IODP Proposal Cover Sheet

Agulhas Transkei Transect

834 - Full 2

Title	Drilling a transect from the Agulhas Plateau into the Transkei Basin: A keyhole into the Cretaceous Hothouse World
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Keywords	deep/intermediate circulation, Hothouse/Warmhouse, palaeoenvironment, climate/ocean
Area	Agulhas Plateau, southwest Indian

Contact Information

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Abstract

The transition from the Cretaceous "Supergreenhouse" to the Oligocene icehouse provides an opportunity to study changes in Earth system dynamics from a time when climate models suggest CO2 levels may have been as high as 3500 ppmv (parts per million by volume) and then declined to less than 560 ppmv. During the Supergreenhouse interval meridional temperature gradients were very low and oceanic deposition was punctuated by episodes of widespread anoxia, termed Oceanic Anoxic Events (OAEs) resulting in large scale burial of organic carbon reflected in positive delta 13C excursions. High CO2, greenhouse climate conditions are envisioned for the near future calling for action to get a better understanding of their potential impacts and dynamics.

Climate models have identified significant geography-related Cenozoic cooling arising from the opening of Southern Ocean gateways, pointing towards a progressive strengthening of the Antarctic Circumpolar Current as the major cause for cooler deep ocean temperatures. Analogous arguments point to an important role for deep circulation in explaining Late Cretaceous climate evolution. The Agulhas Plateau is located in a key area for retrieving high-quality geochemical records to test competing models, e.g. to what extent and exactly when the opening of Drake Passage contributed to cooling of the deep ocean. The proposed drill sites on Agulhas Plateau and Transkei Basin are at high latitudes (65°S-58°S from 100 to 65 Ma) and within a gateway between the newly opening South Atlantic, Southern Ocean and southern Indian Ocean basins. Recovery of expanded and stratigraphically complete pelagic carbonate sequences from this region, and comparison with drilling results from Naturaliste Plateau (760-Full), will provide a wealth of new data to significantly advance the understanding of how Cretaceous temperatures, ocean circulation, and sedimentation patterns evolved as CO2 level rose and fell, and the breakup of Gondwana progressed.

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Scientific Objectives

(A)Did Indian Ocean LIPs related to the breakup of Gondwana tap a similar source and show a similar temporal and geochemical evolution to coeval and older Pacific LIPs?
(B)Did sedimentation started immediately after crust emplacement at 100 Ma under subaerial conditions?
(C)Did deep and intermediate water mass flow as well as climatic events leave their imprint in form of seismic reflections and unconformities?
(D)What was the paelaeotemperature history at high southern latitudes across the rise and decline of Cretaceous Supergreenhouse and through the Paleocene?
(E)Was the Cretaceous and Paleocene Southern Ocean area major source of deep water formation that strongly influenced climatic changes?
(F)What forcing factors caused Cretaceous OAEs and what effects did these events have on the high latitude climate, oceanography and biota?

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	
TB-02A	-35.4749985, 29.6793995	4300	1050	0	1050	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 4) to recover critical interval of ocean/climate transitions 5) sample black shales
TB-01A	-35.6805992, 29.6501999	4500	950	0	950	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene

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-	-	-	-	-	-	4) to recover critical interval of ocean/climate transitions 5) sample black shales
AP-08A	-37.16550105, 24.7980995	3900	400	50	450	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-09A	-40.7822990, 26.5785999	2620	340	200	540	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-07A	-37.0250015, 24.9953003	3400	100	200	300	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-10A	-39.9510994, 26.2362003	2500	620	50	670	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas

-	-	-	-	-	-	Plateau basement
AP-06A	-40.0663986, 25.5009003	2550	200	200	400	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and paleoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and thorugh the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-11A	-40.0671997, 24.2537994	3490	720	50	770	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and paleoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and thorugh the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-05A	-40.0082626245, 25.2681999	2800	450	50	500	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and paleoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-12A	-40.0681992, 24.5436993	3100	750	50	800	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and paleoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement

AP-04A	-41.2919998, 26.1382008	3100	750	50	800	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and Paleoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-13A	-40.0671997, 24.1895008	3850	420	200	620	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and Paleoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-03A	-41.2631989, 26.3272991	3220	300	200	500	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvrionment 4) To recover high latitude palaeotemperature records of the transition from the WCretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-14A	-40.7178993, 26.0069008	2800	650	50	700	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvrionment 4) To recover high latitude palaeotemperature records of the transition from the WCretaceous Supergreenhouse and through the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-02A	-40.8604012, 27.2537003	2620	650	50	700	1) Cretaceous to Neogene record 2) To date the age ranges of the

-	-	-	-	-	-	observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and throught the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement
AP-01A	-40.8800011, 27.4428997	2700	150	200	350	1) Cretaceous to Neogene record 2) To date the age ranges of the observed unconformities and interpret their causes 3) date oldest sediment on crust and determine palaeodepth and palaeoenvironment 4) To recover high latitude palaeotemperature records of the transition from the Cretaceous Supergreenhouse and throught the Paleogene 5) to recover critical interval of ocean/climate transitions 6) unravelling nature of Agulhas Plateau basement

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