3D common-earth modelling of the Lac aux Loutres area, Urban-Barry metallogenic synthesis (phase 1 of 2)

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Abstract

The work carried out in 2003, in the Lac aux Loutres area, aimed at completing the MRNFP's regional mapping started in the summer of 2000 and at promoting the mineral potential of the Urban-Barry Belt (UBB). The objectives of this study include the development of new exploration tools, the validation of the geological context and the preparation of a 3D common-earth model (gOcad®) based on a new regional metallogenic synthesis (Rhéaume ***et al.***, 2004). The results of the metallogenic synthesis confirm the occurrence of three types of mineralization, each having specific characteristics (Rhéaume ***et al.***, 2004). The characteristics of these types vary from syn-volcanic to syn-orogenic.

The main objectives applying to all our 3D modelling projects are:

1. To produce a regional 3D common-earth model (gOcad®) incorporating all available geoscience data into a Voxet (gOcad® subset) whose size changes according to the project (the dimensions for the Lac aux Loutres project Voxet are 9.0 x 5.0 x 1.5 km^3).
2. To define the 3D distribution of lithologies, metals and alterations.
3. To validate the 3D geological model by applying constrained and unconstrained geophysical inversions on the model.
4. To evaluate the use of gOcad® software outside traditional mining camps, in an explored area where the density and the distribution of data are heterogeneous.
5. To formulate queries based on geological, geophysical and geochemical data to identify new areas of high potential for gold and base metal exploration using all available data to their full capacity.

The 3D modelling work has made it possible to build the surfaces, the geological areas as well as gold grade and geophysical inversion isosurfaces. The joint development of the geological map and the 3D geological model by an iterative validation process has made it possible to optimize the use of available data and to produce a solid and reliable 3D geological model.

From here onward, a particular 3D model becomes a dynamic exploration tool susceptible to be queried according to geological criteria reflecting characteristics of various mineralization types (Fallara ***et al.,*** 2003, 2004). For the Lac aux Loutres area 3D model, several interesting analytical results have been obtained for alteration zones (54 surface rock analyses and 365 rock analyses from drill-holes) as well as the definition of economic gold targets (including 12 222 Au analyses) and base metals (including up to 1 232 Cu analyses).

The definition of "volcanogenic massive sulphides" (VMS) for the Lac aux Loutres area has been made in two steps corresponding to the proximal zone (subdivided into a bleaching sub-zone (BZ) and a "metalliferous precipitation sub-zone" (MPZ)) and the distal zone. This approach makes it possible to benefit from lithogeochemical data in the proximal model. The distal model disregards lithogeochemical properties. It is based only on the penetrative properties of the magnetic inversion and the geological affinities. The distal model is thus unaffected by bias from heterogeneous sampling. The orogenic gold target definition in the Lac aux Loutres area has also been realized in two steps corresponding to the proximal and distal gold exploration targets.

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The remaining cells for orogenic-Au and VMS environments were then used as a projection surface for the various properties integrated into the 3D common-earth model of the Lac aux Loutres area. This step has highlighted lateral and vertical zoning in the spatial distribution of some alteration indices or element concentrations for VMS targets. Generally, a more intense alteration affects the southern limb of the targets, an E to SE-oriented zoning is centered on the VMS fault, and an alteration axis trending ESE extends at depth from the surface. The highlighted gold targets have also made it possible to delimit lateral and vertical zoning in the spatial distribution of some element concentrations or alteration indices. Generally, around the Murgor deposit (proximal volume), a positive WSW-trending zone has been observed, as well as two sub-horizontal carbonate alteration zones on two independent levels. The first is at surface-level whereas the second is approximately at a depth of 350 meters. The most marked examples of zoning are namely ICARB and IAB.

The 3D common-earth modelling of the Urban-Barry area demonstrates the usefulness of such a tool outside mature mining camps. In a grass roots exploration context, even though there is little geological data and its spatial distribution is heterogeneous, 3D modelling is a very useful exploration tool which provides a dynamic model that can be enhanced by new data. The Lac aux Loutres area model has provided a better visualisation, a 3D understanding and an optimal use of compiled data leading to the definition of new mineralized zones.