Understanding Gold Mineralization at the Yellowknife City Gold Project, Northwest Territories, using Synchrotron X-ray Spectroscopy

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The Yellowknife City Gold Project (YCGP) is part of the Archean north-south trending Yellowknife Greenstone Belt, a suite of mafic volcanics and greywacke turbidites overlying a gneissic basement. Alteration of host rocks involves chloritization, sericitization, and carbonatization, as well as biotite alteration in wall rock. Exploration and drilling on the prospects in the YCGP by TerraX Minerals Inc. aim to explore for gold along strike with mineralized shear zones and quartz veins associated with the past producing high-grade Con (6.1 Moz @ 16.1 g/t Au) and Giant (8.1 Moz @ 16.0 g/t Au) gold mines. Gold grades on the YGCP range from 0.1 to almost 200 g/t, with higher gold grades being associated with mafic volcanic and greywacke hosts. Gold is associated with both quartz veins and disseminated sulphides, including pyrite and arsenopyrite, or galena and sphalerite in As-poor mineralization. Synchrotron X-Ray Fluoresence (sXRF) spectroscopy is a nondestructive, cost-effective technique that provides in-situ trace element analysis for ore mineral mapping and zonation. X-Ray Absorption Near Edge Structure (XANES) spectroscopy is used to determine the speciation of gold and other associated trace elements, useful for understanding geometallurgy and characterization of deleterious elements. Synchrotron X-Ray Diffraction is a rapid, cost-effective technique for mineralogical analysis, which provides critical mineralogical information on altered and mineralized samples. Coarse sXRF mapping of high-grade half-core samples from several deposits across the YGCP revealed the common association of Au with As within As-rich veining, and with Zn within As-poor cores. XANES analyses of these sulphides will provide information on the metallurgical features of the ores, the association of Au with deleterious elements such as As, and the nature of free-milling and refractory Au. Understanding the relationship of the geographically diverse deposits through mineralogy, with information from both petrography and XRD, will present new insights on the timing and relationship of mineralization events across the Yellowknife City Gold Project, and hopefully help better understand their relationship with the Con and Giant Mines.