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Discrimination of Colombo-tantalite minerals from South Kivu Province (DRC) using XRF techniques

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Coltan ore is one of the "3 T" minerals, which contains technologically important metals, namely tantalum and niobium. Market demand for these metals is growing as technology evolves, making them critical to manufacturing industries. However, the mineral supply chains are required to be conflict free so that Manufacturers do not, although involuntarily, contribute to promote "blood minerals". Such criticism has been evoked against some mineral processing companies in many conflict regions such as Sierra Leone and the Democratic Republic of Congo (DRC). Coltan minerals can be fingerprinted using several analytical methods, which are fairly sophisticated and expensive. This study elucidates the use of a portable XRF (PXRF) analysis technique to define the fingerprint of coltan mineral ores from the South Kivu province of the DRC, in order to trace them along their supply chains. It presents data from 15 samples from 4 artisanal mining areas, with discrimination diagrams. In order to validate the technique, the data were compared with those obtained by ICP-AES and PIXE analysis, and a good correlation was found among them. XRD and SEM-EDS analysis were performed to complete characterization of the composite samples from the 4 regions.
The health risks associated with the presence of children and pregnant women in the artisanal mines of South Kivu are also assessed on the basis of the radionuclide elements that coltan ore may contain.
The results were recently published [1] and presenting their summary at the joint annual meeting of the African Light Source and African Physical Society is intended to highlight current initiatives in DRC while awaiting access to beam time. Given the number of sites and the quantity of samples requiring specific signatures, an African synchrotron laboratory would be a real opportunity for further studies if it were to become a reality in the coming years.

Reference

[1] A. Shikika, N. Aokowa, S. Ngayirwa, A. Mushamalirwa, G Ameli, I. Maluzi, C. Muntu wa Mwami, F. Zabene, F.A. Muvundja, M. C. Mugumaoderha. Resource Geology. 75 (2025) e70014

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