Investigation geophysical by Magnetometry and Modeling Iron Ore desposit Bijar Kurdestan province

Fariba Jamshidi*[,1], Mohammad Poosti[2], Alireza Gorji Chalespari[3], Mohammad Hamedpour Darabi[3]

1- Department of Geology, Payam-e-Noor University, Tehran, Iran.
2- Department of Geology, University of Hormozgan.
3- Department of physics, University of Hormozgan.

* Corresponding Author: jamshidi2498@gmail.com

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Abstract

Iron ore deposit Bijar area is located in east north in Kordestan province based of field observation, ore minerals are magnetite, magnetite-martitite and magnetite-pyrite. No. 922 points on the 16 profiles were collected over about 7500 meters in the area. Magnetometers treatment of advanced devices and new GSM-19T is made in Canada. The data were corrected and the magnetic field intensity map was prepared.The remaining amount was calculated regional field and deposit modeling was performed using reverse Euler and accordingly, in this area a mass burial was diagnosed with high magnetism. Due to the intensity of the magnetic field taken, This mass has a high content of metals and minerals are similar and based on geophysical data, location drilling boreholes, to deposit at least depth, have been proposed.

Keywords: Magnetic Surveys, Modeling, Euler Method, Bijar.

1- Introduction

In order to evaluate the potential of iron ore located within the mirage of a mining town in the city of Bijar, Kurdistan Province Magnetometry operation in this area with the interpretation of the results was performed. According to geological studies, the optimal number of points were identified for removal. Also note the corrections needed to be made to accurately separate anomaly of the noise level.

Based on surface observations, mineral ore types Magnetite, Martite and pyrite-bearing Magnetite, (with or without intermediate skarn rocks) on the Oligo-Miocene limestone marble is formed (Nabavi, 1976).

Igneous rocks of rhyolite masses are often exposed to rhyodacitic and sometimes a cupola and a combination of quartz porphyry trachyte to be seen. Outcrops of intrusive igneous rocks with diorite composition to lucodiorite are in the range of harvest. Faults in this area are often of normal and strike-slip type or a combination of these two requirements. Reverse faults in the region are not observed. Approximately north-south trending faults often, NE-SW, EW and NW-SE are, in some cases (Aghanabati, 2004).

Sedimentary strata dip is mostly low and close to the horizon. However, in areas affected by faulting or igneous intrusions are (like the intrusion of diorite to lucodiorite in limestone south of harvest) classes are modified tilt or vertical approaches. Skarn-type deposit is in those areas. Iron skarn type deposits have host rocks of gabbro, diorite, diabase, Syenite, tonalite, granodiorite, granite and volcanic rocks associated with them. The change may also be found in the limestone. The texture of the rocks, granitic intrusive rocks and sedimentary rocks have been metamorphosed tissues granoblastic to hornfelsic.

2- Geophysical studies

According to the geological field and outcrop of iron ore and host rock, magnetic-survey method was selected for the exploration of the deposit (Zomorodian and Hajeb, 1990). About 922 spot on the 16 profiles and over 7,500 meters in the area were taken. 4 profiles in the northern part and the southern part of the rest of the harvest. All of the profiles in this region are parallel whit together. But generally speaking on the sidelines of the greater distance from the central area in (Figure 1) has been picked network points. In (Table 1) as well as the coordinates of the beginning and end of each profile is along its length.

Table 1) The beginning and end of harvest profiles.

profile	Start coordinate		End coordinate		length
	x	y	x	y	
pr1	727131	4024860	727130	4025300	440
pr2	727110	4025300	727110	4024860	440
pr3	727151	4024861	727150	4025301	440
pr4	727170	4025301	727171	4024861	440
pr5	7271191	4024940	727190	4025300	360
pr6	727211	4025300	727211	4024861	439
pr7	727231	4024861	727230	4025300	439
pr8	727250	4025300	727250	4024860	440
pr9	727270	4024860	727271	4025300	440
pr10	727291	4025300	727290	4024860	440
pr11	727311	4024861	727311	4025300	439
pr12	727331	4025300	727330	4024860	440
pr13	727120	4025410	727120	4025910	500
pr14	727101	4025911	727101	4025411	500
pr15	727080	4025410	727081	4025910	500
pr16	727061	4025911	727060	4025680	230
Total					**17**

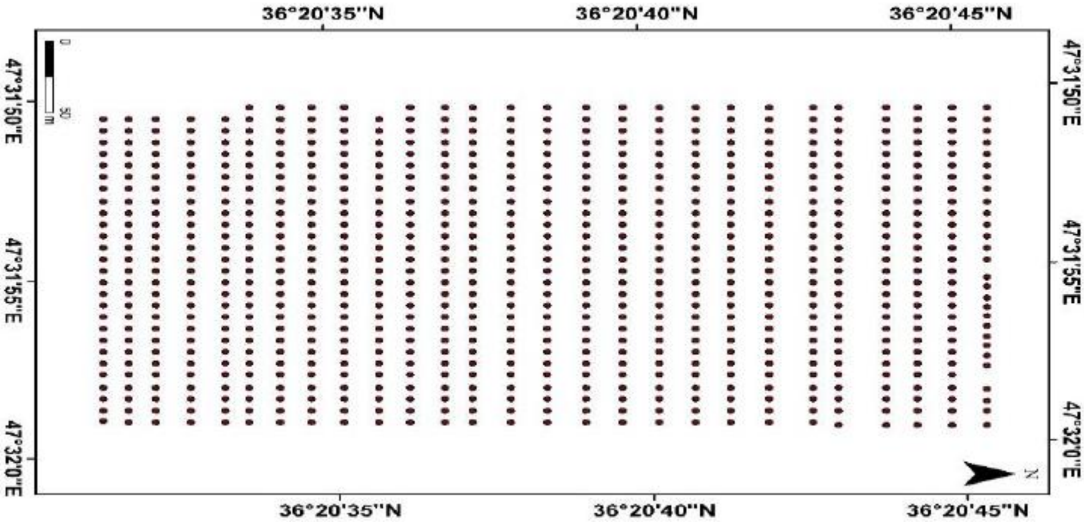

Figure 1) Network points have been harvested in the study area.

Due to observe the process of minerals in the ground (as hematite and magnetite) and also the stretches of rocky outcrops in the central area there, geophysical profiles along the north-south and perpendicular to the existing procedures and were taken . All profiles of each 25 meters was considered and these are regularly maintained throughout the area. The picked up points on each profile was taken 10 meters. These are the areas where most of the changes was reduced.

Operations disassemble parts of the GPS coordinate system (GPS) and with high accuracy and length along the profile was controlled by meter and compass.

2.1- Specification and description of the magnetic field measuring device

Magnetometers operations in the region for recording magnetic data from a new and improved Magnetometre GSM-19T proton is made in Canada that has the following characteristics were used (Table 2).

Table 2) Specifications used in the interpretations.

Sensitivity	< 0/1 nT @ 1HZ
Resolution	0/01 nT
Absolute Accuracy	1 nT
Dynamic Range	10.000 – 120.000 nT
Gradient Tolerance	Over 7000 nT/M
Sampling Rate	Reading per 3 to 60 sec
Operating temperature	-40°ct + 60°

2.2- Earth's magnetic field parameters in the study area

Earth's magnetic field changes with latitude and time, are calculated by a thorough empirical analysis of that as the magnetic field of international reference (IGRF) are remembered.

Magnetic field parameters in the study area using the coordinates of a point system are given in Table 3 IGRF obtained.

In magnetic surveys in the area of the magnetic field intensity (F) is measured and all calculations in this study are based on this amount. The values of the tilt and magnetic deviation is widely used in the modeling.

2.3- Sign raw data in the area

Magnetic field data acquisition operations in the mirage of a proton magnetometer was used. To record daily changes also point out the area were considered and taken every two hours in the network, a reading took place at this location.

Table 3) The parameters of the Earth's magnetic field in the study area.

Horizontal (H)	Downward (Z)	Eastward (Y)	Northward (X)	Declination (D)	Inclindtion (I)	Total Intensity (F)
27770.64 nT	39837.91 nT	2135.36 nT	27688.42 nT	4.41 (Deg)	55.12 (Deg)	48562 nT

2.4- Corrections on the data

Magnetometers necessary for the correct latitude and altitude, as well as changes occur daily. But in the study area due to the small size of the region, as well as a slight difference in the height of the entire region, resulting in negligible impact of these factors on the data from these corrections were the exception. However, the daily corrections should be further investigated.

2.5- Surveying of data

To undertake a detailed interpretation of the data obtained from the harvest of the magnetometers is necessary that the statistical parameters calculated to check the accuracy of data accuracy. The intensity of the magnetic field of statistical parameters for all measurement data in the study area (Table 4) is given.

Table 4) Statistical parameters of the magnetic field data measured in the study area.

Skewness	Elongation	Variance	Standard deviation	Middle	Average	maximum	Minimum	Domain	No data

1.58	**3.37**	**15188704.1**	**3897.27**	**4.47631**	**48453.13**	**61998.5**	**38567.2**	**23431.34**	**952**

Looking carefully at the wide range of data in the table, it becomes clear that in this area of very high intensity areas where the magnetic field strength is very low. Therefore, the probability of magnetic dipole in the region is high. There is also wide variation in the data due to their large dispersion around the mean. After viewing areas as possible anomalies in this area is high. In addition to this the skewed distribution of low and high elongation and overall shape close to a normal distribution function, and this score very high in the estimation of quantities, or to geostatistical methods interpolation (as kriging)'s . On the other side of the histogram can be easily recognized that one of the two independent society anomaly (Figure 2).

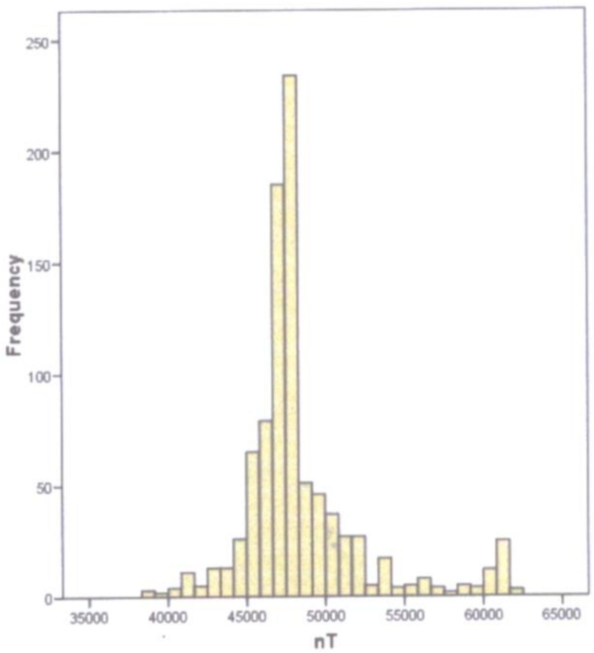

Figure 2) Histogram data distribution function magnetometry in the study area.

3- Discussion and results

Many factors related to the interpretation of the geology and scale removal is the most important. It is necessary to calculate quantitative and qualitative abnormalities simple hypothesis about the source of knowledge about the geological situation because their position is very low mineral structural phenomenon. In order to apply filters on the data collected to the lowest error may be able to achieve the desired results. None of this operation anomaly favorite filter completely separated from non-desirable does not, but for a clearer view of the phenomena of interest, are quite useful.

3.1- Map of the total magnetic field intensity

In general, anomalies or changes in the magnetic field strength of the field in the interaction of surface sources such as metal objects buried anomalies, magnetic minerals or any other source that has a magnetic field is created. By measuring the intensity of the magnetic field in order to draw a profile based on the measured coordinates, the anomaly of the value of background noise, it becomes clear to us. The magnetic field strength in each area on the Earth's magnetic field and magnetism (in the case failed to consider the fields), which is itself associated with magnetic minerals, particularly iron ores and rocks are different. So are the stones that have these minerals. Greater field strength and the magnetic anomalies are detected. Therefore, by measuring the total magnetic intensity magnetic anomaly to identify concentrations of magnetic minerals can be special events, such as contacts and faults may also be specified. In (Figure 3) total magnetic field intensity in the study area has been plotted. The magnetic field of at least 40,340 up to 62,588 gamma change. Most of the profiles on No. 4 to 7 were measured. This area is located in the center of the anomaly along the north-south almost drawn profiles and the profiles (9) (6) start continues. Therefore, the above-mentioned anomalies in 4 profiles to a distance of about 20 and a length of about 120 meters per profile repeated and according to the distance of the harvest in the range of 10 meters, it is the importance and validity of the anomaly adds a lot the conclusions made in this area show the upper field. The remarkable thing about this anomaly is that here there is sharp fluctuations in the value field and anomalies, is quite symmetrical. The range consists of a magnetic dipole is the negative pole to the positive pole is located in the North East. This anomaly, which is the anomaly area, is named as central anomaly.

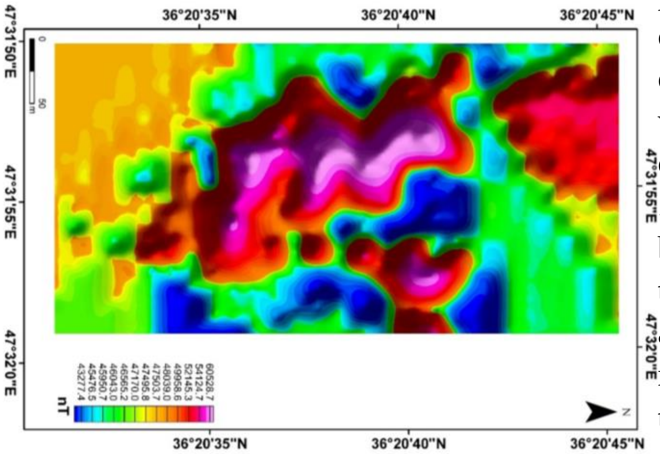

Figure 3) the total magnetic field intensity map of the study area.

After the central anomaly, there is another anomaly in the East area of study that has not expanded much. Its dimensions are approximately 30 to 30 meters, it will be weaker magnetic field strength of the anomaly under the name East anomaly is named. The negative pole of the dipole is located in the northeastern part. In the south of the anomaly some small anomalies can be seen in terms of size, expansion and storage can not be reasonably attributed to them. In other parts of the study area, there are certain anomalies and field harvested at the field area.

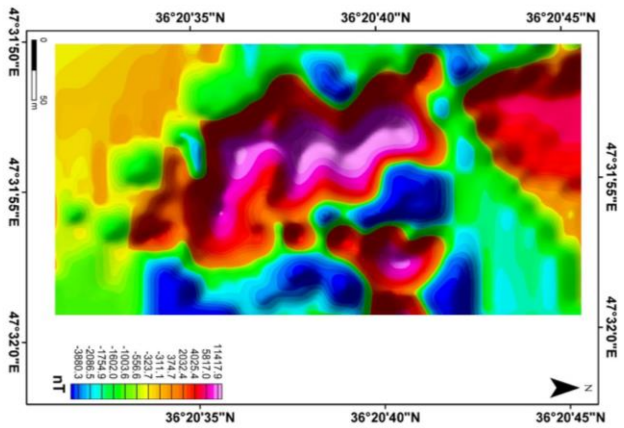

Figure 4) The remaining fields in the area.

3.2- Deposit modeling

In order to obtain the shape and depth of the deposit using various geophysical methods used (Madani, 1987). Each of these methods has particular strengths and weaknesses, but what is certain is that there is a relatively high error rate on these methods and the issue of properties with potential fields of land is not human control many factors in the volatility of interfere . Here are the two ways to check the status of bodies buried in the area has been used. In order to draw a number of profiles on the right and in accordance with the dipole available for both models was in line with them. The profiles of the northern most part of the study area and to the southernmost part of it's name began Profiles A profile D was selected. According to their length and size of the anomaly were chosen in addition to full coverage abnormalities also include parts of the value of background. The sections A, B, C and D were used for modeling. (Fig. 5) This profile position on the map indicates the total field strength.

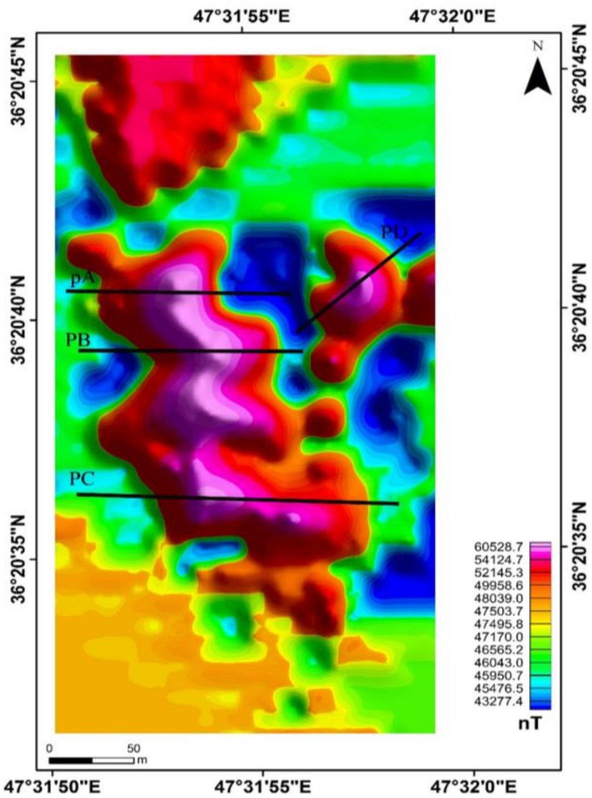

Figure 5) position profile modeling on the field map.

3.3- Estimated depth and form factor deposit Euler's method

For a closer look at the depth and shape of different methods can be used, including Euler's method (Euler Deconvolution). This method is based on calculating the vertical and horizontal gradients at each point and they built plot and in places where there is the greatest difference between these two parameters, the possibility of a unipolar or bipolar magnetic high. This can be a convenient form factor that varies from bipolar won their approximate depth. In this area the main objective is to reach the masses of iron-containing minerals. Therefore, the ratio of 1 or 5/1 can contact the mineral and ore discovered stuck inside it. A profile in Figure 6 replies on Euler's method is given. As can be seen, the mineralization from a depth of about 20 meters above the ground began to move into the East on the depth increases.

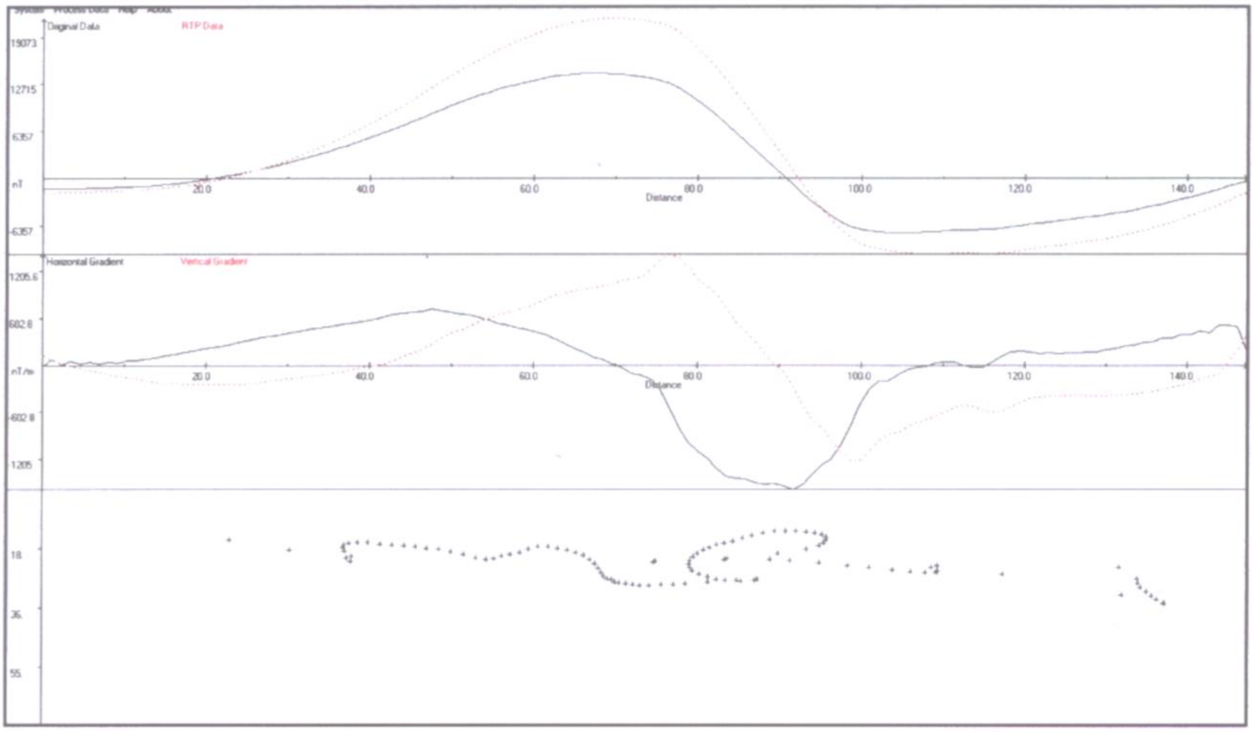

Figure 6) replies on Euler's method A number of profiles.

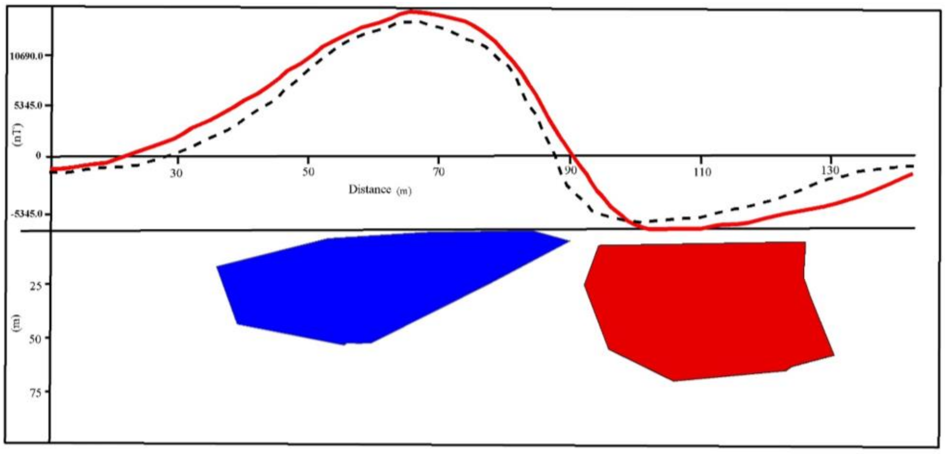

Figure 7) A number of inverse modeling on profiles.

In Figure 7, modeling has been done to reverse the deposit. Using this method can be graphically showed the form and extent of Mineralization. In this method, according to the profile of the magnetic field has been harvested, so the depth of the drawn-out and profile it comes to the field of this form. However, by changing the shape to be taken to profile the profile of the answers are supposed to close. While most compliance exist between the two profiles can be obtained from the shape of the surface.

3- Conclusions

One of the major goals in studies of magnetometers in each area, in addition to the magnetic maps, information on geological and tectonic structure. It requires the beneficial use of this information, combined with other available data including geological maps, such as aeromagnetic geophysical interpretations, well logs and gravity. Analysis and modeling have shown that in this region there are a pile of hidden magnetism that makes up dipole is relatively high. Due to the intensity of the magnetic field harvested at this place, the mass has a high content of metals and minerals similar. Overall area at the center of the study area between latitudes 4024990 to 4025170 meters and longitude 727 170 to 727 280 meters, as his promising area and should be further exploration activities will focus on this area. Within the limits mentioned in the preceding paragraph need to dig some holes are exploratory. With the number of structures in place were appropriate to different modeling. Finally, combination of all the resulting maps and modeling of the drilling was to offer a number of points. This location was chosen the most likely approach is to deposit on the other hand, the minimum depth may reach the deposit. As defined in the geophysical and magnetic method, this method can be the most appropriate place where he is most likely mineralization, for our choices. Therefore, if the drilling is done at this point and the deposit will not encounter not anywhere else in the area was covered by the deposit .The coordinates of the proposed drilling in the Table 4 is given. Because of anomalies is proposed to extend the boreholes drilled vertically to a depth of 100 meters and at least continue .In cases where the method on a mass mineral anomalies that indicate the presence or absence of mineral is doubt, it is better to check with operations Gravimetric magnetic anomalies payment. Gravimetry and magnetometry are based on the anomaly areas for drilling and other areas will be the next priority. This also applies to the study area .Check the profiles that have been harvested in the northern part of the study area represent a significant magnetic anomaly in the North East is the area that needs to continue for several profiles magnetic readings in the East this area closer look at it.

Acknowledgments

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