	10	5	27	18.58	55	18	24.6	4	5	29.45	40.1	„	260	60
250906	3	1	28	19.06	55	18	23.83	4	5	30.41	40.2	„	260	70
250906	3	2	29	19.15	55	18	24.17	4	5	29.34	40.1	„	260	30
250906	3	3	30	19.25	55	18	25.3	4	5	30.76	40.2	„	260	10
250906	3	4	31	19.45	55	18	23.06	4	6	46.52	40.4	„	246	70
250906	3	5	32	19.57	55	18	23.91	4	6	45.73	40.5	„	246	10
250906	7	1	33	20.05	55	18	24.99	4	6	43.5	40.5	„	246	80
250906	7	2	34	20.13	55	18	22.6	4	6	44.88	40.4	„	246	80
250906	7	3	35	20.19	55	18	23.07	4	6	43.34	40.6	„	268	70
250906	8	1	36	21.1	55	16	31.1	4	4	37.32	41.5	„	100	160
250906	8	2	37	21.2	55	16	33.17	4	4	35.9	41.2	„	100	20
250906	8	3	38	21.35	55	16	31.96	4	4	35.32	42	„	100	340

Appendix 2. Examples of side scan sonar and echo sounder images, B13 area

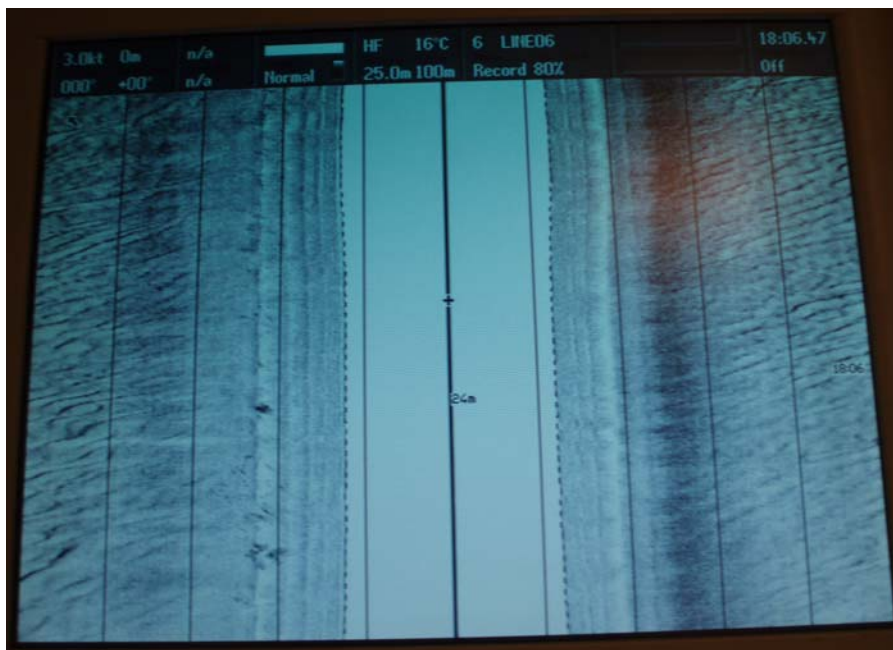


Figure 3a Side scan sonar image an area with clear bed forms at the B13 area.

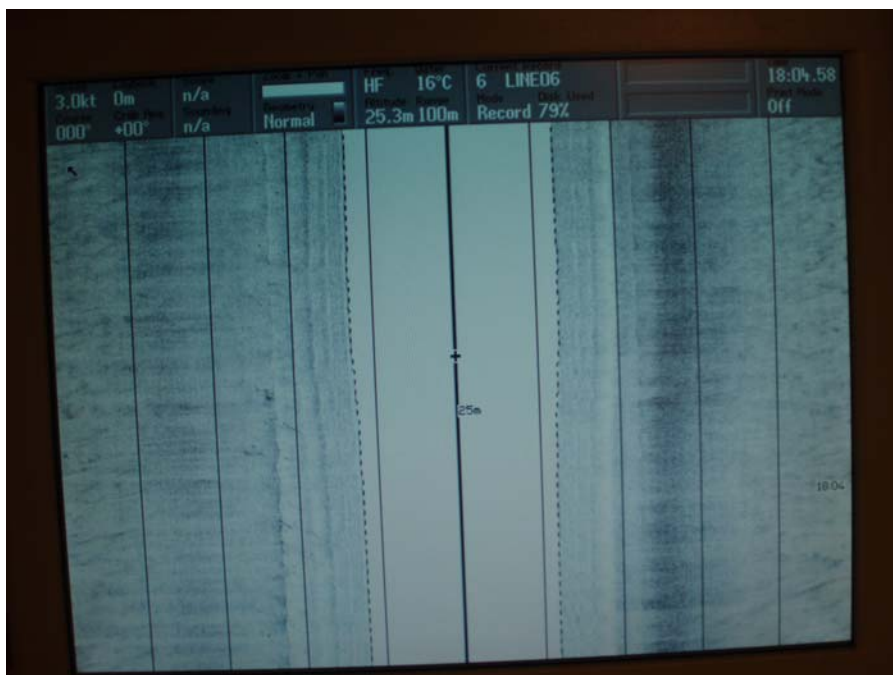


Figure 3b Side scan sonar image of an area with almost no morphological features at the B13 area

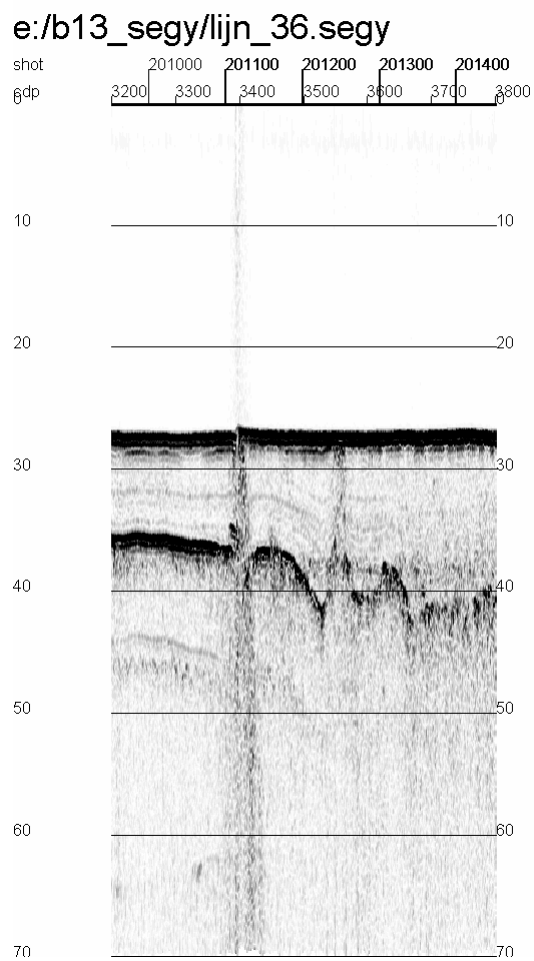


Figure 3c Echo sounder image with shallow gas and gas seepage in the water column at the B13 area