The Gibraltar copper-molybdenum porphyry, near Williams Lake in south-central British Columbia, is hosted in the Late Triassic Granite Mountain batholith. The open pit mine has been in production from 1972 to 1998 and 2004 to present and has 802 million short tons of sulfide mineral reserves at 0.301% Cu and 0.008% Mo (Taseko Mines Ltd). The main ore zone, hosted within the Mine Series Phase tonalite, has been structurally dismembered and the relationship between mineralization and deformation is still uncertain. Our goal is to unravel the geometry, kinematics, and timing of the deformation events that have affected ore distribution and to determine if mineralization was synkinematic with the earliest deformation event. Field observations are based on detailed structural mapping of select benches in the pits, and core logging of drill core. A structural model within the Granite pit is constructed using Leapfrog Geo®.

The mineralized Mine Phase tonalite ranges from undeformed to very well foliated, with a positive correlation between alteration and deformation intensity. A magmatic foliation \((S_0)\) is sub-horizontal, to shallowly dipping to S-SE and is defined by aligned chloritized hornblende crystals. The \(S_0\) foliation is overprinted by a tectonic \((S_1)\) foliation that varies in intensity and is defined by elongate quartz and chlorite: \(S_1\) is typically oriented subparallel to early mineralization-stage sheeted chlorite-chalcopyrite veins that dip shallowly SW. \(S_1\) foliation intensity is correlated with increased chlorite-quartz and QSP alteration. The \(S_0, S_1\) foliations and sheeted chlorite-chalcopyrite veins are locally folded into upright to overturned folds (verging S-SW) that are spatially associated with thrust faults. The thrust faults, common in all pits, verge towards NE-E and dip \(~25^\circ\) SW: conjugate thrusts are common. The thrust faults contain sulfide-rich quartz-molybdenite veins. An \(S_2\) crenulation cleavage is locally prevalent and may be related to progressive deformation associated with thrusting. Large N-S trending high-angle dextral strike slip zones containing \(~1\) m thick foliated cataclasites, cross cut and deform \(S_0/S_1\): along one fault displacement is estimated at \(~120\) m. The dextral faults contain large alteration haloes – defined mostly by an increase in sericite and the ductility of the surrounding rock. A well-developed intersection lineation (intersection of \(S_1\) and the steep foliation within the dextral shear fabric) plunges \(20^\circ\) towards SE, which is parallel fold axes observed within the fault zones. Large N-NE trending high-angle normal faults represent the youngest deformation. These faults have displacements in excess of 350 m, and are characterized by 5-10 m wide caving of wall rock. Ar-Ar (illite) cooling ages will be presented from illite collected from \(S_1\) foliation, the different fault zones, and mineralized veins. Together with hornblende geochronology and microstructure analysis of thin sections, deformation history of the mine geology is proposed.