CCArray: Consequences in Cordillera of Present and Past Plate Interactions

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on behalf of many collaborators

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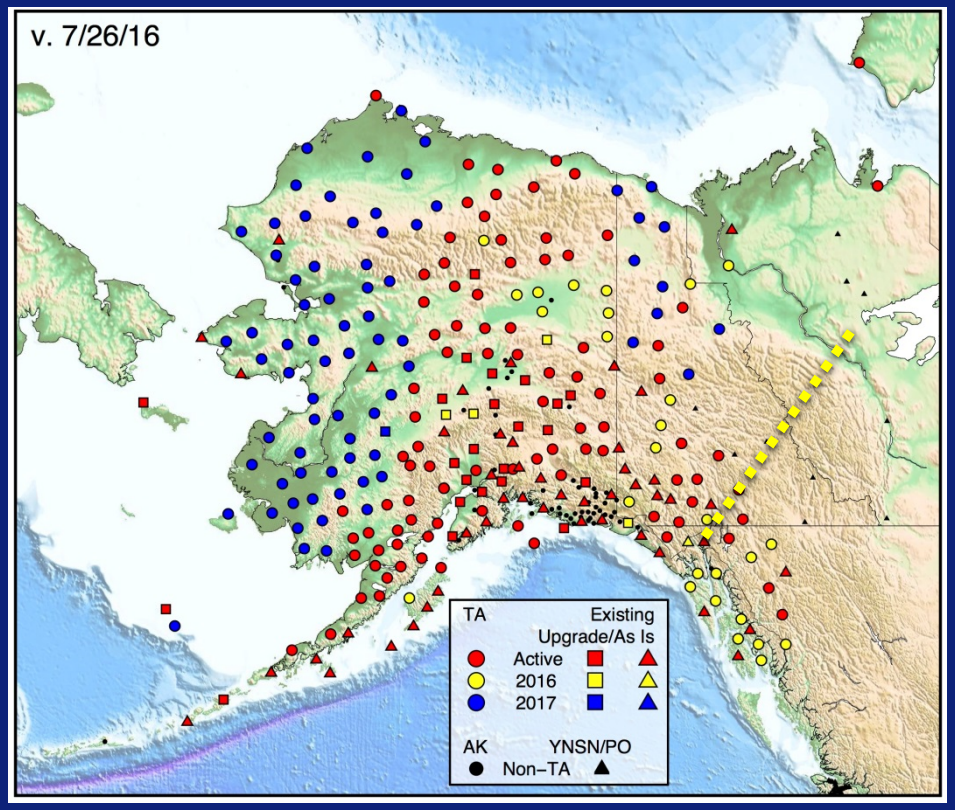
Fill the Northern Cordillera gap in seismic stations (USArray) and in GPS (PBO) between Washington State and Alaska

200-400 Seismic Stations and OBSs, numerous GPS stations, and supporting geoscience

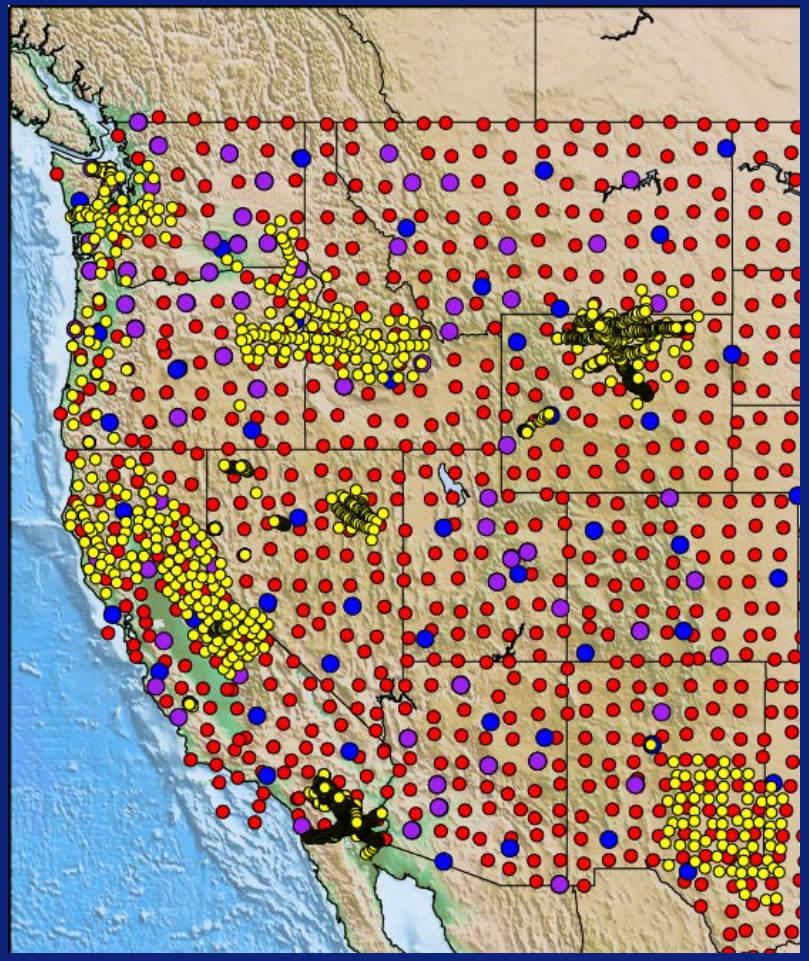
World class scientific objectives to be addressed:



USArray Alaska

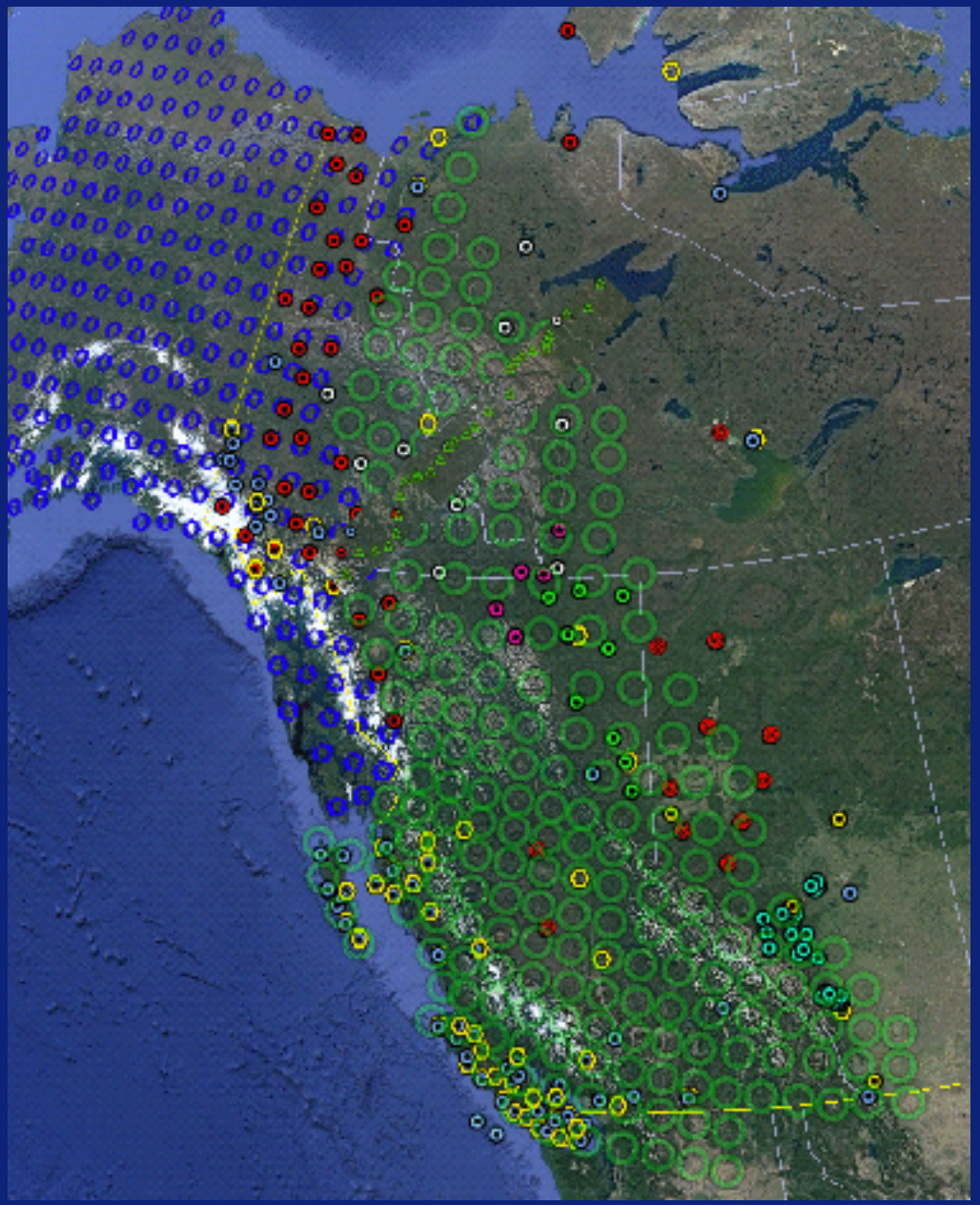
USArray Western US

And some FlexArray



CCArray schematic with current seismic stations

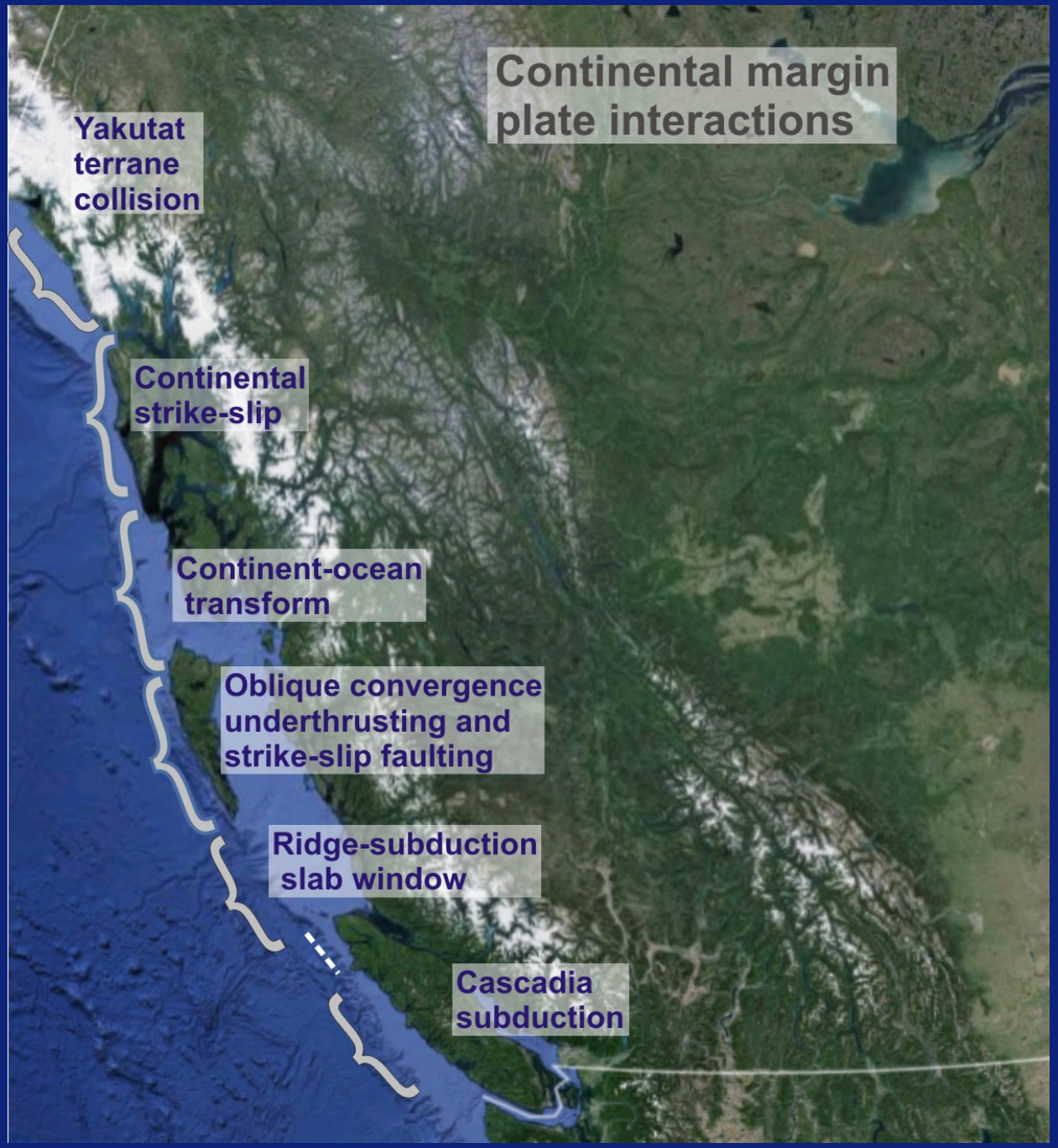
Area to be covered In several phases



Margin Tectonics Targets

1. Current Plate Interactions

2. Past Plate Interactions, assembly of Cordillera

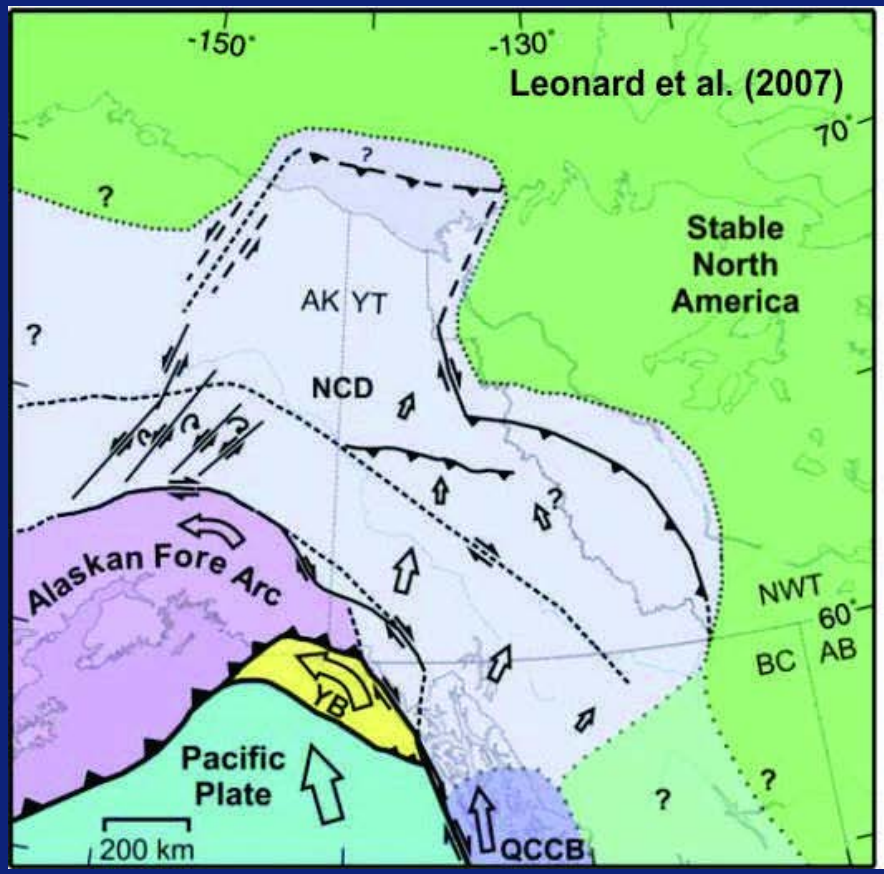


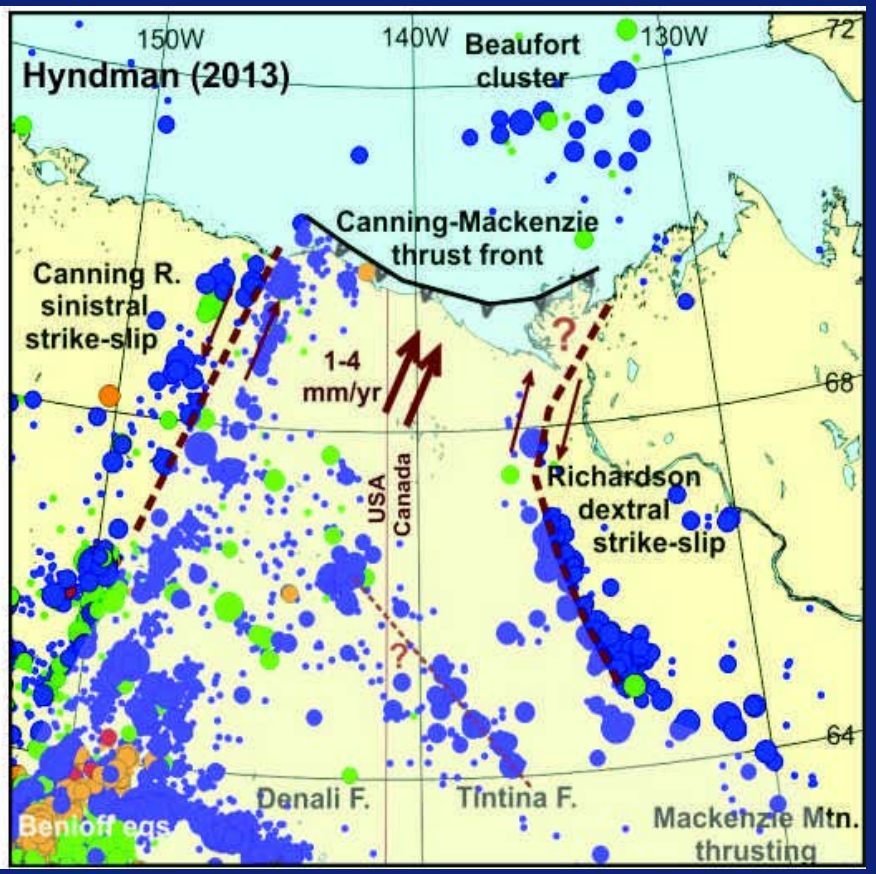
Consequences of Yakutat terrane collision

Landward extension of Steep project etc. studies on margin

Active thrusting on the Beaufort Sea margin

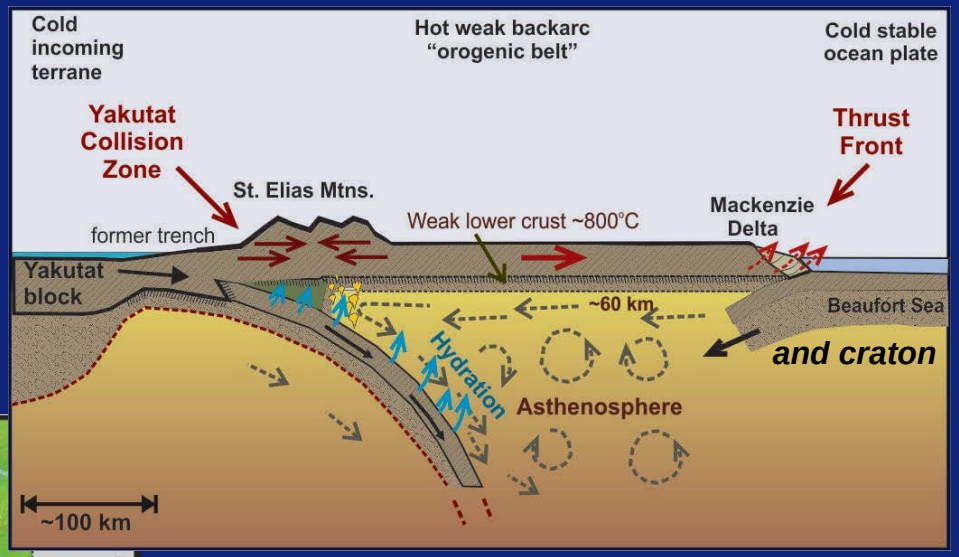
Potential for great thrust earthquakes and tsunamis

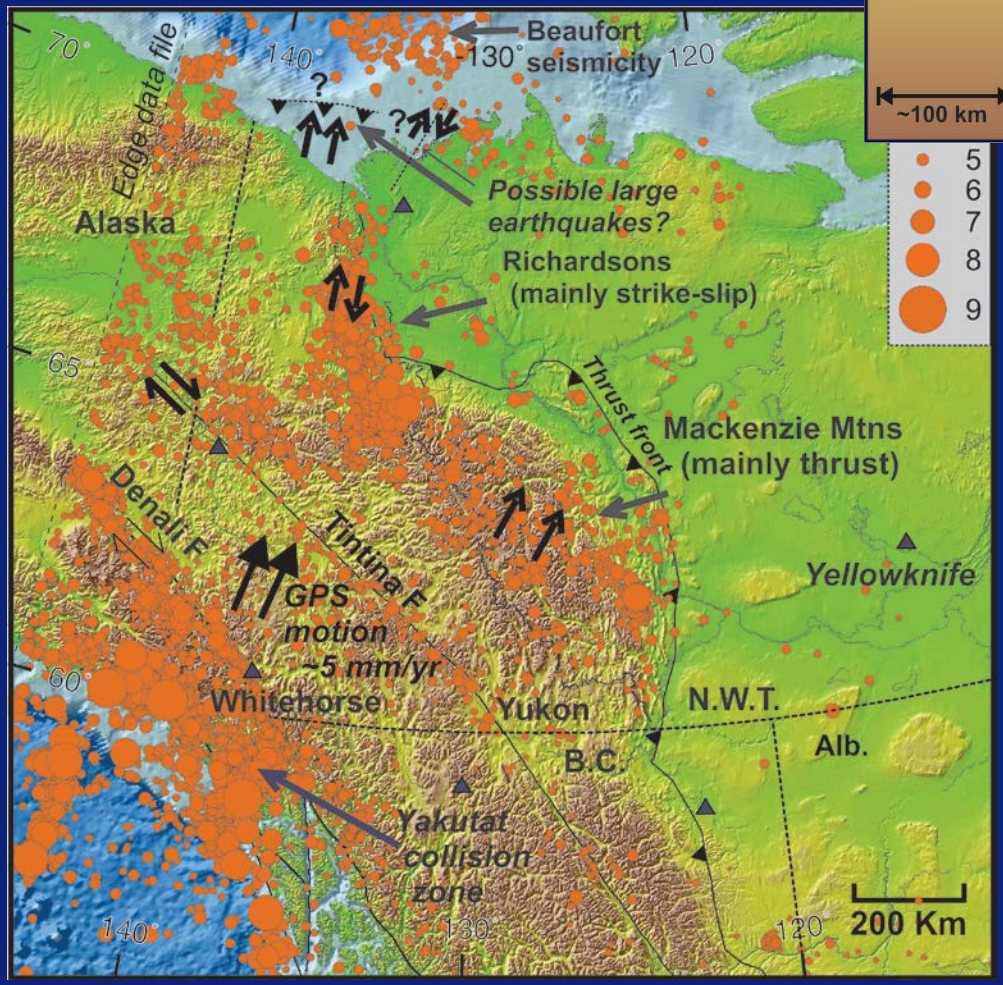




Cordillera-wide deformation and seismicity from Yakutat Terrane collision on margin

(Hyndman and Mazzotti, 2002)



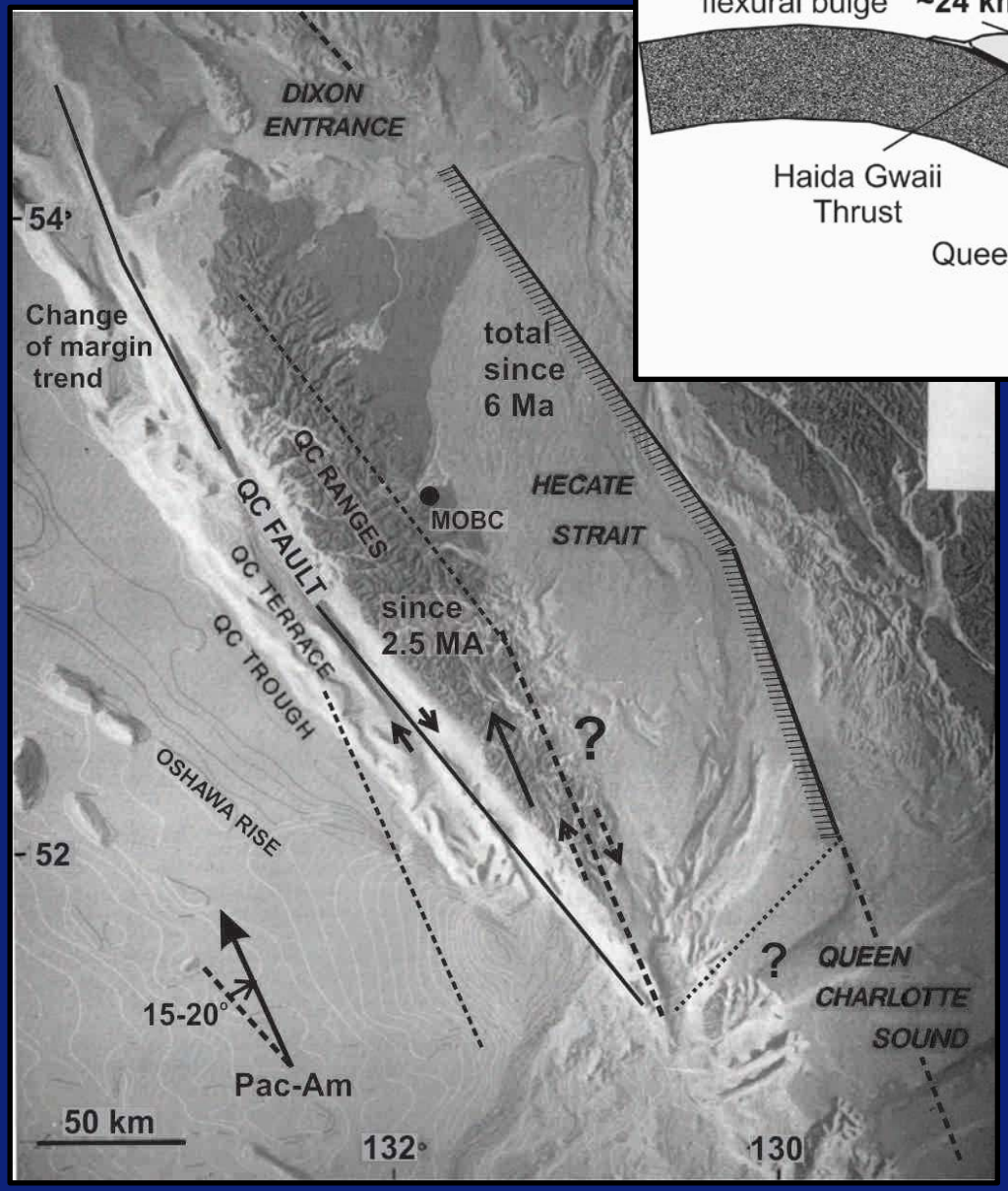


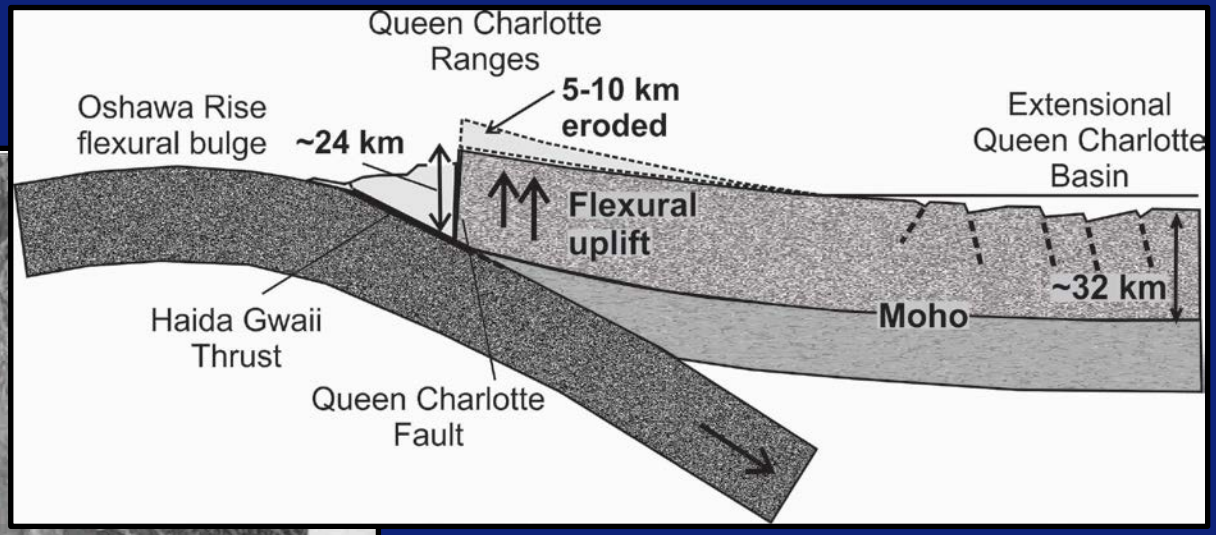
Area with high seismicity and poor seismic station coverage, and poorly defined active faults

Queen Charlotte margin

Subduction initiation
Haida Gwaii margin
2012 megathrust and tsunami

Margin parallel sliver



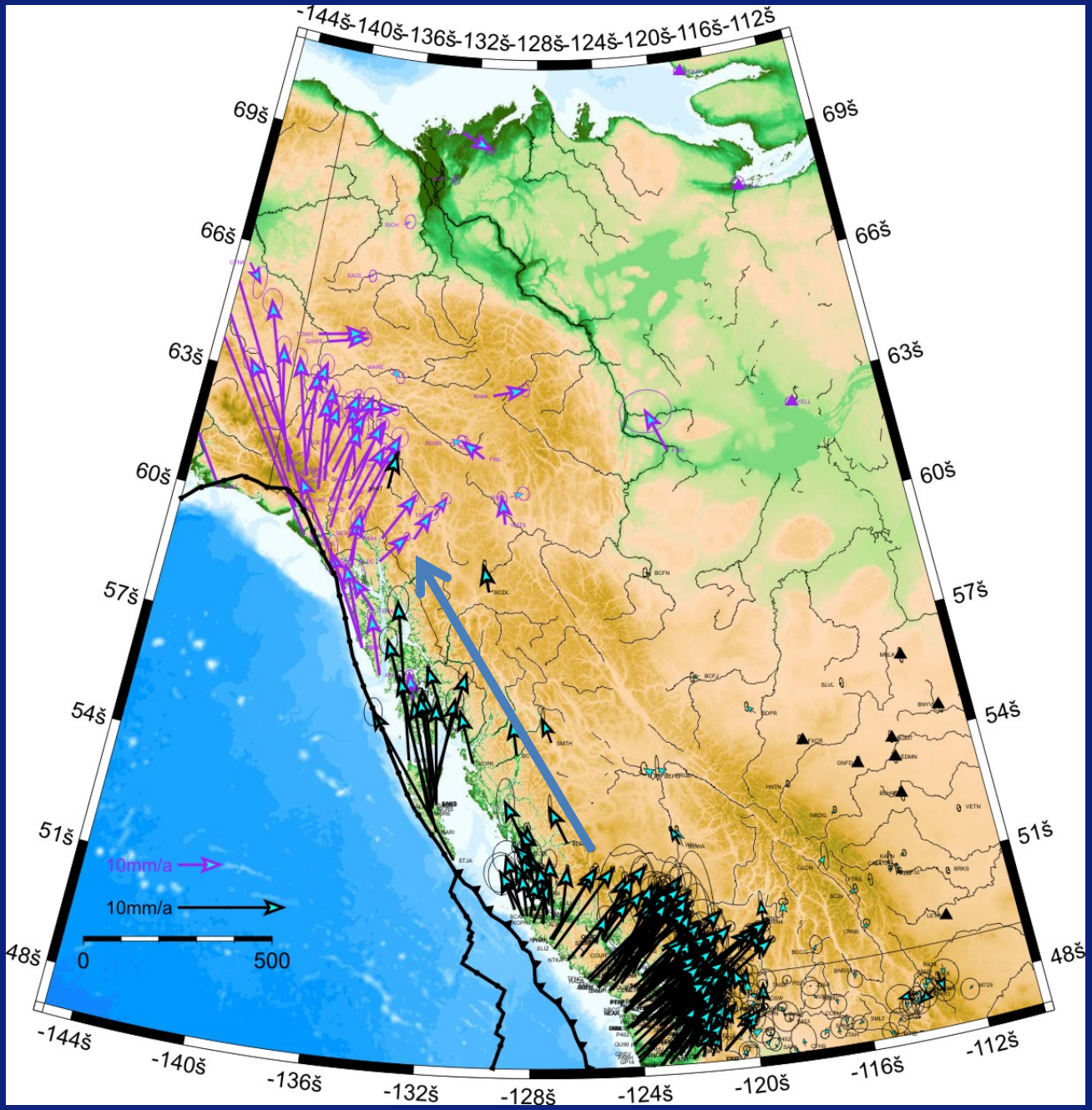


Subduction initiation at ~6 Ma

Uplift created Islands of Haida Gwaii

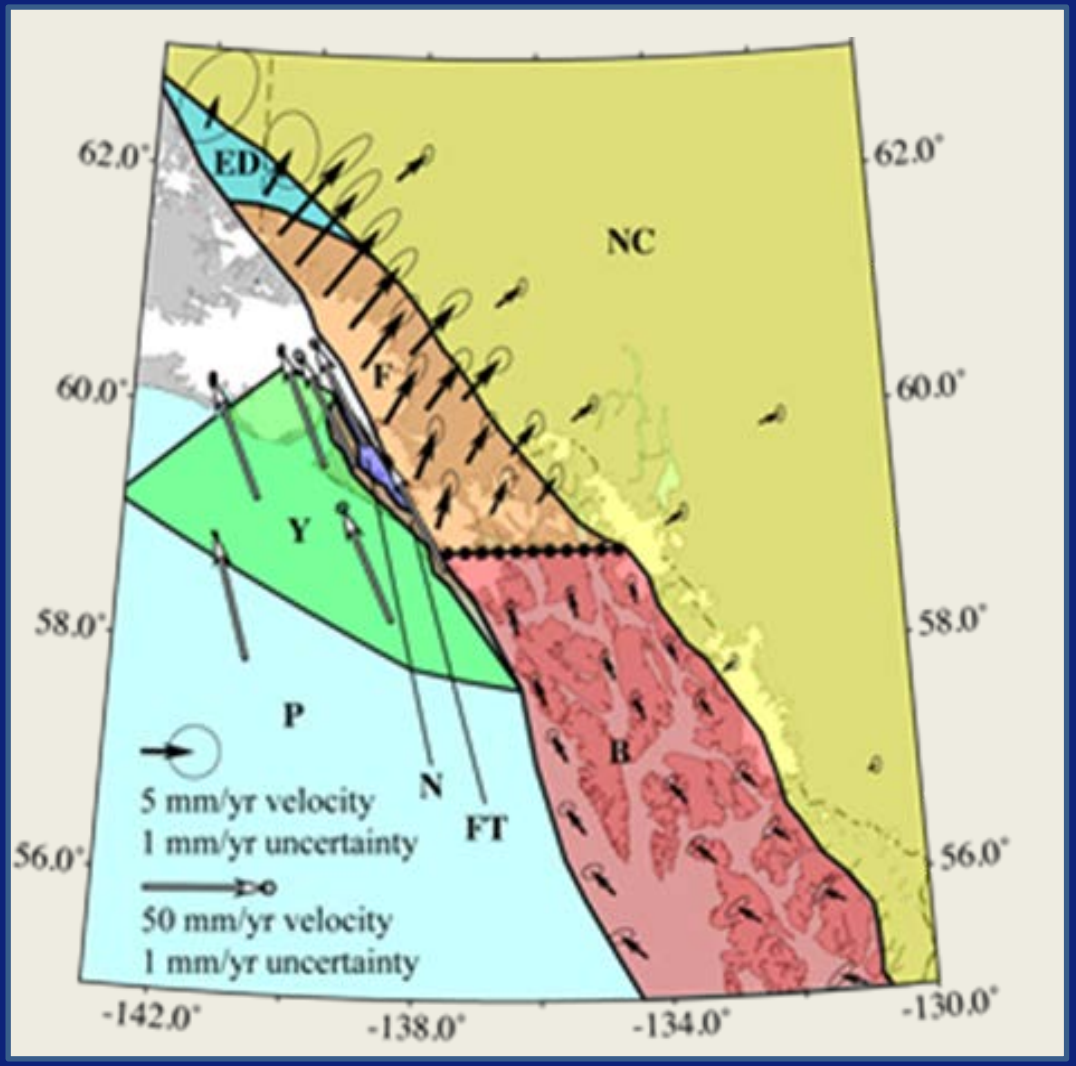
No arc volcanics or slab seismicity yet

Margin parallel coast zone

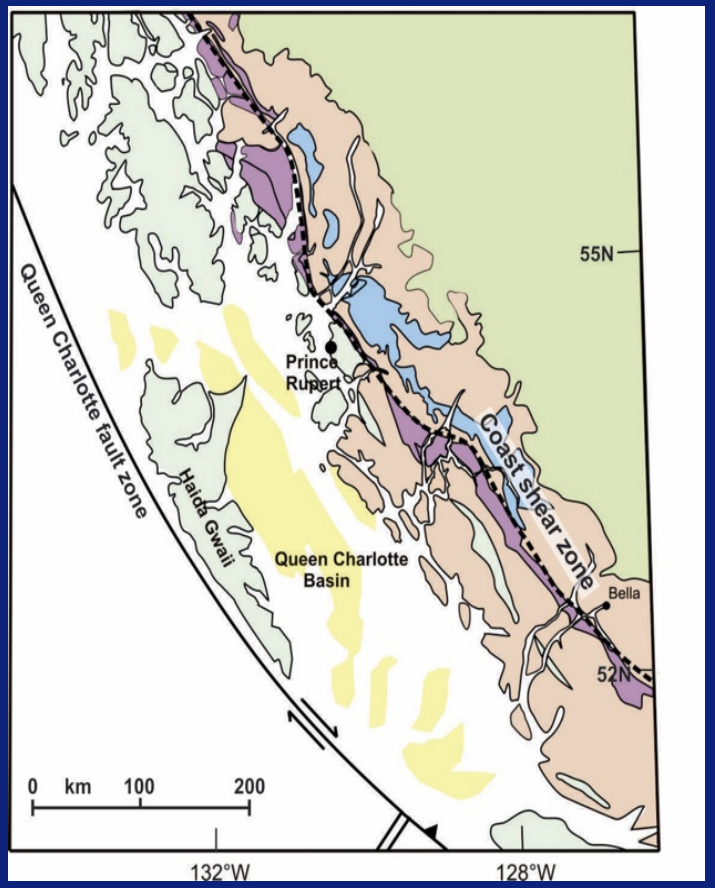


(from J. Jiang)

Margin parallel sliver



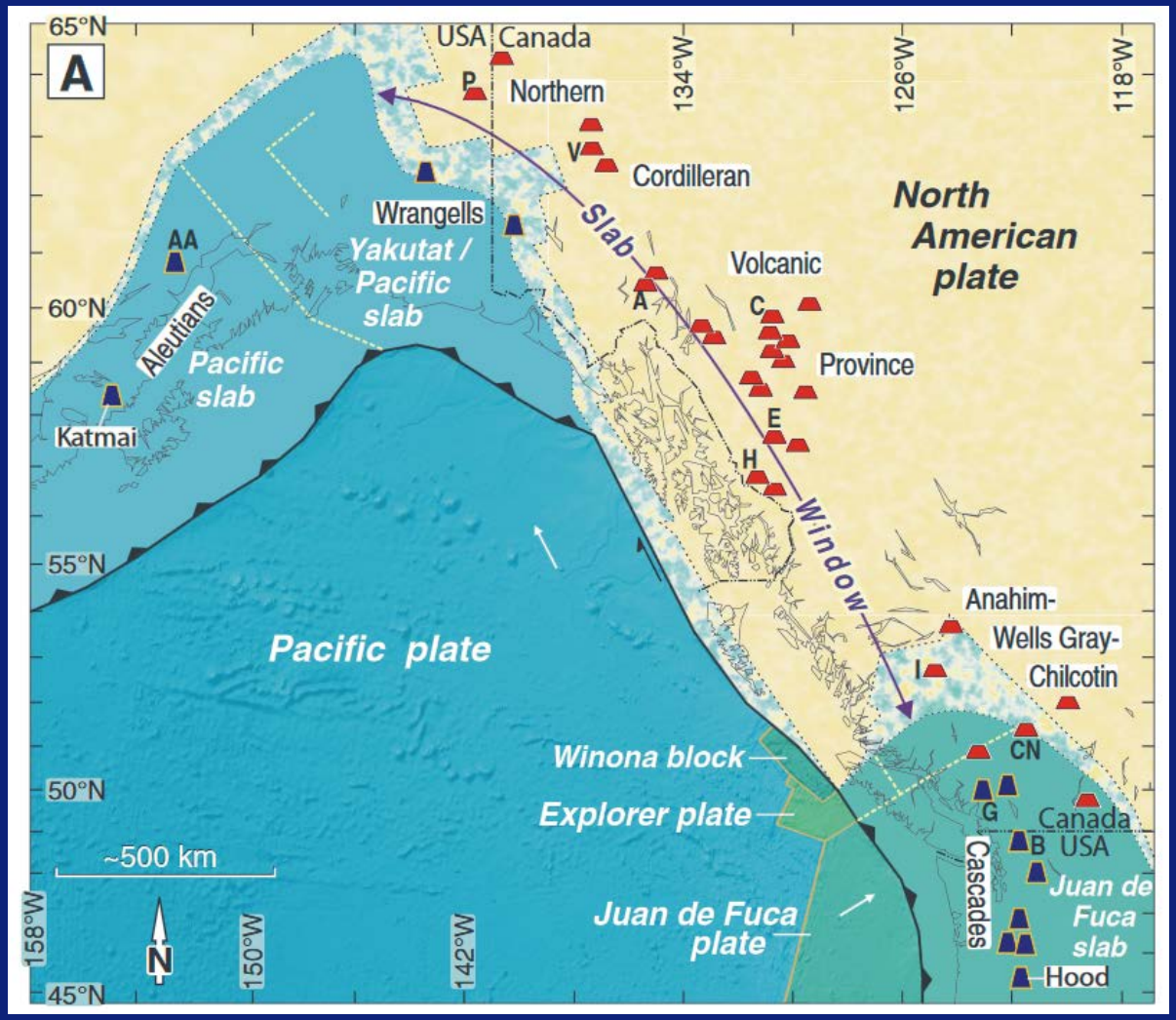
Elliott et al. (2010)



Hippchen (2005)

Ridge subduction
Slab windows

Consequences of ridge subduction and slab window formation



Thorkelson et al., 2011

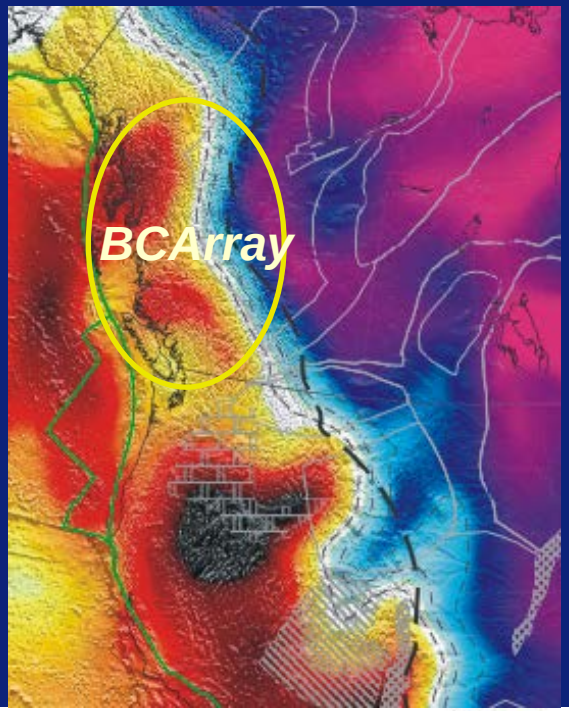
Cordillera terrane deep boundaries

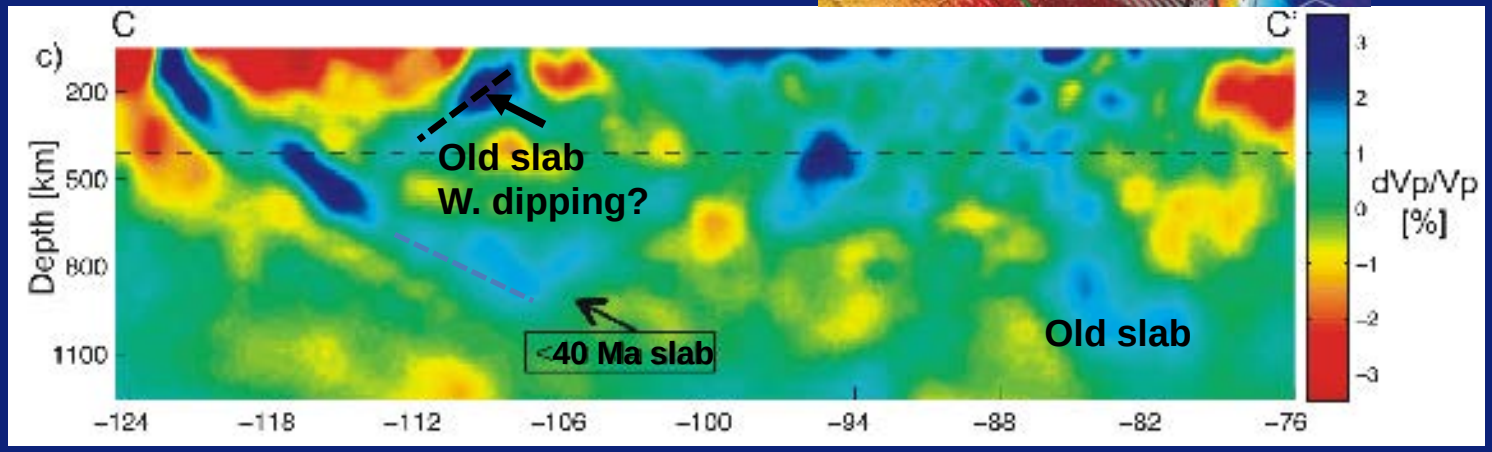
Old subducted slabs

Terrane assembly

Traces of old subducted slabs; Terrane accretion boundaries

Tomography velocities
Western N. America
Depth 100 km
(Schaeffer and Lebedev, 2014)





USArray example section across N. Calif.

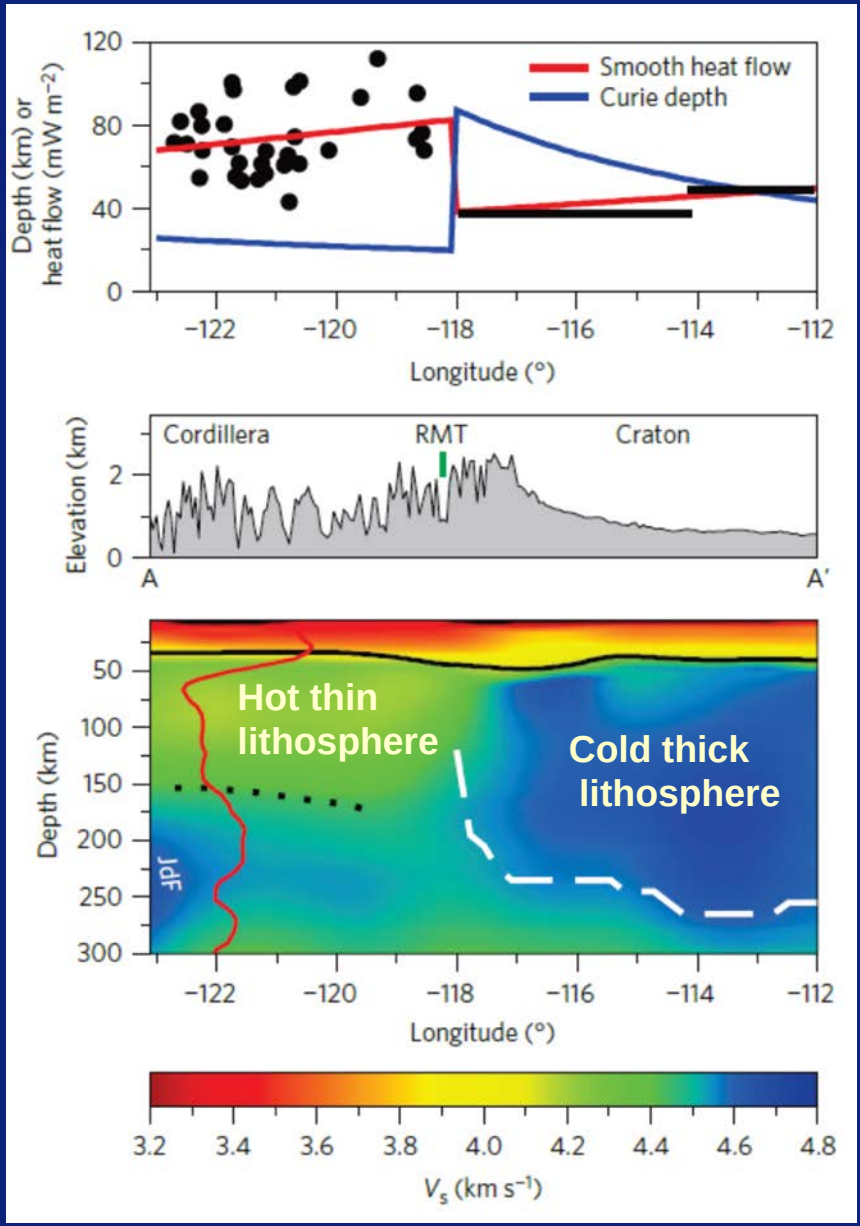
Schmandt and Lin, 2014

Cordillera-craton boundary

Thermal and lithosphere thickness boundary

Thinning of craton lithosphere?
Widening of Cordillera backarc
mobile belt?

Cordillera-craton velocity and thermal boundary



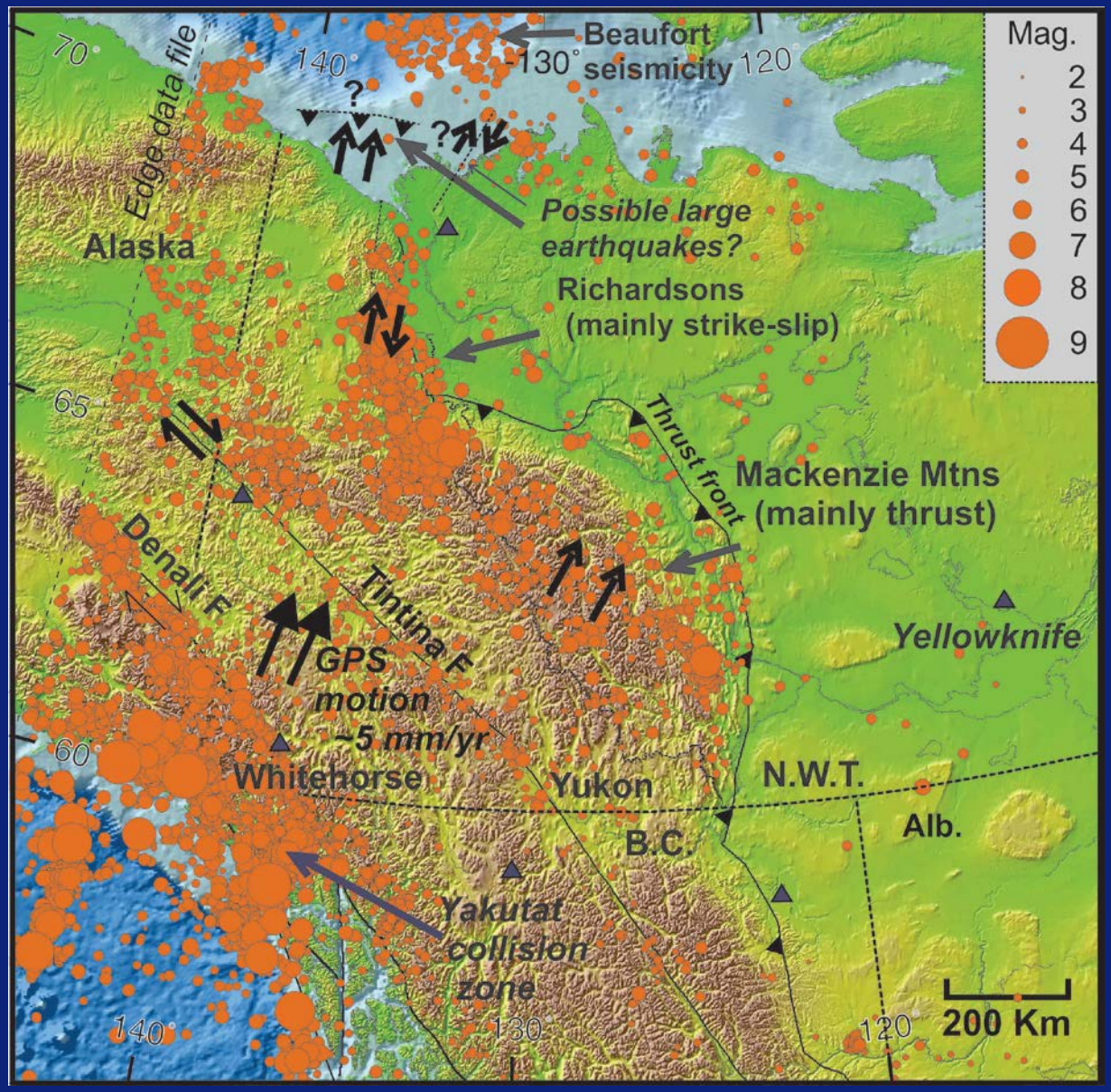
Bao et al., 2014

Seismicity, active fault, hazard

Seismicity in Cordillera

Mapping active faults

Earthquake hazard



Induced seismicity

Mainly western Canada sedimentary basin

Address some world class scientific targets

Fill gap in coverage (USArray) and in GPS (PBO) between Alaska and western US

1. **Delineation of crustal structure of W. Canada**; Underpinnings of Cordillera geology and geological history; terrane assembly; map sutures, old subducted slabs in mantle

2. **Seismicity in W. Canada**; much improved locations, statistics and other hazard characterization; delineation of active faults

3. **Induced seismicity**, especially regional seismicity baselines

4. **Ridge subduction**; effects on continent, from plate edges, slab windows, origin of Cordillera volcanism

5. **Constraints on continental tectonics** from current plate margin interactions, incl. Yakutat terrane collision landward deformation

6. **Subduction initiation** (Haida Gwaii at 6Ma); A key process in past plate re-organizations

7. **Arctic Array continuation**? And then eastern Canada?

Also, meteorology, GPS ionosphere, etc. use of grid with communications and “supporting geoscience”?

Some new technologies for seismic arrays

-Array processing

-Ambient noise and earthquake tomography

-Receiver functions

Crustal and lithosphere thickness
Crust and upper mantle temperatures

For discussion:

(a) input from a number of authors with broad expertise,
(b) further definition of scientific targets and how the new data will address them,
(c) a draft seismic and GPS operational plan; **supporting geoscience**,
other uses of station array
(d) budget estimates
(e) Funding and in-kind sources; NSERC, CFI, NSF, GSC and others

Wide involvement from Canadian and US universities, Geol. Survey Canada, and provincial geological surveys is essential at an early stage.

Some CCArray
Scientific targets