Structural Controls on Gold in the Wells-Barkerville, Cassiar, and Sheep Creek Camps of Interior BC

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• Historically significant gold camps along the eastern margin of the Intermontane terranes dominated by orogenic gold

• GOAL: Contributing exploration value by defining structural/tectonic controls on gold along the strike length of the BC Cordillera
Quartz veins & gold in each camp have a predictable relationship to host rock fabrics
HISTORIC LODGE: ~1.3 Moz
HISTORIC PLACER: ~3.2 Moz
Regional structure – D1

Transposed bedding (S0/S1)

bedding-parallel cleavage (S0/S1)
\[ n = 324 \]

calculated
F2 fold axis
Regional structure – D2

View to 345N

cleavage (S2)
n = 175
Regional structure – D2

L-S tectonites defined by S2/S1 intersection and mineral stretching lineation (L2)

L2 intersection/stretching line. n = 303

F2 fold axis n = 16

(View to N)
Regional structure – D3

F3 crenulation – minor, local, confined to pelite
Island Mountain – carbonate replacement style ore

Rod-shaped geometry of pyritic cb-replacement ore (preferentially forms along F2 fold axes)

BGM website, Jan 2017

Quartz Vein Ore
Looking Down

view to NE

Sulphide Replacement Ore
Looking Northeast
Extensional veins

- Steep and NE-trending
- Sub-perpendicular to $L_2$

Rhys et al., 2009

qtz-Fe-cb
pyrite

L2 intersection/stretching lin.
$n = 303$

F2 fold axis
$n = 16$

extensional veins
$n = 172$

extensional veins
$n = 172$
Shear veins

Cariboo Thompson area
Vein, joint, fault orientations

joints
n = 66

extensional veins
n = 172

shear veins
n = 35

dextral strike-slip fault
n = 18

joints
n = 66

extensional veins
n = 172

shear veins
n = 35

dextral strike-slip fault
n = 18
Kinematic synthesis: Cariboo

$D_1 \rightarrow D_2$
Kinematic synthesis: Cariboo

Progressive D2

e.g., Island Mtn

e.g., BC Vein

N

dZ

dX

quartz-carbonate-pyrite vein
pyrite replacement body
BC Vein – NW-trending, fault-filling
Bonanza Ledge (looking N)

BC Vein

Replacement-style Au
Regional structure – D4

Generally, F₄ folds superimposed on D₂-related fabrics, veins & Au
Regional structure – D4

Late $F_4$ kink/chevron folds generate new extensional veins and locally control Au (BGM, 2017)
Kinematic synthesis: Cariboo

Lateral extrusion & differential NE-SW shortening along strike

F$_4$ folds
1. Accretion / Imbrication

2. NE-SW shortening
Metasedimentary mylonite, immediate footwall of Pundata thrust
1. Accretion / Imbrication

2. NE-SW shortening & NW lateral escape
1. Accretion / Imbrication

2. NE-SW shortening & NW lateral escape

3. Mineralization
1. Accretion / Imbrication

2. NE-SW shortening & NW lateral escape

3. Mineralization

4. N-trending dextral faults
Cariboo structural model on end:

Archaean Val d’Or model:

Same relative geometric relationships between extensional veins, faults/shear veins, and principle stresses

Poulsen and Robert, 1989
736,000 oz Au (13.3 g/t)
365,000 oz Ag
377,000 lbs Pb
312,000 lbs Zn
Sheep Creek

Mathews, 1953
Sheep Creek

Mathews, 1953

Mineralizing trend

L2 F2 fold axes

dextral shear structures

extensional veins

Mathews, 1953
Sheep Creek – vein distribution

Strong stratigraphic control: gold preferentially forms in brittle quartzite units

Mathews, 1953
Historic lode gold production
~240,000 oz

(Ball, 1997)
Vollaug Vein (Table Mtn area)

Thrust-filling vein (Vollaug)

argillite

View to E

metabasalt

listwaenite, serpentinite
based on Rhys, 2009

- quartz-carbonate-pyrite vein
- carbonaceous phyllite
- ultramafic rocks
- mafic rocks
Summary

1. Host rocks in all gold districts have undergone significant orogen-normal shortening & orogen-parallel extension.

2. Quartz veins & Au formed from onset of brittle behaviour during progressive coaxial deformation. Formed preferentially in competent lithologies.

3. Vein geometries & kinematics directly linked to orogen-normal shortening ± gravitational loading (i.e., Cassiar).
Summary

3. Kinematic evidence in Cariboo and Cassiar shows that thrust-bound elements of Slide Mountain terrane were transported top-to-the-NNW (orogen-parallel lateral escape) – Cordilleran-scale phenomenon?

4. Potential to apply structural models for orogenic gold exploration elsewhere in the Northern Cordillera
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