Hydrothermal Alteration in Ramand Region

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Abstract

Our study area as a part of magmatic belt of Urmieh-Dokhtar region is located in the South West of Buin-Zahra among structural zones of central Iran. Approximately distance from provincial capital is about 60 Kilometers. The main geological occurrences are known as igneous and pyroclastics formations such as rhyodacite and rhyolithic tuffs. In this region, extended alterations have been detected by remote sensing techniques. Also these features may be observed due to field activities in volcanic regions. In this research, enhancement of alteration facies has been well done by remotely sensed ETM databases after applying a selective principle component analysis according to Crosta techniques. Advanced Silicification haloes are most important evidence indicate to Base and Precious metals potentials in postmagmatic environments. For identifying the Silica content and related variations in epithermal systems, Crosta technique is adequate. This method introduces to recognition some clay and iron-oxides combinations as the main part of hydrothermal alterations in prospected regions. Concluded photomaps of which signals have been improved by mathematical analysis contained number of unique digital numbers related to epithermal mineralization processes in ramand subregion, Qazvin province, Iran.

Key words: Remote sensing, Crosta technique, silicic alteration, Ramand

1.Introduction

RS (Remote sensing), is a modern technology which without physical contact with the phenomenon, can measure and analyse spectral characteristics. not only Determining the mineralization zones and their variation are the most important usage of this technology, not also determining the alterations and anomalies are feasible as well. Remote sensing techniques allowed the identification of a large area with high accuracy and high speed and low cost.Efficiency and resolution of images increase by using satellite data processing techniques. For many years the ETM sensor images (Landset7) have been used to determine the location of hydrothermal alterations zones by applying techniques such as, "principal component analysis" (PCA) and the "least squares regression" (Ls-fit). The emergence of Aster sensor (satellite Terra), with 14 spectral band has a spatial resolution higher than ETM has increased the accessibility to shortwave infrared (SWIR), this accessibility provided by feasibility recognition the hydrothermal ore related minerals.

In this study, by using selective principal component analysis method, ETM electromagnetic spectrum sensors used to detect the alteration halos of epithermal deposits and the photomap of alteration zones in Ramand mineralized area (in Qazvin province) have been investigated.

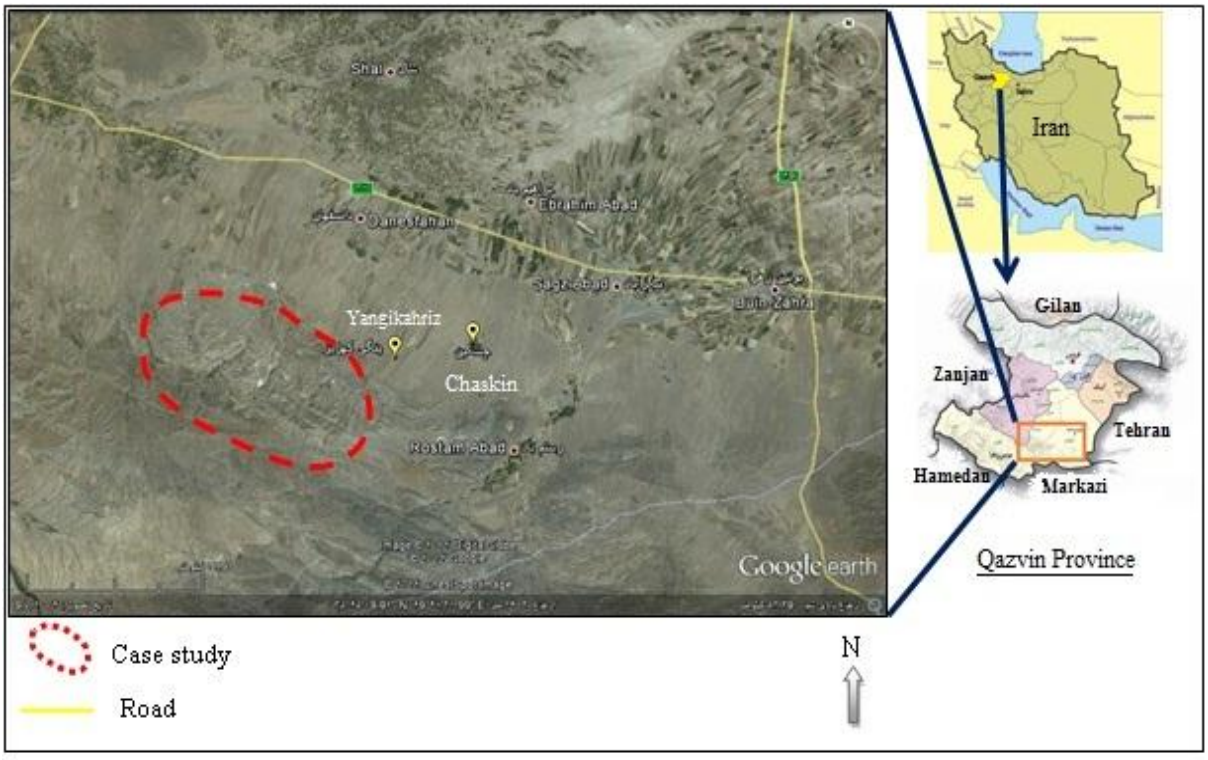

Fig1: Location of the study area

2.Spectral optimization by IHS filtering:

First, in other to have primary display of the area, the boundary of layers and lineaments in ETM image are detected by using Intensity Hue Saturation (IHS) filter. This filter is a high-pass quality filter that despite other ENVI filters, relates to the intensity and quality. how ever it is not relevant to DN values. This filter is used to optimize the image quality and separate the geological layers from alterations zones by ENVI4.7. The advantage of this filter is to identify geological phenomenon Specially faults structures (Vincent, 1997). In figure 2 the RGB(7,4,1) is filtered by IHS. It enhances and separates the different lithological units better.

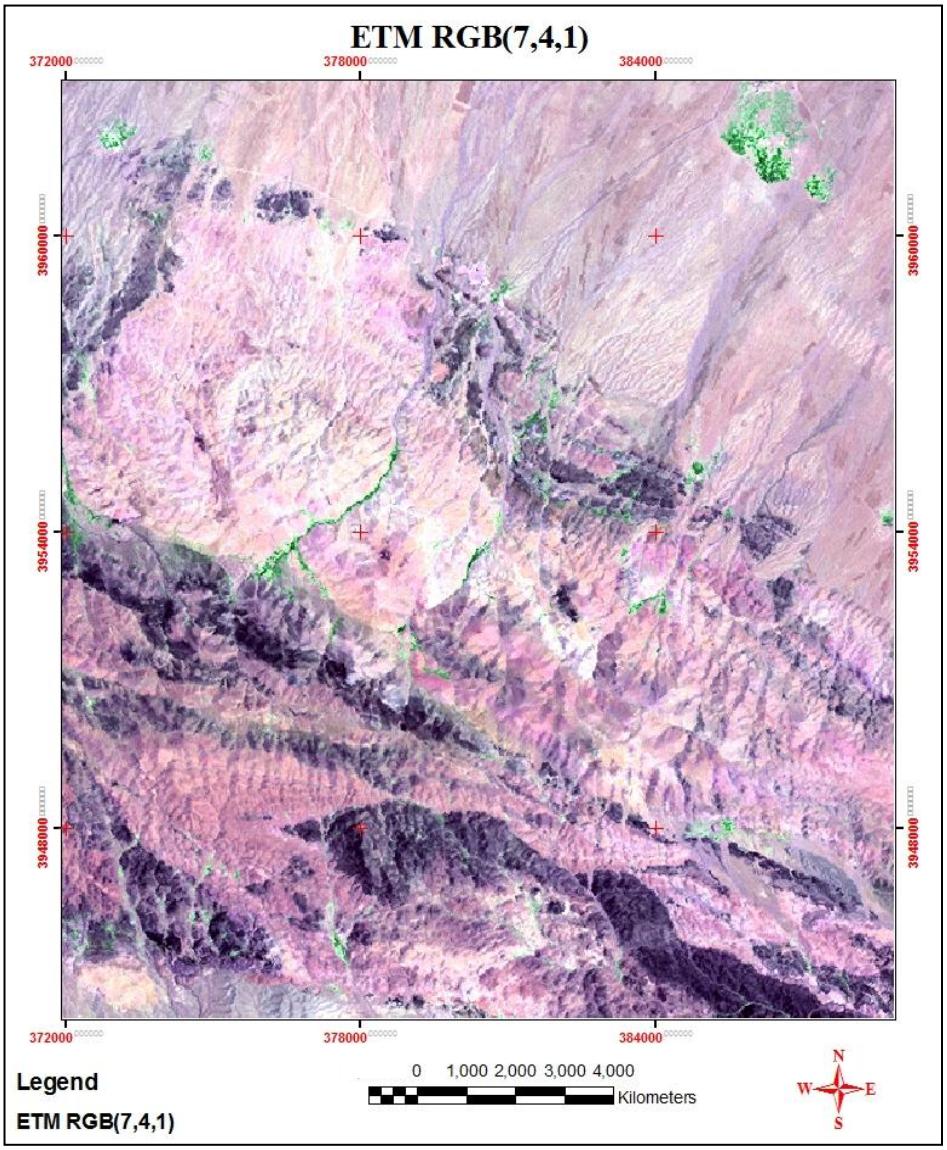

Fig2: Enhancment of lineaments and boundary layers by IHS Filtering.

3. Implementation of Crosta technique for enhancement of alterations in Ramand region:

In this method, reducing of the bands usually increases the probable mapping of definite processes according to discriminations between Eigen values (principal components-PC) (Loughlin, 1991). Hydroxyl-bearing minerals are important because of their abundance in the alteration zones. Crosta technique defines the nature of alteration halos surrounding most of magmatic intrusions. Selective 7,5,4,1 ETM bands for mapping hydroxyls and selective 5,4,3,1 bands for mapping iron oxides have been proposed. The component analysis results of the first selections known as F-series and the second known as H-series.

Studying Eigenvector of F and H-Series, the PC4 values made the most differential spectrums for revealing iron oxides and clayey minerals respectively. Applying Band Math technique caused adding H to F components for obtaining the new H+F spectrums. RGB visible panels were constructed by these components as: R= H, G= H+F and B= F for mapping hydrothermal alterations within yellowish-buff to orange colors of photomap (fig. 3).

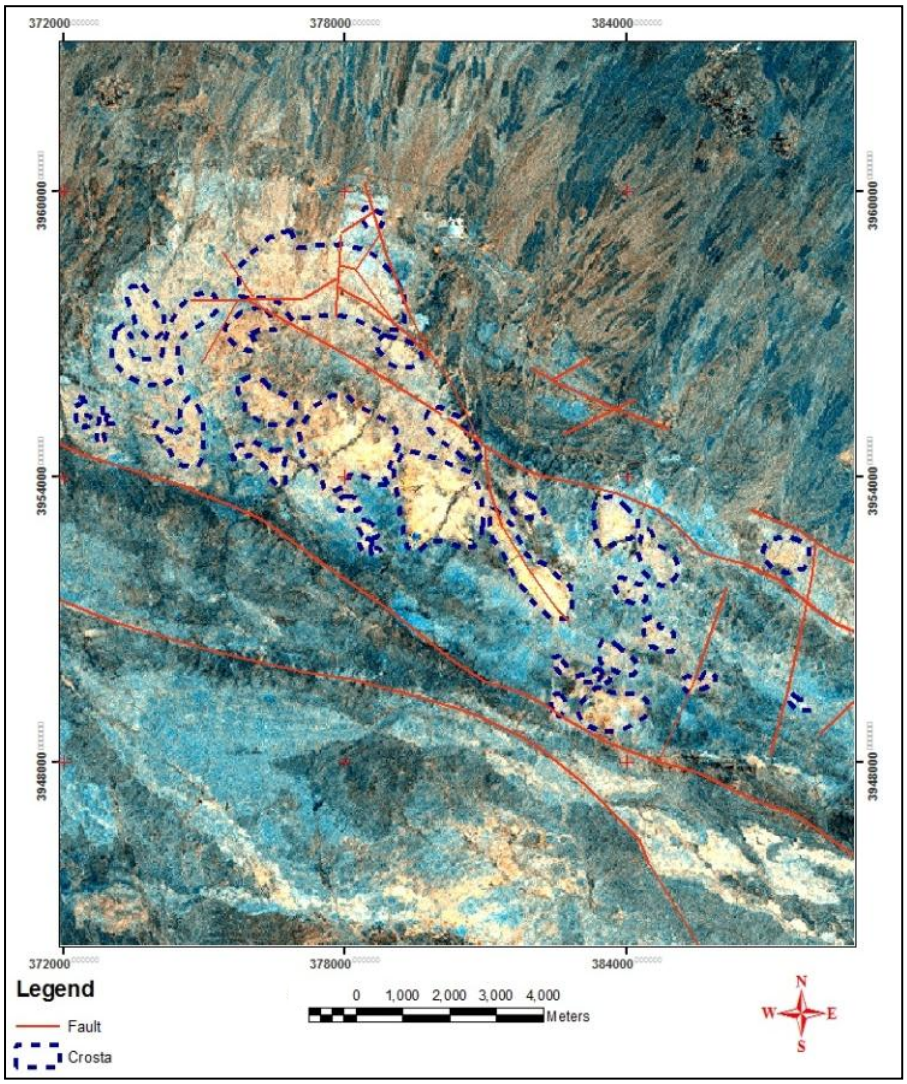

Fig 3: Hydrothermal Alterations according to Crosta PCA

A Selective Principle Component Analysis (SPCA) technique for identifying clay + iron oxide aggregation has been used and correlated with geochemical haloes for introducing young (Neogene) alteration facies related to epithermal mineralization processes in Ramand region.

5. Discussion about detection of siliceous facies using Crosta technique:

Crosta PCA is a recent developed technique for identifing alteration halos related to magmatic - hydrothermal activities. This technique was proposed for the first time by Crosta and Moore (1989), to indicate a specific purpose as a lighter pixel than the other phenomenon, in one of the principal component images. This is an improved technique for revealing hydrothermal alterations containing iron oxides and clayey matrixes with hydroxyl ions combinations mineralogicaly (Mehrnia, 2006). In practice, number of aggregated halos have close relationships with hydrothermal systems. Therefore it can be determined by Crosta technique. In addition, due to large amount of paragenesis of silica mineralization, the electromagnetic responses of Crosta photomap are coincided with clay, iron oxides and Silicification aggregations in this region.

Our field observations (Fig. 4) plus instrumental (X-ray) and micrographic studies (fig. 5) confirmed the reality of remotely sensed mineralization content in close associations with quartz, illite and jarosite paragenesis (Table1) (Ezzati, 1391). It means that, for the first time in Silica-bearing facies, a Crosta based technique has been carried out for separating Si-alterations successfully.

In a prone area of hydrothermal deposits with large scale amounts of siliceous and iron oxide mineralization, Crosta technique can be easily introduced these areas among the hydrothermal alteration halos.

Sample	Major Phase	Minor Phase	Trace Phase
M37	Quartz,Muscovite-Illite	Albite, Natrojarosite	–
M38	Quartz, Illite	Orthoclase, Jarosite	Kaolinite

Table1: x-ray results

Fig 4: Jasperoid facies in the study area(see to the South West).

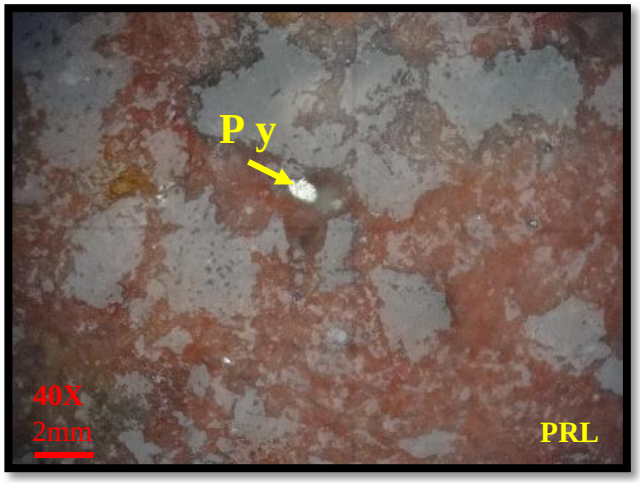

Fig 5: The high contamination of iron oxide leads the red color of matrix. It could be related to presence of jasperoid in this area.

6.Conclusions

Our research is successfully focused on extended altered regions in Ramand mineralized prospects by processing ETM images according to Crosta technique. An aggregated alteration containing clay and iron oxides has been identified due to investigations. Sampling and instrumental analysis results showed that a clayey matrix within silica based mineralization is dominant in this region. Also our thin section studies have been well done and confirmed the hydrothermal origination of ore bearing solutions in a post magmatic environment.

From remote sensing points of view, Ramand prospected regions have enough potentials for epithermal mineralization because of extending number of solution related alterations

on surfaces and existing evidence which indicate continuous alterations in depth of region. Therefore, a deep investigation on altered features and corresponding mineralization processes are highly recommended for further exploration activities in future with emphasizing on precious metals accumulations in the silica veinlets.

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