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The trace element content of pyrite from the orogenic gold deposits of the Abitibi belt

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Northeastern Ontario hosts some of the world's largest orogenic gold deposits within the Porcupine-Destor and Larder Lake-Cadillac deformation zones which crosscut the Abitibi greenstone belt. Despite the importance of these deposits, their mechanisms of formation and fluid sources are not fully understood. Both magmatic and metamorphic fluids have been proposed as potential gold sources, with some studies suggesting that metamorphic fluids can be derived from devolatilization of multiple rock types including carbonaceous shales, komatiites and basalts during greenschist-amphibolite facies metamorphism.

In this project, we investigate pyrite morphology of gold bearing samples from gold camps in the Abitibi region to better understand their paragenesis. Pyrite morphology from these samples will be examined using reflected light microscopy and scanning electron microscopy to determine how many generations are present in the mineralized samples. This provides information on which event resulted in the majority of the gold mineralization and how the textures of the pyrite and generations of pyrite vary across the district. This data will provide the basis for later parts of the project that will investigate the trace element content of these pyrite generations using laser ablation inductively coupled plasma mass spectrometry. The trace element contents will be used to collect information regarding the oxidation state, pH, salinity and temperature of ore forming fluids. In addition, some of the trace elements to be examined are critical metals, including cobalt, nickel, antimony and tellurium. These metals are vital to the transition from hydrocarbon-based energy to green energy sources through their use in electric vehicles, solar panels, windmills and nuclear reactors. By creating associations between various trace elements, their depositional mechanisms and fluid sources, we can better predict which gold deposits may also have potential as critical metal sources.