Received 26 September 2008

IODP Proposal Cover Sheet

732-Full2

☐ **New** ☑ **Revised** ☐ **Addendum**

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Title:	Sediment drifts off the Antarctic Peninsula and West Antarctica		
Proponent(s):	J.E.T. Channell, R. D. Larter, C.D. Hillenbrand, M. Vautravers, D.A. Hodell, F.J. Hernandez Molina, K. Gohl and M. Rebesco		
Keywords: *(5 or less)*	Antarctic Peninsula, West Antarctica, Late Miocene-Quaternary, Paleoceanography, Ice Sheet History	Area:	Antarctica

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Permission to post abstract on IODP Web site: ■ Yes ☐ No

Abstract: (*400 words or less*)

There is intense interest in the response of the Antarctic Peninsula and West Antarctica region to global warming because recent observations suggest this region may be undergoing rapid changes including warming, ice-shelf disintegration and glacial retreat. These recent changes can be considered in a longer geologic perspective by studying ice and marine sediment cores to evaluate the past history and stability of the West Antarctic Ice Sheet (WAIS) and Antarctic Peninsula Ice Sheet (APIS).

Here we propose to drill a series of sites on sediment drifts (contourites) located on the continental rise west of the Antarctic Peninsula and West Antarctica. The proposed sites contain continuous sections with high sedimentation rates that can be dated using relative (geomagnetic) paleointensity and, at shallow-water sites, oxygen isotope stratigraphy. Six proposed sites target expanded Pliocene-Quaternary sequences, with two sites targeting the pre-Pliocene record at locations characterized by thinned younger sediment cover.

Previous coring in the region, including cores recovered during ODP Leg 178 (1998), have indicated that these drift deposits carry a rich high-resolution archive of Antarctic margin paleoceanography and history of the Antarctic Peninsula and West Antarctic ice sheets. The potential of existing ODP cores is compromised by two factors: (1) incomplete composite sections and (2) lack of precise chronological control.

Imprecise chronological control, due in large part to lack of foraminiferal carbonate for isotopic analyses, has stymied paleoceanographic interpretations of sediment cores from high southerly latitudes. The chronological problem can now be partially offset by using relative paleointensity records, and by placing sites at water depths less than 2800 m where enhanced carbonate preservation allows stable isotope analyses.

There are few targets in the circum-Antarctic region that rival the potential offered by the sediment drifts off west Antarctica. The recovery of these sediment cores and integration of these data with polar ice cores will contribute significantly our understanding of the role of West Antarctic and the adjacent Southern Ocean in global atmospheric and oceanographic processes.

"Environmental Change, Processes and Effects" was one of the major three themes identified within the IODP Initial Science Plan (ISP) and 'Rapid Climate Change' was named as a special research initiatives. This proposal is highly relevant to the ISP and, in particular, will contribute critical information regarding the past stability of the Antarctic Peninsula/West Antarctic ice sheets (APIS/WAIS) and its implications for sea-level change.

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Scientific Objectives: (*250 words or less*)

Questions to be answered from Antarctic drift sediments with precise chronological control:

1.) When did the Antarctic Peninsula become fully glaciated? How stable were the Antarctic Peninsula (APIS) and the West Antarctic (WAIS) Ice Sheets? Did the region remain fully glaciated during interglacial periods of the Plio-Pleistocene that were warmer than today?

2.) What was the response of APIS and WAIS during Pleistocene deglaciations? What was the history of grounding line retreat associated with sea level rise associated with Northern Hemisphere deglaciation? Did meltwater pulse 1A or 1B originate from West Antarctica during the last deglaciation?

3.) What was the relationship between ocean temperature change and ice shelf stability? Is there evidence for millennial-scale variability in ice-shelf and/or ice-stream instability preserved as layers rich in IRD in the contourite deposits?s

4.) What was the response of APIS/WAIS to the intensification of northern hemisphere glaciation at 2.7 Ma and the change to large ice volume fluctuations after the Mid-Pleistocene Transition (e.g., sea level linkage)? Did APIS/WAIS respond differently to glacial-interglacial cycles during the 41-K and 100-K worlds?

5.) Is there a history of variations in the strength of Antarctic Circumpolar flow preserved in the drift deposits that can be reconstructed through grain size analyses?

6.) How has surface water stratification changed during the Pliocene-Pleistocene and what role has this played in deep-water ventilation, and atmospheric pCO_2 variation?

7.) Was a permanent ice sheet established in West Antarctica in late Miocene?

8.) What were the Paleogene paleoceanographic conditions off West Anarctica?

Please describe below any non-standard measurements technology needed to achieve the proposed scientific objectives.

None

Proposed Sites:

Site Name	Position	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
PEN-1	64° 54.12' S 69°2.99'W	2370	350	0	350	
PEN-2	66° 11.49' S 72°3.20'W	2780	350	0	350	Late Miocene-Quaternary paleoceanography
PEN-3	67° 39.70' S 74°40.00 W	2460	350	0	350	
PEN-4	67° 53.31' S 76°7.20'W	2750	350	0	350	
PEN-5B	67° 40.07'S 77° 10.47'W	3300	500	0	500	
BELS-1	68° 56.57' S 85°47.36'W	3117	400	0	400	
BELS-2	69° 29.58' S 94°9.48W	3594	400	0	400	
BELS-3	69° 31.72' S 94°35.52'W	4054	600	0	600	Early Cenozoic paleoceanography