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Elemental analysis of Kimberlite and associated Country Rock

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Abstract content
   (Max 300 words)

The elemental analysis of Kimberlite and Country Rock was performed as part of an ongoing study into the Mineral-PET online rock sorting technique. This is a technology proposed to locate high densities of carbon in kimberlite and country rock using the very well known medical physics technique called Positron Emission Tomography (PET). Carbon in kimberlite is not a natural positron emitter; one has to convert the naturally occurring Carbon into a positron-emitting isotope. In this case it is done through a photonuclear transmutation reaction that transforms Carbon(12) into Carbon(11) . We accomplish this reaction by irradiating the host rock using gamma rays with energies in the Giant Dipole Resonance (GDR) region. It is then important to determine the full inventory of radioisotopes produced in this process. The irradiation of Kimberlite was performed using the 100 MeV electron microtron at Aarhus University in Denmark. In this paper, we first describe the experiment, and then perform a complete analysis of the data. This provides quantitative identification of the prompt, short, mid-term and even long-term radioactivity of irradiated Kimberlite, together with the nuclear processes that lead to them. This is necessary in order to assess more efficiently the radiation safety of the equipment and people working in the facility. A unique feature of this analysis in the unambiguous identification and quantification of each radioisotope formed by the two dimensional spectroscopy of the energy and the emission time of the signature gamma lines using time differential spectroscopy.

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Level for award
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PhD

Main supervisor (name and email)
and his / her institution

Prof Simon Connell, shconnell@uj.ac.za, University of Johannesburg

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Primary author: Mr TCHONANG POKAHA, Marius (University of Johannesburg)

Co-authors: Mr BORNMAN, Faan (Multotec Process Equipment (Pty) Ltd); Mr COOK, Martin (University of Johannesburg); Mr BALLESTRERO, Sergio (University of Johannesburg); Prof. CONNELL, Simon (University of Johannesburg)

Presenter: Mr TCHONANG POKAHA, Marius (University of Johannesburg)

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