Geology and petrology of the Catface porphyry Cu-Mo deposit, Vancouver Island, and linkages to porphyry deposits of the Paleogene Cascade magmatic arc, Washington and Coast Mountains, southwestern British Columbia

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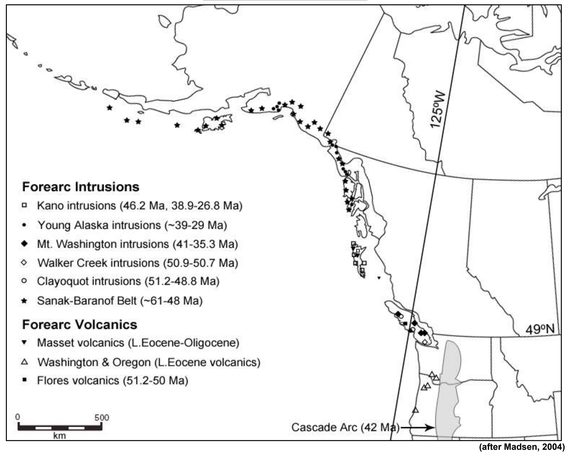
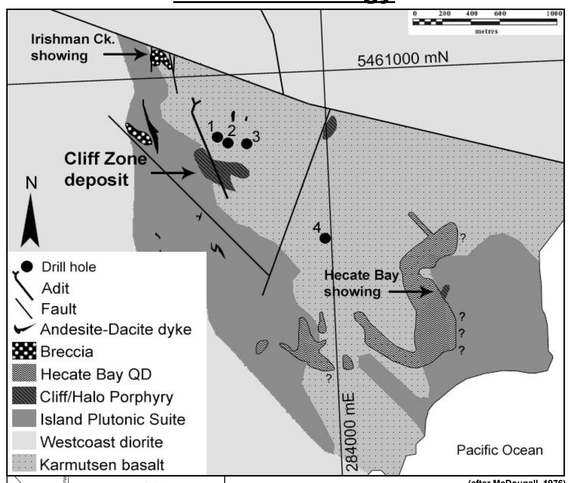
Introduction



(after Madsen, 2004)

- The **Catface porphyry Cu deposit** (PCD), located on the west coast of Vancouver Island, is studied and compared with the Cascadian **North Fork** and southwest British Columbian **O.K. PCDs**
- Test viability of extending the relatively reduced magmatic arc that produced the North Fork and Cascade PCD suite in Washington to Vancouver Island and southwest British Columbia
- The petrology, mineralogy, geochemistry and geochronology of the Catface igneous complex is assessed, as well as the oxidation state and emplacement depth/temperature. Ore system alteration and mineralization are also studied to characterize the mineralization event and compare with other RPCGs deposits in the region

Catface Geology



(after McDougall, 1976)

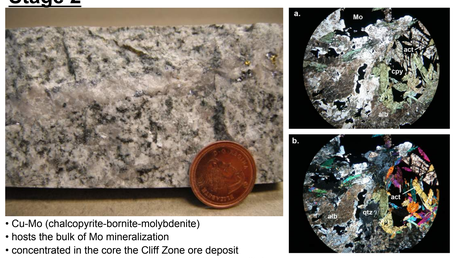
- Triassic Karmutsen Group, Jurassic Westcoast Complex both intruded by Jurassic Island Plutonic Suite
- Whole package intruded by multiple phases of Paleogene magmatism

Mineralization and Alteration Paragenesis

Stage 1 (barren)

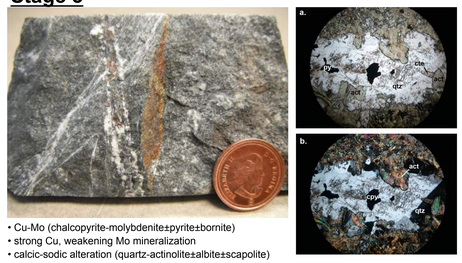
- barren (biotite-feldspar-quartz)
- biotite-rich hornfels in vicinity of some felsic intrusions

Stage 2



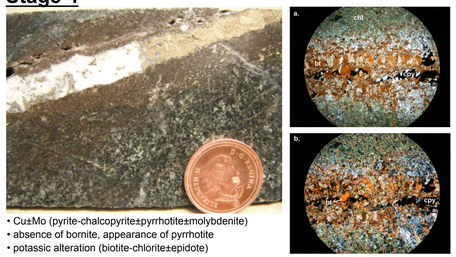
- Cu-Mo (chalcopyrite-bornite-molybdenite)
- hosts the bulk of Mo mineralization
- concentrated in the core the Cliff Zone ore deposit
- sodic-calcic alteration (quartz-albite-actinolite±scapolite)

Stage 3



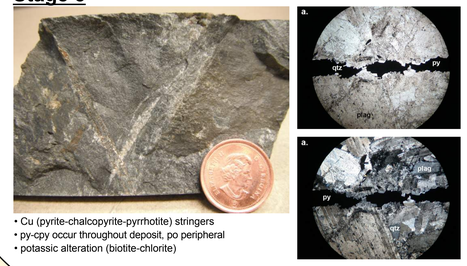
- Cu-Mo (chalcopyrite-molybdenite±pyrite±bornite)
- strong Cu, weakening Mo mineralization
- calcic-sodic alteration (quartz-actinolite±albite±scapolite)

Stage 4



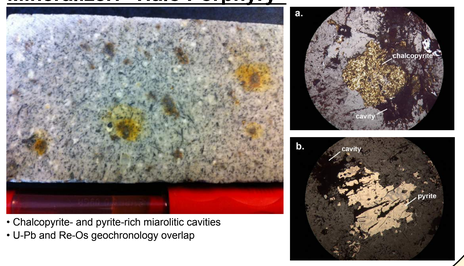
- Cu±Mo (pyrite-chalcopyrite±pyrrhotite±molybdenite)
- absence of bornite, appearance of pyrrhotite
- potassic alteration (biotite-chlorite±epidote)

Stage 5



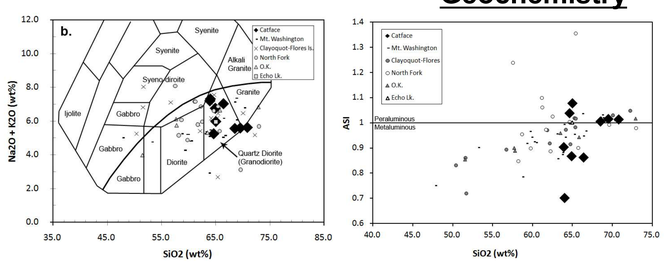
- Cu (pyrite-chalcopyrite-pyrrhotite) stringers
- py-cpy occur throughout deposit, po peripheral
- potassic alteration (biotite-chlorite)

Mineralizer: "Halo Porphyry"

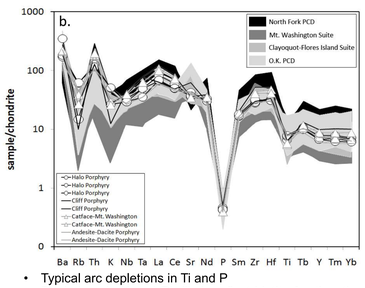


- Chalcopyrite- and pyrite-rich miarolitic cavities
- U-Pb and Re-Os geochronology overlap

Geochemistry

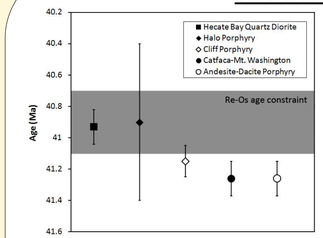


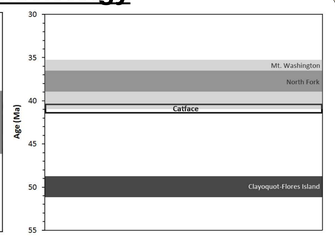
- Granodiorite to quartz diorite, weakly peraluminous to moderately metaluminous
- Comparable major element compositions, I-type granite affinity



- Typical arc depletions in Ti and P
- Depletions in K and Rb likely reflect biotite fractionation for these more evolved intermediate and felsic magmas
- **Strong overall trace element correlations**

Geochronology



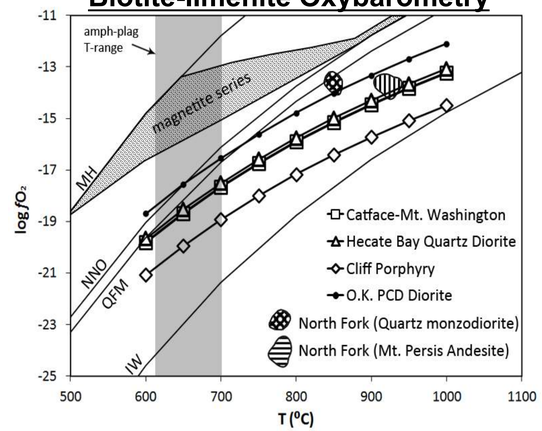


- **Five phases of Paleogene magmatism** (41.4 – 40.4 Ma) defined at Catface Cliff Zone
- Direct **temporal correlation** between **mineralization** and **magmatism**

- Temporal affinity of **Catface PCD** to **Mt. Washington Suite** on Vancouver Island (Madsen, 2004)
- **North Fork PCD** has direct temporal association with **Mt. Washington Suite** on Vancouver Island

Similar timing of Catface, North Fork confirmed; arc extension supported

Biotite-Ilmenite Oxybarometry



- All **studied PCD magmas** crystallized at **fO_2's between NNO and QFM-3**
- **Typical PCD magmas** crystallize **between NNO and HM** ("magnetite series" field)

Reduced Porphyry Cu Mineralization

	Catface	North Fork	O.K.
No primary hematite	✓	✓	✓
No primary sulphates	✓	✓	✓
Hypogene pyrrhotite present	✓	✓	✗
Primary ilmenite > magnetite	✓	✓	?

*******Reduced ore and pluton mineralogies*******

Conclusions

- Catface is a reduced Paleogene PCD on the basis of pluton and ore mineralogies, fO_2 calculations and SO_3 contents in apatite
- A direct temporal correlation between magmatism and mineralization is established: 40.4-41.4 and 40.0 Ma, respectively
- The Halo Porphyry is identified as the mineralizing intrusions at the Catface PCD due to the presence of sulphide-rich miarolitic cavities, and geochronological correlation

References

1. Madsen, J., 2004, Geochemistry and geochronology of Eocene forearc magmatism on Vancouver Island: implications for Cenozoic to recent plate configurations in the Pacific basin, Masters Thesis, Simon Fraser University

2. McDougall, J.J., 1976, Catface; In Porphyry Deposits of the Canadian Cordillera, Part B - Porphyry Copper and Copper-Molybdenum Deposits of the Calc-Alkalic Suite – Special Volume 15, Paper 29, p 299-310