

RV Littorina

Cruise Report L16-09

Eckernförde Bay

Project:

**Submarine Groundwater Discharge in the Eckernförde
Bay**

07th – 11th June 2016

Institute of Geosciences (IfG)
Christian-Albrechts-University (CAU), Kiel

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Cruise Report

This cruise report consists of 6 pages including cover:

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1. Scientific crew

Name	Function	Institute	Leg
Jan Scholten	Chief scientist	IFG	Complete
Feng-Hsin Hsu	Ph.D student	IFG	Complete
Diana Loitz	Student	IFG	Until 10.06.16

2. Objectives of the cruise

Submarine groundwater discharge (SGD), i.e. the subsurface flow of water from the continent to the coastal ocean is an important but largely unexplored process. SGD occurs everywhere the hydraulic gradient on land is above sea level and permeable paths allow the subsurface flow of water to the sea. The dissolved matter transport associated with SGD is of great interest because SGD often carries large amounts of nutrients which may influence the coastal environment.

In the Eckernförde Bay SGD has been observed in the center (Mittelgrund) as well as along the shoreline of the bay. One of the open research questions is the volume of SGD and associated solute fluxes (nutrients) and the contribution of SGD-born nitrogen and phosphorous to the overall nutrient budget of the western Baltic Sea. One approach to quantify SGD is by using a radium isotope mass balance.

One objective of the cruise was to sample the water column in the Eckernförde Bay for the determination of radium isotopes. Furthermore, from short sediment cores (Rumohrlot) sediment pore water was extracted to estimate SGD based on the porewater-salinity distribution.

3. Narrative of cruise

07.06.16	09:10	Departure of RV "Littorina" from Kiel harbor.
07.06.16	11:20	Arrival at the 1th station in the Eckernförde Bay
	17:20	Arrival at Eckernförde harbor
08.07.16	07:45	Departure Eckernförde harbor
	07:50	Arrival at the station. Deployment of tender
	17:30	Arrival at Eckernförde harbor
09.07.16	8:00	Departure Eckernförde harbor
	17:00	Arrival at Eckernförde harbor
10.07.16	08:00	Departure Eckernförde harbor
	17:45	Arrival at Eckernförde harbor
11.06.16	7:30	Departure Eckernförde harbor
	12:00	Arrival at Kiel harbor

3. Scientific equipment and on-board analyses

Conductivity-Temperature-Depth probe (CTD)

At every station a CTD was deployed to investigate the stratification of the water column. The temperature and conductivity distribution was used to identify appropriate water depths for water sampling.

Rumohr-Lot

For sediment sampling a 60cm to 100cm long Rumohr-Lot was used. Pore water was extracted from sediments using Rhizons which were inserted horizontally into the sediments in 0.5cm to 10cm spacing. Typically, 10ml of pore water was obtained which was filled in sample vials for later anion, stable isotope and nutrient analyses in the home labs.

Water sampling

Water sampling for radium isotope analyses was performed using a submersible pump (WAaSP-P5) which allows water sampling up to 30m water depth. About 100l of sea water was filled in 120l barrels. The seawater was filtered over manganese impregnated acrylic fiber with a flow rate < 1l/min. The Mn-fibers were measured for ²²³Ra and ²²⁴Ra on-board the ship and in the home lab. Salinity of seawater samples was determined using a hand-held salinity probe.

4. Scientific report and first results

At 24 locations in the Eckernförde Bay the CTD was deployed and seawater samples in water depth between 5 m and 15 m were obtained (Fig. 1). Further seawater samples close to the bottom were collected at locations where deep SGD locations were assumed (Stations 4, 14, 19, 22). For sea water sampling covering a transect from shallow waters close to the shore to deep waters (transects at Hemmelmark, Langholz, Kiekut), the tender of Littorina was deployed. It was equipped with one 120l barrel which was filled with sea water at the location of interest. The sea water was transported to Littorina for further sea water processing. In total 41 sea water samples for radium isotope analyses were obtained.

Sediment cores were collected at locations at Mittelgrund (stations 4, 15) and off Hemmelmark (station 5, 6) (Fig. 1). At Mittelgrund, where SGD was previously reported, sediment coring was repeated several times. This was due to heavy degassing of sediments, which occurred when the core was on-board the ship. This degassing caused resuspension and mixing of sediments and thus disturbance of the initial sediment and pore water composition. At Hemmelmark sediment coring was conducted to investigate the seaward extent of a deep freshwater aquifer. In total 56 pore water samples were obtained, which will be further analyzed in the home lab.

We expected that the analyses of the samples obtained during Littorina cruise will give a more detailed picture of the influence of SHD on the coastal environment of the Eckernförde Bay

Acknowledgements

We would like to acknowledge the excellent support of the captain and the crew during the cruise.



Fig. 1. The Eckernförde Bay with sampling locations

Appendix

List of stations

Station ID	Longitude	Latitude	Water Depth (m)	Work
1	10°03'19.38"E	54°29'35.44"N	23	CTD, Radium (5m, 15m)
2	10°03'04.43"E	54°30'42.27"N	-	Radium (5m)
3	10°02'53.24"E	54°31'46.84"N	23	CTD, Radium (5m, 15m)
4	10°01'40.90"E	54°29'51.96"N	27	CTD, Radium (5m, 25m) Rumohr Lot
5-1	09°52'36.08"E	54°28'31.55"N	-	Radium (surface)
5-2	09°52'36.00"E	54°28'30.00"N	-	Radium (surface)
5	09°52'43.45"E	54°28'28.69"N		Radium (5m), Rumohr Lot
6	09°52'38.13"E	54°28'21.54"N	19	CTD, Radium (5m), Rumohr Lot
7	09°52'39.12"E	54°28'16.40"N	20	CTD, Radium (5m, 15m)
8	09°52'42.50"E	54°28'08.22"N	23	CTD, Radium (5m, 15m)
9	09°52'48.10"E	54°27'53.89"N	23	CTD, Radium (5m, 15m)
10	09°52'54.42"E	54°27'36.36"N	22	CTD, Radium (5m, 15m)
11	09°55'27.90"E	54°29'07.20"N	24	CTD, Radium (20m)
12-1	09°58'38.79"E	54°30'38.66"N	-	Radium (surface)
12-2	09°58'39.76"E	54°30'36.32"N	-	Radium (surface)
12-3	09°58'41.76"E	54°30'32.70"N	-	Radium (surface)
12-4	09°58'45.01"E	54°30'26.80"N	-	Radium (surface)
13	09°58'49.75"E	54°30'15.54"N	23	CTD, Radium (5m, 15m)
14	09°58'58.39"E	54°29'59.11"N	28	CTD, Radium (5m, 25m, 26.5m)
15	10°01'40.87"E	54°29'53.24"N	27	Rumohr Lot
16	09°59'33.76"E	54°29'35.06"N	23	CTD, Radium (5m, 15m)
17-1	09°52'01.07"E	54°26'54.74"N	-	Radium (surface)
17-2	09°52'04.58"E	54°26'57.81"N	-	Radium (surface)
17-3	09°52'06.32"E	54°27'01.95"N	-	Radium (surface)
17	09°52'07.43"E	54°27'11.88"N		Radium (5m)
18	09°59'46.05"E	54°28'59.17"N	23	CTD, Radium (5m, 15m)
19	09°56'52.89"E	54°29'28.78"N	23	CTD, Radium (5m, 21m)
20	09°57'03.55"E	54°29'04.77"N	25	CTD, Radium (5m, 15m)
21	09°57'13.69"E	54°28'38.69"N	25	CTD, Radium (5m, 15m)
22	09°59'00.03"E	54°29'58.07"N	25	Radium (23m)
23	09°53'58.72"E	54°28'10.06"N	-	Radium (5m)
24	09°51'27.36"E	54°28'00.78"N	-	Radium (5m)
25	09°51'47.58"E	54°27'44.46"N	-	Radium (5m)