



The use of nuclear prospecting measurements for characterizing the radioactive status of Al-Bayyarat and Sabkhet Mouh areas, southern Palmyrides, Syria



J. Asfahani*, R. Al-Hent, M. Aissa

Geology Department, Atomic Energy Commission, P.O. Box 6091, Damascus, Syria

HIGHLIGHTS

- Determine the radioactive characteristics of the study area.
- Explain the radioactive anomaly observed in Al-Bayarat area.
- Analysis of a profile of 30 Km and propose a plausible geo-radioactive model.
- Discuss the radioactive disequilibrium occurred in the study area.

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ABSTRACT

Al-Bayyarat and Sabkhet Mouh areas in southern Palmyride have been radioactively characterized by using different nuclear prospecting measurements. Those measurements include the application of airborne, carborne spectrometric gamma, radon emanation and borehole techniques. The merging of airborne, carborne spectrometric gamma data enables to establish the normalized eU, eTh, and K% maps in the study area. Radon emanation and spectrometric gamma measurements have been applied only in Al-Bayyarat area, where radioactive anomalous zone has been observed. The radioactive characteristics of the study area has been explained through studying and analyzing a profile of 30 Km long, where a plausible geo-radioactive model has been proposed for the uranium leaching and its transport.

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1. Introduction

Airborne gamma spectrometric surveys have been undertaken in Syria during a project conducted in 1987 on some Syrian regions in cooperation with the International Atomic Energy Commission and Riso National Laboratory SYR/86/005 (Riso, 1987).

The main objective of this survey was to assist uranium exploration. It was found that gamma ray anomalies are mainly associated with phosphate deposits encountered in Central Syria, Fig. 1, (Jubeli, 1990).

The present paper is oriented towards the use of different available nuclear prospecting measurements to characterize the study area located between N: 34° 22' 40", E: 38° 12' 54" and N: 34° 35' 57", E: 38° 32' 50" which includes Sabkhet Mouh and Al-Bayyarat areas.

The importance of the study area is related to the fact that it is the lowest land area and surrounded by high topographic features and adjacent phosphatic outcrops. The uranium leaching originated from the phosphatic rocks must be logically accumulated in such low land area, where the prospecting for possible uranium traps is completely justified.

In fact, the airborne spectrometric gamma does not indicate to the presence of radioactive anomalies in the totally of area, while in contrary, the carborne spectrometric gamma realized in the sector shown in Fig. 2, where no available airborne data indicates a wide radioactive anomaly concentrated in Al-Bayyarat area. These radioactive characteristics regarding the uranium distribution in the study area necessitated the merging of both airborne and carborne surveys in order to obtain a complete normalized radioactive maps, corrected from gamma attenuation effect in the study area.

Floremetry, spectrometric gamma measurements on sixteen soil samples and radon emanation measurements have been applied in Al-Bayyarat area only, where an anomalous radioactive zone is located. Radon measurements in water samples taken from

* Corresponding author. Tel.: +963 116111926; fax: +963 116112289.

E-mail address: cscientific2@aec.org.sy (J. Asfahani).

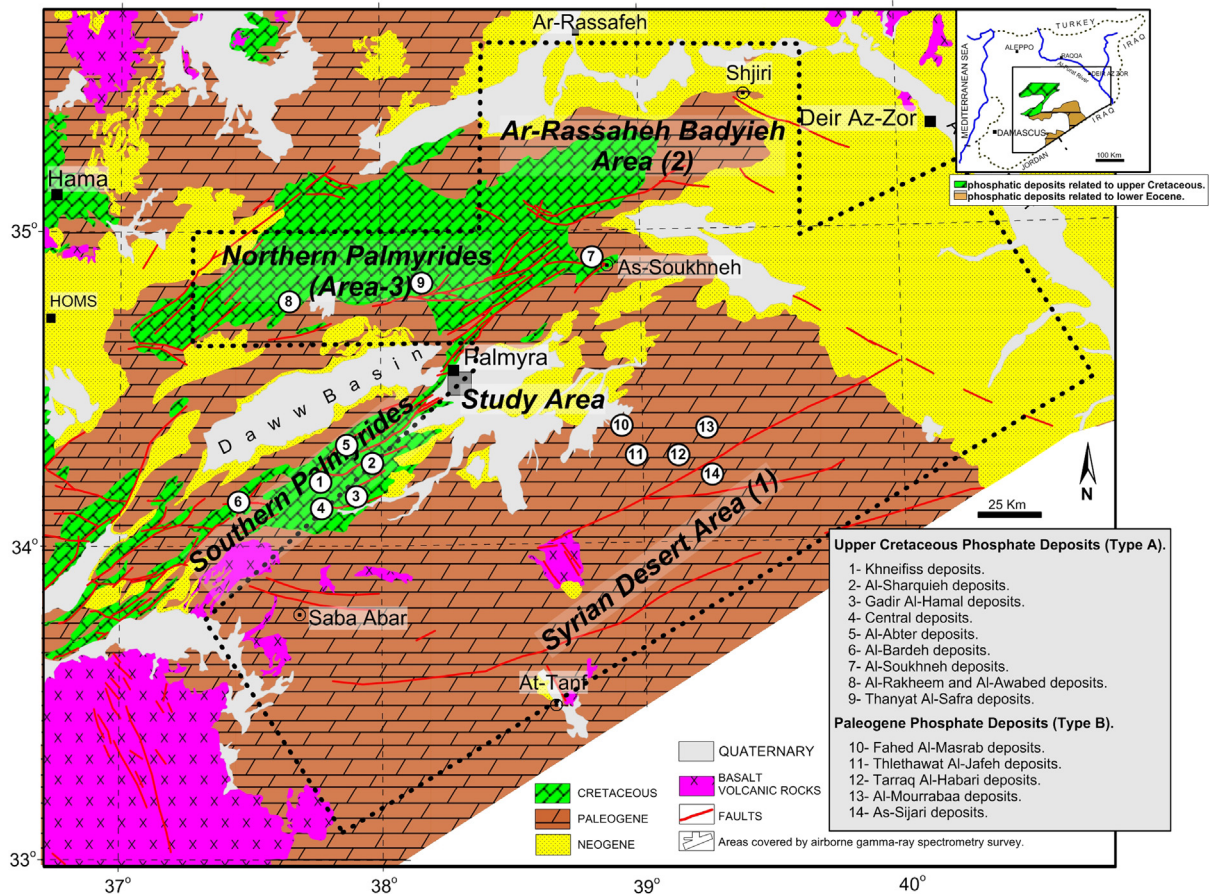


Fig. 1. Areas covered by the airborne gamma-ray spectrometer survey and location of the study area.

different depth levels have been also applied in order to precisely determine the relationship of the surfacial anomalous radioactive zone with depth. Six soil samples have been in addition taken from different vertical depths to evaluate their spectrometric contents of uranium, thorium and potassium.

The main objectives of the present paper are therefore the following:

- Establish the normalized merged radioactive maps for the totally of the study area (Sabkhet Mouh and Al-Bayyarat).
- Determine the radioactive characteristics of the study area (Sabkhet Mouh and Al-Bayyarat) according to the airborne and carborne measurements, and define the distribution pattern of the radioactive elements in the geological formations encountered in this area.
- Characterize the anomalous radioactive zone revealed by the merged airborne and carborne surveys by applying different other nuclear prospecting measurements such as radon and spectrometric gamma applied on rock and water samples.
- Explain and clarify the geological conditions of the surfacial radioactive anomaly zone encountered in Al-Bayyarat area through the analyze of a selected profile "Pr" of a long of 30 Km.
- Propose a plausible geo-radioactive model along the selected profile to explain the uranium leaching and its transport in the study area.

Traditional statistical analysis has been done in order to achieve those objectives and to determine the nature of the radioactive distribution in the study area.

2. Regional setting

2.1. Topography

The study area is located to the south and southeast of Palmyra between the following coordinates N: 34° 22' 40", E: 38° 12' 54" and N: 34° 35' 57", E: 38° 32' 50" as shown in Fig. 2. The north western part of the study area characterizes by sharply rising mountain ridges with absolute elevation ranges between (430–485) m. The surface relief of the study area decreases gradually to the south and south-east, with absolute elevation ranges between (370–400) m. The surface relief of the excluded south eastern part of the study area is a typical stony desert with slightly undulating flat surface. The climate of the area under consideration is semi- arid.

2.2. Stratigraphy

Jurassic, Cretaceous, Palaeogene and Neogene deposits are exposed in the study area.

Quaternary and recent deposits are widely distributed and represented by various genetic complexes, which are dated by flint ancient tools, Fig. 2.

Jurassic deposits are only exposed in the most deeply eroded cores of anticlinal folds of Palmyrian range, as clayey-gypsum and dolomites. Cretaceous deposits are represented by marly limestone, dolomatic-limestone, organic limestone, phosphate beds inter bedded with flint bands, quartz sandstone, and marly-clay. Palaeogene deposits are represented by numulitic limestone, chalky-like limestone, flint, sandy limestone, sometimes phosphate and

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