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## RV METEOR-CRUISE M78/3b

Montevideo – Montevideo, 17.6.2009 – 6.7.2009  
Chiefscientist: Prof. Dr. Gerold Wefer  
Master: Walter Baschek

### *Short Cruise Report*

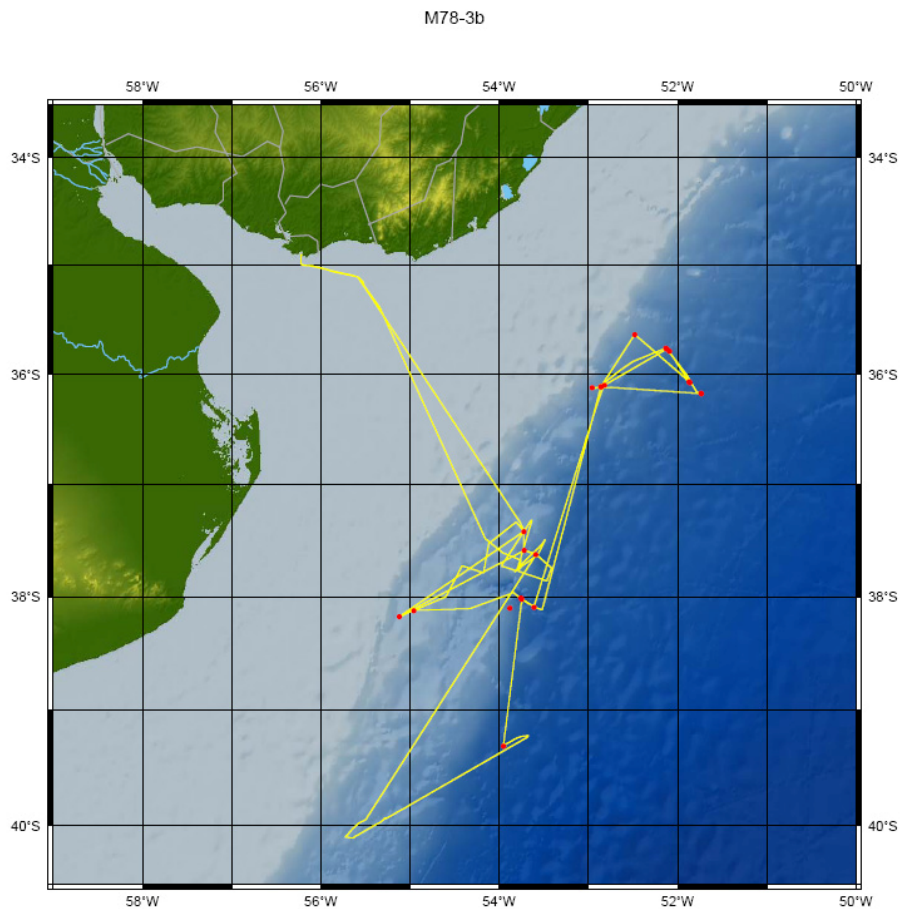


Fig. 1: Cruise track of Meteor cruise M78/3b at the continental margin off Uruguay and northern Argentina

## **Research Program**

The investigation of sediment transport processes at the shelf and continental slope off Uruguay and Northern Argentina was focus of the research cruise M78/3 with RV METEOR. The Rio de la Plata River and other rivers deliver huge amounts of terrigenous sediments into this area. Redistribution of these sediments by turbidity currents, mass wasting and contour currents is characterized by different type of depositional patterns. Following a source-to-sink approach we studied the sediment transport processes from the continental shelf to the deep-sea by means of geophysical mapping as well as geological sampling and geotechnical investigation. These investigations were carried out in two legs. The first leg M78/3a with Prof. S. Krastel as chief scientist focused on seismic mapping as well as geological sampling using conventional geological tools. Next to in-situ geotechnical testing (CPT) and conventional geological sampling tools (gravity corer, multi corer) the sea floor drill rig MeBo was used during this second leg in order to get long sediments cores for a combined sedimentological, geophysical, geotechnical and geochemical investigation of the interacting processes of sediment redistribution, sediment partitioning and sediment diagenesis at the ocean margin off Uruguay and Northern Argentina. The MeBo is a robotic drill rig that is deployed on the sea bed and remotely controlled from the vessel. It can sample the sea floor down to 75 m. The investigations were conducted by the MARUM Center for Marine Environmental Sciences / DFG Research Center "The Ocean in the Earth System" at the University of Bremen with main emphasis on section SD (Sediment dynamics) in cooperation with the Excellence Cluster "Future Ocean", University of Kiel, project B4 (Submarine hazards at continental margins).

## **Narrative of the cruise**

The MeBo-system (MeBo: Abbreviation of Meeresboden-Bohrgerät, the German expression for sea floor drill rig) was shipped within six 20'containers from Bremen and Bremerhaven to Montevideo. The containers were scheduled for arriving in Montevideo on June 4<sup>th</sup>, more than a week before starting installation of the equipment on the deck of RV METEOR on June 14<sup>th</sup>. However, the containers were disembarked on June 2<sup>nd</sup> in Buenos Aires instead of in Montevideo and it was not before the morning of June 18<sup>th</sup> that the containers stood ready for unloading on the pier next to RV METEOR. With optimal support of the METEOR crew and of the agent for the harbor logistics we managed to set up the complicated system within two days. After a successful harbor test of the drill rig and its launch and recovery system RV METEOR left the harbor at June 19<sup>th</sup> at 09:00 pm local time, two and a half days later than initially planned.

The scientific crew included 25 scientists and technicians from the DFG Research Center and Cluster of Excellence "The Ocean in the Earth System" with scientists from the University of Bremen, the Max Planck Institute for Marine Microbiology and the Alfred-Wegener-Institute for Polar and Marine Research, an engineer from the drill rig manufacturer Prakla Bohrtechnik, a technician and a meteorologist from the German Weather Service and one scientist each from Administracion Nacional de Combustibles Alcohol y Portland and the University of Buenos Aires.

After arriving the next evening in the first investigation area characterized by contourite deposits – this area was identified as a promising site for drilling with MeBo during the first leg – we started the scientific program with water sampling for dinoflagellate studies, sea floor mapping with Parasound und multibeam echo sounder and a first test of an experimental sediment sampling tool for piston sampling to be used in combination with a pressure core barrel for the MeBo. In the

morning of June 21<sup>st</sup> the MeBo was deployed on the Contourite site. This deployment had to be stopped after drilling the first barrel due to an electric fault. Although the weather conditions deteriorated during the deployment, we managed thanks to the experienced decks crew to recover the drill rig safely. The deployment and recovery of this 10-tonnes device from a moving platform requires fairly calm conditions (not more than 2 m swell). The weather conditions thus had a major impact on cruise planning during this leg.

Since the Contourite Area was already intensively investigated during leg M78/3a by conventional geological tools and hydroacoustics we decided not to wait on calmer conditions for a second MeBo deployment at this site but to steam to the next investigation area located south of the Mar del Plata Canyon. After deployment of the experimental piston corer, gravity corer, multi corer and CPT the weather conditions allowed a MeBo deployment at the afternoon of June 22<sup>nd</sup>. This site is located at the confluence of the Malvinas and Brazil current and was proposed for a deep drilling site (NAM1) for the drill ship Joides Resolution within the Integrated Ocean Drilling Program (IODP). Results of the MeBo drilling will help to evaluate the suitability of this site for deep drilling in order to reconstruct the history of the Malvinas-Brazil-confluence zone. After 19 hours deployment and 21.5 m drilling depth a strengthening of the wind forced us to finish the deployment and to recover the MeBo. Core recovery rates varied between 50 and 100% depending on the sediment composition and the selected drill bit and core catcher.

After two unsuccessful deployments of the gravity corer at selected sites on the way (the vessel was not able to keep station due to adverse directions of wind waves and currents) a successful sampling, probing and mapping program including water sampling, CPT, gravity corer, experimental piston corer and hydroacoustics was conducted in the northern scarp and drift working area between June 24<sup>th</sup> and June 27<sup>th</sup>. Calming of the sea conditions allowed the next MeBo deployment in this area. After a 24 hours deployment reaching 36 m drilling depth the MeBo was recovered in the early afternoon of June 28<sup>th</sup>. The recovered cores confirmed the interpretation of seismic investigations showing a large older consolidated sediment body covered by a sediment cap consisting of young and soft muds.

An intense low-pressure system forced us to escape towards the south afterwards. On the way three gravity cores were successfully recovered at about 38°/39°S in 3600 to 3700 m water depth in an area known for the occurrence of Ikait-minerals. We were able to recover samples of this diagenetic formed Hexahydrate-Carbonate. The investigation of the minerals as well as the adjacent sediments and pore water profiles will give further insights into the diagenetic formation conditions of this mineral, that is also found at the base of glaciers in high latitudes. Intensification of the storm inhibited a continuation of the station program until the early morning of July 2<sup>nd</sup>.

After taking three gravity cores in a prominent Canyon system, additional water sampling and a further test deployment of the experimental piston corer we returned to the NAM1 site in order to continue the MeBo drilling at this site. A 29 hours deployment until midnight of July, 3<sup>rd</sup> / 4<sup>th</sup> resulted in a drilling depth down to 50.5 m below sea floor. Immediately after recovery, the drill rig was prepared for the next deployment at the contourite site. Within 12 hours drilling time on July, 4<sup>th</sup> a drilling depth of 20 m was reached and pure fine sands were recovered. The research program was concluded with complementary hydroacoustic mapping on the way back to Montevideo. After arrival at the harbor of Montevideo in the morning of July, 6<sup>th</sup> the entire scientific equipment and the recovered samples were unloaded and shipped within ten 20' containers back to Bremen.

Despite of the delay at the start of this expedition and despite of the changing and partly inappropriate weather conditions during the southern hemisphere winter we were able to conduct a comprehensive sampling and mapping program. The MeBo worked reliably and the operational speed of the system could be accelerated considerably. Core recovery rates up to 90 – 100 % were reached especially in cohesive sediments. The sediment material and hydroacoustic data collected during the first leg was specifically supplemented. A valuable data- and sample set of short and long sediment cores was collected in order to reconstruct the sediment transport processes at the continental margin of Uruguay and Northern Argentina.

The scientific party of Meteor Cruise M78/3b gratefully acknowledges the purposive and effective cooperation with Captain Baschek and his crew. The remarkably reliable short- and long-term weather forecast by the DWD was extremely helpful for the station planning. We thank Celeste Saulo and her colleagues from the Centro de Investigaciones de Mar y la Atmosfera at the University of Buenos Aires for their support of the forecast with daily updates of CIMA regional atmospheric model. The compensation of at least some of the delay due to the late container arrival could be compensated thanks to the extraordinary support by Humberto Heins organising the harbor logistics in Montevideo. We also appreciate the professional support by the Leitstelle Meteor/Merian. This expedition was funded by the Deutsche Forschungsgemeinschaft.

## Participants

Name	Discipline	Institution
1. Wefer, Gerold, Prof. Dr.	Chief Scientist	Marum/GeoB
2. Andreula, Roberto	Geotechnics	Marum/GeoB
3. Arnold, Gail Lee, Dr.	Geochemistry	MPI
4. Beck, Andreas	Meteorology	DWD
5. Bender, Vera Barbara	Sedimentology	Marum/GeoB
6. Bergenthal, Markus	MeBo	Marum/GeoB
7. Bogus, Kara	Micropaleontology	Marum/GeoB
8. Collins, James	Geology	Marum/GeoB
9. Dekeyzer, Stefanie	Micropaleontology	Marum/GeoB
10. Diekamp, Volker	Geolab	Marum/GeoB
11. Düßmann, Ralf	MeBo	Marum/GeoB
12. Esteban, Frederico Damian	Hydroacoustics	UBA
13. Freudenthal, Tim, Dr.	MeBo	Marum/GeoB
14. Henkel, Susann	Geochemistry	AWI
15. Hohnberg, Hans-Jürgen	Piston coring	Marum/GeoB
16. Klar, Steffen	MeBo	Marum/GeoB
17. Klein, Thorsten	MeBo	Marum/GeoB
18. Könnecker, Hans-Otto	MeBo	PRAKLA
19. Lange, Matthias	Geotechnics	Marum/GeoB
20. Mund, Oliver	Deck Technician	Marum/GeoB
21. Ochsenhirt, Wolf-Thilo	Meteorology	DWD
22. Preu, Benedict	Hydroacoustics	Marum/GeoB
23. Razik, Sebastian Lukas	Geomagnetics	Marum/GeoB
24. Renken, Jens	MeBo	Marum/GeoB
25. Riedinger, Natascha, Dr.	Geochemistry	MPI
26. Rosiak, Uwe	MeBo	Marum/GeoB
27. Sawicka, Joanna Elzbieta	Geochemistry	MPI
28. Schmidt, Werner	MeBo	Marum/GeoB
29. Seiter, Christian	MeBo	Marum/GeoB
30. Tomasini, Juan	Geochemistry	ANCAP

### Participating Institutions:

ANCAP	Administracion Nacional de Combustibles Alcohol y Portland, Exploracion y Produccion, Montevideo, Uruguay
AWI	Alfred-Wegener-Institut für Polar- und Meeresforschung, Bremerhaven
DWD	Deutscher Wetterdienst – Seewetteramt, Hamburg
Marum/GeoB	Marum, Fachbereich Geowissenschaften, University of Bremen
MPI	Max Planck Institute for Marine Microbiology, Bremen
Prakla	Prakla Bohrtechnik GmbH, Peine
UBA	University of Buenos Aires

## Station list

GeoB #	Date	Time (UTC)	PositionLat	PositionLon	Water depth [m]	Device	Recovery [cm]
13844-1	20.06.09	18:36	37°25.055' S	53°43.315' W	1150	CTD	
13844-2	20.06.09	20:16	37°24.976' S	53°43.291' W	1150	EPC	30
13844-3	20.06.09	20:58	37°24.965' S	53°43.175' W	1151	CTD-ISP	
13844-4	21.06.09	9:30	37°25.07' S	53°43.56' W	1150	MeBo	240
13845-1	22.06.09	3:23	38°10.416' S	55°07.070' W	555	EPC	190
13845-2	22.06.09	10:34	38°10.417' S	55°07.072' W	550	MUC	30
13845-3	22.06.09	11:37	38°10.417' S	55°07.072' W	550	GC-12	-
13845-4	22.06.09	13:30	38°10.42' S	55°07.07' W	550	CPT	
13845-5	22.06.09	14:11	38°10.448' S	55°06.933' W	550	CPT	
13845-6	22.06.09	14:44	38°10.463' S	55°06.798' W	550	CPT	
13845-7	22.06.09	15:23	38°10.485' S	55°06.666' W	550	CPT	
13845-8	22.06.09	18:20	38°10.400' S	55°7.105' W	548	MeBo	2150
13845-9	23.06.09	-	38°10.421' S	55°7.078' W	550	GC-6	-
13845-10	23.06.09	13:30	38°10.43' S	55°07.07' W	549	EPC	83
13845-11	02.07.09	22:09	38°10.436' S	55°7.11' W	547	MeBo	2900
13846-1	23.06.09	15:15	38°7.213' S	54°57.442' W	637	MUC	20
13846-2	23.06.09	16:16	38°7.19' S	54°57.46' W	637	GC-6	520
13847-1	23.06.09	1:18	38°0.50' S	53°45.48' W	3560	GC-12	-
13848-1	24.06.09	17:02	38°5.845' S	52°52.74' W	1111	CPT	
13848-2	24.06.09	18:20	38°5.979' S	52°52.588' W	1126	CPT	
13849-1	25.06.09	4:10	36°10.41' S	51°43.96' W	3278	GC-12	1129
13850-1	25.06.09	7:35	36°10.283' S	51°44.154' W	3267	GC-12	820
13850-2	25.06.09	9:57	36°10.288' S	51°44.113' W	3000	CTD	
13850-3	25.06.09	12:51	36°10.30' S	51°44.06' W	400	CTD	
13851-1	25.06.09	17:28	35°46.00' S	52°07.20' W	2213	GC-12	72
13852-1	26.06.09	0:28	36°5.7015' S	52°48.984' W	1320	GC-6	560
13853-1	26.06.09	3:33	36°7.182' S	52°57.511' W	973	EPC	-
13854-1	26.06.09	9:46	35°45.54' S	52°7.89' W	2109	GC-6	552
13855-1	26.06.09	12:32	35°47.3' S	52°5.48' W	2277	GC-6	479
13856-1	26.06.09	17:29	36°03.94' S	51°52.25' W	3059	GC-12	779
13857-1	26.06.09	20:27	36°4.31' S	51°51.79' W	3077	GC-12	802
13858-1	27.06.09	2:40	35°38.06' S	52°28.73' W	1103	EPC	150
13859-1	27.06.09	8:24	36°06.703' S	52°51.288' W	1197	CPT	
13859-2	27.06.09	9:57	36°6.964' S	52°50.922' W	1227	CPT	
13860-1	27.06.09	11:49	36°6.65' S	52°51.58' W	1190	MeBo	3560
13861-1	28.06.09	0:51	38°5.51' S	53°36.59' W	3715	GC-12	668
13862-1	29.06.09	4:44	38°1.11' S	53°44.7' W	3588	GC-12	1026
13863-1	29.06.09	14:38	39°18.7' S	53°57.16' W	3687	GC-12	856
13864-1	02.07.09	0:25	37°37.43' S	53°35.289' W	2776	GC-12	748
13864-2	02.07.09	2:59	37°37.475' S	53°35.33' W	2757	GC-12	792
13865-1	02.07.09	5:25	37°35.188' S	53°43.102' W	1634	GC-12	530
13866-1	02.07.09	11:08	37°55.373' S	54°30.978' W	-	CTD	-
13866-2	02.07.09	12:06	37°55.356' S	54°30.987' W	-	CTD-ISP	
13867-1	02.07.09	18:48	38°10.403' S	55°7.0066' W	548	EPC	-
13868-1	04.07.09	10:40	37°24.87' S	53°43.32' W	1146	MeBo	727
13869-1	05.07.09	1:23	37°36.67' S	53°37.22' W	2503	CPT	-
13869-2	05.07.09	1:37	37°36.85' S	53°37.35' W	2467	CPT	-

CPT – Cone penetration testing  
 CTD – Multi-water sampler with CTD  
 EPC – Experimental Piston Corer  
 GC – Gravity Corer  
 ISP – In-situ pumps  
 MeBo – Sea floor drill rig  
 MUC – Multicorer