Cruise Report

Belgica 06/12

HERMES Belgica GEO

"La Chapelle Bank"

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& the shipboard scientific party

RCMG

Renard Centre of Marine Geology

Ghent University, Belgium

June 13 - June 20, 2006

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1. Cruise reference

Belgica 06/12
Brest (FR) – Cork (IRE)
13.06.2006 – 20.06.2006

Please refer to this report as:

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2. Framework and objectives

2.1 Framework

The ecological, sedimentological and geophysical research programme of the Belgica cruise 2006/12 frames into several international and national projects:

- **EC FP6 IP HERMES (2006-2008)**

  "Hotspot ecosystem research on the margins of European Seas" frames within the "Global Change and Ecosystem" of the EU 6th framework programme. RCMG focuses on geosphere controls on ecosystem hotspots in mound provinces and on the dynamic interaction between slope sedimentary processes, carbonate mounds and coral banks.

- **EU FP5 RTN EURODOM (2002-2006)**

  The research activities of this European Research and Training Network (RTN) are (1) the assessment of submarine continental slope stability and (2) the investigation of the distribution, composition, functioning and significance of deep-water carbonate mounds and reefs. In the meantime possible relationships between both subjects are investigated. An important role of RCMG within EURODOM is to establish a direct satellite link between scientists on a cruise and classrooms. The class@oceans initiative fully frames within this objective.

- **ESF EUROCORES EUROMARGINS (2003-2006) project MOUNDFORCE**

  Study of the forcing factors controlling mound genesis and growth.

- **FWO project GeNesis (2003-2006) : Gent - NEBROC II Associated project on the Genesis of Mounds**

Research project on the genesis of large carbonate mounds and their precursor phenomena, in particular those possibly related to methane seeps and authigenic carbonate crust formation, with due emphasis on microbial mediation processes.

- **Ph.D. projects of the Flemish IWT and FWO**

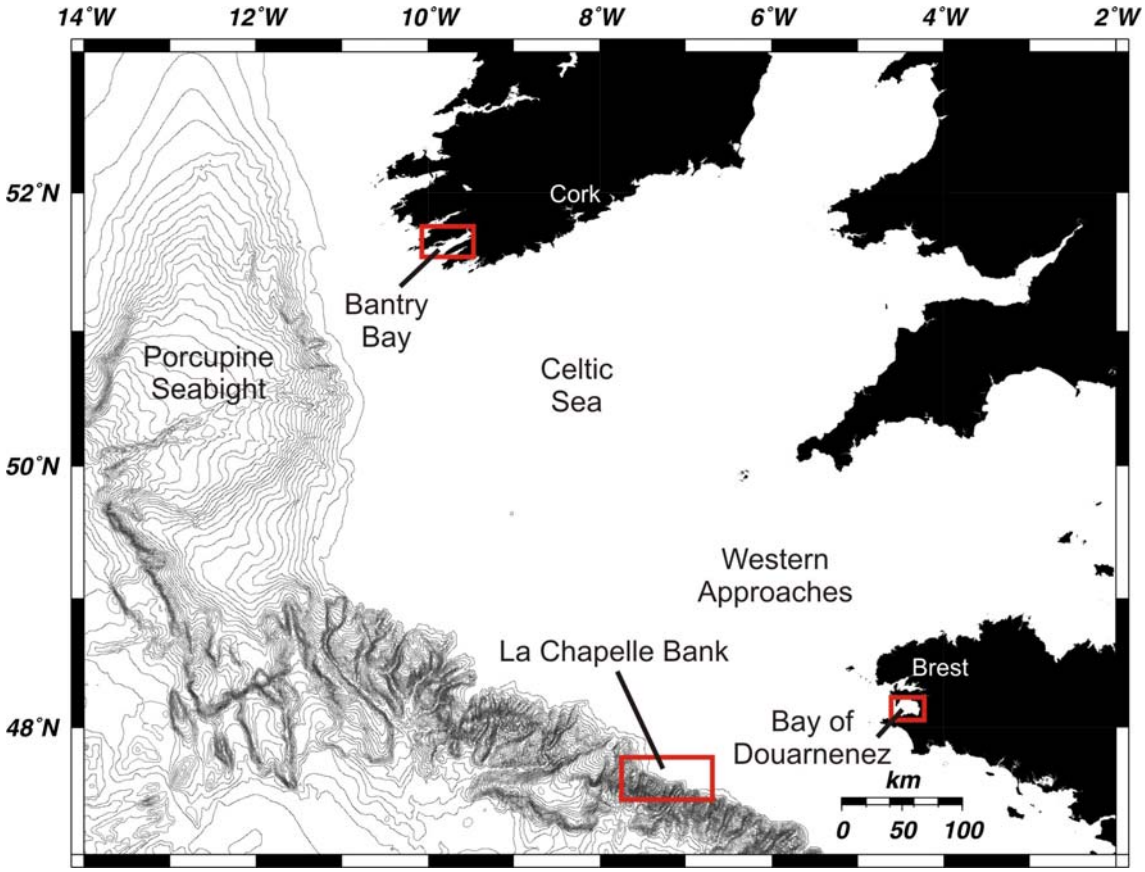

Figure 1: *Overview map of the visited sites during R/V Belgica campaign HERMES Belgica GEO.*

2.2 Objectives

Within the framework of the EC IP FP6 HERMES project, the main RCMG objectice was to test for the first time its ROV (Remotely Operated Vehicle) on several coral-rich sites along the Celtic Margin and the Porcupine Basin (Fig. 1). The La Chapelle Bank (Celtic Margin) and adjacent canyons were earlier recognized by Zibrowius and Le Danois as a "hotspot" of deep-water corals. In the Porcupine Basin, it was planned to revisit the Moira mounds for an extra visual reconnaissance and sampling. Also the recently discovered Enya mounds (R/V Belgica 2003) were to be revisited for additional high-resolution seismic profiling. Due to bad weather conditions, however, only Area 1 on La Chapelle Bank was visited. Additionally, tests were performed in the sheltered environments of Douarnenez Bay (France) and Bantry Bay (France).

This campaign was executed in cooperation with the department DRO-DEEP/LEP of IFREMER (France), University College Cork (Ireland) and the National Oceanography Centre Southampton (United Kingdom).

This campaign focused on the following topics:

- *Brest & La Chapelle Bank*: first testing and deployment for the ROV at the sheltered environment of the Bay of Douarnenez. Visual observations on La Chapelle Bank were supported with multibeam mapping and high-resolution seismic profiling.
- *Bantry Bay (Ireland)*: ROV test dives were performed due to bad weather conditions in the Porcupine Seabight.

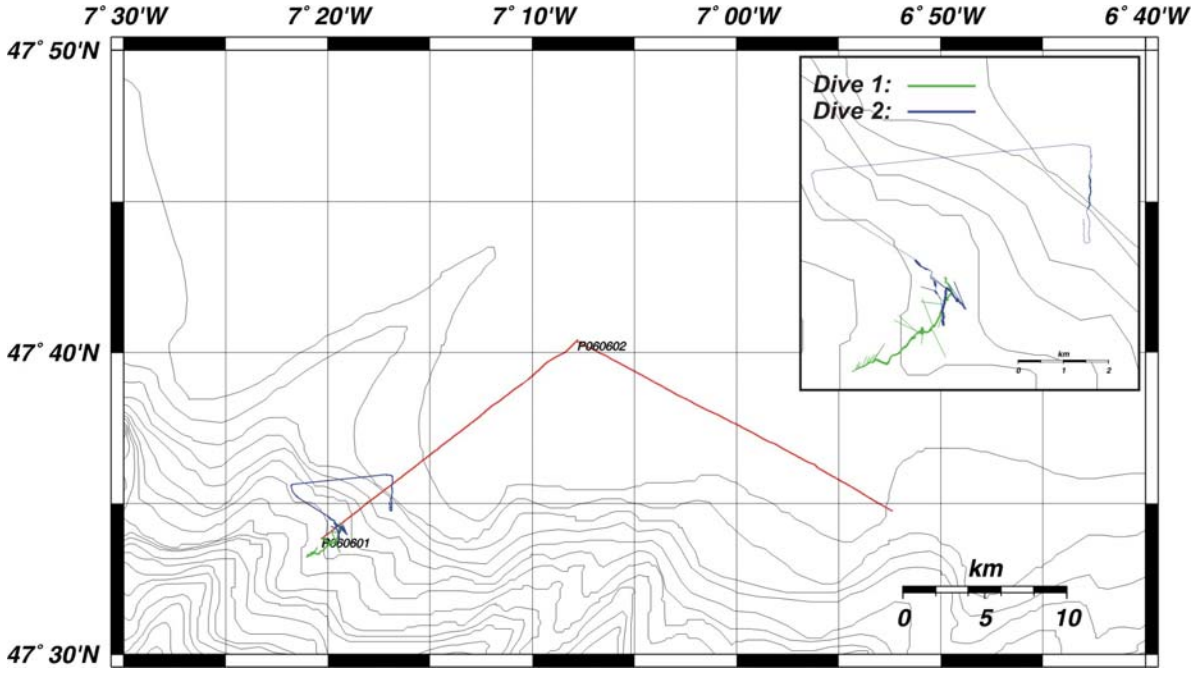

Figure 2: *Location map of the ROV dives (see inset) and seismic profiles (red lines) on La Chapelle Bank.*

3. Departure and arrival of the cruise

Departure: Brest (FR)	14.06.2006, at 02.00h.
Arrival: Cork (IRE)	20.06.2006, at 12.00h.

Belgica 06/12

4. Working area

Three main working areas have been surveyed during this campaign (Fig. 1):

1. **Bay of Douarnenez** (Fig. 1): A first deployment was made of the TMS (Tethered Management System) and ROV in the Bay of Douarnenez (France), due to bad weather on La Chapelle Bank. This also included a stepwise training.
2. **La Chapelle bank** (Fig. 2): ROV deployment on previous dredge tracks performed during the 1997 cruise of André Freiweld (Erlangen). A multibeam survey was performed for morphologic support, as well as a brief seismic reconnaissance survey.
3. **Bantry Bay** (Fig. 1): Due to bad weather conditions in the Porcupine Seabight, further exercises and tests were performed in the sheltered environment of Bantry Bay (Ireland).

4.1 Coordination at Sea

Chief scientist:	Prof. Dr. Jean-Pierre HENRIET
	Renard Centre of Marine Geology (RCMG),
	Ghent University, Belgium
Co-chief scientist:	Dr. David Van Rooij

4.2 Scientific staff

Prof. Dr. Jean-Pierre HENRIET	UGent, RCMG,
Dr. David VAN ROOIJ	UGent, RCMG,
Willem VERSTEEG	UGent, RCMG,
Peter STAELENS	UGent, RCMG,
Anneleen FOUBERT	UGent, RCMG,
Dr. ir. Veerle HUVENNE	NOC Southampton (UK),
Prof. Dr. Andrew WHEELER	UCC (Ireland)
Erwan LE GUILLOUX	IFREMER (France)
Ing. Jeroen VERCRUYSSE	UGent, RCMG,
Ing. Koen DE RYCKER	UGent, RCMG,
Frederik ROOSE	UGent, RCMG, Marelac student,
Katja GUILINI	UGent, RCMG, Marelac student

4.3 Operations

4.3.1 Seismic survey

Most of the seismic profiles are single channel surface sparker lines, acquired with a SIG sparker source (120 electrodes). The sparker was triggered every 2 s reaching 500J energy. The sampling frequency was set at 8 kHz and a record length of 1800 ms TWT was used. The velocity of the ship during surface sparker seismics was maintained at about 3 knots.

4.3.2 CTD measurements

In order to obtain an up to date sound velocity profile in the multibeam survey area, a CTD cast was taken with the aim to convert the temperature and salinity information to sound speed values using the formula of Chen-Millero (Chen Ch.-T. & Millero, F.J. Speed of sound in seawater at high pressures //JASA.-1977.-Vol. 62.-No 5.-P. 1129-1135.). However, some problems were encountered during this operation. Initially the contact between the CTD system (Seacat SBE19) and the recording PC could not be established. When finally this problem was solved (probably by taking another configuration file (.cfg), which did not

contain the plotting of the CTS's altimeter info), and the CTD cast was taken, only the first ~50 lines of data were recorded, while the others were not, although the system had transmitted data all throughout the cast.

As time was pressing, it was decided to use the results of a CTD cast taken during the previous Belgica cruise in the area: 'station 3 cast B', which was located at 47°25'N and 7°16'W. The cast reached to over 1300 m depth, which was more than sufficient for the purposes of the multibeam mapping. We would like to acknowledge the team of Lei Chou and cruise ST0611A for this help to our survey.

The resulting data of this cast were saved in a binary file (.dat), and the configuration settings were saved in the corresponding .con file. The binary data were converted to ASCII using the program SBEDataprocessing_Win32. Only the downcast data were chosen, and the information was binned in 2m intervals. The final file was called '20060615233016.asvp', and transferred onto the UNIX station. Within a UNIX text editor, it is necessary to delete all the windows 'end-of-line' characters, but after that is done, the file could easily be entered into the Simrad software.

4.3.3 Multibeam survey

The multibeam echosounder used during this cruise is the Simrad E1002 system from the Belgian Ministry of Economical Affairs, installed permanently on the Belgica. Standard procedures were chosen for its application. Before leaving the port of Brest, the draft of the ship was measured at four locations, resulting in the average value of 5.358 m. This value was entered in the settings of the multibeam system.

Once arrived at the study site, the sound absorption coefficient in the water was calculated from the temperature and salinity of the surface water. No pH measurement was carried out, but an average value of 7.5 was entered in the formulas. The estimation of the sound velocity is described above.

\\\\\	
DATE	*15/06/06*
SOUND SPEED C in m/s =	1508.9
SEA WATER TEMPERATURE, T in °C =	14.79
SEA WATER SALINITY, S in ppt =	35.4305
SEA WATER pH, pH =	7.5
WATER DEPTH in km =	1
FREQUENCY in KHz, *f*	93
CALCULATIONS :	
A1	0.041569353
A2	0.68957723
A3 (T > 20°C)	0.000228909
A3 (T < = 20°C)	0.000120832
P2	0.8692
P3	0.96219
f1	1.329662915
f2	99.33937294

ABSORPTION COEFFICIENT :	
□□n dB/km (T > 20°C)	29.77094451
□□n dB/km (T < = 20°C)	28.87152609
RATIO (□□□□O (x 100	105.7747759
□□ - 98 KHz	30.53879201
□□ - 93 KHz	28.87152609

Figure 3: *Input parameters for the multibeam calibration*

At the beginning of the survey a roll and pitch calibration was carried out. Therefore 2 tracks were sailed in opposite direction, followed by one perpendicular to it. Neither the roll nor the pitch had to be adjusted. It was chosen to record all possible parameters; position, backscatter image… However, the system appeared to have major problems. Only 56 out of the normal maximum of 111 beams seemed to be active, with every other beam not recording any signal. Fortunately they were spread over the entire swath width of the system, allowing to survey at near-normal line spacing, although with lower resolution. Probably related to this error, the ping rate of the system was also lower than usual, resulting in a resolution loss in the along-track direction too. Furthermore, we did not appear to record any backscatter information. The problem was reported to the Ministry of Economical affairs, who replied promptly, but the suggested options unfortunately did not cure the error. The case will be followed up further in contact with the MEZ and MUMM.

Figure 4: *Screenshot of the multibeam input parameters concerning motion sensors and roll/pitch calibration*

During the actual survey we aimed at keeping a 10% overlap between the consecutive swaths. This resulted in a line spacing ranging from ca. 500 to 900 m (swaths of 2x300 to 2x550 m). For most of the time the system was switched to the manual detection of the appropriate working mode (medium or deep). The beam angles were generally chosen quite narrow (30 to 50°), in order to focus the acoustic energy towards the relatively large

depth below the vessel. It turned out that the system had to be switched to manual mode in order for it to accept the given angle values. The beam spacing was chosen as equiangle. A spike filter of weak to medium strength was switched on, but overall the data seemed fairly spike-free.

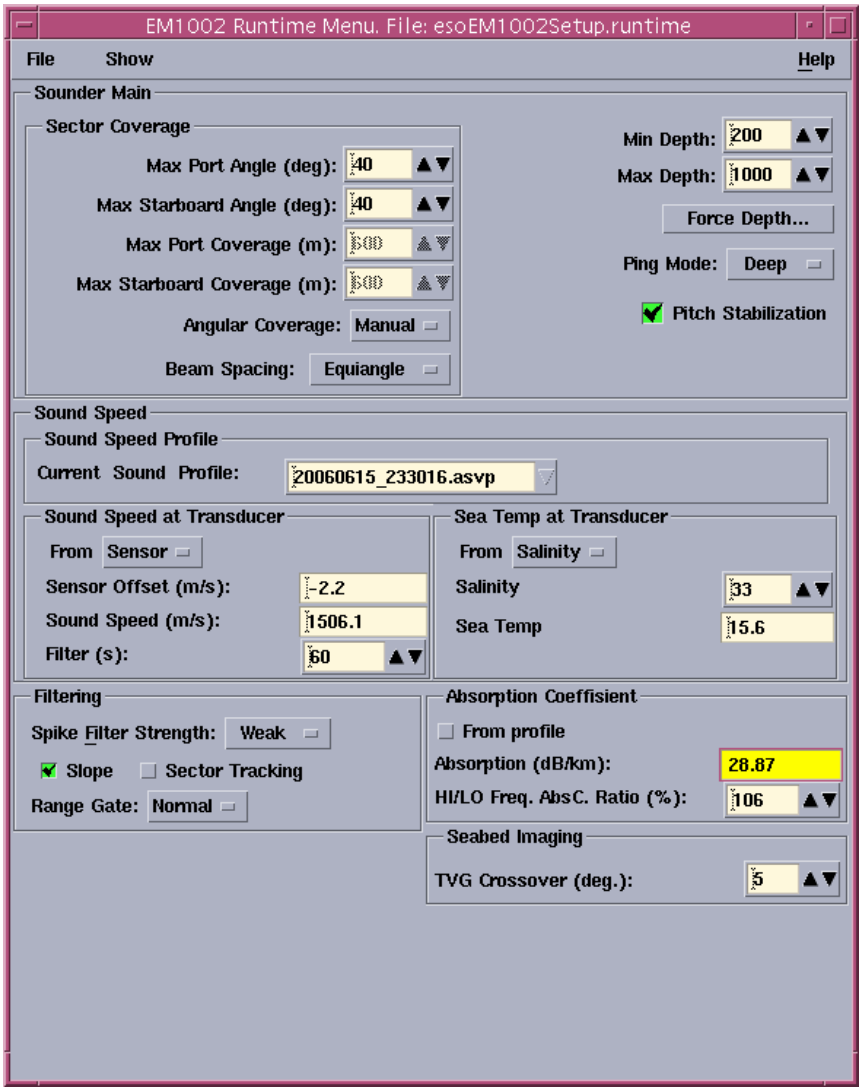

Figure 5: *Screenshot of the multibeam input parameters concerning sound velocity and filtering*

During the multibeam survey, it was tried to keep the vessel speed to 6.5 kn. The system is designed in such way that it can cope with speeds up to 8 kn, but because of the lower number of beams and especially the lower number of pings, it was chosen to keep using 6.5 kn. Overall, the weather conditions were quite good during the survey, and the data quality was fairly good too, until a water depth of ca. 850 m. In such deep waters the system easily lost the bottom (probably also because of the lower number of beams). It was decided to finish surveying there.

Additionally, towards the end of the cruise, the ship had to seek refuge into Bantry Bay (Ireland). Upon entering the bay, it was decided to keep the multibeam running, in order to obtain a rough idea of the morphology of the seabed, and to judge if it would be a suitable environment for any further ROV tests in the area. The system was set to slightly different parameters. A constant sound velocity profile of 1496 m/s was chosen, as no CTD cast was taken. The ping mode was set to shallow, the beam spacing to equidistant, with maximal coverage of 75° at either side. The TVG cross-over was increased to 10 (following advice given by the Marine Institute in Galway, based on their experience during the National Seabed Survey). The absorption coefficient was 106, with 31.04 the coefficient for 93 kHz. Finally the weak anti-spike filter was kept active.

At the end of the survey, all the data were backed up on external hard drive (via ftp from the Sun workstation to the Belgica laptop, including both the raw data files and the proc files). The data were left on the system for the MEZ and MUMM as illustration of the problems encountered.

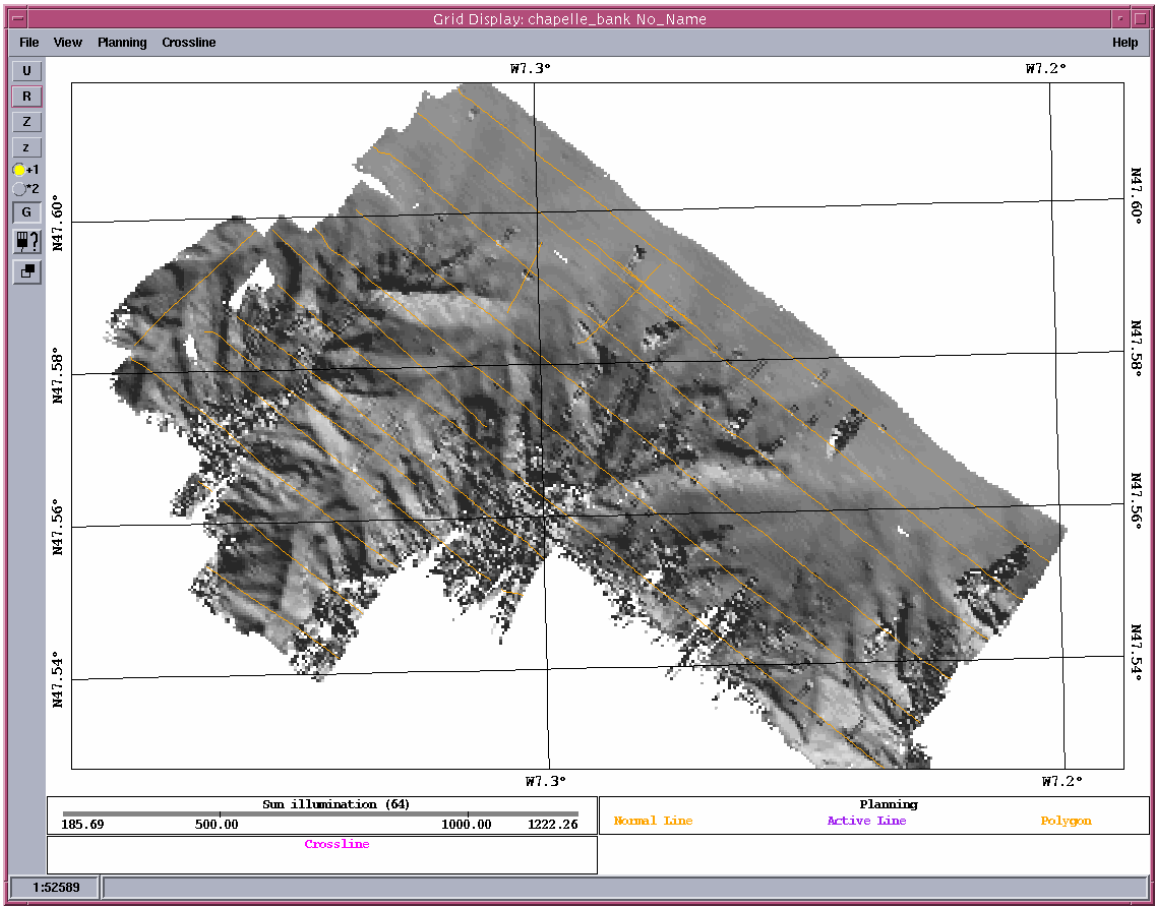

Figure 6: *Screenshot of the La Chapelle survey area in shaded relief mode (illumination from the NE). The multibeam tracks (mainly NW-SE) are indicated in orange*

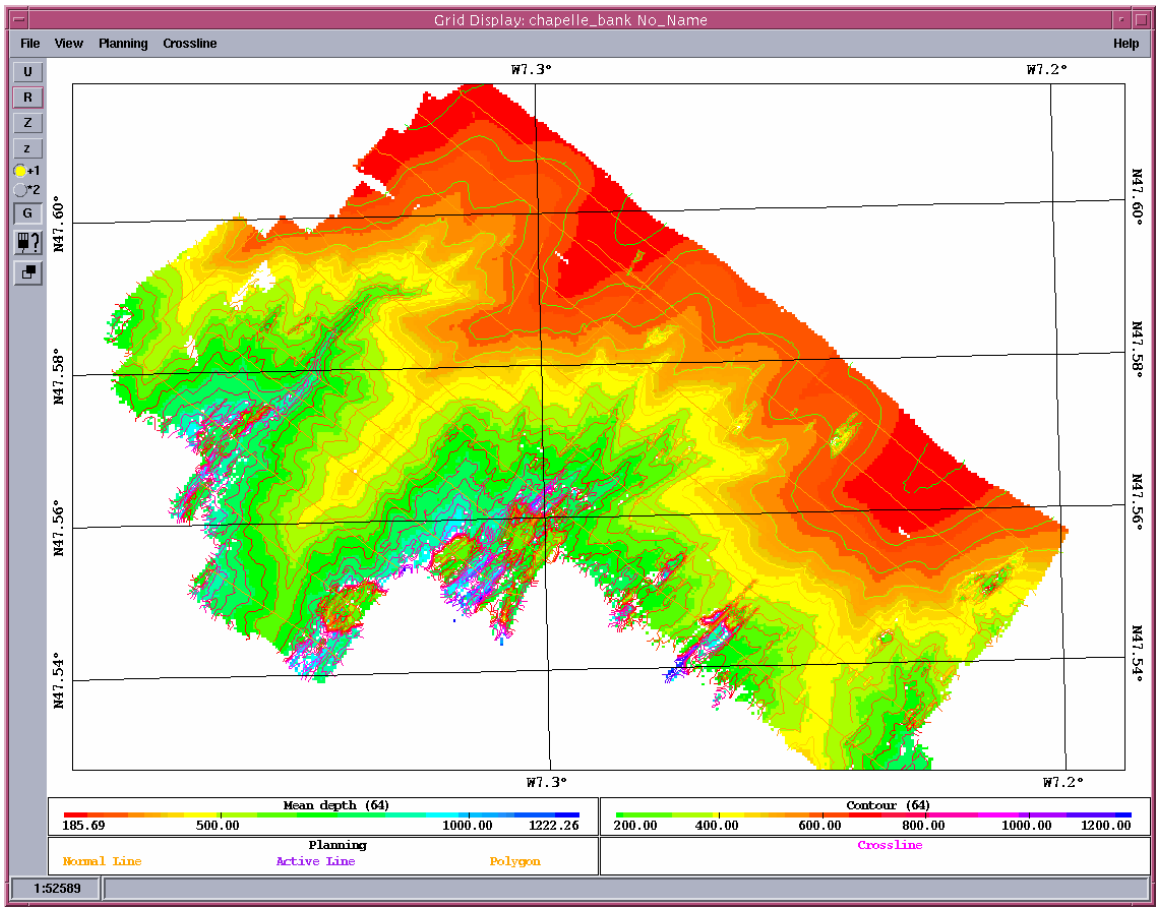

Figure 7: *Screenshot of the multibeam bathymetry acquired on La Chapelle bank*

4.3.4 ROV survey

Figure 8: *ROV "Genesis" recovered in Bantry Bay, Ireland*

The RCMG acquired a Sub-Atlantic Cherokee-type ROV "Genesis" (Fig. 8, 9), with TMS and shipboard winch. This winch hosts a reinforced cable of 1600m which can bring the TMS and ROV to a safe depth prior to ROV launch (with a maximum tether of 200m). The winch cable is connected to a pilot control interface which was installed in the laboratory container. This encompasses the physical control of the ROV and its instruments, as well as the observation (and navigation cameras). 4 cameras and 1 still camera were active: one on the TMS (ROV launch & re-entry control), a backward looking within the ROV (for TMS re-entry and tether inspection) and the two forward-looking black & white and colour (with overlay) cameras (Figs. 9a, b). An overlay on the screen with navigation control information could be put on an arbitrary camera display (Fig. 9n). The main sampling tool on the ROV is the controlled grab arm and a deployable tray in which samples can be stored (Figs. 9a, b, n). The ROV also contains a depth control, an altimeter and a side-looking sonar for detection of seabed objects (Figs. 9g, h, I, j, k, l).

Positioning of the TMS and ROV was done through the GAPS positioning system (IXSEA). This Global Acoustic Positioning System, GAPS, is a portable Ultra Short Base Line (USBL) with integrated Inertial Navigation System (INS) and Global Positioning System (GPS). The GAPS was deployed at the side frame (Davit) and a transponder fixed on the ROV, resulting in the position of the Belgica and the ROV (Figs. 9g, h, i, j).


Fig. 9a


Fig. 9b

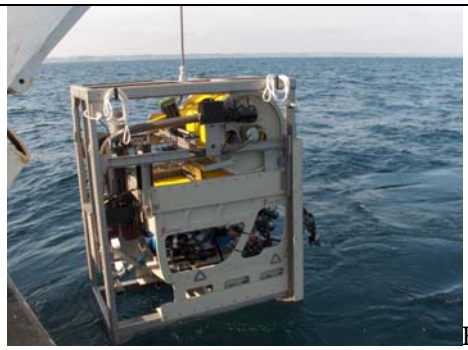
Fig. 9c

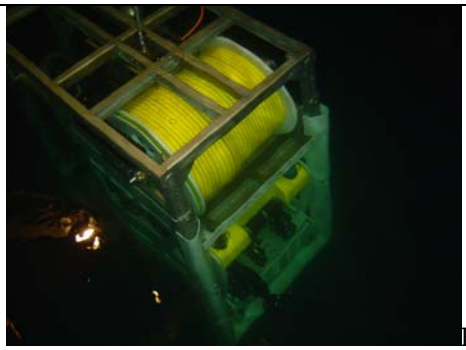
Fig. 9d

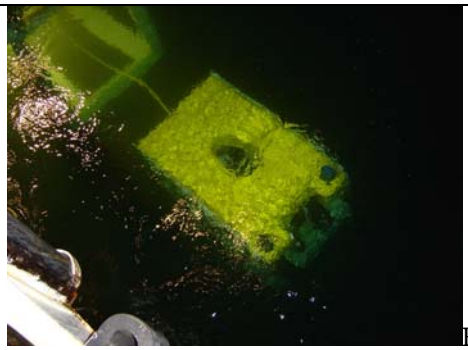
Fig. 9e

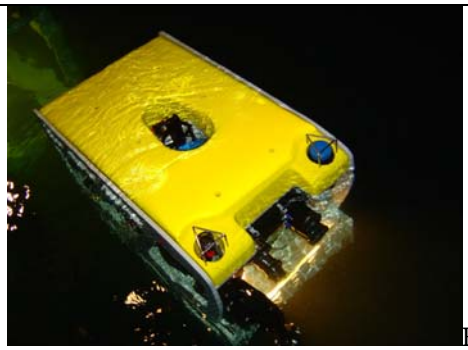
Fig. 9f


Fig. 9g

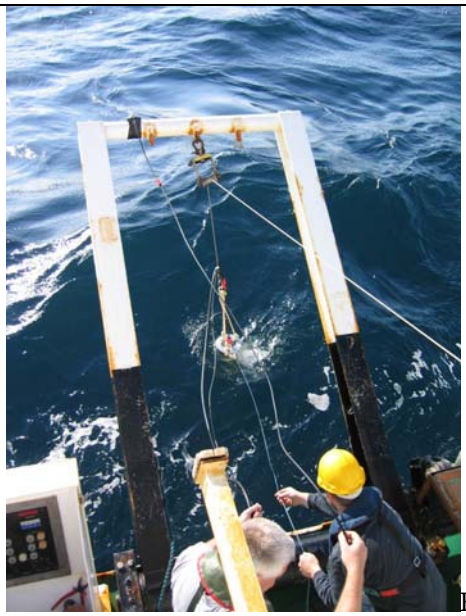
Fig. 9h

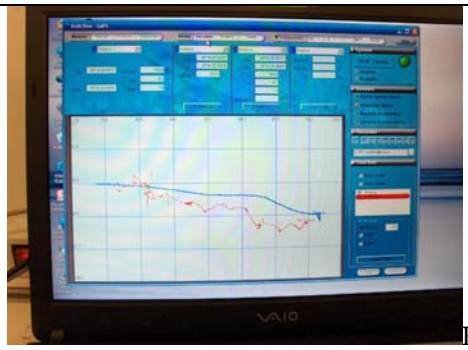
Fig. 9i

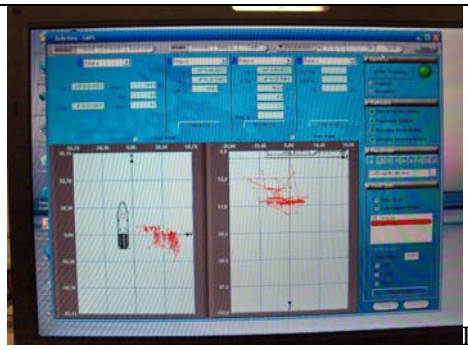
Fig. 9j

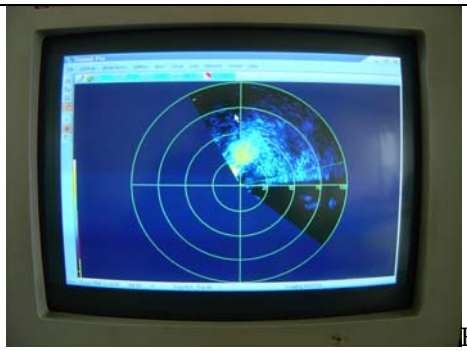
Fig. 9k

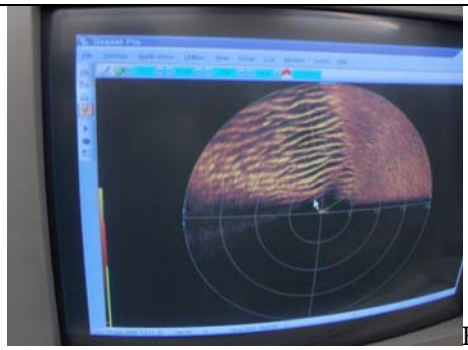
Fig. 9l


Fig. 9m

Fig. 9n

Figure 9: *(a) ROV Genesis within the TMS with view of front cameras, (b) view of grab arm, (c) side view of TMS launched in water, (d) top view of the TMS in the water, (e) ROV launched out TMS, (f) ROV afloat on surface, (g) preparation of GAPS positioning system, (h) deployment of GAPS, (i) GAPS positioning R/V Belgica and ROV Genesis, (j) Position of ROV Genesis with reference to R/V Belgica in plan and depth view, (k) side-looking sonar, (l) seabed morphology on side-looking sonar, (m) control unit of ROV Genesis & TMS and (n) front camera with data overlay.*

During ROV survey, the control is performed by the pilot and the PI scientist (scientist, co-pilot), assisted by another shipboard scientist. The (co-)chief scientist coordinates from the bridge together with the navigator on duty for the ship's velocity, drift and monitoring of the water depth. Propulsion of the ship remained diesel. During operations, the vessel is directed towards wind & waves.

During the trials in the Bay of Douarnenez, several "modus operandi" were tried out. Initially, when the Belgica was anchored, TMS was put in the water up to 5m above seafloor and the ROV was deployed autonomously. Valuable information of the ships movements (forward and drift) were given through the positioning Doppler. Other modes, where the

Belgica was not at anchor, did involve a near-stationary mode or drift. Unfortunately, the Doppler readings were not working properly from than on, so no accurate information was available about the speed and (sideward) drift. Here, TMS was positioned at 10m above seafloor with about 30m of tether towards the ROV. Gentle drift (0.5 knots) of the Belgica towed TMS and ROV. Navigation of ROV and observation was done through its rear-looking camera. For detailed observation or sampling, more tether was given to the ROV and the ship's speed was slowed down. An alternative mode consisted in manoeuvring the ROV underneath the TMS, flying at the same course and speed than R/V Belgica. This method was abandoned since it was too complicated.

Dive name	Date	Location	Start dive		End dive	
			Time	Depth	Time	Depth
B06-01 Test	14/06/06	Bay of Douarnenez (FR)	15:00	18m	16:30	20m
B06-02 Test	14/06/06	Bay of Douarnenez (FR)	17:15	20m	22:30	20m
B06-03 Test	15/06/06	Bay of Douarnenez (FR)	08:44	31m	10:05	31m
B06-04 Test	15/06/06	Bay of Douarnenez (FR)	10:15	31m	11:30	31m
B06-lachap-1	16/06/06	La Chapelle Banc	09:27	282m	10:33	282m
B06-lachap-1bis	16/06/06	La Chapelle Banc	15:10	485m	16:00	475m
B06-lachap-1tris	16/06/06	La Chapelle Banc	16:44	400m	20:05	400m
B06-lachap-2	17/06/06	La Chapelle Banc	09:55	587m	18:44	557m
B06-bantry-1	19/06/06	Bantry Bay, Bear Island	08:43	37m	09:35	37m
B06-bantry-2	19/06/06	Bantry Bay, South cliff	10:20	25m	13:05	30m
B06-bantry-3	19/06/06	Bantry Bay, propeller insp.	15:09	-	15:45	-
B06-bantry-4	19/06/06	Bantry Bay, Doonby Head	17:22	40m	19:31	40m

Table 1: *Names, locations and operational data of the GENESIS ROV dives.*

4.3.5 Operational Report

It is worth noting that the time used in this cruise report and on the seismic survey sheets is the Belgian Summer time (BRAVO TIME = UTC+2hours). Multibeam files were acquired in GMT time.

Friday 09.06.2006

20:00 Arrival of a part of the technical team in Brest (Koen De Rycker & Willem Versteeg)

Saturday 10.06.2006

12:00 Arrival of R/V Belgica in the port of Brest

13:00 Start of mobilisation of ROV and seismic equipment on R/V Belgica

Sunday 11.06.2006

07:00 Start of installation and testing of ROV, with assistance of a Sub-Atlantic engineer

19:30 Arrival of shipboard scientific crew from Gent (Jean-Pierre Henriet, David Van Rooij, Anneleen Foubert, Peter Staelens, Jeroen Vercrussye, Katja Guilini and Frederik Roose).

20:30 Arrival of Veerle Huvenne

Monday 12.06.2006

08:30 Further installation and testing of the ROV equipment, installation of seismic survey equipment and testing of satellite link for the Class@oceans live-stream transmission.

16:00 Malfunction of fibre-optic cables of the ROV is detected.

17:30 Arrival of Andrew Wheeler (UCC, Cork) and Erwan Le Guilloux (IFREMER)

Tuesday 13.06.2006

09:00 Reparation of the fibre-optic connections and further testing of the ROV equipment. The departure of R/V Belgica is postponed, dependant of the progress of the reparation work. The testing of satellite link for the Class@oceans live-stream transmission was successfully continued with Belgian and German classes.

21:00 Scientific briefing

22:00 All ROV systems are working and an immersion test is successfully made. Only the latch-lock system is not working properly. A last check is performed to ensure all material is secured for seagoing.

Wednesday 14.06.2006

Meteo: NE 'ly 15-20 knots in a general clear and dry weather. A swell (1.5-2m) was present in the study area.

02:00 Departure of R/V Belgica towards Area 1: La Chapelle bank

08:00 Due to an unfavourable seastate (4-5 beaufort), the transit to La Chapelle bank is aborted and it was decided to do ROV manipulation exercises in the sheltered environment of the Douarnenez Bay. Exact working zone has to be decided in cooperation with R/V Thalia of IFREMER and with the navy post at Cap de la Chèvre.

14:00 Anchoring at site 13 (48°12.292' N 004°28.719' W), with a water depth between 18 and 20m

14:15 Testing and performing checklist of ROV and deploying GAPS positioning equipment. Testing and set-up of Class@Oceans transmission with the German class

15:00 Start of B06-01 Test. TMS and ROV are put in the water to a depth of 5m above sea floor. At the same time, the Class@Oceans transmission was performed, where scientists answered questions of the German students on corals and the campaign

15:15 The ROV is launched and starts its first seabed survey

16:30 End of B06-01 Test. The ROV is brought back into the TMS and winched on deck for small adjustments and check of the sampling trials.

17:15 Start of B06-02 Test. Second ROV deployment for manoeuvring exercises by pilots and co-pilots.

21:15 Extensive testing of the ROV system has proven the buoyancy of the tether cable is not sufficient to prevent touching of the sea floor. Seen the extensive coral settling in Porcupine Seabight, this might damage the present ecosystem and also the tether. Therefore, it is preferred to first continue testing and make within the La Chapelle bank area first observation dives.

22:30 End of B06-02 Test. TMS & ROV are brought back on deck and rinsed with fresh water

Thursday 15.06.2006

Meteo: NE 'ly 15-20 knots in a general clear and dry weather. A gentle swell (0.5-1.0m) was present in the study area with sea state 3 to 4.

08:00 Anchor in of R/V Belgica, diesel engine propulsion

08:30 GAPS positioning system is deployed from side frame (Davit)

08:40 Start of B06-03 Test. TMS & ROV in the water, winched down up to 10m above seafloor (31m water depth)

08:45 ROV out TMS, 50m of tether

09:00 First test sampling site, ROV is on seafloor

09:30 Testing of positioning with sideward thrusters. Forward speed at maximum of 0.5 knots

09:55 Docking of ROV in TMS, recovery on deck. This in order to solve positioning problems with GAPS. End of B06-03 Test
10:05 Start of B06-04 Test. TMS & ROV back in the water, winched down up to 10m above seafloor (31m water depth)
10:17 Booting problems with GAPS
10:18 Trial of new configuration; ROV sails autonomously at a heading of 096°
11:02 GAPS has been relocated, positioning problem is solved
11:30 ROV is docked in TMS and brought on deck; end of B06)04 Test. Transit to La Chapelle bank
22:55 Arrival at CTD site (47°32.517'N 7°21.611'W)
22:59 CTD back on board; malfunctioning. CTD data is taken from previous campaign. Transit towards first multibeam point

Friday 16.06.2006

Meteo: Easterly wind in a general clear and dry weather. A gentle swell (0.5-1.0m) was present in the study area with sea state 4.

01:41 Start of multibeam calibration line 1 (heading 30°)
01:53 End of multibeam calibration line 1
02:00 Start of multibeam calibration line 2
02:21 End of multibeam calibration line 2
02:27 Start of multibeam calibration line 3
02:38 End of multibeam calibration line 3
03:03 Start of multibeam line 4 (heading 140°), only 50% of the beams are working
04:00 End of multibeam line 4
04:05 Start of multibeam line 5 (heading 310°)
04:53 End of multibeam line 5
04:57 Start of multibeam line 6 & 7(heading 140°)
05:59 End of multibeam line 6 & 7
06:04 Start of multibeam line 8 (heading 310°)
06:51 End of multibeam line 8
06:55 Start of multibeam line 9 (heading 140°)
07:52 End of multibeam line 9, end of multibeam survey
08:30 Preparation and testing of ROV equipment. Special "cocos" mats are laid at the floor of the rear part of the aft deck
09:20 GAPS positioning in the water
09:23 Start of B06-lachap-1. TMS & ROV in the water (282m water depth), winching down to 40m above sea floor
09:44 Compensation alarm on ROV at 20m below sea level.
10:28 ROV & TMS back on deck for reparations. End of B06-lachap-1

11:30 Transit towards multibeam area for additional lines (while ROV is repaired)
12:06 Start of multibeam line 10 & 11 (heading 306°)
13:09 End of multibeam line 10 & 11
13:20 Start of multibeam line 12, line n° jumped back to n°1 (heading 133°)
13:52 End of multibeam line 1 (12)
14:20 Start of multibeam line 2 (heading 310°)
14:29 End of multibeam line 2
14:31 Start of multibeam line 3 (heading 133°)
14:55 End of multibeam line 3, end of multibeam survey, transit towards 2nd ROV dive site
15:10 Start of B06-lachap-1bis. GAPS and TMS & ROV back in the water (water depth 485m)
15:40 New ROV track, due south
15:46 TMS & ROV are winched up again; one of the recovery ropes attached to the TMS has loosened and problem with the ROV latch. End of B06-lachap-1bis.
16:42 Start of B06-lachap-1tris. TMS & ROV back in the water to a water depth of 400m on a N-S downslope transect
17:24 ROV has reached end of station point, continued due south
17:31 Southern drift, 180° with speed 0.5 knots, ROV out TMS
17:38 ROV on sea floor
19:28 ROV needs to be winched up; problem with tether cable
19:45 ROV & TMS on deck; drift robe and fisheries cable was attached to frame
20:05 End of B06-lachap-1tris
20:17 Start of new multibeam survey, new line number, start of multibeam line 1 (heading 310°)
20:38 End of multibeam line 1
20:40 Start of multibeam line 2 (heading 220°)
20:52 End of multibeam line 2
20:53 Start of multibeam line 3 (heading 120°)
21:19 End of multibeam line 3
21:25 Start of multibeam line 4 (heading 312°)
21:40 End of multibeam line 4
21:46 Start of multibeam line 5 (heading 122°)
22:02 End of multibeam line 5
22:09 Start of multibeam line 6 & 7 (heading 220°)
22:20 End of multibeam line 6 & 7, end of multibeam survey
22:25 Preparation of seismic survey, switch to electric propulsion
22:46 Start of line P060601, heading 49° (av. speed 2.4 knots)

Saturday 17.06.2006

Meteo: Easterly wind in a general clear and dry weather. A gentle swell (0.5m) was present in the study area with sea state 3.

00:03 Change of course for line P060601, heading 130°
02:34 End of line P060601
02:45 Start of line P060602, heading 63° (av. speed 3.0 knots)
06:47 End of line P060602, end of seismic survey, transit back to La Chapelle diving area
09:45 GAPS in water
09:50 Start of B06-lachap-2. TMS & ROV in water
18:44 End of B06-lachap-2. TMS & ROV on deck
19:15 Start transit to Porcupine Seabight

Sunday 18.06.2006

Meteo: Westerly wind in a cloudy dry weather. A swell (1.0-1.5m) was present with sea state 5 to 6.

16:10 Transit to Porcupine Seabight was aborted due to bad weather. Change of course towards Bantry Bay for shelter.
21:00 Anchored in Bantry Bay (South of Bear Island)

Monday 19.06.2006

Meteo: Westerly wind in a cloudy dry weather. A swell of approximately 1.0m was present in the study area with sea state 4. However, within the open ocean, gale warnings (state 8) were given.

08:30 R/V Belgica remains anchored during first ROV deployment in Bantry Bay (37m water depth). Pre-dive testing and checklist.
08:43 Start of B06-bantry-1. TMS & ROV are deployed
08:45 GAPS is deployed and launch of ROV
09:05 ROV back in TMS
09:35 Recovery of TMS & ROV, end of B06-bantry-1. Transit to southern edge of Bantry Bay, to perform a E-W cliff transect towards Sheep's Head
10:10 Arrival at site (transect between Glanrooncoosh and Coosbrach)
10:15 Start of B06-bantry-2. TMS & ROV are deployed (water depth of 24.5m)
10:22 Launch of ROV
12:55 ROV back in TMS
13:05 Recovery of TMS & ROV; end of B06-bantry-2. Transit to southern area of Bear Island near Doonby Head
13:59 TMS & ROV are deployed

14:06 R/V Belgica suffers from propeller problem. TMS & ROV are recovered instantaneously on deck and are inspected. Most probably an illegal fisher's net was mixed up in the propeller.
14:10 Transit of R/V Belgica to safe position for anchoring. ROV inspection of the propeller.
15:00 Anchored for Bear Island
15:09 Start of B06-bantry-3. TMS & ROV are deployed to a depth of 5m beneath sea level
15:14 Launch of ROV, start of visual inspection of propeller
15:30 A fisher's net has indeed been mixed up around the propeller shaft. However, no clear visible damage is noticed
15:45 Recovery of TMS & ROV, end of B06-bantry-3. Transit to Doonby Head survey site
17:17 Arrival at ROV survey site
17:22 Start of B06-bantry-4. TMS & ROV are deployed
17:25 GAPS is deployed
18:45 Malfunctioning of tether in/out function on the TMS
19:00 TMS is recovered on deck to detect (mechanical) problem
19:20 GAPS is recovered
19:25 Zodiac in the water for ROV recovery with use of the shipboard crane
19:31 ROV is recovered, end of B06-bantry-4. Disconnecting ROV from TMS
20:00 R/V Belgica is anchored, re-arrangement of aft deck and preparation for transit
24:00 Departure of R/V Belgica to Cork (Ireland)

Tuesday 20.06.2006

08:30 Approach toward Cork harbour entry at Cobh
09:00 Webcam transmission of class@oceans with the Belgian class
10:30 Pick-up of pilot
12:00 R/V Belgica is berthed in Cork, end of campaign ST06/12
13:00 Demobilisation of RCMG material and dismantlement of the TMS connection
14:00 Arrival of Irish Navy divers team to inspect and clear the ship's propeller. Because the Irish Navy also seems to use a Sub-Atlantic Cherokee ROV, further contacts were made.
18:00 Reception on board of R/V Belgica

Wednesday 21.06.2006

08:30 Departure of RCMG shipboard scientific crew, except for David Van Rooij and Willem Versteeg who will stay for the duration of campaign ST0613
11:00 Pick-up of TMS which will be transported to Sub-Atlantic (Aberdeen, Scotland) for reparations

Thursday 22.06.2006

12:30 Visit of staff members of the Irish Navy Diving unit for further information exchange on the use and operation of the Sub-Atlantic Cherokee ROV

4.4 Operational remarks

First of all, we want to thank the captain and crew for their tremendous efforts and the fine cooperation for this campaign. The on-board skilfulness really contributed greatly to this first ROV campaign. In view of a better cooperation during future ROV campaigns, we would like to formulate some suggestions which could stimulate more success:

- During the first trials in the Bay of Douarnenez, the use of the Doppler log was proven very valuable. However, from the moment the ship is moving, and certainly into deeper waters, the readings become unreliable. For ROV work (but possibly also for coring purpose), it would be easier to navigate when knowing the movements of the ship, as well for the ROV pilots, as well for the navigation.
- Also during ROV operations, an accurate depth reading is necessary since no altimeter is present on the TMS. However, the depth reading from the FURUNO echosounder is not always reliable and difficult to interpret in depths greater than 300m. It would be interesting if accurate depth readings (up to 1500m) were immediately available for the navigation on the bridge (which could be relayed through the scientists through the ship's intranet). This could also be of great importance for deep-water sampling.
- During this campaign a lot of positions for tracks or stations were needed. Most of these were changed or added during the campaign. The present way of submission of coordinates has proven to be very time-consuming for the scientists and the navigational staff. Unfortunately this manual input of coordinates also is a source of errors (The dd°mm,mm' format is not easily exported. We believe a lot of time and effort would be saved if coordinates of tracks and stations could be submitted in a digital format (text files with decimal coordinate values) to be uploaded in the Transas programme.

4.5 ROV & geological investigations: preliminary results

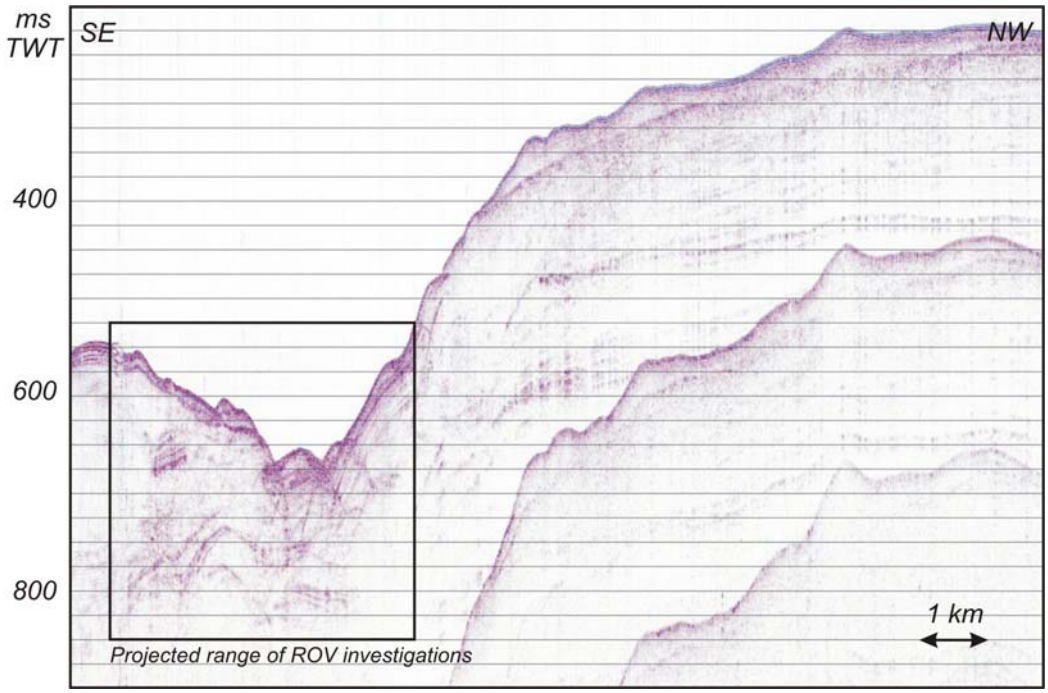

Figure 10: *Seismic profile P060601 along the area where oyster banks were observed by ROV Genesis*

The French canyon system near the Banc de la Chapelle offered a perfect location for rigorous trials of GENESIS: reported cold-water coral finds, rugged topography and hydrodynamics in a setting linking the shelf seas to the deep marine realm. The area was first surveyed using R/V Belgica's multibeam echosounder, imaging deep canyons and thalweg channels between prominent spurs where corals had been reported (Fig. 7). Seismic lines provided a geological context and linked in to the existing seismostratigraphy (Fig. 10).

Two successful dives revealed a sandy-muddy seabed with curious bedforms and erosion exposing consolidated sedimentary sequences, often cut by vertical cliffs up to 10m high (Fig. 11). At the base of the cliffs, fallen blocks provided settlement sites for sessile organisms whilst the cliffs and protruding banks revealed dense communities of oysters with occasional cold-water coral (Lophelia). Though deep-water 'oyster banks' had already been reported earlier by Le Danois (1948) on the base of dredgings, these dramatic seascapes had remained largely hidden to the human eye up to now.

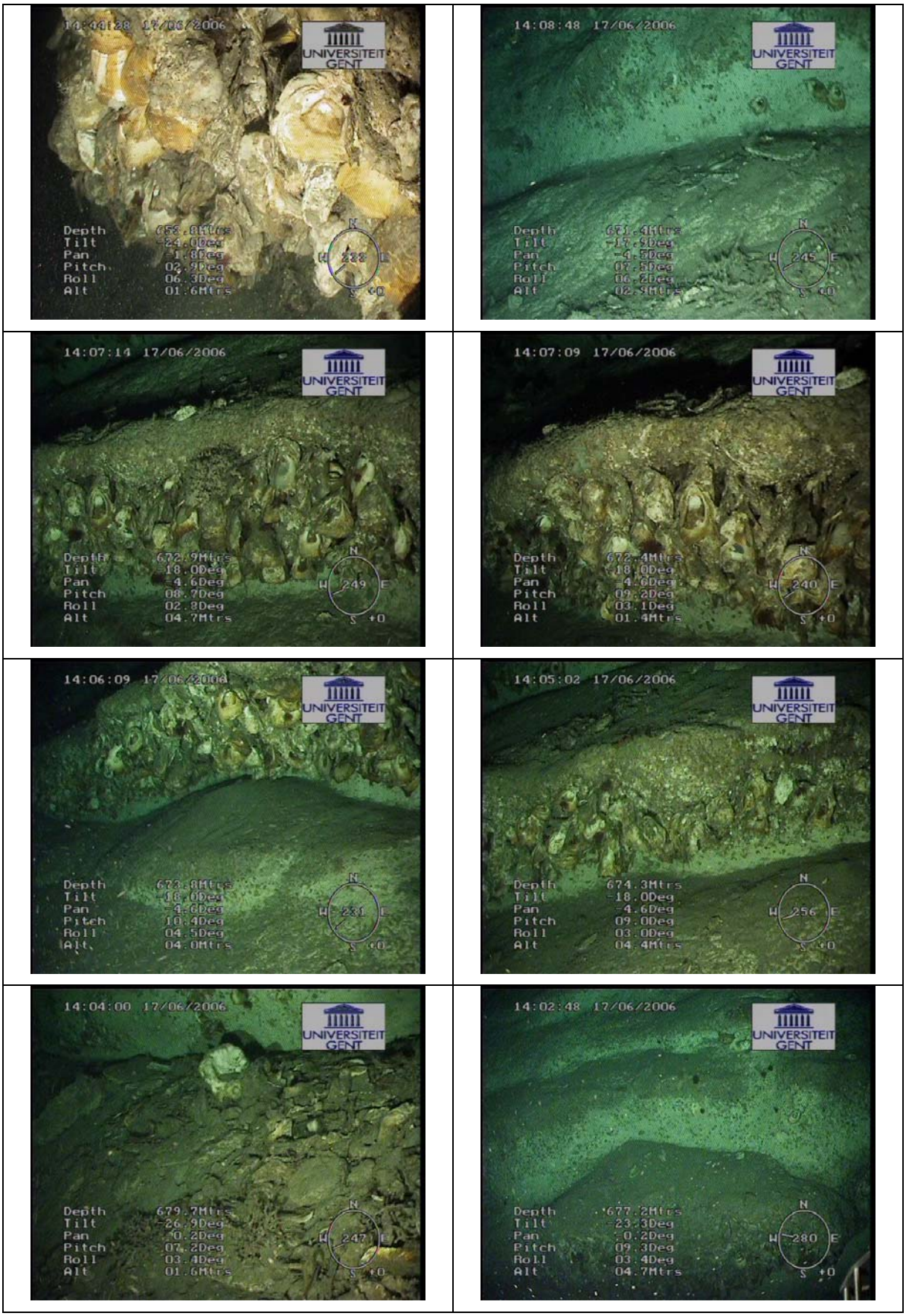

Figure 11: *Camera stills from the ROV Genesis observations on La Chapelle Banc.*

5. Class@oceans

Class@oceans (http://www.vliz.be/projects/classatoceans/index.htm) has the aim to bring marine sciences straightforward into classrooms or to bring the marine world to the youth. It gives students the opportunity to discover the oceans together with scientists. In a first step two classes (Koninklijk Atheneum Gent (B) and the Maria-von-Lindenschule, Heidenheim (D)) were brought into contact with each other by a website-concept (in cooperation with VLIZ). The second step was to introduce the classes into the concept of a scientific campaign with a research vessel (R/V Belgica) and the scientific background (topic of cold-water corals, ROV). The third step is that the classes were introduced (by the webpage) to some scientists and people on board. The fourth step is that the pupils prepare a question towards one of these scientists on board. The fifth step (in cooperation with MUMM) is then a real-time satellite connection between the vessel and the class-room using the new Fleet 77 satellite and the "Skype" software.

Also a daily report from the cruise was be available on the class@oceans-website. The classes had the possibility to follow the cruise in real-time on the website and to ask questions through a forum-concept. Class@oceans fits into the educational strategies of the European projects EURODOM and HERMES.

Figure 12: *The Class@Ocean team ready for transmission in Bantry Bay (left) and Prof. Dr. Andrew Wheeler in discussion with a German student (right).*

6. Data storage

During the Belgica 06/12 campaign, 2 seismic lines were acquired over approximately 62 km. Both 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). Multibeam data also is backed up on DVD, including both the 'raw' and 'proc' data folders.

The ROV imagery (front and backward looking camera) was recorded on Mini-DV tapes through hand-held cameras.

A total of 12 ROV test and scientific dives were performed. This video data is stored on mini-DV tapes. The geophysical and CTD data are stored at the RCMG on DVD, as well as some video extracts. For more information about the seismic, multibeam, video and sedimentological data, please contact

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