Natural radioactivity of Slovenian soils

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Introduction

• history of research of natural radioactivity in Slovenia
  • systematic radon survey in living and working environment
    Humar et al., 1992; Vaupotič et al., 2010
  • radium and uranium in ground, spring and surface waters
    Kobal et al., 1990; Popit et al., 2004; Vaupotič, 2002
  • equivalent uranium and equivalent thorium concentrations in soil
    samples from 30 cm of depth (60 points)
    Andjelov and Brajnik, 1996; Brajnik et al., 1992
  • $^{40}\text{K}$, $^{232}\text{Th}$, $^{238}\text{U}$, $^{226}\text{Ra}$, $^{228}\text{Ra}$ in terra rossa and
eutric cambisol soil samples from 80 cm of depth within regular 25 m × 25 m grid
    Vaupotič et al., 2007
  • radon measurements in soil gas at 70 points
    Vaupotič et al., 2008

• soil samples collected at 70 points
  • analysed for $^{40}\text{K}$, $^{232}\text{Th}$, $^{226}\text{Ra}$
  • $^{234}\text{U}$ and $^{238}\text{U}$ (29 points)
Analysis of soil samples

Sample collection and preparation:
80 cm of depth, drying in air and then at 105 °C until the constant weight

High-resolution gamma spectrometry

Radiochemical preparation → alpha spectrometry

$^{40}$K  $^{232}$Th  $^{226}$Ra  $^{234}$U  $^{238}$U
Measurement locations
Log-normal distribution
Radionuclides and lithological units

A – alluvial and glacial deposits
B1 – clastic sediments containing clay
B2 – coarse clastic sediments
B3 – flysch
C – carbonates
D – metamorphic rocks
E – sea and lake sediments
Correlation: $^{222}\text{Rn} - ^{226}\text{Ra}$

(a) $R_{\text{soil}} = 0.54$

(b) $R_{\text{air}} = 0.60$
Spatial distribution of radionuclides

$^{40}$K

$^{232}$Th

$^{226}$Ra
Conclusion

• The highest average values for
  – $^{40}\text{K}$, $^{232}\text{Th}$: clastic sediments containing clay
  – $^{226}\text{Ra}$: carbonate rocks

• The lowest concentrations of radionuclides on flysch sediments

• Comparing the results of radon measurements in soil gas and outdoor air with radium levels in soil, relatively good correlations were observed.
THANK YOU FOR ATTENTION!