



## **Assessment of gamma radiation exposure and distribution of natural radioactivity in beach sands associated with plutonic rocks of Greece**

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This study aims to evaluate the activity concentrations of  $^{238}\text{U}$ ,  $^{226}\text{Ra}$ ,  $^{232}\text{Th}$ ,  $^{228}\text{Th}$  and  $^{40}\text{K}$  along beaches of Greece associated with plutonic rocks. They range from 6-940, 1-2292, 5-10143, 5-9953 and 27-1319 Bq/kg respectively, with some of them representing the highest values of natural radioactivity measured in sediments in Greece. The investigated beaches include Sithonia peninsula (Chalkidiki, N. Greece), some islands of the Aegean Sea (Mykonos, Paros, Naxos, Serifos, Ikaria), the area of Kavala (N. Greece), Samothraki island, NE Chalkidiki and Maronia (NE Greece). Several of these places are associated with high touristic activity such as Mykonos, Naxos, Paros, Serifos, Ikaria, Sithonia and Kavala. The (% wt.) heavy magnetic fraction (HM) (allanite, amphibole, mica, clinopyroxene, magnetite and hematite), the heavy non-magnetic fraction (HNM) (monazite, zircon, titanite and apatite) and the total heavy fraction (TH), were correlated with the concentrations of the measured radionuclides in the bulk samples. The heavy fractions seem to control the activity concentrations of  $^{238}\text{U}$  and  $^{232}\text{Th}$  of all the samples, showing some local differences in the main  $^{238}\text{U}$  and  $^{232}\text{Th}$  mineral carrier. The measured radionuclides in the beach sands were normalized to the respective values measured in the granitic rocks, which are their most probable parental rocks, so as to provide data upon their enrichment or depletion. The highest values of the equivalent dose have been reported in Mykonos, Naxos, Kavala and Sithonia. The annual equivalent dose which should be limited to at least 1 mSv y<sup>-1</sup>, varies between 0.003 and 0.759 mSv y<sup>-1</sup> for tourists and from 0.012 to 3.164 mSv y<sup>-1</sup> for local people working on the beach.