

# DISTRIBUTION OF NATURAL RADIONUCLIDES IN ABU-QIR BAY, EGYPT.

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## Abstract

Consideration of natural radionuclides belonging to <sup>238</sup>U and to <sup>234</sup>Th decay chains in sands and bottom sediments at various locations over Abu-Qir bay have been determined using low background computerized high resolution gamma ray spectrometer. Mean grain sizes of the investigated sediments have been determined. A distribution map for each radionuclide distribution was presented for the study area as well as that for the distribution of mean grain size.

**Keywords:** Radioactivity, Sediments, Mean grain size.

## Introduction

The natural radionuclides in the environment are classified into cosmogenic and primordial types. Cosmogenic radionuclides such as <sup>3</sup>H, <sup>14</sup>C, <sup>22</sup>Na and <sup>24</sup>Na do not contribute significantly to the external gamma radiation dose at ground levels. Primordial radionuclides such as <sup>40</sup>K, <sup>87</sup>Rb and the elements of the three radioactive series headed <sup>235</sup>U, <sup>238</sup>U and <sup>232</sup>Th have been investigated in different environments (1). As a matter of fact, the radionuclides present in the <sup>235</sup>U decay series contribute very little to environmental radioactivity (1). <sup>3</sup>H has natural and man made sources in the environment; the nuclides were studied previously in the area under investigation (2). The natural radionuclides <sup>238</sup>U, <sup>232</sup>Th and <sup>40</sup>K have been determined in Alexandria beach sediments (3). These nuclides also were measured in soil of Nile Delta and middle Egypt (4). Radiation dose assessment has been carried out by Naim *et al.* (5), and a regional study of black sands radioactivity along the beach north of the Egyptian Delta was undertaken by El-Khatib and Abou-El-Kheir (6).

In the present work, radionuclides were determined in sediments over the area under investigation from Abu-Qir bay to the Rashid coast. This area is famous for its black sand deposits and a considerable volume of industrial pollutants discharged into the bay through El-Tabia pumping station, from Rakta paper factory and from Abu-Qir fertilizers company at El-Tarh. Also, drainage water from cultivated areas of El-Behera district open into the bay through the El-Amia drain.

The aim of this work was to determine the levels of radioactive isotopes that exist in Abu-Qir bay, as well as their distribution throughout the bay and to assess radioactivity levels in the surrounding marine environment.

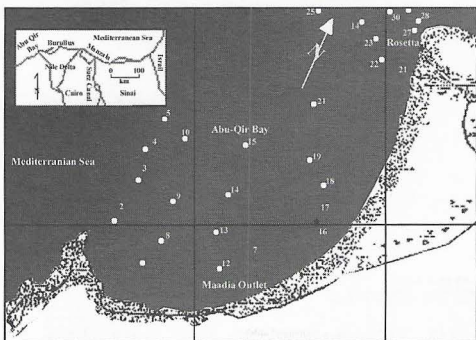


Fig. 1. Location of sites in the study area

## Experimental work

Sediment samples were collected from various locations in Abu-Qir bay (Figure 1). Samples were homogenized, heated and dried using a vacuum drier at 100 °C in the lab, then cleaned from gravel and large shell fragments. Complete grain size analysis was carried out and the mean grain size was calculated. Each sample was packed in a 1000 cm<sup>3</sup> Marinelli beaker, weighed and analyzed for radioactivity. Samples were measured using a computerized pre-calibrated high-resolution gamma ray spectrometer. This detection system was based on a coaxial HPGe detector (Model CS20-A31C-Aptec) with 108 cm<sup>3</sup> sensitive volume and 5.4 cm diameter. The detector has a photo-peak relative efficiency of 24.5 % for 1332 keV gamma transition of <sup>60</sup>Co. The system was calibrated for efficiency using <sup>152</sup>Eu standard source. Radioelements were assigned to their energy photopeaks according to IAEA, 1989.

## Results and discussion

The detected radionuclides are classified into three categories according to their origin. These are: <sup>234</sup>Th, <sup>226</sup>Ra, <sup>214</sup>Pb and <sup>214</sup>Bi, which belong to the <sup>238</sup>U decay chain and <sup>228</sup>Ac, <sup>212</sup>Pb, <sup>208</sup>Tl and <sup>212</sup>Bi, belonging to the <sup>232</sup>Th decay chain. It was observed that the levels of <sup>234</sup>Th ranged from 4.58 Bq/kg to 231.94 Bq/kg with an average of 53.32 Bq/kg; the levels of <sup>226</sup>Ra ranged from 11.01 Bq/kg to 499.18 Bq/kg with an average of

89.84 Bq/kg. The distribution of <sup>238</sup>U and <sup>232</sup>Th series radionuclides is shown in Figs. 2 and 3, reflecting those radionuclides belonging to both <sup>232</sup>Th and <sup>238</sup>U series which displayed high levels at the Rashid promontory.

## Conclusions

The results from the study discussed have shown the areas of natural decay series, e.g. those originated from <sup>238</sup>U and <sup>234</sup>Th decay chains as well as <sup>40</sup>K. The maximum levels of radionuclides are observed near the Rashid coast. Furthermore, the grain size of the sediments plays an important role in controlling the distribution and concentration of radionuclides in this area.

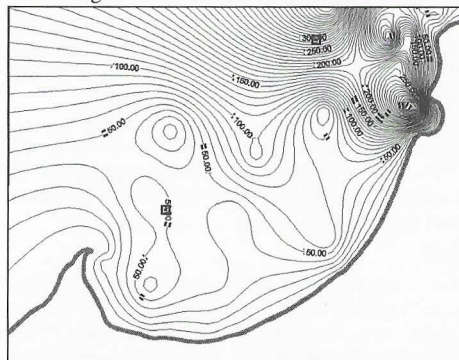


Fig. 2. Distribution map for <sup>226</sup>Ra at Abu-Qir bay

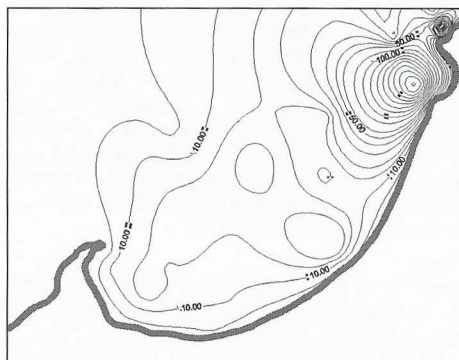


Fig. 3. Distribution map for <sup>214</sup>Pb at Abu-Qir bay.

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