Integrated Ocean Drilling Program
Expedition 339 Scientific Prospectus Addendum

Mediterranean Outflow

Environmental significance of the Mediterranean Outflow Water and its global implications

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Disclaimer

This IODP *Scientific Prospectus* is based on precruise Science Advisory Structure panel discussions and scientific input from the designated Co-Chief Scientists on behalf of the drilling proponents. During the course of the cruise, actual site operations may indicate to the Co-Chief Scientists, the Staff Scientist/Expedition Project Manager, and the Operations Superintendent that it would be scientifically or operationally advantageous to amend the plan detailed in this prospectus. It should be understood that any proposed changes to the science deliverables outlined in the plan presented here are contingent upon the approval of the IODP-USIO Science Services, TAMU, Director in consultation with IODP-MI.

September 2011

Introduction

Following review of the proposed drill sites during the 12th meeting of the Integrated Ocean Drilling Program (IODP) Environmental Protection and Safety Panel (EPSP) (1–3 June 2011), several adjustments to site locations and penetration depths were recommended and approved by the EPSP. A summary of these changes is as follows:

- Proposed Sites GC-01A, GC-09A, GC-11A, WI-01B, and SHACK-04A were approved as proposed.
- Proposed Site GC-2B was approved to a revised depth of 350 meters below seafloor (mbsf).
- Proposed Site GC-04D was approved at a new location (crossing of seismic Lines S81A-07 and S81A-16).
- Proposed Site GC-10C was approved as an alternate site at the crossing of seismic Lines CADIZ-21 and S81A-07.
- Proposed Site GC-05B was not approved. It is substituted by proposed Site GC-11A.
- Proposed Sites GC-04C (new location on seismic Line S81A-16) and GC-10B (seismic Line CADIZ-21) are retained as potential alternate sites pending approval by the EPSP.

This addendum provides new site summary sheets for the revised sites, including new locations and seismic figures, and a revised operations strategy. All other details contained within the *Scientific Prospectus* published by IODP Management International in May 2011 remain the same.

Operations plan/Drilling strategy

The Expedition 339 drilling program targets seven primary site and three alternate sites, all located in either Portuguese or Spanish territorial waters (Tables **T1, T2, T3**), two of which are on the southwest Portuguese continental margin and the remaining five in the Gulf of Cádiz (Figs. **F1, F2**). The final operations plan and number of sites to be cored is contingent upon changes to the R/V *JOIDES Resolution* operations schedule, operational risks, and the outcome of a request for permission to occupy these sites.

The coring strategy will consist of advanced piston coring (APC) in two holes (A and B) at each site to refusal using nonmagnetic core barrels, except at proposed Site

SHACK-04 where four APC holes to 150 mbsf are planned. Multiple holes will allow us to build a composite section at each site. If a complete composite record of the APC section cannot be achieved by double coring, a third hole (C) may be spot-cored to complete the splice or fill any desirable gaps. The "drillover" technique will be employed to maximize APC penetration where desirable. For planning purposes, the APC refusal depth for most sites is estimated at 100 mbsf, although we anticipate that this may be exceeded at some of the more mud-rich sites. APC refusal will be followed by extended core barrel coring at each site to ~350 mbsf and then by rotary core barrel coring to total depth (Tables **T1**, **T2**).

References

Hernández-Molina, F.J., Llave, E., Stow, D.A.V., García, M., Somoza, L., Vázquez, J.T., Lobo, F.J., Maestro, A., Díaz del Río, V., León, R., Medialdea, T., and Gardner, J., 2006. The contourite depositional system of the Gulf of Cádiz: a sedimentary model related to the bottom current activity of the Mediterranean Outflow Water and its interaction with the continental margin. *Deep-Sea Res., Part II,* 53(11–13):1420–1463. **doi:10.1016/j.dsr2.2006.04.016**

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Llave, E., Hernández-Molina, F.J., Somoza, L., Díaz del Río, V., Stow, D.A.V., Maestro, A., and Alveirinho Dias, J.M., 2001. Seismic stacking pattern of the Faro-Albufeira contourite system (Gulf of Cádiz): a Quaternary record of paleoceanographic and tectonic influences. *Mar. Geophys. Res.,* 22(5–6):487–508. **doi:10.1023/A:1016355801344**

Table T1. Primary and alternate proposed sites, Expedition 339.

Site	Location	Water depth (mbsl)	Approved penetration (mbsf)	Objectives and estimated sediment age
Primary sites				
SHACK- 4A	37.571475°N, 10.12616°W	2578	150	Pliocene–Pleistocene history of upper deep water circulation; history of the intensification of Northern Hemisphere glaciations
GC-01A	36.828136°N, 7.7554527°W	566	526	MOW upper core (Quaternary) [Themes 1, 2, and 3]
GC-09A	36.805275°N, 7.7190444°W	567	784	MOW upper core (Pliocene) [Themes 1, 2, and 3]
GC-04D	36.268972°N, 6.7942972°W	670	1550	Close to the Gibraltar Gateway [Themes 2 and 3]
GC-11A	36.425294°N, 7.2781422°W	671	990	MOW lower core (Pliocene and Quaternary) [Themes 1, 2, and 3]
GC-02B	36.317328°N, 7.718025°W	980	350	Neotectonic [Theme 4]
WI-01B	37.359036°N, 9.4109472°W	1074	675	MOW West Iberian margin [Themes 2, 3]
Alternate sites				
GC-10C	36.267022°N, 6.7910083°W	671	990	Same as GC-04D
GC-10B*	36.268653°N, 6.7898611°W	671	990	Same as GC-04D
GC-04C*	36.270328°N, 6.7931666°W	671	1550	Same as GC-04D

* = pending Environmental Protection and Safety Panel approval. Relocation of previous proposed Site GC-04B is due to its proximity to an explosives dumping ground. MOW = Mediterranean Outflow Water.

Table T2. Operations plan and additional logging, Expedition 339.

Expedtion: 339
Start Date & Time: 11/17/11 06:00
End Date & Time: 01/17/12 03:28

Proposal Number: 644 Full2
Proposal Name: Med Outflow
Last Edited By: Grout

Operations Plan Summary

Site No.	Location (Latitude Longitude)	Seafloor Depth (mbrf)	Operations Description		Transit (days)	Drilling Coring (days)	LWD/MWD Log (days)
Ponta Delgada, Azores			Begin Expedition	5.0	port call days		
			Transit ~743nmi to SHACK-04A (Portugal) @ 10.5		2.9		
SHACK-04A (Portugal)	37° 34.29' N	2589	Hole A - APC to 100 mbsf and XCB to 150 mbsf. 4-APCT and 2 SET measurements. TV survey.			1.8	
EPSP	10° 7.57' W		Hole B - APC to 100 mbsf and XCB to 150 mbsf			0.7	
to 150 mbsf			Hole C - APC to 100 mbsf and XCB to 150 mbsf			0.7	
			Hole D - APC to 100 mbsf and XCB to 150 mbsf.			1.0	
			Sub-Total Days On-Site:	4.2			
			Transit ~134 nmi to GC-01A (Portugal) @ 10.5		0.5		
GC-01A (Portugal)	36° 49.69' N	577	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET Measurements. TV survey.			1.9	
EPSP	7° 45.33' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf			1.2	
to 526 mbsf			Hole C - Drill to 350 mbsf and RCB core to 526 mbsf. Log Triple combo, FMS-sonic, and VSP.			2.2	0.9
			Sub-Total Days On-Site:	6.2			
			Transit ~2 nmi to GC-09A (Portugal) @ 10.5		0.0		
GC-09A (Portugal)	36° 48.32' N	578	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4 APCT and 2 SET Measurements. TV survey.			1.7	
EPSP	7° 43.14' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf			0.8	
to 784 mbsf			Hole C - Drill to 350 mbsf and RCB core to 784 mbsf. Log with Triple combo, FMS-sonic, and VSP.			3.4	1.1
			Sub-Total Days On-Site:	7.1			
			Transit ~55 nmi to GC-04D (Spain) @ 10.5		0.2		
GC-04D (Spain)	36° 16.14' N	681	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET Measurements. TV survey.			1.8	
EPSP	6° 47.66' W		Hole B - APC to 100 mbsf and XCB to 400 mbsf. Log with Triple Combo, FMS-sonic, and VSP.			1.9	0.9
to 1550 mbsf			Hole C - Drill to 350 mbsf and RCB core to 1300 mbsf. Log with Triple combo, FMS-sonic, and VSP.			7.1	1.6
			Sub-Total Days On-Site:	13.2			
			Transit ~23 nmi to GC-11A (Spain) @ 10.5		0.1		
GC-11A (Spain)	36° 25.52' N	682	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4 APCT and 2 SET Measurements. TV survey.			1.8	
EPSP	7° 16.69' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf			1.2	
to 990 mbsf			Hole C - Drill to 350 mbsf and RCB core to 650 mbsf. Log with Triple combo, FMS-sonic, and VSP.			2.8	1.0
			Sub-Total Days On-Site:	6.8			
			Transit ~24 nmi to GC-02B (Portugal) @ 10.5		0.1		
GC-02B (Portugal)	36° 19.04' N	991	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET Measurements. TV survey.			2.0	
EPSP	7° 43.08' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf			1.4	
to 350 mbsf			Hole C - APC to 100 mbsf and XCB to 350 mbsf. Log with Triple combo, FMS-sonic, and VSP.			1.9	0.8
			Sub-Total Days On-Site:	6.1			
			Transit ~115 nmi to WI-01B (Portugal) @ 10.5		0.5		
WI-01B (Portugal)	37° 21.54' N	1085	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET measurements. TV survey.			2.0	
EPSP	9° 24.66' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf			1.5	
to 675 mbsf			Hole C - Drill to 350 mbsf and RCB core to 675 mbsf. Log with Triple combo, FMS-sonic, and VSP.			3.2	1.0
			Sub-Total Days On-Site:	7.7			
			Transit ~90 nmi to Lisbon, Portugal @ 10.5		0.4		
Lisbon, Portugal			End Expedition		4.7	44.0	7.2

Port Call:	5.0	Total Operating Days:	56.0
Sub-Total On-Site:	51.3	Total Expedition:	61.0

LWD/MWD = logging while drilling/measurement while drilling. EPSP = Environmental Protection and Safety Panel, APC = advanced piston corer, XCB = extended core barrel, APCT = advanced piston corer temperature tool, SET = Sediment Temperature Tool, RCB = rotary core barrel, triple combo = triple combination tool string, FMS-sonic = Formation MicroScanner-sonic tool string, VSP = vertical seismic profile.

Table T3. Logging plan for alternate sites, Expedition 339.

Expedtion: 339
Start Date & Time: 11/17/11 06:00
End Date & Time: 01/17/12 03:28

Proposal Number: 644 Full2
Proposal Name: Med Outflow
Last Edited By: Grout

Alternate Sites

Site No.	Location (Latitude Longitude)	Seafloor Depth (mbrf)	Operations Description	Drilling Coring (days)	LWD/MWD Log (days)
GC-04C (Spain)	36° 16.22' N	693	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET Measurements. TV survey.	1.8	
EPSP	6° 47.59' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf	1.5	
to 1500 mbsf			Hole C - Drill to 350 mbsf and RCB core to 1550 mbsf. Log with Triple combo, FMS-sonic, and VSP.	9.3	1.4
Pending Approval			Sub-Total Days On-Site: 14.0		
GC-10C (Spain)	36° 16.02' N	693	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET Measurements. TV survey	1.8	
EPSP	6° 47.46' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf	1.2	
to 990 mbsf			Hole C - Drill to 350 mbsf and RCB core to 990 mbsf. Log with Triple combo, FMS-sonic, and VSP.	4.9	1.3
			Sub-Total Days On-Site: 9.3		
GC-10B (Spain)	36° 16.12' N	682	Hole A - APC to 100 mbsf and XCB to 350 mbsf. 4-APCT and 2 SET Measurements. TV survey	1.8	
EPSP	6° 47.39' W		Hole B - APC to 100 mbsf and XCB to 350 mbsf	1.2	
to 990 mbsf			Hole C - Drill to 350 mbsf and RCB core to 990 mbsf. Log with Triple combo, FMS-sonic, and VSP.	4.9	1.3
Pending Approval			Sub-Total Days On-Site: 9.3		

EPSP = Environmental Protection and Safety Panel, APC = advanced piston corer, XCB = extended core barrel, APCT = advanced piston corer temperature tool, SET = Sediment Temperature Tool, RCB = rotary core barrel, triple combo = triple combination tool string, FMS-sonic = Formation MicroScanner-sonic tool string, VSP = vertical seismic profile.

Figure F1. Expedition 339 revised site locations in the Gulf of Cádiz (GC) and West Iberian (WI) margin.

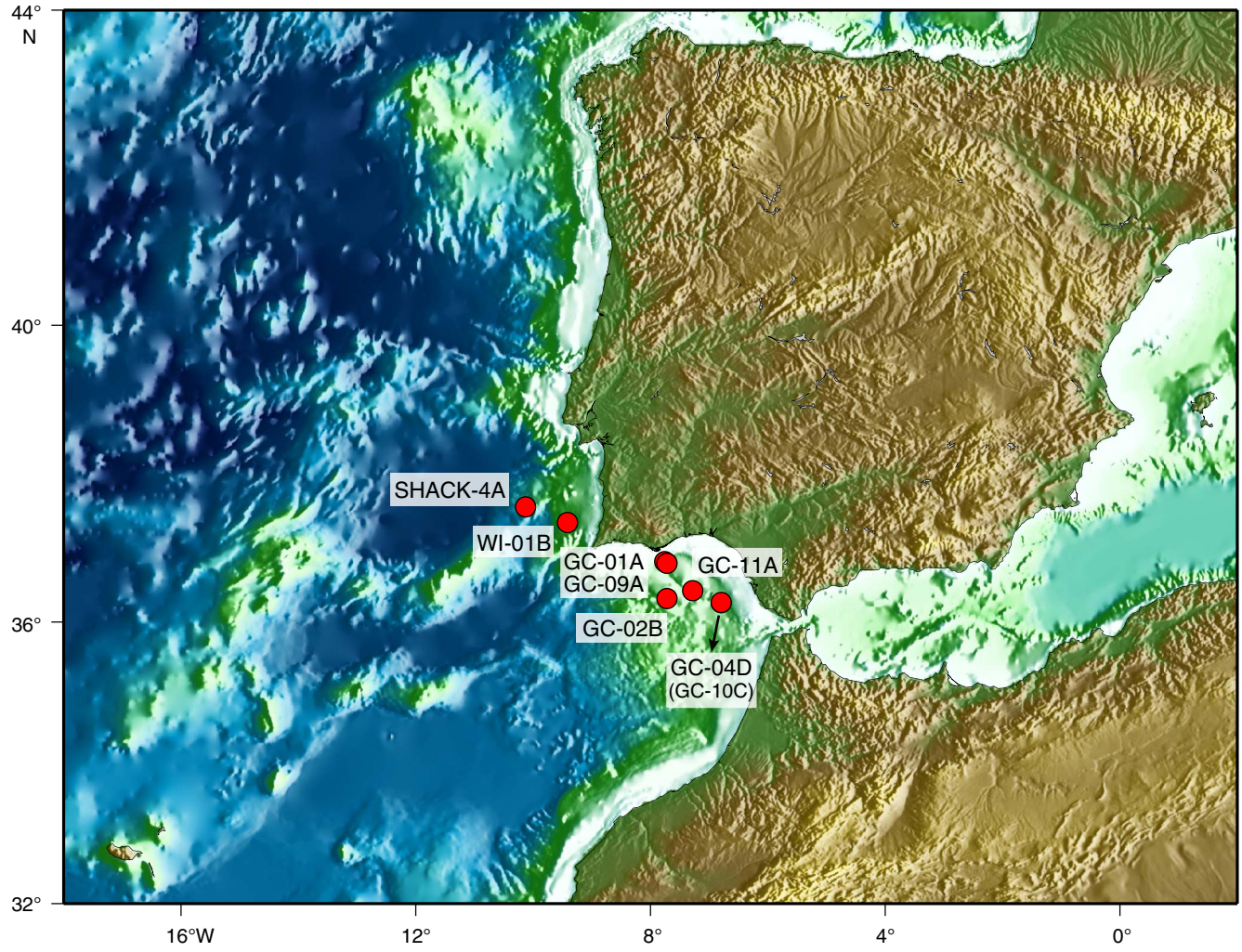
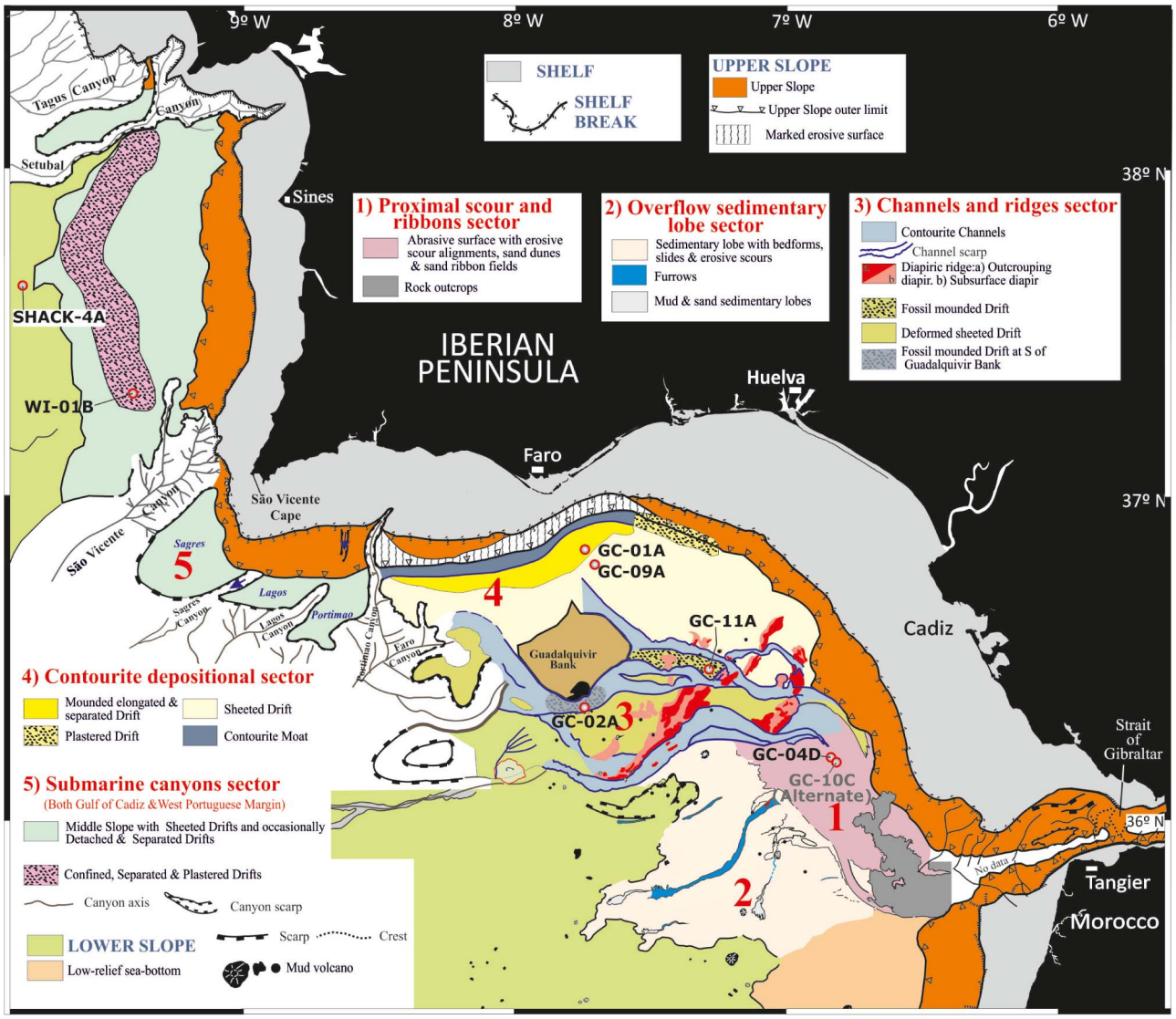


Figure F2. Regional map of the contourite depositional system on the middle slope of the Gulf of Cádiz and West Iberian margin with proposed site locations. Morphosedimentary sectors (1–5) based on Hernández-Molina et al. (2003, 2006) and S. Lebreiro (pers. comm., 2006).



Site summaries

Site GC-01A

Priority:	Primary site
Position:	Lat 36°49′41.29″N (36.828136°), Long 7°45′19.63″W (–7.7554527°) (WGS 84)
Water depth (m)	566
Target depth (mbsf):	526
Approved maximum penetration (mbsf):	526
Previous drilling in area:	None
Comments:	Jurisdiction: Portugal Potential hazards: shallow gas, shallow-water flow, soft seabed, strong currents
Survey coverage (track map, seismic profile)	• Bathymetric sketch and site location with seismic lines position on the contourite depositional system (Fig. **AF1**) • Sparker seismic reflection profile (Line FADO L-38) across the Faro-Albufeira Drift (Fig. **AF2**).
Objectives (see text for complete details):	• Recover complete Quaternary sedimentary record. • MOW upper core • Related to scientific objectives (1) Influence of the Gibraltar Gateway, (2) MOW paleoceanography and global climate significance, (3) sea level changes and sediment architecture
Drilling/coring program:	Double APC to refusal, then single XCB/RCB to 526 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, and clays

Site summaries (continued)

Site GC-09A

Priority:	Primary site
Position:	Lat 36°48′18.99″N (36.805275°), Long 7°43′08.56″W (–7.7190444°) (WGS 84)
Water depth (m)	567
Target depth (mbsf):	784
Approved maximum penetration (mbsf):	784
Previous drilling in area:	None
Comments:	Jurisdiction: Portugal Potential hazards: shallow gas, shallow-water flow, soft seabed, strong currents
Survey coverage (track map, seismic profile)	• Bathymetric sketch and site location with seismic lines position on the contourite depositional system (Fig. **AF1**) • Multichannel seismic reflection (MCS) profile (Line P74-45) across the Faro-Albufeira Drift (Fig. **AF3**).
Objectives (see text for complete details):	• Recover complete Pliocene sedimentary record. • MOW upper core • Related to scientific objectives (1) Influence of the Gibraltar Gateway, (2) MOW paleoceanography and global climate significance, (3) sea level changes and sediment architecture
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 784 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, clays, and marls

Site summaries (continued)

Site GC-04D

Priority:	Primary site
Position:	Lat 36°16′8.30″N (36.268972°), Long 6°47′39.47″W (–6.7942972°) (WGS 84)
Water depth (m)	670
Target depth (mbsf):	1550 (primary operation plan based on 1139 m penetration)
Approved maximum penetration (mbsf):	1550
Previous drilling in area:	None
Comments:	Jurisdiction: Spain Potential hazards: shallow gas, shallow-water flow, soft seabed, strong currents Relocation of previous proposed Site GC-04B due to its proximity to explosives dumping ground.
Survey coverage (track map, seismic profile)	• Bathymetric sketch with site location and seismic lines on the contourite depositional system on the middle slope of the Gulf of Cádiz (close to the Strait of Gibraltar) (Fig. **AF4**) • Multichannel seismic reflection (MCS) profile (Line S81A-16) across the middle slope (Fig. **AF5**).
Objectives (see text for complete details):	Influence of the Gibraltar Gateway on MOW during the Quaternary and late Pliocene
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 1550 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Mainly sands, but also silts and clays

Site summaries (continued)

Site GC-02B

Priority:	Primary site
Position:	Lat 36°19′02.38″N (36.3173277°), Long 7°43′04.89″W (–7.718025°) (WGS 84)
Water depth (m)	980
Target depth (mbsf):	350
Approved maximum penetration (mbsf):	350
Previous drilling in area:	None
Comments:	Jurisdiction: Portugal Potential hazards: shallow gas, shallow-water flow, soft seabed, strong currents
Survey coverage (track map, seismic profile)	• Bathymetric sketch with proposed Site GC-02B and seismic lines position on the contourite depositional system on the middle slope of the Gulf of Cádiz (Fig. **AF6**) • Multichannel seismic reflection (MCS) profile (Line Tasyo L-8) of the western area of the central sector of the middle slope (Fig. **AF7**)
Objectives (see text for complete details):	Synsedimentary neotectonic control on architecture and evolution of the contourite depositional system
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 350 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, clays, and marls

Site summaries (continued)

Site GC-11A

Priority:	Primary site
Position:	Lat 36°25′31.058″N (36.4252938°), Long 7°16′41.312″W (–7.2781422°) (WGS 84)
Water depth (m)	660
Target depth (mbsf):	991 (primary operations plan based on 650 m penetration)
Approved maximum penetration (mbsf):	990
Previous drilling in area:	None
Comments:	Jurisdiction: Spain Alternate to proposed Site GC-05B
Survey coverage (track map, seismic profile)	• Bathymetric sketch with site location and seismic lines position around proposed Site GC-11A on the contourite depositional system on the middle slope of the Gulf of Cádiz (Fig. **AF8**) • Multichannel seismic reflection (MCS) profile (Line HE91-20) across the sheeted Drifts (Fig. **AF9**)
Objectives (see text for complete details):	MOW lower core (Pliocene and Quaternary record)
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 650 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, and clays

Site summaries (continued)

Site WI-01B

Priority:	Primary site
Position:	Lat 37°21′32.53″N (37.35903611°), Long 9°24′39.41″W (–9.4109472°) (WGS 84)
Water depth (m)	1074
Target depth (mbsf):	675
Approved maximum penetration (mbsf):	675
Previous drilling in area:	None
Comments:	Jurisdiction: Portugal Potential hazards: shallow gas, shallow-water flow, soft seabed, strong currents
Survey coverage (track map, seismic profile)	• Bathymetric sketch with site and seismic lines positions on the contourite depositional system on the western Portuguese middle slope (Fig. **AF10**) • Multichannel seismic reflection (MCS) profile (Line PD00-522) across the plastered drift on the middle slope (Fig. **AF11**)
Objectives (see text for complete details):	Quaternary and Pliocene sedimentary record due to MOW in a distal part of the contourite system (West Iberian margin)
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 675 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, and clays

Site summaries (continued)

APL Site SHACK-04A

Priority:	Primary site
Position:	Lat 37°34.29′N (37.571475), Long 10°7.57′W (–10.12616) (WGS 84)
Water depth (m)	2578
Target depth (mbsf):	150
Approved maximum penetration (mbsf):	150
Previous drilling in area:	None
Comments:	Jurisdiction: Portugal Potential hazards: shallow gas, shallow-water flow, soft seabed, strong currents
Survey coverage (track map, seismic profile)	• Track lines for seismic Lines Steam-9407 and BS-09 indicating position of proposed Site SHACK-04A (Fig. **AF12**). • Seismic Line BS09 indicating the position of proposed Site SHACK-04A at shotpoint 3950 (Fig. **AF13**) • Seismic Line Steam-9407 showing the position of proposed Site SHACK-04A and depth of penetration (~150 mbsf) (Fig. **AF14**)
Objectives (see text for complete details):	• Recover millennial-scale marine reference section for the Pleistocene • Provide marine sediment analog to the polar ice cores • Reconstruct deep water circulation changes (i.e., mixing ratio of southern and northern component water) • Facilitate marine-terrestrial correlations • Construct an integrated stratigraphy
Drilling/coring program:	Quadruple APC to refusal, drillover Temperature measurements: APCT-3
Downhole logging program:	None
Anticipated lithology:	Hemipelagic muds

Site summaries (continued)

Site GC-10C

Priority:	Alternate site
Position:	Lat 36°16′1.28″N (36.267022°), Long 6°47′27.63″W (–6.7910083°) (WGS 84)
Water depth (m)	671
Target depth (mbsf):	990
Approved maximum penetration (mbsf):	990
Previous drilling in area:	None
Comments:	Jurisdiction: Spain Alternate to proposed Site GC-04D. Final alternate site approved by EPSP June 2011 of previous proposed Site GC-04B due to its proximity to an explosives dumping ground.
Survey coverage (track map, seismic profile)	• Bathymetric sketch of alternate proposed Site GC-10C and seismic lines position on the contourite depositional system on the middle slope of the Gulf of Cádiz (close to the Strait of Gibraltar) (Fig. **AF4**). • Airgun seismic reflection (MCS) profile (Line CADIZ-21) across the middle slope (Fig. **AF15**)
Objectives (see text for complete details):	Influence of the Gibraltar Gateway on MOW during the Quaternary and late Pliocene
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 990 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, and clays

Site summaries (continued)

Site GC-04C

Priority:	Alternate site
Position:	Lat 36°13′18″N (36.2703277°), Long 6°47′35.40″W (–6.7931666°) (WGS 84)
Water depth (m)	671
Target depth (mbsf):	1139 (primary operation plan based on 1139 m penetration)
Approved maximum penetration (mbsf):	1550 (pending EPSP approval)
Previous drilling in area:	None
Comments:	Jurisdiction: Spain Alternate site to proposed Site GC-04D. Final alternate site approved by EPSP June 2011 of previous proposed Site GC-04B due to its proximity to an explosives dumping ground.
Survey coverage (track map, seismic profile)	• Bathymetric sketch with site location and seismic lines on the contourite depositional system on the middle slope of the Gulf of Cádiz (close to the Strait of Gibraltar) (Fig. **AF4**) • Multichannel seismic reflection (MCS) profile (Line CADIZ-21) across the middle slope (Fig. **AF5**).
Objectives (see text for complete details):	Influence of the Gibraltar Gateway on MOW during the Quaternary and late Pliocene
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 1550 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, and clays

Site summaries (continued)

Site GC-10B

Priority:	Alternate site
Position:	Lat 36°16′7.15″N (36.2686527°), Long 6°47′23.5″W (–6.7898611°) (WGS 84)
Water depth (m)	671
Target depth (mbsf):	990
Approved maximum penetration (mbsf):	990 (pending EPSP approval)
Previous drilling in area:	None
Comments:	Jurisdiction: Spain Alternate site to proposed Site GC-04D. Final alternate site approved by EPSP June 2011 of previous Site GC-04B due to its proximity to an explosives dumping ground.
Survey coverage (track map, seismic profile)	• Bathymetric sketch of alternate proposed Site GC-10C and seismic lines position on the contourite depositional system on the middle slope of the Gulf of Cádiz (close to the Strait of Gibraltar) (Fig. **AF4**). • Airgun seismic reflection (MCS) profile (Line CADIZ-21) across the middle slope (Fig. **AF15**)
Objectives (see text for complete details):	Influence of the Gibraltar Gateway on MOW during the Quaternary and late Pliocene
Drilling/coring program:	Double APC to refusal, then single XCB/RCB hole to 990 mbsf Temperature measurements: APCT-3
Downhole logging program:	Standard tools: triple combo, FMS-sonic, VSI
Anticipated lithology:	Sands, silts, and clays

Figure AF1. Bathymetric sketch with proposed Sites GC-01A and GC-09A on the contourite Depositional System on the middle slope of the Gulf of Cádiz.

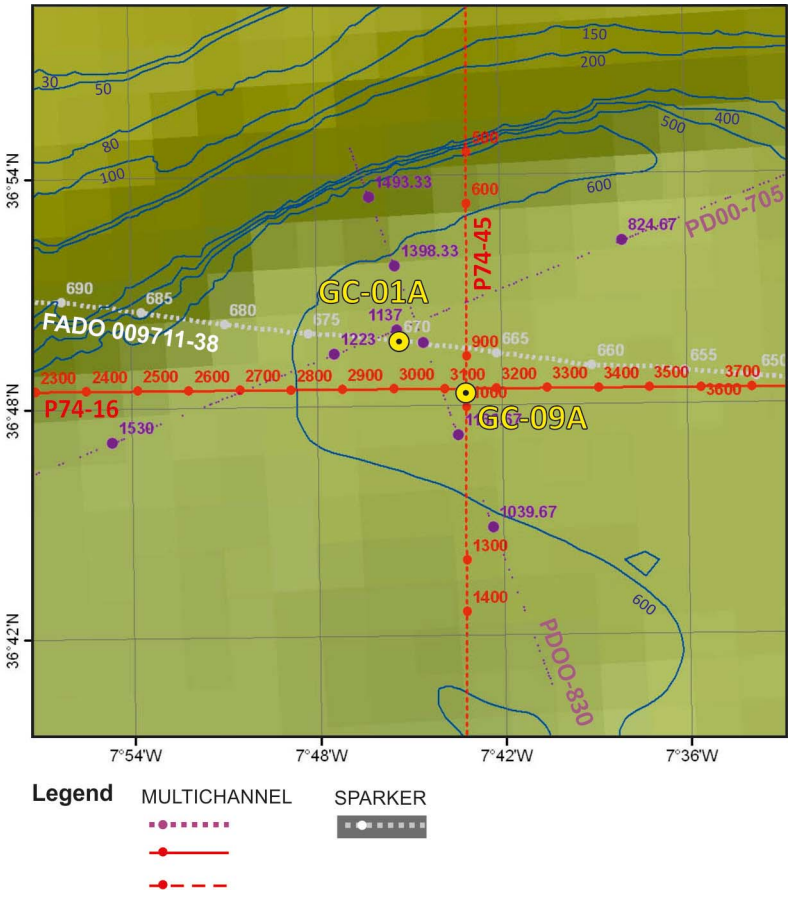


Figure AF2. Sparker seismic reflection profile (Line FADO L-38) across the Faro-Albufeira drift on the middle slope showing location of proposed Site GC-01A. Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: LPR (early Pliocene?), QBD (base of the Quaternary?), and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation.

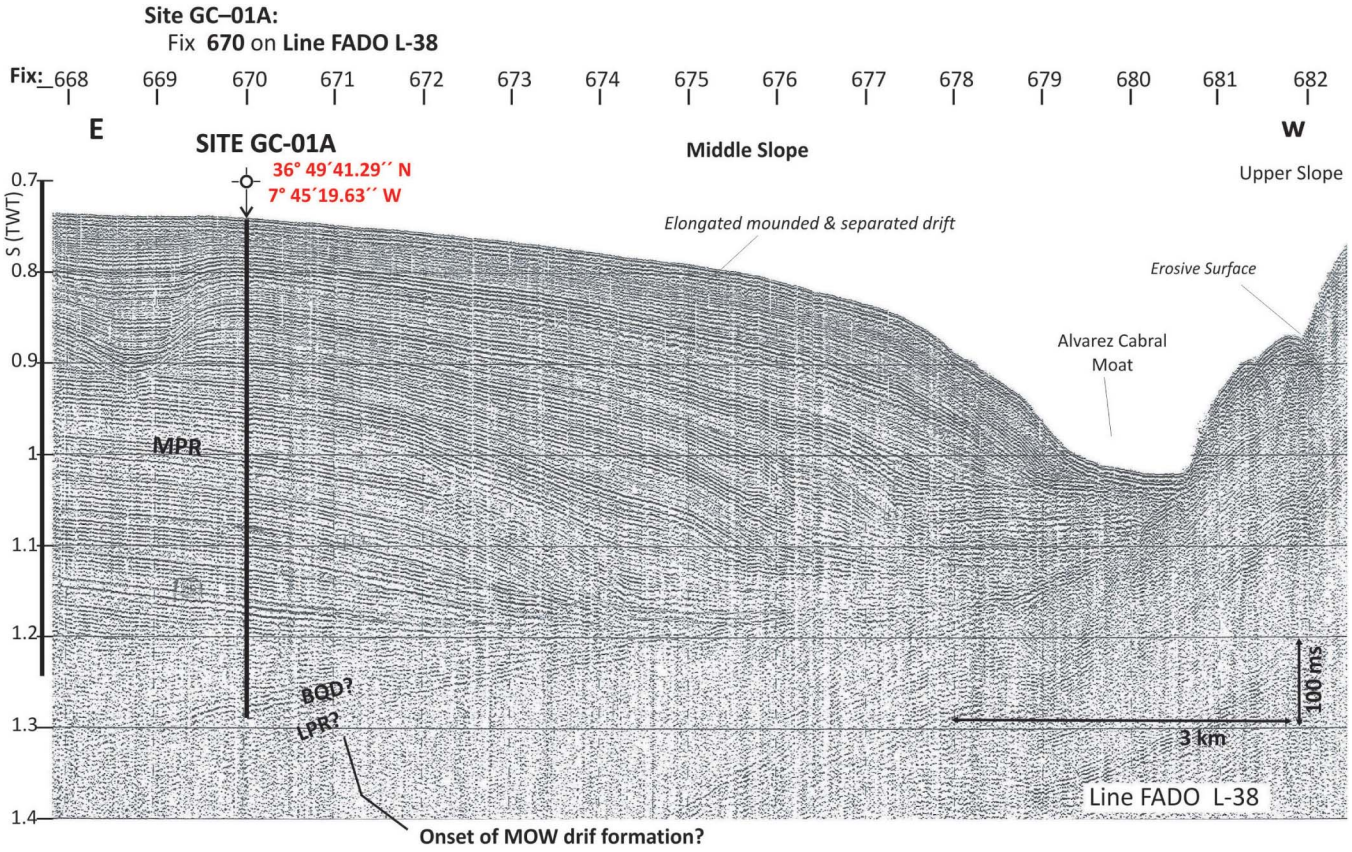


Figure AF3. Multichannel seismic (MCS) reflection profile (Line P74-45) across the Faro-Albufeira drift on the middle slope showing location of proposed GC-09A (MCS lines provided by REPSOL Oil Company). Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: M (late Messinian) LPR (early Pliocene?), QBD (base of the Quaternary?), and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation. TWT = two-way traveltime. MOW = Mediterranean Outflow Water.

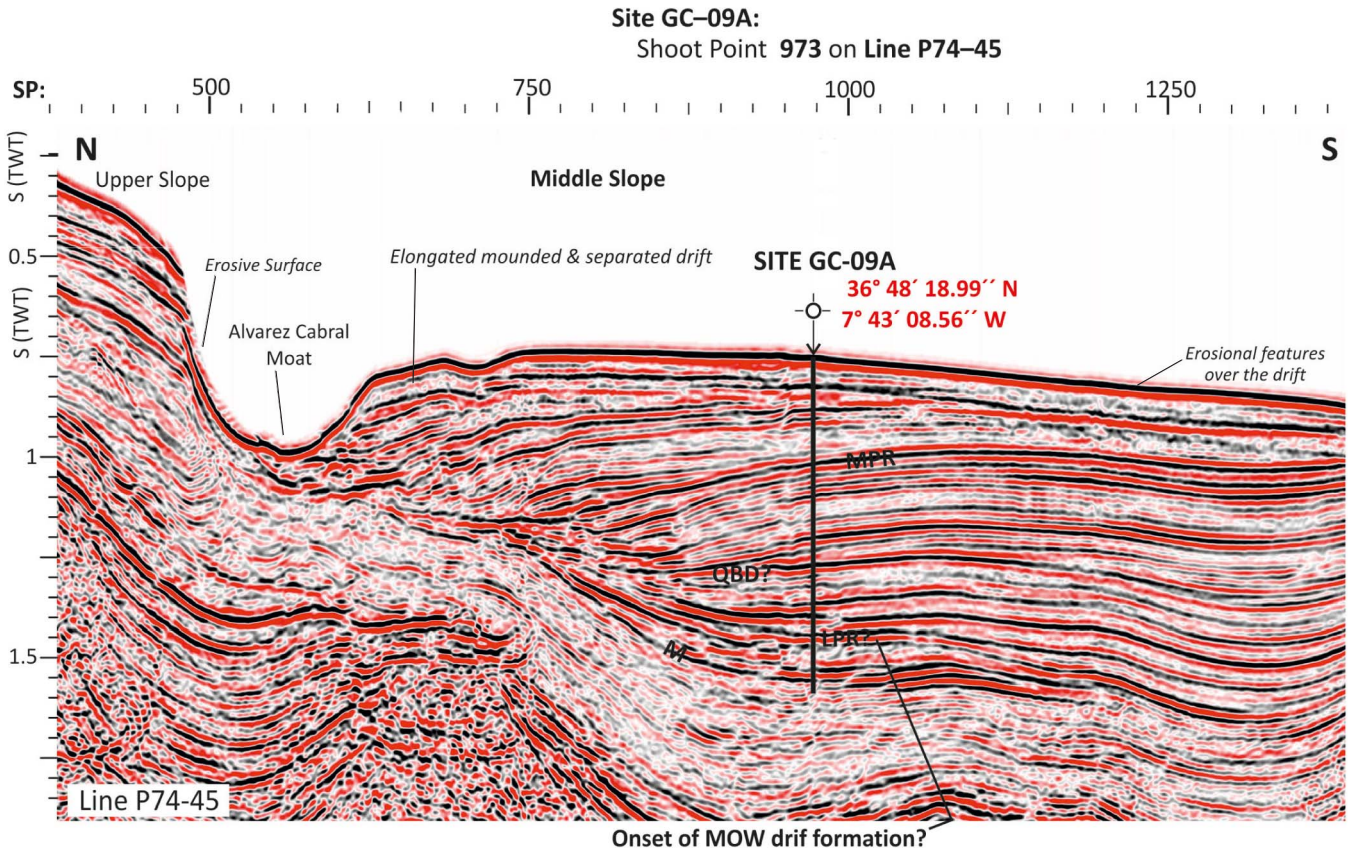


Figure AF4. Bathymetric sketch with proposed Sites GC-04C, GC-04D, GC-10B, and GC-10C on the contourite Depositional System on the middle slope of the Gulf of Cádiz (close to the Strait of Gibraltar).

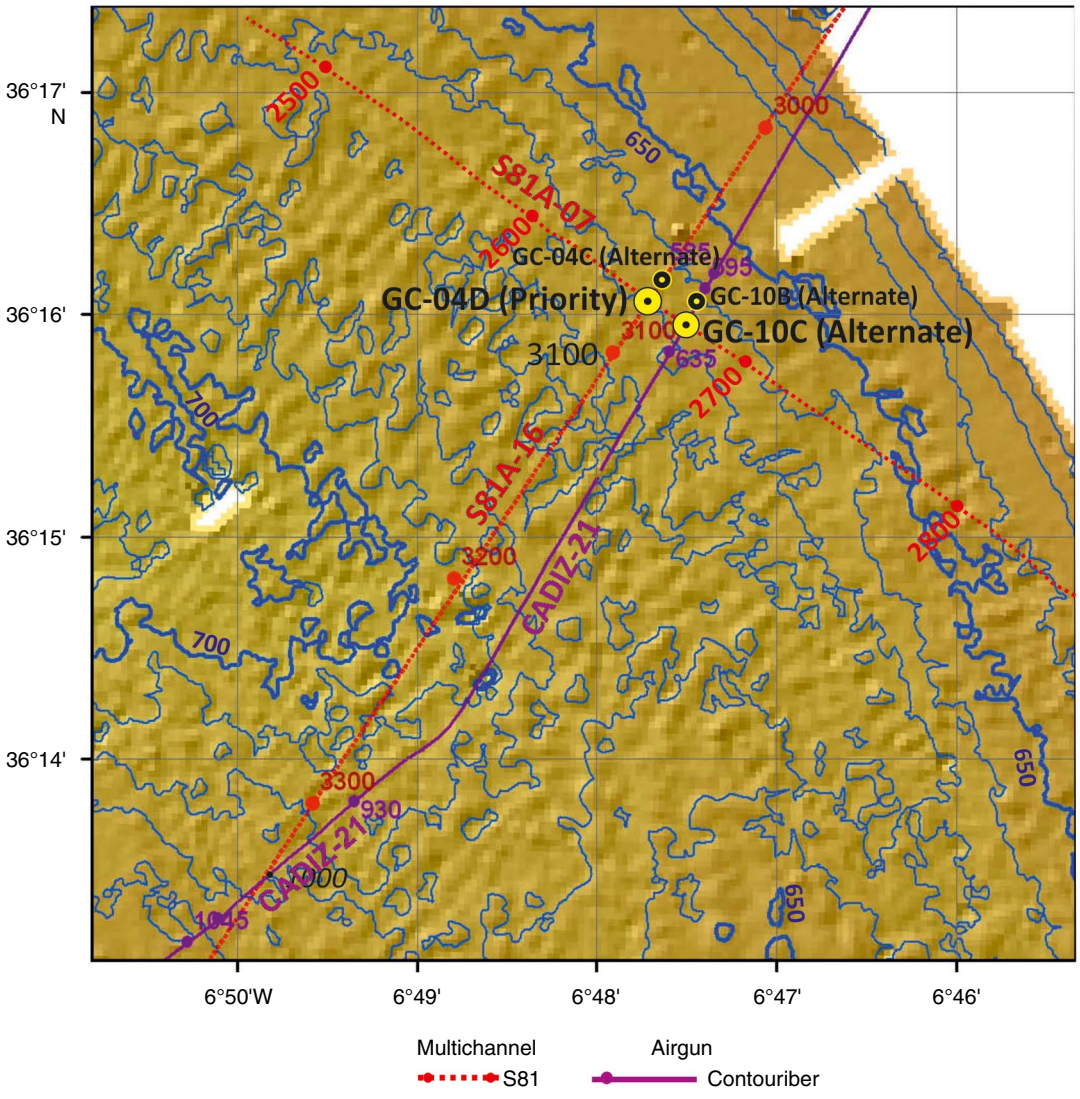


Figure AF5. Multichannel seismic (MCS) reflection profile (Line S81A-16) across the middle slope showing the location of proposed Sites GC-04C and GC-04D (MCS lines provided by REPSOL-YPF Oil Company). Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: LPR (early Pliocene?), QBD (base of the Quaternary?), and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation. TWT = two-way traveltime.

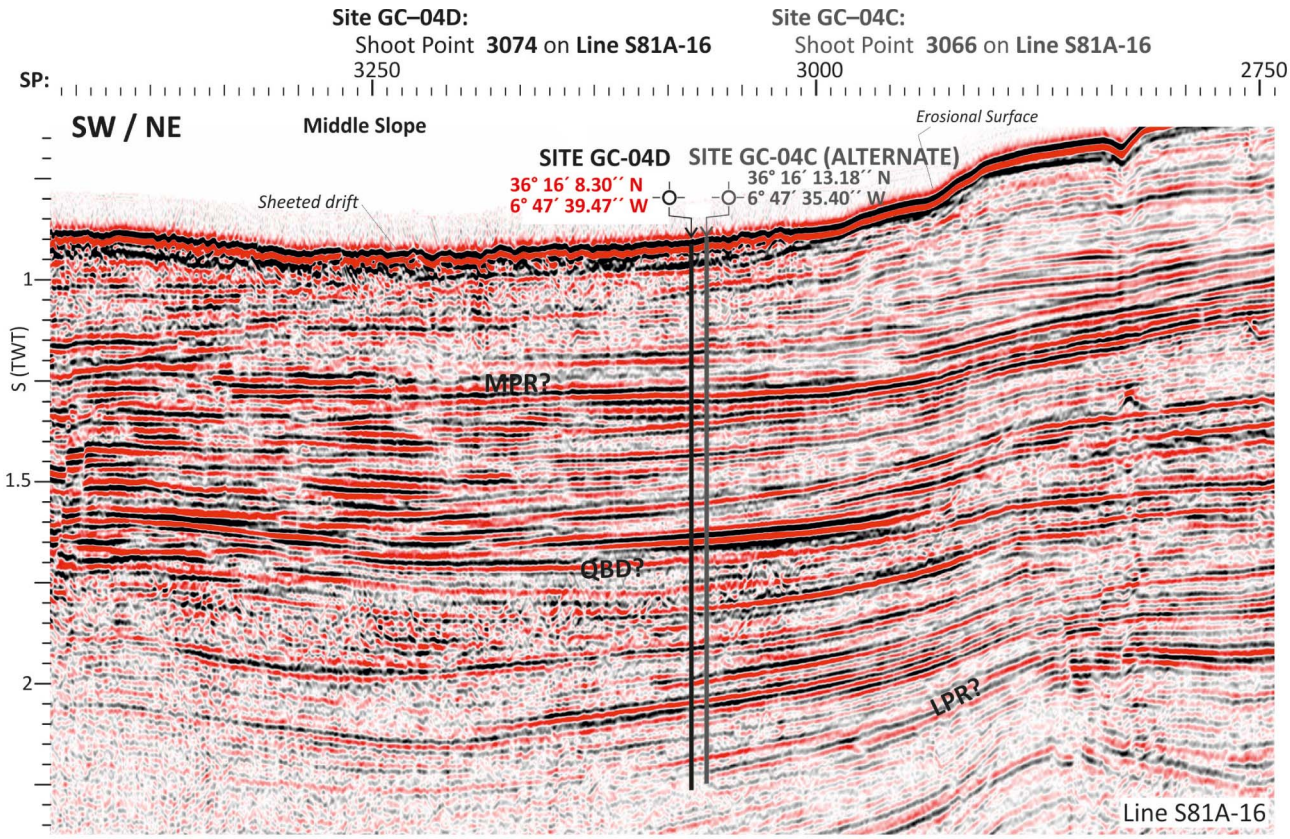


Figure AF6. Bathymetric sketch with proposed Site GC-02B on the contourite depositional system on the middle slope of the Gulf of Cádiz.

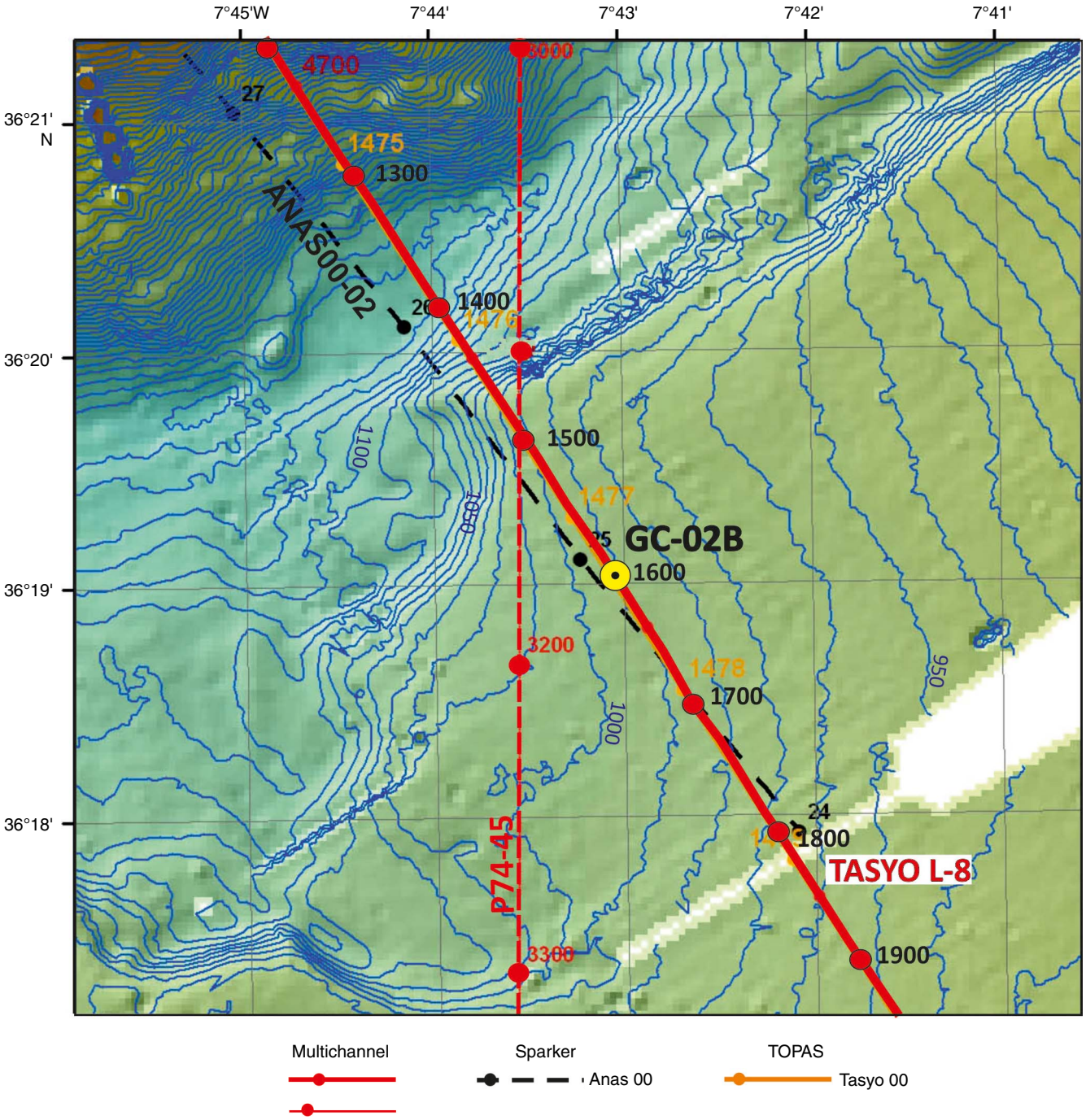


Figure AF7. Multichannel seismic (MCS) reflection profile (Line Tasyo L-8) of the western area of the central sector of the middle slope showing the location of proposed Site GC-02B (TASYO Project). Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: QBD (base of the Quaternary?) and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation. TWT = two-way traveltime.

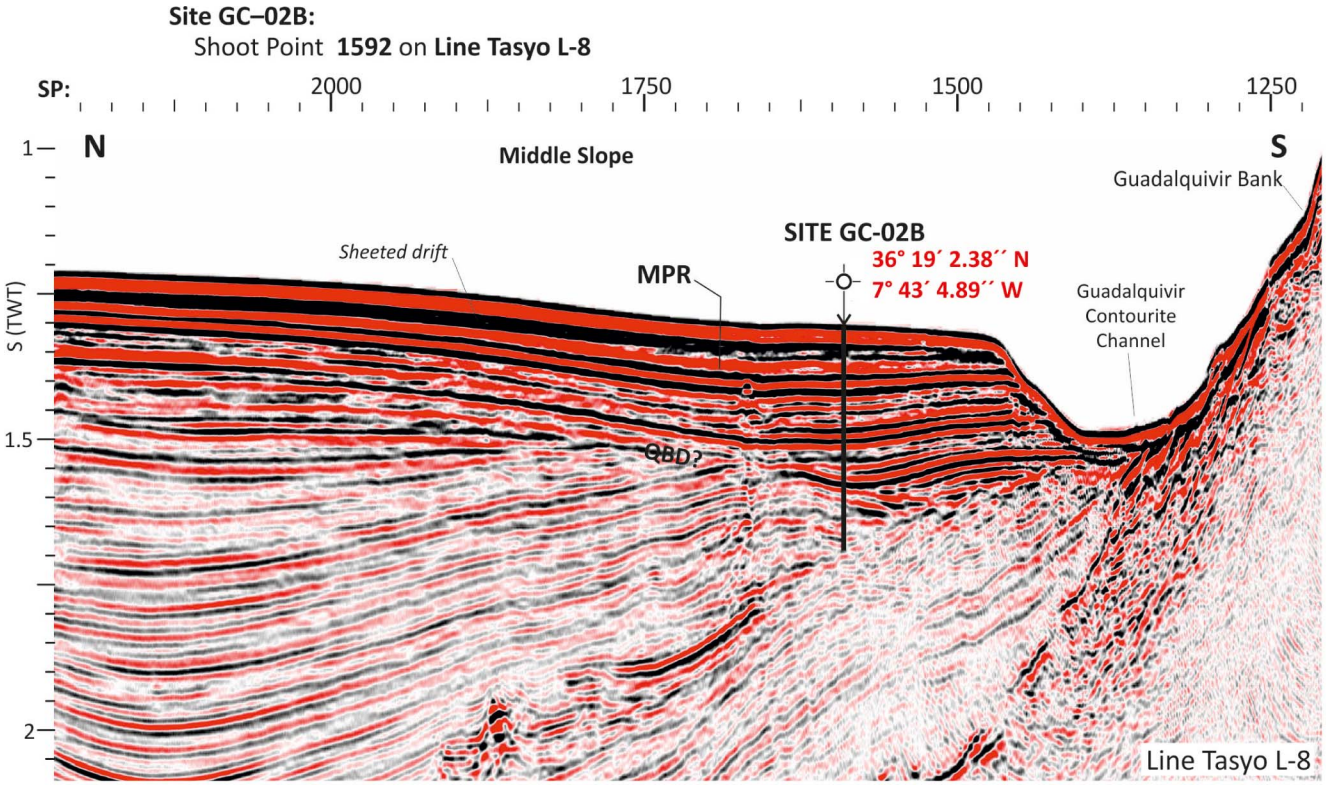


Figure AF8. Bathymetric sketch with proposed Site GC-11A on the contourite depositional system on the middle slope of the Gulf of Cádiz.

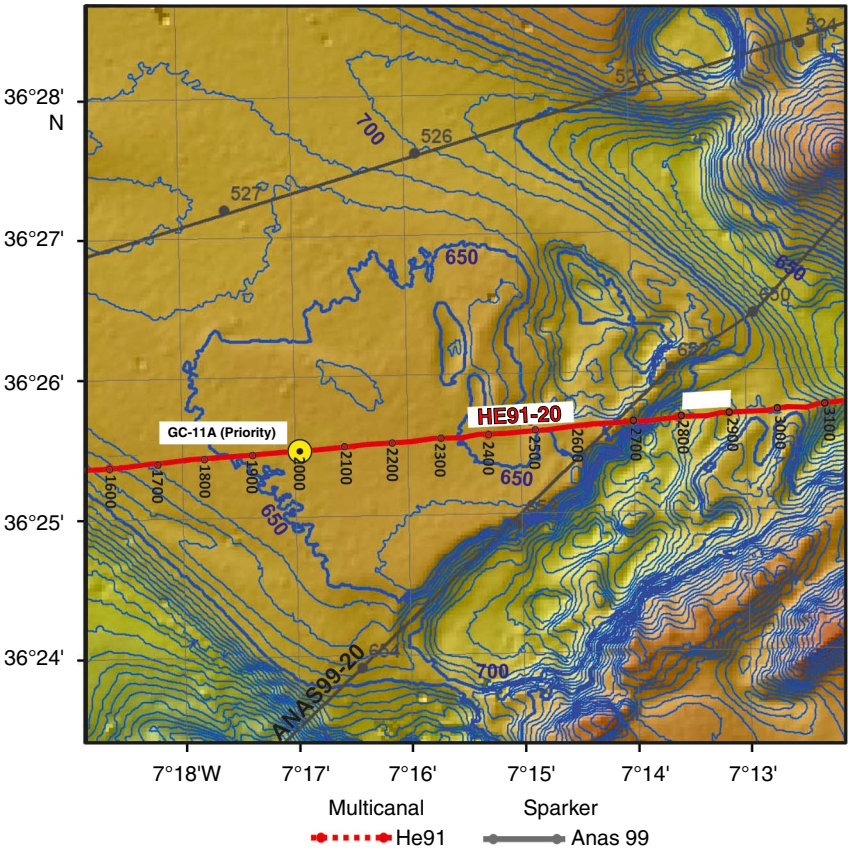


Figure AF9. Multichannel seismic (MCS) reflection profile (Line HE91-20) across the sheeted drifts showing the location of proposed Site GC-11A (MCS lines provided by REPSOL Oil Company). Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: LPR (early Pliocene?), QBD (base of the Quaternary?) and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation. TWT = two-way traveltime.

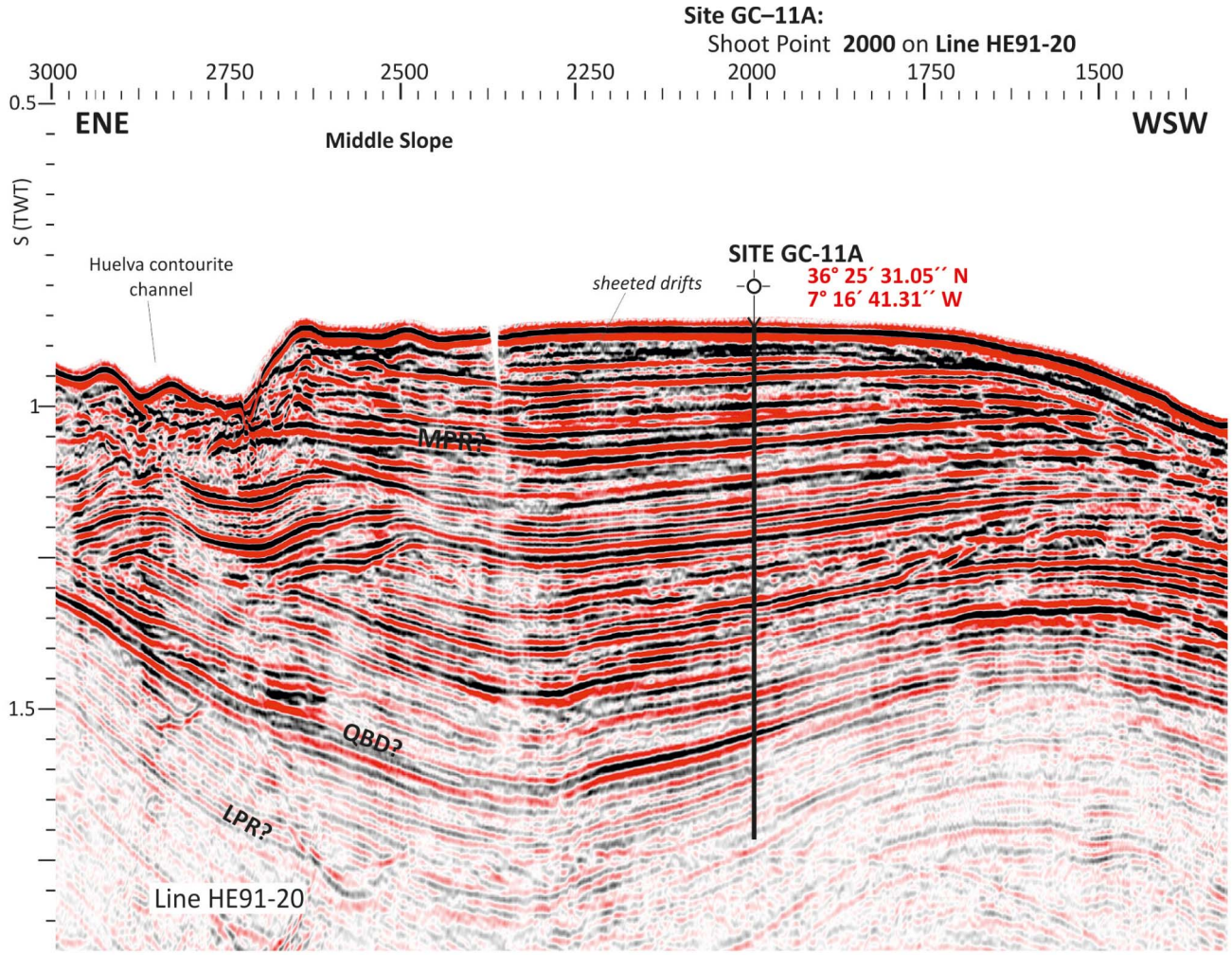


Figure AF10. Simplified bathymetric sketch with proposed Site WI-01B on the contourite depositional system on the western Portuguese middle slope.

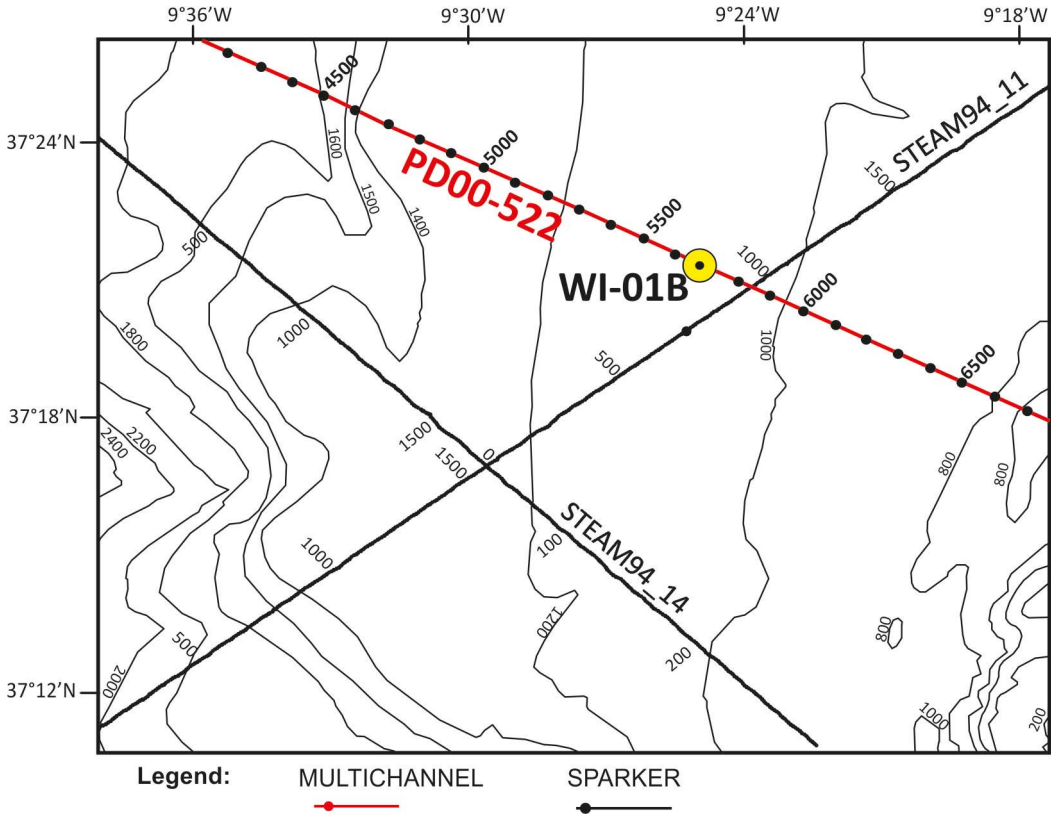


Figure AF11. Multichannel seismic (MCS) reflection profile (Line PD00-522) across the plastered drift on the middle slope showing the location of proposed Site WI-01B (MCS lines provided by TGS-NOPEC Oil Company). Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: M (late Messinian), QBD (base of the Quaternary?) and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation. TWT = two-way traveltime.

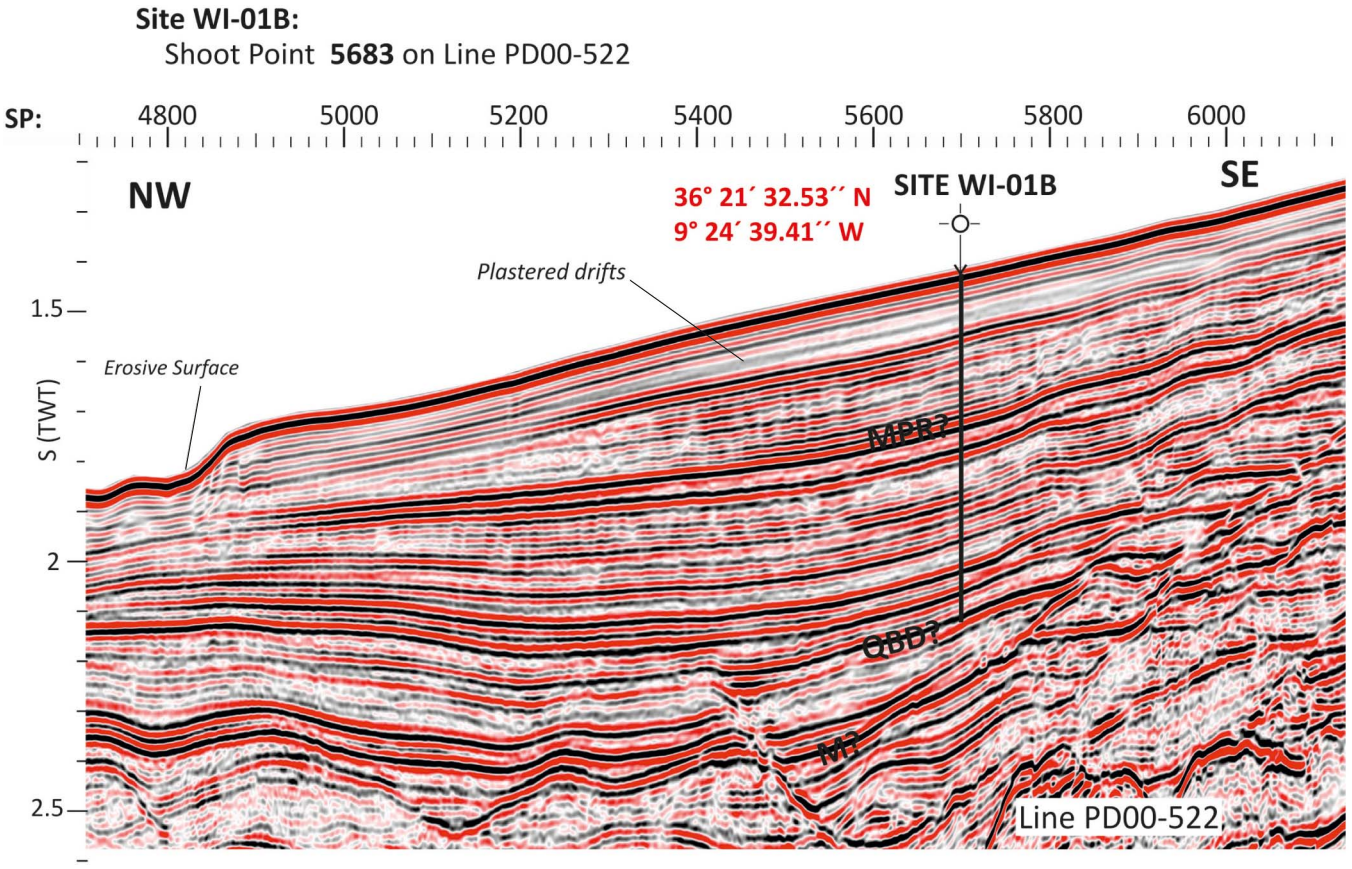


Figure AF12. Track lines for seismic Lines Steam-9407 and BS-09 indicating position of proposed Site SHACK-04A.

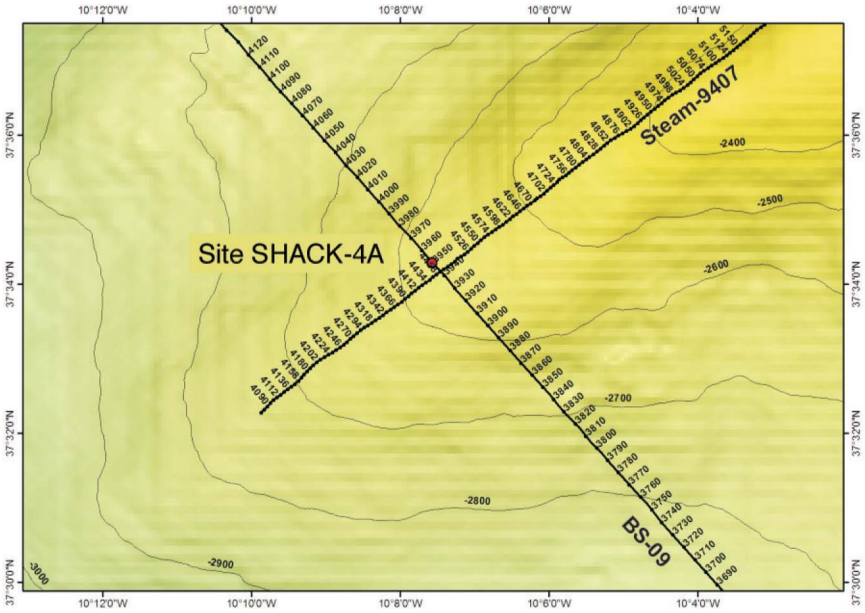


Figure AF13. Seismic Line BS09 indicating the position of proposed Site SHACK-04A at shotpoint 3950.

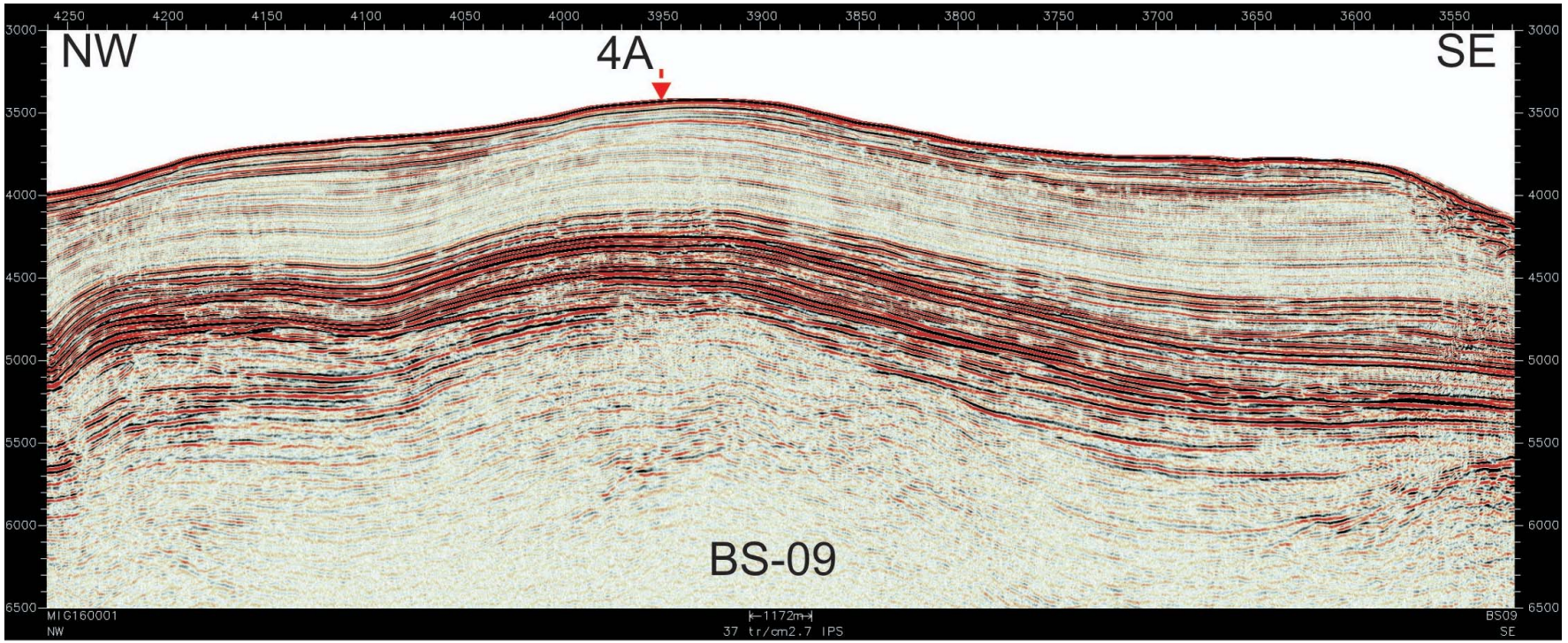


Figure AF14. Seismic Line Steam-9407 showing the position of proposed Site SHACK-04A and depth of penetration (~150 mbsf).

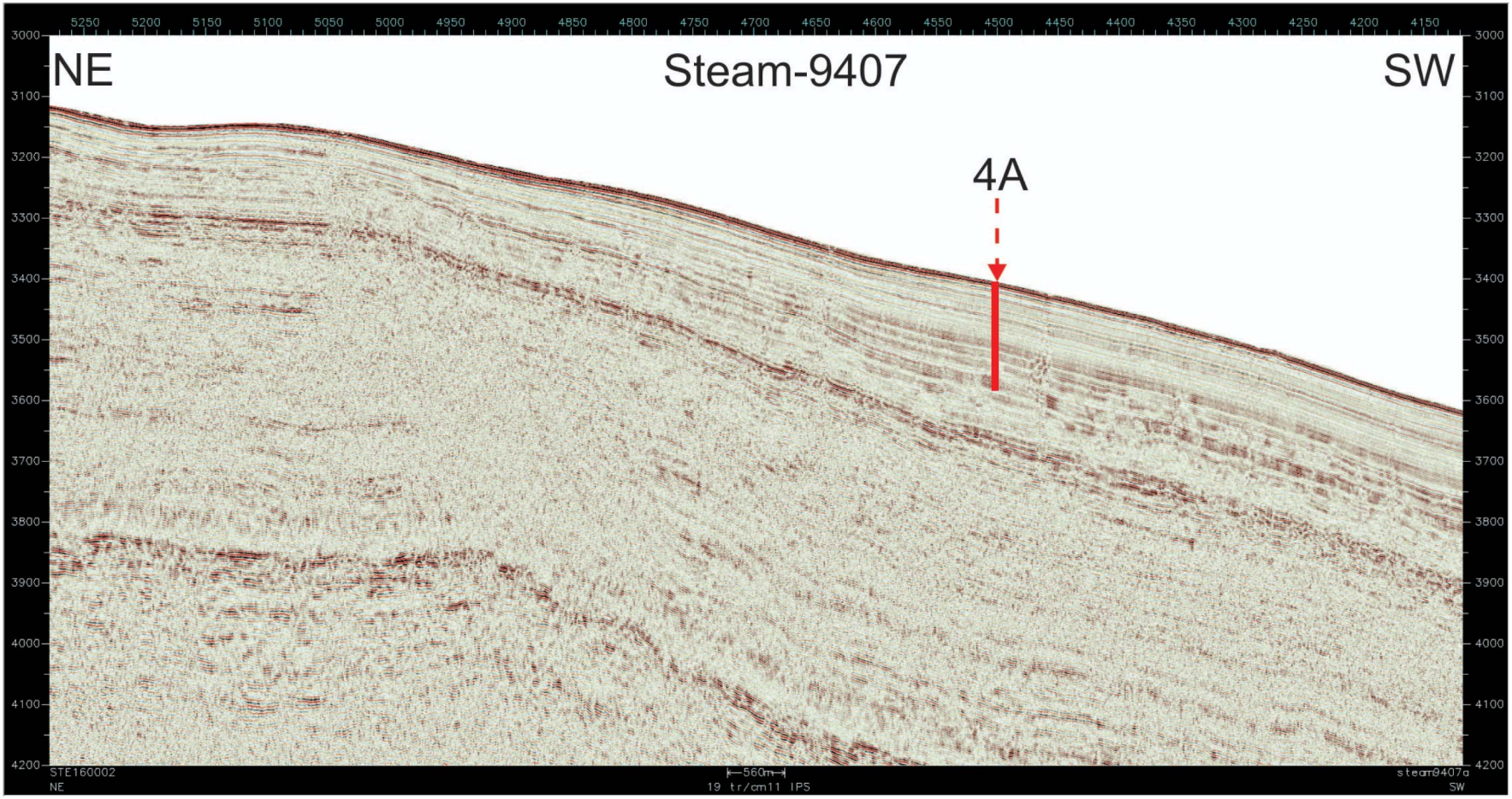


Figure AF15. Multichannel seismic (MCS) reflection profile (Line CADIZ-21) across the middle slope (CONTOURIBER Project) showing the location of proposed Sites GC-10B and GC-10C. Four major low-resolution depositional sequences have been recognized in the Pliocene and Quaternary sedimentary record (Llave et al., 2001; Hernández-Molina et al., 2002, 2006) and are separated by four relevant discontinuities: QBD (base of the Quaternary?) and MPR (mid-Pleistocene?). LPR erosive discontinuity could represent the onset of drift formation. TWT= two-way traveltime.