# Application of Remote Sensing and Field Geophysics for Exploration of Cu Deposits in Bab-Zangoeie, Chahar-Gonbad Region of Kerman, Iran

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## Abstract

Chahar-Gonbad region of Kerman province is geologically located in the southern part of central Iran zone, dominantly in Uromieh-Dokhtar volcanic belt. In this region, many high potential prospects, specially Cu-Au mineralization, have been detected during large scale exploration and reconnaissance phases. In this paper, remote sensing and field geophysics were used for alteration mapping on the surface and ore body delineation on the subsurface, respectively. To this end, we used an ASTER satellite image and different maps were generated by spectral technics such as false color composites and spectral ratios. Results showed argillic (and phillic) alteration in Bab-Zangoeie area is surrounded by propylitic alteration, which could be a promising evidence for Cu mineralization. Integrating these results with previous exploration studies led to selecting target area selection for ground study and field geophysics. We used both induced polarization (IP) and resistivity (RS) methods as two powerful geoelectrical methods by a pole-dipole array along four profiles. After preprocessing analysis, forward and inverse models were constructed in 2D section and 3D overlay model of joint IP/RS anomalies were constructed. Based on the obtained results, the

deposit in depth where we proposed drilling targets. Further drilling operation have proved the mineralization in our proposed targets.

**Keywords:** Remote sensing, Geoelectric, Inverse modeling, Bab-Zangoeie, Chahar-Gonbad

## Introduction

Our study area is Chahar-Gonbad region in the Kerman province, Iran. It is geologically located in the southern part of the central Iran zone, dominantly in Uromieh-Dokhtar zone. Uromieh-Dokhtar volcanic belt is extended from Sahand to Bazaman along a north-west to south-east trend parallel to Sanandaj-Sirjan zone. Majority of this belt is consisted by volcanic and clastic Tertiary rocks. In Chahar-Gonbad region, plutonic activities are exposed as intrusions and subvolcanic bodies with Oligocene and upper Miocene age. In reconnaissance phase (1:50000 and 1:25000 scale), large scale exploration studies such as geological mapping, stream sediment geochemistry and aerial geophysics in this region have proved some high potential targets for Cu and Au mineralization, reported by Geological Survey of Iran (GSI). In this study, these potentials were explored by remote sensing and field geophysics as local exploration. We used remote sensing to localize alterations and find promising areas of mineralization and, then, ground geophysics was applied to study probable mineralizations in depths.

## Methodology and Approaches

In remote sensing studies, an ASTER satellite image was applied and different processing technics such as false color composites (FCC) and spectral ratios (SR) were implemented to delineate different alterations. According to standard reflectance curves introduced by the United State Geological Survey (USGS), Montmorillonite, Kaolinite, Muscovite and Illite, which are index minerals for argillic and phyllic alterations, show the maximum and minimum reflectance in bands number 4 and 6, respectively. These are bands number 6 (or 5) and 8 for Chlorite and Epidote. Therefore, a 4-6-8 FCC map was produced, which argillic-phyllic and propylitic alterations are found in red to pink and green colors, respectively. However, we mapped a 5/8 band ratio, which reveals propylitic alteration.

Results showed that most of argillic and phillic alterations in Bab-Zangoeie area are surrounded by propylitic alteration. This is a typical distribution of mineral alteration model for hidden Cu deposits. Integrating these results as well as other exploration reports led to select a target area for field geophysics. We used induced polarization (IP) and resistivity (RS) methods to explore mineralization in depths. A pole-dipole array was selected because of proper horizontal and depth coverage, higher signal to noise ratio and more effective ground work time. In this survey, 4 profiles with 500 m length and 100 to 200 m interval were designed perpendicular to main alteration structure. In each profile, 26 electrodes with 20 m electrode interval were used.

**Results and Conclusions**

After preprocessing analysis, data were modeled by forward and inverse modeling. These steps led to delineate anomalous areas in 2D depth sections in each profile. To have a better spatial visualization, 3D models of both IP and RS data were built using an interpolation of 2D profiles. An overlay 3D model of IP and RS data was also generated to have better 3D interaction map of IP and RS anomalies. These procedures are useful tools to explore a more detailed layout of hidden anomalous body in depth. In this model, areas with high chargeability and low resistivity were modeled since a Cu ore is capable to increase chargeability and, simultaneously, to reduce resistivity of the earth. Drilling targets were proposed based on the aforementioned models. Results from drilling operation have proved mineralization in depth.

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