

Short Report

ALKOR Cruise No. 422



Biogeochemistry interactions in the anoxic/suboxic eastern Gotland Basin: redox-dependent cycles of nitrogen species, phosphorous and iron.

Kiel – Riga - Kiel: 16. 08. – 14. 09. 2013

Cruise Lead: Dr. Olaf Pfannkuche

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I. Objectives of the cruise

Eutrophication in the central Baltic Sea and associated spreading of hypoxic and sulfidic habitats is, besides physical mixing, to a large extent regulated by internal loading of nutrients from the seafloor. Despite this, measurements for the quantification of the internal nutrient loading are scarce. First results obtained during Alkor cruise AL355 in 2010 indicate that sediments covered with microbial mats (Fig. 1) at the oxycline at the edge of the eastern Gotland basin contribute much more to the regulation of bottom water N- and P-inventories on a per area basis than those in the deep basin. Cruise ALKOR 422 to the eastern Gotland Basin (Baltic Sea) investigated the same sites as those studied during cruise AL355, yet later in the year (August to early September) to capture the partial deposition of the cyanobacterial bloom on the sea floor. Investigations were mainly carried out in the Latvian sector of the Gotland basin along a depth gradient from 50 m to 170m and included sites with both oxygenated and anoxic to sulfidic bottom waters (Fig. 2). The cruise took place within the framework of the projects PACES and ROBEX. Major aims were in situ benthic flux measurements (O_2 , N-species, P, Fe) of the natural background covering the entire oxic to anoxic depth gradient. More specific aims consisted of in situ experiments using landers to verify and investigate transient uptake and release of P from microbial mats under oscillating bottom water O_2 conditions as well as their contribution to the recycling of dissolved inorganic N (DIN) during dissimilatory nitrate reduction to ammonium (DNRA) or

loss during denitrification and anammox. Further objectives focused on the quantification of benthic nitrogen fractionation.

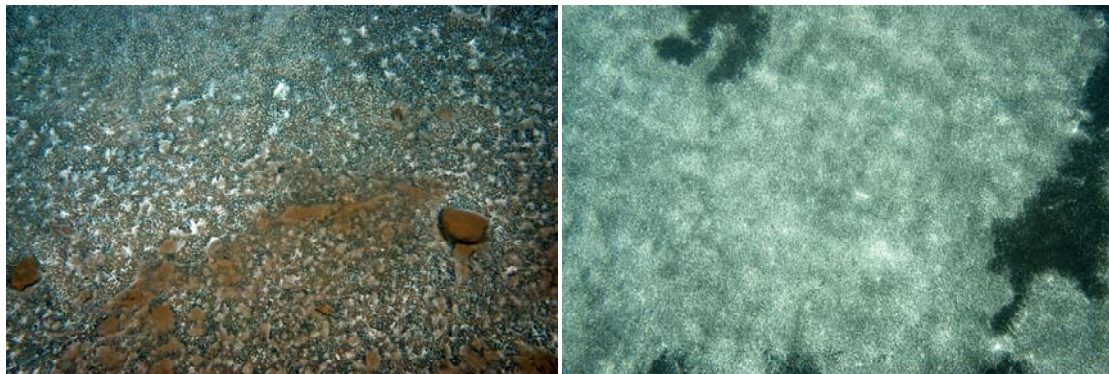


Fig. 1: Whitish microbial mats covering sediments below the oxycline down to 130 m water depth. Images were obtained using the towed camera system OFOS (Ocean Floor Observation) during cruise ALKOR 355 (June 2010).

II. Area of Investigations

Investigations were carried out both in the Latvian and Swedish EEZ. The limits of the working areas were:

Latvian EEZ: limits S to N, 56°'50'N to Latvia/Estonia EEZ line;

limits W to E, EEZ line Latvia/Sweden to 12nm beyond the Latvian coast.

Swedish EEZ: limits S to N, 57°N to 58°N;

limits W to E, 12sm beyond the Swedish coast to EEZ line Sweden/Latvia.

Main working activities were focused to a depth transect in the Latvian EEZ (Fig. 2), which was already investigated during previous cruises e. g. ALKOR cruises 355 and 346 (2009 and 2010). The wider area including the stations in the Swedish EEZ were only surveyed by TV-guided CTD/Rosette water sampler casts and Ocean Floor Observation System deployments to monitor the distribution of the oxycline and the occurrence of bacterial mats around rim of the eastern Gotland Basin.

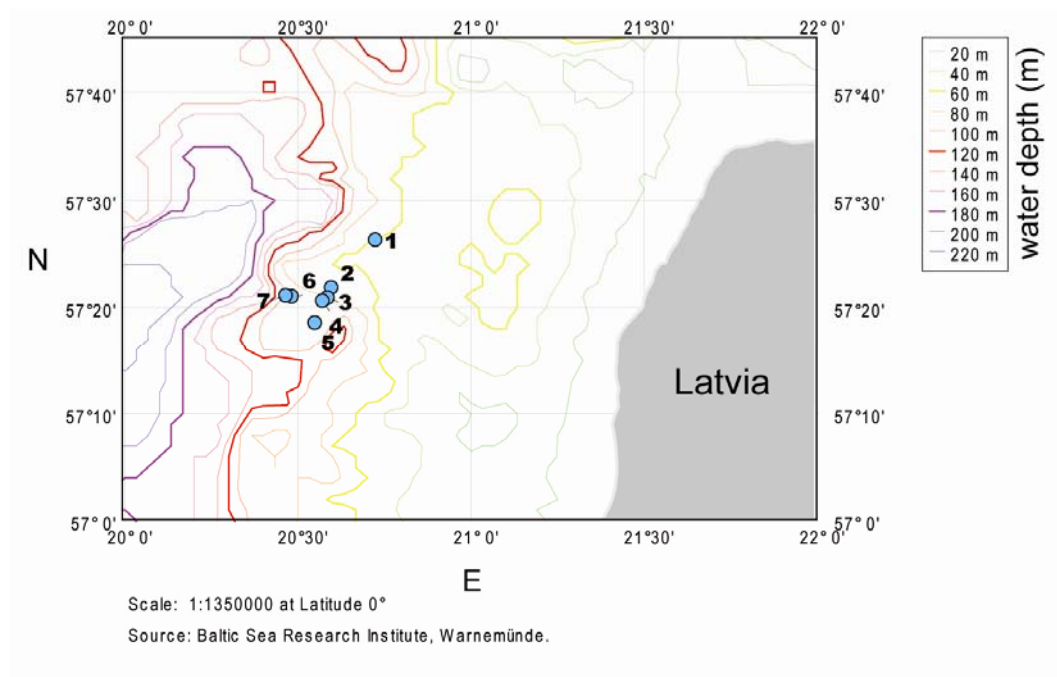


Fig. 2: Depth transect in the Latvian EEZ over station 1-7 (1: 65m oxic, intrusions of deeper anoxic water possible; 2: 80m oxycline; 3-5: 80-125m lower boundary of the oxycline, highly variable bottom water O₂-conditions; 6: 150m anoxic deep water; 7: 170m sulfidic deep water).

III. Narrative of the cruise

Friday, 16-08-13: R/V ALKOR left the GEOMAR Pier in Kiel at 12:00h starting expedition No. 422. On board was a group of 12 scientists and technicians from GEOMAR. The destination was the Latvian EEZ in the eastern Gotland Basin.

Saturday, 17-08-13: We continued our passage through the Baltic Sea to the eastern Gotland Basin.

Sunday, 18-08-13: We reached the first station on the depth transect in the Latvian EEZ at 08:00h and started station work with a CTD/Rosette Water Sampler (CTD/RO) cast (Stat. 550) by 50m. The following deployment of the Ocean Floor Observation System (OFOS, Stat 51) was cancelled because the LWL-transmission of the winch cable did not function. Next came a transect of five CTD/RO casts to monitor the oxygen content in the bottom water over a depth gradient of 65 to 170m (Stat. 552-556). Station work ended with the deployment of a small lander (POZ-Lander) to monitor near bottom currents, temperature, salinity, oxygen and turbidity for the whole period of AL-422 (Stat. 557).

Monday, 19-08-13: our station work was focused to the belt of hypoxic water between 90m to 125m depth. We started with a CTD/RO and MUC cast by 95m (Stat. 558-59). Afterwards we deployed another small long-term observation lander (SLM Lander) by 123m (Stat. 560). We then returned to the 95m area where we deployed the Biogeochemical Laboratory Lander (BIGO/II) succeeded by a CTD/RO cast (Stat. 561-62).

Tuesday, 20-08-13: Our activities were still focused to the hypoxic zone. They started with a CTD/RO and MUC cast by 123m (Stat. 563-64). The following series of CTD/RO cast was driven by 93m, 121m and 140m (Stat. 565-567). The day ended with the deployment of the BIGO/I Lander by 123m (Stat. 568).

Wednesday, 21-08-13: We started with a cast with the Ruhmor corer (RULO) which retrieved an one-meter sediment core (Stat. 569) from 97m water depth. Afterwards we retrieved the BIGO/II Lander deployed on Monday (Stat. 570). Two CTD/RO casts by 95m and 124m followed (Stat. 571-72). We finished station work for the day and called at Ventspils to pick up some spare parts for the OFOS which were delivered by air freight from Kiel.

Thursday, 22-08-13: We left Ventspils in the early morning and returned to our working area where we retrieved the BIGO/I Lander deployed on Tuesday (Stat. 573). We then turned to an OFOS video/photographic transect by 83-86m (Stat. 574). A CTD/RO cast was driven at the end of the OFOS transect (Stat. 575). We then moved to 70m where we drove a CTD/RO and a corresponding OFOS transect (Stat. 576-77).

Friday, 23-08-13: We started work by 80m with a CTD/RO cast (Stat. 578) followed by a series of three MUC casts (Stat. 578-81). We then steamed to the 100m depth contour for a CTD/RO cast and an OFOS transect (Stat. 582-83). We then returned to 80m to deploy the BIGO/I Lander (Stat. 584). Afterward a second lander carrying an in situ Ammonium analyser (ISAR Lander) was deployed at 110m depth (Stat. 585).

Saturday, 24-08-13: We started our work in the deeper sulfidic part of the eastern Gotland Basin by 173m with a CTD/RO and a MUC cast (Stat. 586-87). We then returned to shallower water where we drove two CTD/ROs with an OFOS transect between the stations (Stat. 588-90). For the deployment of the BIGO/II Lander we returned to 173m. All GEOMAR lander are deployed under video control with a launching system on top of the lander which is released on the sea bed from the lander to ensure a soft landing on a video-surveyed spot. The launcher/lander combination is deployed on a coaxial cable which is used for the on-line video transmission and the lander release. During the deployment the coaxial cable broke when BIGO/II was launched from the working deck caused by a vigorous movement of the gear when a caught safety line was cut with a knife. In consequence the lander with the launcher on top sunk to the seabed. Under this conditions the lander had to be given up for the moment since even with dropped ballast weights the lander + launcher are too heavy to swim back to the surface. We tried to salvage the BIGO/II by dragging a hook under video-control. After some hours we stopped the salvage procedure although we managed to spot the lander with the camera but the hook failed to grasp.

Sunday, 25-08-23: In the morning we retrieved the ISAR Lander and the BIGO/I Lander deployed on Friday afternoon (Stat. 592-93). We then decided to return to the site of the lost BIGO/II Lander for another dredging attempt. This time we attached two hooks to the dredging gear. After several hours of fruitless dredging courses we managed to spot the lander with our camera system. This time one of the hooks got a firm grasp of the Lander and we managed to get the BIGO/II back on the ALKOR. We then moved to the deepest part of the Gotland Basin where we drove a CTD/RO by 237m (Stat. 594).

Monday, 26-08-13: We started operation with a combined CTD/RO and MUC cast by 110m (Stat. 95-96). We changed for deeper water for a CTD/RO cast by 140m, an OFOS transect in upslope direction and an another CTD/RO cast at the end of the OFOS transect by 123m (Stat. 597-99). Station work ended with the deployment of BIGO/II by 110m (Stat. 600).

Tuesday, 27-08-13: All our activities were directed to the 150m contour line where we made a CTD/RO and a MUC cast (Stat. 601-602) and deployed the BIGO/I Lander (Stat. 603). In the afternoon we called at Ventspils to pick up some specialist arriving from Germany to check the ship's navigation system.

Wednesday, 28-08-13: We left Ventspils in the morning and headed back to our working area for retrieval of the BIGO/II Lander deployed on Monday (Stat. 604). Afterwards we drove several CTD/RO by 137m, 172m and 237m (Stat. 605-07). We then returned to

shallower water for another CTD/RO cast by 65m followed by a short OFOS survey (Stat. 608-09). In the evening we returned to Ventspils to disembark the two specialists.

Thursday, 29-08-13: We left Ventspils in the morning and headed to the BIGO/I deployment site to retrieve the lander (Stat. 610). We then turned to deeper water where we made a series of test-measurements with the ISAR lander attached to the wire in different water depth covering the gradient from oxic to anoxic and sulfidic (Stat. 611). In the evening we left the working area and headed to Riga.

Friday, 30-08-13: We called at Riga in the morning. A team of specialists from Germany joined us to repair the glass fiber cable of the mobile LWL-winch.

Saturday, 31-08-13: We prepared the ship during the morning for a reception in the late afternoon. The captain and chief scientist gave a reception to Latvian officials from government, administration, navy, and science as well as representatives from the industry, press and the German Embassy.

Sunday, 01-09-13: FS ALKOR remained moored at Riga.

Monday, 02-09-13: We left Riga in the morning and steamed back to our working area at 57°21'N / 20°28'E. In the course of the day wind speed accelerated to BFT 5 to 7. A gale was announced for the evening. Since station work was not possible we decided to call at Ventspils. We reached Ventspils shortly before the onset of the gale.

Tuesday, 03-09-13: Strong winds and a heavy swell prevented station work also on Tuesday. In consequence we stayed at Ventspils.

Wednesday, 04-09-13: The wind ceased during the night and in consequence we left Ventspils in the early morning and headed to the 95m-Station where we performed two CTD/RO and one MUC cast (Stat. 612-14). We then turned to 172m for another CTD/RO cast (Stat. 615). Afterwards we returned to 70m for a combined CTD/RO and OFOS survey (Stat. 616-17). In the late afternoon we deployed the BIGO/II Lander by 173m (Stat. 618).

Thursday, 05-09-13: During the night we entered the Swedish EEZ to investigate the eastern slope off northern Gotland. We performed a series of combined CTD/RO and OFOS surveys by 88m, 99m and 125m (Stat. 619-624). After a MUC sample by 125m (Stat. 625) we returned to the main working area in the Latvian EEZ where we deployed the BIGO/I Lander by 123m (Stat. 626).

Friday, 06-09-13: We started with the retrieval of the BIGO/II deployed on Wednesday (Stat. 627). We changed to shallower water for two CTD/RO casts by 79m to 98m (Stat. 628-29). Then followed three OFOS surveys with combined CTD/RO casts at the start and end of the OFOS lines (Stat. 630-34). The day ended with the re-deployment of the BIGO/II by 140m (Stat. 635).

Saturday, 07-09-13: The BIGO/I deployed on Thursday was retrieved in the morning (Stat. 636) followed by two combined OFOS and CTD/RO surveys by 98m – 100m respectively 125m (Stat. 637-640). A test of the ISAR Lander by 123m attached to the wire followed (Stat. 641). The day ended with the re-deployment of the BIGO/I by 123m (Stat. 642).

Sunday, 08-09-13: Our first activity was the retrieval of the BIGO/II deployed on Friday. We continued with combined OFOS and CTD/RO surveys (Stat. 644-647). We then turned to the 110m contour line where we performed a CTD/RO and a MUC cast (Stat. 648-649) and made another ISAR test on the wire (Stat. 650). The BIGO-II was re-deployed by 65m (Stat. 651).

Monday, 09-09-13: The BIGO/I deployed on Saturday was retrieved in the morning (Stat. 652). After a MUC cast by 65m (Stat. 653) we turned to two combined OFOS and CTD/RO

survey lines (Stat. 654-57). The BIGO/I was re-deployed in the late afternoon by 110m (Stat. 658).

Tuesday, 10-09-13: The BIGO/II deployed on Sunday was retrieved in the morning (Stat. 659), Afterwards we headed to an area south of our main working area for a series of OFOS and CTD/RO surveys (Stat. 660-65).

Wednesday, 11-09-13: The morning was dedicated to the retrieval of all landers in succession BIGO/I, SLM and POZ and a CTD/RO cast at the SLM- and POZ deployment site (Stat. 666-70). A series of three MUC casts by 93m, 113m and 172m followed (Stat. 671-73). We then turned to shallower water for an OFOs survey by 65m (Stat. 674).

Thursday, 12-09-13: During the night we steamed to the southern rim of the eastern Gotland Basin. With a CTD/RO followed by an OFOS survey (Stat. 675-76) we finished our research activities in the Latvian EEZ. We then steamed to the southern Gotland slope in the Swedish EEZ where we performed a series of combined OFOS and CTD/RO surveys on two transect lines (Stat 677-84). At 19:00h we finished our research activities and started our transit to Kiel.

Friday, 13-09-13: We continued our transit to Kiel.

Saturday, 14-09-13: We arrived at Kiel harbor at 08:30h thus finishing ALKOR Expedition No. 422.

IV. Participants

1. Pfannkuche, Olaf Dr.	chief scientist	GEOMAR
2. Berghäuser, Thorben	electr. engineer	GEOMAR
3. Cherednichenko, Sergiy	electr. engineer	GEOMAR
4. Dale, Andy	scientists	GEOMAR
5. Domeyer, Bettina*	lab. Technician	GEOMAR
6. Fabrizius, Eduard	video technician	GEOMAR
7. Kriwanek, Sonja	lab. Technician	GEOMAR
8. Petersen , Asmus	gear technician	GEOMAR
9. Sommer, Stefan Dr.	scientist	GEOMAR
10. Trinkler, Sven	lab. Technician	GEOMAR
11. Türk, Mathias	electr. Engineer	GEOMAR
12. Yücel, Mustafa	scientist	GEOMAR

*Replaced by Dr. Lee Bryant, GEOMAR on 31. 08. 13

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V. Station and gear list

Tab 1: List of employed gear with abbreviations

CTD/RO	CTD-Rosette water sampler
MUC	TV-multiple corer
OFOS	Ocean Floor Observation System
BIGO-I	Biogeochemistry Laboratory-Lander No.1
BIGO-II	Biogeochemistry Laboratory-Lander No.2
ISAR	ISAR Lander (In situ Ammonium Recorder on Lander)
SLM	Satellite Lander
POZ	POZ Lander

Tab. 2: Station list ALKOR No. 422.

Coordinates 1: CTD/RO, MUC, all Lander, position of deployment or bottom sample
OFOS, start of bottom view, start of OFOS transect
Coordinates 2: OFOS, end of bottom view, end of OFOS transect

Station	Gear	No.	Date	Coordinates 1		Time	Depth	Coordinates 2		Time	Depth
AL422-No.			2013	Lat. °N	Long. °E	(UTC)	(m)	Lat. °N	Long. °E	(UTC)	(m)
550	CTD/RO	1	18.08.	57°30.00´	20°56.03´	06:23	49				
551	OFOS	1	18.08.	57°30.00´	20°56.04´	06:37	49				
552	CTD/RO	2	18.08.	57°26.53´	20°43.43´	08:36	65				
553	CTD/RO	3	18.08.	57°20.73´	20°35.32´	10:28	94				
554	CTD/RO	4	18.08.	57°18.54´	20°33.07´	11:56	123				
555	CTD/RO	5	18.08.	57°21.07´	20°27.96´	12:59	173				
556	CTD/RO	6	18.08.	57°20.50´	20°29.11´	13:40	140				
557	POZ	1	18.08.	57°20.74´	20°35.32´	14:48	96				
558	CTD/RO	7	19.08.	57°20.76´	20°35.32´	07:00	95				
559	MUC	1	19.08.	57°20.76´	20°35.30´	07:43	94				
560	SLM	1	19.08.	57°18.54´	20°33.03´	08:46	123				
561	BIGO-II Depl	1	19.08.	57°20.76´	20°35.32´	13:46	95				
562	CTD/RO	8	19.08.	57°12.80´	20°32.25´	14:56	98				
563	CTD/RO	9	20.08.	57°18.51´	20°33.01´	06:04	123				
564	MUC	2	20.08.	57°18.51´	20°33.00´	06:55	123				
565	CTD/RO	10	20.08.	56°59.85´	20°23.89´	09:01	93				
566	CTD/RO	11	20.08.	57°01.85´	20°19.71´	10:03	121				
567	CTD/RO	12	20.08.	57°01.91´	20°15.36´	11:02	142				
568	BIGO-I Depl	1	20.08.	57°18.51´	20°32.99´	14:40	123				
569	RULO	1	21.08.	57°20.74´	20°35.29´	06:03	97				
570	BIGO-II Retr	1	21.08.	57°20.73´	20°35.38´	06:27	95				

Station	Gear	No.	Date	Coordinates 1		Time	Depth	Coordinates 2		Time	Depth
AL422-No.			2013	Lat. °N	Long. °E	(UTC)	(m)	Lat. °N	Long. °E	(UTC)	(m)
571	CTD/RO	13	21.08.	57°33.51´	20°38.07´	09:17	95				
572	CTD/RO	14	21.08.	57°33.35´	20°37.14´	10:04	124				
573	BIGO-I Retr	1	22.08.	57°18.46´	20°33.06´	08:28	123				
574	OFOS	2	22.08.	57°21,45´	20°35,77´	12:12	83	57°21,49´	20°35,57´	12:42	86
575	CTD/RO	15	22.08.	57°21,48´	20°35,56´	12:50	86				
576	CTD/RO	16	22.08.	57°21,79´	20°36,51´	13:22	70m				
577	OFOS	3	22.08.	57°21,81´	20°36,46´	13:50	70	57°21,92´	20°36,25´	14:25	75
578	CTD/RO	17	23.08.	57°21,81´	20°35,86´	06:06	80				
579	MUC	3	23.08.	57°21,79´	20°35,77´	06:26	82				
580	MUC	4	23.08.	57°21,80´	20°35,73´	07:12	82				
581	MUC	5	23.08.	57°21,81´	20°35,88´	07:31	80				
582	CTD/RO	18	23.08.	57°28,51´	20°35,86´	08:45	100				
583	OFOS	4	23.08.	57°28,58´	20°35,94´	09:08	100	57°29,74´	20°37,23´	12:48	74
584	BIGO/I Depl	2	23.08.	57°21,80´	20°35,87´	14:06	80				
585	ISAR	1	24.08.	57°20,57´	20°34,34´	06:42	110				
586	CTD/RO	19	24.08.	57°21,05´	20°27,97´	07:30	173				
587	MUC	6	24.08.	57°21,05´	20°27,95´	08:33	173				
588	CTD/RO	20	24.08.	57°29,23´	20°36,73´	10:06	83				
589	OFOS	5	24.08.	57°29,24´	20°36,75´	10:33	83	57°29,85	20°37,34´	12:08	74
590	CTD/RO	21	24.08.	57°29,86´	20°37,32´	12:14	74				
591	BIGO-II Depl	2	24.08.	57°21,05´	20°27,96´	14:00	173				
592	ISAR	1	25.08.	57°20,55´	20°34,23´	06:06	110				
593	BIGO/I Retr	2	25.08.	57°21,78´	20°35,88´	07:05	80				
594	CTD/RO	22	25.08.	57°21,12´	20°08,27´	13:33	237				
595	CTD/RO	23	26.08.	57°20,57´	20°34,33´	06:03	110				
596	MUC	7	26.08.	57°20,58´	20°34,33´	06:50	110				

Station	Gear	No.	Date	Coordinates 1		Time	Depth	Coordinates 2		Time	Depth
AL422-No.			2013	Lat. °N	Long. °E	(UTC)	(m)	Lat. °N	Long. °E	(UTC)	(m)
597	CTD/RO	24	26.08.	57°20,57´	20°29,17´	07:50	140				
598	OFOS	6	26.08.	57°20,50´	20°29,25´	08:27	134	57°20,50´	20°30,87´	10:27	123
599	CTD/RO	25	26.08.	57°20,50´	20°30,87´	10:39	123				
600	BIGO/II Depl	3	26.08.	57°20,58´	20°34,32´	13:26	110				
601	CTD/RO	26	27.08.	57°20,98´	20°29,03´	07:00	150				
602	MUC	8	27.08.	57°20,95´	20°28,99´	07:50	150				
603	BIGO/I Depl	3	27.08.	57°20,98´	20°28,99´	10:30	151				
604	BIGO/II Retr	3	28.08.	57°20,32´	20°34,28´	09:05	110				
605	CTD/RO	27	28.08.	57°20,46´	20°29,24´	10:15	137				
606	CTD/RO	28	28.08.	57°21,04´	20°27,96´	10:40	172				
607	CTD/RO	29	28.08.	57°21,14´	20°08,02´	12:10	237				
608	CTD/RO	30	28.08.	57°26,47´	20°43,51´	14:17	65				
609	OFOS	7	28.08.	57°26,45´	20°43,46´	14:50	65	57°26,42´	20°43,37´	14:58	65
610	BIGO/I Retr	3	29.08.	57°20,88´	20°29,03´	08:40	150				
611	ISAR	2	29.08.	57°21,04´	20°27,95´	12:10	173				
612	CTD/RO	31	04.09.	57°20,76´	20°35,34´	07:09	95				
613	CTD/RO	32	04.09.	57°20,75´	20°35,34´	07:53	95				
614	MUC	9	04.09.	57°20,76´	20°35,32´	08:42	95				
615	CTD/RO	33	04.09.	57°21,04´	20°28,00´	09:21	172				
616	CTD/RO	34	04.09.	57°26,96´	20°37,30´	10:37	70				
617	OFOS	8	04.09.	57°26,94´	20°37,08´	11:24	74	57°27,03´	20°37,94´	12:34	65
618	BIGO/II Depl	4	04.09.	57°21,05´	20°27,97´	14:09	173				
619	CTD/RO	35	05.09.	57°38,15´	19°27,54´	06:03	88				
620	OFOS	9	05.09.	57°38,18´	19°27,39´	06:49	87	57°38,22´	19°27,20´	07:05	87
621	CTD/RO	36	05.09.	57°37,77´	19°32,49´	07:40	99				
622	OFOS	10	05.09.	57°37,77´	19°32,40´	08:19	99	57°37,81´	19°32,24´	08:39	99

Station	Gear	No.	Date	Coordinates 1		Time	Depth	Coordinates 2		Time	Depth
AL422-No.			2013	Lat. °N	Long. °E	(UTC)	(m)	Lat. °N	Long. °E	(UTC)	(m)
623	CTD/RO	37	05.09.	57°33,74´	19°46,23´	09:45	125				
624	OFOS	11	05.09.	57°33,70´	19°46,26´	10:25	125	57°33,58´	19°46,35´	10:55	125
625	MUC	10	05.09.	57°33,53´	19°46,39´	11:22	125				
626	BIGO/I Depl	4	05.09.	57°18,50´	20°33,01´	14:59	123				
627	BIGO/II Retr	4	06.09.	57°21,09´	20°27,92´	06:00h	173				
628	CTD/RO	38	06.09.	57°53,38´	20°32,72´	09:15	98				
629	CTD/RO	39	06.09.	57°50,75´	20°53,06´	10:40	79				
630	OFOS	12	06.09.	57°50,81´	20°53,21´	11:11	79	57°50,86´	20°53,35´	11:26	78
631	CTD/RO	40	06.09.	57°46,82´	20°47,98´	12:08	102				
632	OFOS	13	06.09.	57°46,85´	20°48,04´	12:33	101	57°46,88´	20°48,18´	12:48	100
633	CTD/RO	41	06.09.	57°45,36´	20°45,90´	13:15	125				
634	OFOS	14	06.09.	57°45,38´	20°46,08´	13:45	125	57°45,41´	20°46,16´	14:00	123
635	BIGO/II Depl	5	06.09.	57°14,99´	20°27,13´	17:08	140				
636	BIGO/I Retr.	4	07.09.	57°18,51´	20°32,97´	06:06	123				
637	CTD/RO	42	07.09.	57°08,87´	20°28,57´	07:15	100				
638	OFOS	15	07.09.	57°08,90´	20°28,55´	07:46	98	57°08,90´	20°28,85´	08:16	94
639	CTD/RO	43	07.09.	57°08,76´	20°26,46´	08:40	126				
640	OFOS	16	07.09.	57°08,77´	20°26,56´	09:19	125	57°08,75´	20°26,71´	09:33	123
641	ISAR	3	07.09.	57°08,75´	20°26,78´	10:21	123				
642	BIGO/I Depl	5	07.09.	57°18,50´	20°33,04´	14:55	123				
643	BIGO/II Retr	5	08.09.	57°15,00´	20°27,17´	06:08	140				
644	OFOS	17	08.09.	57°20,75´	20°35,42´	07:16	93	57°20,89´	20°35,70´	07:46	85
645	CTD/RO	44	08.09.	57°20,91´	20°35,81´	08:00	83				
646	OFOS	18	08.09.	57°18,53´	20°33,03´	08:48	123	57°18,56´	20°33,17´	09:03	124
647	CTD/RO	45	08.09.	57°18,59´	20°33,28´	09:13	125				
648	CTD/RO	46	08.09.	57°20,58´	20°34,43´	10:03	110				

Station	Gear	No.	Date	Coordinates 1		Time	Depth	Coordinates 2		Time	Depth
AL422-No.			2013	Lat. °N	Long. °E	(UTC)	(m)	Lat. °N	Long. °E	(UTC)	(m)
649	MUC	11	08.09.	57°20,56′	20°34,33′	10:37	110				
650	ISAR	4	08.09.	57°20,51′	20°34,30′	11:36	110				
651	BIGO/II Depl	6	08.09.	57°26,26′	20°43,53′	14:35	65				
652	BIGO/I Retr	5	09.09.	57°18,49′	20°32,97′	06:08	123				
653	MUC	12	09.09.	57°26,52′	20°43,55′	07:35	65				
654	OFOS	19	09.09.	57°00,03′	20°19,28′	10:50	102	56°59,98′	20°20,39′	11:25	94
655	CTD/RO	47	09.09.	56°59,97′	20°20,39′	11:31	93				
656	OFOS	20	09.09.	56°59,88′	20°16,78′	12:25	128	56°59,86′	20°16,88′	12:40	127
657	CTD/RO	48	09.09.	56°58,87′	20°16,91′	12:54	126				
658	BIGO/I Depl	6	09.09.	57°20,59′	20°34,30′	16:00	110				
659	BIGO/II Retr	6	10.09.	57°26,52′	20°43,50′	07:10	65				
660	CTD/RO	49	10.09.	57°27,01′	19°25,30′	11:50	99				
661	OFOS	21	10.09.	57°26,97′	19°25,23′	12:18	99	57°27,03′	19°25,09′	12:38	97
662	CTD/RO	50	10.09.	57°23,29′	19°26,83′	13:21	123				
663	OFOS	22	10.09.	57°23,26′	19°26,87′	13:51	123	57°23,33′	19°26,89′	14:09	123
664	CTD/RO	51	10.09.	57°20,55′	19°34,08′	14:50	88				
665	OFOS	23	10.09.	57°20,53′	19°34,00′	15:16	87	57°20,56′	19°33,99′	15:31	88
666	BIGO/I Retr	6	11.09.	57°20,47′	20°34,36′	06:05	110				
667	SLM Retr	1	11.09.	57°18,54′	20°33,00′	07:18	123				
668	CTD/RO	52	11.09.	57°18,53′	20°33,03′	07:35	123				
669	POZ Retr	1	11.09.	57°20,73′	20°35,33′	08:36	96				
670	CTD/RO	53	11.09.	57°20,73′	20°35,31′	08:45	95				
671	MUC	13	11.09.	57°20,73′	20°35,42′	10:09	93				
672	MUC	14	11.09.	57°18,37′	20°32,80′	12:04	119				
673	MUC	15	11.09.	57°21,09′	20°28,00′	13:14	172				
674	OFOS	24	11.09.	57°26,42′	20°43,27′	14:32	65	57°26,56′	20°43,61′	15:12	165

Station	Gear	No.	Date	Coordinates 1		Time	Depth	Coordinates 2		Time	Depth
AL422-No.			2013	Lat. °N	Long. °E	(UTC)	(m)	Lat. °N	Long. °E	(UTC)	(m)
675	CTD/RO	54	12.09.	56°52,28′	19°37,92′	06:05	109				
676	OFOS	25	12.09.	56°52,33′	19°37,82′	06:42	110	56°52,17′	19°37,84′	07:12	110
677	CTD/RO	55	12.09.	57°10,26′	19°09,78′	10:03	120				
678	OFOS	26	12.09.	57°10,23′	19°09,75′	10:45	121	57°10,22′	19°09,65′	11:00	121
679	CTD/RO	56	12.09.	57°11,36′	19°07,09′	11:33	99				
680	OFOS	27	12.09.	57°11,35′	19°07,11′	12:007	99	57°11,50′	19°06,93′	12:37	99
681	CTD/RO	57	12.09.	57°00,10′	18°51,50′	14:05	99				
682	OFOS	28	12.09.	57°00,12′	18°51,56′	14:35	99	57°00,16′	18°51,86′	14:55	100
683	CTD/RO	58	12.09.	57°00,19′	18°54,96′	16:00	117				
684	OFOS	29	12.09.	57°00,18′	18°54,97′	16:33	117	57°00,17′	18°55,09′	16:48	117