7.2 Geochemistry of carbon and silica: water column and sediment sampling. Material, methods and first results

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Introduction

The Arctic Ocean makes up only 1.5% of the global ocean, but receives about 10% of the global river discharge (Aargard 1994). More than one third of the total freshwater discharge to the Arctic Ocean occurs into the Kara Sea, mainly via Ob and Yenisey (Milliman et al. 2000) which are the second and, respectively, third largest Arctic rivers (Telang et al. 1991). During the "Akademik Boris Petrov" expedition 2001 sampling of sediments and suspended matter was carried out along the salinity gradient from the estuaries to the offshore area. The samples will be analyzed to determine sources, cycling processes and burial rates of organic matter in the Kara Sea. Organic composition and stable isotope analyses of suspended matter, sinking particles and recent sediments can be used to determine the degradational state and source of organic matter and its potential to be buried in the sediments.

Shipboard sampling program and methods

During the "Akademik Boris Petrov 2001" expedition special emphasis was put on the northern and northeastern part of the Kara Sea and on the Ob river. At the southernmost sampling locations water masses of pure riverine nature (=0‰ salinity) were found in the Ob as well as in the Yenisey. Particulate matter from these stations are expected to represent the riverine material delivered by the Ob and Yenisey to the Kara Sea at the end of the high discharge period during summer. Transects from the Ob and Yenisey, respectively, to the Kara Sea will give an insight into processes taking place on particulate matter on its way from the rivers to the ocean, passing the marginal filter (Lisitsyn 1995). Sampling of particulate matter was carried out on 48 stations (Tab. 7.2). Sampling depths were chosen according to the CTD profiles. In most cases, a rather distinct thermohalocline separated an upper low saline from a deeper higher saline water mass. Therefore, one sample was taken from the surface, one from the deeper water mass and one from the thermohalocline. Surface samples were taken by means of a bucket, whereas the thermohalocline sample was taken with a 24-bottle Niskin rosette and the deep water sample with a large volume sampler (Bathomat, 200lt). One part of the samples was filtered through preweighted polycarbonate membrane filters (Whatman) with a pore size of 0.4_m for biogenic silica (opal) analysis. The remaining water was filtered through preweighted glass fiber filters (GF/F Whatman) for organic compound analysis and calculation of total suspended matter concentrations. The filters were dried onboard at 40° for 24 hours. In addition to the particulate matter samples, surface sediment were collected at 30 stations (Tab. 7.2) from a multiple corer. The samples were stored frozen and freeze-dried in the home laboratory for further analyses.

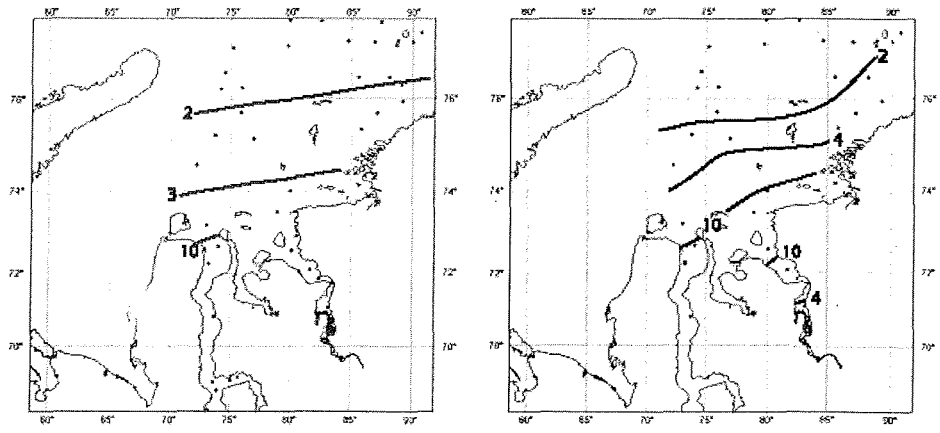

Figure 7.2: Total suspended matter (TSM) concentrations (in mg/l). Left panel: surface water; right panel: deep water.

First results

As a first approach, the amount of total suspended matter (TSM) per filter was calculated. TSM of surface water shows a clear gradient from high values in the rivers to low values in the open Kara Sea (Fig. 7.2) with generally higher values in the Ob compared to the Yenisey. In the more southern part of the Ob Bay, where the Taz enters the Ob, very high TSM values are observed in the surface water corresponding to the very muddy waters observed in this region. TSM in the deep water also shows a gradient from high to low values along a river – open Kara Sea transect. Again, TSM is higher in the Ob, even though some values from the Yenisey Bay are higher due to resuspension processes.

Ongoing analyses

The particulate material as well as the sediment samples will be analyzed for organic compound, biogenic silica (opal), amino acids, hexosamines and nitrogen isotopes. The particulate matter furthermore will be analyzed for carbon isotopes.

Acknowledgements

We would like to express our thanks to the Captain and crew of R/V "Akademik Boris Petrov" for their excellent work. We would also like to thank all colleagues on board "Akademik Boris Petrov" for their assistance during the cruise.

Table 7.2: Samples collected during "Akademik Boris Petrov" expedition 2001.

Station	Filter	Surface Sediment	Station	Filter	Surface Sediment	Station	Filter	Surface Sediment
BP01-01	x	x	BP01-32	x		BP01-59	x	x
BP01-03	x		BP01-34	x	x	BP01-61	x	x
BP01-04	x		BP01-35	x	x	BP01-62	x	x
BP01-05	x		BP01-37	x	x	BP01-65	x	x
BP01-06	x		BP01-38	x		BP01-66	x	x
BP01-07		x	BP01-40	x		BP01-67	x	x
BP01-08	x	x	BP01-41	x	x	BP01-68	x	x
BP01-11	x		BP01-43	x	x	BP01-70	x	x
BP01-14	x		BP01-45	x	x	BP01-72	x	
BP01-16	x	x	BP01-46	x	x	BP01-73	x	
BP01-19	x		BP01-48	x	x	BP01-75	x	x
BP01-23	x		BP01-49		x	BP01-77	x	
BP01-26	x	x	BP01-51	x	x	BP01-78	x	
BP01-28	x	x	BP01-52	x	x	BP01-79	x	
BP01-29	x		BP01-55	x	x	BP01-80	x	
BP01-30	x	x	BP01-56	x	x	BP01-82	x	
BP01-31	x	x	BP01-58	x	x			