New geochronological constraints from the Bonavista Peninsula, northeastern Newfoundland

Newfoundland Labrador

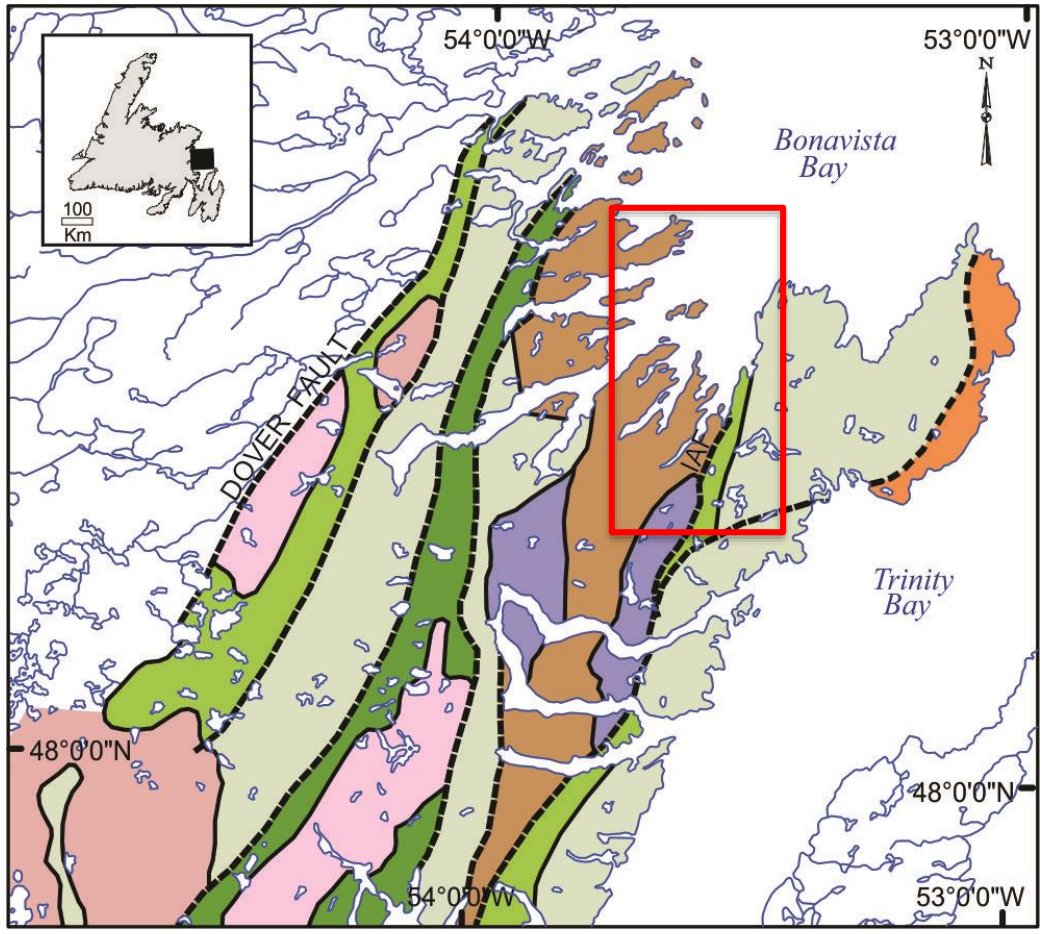
Andrea Mills and Greg Dunning

Outline

- Stratigraphic overview (CPG, MG)
- 4 U-Pb sample sites from CPG / Sweet Bay area – stratigraphy, lithology of each site THEN results
- 2 U-Pb sample sites from Plate Cove volcanic belt (PCvb) – description THEN results (February 2016)
- Summary of results

Overview

-talk focuses on western Bonavista Peninsula
-underlain mainly by Connecting Point Group



Modified from S.J. O'Brien, 1993

Connecting Point Group (CPG)
-overlies ca. 620 Ma Love Cove Gp
-2 cycles of turbiditic sandstone and shale separated by regional olistostrome
-overlain by Musgravetown Gp, either CCF cglm or BAF volcanics
-Cambrian outlier to the south

LEGEND

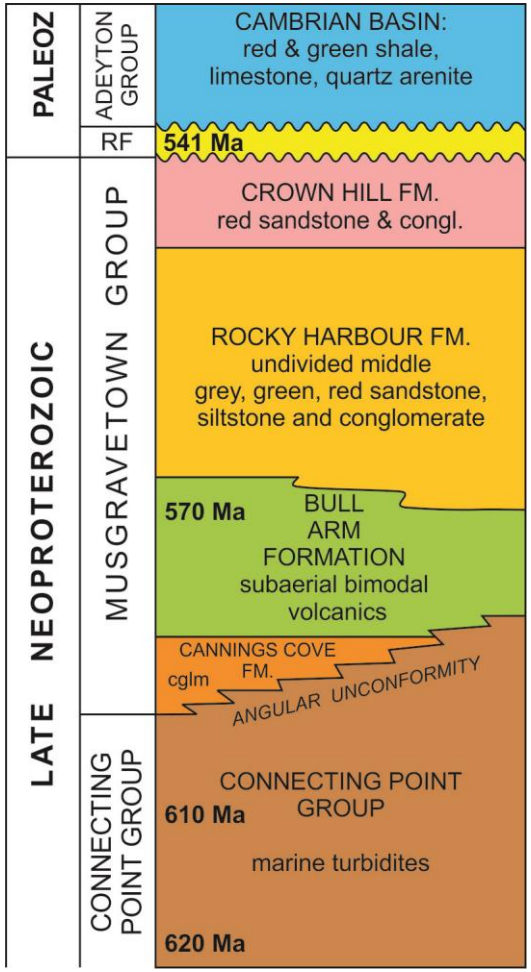
- Devonian granite
- Cambrian sedimentary rocks
- Precambrian granite
- East Avalon basin (Conception, St. John's, Signal Hill gps)
- Musgravetown Group; mainly terrestrial sedimentary rocks
- Musgravetown Group; mainly volcanic rocks
- Connecting Point Group
- Love Cove Group

SYMBOLS

Contact.....

Fault (major, minor).....

Previous age constraints

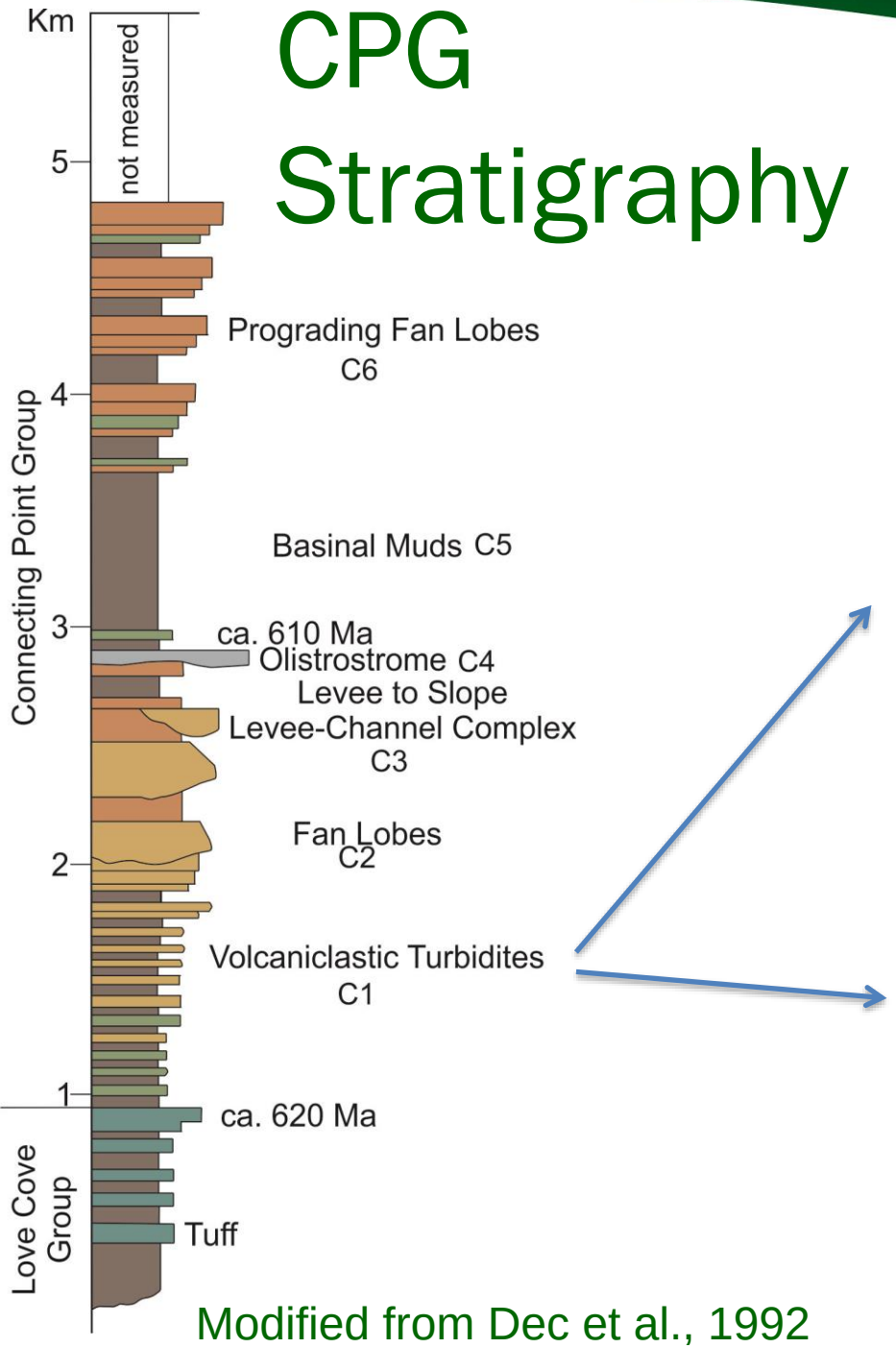


570 Ma age reinterpreted as a flow within the Rocky Harbour Formation (O'Brien and King, 2004):

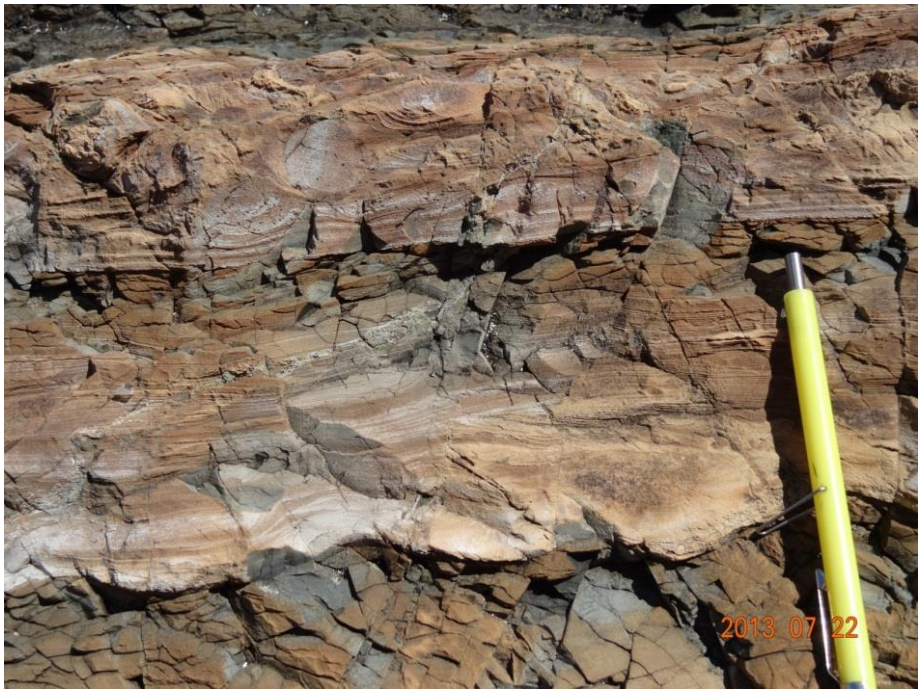
The absolute age of the Musgravetown Group remains unconstrained in this area. A comparable succession of Rocky Harbour and Crown Hill rocks is developed on the west side of Bonavista Bay, where rhyolite flows at the base of the Rocky Harbour Formation have yielded a zircon age of 570 +5/-3Ma (O'Brien et al., 1989).

Ages from S.J. O'Brien et al., 1989 and Dec et al., 1992.

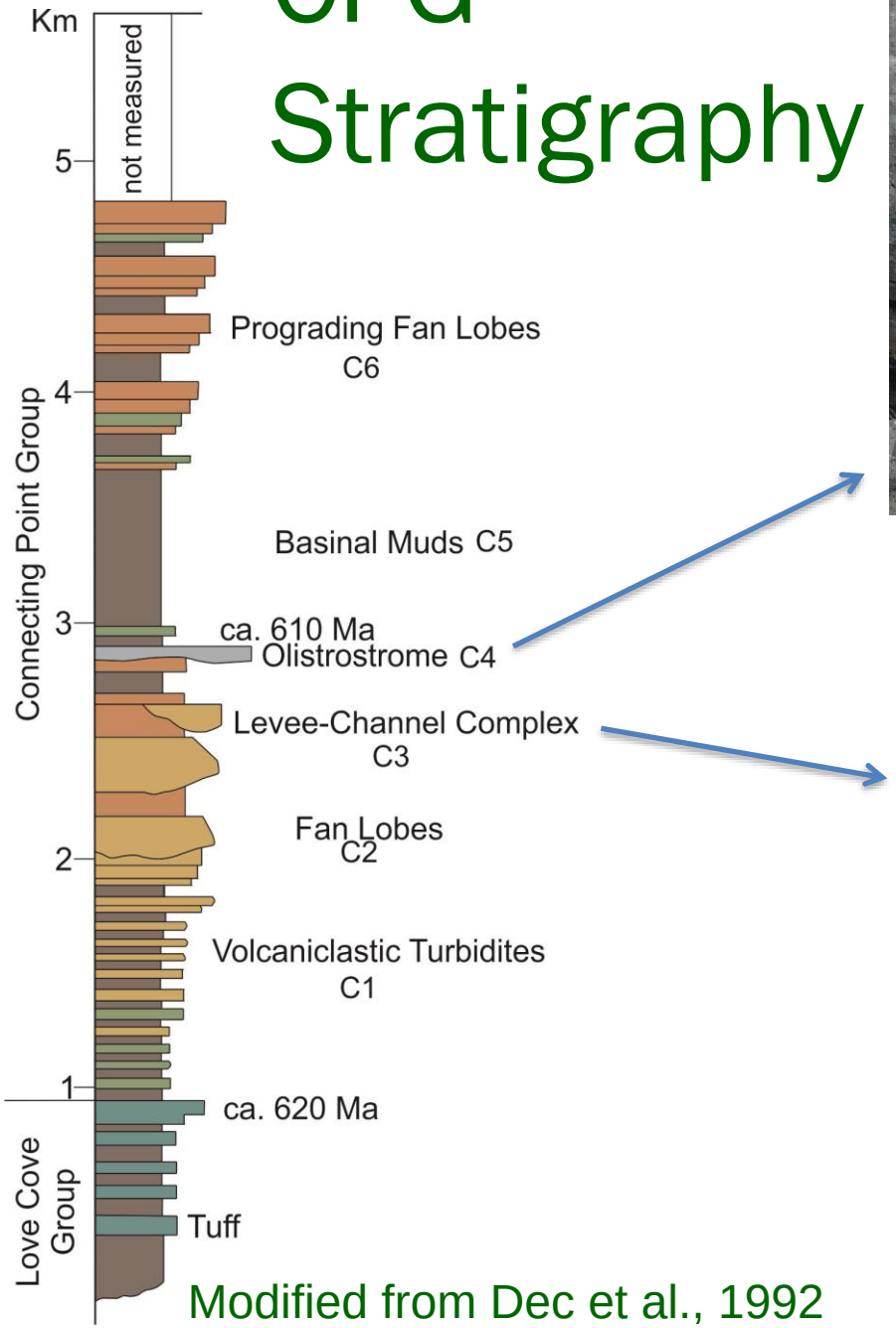
CPG Stratigraphy



Modified from Dec et al., 1992



CPG Stratigraphy

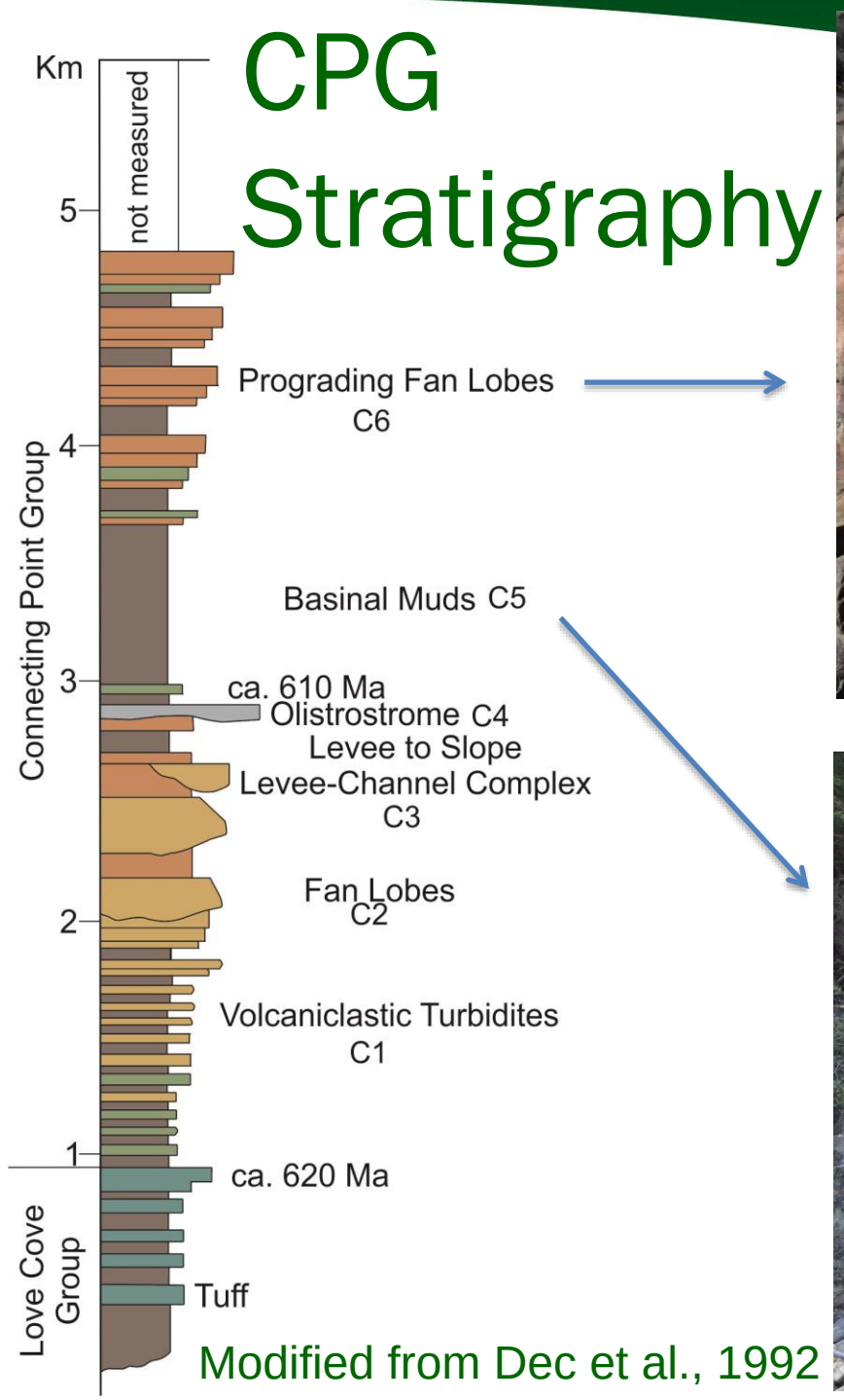


Modified from Dec et al., 1992

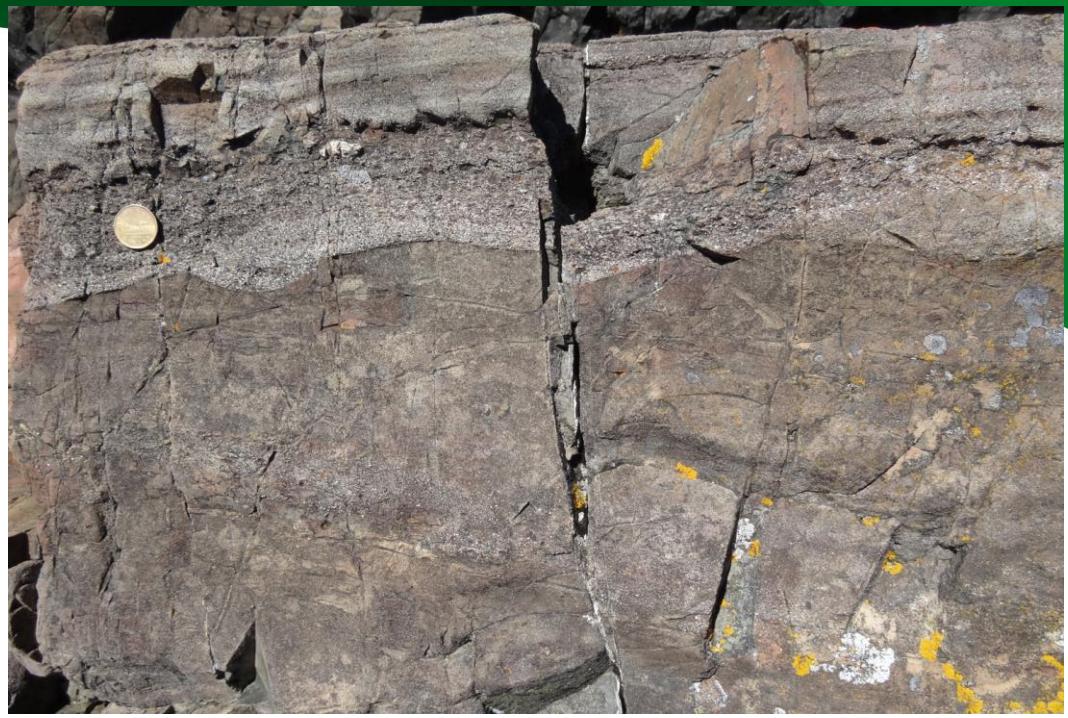
Significance of the Olistostrome

- Regional (sporadic outcroppings over >30 km)
- Olistoliths up to 30 m, locally recumbantly folded
- Massive debris flow
- Clasts oriented with long axes trending SE (downslope direction) – but their internal bedding dips SW (re-oriented due to uplift to the NE??)

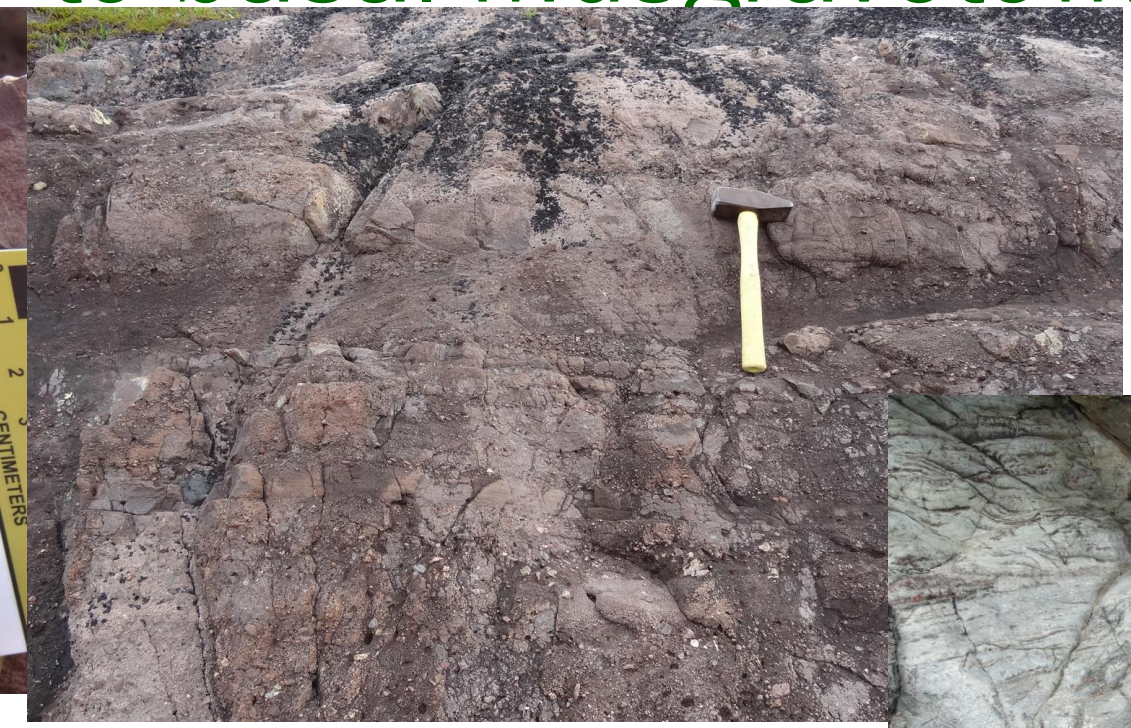
CPG Stratigraphy



Modified from Dec et al., 1992



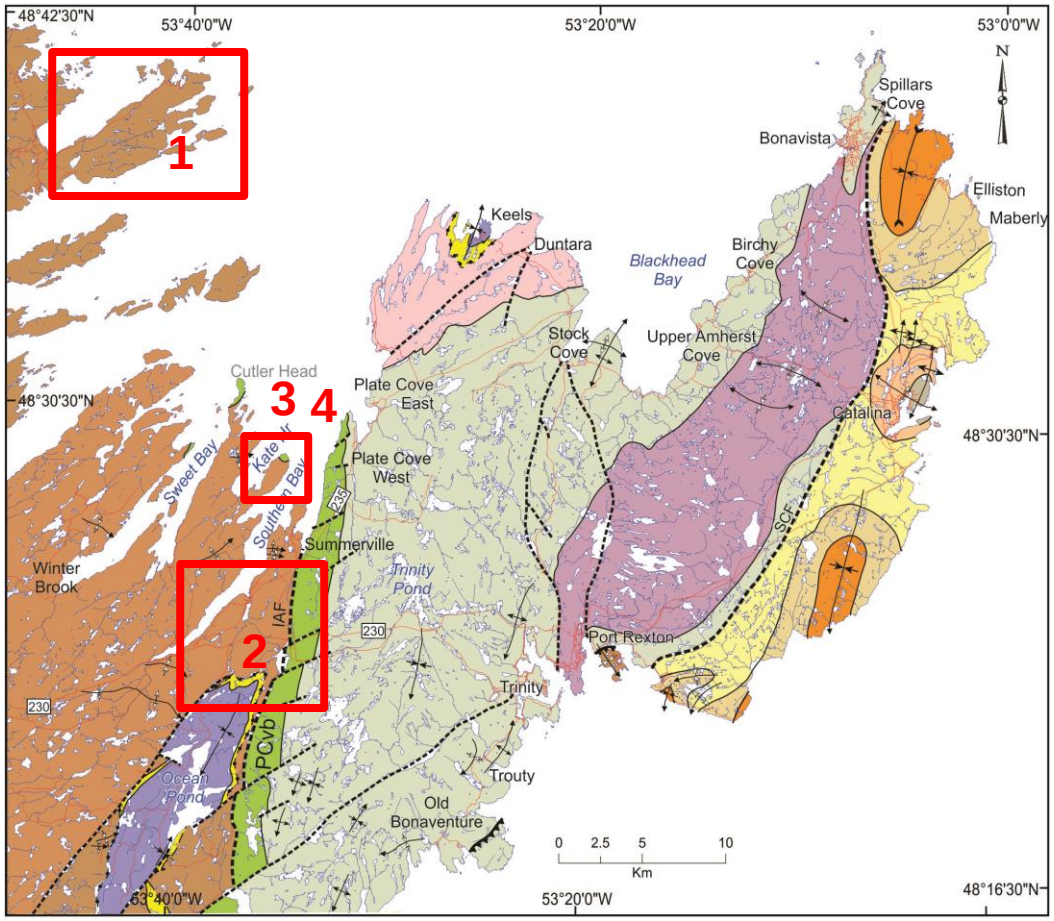
Top of CPG to basal Musgravetown

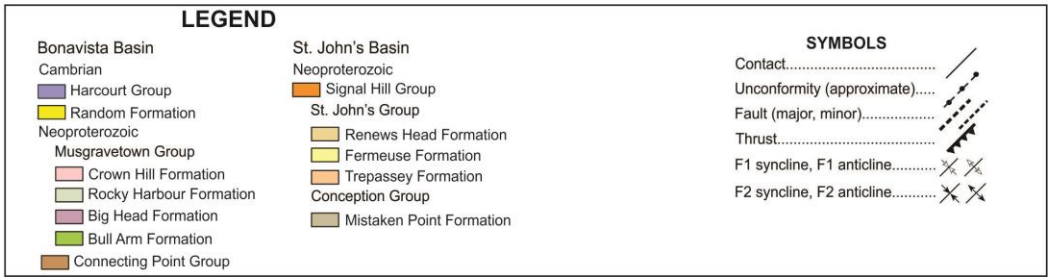


-pebbly, channelized sst (alluvial deposits) locally at top of CPG
-'Kate Hr fm' = similar to CCF but without apparent hiatus

-basal MG = CCF but with fault or depositional hiatus separating it from underlying CPG
-local outsized volcanic clasts and agglomerate, tuffaceous sst
-passes upward into calc-alkaline Headland basalts

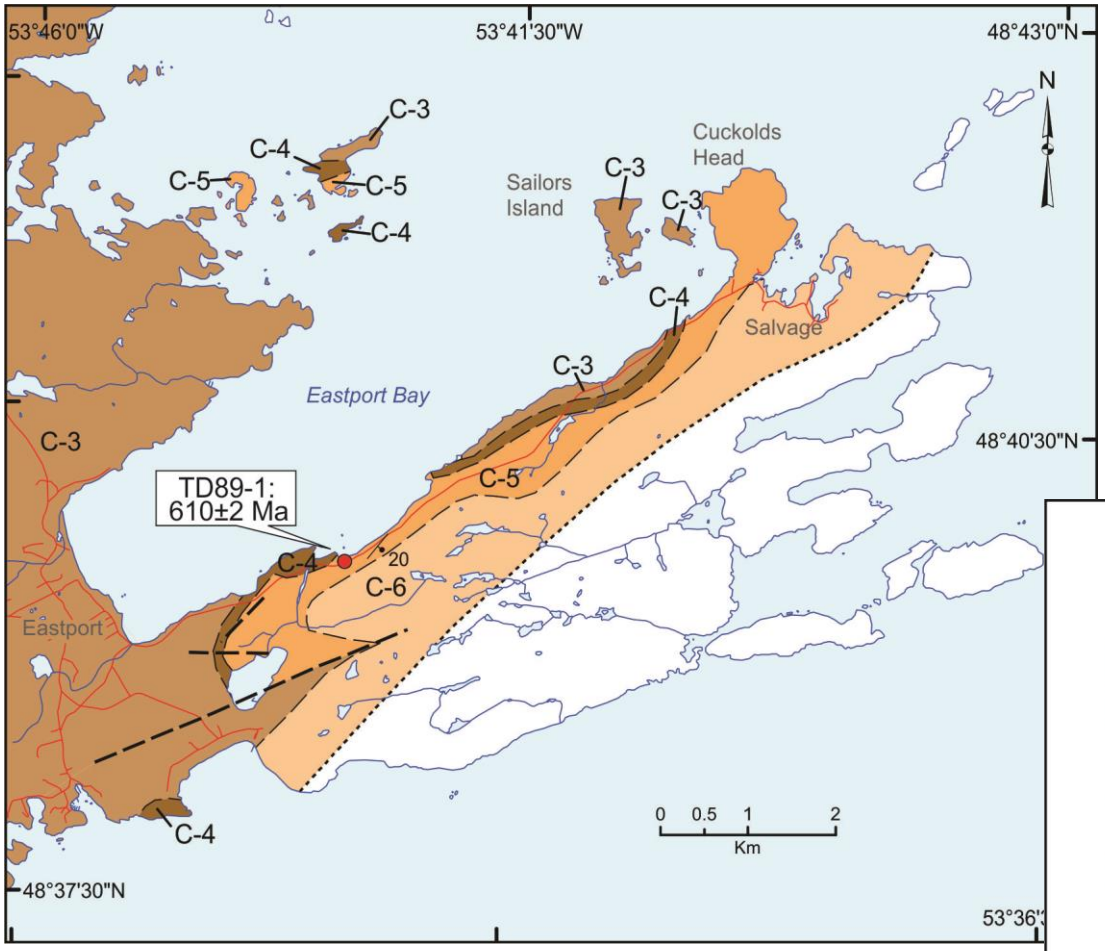
U-Pb Sample Sites





1. Eastport Tuff
2. Muddy Pond river
3. Southward Head East – above the unconformity
4. Southward Head West – below the unconformity
5. Plate Cove volcanic belt (west side)
6. Plate Cove volcanic belt (east side)

Sample TD89-1



LEGEND

Neoproterozoic

Upper CPG

C-6 Mainly siliceous, medium-bedded turbidite sandstone

C-5 Shale, thin bedded sandstone, commonly slumped

Middle CPG

C-4 Mixtite

Lower CPG

C-3 Mainly thin-bedded sandstone, siltstone and shale

SYMBOLS

Contact (approximate).....

Fault (approximate).....

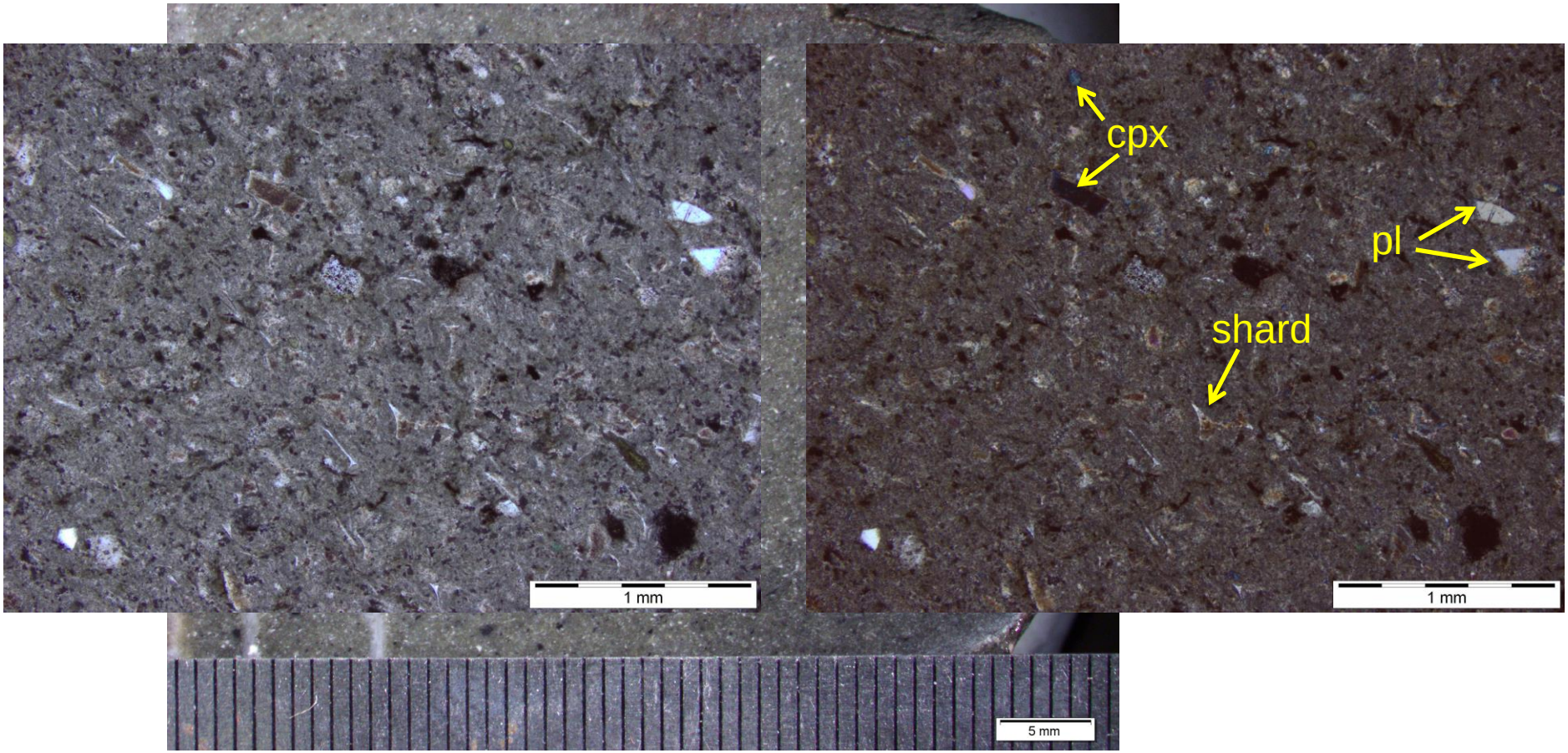
Limit of mapping.....

U-Pb sample site.....

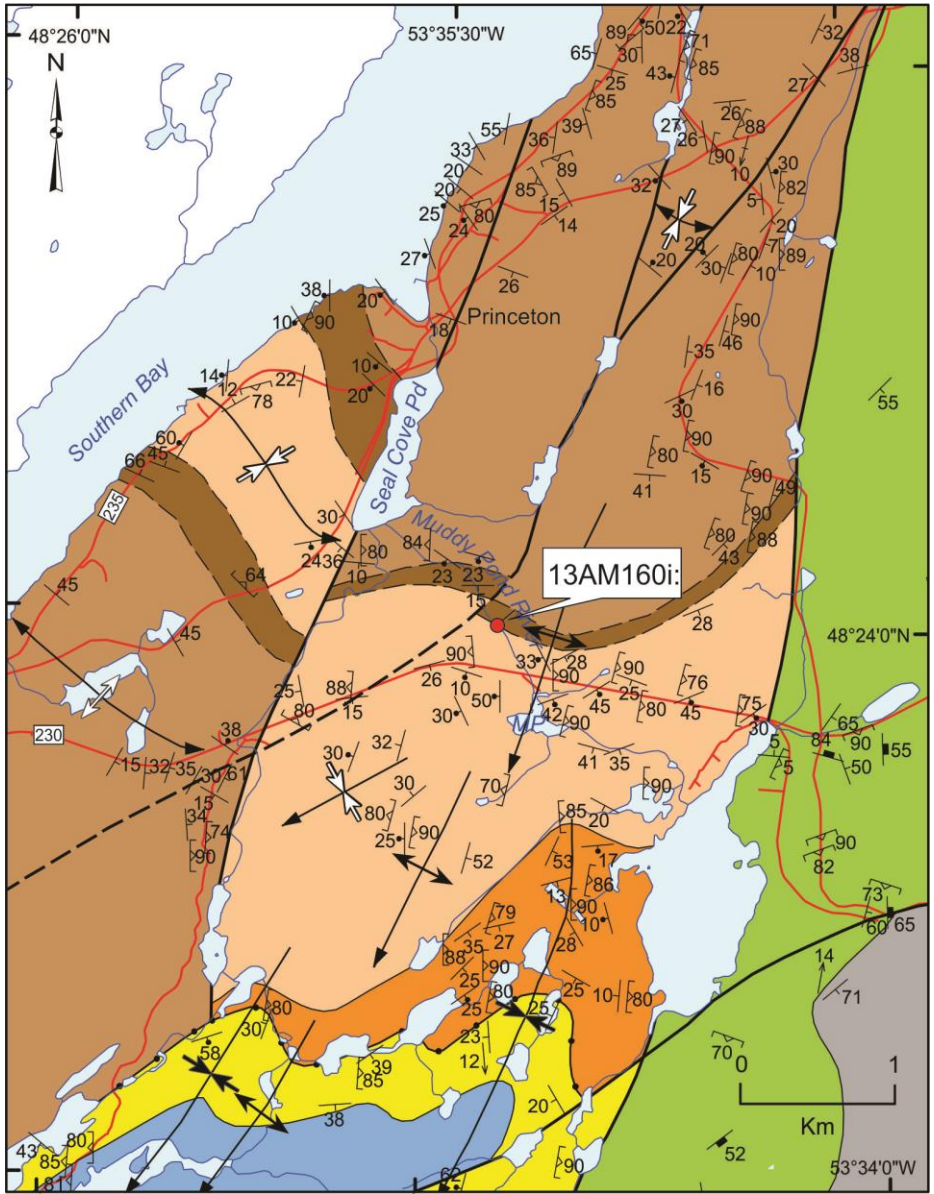
Bedding (tops known).....

Eastport area

Eastport crystal ash tuff



Muddy Pond river



LEGEND

Paleozoic

Adeytown Group

- Bonavista Formation - Green and red shale to slate
- Random Formation - Quartz arenite

Neoproterozoic

Musgravetown Group

- Red pebble conglomerate (possibly equivalent to Cannings Cove Formation or Crown Hill Formation)
- Rocky Harbour Formation (Plate Cove volcaniclastic conglomerate)
- Plate Cove volcanic belt (undivided; Bull Arm Formation equivalent)

Connecting Point Group

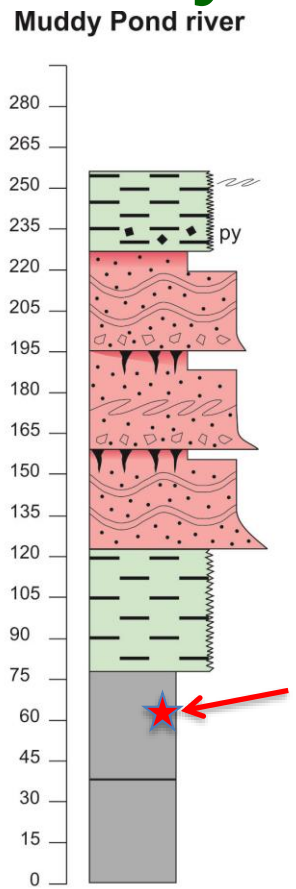
- Upper CPG: Grey, medium-grained, thick-bedded sandstone, locally convolute bedded
- Middle CPG: Mainly black shale, argillite and mixtite
- Lower CPG: Mainly thin-bedded, green-grey, siliceous siltstone with fine black laminations

SYMBOLS

- Contact (defined, approximate).....
- Unconformity.....
- Fault (defined, approximate).....
- F1 anticline, F1 syncline.....
- F2 anticline, F2 syncline.....
- Fold axis, linear fabric (generation unknown, 1 st)....
- Bedding (tops unknown, known, overturned) tick for dip direction, dot for facing direction .....
- Foliation or cleavage (generation unknown).....
- Layering; primary flow, in igneous rocks (inclined).....
- U-Pb Geochronology sample site.....

Muddy Pond river ash tuff

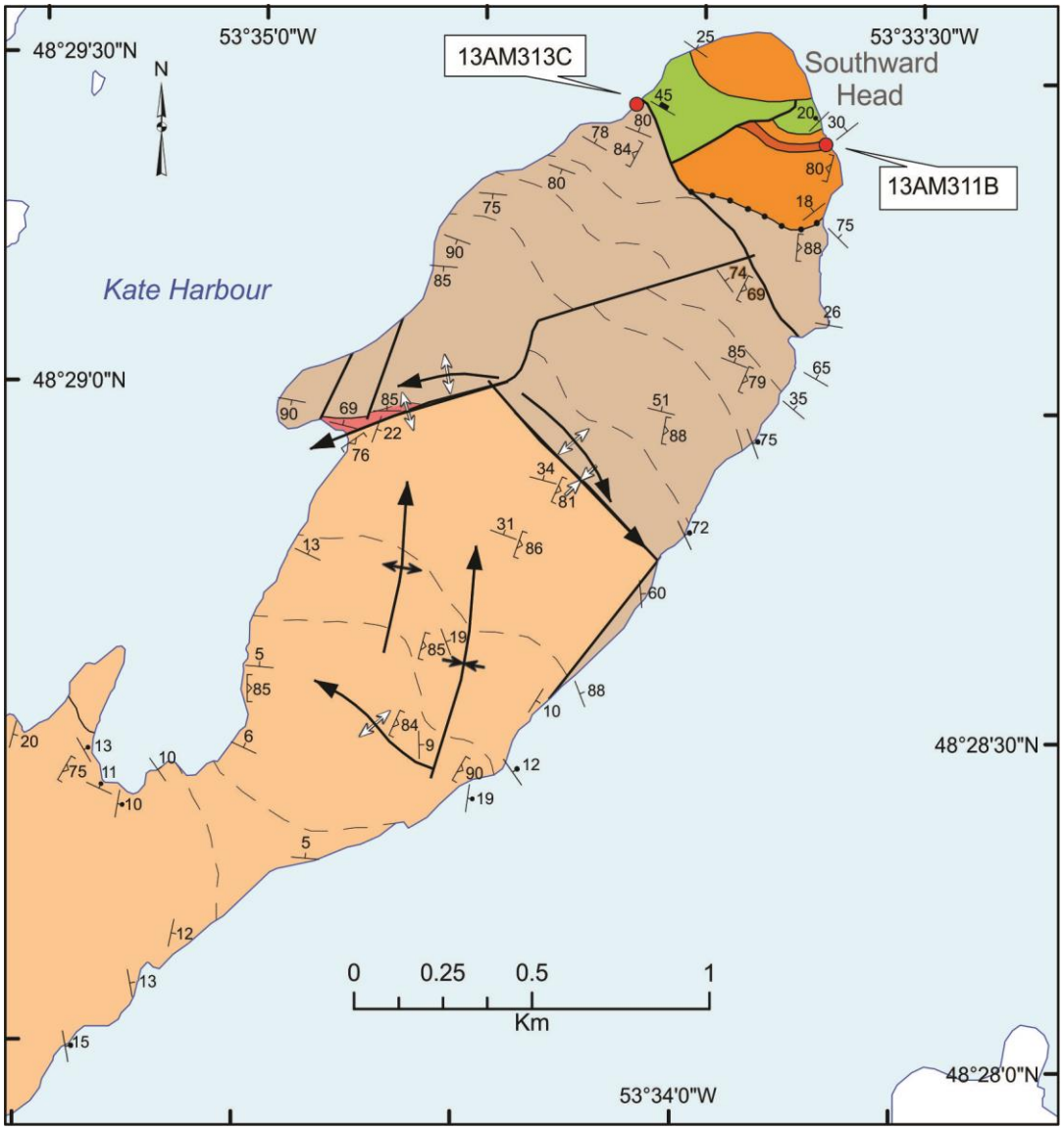
Muddy Pond river ash tuff



LEGEND

- ripple marks
- dessication cracks
- rip-up clasts
- euhedral pyrite
- wavy bedding
- convolute bedding

Southward Head



LEGEND

Neoproterozoic

Musgravetown Group

- Headland Basalt BAF
- Red cobble conglomerate (CCF); minor feldspathic crystal tuff

(Upper) Connecting Point Group

- Thin-bedded siltstone, minor tuffaceous rocks
- Fault breccia
- Thick-bedded sandstone

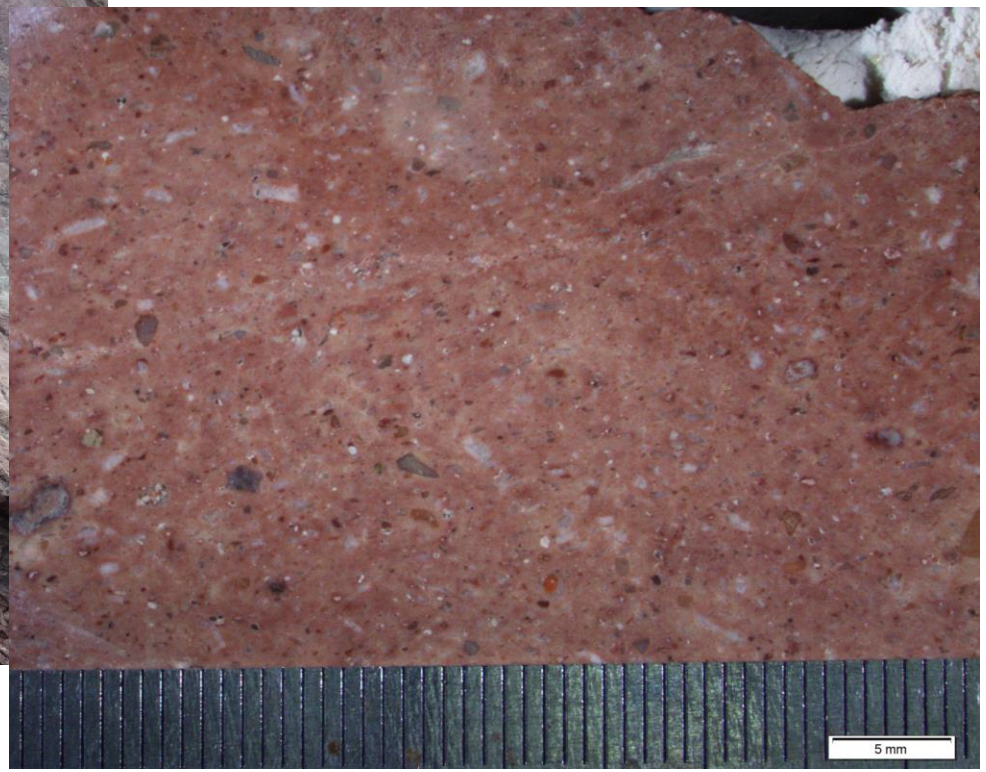
SYMBOLS

- Contact
- Unconformity
- Bedding trace
- Fault
- F1 anticline, F1 syncline
- F2 anticline, F2 syncline
- Bedding (tops unknown, known, overturned) tick for dip direction, dot for facing direction
- Foliation or cleavage (generation unknown)
- Layering; primary flow, in igneous rocks: inclined
- U-Pb sample site

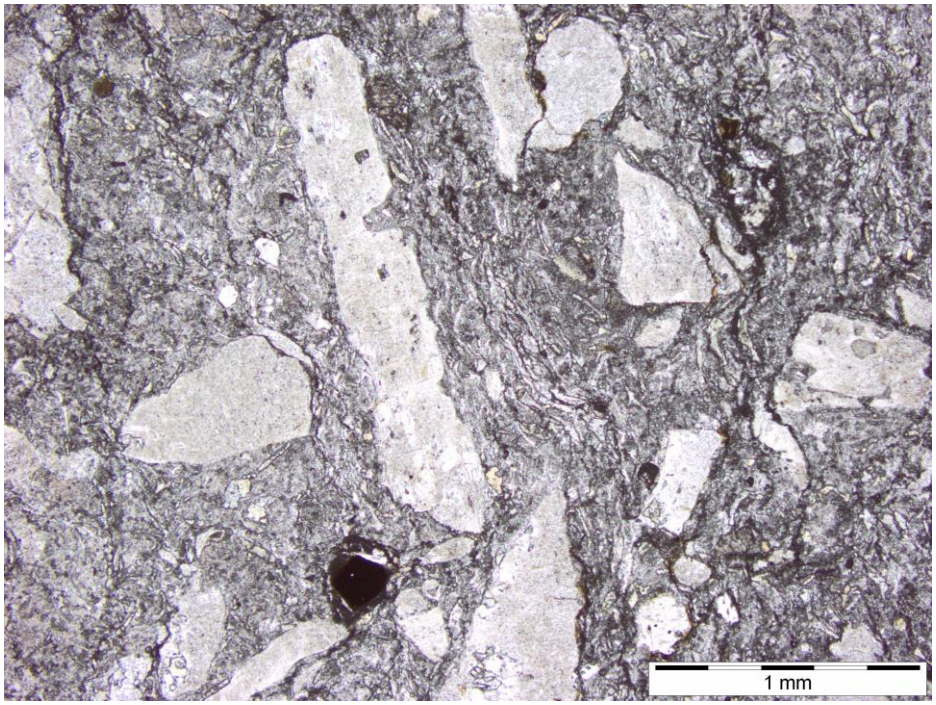
Southward Head: Above the unconformity

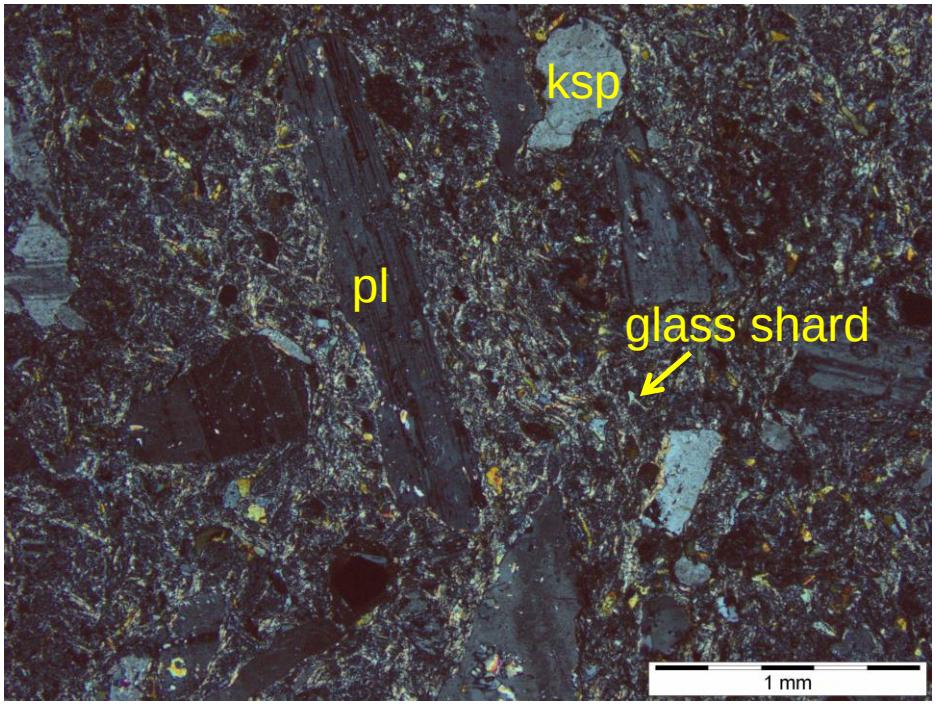
Southward Head: Above the unconformity

Southward Head:
crystal lithic tuff (above unconformity)



Southward Head: intermediate crystal lithic tuff (above unconformity)



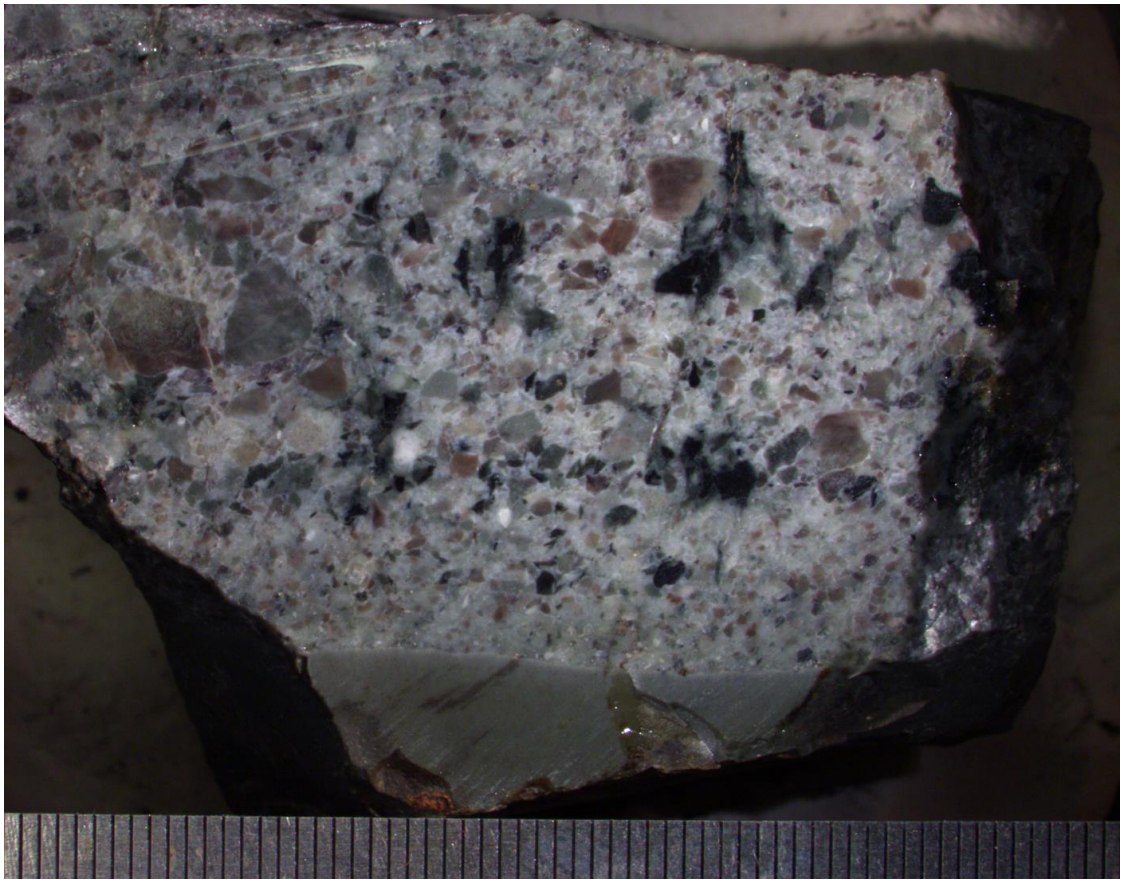


Subhedral plagioclase (30%), <10% lithic clasts, ~60% matrix
NB. Glass shards in matrix – minimal transport

Southward Head:
Below the (faulted) unconformity

Southward Head: Below the unconformity

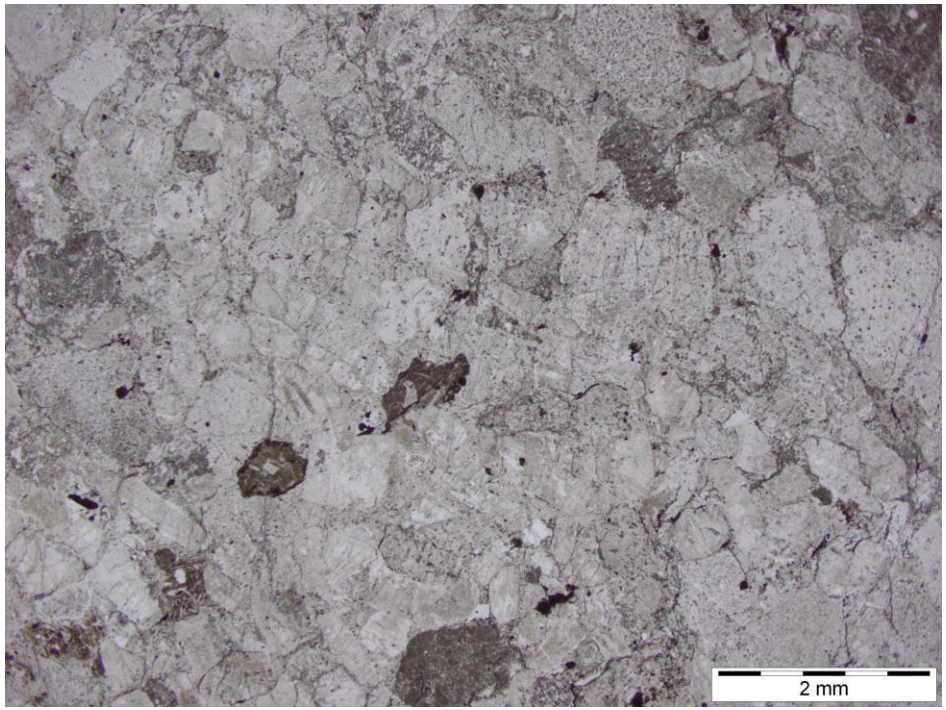
Southward Head: lithic tuff (above unconformity)

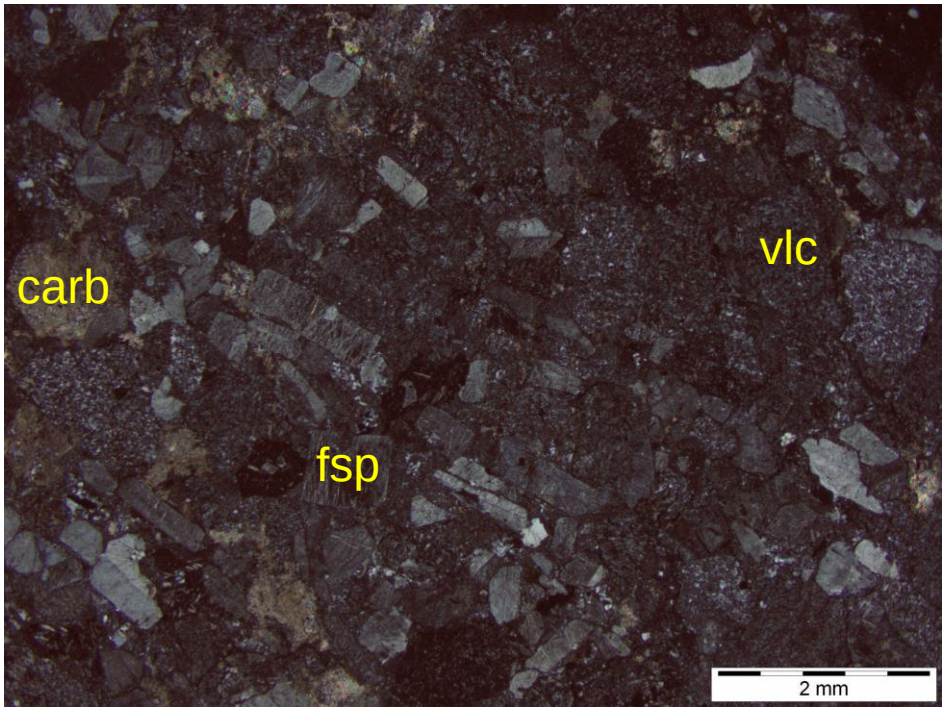


-wave-winnowed lithic tuff (absence of fine-grained matrix material) – consistent with ripple marks in underlying siltstone
-30-35% alkali feldspar
-50% lithic clasts – grey/pink siltstone (30%)
Black volcanic fragments (20%)

-epiclastic rock

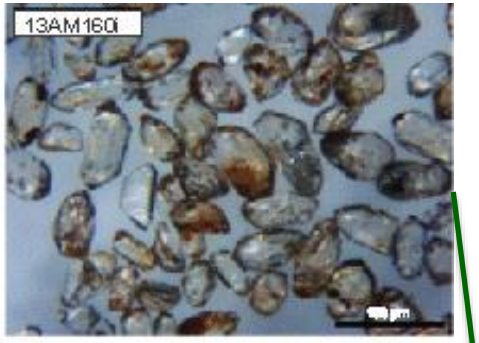
Southward Head: lithic tuff (above unconformity)

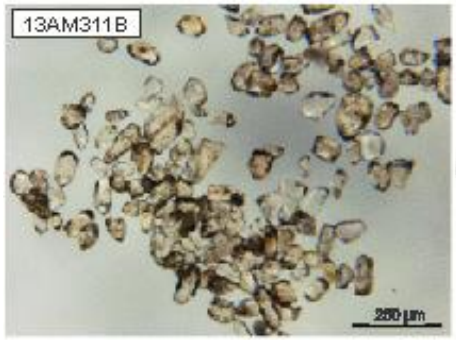


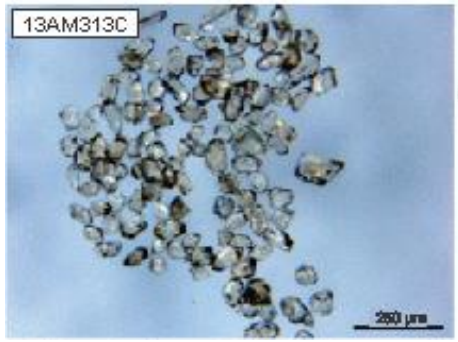


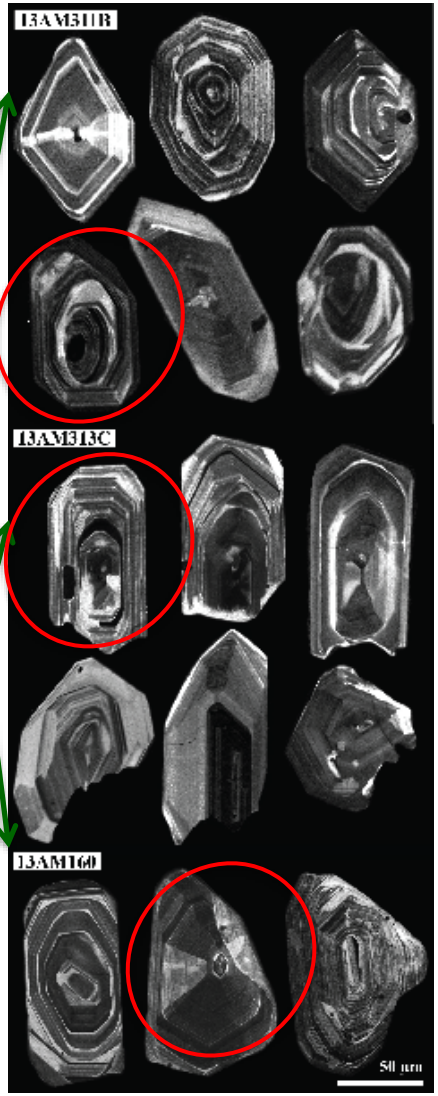
35% alkali feldspar; 30% volcanic clasts; 25% siliciclastic clasts; 10% carbonate clasts; lack of matrix = wave-winnowed.

Zircon morphology



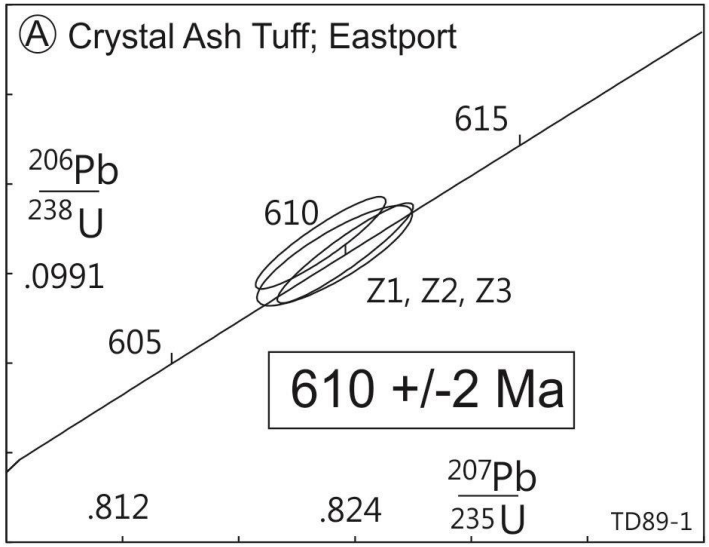


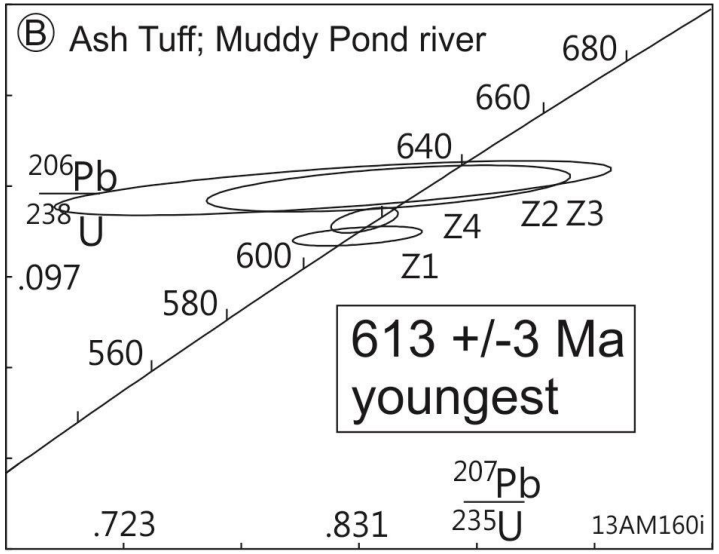


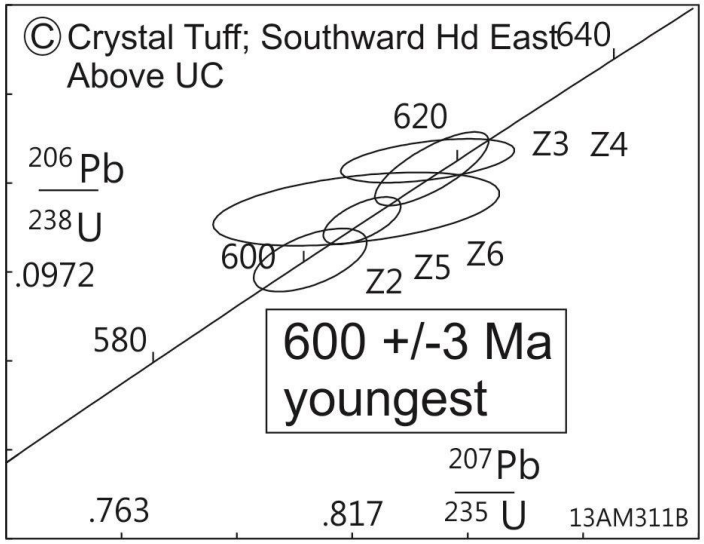


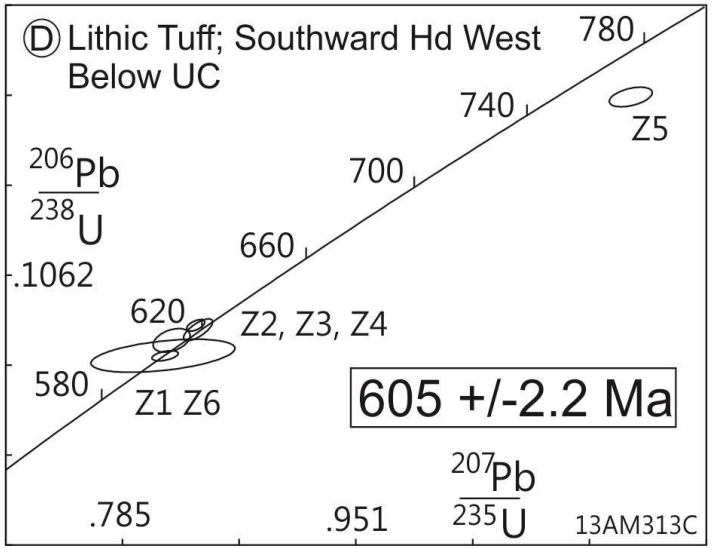
- 13AM160i – Muddy Pond ash tuff; mainly stubby, red stain; excellent oscillatory zoning; 1 grain shows poss inherited core
- 13AM311B – above unconformity; broken, euhedral, stubby and elongate prisms; clear, colourless; 1 grain contains poss inherited core
- 13AM313C – below unconformity; stubby and elongate; clear, colourless, 1 grain contains poss inherited core
- TD89-1 – Eastport sample; 10-20 grains per fraction; physically abraded but not chemically abraded.

Geochronology Results



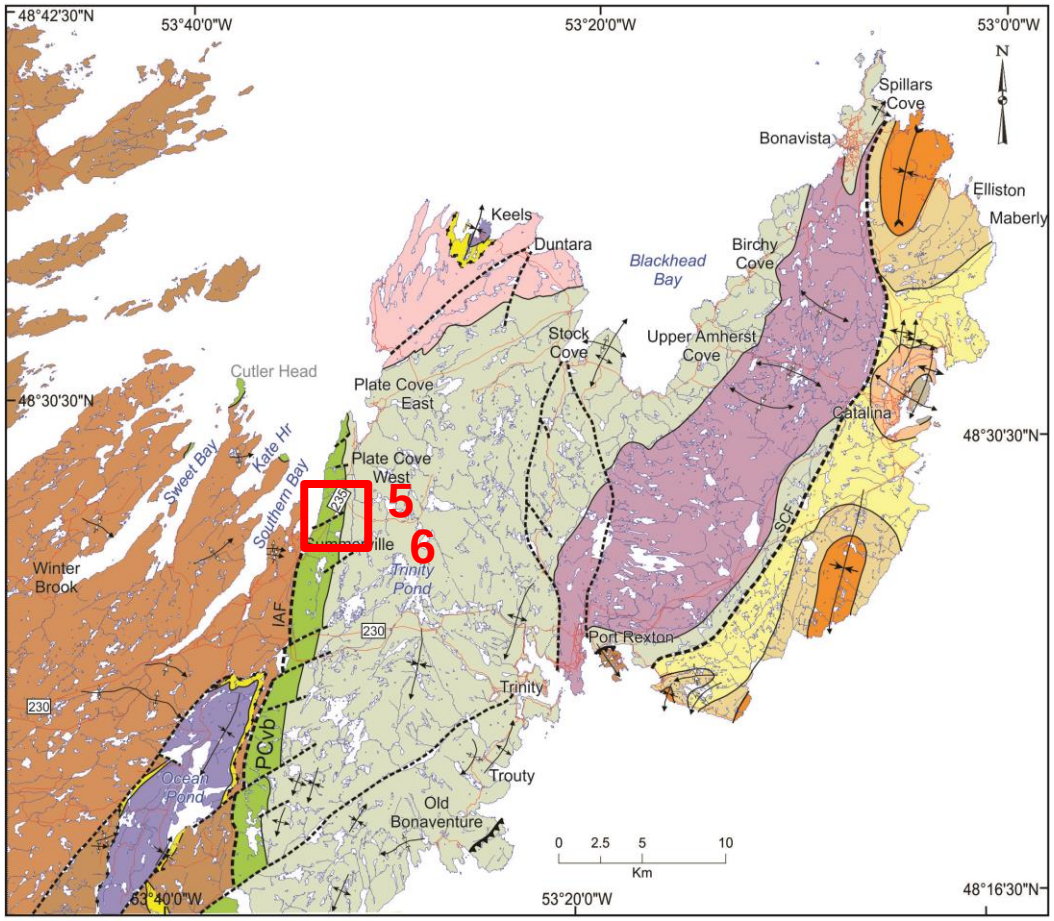


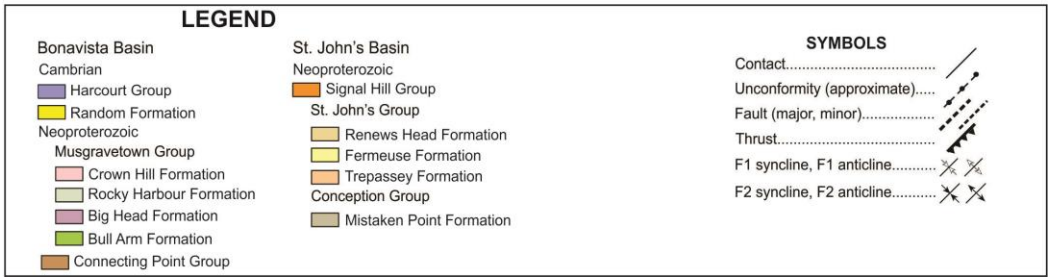




NB. 630-610 Ma Inheritance evident in all Sweet Bay samples – uplift of Love Cove Group shedding volcanic/clastic detritus into CPG basin

Hot off the Press!

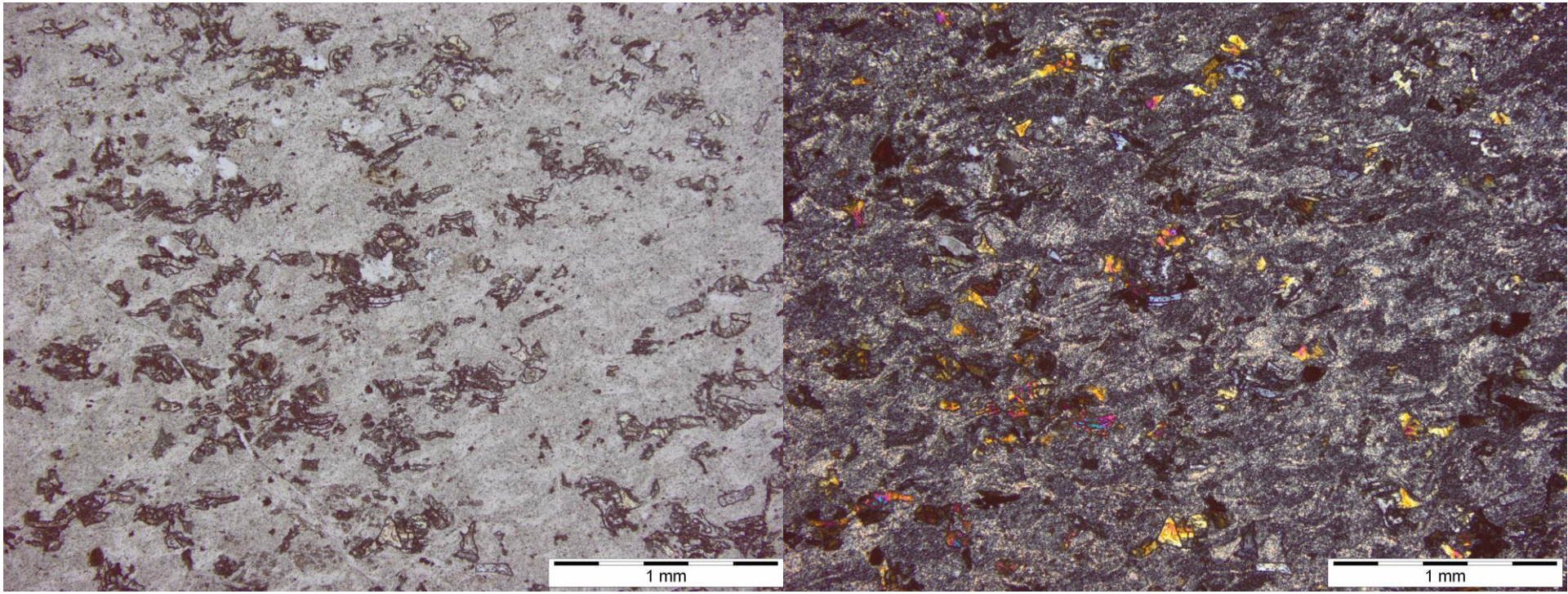




- New U-Pb results from East and West side of Plate Cove volcanic belt

15AM125

15AM125 – west side of PCvb Summerville roadcut -felsic crystal tuff



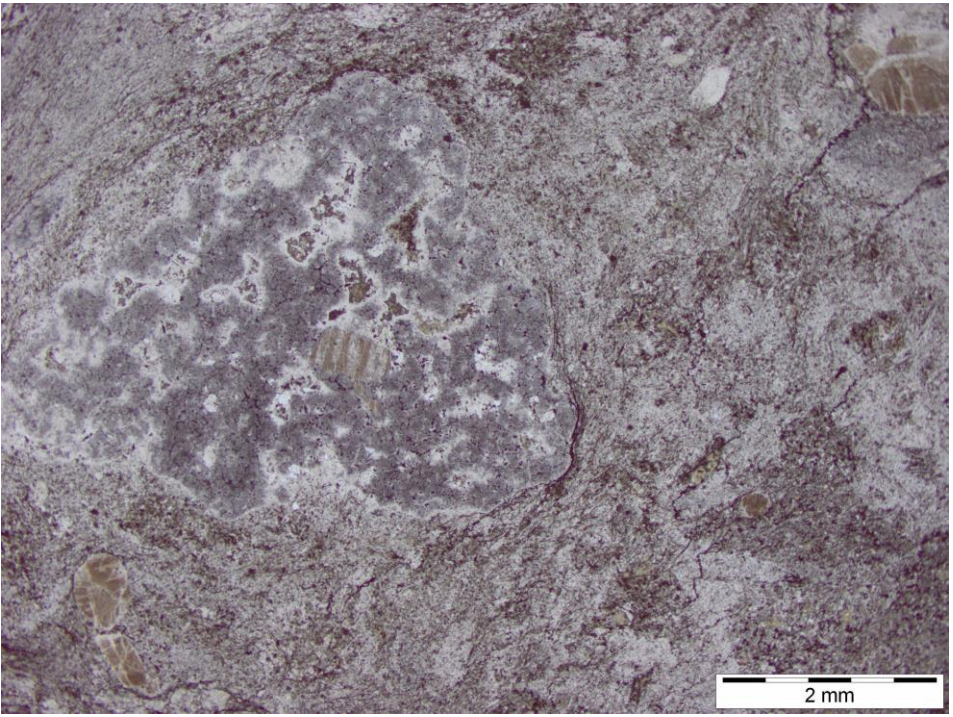
Epidote crystals – replacing 1° crystals and/or glass shards
Few qtz and plagioclase crystals
Patchy, altered groundmass – v.f.gr. sericite

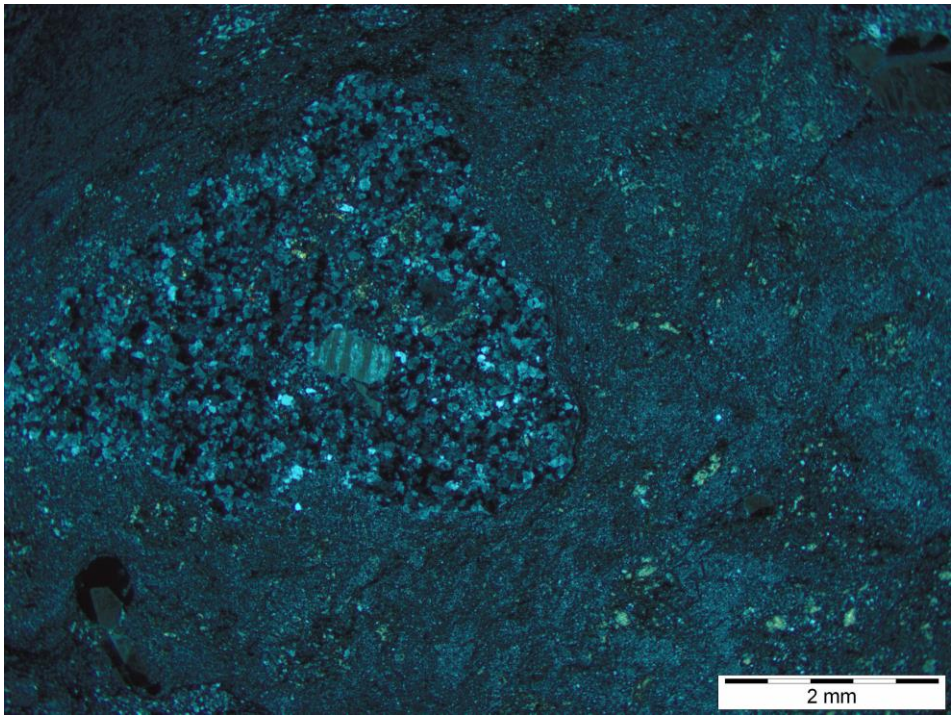
15AM201

-East side of PCvb
-Intermediate lapilli tuff

15AM201

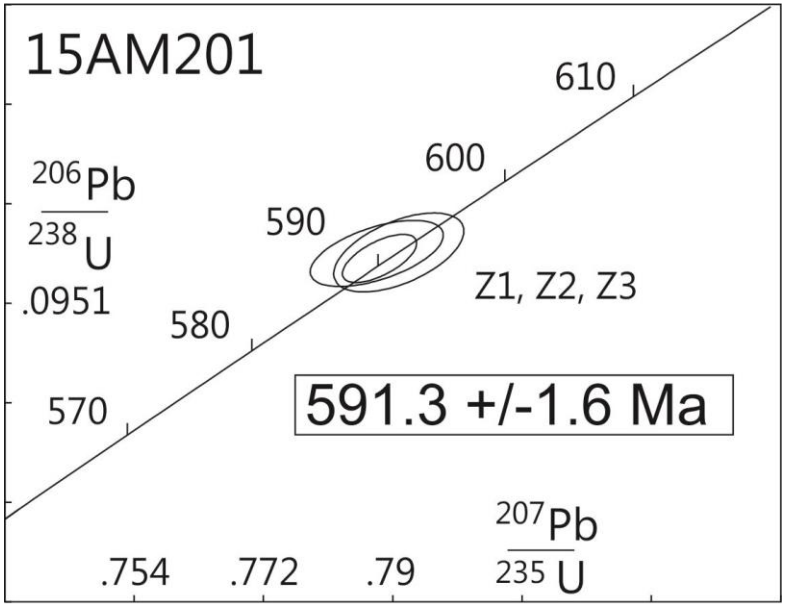
Feldspar porphyritic lapilli in fine-grained, intermediate, crystal-bearing matrix





Rounded qtz and alkali feldspar crystals in matrix; flow-banded matrix
Most lapilli have very diffuse margins

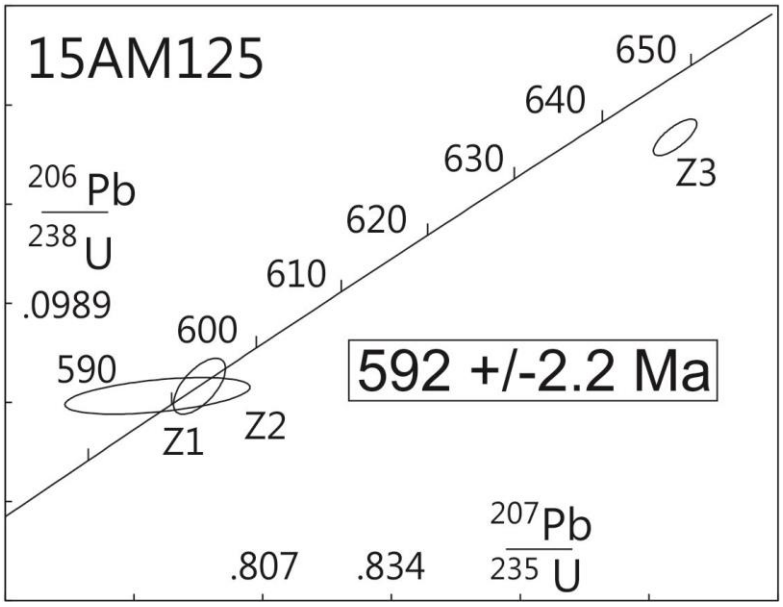
Lapilli tuff (east side of PCvb):



New ages raise new questions:

1. Should this now be considered the age of the ‘Bull Arm Formation’?
2. Are the similar ages on west and east side of the volcanic belt a result of folding?
3. What is the full age range of volcanism within the Plate Cove volcanic belt?

Altered crystal tuff (west side of PCvb):

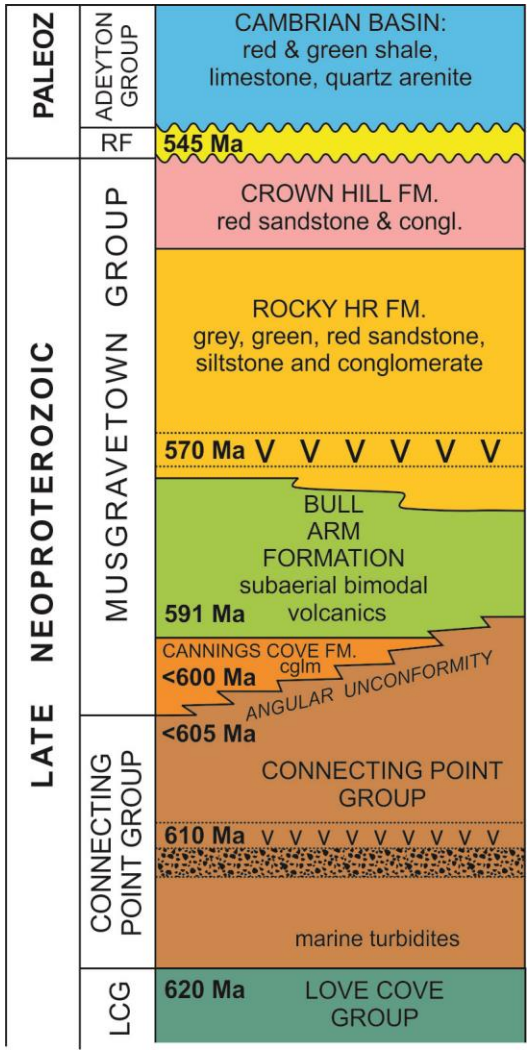


Summary

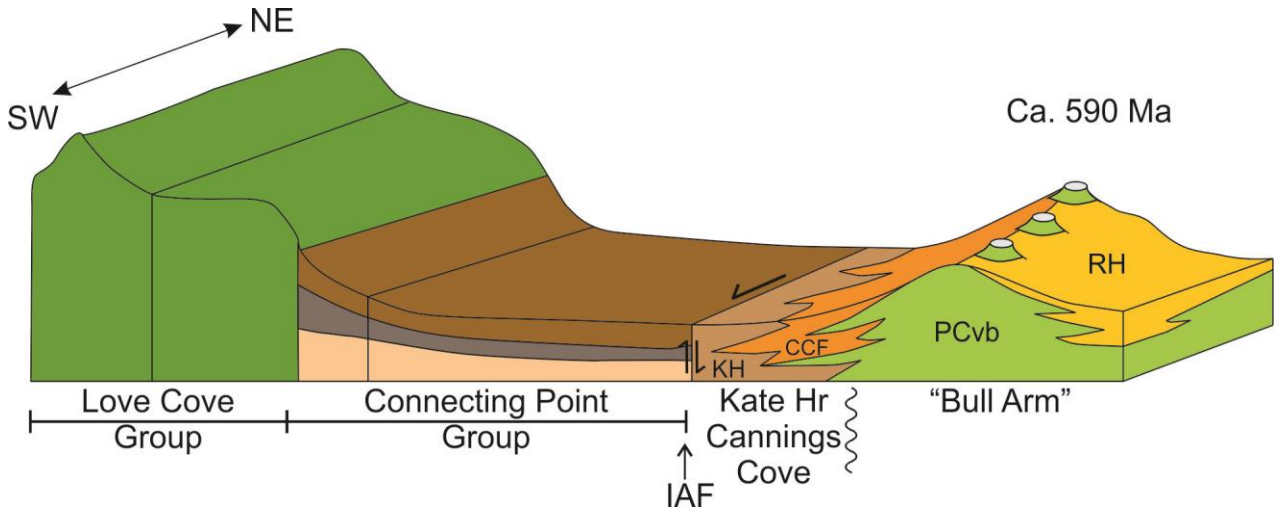
1. 630-610 Ma inheritance in all Sweet Bay samples – age of Avalonian arc, vestiges of which are now represented by Love Cove Group (e.g. Dec et al., 1992).
2. Concordant 610 Ma dates for all fractions from Eastport tuff = 610 ±2 Ma; constrains minimum age for underlying olistostrome. **Uplift at ca. 610 Ma**.
3. Age of ash tuff from Muddy Pond river is similar (maximum age 613 ±3 Ma); consistent with interpretation that this represents same stratigraphic position.
4. Wave-winnowed lithic tuff, below Southward Hd unconformity = 605 ± 2.2 Ma max. age for upper CPG, locally.
5. Crystal lithic tuff in Cannings Cove Fm cglm = 600 ±3 Ma = max age for CCF.
6. Age of Southward Hd unconformity: **ca. 605-600 Ma = Uplift**.
7. Age of SOME of the volcanic rx in the PCvb = 592-591 Ma. **New age for base of Bull Arm Fm??**
8. When was the CPG block (west of Indian Arm Fault) uplifted?

…. Episodic Uplift….

Summary



Cambrian cover sequence at Ocean Pond overlies the CPG with angular unconformity.
Timing of uplift of CPG block likely episodic during Ediacaran – ca. 610 Ma, 605-600 Ma, pre-591 Ma.
Possibly Precambrian extensional movements predate Precambrian contractional deformation that Tom Calon will tell us about IN APRIL!



Acknowledgements

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