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3.10 Meiofauna and water masses: looking for the link

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Objectives

In line with the general benthic concept, our main focus during ANT-XXIX/3 was to find out whether there are differences in meiofauna shelf communities among three Antarctic regions with differing water masses, ice conditions, topography, and surface productivity. Meiofauna mainly consists of free-living nematodes (70-90 % of total abundance) and harpacticoid copepods. Organisms of the meiofauna size class measure between 32 µm and 1 mm. They play a significant role in the benthic food web and the remineralisation of nutrients.

By combining the community approach with stable isotope analysis of organic matter from the water column, the sediment, and the meiofauna organisms we want to shed light on the link between surface water productivity and the benthic response. The three investigated oceanic regimes differed in chlorophyll concentration. The Weddell Sea area had a lower surface chlorophyll content at the time of sampling than both Bransfield Strait and Drake Passage.

In our study we address the following questions:

- Do diversity and abundance of meiofauna shelf communities increase along the observed productivity gradient from the Weddell Sea water masses to the Bransfield Strait and the Drake Passage?
- How do water mass and productivity regime influence carbon ($\delta^{13}C$) and nitrogen ($\delta^{15}N$) stable isotope signatures of meiofauna organisms in the sediment?

Work at sea

The sampling for our study during ANT-XXIX/3 was carried out at all stations where successful MUC6 deployments could be expected. Beforehand information on sediment composition and bottom topography was provided by the OFOS (Ocean Floor Observing System) and the bathymetry teams, see chapters 3.3 Megabenthic distribution patterns and 3.12 Regional bathymetry, both this volume. The MUC6 was mainly deployed at the deeper stations of the selected core sites in the Weddell Sea. Following the expedition's general concept for the benthos work, we deployed the MUC6 (and collected the additional CTD water samples) at all slope and canyon stations in the Bransfield Strait and the Drake Passage.

Quantitative samples for meiofauna analyses were collected at 18 stations in the 3 different areas (Weddell Sea, Bransfield Strait and Drake Passage, see Table 3.10.1). In most cases, the multicorer (MUC6) was used to recover undisturbed sediment cores. The MUC6 can mount up to 12 plexiglass cores, each with an inner diameter of 57 mm (surface 25.5 cm²). When conditions did not allow for the successful deployment of the MUC6, subsamples (25.5 cm² and 10 cm² cores) from the giant boxcorer (GKG) were taken. This was the case at the Volcano stations since these sediments contained many stones that would have damaged the MUC cores. At all stations, the MUC sampling was accompanied by CTD water column sampling with niskin bottles. At two locations (stns 190-1 and 230-1), we collected only CTD water samples to complement our dataset or that of other experts onboard.

At each location, three MUC6 deployments were carried out in order to collect true replicates. From each successful MUC6 deployment, different samples were collected for a variety of analyses. A first set of samples will be used for meiofauna community analysis. For that purpose, two cores from each deployment were sliced in 1 cm-layers down to 5cm depth and stored in a 4 % formaldehyde-seawater solution (borax-buffered). Later on, all meiofauna will be extracted, counted and identified to major taxon level in the home institutes. Harpacticoid copepods will be identified to genus/species level at FS-DZMB and nematodes to genus level at UGent.

Next to that, 3 or 4 cores of each deployment were stored for stable isotope analysis of copepods and nematodes. The first 3 centimetres of each core were sliced per cm and stored in petridishes at –20° C. In the FS-DZMB and UGent labs, copepods and nematodes will be picked out from these sediment slices and analysed for carbon and nitrogen isotopes.

Finally, remaining cores of each deployment were subsampled for environmental parameters with cut-off 10 mL syringes that were pushed into the core. One of those syringes will be used to analyse the pigment content of the sediment, another one for grain size determination and a third one for sediment stable isotope measurements (to relate isotopic signals of sediments with those of animals and the water column). Syringes for grain size and stable isotope analyses were stored at –20° C, whereas the subsamples for pigments were stored at –80° C.

In order to compare pigment content and stable isotope signals of the benthic components with the water column, chlorophyll-maximum and bottom water was sampled with a CTD rosette mounted with Niskin bottles (see chapter 4. Oceanography and tracer measurements, this volume). For both depths, water was filtered over one GF/C (for pigment samples) and one GF/F filter (for stable isotope samples). In case of the bottom water, 3–5L were collected per filter. Lower amounts of water were filtered when resuspended material lead to low filtering performance. For the chlorophyll maximum 3–5L were filtered depending on the colouring of the filters. Filtering was performed at approximately 200 mbar to avoid rupture of cells. The GF/C filters were stored at –80° C and will be used for pigment analysis in the UGent lab using HPLC. The GF/F filters are kept at –20° C and will be analysed for $\delta^{13}C$ and $\delta^{15}N$ stable isotope signatures.

Additionally, with the help of the CCAMLR krill team (see chapter 5. Antarctic krill population dynamics in the north-western Weddell Sea (CCAMLR), this volume), we obtained 17 krill samples (*Euphausia superba* and *E. crystallorophias*) from 12 stations in the three different regions for stable isotope analyses. With these samples we add another important component to our overview on links between the pelagic and the benthic compartments of the food web.

Tab. 3.10.1: List with CTD, GKG and MUC stations sampled for meiofauna communities as well as sediment and water column characteristics.

Station name	Stn no.	Date (2013)	Latitude	Longitude	depth (m)	gear	samples collected
B_JN_B (BS_Joinville_ North_bank)	116-1	26.01.	62°35.50´S	56°27.34´W	201.5	CTD	no
	116-7	26.01.	62°33.85´S	56°23.68´W	192.2	MUC	
	116-8	26.01.	62°33.89´S	56°23.62´W	190.6	MUC	
B_JN_U (BS_Joinville_ North_upper slope)	118-1	27.01.	62°26.47´S	56°17.26´W	439.5	CTD	yes
	118-9	27.01.	62°26.95´S	56°17.14´W	423.3	MUC	
	118-10	27.01.	62°26.90´S	56°17.19´W	427	MUC	
	118-11	27.01.	62°26.89´S	56°17.22´W	427	MUC	
W_JE_B (WS_Joinville_ East_bank)	119-1	28.01.	63°10.08‘S	54°7.17‘W	224.3	CTD	no
W_JE_D (WS_Joinville_ East_depression)	120-1	28.01.	63°4.62´S	54°33.11´W	530.4	CTD	yes
	120-5	28.01.	63°4.58´S	54°31.00´W	503.6	MUC	
	120-6	28.01.	63°4.10´S	54°30.86´W	484.8	MUC	
	120-7	28.01.	63°3.72´S	54°30.87´W	436.8	MUC	
W_ET_B (WS_Erebus_ Terror_bank)	162-1	10.02.	64°0.27´S	56°44.28´W	219.6	CTD	yes
	162-3	10.02.	64°0.11´S	56°44.28´W	222.1	MUC	
	162-4	10.02.	64°0.07´S	56°44.20´W	223.4	MUC	
	162-5	10.02.	64°0.14´S	56°44.33´W	221.9	MUC	
W_ET_D (WS_Erebus_ Terror_deep)	163-1	10.02.	63°53.07´S	56°26.19´W	468	CTD	yes
	163-4	11.02.	63°50.95´S	56°24.43´W	517.6	MUC	
	163-5	11.02.	63°51.01´S	56°23.97´W	516.6	MUC	
	163-6	11.02.	63°51.03´S	56°23.68´W	517.1	MUC	
W_DI_B (WS_Dundee_ Island_bank)	164-1	11.02.	63°37.07´S	56°13.53´W	196.7	CTD	no
W_VO_U (WS_Volcano_ upper slope)	185-2	19.02.	63°52.20´S	55°36.67´W	232	GKG	yes
W_VO_D (WS_Volcano_deep)	188-2	19.02.	63°51.86´S	55°34.39´W	339	GKG	no
	188-3	19.02.	63°52.01´S	55°35.15´W	310	GKG	yes
(W_VO_D) (H.Link)	190-1	20.02.	63°50.49´S	55°33.64´W	400	CTD	yes
B_E_S (BS_East_slope)	193-1	23.02.	62°43.01´S	57°34.16´W	577	CTD	yes
	193-4	23.02.	62°43.03´S	57°34.23´W	577	MUC	
	193-5	23.02.	62°43.03´S	57°34.24´W	579	MUC	
	193-6	23.02.	62°43.03´S	57°34.25´W	578	MUC	

Station name	Stn no.	Date (2013)	Latitude	Longitude	depth (m)	gear	samples collected
B_E_C (BS_East_canyon)	196-1	24.02.	62°48.01´S	57°4.97´W	567	CTD	yes
	196-4	24.02.	62°48.00´S	57°4.98´W	561	MUC	
	196-5	24.02.	62°48.03´S	57°4.97´W	567	MUC	
	196-6	24.02.	62°48.04´S	57°5.00´W	574	MUC	
	196-7	24.02.	62°48.00´S	57°4.99´W	559	MUC	
B_C_C (BS_Central_canyon)	202-1	27.02.	62°56.00´S	58°0.47´W	758	CTD	yes
	202-3	27.02.	62°56.00´S	58°0.49´W	756	MUC	
	202-4	27.02.	62°56.01´S	58°0.52´W	756	MUC	
	202-5	27.02.	62°55.99´S	58°0.61´W	757	MUC	
B_C_S (BS_Central_slope)	215-1	01.03.	62°53.57´S	58°14.66´W	530	CTD	yes
	217-1	02.03.	62°53.31´S	58°14.14´W	527	MUC	
	217-2	02.03.	62°53.31´S	58°14.17´W	529	MUC	
	217-3	02.03.	62°53.31´S	58°14.12´W	527	MUC	
	217-4	02.03.	62°53.29´S	58°14.09´W	527	MUC	
B_W_C (BS_West_canyon)	218-1	02.03.	62°56.93´S	58°25.66´W	691	CTD	yes
	218-4	02.03.	62°56.95´S	58°25.81´W	689	MUC	
	218-5	02.03.	62°56.95´S	58°25.84´W	689	MUC	
	218-6	02.03.	62°56.93´S	58°25.81´W	689	MUC	
B_W_S (BS_West_slope)	225-1	04.03.	62°56.07´S	58°40.62´W	539	CTD	yes
	225-3	04.03.	62°56.04´S	58°40.73´W	545	MUC	
	225-4	04.03.	62°56.06´S	58°40.76´W	544	MUC	
	225-6	04.03.	62°56.05´S	58°40.77´W	546	MUC	
B_DE_S (BS_Deception_slope)	230-1	05.03.	63°8.37´S	60°39.30´W	677	CTD	yes
D_W_S (DP_West_slope)	235-1	07.03.	62°16.30´S	61°10.27´W	369	CTD	yes
	235-4	07.03.	62°16.29´S	61°10.24´W	373	MUC	
	235-5	07.03.	62°16.31´S	61°10.24´W	363	MUC	
	235-6	07.03.	62°16.35´S	61°10.25´W	350	MUC	
D_W_C (DP_West_canyon)	238-2	08.03.	62°20.73´S	61°20.15´W	465	CTD	yes
	238-4	08.03.	62°20.82´S	61°20.01´W	460	MUC	
	238-5	08.03.	62°20.78´S	61°20.10´W	464	MUC	
	238-6	08.03.	62°20.80´S	61°20.06´W	466.5	MUC	
D_C_S (DP_Central_slope)	241-1	09.03.	62°6.63´S	60°36.52´W	395	CTD	yes
	244-5	10.03.	62°6.64´S	60°36.53´W	398	MUC	
	244-6	10.03.	62°6.62´S	60°36.50´W	400	MUC	
	244-7	10.03.	62°6.65´S	60°36.54´W	396	MUC	
D_C_C (DP_Central_canyon)	243-1	10.03.	62°12.27´S	60°44.42´W	497.4	CTD	yes
	243-3	10.03.	62°12.32´S	60°44.47´W	497.8	MUC	
	243-4	10.03.	62°12.31´S	60°44.48´W	497.7	MUC	
	243-5	10.03.	62°12.31´S	60°44.54´W	495.2	MUC	

Station name	Stn no.	Date (2013)	Latitude	Longitude	depth (m)	gear	samples collected
D_E_S (DP_East_slope)	247-2	11.03.	61°56.90´S	60°7.49´W	401	CTD	yes
	247-4	11.03.	61°56.93´S	60°7.48´W	396	MUC	
	247-5	11.03.	61°56.94´S	60°7.51´W	397	MUC	
	247-6	11.03.	61°56.93´S	60°7.44´W	396	MUC	
	247-7	11.03.	61°56.91´S	60°7.47´W	400	MUC	
D_E_C (DP_East_canyon)	250-1	12.03.	62°2.28´S	60°12.11´W	487	CTD	yes
	250-3	12.03.	62°2.22´S	60°12.01´W	489	MUC	
	250-4	12.03.	62°2.24´S	60°12.06´W	488	MUC	
	250-5	12.03.	62°2.24´S	60°12.03´W	488	MUC	

Preliminary results

Since extraction of animals and the analyses of environmental parameters and stable isotopes have to be done in a standardised way in the lab, all samples were shipped to the home institutes. Therefore, no preliminary results are available for the meiobenthos at this stage.

Data management

Data will be stored in the SCAR-MarBIN, PANGAEA, and VLIZ MDA data bases and will be made available after publication.

3.11 Marine mammal survey

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Objectives

Knowledge on the distribution, density and abundance of cetaceans in the Southern Ocean is still limited. Even less research has been conducted in the pack-ice region, as only few vessels are ice-strengthened enough to be able to penetrate into the ice. Macro-scale investigations on the distribution and abundance of Antarctic minke whales *(Balaenoptera bonaerensis)* have been conducted during three circum-Antarctic surveys by the International Whaling Commission's IDCR Programme from 1978/79 to the second half of the 1990s. Estimated Minke whale abundance declined from the second to the third circum-Antarctic survey by approximately 30 % (IWC, 2012). However, if their number has really declined, or to what extent minke whales have reacted to changing sea ice conditions in some areas, by changes in distribution and abundance on various scales, is unknown. The distribution and density of whales in the pack-ice could not be estimated by the IWC surveys, because survey vessels were not ice-strengthened. Therefore it remains debatable, to what extent minke whales inhabit the pack ice, and if they have moved into the pack-ice in larger numbers than hitherto thought (e.g. Kelly et al., 2012). *Polarstern* as one of the few ice-breaking vessels in the Southern Ocean offers the opportunity to study the distribution and abundance of minke whales in the pack-ice (Scheidat et al., 2007a; 2007b; 2011; Kock et al., 2009).

Aerial surveys conducted in the pack-ice provide a chance to test the hypotheses to what extent Minke whales utilize the pack-ice as habitat. In continuation of the