

Natural radioactivity in stream sediments of Oltet River, Romania

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The concentration of naturally occurring radionuclides (U-238, Th-232 and K-40) in stream sediments of the Oltet River was measured in order to establish the primary sources of radionuclides, the transport pathways and the geochemical factors favouring their mobilisation and concentration in the existing geological context.

The Oltet River has a length of 185 Km and crosses the southern central part of the country, being the right tributary of the Olt River. The range in elevation of the watercourse varies between 1963 m in the springs area (Parîng Mountains) and 200 m at the confluence with the Olt River, whereas the relief of the Oltet Basin has a varied character, manifested by the presence of diverse forms of relief, starting with major mountainous heights and ending with low-lying plains regions. In cross section from North to South, the Oltet River cuts metamorphic rocks (schist, gneisses, quartzite, marble, mica-schist's), magmatic rocks (granite and granitoid massifs - intruded by veins of microgranite, aplite, pegmatite and lamprophyre) and limestone, followed by deposits composed of clays, marls, sands and gravels, that are characterized by the presence of lignite seams.

44 stream sediment samples were collected in summer of 2016 from sampling points distributed along the river with an equidistance of about 4 - 5 km. The activity concentrations of the U-238, Th-232 and K-40 were measured by gamma ray spectrometry using HPGe detector (ORTEC) with 26% relative efficiency in multilayer shielding. The reference materials used were IAEA - RGK-1 and IAEA - 314. Analysis was performed on the <2 mm fraction of sediment sample, each sample was counted for 24,000 s.

U-238 specific activity in the stream sediments varies between 6.18 and 68.76 Bq/Kg and Th-232 specific activity from 8.12 to 89.28 Bq/Kg, whereas the K-40 specific activity in sediments ranges from 99.01 to 312.16 Bq/Kg.

In the upper sector of the Oltet River, concentrations of U-238, Th-232 and K-40 show a good correlation between them and reflect the lithological features, the mechanical degradation of the rocks overcomes their chemical decomposition. In the middle part of the river as result of almost abrupt passage between mountain and hilly terrains increases and concentration of radionuclides; effect of large quantities of clastic material deposited by torrents. The mechanical migration of resistant uranium, thorium and potassium bearing mineral determines the movement of rock particles under moving water effect, and redistribution in alluvial sediments with preservation of the native features. In this zone under the action of biochemical processes and other chemical weathering agents, uranium is released from rocks and penetrates in the superficial circulation area or groundwater. Through this geochemical process the amounts of thorium and potassium released are modest, leaching of uranium being the dominant feature (uranyl ion). The downstream lignite seams are the secondary geochemical barriers in accumulation of uranium; the radiometric data obtained for stream sediments emphasize this enrichment.