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Short Cruise Report

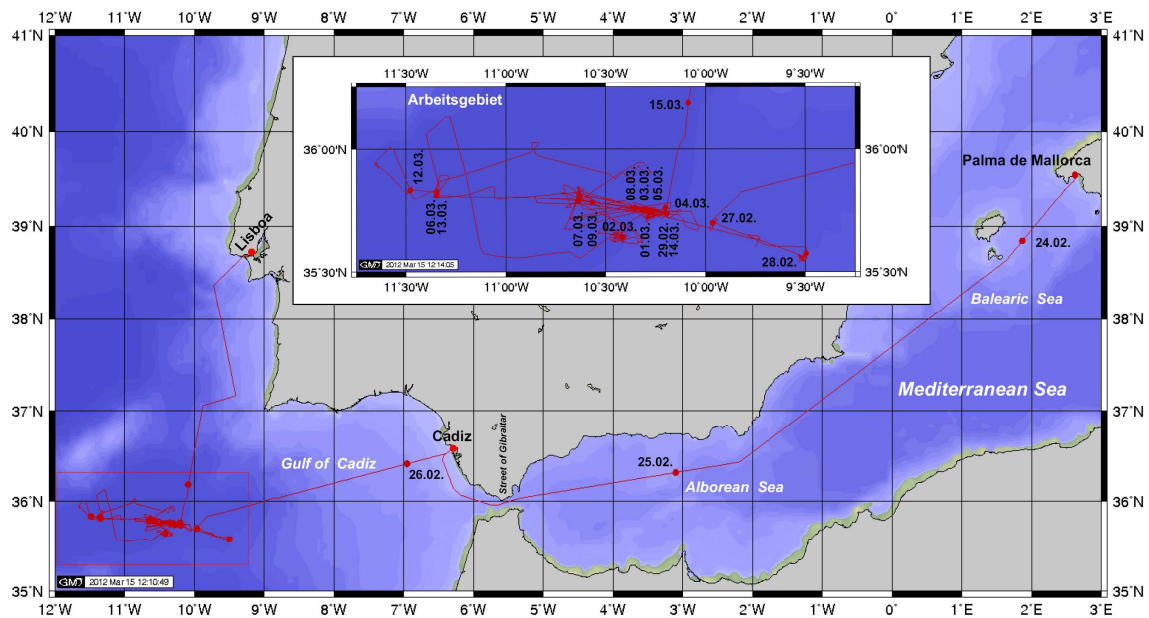
RV METEOR Cruise M86/5

Palma de Mallorca / Spain to Lisbon / Portugal

23. February – 16. March 2012

Chief Scientist: Christian Hensen

Captain: Stefan Schwarze



Objectives

Cruise M86/5 aimed at collecting data from potential fluid dewatering sites located in the deep-sea region of the western part of the Gulf of Cadiz and the adjacent deep sea plain. Previous work on mud volcanoes (cruises SO175 and MSM1/3) located on the accretionary wedge in the Gulf of Cadiz showed that mud volcano fluids are typically sourced at several km depth below the seafloor. In addition, the geochemical composition of fluids from the deepest mud volcano in this area which is located on a west-east trending transform lineament (SWIM1) indicated that these fluids are typical for having been altered by the reaction with oceanic crust. This implies that there is active flow connecting the oceanic basement and the seafloor. To date, such kind of hydrothermal circulation is only known for relatively young oceanic crust (<60 Ma). Hence, the existence of a hydrological connection between old, sedimented oceanic crust and the seafloor is a phenomenon, which essentially has not been investigated in the past, and may represent a (missing) link between hot vents at mid-ocean ridges and cold seeps at continental margins. On the cruise, we followed an interdisciplinary approach characterized by extensive geochemical sampling in the water column and the sediment, heat flow measurements, and detailed mapping with AUV and ship-based hydroacoustic systems. We mainly investigated selected sites with conspicuous backscatter anomalies recorded on previous cruises along the SWIM1 lineament: (i) within the transition between the accretionary prism and the Horseshoe Abyssal Plain and (ii) on seafloor highs within the Horseshoe Abyssal Plain itself. The geotectonic environment in both sections is completely different from the situation on the accretionary wedge, where numerous mud volcanoes were detected on previous cruises. Within the transition zone three new mud volcanoes were discovered and extensively sampled. Preliminary pore water analyses show that the fluids indicate a deep origin, but show distinctive differences to those found on the mud volcanoes on the wedge. On the seafloor highs along the SWIM1 lineament in the Horseshoe Abyssal Plain no seeps or mud volcanoes were discovered. However, the lineament seems to be active in terms of fluid flow as indicated by pore water and heat flow anomalies as compared to values measured off the lineament. Overall, the major goal of the cruise could be fulfilled: fluid seeps related to active faults were discovered in new geotectonic environment.

Narrative of the cruise

FS Meteor arrived at Palma de Mallorca in the morning of the 20th of February 2012. Most of the scientific equipment could be loaded within the following two days. However, the container with the AUV Abyss arrived only in the morning of the 23rd of February due to logistical problems. Since a harbor test of this device was obligatory the departure had to be postponed by one day. Meteor left the port of Palma de Mallorca in the morning of the 24th of February 2012 with an international group of 28 scientists onboard and on a transit of about 3 days into the working area, the western extension of the Gulf of Cadiz. The time during the transit was used to set up laboratories and prepare scientific equipment. One important aspect was to check and fix important working modes of the AUV. These tasks could successfully be fulfilled during the first 2 days of the transit and a technician of the company Remus, producing the multibeam-bathymetry device mounted on the AUV, could leave the ship during a stopover in Cadiz.

In the early morning of the 27th of February the station work started with recording a number of Multibeam and Parasound (MB/PS) transects across 3 preselected sites, which were

considered as potential seep locations. Ground-truthing by gravity corer, however, did not reveal evidence for active seepage here. On the following two days station work was mostly dedicated to run and test all gears and scientific devices at Porto mud volcano (MV), a known active seep site located at the western margin of the accretionary wedge. In spite of minor problems all station work could be successfully carried out at this position. Thereafter, new potential mud volcano sites were explored along the E-W trending SWIM1 fault north of Coral Patch Ridge. On the 1st of March the first successful deployment of a gravity corer at 35°44.3'N and 10°12.1' W retrieved sediments from an active mud volcano located at about 30 nautical miles west of Porto MV. Almost coincident, the existence of another two mud volcanoes could be confirmed on an AUV sidescan survey a few miles further to the west. During the following days the mud volcanoes were intensively sampled by gravity corer, box corer, CTD, and heat flow probe. In addition, all three structures were mapped during high resolution side scan and bathymetry surveys. Unfortunately, on the 2nd of March the coaxial cable broke, and as a consequence the TV-guided multicorer could not be deployed further on.

Almost parallel to the sampling of the known sites, new sites were explored further to west in the Horseshoe Abyssal Plain and to the north along the Horseshoe fault. However, those backscatter anomalies in the north were abandoned after some surveys with the Parasound sub-bottom profiler system as they could be identified as being related to morphological features at the seafloor and not to fluid emanation. Hence, most of the working time was thereafter dedicated to the study of seafloor highs and other conspicuous sites in the Horseshoe Abyssal Plain along the SWIM 1 lineament. Although no further seepage sites could be found here, the major fault line could be proven to be active in terms of recent tectonics, heat flow and fluid flow. In addition, a number of backscatter anomalies were investigated at the southern slope of the Gorringer Bank and the northwestern slope of Coral Patch Ridge. These backscatter anomalies, however, turned out to be caused either by outcrops of consolidated sediments, slope morphology or even ship wrecks. Two wrecks were mapped in detail during AUV surveys. During the last 2 days of the cruise one of the M. Ivanov MV was revisited in order to fill in the remaining sample gaps. As a highlight, a gravity core of approximately 1m length containing a massive piece of gas hydrate could be retrieved. Finally, a photo survey with the AUV was performed here in order to compensate for the lack of other video guided instruments. At the end of this station the AUV had to be recovered by zodiac because the messenger line of the device was twisted around its propeller. Station work of a successful cruise ended in the morning of the 15th of March. After a transit of about 20 hours RV Meteor moored at the pier "Terminal de Cruzeiros da Rocha Conde de Óbidos" in Lisbon at 08:00 on the 16th of March.

Acknowledgments

We would like to thank Captain Stefan Schwarze and his crew for their unlimited support and the very friendly atmosphere on M86/5. The cruise was funded by the Deutsche Forschungsgemeinschaft (TRANSFLUX grant).

Participants

1. Christian Hensen	Chief scientist	GEOMAR
2. Florian Scholz	Pore water geochemistry	GEOMAR
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8. Anke Bleyer	Gas geochemistry	GEOMAR
9. Marianne Nuzzo	Organic geochemistry	LNEG
10. Erica dos Santos Godinho	Organic geochemistry	LNEG
11. Hector Perea	Hydroacoustics	CSIC / CMIMA
12. Vasco Valadares	Hydroacoustics	FCUL / LNEG
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15. Klas Lackschewitz	AUV	GEOMAR
16. Fred Wendt	AUV	GEOMAR
17. Marcel Rothenbeck	AUV	GEOMAR
18. Norbert Kaul	Heat Flow	GeoB
19. Bernd Heesemann	Heat Flow	GeoB
20. Tobias Kulgemeyer	Heat Flow	GeoB
21. Elena Pinero	Sedimentology	GEOMAR
22. Vitor Magalhães	Sedimentology	CESAM / UA
23. Asmus Petersen	Coring	GEOMAR
24. Claus Hinz	Sensorics, video technics	GEOMAR
25. Marina Cunha	Benthos Biology	CESAM / UA
26. Ana Hilario	Benthos Biology	CESAM / UA
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Stationlist

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
26.02.2012	1-1	305	HA	23:58	-	-	00:20	00:22	35°49.77'	9°49.13'	35°47.99'	9°50.96'	-	-	-	-
27.02.2012	1-2	305	HA	01:00	-	-	01:32	00:32	35°42.80'	9°57.67'	35°40.18'	9°59.06'	-	-	-	-
27.02.2012	1-3	305	HA	01:39	-	-	02:17	00:38	35°39.90'	9°58.56'	35°42.87'	9°56.83'	-	-	-	-
27.02.2012	2	306	CTD	03:36	-	-	08:27	04:51	35°42.01'	9°57.94'	35°42.30'	9°57.92'	-	-	-	-
27.02.2012	3	307	TV-MUC-01	09:18	11:18	-	13:04	03:46	35°42.003'	9°57.925'	35°42.003'	9°57.926'	35°42.007	9°57.927'	-	-
27.02.2012	4	308	MUC-02	15:42	17:03	-	18:25	02:43	35°33.73'	9°30.46'	35°33.714'	9°30.443'	-	-	-	-
27.02.2012	5-1	309	HF	19:15	20:29	20:45	-	-	35°33.783'	9°30.515'	-	-	-	-	-	-
27.02.2012	5-2	309	HF	-	21:14	21:24	-	-	35°33.845'	9°30.476'	-	-	-	-	-	-
28.02.2012	5-3	309	HF	-	00:52	01:10	03:04	08:11	35°34.065'	9°30.355'	-	-	-	-	-	-
28.02.2012	6	310	TP-AUV	03:45	-	-	06:57	03:12	35°33.72'	9°31.74'	-	-	-	-	-	-
28.02.2012	7-1	311	AUV	07:55	-	-	12:44	04:49	35°33.32'	9°29.35'	35°34.385'	9°29.995'	-	-	-	-
28.02.2012	7-2	311	AUV	-	-	-	14:20	01:36	35°34.385'	9°29.995'	35°33.28'	9°34.93'	-	-	-	-
28.02.2012	8	312	GC-1	17:59	19:17	19:20	21:00	03:01	35°33.71'	9°30.45'	35°33.71'	9°30.45'	35°33.708'	9°30.443'	33.705'	9°30.442'
28.02.2012	9	313	TP-AUV	19:45	-	-	20:22	00:37	35°33.71'	9°30.44'	-	-	-	-	-	-
28.02.2012	10	314	CTD	23:00	01:18	01:42	03:10	04:10	35°33.71'	9°30.449'	35°33.79'	9°30.47'	-	-	-	-
29.02.2012	11	315	HA	03:29	-	-	04:07	00:38	35°33.75'	9°31.07'	35°35.91'	9°29.46'	-	-	-	-
29.02.2012	12	316	HA	05:05	-	-	05:20	00:15	35°36.74'	9°42.41'	35°37.47'	9°44.15'	-	-	-	-
29.02.2012	13	317	HA	06:06	-	-	06:30	00:24	35°38.20'	9°43.65'	35°38.87'	9°44.95'	-	-	-	-

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
29.02.2012	14	318	GC-2	06:49	08:13	08:14	09:36	02:47	35°37.658'	9°44.129'	35°37.652'	9°44.115'	35°37.645'	9°44.107'	35°37.653'	9°44.114'
29.02.2012	15	319	HA	12:10	-	-	12:53	00:43	35°44.76'	10°18.37'	35°45.96'	10°22.28'	-	-	-	-
29.02.2012	16-1	320	TP-AUV	13:22	-	-	14:30	01:08	35°45.296'	10°16.322'	35°43.087'	10°17.502'	-	-	-	-
29.02.2012	17	321	HA	14:45	-	-	15:11	00:26	35°43.65'	10°18.55'	35°45.55'	10°18.54'	-	-	-	-
29.02.2012	18	322	GC-3	15:35	17:05	-	18:41	03:06	35°44.974'	10°19.162'	35°44.995'	10°19.143'	35°44.995'	10°19.142'	35°44.995'	10°19.141'
29.02.2012	16-2	320	TP-AUV	19:05	-	-	20:54	04:45	35°45.40'	10°16.48'	35°44.6'	10°17.69'	-	-	-	-
29.02.2012	19-1	323	AUV	21:45	-	-	23:50	04:45	35°44.89'	10°18.10'	35°44.88'	10°18.30'	-	-	-	-
01.03.2012	19-2	323	AUV	-	-	-	18:13		35°46.89'	10°21.44'	-	-	-	-	-	-
01.03.2012	20	324	HA	00:32	-	-	01:11	00:39	35°43.01'	10°12.31'	35°47.11'	10°11.30'	-	-	-	-
01.03.2012	21	325	HA	01:19	-	-	02:13	00:54	35°47.18'	10°10.260'	35°43.35'	10°10.27'	-	-	-	-
01.03.2012	22	326	HA	02:32	-	-	03:50	01:18	35°45.035'	10°7.85'	35°43.70'	10°15.80'	-	-	-	-
01.03.2012	23	327	CTD	04:18	-	-	08:44	04:26	35°44.35'	10°12.06'	35°44.31'	10°12.14'	35°44.33'	10°12.053'	35°44.314'	10°12.132'
01.03.2012	24	328	GC-4	08:55	10:26	10:26	12:20	03:25	35°44.335'	10°12.055'	35°44.337'	10°12.057'	35°44.335'	10°12.060'	35°44.333'	10°12.060'
01.03.2012	25	329	BC-1	12:56	14:33	14:33	16:20	03:24	35°44.338'	10°12.057'	35°44.338'	10°12.056'	35°44.338'	10°12.064'	35°44.337'	10°12.064'
01.03.2012	26-1	330	HF	19:23	20:56	21:12	-	-	35°44.355'	10°12.03'	-	-	35° 44.333'	10° 12.053'	-	-
01.03.2012	26-2	330	HF	-	21:42	21:53	-	-	35°44.44'	10°12.027'	-	-	-	-	-	-
01.03.2012	26-3	330	HF	-	22:20	22:38	-	-	35°44.551'	10°11.999'	-	-	35° 44.548'	10° 11.998'	-	-
01.03.2012	26-4	330	HF	-	23:17	23:25	-	-	35°44.743'	10°11.947'	-	-	-	-	-	-
02.03.2012	26-5	330	HF	-	00:08	00:31	-	-	35°45.005'	10°11.871'	-	-	-	-	-	-
02.03.2012	26-6	330	HF	-	01:09	01:32	-	-	35°45.291'	10°11.800'	-	-	35° 45.211'	10° 11.800'	-	-

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
02.03.2012	26-7	330	HF	-	02:09	02:42	-	-	35°45.211'	10°11.723'	-	-	35°45.584'	10°11.723'	-	-
02.03.2012	26-8	330	HF	-	03:14	03:34	-	-	35°45.842'	10°11.655'	-	-	-	-	-	-
02.03.2012	26-9	330	HF	-	04:10	04:39	-	-	35°46.152'	10°11.578'	-	-	-	-	-	-
02.03.2012	26-10	330	HF	-	05:18	05:34	-	-	35°46.478'	10°11.491'	-	-	-	-	-	-
02.03.2012	26-11	330	HF	-	06:19	06:45	09:00	-	35°46.801'	10°11.406'	-	-	-	-	-	-
02.03.2012	27	331	GC-5	10:40	12:07	12:10	13:53	03:13	35°45.713'	10°21.236'	35°45.727'	10°21.246'	35°45.724'	10°21.249'	35°45.726'	10°21.246'
02.03.2012	28	332	GC-6	14:28	15:57	15:59	17:34	03:06	35°45.020'	10°19.000'	35°45.038'	10°19.033'	35°45.032'	10°19.034'	35°45.039'	10°19.038'
02.03.2012	29	333	AUV	17:37	-	-	20:23	02:46	35°44.22'	10°17.77'	35°45.02'	10°18.93'	-	-	-	-
03.03.2012	29	333	AUV	-	-	-	12:40	-	35°44.51'	10°14.50'	-	-	-	-	-	-
03.03.2012	30	334	CTD	20:43	-	-	02:17	05:34	35°45.72'	10°21.28'	35°45.79'	10°21.39'	35°45.73'	10°21.319	35°45.78'	10°21.371'
03.03.2012	31	335	HA	02:53	-	-	03:49	00:56	35°47.39'	10°24.53'	35°46.42'	10°31.62'	-	-	-	-
03.03.2012	32	336	HA	04:11	-	-	05:08	00:57	35°48.48'	10°35.58'	35°45.82'	10°42.136'	-	-	-	-
03.03.2012	33	337	HA	05:20	-	-	06:16	00:56	35°45.77'	10°40.88'	35°51.48'	10°42.95'	-	-	-	-
03.03.2012	34	338	HA	06:35	-	-	07:30	00:55	35°50.76'	10°39.69'	35°45.27'	10°36.77'	-	-	-	-
missing	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
03.03.2012	36	339	BC-2	08:44	10:06	10:08	11:35	02:51	35°45.782'	10°21.330'	35°45.712'	10°21.248'	35°45.713'	10°21.244'	35°45.712'	10°21.250'
03.03.2012	37	340	GC-7	13:53	15:24	15:25	17:09	03:16	35°45.712'	10°21.204'	35°45.711'	10°21.249'	35°45.716'	10°21.251'	35°45.713'	10°21.248'
03.03.2012	38-1	341	HF	18:45	20:23	20:45	-	-	35°47.503'	10°37.971'	-	-	-	-	-	-
03.03.2012	38-2	341	HF	-	21:54	22:06	-	-	35°47.257'	10°37.844'	-	-	-	-	-	-
03.03.2012	38-3	341	HF	-	23:00	23:10	-	-	35°47.012'	10°37,727'	-	-	-	-	-	-

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
04.03.2012	38-4	341	HF	-	00:06	00:25	-	-	35°46.756'	10°37.591'	-	-	-	-	-	-
04.03.2012	38-5	341	HF	-	01:26	01:38	-	-	35°46.505'	10°37.450'	-	-	-	-	-	-
04.03.2012	39	342	AUV	05:45			08:30	02:45	35°43.82'	10°14.28'	35°44.33'	10°15.35'	-	-	-	-
04.03.2012	39	342	AUV	-	-	-	22:55	00:45	35°45.37'	10°22.42'	35°45.28'	10°22.15'	-	-	-	-
04.03.2012	40	343	GC-8	08:58	10:25	10:26	12:01	03:03	35°45.591'	10°11.758'	35°45.719'	10°12.099'	35°45.585'	10°11.730'	35°45.489'	10°11.733'
04.03.2012	41	344	GC-9	12:29	13:59	14:00	15:41	03:12	35°44.321'	10°12.078'	35°44.34'	10°12.07'	35°44.343'	10°12.077'	35°45.349'	10°12.078'
04.03.2012	42	345	GC-10	16:10	17:33	17:34	19:00	2:50	35°44.341'	10°12.073'	35°44.403'	10°12.174'	35°44.398	10°12.181'	35°44.403'	10°12.174'
04.03.2012	43	346	TP-AUV	19:34			21:22	01:52	35°45.06'	10°14.70'	35°42.93'	10°17.67'	-	-	-	-
05.03.2012	44	347	CTD	00:22	02:30	04:03	05:57	05:35	35°44.31'	10°12.15'	35°44.35'	10°12.14'	35°44.229'	10°12.089'	35°44.332'	10°12.143'
05.03.2012	45	348	BC-3	06:25	07:54	07:56	09:30	03:05	35°44.410'	10°12.186'	35°44.410'	10°12.179'	35°44.419'	10°12.178'	35°44.403'	10°12.167'
05.03.2012	46	349	BC-4	10:15	11:41	11:42	13:24	03:09	35°45.058'	10°19.042'	35°45.046'	10°19.026'	35°45.052'	10°19.035'	35°45.048'	10°19.020'
05.03.2012	47	351	GC-11	16:34	18:07	18:08	19:54	03:20	35°47.302'	10°38.532'	35°47.308'	10°38.525'	35°47.302'	10°38.537'	35°47.306'	10°38.525'
05.03.2012	48-A	350	TP-AUV	15:17	-	-	16:08	01:09	35°50.84'	10°38.29'	35°48.63'	10°37.60'	-	-	-	-
05.03.2012	48-A	350	TP-AUV	20:20	-	-	22:02	01:42	35°48.47'	10°37.82'	35°49.61"	10°39.04'	-	-	-	-
05.03.2012	49	350	AUV	-	-	-	23:15	00:55								
06.03.2012	50	352	HA	01:20	-	-	01:52	00:32	35°48.019'	11°1.11'	35°50.815'	11°3.323'	-	-	-	-
06.03.2012	51	353	HA	03:07	-	-	04:07	01:00	35°48.226'	11°20.200'	35°53.578'	11°20.17'	-	-	-	-
06.03.2012	52	354	HA	04:23	-	-	05:34	01:11	35°53.72'	11°16.78'	35°48.008'	11°21.735'	-	-	-	-
06.03.2012	53	355	HA	05:34	-	-	06:12	00:38	35°48.008'	11°21.735'	35°51.38'	11°20.731'	-	-	-	-
06.03.2012	54	356	GC-12	06:30	08:03	08:04	09:46	03:16	35°49.677'	11°20.789'	35°49.68'	11°20.79'	35°49.676'	11°20.774'	35°49.673'	11°20.794'

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
06.03.2012	55-1	357	HF	10:15	11:45	12:08	-	-	35°49.684'	11°20.790'	-	-	-	-	-	-
06.03.2012	55-2	357	HF	-	12:45	12:58	-	-	35°49.882'	11°20.787'	-	-	-	-	-	-
06.03.2012	55-3	357	HF	-	13:36	13:49	-	-	35°50.084'	11°20.78'	-	-	-	-	-	-
06.03.2012	55-4	357	HF	-	13:29	14:48	-	-	35°50.284'	11°20.785'	-	-	-	-	-	-
06.03.2012	55-5	357	HF	-	15:28	15:41	-	-	35°50.484'	11°20.777'	-	-	-	-	-	-
06.03.2012	55-6	357	HF	-	16:52	17:01	-	-	35°50.884'	11°20.778'	-	-	-	-	-	-
06.03.2012	55-7	357	HF	-	18:22	18:42	-	-	35°51.331'	11°20.790'	-	-	-	-	-	-
06.03.2012	55-8	357	HF	-	19:52	20:02	21:53	-	35°51.725'	11°20.780'	-	-	-	-	-	-
07.03.2012	56	358	HA	00:29	-	-	01:05	00:36	35°59.305'	10°52.60'	36°01.514'	10°49.778'	-	-	-	-
07.03.2012	57	359	HA	01:22	-	-	01:57	00:35	36°14.28'	10°52.572'	35°58.597'	10°50.798'	-	-	-	-
07.03.2012	58	360	HA	03:40	-	-	03:56	00:16	35°53.87'	10°28.448'	35°52.725'	10°27.413'	-	-	-	-
07.03.2012	59	361	HA	04:19	-	-	04:49	00:30	35°54.455'	10°24.785'	35°52.224'	10°22.52'	-	-	-	-
07.03.2012	60	362	HA	05:28	-	-	06:02	00:30	35°56.009'	10°20.366'	35°53.311'	10°17.702'	-	-	-	-
07.03.2012	61	363	HA	06:16	-	-	06:57	00:41	35°54.280'	10°16.328'	35°54.280'	10°19.199'	-	-	-	-
07.03.2012	62	364	GC-13	08:40	10:12	10:13	12:33	03:53	35°47.471'	10°38.436'	35°47.317'	10°38.453'	35°47.316'	10°38.454'	35°47.306'	10°38.453'
07.03.2012	63	365	GC-14	13:15	15:00	15:01	17:00	03:45	35°47.315'	10°38.450'	35°47.257'	10°38.506'	35°47.252'	10°38.514'	35°47.258'	10°38.577'
07.03.2012	64	366	BC-5	17:32	19:05	19:07	20:38	03:06	35°47.257'	10°38.507'	35°47.265'	10°38.499'	35°47.253'	10°38.509'	35°47.256'	10°38.503'
07.03.2012	65	367	HA	21:06	-	-	22:42	01:36	35°47.265'	10°38.499'	35°40.475'	10°40.255'	-	-	-	-
08.03.2012	66	368	CTD	00:43	02:38	04:04	06:10	05:27	35°45.05'	10°19.04'	35°45.05'	10°19.04'	35°45.015'	10°19.978'	35°45.046'	10°19.04'
08.03.2012	67	369	BC-6	06:23	07:54	07:56	09:24	03:01	35°45.048'	10°19.032'	35°45.045'	10°19.018'	35°45.034'	10°19.021'	35°45.033'	10°19.020'

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
08.03.2012	68	370	GC-15	09:56	11:20	11:21	12:59	03:03	35°45.045'	10°19.017'	35°45.04'	10°19.02'	35°45.046'	10°19.016'	35°45.040'	10°19.016'
08.03.2012	69	371	GC-16	14:56	16:25	16:27	18:08	03:12	35°42.923'	10°40.940'	35°42.925'	10°40.963'	35°42.924'	10°40.963'	35°42.924'	10°40.963'
08.03.2012	70-1	372	AUV	18:59	-	-	20:30		35°49.00'	10°38.33'	35°49.67'	10°38.25'	-	-	-	-
09.03.2012	70-2	372	AUV	-	-	-	10:48									
08.03.2012	71-1	373	HF	21:15	23:10	23:20	-		35°42.931'	10°40.962'	-	-	-	-	-	-
08.03.2012	71-2	373	HF	-	23:33	23:45	01:28		35°42.932'	10°40.964'	-	-	-	-	-	-
09.03.2012	72	374	CTD	03:18	05:04	06:51	08:50	05:32	35°45.71'	10°21.25'	35°45.81'	10°21.32'	35°45.694'	10°21.329'	35°45.779'	10°21.336'
09.03.2012	73	375	GC-17	11:54	13:31	13:34	15:27	03:33	35°46.889'	10°34.040'	35°46.768'	10°34.545'	35°46.889'	10°34.041'	35°46.902'	10°34.038'
09.03.2012	48-B	376	TP-AUV	16:00	-	-	18:59	02:59	35°49.45'	10°38.85'	35°50.81'	10°38.76'	-	-	-	-
09.03.2012	74	377	TP-AUV	20:55	-	-	21:42									
09.03.2012	75-1	378	HA	22:06	-	-	22:38	00:32	35°39.943'	10°25.106'	35°37.046'	10°24.900'	-	-	-	-
09.03.2012	75-2	378	HA	23:03	-	-	23:27	00:24	35°38.286'	10°26.402'	35°38.619'	10°23.634'	-	-	-	-
10.03.2012	76-1	379	AUV	02:15	-	-										
10.03.2012	76-2	379	AUV	-	-	-	18:56									
10.03.2012	75-3	380	HA	04:46			05:17	00:31	35°39.624'	10°20.502'	35°37.125'	10°18.614'	-	-	-	-
10.03.2012	75-4	380	HA	05:35			05:59	00:24	35°37.742'	10°20.696'	35°39.115'	10°17.95'	-	-	-	-
10.03.2012	77	381	GC-18	06:58	08:24	08:26	09:53	02:55	35°38.349'	10°19.551'			35°38.346'	10°19.512'	35°38.347'	10°19.496'
10.03.2012	78	382	GC-19	10:58	12:23	12:26	14:17	03:19	35°38.426'	10°24.956'	35°38.430'	10°24.915'	35°38.432'	10°24.923'	35°38.375'	10°24.915'
10.03.2012	79-1	383	HA	15:14			15:32	00:18	35°40.744'	10°31.383'	35°39.222'	10°32.735'	-	-	-	-
10.03.2012	80	384	TP-AUV	16:00	-	-	18:15	02:15	35°39.03'	10°27.47'	35°37.32'	10°27.19'	-	-	-	-

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									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
10.03.2012	79-2	385	HA	16:09			16:19	00:10	35°38.850'	10°25.960'	35°38.39'	10°25.03'	-	-	-	-
10.03.2012	81-1	386-1	HF	22:10	23:45	23:57	-	-	35°47.307'	10°38.506'	-	-	-	-	-	-
11.03.2012	81-2	386-2	HF	-	00:52	01:04	-	-	35°47.517'	10°38.253'	-	-	-	-	-	-
11.03.2012	81-3	386-3	HF	-	02:01	02:13	-	-	35°47.730'	10°37.992'	-	-	-	-	-	-
11.03.2012	81-4	386-4	HF	-	03:03	03:15	05:02	-	35°47.941'	10°37.732'	-	-	-	-	-	-
11.03.2012	82	387	TP-AUV	07:12	-	-	14:14	07:02	35°45.04'	10°15.69'	35°44.66'	10°18.43'	-	-	-	-
11.03.2012	83	388	BC-7	08:44	10:10	10:12	11:49	03:05	35°44.336'	10°12.075'	35°44.327'	10°11.965'	35°44.335'	10°12.062'	35°44.330'	10°11.965'
11.03.2012	84	389	AUV	14:28	-	-	16:00	1:32	35°43.33'	10°17.62'	35°44.04'	10°14.34'	-	-	-	-
11.03.2012	85	390	HA	23:52	-	-	01:13	1:21	35°54.49'	11°12.17'	36°08.125'	11°16.891'	-	-	-	-
12.03.2012	86	391	HA	01:52	-	-	03:02	02:10	36°03.387'	11°24.087'	35°51.098'	11°20.135'	-	-	-	-
12.03.2012	87	392	HA	03:38	-	-	04:55	01:17	35°47.557'	11°27.557'	36°0.674'	11°34.300'	-	-	-	-
12.03.2012	88	393	HA	05:31	-	-	05:53	00:22	35°56.699'	11°39.426'	35°55.29'	11°37.811'	-	-	-	-
12.03.2012	89	394	HA	06:05	-	-	06:14	00:09	35°55.822'	11°38.972'	35°56.44'	11°38.58'	-	-	-	-
12.03.2012	90	395	HA	06:22	-	-	06:31	00:09	35°56.719'	11°38.872'	35°56.067'	11°39.368'	-	-	-	-
12.03.2012	91	396	HA	08:19	-	-	08:06	00:47	35°49.28'	11°29.68'	35°50.5932'	11°28.6596'	-	-	-	-
12.03.2012	92	397	GC-20	09:26	10:54	10:56	12:38	03:12	35°50.083'	11°28.837'	35°50.073'	11°28.736'	35°50.067'	11°28.804'	35°50.069'	11°28.804'
12.03.2012	93	398	GC-21	13:48	15:24	15:27	17:17	03:29	35°49.850'	11°20.197'	35°49.790'	11°20.172	35°49.797'	11°20.167'	35°49.751'	11°20.175'
12.03.2012	94-1	399	HF	17:55	19:28	19:39	-	-	35°48.665'	11°20.851'	-	-	-	-	-	-
12.03.2012	94-2	399	HF	-	20:36	20:48	-	-	35°48.980'	11°20.824'	-	-	-	-	-	-
12.03.2012	94-3	399	HF	-	21:48	21:54	-	-	35°49.276'	11°20.798'	-	-	-	-	-	-

				Time (UTC)					Begin / on seafloor		End / off seafloor		Begin / on seafloor		End / off seafloor	
									Position Ship				Position device			
Date UTC	St.No.	St. No	Instrument	Begin	Start Sci. Program	End Sci. Program	End	Duration hh:mm	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°	Latitude N°	Longitude W°
13.03.2012	94-4	400	HF	-	01:54	02:05	-	-	35°49.685'	11°10.762'	-	-	-	-	-	-
13.03.2012	94-5	400	HF	-	02:59	03:11	-	-	35°49.979'	11°20.743'	-	-	-	-	-	-
13.03.2012	94-6	400	HF	-	04:04	04:15	-	-	35°50.274'	11°20.717'	-	-	-	-	-	-
13.03.2012	95	401	GC-22	06:44	08:15	08:17	09:54	03:10	35°50.273'	11°20.717'	35°50.274'	11°20.734'	35°50.274'	11°20.736'	35°50.276'	11°20.736'
13.03.2012	96	402	GC-23	10:21	11:48	11:50	13:42	03:21	35°48.659'	11°20.839'	35°48.675'	11°20.850'	35°48.674'	11°20.858'	35°48.676'	11°20.850'
13.03.2012	97	403	GC-24	16:55	18:27	18:28	20:08	03:13	35°47.876'	10°40.762'	35°47.873'	10°40.765'	35°47.875'	10°40.764'	35°47.873'	10°40.765'
13.03.2012	98	404	CTD	22:27	00:19	01:50	04:40	06:13	35°44.33'	10°12.08'	35°44.50'	10°12.07'	35°44.344''	10°12.066'	35°44.426'	10°12.181'
14.03.2012	99-1	405	HA	05:18	-	-	06:03	00:45	35°44.852'	10°4.491'	35°40.156'	10°1.667'	-	-	-	-
14.03.2012	99-2	405	HA	06:03	-	-	06:27	00:24	35°40.156'	10°1.667'	35°40.893'	10°6.187'	-	-	-	-
14.03.2012	99-3	405	HA	06:27	-	-	06:47	00:20	35°40.893'	10°6.187'	35°43.801'	10°7.303'	-	-	-	-
14.03.2012	100	406	GC-25	07:13	08:36	08:38	10:19	03:06	35°44.340'	10°12.059'	35°44.341'	10°12.056'	35°44.341'	10°12.061'	35°44.341'	10°12.061'
14.03.2012	101	407	BC-8	10:45	12:09	12:11	13:48	03:03	35°44.341'	10°12.057'	35°44.342'	10°12.056'	35°44.339'	10°12.063'	35°44.336'	10°12.064'
14.03.2012	102-1	408	AUV	14:49	-	-	16:26		-	-	-	-	-	-	-	-
15:03	102-2	408	AUV	-	-	-	09:36		-	-	-	-	-	-	-	-
14.03.2012	103	409	HF	19:10	20:41	20:53	-	-	35°47.192'	10°50.909'	-	-	-	-	-	-
15.03.2012	104	410	HF	-	00:36	00:48	-	-	35°48.476'	10°51.332'	-	-	-	-	-	-
15.03.2012	105	411	TP-AUV	05:27	-	-	07:57	-	-	-	-	-	-	-	-	-

AUV: Autonomous underwater vehicle, TP: Transponders, TV-MUC: TV-Multicorer, GC: Gravity Corer, BC: Box Corer, HF: Heat Flow, CTD-ROS: Conductivity Temperature Density + Rosette Water Sampler, HA: HydroAcustics: EM122 + PS, EM122: Multibeam, PS: Parasound