Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.38410

The Anthropogenic Salt Cycle and Its Impacts on Earth's Future - *Earl Ingerson Lecture*

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Salinization is a growing agent of global change that causes a constellation of geochemical and biogeochemical impacts in the natural and built environment. Symptoms of salinization include contaminant mobilization, formation of harmful chemical cocktails, loss of biodiversity, corrosion of infrastructure, decreased drinking water safety, increased human health risks, and more. Direct and indirect impacts of salinization can be diagnosed holistically as the Freshwater Salinization Syndrome (FSS). FSS refers to the interrelated suite of impacts on multiple biological, physical, geological, and chemical systems. We explore the development and expansion of the FSS concept from studies of increased salinization in freshwaters during the past century to the rapidly increasing magnitude and scope of FSS on regional, continental, and global scales in a saltier future. We illustrate how multiple salt ions are increasing due to human activities and acting as agents of global change across different Earth systems (land, air, and water) leading to the emergence of the anthropogenic salt cycle. We explore pathways along an altered anthropogenic salt cycle and its cascading effects on the environment, infrastructure, and human health. We discuss the combined risks of freshwater salinization from land and saltwater intrusion from the sea in a saltier future. Finally, we illustrate how different salt ions and salty chemical cocktails (novel mixtures of elements mobilized by and associated with salt ions) can be geochemical tracers of opportunity for tracking watershed pollution sources, evaluating river restoration efforts, and revealing physical, chemical, and biological processes controlling the fate and transport of multiple chemical elements and pollutants from land to sea.