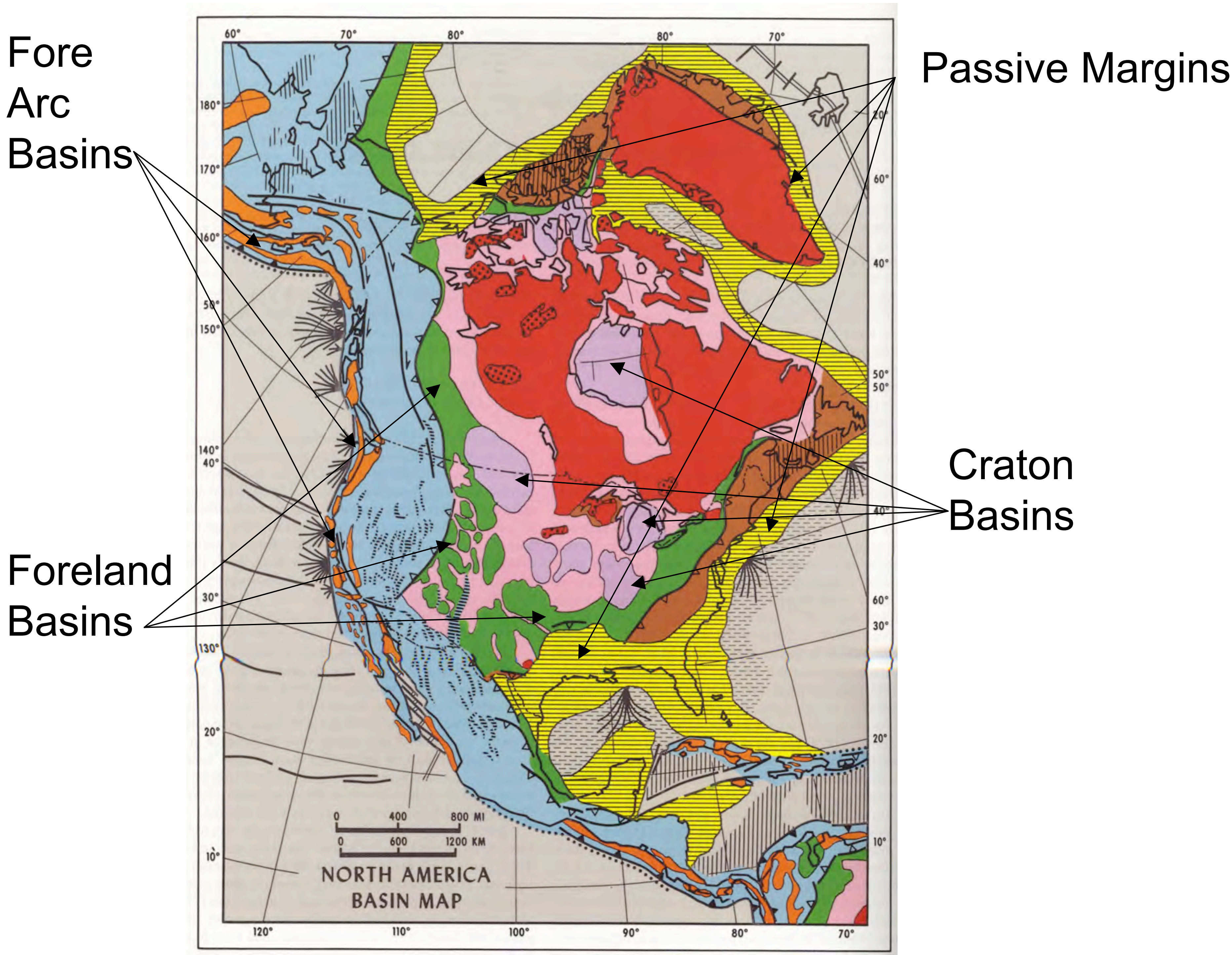

Fore Arc Basins
Passive Margins
Craton Basins
Foreland Basins
NORTH AMERICA BASIN MAP
0 400 800 MI
0 600 1200 KM

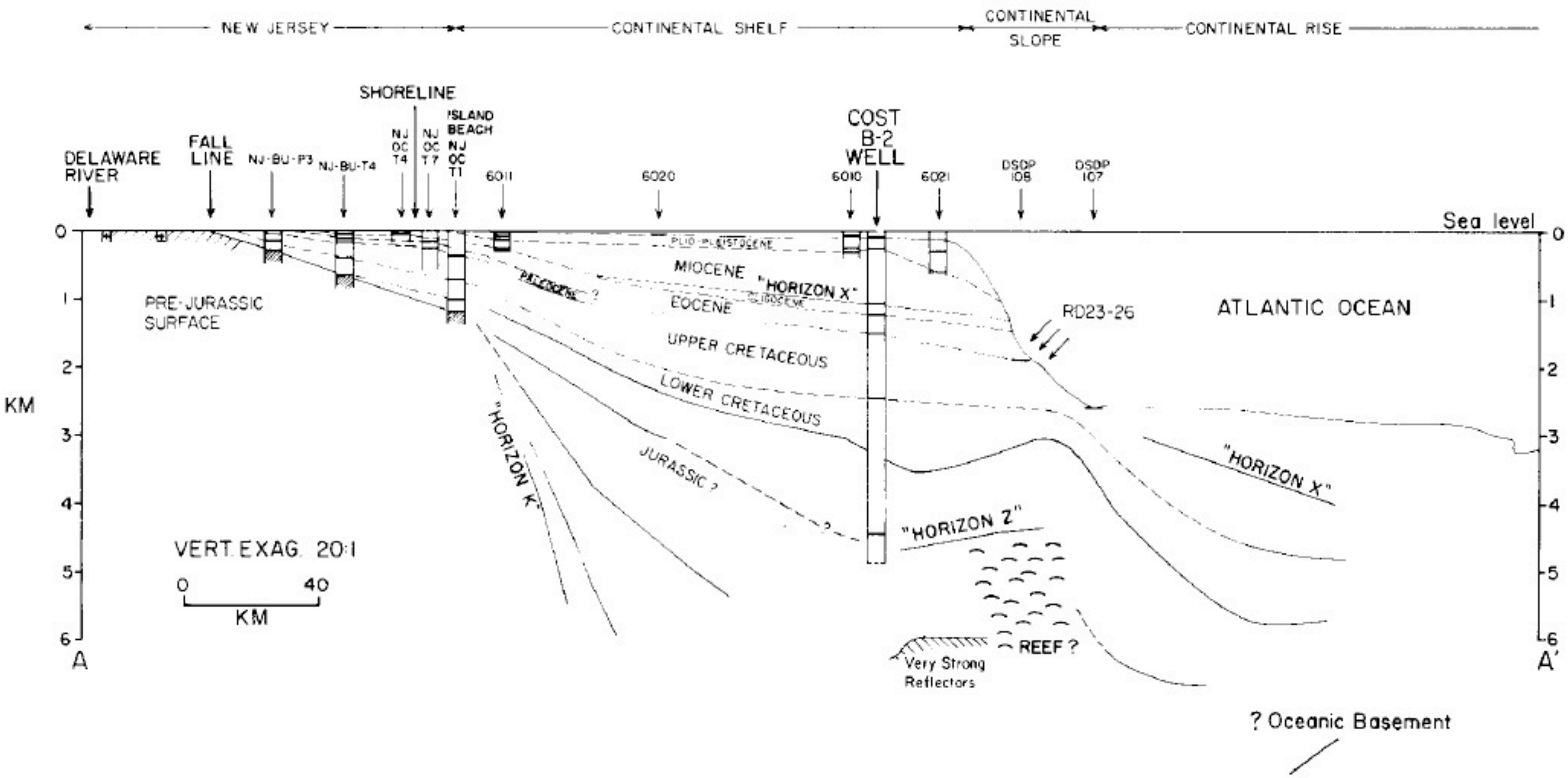
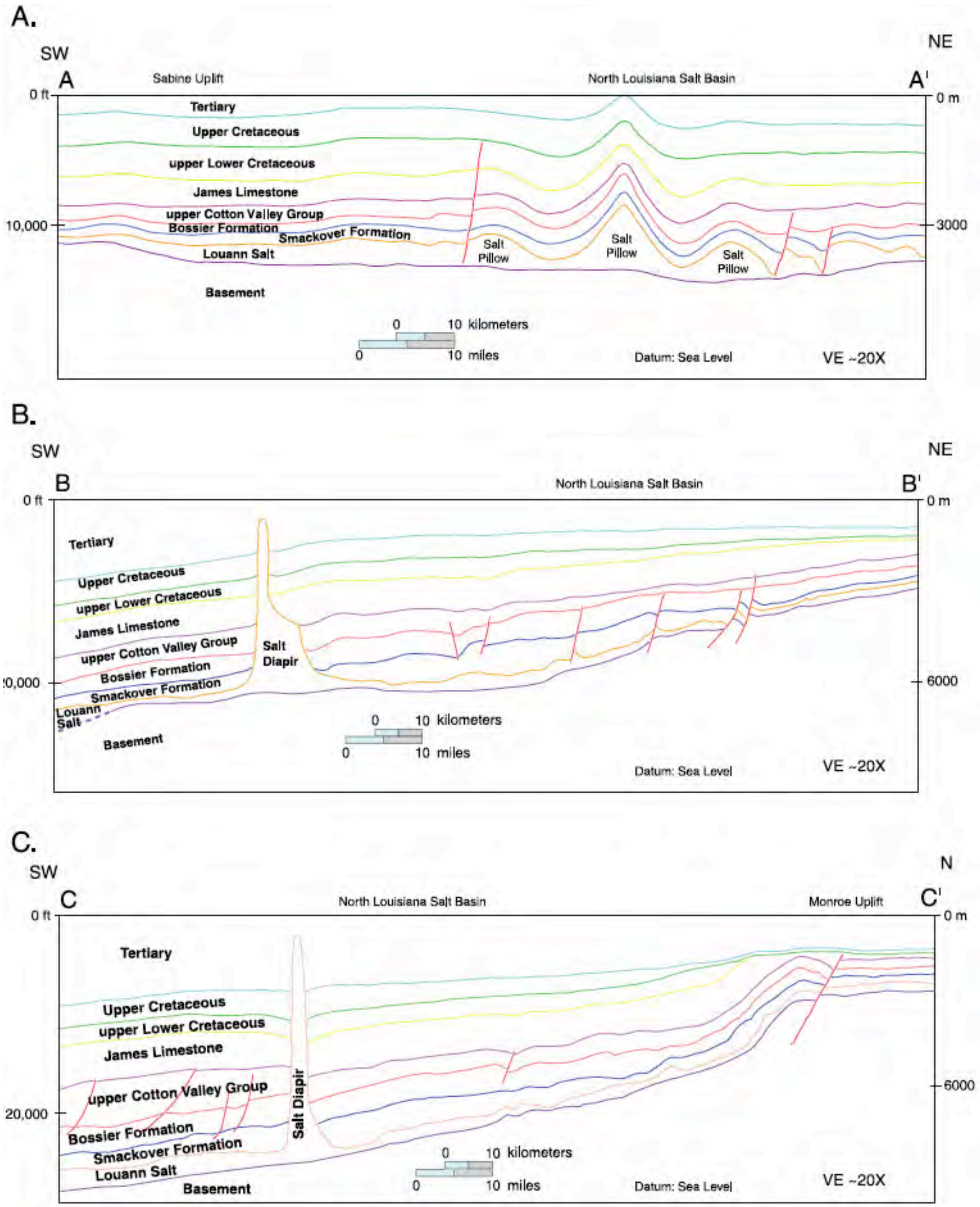


Fig. 2. Schematic cross-section of the continental shelf and margin off New York along profile *A-A'* (Fig. 1). The identification of sedimentary horizons is based mainly on the COST B-2 well and other boreholes in the shelf and margin. The continuity of sedimentary horizons between boreholes is based on the nearby multichannel Line 2 ([4]; Fig. 1). The solid lines in the cross-section are based on prominent seismic horizons summarized in fig. 11 of Schlee et al. [4].

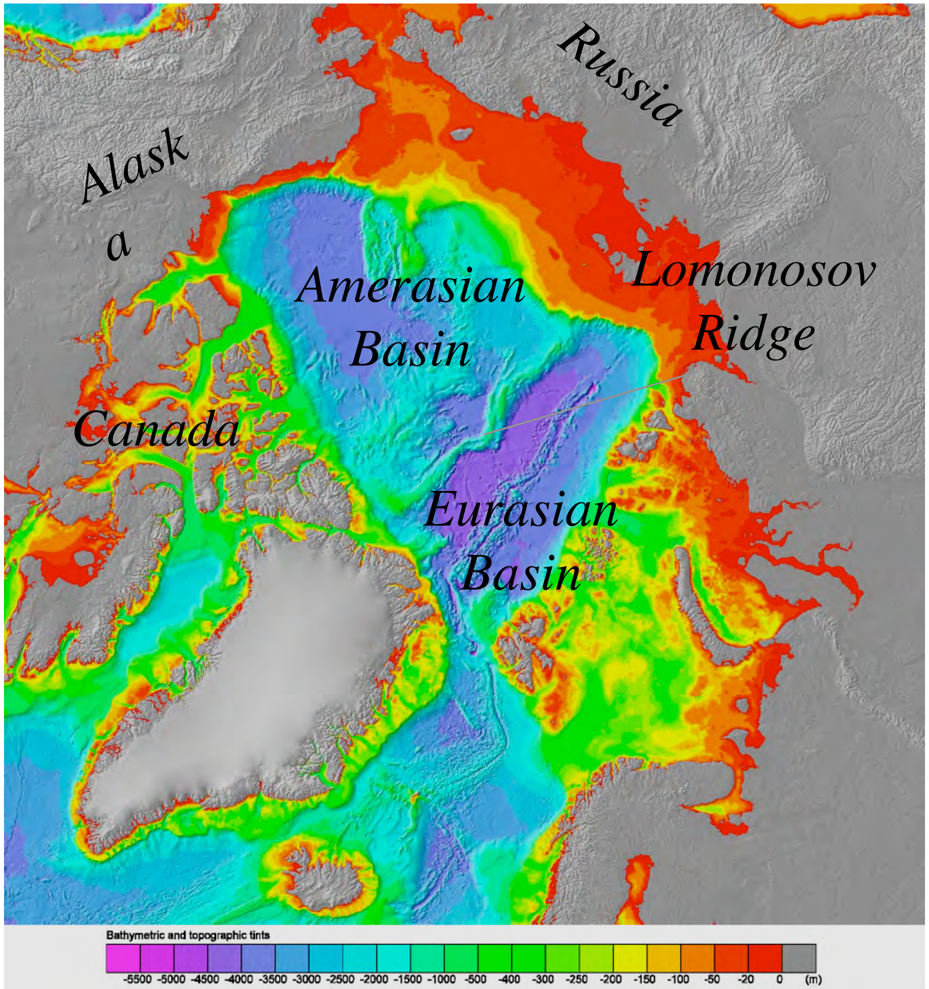
Atlantic Passive Margin

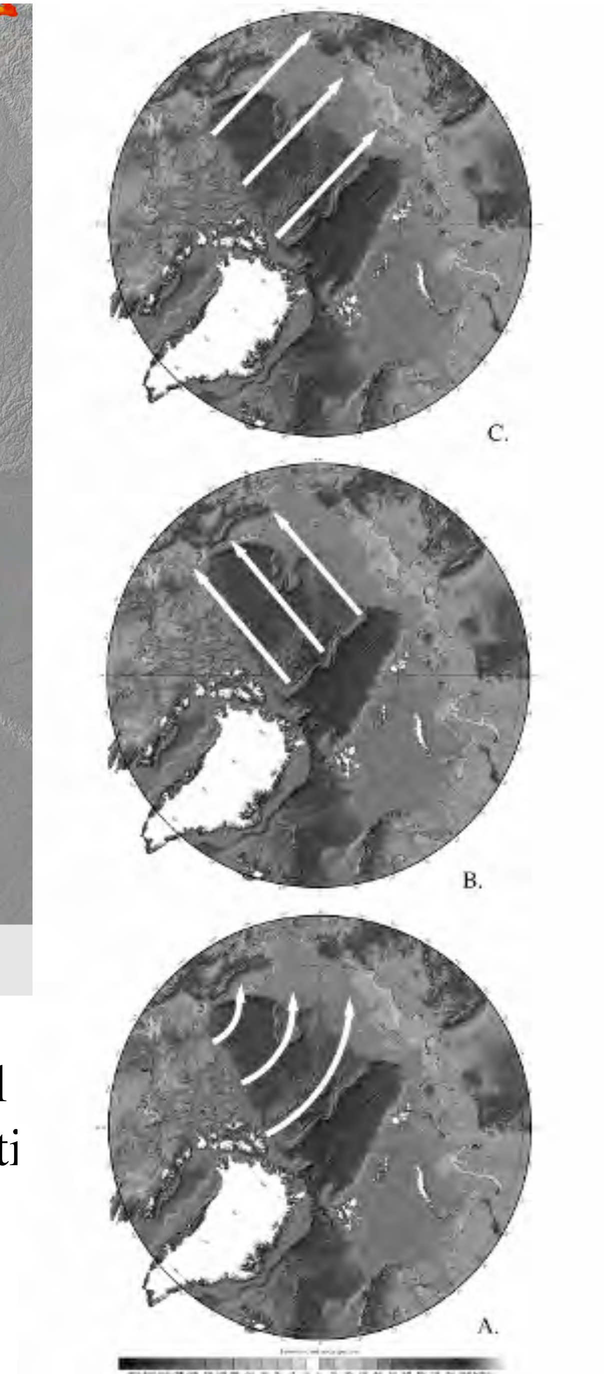
Gulf Coast Passive Margin



Mancini et al 2008

Arctic Passive Margin

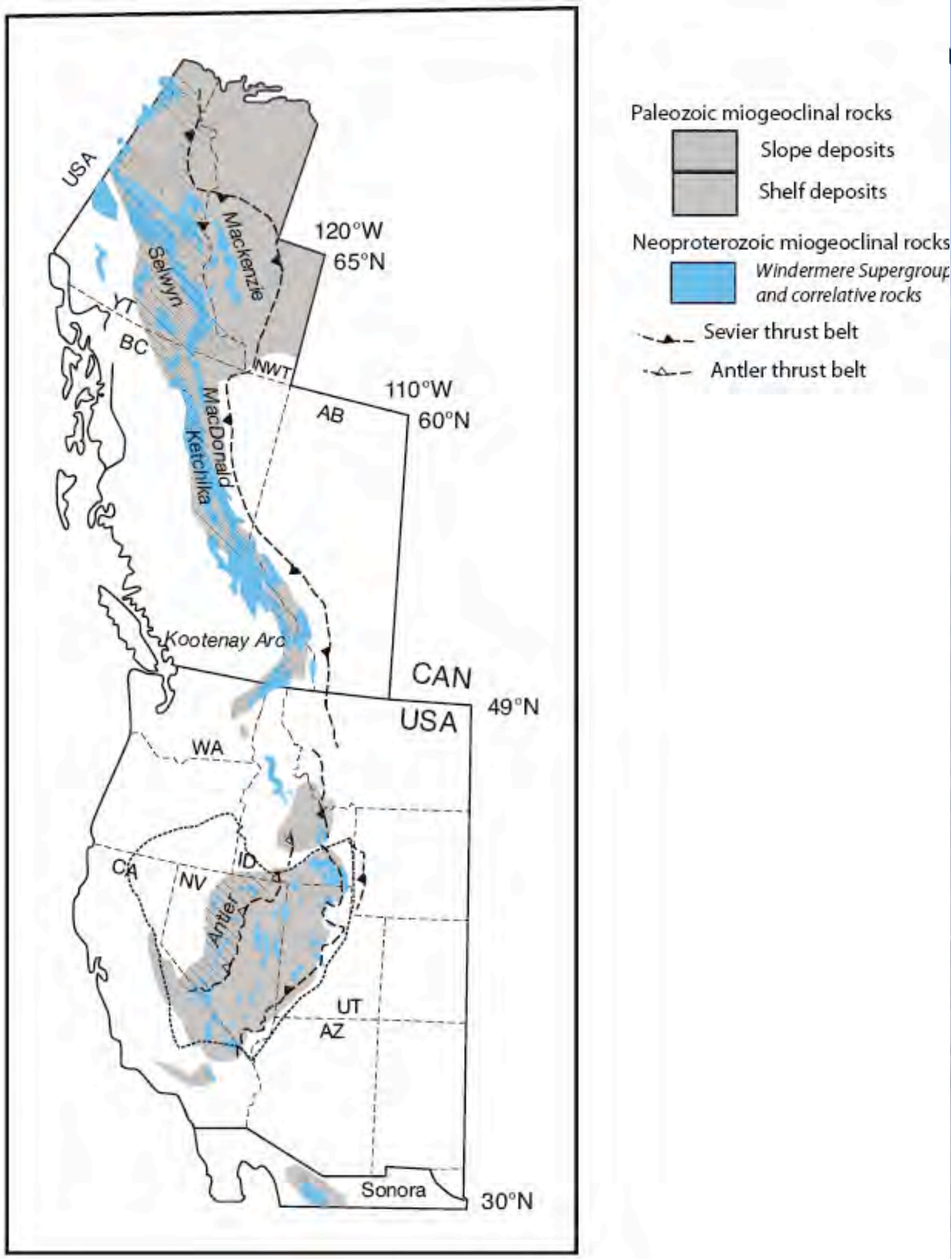


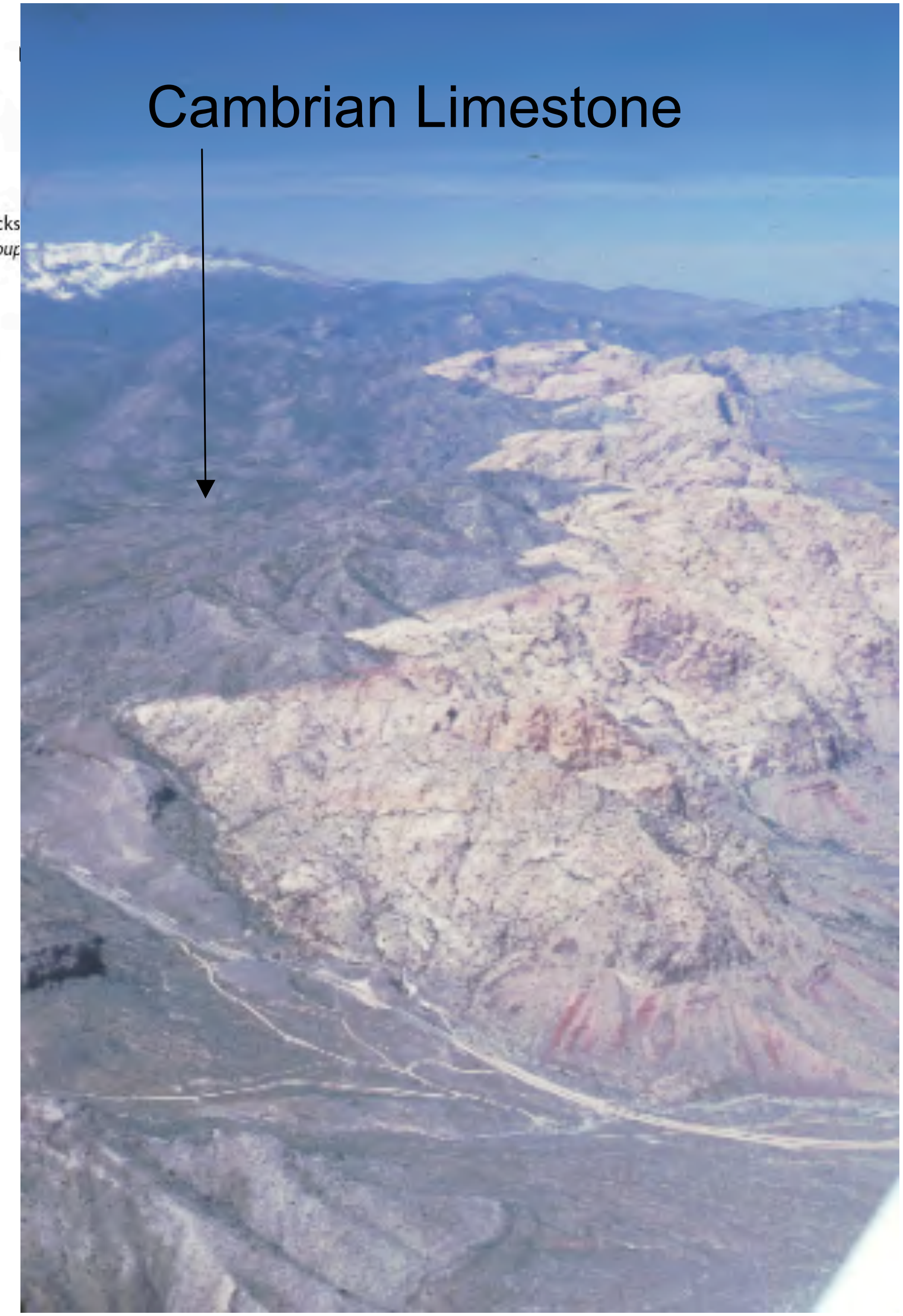


Other models proposed for the formation of the Amerasian Basin -none except the rotation model are viable for Alaska given the geologic and magneti anomaly constraints

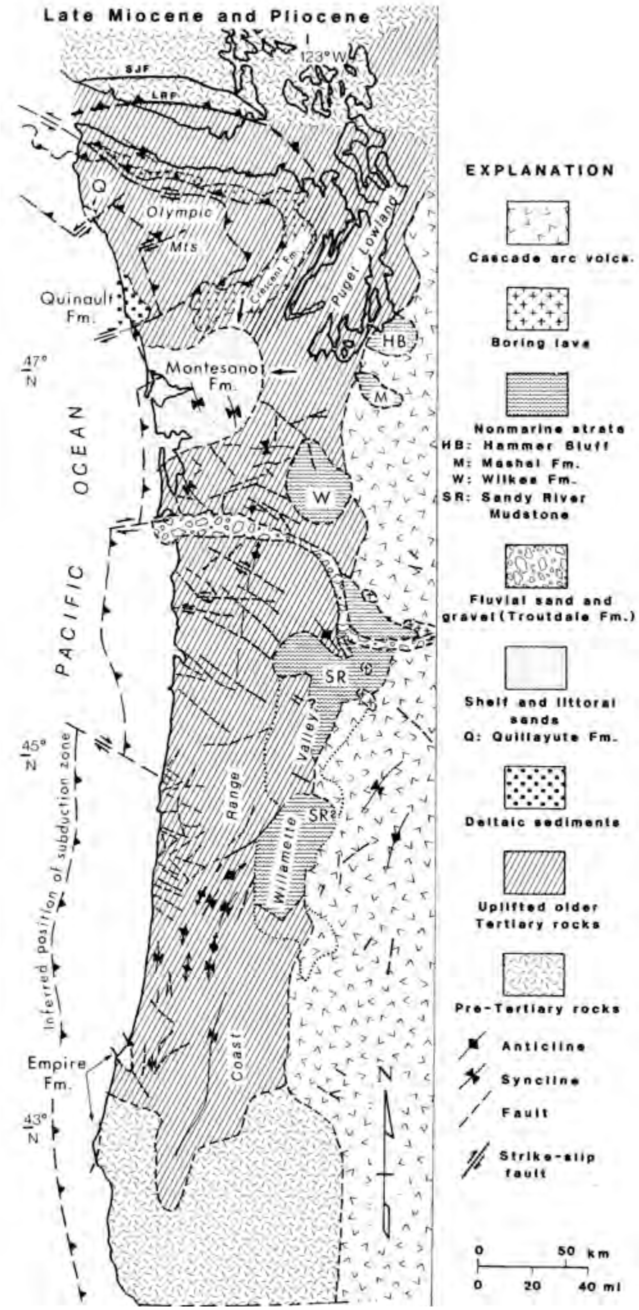
Rifting models for Amerasian Basin summarized by Lawver and Scotese (1990) with specific predictions for rift versus transform origin of marginsand the geologic matches of margins. Base map IBCAO (2000)

Slide courtesv EL Miller. Stanford


USA
Selwyn
Mackenzie
120°W
65°N
YT
BC
NWT
110°W
60°N
AB
MacDonald
Ketchika
Kootenay Arc
CAN
USA
49°N
WA
ID
CA
NV
Antler
UT
AZ
Sonora
30°N
Paleozoic miogeoclinal rocks
Slope deposits
Shelf deposits
Neoproterozoic miogeoclinal rocks
Windermere Supergroup and correlative rocks
Sevier thrust belt
Antler thrust belt

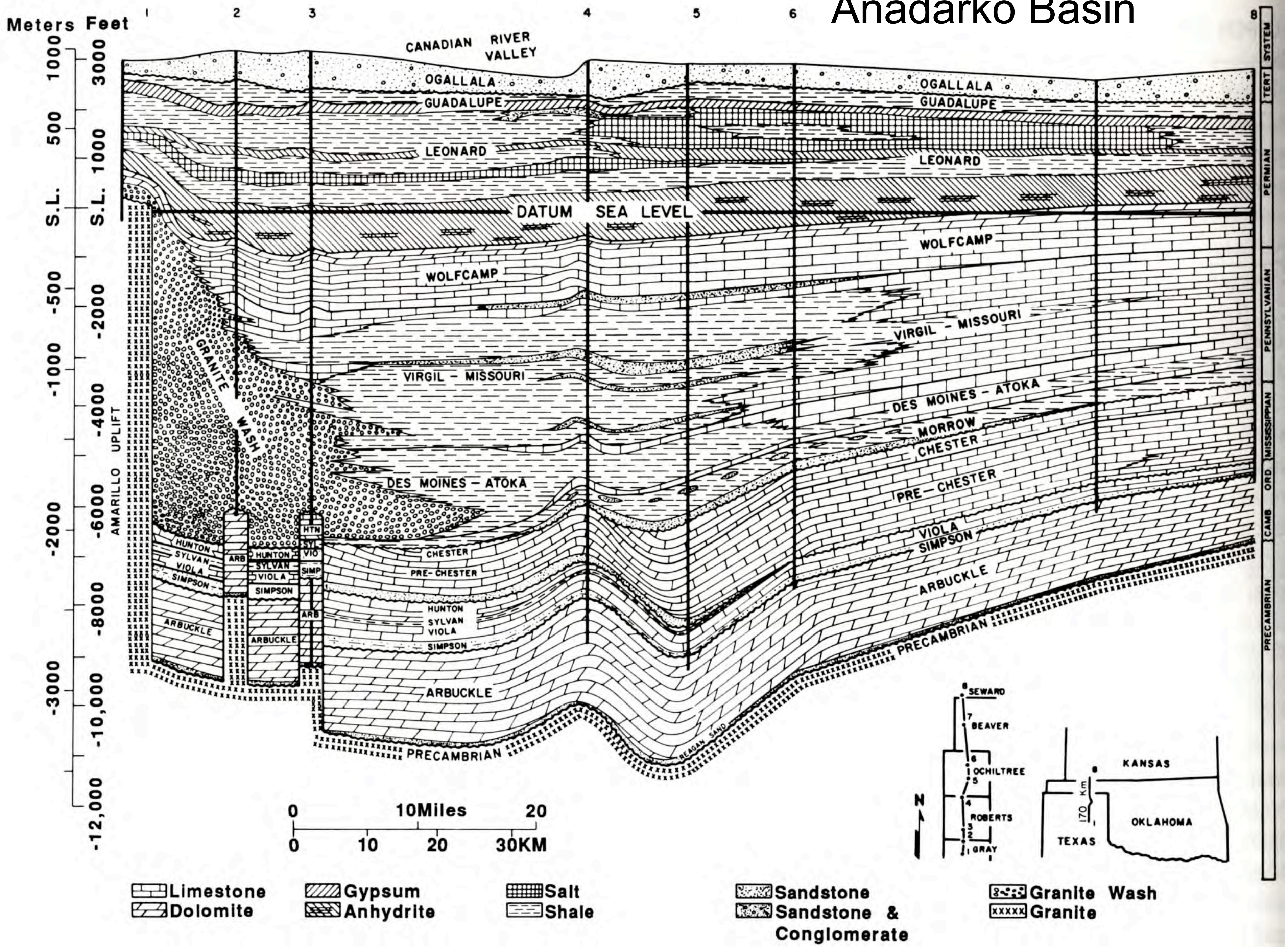

Cambrian Limestone

Cascade Fore-arc Basin



113 Puget Sound Washington

Anadarko Basin



Permian Basin: Guadalupe National Park Permian Reef

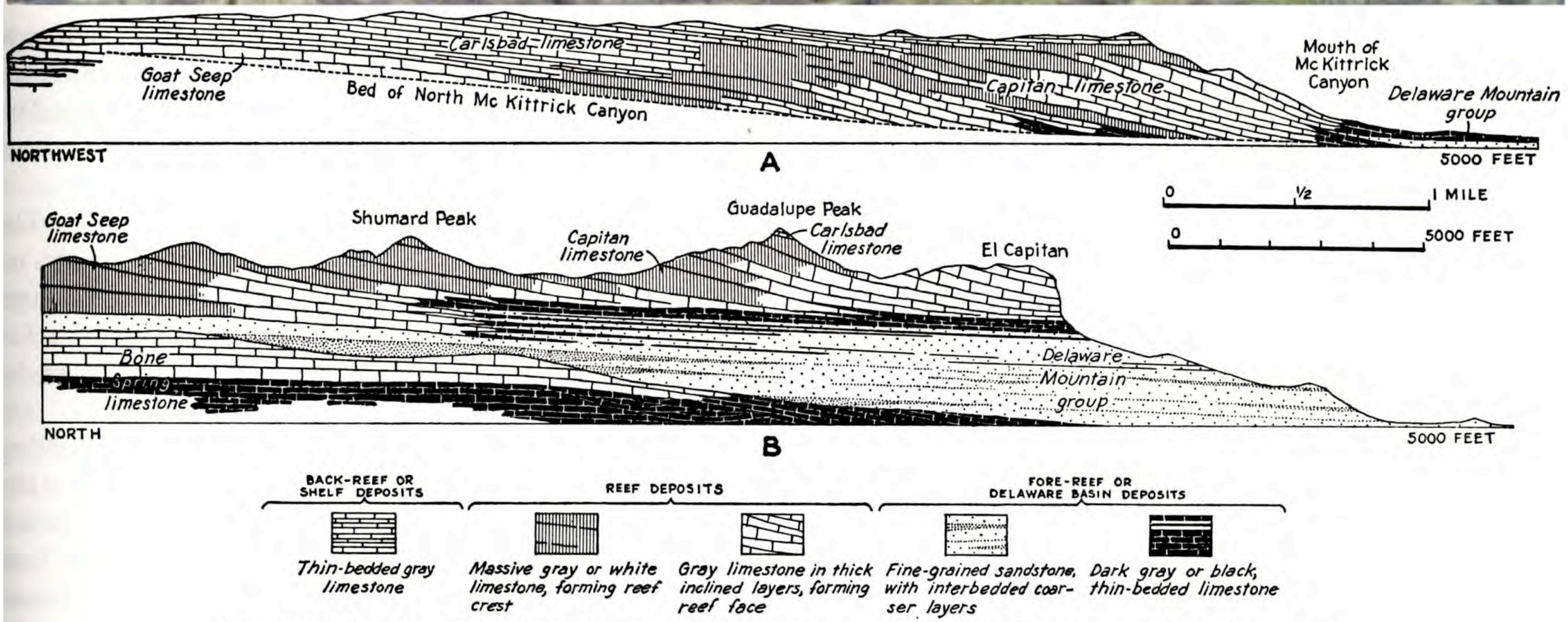
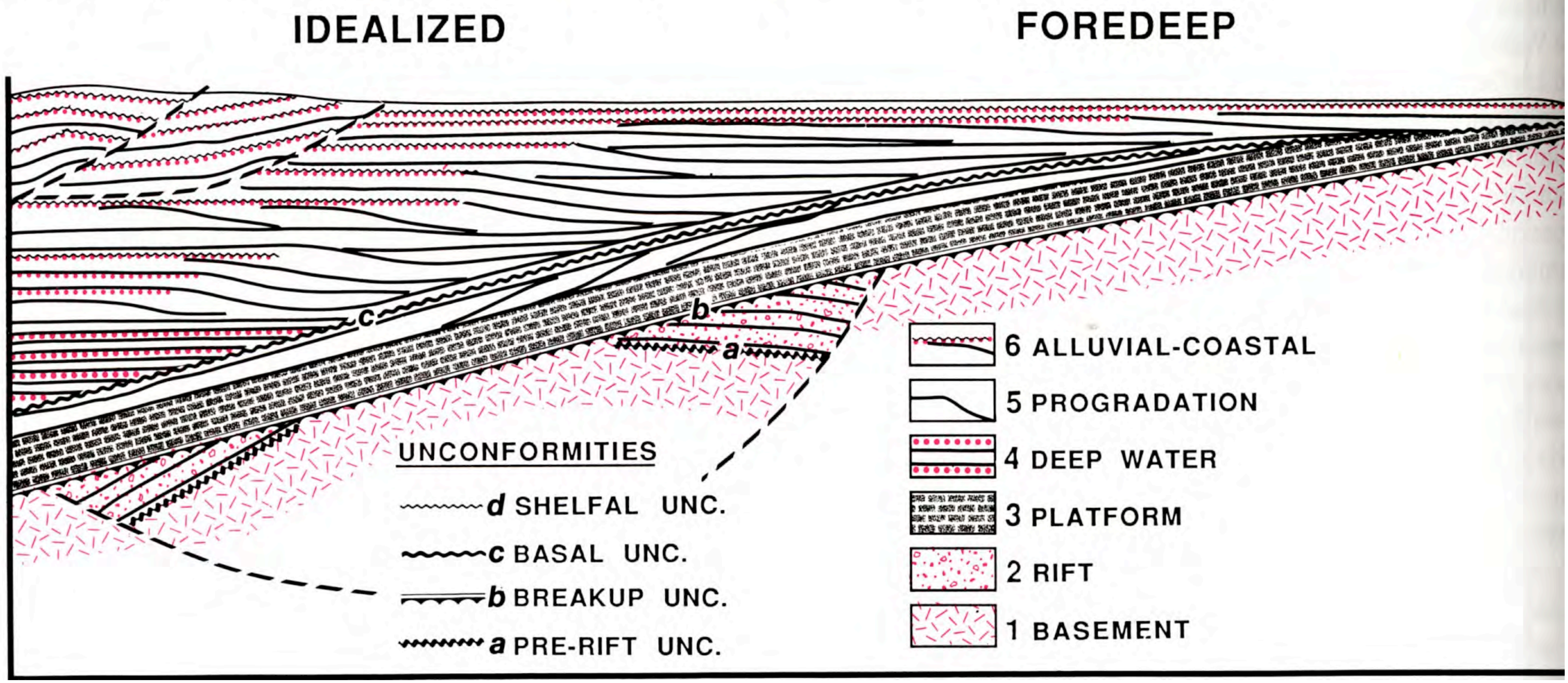
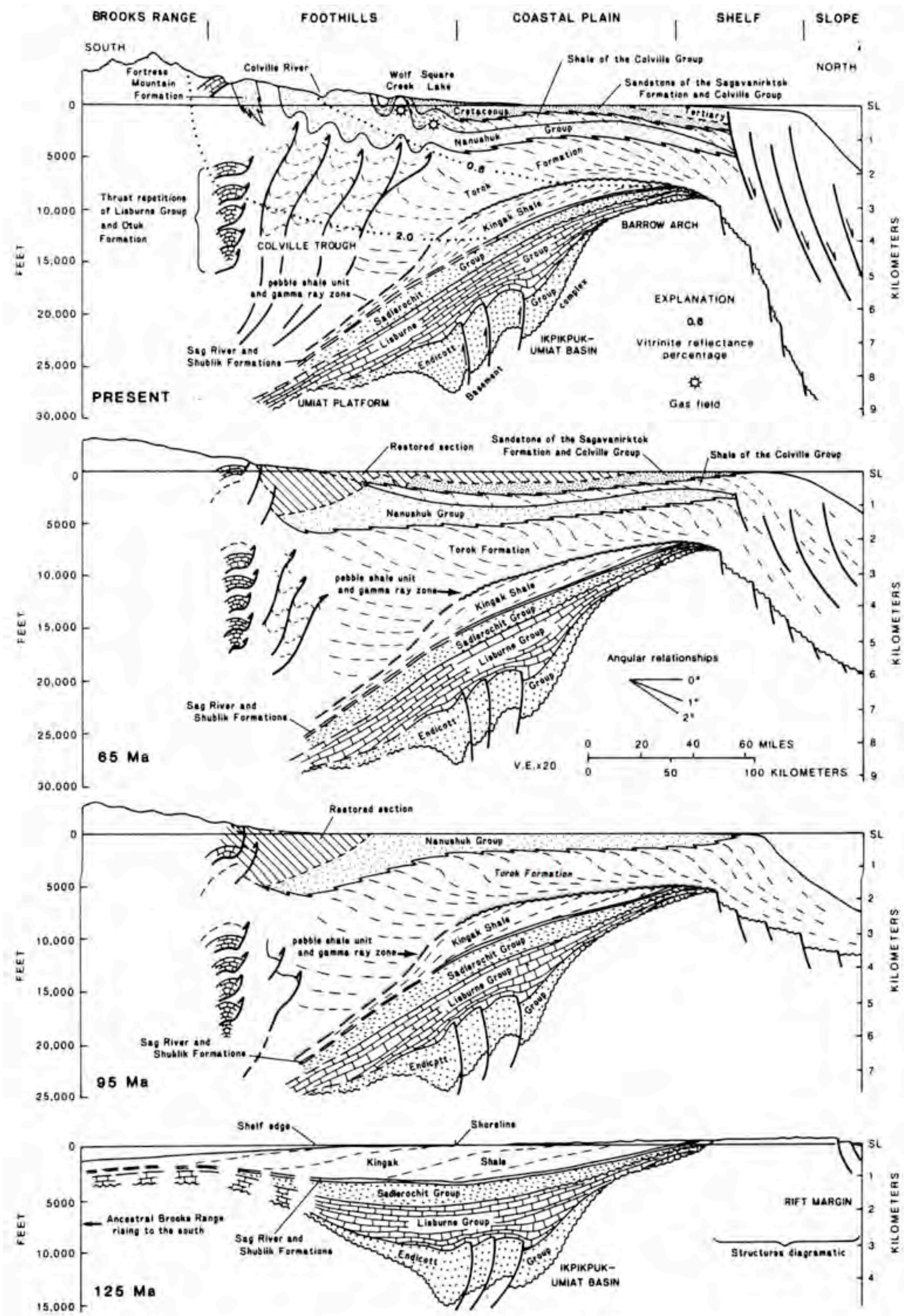
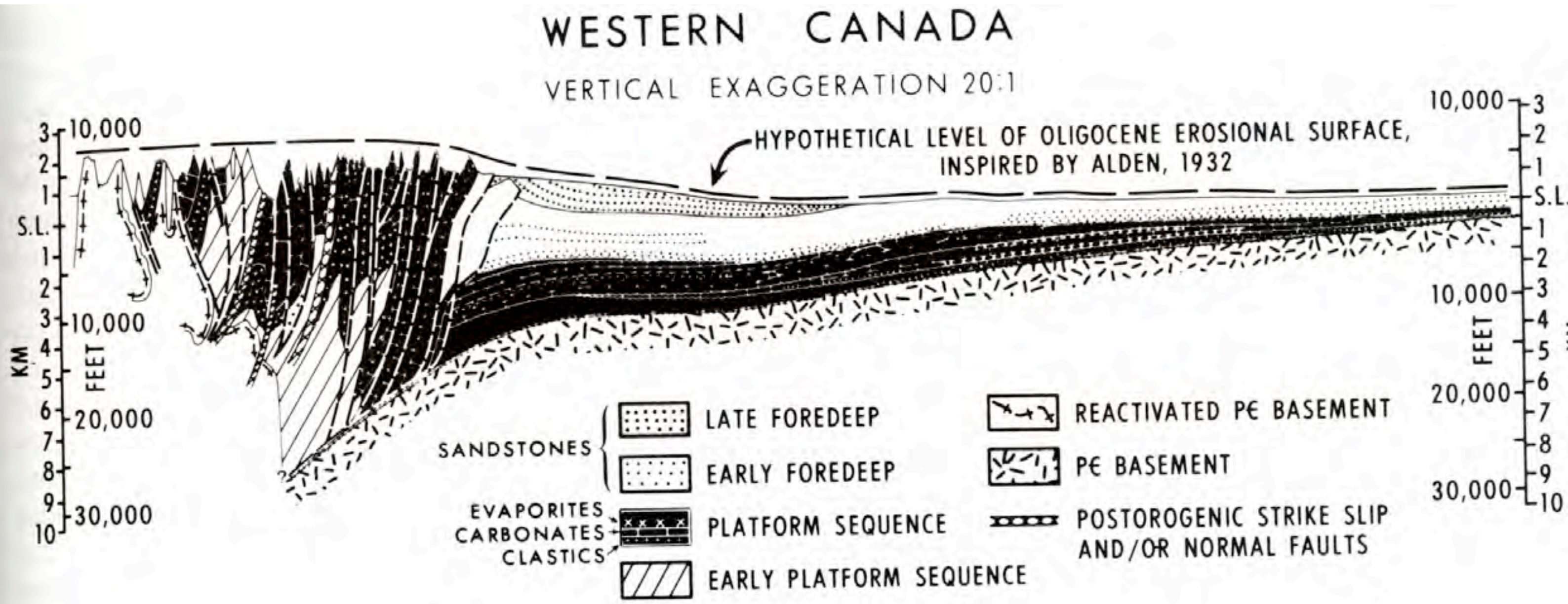


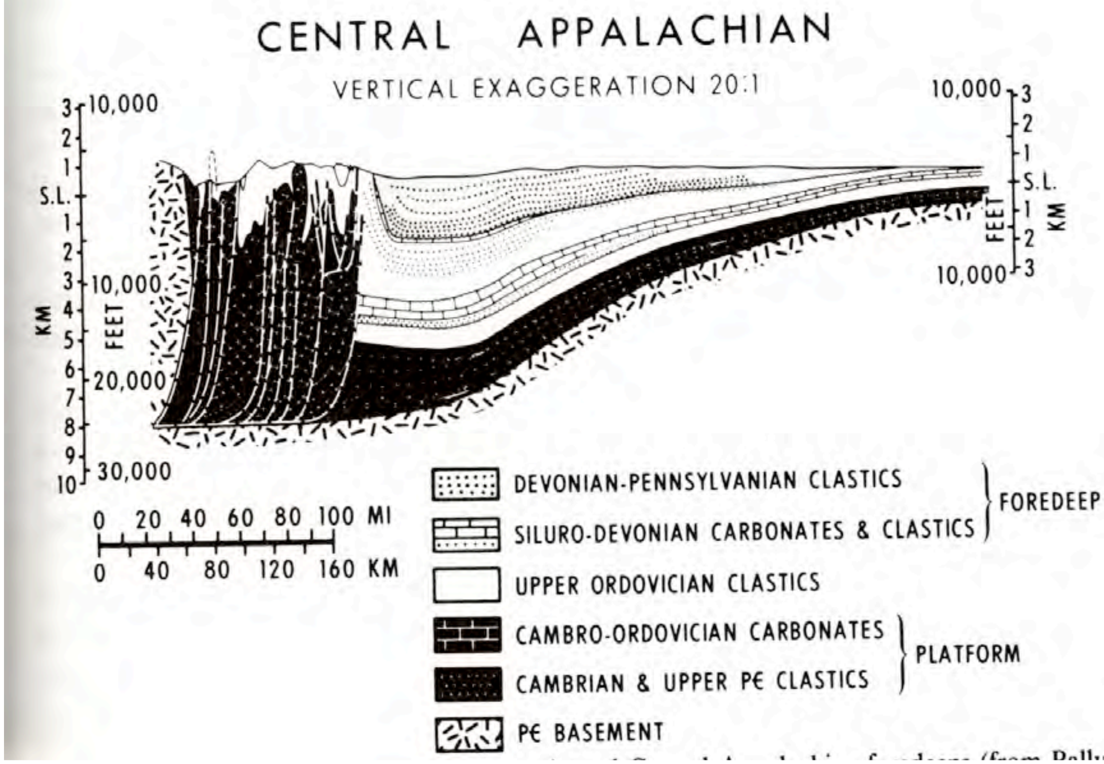
Figure 20. Permian reefs of the Guadelupe Mountains, west Texas. Section A, upper part of sections, Section B, lower part of succession (from King, 1948).


IDEALIZED
FOREDEEP
c
b
a
UNCONFORMITIES
d SHELFAL UNC.
c BASAL UNC.
b BREAKUP UNC.
a PRE-RIFT UNC.
6 ALLUVIAL-COASTAL
5 PROGRADATION
4 DEEP WATER
3 PLATFORM
2 RIFT
1 BASEMENT

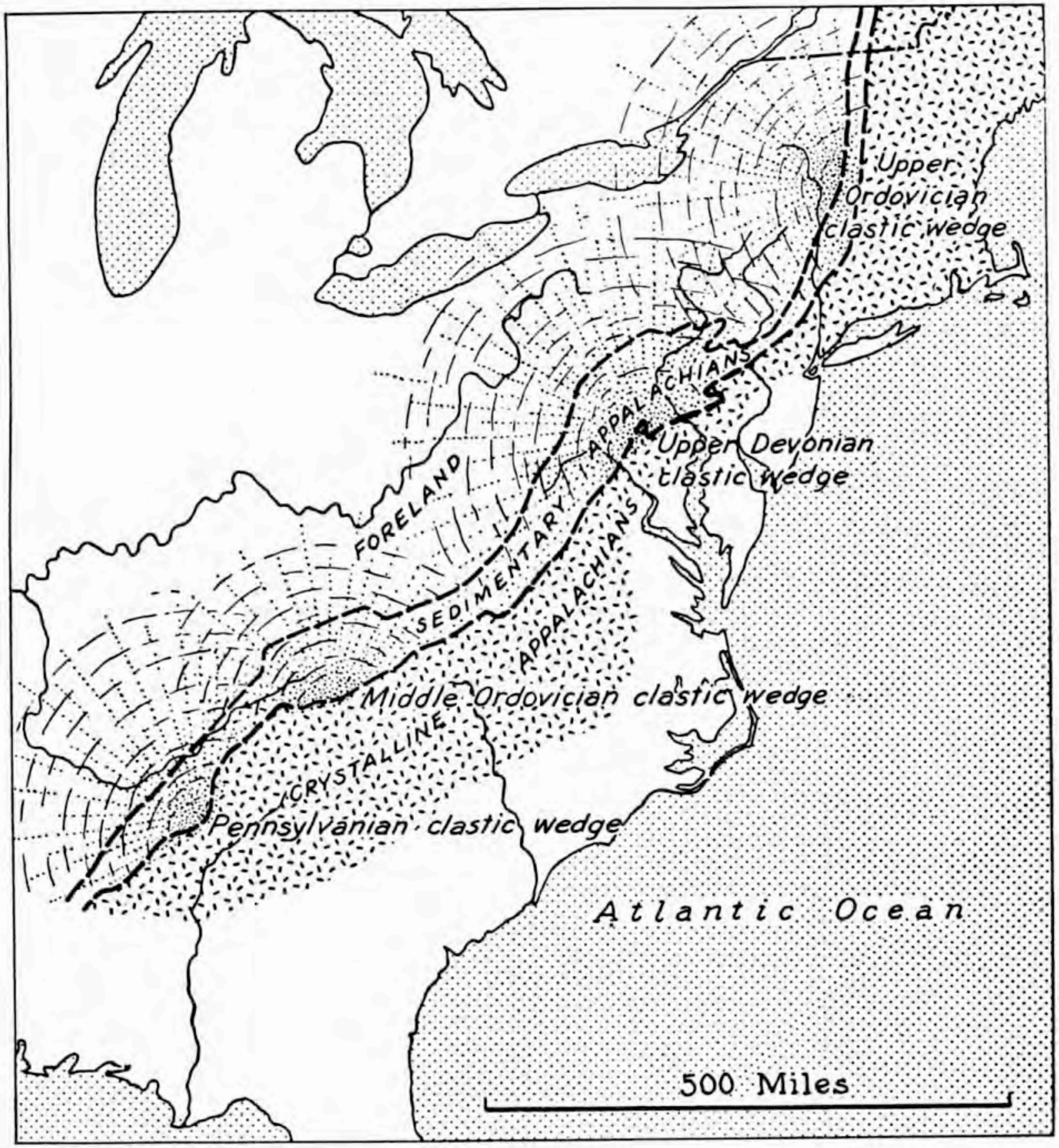


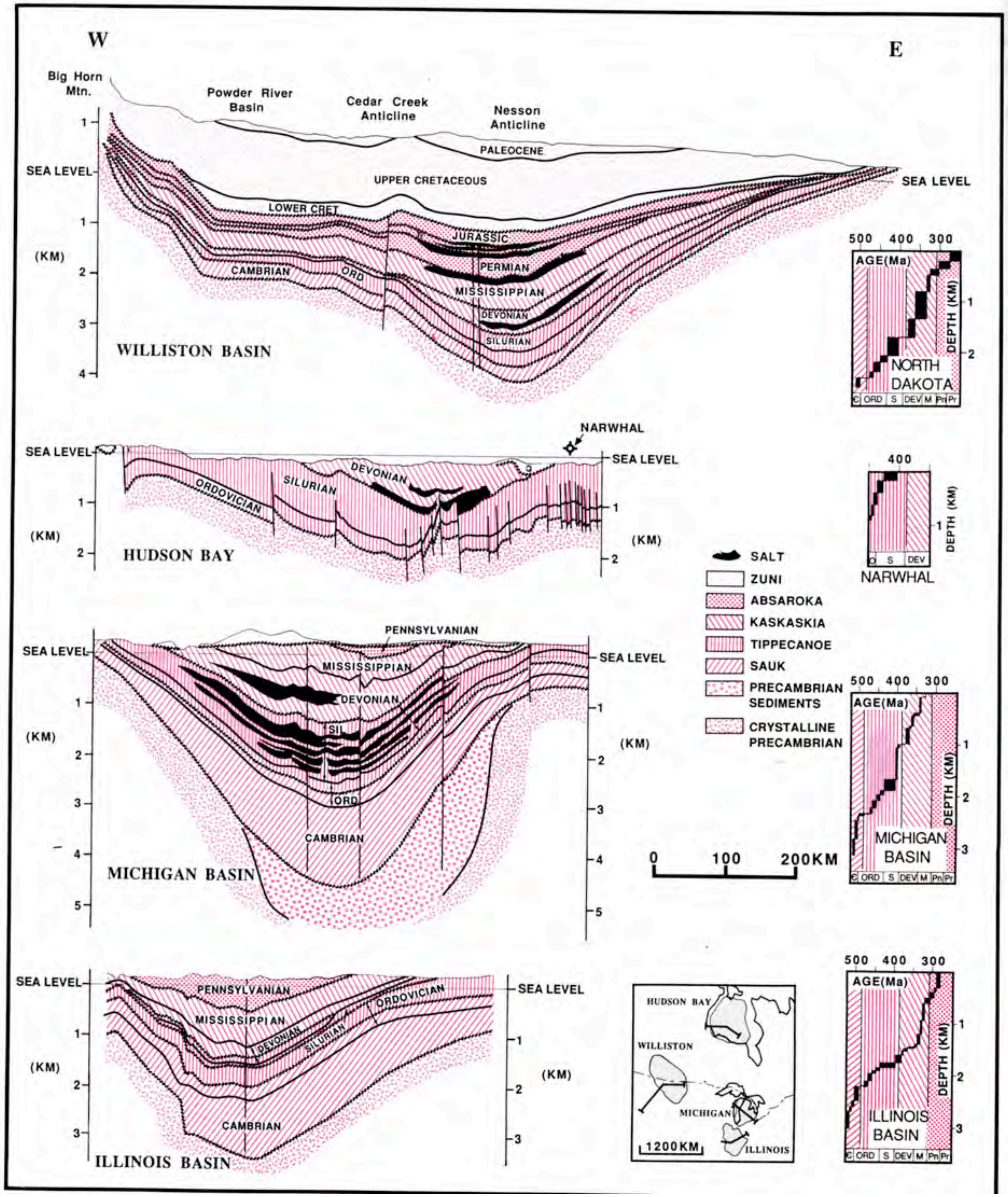
BROOKS RANGE
FOOTHILLS
COASTAL PLAIN
SHELF
SLOPE
SOUTH
NORTH
Fortress Mountain Formation
Colville River
Wolf Creek
Square Lake
Shale of the Colville Group
Sandstone of the Sagavanirktok Formation and Colville Group
Cretaceous
Tertiary
Nanushuk Group
Torok Formation
Thrust repetitions of Lisburne Group and Otuk Formation
COLVILLE TROUGH
Kingak Shale
BARROW ARCH
pebble shale unit and gamma ray zone
Sadlerochit Group
Lisburne Group
Group complex
Endicott
Basement
IKPIKPUK–UMIAT BASIN
Sag River and Shublik Formations
UMIAT PLATFORM
EXPLANATION
0.6
Vitrinite reflectance percentage
Gas field
PRESENT
FEET
KILOMETERS
SL
Restored section
Angular relationships
V.E.x20
60 MILES
100 KILOMETERS
65 Ma
95 Ma
Shelf edge
Shoreline
Kingak Shale
Ancestral Brooks Range rising to the south
RIFT MARGIN
Structures diagramatic
125 Ma





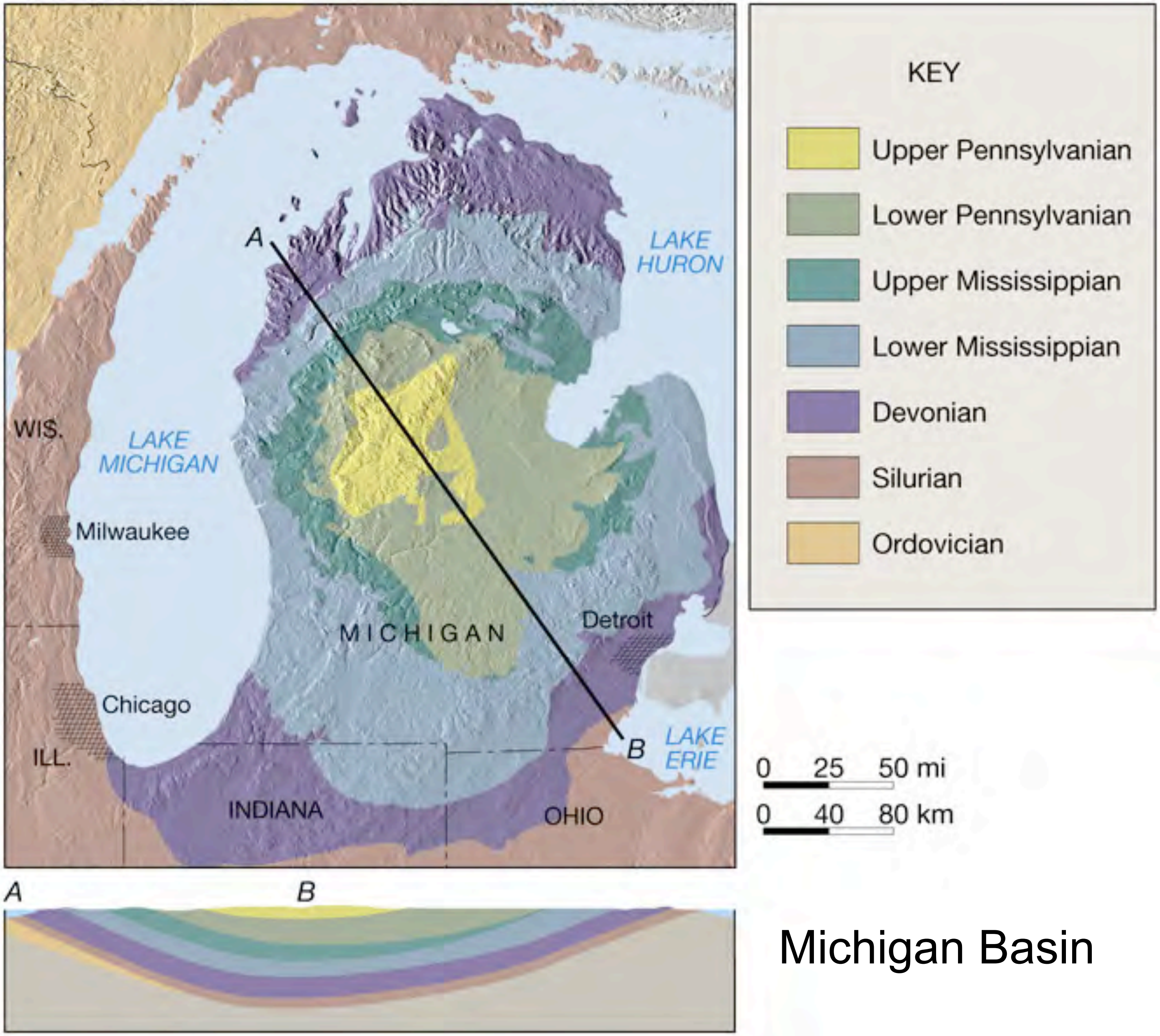
(from Bally and Snelson, 1980). The


Upper Ordovician clastic wedge
Upper Devonian clastic wedge
FORELAND
SEDIMENTARY APPALACHIANS
CRYSTALLINE APPALACHIANS
Middle Ordovician clastic wedge
Pennsylvanian clastic wedge
Atlantic Ocean
500 Miles



W
E
Big Horn Mtn.
Powder River Basin
Cedar Creek Anticline
Nesson Anticline
PALEOCENE
UPPER CRETACEOUS
LOWER CRET
JURASSIC
PERMIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
CAMBRIAN
ORD
SEA LEVEL
(KM)
WILLISTON BASIN
AGE(Ma)
DEPTH (KM)
NORTH DAKOTA
C ORD S DEV M Pn Pr
NARWHAL
ORDOVICIAN
SILURIAN
DEVONIAN
HUDSON BAY
SALT
ZUNI
ABSAROKA
KASKASKIA
TIPPECANOE
SAUK
PRECAMBRIAN SEDIMENTS
CRYSTALLINE PRECAMBRIAN
PENNSYLVANIAN
MISSISSIPPIAN
DEVONIAN
SIL
ORD
CAMBRIAN
MICHIGAN BASIN
0 100 200KM
PENNSYLVANIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
ORDOVICIAN
CAMBRIAN
ILLINOIS BASIN
HUDSON BAY
WILLISTON
MICHIGAN
ILLINOIS
1200KM


Williston Basin:Paleocene Sentinel Butte Fm, Roosevelt NP North Dakota

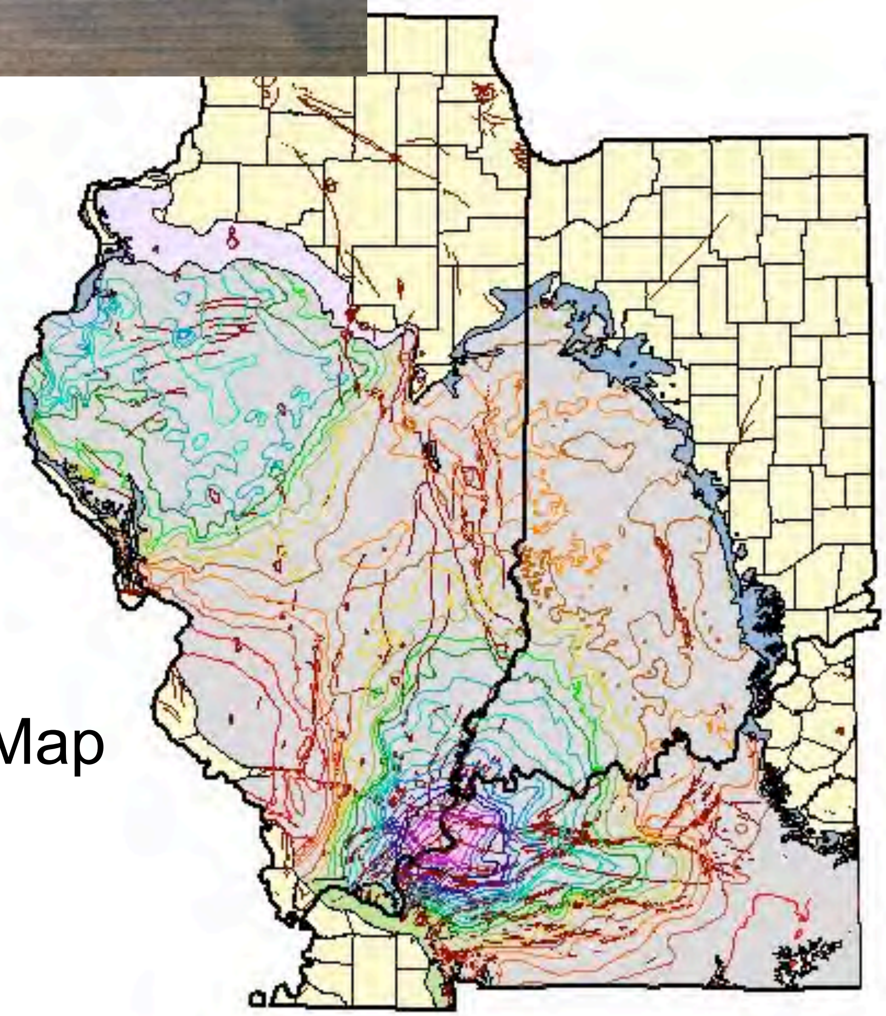


Michigan Basin

Michigan Basin:
Ordovician Queenston Shale, Cheltenham Badlands, Ontario

Patriot Coal Mine, Illinois Basin

http://www.patriotcoal.com/



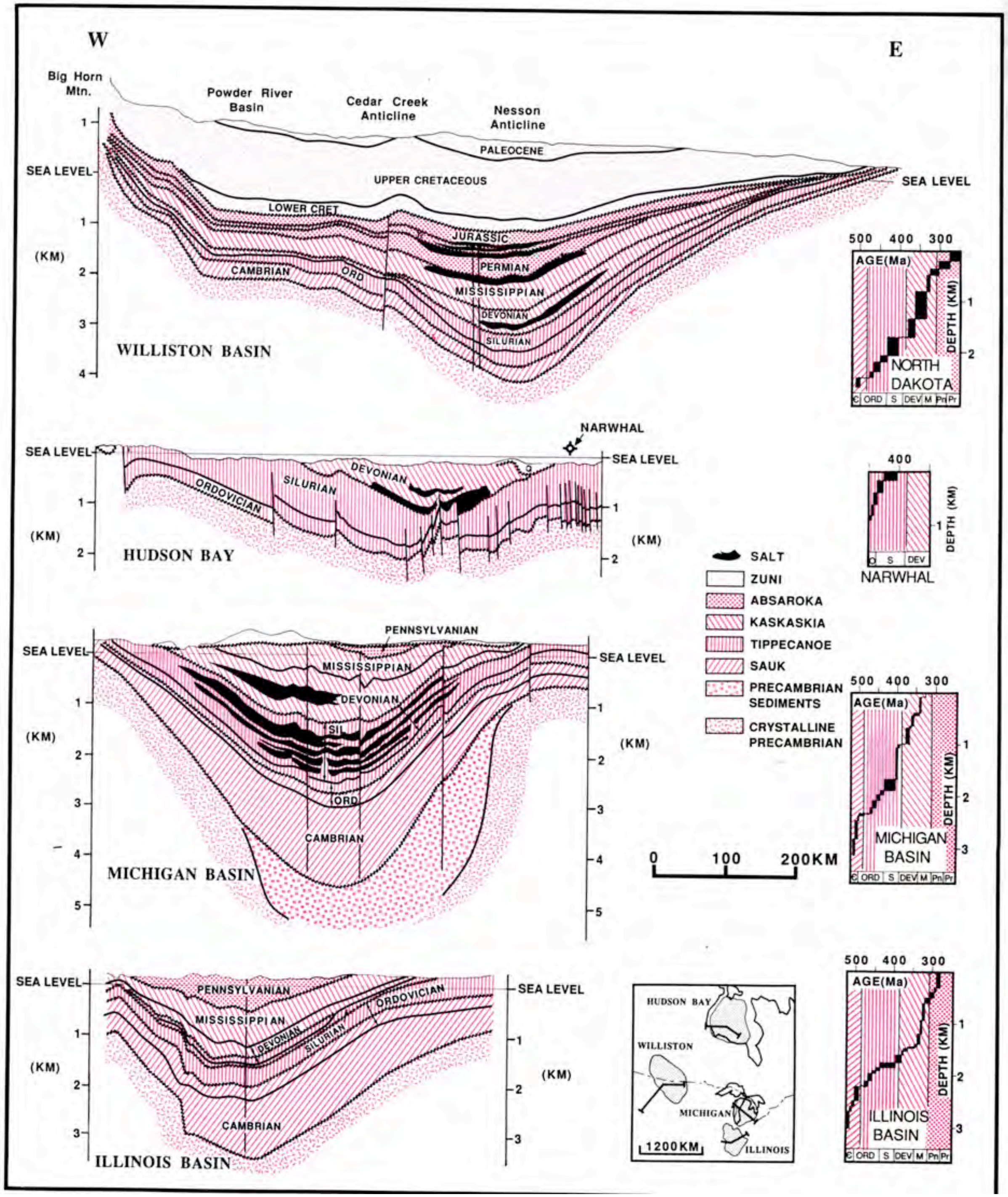
Albany Shale Map
Illinois Basin

Hudson Bay Basin


Typical Muskeg Habitat


U Ordovican Beach Sandstones

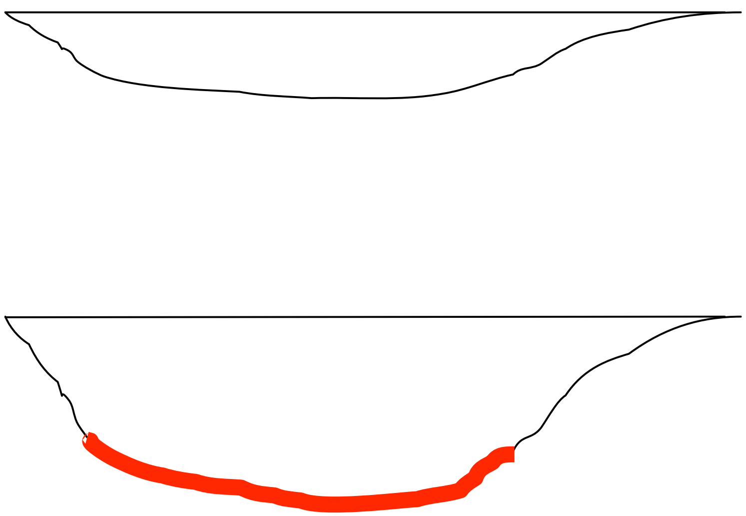

Typical Hudson Bay Geologist in Field Gear



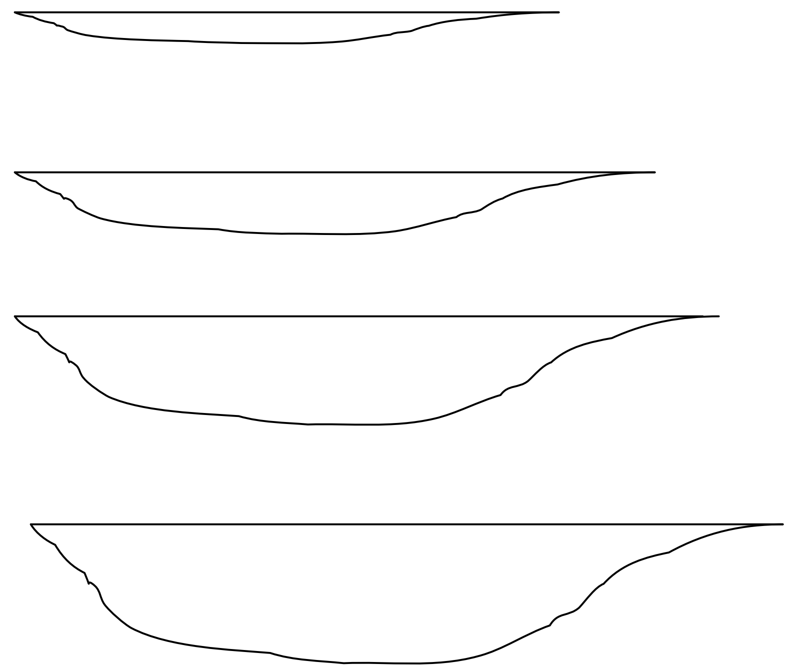
W
E
Big Horn Mtn.
Powder River Basin
Cedar Creek Anticline
Nesson Anticline
PALEOCENE
UPPER CRETACEOUS
LOWER CRET
JURASSIC
PERMIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
CAMBRIAN
ORD
SEA LEVEL
(KM)
WILLISTON BASIN
AGE(Ma)
DEPTH (KM)
NORTH DAKOTA
NARWHAL
ORDOVICIAN
HUDSON BAY
SALT
ZUNI
ABSAROKA
KASKASKIA
TIPPECANOE
SAUK
PRECAMBRIAN SEDIMENTS
CRYSTALLINE PRECAMBRIAN
PENNSYLVANIAN
SIL
MICHIGAN BASIN
0 100 200KM
ILLINOIS BASIN
HUDSON BAY
WILLISTON
MICHIGAN
ILLINOIS
1200KM

Two Models for Cratonic Basins

Eclogite Keel

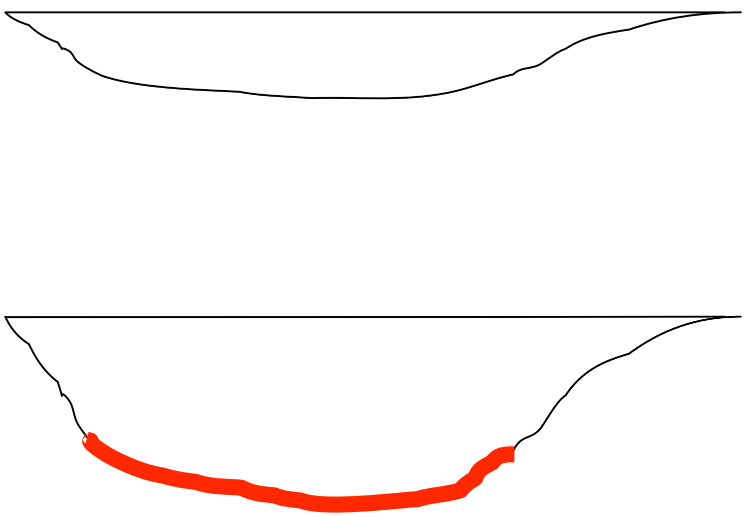


Very Slow, Steady Extension

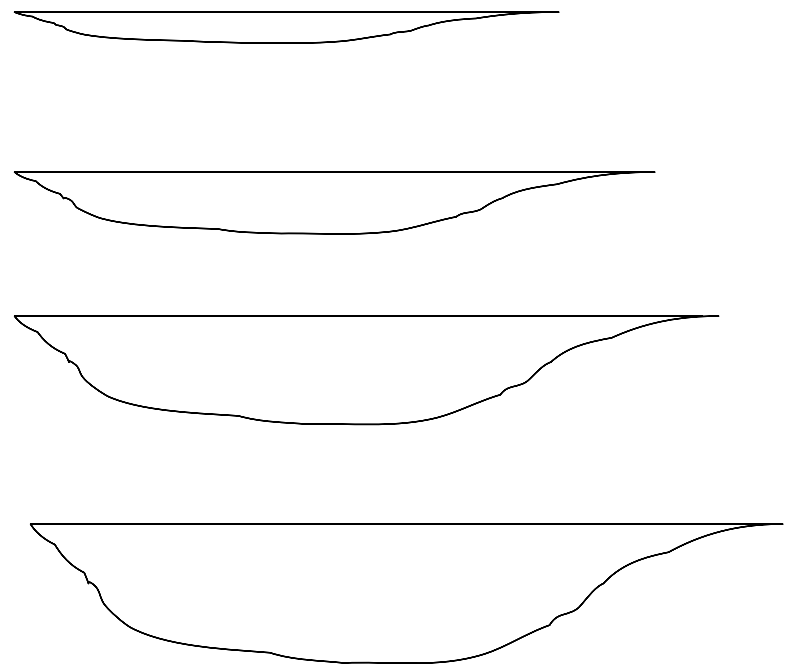


Two Models for Cratonic Basins:
How do we test these models?

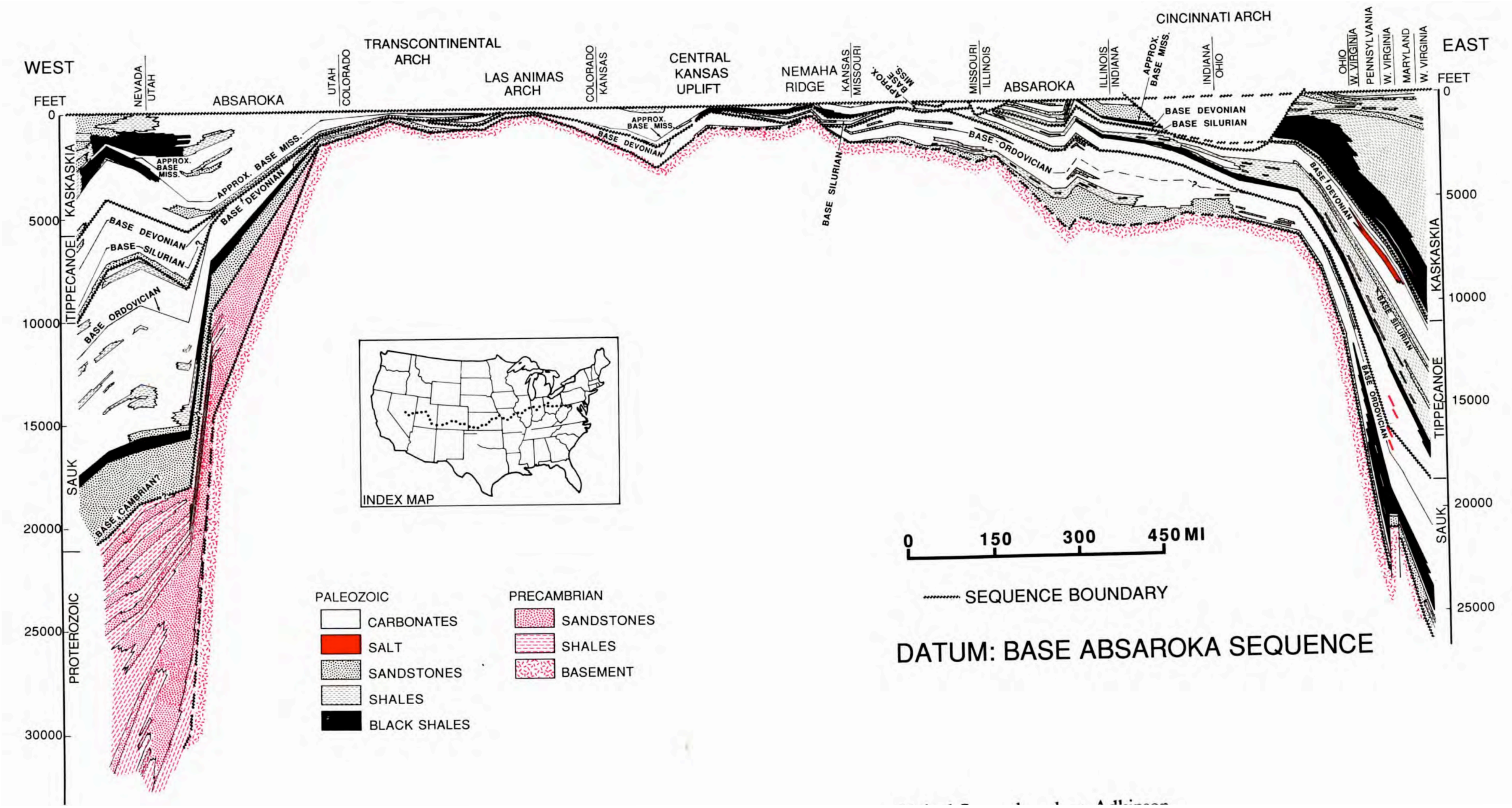
Eclogite Keel



Very Slow, Steady Extension



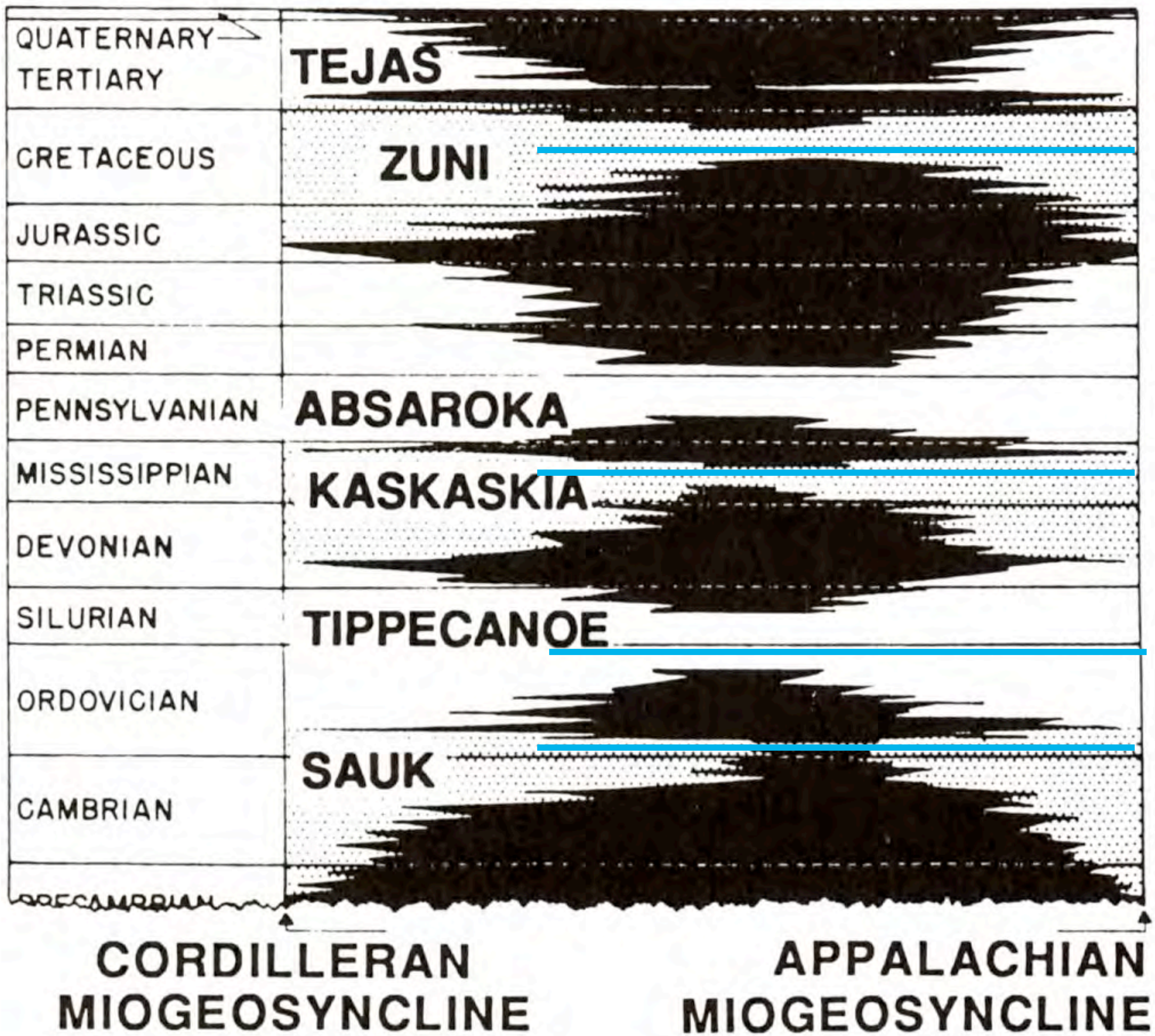
There is nothing to image with seismic data: no faults.
The eclogite keel is too deep to reach by drilling.



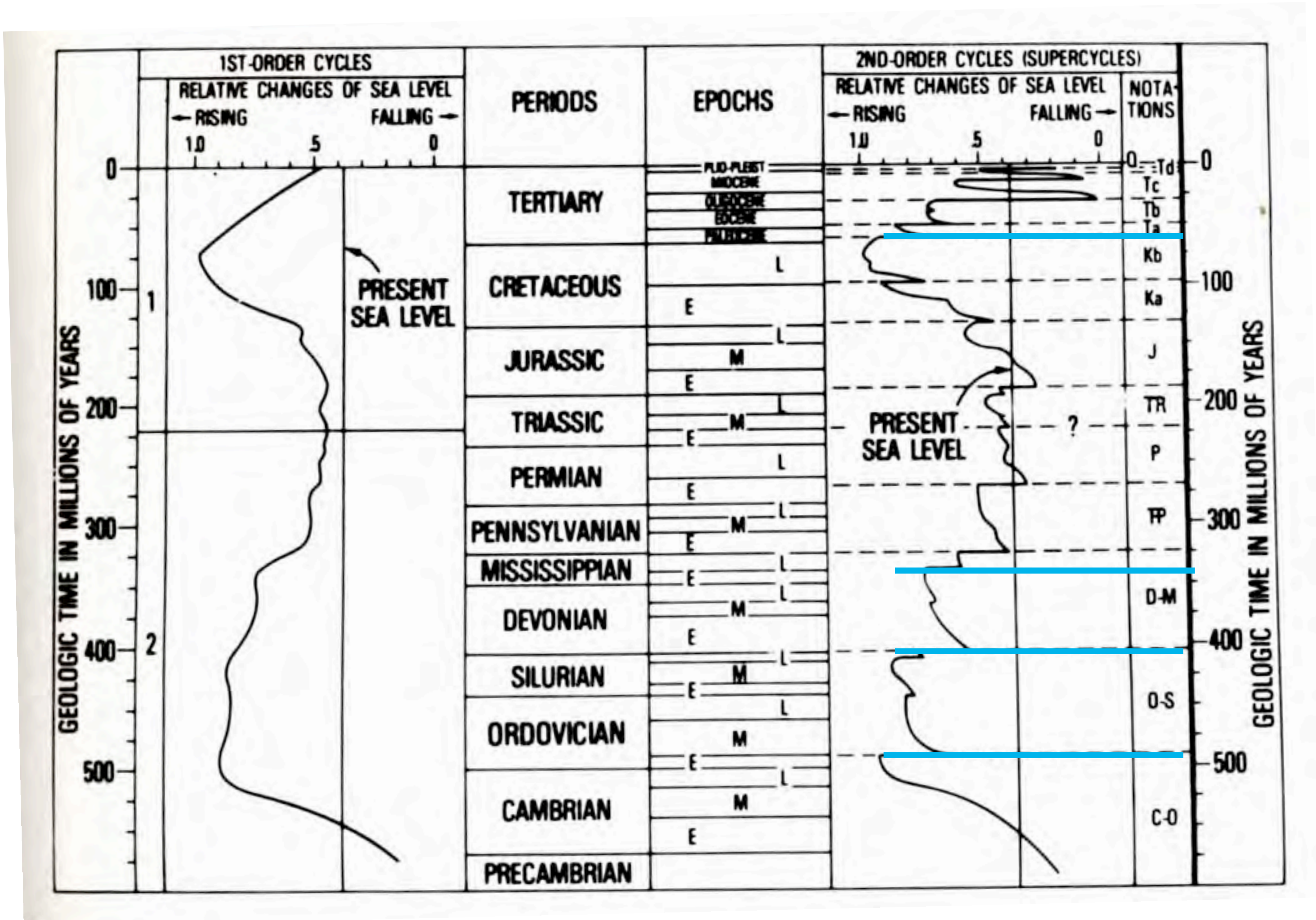
Note that the scale of the cratonic basins is realatively small.

Basin Models

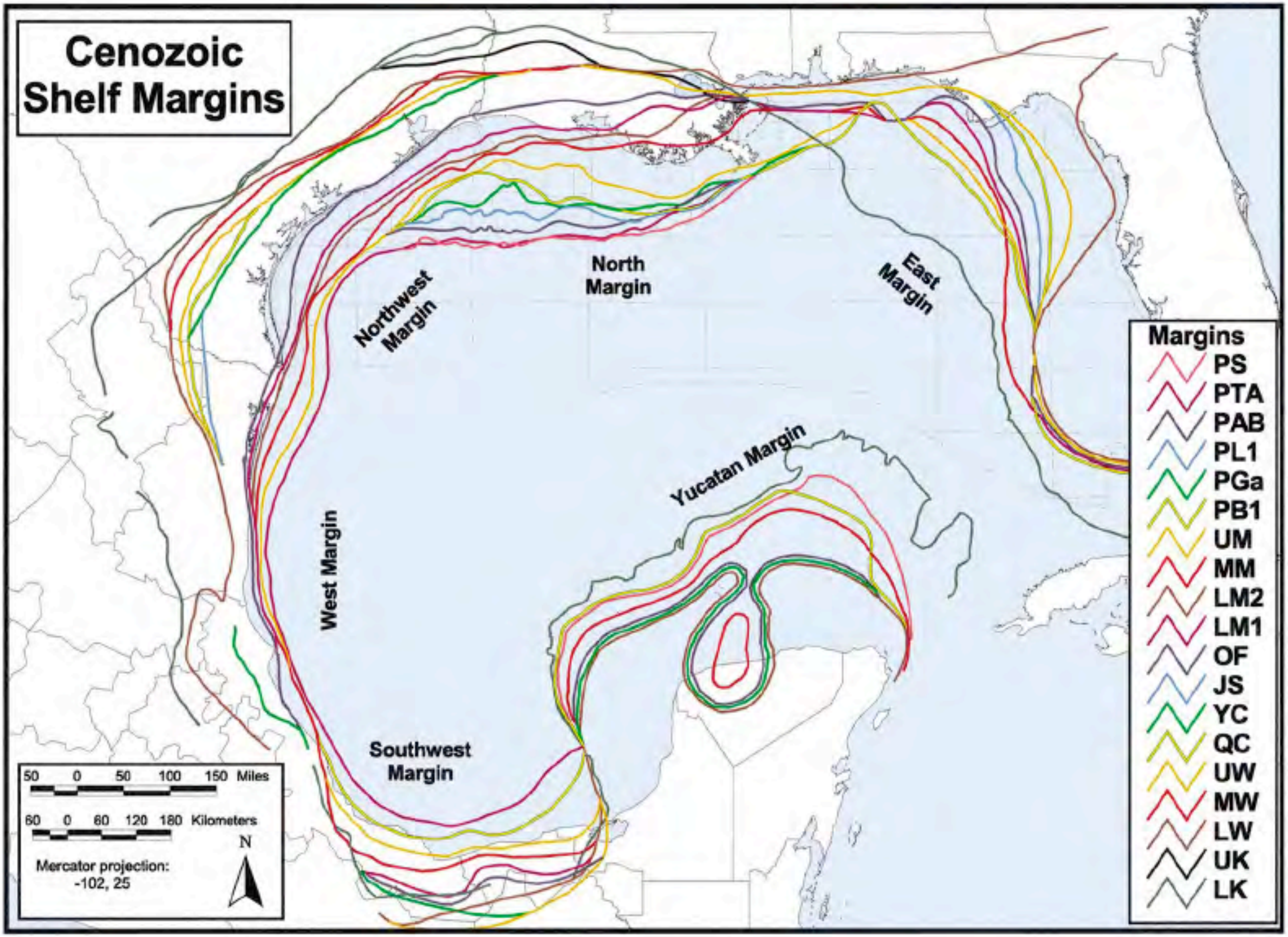
- Rift basins: faulting in crust
- Fore-arc basins: slab rollback
- Back-arc basins: slab rollback
- Foredeep basins: response to thrust loads
- Craton basins
  - ?deep crustal faults-not imaged on seismic
  - ?elevated Moho, mantle dymics-not imaged
  - ?cooling lithosphere anomaly-?what evidence

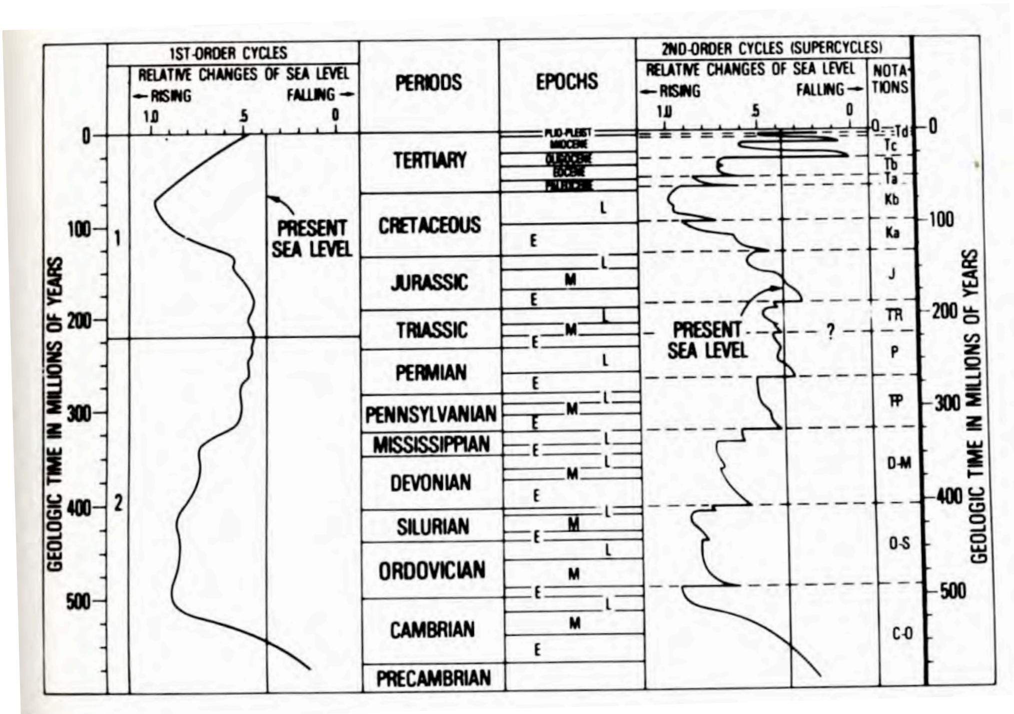

QUATERNARY
TERTIARY
CRETACEOUS
JURASSIC
TRIASSIC
PERMIAN
PENNSYLVANIAN
MISSISSIPPIAN
DEVONIAN
SILURIAN
ORDOVICIAN
CAMBRIAN
PRECAMBRIAN
TEJAS
ZUNI
ABSAROKA
KASKASKIA
TIPPECANOE
SAUK
CORDILLERAN MIOGEOSYNCLINE
APPALACHIAN MIOGEOSYNCLINE

Sloss
1963

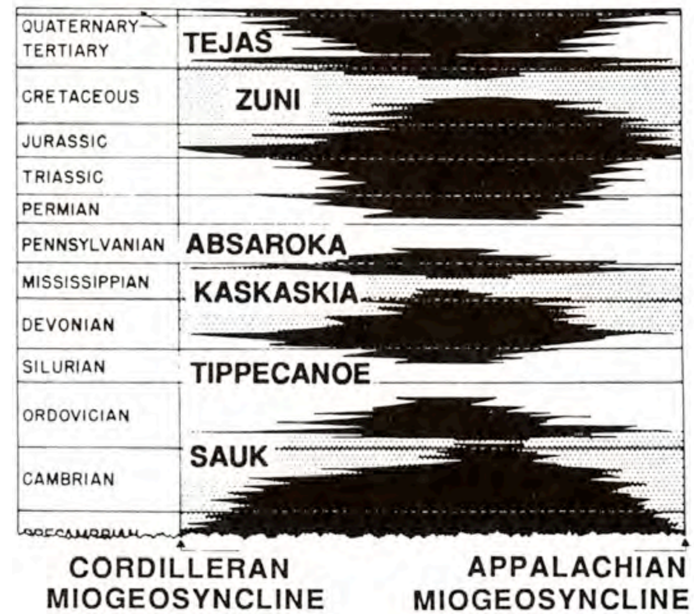


Vail et al 1977

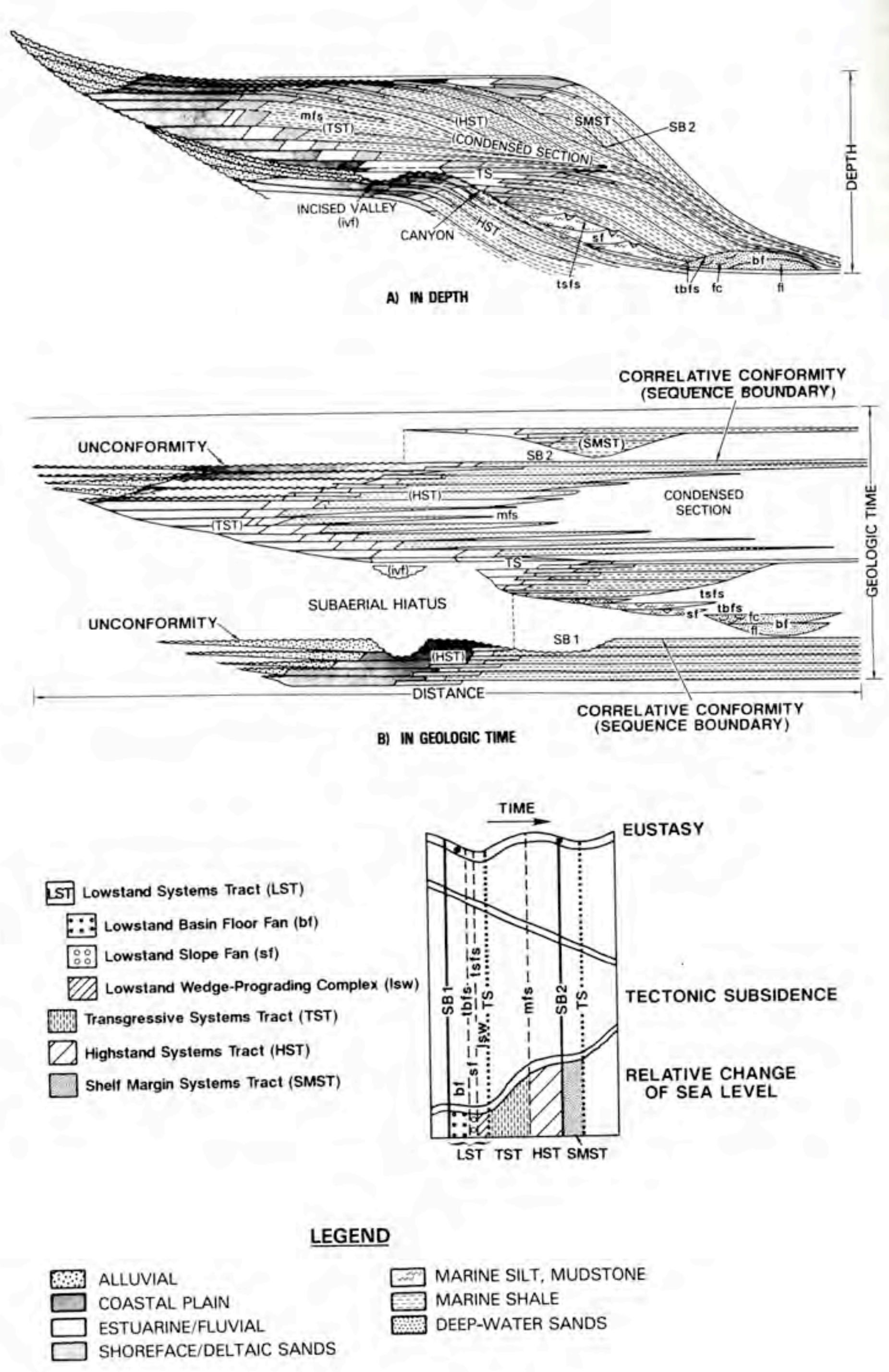

Cenozoic
Shelf Margins
North
Margin
East
Margin
Northwest
Margin
Yucatan Margin
West Margin
Southwest
Margin
Margins
PS
PTA
PAB
PL1
PGa
PB1
UM
MM
LM2
LM1
OF
JS
YC
QC
UW
MW
LW
UK
LK
50 0 50 100 150 Miles
60 0 60 120 180 Kilometers
N
Mercator projection:
-102, 25



Vail et al 1977 sea level curve



Sloss 1963 Sequences


mfs
(TST)
(HST)
SMST
SB 2
(CONDENSED SECTION)
TS
INCISED VALLEY
(ivf)
CANYON
HST
sf
bf
tsfs
tbfs
fc
fl
DEPTH
A) IN DEPTH
CORRELATIVE CONFORMITY
(SEQUENCE BOUNDARY)
UNCONFORMITY
(SMST)
SB 2
(HST)
CONDENSED SECTION
mfs
(TST)
TS
(ivf)
SUBAERIAL HIATUS
tsfs
tbfs
sf
fc
fl
bf
UNCONFORMITY
SB 1
(HST)
GEOLOGIC TIME
DISTANCE
CORRELATIVE CONFORMITY
(SEQUENCE BOUNDARY)
B) IN GEOLOGIC TIME
TIME
EUSTASY
LST Lowstand Systems Tract (LST)
Lowstand Basin Floor Fan (bf)
Lowstand Slope Fan (sf)
Lowstand Wedge-Prograding Complex (lsw)
Transgressive Systems Tract (TST)
Highstand Systems Tract (HST)
Shelf Margin Systems Tract (SMST)
SB1
tbfs
tsfs
lsw
TS
mfs
SB2
TS
bf
sf
TECTONIC SUBSIDENCE
RELATIVE CHANGE
OF SEA LEVEL
LST TST HST SMST
LEGEND
ALLUVIAL
COASTAL PLAIN
ESTUARINE/FLUVIAL
SHOREFACE/DELTAIC SANDS
MARINE SILT, MUDSTONE
MARINE SHALE
DEEP-WATER SANDS

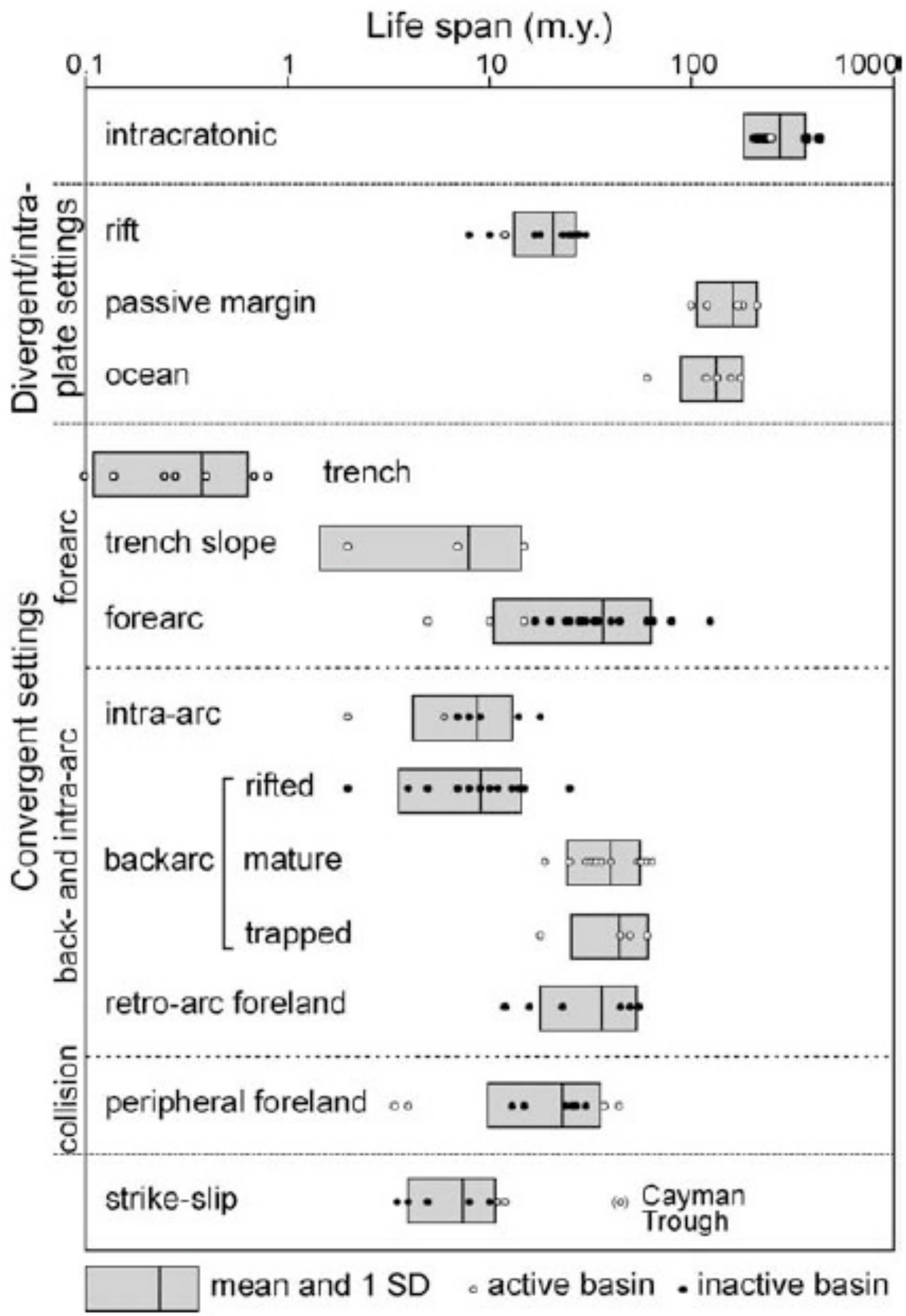
ASSUMPTIONS:

1. Stable Continental Platforms
2. First and Second Order Cycles represent changes sea floor spreading rate
3. Rapid sea floor spreading reduces ocean basin volume, displacing sea water onto shelves

PROBLEMS WITH EUSTACY:

1. Continental Platforms Do Not Appear to be Stable in simulations of mantle flow
2. First and Second Order Cycles may represent changes in dynamic topography as well as changes in sea floor spreading.
3. “Say Goodby to Global Eustacy”-Jerry Mitrovica, AGU Fall Meeting 2008

http://www.agu.org/meetings/fm09/lectures/lecture_videos/T34A.shtml



The Lifespan Of Sedimentary Basin

Woodcock 2005

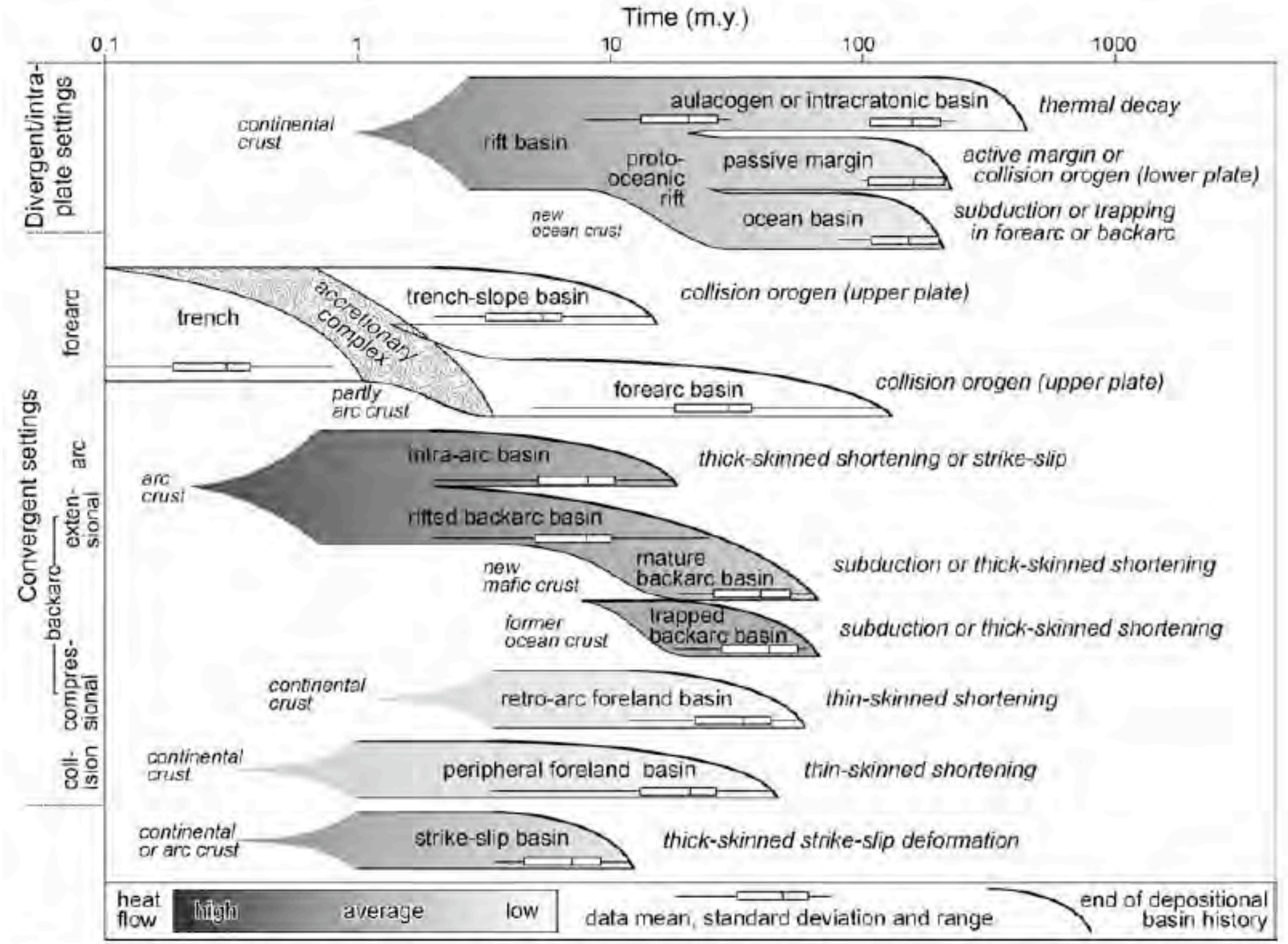


Figure 2. Typical fates of different classes of sedimentary basin through time, plotted on logarithmic scale. Small italics show basement to each class. Large italics show deformational or thermal consequent fates of each class. Estimates of basin heat flow are from compilation by Allen and Allen (1990).

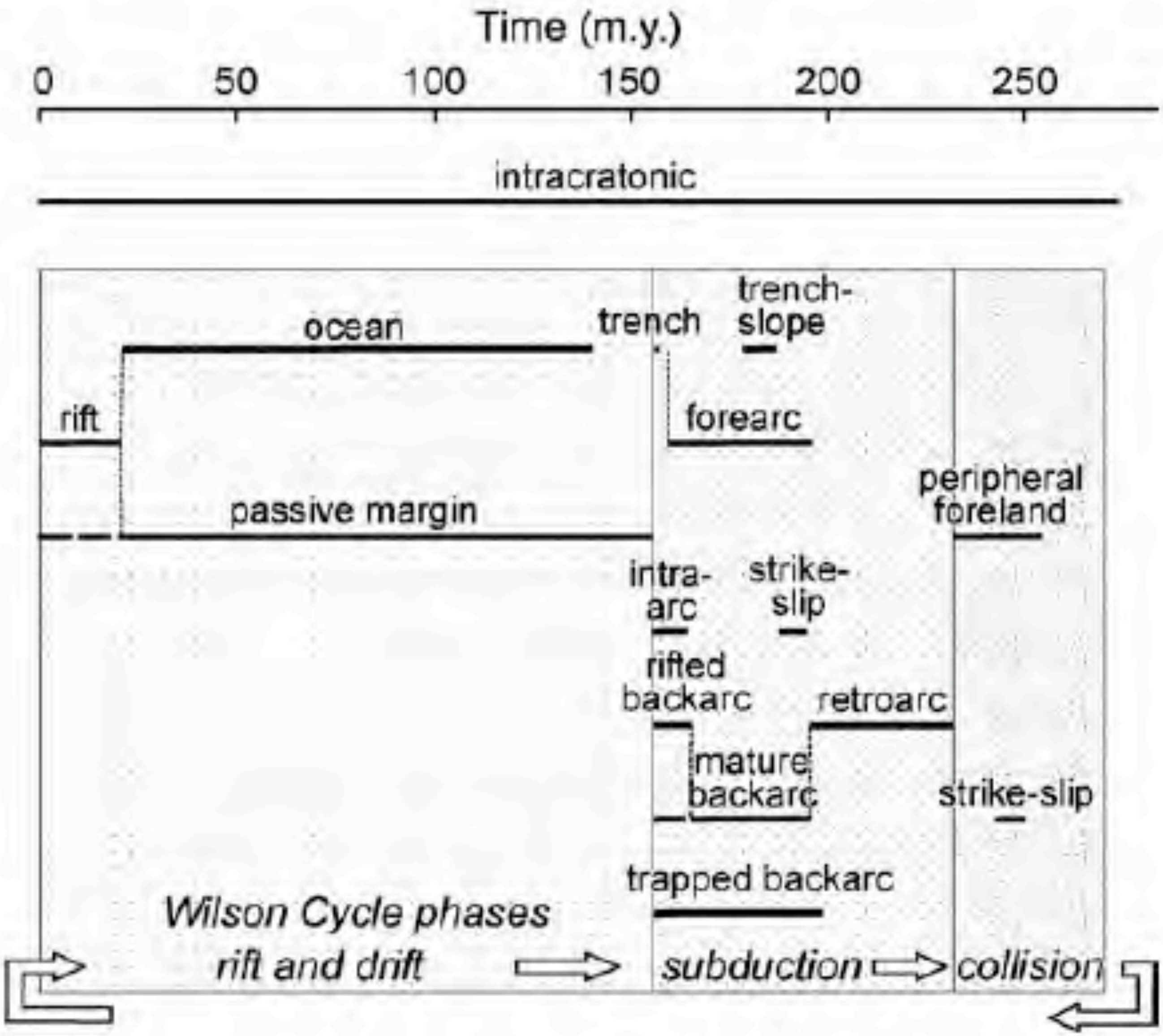


Figure 3. Average life span of basin classes used to calibrate Wilson Cycle of ocean opening and closing. Note linear time scale. Dashed lines are sequential links between basin classes that help to constrain lengths of cycle phases.

Wilson cycle

1. A continent rifts when it breaks up

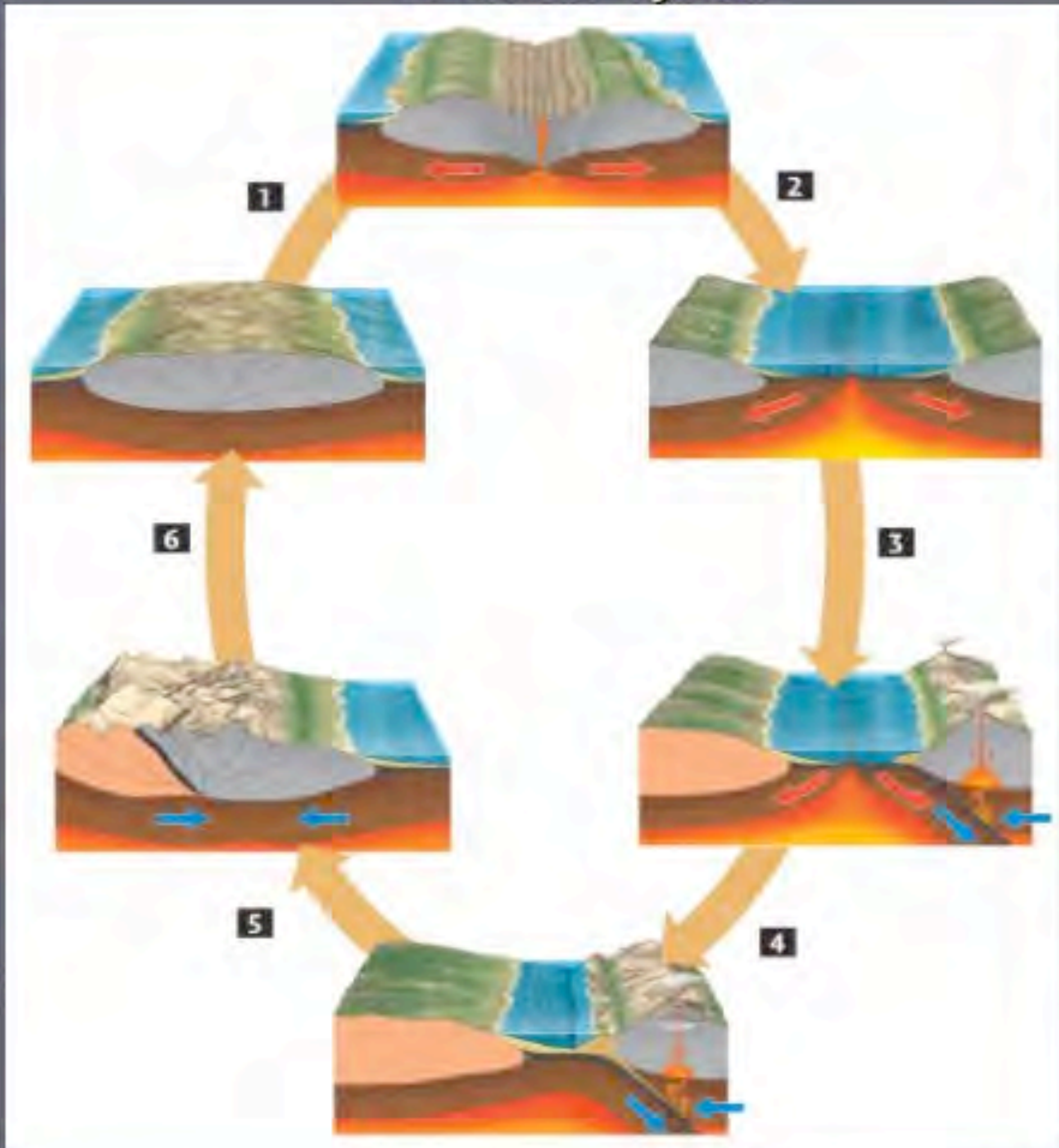
2. As spreading continues an ocean opens, passive margin cools and sediments accumulate

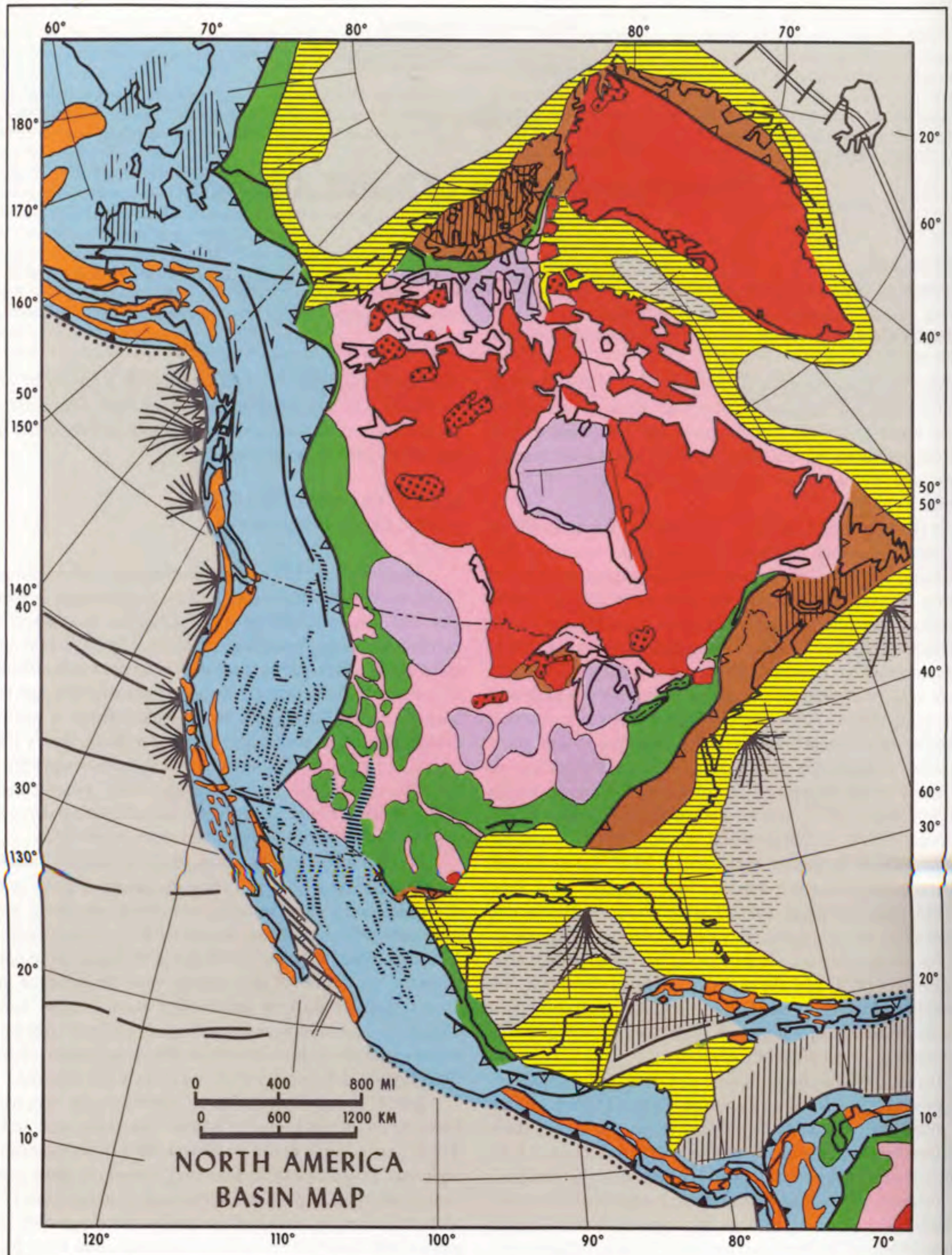
3. Convergence begins; an oceanic plate subducts, creating a volcanic chain at an active margin

4. Terraine accretion-from the sedimentary wedge welds material to the continent

5. As two continents collide orogeny thickens the crust and building mountains

6. The continent erodes, thinning the crust





NORTH AMERICA
BASIN MAP
0 400 800 MI
0 600 1200 KM
60°
70°
80°
80°
70°
180°
170°
160°
50°
150°
140°
40°
30°
130°
20°
10°
20°
60°
40°
50°
50°
40°
60°
30°
20°
10°
120°
110°
100°
90°
80°
70°