Estimating input of mercury from historical local sources and long range transport into the coastal marine system of Kongsfjorden, Svalbard

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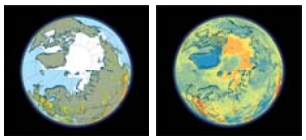
Contaminants present in coal mine tailings are transported from the mine location to the marine ecosystem by fresh water runoff. Organisms take up these contaminants via water and sediment. As contaminants move through the food web, they become more concentrated at higher trophic levels. Mercury (Hg) is found to accumulate in top predators of the Arctic ecosystem in levels that can affect the functioning of organisms. Mercury in the Arctic environment also originates from global sources due to long-range transport. The main global sources of mercury emissions to air are coal fired power stations and small scale gold mining (map 1).

Map 1: Global mercury emissions 2010 (AMAP/UNEP 2013)



Mercury emissions (left) and deposition (right) (emissions: F. Steenhuisen AMAP/UNEP 2013, depositions: MSC-E 2013)

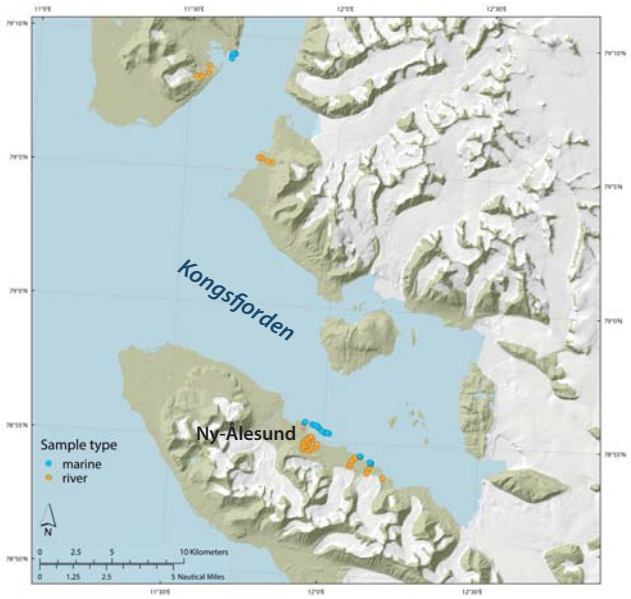
Introduction

Pilot studies have found elevated Hg levels in terrestrial samples in the historic mining area of Ny-Ålesund, Kongsfjorden, Svalbard. Hg in mining piles and tailings enters the marine ecosystem through the melt water streams. Marine organisms now have access to these contaminants via water and sediment.

This project is aimed at comparing mercury levels nearby to, and further away from, the coal mine near Ny-Ålesund to distinguish between the contribution of mining-related Hg pollution and the deposition of long-range atmospheric transport of mercury in the Arctic coastal marine system. Polycyclic Aromatic Hydrocarbons (PAHs) are needed to underpin and support these findings.

Objectives

1. Assess the concentrations of Hg and PAHs in marine and river sediments near and away from mining run off sites;
2. Assess Hg and PAH concentrations in marine invertebrates at or near the marine sediment sampling sites;
3. Gain insights into the relative contribution of local and global sources of Hg and PAH contamination by comparing impacted and non-impacted sites.



Map 2: Sampling sites of marine and river sediments July 2017

Sampling river sediment (top), melt water streams east of Ny-Ålesund (bottom)

Methods

Sampling took place in July 2017 in Kongsfjorden, Svalbard. Sediments were collected in melt water streams and in the fjord near the coal mine of Ny-Ålesund. Marine benthic organisms were collected near the outflow of these melt water streams. Similar samples were taken on two control sites further away from the mining site (map 2).

River sediment was sampled using sediment cores, marine sediment using a Van Veen grab, and marine biota by sieving additional marine sediment. Hg samples were stored in plastic jars, PAH samples were stored in glass jars.

Analysis of Hg and PAH in the collected samples is currently being conducted by the laboratory of Wageningen Marine Research.
The relative contribution of local and global sources of Hg and PAH contamination will be assessed by comparing the mine site and the control sites.

Biota samples (*Astarte borealis*) (left), sampling from the stern deck of mv Teisten (right)

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