Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30806

Enhancing Environmental Monitoring of Radioactive Contaminants: Advances in DGT and Isotope Geochemistry

DR. JOSSELIN GORNY[1], ALKIVIADIS GOURGIOTIS[1], CHARLOTTE LAFONT[1], CLÉMENTINE SAPEY[1], CYRIELLE JARDIN[1], OLIVIER DIEZ[1], LAURELINE FÉVRIER[2], FRÉDÉRIC COPPIN[2], CAROLINE SIMONUCCI[1], STEFFEN HAPPEL[3], JOSEP GALCERAN[4], CLAIRE VOISEUX[5] AND CLAIRE GODINOT[5]

[1]Autorité de sûreté nucléaire et de radioprotection (ASNR) – PSE-ENV/SPDR/LT2S, PSE-ENV/SIRSE/LER-NORD F-92260, Fontenay-aux-Roses, France.

[2]Autorité de sûreté nucléaire et de radioprotection (ASNR), PSE-ENV/SPDR/LT2S, F-13115, Saint-Paul-lez-Durance, France

[3]TrisKem International

[4]Departament de Química, Física i Ciències Ambientals i del Sòl, Universitat de Lleida and AGROTECNIO-CERCA, Rovira Roure 191, 25198, Lleida, Spain

[5]Autorité de sûreté nucléaire et de radioprotection (ASNR) - PSE/ENV/STAAR/LRTA, F-50130, Cherbourg-en-Cotentin, France.

Detection of minor uranium isotopes (^{234}U, ^{235}U, ^{236}U) and ^{129}I at ultra-trace levels is crucial for environmental monitoring to delimitate contaminated sites and identifying contamination sources. Minor U isotopes help to distinguish anthropogenic from natural inputs, while ^{129}I mainly originates from nuclear activities such as fuel reprocessing and global fallout. Sampling techniques like Diffusive Gradients in Thin-films (DGT) can preconcentrate these isotopes from soil, sediment, or water, enhancing sensitivity for ultra-trace analysis, like Inductively Coupled Plasma Mass Spectrometry (ICP-MS). The selective binding of DGT isolates U and I isotopes from the sample matrices, aiding accurate isotope ratio measurements by limiting analytical interference from organic matter and other major elements of the matrices. Unlike individual measurements (traditional sampling and preconcentration methodologies), this integrative technique enables continuous monitoring, improving the detection of variations over time enhancing, thus, radiological assessment reliability.

Since the 2020s, we have evaluated DGT performance by testing the well-known binding gels against their chelating power and we developed new ones to improve their specificity for U isotopes and to open perspectives for I isotopes. Ours works also contributed to extend sampling duration and to improve the detection of minor isotopes with a specific redox state *i.e.*, U(VI) and I(-I). This presentation will highlight the methodology for selecting and using the optimal uranium sensor and its environmental application in source identification [1]. Additionally, results for iodide detection [2] and perspectives on long-term monitoring will be discussed.

Finally, the presentation will show how these procedures can be integrated into nuclear safety and radiation protection monitoring to strengthen radiological oversight.

References:

[1] Gorny, Lafont, Sapey, Happel, Gourgiotis, Février, Galceran, Analytica Chimica Acta, 2024, 343266.

[2] Gorny, Jardin, Diez, Galceran, Gourgiotis, Happel, Coppin, Février, Simonucci, Cazala, Analytica Chimica Acta, 2021, 1177, 338790.