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MOBILITY OF GOLD IN HIGH-GRADE METAMORPHIC DEPOSITS

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DETAIL

Gold exploration of high-grade metamorphic deposits (i.e., $\geq 600^{\circ}\text{C}$; upper amphibolite to granulite facies) presents many challenges including the recognition of protoliths, alterations, and geometric modifications related to deformation processes. One of the major issues is the recognition of and the impact from metamorphic processes on the redistribution of gold. This project aims to provide some preliminary findings regarding this complex problem to assess the issues confronting exploration in highly metamorphosed territories, regions that are ubiquitous in the northern and far northern regions of Quebec, and to identify future avenues of research.

Several Au-VMS and orogenic gold deposits that were formed prior to the peak of metamorphism (pre-peak deposits), as well as mineralizations identified as being post- or syn-peak (this idea is debated as to whether they are truly pre-peak in origin) were compiled. Through these examples, from Quebec and elsewhere in the world, we identified the main metamorphic process able to modify the levels and tonnages of gold of these deposits, as well as their main characteristics (alteration halo, structure, etc.). The main metamorphic processes are: 1) mechanical mobilization (travel in the solid state); 2) circulation of fluids (H-S fluids that can dissolve and carry the gold); 3) circulation of Si and/or S melts (the sulphide as liquids incorporates the gold while the felsic silicate melts do not incorporate gold); and 4) retrogression (H fluids that do not carry the gold but that can modify high-grade assemblages).

Some considerations are derived from genetic models used to interpret gold found within high-grade deposits. For example, the crustal Continuum model permits the creation of a syn-peak deposit in the granulite facies, an aspect that remains an issue of debate in the literature.

However, the model of metamorphic devolatilization does not allow the syn-peak formation of deposits under high-grade conditions. The deposits studied and interpreted via this model are recognized as being post-peak (rare) or pre-peak, in which case metamorphism must be considered.

For the studied deposits, we evaluated the positive, negative, or neutral effects that metamorphism had on gold levels in a deposit, but much work remains to be done to quantify these effects. For exploration, the challenge remains to recognize the footprint of the deposits altered by metamorphic processes as well as the nature, form, and the geometry of the created traps.

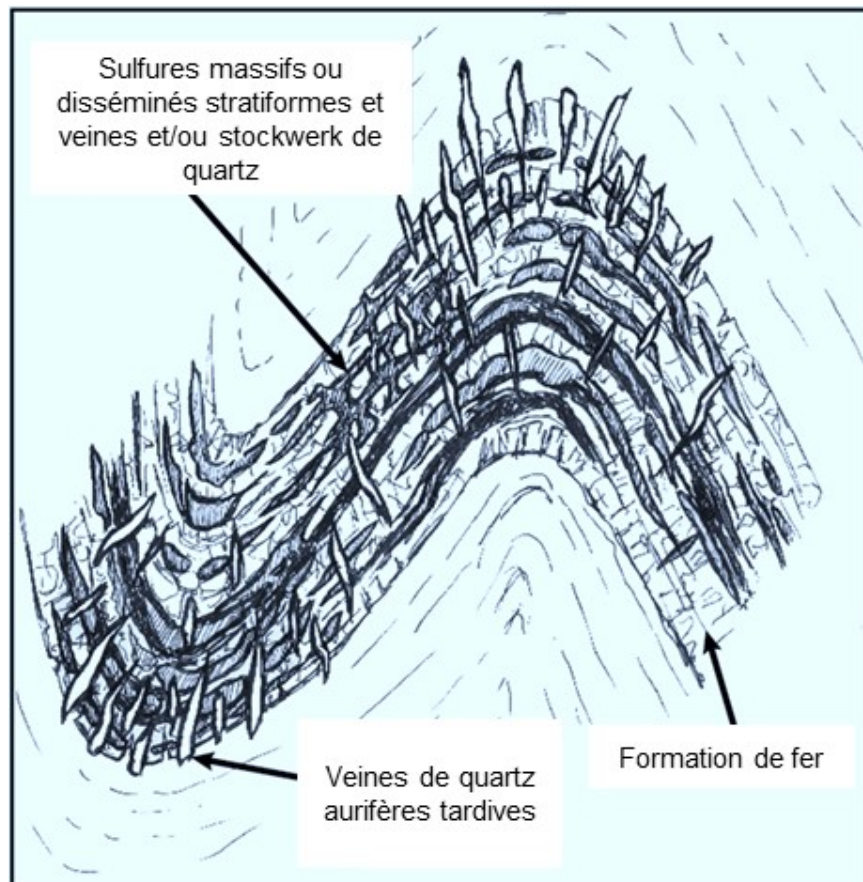


Diagram summarizing the various textures and morphologies that can be observed in an orogenic gold deposit located in an iron formation and metamorphosed under amphibolite facies conditions (not to scale).

SUMMARY SHEET

Objectives

- Document from the existing scientific literature the characteristics of gold located in high-grade metamorphic deposits.
- Deduct the impact and the changes associated metamorphism.

Results & Innovations

- Identification of the issues related to gold exploration.
- Identification of mechanisms that permit the remobilization of gold in high-grade metamorphic deposits.
- Judgment regarding the positive or negative effects, depending on the specific case, that metamorphism can have on gold concentrations.