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Geophysical modeling of time domain electromagnetic and potential field data in the Equity silver polymetallic deposit: British Columbia, Canada

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Extended Abstract

Summary

The Equity silver mine, located 38 km southeast of Houston, British Columbia, Canada, is a volcanic-hosted sulfide deposit associated with intrusive activity. The original prospect (locally referred to as the Sam Goosly prospect) was a new discovery found as a result of regional silt geochemical surveys conducted by Kennco Exploration (Western) Ltd in 1967. Further investigations confirmed the existence of two distinct mineralized zones, the Main zone and the Southern Tail zone. The purpose of this research is to provide useful three-dimensional (3D) physical property products that can directly be employed in locating and identifying feeder areas related to polymetallic mineralization in the Equity silver area in central British Columbia, Canada. In this research work, airborne gravity, magnetic and electromagnetic data from the study area were used. The data inversions were performed using the UBC-GIF GRAV3D, MAG3D and EM Flow, suite of algorithms for the gravity, magnetic, and AEM data respectively. The products were 3D inversion models of density contrast, magnetic susceptibility, and electrical conductivity, and integrated products combining the individual physical property models. For the study area, surface geological observations, 3D inversion results of airborne gravity, magnetic and electromagnetic data were integrated to build a 3D geological model to identify mineral targets. Finally, a prospect zone was discovered with higher density contrast and higher electrical conductivity property compared to the surrounding environment. The thickness of this part was found to be between 30 and 60 meters and extended to a depth of about 200 meters from the surface.

Introduction

Geophysical prospecting methods used in the subsurface exploration provide information about the physical properties of the subsurface. These properties can in turn be interpreted in terms of lithology and/or geological processes. Moreover, the geometric distribution of physical properties can help to delineate geological structures and may be used as an aid to determine mineralization and subsequent drilling targets. We have fulfilled 3D density contrast, magnetic susceptibility and conductivity inverse modelling of Equity silver deposit. The models will more easily facilitate geologic interpretation and definition of favorable geology than the data and the models can provide important information for determining the depth of overburden and designing appropriate follow-up data acquisition campaigns in favorable areas. Density contrast, magnetic susceptibility, and electrical conductivity models can be used to constrain each other.

Methodology and Approaches

In 2008, according to the request of the British Columbia Geosciences Association, a gravity survey was carried out using the SGL AIRGrav G2-7 survey system, and in the continuation of the exploration activity, airborne electromagnetic and magnetic survey was carried out by the Aero quest flight system at the same time. The data inversions were performed using the UBC-GIF GRAV3D, MAG3D and EM Flow. The products were 3D inversion models of density contrast, magnetic susceptibility, and electrical conductivity, and integrated products combining the individual physical property models. The combination of geological knowledge with 3D modeling of gravity, magnetic and electromagnetic data can define the geometry of geological objects and reduce geological uncertainties at depth. This is useful for geological exploration and evaluation of exploration targets, especially polymetallic deposits.

Results and Conclusions

Rocks are not uniquely characterized by a physical feature. The importance of the activity carried out in this study is that by performing integrated modeling, we managed to identify the main mineralization zone, which was characterized by two geophysical features of high-density contrast and high-conductivity. According to the existing geological background, this zone is most likely related to Cu-Au-Mo porphyry, Ag, Pb and Zn mineralization. This part has a thickness between 30 and 60 meters and continues to a depth of about 200 meters from the surface. In the eastern part of the region, there is a layer with high magnetic susceptibility, which is probably due to ultramafic rocks with high magnetic degree, which can be assigned to monzonite, andesite flows and other oceanic igneous rocks.