

# SEG 100 Conference: Celebrating a Century of Discovery

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## G3

### **Metallogeny of the Neoproterozoic Malartic Gold Camp, Abitibi and Pontiac Subprovinces, Canada**

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The Neoproterozoic Abitibi greenstone belt hosts most of the gold resources in the Superior Province. Many of the gold camps of the belt are located along its southern margin and contact with the Pontiac subprovince, i.e., along the Larder Lake-Cadillac fault zone (LLCfz, Fig. 1A). This includes the Malartic camp and the Canadian Malartic deposit (10.5 Moz Au in past-production: 1935–1984 and 2011–2019; 16 Moz in reserves and resources), which is currently mined as a low-grade open-pit operation (~1 g/t Au; Fig. 1B). Recent work in the Malartic camp has led to an in-depth documentation of the Canadian Malartic deposit geology and footprint and to an improved understanding of ore-forming processes in the southern Abitibi and northern Pontiac subprovinces.

The Canadian Malartic deposit comprises disseminated-stockwork replacement-style mineralization in greenschist facies 2685–2682 Ma turbidites of the Pontiac subprovince and ~2678 Ma subalkaline to alkaline porphyritic quartz monzodiorite and granodiorite (Fig. 1C). The emplacement of these intrusions was coeval with the Timiskaming episode of fluvial-alluvial sedimentation (<2679 to <2669 Ma), prior to main-phase regional deformation (D<sub>2</sub>) and associated Barrovian metamorphism (ca. 2665–2650 Ma). The mineralization occurs along two trends subparallel to the NW-striking S<sub>2</sub> cleavage and the axial surface of F<sub>2</sub> folds, and to the south-dipping Sladen fault. The syn-D<sub>2</sub> ductile-brittle Sladen fault is mineralized along a strike length of ~5 km. The orebodies are zoned outward and most of the higher-grade ore (>1 g/t Au) was deposited as a result of iron sulfidation, Na-K metasomatism, and formation of carbonates. Mineralization was dated using gold-associated molybdenite (Re-Os) and titanite (U-Pb) that yielded ages of ~2664 and ~2661 Ma, respectively. These ages are within error of the ~2660–2658 Ma age for peak metamorphism in greenschist facies metasedimentary rocks of the Pontiac Group south of the mine. Mineralization occurred ~15 Ma after the crystallization of the intrusions that host part of the ore and postdates the Timiskaming episode of sedimentation.

Smaller deposits (<1.7 Moz) in the camp include auriferous disseminated-stockwork zones, quartz ±carbonate-pyrite veins, and breccias along faults in chemically and mechanically favorable rocks. The age of these deposits is poorly constrained, but U-Pb zircon dating of post-mineral dikes (~2694–2692 Ma) highlights an early phase of mineralization. Field relationships suggest that the formation of these small deposits was incremental and can be bracketed between the end of volcanism (~2698 Ma), and the waning stages of D<sub>2</sub> deformation (~2640 Ma). Nevertheless, the bulk of the gold in the camp is concentrated in the Canadian Malartic deposit, which formed along the LLCfz and second order faults. Mineralized structures are compatible with north-south shortening and regional metamorphism, and the Canadian Malartic deposit is therefore attributed to the orogenic class of gold deposits. Hence, the timing, location, and nature of the mineralized structures along the LLCfz have played a major role in concentration of the gold endowment.

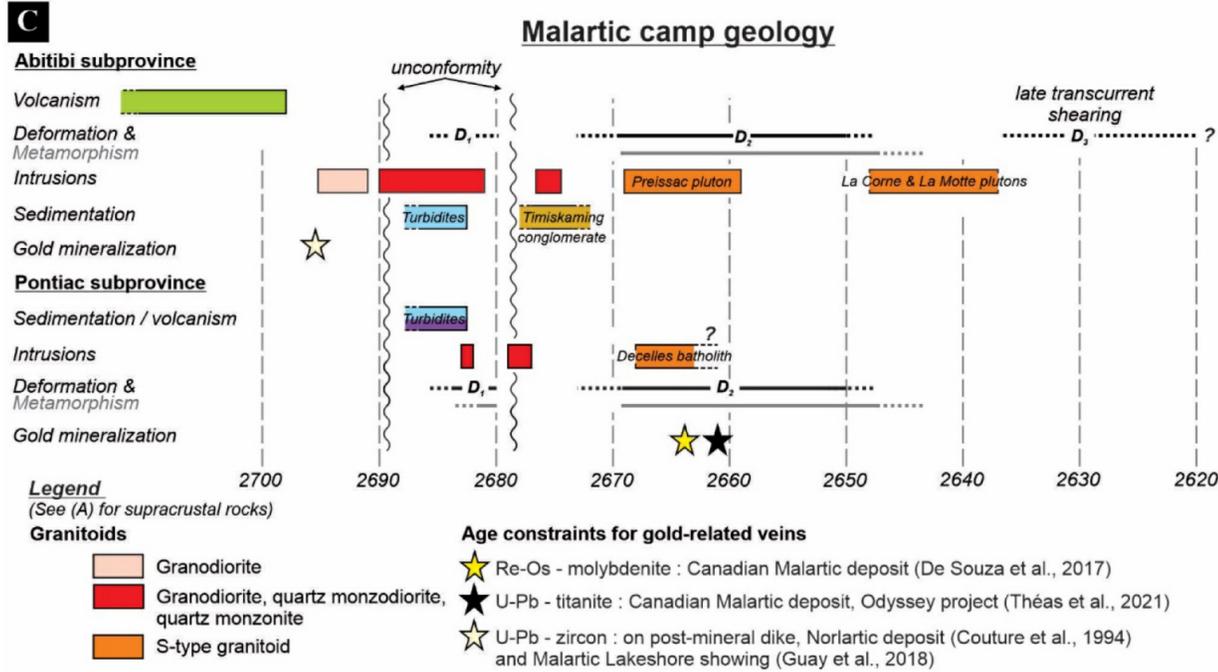
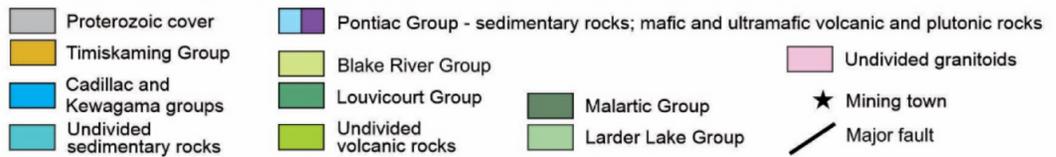
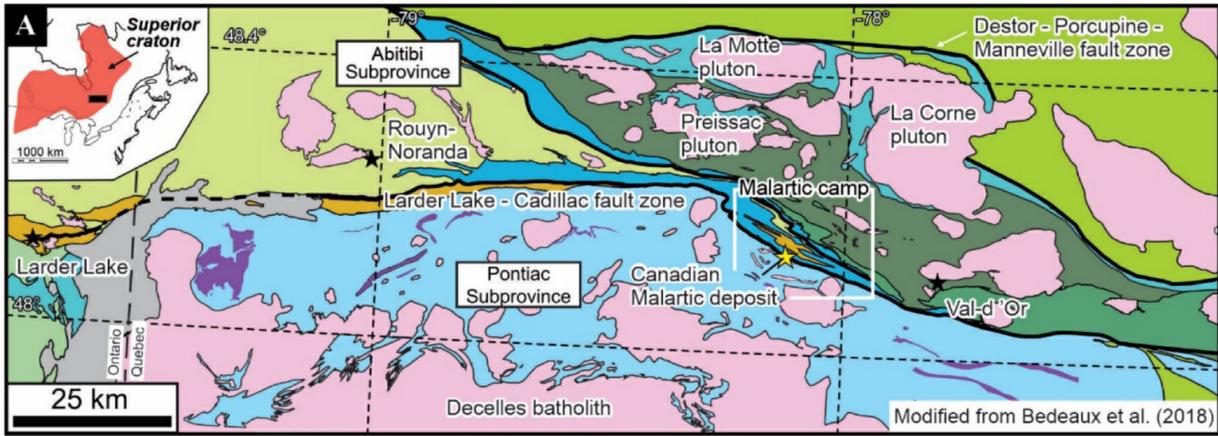


Figure 1: A) Map of the Abitibi and Pontiac subprovinces and location of the Malartic camp; B) Photograph of the Canadian Malartic mine; C) Geological summary of the Malartic camp.