Can be geogenic radon potential indirectly inferred?

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Epidemiological findings of radon risk related studies confirm that residential radon represents worldwide an important cause of lung cancer mortality. The ^{222}Rn is one of the most abundant of this noble trace element, which can be transported from the source to indoor spaces. Inhalation of radon gas and its solid decay products (i.e., ^{218}Po, ^{214}Po) can lead to high-energy alpha irritation of bronchial tissues, which can finally cause lung cancer. The concentration of radon in a dwelling is a complicated function of geogenic factors, such as: geological features (accessory minerals bearing uranium in lithology and geological age), geochemical characteristics (^{238}U, ^{232}Th and ^{226}Ra content), soil permeability, grain size, presence of faults, fractures and karst zone. Uranium/radium contents in igneous, metamorphic and sedimentary rocks can vary in a wide range from low to very high levels. Higher contents typically occur in some organic-rich argillaceous rocks (Hot Shale), heavy minerals placers deposits, reworked igneous or magmatic clastic rocks and, sometimes, in phosphates. When searching for radon prone areas, the influence of the uranium mineralization in vein or stock work should be taken into consideration, as they typically cause radon emission. Actually, the geology is one of the most important factors in controlling the distribution and level of indoor radon, so that the identification of geogenic radon potential of different areas becomes the most important step in the risk assessment procedures.

Direct soil gas radon measurement are scarce and inhomogeneously distributed, especially in Sardinia. Several methods have been proposed by the international literature to produce GRP map where lack of direct soil gas measurements occurs. In some cases, Rn values of regions with sufficient data have been extended to areas with alleged similar geology or geogenic maps of European territories have been produced based on geological units, mainly defined on the basis of lithology and age. The problem with those approaches is the large variability of the Rn potential within the same geological unit, making the methodology sometimes ambiguous. In fact, the geological conditions that controls the enrichment of U (then Rn) in lithotypes are complex and the lithology cannot always represent the real occurrence of U enrichment. In general, lithotypes are classified with textural and compositional criteria. The latter criterion is based on the main and most common minerals in the crust. Therefore, rocks classified as the same category from a lithological point of view may have different compositions of accessory phases, which may have very different U contents. Rocks can hold U enrichments according to geodynamic, stratigraphic, environmental and geochemical features, climatic conditions and, mainly for sedimentary rocks, composition of the source areas which feed the sedimentary basins. Thus, it can be assumed that different geological evolutions related to the paleogeography of the geological regions do not allow to automatically exporting the measurements performed in other geological regions, in the absence of appropriate measurements that define the contents of Rn producing elements. As a matter of fact, a geogenic potential map must be preliminary drawn to take into account the local geological condition and the geodynamic environment from which they derive.