International Ocean Discovery Program
Expedition 383 Scientific Prospectus Addendum

Dynamics of the Pacific Circumpolar Current (DYNAPACC)

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Introduction

This addendum to the International Ocean Discovery Program (IODP) *Expedition 383 Scientific Prospectus* (Dynamics of the Pacific Antarctic Circumpolar Current; Lamy et al., 2018) addresses the results of the safety review of 10 new proposed drill sites by the IODP Environmental Protection and Safety Panel (EPSP) on 4–6 September 2018 and a change to the operations plan and the end port call for Expedition 383.

Because of an adjustment to the R/V *JOIDES Resolution* 2018–2019 operations schedule, the end port for Expedition 383 has changed from Valparaiso, Chile, to Punta Arenas, Chile. Therefore, at the time of publication of this addendum, the expedition is scheduled to start and end in Punta Arenas, Chile. The dates of the expedition remain unchanged from the original *Expedition 383 Scientific Prospectus* (Lamy et al., 2018), from 20 May to 20 July 2019. The change in port reduces the distance and hence the transit time between the last drill site in the central South Pacific and the port in Chile, providing ~3 additional days for scientific drilling operations. For that reason, a new proposed primary site (CSP-7A) in the central South Pacific has been added to the original operations plan from Lamy et al. (2018), bringing the total number of primary sites planned for Expedition 383 to seven (Figures **F1**, **F2**, **F3**, **F4**).

The current operations plan and time estimates include 5 days of port call activities, 38.2 days of operations, and 17.7 days of transit.

Site evaluation by the Environmental Protection and Safety Panel

After consultation and guidance from the EPSP in September 2018, all 10 pending proposed sites in the *Scientific Prospectus* (Lamy et al. 2018) were approved as requested, including five sites along the Chilean margin (CHI-1C [primary], CHI-5A, CHI-6A, CHI-7A, and CHI-8A), one site in the eastern South Pacific (ESP-2A), and four sites in the central South Pacific Ocean (CSP-4A, CSP-5A, CSP-6A, and CSP-7A [primary]). Table **T1** shows all primary and alternate sites with their locations, approved penetration depths, anticipated lithologies, and scientific objectives.

Operations plan/drilling strategy

Expedition 383 aims to achieve an ambitious coring program that prioritizes seven primary sites and eight alternate sites in 1060–5141 m of water (Tables **T1**, **T2**). Four proposed primary sites (CSP-1A, CSP-2B, CSP-3A, and CSP-7A) are located in the central South Pacific between the modern Polar Front and the Subantarctic Zone at water depths ranging from 3600 to 5141 m. The three other proposed primary sites (CHI-1C, CHI-4B, and ESP-1B) are positioned along the Chilean margin close to the Drake Passage in ~1100 to ~3900 m of water on a depth transect across the major Southern Ocean water masses. The sites are located at latitudes and water depths where sediments will allow the application of a wide range of siliciclastic, carbonate, and opal-based proxies for reconstructing surface to deep-ocean variations and their relation to atmosphere and cryosphere changes with unprecedented stratigraphic detail. For details, see the original Expedition 383 Scientific Prospectus (Lamy et al., 2018).

The planned coring/drilling strategy is designed for recovering sediment sequences suitable for high-resolution studies. Therefore, we will primarily use the *JOIDES Resolution's* advanced piston corer (APC) system and nonmagnetic core barrels to deepen three holes (A, B, and C) at each site. Each hole will be APC cored to ~300 meters below seafloor (mbsf) or to APC refusal depth (except for proposed Sites CSP-1A (180 m) and CSP-7A (100 m), which have shallower depth objectives). For proposed Sites CHI-4B and ESP-1B, which have deeper depth objectives (500 and 400 mbsf, respectively), the half-length APC (HLAPC) coring system could be deployed in favor of the extended core barrel (XCB) system until HLAPC refusal. The HLAPC coring system uses a 4.7 m long core barrel and can be deployed after APC refusal to attain significantly greater continuous APC sampling depths than would otherwise be possible. During use of the HLAPC system, the same criteria for APC refusal are applied, at which point the XCB system would be deployed to reach the target depth. However, the final operations plan and number of sites and holes to be cored are contingent upon the *JOIDES Resolution* operations schedule, weather during the expedition, and operational risks (see Lamy et al., 2018), as well as the outcome of a request to occupy the sites in Chilean territorial waters. The long transit to the central Pacific Ocean is of particular relevance because, should ship speed be less than the estimated average of 10.5 kt, the drilling schedule could be significantly impacted. An updated operations plan with time estimates is shown in Table **T2**.

For specific information on the scientific objectives of each individual site, please refer to the original *Scientific Prospectus* (Lamy et al., 2018) and the **Site summaries**.

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Table T1. Proposed primary and alternate sites, Expedition 383. Bold = primary sites. EPSP = Environmental Protection and Safety Panel. ACC = Antarctic Circumpolar Current, CHC = Cape Horn Current. PDW = Pacific Deep Water, AABW = Antarctic Bottom Water, CDW = Circumpolar Deep Water. SST = sea-surface temperature, IRD = ice-rafted debris.

Site	Latitude (°S)	Longitude (°W)	Water depth (m)	Proposed penetration (mbsf)	EPSP approved penetration (mbsf)	Scientific objectives	Anticipated lithology	Jurisdiction
Chile margin								
CHI-1C	**−55.5367**	**−71.5931**	**2093**	**300**	**300**	• High-resolution Pleistocene paleoceanography • Northern ACC strength before entering Drake Passage • Core of PDW, transition to CDW • Patagonian ice sheet dynamics	Calcareous clayey silt with minor IRD during glacials; fine grain turbidites possible	Chile
CHI-6A	−55.6036	−71.4647	2100	300	300			
CHI-4B	**−52.7048**	**−75.5965**	**1100**	**500**	**500**	• High-resolution Pleistocene paleoceanography • Northern ACC strength before entering Drake Passage, CHC • Reconstruction of intermediate water mass properties • Patagonian ice sheet dynamics		
CHI-5A	−52.7227	−75.6077	1170	500	500			
CHI-7A	−52.7448	−75.6232	1250	500	500			
CHI-8A	−52.6929	−75.5882	1060	200	200			
Eastern South Pacific								
ESP-1B	**−54.5844**	**−76.6765**	**3870**	**400**	**400**	• Plio/Pleistocene (Miocene) paleoceanography • Northern ACC strength before entering Drake Passage, CHC • Reconstruction of AABW properties • Long-term Patagonian ice sheet dynamics	Calcareous ooze and clay	Chile
ESP-2A	−54.5534	−76.5213	3850	400	400			
Central South Pacific								
CSP-1A	**−54.2126**	**−125.4258**	**3610**	**180**	**230**	• Across polar and subantarctic frontal transect • Moderate to high-resolution subantarctic late Miocene–Quaternary carbonate records from AABW and CDW • Subantarctic SST, water mass pCO_2, productivity record • Record of dust/iron fertilization in the South Pacific	Silty clay bearing siliceous and calcareous ooze	International
CSP-2B	**−56.151**	**−115.1341**	**4110**	**300**	**300**			
CSP-4A	−56.1859	−115.1922	4110	300	300			
CSP-6A	−55.1582	−114.7887	3570	125	125			
CSP-7A	**−55.1411**	**−114.8420**	**3540**	**150**	**100**			
CSP-3A	**−60.7361**	**−115.9063**	**5141**	**300**	**300**		Siliceous ooze	Antarctic treaty
CSP-5A	−60.7786	−116.0003	5130	300	300			

Table T2. Operations and time estimates for Expedition 383. EPSP = Environmental Protection and Safety Panel, APCT-3 = advanced piston corer temperature tool, APC = advanced piston corer, XCB = extended core barrel, HLAPC = half-length APC.

Site No.	Location (Latitude Longitude)	Seafloor Depth (mbrf)	Operations Description	Transit (days)	Drilling Coring (days)	Logging (days)
Punta Arenas			Begin Expedition 5.0 port call days			
			Transit ~235 nmi toCHI-4B@ 10.5	0.9		
CHI-4B	52° 42.2880' S	1111	Hole A - APC 300 mbsf w/APCT3	0.0	1.4	0.0
EPSP	75° 35.7900' W		Hole B - APC 300 mbsf	0.0	0.9	0.0
to 500 mbsf			Hole C - APC/XCB to 500 mbsf and log with modified triple combo	0.0	1.9	0.5
			Sub-Total Days On-Site: 4.7			
			Transit ~136nmi to(Waypoint Name)@ 10.5	0.5		
			Transit ~85nmi toCHI-1C@ 10.5	0.3		
CHI-1C	55° 32.2002' S	2091	Hole A - APC 300 mbsf w/APCT3	0.0	1.5	0.0
EPSP	71° 35.5836' W		Hole B - APC 300 mbsf	0.0	1.2	0.0
to 0 mbsf			Hole C - APC 300 mbsf and log with modified triple combo	0.0	1.4	0.4
			Sub-Total Days On-Site: 4.6			
			Transit ~184nmi toESP-1B@ 10.5	0.7		
ESP-1B	54° 35.0640' S	3881	Hole A - APC/HLAPC 400 mbsf w/APCT3	0.0	2.9	0.0
EPSP	76° 40.5900' W		Hole B - APC/HLAPC 400 mbsf	0.0	2.4	0.0
to 400 mbsf			Hole C - APC/HLAPC 400 mbsf and log with modified triple combo	0.0	2.6	0.5
			Sub-Total Days On-Site: 8.5			
			Transit ~1290nmi toCSP-3A@ 10.5	5.1		
CSP-3A	60° 44.1660' S	5141	Hole A - APC to 300 mbsf w/APCT3	0.0	2.6	0.0
EPSP	115° 54.3780' W		Hole B - APC to 300 mbsf	0.0	2.1	0.0
to 300 mbsf			Hole C - APC to 300 mbsf	0.0	2.6	0.0
			Sub-Total Days On-Site: 7.3			
			Transit ~496nmi toCSP-1A@ 10.5	2.0		
CSP-1A	54° 12.7560' S	3621	Hole A - APC to 180 mbsf w/APCT3	0.0	1.5	0.0
EPSP	125° 25.5480' W		Hole B - APC to 180 mbsf	0.0	1.1	0.0
to 230 mbsf			Hole C - APC to 180 mbsf	0.0	1.6	0.0
			Sub-Total Days On-Site: 4.2			
			Transit ~371nmi toCSP-2B@ 10.5	1.5		
CSP-2B	56° 9.0600' S	4111	Hole A - APC to 300 mbsf w/APCT3	0.0	2.3	0.0
EPSP	115° 8.0460' W		Hole B - APC to 300 mbsf	0.0	1.8	0.0
to 300 mbsf			Hole C - APC to 300 mbsf	0.0	2.2	0.0
			Sub-Total Days On-Site: 6.4			
			Transit ~61nmi toCSP-7A@ 10.5	0.2		
CSP-7A	55° 8.4666' S	3551	Hole A - APC to 100 mbsf w/APCT3	0.0	1.0	0.0
EPSP	114° 50.5182' W		Hole B - APC to 100 mbsf	0.0	0.7	0.0
to 150 mbsf			Hole C - APC to 100 mbsf	0.0	0.9	0.0
			Sub-Total Days On-Site: 2.6			
			Transit ~1609 nmi toPunta Arenas@ 10.5	6.4		
Punta Arenas			End Expedition	17.7	36.7	1.5

Port Call:	5.0	Total Operating Days:	55.9
Sub-Total On-Site:	38.2	Total Expedition:	60.9

Figure F1. Antarctic Circumpolar Current (from Marshall and Speer, 2012) and the Expedition 383 drill sites. The climatological positions of the Subantarctic Front (SAF) and Polar Front (PF) are marked in orange; line thickness represents the variability in the latitudinal position of the corresponding front. Green arrows indicate the observed speed and direction of surface ocean currents as measured by drifters floating at a depth of 15 m. Red shaded area indicates estimated glacial dust supply, based on reconstructions from Lamy et al. (2014). Red dots indicate the planned drill sites for Expedition 383; the seven primary sites are noted in a larger font. NZ = New Zealand.

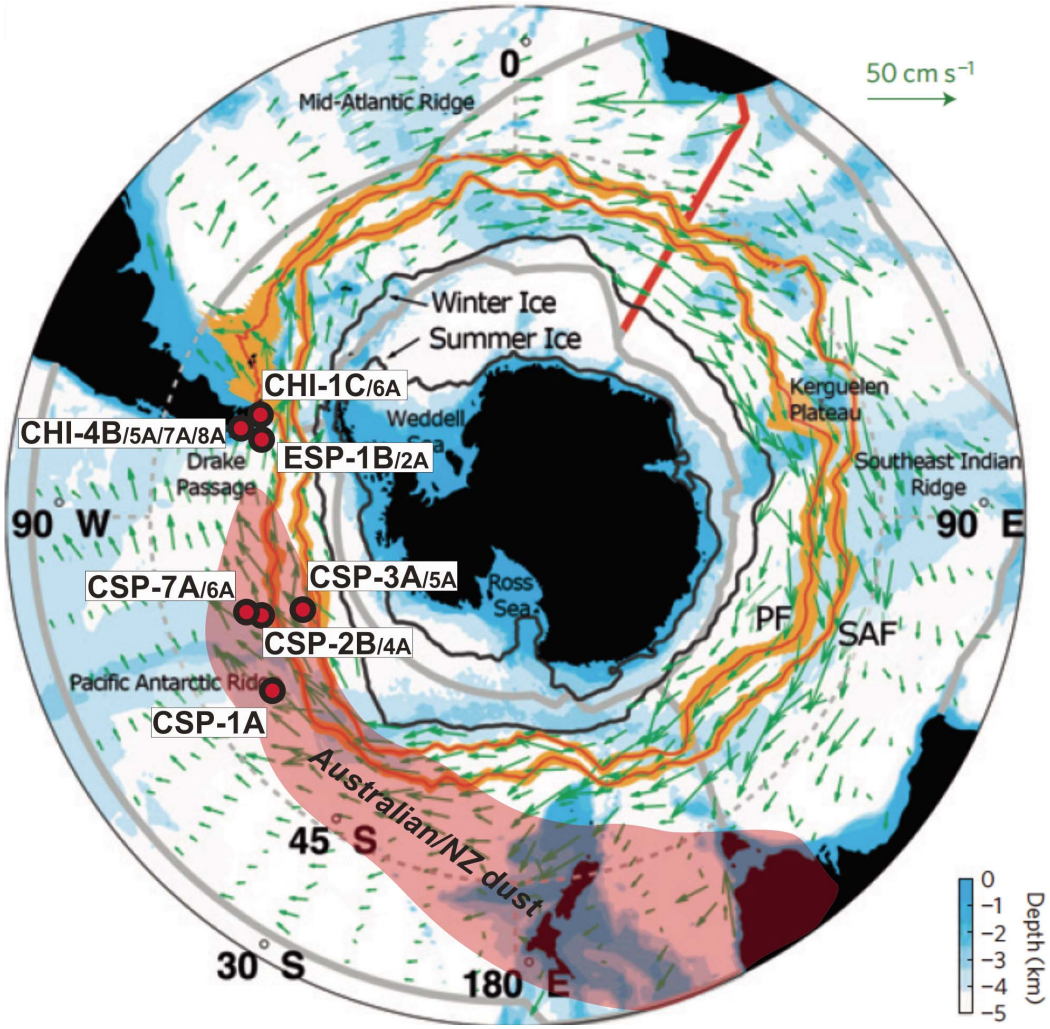


Figure F2. Examples of surface buoy trajectories (dots = 30-day positions) indicating northeast flow of northern Antarctic Circumpolar Current (ACC) water after crossing the East Pacific Rise. Also shown is the bifurcation of surface waters close to the Chilean coast (at ~45°S) with northward flowing water in the Humboldt Current System (HCS) and strongly accelerated southward flow in the Cape Horn Current (CHC) toward the Drake Passage. West–east drifting buoys follow the South Pacific current (SPC). Modified from Chaigneau and Pizarro (2005) and Lamy et al. (2015).

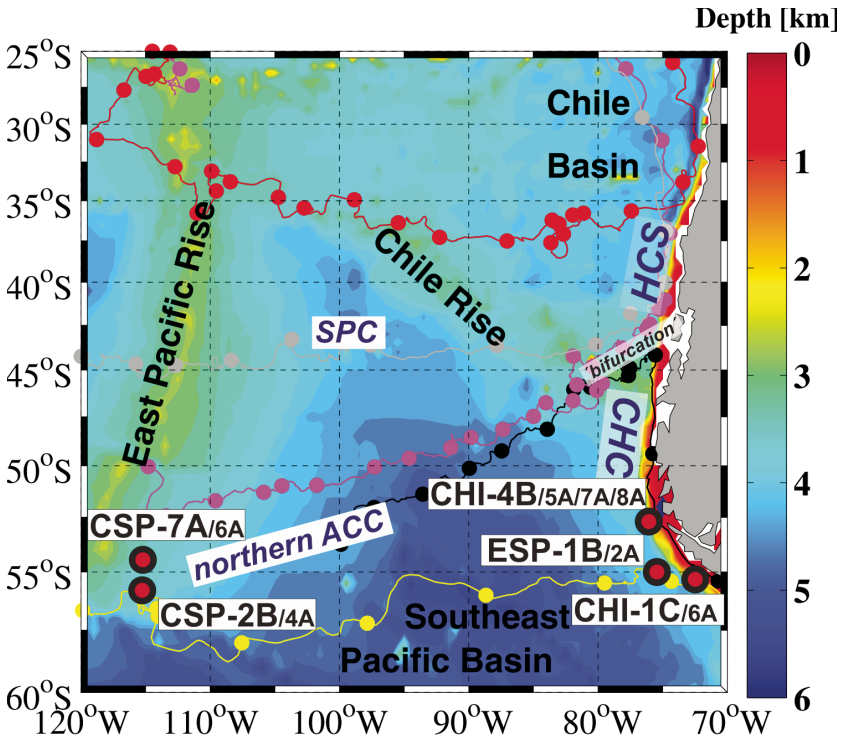


Figure F3. Basement ages of South Pacific oceanic crust (from Eagles, 2006; number indicates age in Ma). Locations of Expedition 383 sites are indicated.

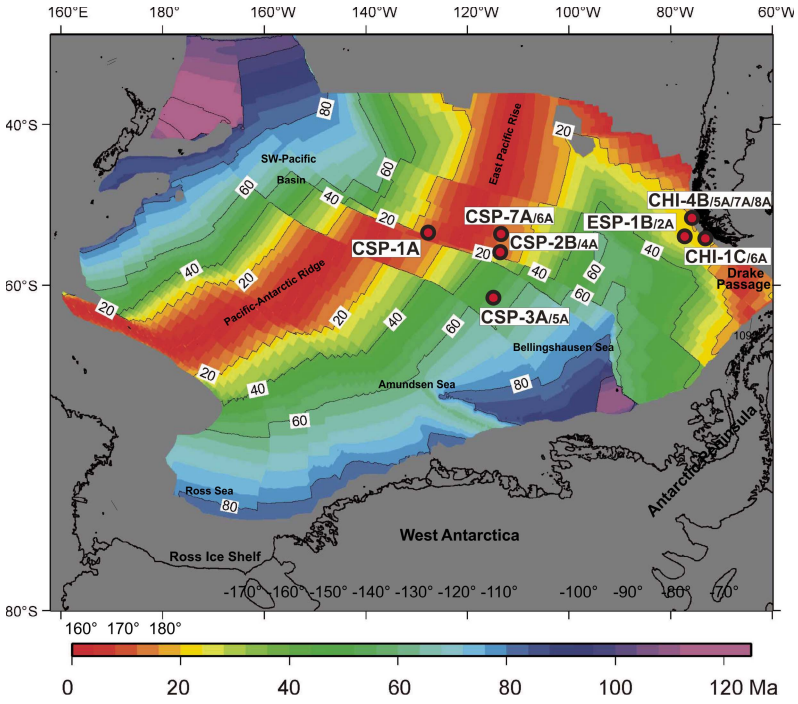
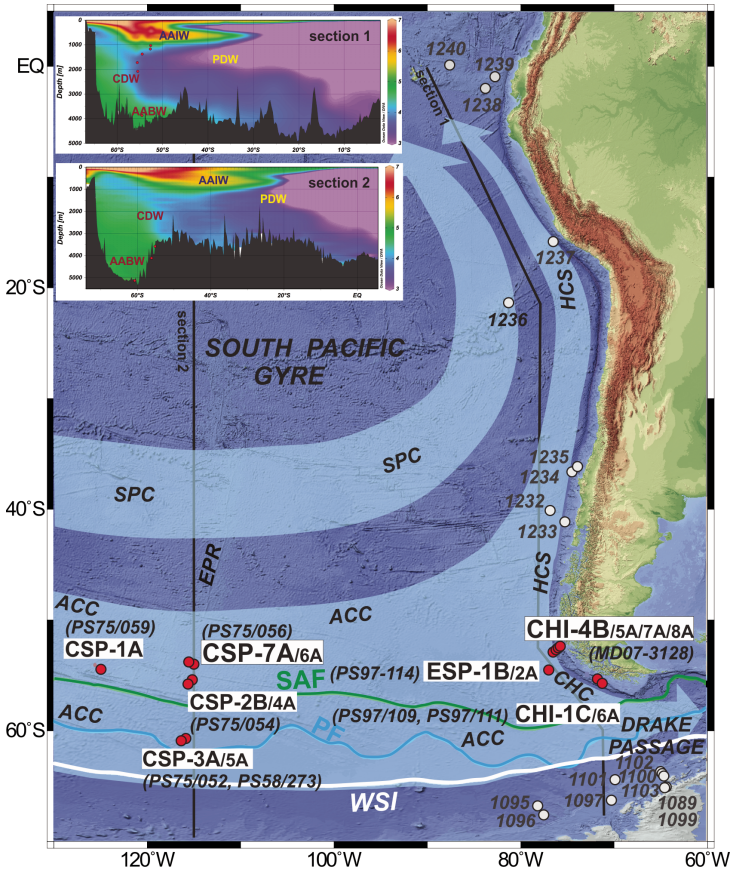


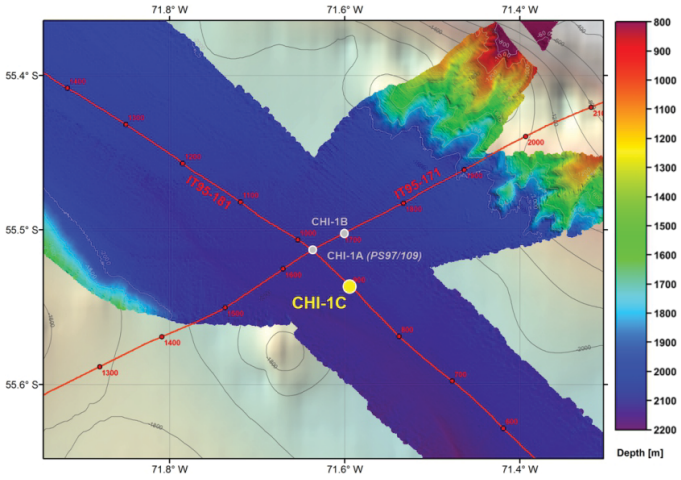
Figure F4. Location of the proposed drilling sites in the Pacific Antarctic Circumpolar Current (ACC) (red dots = proposed sites with site survey cores) and cores collected previously during various expeditions in the eastern Pacific (see text; white dots = ODP Leg 202, Sites 1232–1240; ODP Leg 178, Sites 1095–1102) in the context of the modern oceanography. Modern locations after Orsi et al. (1995) and Reynolds et al. (2002, 2007). WSI = winter sea ice, SAF = Subantarctic Front, PF = Polar Front, SPC = South Pacific Current, HCS = Humboldt Current System, CHC = Cape Horn Current, EPR = East Pacific Rise. EQ = equator. Small inset figures show vertical water mass structure along two transects in the central and eastern South Pacific (oxygen content). AABW = Antarctic Bottom Water, AAIW = Antarctic Intermediate Water, CDW = Circumpolar Deep Water, PDW = Pacific Deep Water.

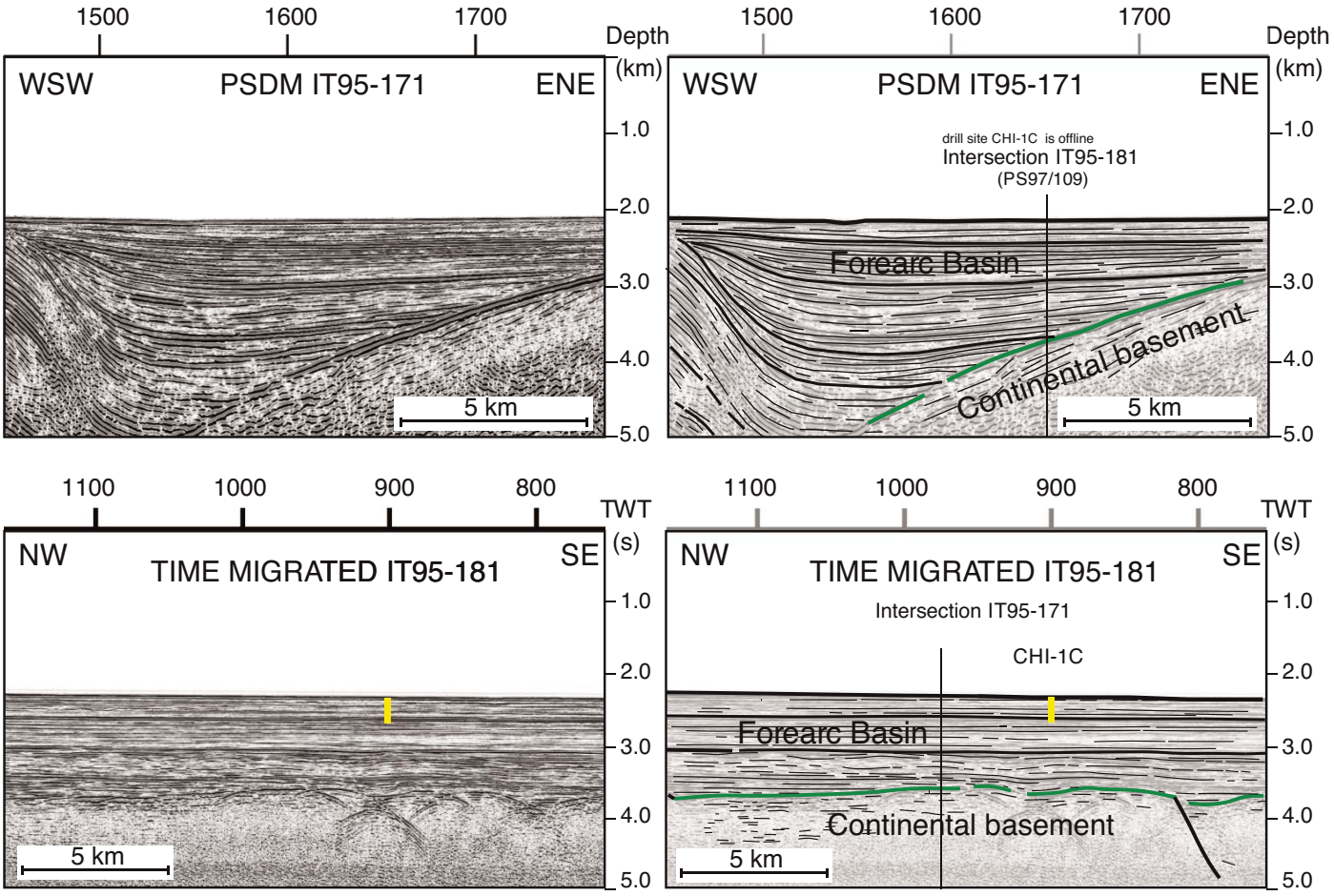


Site summaries

Site CHI-1C

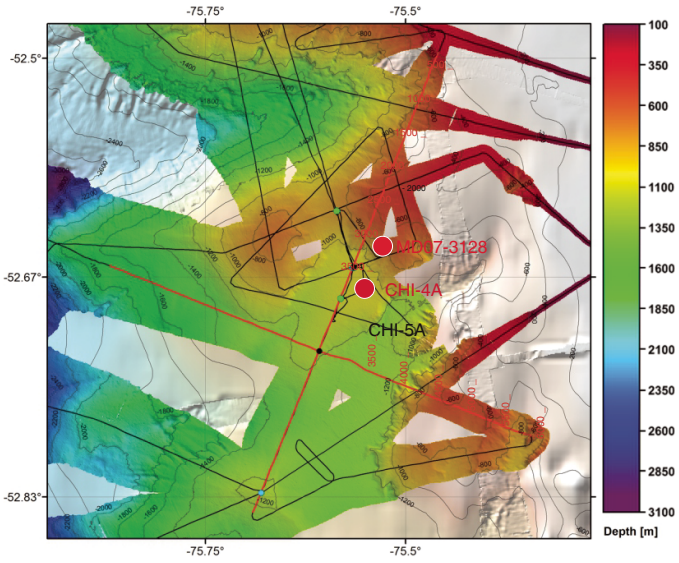
Priority:	Primary
Position:	55°32.2002′S, 71°35.5836′W
Jurisdiction:	Chile
Water depth (m):	2093
Target drilling depth (mbsf):	300
Approved maximum penetration (mbsf):	300
Survey coverage (track map; seismic profile):	• One multichannel seismic (MCS) line over site (IT95-171) • Crossing Line IT95-181 is located ~2 km WSW • Location: fore-arc basin, ~60 km from land; bathymetry is very flat; proximal to South American sediment sources avoiding pathways of turbidity currents
Objective(s):	• High-resolution Pleistocene paleoceanographic records • Northern Antarctic Circumpolar Current (ACC) strength before entering Drake Passage, Cape Horn Current • Core of Pacific Deep Water, transition to Circumpolar Deep Water • Patagonian ice sheet dynamics
Coring program:	• Triple APC to 300 m or refusal, HLAPC if required to reach target depth
Logging/downhole measurements program:	• Temperature measurements (with advanced piston corer temperature tool [APCT-3])
Nature of rock anticipated:	Calcareous clayey silts; minor ice-rafted debris (IRD) during glacials; fine-grained turbidites possible

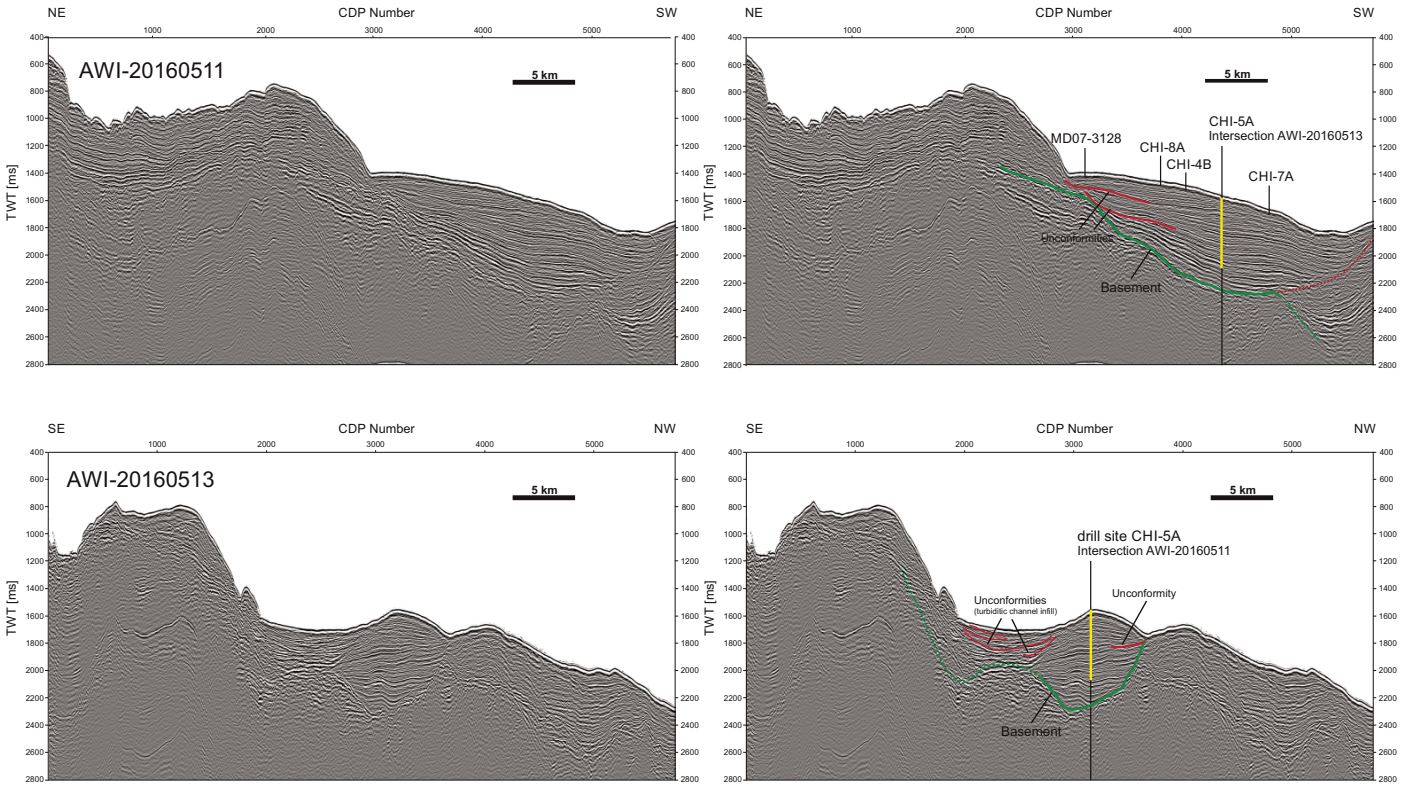




Site CHI-5A

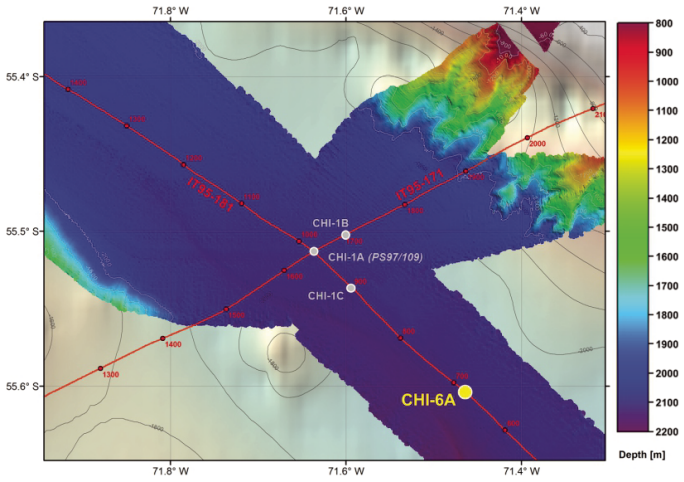
Priority:	Alternate
Position:	52°43.362′S, 75°36.462′W; Chilean waters
Jurisdiction:	Chile
Water depth (m):	1170
Target drilling depth (mbsf):	500
Approved maximum penetration (mbsf):	500
Survey coverage (track map; seismic profile):	• Location: on a sediment drift in the upper continental slope, ~50 km from land; bathymetry in the sediment drift is slightly inclined (dip < 1.5%); proximal to South American sediment sources avoiding pathways of turbidity currents; at intersection of MCS Lines AWI-20160511
Objective(s):	• High-resolution Pleistocene paleoceanographic records • Northern ACC strength before entering Drake Passage, Cape Horn Current • Reconstruction of intermediate water mass properties • Patagonian ice sheet dynamics
Coring program:	• Triple APC to 300 m or refusal, HLAPC if required • XCB to reach target depth of 500 m in one hole
Logging/downhole measurements program:	• Temperature measurements (with APCT-3) • Downhole logging with modified triple combo
Nature of rock anticipated:	Calcareous clayey silts; minor IRD during glacials; fine-grained turbidites possible

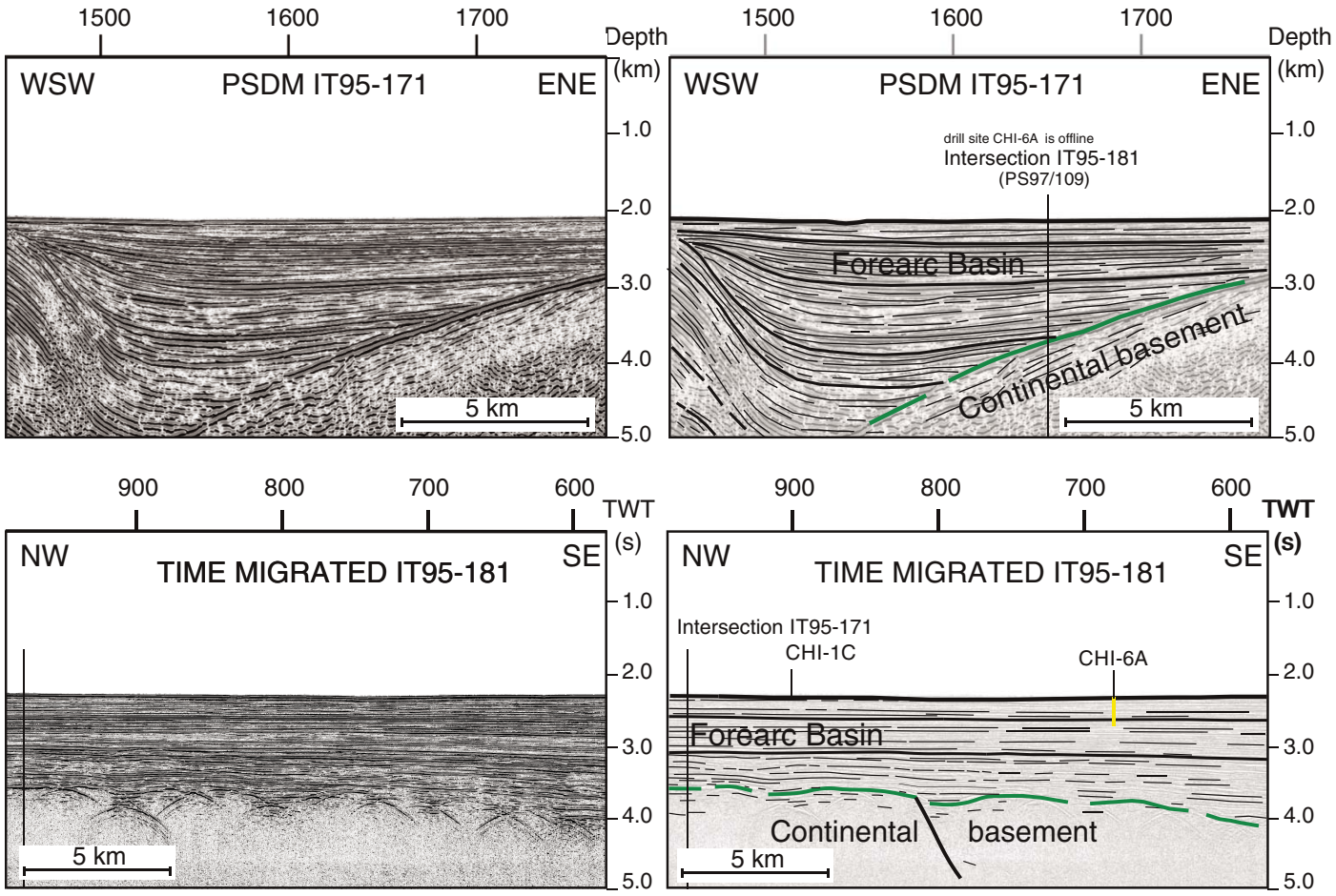




Site CHI-6A

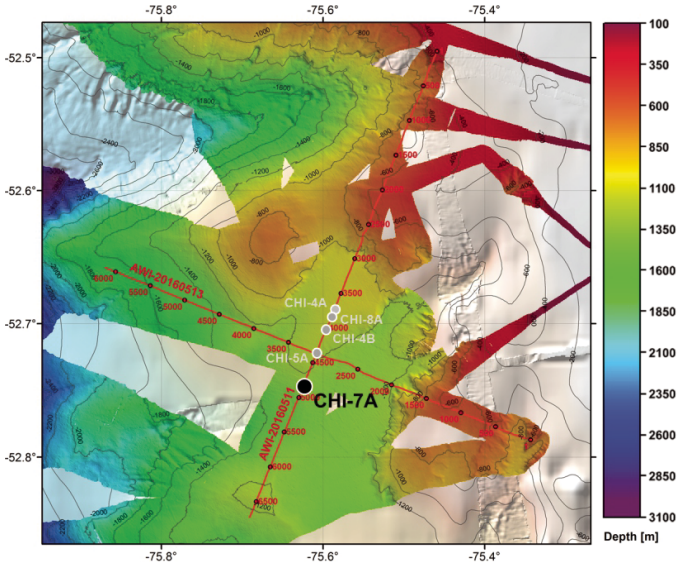
Priority:	Alternate
Position:	55°36.2166′S, 71°27.8832′W
Jurisdiction:	Chile
Water depth (m):	2100
Target drilling depth (mbsf):	300
Approved maximum penetration (mbsf):	300
Survey coverage (track map; seismic profile):	• Primary line: IT95-181, Common Depth Point (CDP) 680 • Crossing Line IT95-171 is located 16 km WSW • Location: fore-arc basin, 60 km from land; bathymetry is very flat
Objective(s):	• High-resolution Pleistocene paleoceanographic records • Northern ACC strength before entering Drake Passage, Cape Horn Current • Core of Pacific Deep Water, transition to Circumpolar Deep Water • Patagonian ice sheet dynamics
Coring program:	• Triple APC to 300 m or refusal, HLAPC if required to reach target depth
Logging/downhole measurements program:	• Temperature measurements (with APCT-3)
Nature of rock anticipated:	Calcareous clayey silts; minor IRD during glacials; fine-grained turbidites possible

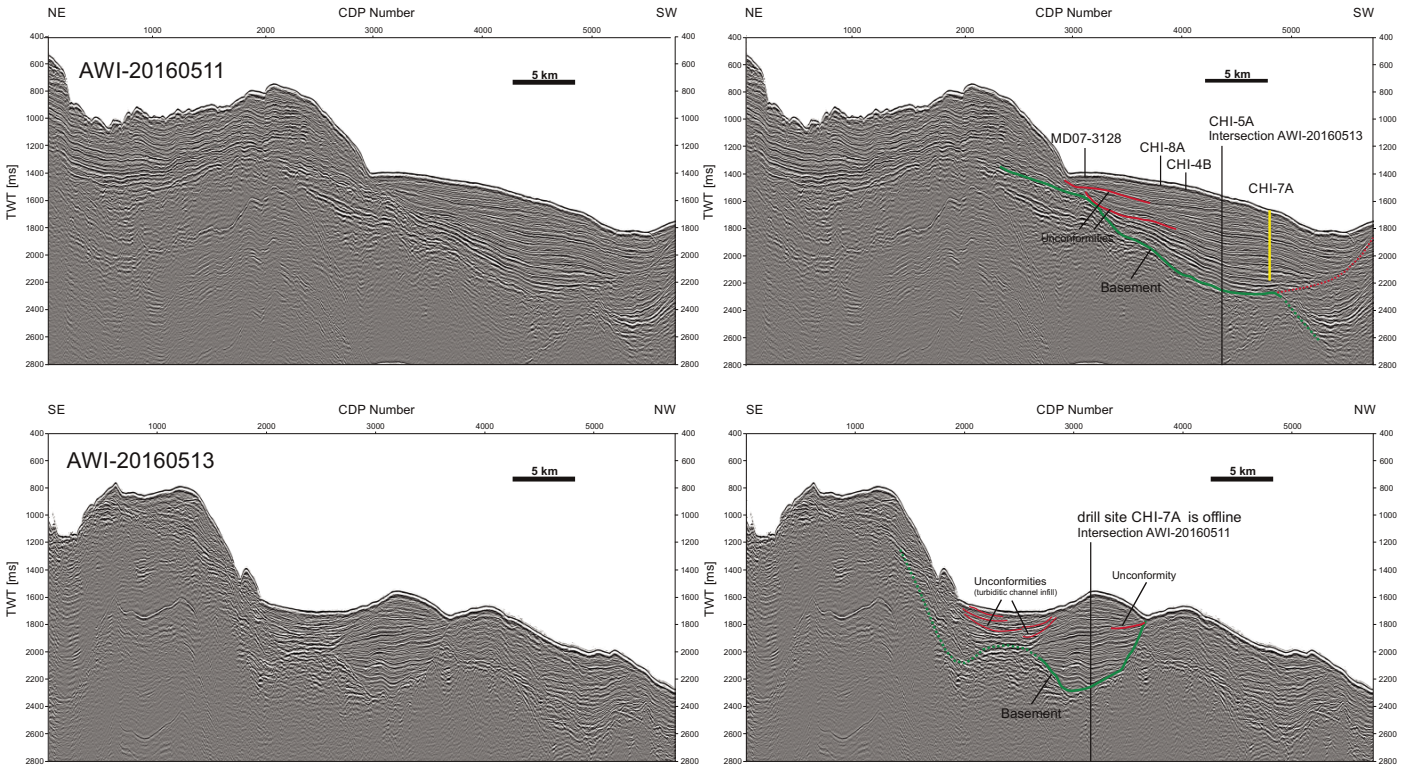




Site CHI-7A

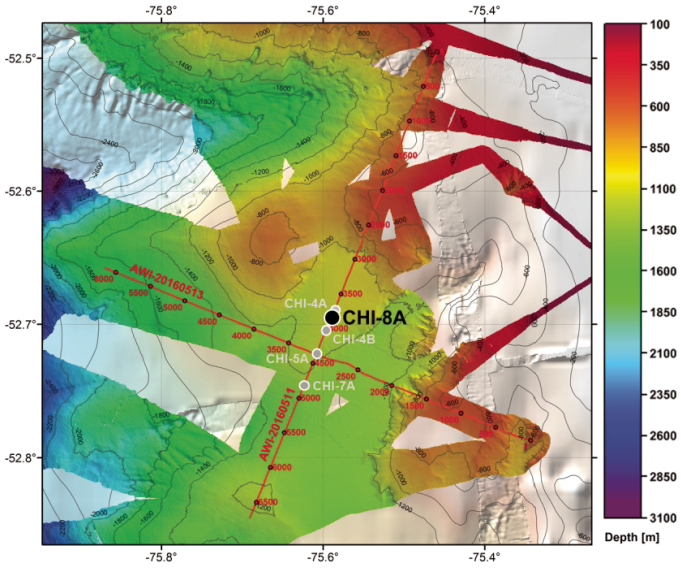
Priority:	Alternate
Position:	52°44.6887′S, 75°37.3938′W
Jurisdiction:	Chile
Water depth (m):	1250
Target drilling depth (mbsf):	500
Approved maximum penetration (mbsf):	500
Survey coverage (track map; seismic profile):	• Primary line: AWI-20160511, CDP 4800 • Crossing Line AWI-20160513 is located 3 km SW • Location: on a sediment drift in the upper continental slope, 50 km from land; bathymetry is slightly inclined (dip < 1.5%); proximal to South American sediment sources
Objective(s):	• High-resolution Pleistocene paleoceanographic records • Northern ACC strength before entering Drake Passage, Cape Horn Current • Reconstruction of intermediate water mass properties • Patagonian ice sheet dynamics
Coring program:	• Triple APC to 300 m or refusal, HLAPC if required • XCB to reach target depth of 500 m in one hole
Logging/downhole measurements program:	• Temperature measurements (with APCT-3) • Downhole logging with modified triple combo
Nature of rock anticipated:	Calcareous clayey silts; minor IRD during glacials; fine-grained turbidites possible

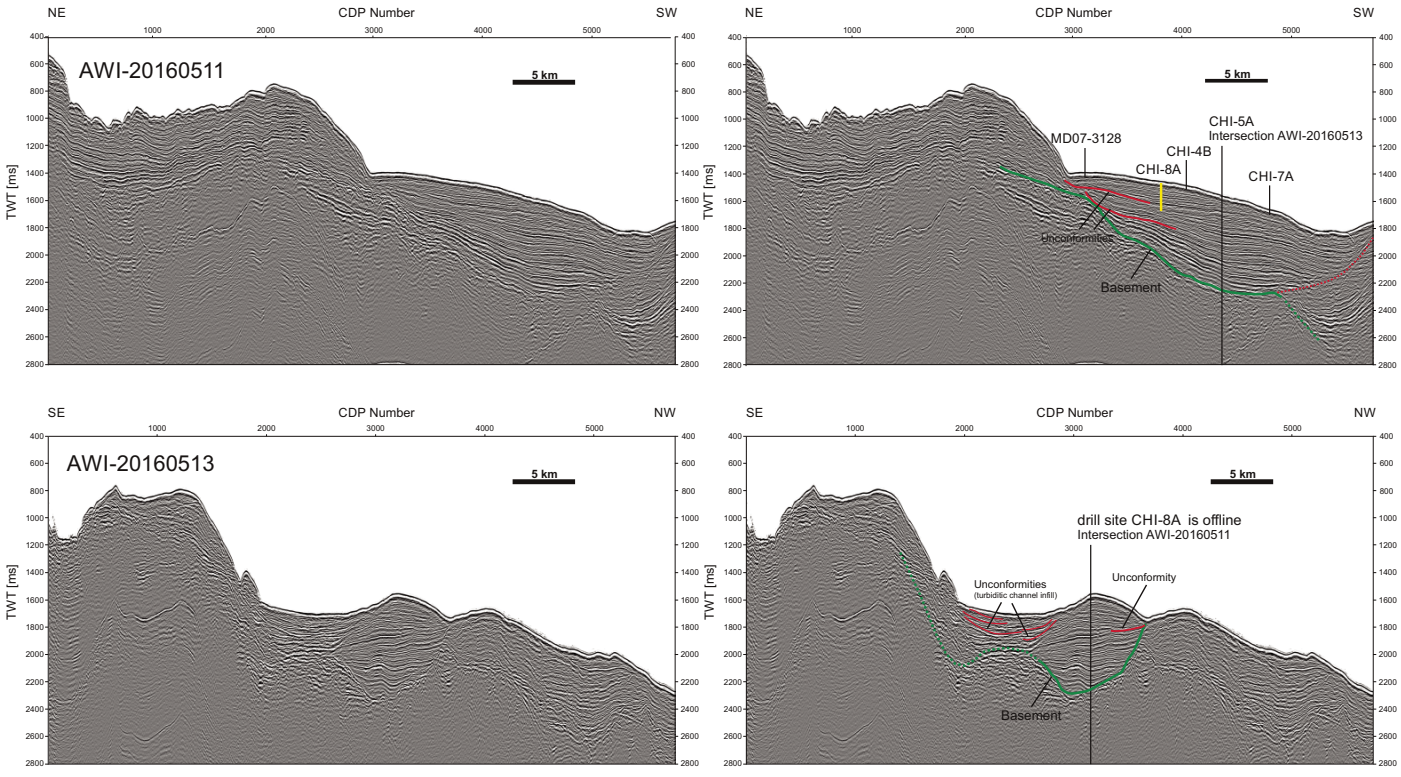




Site CHI-8A

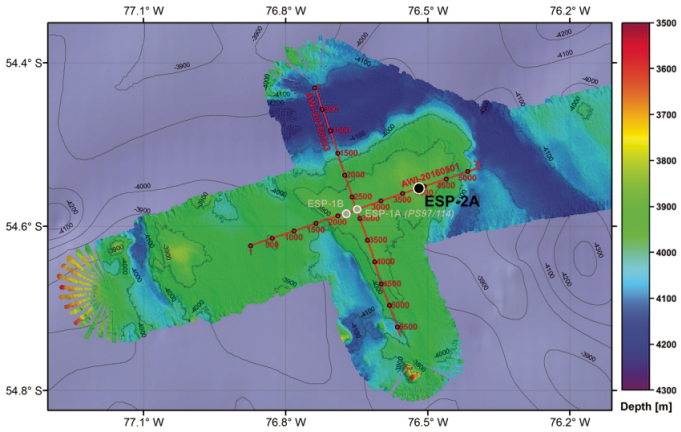
Priority:	Alternate
Position:	52°41.5728′S, 75°35.2902′W
Jurisdiction:	Chile
Water depth (m):	1060
Target drilling depth (mbsf):	200
Approved maximum penetration (mbsf):	200
Survey coverage (track map; seismic profile):	• Primary line: AWI-20160511, CDP 3800 • Crossing Line AWI-20160513 is located 3 km NE • Location: on a sediment drift in the upper continental slope, 50 km from land; bathymetry is slightly inclined (dip < 1.5%); proximal to South American sediment sources
Objective(s):	• High-resolution Pleistocene paleoceanographic records • Northern ACC strength before entering Drake Passage, Cape Horn Current • Reconstruction of intermediate water mass properties • Patagonian ice sheet dynamics
Coring program:	• Triple APC to 200 m or refusal, HLAPC if required
Logging/downhole measurements program:	• Temperature measurements (with APCT-3) • Downhole logging with modified triple combo
Nature of rock anticipated:	Calcareous clayey silts; minor IRD during glacials; fine-grained turbidites possible

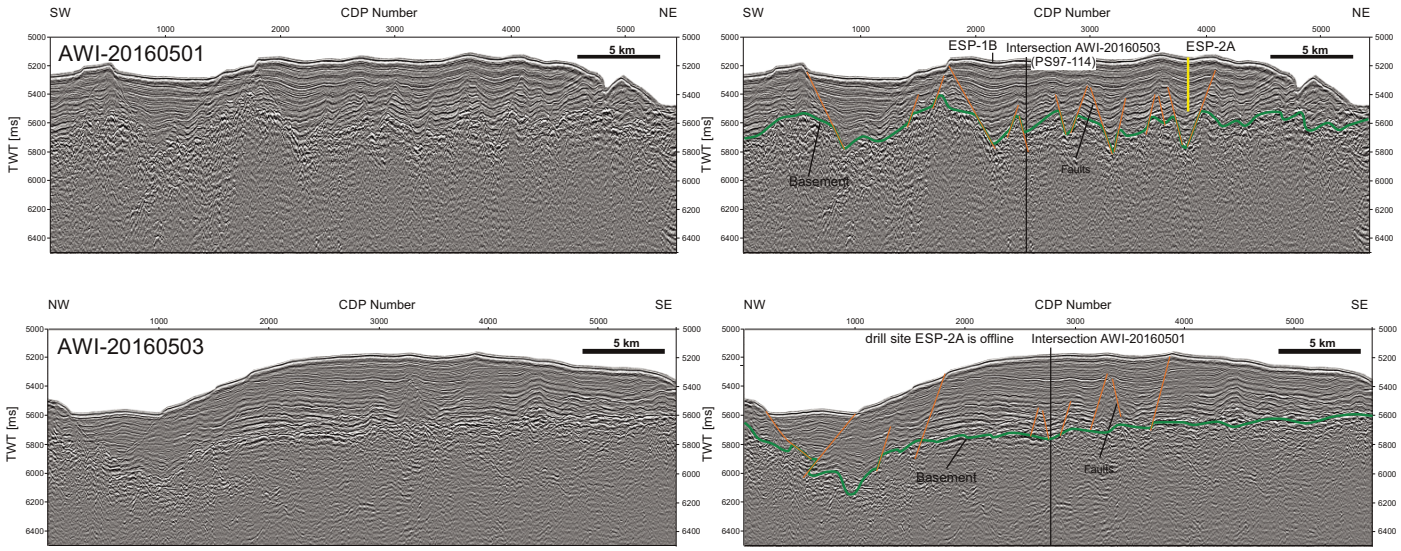




Site ESP-2A

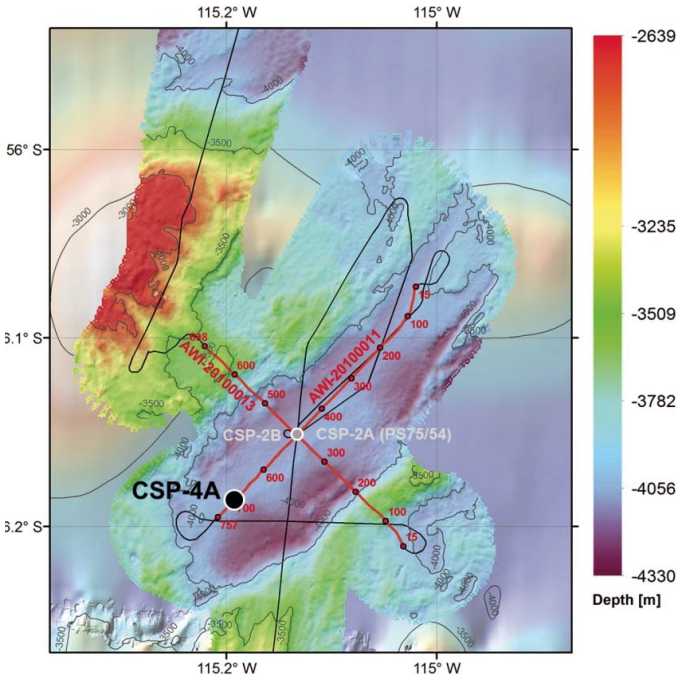
Priority:	Alternate
Position:	54°33.2022′S, 76°31.2768′W
Jurisdiction:	Chile
Water depth (m):	3850
Target drilling depth (mbsf):	400
Approved maximum penetration (mbsf):	400
Survey coverage (track map; seismic profile):	• Primary line: AWI-20160501, CDP 3850 • Crossing Line AWI-20160513 is located 1.5 km NE • Location: deep Pacific Basin, west of Peru-Chile Trench, ~210 km from land on elevated ridge with thick sediment cover; bathymetry is slightly inclined (dip <1.5%); distal from South American sediment sources
Objective(s):	• Plio/Pleistocene (Miocene) paleoceanographic records • Northern ACC strength before entering Drake Passage, Cape Horn Current • Potential record of Antarctic Bottom Water during glacials • Long-term Patagonian ice sheet dynamics
Coring program:	• Triple APC to 400 m or refusal, HLAPC if required to reach target depth
Logging/downhole measurements program:	• Temperature measurements (with APCT-3) • Downhole logging with modified triple combo
Nature of rock anticipated:	Calcareous ooze and clay; minor IRD during glacials

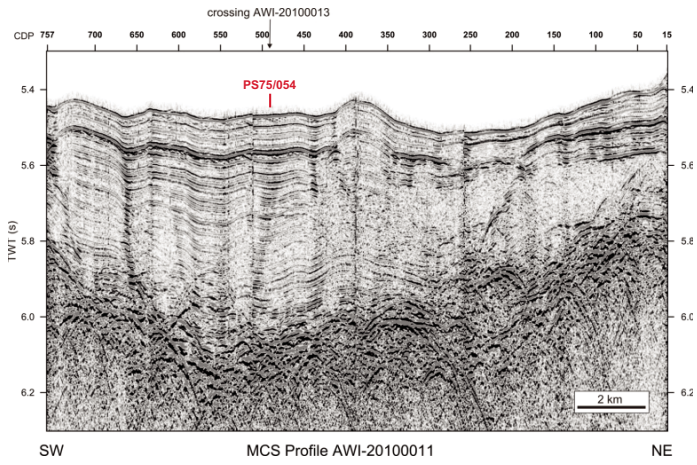


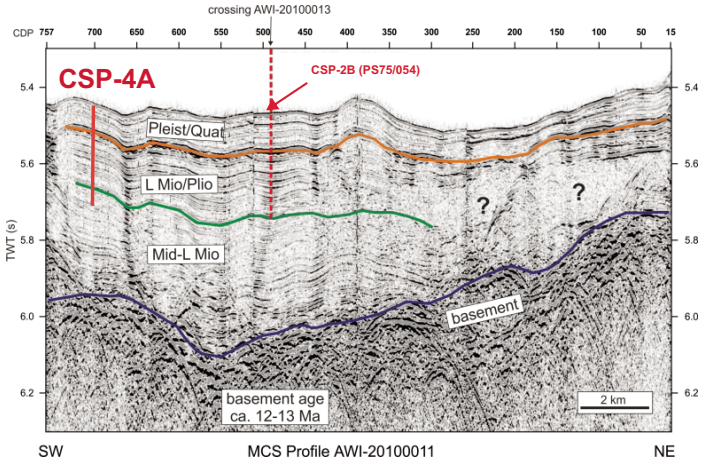


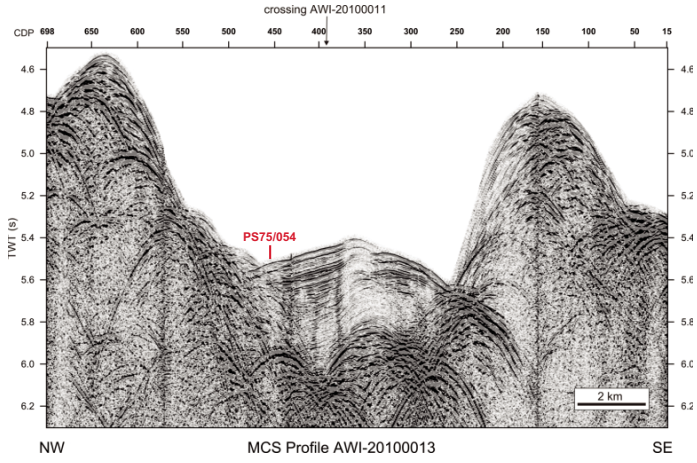
Site CSP-4A

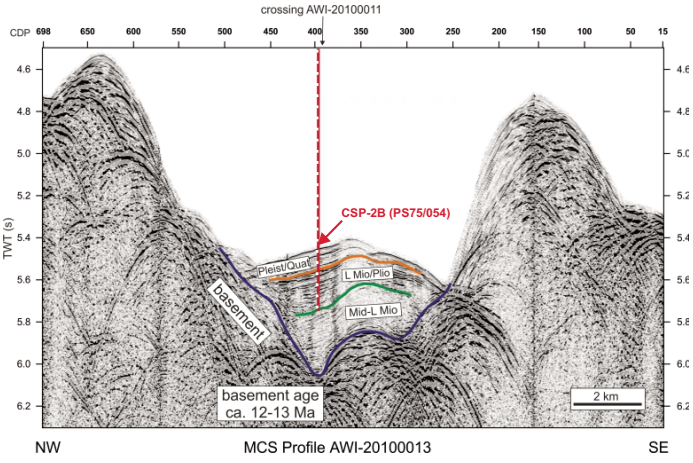
Priority:	Alternate
Position:	56°11.154′S, 115°11.532′W
Jurisdiction:	
Water depth (m):	4110
Target drilling depth (mbsf):	300
Approved maximum penetration (mbsf):	300
Survey coverage (track map; seismic profile):	• Primary line: AWI-20100011, CDP 700 • Location: central South Pacific, ~210 nmi east of East Pacific Rise, about 2200 km from nearest land
Objective(s):	• Moderate to high-resolution subantarctic late Miocene–Quaternary carbonate record from lower Circumpolar Deep Water depth • Subantarctic sea-surface temperature, water mass, pCO_2, productivity record • Central site of cross-frontal transect
Coring program:	• Triple APC to 300 m or refusal
Logging/downhole measurements program:	• Temperature measurements (with APCT-3)
Nature of rock anticipated:	Calcareous-biosiliceous ooze





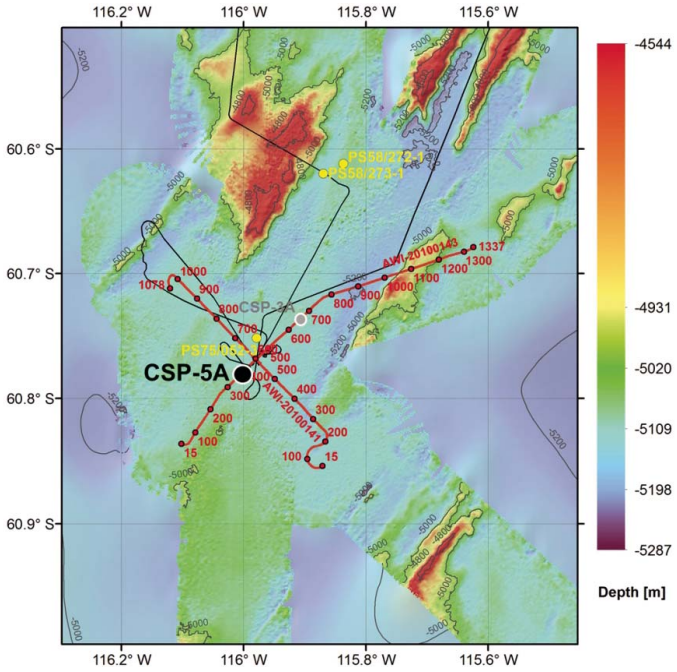


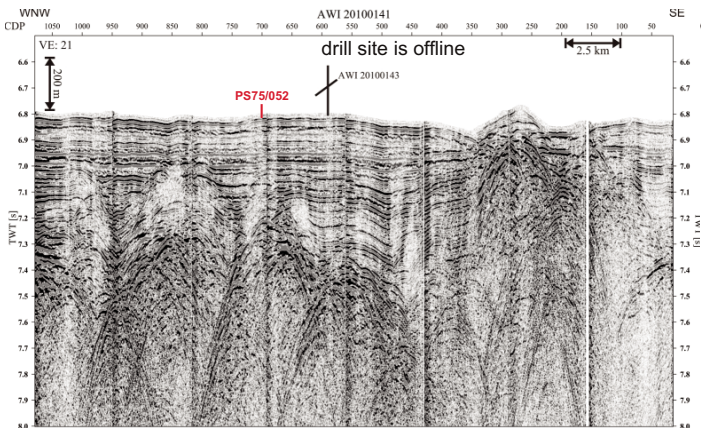


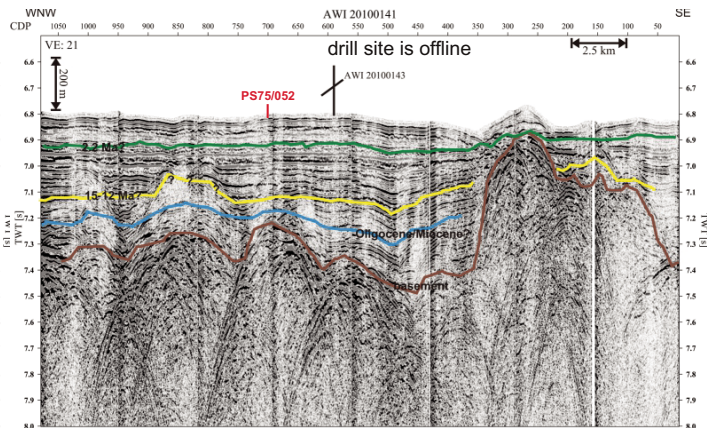


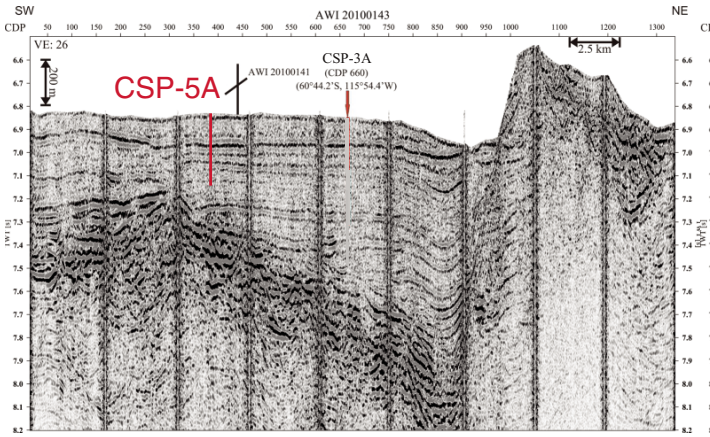
Site CSP-5A

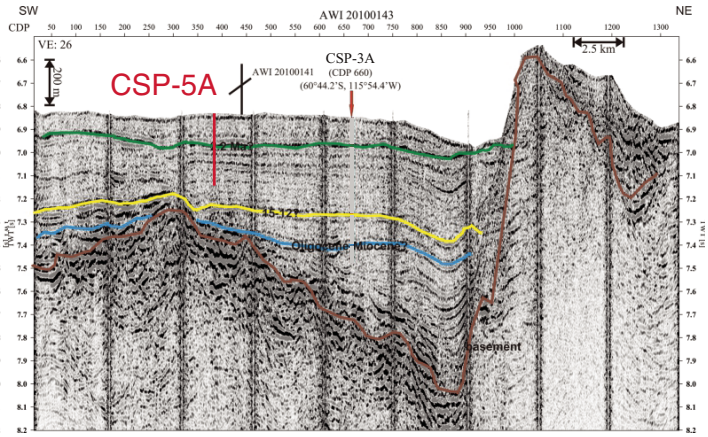
Priority:	Alternate
Position:	60°46.716′S, 116°00.018′W
Jurisdiction:	Antarctic Treaty
Water depth (m):	5130
Target drilling depth (mbsf):	300
Approved maximum penetration (mbsf):	300
Survey coverage (track map; seismic profile):	• Primary line: AWI-20100143, CDP 380 • Location: central South Pacific, ~210 nmi east of the crest of the East Pacific Rise; distance from land about 2200 km
Objective(s):	• Moderate to high-resolution subantarctic late Miocene–Quaternary carbonate record from lower Circumpolar Deep Water depth • Subantarctic sea-surface temperature, water mass, pCO_2, productivity record • Southernmost site of cross-frontal transect
Coring program:	• Triple APC to 300 m or refusal
Logging/downhole measurements program:	• Temperature measurements (with APCT-3)
Nature of rock anticipated:	Calcareous-biosiliceous ooze





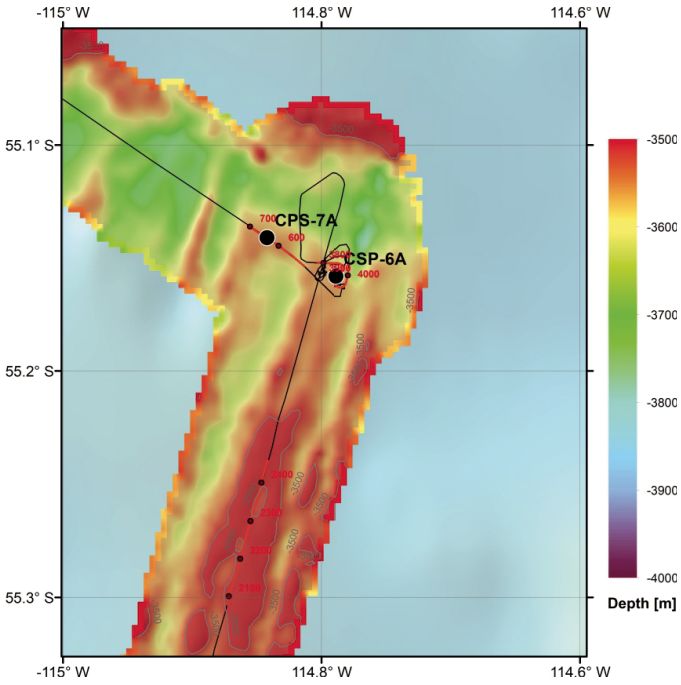


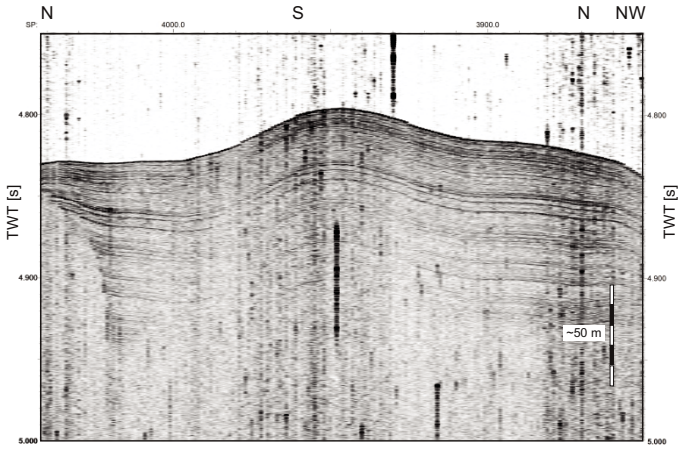


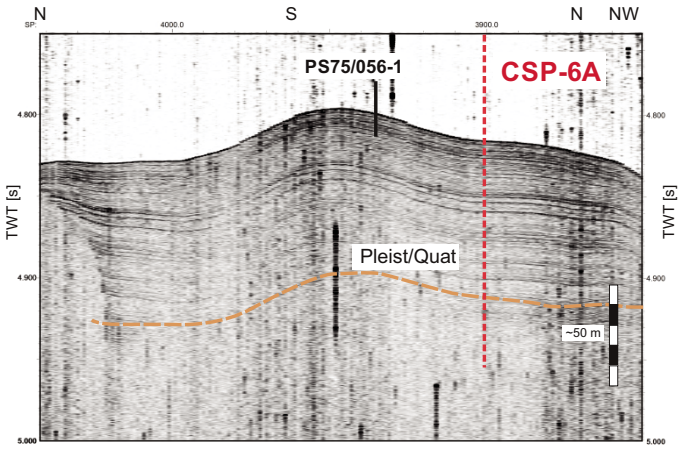


Site CSP-6A

Priority:	Alternate
Position:	55°9.4896′S, 114°47.322′W
Jurisdiction:	International
Water depth (m):	3570
Target drilling depth (mbsf):	125
Approved maximum penetration (mbsf):	125
Survey coverage (track map; seismic profile):	• Based on Parasound data only (SP 3900) • Location: central South Pacific, ~200 nmi from East Pacific Rise, ~2200 km from land
Objective(s):	• Moderate to high-resolution subantarctic late Miocene–Quaternary carbonate record from lower Circumpolar Deep Water depth • Subantarctic sea-surface temperature, water mass, pCO_2, productivity record • Central site of cross-frontal transect
Coring program:	• Triple APC to 125 m or refusal
Logging/downhole measurements program:	• Temperature measurements (with APCT-3)
Nature of rock anticipated:	Calcareous-biosiliceous ooze







Site CSP-7A

Priority:	Primary
Position:	55°8.4666′S, 114°50.520′W
Jurisdiction:	International waters
Water depth (m):	3540
Target drilling depth (mbsf):	150
Approved maximum penetration (mbsf):	150
Survey coverage (track map; seismic profile):	• Based on Parasound data only (SP 3900) • Location: central South Pacific, ~200 nmi east of East Pacific Rise, ~2200 km from land
Objective(s):	• Moderate to high-resolution subantarctic late Miocene–Quaternary carbonate record from lower Circumpolar Deep Water depth • Subantarctic sea-surface temperature, water mass, pCO_2, productivity record • Central site of cross-frontal transect
Coring program:	• Triple APC to 100 m or refusal
Logging/downhole measurements program:	• Temperature measurements (with APCT-3)
Nature of rock anticipated:	Calcareous-biosiliceous ooze