

Mahabad investigation on geology and exploration via remote sensing

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Abstract. Capture images in different areas of the electromagnetic spectrum from visible to infrared is one of the advantage of satellite, also broad vision for large-scale study of the phenomena, repeated imaging, resolution of various ground targets case studies, comments and imaging areas impassable to mention.

Width Mahabad zone with about 154 km² area is located in Mahabad – Marivan, southern part of west Azarbayejan province Iranian. This area situated in Sanandaj-Sirjan zone that Consisted of Mahabad, Bayandor and Soltanieh Dolomite formations Precambrian and Zaigun, Mila and Barut formation Cambrian in age.

Investigation ETM image Landsat 7 remote sensing of this area shows that faults, alteration and rocks unite. The results of research on this area had been recognized of alteration kind of Argilic, Siliciouc and Iron Oxide. This region main fault is NW- SE, No Intrusive bulk, connected results of and alteration, fault are research result, show anomalies in this zone.

Keywords: Remote sensing, Mahabad, ETM image Landsat 7

1. Introduction

capture images in different areas of the electromagnetic spectrum from visible to infrared is one of the advantage of satellite, also broad vision for large-scale study of the phenomena, repeated imaging, resolution of various ground targets case studies, comments and imaging areas impassable to mention. Remote sensing in exploration of deposit has below advantage: (Sirvastav et al, 2000, Sabins, 1999):

1. Units lithology Mapping, stratigraphy, and major lineaments and structural trends along of areas are creative ore.
2. Patterns of local structural fractures mapping, have specially deposited.
3. Identify altered regions related to deposits and masses separation
4. Basic geological information providing.

2. General description

Mahabad sheet is located in Mahabad- Marivan zone in the west of Iran, 35 km East of Mahabad and 8 km southeast and South West Gogh Tapeh Village.

"12 '56 ° 45 and" 40 '44 ° 45 as longitude and "11 '50 ° 36 and" 21 '44 ° 36 as latitude are the coordinate of studies area. Mahabad area with 154 square kilometers in 1:250000 and 1:1000000 Mahabad and 1:50000 topography sheets. Miandoab -Mahabad or through Uromia–naghadeh Mahabad are the main ways.

3. Geology studied:

Part of studied area Mahabad 1:100000 geological sheets by Eftekharnajhad and colleagues in 1981 have been studied.

3.1. Precambrian

3-1-1- Mahabad Formation (P€^{mr})

Mahabad formation characterize the lower unite of infracambrian rocks. It consists of mainly acidic volcanic and volcano- detritic rocks. The amount of volcanic rocks, comparing with shale in the sequence, greatly varies in different location. Volcanic almost constitute 80% of the total sequence of Mahabad Formation east of Mahabad. These rocks are mainly rhyolite, ignimbrite, fine and coarse grained acidic tuffs.

3-1-2- Bayandor Formation (P€^{br})

At the eastern range of Mahabad similar sequence consisting of dark purple to wine red micaceous sandy shale, red silty and argillaceous shale, sandstone, meta- rhyolite, crystal acidic tuff with alternation of cherty dolomite (mainly in the upper part), with subordinate thin layer of black, stromatolite bearing limestone, overlies the Mahabad formation with complete conformity and rather transitional contact.

3-1-3- Soltanieh Dolomite (P€-€s)

Recent systematic studies revealed the extensive occurrence or the Soltanieh Dolomite almost throughout the Mahabad Quardangle map. Its lithology in slightly different from the type locality in the Soltanieh Range and comprises of light gray, thick to well bedded, recrystallized, slightly silicified dolomite with chert which very frequency occurs as thin bands or irregular nodules. Chopoghlu shale member has not been observed within the map limit.

3-1-4- Barut Formation (€b)

Barut Formation in Mahabad area is characterized by regular alternation of silty to fine sandy, argillaceous and micaceous shale predominately purple to violet, olive green colour with recrystallized slightly silicified, grey chert, banded dolomite and sub- ordinate black stromatalite limestone.

4. Image processing desired area

The used satellite in this filed are Landsat 7 ETM. The passing numbers and rows of images are (168 and 34) and (168 and 35), with 1/25000 scale Mahabad. Because of desired area image map located in two satellite images, images are mosaic.

1:25000 scales remote sensing studies result in the main and secondary faults, geological units and alteration type's determination. This study steps included data gathering and ETM images of Landsat 7 processing:

1. To make images mosaic, 2. To result faults, 3. To separate geological units, 4. To separate, isolation of alteration:

The first steps in processing are ETM mosaic images; the main goal of this processing is to create one special image.

4.1. Faults Investigation

In many environments, geological faults have noticeable relation mineralization, directing mineralization process. Faults are the great place to adopt deposits. Landsat ETM satellite images are the most well-known for faults discovery. Metamorphism mineralization at the intersection of faults or annular structures occurred was showed by experience. So, recognition & drawing of the faults in satellite images will noticeably discover deposit. first image combined 5 3 1 band RGB environment, using Geomatica 8.1 software, Arc View 3.2 software structures in this compound were identified, then a 6 4 1 band combine to verify data was extracted using Edge Sharpening filters to detect faults border. Major and minor faults were highlighted by red color and low color, specified in the ETM images (Figure 3).

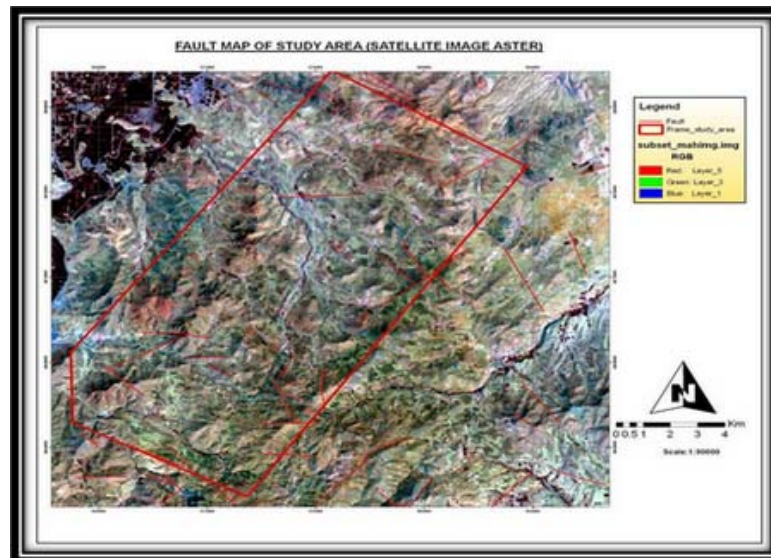


Figure 3 - Fault region

4.2. Geological unit separation

Separation all units are not generally possible without field observation. In general, all units separately are not rats band 5 3 1 and band 7 4 2 are used to separate geological units in this field, respectively. Also in 5 3 1 band combination roots and linear detector is used. In resultant no specific intrusion was observed, and young units were discovered, impossible to separate by satellite images.

4.3. Alteration

There alteration need, proper rock units to host for adoption hot fluids (hydrothermal), to result physical and chemical changes in host rock, the changes effect are observable in satellite images, in clay alteration an iron oxide forms, the position and relation with faults will be investigated. Alteration of iron oxide in a band of TM images has absorptive behavior and the band 3 TM reflection has too high reflection, 3 band because to show an iron alteration. (Ratio (3/1)). In this region, initial analysis for iron oxide alteration considerable with above ratio method. On the other hand, clay alterations in the 5 band have a high reflection, and in 5 to 7 TM band instead have low reflectivity. Thus the ratio of 5 to 7 band shows areas of clay alteration clearly.

4-3-1 - Argelic alteration

At First ETM image review was prepared, then 5 3 1 band combines applied to detected uncertain argelic and iron oxide alteration. After applying any combination upward image to detect with band zoom and liner. In this case, we can see light gold argelic alteration, again they observed white with another zoom and liner detection. (Light contrast and low brightness). Extract data from the ETM image sensor was used. For extraction data image separation of potassic and propolitic alteration zone separating are difficult and this type of alteration included argelic alteration they have widely area other than the alteration where faults observed, alteration was more that indicate mineralization is possible (Figure 4).

4-3-2 - Iron oxide alteration

At the same band in a 5 3 1 image LANDSAT 7 ETM satellite images show more than 70% iron oxide that in the areas are of white color and very light golden brown may be sing wrong with red cover . (As low color and high color or color combinations them). Then 7 4 2 band applied to detected green vegetation .This type of alteration in the region as there have been scattered and argillic alteration may be wrong for the color that to confirm using the ARI method described below is also necessary to mention that in silica alteration region was observed.(Figure5), (Figure 6).



Figure 4 - Argillic alteration zone with 531 band



Figure 5 - Iron oxide alteration with 531 band

4-3-3 – Alterations Confirm

That there are many ways to ensure that alterations are true or not:

1. Bands making differentiation, 2. Bands making ratio, 3. Make PCA

In this project, the way that we have used to confirm the alteration is creating an empty band in Geomatica environment that we make band diffractions by use ARI Method. The most famous diffractions band make to detect and confirm with 5-7, 4-2, and 3-1 combines that in method the argillic alteration with pink or purple, iron oxide with blue and the alterations silica units with green tones. It should be mentioned that subtraction operations are carried Xpace environment and we introduce the ARI here (Figure 7). Finally, an overall picture of all effects in satellite LANDSAT 7 ETM images, we can be observed green vegetation with 742 bands (Figure 8).

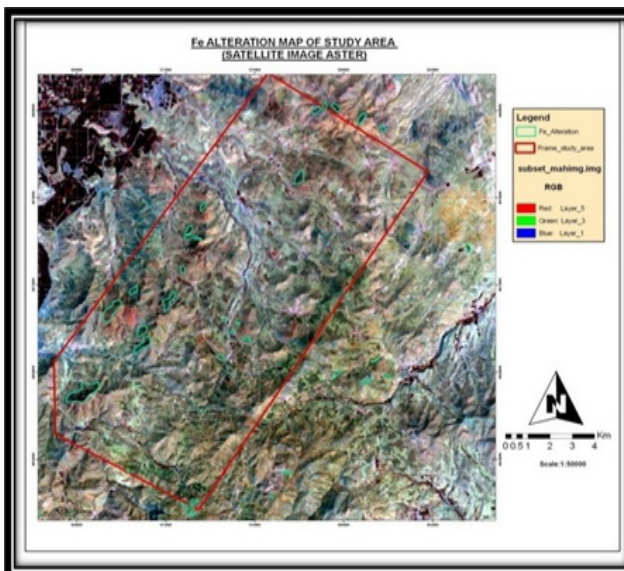


Figure 6 - silica alteration to the limited



Figure 7 - confirmed argillic and iron oxide in ARI method

5. Conclusion

1. Main faults have northwest - southeast and north - south trend and there are small faults in the region that they cut which the main trends.
2. In this area wasn't observed intrusion and only units that separated by satellite images which is young units.
3. In areas where faults have been observed, argillic alterations have greater dispersion that indicates may be the mineralization. These alterations mostly have been observed in southern and southwestern sheet that with heavy mineral studies in this area, particularly the gold, there is good overlap between the anomaly and alteration.
4. According to studies exploration in the region with anomalies such as iron and the heavy mineral such as hematite, magnetite show a good overlap with Alteration of iron oxide, and they are more marked in south and southwest of Mahabad 1:25000 sheets.
5. In the region we can see limited silica alteration.

6. Sources

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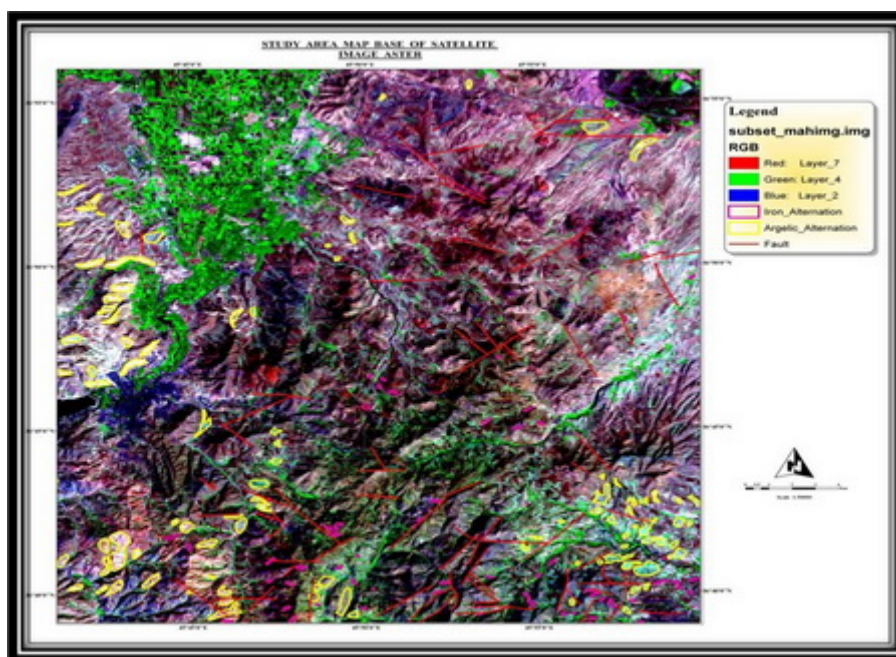


Figure 8 - Images ETM region with special perspective on vegetation