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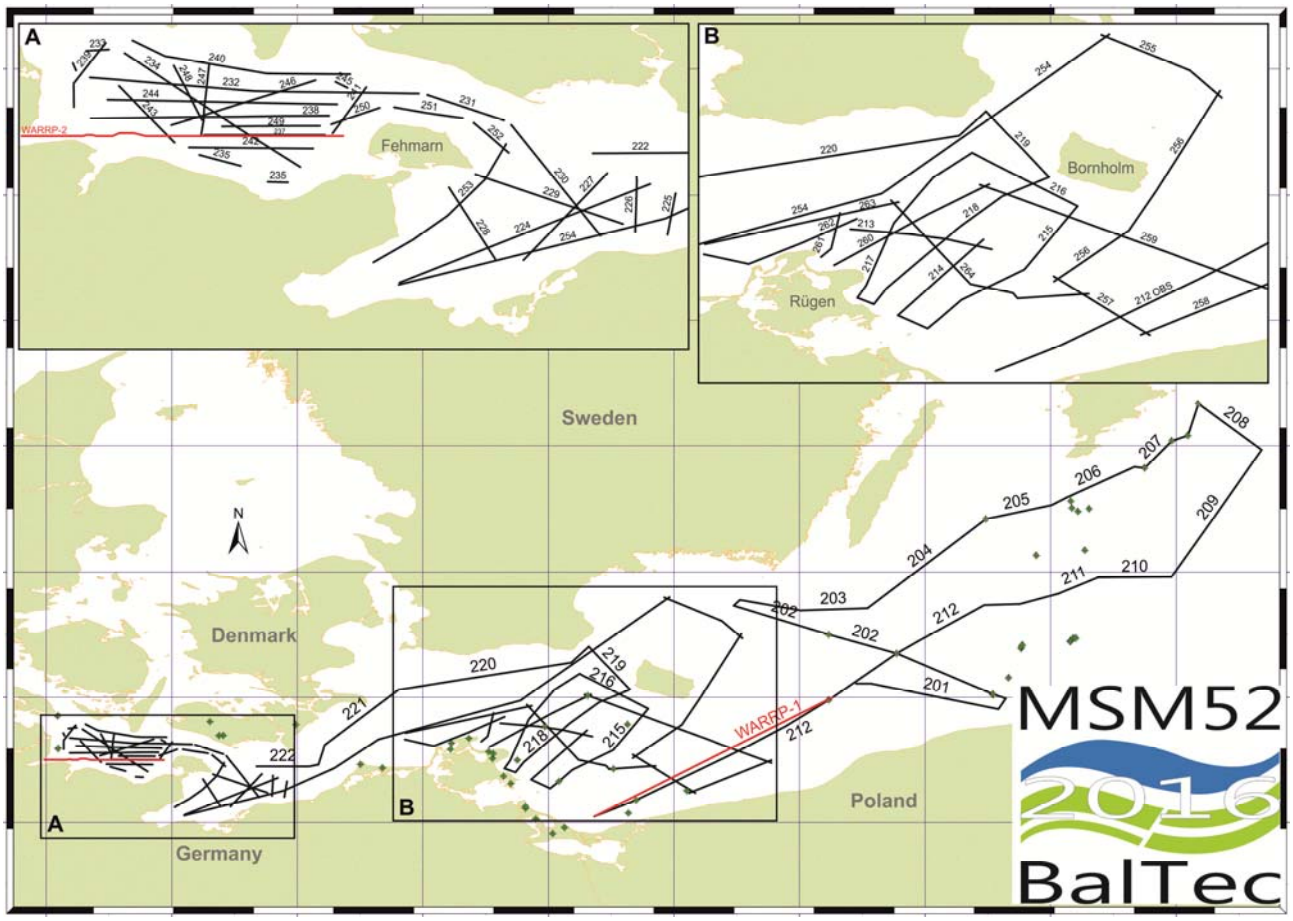
Short Cruise Report
Maria S. Merian MSM52

Rostock - Kiel
01.03.2016 – 28.03.2016
Chief Scientist: Christian Hübscher
Captain: Ralf Schmidt



Objectives

The Baltic sector of the Northeast German Basin and Tornquist Fan comprises the major pre-Alpine tectonic fault system of northern Europe. Two major working hypotheses shall be investigated by means of hydroacoustic and high-resolutions reflection seismic data. We postulate that advances and retreats of ice-sheets during the glacials initiated and reactivated faulting of the Post-Permian succession, thereby generating several kilometers long near-vertical faults and anticlines. This little understood, but for high latitudes fundamental earth process can be exemplarily studied within the Baltic Sea by taking advantage of marine geophysics. We further postulate that – in contrast to the generally accepted text book models – deformation of the initially up to 1800 m thick Zechstein salt started already during salt deposition as the consequence of salt load induced basin subsidence and resulting salt creep. Conceptual models which assume tectonic extension would be obsolete. Other scientific objectives are the interrelation between ice-sheet loading and unloading on the Zechstein salt and the neotectonics of the Tornquist Fan.
Within the Bay of Kiel, several troughs and boundary faults have been proposed by various authors. Their relation to the Glückstadt Graben and the NW-SE trending faults between the Ringkøbing-Fyn horst structures is unknown. The Grimmen High is a peculiar feature that has been described a drag-related salt anticline or strike-slip feature. Its origin can be considered as highly uncertain.
There are several options to explain faults in Cretaceous and Jurassic strata in the very western Pomeranian Bay between 12° and 13° E and 54°40'N and 55°10'N. The southward limit of the faults may either represent the southern margin of a fault swarm related to the STZ, or the limit marks the NE pinch-out line of the mobile Zechstein. North of it no mobile stratum decouples sub-salt faults from Post-Permian strata. Understanding of the fault system may help to decipher the structural overprint of the island of Rügen.
We further intend to address the question whether the thickening of the elongated Upper Cretaceous strata along the southern rim of the STZ results from current moderated sedimentation or inversion. The data represent further a valuable contribution to the emerging project *Geopotentials of the German Baltic Sector* (GPDO).

Narrative

The RV MARIA S. MERIAN berthed in Rostock harbor in the morning of February 27th. Unloading of the containers from the previous cruise started immediately, followed by the mobilization of the scientific gear of the University of Hamburg, the BGR (Hanover) and the Polish Academy of Science (Warsaw). The volume of the loaded gear corresponded to that of 8 containers. The marine gravimeter started to measure which continued until the end of the cruise. Deck and lab installations lasted until the late evening of February 29. A ship`s tour was held for Dr. Hoth from the Federal Ministry for Economic Affairs and Energy and other visitors. RV MARIA S. MERIAN disembarked in the morning of March 1st, followed by some engine tests in the north-eastern Bay of Mecklenburg. We called Warnemünde harbor around noon and some technicians left the vessel. The transit to the western Pomeranian Bay started shortly afterwards. Early the next day the BGR group began to deploy their about 2700 m long seismic cable. The buoyancy was tested by various speeds and some additional floatation tubes were attached to the cable. The visual search for marine mammals started in the early afternoon, but no one could be detected. In the late evening two arrays of seismic signal sources were deployed and tuned. Based on some test measurements the final recording parameters were determined and we switched to production mode. Since the late evening of March 2nd we continuously collected multi-channel seismic, Parasound, Multibeam and Gravity data on a 24/7

schedule.
The first profile crossed two production wells in Polish waters, continued to the Yoldia well and ended within Hanø Bay (Sweden). Since March 3rd 05:00 the towed gear was watched over by guard vessel NORDSØN in order to prevent that any vessel crosses the towed seismic cable. Profiling continued on north-easterly courses along the east coast of Øland towards east of Gotland where we arrived on March 5th. After a short NW-SE striking profile across a suggested glacial sedimentary feature called drumlin we changed course again and profiled south-westwards along the border between Swedish and Latvia's and Lithuania's waters, respectively. Seismic profiling ended north of Swinoujście on March 7th in the afternoon. The fast transit to Warnemünde harbor ended on the 8th in the morning where two technicians disembarked. During the night to the 9th we sailed back around Rügen into Polish territorial waters where we started deploying 15 ocean-bottom seismometers along a 120 nm long profile crossing the Tesseyre-Tornquist Zone. 8 clustered G-Guns were used as the seismic source which released their signals during 30 hours. On the 11th we recovered the OBS which lasted until the 12th in the early morning. Afterwards we called Sassnitz harbor where technical and scientific crew members were exchanged. In the afternoon we commenced reflection seismic profiling between Rügen and Bornholm and investigated the Caledonian Deformation Front and the West-Pomeranian Fault System until March 14th. In the night to the 15th we investigated the transition from Baltica to Avalonia in the Kadetrinne. Salt pillows in Mecklenburg Bay were the scientific target of seismic profiles on the following day. We crossed Fehmarn Belt during the night to March 17th without any problems and continued profiling in the Bay of Kiel, which lasted until Saturday (March 19th) early morning. Afterwards we deployed 10 OBS between Fehmarn and the eastern Eckernförde Bay. Seismic signals were released during the night to Sunday. Colleagues from the University of Kiel had installed land station both on Fehmarn and along the southern coast of Eckernförde Bay, so the signals were recorded not only by the OBS. The recovery lasted until Sunday late evening. During the night we collected gravity data where we could not measure with the streamer deployed. On Monday morning (March 21st) we called Kiel harbor for another crew exchange. In the afternoon the same day the reflection seismic gear was deployed again. Reflection seismic profiling in the Bays of Kiel and Mecklenburg was completed on March 22nd. One of the key profiles started in the south-western end of Mecklenburg Bay which is part of the North German Basin. The north-east directed profile crossed Grimmen High and the West Pomeranian Fault System between Darss and Falster and the Sorgenfrei-Tesseyre Zone between Bornholm (Denmark) and Skåne (Sweden). This about 350 km long seismic line ended in Hanø Bay (Sweden) on March 23rd. We collected two more seismic lines across the Tesseyre-Tornquist Zone and one more across the Rønne Graben until March 25th. We spent the last two days north of Rügen and collected seismic data which will be used to link regional data grids which have been collected during previous surveys. All scientific measurements stopped on Sunday March 27th in the morning. When the seismic equipment was on deck we started our transit back to Kiel where we arrived on Monday 28th in the morning. We disassembled all our installations and packed all gear in boxes and containers. Ship was unloaded on the 29th and the BalTec cruise MSM52 was over.

Acknowledgements

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Participants

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Station List

Station Number	Profile BGR16-	Start (March 2016)	Start Time	Start Latitude (°N)	End Longitude (°E)	End (March 2016)	End Time	End Latitude (°N)	End Longitude (°E)
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MSM52/105-1	202	03.	09:51:20	55,01282	17,60484	04.	02:01:00	55,72357	15,51265
MSM52/105-1	202t	04.	02:03:51	55,72637	15,50663	04.	02:55:18	55,77483	15,56212
MSM52/105-1	203	04.	02:57:10	55,77403	15,56695	04.	09:31:10	55,72509	16,54869
MSM52/105-1	204	04.	09:32:10	55,72626	16,55026	04.	20:15:20	56,42973	17,48982
MSM52/105-1	205	04.	20:17:10	56,43083	17,49442	04.	23:37:20	56,54155	18,00740
MSM52/105-1	206	04.	23:39:40	56,54391	18,01226	05.	04:49:30	56,83812	18,67760
MSM52/105-1	207	05.	04:51:00	56,83798	18,68178	05.	05:22:50	56,84787	18,76193
MSM52/105-1	207a	05.	05:23:30	56,84874	18,76289	05.	07:48:20	57,04211	18,95671
MSM52/105-1	207b	05.	07:52:21	57,04690	18,96335	05.	11:34:12	57,29321	19,23925
MSM52/105-1	208	05.	11:36:27	57,29048	19,24309	05.	15:43:48	56,98994	19,66037
MSM52/105-1	208t	05.	15:46:48	56,98604	19,66467	05.	16:01:57	56,96360	19,66648
MSM52/105-1	209	05.	16:04:03	56,96064	19,66439	06.	03:48:18	55,97411	18,93670
MSM52/105-1	210	06.	03:50:06	55,97388	18,93176	06.	07:19:12	55,96303	18,36654
MSM52/105-1	211	06.	07:20:42	55,96178	18,36320	06.	13:13:03	55,74030	17,46086
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MSM52/122-1	215	13.	03:01:57	54,33065	13,89306	13.	04:07:48	54,92586	14,76726
MSM52/122-1	216	13.	12:44:07	54,92821	14,76279	13.	17:10:12	55,17447	14,22208
MSM52/122-1	217	13.	17:12:00	55,17280	14,21829	14.	01:45:36	54,63508	13,97794
MSM52/122-1	218	14.	04:17:51	54,63489	13,97771	14.	11:47:33	55,09255	14,61867
MSM52/122-1	219	14.	11:54:09	55,10152	14,61010	14.	15:44:15	55,37214	14,28120
MSM52/122-1	220	14.	15:46:30	55,36946	14,27728	15.	01:54:36	55,05859	12,80079
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Station Number	Profile BGR16-	Start (March 2016)	Start Time	Start Latitude (°N)	End Longitude (°E)	End (March 2016)	End Time	End Latitude (°N)	End Longitude (°E)
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MSM52/124-1	233	17.	11:16:39	54,68302	10,14346	17.	12:08:51	54,74666	10,17082
MSM52/124-1	234	17.	12:10:03	54,74687	10,17394	17.	18:00:54	54,39032	10,81651
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MSM52/124-1	238	18.	00:42:45	54,55673	10,90741	18.	05:50:06	54,57650	10,13171
MSM52/124-1	239	18.	05:51:36	54,57876	10,13169	18.	08:37:12	54,78228	10,29594
MSM52/124-1	240	18.	8:38:15	54,78128	10,29806	18.	13:36:36	54,64570	11,00198
MSM52/124-1	241	18.	13:37:30	54,64438	11,00144	18.	15:54:36	54,45980	10,85280
MSM52/124-1	242	18.	15:55:48	54,45965	10,84968	18.	18:35:24	54,47189	10,43718
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MSM52/137-1	247	21.	17:28:12	54,50107	10,51043	21.	20:54:18	54,70656	10,42659
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MSM52/137-1	264	26.	22:08:42	54,94930	13,81874	27.	07:00:00	54,51346	14,72775