Cruise Report Belgica 01/12

Porcupine Basin, off Western Ireland

May 02 - May 11, 2001

David Van Rooij

Veerle Huvenne

Jean-Pierre Henriet

RCMG

Renard Centre of Marine Geology

Ghent University, Belgium

INTERNAL PUBLICATION

TABLE OF CONTENTS

Van Rooij, D., Huvenne, V. & Henriet, J.-P. (2001). Cruise Report Belgica 01/12. RCMG Internal Publication, 33 pp.

1. Cruise reference

Belgica 01/12
Zeebrugge - Galway
02.05.2001 - 11.05.2001

2. Framework and objectives

2.1 Framework

The geophysical research programme of the Belgica cruise 2001/12 frames into several national and international projects:

- **Geconcerteerde Onderzoeksactie (GOA) "Porcupine-Belgica":**

  (Bijzonder onderzoeksfonds, Universiteit Gent, 1999-2004) Development of a measurement technique for assessing the physical properties of the seabed with a deep-tow system, with emphasis on carbonate mounds and hydrate studies

- **EU 5th Framework Projects (FP5) GEOMOUND (coördinator RCMG) and ECOMOUND**
- **Preparation of an Ocean Drilling Programme (ODP) proposal** (presently under evaluation): survey of potential sites for high-resolution coring in the Porcupine Basin
- **Training at sea** of young scientists from Galway, Moscow and Ghent (EU, Flemish Government)
- **"Cetaceans and Birds at Sea"** project, Coastal Resources Centre, University College Cork (UCC), Ireland
- **ACES** (Atlantic Coral Ecosystem Study - EU FP5)
- **Ph.D. projects of the IWT and FWO**

2.2 Objectives

(1) Some fundamental contributions to the study of the general geological setting of deep-sea carbonate mounds and of the associated deep water coral ecosystems in Porcupine Basin.

One of the major aims of the 2001 PORCUPINE-BELGICA cruise was the seismic surveying of an area in Porcupine Basin, characterised by the presence of various large deep-sea mounds and related features. The profiles were planned in such way to provide maximum information about the mound genesis, possible gas migration pathways, slope instabilities, etc. The seismic profiling also focused on a more detailed geological picture of some features identified during the previous Belgica cruises (97/12, 98/11, 99/13 and 00/16-17). One SW-NE seismic line was planned to make a connection between the *Belgica* and the *Hovland-Magellan* mound provinces, in order to better assess the relative timing of mound growth and the stratigraphy of the surrounding (drift) sediments. The gathered data also contribute to the documentation of sampling sites for an Ocean Drilling Program (ODP) proposal (under review) and for coring in the framework of the E.C. 5th Framework Programme proposal "GEOMOUND". DSDP site 548 on Goban Spur was also targeted with the intention to calibrate the high-resolution seismic profiles with lithologic data, contributing to the ODP proposal and ongoing studies in the Porcupine basin.

In cooperation with the Marine Biology unit of the Ghent University, several boxcores have been taken on sites prepared by the ANT/XVII/4 hydrosweep multibeam survey (R/V Polarstern) and the high-resolution seismic data in the framework of the ACES project (FP5). The aim of this sampling was to study the meio and macro benthos ecosystems and diversity in association with the mounds.

(2) Reconnaissance of channels and canyons on the slopes of the Porcupine Basin

A second goal of this campaign was the acquisition of high-resolution seismic profiles over the channels and canyons cutting the eastern slope of the basin, based upon Hydrosweep multibeam data and previously acquired seismic data. Three types of channels can be distinguished. In the south, the Gollum Channel system (E-W tributary system) was already subject of seismic profiling during the 99/13 campaign of R/V Belgica. The seismic lines were planned to intersect two upper slope canyons, investigating the suggested presence of faults and possible perched turbidite deposits. More to the north, other E-W oriented channels are broader and are supposed to be related to mass wasting events. Finally profiles were planned through and across the axis of south-north running (contourite) channels.

(3) Development of a new high-resolution deep-tow seismic measurement system.

Porcupine Basin has further been used as a major natural field laboratory for testing the RCMG deep-towed seismic system (cfr. tests in cruises 97/12, 98/11, 99/13 and 00/16), in preparation of future seismic research.

3. Departure and arrival of the cruise

departure: Zeebrugge	02.05.2001, at 13.40h.
arrival: Galway	11.05.2001, at 09.00h.

Belgica 01/12

Remark: Galway is only accessible during a tidal window

4. Working area

The working area during the expedition was 52°30'N – 13°30'W and 48°30'N-11°00'W (Fig. 1). The objective of the expedition was the geophysical acquisition of high-resolution seismic data on Goban Spur (Fig. 6), the Gollum channels and the Belgica Mound Province (Fig. 7) and the Hovland and Magellan Mound Provinces (Fig. 8) in Porcupine Basin, off Western Ireland.

5. Expedition report

5.1 Coordination at Sea

Chief scientist:	HENRIET, Jean-Pierre Renard Centre of Marine Geology, Ghent University, Belgium
Second scientist:	VERSTEEG, Willem Renard Centre of Marine Geology, Ghent University, Belgium

5.2 Scientific staff

Jean-Pierre HENRIET	Renard Centre of Marine Geology (RCMG),
Koen DE RIJCKER	RCMG
Veerle HUVENNE	RCMG
Geert MOERKERKE	RCMG
Kevin SMET	RCMG
Peter VAN DAMME	RCMG
David VAN ROOIJ	RCMG
Willem VERSTEEG	RCMG
Guy DE SMET	UG MARINE BIOLOGY
Pavel SHASHKIN	Moscow State University (Russia)
Hugo GALANES-ALVAREZ	University of Wales, Bangor (U.K.)
Mick MACKEY	University College Cork (Ireland)

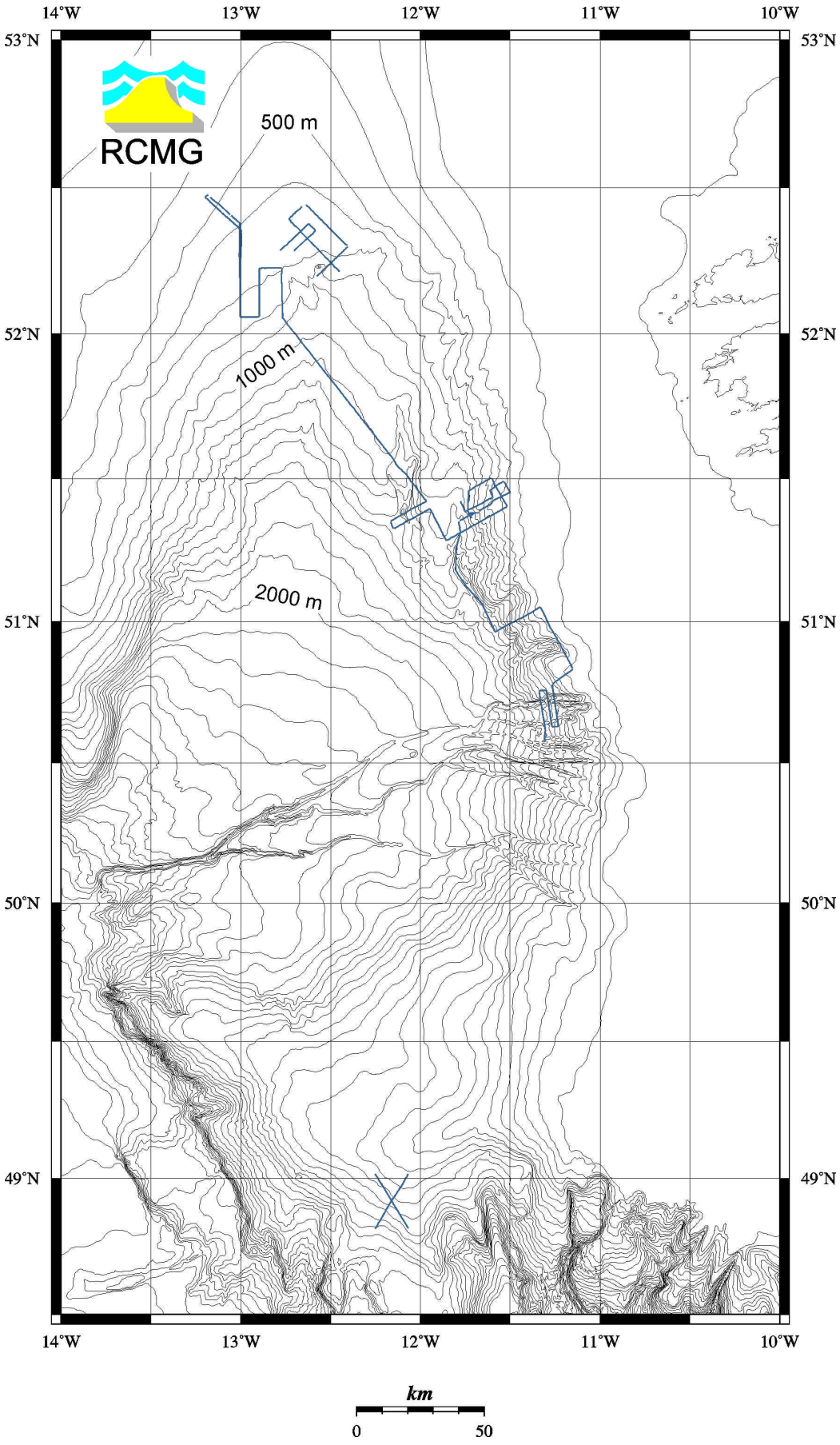


Figure 1: *Location map of the working area (Mercator projection, WGS-84).*

5.3 Operations

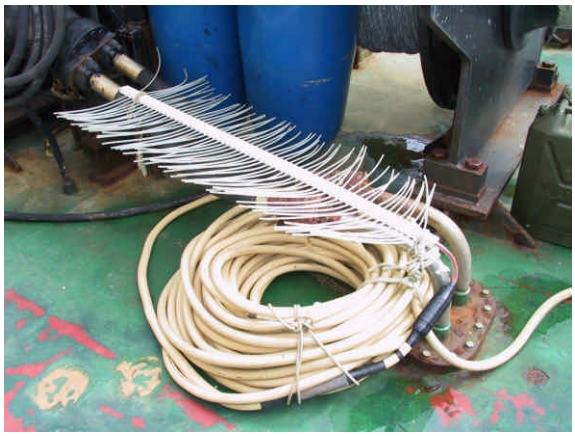


Figure 3: *500 J sparker source.*

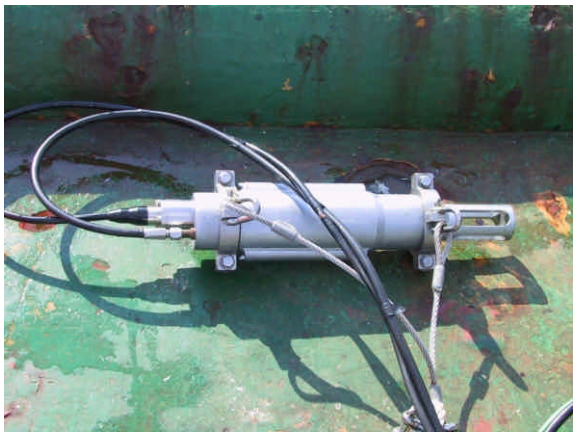


Figure 2: *15 cu inch watergun source.*

The table below gives a summary of the different combinations between the sources and the streamers during the acquisition of the data.

Profiles	Source (*)	Receiver (**)
P010501-26	sparker	SS
P010527-28	sparker	DT_8 & SS
P010529-40b	sparker	SS
P010541-43	watergun	DT_8 & SS
P010542-50	sparker	SS
P010551-52	watergun	SS

*The acoustic sources used during this campaign were a SIG sparker (80 electrodes) with an energy of 500J or a watergun (15 cu. inch)

** The streamers used were the MC deeptow streamer (DT_i) where "*i*" is the number of the channels connected to the computer and/or the SIG surface single channel streamer (SS)

Figure 4: *deeptow bottle and multichannel streamer.*

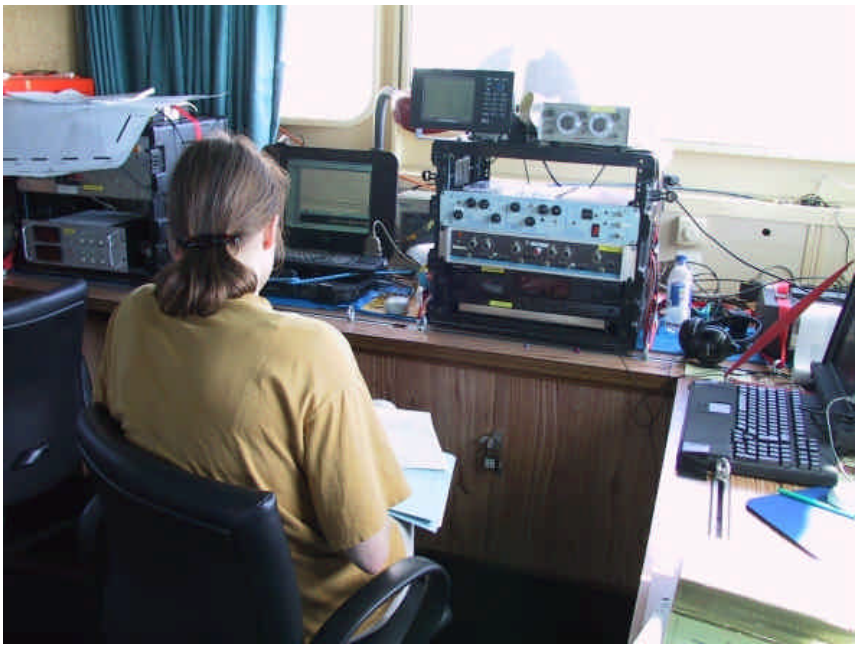


Figure 5: *setup of seismic acquisition equipment (single channel surface and multichannel deetow system) on the bridge of R/V Belgica.*

It is worth noting that the time used in the logbook is the Belgian time (BRAVO TIME = UTC+2hours) and the time in the Odas-file is the UTC time.

Wednesday 02.05.2001

09:30 Arrival of scientific team in Zeebrugge, seismic instrumentation has already been set up on the 26th and 27th of April. The departure of the ship is slightly delayed by a delay in delivery of a repaired deeptow cable head (from Denmark).

13:40 Departure R/V Belgica A962, calm sea state (3-4 bft)

Thursday 03.05.2001

Transit to the working area. Calm sea state (2-3 bft), good visibility.

10:00 Scientific briefing

Roughening of the weather in the late afternoon.

Friday 04.05.2001

Transit to the working area. Sea agitated (5-6 bft), good visibility.

08:00 Water sampling. A bucket was used instead of a Niskin bottle. Surface water was sampled instead of water at 3m depth. This was decided due to the sea state: the upper water layers were sufficiently mixed due to the wave action. A total volume of 50 l of water was sampled, stored in 5 containers of 10 liter, covered with black plastic bags and put in the fridge. The coordinates of the sampling point were

retrieved from the ODAS data at beginning and end of the sampling. Printed information was included with the samples):

Latitude:	49°27,4760' N
Longitude:	8° 8,4536' W
Water temperature:	10,94 °C
Salinity:	35,4 psu

21:00 Observation of a dozen (estimation) of Bottle-nosed dolphins, within close proximity of the ship (50-500 m).

23:30 Sea state stable 4-5 bft, switch from diesel to electric propulsion. Preparation and testing of seismic equipment

23:55 Start of line P010501

Saturday 05.05.2001

02:10 Passing DSDP site 548

04:06 End of line P010501; transit to next waypoint

05:56 Start of line P010502

08:18 Passing DSDP site 548

09:00 Sea state 3-4 bft, partly cloudy but sunny and good visibility

10:48 End of line P010502; streamer and sparker were taken out of the water; switch to diesel propulsion and transit to next waypoint (Gollum Channels)

21:10 Arrival Gollum Channels, switch to electric propulsion

21:15 Start of line P010503

Sunday 06.05.2001

Sea state 3-4 bft, good visibility and sunny weather

00:20 End of line P010503

00:30 Start of line P010504

00:43 End of line P010504

00:46 Start of line P010505

02:46 End of line P010505

02:48 Start of line P010506

03:07 End of line P010506

03:09 Start of line P010507

05:27 End of line P010507

05:30 Start of line P010508

06:48 End of line P010508

06:50 Start of line P010509

06:50 Start of line P010509

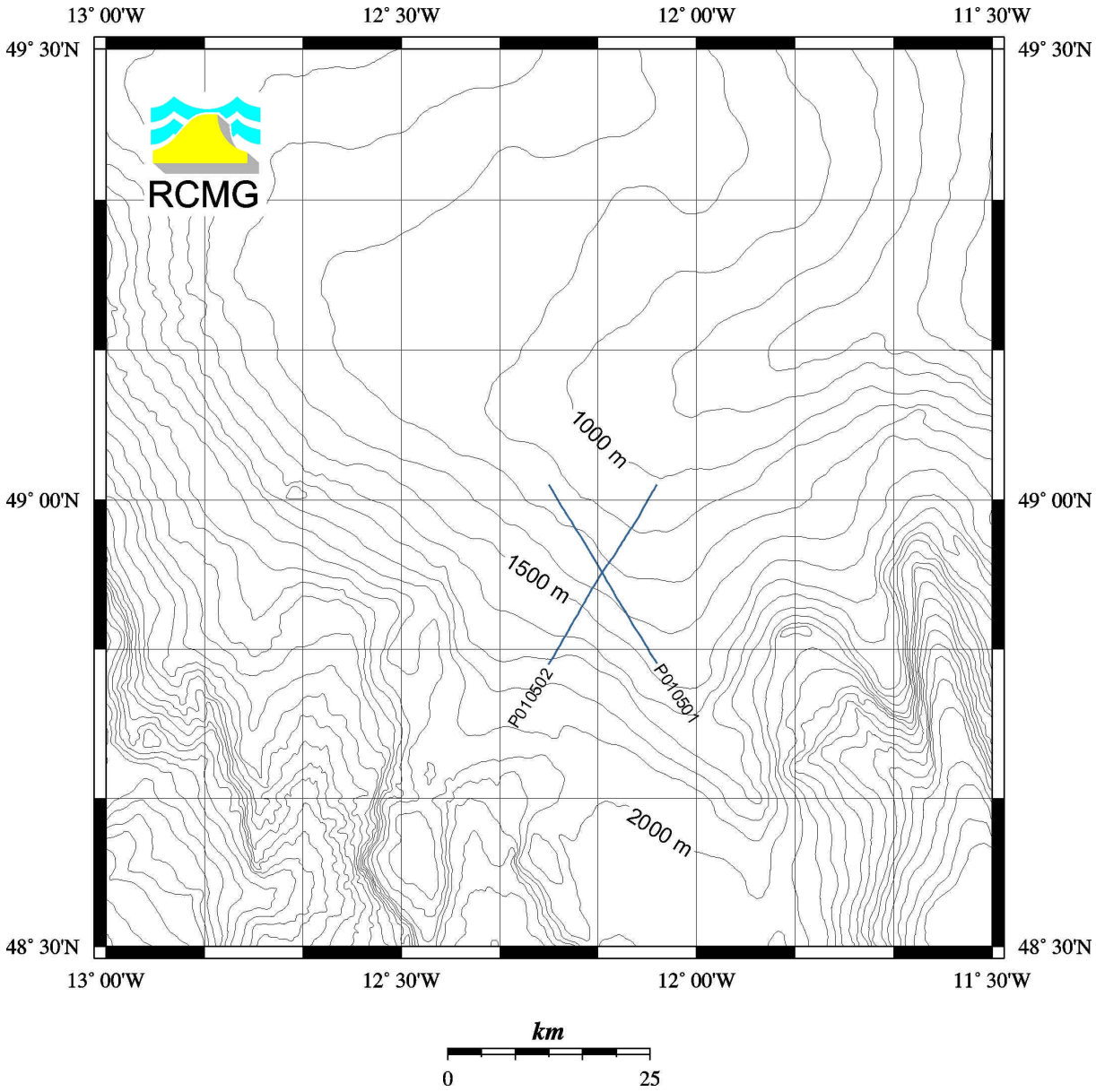


Figure 6: *Location map of the seismic profiles acquired on Goban Spur (Mercator projection, WGS-84).*

10:40 End of line P010509

10:54 Start of line P010510

11:40 Passing proposed ODP drill site Porc 01-A

13:29 End of line P010510

13:39 Start of line P010511

17:19 Change of course

18:10 Change of course

18:34 Change of course

19:10 Observation of approximately 10 long-finned pilot whales at an estimated distance of 300 m, then passing astern. The sounds these mammals made were observed and recorded through the seismic streamer

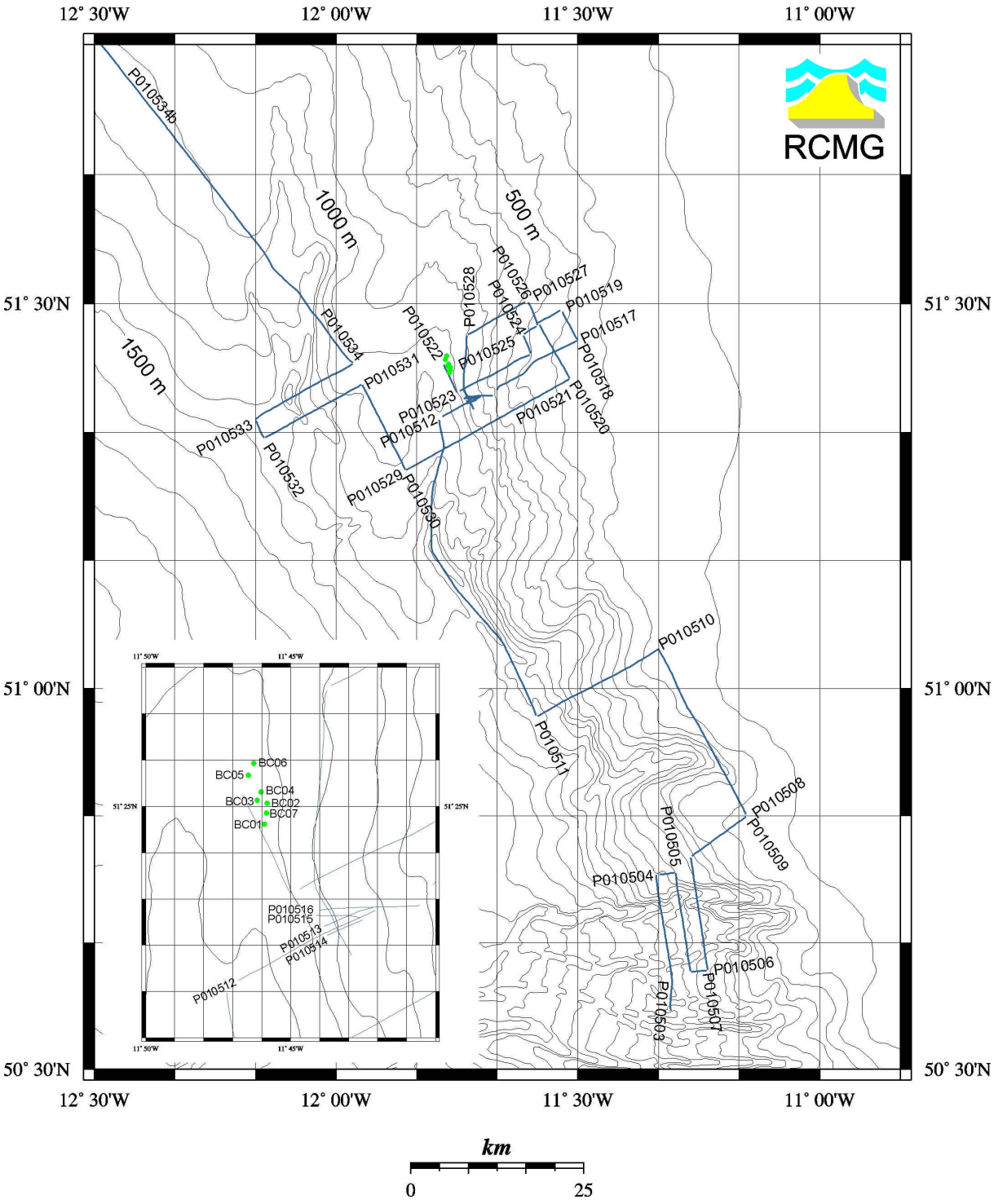


Figure 7: *Location map of the seismic profiles acquired in the Belgica Mound Province. The position of the boxcores (green dots) and some small profiles are shown on the inset map (Mercator projection, WGS-84).*

19:26 Triggering of the seismic source was ceased to record the whale sounds

19:32 Restart triggering of the seismic source

19:57 End of line P010511

20:05 Start of line P010512

20:40 Passing proposed ODP drill sites Porc 03-A & 04-A

21:00 End of line P010512, it is decided to acquire some small additional lines (P010513-16) on the proposed ODP sites
21:04 Start of line P010213
21:20 End of line P010213
21:28 Start of line P010514
21:44 End of line P010514
21:45 Start of line P010515
21:57 End of line P010515
22:02 Start of line P010516
22:35 End of line P010516
22:43 Start of line P010517
22:53 Passing site of MD992327
23:20 Change of course
23:37 Change of course

Monday 07.05.2001

00:33 End of line P010517
00:36 Start of line P010518
01:10 End of line P010518
01:15 Start of line P010519
01:50 End of line P010519
01:54 Start of line P010520
03:10 End of line P010520
03:12 Start of line P010521
06:31 End of line P010521, transit to boxcore site N°1. Weather conditions are fair, practically no wind (2 bft.), but a low-frequent swell is present
07:42 Boxcore site 1 (51°24,7670'N / 11°45,8658'W); the boxcore did not reach the seafloor and was thus not closed
08:03 Second attempt for Boxcore 1 (51°24,6150'N / 11°45,9063'W)
08:51 Boxcore site 2 (51°25,0680'N / 11°45,8097'W)
09:54 Boxcore site 3 (51°25,3120'N / 11°46,0226'W)
10:53 Boxcore site 4 (51°25,1290'N / 11°46,1553'W)
11:57 Boxcore site 5 (51°25,9290'N / 11°46,2717'W)
13:12 Boxcore site 6 (51°25,6700'N / 11°46,4553'W)
14:04 Boxcore site 7 (51°24,8970'N / 11°45,7773'W); this is the same location as boxcore site 1, in order to obtain more recovery. A rock was caught in between the boxcore bucket and the closing plate, causing an empty boxcore.
14:43 Second attempt boxcore site 7 (51°24,8560'N / 11°45,8289'W), transit to the next waypoint for seismic acquisition
15:34 Start of line P010522

16:11 End of line P010522
16:15 Start of line P010523
17:53 End of line P010523
17:56 Start of line P010524, first tests of the deeptow streamer, towed at the surface (not recorded)
18:17 End of line P010524
18:20 Start of line P010525
18:38 End of line P010525
18:40 Start of line P010526
19:10 End of line P010526
19:22 Start of line P010527
19:55 Interruption (noise), switch of power supply
20:30 Speed of ship reduced to 2 knots due to deeptow testing
20:40 End of line P010527
20:49 Start of line P010528
20:51 Start of simultaneous deeptow and surface streamer recording
23:50 End of simultaneous deeptow and surface streamer recording

Tuesday 08.05.2001

00:01 End of line P010528
00:56 Start of line P010529
01:52 End of line P010529
01:55 Start of line P010530
02:30 Passing proposed ODP drill site Porc 05-A
03:44 End of line P010530
03:47 Start of line P010531
06:07 End of line P010531
06:09 Start of line P010532
06:31 End of line P010532
06:34 Start of line P010533
08:47 End of line P010533
08:50 Start of line P010534
15:05 End of line P010534, start of line P010534b
21:50 End of line P010534b
21:54 Start of line P010535
23:10 Passing proposed ODP drill site Porc 07-A (Propellor mound)

Wednesday 09.05.2001

00:39 End of line P010535
00:41 Start of line P010536

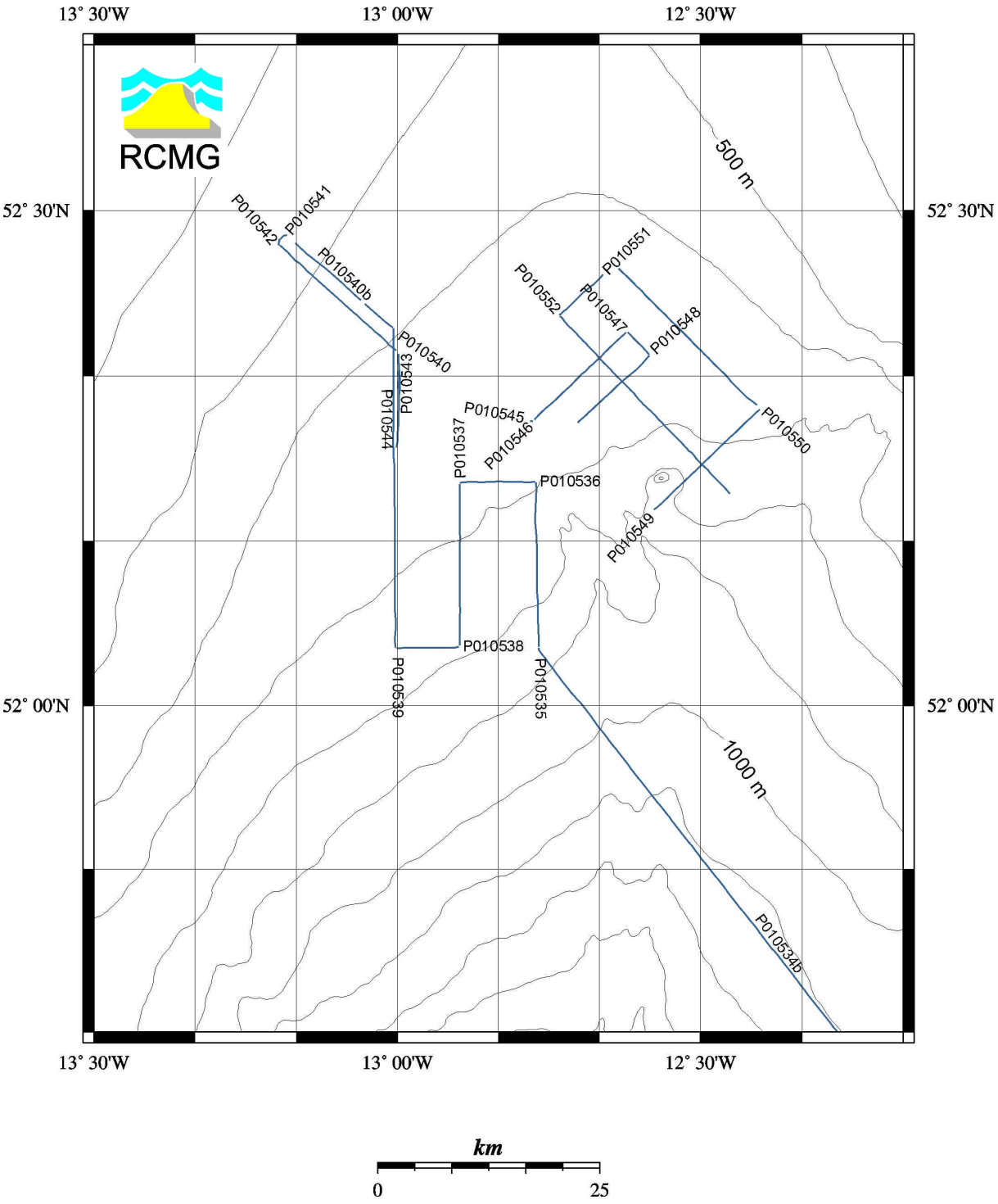


Figure 8: *Location map of the seismic profiles acquired in the Hovland-Magellan Mound Province (Mercator projection, WGS-84).*

01:55 End of line P010536

01:59 Start of line P010537

04:29 End of line P010537

04:31 Start of line P010538

05:33 End of line P010538

05:35 Start of line P010539

09:27 Passing proposed ODP drill site Porc 12-A

10:26 End of line P010539

10:28 Start of line P010540

11:00 90 traces were not recorded, a new line (P010540b) was recorded

12:37 End of line P010540b

12:47 Start of line P010541; simultaneous use of deeptow and surface streamer with a watergun source

13:00 End of line P010541

13:05 Start of line P010542

17:31 End of line P010542

17:40 Start of line P010543

19:20 Observation of 2 small Minke whales playing around the ship for approximately 1u30. Triggering of watergun stopped and line P010543 was ended. Streamer kept recording possible whale sounds

Figure 9: *images of the Minke whale playing around the ship*

20:50 Start of line P010544

21:50 Passing proposed ODP drill site Porc 13-A "Minke whale mound"

22:00 Observation of possible whale noise through the streamers

22:12 End of line P010544; transit to next waypoint

23:57 Start of line P010545

Thursday 10.05.2001

01:20 Passing proposed ODP drill site Porc 09-A

01:57 End of line P010546

02:00 Start of line P010547

02:39 End of line P010547

02:41 Start of line P010548

04:22 End of line P010548

05:34 Start of line P010549

08:07 End of line P010549

08:12 Start of line P010550

11:14 End of line P010550

11:35 Start of line P010551, change of source from sparker to watergun

12:43 End of line P010551

12:44 Start of line P010552

13:50 Two possible Minke whales were observed astern of the ship

14:10 Breaching Minke whales (10 times) at approximately 1-2 nautical miles

17:16 Passing proposed ODP drill site Porc 11-A

18:10 End of line P010552 and end of the acquisition of campaign R.V. Belgiva 01/12; Transit to Galway

Friday 11.05.2001

08:30 Arrival of pilot on board

09:00 Arrival in the port of Galway, end of campaign R.V. Belgica 01/12.

6. Preliminary Results

6.1 Geological investigations

The previous very high-resolution seismic surveys carried out in 1997, 1998, 1999 and 2000 through an Irish-Belgian co-operative action, within the framework of the EC ENAM II and Corsaires projects, had allowed the identification of three major seabed mound provinces. A province of largely buried mounds, the "**Magellan area**" in the northern part of the Porcupine basin, is limited to the south by a depression in which larger outcropping seabed mounds occur, the "**Hovland mounds**". Further south along the eastern Irish continental margin a third province has been identified, where the mounds are observed along the flanks of a blind channel which runs parallel with the slope: the "**Belgica mounds**".

During the present cruise (Belgica 01/12) all objectives were accomplished and the coverage of all proposed ODP drilling sites by a small network of profiles was completed (Fig. 1). Furthermore, 5 multichannel deeptow lines were acquired with the new 'geode' system. An overview of the preliminary results of the geophysical investigations is presented together with some samples in the next 6 sections: Goban Spur, the Gollum channels, the channels and slumps, Belgica mounds and Hovland-Magellan mounds. A last section will discuss preliminary results of the deeptow tests.

6.1.1 Goban Spur transect (P010501-02)

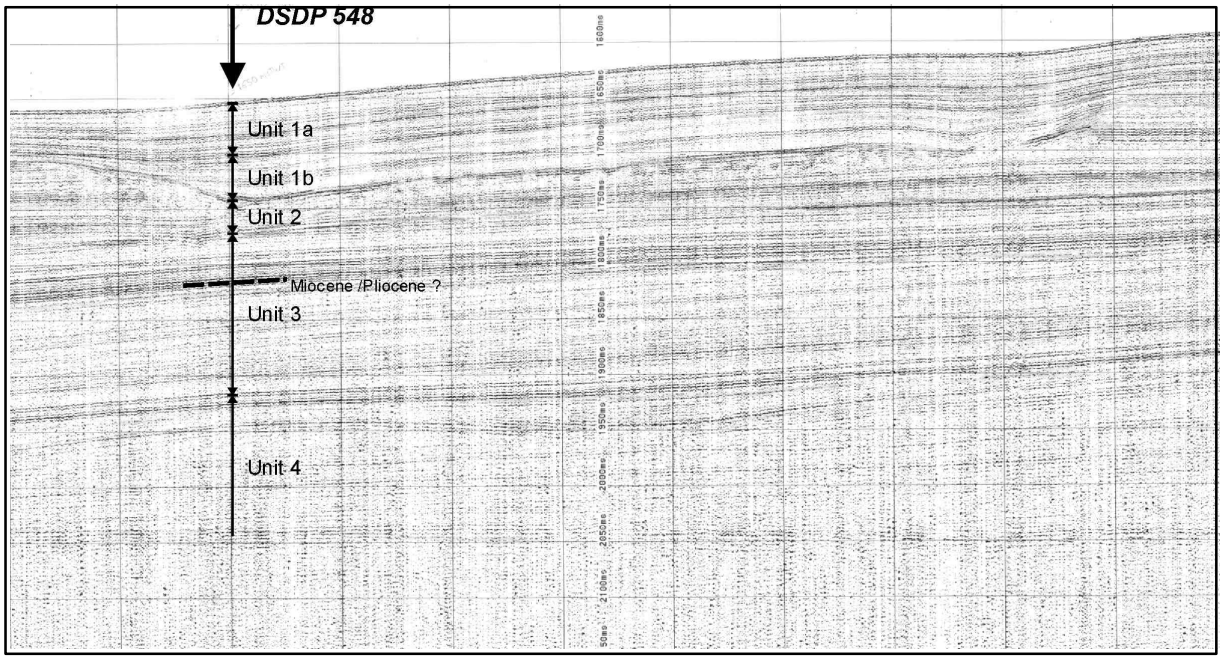


Figure 10: *Profile P010501 (NNW-SSE) across DSDP hole 548. Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

The first two seismic profiles of this campaign were centered on Hole 548 of DSDP Leg 80 (1981). The initial reports of this drill site suggest the presence of only one major unconformity separating the Middle from the Upper Miocene within the acquired acoustic penetration of 400 ms TWT [de Graciansky *et al.*, 1984]. However, several unconformities are observed on the seismic profiles. Still, they can be correlated with the lithological units described in the initial reports.

A first unconformity is characterised by the presence of locally very broad incisions. The one presented in figure 10 is approximately 4km wide and 50 ms TWT deep (approximatley 40 m). This probably is the base of the Holocene to Pleistocene Unit 1, consisting out of gray calcareous muds, marly nannofossil oozes and marly nannofossil-foraminifer oozes. Here, the presence of muddy turbidites is inferred. Based upon calcium carbonate content, sedimentary structures and gamma ray intensity data, this unit is subdivided in Subunit 1a (0-59.9 m) and Subunit 1b (59.9 - 72 m). Also, an abrupt erosional contact between the two subunits is reported. On the seismic profiles, only a change in amplitude towards the lower strata might suggest the presence of this second subunit, which only seems to be present in the broad incisions (and acts as a fill-up unit).

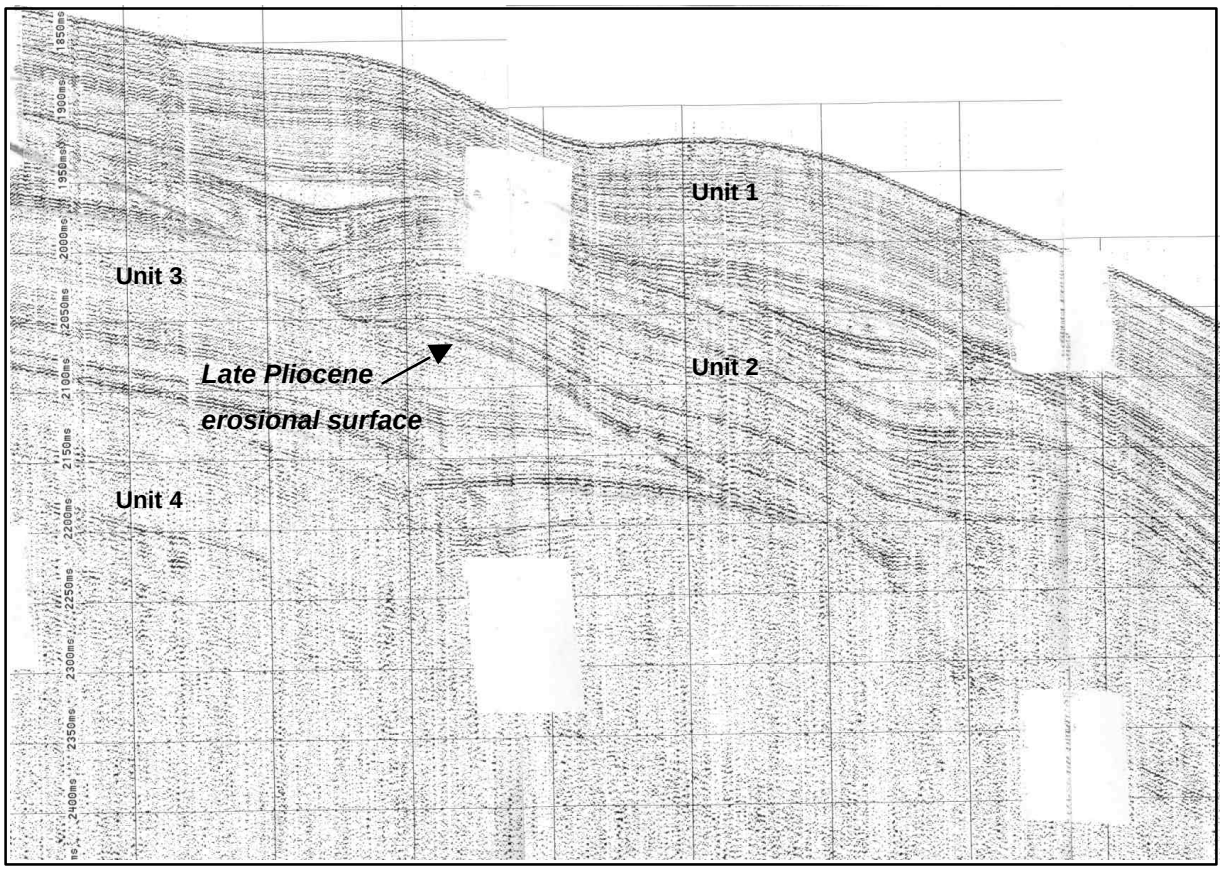


Figure 11: *Profile P010502 (NNE-SSW), south of DSDP hole 548. Note the presence of the steep erosional surface and the overlying undulating units.Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

Below this probable early Pleistocene unconformity, a small unit is present with a subtle unconformity as lower boundary. However, sometimes this unconformity also is characterised by locally wide incisions. This relatively thin unit can be correlated with the early Pleistocene to late Pliocene Unit 2 (foraminifer-nannofossil oozes, from 72 to 108.5 m). The erosion event preceding the deposition of this unit has already been observed in many Northeast-Atlantic drill sites and can be interpreted in terms of the reintroduction of MOW in the NE Atlantic, as well as the effect of glacial-interglacial events on deep-water circulation [Stow, 1982; Pearson and Jenkins, 1986]. More to the south (P010502, Fig. 11), where the slope becomes steeper, this erosion event is observed to cut very deeply in underlying strata. Furthermore, on this slope, units 1 and 2 are thicker and their geometry is more undulating, suggesting a possible more energetic hydrodynamic environment.

The next unit is relatively thick (150 ms TWT) and its lower boundary seems to cut off undulating strata. This unit has been described by [de Graciansky *et al.*, 1984] as the late Pliocene to late Miocene third unit (108.5 - 304.75 m). It consists of homogeneous bioturbated nannofossil oozes and chalks interbedded with turbiditic silty mudstones. The lower boundary seems to represent a hiatus of 6 Ma. This hiatus has been observed at several other North Atlantic core sites. Its origin may be related to vigorous bottom currents that developed as the Norwegian Sea became a source of North Atlantic bottom waters [de Graciansky *et al.*, 1985]. The change in amplitude from moderate to low in this unit might be the transition from Miocene to Pliocene, as also was observed in a change of physical properties [de Graciansky *et al.*, 1984].

The last visible unit can be the upper part of Unit 4a, composed of Lower Miocene foraminifer-nannofossil chalks.

6.1.2 Gollum channels (P010503-07)

The location of the seismic profiles over the upper parts of the Gollum channels (900 - 1400 m) was determined upon morpho-structural features observed on the Hydrosweep multibeam map acquired by R/V Polarstern in june 2000 (Data courtesy: AWI-Bremerhaven). Furthermore, on a seismic profile acquired during the 1999 campaign (P99006), a possible fault was recognised. This could be linked with the morphology of 2 bayonet-shaped and steeply walled channels, which were targeted for the survey. Three transects over the channels were made (P010503, 05 and 07) together with 2 connecting lines (P010504 and 06). These profiles indeed yield steeply walled channels with perched turbidites up to 400 ms TWT thick (Fig. 12). The thickness of this turbidite deposit increases downslope. On both sides of the channels, large levees are developed. In between both channels, the presence of a south-north oriented fault is observed. Evidence of slumping is also observed near the channel walls.

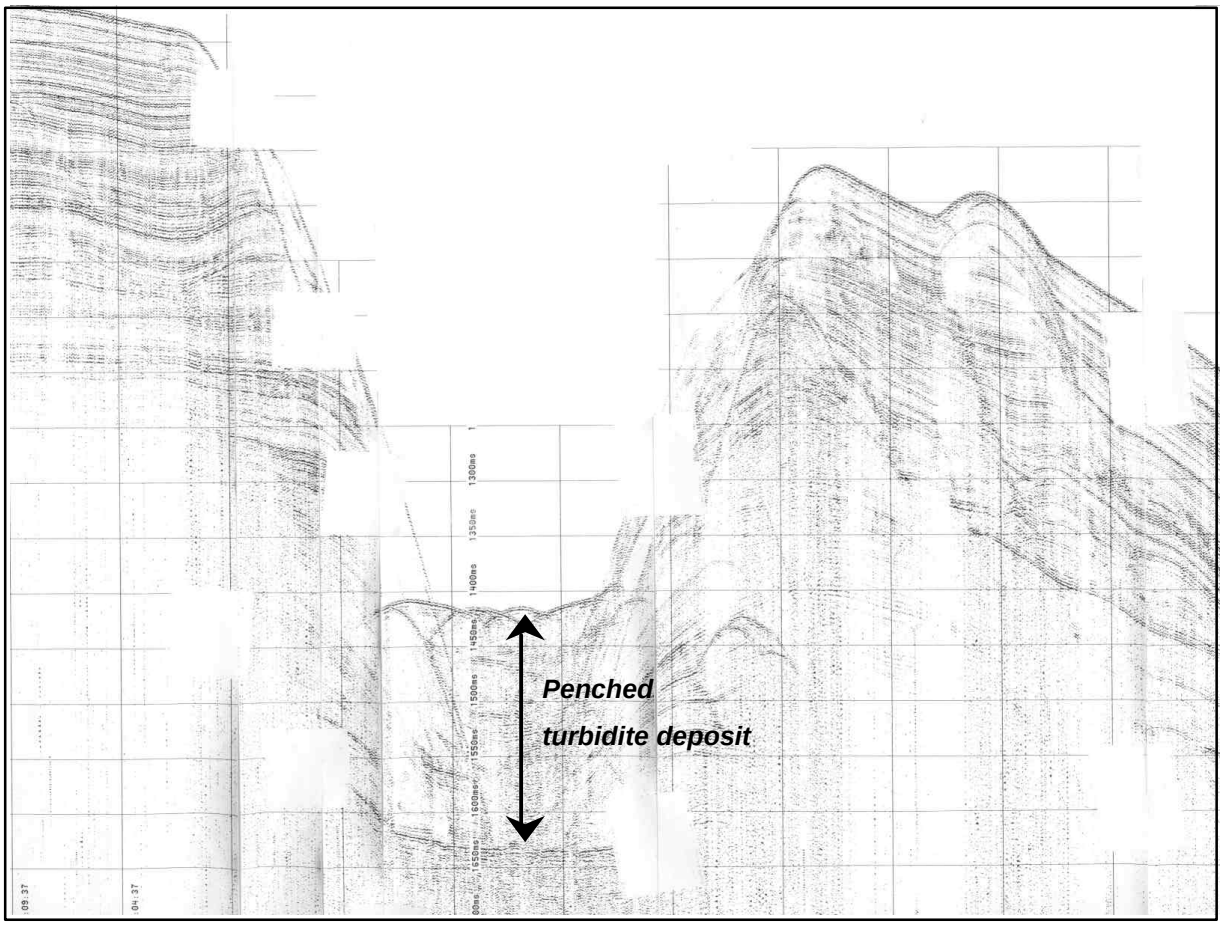


Figure 12: *Profile P010507 (N-S) on the upper reaches of the Gollum channels. Note the presence of steep channel walls, the thick turbidite deposit and the strange morphology of the levees. Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

6.1.3 Channels & slumps

This section deals with the profiles located in between the Gollum channels and the Belgica mound region. The morphology of the slope channels in this area suggest they have a different nature compared with the Gollum channels. Preliminary results from the Polarstern ANT XVII/4 campaign suggests a more mass-wasting controlled origin. Yet another different style of channel runs parallel with the slope. Already a set of transverse profiles across this channel exist, featuring possible mass-wasting deposits in a steep channel axis.

Towards the upper parts of the slope, profile P010508 features a sigmoïd and wavy geometry, suggesting a possible interaction with bottom currents. From a water depth of about 400 m bsl, the seabed morphology becomes more irregular, which could be due to a high-velocity shelf edge current. The seismic facies of the upper strata gets a more diffuse character; most of the reflectors are just nearly visible (Fig 13). Here we suggest the presence of glaci-marine deposits. These two features are characteristic for the entire southeastern shelf edge of the Porcupine Seabight.

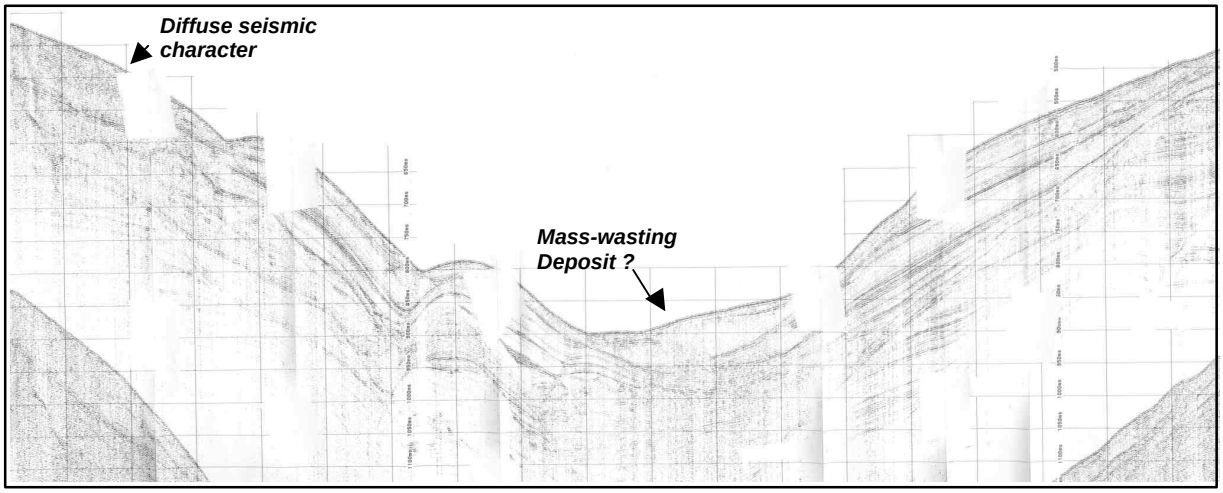


Figure 13: *Profile P010509 (NW-SE) across one of the large channels in between the Gollum channel system and the Belgica Mound Province. Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

During this transect over the shelf edge, two profiles (P010509 and P010510) yielded some more information about the "intermediate slope channels". Figure 13 clearly indicates these channels have been created by multiple phases of erosion. On the channel floor, an acoustically transparent body suggest mass-wasting deposition. The channel flanks feature lensoid bodies (right) and apparent wavy sediment lobes (left). These features are cleary current-related, but the relative importance of bottom or turbidity currents needs to be investigated.

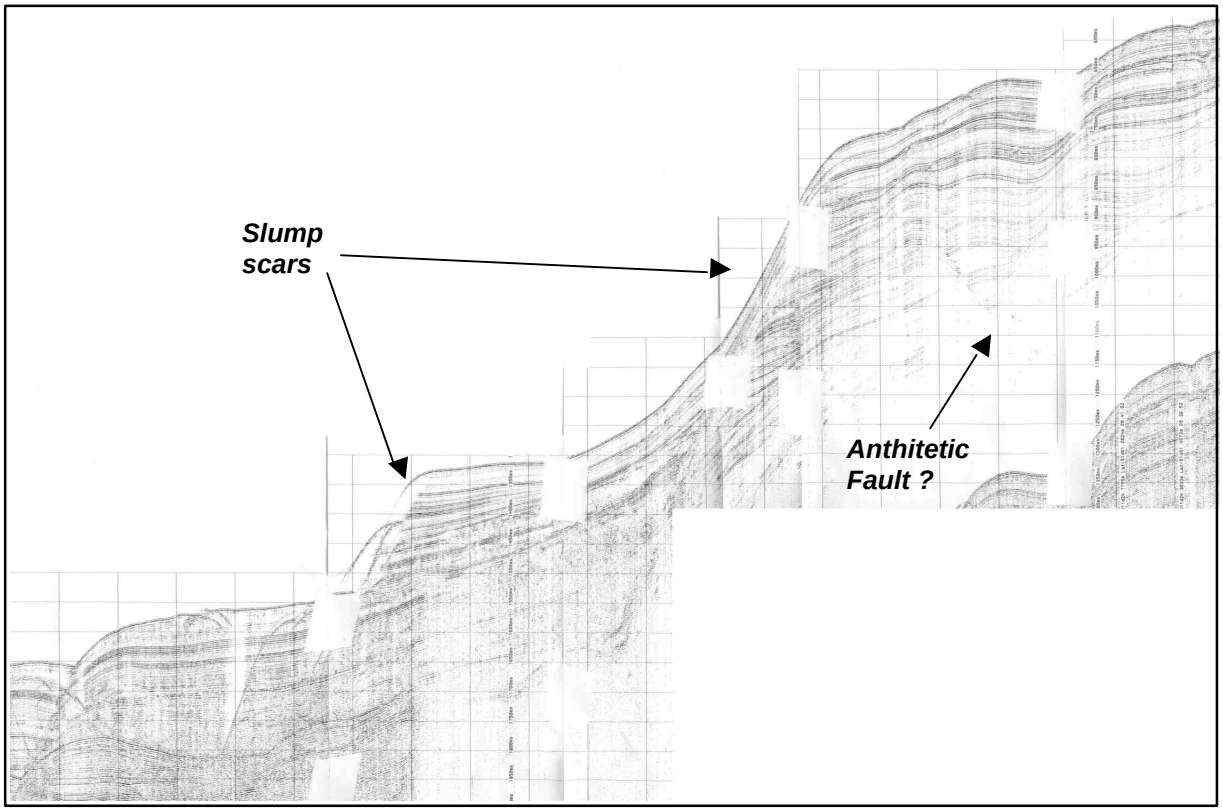


Figure 14: *Profile P010510 (SW-NE) from the shelf edge towards the start of the alongslope 'blind' channel. Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

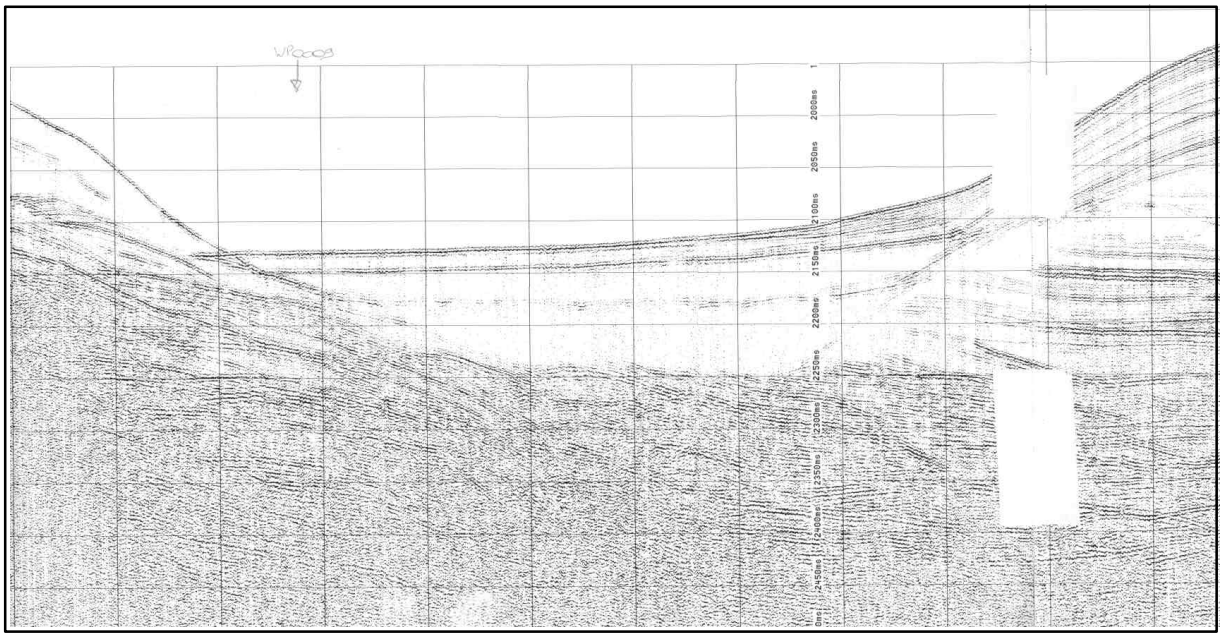


Figure 15: *Profile P010511 (NW-SE) along the axis of the alongslope running channel. Note the presence of the large mass-wasting deposit. Horizontal scale = 460 m; vertical scale = 50 ms TWT.*

A downslope oriented profile (Fig. 14) highlights another aspect of these "intermediate" channels. Two slump scars are observed, of which the lowermost seems to be relatively recent with a scarp of 80 ms TWT (approximately 60 m). Upslope, a possible synsedimentary anthithetic fault is observed, influencing the geometry of overlying strata. Together with some structures observed on the Hydrosweep multibeam map, we might not underestimate the possible influence of past faulting events in this region. The aim of profile P010511 was to acquire data long the axis of the slope channel. The first kilometers of this profile are recorded on the foot of a second "intermediate" channel. Here the seafloor and also the underlying strata reflect a coarse morphology. This is followed for 3 km with a thick, uniform hemipelagic unit. As illustrated on the righthand side of figure 15, this situation changes at the beginning of the blind slope channel to a more dynamic environment with a lot of erosional features. The most remarkable feature is the 'plunge pool', illustrated on figure 15, with possibly turbiditic deposits of about 80 ms TWT. Towards the north, the channel progressively shallows and an elongated mounded deposit is observed on the presumed channel floor (Fig. 16). Underneath this presumed channel floor, a multitude of northwesterly climbing sigmoidal bodies is observed. This again suggests a very dynamic sedimentary environment (sediment waves ?).

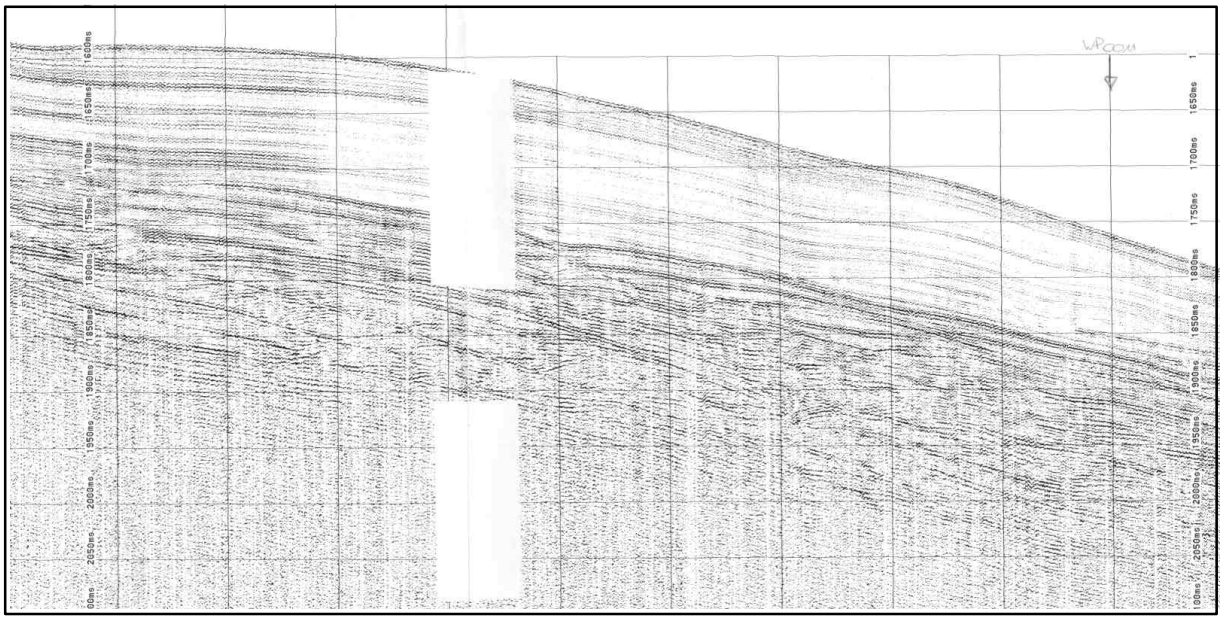


Figure 16: *Profile P010511 (NW-SE) along the axis of the alongslope running channel. Note the presence of the NW climbing sigmoidal bodies, covered with a draping unit. Horizontal scale = 460 m; vertical scale = 50 ms TWT.*

6.1.4 The Belgica mounds

The main goal of this survey in the Belgica Mound Province was to acquire profiles over the ODP target sites and to add supplementary data to the already existing network of seismic profiles. A few new mounds as well as some other (new) remarkable features were observed. First of all, on profile P010521, the seismic characteristics of the acoustically transparant unit P2 seem to change upslope, where more reflectors can be observed.

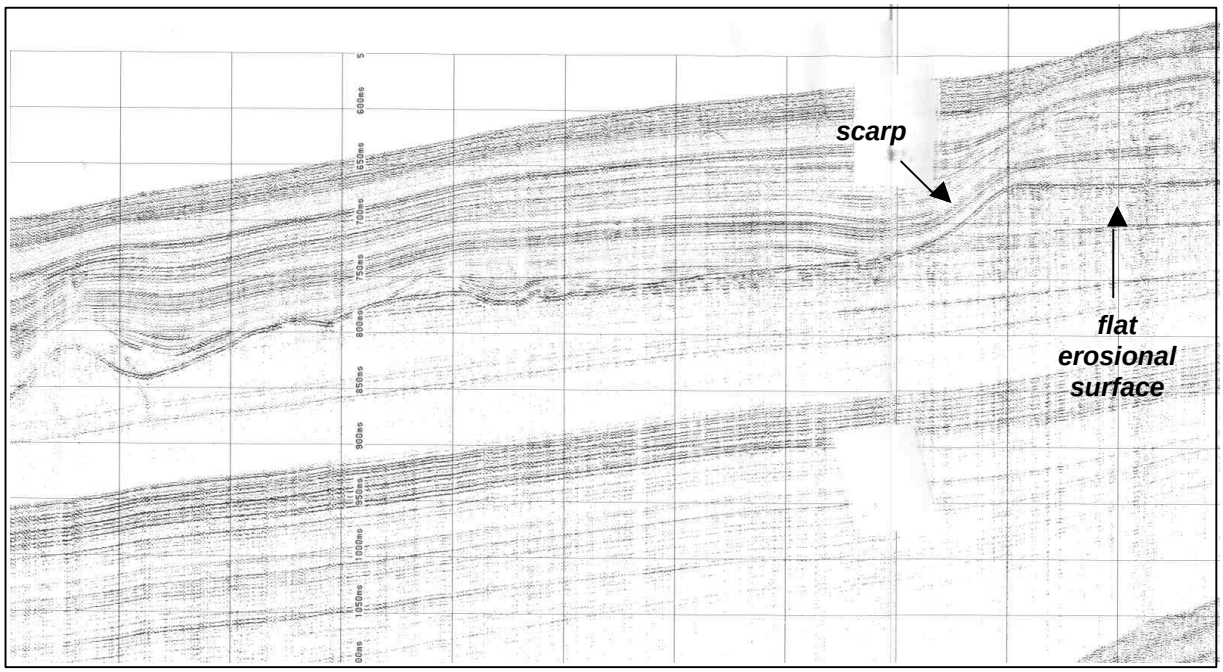


Figure 17: *Profile P010521(SW-NE) with the remarkable vertical change in facies of Unit P2. Horizontal scale = 460 m; vertical scale = 50 ms TWT.*

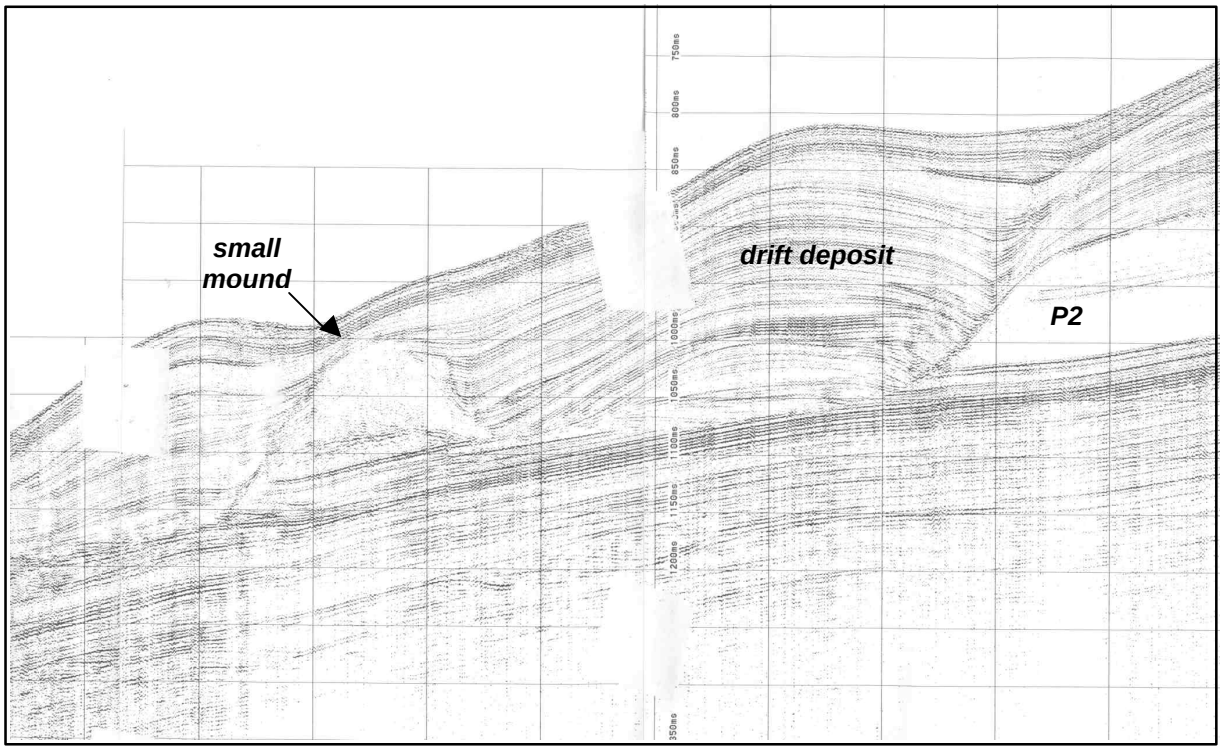


Figure 18: *Profile P010521 (SW-NE) with a mound and a small drift deposit. Horizontal scale = 460 m; vertical scale = 50 ms TWT.*

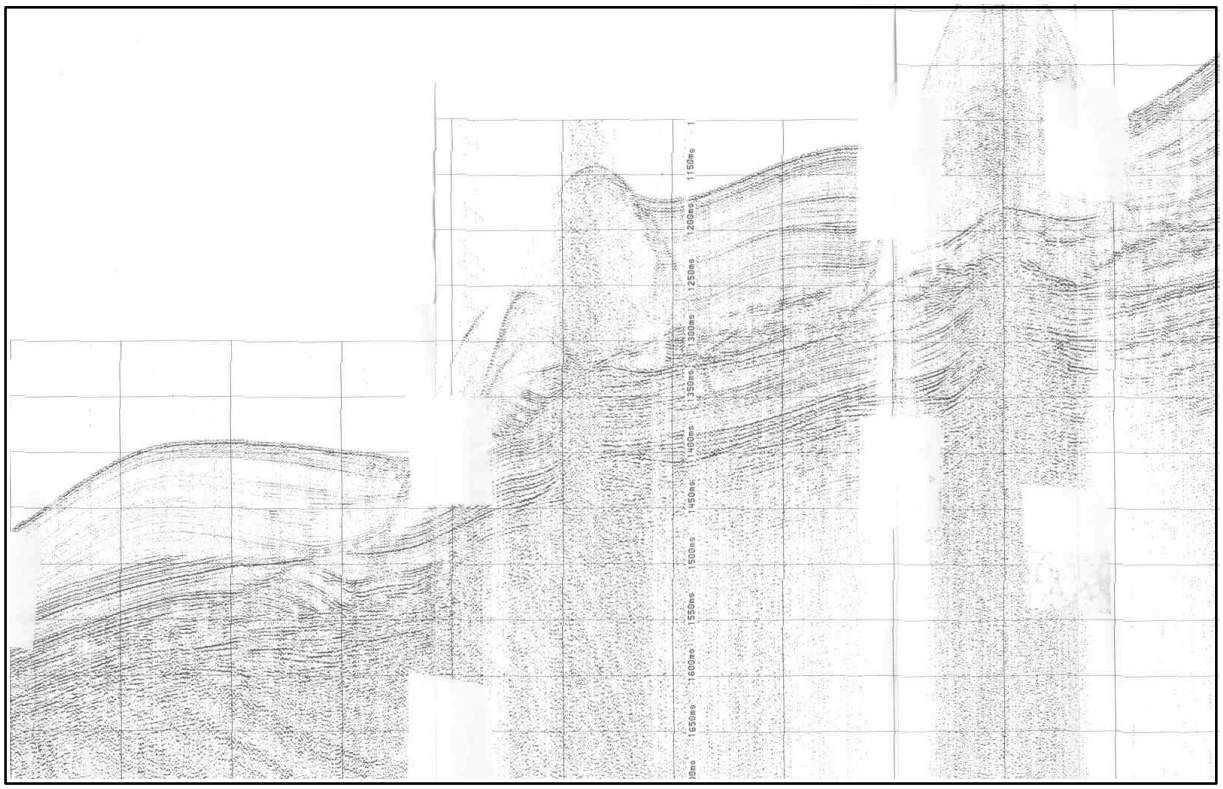


Figure 19: *Profile P010521 (SW-NE) with 2 mounds and two different levels of sigmoïdal bodies within unit P1. Horizontal scale = 460 m; vertical scale = 50 ms TWT.*

Also, a scarp and a remarkably flat erosional surface can be observed, covered with the typically highly stratified P3-strata. A few kilometres towards the centre of the basin, there is another scarp in the acoustically transparant unit P2 (Fig. 18). The sediment deposited on this surface onlaps and the general morphology of this overlying unit is mounded, constituting a small-scaled sediment drift. Beneath the large mound on figure 19, we observed for the first time 2 levels of sigmoidal bodies, suggesting 2 distinct phases of a high-energetic environment prior to the development of the mounds. On one of the northernmost profiles in this area (Fig. 20), we observed for the first time strata of unit P1 onlapping on a yet undescribed unconformity.

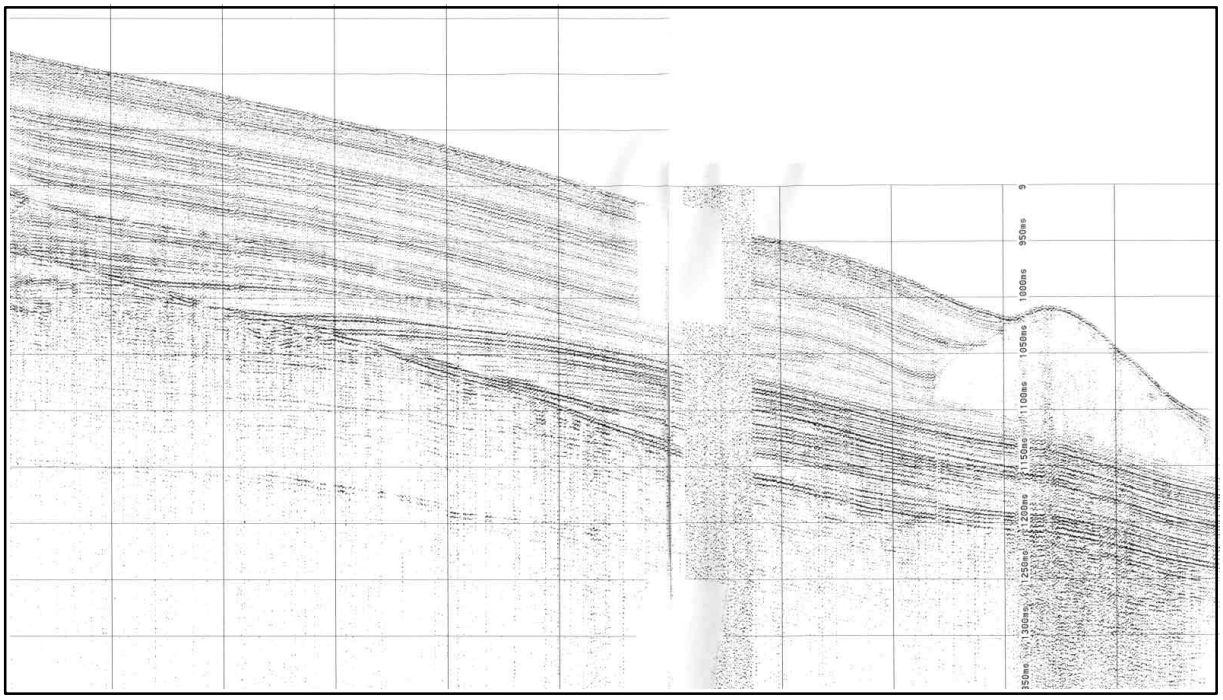


Figure 20: *Profile P010527(NE-SW) with onlap within unit P1. Horizontal scale = 460 m; vertical scale = 5 ms TWT.*

At the end of the survey within the Belgica mound province, some of the alongslope running channels were targeted before a transit line was shot towards the Hovland-Magellan province. Already during the R/V Belgica campaing in 2000, these channels were partly investigated. On one of the channels flanks, a set of sigmoïdal sediment bodies is observed, suggesting they might be sediment waves. Although, here we might not exclude the possibility their genesis has also been influenced by synsedimentary deformations (slides). So, it would be safer to call these features multi-proces dunes [Faugères, pers. comm.]. On the channel floor, the one profile shows a turbidite deposit, whereas the other shows only a thin cover of sediment. The geometry of the deposits near the channel flanks suggests an influence of currents upon its deposition, although for the moment we can not assess the dominance of either bottom currents or turbidite currents.

6.1.5 The Hovland - Magellan mounds

Profile P010534 (a & b) were acquired in order to link Belgica and Hovland mound provinces. Unfortunately, the profile crosses a channel and some erosional surfaces, making it very hard to correlate the upper units on both sides of the channel. The only possible way is by comparison of the seismic facies. Towards the end of this line, the upper unit displays the presence of small faults and possibly pockmarks.

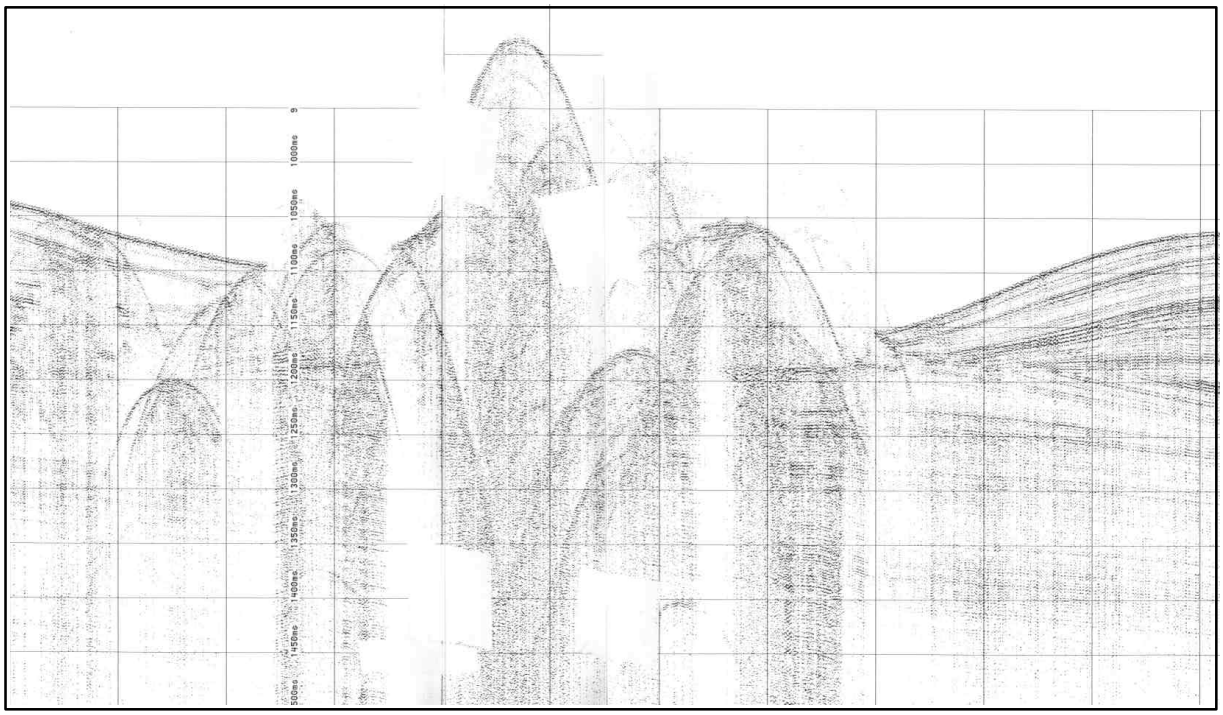


Figure 21: *Profile P010535 (N-S) passing the proposed ODP-site Porc 07-A. Horizontal scale unit = 460 m; verticale scale unit = 50 ms TWT.*

In the Hovland-Magellan mound province the majority of the data was collected to extend the ODP drilling proposal. One of the features to be drilled is the “Propellor” mound (Fig. 21). South (but also north) of this mound, a nice moat is observed. Furthermore, a lot of relatively small mounds were discovered. Some of theses mini-mounds are only a few milliseconds TWT high. Figure 22 shows a set of larger buried mounds covered with a sediment drape and sitting on an erosional surface. The last profile that was acquired during this campaign, features a spectacular cut and fill unit (Fig. 23).

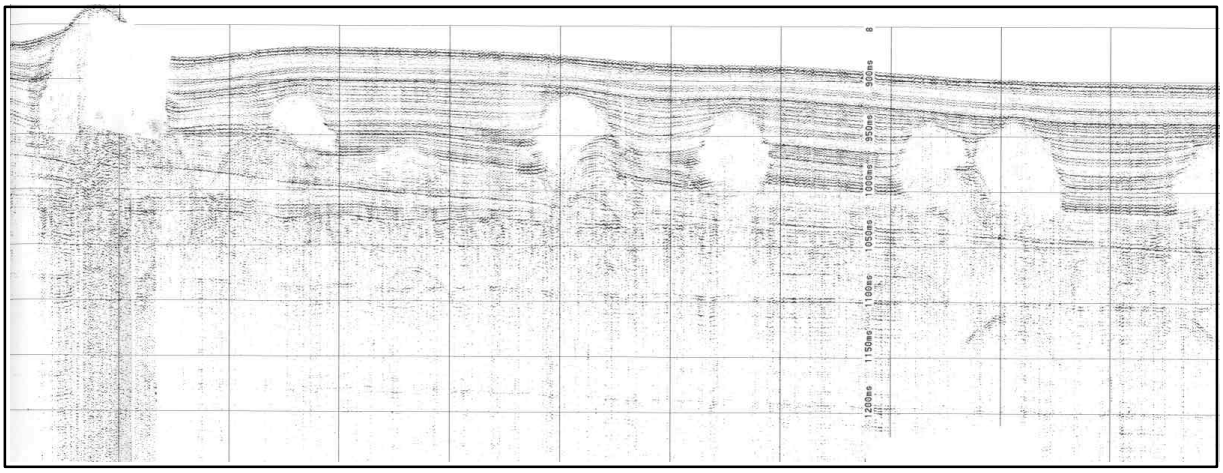


Figure 22: *Profile P010539 (N-S) with 6 buried mounds and one surfacing mound. They all are rooted to one common reflector and are buried with a highly stratified, draping unit. Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

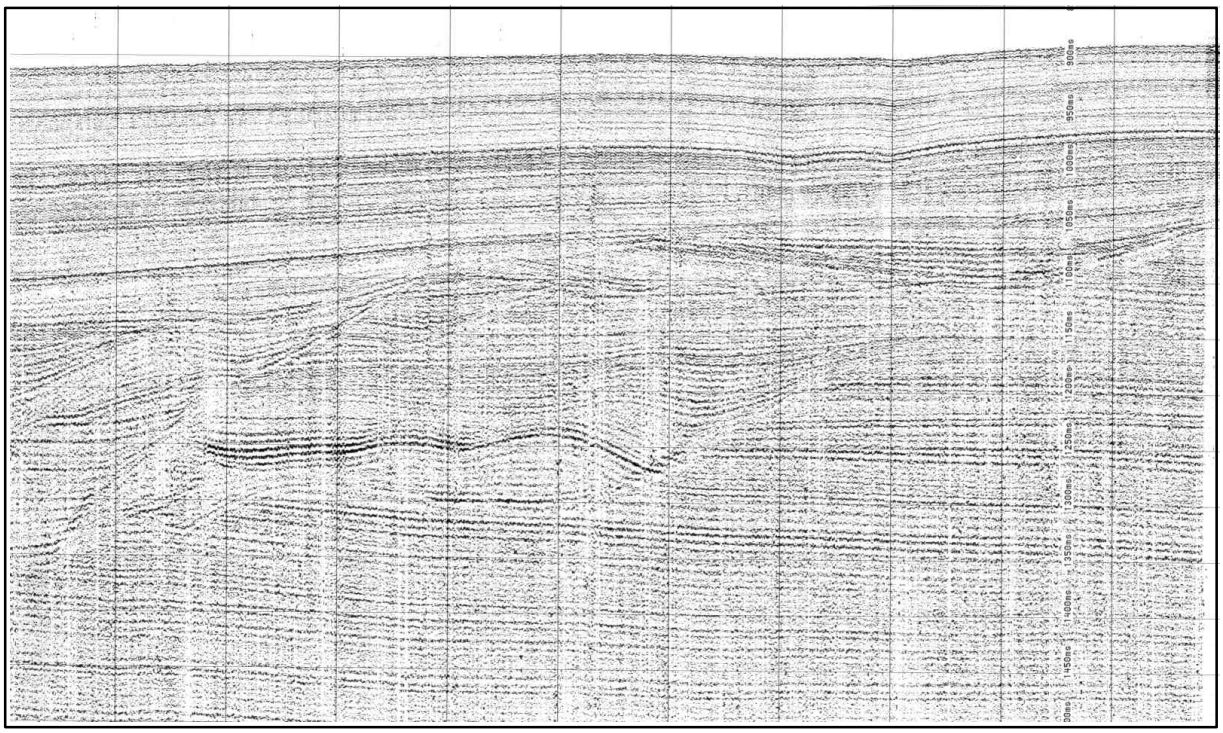


Figure 23: *Profile P010552 (NW-SE) featuring a large cut and fill unit. Horizontal scale unit = 460 m; vertical scale unit = 50 ms TWT.*

6.2 Biological investigations

On Monday 7/5, 7 boxcores were taken on off-mound and on-mound sites (Fig. 3). Sea state during the operations was calm, 2 beaufort wind speed and partly cloudy. These locations were determined on the ANTXVII multibeam map of the Belgica mound area. The operations were lead by Guy De Smet (UG, Marine Biology). Every time the boxcore reached the bottom, a print-out of the ODAS-files (Sea state, temperature, position,...) was made.

The procedure of the operations consisted in respectively the collection of overlying water (through a 38 µm sieve and preserved with formaldehyde buffered to 4%). When surface organisms were present, they were collected separately and preserved with buffered formaldehyde. Next, 3 meiofauna cores were taken and 1 sediment core (which was put in the oven at 60°C). When possible, another core of 5 cm diameter was taken for Ms. Kiriakoulakis and immediately frozen at –20°C. The rest of the sediment has been put into a 15l bucket and preserved with formaldehyde (concentration of 4%) for macrofauna research.

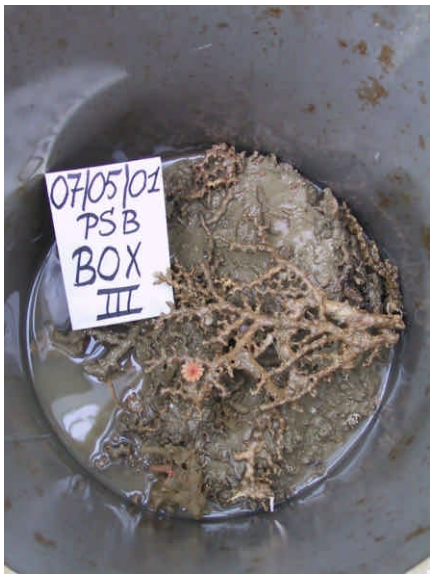
PSB Box I (957 m bsl):

The first deployment failed because the boxcore did not touch the sea floor and was subsequently not closed. During the second deployment, there was little penetration (2-5 cm sediment) and the overlying water leaked during the opening of the boxcore. The sediment sample was preserved anyway. One small piece of *Lophelia pertusa* was sampled and preserved in 95% EtOH for Ms. M.C. Le Goff. Three meiofauna cores were taken, but no core for sediment analysis (not enough sediment available). A small part of the meiofauna sample was lost.

PSB box II (904 m bsl.)

The deployment of this core was perfect. 19 cm of sediment were recovered, completely overlain with water. The coverage was almost 100% with mainly dead coral, and only a few pieces of living coral. All organisms were collected and 3 meiofauna cores were taken as well as 1 sediment core and a core for Ms. Kiriakoulakis. On the bottom of the boxcore some glauconite patches were

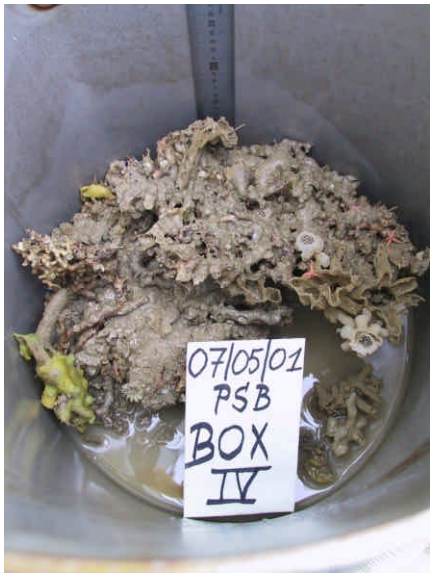
observed in a light grey silty clay.



PSB box III (969 m bsl.)

No print-out of the ODAS-files was available. The deployment of this core was perfect. 21 cm of sediment were recovered and completely overlain with water. Despite the core was taken in a channel in between the mounds, the coverage was 70 to 80% with mainly dead coral and a few pieces of living coral. All organisms were collected together with 3 meiofauna cores, 1 sediment core and a core for Ms. Kiriakoulakis.

PSB box IV (972 m bsl.)



A good take with 2 to 5 cm of sediment present, but the overlying water partly leaked during the opening of the boxcore. The remaining water was collected over a 38 µm sieve and preserved with formaldehyde buffered to 4%. Despite the core had been taken in a channel between the mounds, the coverage was 70 to 80% with mainly dead coral, a few pieces of living coral, severall brittle stars and one swimming crab. All organisms were collected together with 3 meiofauna cores and 1 sediment core. No core was taken for Ms. Kiriakoulakis.

PSB box V (880 m bsl.)

A good sample, but no overlying water was left due to leakage. 15 cm of very coarse sediment underlain by layer of 3 to 4 cm, of clay was recovered. The coverage was 70 to 80% with a lot of dead coral and a few pieces of living coral. All organisms were collected and no cores were taken.

PSB box VI (950 m bsl.)

A very good sample with 20 cm of sediment and lots of overlying water. The coverage was 50 to 60% with mainly dead material. The sediment and the corals were tilted 45° in the boxcore. All organisms were collected together with 3 meiofauna cores (bulk in 1 jar), 1 sediment core and a core for Ms. Kiriakoulakis.

PSB box VII (862 m bsl.)

This boxcore was taken to resample the site of the first boxcore (water leaked away). The first deployment failed. A second deployment of the boxcore retrieved neither sediment, nor overlying water. Only big chunks of mainly dead coral were present (90% coverage) and 1 big polychaete. All organisms were collected, but no cores were taken.

7. Data storage

During the Belgica 01/12 campaign, 52 seismic lines were acquired of which 5 were also recorded with the MC deeptow streamer. The surface streamer lines were recorded in ELICS format and were converted in a SegY-Motorola format with associated navigation files (these are text files containing shot point, longitude, latitude, date and time). Furthermore, additional data such as wind speed, salinity, water depth, temperature etc. were extracted from the ODAS files (text files, logged every 10 minutes).

A full set of seismic data copies has been transferred to the Petroleum Affairs Division, Dublin (Mr. Peter Croker).

For more information about the geophysical data, please contact Prof. Dr. Jean-Pierre Henriet (JeanPierre.Henriet@rug.ac.be):

Renard Centre of Marine Geology (RCMG)
Ghent University
Krijgslaan 281 s8
9000 Gent
Belgium

For more information of the biological data acquired during this campaign, please contact Prof. Dr. Ann Vanreusel (Ann.Vanreusel@rug.ac.be) :

Marine Biology unit
Ghent University
K. Ledeganckstraat 35
9000 Gent
Belgium

The digital images illustrating this report were taken by Guy Desmet (Marine Biology unit) with a *Canon Powershot G1*.

8. References

de Graciansky, P. C., Poag, C. W., Cunningham, R., Loubere, P., Masson, D. G., Mazzullo, J. M., Montadert, L., Müller, C., Otsuka, K., Reynolds, L. A., Sigal, J., Snyder, S. W., Townsend, H. A., Vaos, S. P. & Waples, D. (1985). The Goban Spur transect: Geologic evolution of a sediment-starved passive continental margin. *Geological Society of America Bulletin*, **96**, 58-76.

de Graciansky, P. C., Poag, C. W., Cunningham, R., Loubere, P., Masson, D. G., Mazzullo, J. M., Montadert, L., Müller, C., Otsuka, K., Reynolds, L. A., Sigal, J., Snyder, S. W., Vaos, S. P. & Waples, D. (1984). Site 548. In: *Initial Reports of the Deep Sea Drilling Project, Vol. 80* (Ed. by P. C. de Graciansky, C. W. Poag, R. Cunningham, P. Loubere, D. G. Masson, J. M. Mazzullo, L. Montadert, C. Müller, K. Otsuka, L. A. Reynolds, J. Sigal, S. W. Snyder, S. P. Vaos and D. Waples), pp. 33-122. U.S. Government Printing Office, Washington.

Pearson, I. & Jenkins, D. G. (1986). Unconformities in the Cenozoic of the North-East Atlantic. In: *North Atlantic Palaeoceanography, Vol. 21* (Ed. by C. P. Summerhayes and N. J. Shackleton), pp. 79-86, London. *Geological Society Special Publication*.

Stow, D. A. V. (1982). Bottom currents and contourites in the North Atlantic. *Bull. Inst. Géol. Bassin d'Aquitaine*, **31**, 151-166.