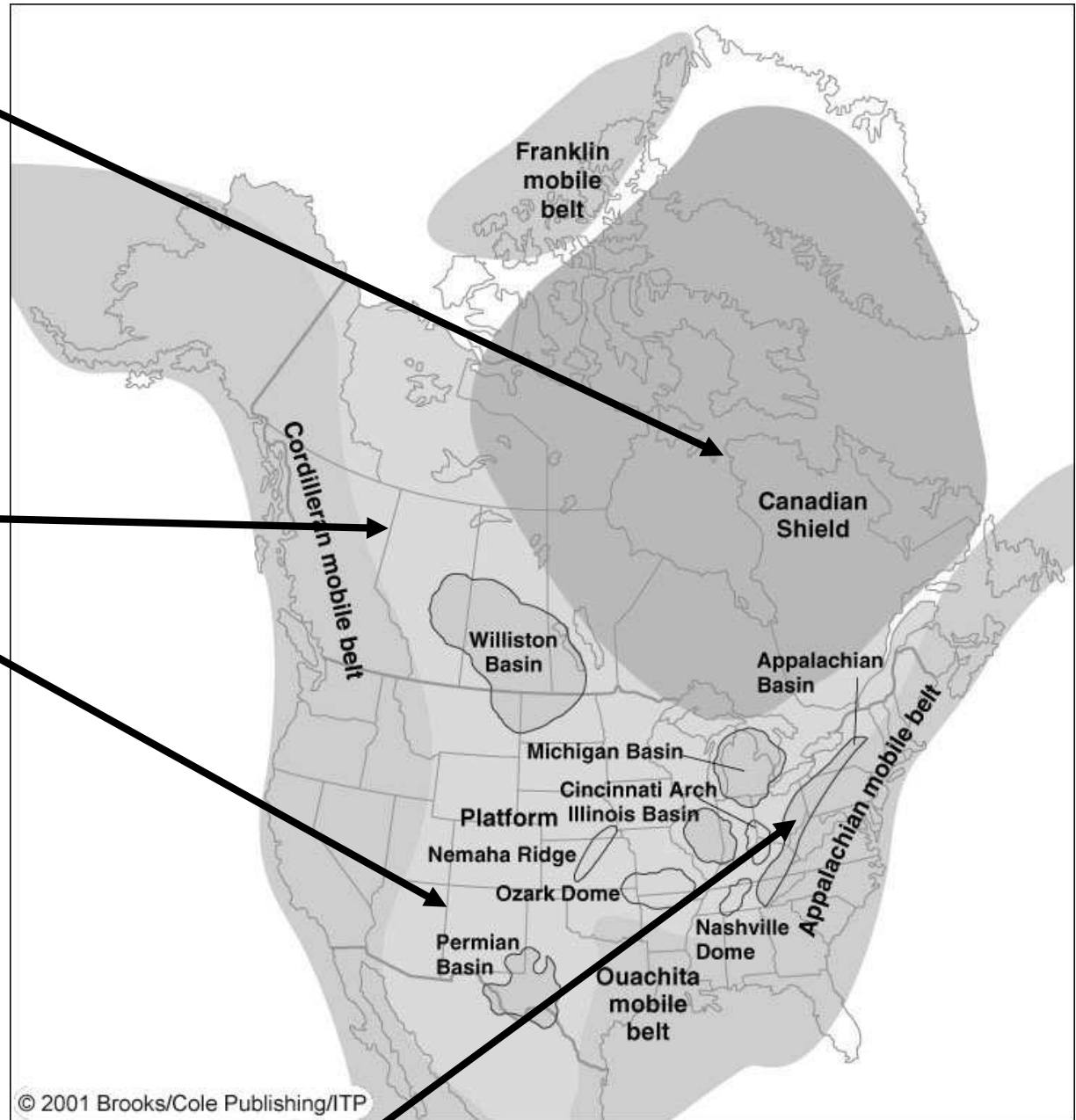
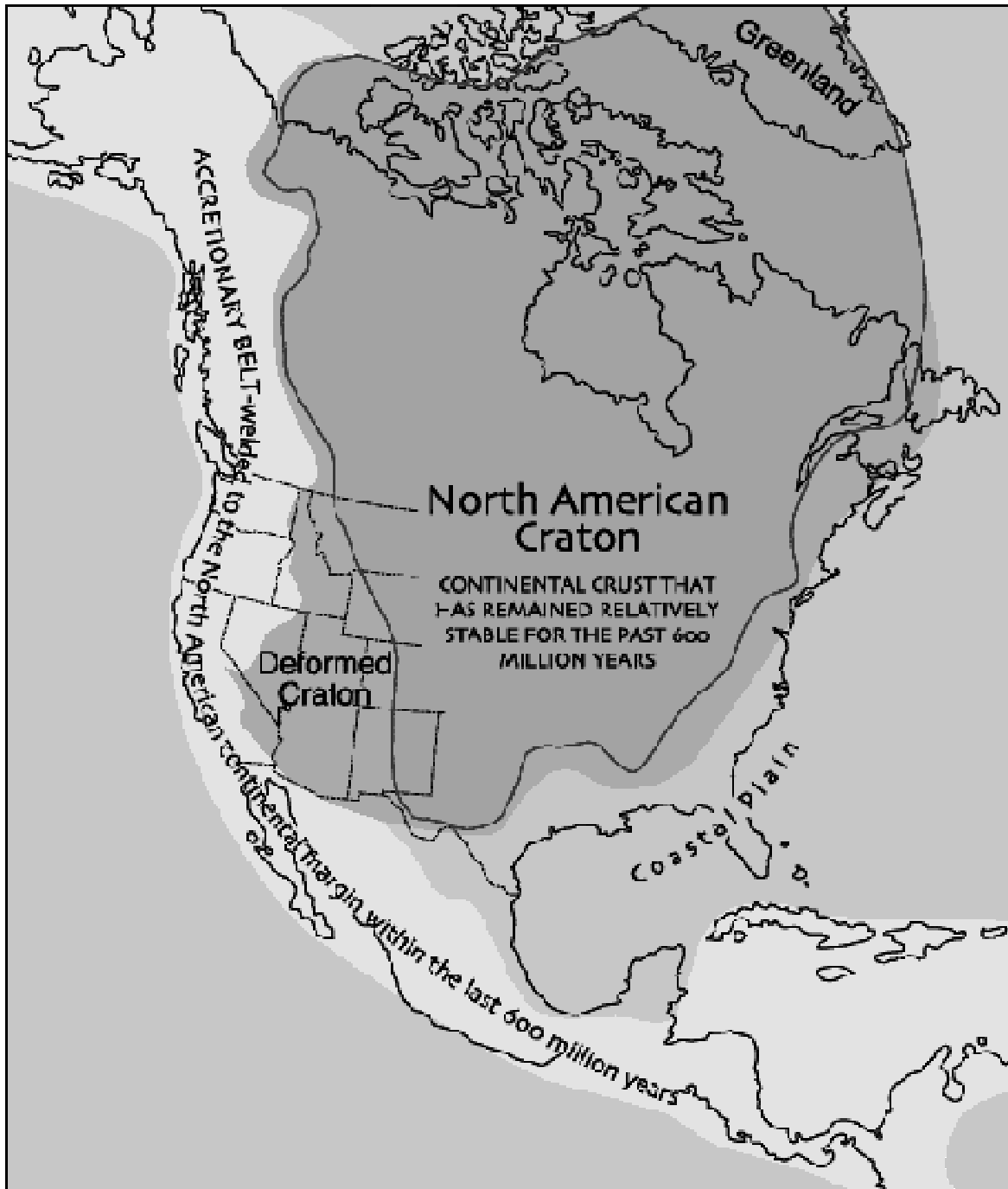


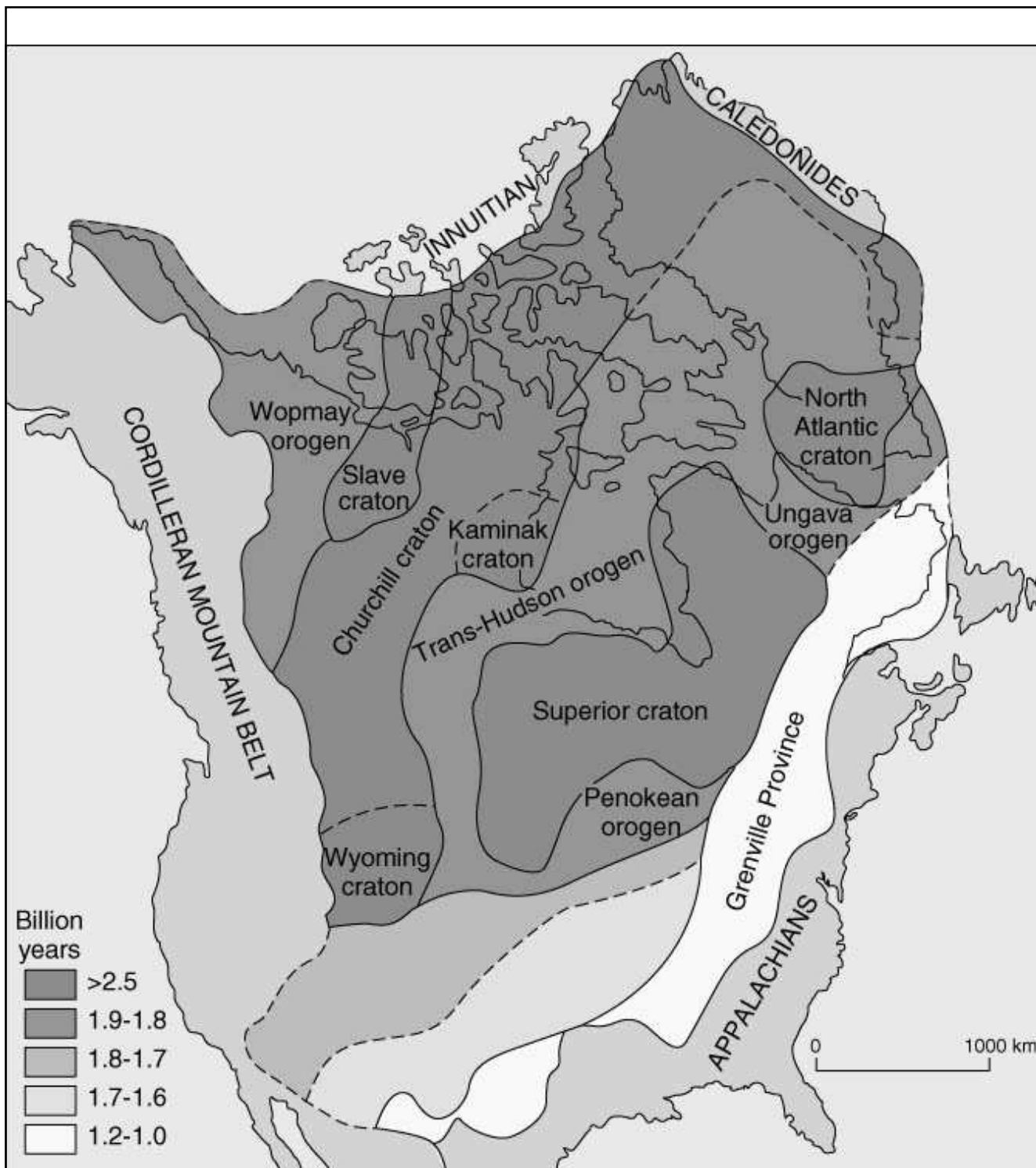
4

Canadian shield – not covered during Paleozoic, re-mainder of craton (light brown) was periodically covered by epeiric (shallow, inland) seas. Green (basins) & yellow (domes) = local areas of gentle warpage of platform sedimentary rocks.



Appalachian Basin





Hlavní část laurentského štítu byla vytvořena při **transhudsonské** orogenezi (1,8-1,9 Ga), menší části byly přiřčleněny při **mazatzalské** a **penocké** orogenezi (1,5-1,8). Nejmladší proterozoickou orogenezi je **grenvilská**, která skončila před 1,0 Ga.

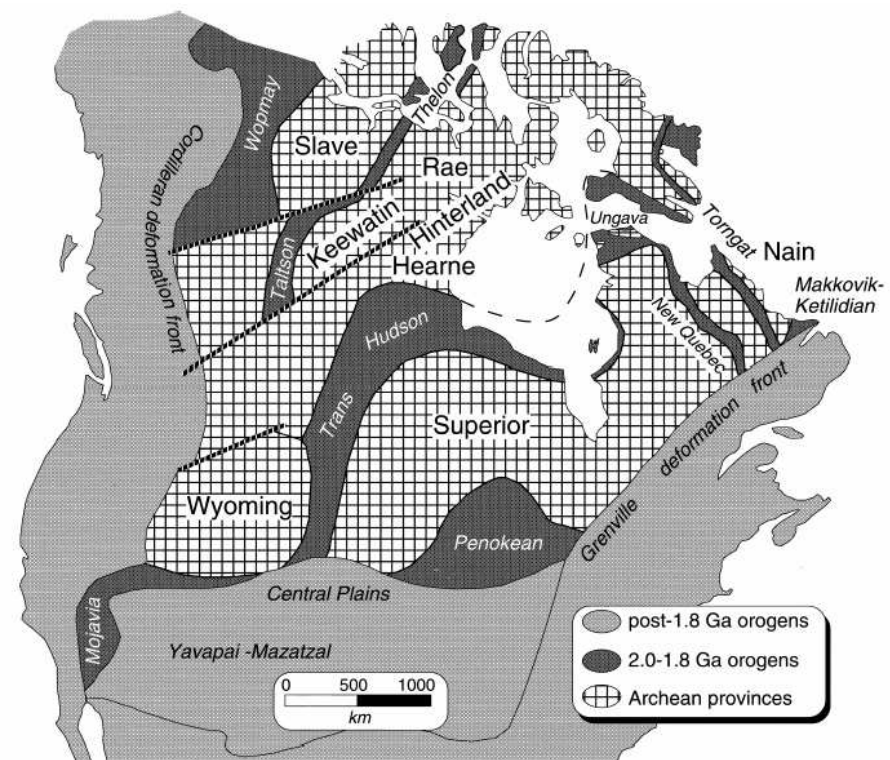
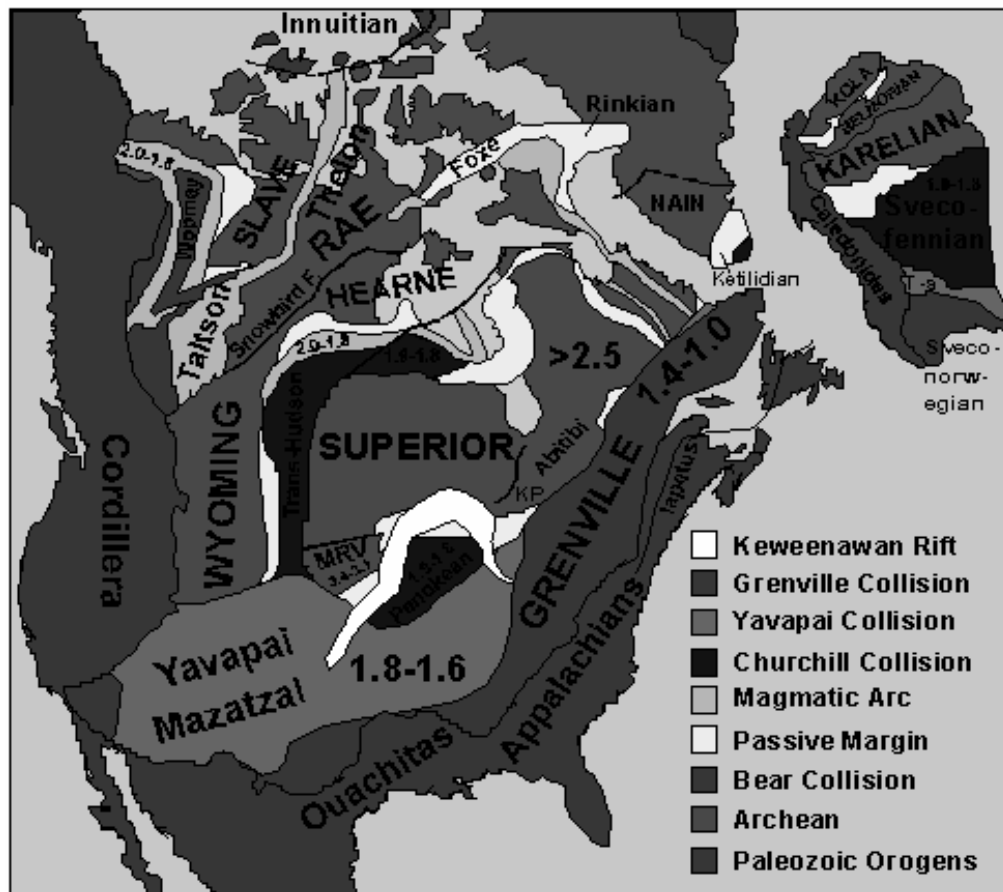


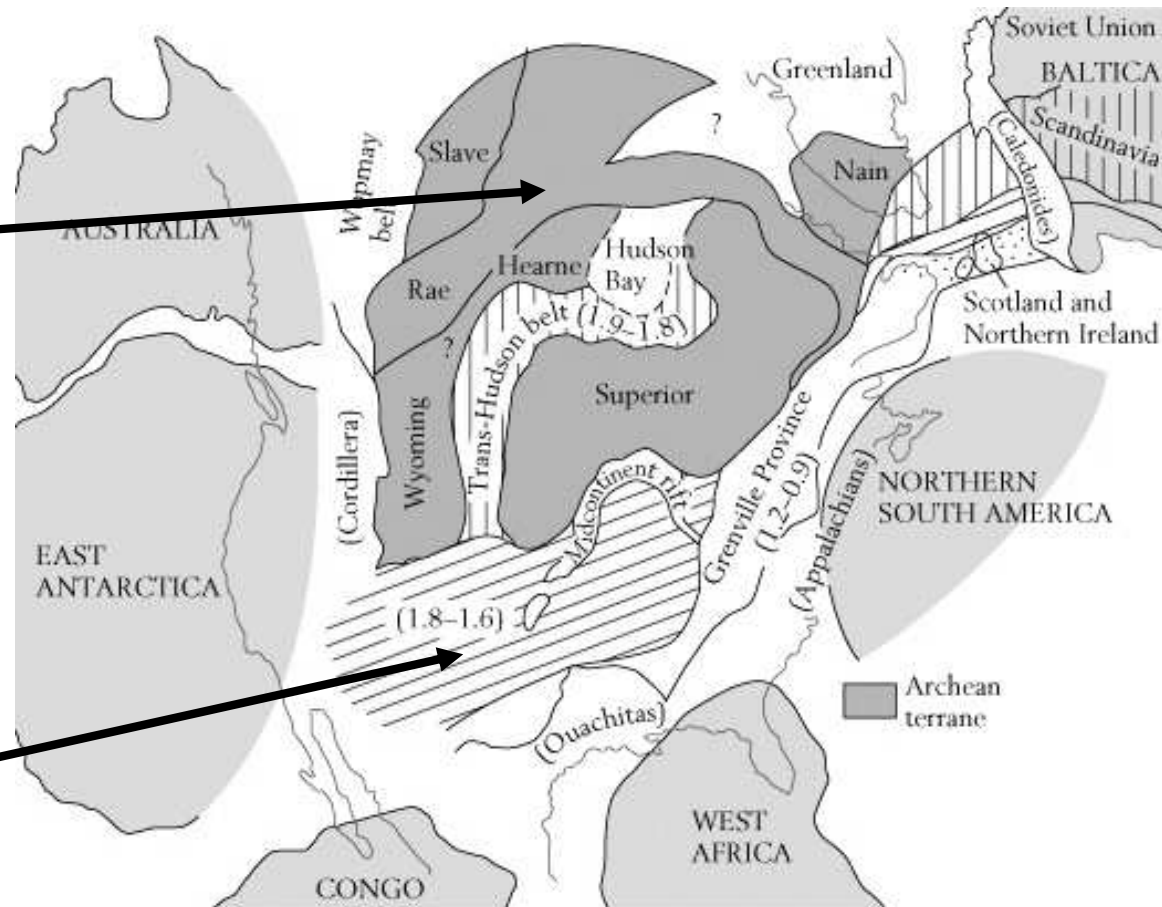
Fig. 1. Archean provinces and surrounding orogens in North America. For simplicity, ca. 2.5–2.1 Ga cover rocks have been omitted. Modified after Hoffman (1988, 1989a).

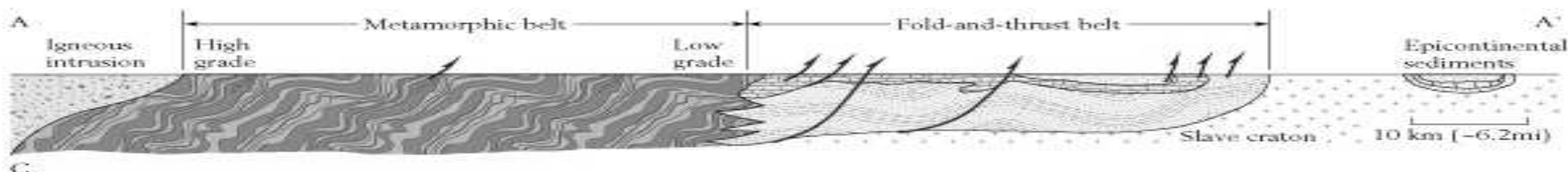
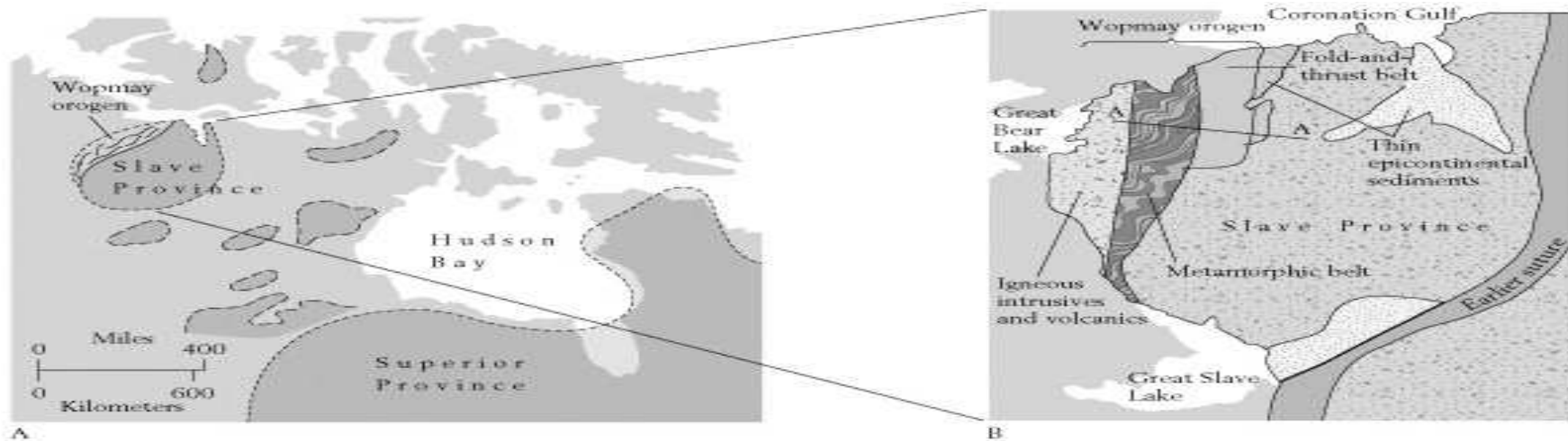
Continental Accretion

- During Proterozoic, Laurentia was growing by accretion

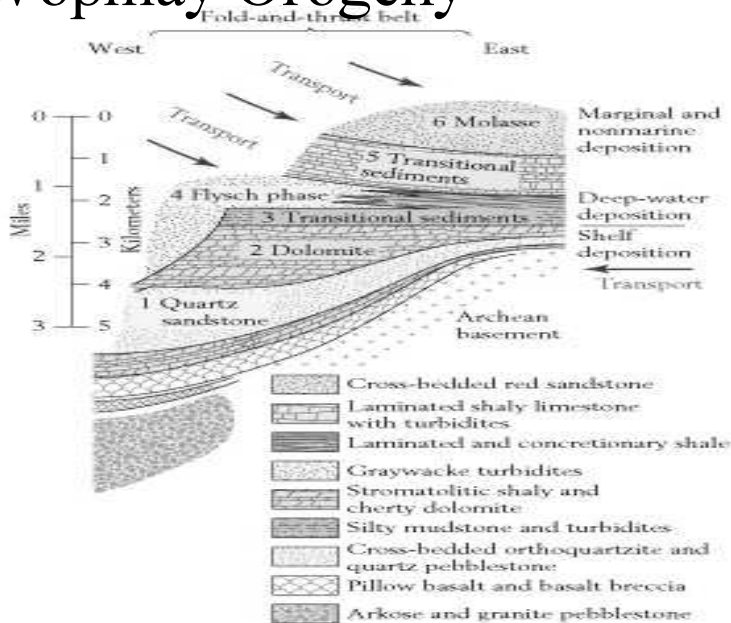
Phase 1:
1.95-1.85 bya
Suturing of ~six
microcontinents

Phase 2:
1.8-1.6 bya
Suturing of island
arc to south





Wopmay Orogeny



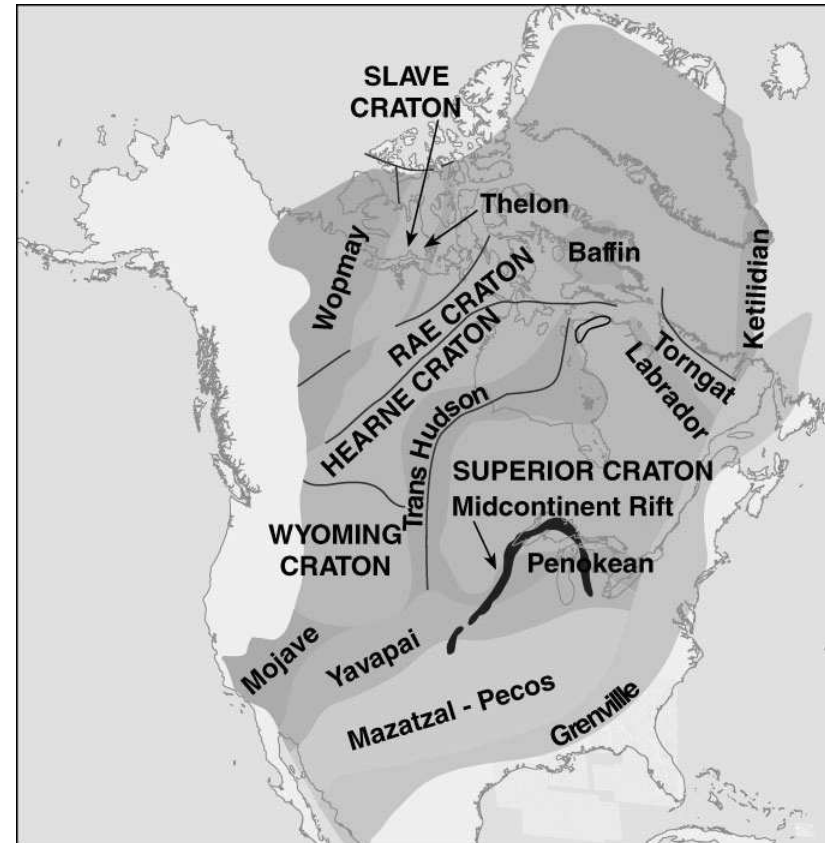
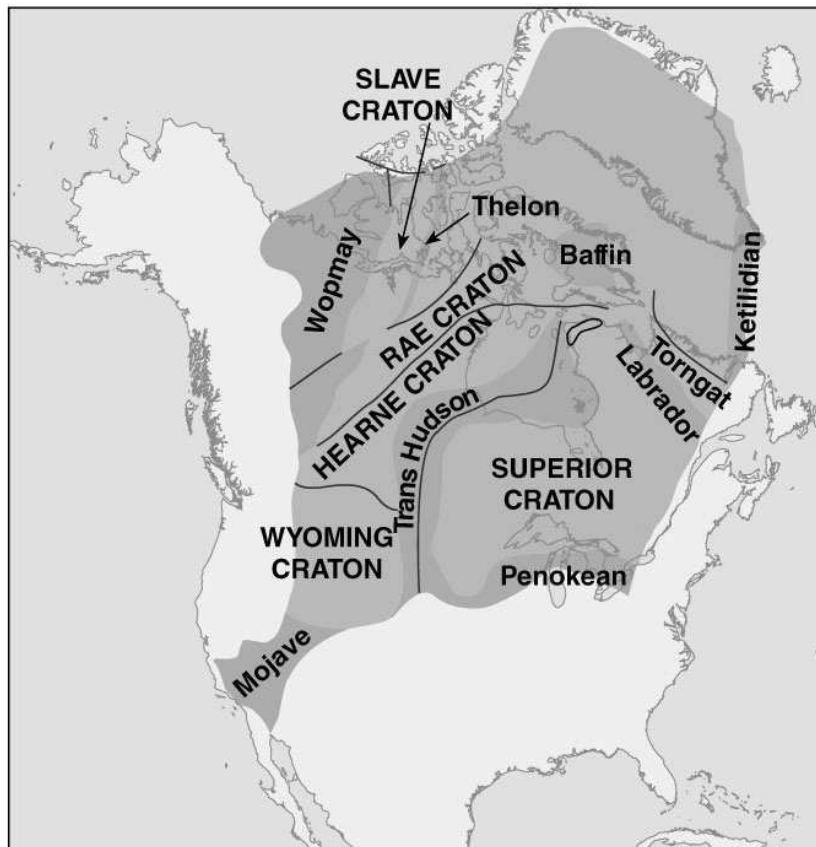
NA geologic provinces

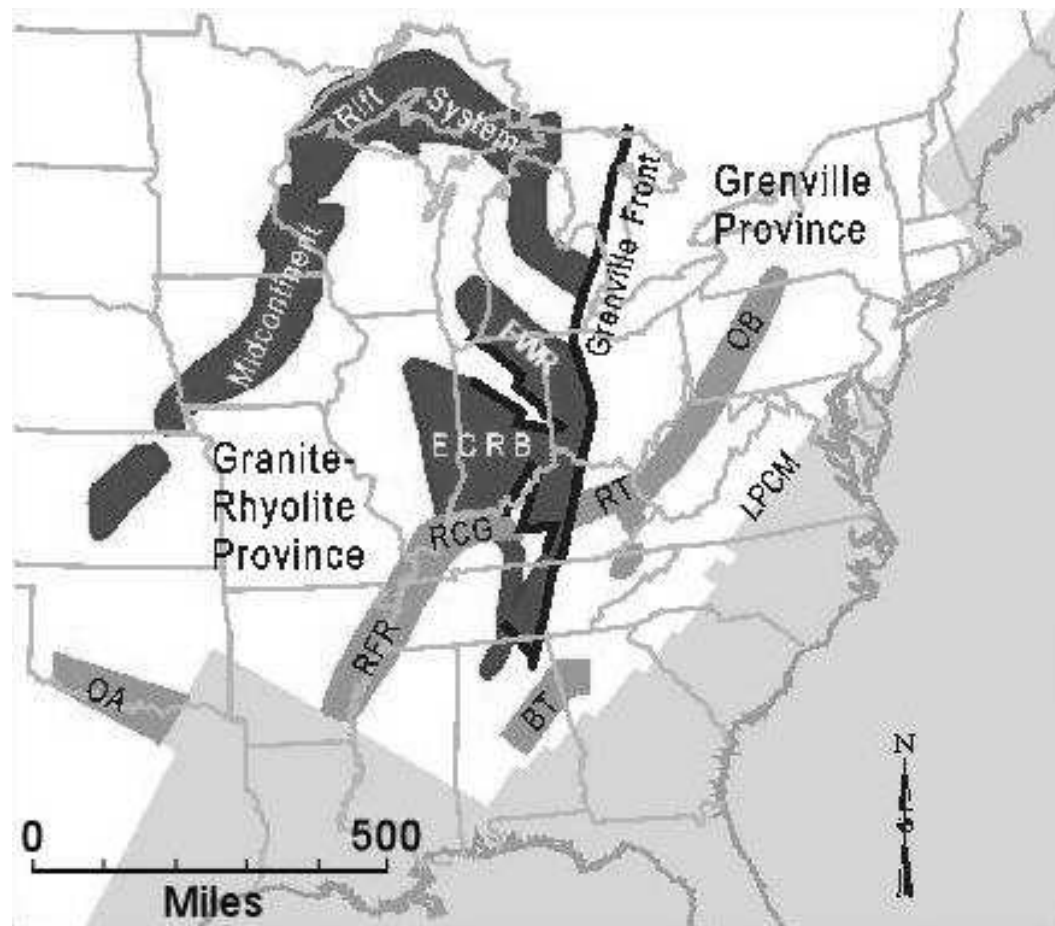


4

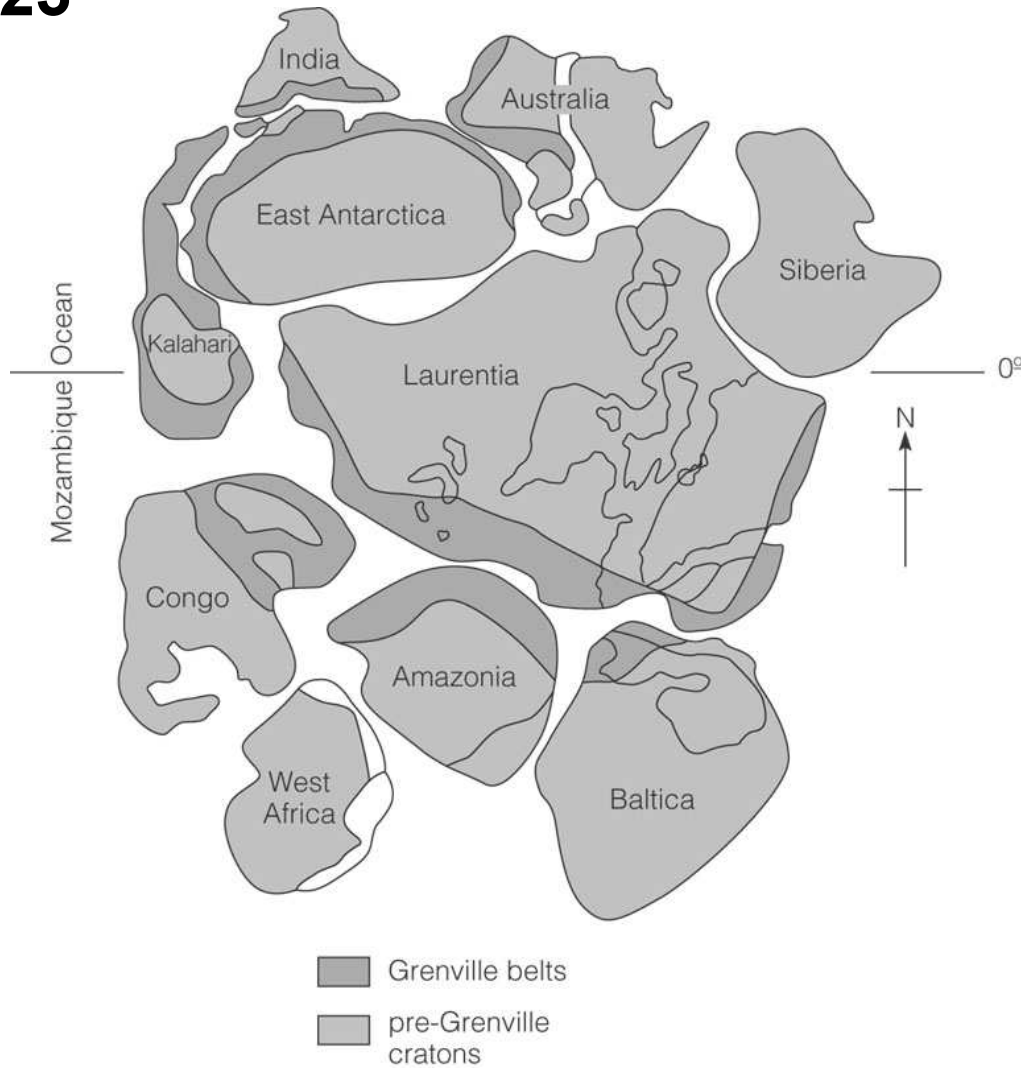
-  900 million - 1.2 billion
-  1.6 billion- 1.75 billion
-  1.75 billion- 1.8 billion
-  1.8 billion - 2.0 billion
-  2.5 billion - 3.0 billion

During Proterozoic, Laurentia grew to southeast by accretion of other cratons. Collision zones = orogenic belts. Brown masses – Archean age.

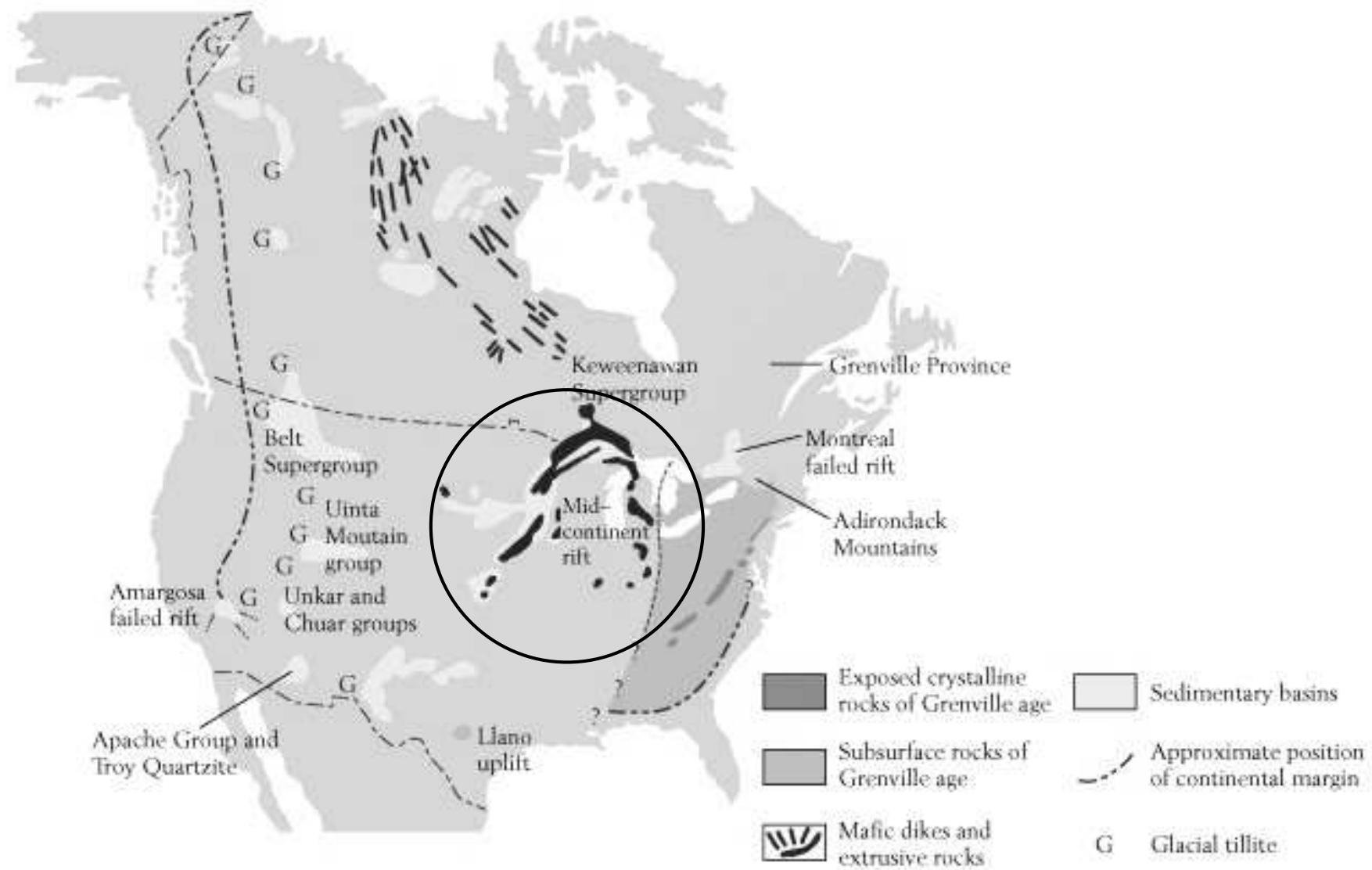




23



**Rodinia – final
“assembly” during
Grenville Orogeny
(1.3 to 1.0 b.y. ago),
then fragmentation
began 750 m.y. ago.**



Fanerozoické mobilní zóny

Kaledonsko – apalačská mobilní zóna

Kordilerská mobilní zóna

Franklinsko-inuitská mobilní zóna

KALEDONSKO-VARISKÁ OROGENEZE

Grónské kaledonidy

**Apalače – terání stavba, kaledonské (takonská, akadská)
i variské (alleghanská) fáze**

**Pásmo Quatchita-Marathon – alleghanská fáze, kolize s
jihoamerickou částí Gondwany**

APALAČE

Laurentia – Humber, Valley and Ridge, Blue-Ridge terranes

Centrální zóna – hlavně vulkanické oblouky (Notre Dam, Dunnage, Exploit, Piedmony aj.)
a akreční melanz Iapetu

Gondwanské terány – Avalonia, Meguma, Gondwana

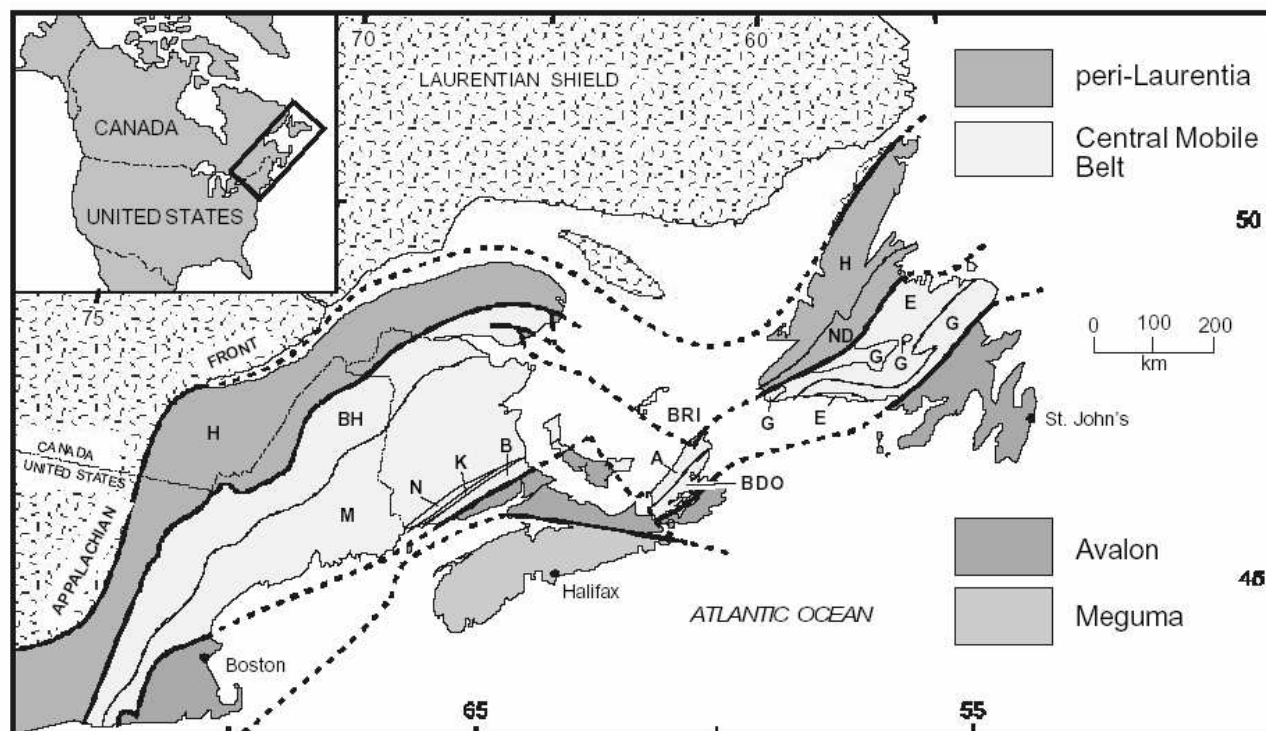
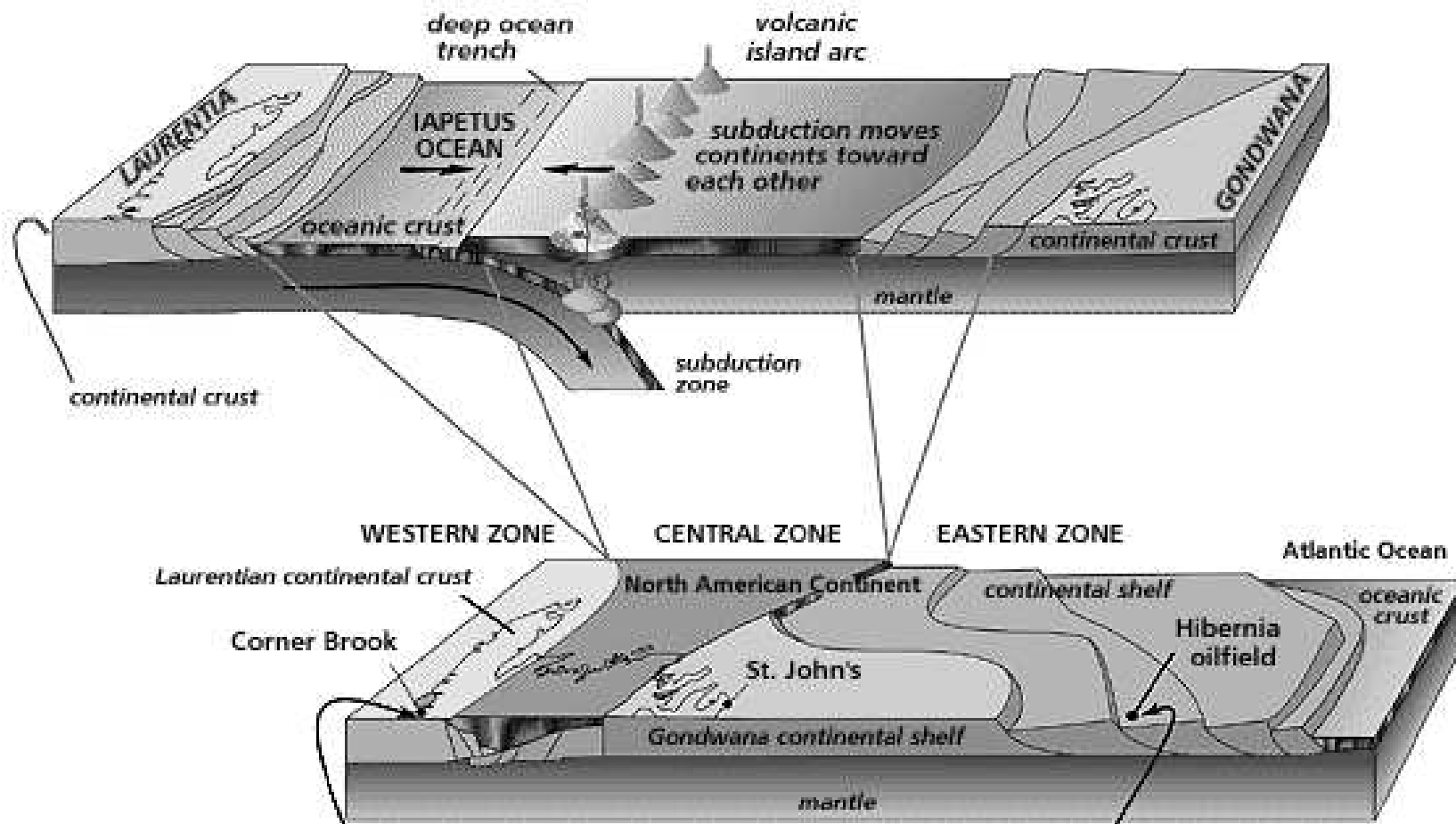


Figure 1. Simplified map of the northern Appalachian orogen showing crustal blocks and terranes (A, Aspy; B, Brookville; BDO, Bras d'Or; BH, Bronson Hill; BRI, Blair River inlier; E, Exploits; G, Gander; H, Humber; K, Kingston; M, Miramichi; N, New River; ND, Notre Dame;

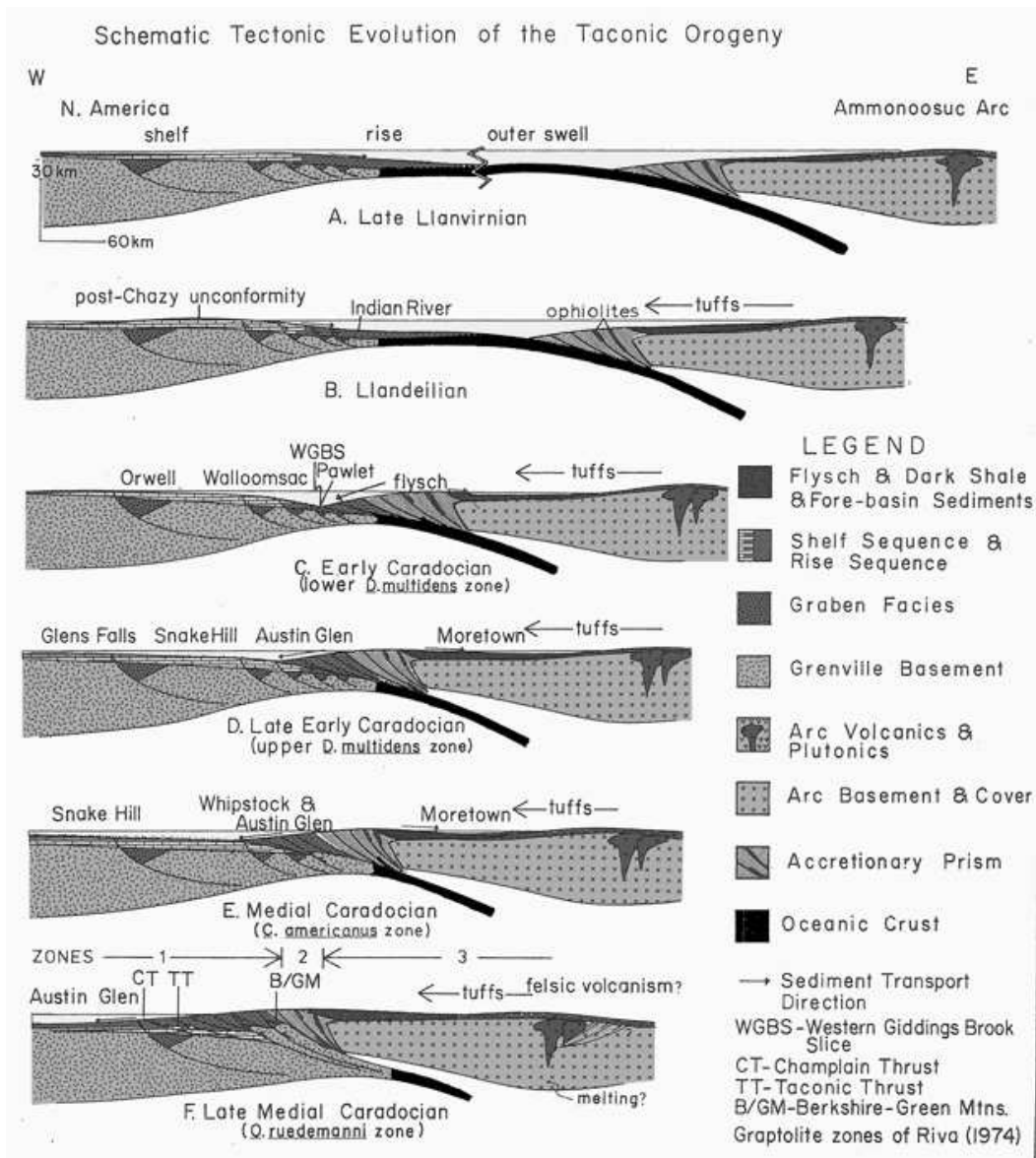
EARLY PALEOZOIC EVENTS

ORDOVICIAN PALEO GEOGRAPHY

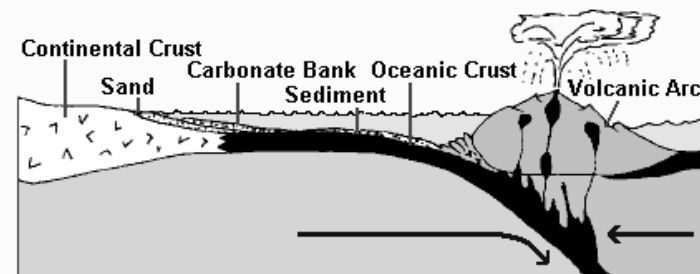


Ophiolite slabs near Corner Brook were trapped on the Laurentian continental margin when it was pulled into the Ordovician trench and then floated back up again

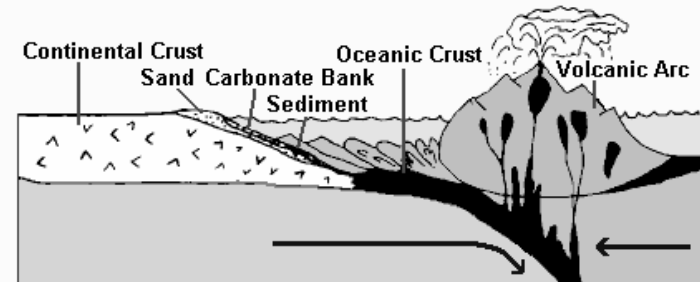
Sediment rich in organic remains was deposited in depressions created by slumping of the new continental margin, as North America began drifting away from Europe and Africa, 200 million years ago



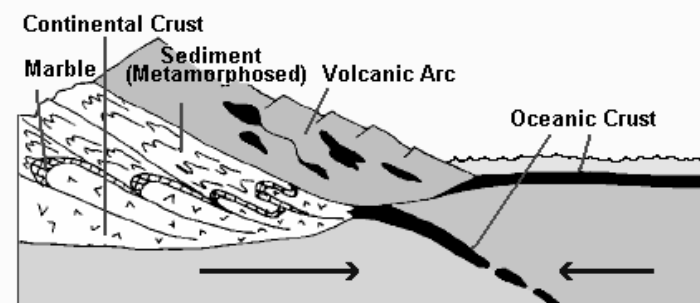
Cross Sections of Eastern North America (as it may have looked)



543 million years ago, active volcano is offshore



500 million years ago, volcano and pile of sediments scraped off the subducting slab are larger



440 million years ago, collision between the volcanic islands and the ancient continent (Taconic Orogeny) formed a tall mountain range. This range has since eroded leaving its roots exposed in the rolling hills of the Eastern Piedmont



Topinka, USGS/CVO, 2001; Modified from: Plank and Schenck, 1998, Delaware Piedmont Geology, Delaware Geological Survey

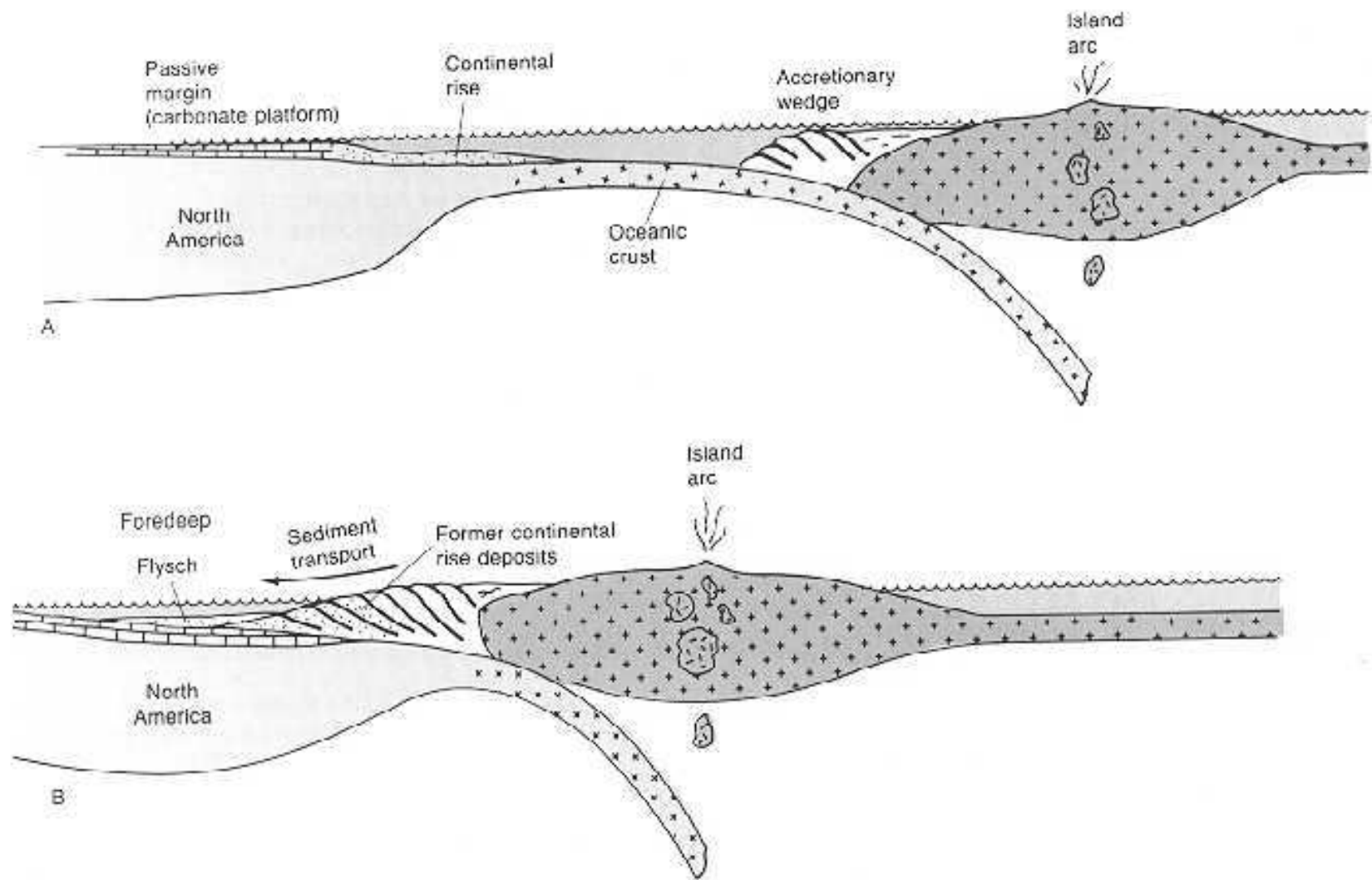
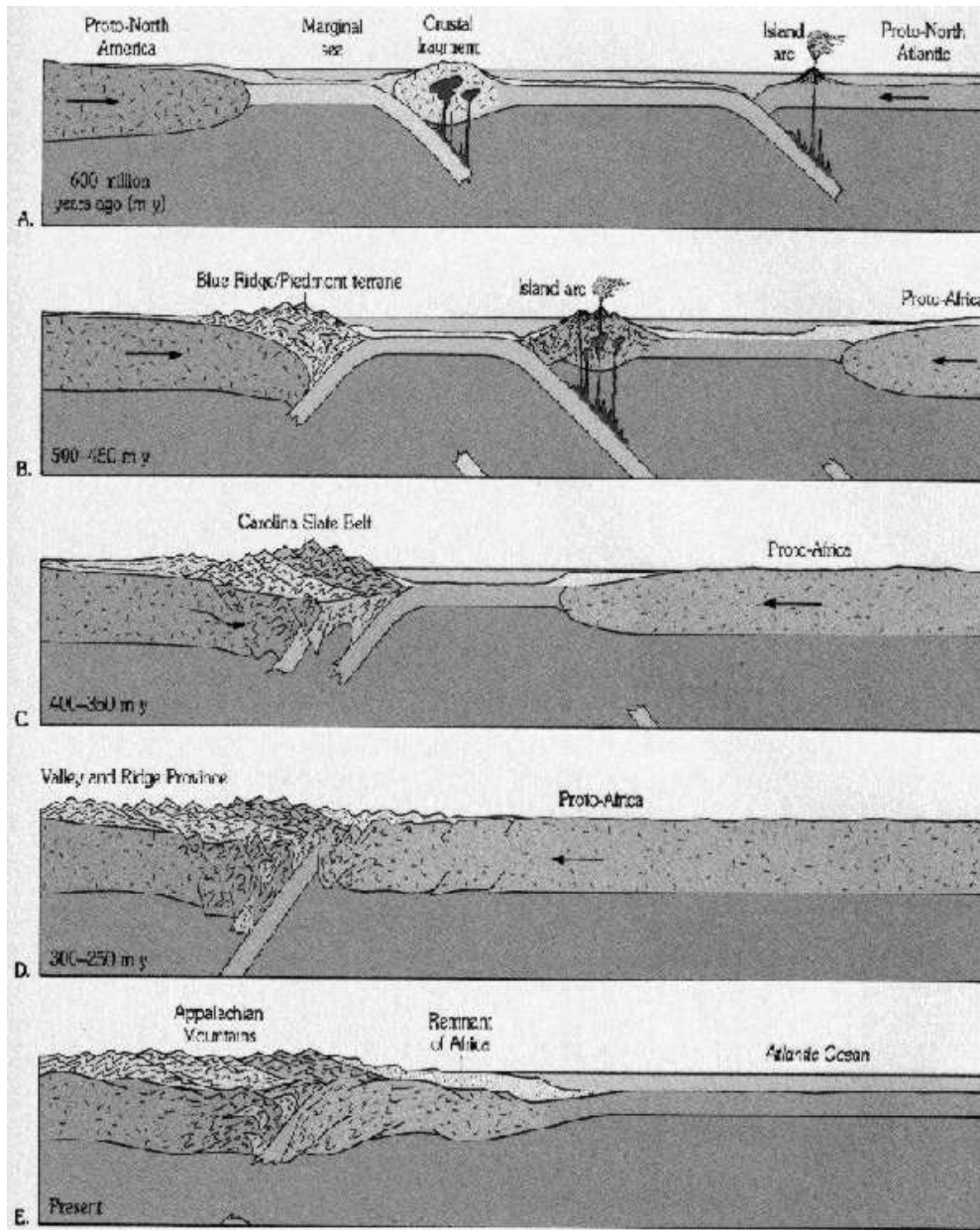
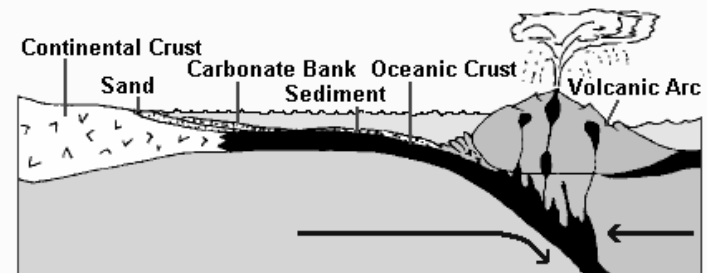


FIGURE 8-29 Diagrammatic illustration of the plate movements that in mid-Ordovician time transformed the passive margin of northeastern North America (A) into a foredeep (B). This happened when the passive margin, which supported a carbonate bank, encountered an island arc. The accretionary wedge

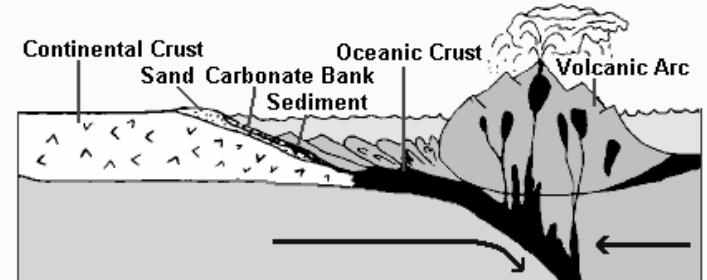
bordering the island arc was thrust over the continental margin, as were deep-water deposits that had accumulated along the continental rise of North America, in front of the carbonate bank. The island arc thus joined North America as an exotic terrane.



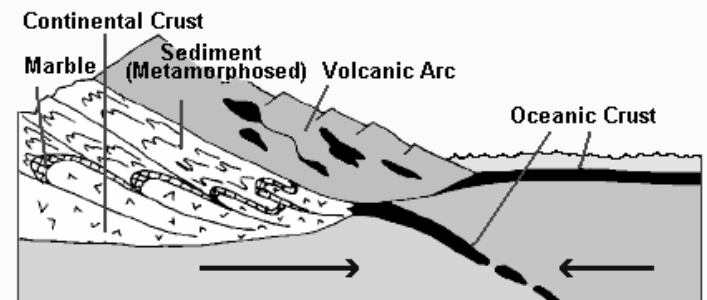
Cross Sections of Eastern North America (as it may have looked)



543 million years ago, active volcano is offshore



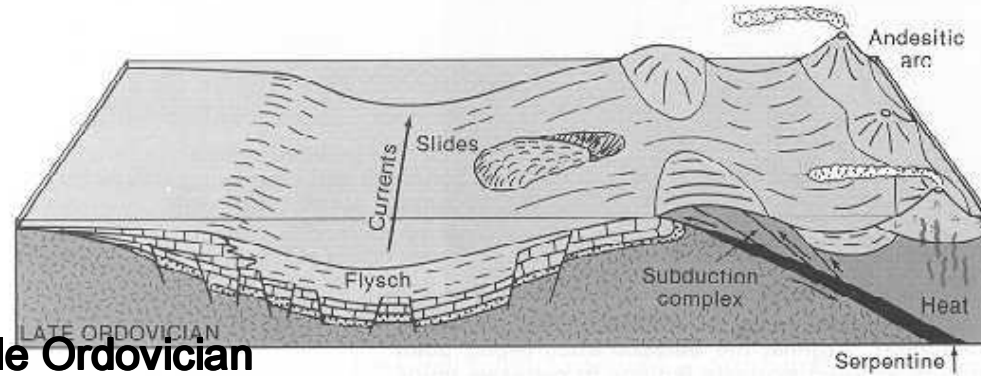
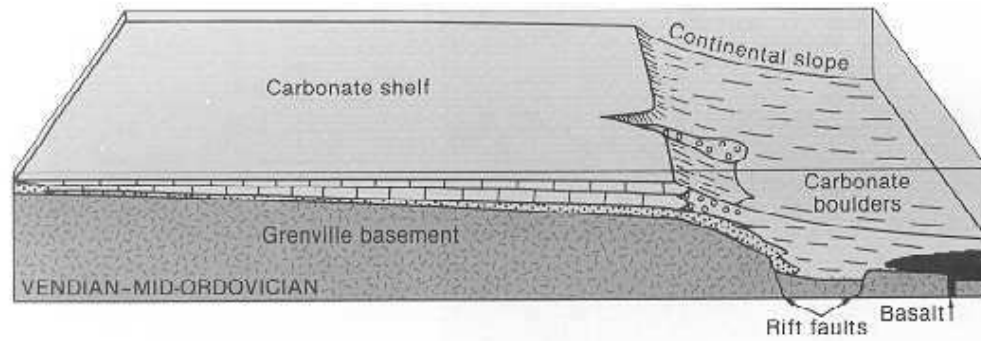
500 million years ago, volcano and pile of sediments scraped off the subducting slab are larger



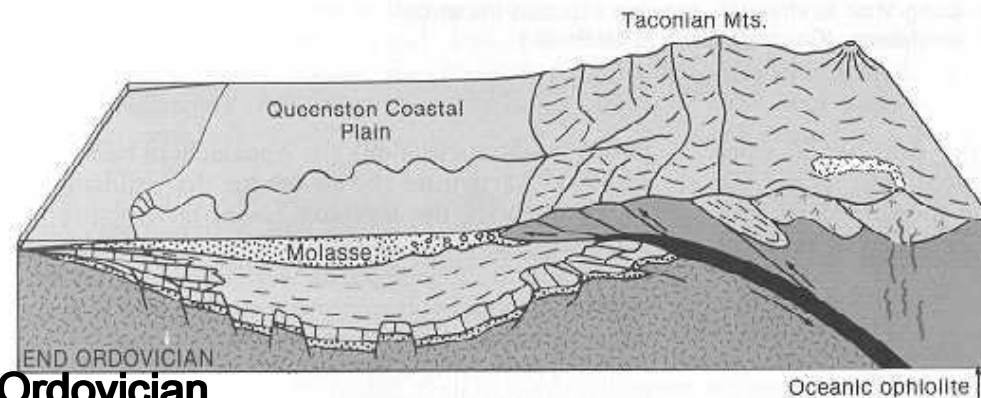
440 million years ago, collision between the volcanic islands and the ancient continent (Taconic Orogeny) formed a tall mountain range. This range has since eroded leaving its roots exposed in the rolling hills of the Eastern Piedmont



Topinka, USGS/CVO, 2001; Modified from: Plank and Schenck, 1998, Delaware Piedmont Geology, Delaware Geological Survey



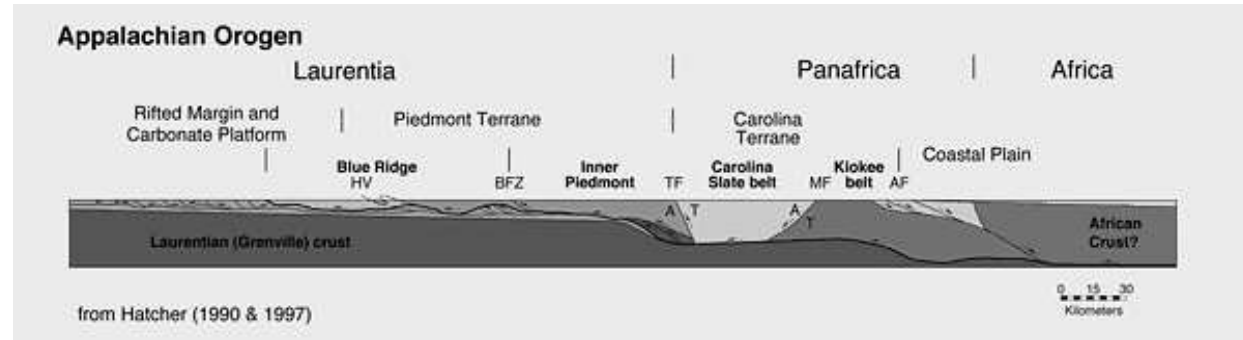
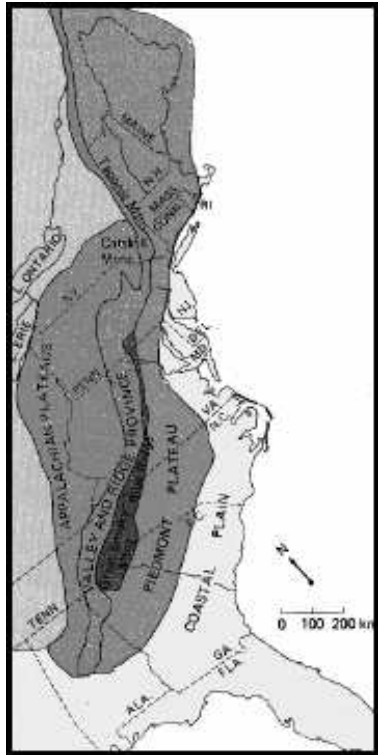
Middle Ordovician

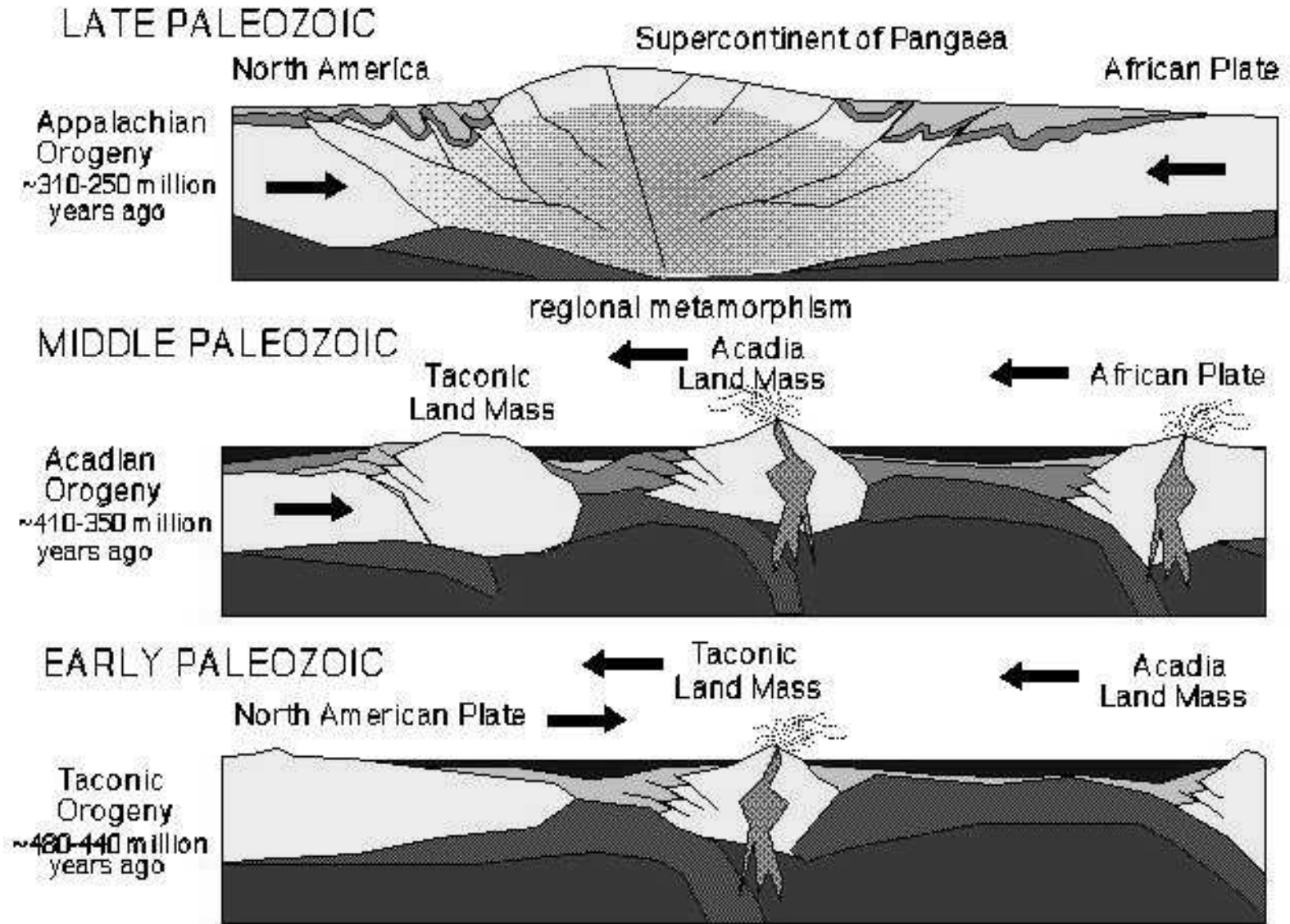


Late Ordovician

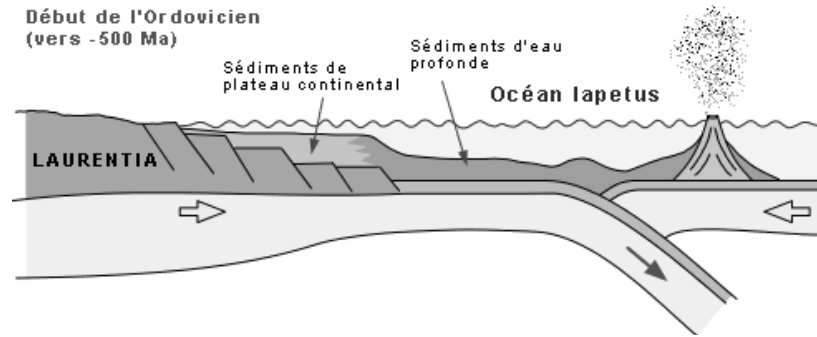
The Taconic Orogeny changed eastern North America from a passive margin to a foreland basin setting. Ancient slope and rise and abyssal plain sediment was thrust up onto the continent east of the Hudson River, NY going south to Harrisburg, PA. This rock is called the Taconic allochthon. The line between the allochthon and the autochthon (rock that was not moved) is called Logan's Line. Parts of the island arc that collided with North America can be seen in the Berkshire Mts., MA. Ophiolite successions can be seen in New Foundland.

FIGURE 11.33 Restoration of eastern North America showing evolution from a passive to an active continental margin culminating in arc collision, which caused the Taconian orogeny. As the continental margin was downwarped in Late Ordovician time, carbonate sedimentation gave way to deeper-water flysch deposition. Finally, Taconian upheaval resulted in westward spreading of nonmarine molasse. (Adapted from J. F. Dewey and J. M. Bird, 1970, *Bulletin of the Geological Society of America*, v. 81, pp. 1031-1061; and D. B. Rowley and W. F. Kidd, 1981, *Journal of Geology*, v. 89, pp. 199-218.)

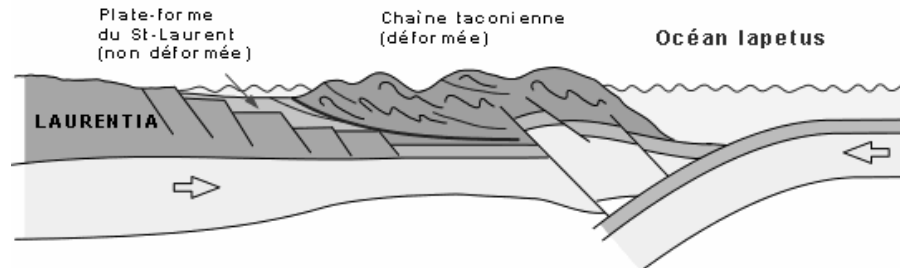




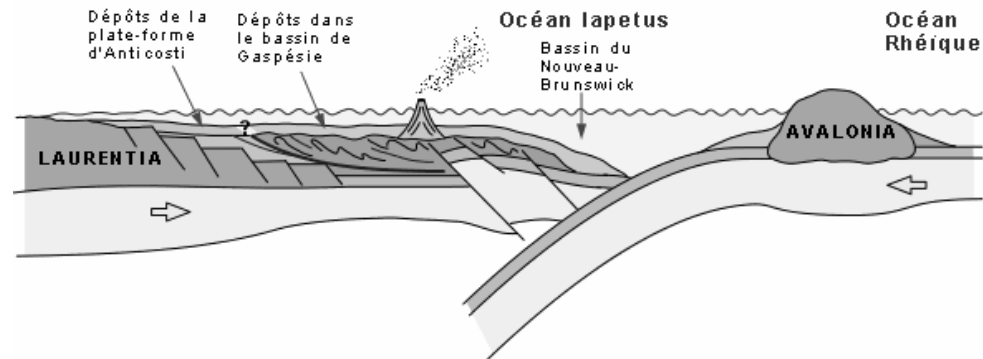
Début de l'Ordovicien
(vers -500 Ma)



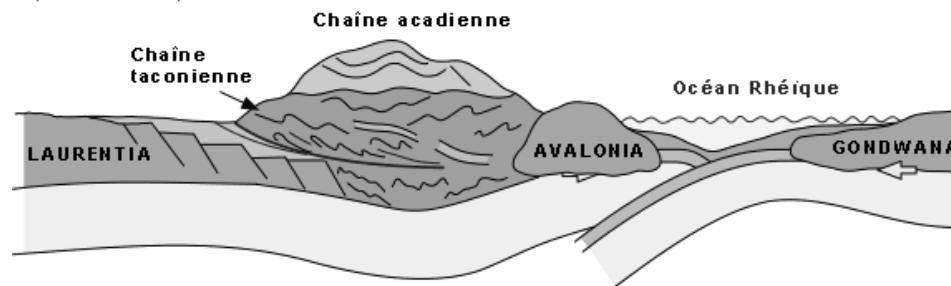
Milieu de l'Ordovicien
(vers -460 Ma)



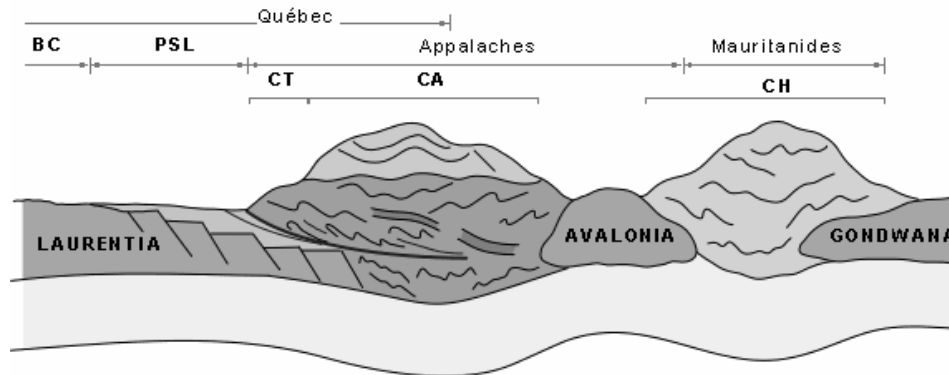
Milieu du Silurien
(vers -420 Ma)



Milieu du Dévonien
(vers -390 Ma)

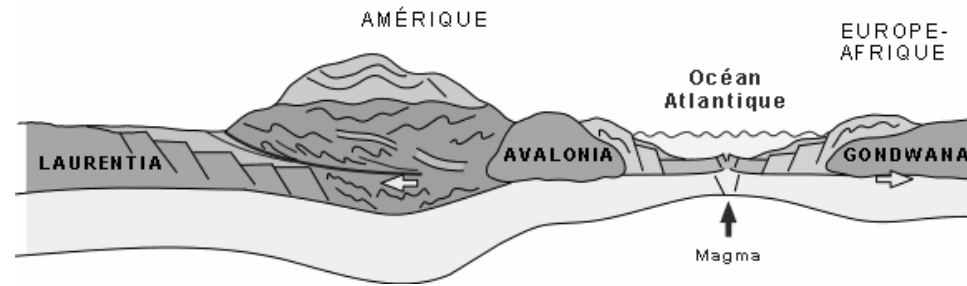


Fin du Carbonifère
(vers -310 Ma)

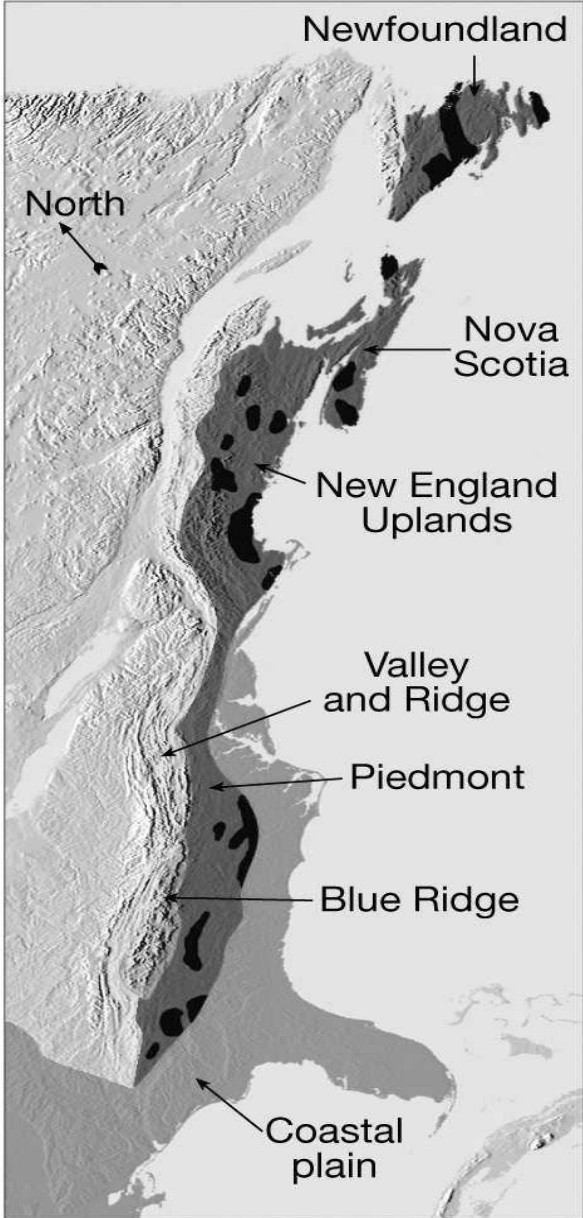


BC Bouclier canadien
Jurassique
(vers -160 Ma)

CT Chaîne taconienne

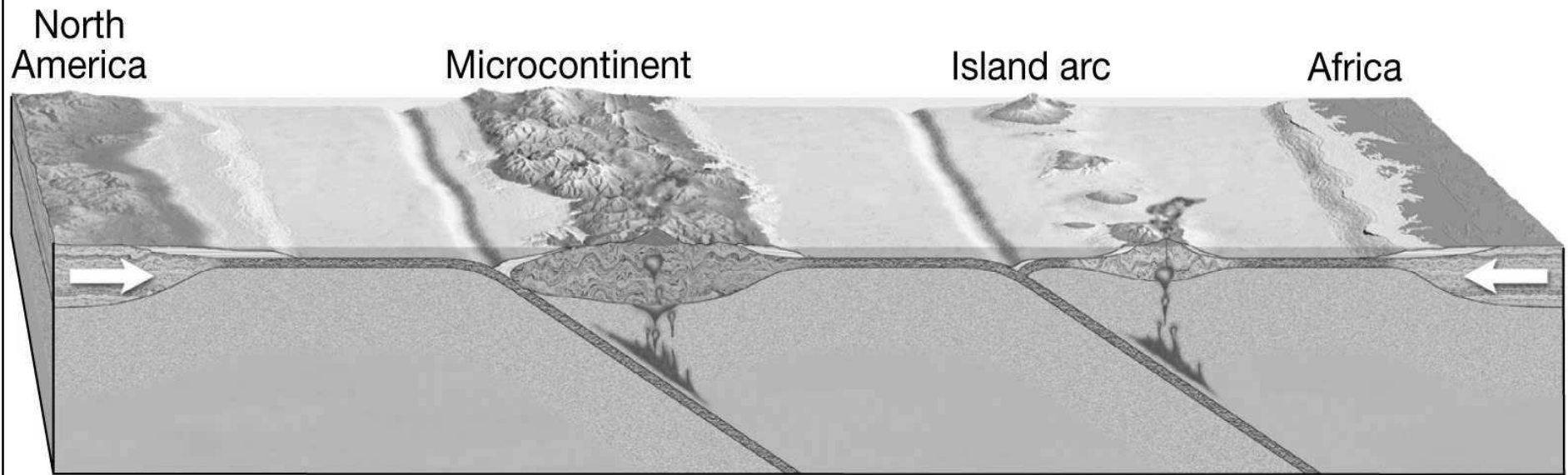


Development of the Appalachian Mountains

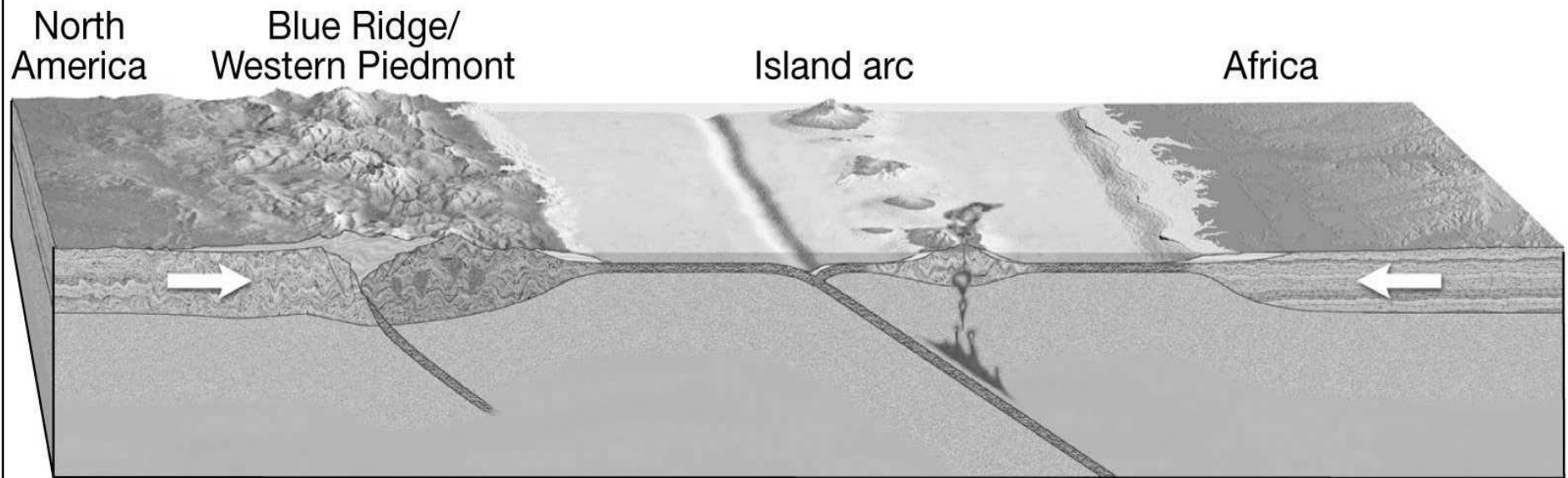


- Key**
- Fold and thrust belts
 - Metamorphic rocks
 - Granite plutons

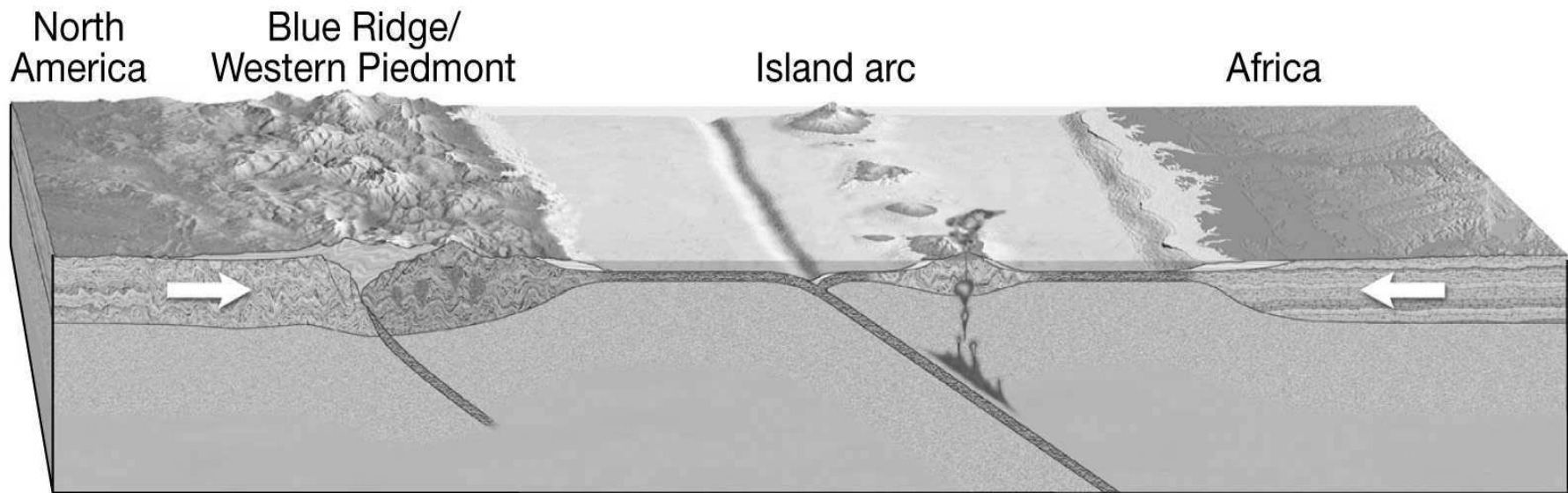
F. Major structural features of the Appalachians



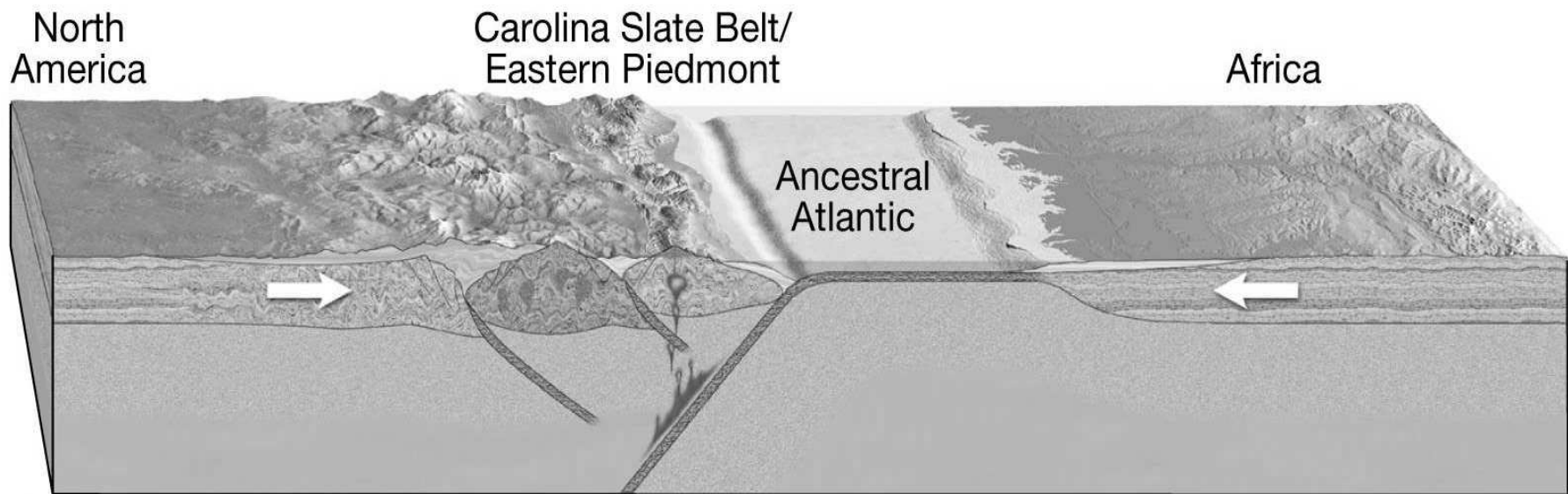
A. 600 million years ago



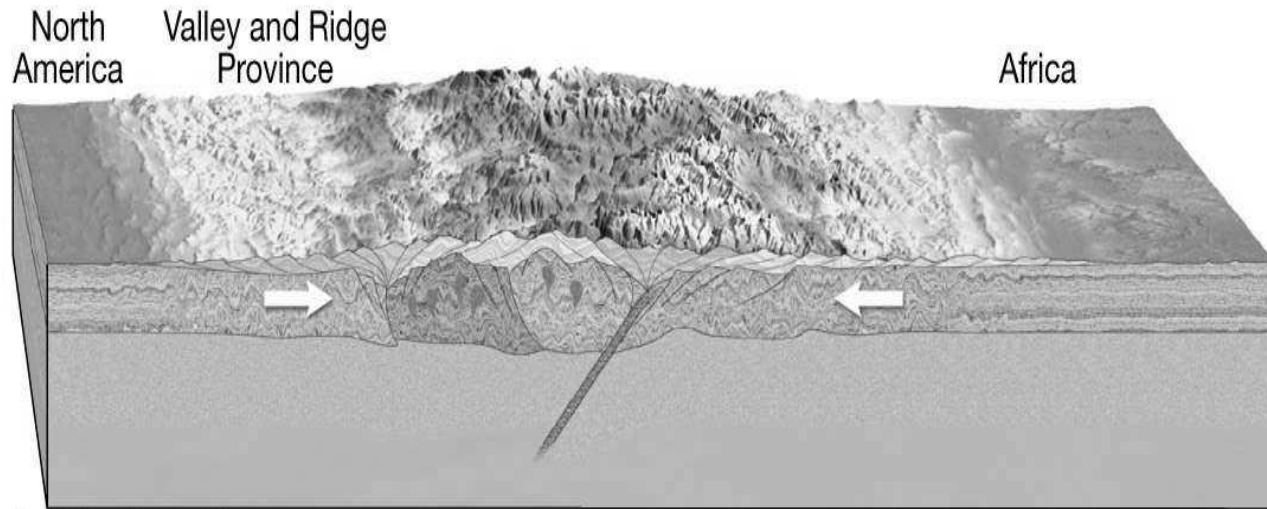
B. 450–500 million years ago



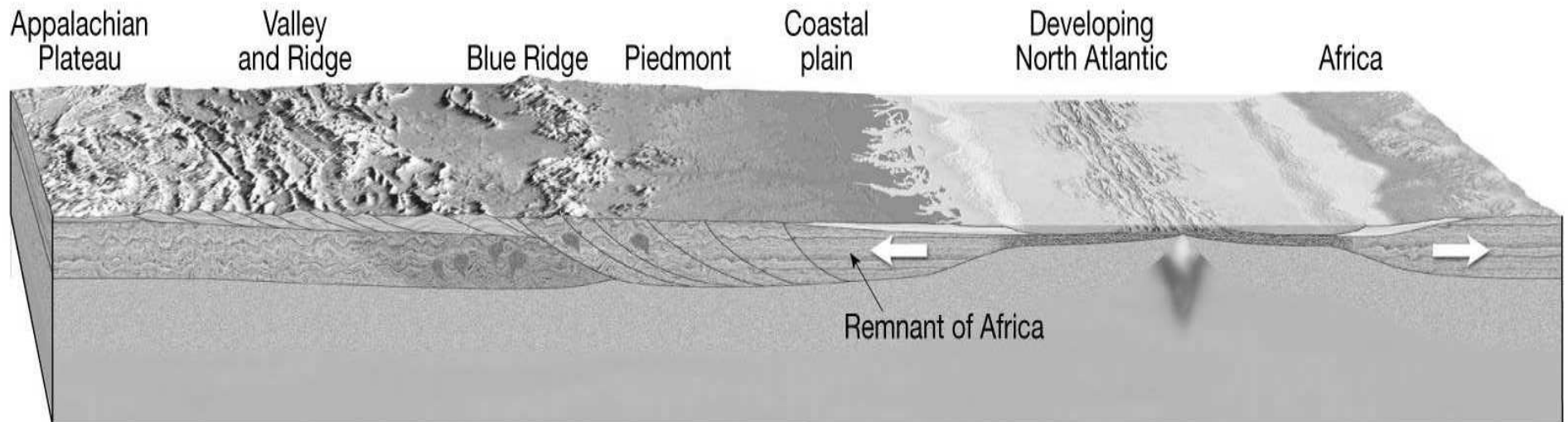
B. 450-500 million years ago



C. 400 million years ago



D. 250-300 million years ago



E. Begin 200 million years ago North Atlantic begin to open

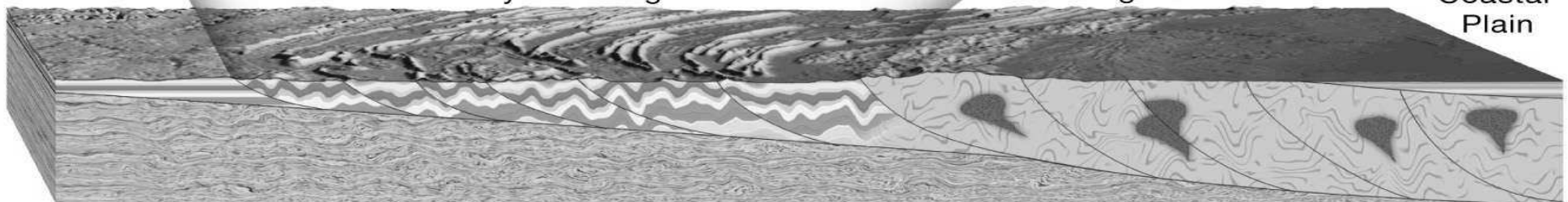


Valley and Ridge

Blue Ridge

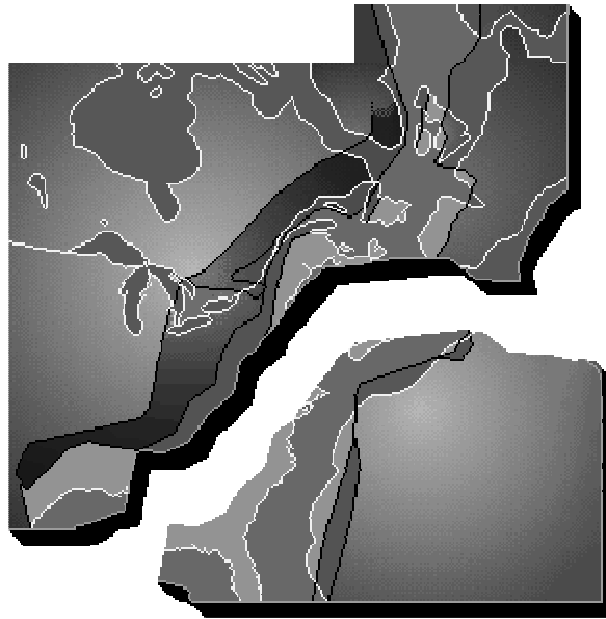
Piedmont

Coastal
Plain

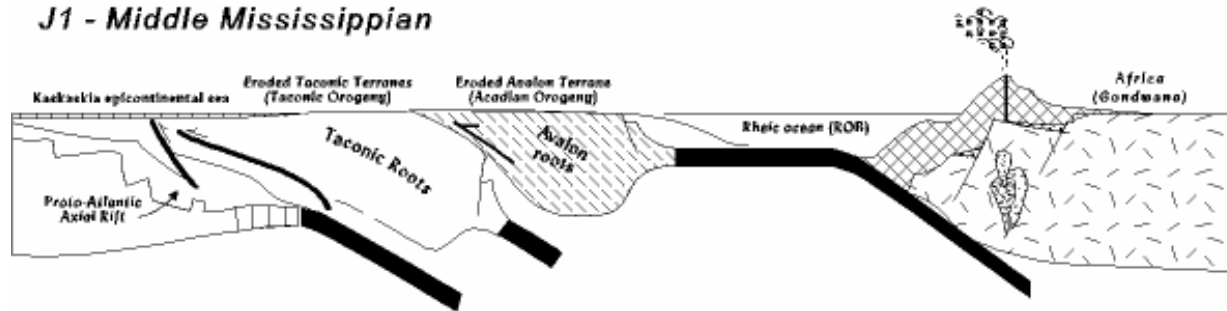


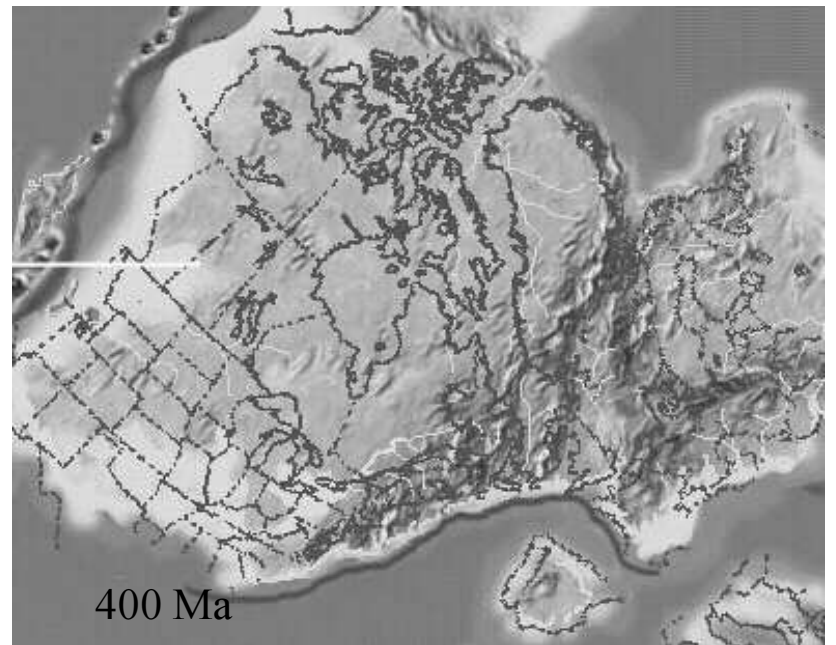
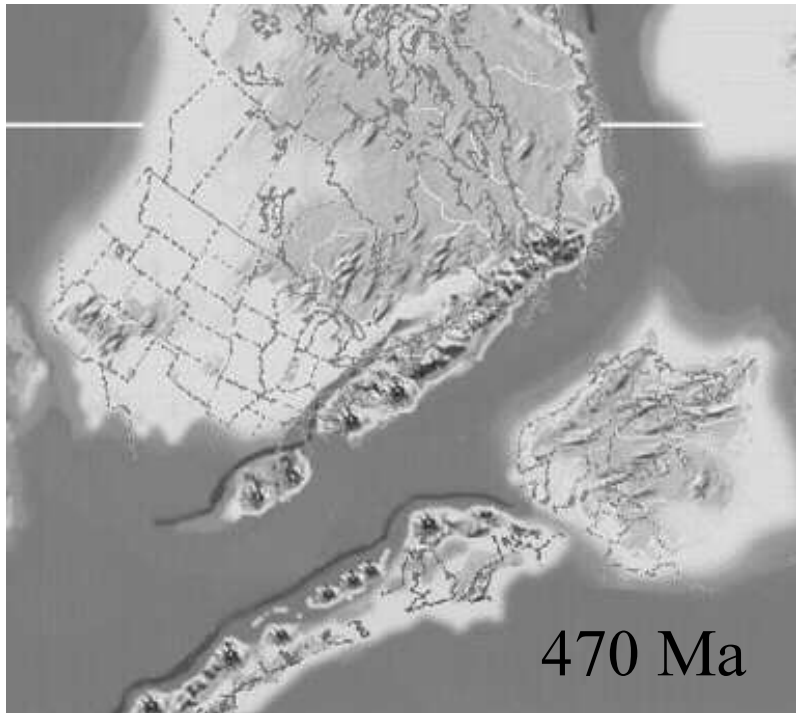
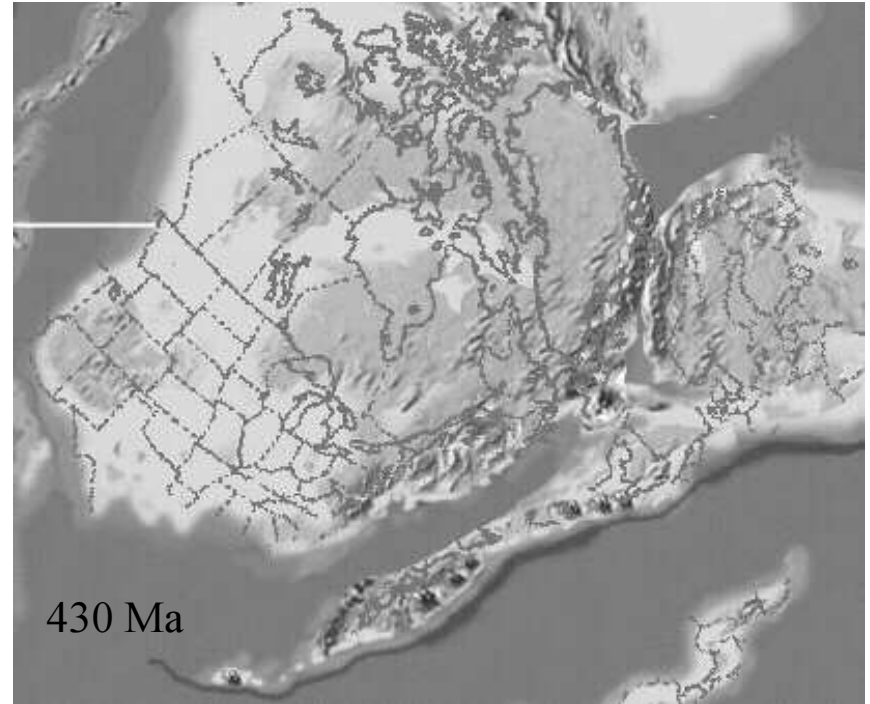
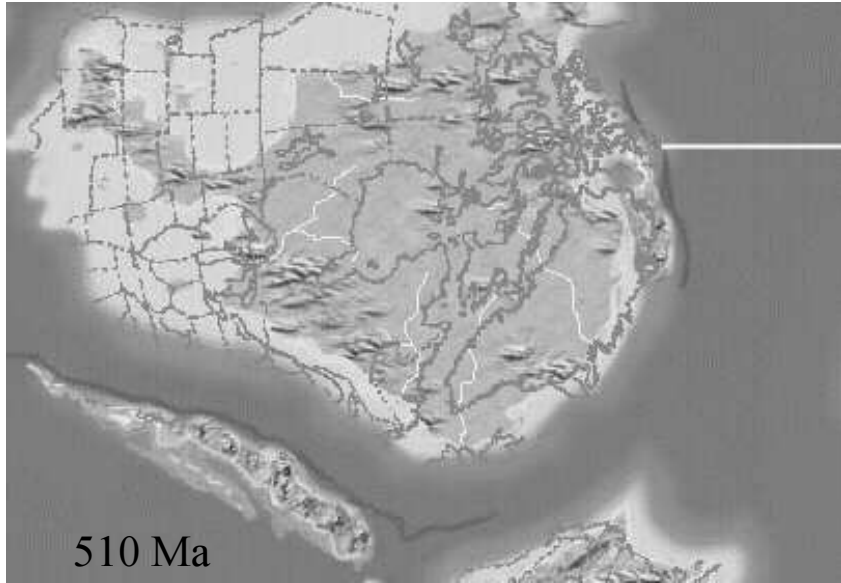
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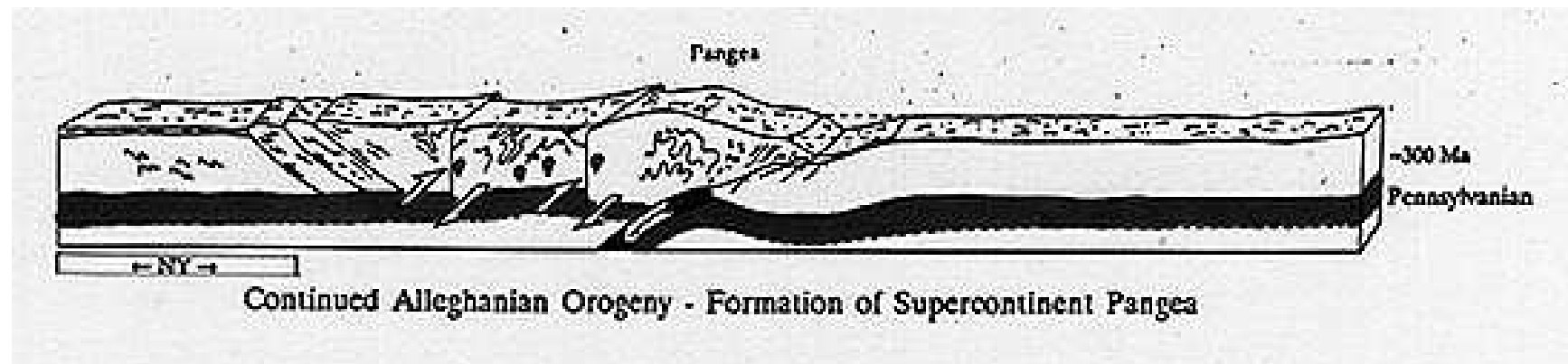
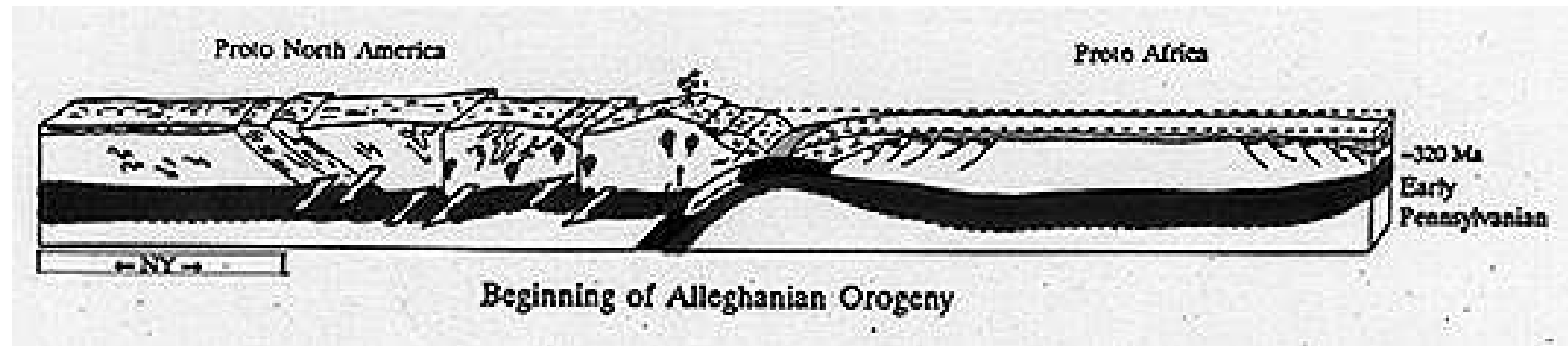
Folded mountains in the Valley and Ridge Province

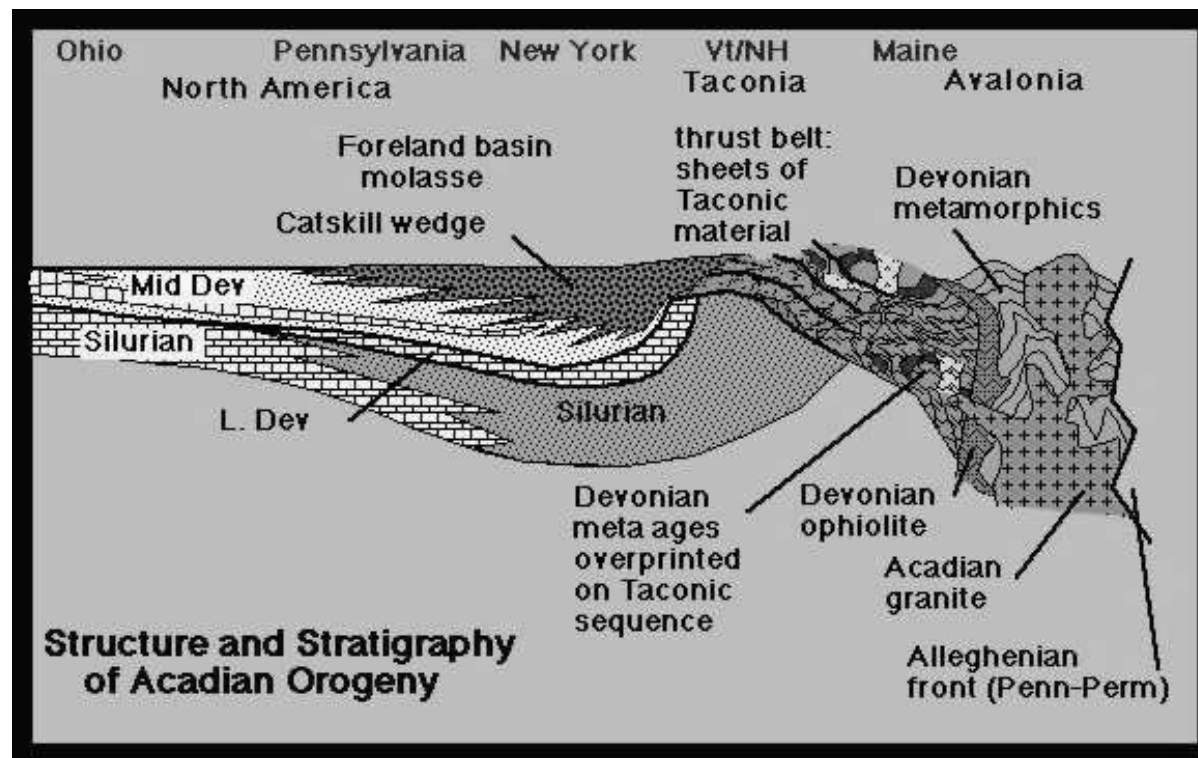
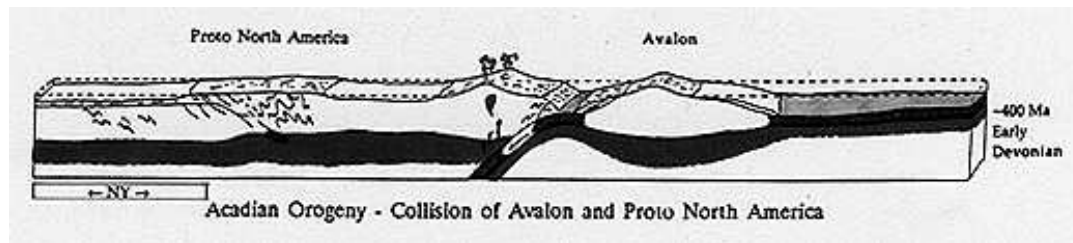


J1 - Middle Mississippian









Apalače představují složený orogen, jehož tvorba probíhala jak během kaledonských fází tak během variských fází . V jejich rámci můžeme rozlišit několik teránů.

Údaje seismiky ukazují, že celá jižní část Apalačí je pravděpodobně podstýlána velkou zónou odlepení a celý horský hřeben je alochtonní. Podobné struktury se dají pozorovat v seismických řezech i v severních Apalačích. Pro geologickou stavbu jsou významné alochtonní terány.

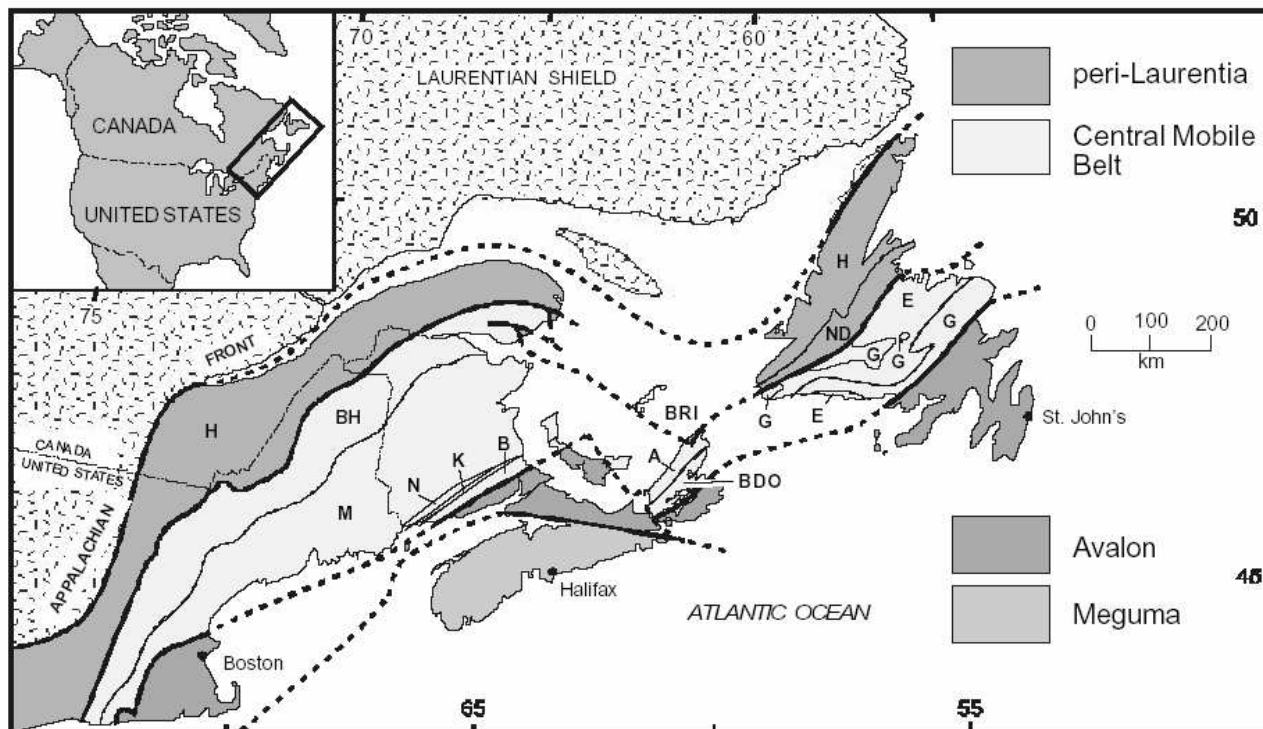


Figure 1. Simplified map of the northern Appalachian orogen showing crustal blocks and terranes (A, Aspy; B, Brookville; BDO, Bras d'Or; BH, Bronson Hill; BRI, Blair River inlier; E, Exploits; G, Gander; H, Humber; K, Kingston; M, Miramichi; N, New River; ND, Notre Dame;

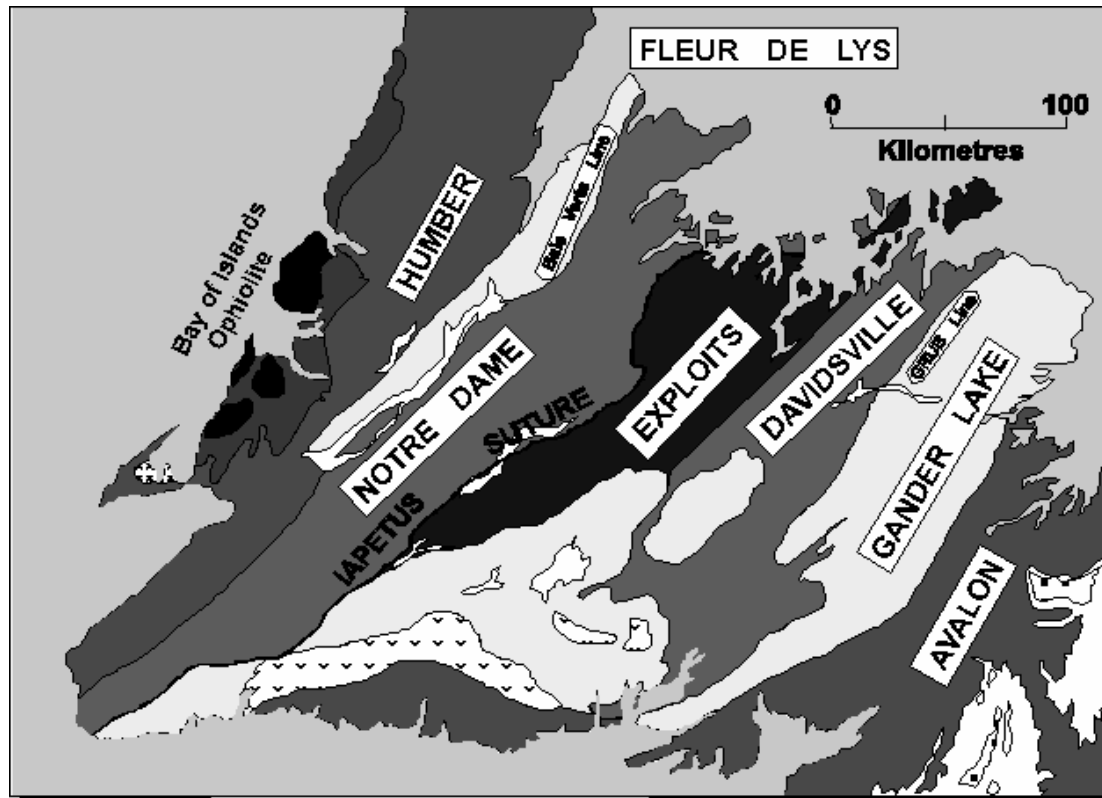
Terány skupiny I je tvořen sedimenty nejvyššího proterozoika a spodního paleozoika a svrchnoproterozoickým krystalinikem. Reprezentuje **fragментy Laurentie** nebo **mikrokontinenty** původně situované blízko jejího kontinentálního okraje.

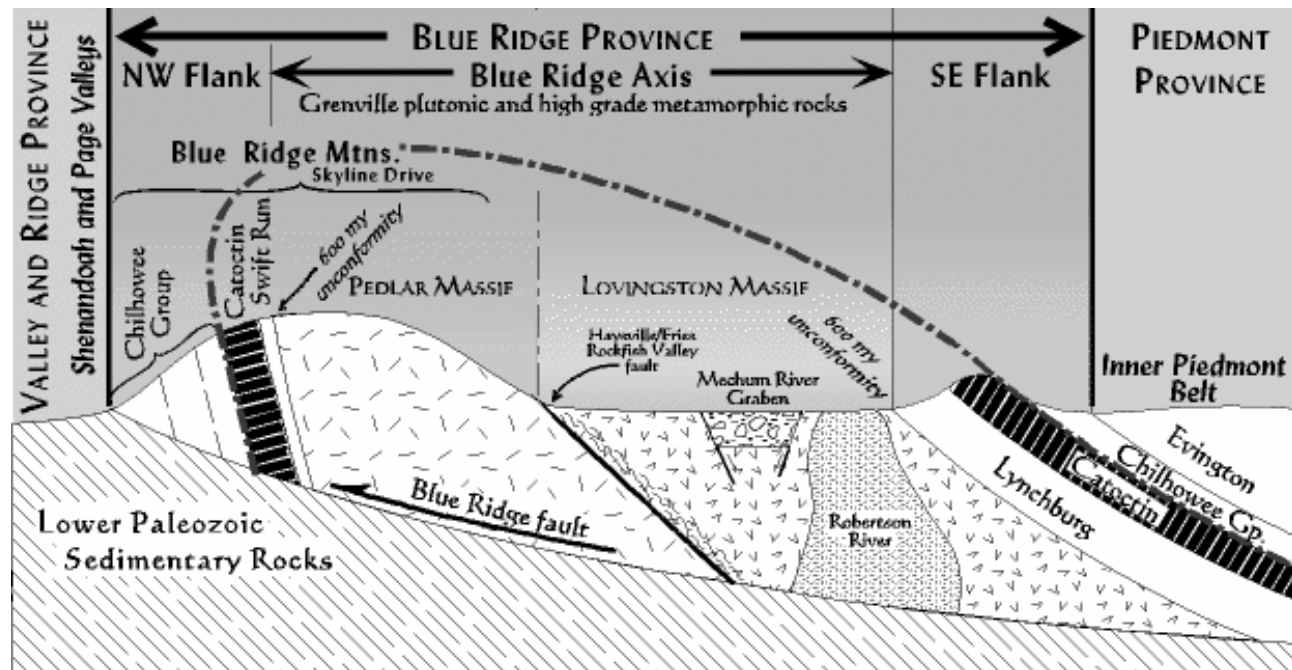
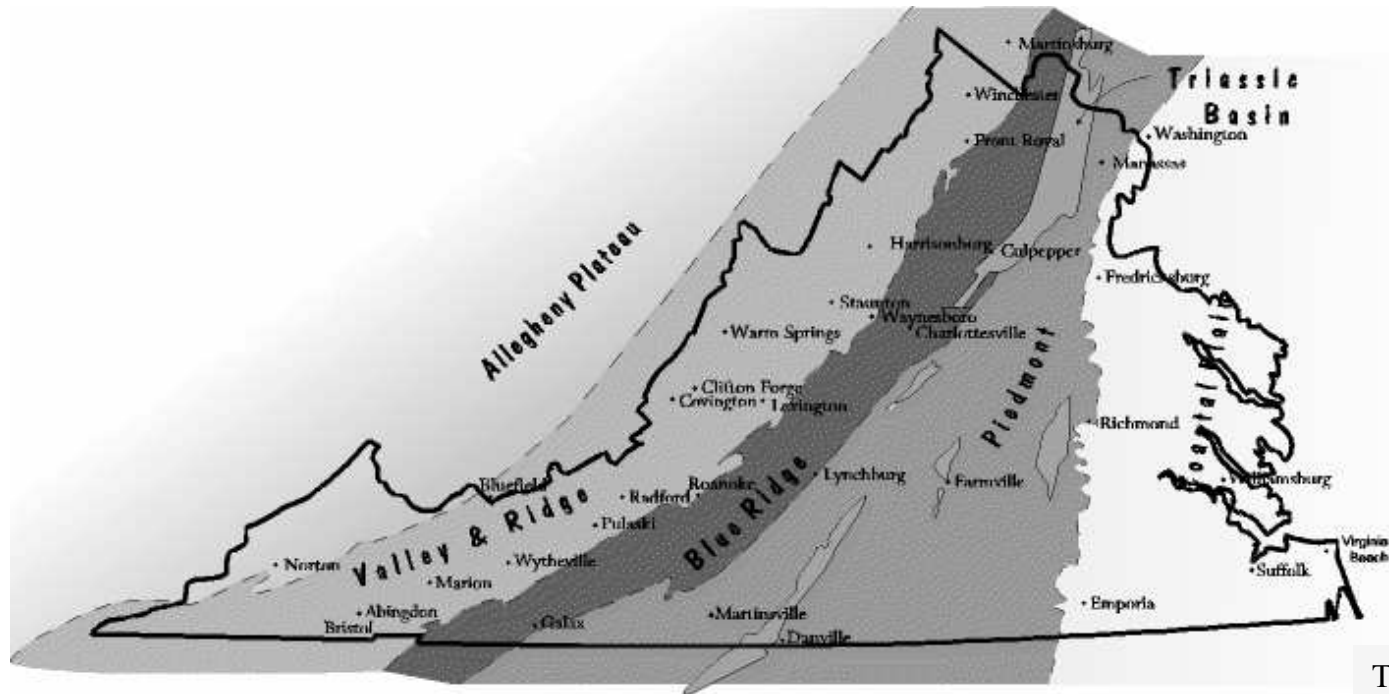
Terán Humber

Tento terán zahrnuje miogeosynklinálu situovanou na laurentinském pasivním kontinentálním okraji a takonské alochtony. Táhne se od SZ Newfoundlandu do zóny **Valley and Ridge** a **Blue Ridge** na jihu. Basement se skládá z **grenvilských** rul (1,0Ma) na kterých spočívají klastické a karbonátové riftové **sedimenty** kambria až spodního ordoviku

Na kontinentální okraj jsou obdukovány dva typy teránů – **Fleur de Lys Supergroup** (metapelity a meetapsamity interpretované jako sedimenty kontinentálního svahu na jv od karbonátové lavice) a **velké alochtony** obsahující **ofiolity** jako jsou **Bay of Islands Complex**, který byl obdukován v Ilnvirnu.

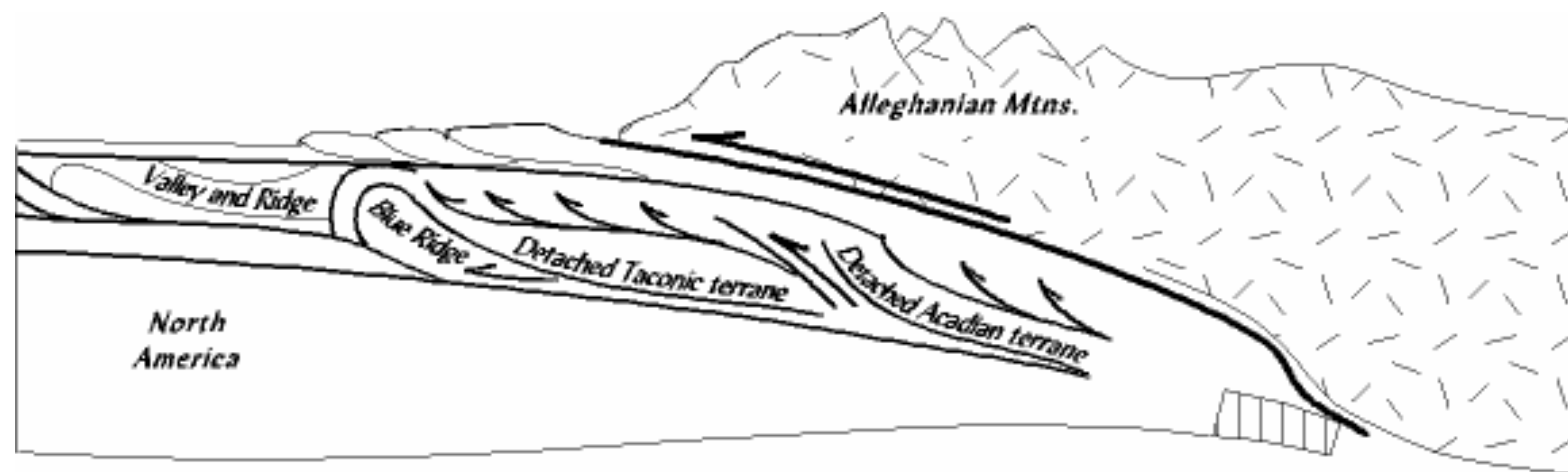
První výskyt **flyšových** úlomků v slepencích karbonátového okraje datuje přiřazení prvních teránů k americkému kontinentálnímu okraji v nejvyšším **arenigu-Ilnvirnu**.





The modern Blue Ridge is an overturned anticline. That is, the rocks have been arched up into a fold, and then shoved over toward the west (left) so that the rocks on the western flank are now no longer right side up (follow the red dashed line).

Notice the Blue Ridge thrust fault at the base; the Blue Ridge province has been moved westward from its site of origin, perhaps as far east as Richmond. Below the Blue Ridge fault Cambrian and Ordovician sediments ("Lower Paleozoic Sedimentary Rocks") of the Valley and Ridge extend eastward under the Blue Ridge and piedmont provinces (cross section).



Terány II a III reprezentuje **ostrovní oblouky**, jedná se o **ofiolity** a přidruženou **akreční melánž**, Zahrnuje **takonskou** sekvenci v USA a Kanadě (Notre Dame) a terány **Dunnage a Exploit a Gander** v Kanadě a terán **Piedmont** v jižních Apalačích.. Seismické údaje ukazují, že terány Dunnage a Gander jsou alochtonní nad spodní kontinentální kůrou a že seveoamerický okraj pokračuje 70 km pod terán Tyto terány představují jenom velmi hrubé rozdělení, protože **každý z nich se skládá ze značného počtu fragmentů** (nebo dílčích teránů?) různého původu. Obsahují mnoho ofiolitů a oblouků odvozených z lapetu a deformovaných během kolize kontinentálních okrajů Laurentie a Avalonie.

Terán Piedmont (nebo Vnitřní Piedmont) je složený z několika různých **teránů a fragmentů**. Jedná se o nakupení na západ sunutých příkrovů obsahujících krystalické břidlice, ruly, amfibolity a mafické-ultramafické tělesa, které mohou reprezentovat zbytky ofiolitů. Původně okraj severní Ameriky, odděleny riftingem na počátku paleozoika. Reflexní profily ukazují, že piedmontský terán a přilehlé pásy **břidlic Blue Ridge, Charlotte a Carolina** náležejí 6-15 km mocnému příkrovu nad autochtonním basementem. Zdá se, že byl transportován přinejmenším **260km přes kontinentální okraj** Laurentie během alleghanské orogeneze produkované kolizí Severní Ameriky a Afriky.

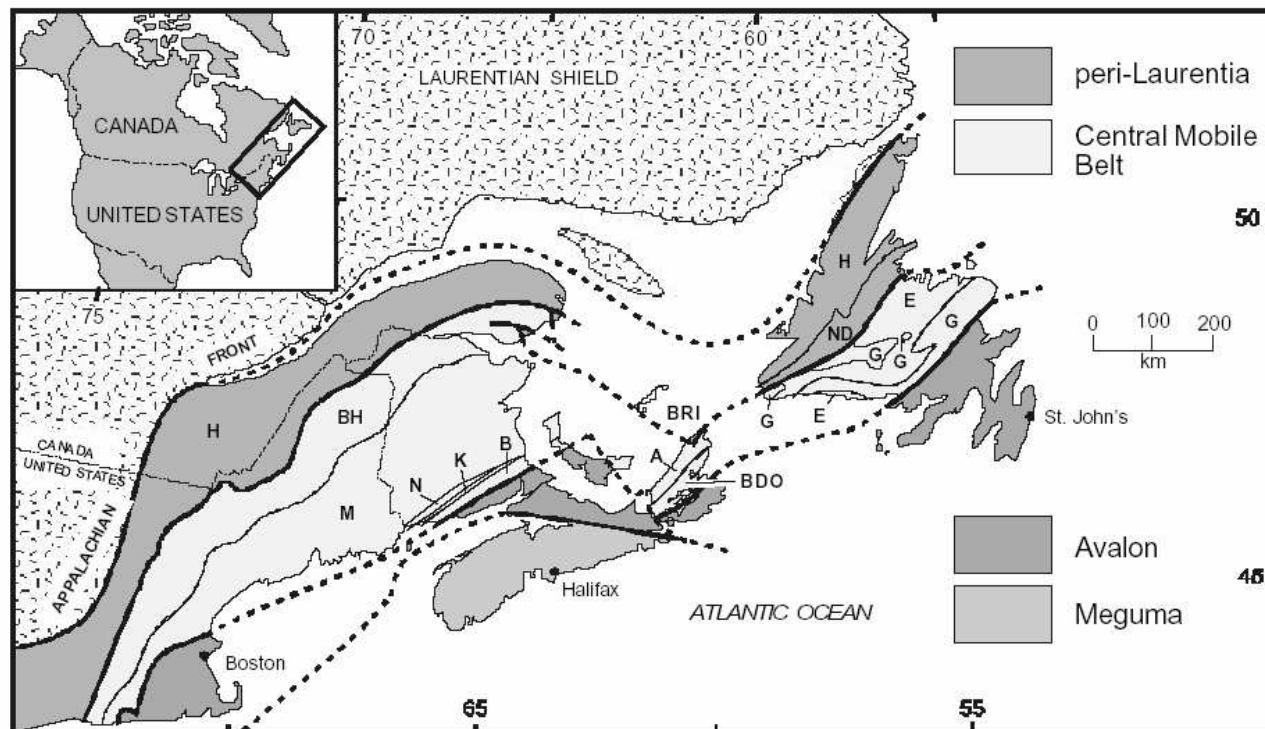


Figure 1. Simplified map of the northern Appalachian orogen showing crustal blocks and terranes (A, Aspy; B, Brookville; BDO, Bras d'Or; BH, Bronson Hill; BRI, Blair River inlier; E, Exploits; G, Gander; H, Humber; K, Kingston; M, Miramichi; N, New River; ND, Notre Dame;

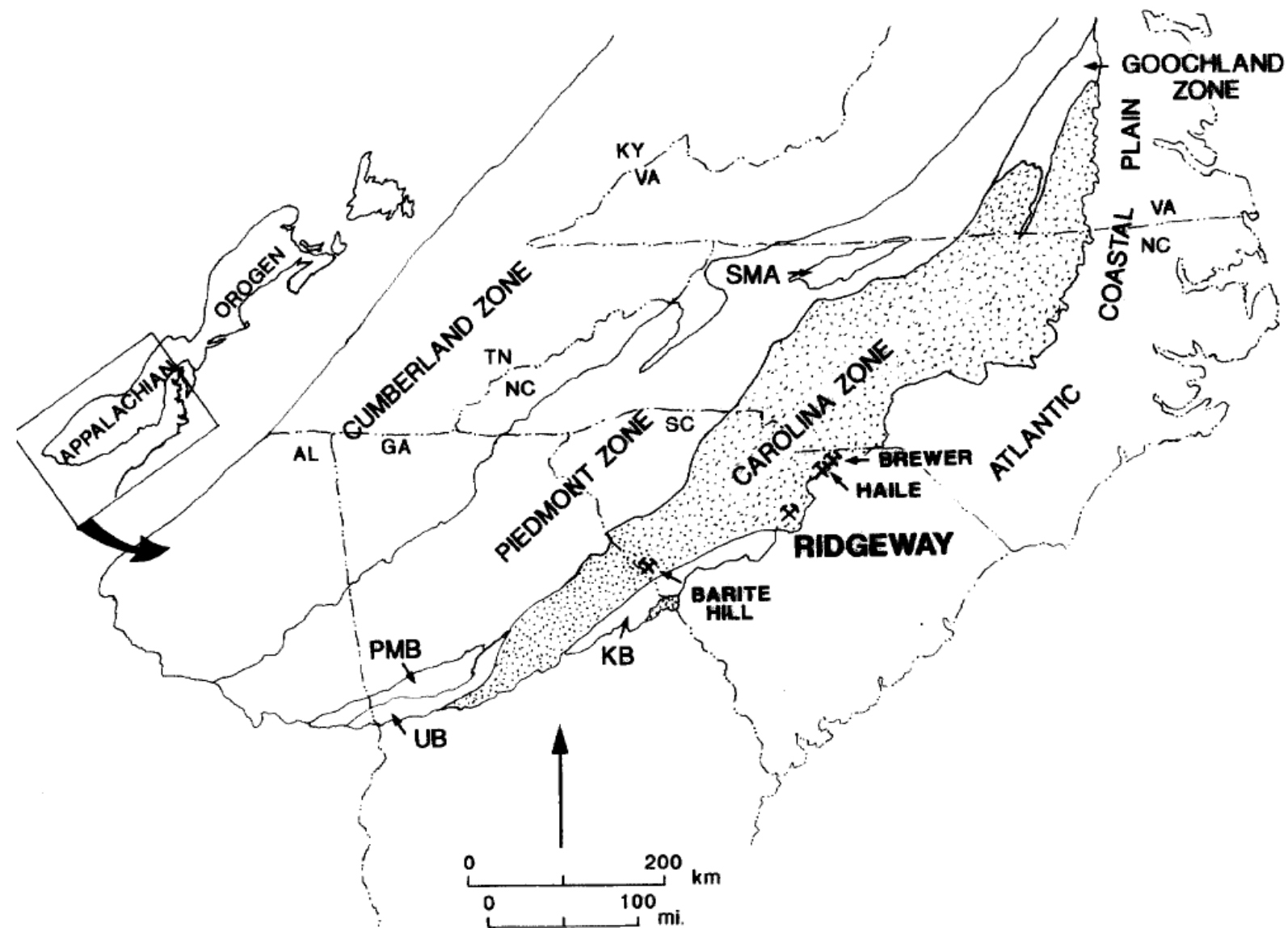


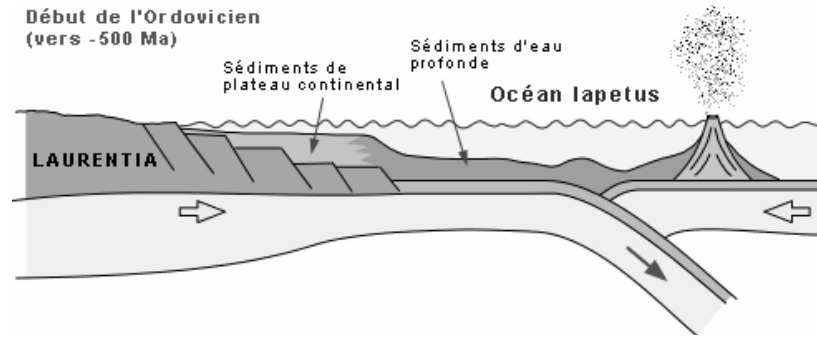
Figure 1. Tectonostratigraphic zonal map of the Southern Appalachian orogen (after Hibbard and Samson, 1995). Locations of the four gold mines active in South Carolina during the late twentieth century are posted on the map. The mines are located within the Carolina zone, whose largest subunit is the Carolina terrane subduction volcanic arc.



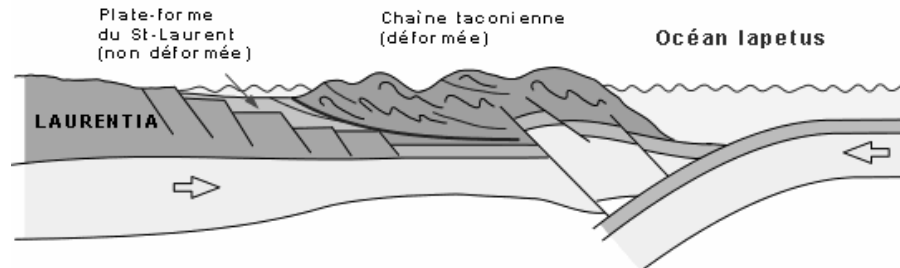
Terány skupiny IV. Zahrnuje v jižní části Apalačí **karolinské břidličné pásmo** a **avalonský sled** v severních Apalačích. **Avalonský terán** obsahuje menší **dílčí fragmenty** je označován jako **avalonský složený terán** nebo jako **avalonský superterán**. Obsahuje **ruly, vulkanické a sedimentární horniny** pozdně prekambriického až spodnopaleozoického stáří, které jsou již dlouho považovány za africko-gondwanské. **Avalonský terán** má jinou přesilurskou historii než terán Gander a západnější terány, obzvláště **odlišnou kambrickou trilobitovou faunu**.

Terán V. Jedná se o sekvenci kambrických-ordovických drob a břidlic usazenou poblíž okraje kontinentu. V Apalačích se označuje jako terán **Meguma** a podobné horniny jsou známy i ze severozápadní Afriky z **mauritanid**. Terán Meguma obsahuje kambro-ordovický **flyš**.

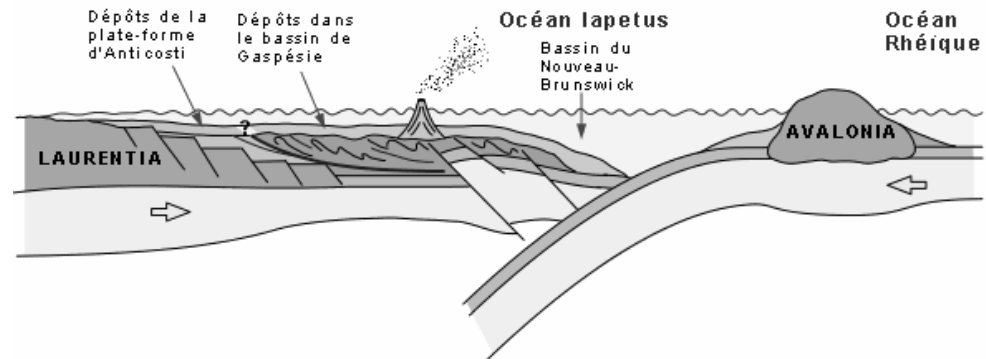
Début de l'Ordovicien
(vers -500 Ma)



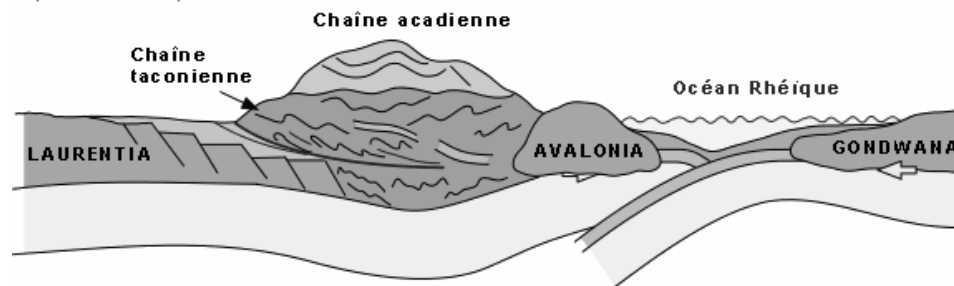
Milieu de l'Ordovicien
(vers -460 Ma)



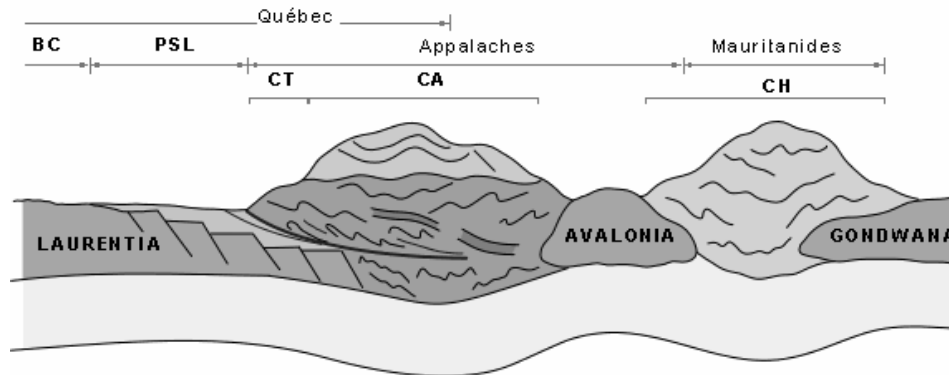
Milieu du Silurien
(vers -420 Ma)



Milieu du Dévonien
(vers -390 Ma)



Fin du Carbonifère
(vers -310 Ma)



BC Bouclier canadien
Jurassique
(vers -160 Ma)

CT Chaîne taconienne



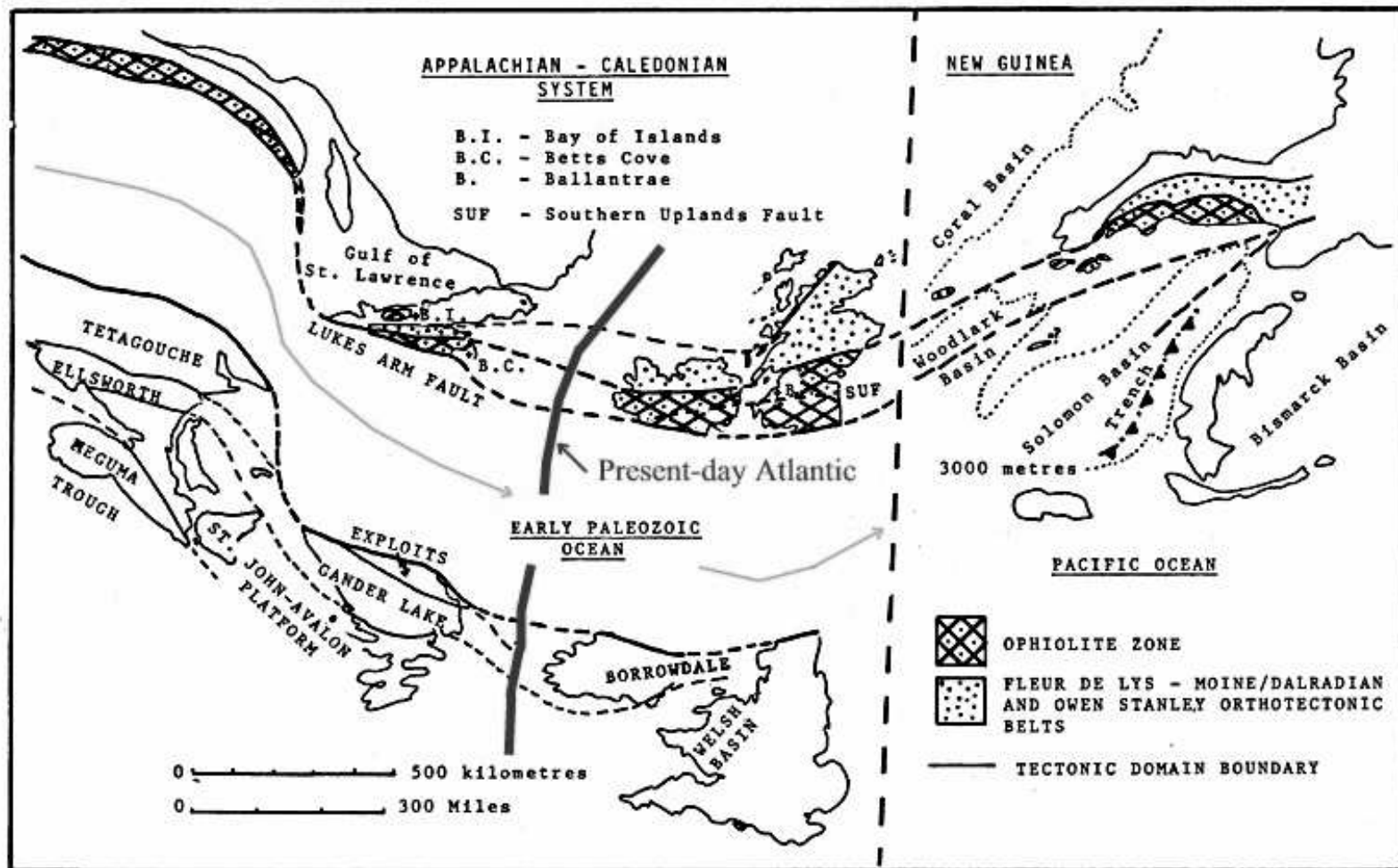
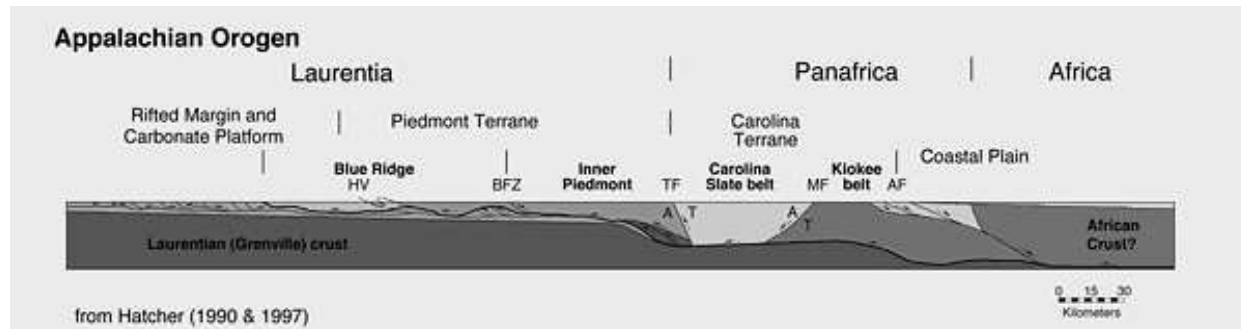
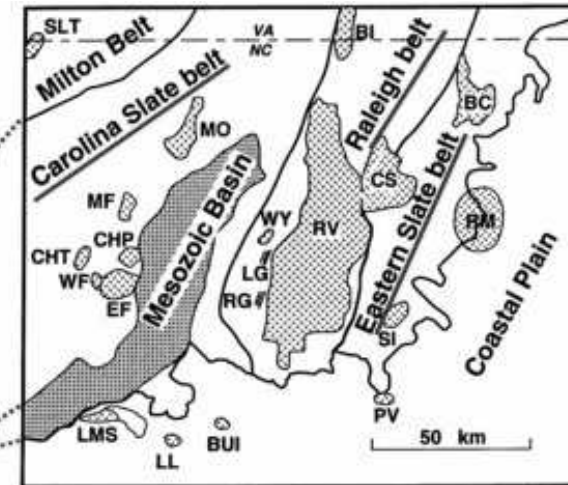
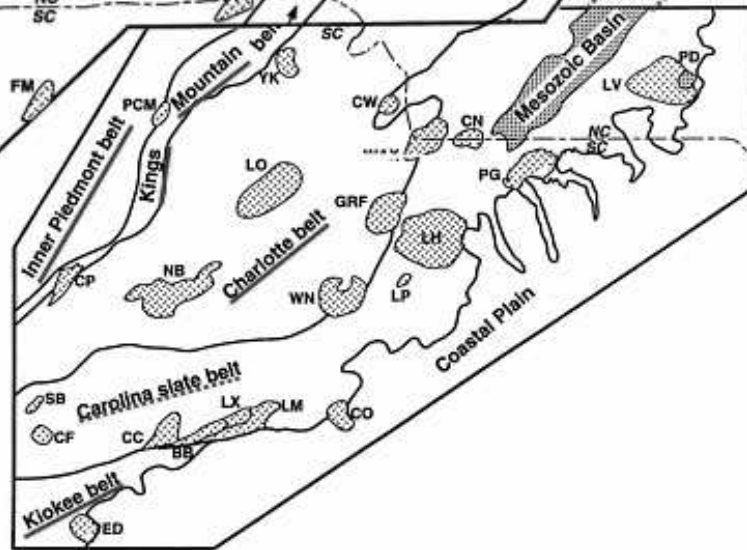
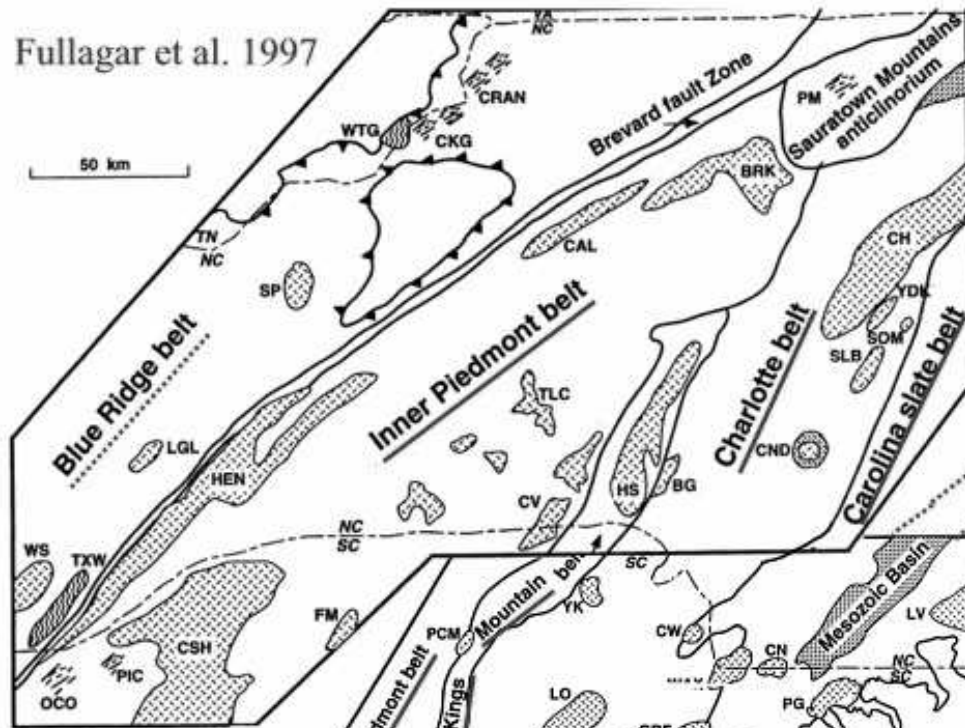
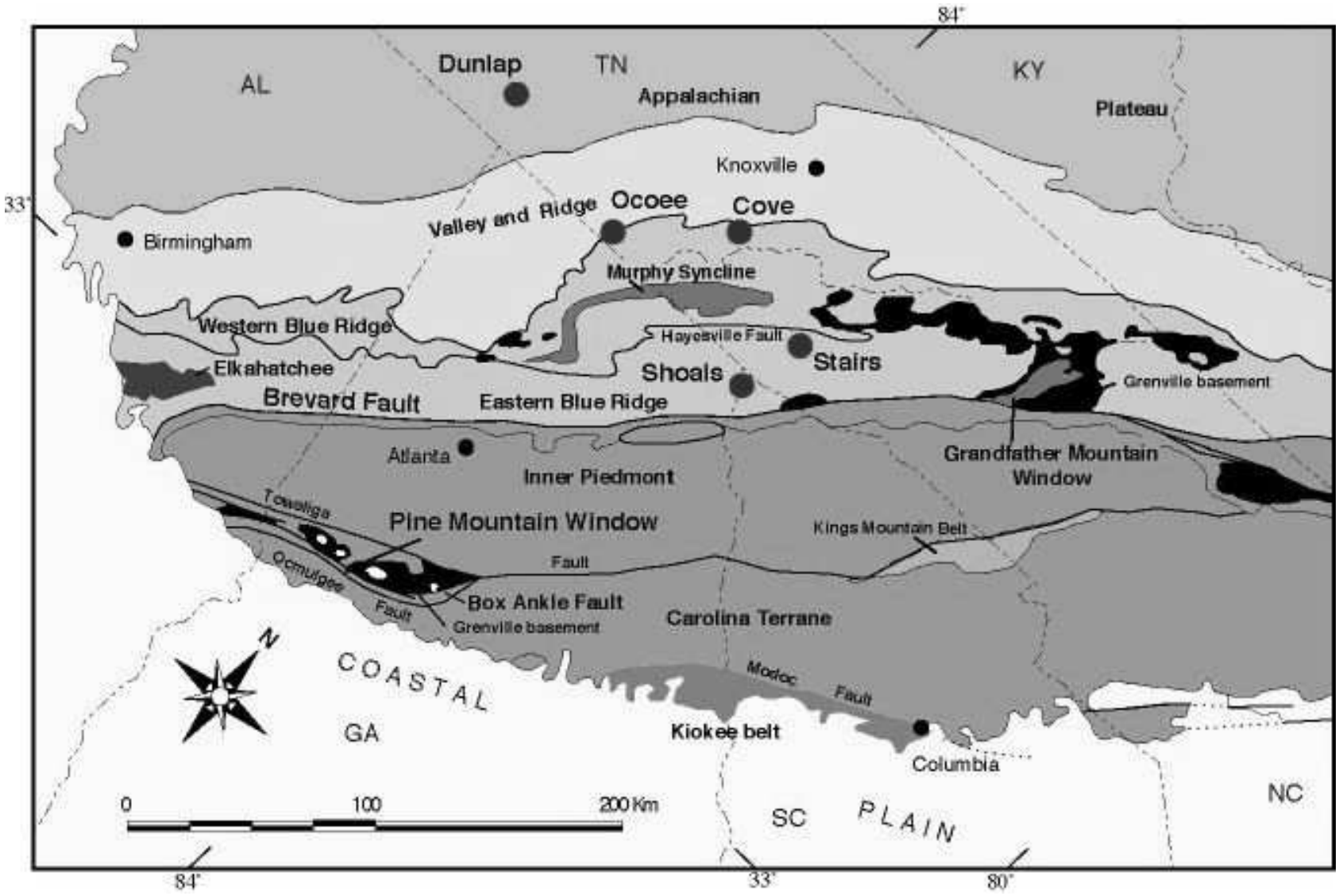


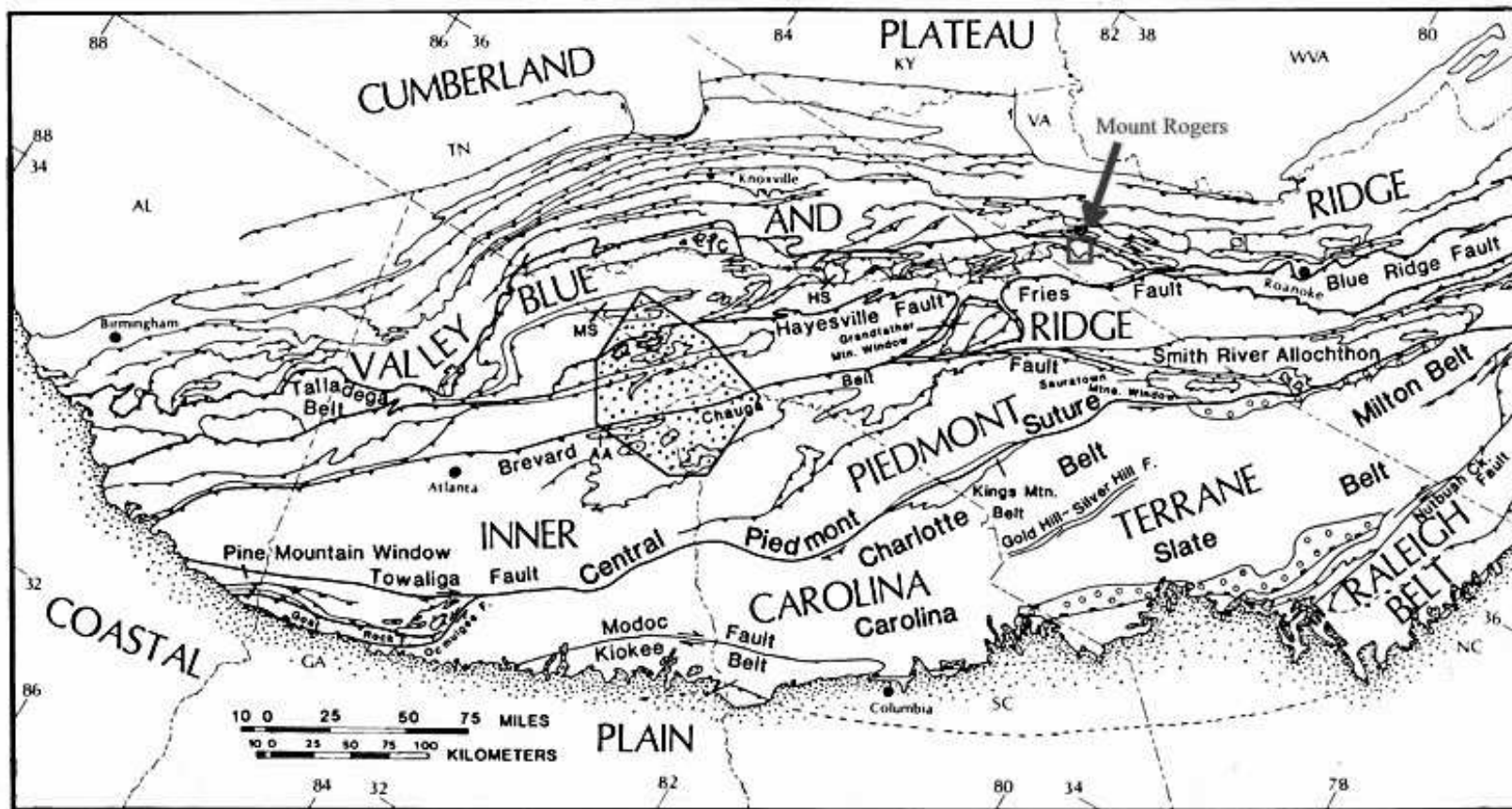
Figure 3. Map illustrating the distribution of the ophiolite and orthotectonic metamorphic belts of New Guinea and the Appalachian-Caledonian system.

Fullagar et al. 1997





Newfoundland	S. Appalachians
No correlative	Valley and Ridge Tectonic Province
Western Newfoundland foreland	Jefferson terrane
Fleur de Lys	Potomac terrane
Notre Dame Bay ophiolite/arc terrain	Bel Air/Chopawamsic ophiolitic arc terranes
Burlington Granodiorite	Occoquan pluton
IAPETUS SUTURE	
Exploits	Inner Piedmont terrane
Davidsville/GRUB line	Juliette terrane
Gander Lake	Uchee or Charlotte terranes
Avalonia	Carolina terrane
RHEIC SUTURE	
No correlative	Suwannee



Hopson et al., 1989

Figure 1. Lithotectonic map of the southern Appalachians. The stippled area is the region shown in Figure 2. The Hayesville fault separates the Blue Ridge into eastern and western segments. MS, Murphy Syncline; AA, Alto allochthon; TC, Tuckaleechee Cove window; HS, Hot Springs Window.

Figure 3c.

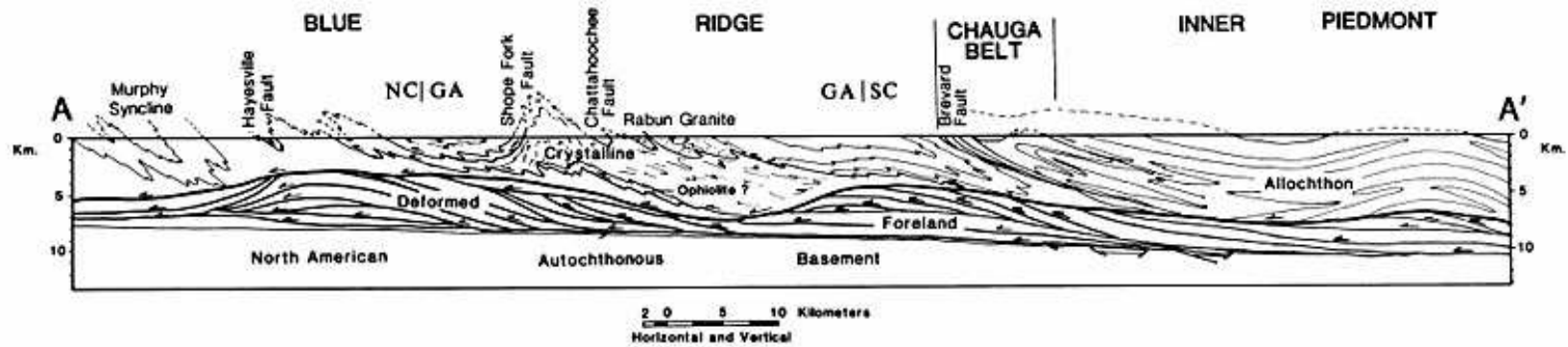
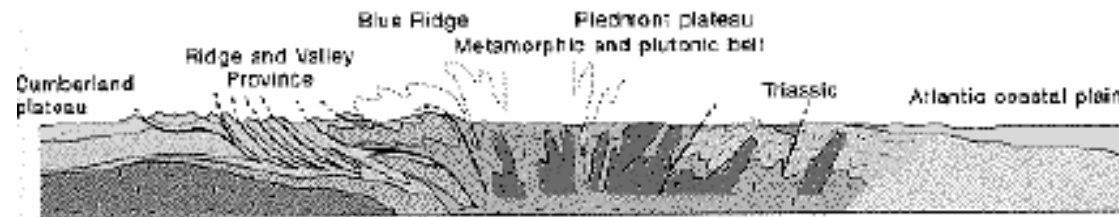
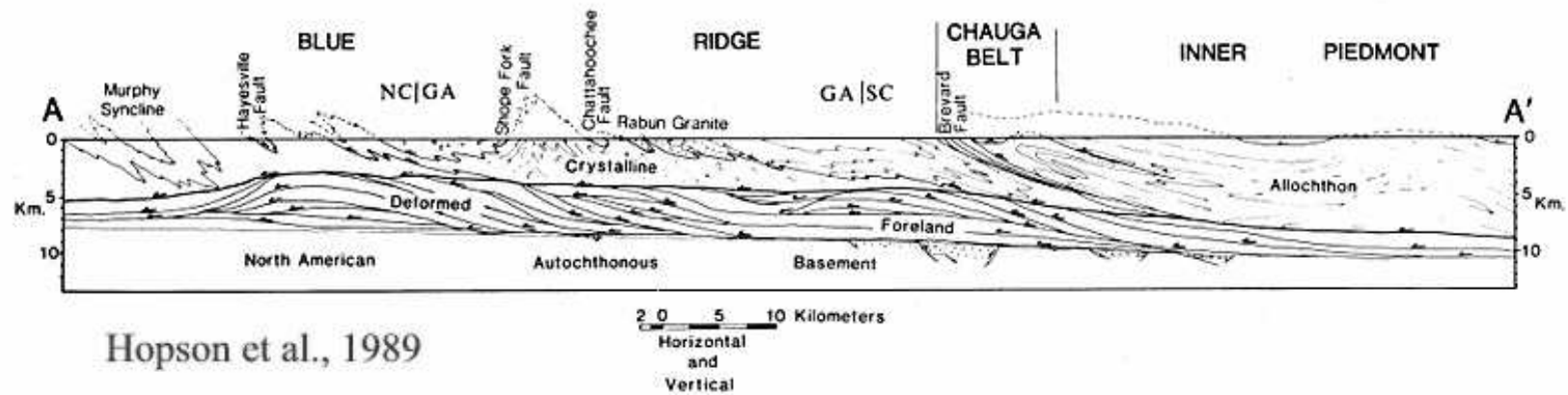
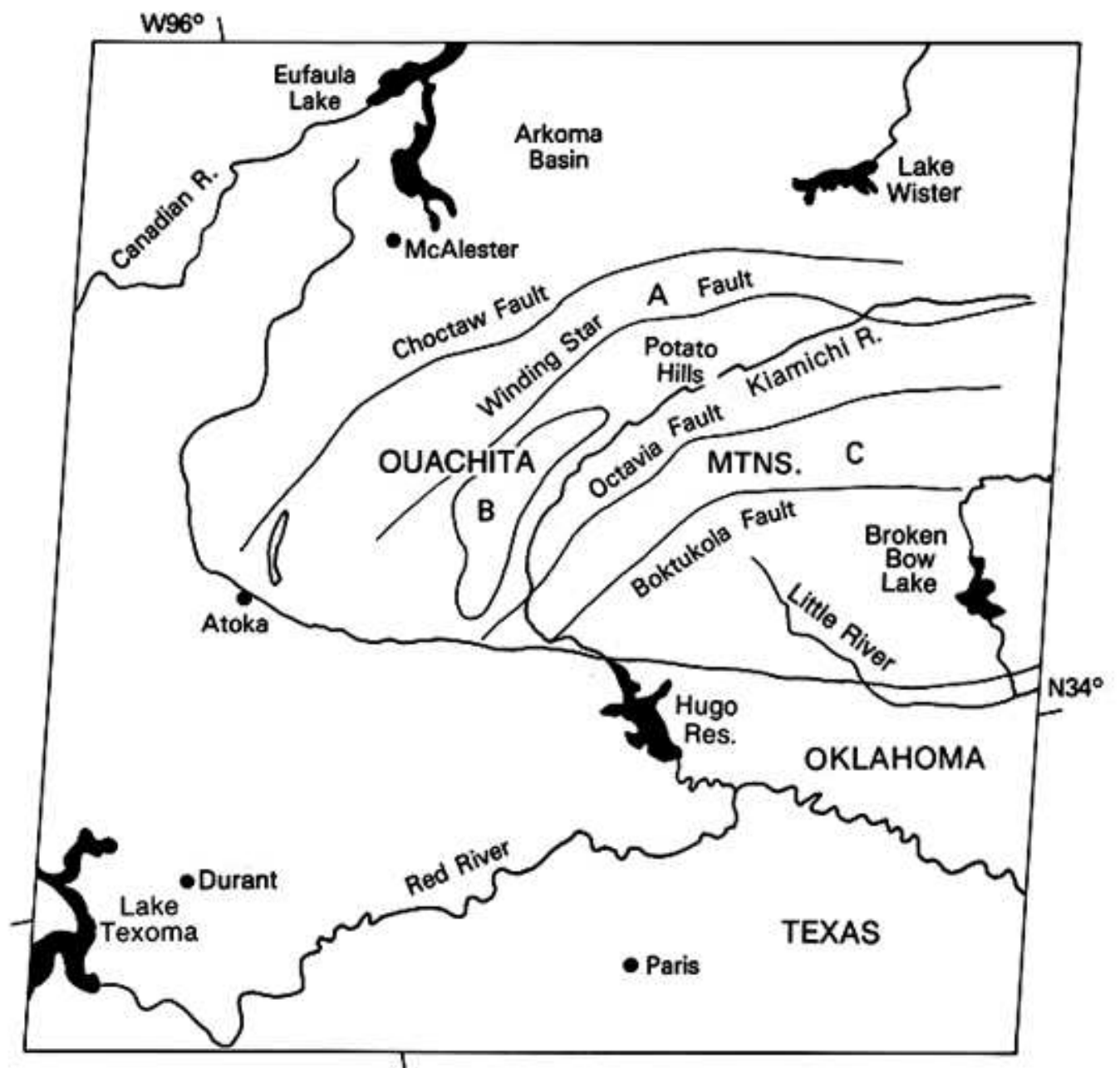


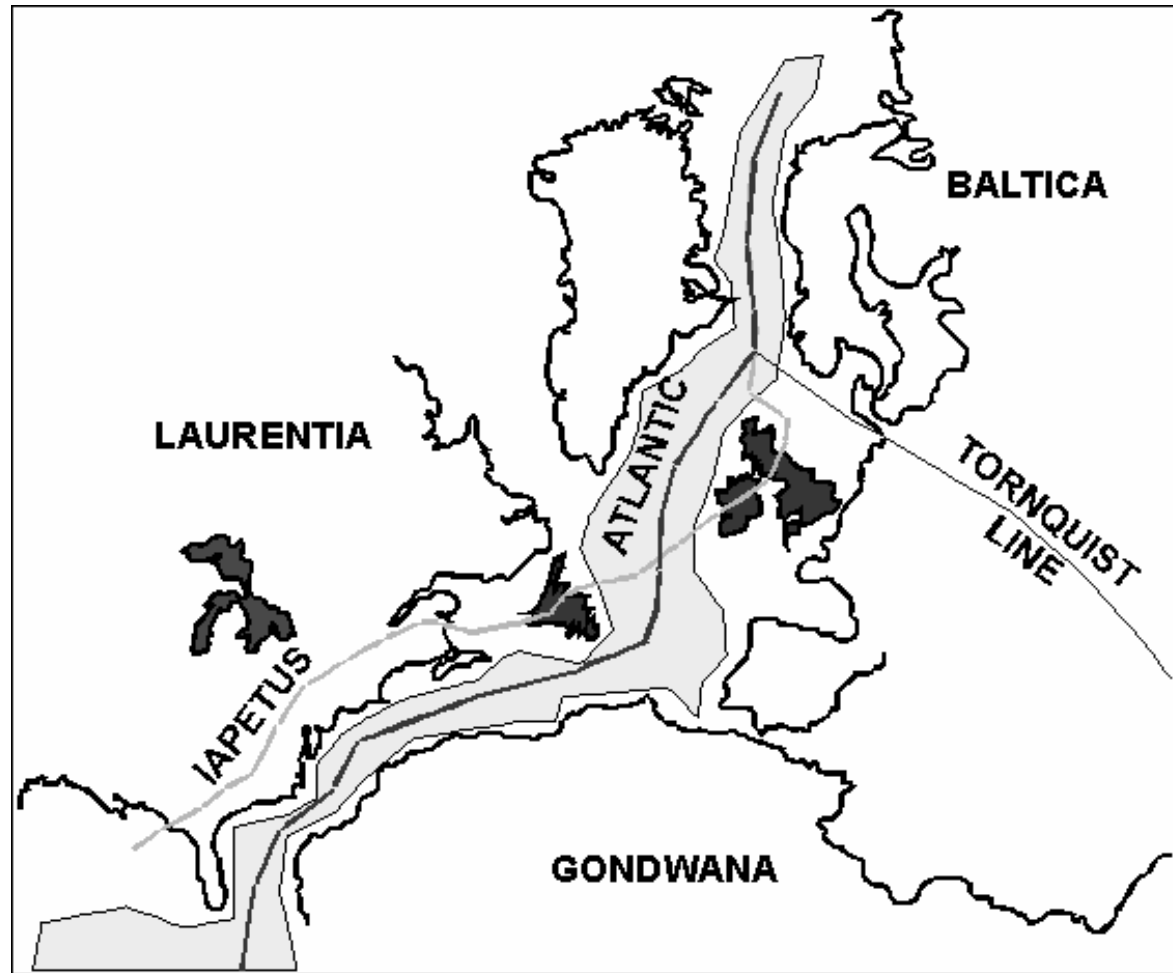
Figure 3d.



Hopson et al., 1989

**Pásmo Quatchita-Marathon – alleghanská fáze, kolize s
jihoamerickou částí Gondwany**

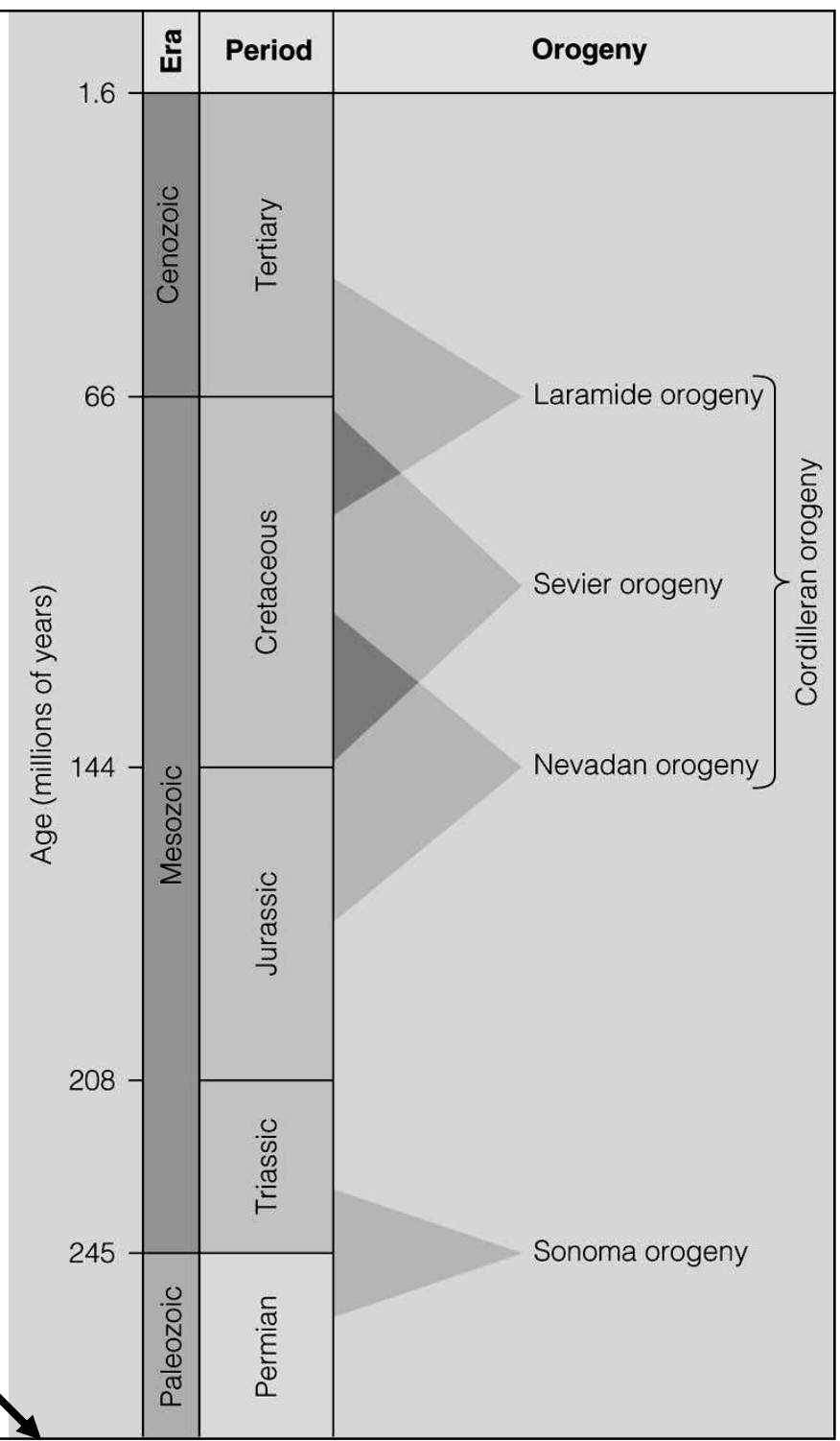
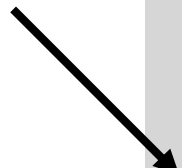


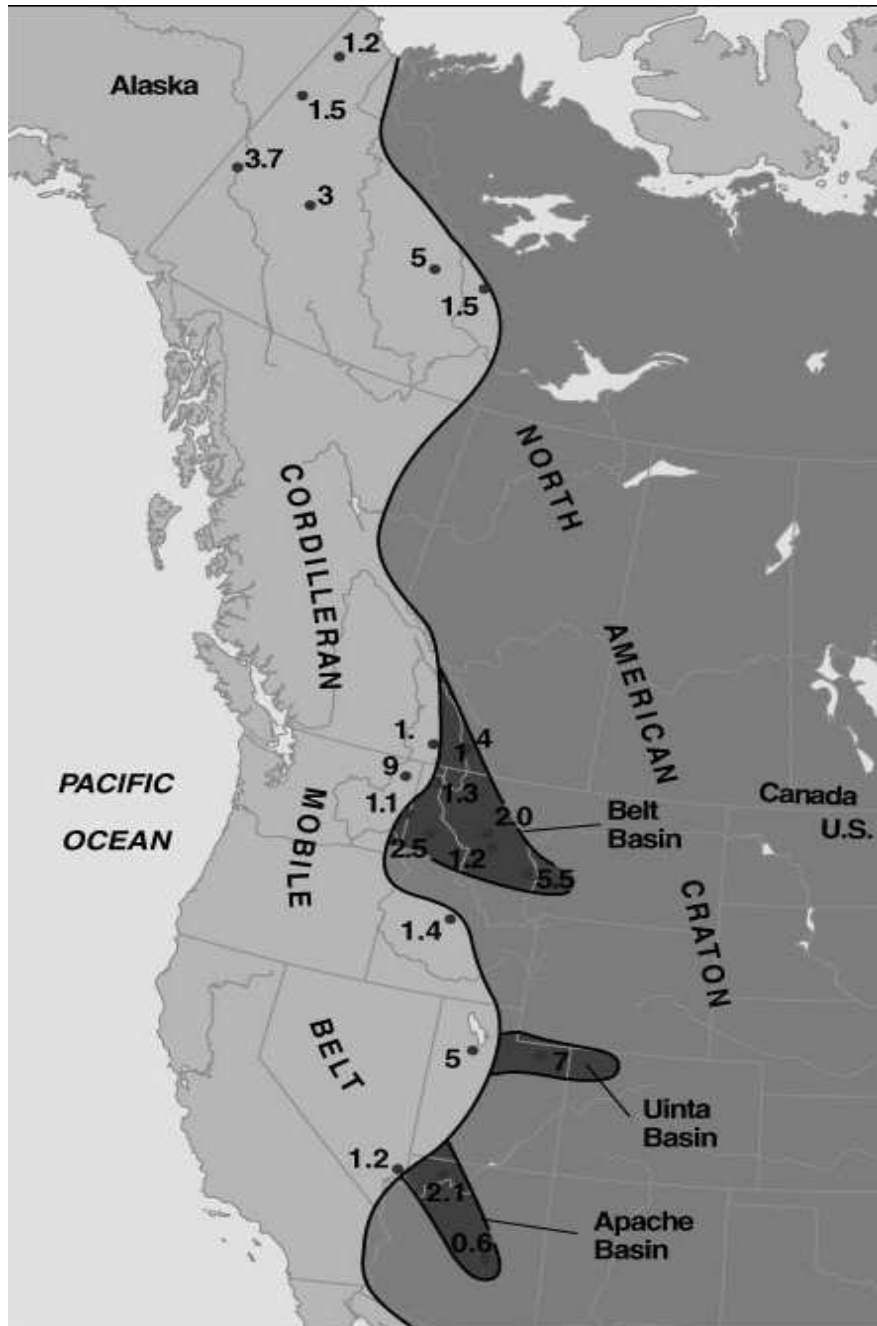


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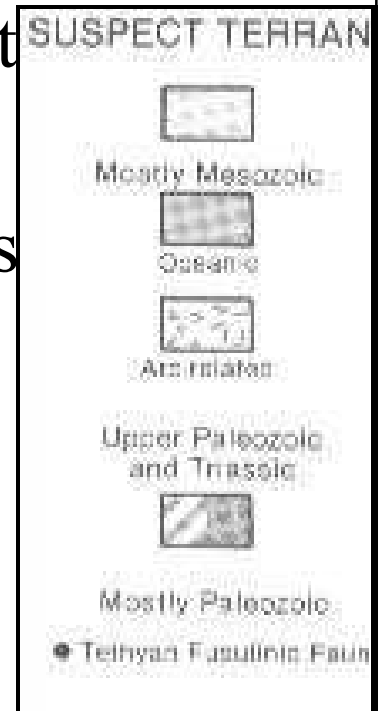
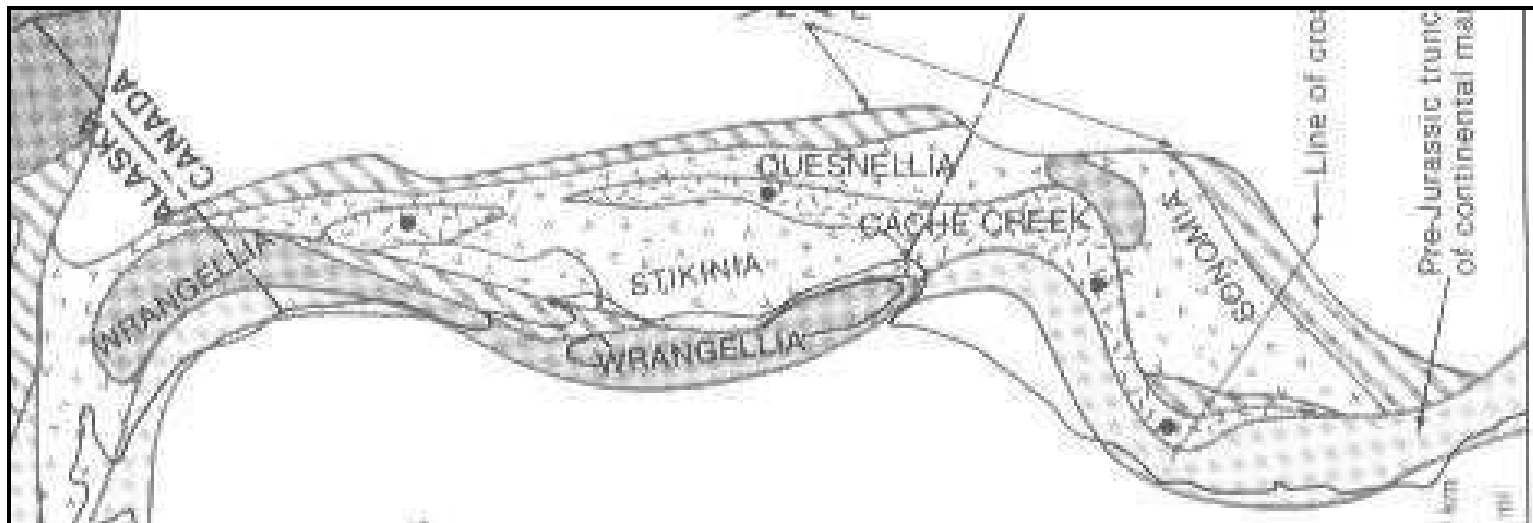
**Antler Orogeny
in Devonian**





The Western Collage

- Cordillera an collage of microplates and arcs
 - accreted during the Paleozoic and Mesozoic
 - terrains have different rock types and fossil assemblages that cannot be correlated
 - suspect terrains--fault-bounded regions that cannot be correlated



Paleozoic Passive Margin

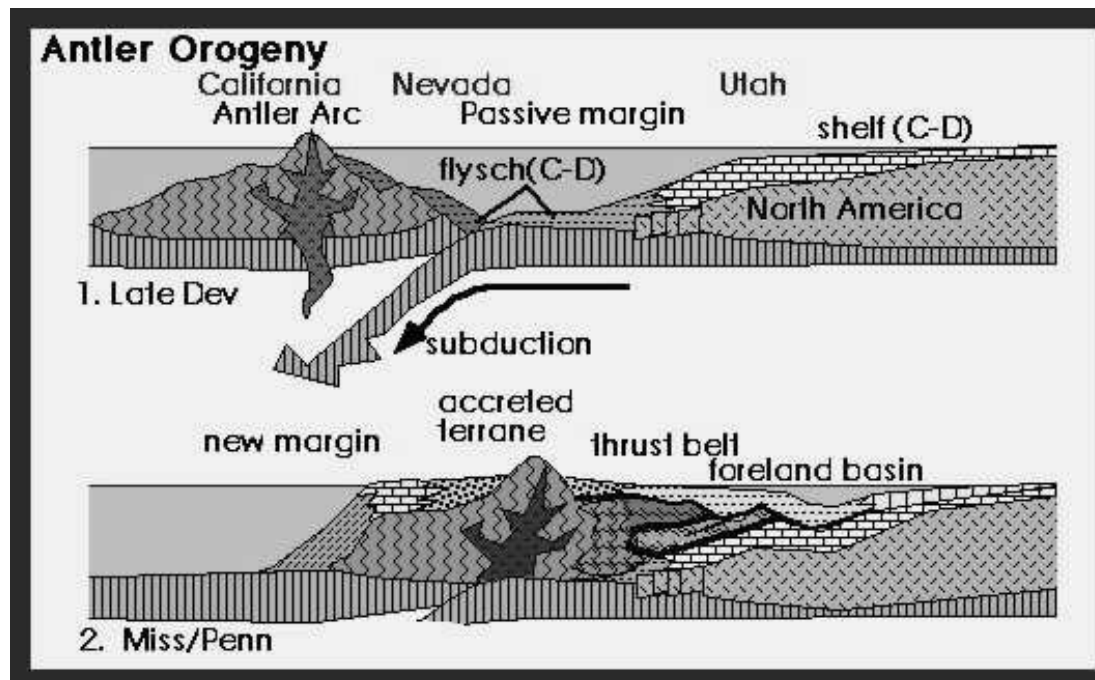
- Existed in Late Precambrian and Early Paleozoic
- Craton and cratonic basin deposits
- Miogeocline continental shelf deposits
- An arc formed in the Ordovician

Antler Orogeny

(300 (300-375 Ma) 375 Ma)

- Late Devonian - Early Mississippian
- Collision of the arc with a passive margin
- Roberts Mountain Allochthon thrust over the passive margin
- A series of foreland basins formed in eastern Nevada

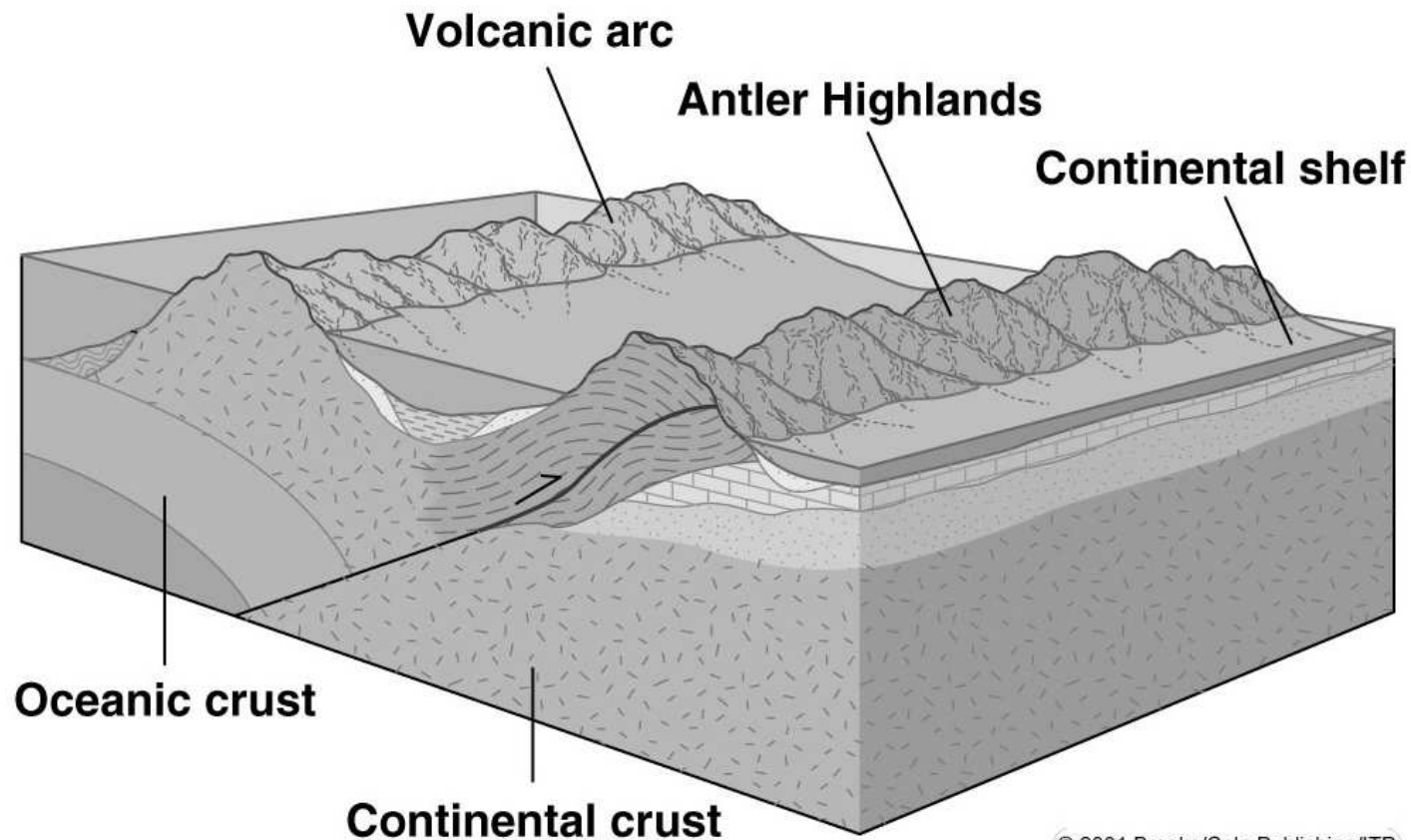
Orogeneze: antlerská, kolize klamathského ostrovního oblouku v devonu a spodním karbonu



20 Western craton (Cordilleran) was a passive margin Late Proterozoic to Early Paleozoic.

Beginning in the Middle Paleozoic - an island arc formed off the western margin of the craton.

Antler Orogeny – collision of island arc with craton – Late Devonian/Early Mississippian.



From the Antler Orogeny, the western margin remains an active margin.

Sonoma Orogeny (200-280 Ma)

- Permo -Triassic
- Collision of Arc With a Passive Margin
- Island Arc Terrains Were Accreted
- Golconda Allochthon
 - Thrust Partly Over Roberts Mountain

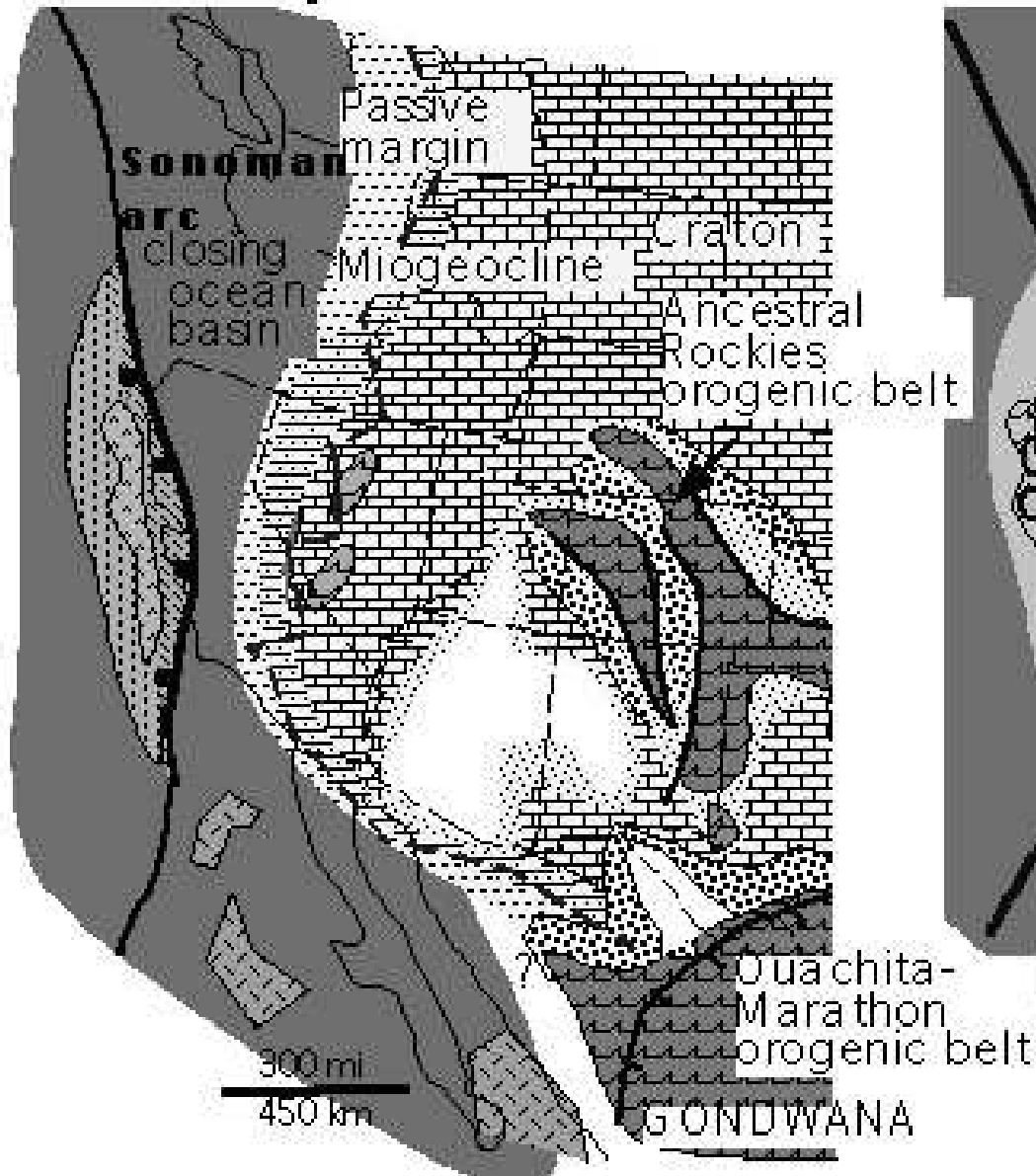
Allochthon

Nevadan Orogeny (140-150 Ma)

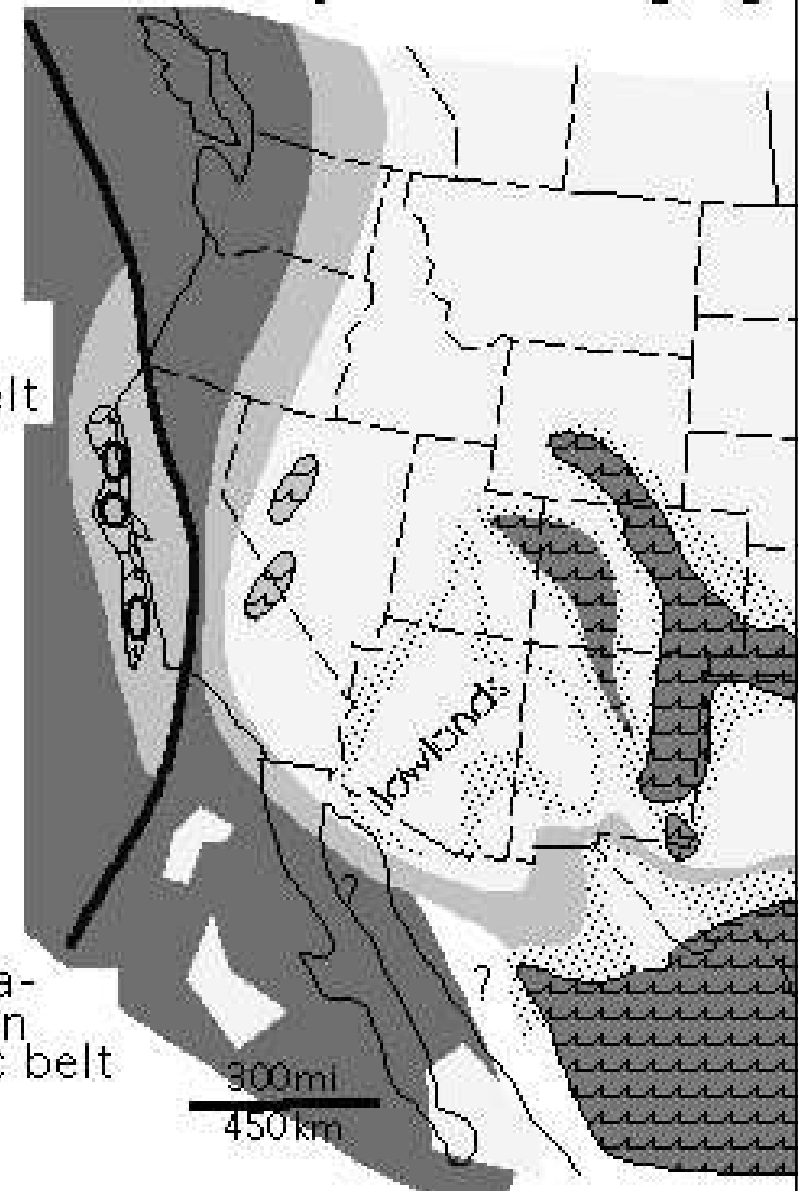
- Several Upper Jurassic Arcs Collided
- Cretaceous Franciscan Fm in the accretionary prism
- Great Valley Sequence filled an elongated forearc basin
- Sierra Nevada was the root zone of the arc

Western U.S., Mid Penn

Middle Pennsylvanian Facies/Tectonics

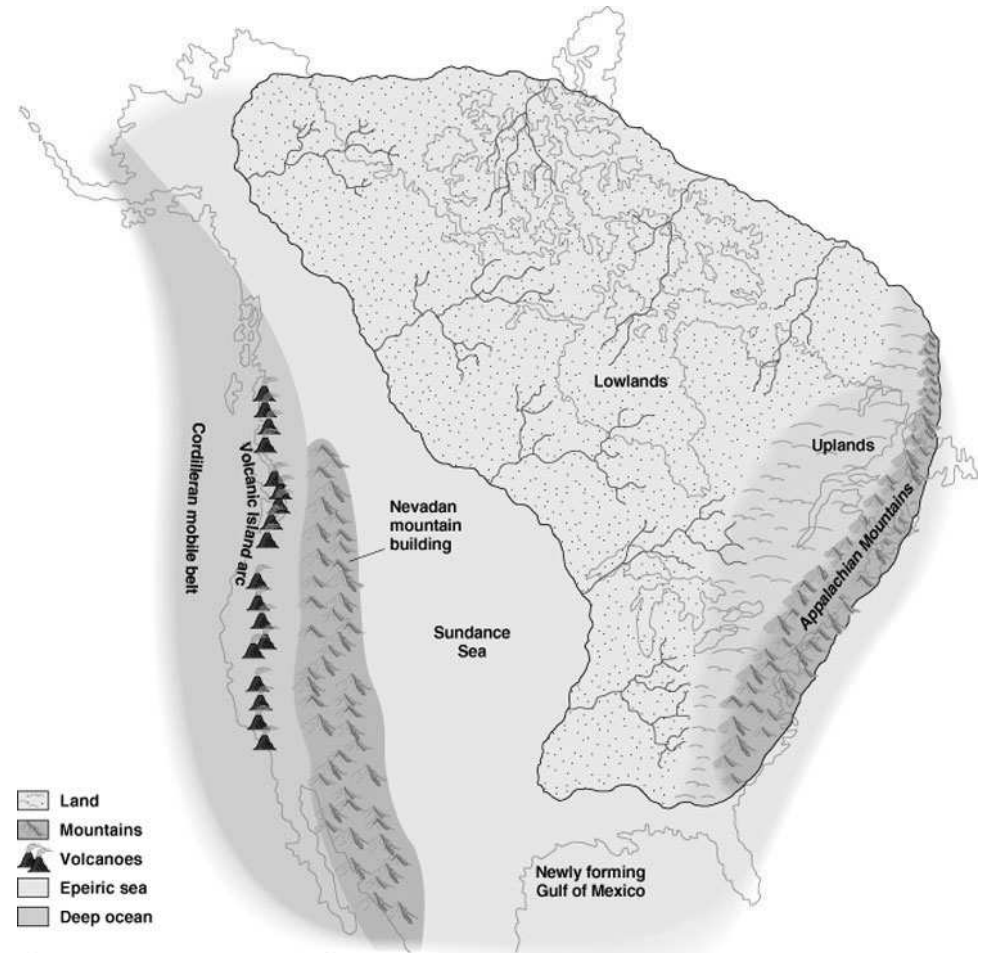


Middle Pennsylvanian Paleogeog

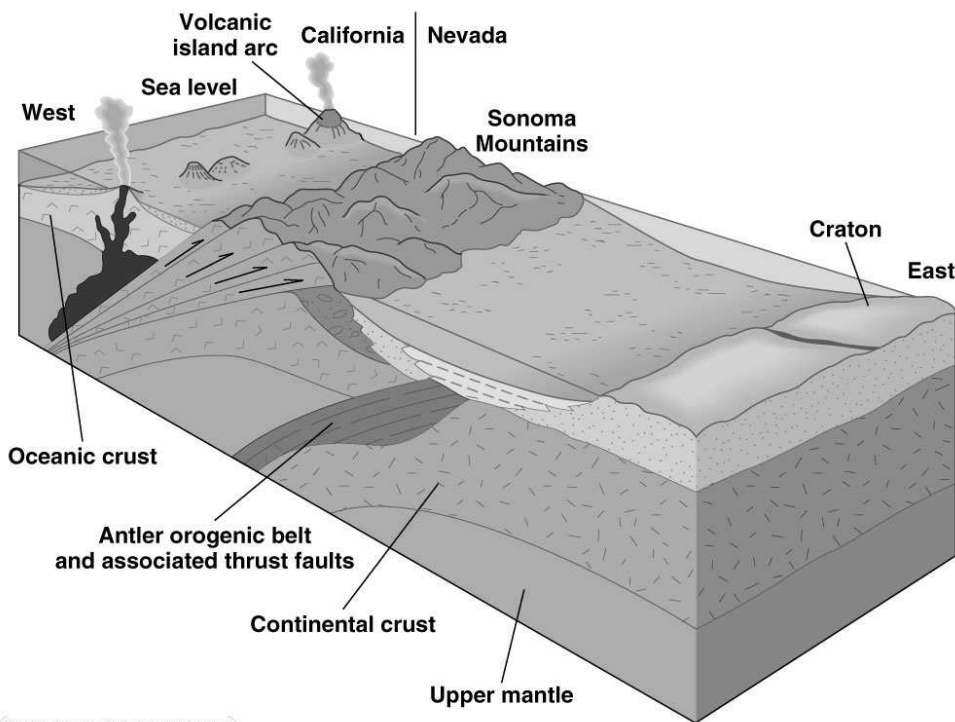




Jurassic Period – after collision between island arc & continent, Cordilleran margin became a continental arc.

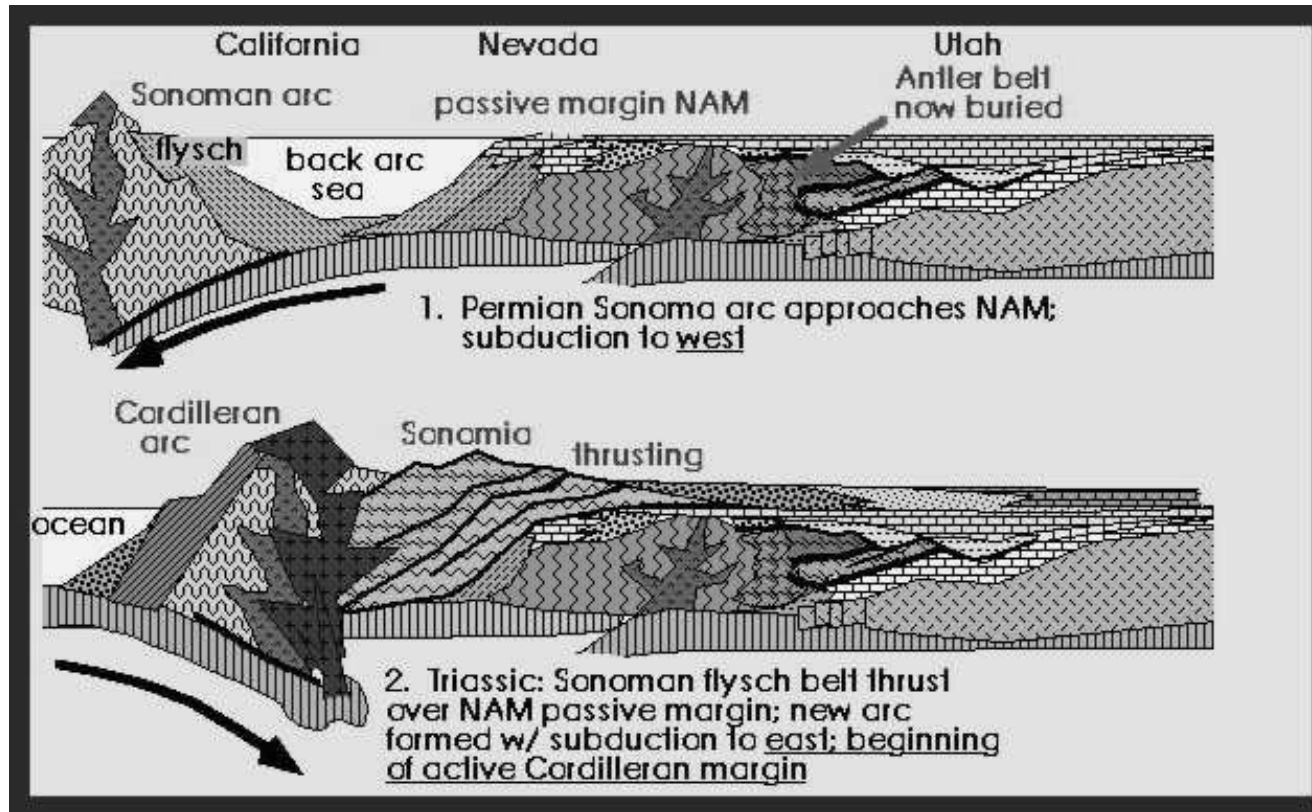


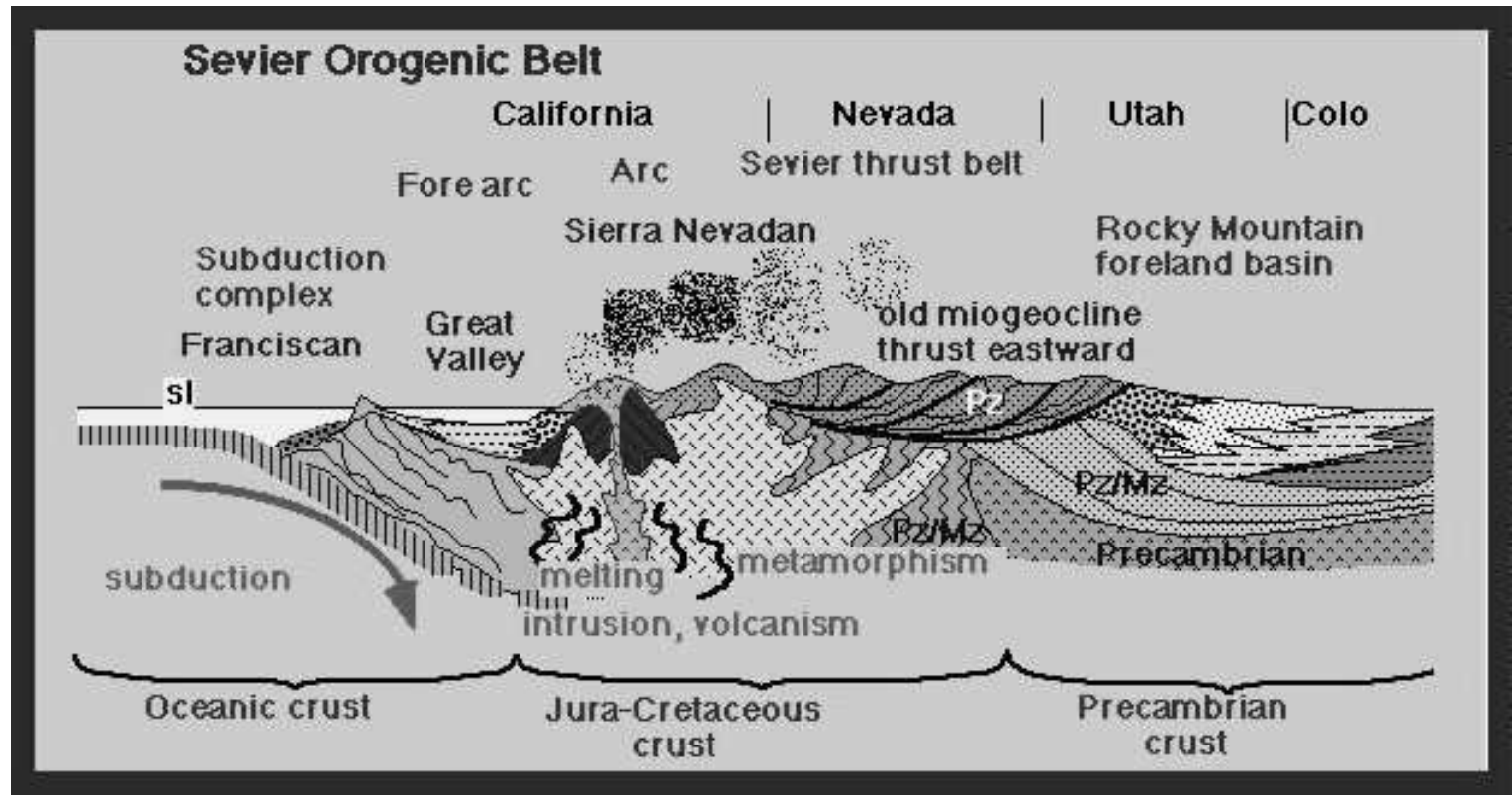
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sonomská, kolize dalšího ostrovního oblouku na konci paleozoika





Sevier Orogen (80-130 Ma)

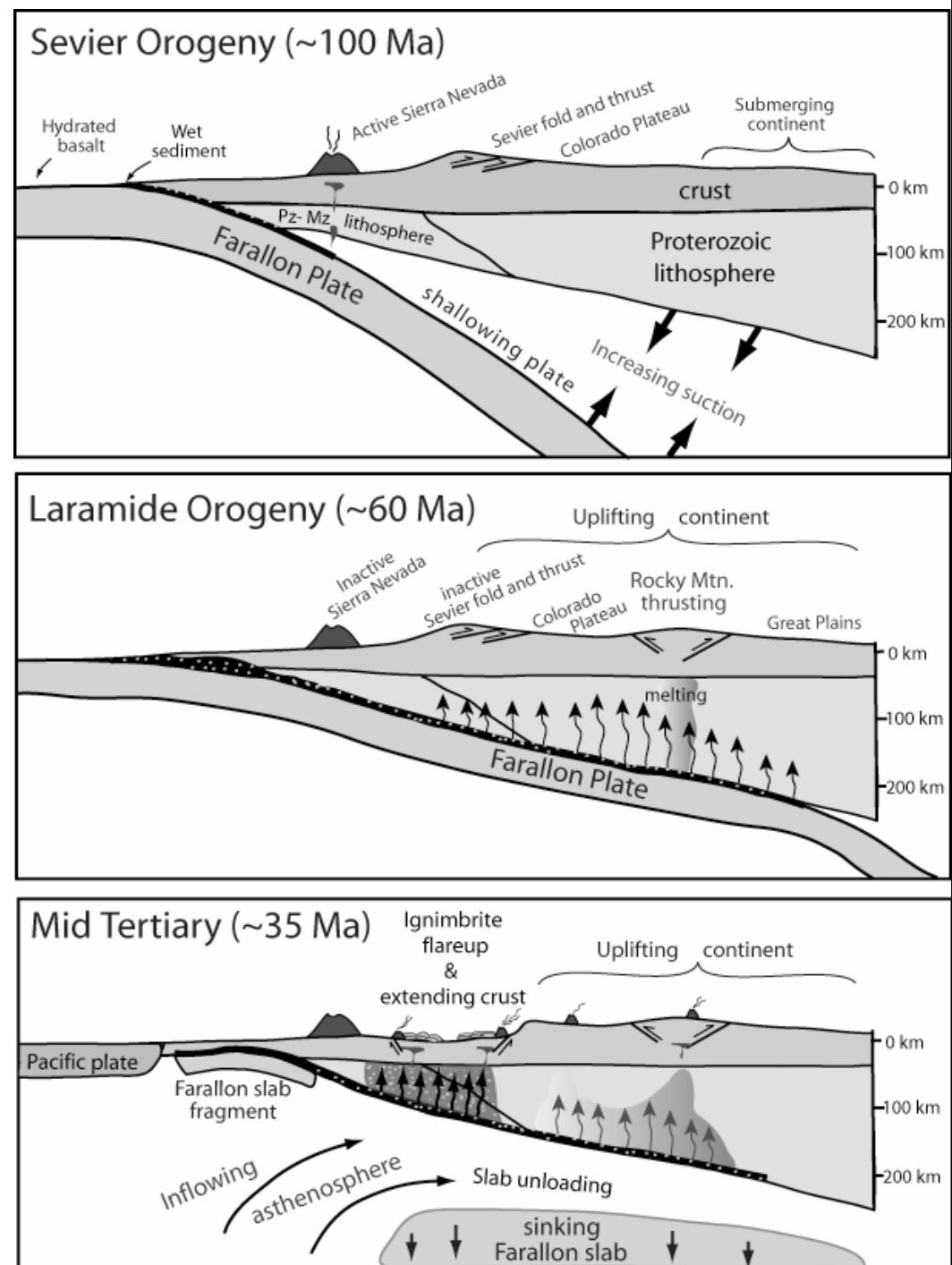
- Fold-thrust belt behind the arc
- Eastward directed thrusts
- Prominent retro arc basins to the East
- Late Jurassic to Late Cretaceous
- Batholithic intrusions
- Great Valley Sequence
- Franciscan Formation

Laramide Orogeny (50- 80 Ma)

- Late Cretaceous - Early Eocene
- Deformation shifted eastward following magmatism
- Westward directed thrusts

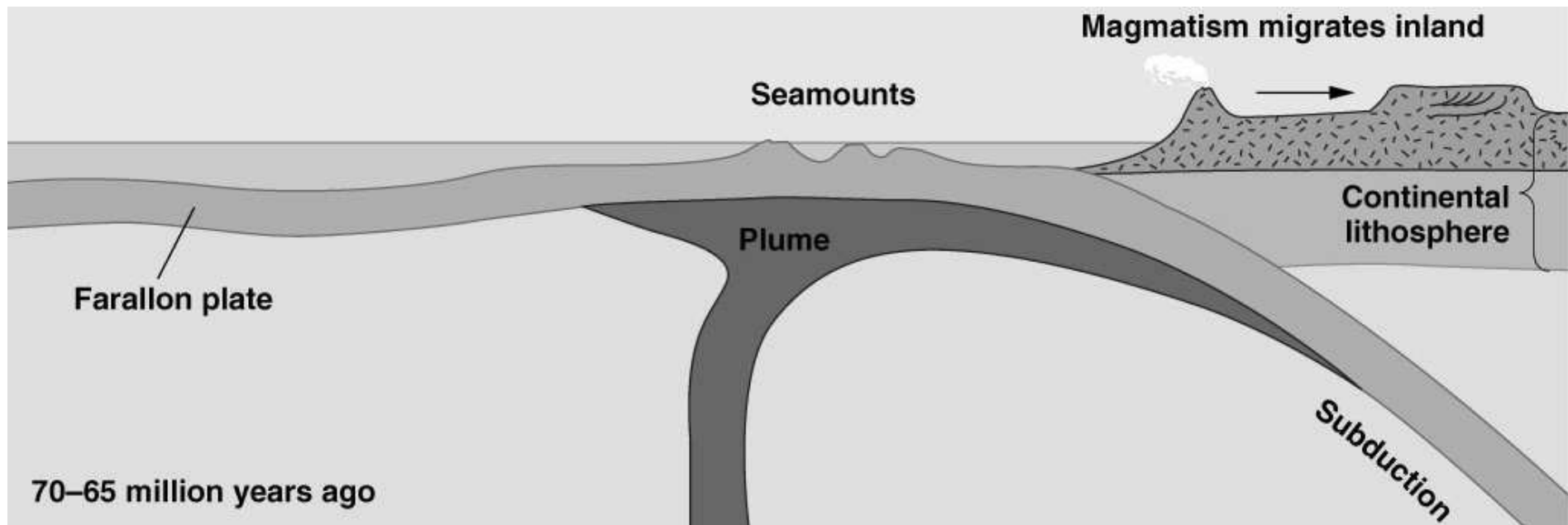
Lithospheric response to tectonics through time

- In southern Rocky Mts major variations in strength and fertility occur between the Phanerozoic and Proterozoic lithosphere
- In northern Rocky Mts there are major differences in strength and partial melt productivity between the Proterozoic and Archean as well.
- How far northeast did the effects of Laramide shallow subduction extend?
- Asthenospheric upwelling at 54-50 Ma (older than in the south)



Laramide orogeny

- took place as the Farallon plate, buoyed up by a mantle plume subducted beneath North America at a decreasing angle and igneous activity shifted inland

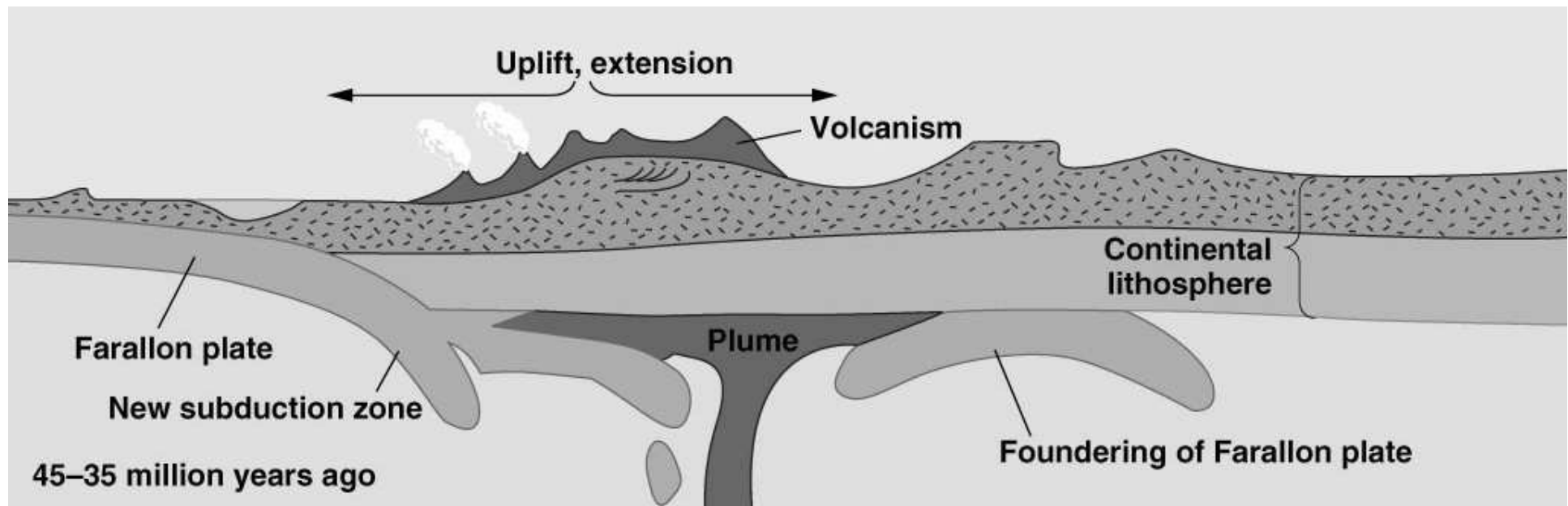


Change to Shallow Subduction

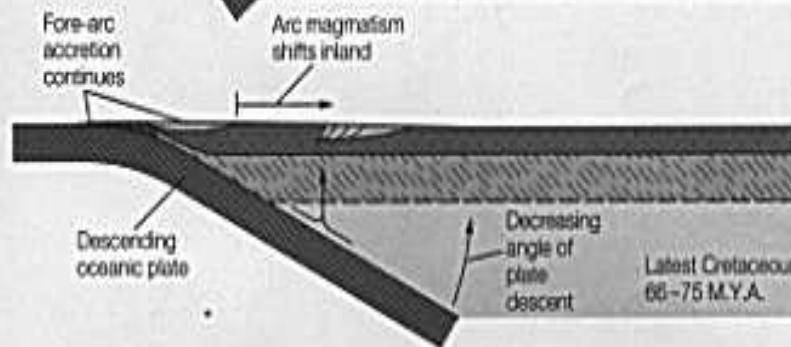
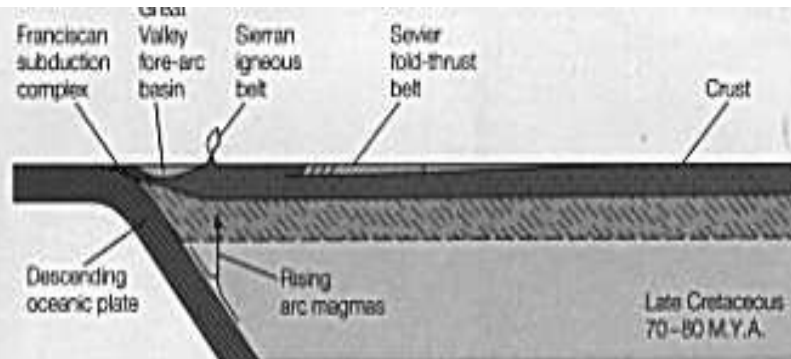
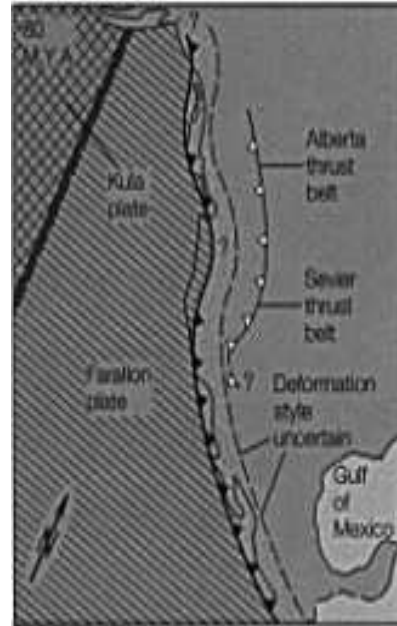
- By Early Tertiary time,
 - the westward-moving North American plate
 - had overridden the part of the Farallon plate,
 - above the head of the mantle plume
- The lithosphere
 - immediately above this plume
 - was buoyed up,
 - accounting for a change
 - from steep to shallow subduction

Renewed Igneous Activity

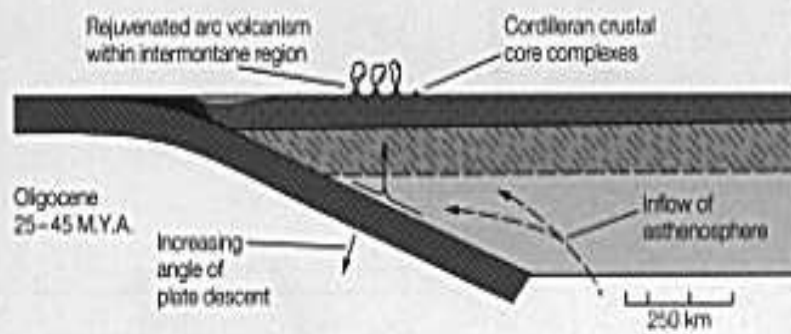
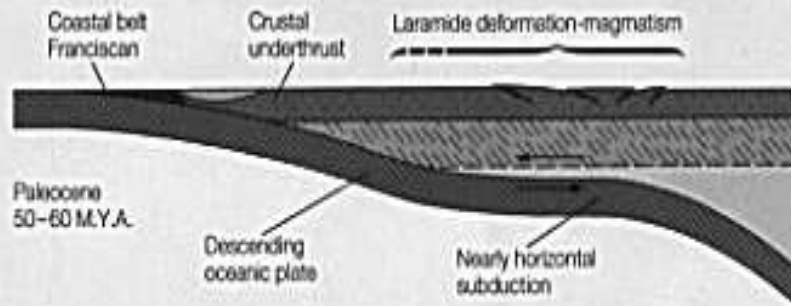
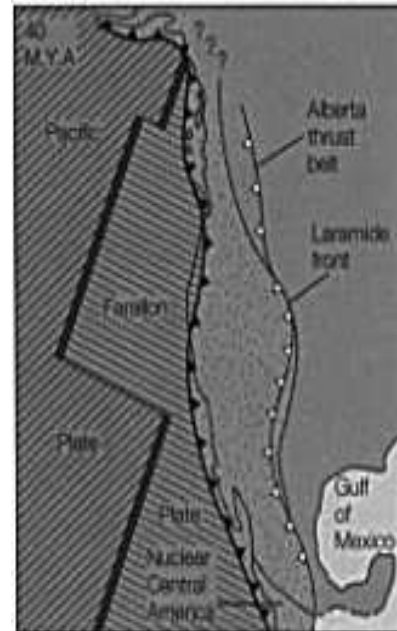
- Disruption of the oceanic plate by the mantle plume marked the onset of renewed igneous activity



Late Cretaceous



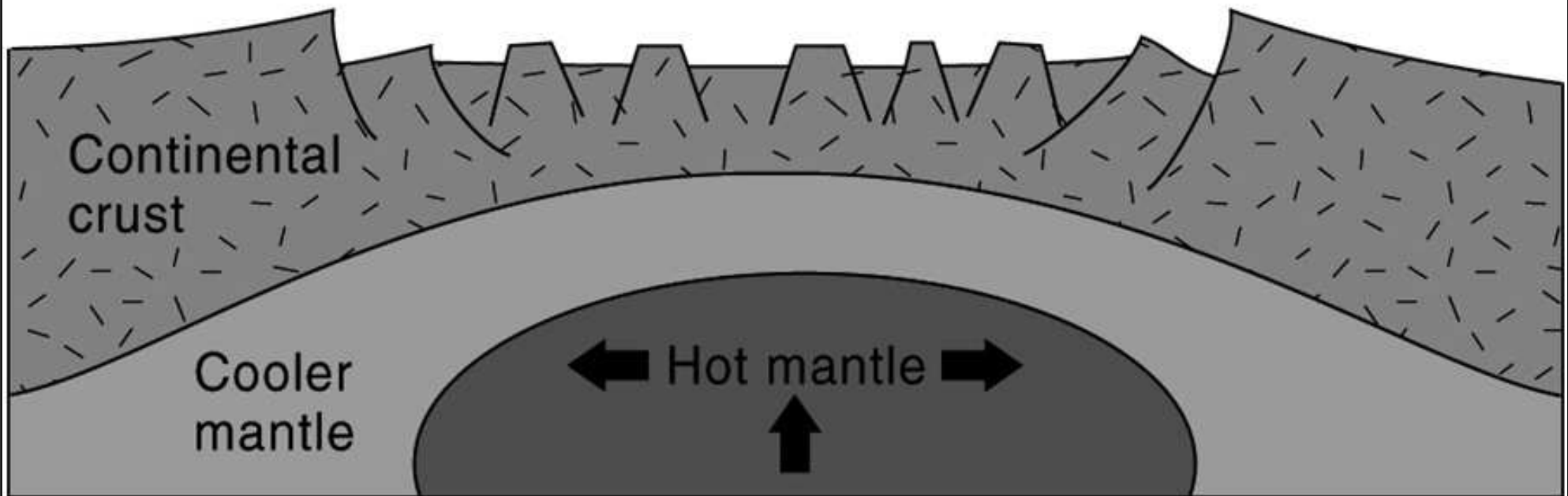
Eocene



The mechanism responsible for formation of the North American Basin and Range province

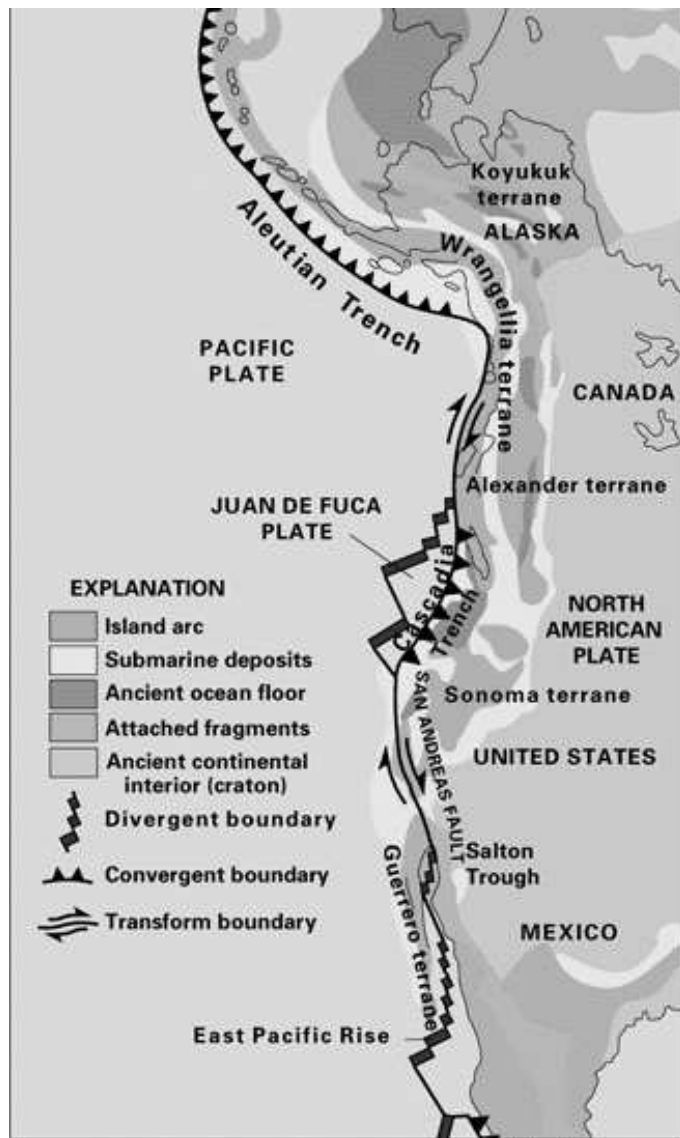
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← Extension →



The Tetons (a range), as seen looking west across Jackson Hole, WY (a basin)





Post Laramide Events

- Cenozoic extension
- Basin and Range formation
- Cenozoic magmatism
- Widespread volcanism

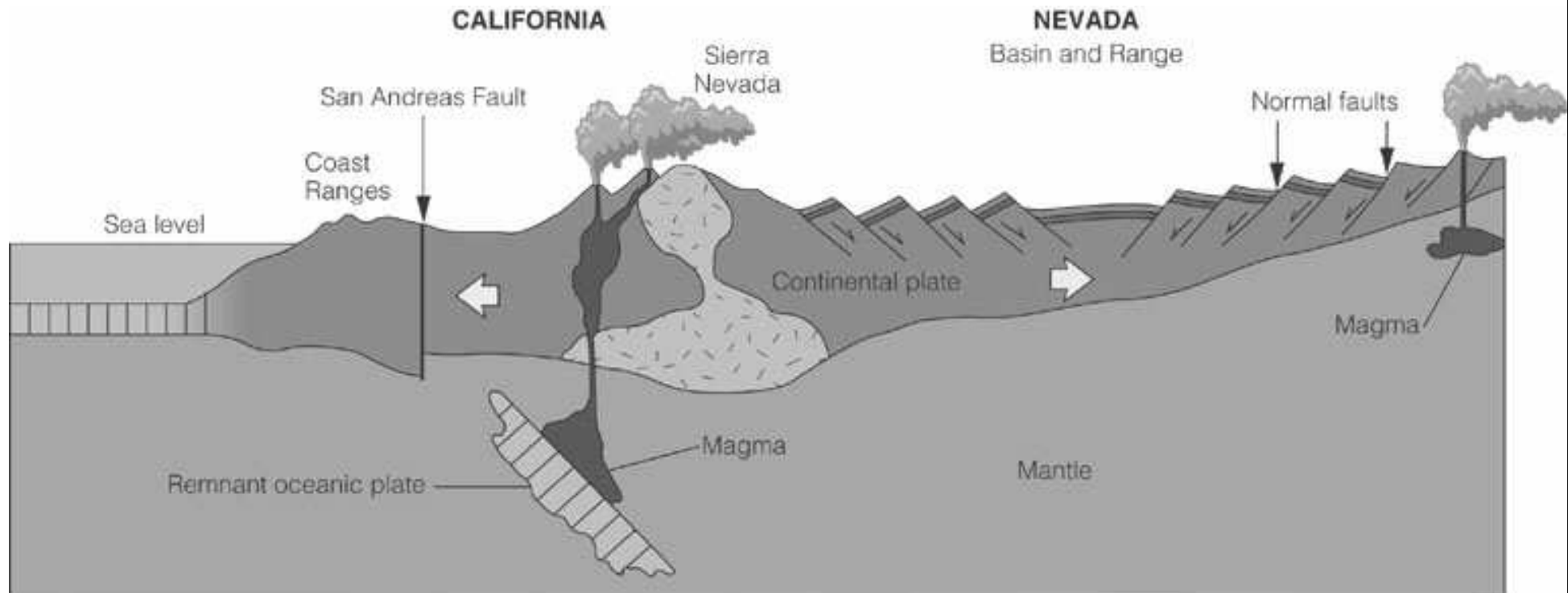
Colorado Plateau

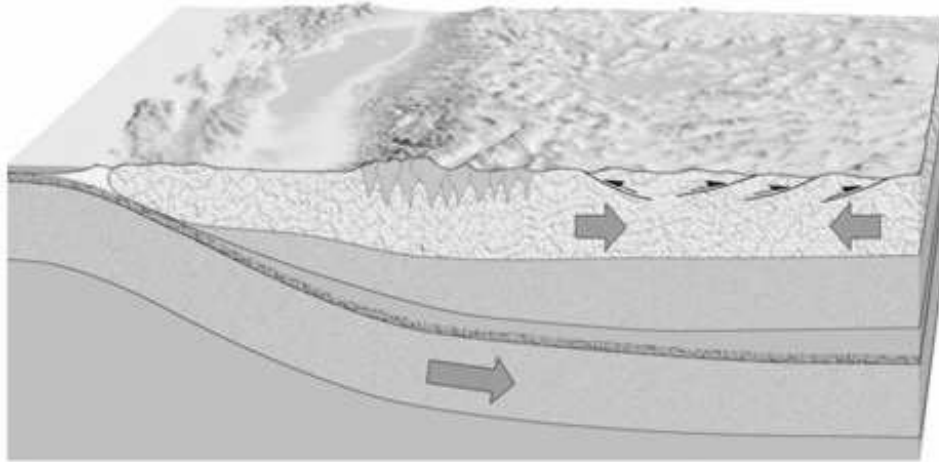


- | | | | |
|--|---|---|--|
|  Cenozoic basins of Pacific Coast |  Cenozoic volcanics |  Mountains |  Plains |
|  Pliocene-Pleistocene volcanics |  Mesozoic batholiths |  Plateaus |  Volcanoes of Cascade Range |

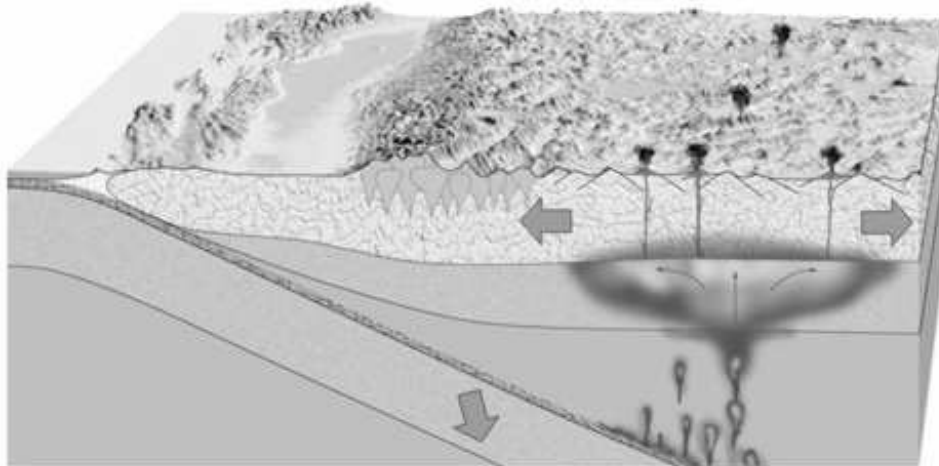
Basin and Range Province

- Generalized cross section of the Basin and Range Province
 - ranges are bounded by faults



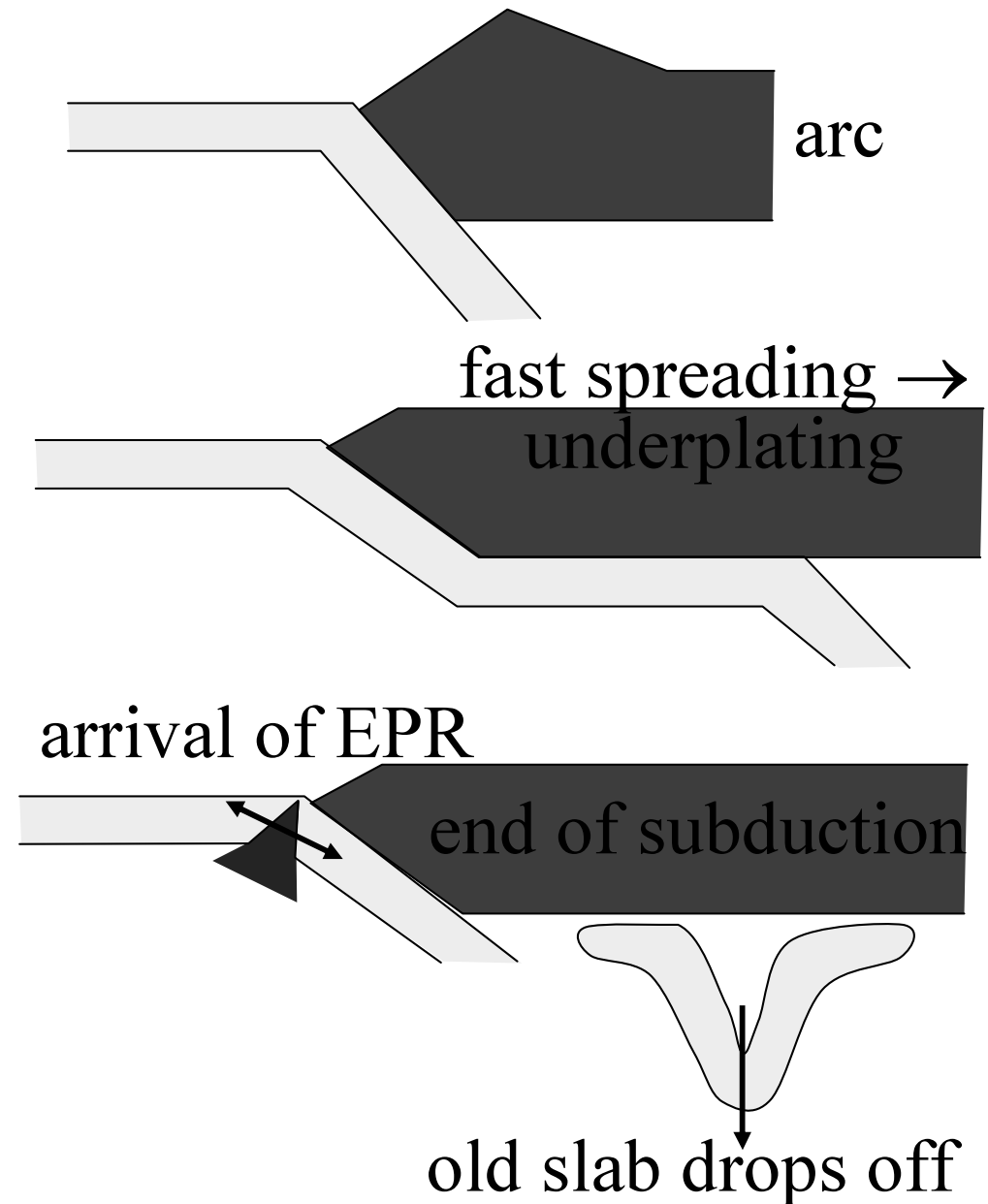


Bottom: Sinking of this oceanic slab allowed for the upwelling of hot material from the asthenosphere. The buoyancy of the warm material caused upwarping and tensional fracturing in the crust above. This event was associated with volcanism and east-west extension of the crust by nearly 150 kilometers.



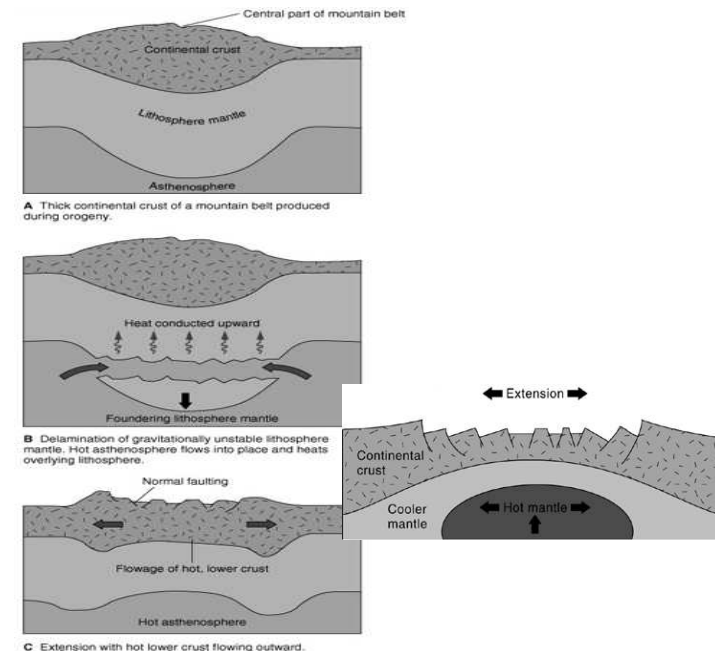
Basin and Range

- why is there extension in the Basin and Range in the first place?
- extension started about 25 Ma - same time as the beginning of subduction of the East Pacific Rise
- when slab drops off, mantle oozes around it → huge positive gravity anomaly
- fast uplift of Colorado Plateau (since 5 Ma) as a result of thermal expansion



Evolution of Mountain Belts

- Basin-and-Range province of western North America may be the result of *delamination*
 - Overthickened mantle lithosphere beneath old orogenic mountain belt may break off and sink (*founder*) into asthenosphere
 - Resulting inflow of hot *asthenosphere* can stretch and thin overlying crust, producing normal faults under tension



A Thick continental crust of a mountain belt produced during orogeny.

B Delamination of gravitationally unstable lithosphere mantle. Hot asthenosphere flows into place and heats overlying lithosphere.

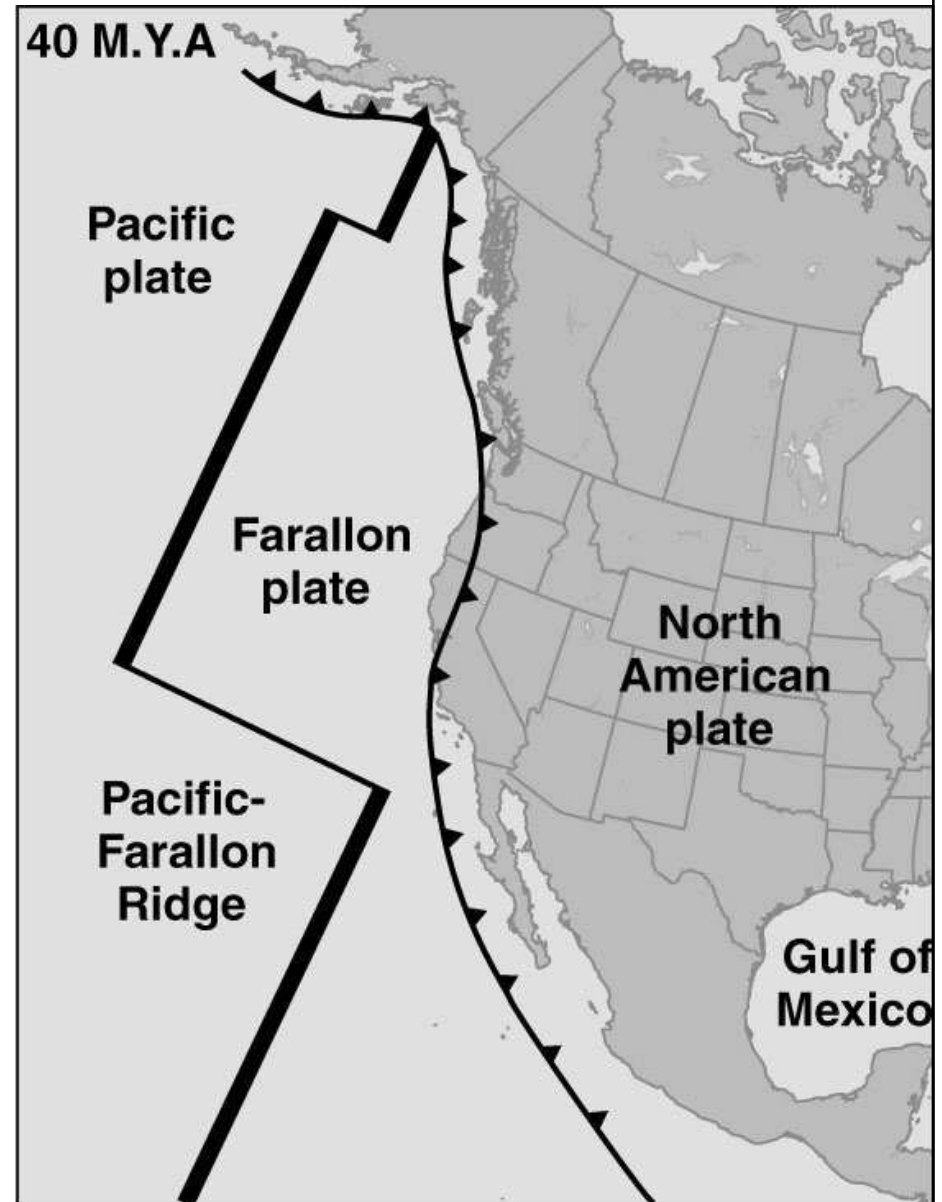
C Extension with hot lower crust flowing outward.

Cordillera Evolved

- After Laramide deformation, Cordillera continued to evolve with large-scale block-faulting, extensive volcanism and vertical uplift and deep erosion
 - **Basin and Range**
- During about the first half of the Cenozoic Era, a subduction zone was present along the entire western margin of the Cordillera, but now most of it is a transform plate boundary

Pacific Coast

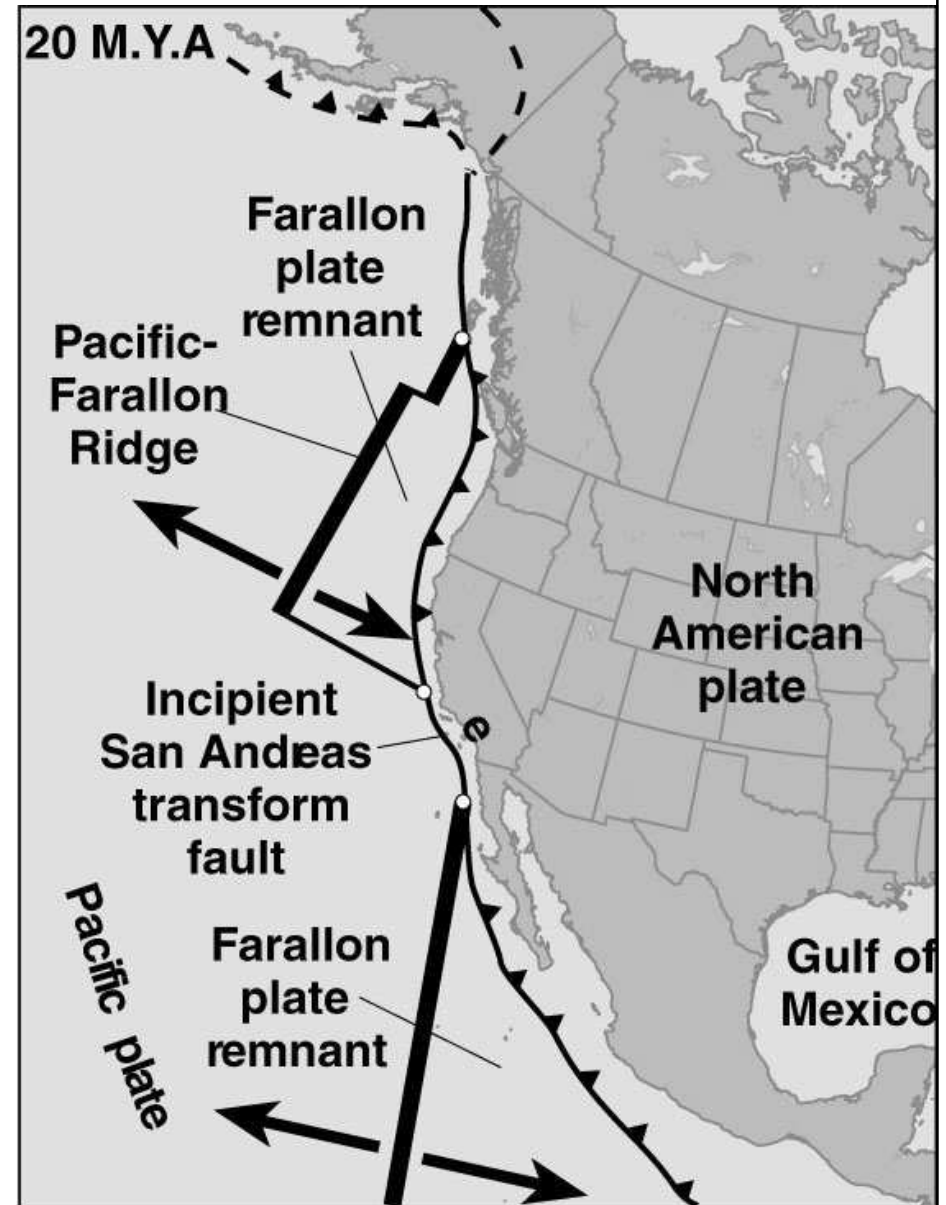
- Before the Eocene,
 - the entire Pacific Coast was a convergent plate boundary
 - Farallon plate was consumed at a subduction zone
 - stretched from Mexico to Alaska



(a)

Change from Subduction

- As the North American Plate overrode the Pacific–Farallon Ridge, its margin became transform faults
 - the San Andreas
 - and the Queen Charlotte
- alternating with subduction zones

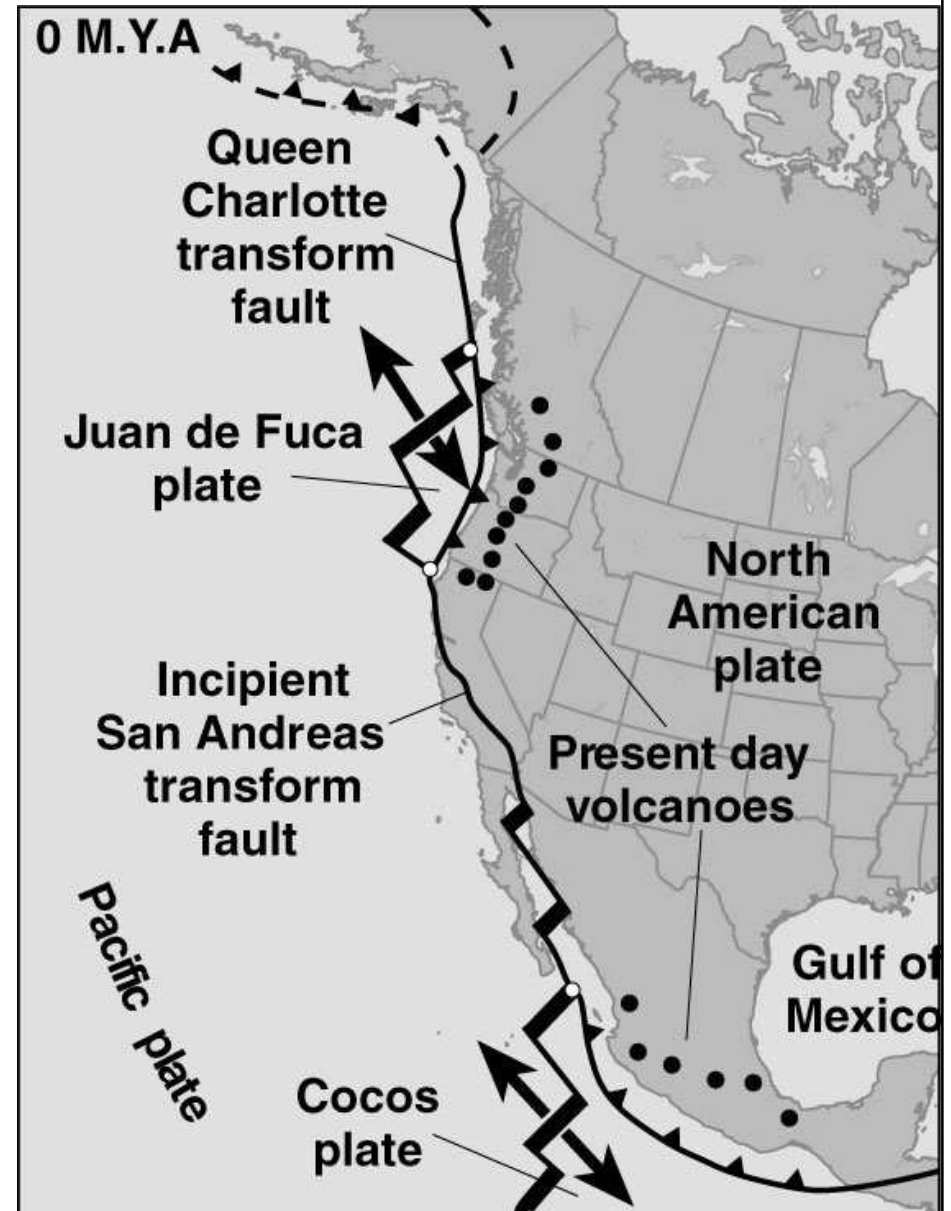


(b)

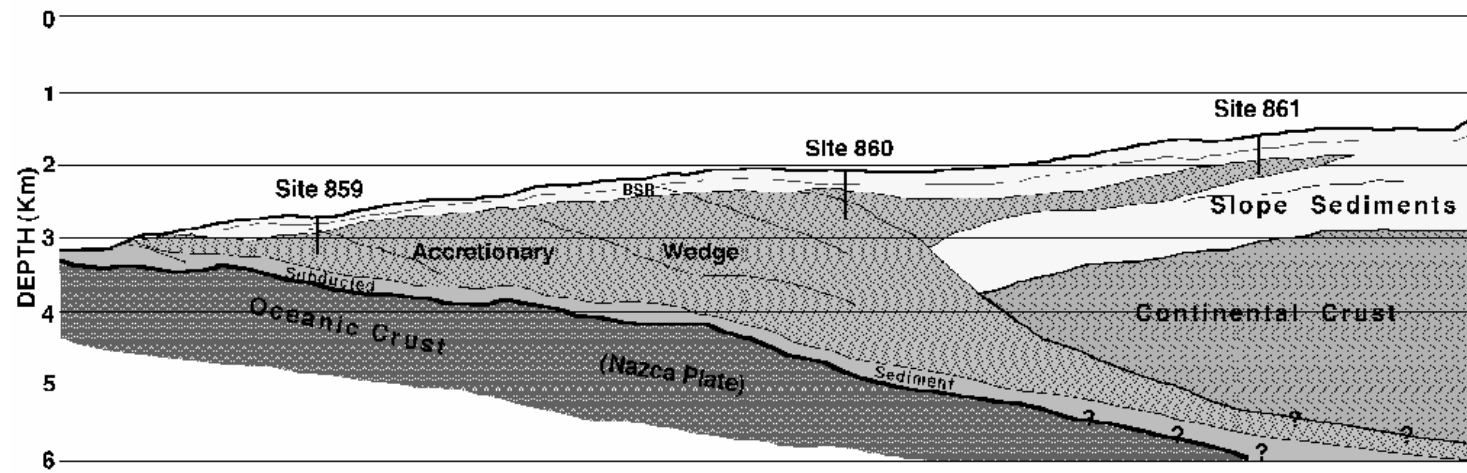
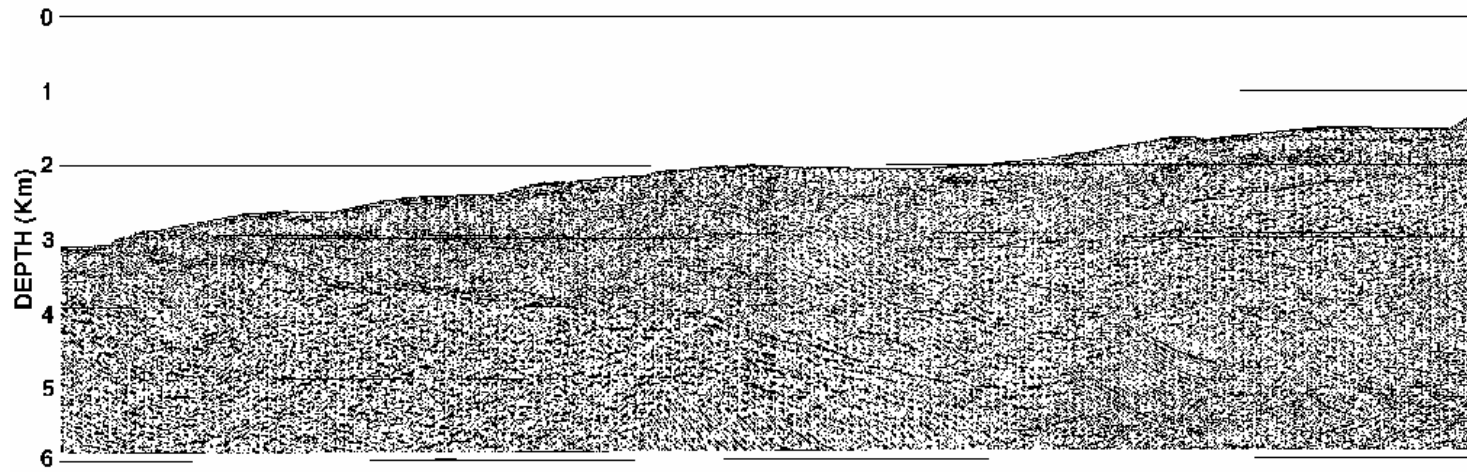
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Extending the San Andreas Fault

- Further overriding of the ridge extended the San Andreas Fault and diminished the size of the Farallon–Plate remnants
- Now only two small remnants of the Farallon plate exist
 - the Juan de Fuca and Cocos plates



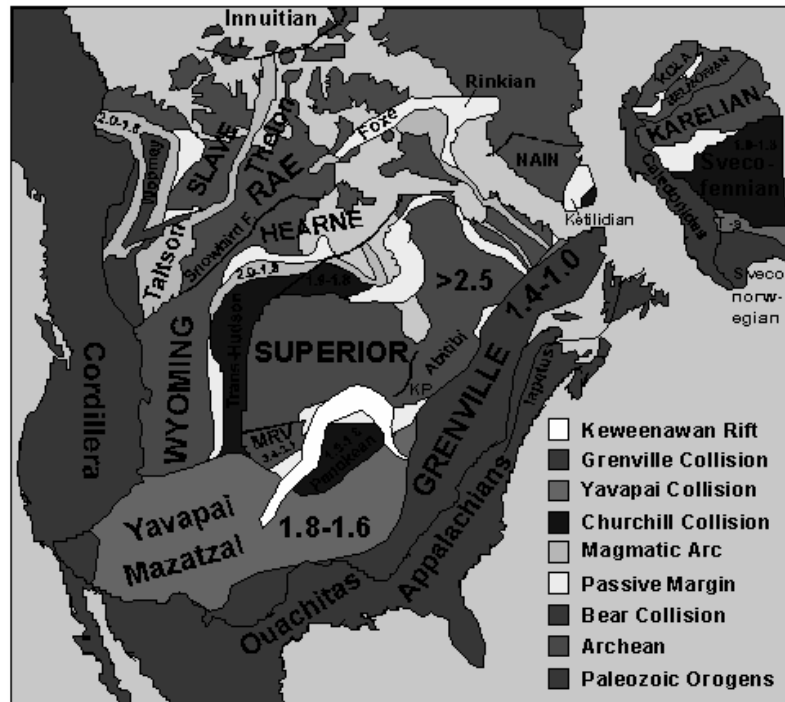
Line 745



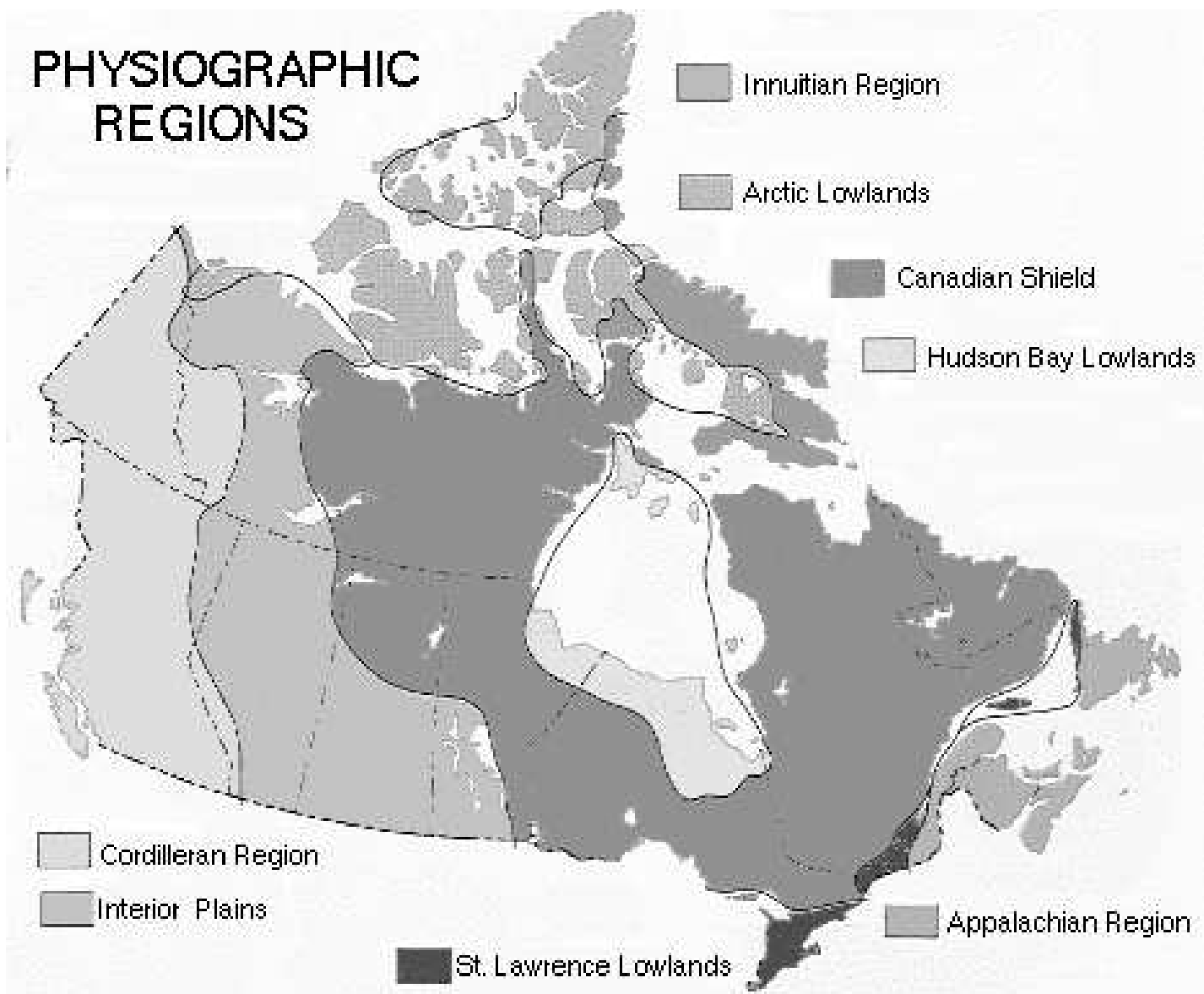
Franklinsko – inuitská orogeneze

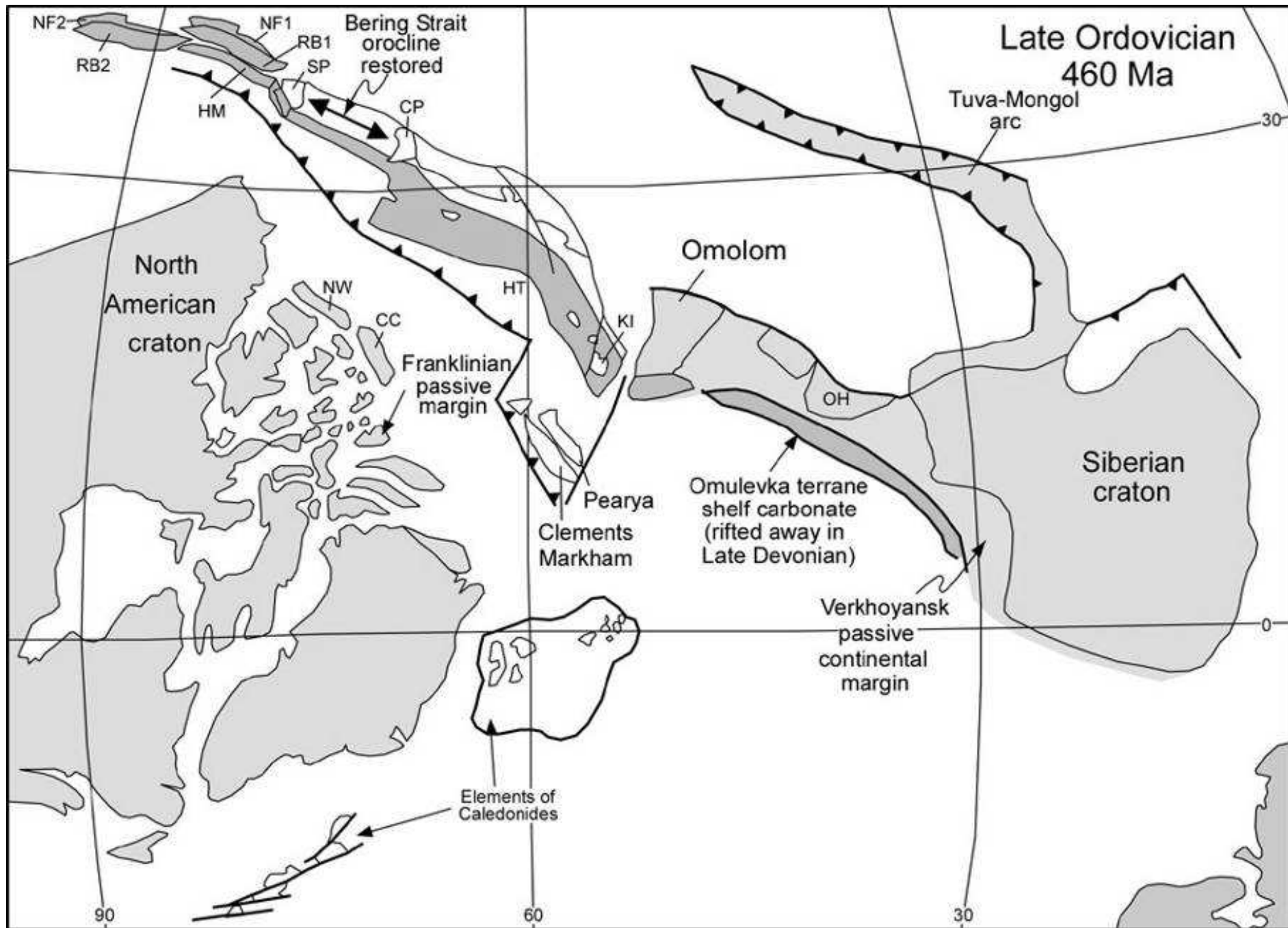
The **Franklinian orogeny**, in the northwestern Canada (Plafker & Berg, 1994), could be a result of collision of the Verkhoyanskian part of Siberia with the North Slope-Chukotkan part of Laurentia. According to Okulitch (1998), the suturing in the Canadian Islands occurred during Ordovician-Silurian time.

The **Innuitian Orogeny** started in the earliest Middle Devonian and may be linked to plate movements that also emplaced an exotic terrane, Pearya, on the northern edge of the region.

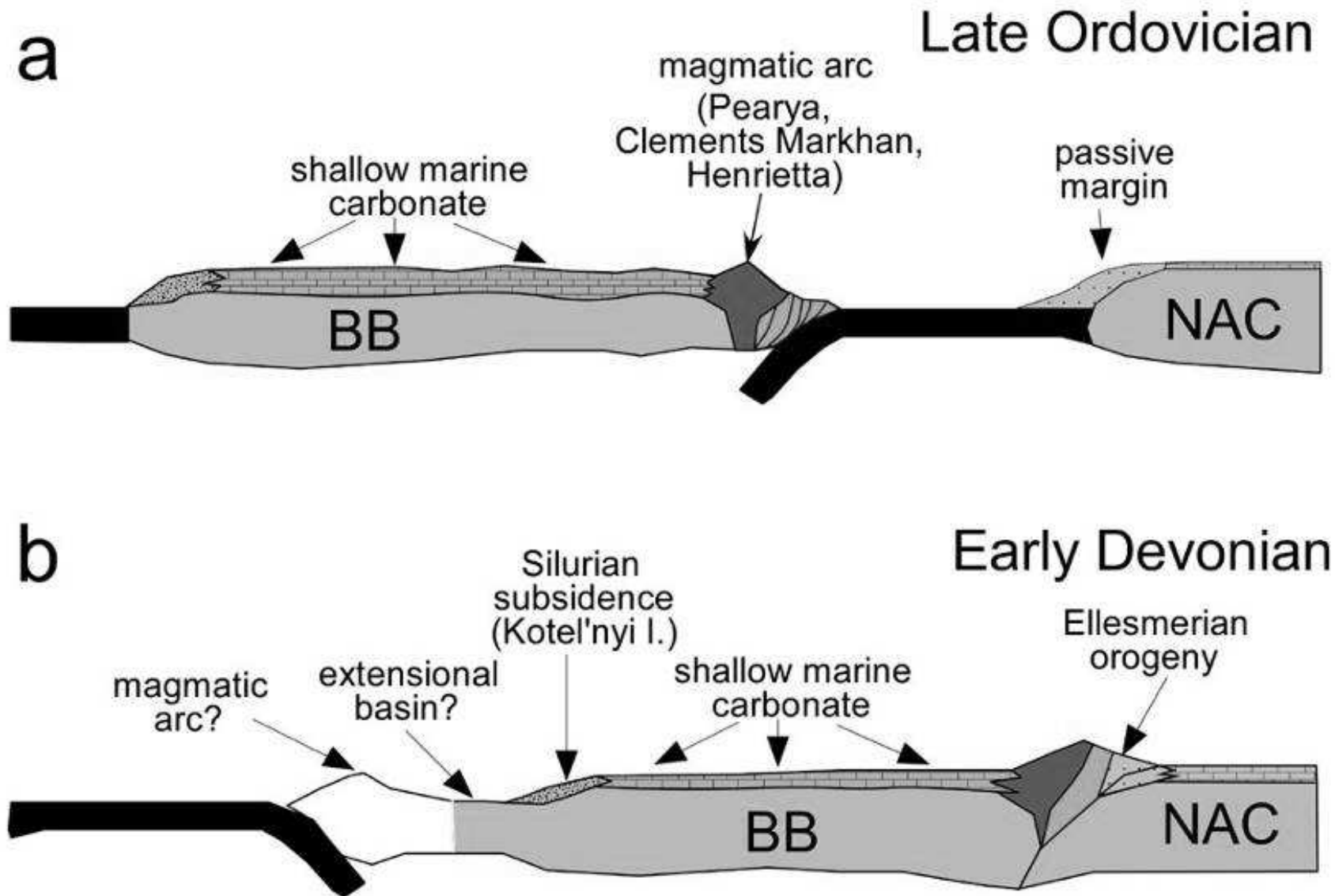


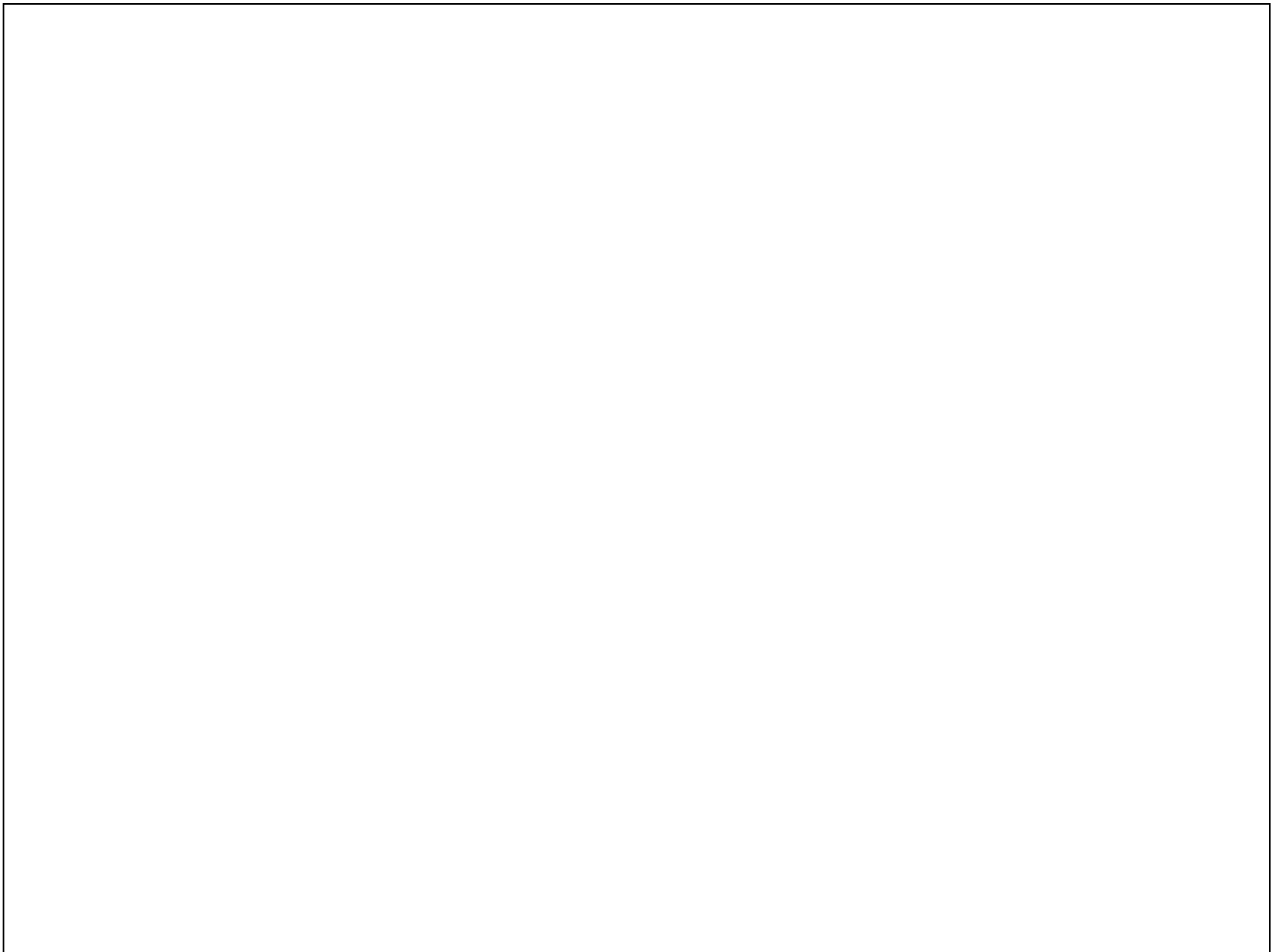
PHYSIOGRAPHIC REGIONS



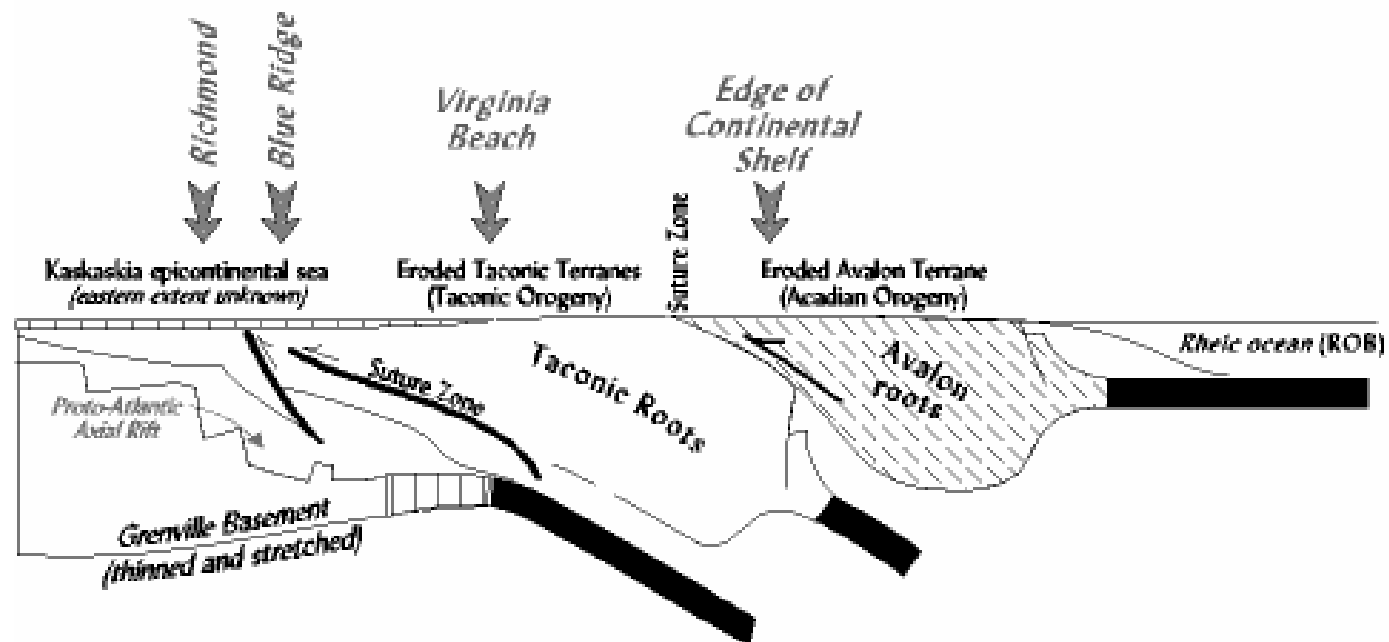


The late Silurian-early Devonian collision of the Bennett-Barrovia block





*Approximate locations of modern geographic features
on the Pre-Alleghenian Mid-Atlantic Region*



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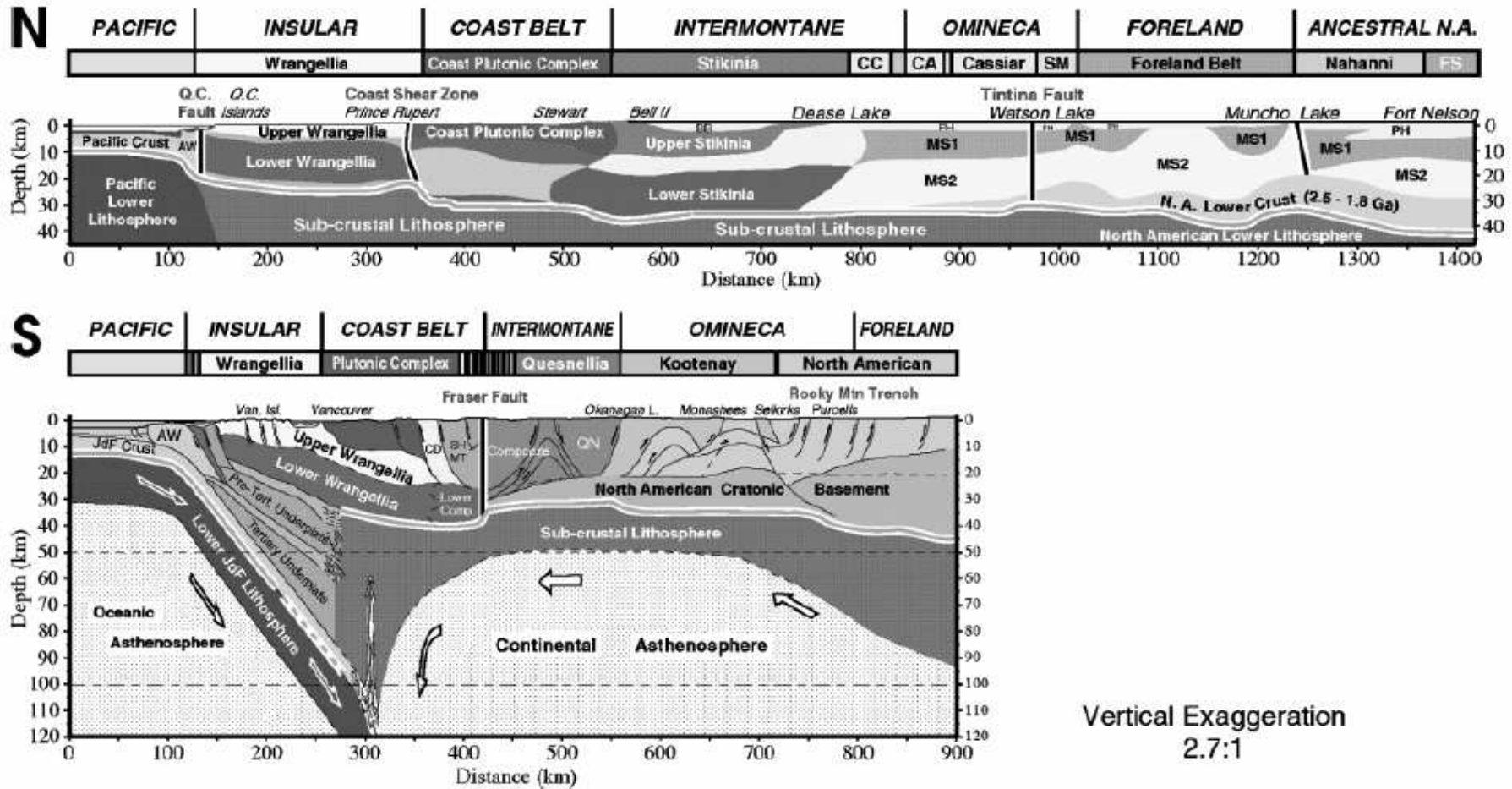


Figure 2. Comparison of interpreted simplified lithospheric structures along the northern (N) and southern (S) Cordilleran Lithoprobe transects, whose locations are shown by the red lines in Figure 1. In both profiles, the heavy green line is the crust-mantle boundary (Moho). AW accreted wedge; AX Alexander terrane; BB Bowser Basin; CA Cassiar terrane; CC Cache Creek terrane; CD Cadwallader terrane; FS, Fort Simpson (a Precambrian terrane in the craton); KO Kootenay terrane; MS1 undivided Precambrian (1200-800 Ma) metasedimentary rocks; MS2 undivided Precambrian (1800-1200 Ma) metasedimentary rocks; MT-SH undivided Methow and Shuksan terranes; QN Quesnel terrane; SM Slide Mountain terrane; ST Stikine terrane; WR Wrangellia. Most terrane descriptions are in Table 2. Figure modified by P.T.S. Hammer from Clowes and Hammer, 2000.

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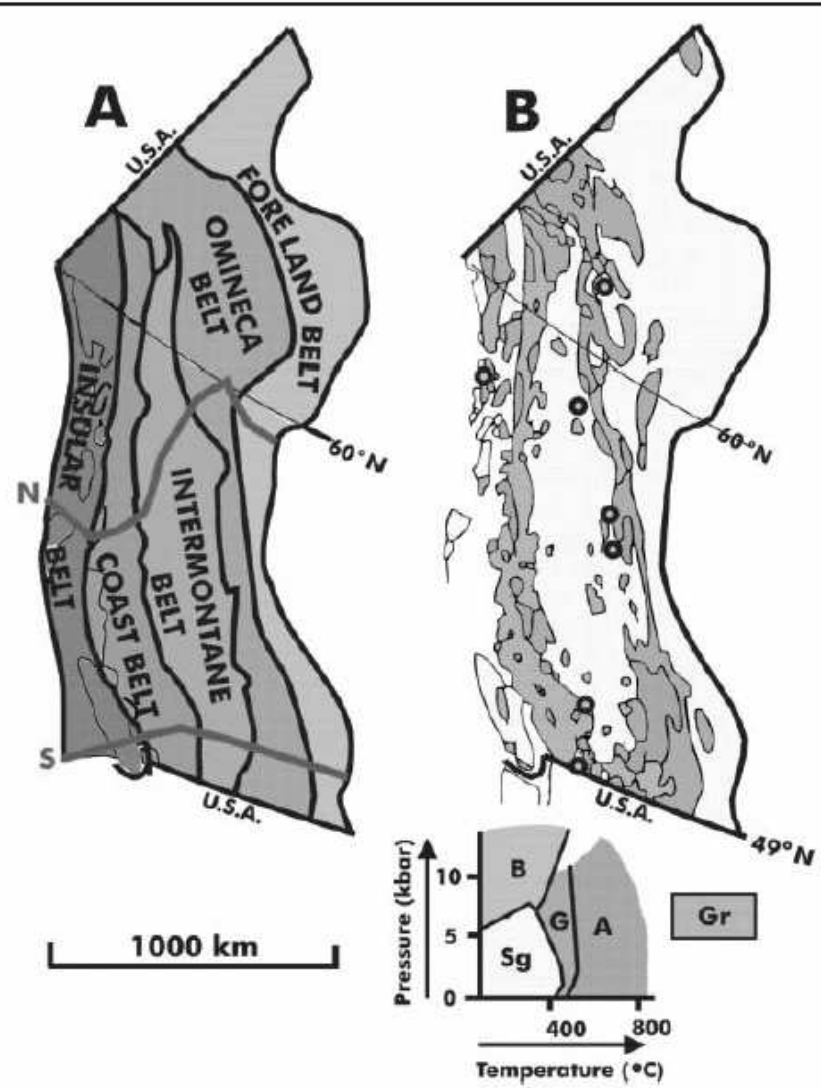


Figure 1. The Canadian Cordillera and adjoining parts of southeastern Alaska showing:
A Location of the five morphogeological belts (details in Table 1); red lines show approximate positions of the northern (N) and southern (S) Canadian Cordilleran Lithoprobe transects, details of which are in Figure 2.
B Simplified metamorphic map of the Canadian Cordillera, showing the close correspondence between the distribution of higher grade metamorphic rock facies and granitic rocks and Omineca and Coast belts. The map legend below is a pressure-temperature diagram whose colours correspond with those on the map; metamorphic facies are: Sg subgreenschist; G greenschist; A amphibolite, and B blueschist (blue dots on map); box labelled Gr denotes granitic rock.

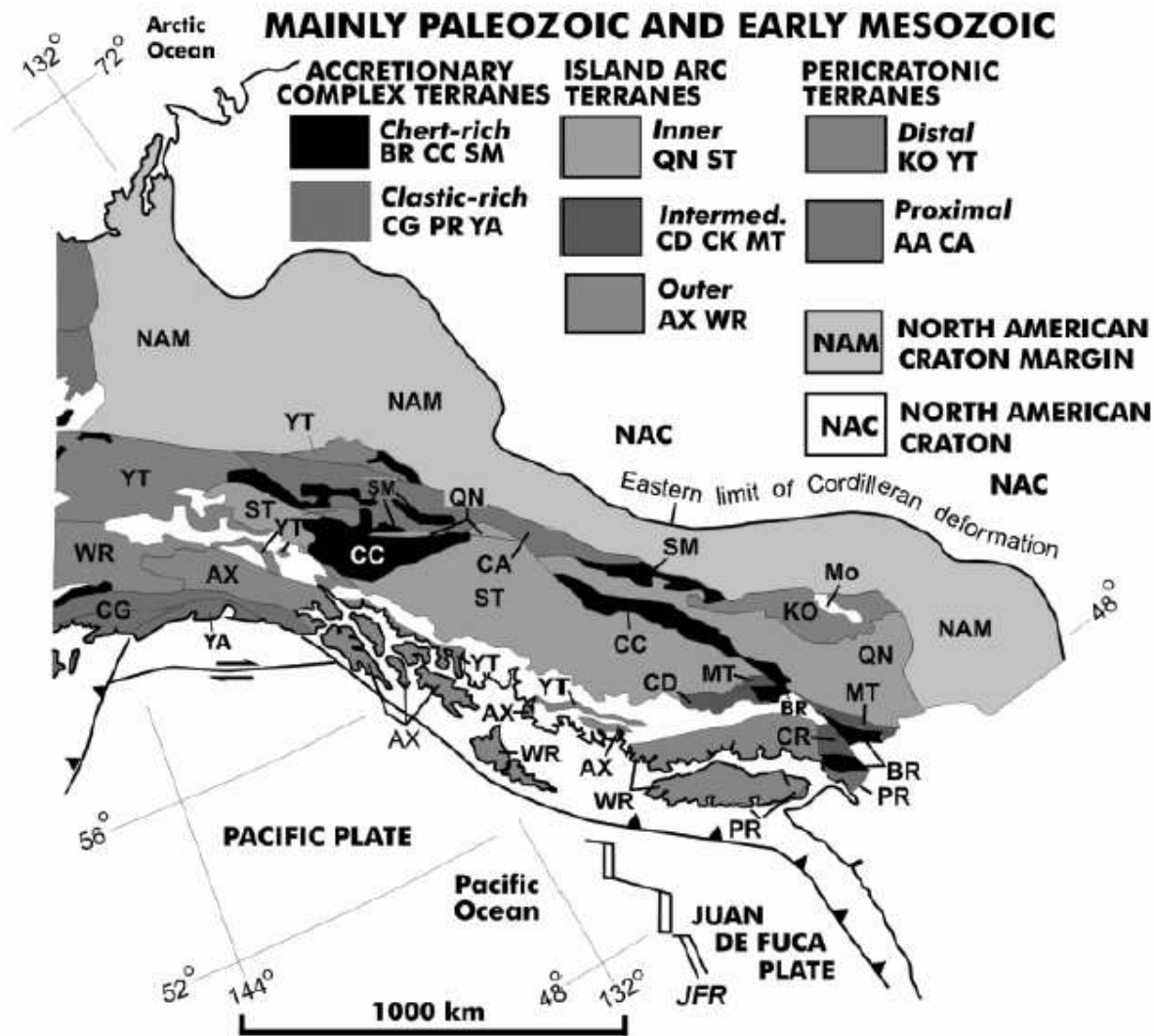


Figure 3. Terrane map of the Canadian Cordillera and adjacent parts of Alaska; most rocks shown are of Paleozoic and early Mesozoic ages. Map shows locations of: (1) rocks (NAM) that were deposited on the ancient continental margin; Mo is part of the craton exposed in a structural window; (2) proximal (CA) and distal (KO, YT) pericratonic terranes that formed along the margin but in uncertain paleogeographic relationship to it; (3) accreted terranes of (3a) (mainly island arc affinity; "inner terranes" (QN, ST) accreted in the Jurassic; "outer terranes" (AX, WR) accreted in the Cretaceous; (3b) accretionary complexes; "chert-rich" (BR (part), CC, SM) are pre-Middle Jurassic; "clastic-rich" (BR (part), CG, PR) include Late Jurassic to Recent rocks. The terranes are named and their nature summarized in Table 2. White areas, mainly in the Coast Belt, feature voluminous Middle Jurassic and younger granitic rocks; JFR is the Juan de Fuca Ridge (modified from Monger and Nokleberg, 1996 and Nokleberg et al., 2000).

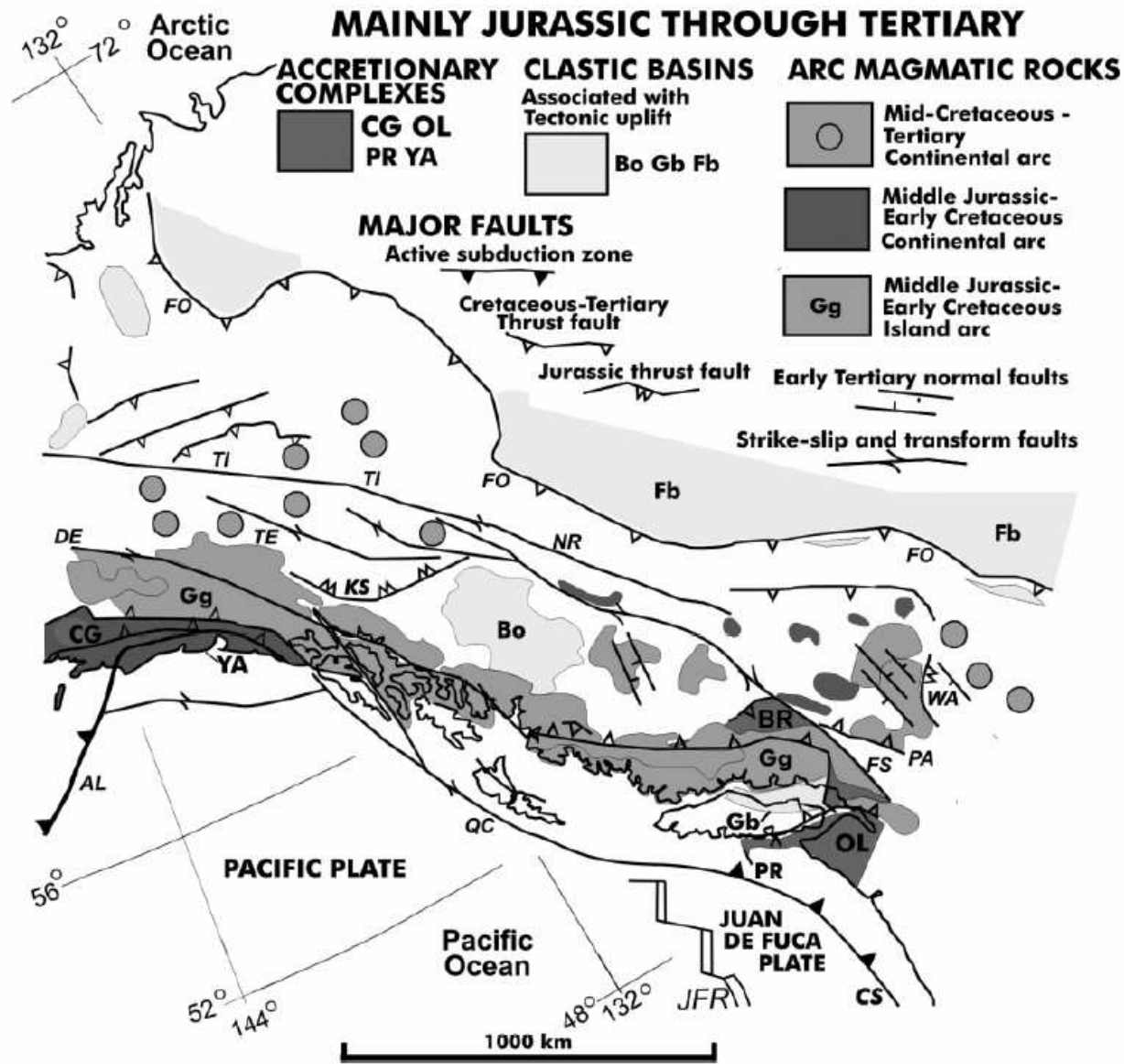


Figure 4. Locations of features of the Canadian Cordillera and adjacent parts of Alaska that formed during the period of terrane accretion and mountain building, mainly from Middle Jurassic through early Tertiary time (~180-40 Ma). (1) Middle Jurassic to Early Cretaceous continental arcs that are emplaced across CC, QN, KO; (2) Middle Jurassic through Early Cretaceous Gravina-Gambier (Gg) island arc, emplaced across WR, AX; (3) Mid-Cretaceous through early Tertiary continental arcs emplaced across all terranes, with exception of the accompanying accretionary complexes; filled circles denote plutons too small to show on the map; (4) clastic sedimentary basins (Bo Bowser Basin; Fb Foreland Basin, Gb Georgia Basin; not shown are basins on the continental shelf filled with material eroded from adjoining, uplifted fold and thrust belts. (5) Major faults include (5a) active subduction zones (AL Aleutian; CS Cascade); (5b) active transform fault (QS Queen Charlotte); (5c) major thrust fault systems of (a) Jurassic age (KS King Salmon; WA Waneta) and (b) mid-Cretaceous and early Tertiary ages (FO Foreland; PA Pasayten); (5d) major strike-slip faults of mainly Late Cretaceous and Tertiary ages (DE Denali; NR Northern Rocky Mountain Trench; TE Teslin; TI Tintina); (5e) early Tertiary normal faults.

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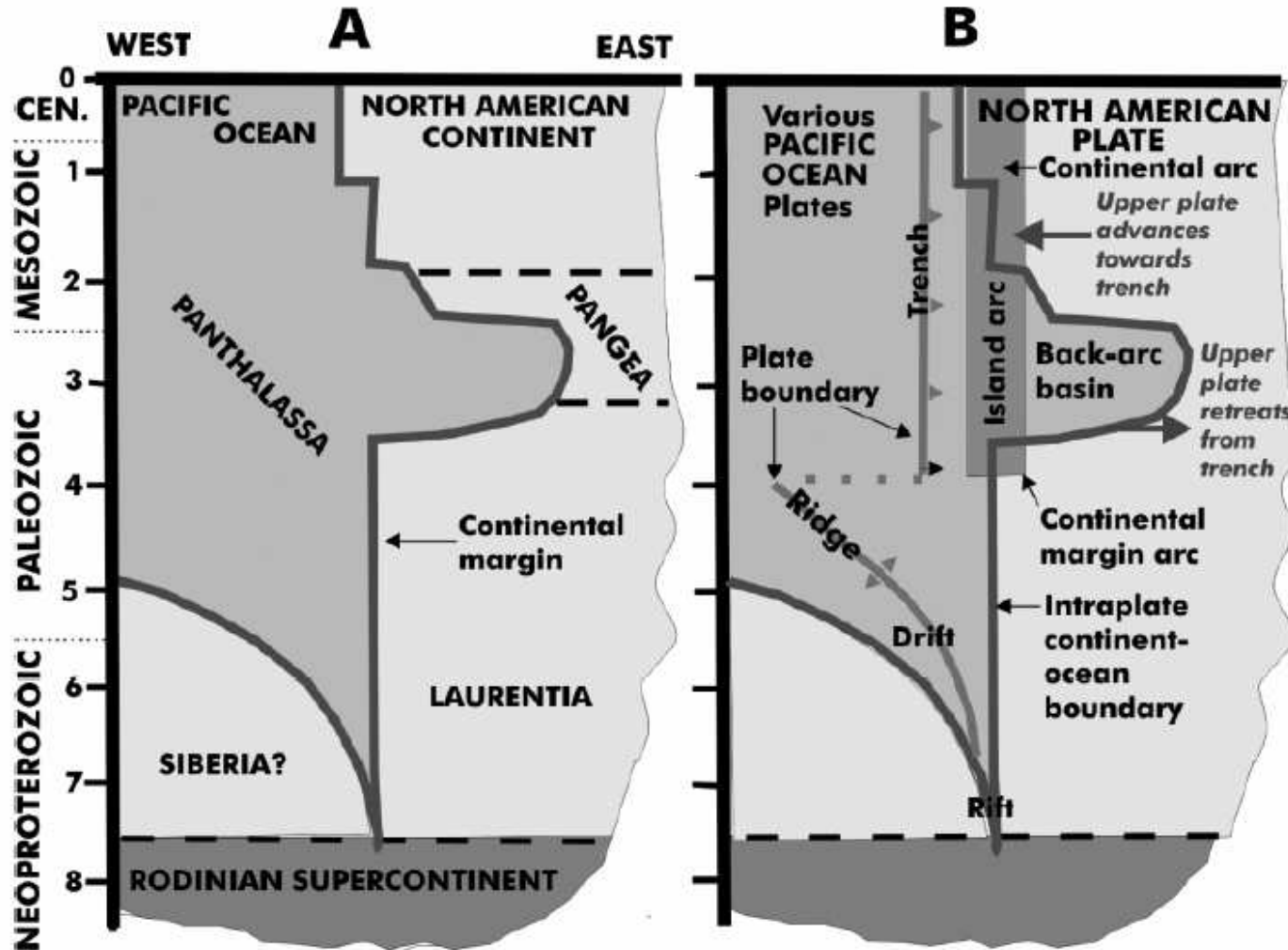


Figure 5: Evolution of the Canadian Cordillera cartooned on space-time diagrams. Horizontal coordinate: west to east (in present geographic coordinates); geographic position (after Early Devonian time) is fixed relative to the trench; vertical coordinate: numbers show age in hundreds of millions of years before present. A gives names of continents and ocean at different times and the names applied to each at those times. B shows features related to the plate tectonic activity at different times.

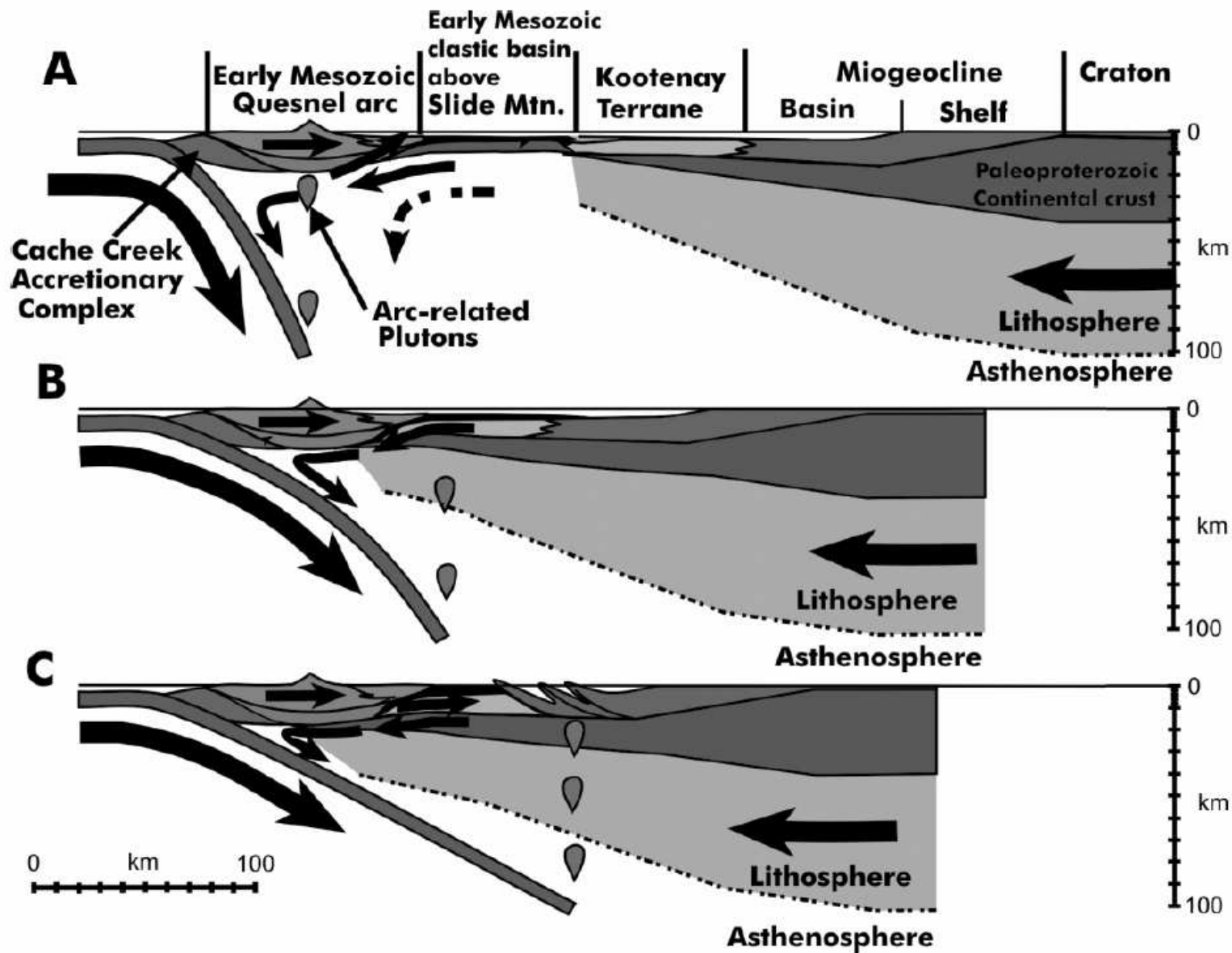


Figure 6: Tectonic wedging and crustal thickening in southeastern British Columbia.

A: Early Jurassic (~185 Ma) island arc (of QN, Figure 3) and its early Mesozoic back-arc basin, (mainly) on top of Slide Mountain terrane; onset of convergence of North America with trench to west and collapse of back-arc basin. B: Late Early Jurassic (~180 Ma) collapsed basin thrust over old continental margin; flattening of subduction zone and initiation of continental margin arc. C: Early Middle Jurassic (~170 Ma) southwest verging deformation occurred as Kootenay terrane was detached from North America and wedged under the old continental margin deposits; North American lithosphere wedged under Quesnel terrane; entrained and consumed in the subduction zone; subduction zone flattened and magmatic arc migrated eastward into the zone of southwest verging deformation.

