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UBC a place of mind

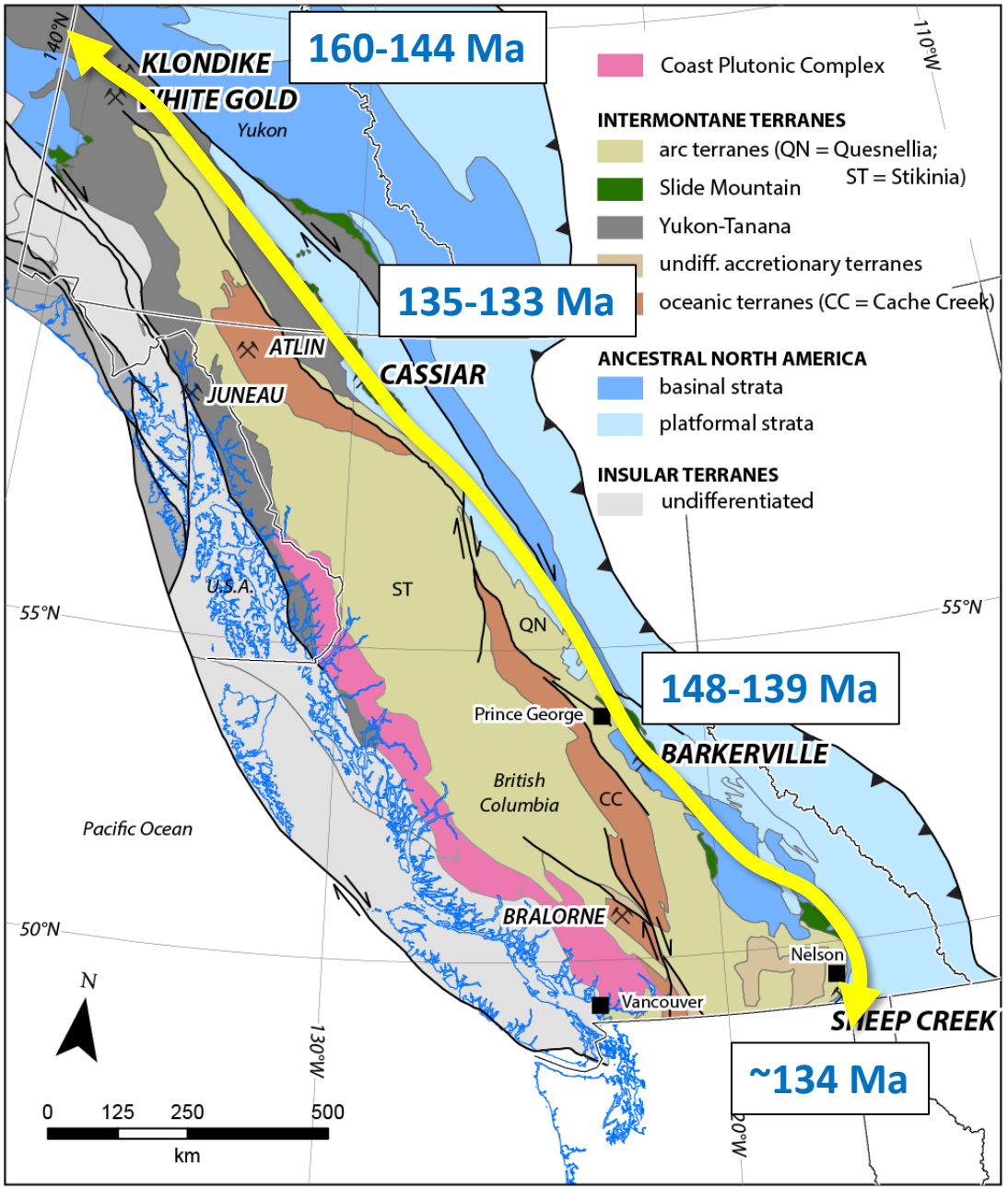
Structural Controls on Gold in the Wells-Barkerville, Cassiar, and Sheep Creek Camps of Interior BC

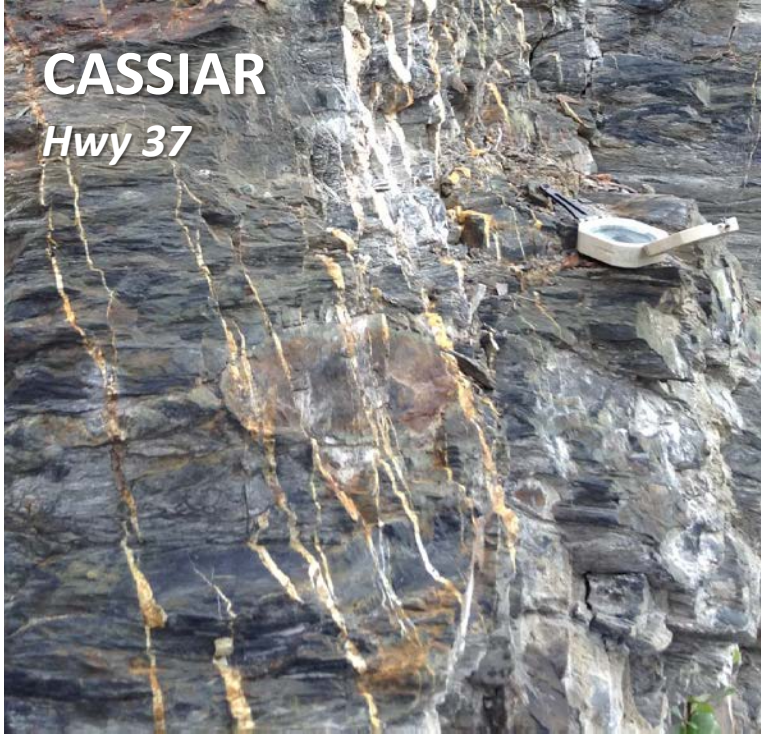
Murray Allan

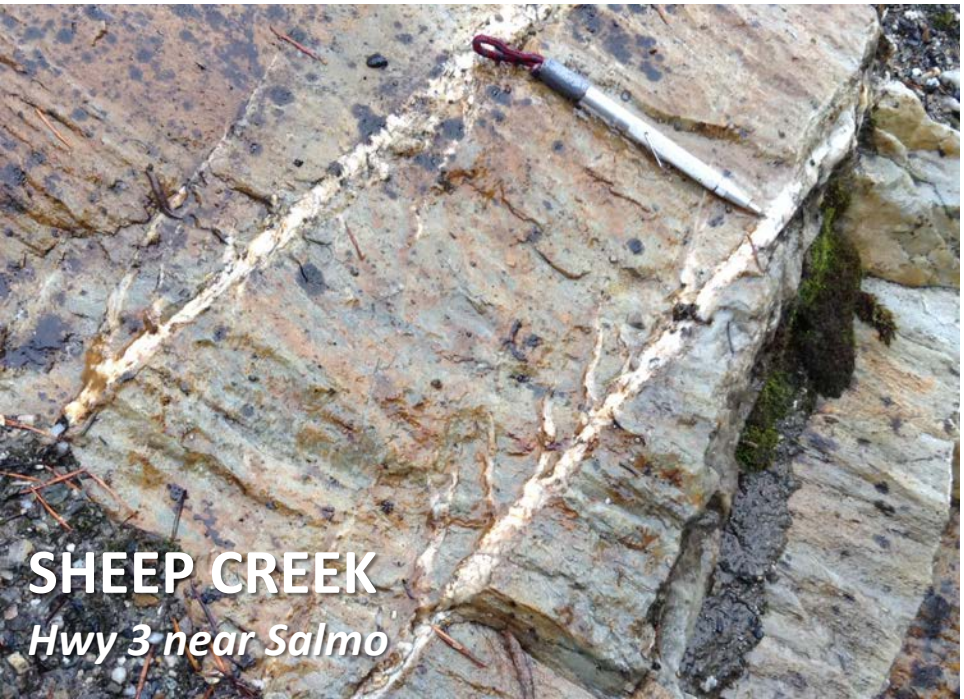
April 4th, 2017

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

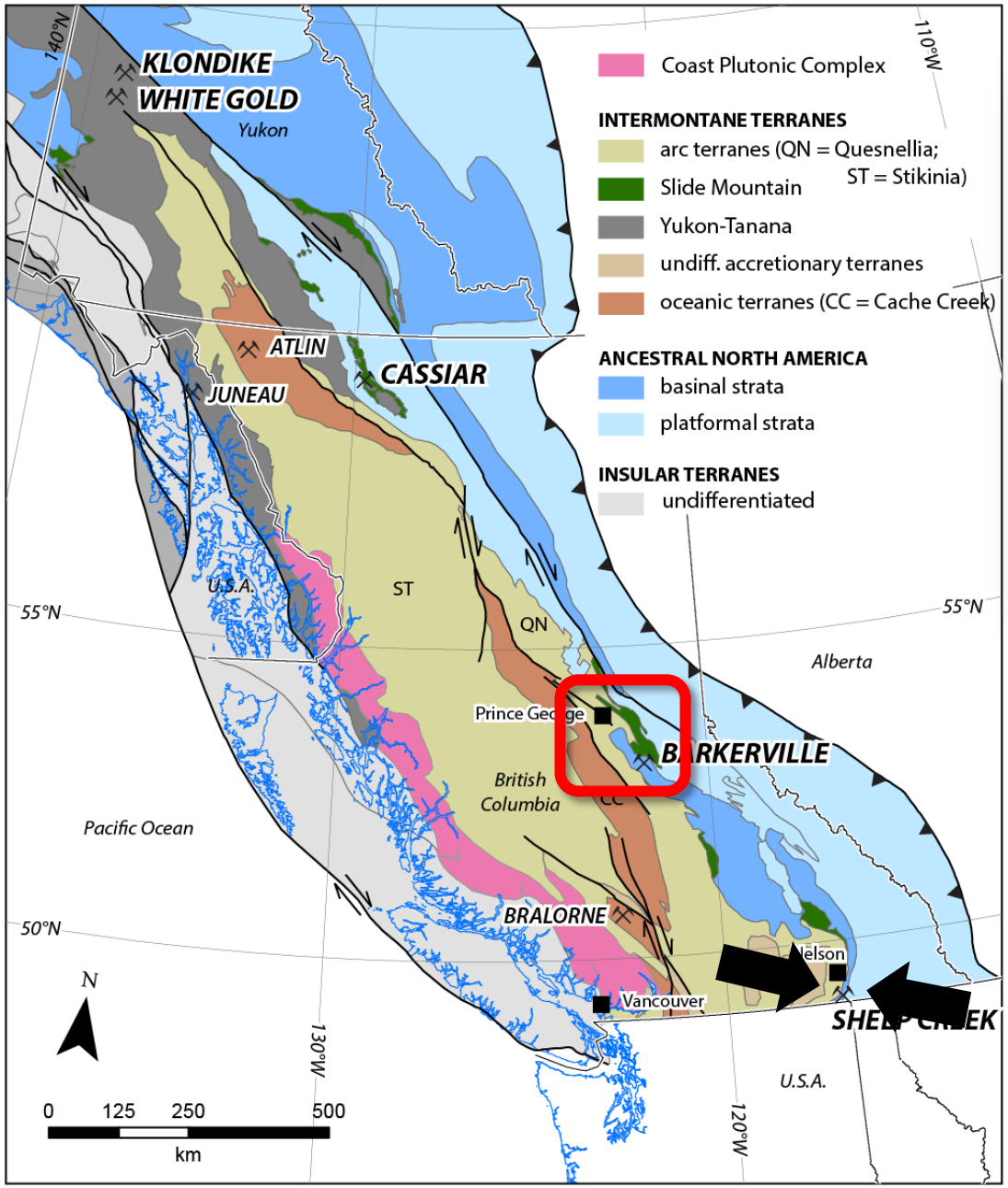
- **GOAL: Contributing exploration value by defining structural/tectonic controls on gold along the strike length of the BC Cordillera**

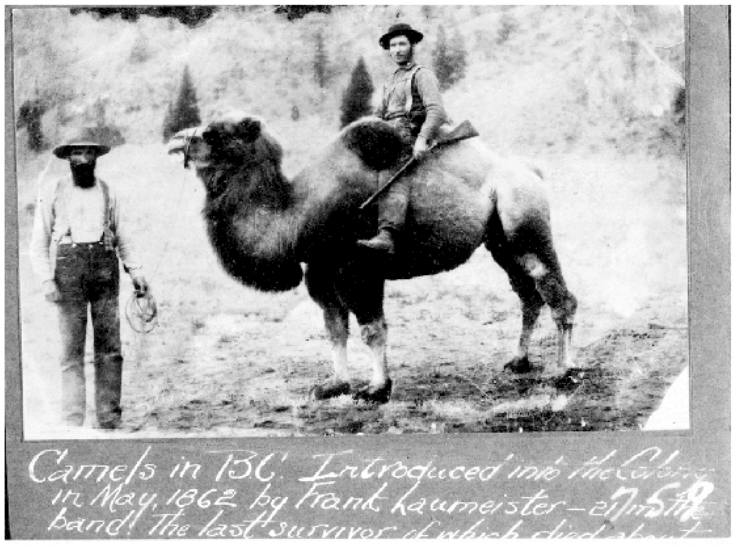






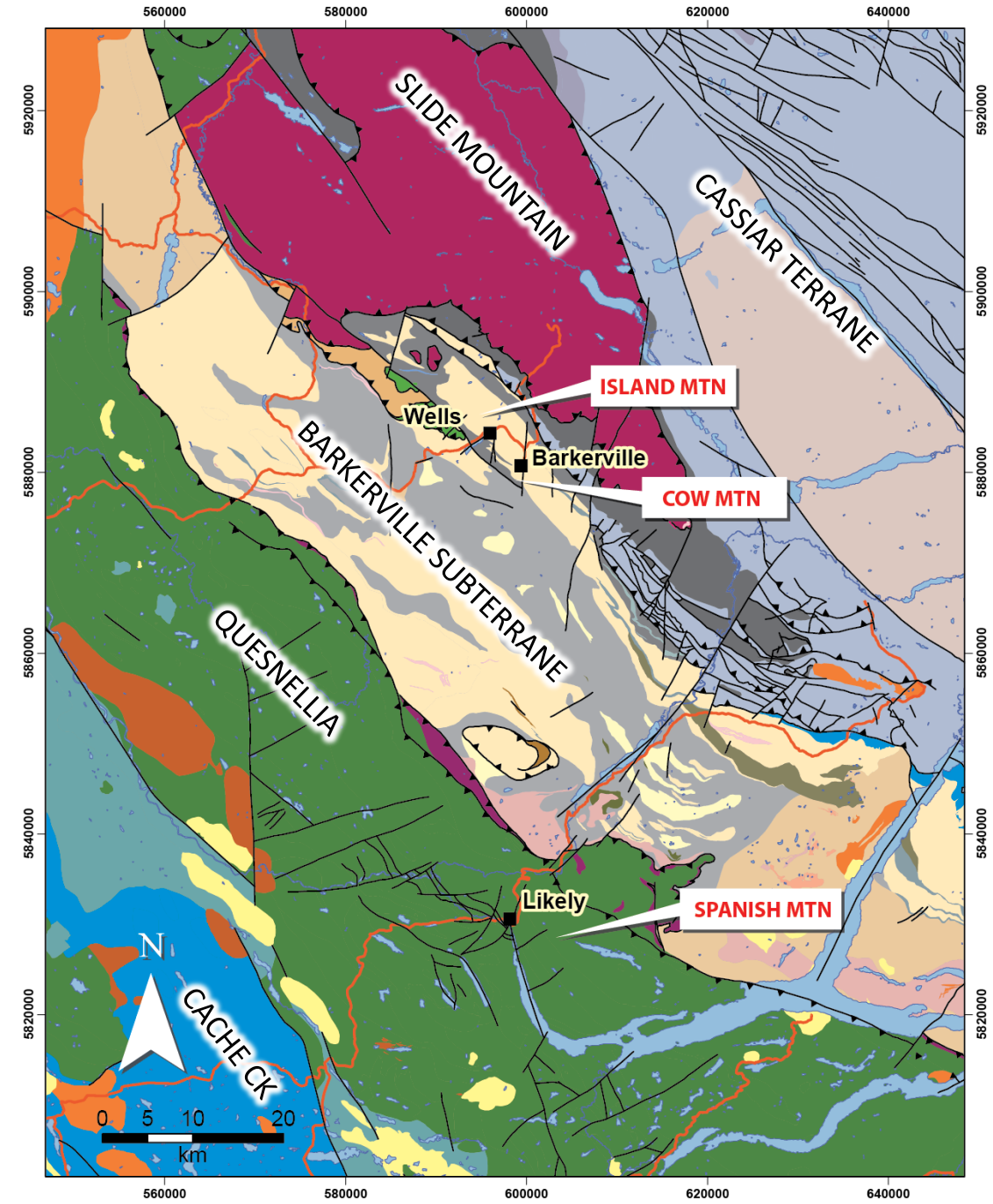
Quartz veins & gold in each camp have a predictable relationship to host rock fabrics

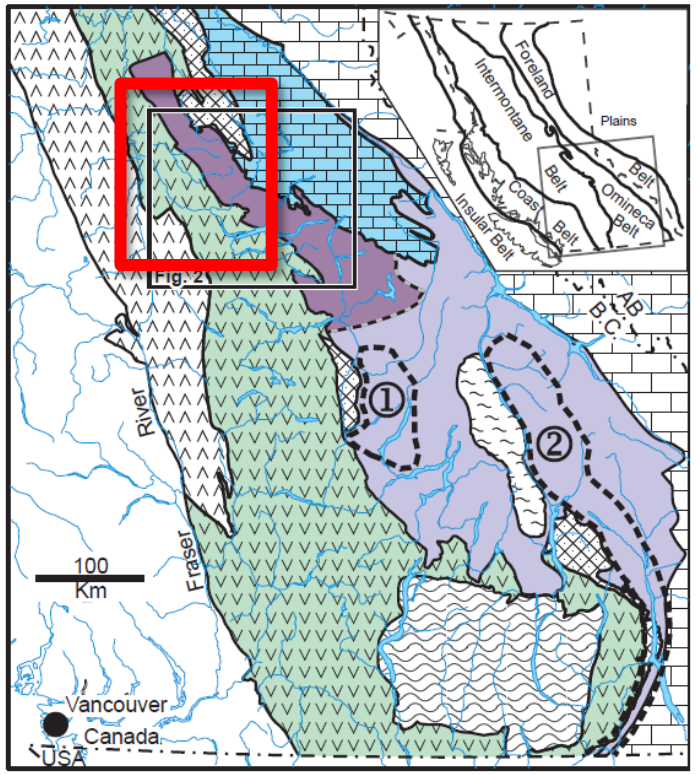




HISTORIC LODE: **~1.3 Moz**

HISTORIC PLACER : **~3.2 Moz**





Cache Creek terrane
Quesnel terrane
Slide Mountian terrane
Cariboo terrane
Rocky Mountains
Kootenay terrane
Barkerville subterrane
Monashee complex
Undifferentiated

Ferri and Schiarizza, 2006 (GAC SP45)

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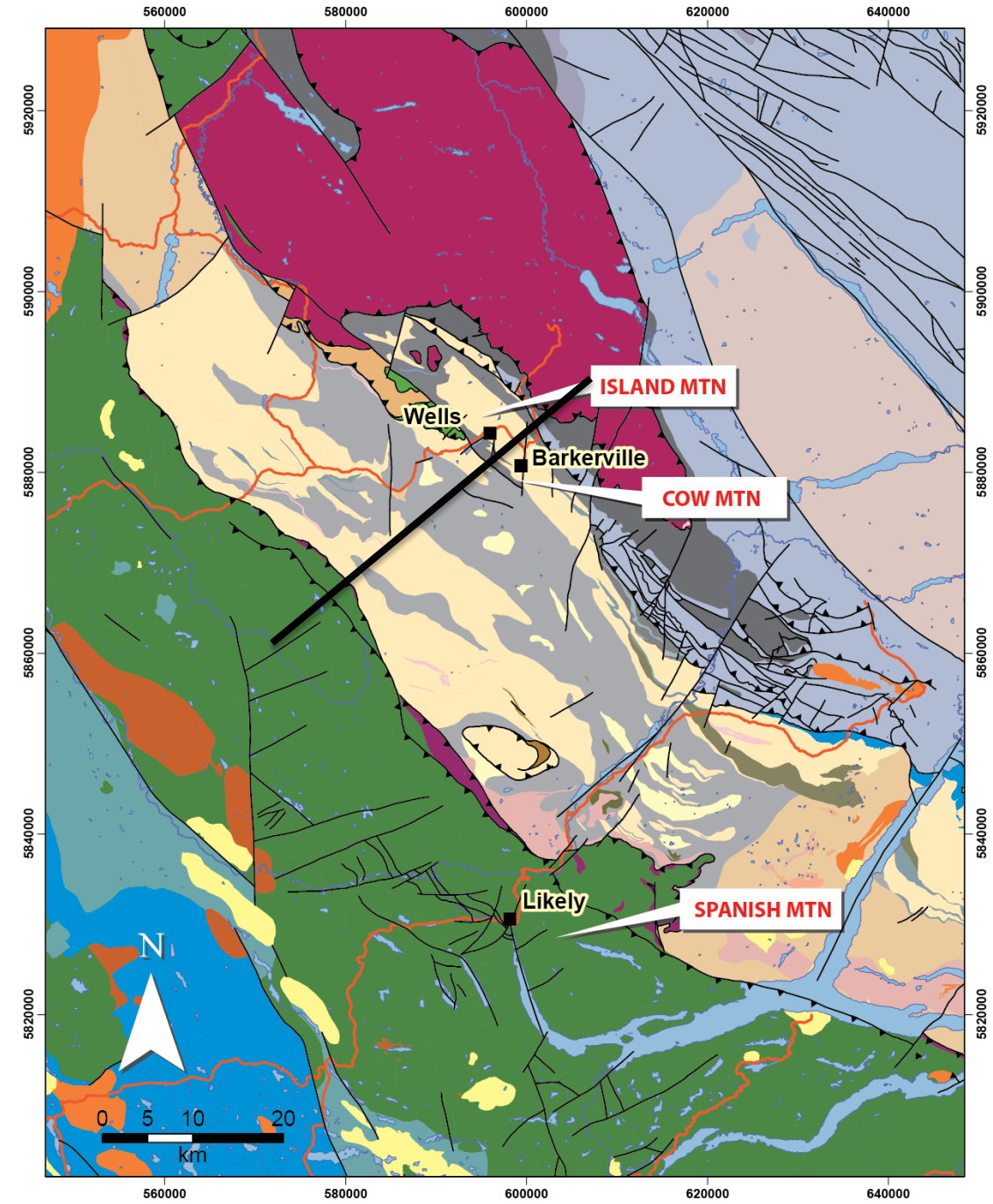

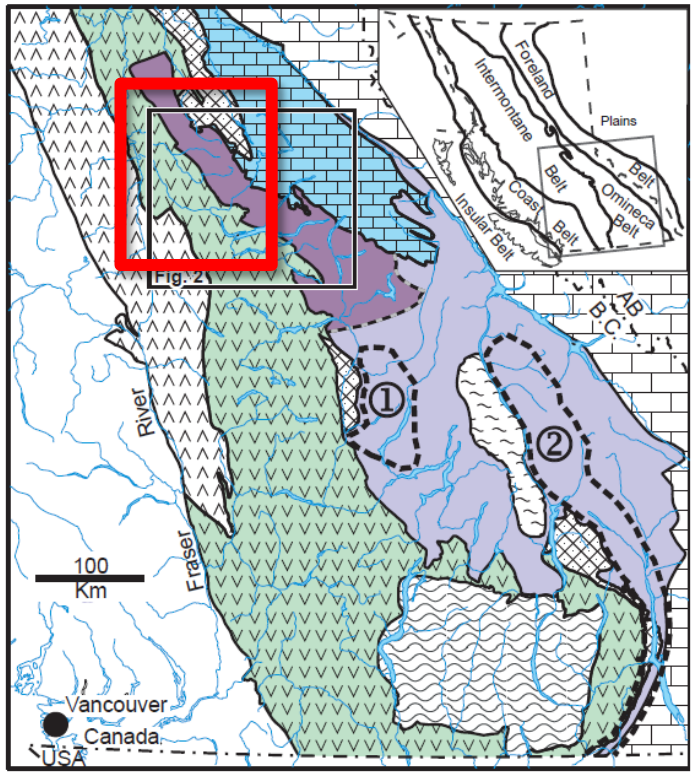

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Quesnel terrane
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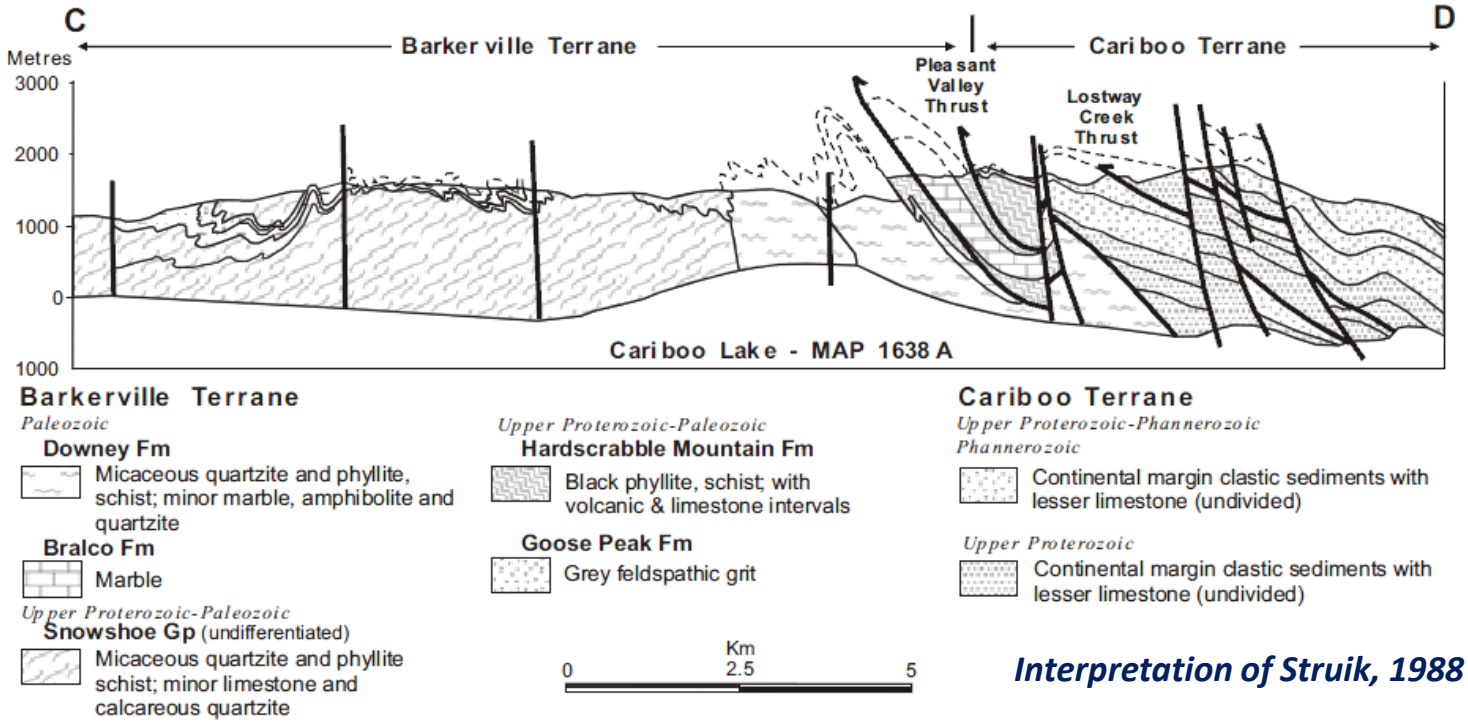
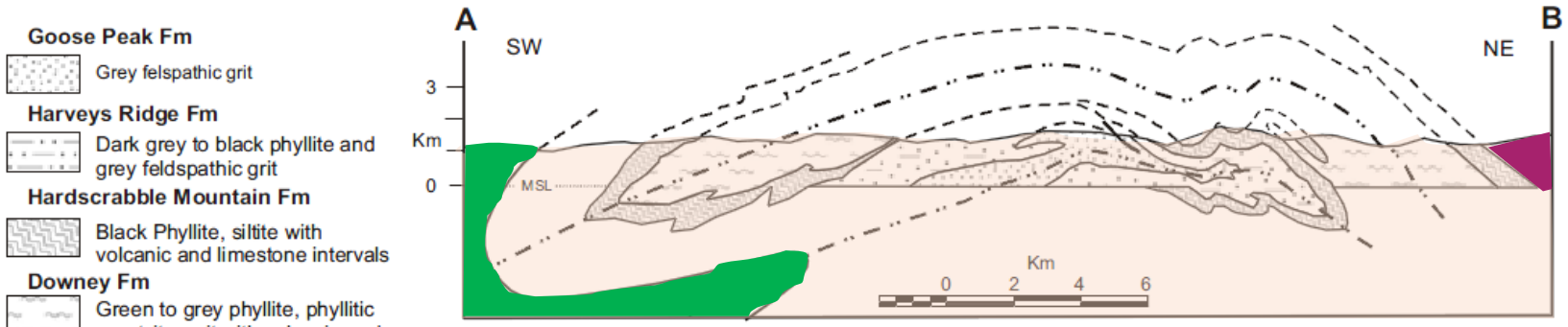


Interpretation of Struik, 1988

Snowshoe Gp.



Interpretation of Schiarizza and Ferri, 2003

Sutherland-Brown and Ash (2009)

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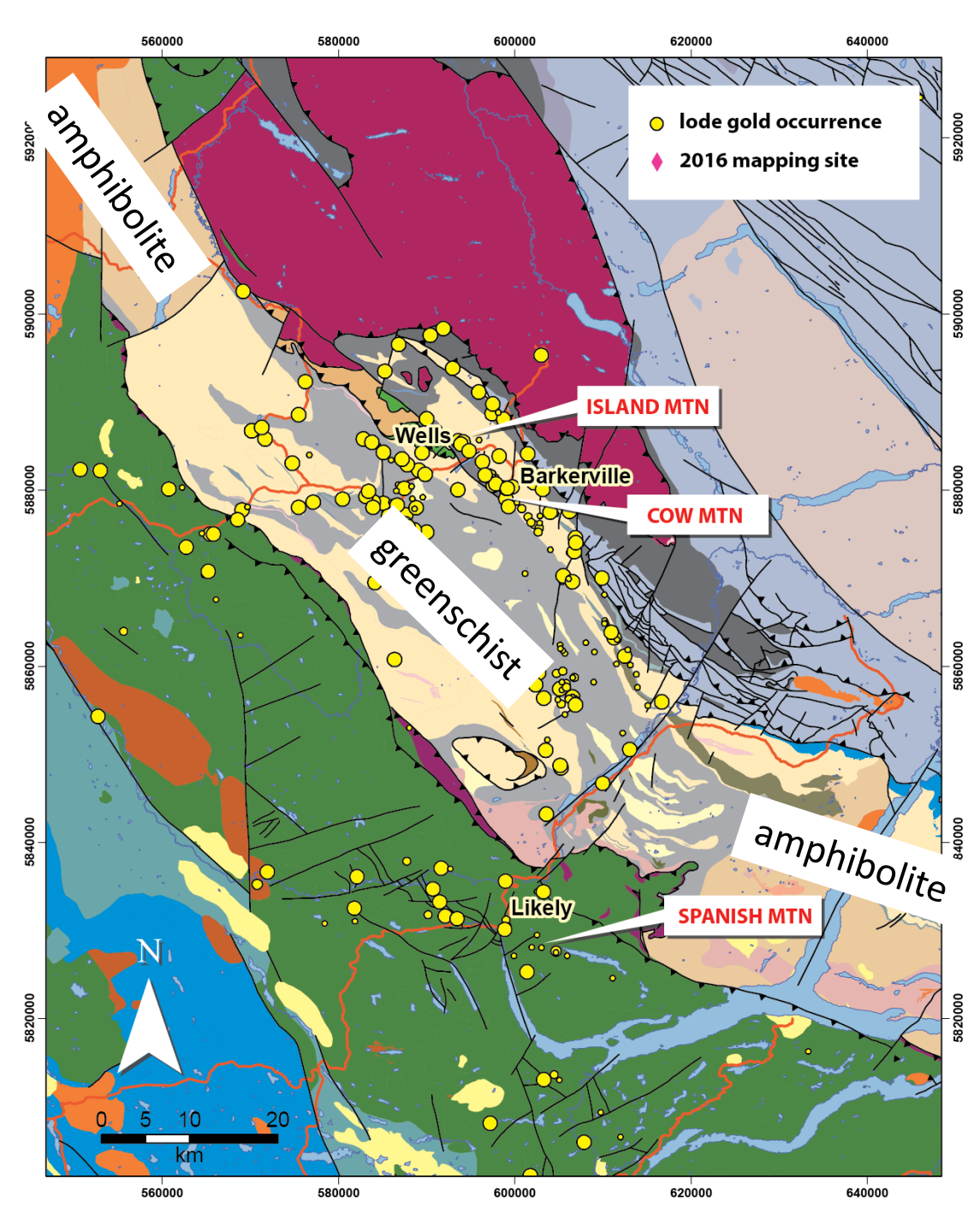
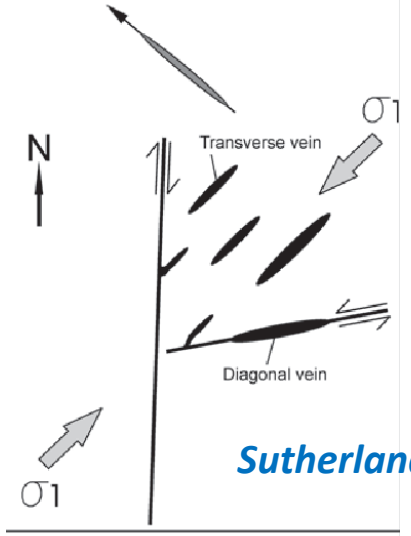
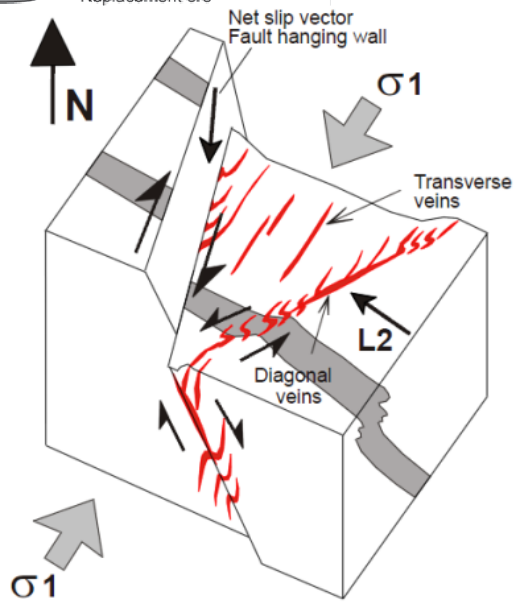




Sutherland Brown (1957)



Rhys et al. (2009)

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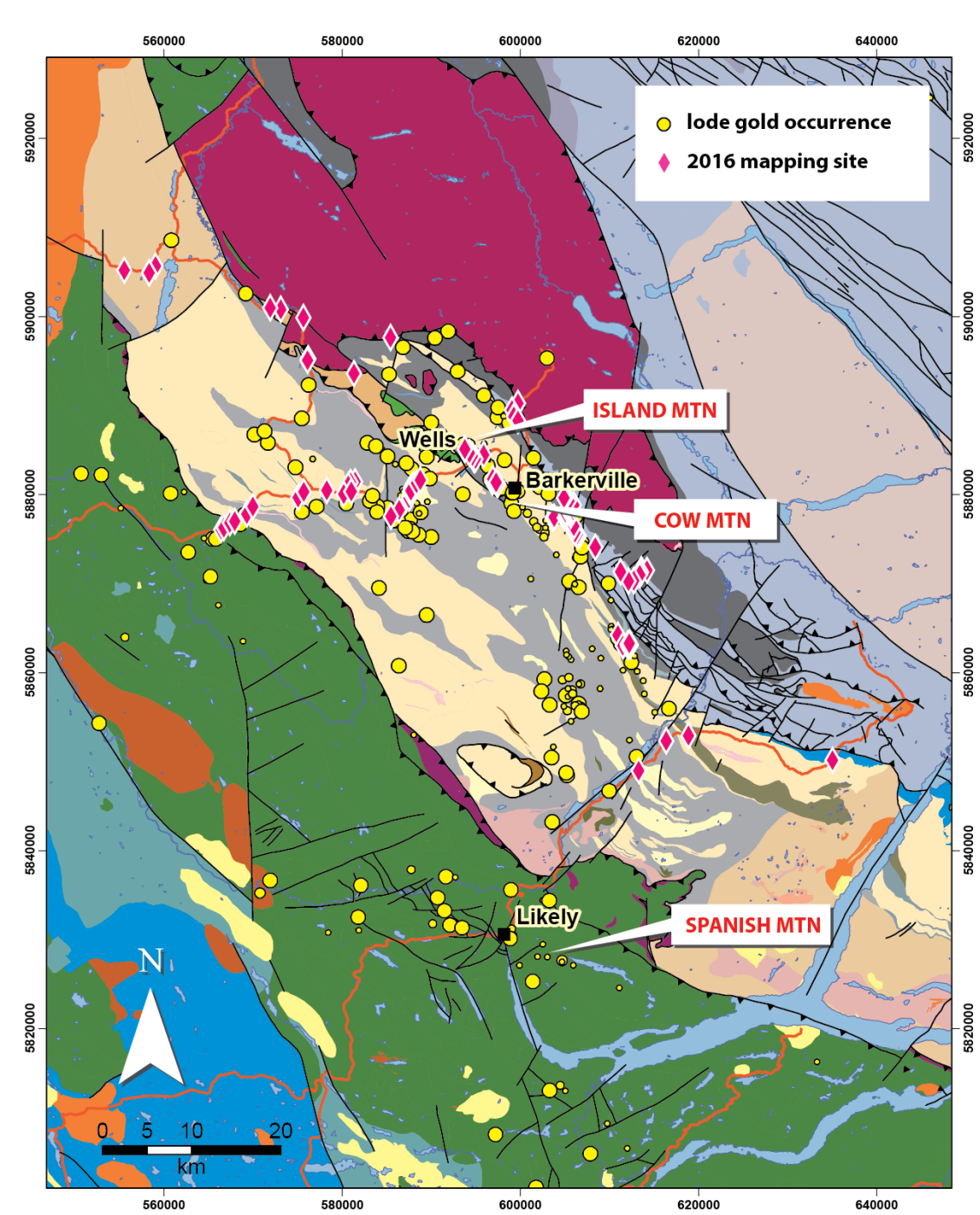
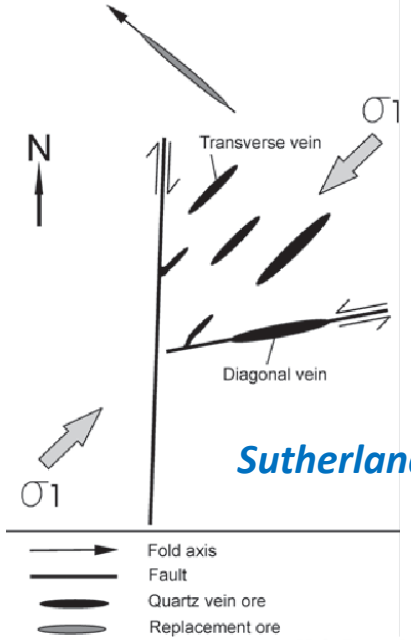
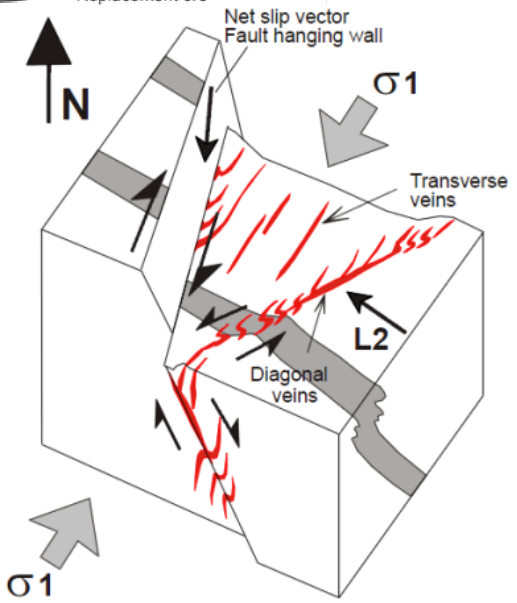




Sutherland Brown (1957)



Rhys et al. (2009)

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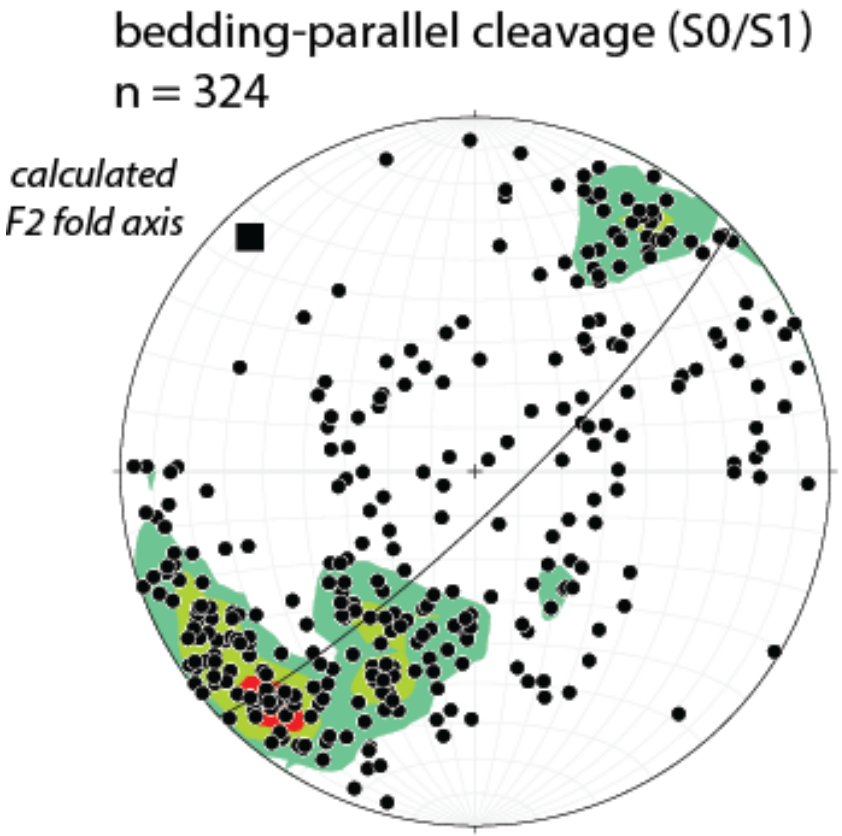
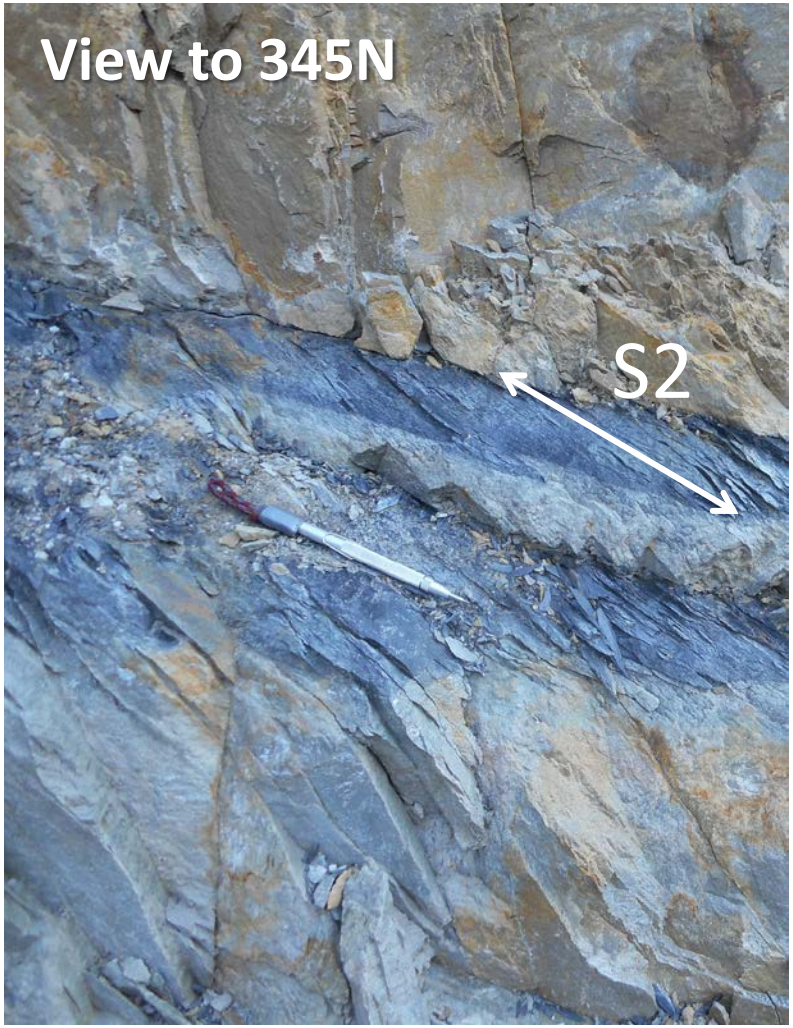
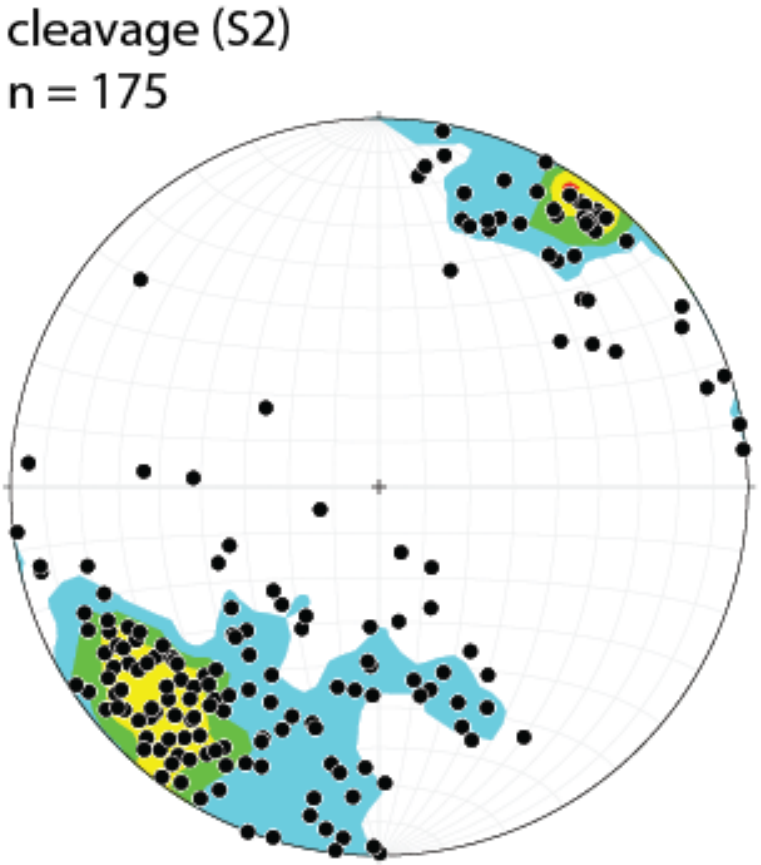
Regional structure – D1

Transposed bedding (S0/S1)



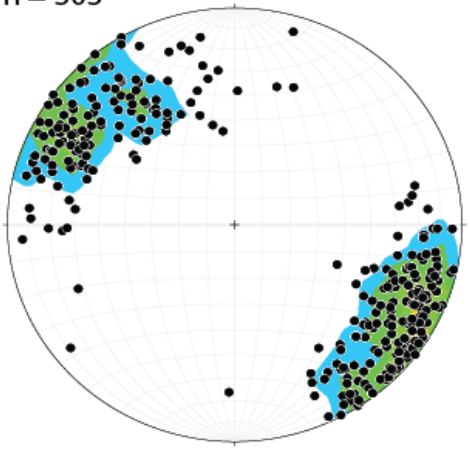
Regional structure – D2



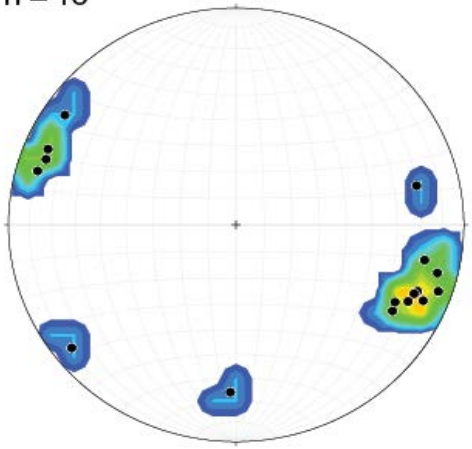


Regional structure – D2

L2 intersection/stretching lin.
n = 303



F2 fold axis
n = 16



(View to N)

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

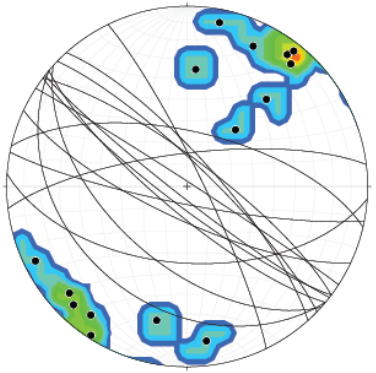
S2

L2

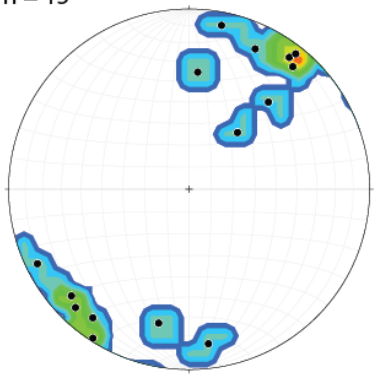
S1/S0

Regional structure – D3

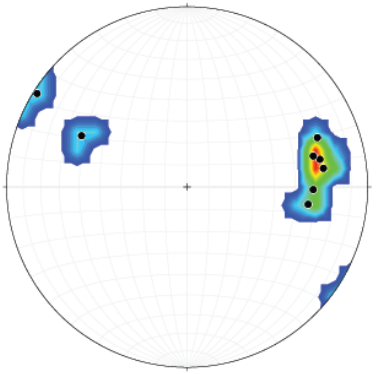
cleavage (S3)
n = 15



cleavage (S3)
n = 15



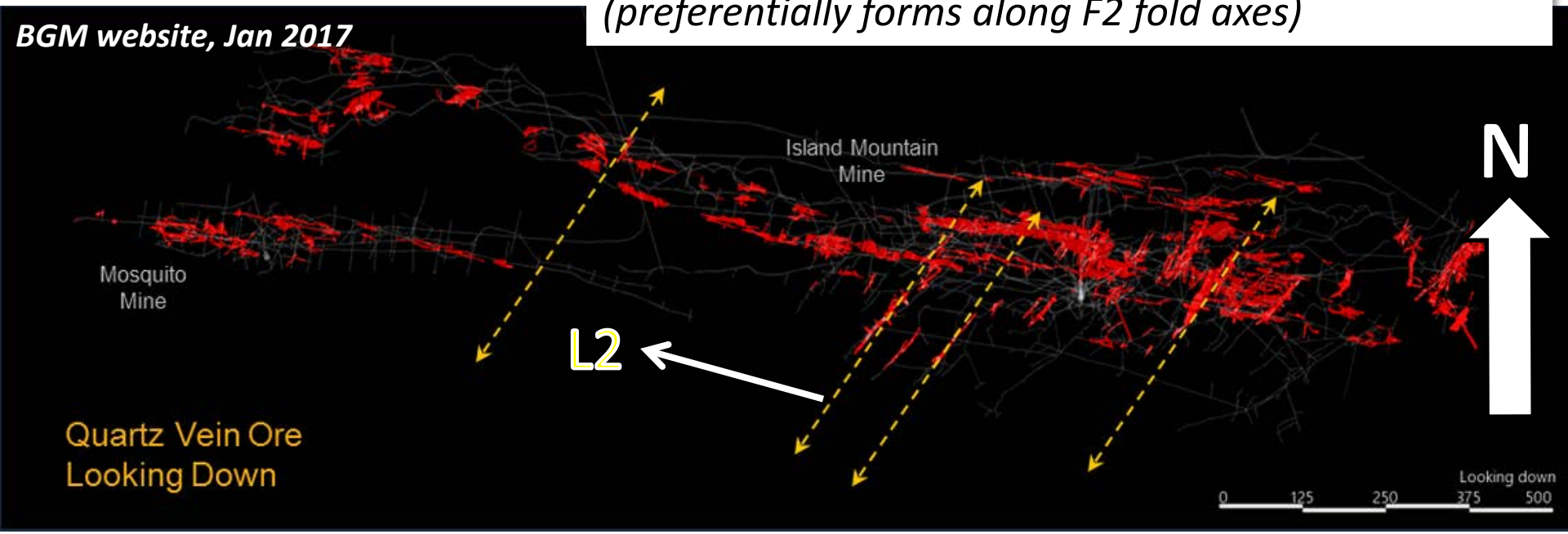
F3 fold axis / crenulation
n = 8

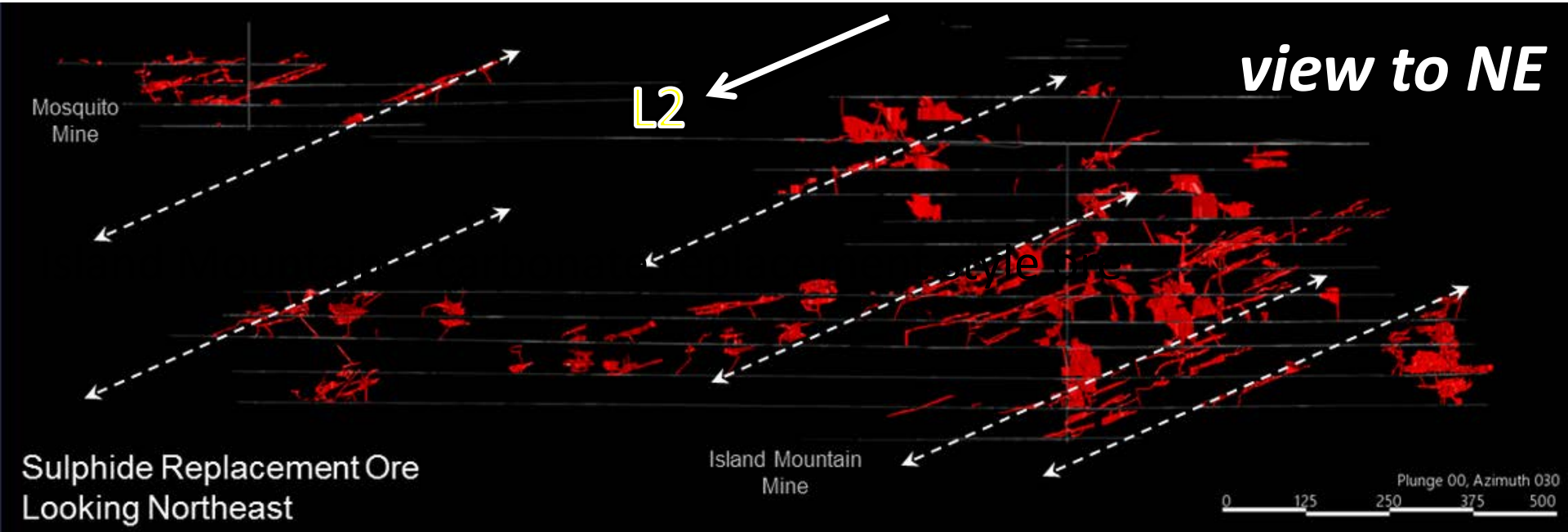


F3 crenulation – minor, local, confined to pelite

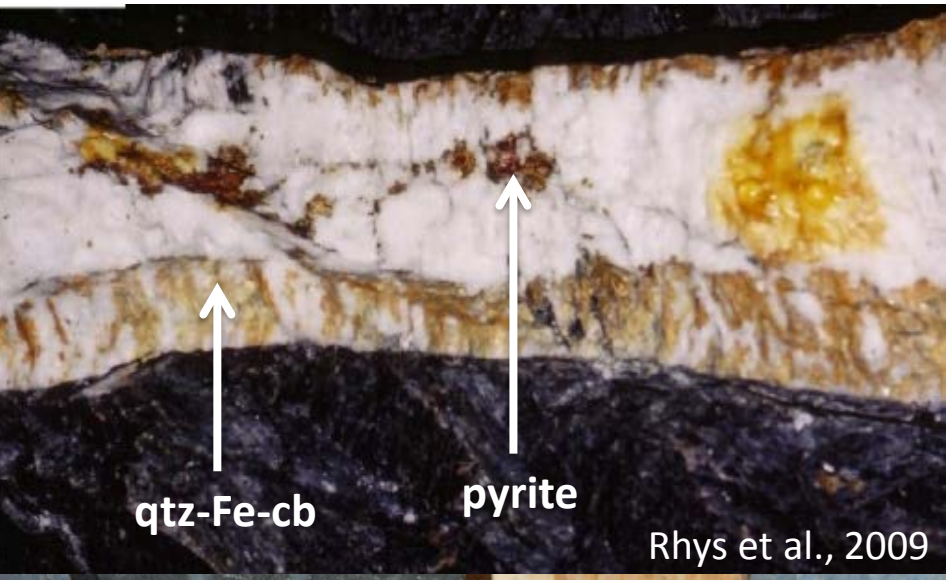
Island Mountain

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

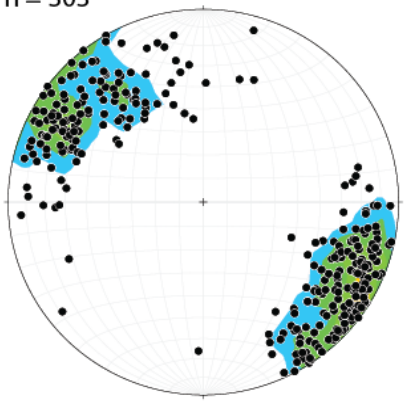


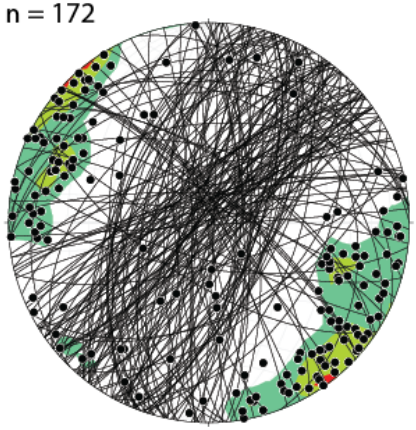


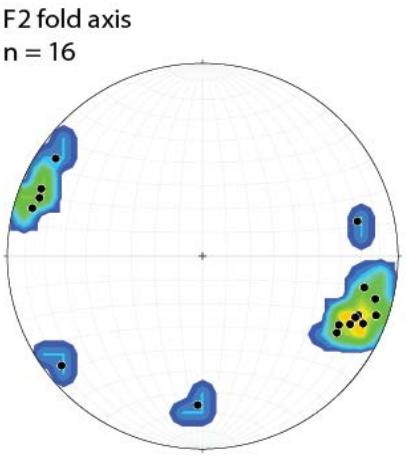
Extensional veins

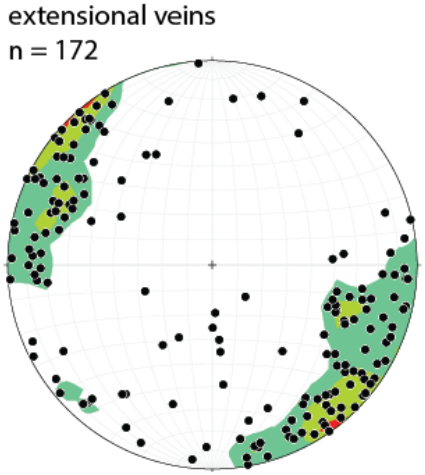


- **Steep and NE-trending**
- **Sub-perpendicular to L_2**



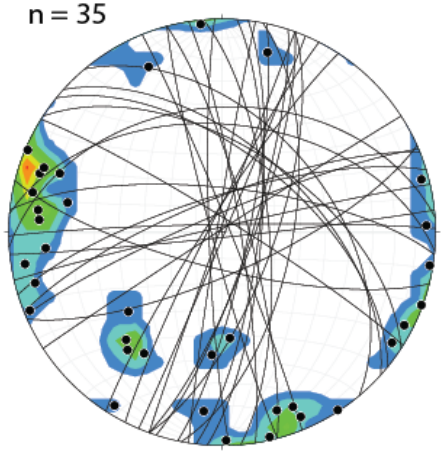




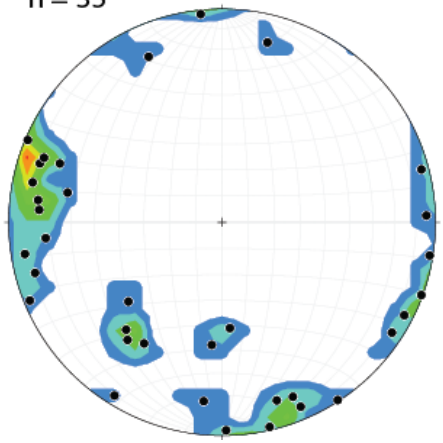


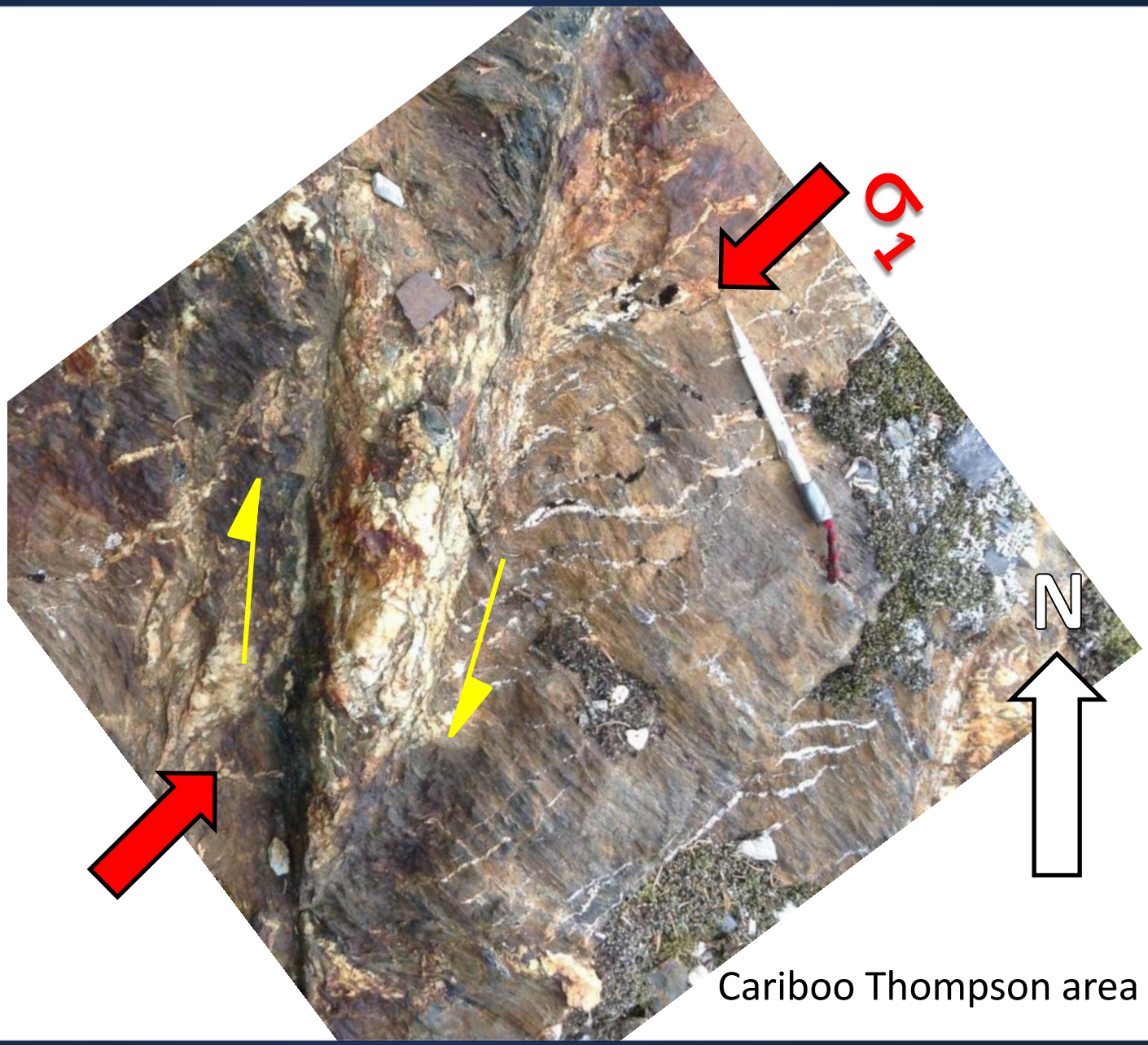
Shear veins

shear veins
n = 35



shear veins
n = 35

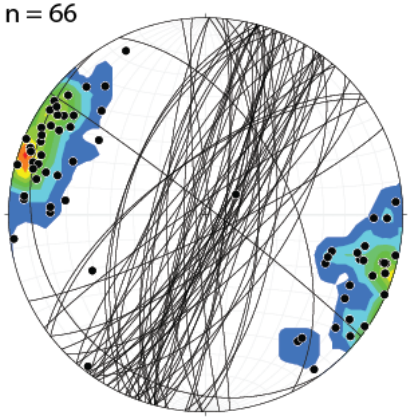




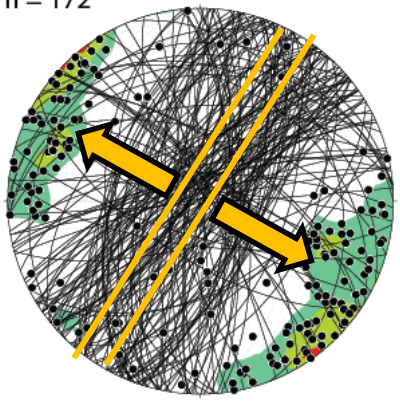
Cariboo Thompson area

Vein, joint, fault orientations

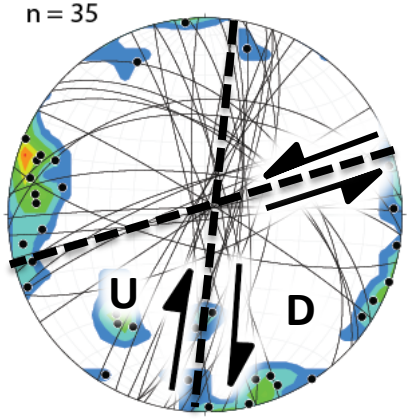
joints
n = 66



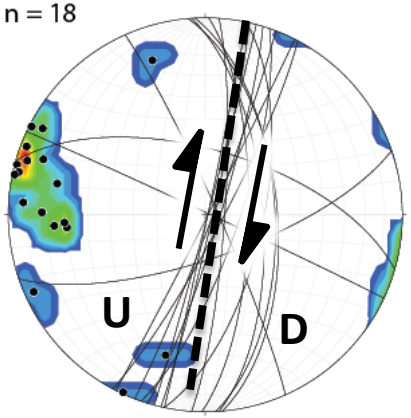
extensional veins
n = 172



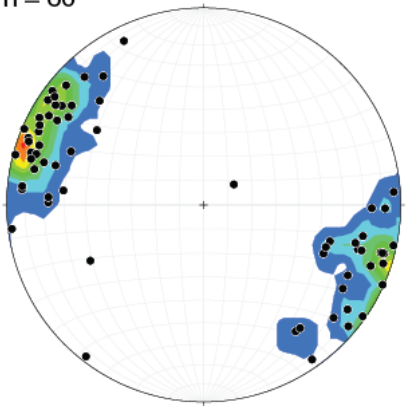
shear veins
n = 35



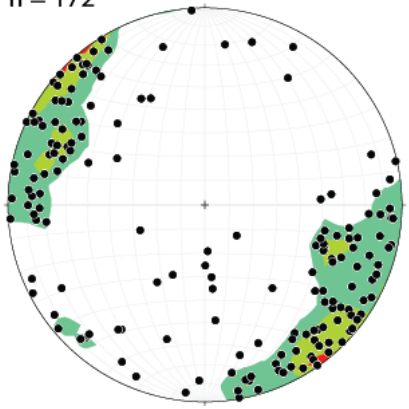
dextral strike-slip fault
n = 18



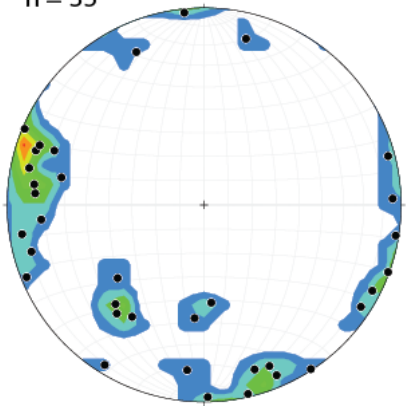
joints
n = 66



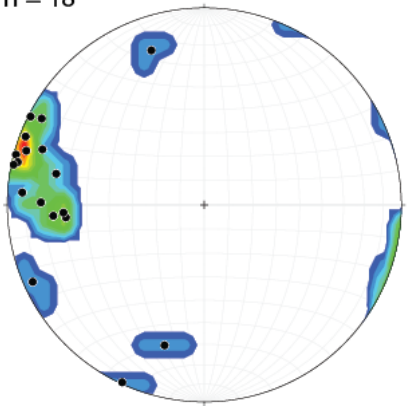
extensional veins
n = 172



shear veins
n = 35

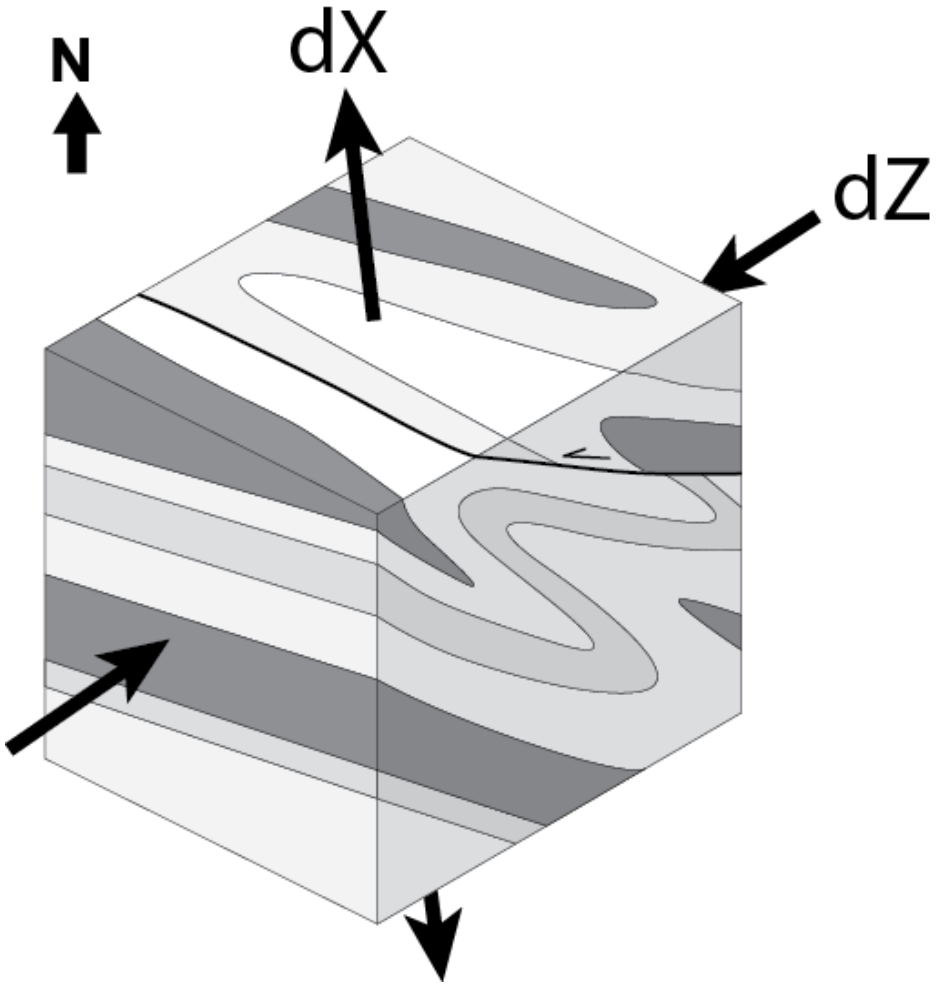


dextral strike-slip fault
n = 18



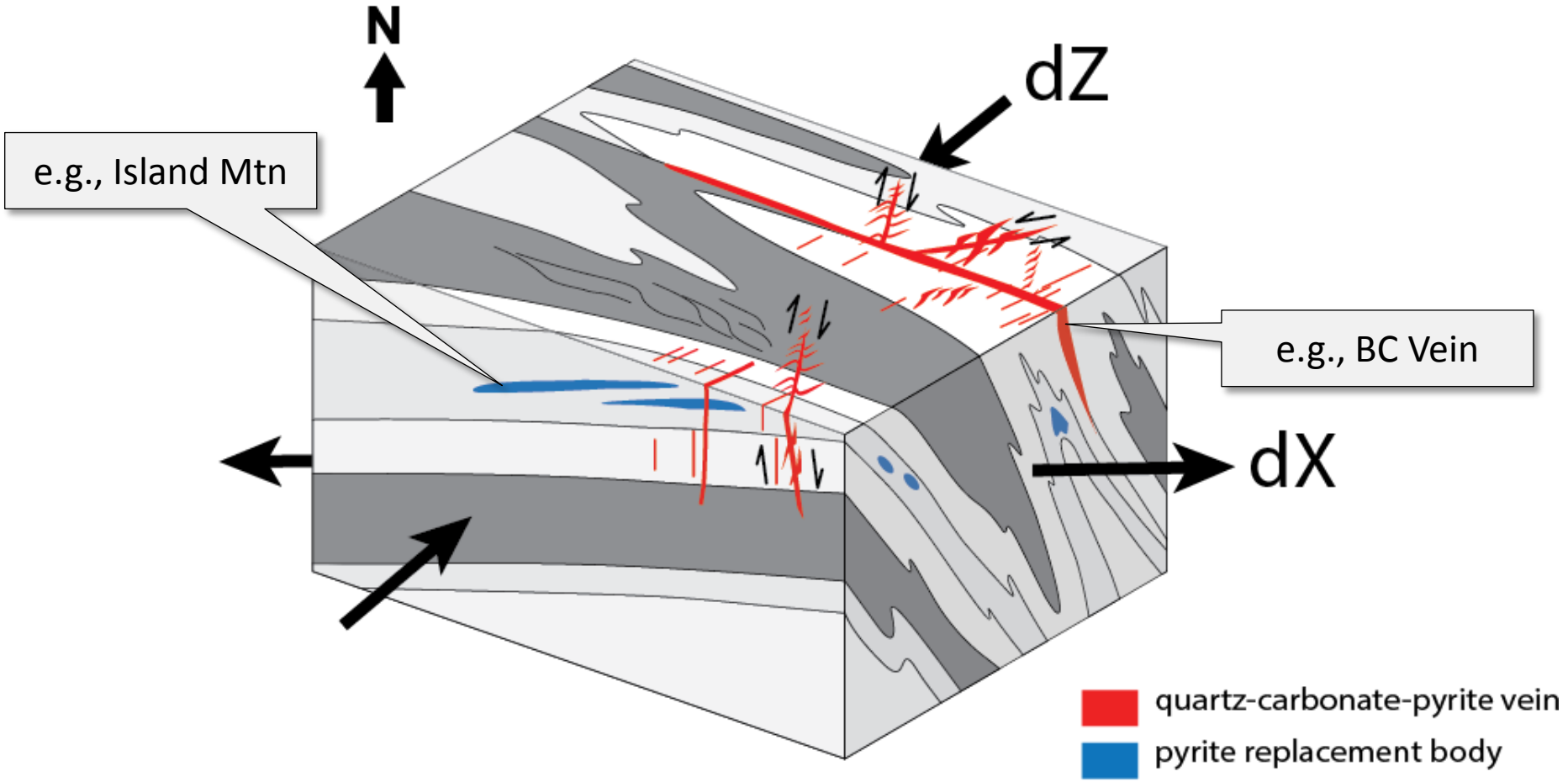
Kinematic synthesis: Cariboo

$D_1 \rightarrow D_2$



Kinematic synthesis: Cariboo

Progressive D2

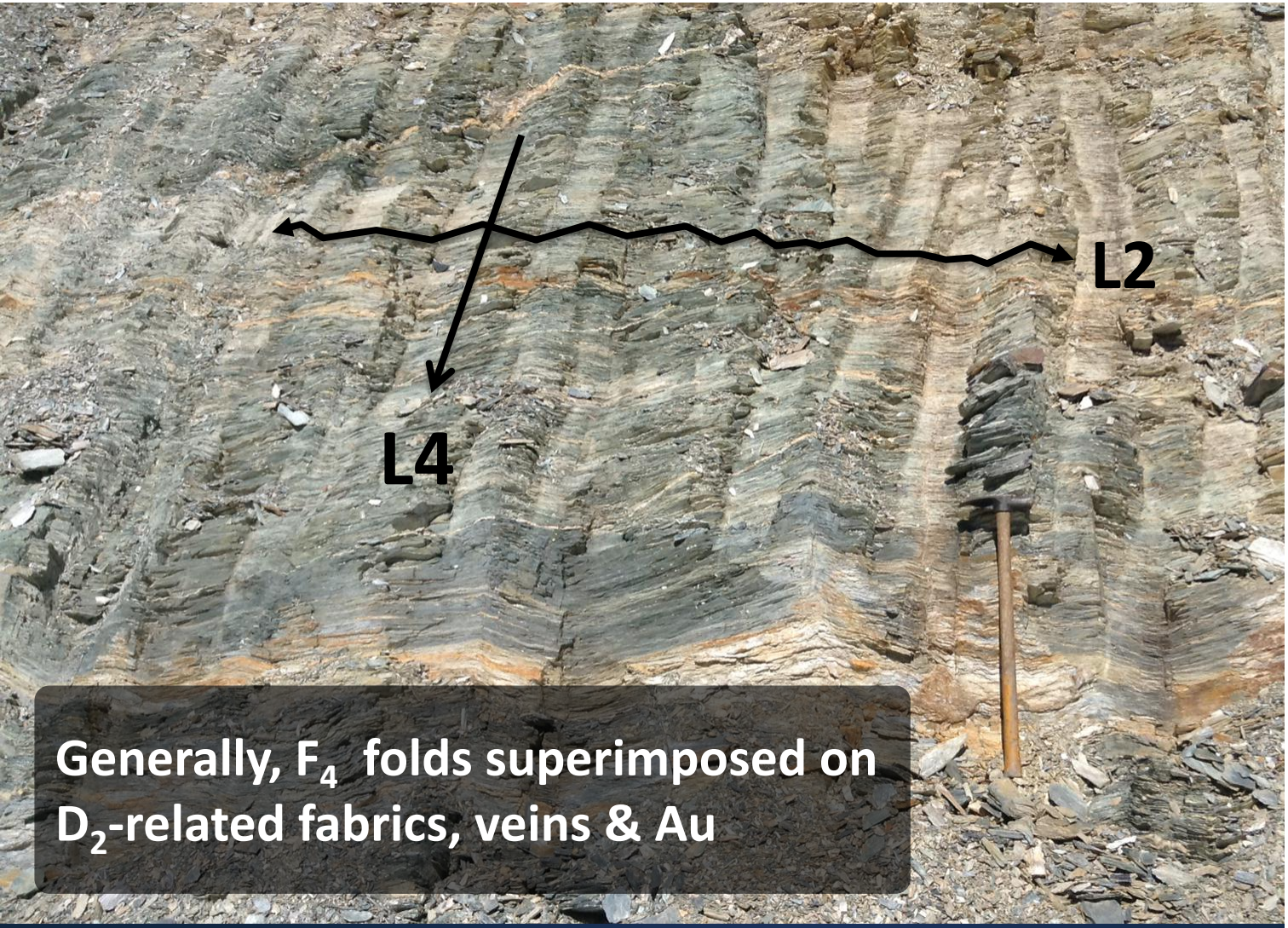


BC Vein – NW-trending, fault-filling

View to N

Bonanza Ledge (looking N)

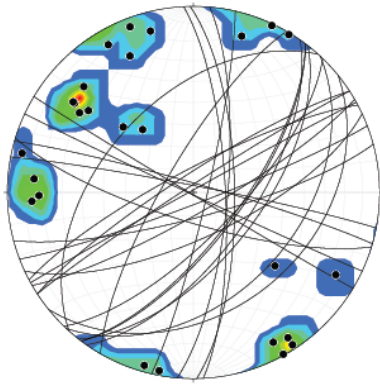
Regional structure – D4



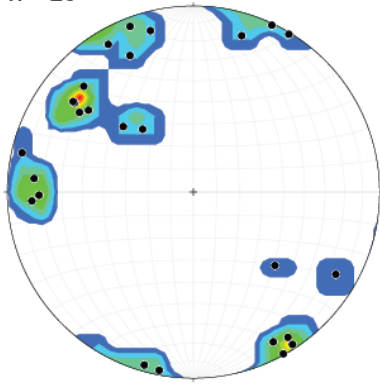
Generally, F_4 folds superimposed on D_2-related fabrics, veins & Au

Bonanza Ledge, view to NE

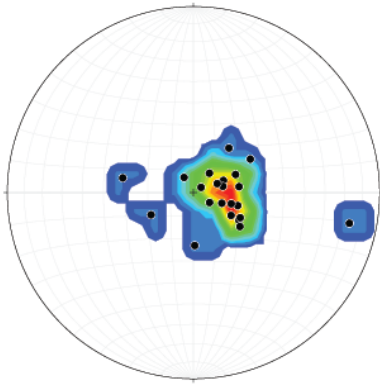
cleavage (S4)
n = 26



cleavage (S4)
n = 26



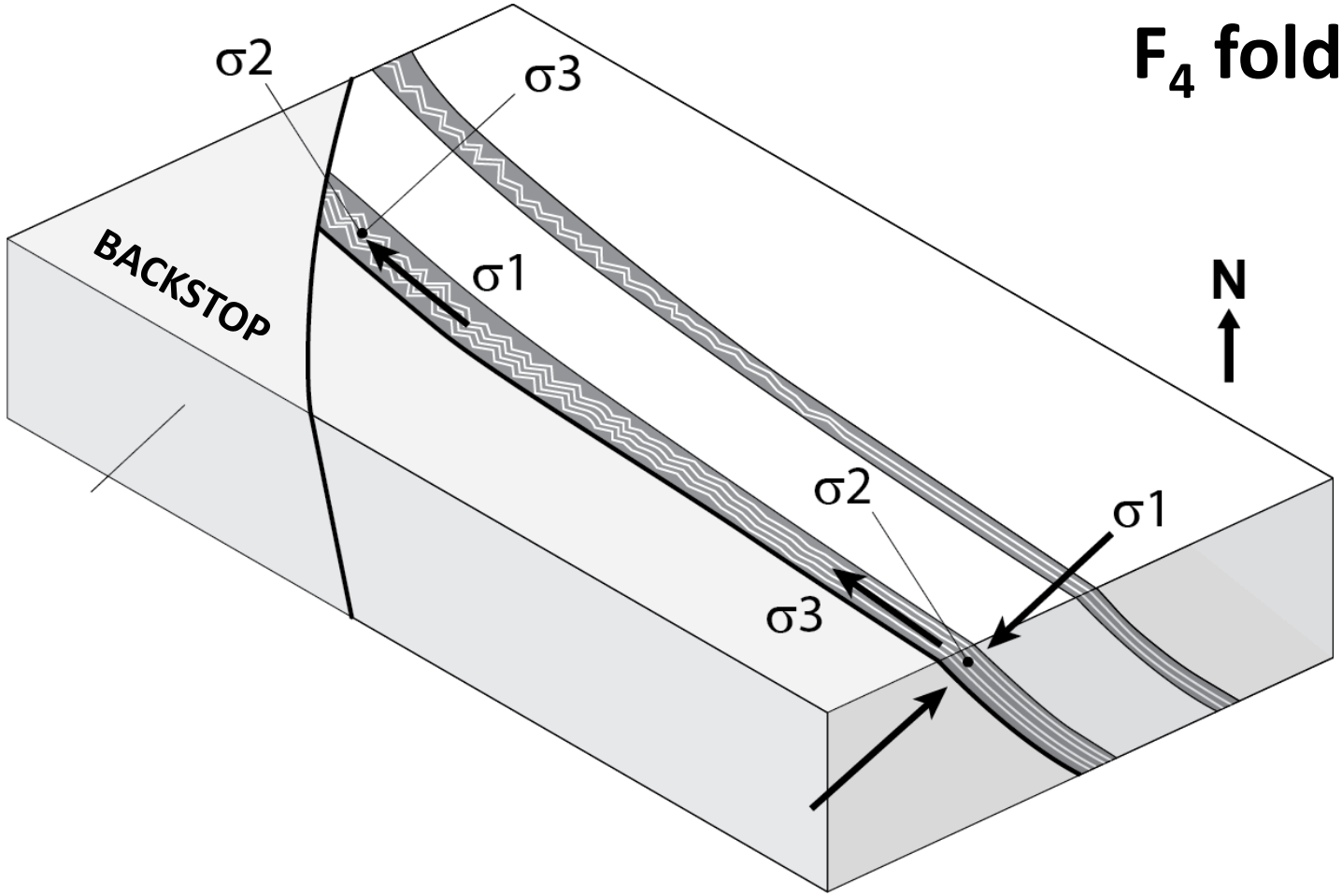
F4 fold axis
n = 22



Regional structure – D4

Late F_4 kink/chevron folds generate new extensional veins and locally control Au *(BGM, 2017)*

Kinematic synthesis: Cariboo

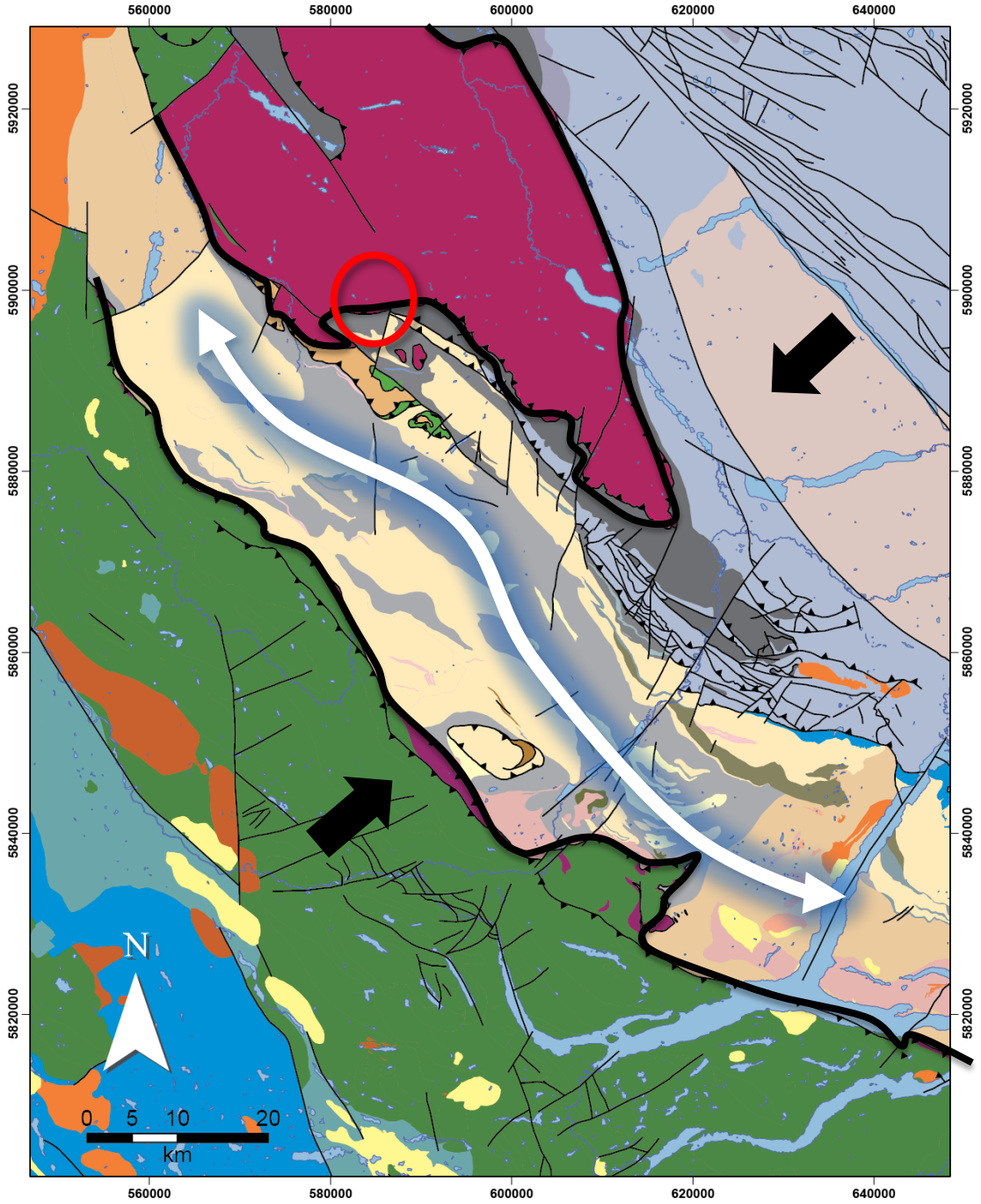


F_4 folds

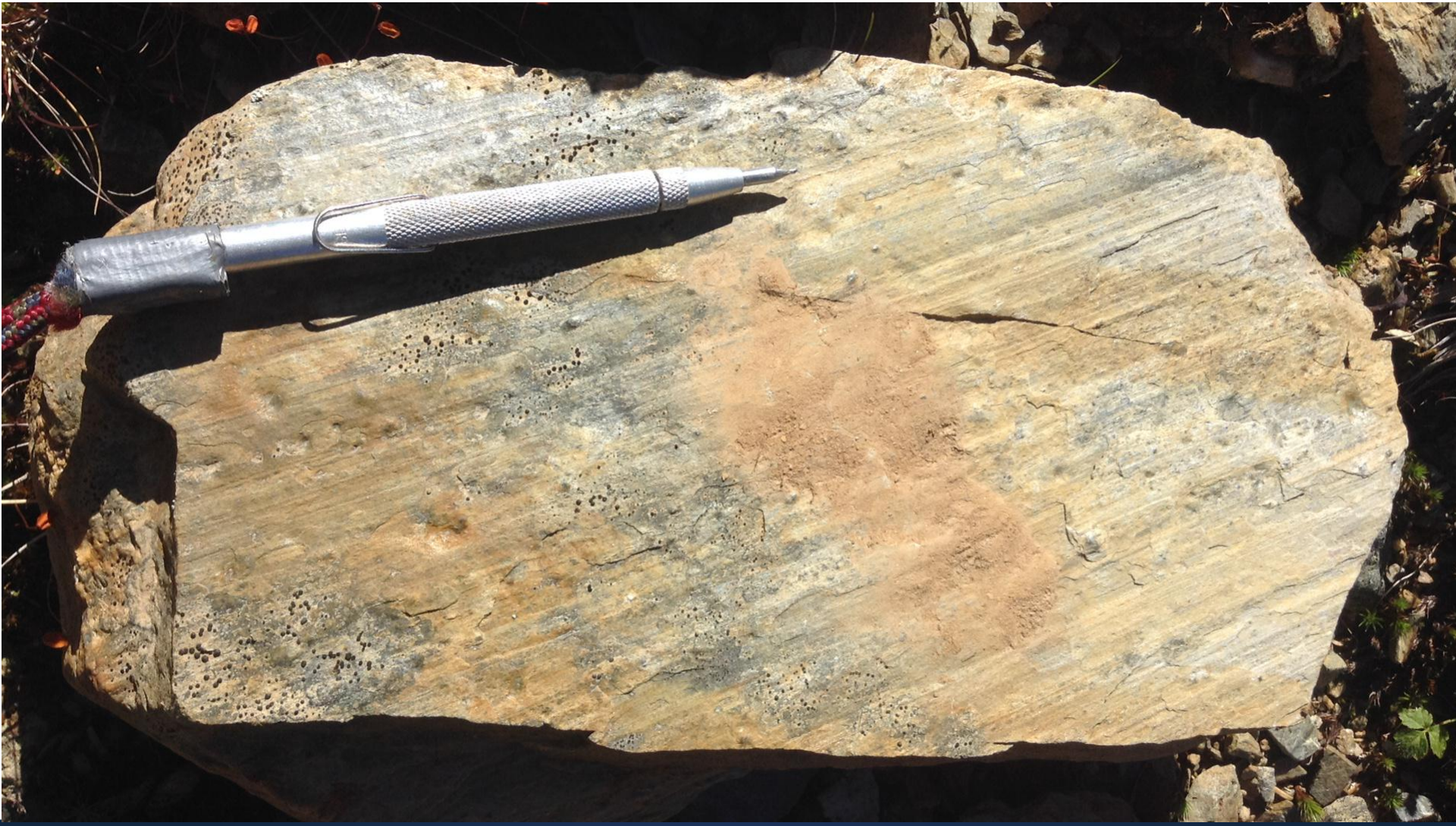
Lateral extrusion & differential NE-SW shortening along strike

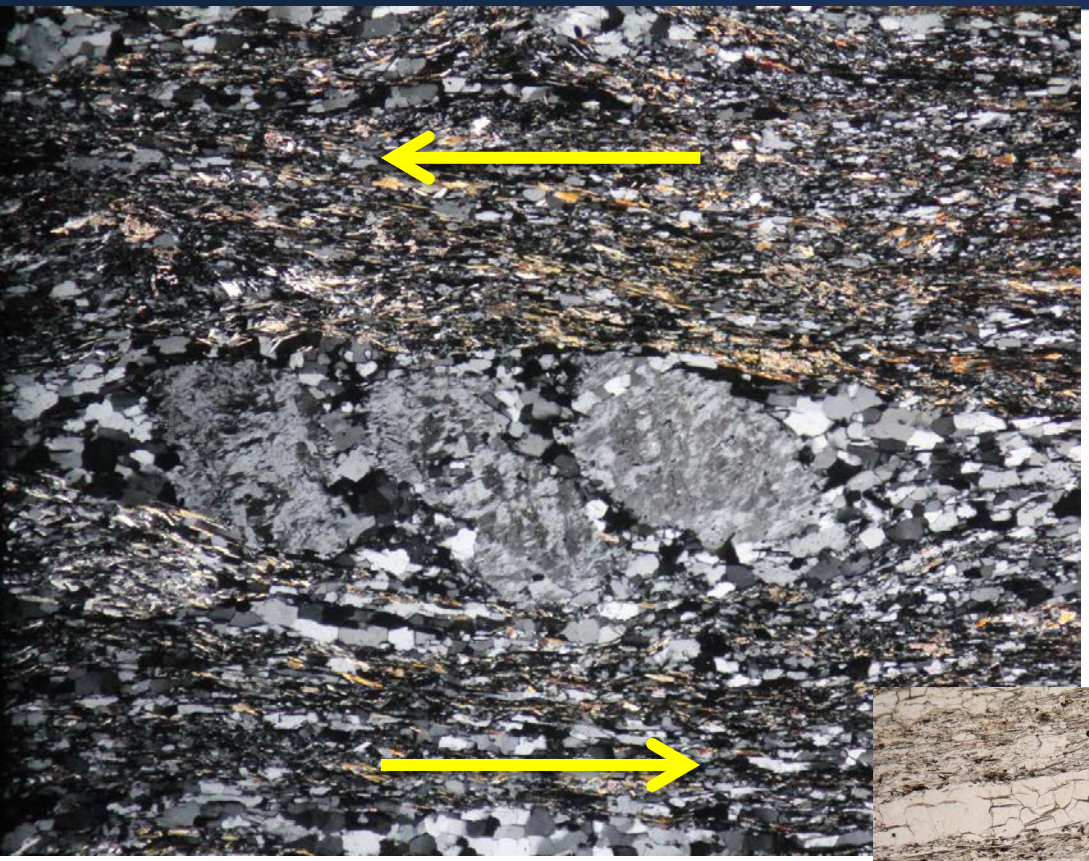
1. Accretion / Imbrication

2. NE-SW shortening

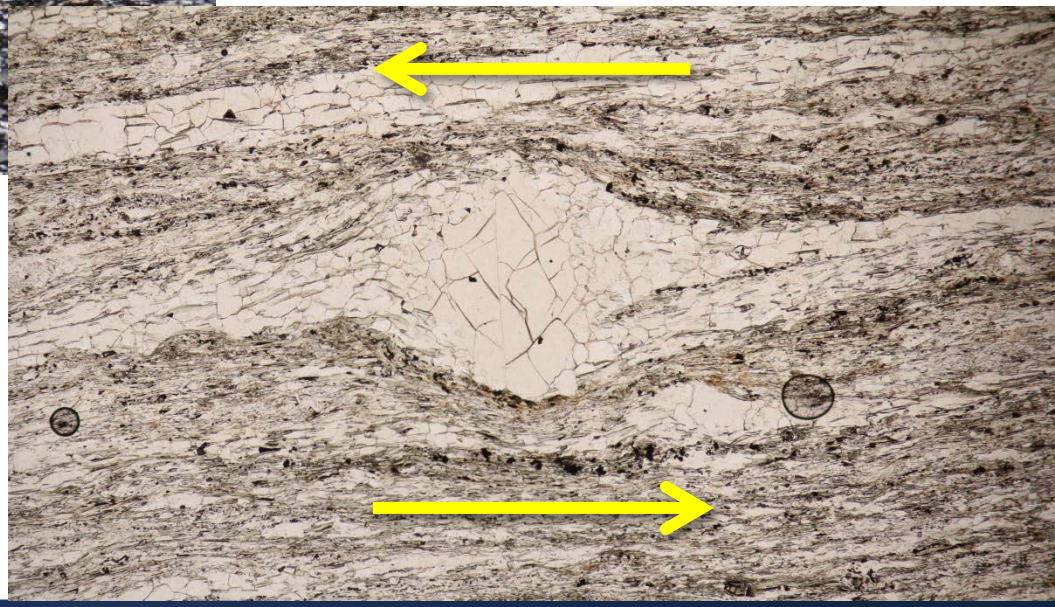


Metasedimentary mylonite, immediate footwall of Pundata thrust



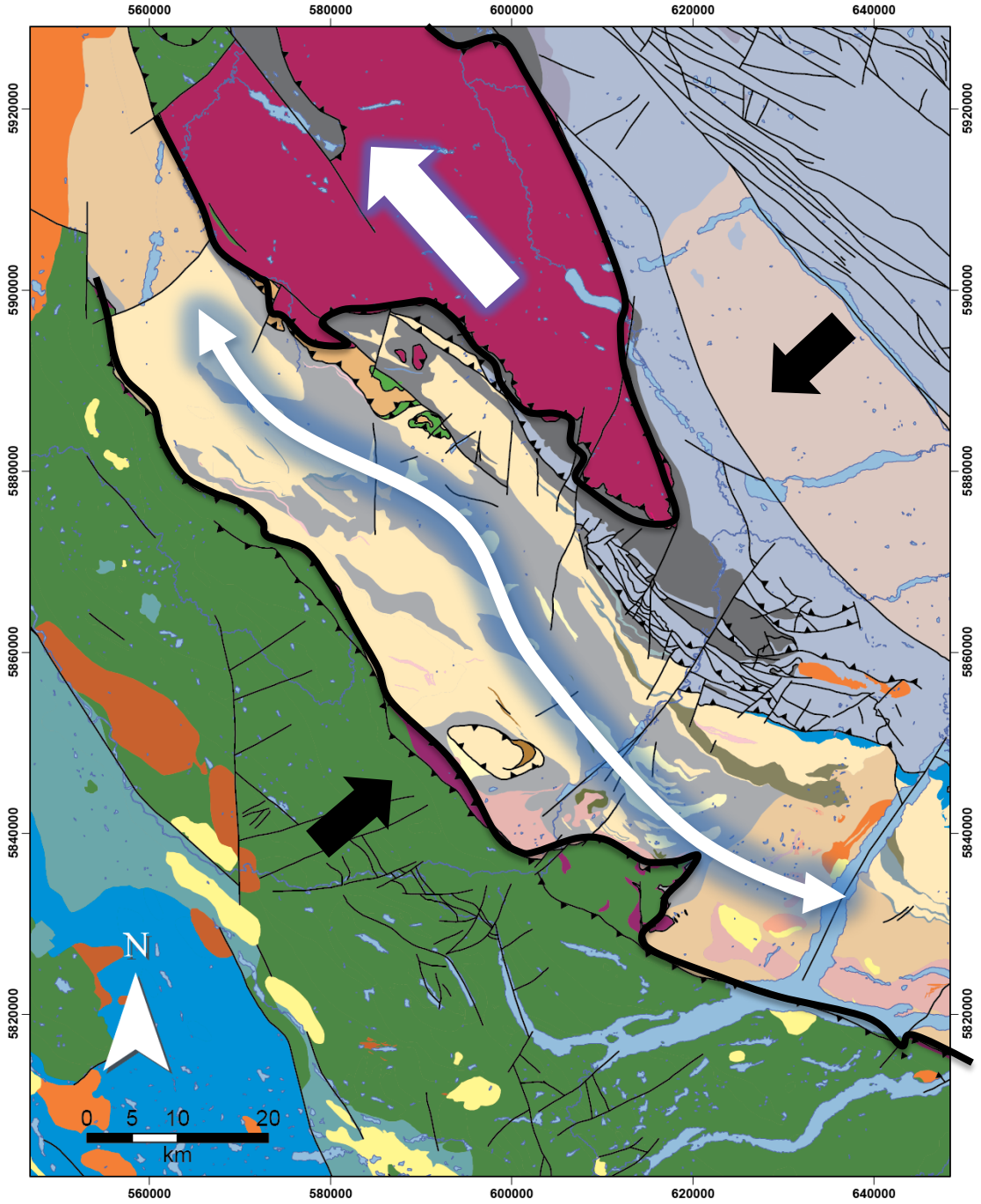


47 º / 347 º N



1. Accretion / Imbrication

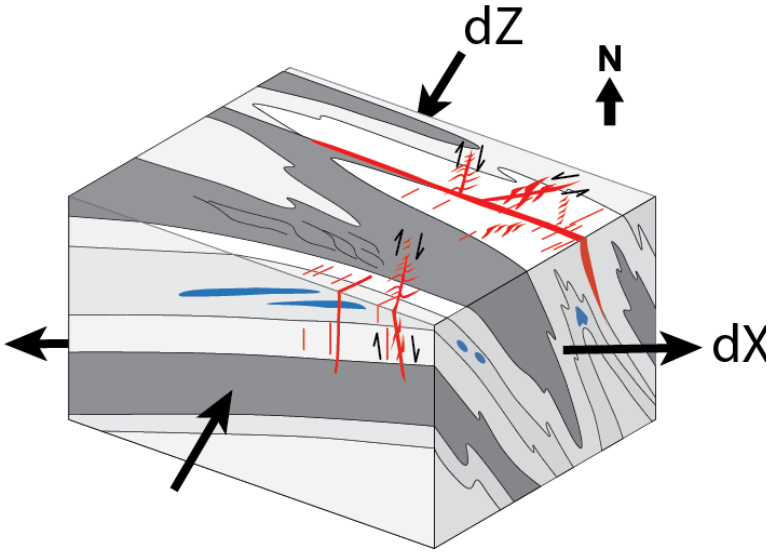
2. NE-SW shortening & NW lateral escape

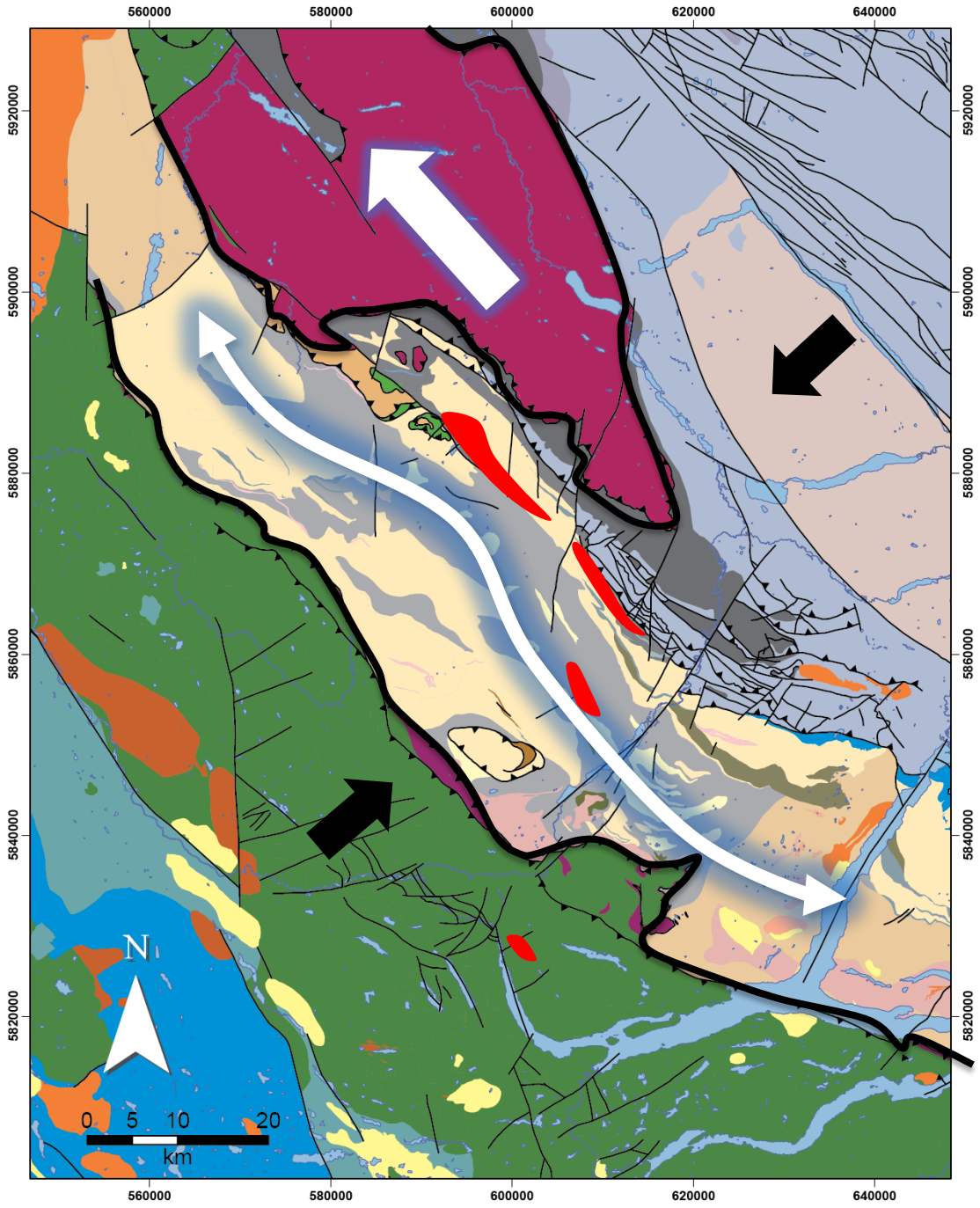


1. Accretion / Imbrication

2. NE-SW shortening & NW lateral escape

3. Mineralization





1. Accretion / Imbrication

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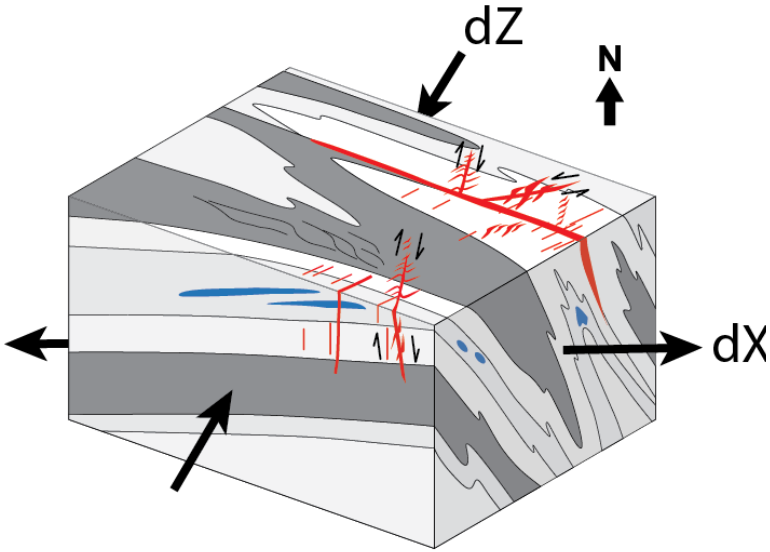
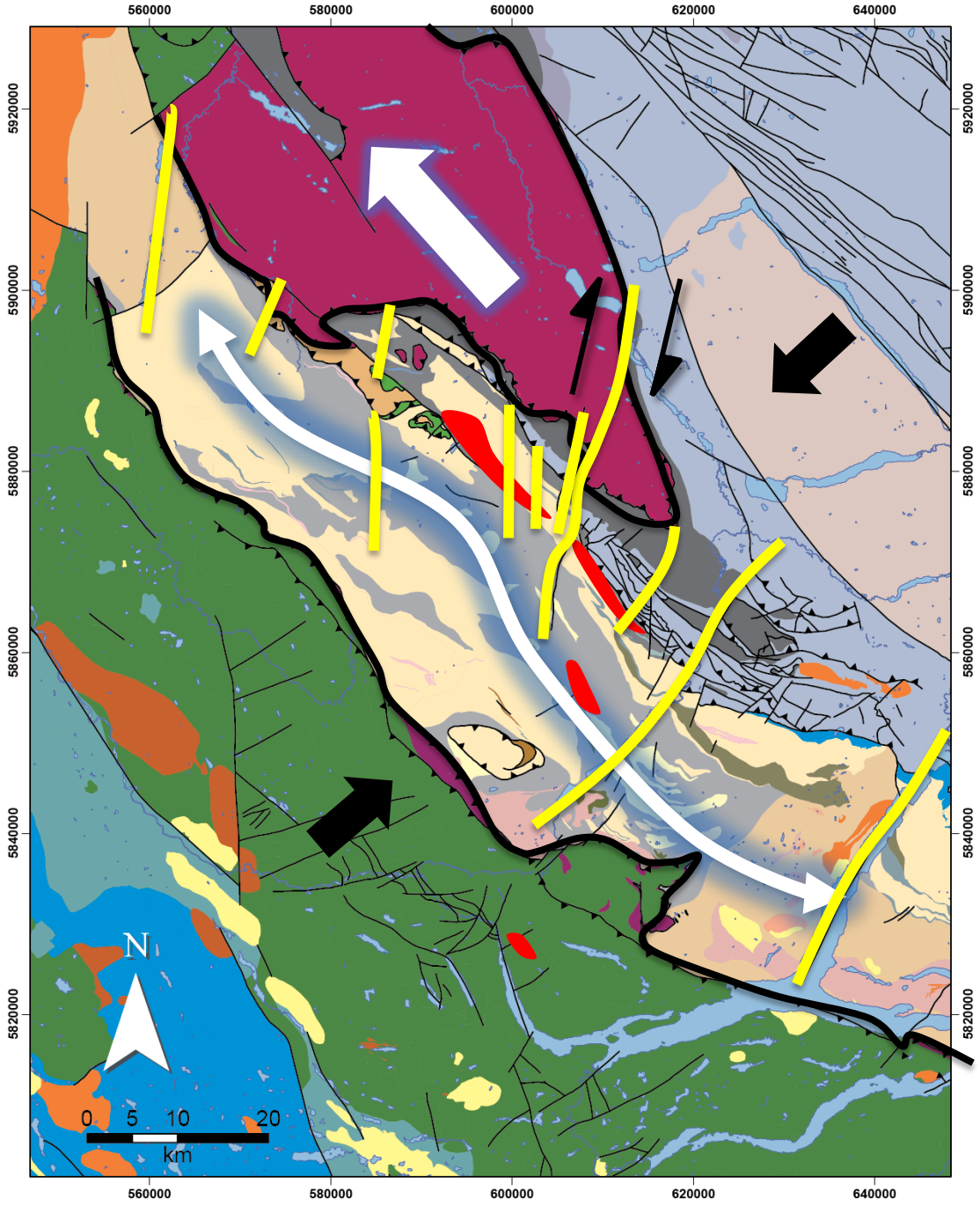
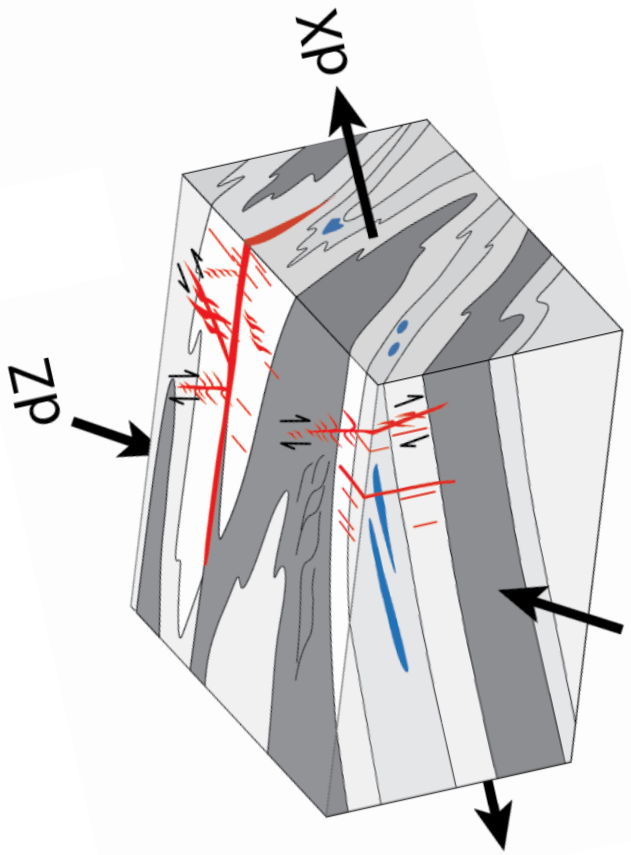


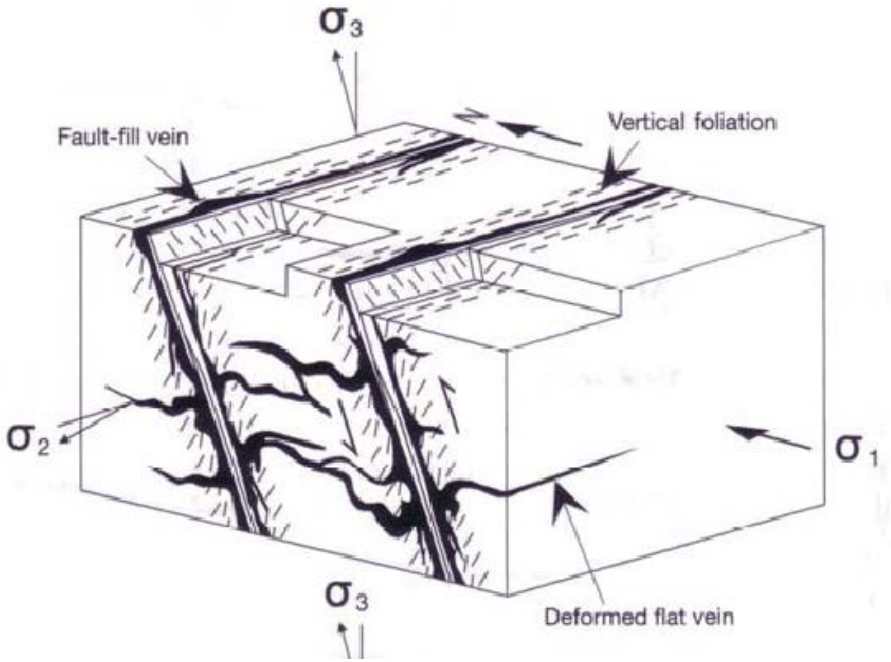
4. N-trending dextral faults



Cariboo structural model on end:

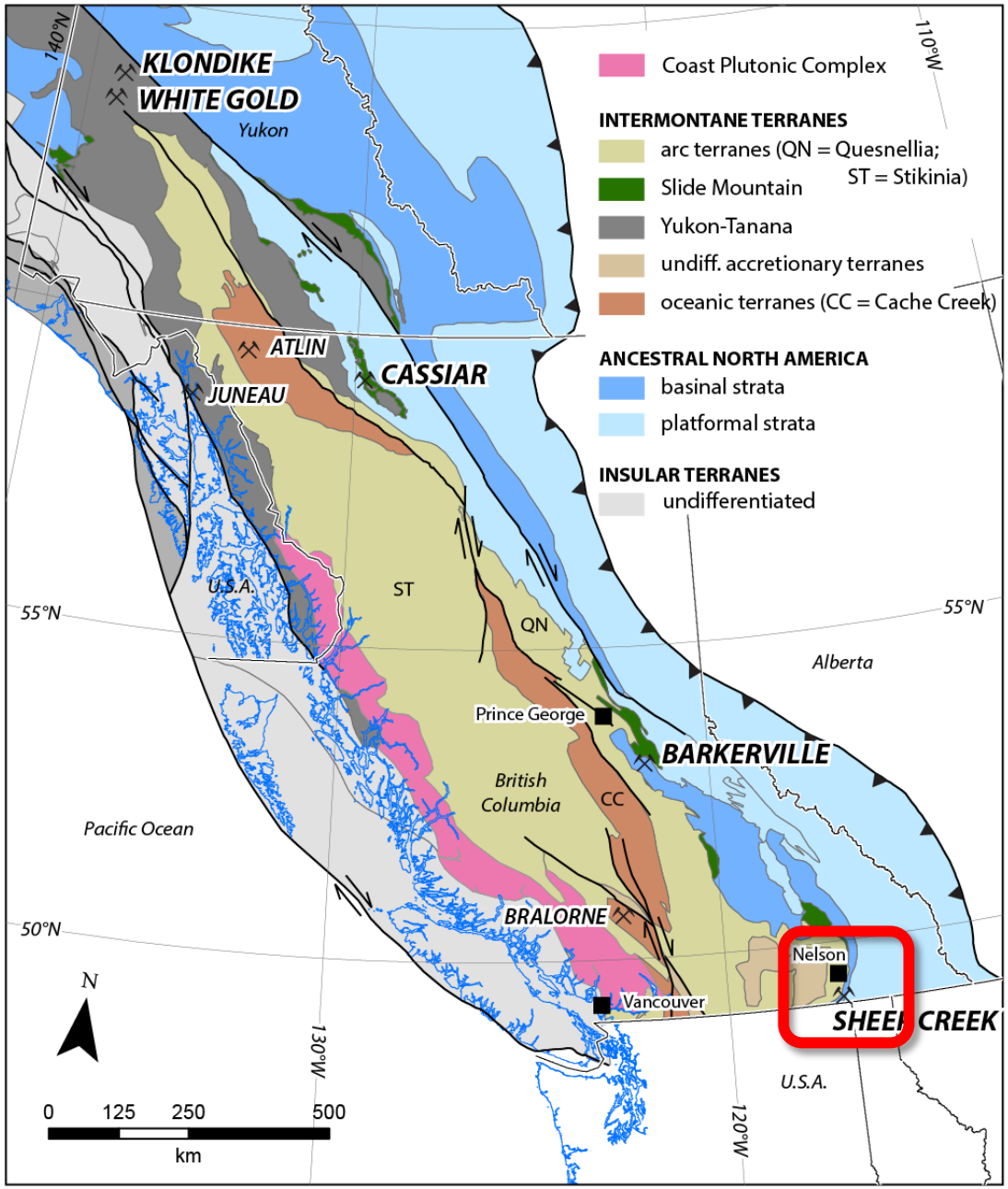


Archaean Val d'Or model:



Poulsen and Robert, 1989

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



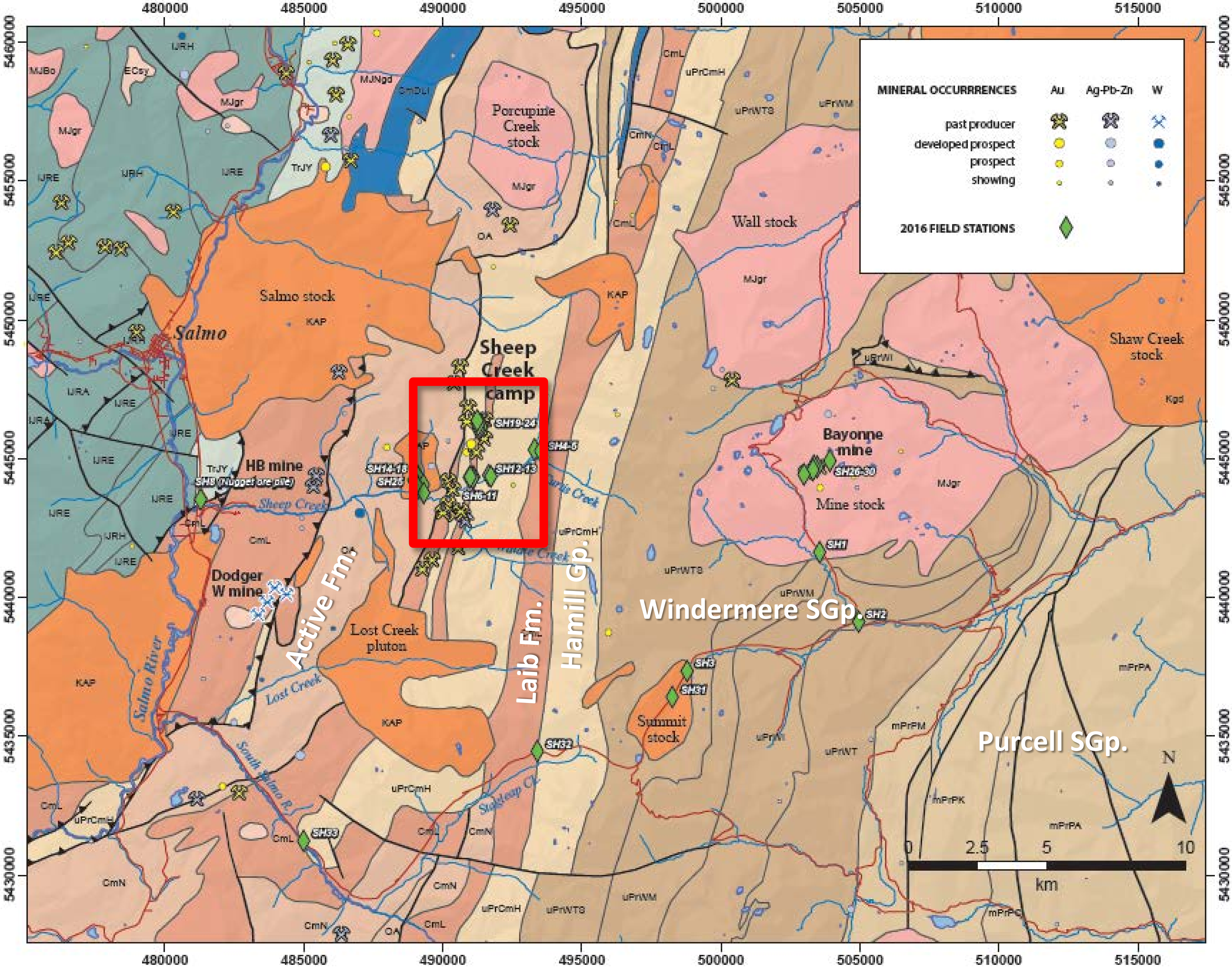
BULLETIN No. 31

GEOLOGY OF THE SHEEP CREEK CAMP

By W. H. Mathews

VICTORIA, B.C.
Printed by DON MCDIARMID, Printer to the Queen's Most Excellent Majesty
1953

736,000 oz Au (13.3 g/t)
365,000 oz Ag
377,000 lbs Pb
312,000 lbs Zn

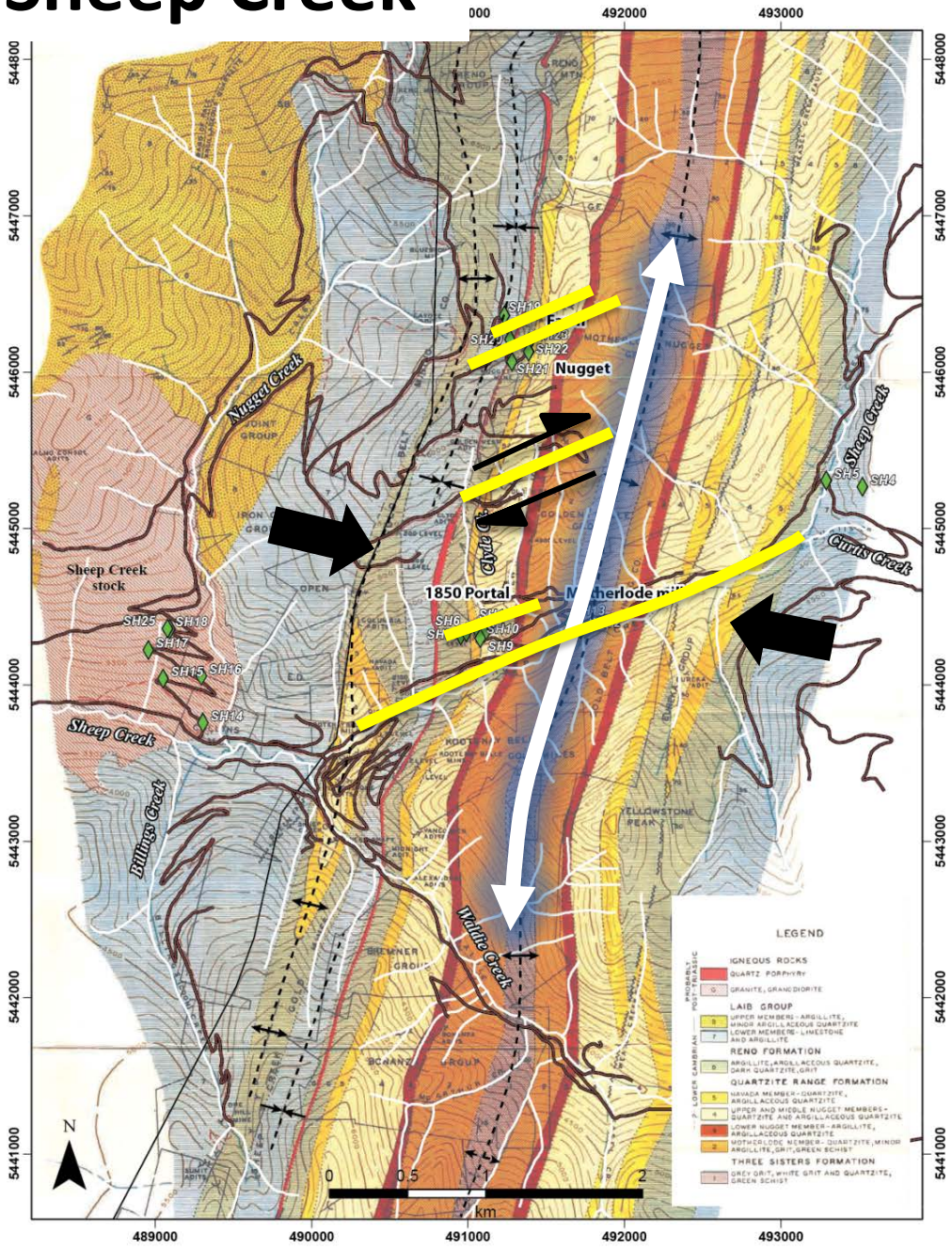


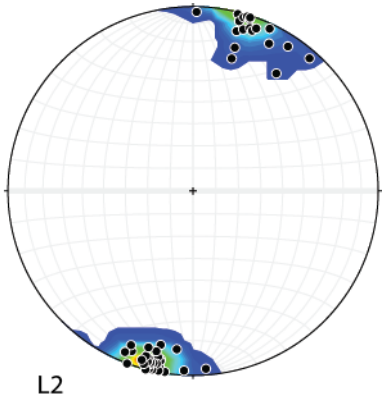
MINERAL OCCURRRENCES
Au
Ag-Pb-Zn
W
past producer
developed prospect
prospect
showing
2016 FIELD STATIONS
Salmo
Salmo stock
Porcupine Creek stock
Wall stock
Shaw Creek stock
Sheep Creek camp
HB mine
Dodger W mine
Bayonne mine
Mine stock
Lost Creek pluton
Summit stock
Active Fm.
Laib Fm.
Hamill Gp.
Windermere SGp.
Purcell SGp.
Sheep Creek
Lost Creek
Salmo River
South Salmo R.
SH8 (Nugget ore pile)
SH19-24
SH4-5
SH12-13
SH14-18
SH25
SH6-11
SH26-30
SH1
SH2
SH3
SH31
SH32
SH33
N
0
2.5
5
10
km
480000
485000
490000
495000
500000
505000
510000
515000
5460000
5455000
5450000
5445000
5440000
5435000
5430000

Sheep Creek

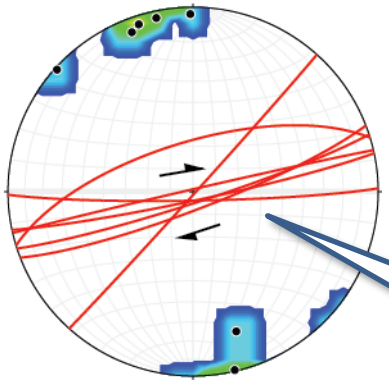
Mathews, 1953

Sheep Creek

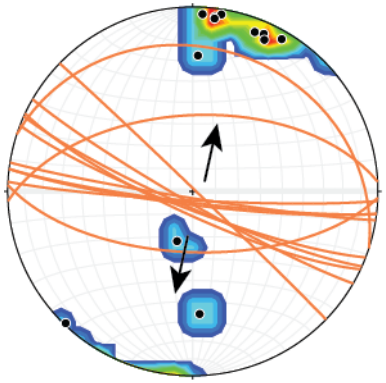




L2
F2 fold axes



dextral shear structures



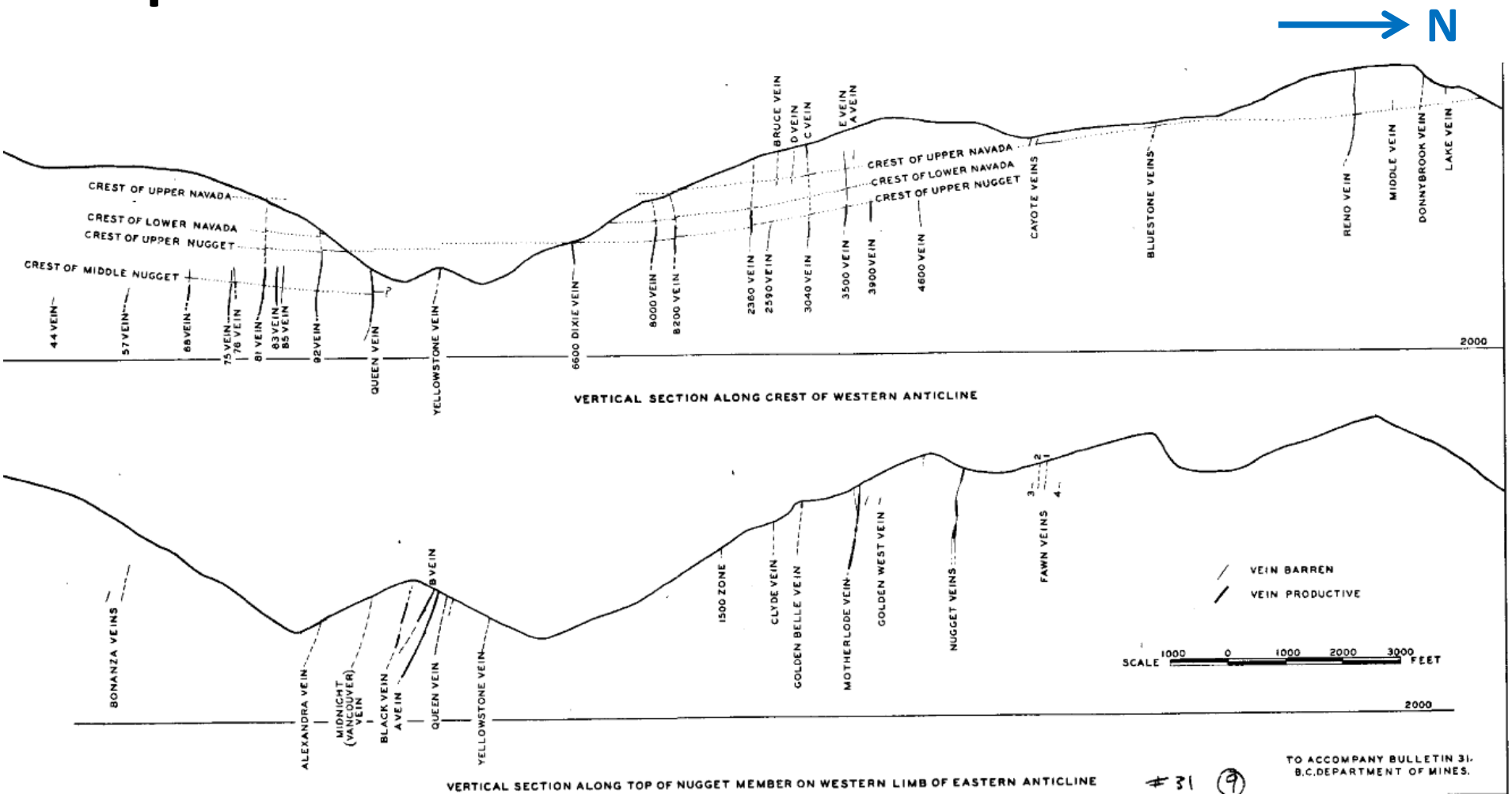
extensional veins

Mineralizing trend

Mathews, 1953

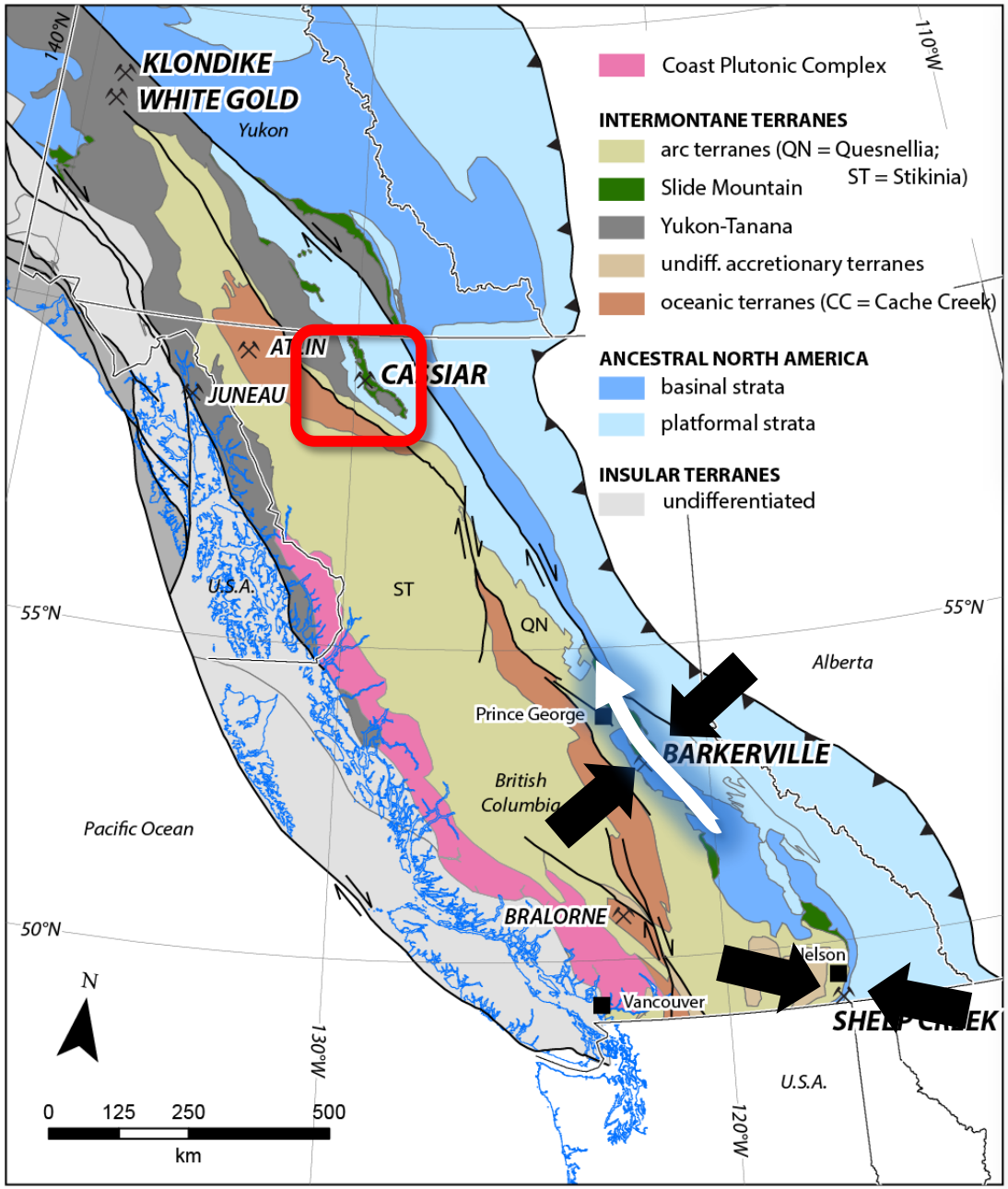
MDRU
Mineral Deposit Research Unit

Sheep Creek – vein distribution



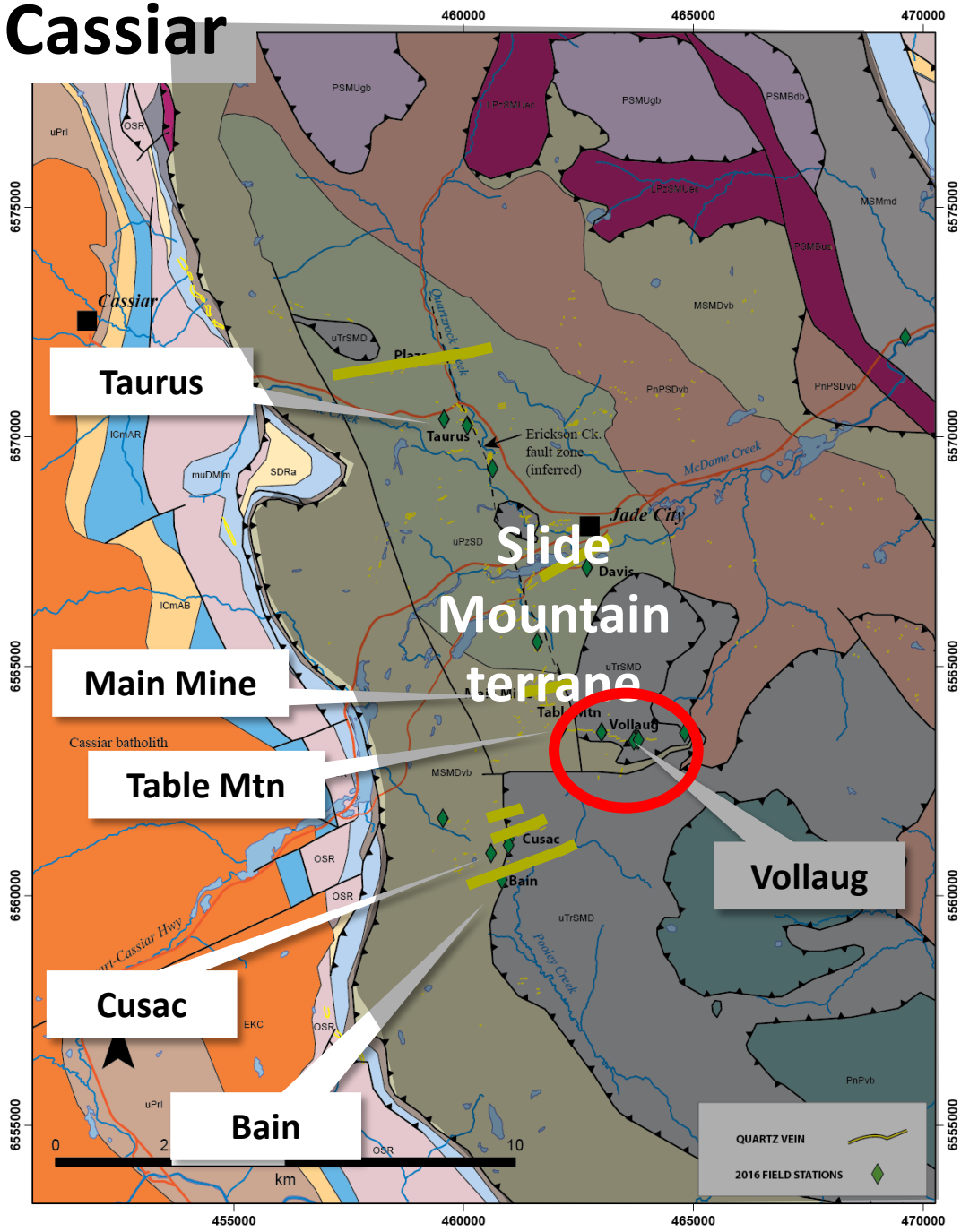
Strong stratigraphic control: gold preferentially forms in brittle quartzite units

Mathews, 1953



Historic lode gold production ~240,000 oz

Cassiar



LEGEND

Intrusive rocks

EKC — **Casiar batholith (Early Cretaceous)** – biotite-hornblende and biotite-muscovite granite, locally megacrystic; quartz monzonite, granodiorite

Slide Mountain terrane (Sylvester allochthon)

DIVISION III - Pennyslvanian to Permian

PnPvb — **Huntergroup volcanics** – Augite (-hornblende-plagioclase) porphyry, lapilli tuff, tuffaceous sandstone, limestone, minor chert and argillite.

DIVISION II - Mississippian to Triassic

uTrSMD — **Table Mountain Sediments** – Slate, calcareous siltstone, halobia-bearing platey grey limestone.

PSMUgb — **Zus Mountain gabbro** – gabbro, in part layered, foliated.

LPzSMUed — **Cassiar-Quartzrock Creek Ultramafite** – serpentinite, harzburgite tectonite, pyroxenite, gabbro; includes serpentinite of the Blue Dome fault zone.

PnPSDvb — Basalt flows and tuffs (including maroon, red and green), volcaniclastics, variegated chert, polymictic breccia, phyllite, argillite, quartz-chert sandstone, rhodonite, diabase.

uPzSD — Massive and pillowed basalt flows (olivine-phyric near Mt. Sylvester), lesser tuff.

MSMDvb — Basalt, diabase, grey and green chert, black, grey and green argillite, calcarenite, quartz-chert sandstone, chert-pebble conglomerate.

DIVISION I - Mississippian to Permian

MSMmd — Black, grey and green argillite, quartz-chert sandstone, grey, green and black chert, calcarenite, minor tuff, siliceous exhalite; includes up to 10% diabase, basalt sills

Cassiar terrane (autocthonous strata)

DMEmb — **EARN GROUP** (Upper Devonian to Lower Mississippian) – Slate (variably graphitic, calcareous, pyritic), siltstone, sandstone, conglomerate, porcellanite, light green tuffaceous shale, dark grey limestone, siliceous and baritic exhalite.

muDMlm — **McDAME GROUP** (Devonian) – Limestone, dolostone, limestone-dolostone breccia; in part subdividable into upper member: light grey, platy, limestone, with local karst breccia; lower member: dolostone, dark grey fetid, limestone, carbonate breccia.

OSR — **ROAD RIVER GROUP** (Ordovician to Silurian)– Black, commonly limy slate, locally graptolitic; argillaceous limestone.

CmOKlc — **KECHIKA GROUP** (Cambrian to Ordovician) – Limestone, argillaceous limestone, pale calcareous slate, phyllitic limestone, calcareous phyllite, pyritic and carbonaceous slate and shale; conglomerate and greenstone; may include dark slates of Road River Group.

lCmAR — **ATAN GROUP, Rosella Formation** (Lower Cambrian) – limestone, dolostone, calcareous shale, brown, grey and green-grey slate.

lCmAB — **ATAN GROUP, Boya Formation** (Lower Cambrian) – quartzitic sandstone, siltstone, slate and phyllite.

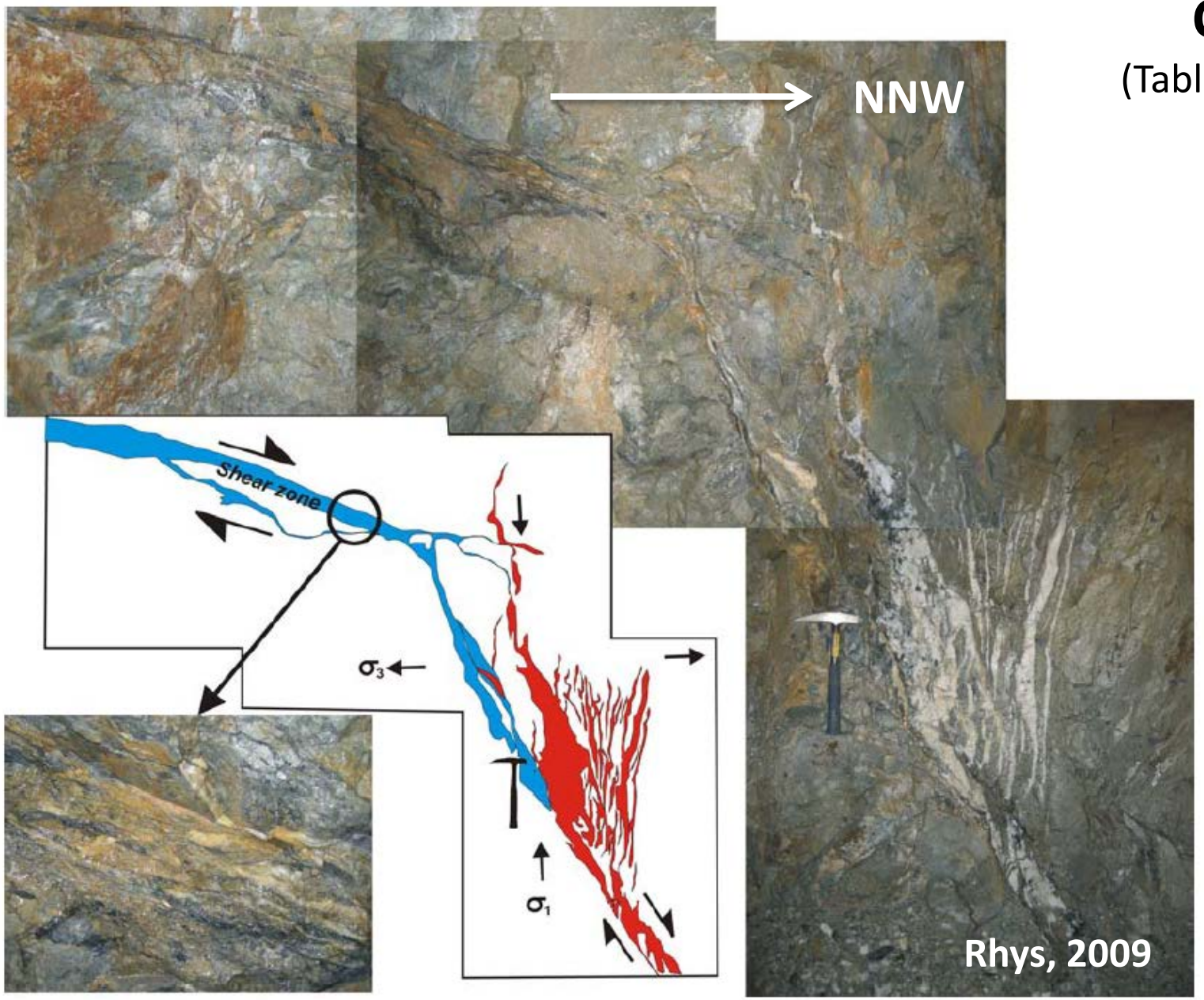
uPrI — **INGENIKA GROUP, undivided** (Neoproterozoic) – quartzite, micaceous quartzite, phyllite, schist, gneiss, limestone, shale, sandstone, sandy limestone, dolomite, chlorite-muscovite schist, slate, argillite, micaceous crystalline limestone, pebble conglomerate.

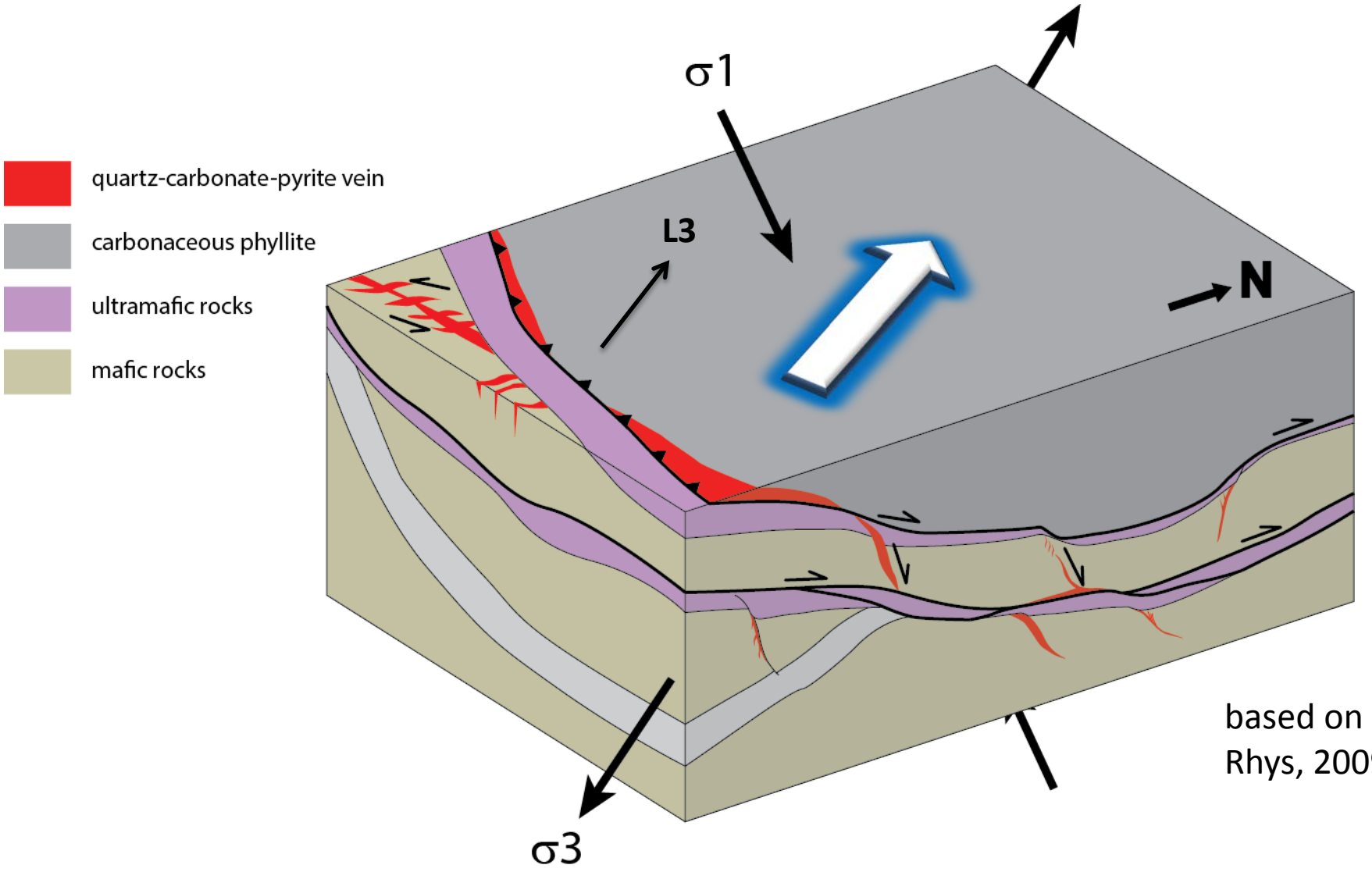
Vollaug Vein (Table Mtn area)

View to E

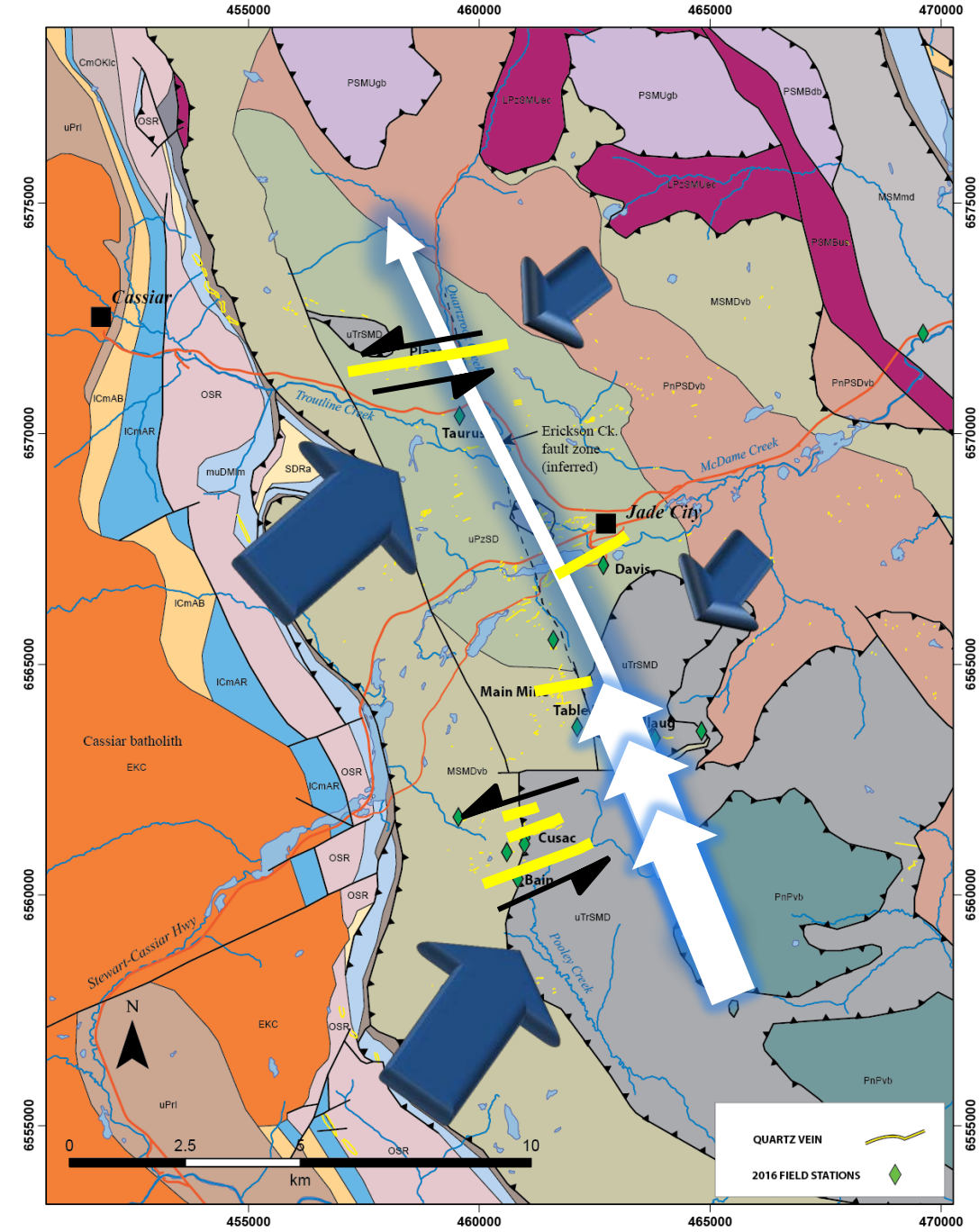
Cusac

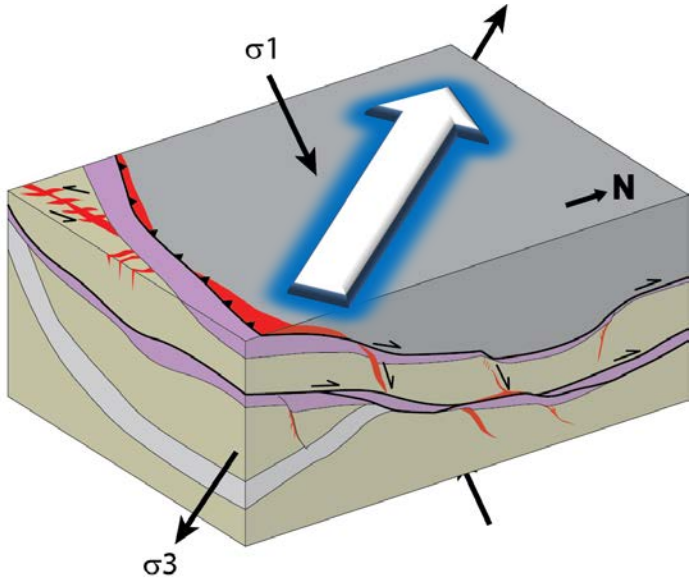
(Table Mtn area)





based on
Rhys, 2009





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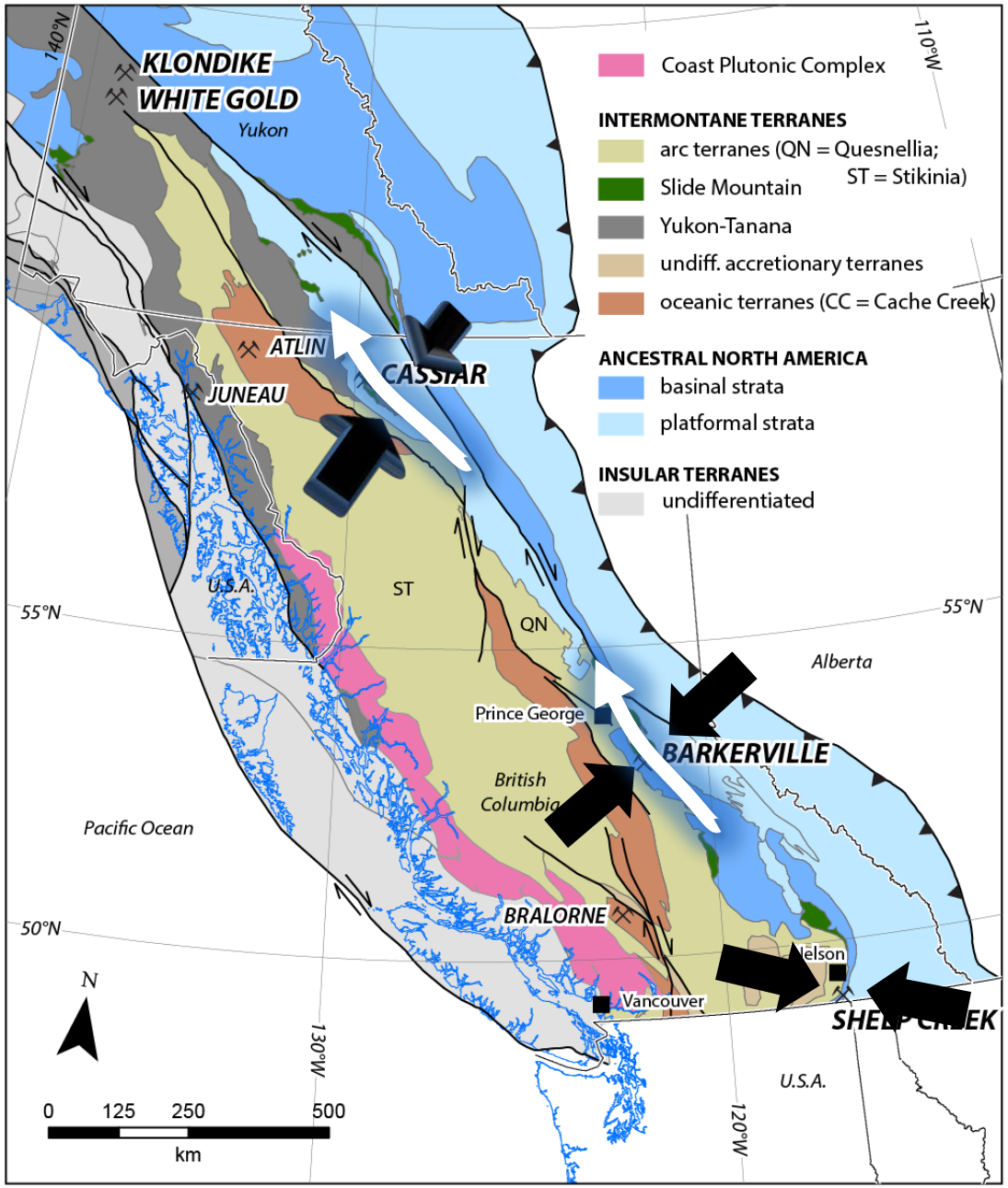
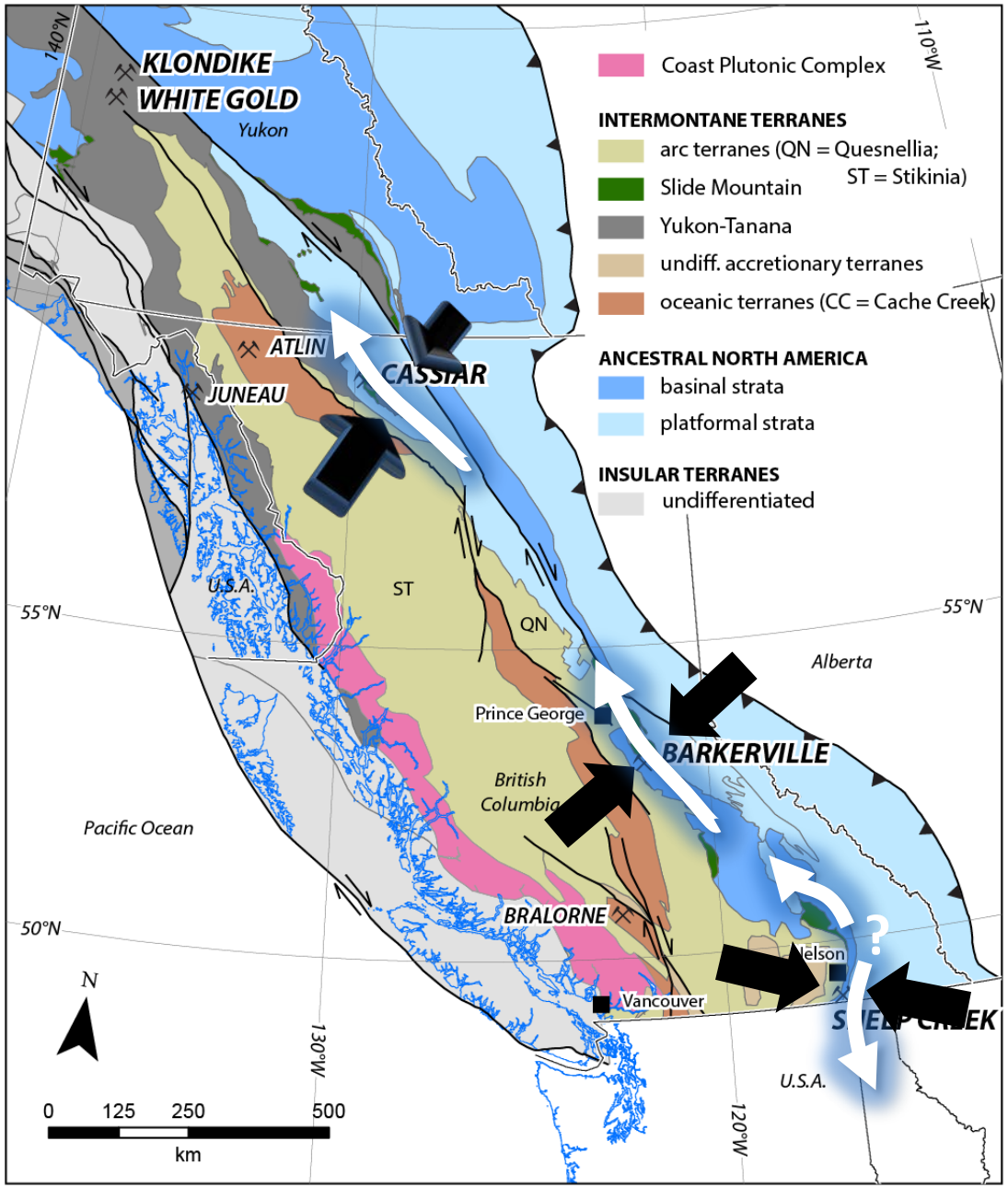


Summary

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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