IODP Proposal Cover Sheet

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Brazilian Equatorial Margin Tectonics

Received for: 2016-10-03

Title	Tectonics of the Brazilian Equatorial Margin (BEM): The Romanche Fracture Zone, from Cretaceous Birth to Neogene Rejuvenation
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Keywords	Fracture zone, Brazil, earthquake, Romanche
Area	Brazilian Equatorial Margin

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Abstract

Transform faults are a fundamental type of plate boundary, though the exploration of the evolution of a transform faults/fracture (TF/FZ) zone system is well behind that of divergent and/or convergent plate boundary systems. Outstanding questions regards

1)The evolution, in time and space, of a TF/FZ system: transform faults should be active strike-slip plate boundaries only in between the ridge crests, but there is a growing recognition that FZs may continue to play a role in tectonic geological processes long after they are conventionally believed to have become inactive.

2)The contrast in thermal regimes and the amount of thermal exchange at the continent to ocean transition across a transform fault, this should drive vertical tectonics, but ODP Leg 159 –so far the only expedition in DSDP-ODP-IODP history to study a TF/FZ system - showed a rather different evolution.

Here we target the Romanche TF/FZ system offshore Brazil, at the western end of the study area of ODP Leg 159. The Romanche TF/FZ extends for >5000 km, it has the second longest active TF displacement in the world, 950 km, and it is the longest to offset a continental margin. It was formed in the Valanginian (ca. 140 Ma) and by the Albian (ca. 110 Ma) the separation of Africa from South America was completed by transtensional rifting.

Most surprisingly, the evidence for active deformation of the Romanche FZ is overwhelming: seismicity, quaternary faults cutting onshore outcrops and the seafloor, paleoseismic evidence of M7 EQs, among the others. This intriguing tectonic activity is not well explained by exiting models –it is in fact not within the expectation of the classic plate tectonic theory.

We propose six drilling sites to collect samples, geophysical logs, make downhole measurements. These sites are designed to sample across and within the FZ to address the following scientific objectives: 1) acquire cores to implement a record of the evolution of the thermal and deformation regime, stratigraphy and ages; an accurate sedimentary analysis, including paleoenvironmental studies and chronology, are especially useful to estimate the depths and vertical motion recorded by the transform margin; 2) characterize material properties, and stress conditions through cores and logging; and 3) define the modern thermal regime and fluid flow through in-situ measurements and fluid geochemistry. Together, data from these sites will test a suite of hypotheses about fundamental behavior and evolution of TF/FZ and their relationship with the active tectonics along the transform continental margin.

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Scientific Objectives

Drilling, coring, downhole logging at the T-BEM sites will resolve competing hypotheses and key questions regarding the evolution of TF/FZ systems and the present tectonic activity along the Romanche FZ. Major questions that will be addressed are:
1: How did deformation styles change from the birth of the Romanche FZ (Cretaceous) to now? Has it been continuously active or did it get rejuvenated?
2: Do fracture zones obey simple plate tectonics and thermal subsidence rules? If not, how are they (mis)behaving?
3: What causes tectonic activity at a fracture zone?
4: Is fracture zone rejuvenation controlling the dynamics of sediment deposition at a passive transform margin?
5: Is there a genetic relationship between Cenozoic magmatism and the Romanche fracture zone?

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

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

Site Name	Position (Lat, Lon)	Water Depth (m)	Penetration (m)			Brief Site-specific Objectives
			Sed	Bsm	Total	
ROMFZ-1A (Primary)	-1.998808 -36.628316	3570	1500	0	1500	Core and log Neogene sedimentary section 1. Age, lithology, physical and thermal properties, sedimentation history 2. Deformation state of oceanic sediments 3. State of stress within the oceanic sediments 4. Pore fluid profile within the oceanic sediments
ROMFZ-2A (Primary)	-1.885448 -36.542715	2806	100	450	550	Core and log sedimentary section and Romanche Ridge basement 1. Age, lithology, physical and thermal properties, sedimentation history 2. Deformation state of oceanic sediments and basement 3. Pore fluid profile within the sediments 4. Nature of basement and its alteration history
ROMFZ-3A (Primary)	-1.822221 -38.026974	3252	1064	0	1064	Core and log Neogene sedimentary section 1. Age, lithology, physical and thermal properties, sedimentation history 2. Pore fluid profile within the oceanic sediments 3. State of stress within the oceanic sediments 4. Tephra statigraphy
ROMFZ-4A (Primary)	-2.068621 -37.586715	3211	1075	0	1075	Core and log Neogene sedimentary section 1. Age, lithology, physical and thermal properties, sedimentation history 2. Pore fluid profile within the oceanic sediments 3. State of stress within the oceanic sediments 4. Tephra statigraphy
ROMFZ-5A (Primary)	-1.98853189 -39.06813136	2230	1192	0	1192	Core and log Cenozoic and Late Cretaceous continental rise sedimentary section 1. Age, lithology, physical and thermal properties, sedimentation history 2. Deformation state of continental rise sediments 3. State of stress within the continental rise sediments 4. Pore fluid profile within the continental rise sediments
ROMFZ-6A (Primary)	-1.86573294 -39.08372978	3268	1172	0	1172	Core and log Cenozoic and Late Cretaceous continental rise sedimentary section 1. Age, lithology, physical and thermal properties, sedimentation history 2. Deformation state of continental rise sediments 3. State of stress within the continental rise sediments 4. Pore fluid profile within the continental rise sediments