896393 Valley Copper

Michael B. Jones

Hydrothermal altn & mnlzn of the Valley Copper deposit, Highland Valley, B.C.

1974

Oregon State University

Batholith of calc alkaline contained metal related to early Mesozoic subduction zone (Pacific [Farallon] and North American plates). Paleosub. zone ~140 km below the Batholith.

major altn mins

Kaol. ser microcline & qtz

Lesser " "

calcite biotite gyp anhy.

Loca + distn of altn mins controlled by fractures

--- veins ... selvedges ... pervasive zones

Most copper in qtz-ser veins

Superimposed & prograde altn sequence

① Propylitic (?)

② argillic

③ pervasive sericite (py. cpy sphal)

I Disagree with this timing of altn → ④ barren qtz vein stockwork & potassic altn

⑤ qtz-ser veins (bn, cpy, MoS_2)

⑥ mnlzd qtz veins (bn, cpy, MoS_2, cct, covellite)

⑦ gypsum veins

Sericite (198 ± 8 My) MoS_2 (202 ± 8 MY)

Bsda dyke (pre-ore) (204 ± 4) Vogesite lamprophyre (13.2 ± 3 MY)

ones

Hydrothermal altn mainly by base leaching of Ca^{++} + Na^{+} from plag + by metasom. addition of K^{+}, H^{+} and SiO_2 to the host.

Heat dissipation in the deposit (to get rid of heat generated by altn rx's) by conduction, convection, throttling and influx of rel. cool fluids [via connate or ocean water].

Oxygen + hydrogen isotopes

PRIMARY MINS

		# done	
δD	Qtz (10)	δO^{18} permil values are	+7.27 to +8.98
	Kspar (7)		+5.67 to ~~8.90~~ 9.70
	Plag (9)		+5.22 to +8.96
-66.1 to -111.8	Biotite (8)		+1.95 to +5.02

ALTN MINS

δO^{18}	Qtz (9)	+8.74 to +12.57
	Kspar (6)	7.65 to 8.74
	~~Plag~~ ~~Kaolinite (4)~~ sericite (6)	+6.60 to 7.56
	Kaolinite (4)	

δD	sericite (6)	-64.8 to -53.1
	biotite (2)	-91 to -76
	Kaolinite (3)	-116 to -95.2

δS^{34}	MoS_2 (1)	+0.50
	Pyrite (1)	-3.08
	sphal (1)	-4.11
	cpy (5)	-3.30 to +1.53
	Bn (4)	-.94 to +1.45
	anhydrite (2)	+11.76 to +14.88
	gypsum (2)	+13.13 to +15.22

mean -0.81 + range 5.64 of sulphides ~~typical~~ of other Cordilleran porphyry deposits in which sulphur thought to come fm deep crystal or mantle source.

Oxygen isotopes primary minm 850 to 265°C
Hydr minerals 480°C qtz-ser in sulphide brg qtz vein
to 260°C " " " pervasive altn zone

Sulphur Isotopes
480°C anhy. bn in pervasive espan altn
to 266°C pyr.-sphal in perv. sericite altn

ie Margin of deposit ~300°C
core " " ~500°C
Temperatures increase w. altn paragenesis

@ 400°C { pH 1.74 to 4
-log fO_2 20 to 23
-log fS_2 1.4 to 4.5 } Hydro. altn

pH 2.5 - 3
-log fO_2 22.2
-log fS_2 1.5 to 3.6
vein sericite altn + sulphide dpsn

Fluid Inclusions
a few sylvite + halite xls + liquid CO_2
∴ max. Concn K^+ 4.6 m
" " Na^+ 6.4 m
" " PCO_2 100 to 300 bars

Isotopic compsn of hydr fluid ... magmatic water + ocean water (based on oxygen, hydrogen isotope values fm sericite)

Early pervasive sericite ... ocean water 70%
Marg stage qtz-ser veins ... " " 20%
Gypsum veins ... 94%
(may have quenched hydroth. altn)