Alteration and Mineralization at the Red Chris Cu-Au Porphyry Deposit, Northwestern British Columbia

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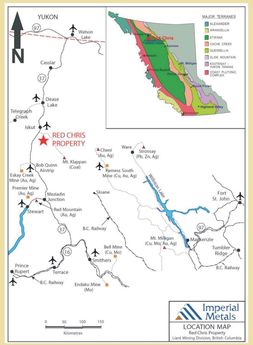
Introduction

The Red Chris porphyry Cu-Au deposit in British Columbia has geological features typical of both alkalic and calcalkalic porphyry deposit types:

- Quartz-vein stockworks characterize the mineralized zones, typically absent in alkalic porphyries.
- Intense late-stage sericitic alteration, characteristic of calcalkalic porphyry deposits.
- Widespread and intense late carbonate alteration (Baker et al., 1999), which is not a common feature of porphyry Cu systems (Seedorf et al., 2005).
- A relatively limited lateral extent of mineralization, Mo deficient, and abundant hematite alteration.
- High Au grades typical of BC alkalic porphyry deposits (Newell and Peatfield, 1995; Baker et al., 1999; Holliday and Cooke, 2007).

Location

- Northwestern British Columbia
- ~80 Km southwest of the town of Dease Lake.
- Northern tip of the Stikinia terrane.
- Quesnellia and Stikinia are two terranes in British Columbia that host most of the province's porphyry deposits.



Red Chris Property Location Map: Nearby mineral occurrences and deposits are noted. Inset shows tectonic terranes of the Canadian Cordillera.

Regional Geology

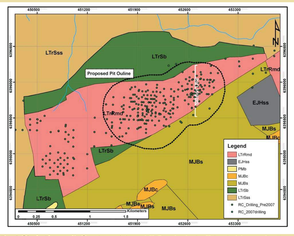
- LTrS - Stuhini Group (host rock of the Red Stock)
  - Late Triassic volcanic and volcanically derived sedimentary rocks.
  - Augite phyric basaltic pillowed flows and breccias (Ash, 1995).

LTrRmd - Red Stock (host of mineralization)
- Late Triassic plagioclase-hornblende porphyritic monzodiorite.
- U-Pb dating from zircons place the Red Stock as 203.8 Ma (Friedman and Ash, 1997).
- Elongated in an east-northeasternly direction, ~4.5 Km long and up to ~1.5 Km wide (Ash, 1995; Ferreira, 2009).

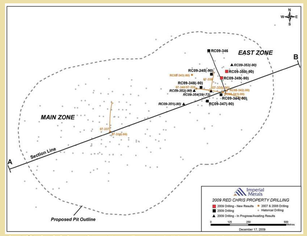
MJB - Bowser Lake Group (Ashman Fm.)
- Middle Jurassic marine clastic sedimentary rocks deposited uncomformably on top of LTrS and LTrRmd (Evenchick and Thorkelson, 1993).

Ore Zones and Mineralization

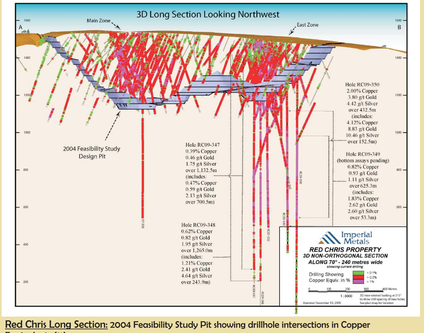
- There are several mineralized zones, however only the Main and East zones host economic resources. This study is focused on the East zone.
- The orebodies are vertical to subvertical pipe-like structures, elongated along general east-northeast trending faults in the region (Collins et al., 2004).
- Copper mineralization occurs as dissemintated and fracture controlled chalcopyrite and bornite.
- Gold occurs as microscopic inclusions within the Cu-sulphides.
- Copper and gold occur within banded quartz stockwork veins and sulphide-only veins.



Red Chris Deposit Geology Map: LTrRmd = Late Triassic Monzodiorite (Red Stock). Proposed open pit outlined with a dashed line; drillholes are green dots; white line is Section 452700E logged in this study.



Red Chris Drilling Plan Map: Recent drill holes are labeled; A-B Section Line for Long Section below.



Red Chris Long Section: 2004 Feasibility Study Pit showing drillhole intersections in Copper Equivalents (%).

Selected Drill Results of the East Zone

RC07-335
4.90m - 1029.00m
1.02% Cu
1.26 g/t Au
3.92 g/t Ag

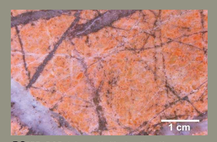
RC09-350
@504m depth, 152m of
4.12% Cu
8.83 g/t Au
10.46 g/t Ag

Observations

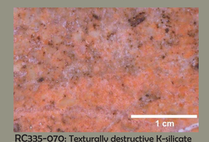
K-Silicate Alteration

- The main zone is in deeper parts (>350 m) of section 452700E, and forms a narrow vertical zone centered near drillhole RC07-335.
- Potassium-silicate alteration in the shallower portion of the section has been overprinted by illite and kaolinite alteration, making it difficult to determine the original extent of the K-silicate zone.

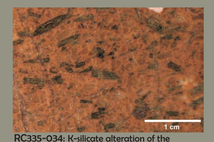
Characterized by:
- Secondary biotite and magnetite replacing igneous amphibole, and by texturally destructive K-feldspar that has replaced the groundmass and primary plagioclase feldspar phenocrysts.
- Primary mafic minerals are also locally replaced by later chlorite.
- Hematite, also in the mafic sites, is the dominant oxide above 400 m (vertical depth), whereas magnetite is in much greater abundance below 400 m, an observation also made by Baker et al. (1999).



RC335-060: Intense K-silicate alteration of the groundmass; drillhole RC07-335 (863.54 m).



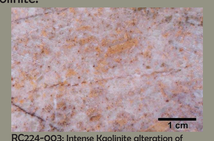
RC335-070: Texturally destructive K-silicate alteration of monzodiorite; drillhole RC07-335 (986.37 m).



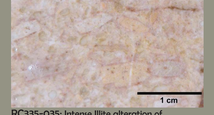
RC335-034: K-silicate alteration of the groundmass with secondary biotite phenocrysts being altered to magnetite and chlorite; drillhole RC07-335 (409.48 m).

Illite - Kaolinite Alteration

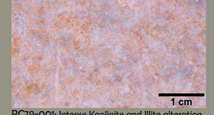
- Widespread, dominantly in the upper ~300 m of the section and outboard from the margins of the K-silicate zone.
- Gradational overprint on the K-silicate altered monzodiorite.
- Illite and kaolinite pervasively alter both plagioclase and alkali feldspars and hornblende phenocrysts of the primary monzodiorite to buff white, pale orange and locally pale green colours.
- All illite and kaolinite was originally logged as sericite, however with the use of the TerraSpec (SWIR), the mineralogy has been determined to be dominantly illite and kaolinite.
- Pervasive but minor very fine grained, maroon hematite occupies the mafic sites with both sharp and diffuse grain boundaries.
- Pyrite within the illite-kaolinite zone tends to increase in the upper portion of the section, as very fine to fine-grained anhedral crystals occurring preferentially within the mafic crystal sites.
- Pervasive carbonate alteration is spatially associated with the illite-kaolinite alteration in the upper portions of the section. Baker et al. (1999) reported a ferroan-dolomite composition for this carbonate alteration.



RC224-003: Intense Kaolinite alteration of phenocrysts and groundmass; drillhole RC95-224 (97.98m).

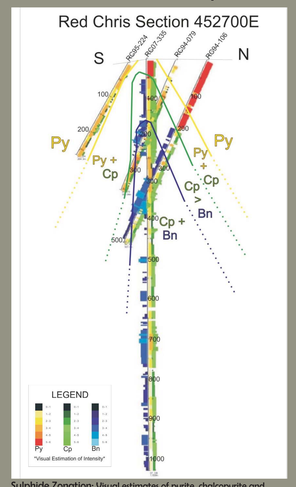


RC335-035: Intense Illite alteration of phenocrysts and groundmass; drillhole RC07-335 (441.77m).

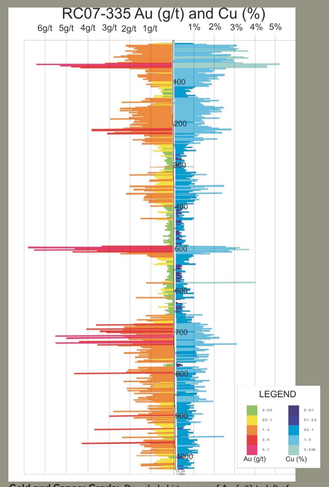


RC79-001: Intense Kaolinite and Illite alteration of phenocrysts and groundmass; drillhole RC94-079 (8.30m).

Cross Section 452700E: Sulphide Zonation and Mineralization

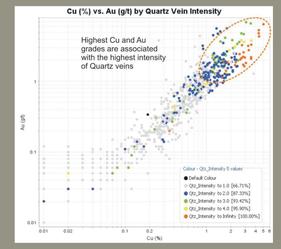


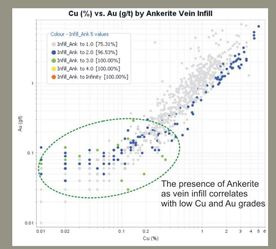
Sulphide Zonation: Visual estimates of pyrite, chalcopyrite and bornite exhibit a lateral zonation across the section. Zones are Py, Py+Cp, Cp > Bn, and Cp+Bn.

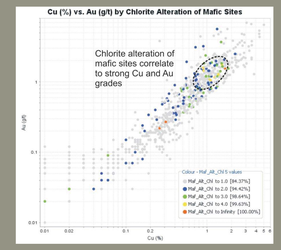


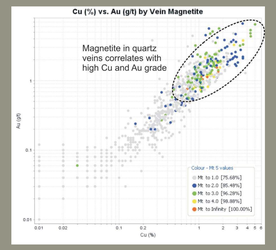
Gold and Copper Grades: Downhole histograms of Au (g/t) to left of drill trace and Cu (%) to right of drill trace in drillhole RC07-335.

Cu (%) vs. Au (g/t) in RC07-335 by Different Geologic Parameters



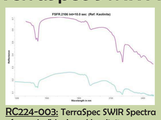




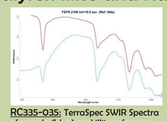


Interpretations

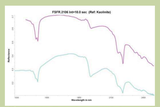
TerraSpec SWIR Analyses: Illite and Kaolinite Alteration



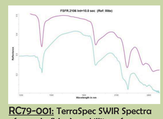
RC224-003: TerraSpec SWIR Spectra of sample (blue) and kaolinite reference (pink).



RC335-035: TerraSpec SWIR Spectra of sample (blue) and illite reference (pink).



RC79-001: TerraSpec SWIR Spectra of sample (blue) and kaolinite reference (pink).



RC79-001: TerraSpec SWIR Spectra of sample (blue) and illite reference (pink).

- Samples taken from drillholes RC07-335, RC95-224, RC94-106 and RC94-079 were analyzed for clay alteration mineralogy using the TerraSpec (Short Wave InfraRed Spectroscopy).
- The majority of the samples contain illite, and some contain kaolinite. Few samples contain illite and kaolinite.
- The alteration assemblage illite-kaolinite dominates along section 452700E, especially closer to the core of the mineralization near RC07-335. This differs from the sericite alteration originally believed to be the dominant alteration mineral in this area of the deposit.
- The illite-kaolinite alteration indicates a lower temperature assemblage than sericitic alteration.

Acknowledgements

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