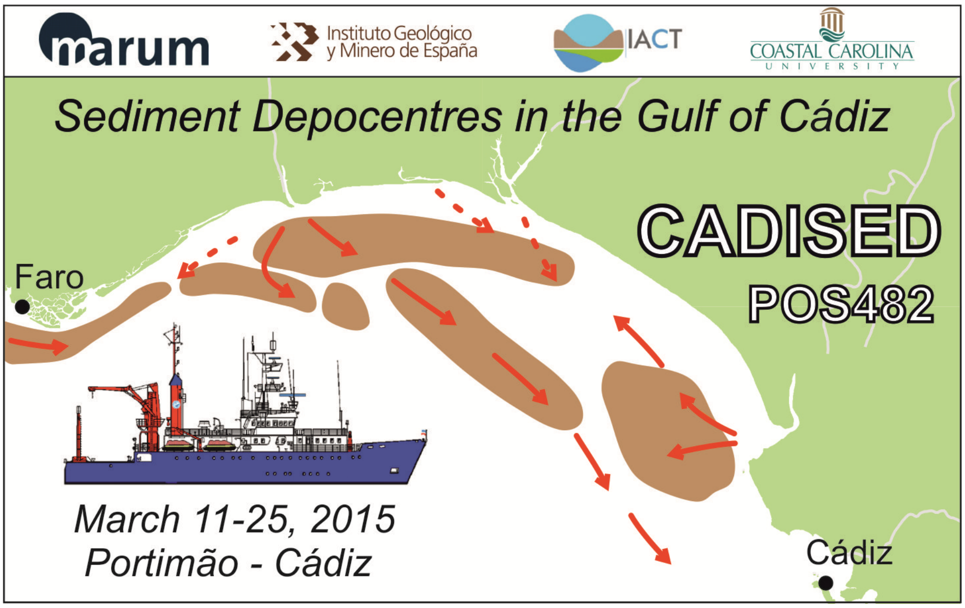
RV POSEIDON
Cruise Report POS482

CADISED (Cadiz Shelf Sediment Depocentres)



Confined transgressive and highstand sediment depocentres in the Gulf of Cadiz: reconstruction of formation history and past environmental changes.

Lantzsch, H., Hanebuth, T.J.J., Bergmann, F., Kestner, M., King, M.L., Lobo, F.J., Luján, M., Mendes, I., Reguera, I., Schwenk, T., Steinborn, B., Warratz, G.

March 14 – 25, 2015
Portimão (Portugal) – Málaga (Spain)

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1. Scientific crew

Table 1. Scientific participants of Cruise POS482.

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2	King	Mary Lee	Master student	Sedimentology	SCMSS
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7	Lobo S.	Dr. Francisco	Senior Scientist	Stratigraphy	IACT
8	Luján	Dr. María	Senior Scientist	Marine Geology	IACT
9	Mendes	Dr. Isabel	Postdoc	Micropalaeont.	IACT/UAlg
10	Reguera	Dr. Isabel	Scientist	Sedimentology	IGME

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SCMSS: School of Coastal and Marine Systems Science
GeoB: Department of Geosciences, University of Bremen
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2. Research programme

Local sediment depocentres on clastic continental shelves contain highly valuable information concerning their history of development, the dynamics of sediment distribution, and variability of climate-related parameters such as sea level and continental input. Previous seismo-acoustic profiling revealed a number of well-defined transgressive and Holocene sediment bodies in the northern Gulf of Cadiz shelf system. Such deposits are highly suited for palaeo-environmental reconstructions.

The three super-ordinate scientific targets of this expedition are: (1) to develop a comprehensive sedimentary-stratigraphic model on the origin of defined transgressive and high-stand shelf deposits as a result of forces interacting with each other (sea level, topography, sediment availability, climate, human impact) using the example of the Cadiz shelf; (2) to broaden the poor knowledge on sediment depocentres with special emphasis on their development dynamics and, most significant, to calculate a marginal-marine sediment budget on the base of such deposits along defined time slices; and (3) to use Holocene MDCs as high-resolution archives in terms of oceanographic and continental palaeo-environmental changes in a regional and Atlantic-wide context.

3. Narrative of cruise with technical details

Cruise POS482 (Fig. 1) started in Portimão, Portugal, with a delay of three days due to technical problems with the vessel's propeller. The existing acoustic subbottom echosounder data set belonging to participant Dr. F. Lobo (IACT, Granada) provided the base for our own acoustic and sediment-coring program. The study area was divided into three sections for a better coordination with the coastal authorities.

We spent the first two days in the western section (Faro Area) adding a number of profiles to the existing acoustic data grid for a better area-wide coverage. Sediment was cored at seven stations in this area with a 6-m long Gravity Corer (Fig. 1). Three of these stations were located east of Faro along a transect over an inner-shelf progradational sand wedge. Two stations were taken at the outer-shelf mud depocentre southwest of Faro, one at a proximal location (high sediment accumulation, i.e. young high-resolution record), one at a distal location (condensed sedimentation, i.e. deeper into older strata). Two further locations were attempted just south of Cabo de Santa Maria to collect sands from this part of the inner-shelf progradational wedge extending around the cape.

On the third day of the cruise (March 16), we planned to sample the older depositional system for the first time in the Gulf of Cádiz. The strata are composed of stacked progradational, overall retrograding sequences of assumed deglacial age. We deployed a 5-m long vibrocorer in the middle section of the study area (Guadiana Area). During this deployment in 40 m water depth, northeast of Faro, the vessel's cable broke because the Vibrocorer was stuck. Thus, the device was left on the seafloor and a professional diving company was hired for a rescue operation.

During the next two days (March 17 and 18), we mapped the eastern section (the Guadalquivir Area) with a number of shelf-crossing profiles and took ten sediment cores (Fig. 1). These locations covered the entire area of the "Guadalquivir Prodelta" following the strategy to cover the marginal, central, and most proximal areas of this depocentre.

During the morning of March 20, we met with divers at the Vibrocorer location. The second recovery attempt was successful and we were fortunately able to recover the drilling device as well as the sediment core.

We mapped in the Guadiana Area the following two nights to complete the existing acoustic grids (Fig. 1). During the day, we took sediment cores along a short transect of mud infill in the buried Guadiana paleo-channel (four stations). Two of the stations were from the mid-shelf mud depocentre off Tavira and along an east-west transect on the outer shelf in 120 m water depth. The latter target was chosen in order to sample the underlying progradational (deglacial) system at locations where this unit reaches close to the modern seafloor, as depicted by acoustic data. However, it seems that a thin carbonate-rich muddy/sandy open-shelf facies drapes the entire outer shelf zone.

During the final two days of the cruise (March 23 and 24), we focused our acoustic surveying on the Guadalquivir Area to produce a grid of adequate lateral coverage. Six stations were cored at the mid-shelf mud depocentre at the transition between the Guadiana and the Guadalquivir Areas (Fig. 1). Finally, we have chosen two distinct morphological elements for an in-detail investigation with a dense grid of acoustic profiles and two sediment cores. The first target was a mounded structure at the shelf edge offshore of Cádiz. The second was a local sediment depocentre just off the shelf edge at 180 m water depth. At noon on March 24, our research programme officially ended and the transit to Málaga, Spain, began.

In summary, Cruise POS482 was very successful, adding 1100 nm of new acoustic sub-bottom echosounder profiles (and multibeam bathymetry data) to the existing data set, and providing sediment surface samples and cores from 40 stations. Collecting sediment cores from the underlying stacked-progradational and channel-fill systems remains a future target.

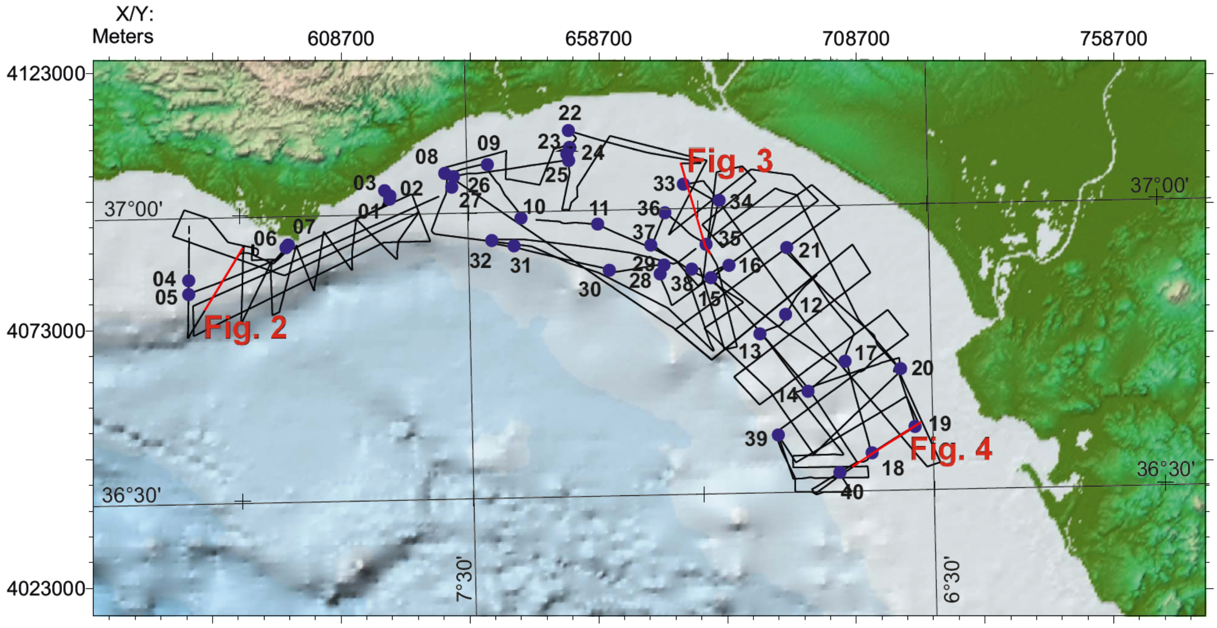

Figure 1. Map of the POS482 study area. Acoustic profiles are displayed as black lines. Core positions are shown as dark-blue dots. Station numbers are provided in short form, e.g., GeoB19501 is depicted as "01". Location of the acoustic profiles displayed in Figs. 2-4 are shown as red lines.

4. Scientific equipment and first results

4.1 Multibeam echosounder

4.1.1 Technical description

The ELAC Nautik SeaBeam 3050 installed on RV Poseidon is a hull-mounted multibeam echosounder for mid-water depths down to 3000 m and is suitable to collect bathymetric, backscatter and water column imaging data. The SeaBeam 3050 operates at 50 kHz and incorporates a multi-ping capability (two swaths per ping) with up to 315 beams per swath. The system has a total swath width of up to 140°, whereas the widths of the individual beams are 1.5° x 2°. This configurations leads to maximum swath coverage sector of 5.5 times the water depth, however, the maximum coverage is limited to 3500 m.

The SeaBeam system is able of full compensation for vessel pitch, roll and yaw motion. This is achieved by splitting the transmit fan in several individual sectors which can be steered individually. Motion information as well as navigation are provided by the vessel. Ray bending in the water column due to changes of sound speed in the water column can be corrected by using sound velocity profiles of the water column.

The multibeam echosounder was operated during the entire cruise in a 24 hour watch mode and worked reliable without any significant technical problems. Bathymetric and backscatter data were collected continuously, whereas Water Column Imaging data was only gathered episodically due to the extraordinary huge amount of raw data.

4.1.2 Processing of the data

Processing and analysis of the data will be done after the cruise. During the cruise, bathymetric maps of unprocessed data were created using the software MB-systems for planning purpose only.

4.2 Sediment echo sounding (INNOMAR)

4.2.1 Technical description

Sediment echosounder system SES-2000 Standard (INNOMAR Technologie GmbH) was used for imaging the sediment subsurface. This parametric sub-bottom profiler uses the parametric effect for signal transmission. Two slightly different frequencies, the so called primary frequencies, are transmitted simultaneously at high sound pressures into the water column. Interaction of these frequencies generates secondary frequencies, e.g. the difference frequency of the transmitted primary waves. The generation of the secondary frequency is restricted to the central lobe of the transmitted beam pattern. This leads to a very narrow transmission beam, increases therefore the lateral resolution and allows to image small scale structures. Furthermore, using the parametric effect has the advantage of transmitting a low-frequency signal in a narrow cone using a reasonable sized, transportable transducer array.

The SES standard supports a secondary frequency range of 4–15 kHz. The primary frequency signals are around 100 kHz and are also used for seafloor depth detection. In the multi-frequency mode it is possible to record up to 3 different secondary frequencies by generating the 3 different signals successional.

The SES standard covers a depth range of 1–500 m and achieves a maximum bottom penetration of 50 m. However, the sediment penetration is strongly depending on local sediment properties, and reached a maximum penetration of ~20 m during POS482. During this expedition the transducer was installed in the ship's Moonpool. Ship motions such as heave, roll and pitch were directly corrected for using a motion sensor installed above the SES-transducer. Navigation was provided by the ship's navigation system. The SES standard was operated in a 24 hour watch mode. It was running stable during the complete POS482 and was just switched off during station times.

4.2.2 Processing of the data

During the cruise, INNOMAR data were routinely converted into sgy format with the custom-made software ps32sgy (manufactured by H. Keil, University of Bremen) and loaded into the interpretation software "The Kingdom" to identify suitable coring locations, but also for profile planning. During conversion, the data were processed by applying an envelope calculation. Outliers within the navigation data in the header were eliminated, and the positions were converted to UTM projection. Finally, the data were resampled to decrease file sizes.

4.2.3 Preliminary results

The geophysical lines recorded during Cruise POS482 were planned taking into account pre-existing geophysical data from former surveys (a large data set of seismic profiles with various resolutions and collected with different seismic sources). If the respective cruise reports are available, citations are provided in the following. The preliminary results in this chapter are based on the INNOMAR data recorded during Cruise POS482. The study area was divided into three sectors: (1) Faro Shelf; (2) Guadiana Shelf; and (3) Guadalquivir Shelf.

Faro Shelf

In the Faro Shelf area, existing data comprises analogue profiles mainly collected during FADO and WADIANA Surveys (Alveirinho Dias et al., 2001) with an Uniboom seismic system. During Cruise POS482, geophysical profiles were mainly collected in order to fill the gaps between these pre-existing lines by following a zigzag pattern. The landward extension of the seismic lines was limited by the ship draught, i.e. to water depths below 20 m. The seaward limit included the erosional regime on the uppermost continental slope. Apart from the profiles perpendicular to the coastline, a number of along-shelf profiles was collected at various water depths, in order to improve the correlation of all seismic lines and to overcome the until then existing lack of profiles oriented parallel to the coast.

A significant sedimentary feature on the Faro Shelf is a sigmoid progradational wedge that is located off Cape Santa Maria next to Faro. This wedge shows weak penetration of the seismic signal, indicating coarse sediments. Offshore of the proximal wedge, recent deposits are composed of several sheet-like mud depocentres with low acoustic amplitudes and sub-parallel stratification (Fig. 2). At the upper slope, penetration was limited, possibly due to the existence of an erosional surface.

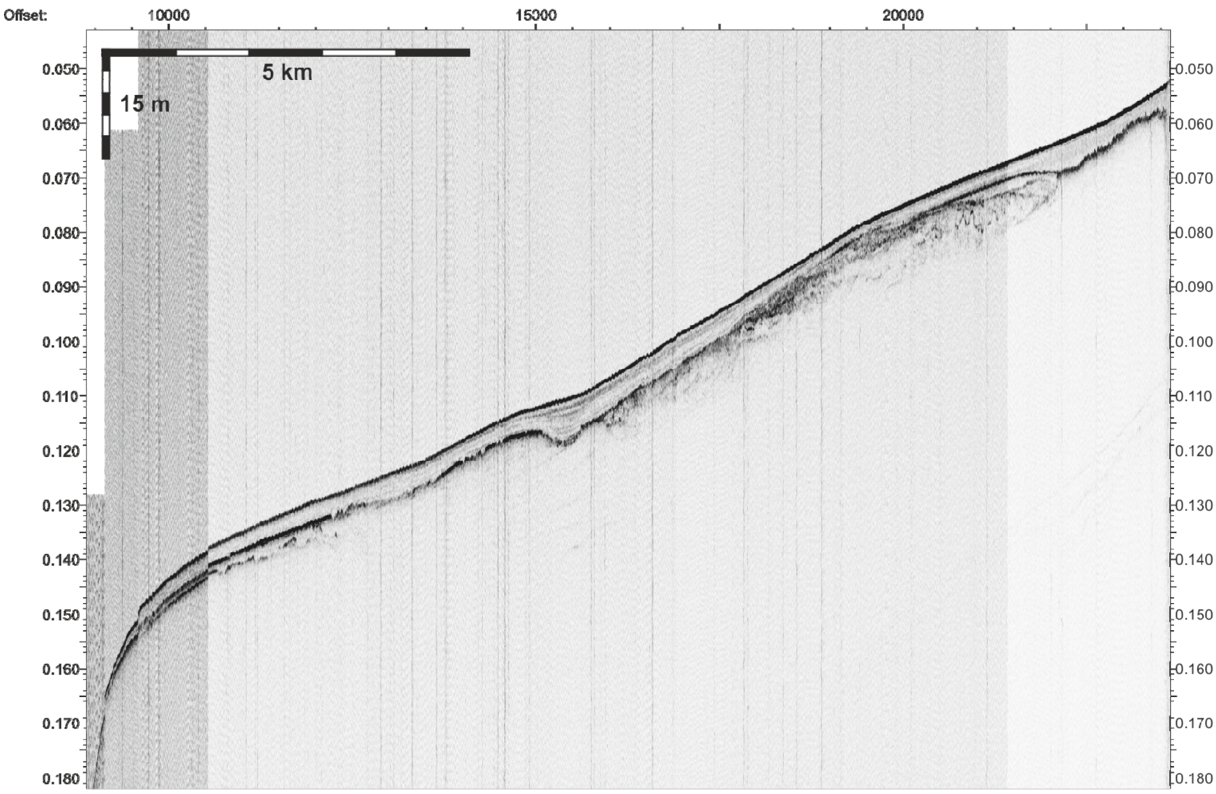

Figure 2. A sheet-like mud depocentre with low acoustic amplitudes and sub-parallel stratification (see Fig. 1 for location).

Guadiana Shelf

In the middle area, the Guadiana Shelf, the total length of geophysical lines collected during Cruise POS482 was significantly lower than in the adjacent two sectors due to the extensive seismic data base already available. These pre-existing data were mainly collected during LASEA Cruise (TOPAS parametric profiles and Sparker profiles; Lobo, 2013) and BELGICA Survey (Sparker profiles; Van Rooij and Vandorpe, 2013). As a consequence, geophysical data acquisition on the Guadiana Shelf during Cruise POS482 was mainly limited to a number of lines along the inner and outer shelf, which were collected during transits between the three study areas and during transits between the coring stations within this area. In addition, a number of across-shelf profiles was collected by following the path of several incised valley structures on the inner shelf.

Geophysical data collected on the Guadiana Shelf indicates buried depositional successions of relatively coarse-grained compositions, as evidenced by their limited acoustic responses and very strong confined internal reflectors. Highly reflective deposits were found on the inner shelf and also along the pathways of the buried incised valleys. This paleo-valley is refilled by horizontally stratified fine deposits. To the east of the Guadiana River, the mid-shelf area is covered by a thick, semi-transparent deposit with sub-parallel reflections, assumed to be the Guadiana Mud Belt (Fig. 4). It extends to the southeast and seems to merge gradually with the Guadalquivir-derived depocentre. A thin progradational deposit is found on the outer shelf, topped by an irregular, highly reflective surface. Over wide parts of the Guadiana Shelf area, a strong, very irregular reflector close to the modern seabed and directly above a supposedly transgressive unit seems to indicate that major parts were exposed to erosion and compaction/cementation processes at a certain stage.

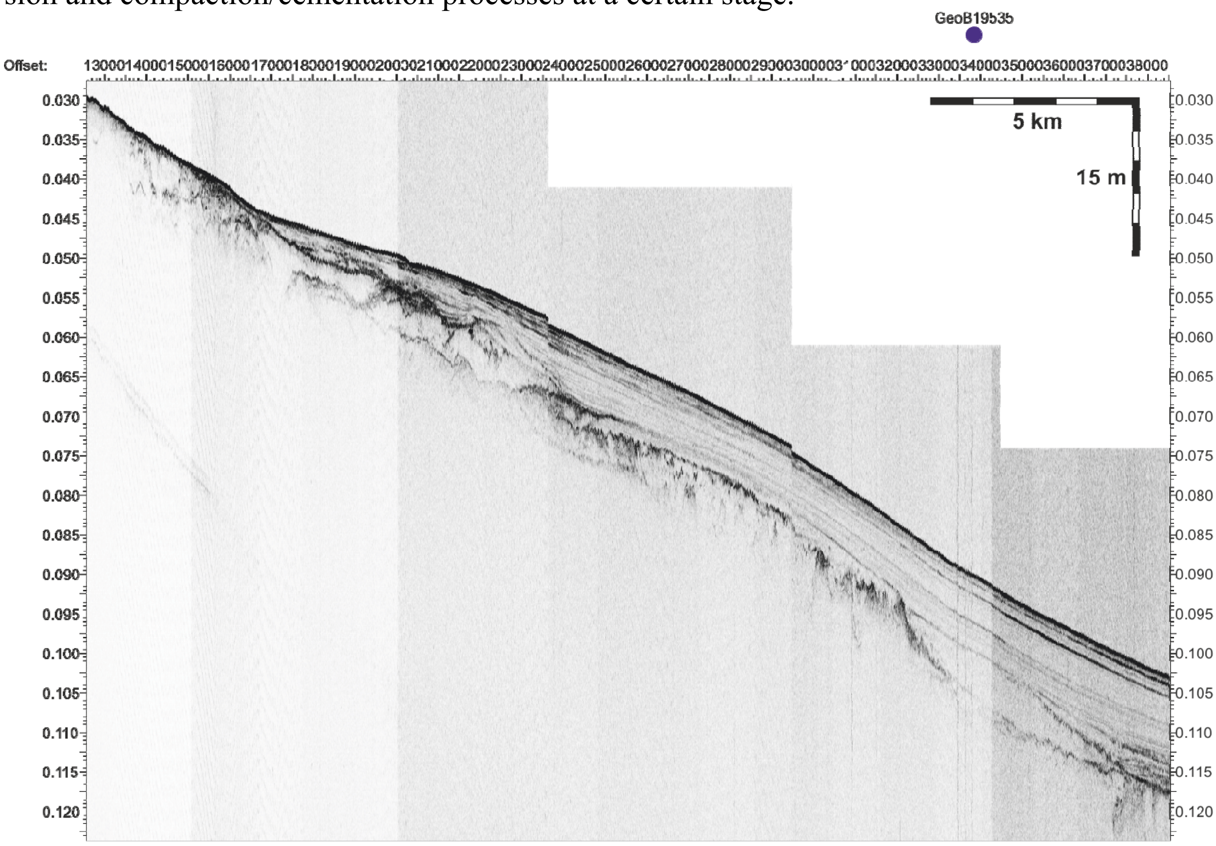

Figure 3. Depositional successions of relatively coarse-grained compositions buried by a thick, semi-transparent deposit with sub-parallel reflections (Guadiana Mud Belt) and coring station GeoB19535 (see Fig. 1 for location).

Guadalquivir Shelf

Pre-existing data were scarce in the Guadalquivir Shelf area and restricted to low-density analogue data collected during the Surveys GOLCA 93 and GC-86-1 with Uniboom sources. The survey strategy in this area included the collection of: (a) profiles perpendicular to the coast line, parallel to the few existing profiles; (b) profiles with oblique orientations in the transitional area between Guadiana and Guadalquivir shelves to link both areas with each other; (c) along-shelf profiles in order to allow for a robust correlation between the different shelf sectors north and south of the Guadalquivir River (this kind of information was fully lacking up to now). In addition, a number of smaller-scale surveys was executed in this area in order to focus on specific geological features of limited spatial extent but with a high content of environmental information, such as the palaeo-valley linked to the Guadalquivir River and a recent fault-generated morphological high serving as local sediment sink.

On the Guadalquivir Shelf, a major wedge-shaped depocentre was found through successive across-shelf lines (Fig. 4). The thickest part of this depocentre occurs at its center in mid-shelf position, and its sediment thickness decreases seaward. Landward, the depositional pattern is more complex, as the sediment thickness at proximal locations exhibit along-shelf changes, probably recording the occurrence of auto-cyclic delta lobe switching. The internal configuration of the main depocentre shows vertical stacking of at least four subunits that exhibit contrasting reflectivity patterns and, therefore, changes in the environmental forcing mechanisms. Some areas of the prodeltaic wedge appear obscured by the presence of acoustic masking, assumedly related to shallow biogenic gas. Several bedforms were also recognised in shallowest water depths north of the Guadalquivir River mouth. Other features identified at the shelf margin offshore of the Guadalquivir River include a semi-transparent to chaotic upper slope facies, which might indicate the occurrence of mass movement processes, and a W-E oriented seafloor elevation, apparently triggered by a fault.

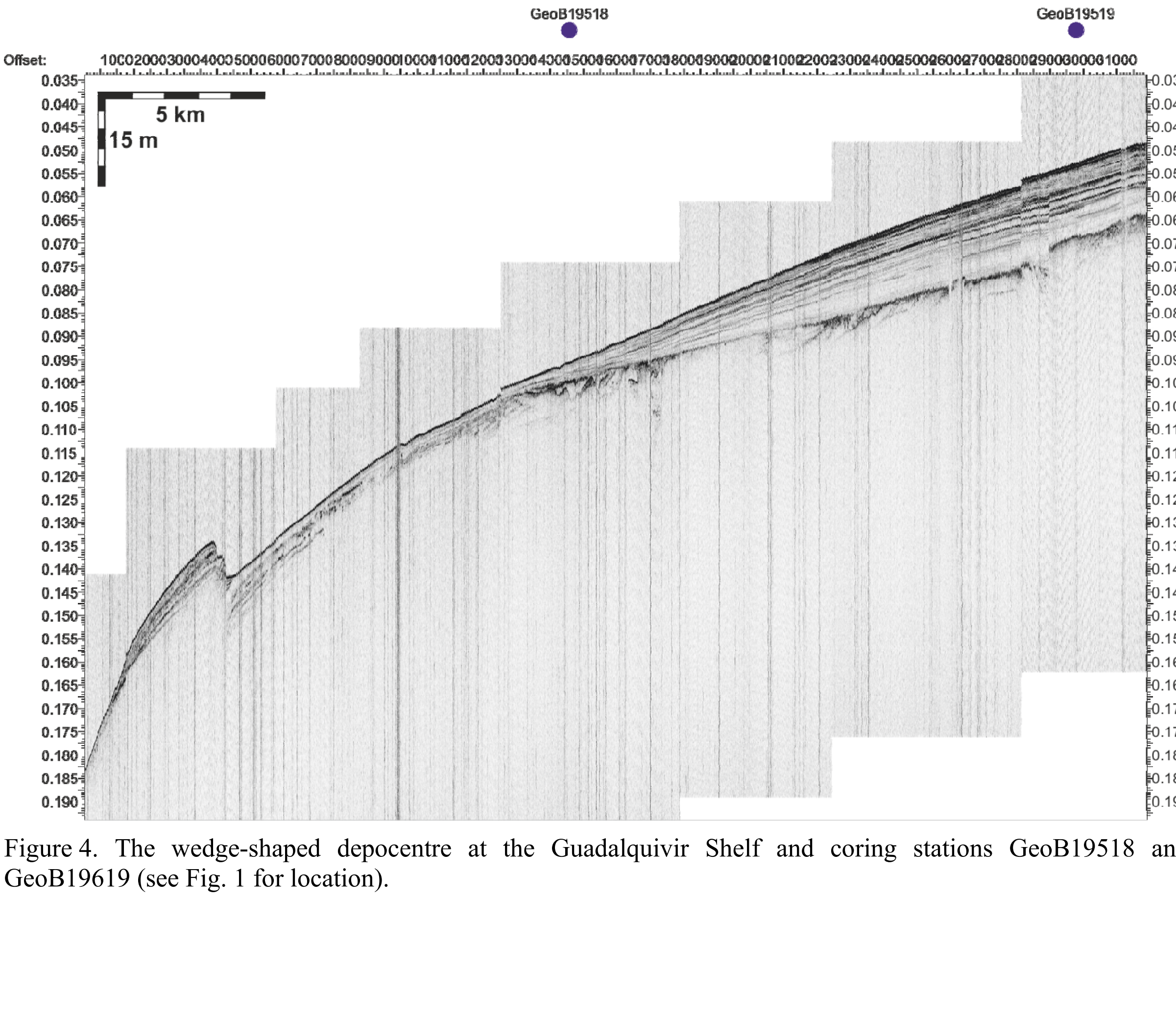

Figure 4. The wedge-shaped depocentre at the Guadalquivir Shelf and coring stations GeoB19518 and GeoB19619 (see Fig. 1 for location).

4.3 Sediment surface sampling and coring

4.3.1 Sediment sampling devices

Depending on the expected lithology, either a Grab Sampler (for gravelly/pebbly seabed, hard seafloor), a Giant Box Corer (for muddy and sandy sediments), a Rumohr Corer (for any type of soft sediments), a Gravity Corer (for deeper subsurface sampling of muddy sediments), or a Vibrocorer (for deeper subsurface sampling of sandy sediments) was deployed (Fig. 5).

Figure 5. Sediment sampling devices deployed during cruise POS482: A) Grab Sampler; B) Giant Box Corer, C) Rumohr Corer; D) Gravity Corer, E) Vibrocorer.

Grab Sampler (GS)

A GS with a dimension of 50 x 30 cm was used to collect a representative sample of seabed sediments (Fig. 5A). Penetration depth ("bite") of the sampler is about 20 cm. The closing mechanism prevents sediment wash-out during retrieval. The GS was used when Rumohr Corer and Giant Box Corer did not work satisfactory due to very coarse-grained and rocky material.

Giant Box Corer (GBC)

The GBC, with a sampling area of 50 x 50 cm and a maximal penetration depth of 50 cm, was applied as a tool to provide an amount of surface material sufficiently enough for all involved research groups (Fig. 5B). The core recovery was variable due to the nature of the sampled material. After arriving on deck, the supernatant water was removed and the sediment surface was documented by visual description and photography. Then, plastic liners were pressed in and surfaces samples were taken. Afterwards, the front of the box was opened and the downcore profile was described, photographed and sampled. Finally, the liners were removed and stored.

Rumohr Corer (RC)

The RC is a small gravity corer with a plastic tube (100-cm long and 8 cm in diameter) and a top weight of 50 kg made of two lead rings (Fig. 5C). The corer uses a tight-fitting lid closing the top of the coring tube during retrieval and thereby retaining the sediment core inside the tube. The advantage of this device is to obtain an undisturbed sediment surface including the supernatant water.

Gravity Corer (GC)

The GC was used to retrieve sediment cores of a maximum length of 6 m (Fig. 5D). The top weight was about 1.5 tons. A 12-cm wide plastic pipe is stored inside an iron casing, which itself is accompanied by a lid on top and a core catcher at the base. The GC was deployed where the sediments were fine enough to allow gravity-driven penetration.

Vibrocorer (VC)

A VKG-5 Vibrocorer was of essential use to obtain subbottom samples from coarse-grained shelf areas (Fig. 5E). The maximum core length is 504 cm with a diameter of 10 cm. Deployed with a 300-m long electricity cable, coring at maximum water depths of 220 m is possible during calm weather conditions.

4.3.2 Preliminary results

The selection of stations and coring locations was based on the preliminary interpretation of acoustic data (Table 2).

Table 2. Selection of coring stations.

Station	Area	Target
19501	Faro	Sand wedge east of Faro, distal pinch-out
19502	Faro	Sand wedge east of Faro, half-way upslope
19503	Faro	Sand wedge east of Faro, most proximal
19504	Faro	Outer-shelf mud depocentre, central
19505	Faro	Outer-shelf mud depocentre, distal
19506	Faro	Sand wedge east of Faro, distal
19507	Faro	Sand wedge east of Faro, proximal
19508	Guadiana	Transgressive system, incised valley fill
19509	Guadiana	Stacked transgressive system
19510	Guadiana	Stacked transgressive system
19511	Guadiana	Stacked transgressive system
19512	Guadalquivir	Mud depocentre, central
19513	Guadalquivir	Mud depocentre, distal
19514	Guadalquivir	Mud depocentre, distal
19515	Guadalquivir	Mud depocentre, distal
19516	Guadalquivir	Mud depocentre, central
19517	Guadalquivir	Mud depocentre, central
19518	Guadalquivir	Mud depocentre, central
19519	Guadalquivir	Mud depocentre, proximal
19520	Guadalquivir	Mud depocentre, proximal
19521	Guadalquivir	Mud depocentre, proximal
19522	Guadiana	Proximal filling of paleo-valley
19523	Guadiana	Central filling of paleo-valley
19524	Guadiana	Central filling of paleo-valley
19525	Guadiana	Distal filling of paleo-valley
19526	Guadiana	Western edge of Tavira mud depocentre
19527	Guadiana	Western edge of Tavira mud depocentre
19528	Guadalquivir	Outer-shelf sediment cover (for oceanography)
19529	Guadalquivir	Outer-shelf sediment cover (for oceanography)
19530	Guadalquivir	Outer-shelf sediment cover (for oceanography)
19531	Guadiana	Outer-shelf sediment cover (for oceanography)
19532	Guadiana	Outer-shelf sediment cover (for oceanography)
19533	Guadalquivir	Mud depocentre, proximal
19534	Guadalquivir	Mud depocentre, proximal
19535	Guadalquivir	Mud depocentre, central
19536	Guadalquivir	Mud depocentre, central
19537	Guadalquivir	Mud depocentre, distal
19538	Guadalquivir	Mud depocentre, distal
19539	Guadalquivir	Uppermost slope terrace (shelf sediment export)
19540	Guadalquivir	Local sediment filling on lee-side of shelf-edge nose (local depocentre)

Grab Sampler (GS)

The grab sampler was successfully deployed at 4 stations (Table 3) and one sample was collected at each station (for GeoB). At Station GeoB19502-4, after the deployment of 3 empty Rumohr Cores, the obtained sediments were composed of yellowish brown medium to fine sands and rounded gravels with different lithologies: sandstones incrusted by algae and sponges, shells and shell fragments (mostly bivalves). At Station GeoB19503-1, located close to the previous one, sediments consisted of reddish-brown medium to coarse sands and rounded gravel (sandstones, bivalve shells and shell fragments). At Stations GeoB19528-1 and GeoB19529-1, the GS was used to determine the sediment type, since these samples were located in the area where the progradational (deglacial) system reaches close to the modern seafloor and, therefore, coarse sediments were expected. However, the obtained sediments were sandy mud with few shell fragments, brown colour at the surface and olive grey in deeper parts.

Giant Box Corer (GBC)

The GBC was deployed at 5 stations (Table 3). At each station, two 12-cm diameter plastic pipes were pressed into the sediment from the surface to the bottom (for GeoB). Additionally one surface sample for living (stained) benthic foraminiferal analyses was collected (for IACT/UAlg). Five surface sediment samples (0-1 cm) were collected at random places using a syringe (3.5 cm diameter) in order to obtain ~50 cm^3 of volume. Immediately afterwards, these samples were stained and preserved with a solution of Rose Bengal and ethanol (2 g/l). Sediment temperature was measured using a needle thermometer.

Stations GeoB19528-2 and GeoB19529-2 showed surface sediments characterised by yellowish brown mud. At Station GeoB19530-1 muddy fine sands occurred, with small shell fragments and black mineral grains. A yellowish brown mud layer was also observed at Station GeoB19531-1 and the down core profile showed a high content of bivalves and gastropods shells (some with >5 cm length), and shell fragments. Some of these shells were sampled and stored in vials for further analysis. Sediments at GeoB19532-1 consisted of muddy sands, with high contents of small shell fragments, and some mineral particles with a general yellowish-brown colour.

Rumohr Corer (RC)

The RC was successfully deployed at 33 stations, with a total of 64 retrieved sediment cores (Table 3). Two RCs were collected at each station, with the exception of Stations GeoB19539 and GeoB19540, where only one RC was collected. Generally, the longer RCs were sampled for sedimentological analysis, according to the scheme shown in Figure 5A. The middle part of the RC was sampled for density determination (for SCMSS) with a 5 cm long syringe until the end of the core. The remaining first centimetre of the core top was divided into three parts, 1/3 for sedimentological analysis at GeoB, 1/3 for SCMSS and 1/3 for carbon content analysis at IACT/UAlg. The latter sample was immediately frozen at -20ºC. For the second centimetre down core, one halve of the core was sampled into 2 cm slices (for GeoB) and the other half in 1 cm slices (for SCMSS). The only exception was Station GeoB19504-2 where both halves were sampled in 1 cm slices. The supernatant water of the second RC at this station was measured for temperature, salinity, dissolved oxygen, and pH by using an YSI 556 MPS probe. After removal of the water, the RC was sampled for living (stained) benthic foraminiferal analysis (IACT/UAlg; Fig. 5B). In Rumohr Cores GeoB19504-1 to GeoB19507-2, the topmost centimetre was sampled in two slices, i.e. 0-0.5 and 0.5-1 cm. In the remaining Rumohr Cores, the sediments were mud with high water contents and the top part was sampled in 1-cm slices until 6 cm depth. Additionally, in samples GeoB19505-2 to GeoB19507-2, the level 9-10 cm was also sampled in order to validate the depth of infaunal benthic foraminiferal species. In Cores GeoB19539-1 and GeoB19540-1, located near the shelf break, only the first 0-1 cm was sampled. Immediately after collection the samples were stained and preserved with a solution of Rose Bengal and ethanol. The remaining material from these RCs was discarded, except for Cores GeoB19522-1 and GeoB19525-1, located in the most proximal and distal area of the Guadiana paleo-valley, respectively. These cores were sampled down to 6 cm depth in 1-cm slices in order to observe dead (unstained) benthic foraminiferal faunas.

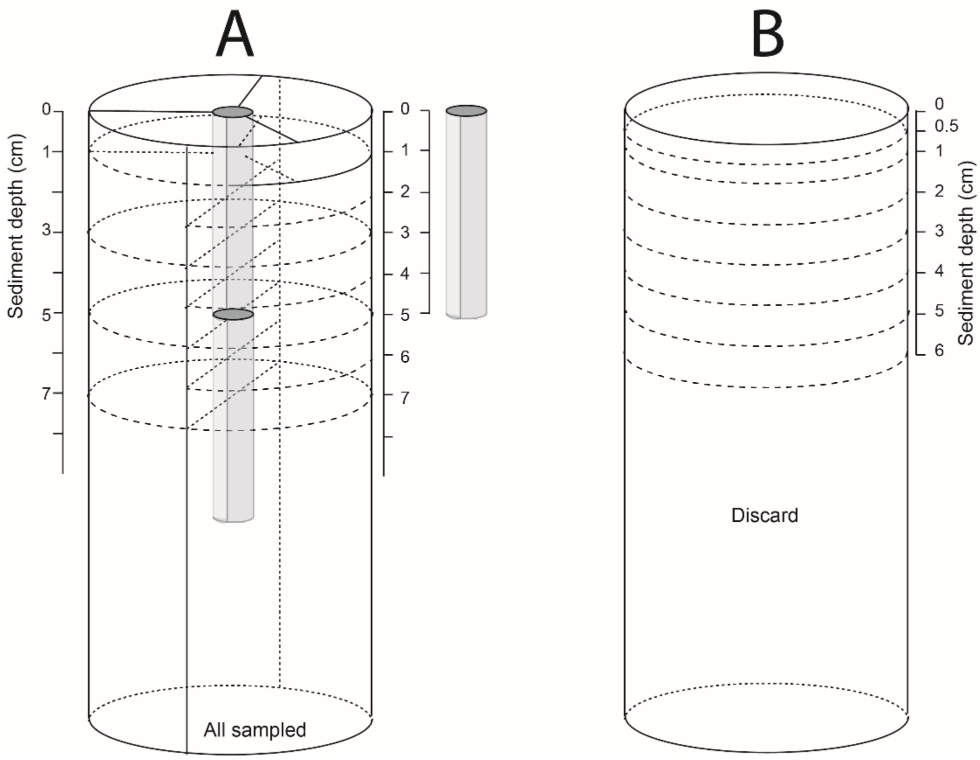

Figure 5. Sampling scheme for sediment retrieved by the Rumohr Corer. A. Sampling for sedimentological analysis, B. Sampling for living benthic foraminiferal analysis.

Gravity Corer (GC)

The GC was successfully deployed at 27 stations (Table 3). Sediment recovery was variable, from 37 cm at the first Station (GeoB19501-3) to 555 cm at Station GeoB19525-3 in the Guadiana paleo-valley (Figure 1). At 20 stations, sediment recovery was higher than 400 cm. After retrieval, the plastic liner was cut into 1-m long sections, closed with caps, and labelled according to the general GeoB scheme. All segments were stored in boxes and will be opened, described, and sampled during the sampling party.

Vibrocorer (VC)

The VC was successfully deployed at Stations GeoB19507 and GeoB19508, with a sediment recovery of 495 and 494 cm, respectively (Table 3). At Station GeoB19503 the VC was also deployed but part of the sediment was lost in the water column. After core retrieval, the same procedure was applied as for gravity cores.

5. Data and sample storage

A Cruise Summary Report (CSR) was compiled and submitted to DOD (Deutsches Ozeanographisches Datenzentrum) and BSH (Bundesamt für Seeschifffahrt und Hydrographie, Hamburg) immediately after the cruise. The cruise was performed within waters of Portuguese and Spanish jurisdiction. Sediment echosounder profiles, multibeam bathymetric and thermosalinigraph data were provided to the Spanish Hydrographic Institute. Raw multibeam and sediment echosounder data are stored in the data base of the Research Group "Marine Technology -Environmental Research" at the University of Bremen and will be made available on request (Contact: Tilmann Schwenk, tschwenk@uni-bremen.de).

GeoB sediment cores and samples are stored at the MARUM GeoB Core Repository. Responsible persons for the IACT/UAlg and SCMSS sediment samples are Dr. Francisco Lobo (pacolobo@iact.ugr-csic.es) and Prof. Dr. Till Hanebuth (thanebuth@coastal.edu), respectively. The entire data set, which will be generated during the CADISED Project, will be made available on the open-access information system PANGAEA (www.pangaea.de) after publication. An intensive and open exchange between the cooperation partners is obligatory.

6. Station list

Table 3. Station list of Cruise POS482.

Station No.	Gear	Date	Time [UTC]	Latitude	Longitude	Water Depth [m]
GeoB19501-1	RC	15.03.15	13:44:00	37° 1.577´N	7°40.382´W	50.6
GeoB19501-2	RC	15.03.15	13:57:00	37° 1.587´N	7°40.355´W	50.6
GeoB19501-3	GC	15.03.15	14:43:00	37° 1.569´N	7°40.350´W	50
GeoB19502-1	RC	15.03.15	15:52:00	37° 1.927´N	7°40.906´W	19.5
GeoB19502-2	RC	15.03.15	15:55:00	37° 1.927´N	7°40.906´W	19.5
GeoB19502-3	RC	15.03.15	15:58:00	37° 1.917´N	7°40.912´W	19.6
GeoB19502-4	GS	15.03.15	16:13:00	37° 1.900´N	7°40.903´W	19.9
GeoB19503-1	GS	15.03.15	16:40:00	37° 2.478´N	7°40.988´W	16.6
GeoB19503-2	VC	15.03.15	17:11:00	37° 2.486´N	7°40.986´W	17.2
GeoB19504-1	RC	16.03.15	08:13:00	36°53.282´N	8°6.724´W	90.4
GeoB19504-2	RC	16.03.15	08:24:00	36°53.270´N	8°6.717´W	90.4
GeoB19504-3	GC	16.03.15	10:25:00	36°53.257´N	8°6.749´W	90.7
GeoB19505-1	RC	16.03.15	08:57:00	36°51.787´N	8°6.803´W	100.4
GeoB19505-2	RC	16.03.15	09:10:00	36°51.804´N	8°6.776´W	100.7
GeoB19505-3	GC	16.03.15	09:39:00	36°51.806´N	8°6.770´W	100.7
GeoB19505-4	GC	16.03.15	10:59:00	36° 5.159´N	8° 6.806´W	100.7
GeoB19506-1	RC	16.03.15	13:12:00	36°56.634´N	7°53.984´W	47
GeoB19506-2	RC	16.03.15	13:17:00	36°56.619´N	7°53.974´W	47.7
GeoB19506-3	GC	16.03.15	13:29:00	36°56.618´N	7°53.987´W	47.4
GeoB19507-1	RC	16.03.15	14:08:00	36°56.907´N	7°53.755´W	24.5
GeoB19507-2	RC	16.03.15	14:11:00	36°56.907´N	7°53.755´W	24.5
GeoB19507-3	VC	16.03.15	15:14:00	36°56.913´N	7°53.680´W	25
GeoB19508-1	RC	17.03.15	08:03:00	37° 4.202´N	7°33.083´W	40.4
GeoB19508-2	RC	17.03.15	08:09:00	37° 4.197´N	7°33.080´W	40.6
GeoB19508-3	RC	17.03.15	08:14:00	37° 4.208´N	7°33.087´W	40.2
GeoB19508-4	VC	17.03.15	08:46:00	37° 4.229´N	7°33.057´W	40.6
GeoB19509-1	RC	17.03.15	11:16:00	37°5.003´N	7°27.498´W	35.4
GeoB19509-2	RC	17.03.15	11:21:00	37°5.040´N	7°27.478´W	35.4
GeoB19510-1	RC	17.03.15	12:42:00	36°59.353´N	7°23.208´W	96.1
GeoB19510-2	RC	17.03.15	12:50:00	36°59.373´N	7°23.198´W	97.1
GeoB19511-1	RC	17.03.15	14:39:00	36°58.602´N	7°13.190´W	85.4
GeoB19511-2	RC	17.03.15	14:48:00	36°58.611´N	7°13.174´W	85.6
GeoB19512-1	RC	18.03.15	08:03:00	36°48.688´N	6°48.877´W	58
GeoB19512-2	RC	18.03.15	08:07:00	36°48.699´N	6°48.871´W	58.1
GeoB19512-3	GC	18.03.15	08:20:00	36°48.714´N	6°48.867´W	58.1

Station No.	Gear	Date	Time [UTC]	Latitude	Longitude	Water Depth [m]
GeoB19513-1	RC	18.03.15	09:19:00	36°46.716´N	6°52.257´W	91.1
GeoB19513-2	RC	18.03.15	09:26:00	36°46.723´N	6°52.278´W	91.1
GeoB19513-3	GC	18.03.15	09:35:00	36°46.721´N	6°52.267´W	91.1
GeoB19514-1	RC	18.03.15	11:08:00	36°40.584´N	6°46.140´W	89.6
GeoB19514-2	RC	18.03.15	11:15:00	36°40.588´N	6°46.140´W	90.1
GeoB19514-3	GC	18.03.15	11:24:00	36°40.580´N	6°46.150´W	90.4
GeoB19515-1	RC	18.03.15	14:21:00	36°52.729´N	6°58.475´W	90.9
GeoB19515-2	RC	18.03.15	14:29:00	36°52.725´N	6°58.507´W	91.4
GeoB19515-3	GC	18.03.15	14:41:00	36°52.743´N	6°58.506´W	90.1
GeoB19516-1	RC	18.03.15	15:20:00	36°53.989´N	6°56.156´W	69.9
GeoB19516-2	RC	18.03.15	15:27:00	36°54.013´N	6°56.143´W	70
GeoB19516-3	GC	18.03.15	15:37:00	36°53.994´N	6°56.121´W	69.9
GeoB19517-1	RC	19.03.15	08:02:00	36°43.643´N	6°41.262´W	39.4
GeoB19517-2	RC	19.03.15	08:09:00	36°43.642´N	6°41.255´W	39.1
GeoB19517-3	GC	19.03.15	08:15:00	36°43.649´N	6°41.246´W	39.1
GeoB19518-1	RC	19.03.15	10:02:00	36°33.974´N	6°37.984´W	71.7
GeoB19518-2	RC	19.03.15	10:02:00	36°33.967´N	6°38.004´W	72.2
GeoB19518-3	GC	19.03.15	10:09:00	36°33.962´N	6°38.011´W	72.4
GeoB19519-1	RC	19.03.15	11:08:00	36°36.606´N	6°32.340´W	40
GeoB19519-2	RC	19.03.15	11:13:00	36°36.612´N	6°32.341´W	40.6
GeoB19519-3	GC	19.03.15	11:20:00	36°36.618´N	6°32.336´W	40
GeoB19520-1	RC	19.03.15	12:32:00	36°42.519´N	6°34.168´W	22.9
GeoB19520-2	RC	19.03.15	12:38:00	36°42.516´N	6°34.167´W	22.6
GeoB19520-3	GC	19.03.15	12:42:00	36°42.515´N	6°34.151´W	22.4
GeoB19521-1	RC	19.03.15	15:37:00	36°55.707´N	6°48.501´W	42.5
GeoB19521-2	RC	19.03.15	15:41:00	36°55.722´N	6°48.491´W	37
GeoB19521-3	GC	19.03.15	15:49:00	36°55.726´N	6°48.514´W	36.7
GeoB19522-1	RC	21.03.15	08:02:00	37°8.487´N	7°16.779´W	13.7
GeoB19522-2	RC	21.03.15	08:04:00	37°8.489´N	7°16.780´W	13.9
GeoB19522-3	GC	21.03.15	08:17:00	37°8.480´N	7°16.780´W	13.9
GeoB19523-1	RC	21.03.15	08:52:00	37°6.684´N	7°16.664´W	20.1
GeoB19523-2	RC	21.03.15	08:56:00	37°6.694´N	7°16.668´W	20.5
GeoB19523-3	GC	21.03.15	09:02:00	37°6.690´N	7°16.676´W	20
GeoB19524-1	RC	21.03.15	09:25:00	37°6.036´N	7°17.037´W	23.5
GeoB19524-2	RC	21.03.15	09:27:00	37°6.031´N	7°17.029´W	23.5
GeoB19524-3	GC	21.03.15	09:33:00	37°6.032´N	7°17.030´W	23.6
GeoB19525-1	RC	21.03.15	09:55:00	37°5.348´N	7°16.842´W	27.6
GeoB19525-2	RC	21.03.15	09:59:00	37°5.344´N	7°16.833´W	27.4
GeoB19525-3	GC	21.03.15	10:11:00	37°5.345´N	7°16.826´W	27.6
GeoB19526-1	RC	21.03.15	12:59:00	37°3.830´N	7°31.952´W	54.4
GeoB19526-2	RC	21.03.15	13:05:00	37°3.833´N	7°31.959´W	54.4
GeoB19526-3	GC	21.03.15	13:10:00	37°3.841´N	7°31.950´W	54.4
GeoB19527-1	RC	21.03.15	13:47:00	37°2.742´N	7°32.174´W	73.4
GeoB19527-2	RC	21.03.15	13:50:00	37°2.741´N	7°32.174´W	73.4
GeoB19527-3	GC	21.03.15	13:57:00	37°2.737´N	7°32.184´W	73.4

Station No.	Gear	Date	Time [UTC]	Latitude	Longitude	Water Depth [m]
GeoB19528-1	GS	22.03.15	08:06:00	36°53.245´N	7°5.137´W	104.1
GeoB19528-2	GBC	22.03.15	08:44:00	36°53.269´N	7°5.099´W	103.6
GeoB19529-1	GS	22.03.15	09:19:00	36°54.183´N	7°4.595´W	95.1
GeoB19529-2	GBC	22.03.15	09:27:00	36°54.178´N	7°4.594´W	94.6
GeoB19530-1	GBC	22.03.15	10:49:00	36°53.735´N	7°11.766´W	122.1
GeoB19531-1	GBC	22.03.15	13:03:00	36°56.469´N	7°24.163´W	129.9
GeoB19532-1	GBC	22.03.15	14:09:00	36°57.069´N	7°27.063´W	124.4
GeoB19533-1	RC	23.03.15	08:03:00	37°2.608´N	7°1.839´W	36
GeoB19533-2	RC	23.03.15	08:06:00	37°2.614´N	7°1.844´W	35.9
GeoB19533-3	GC	23.03.15	08:12:00	37°2.613´N	7°1.854´W	35.9
GeoB19534-1	RC	23.03.15	09:09:00	37°0.842´N	6°57.229´W	36.6
GeoB19534-2	RC	23.03.15	09:14:00	37°0.843´N	6°57.228´W	36.7
GeoB19534-3	GC	23.03.15	09:19:00	37°0.847´N	6°57.221´W	330
GeoB19535-1	RC	23.03.15	10:20:00	36°56.243´N	6°59.078´W	65.7
GeoB19535-2	RC	23.03.15	10:23:00	36°56.251´N	6°59.068´W	65.1
GeoB19535-3	GC	23.03.15	10:29:00	36°56.258´N	6°59.047´W	64.9
GeoB19536-1	RC	23.03.15	12:09:00	36°59.651´N	7°4.335´W	55.1
GeoB19536-2	RC	23.03.15	12:16:00	36°59.650´N	7°4.337´W	54.6
GeoB19536-3	GC	23.03.15	12:29:00	36°59.658´N	7°4.350´W	55.6
GeoB19537-1	RC	23.03.15	13:25:00	36°56.276´N	7°6.239´W	90.9
GeoB19537-2	RC	23.03.15	13:34:00	36°56.282´N	7°6.272´W	90.9
GeoB19537-3	GC	23.03.15	13:40:00	36°56.294´N	7°6.271´W	90.6
GeoB19538-1	RC	23.03.15	14:59:00	36°53.680´N	7°0.986´W	94.6
GeoB19538-2	RC	23.03.15	15:09:00	36°53.666´N	7°0.986´W	95.1
GeoB19538-3	GC	23.03.15	15:17:00	36°53.674´N	7°0.977´W	95.4
GeoB19539-1	RC	24.03.15	08:21:00	36°36.068´N	6°50.209´W	200.8
GeoB19539-2	GC	24.03.15	08:32:00	36°36.069´N	6°50.165´W	198.2
GeoB19540-1	RC	24.03.15	11:11:00	36°31.999´N	6°42.318´W	106.6
GeoB19540-2	GC	24.03.15	11:25:00	36°31.991´N	6°42.255´W	105.6

GC = Gravity Corer; VC = Vibrocorer; RC = Rumohr Corer; GBC = Giant Box Corer; GS = Grab Sampler.

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