



Middle Ordovician clastic wedges in East Tennessee: A new look at an old basin

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Acknowledgements

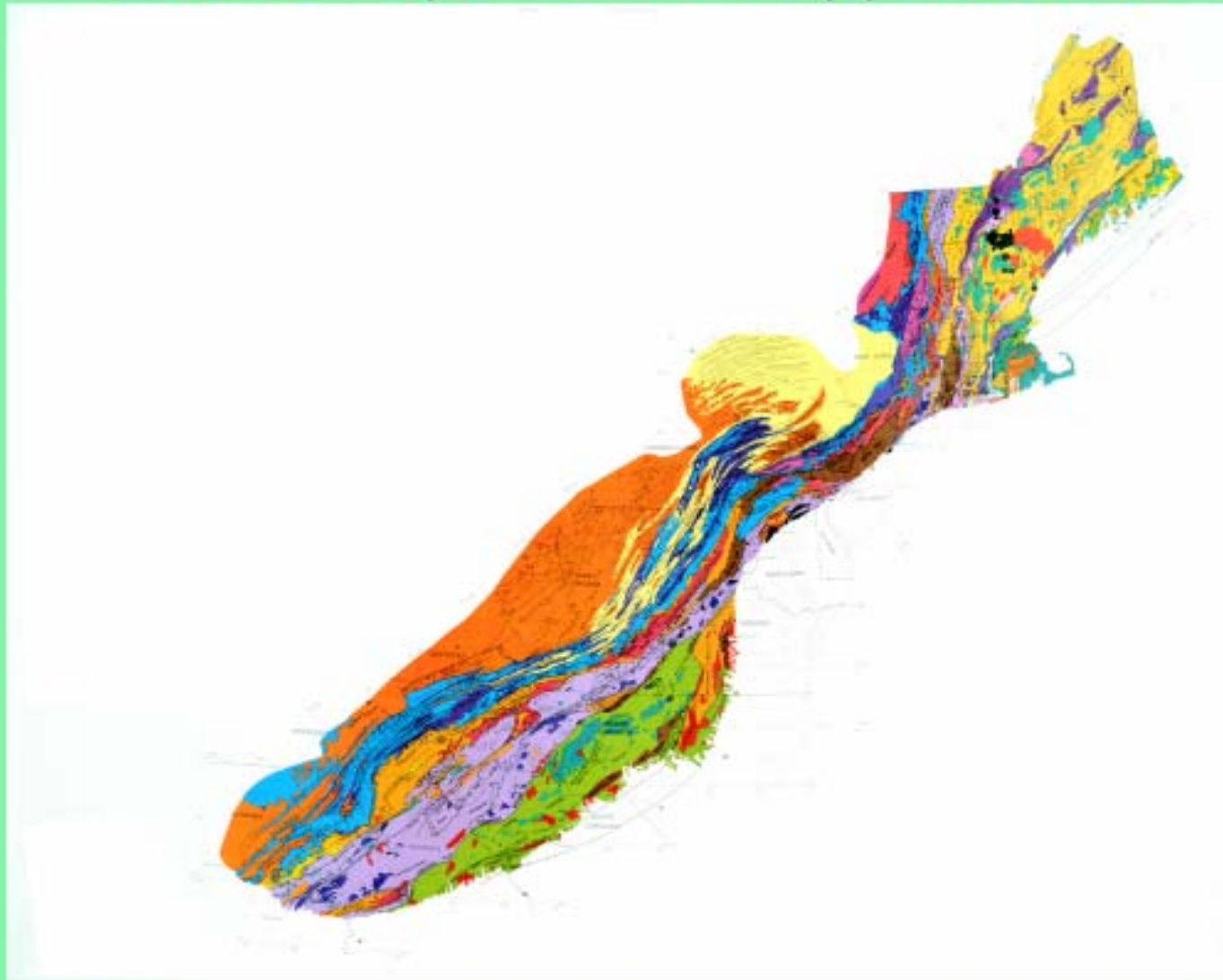


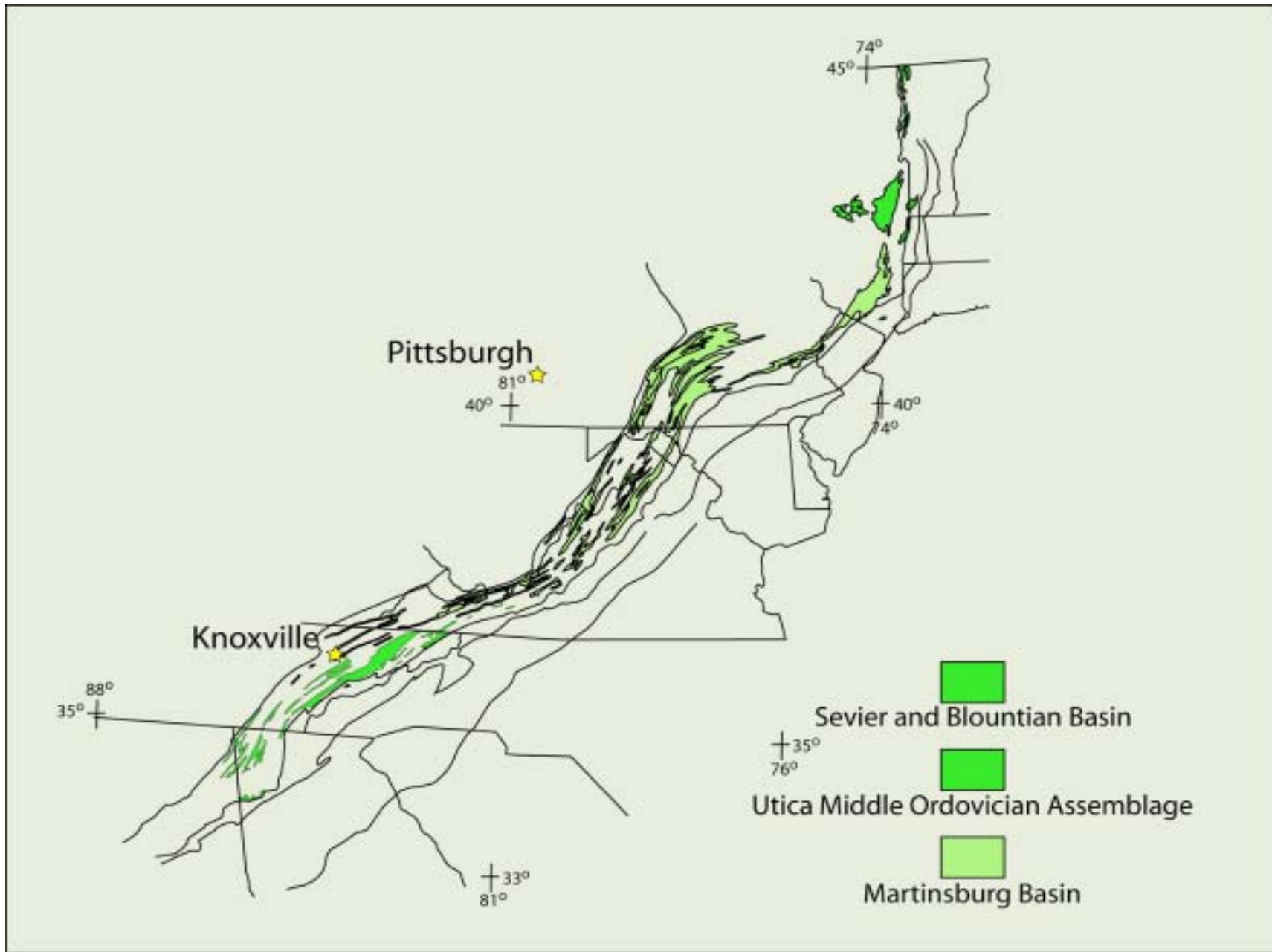
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Petroleum Technology Office Grant DE-PS26-01NT1048

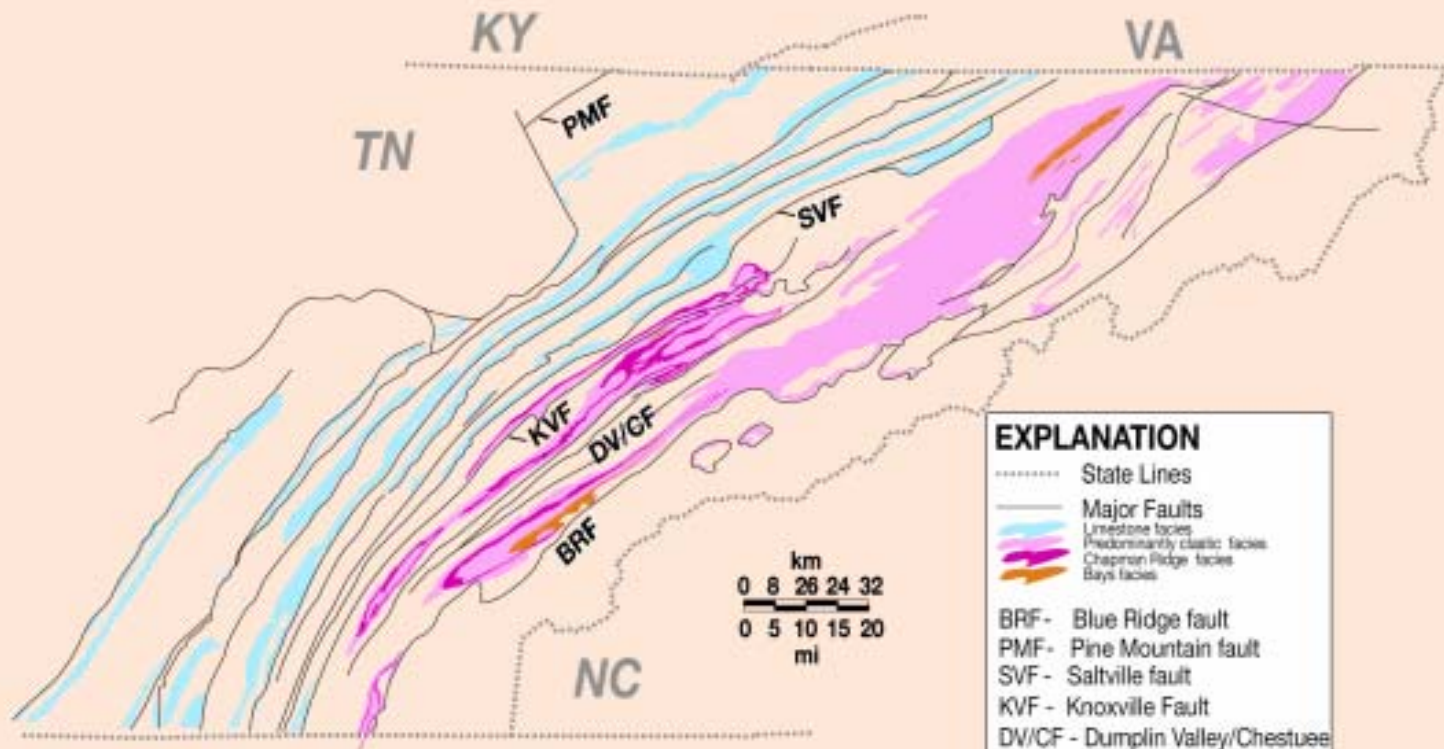
USGS EDMAP Program

University of Tennessee
Science Alliance Center of Excellence

Tectonic Map of the U.S. Appalachians



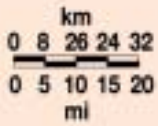




EXPLANATION

- State Lines
- Major Faults
- Light Blue Limestone facies
- Pink Predominantly clastic facies
- Magenta Chaparral Ridge facies
- Orange Bays facies

BRF - Blue Ridge fault
 PMF - Pine Mountain fault
 SVF - Saltville fault
 KVF - Knoxville Fault
 DW/GF - Dumplin Valley/Chestnee faults



Ages

Upper Ordovician



Martinsburg basin

Middle Ordovician



Sevier-Blountian basin

***Middle Ordovician
Unconformity***



*Lower Ordovician
to Upper Cambrian*



Knox Group carbonate bank

Sevier Basin

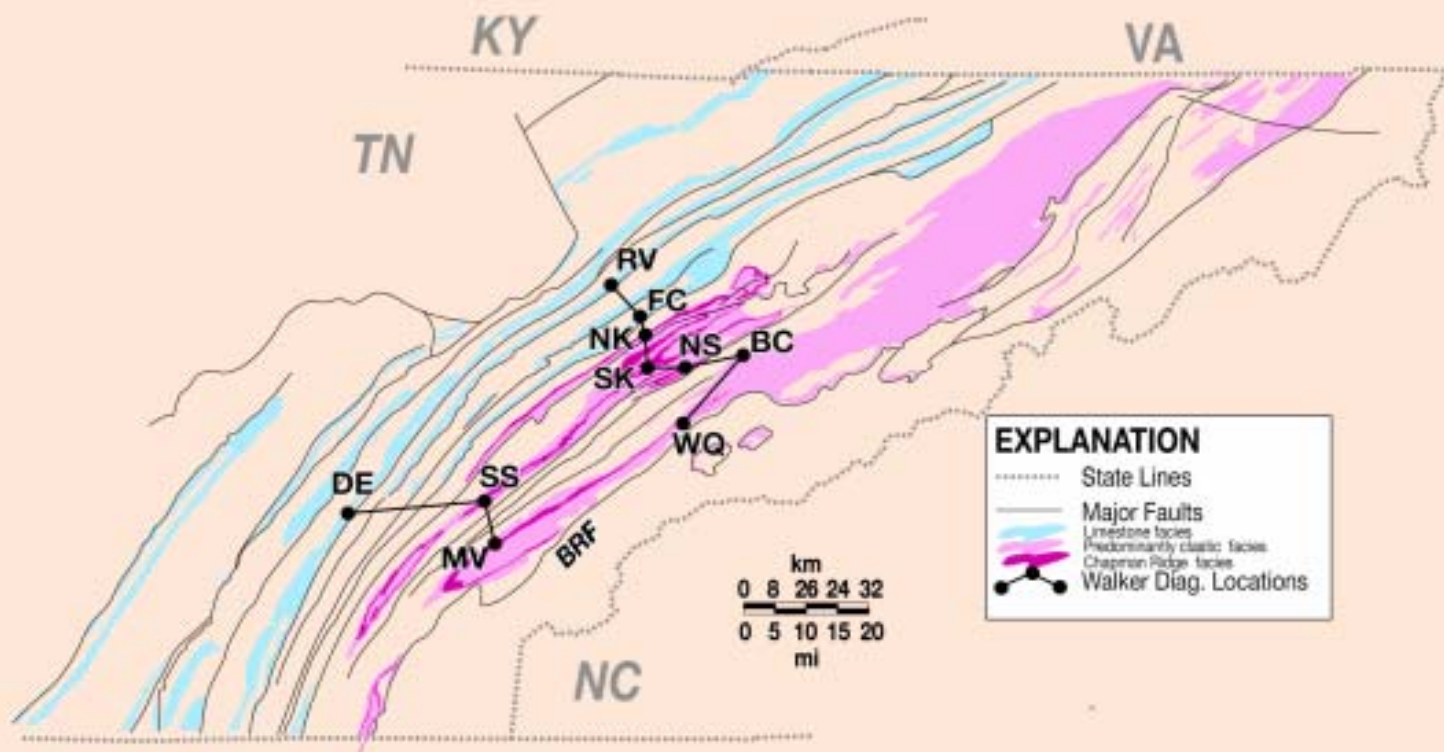


*Up to 3,000 meters of sediment (Rodgers, 1953;
Shanmugam and Walker, 1978)*

Taconic foredeep (Shanmugam and Walker, 1978)

*Contact of Middle Ordovician with Knox Group is
Middle Ordovician unconformity*

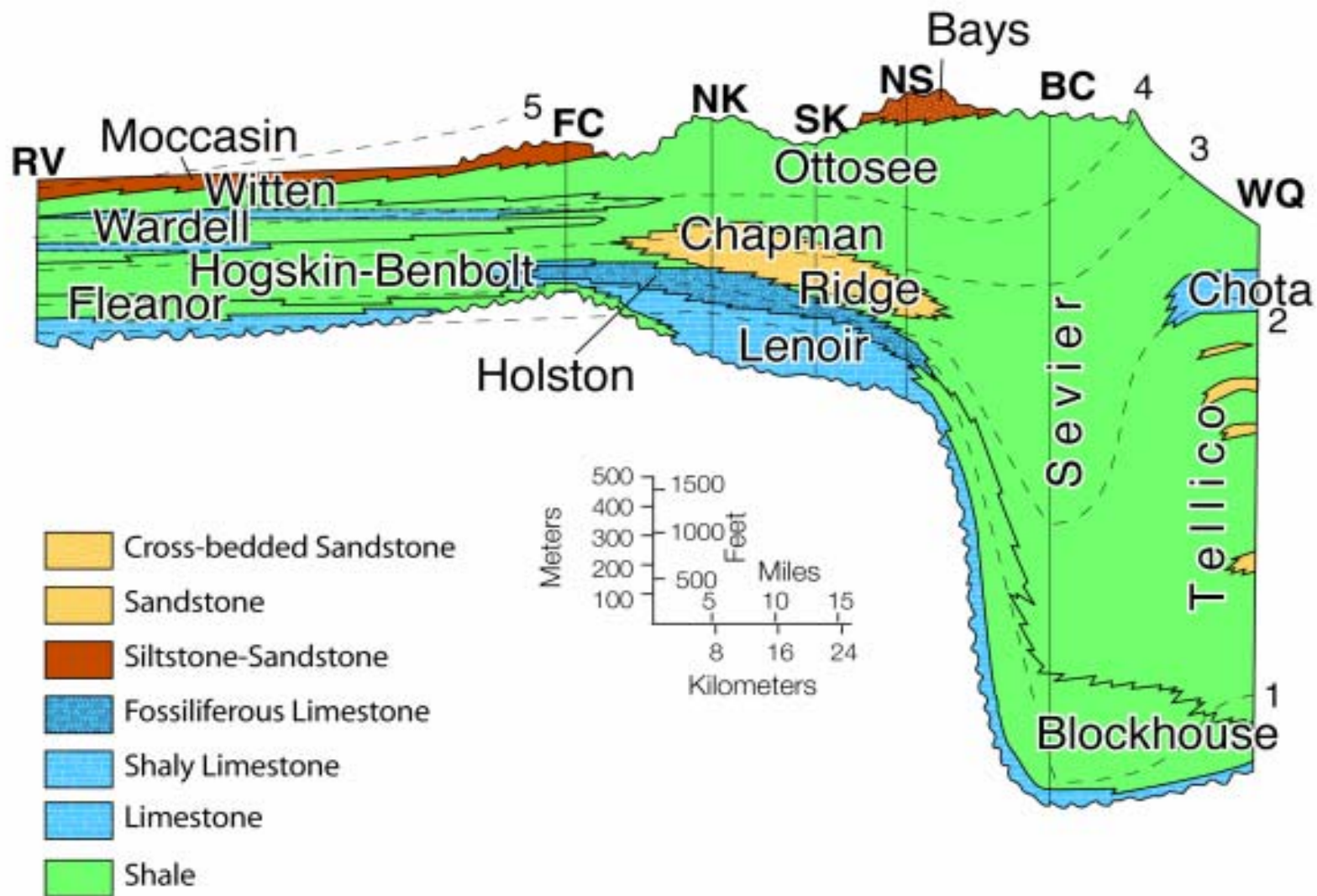
*Carbonates become drowned out by clastics
prograding to the west*



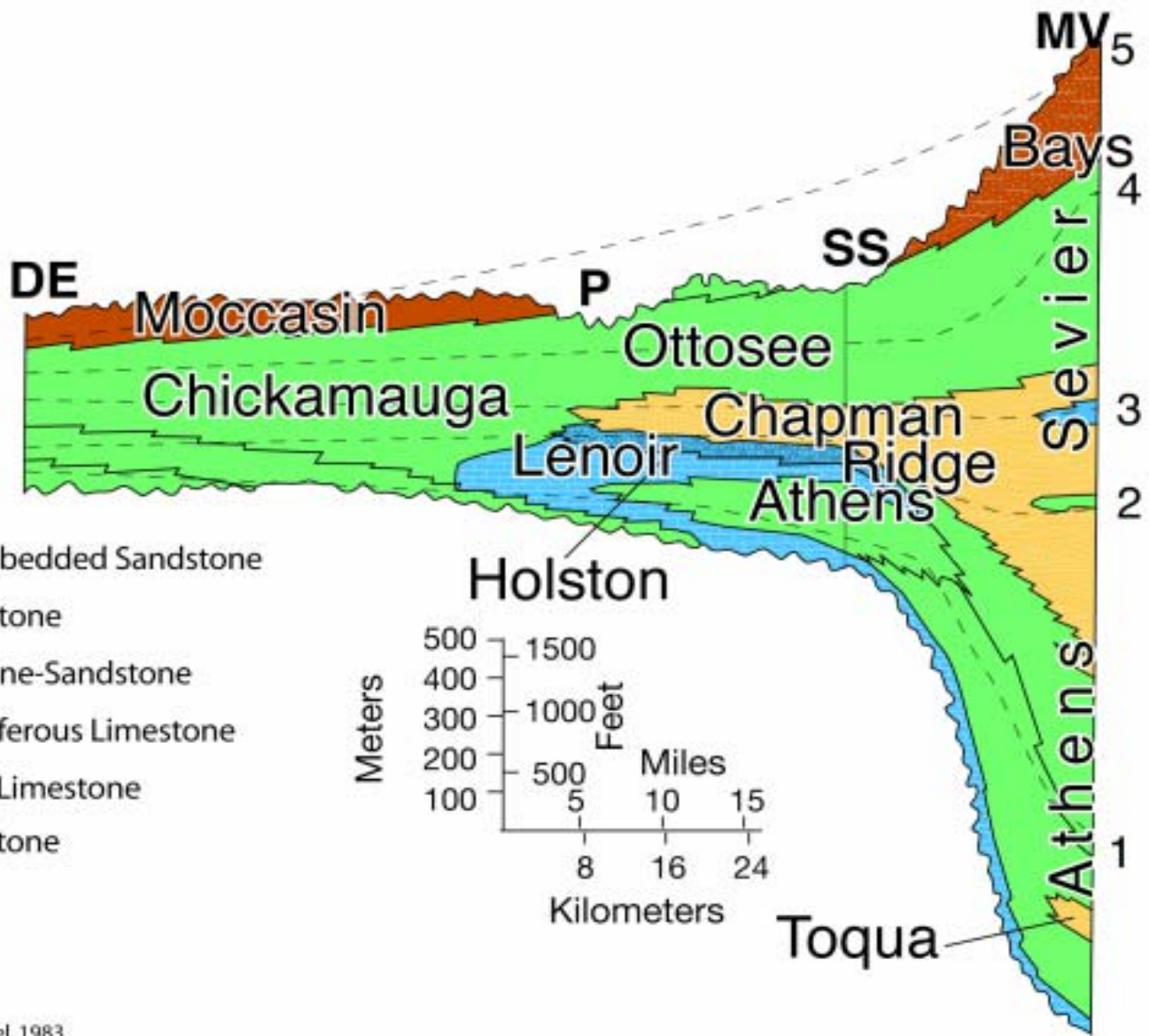
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- Magenta Choptank Ridge facies
- Walker Diag. Locations

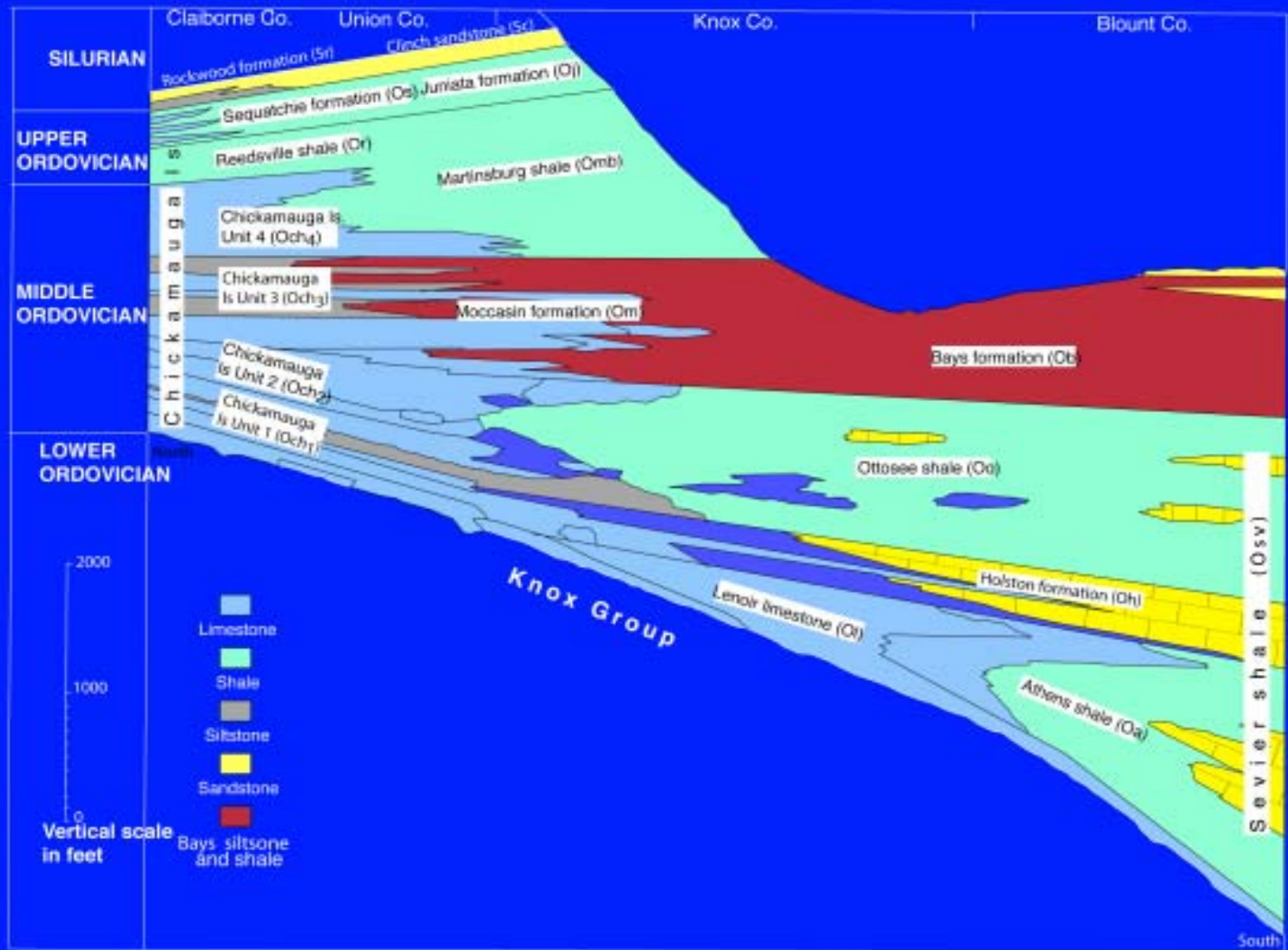
km
0 8 26 24 32
mi
0 5 10 15 20



modified from Walker,
Shanmugam, and Ruppel, 1983

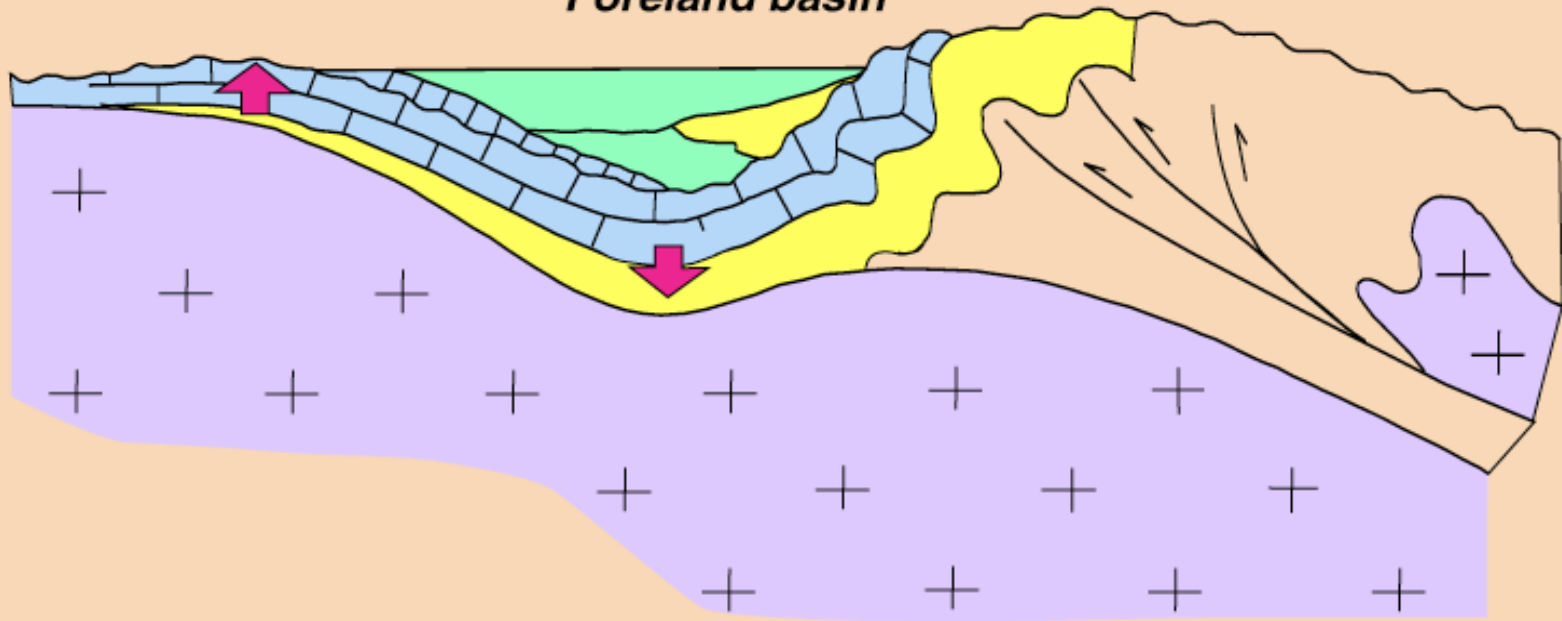


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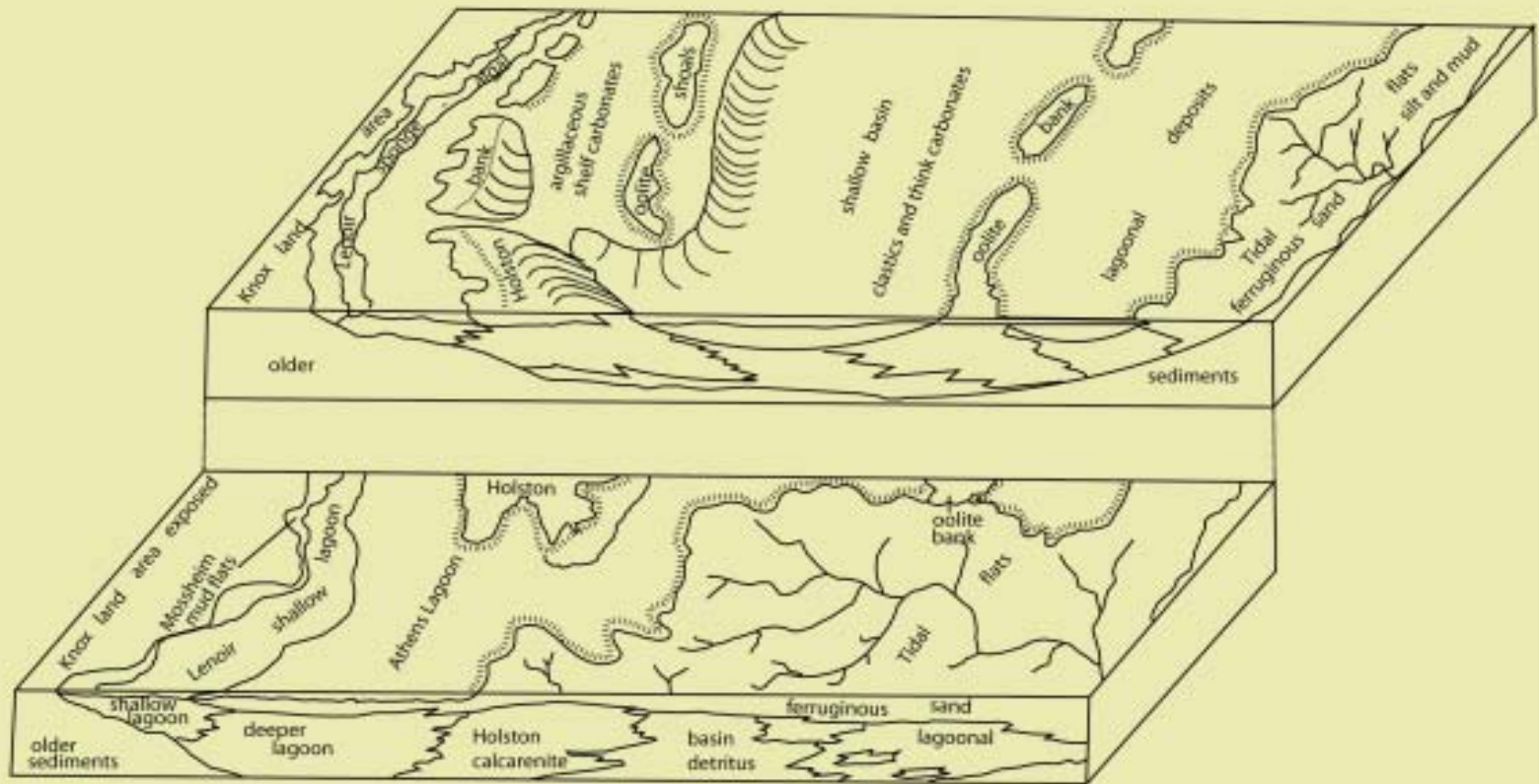


**Arch
(peripheral bulge)**

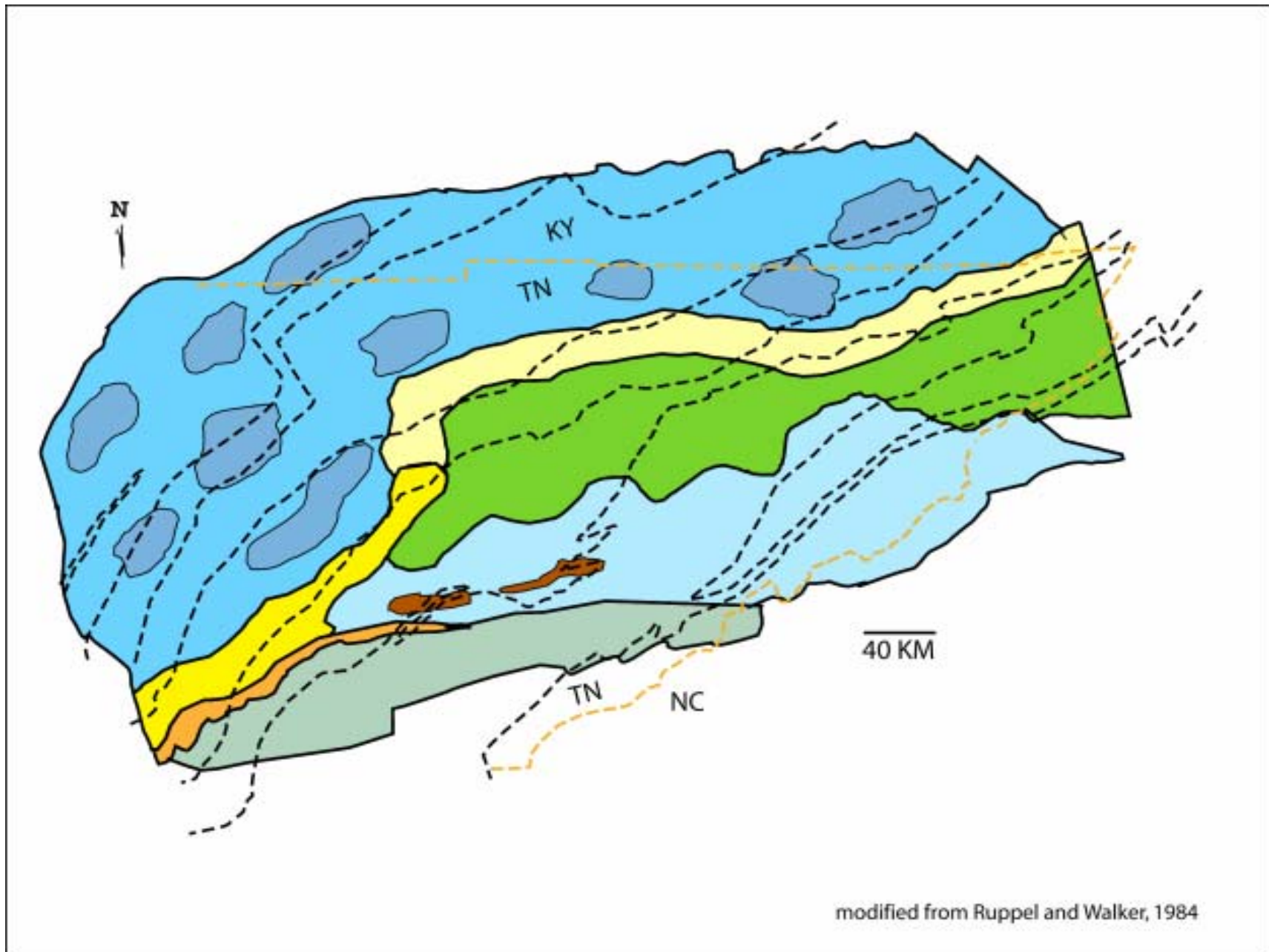
Foreland basin

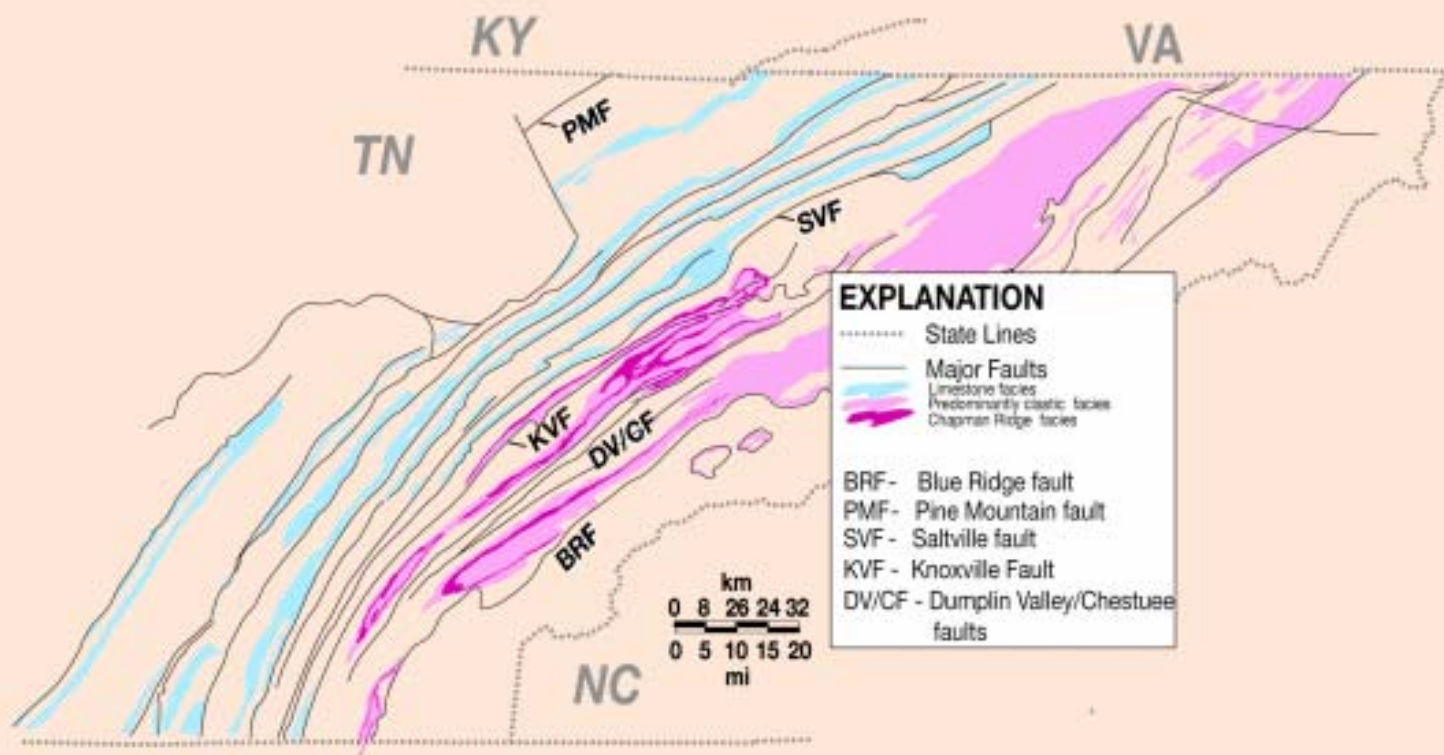


after Mussman and Read (1986)



modified from Smith, 1976



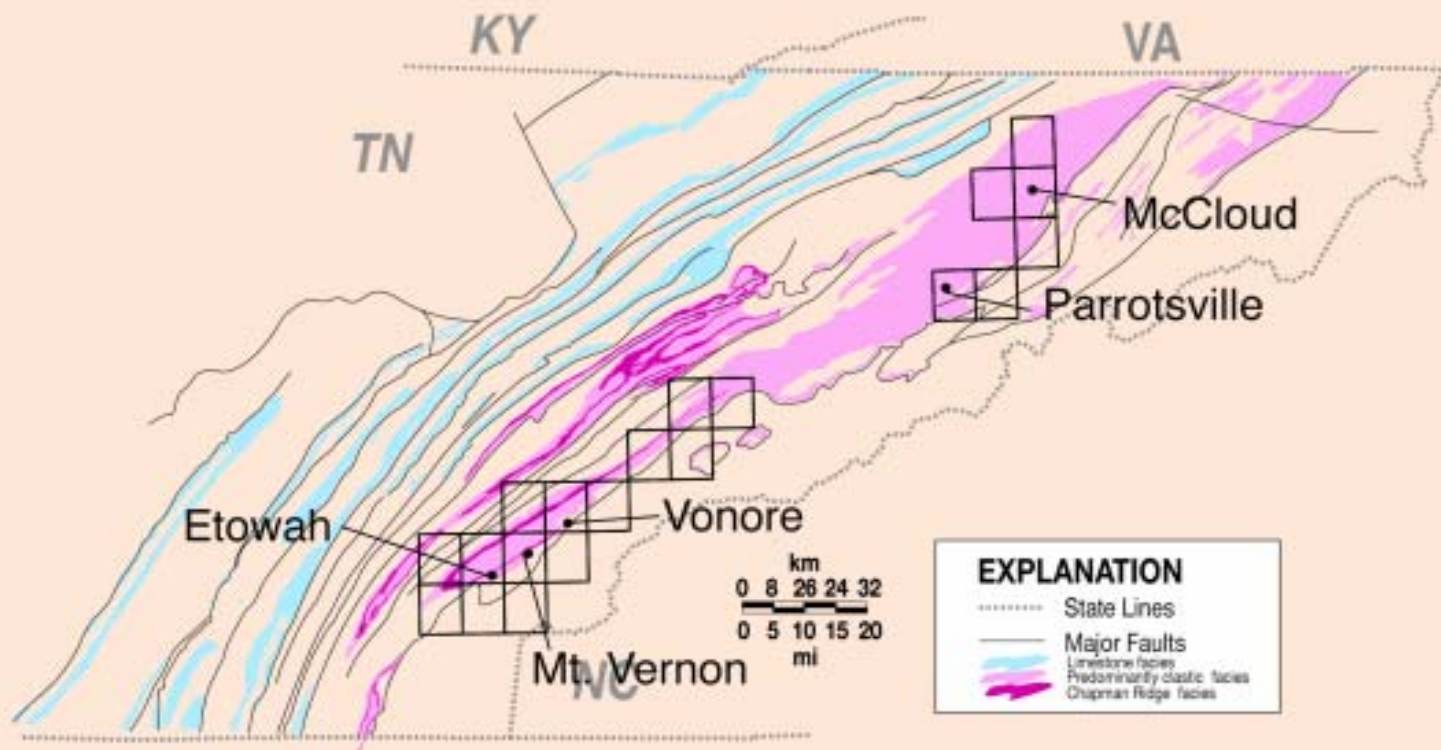


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km
 0 8 26 24 32
 mi
 0 5 10 15 20



EXPLANATION

- State Lines
- Major Faults
- Light Blue Limestone facies
- Light Purple Predominantly clastic facies
- Dark Purple Chapman Ridge facies

Middle Ordovician	
Lower Ordovician	Knox Group
U. Cambrian	

McCloud

Interbedded arenite & fine grained red sandstone

Martinsburg Fm.
Bays Fm.

Gray calcareous siltstone (upper), tan fine grained calcareous shale (middle) grey silty limestone (lower)

Sevier Shale

Gray nodular limestone
Dove gray limestone

Lenoir Limestone
Mosheim member

Parrotsville

top removed by erosion
total thickness unknown

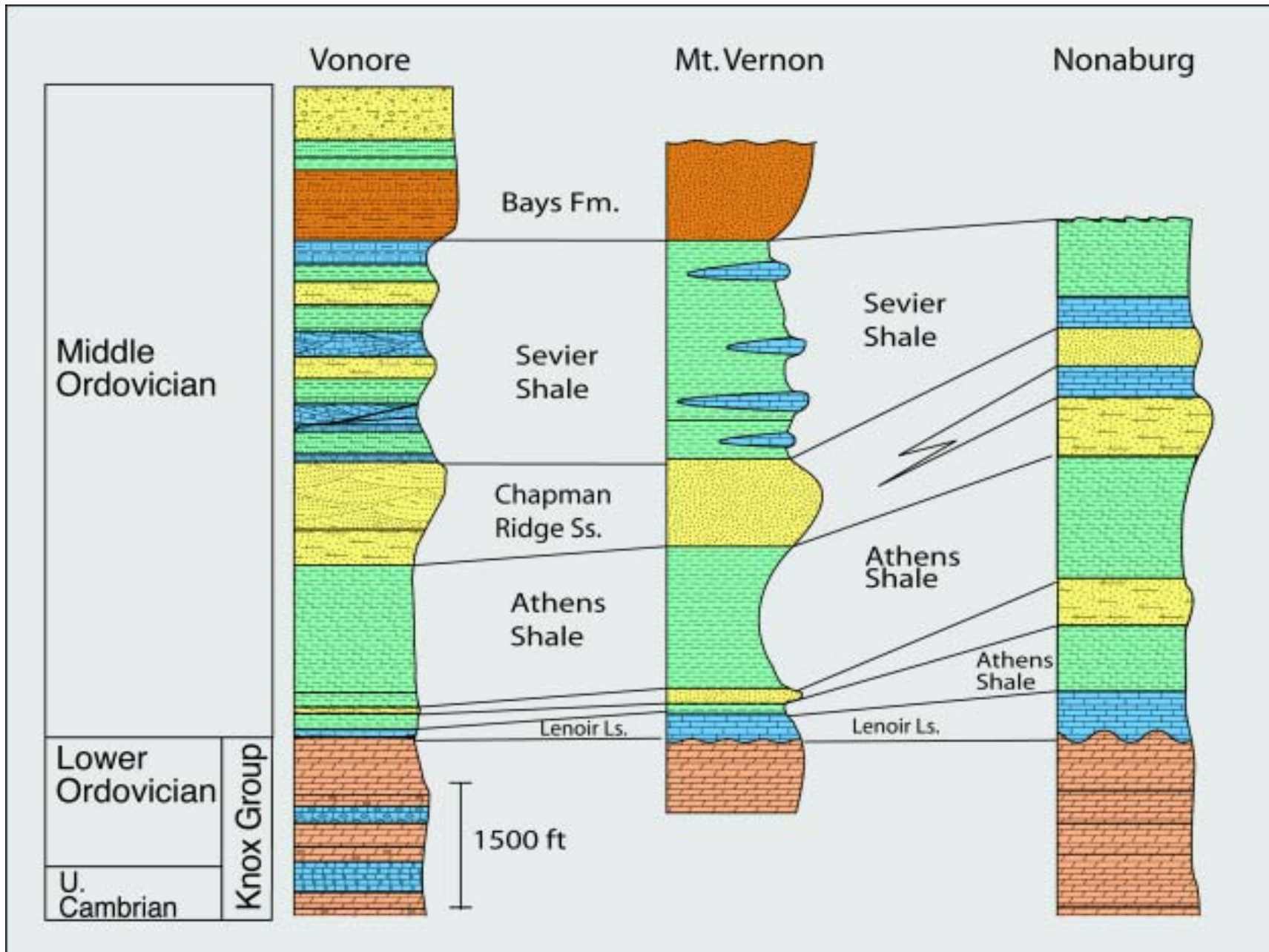
Tan fine grained calcareous shale/
interbedded calcareous siltstones and limestones

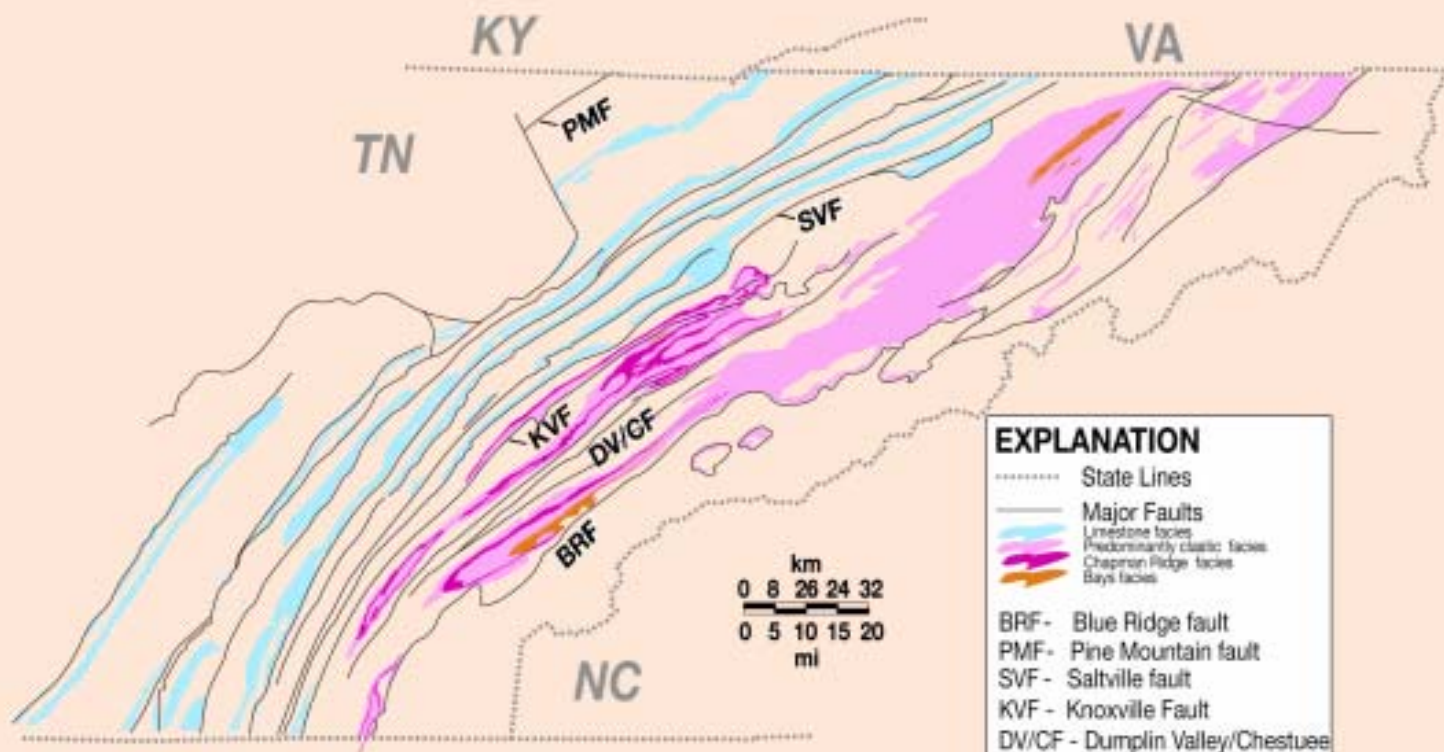
Sevier Shale

Sandy/silty limestone
Tan fine grained shale

Mosheim member of Lenoir Ls.



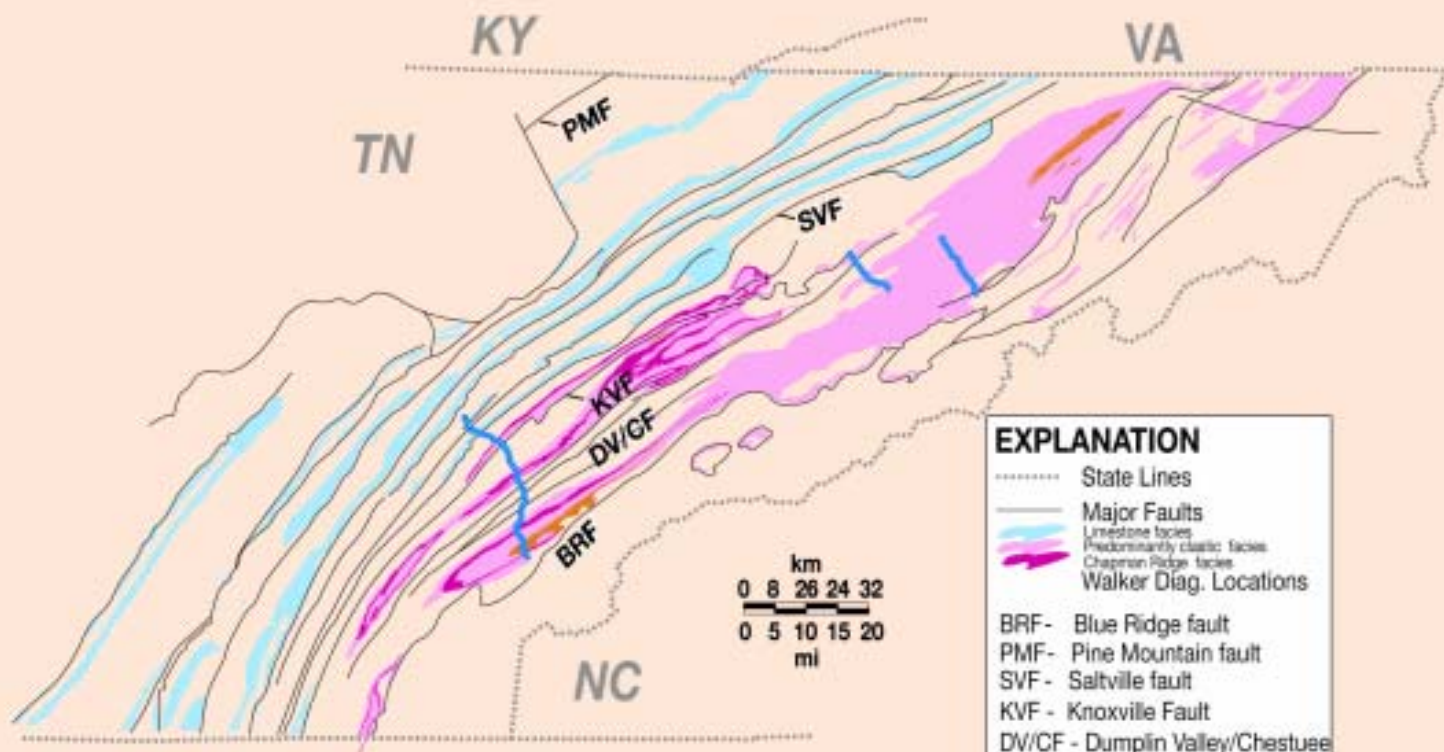




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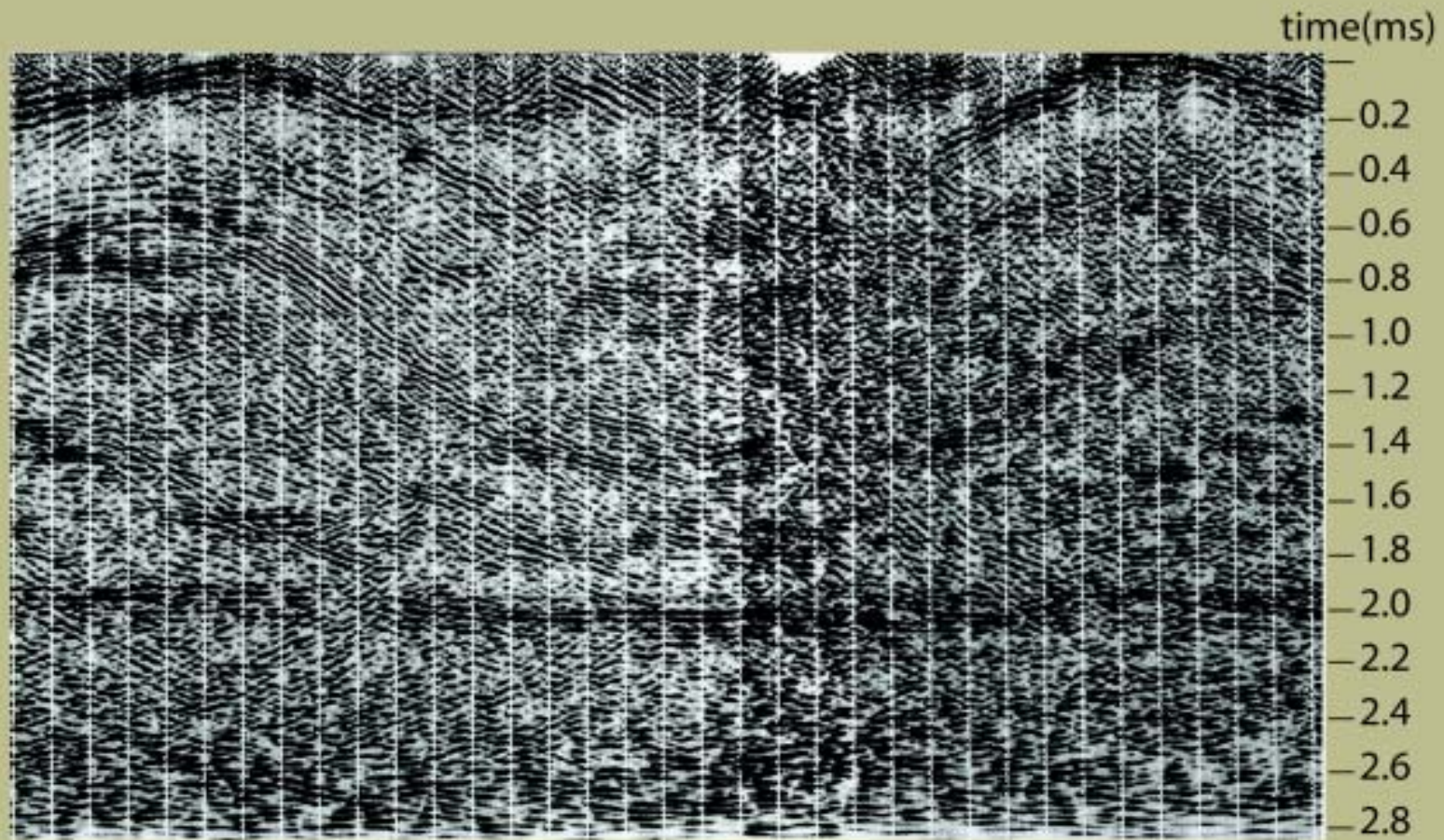
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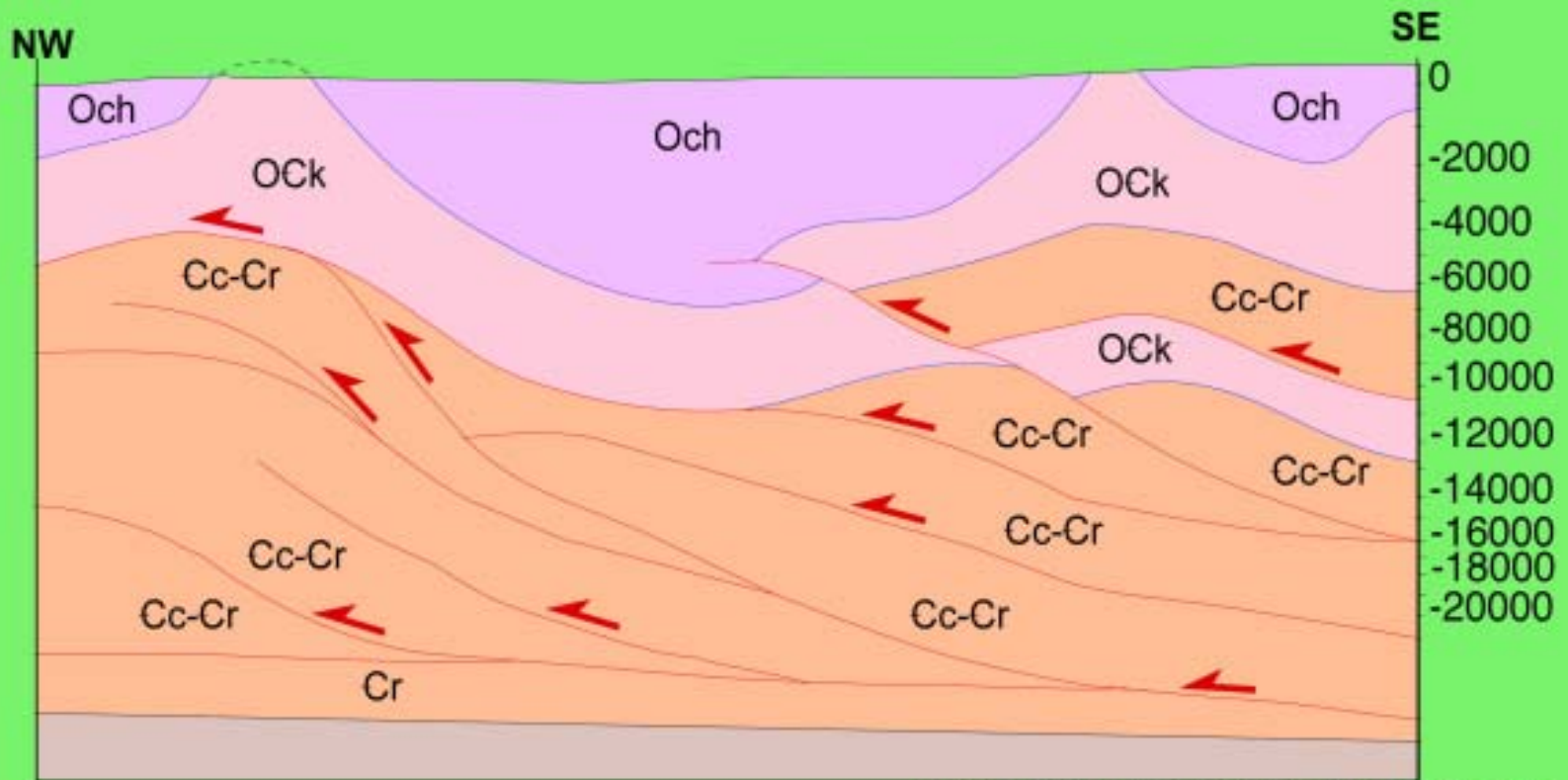
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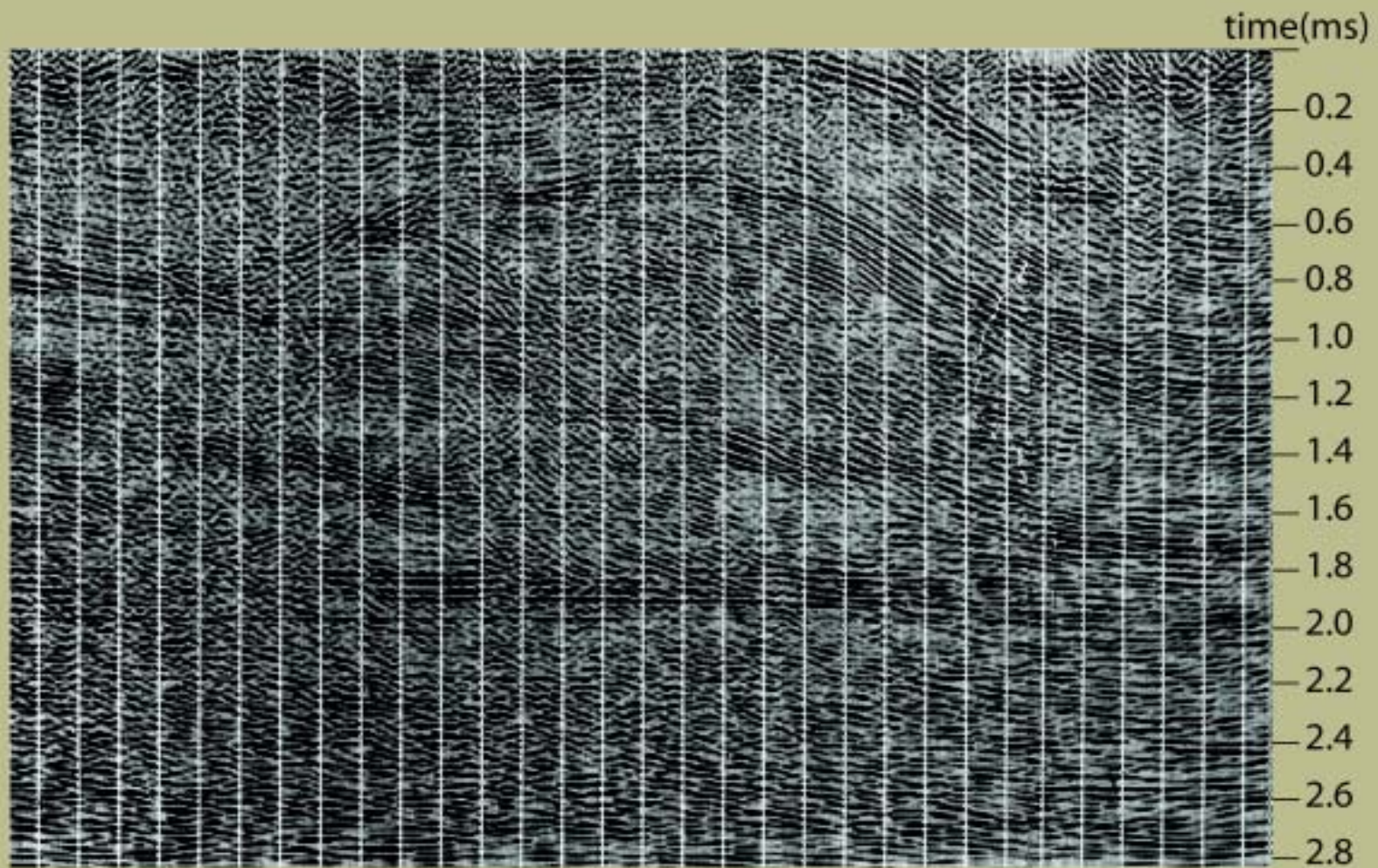


Industry seismic

- Och Chickamauga Group
- Ock Knox Group
- Cc-Cr Conasauga Group/Rome Formation

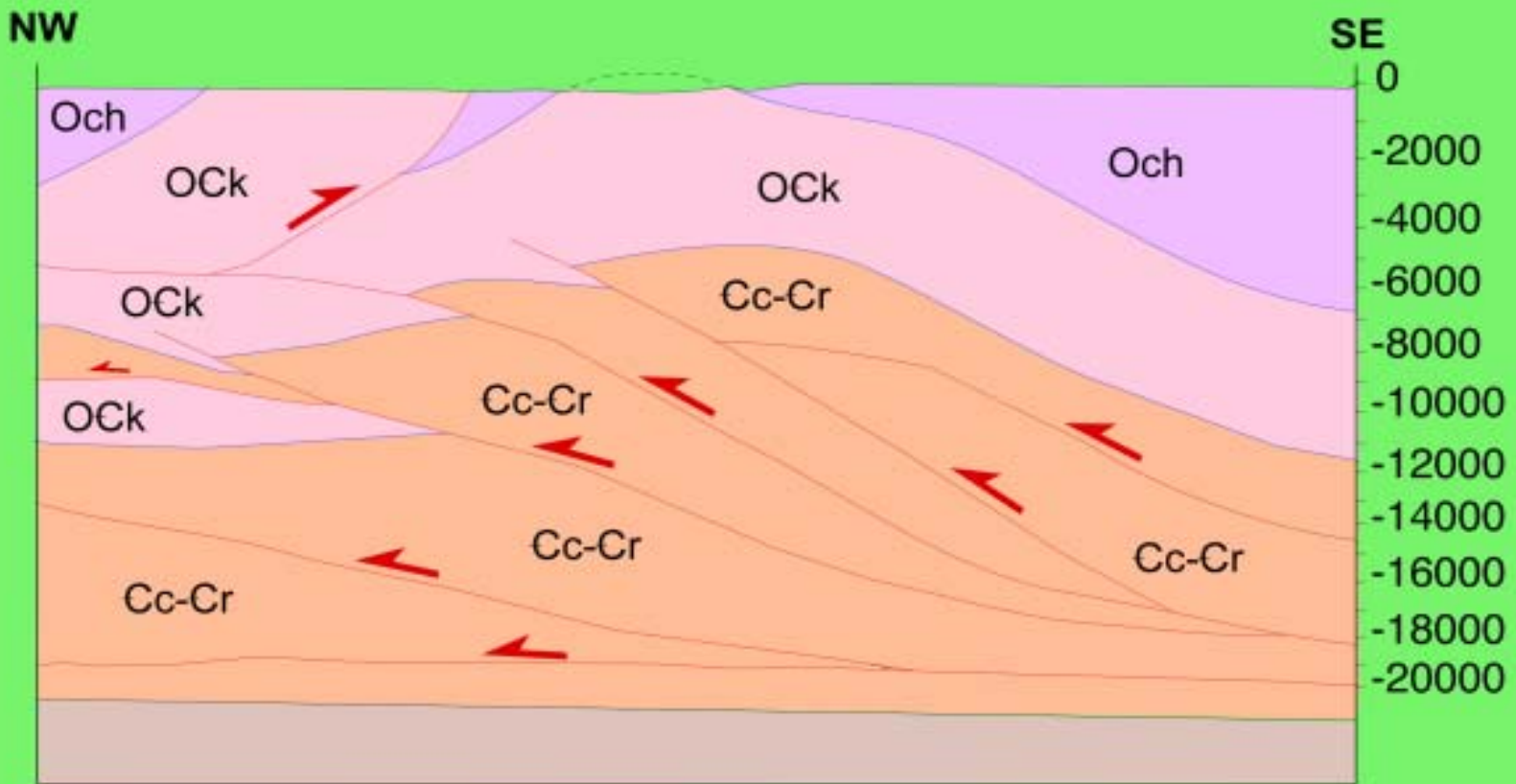


modified from Hatcher, Whisner, and McCown, 2001

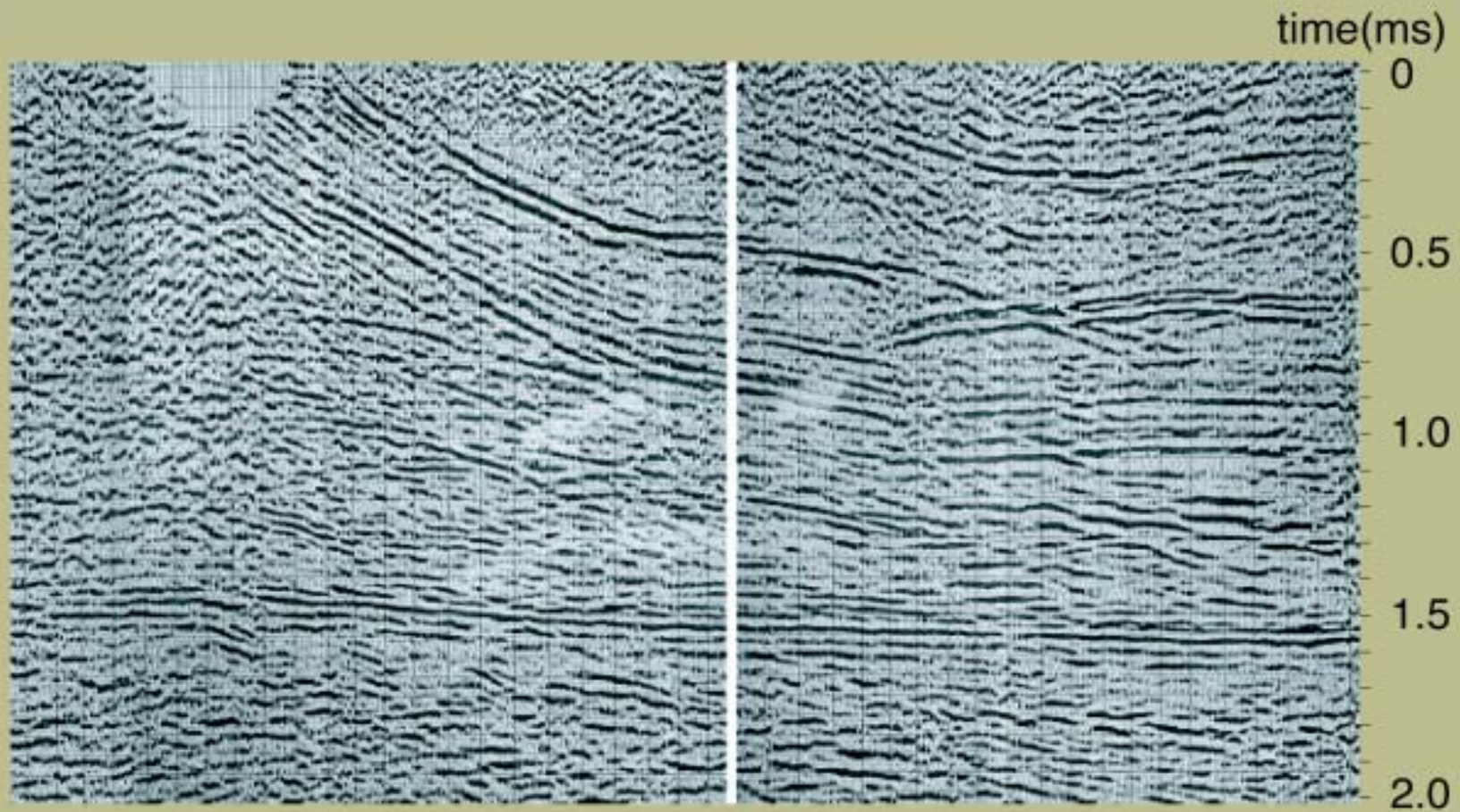


Industry seismic

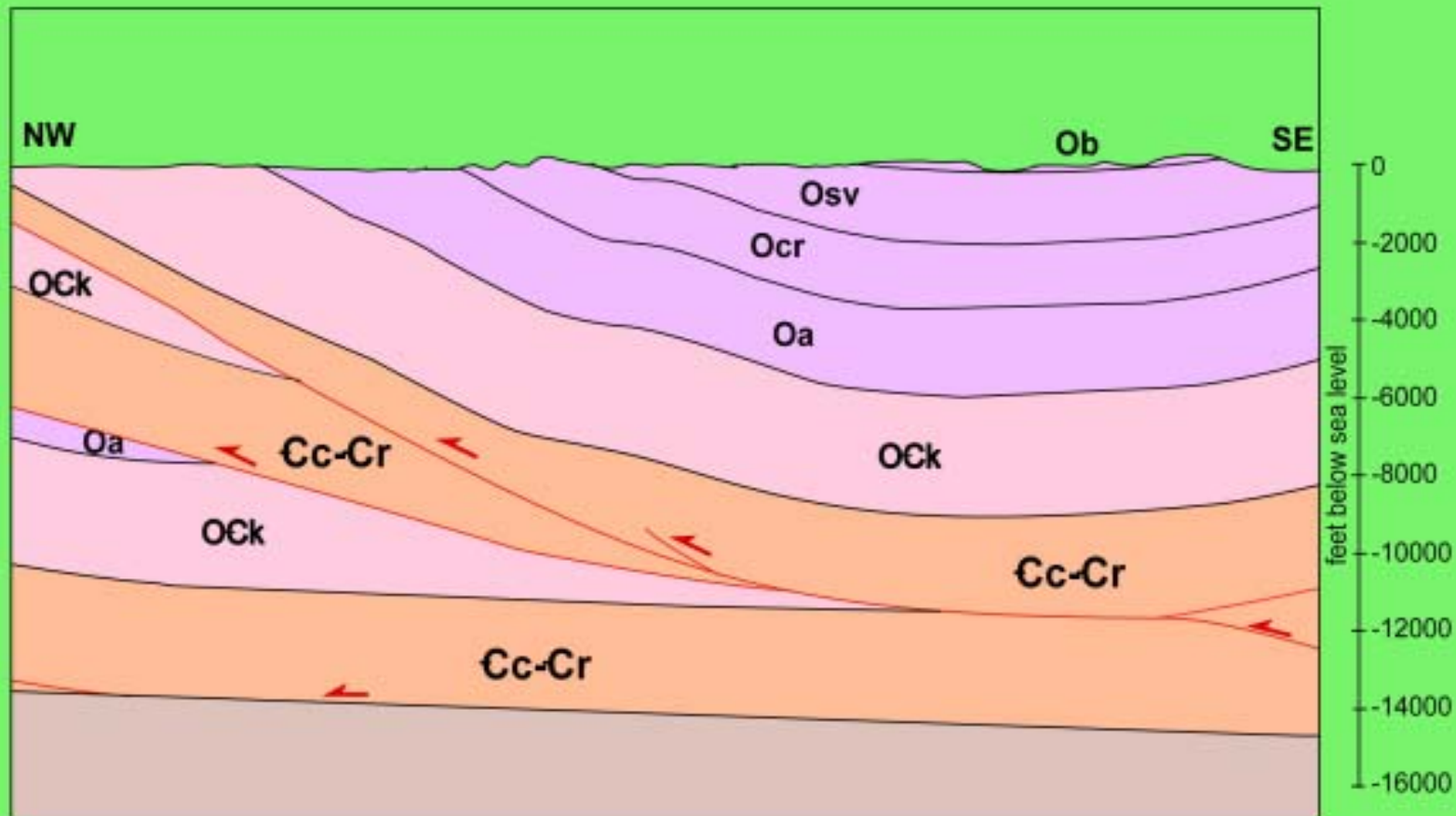
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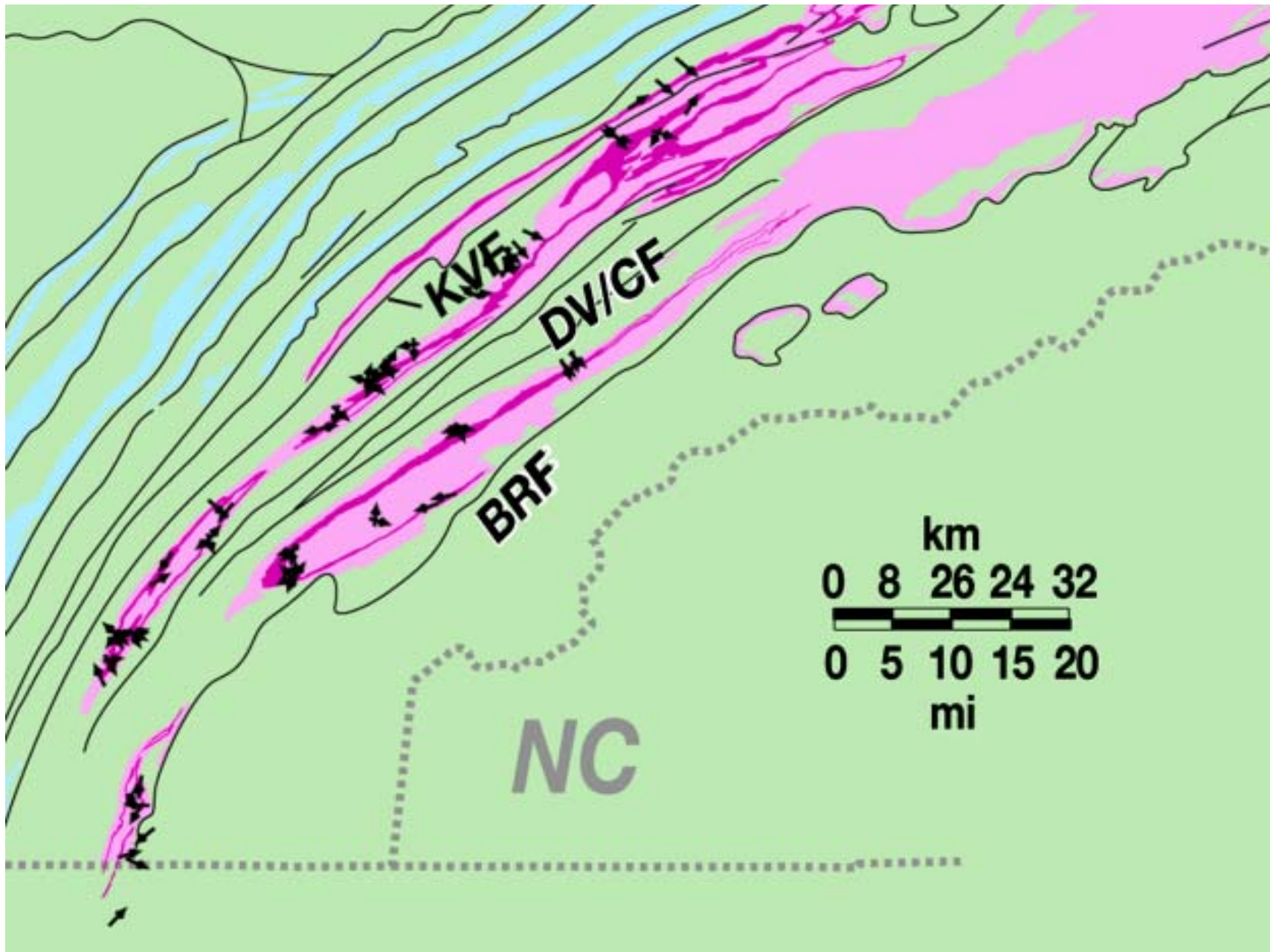


modified from Hatcher, Whisner, and McCown, 2001



industry seismic







East of Kite, TN



Cleaved Bays, South of Mt. Zion



Walland, TN



Heath, 2003

Nonaburg, TN

Sediment Sources



Tectonic land to the southeast (Shanmugam and Walker, 1982)?

Middle Ordovician conglomerate clasts are primarily carbonates (Kellberg and Grant, 1956).

Taconic highland with longshore currents?

Current indicators show random transport directions.

Did a barrier exist between the Taconic highlands and the foredeep basin?

Oil Sources

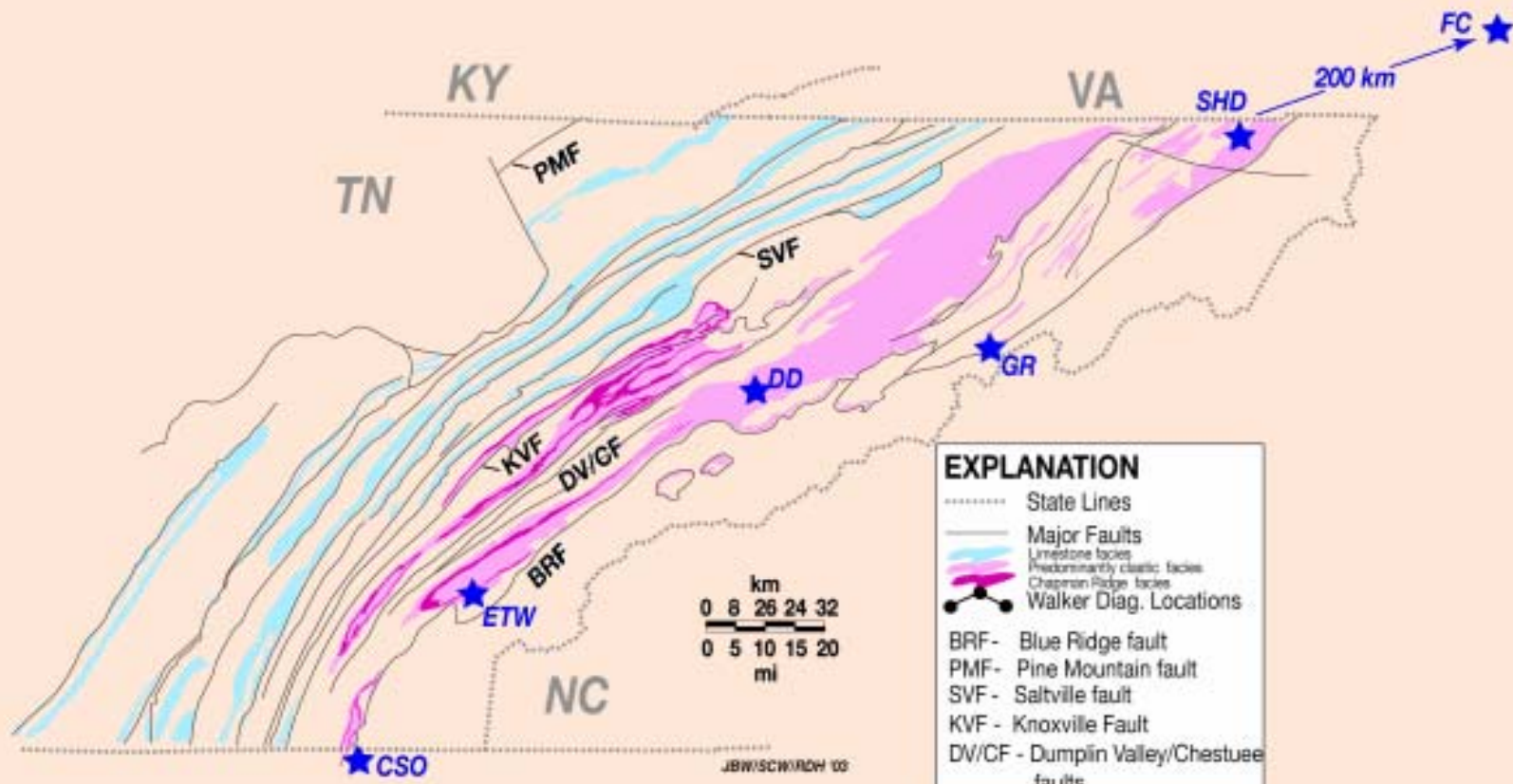


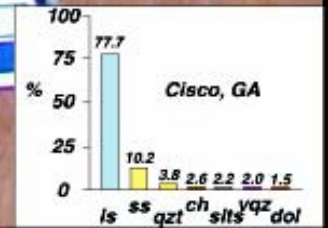
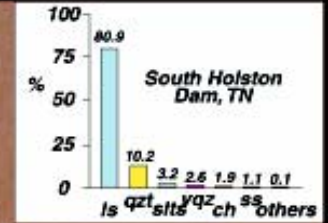
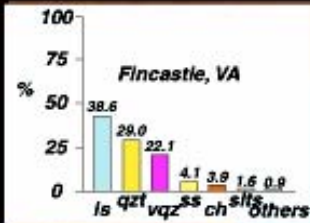
*Self-sourced Middle Ordovician
Plateau rocks?*

*Out of basin migration of organic
Sevier Shale?*

*From older Cambrian and Ordovician
rocks (Copper Ridge)?*

Black shales in the Chattanooga?





Clast percents from Kellberg and Grant (1956)

Conglomerate Source

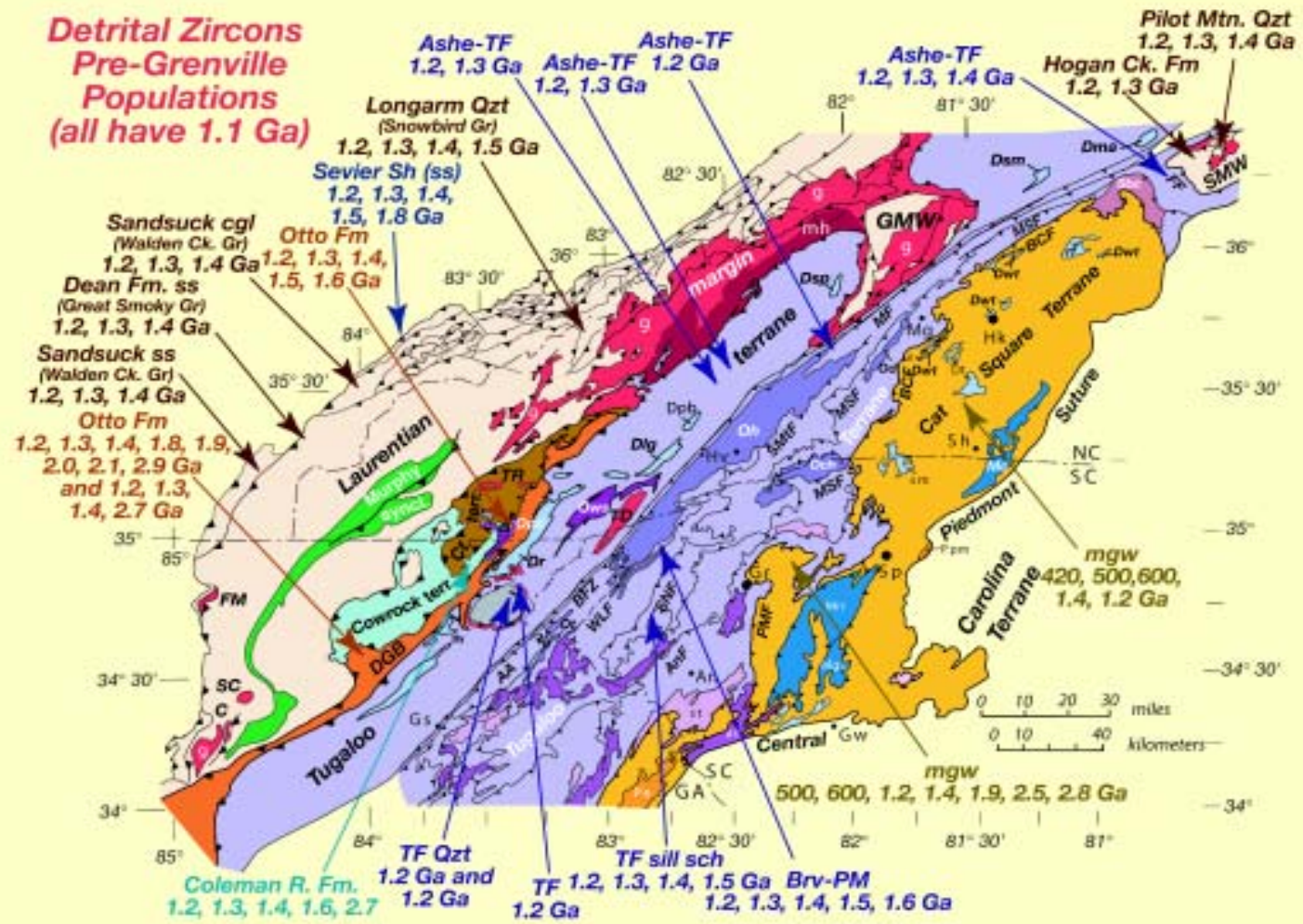


Chilhowee sediments

Cambrian carbonate shelf

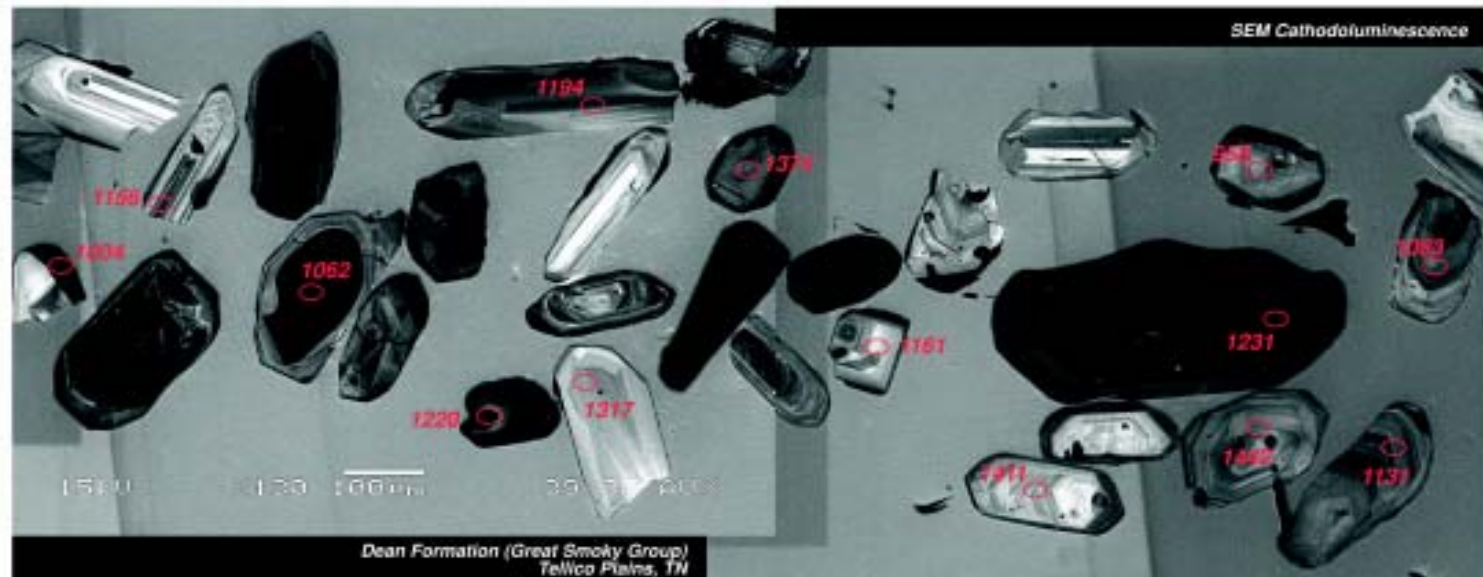
Middle Ordovician carbonates

**Detrital Zircons
Pre-Grenville
Populations
(all have 1.1 Ga)**



Example detrital zircons

○ Age in Ma



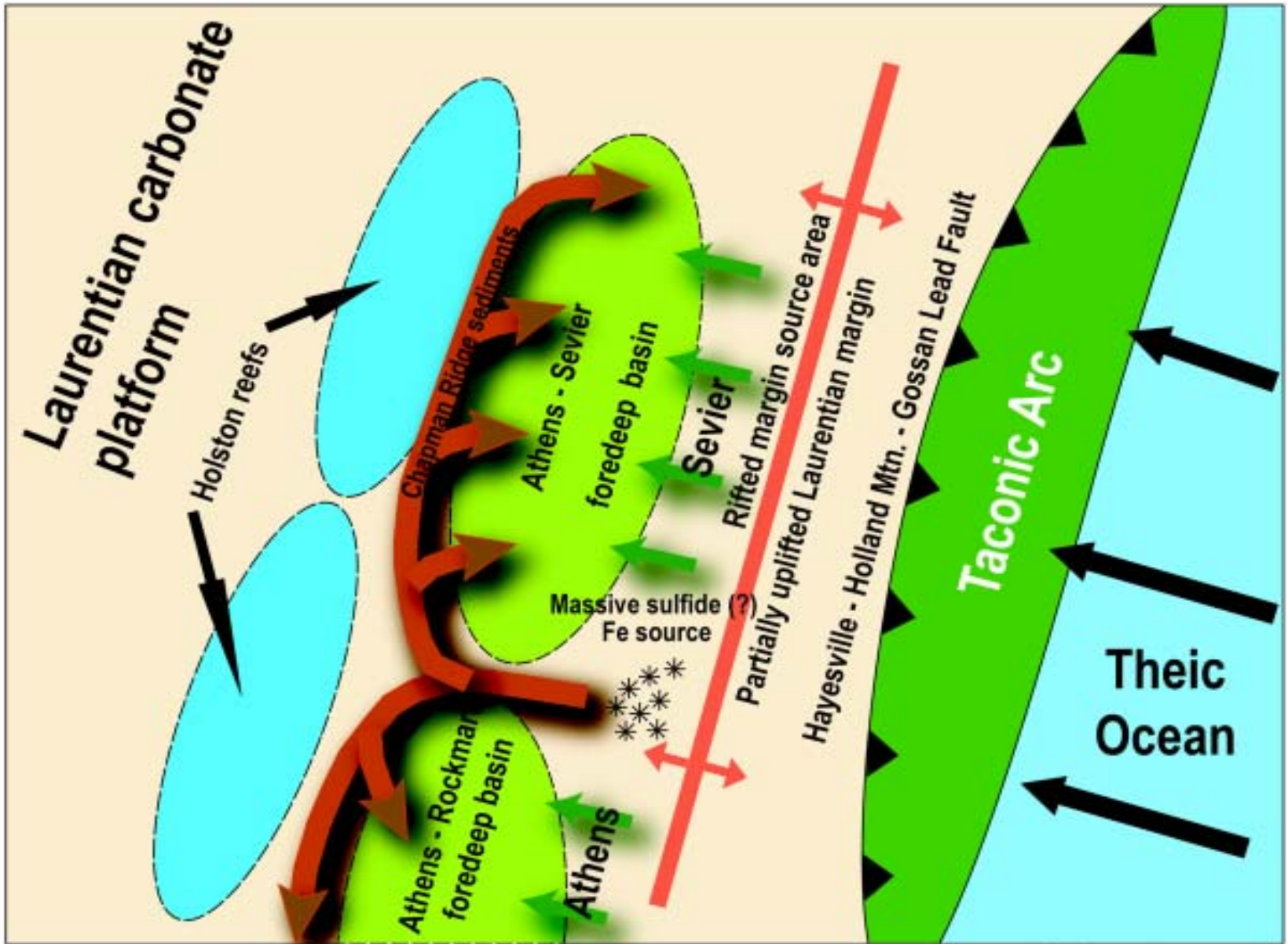
Zircon Data



24 Middle Ordovician Sevier shale detrital zircon analyses show only pre-Paleozoic cores (Bream, 2003)

Other zircon analyses from the Ordovician through Pennsylvanian sediments in the Central and Southern Appalachians show few Paleozoic cores until the Carboniferous (Gray and Zeitler, 1997; Eriksson et al, 2002)

Unroofing of the southern and central Appalachians did not occur until the late Paleozoic



modified from Thigpen, 2002



Conclusions

The Sevier basin could be either a foredeep or backbulge

Transport directions in the Chapman Ridge do not identify the source clearly

Thicknesses obtained via detailed structural mapping are similar to thicknesses of Shanmugam and Walker (1978).