SEG 100 Conference: Celebrating a Century of Discovery

ST.019
Structural and Geometric Evaluation of the Tom Deposit, Selwyn Basin, Yukon

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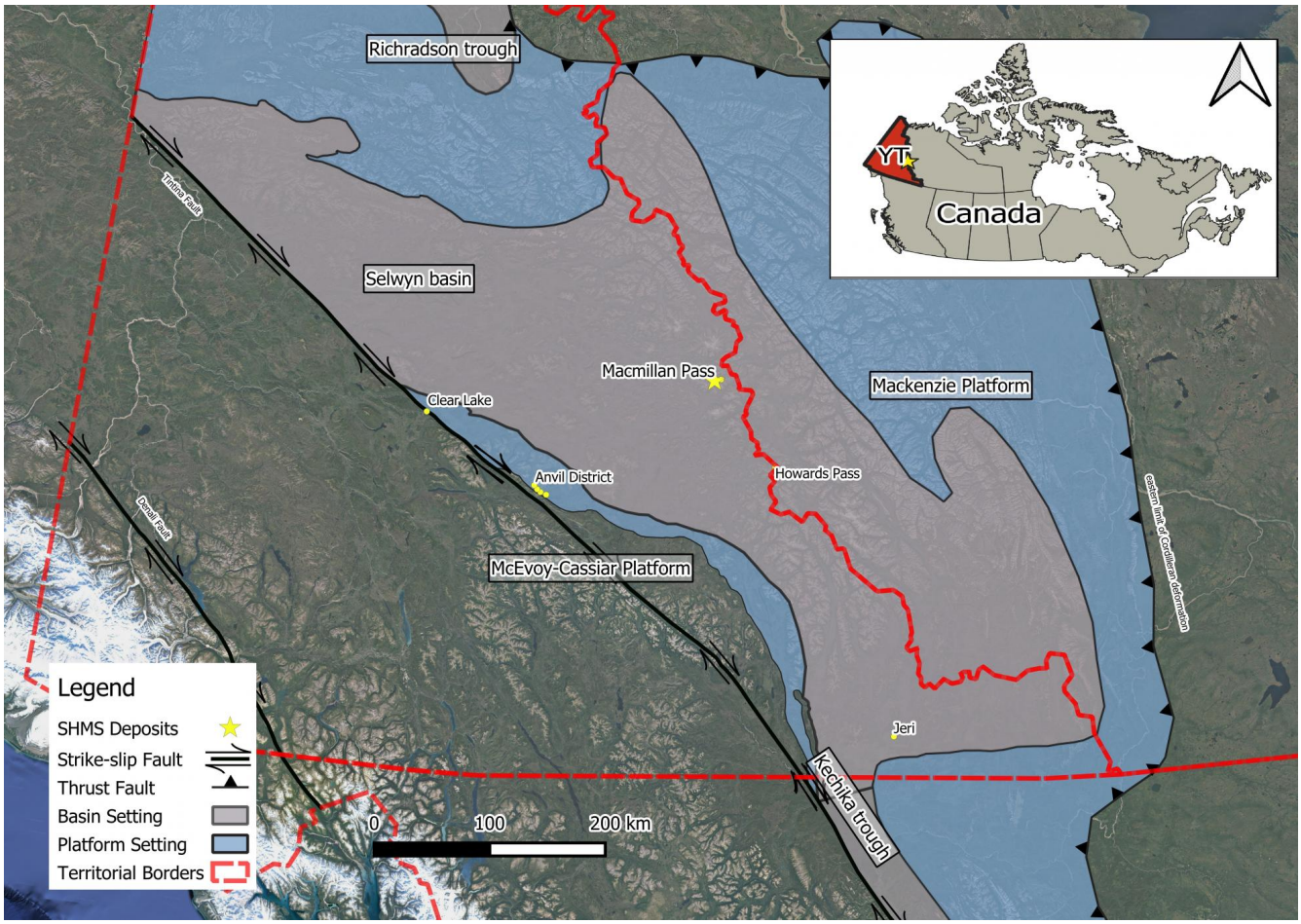
Stratiform Pb-Zn orebodies that make up shale-hosted massive sulphide (SHMS) deposits account for 40% of Zn and 60% of Pb reserves globally. SHMS deposits form at shallow depths and low temperatures in reduced sedimentary basins from deep convection of hydrothermal fluid within the host sedimentary basin. Fluid circulation is dependent on active faults to provide vertical permeability across sedimentary layering. Defining the fault architecture of a basin is a critical step in reconstructing basin geometry and identifying prospective areas for SHMS mineralization along these fluid pathways and their respective trap sites.

The Selwyn Basin in Yukon, Canada, comprises Neoproterozoic to earliest Mississippian passive margin clastic sedimentary strata deposited along the continental margin of Laurentia. From the Late Devonian, the Laurentian passive margin transitioned into a convergent margin with eastward-directed subduction. Subduction was accompanied by back-arc extension and the formation of back-arc basins into which Devonian to Mississippian sediments were deposited. The Macmillan Pass Tom and Jason SHMS deposits are hosted in one such Mid-Devonian to Mississippian extensional sub-basins where mineralization occurred along syngenetic fault structures. Continued subduction and plate convergence through the Jurassic and Cretaceous resulted in the Cordilleran orogeny that deformed the earlier SHMS deposits. Within the Selwyn basin, the Cordilleran orogeny is manifest as a foreland fold and thrust belt that is up to 130 km wide. The Macmillan Pass SHMS deposits occur at the eastern edge of this belt, west of a transition into a fold and thrust belt in Mackenzie platform strata. These deposits are hosted in Devonian strata that have been extensively folded by mid-Cretaceous crustal shortening with deformation manifest as thrust duplexes in the northern portion of the Macmillan Pass area and up to 3 phases of upright folds in its central portion. This study's principal objective is to decipher the structural evolution of the Macmillan Pass area and evaluate the fault geometry and structure of the Tom deposit within the central portion of Macmillan Pass to identify faults that may have controlled hydrothermal fluid flow and SHMS mineralization. This project intends to improve upon previous local mapping in the Macmillan Pass area and advance the structural understanding of the Cordilleran deformation's effect on SHMS mineralization in the Selwyn Basin. Evaluating the Macmillan Pass area's structural controls and identifying fault geometry and kinematic histories further define the structural geometry, spatial variation in strain accommodation, overprinting relationships, and current state of SHMS mineralization seen at the Tom Deposit. This would provide an important constraint on the regional distribution of SHMS deposits within the Selwyn Basin. Analysis of the Cordilleran overprint will assess the extent to which deformation has affected the geometry and grade distribution of SHMS deposits at Macmillan Pass and will bring an understanding to the degree to which the sulphides, their siliciclastic host rocks, and ore-controlling structures have been overprinted and/or reactivated by Cordilleran deformation.


Richradson trough
Selwyn basin
Macmillan Pass
Clear Lake
Anvil District
Howards Pass
Mackenzie Platform
McEvoy-Cassiar Platform
Kechika trough
Jeri
Tintina Fault
Denali Fault
eastern limit of Cordilleran deformation
YT
Canada
Legend
SHMS Deposits
Strike-slip Fault
Thrust Fault
Basin Setting
Platform Setting
Territorial Borders
0
100
200 km