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PREVIEW

NEWS AND COMMENTARY

Survey updates

Conventional wisdom in mineral exploration

Hard rock seismic

Forecasting the future - the view from the Australian Treasury

FEATURES

AEGC 2021 Conference handbook

61: Expanding the reserve base of operating mines: Insights from an airborne MobileMT survey in the Omsukchan depression, Russian Far East

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The Dukat silver-gold ore field occurs in the central section of the Omsukchan (or Balygychan-Sugoi) rift-like trough formed in the Early Cretaceous period along a North-South fault system. The framework of the graben-shaped depression (~150 km long) is intruded by numerous Early and Late Cretaceous granitoid polyphase stocks and plutons, porphyry, and dykes. A number of known epithermal silver-gold deposits and occurrences form the Dukat ore field including the eponymous world's third-largest silver deposit. Currently, four deposits are under mining operations in the Polymetal's Dukat hub with a predicted end-of-life of 2026.

The geology of the region has been explored and well studied from the surface during the last 50 years. The central part of the epithermal-type Au-Ag ore field Dukat contains a dome-like structure (a granite-granodiorite pluton) which is intersected by drill holes at a depth of 1200-1500 m below the surface. The main elements of the Dukat deposit that govern the ore bodies' structure are sub-vertical zones consisting of systems of sub-parallel shear cracks, zones of mylonite along faults, veins controlled by faults, and individual large fractures.

In order to develop an exploration concept based on the deep structures, a MobileMT survey was carried out over part of the trough structure covering about 1325 km^2. The airborne MobileMT EM technology was able to identify: 1) the deep dome structure as the main controlling factor of the known Au-Ag mineralization system; 2) other deep dome structures in the depression — potential for new, near-surface, and buried discoveries; 3) the sub-vertical fault zones as feeding, fluid transport channels from deep magmatic bodies to near-surface host rocks, and the resultant alteration and ore zones. The survey results were presented in 2D resistivity sections, depth slices up to 2.5 km depth from surface, 3D isosurfaces, and a voxel.

62: MobileMT for porphyry exploration – model studies and field examples

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Resistivity methods are an important part of the arsenal of geophysical techniques for the exploration of porphyry-copper style mineralization. MobileMT technology, an airborne, electromagnetic system utilizing natural electromagnetic fields, has a depth of investigation of up to 2.5 km, significantly exceeding any controlled-source airborne electromagnetic system. MobileMT is sensitive to a wide range of resistivities and to geological formations of any arbitrary geometry. The advantages offered by the MobileMT technology make it especially useful for studying the wide variety of complex porphyry systems.

There is no unifying or common geophysical model for porphyry systems. The different host rock lithologies and compositions, the extent and degree of specific following alteration processes and fracture/faulting system development, possible superimposed infiltrations, post-ore tectonic events, and a current erosion level are all factors which affect the resistivity pattern of porphyry assemblages.

We investigated several known porphyry models with different geoelectrical patterns by calculating the natural electromagnetic field response from the models followed by the model's recovery from the noise-added data. The results of the investigation of the synthetic models demonstrated that the MobileMT technology has many capabilities for detecting porphyry-ore systems, including those that are deeply located or masked by challenging post-mineral conductive cover.

The field examples presented several areas which have been flown by the MobileMT system and are prospective for porphyry-style mineralization. The field data yielded the characteristic patterns of porphyry systems which were analyzed in relation to the synthetic models.