Journal of Biodiversity and Environmental Sciences (JBES)
ISSN: 2220-6663 (Print) 2222-3045 (Online)
Vol. 6, No. 1, p. 761-767, 2015
http://www.innspub.net

INNSPUB
RESEARCH PAPER

OPEN ACCESS

Area exploration based on airborne radiometric geophysical data by surfer software at rizab (the South East of Ardakan)

Hamid Reza Sabok Khiz*, Ayob Memar Koche Bagh, Mohammad Ehsan Hekmatian

Department of Mining Engineering, South Tehran Branch, Islamic Azad University, Tehran, Iran

Article published on January 01, 2015

Key words: Surfer Software, Airborne Geophysics, Exploration Geophysics, Area Exploration, Rizab Sheet.

Abstract

Geology studies is a multi-stage activity that is began in a small scale and is became to large scale. With combining the results of each phase, study area gets smaller and eventually sites is selected as target for drilling, in order to achieve mineral deposits. Data resulting from studies of topography, geology, geochemistry, geophysics and drilling will achieve a tremendous amount of information that when they to be organized properly, reliable and useful results will presented. With regard to achieved progresses in the field of geographic information system (GIS), significant development occurred in the earth sciences, including obtaining, saving, retrieving, processing, displaying, using and sharing information of reference location. This paper investigates and analyzes appropriate sites of area exploration in sheet of 1:100,000 of Rizab with using airborne geophysical data and surfer software as well as combining data.

***Corresponding Author:** Hamid Reza Sabok Khiz ✉ Hamidsbk@chmail.ir

Introduction

Analysis of most of exploration techniques is based on possibility of results obtaining from it. In classical statistical, distributions of desired quantities are examined in one or more of the community, regardless of their spatial positions relative to one another. The most important part of exploratory work is use of airborne geophysical data in determination of anomalies. First, using classical statistical method and using determination of statistical parameters on collected geophysical data at 1:100,000 sheet of Rizab, anomaly separation is performed and then frequency distribution table of the uranium and thorium elements as well as frequency distribution histograms these elements are drawn. After drawing frequency distribution histograms, statistical parameters of uranium and thorium are calculated and finally the separation of anomaly communities has been performed based on dispersion around the mean.

Rizab has been located between to eastern longitude and to northern latitude. Rizab 1:100000 sheet is on 1:2500000 geological map of Ardakan and it has been located in the heart of central desert of Iran in northwest Yazd. The regional geology of the precambrian, cambrian, paleozoic, cretaceous and quaternary are mainly in the area of mesozoic and the cretaceous unit is quaternary. This area can be used to make the famous formations Tashak, Boone Shoru, Chapdony noted. Intrusive in the northwest and southeast are located here, including granite, schist and biotite are pink.

The purpose of this study was investigates and analyzes appropriate sites of area exploration in sheet of 1:100,000 of Rizab with using airborne geophysical data and surfer software as well as combining data.

Material and methods

Area under study

Rizab has been located between to eastern longitude and to northern latitude. Rizab 1:100000 sheet is on 1:2500000 geological map of Ardakan and it has been located in the heart of central desert of Iran in northwest Yazd province between latitude of 55-55,30' north and longitude of 32-32,30' east. Ardakan has been located in the heart of central desert of Iran. In terms of topography, the major city with approximately 1500m contour line is limited. Only about 5% of the city area is mountainous and the average height of 1234 meters above sea level in the city. The major mountain that exist in this area are sand dunes mountain (elevation 1605m) 25km northeast of Ardekan and Khoranagh mountain (height 3199m) southeast of the city.

Fig. 1. Google Earth image of the study area.

The area northern part has been composed of gneiss metamorphic, marble, and amphibolites. Its southern part has been composed of marl sediments and Miocene sandstone.

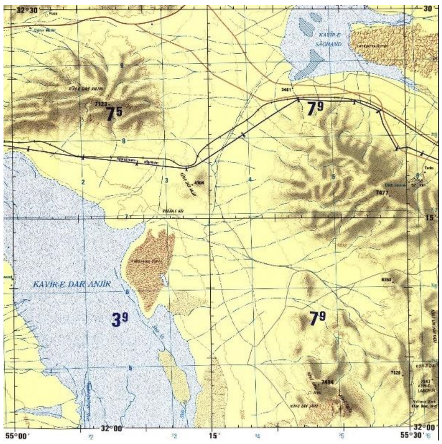


Fig. 2. Combining Google Earth image and the geological map of the study area.

Results and discussions

The regional geology of the precambrian, cambrian, paleozoic, cretaceous and quaternary are mainly in the area of mesozoic and the cretaceous unit is quaternary. This area can be used to make the famous formations Tashak, Boone Shoru, Chapdony noted. Intrusive in the northwest and southeast are located here, including granite, schist and biotite are pink. These rocks have been covered directly by the deposition of oligomiocene as incompatible. It appears metamorphic rocks have formed highland heights from the second period onwards, and no sedimentation has been done on them or due to uplift and erosion it has removed. Generally, strata row of rocks in the study area from bottom to top is consists of precambrian metamorphic rocks, sedimentary rocks of late precambrian and cambrian- ordovician, paleozoic metamorphic rocks, diorite intrusions, granodioriti, granite, sedimentary and volcanic rocks of oligomiocene and pliocene and quaternary younger deposits, respectively.

Fig. 3. The path of access to the area.

The Poshte-Badam fault is the most important fault in this zone. The north - south and the red line shows the range of passes. Terraces in the eastern part of the study area are marked in blue. It is the fault arc and along the north - south and south east regions Badam passes moves. Poshte-Badam fault activity is related to the phase katangaei and mesozoic reactivation of structures and graben been extraterrestrial.

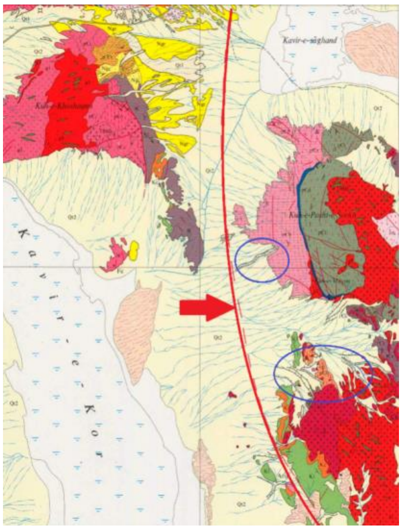


Fig. 4. Poshte-Badam fault has been shown on Rizab geological sheet.

Data preparation (Geostatistical data)

In order to sort airborne geophysical exploration data, which has a wide range, data classification should make up in a specified category to achieve a significant frequency distribution. In this context, domain of the smallest to the largest measured amount for each category of radiometric data information, including Uranium, Thorium was determined and classes were divided into equal intervals. Domain of each category was selected based on the sturge rule and integer number was selected for category domain. Data number in each category indicates absolute frequency of desired category. The relative frequency of each category is determined by dividing the absolute frequency to total frequency that is expressed as a percentage. The cumulative frequency is obtained of data summation in each category. Data frequency distribution has been specified in the following tables.

Table 1. Thorium data frequency distribution and its histogram.

Statistical Analysis Uranium	
The Number of Content	172721
Median	6.63
Standard Deviation	4.91
Variance	24.06
Skewness	1.14
Kurt	0.91
The Minimum Data	0.01
The Maximum Data	28.85

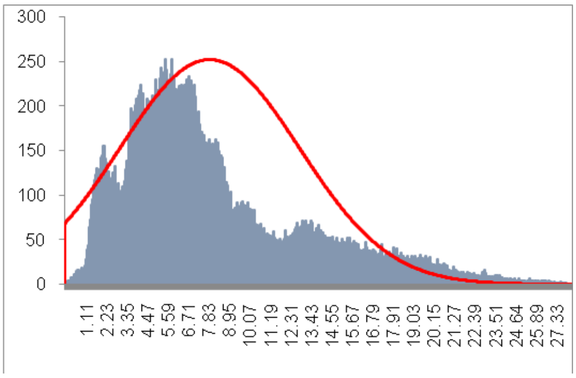
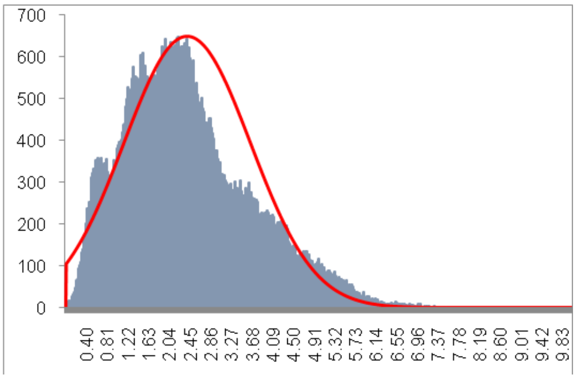


Table 2. Uranium data frequency distribution and its histogram.

Statistical Analysis Uranium	
The Number of Content	172703
Median	2.22
Standard Deviation	1.25
Variance	1.57
Skewness	0.66
Kurt	0.08
The Minimum Data	0.01
The Maximum Data	8.65



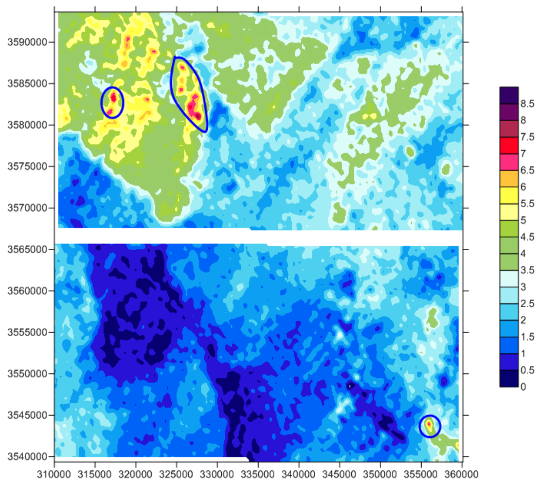


Fig. 5. Two-dimensional map obtained using Surfer software for Thorium and Uranium, respectively.

In the Rizab, according to the results obtained for the separation of anomalous communities, it is recommended to continue exploration processes in areas that are most likely to the radioactive elements. These areas can be determined using these Wire Firm. Combining satellite data can be performed based on index overlay model based on weighting of the information different layers. This weighting is performed based on the accuracy and validity of the various layers. After determining factor weights and appropriate classes for every factor, with applying these weights to information layers, weighted maps is produced and finally final map is determined by using weight of each pixel in the index overlap model. Improvements in airborne EM survey methods, such as MEGATEM and VTEM, have facilitated exploration in deeper parts of the Athabasca Basin. Airborne EM techniques have successfully imaged conductive packages to depths of as much as 800 m, in significantly reduced time frames and at costs much less than traditional ground EM survey methods. These systems have the potential to map interpreted fault offsets and potential zones of alteration along conductive trends. This has led to a better understanding of the large to intermediate scale geological setting. However drill hole targeting still relies heavily on the resolution and confidence of ground EM methods. The three large loop EM configurations currently used in the Athabasca basin are summarized. The Fixed Loop TDEM method remains a commonly used first pass exploration tool along new and/or under-explored conductor corridors. It employs a large rectangular transmitter loop placed well back from a suspected conductor trend while a roving receiver maps the conductive response(s). It is a common technique for initially mapping conductor systems, but will not necessarily map, or even identify, all discrete conductors accurately in a complex conductive environment. The interpreted location of a conductor can be skewed or entirely masked by the presence of 1) a strong half-space or layered-earth response, 2) a conductive host lithology, 3) conductive regolith and/or conductive brine pooling at the unconformity, 4) conductive brine in permeable fault ones, 5) the bounding conductors in a multi-conductor package, 6) unresolved conductors adjacent to the target conductor, and 7) hanging wall conductors at a reverse faulted offset of the unconformity. Consequently Fixed Loop surveys alone can easily miss the conductor that hosts a significant uranium deposit. In areas with complex or multiple conductor systems Moving Loop surveys are used to supplement or replace Fixed Loop delineation of conductors (after airborne EM surveys). Conductor mapping is improved with Tandem Moving Loop by presenting a constant EM array, thus diminishing the influence of the layered earth response that can be problematic in interpreting Fixed Loop data. But because the fixed transmitter – receiver separation can limit conductor resolution, it is advantageous to employ multiple separations and/or include some Fixed Loop coverage to help ensure that all conductors are mapped. The Stepwise Moving Loop or Step Loop method (Powell, 1990; Matthews *et al.*, 1997) is a hybrid of Fixed Loop and Tandem Moving Loop methods, and thus has some qualities of both. The survey is conducted in a fashion similar to a seismic reflection survey with the transmitter loop located at the center of each group of readings associated with that loop. The loop is moved along the survey line at relatively large intervals, typically equal to one-half or one loop dimension. Multiple transmitter-receiver separations provide a wider range of responses and resolutions than can be achieved with Tandem Moving Loop, so conductor picks tend to be less skewed by nearby conductive features.

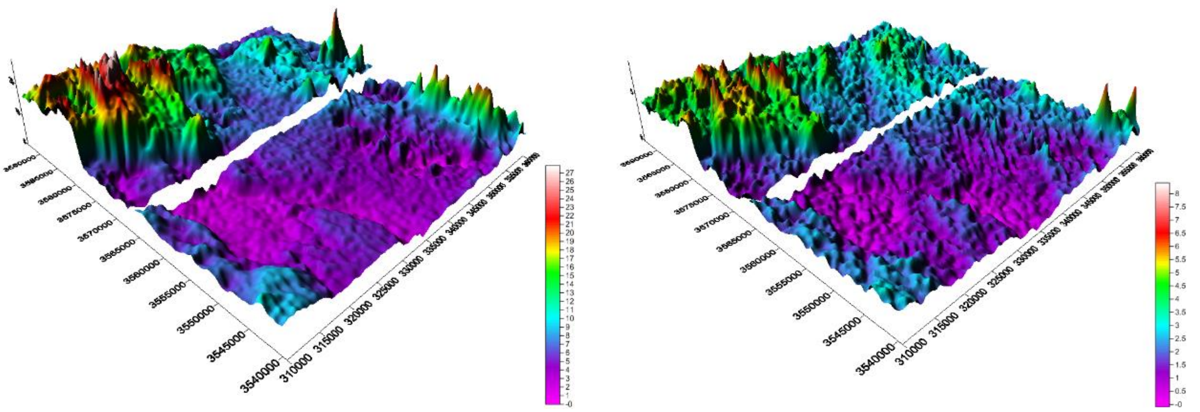


Fig. 6. Three-dimensional map produced using Surfer software for Thorium and Uranium, respectively.

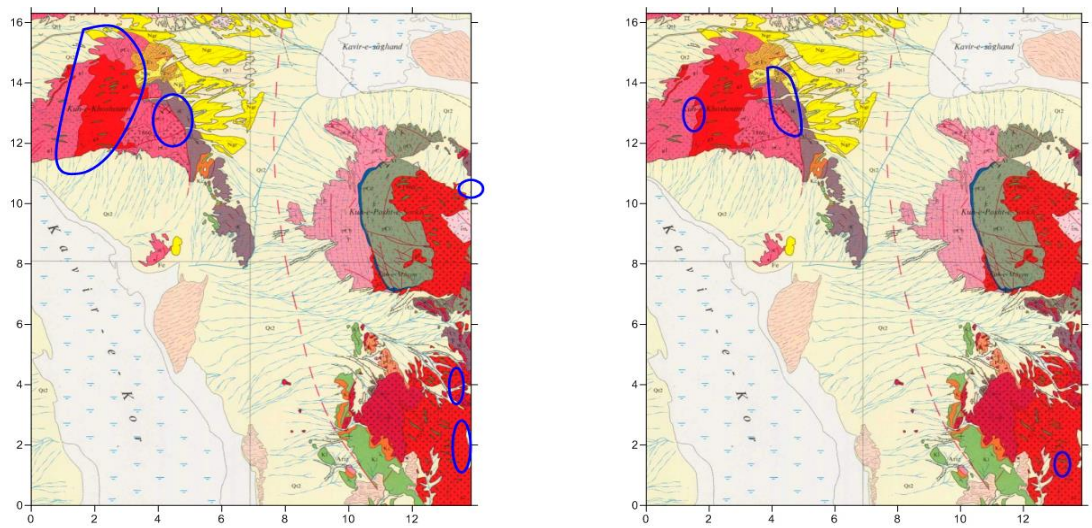


Fig. 7. Geological maps promising areas.

As described below, the Step Loop method has been used to map the location of: 1) embedded conductors in multiple conductor systems where bounding conductors can otherwise mask them, and 2) footwall conductors at significant unconformity offsets related to reverse faults where a hanging wall conductor can otherwise mask them. Fixed and Step Loop surveys have relatively low acquisition costs per reading because the number of readings taken per transmitter loop setup are maximized and survey logistics are relatively simple. On the other hand Step Loop and Tandem Moving Loop have the highest acquisition costs per kilometer of total coverage because of the greater total amount of labor involved per kilometer with these more elaborate surveys. However depending on the survey parameters, Step Loop may have a smaller total survey cost than Tandem Moving Loop because only the zone of interest needs to be covered, as with Fixed Loop.

Combining data using software

The accuracy of input information and verification of the raw and initial data, correct selection of markers, and selection of the appropriate model for layers integration are three phases that can be used in the mining exploration operations.

Conclusion

With combining the above map is achieved the following results: Rizab sheet: Amphibole rocks with layers made of marble and metamorphosed ophiolite rocks and lava of andesitic and basaltic and basaltic andesite and andesitic breccias volcanic with volcanic conglomerate. Ardakan sheet: Marl-Sandstone-Siltstone and mudstone. According to deposits formed environment of Uranium and Thorium and the potassic zone, appropriate sites can be investigated for sampling. In the northwest area similar to what was seen in the analysis of Thorium, Uranium potential anomalies in the intrusive Zrygan also there. However, in the study area is low-grade uranium. The extent of mineralization is limited. As can be seen, the entire map display a particular process in relation to area mineralization zone that it is the first layer of information. To obtain exact results, studies in other fields are required. As can be seen, the greatest anomaly is related to sheet in the North West region and type of area anomalies in Rizab - Ardakan are mostly gneiss, amphibolite and marble as well as in some areas are sandstone and shale.

Acknowledgements

The authors thank **Dr. Afshar Zia Zarifi** for give data and **Eng. Alireza Ashofteh** for remarkable contribution of this research

References

EGSMA. 1981. Geologic map of Egypt, Scale 1:200,000 Egyptian Geological Survey and Mining Authority.

El-Hadidy MS. 2012. Seismotectonics and seismic hazard studies in and around Egypt. PhD thesis, Faculty of Science, Ain Shams University, Egypt.

Feizi F, Ashofteh A. 2014. Area exploration takhtesoleiman based on geophysical and satellite imagery, Journal of Middle East Applied Science and Technology(JMEAST), ISSN2305-0225 **3(10),** 414-417.

Gardner GHF, Gardner LW, Gregory AR. 1974. Formation velocity and density – the diagnostic basics for stratigraphic traps. Geophysics **39**, 770–780.

Hekmatian ME. 1375. Report interpretation of aerial geophysical exploration plans Ryzab area, the Atomic Energy Organization of Iran.

Majidi Seyyed Bayglou A, Lotfi MR, Hezareh M, ZiyaZarifi A. 2010. An assessment of Neflin Cinit mass in Razgah and its surrounding sediment units with the purpose of uranium explorations of type sedimentary (northern Azarbayjan), Earth and Resource research – scientific quarterly, Lahijan branch, 3rd, year, no.1, spring, 51-58.

Minty B. 2011. short note: on the use of radioelement ratios to enhance gamma-ray spectrometric data. Exploration geophysics **42**, 116-120.

Noohi A, Ziazarifi A, Teimoornegad K. 2010. Geological studies on Uranium, Thorium, Potassium based on airborne radiometric geophysical data in Harsin (the south of Ahar – eastern Azarbayjan), International Journal of Geology **(6).**

Powell B. 1990. Large loop EM surveys in the Athabasca Basin, in Beck, L.S. and Harper, C.T., eds., Modern Exploration Techniques, Saskatchewan Geological Society 74 - 93.

Powell BM, Leppin G, Wood CO, Dowd Brisbin D. 2006. Geophysics applied to new uranium discoveries in the Athabasca Basin, Society of Exploration Geophysicists Uranium Workshop, New Orleans.

Powell BM, Leppin G, Wood CO, Dowd. 2005. Recent innovative applications of geophysics to new uranium discoveries in the Athabasca Basin, in Proceedings of an International Symposium, Uranium Production & Raw Materials for the Nuclear Fuel Cycle: Supply and Demand, Economics, the Environment and Energy Security, IAEA, Vienna 169-178.

Roy C, Halaburda J, Thomas D, Hirsekorn D. 2005. Millennium deposit – basement-hosted derivative of the unconformity uranium model, in Proceedings of an International Symposium, Uranium Production & Raw Materials for the Nuclear Fuel Cycle: Supply and Demand, Economics, the Environment and Energy Security, IAEA, Vienna, 111-121.

Sabokkhiz HR. Under the supervision of A. Memar Kouche Bagh, Area exploration Ardakan (Rizab) based on radiometric geophysical data in sheet 1:100000.

Walker P, Lamontagne Y. 2007. Electromagnetic Modelling of the Cree Lake Extension, Millennium Deposit, with Multi Loop II; in Proceedings of Exploration 2007, Exploration in the New Millennium, Fifth Decennial conference on Mineral Exploration, Toronto.

Wannamaker PE. 1995. Magnetotelluric surveying one can afford: Interpretation of MT sounding profiles in natural environments, International Symposium on Three Dimensional Electromagnetics 511-528.

ZiyaZarifi A. 2010. The bases of radiometric geophysical explorations, 1stedition, Azad University press, Lahijan branch, 308.