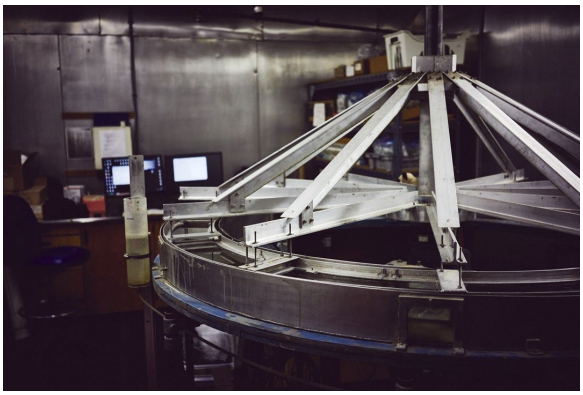
Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35450



Sediment biostabilization implications on resuspension: microbial control of particulate/pollutant mobility

TOM REID, RENEE MCFADYEN AND REZA VALIPOUR
Environment and Climate Change Canada

Sediments act as both sinks and potential sources of particulate pollutants, including nutrients, legacy contaminants, and emerging materials such as microplastics. The remobilization of these materials is governed by sediment resuspension, a threshold-driven process controlled by hydrodynamic forcing and sediment properties. Increasingly, biological processes—particularly biofilm development—are recognized as critical regulators of sediment stability. Biofilms enhance bed cohesion, increasing resistance to erosion, thereby altering the critical shear stress required for resuspension. This biostabilization introduces temporal variability in sediment erodibility, with important implications for the timing and magnitude of particulate pollutant release to the overlying water column.

Despite the importance of these processes, resuspension dynamics remain poorly constrained within loading models, which often rely on static or poorly parameterized erosion thresholds. This limits our ability to accurately quantify internal loading and predict the transport and fate of particulate-associated contaminants across environmental compartments.

In this study, we experimentally simulate and characterize sediment resuspension dynamics from two large lake systems using controlled laboratory erosion experiments designed to quantify critical shear stress, erosion rates, and suspended particulate flux. We evaluate how sediment properties and biofilm-mediated stabilization influence erosion thresholds and resuspension magnitude. These measurements are used to re-parameterize resuspension metrics within loading frameworks, enabling improved estimates of particulate-associated nutrient and contaminant flux from sediments to the water column.

Our results demonstrate that sediment stability is temporally dynamic and strongly influenced by biological stabilization, resulting in measurable variability in resuspension susceptibility in the time after sediment deposition. These findings highlight the need to incorporate biologically mediated sediment stabilization into predictive models of particulate transport. Improving representation of resuspension dynamics will enhance our ability to quantify internal loading, understand the mobility of particulate pollutants, and predict ecosystem responses to physical disturbance. This work provides a mechanistic link between biological stabilization, physical resuspension processes, and biogeochemical cycling, with implications for managing water quality and contaminant transport in large aquatic systems.