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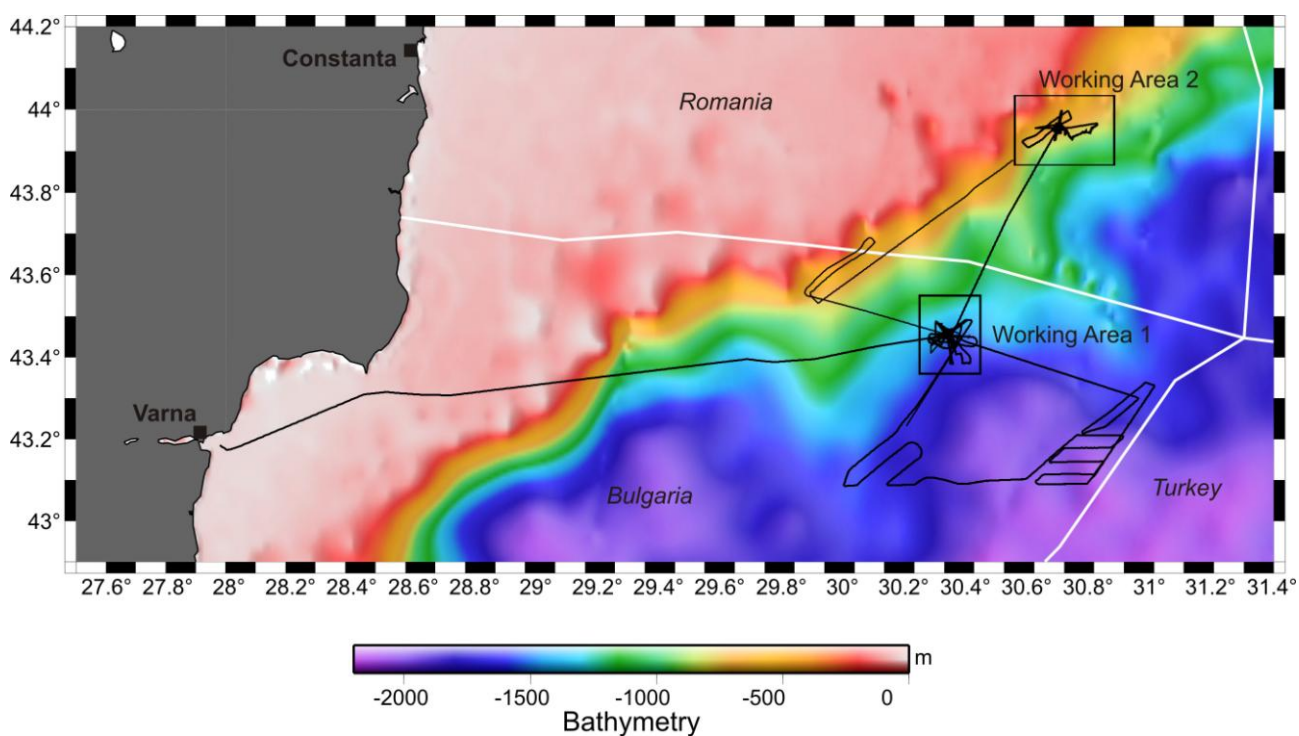
Short Cruise Report MARIA S. MERIAN - MSM35

Varna, Bulgaria – Istanbul, Turkey

20.01.2014 – 05.02.2014

Chief Scientist: Dr. Katrin Schwalenberg

Captain: Ralf Schmidt



MSM35 Cruise Tracks and CSEM Working Areas

Objectives

The aim of Maria S. MERIAN voyage MSM35 was to conduct marine controlled source electromagnetic (CSEM) measurements in the Danube Delta, Black Sea, to identify suitable gas hydrate deposits for a future MEBO drilling test site for methane production and CO₂ sequestration in hydrate form. Marine CSEM is a geophysical exploration method to derive the electrical properties, i.e. resistivity of the seafloor. Gas hydrates and free gas are electrically insulating and replace conductive pore fluid. Thus, the formation resistivity is elevated where gas hydrates and free gas are present in the sediment.

Cruise MSM35 follows thematically previous cruise MSM34 Legs 1 and 2, where colleagues from GEOMAR, Kiel, and IMST-Seislab, Turkey, collected high resolution 2D and 3D seismic data, OBS data, as well as heat flow data and gravity cores for pore water analysis. Both voyages MSM34 and MSM35 are closely related to the German joint venture project SUGAR – submarine gas hydrate reservoirs. The joint interpretation of the different methods aims at a better evaluation of the free gas / gas hydrate distribution.

Based on the preliminary seismic results from MSM34 two working areas have been selected for the CSEM experiments. The target in the first working area is a strong seismic reflector in a buried canyon system of the deeper Danube delta fan in 1400m water depth, and thus within the gas hydrate stability zone. The second area is located at the edge of the hydrate stability field, and is characterized by a slope slide in 600 m water depth. The observed bottom simulating reflector shows anomalous upward warping, and heat flow data show a low thermal gradient which is assumed to be a consequence of the dissolution of gas hydrate caused by submarine slope slides. During cruise MSM35 two marine CSEM systems have been used: 1) a seafloor-towed CSEM system developed at BGR called HYDRA to collect two-dimensional (2D) data along profiles; 2) stationary ocean bottom electromagnetic (OBEM) receivers and a mobile CSEM dipole source called Sputnik by GEOMAR with the aim to collect a local 3D CSEM data set. Both CSEM data sets will be processed and interpreted in terms of the electrical resistivity distribution which can be related to the local and regional gas hydrate and free gas occurrences.

Narrative

On Friday, January 17th 2014, R/V Maria S. MERIAN returned to the port of Varna, Bulgaria, from voyage MSM34/2. During this leg and the previous leg MSM34/1 different groups led by GEOMAR collected 2D and 3D seismic data (P-Cable), multicorer, gravity corer, heatflow data, multibeam and Parasound data in three target areas of the Danube Delta fan offshore Romania and Bulgaria with the aim to identify suitable gas hydrate deposits for a future test drill site with MEBO

In the afternoon all equipment of the previous cruise was unloaded, and the CSEM equipment of the two electromagnetic (EM) teams from BGR and GEOMAR were loaded onboard the MERIAN. First results and information on the specific target areas were passed on from Dr. Bialas and Dr. Haeckel who were leading the previous cruise MSM34 to Dr. Schwalenberg, chief scientist of cruise MSM34, who arrived in Varna same day with two technicians from BGR.

In the night to Saturday, January 18th the GEOMAR Team arrived in Varna with 6 colleagues. During the day both groups started arranging the laboratories and preparing the equipment. Two scientists from BGR and one colleague from Max-Planck-Institute of Meteorology in Hamburg arrived in the evening of January 18th. Sunday, January 19th, preparations of the CSEM equipment continued. Due to fog and bad weather conditions the connection flight from Sofia to Varna of our last science crew member was canceled, who made it last minute onboard after a nightly, 500 km long, adventurous cab ride.

On Monday morning, January 20th MERIAN left the port of Varna at 8am for a short machine test and returned to disembark a service technician before the ship left to the first working area in the Danube Delta, which was reached around 6pm local time. The afternoon was used to continue instrument preparations and lab tests. An informative meeting was held between the captain, officers, bosun, and science team leaders Dr. Schwalenberg and Dr. Hoelz, and the obligatory safety familiarization took place with all crew members.

At 10pm the GEOMAR group started deploying 12 OBEM (Ocean Bottom Electromagnetic) Receivers along two 3 km long profiles of 6 receivers around a seismic amplitude anomaly which could be a possible gas hydrate reservoir. Deployment was completed around 7:30pm local time on the next day Tuesday, January 21st, 2014.

Meanwhile, the BGR team prepared the bottom-towed HYDRA-System for its first deployment. The belly of the instrument platform "pig" was packed with several pressure vessels including the new signal generator, a battery container, communication unit, CTD sensor and Posidonia transponder, as well as the junction box terminating the deep tow cable. For the first deployment, the array was equipped with two new receiver units which allow online communication between deck unit and seafloor instruments via the optical fibre of the deep tow cable. At 8pm local time the array was connected and arranged on deck and deployment started with the last receiver along a profile in NE-SW direction at an offset of 200 m parallel to the OBEM receiver stations. At 10pm local time (LT) all connections were made and the pig got deployed using the A-frame and lowered to the seafloor by paying out the deep tow cable. Once the pig with the transmitter-receiver array was aligned on the seafloor surveying started at 00:45pm in a stop and go manner. Surveying continued over night until 7:00am, and the HYDRA-System was back on deck at 10:00am next morning.

After the deck crew has moved the termination of the deep tow cable to the starboard jib crane, and has connected the termination and the junction box onto Sputnik, GEOMAR's mobile CSEM source, surveying started at 2:20pm in a yoyo-manner along three lines over and between the OBEM stations. Until Friday, January 24th, three profiles of 81 transmission points were completed when Sputnik was brought back on deck at 9:40am in the morning

The BGR team was using the last two days to evaluate the first HYDRA deployment and to make some necessary modifications. At 11:30am the array with two new HYDRA III receiver unit followed by one HYDRA II receiver unit was arranged and connected on deck, and deployment started over the aft deck. The pig got deployed at 12:20pm, and seafloor surveying started at 2:20pm along the same profile as three days before, but in the opposite direction. Surveying continued until 4:45pm when the communication to the signal generator got interrupted, and the pig was brought back on deck for inspection while the data cable remained in the water. After the signal generator could be restarted, the pig got redeployed at 6:30pm and surveying continued until 8:45pm. The HYDRA system was back on deck at 11:20pm.

Bad weather conditions didn't allow any outboard operations for the next three days until Monday,

January 27th. A gap in the bathymetric map was filled using the EM122 multibeam system between Saturday, January 25th 1:00am and Sunday, January 26th 04:30am when the weather got too bad to collect any useful data.

In the evening of Monday, January 27th, the sea finally calmed down enough to risk the next HYDRA deployment. As far as ship movements allowed the past days, preparations and laboratories test have been performed. For this deployment the seafloor array consists of five receiver units, two new HYDRA III and three HYDRA II units with a total length of nearly 950 m. At 11pm the complete system was in the water, and surveying started at 00:30am. To facilitate position keeping, the profile direction was chosen in E-W direction opposite to the wind, and intersected the OBEM / Sputnik profiles at the location of the seismic amplitude anomaly. Surveying continued until 6:40am next morning, Tuesday, January 28th, when the connection to the seafloor signal generator got interrupted. The pig with the signal generator was brought back on deck for inspection and could be redeployed at 12:40pm until 3:20pm when the connection to the signal generator broke down again, and HYDRA was back on deck at 6:15pm.

At 7:00pm on January 28th, the GEOMAR team started releasing and recovering the 12 OBEM receivers. This lasted until 04:30 in the early morning of Wednesday, January 29th. Unfortunately one OBEM could not be recovered. In the progress of the day a bad weather front again prevented any outboard operations. R/V MERIAN slowly transited to the second working area about 32 nm NW where a slump area at the edge of the hydrate stability field may have caused the dissolution of gas hydrates.

On Thursday, January 30th the weather has improved and the Geomar team started deploying the remaining 11 OBEM receivers at 01:45pm which was completed at 7:00am in the morning of Friday, January 31st. Temperatures had dropped over night and in the morning the wooden deck of the MERIAN was covered with a thin layer of snow. At 12:20pm the HYDRA system with five receivers was connected and aligned on deck ready for deployment which was completed when the pig got picked up by the A-frame at 01:45pm and lowered in the water. For this deployment, and the very last deployment on February 3rd, a backup current transverter was used which was provided last minute by Prof. Nigel Edwards, University of Toronto. Different from the new signal generator in the pig this transverter is located onboard in the lab. The output peak current is limited by the resistance of the deep tow cable. However the transverter worked reliable during the entire deployment. Surveying started at 02:10pm when the pig reached the seafloor along a profile in SSW to NNE direction intersection the centre of the OBEM and previous heat flow positions. The profile was completed at 10:20pm and HYDRA was back on deck at 01:00am.

Saturday, February 1st, started with Sputnik the mobile CSEM source over the previously deployed OBEM sites. Between 03:00am and 00:00am 40 transmission sites were completed. Subsequently, the GEOMAR team proceeded with the recovery of the 11 OBEM receivers which was finished at 05:15 in the morning of Sunday, January 2nd. Between 9 and 12am a small gap in the bathymetric map was filled using the multibeam E122 system.

At 12:30am HYDRA was again ready on deck for deployment, this time with four receivers and again with the new, deep-tow signal generator, which was updated with some technical changes. The pig was in the water at 1:20pm and surveying continued along a W-E profile from 2:00 to 9:50pm. HYDRA was back on deck 11:50pm. After that, multibeam data were collected between 1:00am and 12:15 next day, Monday, February 3rd. The MERIAN then returned to the first working area where HYDRA was going to be deployed for the last time during this cruise. Deck preparations were completed at 5:00pm and HYDRA was in the water with 4 receivers at 6:10pm. Surveying continued between 7:15 and 07:45am in the morning of Tuesday, January 4th, and HYDRA was back on deck at 11:00am.

The GEOMAR team then attempted to recover the missing OBEM using Sputnik with camera, spot lights and several hooks attached below its frame. This lasted from 12:00 - 4:30pm when Sputnik was back on deck, unfortunately with no success.

After that the MERIAN left the working area and reached the entrance of the Bosphorus in the morning of Wednesday, January 5th at bright sunshine for the first time during the last week. 13 scientists left the vessel in Istanbul leaving behind a colleague from MPI-Meteorology who continued aerosol measurements during the next transit to Malaga.

Voyage MSM35 provided two densely spaced 3D CSEM data sets for the GEOMAR team, and besides of several technical problems for the BGR team data from five profiles and first results with the newly developed signal generator and online communication with the seafloor instruments.

Acknowledgements

The science party of MSM35 would like to thank Captain Ralf Schmidt and his crew for their professional assistance, and the friendly atmosphere and care onboard the MERIAN. We most value the high flexibility and technical support of the crew which was very helpful when technical problems with the gear delayed the schedule. Prof. Nigel Edwards, University of Toronto, is thanked for sending his current transverter as a backup last minute to Varna. We also acknowledge the support of the Leitstelle Deutsche Forschungsschiffe. Financial support was also provided by funds of the German SUGAR Project to BGR (BMW Grant 03SX320Z).

MSM35 Cruise Participants

No.	Name	Expertise	Institution
1	Dr. Katrin Schwalenberg	Chief Scientist / CSEM-2D	BGR
2	Dr. Udo Barckhausen	CSEM-2D / Multibeam	BGR
3	Dr. Dennis Rippe	CSEM-2D	BGR
4	Dr. Davood Moghadas	CSEM-2D	BGR
5	Joachim Deppe	CSEM-2D	BGR
6	Boris Hahn	CSEM-2D	BGR
7	Dr. Sebastian Hoelz	CSEM-3D	GEOMAR
8	Martin Wollatz-Vogt	CSEM-3D	GEOMAR
9	Patrick Schroeder	CSEM-3D	GEOMAR
10	Thomas Eckardt	CSEM-3D	GEOMAR
11	Frank Joris	CSEM-3D	GEOMAR
12	Moritz Luedemann	CSEM-3D	GEOMAR
13	Eloi Vilamajo Llobera	CSEM-3D	U-Barcelona
14	Dr. Traute Crueger	Meteorology	MPI-M

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Station Lists MSM35

Tab.1 OBEM List Area 1

Station No.	Date	Time [UTC]	Position Lat	Position Lon	Depth [m]	Gear	
MSM35/092-1	20.01.2014	19:40	43° 27,20' N	30° 24,38' E	1496	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/093-1	20.01.2014	22:01	43° 27,30' N	30° 24,57' E	1505,2	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/094-1	21.01.2014	00:14	43° 27,40' N	30° 24,76' E	1502,4	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/095-1	21.01.2014	02:23	43° 27,49' N	30° 24,94' E	1501,8	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/096-1	21.01.2014	04:14	43° 27,59' N	30° 25,12' E	1476,2	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/097-1	21.01.2014	05:58	43° 27,69' N	30° 25,30' E	1469,3	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/098-1	21.01.2014	08:08	43° 27,90' N	30° 25,06' E	1482	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/099-1	21.01.2014	09:49	43° 27,81' N	30° 24,88' E	1476,6	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/100-1	21.01.2014	11:36	43° 27,72' N	30° 24,69' E	1483,6	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/101-1	21.01.2014	12:26	43° 27,63' N	30° 24,50' E	1504,7	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/102-1	21.01.2014	15:09	43° 27,53' N	30° 24,34' E	0	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/103-1	21.01.2014	16:52	43° 27,43' N	30° 24,15' E	0	Ocean Bottom Electromagnetic Sensor	OBEM

Tab. 2: SPUTNIK List Area 1

Station No.	Date	Time [UTC]	Position Lat	Position Lon	Depth [m]	Gear	
MSM35/105-1	22.01.2014	13:26	43° 27,92' N	30° 25,75' E	1471,9	Controlled Source EM	SPUTNIK
MSM35/106-1	22.01.2014	14:10	43° 27,88' N	30° 25,66' E	1475,3	Controlled Source EM	SPUTNIK
MSM35/107-1	22.01.2014	14:39	43° 27,83' N	30° 25,57' E	1475,5	Controlled Source EM	SPUTNIK
MSM35/108-1	22.01.2014	15:04	43° 27,79' N	30° 25,51' E	1487,1	Controlled Source EM	SPUTNIK
MSM35/109-1	22.01.2014	15:28	43° 27,76' N	30° 25,45' E	1478,2	Controlled Source EM	SPUTNIK
MSM35/110-1	22.01.2014	15:51	43° 27,73' N	30° 25,39' E	1478,1	Controlled Source EM	SPUTNIK
MSM35/111-1	22.01.2014	16:23	43° 27,70' N	30° 25,33' E	1469,4	Controlled Source EM	SPUTNIK
MSM35/112-1	22.01.2014	16:51	43° 27,67' N	30° 25,27' E	1470,7	Controlled Source EM	SPUTNIK
MSM35/113-1	22.01.2014	17:14	43° 27,63' N	30° 25,22' E	1471,3	Controlled Source EM	SPUTNIK
MSM35/114-1	22.01.2014	17:37	43° 27,60' N	30° 25,16' E	1477,8	Controlled Source EM	SPUTNIK
MSM35/115-1	22.01.2014	18:00	43° 27,57' N	30° 25,10' E	1484,8	Controlled Source EM	SPUTNIK
MSM35/116-1	22.01.2014	18:24	43° 27,54' N	30° 25,04' E	1478,5	Controlled Source EM	SPUTNIK
MSM35/117-1	22.01.2014	18:49	43° 27,50' N	30° 24,98' E	1490,3	Controlled Source EM	SPUTNIK
MSM35/118-1	22.01.2014	19:12	43° 27,47' N	30° 24,92' E	1628,6	Controlled Source EM	SPUTNIK
MSM35/119-1	22.01.2014	19:37	43° 27,44' N	30° 24,86' E	1499,6	Controlled Source EM	SPUTNIK
MSM35/120-1	22.01.2014	20:09	43° 27,41' N	30° 24,80' E	1496,6	Controlled Source EM	SPUTNIK
MSM35/121-1	22.01.2014	20:45	43° 27,38' N	30° 24,74' E	1525,5	Controlled Source EM	SPUTNIK
MSM35/122-1	22.01.2014	21:11	43° 27,35' N	30° 24,69' E	1503,3	Controlled Source EM	SPUTNIK
MSM35/123-1	22.01.2014	21:34	43° 27,33' N	30° 24,65' E	1503,5	Controlled Source EM	SPUTNIK
MSM35/124-1	22.01.2014	21:58	43° 27,30' N	30° 24,61' E	1503,3	Controlled Source EM	SPUTNIK
MSM35/125-1	22.01.2014	22:23	43° 27,28' N	30° 24,56' E	1505,8	Controlled Source EM	SPUTNIK
MSM35/126-1	22.01.2014	22:47	43° 27,25' N	30° 24,52' E	1500,6	Controlled Source EM	SPUTNIK
MSM35/127-1	22.01.2014	23:12	43° 27,23' N	30° 24,47' E	1500,6	Controlled Source EM	SPUTNIK

MSM35/128-1	22.01.2014	23:35	43° 27,21' N	30° 24,43' E	1496,5	Controlled Source EM	SPUTNIK
MSM35/129-1	23.01.2014	00:00	43° 27,18' N	30° 24,38' E	1496,5	Controlled Source EM	SPUTNIK
MSM35/130-1	23.01.2014	00:21	43° 27,16' N	30° 24,34' E	1496,3	Controlled Source EM	SPUTNIK
MSM35/131-1	23.01.2014	00:48	43° 27,13' N	30° 24,28' E	1498,4	Controlled Source EM	SPUTNIK
MSM35/132-1	23.01.2014	01:15	43° 27,09' N	30° 24,22' E	1477,9	Controlled Source EM	SPUTNIK
MSM35/133-1	23.01.2014	01:52	43° 27,05' N	30° 24,14' E	1458,8	Controlled Source EM	SPUTNIK
MSM35/133-1	23.01.2014	02:01	43° 27,05' N	30° 24,14' E	1459,6	Controlled Source EM	SPUTNIK
MSM35/134-1	23.01.2014	02:20	43° 27,03' N	30° 24,10' E	1448,3	Controlled Source EM	SPUTNIK
MSM35/134-1	23.01.2014	02:24	43° 27,03' N	30° 24,10' E	1444,5	Controlled Source EM	SPUTNIK
MSM35/135-1	23.01.2014	05:03	43° 28,14' N	30° 25,52' E	1463,1	Controlled Source EM	SPUTNIK
MSM35/136-1	23.01.2014	05:27	43° 28,09' N	30° 25,43' E	1470,3	Controlled Source EM	SPUTNIK
MSM35/137-1	23.01.2014	05:47	43° 28,04' N	30° 25,33' E	1466,5	Controlled Source EM	SPUTNIK
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MSM35/139-1	23.01.2014	06:45	43° 27,95' N	30° 25,15' E	1478,7	Controlled Source EM	SPUTNIK
MSM35/140-1	23.01.2014	07:07	43° 27,92' N	30° 25,09' E	1477,2	Controlled Source EM	SPUTNIK
MSM35/141-1	23.01.2014	07:32	43° 27,89' N	30° 25,03' E	1496,8	Controlled Source EM	SPUTNIK
MSM35/142-1	23.01.2014	07:53	43° 27,86' N	30° 24,97' E	1499,1	Controlled Source EM	SPUTNIK
MSM35/143-1	23.01.2014	08:15	43° 27,83' N	30° 24,91' E	1498,9	Controlled Source EM	SPUTNIK
MSM35/143-1	23.01.2014	10:26	43° 27,83' N	30° 24,91' E	1500,2	Controlled Source EM	SPUTNIK
MSM35/143-1	23.01.2014	13:05	43° 27,83' N	30° 24,91' E	1498,8	Controlled Source EM	SPUTNIK
MSM35/144-1	23.01.2014	13:44	43° 27,80' N	30° 24,86' E	1497,8	Controlled Source EM	SPUTNIK
MSM35/145-1	23.01.2014	14:08	43° 27,78' N	30° 24,82' E	1489,2	Controlled Source EM	SPUTNIK
MSM35/146-1	23.01.2014	14:27	43° 27,76' N	30° 24,77' E	1482,8	Controlled Source EM	SPUTNIK
MSM35/146-1	23.01.2014	14:30	43° 27,76' N	30° 24,77' E	1482,5	Controlled Source EM	SPUTNIK
MSM35/147-1	23.01.2014	14:52	43° 27,73' N	30° 24,71' E	1488,8	Controlled Source EM	SPUTNIK
MSM35/148-1	23.01.2014	15:16	43° 27,69' N	30° 24,65' E	1488,8	Controlled Source EM	SPUTNIK
MSM35/149-1	23.01.2014	15:36	43° 27,66' N	30° 24,59' E	1504,3	Controlled Source EM	SPUTNIK
MSM35/149-1	23.01.2014	15:40	43° 27,66' N	30° 24,59' E	1501,8	Controlled Source EM	SPUTNIK
MSM35/150-1	23.01.2014	15:59	43° 27,63' N	30° 24,53' E	1493,9	Controlled Source EM	SPUTNIK

MSM35/151-1	23.01.2014	16:28	43° 27,61' N	30° 24,49' E	1496,2	Controlled Source EM	SPUTNIK
MSM35/152-1	23.01.2014	16:53	43° 27,59' N	30° 24,44' E	1492,8	Controlled Source EM	SPUTNIK
MSM35/153-1	23.01.2014	17:12	43° 27,56' N	30° 24,39' E	1493,2	Controlled Source EM	SPUTNIK
MSM35/154-1	23.01.2014	17:30	43° 27,54' N	30° 24,35' E	1495,9	Controlled Source EM	SPUTNIK
MSM35/155-1	23.01.2014	17:50	43° 27,52' N	30° 24,30' E	1492,7	Controlled Source EM	SPUTNIK
MSM35/156-1	23.01.2014	18:11	43° 27,49' N	30° 24,26' E	1486,8	Controlled Source EM	SPUTNIK
MSM35/157-1	23.01.2014	18:35	43° 27,46' N	30° 24,20' E	1491,7	Controlled Source EM	SPUTNIK
MSM35/158-1	23.01.2014	18:59	43° 27,43' N	30° 24,14' E	1529,1	Controlled Source EM	SPUTNIK
MSM35/159-1	23.01.2014	19:25	43° 27,38' N	30° 24,04' E	1478,8	Controlled Source EM	SPUTNIK
MSM35/160-1	23.01.2014	19:53	43° 27,34' N	30° 23,95' E	1559	Controlled Source EM	SPUTNIK
MSM35/161-1	23.01.2014	20:16	43° 27,29' N	30° 23,86' E	1424,8	Controlled Source EM	SPUTNIK
MSM35/163-1	23.01.2014	21:25	43° 27,15' N	30° 23,90' E	1426,2	Controlled Source EM	SPUTNIK
MSM35/164-1	23.01.2014	21:54	43° 27,20' N	30° 24,00' E	1465,4	Controlled Source EM	SPUTNIK
MSM35/165-1	23.01.2014	22:25	43° 27,25' N	30° 24,09' E	1491,8	Controlled Source EM	SPUTNIK
MSM35/166-1	23.01.2014	22:53	43° 27,29' N	30° 24,18' E	1494,8	Controlled Source EM	SPUTNIK
MSM35/167-1	23.01.2014	23:14	43° 27,32' N	30° 24,24' E	1497,1	Controlled Source EM	SPUTNIK
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MSM35/169-1	24.01.2014	00:01	43° 27,39' N	30° 24,36' E	1499,7	Controlled Source EM	SPUTNIK
MSM35/170-1	24.01.2014	00:24	43° 27,42' N	30° 24,42' E	1497,1	Controlled Source EM	SPUTNIK
MSM35/171-1	24.01.2014	00:50	43° 27,45' N	30° 24,48' E	1496	Controlled Source EM	SPUTNIK
MSM35/172-1	24.01.2014	01:16	43° 27,48' N	30° 24,54' E	1492,2	Controlled Source EM	SPUTNIK
MSM35/173-1	24.01.2014	01:38	43° 27,51' N	30° 24,60' E	1495,1	Controlled Source EM	SPUTNIK
MSM35/174-1	24.01.2014	02:04	43° 27,54' N	30° 24,66' E	1493,5	Controlled Source EM	SPUTNIK
MSM35/175-1	24.01.2014	02:25	43° 27,57' N	30° 24,72' E	1485,4	Controlled Source EM	SPUTNIK
MSM35/176-1	24.01.2014	02:45	43° 27,60' N	30° 24,78' E	1485,5	Controlled Source EM	SPUTNIK
MSM35/177-1	24.01.2014	03:04	43° 27,63' N	30° 24,84' E	1475,6	Controlled Source EM	SPUTNIK
MSM35/178-1	24.01.2014	03:24	43° 27,67' N	30° 24,91' E	1479,4	Controlled Source EM	SPUTNIK
MSM35/179-1	24.01.2014	03:43	43° 27,70' N	30° 24,97' E	1476,2	Controlled Source EM	SPUTNIK
MSM35/180-1	24.01.2014	04:04	43° 27,73' N	30° 25,03' E	1471,3	Controlled Source EM	SPUTNIK

MSM35/181-1	24.01.2014	04:23	43° 27,76' N	30° 25,09' E	1473	Controlled Source EM	SPUTNIK
MSM35/182-1	24.01.2014	04:44	43° 27,79' N	30° 25,15' E	1476,3	Controlled Source EM	SPUTNIK
MSM35/183-1	24.01.2014	05:14	43° 27,84' N	30° 25,24' E	1470,1	Controlled Source EM	SPUTNIK
MSM35/184-1	24.01.2014	05:37	43° 27,88' N	30° 25,33' E	1477,2	Controlled Source EM	SPUTNIK
MSM35/185-1	24.01.2014	06:00	43° 27,93' N	30° 25,42' E	1473,5	Controlled Source EM	SPUTNIK
MSM35/186-1	24.01.2014	06:25	43° 27,98' N	30° 25,51' E	1472,8	Controlled Source EM	SPUTNIK
MSM35/187-1	24.01.2014	06:51	43° 28,02' N	30° 25,60' E	1467,9	Controlled Source EM	SPUTNIK

Tab.3: OBEM List Area 2

Station No.	Date	Time [UTC]	Position Lat	Position Lon	Depth [m]	Gear	
MSM35/192-1	30.01.2014	13:00	43° 57,29' N	30° 46,44' E	699,1	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/193-1	30.01.2014	14:50	43° 56,81' N	30° 46,70' E	742,5	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/194-1	30.01.2014	16:33	43° 56,94' N	30° 46,57' E	730,8	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/195-1	30.01.2014	18:17	43° 57,07' N	30° 46,43' E	717,7	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/196-1	30.01.2014	19:45	43° 57,21' N	30° 46,29' E	702,8	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/197-1	30.01.2014	21:04	43° 57,34' N	30° 46,15' E	693,6	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/198-1	30.01.2014	22:40	43° 56,98' N	30° 47,00' E	773,1	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/199-1	31.01.2014	00:16	43° 57,11' N	30° 46,87' E	733	Ocean Bottom Electromagnetic Sensor	OBEM

MSM35/200-1	31.01.2014	01:51	43° 57,24' N	30° 46,72' E	711,1	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/201-1	31.01.2014	03:20	43° 57,36' N	30° 46,58' E	689,1	Ocean Bottom Electromagnetic Sensor	OBEM
MSM35/202-1	31.01.2014	04:50	43° 57,52' N	30° 46,45' E	671,9	Ocean Bottom Electromagnetic Sensor	OBEM

Tab. 4: SPUTNIK List Area 2

Station No.	Date	Time [UTC]	Position Lat	Position Lon	Depth [m]	Gear	
MSM35/204-1	01.02.2014	01:47	43° 56,77' N	30° 47,20' E	804,6	Controlled Source EM	SPUTNIK
MSM35/205-1	01.02.2014	02:45	43° 56,83' N	30° 47,14' E	794,7	Controlled Source EM	SPUTNIK
MSM35/206-1	01.02.2014	03:11	43° 56,90' N	30° 47,08' E	0	Controlled Source EM	SPUTNIK
MSM35/207-1	01.02.2014	03:37	43° 56,94' N	30° 47,03' E	785,5	Controlled Source EM	SPUTNIK
MSM35/208-1	01.02.2014	03:59	43° 56,99' N	30° 46,99' E	773	Controlled Source EM	SPUTNIK
MSM35/209-1	01.02.2014	04:19	43° 57,03' N	30° 46,95' E	0	Controlled Source EM	SPUTNIK
MSM35/210-1	01.02.2014	04:46	43° 57,08' N	30° 46,90' E	0	Controlled Source EM	SPUTNIK
MSM35/211-1	01.02.2014	05:08	43° 57,12' N	30° 46,86' E	0	Controlled Source EM	SPUTNIK
MSM35/212-1	01.02.2014	05:28	43° 57,16' N	30° 46,82' E	0	Controlled Source EM	SPUTNIK
MSM35/213-1	01.02.2014	05:49	43° 57,21' N	30° 46,77' E	0	Controlled Source EM	SPUTNIK
MSM35/214-1	01.02.2014	06:10	43° 57,25' N	30° 46,73' E	0	Controlled Source EM	SPUTNIK
MSM35/215-1	01.02.2014	06:35	43° 57,29' N	30° 46,68' E	0	Controlled Source EM	SPUTNIK
MSM35/216-1	01.02.2014	07:00	43° 57,34' N	30° 46,64' E	0	Controlled Source EM	SPUTNIK
MSM35/217-1	01.02.2014	07:16	43° 57,38' N	30° 46,60' E	0	Controlled Source EM	SPUTNIK
MSM35/218-1	01.02.2014	07:34	43° 57,43' N	30° 46,55' E	0	Controlled Source EM	SPUTNIK
MSM35/219-1	01.02.2014	07:52	43° 57,47' N	30° 46,51' E	0	Controlled Source EM	SPUTNIK
MSM35/220-1	01.02.2014	08:11	43° 57,51' N	30° 46,47' E	0	Controlled Source EM	SPUTNIK
MSM35/221-1	01.02.2014	08:29	43° 57,56' N	30° 46,42' E	0	Controlled Source EM	SPUTNIK

MSM35/222-1	01.02.2014	08:50	43° 57,60' N	30° 46,38' E	0	Controlled Source EM	SPUTNIK
MSM35/223-1	01.02.2014	09:14	43° 57,67' N	30° 46,31' E	0	Controlled Source EM	SPUTNIK
MSM35/224-1	01.02.2014	09:34	43° 57,73' N	30° 46,25' E	0	Controlled Source EM	SPUTNIK
MSM35/225-1	01.02.2014	11:15	43° 56,60' N	30° 46,92' E	0	Controlled Source EM	SPUTNIK
MSM35/226-1	01.02.2014	11:38	43° 56,66' N	30° 46,85' E	0	Controlled Source EM	SPUTNIK
MSM35/227-1	01.02.2014	12:02	43° 56,73' N	30° 46,78' E	0	Controlled Source EM	SPUTNIK
MSM35/228-1	01.02.2014	12:23	43° 56,77' N	30° 46,74' E	0	Controlled Source EM	SPUTNIK
MSM35/229-1	01.02.2014	12:42	43° 56,81' N	30° 46,69' E	0	Controlled Source EM	SPUTNIK
MSM35/230-1	01.02.2014	13:02	43° 56,86' N	30° 46,65' E	0	Controlled Source EM	SPUTNIK
MSM35/231-1	01.02.2014	13:20	43° 56,90' N	30° 46,61' E	0	Controlled Source EM	SPUTNIK
MSM35/232-1	01.02.2014	13:38	43° 56,95' N	30° 46,56' E	0	Controlled Source EM	SPUTNIK
MSM35/233-1	01.02.2014	13:58	43° 56,99' N	30° 46,52' E	0	Controlled Source EM	SPUTNIK
MSM35/234-1	01.02.2014	14:16	43° 57,03' N	30° 46,47' E	0	Controlled Source EM	SPUTNIK
MSM35/235-1	01.02.2014	14:34	43° 57,07' N	30° 46,43' E	0	Controlled Source EM	SPUTNIK
MSM35/236-1	01.02.2014	14:54	43° 57,12' N	30° 46,38' E	0	Controlled Source EM	SPUTNIK
MSM35/237-1	01.02.2014	15:14	43° 57,17' N	30° 46,34' E	0	Controlled Source EM	SPUTNIK
MSM35/238-1	01.02.2014	15:30	43° 57,20' N	30° 46,29' E	0	Controlled Source EM	SPUTNIK
MSM35/239-1	01.02.2014	15:53	43° 57,25' N	30° 46,25' E	0	Controlled Source EM	SPUTNIK
MSM35/240-1	01.02.2014	16:13	43° 57,29' N	30° 46,21' E	0	Controlled Source EM	SPUTNIK
MSM35/241-1	01.02.2014	16:33	43° 57,34' N	30° 46,16' E	0	Controlled Source EM	SPUTNIK
MSM35/242-1	01.02.2014	16:54	43° 57,38' N	30° 46,12' E	0	Controlled Source EM	SPUTNIK
MSM35/243-1	01.02.2014	17:12	43° 57,42' N	30° 46,07' E	0	Controlled Source EM	SPUTNIK
MSM35/244-1	01.02.2014	17:31	43° 57,49' N	30° 46,01' E	0	Controlled Source EM	SPUTNIK
MSM35/245-1	01.02.2014	17:55	43° 57,55' N	30° 45,94' E	0	Controlled Source EM	SPUTNIK
MSM35/246-1	01.02.2014	19:15	43° 57,08' N	30° 46,05' E	0	Controlled Source EM	SPUTNIK
MSM35/247-1	01.02.2014	19:41	43° 57,14' N	30° 46,17' E	0	Controlled Source EM	SPUTNIK
MSM35/248-1	01.02.2014	20:14	43° 57,25' N	30° 46,36' E	0	Controlled Source EM	SPUTNIK
MSM35/249-1	01.02.2014	20:34	43° 57,29' N	30° 46,44' E	0	Controlled Source EM	SPUTNIK
MSM35/250-1	01.02.2014	20:54	43° 57,33' N	30° 46,51' E	0	Controlled Source EM	SPUTNIK

MSM35/251-1	01.02.2014	21:21	43° 57,43' N	30° 46,71' E	0	Controlled Source EM	SPUTNIK
MSM35/252-1	01.02.2014	21:43	43° 57,49' N	30° 46,82' E	0	Controlled Source EM	SPUTNIK

Tab. 5: CSEM HYDRA Profiles

HYDRA Profile 1, Area 1								
MSM35/104-1	21.01.2014	22:46	43° 27,96' N	30° 25,53' E	1468,4	Bottom towed CSEM systems	HYDRA	start profile
MSM35/104-1	22.01.2014	04:48	43° 25,92' N	30° 21,53' E	1492,7	Bottom towed CSEM system	HYDRA	end profile
HYDRA Profile 2, Area 1								
MSM35/188-1	24.01.2014	12:22	43° 26,88' N	30° 23,39' E	1440,7	Bottom towed CSEM system	HYDRA	start towing
MSM35/188-1	24.01.2014	19:04	43° 29,38' N	30° 28,19' E	1301,4	Bottom towed CSEM system	HYDRA	end profile
HYDRA Profile 3, Area 1								
MSM35/190-1	27.01.2014	22:37	43° 27,20' N	30° 25,38' E	1493,3	Bottom towed CSEM system	HYDRA	start towing
MSM35/191-1	28.01.2014	13:21	43° 28,04' N	30° 23,64' E	1461,1	Bottom towed CSEM system	HYDRA	end profile
HYDRA Profile 4, Area 2								
MSM35/203-1	31.01.2014	12:10	43° 56,42' N	30° 46,34' E	676,2	Bottom towed CSEM system	HYDRA	start towing
MSM35/203-1	31.01.2014	20:18	43° 59,65' N	30° 47,37' E	596,4	Bottom towed CSEM system	HYDRA	end profile
HYDRA Profile 5, Area 2								
MSM35/254-1	02.02.2014	12:10	43° 57,31' N	30° 43,52' E	532,3	Bottom towed CSEM system	HYDRA	start towing
MSM35/254-1	02.02.2014	19:50	43° 57,32' N	30° 48,54' E	768	Bottom towed CSEM system	HYDRA	end profile
HYDRA Profile 6, Area 1								
MSM35/256-1	03.02.2014	17:14	43° 26,45' N	30° 22,72' E	1473,6	Bottom towed CSEM system	HYDRA	start towing
MSM35/256-1	04.02.2014	05:46	43° 29,46' N	30° 28,30' E	1267,6	Bottom towed CSEM system	HYDRA	end profile

Tab.6: Multibeam Profiles

Station No.	Date	Time [UTC]	Position Lat	Position Lon	Depth [m]	Gear	Action
MSM35/189-1	24.01.2014	23:10	43° 13,34' N	30° 14,58' E	1669	Deep-Sea Multibeam Echosounder, EM122	Start Profile
MSM35/189-1	26.01.2014	02:36	43° 17,55' N	31° 2,31' E	1526,1	Deep-Sea Multibeam Echosounder, EM122	End Profile
MSM35/253-1	02.02.2014	06:52	43° 57,07' N	30° 45,80' E	681,4	Deep-Sea Multibeam Echosounder, EM122	Start Profile
MSM35/253-1	02.02.2014	10:01	43° 57,36' N	30° 42,68' E	488,3	Deep-Sea Multibeam Echosounder, EM122	End Profile
MSM35/255-1	02.02.2014	23:00	0° 0,00' N	0° 0,00' E	0	Deep-Sea Multibeam Echosounder, EM122	Start Profile
MSM35/255-1	03.02.2014	10:16	43° 33,09' N	29° 56,28' E	724	Deep-Sea Multibeam Echosounder, EM122	End Profile