**Modelling the relationship between naturally occurring radionuclides and grain size of sediment from the Karoo Supergroup**

***Jacques Bezuidenhout1,\****

*1Faculty of Military Science, Stellenbosch University, South Africa:*

*\*jb@sun.ac.za*

**Abstract:** Sediments play a fundamental role in understanding environmental processes within aquatic systems, with naturally occurring radionuclides serving as valuable tracers for sediment transport, deposition, and erosion. This study investigates the relationship between sediment grain size and the concentrations of the naturally occurring radionuclides, potassium (K40), uranium (U238) and thorium (Th232). Sediment samples were collected from various locations within the Mkomazi River Basin, South Africa and analysed by means of gamma spectroscopy to extract radionuclide concentrations. The results revealed a distinct relationship between radionuclide activity and sediment grain size, characterized by an initial exponential decline in nuclide concentrations followed by a linear increase as grain size increased. The concentrations of the three naturally occurring radionuclides were combined to derive an arbitrary activity, which was found to have a strong correlation with the average grain size of the samples. A mathematical model was devised to estimate the average sediment grain size by using this arbitrary activity, and a mean estimation error of 17.2% was achieved. Findings suggest that U238 concentrations are the most significant predictor of sediment grain size, while Th232 has minimal influence. This study highlights the potential for in situ radionuclide measurements to estimate sediment grain size in aquatic environments, offering a novel approach for sediment transport studies.