**Radon concentrations, causes, and exposure in South African tourist caves**

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Radon is a naturally occurring radioactive gas resulting from the decay of uranium, which is present in varying amounts in all rocks and soil. In caves, radon concentrations can be particularly high due to the confined nature and limited ventilation of these environments. The concentration of radon in caves is influenced by several factors, including the lithology of the cave, the uranium content of the surrounding geology, the rate of radon emanation, and the cave's ventilation dynamics. Limestone caves, for example, can exhibit significantly different radon levels compared to caves formed in other rock types, due to differences in permeability and uranium content.

High radon levels pose significant health risks to humans, particularly to cave explorers, guides, and researchers who may spend extended periods in these environments. Radon is a known carcinogen, and prolonged exposure to high concentrations can lead to lung cancer. Therefore, monitoring and mitigating radon levels in caves is essential for the safety of frequent visitors and workers in these natural formations. Furthermore, understanding radon behavior in caves provides valuable insights into geological and environmental processes, making it a critical area of study in both environmental science and public health.

This study presents measurements of radon concentrations in various tourist caves in South Africa, aiming to assess radon exposure and risk to guides, tourists, and researchers. Additionally, it investigates the relationship between radon concentrations and cave dynamics, along with the environmental processes influencing its accumulation. Measurements were conducted using electret ion chambers (EICs) and the radon concentrations determined in different parts of the caves. These results were mapped and analyzed with geographic information systems (GIS) software and areas with elevated radon levels were identified. These areas were then correlated with occupation by tour guides and tourists to determine their exposure. Finally, the cave geometry, dynamics and geology are then used to determine the possible causes of elevated radon concentrations and explain its accumulation.