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Proposing the optimum locations for drilling in Saveh North-Narbaghi porphyry copper deposit on the basis of geophysical data modeling

R. Ahmadi[*1], M. R. Rezapour[2]

Abstract

In the present research, modeling of magnetic, resistivity (Rs) and induced polarization (IP) data of Saveh North-Narbaghi deposit has been carried out. Also 23 deep boreholes with a total depth of 2425m have been drilled scattered at the studied area. In the first step, processing sequences were applied for magnetic data to highlight the deep anomalies using the Oasis montaj. Afterward, inverse modeling of the geoelectric profiles were done using Res2dinv and the optimum location of drilling was proposed on the basis of qualitative interpretation of geophysical real sections containing chargeability, resistivity and metal factor (MF). In the following the depth variations map of geoelectric properties was plotted and interpreted for inverted data in four depths of 10, 25, 43 and 78 meters. Afterward, to imagine the spatial variations of the electrical properties of the region and proposing the most appropriate location for drilling operation, the quasi three-dimensional solid model of Rs, IP and MF variations of the deposit after the smoothness inversion was mapped using Rockworks. Plotting ore deposit cross-section along the geophysical profiles using the assay data from the boreholes, revealed that drilling of some boreholes located on the profiles and independent of the results of geophysical operation, has been carried out without any right logic, purpose and design with no ore body. Also the qualitative accordance of the results of geoelectrical operations with the assay data from boreholes having ore body, located on the geophysical profiles, showed in general a moderate qualitative accordance between these data.

Key words: *Saveh North-Narbaghi copper deposit, Magnetic survey, Resistivity (Rs), Induced polarization (IP), Geophysical modeling*

[1.]Assistant Professor, Mining Engineering Department, Arak University of Technology
[2.]MSc of Mining Engineering, Mining Engineering Department, Arak University of Technology
[*] Corresponding Author

Extended Abstract

1. Introduction

To explore metallic deposits such as porphyry copper, the variety of exploration methods should be employed. Applying appropriate geophysical methods is the first step and optimal decision for exploration of these types of deposits (Reynolds, 2011; Milsom, 2003; Keary, 2002). Geophysical methods containing magnetometry, resistivity (Rs) and induced polarization (IP) are the most useful methods for the discovery of hidden mineralization parts in these type deposits. This fundamental step leads to propose optimal drilling location and full knowledge of the ore deposit to achieve the ore reserve. In the present research, modeling of geophysical data containing magnetic, resistivity and induced polarization of North-Narbaghi porphyry copper deposit has been carried out. Geophysical operations have also been qualitatively validated using assay data of exploratory boreholes over the geophysical profiles.

The North-Narbaghy exploratory area is located northeast of Markazi province, 26 km northeast of Saveh district, at the 1:100,000 geologic sheet of Zavieh. The monzogranite-quartzmonzodioritic intrusive mass is the main host rock of mineralization in the North-Narbaghi exploration area. In general the mineralization is mainly in the form of malachite, azorite, pyrite and less chalcopyrite and chalcocite that are observed in two forms: dispersive or disseminated and filling of fractures (veins and veinlets) in the host rock and is partly subjected to argillic and sericitic alteration (Pichab Kansar, 2015). The most important exploration activities in the North-Narbaghi copper deposit include topographic and geologic maps with the scale of 1:1000, geophysical surveys by magnetic, resistivity and induced polarization methods and borehole drilling.

2. Methodology and Approaches

The geophysical operations in this deposit comprise acquiring 1077 magnetic data as well as IP and Rs surveys along the seven profiles called p1 to p7 with the dipole-dipole configuration. In addition, 23 deep boreholes with a total depth of 2425m have been drilled scattered at the studied area, where lithologic information and copper assay yielding from drilling cores are available. Geoelectrical surveys and most of the deep exploration boreholes are concentrated in the range of moderate magnetic intensity (possibly related to the alteration zones and consequently mineralization). In the first step, the required processing sequences such as reduction to pole and upward continuation filters were applied for magnetic data to highlight the deep anomalies (Kellogg, 2010; Gupta and Ramani, 1980) using the Oasis montaj software. Afterward, smoothness inverse modeling of the seven geoelectrical profiles were done using Res2dinv software and the optimum location of drilling on each profile was proposed on the basis of qualitative interpretation of geophysical real sections containing chargeability, resistivity and metal factor (MF). In the following the depth variations map of geoelectrical properties of the region was plotted and interpreted for inverted data in four depths of 10, 25, 43 and 78 meters. Afterward, to imagine the spatial variations of the electrical properties of the region and proposing the most appropriate location for drilling operation, the quasi three-dimensional solid model of IP, Rs and MF variations of the deposit after the smoothness inversion was mapped with advanced inverse distance weighted (IDW) algorithm using Rockworks software.

3. Results and conclusions

Plotting ore deposit cross-section along the geophysical profiles using the assay data from the boreholes, revealed that drilling of some boreholes located on the profiles and independent of the results of geophysical operation, has been carried out without any right logic, purpose and design with no ore body. The qualitative accordance of the results of geoelectrical operations with the assay data from boreholes having ore body, located on the geophysical profiles, showed in general a moderate qualitative accordance between these data. Also in the surface parts (depths less than 10 m) there is little accordance between the mentioned data which this subject is due to the influence of surface noises (wet clay soils and weathered surface layers) on the geoelectrical surveys. It is therefore suggested that the new exploration boreholes proposed based on the results of inverted geoelectrical sections, are drilled and assay data of new drilling cores are used in different stages of processing and interpretation of the deposit.

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