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Comparative analysis of kimberlite Rock Using Activation Technique

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Kimberlite rocks are the primary hosts of diamonds. These rocks have natural radioisotopes that originated from elements formed during supernova processes. These rocks produce new radioisotopes when activated. This work compares the spectral lines of unirradiated kimberlite with irradiated kimberlite. Experimentally, two kimberlites rock with identification numbers S11 and K6 were prepared, and the Aarhus 100 MeV microtron injector was incident on a target to produce a bremsstrahlung photon to irradiate the S11 kimberlite rock to become radioactive. The S6 kimberlite was not irradiated. Both kimberlite samples were detected under high-purity germanium detectors to acquire spectral line data. Gamma spectroscopy analysis was performed on the high-purity germanium data, and the ENDF/TENDL nuclear database was used to identify all the spectral lines in both spectra. The 511 keV PET peak in the S11 kimberlite showed the highest peak as compared with the K6 sample. In contrast, potassium-40 exhibits the highest half-life of 1.248 x 109 years in both spectra, which are crucial in mineralogy processes and radiology safety in the environment.

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