

The Formation of the Young-Davidson Orogenic Gold Deposit

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The Archean-aged Superior Province of the Canadian Shield is an important supplier of gold, producing approximately 88% of Canadian gold production [1]. One important subprovince is the Cadillac-Larder Lake deformation zone in the south of the Abitibi greenstone belt, it is located throughout Northern Ontario. The Young-Davidson (YD) Mine, Matachewan, Ontario is in the western most deposit of this zone. Gold mineralization at YD is principally hosted by syenite with an extensive hydrothermal alteration halo. Quartz veins with strong hematite alteration are the main targets for gold production. However, despite the late stage of the project, the geology is still relatively poorly understood at the YD Mine. Our objective is to clarify the genetic model and to identify the major evidence of gold precipitation by using macro to micro-scale analyses.

In this presentation we present preliminary results from a mine visit in the winter of 2024 including core logging of six drill holes and five different locations in the underground distributed across different sections of the ore zone. Samples represent different lithologies, mineralization, and alteration zones. Initial investigation identified that pyrite is the most common mineral associated with gold. In particular, high-grade gold is found as an inclusion where pyrite is disseminated and quartz veining increases. Further, all assay results from the diamond drill holes show that the gold grades increase dramatically where pyrite mineralization also increases.

To identify controls of the formation and evolution of the Young-Davidson gold deposit, we will perform a detailed investigation of pyrite textures (reflected light microscopy), trace element content (LA-ICPMS), and sulfur isotopes (S32, S33, S34) to identify the source of the gold and determine which generations of pyrite are associated with the gold mineralization. These observations will provide a better comprehension of gold precipitation via hydrothermal fluids in the area, developing tools to predict gold grades before mining.

[1] Dubé & Gosselin, (2007), *Mineral Deposits of Canada*. [2] Percival et al., (2006), *Canadian Journal of Earth Sciences*, 43(7), 1085-1117; Poulsen et al., (1992). *Precambrian Research*, 58(1-4), 25-54.