Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.36952

Tracking the Environmental Journey of Trace Elements by Integrating Biogeochemistry and Hydrological Context

LENNY H.E. WINKEL

Eawag, Swiss Federal Institute of Aquatic Science and Technology, ETH, Swiss Federal Institute of Technology

Functioning as either essential micronutrients or potent toxicants, trace elements carry significant implications for environmental and human health. Understanding their distribution requires decoding their biogeochemical cycles, which inherently depends on bridging microscopic molecular interactions with macroscopic transport processes, a key aspect of Professor Laurent Charlet's pioneering research. Studying an element or its speciation in isolation provides merely a static snapshot, often obscuring the dynamic mechanisms that actually govern its mobility and complex environmental pathways.

To better follow the biogeochemical journey of trace elements and predict their distributions, we must integrate elemental and biogeochemical data with broader environmental data. In this presentation, the coupling of trace element biogeochemistry with macroscopic environmental processes will be discussed, with a specific focus on the water cycle, which can act as a primary driver of transport and helps to elucidate environmental pathways. Echoing Laurent Charlet's interdisciplinary approach, this presentation demonstrates that by integrating hydrological, hydrochemical and isotopic signatures with trace element biogeochemistry, we can significantly expand our knowledge of their residence times and environmental distributions, with examples for groundwater systems and the atmosphere. Ultimately, learning more about where these elements occur and in what forms allows us to better understand their broader impacts on environmental and human health.