

IODP Proposal Cover Sheet

983 - Pre

Kerguelen Plateau Climate Chronicles

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Title	Kerguelen Plateau Climate Chronicles - outstanding high-resolution archive of Cenozoic climatic and oceanographic changes in the southern Indian Ocean		
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Proponent Information

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Abstract

We propose to drill Cenozoic sediment packages in the subantarctic southern Indian Ocean on the Southern Kerguelen Plateau (Raggatt and Labuan basins). The Kerguelen Plateau is one of the world's largest Large Igneous Provinces, with complex topography that strongly influences pathways of Antarctic Bottom Water and water masses within the Antarctic Circumpolar Current. In the Cenozoic Era significant modifications in pathways and intensity of those water masses were driven by the tectonomagmatic development of the Kerguelen Plateau, as well as the openings of the Tasman Gateway and the Drake Passage, and major global climatic changes. Previous Ocean Drilling Program expeditions have revealed that sediments deposited in the Kerguelen Plateau region have the potential to provide an out-standing chronicle of regional and global climate changes. In particular, this area is an excellent location to (i) monitor subantarctic and high-latitude climate dynamics and (ii) obtain far-field information documenting Antarctic climate history in a world warmer than today. However, none of the previous Kerguelen Plateau expeditions recovered complete, multiple-hole, APC-cored expanded sedimentary sequences, as standard today for paleoceanography-focused IODP expeditions. Guided by new seismic reflection data, we propose to recover an expanded and continuous sediment succession of the Cenozoic, specifically targeting sequences that can provide new insight into high southern latitudes biotic responses to climate conditions warmer than today. Multi-proxy datasets from expanded hemipelagic sections on the Kerguelen Plateau will shed new light on climate change, biotic shifts, and deep-sea chemistry, allowing evaluation of: (i) the magnitude of temperature change and response of high-latitude biota across transient warming events during the Early Eocene Climate Optimum, (ii) the initiation of southern high latitude cooling and onset of Antarctic Peninsula glaciation during the Eocene to Oligocene, and (iii) changes in biota and the frontal system related to the onset, duration, and termination of the middle Miocene Climate Optimum. 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 and follows strategic objectives outlined in the Scientific Ocean Drilling Program 2050 Framework.

Scientific Objectives

- 1) Resolve the magnitude of mid-to-high latitude Southern Hemisphere temperature change across transient warming events in the Paleogene and Miocene. Was there a significant response of high-latitude biota to past global warmth? How were ecological communities affected?
- 2) Is there lithological, mineralogical, or geochemical evidence for East Antarctic glaciation long before the Eocene-Oligocene Transition in the subpolar Indian Ocean?
- 3) When exactly did southern high-latitude cooling and Antarctic glaciation cause changes in deep- and bottom-water circulation as well as frontal zone movements in the Eocene to Miocene subpolar Indian Ocean? Is there a link to the opening of ocean gateways and changes in Antarctic Circumpolar Current evolution?
- 4) What is the role of the Southern Oceans biological pump in Cenozoic climate evolution? How is the response of the biological pump as surface and deep sea connection is initiated in the early Paleogene? Are changes in biota (evolution, community structure) and the frontal system related major global climate events like the post-EECO cooling and Miocene Climate Optimum?
- 5) Is there a consistent teleconnection between high and low latitude climate variability during the Cenozoic? Are major southern Ocean biohorizons synchronous or diachronous to low latitude biohorizons?

All of the objectives require to establish a complete astronomically calibrated stable isotope and magneto-biostratigraphy for the Southern Hemisphere high latitudes with the proposed drill sites forming the framework.

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

Proposed Sites (Total proposed sites: 8; pri: 6; alt: 2; N/S: 0)

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
KRAG-01A (Primary)	-57.93097 80.35061	1680	320	0	320	Recover Miocene to early Oligocene calcareous nannofossil ooze with diatoms
KRAG-02A (Primary)	-57.78697 80.73086	1750	300	0	300	recover early Oligocene to late Eocene calcareous nannofossil ooze, including a complete multiple APC record of the EOT
KRAG-03A (Primary)	-57.59217 81.24004	2050	300	0	300	recover a full late to middle Eocene record of calcareous nannofossil ooze
KRAG-04A (Primary)	-57.49652 81.39065	2290	300	0	300	recover early Eocene and Paleocene record of calcareous nannofossil ooze and the K/Pg boundary
KRAG-05A (Primary)	-56.77822 79.85265	1980	300	0	300	recover early to middle Eocene calcareous nannofossil ooze
KLAB-01A (Primary)	-54.86365 80.01386	3650	650	0	650	recover sediments for dating the Oligocene to recent seismic horizons identified in a sediment drifts during SO272 cruise
KALT-01A (Alternate)	-53.5518 75.9749	1141	300	0	300	recover late Pleistocene foraminifera-bearing diatom ooze to late Oligocene foraminifera-bearing nannofossil ooze
KALT-02A (Alternate)	-59.6999 84.2735	1567	300	0	300	recover middle Eocene to Maastrichtian foraminifera-bearing nannofossil ooze