Interactions between algal-bacterial populations and trace metals in fjord surface waters during a nutrient-stimulated summer bloom - DTU Orbit (21/08/2019)

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We examined how variations in algal-bacterial community structure relate to Cu, Zn, and Mn speciation during a diatom-rich bloom that was induced by daily additions of inorganic macronutrients to fjord waters in August 2002. The experiments were carried out in 11-m³ floating mesocosm bags deployed in the Rauneljord, near Bergen, Norway, and operated in a chemostat (flow-through) mode. Copper speciation was controlled by the formation of very strong organic complexes (log K₁' = 15.2-15.8; log K₂' = 13.0-13.4) whose likely source was the cyanobacterium Synechococcus sp. Strong ligand concentrations were comparable to dissolved Cu levels. This covariation kept the free Cu²⁺ concentration within the range of 10⁻¹².4 to 10⁻¹¹.2 mol L⁻¹, i.e., below the toxicity threshold for Synechococcus. Weaker ligands (log K₃' = 8.2-9.4) were released during-and up to 4 d following-the exponential growth of algae. During this period, the weaker Cu-binding ligands appeared to have the same source or production process as the proteinlike fluorophores detected in these coastal waters. Zinc speciation was controlled by complexation with a single class of organic ligands that appeared to be released inadvertently upon the death and/or grazing of phytoplankton. Labile manganese fluctuations were inversely synchronized with the abundance of heterotrophic bacteria until the coastal waters experienced a massive rain event on day 17 of the experiment. The rainfall, which was a source of nitrogen and micronutrients, appeared to stimulate the growth of larger cells (diatoms) but to inhibit that of the smaller cells (heterotrophic bacteria and cyanobacteria).

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