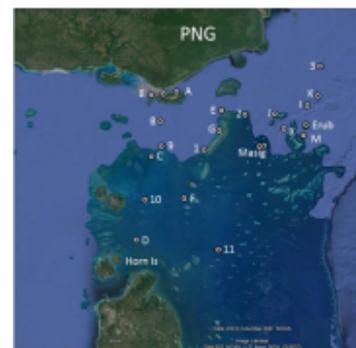


Concentration of trace metals from mine-derived pollution in marine waters and sediments across the Torres Strait (TS), October 2016 (NESP TWQ 2.2.2, CSIRO)



[Metadata](#) | [Metadata \(XML\)](#)
[Visualization service URL \(WMS\) \(nesp2:TS_NESP-TWQ-2-2-2_CSIRO_TS-Mine-Pollution_Survey_201610_tss\)](#) |

Title	Concentration of trace metals from mine-derived pollution in marine waters and sediments across the Torres Strait (TS), October 2016 (NESP TWQ 2.2.2, CSIRO)
Date	2019-05-10
Date type	Publication

Abstract	<p>This dataset summarises the results of a survey to determine the concentration of trace metals from mine-derived pollution in marine waters and sediments across the Torres Strait during October 2016. Sampling was performed by a CSIRO team between 3 and 16 October 2016 on board the MV Eclipse. Surface water samples were collected from 21 sites using strict sampling protocols that are designed to minimise contamination (USEPA, 1996; Angel et al., 2010b).</p> <p>METHODS:</p> <p>- Sample Collection</p> <p>Clean powder-free vinyl gloves were worn for the handling of all sample bottles and sampling equipment, and the collection of water samples before sediment samples at any given site. Acid washed sampling bottles (0.5, 1, and 5 L), double-bagged in zip-lock bags and stored inside an esky containing ice bricks was transported on the tender to each site. The 0.5 L bottle was used to collect a sample for total mercury analysis. The 1 L bottle was used for collecting a sample for total recoverable metals analyses other than mercury, and the 5 L bottle was used for collecting a sample for filterable (dissolved) and TSS-bound metals analyses other than mercury. At every sampling site a ‘clean hands’, ‘dirty hands’ protocol was used for taking water samples. This involved the ‘clean hands’ person opening the esky, placing gloves on hands, withdrawing the 1 L sample bottle from pre-labelled zip-lock bags, placing it into an attachment on a purpose built Perspex pole sampler, uncapping the bottle and holding onto the cap. The ‘dirty hands’ person then rapidly submerged the bottle in the pole sampler to a depth of approximately 50 cm to take the sample. Each sample bottle was rinsed twice with water from the sample site by filling each bottle, capping, shaking and emptying. The 1 L bottle was used to collect water samples that were decanted into the 0.5 and 5 L bottles until they were full of sample, after which the 1 L bottle was filled a final time. The ‘clean hands’ person capped each bottle once they were well filled and replaced them into the zip-lock bags in the esky. The water samples were placed into a fridge on board the MV Eclipse prior to filtration. The samples were filtered within 6 hours of sample collection.</p> <p>For quality control purposes, field blanks were collected at sites M, O and 8 and duplicate samples were collected at sites N, O and A. Field blanks for trace metals analysis were prepared at the designated sites by opening a 1 L bottle to the air for approximately 30 seconds followed by capping and returning to its zip-lock bag. On return to the MV Eclipse, the bottle was then filled with 1 L of deionised water.</p> <p>Salinity and pH were measured using an Orion Star A329 portable meter (Thermo Scientific). Sample pH was measured using a Thermo Scientific Orion Gel-Filled ROSS pH Ultra Triode</p>
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Electrode (8107UWMMD) that was calibrated using pH 4.00, 7.00 and 10.00 buffers. Salinity was measured using a Thermo Scientific Orion Conductivity Cell (013010MD) that was calibrated using KCl conductivity standards.

Sediment samples were collected from each site immediately after the water sampling. A combination of techniques were employed to collect the sediment samples that depended on the local water current conditions and ability of the corer to penetrate the sediment. Firstly, a gravity core sampler was deployed from the Eclipse, which collected up to 12 cm deep sediment within pre-loaded plastic core tubes. If this was unsuccessful divers took hand cores of up to 7 cm depth by diving to the sea bed. The core tubes were capped with plastic stoppers and wherever possible, returned to the surface in an upright position. If the substrate was too hard for hand coring, the divers took a grab of loose sediment samples by hand inside 250 mL polycarbonate vials.

The core tubes were withdrawn from the corer on-board the MV Eclipse, placed into zip-lock bags, and placed inside a freezer until frozen. The cores were then sectioned by allowing a core to partially thaw so that the sediment core could be extruded with a plastic plunger, before cutting into sections (typically 1-2 cm length) with a plastic blade. The core sections were placed into zip-lock bags and stored frozen for transport to the Lucas Heights laboratories. The contents of some of the shorter unconsolidated sediment cores became mixed, in which case the entire core was treated as a single sample rather than sub-sectioning. Triplicate cores/sediment grabs were generally taken at each site in order to assess sampling heterogeneity.

- Water sample processing

Water samples for analysis of trace metals were vacuum filtered through acid-washed 0.45 µm Millipore membrane filters using an acid washed polycarbonate filtration apparatus (Sartorius). The filtration assemblies were further cleaned before processing each sample by first filtering a 100 mL volume of 10% v/v nitric acid solution followed by two 150 mL volumes of deionised water, and finally, a 50 mL volume of sample. For each volume of these solutions the filtration rig was held on an angle and rotated both before and after filtration so that the solutions came into contact with all surfaces of the top and bottom compartments of the apparatus to ensure rigorous rinsing / pre-treatment was achieved. The 50 mL aliquot of sample used to pre-clean the filtration rig was poured into the 1 L acid washed Nalgene filtrate receiving bottle, shaken to pre-treat the bottle, and discarded to waste. The sample was then filtered and the filtrate transferred into the receiving bottle. Between 4-6 L of each sample filtrate was retained for analysis. Filtrates were then preserved by addition of 2 mL/L of concentrated nitric acid (Merck Tracepur).

For the field blanks, approximately half of the 1L sample was filtered and preserved. The remaining 500 mL was acidified and retained for subsequent analysis. The difference between the filtered and unfiltered field blanks gave an indication if filtration resulted in contamination.

Suspended sediment samples for total suspended sediment (TSS) and TSS-bound metals analyses were acquired by filtering known volumes of water through pre-weighed 0.45 µm membrane filters (Millipore). The filters were rinsed with 10% nitric acid before use and each sample was filtered using the filtration procedure described above. After the sample was filtered and the filtrate removed, the upper compartment of the filtration apparatus and the filter were rinsed with approximately 20 mL of deionised water to remove any salt. The filters were placed into acid-washed plastic Petri slides and stored frozen. The filters were transferred to the CSIRO Lucas Heights laboratories, after which they were oven-dried at 60°C, cooled to room temperature in a desiccator, and weighed. This procedure was repeated three times to ensure the mass was consistent, after which, the filters were stored at room temperature until total recoverable (TR) metals analysis was performed. The TSS concentration (mg/L) of the water samples was calculated using the difference in the mass of the filter before and after filtration divided by the volume of sample filtered.

- Analysis of dissolved metals

Dissolved Cd, Co, Cu, Ni, Pb and Zn in filtered samples were analysed by complexation and solvent extraction prior followed by quantitation of the pre-concentrated metals by ICPMS. The extraction procedure allowed the pre-concentration of metals by a factor of 25, thus allowing more accurate quantification. A dithiocarbamate complexation/solvent extraction method based on the procedure described by Magnusson and Westerlund (1981) was employed. The major differences were the use of a combined sodium bicarbonate buffer/ammonium pyrrolidine dithiocarbamate reagent (Apte and Gunn, 1987) and 1,1,1-trichloroethane as the extraction solvent in place of Freon. In brief, sample aliquots (250 mL) were buffered to pH 5 by the addition of the combined reagent and extracted into two 10-mL portions of triple-

distilled trichloroethane. The extracts were combined and the metals back-extracted into 1 mL of concentrated nitric acid (Merck Tracepur). The back extracts were diluted to a final volume of 10 mL by addition of deionised water and analysed by inductively coupled plasma-mass spectrometry (ICPMS) (Agilent, 7500CE) using the instrument operating conditions recommended by the manufacturer. For quality control purposes a portion of the certified reference seawater NASS-6 (National Research Council (NRC), Canada) CRM was analysed in every sample batch.

Dissolved aluminium and iron concentrations were measured directly on portions of acidified filtered waters by ICP-AES (Varian730 ES) using matrix-matched standards. The concentrations of dissolved chromium were measured directly by ICP-MS (Agilent 7500CE) following three-fold dilution with deionised water and calibration against matrix-matched standards.

The concentration of dissolved arsenic in the filtered samples was measured by hydride generation atomic absorption spectrometry (HG-AAS), using procedures based on the standard methods described by APHA (1998). Samples were first digested by addition of potassium persulfate (1% m/v final concentration) and heating to 120°C for 30 min in an autoclave. Hydrochloric acid, (3 M final concentration) was then added to the samples. Pentavalent arsenic was then pre-reduced to arsenic (III) by addition of potassium iodide (1% (m/v) final concentration) and ascorbic acid (0.2% (m/v) final concentration) and left standing for at least 30 min at room temperature prior to analysis. Arsenic concentrations were then measured by HG-AAS using a Varian VGA system operated under standard conditions recommended by the manufacturer. Arsenic (III) in solution was reduced to arsine by reduction with sodium borohydride, which was stripped from solution with argon gas into a silica tube, electrically heated at 925°C. Heating converted arsine into arsenic vapour, which was quantified by atomic absorption spectrometry.

For quality control purposes a portion of the certified reference seawater NASS-6 (National Research Council (NRC), Canada) CRM was analysed in every sample batch.

DOC was measured on aliquots of filtered samples collected during the June 2018 survey using a Shimadzu TOC-LCSH Total Organic Carbon Analyser using the procedures recommended by the manufacturer.

- Analysis of metals bound to total suspended solids (TSS) and benthic sediment
The TSS and benthic sediment was digested in pre-cleaned Teflon digestion vessels using aqua-regia digestions in a microwave-assisted reaction system (MARS). The membrane filters containing the suspended sediments or known quantities of dry benthic sediment were transferred into the MARS digestion vessels and subjected to pressurised digestion. The method involved adding 2.5 mL of concentrated nitric acid (Tracepur, Merck) and 7.5 mL of concentrated hydrochloric acid (Tracepur, Merck) to each digestion vessel and heating at high pressure in a MARS digestion system for 90 minutes. Once cool, the digest vessels were vented followed by dilution of the digest to a final volume of 40 mL using deionised water. The masses of the empty vessel, the vessel plus sample, and the vessel plus sample and acid mixture before and after heating were recorded to allow calculation of a dilution factor used in the determination of metal concentrations in the initial undiluted sample. For quality control purposes, portions of the certified reference sediments ERM-CC018 (IRMM) and PACS-3 (NRC Canada) were analysed in each sample batch.

Format:

This dataset consists of multiple Comma Separated Value (CSV) tables containing the data provided by the project team.

Data Location:

This dataset is filed in the eAtlas enduring data repository at: data\NESP-TWQ-2\2.2.2_TS-mine-pollution

Metadata language

eng

Character set

UTF8

Hierarchy level	Dataset
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OnLine resource

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Protocol	WWW:LINK-1.0-http--related
Linkage	https://maps.eatlas.org.au/maps/wms
Protocol	OGC:WMS-1.1.1-http-get-map

Point of contact

Individual name	Apte, Simon, Dr
Organisation name	CSIRO Land and Water
Role	Point of contact
Topic category	Biota

Extent

Description	Torres Strait, Australia
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Geographic bounding box

West bound	143.402
East bound	142.079
South bound	-10.607
North bound	-9.217

File identifier	c026de9e-bff4-4268-ad44-7c2e9bece110
Metadata language	eng
Character set	UTF8

Metadata author

Individual name	eAtlas Data Manager
Organisation name	Australian Institute of Marine Science (AIMS)
Role	metadataContact
Date stamp	2019-05-13T03:32:24