

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

KM Jellicoe¹, S Lin¹, T Ciufu¹, P Mercier-Langevin²

¹Department of Earth and Environmental Sciences, University of Waterloo, Waterloo, Ontario

²Geological Survey of Canada, Quebec City, Québec;

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_1 structures in the study area consist of regional- and camp-scale F_1 folds that are associated with a penetrative, axial-planar S_1 foliation and L_1 stretching lineation. The study area is located along the northern limb of such a regional F_1 fold and contains a parasitic, large-scale s-fold. The S_1 foliation is subvertical and strikes $\sim N070^\circ$, at an acute angle to steeply north-dipping stratigraphy in the study area. The stretching lineation L_1 is developed on the S_1 foliation surface and plunges steeply to the northeast. The GLDZ formed during D_1 deformation and is centered along a major lithologic contact. D_2 structures consist of camp- and outcrop-scale F_2 folding, S_2 foliation, and brittle reverse faults. F_2 folding overprints the S_1 foliation and consists of open to tightly folded, shallowly-plunging z-folds. The S_2 foliation dips steeply to the north and consists of transposed S_1 foliation. Brittle reverse faults dip moderately to the south and cross-cut the S_1 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 $\sim N070^\circ$ 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_1 deformation, V1 and V2 ore veins were emplaced sub-parallel to the S_1 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_2 deformation. V3 veins were also emplaced during D_2 in areas of high competency contrast.