



Mesozoic crustal structure and metalogenic setting of the northern Intermontane terranes, Yukon

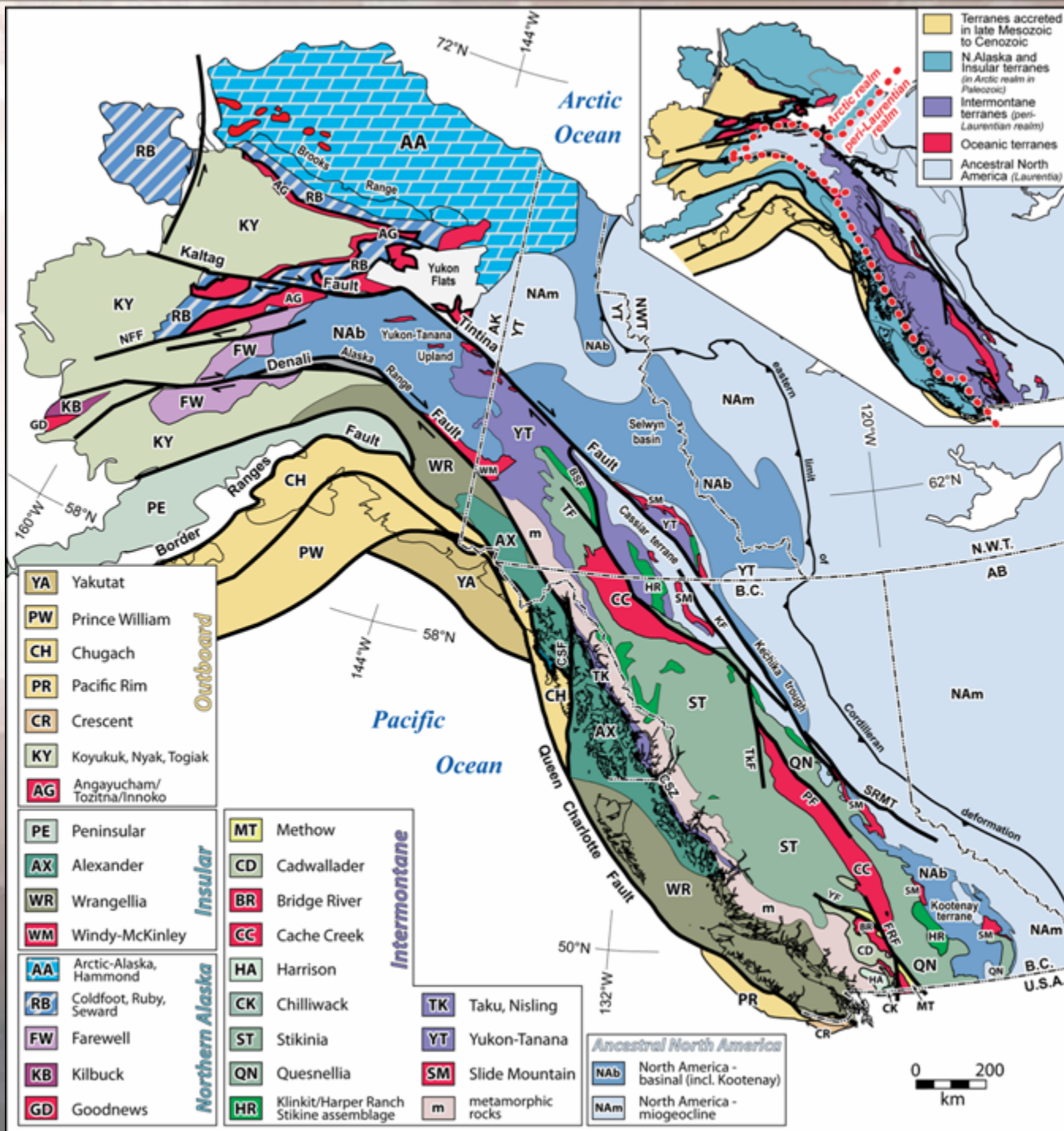
***Maurice Colpron
& Venessa Bennett***

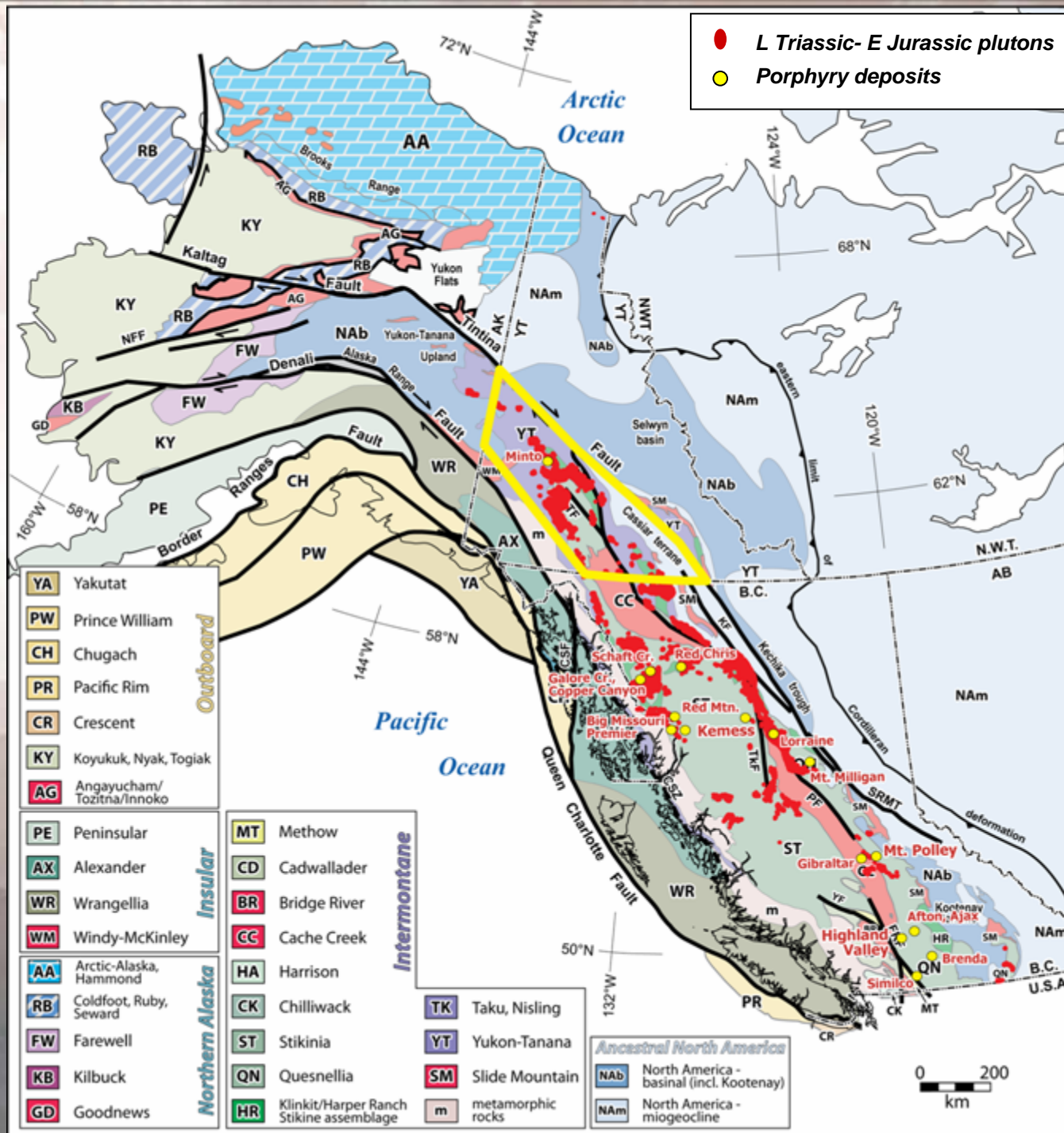
Yukon Geological Survey

Miscellaneous Report 2

Presentation 1

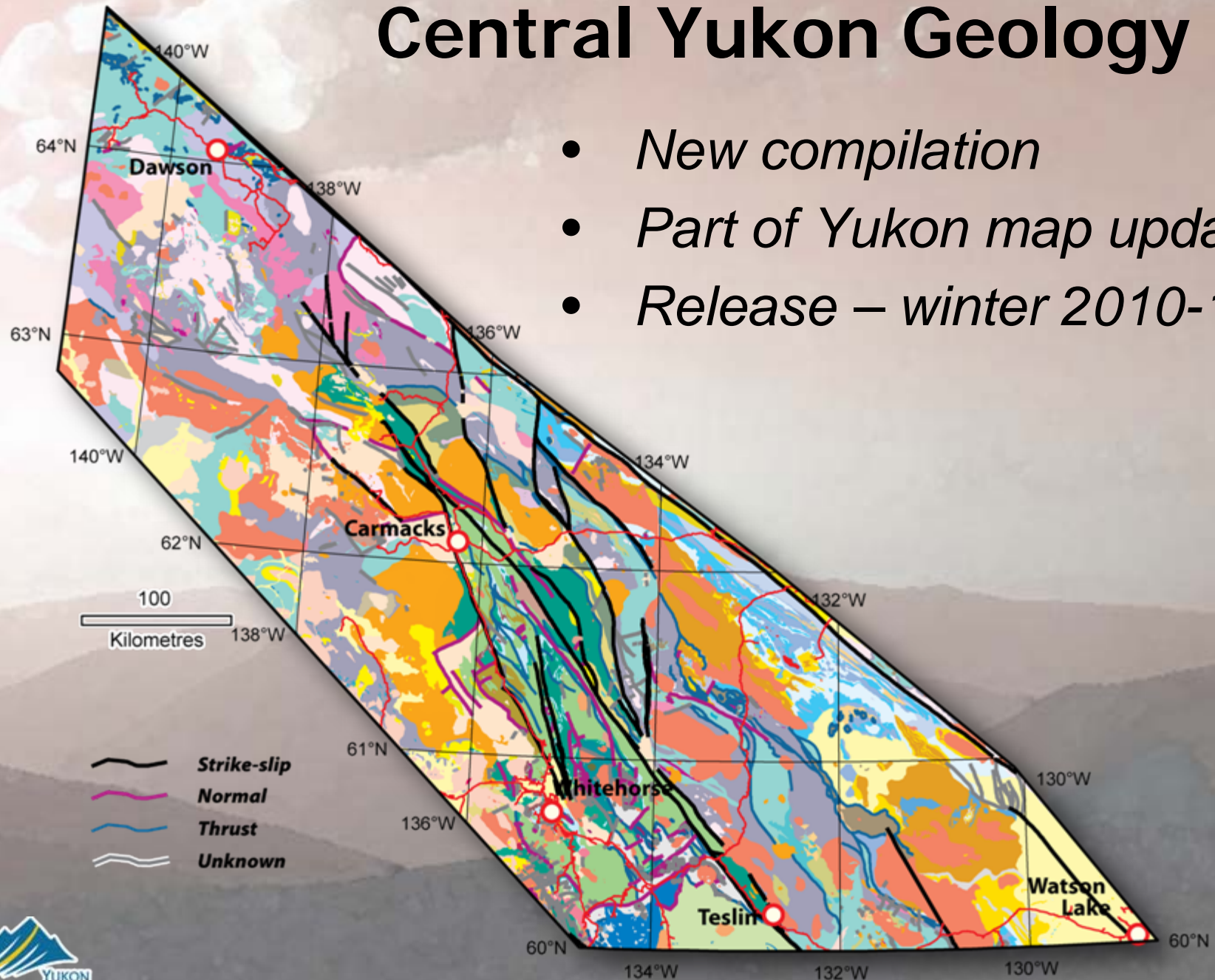
***GAC Cordilleran section - Cordilleran Metallogeny Workshop
Porphyry Settings
Vancouver Convention Centre, April 27, 2010***



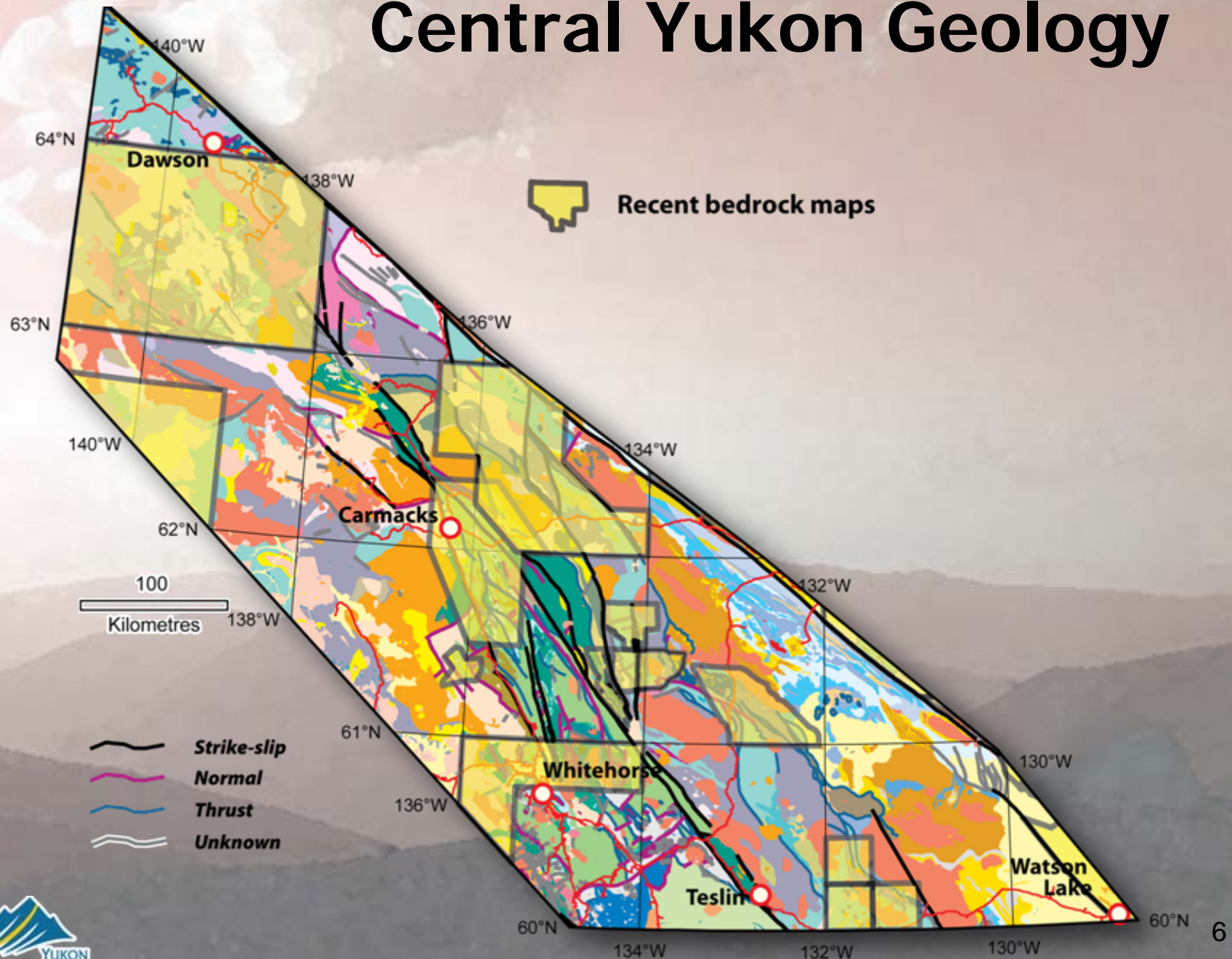


Central Yukon Geology

- *New compilation*
- *Part of Yukon map update*
- *Release – winter 2010-11*



Central Yukon Geology



Central Yukon Geology

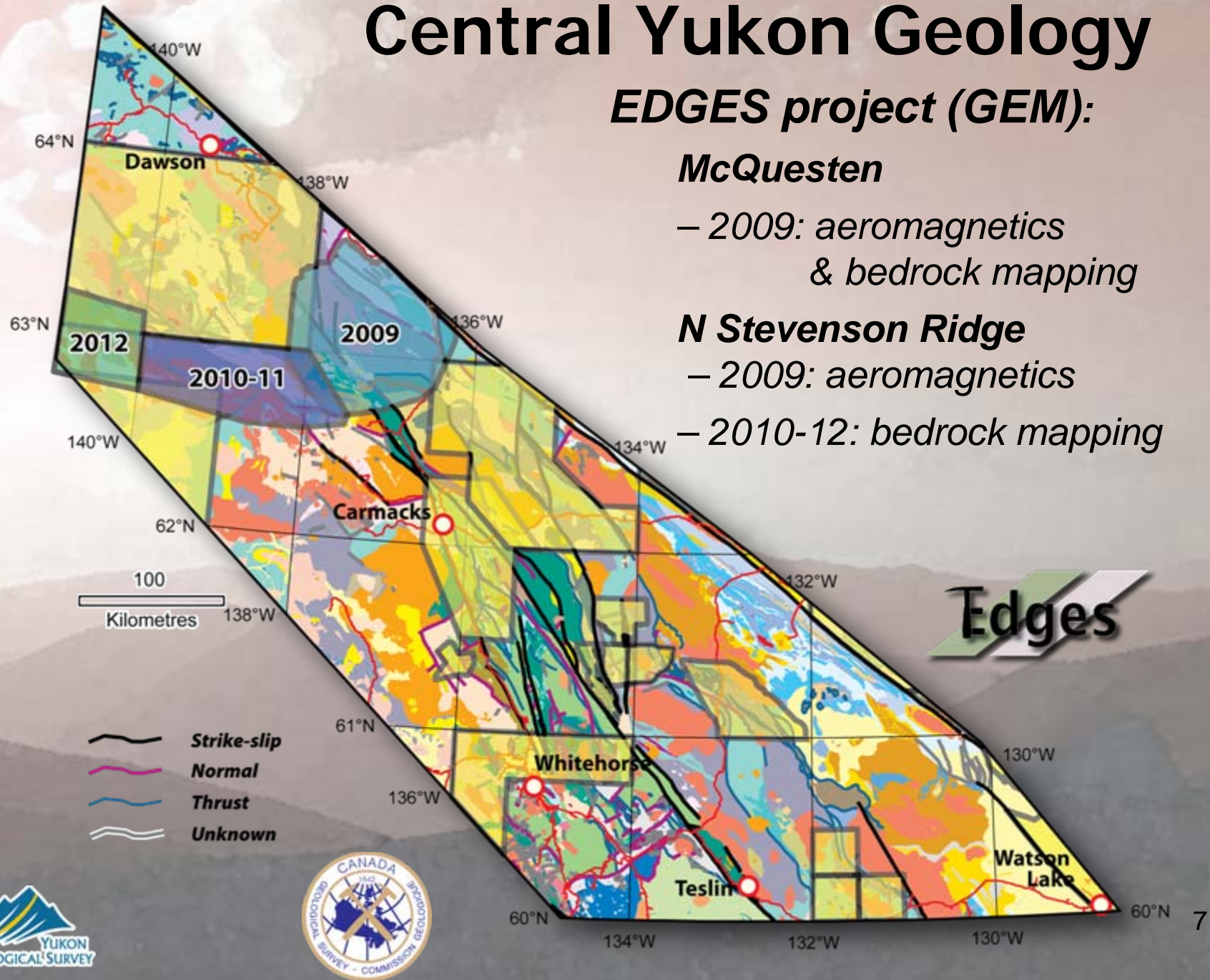
EDGES project (GEM):

McQuesten

– 2009: aeromagnetics
& bedrock mapping

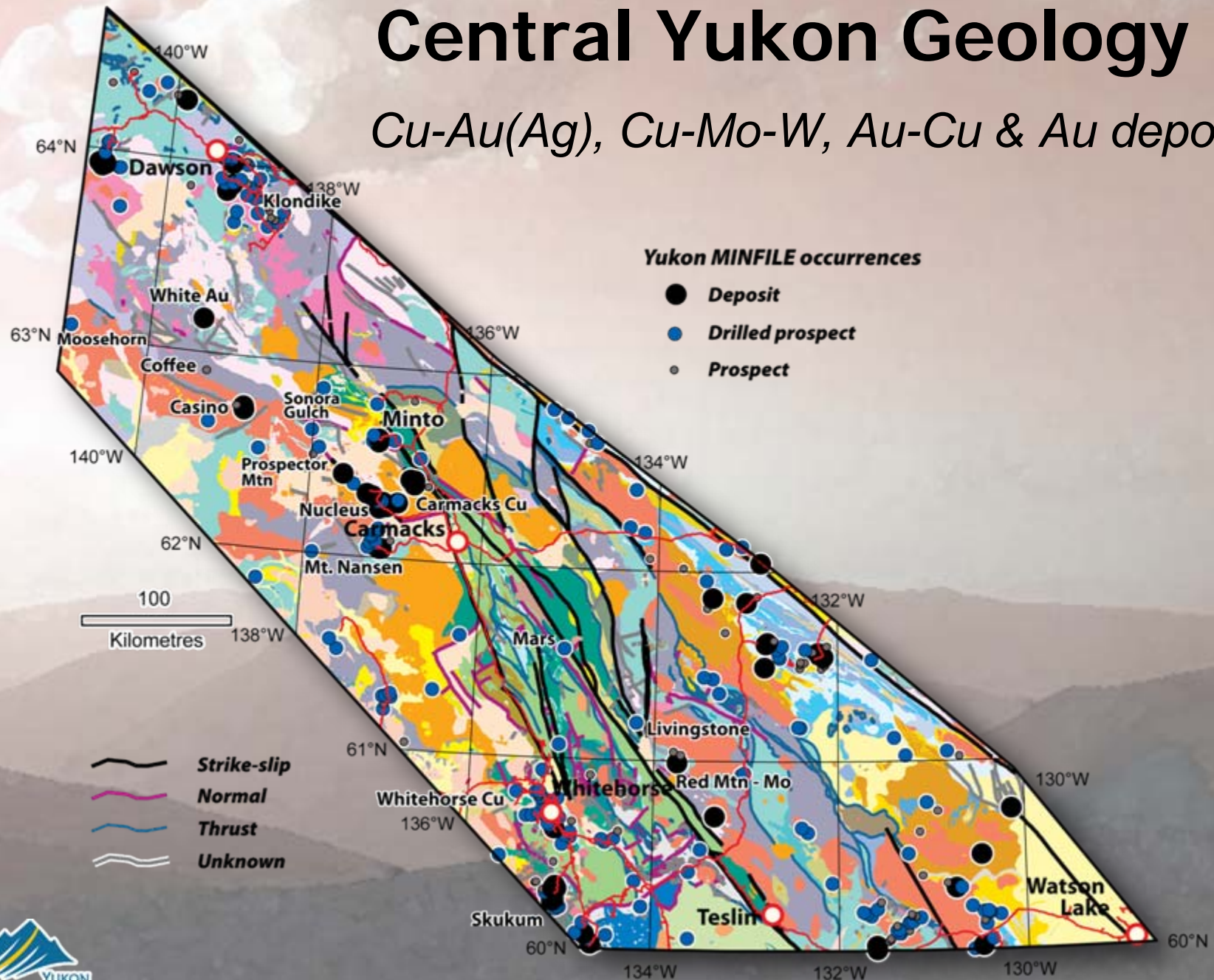
N Stevenson Ridge

– 2009: aeromagnetics
– 2010-12: bedrock mapping

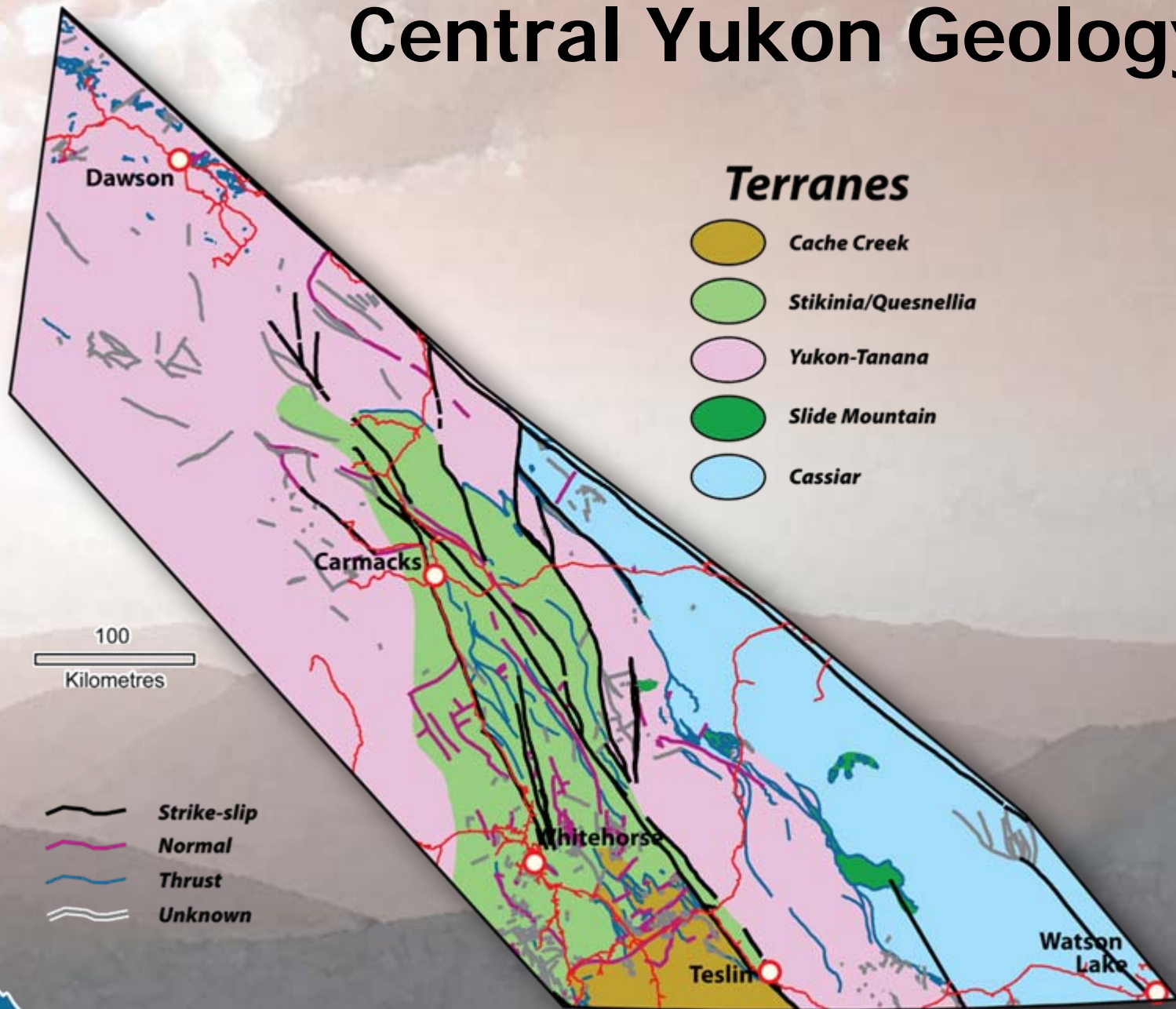


Central Yukon Geology

Cu-Au(Ag), Cu-Mo-W, Au-Cu & Au deposits

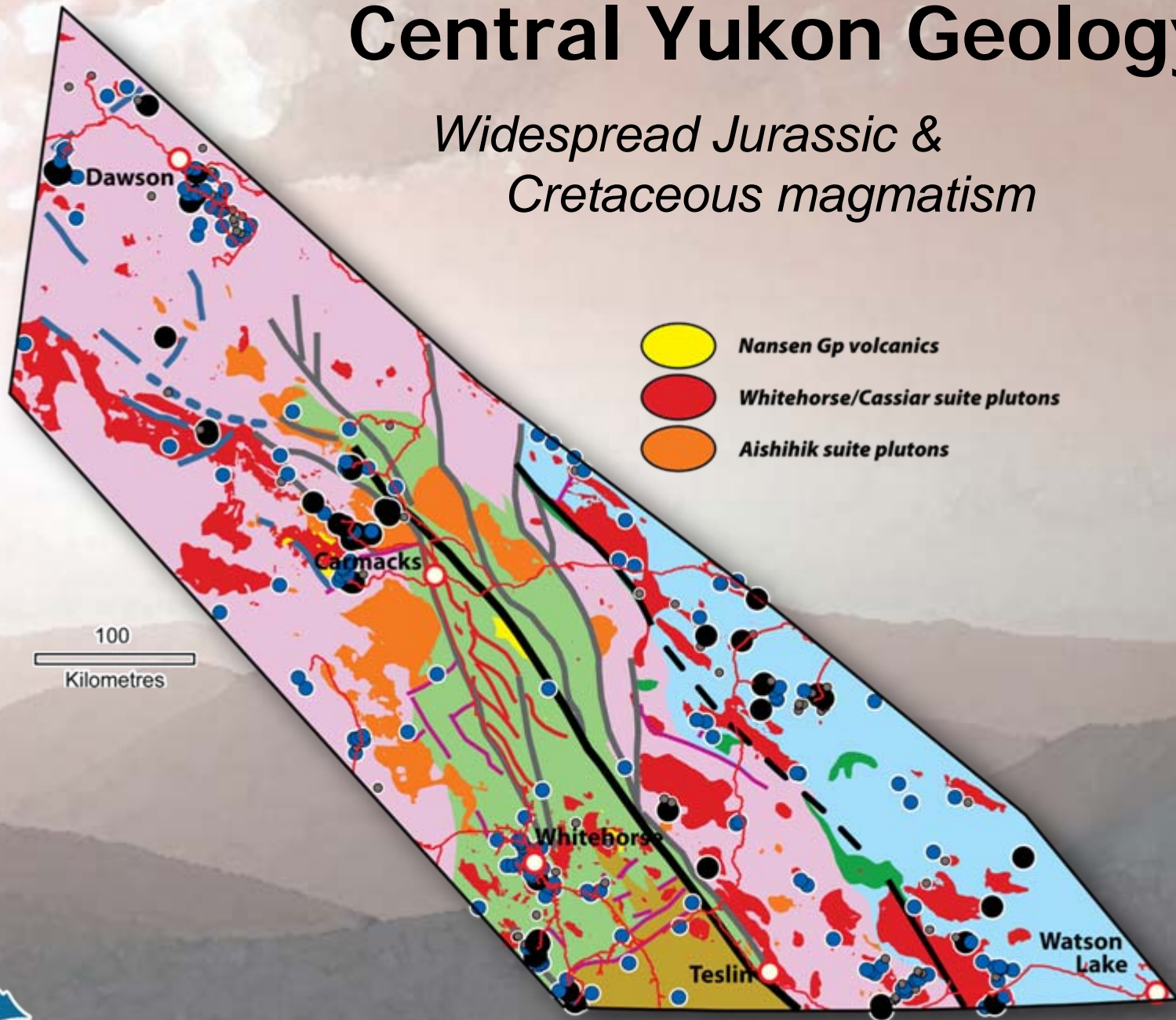


Central Yukon Geology



Central Yukon Geology

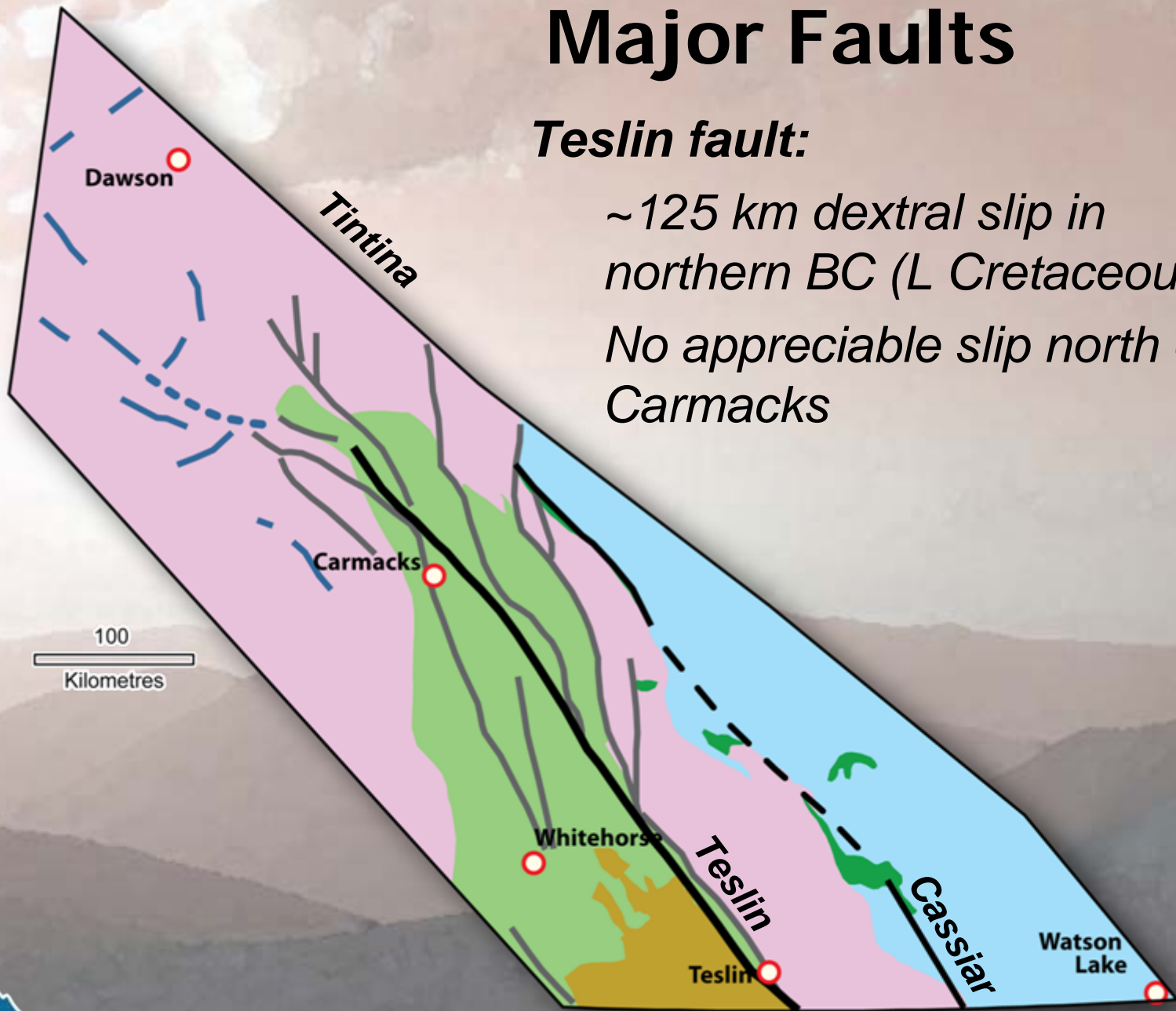
*Widespread Jurassic &
Cretaceous magmatism*



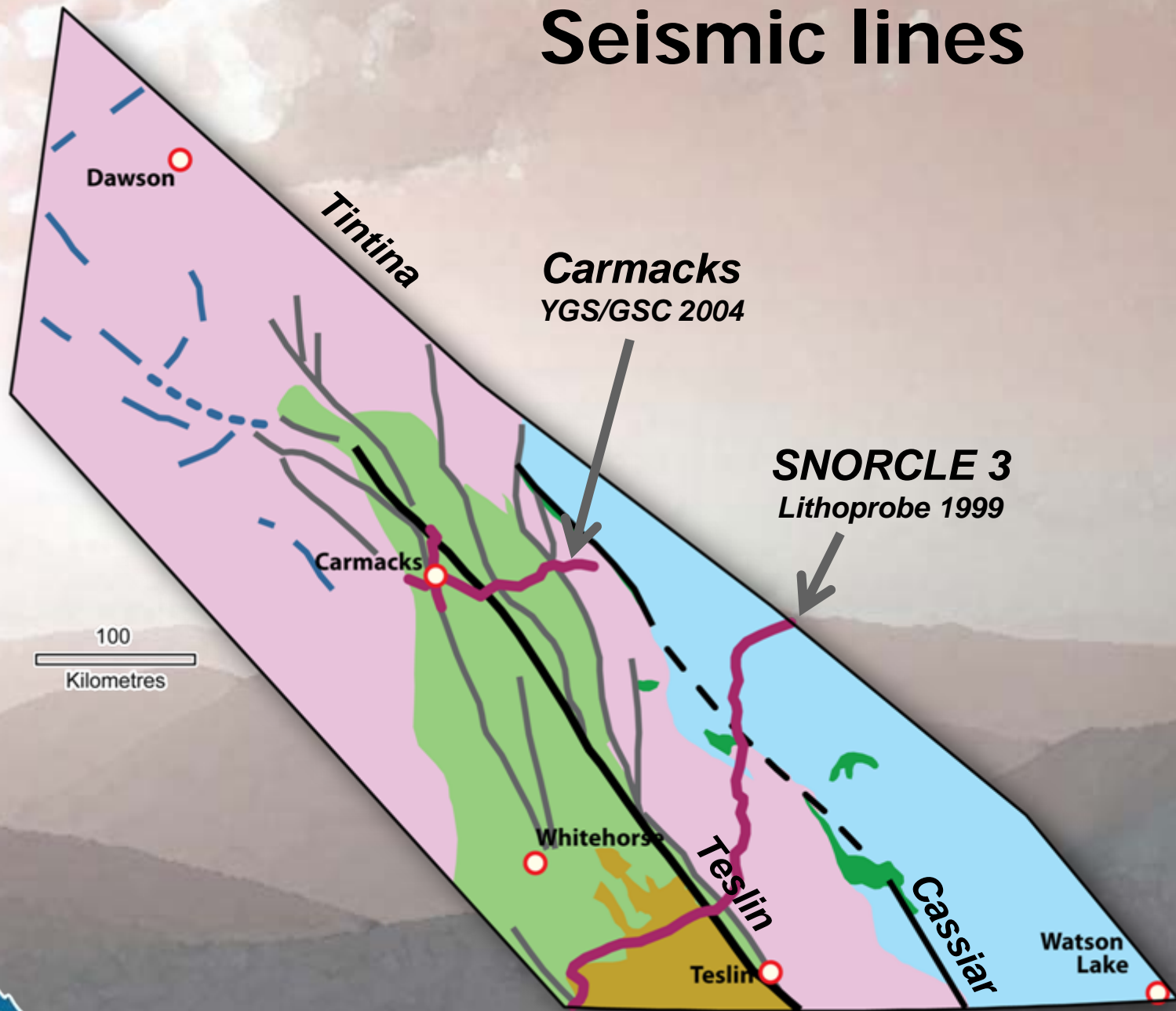
Major Faults

Teslin fault:

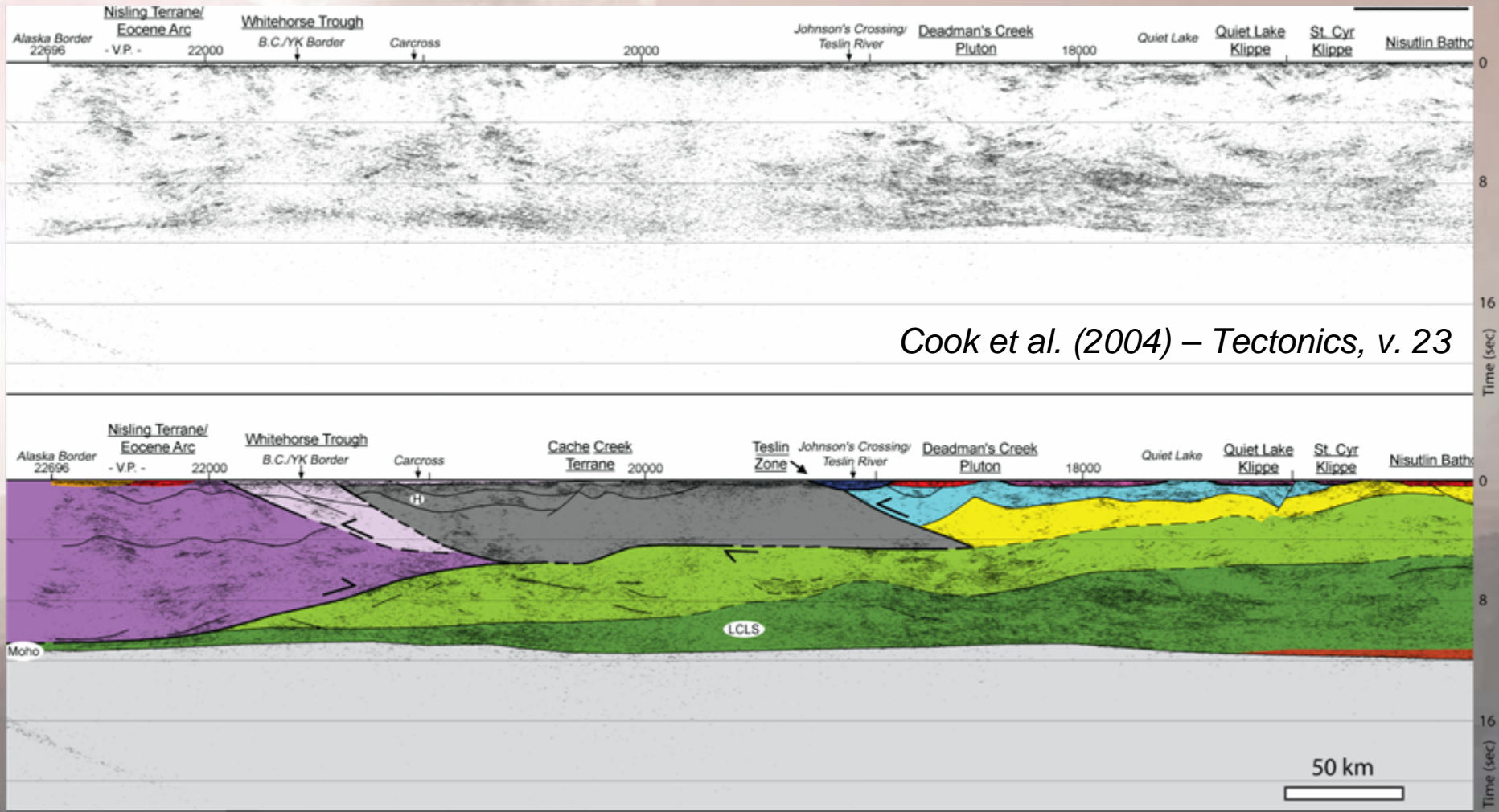
*~125 km dextral slip in
northern BC (L Cretaceous)
No appreciable slip north of
Carmacks*



Seismic lines

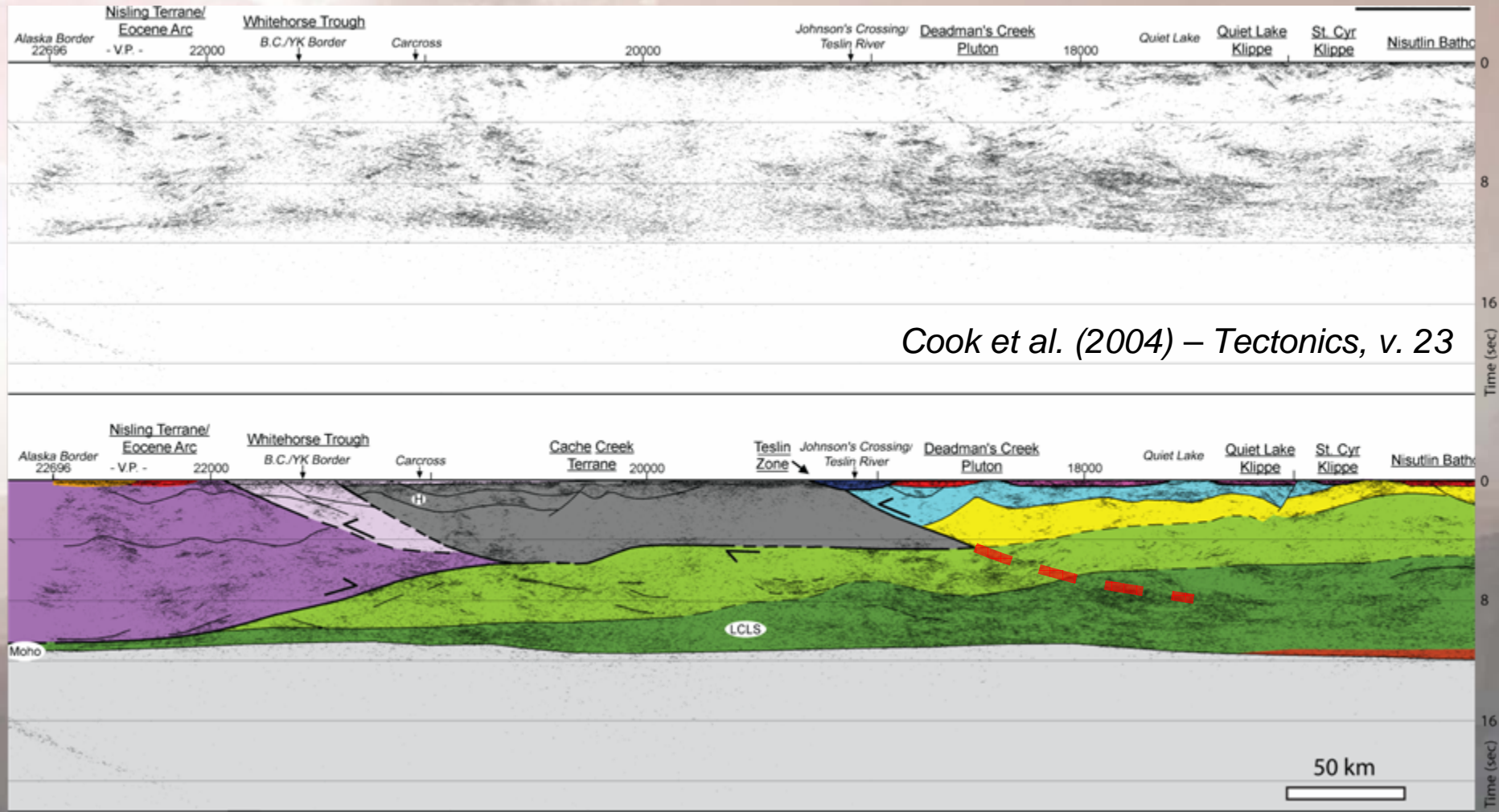


SNORCLE line 3



Cook et al. (2004) – Tectonics, v. 23

SNORCLE line 3

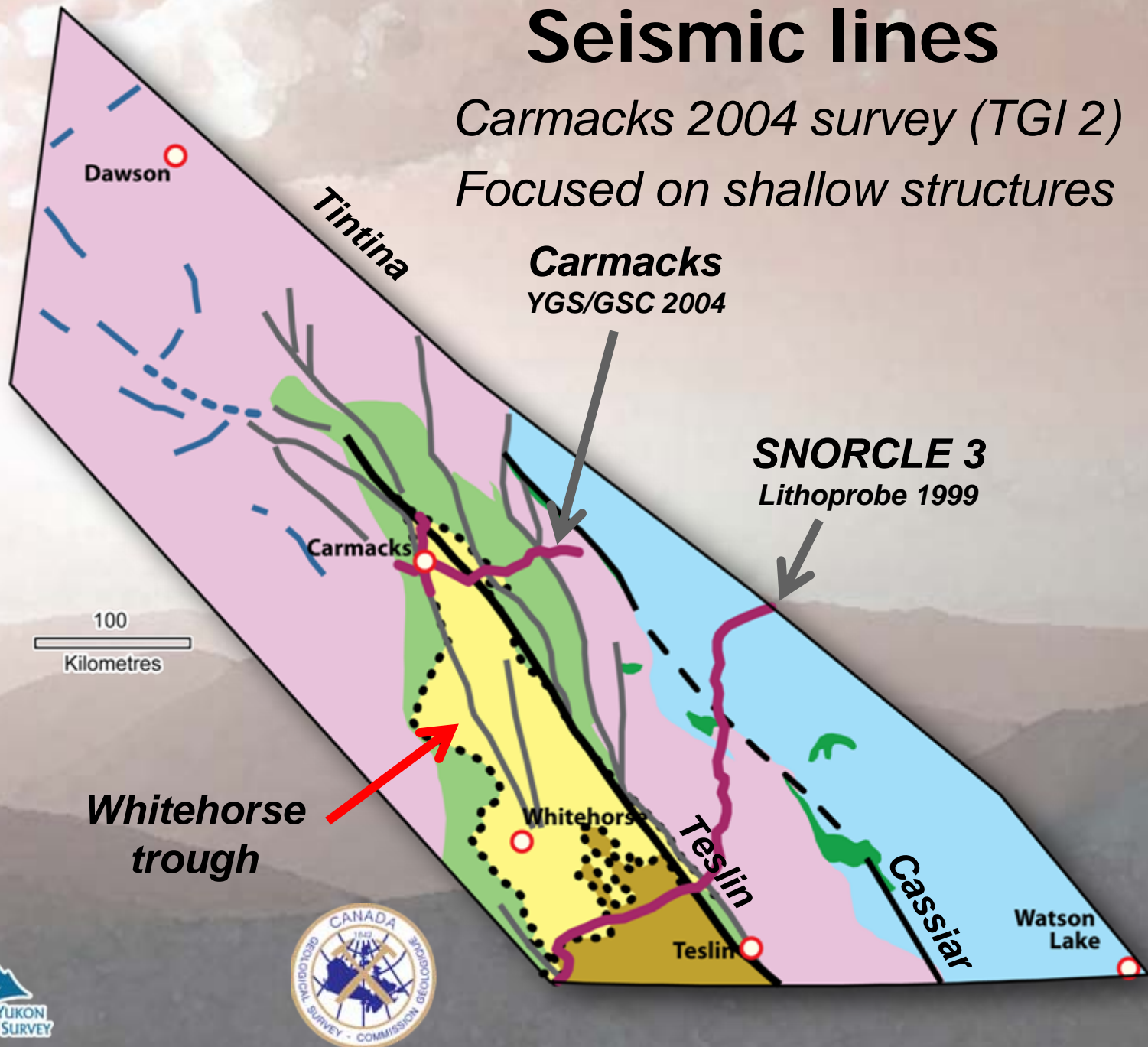


Cook et al. (2004) – Tectonics, v. 23

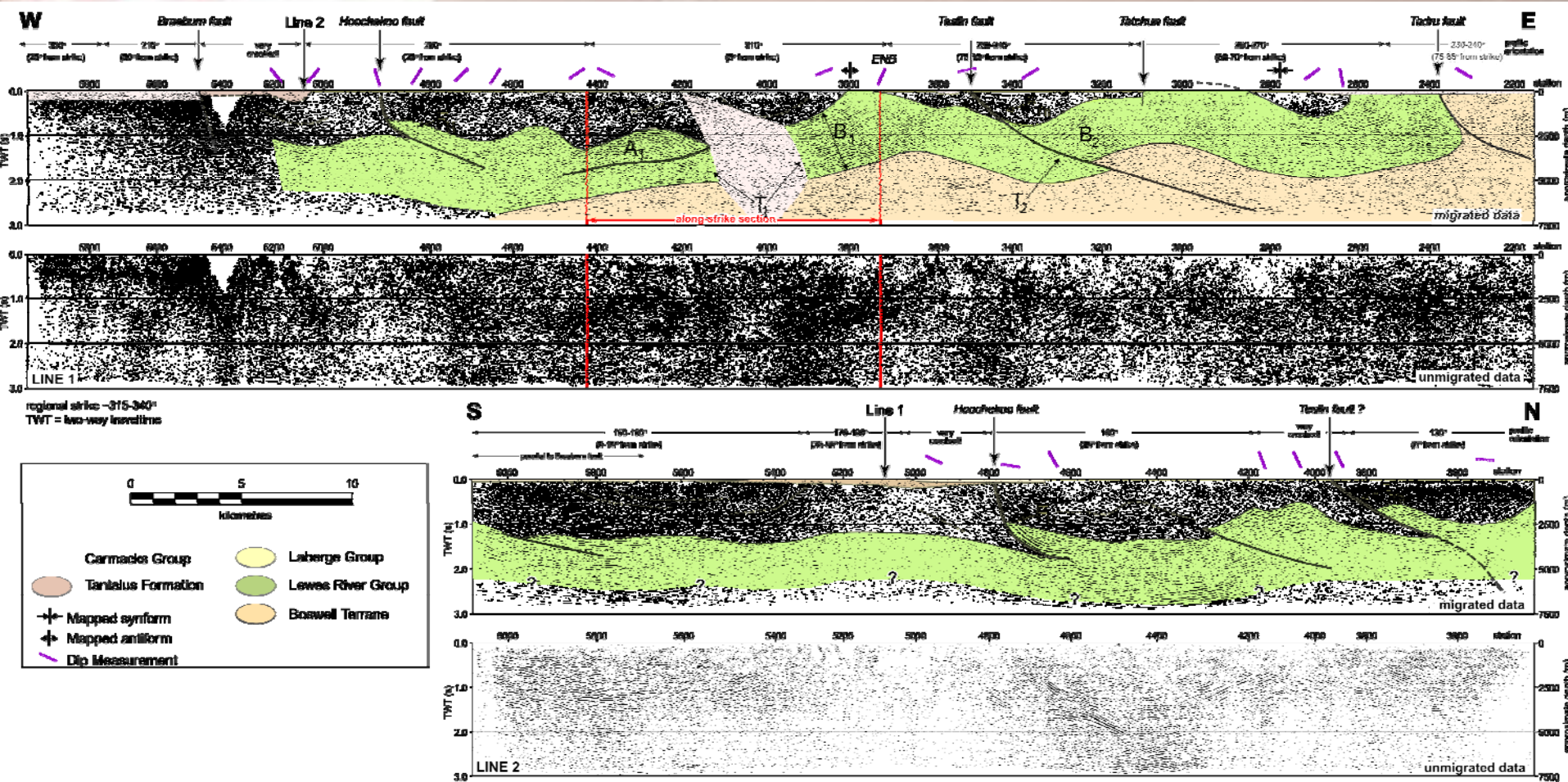
Seismic lines

Carmacks 2004 survey (TGI 2)

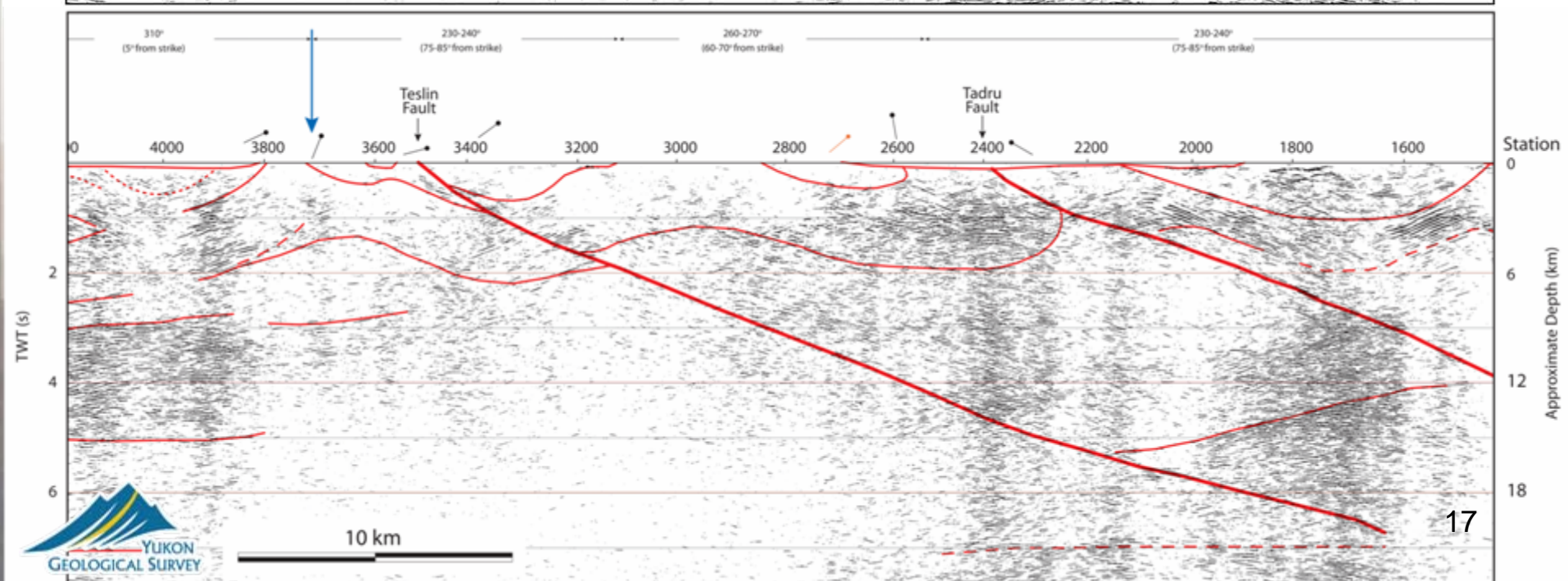
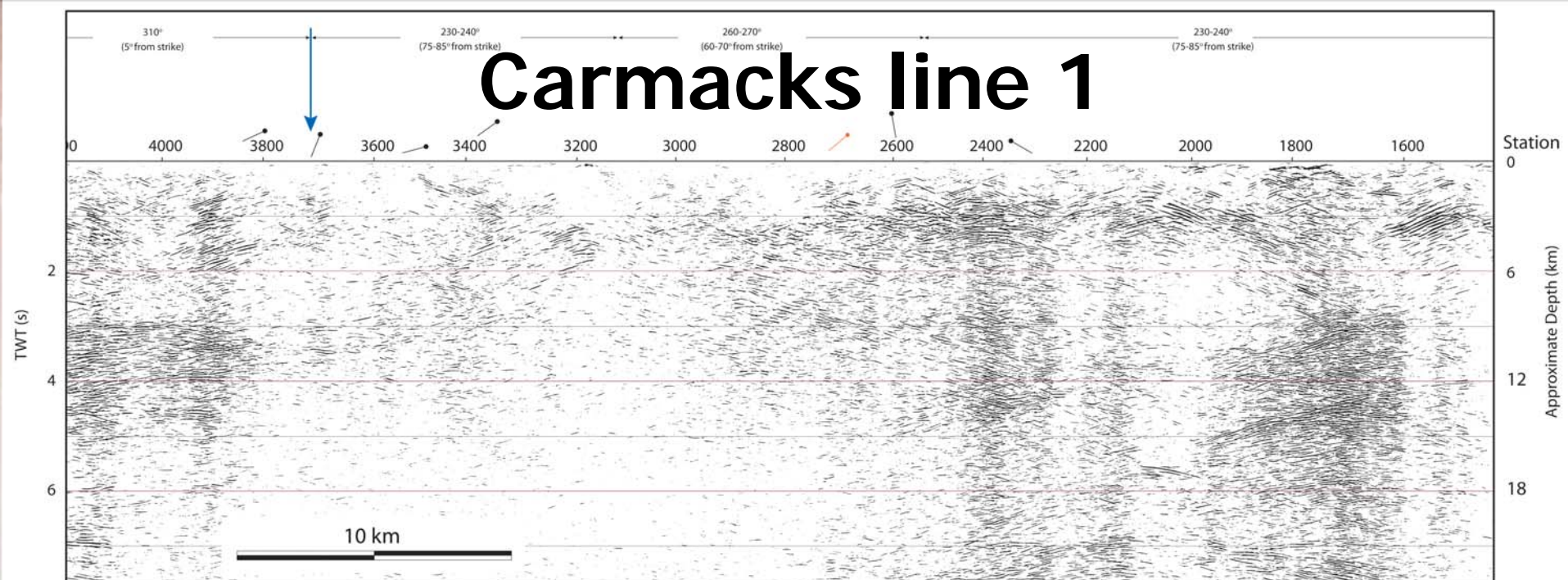
Focused on shallow structures



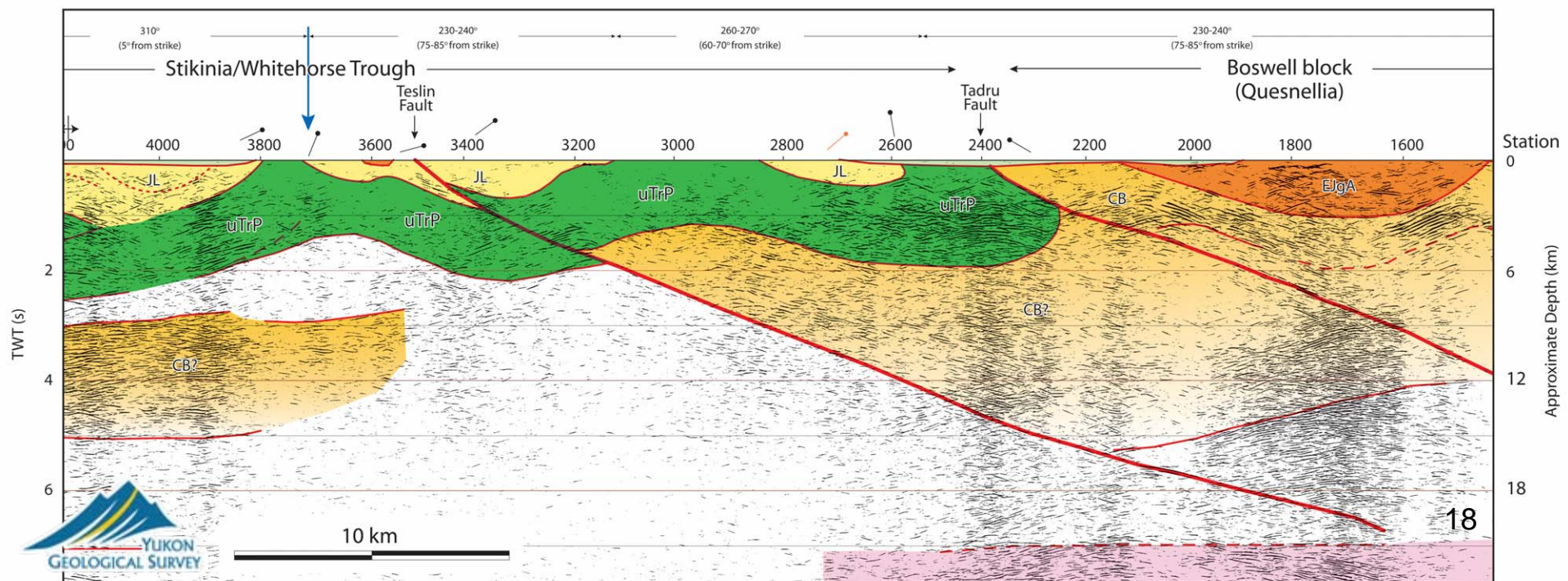
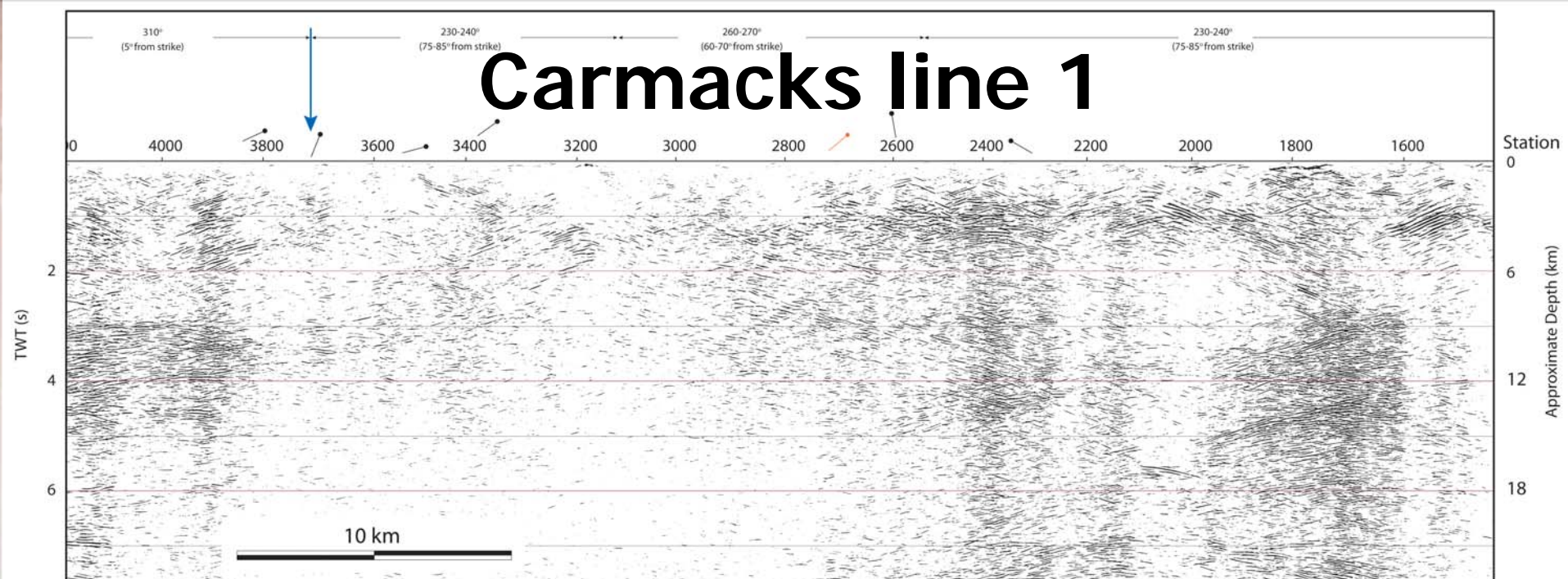
Carmacks survey



Carmacks line 1

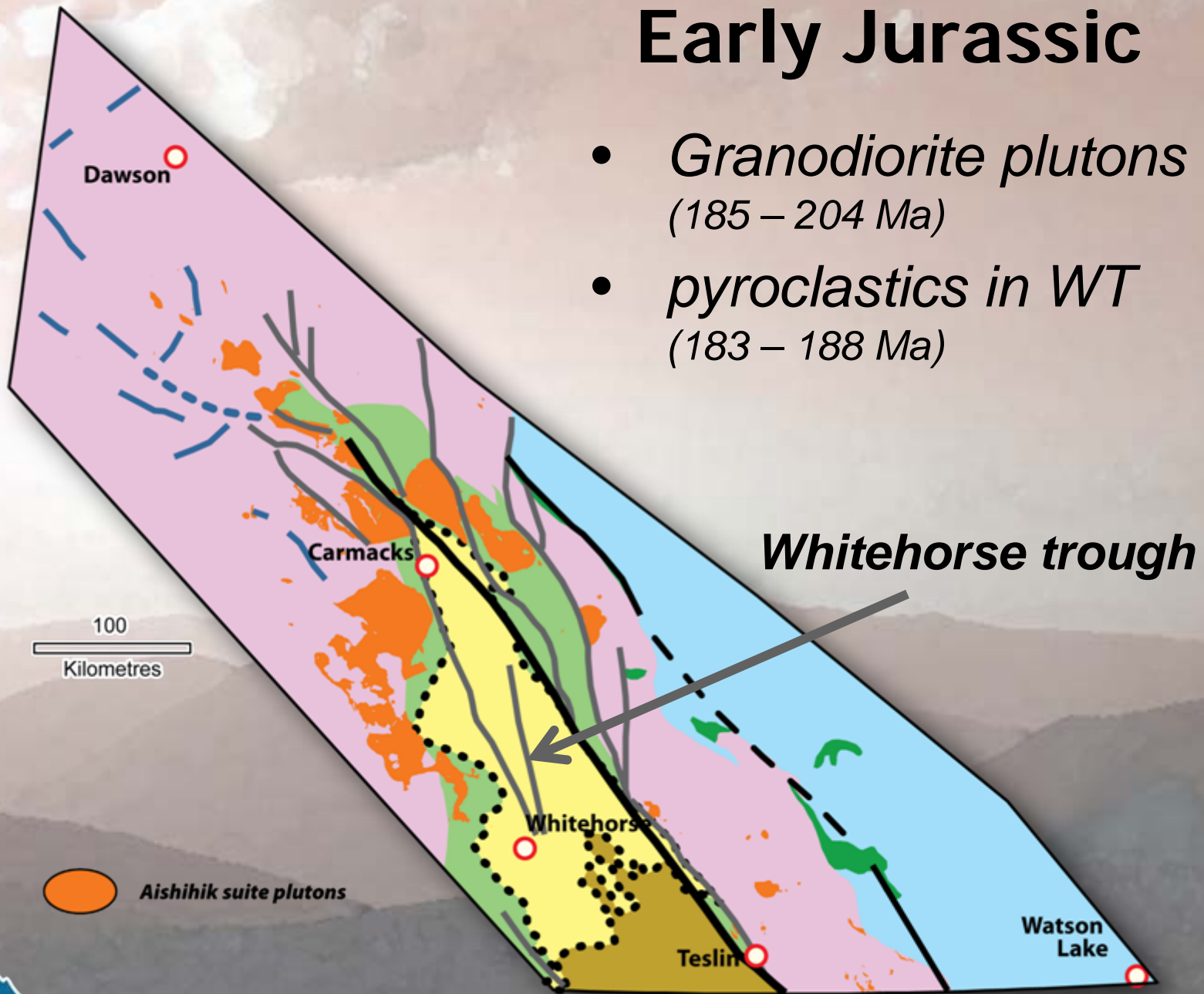


Carmacks line 1



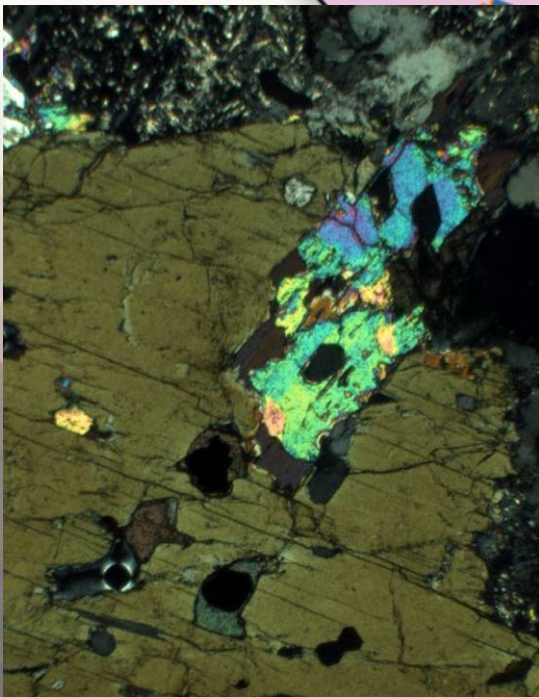
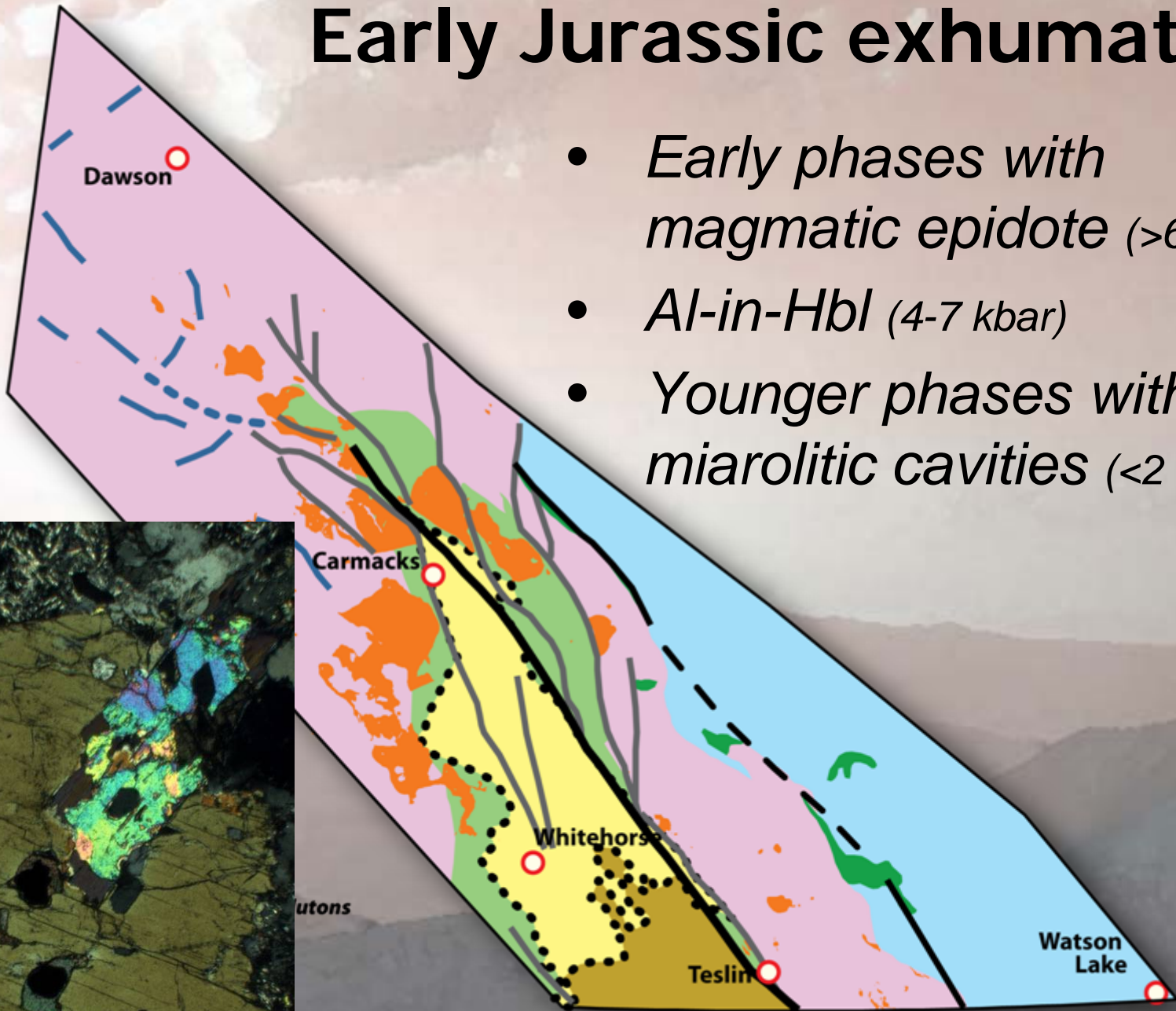
Early Jurassic

- *Granodiorite plutons*
(185 – 204 Ma)
- *pyroclastics in WT*
(183 – 188 Ma)



Early Jurassic exhumation

- *Early phases with magmatic epidote (>6 kbar)*
- *Al-in-Hbl (4-7 kbar)*
- *Younger phases with miarolitic cavities (<2 kbar)*



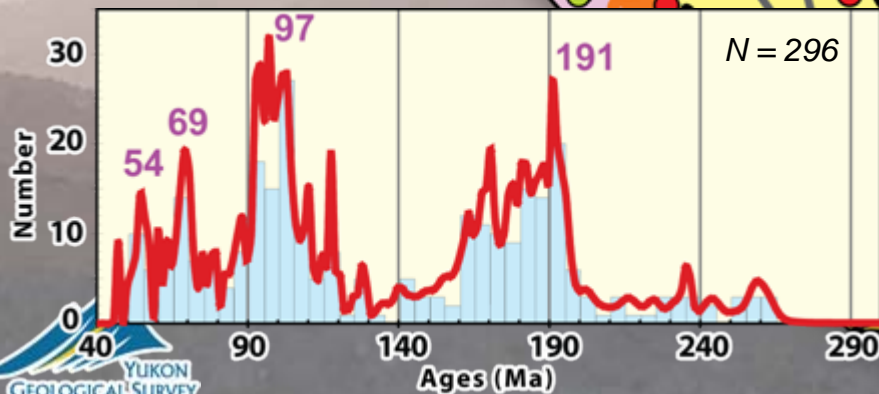
Mica Cooling Ages

$^{40}\text{Ar}/^{39}\text{Ar}$ & K-Ar mica ages

- Tertiary (<63 Ma)
- Late Cretaceous (63 - 85 Ma)
- Early Cretaceous (85 - 119 Ma)
- Jura-Cretaceous K-Ar (119 - 160 Ma)
- Jurassic (160 - 206 Ma)
- Triassic and older (>206 Ma)

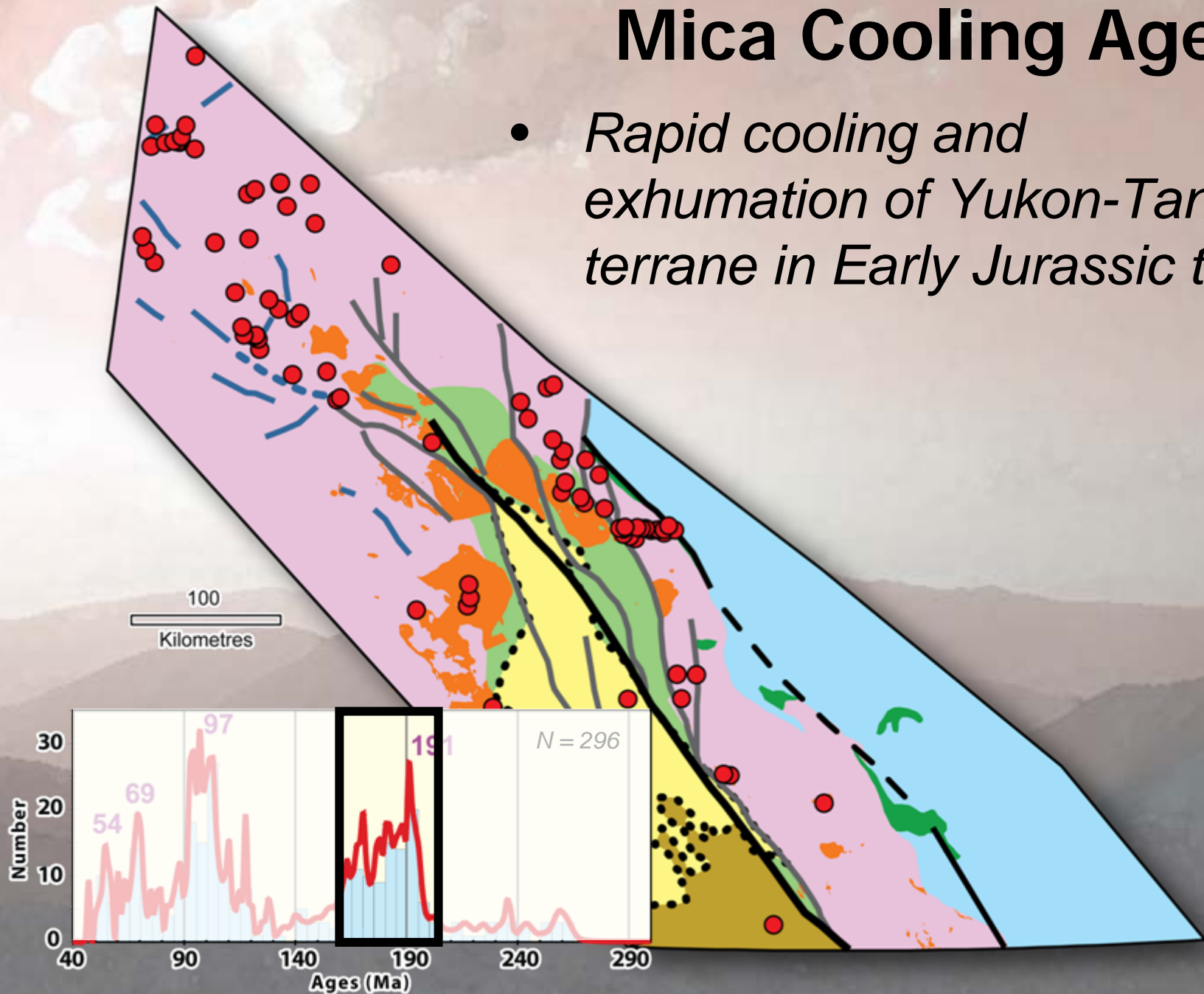
Data from Yukon Age database and unpublished data by YGS and GSC

100
Kilometres



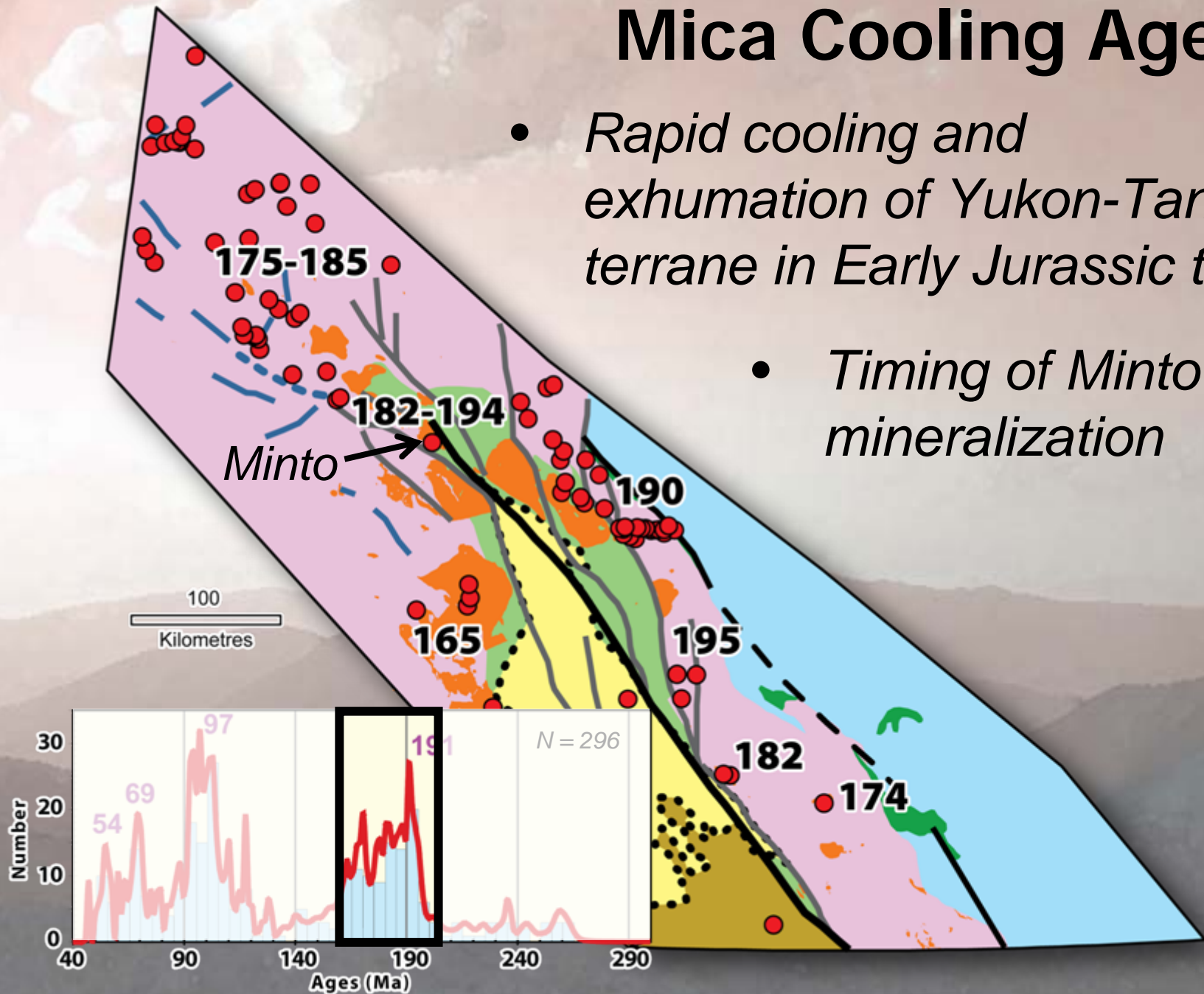
Mica Cooling Ages

- Rapid cooling and exhumation of Yukon-Tanana terrane in Early Jurassic time*



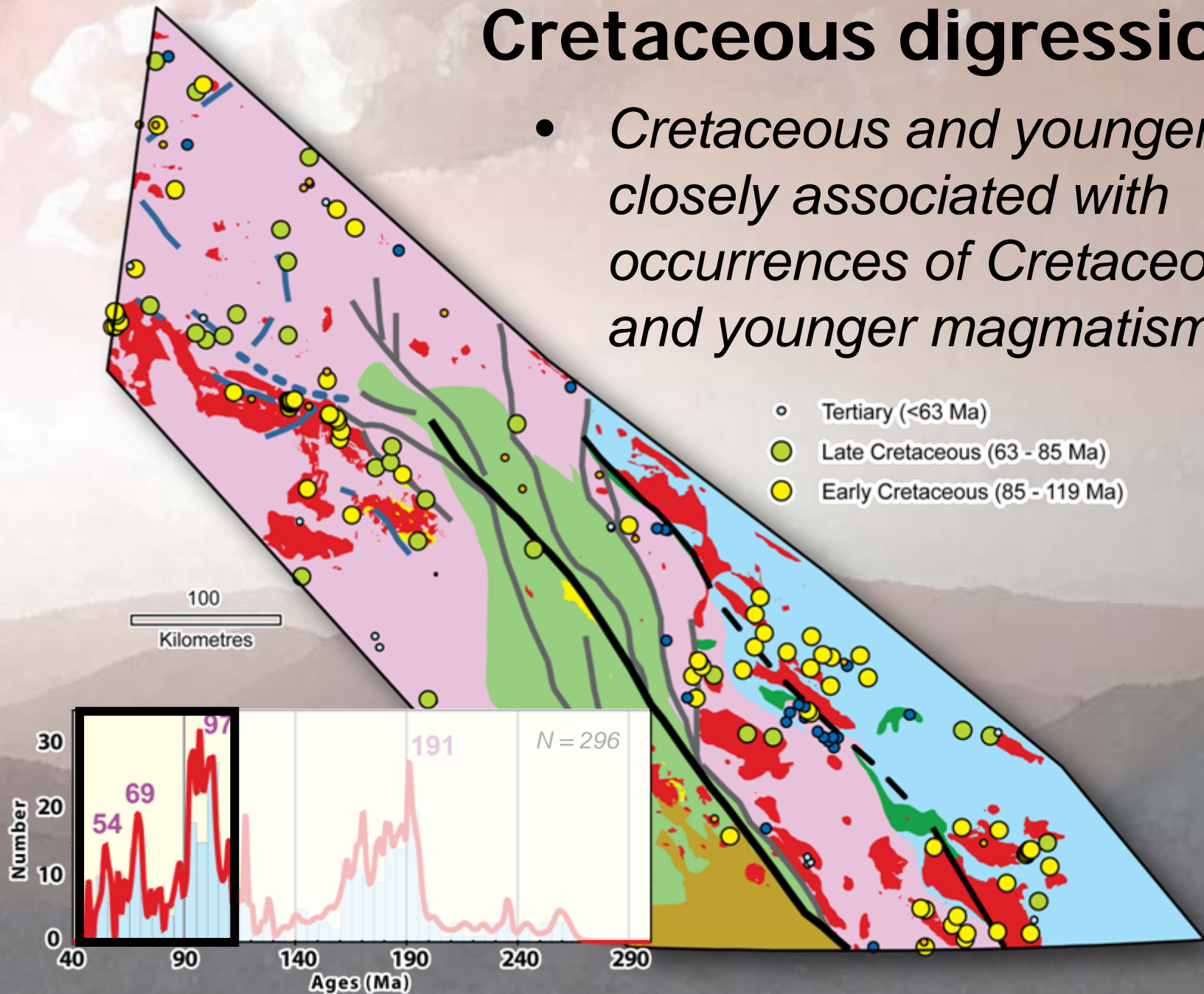
Mica Cooling Ages

- *Rapid cooling and exhumation of Yukon-Tanana terrane in Early Jurassic time*
- *Timing of Minto mineralization*

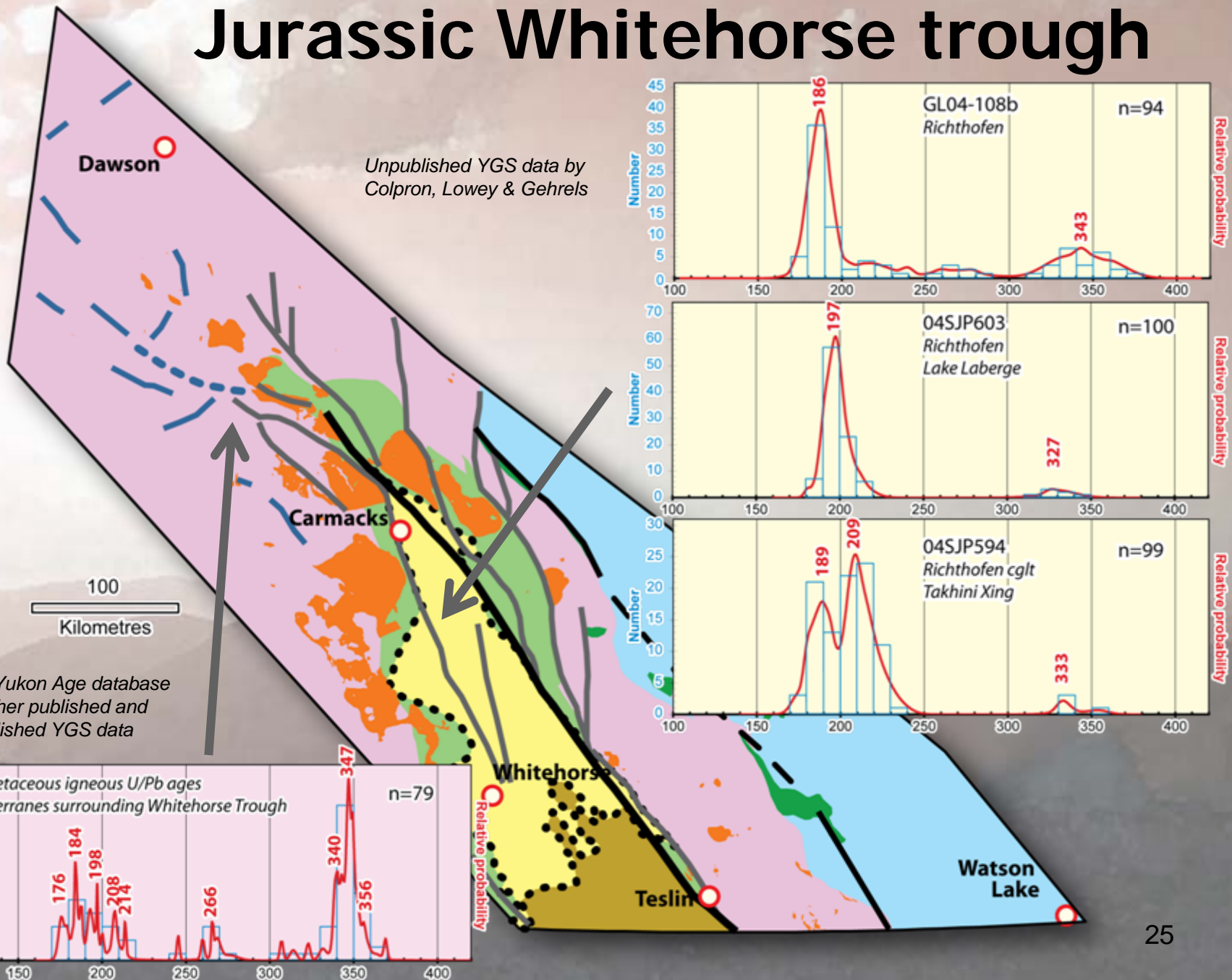


Cretaceous digression...

- Cretaceous and younger ages closely associated with occurrences of Cretaceous and younger magmatism*

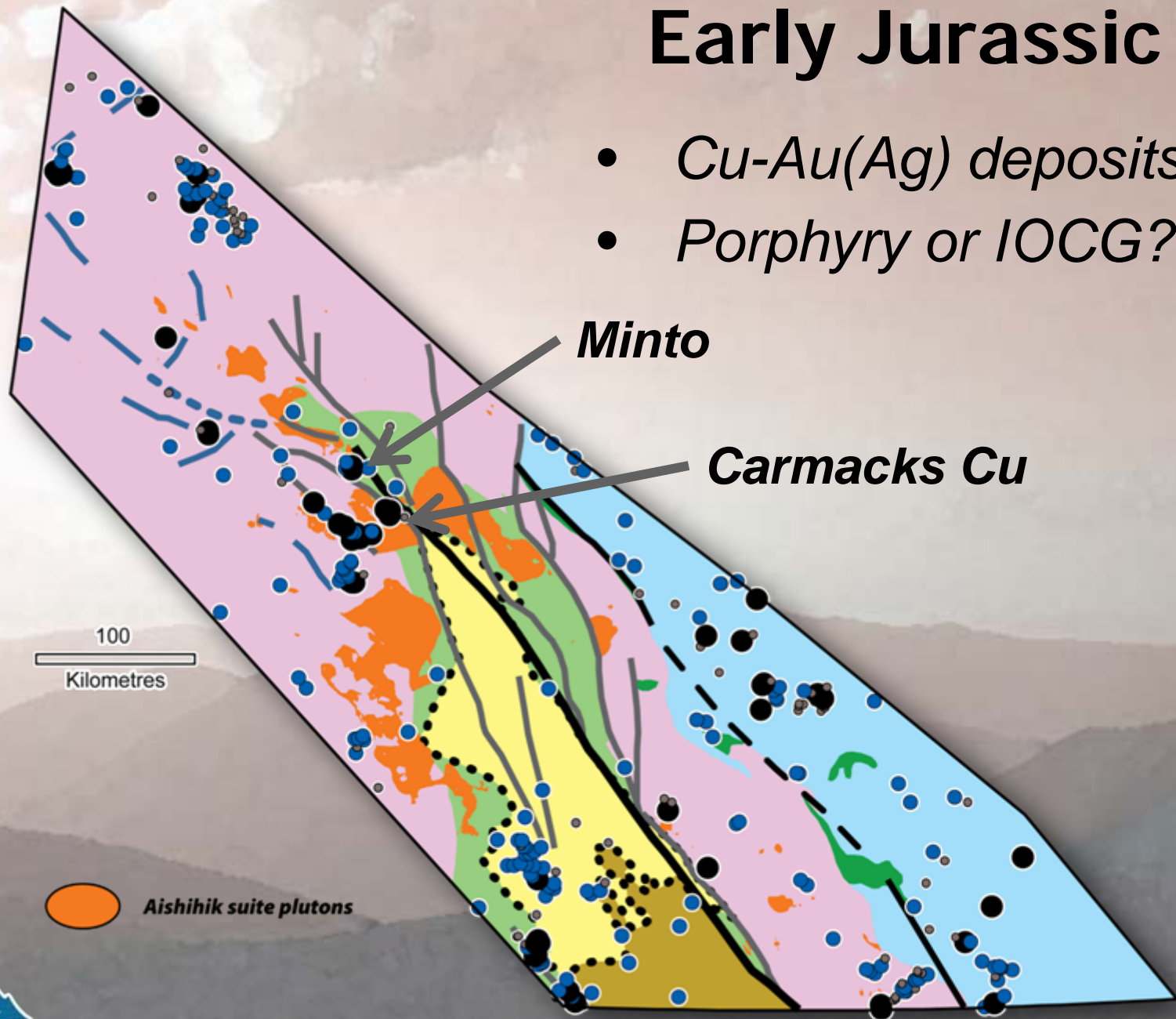


Jurassic Whitehorse trough



Early Jurassic

- *Cu-Au(Ag) deposits*
- *Porphyry or IOCG?*

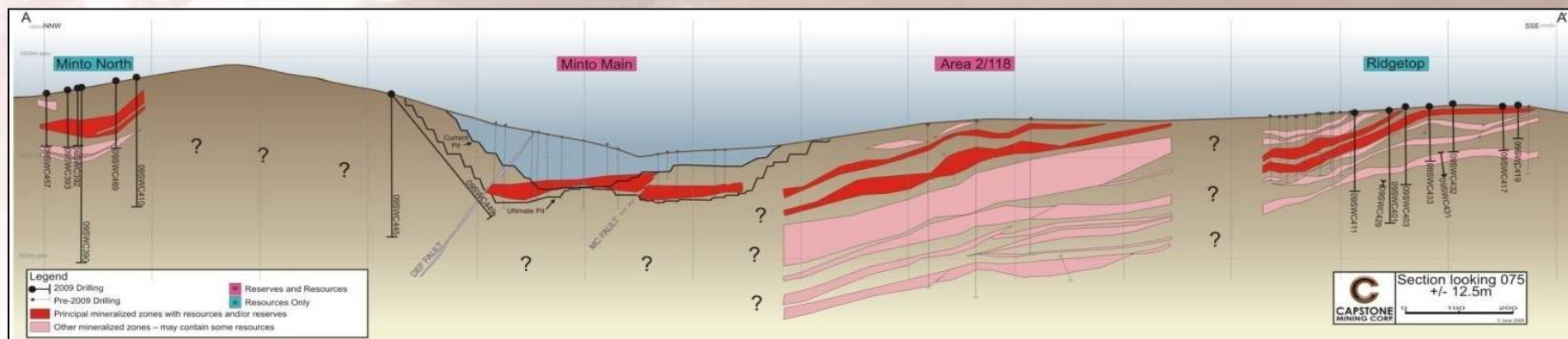




Capstone Mining Corp.

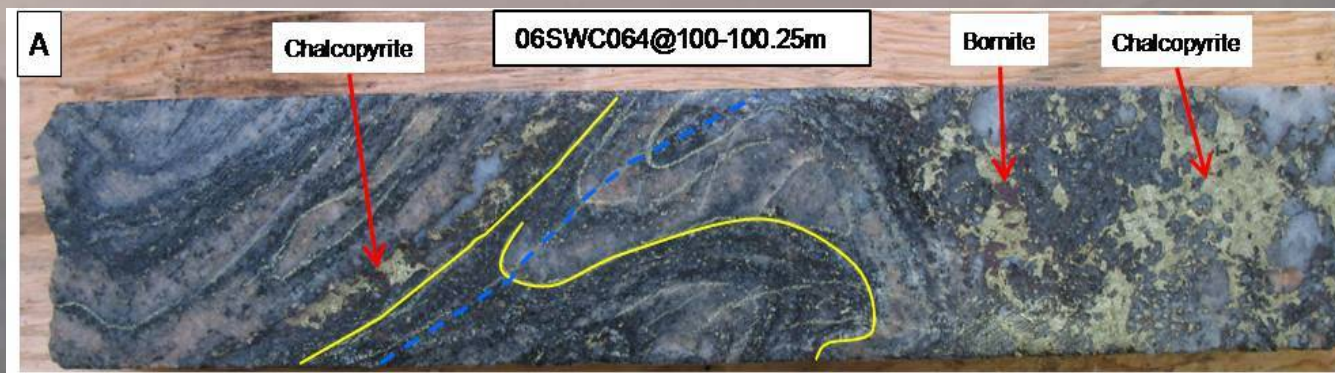
Minto mine

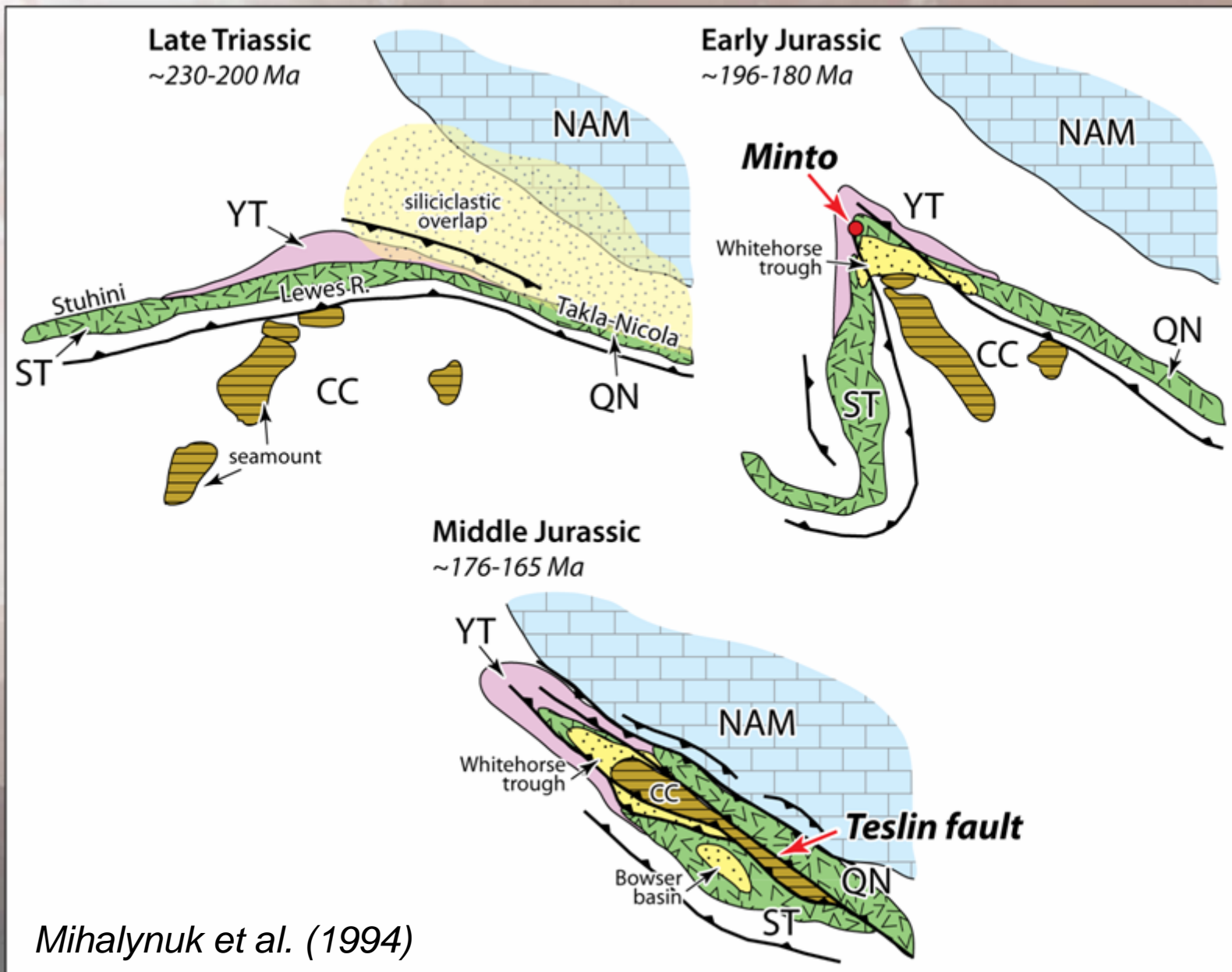
<http://capstonemining.com/s/Minto.asp>



(looking east)

- *M+I resources: ~30 MT @ 1.22% Cu, 0.45 g/t Au, 4.48 g/t Ag*
- *Mineralization hosted in N/NE-dipping foliated/gneissic zones*
- *Multiple stacked mineralized horizons*
- *Several generations of foliations (S. Hood, MSc candidate, UBC)*

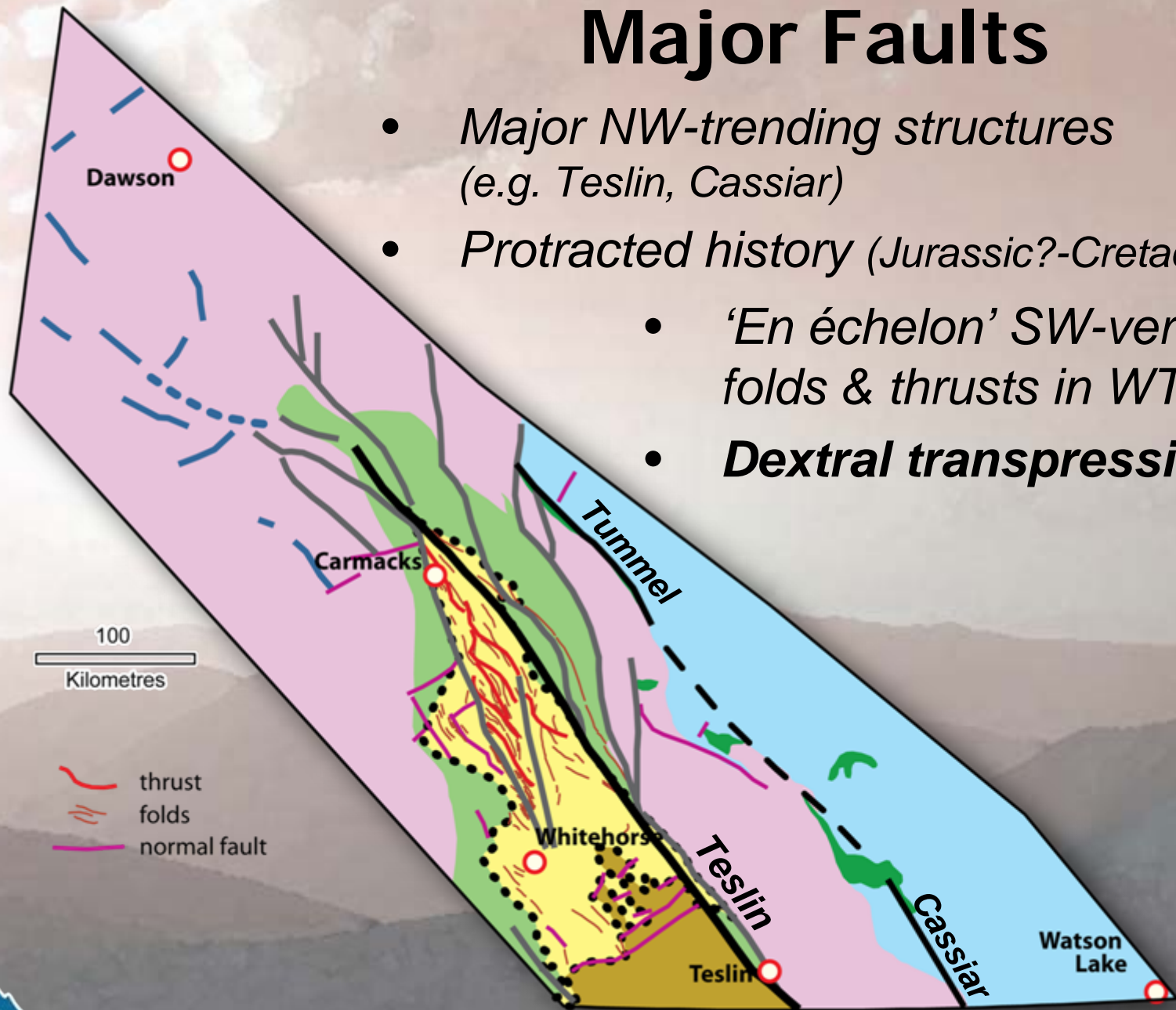




Mihalynuk et al. (1994)

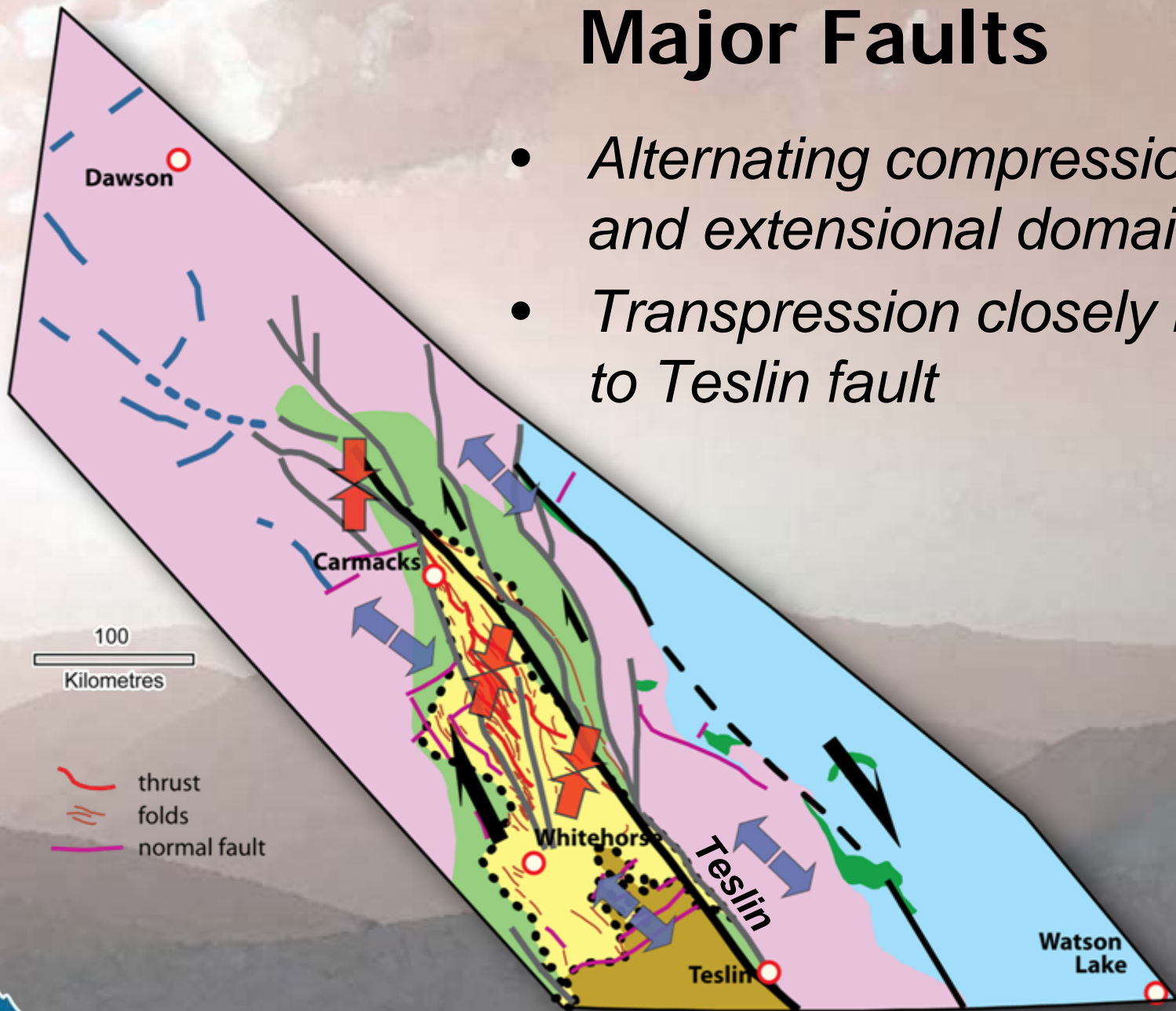
Major Faults

- Major NW-trending structures (e.g. Teslin, Cassiar)
- Protracted history (Jurassic?-Cretaceous)
 - 'En échelon' SW-verging folds & thrusts in WT
 - **Dextral transpression**



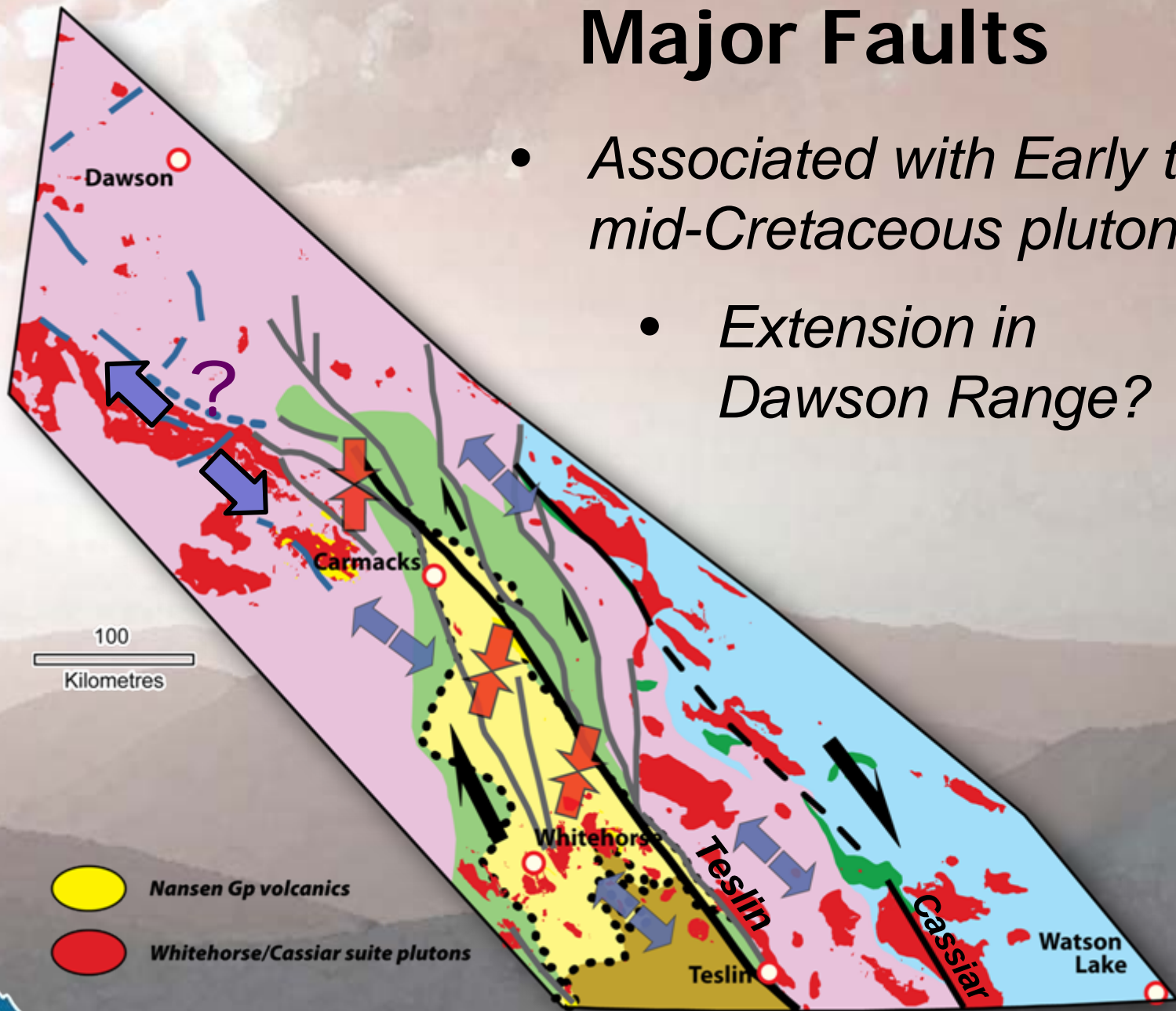
Major Faults

- *Alternating compressional and extensional domains*
- *Transpression closely linked to Teslin fault*



Major Faults

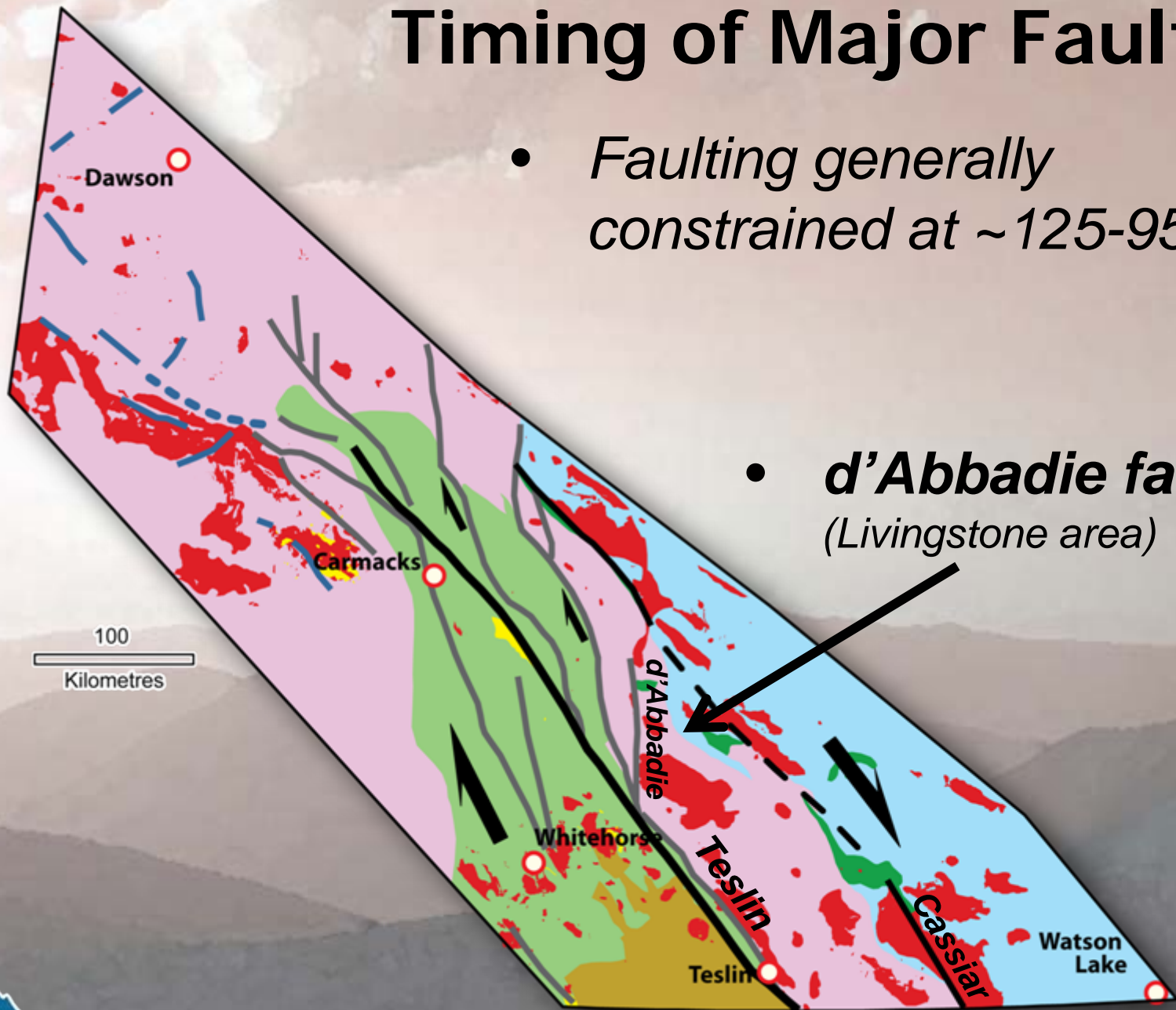
- Associated with *Early to mid-Cretaceous* plutons
- *Extension in Dawson Range?*



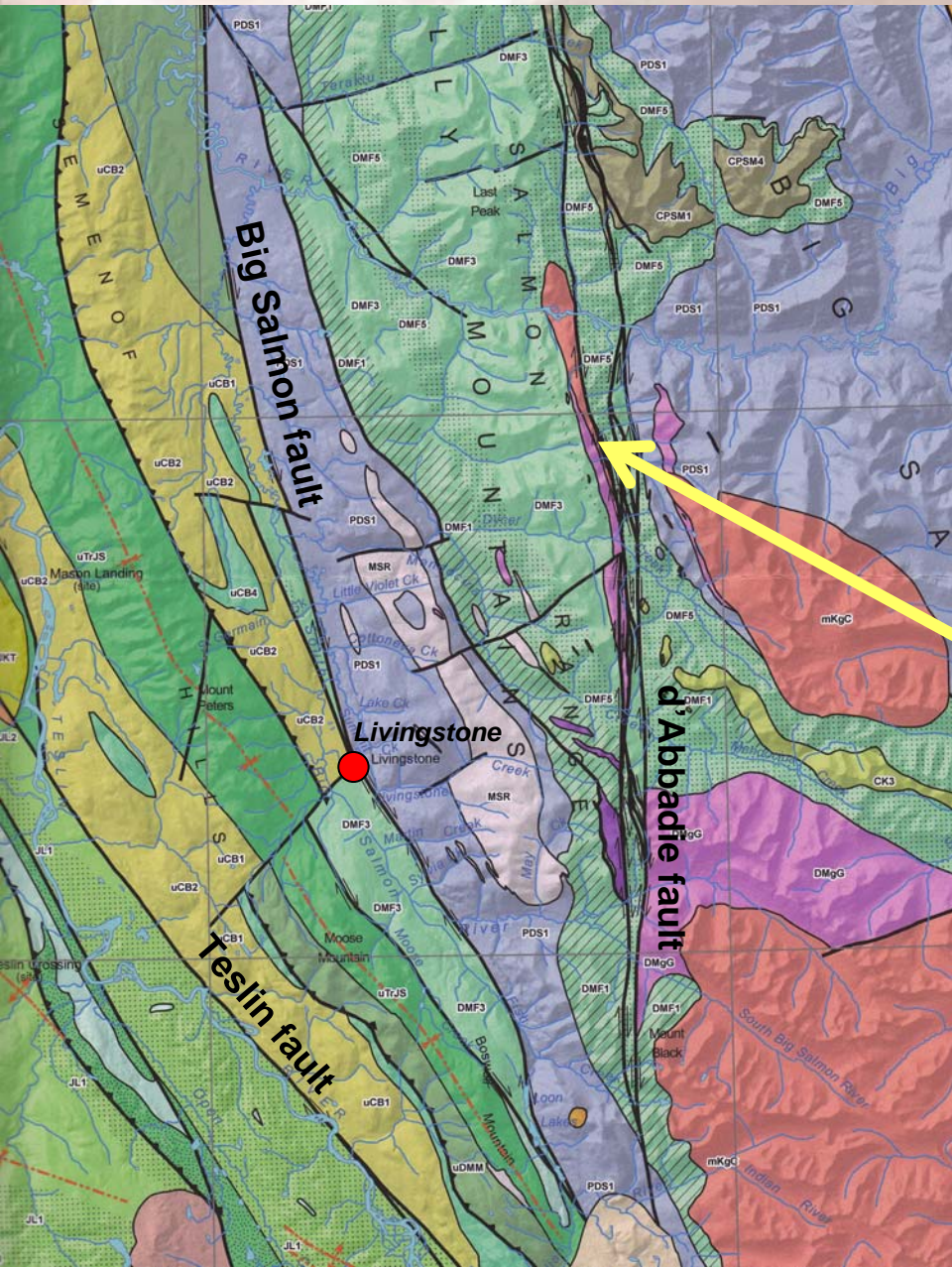
Timing of Major Faults

- *Faulting generally constrained at ~125-95 Ma*

- ***d'Abbadie fault***
(Livingstone area)



d'Abbadie fault



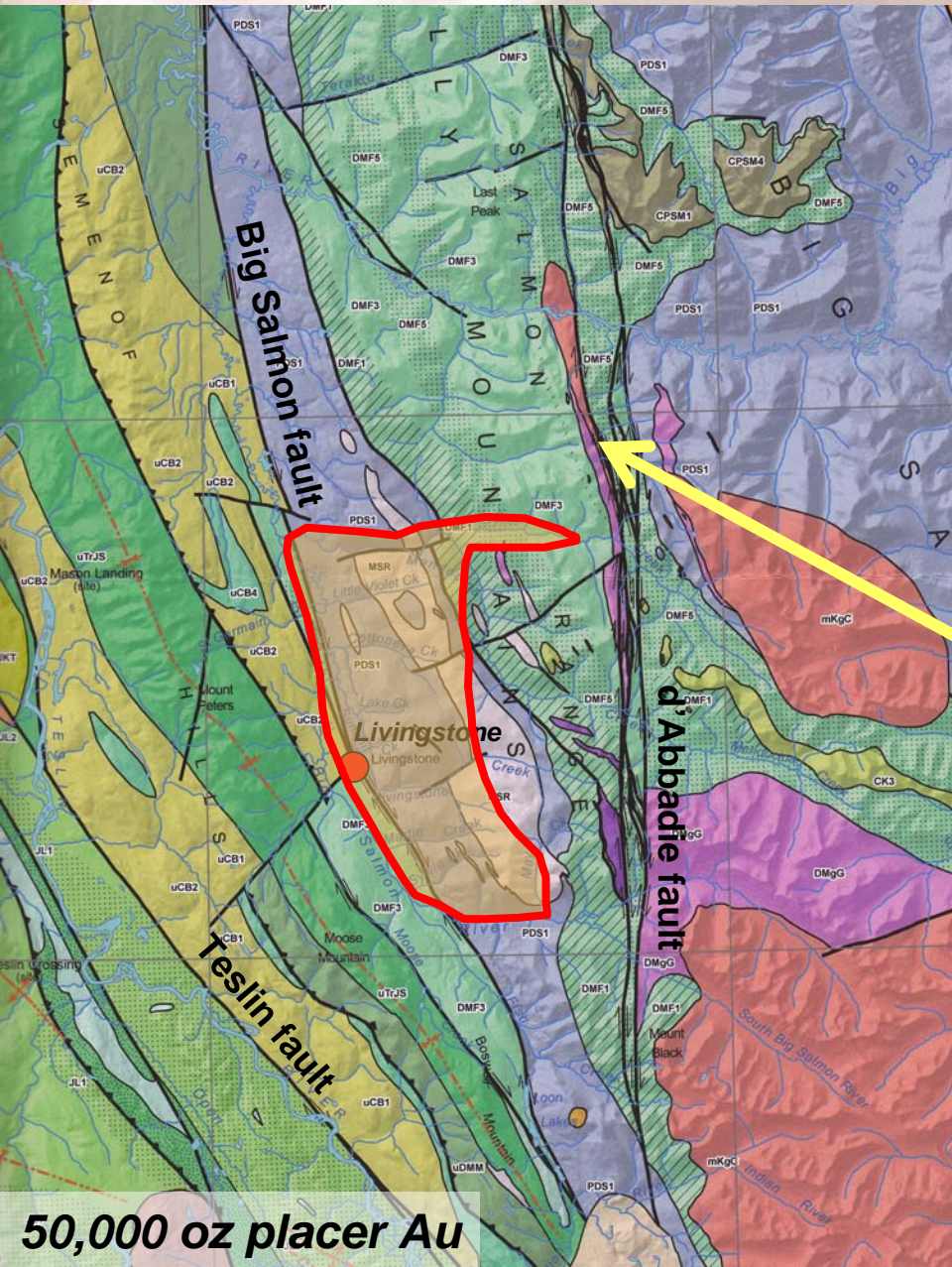
Last Peak granite

ca. 96 Ma



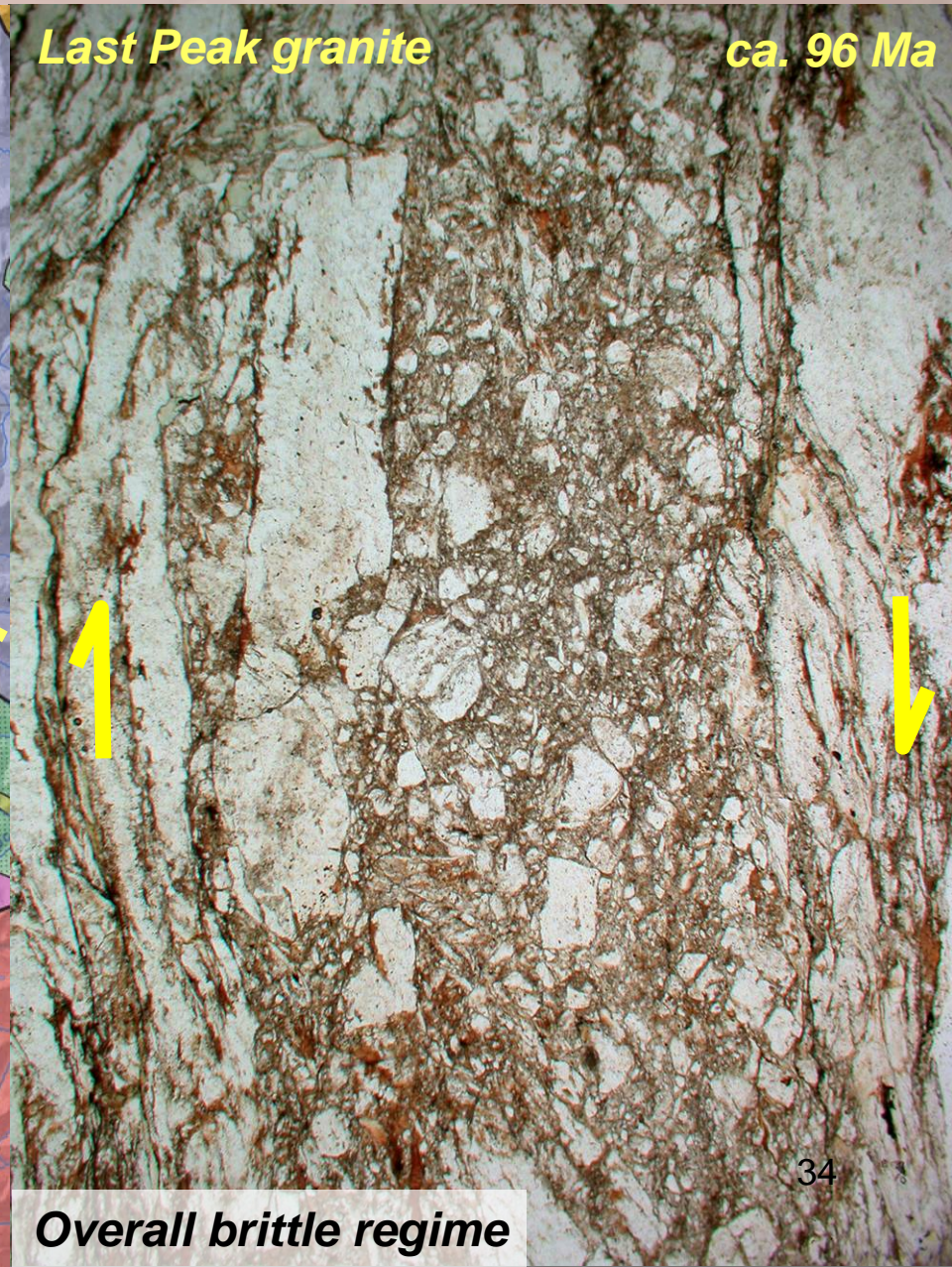
Syntectonic emplacement

d'Abbadie fault



Last Peak granite

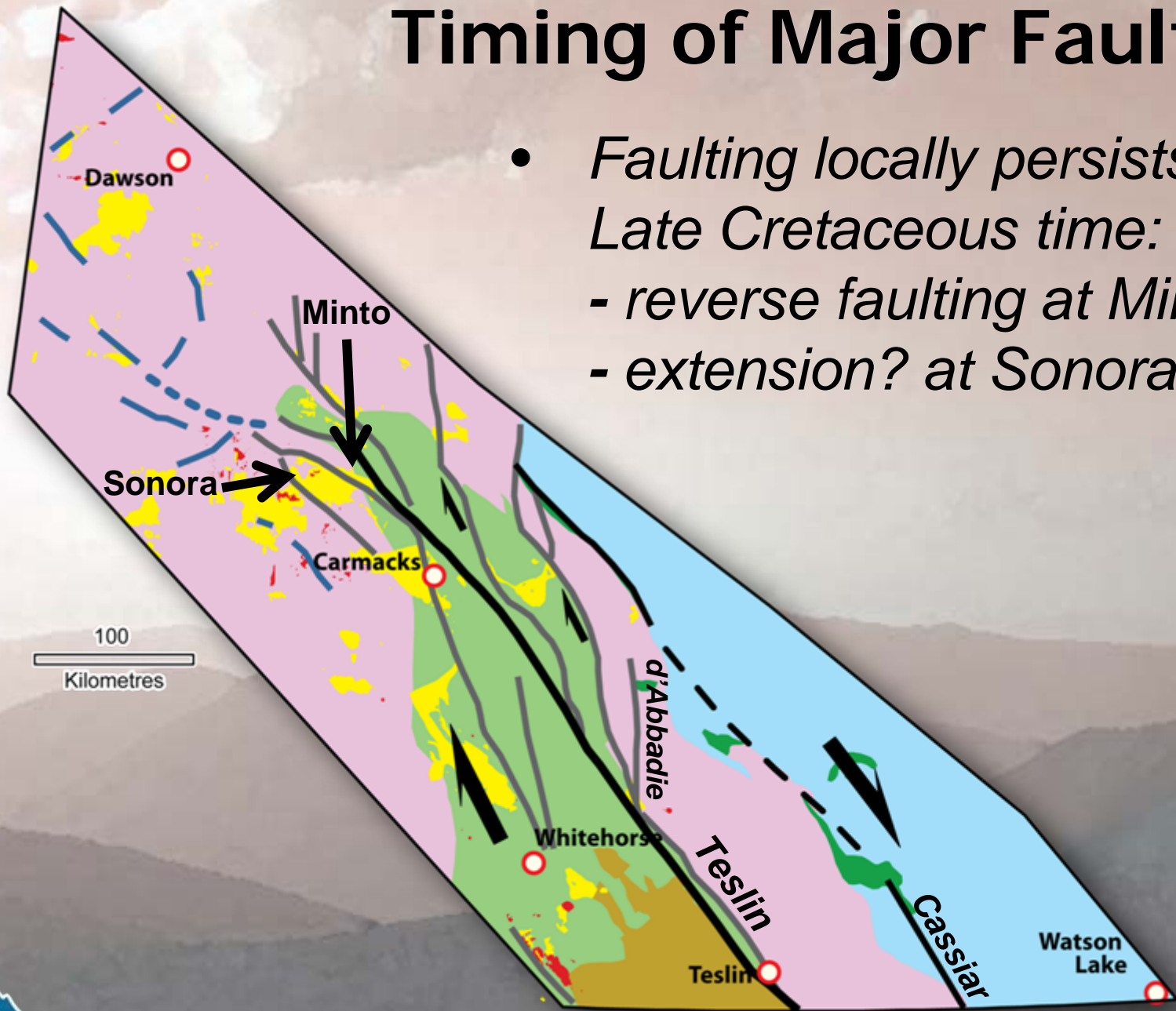
ca. 96 Ma



Overall brittle regime

Timing of Major Faults

- *Faulting locally persists into Late Cretaceous time:*
 - *reverse faulting at Minto*
 - *extension? at Sonora*





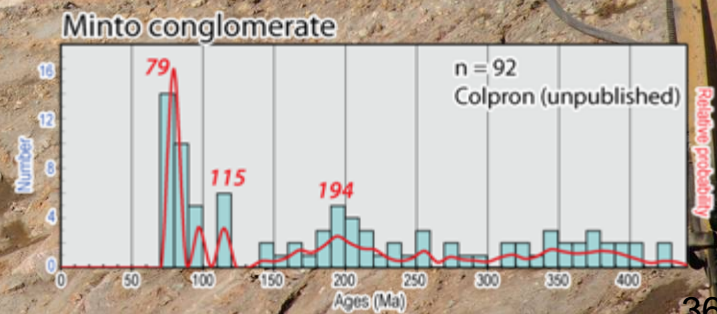
Capstone Mining Corp.

Minto mine

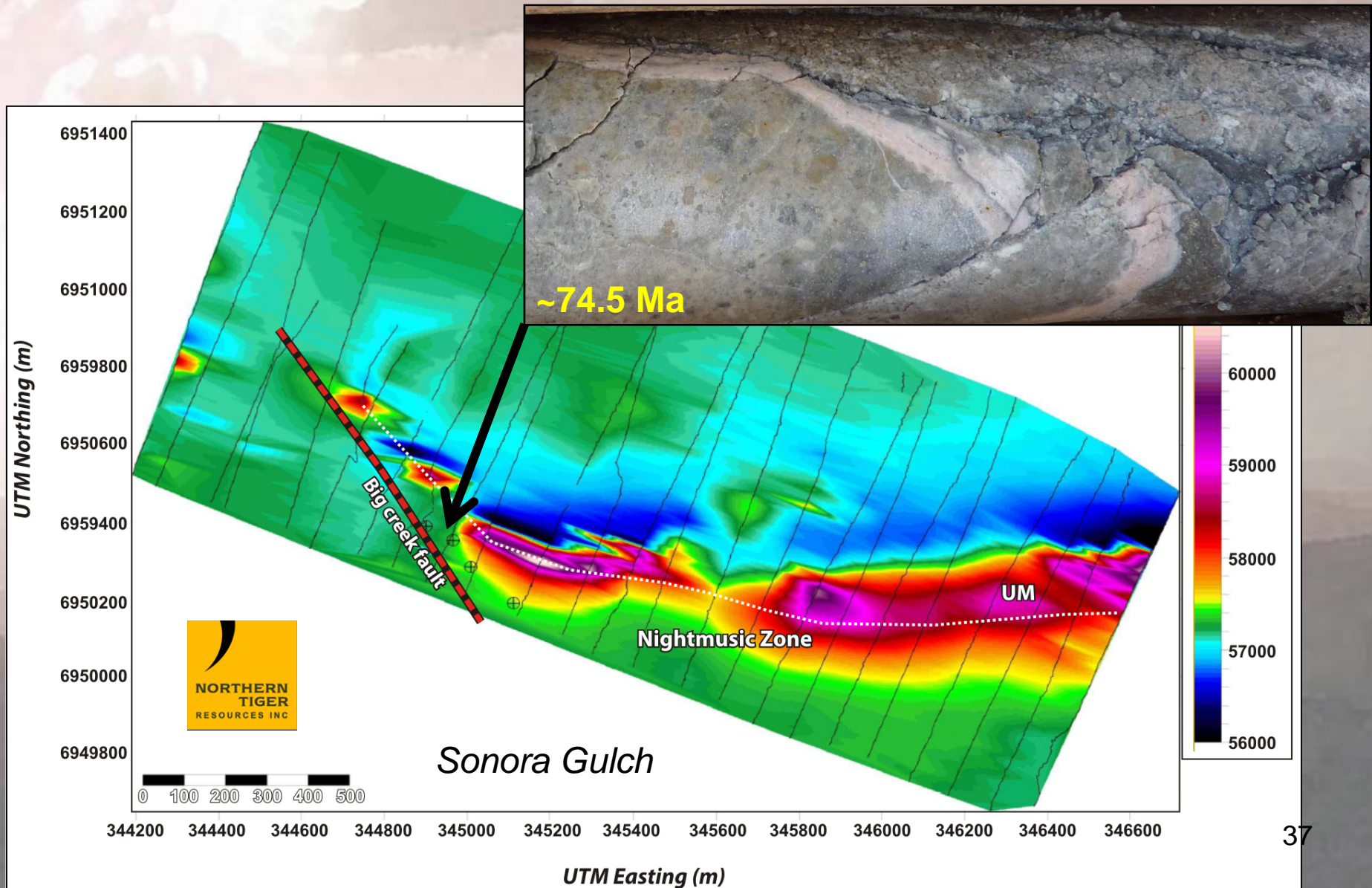
Looking east

*Early Jurassic
granodiorite*

*Upper Cretaceous
conglomerate*

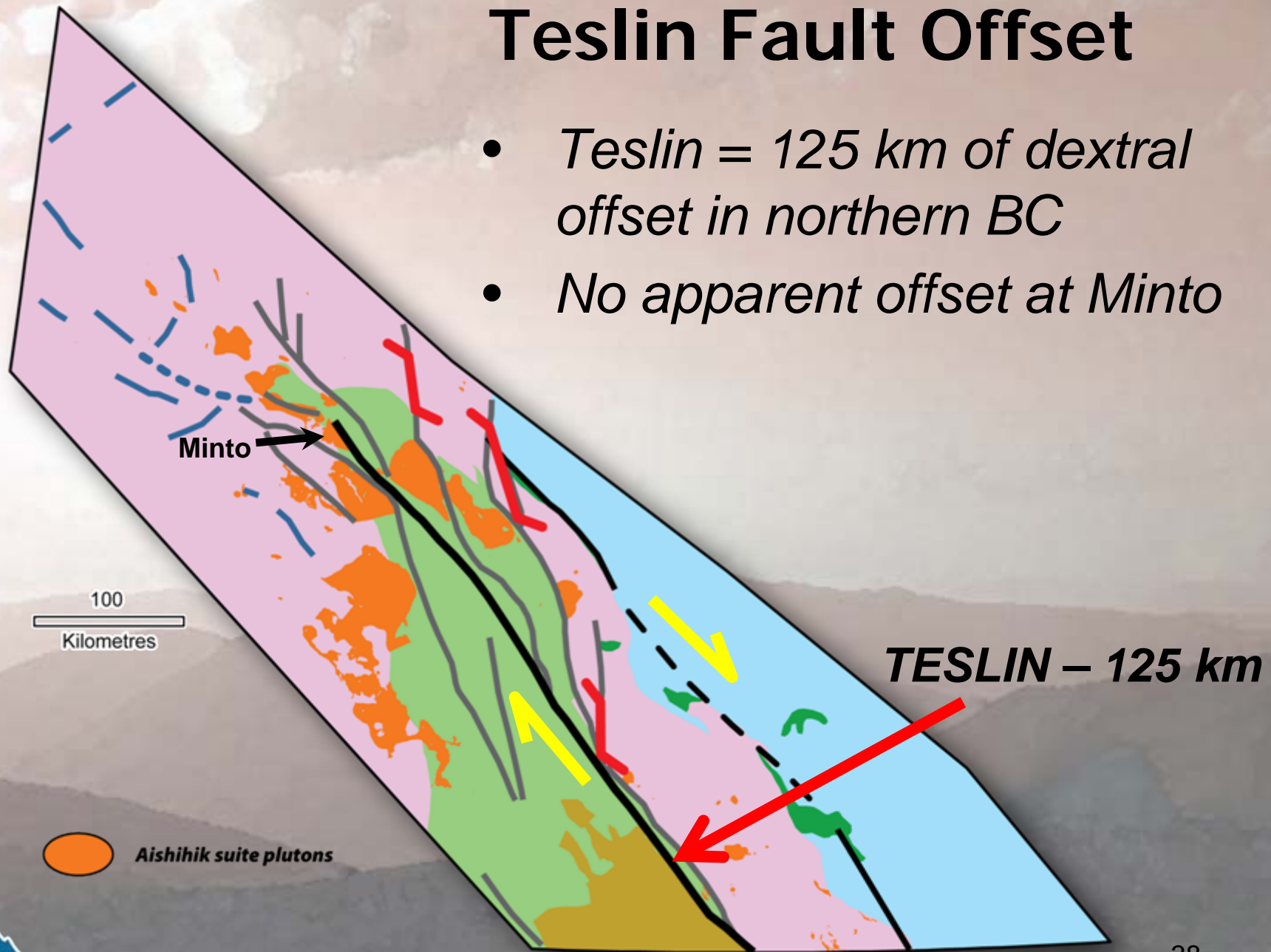


Big Creek fault

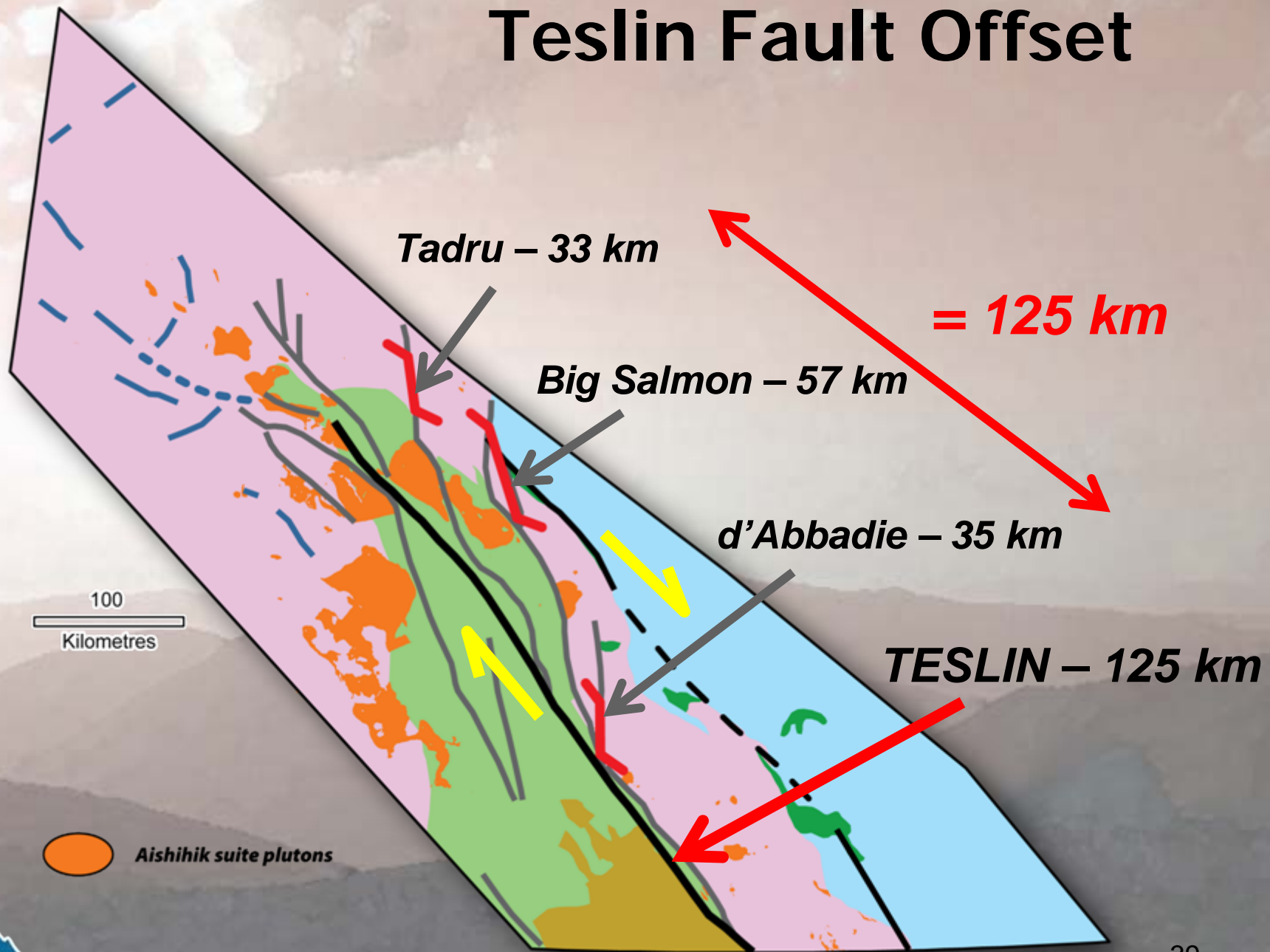


Teslin Fault Offset

- *Teslin = 125 km of dextral offset in northern BC*
- *No apparent offset at Minto*

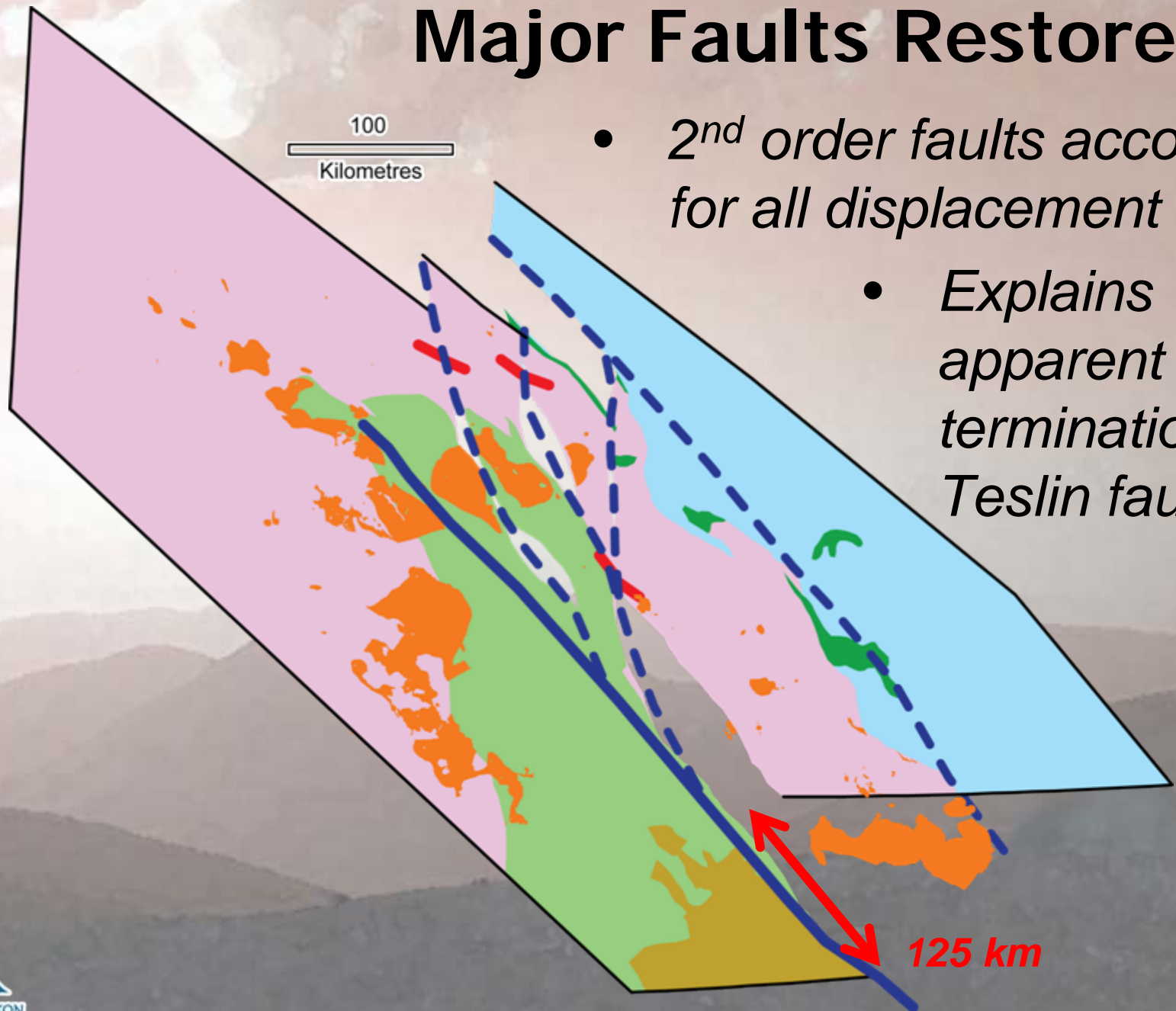


Teslin Fault Offset

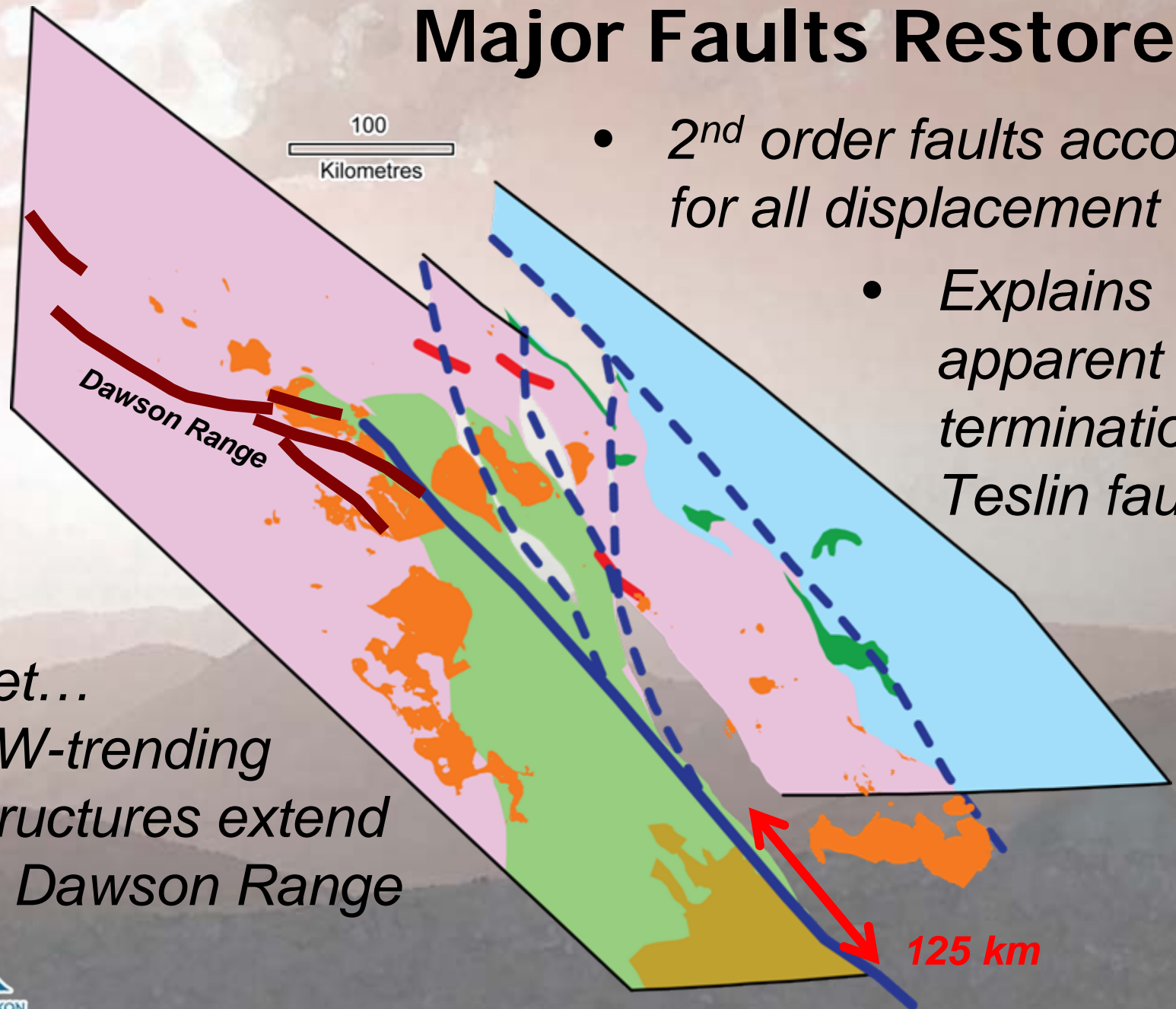


Major Faults Restored

- *2nd order faults account for all displacement*
- *Explains apparent termination of Teslin fault*



Major Faults Restored

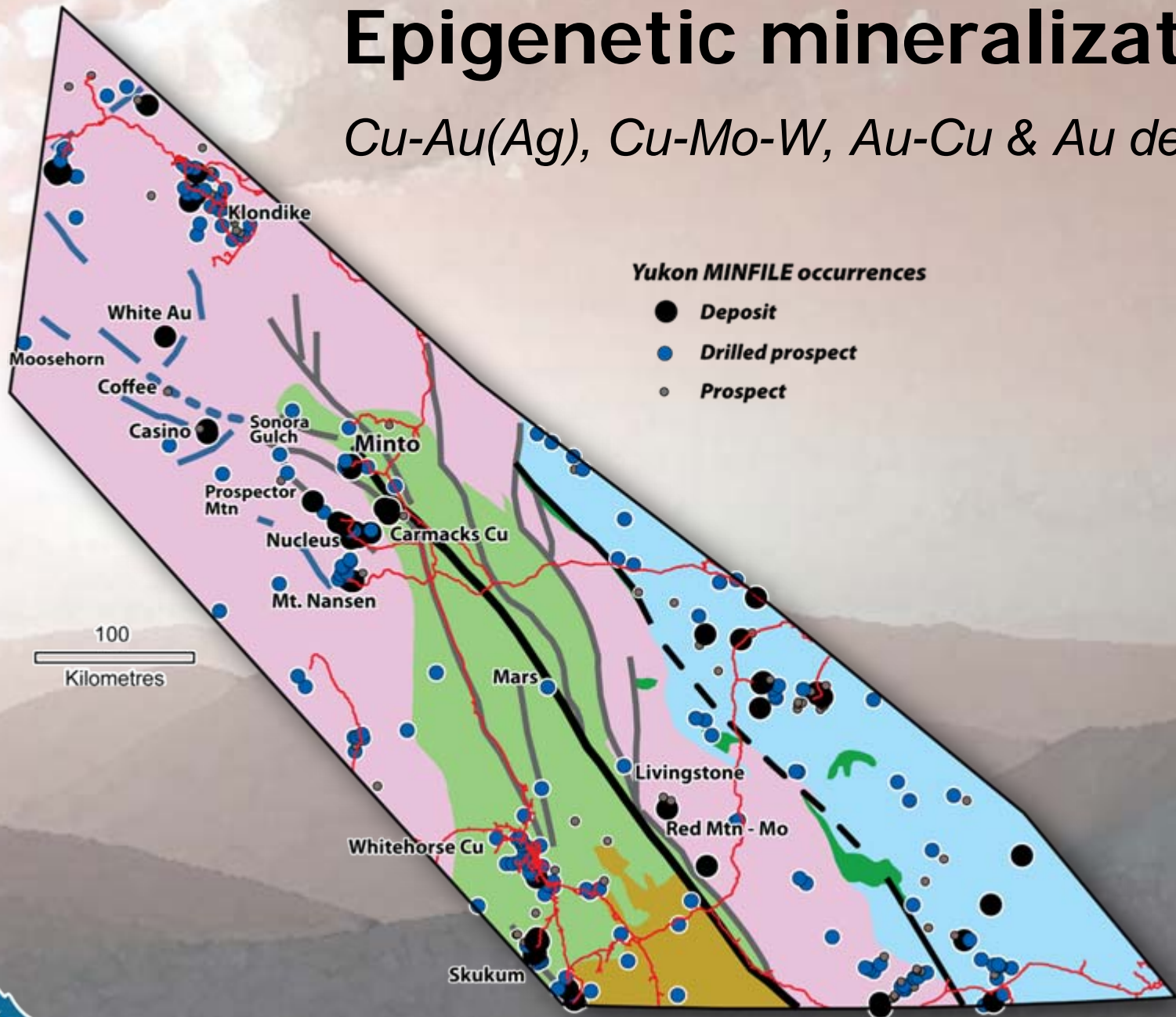


- *2nd order faults account for all displacement*
- *Explains apparent termination of Teslin fault*

- *Yet... NW-trending structures extend to Dawson Range*

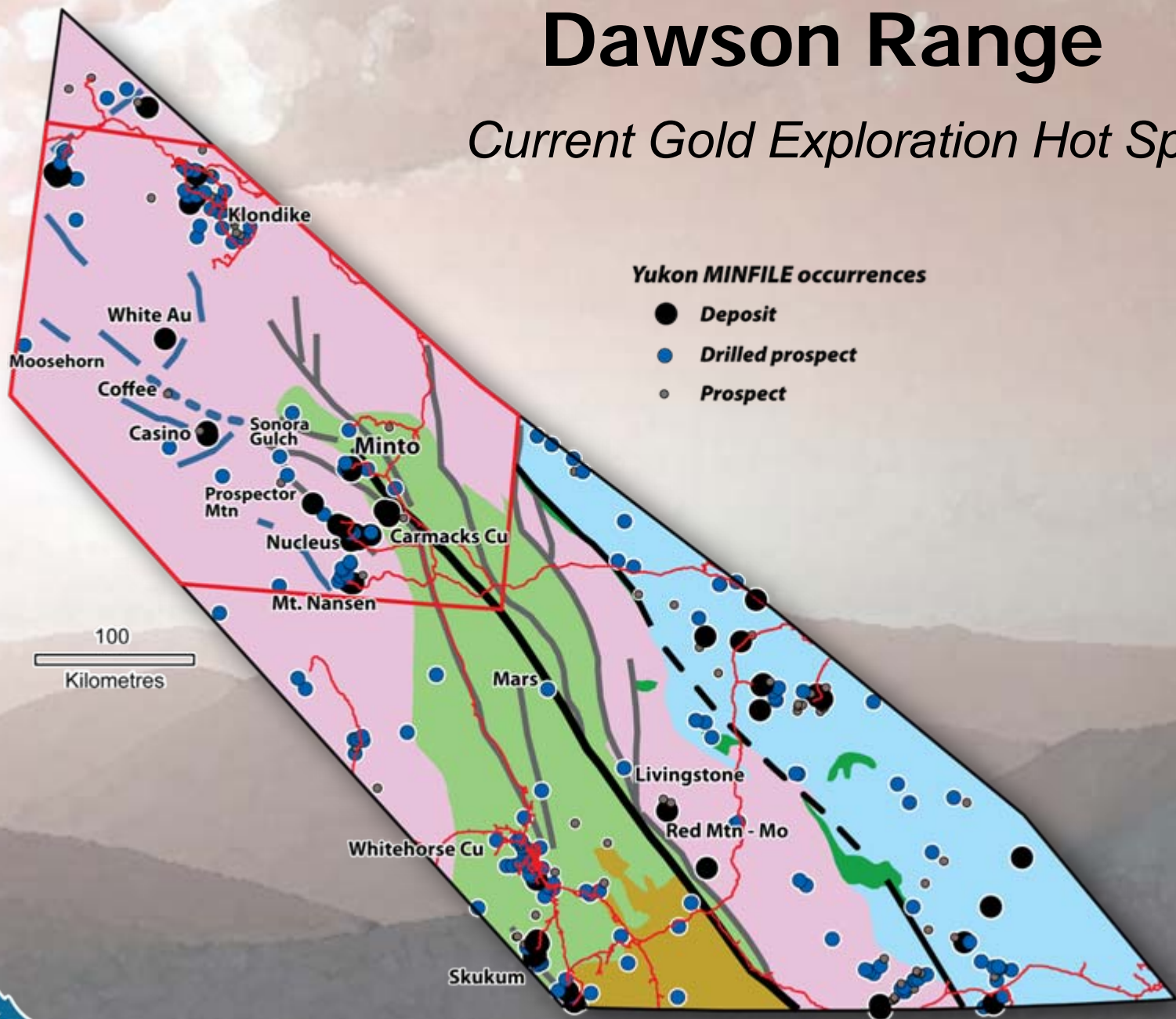
Epigenetic mineralization

Cu-Au(Ag), Cu-Mo-W, Au-Cu & Au deposits

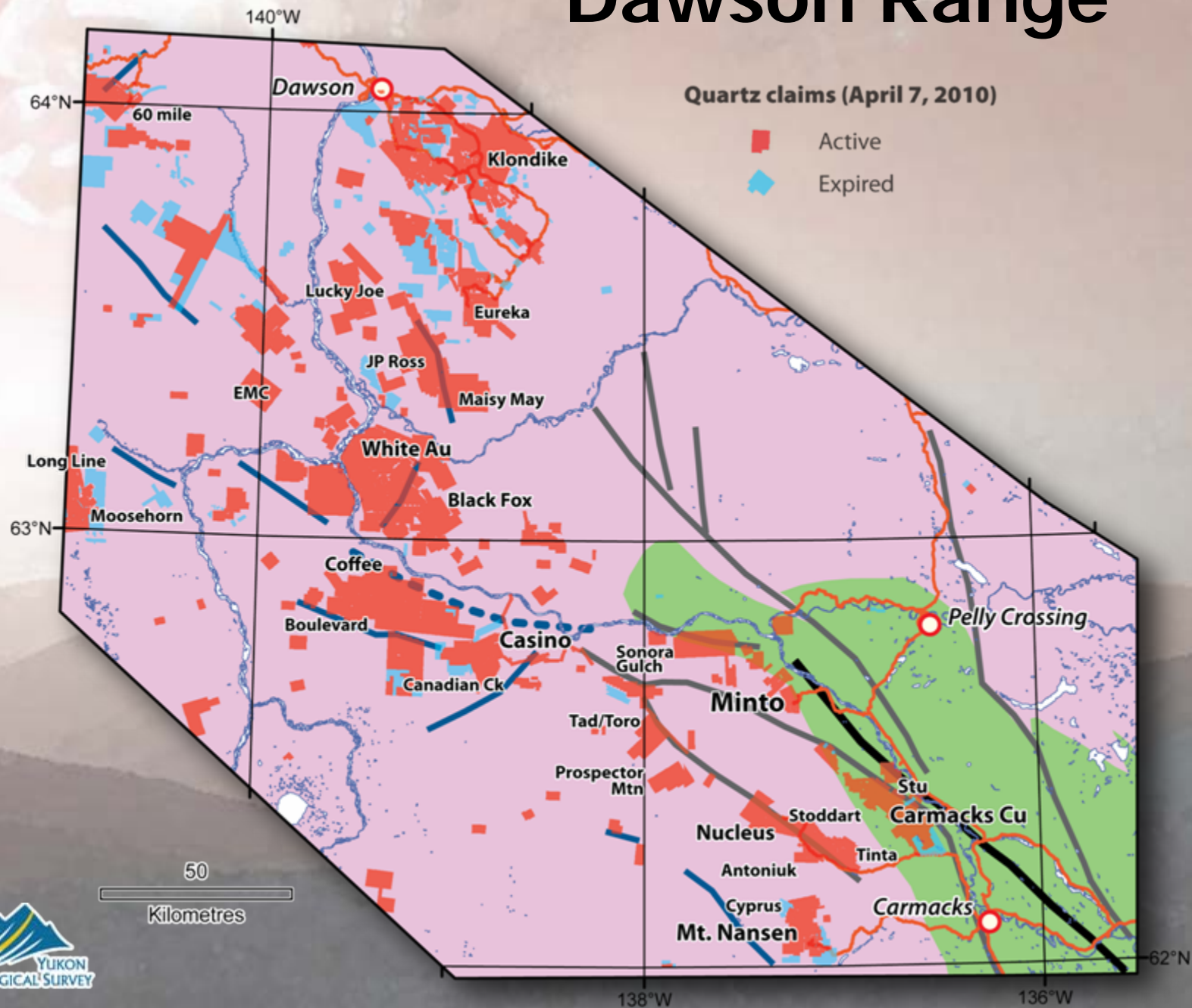


Dawson Range

Current Gold Exploration Hot Spot

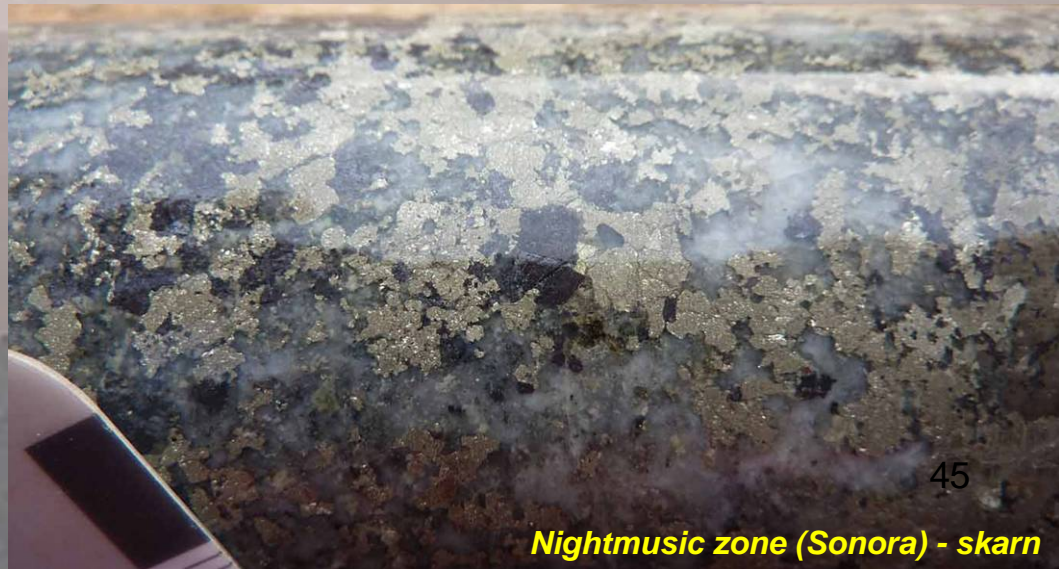


Dawson Range

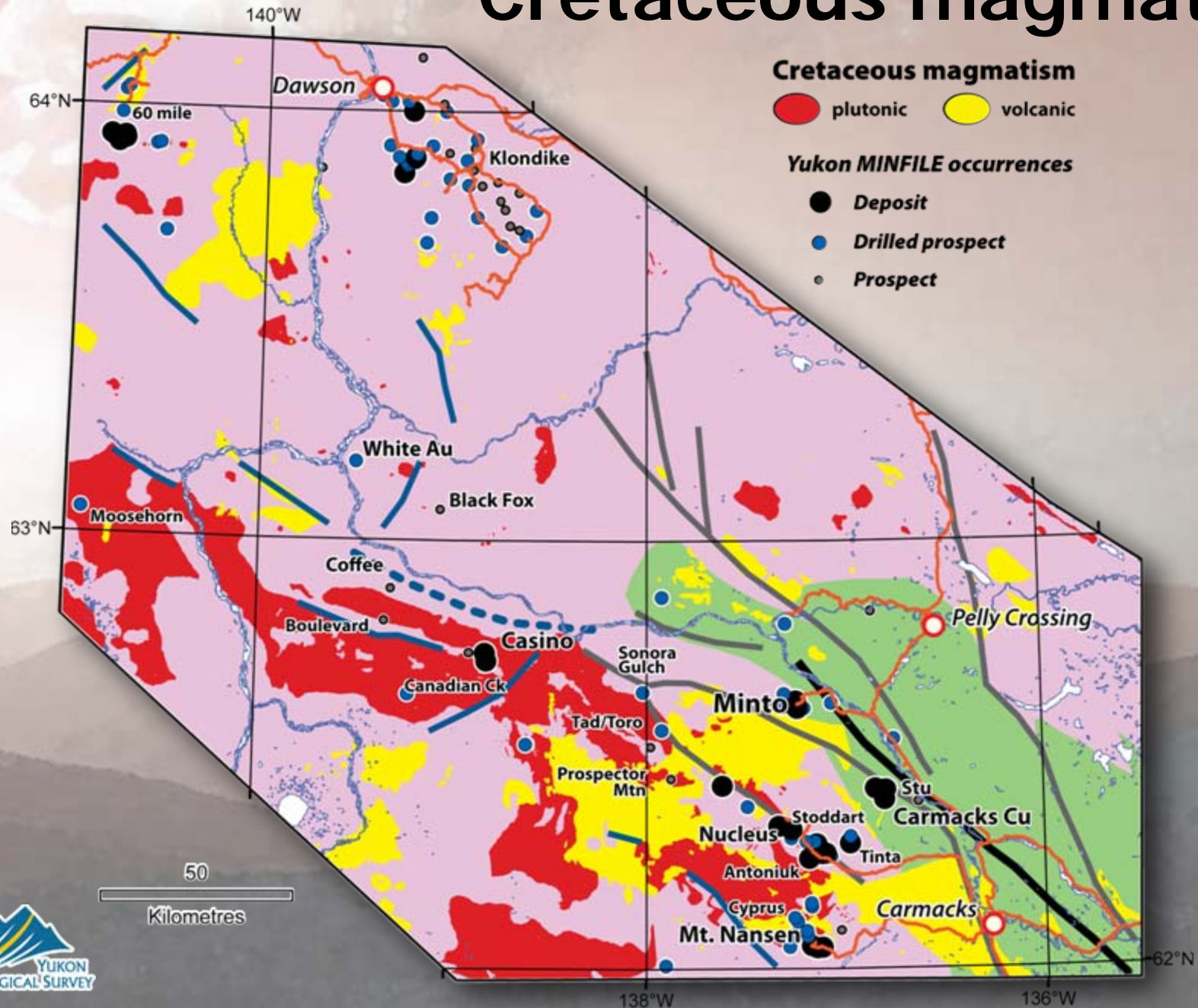


Dawson Range

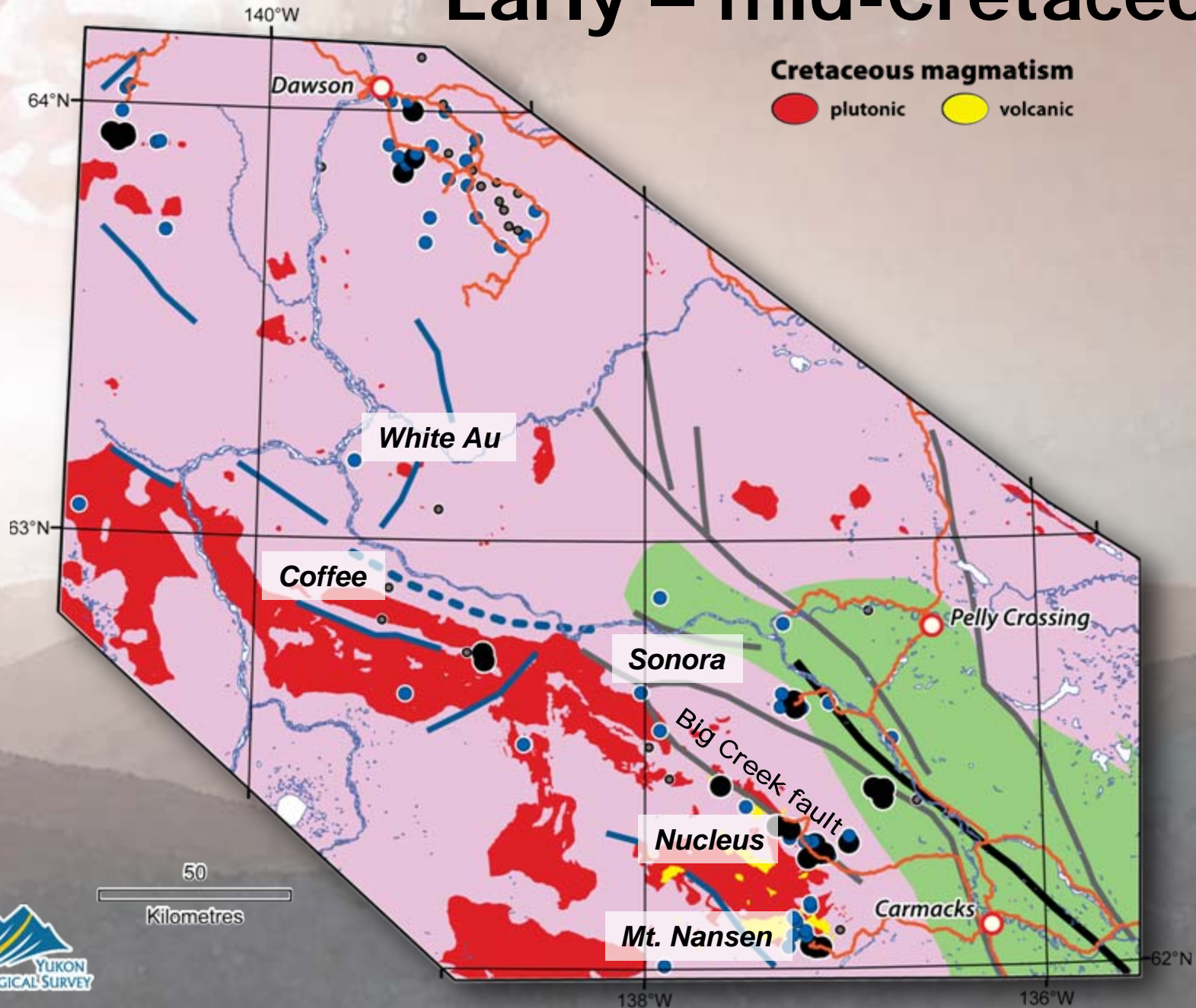
- *Wide range in style of Cu-Au mineralization*
 - *Porphyry, skarn/replacement, breccia, veins, epithermal overprint*
- *Commonly structurally-controlled*
- *1st order NW – WNW-trending faults*
 - *2nd order NE- or N-trending faults*
- *Evidence of polyphase mineralization common*



Cretaceous magmatism



Early – mid-Cretaceous

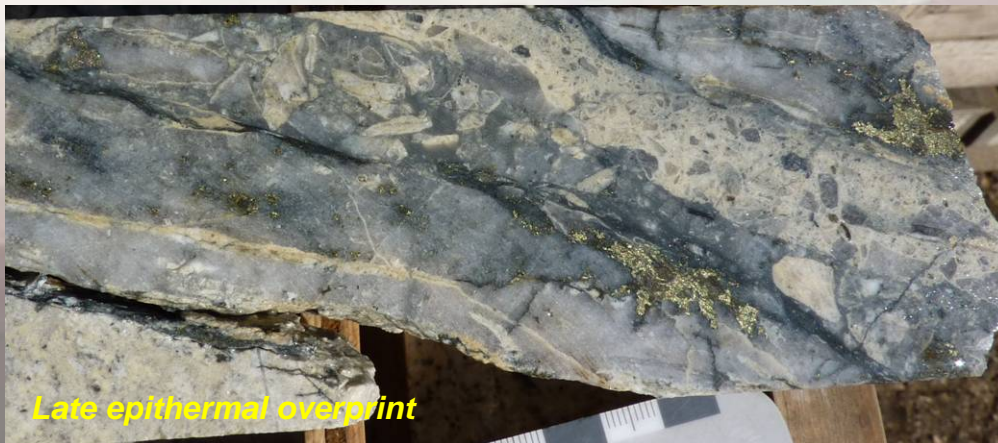


Nucleus zone (Freegold Mtn)



- >1 Moz Au @ 0.5 g/t
- Skarn
- Porphyry dikes
- Breccia, stockwork
- Polyphase veining
- 2 mineralizing events:
 - ~ 125-95 Ma – struct.-controlled
 - ~ 75 Ma – porphyry-epithermal

www.northernfreegold.com/



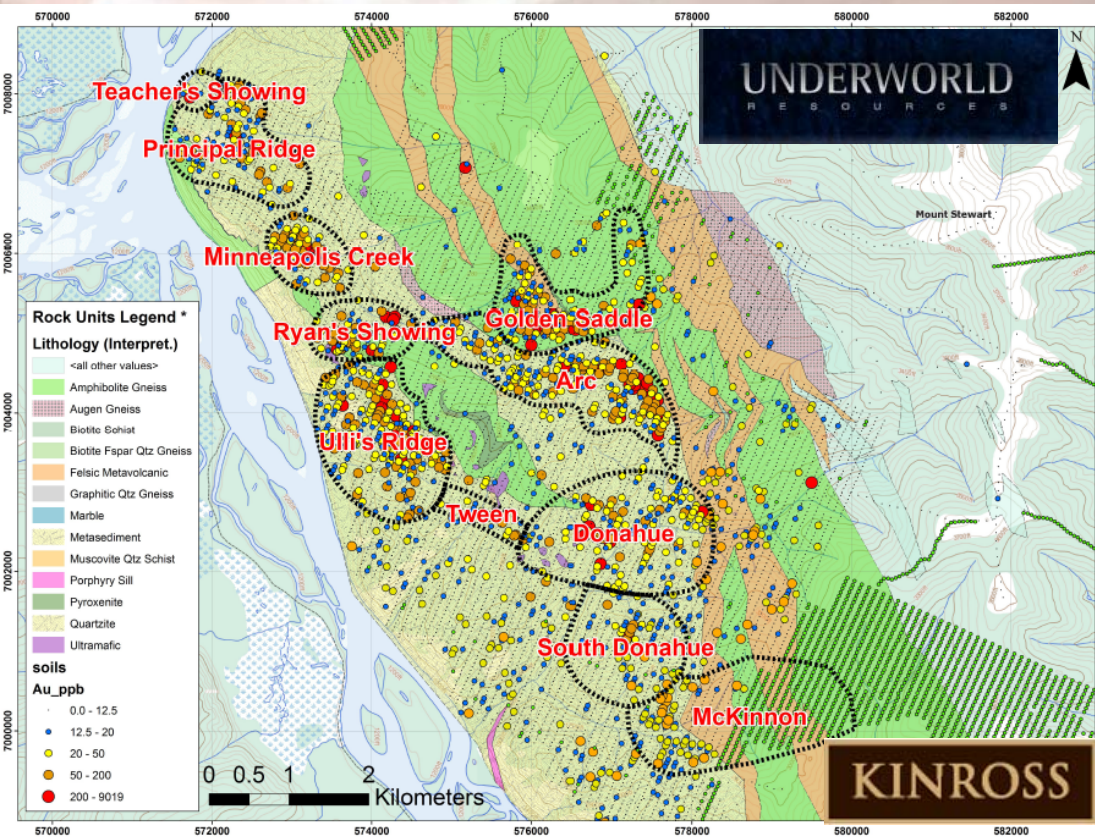
Nightmusic zone (Sonora Gulch)

www.northern-tiger.com/

- Skarn
- Replacement zones
- Structurally-controlled veins
- Stockwork
- Litswanite-altered UM (\gg Au)
- Late K epithermal overprint

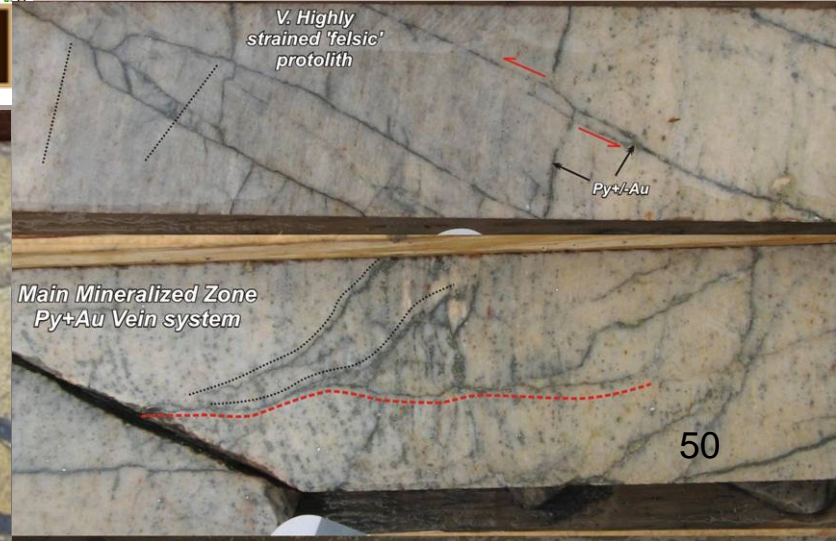


Whitegold project



- Golden Saddle zone
~1 Moz Au @ 3.2 g/t
- Breccia (structural & hydrothermal)
- Polyphase Py veins
- Stockwork
- UM association (>Au)

www.underworldresources.com/



Similarities between occurrences

Whitegold

Golden Saddle Zone

Underworld Resources

Amadeus Zone

Sonora Gulch

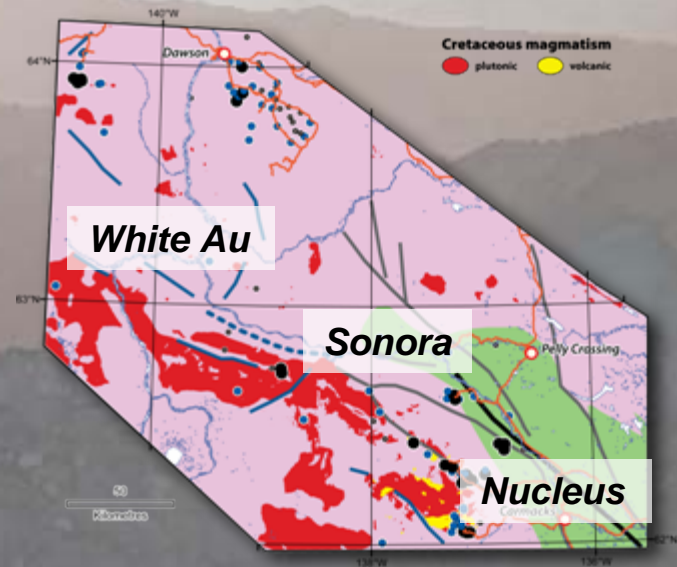
Northern Tiger Resource

Nucleus Zone

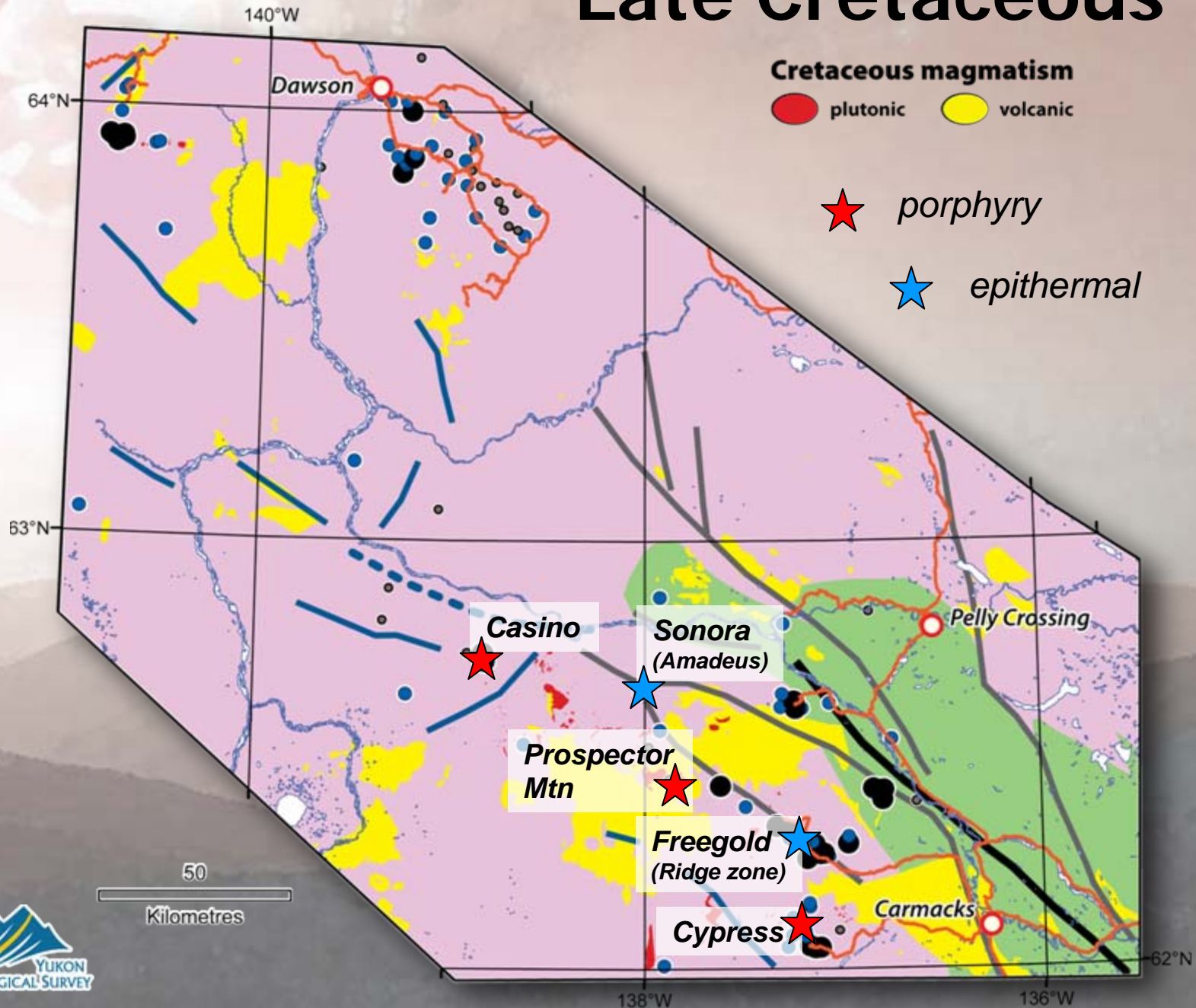
Freegold Mtn

Northern Freegold Resources

- *Similarities in style of mineralization and structural controls between Whitegold, Sonora & Nucleus*
- *Suggest same prevalent structural regime*

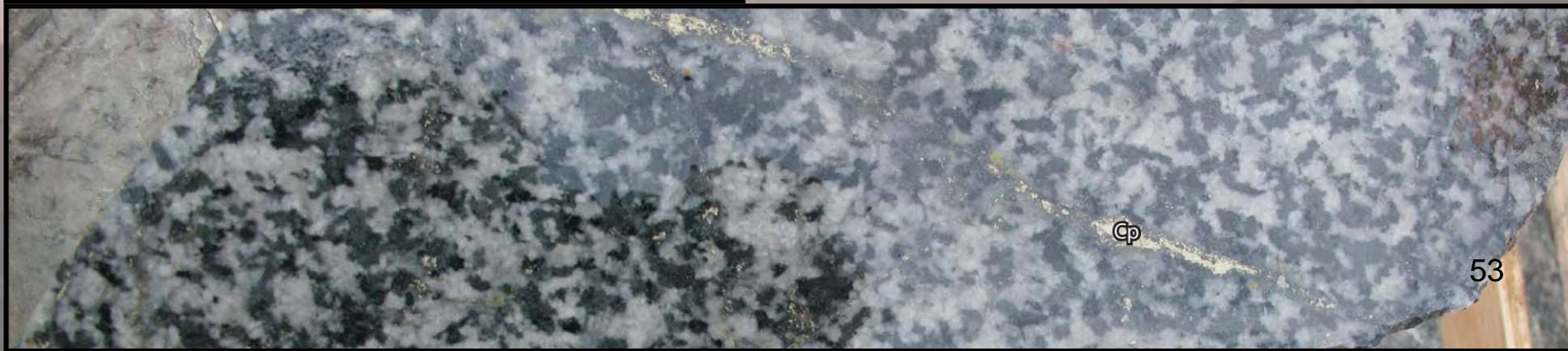


Late Cretaceous



Casino

- 914 Mt – 0.21% Cu, 0.024% Mo, and 0.24 g/t Au
- Au-Cu-Mo(Ag) porphyry
 - Late K Patton porphyry intruding mid-K Dawson Range batholith
 - Permitting stage

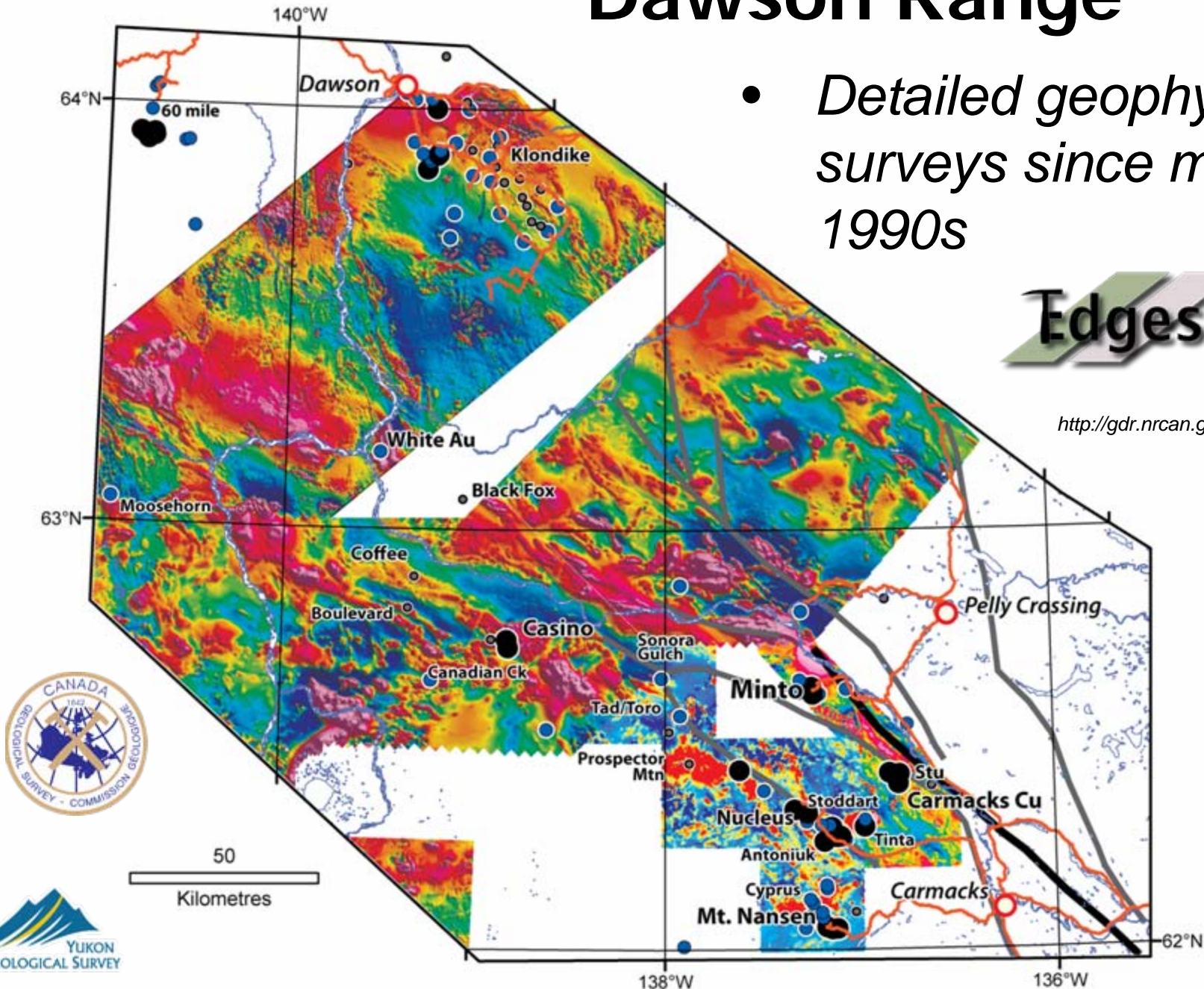


Dawson Range

- Detailed geophysical surveys since mid-1990s*

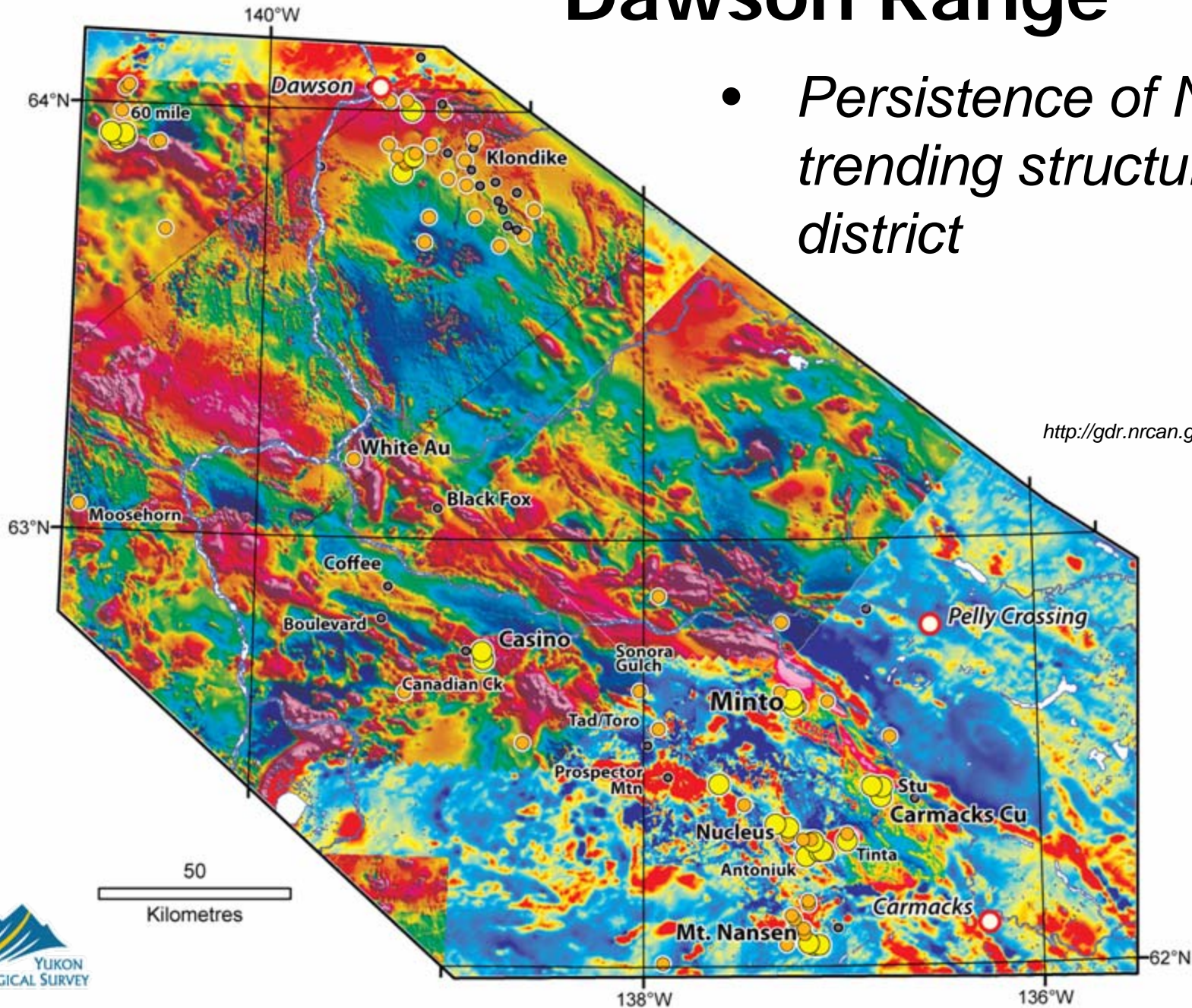
Edges

<http://gdr.nrcan.gc.ca>



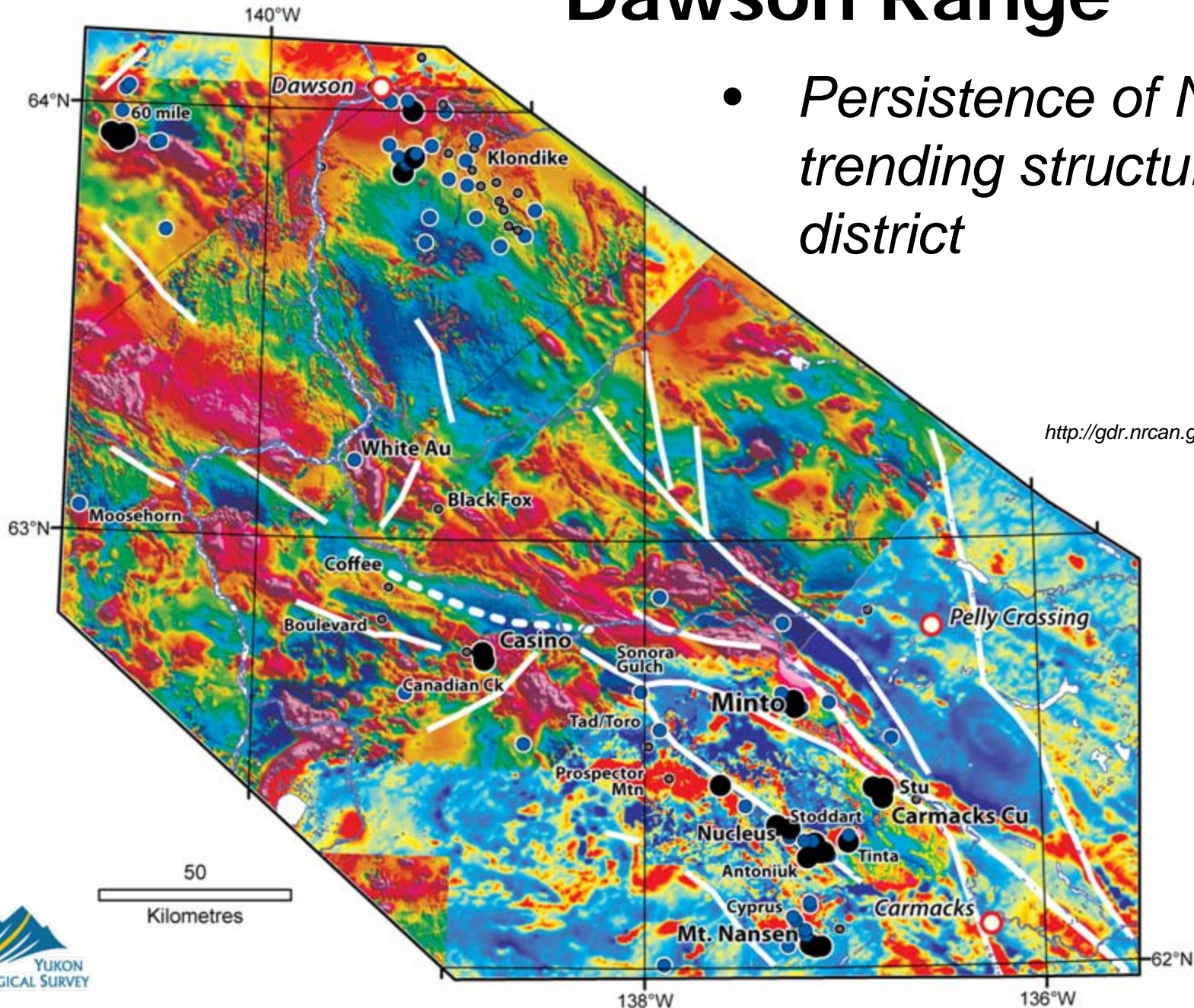
Dawson Range

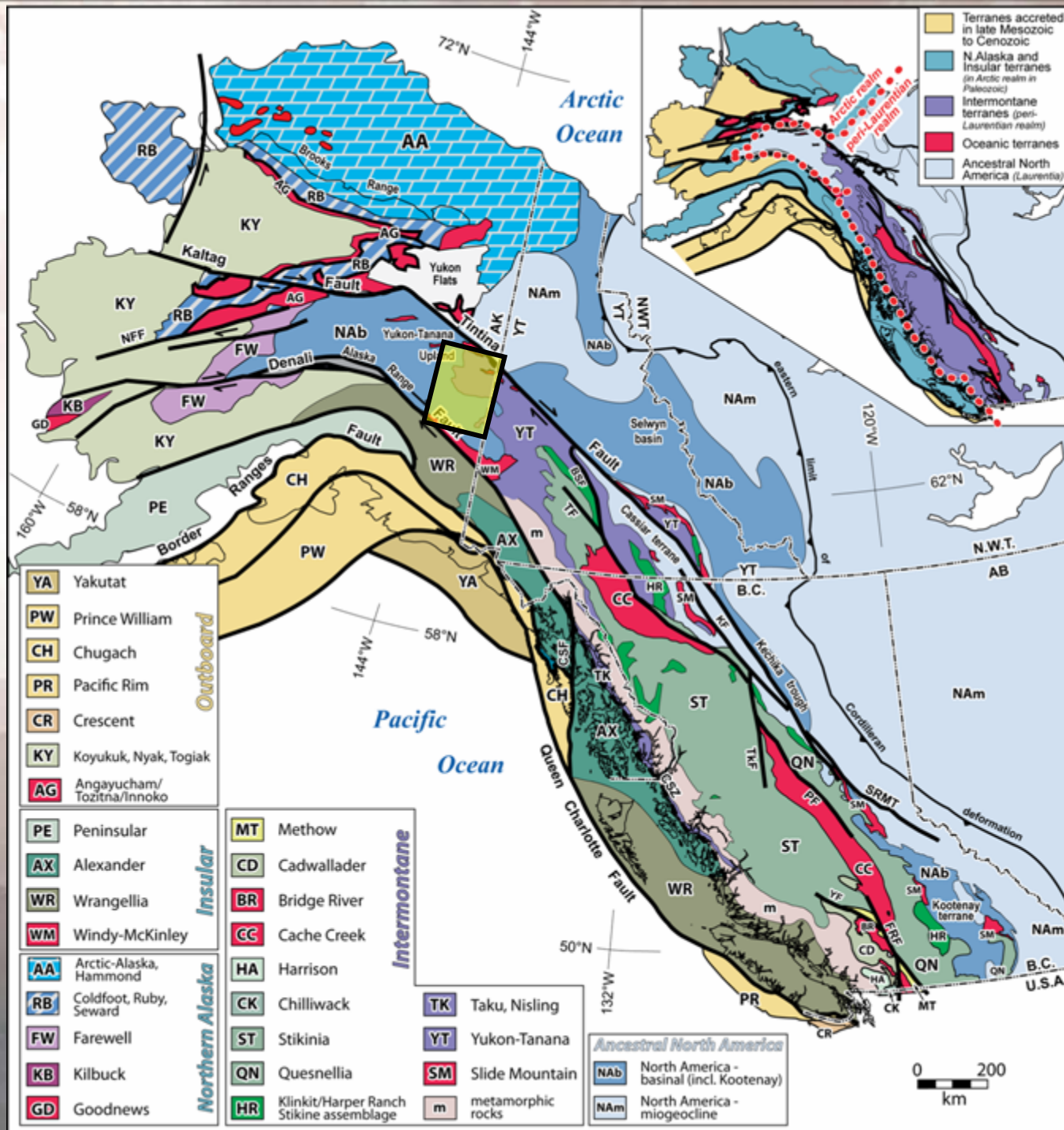
- Persistence of NNW-trending structures in district*



Dawson Range

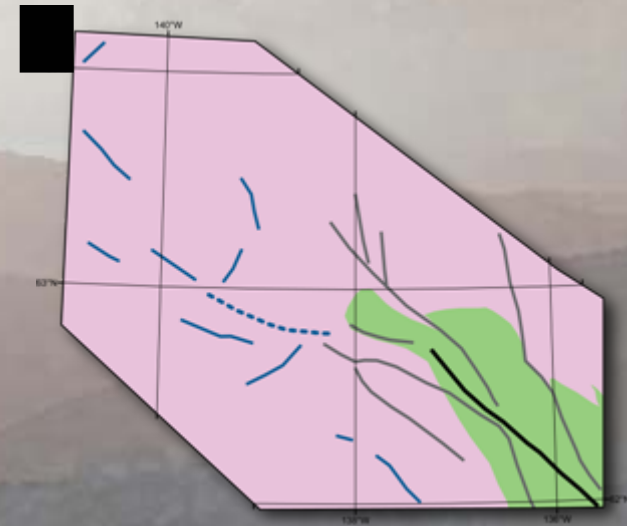
- Persistence of NNW-trending structures in district*





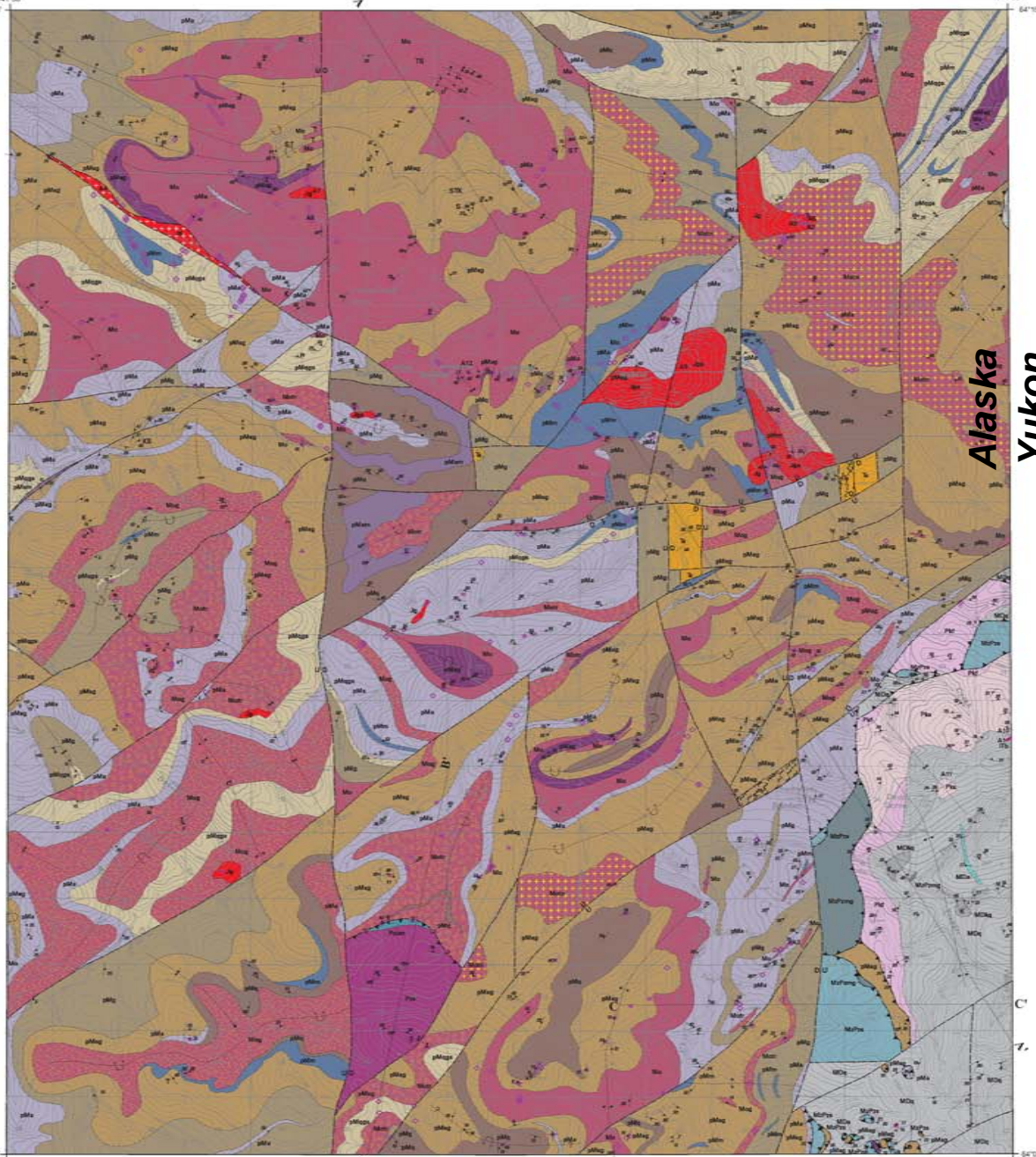
Eastern Alaska

- *Prominence of NE & N-trending structures*



58

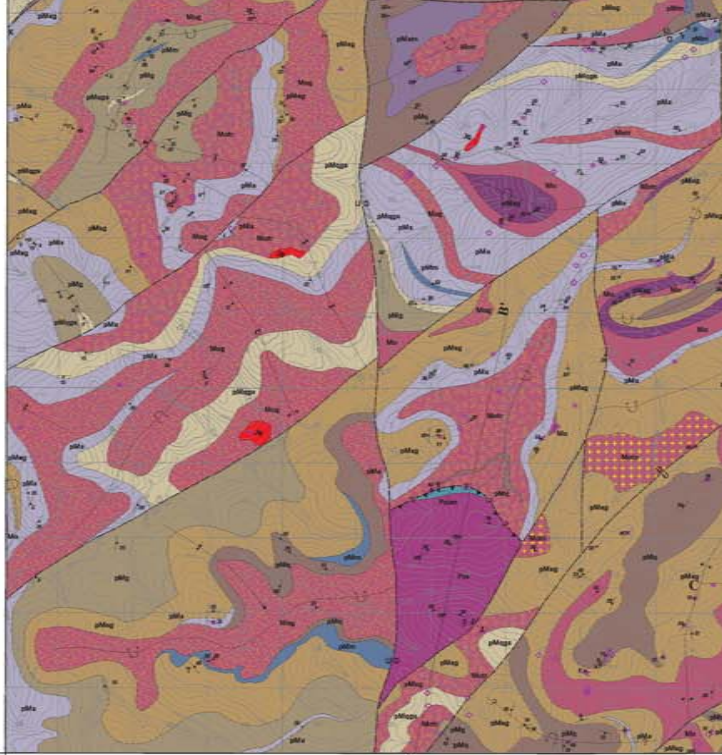
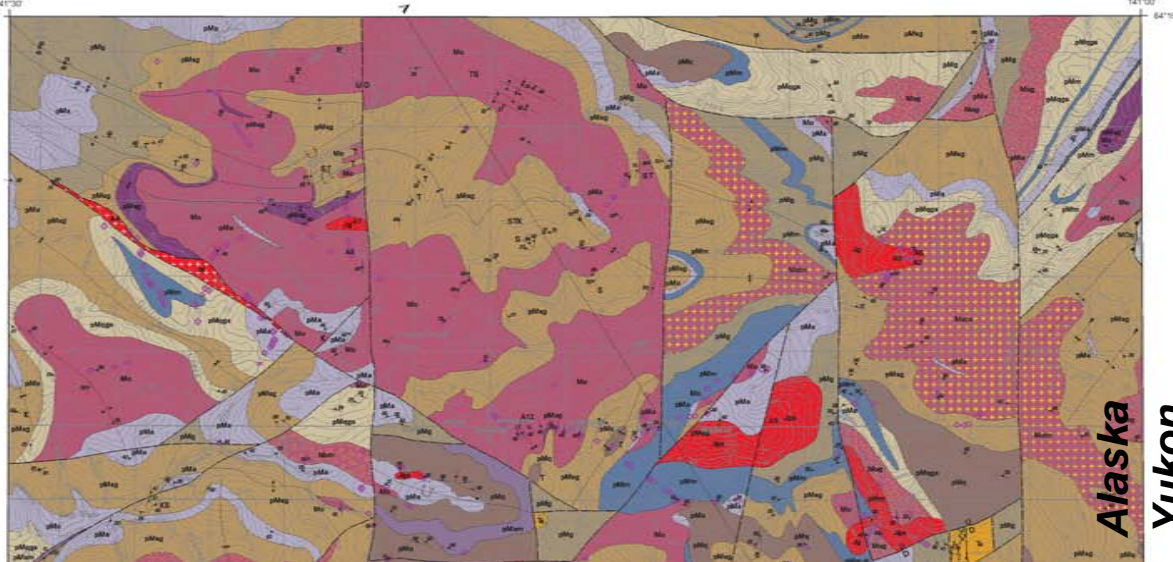
Sumigala et al. (2002)



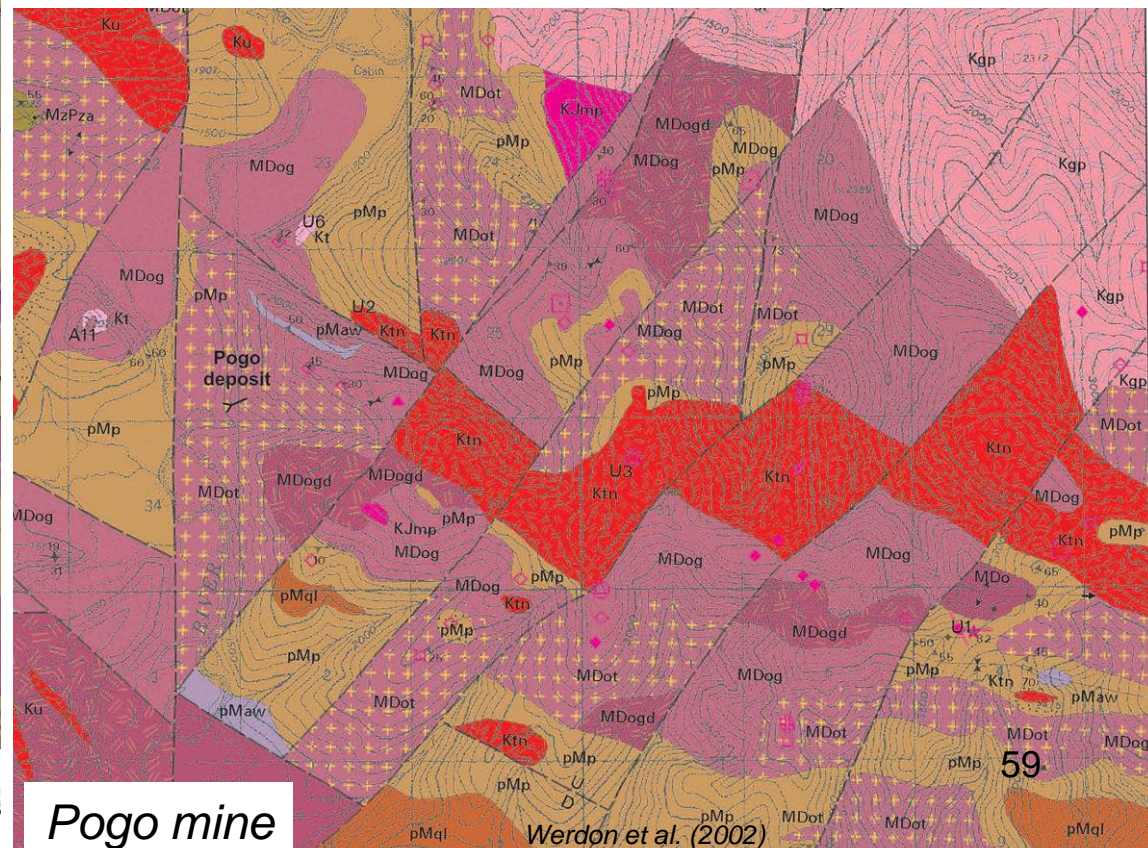
Eagle A-1 quad

Eastern Alaska

- *Prominence of NE & N-trending*



Eagle A-1 quad

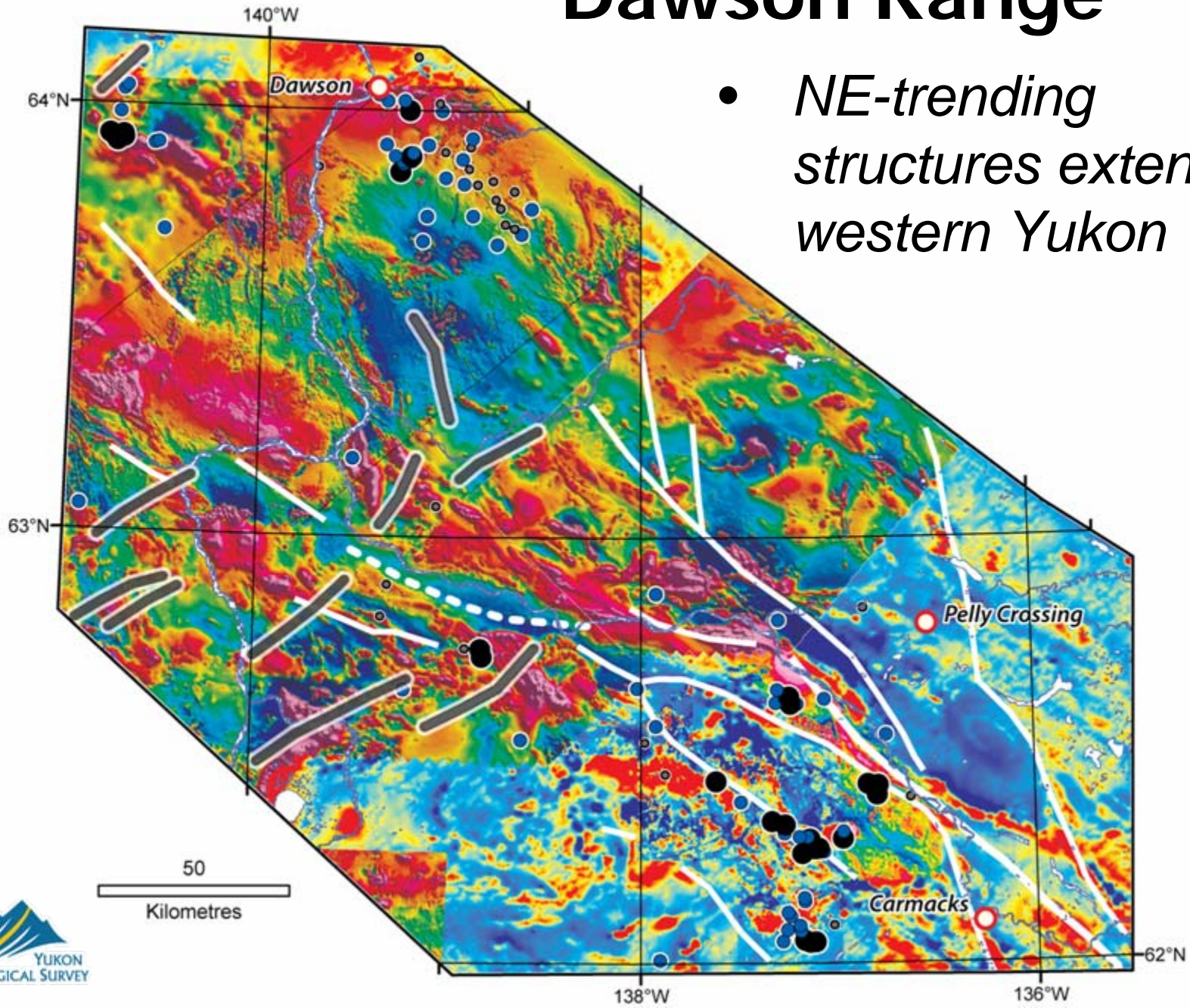


Pogo mine

Weldon et al. (2002)

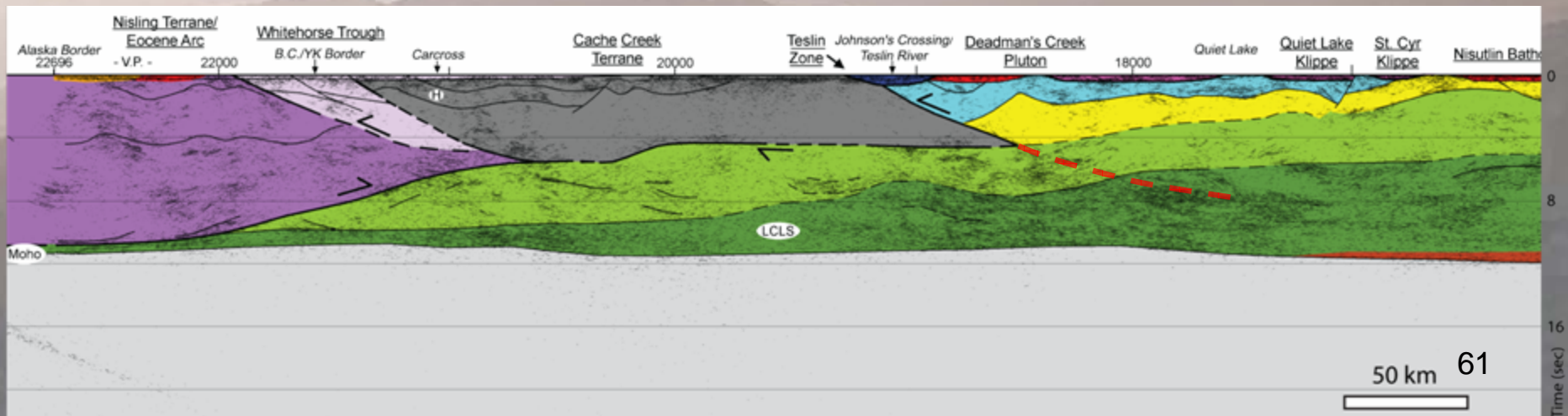
Dawson Range

- NE-trending structures extend in western Yukon*

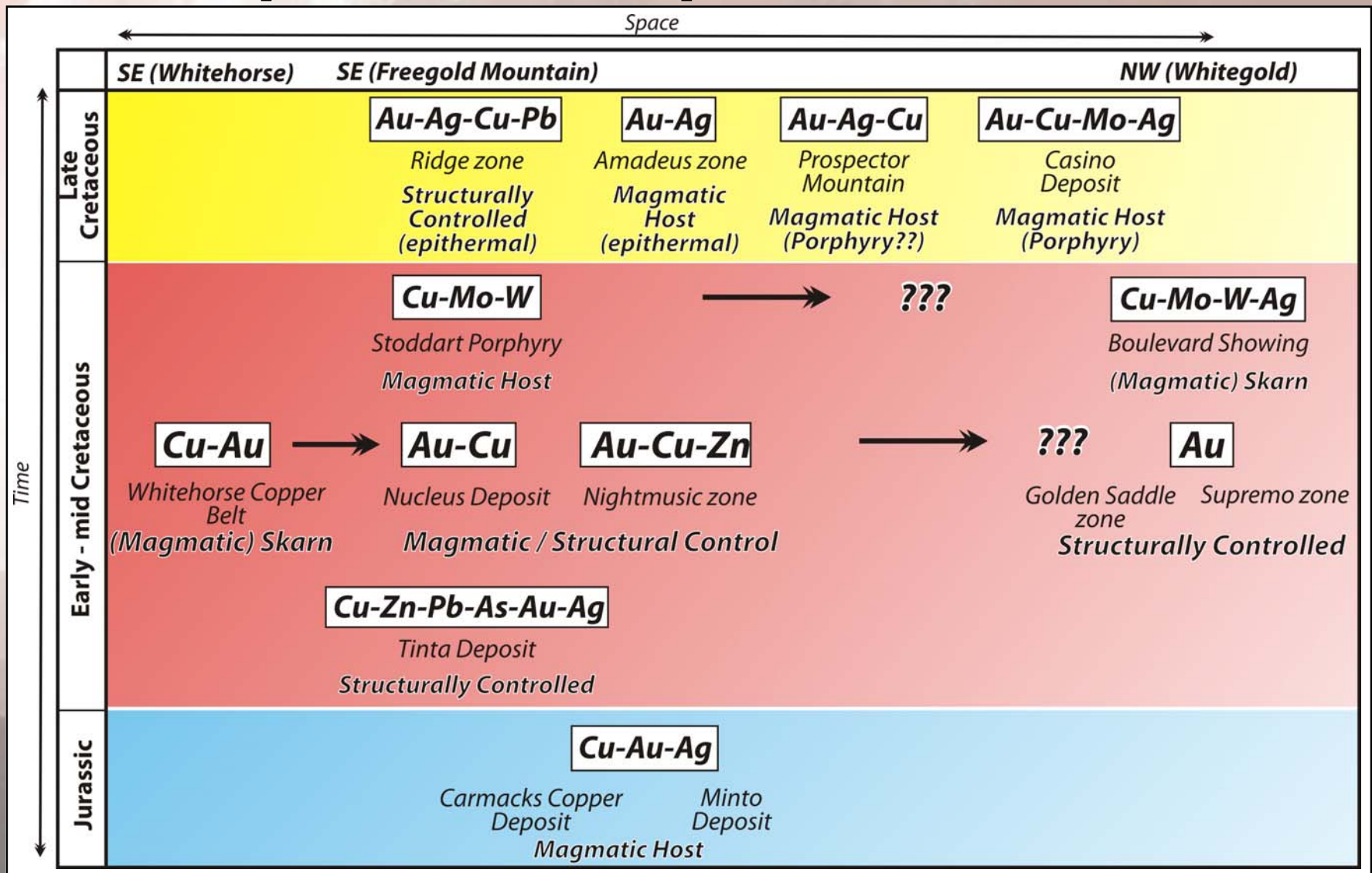


Structural Controls

- *Deep, NW-trending crustal breaks – **Teslin***
- *Extension into Dawson Range?*
- *Subsidiary structures ‘tap’ into Teslin deep conduit? – d’Abbadie, Big Salmon, Big Creek?*
- *Cretaceous magmatism in domains of extension within an overall dextral tranpressive system*
- *Importance of NE- and N-trending faults?*

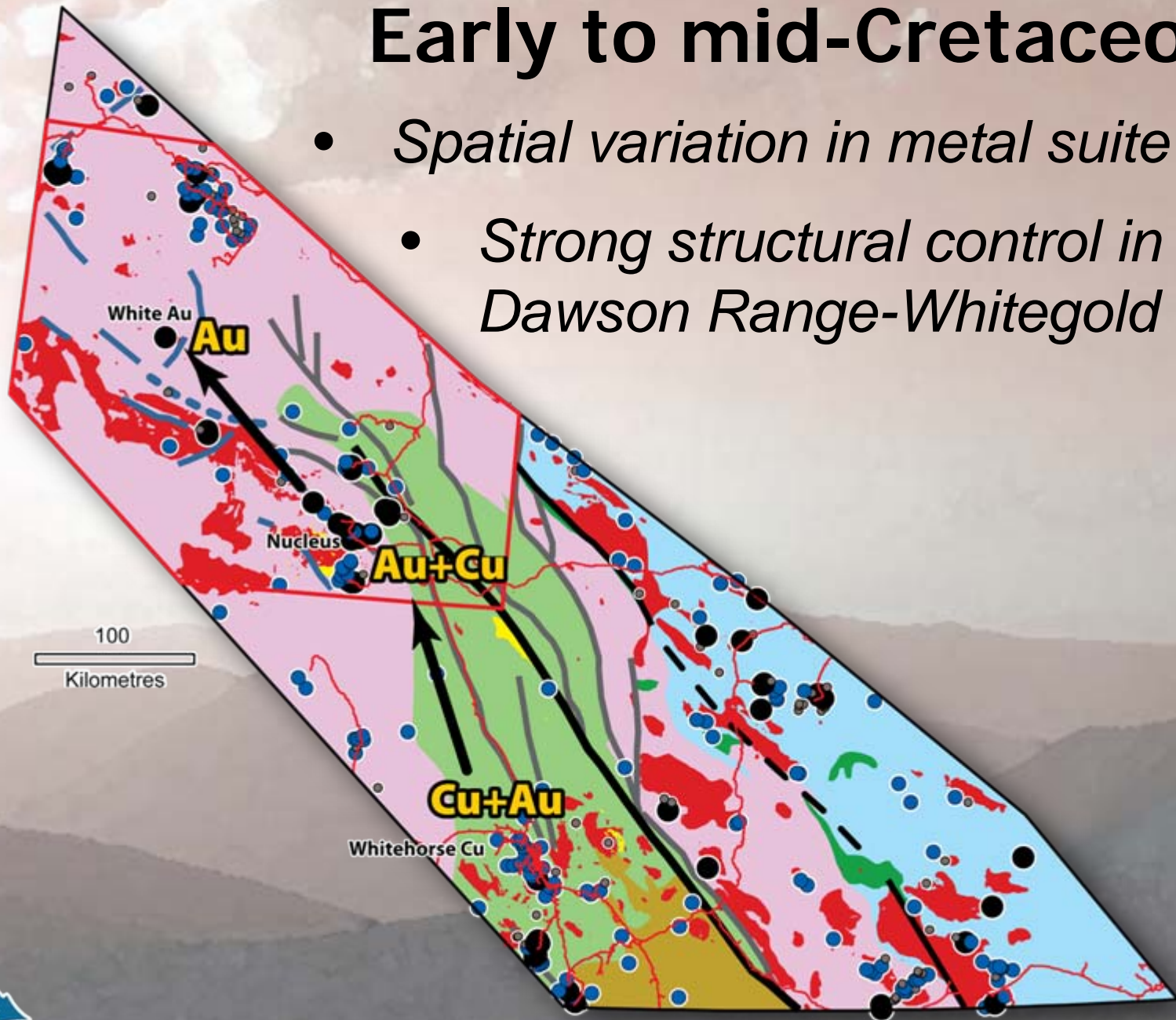


Temporal and Spatial variations



Early to mid-Cretaceous

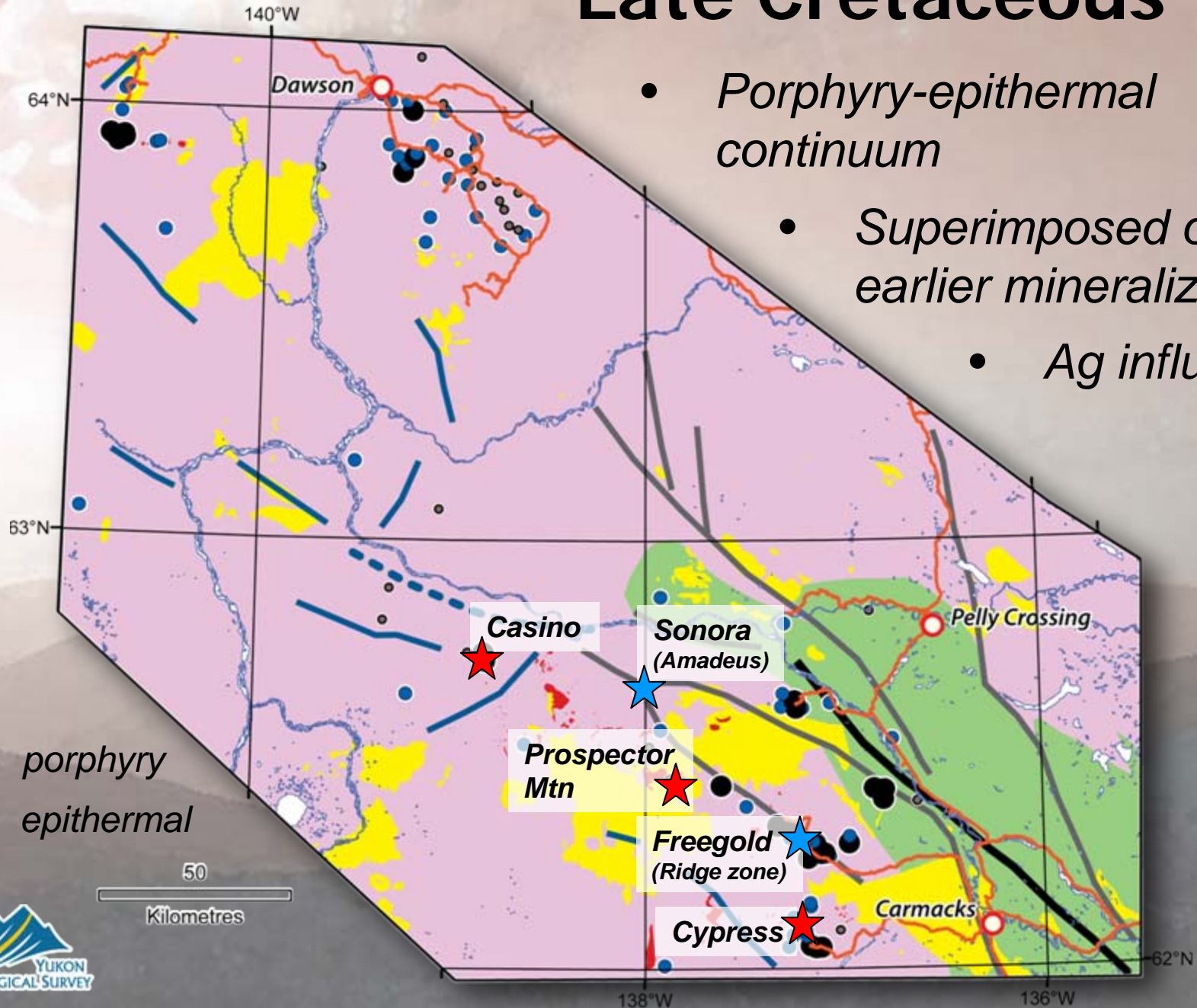
- *Spatial variation in metal suite*
 - *Strong structural control in Dawson Range-Whitegold district*



Late Cretaceous

- *Porphyry-epithermal continuum*
- *Superimposed on earlier mineralization*
- *Ag influx*

★ porphyry
★ epithermal



Late Cretaceous porphyries

