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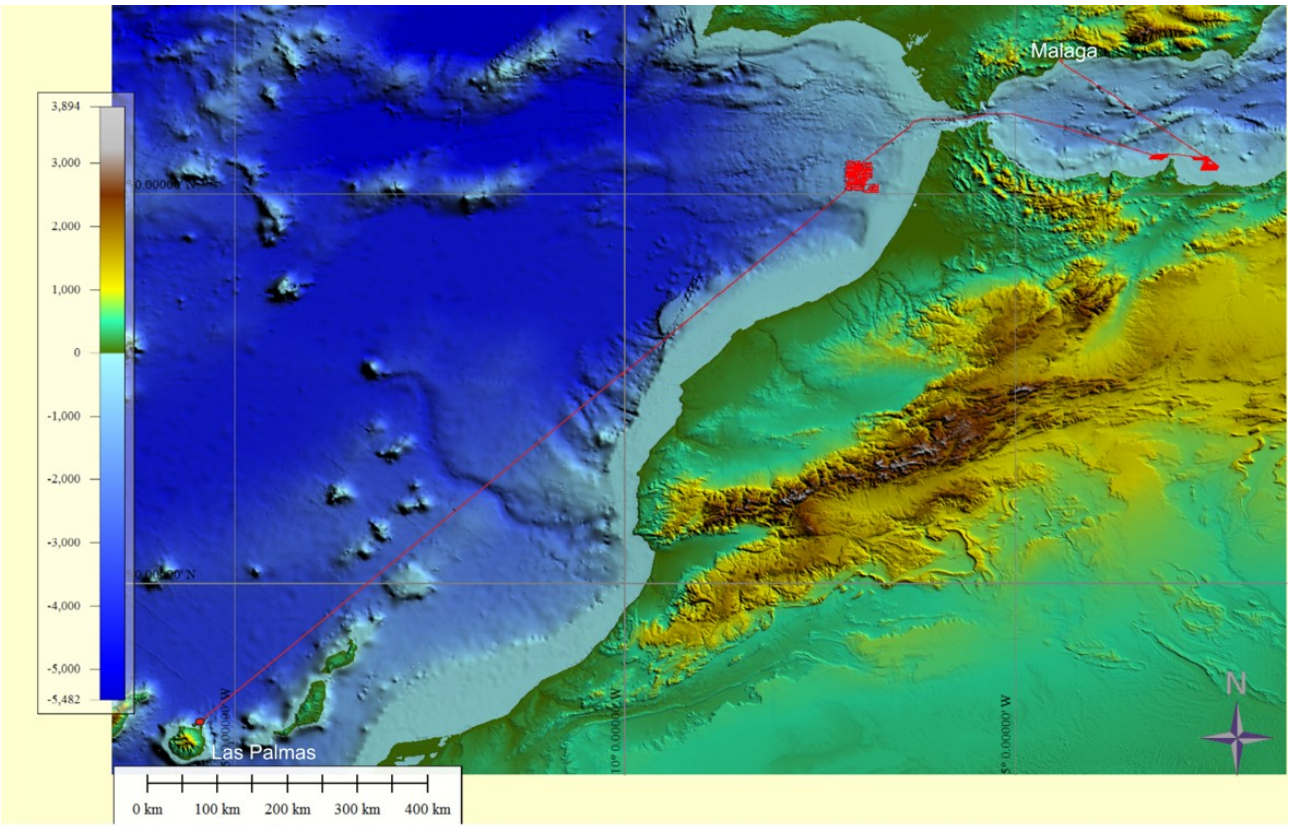
Short Cruise Report
RV MARIA S. MERIAN Cruise MSM 36

Malaga – Las Palmas
18.2.2014 – 17.3.2014
Chief Scientist: Dierk Hebbeln
Captain: Ralf Schmidt



Cruise track of RV MARIA S. MERIAN expedition MSM36

Objectives

RV MARIA S. MERIAN expedition MSM 36 aimed to investigate cold-water coral mounds along the Moroccan Mediterranean and Atlantic continental margins. The major goal was to obtain very long sedimentary records of up to 70 m in length from such structures using the Bremen Deep-Sea Drill Rig MeBo. Cold-water corals (CWC) act as ecosystem engineers as they form unique and important ecosystems of the bathyal zone, which show a high biodiversity and are worldwide distributed (Roberts et al. 2006). In addition, CWC have the capability to build large 3-dimensional seabed structures, so-called coral carbonate mounds, which may exhibit 10s of meters in height and hundreds of meters in length. These mounds are composed of the skeletal remnants of the CWC, shells of associated fauna, and hemipelagic sediments which deposited over thousands to hundred thousands of years (e.g., Dorschel et al. 2005).

Along the Moroccan continental margin, in the western Mediterranean Sea (Alboran Sea) and in the Atlantic Ocean (Gulf of Cádiz), numerous of such coral mounds were recently discovered, which exhibit heights between 10 and 90 m. In the Mediterranean a cluster of coral mound structures was discovered in 2006 off the Moroccan coast close to the Spanish enclave Melilla, named "Melilla coral province" (Comas and Pinheiro 2008). In 2008, additional ridge structures were discovered ("Brittlestar ridges") (Hebbeln et al. 2009). Video observations and sediment cores proved that theses ridges are build up by CWC (Fink et al. 2013). In addition, live occurrences of CWC were detected. In 2014 another, nearby setting, the “West Melilla coral province” has been described (LoIaconno et al. 2014), On the other side of the Strait of Gibraltar, namely in the Gulf of Cádiz, numerous coral mounds exist as well, partly arranged as clusters. In contrast to the Alboran Sea, today almost no living CWC were found in this region instead large areas are covered by fossil CWC debris.

Datings obtained from CWC fragments collected mainly from gravity cores retrieved from the Atlantic and Mediterranean Moroccan coral mounds revealed a conspicuous (most likely climate-driven) Gibraltar-seesaw pattern regarding their temporal evolution. CWC in the Alboran Sea started to colonize the area at ~14 ka BP, thereby their subsequent development until today was most likely stimulated and controlled by productivity (Fink et al. 2013). In contrast, in the Gulf of Cádiz CWC almost completely disappeared from the area with the onset of the Holocene (~10 ka BP), whereas they showed a wide distribution during the previous glacial. Again, enhanced productivity seems to have been the main trigger for a sustained development of the CWC (Wienberg et al. 2010).

However, these findings just refer to material obtained from the top sequences of the described Moroccan coral mounds conventional piston and gravity coring so far has not been able to retrieve sedimentary records longer than ~10-12 m from such coral mounds. Thus, the obtained MeBo-cores with maximum lengths of 70 m will provide for the first time the opportunity to test the following hypotheses:

- The Gibraltar-seesaw pattern describing the LGM-Holocene development of CWC along the Moroccan margins on both sites of the Strait of Gibraltar is a long-lasting productivity-driven feature spanning at least the last glacial-interglacial cycle.
- The long-term development of the Moroccan coral mounds is characterised by a major change in growth patterns as proposed by several mound development models.
- The initiation of the Moroccan coral mounds on both sides of the Strait of Gibraltar is triggered by major large-scale paleo-environmental change(s)

Narrative

In the afternoon of February 18, the RV MARIA S. MERIAN left the port of Malaga and steamed towards the first working area in the southern Alboran Sea off the coast of Morocco. There the vessel worked from February 19 to 28 in the so-called East Melilla Cold-Water Coral Province. During these days five MeBo drillings, partly lasting for >30 hours, several gravity core and CTD-

water sampler operations have been carried out accompanied by hydroacoustic surveys for bathymetric mapping and sub-seafloor imaging. Especially the long MeBo cores collected (up to 70 m in length) will contribute to test the hypotheses set out above.

The next working are, the West Melilla Cold-Water Coral Province, was located only 30 nm westward. On February 28 and March 1 this region was surveyed with hydroacoustics and some gravity cores have been taken. MeBo deployments were not possible due to poor weather conditions. In the afternoon of March 1 the vessel set course to the Strait of Gibraltar to leave the Mediterranean Sea towards the next working area, the Moroccan Atlantic margin at ~35°20'N.

Station work in this area commenced on March 2 in the afternoon. Until March 14 the vessel stayed in this region and conducting a programme very similar to what has been done in the first working area. Again, the work with the MeBo was in the focus and a total of 6 successful drillings could be done. Due to stronger swell only drillings down to a maximum depth of 52 m were possible. In the evening of March 14 the RV MARIA S. MERIAN left the area and headed for Las Palmas where the cruise ended in the morning of March 17.

Acknowledgements

We like to thank captain Ralf Schmidt, his officers and crew of RV MARIA S. MERIAN for their support of our programme and for creating a very friendly atmosphere on board. We also greatly acknowledge the support by the "Auswärtiges Amt" (German Foreign Office) in Berlin and in the German embassy in Rabat.

The ship time on RV MARIA S. MERIAN was provided by the Deutsche Forschungsgemeinschaft (DFG) within the core program METEOR/MERIAN. This project contributes to the international TRACES (Trans-Atlantic Cold-Water Coral Ecosystem Study) initiative. We also benefited from financial contributions by the research institutes involved. We gratefully acknowledge all this support.

Cruise participants

Name	Discipline	Institution
Hebbeln, Dierk, Prof. Dr.	Marine Geology / Chief Scientist	MARUM
Wienberg, Claudia, Dr.	Marine Geology	MARUM
Bartels, Martin	Marine Geology	MARUM
Gaide, Stefanie	Hydroacoustics	MARUM
Meyer-Schack, Birgit	Marine Geology	MARUM
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Bergenthal, Markus	MeBo	MARUM
Kaszemeik, Kai	MeBo	MARUM
Klar, Steffen	MeBo	MARUM
Klein, Thorsten	MeBo	MARUM
Kuhnert, Markus	MeBo	MARUM
Noorlander, Cornelis	MeBo	MARUM
Reuter, Michael	MeBo	MARUM
Rosiak, Uwe	MeBo	MARUM
Schmidt, Werner	MeBo	MARUM
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Henriet, Jean-Pierre, Prof. Dr.	Hydroacoustics	RCMG
Van Rooij, David, Prof. Dr.	Hydroacoustics	RCMG
Terhzaz, Loubna	Marine Geology	UR
Frank, Norbert, Prof. Dr.	Geochemistry	IUP
Krengel, Thomas	Geochemistry	IUP

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RCMG	Renard Centre for Marine Geology, University of Ghent, Belgium
UR	University of Rabat, Morocco
IUP	Institut für Umweltphysik, Universität Heidelberg, Germany

Station list MSM 36

Station No.	Device	Date	Time (UTC)	Latitude	Longitude	Elevation	Recovery (cm)
GeoB18101-1	CTD+Rosette	18.02.2010	01:48	35°25.793	-2°30.922	-468	
GeoB18102-1	MBES+PS	18.02.2010	04:26	35°20.612	-2°35.659	-280	
GeoB18103-1	MeBo	18.02.2010	13:04	35°26.300	-2°30.910	-342	
GeoB18103-2	MeBo	18.02.2010	18:50	35°26.320	-2°30.950	-335	
GeoB18104-1	MBES+PS	18.02.2010	21:44	35°19.854	-2°24.434	-263	
GeoB18105-1	GC6	19.02.2010	07:42	35°18.440	-2°31.318	-224	571
GeoB18106-1	GC6	19.02.2010	09:10	35°19.418	-2°35.327	-240	574
GeoB18107-1	GC6	19.02.2010	10:35	35°20.507	-2°29.368	-258	573
GeoB18108-1	GC6	19.02.2010	11:39	35°20.154	-2°27.885	-254	561
GeoB18109-1	GC6	19.02.2010	12:45	35°19.993	-2°28.385	-246	570
GeoB18110-1	CTD+Rosette	19.02.2010	13:59	35°19.892	-2°29.604	-220	
GeoB18110-2	MeBo	19.02.2010	17:17	35°19.900	-2°29.610	-259	4338
GeoB18111-1	MBES+PS	20.02.2010	17:48	35°19.880	-2°29.440	-276	
GeoB18112-1	MBES+PS	20.02.2010	19:22	35°20.850	-2°31.880	-300	
GeoB18113-1	MBES+PS	20.02.2010	20:20	35°18.980	-2°34.580	-240	
GeoB18114-1	MBES+PS	20.02.2010	22:26	35°26.770	-2°33.990	-341	
GeoB18115-1	MBES+PS	20.02.2010	23:50	35°25.801	-2°33.708	-350	
GeoB18116-1	GC12	21.02.2010	09:33	35°18.631	-2°34.927	-225	1150
GeoB18116-2	MeBo	21.02.2010	11:11	35°18.642	-2°34.933	-236	7149
GeoB18117-1	MBES+PS	22.02.2010	21:11	35°19.402	-2°34.792	-276	
GeoB18118-1	GC12	23.02.2010	09:27	35°26.139	-2°30.765	-332	873
GeoB18118-2	MeBo	23.02.2010	13:41	35°26.160	-2°30.810	-329	5298
GeoB18119-1	MBES+PS	24.02.2010	22:14	35°26.140	-2°31.263	-468	
GeoB18120-1	GC12	25.02.2010	10:51	35°19.883	-2°29.603	-249	1016
GeoB18121-1	GC12	25.02.2010	11:59	35°19.888	-2°29.310	-268	818
GeoB18121-2	MeBo	25.02.2010	13:42	35°19.893	-2°29.322	-272	1251
GeoB18122-1	CTD Yoyo	26.02.2010	01:00	35°25.782	-2°30.914	-476	
GeoB18123-1	GC12	26.02.2010	09:47	35°27.103	-2°34.613	-331	877
GeoB18123-2	MeBo	26.02.2010	17:37	35°27.120	-2°34.620	-358	3300
GeoB18124-1	MBES+PS	27.02.2010	10:21	35°28.652	-2°44.887	-239	
GeoB18125-1	GC12	27.02.2010	14:38	35°28.262	-3°7.804	-414	77
GeoB18126-1	GC6	27.02.2010	16:33	35°28.702	-3°5.788	-352	36
GeoB18127-1	GC6	27.02.2010	17:34	35°28.969	-3°4.641	-365	563
GeoB18128-1	MBES+PS	27.02.2010	18:13	35°28.986	-3°4.725	-372	
GeoB18129-1	GC6	28.02.2010	09:36	35°28.093	-3°9.305	-454	581
GeoB18130-1	GC6	28.02.2010	10:37	35°28.099	-3°8.747	-379	148
GeoB18131-1	GC12	28.02.2010	11:58	35°28.093	-3°9.301	-457	851
GeoB18132-1	CTD+Rosette	01.03.2010	10:32	35°19.940	-7°2.538	-991	
GeoB18133-1	MBES+PS	01.03.2010	12:03	35°19.998	-7°2.564	-999	
GeoB18134-1	MeBo	02.03.2010	11:02	35°20.216	-6°58.665	-903	1661
GeoB18135-1	PS	03.03.2010					
GeoB18136-1	CTD Yoyo	03.03.2010	19:00	35°6.210	-7°7.920	-990	
GeoB18137-1	MeBo	04.03.2010	08:55	35°7.167	-6°57.380	-814	939
GeoB18138-1	MBES+PS	04.03.2010	21:49	35°7.375	-6°57.421	-816	

GeoB18139-1	GC6	05.03.2010	08:42	35°7.143	-7°7.730	-940	520
GeoB18139-2	MeBo	05.03.2010	12:27	35°7.180	-7°7.74	-945	
GeoB18140-1	MBES+PS	05.03.2010	16:03	35°7.359	-7°7.877	-954	
GeoB18141-1	MeBo	06.03.2010	12:59	35°7.155	-7°7.755	-944	4163
GeoB18142-1	MBES+PS	07.03.2010	22:06	35°8.250	-7°3.838	-896	
GeoB18143-1	GC6	08.03.2010	08:44	35°11.168	-6°55.825	-751	411
GeoB18144-1	GC6	08.03.2010	09:57	35°11.714	-6°54.628	-783	436
GeoB18144-2	MeBo	08.03.2010	12:14	35°11.735	-6°54.642	-783	3888
GeoB18144-3	MeBo	09.03.2010					
GeoB18145-1	MBES+PS	09.03.2010	16:21	35°11.785	-6°54.596	-795	
GeoB18146-1	GC6	09.03.2010	19:39	35°11.705	-6°54.626	-783	444
GeoB18147-1	GC6	09.03.2010	21:17	35°7.136	-6°57.362	-815	562
GeoB18148-1	MBES+PS	09.03.2010	22:22	35°7.259	-6°53.301	-800	
GeoB18149-1	MeBo	10.03.2010	10:08	35°8.529	-7°2.767	-880	2863
GeoB18150-1	MBES+PS	11.03.2010	09:18	35°8.568	-7°2.724	-884	
GeoB18151-1	GC12	11.03.2010	14:07	35°8.530	-7°2.767	-885	632
GeoB18152-1	CTD+Rosette	11.03.2010	17:24	35°24.994	-7°0.024	-890	
GeoB18153-1	CTD+Rosette	11.03.2010	19:09	35°20.009	-7°2.521	-959	
GeoB18154-1	CTD+Rosette	11.03.2010	20:40	35°14.985	-7°5.028	-900	
GeoB18155-1	CTD+Rosette	11.03.2010	22:10	35°9.976	-7°7.568	-890	
GeoB18156-1	CTD+Rosette	11.03.2010	23:42	35°4.971	-7°10.025	-1005	
GeoB18157-1	CTD+Rosette	12.03.2010	01:14	35°4.991	-7°5.032	-925	
GeoB18158-1	CTD+Rosette	12.03.2010	02:29	35°4.979	-7°0.028	-860	
GeoB18159-1	CTD+Rosette	12.03.2010	03:52	35°10.010	-7°0.020	-840	
GeoB18160-1	CTD+Rosette	12.03.2010	05:15	35°15.012	-7°0.037	-960	
GeoB18161-1	MeBo	12.03.2010	09:30	35°08.529	-7°2.724	-880	3364
GeoB18162-1	MBES+PS	13.03.2010	09:11	35°8.315	-7°3.844	-893	

MBES	Multibeam Echosounding System
PS	PARASOUND
MeBo	Bremen Deep-Sea Drill Rig
GC	Gravity Corer (6 or 12 m long)