

# Trace metal aerosol data from R/V Polarstern cruise ARK-XXVI-3 from Tromso, Norway to Bremerhaven, Germany in 2011 (Be-7 Tracer Method project)

**Website:** <https://www.bco-dmo.org/dataset/538512>

**Version:** 14 Nov 2014

**Version Date:** 2014-11-14

## Project

» [Sample Analysis to Test a Novel Method of Determining Atmospheric Deposition of Trace Elements to the Ocean/Ice System of the Arctic](#) (Be-7 Tracer Method)

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## Dataset Description

Aerosol data collected on R/V Polarstern cruise ARK-XXVI-3.

## Methods & Sampling

Aerosols were sampled at a rate of 1 cubic meter per minute (1 m<sup>3</sup>/min) using the Florida State University high volume aerosol sampler (Tisch Environmental TSP TE5170V). The sampler was located on the flying deck, forward railings. Acid-washed Whatman 41, 47 mm disc (cellulose esters; W41) filters were used.

### Method references:

**Buck**, C.S., et al. 2010. The solubility and deposition of aerosol Fe and other trace elements in the North Atlantic Ocean: observations from the A16N CLIVAR/CO<sub>2</sub> repeat hydrography section. *Marine Chemistry* 120, 57-70. doi: [10.1016/j.marchem.2008.08.003](https://doi.org/10.1016/j.marchem.2008.08.003).

**Buck**, C. S., Landing, W.M., Resing, J. A., Lebon, G. T. 2006. Aerosol iron and aluminum solubility in the northwest Pacific Ocean: Results from the 2002 IOC cruise. *Geochemistry, Geophysics, Geosystems*. 7. doi: [10.1029/2005GC000977](https://doi.org/10.1029/2005GC000977).

**Morton**, P.L. et al. 2013. Methods for the sampling and analysis of marine aerosols: results from the 2008 GEOTRACES aerosol intercalibration experiment. *Limnology and Oceanography Methods* 11:62-78. doi: [10.4319/lom.2013.11.62](https://doi.org/10.4319/lom.2013.11.62).

## Data Processing Description

Concentrations below the detection limit are flagged as "BDL" in the data columns. Detection limits were

calculated using an air volume of 1200 cubic meters. See [PDF of detection limits for this dataset](#).

Quality flag definitions:

BDL = below detection limit.

0 = No QC performed.

1 = Good data.

2 = Probably good data.

3 = Probably bad data that is potentially correctable.

4 = Bad data.

5 = Value changed.

6 = Sample < blank.

8 = Interpolated value.

9 = Missing value.

BCO-DMO edits:

- changed Aug and Sept to 08 and 09 in month columns;
- replaced blanks with 'nd' to indicate 'no data';
- modified parameter names to conform with BCO-DMO naming conventions;
- removed % signs from RSD columns.

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## Data Files

File
<b>aerosols.csv</b> (Comma Separated Values (.csv), 2.59 KB) MD5:bfd65c0ccfee7807c5ddeea43853ddc3
Primary data file for dataset ID 538512

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## Parameters

Parameter	Description	Units
julian_day_start	Julian day at the start of the sampling event.	day of year
cruise_id	Cruise identification number.	dimensionless
day_start	2-digit day of month at the start of the sampling event.	dd (01 to 31)
month_start	2-digit month of year at the start of the sampling event.	mm (01 to 12)
year_start	4-digit year of the start of the sampling event.	YYYY
time_start_UTC	Time (UTC) in hours and minutes at the start of the sampling event; 24-hour clock.	HHMM
lat_start	Latitude at the start of the sampling event.	decimal degrees
lon_start	Longitude at the start of the sampling event.	decimal degrees
day_end	2-digit day of month at the end of the sampling event.	dd (01 to 31)
month_end	2-digit month of year at the end of the sampling event.	mm (01 to 12)
year_end	4-digit year of the end of the sampling event.	YYYY
time_end_UTC	Time (UTC) in hours and minutes at the end of the sampling event; 24-hour clock.	HHMM
lat_end	Latitude at the end of the sampling event.	decimal degrees
lon_end	Longitude at the end of the sampling event.	decimal degrees
air_vol_total	Total volume of air sampled.	cubic meters (m <sup>3</sup> )

air_vol_per_filter	Volume of air filtered per filter.	cubic meters (m <sup>3</sup> )
Na_Total	Total aerosol Na (Sodium) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
Na_Total_var	Total aerosol Na concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
Na_Total_RSD	Relative standard deviation (rsd) of total aerosol Na concentration.	percent (%)
Mg_Total	Total aerosol Mg (Magnesium) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
Mg_Total_var	Total aerosol Mg concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
Mg_Total_RSD	Relative standard deviation (rsd) of total aerosol Mg concentration.	percent (%)
Al_Total	Total aerosol Al (Aluminum) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
Al_Total_var	Total aerosol Al concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
Al_Total_RSD	Relative standard deviation (rsd) of total aerosol Al concentration.	percent (%)
P_Total	Total aerosol P (Phosphorus) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
P_Total_var	Total aerosol P concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
P_Total_RSD	Relative standard deviation (rsd) of total aerosol P concentration.	percent (%)
Sc_Total	Total aerosol Sc (Scandium) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
Sc_Total_var	Total aerosol Sc concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
Sc_Total_RSD	Relative standard deviation (rsd) of total aerosol Sc concentration.	percent (%)
Ti_Total	Total aerosol Ti (Titanium) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
Ti_Total_var	Total aerosol Ti concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
Ti_Total_RSD	Relative standard deviation (rsd) of total aerosol Ti concentration.	percent (%)
V_Total	Total aerosol V (Vanadium) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
V_Total_var	Total aerosol V concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
V_Total_RSD	Relative standard deviation (rsd) of total aerosol V concentration.	percent (%)
Cr_Total	Total aerosol Cr (Chromium) concentration.	nanograms per cubic meter (ng/m <sup>3</sup> )
Cr_Total_var	Total aerosol Cr concentration variance.	nanograms per cubic meter (ng/m <sup>3</sup> )
Cr_Total_RSD	Relative standard deviation (rsd) of total aerosol Cr concentration.	percent (%)

Mn_Total	Total aerosol Mn (Manganese) concentration.	nanograms per cubic meter (ng/m3)
Mn_Total_var	Total aerosol Mn concentration variance.	nanograms per cubic meter (ng/m3)
Mn_Total_RSD	Relative standard deviation (rsd) of total aerosol Mn concentration.	percent (%)
Fe_Total	Total aerosol Fe (Iron) concentration.	nanograms per cubic meter (ng/m3)
Fe_Total_var	Total aerosol Fe concentration variance.	nanograms per cubic meter (ng/m3)
Fe_Total_RSD	Relative standard deviation (rsd) of total aerosol Fe concentration.	percent (%)
Co_Total	Total aerosol Co (Cobalt) concentration.	nanograms per cubic meter (ng/m3)
Co_Total_var	Total aerosol Co concentration variance.	nanograms per cubic meter (ng/m3)
Co_Total_RSD	Relative standard deviation (rsd) of total aerosol Co concentration.	percent (%)
Ni_Total	Total aerosol Ni (Nickel) concentration.	nanograms per cubic meter (ng/m3)
Ni_Total_var	Total aerosol Ni concentration variance.	nanograms per cubic meter (ng/m3)
Ni_Total_RSD	Relative standard deviation (rsd) of total aerosol Ni concentration.	percent (%)
Cu_Total	Total aerosol Cu (Copper) concentration.	nanograms per cubic meter (ng/m3)
Cu_Total_var	Total aerosol Cu concentration variance.	nanograms per cubic meter (ng/m3)
Cu_Total_RSD	Relative standard deviation (rsd) of total aerosol Cu concentration.	percent (%)
Zn_Total	Total aerosol Zn (Zinc) concentration.	nanograms per cubic meter (ng/m3)
Zn_Total_var	Total aerosol Zn concentration variance.	nanograms per cubic meter (ng/m3)
Zn_Total_RSD	Relative standard deviation (rsd) of total aerosol Zn concentration.	percent (%)
Rb_Total	Total aerosol Rb (Rubidium) concentration.	nanograms per cubic meter (ng/m3)
Rb_Total_var	Total aerosol Rb concentration variance.	nanograms per cubic meter (ng/m3)
Rb_Total_RSD	Relative standard deviation (rsd) of total aerosol Rb concentration.	percent (%)
Sr_Total	Total aerosol Sr (Strontium) concentration.	nanograms per cubic meter (ng/m3)
Sr_Total_var	Total aerosol Sr concentration variance.	nanograms per cubic meter (ng/m3)
Sr_Total_RSD	Relative standard deviation (rsd) of total aerosol Sr concentration.	percent (%)
Zr_Total	Total aerosol Zr (Zirconium) concentration.	nanograms per cubic meter (ng/m3)

Zr_Total_var	Total aerosol Zr concentration variance.	nanograms per cubic meter (ng/m3)
Zr_Total_RSD	Relative standard deviation (rsd) of total aerosol Zr concentration.	percent (%)
Cd_Total	Total aerosol Cd (Cadmium) concentration.	nanograms per cubic meter (ng/m3)
Cd_Total_var	Total aerosol Cd concentration variance.	nanograms per cubic meter (ng/m3)
Cd_Total_RSD	Relative standard deviation (rsd) of total aerosol Cd concentration.	percent (%)
Sb_Total	Total aerosol Sb (Antimony) concentration.	nanograms per cubic meter (ng/m3)
Sb_Total_var	Total aerosol Sb concentration variance.	nanograms per cubic meter (ng/m3)
Sb_Total_RSD	Relative standard deviation (rsd) of total aerosol Sb concentration.	percent (%)
Ba_Total	Total aerosol Ba (Barium) concentration.	nanograms per cubic meter (ng/m3)
Ba_Total_var	Total aerosol Ba concentration variance.	nanograms per cubic meter (ng/m3)
Ba_Total_RSD	Relative standard deviation (rsd) of total aerosol Ba concentration.	percent (%)
La_Total	Total aerosol La (Lanthanum) concentration.	nanograms per cubic meter (ng/m3)
La_Total_var	Total aerosol La concentration variance.	nanograms per cubic meter (ng/m3)
La_Total_RSD	Relative standard deviation (rsd) of total aerosol La concentration.	percent (%)
Ce_Total	Total aerosol Ce (Cerium) concentration.	nanograms per cubic meter (ng/m3)
Ce_Total_var	Total aerosol Ce concentration variance.	nanograms per cubic meter (ng/m3)
Ce_Total_RSD	Relative standard deviation (rsd) of total aerosol Ce concentration.	percent (%)
Nd_Total	Total aerosol Nd (Neodymium) concentration.	nanograms per cubic meter (ng/m3)
Nd_Total_var	Total aerosol Nd concentration variance.	nanograms per cubic meter (ng/m3)
Nd_Total_RSD	Relative standard deviation (rsd) of total aerosol Nd concentration.	percent (%)
Pb_Total	Total aerosol Pb (lead) concentration.	nanograms per cubic meter (ng/m3)
Pb_Total_var	Total aerosol Pb concentration variance.	nanograms per cubic meter (ng/m3)
Pb_Total_RSD	Relative standard deviation (rsd) of total aerosol Pb concentration.	percent (%)
Th_Total	Total aerosol Th (Thorium) concentration.	nanograms per cubic meter (ng/m3)

Th_Total_var	Total aerosol Th concentration variance.	nanograms per cubic meter (ng/m3)
Th_Total_RSD	Relative standard deviation (rsd) of total aerosol Th concentration.	percent (%)
U_Total	Total aerosol U (Uranium) concentration.	nanograms per cubic meter (ng/m3)
U_Total_var	Total aerosol U concentration variance.	nanograms per cubic meter (ng/m3)
U_Total_RSD	Relative standard deviation (rsd) of total aerosol U concentration.	percent (%)

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## Instruments

<b>Dataset-specific Instrument Name</b>	Tisch Environmental TSP TE5170V
<b>Generic Instrument Name</b>	Aerosol Sampler
<b>Generic Instrument Description</b>	A device that collects a sample of aerosol (dry particles or liquid droplets) from the atmosphere.

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## Deployments

### ARK-XXVI-3

<b>Website</b>	<a href="https://www.bco-dmo.org/deployment/537987">https://www.bco-dmo.org/deployment/537987</a>
<b>Platform</b>	R/V Polarstern
<b>Report</b>	<a href="http://dmoserv3.whoi.edu/data_docs/Be7_Tracer/649-2012_Schauer_ARK-26-3.pdf">http://dmoserv3.whoi.edu/data_docs/Be7_Tracer/649-2012_Schauer_ARK-26-3.pdf</a>
<b>Start Date</b>	2011-08-05
<b>End Date</b>	2011-10-06
<b>Description</b>	The Polarstern expedition ARK-XXVI/3 "TransArc" (Trans-Arctic survey of the Arctic Ocean in transition) served the overarching goal to capture the physical, biological and chemical state of the Arctic Ocean in a changing climate. During TransArc, investigators sampled the ocean and ice properties and their ecosystems along gradients from the Eurasian shelf edge to the Canadian Basin. Polarstern left Tromso on August 5, 2011, with 54 scientists from 10 institutes of 7 countries and 43 crew members on board. A number of ice-tethered buoys and bottom-mounted moorings were deployed and recovered respectively. Ice thickness and optical measurements were made at stations, and an ROV was deployed for under ice observations. CTD casts, plankton net casts and sediment sampling were also conducted. The station work finished on September 26. After passing the ice-free Northern Sea Route to the western Barents Sea and the stormy Norwegian and North Seas, Polarstern returned to Bremerhaven on 6 October 2011.

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## Project Information

## Sample Analysis to Test a Novel Method of Determining Atmospheric Deposition of Trace Elements to the Ocean/Ice System of the Arctic (Be-7 Tracer Method)

*Description from the NSF award abstract:*

The investigators propose to use the naturally occurring isotope beryllium-7, which is produced in the atmosphere by cosmic rays and has a 53.3-day half-life, as a tracer for estimating the atmospheric fluxes of a variety of trace elements to the surface of the Arctic Ocean. They have collected samples of snow, sea ice, surface waters, and atmospheric aerosols through an international collaboration concurrent with the preparation of this proposal. This project provides funding for the analysis of Be-7 and for trace elements including aluminum, manganese, iron, copper, zinc, cadmium, and lead. The atmospheric input of numerous chemical species into the global ocean has been shown to equal or exceed that from river sources. In the Arctic, several contaminant elements in particular are dominated by atmospheric sources, with implications for the Arctic ecosystem and human health. The project will investigate several elements of interest to the international GEOTRACES program, which is currently formulating plans for coordinated Arctic work. The project will support a Ph.D. student who will incorporate these results into his dissertation.

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### Funding

Funding Source	Award
<a href="#">NSF Arctic Sciences (NSF ARC)</a>	<a href="#">PLR-1202992</a>

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