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Dis-equilibrium in the 238U series and its significance to environmental analysis

Environmental analysis of naturally occurring radionuclides is an important analytical requirement of a radio-analytical laboratory. This is true in South Africa, where mining is a huge part of the economic activity. Uranium-238 and its daughters contribute a large percentage in environmental assessments. A study was conducted on different naturally occurring radioactive material emissions to study the effect of dis-equilibrium in the 238U series and its impact on environmental radio-analysis. Coal, fly-ash, uranium ore, gold mine tailings and acid mine drainage samples were analyzed using a HPGe detector. The results showed that in most of the samples analyzed, there was no secular equilibrium in the 238U series with the exception of uranium ore samples. Therefore, it was concluded that analysis of the different nuclides in the 238U series is necessary for accurate results and that the common assumption that 226Ra is in equilibrium with 238U is incorrect and leads to incorrect results. The study recommends the analysis based on three major sub-series which develop within the 238U series: 238U - 234U, 226Ra - 214Po and 210Pb - 210Po

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