Investigation of the radioactive elements Dispersion west of Bam (South-East Iran)

Mohammad Gol Kahrazeh
Department of Geology, Faculty of Basic Sciences, Islamic Azad University, Zahedan Branch, Zahedan, I.R. Iran

Abstract

The study area is located in Kerman province in the South East of Iran. In this study, geophysical exploration data for determination of abnormality radioactive elements are processed and then radiometric Exploration data have been interpreted. Based on the results, analysis and processing of the airborne radiometric data showed several abnormalities of radioactive elements with NW-SE strike. These abnormalities radioactive elements exist in rhyolite, andesite and tuff lithic units. Two areas of abnormalities are located in the northeast corner of the sheet that isintroduced as anomalies for further explorations.

KEYWORD:uranium, thorium, Bam, abnormally.

Introduction

The geophysical airborne radiometric is the best way for uranium and thorium regional's exploration. Exploration of radioactive materials and magnetic survey was done in 1977 in the East of Iran. Alpha, Beta and Gamma rays are obtained from radioactive elements decay[1](Sami, 2001).Gamma – ray it used in radiometric airborne explorations Due to the permeability power. Airborne Gamma – ray spectrometry is used for the direct detection of minerals and as a tool for determining the lithological maps. The study area is located in the SE- Iran within 29°, 00 to 29°, 30′ latitude and 57°, 30′ to 57°, 45′ longitude(Figure 1). In the geological classification the study area is located in Urumieh-dokhtar volcanic arc and Lout block[2].

Tectonic structures and faults in the study area mostly have NW – SE strike. The oldest lithic units in the area consist of metamorphosed sandstone, phylite, argillite schist's and Calc-schist that refer Triassic age. Topography of this area is high in most places, but in a few parts of eastern and northeastern, topography is soft. Near Jabal-e-Barez Mountain, the height has increased greatly. The objective of this study is investigating uranium and thorium anomalies in Goor-e-Bala (7548-3) and FathAbad (7548-4) that is located in the West of Bam (Figure1).

General geology

According to Khaneh Khatoon 1:100000 geological maps can be seen some important notes in this area. Regarding the lithic units, we can understand that the area is full of volcanic rocks. Most lithic units are consisted of rhyolite, basalt, gabbro, tuff and agglomerate[2]. Since the radioactive elements of uranium and thorium that are the target of our explorations can be mostly found in volcanic rocks rhyolite and basalt; therefore, the area can be thought as promising.

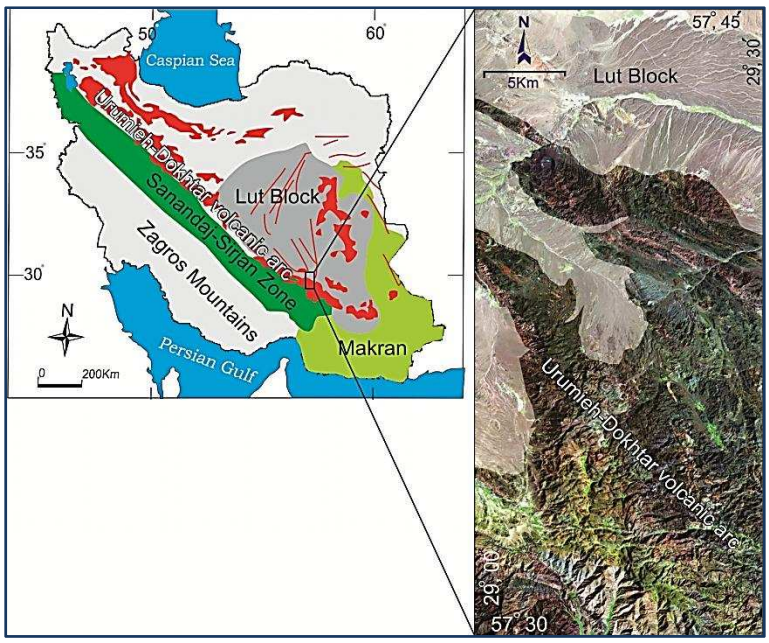

Figure1:A view of the scope of the study

Goor– e-Bala geology

Based on information of geological map, over 50% of the exploration area consists of intrusive rock units such as granitic and granodiorite of middle to upper Eocene age (Andesite, Basalt and Pyroclastic of lower Eocene age) which are in W, SW and central zone. Calcareous sediments and clay exist in N and NW. A large variety of volcanic rocks, such as acidic and basic lava rocks to rhyolite, andesite, basalt, tuff and conglomerate exist in N and NE. A variety of volcanic layers such as Rhyolite Riodacite, tuff and agglomerate exist in SW. Tuffitics and stones, Rhyolites and Riodacite exist in SE. Finally Riodacite, rhyolites and tuffs exist in W and SW (Figure 1).

Airborne geophysical data

Area airborne geophysical data contains radiometric data (U, Th, K) and magnetic surveys in local-scale.They are provided for IAEO In the way of air extraction 1976-1978.Data collected on a grid of 500m x 1000m and 15km tie line spacing and flying height was 100m for the IAEO by three foreign companies, namely ASTYREKS Australia, PRAKLA- SEISMOS Germany and CGG France done[3].

This extractions are consists of measuring the elements like uranium, thorium, potassium, magnetite and uranium respect to thorium ratio, uranium respect to potassium ratio and thorium respect to potassium ratio. This information has been taken in the way of drop survey by helicopter which means following the topography elevation by a proton magnetometer with a sensitivity of 0.5 nanotesla was used for magnetic data collection. IGRF correction was performed by the 1975 model and radiometric data by the 512-channel gamma ray spectrometer has been taken with the following characteristics:

2PI ARRAY 512 CHANNELS (FW) 5.300 CM NAI (TL)
(RW) 5.300 CM NAI (TL)
4PI ARRAYS 512 CHANNELS (FW) 50.300 CM NAI (TL)
(RW) 33.600 CM NAI (TL)[4].

The spectrometer height of from the ground has been 6 m, height of magnetometer sensor 45m, and height of electro-magnetometer sensor 30meters. It is notable that all the corrections and initial processing of the data is performed by the German company which has contracts with the IAEO. Part of the information as image files Grid and other parts as contour maps have been delivered to the Geological Survey.

Figure2: Spectrometry device modelMGS 150(MINI GAMMA RAY SPECTROMETER Designed for rapid field gamma ray spectrometry, especially for determination of K,U,Th contents and total gamma ray activity.)

Zia- e- zarifi&Jafari(2009) The research report titled Explore the area of uranium and thorium radiometric geophysical data on the air in the region of DehBakri (Kerman province) with analyzing data from aerial geophysical surveys in the form of 1: 50,000 DehBakri in South East Iran, Promising areas for uranium and thorium have identified elements. They ground control data in promising areas Ground geophysical operations and surface sampling all the promising areas And perform chemical analysis on them, Geophysical data accuracy have been checked. As well as this paper examines geological data and the results of geophysical data have been compared. Finally, by analyzing the resulting map, Promising areas for later exploration of uranium in the form of the proposal have been introduced[5].

Zia -e-Zarifi, and et al.(2014) in the article with the title Investigation on Distribution of Radioactive Elements in SW Masuleh Based on the Airborne Radiometer Data, Gilan Province, IranWrote: Airborne radiometer data is the best to study the distribution of radioactive elements of an area. In this paper, separation of anomaly values have been performed by means of the classical statistics, the tables of frequency distribution of uranium, thorium and potassium have been produced, the frequency distribution histograms that are introducer of distribution and dispersion of these elements have been plotted, and the statistical parameters of these elements have been estimated. The separation of anomaly value has been done based on the dispersion around the average. The distribution maps of radioactive elements were drawn. These mentioned data were controlled in the field by the radiometric measurements and chemical analysis. Finally, the results of radiometric measurements and chemical analysis revealed non-economic mineralization in the region[6].

Radiometric geophysical data processing and analysis of the study area

Airborne geophysical surveys are done over a regular grid in parallel lines. Gamma ray spectrometry data is usually taken over one-second interval sampling[7]. During this interval, a fixed wing aircraft is traveling a distance of about 55 meters along the lines .Data Ready for processing, from the flights are made in digital forms X, Y, Z, that stand Respectively, for longitude, latitude and concentration (grade) of the desired measurement.To obtain the frequency distribution of uranium in the region, the data were arranged in ascending order from lowest to highest. The data are contained 43200 digital data for Goor– e- Bala area and 43248 digital data for FathAbad area. The data were sorted .Then false data were deleted by filtering and were prepared for statistical calculations.

Considering the calculated statistical parameters, we discuss background and anomalies for Goor-e-Bala and FathAbad regions are separately. Here the average amounts determine the limit of the data background. To calculate the threshold we need the standard deviation parameter. We usually consider x+δ as background, x+2δ as threshold and values greater than x+2δ as a possible anomaly.

Offering the radioactive anomaly map of the area

In this step after interpolation and data processing in mapping software, the distribution model and map are obtained as output in software. The Surfer software applications are extremely varied. For Goor-e-Bala and FathAbad areas, two countering and 3-Doutput are used. The countering output shows the obvious anomaly in the exact location on the map. So that a careful look at the exact location of the anomaly cause to it find. 3-D output also helps the viewer to get an exact image amount of anomaly and helps them to notice its differences with limit of the background (Figures 3 to 8).

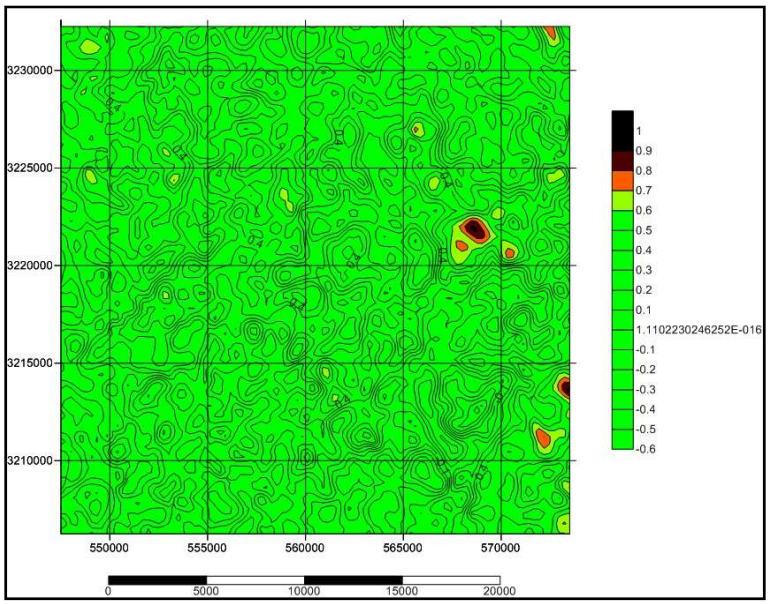

Figure 3: Element uranium anomalies in the area map goor-e-bala

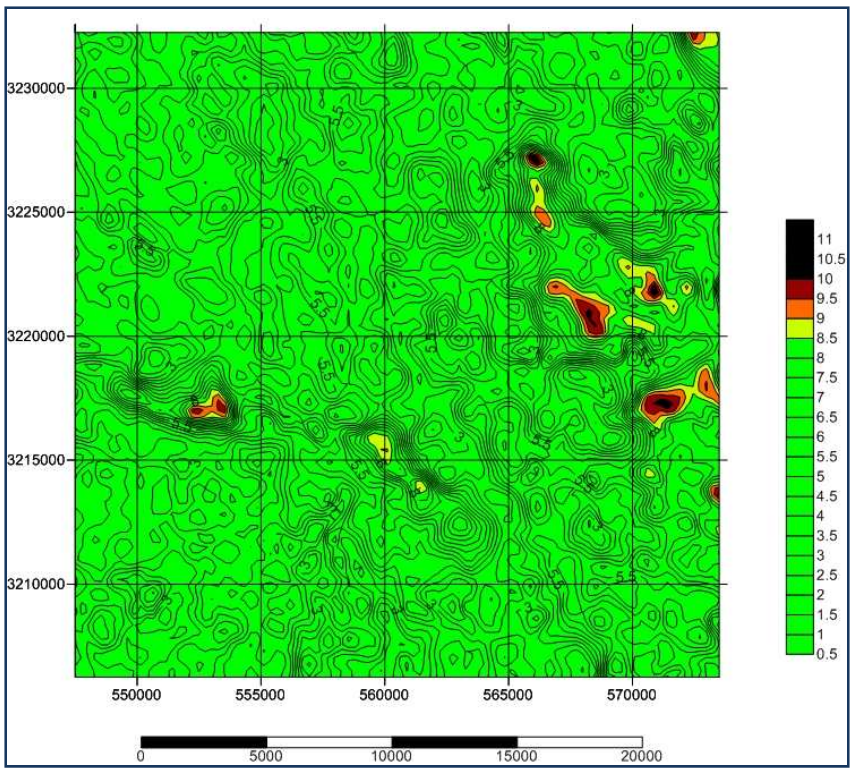

Figure 4 Element thorium anomalies in the area map Goor-e-bala

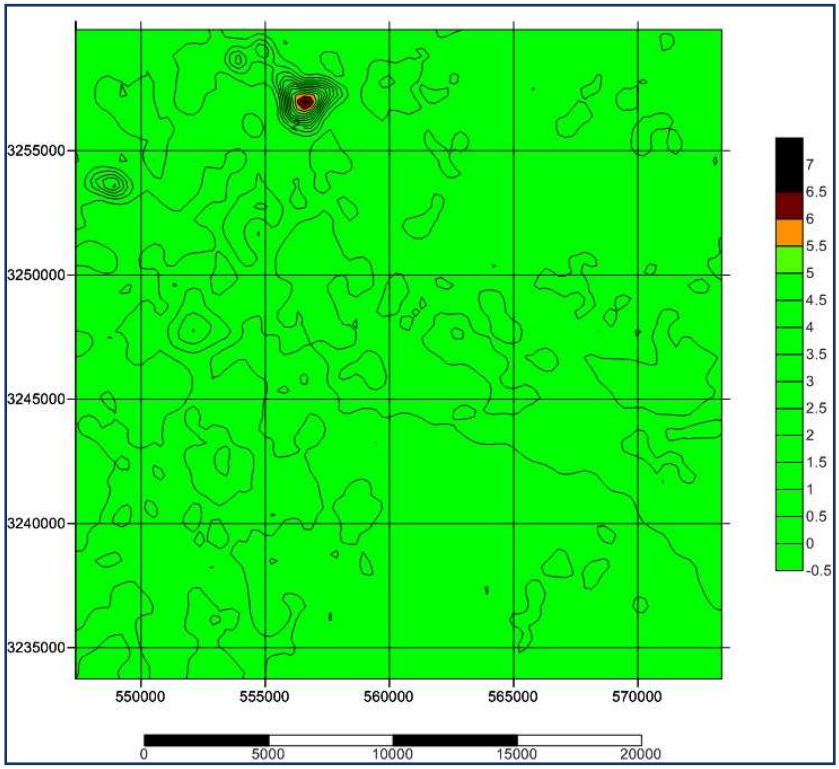

Figure 5: Element uranium anomalies in the area map fathAbad

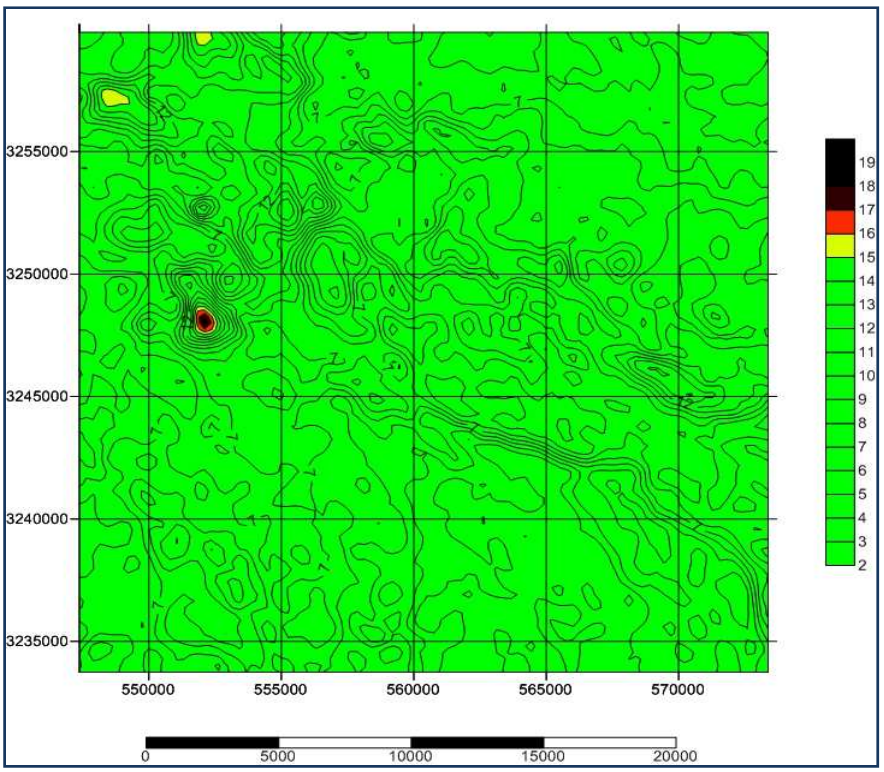

Figure 6: Element thorium anomalies in the area map fathAbad

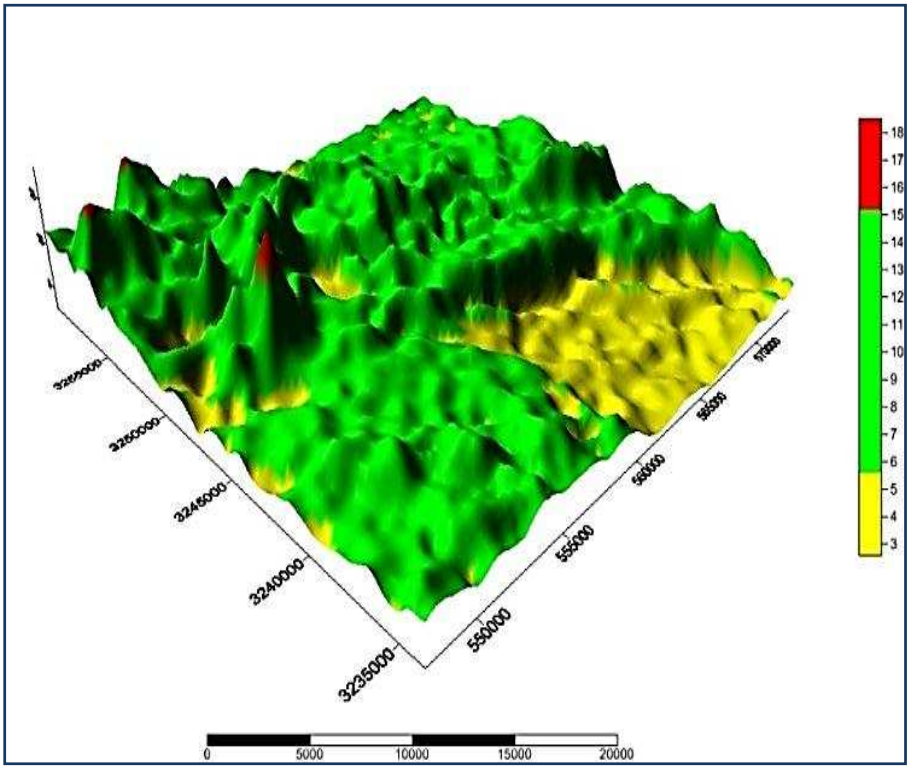

Figure 7: Element uranium anomalies in the area map fathAbad

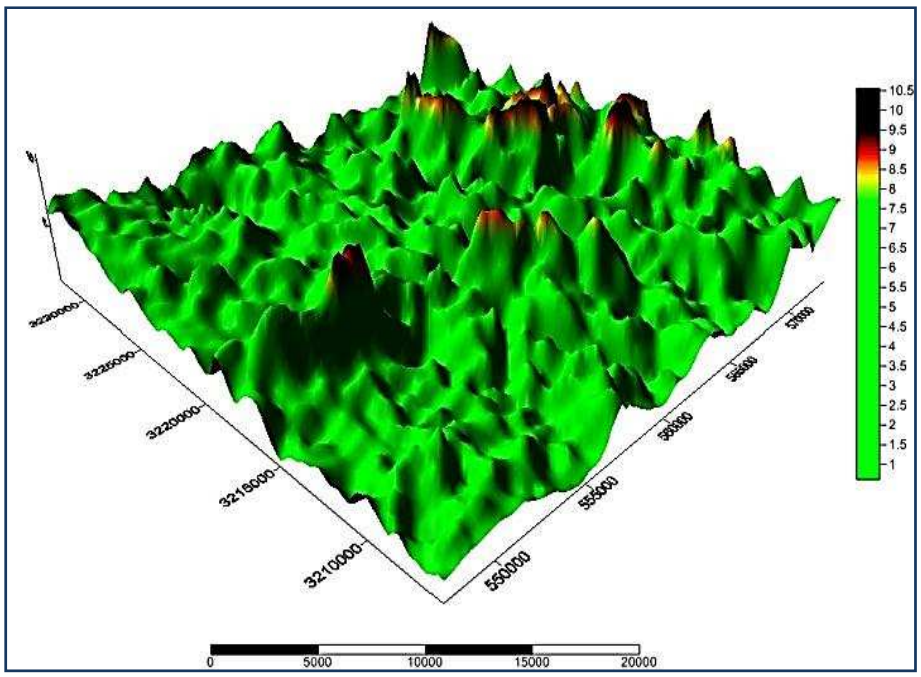

Figure 8: Element thorium anomalies in the area map goor-e-bala

Results

With the processing and analysis of airborne radiometric exploratory data and preparing the radioactive element counter maps, Anomalous areas were identifiedwest of Bam (fathAbad&goor -e- bala) (South-East Iran). In the study area, focus of the radioactive anomalies generally are on the Central, West and South West and these radioactive elements abnormalities exist in granite and granodiorite lithic units (middle – late Eocene age).Two of the anomalies are located in the western and south-western corner sheet that is introduced as the worthy anomalies for future explorations.

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