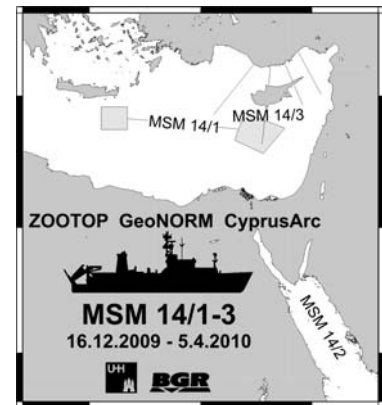


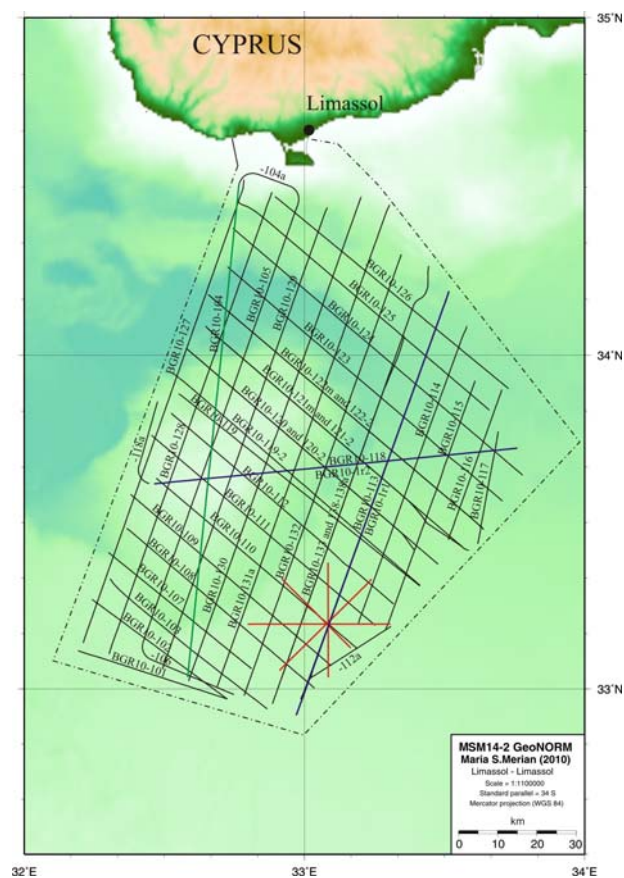
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## Short Cruise Report Maria S. Merian MSM14/2

Limassol (Cyprus) - Limassol  
16.01.2010 – 26.02.2010  
Chief Scientist: Axel Ehrhardt  
Captain: Matthias Günther



## Objectives:

The initial study area of the cruise MSM14/2 *GeoNORM* was the northern Red Sea. However, because of not given research permission from Egypt and Saudi Arabia, the study area had to be changed to the alternative study area Eratosthenes Seamount (ESM), south of Cyprus.

The Eratosthenes Seamount is supposed to represent a continental fragment of the former African-Arabian Plate that is entering the subduction zone south of Cyprus. I.e. the subduction turns into collision in the area of the ESM. This changes the entire tectonic pattern in the Eastern Mediterranean. The collision was made responsible for the accelerated uplift of Cyprus since the early Pliocene and the flexure of the ESM. E-W trending normal faults are reported from the plateau of the seamount. The faulting could be the causative reason for catastrophic submarine landslides that are visible on the northern and western slopes of the seamount.

The ESM is surrounded by a steep rim. The Messinian evaporates terminate close to the slopes of the seamount building a steep escarpment. The tectonic history of the seamount and the migration of the Messinian salt play a vital role for the recent morphology.

The main objectives of the cruise MSM14/2 in the Eratosthenes area can be summarized as follows:

- What is the influence of the commencing collision of the ESM to the Cyprus Arc?
- What is the influence of the commencing collision to the ESM? Does it affect the integrity of the seamount?
- Do we find further evidence for the origin of the ESM? This can shed more light to the fault pattern that is observed at the ESM.
- Is the prominent escarpment around the ESM also a result of the collision? What is the reaction of the Messinian Evaporates?
- The Messinian Evaporates build an approximately 2 km thick cover above a Mesozoic sediment basin. In order to image the sub salt sediments correctly it is necessary to know the correct sound velocities. A star shaped sub survey within the study area should show whether anisotropic affinity of the salt body can distort the imaging of the sub salt.

In order to address these objectives a comprehensive geophysical survey was planned to be carried out including multichannel seismic (MCS), refraction seismics, magnetic, gravity measurements and marine magnetotelluric measurements (marine MT), as well as the ship-borne multibeam and sediment echosounder.

- MCS: Streamer: 3900 m active length (312 channels); Source: two G-Gun arrays Starboard and Port side with 3100 in<sup>3</sup> total volume.
- Refraction seismics: 8 Ocean Bottom Hydrophones (OBH) and 4 Ocean Bottom Seismometer (OBS).
- Magnetics: Two sensor total intensity gradiometer plus 3 component fluxgate sensor towed behind the vessel and one vessel mounted fluxgate magnetometer.
- Gravity: Bodenseewerke KSS40 gravimeter, vessel mounted.
- Marine MT: 10 IFM-GEOMAR OBMT devices
- Hydroacoustics: Simrad EM120 Multibeam, ParaSound sediment echosounder

A dense MCS line grid was designed with line spacing of approx. 5 nautical miles in NW-SE direction and in WNW-ESE direction (please see track chart above). Magnetic measurements were done coeval with the MCS measurements. Refraction and marine MT measurements were done along two selected lines (please see track chart above). Continuous recording was done for the hydroacoustics and the gravity measurements.

## Narrative of the Cruise MSM14/2 Limassol (Cyprus) – Limassol

January, 16 <sup>th</sup>	The BGR/IFM-GEOMAR crew arrived at R/V Maria S. Merian and started with the mobilization of the comprehensive geophysical equipment. Especially the installation of the airgun arrays with their umbilicals was time consuming. Furthermore the OBS/OBH and OBMT stations were stored in the Hangar and the MCS data acquisition unit in the seismic laboratory.
January, 18 <sup>th</sup>	R/V Maria S. Merian left the harbor of Limassol and steamed in direction Eratosthenes Seamount. Since the final decisions by the respective countries concerning the research permission for the Red Sea project was still pending, we decided to wait half way from Limassol to Port Said and used the time to finish the preparation our geophysical equipment. The test of the OBS/OBH/OBMT releaser was done after entering the alternative research area. In addition a sound velocity probe was deployed from the vessel in order to record the sound velocity-depth function for the calibration of the echosounder.
January 19 <sup>th</sup>	Resuming the mobilization work for the airguns. For the calibration of the magnetometers we towed the magnetometer probes on a two full circle loop course. Calibration was successful, but one probe showed a water leakage and had to be replaced. As we still had no research permit we decided to start the geophysical research as soon as possible within the alternative study area (Eratosthenes) and in case of getting a research permit until the 23 <sup>rd</sup> January we were prepared to stop the research activities in order to go to the Red Sea. After January 23 <sup>rd</sup> we would stay in the alternative area anyway, as the transit to the Red Sea would have been too long.
January 20 <sup>th</sup>	The second calibration test for the replaced magnetometer probe was successful. Pressure test of the airguns was successful. Prolongation of the maximum active streamer length to 3900 m. All systems were ready. First deployment was planned for the first daylight of the next day.
January 21 <sup>st</sup>	After the deployment of the streamer and the airguns we started the MCS data acquisition with a softstart (ramp-up). The first shot on line BGR10-101 was done at 16:04h LT.
January 22 <sup>nd</sup>	MCS data acquisition
January 23 <sup>rd</sup>	As we didn't get a research permit for the Red Sea until the deadline we decided to stay in the Eratosthenes area.
January, 24 <sup>th</sup> -26 <sup>th</sup>	Continuing with seismic data acquisition.
January 27 <sup>th</sup>	We decided to stop the MCS work in the evening and to deploy the OBMT and OBS/OBH stations in order to give the OBMT stations a long registration time. After End of Line (EoL) BGR10-113 all equipment was recovered on deck.

January 28 <sup>th</sup>	Starting with deployment of OBMT stations, followed by the deployment of OBS/OBH stations.
January 29 <sup>th</sup>	The start of shooting along the OBS/OBH line was delayed because of problems with both manifolds. Until the afternoon only the starboard manifold was repaired. We decided to move the high volume guns to the starboard array and to shoot the line with only one array.
January 30 <sup>th</sup>	End of the refraction line at 15:00h LT and start of the recovery of the OBS/OBH stations.
January 31 <sup>st</sup>	All stations but OBH 10 were recovered. Decision to wait for the time release and to do hydrographic work in the meantime. In the evening the OBH popped up and could be recovered. First analysis showed a damage of the hydrophone connector cable. After the recovery the MCS equipment and magnetometer were deployed again and we restarted MCS recording.
1 <sup>st</sup> – 3 <sup>rd</sup> February	Continuing MCS data acquisition.
4 <sup>th</sup> February	Stopped MCS data acquisition because of heavy sea and weather conditions. Airguns and streamer on deck. Magnetometer still deployed. A broken wire for dragging the portside airgun array caused heavy damage at the umbilical. Maintenance of airgun arrays.
5 <sup>th</sup> – 8 <sup>th</sup> February	Weather conditions were improved. Deployment of streamer and starboard array. Portside array still in maintenance. Re-shooting of lines BGR10-119 to 122 because of the weather biased data.
9 <sup>th</sup> February	Continuing MCS data acquisition. Weather is improving. 13:00h all equipment on deck and transit to Limassol in order to get spare parts for the manifolds. 19:00h all equipment deployed again and restart of MCS data acquisition
10 <sup>th</sup> –16 <sup>th</sup> February	Continuing MCS data acquisition.
17 <sup>th</sup> February	Begin of star-shaped survey. 14:20h: tanker is not responding, will cross the streamer. Streamer down to 25 m. Tanker crosses without damaging the streamer.
18 <sup>th</sup> February	End of star-shaped survey. Begin of line with spatial controlled airgun trigger (37.5m and 25 m). Airguns were operated in flip-flop mode. 21:00h: End of line. Recovering of the streamer.
19 <sup>th</sup> February	00:30h: Streamer on deck. 03:30h: Begin deploying OBS/OBH devices.
20 <sup>th</sup> February	Begin of refraction line.
21 <sup>st</sup> February	Retrieval of airguns, recovery of OBS/OBH stations, OBH 21 is not responding to release code. 19:15h UTC: Decision to abort and to go on to the next OBH station and to come back for the time release.

22 <sup>nd</sup> February	01:30h: all remaining OBH/OBS station successfully recovered. Begin recovery of OBMT stations.
23 <sup>rd</sup> February	02:30h: all OBMT stations successfully recovered. Transit to OBH 21 for the time release. Begin of demobilization. 17:00 h UTC: OBH 21 recovered. All equipment on deck!
24 <sup>th</sup> –25 <sup>th</sup> February	Demobilization.
26 <sup>th</sup> February	Disembarkation.

## Acknowledgements

We would like to thank Captain Matthias Günther, his officers and the crew of R/V Maria S. Merian who contributed with their competent and professional support significantly to the success of the cruise. Everybody enjoyed the cooperativeness and the friendly atmosphere aboard.

The ship time of R/V Maria S. Merian was provided by the Deutsche Forschungsgemeinschaft (DFG) within the core program METEOR/MERIAN. We also benefited from financial contributions by the research institutes involved. We gratefully acknowledge all this support.

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**Station list:**

a: Reflection seismic line coordinates:

Methods: S=Seismic, M=Magnetics, G=Gravity, B=Bathymetry

line number	SP	date	time	latitude	longitude	course	methods	Profile km
BGR10-101	1	21.01.10	14:04:31	33° 06.780 N	32° 12.002 E		S,M,G,B	
	441	21.01.10	16:16:34	33° 03.138 N	32° 25.414 E	108°		21.87 km
BGR10-101a	1	21.01.10	16:50:17	33° 02.214 N	32° 28.820 E		S,M,G,B	
	480	21.01.10	19:14:03	32° 58.202 N	32° 43.510 E	108°		23.99 km
BGR10-102	1	21.01.10	23:11:04	32° 58.317 N	32° 43.246 E		S,M,G,B	
	1111	22.01.10	04:44:15	33° 16.167 N	32° 14.545 E	307°		55.44 km
BGR10-103	1	22.01.10	06:18:38	33° 19.893 N	32° 18.383 E		S,M,G,B	
	1363	22.01.10	13:07:13	32° 56.383 N	32° 52.052 E	130°		67.97 km
BGR10-104	1	22.01.10	18:10:28	33° 02.116 N	32° 35.003 E		S,M,G,B	
	3281	23.01.10	10:34:29	34° 30.127 N	32° 45.953 E	6°		163.84 km
BGR10-104a	1	23.01.10	10:37:19	34° 30.367 N	32° 45.996 E		S,M,G,B	
	531	23.01.10	13:16:20	34° 27.084 N	32° 58.670 E	107°		20.28 km
BGR10-105	1	23.01.10	13:19:12	34° 26.891 N	32° 58.604 E		S,M,G,B	
	3103	24.01.10	04:49:47	33° 08.482 N	32° 25.491 E	199°		153.87 km
BGR10-106	1	24.01.10	04:54:58	33° 08.039 N	32° 25.353 E		S,M,G,B	
	720	24.01.10	08:30:43	32° 59.009 N	32° 44.897 E	119°		34.64 km
BGR10-107	1	24.01.10	09:55:51	33° 03.644 N	32° 48.715 E		S,M,G,B	
	1234	24.01.10	16:05:41	33° 24.619 N	32° 18.073 E	309°		61.32 km
BGR10-108	1	24.01.10	17:38:20	33° 28.975 N	32° 21.961 E		S,M,G,B	
	1644	25.01.10	01:51:33	33° 00.174 N	33° 02.149 E	130°		81.96 km
BGR10-109	1	25.01.10	03:25:00	33° 04.165 N	33° 05.721 E		S,M,G,B	
	1810	25.01.10	12:27:46	33° 35.071 N	32° 22.814 E	311°		87.64 km
BGR10-110	1	25.01.10	14:15:00	33° 37.993 N	32° 28.266 E		S,M,G,B	
	1759	25.01.10	23:02:45	33° 07.335 N	33° 11.266 E	130°		87.43 km
BGR10-111	1	26.01.10	00:36:35	33° 11.491 N	33° 15.181 E		S,M,G,B	
	1960	26.01.10	10:24:20	33° 45.660 N	32° 27.315 E	311°		97.30 km
BGR10-112	1	26.01.10	1200:40	33° 49.651 N	33° 15.181 E		S,M,G,B	
	1951	26.01.10	21:46:30	33° 15.362 N	33° 19.076 E	131°		97.09 km
BGR10-112a	1	26.01.10	22:39:16	33° 11.315 N	33° 18.574 E		S,M,G,B	
	656	27.01.10	01:55:46	33° 01.743 N	33° 00.869 E	237°		32.68 km
BGR10-113	1	27.01.10	05:00:00	32° 58.144 N	32° 59.203 E		S,M,G,B	
	2800	27.01.10	18:59:40	34° 09.243 N	33° 30.051 E	20°		139.99 km
BGR10-1R1	1	29.01.10	13:00:00	34° 11.426 N	33° 30.973 E		S,G,B	
	32	29.01.10	13:31:00	34° 09.702 N	33° 30.254 E	199°		3.38 km
BGR10-1R1a	1	29.01.10	14:34:00	34° 10.045 N	33° 30.427 E		S,G,B	
	1369	30.01.10	13:21:00	32° 55.258 N	32° 58.267 E	200°		147.10 km
BGR10-114	1	01.02.10	00:26:54	34° 05.211 N	33° 34.756 E		S,M,G,B	
	2102	01.02.10	10:58:23	33° 11.836 N	33° 11.634 E	200°		105.06 km
BGR10-115	1	01.02.10	12:17:02	33° 10.808 N	33° 17.418 E		S,M,G,B	
	1756	01.02.10	21:03:37	33° 55.416 N	33° 36.559 E	20°		87.72 km
BGR10-116	1	01.02.10	22:28:27	33° 53.867 N	33° 42.286 E		S,M,G,B	
	1057	02.02.10	03:45:13	33° 26.948 N	33° 30.834 E	200°		52.88 km
BGR10-117	1	02.02.10	05:27:35	33° 26.170 N	33° 37.154 E		S,M,G,B	
	760	02.02.10	09:15:18	33° 46.321 N	33° 41.512 E	10°		37.91 km
BGR10-118	1	02.02.10	11:24:44	33° 43.368 N	33° 45.632 E		S,M,G,B	
	2425	02.02.10	23:31:50	33° 36.971 N	32° 27.885 E	265°		120.39 km
BGR10-118a	1	02.02.10	23:42:32	33° 37.027 N	32° 26.809 E		S,M,G,B	
	606	03.02.10	02:44:00	33° 51.701 N	32° 28.575 E	6°		27.31 km
BGR10-119	1	03.02.10	03:36:46	33° 53.117 N	32° 33.102 E		S,M,G,B	
	2157	03.02.10	14:23:41	33° 18.643 N	33° 24.689 E	129°		102.00 km
BGR10-120	1	03.02.10	16:55:01	33° 25.076 N	33° 23.520 E		S,M,G,B	
	2042	04.02.10	03:07:15	34° 01.187 N	32° 34.789 E	312°		100.52 km
BGR10-121	1	04.02.10	04:35:47	34° 05.207 N	32° 38.813 E		S,M,G,B	

	444	04.02.10	06:48:44	33° 57.370 N	32° 49.671 E	131°		22.09 km
BGR10-121m		04.02.10	06:49	33° 57.352 N	32° 49.698 E		M,G,B	
		04.02.10	17:10	33° 25.005 N	33° 35.266 E	130°		92.29 km
BGR10-122m		04.02.10	18:00	33° 28.744 N	33° 38.374 E		M,G,B	
		05.02.10	08:45	34° 06.291 N	32° 45.827 E	311°		106.59 km
BGR10-122v	1	05.02.10	08:45:00	34° 06.291 N	32° 45.827 E		S,M,G,B	
	490	05.02.10	10:06:30	34° 10.491 N	32° 39.900 E	311°		11.96 km
BGR10-119-2	1	05.02.10	13:55:24	33° 56.657 N	32° 32.076 E		S,M,G,B	
	4357	06.02.10	02:01:28	33° 18.764 N	33° 24.688 E	131°		107.26 km
BGR10-120-2	1	06.02.10	03:41:30	33° 22.497 N	33° 28.671 E		S,M,G,B	
	4460	06.02.10	16:04:23	34° 01.160 N	32° 34.842 E	311°		109.55 km
BGR10-121-2	1	06.02.10	17:53:33	34° 04.745 N	32° 39.356 E		S,M,G,B	
	4493	07.02.10	06:22:16	33° 25.606 N	33° 33.869 E	131°		110.88 km
BGR10-122-2	1	07.02.10	07:58:00	33° 28.970 N	33° 38.275 E		S,M,G,B	
	4856	07.02.10	21:27:29	34° 10.849 N	32° 39.410 E	311°		119.21 km
BGR10-123	1	07.02.10	23:17:21	34° 15.781 N	32° 43.548 E		S,M,G,B	
	4845	08.02.10	12:44:46	33° 33.907 N	33° 42.412 E	130°		119.14 km
BGR10-124		08.02.10	14:47	33° 38.521 N	33° 46.750 E		M,G,B	
	1	08.02.10	15:20:05	33° 39.941 N	33° 44.741 E		S,M,G,B	
	4850	09.02.10	05:04:49	34° 22.651 N	32° 44.737 E	311°		125.45 km
BGR10-125	1	09.02.10	17:52:03	34° 27.446 N	32° 45.764 E		S,M,G,B	
	2916	10.02.10	06:00:57	33° 50.206 N	33° 39.607 E	130°		107.53 km
BGR10-126	1	10.02.10	07:38:33	33° 54.025 N	33° 43.707 E		S,M,G,B	
	2694	10.02.10	18:51:53	34° 28.299 N	32° 53.749 E	310°		99.41 km
BGR10-127	1	10.02.10	20:58:00	34° 31.352 N	32° 47.010 E		S,M,G,B	
	4417	11.02.10	15:23:14	33° 08.343 N	32° 12.652 E	199°		162.54 km
BGR10-128	1	11.02.10	17:02:00	33° 06.306 N	32° 18.193 E		S,M,G,B	
	4384	12.02.10	11:17:59	34° 29.059 N	32° 53.056 E	19°		162.35 km
BGR10-129	1	12.02.10	14:01:58	34° 26.364 N	33° 04.936 E		S,M,G,B	
	4379	13.02.10	08:16:58	33° 03.740 N	32° 29.653 E	200°		162.35 km
BGR10-130	1	13.02.10	10:01:35	33° 01.441 N	32° 35.217 E		S,M,G,B	
	4604	14.02.10	05:12:18	34° 28.242 N	33° 12.155 E	19°		170.49 km
BGR10-131	1	14.02.10	06:49:13	34° 26.870 N	33° 12.155 E		S,M,G,B	
	353	14.02.10	08:17:11	34° 20.309 N	33° 15.314 E	200°		12.95 km
BGR10-131a	1	14.02.10	08:59:49	34° 17.091 N	33° 13.924 E		S,M,G,B	
	4065	15.02.10	01:55:59	33° 00.460 N	32° 41.363 E	200°		150.51 km
BGR10-132	1	15.02.10	03:37:10	32° 58.793 N	32° 41.363 E		S,M,G,B	
	4200	15.02.10	21:07:00	34° 17.967 N	33° 20.752 E	19°		155.51 km
BGR10-133	1	15.02.10	22:47:53	34° 15.953 N	33° 26.613 E		S,M,G,B	
	4193	16.02.10	16:15:48	32° 57.343 N	32° 53.172 E	200°		154.42 km
BGR10-134	1	16.02.10	20:51:41	33° 11.692 N	32° 47.860 E		S,M,G,B	
Stern W - E	1283	17.02.10	02:12:13	33° 11.736 N	33° 18.436 E	90°		47.38 km
BGR10-135	1	17.02.10	05:10:35	33° 19.829 N	33° 14.350 E		S,M,G,B	
Stern NE - SW	1165	17.02.10	10:01:31	33° 03.373 N	32° 54.707 E	225°		43.07 km
BGR10-136	1	17.02.10	13:15:36	33° 02.089 N	33° 05.122 E		S,M,G,B	
Stern S - N	1038	17.02.10	17:34:55	33° 22.777 N	33° 05.066 E	360°		38.31 km
BGR10-137	1	17.02.10	20:22:53	33° 19.935 N	32° 55.195 E		S,M,G,B	
Stern NW - SE	871	18.02.10	00:00:25	33° 07.445 N	33° 09.879 E	135°		32.44 km
BGR10-138	1	18.02.10	04:17:27	33° 01.922 N	32° 55.107 E		S,M,G,B	
	1000	18.02.10	08:30:58	33° 20.978 N	33° 03.144 E	19°		37.42 km
BGR10-138a	1	18.02.10	08:38:18	33° 21.535 N	32° 03.361 E		S,M,G,B	
	3284	18.02.10	18:08:09	34° 03.394 N	33° 21.399 E	20°		82.34 km

b: OBS/OBH station list:

Line BGR10-1r1

<i>Date</i>	<i>Lat</i>	<i>Lon</i>	<i>Depth (m)</i>	<i>Device</i>
28.01.2010 16:03	32° 57.6' N	32° 58.9' E	1458	OBH 1
28.01.2010 16:57	33° 3.53' N	33° 1.7' E	1540	OBH 2
28.01.2010 17:54	33° 10.12' N	33° 4.67' E	1619	OBH 3
28.01.2010 19:21	33° 16.71' N	33° 7.47' E	1726	OBH 4
28.01.2010 20:18	33° 23.3' N	33° 10.28' E	1808	OBH 5
28.01.2010 21:15	33° 29.89' N	33° 13.09' E	1912	OBS 6
28.01.2010 22:10	33° 35.9' N	33° 16.6' E	2029	OBS 7
28.01.2010 23:15	33° 44' N	33° 19.1' E	2177	OBS 8
29.01.2010 00:09	33° 50.1' N	33° 21.8' E	2263	OBS 9
29.01.2010 01:03	33° 56.24' N	33° 24.38' E	2287	OBH 10
29.01.2010 02:00	34° 2.84' N	33° 27.22' E	2225	OBH 11
29.01.2010 02:49	34° 8.11' N	33° 29.48' E	2136	OBH 12



Line BGR10-1r2

<i>Date</i>	<i>Lat</i>	<i>Lon</i>	<i>Depth (m)</i>	<i>Device</i>
19.02.2010 01:30	33° 43.58' N	33° 48.01' E	2121	OBH 1
19.02.2010 02:16	33° 43.13' N	33° 43' E	2131	OBH 2
19.02.2010 03:18	33° 42.52' N	33° 35.5' E	2140	OBH 3
19.02.2010 04:00	33° 42.17' N	33° 31.17' E	2136	OBH 4
19.02.2010 05:21	33° 41.32' N	33° 20.78' E	2129	OBH 5
19.02.2010 06:19	33° 40.75' N	33° 13.88' E	2129	OBH 6
19.02.2010 07:28	33° 40.11' N	33° 5.2' E	2297	OBH 7
19.02.2010 08:51	33° 39.15' N	32° 54.37' E	1795	OBH 8
19.02.2010 09:57	33° 38.48' N	32° 46.37' E	1034	OBH 9
19.02.2010 10:54	33° 37.93' N	32° 39.62' E	799	OBH 10
19.02.2010 11:51	33° 37.38' N	32° 32.92' E	910	OBH 11
19.02.2010 13:06	33° 36.6' N	32° 23.4' E	1397	OBH 12

c: OBMT station list:  
BGR10-MT1

<i>Date</i>	<i>Lat</i>	<i>Lon</i>	<i>Depth (m)</i>	<i>Device</i>
28.01.2010 04:26	34° 25' N	32° 46' E	1953	OBMT 1
28.01.2010 06:27	34° 13' N	32° 44.33' E	2798	OBMT 2
28.01.2010 07:54	34° 5.5' N	32° 43' E	2717	OBMT3
28.01.2010 07:45	33° 57.79' N	32° 41.78' E	1810	OBMT 4
28.01.2010 09:33	33° 47.33' N	32° 41' E	915	OBMT 5
28.01.2010 11:14	33° 38' N	32° 39.5' E	799	OBMT 6
28.01.2010 11:58	33° 26' N	32° 38' E	1475	OBMT 7
28.01.2010 13:59	33° 14' N	32° 36' E	2009	OBMT 8
28.01.2010 13:30	33° 2.5' N	32° 35' E	1404	OBMT 9
28.01.2010 18:17	33° 11.45' N	33° 5.13' E	1639	OBMT 10