Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.35103

DOM-driven uraninite dissolution: resolving fraction-specific rates, U(IV)-binding, and complex reactivity by LC-ICPMS

CHRISTIAN DEWEY AND MERISSA MOREY
University of Delaware

Uranium mobilization from reduced soils and sediments is generally attributed to oxidation of U(IV) to U(VI). In this framework, sparingly soluble reduced phases – uraninite or U(IV) adsorbed to particulate organic matter – are converted to highly soluble uranyl carbonato and hydroxo complexes upon exposure to oxidizing conditions. However, this framework does not account for the role of organic ligands in promoting U(IV) dissolution and aqueous stabilization without oxidation. While previous work has examined U(IV) dissolution and stabilization by siderophores, little is known about how DOM – a far more abundant and molecularly complex ligand pool – interacts with U(IV), or about the reactivity of resulting complexes. Here, using LC with online triple quadrupole ICP-MS, we (1) resolve uraninite dissolution rates by individual DOM fractions; (2) determine the stability of U(IV)-DOM complexes against cation displacement; and (3) quantify oxidation rates of U(IV) bound to DOM. Our results indicate that DOM can dissolve uraninite and stabilize U(IV) in solution under reducing conditions, challenging the assumption that oxidation is required for U mobilization.