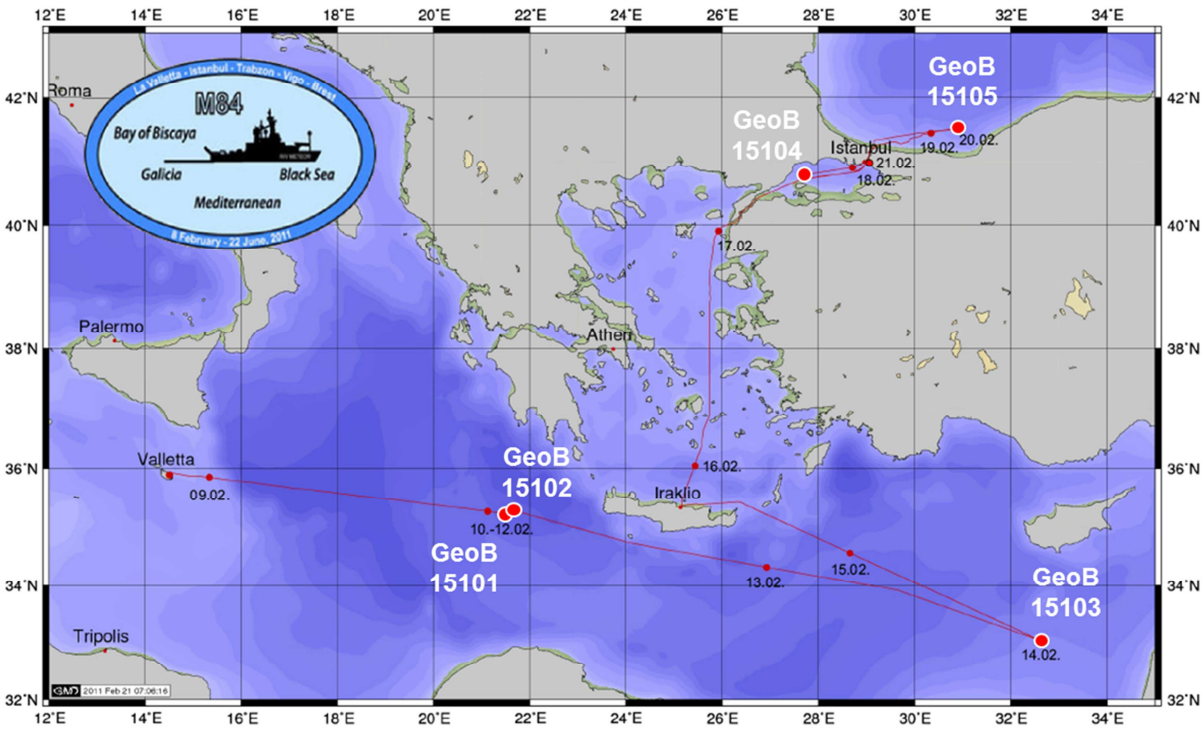
Matthias Zabel
Marum – Center for Marine Environmental Sciences
Bremen University
Leobener Str.
D-28359 Bremen

Tel.: +49 40 218 65103
Fax: +49 40 218 9865103
e-mail: mzabel@uni-bremen.de

Short Cruise Report
RV METEOR Cruise M84-1

Valletta (Malta) – Istanbul (Turkey)
09. – 22. February 2011
Chief Scientist: Matthias Zabel
Captain: Michael Schneider



Ship track of RV Meteor cruise M84-1 with GeoB locations of sampling marked.

Summary / Objectives

Central objective of this expedition was the sampling of sediment and suspended particulate material from locations with extremely different environmental conditions. These samples will be used to constrain factors that influence the distribution of benthic archaea in marine sediments and thus determine their role in the marine carbon cycle. Five locations with a broad spectrum of environmental conditions were selected in the Mediterranean, Marmara and Black Seas based on published data. Therefore, site survey was not necessary and all ship time could be used for the deployment of the four different sampling devices, which we had available (gravity corer, multicorer, CTD rosette, in-situ pumps). Due to the shortness of the leg, only few sedimentological and geochemical investigations could be conducted on board directly. In contrast, great effort was made for preparation and storage of subsamples for the planned analysis and experiments in the home laboratories that will employ a great variety of complex methods. Taking the very ambitious schedule into account, with two stops at anchor for (dis)embarkations, three transfers through very busy straits, more than 2.100 nm transit and extensive sampling programs at five locations, it has to be stated that the cruise was extremely successful. The recovered number of very promising samples has exceeded our initial expectations and constitutes an excellent basis for future scientific studies.

Research Program and Narative

Our research approach involves the examination of *benthic archaea* in a global range of diverse sedimentary environments. The expedition DARCSEAS is the first concerted step toward this direction as it aims to capture the largest possible range of contrasting biogeochemical and depositional conditions in the Mediterranean Sea and adjacent basins.

In the Eastern Mediterranean the Urania Basin (Station GeoB 15101) and Discovery Basin (Station GeoB 15102) West off Crete represent two deep basins which only recently filled with highly saline, anoxic brines of different salinity and salt composition, thus creating extreme conditions for life. South of Cyprus Station GeoB 15103 targets a highly oligotrophic area where organic-lean coccolith oozes are intercalated with organic-rich sapropels. These sapropels may act as bioreactors in otherwise biologically largely inactive sediments. Station GeoB 15104 in the Marmara Sea is largely composed of clay-rich coccolith oozes and an organic rich sapropel layer, while Station GeoB 15105 at the southeastern slope of the Black Sea is situated in anoxic waters and comprises the succession of modern coccolith oozes, the early Holocene sapropel, and the late Pleistocene brackish mud. Taken together these sites cover sediments with largely varying inputs of organic matter, salinities, sedimentation rates, and depositional and paleoenvironmental regimes. Our sampling strategy was designed to generate a comprehensive set of geochemical and microbiological data that capture the chemical environment as well as the composition and processes of microbial communities in the subseafloor. It included: (a) sedimentological description of recovered cores; (b) geochemical characterization of sediment pore-waters with respect to nutrients, electron acceptors and donors, and water-soluble organic metabolites; (c) quantification and molecular characterization of particulate and dissolved organic matter; (d) characterization of microbial communities by coupled lipid biomarker/DNA-based approaches and cultivation. In addition, we collected water samples and suspended particulate matter at the two brine basins and in the Black Sea in order to characterize the modern marine chemistry and

composition of oceanic microbial communities and their linkage to their sedimentary counterparts. Moreover, excellent existing background information on the lithostratigraphy at stations GeoB 15103-15105 will enable us to study the late Quaternary paleoenvironmental conditions on a North-South transect from the southern Eastern Mediterranean to the Black Sea. The combination of biogeochemical, microbiological and paleoenvironmental data provides opportunities for examining the relationships between subsurface microbial life and paleoenvironmental conditions at time of deposition. For example, we will compare early Holocene sapropel layers that were deposited simultaneously in three different oceanic basins.

The expedition started 09:00 am on Wednesday, 09 February with leaving the port of Valletta (Malta). The scientific crew of 27 persons was completed by Dr. Alexandra Gogou, the Grecian observer and colleague from the Hellenic Centre for Marine Research, and Andreas Schön, an artist and special guest on this cruise leg. After a transit of about 350 nm we arrived at the first station, GeoB 15101, in the Urania Basin in the afternoon of February 10. First samples were taken from the water column by using a CTD rosette sampler. As to be expected, a distinct change in salinity could be observed at around 3460m water depth. At this location, an active mud volcano has been described in the literature. A thick fluid mud layer could be sampled, but hampered also the deployment of our instruments for sediment sampling, gravity corer and multicorer. Station work was finished in the early evening of February 11. After only about 1 hour transit time we arrived at station GeoB 15102 in the Discovery Basin. Again, a huge amount of water column and sediment samples could be obtained. The transit to the third sampling site GeoB 15103, located in the central eastern Mediterranean Sea, started in the afternoon of February 12. Like planned before, we took sediment samples at this site only. With the gravity corer the uppermost sequence of sapropel layers could be sampled. Before passing the Aegaen Sea, the Grecian observer and an engineer of Kongsberg were disembarked in the harbor entrance of Heraklion (Crete). In turn, an inspector of the shipping company (Laeisz) embarked. After passing the Dardanelles without delay we arrived at Istanbul in the morning of February 18. Despite an official announcement, the waiting for the Turkish observers was more than 4 hours. So, we arrived at station GeoB 15104 in the Marmara Sea only at 6 pm. Again all instruments for sampling could be used successfully. In the morning of February 19 we passed the Bosporus Strait and arrived at our last sampling site GeoB 15105 in the late afternoon. After finishing the scientific program in the early evening of the 20th February, the cruise ended one day later in the harbor of Istanbul.

Acknowledgements

The overall successful course of this expedition needs to be attributed to the friendly cooperation and very efficient technical assistance of Captain Michael Schneider, his officers and crew. No matter in which area, we always were attentively cared for. It was always obvious that all people on board worked on a common task. For this we would like to thank everybody involved, last but not least also the Leitstelle METEOR Hamburg. We would like to cordially thank Götz Ruhland (MARUM/Bremen University), Klaus Bohn (LPL Projects + Logistics GmbH) and their teams for professional support of expedition logistics.

The work was funded by the Deutsche Forschungsgemeinschaft (DFG) and the European Research Council (ERC).

Cruise participants

Name	Discipline	Institution
Zabel, Matthias, PD Dr.	chief scientist	Marum
Aiello, Ivano, Dr.	Sedimentology	ML
Becher, Kevin, MSc-stud.	organic geochemistry	GeoB
Braun, Stefan, MSc-stud.	organic geochemistry	GeoB
Broda, Nadine, MSc-stud	organic geochemistry	GeoB
Dibke, C., MSc-stud.	organic geochemistry	GeoB
Elvert, Marcus, Dr.	organic geochemistry	GeoB / Marum
Gagen, Emma, Dr.	Microbiology	UR
Goldhammer, Tobias, Dr.	inorganic geochemistry	Marum
Heuer, Verena, Dr.	organic geochemistry	GeoB / Marum
Hinrichs, Kai-Uwe, Prof. Dr.	organic geochemistry	GeoB / Marum
Koch, Boris, Dr.	organic geochemistry	AWI
Lazar, Cassendre, Dr.	Microbiology	UNC
Lin, Yu-Shih, Dr.	organic geochemistry	Marum
Lipp, Julius, Dr.	organic geochemistry	GeoB / Marum
Meador, Travis, Dr.	organic geochemistry	Marum
Pape, Silvana, techn.	inorganic geochemistry	Marum
Peters, Carl, MSc- stud.	organic geochemistry	GeoB
Schmal, Jessica, techn.	organic geochemistry	GeoB / Marum
Schmidt, Frauke, Dr.	organic geochemistry	GeoB / Marum
Schön, Andreas, artist	special guest	---
Schröder, Jan, PhD-stud.	organic geochemistry	GeoB
Teske, Andreas, Prof. Dr.	Microbiology	UNC
Wendt, Jenny, techn.	inorganic geochemistry	GeoB
Wörmer, Lars, PhD-stud.	organic geochemistry	GeoB / Marum
Yoshinaga, Marcos, Dr.	organic geochemistry	GeoB / Marum
Zhu, Charlie, Dr.	organic geochemistry	Marum
Knuth, Edmund, Dr.	Meteology	DWD
Gogou, Alexandra, Dr.	Observer (GR) / org. biogeochem.	HCMR
Erdem, Zeynep	Observer (TR)	ITU EMCOL
Kacar, Asli, Dr.	Observer (TR)	UI

Participating Institutions

AWI	Alfred Wegener Institute for Polar- and Marine Research, Stilleweg 2, D 30655 Hannover, Germany	www.awi-bremerhaven.de
DWD	Deutscher Wetterdienst, Geschäftsfeld Seeschifffahrt, Bernhard-Nocht-Str. 76, D 20359 Hamburg, Germany	www.dwd.de
GeoB	Dept. of Geosciences, Bremen University Klagenfurter Str., D 28359 Bremen, Germany	www.geo.uni-bremen.de

HCMR	Hellenic Centre for Marine Research, 46.7 km Athens-Sounion Av., 19013 Anavyssos, Greece	www.hcmr.gr
ITU EMCOL	Istanbul Technical University	
Marum	Centre for Marine Environmental Sciences Leobener Str., D 28359 Bremen, Germany	www.marum.de
UNC	University of North Carolina at Chapel Hill, Dept. of Marine Sciences, Chapman Hall 351, CB 3300, Chapel Hill, NC 27599, USA	www.marine.unc.edu
UR	Institute for Microbiology, University Regensburg, Universitätsstraße 31, D 93053 Regensburg, Germany	www.biologie.uni-regensburg.de
UI	University of Izmir	

Station List

Station No.	GeoB No.	Date (2011) dd.mm	Time (UTC)	Lat [N]	Long [E]	Water Depth [m]	Gear	max. rope tension [kN]
ME841/107-1	15101-1	10.02	15:41	35°13,87'	21°28,31'	3599*	CTD	---
ME841/108-1	15101-2	10.02	20:42	35°13,87'	21°28,30'	3600*	ISP	---
ME841/109-1	15101-3	11.02	03:09	35°13,87'	21°28,30'	3599*	MC	47,3
ME841/110-1	15101-4	11.02	06:14	35°13,87'	21°28,30'	3599*	MC	58,7
ME841/111-1	15101-5	11.02	09:46	35°13,88'	21°28,31'	3603*	GC	67,7
ME841/112-1	15101-6	11.02	12:52	35°13,87'	21°28,30'	3602*	CTD	---
ME841/113-1	15101-7	11.02	15:46	35°13,87'	21°28,30'	3602*	GC	67,5
ME841/114-1	15102-1	11.02	20:21	35°16,43'	21°41,50'	3615	GC	66,2
ME841/115-1	15102-2	11.02	23:18	35°16,43'	21°41,50'	3615	CTD	---
ME841/116-1	15102-3	12.02	03:18	35°16,43'	21°41,50'	3615	ISP	---
ME841/117-1	15102-4	12.02	09:48	35°16,43'	21°41,50'	3615	MC	48
ME841/118-1	15102-5	12.02	12:40	35°16,43'	21°41,50'	3624	GC	65,3
ME841/119-1	15103-1	14.02	12:50	33°02,00'	32°38,00'	1424	GC	48,7
ME841/120-1	15103-2	14.02	15:03	33°01,65'	32°37,80'	1367	GC	40,8
ME841/121-1	15103-3	14.02	16:35	33°01,65'	32°37,80'	1366	MC	30,3
ME841/122-1	15104-1	18.02	16:08	40°47,97'	27°43,49'	606	MC	18,0
ME841/123-1	15104-2	18.02	17:14	40°47,97'	27°43,49'	600	GC	36,1
ME841/124-1	15104-3	18.02	18:08	40°47,97'	27°43,49'	600	GC	34,2
ME841/125-1	15104-4	18.02	19:01	40°47,98'	27°43,49'	601	GC	35,9
ME841/126-1	15105-1	19.02	16:02	41°31,70'	30°53,07'	1268	GC	50,9
ME841/127-1	15105-2	19.02	17:26	41°31,71'	30°53,07'	1266	GC	40,8
ME841/128-1	15105-3	19.02	18:51	41°31,70'	30°53,10'	1267	GC	43,9
ME841/129-1	15105-4	19.02	20:07	41°31,70'	30°53,09'	1266	MC	21,6
ME841/130-1	15105-5	19.02	21:58	41°31,70'	30°53,10'	1264	CTD	---
ME841/131-1	15105-6	19.02	23:45	41°31,70'	30°53,10'	1266	ISP	---
ME841/132-1	15105-7	20.02	05:53	41°31,70'	30°53,10'	1263	ISP	---
ME841/133-1	15105-8	20.02	11:38	41°31,69'	30°53,09'	1227	ISP	---
ME841/134-1	15105-9	20.02	17:00	41°31,70'	30°53,10'	1231	ISP	---

* apparent depth! Surface of the fluid mud