Metallogenic synthesis and 3D modelling of the Porcupine-Destor Fault in the Duparquet area, Abitibi Subprovince (phase 2 of 3)

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Abstract

The Porcupine-Destor Fault (PDF) constitutes one of the most important gold metallotects in the Abitibi Subprovince. The work begun in 2002 along the PDF was aimed at completing the regional mapping started during the 1990s and to put into focus the PDF. This focussing consisted in developing new exploration tools for gold based on a regional metallogenic synthesis and 3D modelling. The metallogenic synthesis reports the occurrence of at least five gold mineralization types, each displaying specific characteristics. Epithermal veins exhibit free-space crystallization textures such as colloform, cockade and incrusted as well as anomalous Zn, Pb and Hg concentrations characteristic of low-sulphidation epithermal mineralizations. Disseminated sulphides associated with bleaching occur as massive remnants of quartz-pyrite (5-10%) suggesting high-sulphidation epithermal deposits. Quartz-carbonate veins are located in deformation zones highly altered with iron-carbonate and are thus characteristic of orogenic deposits. Silver-bearing quartz veins are extension veins rich in Cu, Sb, Zn and Hg which possess the attributes of Ag-Pb-Zn veins in clastic metasedimentary rocks. Intrusion-associated disseminated sulphide occurrences can be subdivided with respect to the intrusion composition. Those associated with alkaline rocks are sulphide-rich and show pervasive silicification. This mineralization is a typical example of disseminated sulphides associated with syenites (Robert, 2001). Showings associated with calcalkaline rocks are sulphide-poor and generally show strong carbonatization. They likely represent a variation of the classic orogenic deposit. Isotopic geochemistry and microprobe work confirm the classification of the various mineralization types established in the field.

3D modelling work (gOcad®) has made it possible to build surfaces and geological areas, a geophysical inversion and gold concentration 3D isosurfaces. In areas where little geological information is available, geophysical inversions are a very useful tool. The unconstrained magnetic inversions correspond well with linear structures extending from surface to depth. The constrained magnetic inversion allows for a more precise evaluation of the dip or depth of some units where field or drill-hole data is lacking. Several physico-chemical properties measured in drill-holes can be represented in 3D as geometrical forms called isosurfaces. Gold concentration isosurfaces allow for the 3D identification of the various gold zones as well as for the dip evaluation of the mineralized bodies. A query example to determine gold exploration targets is presented in the report in order to illustrate the benefits of 3D modelling.

This study reveals that gold was emplaced at different depths and during different stages in the geological evolution of the area. The definition of the characteristics of the various mineralization types will allow for better exploration targeting in the area. The current study shows the usefulness of gOcad® 3D common-earth modelling in mature mining camps where important and poorly exploited data banks are available. 3D modelling helps to better understand a mining camp and make optimal use of available data.

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