Near-shore tailings deposition in Ballangen Fjord, Norway: A look into Ni and other toxic element release rate in a shallow sea environment and its potential for Ni recovery

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In Ballangen, Norway, mine tailings from the closed Råna Nickel-olivine mine were discharged in the nearby Ballangen Fjord, covering old high sulfide containing mine tailings from a massive sulfide deposit. A tailings dam was built in the inner part of the fjord filling the old tidal flats that also contain an older tailings deposit. The leaching of metals especially Ni and other toxic elements into the fjord is a major threat to shallow sea and bottom dwelling organisms in the area. To determine the rate of release of Ni and other potential toxic elements into the surrounding ecosystem, column experiments using the old tailings obtained from a depth of 8 to 40 cm from different locations within the tailings deposit, beach sand, and stream bed sample from a nearby creek were conducted for 40 weeks. A column containing the same material that has been running for over 150 weeks was also used to compare long-term reaction rates. Initial results from the recent kinetic testing show that the beach sediments have the highest and almost constant TDS followed by the middle portion of the dumpsite and the stream sediment sample. Tailings on the west side have clearly higher pH in the range of 5 to 7 while those on the east side are more acidic with pH of 3 to 4. All the metals analysed (Ni, Cu, Mn and Fe) decrease in concentration in time. Current data suggests Cu and Mn are highest in the stream sediment, while the middle part of the dumpsite close to the stream has elevated Ni and Fe. Elevated Mg concentration in the leachates collected suggests significant weathering of olivine. Based on the long-term data for 150 weeks it was observed that Ni release generally increased as pH decreased. From the Ni leaching rates observed, the possibility for Ni recovery from mine tailings is not unlikely. The interplay of spatial variation, mineralogy of the material and groundwater movement play a significant role in the resulting leachate chemistry.