Synchrotron-based µXRF Analysis of Early Gold-Bearing Pyrites at the Dome Mine, Timmins

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Abstract

Trace element associations in gold bearing sulphide minerals provide integral information regarding the nature of mineralizing fluids. The intensity and energy flux provided by synchrotron radiation allows for micron scale and ppm sensitivity to characterize trace element distributions in these minerals. By using synchrotron-based µXRF mapping, micron scale growth halos, and correlation between gold and other trace metals can be resolved. Additionally, using x-ray absorption near edge structure (XANES) analysis, the oxidation state of these elements can be elucidated, providing evidence for fluid redox states. This information provides insights into fluid evolution, mineralization conditions and depositional history as well as controls on mineralization and gold remobilization that can be applied to myriad deposit types. The Dome mine, located in the prolific Porcupine gold camp of the Abitibi Greenstone belt is host to a world-class greenstone hosted quartz-carbonate vein deposit. The mine has been in operation for over 100 years, and is host to a unique set of early gold bearing crustifom banded ankerite veins. These sheeted vein arrays are overprinted by main stage gold bearing quartz veins that are commonly found at flow contacts and extend sub parallel to lithological layering over 500m in strike, 900m vertically and 2m in width. Multiple veins have been sampled across their lateral extent at different levels of the mine. Thin sections were characterized using conventional methods, and pyrite grains were selected for µXRF mapping at the Canadian Light Source Synchrotron VESPERS beam line (Saskatoon), and beam line 20-ID,B,C at the Advanced Photon Source (Argonne National Lab, Chicago). Spot µXRF analysis and XANES were also performed. These techniques have provided information regarding patterns of trace element associations with gold and important new information about the mineralization history of these enigmatic early ankerite veins.