Controls on syenite-hosted gold mineralization in the western Timmins camp, Timmins, Ontario*

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Syenites at Lake Shore Gold Corp’s Thunder Creek deposit and Highway-144 property both host gold located approximately 20 km west of Timmins, Ontario. The former is part of the Timmins West mine and the latter is a prospect. The hosts are alkaline, similar to the Kirkland Lake camp, thus these prospects/deposits represent a new exploration target for gold mineralization in the Timmins camp. Geochemical, structural, and petrological data were collected to analyse the controls on gold mineralization and to recognize syenites that potentially are mineralized. The mineralized syenites intruded along the contact of Tisdale volcanic rocks and Porcupine sedimentary rocks. They are part of the larger Bristol Township Alkalic Complex, which is composed of pyroxenite, strongly carbonitized/mylonitized shear zone, and syenite. However, where fresh, the syenite has a quartz-monzonite composition, but its alkaline affinity is apparent from the presence of alkali amphiboles. In contrast to syenite-hosted mineralization elsewhere, the Thunder Creek syenite is relatively unaltered at the core of the mineralization, with increasing potassic and hematitic alteration in the poorly mineralized upper structural portion of the intrusion.

Approximately one hundred samples of the host syenite with disseminated pyrite, early deformed $V_1$ Qtz-Py±Ga veins, later $V_2$ extensional flat Qtz-Py±Sche±Ga veins and the youngest $V_3$ subvertical Qtz-Py veins were assayed to determine gold distribution. In the core of the Thunder Creek deposit $V_2$ hosts the main stage of mineralization, but disseminated pyrite, $V_1$ and $V_3$ veins are all mineralized, and the highest grades are where the four mineralizing events are superimposed. Pyrite occurs as: i) Fine to medium grained disseminated pyrite, ii) medium- to coarse-grained fracture-controlled pyrite and iii) medium to coarse corroded vein-hosted pyrite. Gold is present primarily in coarse vein-hosted pyrite grains along fractures and less commonly as inclusions. A combination of WDS mapping of trace elements in pyrite, laser ablation across pyrite grains, and in situ S isotopic analyses of different pyrite generations constrain two very different fluid compositions between the Timmins West Mine and exploration prospect. The effect of fluid composition gold solubility and precipitation during transport is the current focus of this investigation.