

# THE ROYAL MUSEUM FOR CENTRAL AFRICA

is hiring a

Research Assistant (f/ m / x)

## Context

**Characterizing mining-induced environmental changes (MIEC) in Eastern DRC using remote sensing: multi- & hyperspectral analysis and machine learning applications**

*Characterisation of mining-induced environmental change (MIEC) in eastern DRC using remote sensing: multi- and hyperspectral analysis and machine learning applications*

The RMCA and ITC are launching a call for applications for a researcher to carry out a PhD, which is an integral part of the EDITOR project funded by the [STEREO-IV](#) programme of the Belgian Science Policy (Belspo): "[Environmental hazards associated with mining activities in the tropics](#)", which began in March 2024.

In order to benefit from the expertise of both partner institutions, the PhD will alternate between the RMCA (2 years) and the ITC (2 years), and will be registered with the University of Twente's doctoral school.

**Host institute 1:** Royal Museum for Central Africa, Department of Earth Sciences, Geodynamics and Mineral Resources Department & Natural Hazards Department, Tervuren, Belgium

**Host institute 2:** ITC, Department of Applied Earth Sciences, University of Twente, Enschede, The Netherlands

## Partner institutions

The [Royal Museum for Central Africa \(RMCA\)](#) is a multidisciplinary federal scientific institute (FSI) focusing on Africa, and more specifically on Central Africa. With solid expertise in the human and natural sciences, research and collection-related activities are organised in three departments: Earth Sciences, Cultural Anthropology and History, and Biology. The RMCA has research activities in more than 20 African countries, and its scientific work is strengthened by the development of collaborative initiatives with scientific institutions in Africa. The Department of Earth Sciences is made up of two divisions: the Natural Hazards Service (<https://georiska.africamuseum.be/>) and the Geodynamics and Mineral Resources Service. The two teams are interdisciplinary and carry out their research activities in the fields of geology, mineralogy, tectonics, geomorphology, natural hazards and risk assessment in the context of environmental change. Most of the study areas are located in Central Africa. Remote sensing techniques, GIS and fieldwork are used to support research as well as to assist with thematic mapping. The department is also responsible for managing the collections (rocks, geological archives, maps and aerial photographs) and facilitating access to them. The Natural Hazards Service is helping to meet the challenges of reducing the risk of disasters linked to geo-hydrological hazards in Africa's changing environments. The Geodynamics and Mineral Resources Service focuses on geological mapping and understanding of natural resources, with a view to more sustainable exploration and exploitation.

[University of Twente's Faculty of Geo-Information Science and Earth Observation \(ITC\)](#) is the Faculty of Geoinformation Sciences and Earth Observation at the University of Twente. The ITC is one of the

world's top ten institutes for university teaching, scientific research and technological development in the field of earth observation and geo-information. The Department of Applied Earth Sciences combines earth science knowledge with dynamic modelling and advanced remote sensing to analyse earth systems and processes in space and time. The aim is to contribute to meeting global challenges concerning future demands on Earth resources, and to help reduce the risk of disasters and the impact of natural hazards on communities living in changing environments. The JTI aims to develop additional expertise in mapping terrestrial materials using high spectral resolution remote sensing to provide mineralogical, chemical and physical parameters validated by traditional laboratory methods. In the context of exploration, the ITC is also focusing on long-term monitoring of mining areas and their surroundings in order to understand the effect of environmental changes and the anthropogenic effects of exploitation.

## The EDITOR project

The Democratic Republic of Congo (DRC), particularly the east of the country, is renowned for its abundant mineral resources and large-scale industrial and artisanal mining of minerals such as tin, tantalum, gold, copper and cobalt. The geological context of this region is characterised by a unique combination of geological formations favourable to mineralisation, as well as by the ongoing development of the East African Rift and its humid tropical climates. These factors contribute to the distinct geomorphology and rock weathering processes in the region, and play a major role in the occurrence of geo-hydrological hazards such as landslides, (flash) floods and erosion. These hazards are further exacerbated by agricultural expansion, deforestation, road construction, urbanisation and intensive mining activity.

Using advanced Earth observation techniques, the EDITOR project (2024-2029; STEREO-IV) seeks to assess the extent to which mining activity and associated landscape disturbance, including population and habitat growth, cause or amplify the prevalence of geo-hydrological hazards affecting the environment in the mine's zone of influence. The project will focus on artisanal (ASM) and industrial (LSM) mining and will assess the impacts of soil and rock mobilisation, the creation of unstable slope conditions, downstream sedimentation or the input or concentration of toxic substances used in mineral processing.

More specifically, the project aims to detect in space and time environmental changes associated with mining activity (MIEC), analyse and characterise MIEC at local level, assess the regional trend using a machine learning approach, and characterise the spatio-temporal variability of the population's exposure and vulnerability to MIEC.

This 5-year project is coordinated by the Royal Museum for Central Africa, in collaboration with the Centre spatial de Liège (CSL), the University of Twente's Faculty of Geo-Information Science and Earth, and the Universiteit van Antwerpen (UA).

## PhD project

The aim of this doctoral research is to develop new tools for detecting mining-induced environmental change (MIEC) in the mine's area of influence. The MIEC will be identified on a selection of mining sites and will be characterised on a local and regional scale. **The doctoral research will be based mainly on multi- and hyperspectral remote sensing techniques applied to bare surfaces associated with mining site activities.** These techniques will be combined with surface change detection results obtained from medium- and high-resolution SAR and optical imagery, as well as the RMCA's historical archives.

The PhD will be carried out in close collaboration with the project's partners, including the Centre Spatial de Liège (CSL), where post-doctoral research is being carried out as part of the same project on the implementation of machine learning techniques applied to satellite imagery, and the Universiteit Antwerpen (UA), where another doctoral study is being carried out in parallel, focusing on the social implications of mining, and in particular the study of the population's exposure and vulnerability to MIEC. The PhD candidate will therefore be part of an international, multidisciplinary network within the EDITOR consortium, which in addition to the RMCA and the ITC includes partners in DR Congo such as the Centre de Recherche en Gestion Minière (CEGEMI), the Université Officielle de Bukavu (UOB) and the Service Géologique National du Congo (SGN-C).

### Tasks planned :

- Selection of study sites and characterisation of MIEC;
- Fieldwork and sampling at mining sites (artisanal/industrial);
- Mineralogical/hyperspectral analysis of samples taken in the field and/or extracted from the RMCA's collection;
- Data collection and processing of multi-, hyperspectral and SAR data;
- Exploiting synergies between different satellite sensors (optical and SAR) ;
- Presentation of results at conferences and in peer-reviewed publications;
- Participation in and organisation of activities within the department (at ITC and RMCA);
- Communicate the results to the general public by taking part in awareness-raising events.

### Candidate profile

We are looking for a scientist with a background in Earth sciences. Enthusiastic, motivated, dynamic, communicative and with solid experience in geology, mineralogy and spatial data analysis, he/she will be particularly interested in the applications of remote sensing to the study of mineral resources. The ideal candidate will have a Master's degree in Earth Sciences, Geodesy or equivalent. Fluency in written and spoken English is essential for the post.

#### **Qualifications:**

- Master's degree or equivalent in earth sciences, geography, Earth observation, geodesy ;
- Sufficient basic knowledge of soil mineral chemistry, optical microscopy and/or mineralogical/geochemical analysis;
- Particular interest in mineralogy and multi- and hyperspectral remote sensing;
- Interest in big data analysis;
- Fluency in written and spoken English ;
- Flexible, dynamic and enjoy working in a diverse and international team. Willing to travel between the Netherlands and Belgium and to settle there during the PhD;
- Ability to work effectively independently and as part of a multidisciplinary and international team;
- Experience in spatial data analysis, in the use of GIS software (ArcGIS/QGIS), and in coding (R or Python).

#### **Assets :**

- Experience in machine learning or artificial intelligence techniques for data processing;
- Ability to communicate in Dutch and/or French ;
- Field experience (geology/sampling) is an advantage.

## Offer

- A 48-month fixed-term contract as a research assistant (SW 10)
- a salary in line with federal government scales (SW10: 44,000 euros gross, indexed annual salary)
- A pleasant working environment within a dynamic and diverse team
- Participation in international collaborative research projects
- Attractive holiday arrangements
- Reimbursement of public transport costs (2nd class) or compensation for cycling in Belgium.
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Find all the information and benefits associated with working for the federal government on FedWeb, the federal personnel portal, <https://fedweb.belgium.be>.

## Interested?

- For more information about the position, please contact **Dr Harald van der Werff** ([h.m.a.vanderwerff@utwente.nl](mailto:h.m.a.vanderwerff@utwente.nl)) or **Dr Anouk Borst** ([Anouk.borst@africamuseum.be](mailto:Anouk.borst@africamuseum.be)).
- For more information on the RMCA, please visit: [www.africamuseum.be/en/research/discover/earth\\_sciences](http://www.africamuseum.be/en/research/discover/earth_sciences)
- For more information on the ITC, please visit: <https://www.itc.nl/>

- The deadline for applications is **15 June 2024**.
- If you are shortlisted, prepare for an interview on **25 or 26 June 2024**
- Starting date is set for **September 2024**.