# RV BELGICA CRUISE 2014/16 – CRUISE REPORT



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**Geology: 13/06/2014 - 23/06/2014**

## 1. CRUISE DETAILS

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| 1. | Cruise number | 2014/16 |
| 2. | Date/time | Porto TD: 13/06/2014 at 14h20<br>Zeebrugge TA: 23/06/2014 at 07h00 |
| 3. | Chief Scientist<br><br>Participating institutes | Prof. Dr. David Van Rooij<br><br>Ghent University - RCMG<br>University of Vigo (Spain)<br>British Geological Survey (UK)<br>Plymouth University-Marine Biology and Ecology Research Centre (UK) |
| 4. | Area of interest | UK EEZ: Celtic Margin • Dangeard & Explorer Canyons<br>48°45’N – 48°00’N – 10°15’W – 09°15’W |

## 2. LIST OF PARTICIPANTS

| INSTITUTE | NAME | 13/06 - 23/06/14 |
|---|---|---|
| **UGent - RCMG** | David VAN ROOIJ | Embarkation on 11/06 |
| | Tim COLLART | Embarkation on 11/06 |
| | Koen DE RYCKER | Embarkation on 11/06 |
| | Thomas VANDORPE | Embarkation on 11/06 |
| **British Geological Survey** | Heather STEWARD | Embarkation on 11/06 |
| | Ian PHEASANT | Embarkation on 11/06 |
| | David WALLIS | Embarkation on 11/06 |
| **Plymouth University** | Kerry HOWELL | Embarkation on 11/06 |
| | Marcus SHIRLEY | Embarkation on 11/06 |
| **University of Vigo** | Angel MENA | Embarkation on 11/06 |
| | Total number of participants: | 10 |

## 3. SCIENTIFIC OBJECTIVES

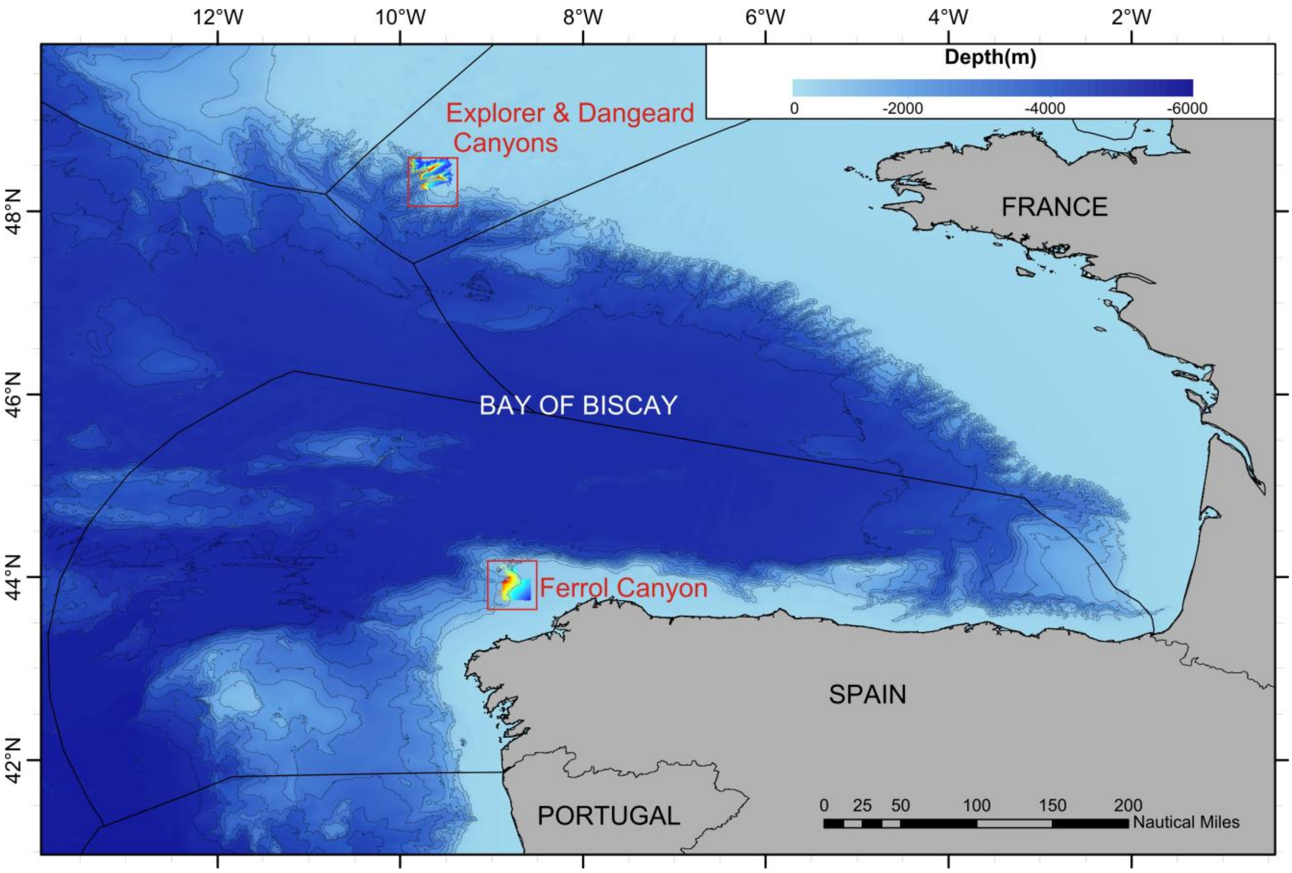


***Fig. 1: Locations of the study area's for the R/V Belgica ST1416 on the EMODnet Bathymetry (contour lines every 500m). Bolt black lines indicate the EEZ boundaries.***

**<u>FWO MINIMOUND Project</u>: Using Cold-water coral mini-mounds as analogue for giant mound growth: assessment of environmental drivers and anthropogenic impact**

Cold-water corals (CWC) are found along the entire north-eastern Atlantic Margin from Norway to the Gulf of Cadiz. In the Porcupine Seabight, these coral reefs (mainly *Lophelia pertusa* and *Madrepora oculata*) accumulate into large mounds of up to 250m high (e.g. Challenger Mound), which have been well studied over the past two decades (Roberts et al., 2006). The detailed mechanism of the start-up phase of such large CWC mounds is however not yet fully understood. Therefore, it is essential to study analogues of these stages that are not well recorded in larger mounds. The FWO MINIMOUND project (2013-2016) aims to investigate the initiation, growth and demise of "small" CWC mounds and to determine the role of climatic and hydrocarbon-seepage related processes as well as anthropogenic impact. This high-resolution multidisciplinary study will focus on three "minimound" provinces along the Biscay continental margin: (1) the Explorer and Dangeard Canyons on the Celtic Margin (Fig. 1; Stewart et al., 2013), (2) the Guilvinec Canyon on the Armorican Margin (De Mol et al., 2011) and (3) the Upper Ferrol Canyon on the Cantabrian Margin (Fig. 1). These minimounds are fossil (9.7ka BP) and occur at relative shallow depth on the interface between the Eastern North Atlantic Central Water (ENACW) and the Mediterranean Outflow Water (MOW). Contrastingly, most present-day living CWC reef habitats dwell in the deeper MOW depth range, relying on the density and dynamics of this water mass for their food supply.

The objectives of the project are threefold: (1) the establishment of a chronostratigraphic framework and the reconstruction of palaeoceanographic changes over the last 15.000 years in order to determine the impact of glacial to interglacial climate change on the ENACW-MOW interface and the CWC habitats (Frank et al., 2011); (2) the minimound province at the Upper Ferrol Canyon shows a close association with hydrocarbon-seepage (pockmarks) which allows to assess the role of hydrocarbon related processes in CWC mound formation; (3) the potential impact of anthropogenic fisheries activities will be investigated.

These objectives will be tackled through a coupled geophysical, sedimentological and integrative approach, including the palaeoceanographic and biogeochemical study of USBL guided cores in cooperation with the BGS (UK), LSCE (Gif-sur-Yvette, France), IFREMER (France), IGME (Spain) and IEO (Spain). Two sampling campaigns with the R/V Belgica will be undertaken. The first campaign in June 2014 aims to take cores through the minimounds located on the Upper Ferrol Canyon (ES) and the Explorer and Dangeard Canyons (UK) using vibrocorer provided by the BGS (Fig. 1). In addition to core collection, drop frame video data will be acquired to allow habitat mapping and predictive modeling of the CWC habitats in cooperation with the Marine Institute of Plymouth University (UK). Unfortunately weather did not allow any research activities in the Upper Ferrol Canyon area and hence the campaign was entirely shifted to the Explorer and Dangeard Canyon areas.

**OD NATURE-LN (AUMS)**

The AUMS (Autonomous Underway Measurement System) project is inspired by the success of similar systems deployed on various ships of opportunity in the framework of the European Union FerryBox project (www.ferrybox.org). The instrumentation will greatly enhance the continuous oceanographic measurements made by RV Belgica by taking advantage of the significant technological improvements since the design of the existing (salinity, temperature, fluorescence) systems. In particular, many new parameters can now be measured continuously including important ecosystem parameters such as nitrate, ammonia, silicate, dissolved oxygen and CO2, turbidity, alkalinity and phytoplankton pigments. In addition, the new equipment allows automatic acquisition and preservation of water samples, rendering RV Belgica operations significantly more efficient by reducing onboard human resources. Data will be available in near real-time via OD NATURE's public web site and following quality control, from the Belgian Marine Data Centre.

**ESA-MC (GNSS)**

For the European Space Agency continuous GNSS (Global Navigation Satellite system) data is autonomously acquired in the maritime environment for performance evaluation under different conditions.

## 4. OPERATIONAL COURSE

*All times are given in local time (UTC +1). All coordinates in WGS84.*
*Throughout the campaign, measurements are made with the AUMS system.*

**11/06/2014**

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|---|---|
| 09h00 | Arrival BGS team (Heather Stewart, Iain Pheasant, David Wallis) and RCMG team (Koen De Rycker, Thomas Vandorpe, Tim Collart) at RV Belgica in Leixoes Harbour, Passenger Terminal, Dock 1 North |
| 10h00 | Demobilization Belgica 2014-15 campaign |
| 11h00 | Installation seismic equipment |
| 13h00 | Installation seismic control unit equipment and navigation computers (GPS, desktop with MMI and OFOB software) on the bridge |
| 17h00 | Arrival Plymouth Team (Kerry Howell & Marcus Shirley) and Chief Scientist David Van Rooij |
| 18h00 | Reception on the Belgica |

**12/06/2014**

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| 09h00 | Delay of vibrocorer containers and videodropframe delivery due to customs and national holiday on 10/06 |
| 10h00 | Arrival land crane for vibrocorer container mobilization |
| 14h00 | Arrival vibrocorer containers, loading of control unit container and vibrocorer parts with the land crane |
| 15h00 | Arrival videodropframe pallet |
| 16h00 | Building of vibrocorer and videodropframe |
| 18h00 | Decision to postpone departure on 13/06 till 14h00 to allow for a vibrocorer deployment test in the harbor |
| 20h00 | Building of vibrocorer and videodropframe (continued) |

**1st day 13/06/2014**

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| 09h00 | Briefing vibrocorer deployment crew |
| | Blackout and alarm test |
| 13h40 | Operational briefing |
| | Vibrocorer deployment test |
| 14h20 | Start transit towards zone 1 (Ferrol Canyon) |
| 15h00 | Abandon ship safety test |
| 16h00 | Scientific meeting (briefing) |
| 18h00 | Rendez-vous with BNS Godetia |

**2nd day 14/06/2014**

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|---|---|
| 10h33 | Arrival in zone 1 (Ferrol Canyon) |
| | Weather does not allow vibrocoring and forecasts do not look favorable |
| | Decision to shift campaign goal entirely to zone 2 (Explorer-Dangeard Canyon) |
| | Start transit to zone 2 |

**3rd day 15/06/2014**

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|---|---|
| 12h00 | Arrival zone 2 (Explorer-Dangeard Canyon) |
| 13h00 | Preparations vibrocorer |
| 13h15 | Test vibrocorer functioning |
| 14h25 | Approach of site DI-15 |
| 14h26 | Vibrocorer launched to site DI-15 |
| 14h50 | Vibrocorer at 240 m water depth, approaching site for landing |
| | GAPS signal is not constantly updated |
| 14h56 | Vibrocorer at the seafloor (Long: 9°35,71'W; Lat: 48°18,106'N; Depth: 275 m) |
| | GAPS position stable |
| | Coring process started (15 min) |
| 15h00 | Inconsistent GAPS position (double water depth) |
| | Rebooting MMI (GAPS Software) |
| | Inconsistent position |
| 15h12 | Vibrocorer off the seafloor, gradually coming up |
| | GAPS position reestablished |
| 15h20 | Vibrocorer brought back on deck successfully |
| | 1.5 m of core tube not back in the rig (not able to core fully or pulled out too soon) |
| | Reconfigured pull back time |
| | Battery loosened but recovered |
| 15h24 | Ready for core extraction |
| 15h39 | 214 cm of core recovered |
| | Navigation to next site DI-29 |
| 16h35 | Vibrocorer launched to site DI-29 |
| | Continues GAPS position updates |
| | Tracking SUB 1,2,3 and 4 in OFOB to see if position is logged |
| 16h39 | GAPS position lost, acoustic array loss |
| | Rebooting MMI software |
| | GAPS position reestablished |
| | Vibrocorer at 220 m water depth, approaching site for landing |
| 17h10 | Vibrocorer at the seafloor (Long: 9°35,266'W; Lat: 48°17,983'N; Depth: 262 m) |
| | Coring process started (20 min) |
| | GAPS position lost and reestablished |
| | Correct position close to target site DI-29 |
| | Inconsistent GAPS positioning during coring |
| 17h30 | Vibrocorer off the seafloor |
| 17h39 | Vibrocorer on deck, core barrel fully in the rig |
| | Ready for core extraction |
| 17h58 | 218 cm of core recovered |
| 19h21 | Delay in video dropframe deployment due to problems with hydraulics on the starboard winch |

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| | Problems being diagnosed | |
| 22h12 | Hydraulic system still not operational, reparation will be done by 10h00 the next day | |
| | Seismic acquisition will be done in that time | |
| | GAPS system out of the water | |
| 23h10 | Approach of seismic line EDI14-0601 | |
| 23h15 | Switched to electrical propulsion | |
| | Speed kept at approximately 3kn | |
| 23h20 | Streamer and sparker in the water | |
| | Start testing | |
| 23h25 | Start of line ED14-0601 | |

**4th day 16/06/2014**

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| 04h27 | End of line ED14-0601 | (heading: 66; average speed: 2.9 knots) |
| 05h56 | Start of line ED14-0602 | |
| 09h07 | End of line ED14-0602 | (heading: 242; average speed: 2.9 knots) |
| 09h21 | Start of line ED14-0603 | |
| 10h39 | End of line ED14-0603 | (heading: 68; average speed: 3.1 knots) |
| 10h43 | Seismic streamer and sparker back on board | |
| | Engine switched back to diesel propulsion | |
| | Navigation towards vibrocorer site DI-4 | |
| 11h05 | Approach of site DI-4, GAPS in the water | |
| 11:17 | Vibrocorer launched to site DI-4 | |
| | Problems with GAPS, no constant positioning | |
| 11h29 | Vibrocorer at the seafloor | (Long: 9°37,362'W; Lat: 48°17,788'N; Depth: 316 m) |
| | GAPS positioning is working | |
| | Coring process started (25 min) | |
| 11h41 | Loss of GAPS position | |
| 11h58 | Vibrocorer off the seafloor | |
| 12h17 | Vibrocorer on deck | |
| 12h23 | Only 43 cm of core acquired | |
| | Site DI-4 will be repeated (DI-4b) | |
| | Fixed problem with USBL depth logging in the OFOB software | |
| 12h54 | Vibrocorer launched to site DI-4b | |
| | No GPS received by MMI, rebooting | |
| | GAPS position reestablished | |
| 13h05 | Vibrocorer at the seafloor | (Long: 9°37,35'W; Lat: 48°17,797'N; Depth: 316 m) |
| | GAPS positioning is working | |
| | Coring process started (25 min) | |
| 13h33 | Vibrocorer off the seafloor | |
| 13h39 | Vibrocorer on deck | |
| 13h59 | 103cm of core recovered | |
| | Core catchers deformed, part of core pulled back out | |
| | Use of double core catcher in future coring | |
| | Coral present at the top | |
| | Core valve was damaged, repairs being done | |
| | Navigation to site DI-10 | |
| 15h10 | Core valve repaired | |
| 15h50 | Vibrocorer launched to site DI-10 | |
| 16h04 | Vibrocorer at the seafloor | (Long: 9°37,363'W; Lat: 48°17,737'N; Depth: 315 m) |
| | GAPS position correct | |
| | Coring process started (25 min) | |
| 16h09 | GAPS positioning problems | |
| | Rebooting MMI | |
| | No GAPS positioning | |
| 16h30 | Vibrocorer off the seafloor | |
| | Still no GAPS positioning | |
| | Rebooting MMI | |
| 16h36 | Vibrocorer on deck | |

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| 16h50 | 131 cm of core recovered |
| | transit to revisit DI-15 (DI-15b) |
| 17h22 | Vibrocorer launched to site DI-15b |
| 17h34 | Vibrocorer at the seafloor (Long: 9°35,717'W; Lat: 48°18,121'N; Depth: 271 m) |
| | Coring process started (25 min) |
| | Loss of GAPS positioning |
| | Rebooting MMI |
| 18h02 | Vibrocorer off the seafloor |
| 18h10 | Vibrocorer on deck |
| 18h25 | 229 cm of core recovered |
| | Preparing for video transects |
| 18h51 | Video dropframe launched for dive T12 and T15 (both stations visited in 1 dive) |
| | OFOB crashes |
| | Protocol logging continued in T12T15cont |
| 19h06 | Video dropframe at the seafloor, starting transect T12T15 |
| 19h48 | Passed over station T12 |
| | GAPS positioning is working |
| 19h55 | MMI reboot, lost GAPS position for approx. 1-2min |
| 20h10 | Lost GAPS position for 2 min, MMI rebooted |
| 20h14 | GAPS position reestablishes |
| 20h16 | Lost GAPS position |
| 20h18 | GAPS position reestablished |
| 20h24 | Passed over station T15 |
| 20h32 | 100 m past station T15, decision to end the transect |
| 20h32 | Video dropframe off the seafloor |
| 20h35 | Video dropframe on deck |
| | Start of 3 hours transit at 1,5 knots to station T21 |
| | Charging of dropframe batteries |

**5th day 17/06/2014**

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| 00h32 | Preparations for dive |
| 00h57 | Video dropframe launched for dive T21 |
| 01h12 | Lost GAPS position |
| | Video dropframe at the seafloor |
| | GAPS position reestablished |
| | Transect started 500m before station T21 |
| 01h34: | Lost GAPS position for approx. 1 min |
| 01h58 | Video dropframe off the seafloor |
| | Stopped transect 150m past station T21 |
| | Approx. 800 m of transect |
| 02h07 | Video dropframe on deck |
| 02h10 | Start transit to station T25 |
| 02h27 | Decision to skip T25 |
| | Start transit to next station T18, arrival in 2 hours |
| | Time for recharging batteries and getting dropframe operational again |
| 04h08 | Preparing video dropframe for launch |
| 04h55 | Video dropframe launched for dive T18 |
| 04h58 | Lost GAPS position |
| | Rebooting MMI |
| 04h59 | GAPS position reestablished but noisy |
| 05h13 | Video dropframe at the seafloor |
| | Start transect T18 |
| | GAPS positioning is working |
| | Occasional loss of position for 10 sec |
| 06h10 | Passed T18 approx. 30 m off station |
| | Continuing transect |
| 06h20 | Video dropframe off the seafloor |
| 06h34 | Video dropframe on deck |

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| | Transit to vibrocore site DI-31 | |
| 08h00 | Approach of site DI-31 | |
| | Problem with hydraulics | |
| 09h01 | Hydraulic problems solved | |
| | Vibrocorer launched to site DI-31 | |
| | No GAPS position for 10 min | |
| | Blind navigation to site | |
| 09h33 | Vibrocorer at the seafloor | (Long: 9°39,472'W; Lat: 48°18,491'N; Depth: 426 m) |
| | Coring process started (25 min) | |
| 10h01 | Vibrocorer off the seafloor | |
| 10h10 | Vibrocorer on deck | |
| | 288 cm of core recovered | |
| | Navigation to site DI-12 | |
| 10h27 | GAPS transponder broke during dive, new transponder has been placed on the vibrocorer frame | |
| 10h40 | Delay in site approach due to engine problems | |
| 11h30 | Engine problems solved | |
| | Approach of site DI-12 | |
| 11h42 | Vibrocorer launched to site DI-12 | |
| | No GAPS position | |
| | Rebooting MMI | |
| | GAPS position reestablished | |
| 12h09 | Vibrocorer at the seafloor | (Long: 9°39,094'W; Lat: 48°17,794'N; Depth: 374 m) |
| | Coring process started (25 min) | |
| 12h40 | Vibrocorer on deck | |
| | Navigation to site DI-14 | |
| 13h30 | Vibrocorer launched to DI-14 | |
| 13h32 | No GPS received on MMI | |
| | Rebooting MMI | |
| | GAPS position reestablished | |
| 13h41 | Vibrocorer at the seafloor | (Long: 9°38,515'W; Lat: 48°17,594'N; Depth: 354 m) |
| 13h52 | Lost GAPS position | |
| | MMI rebooted | |
| 13h56 | GAPS position reestablished but incorrect | |
| 14h04 | Correct GAPS location reestablished | |
| 14h09 | Vibrocorer off the seafloor | |
| 14h14 | Vibrocorer on deck | |
| 14h30 | 303 cm of core recovered | |
| | Navigation to site DI-3 | |
| 14h51 | Vibrocorer launched to site DI-3 | |
| 14h57 | Lost GAPS position | |
| | Rebooting MMI | |
| 14h59 | GAPS position reestablished | |
| 15h03 | Vibrocorer at the seafloor | (Long: 9°38,465'W; Lat: 48°17,666'N; Depth: 347 m) |
| | GAPS position correct | |
| 15h08 | Inconsistent GAPS position | |
| 15h17 | Rebooted MMI | |
| | Correct GAPS position reestablished | |
| 15h28 | Lost GAPS position | |
| | Rebooted MMI | |
| 15h29: | Vibrocorer off the seafloor | |
| | No correct gaps position | |
| 15h36 | Vibrocorer on deck | |
| 15h50 | 307 cm of core recovered | |
| 16h10 | Navigating to site DI-32 | |
| 16h53 | Vibrocorer launched to site DI-32 | |
| | GAPS positioning working | |
| 16h59 | GAPS position is noisy | |
| 17h06 | Vibrocorer at the seafloor | (Long: 9°41,249'W; Lat: 48°16,074'N; Depth: 434 m) |
| | GAPS positioning working | |

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| | Coring process started (25 min) |
| 17h10 | Meeting for discussing future video dropframe and vibrocorer targets |
| 17h33 | Vibrocorer off the seafloor |
| 17h39 | Vibrocorer on Deck |
| | 287 cm of core recovered |
| 19h15 | Navigating toward Video dropframe station C_3_7 (new station matching video transect of 2007 MESH campaign) |
| 20h22 | Video dropframe ready for deployment |
| | Trying out new version of GAPS MMI software |
| 20h25 | Video dropframe launched for dive C_3_7 |
| | Problems with GAPS positioning |
| 20h38 | Video dropframe at the seafloor |
| | Start of Transect C_3_7 |
| 20h40 | GAPS position reestablished, seems more stable |
| 21h21 | End of transect C_3_7 |
| | Video dropframe off the seafloor |
| 21h27 | Video dropframe on deck |
| | Navigation to station T20 |
| | Charging video dropframe batteries |
| 22h51 | Video dropframe ready for deployment to station T20 |
| | Course changed to 70° to allow for a straight transect |
| 22h58 | Video dropframe launched for dive T20 |
| 23h05 | Video dropframe at the seafloor |
| | Start of transect T20 |
| | GAPS position unreliable |
| 23h06 | GAPS position is stable |
| 23h58 | End of transect T20 |
| | Video dropframe off the seafloor |

**6th day 18/06/2014**

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| 00h08 | Video dropframe on deck |
| | Error with HD cameras. No HD footage recorded during dive to transect T20 |
| 00h21 | 2 hours transit to station T25 |
| | Charging video dropframe batteries |
| 02h41 | Video dropframe launched for dive T25 |
| | Started position logging at 50 m depth |
| 02h47 | Drifting of course, difficult to correct at 0,5kn (speed for video dropframe) |
| 02h52 | Decision to leave the target station T25 and follow the drift for 500m as it is a normal seabed transect (not a minimound) |
| 03h01 | Lost GAPS position |
| | Rebooted MMI |
| | GAPS unreliable position after reboot |
| 03h07 | GAPS position stable |
| 03h26 | Dropframe off the seafloor |
| | End of transect T25 |
| | GAPS position noisy |
| 03h35 | Video dropframe on deck |
| | 2 hours transit to charge batteries |
| 04h03 | Decision to repeat T20 as camera failed last time |
| | Navigation files will be saved as T20bis |
| 05h59 | Launch of video dropframe for dive T20bis |
| 06h05 | OFOB position logging crashed |
| | Continued protocol in T20biscont |
| 06h12 | Video dropframe at the seafloor |
| | Start of transect T20bis |
| 06h38 | Lost GAPS position for several minutes |
| 06h43 | Passing over station T20 |

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| 06h40 | Video dropframe off the seafloor | |
| | End of transect T20bis | |
| 07h01 | Video dropframe on deck | |
| | Start transit to the Explorer Interfluve | |
| 08h21 | GAPS out of the water | |
| 08h30: | Vessel speed increased to 10 knots | |
| 08h54 | GAPS into the water | |
| | Vessel speed reduced to 2kn | |
| 09h02 | Vibrocorer launched to site EI-25 | |
| 09h03 | Problems with MMI software | |
| 09h13 | MMI started successfully | |
| 09h35 | OFOB software crashed several times | |
| | Eventual navigation file saved as EI25_cont_3 | |
| 09h52 | Vibrocorer at the seafloor | (Long: 9°41,109'W; Lat: 48°22,854'N; Depth: 399 m) |
| | Coring process started (25 min) | |
| 10h18 | Vibrocorer off the bottom | |
| 10h24 | Vibrocorer on deck | |
| | 181 cm of core recovered | |
| 11h03 | Vibrocorer launched to site EI-16 | |
| 11h28 | Vibrocorer at the seafloor | (Long: 9°41,63'W; Lat: 48°23,127'N; Depth: 338 m) |
| | Coring process started (25 min) | |
| 11h54: | Vibrocorer off the seafloor | |
| 12h02 | Vibrocore on deck. | |
| | 109 cm of core recovered | |
| 12h49 | Vibrocorer launched to site EI-51 | |
| 13h12 | Vibrocorer at the seafloor | (Long: 9°41,214'W; Lat: 48°24,111'N; Depth: 325 m) |
| 13h40 | Vibrocorer off the bottom | |
| 13h45 | Vibrocorer on deck | |
| | Small repairs needed for vibrocorer: battery and cable replacement | |
| 14:52 | Vibrocorer repaired | |
| | Navigation to site EI-41 | |
| 15h22 | Vibrocorer launched to site EI-41 | |
| 15h30 | OFOB crashed, navigation log continued in EI41CONT | |
| 15h38 | Vibrocorer on the seafloor | (Long: 9°41,308'W; Lat: 48°24,099'N; Depth: 329 m) |
| | GAPS position correct | |
| | Coring process started (25 min) | |
| 16h05 | Vibrocorer off the seafloor | |
| 16h13 | Vibrocorer on deck | |
| 16h33 | 224 cm of core recovered | |
| | Core tube was stopped by a harder layer (caused by geology not mechanical issues) | |
| 16h20 | Diagnosed technical problem on the engine (generator), standby to see if problem can be solved | |
| 17h00 | Decision to switch to seismic acquisition | |
| 17h35 | Approaching op seismic line and set up of seismic streamer and sparker | |
| 18h05 | Switch to electrical propulsion, speed 3 knots | |
| 18h20 | Streamer and sparker in the water, start testing at 2 s | |
| 18h33 | Start of line ED14-0604 | |
| | Initially too deep for good signal | |
| 19h40 | Reached an appropriate depth for sparker | |
| | Good signal | |
| 22h22 | Acquisition unit (Delph) stopped working | |
| | Continued line as ED14-0604_2 | |
| 23h38 | Increased wind (force 4) | |

**7th day 19/06/2014**

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| 00h32 | End of line ED14-0604 | (heading: 71; average speed: 2.5 knots) |
| 00h33 | Start of line ED14-0605 | |
| 01h09 | End of line ED14-0605 | (heading: 159; average speed: 2.6 knots) |
| 01h21 | Start of line ED14-0606 | |
| 04h10 | End of line ED14-0606 | (heading: 241; average speed: 3.2 knots) |
| 04h14 | Start of line ED14-0607 | |
| 08h42 | End of line ED14-0607 | (heading: 337; average speed: 2.9 knots) |
| 08h52 | End of seismic acquisition | |
| | Switch engine to diesel propulsion | |
| | Sparker and streamer out of the water | |
| 09h33 | GAPS in the water | |
| | Navigation to vibrocore site EI-53 | |
| 09h58 | Vibrocorer launched to site EI-53 | |
| 10h15 | Vibrocorer at the seafloor | (Long: 9°41,269'W; Lat: 48°25,133'N; Depth: 420 m) |
| | Coring process started (25 min) | |
| 10h41 | Vibrocorer off the seafloor | |
| 10h51 | Vibrocorer on deck | |
| | 174 cm of core recovered | |
| | Changed batteries of the transponder | |
| | Transit to site EI-48 | |
| 11h23 | Vibrocorer launched to site EI-48 | |
| 11h50 | Vibrocorer at the seafloor | (Long: 9°41,935'W; Lat: 48°24,433'N; Depth: 359 m) |
| | Coring process started (25 min) | |
| 12h17 | Vibrocorer off the seafloor | |
| 12h22 | Vibrocorer on deck | |
| | Only 16 cm of core recovered | |
| | Site EI-48 will be repeated later (EI-48b) | |
| | Navigation to site EI-47 | |
| 12h49 | Vibrocorer launched to site EI-47 | |
| | GAPS positioning not working, decision to go without the GAPS positioning | |
| 13h00 | Vibrocorer at the seafloor | (Long: 9°42,026'W; Lat: 48°24,42'N; Depth: 359 m) |
| | MMI rebooted | |
| | GAPS position reestablished | |
| 13h26 | Vibrocorer off the seafloor | |
| 13h32 | Vibrocorer on deck | |
| 13h40 | Core barrel empty, site EI-47 could not be repeated due to technical problems | |
| 14h00 | Navigation to site EI-48b | |
| 14h08 | Vibrocorer launched to site EI-48b | |
| | Rebooted MMI | |
| 14h14 | GAPS position stable | |
| 14h28 | Vibrocorer at the seafloor | (Long: 9°41,935'W; Lat: 48°24,443'N; Depth: 358 m) |
| | Coring process started (25 min) | |
| 14h55 | Vibrocorer off the seafloor | |
| 15h02 | Vibrocorer on deck | |
| | Loading in new Sound Velocity profile from the Explorer-Dangeard Area from MESH2007 CTD data | |
| 15h10 | 29 cm of core recovered | |
| | Core catcher deformed, containing dense clay, probably reason of short cores in this area | |
| 15h21 | Navigation to site EI-46 | |
| | Problems with the winch used for the vibrocorer | |
| | Technical checkup of winch | |
| 15h32 | Vibrocorer launched for site EI-46 | |
| | GAPS positioning is working correct | |
| 15h45 | Missed target site, turning for a new approach | |
| 16h24 | Second approach missed, retrying | |
| 16h39 | Vibrocorer at the seafloor | (Long: 9°42,113'W; Lat: 48°24,422'N; Depth: 361 m) |
| | Coring process started (25 min) | |
| 17h04 | Vibrocorer off the seafloor | |

| | |
|---|---|
| 17h13 | Vibrocorer on deck |
| | 50 cm of core recovered |
| | Problems with winch persist, several tries were necessary to bring vibrocorer up |
| | Decision to stop with vibrocorer operations, remaining day on site will be used for video dropframe and seismic acquisition |
| | Switching to video dropframe operation, transit to station T22 |
| 18h25 | Video dropframe launched for dive T22 |
| 18h43 | Video dropframe at the seafloor |
| | Start of transect T22 |
| 19h14 | Video dropframe over station T22 |
| 19h20 | End of transect T22 |
| | Video dropframe off the seafloor |
| 19h36 | Video dropframe on deck |
| | Navigation to station T17 |
| | Charging video dropframe batteries |
| 20h54 | Issues with received GPS signal in the MMI software |
| | Forced GPS input, ready for video dropframe dive |
| 21h03 | Dropframe launched for dive T17 |
| 21h10 | Video dropframe at the seafloor |
| | Start of transect T17 |
| 21h33 | End of transect T17 |
| | Video dropframe off the seafloor |
| 21h41 | Video dropframe on deck |
| | Charging video dropframe batteries |
| | Navigation to station T16 |

**7th day 20/06/2014**

| | |
|---|---|
| 01h05 | Video dropframe launched for dive T16 |
| | No GAPS positioning |
| | Transponder not set correctly, only ships navigation available for dive T16 |
| 01h14 | Video dropframe at the seafloor |
| | Start transect T16 |
| 01h47 | End of transect T16 |
| | Video dropframe off the seafloor |
| 01h51 | Video dropframe on deck |
| | Charging video dropframe batteries |
| | Transit to station T13 |
| 02h39 | Video dropframe launched for dive T13 |
| | GAPS positioning is working |
| 02h47 | Video dropframe at the seafloor |
| | Start transect T13 |
| | Initially speed is too high (1 knot), at 250m from station T13 speed is lowered to 0,5 knots |
| 03h16 | End of transect T13 |
| | Video dropframe off the seafloor |
| 03h22 | Video dropframe on deck |
| | 2 hours transit to station T24 |
| 05h33 | Approach station T24 |
| 05h36 | Video dropframe launched for dive T24 |
| | GAPS positioning is working |
| 05h50 | Video dropframe at the seafloor |
| | Only 100 m from station T24 |
| | Start transect T24 |
| 06h12 | End of transect T24 |
| | Video dropframe off the Seafloor |
| 06h26 | Video dropframe on deck |
| | Switching to seismic acquisition |
| | Start transit to line ED14-0608 |
| 08h00 | Switch to electrical propulsion |

| | | |
|---|---|---|
| | Seismic streamer and sparker in the water | |
| 08h32 | Start of line ED14-0608 | |
| 08h43 | Going at higher speed for a short while (4 knots) to restart the engine, afterwards switch to 3 knots | |
| 10h54 | End of line ED14-0608 | (heading: 70; average speed: 3.2 knots) |
| | Start of line ED14-0609 | |
| 13h22 | End of line ED14-0609 | (heading: 165; average speed: 3.3 knots) |
| | Transit to video dropframe station T14 | |
| 15h31 | Video dropframe launched for dive T14 | |
| | Decreasing speed to 0,5 knots | |
| 15h40 | Video dropframe at the seafloor | |
| | Start transect T14 | |
| 15h45 | Passing over station T14 | |
| 16h01 | End of transect after 500m | |
| | Video dropframe off the seafloor | |
| 16h09 | Video dropframe on deck | |
| | Transit to station T19 | |
| 16h25 | Gaps out of the water to allow for faster transit | |
| 17h05 | Approach station T19 | |
| 17h12 | GAPS in the water | |
| 17h28 | Video dropframe launched for dive to station T19 | |
| | GAPS positioning is working | |
| 17h38 | Video dropframe at the seafloor | |
| | Start transect T19 | |
| 18:02 | End of transect T19 | |
| | Video dropframe off the seafloor | |
| 18h14 | Video dropframe on deck | |
| 18h22 | GAPS on board | |
| | Start transit to Zeebrugge | |

**8th day 21/06/2014**

Transit to Zeebrugge

**9th day 22/06/2014**

Transit to Zeebrugge

**10th day 23/06/2014**

| | |
|---|---|
| 07h00 | Arrival at Zeebrugge |
| 09h00-13h00 | Demobilization of video dropframe, cores and seismic equipment |
| | Arrival land crane and vibrocorer demobilization |
| | Disembarkation of scientific crew |
| | Open top container for storing vibrocorer did not arrive, this will be done the next day |

**24/06/2014**

| | |
|---|---|
| 16h00 | Arrival of open top container and land crane to allow shipping of vibrocorer |

- End of campaign 2014/16 -

## 5. TRACK PLOT

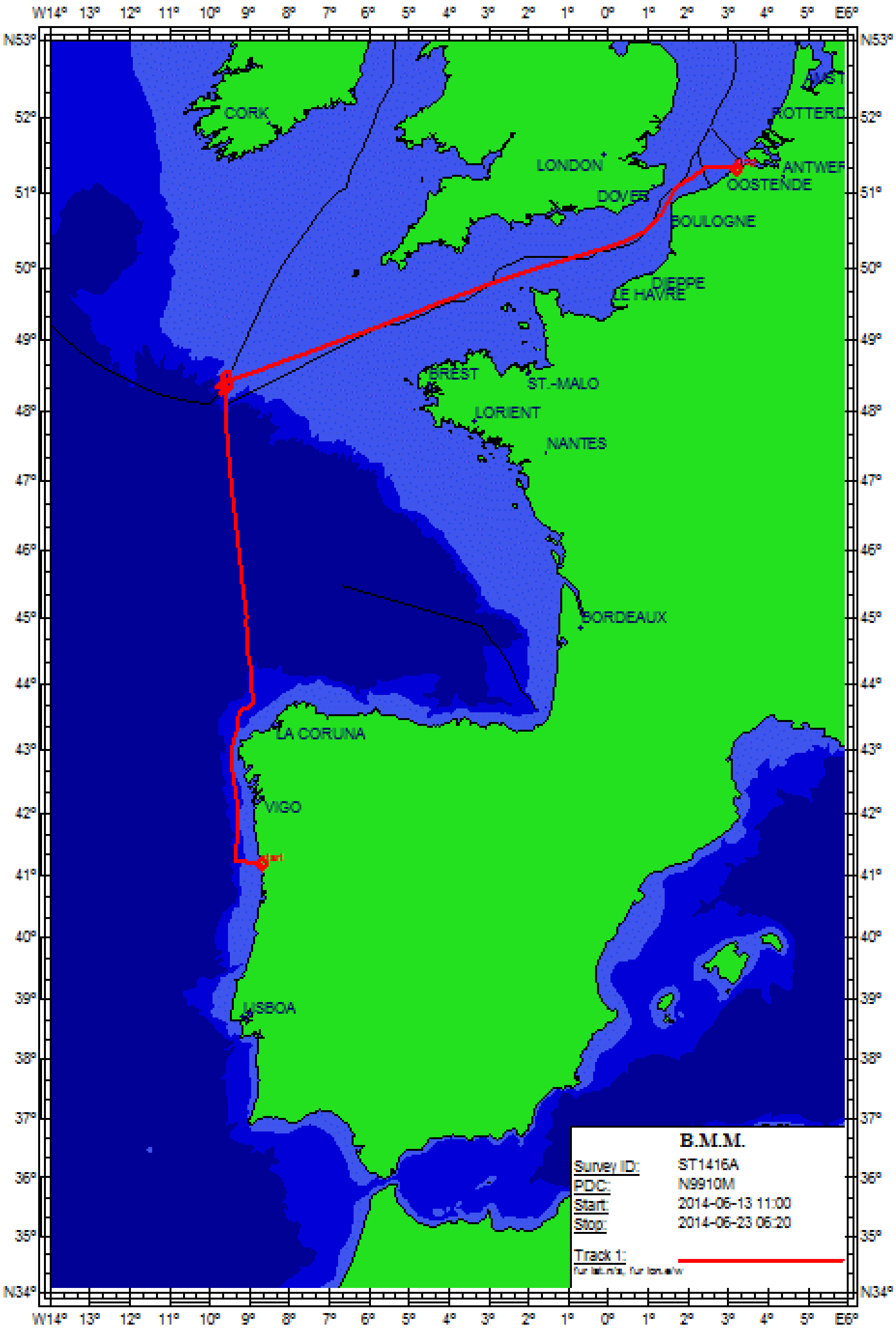


*Figure 1: MUMM official Track plot of campaign 2014/16*

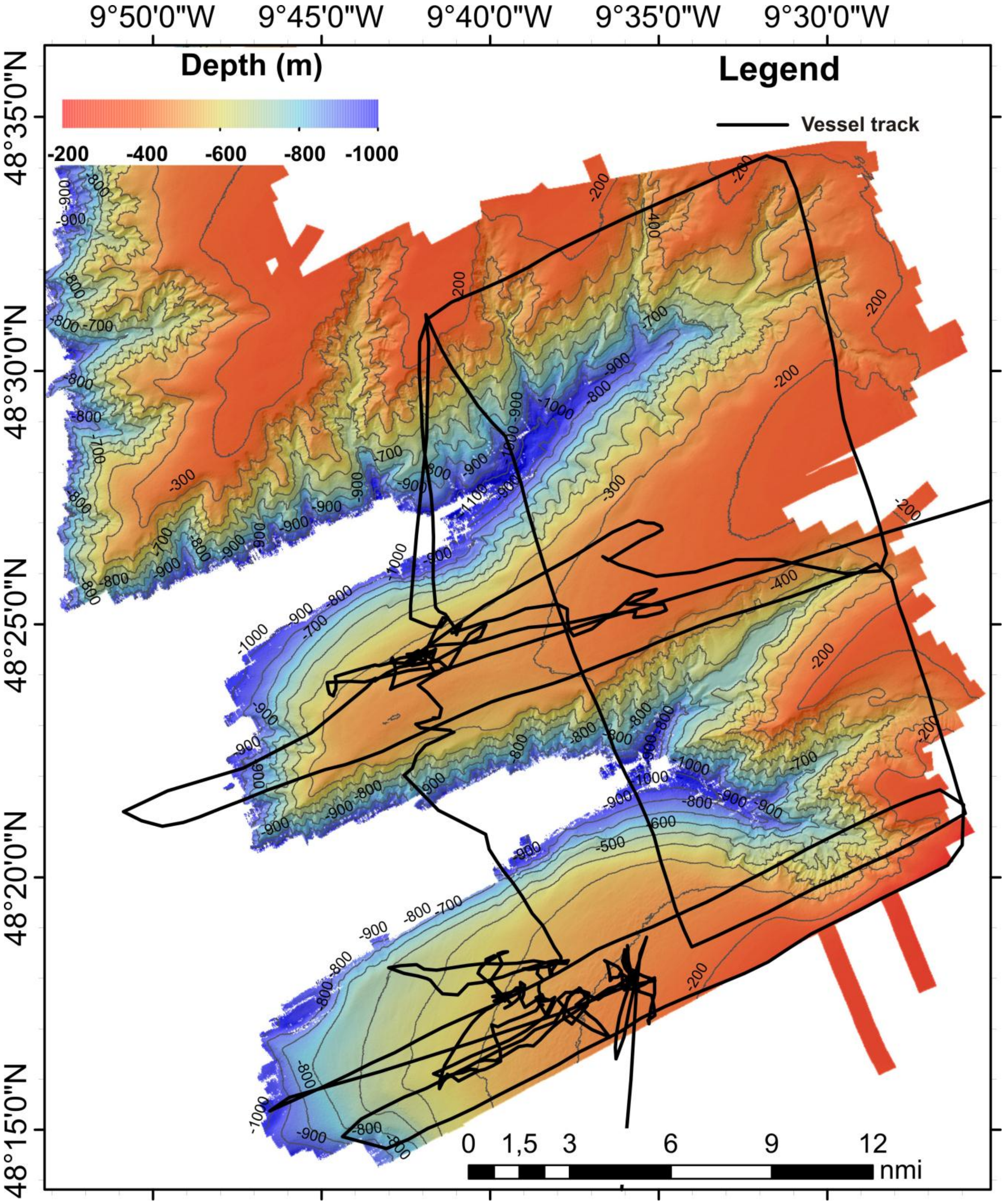


***Figure 2: Detailed track plot of campaign 2014/16 in the Explorer and Dangeard Canyon study areas(MESH 2007 bathymetry map). The track navigation data was provided by ODAS***

## 6. MEASUREMENTS AND SAMPLING

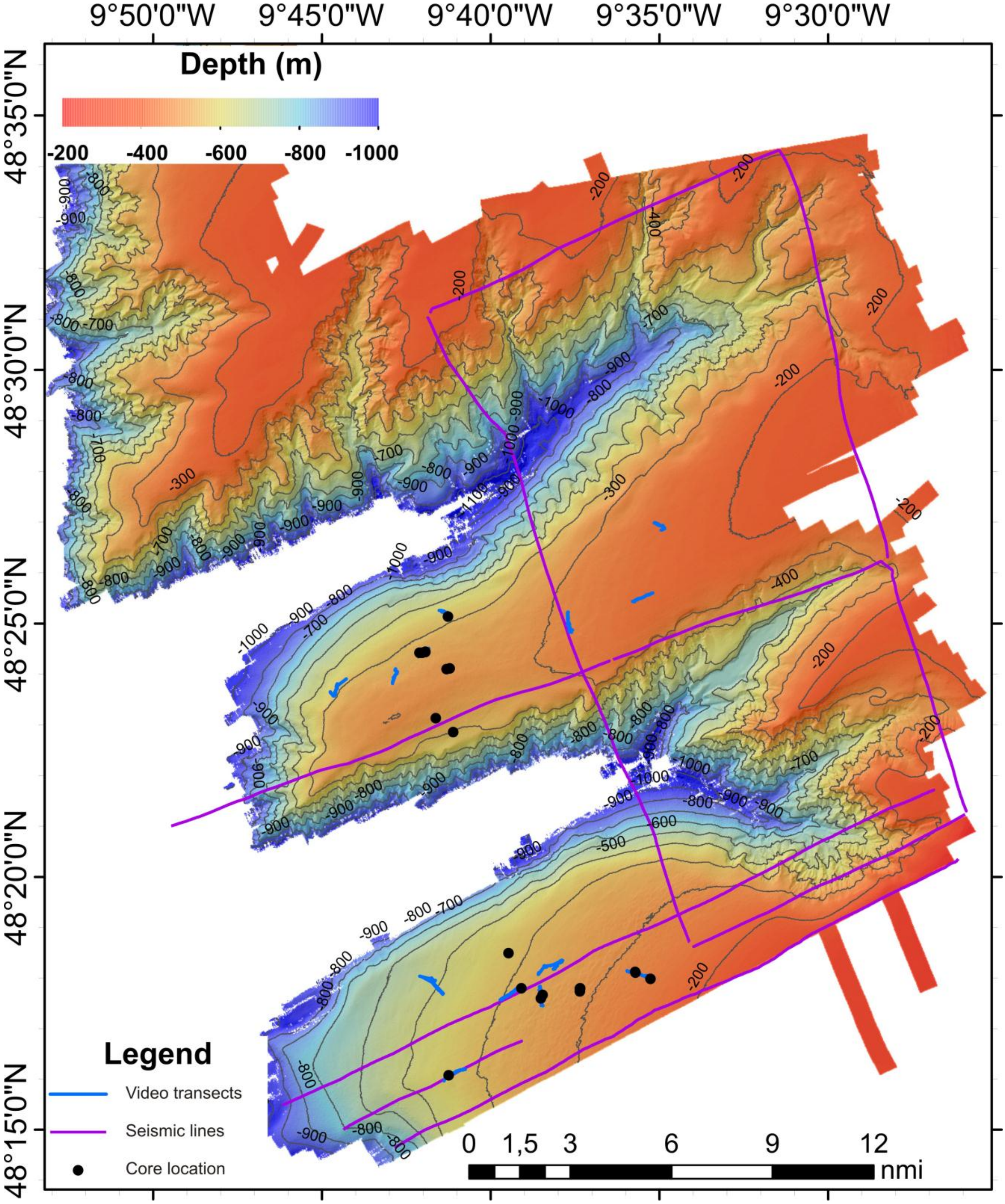


*Figure 3: Overview of the locations of the cores (black dots) video dropframe transects (blue lines) and seismic lines (purple lines) acquired during the campaign 2014/16 in the Explorer and Dangeard Canyon study areas (MESH 2007 bathymetry map).*

## 6.1. Cores

The British Geological Survey (BGS) 3m battery operated vibrocorer was used to acquire a total of 19 vibrocores at 20 sites (Table 1; Figure 3). The position of the vibrocorer sites were determined using a GAPS USBL system. One site had no recovery probably due to hard sea bed. Eleven vibrocores (+48-010/201VE-211VE) were acquired on Dangeard Interfluve (Figure 4), and nine vibrocores (+48-010/212VE-220VE) were acquired on Explorer Interfluve (Figure 5). In total 34.96 metres of cores were collected. The cores were labelled according to the BGS Core Labelling and Core Curation Procedure (See Appendix I). The cores were cut into 1 m sections but not opened on board the vessel. The core sections and any bagged core catcher samples were placed in the cold store for the duration of the campaign. For every core a vibrocorer penetration graph was recorded (See Appendix II).

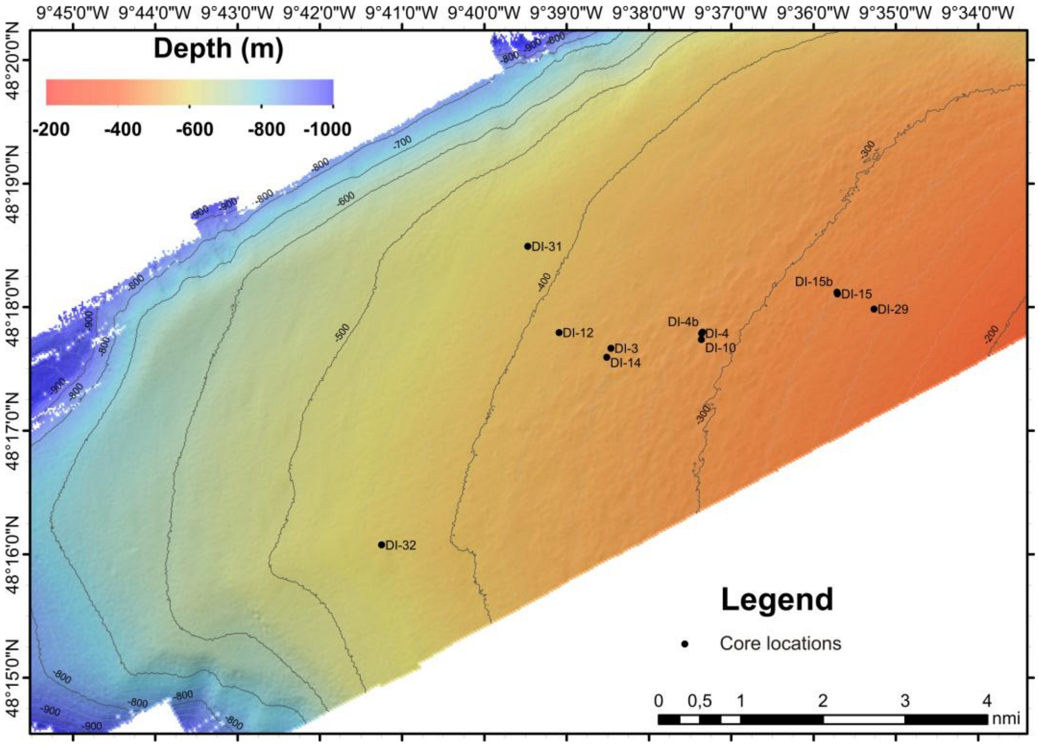


*Figure 4: Visited vibrocorer sites on the Dangeard Interfluve (MESH 2007 bathymetry map)*

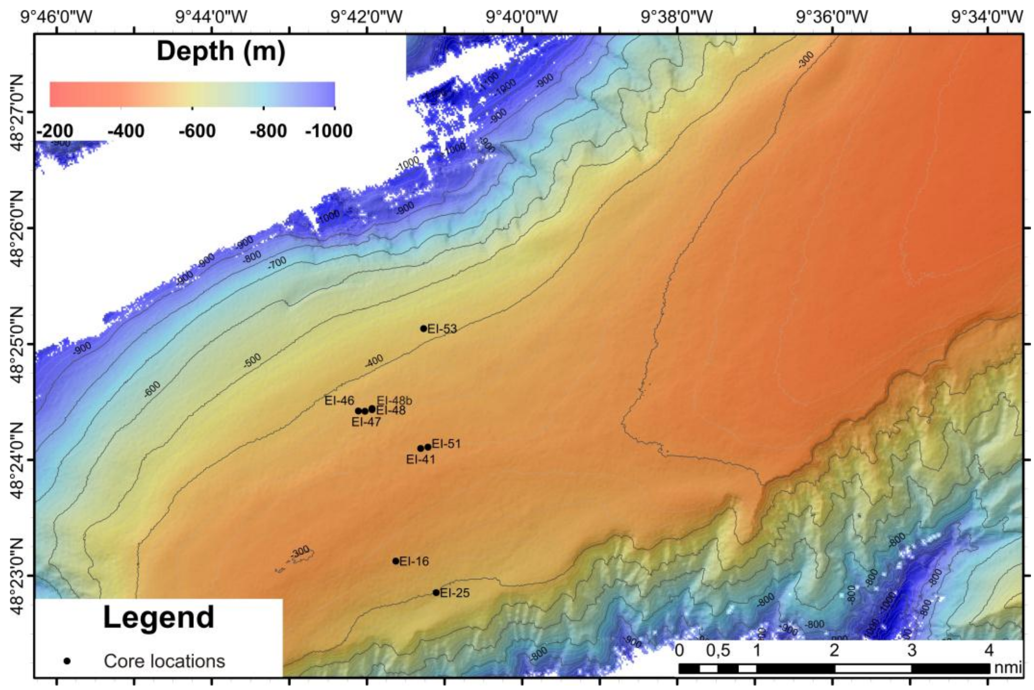


*Figure 5: Visited vibrocorer sites on the Explorer Interfluve (MESH 2007 bathymetry map).*

***Table 1: List of visited vibrocorer sites and the associated core label, position, depth, recovered core length, target feature, date and interfluve.***

| Old Name | New Name | Longitude | Latitude | Depth (m) | Recovery | Target | Date | Location |
|---|---|---|---|---|---|---|---|---|
| DI-15 | +48-010/201VE | 9°35,710'W | 48°18,106'N | 275 | 214 cm | On mini-mound. Coincident with transect (T12). | 15/06 | Dangeard Interfluve |
| DI-29 | +48-010/202VE | 9°35,266'W | 48°17,983'N | 262 | 218 cm | Normal sea bed. Coincident with transect (T15). | 15/06 | Dangeard Interfluve |
| DI-4 | +48-010/203VE | 9°37,362'W | 48°17,788'N | 316 | 38 cm | On mini-mound. | 16/06 | Dangeard Interfluve |
| DI-4b | +48-010/204VE | 9°37,350'W | 48°17,797'N | 316 | 103 cm | On mini-mound. | 16/06 | Dangeard Interfluve |
| DI-10 | +48-010/205VE | 9°37,363'W | 48°17,737'N | 315 | 131 cm | Off mini-mound. | 16/06 | Dangeard Interfluve |
| DI-15b | +48-010/206VE | 9°35,717'W | 48°18,121'N | 271 | 229 cm | On mini-mound. Coincident with transect (T12). | 16/06 | Dangeard Interfluve |
| DI-31 | +48-010/207VE | 9°39,472'W | 48°18,491'N | 426 | 288 cm | Normal sea bed. | 17/06 | Dangeard Interfluve |
| DI-12 | +48-010/208VE | 9°39,094'W | 48°17,794'N | 373 | 303 cm | On mini-mound. Coincident with transect (T18). | 17/06 | Dangeard Interfluve |
| DI-14 | +48-010/209VE | 9°38,515'W | 48°17,594'N | 354 | 303 cm | Off mini-mound. Coincident with transect C-3-7 | 17/06 | Dangeard Interfluve |
| DI-3 | +48-010/210VE | 9°38,465'W | 48°17,666'N | 347 | 307 cm | On mound. Coincident with transect C-3-7 | 17/06 | Dangeard Interfluve |
| DI-32 | +48-010/211VE | 9°41,249'W | 48°16,074'N | 434 | 287 cm | On mini-mound. Coincident with transect (T21). | 17/06 | Dangeard Interfluve |
| EI-25 | +48-010/212VE | 9°41,109'W | 48°22,854'N | 399 | 181 cm | On mini-mound/ridge like feature. | 18/06 | Explorer Interfluve |
| EI-16 | +48-010/213VE | 9°41,630'W | 48°23,127'N | 339 | 109 cm | On mini-mound. | 18/06 | Explorer Interfluve |
| EI-51 | +48-010/214VE | 9°41,214'W | 48°24,111'N | 325 | 281 cm | Normal sea bed. | 18/06 | Explorer Interfluve |
| EI-41 | +48-010/215VE | 9°41,308'W | 48°24,099'N | 329 | 223 cm | On mini-mound. | 18/06 | Explorer Interfluve |
| EI-53 | +48-010/216VE | 9°41,269'W | 48°25,133'N | 420 | 174 cm | Normal sea bed. Coincident with transect (T24). | 19/06 | Explorer Interfluve |
| EI-48 | +48-010/217VE | 9°41,935'W | 48°24,433'N | 359 | 16 cm | On mini-mound. Coincident with transect (T17). | 19/06 | Explorer Interfluve |
| EI-47 | +48-010/218VE | 9°42,026'W | 48°24,420'N | 359 | None | Off mini-mound. Coincident with transect (T17). | 19/06 | Explorer Interfluve |
| EI-48b | +48-010/219VE | 9°41,935'W | 48°24,443'N | 358 | 29 cm | On mini-mound. Coincident with transect (T17). | 19/06 | Explorer Interfluve |
| EI-46 | +48-010/220VE | 9°42,113'W | 48°24,422'N | 361 | 62 cm | On mini-mound. Coincident with transect (T17). | 19/06 | Explorer Interfluve |

## 6.2. Video data

Video data was collected using the DS1 Towed Video and Data Dropframe System by MrROV.com in cooperation with Plymouth University Marine Institute. This system was deployed using the CTD coax cable of the vessel. It is equipped with a SD camera of which the footage is transmitted through the coax cable to allow for navigation of the video dropframe, an HD camera, light sources, a laser scale and a CTD. However, no temperature data was collected as the temperature sensor of the CTD was not operational. The position of the video frame was recorded using a GAPS USBL system. The direction of the transects was based on the most convenient to keep course at a vessel speed of 0.5 knots (the acquisition speed). In total 14 video transects were made over 14 different sites (Table 2) of which there are 7 sites on the Dangeard Interfluve and 7 sites on the Explorer Interfluve (Figure 6 & 7). During transect T20 no HD footage was recorded due to technical problems, the SD footage was however recorded and the site was repeated during transect T20R. For transect T16 no GAPS positioning data was acquired. The transects position was based off the vessels GPS position but includes a certain tow offset.

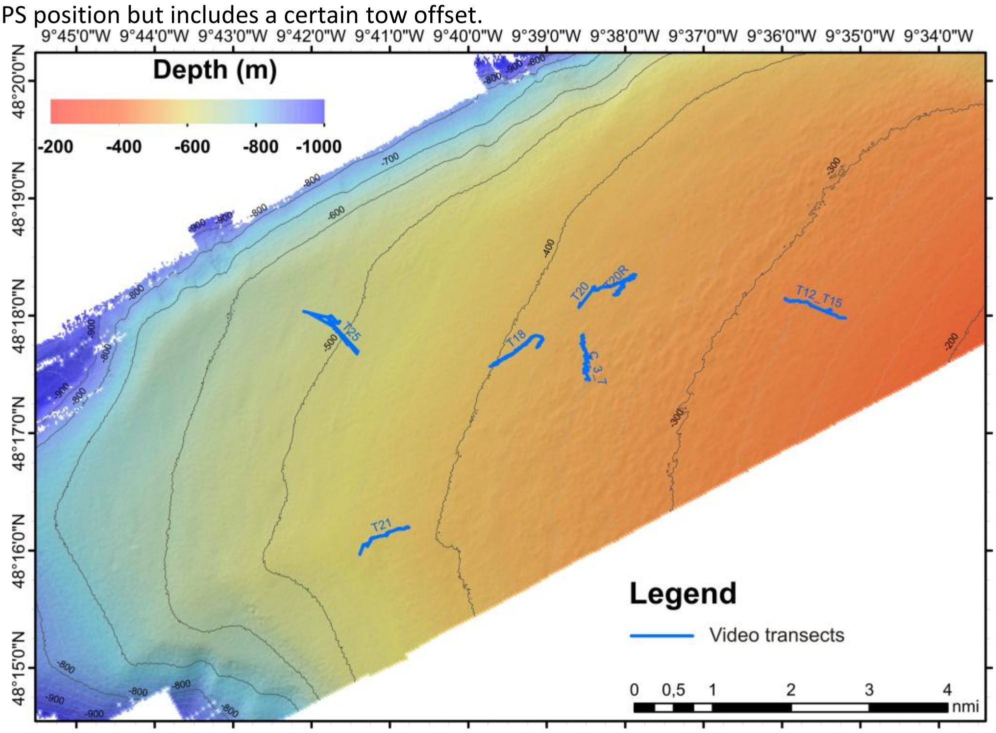


*Figure 6: Recorded video transects on the Dangeard Interfluve (MESH 2007 bathymetry map)*

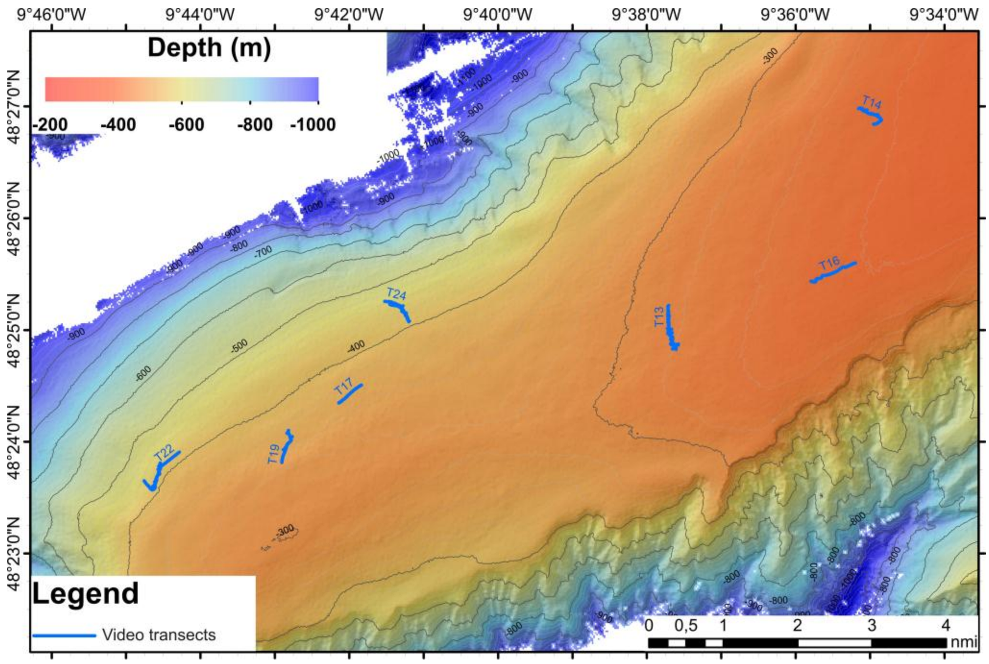


*Figure 7: Recorded video transects on the Explorer Interfluve (MESH 2007 bathymetry map)*

***Table 2: List of acquired video transects and associated start and end points, depth range, target and additional remarks..***

| | Start of transect | | End of transect | | | | |
|---|---|---|---|---|---|---|---|
| **Transect name** | **Longitude** | **Latitude** | **Longitude** | **Latitude** | **Depth range (m)** | **Target** | **Remarks** |
| T12T15 | 9°35,959'W | 48°18,148'N | 9°35,191'W | 48°17,981'N | 200-300 | minimound and normal seabed | Station T12 and T15 were visited in one dive. Coinciding with core sites DI-15, DI-15b and DI-29. |
| T21 | 9°40,756'W | 48°16,195'N | 9°41,385'W | 48°15,967'N | 400-500 | minimound | Coinciding with core sites DI-32. |
| T18 | 9°39,723'W | 48°17,568'N | 9°39,095'W | 48°17,743'N | 300-400 | minimound | Coinciding with core sites DI-12. |
| C_3_7 | 9°38,501'W | 48°17,46'N | 9°38,549'W | 48°17,828'N | 300-400 | minimound and normal seabed | Repeat of video transect of 2007 MESH campaign. Coinciding with core sites DI-3 and DI-14. |
| T20 | 9°38,572'W | 48°18,108'N | 9°37,884'W | 48°18,322'N | 300-400 | normal seabed | No HD footage recorded due to technical problems. |
| T25 | 9°41,902'W | 48°17,995'N | 9°41,597'W | 48°17,811'N | 500-600 | normal seabed | Missed original target due to drift (no minimound target). |
| T20R | 9°38,144'W | 48°18,177'N | 9°37,897'W | 48°18,351'N | 300-400 | normal seabed | Repeat of transect T20. |
| T22 | 9°44,757'W | 48°23,651'N | 9°44,54'W | 48°23,81'N | 400-500 | minimound | |
| T17 | 9°42,139'W | 48°24,348'N | 9°41,836'W | 48°24,508'N | 300-400 | minimound | Coinciding with core sites EI-46, EI-47, EI-48 and EI-48b. |
| T16 | 9°35,794'W | 48°25,437'N | 9°35,198'W | 48°25,6'N | 200-300 | pockmark | No GAPS navigation due to technical problems. Only ships navigation. |
| T13 | 9°37,608'W | 48°24,828'N | 9°37,707'W | 48°25,221'N | 200-300 | minimound | |
| T24 | 9°41,2'W | 48°25,074'N | 9°41,463'W | 48°25,255'N | 400-500 | normal seabed | Coinciding with core sites EI-53. |
| T14 | 9°34,952'W | 48°26,843'N | 9°35,142'W | 48°26,986'N | 200-300 | normal seabed | |
| T19 | 9°42,815'W | 48°24,102'N | 9°42,907'W | 48°23,815'N | 300-400 | normal seabed | |

## 6.3. Seismic data

The acquisition of the single channel sparker seismic data was done as a backup activity when problems with the engine or hydraulics did not allow for vibrocorer and video dropframe deployment. In total 9 seismic lines were acquired (Tabel 3; Figure 8). During acquisition the vessel was on electrical propulsion and keeping a speed of approx. 3 knots. The used energy was set at 600 J, with a shooting rate of 2 s. The source-to-vessel offset of streamer and sparker was about 25 m, which has been accounted for in the acquisition. The data was recorded digitally at a 10 kHz sampling rate and 1,9 s record length

***Table 3: Coordinates of the acquired seismic lines during campaign 2014/16***

| Line number | Start of line | | End of line | | Heading | Average speed (knots) |
|---|---|---|---|---|---|---|
| | Longitude | Latitude | Longitude | Latitude | | |
| ED14-0601 | 9°46,159'W | 48°15,487'N | 9°26,858'W | 48°21,714'N | 66 | 2.9 |
| ED14-0602 | 9°26,15'W | 48°20,35'N | 9°42,815'W | 48°14,652'N | 242 | 2.9 |
| ED14-0603 | 9°44,358'W | 48°15,003'N | 9°39,074'W | 48°16,758'N | 68 | 3.1 |
| ED14-0604 | 9°49,461'W | 48°21,005'N | 9°36,469'W | 48°24,263'N | 71 | 2.5 |
| ED14-0604_1 | 9°36,361'W | 48°24,291'N | 9°28,246'W | 48°26,126'N | 71 | 2.5 |
| ED14-0605 | 9°28,231'W | 48°26,119'N | 9°25,901'W | 48°21,287'N | 159 | 2.6 |
| ED14-0606 | 9°25,951'W | 48°21,229'N | 9°33,996'W | 48°18,62'N | 241 | 3.2 |
| ED14-0607 | 9°34,116'W | 48°18,716'N | 9°41,865'W | 48°31,032'N | 337 | 2.9 |
| ED14-0608 | 9°41,795'W | 48°31,118'N | 9°31,422'W | 48°34,293'N | 70 | 3.2 |
| ED14-0609 | 9°31,415'W | 48°34,285'N | 9°28,235'W | 48°26,303'N | 165 | 3.3 |

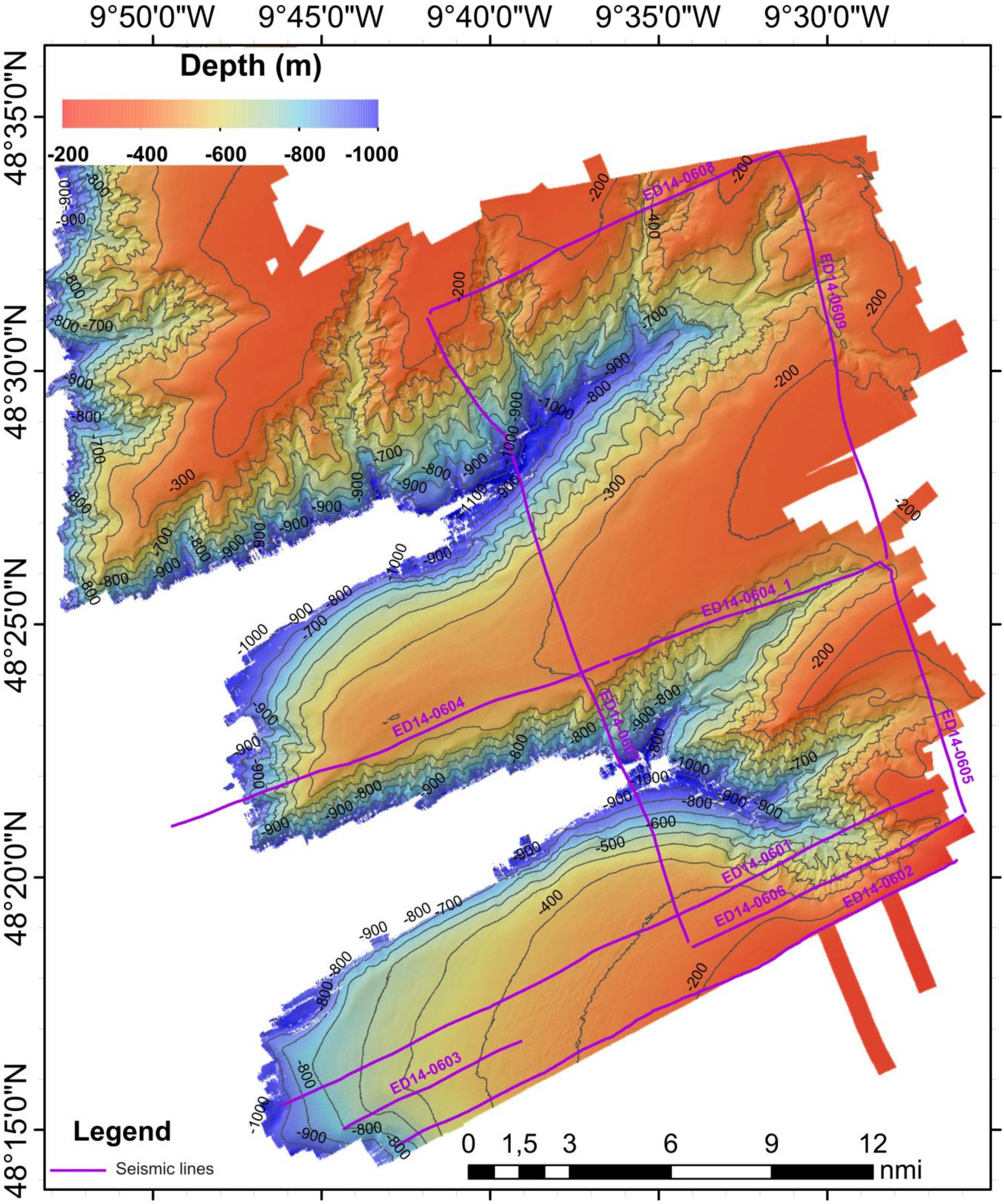


*Figure 8: Seismic lines acquired in the Explorer and Dangeard Canyon study area (MESH 2007 bathymetry map).*

## 7. REMARKS

- Weather conditions did not allow vibrocorer deployment in zone 1 (Ferrol Canyon area) and thus the campaign was shifted entirely to zone 2 (Explorer and Dangeard Canyons area) where weather conditions were favorable. Zone 1 will be revisited on a follow up Belgica campaign in 2015.

- Technical problems with the vessels hydraulics did occasionally not allow vibrocorer and video dropframe deployment. Single channel seismics were done as a backup option.

## 8. DATA STORAGE

- Stored data: Cores
  Video data: The HD and SD footage was stored as MP4 files
  Seismic data: The seismic lines were recorded directly in SegY-Motorola format with associated navigation files (these are text files containing shot point, longitude, latitude, date and time)

- Storage:
  The cores will be stored at VLIZ in Ostend, Belgium.
  The raw video data will be stored at Plymouth University, Plymouth, UK.
  The seismic data will be stored at the Renard Centre for Marine Geology (RCMG) of Ghent University, Ghent, Belgium.

- The British Geological Survey (BGS) has been provided with a copy of the seismic data.
  Renard Centre for Marine Geology (RCMG)has been provided with a copy of the raw video data.

- Contact persons:

  Cores and seismic data:
  Prof. Dr. David Van Rooij
  Renard Centre of Marine Geology
  Dept. of Geology and Soil Science
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  Krijgslaan 281 S8
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## Appendix I: The British Geological Survey Core Labelling and Core Curation Procedure

**Purpose**

To formalise and standardise the method by which marine cores collected by the British Geological Survey (BGS) are labelled.

**Definitions**

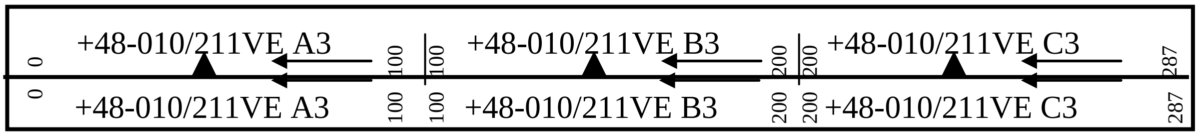
**BGS Sample Number** The unique identifier each sample is labelled with. This comprises the degree square in which it is collected, a sequentially increasing number and the equipment-type code.

**Equipment Type Code** A two letter abbreviation identifying the equipment used to collect the sample.

**Core Section Identifier** The label assigned to core sections; the top-most, or sea-bed, being 'A' followed by 'B' and so on. In addition the number of sections within a core should also be included to each letter label thus, A6, B6…..F6 or A2 and B2 etc.

**Procedure For Initial Core Labelling**

1. Lay the core length on the bench (for the remainder of this procedure, the base will be to the right).
2. Cut off any spare liner at the top of the core and cap with a yellow cap labelled 'A'. Put a black cap on the base, having put any shoe sample into a bag or bottle (labelled with the relevant sample number and 'core catcher' or 'shoe sample').
3. Clean the core thoroughly and dry the top surface.
4. Draw an orientation line along the length of the core.
5. Measuring from the **top**, mark off 1-metre sections. If there is a length of core at the base that measures more than 1 m, but less than 0.4 m, cut it in half. Do not leave a piece smaller than 0.4m as these are difficult to curate. Note that for this cruise, the core sections more than 1 m but less than 1.4 m were left as a single piece.
6. Before cutting, each section must be labelled with the BGS Sample Number and Core Section Identifier: e.g. +48-010/211 VE A2.
   A safeguard symbol (an arrow indicating the top) is also included on **both sides** of the orientation line.
7. A tick should be marked at the midpoint of each core section on one side of the orientation line (and ensure that the same half of the core is photographed should this prove desirable, e.g. with dipping beds ), thus:




8. Remember to allow room for caps, tape and mark at the ends of each section.
9. The core is now cut into sections along the lines marked.

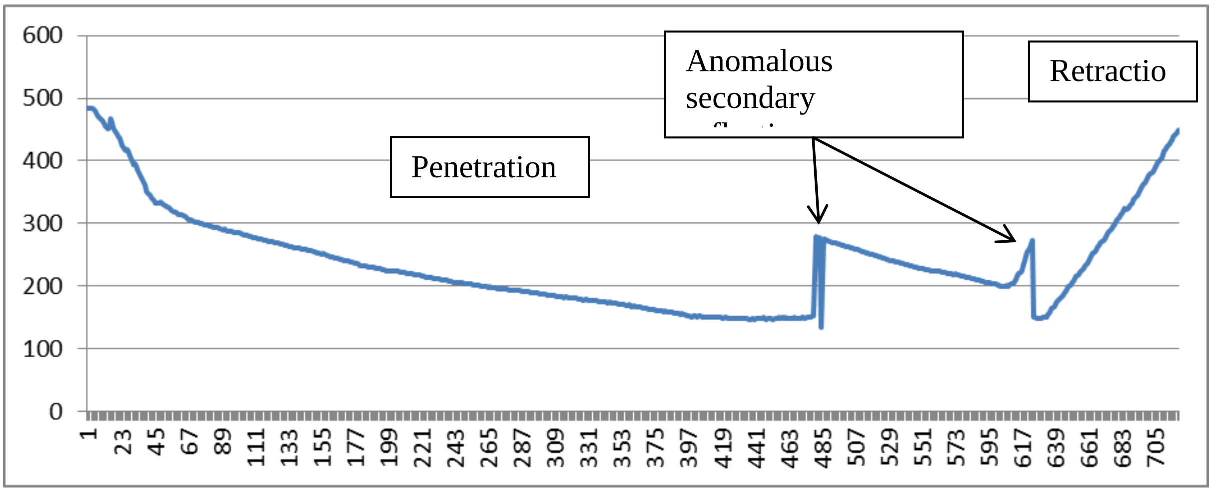
**Procedure For Cutting Core**

1. Yellow caps marked with station number and core section identifier, A2, B2 etc are placed at the tops of the sections, black caps at the base.
2. The caps are now taped onto the liner using 35mm black tape, which must be wound very tightly.

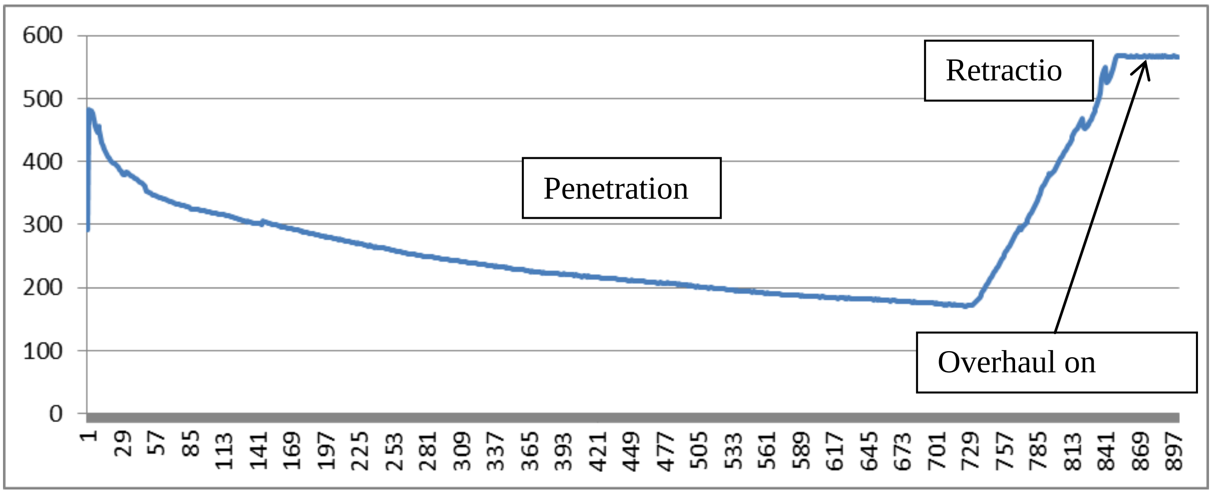
## Appendix II: The British Geological Survey Core Labelling and Core Curation Procedure

Note that the 'time' is on the x-axis is seconds of operational period on the sea bed. The values on the y-axis represent power output and are representative of 'penetration' which ranges from 0 to 300 cm.

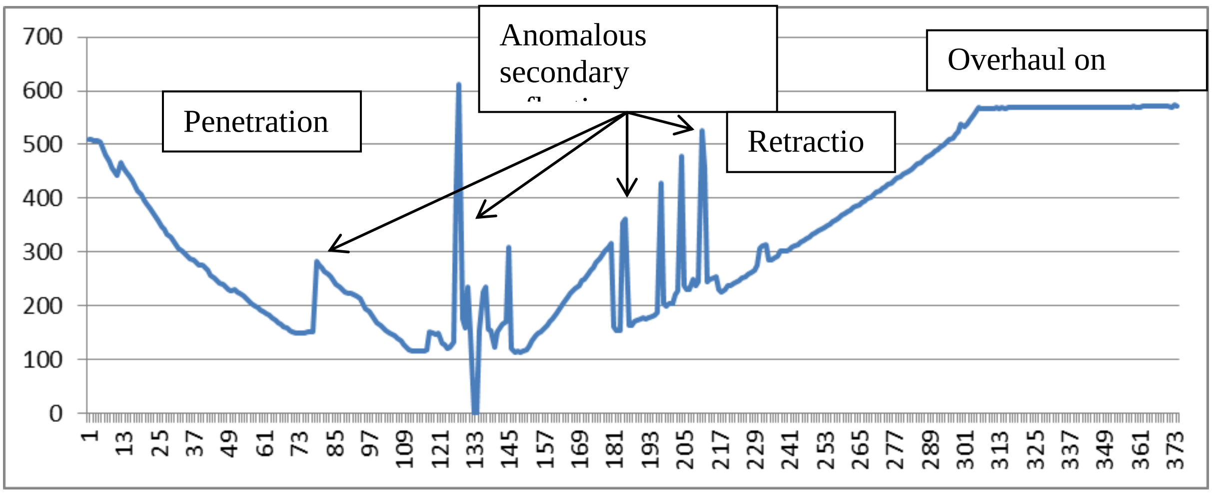
**+48-010/201VE (DI 15; 214 cm recovery)**



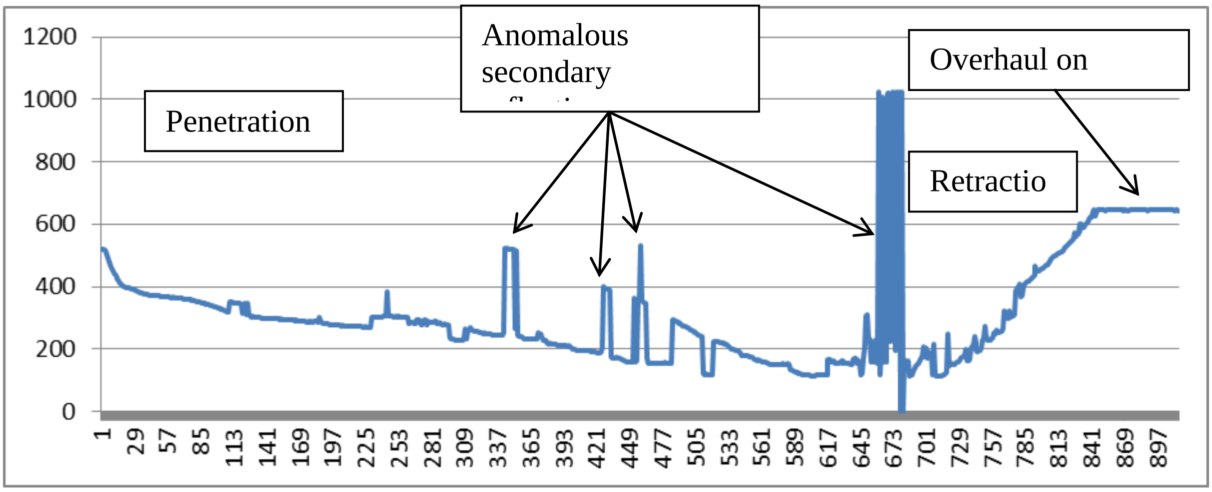

**+48-010/202VE (DI-29; 218 cm recovery)**



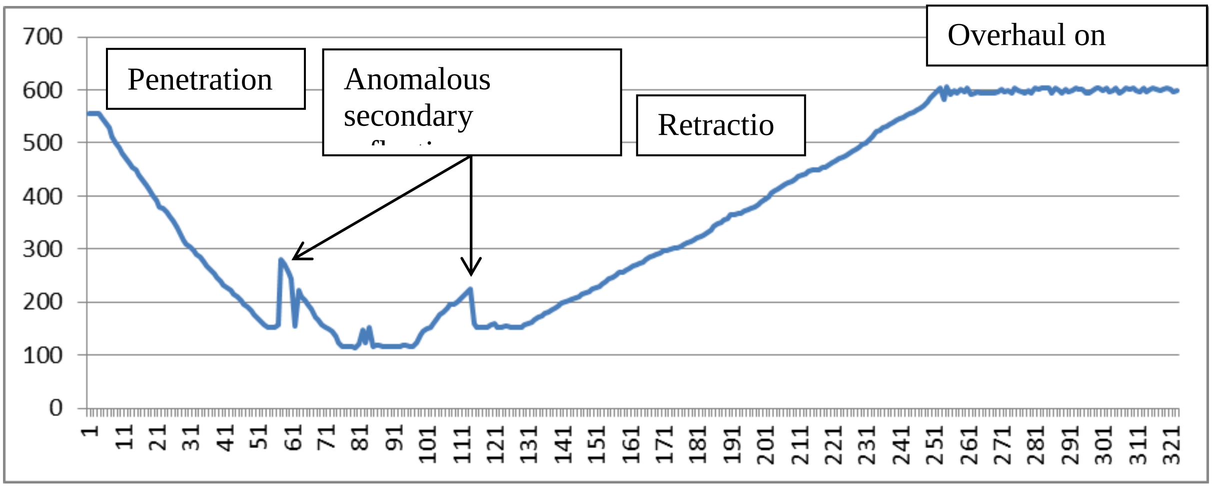
**+48-010/203VE (DI-4; 38 cm recovery)**



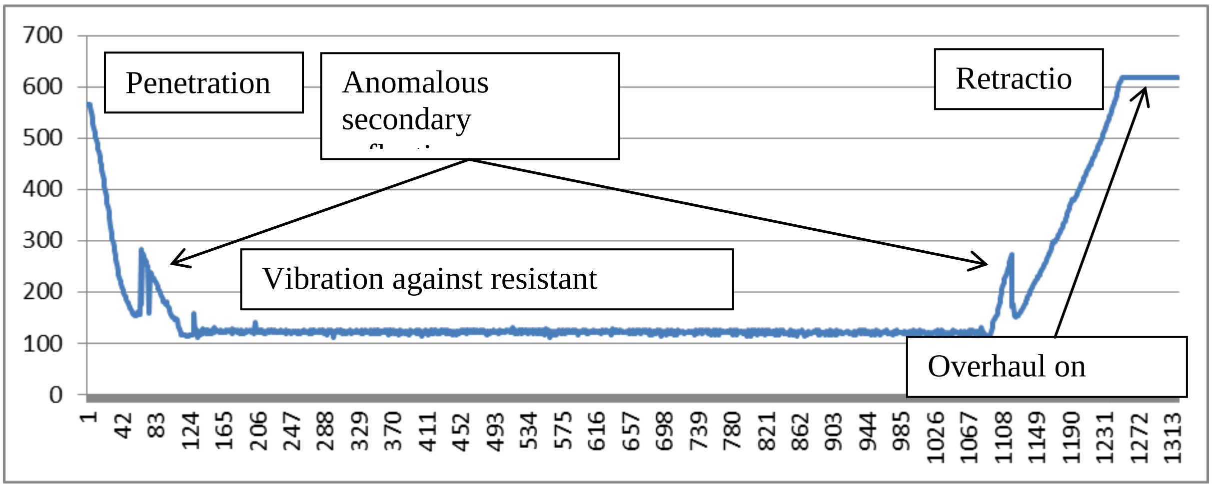

**+48-010/204VE (DI-4b; 103 cm recovery)**



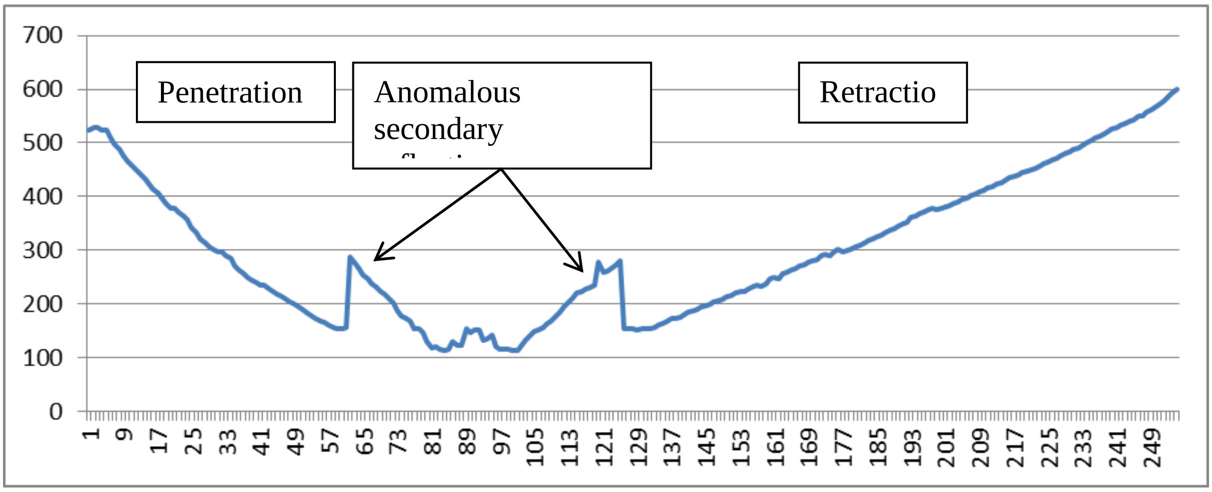

**+48-010/205VE (DI-10; 131 cm recovery)**



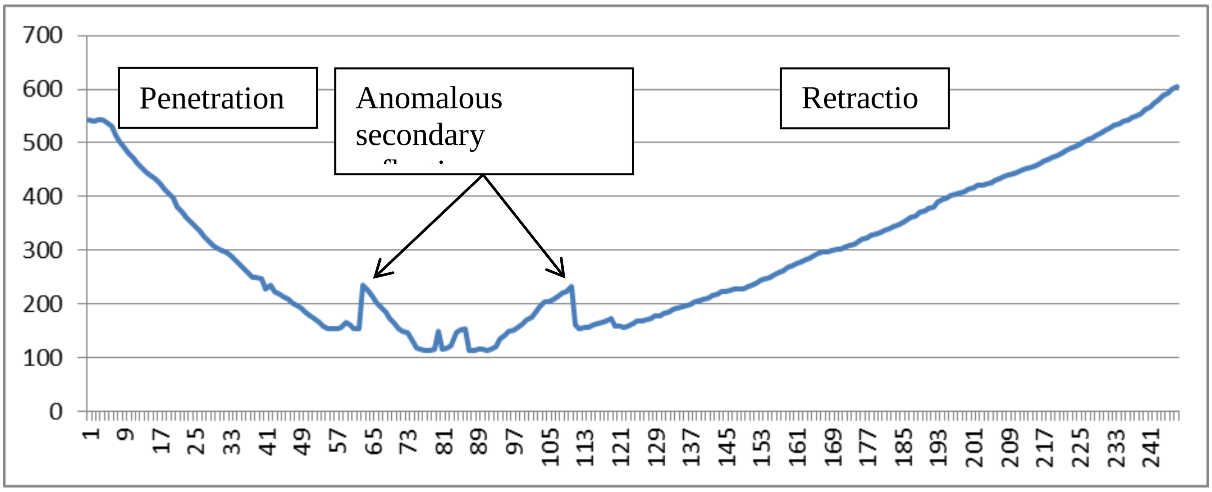
**+48-010/206VE (DI-15b; 229 cm recovery)**



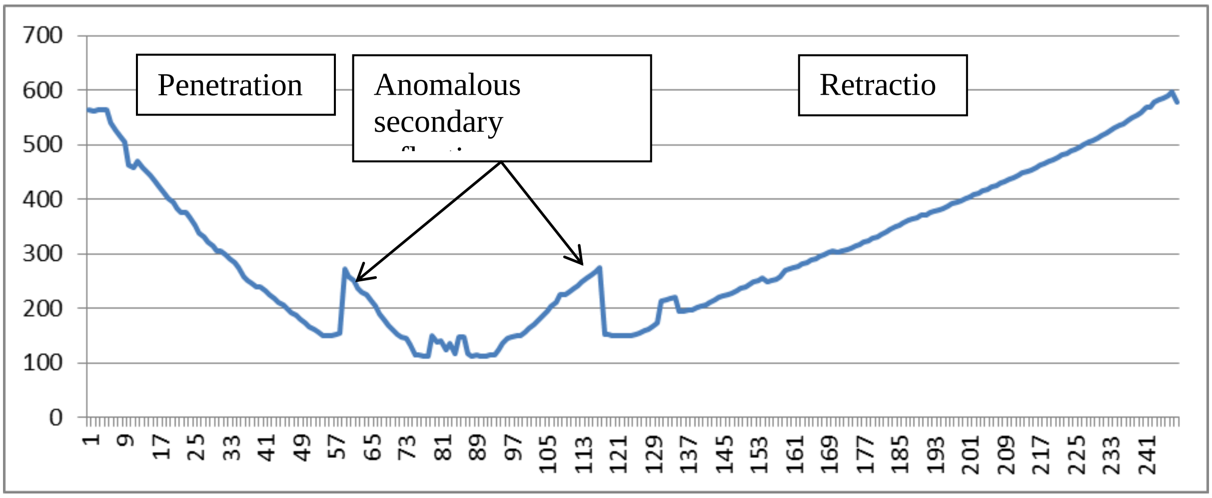

**+48-010/207VE (DI-31; 288 cm recovery)**



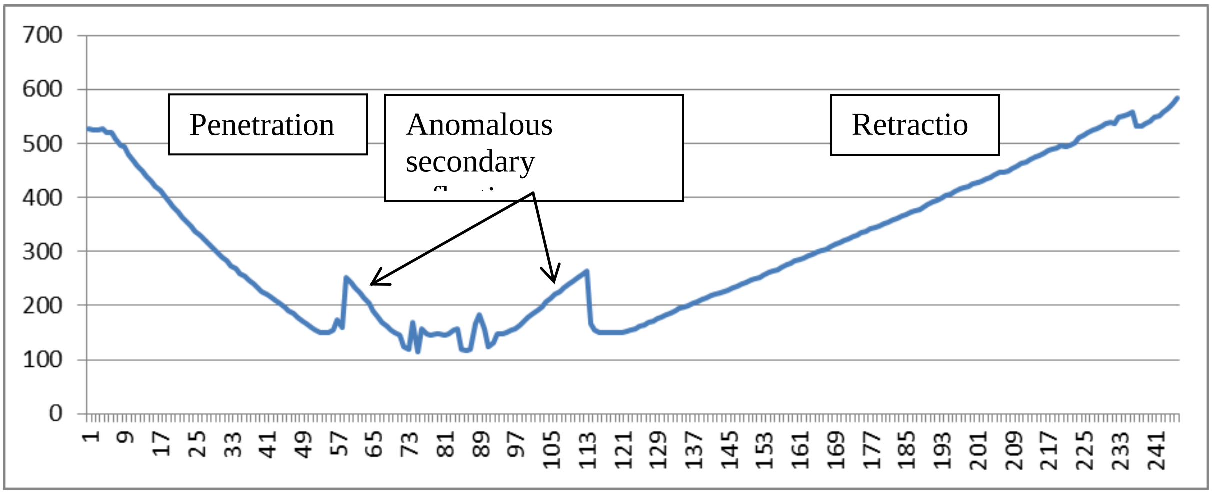

**+48-010/208VE (DI-12; 303 cm recovery)**



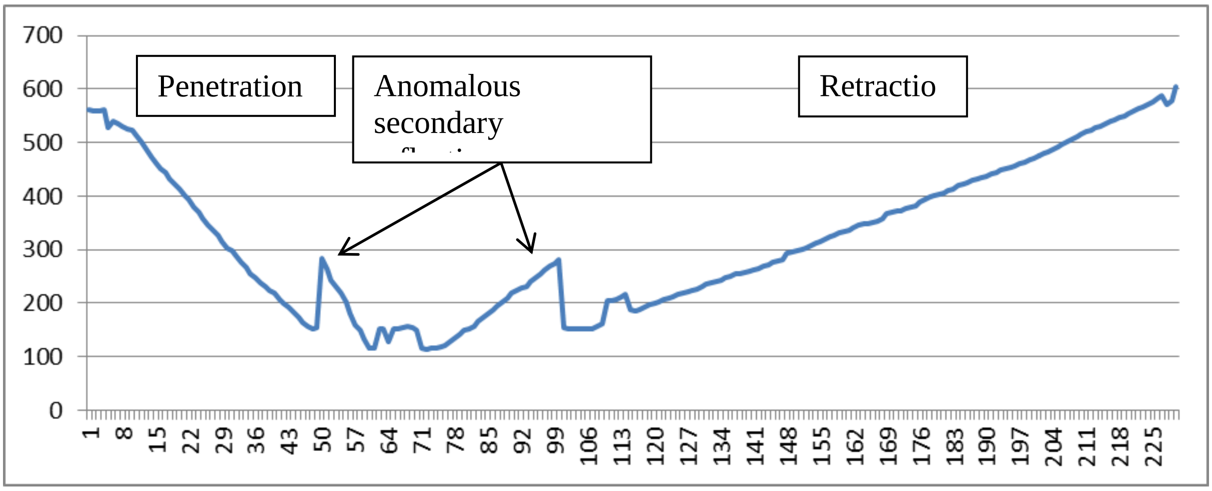
**+48-010/209VE (DI-14; 303 cm recovery)**



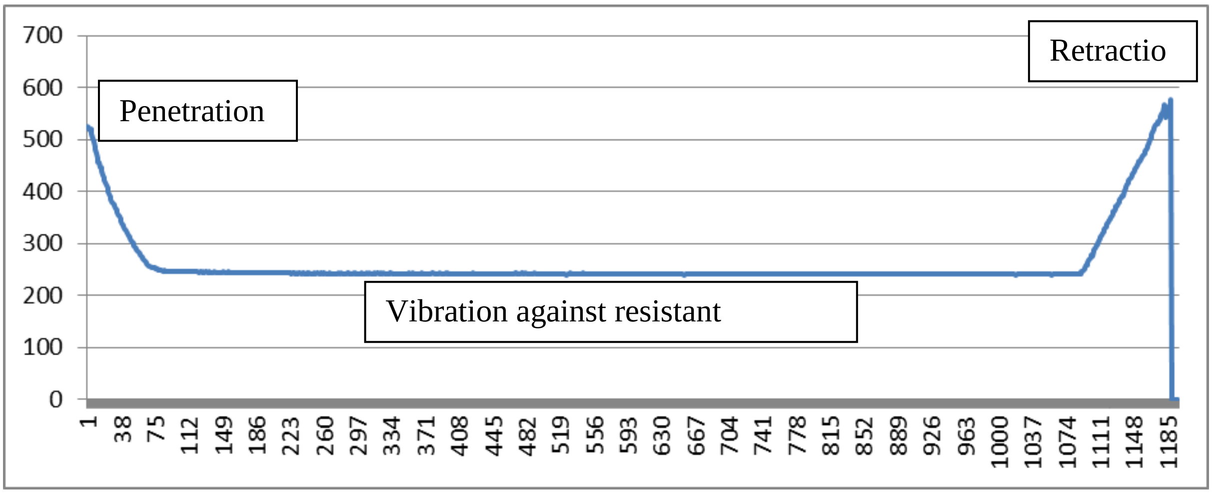

**+48-010/210VE (DI-3; 307 cm recovery)**



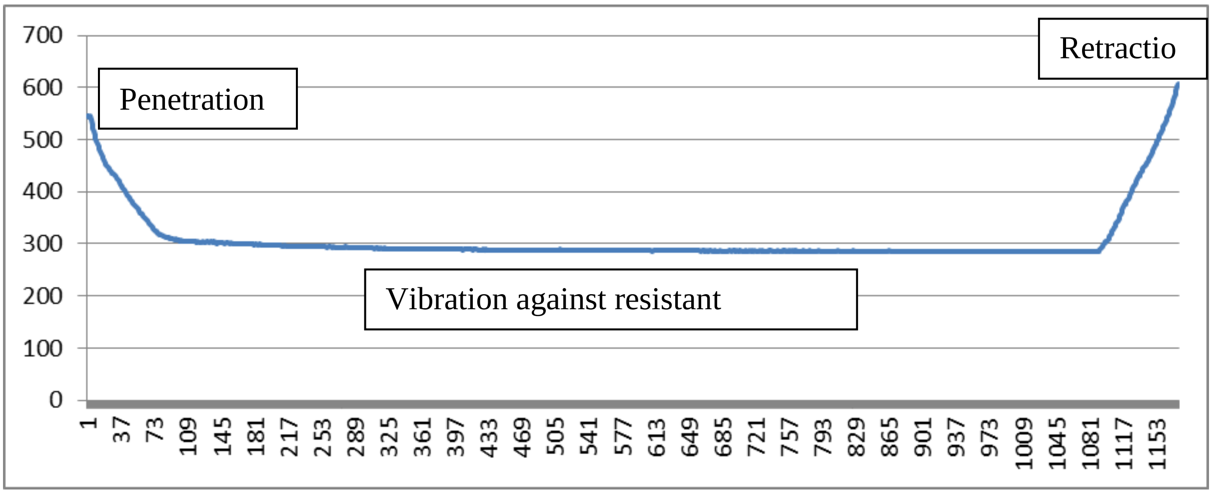

**+48-010/211VE (DI-32; 287 cm recovery)**



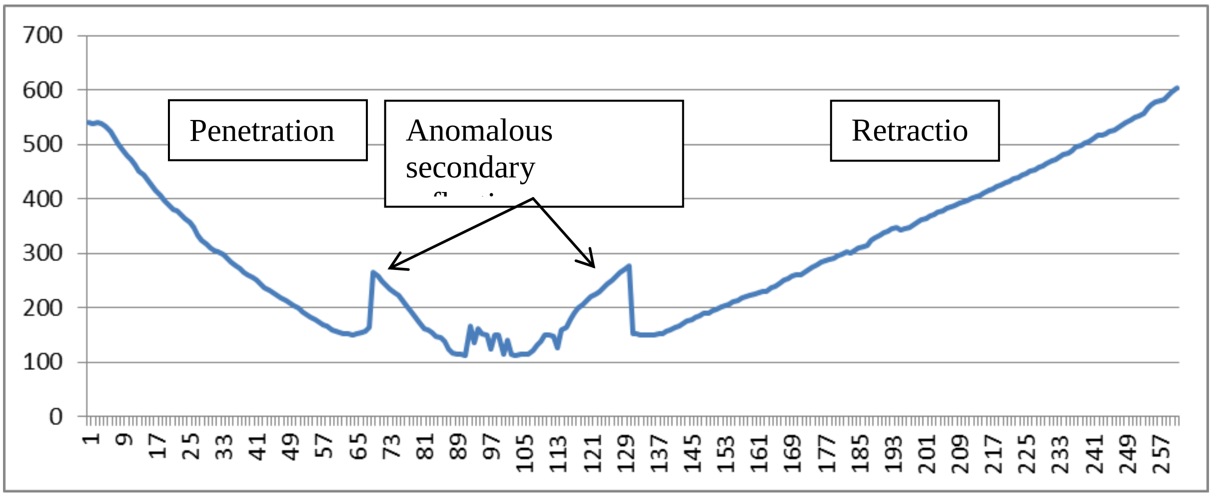
**+48-010/212VE (EI-25; 181 cm recovery)**



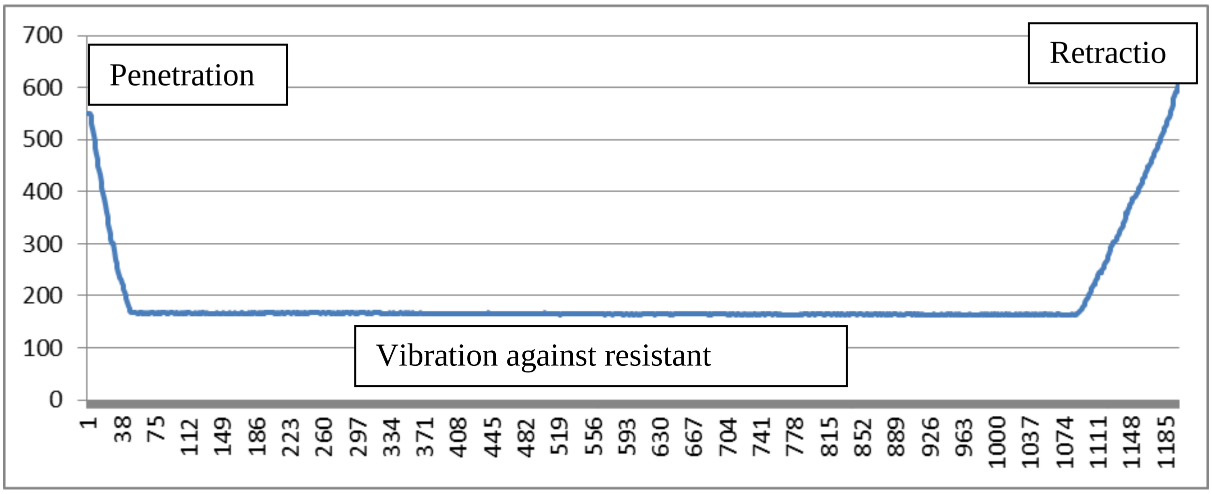

**+48-010/213VE (EI-16; 109 cm recovery)**



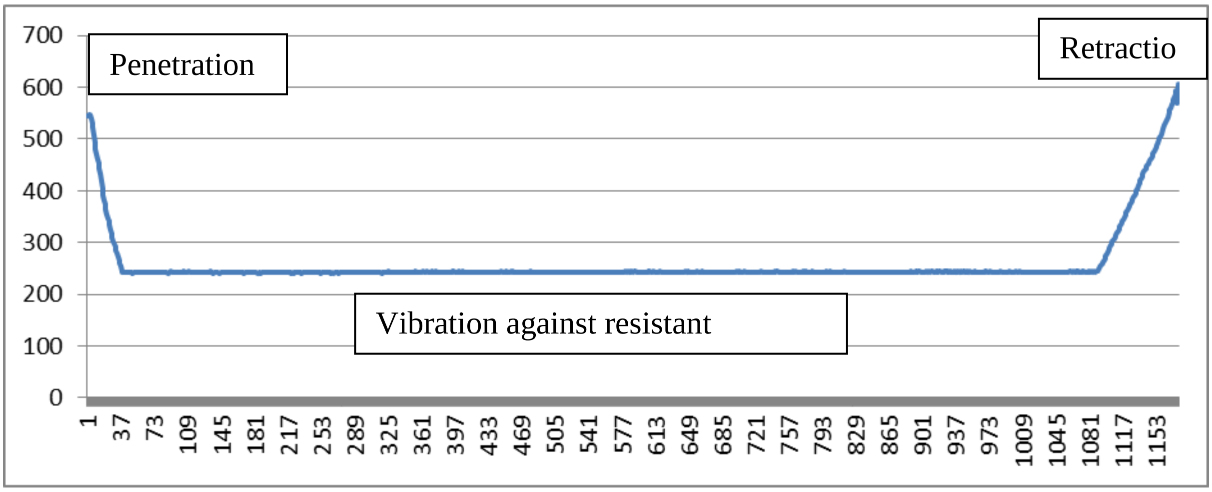

**+48-010/214VE (EI-51; 281 cm recovery)**



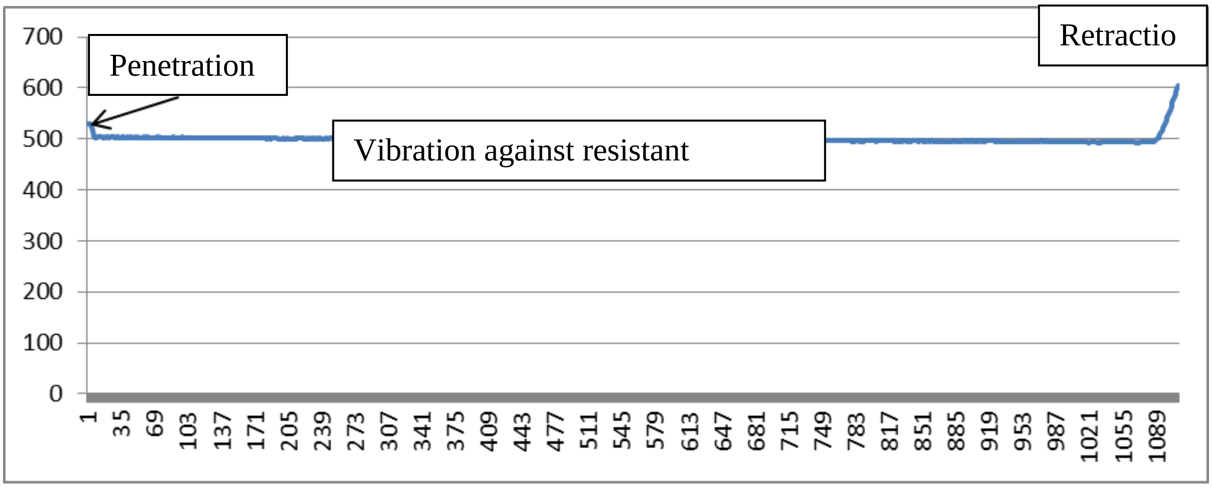
**+48-010/215VE (EI-41; 223 cm recovery)**



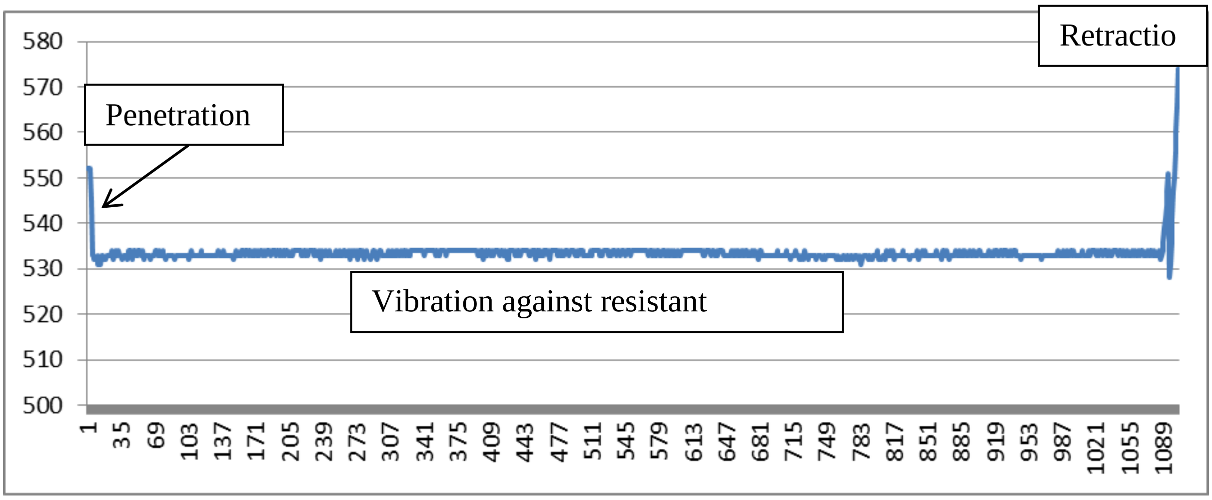

**+48-010/216VE (EI-53; 174 cm recovery)**



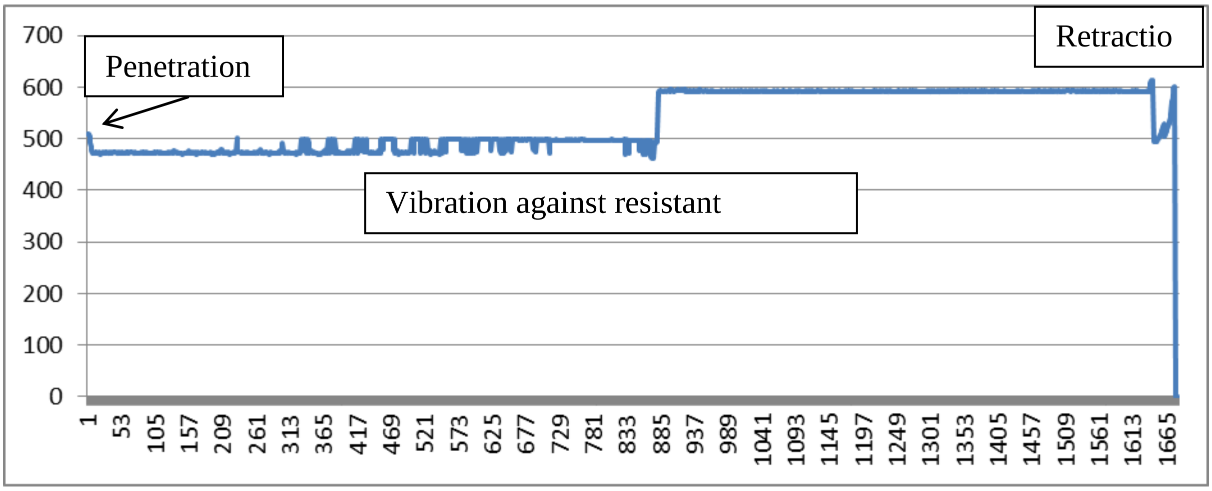

**+48-010/217VE (EI-48; 16 cm recovery)**



**+48-010/218VE (EI-47; no recovery)**




**+48-010/219VE (EI-48b; 29 cm recovery)**




**+48-010/220VE (EI-46; 62 cm recovery)**