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Environmental Analysis and Radioactivity Assessment of Samples from South Egypt Region for Industrial Applications

Thesis

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By

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ABSTRACT

The aim of this thesis is to utilize the nondestructive neutron activation (NA) method for the analysis of six representative samples collecting from Abu Rasheid area using the Second Egyptian Research Reactor (2 MW) in the Atomic Energy Authority in Inshas. Several strategic and important elements are found in the investaged samples (Zr, Zn, Mn and Cr). These elements are necessary for many future industrial development.

Natural radioactivity levels for eighteen samples from Abu Rusheid Area in South Eastern Desert of Egypt have been carried out. The concentrations of ^{238}U, ^{232}Th and ^{40}K were measured by low background spectroscopy using hyper-pure germanium (HPGe) detector. The mean activities due to ^{238}U (^{226}Ra), ^{232}Th and ^{40}K radionuclides were found to be 2384 ± 106, 1240 ± 6.6 and 819 ± 53 Bq/kg, respectively. The absorbed dose rates due to the natural radioactivity in the samples under investigation ranged from 745 ± 45 to 3836 ± 53 nGy/h which is higher than the permissible limit. The radium equivalent activity varied from 1647 ± 114 to 6172 ± 133 Bq/kg. Also, the representative external hazard index values were estimated.

From X- ray study, it is found that all the samples contain considerable strategic elements concentrations such as Barium, Zinc and Niobium

Key Words: ^{238}U, ^{232}Th, ^{40}K/ Norm/ South Eastern / Absorbed Dose Rates/ Radium Equivalent Activity/ External Hazard Index.

Contents

Abstract

Introduction

INTRODUCTION

Mining and milling of both nuclear and non-nuclear materials may cause significant environmental and occupational radiological impacts. NORM incommercial and industrial products has the potential to expose workers and members of the public to high values of radioactive doses. Radionuclides are present always in the natural environment. The main natural contributors to external exposure from gamma-radiation are uranium and thorium series together with ^{40}K [1]. Natural radiation is usually classified as either cosmic or terrestrial radiation [2]. Large variations in dose rates of both cosmic and terrestrial radiation are found depending on where the measurements are made [3,4]. Emanation of radon (^{222}Rn), for example is associated with the presence of radium and its ultimate precursor uranium in the ground [5]. The inhalation of its short-lived daughter produces a major contributor to the total radiation dose to exposed subjects[6].

Many studies have investigated the radioactive elements in different ore samples [7]. The main external source of irradiation to the human body is represented by the gamma radiation emitted by naturally occurring radio isotopes, also called terrestrial environmental radiation. These radio isotopes, such as ^{40}K and the radionuclides from the ^{232}Th and ^{238}U series and their decay products, exist at trace level sin all ground formations. Therefore, natural environmental radioactivity and the associated external exposure due to gamma radiation depend primarily on the geological and geographical conditions, and appear

at different levels in the soil so reach different geological locality [7].

Abu Rushied area in South Eastern Desert of Egypt is located between a major thrust to the NE and a minor one to the SW. The main rock units encountered in this area are metasediments, ophiolitic mélange, amphibolites, metagabbros, cataclastic rocks and leuco- and pink granites [8]. Although South Eastern gneisses were originally identified as psammitic gneisses [9], some authors described these rocks as gneissic granites and cataclastic granites [10]. The detailed geologic map of the study area is characterized by low to moderate topography [11]. The tectonostratigraphic sequence of the precambrian rocks unit of the studied area are arranged properly as shown in Figure (a).

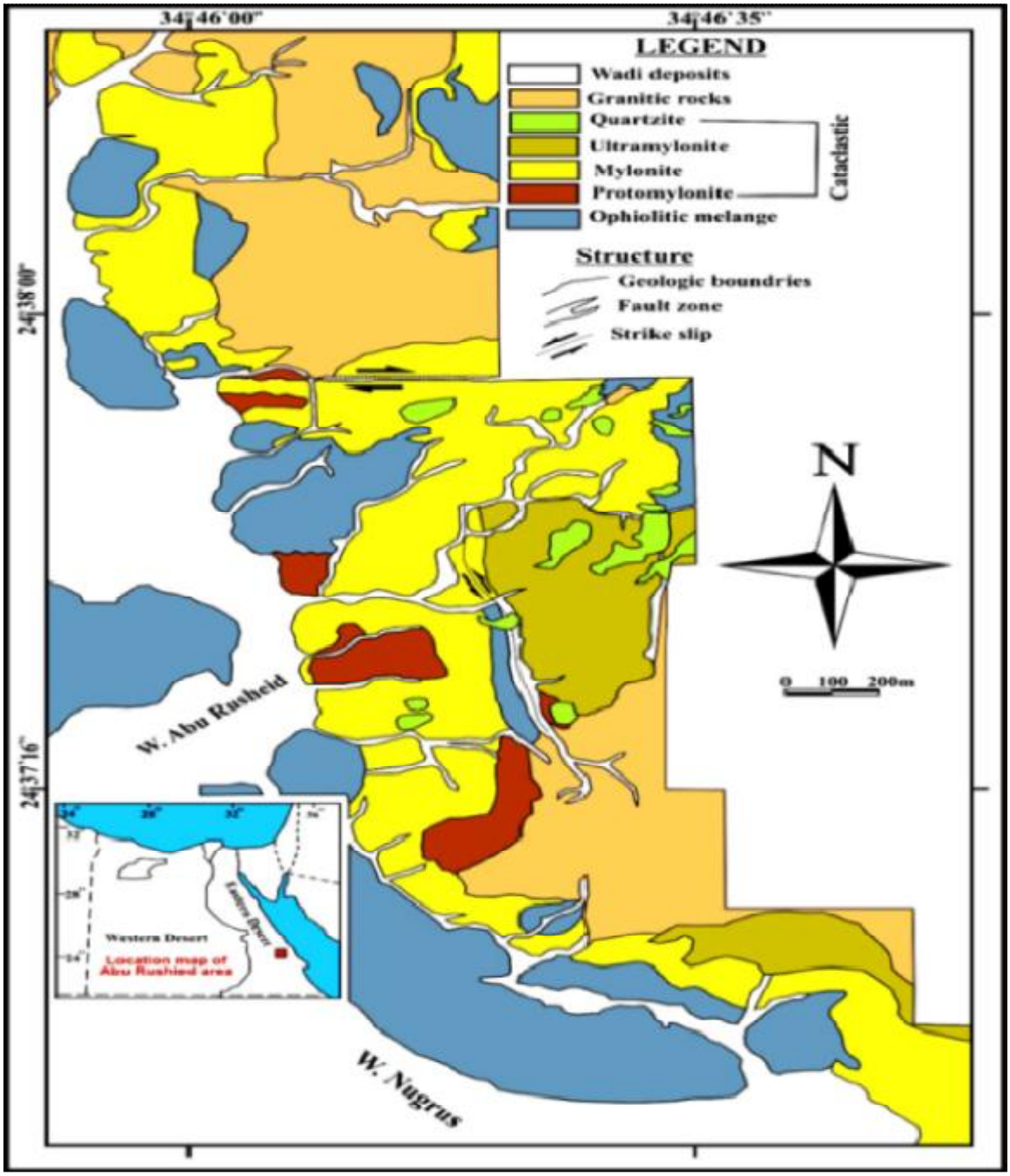

Fig.(a): location map and detailed geologic map of Abu Rushied area, South Eastern Desert, Egypt[11]