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Investigation of the accuracy of the results of geoelectrical surveys to determine the depth and thickness of bauxite layer in one of Jajarm bauxite deposits

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Extended Abstract

Summary

In this research, the efficiency of electrical sounding method in recognizing the mineral layer in karstic bauxite deposits having coarse topography is investigated. For this purpose, 21 electrical sounding locations beside drilled points along a survey line in one of Jajarm bauxite deposit have been designed and surveyed. First, the acquired data have been interpreted using standard curves, and then, the obtained results have been modelled by IXID software. Because of enough resistivity contrast between the bauxite and dolomite bed rock, the recognition of basement is possible. Despite this, due to low resistivity contrast between the bauxite and upper layers, the recognition of upper layers, and thus, determination of the bauxite layer thickness is difficult. In order to investigate the accuracy of the results of the geoelectrical surveys in the mineralized area, these results were compared with the results of exploration drilling in the study area. After comparison, it was identified that estimation error of the results of 5 sounding locations were above 50%,, estimation error of the results of 10 sounding points were between 10% and 30%, and estimation error of the results of 6sounding locations was less than 10%. Kendall rank correlation coefficient between estimated depth of basement by geoelectrical method and the achieved depth of drilling results was 0.486 that revealed a good correlation between contact of recognized dolomite depth and bauxite from the interpretation of sounding results and from the results of drilling data in the study area.

Introduction

Bauxite exploration methods like exploration of most of minerals have divided into direct and indirect methods. Different drilling methods such as borehole drilling, core drilling and trench drilling are different kinds of direct methods, which are expensive and taking very much time. Among indirect exploration methods, we can refer to geophysical methods, which their applications are spreading because they are cheaper and faster, i.e. have higher operation speed. The major question of this research is whether electrical resistivity method is effective in bauxite exploration or not? and also, how much is the accuracy of modeling results and interpretation of electrical sounding surveys in determination of the depth and thickness of bauxite layer in the study area?

Methodology and Approaches

In this research, resistivity method has been used for recognition of bauxite layer in Jajarm bauxite mine. After preliminary studies and inspection of Jajarm bauxite mine, one part of that area has been selected as an area for planning and acquisition of geoelctrical surveys. This area has coarse topography that limits the planning of survey network. Finding the depth and thickness of the bauxite layer is the purpose of this research. As the resistivity in vertical direction changes more than resistivity in horizontal direction in the area, vertical changes in resistivity represent the properties of bauxite layer in the vertical direction, and thus, the Schlumberger electrode array was used for geoelectrical sounding surveys. The distance between successive sounding points in survey lines according to exploration boreholes was considered 25 meters. Geological and exploration reports as well as the positions of the bauxite outcrops show the dip of bauxite layers. Considering this point, 21 electrical sounding points having 25 m distances from each other were surveyed. In this research, first, electrical sounding data were interpreted by standard curves, and then, the achieved results as the primary model were modeled by IXID software. Kendall rank correlation

coefficient between estimated depth of basement as a result of modeling electrical sounding data and the achieved depth of drilling results was 0.486 that revealed a good correlation between the basement depth from the interpretation of sounding results and from the results of drilling data in the study area.

Results and Conclusions

Five geoelectrical layers have generally been recognized in the study area as a result of the interpretation of all the acquired electrical sounding data, and also, the geological evidences from the area. Insufficient resistivity contrast between the bauxite unit and its overlying layer cause that these two units cannot be separable, and thus, determination of the thickness of the bauxite layer using geoelectrical method seems to be difficult. Although there is sufficient resistivity contrast between the bauxite unit and its underlying karstic dolomite basement, the estimated contact depths between these two layers from the interpretation of sounding data in 5 sounding locations, based on the drilling results in these locations, are not acceptable because of artificial noises from different human factors such as drilling equipment, drilling debris and other human installation, and also, because of geological noises such as varying thickness and dip of soil and rock layers and the existence of coarse topography in the study area. In general, based on the obtained results from the interpretation of the electrical sounding data, we can say that the accuracy of the geophysical method in estimation of subsurface information in this research is acceptable. We can also conclude that the geoelectrical method in the estimation of bauxite and basement layers has high accuracy.