Pump CTD profiles from the EMB276 cruise on R/V Elisabeth Mann Borgese in the Baltic Sea from September 20-27, 2021

Website: https://www.bco-dmo.org/dataset/934904
Data Type: Cruise Results
Version: 1
Version Date: 2024-08-16

Project
» Collaborative Research: Manganese Cycling and Coupling Across Redox Boundaries within Stratified Basins of the Baltic Sea (MnIONS)

Contributors	Affiliation	Role
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Abstract
Pump CTD profiles include data on time, latitude, longitude, depth, h2s, o2, sulfide, pH, po4, NO3, NO2, NH4, SiO2, fluorescence, turbidity, density, temperature, and salinity from six stations in the Baltic Sea collected between September 20 - 27, 2021. Data was collected from the R/V Elisabeth Mann Borgese.

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Coverage

Location: Data were collected from September 20 - 27, 2021 during a research cruise (EMB276) on the R/V Elisabeth Mann Borgese. Seven different stations in and around the eastern Gotland Basin were studied
Spatial Extent: **N**:58.01083333 **E**:20.35083333 **S**:56.64388889 **W**:19.19333333
Temporal Extent: 2021-09-20 - 2021-09-27

Methods & Sampling

An independent pump CTD was used to collect data on macronutrients, described by Strady et al., 2008 and Schulz-Vogt et al., 2019 . Nutrient analyses were done according to guidelines of Grasshoff et al., 1999, with the precision on each nutrient being 0.01 (PO_4^{3-}), 0.02 (NO_3^-), 0.006 (NO_2^-), and 0.05 (NH_4^+) µM.

The pump CTD was designed by groups at IOW and MPI, for the CTD in the PUMP–CTD-System a SBE911+ from SEABIRD-Electronics USA is used. Further details are provided in Strady et al., (2008).

CTD sensor measurements: temperature, conductivity and pressure. Temperature and salinity are mean values obtained from Temp (ITS-90) and Salinity Practical (PSU) from CTD data. Nutrients measured with Quattro Seal: NO3, NO2, NH4 and PO4.

Sensors connected to pump CTD O2, H2S and pH. See supplemental files for detection limits and calibration of these sensors.

Data Processing Description

The nutrient pump CTD data are smoothed using a gliding average over 7 depths.

BCO-DMO Processing Description

* merged 6 profiles into 1 file
* standardized date formet (mm-dd-yy)
* added ISO DateTime parameter
* adjusted parameter names to comply with database requirements

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Data Files

File
934904_v1_ctd.csv (Comma Separated Values (.csv), 6.62 MB) MD5:b565987d8742cab8b206c85c826a7e30 Primary data file for dataset ID 934904, version 1

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Supplemental Files

File
Sensors connected to pump CTD.pdf (Portable Document Format (.pdf), 82.80 KB) MD5:f8d4ada9210d9b3f6114f89dfe20403d Detection limit, range and calibration of the sensors connected to the pump CTD

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Related Publications

Grasshoff, K., Kremling, K., & Ehrhardt, M. (Eds.). (1999). Methods of Seawater Analysis. doi:10.1002/9783527613984
Methods

Schulz-Vogt, H. N., Pollehne, F., Jürgens, K., Arz, H. W., Beier, S., Bahlo, R., Dellwig, O., Henkel, J. V., Herlemann, D. P. R., Krüger, S., Leipe, T., & Schott, T. (2019). Effect of large magnetotactic bacteria with polyphosphate inclusions on the phosphate profile of the suboxic zone in the Black Sea. The ISME Journal, 13(5), 1198–1208. https://doi.org/10.1038/s41396-018-0315-6
Methods

Strady, E., Pohl, C., Yakushev, E. V., Krüger, S., & Hennings, U. (2008). PUMP–CTD-System for trace metal sampling with a high vertical resolution. A test in the Gotland Basin, Baltic Sea. Chemosphere, 70(7), 1309–1319. https://doi.org/10.1016/j.chemosphere.2007.07.051
Methods

Taenzer, L., Grabb, K., Kapit, J., Pardis, W., Wankel, S. D., & Hansel, C. M. (2022). Development of a Deep-Sea Submersible Chemiluminescent Analyzer for Sensing Short-Lived Reactive Chemicals. Sensors, 22(5), 1709. https://doi.org/10.3390/s22051709
Methods

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Parameters

Parameter	Description	Units
cruise_name	Name of the cruise	unitless
station_number	Station number	unitless
station_name	Name of the station	unitless
date	Date	unitless
time_UTC	Time in UTC	unitless
ISO_DateTime_UTC	Date Time in ISO format notation (UTC timezone)	unitless
latitude_N	latitude, south is negative	decimal degrees
longitude_E	longitude, west is negative	decimal degrees
max_depth_m	the maximum depth at that station	meters (m)
depth	depth of data	meters (m)
H2S_uM	hydrogen sulfide	micromolar (µM)
O2_uM	oxygen	micromolar (µM)

total_sulfide_umol_l	total sulfide	micromole per liter (µmol/L)
pH	pH	unitless
PO4_umol_l	phosphate	micromole per liter (µmol/L)
NO3	nitrate	micromole per liter (µmol/L)
NO2_umol_l	nitrite	micromole per liter (µmol/L)
NH4_umol_l	ammonium	micromole per liter (µmol/L)
SiO2_umol_l	silicate	micromole per liter (µmol/L)
Fluor_mg_m3	fluorescence	mg/m^3
Turb_NTU	turbidity	NTU
Density_Sig_tet	density	unitless
Temp_C	temperature	degrees Celsius (°C)
Salinity_PSU_	salinity	PSU

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Instruments

Dataset-specific Instrument Name	PUMP–CTD-System
Generic Instrument Name	CTD Sea-Bird 911
Dataset-specific Description	Pump CTD was designed by groups at IOW and MPI, for the CTD in the PUMP–CTD-System a SBE911+ from SEABIRD-Electronics USA is used. Further details are provided in Strady et al., (2008).
Generic Instrument Description	The Sea-Bird SBE 911 is a type of CTD instrument package. The SBE 911 includes the SBE 9 Underwater Unit and the SBE 11 Deck Unit (for real-time readout using conductive wire) for deployment from a vessel. The combination of the SBE 9 and SBE 11 is called a SBE 911. The SBE 9 uses Sea-Bird's standard modular temperature and conductivity sensors (SBE 3 and SBE 4). The SBE 9 CTD can be configured with auxiliary sensors to measure other parameters including dissolved oxygen, pH, turbidity, fluorescence, light (PAR), light transmission, etc.). More information from Sea-Bird Electronics.

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Deployments

EMB276

Website	https://www.bco-dmo.org/deployment/934931
Platform	R/V Elisabeth Mann Borgese
Start Date	2021-09-17
End Date	2021-09-29

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Project Information

Collaborative Research: Manganese Cycling and Coupling Across Redox Boundaries within Stratified Basins of the Baltic Sea (MnIONS)

Coverage: Baltic Sea

NSF Award Abstract:
The trace element manganese (Mn) is distributed widely throughout the global ocean where it cycles among three dominant oxidation states. Manganese in the higher oxidation states is highly reactive and thereby influences the cycling of nearly all other elemental cycles, including those of oxygen and nitrogen. The intermediate Mn species has only recently become recognized as an abundant component of the Mn pool, presenting now a previously unrecognized factor that may control the chemistry of the ocean. The Baltic Sea contains high Mn concentrations and preliminary investigations have pointed to the presence of an operationally defined "reactive" form of Mn but the composition and consequence of this Mn pool are unknown. This research will explore the cycling of Mn within the Baltic Sea enabled by an established collaboration with the Leibniz Institute for Baltic Sea Research in Warnemunde, Germany. By coupling field measurements and targeted shipboard incubations, this study will shed light on the processes controlling the Mn cycle and its link to the oxygen, iodine, and nitrogen cycles. This project will educate several undergraduate and graduate students and promote scientific exchange between research groups within the United States and Germany. Further, outreach efforts associated with this research will continue an existing collaboration between the PIs and the Boston Green Academy in South Boston to introduce high school students to chemical oceanography, and in particular biogeochemistry.

Manganese (Mn) is intricately linked to nearly all elemental cycles, and yet we know little about the processes governing its redox cycling within natural systems. Over the past decade a number of key scientific discoveries have provided greater insight into the diversity of processes and mechanisms involved in Mn redox cycling and introduced Mn(III) ligand complexes as important components of the dissolved Mn pool. The Baltic Sea is one of the most well studied stratified marine systems and reactive Mn has been implicated as a key factor in the formation and maintenance of suboxic zones. Thus, the goal of this research is to explore the cycling and elemental coupling of Mn within stratified basins of the Baltic Sea. The PIs predict that reactive Mn, as Mn(III) ligand complexes and Mn oxide particles, is a primary control on the redox landscape of stratified marine waters, particularly at redox boundaries and within the suboxic zone. The PIs propose fieldwork in a local permanently stratified brackish pond to refine experimental procedures followed by two cruises to suboxic basins in the Baltic Sea enabled by an established collaboration with the Leibniz Institute for Baltic Sea Research in Warnemunde. Field measurements will be obtained using a combination of in situ sensors and ship/lab-based instrumentation at several Baltic Sea sites to define the distribution of Mn species and the rates of Mn redox transformations spanning the redoxcline along with a suite of chemical information. Further, a matrix of shipboard incubations will be conducted to constrain the underlying (a)biotic processes responsible for the observed Mn profiles. Specifically, across oxygen and Mn gradients spanning the redoxcline, the PIs will interrogate the link between the Mn cycle and iodine and nitrogen species, which will ultimately help constrain current gaps in the mass balance of these elements in Baltic Sea models.

This award reflects NSF's statutory mission and has been deemed worthy of support through evaluation using the Foundation's intellectual merit and broader impacts review criteria.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1924236

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