Assessment of lithogenic radioactivity in the Euganean Hills magmatic district (NE Italy)

Abstract:
The Euganean Hills of North East Italy have long been recognised as an area characterized by a higher than average natural radiation background. This is due to two main reasons: a) primary lithogenic radiation due to rhyolitic and trachytic outcrops, which are “acidic alkaline” magmatic rocks potentially enriched in uranium and thorium; b) secondary sources related to a geothermal field – widely exploited for spa tourism in the area since the Roman age – producing surface release of radon-enriched fluids. Though radioactivity levels in the Euganean district have been often investigated in the past – including recent works aimed at assessing the radiation doses from radon and/or total gamma radiation – no effort has been put so far into producing a thorough assessment linking radiation protection data to geological-structural features (lithology, faults, water, organic matter content, etc.). This work represents the first part of the interdisciplinary project “Geological and geochemical control on Radon occurrence and natural radioactivity in the Euganean Hills district (North-Eastern Italy)”, aimed at producing detailed results of the actual radiation levels in connection mainly with lithological parameters. A detailed sampling strategy, based on lithostratigraphy, petrology and mineralogy, has been adopted. The 151 rock samples collected were analyzed by high resolution γ-ray spectrometry with ex situ HPGe detectors. Statistical and geostatistical analyses were performed, and outlier values of U and Th – possibly associated with anomalies in the geological formation – were identified. U, Th and K concentration maps were developed using both the entire database and then again after expunging the outliers; the two were then compared. In all maps the highest values can be associated to trachyte and rhyolite lithologies, and the lowest ones to sedimentary formations. The external dose due to natural radionuclides in the soil – the so called terrestrial gamma dose rate – has been calculated using the U, Th and K distribution measured in the bedrock samples.

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