ABSTRACT

A systematic study on the long-term impact of corpuscular radiation in naturally occurring minerals is essential in order to assess the nature of radiation damage and the radiation exposure due to population in uranium mineralization area. The present research is focused on quantitative assessment of mineralogical alteration due to alpha radiation, nature of metamict minerals as well as environmental radioactivity studies which include indoor radon and gamma variation in parts of East Singhbhum area.

Petrographic study of uranium bearing rocks showed distinct radiation damage patterns like internal fracturing, anastomosing system of cracks, radiohaloes and discoloration surrounding uraniferous minerals within chlorite and biotite. These cracks are presumed to have resulted from the expansion of the crystal lattice subsequent to disintegration of radioactive elements. Allanite, and epidote group of mineral, rich in light rare earth elements (LREE: La,Ce and Nd) was identified in the study area. Allanite exhibited metamict nature, due to incorporation of small amounts of actinides in the crystal structure leading to complete amorphization. The metamict nature of allanite was analyzed subsequently by structural and chemical analysis using Raman spectroscopy and SEM/EDS technique.

Systematic indoor radon survey revealed the seasonal variation in the study area. Radon concentration exhibited lognormal distribution, with higher values in winter and lower values during rainy season. The gamma distribution in the region was entirely contributed by the potassium bearing rocks. The result of (^{238}U, ^{232}Th and ^{40}K) from soils analyzed by HPGe indicated the predominance of uranium series elements and was related to the measured dose. Radium estimated by emanometric method was validated with the results obtained using HPGe. The measured dose is primarily due to uranium activity, which indicated the predominance of wide spread uranium mineralization in the study area.

Key words: Radiation damage, Radioactivity, Dosimetry, Allanite, Uranium mineralization.