Long-term dispersion and availability of metals from submarine mine tailing disposal in a fjord in Arctic Norway

Mining of Cu took place in Kvalsund in the Arctic part of Norway in the 1970s, and mine tailings were discharged to the inner part of the fjord, Repparfjorden. Metal speciation analysis was used to assess the historical dispersion of metals as well as their potential bioavailability from the area of the mine tailing disposal. It was revealed that the dispersion of Ba, Cr, Ni, Pb and Zn from the mine tailings has been limited. Dispersion of Cu to the outer fjord has, however, occurred; the amounts released and dispersed from the mine tailing disposal area quantified to be 2.5-10 t, less than 5% of Cu in the original mine tailings. An estimated 80-390 t of Cu still remains in the disposal area from the surface to a depth of 16 cm. Metal partitioning showed that 56-95% of the Cu is bound in the potential bioavailable fractions (exchangeable, reducible and oxidisable) of the sediments, totalling approximately 70-340 t, with potential for continuous release to the pore water and re-precipitation in over- and underlying sediments. Surface sediments in the deposit area were affected by elevated Cu concentrations just above the probable effect level according to the Norwegian sediment quality criteria, with 50-80% Cu bound in the exchangeable, reducible and oxidisable fractions, potentially available for release to the water column and/or for uptake in benthic organisms.

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