Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.32155

Selenium Speciation in Hyperaccumulating Desert Plants from an Abandoned Uranium Mine (Arizona, USA)

CLARA CHANG[1], RONALD GLABONJAT[2], KATHRIN SCHILLING[3], DAVID TIBBITS[4], SEAN KINNEY[1], ADAM MARSH[5], GILBERT JOHN[6], ANA NAVAS-ACIEN[3] AND ANIRBAN BASU[3]

[1]Lamont Doherty Earth Observatory, Columbia University
[2]Mailman School of Public Health, Columbia University
[3]Mailman School of Public Health, Columbia University
[4]Rutgers University
[5]Petrified Forest National Park
[6]Colorado State University

Selenium (Se) is an essential micronutrient for many life forms, including humans, but toxic at high levels. While not required for plant growth, Se helps plants withstand UV, salinity, and heavy metal stress. However, excessive Se can be harmful, leading to growth inhibition and even plant death. Some plant species not only thrive in Se rich soil environments but also accumulate Se in their aboveground tissues at levels reaching 0.1% of their dry weight. These hyperaccumulating plants appear to have evolved unique metabolic pathways and possess mechanisms that distinguish Se from its analog sulfur (S). Here, we describe a plant specimen of *Ericameria nauseosa* collected from an abandoned uranium (U) mine in Arizona, USA. This specimen exhibits exceptionally high Se concentrations (~2.0% of dry weight). Notably, this specimen has also accumulated high concentrations of U in its aboveground tissues (~0.05% of dry weight). *E. nauseosa* was growing in close proximity to two other plants, *Halogeton glomeratus* and *Atriplex canescens,* which also exhibit high concentrations of Se in aboveground tissues (~0.2% and ~0.07% respectively), although to a lesser extent compared to *E. nauseosa*. To understand the mechanisms by which these plants concentrate Se and remain resistant to its toxicity, we conducted sequential extractions to analyze Se speciation (e.g., inorganic, methylated, or protein bound) between different plant specimens and between plant parts. In *E. nauseosa*, we found the highest Se concentration in the flowers, followed by the leaves, stems, and roots. However, in *A. canescens* we found the highest Se concentration in the stem, followed by the seeds and leaves. Our findings reveal three common plant species with Se hyperaccumulating traits, which appear to metabolize Se in different ways. These findings are significant because these plants may expose humans and livestock to toxic levels of Se. *E. nauseosa* and *A. canescens* are common food for livestock and are used in traditional medicine**.** It is crucial to better understand Se cycling in plants, not only to ensure adequate Se intake for human health, but also to prevent exposure to toxic Se levels.