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IODP Proposal Cover Sheet

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[X] **New** [ ] **Revised** [ ] **Addendum**

Please fill out information in all gray boxes

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Title:	**Tanzania Offshore Paleoclimate (TOP): Tropical climate modes during greenhouse and icehouse conditions**		
Proponent(s):	Bridget Wade, Chris Nicholas, Paul Pearson, Dick Kroon, Paul Bown, Dennis Kent, Appy Sluijs, Richard Pancost, John Firth, Thomas Westerhold, Peter deMenocal, Brian Huber and Joyce Singano.		
Keywords: *(5 or less)*	Cenozoic, Paleoceanography, Tanzania, Indian Ocean	Area:	Indian Ocean

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Permission to post abstract on IODP-MI Web site: X Yes No

Abstract: (*400 words or less)*

Significant climate perturbations took place during the Cenozoic as the Earth shifted from greenhouse to icehouse states, but what was the history of tropical climate during the Cenozoic and to what extent did declining atmospheric carbon dioxide content (pCO_2) contribute to global cooling? Many of the crucial episodes in Cenozoic climate evolution have been poorly recovered or have not had the required organics and well-preserved microfossils to reconstruct marine temperatures and pCO_2, therefore the response of the tropical climate system to major climate transitions is still enigmatic. There is a critical need for expanded, well-dated sedimentary sequences from the tropics to answer fundamental and pressing questions of global climate change.

The expanded, clay rich sediments offshore Tanzania are unique in that they possess exceptionally preserved and abundant calcareous microfossils and organic biomarkers, and are thus ideal for quantitative detailed reconstructions of tropical ocean and terrestrial temperatures, carbon dioxide, productivity and hydrology utilizing inorganic and organic proxies. Our proposal aims to recover as complete a succession as possible from the late Paleocene to Recent. The recovery of expanded sequences, rich in microfossils will provide important data on the biotic responses to critical climate changes and evolutionary history of organisms. These new stratigraphic reference sections will contribute towards the development of the Cenozoic time scale by linking foraminiferal and nannofossil records with dinoflagellates, stable isotopes, astronomical cycles and paleomagnetics for global correlation. Our proposed drill sites also are sufficiently close to the African continent to connect marine records with terrestrial vegetation and hydrology to hominin evolution.

The proposed drilling is anticipated to have major scientific dividends on the fields of paleoclimate, paleoceanography, plankton evolution, paleoanthropology and regional tectonics. It is expected that IODP drilling offshore Tanzania will transform our understanding of the mechanisms of climate change for the last ~56 million years and will lead to primary new scientific contributions to variations in tropical and meridonial temperatures and evolutionary history in relation to pCO_2 through greenhouse and icehouse climate regimes. These records hold vital information to address transitional climate change, the mechanisms by which extreme climates develop and terminate, and forcing and feedback mechanisms in the ocean-atmosphere system, thus contributing to key scientific objectives of the IODP Initial Science Plan and the IODP Extreme Climates Initiative.

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Scientific Objectives: (*250 words or less*)

We propose to drill offshore Tanzania and recover several tropical Pleistocene-Paleocene clay rich sedimentary successions to document periods of rapid Cenozoic climate change with exceptionally preserved microfossils and sufficient organics for multiproxy paleoclimate measurements. Our proposed sites are proximal to the present and paleo Tanzania coastline and thus are uniquely placed for determining both marine and terrestrial paleoclimate. Constraining Cenozoic pCO_2 and tropical temperatures are the most compelling scientific goals of the proposed drilling and are critically needed to test the role of carbon dioxide on Earth system sensitivity in greenhouse and icehouse worlds and major climatic steps through the Cenozoic. Based on our recent seismic site survey, previous drilling by DSDP and the Tanzania Drilling Project we target three sites (TOP-1 to -3), with one alternative site (TOP-4). Recovered cores will address the following scientific objectives:

1) Establish Cenozoic tropical marine temperatures using extremely well preserved foraminifera and organic proxies ($\delta^{18}O$, Mg/Ca, TEX_{86}, U^{K}_{37}).
2) Reconstruct Cenozoic pCO_2 using inorganic and organic proxies and establish the relationship between temperature and atmospheric carbon dioxide.
3) Document terrestrial and marine biotic evolution and the biotic response to climate perturbations through critical intervals.
4) Ascertain continental air temperatures, hydrology and tropical terrestrial vegetation change using molecular and palynological methods.
5) Advance correlations to the Geomagnetic Polarity Time Scale through the recovery of cyclic sediments with abundant carbonate microfossils, dinoflagellates and paleomagnetics.

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	
						All sites target expanded clay-rich sediments with exceptionally well-preserved microfossils and biomarkers suitable for quantitative temperature and pCO_2 reconstruction using a full suite of inorganic and organic proxies.
TOP-1A	9°55'35"S, 40°18'41"E	1250	1150	0	1150	Pleistocene to Paleocene.
TOP-2A	10°4'37"S, 40°11'57"E	400	450	0	450	Pleistocene to upper Miocene.
TOP-3A	8°56'26"S, 41°30'1"E	3450	800	0	800	upper Miocene to Paleocene.
TOP-4A	9°0'5"S, 41°30'39"E	2900	850	0	850	Pleistocene to upper Eocene.