An evaluation of regional geochemistry in the Kirkland Lake area: Towards a new gold exploration model

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Canadian Malartic Corporation (CMC) currently maintains the largest land holdings package in the Kirkland Lake gold camp. Recent work on the property is focused on developing a structural, chemical, and rheological framework for fluid-rock interactions, deposition mechanisms, and gold mineralization across the entire property. The objective of this study is to assist in the development of a new “district wide bulk tonnage” model by assessing trace element associations with gold mineralization among and within CMC’s Kirkland Lake properties to elucidate the source of the gold and to inform future exploration efforts. The project will utilize whole-rock geochemical data collected by CMC from drill-hole and surface outcrop sampling programs for their 5 main exploration projects. ioGAS™ and Leapfrog Geo™ will be used to identify large-scale geochemical trends and to identify areas that would benefit from further sampling. Collected samples will undergo a combination of petrography, X-ray diffraction, scanning electron microscope, synchrotron μ-XRF, stable isotope, and age dating analyses to aid in determining mineralizing fluid composition, temperature, and source. Preliminary synchrotron analysis of auriferous pyrite grains from the South Contact Zone of the Upper Beaver (UB) deposit identified Co, Ni, and As hydrothermal overgrowth patterns, suggesting that distinct generations of Co, Ni, and As rich fluid may have been associated with the gold mineralization. Further whole-rock geochemical analysis of drill-hole and surface samples from the entire UB deposit show a correlation between Co, Ni, As and Au and reveal, in particular, that rocks which are more enriched in Ni and As relative to Co also tend to have a higher Au content. Trace element studies on the Young-Davidson and Macassa mine show similar Ni, Co, and As growth patterns within pyrite grains associated with multiple generations of gold mineralization. These similarities in mineralization among the different deposits may prove to have important implications for ore genesis and future exploration efforts.