Contribution ID: **367** Type: **Interactive Content Presentation**

Investigation of the rare-earth element pattern of uranium oxide (U3O8) for attribution of uranium in safeguard and nuclear forensics environment

Illicit trafficking of radioactive material and especially nuclear material (thorium, uranium, and plutonium) has been an issue of concern since the beginning of the 1990s, when the first seizures of nuclear material were reported to the International Atomic Energy Agency. In this work, twenty samples selected for investigation originate from South Africa and Namibia uranium mines. The aim of this study was to determine whether the rare-earth elements patterns measured in a particular samples can be used to attribute the sample to the production or reprocessing plant. Rare earths elements (REE) are a set of seventeen chemical elements in the periodic table, specifically the fifteen Lanthanides with the addition of scandium and yttrium.

The REE share numerous common physical and chemical properties that make them difficult to chemically separate from each other. The atomic number (Z) for these REE metals range from 57 to 71 and they are divided into two sub-groups, namely the light rare earth elements (LREE) and the heavy rare earth elements (HREE). The LREE consists of the following metals namely, lanthanum (La), cerium (Ce), praseodymium (Pr), neodymium (Nd), promethium (Pm), samarium (Sm), europium (Eu) and gadolinium (Gd). The HREE include metals such as terbium (Tb), dysprosium (Dy), holmium (Ho), erbium (Er), thulium (Tm), ytterbium (Yb) and lutetium (Lu).

A large amount of uranium is found in rare earths deposits, and may be extracted as a by-product. As a results, REE in uranium compounds can be used as an evidence of uranium origin. In this study, REE was measured in the uranium oxide (U3O8) collected from South African and Namibian gold mine. Measurements were carried out using a inductively coupled plasma mass spectrometer (ICP-MS) NexION 2000. The results for the Namibian mine show the REEs exhibit light REE-enriched patterns with pronounced positive Ce anomaly when normalized to chondrite which indicates that the REEs are taken up in proportion to their relative concentration in the source rocks. While for the South African mine, the REEs exhibit heavy REE-enriched patterns with pronounced positive Tb anomaly when normalized to chondrite. These results confirm that, REE patterns used for origin location do reflect significant variation within mine and thus provide valuable information about the geochemical formation and origin.

Gender

Female

State

South Africa

Authors: Mr KUPI, Tebogo Gilbert (North-West University Mafikeng); Ms MOKHINE, Naomi Dikeledi (North-West University Mafikeng); Prof. MATHUTHU, Manny (North-West Univesity Mafikeng)

Presenters: Mr KUPI, Tebogo Gilbert (North-West University Mafikeng); Ms MOKHINE, Naomi Dikeledi (North-West University Mafikeng)

Track Classification: MORC: Nuclear forensics