

## **Structural controls and deformation history of the orogenic Island Gold deposit, Michipicoten greenstone belt, Wawa, Ontario**

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The Island Gold mine is a currently producing, high-grade orogenic gold deposit in northern Ontario. It is hosted by the Goudreau Lake Deformation Zone (GLDZ), which transects the Michipicoten greenstone belt in the Wawa subprovince. The Island Gold mine has been in production for over ten years and mineralization is still open laterally and at depth. An improved understanding of the deposit and its tectonic setting is, however, necessary to optimize exploration at the mine and elsewhere in the district. This structural study aims to determine the controls on mineralization and the deformation history of the deposit and surrounding area. D<sub>1</sub> structures in the study area consist of regional- and camp-scale F<sub>1</sub> folds that are associated with a penetrative, axial-planar S<sub>1</sub> foliation and L<sub>1</sub> stretching lineation. The study area is located along the northern limb of such a regional F<sub>1</sub> fold and contains a parasitic, large-scale s-fold. The S<sub>1</sub> foliation is subvertical and strikes ~N070°, at an acute angle to steeply north-dipping stratigraphy in the study area. The stretching lineation L<sub>1</sub> is developed on the S<sub>1</sub> foliation surface and plunges steeply to the northeast. The GLDZ formed during D<sub>1</sub> deformation and is centered along a major lithologic contact. D<sub>2</sub> structures consist of camp- and outcrop-scale F<sub>2</sub> folding, S<sub>2</sub> foliation, and brittle reverse faults. F<sub>2</sub> folding overprints the S<sub>1</sub> foliation and consists of open to tightly folded, shallowly-plunging z-folds. The S<sub>2</sub> foliation dips steeply to the north and consists of transposed S<sub>1</sub> foliation. Brittle reverse faults dip moderately to the south and cross-cut the S<sub>1</sub> foliation. The Island Gold deposit forms a mineralized corridor within the southern GLDZ, south of the north-dipping, trondhjemitic Webb Lake Stock. The main deposit is hosted in intermediate fine-grained volcanoclastic rocks and consists of subparallel ore zones of predominantly smoky grey, laminated V1 quartz veins and sub-parallel V2 crack-seal veinlets within a silicic and sericitic alteration package. The ore zones strike ~N070° with an average dip of 80° to the south. Barren V3 quartz-carbonate extensional veins cross-cut V1 ore veins and often appear as “boudin necks” in drift faces. During D<sub>1</sub> deformation, V1 and V2 ore veins were emplaced sub-parallel to the S<sub>1</sub> foliation in a strain shadow created by the Webb Lake Stock. The ore zones were folded and sheared into the current form during subsequent D<sub>2</sub> deformation. V3 veins were also emplaced during D<sub>2</sub> in areas of high competency contrast.