

SIMS 7F: Enhance radiation protection with insights into processes and origins

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▶ To cite this version:

David Suhard, Yann Guéguen, Alkiviadis Gourgiotis, Céline Bouvier-Capely. SIMS 7F: Enhance radiation protection with insights into processes and origins. 24th International Conference on Secondary Ion Mass Spectrometry, Sep 2024, La Rochelle, France. . irsn-04700856

HAL Id: irsn-04700856 https://irsn.hal.science/irsn-04700856v1

Submitted on 18 Sep 2024 $\,$

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SIMS 7F:



Enhance radiation protection

with insigths into processes and origins

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Obtaining information on the origin and transfer mechanisms of radionuclides in the environment, as well as their fate in the human body in the event of internal contamination, is an important requirement for enhancing radiation protection. To this end, the CAMECA SIMS 7FE7 instrument is used to characterize the elemental and isotopic distribution in environmental and biological matrices. BIOLOGY ENVIRONMENT Soils and sediments near former uranium mining sites often contain elevated levels Uranium (heavy metal) has both chemical and radiological toxicities and accumulates of uranium and its decay products compared to the local geochemical background preferentially in kidneys (proximal convoluted tubules or PCT) and bones leading nephrotoxicity (after acute exposure) High uranium content (and its decay products) in soils and sediments, comparable Precipitates in the cytoplasm revealed by Transmission Electron Microscopy (TEM) to mining activities may also result from natural weathering/erosion of the local in cells bedrock Weathering and erosion

cytoplasm

Uranium precipitates in

cytoplasm (TEM)

nuclei

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Objective

Detection and localisation of uranium in various physical forms from tissue to cellular scale

➔ Contribute to studies on the incidence of the development of kidney cancer in case of occupational exposure to uranium

Objective

Identify the sources and transfer/transport mechanisms of radioactive elements

J mining activitie

Tailing

storage

Radioactive mining

contaminations

Processing

plant

Crucial for decision-making, management, and remediation of contaminated areas

SAMPLES PREPARATION



RESULTS



CONCLUSIONS		REFERENCES
U heterogeneous distribution in rodent renal tissue	Confirmation of the presence of a U-rich phase from solid sample	Carrière et al, (2008). Transmission electron microscopic and X-ray absorption fine structure spectroscopic investigation of U repartition and speciation after accumulation in renal cells. Journal of Biological Inorganic Chemistry
Preferential localisation of U in the PCT nucleus confirmed by studies on	Identification of two Pb isotope ratios (²⁰⁶ Pb/ ²⁰⁸ Pb)	Yann Guéguen et al, (2015). Low-dose uranium enters the HepG2 cell nucleus rapidly and induces cell stress response. <u>Toxicology in Vitro</u>
cell culture and organoids		David Suhard et al, (2018). Intracellular uranium distribution: Comparison of cryogenic fixation versus chemical fixation methods for SIMS analysis, <u>Microscopy research and Technique</u>
In provide micro distribution of radionuclides for a better understanding of radionuclides transfer/transport mechanisms	Io characterize contamination origin (anthropogenic or natural) based on lead isotope signatures	Tingting Geng et al, (2024). Unveiling the origins and transport processes of radioactive pollutants downstream from a former U-mine site using isotopic tracers and U-238 series disequilibrium. Journal of Hazardous Materials
SIMS 7F is a valuable tool for radiation protection research in the environmental as well as biological fields		Aurélien Beaumais et al, (2022). Combined U-Pb isotopic signatures of U mill tailings from France and Gabon: A new potential tracer to assess their fingerprint on the environment. Journal of Hazardous Materials





