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Title: Heavy Metal Monitoring in Sediments of the North Alaskan Arctic

Abstract: Total Hg and methyl Hg in gross surficial sediments, and a suite of heavy metals (Cu, Cr, V, Ni, Zn, Sn, As, Cd, Ba, Mn and Fe) in the mud fraction (<62 μm size) of sediments were analyzed on samples collected from the urbanized Elson Lagoon adjacent to Barrow Village, industrialized Colville Delta-Prudhoe Bay, and relatively pristine Beaufort Lagoon adjacent to the Arctic National Wildlife Refuge, Beaufort Sea, north Arctic Alaska. Comparison of the mean concentrations of the metals at approximately 10-year intervals (1977, 1986, 1997), within the Colville Delta-Prudhoe Bay shows significantly increased concentrations of V in 1986 and 1997 from 1977 and an increase in Ba from 1986 to 1997. The sources of V and Ba contaminants are unknown. The mean concentrations of V, Cr, Ni and THg in Elson Lagoon, and V in Beaufort Lagoon are significantly higher ($p < 0.05$) than in the Colville Delta-Prudhoe Bay. Higher concentrations of V, Cr, Mn, and Zn are also noted in Elson Lagoon compared to the Beaufort Lagoon. The higher concentrations of metals in the Elson Lagoon could be due to relatively greater anthropogenic contaminant input from local sources, lower sedimentation rates, and/or focused deposition of contaminants from long-distance atmospheric transport originating from Eurasia. The levels of all metals in the study areas are below or similar to those in unpolluted marine sediments. The geochemical partitioning of selected metals was deduced from metal analyses in the lithogenous and non-lithogenous sediment fractions. Of the total contents ~50% of Mn, 25-35% Co, 15-20% Zn, Cu and Ni, 10% of V and Fe and < 3% of Cr are bound in the non-lithogenous phase, presumably in organic matter, clays and Fe-Mn oxide/hydroxides. In contrast, almost all of Cr, Cd and Ba are lattice-held, and < 1% of Hg is methylated. In summary, the nearshore of Alaska's North Slope has remained a relatively clean environment, as far as sediment trace metals are concerned, despite the accelerated anthropogenic activities and urbanization there during the past 30 years.

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