

**MagellanPlus Workshop Series Programme**

**Brazilian Equatorial Margin, BEM II**

**March 30-April 1, 2016 Ubatuba Brazil**

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**Summary**

The MagellanPlus BEM II workshop held in Ubatuba, Brazil, in March-April 2016 brought together scientists interested in exploration offshore the Brazilian Equatorial Margin. BEM II followed a previous meeting, BEM I, that was organized in Maresias in 2014. BEM offers a unique opportunity for scientists to focus on a margin that has maintained a stable intertropical latitude since its formation in the Early Cretaceous, and has contributed to the reconfiguration of the world's ocean circulation. Furthermore BEM is shaped by the interaction of the continental margin with transform faults/fracture zones so it remains a rare seismically active intraplate environment. Among the different themes discussed at the first BEM I meeting, two themes were developed to the stage of submission of two pre-proposals in October 2014: 875-Pre, the Cenozoic Paleooceanography of BEM (P-BEM), and 882-Pre, the Tectonics of BEM (T-BEM). P-BEM focuses on unraveling the Cenozoic paleoclimate and paleoceanographic record in the inter-tropical latitudes, while T-BEM aims at understanding the role of transform faults/fracture zones in the evolution of continental margins. Following the encouragement of the IODP's Science Evaluation Panel, the goal of this BEM-II workshop was to move forward with organizing, coordinating and writing the two full proposals for drilling in the Brazilian Equatorial Margin. The MagellanPlus BEM II workshop was also an outstanding opportunity to build upon the Brazilian community's knowledge of the equatorial margin and to review the large amount of industry-related datasets on the submarine margin. CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) and FAPESP (Fundação de Amparo à Pesquisa do Estado de São Paulo) research foundations also sponsored the workshop which resulted in 45 attendees from 9 countries. The outcome was a wide open discussion and sharing of data and new results that gave a clear focus for building on this knowledge to explore and develop a drilling strategy to recover the critical record of the BEM.

The workshop comprised a series of 6 scientific oral sessions with posters followed by break-out group discussions stimulated by key insights captured by rapporteurs during the sessions. The meeting culminated on its final day with plenary and break-out sessions in which seismic data from the BEM region was presented, key research questions were revised and new questions identified, and possible drilling targets were discussed. A two-day post-workshop discussion was organized to enable the conveners and principal proponents of the two initiatives, P-BEM and T-BEM, to review and recapitulate the wider group consensus and start the actual writing of the full-proposals.

As a result of this MagellanPlus workshop the proponents received a clear mandate from the attendees to work toward the development of the two P-BEM and T-BEM full proposals. The scientific importance of the BEM and the expertise of the scientists working on the proposals give these projects a high credibility profile. However, while key areas and general strategies have been identified to answer the

scientific questions, there remains a major challenge that needs to be overcome before these two proposals will be ready to be considered for actual drilling. More site survey work is still needed to better define the identified ideal target locations for drilling. In particular, even once remaining confidentiality issues regarding some geophysical datasets are solved, most of the ideal drilling sites sit in abyssal environment where geophysical information is good enough to design the drilling strategy and main targets, but not to characterize the anticipated drilling conditions according to IODP standards. Those working on seismic data in collaboration with Brazilian proponents agreed to work together and to pursue a necessary site survey campaign that will be scheduled within the year following the workshop.

A final important component of the success of the workshop was the high profile contribution given by scientists not previously involved in IODP projects and by Early Stage Researchers, particularly from Brazil. The Atlantic Ocean offshore Brazil is a main exploration area for industry, yet it is poorly known by academia. We look forward to learn much more about the equatorial Atlantic through the development of these drilling projects in the years to come.

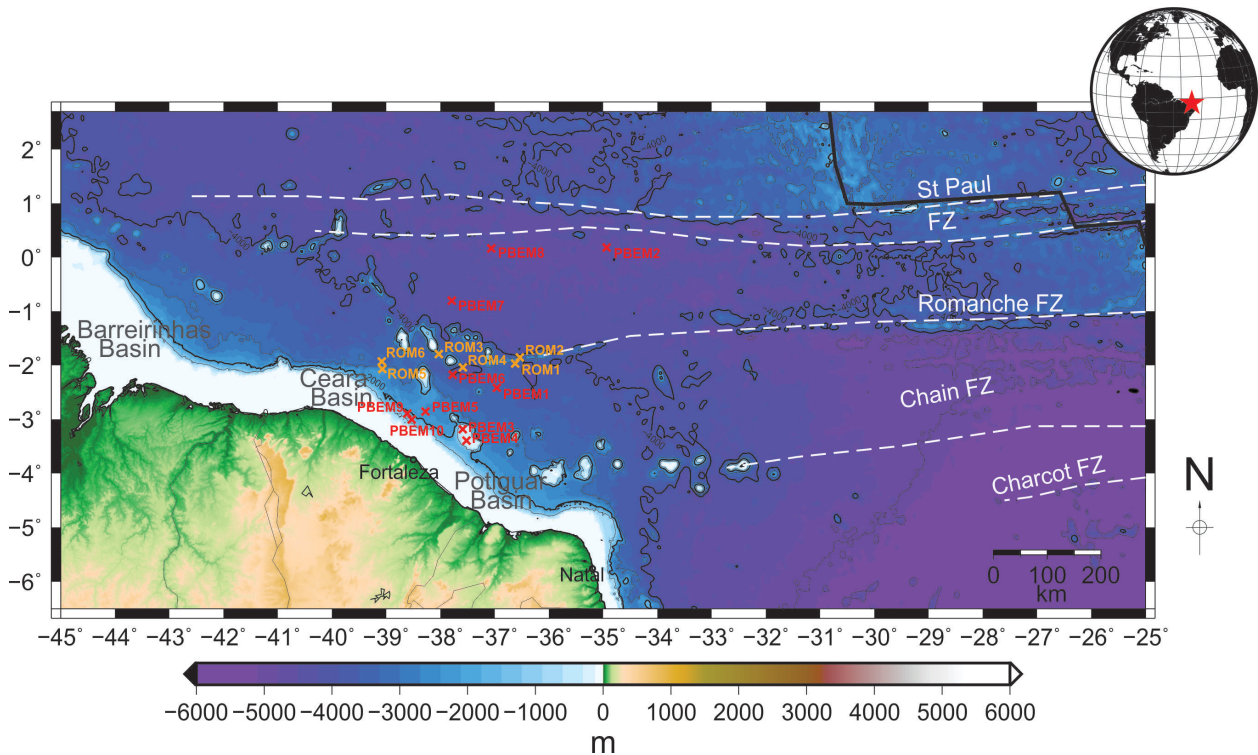


Figure 1  
Location of drilling sites identified during the BEM II workshop and included in P-BEM and T-BEM (ROM) proposals

**Objectives**

The combination of a new Brazilian IODP membership and the near-future possibility of JR operations in the South Atlantic are building tremendous scientific momentum to investigate the issues to be tackled with drilling the BEM. In particular two initiatives, T-BEM and P-BEM, are strongly linked in their areas of geographic interest (Fig. 1), even though they encompass a wide range of scientific themes. Specifically T-BEM focuses on the interaction of fracture zones with continental margins, the stress regime, the fluid circulation and tectonic activity of fracture zones and their influence in sediment deposition and intraplate volcanism. P-BEM instead concentrates in the Equatorial Atlantic paleoclimates through the sedimentary record at permanent equatorial conditions, the specific responses of tropical ecosystems to the Cenozoic climatic fluctuations.

The BEM II workshop offered the possibility to concentrate on both common and specific challenges for each BEM proposal. The objectives of the workshop were therefore to:

- 1) Identify drilling locations and possible sites to be shared between the two proposals.
- 2) Strengthen the links and synergies across the two BEM proposals
- 3) Discuss issues raised by SEP and reach agreement on the prime scientific objectives of each proposal.
- 4) Develop drilling, logging and sampling programs for each proposal.

#### Program

<b>Day 1</b>	<b>30<sup>th</sup> March 2016</b>
8:45 – 9.00	Welcome and workshop Introduction – Luigi Jovane
9:00-9:30	Mercedes Maria da Cunha Bustamante – Director IODP-CAPES (video)
<b>9.30 – 10.10</b>	<b>Overview of BEM proposals</b> <b>Chair F. H. Bezerra</b>
9.30	P-BEM – Luigi Jovane
10:00	T-BEM – Paola Vannucchi
10.30 Coffee break (10.30-11.00)	
<b>11.00-12:35</b>	<b>The IODP evaluation system and Reviews of Pre-Proposals</b> <b>Chair: L. Jovane</b>
11.00	The Importance of Brazil and the South Atlantic for IODP – J. Austin – IODP Forum Chair
11.30	The IODP Drilling Proposal Submission and Evaluation Process - D. Mallinson – SEP Co-chair
12.00	ECORD Magellan Plus – W. Piller
12.15	BEM Pre-Proposal Review – P. Clift – T-BEM and P-BEM watchdog

12.35 Lunch (12.35-14.00)	
14.00-15.30	<b>Beyond BEM: Synergy with other research groups</b> <b>Chair: H. Vital</b>
14.00	Impact of fluid circulation in old oceanic lithosphere on the seismicity of transform-type plate boundaries: The FLOWS project (EU-COST ES1301). Subtitle: "The beginning of the story of real time on-site gas analysis, Black Smokers and the Paleocene-Eocene-thermal maximum" – Rolf Kipfer
14.20	Time and mechanism constraints of vertical tectonics at the Vema and the Romanche F.Z – Luca Gasperini
14:40	Other initiatives: N-BEM – Helenice Vital /Jorge Figueiredo (10 min) The Equatorial Atlantic Gateway – Mel Murray (10 min) Rio Grande Rise – Peter Hackspacher (10 min)
15.10 -16.30	Break-out sessions - Tasks for each proposal: 1) revisit the specific scientific goals (old and new) 2) identify possible overlap/common targets between the BEM proposals
16.30 Coffee break (16.30-17.00)	
<b>17.00 -18.30</b>	<b>Plenary session on BEM proposals synergy</b> <b>Chair: P. Vannucchi</b>

<b>Day 2</b>	<b>31<sup>st</sup> March 2016</b>
<b>8.30 – 10.00</b>	<b>Geophysical data: Present and future</b> <b>Chair: F. Balsamo</b>
8.30	Overview of the Structure of the BEM based on potential and seismic data – D. de Castro
8.45	Commercial seismics from the Brazilian Equatorial Margin - D. Iacopini
9.10	Commercial seismics from the Brazilian Equatorial Margin - T. Alves
9.35	Overview of IODP Pre-Proposal 864 Site Survey- Murray Hoggert
10.00 Coffee break (10.00-10.30)	
<b>10.30 – 11.30</b>	<b>Geophysical data: Present and future (continue)</b> <b>Chair: F. Balsamo</b>
10.30	Report from Brazil (CAPES)-funded offshore projects – H. Vital
10.40	Risk analysis for the drilling of subsea stratigraphic wells in the BEM – M. Yamamoto
11.00	ICDP Trans Amazonian drilling project – W. Piller
<b>11.20-13.00</b>	<b>Case-histories on onshore-offshore tectonics, sedimentology, stratigraphy, geochemistry in BEM and related environment.</b> <b>Chair: L. Jovane</b>
11.20	Ceara Plateau seismostratigraphy – D. Pavani
11.35	Regional Geology and stratigraphy along BEM – J. Figueiredo

12.15 Lunch (12.15-14.00)	
<b>14.00-16.00</b>	<b>Case-histories on onshore-offshore tectonics, sedimentology, stratigraphy, geochemistry in BEM and related environment (continue)</b> <b>Chair: L. Jovane</b>
14.00	Active tectonics along the Brazilian Equatorial Margin – F.H. Bezerra
14.30	Faults in shallow sediments along the Brazilian Equatorial Margin: structure and fluid flow– F. Balsamo
15.00	Sedimentary systems and margin instability offshore BEM – H. Vital/Moab Gomes
15:30	Magmatism in the Equatorial Margin – Marcia Ernesto
<b>16.00-16.30</b>	<b>Preparation of break-out session – Coordinator: Cathy Busby</b>
16.30 Coffee break (16.30-17.00)	
16.30 -18.30	P-BEM and T-BEM separately: <b><i>Report and discussion on proposal section outline presented by section leaders to working group.</i></b> <b>1) Outline full-proposal sections</b> <b>2) Assign teams and team leaders for each section</b>

<b>Day 3</b>	<b>1<sup>st</sup> April 2016</b>
9.00 – 10.30	<b>Plenary session:</b> Review of day 1 and 2 implication for proposal development Chairs: Paola Vannucchi and Luigi Jovane
10.30 Coffee break (10.30-11.00)	
11.00-13.00	<b>Break-out sessions</b> implementing each section of each proposal, with figures, and definition of the final full-proposal writing strategy <b>Team Leaders</b>
13.00 Lunch (13.00-14.30)	
14.30-16.30	<b>Continue break-out sessions</b> <b>Team Leaders</b>
17.00 Coffee break (17.00-18.00)	
17.00-18.30	Plenary Discussion of targeted sites and scientific objectives <b><i>Key points for the workshop final report</i></b> <b><i>Distribute handouts/digital copies of rough section drafts, for group discussion</i></b> Summary of Timeline and key actions for each proposal team <b>Chairs: Luigi Jovane and Cathy Busby</b>

## Outcomes

The participants to the BEM II workshop committed to develop and submit both T-BEM and P-BEM full-proposals for the October 2016 deadline.

1) Identify drilling locations and possible sites to be shared between the two proposals.

Brazilian waters are well surveyed for industry purposes, in particular within the shelf, and, on the east coast also the abyssal plain. In contrast the slope and the abyssal plain of BEM, where drilling targets are more approachable, have limited datasets; therefore, the BEM proposals will share some site-survey data to maximize the possibility of solving their specific scientific questions. A site survey-task group was put in place since 2015 and it is still actively working on improving seismic imaging. The BEM-II workshop offered the opportunity for discussion of appropriate seismic datasets by the larger community and with the input from industry, to identify: 1) primary drilling sites aiming at the recovery of complete Cenozoic sedimentary sequences in several basins; 2) favorable places to extend drilling to the basement deformed by fracture zones. BEM-II has resulted in a close coordination of the drilling strategy and of work toward the successful submission of site survey packages to IODP.

2) Strengthen the links and synergies across the two BEM proposals.

As strongly advised by SEP, a coordinated approach to the paleogeography and tectonic of BEM will allow to identify main targets for each drill site. BEM II brought together academics and industry representatives to actively engage in both BEM proposals. The workshop was attended by 48 participants of 8 different countries. The discussion was enlarged to the proponents of IODP Pre-864 “Atlantic Gateway” and the developing “Rio Grande Rise” pre-proposal who were also invited to the workshop to present their state of the art. The keynote speakers: Peter Clift (University of Louisiana, USA), Tiago Alves (University of Cardiff, UK), David Iacopini (University of Aberdeen, UK), Fabrizio Balsamo (University of Parma, Italy), Hilario Bezerra (Federal University of Rio Grande do Norte, Natal, Brazil), provided stimulating input for both paleogeography and tectonics group to discuss. Early career scientists, among which is it worth to mention the big contingent from Brazil with 13 out of 15 participants, contributed to this discussion in a whole range of ways: presenting seismic, magnetic and stratigraphic data that guided some of the potential drilling site selection.

3) Discuss issues raised by SEP and reach agreement on the prime scientific objectives of each proposal.

The BEM II participants reviewed and discussed new objectives for each proposal. The outcome of the workshop was to keep the focus of each proposal separate, because the nature of the “ideal” site for paleogeography and tectonics is very different: a continuous record of sediments in key intervals for paleogeography, and a complete record of regional unconformities and basement penetration for tectonics. The discussion, therefore, focused on how the collection of complementary data would be useful for the other BEM project. Controls on paleogeography include tectonics that in this region might have been active from rifting to the present time. Conversely continuous sedimentary stratigraphy can help unravelling the tectonic history, as it provides a reference frame. The BEM II proponents felt that ultimately disentangling the two signals is critical to understand the evolution of the BEM, but that each project needs to concentrate on sites that have the higher potential to isolate different drivers through the targeted timescale.

4) Develop drilling, logging and sampling programs for each proposal.

The participants of the BEM II workshop were very active in developing both proposals within a consistent scientific frame. After discussing different possible strategies each group agreed on specific objectives for each proposals and key potential drilling sites. The sites were prioritized and geophysical data were reviewed.

### Future plans

The main outcome of the BEM II workshop is the preparation of two proposals, P-BEM and T-BEM, that will be submitted to IODP in October 2016.

In addition, a requirement in the BEM initiative is the acquisition of site survey data. Several possibilities were discussed at the workshop. Two in particular were looking quite promising: using the Brazilian navy oceanographic vessel “Vital de Oliveira” or the research vessel of the Oceanographic Institute of the University of São Paulo “Alpha Crucis”. For that purpose the participants of BEM II prepared a detailed plan for a 20-days cruise to collect bathymetric and reflection seismic data in the areas of interest (Fig. 1).

### Participants



Figure 1  
Group photo of participants in Ubatuba



Table 1 Participants (In bold the conveners of the workshop; \*early career scientists)

<b>Surname</b>	<b>Name</b>	<b>Institution</b>	<b>Country</b>
Alves	Daniel*	USP	Brazil
Alves	Tiago	Cardiff Uni	UK
Aquino da Silva	Andre' Giskard*	USP	Brazil
Austin	Jamie	U Texas	USA
Balsamo	Fabrizio	Uni Parma	Italy
Barros Nascimento	Debora*	Uni Federal Rio de Janeiro	Brazil
Bongiolo	Everton	Uni Federal Rio de Janeiro	Brazil
Bonilla	Lucy*	IO-USP	Brazil
Busby	Cathy	UC Davis	USA
Bustamante	Mercedes	UnB-CAPES	Brazil
Carreira	Renato	PUC-Rio	Brazil
Clift	Peter	LSU	USA
Coutinho de Oliveira	Celine*	IO-USP	Brazil
da Fonseca Carrasqueira	Igor Gustavo*	IO-USP	Brazil
De Castro	David	UFRN	Brazil
de Moraes Rios Netto	Aristoteles	Uni Federal Rio de Janeiro	Brazil
<b>do Rego Bezerra</b>	<b>Hilario Francisco</b>	<b>UFRN</b>	<b>Brazil</b>
Ernesto	Marcia	Brazil	Brazil
Fauth	Gerson	Uni Sinos	Brazil
Ferre'	Eric	Southern Illinois U	USA
Figueredo	Jorge	PetroGeo	Brazil
Gasperini	Luca	ISMAR-Bologna	Italy
Giorgioni	Martino*	IO-USP	Brazil
Hoggett	Murray*	Uni Birmingham	UK
Hoogakker	Babette	Oxford Uni	UK
Iacopini	David	Aberdeen Uni	UK
<b>Jovane</b>	<b>Luigi</b>	<b>IO-USP</b>	<b>Brazil</b>
Kipfer	Rolf	ETH	Switzerland
Lanci	Luca	Uni Urbino	Italy
Mallinson	David	U East Carolina	USA
Morgan	Jason	RHUL	UK
Murphy	Melissa*	Oxford Uni	UK
Nascimento	Aderson	UFRN	Brazil
Piller	Werner	Graz Uni	Austria
Pinheiro Beck Eichler	Patricia*	UFRN	Brazil
Praxedes Gomes	Moab	UFRN	Brazil
Rios	Isabella*	Uni Estado Rio de Janeiro	Brazil



Rodelli	David*	IO-USP	Brazil
Savian	Jairo	UFRGS	Brazil
Siciliano	Eric*	IO-USP	Brazil
Silva de Moura	Denise*	IO-USP	Brazil
Sousa	Zorano	UFRN	Brazil
Sousa e Mello	Silvia Helena	IO-USP	Brazil
Toledo	Felipe	IO-USP	Brazil
<b>Vannucchi</b>	<b>Paola</b>	<b>RHUL</b>	<b>UK</b>
<b>Vital</b>	<b>Helenice</b>	<b>UFRN</b>	<b>Brazil</b>
Waldmann	Nicolas	Haifa U	Israel
Yamamoto	Marcio	Uni Tokyo	Japan

### How the MagellanPLUS Grant was spent

The allocated sum amounted to €15000. The total expenditure for the ECORD contingent is given below. UK-IODP shared part of the costs for Tiago Alves and David Iacopini.

Object	Amount (€)
Travel cost for 14 participants	13360
Accommodation and meals for 3 days for 14 participants	2100
Accommodation and meals for 2 extra days for 5 participants	500