Evidence of Simultaneous Brittle-Ductile Deformation in the Main Break Fault System in Kirkland Lake, ON

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Abstract

Microstructural analysis provides evidence of significant ductile deformation concentrated along the main break, in Kirkland Lake, ON. The Main Break is an east-west striking mineralized fault system that has sustained multiple gold mines since its discovery in 1911. It is found in the southern Abitibi gold belt on Kirkland Lake Gold Inc.'s Lakeshore Mine property, which is a structurally controlled orogenic gold deposit. Oriented samples for microstrucural analysis were collected from two new 1-meter long channels across the main break spaced eight meters apart. Samples were examined in transmitted and reflected light microscopy. Evidence of ductile deformation by dislocation creep to produce mylonite includes porphyroclasts of potassium feldspar in an extremely fine-grained matrix, mineral alignment, and undulatory extinction and subgrains in potassium feldspar. Sericite aggregates replacing potassium feldspar likely enhanced grain softening during this ductile deformation process. Sericite as well as evidence of pressure solution along grain boundaries indicate the presence of a hydrous fluid during deformation. Large fractured porphyroclasts of potassium feldspar can be explained by unfavorable crystal lattice orientations during deformation. The most significant evidence of simultaneous brittle-ductile deformation is a potassium feldspar porphyroclast with strong undulatory extinction and subgrains in one half of the grain and microfractures in the other half. We conclude that the Main Break is a narrow ductile shear zone with minor brittle deformation.