

Uranium mobility and stability within organic-matter rich sediments: Implications from deposit formation to waste disposal

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The mobility and stability of uranium (U) is influenced by its oxidation state and the availability of competing ions. Where U(IV) forms complexes with ionic ligands they tend to have limited solubility, in contrast U(VI) complexes (as UO_2^{2+} ions) have varying degrees of solubility and mobility. In addition to inorganic ligands, organic matter (OM) is showing increasing importance in terms of its ability to influence both the mobility and stability of U; whether OM is dissolved or particulate [1]. Drawing on samples analysed from natural deposits (spec. Mulga Rock (MR), WA, 65Mt U_3O_8), coupled with additional laboratory studies, U may be finely dispersed within OM and/or precipitate as discrete minerals [2],[3]. Synchrotron analyses of MR bulk samples revealed that 70% of total U was as U(VI) [4]. Further investigation in the form of a column experiment revealed that the uptake of mobile U(IV) by OM is rapid and can occur without reduction to U(IV) [5]. Another synchrotron study, which revealed rims of U(IV) coffinite around framboidal pyrite situated within OM samples, indicated that although bacteria cannot be ruled out, pyrite is likely a factor in U(VI) to U(IV) reduction [6]. Rather than U stability occurring through OM reduction pathways, these studies point to: 1) U may be stable within the OM matrix without reduction; and 2) that other factors within the OM matrix may be responsible for U reduction. Understanding why and how U accumulates with OM has relevance to all stages of the U-nuclear lifecycle from deposition, exploration, extraction, remediation and the long-term storage of wastes.

REFERENCES

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