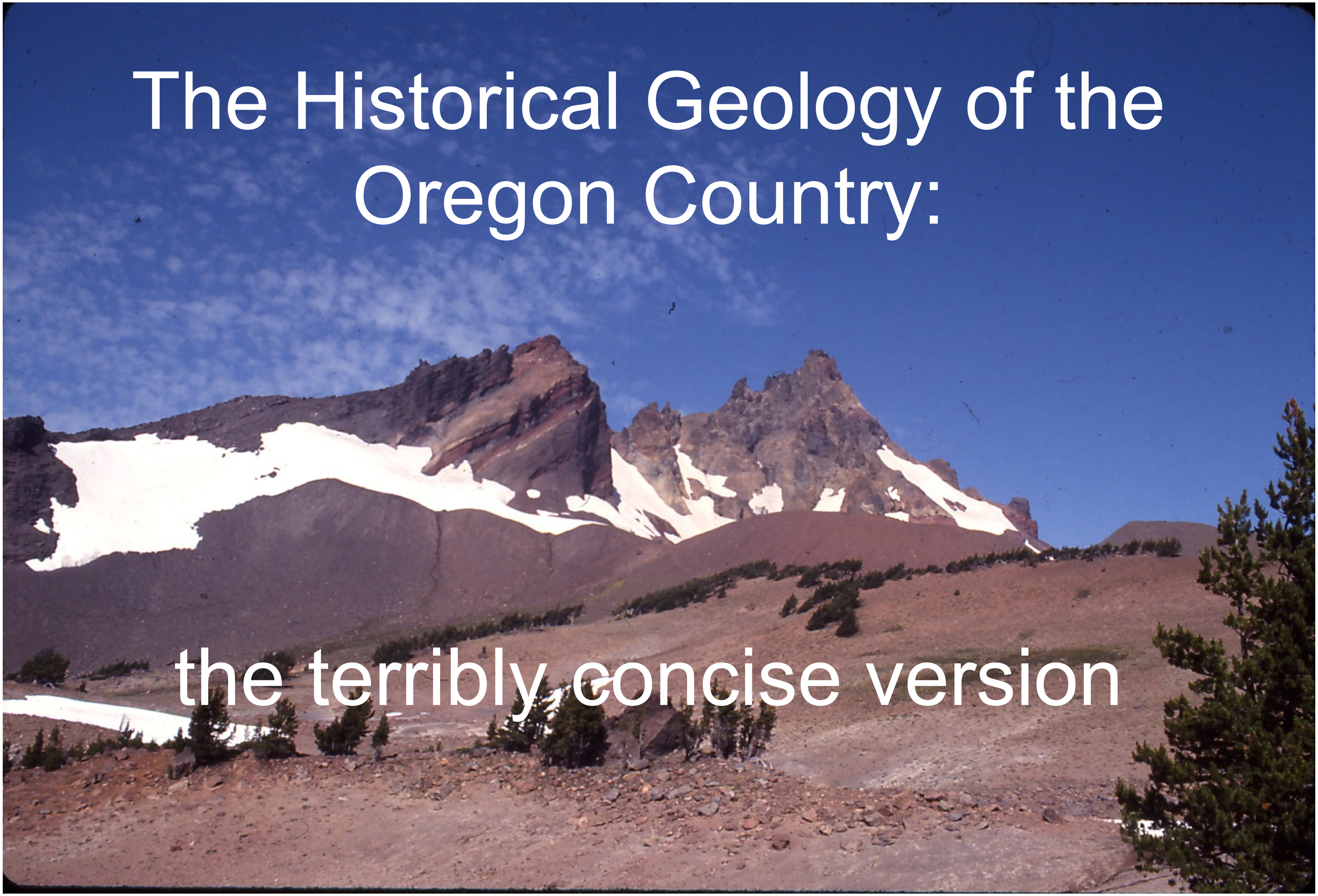
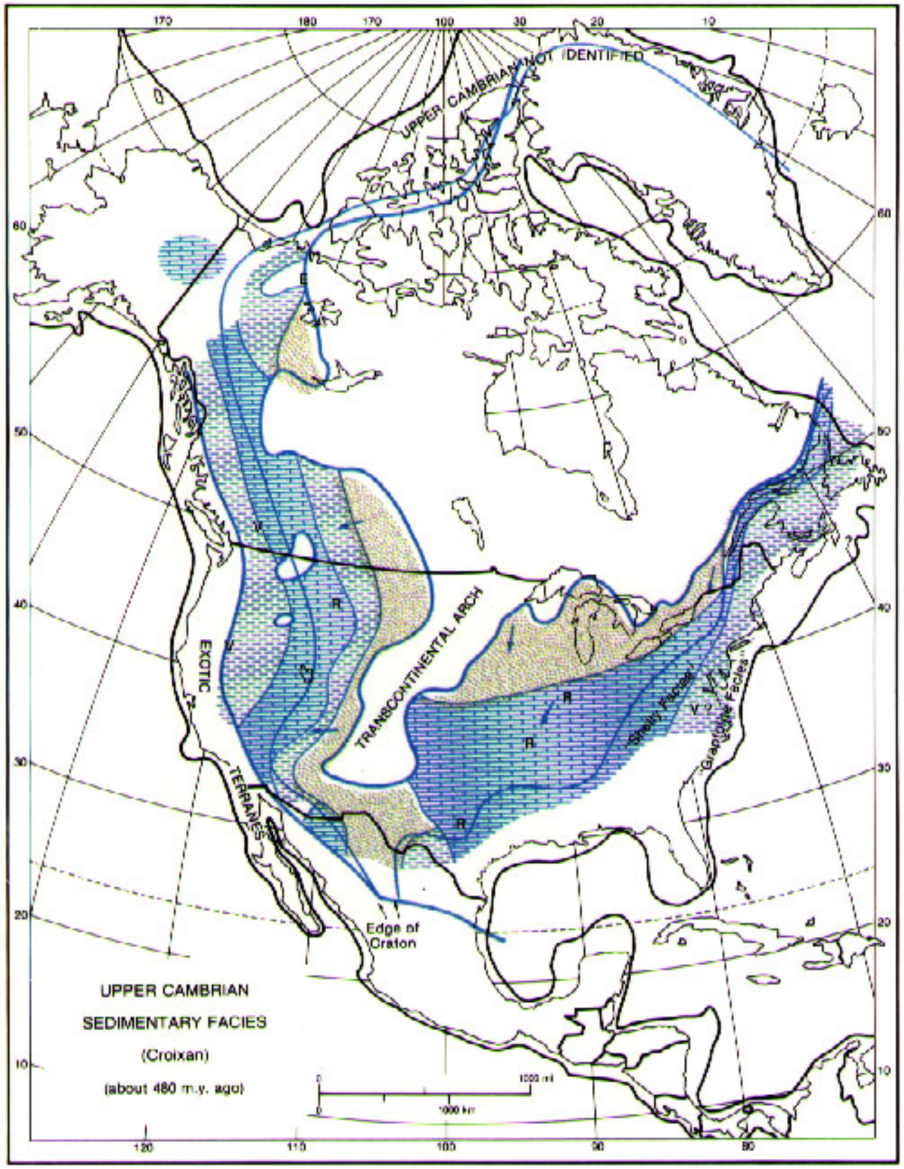
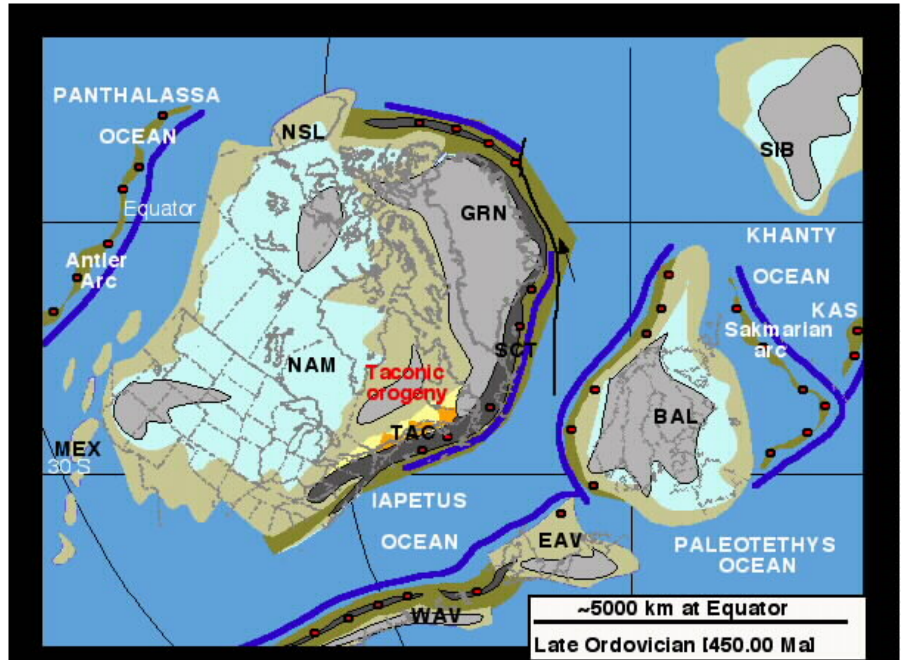
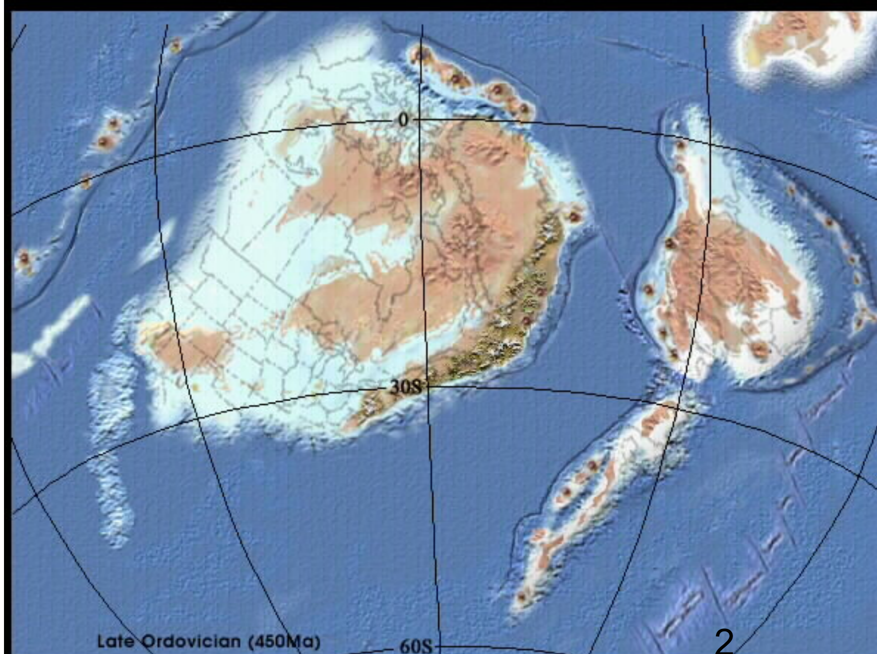

The Historical Geology of the
Oregon Country:
the terribly concise version

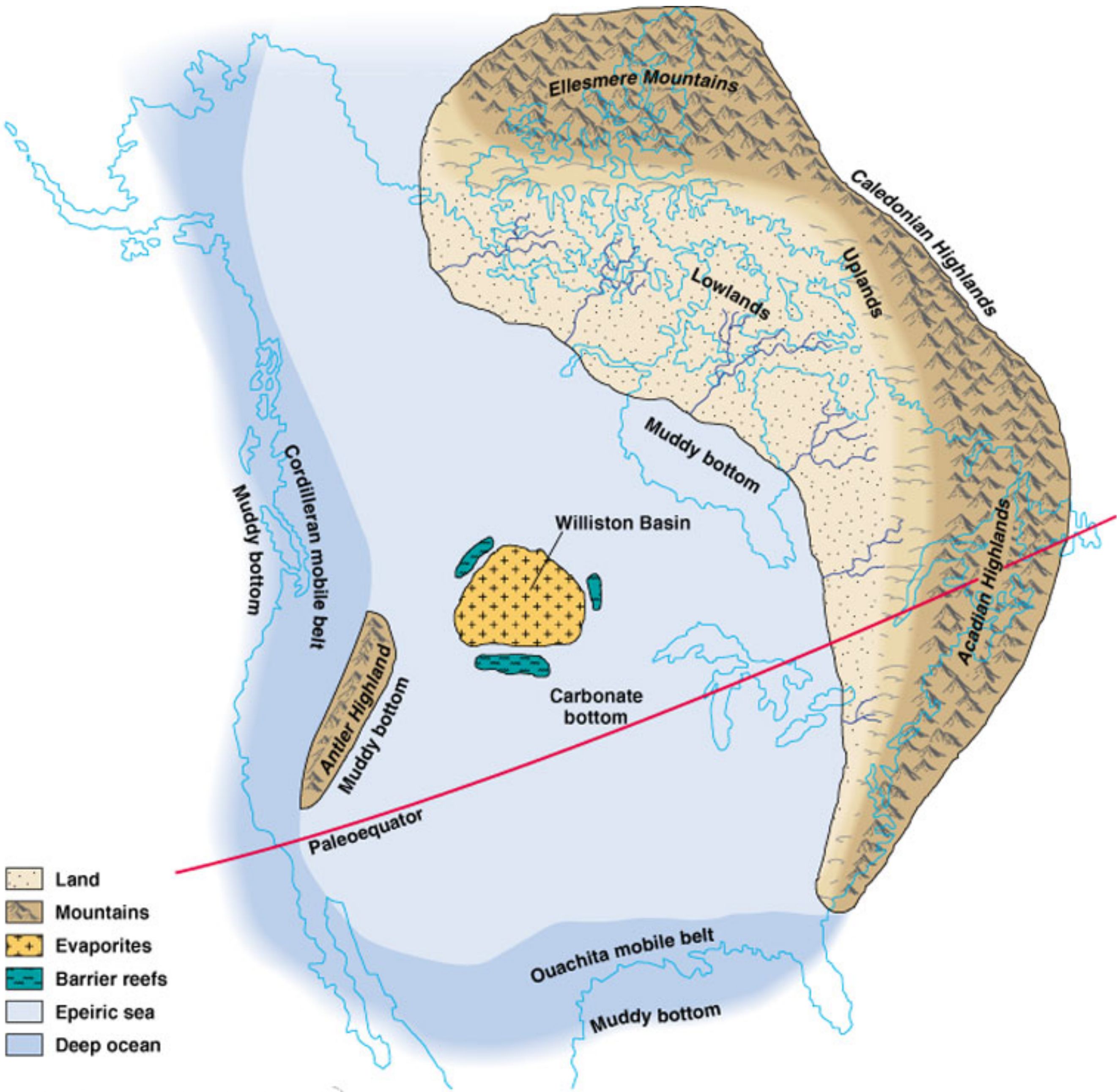
61 Figure 10.8



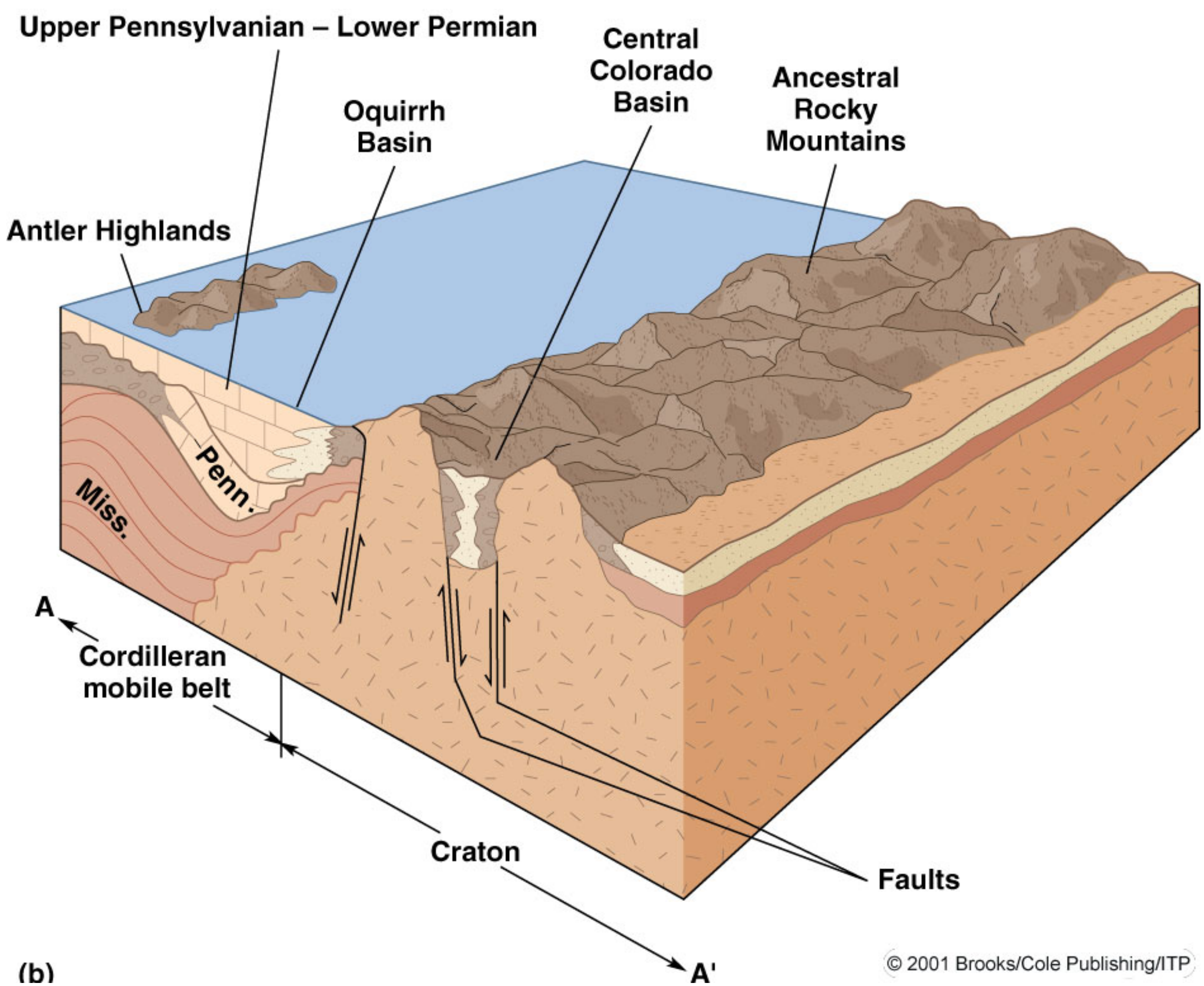
Cambrian (600 MA)



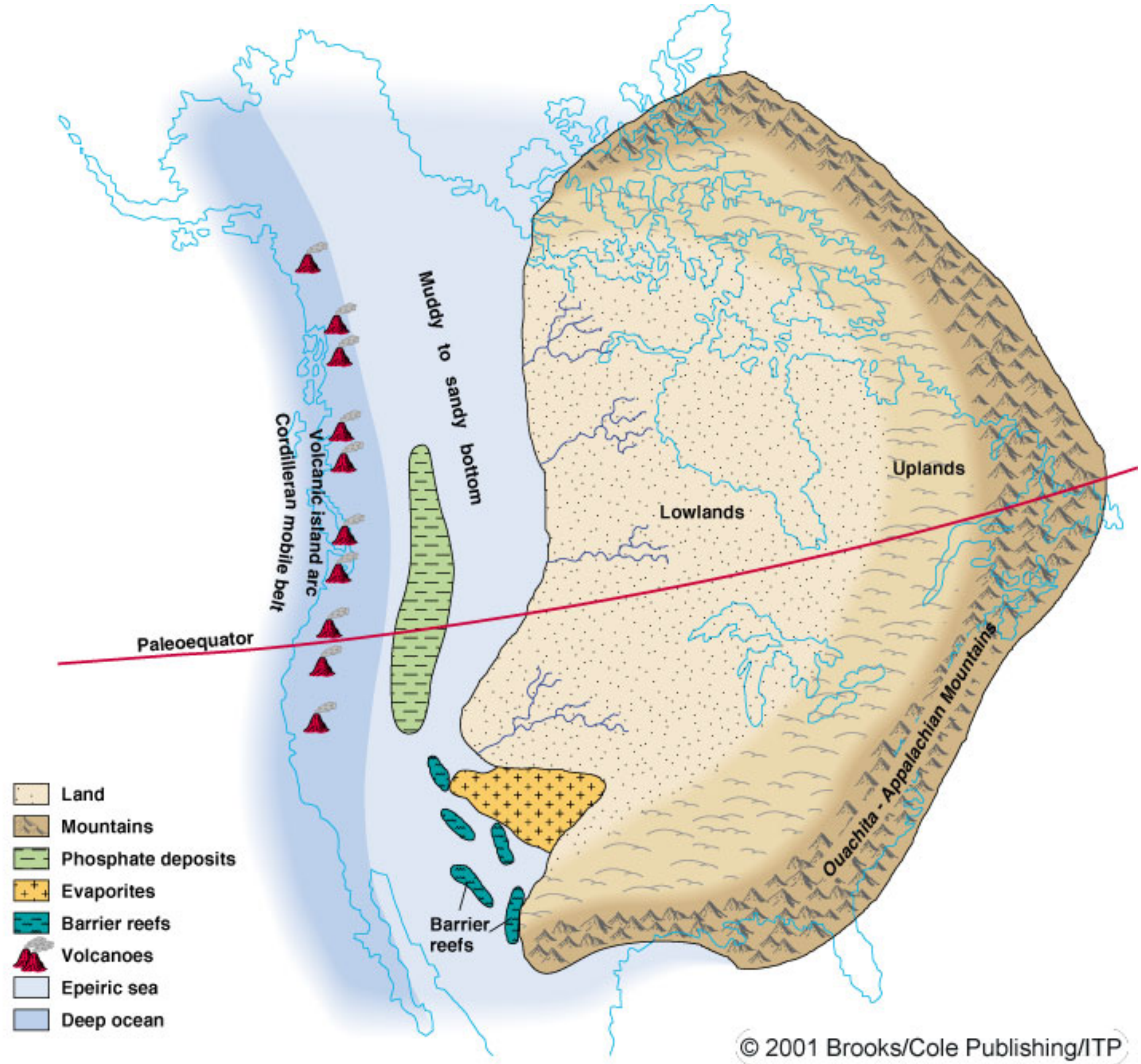




Mississippian (325 MA) Period Paleogeography



Late Penn-Early Permian (300 MA) Paleogeography

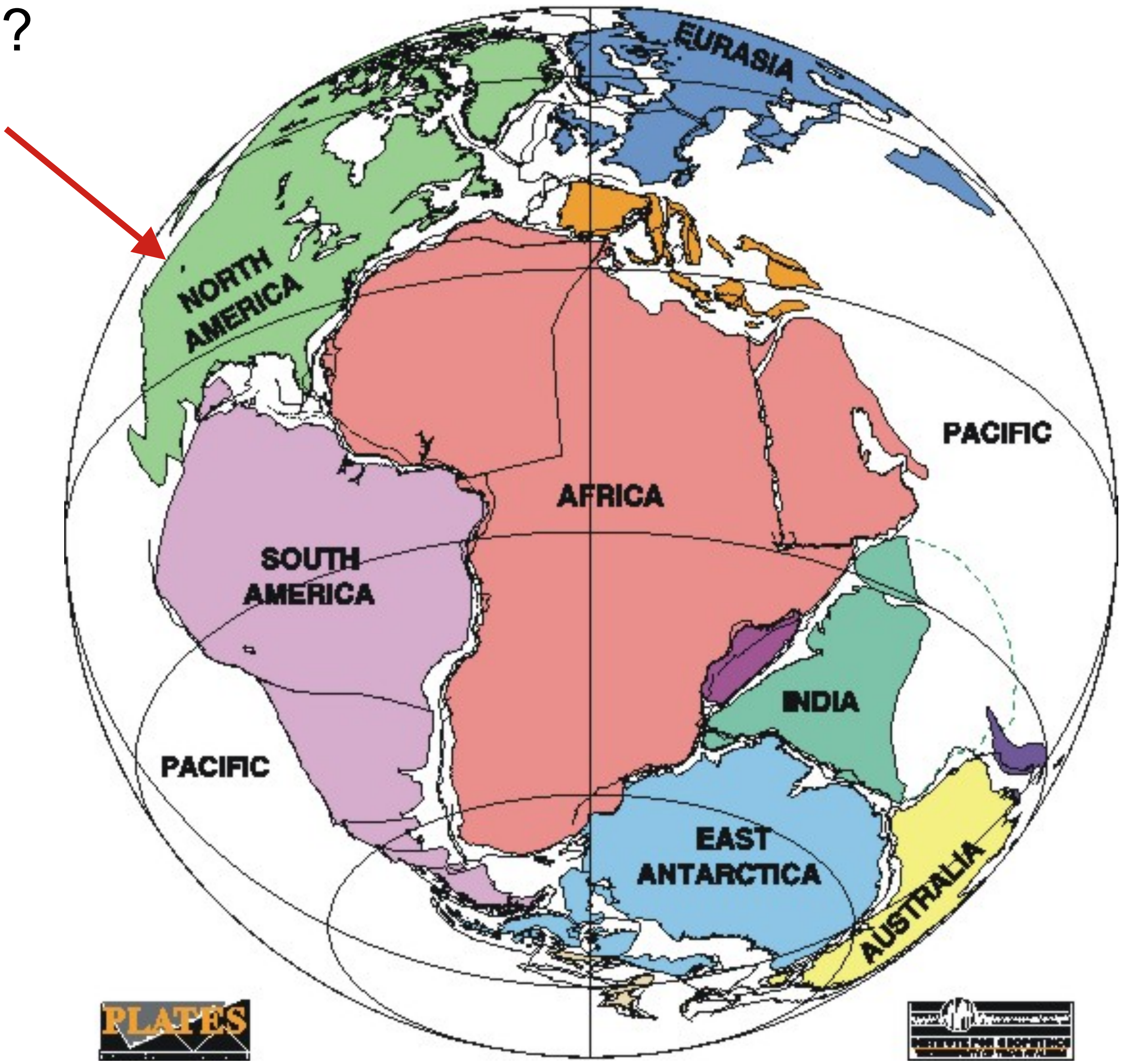


Late Permian (260 MA) Paleogeography

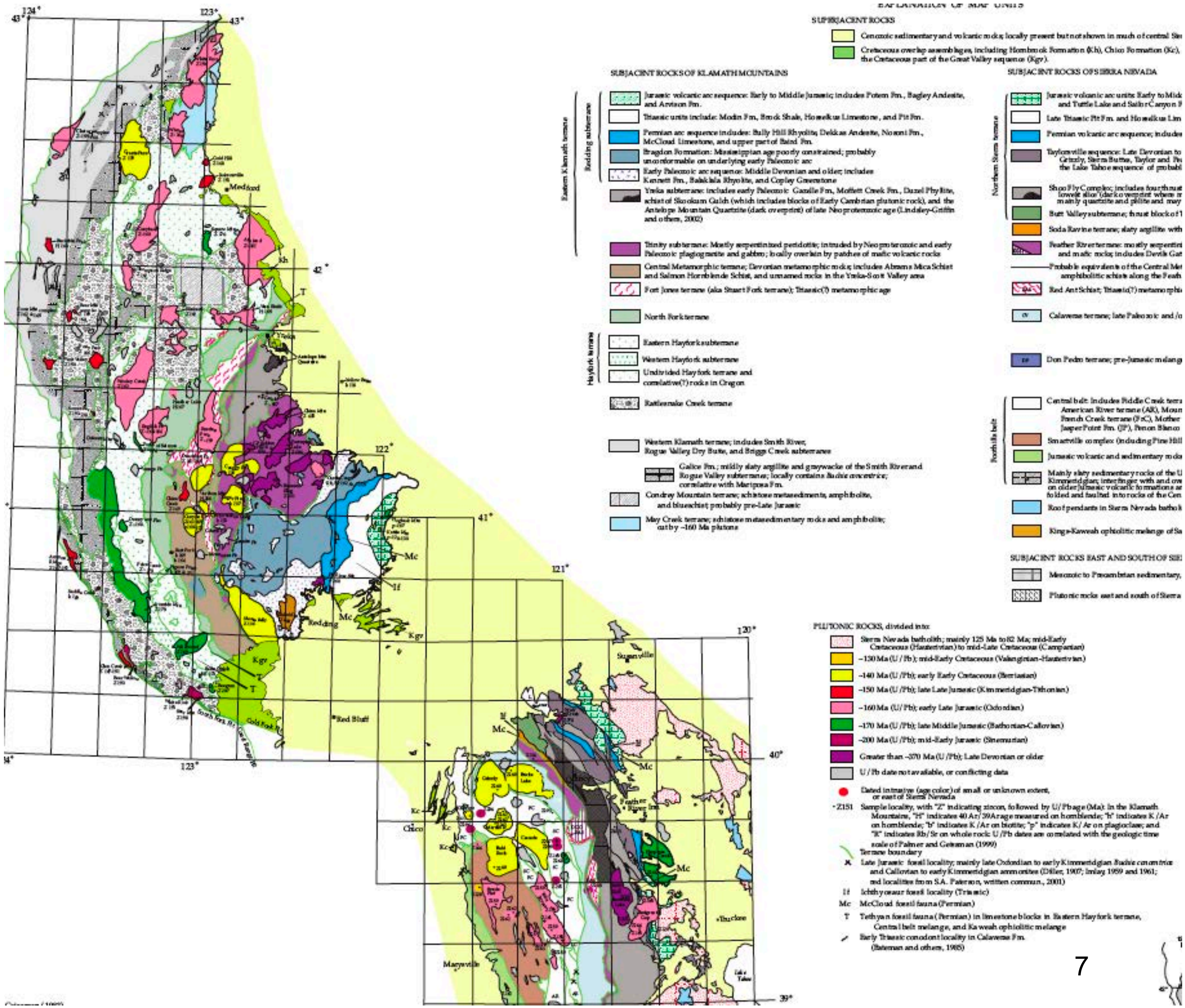
What's Going on Here?

PANGEA

End Permian (250 MA)



(UT-Austin)


SUPERJACENT ROCKS
Cenozoic sedimentary and volcanic rocks; locally present but not shown in much of central
Cretaceous overlap assemblages, including Hornbrook Formation (Kh), Chico Formation (Kc), the Cretaceous part of the Great Valley sequence (Kgv).
SUBJACENT ROCKS OF KLAMATH MOUNTAINS
Eastern Klamath terrane
Redding subterrane
Jurassic volcanic arc sequence: Early to Middle Jurassic; includes Potem Fm., Bagley Andesite, and Arvison Fm.
Triassic units include: Modin Fm, Brock Shale, Hosselkus Limestone, and Pit Fm.
Permian arc sequence includes: Bully Hill Rhyolite, Dekkas Andesite, Nosoni Fm., McCloud Limestone, and upper part of Baird Fm.
Bragdon Formation: Mississippian age poorly constrained; probably unconformable on underlying early Paleozoic arc
Early Paleozoic arc sequence: Middle Devonian and older; includes Kennett Fm., Balaklala Rhyolite, and Copley Greenstone
Yreka subterrane: includes early Paleozoic Gazelle Fm, Moffett Creek Fm., Duzel Phyllite, schist of Skookum Gulch (which includes blocks of Early Cambrian plutonic rock), and the Antelope Mountain Quartzite (dark overprint) of late Neoproterozoic age (Lindsley-Griffin and others, 2002)
Trinity subterrane: Mostly serpentinized peridotite; intruded by Neoproterozoic and early Paleozoic plagiogranite and gabbro; locally overlain by patches of mafic volcanic rocks
Central Metamorphic terrane; Devonian metamorphic rocks; includes Abrams Mica Schist and Salmon Hornblende Schist, and unnamed rocks in the Yreka-Scott Valley area
Fort Jones terrane (aka Stuart Fork terrane); Triassic(?) metamorphic age
North Fork terrane
Hayfork terrane
Eastern Hayfork subterrane
Western Hayfork subterrane
Undivided Hayfork terrane and correlative(?) rocks in Oregon
Rattlesnake Creek terrane
Western Klamath terrane; includes Smith River, Rogue Valley Dry Butte, and Briggs Creek subterranes
Galice Fm.; mildly slaty argillite and graywacke of the Smith River and Rogue Valley subterranes; locally contains Buchia concentrica; correlative with Mariposa Fm.
Condrey Mountain terrane; schistose metasediments, amphibolite, and blueschist; probably pre-Late Jurassic
May Creek terrane; schistose metasedimentary rocks and amphibolite; cut by ~160 Ma plutons
SUBJACENT ROCKS OF SIERRA NEVADA
Northern Sierra terrane
Late Triassic Pit Fm. and Hosselkus
Permian volcanic arc sequence;
Butt Valley subterrane; thrust
Soda Ravine terrane; slaty argillite
Feather River terrane: mostly
Probable equivalents of the Central
Red Ant Schist; Triassic(?)
Calaveras terrane; late Paleozoic and
Don Pedro terrane; pre-Jurassic
Foothills belt
Smartville complex (including
Jurassic volcanic and sedimentary
Roof pendants in Sierra Nevada
Kings-Kaweah ophiolitic melange of
SUBJACENT ROCKS EAST AND SOUTH OF
Mesozoic to Precambrian sedimentary,
Plutonic rocks east and south of
PLUTONIC ROCKS, divided into:
Sierra Nevada batholith; mainly 125 Ma to 82 Ma; mid-Early Cretaceous (Hauterivian) to mid-Late Cretaceous (Campanian)
~130 Ma (U/Pb); mid-Early Cretaceous (Valanginian-Hauterivian)
~140 Ma (U/Pb); early Early Cretaceous (Berriasian)
~150 Ma (U/Pb); late Late Jurassic (Kimmeridgian-Tithonian)
~160 Ma (U/Pb); early Late Jurassic (Oxfordian)
~170 Ma (U/Pb); late Middle Jurassic (Bathonian-Callovian)
~200 Ma (U/Pb); mid-Early Jurassic (Sinemurian)
Greater than ~370 Ma (U/Pb); Late Devonian or older
U/Pb date not available, or conflicting data
Dated intrusive (age color) of small or unknown extent, or east of Sierra Nevada
• Z151 Sample locality, with "Z" indicating zircon, followed by U/Pb age (Ma). In the Klamath Mountains, "H" indicates 40 Ar/39Ar age measured on hornblende; "h" indicates K/Ar on hornblende; "b" indicates K/Ar on biotite; "p" indicates K/Ar on plagioclase; and "R" indicates Rb/Sr on whole rock. U/Pb dates are correlated with the geologic time scale of Palmer and Geissman (1999)
Terrane boundary
Late Jurassic fossil locality; mainly late Oxfordian to early Kimmeridgian Buchia concentrica and Callovian to early Kimmeridgian ammonites (Diller, 1907; Imlay 1959 and 1961; and localities from S.A. Paterson, written commun., 2001)
If Ichthyosaur fossil locality (Triassic)
Mc McCloud fossil fauna (Permian)
T Tethyan fossil fauna (Permian) in limestone blocks in Eastern Hayfork terrane, Central belt melange, and Kaweah ophiolitic melange
Early Triassic conodont locality in Calaveras Fm. (Bateman and others, 1985)

I 5 Roadcut near Roseburg OR: Basalt Flows

Hanna Nickel Mine site, Riddle OR

Serpentinite I-5 Roadcut, near Riddle OR

Trinity Ophiolite, Klamath Mountains above Hornbrook, CA

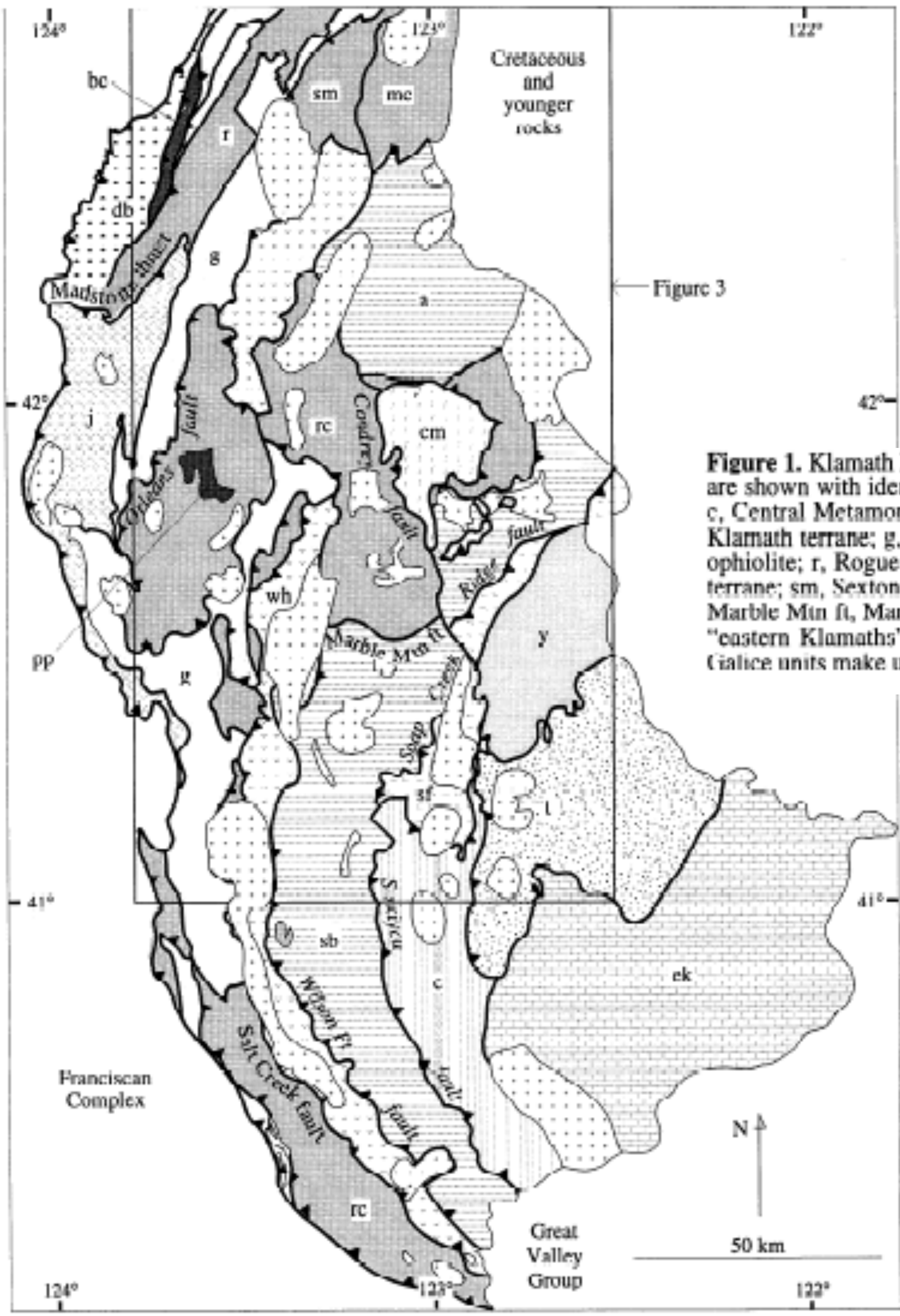
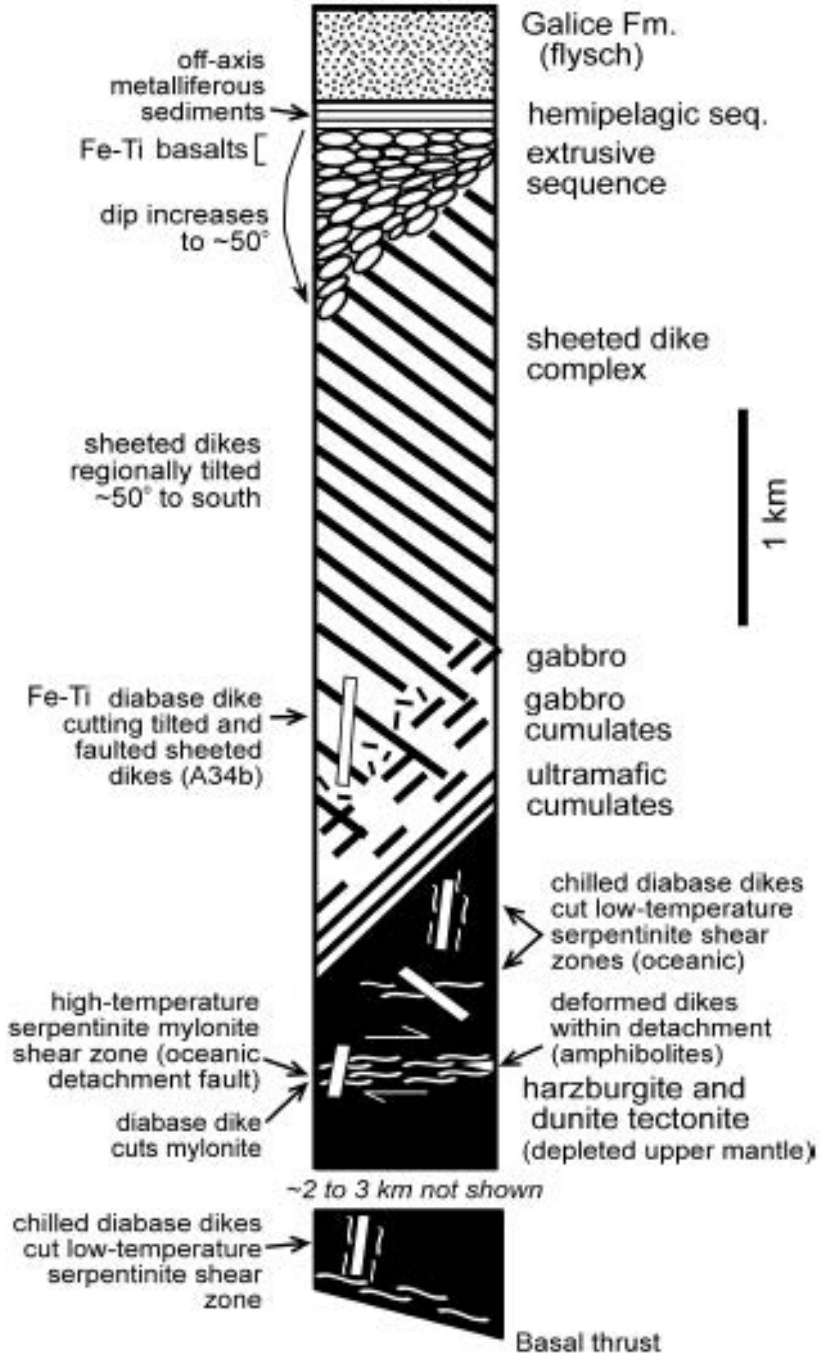


Figure 1. Klamath Mountains rock units [after *Hacker and Ernst*, 1993]. Potentially correlative terranes are shown with identical patterns. Abbreviations are a, Applegate terrane; bc, Briggs Creek subterrane; c, Central Metamorphic terrane; cm, Condrey Mountain terrane; db, Dry Butte subterrane; ek, Eastern Klamath terrane; g, Galice Formation; j, Josephine ophiolite; mc, May Creek terrane; pp, Preston Peak ophiolite; r, Rogue Formation, rc, Rattlesnake Creek terrane; sb, Sawyers Bar terrane; sf, Stuart Fork terrane; sm, Sexton Mountain terrane; t, Trinity terrane; wh, Western Hayfork terrane; y, Yreka terrane; Marble Mtn ft, Marble Mountains fault. The Yreka, Trinity, and Eastern Klamath terranes compose the "eastern Klamaths" referred to in the text, and the Dry Butte, Rogue, Briggs Creek, Josephine, and Galice units make up the western Klamath terrane.

Terrane

- A crustal block or fragment bounded by faults
- Preserves a geologic history that is distinct from adjacent terranes
- Accreted to a continent by tectonic processes



2. Sequence of lithologies in the Josephine Ophiolite (modified from Harper, 1984,

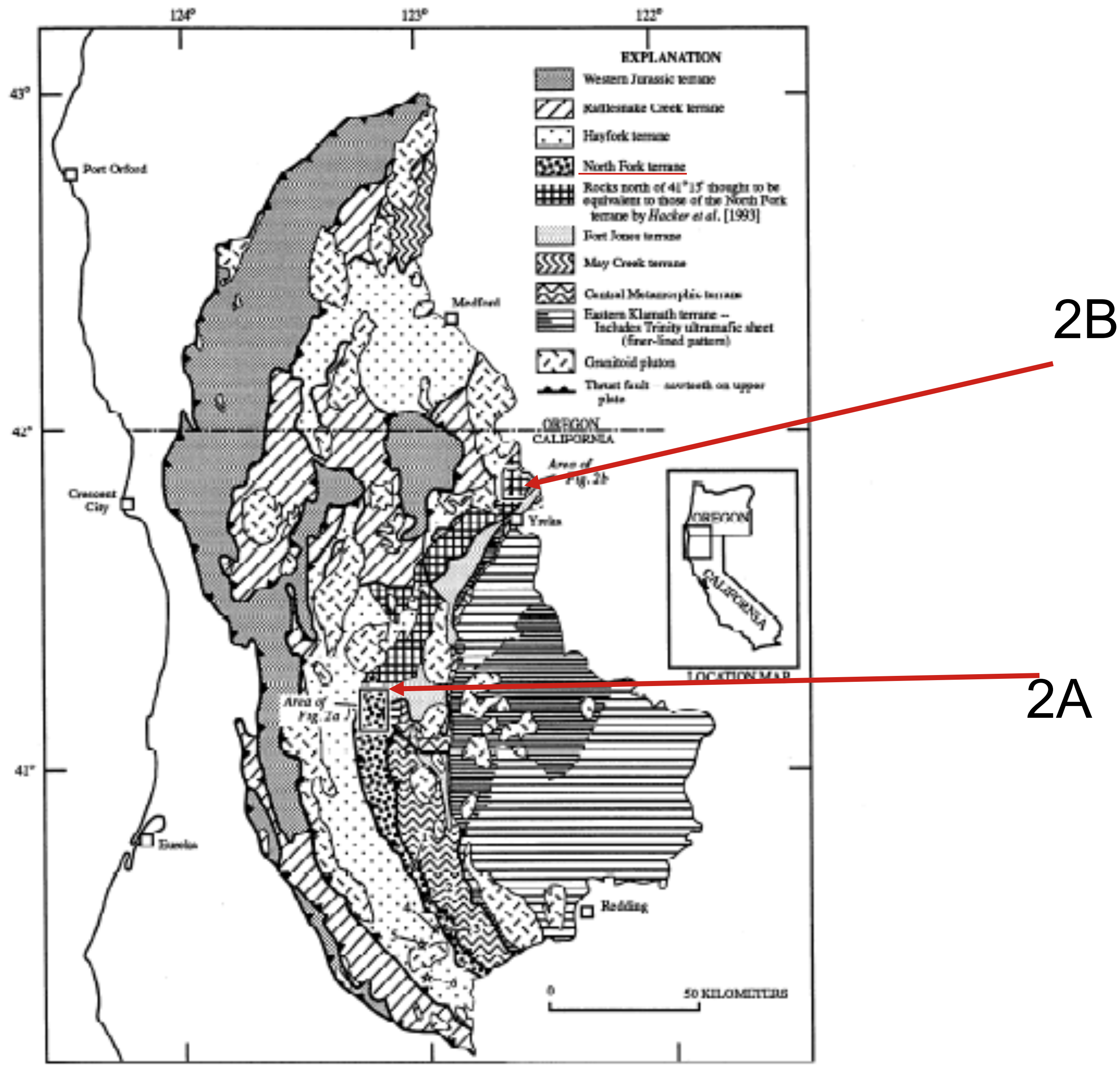
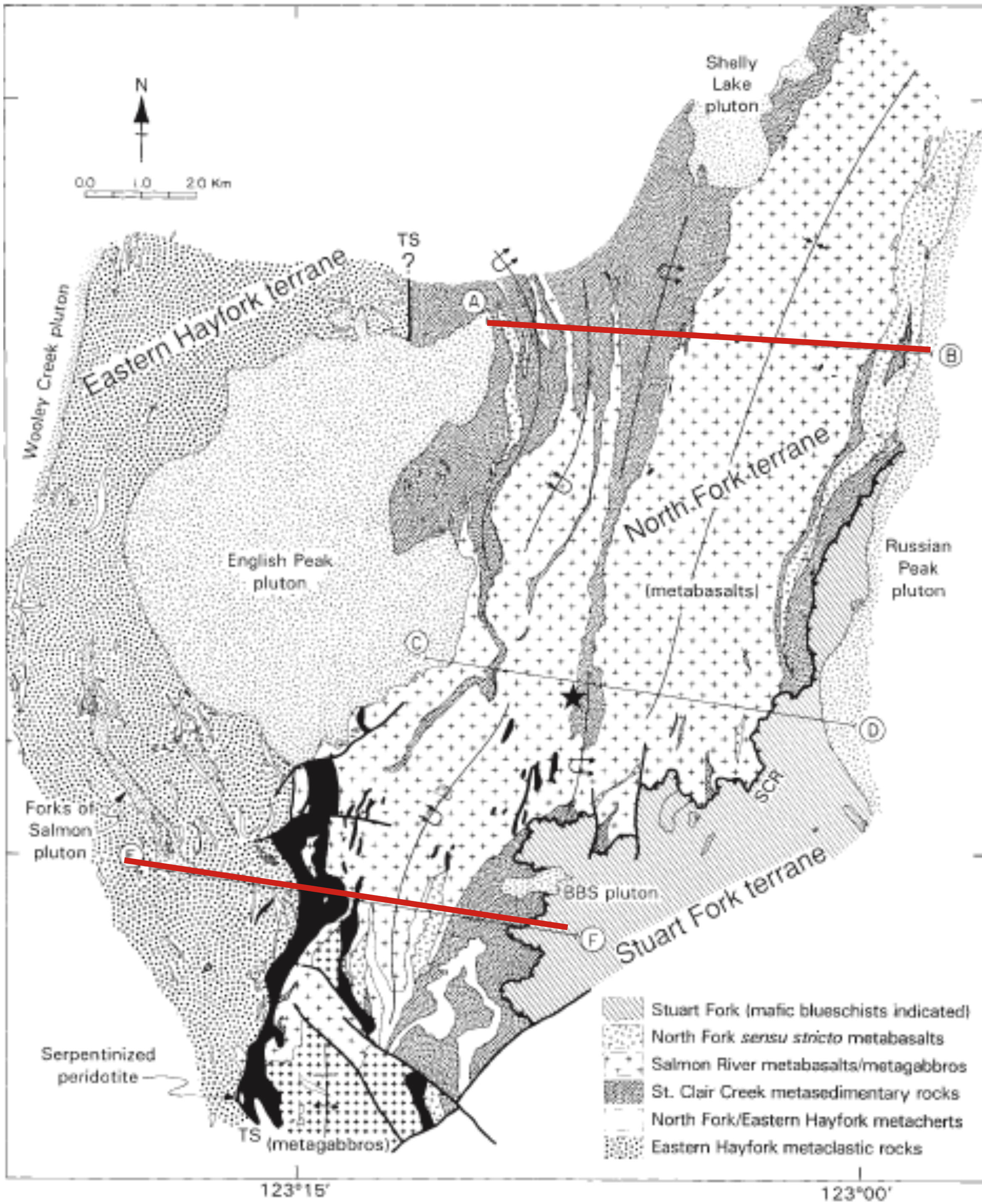
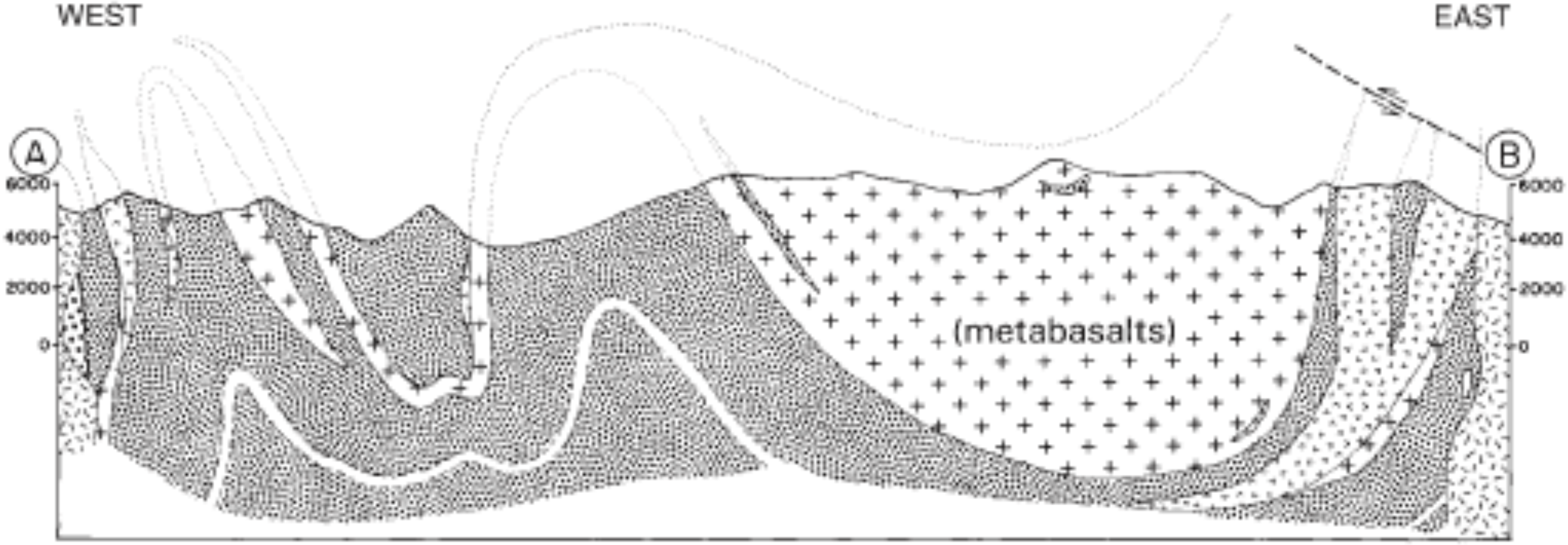


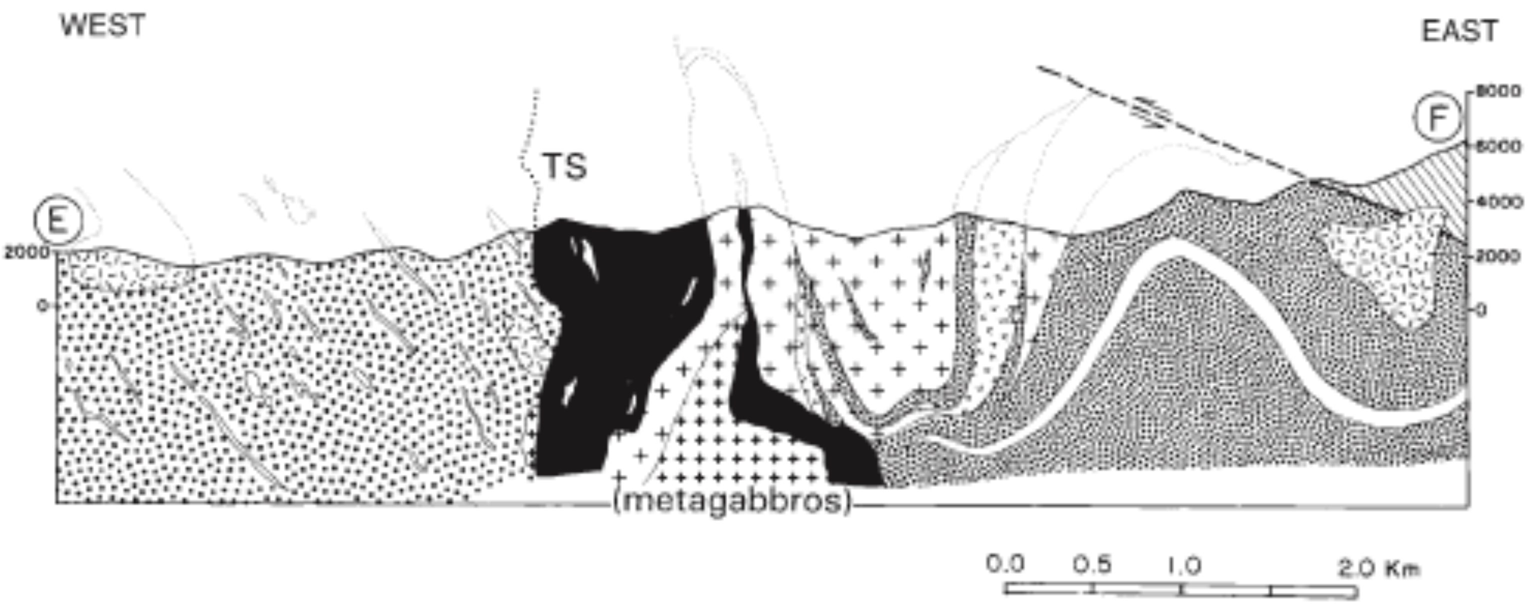
Figure 1. Sketch showing principal terranes of the Klamath Mountains province and areas sampled for paleomagnetism and paleontology. Dots are localities within the North Fork terrane with a schwagerinid fusulind fauna; stars are localities within the Eastern Hayfork terrane with a Tethyan foraminiferal fauna.



Shelly
Lake
pluton
41°30'
N
0.0 1.0 2.0 Km
TS
?
Eastern Hayfork terrane
Wooley Creek pluton
A
B
North Fork terrane
English Peak
pluton
(metabasalts)
Russian
Peak
pluton
C
D
SCR
Forks of
Salmon
pluton
E
41°15'
BBS pluton
F
Stuart Fork terrane
Serpentinized
peridotite
TS (metagabbros)
Stuart Fork (mafic blueschists indicated)
North Fork *sensu stricto* metabasalts
Salmon River metabasalts/metagabbros
St. Clair Creek metasedimentary rocks
North Fork/Eastern Hayfork metacherts
Eastern Hayfork metaclastic rocks
123°15'
123°00'

Ernst 1999


WEST
EAST
A
B
6000
4000
2000
0
(metabasalts)


WEST
EAST
E
F
TS
2000
0
8000
6000
4000
2000
0
(metagabbros)
0.0
0.5
1.0
2.0 Km

Ernst 1999

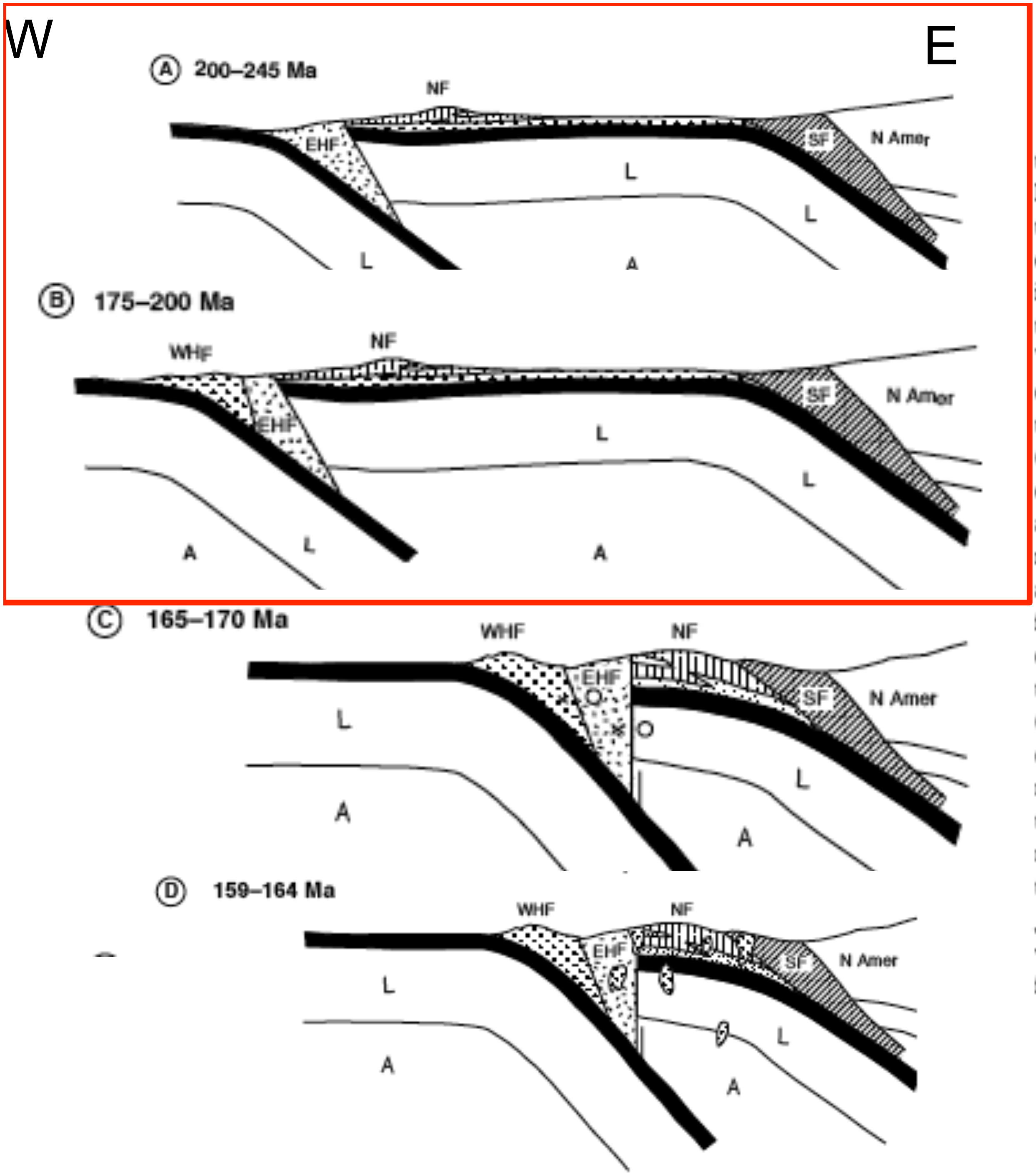
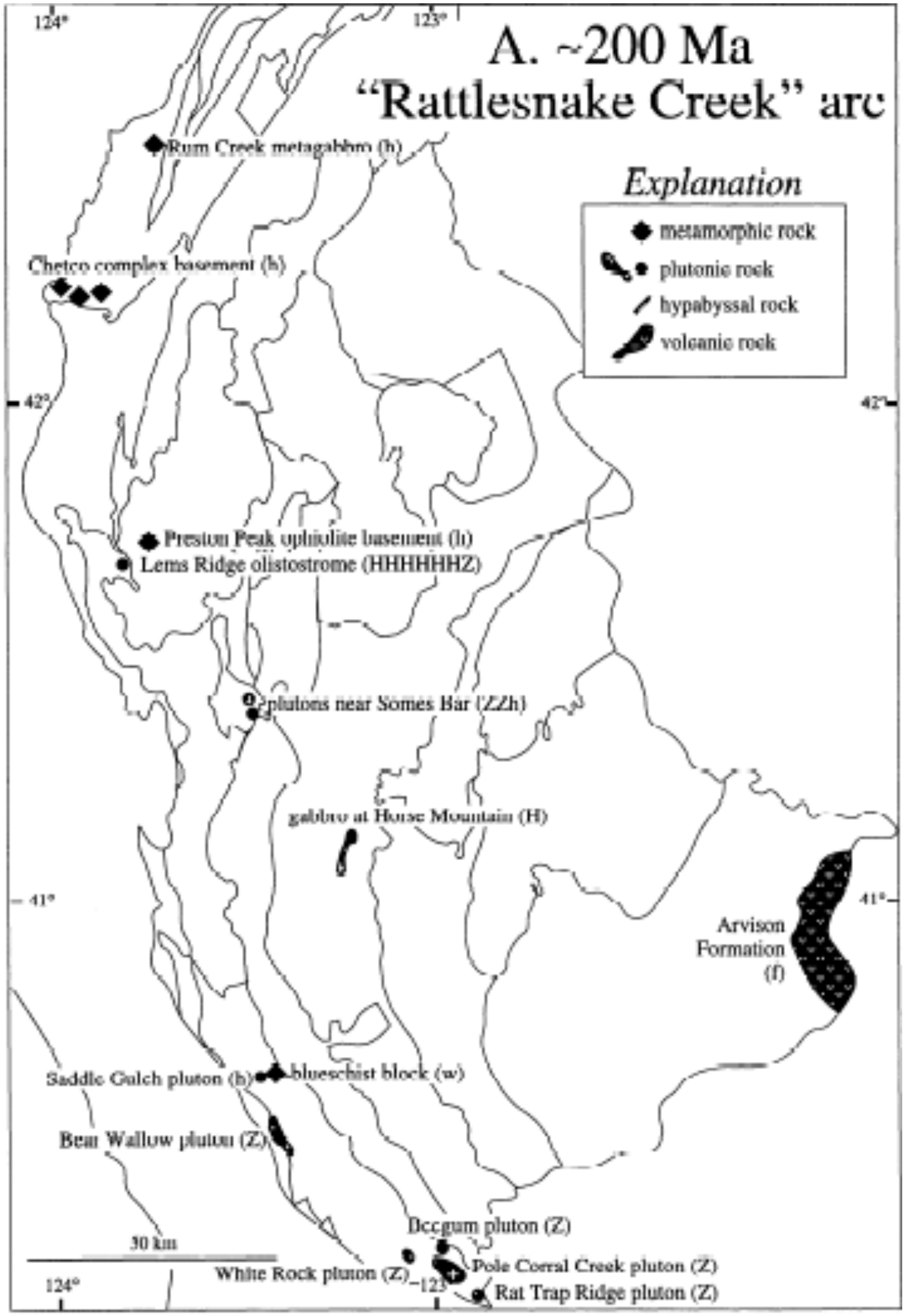
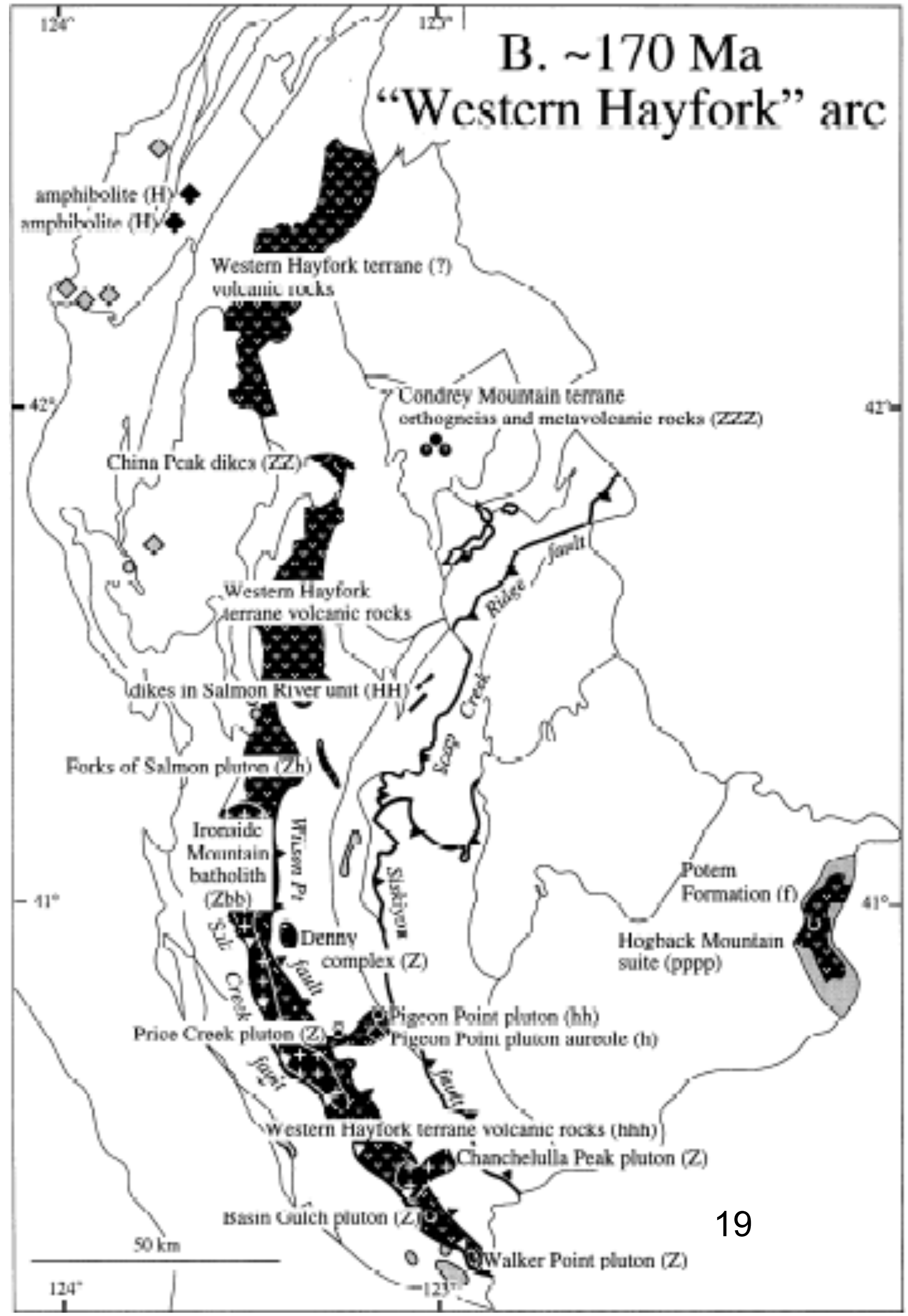


Figure 6. Speculative plate tectonic history of the central portion of the Western Paleozoic and Triassic belt, based on detailed mapping, petrotectonics, and geochemistry of the Sawyers Bar area. View is to the north. Abbreviations: A—asthenosphere; L—lithosphere; WHF—Western Hayfork terrane; EHF—Eastern Hayfork terrane; NF—North Fork terrane; and SF—Stuart Fork terrane. (A) Triassic-earliest Jurassic time; eastern subduction zone becomes inactive and Stuart Fork terrane is sequestered at midcrustal levels by ca. 227 Ma; (B) Early and Middle Jurassic time; Western Hayfork is juxtaposed against inboard Eastern Hayfork through consumption of intervening basin or due to transpression; (C) late Middle Jurassic time; outer subduction zone is still active (X indicates relative movement into the plane of section, i.e., northward; bull's eye indicates relative movement out of the plane of section, i.e., southward); and (D) early Late Jurassic time; local termination of convergence and thermal relaxation. See text for discussion.


A. ~200 Ma
"Rattlesnake Creek" arc
Explanation
metamorphic rock
plutonic rock
hypabyssal rock
volcanic rock
Rum Creek metagabbro (h)
Chetco complex basement (h)
Preston Peak ophiolite basement (h)
Lems Ridge olistostrome (HHHHHHZ)
2 plutons near Somes Bar (ZZh)
gabbro at Horse Mountain (H)
Arvison Formation (f)
Saddle Gulch pluton (h)
blueschist block (w)
Bear Wallow pluton (Z)
Deegum pluton (Z)
White Rock pluton (Z)
Pole Corral Creek pluton (Z)
Rat Trap Ridge pluton (Z)
30 km
124°
123°
42°
41°


B. ~170 Ma
"Western Hayfork" arc
amphibolite (H)
amphibolite (H)
Western Hayfork terrane (?) volcanic rocks
Condrey Mountain terrane
orthogneiss and metavolcanic rocks (ZZZZ)
China Peak dikes (ZZ)
Western Hayfork terrane volcanic rocks
dikes in Salmon River unit (HH)
Forks of Salmon pluton (Zh)
Ironside Mountain batholith (Zbb)
Wilson Pt
Siskiyou fault
Soap Creek Ridge fault
Salt Creek fault
Denny complex (Z)
Potem Formation (f)
Hogback Mountain suite (pppp)
Pigeon Point pluton (hh)
Pigeon Point pluton aureole (h)
Price Creek pluton (Z)
Western Hayfork terrane volcanic rocks (hhh)
Chanchelulla Peak pluton (Z)
Basin Gulch pluton (Z)
Walker Point pluton (Z)
50 km
124°
123°
42°
41°

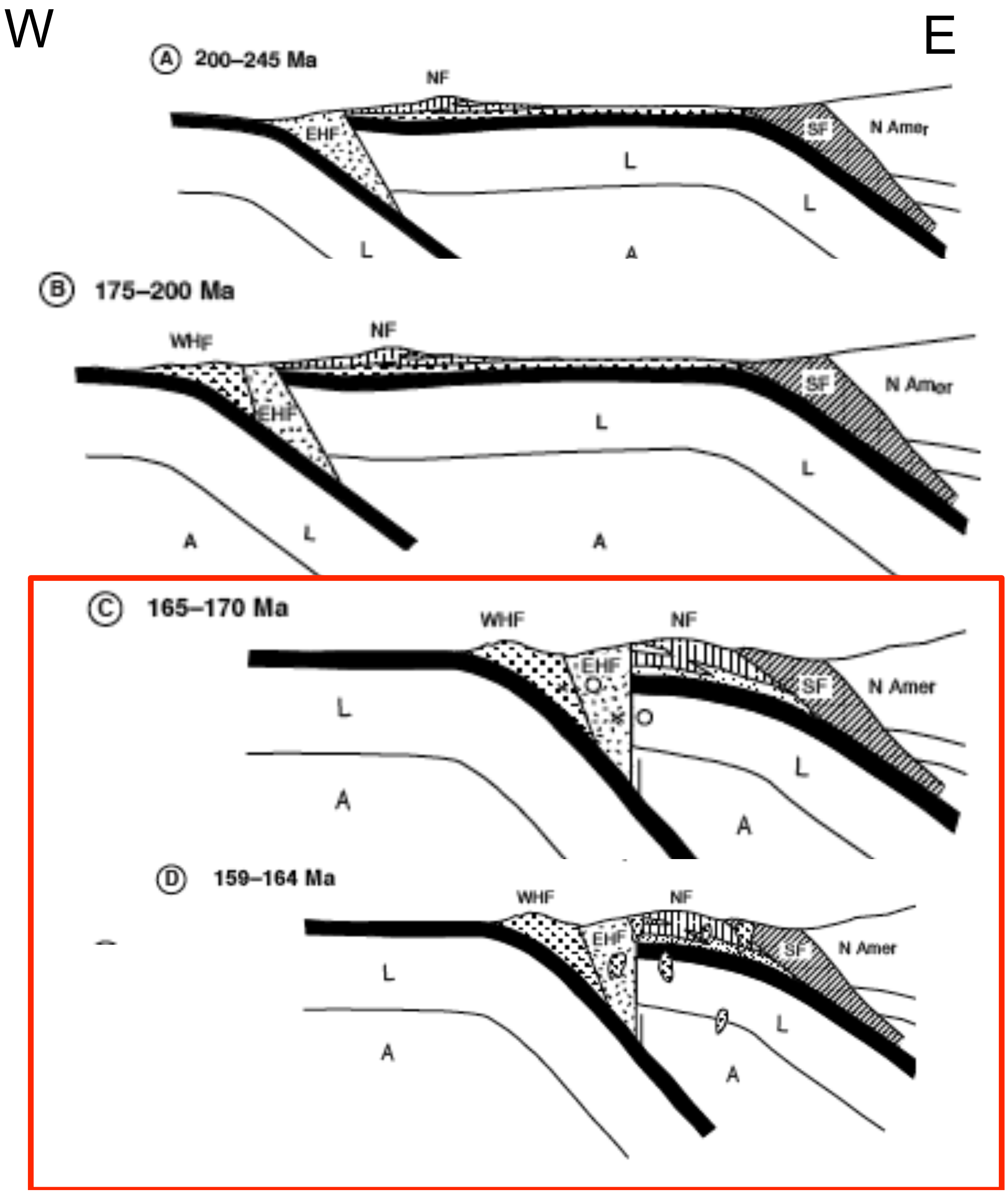
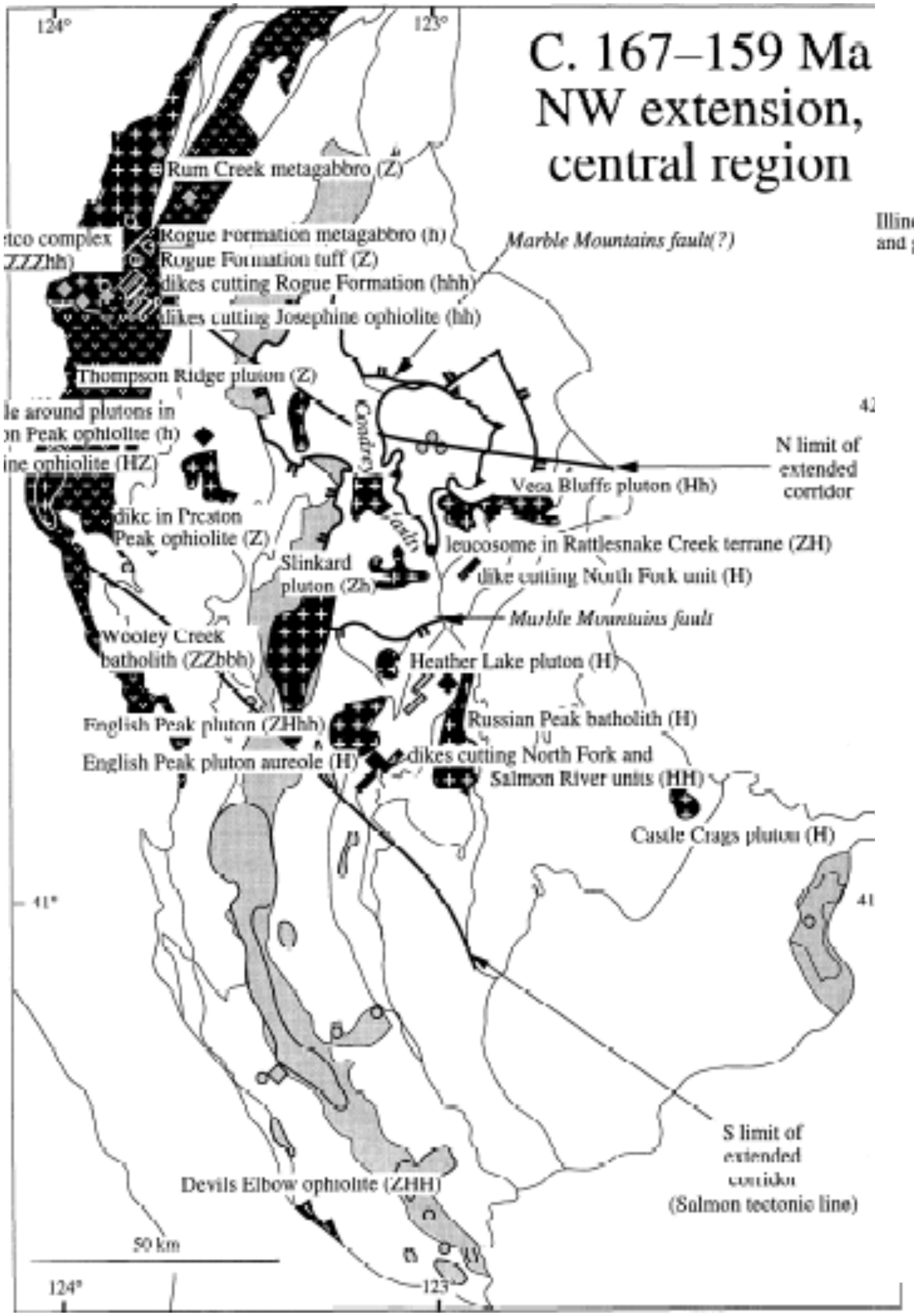
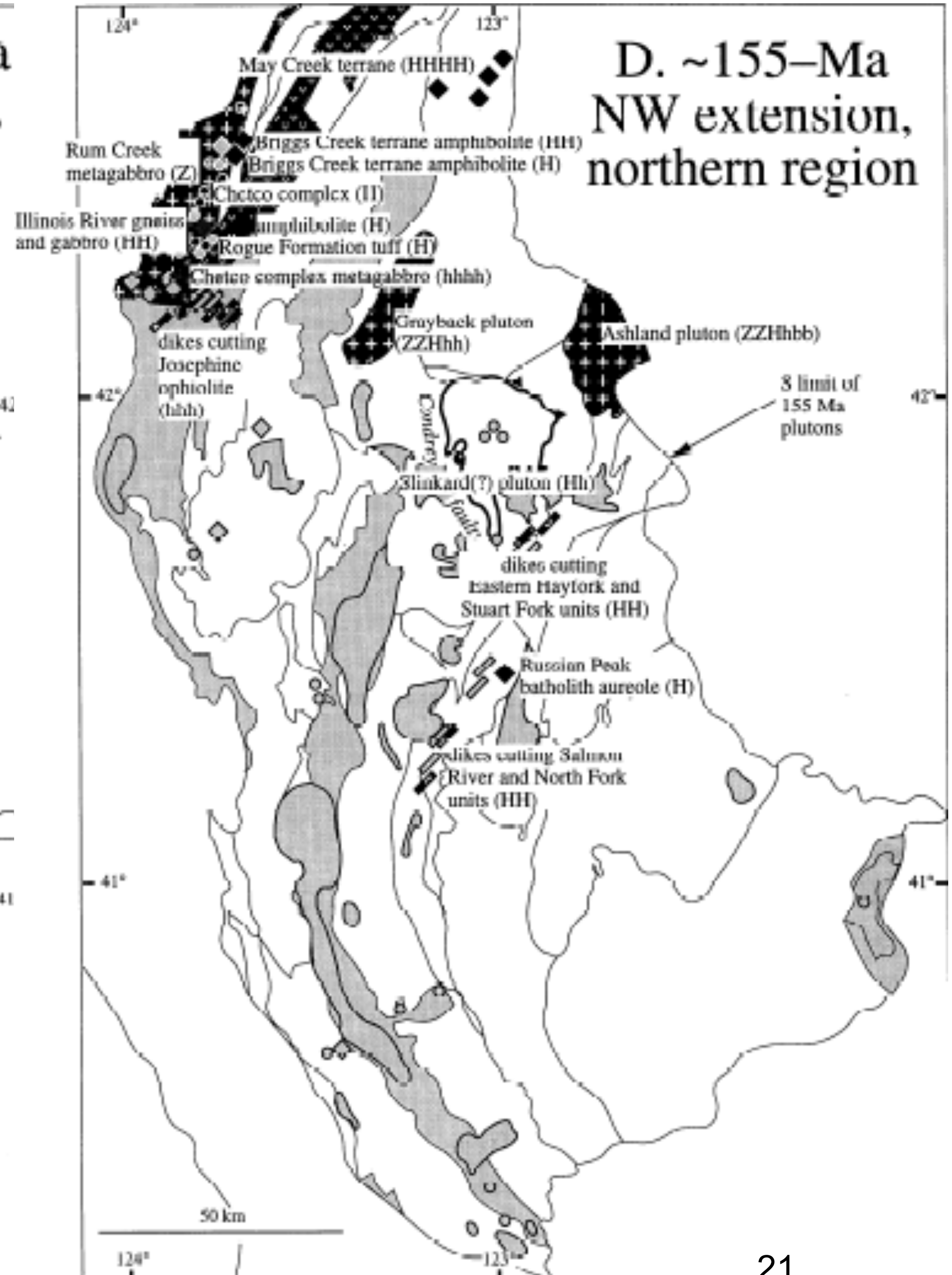
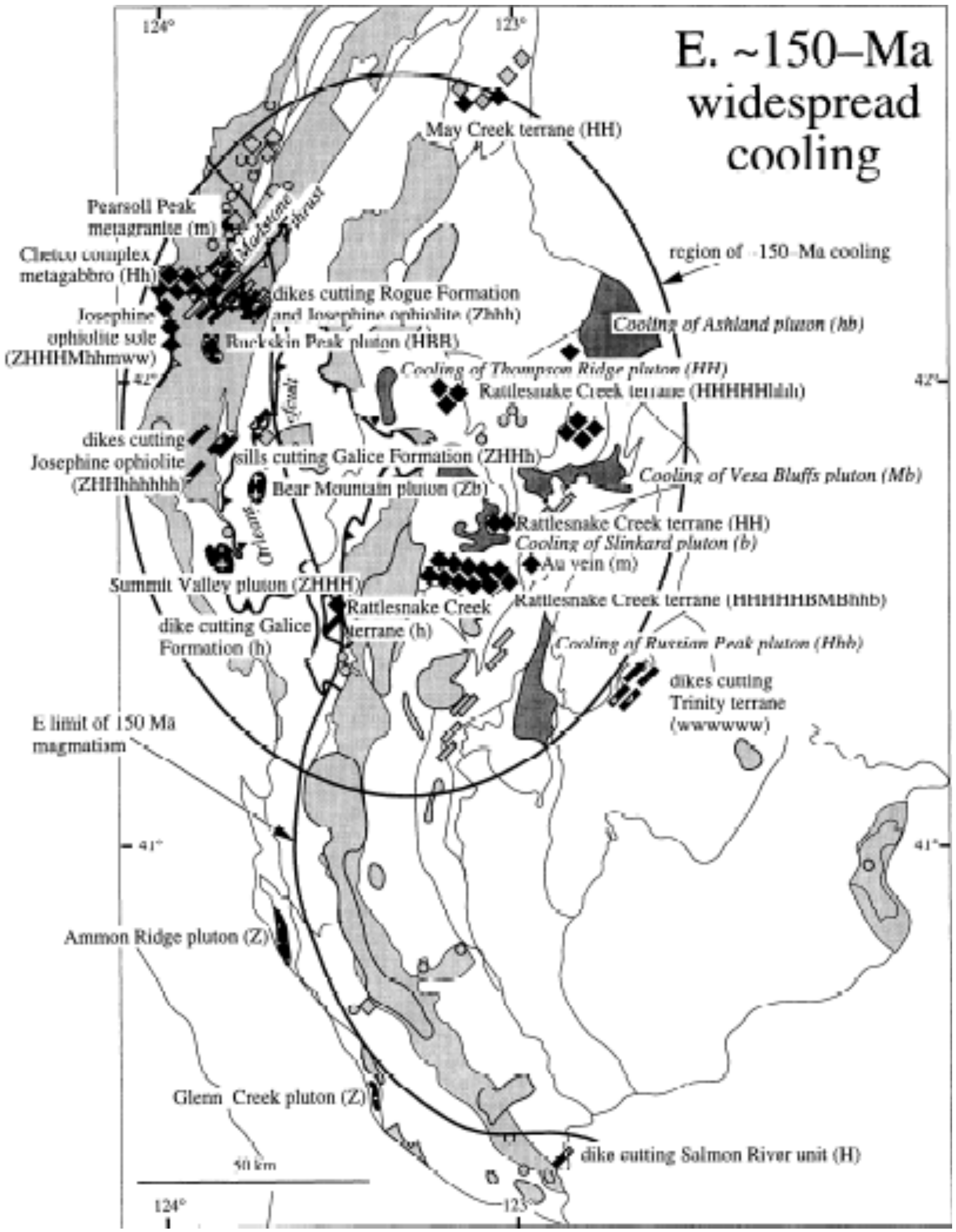
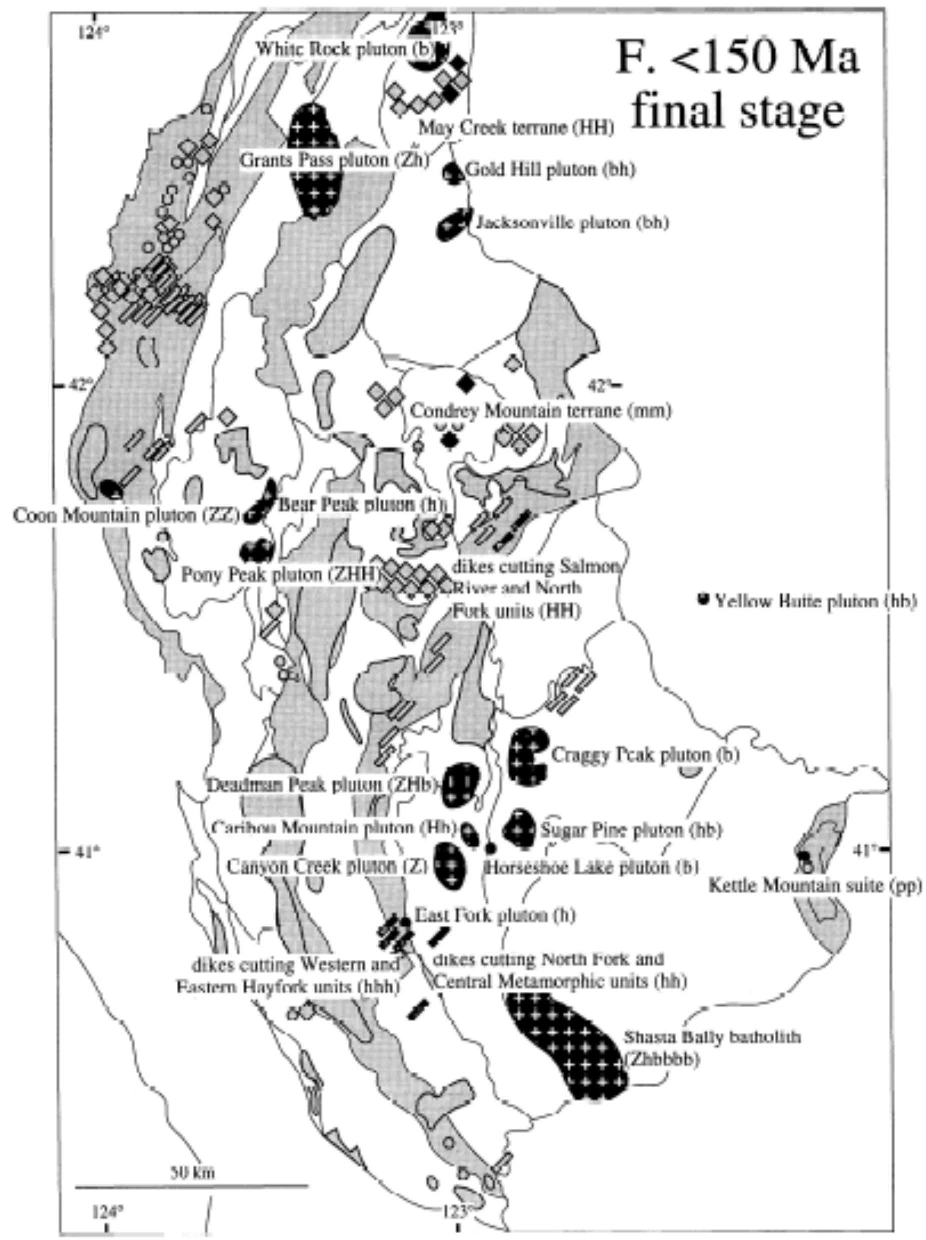


Figure 6. Speculative plate tectonic history of the central portion of the Western Paleozoic and Triassic belt, based on detailed mapping, petrotectonics, and geochemistry of the Sawyers Bar area. View is to the north. Abbreviations: A—asthenosphere; L—lithosphere; WHF—Western Hayfork terrane; EHF—Eastern Hayfork terrane; NF—North Fork terrane; and SF—Stuart Fork terrane. (A) Triassic-earliest Jurassic time; eastern subduction zone becomes inactive and Stuart Fork terrane is sequestered at midcrustal levels by ca. 227 Ma; (B) Early and Middle Jurassic time; Western Hayfork is juxtaposed against inboard Eastern Hayfork through consumption of intervening basin or due to transpression; (C) late Middle Jurassic time; outer subduction zone is still active (X indicates relative movement into the plane of section, i.e., northward; bull's eye indicates relative movement out of the plane of section, i.e., southward); and (D) early Late Jurassic time; local termination of convergence and thermal relaxation. See text for discussion.


C. 167–159 Ma
NW extension,
central region
Rum Creek metagabbro (Z)
Rogue Formation metagabbro (h)
Rogue Formation tuff (Z)
dikes cutting Rogue Formation (hhh)
dikes cutting Josephine ophiolite (hh)
Marble Mountains fault(?)
Thompson Ridge pluton (Z)
Condrey Mountain fault
N limit of
extended
corridor
Vesa Bluffs pluton (Hh)
dike in Preston
Peak ophiolite (Z)
leucosome in Rattlesnake Creek terrane (ZH)
Slinkard
pluton (Zh)
dike cutting North Fork unit (H)
Marble Mountains fault
Wooley Creek
batholith (ZZbbh)
Heather Lake pluton (H)
English Peak pluton (ZHhh)
Russian Peak batholith (H)
English Peak pluton aureole (H)
dikes cutting North Fork and
Salmon River units (HH)
Castle Crags pluton (H)
S limit of
extended
corridor
(Salmon tectonic line)
Devils Elbow ophiolite (ZHH)
50 km
124°
123°
41°


D. ~155–Ma
NW extension,
northern region
May Creek terrane (HHHH)
Briggs Creek terrane amphibolite (HH)
Briggs Creek terrane amphibolite (H)
Rum Creek
metagabbro (Z)
Chetco complex (H)
Illinois River gneiss
and gabbro (HH)
amphibolite (H)
Rogue Formation tuff (H)
Chetco complex metagabbro (hhhh)
Grayback pluton
(ZZHhh)
Ashland pluton (ZZHhbb)
dikes cutting
Josephine
ophiolite
(hhh)
8 limit of
155 Ma
plutons
Condrey
Slinkard(?) pluton (Hh)
dikes cutting
Eastern Hayfork and
Stuart Fork units (HH)
Russian Peak
batholith aureole (H)
dikes cutting Salmon
River and North Fork
units (HH)
50 km
124°
123°
42°
41°


E. ~150–Ma widespread cooling
May Creek terrane (HH)
Pearsoll Peak metagranite (m)
Chetco complex metagabbro (Hh)
Josephine ophiolite sole (ZHHHMhhmww)
dikes cutting Rogue Formation and Josephine ophiolite (Zhhh)
Buckskin Peak pluton (HBB)
region of ~150–Ma cooling
Cooling of Ashland pluton (hb)
Cooling of Thompson Ridge pluton (HH)
Rattlesnake Creek terrane (HHHHHhhh)
dikes cutting Josephine ophiolite (ZHHhhhhhh)
sills cutting Galice Formation (ZHHh)
Bear Mountain pluton (Zb)
Cooling of Vesa Bluffs pluton (Mb)
Rattlesnake Creek terrane (HH)
Cooling of Slinkard pluton (b)
Au vein (m)
Summit Valley pluton (ZHHH)
Rattlesnake Creek terrane (h)
Rattlesnake Creek terrane (HHHHHBMBhhb)
dike cutting Galice Formation (h)
Cooling of Russian Peak pluton (Hhb)
dikes cutting Trinity terrane (wwwwww)
E limit of 150 Ma magmatism
Ammon Ridge pluton (Z)
Glenn Creek pluton (Z)
dike cutting Salmon River unit (H)
50 km
124°
123°
42°
41°


F. <150 Ma final stage
White Rock pluton (b)
May Creek terrane (HH)
Grants Pass pluton (Zh)
Gold Hill pluton (bh)
Jacksonville pluton (bh)
Condrey Mountain terrane (mm)
Coon Mountain pluton (ZZ)
Bear Peak pluton (h)
Pony Peak pluton (ZHH)
dikes cutting Salmon River and North Fork units (HH)
Yellow Butte pluton (hb)
Craggy Peak pluton (b)
Deadman Peak pluton (ZHb)
Caribou Mountain pluton (Hh)
Sugar Pine pluton (hb)
Canyon Creek pluton (Z)
Horseshoe Lake pluton (b)
Kettle Mountain suite (pp)
East Fork pluton (h)
dikes cutting Western and Eastern Hayfork units (hhh)
dikes cutting North Fork and Central Metamorphic units (hh)
Shasta Bally batholith (Zhbbbb)
50 km
124°
123°
42°
41°

USGS
OF 99-374

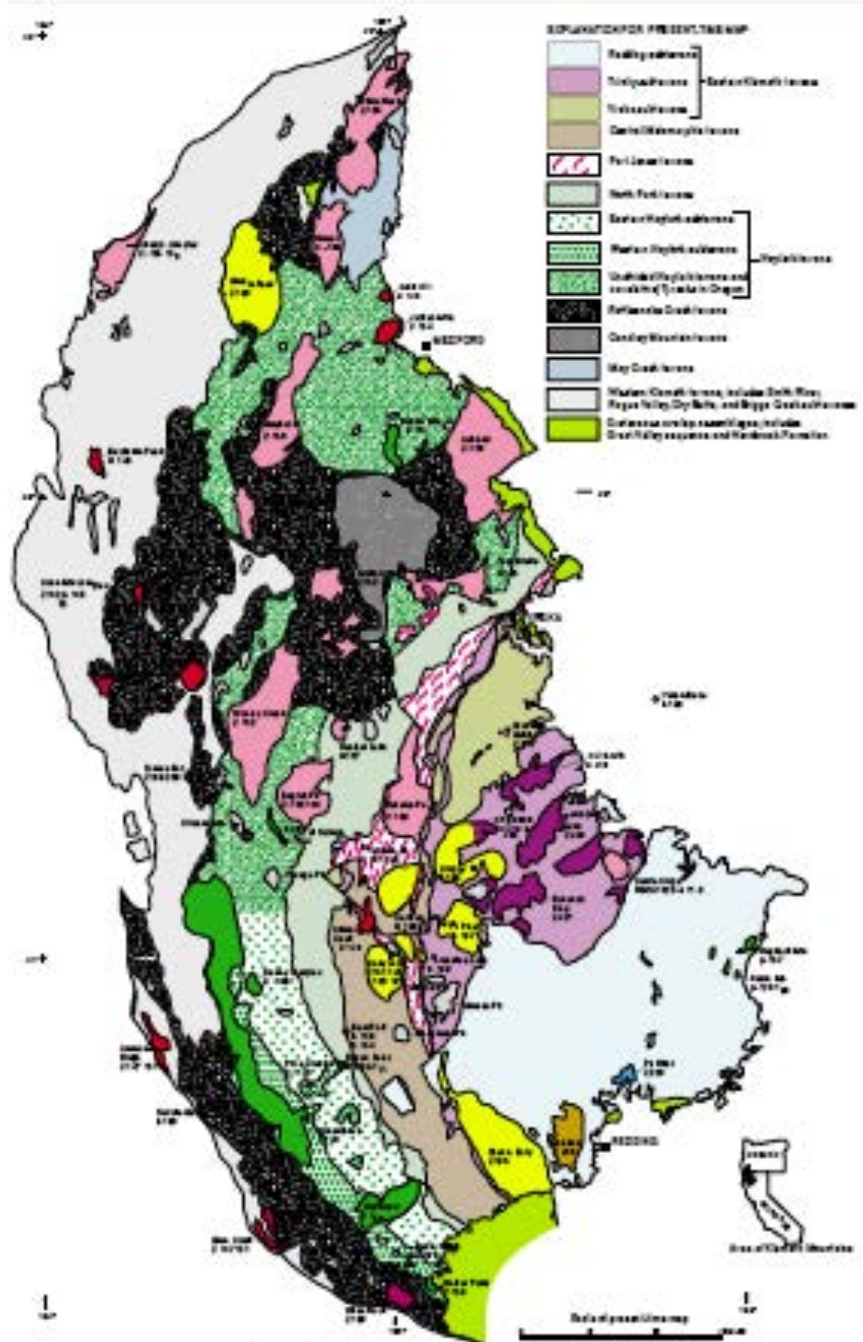
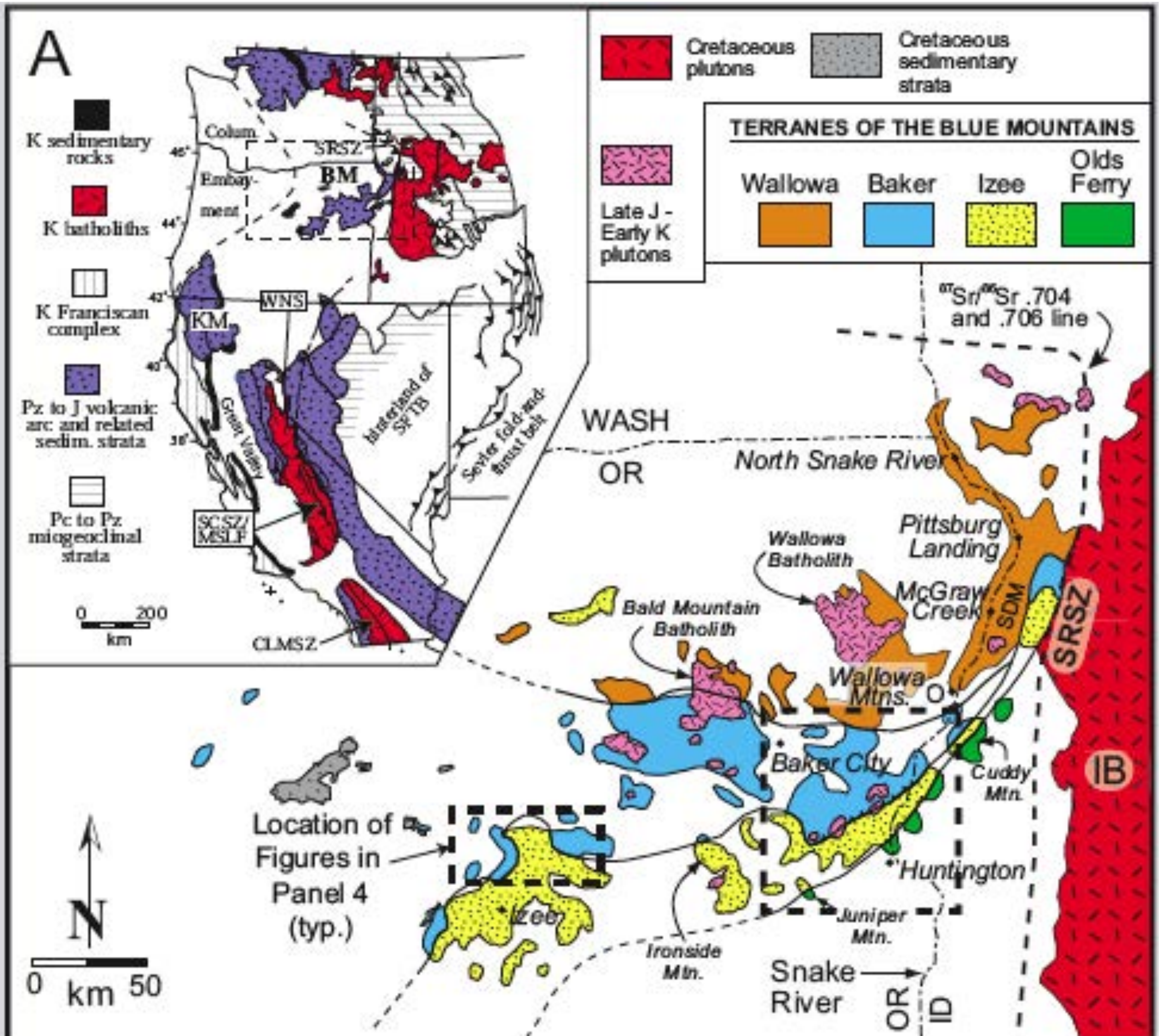


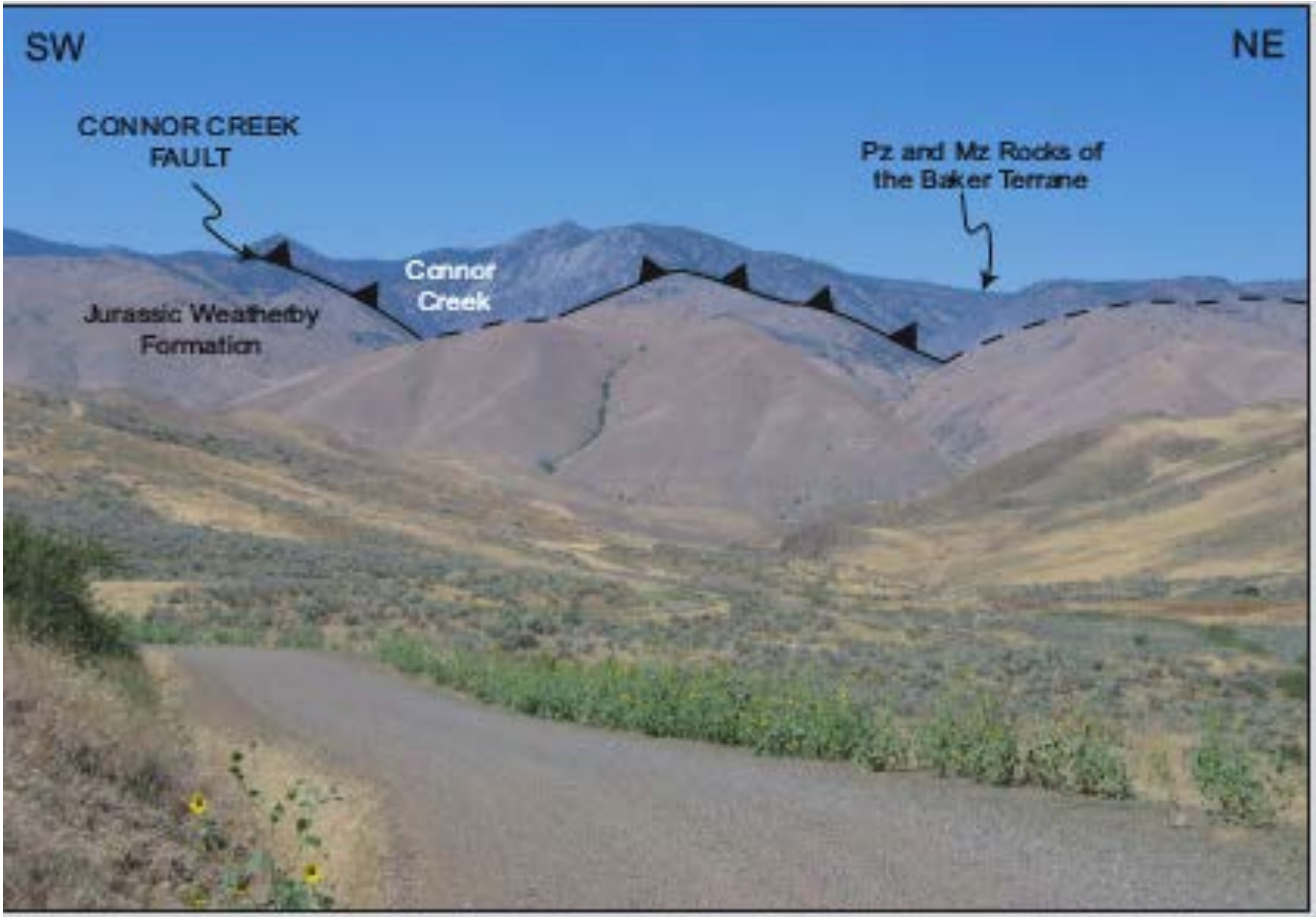
Figure 9
Present time
Geology modified from Irwin (1994)


The Blue Mountains:
The Ochocos
The Wallowas
The Strawberries
. . .

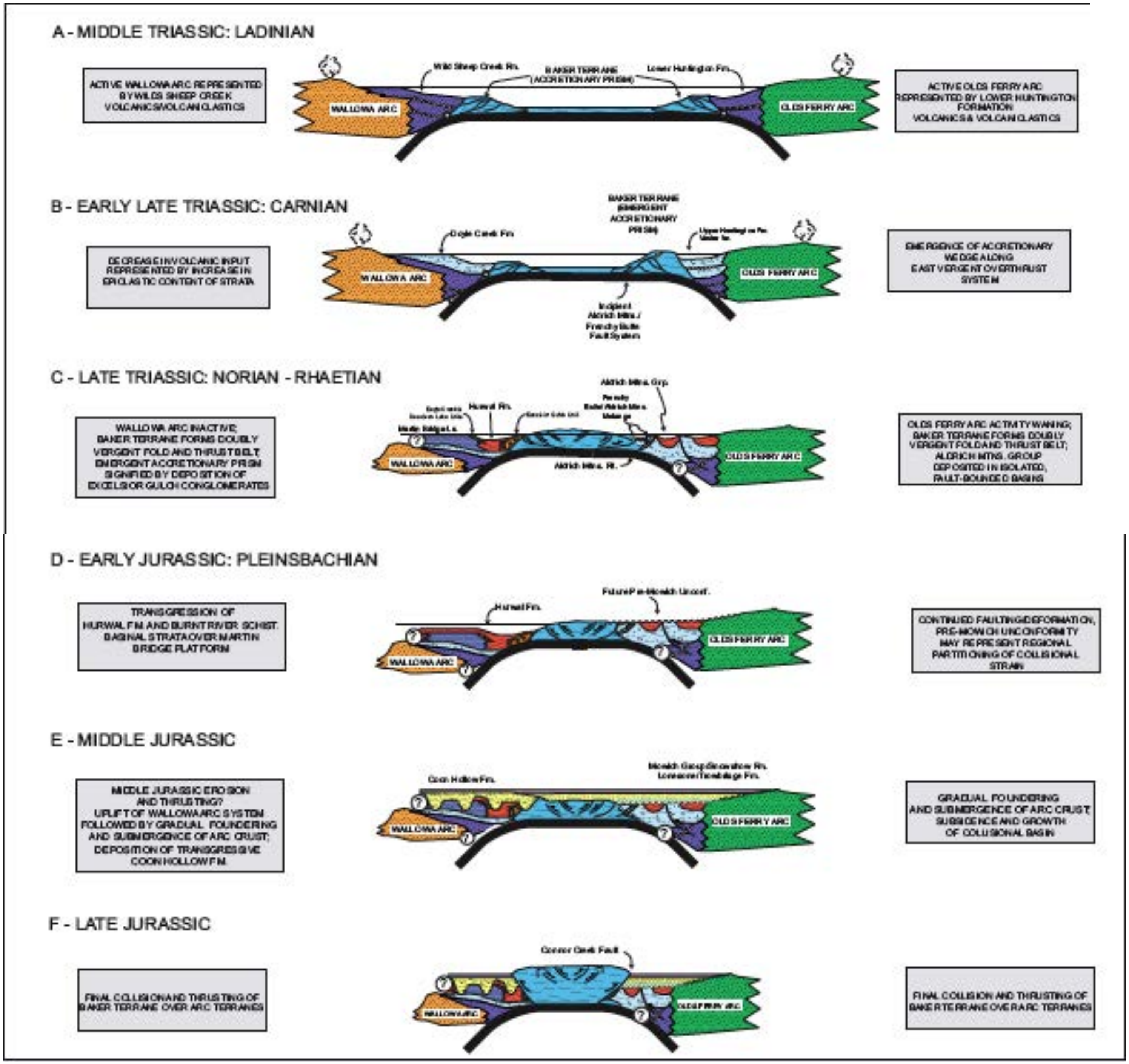


(A) Pre-Tertiary geology of the western United States modified from Wyld and Wright (2001). Dashed line in oregon and Washington defines the Columbia Embayment and follows approximate trend of fabrics in accreted terranes of the Blue Mountains and Klamath Mountains. SRSZ coincides with the 87Sr/86Sr isotope boundary. (B) Distribution of acreeted terranes in central and eastern Oregon, which comprise the Blue Mountains province, modified from Dickinson (1979) and Vallier (1995).

BM = Blue Mountains; WNS = Western Nevada Shear Zone; KM = Klamath Mountains; SCSZ = Sierra Crest Shear Zone; MSLF = Mojave-Snow Lake Fault; O = Oxbow; PL = Pittsburg Landing; CH = Coon Hollow; SDM = Seven Devils Mtns.; SRSZ = Salmon River Suture Zone; IB = Idaho Batholith.



View looking northwest from Washington County, Idaho into Oregon across the Snake River (hidden in foreground). Paleozoic and Mesozoic argillaceous melange, sperpentenites and mafic ophiolitic rocks overlie the Jurassic Wealtherby Formation, forearc basin volcaniclastic turbidite deposits, along the steeply northwest-dipping Connor Creek Fault.



A - MIDDLE TRIASSIC: LADINIAN
ACTIVE WALLOWA ARC REPRESENTED BY WILDS SHEEP CREEK VOLCANICS/VOLCANICLASTICS
Wild Sheep Creek Fm.
BAKER TERRANE (ACCRETIONARY PRISM)
Lower Huntington Fm.
WALLOWA ARC
OLDS FERRY ARC
ACTIVE OLDS FERRY ARC REPRESENTED BY LOWER HUNTINGTON FORMATION VOLCANICS & VOLCANICLASTICS
B - EARLY LATE TRIASSIC: CARNIAN
DECREASE IN VOLCANIC INPUT REPRESENTED BY INCREASE IN EPICLASTIC CONTENT OF STRATA
Doyle Creek Fm.
BAKER TERRANE (EMERGENT ACCRETIONARY PRISM)
Incipient Aldrich Mtns./ Frenchy Butte Fault System
WALLOWA ARC
OLDS FERRY ARC
EMERGENCE OF ACCRETIONARY WEDGE ALONG EAST VERGENT OVERTHRUST SYSTEM
C - LATE TRIASSIC: NORIAN - RHAETIAN
WALLOWA ARC INACTIVE; BAKER TERRANE FORMS DOUBLY VERGENT FOLD AND THRUST BELT, EMERGENT ACCRETIONARY PRISM SIGNIFIED BY DEPOSITION OF EXCELSIOR GULCH CONGLOMERATES
Hurwal Fm.
Aldrich Mtns. Grp.
Aldrich Mtns. Flt.
WALLOWA ARC
OLDS FERRY ARC
OLDS FERRY ARC ACTIVITY WANING; BAKER TERRANE FORMS DOUBLY VERGENT FOLD AND THRUST BELT; ALDRICH MTNS. GROUP DEPOSITED IN ISOLATED, FAULT-BOUNDED BASINS
D - EARLY JURASSIC: PLEINSBACHIAN
TRANSGRESSION OF HURWAL FM AND BURNT RIVER SCHIST. BASINAL STRATA OVER MARTIN BRIDGE PLATFORM
Hurwal Fm.
Future Pre-Mowich Unconf.
WALLOWA ARC
OLDS FERRY ARC
CONTINUED FAULTING/DEFORMATION, PRE-MOWICH UNCONFORMITY MAY REPRESENT REGIONAL PARTITIONING OF COLLISIONAL STRAIN
E - MIDDLE JURASSIC
MIDDLE JURASSIC EROSION AND THRUSTING? UPLIFT OF WALLOWA ARC SYSTEM FOLLOWED BY GRADUAL FOUNDERING AND SUBMERGENCE OF ARC CRUST; DEPOSITION OF TRANSGRESSIVE COON HOLLOW FM.
Coon Hollow Fm.
WALLOWA ARC
OLDS FERRY ARC
GRADUAL FOUNDERING AND SUBMERGENCE OF ARC CRUST, SUBSIDENCE AND GROWTH OF COLLISIONAL BASIN
F - LATE JURASSIC
FINAL COLLISION AND THRUSTING OF BAKER TERRANE OVER ARC TERRANES
Connor Creek Fault
WALLOWA ARC
OLDS FERRY ARC
FINAL COLLISION AND THRUSTING OF BAKER TERRANE OVER ARC TERRANES

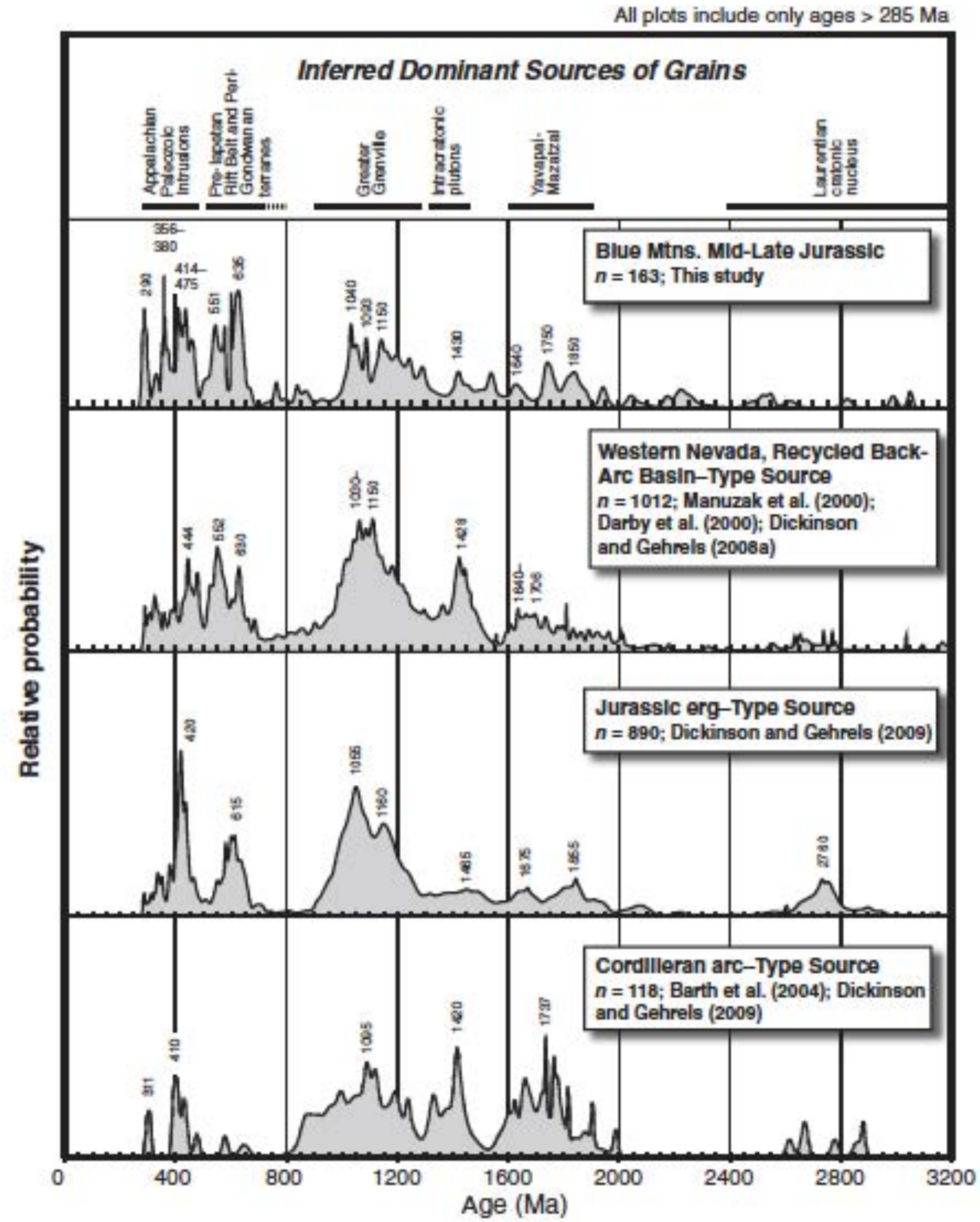
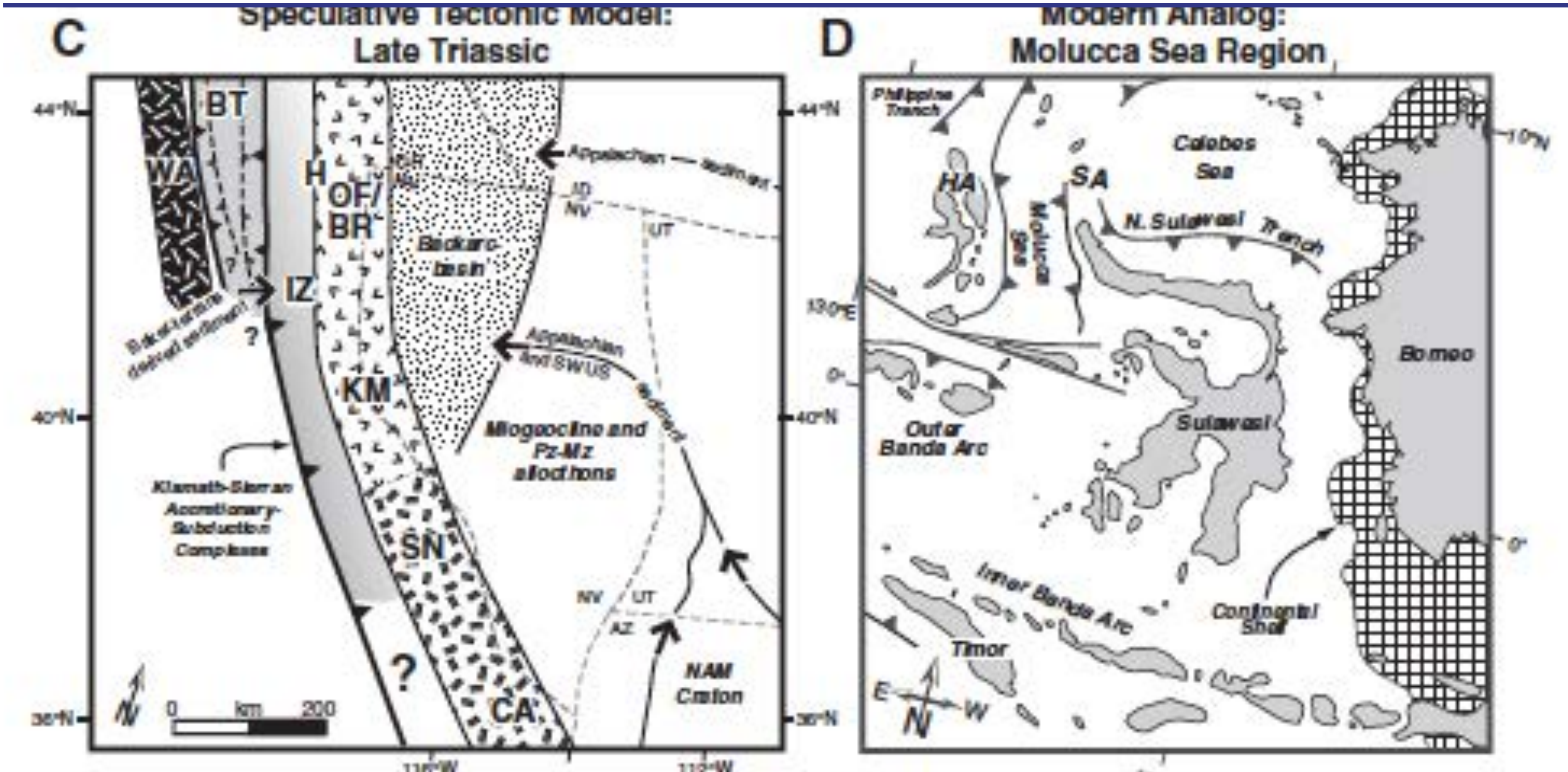
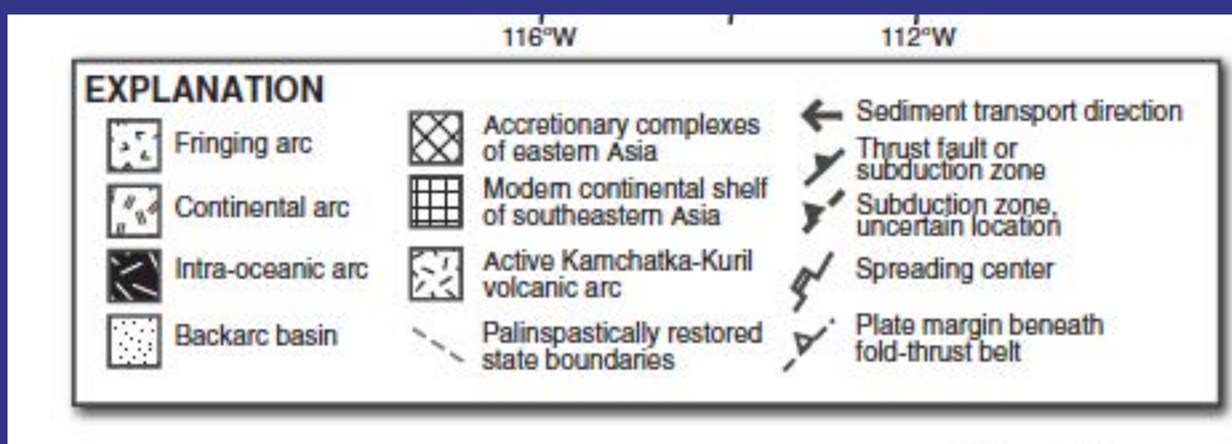


Figure 13. Comparison of detrital zircon age distributions in Middle to early Late Jurassic samples from the Blue Mountains (Snowshoe and Lonesome formations) and potential source areas representing recycled backarc-basin transcontinental sand from western Nevada, transcontinental sand from the Jurassic ergs of the Colorado Plateau, and interstratified quartzose sands of Cordilleran arc. For clarity, only ages older than 285 Ma are plotted (cf. Dickinson and Gehrels, 2009). Inferred dominant sources of grains have been modified from Dickinson and Gehrels (2003, 2009) and Whitmeyer and Karlstrom (2007). Data for western Nevada, recycled backarc-basin–type rocks,

LaMaskin et al 2011





LaMaskin et al 2011

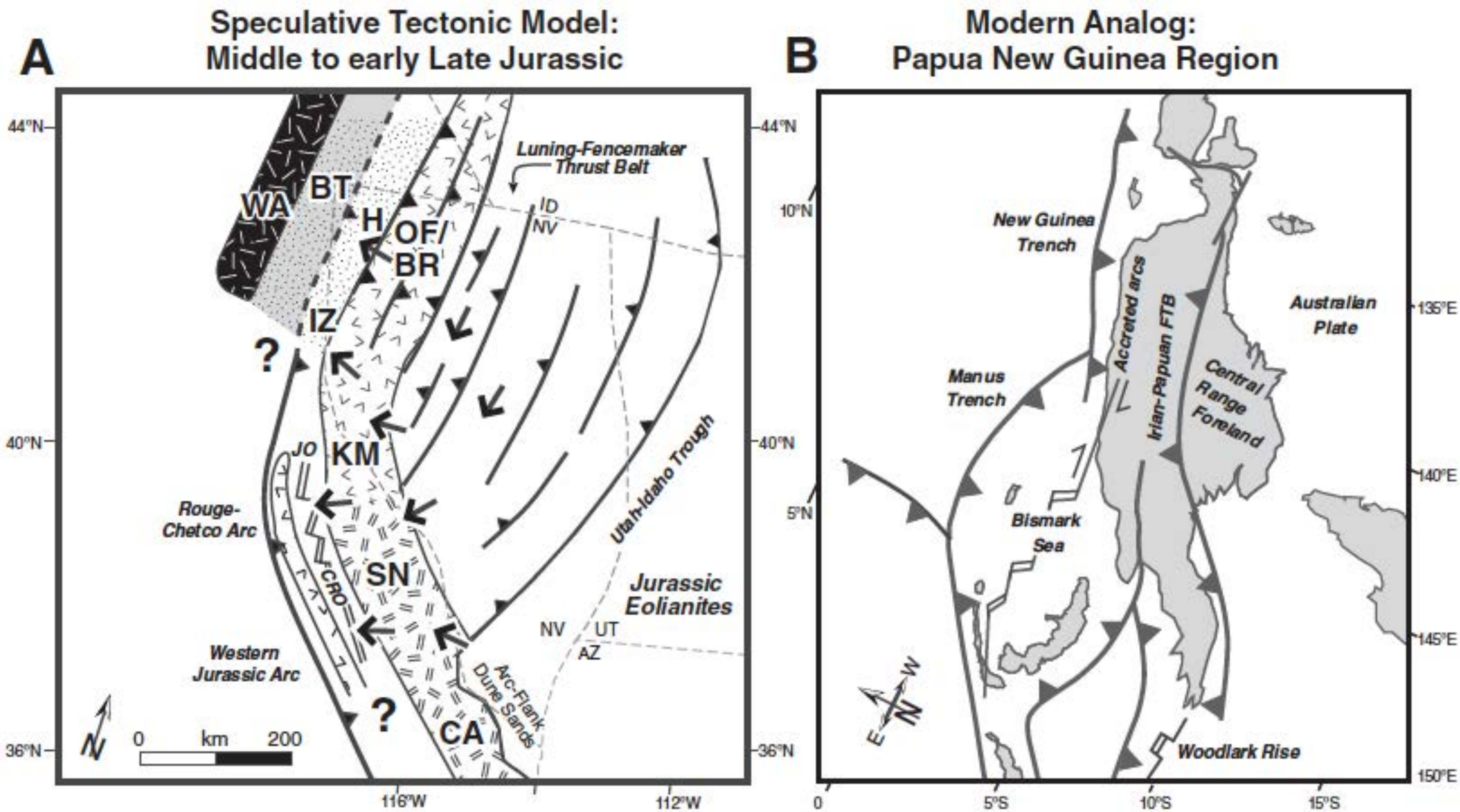
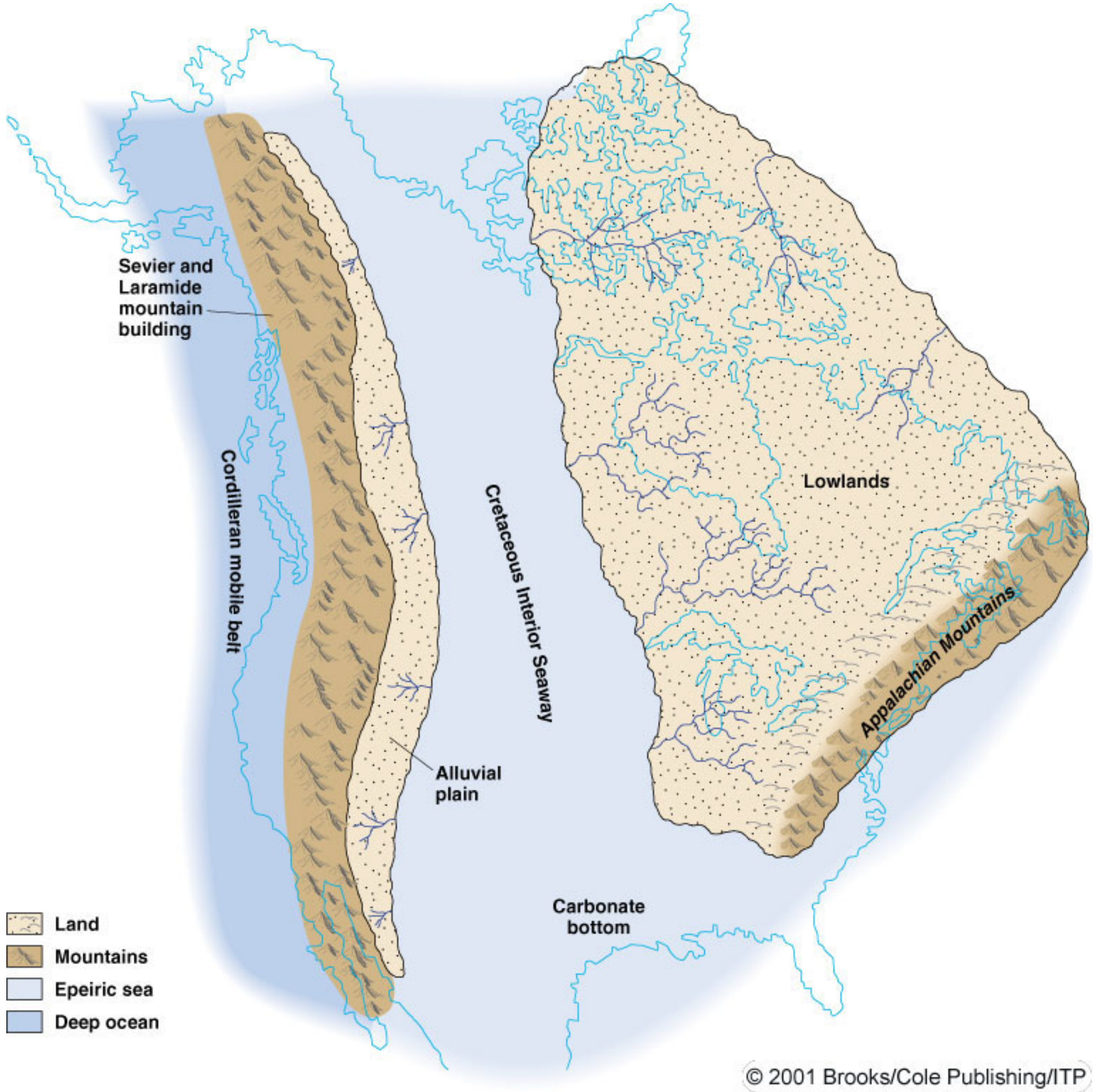


Figure 15. Proposed tectonic models for central western North America during Middle to early Late Jurassic time. See Figure 14 for explanation of symbols and abbreviations used. Palinspastic base in A is modified from Wyld et al. (2006). Rocks of the Blue Mountain Province have been restored ~400 km to the south. (A) Middle to early Late Jurassic time. Sediment deposited in the John Day region is derived from (1) tectonic closure, uplift, and erosion of the Triassic backarc basin and formation of the Luning-Fencemaker fold-and-thrust belt, and/or (2) mixed arc and erg dune sands. Similar sediment is deposited in the intra-arc Josephine–Galice (JO) and Coast Range–Basal Great Valley basins (CRO). (B) Proposed modern analog of the Papua New Guinea region modified from Cloos et al. (2005). Note north arrow and flipped E-W arrows. Accretion of the Melanesian arcs has resulted in formation of the Irian-Papuan fold-and-thrust belt (FTB) and



Cretaceous (80 MA) Paleogeography

During the Cretaceous the Pacific margin was dominated by east directed subduction of the Farallon Plate beneath North America. Island-arc volcanism extended from Mexico to southeast Alaska. Today we see the batholiths emplaced beneath the arc volcanoes, as well as remnants of both fore-arc and back-arc basins

Trinity Alps near Dunsmuir, CA

Upper Cretaceous Hornbrook Fm, I-5 Siskiyou Pass, OR

Hornbrook CA: Hornbrook Formation sandstones and claystones

Cretaceous Hudspeth Fm turbidites
Eocene Clarno Fm dike intruding Hudspeth Fm

Cretaceous Gable Creek Fm intra-formational breccia

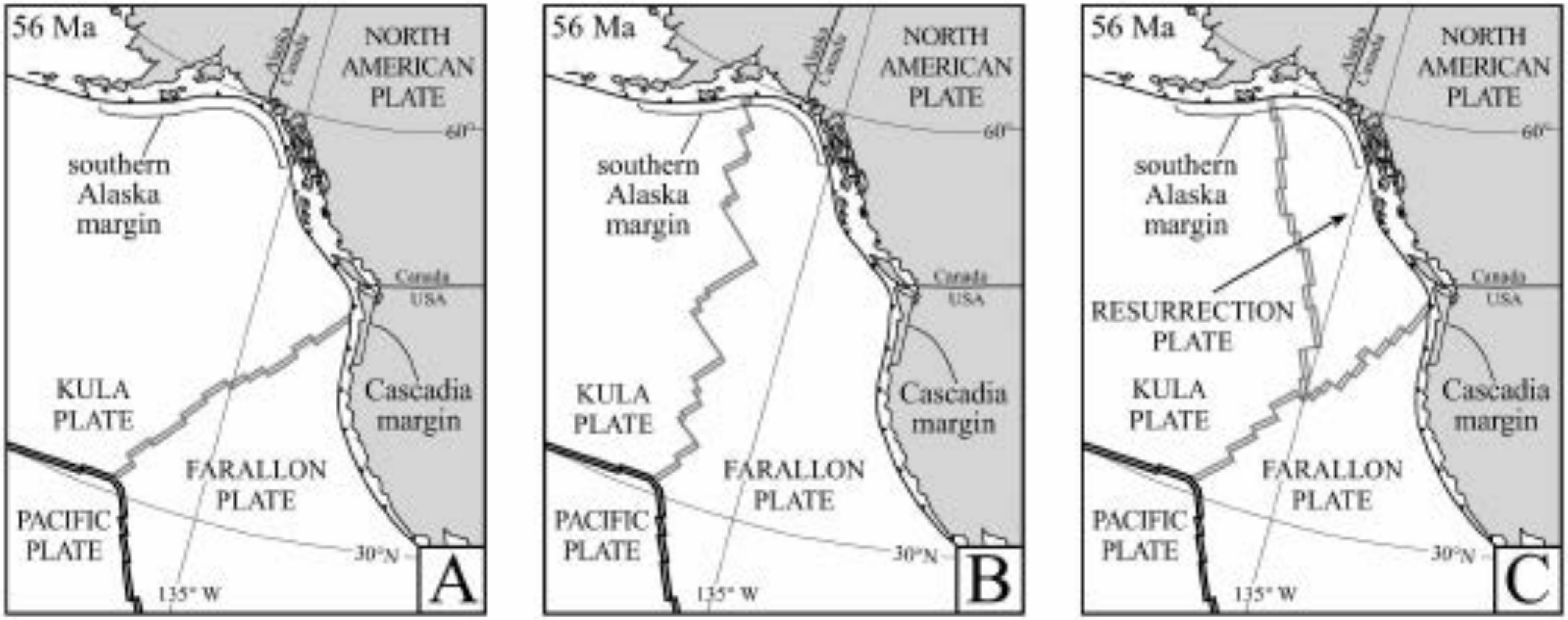
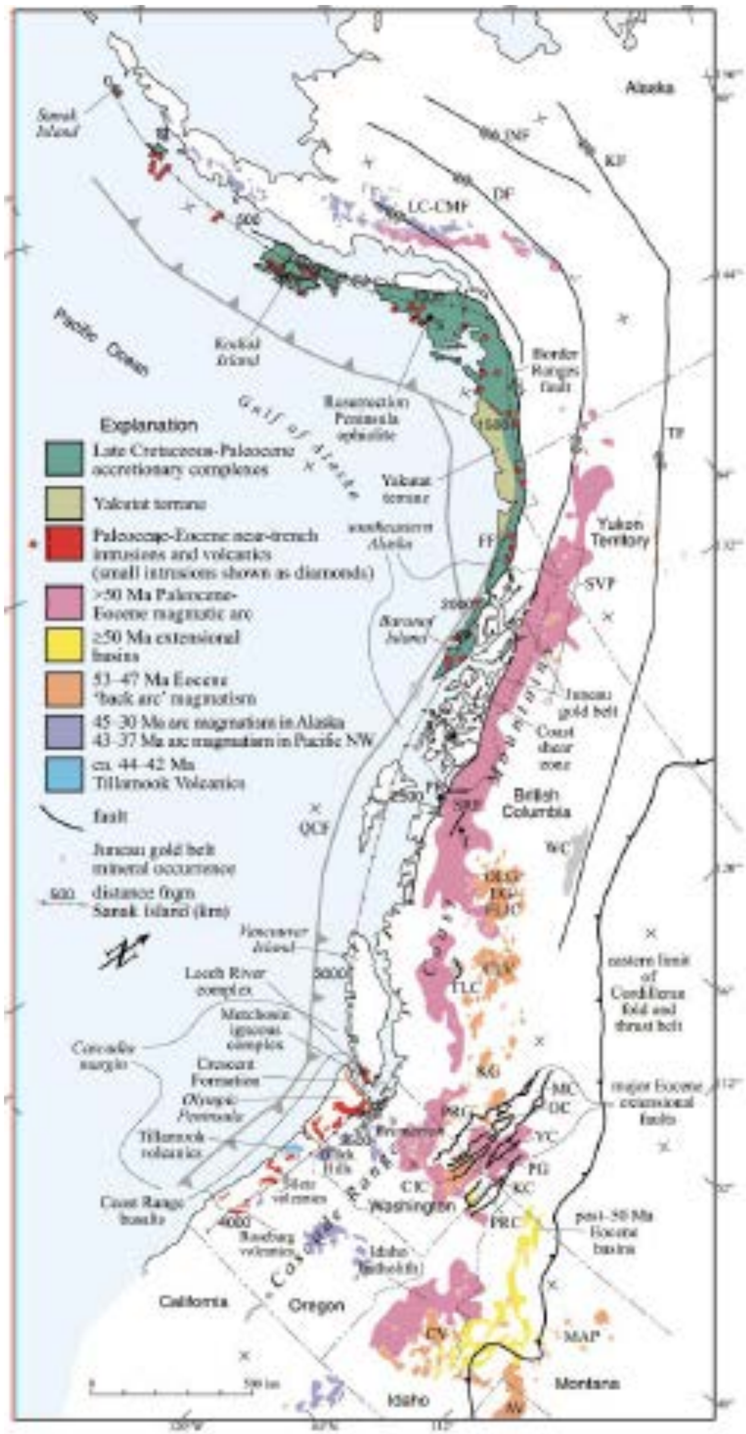


Figure 1. Plate geometries proposed to explain the latest Cretaceous to early Tertiary near-trench magmatic record of western North America at Chron 25 time (56.1 Ma). The orientation and geometry of spreading ridges in gray are speculative. (A) Kula-Farallon TRT triple junction would explain near-trench magmatism along the Cascadia margin, but not in southern Alaska. (B) Kula-Farallon TRT triple junction would explain near-trench magmatism in southern Alaska, but not along the Cascadia margin. (C) Two TRT triple junctions, one in southern Alaska and another along the Cascadia margin, indicate the presence of an additional oceanic plate—the Resurrection plate. This is the hypothesis we prefer and explore in this paper.

Three Models of subduction in late Cretaceous to early Tertiary (Heussler et al 2001)



Cascade Head: Eocene Siletz Volcanics

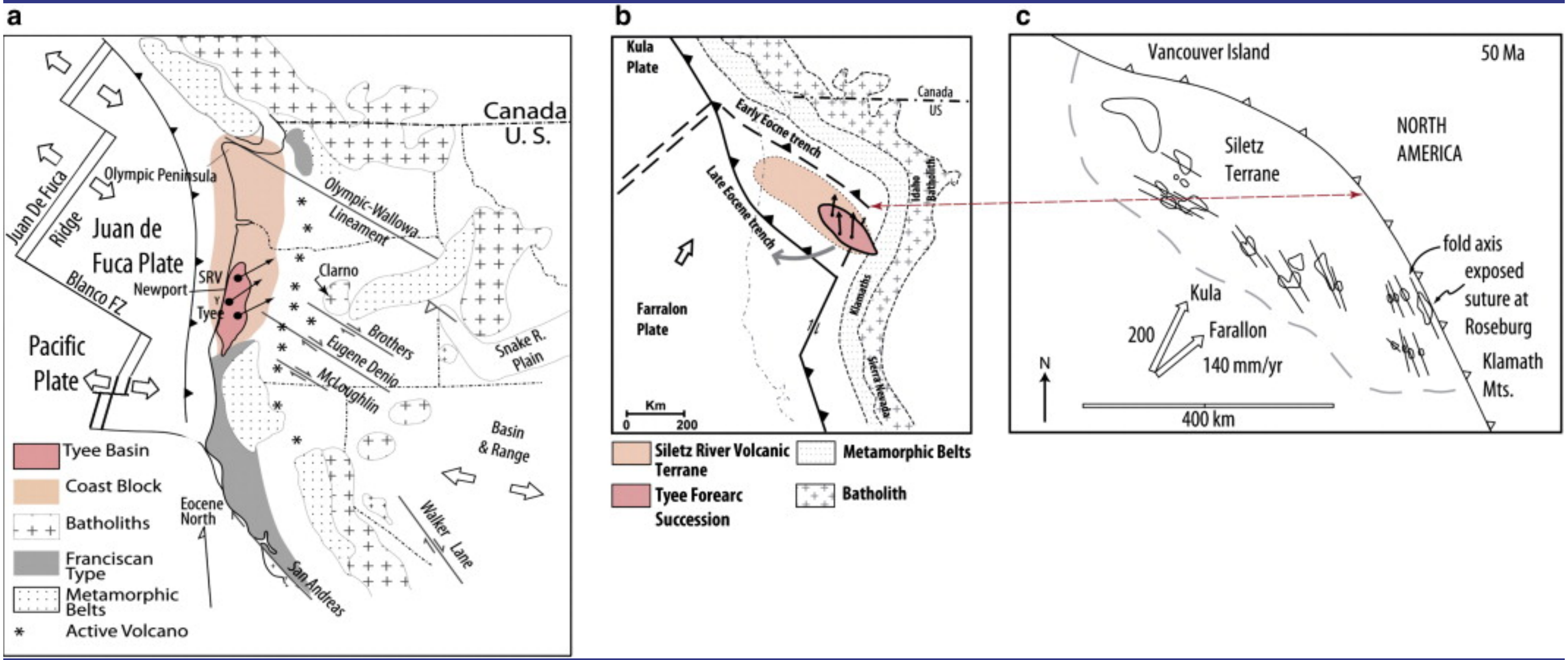


Fig. 3 Some important tectonic elements of the present-day western North America and a model for accretion and post-Early Eocene rotation of Siletz River Volcanics (SRV).

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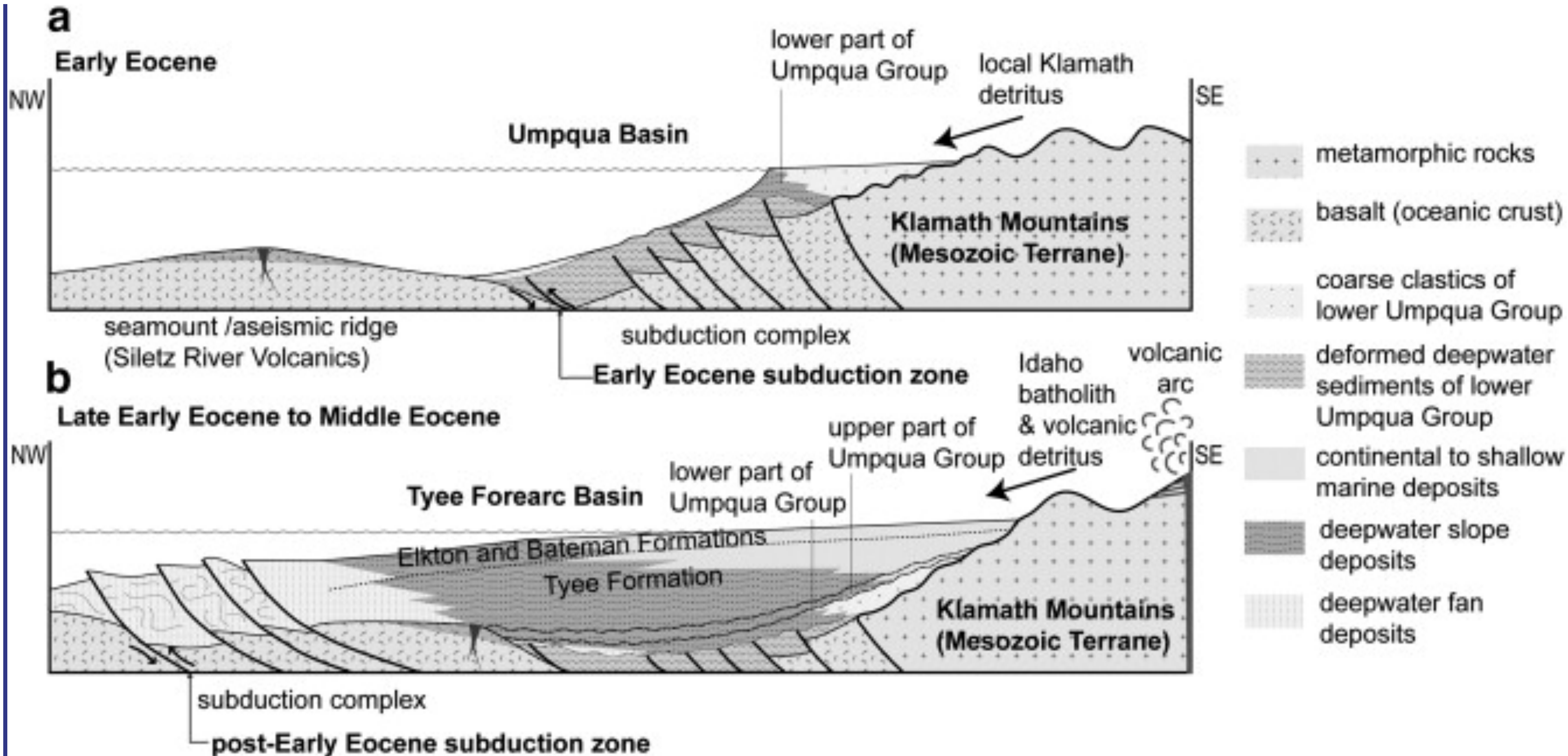

Fig. 4 Depo-tectonic model for the Tyee forearc Basin. a. Early Eocene subduction and deposition of the Umpqua Group. b. Arresting of subduction along early Eocene trench and formation of a new subduction zone in late Early Eocene

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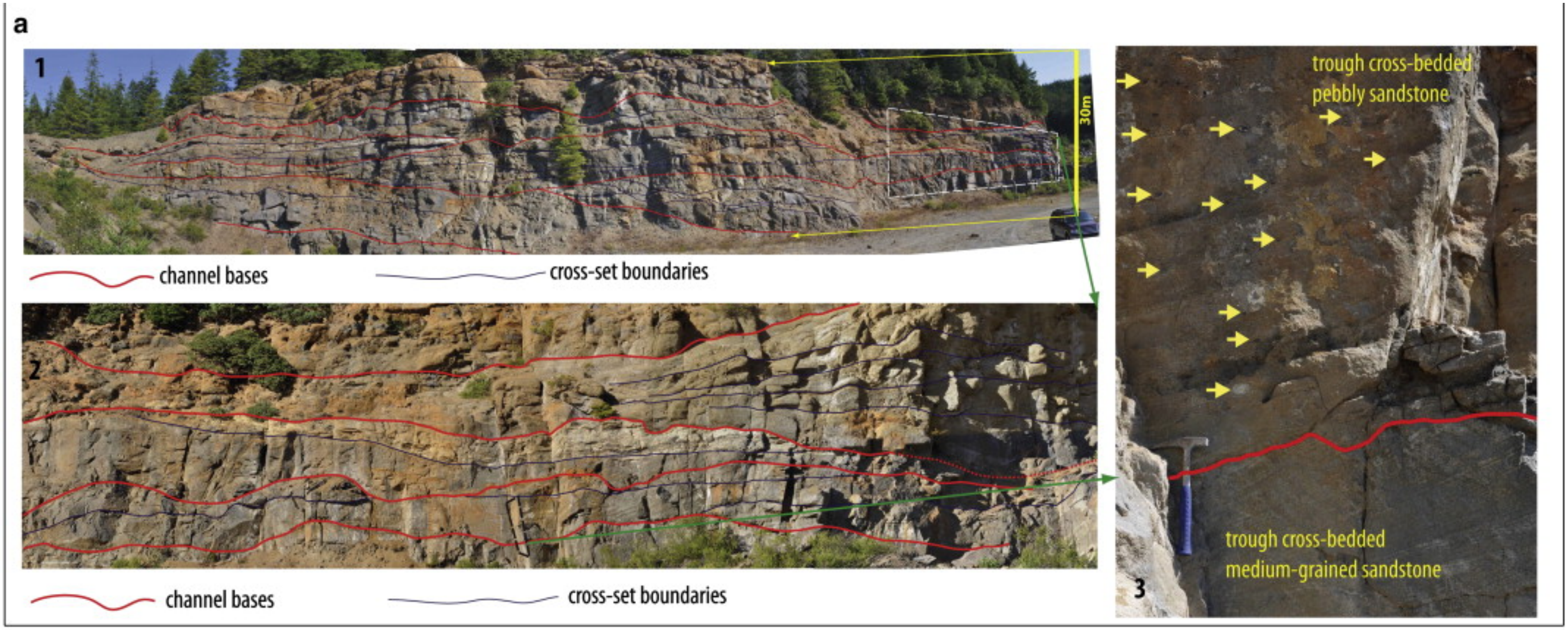

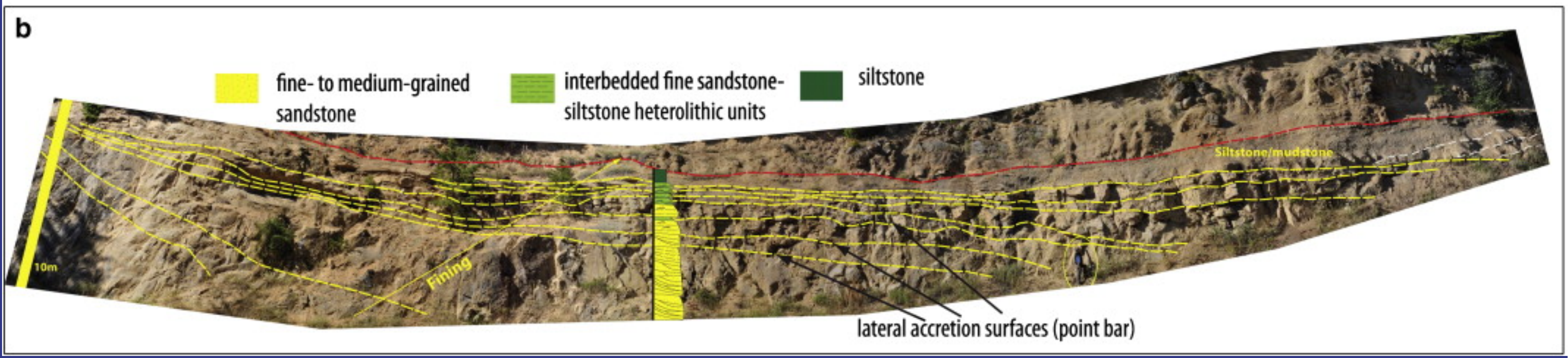

Fig. 9 Outcrop examples of fluvial deposits — southern Tyee Forearc Basin; coarse-grained braided river deposit with pebbles (Fig. a-1, 2, 3), and fining upward pointbar deposits with associated muddy flood-plain deposits (panel b).

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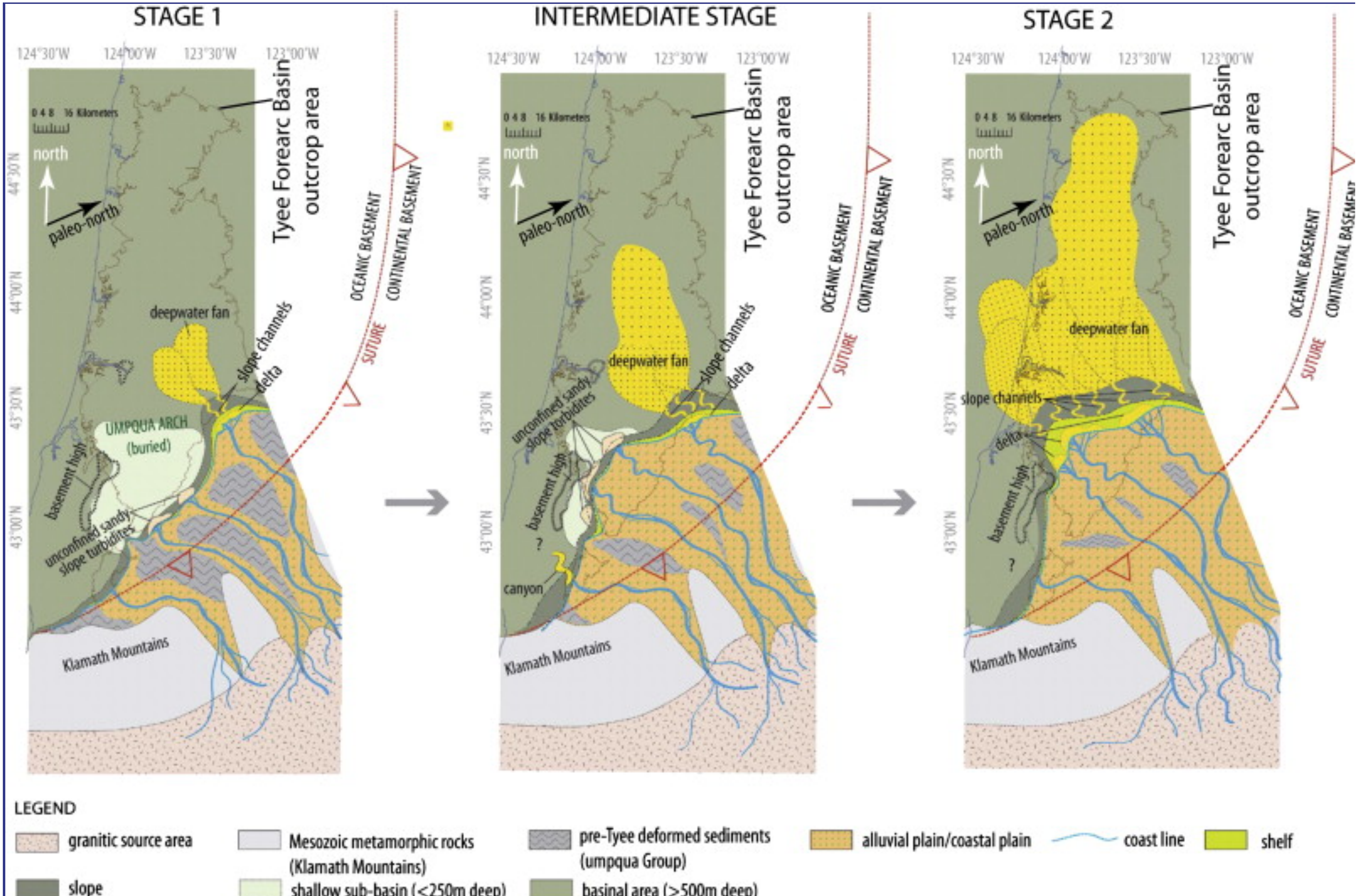

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Sheep Mountain
Eocene John Day Formation

Painted Hills, OR

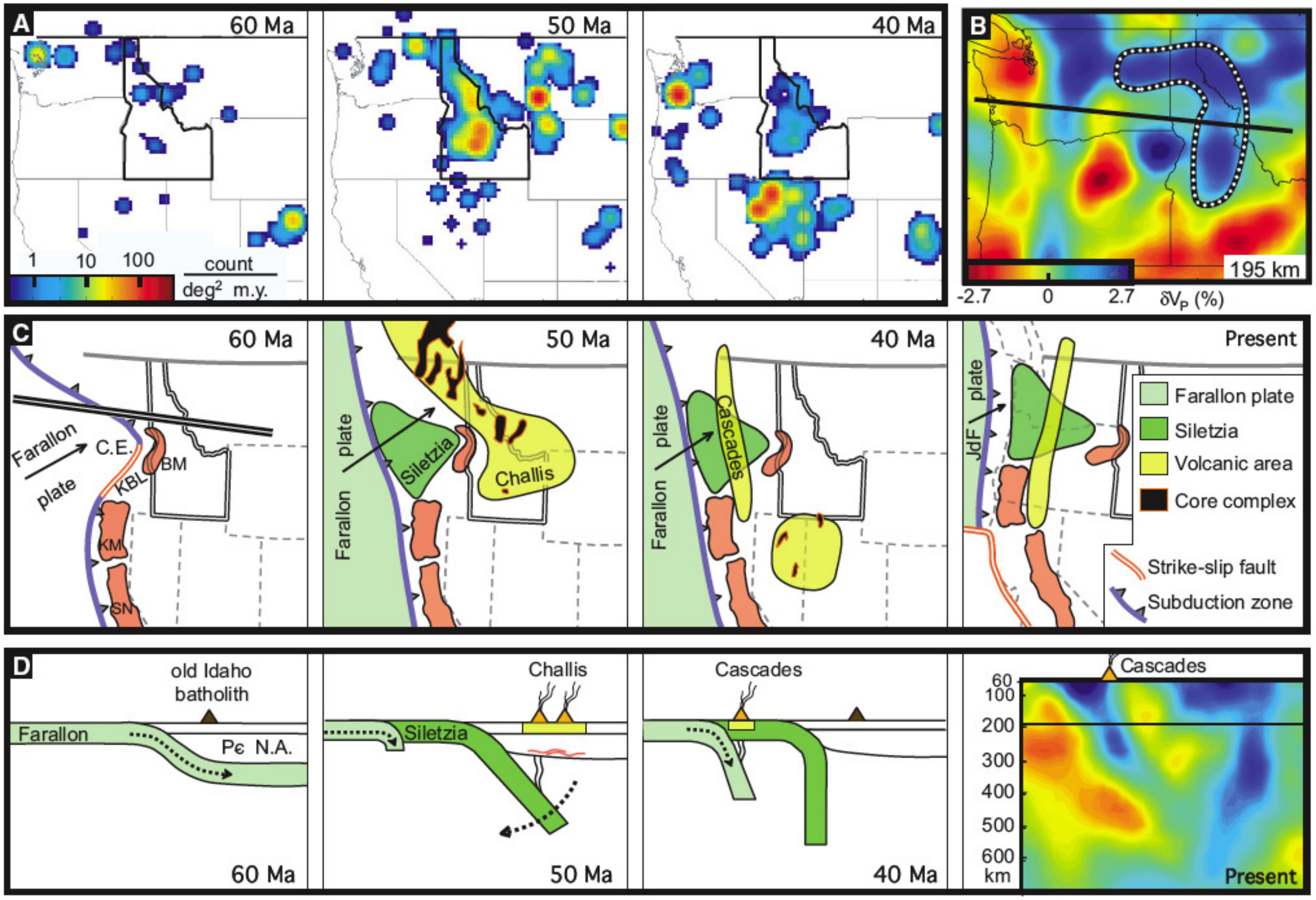


Figure 2. Maps and cross sections of northwestern United States at 60, 50, 40, and 0 Ma. Border of Idaho is highlighted. A: Maps showing density of reported dated igneous rocks from NAVDAT (North American volcanic and intrusive rock database; Walker et al., 2004). Data are binned in time and space (age data distributed equally over reported range, and age uncertainty >10 m.y. rejected). Results are smoothed over 50 km in space and 1 m.y. in time. Large dynamic range requires log scale and indicates variations between lulls and flare-ups. B: P-wave tomography, emphasizing correlation between imaged curtain and Challis magmatism. Dotted line—Siletzia curtain outline. Dark line—location of cross-section A–A′. C: Maps illustrating regional tectonic and magmatic evolution, modified after Dickinson (2006). Intact and coherent units defined by presence of Mesozoic to Cretaceous plutons and associated arc-related rocks are shown in pink; Klamath Mountains (KM), Blue Mountains (BM), and Sierra Nevada (SN). Prior to accretion, 60 Ma, Klamath–Blue Mountains lineament (KBL) is shown as transform boundary (Riddihough et al., 1986). At 60 Ma Farallon plate subducted to northeast in Columbia Embayment (C.E.). Siletzia accreted and subduction stepped west ca. 55–53 Ma, and by 50 Ma Challis magmatism was strong (JdF—Juan de Fuca). D: Cross sections (along B–B′ shown in C, left panel) show our interpretation of subduction history. At 60 Ma, Farallon slab subducts flat against Precambrian (Pє) North America (N.A.). Then, shortly after Siletzia accretion (50 Ma), Cascadia subduction initiates and abandoned, previously flat Farallon slab rolls back, exposing basal North America and Farallon crust to inflowing asthenosphere, causing melting. Event is over by 40 Ma, and little has changed to present, represented by tomography cross section, A–A′.

Schamdt and Humphreys 2011

Western Cascades:
Oligo-Miocene (?)
Sardine Formation
Eagle Creek Formation

Western Cascades

Sandy River Glacier Volcano, buried by Mt Hood

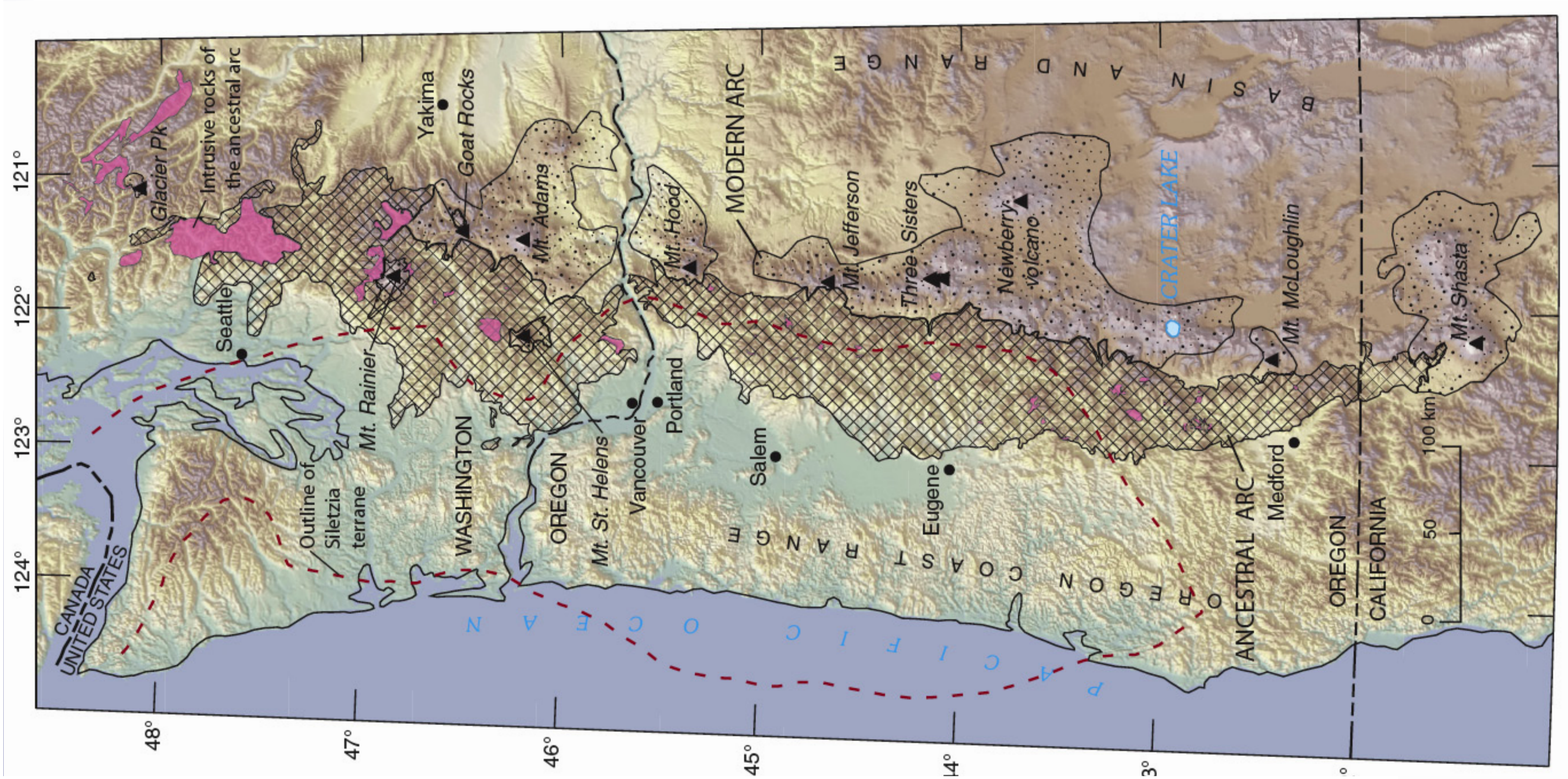
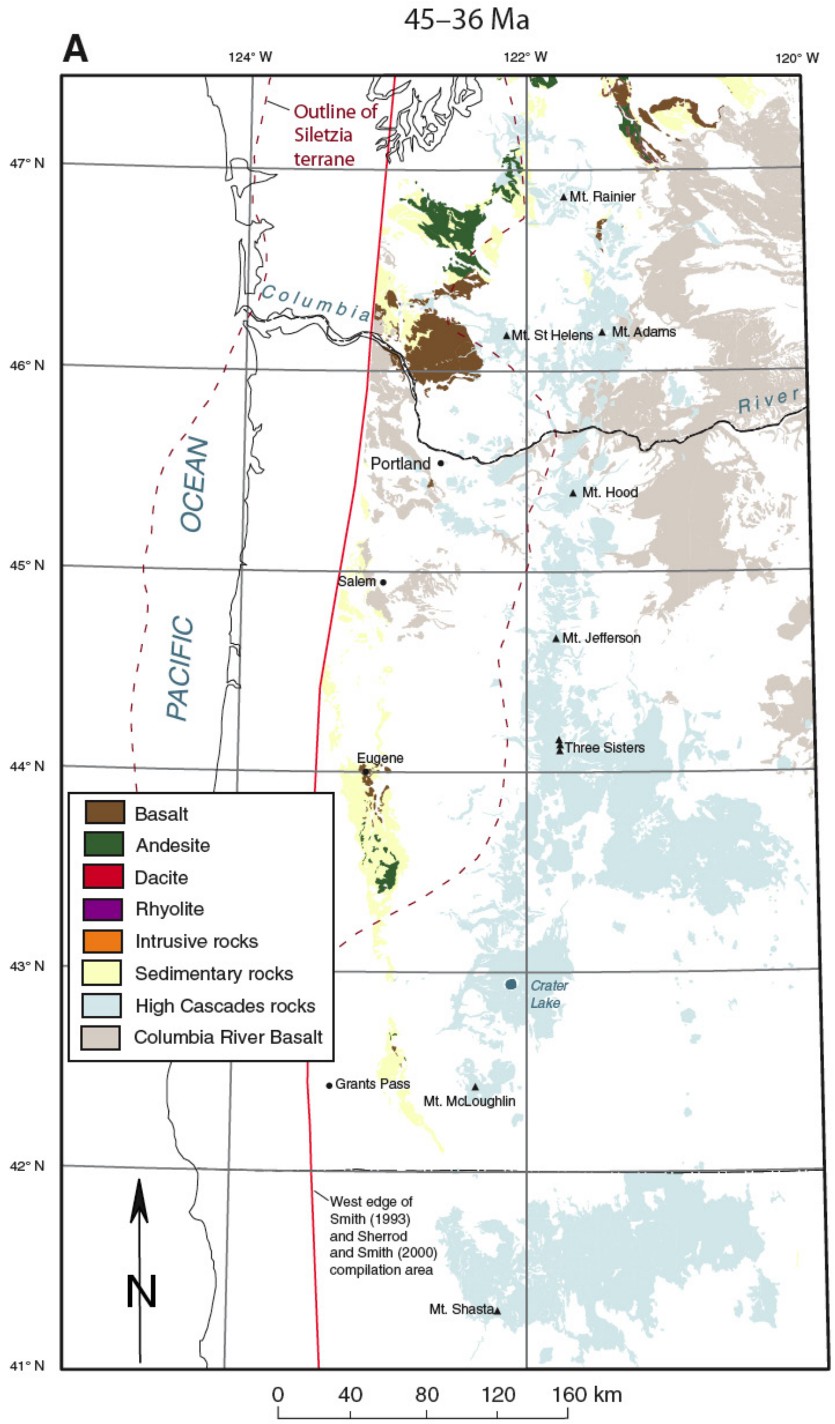
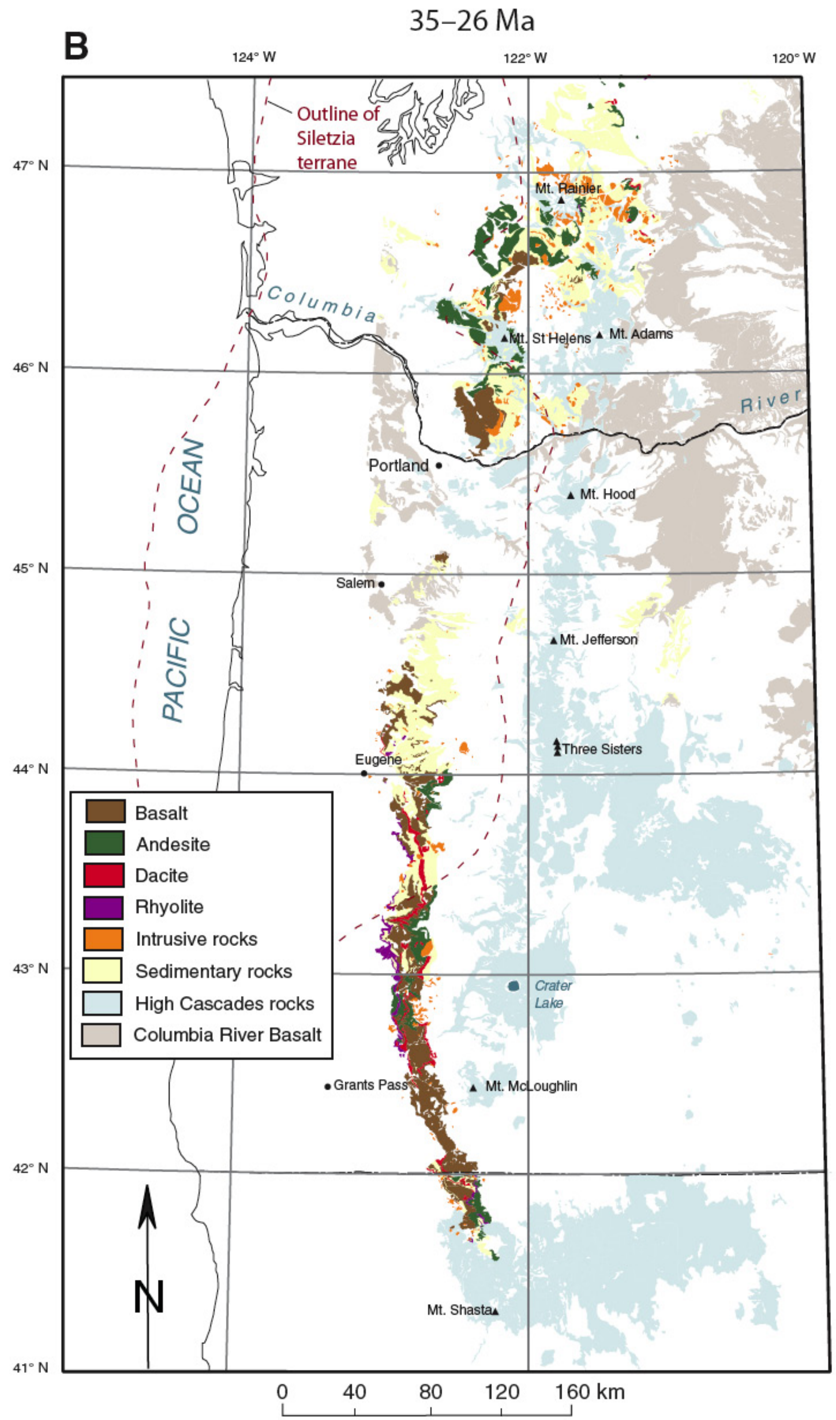


TABLE 1. GENERALIZED CHARACTERISTICS OF THE ANCESTRAL CASCADES ARC, WASHINGTON, OREGON, AND NORTHERNMOST CALIFORNIA

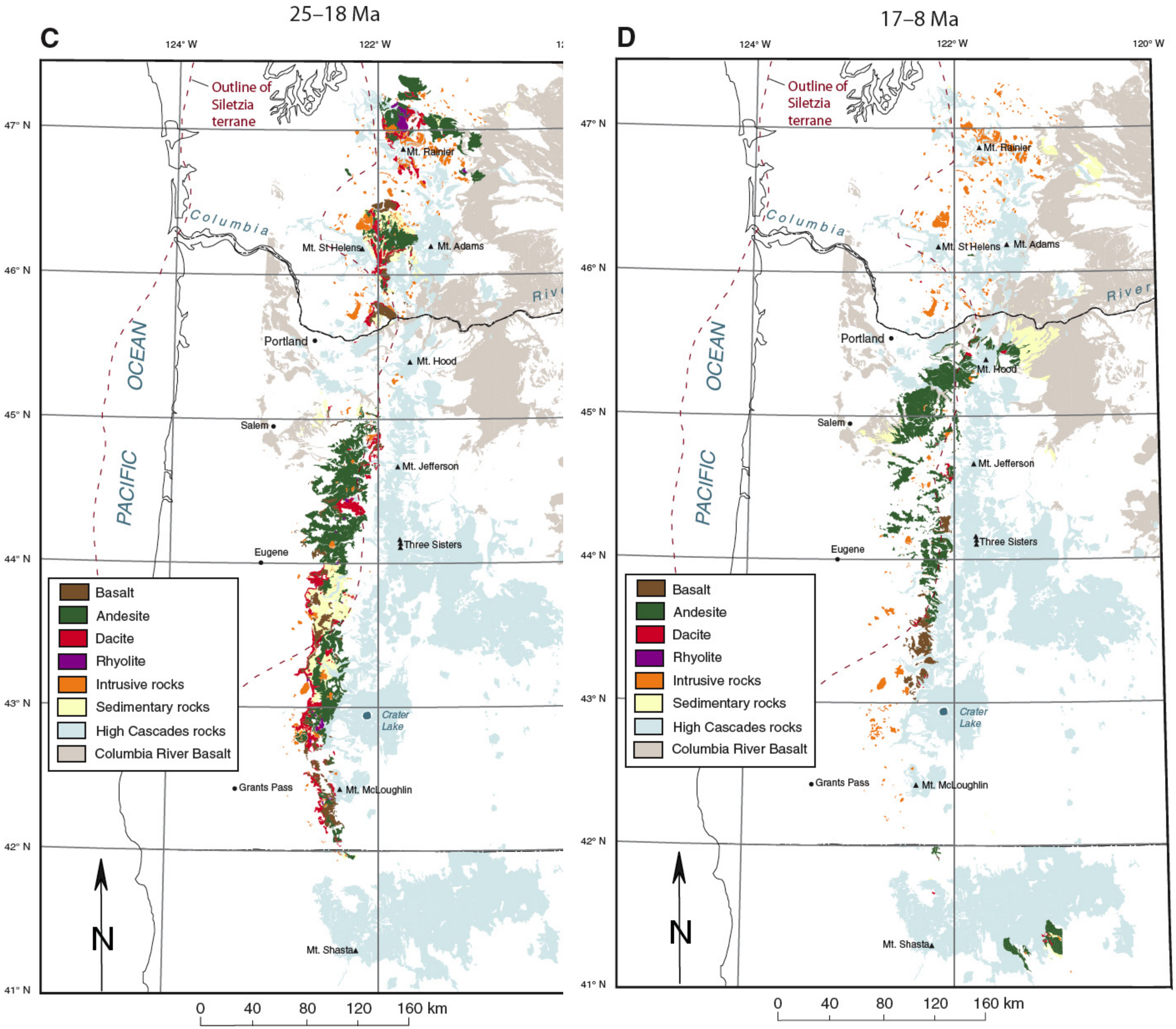
Time period (Ma)	Distribution	Relative volume	Dominant compositions	Dominant magma series	Tectonic setting	Pluton abundance	Mineral deposits
45–36	Mostly southwest Washington	Small	Basalt, basaltic andesite, andesite	Tholeiitic to calc-alkaline	Subduction, compression, slab window	Rare	Rare Cu breccia pipe deposits
35–26	Entire arc, except Mount Hood area	Moderate	Basalt, basaltic andesite, andesite	Tholeiitic to calc-alkaline	Subduction, compression	Sparse	Rare Cu breccia pipe deposits
25–18	Entire arc, except Mount Hood area and northern California; slight eastward axis shift	Large	Basaltic andesite, andesite, dacite, rhyolite	Tholeiitic to calc-alkaline	Subduction, compression north of Columbia River and extension to the south	Common	Common porphyry Cu and related deposits; rare epithermal Au-Ag deposits
17–8	Oregon arc segment	Small	Basaltic andesite, andesite	Calc-alkaline	Subduction, compression north of Columbia River and extension to the south	Rare	Rare porphyry Cu and related deposits
7–4	Oregon–northern California arc segment; additional eastward axis shift	Moderate	Basalt, basaltic andesite	Calc-alkaline	Subduction, compression north of Columbia River and extension to the south	None	Rare porphyry Cu-Mo deposits

DuBray & Johnson 2011

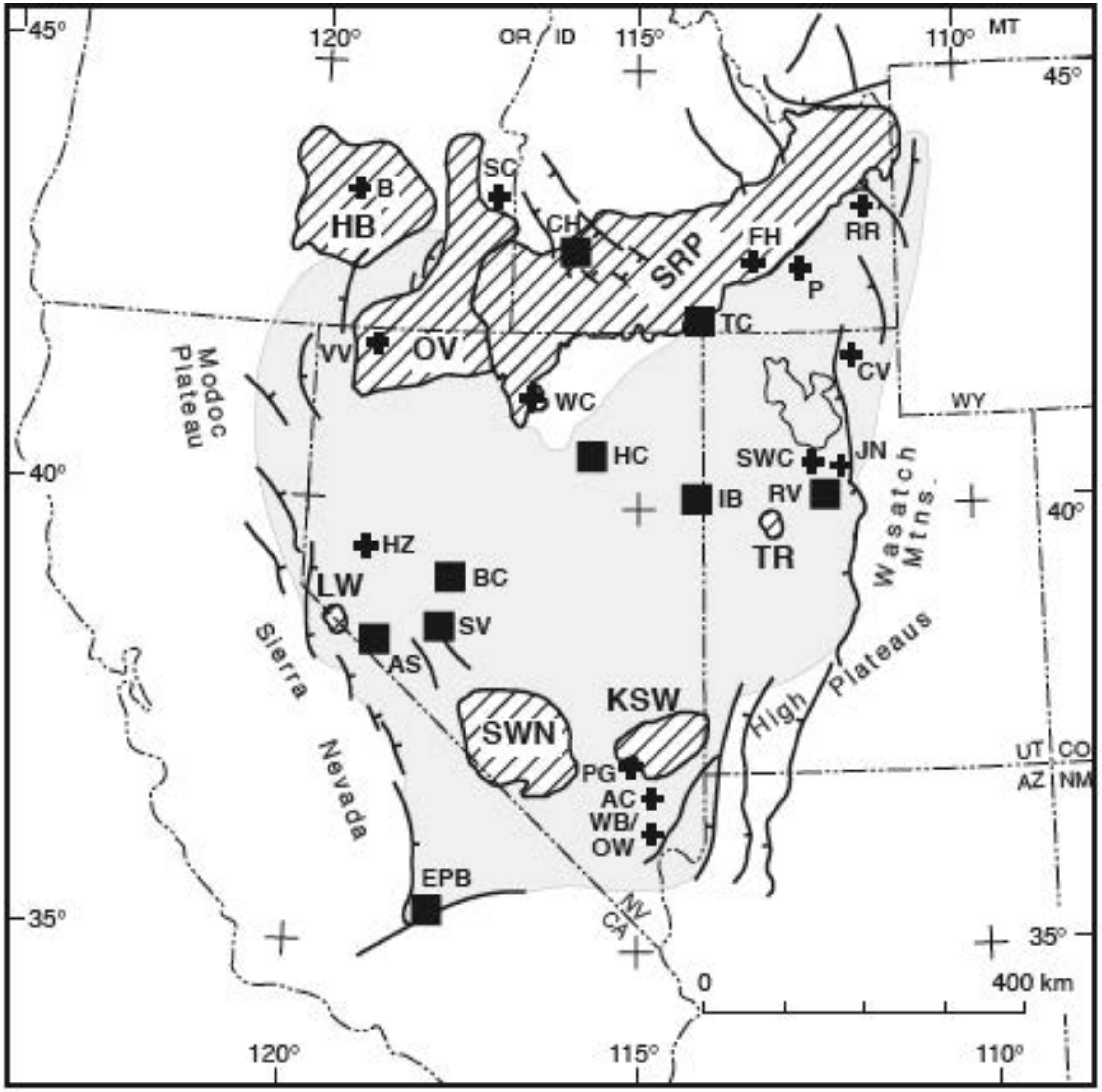




DuBray & Johnson 2011



DuBray & Johnson 2011



Miocene Silicic Volcanic Centers

Columbia River Basalt, Saddle Mountain, Coast Range

Columbia River Basalt, Mosier Anticline from south

CRB dikes in Wallow Granite

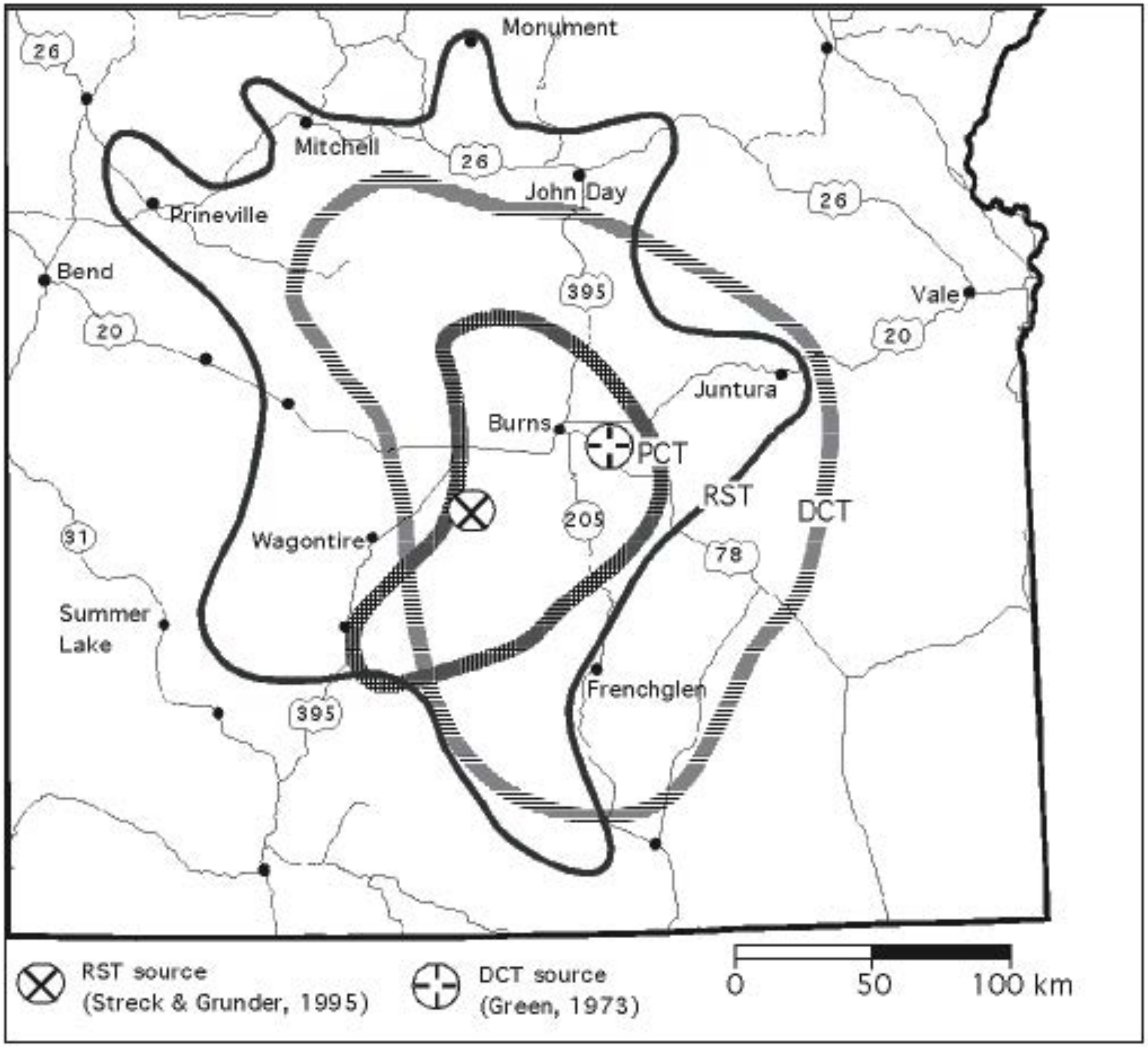


Figure 4. Inferred outlines and source areas of Harney Basin Tuffs. RST, Rattlesnake Tuff; PCT, Prater Creek Tuff; DCT, Devine Canyon Tuff. Outlines for DCT and PCT modified from Green (1973) and Walker (1979), respectively.

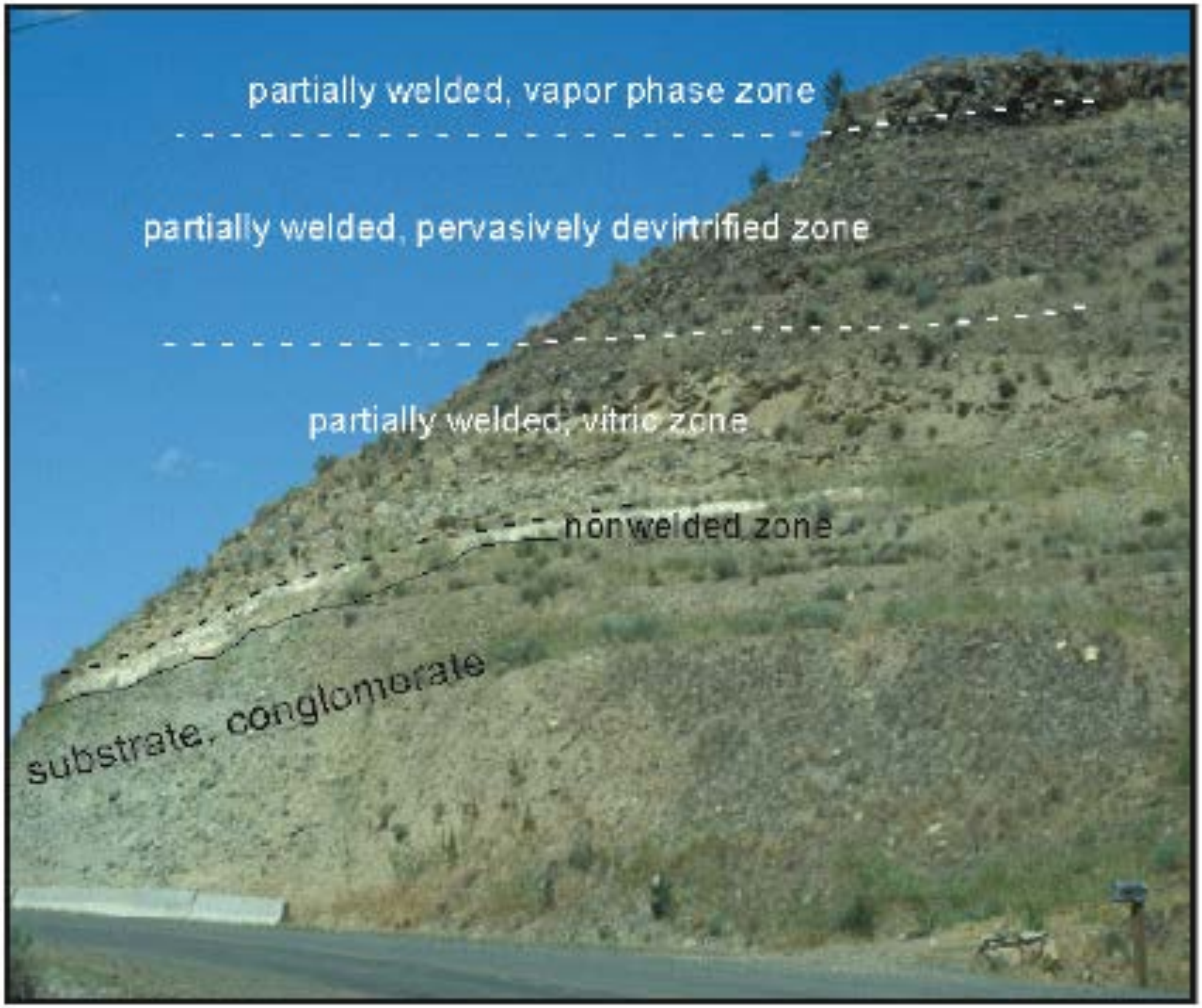


Figure 7. Outcrop stratigraphy of Rattlesnake Tuff at Stop 9.

Distal edge of Rattlesnake Tuff

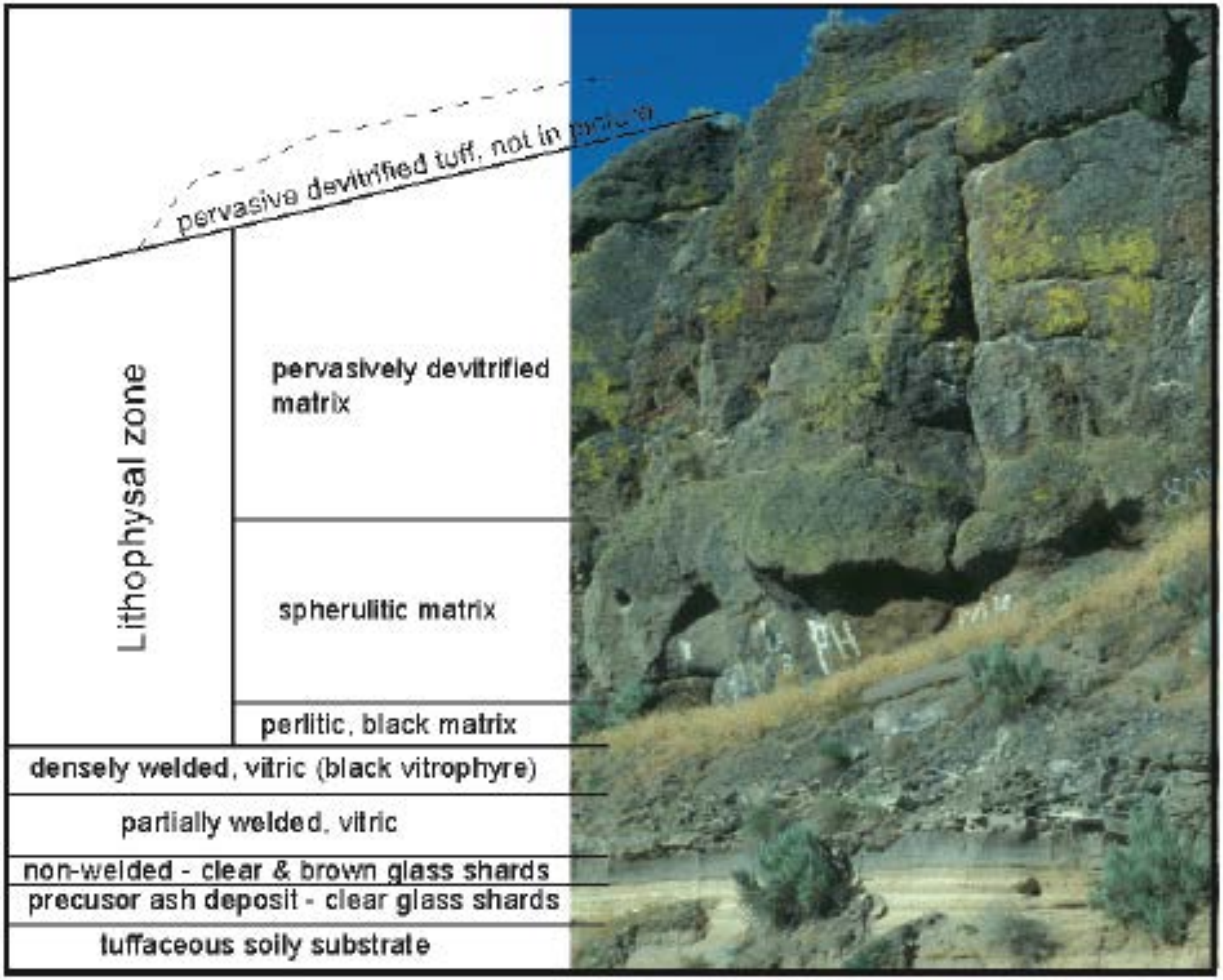
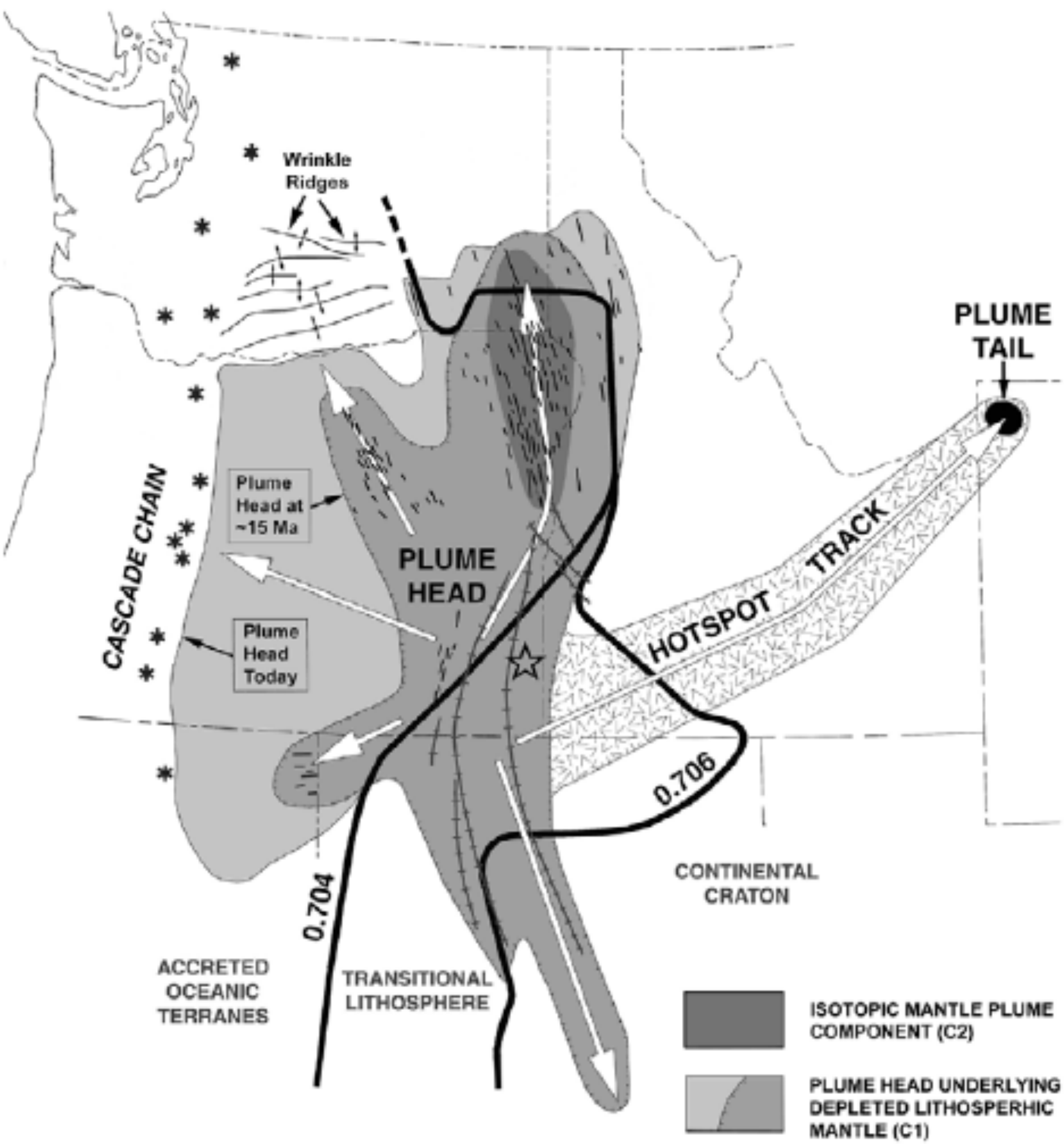


Figure 6. Outcrop stratigraphy of Rattlesnake Tuff at Stop 7.

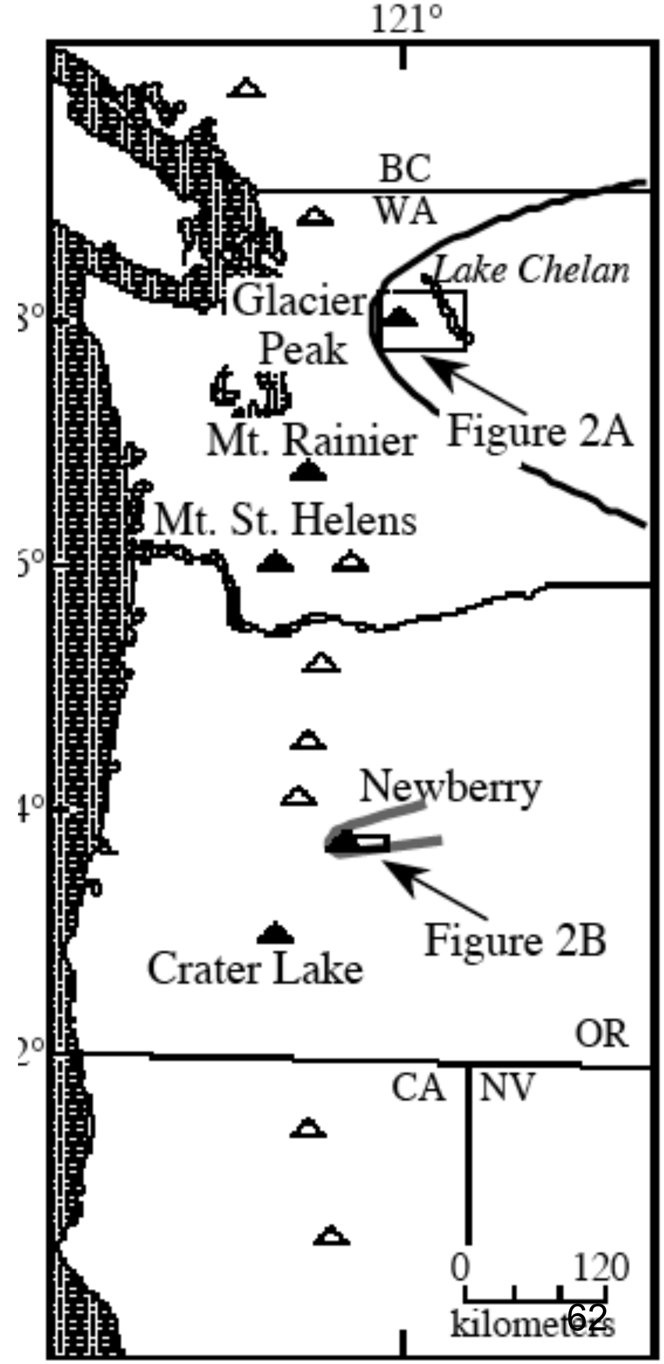
Strawberry Mountain, south of John Day,OR
Miocene composite volcano with basalt and andesite lava flows erupted from two vents.



Miocene Bi-modal Volcanism: The Plume Hypothesis

Cascade Volcanism

8 March 2005 eruption of Mount St.Helens, Washington. (USGS photo)



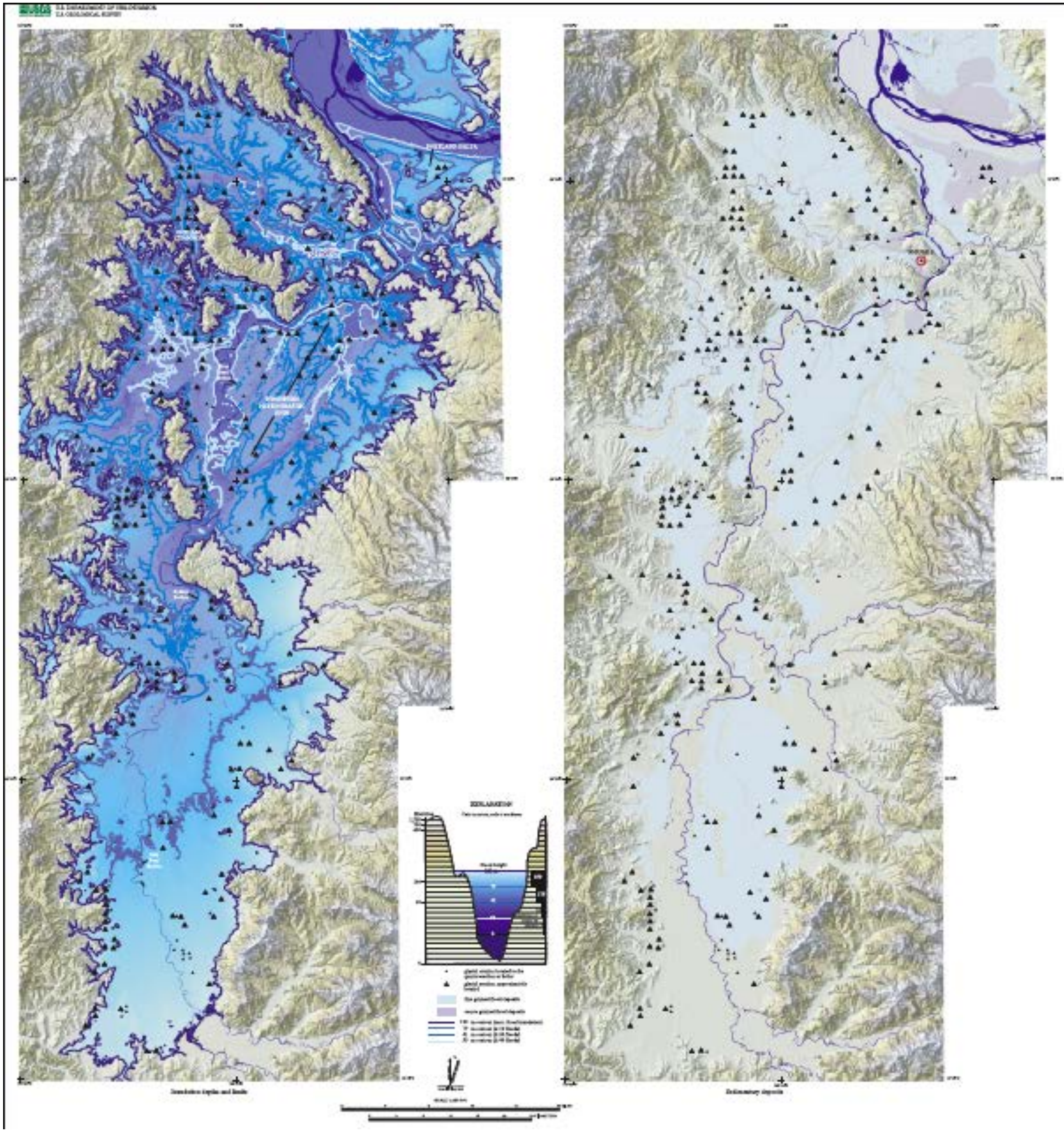
Late Miocene-Pliocene Cove Palisades plateau basalts

Cascade lavas east of I-5, Medford, OR

Summer Lake, Oregon
Pleistocene Lake


Alvord Lake, Oregon


Dry Falls



Missoula Flood

Innundation

Depths,

Willamette

Valley

Quaternary Volcanism

Cinder cone, Sisters Wilderness Area

Obsidian flow, Newberry volcano

Crater Lake: Mount Mazama's 6700 year old caldera

The "current" situation-an evolving plate margin