IODP Proposal Cover Sheet

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Argentine Margin Seaward Dipping Reflectors

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Title	Deep Drilling on the Argentine Passive Volcanic Continental Margin (APVCM): Exploring the Transition from Continental Breakup to Passive Margin
Proponents	Denise K. Kulhanek, Ricardo Gerster, Pedro Kress, Nestor Bolatti, Marta Ghidella, Marcelo Paterlini, Romain Meyer, Christian Berndt, Ernesto Schwarz, Juan Pablo Pérez Panera, Clifford "Chip" Heil, Roberto Violante, Daniel Ariztegui, Maria Cristina Rondoni, Brandon Briggs, Natascha Riedinger, Jens Kallmeyer, Manika Prasad, Thomas Gorgas, Tobias Weber
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Area	Argentine Margin

Proponent Information

Proponent	Denise K. Kulhanek
Affiliation	Texas A&M University
Country	United States

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Abstract

The Argentine Margin is a passive volcanic continental margin formed as a result of the breakup of Gondwana and opening of the South Atlantic during the Early Cretaceous. How this occurred is still a matter of debate, with various models focusing on different aspects of the breakup and development of segmentation. Seaward dipping reflectors (SDRs) underlie the Argentine continental margin; these are characteristic features of volcanic rifted margins, yet they have only been sampled through scientific ocean drilling in the NE Atlantic off Greenland and Norway in an area impacted by hotspot volcanism. Here we propose a drilling program to core two sites on the Argentine Margin to sample the SDRs and sedimentary record deposited since their formation. Sampling the SDRs to determine their age and composition will allow us to better understand the opening and fragmentation of the South Atlantic and in particular the source of the magma for initial melts emplaced during opening. This will also help us to understand magma/crust interactions and the implications for crustal anatexis and the impact this volcanism had on climate through delivery of gases to the ocean/atmosphere. Following breakup, the progressive opening of the South Atlantic resulted in a major change in the configuration of landmasses and ocean water mass distribution, with significant implications for climate evolution during the Cretaceous. The Cretaceous Atlantic was marked by deposition of widespread black shales during oceanic anoxic events (OAEs), yet we do not fully understand what caused their formation. The record of Upper Cretaceous OAEs in the southern South Atlantic is sparse and sampling the Cretaceous on the Argentine margin could fill this gap and provide significant insight into the formation and expression of these deposits. During the Cenozoic, uplift of the Andes had a major impact on atmospheric circulation and landscape evolution in South America. The Argentine Basin is an ideal location to recover records of this evolution and the impact it had on paleoclimate, including the development of the South American monsoon. Finally, the non-steady state nature of sedimentation along the Argentine Margin due to continual reworking of sediments makes it an exciting setting to study the interactions of sedimentation, basin evolution, microbial life, and carbon fluxes.

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Scientific Objectives

-Age and composition of seaward dipping reflectors (SDRs)
-Magma sources for initial melts associated with opening of the South Atlantic and implications for models of continental rifting/fragmentation
-Nature of magma and continental crust interactions during SDRs emplacement and better understanding on contemporaneous crustal anatexis, crustal lithology, and composition of gases delivered to the ocean and/or atmosphere
-Age of earliest marine sedimentation in the Argentine Basin, rates of South Atlantic deepening and timing of first record of northern-sourced water
-Sedimentological expression of Cretaceous OAEs and their temporal variations
-Importance of circulation changes versus productivity in the formation of OAEs
-Nature of the deepwater mass during the Late Cretaceous Supergreenhouse and timing of the first significant contribution from southern-(Antarctic) sourced deepwater
-Evidence for Andean uplift and its possible effects on climate (atmospheric circulation, oceanographic circulation, etc.)
-Dust input variations (primarily from the Andes) and implications for primary productivity (and thus CO2 uptake/release) during the Neogene
-Evolution of the South Atlantic Anticyclone across major climate transitions and its impact on precipitation, monsoon development, and carbon sequestration/release as a result of changes in weathering and erosion patterns
-Diversity and activity of microbioal life under non-steady state conditions and variations with depth, geochemistry, and sediment composition and age
-Spatial and temporal variations in the amount and flux of carbon in relation to changing primary external parameters

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

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

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
APVCM-10A (Primary)	-39.03177 -54.03040	3104	1120	200	1320	-Age, composition, magma source of the SDRs -Magma sources for initial melts associated with opening of the South Atlantic -Nature of magma and continental crust interactions during SDR emplacement -Cretaceous OAEs and ocean circulation -Nature and evolution of Cretaceous deepwater mass -Andean uplift and effect on climate, including atmospheric and oceanic circulation, precipitation, etc. -Dust input and implications for productivity/carbon sequestration -Diversity and activity of microbial life -Spatio-temporal variations in carbon flux to the basin
APVCM-05A (Primary)	-41.24528 -55.47090	4045	1386	100	1486	-Age, composition, magma source of the SDRs -Magma sources for initial melts associated with opening of the South Atlantic -Nature of magma and continental crust interactions during SDR emplacement -Cretaceous OAEs and ocean circulation -Nature and evolution of Cretaceous deepwater mass -Andean uplift and effect on climate, including atmospheric and oceanic circulation, precipitation, etc. -Dust input and implications for productivity/carbon sequestration -Diversity and activity of microbial life -Spatio-temporal variations in carbon flux to the basin