PhD POSITION (M/F)

Dynamics and chronology of a giant uranium system

The McArthur River-Yalowega-Close Lake corridor, southeastern Athabasca Basin

GeoRessources · Vandœuvre-lès-Nancy · France

CONTRACT	Full-time, fixed-term PhD contract · 36 months
START DATE	15 October 2026
SALARY	€2,300 gross per month
DEADLINE	24 September 2026 at 23:59
REFERENCE	UMR7359-JULMER-013

A project within the CREGU joint laboratory

A joint laboratory bringing together CNRS, Université de Lorraine and Orano, hosted by GeoRessources. Industrial supervision and fieldwork support provided by Orano and Cameco.

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This position is open to applicants with officially recognised disabled worker status.

Research background and objectives

Unconformity-type uranium deposits are a key research target for the CREGU joint laboratory (CNRS-Orano-Université de Lorraine) due to their status as a significant uranium source for the nuclear industry. Current production is concentrated in the Paleoproterozoic to Mesoproterozoic Athabasca Basin in Canada. These deposits are actively explored and mined at the interface between the basin and the underlying basement, as they contain substantial tonnages and, crucially, average uranium grades that can exceed 15%, as at Cigar Lake and McArthur River. The formation of such geochemical anomalies required the convergence of highly efficient physical and chemical processes, a subject academic researchers have been investigating for over 60 years.

The widely accepted metallogenic model considers that these deposits formed between 1.7 and 1.2 billion years ago through large-scale circulation of basin-derived fluids into structural and physicochemical traps located at the intersection between basement-rooted graphitic structures (known as graphitic conductors) and the Athabasca Basin unconformity. The deposits are spatially associated with the basin-basement unconformity and linked to the structural framework, fluid flow pathways, physical properties of the host rocks and precipitation mechanisms operating in this zone.

The formation of these hydrothermal deposits at this interface involved intense fluid circulation, evidenced today by clay alteration halos extending over several kilometres in both the basement and the basin around the uranium mineralization. These alteration patterns vary between and within deposits, with major phases (clays) and minor phases (sulfides, carbonates, APS minerals, etc.) developed to different extents. These phases record the differential mobility of elements such as K in illite, Mg in chlorite and B in tourmaline, controlled by changes in physicochemical conditions at the interface over time.

Although these hydrothermal markers are broadly spatially associated with uranium mineralization, they remain underused in characterizing the formation and evolution of unconformity-type uranium deposits and in explaining variations in uranium tonnage and grade between altered zones of the basin. These differences challenge the current metallogenic model, which assumes similar timing and genetic conditions throughout the basin. The genetic relationships between mineralizing hydrothermal episodes, specific structural settings, successive fluid events and different hydrothermal mineral assemblages remain poorly understood.

In this context, the aim of this PhD is to establish the dynamics and chronology of formation of the basin's most emblematic hydrothermal and mineralized system: the McArthur River-Yalowega-Close Lake corridor in the southeastern Athabasca Basin.

The three research objectives

The PhD project comprises three complementary research objectives:

Objective 1 · Mineralogical and physicochemical characterization of the regional alteration halo surrounding the McArthur River-Yalowega-Close Lake corridor

This objective aims to develop an evolutionary model of the hydrothermal events that affected the southeastern Athabasca Basin and produced the present regional alteration halo. The model will draw on the study of the different hydrothermal mineral phases, their spatial distribution and their paragenetic relationships in relation to the distribution of uranium mineralization.

Objective 2 · Characterization of the structural controls and their relationships with mineralization and hydrothermal alteration at corridor scale

This objective will investigate potential changes in the nature and properties of structures along the corridor, in relation to the variations in hydrothermal alteration and mineralization established in Objective 1. It will focus on several fault zones through structural analysis of drill core and characterization of hydrothermal alteration and mineralization associated with different structural types and sets.

Objective 3 · Dating of hydrothermal and mineralizing events and development of a conceptual model for the formation and evolution of the McArthur River-Yalowega-Close Lake uranium-mineralized corridor

The aim is to provide absolute age constraints on the structural, hydrothermal and mineralizing episodes identified in Objectives 1 and 2, and thereby determine the key geological events and settings responsible for the development of this world-class corridor. Several in situ geochronological methods will be tested: Rb-Sr on micas and associated alteration products; K-Ar and/or Ar-Ar on illite; U-Pb on phosphates, carbonates and TiO_2; and U-Pb on uranium oxides.

Research area

Earth and terrestrial planets: structure, history and models

Research environment

The PhD will be conducted primarily at the GeoRessources laboratory in Nancy. It will be supervised by Julien Mercadier (CNRS Research Director) and Gaétan Milesi (Associate Professor, Université de Lorraine). The project will be integrated into the CREGU joint laboratory (Centre for Research and Study of Uranium Deposits), a partnership between Orano, CNRS and Université de Lorraine, hosted by GeoRessources.

The work will benefit from additional supervision by the industrial partners, Orano and Cameco, with regular progress meetings. Several field campaigns lasting several weeks each are planned in Canada to undertake structural measurements, mineralogical characterization and sampling, with support from both industrial partners.

The research will utilize analytical facilities at GeoRessources and partner laboratories. Instruments will be used to characterize minerals (optical and electron microscopy, µXRF and XRD), determine chemical compositions (electron microprobe, µXRF, LA-ICP-MS and whole-rock geochemistry) and isotopic compositions (LA-ICP-MS and SIMS), and date mineral formation (LA-ICP-MS, SIMS and argon mass spectrometry).

Candidate profile

The successful candidate will have recently completed a Master's degree in geosciences, preferably with a focus on hydrothermal and/or metal-bearing mineralized systems. Experience in structural measurements on drill core and processing the resulting data is expected, along with a solid grounding in mineral identification, characterization and analysis using microscopy. The ability to synthesize information and an aptitude for literature-based research are prerequisites.

Proficiency in laboratory methods and techniques for investigating hydrothermal fluid circulation in the geological settings considered would be an asset. The candidate should enjoy teamwork within an academic-industrial project involving English-speaking scientists. A strong command of spoken and written English is essential. The candidate must be able to work independently, take initiative and propose new ideas.

Salary and benefits

Salary: €2,300 gross per month.
Annual leave and working-time reduction days (RTT): 44 days in total.
Remote working: arrangements and associated allowance.
Transport: 75% reimbursement of transport costs and a sustainable mobility allowance of up to €300.

Constraints and risks

None specified.

Source and application

CNRS vacancy UMR7359-JULMER-013, checked on 9 September 2026.
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