Mapping ^{226}Ra Micro-Distribution in Radium Dial Painter Skeleton

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The United States Transuranium and Uranium Registries (USTUR) studies actinide biokinetics and tissue dosimetry by following up occupationally exposed individuals. Estimation of the micro-scale distribution of radionuclides in tissues is an important task to support dose assessment. Previously, an ionizing radiation quantum imaging detector (iQID) system was used to study micro-distribution of ^{239}Pu and ^{241}Am. In this study, ^{226}Ra micro-distribution was mapped in bones of a radium dial painter (RDP) who worked for 6 years, had estimated ^{226}Ra uptake of 58.9 MBq, and died at age 24. These samples were obtained from the National Human Radiobiology Tissue Repository (NHRTR), which is a part of the Registries. The NHRTR holds collection of tissue materials obtained from various radium worker studies, including histological bone slides and tissue blocks from RDPs. Two plastic embedded bone sections selected from left femur middle shaft and left side of thoracic vertebra were imaged with iQID. Regions of interest (ROI) for cortical bone (CB) and trabecular bone (TB) were segmented in each bone section and surface activity was quantified within each ROI. The surface activity (A_s) ranges from 1.3 to 56.9 mBq/mm^2 (average surface activity $\bar{A}_s$ = 17.9 mBq/mm^2) in CB and from 0.6 to 27.5 mBq/mm^2 ($\bar{A}_s$ = 0.6 mBq/mm^2) in TB. This study showed that iQID imaging approach is an effective method for micro-scale heterogeneous distribution studies.

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