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Geophysical prospecting of a copper deposit using airborne magnetometry, induced polarization and resistivity methods in the Torud, Semnan Province, Iran.

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Keywords	Extended Abstract

Summary

Geophysical methods are suitable methods for prospecting and exploration of mineral deposits. Using two or more exploratory methods together and combining them with other information such as geological studies can increase the probability of discovering and reaching promising areas. According to the evidence of metallic and sulfide mineralization in the study area (the exploratory area of Pirmardan), the use of magnetic, induced polarization (IP) and electrical resistivity (Res) for prospecting and exploration of the mineralization in the area is of great importance. The position and the spatial relationship between mineralization and lineaments have long been considered by geologists. Airborne magnetic data and geological information are used to diagnose and distinguish the general trends of structures, lineaments, and large faults using tilt filter on magnetic data. By processing and interpretation of the airborne magnetic data of the region, the existing structures in the region have been investigated. Moreover, considering the available geological information in the region, the induced polarization and the electrical resistivity data have been acquired using the rectangle arrangement to detect the subsurface anomalies and also using the dipole-dipole arrangement along two survey lines to obtain the lateral and depth extension of the anomalies. Airborne magnetic data processing has been performed using Oasis Montaj software, and also, processing and modeling of induced polarization and electrical resistivity data have been carried out using RES2DINV and ZONDRES2D software packages. The final results obtained from the interpretation of airborne magnetic, induced polarization and electrical resistivity data confirm the relationship between lineaments and the probability of hidden copper reserves in the study area. These results have led to propose five spots for exploration drilling.

Introduction
Geophysical methods are among the most significant techniques for prospecting and exploration of underground resources. These methods provide information about the target areas without the need for drilling. Many copper deposits are associated with sulfide zones. Therefore, the best way for the geophysical exploration of copper deposits is through the identification of its paragenesis sulfides. The main methods for geophysical studies of sulfide deposits are the electrical resistivity and induced polarization (IP) methods. But on a large scale, magnetic lines and faults are directly linked to mineralization zones. Lineaments have been defined as structural, geological, geophysical and geomorphological trends that can have up to hundreds of kilometers length and a few tens of kilometers width. Geologists have long recognized the relation between lineaments and geospatial places of deposits.

Methodology and Approaches
First, the geological structures and faults in the region were studied using airborne magnetic data. To determine the probable places of copper mineralization in the subsurface, two survey lines was mapped using IP and electrical resistivity methods by employing the dipole-dipole electrode array with electrode spacing of 20 meters, and then, two-dimensional (2D) inverse modeling of the obtained IP and resistivity data was made using RES2DINV and ZONDRES2D software packages, and as a result, subsurface geophysical anomalies were detected. Finally, five spots for drill holes were proposed.

Results and Conclusions
By modeling and interpretation of IP and resistivity data acquired along two survey lines, five points for exploration drilling were proposed. It should be noted that the proposed points were associated with high IP values, which can be due to the presence of metallic minerals such as pyrite and copper.