Sulfides in the sulfur-poor zones of the Stillwater Complex, Montana, USA.

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OVERVIEW

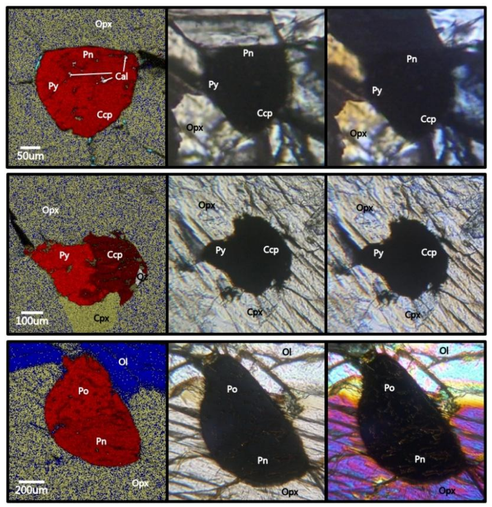
Objective: To characterize the sulfide assemblages in the sulfur-poor regions above and below the J-M reef in order to elucidate the processes that went to form the Stillwater Complex.

Background: Layered igneous intrusions such as the Stillwater Complex, Montana, USA and the Bushveld Complex, South Africa, contain the richest deposits of platinum-group elements (PGE) in the world. The processes that went to form these deposits, and particularly the role of fluids in their genesis, are still highly debated.

Key: Po pyrrhotite; Pn pentlandite; Ccp chalcopyrite; Py pyrite; Sp sphalerite; Cu native copper; Mag magnetite; CuFe delafossite; Ol olivine; Cpx clinopyroxene; Opx orthopyroxene; Pl plagioclase; Bt biotite; Qz quartz; Carb carbonates; Cal calcite; Dol dolomite.

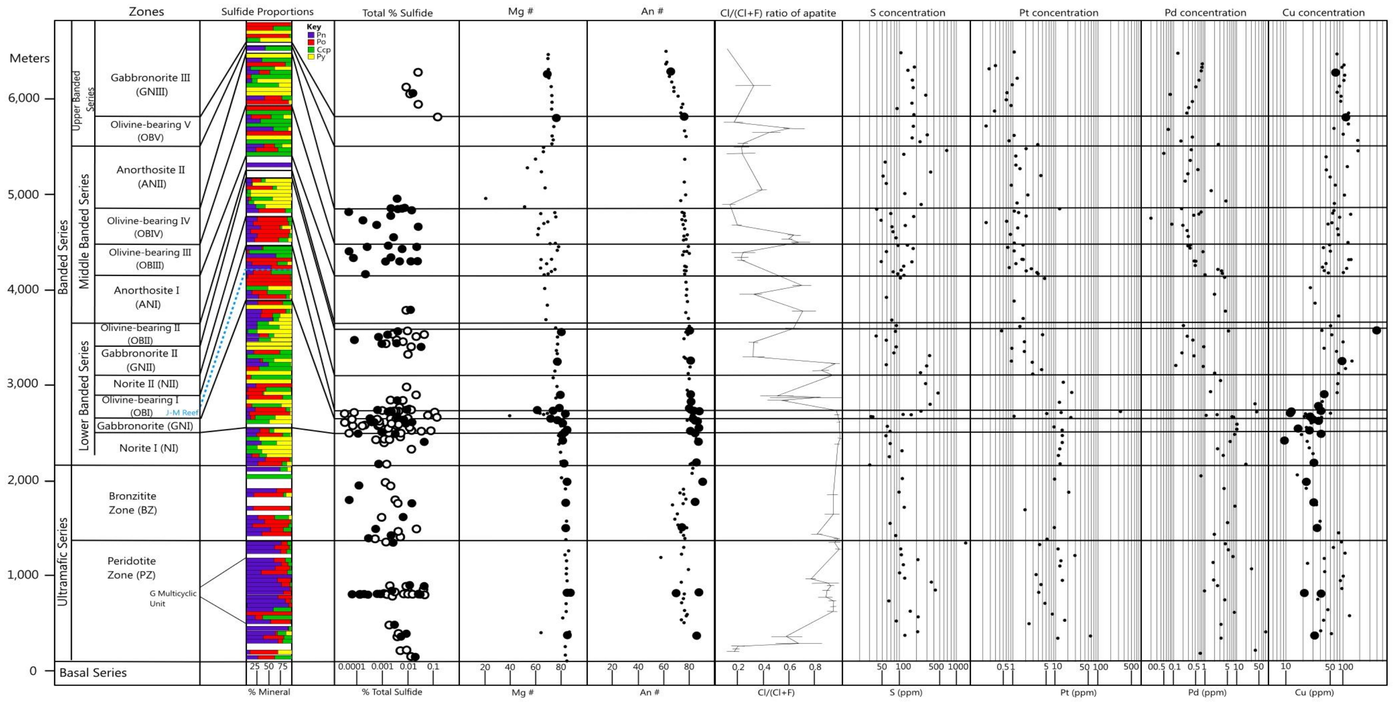
PRISTINE SULFIDES

Multiphase aggregates of sulfide with no low-temperature alteration of associated silicate minerals.



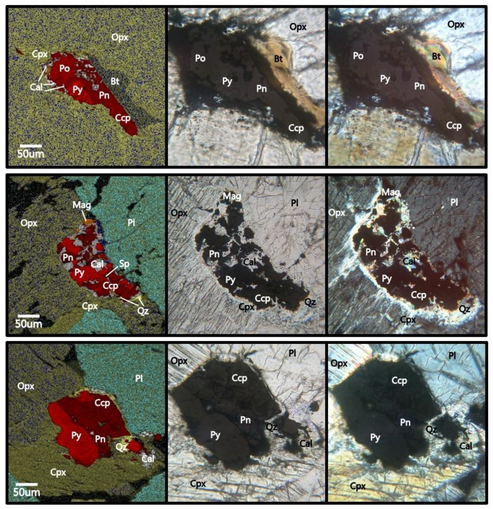
COMPOSITIONAL DATA

Increase in Pn upwards from base to middle of PZ, concurrent with increase in Cl contents of apatites. Ccp highly variable throughout section but higher above reef. Py present throughout but most common above reef. Po variable but prevalent immediately above and below reef. Concentration of Cu higher above reef than below.



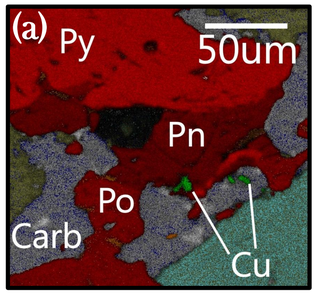
HIGH-T SULFIDES

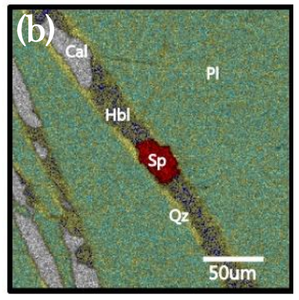
Multiphase aggregates of sulfide associated with high-temperature cal-dol exsolution and opx reaction rims.



a) NATIVE COPPER

Tiny grains of native copper in association with Py, Pn, Po and high-temperature carbonates. Present in PZ and GN-I.



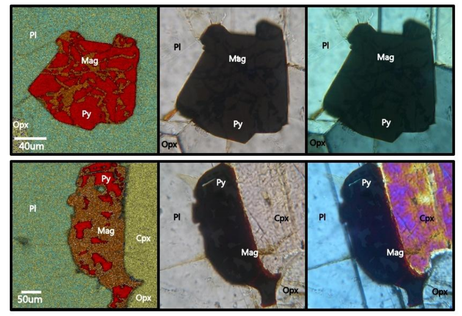


b) SPHALERITE

Sphalerite in high-temperature calcite-hornblende vein through plagioclase. Vein is bounded by quartz lining. Host plagioclase shows no low-temperature alteration. Present in GN-I.

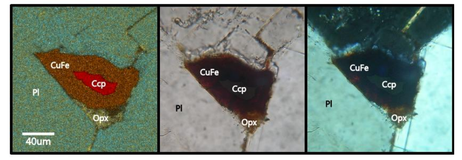
HIGH-T DESULFIDATION

Alteration of pyrite to magnetite. Most common in GN-III, AN-II and GN-II, but is also observed in N-II, BZ and PZ.



HIGH-T DESULFIDATION

Alteration of chalcopyrite to delafossite. Only present in GN-II.



CONCLUSIONS

Data indicate loss of S and Cu from base of complex and remobilization upwards (high Ccp and Py above reef). Likely due to degassing or to mobilization by high-temperature fluids. Presence of high-T carbonates and Cl-rich apatite in this section suggest interaction of Cl-rich, carbonic fluid, as do sphalerite-bearing calcite-hornblende veins. Presence of native copper indicates a complicated desulfidation history.

ACKNOWLEDGEMENTS