

Pyrite compositions from contrasting styles of syenite-hosted Au at the Young-Davidson and Thunder Creek deposits, Abitibi Belt, Canada

R. L. LINNEN¹, R. CAMPBELL¹, R. D. MARTIN²³,
G. D. LAYNE⁴, B. WING⁵, J. E. GAGNON⁶, S. LIN² AND
J. ZHANG⁷

¹Earth Sci., Western Univ., London, ON, N6A 5B7

(rlinnen@uwo.ca)

²Earth & Env. Sci., Univ. Waterloo, Waterloo ON, N2L 3G1

³Civil & Env. Eng., Univ. Alberta, Edmonton AB, T6G 2V4

⁴Earth Sci., Memorial Univ., St. John's, NL A1B 3X5

⁵Earth & Planet. Sci., McGill Univ., Montreal, QC H3A 0E8

⁶Earth & Env. Sci., Univ. Windsor, Windsor ON, N9B 3P4

⁷Earth System Sci., Chinese Univ. of Hong Kong, Shatin, NT

The Young-Davidson (YD) and Thunder Creek (TC) gold deposits are both associated with Timiskaming-age syenite intrusions, west of Kirkland Lake and Timmins, respectively. At both deposits gold grade correlates with pyrite abundance and there are multiple deformation events and vein sets that contain gold, as well as gold with disseminated pyrite. Two textural types of pyrite are observed at both deposits: Type 1 is porous, corroded pyrite, which is associated with the best gold grades. Gold in Type 1 pyrite commonly occurs as inclusions, filling secondary porosity. Type 2 pyrite is euhedral, is less mineralized and gold tends to occur along fractures in pyrite or as free gold.

At YD, gold is dominantly associated with potassic alteration, anhydrite is present and ankerite alteration is pervasive. Strong Ni-Co zoning is observed in both pyrite Types, Co can be in excess of 1%, Ni and As are commonly 1000s of ppm. Bulk $\delta^{34}\text{S}$ values typically range from -1.0 to +2.0 ‰. However, in situ microanalysis indicates considerable variation within single grains, in one case from -2.7 to +4.3‰. Mineralization is interpreted to have been controlled by fluid mixing.

At TC silicification is present, barite is common, but potassic and carbonate alteration are poorly developed, although at the Hwy 144 area, south of the deposit these alteration styles are present. Ni and Co contents are all low (100s ppm), in contrast to weakly mineralized pyrite at the Hwy 144 prospect which contains 0.5 to 1.3 wt% Ni and Co. Pyrite from both areas contain only 10s ppm As. $\delta^{34}\text{S}$ micronanalysis of pyrite at TC range from -3.0 to -6.0 ‰. It is not clear whether there are different sources for TC compared to YD or whether processes such as oxidation occurred to different extents at the two areas. What is clear however is that syenite-hosted gold mineralization in the Abitibi belt cannot be explained by a single model.