IODP Proposal Cover Sheet

SW Atlantic Paleogene Climate

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Title	Maurice Ewing Bank-Georgia Basin Depth Transect: A Southern Ocean Perspective on Paleogene Climate Evolution
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Abstract

We propose to drill a depth transect of Paleogene sites in the subantarctic South Atlantic Ocean on the easternmost tip of the Falkland Plateau (Maurice Ewing Bank and Georgia Basin). In the modern ocean, this is a critical area for deep-water mixing and communication between the Pacific and Atlantic oceans across the Drake Passage, with local bathymetry controlling the dispersal and propagation of deep- and bottom-waters throughout the Atlantic. Guided by new seismic data, we will recover a composite of Paleogene sections spanning an extensive range of paleo-water depths (~500-4500 m). Our primary focus will be on determining the timing and variability of shallow- and deep-water connectivity across the Drake Passage and testing whether the onset of a proto-Antarctic Circumpolar Current (ACC) circulation had a direct impact on high-latitude and global climate evolution. These drillcores will thus provide crucial insight on the long-standing question of the relative influence of atmospheric pCO2 drawdown vs. Southern Ocean gateways in driving Paleogene climate evolution. The target sites are also ideally positioned to assess the relationships between local tectonic subsidence of deep-water barriers, high-latitude climate change, and the onset of bottom-water production in the Weddell Sea and northward propagation into to the deep western Atlantic-a process that, along with ACC circulation, fundamentally altered Cenozoic circulation in the Atlantic. Multi-proxy datasets from expanded hemipelagic sections will shed new light on climate change, biotic shifts, and deep-sea chemistry during the Paleogene, allowing evaluation of: (i) the magnitude of temperature change and response of high-latitude plankton groups across transient 'greenhouse' events, (ii) the initiation of southern high latitude cooling and onset of Antarctic Peninsula glaciation during the middle Eoceneearly Oligocene 'greenhouse' to 'icehouse' transition, and (iii) variation in the Calcite Compensation Depth in the South Atlantic and its relation to changes in global carbon cycling. The objectives for this expedition directly relate to the Climate and Ocean Change and Biosphere Frontiers research themes in the IODP Science Plan for 2013-2023.

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Scientific Objectives

1.Evaluate the timing and effect of the (i) progressive opening Drake Passage, and (ii) the deepening of deep-water barriers across the western reaches of the Islas Orcadas Rise-Meteor Rise ridge system in the Georgia Basin, assessing the global impact of circumpolar deep-water circulation through the Drake Passage and the history of bottom-water production in the Weddell Sea and its communication to the deep South Atlantic.
2.Establish a detailed reconstruction of the Calcite Compensation Depth (CCD) in the South Atlantic to decipher relationships between deep water chemistry, climate variability, and global carbon cycle dynamics, providing tests of mechanisms for long-term and short-term climate change during the Paleogene.
3.Reconstruct high-resolution changes in atmospheric pCO2 and climate in the southern high latitudes from the cool early Paleocene through the warm late Paleocene, the Early Eocene Climate Optimum (EECO), and the descent into the 'Icehouse' during the dynamic middle-late Eocene leading up to the EOT.
4.Recover expanded records of transient hyperthermal events at southern high latitudes, including the PETM, ETM-2, and the MECO, to (i) gain insight into onset, duration and termination, (ii) compare with lower latitude sites, (iii) evaluate the relation between climate change and the response of siliceous and carbonate photosynthesizers.
5.Determine the detailed progression of late Eoceneearly Oligocene subantarctic cooling, investigate suspected short-lived Antarctic glacial events in the late Eocene, and test whether an Antarctic Peninsula ice cap formed at the EOT.
6.Test and refine the astronomically tuned Paleogene time scale.

Non-standard measurements technology needed to achieve the proposed scientific objectives.

Proposed Sites

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
EGB-3A	-50.946433, -26.368783	4000	250	0	250	Eocene to early Paleocene to track CCD and hyperthermals, identify change/switch in ocean circulation
EGB-2A	-51.533200, -30.278283	3600	350	0	350	early Eocene to late Cretaceous to monitor CCD, hyperthermals, identify change/switch in ocean circulation
EGB-1A	-51.542283, -30.676983	3700	250	0	250	Oligocene to late Eocene to track CCD and CAE's, monitor changes in CCD and circulation around EOT during the opening of the Drake Passage deep-water gateway
NEGR-2A	-49.628533, -36.3965	4700	200	0	200	early Eocene to Maastricht, Deepest site to track CCD, K/Pg
NEGR-1A	-51.458500, -33.099333	2100	150	0	150	early Eocene to Maastricht, track CCD, hyperthermals at shallow waterdepth, Paleocene climate development and identify change/switch in ocean circulation, K/Pg

MEB-3A	-49.869650, -40.845200	1900	250	0	250	middle Eocene to late Paleocene to track CCD and CAE; hyperthermals (PETM), identify change/switch in ocean circulation
MEB-2A	-50.103733, -41.818000	1750	200	0	200	of late to middle Eocene calcareous nannofossil ooze to track CCD and CAE's, find hyperthermals, identify change/switch in ocean circulation
MEB-1A	-51.004667, -46.971667	2600	250	0	250	early Oligocene to late Eocene to monitor changes in CCD and circulation around EOT during the opening of the Drake Passage deep-water gateway