Structural controls on gold mineralization within the Walsh formation of the Yellowknife greenstone belt

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The Yellowknife greenstone belt (YGB) is one of several greenstone belts located within the Archean Slave province. The YGB hosts several gold deposits, the most significant being the past producing Giant (8.1 Moz @ 16.10 g/t) and Con (6.1 Moz @ 16.0 g/t) deposits. These gold deposits are associated with a major fault-zone called the Yellowknife River Fault Zone (YRFZ) that cross cuts, at a low angle, a sequence of mafic metavolcanic rocks overlain by felsic metavolcanic rocks and turbiditic sandstone and capped by a Timiskaming-type conglomerate named the Jackson Lake Formation. Previous research has focused on mapping the kinematics of the YRFZ, and related structural features within the Jackson Lake Formation, as well as the structural controls on gold mineralization at the Giant and Con mines. This study focuses on the structural controls on gold mineralization at the Mispickel zone, in which significant gold has been intersected in diamond drilling; 8.00 m @ 60.6 g/t and 7.30 m @ 23.60 g/t. The gold mineralization is hosted within a sequence of thinly bedded graphitic and sulphidic argillite, siltstone, and turbiditic sandstone of the Walsh Formation. Mineralization is associated with fine-grained arsenopyrite and pyrite in quartz veins and the associated chloritized and silicified alteration haloes. The veins are tightly folded within the hinge zones of regional tight folds and therefore predate the formation of these folds. The Walsh Formation is strongly folded and deformed, however, there are still well preserved primary structures. These include graded bedding, load structures, and cross-bedding; these structures are excellent for distinguishing fold limbs within this tightly folded system. Previous research has documented four generations of deformation with gold mineralization associated with the first two generations. Faults have been categorized as pre-diabase faults and post diabase, where the gold mineralization is associated with the former and offset by the latter. Two main sets of veins are typical within the Mispickel area, lenses of boudinaged quartz veins and discontinuous stringer veins. Downhole geochemistry and structural data will be used to create a 3-D model to associate relationships between alteration zones, structure, vein types, and gold mineralization. An SEM will be used to analyze the alteration and veins associated with gold mineralization in order to classify the different styles of mineralization.