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Physical Characteristics and Evaluation of Natural Radioactivity in Lake Qarun , Egypt

Thesis submitted for the partial fulfillment of master degree in physics (Nuclear physics)

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Qualification

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ABSTRACT

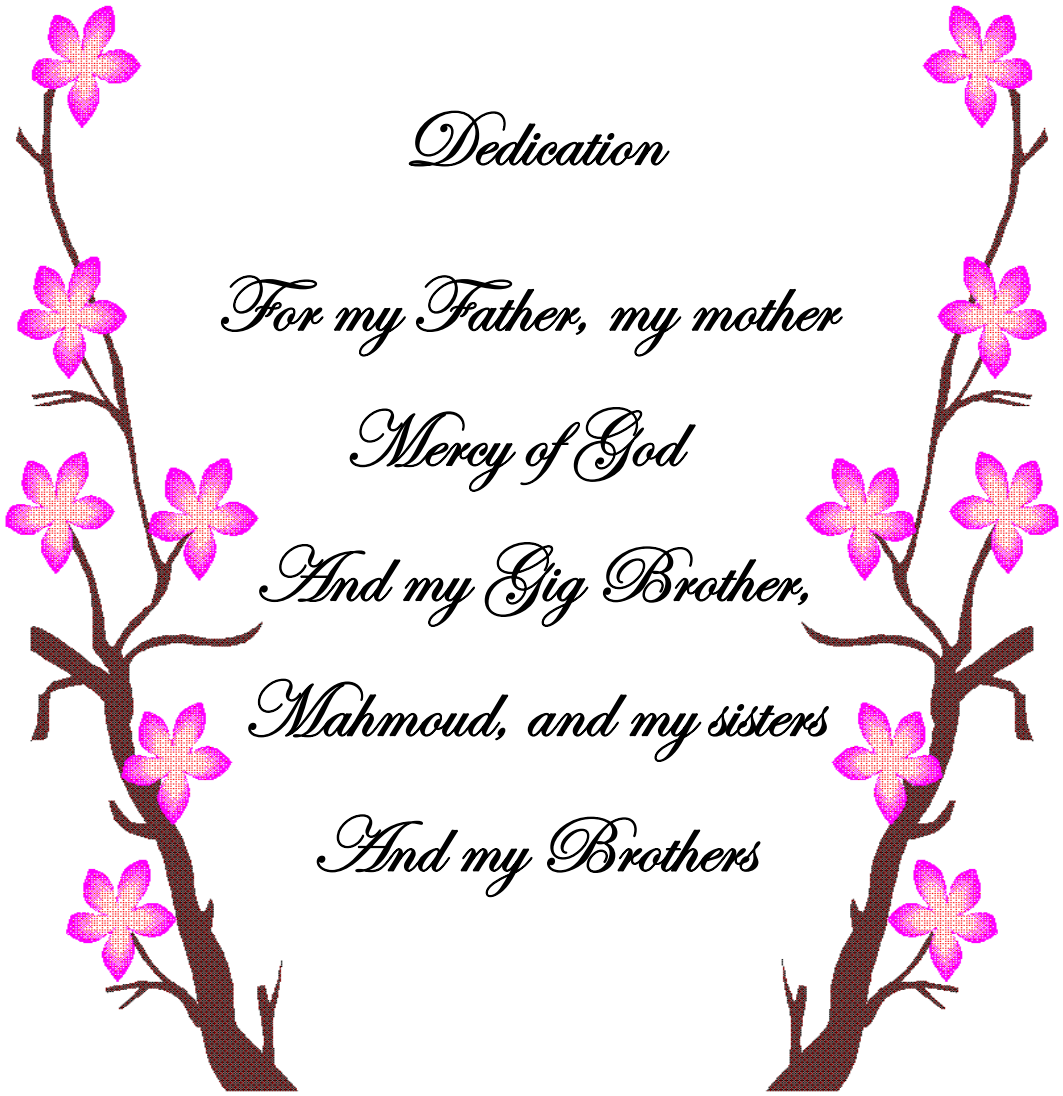
The present study aims mainly to investigate physical limnology and the natural radioactivity, dose rate and the environmental impacts in Lake Qarun. In addition, natural radioactivity in the soil samples from its surrounding area was also determined.

The present study deals with the physical and chemical characteristics of the water of Lake Qarun. Determination of physical parameters (air and water temperatures, transparency, electrical conductivity, salinity, and total dissolved solids) and chemical parameters (pH, chlorinity, water density and dissolved oxygen) were carried out to identify the nature and quality of the water of Lake Qarun. Concentration of radioactivity levels and heavy metals was measured in sediments of Lake Qarun during winter and summer seasons. Gamma-radiation measurements were performed using high resolution (HPGe) detector, while the concentration of heavy metals was determined by Atomic Absorption Spectrometry (AAS). Heavy metals and major elements concentrations of the sediments were found decreasing in sequence of $CaCO_3$>Fe>P>Mn>Pb>Cu>Cd. The environmental measurements of gamma-ray showed that the activity concentrations of ^{232}Th and ^{40}K in the sediments samples are within the average world value. The activity concentration of ^{238}U was found to be higher than that of the average world. ^{137}Cs was observed in all the samples, ranging from 0.28 to 4.96 Bq Kg^{-1} during winter, while in summer, it varies from 0.09 to 5.37 Bq Kg^{-1}. Correlation analysis between radionuclide isotopes and heavy metal was determined, using the Pearson correlation coefficients.

The radium-equivalent; dose rate in air, external hazard index and annual effective dose rate were evaluated. The mean activity concentrations of the gamma-emissions from radionuclides in Lake Qarun were relatively low.

The activity concentrations of ^{238}U, ^{232}Th, ^{40}K and ^{137}Cs for surrounding area of Lake Qarun are fluctuated (0-74.6) Bq kg^{-1}, (5.4-28.2) Bq kg^{-1}, (100.9-372.4)Bq kg^{-1} and (0.04-2.9) Bq kg^{-1} during winter, respectively. But during summer, the activity concentrations are ranged (10.2-65.4) Bqkg^{-1}, (2.7-22) Bq kg^{-1}, (36.4-296.7) Bq kg^{-1} and (0.03-1.8)Bq kg^{-1} respectively. This activity is in agreement with the recommended values except the average activity concentration of ^{238}U is relatively high. The worldwide average values are 35, 30 and 400 for ^{238}U-^{226}R series, ^{232}Th series and ^{40}K respectively.

The estimated dose rates, annual effective dose, mean radium equivalent activity and external hazard index in all locations surrounding area of Lake Qarun are lower than the recommended values. Therefore, this region is safe for human beings.



Dedication

For my Father, my mother

Mercy of God

And my Gig Brother,

Mahmoud, and my sisters

And my Brothers


بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ
الْحَمْدُ لِلّٰهِ الَّذِى هَدَانَا لِهَذَا
وَمَا كُنَّا لِنَهْتَدِى لَوْلا أَنْ هَدَانَا اللّٰهُ

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