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The use of Li-Oldenburg and smoothness constrained methods for inversion of IP and resistivity data in order to identify a polymetal deposit in Oshvand area

Zeinab Alaei Kakhki[1] , Ali Nejati Kalate[2*], Alireza Arab-Amiri[2] and firouz Jafari[3]

1- M.Sc. Student, School of Mining, Petroleum and Geophysics, Shahrood University of Technology, Shahrood, Iran
2- Associate Professor, School of Mining, Petroleum and Geophysics, Shahrood University of Technology, Shahrood, Iran
3- Geologist, Geological Survey and Mineral Exploration of Iran

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Corresponding author: nejati@shahroodut.ac.ir

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Extended Abstract

Summary

This paper presents the results of inverse modeling of induced polarization (IP) and resistivity data, acquired from Oshvand polymetal deposit area, using the Li-Oldenburg and Smoothness constrained algorithms. Oshvand deposit is located in northeast of Nahavand City in-Hamedan Province of Iran. To demonstrate the effectiveness of these algorithms, we have applied them on both synthetic and real data. In the synthetic case, good agreement is seen between the synthetic model and the estimated model, which is extracted from the inversion procedure. The inversion results of the real data example show good agreement between the results and geological evidences. It is also shown that two-dimensional (2D) inverse modeling of IP and resistivity data provide invaluable information about the subsurface resistivity and chargeability distributions.

Introduction

The simultaneous use of IP and electrical resistivity methods is the most common approach in the exploration of polymetal deposits, especially containing Cu and Fe elements. The Oshvand polymetal deposit containing Cu, Fe, Zn, and Au elements is considered as the study area. It is located 15 km northeast of the Nahavand City and 2 km northeast of Oshvund Village. The main stratigraphic unit in this area is the Paleozoic marble limestone. This geological structure is resistive compared to the surrounding rocks. Therefore, IP and resistivity methods can have good geophysical responses to study the geometry and related physical properties of these subsurface media. The area also contains a wide range of metamorphic rocks including slate, phyllite and schist, which have medium to high resistivity and low to medium chargeability values. Therefore, it is required to combine the results of both IP and resistivity methods. In this paper, the inverse modelling of IP and resistivity data by Li-Oldenburg and smoothness constrained algorithms is investigated. The inversion results are in good agreement with the results of superficial trenches and geological evidence.

Methodology and Approaches

The IP and resistivity data in the study area were acquired along 7 survey lines parallel and perpendicular to the probable geological strike that is north-south direction. An interval distance of 50 meters between the survey lines and a minimum electrode spacing of 20 m with the dipole-dipole electrode array were used for the acquired IP and resistivity data in a surface area of 350*400. Furthermore, the Li-Oldenburg and smooth inversion methods were applied on the data with the help of DCIP2D and Res2dinv software packages.

Results and Conclusions

The following main conclusions could be extracted from this investigation:

- This is appropriate agreement between the inversion results obtained using Li-Oldenburg and smoothness constrained inversion algorithms.
- The performance of smoothness algorithm decreases in the vicinity of edges and boundaries.
- The locations of boundaries obtained from the Li-Oldenburg algorithm are found to be more accurate compared to those of the smoothness algorithm, and thus, it is more appropriate to propose drilling locations based on the Li-Oldenburg inversion algorithm.