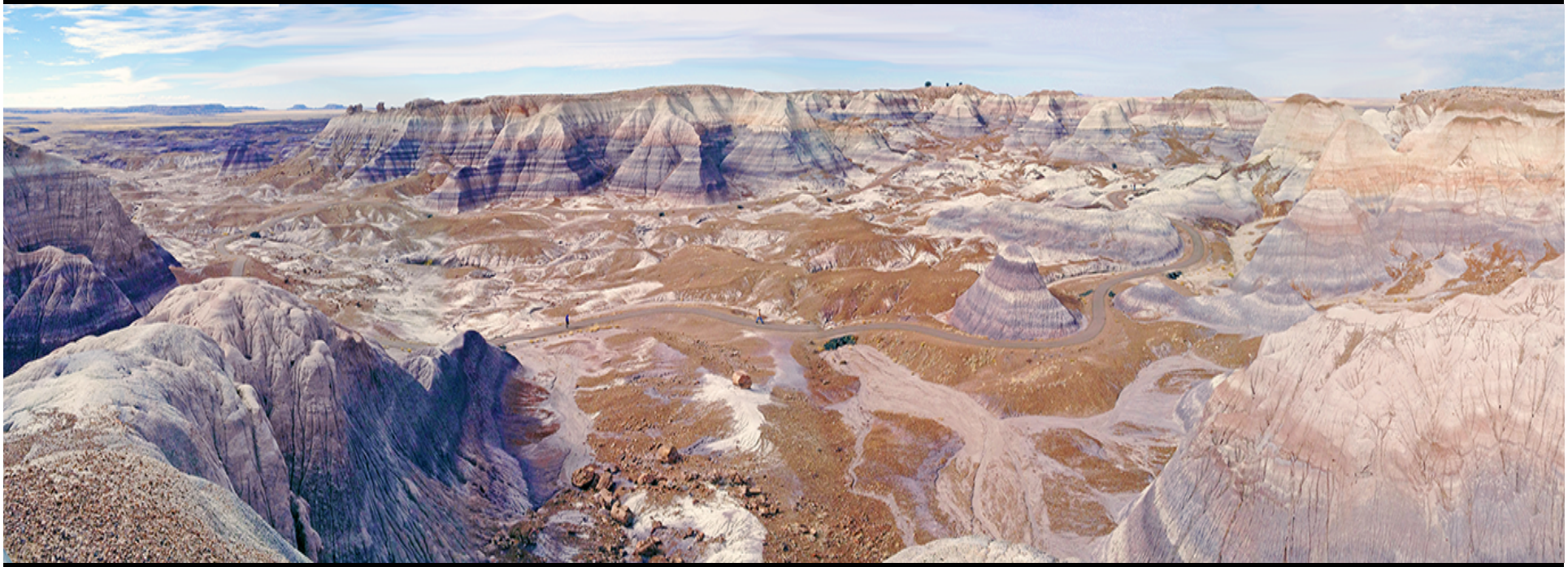
INCIPIENT PANGEAN RIFTING RESPONSIBLE FOR THE INITIATION OF CHINLE-DOCKUM SEDIMENTATION: INSIGHTS FROM THE NEWARK SUPERGROUP AND SHARED LATE TRIASSIC PLATE-SCALE TECTONIC EVENTS AND GEOCHRONOLOGIES

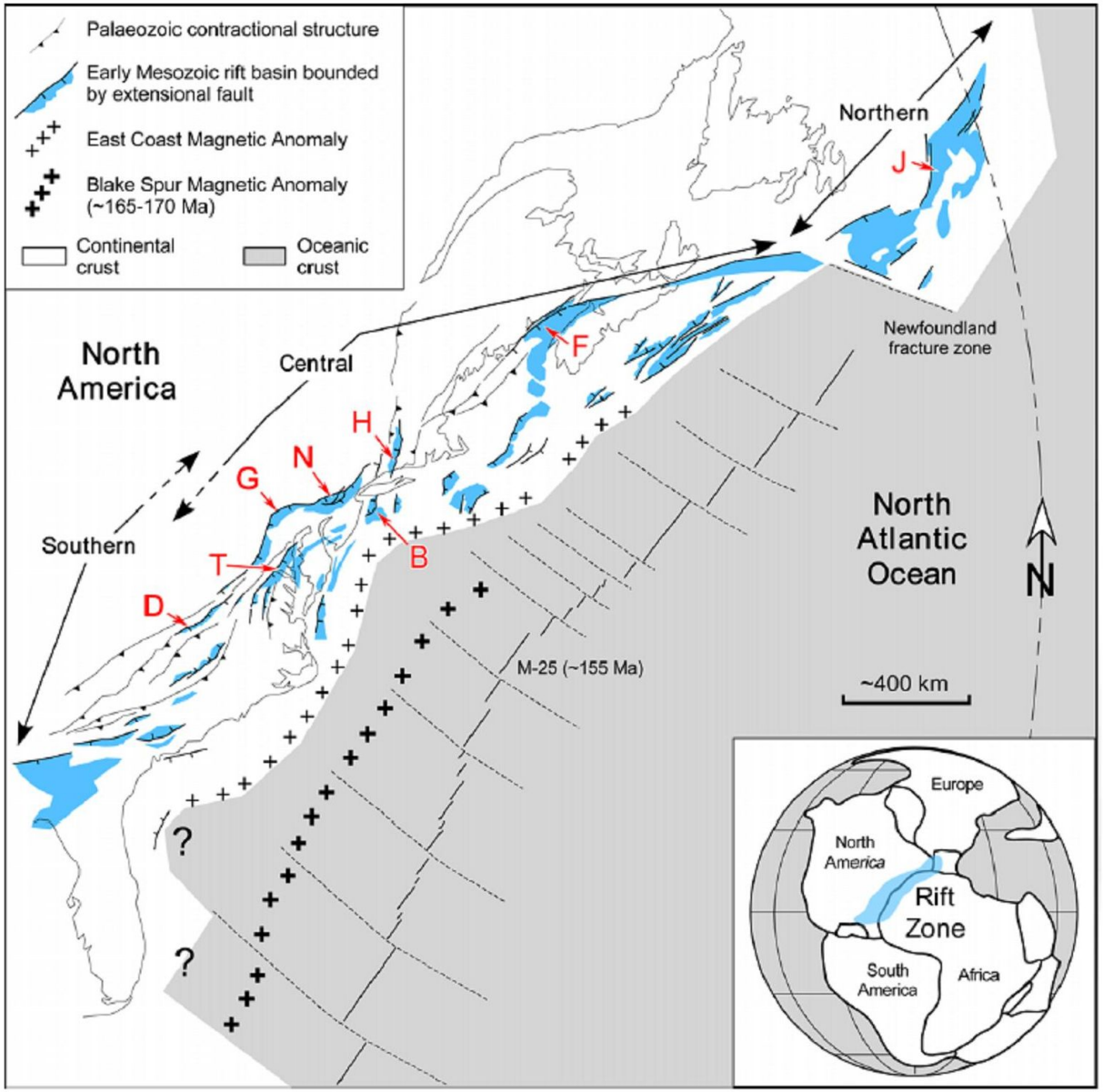


HUBER, Phillip, Geoscience Books, PO Box 1036, Faribault, MN 55021

OLSEN, Paul E., Department of Earth and Environmental Sciences, LDEO, Columbia University, Palisades, NY 10964-1000 and

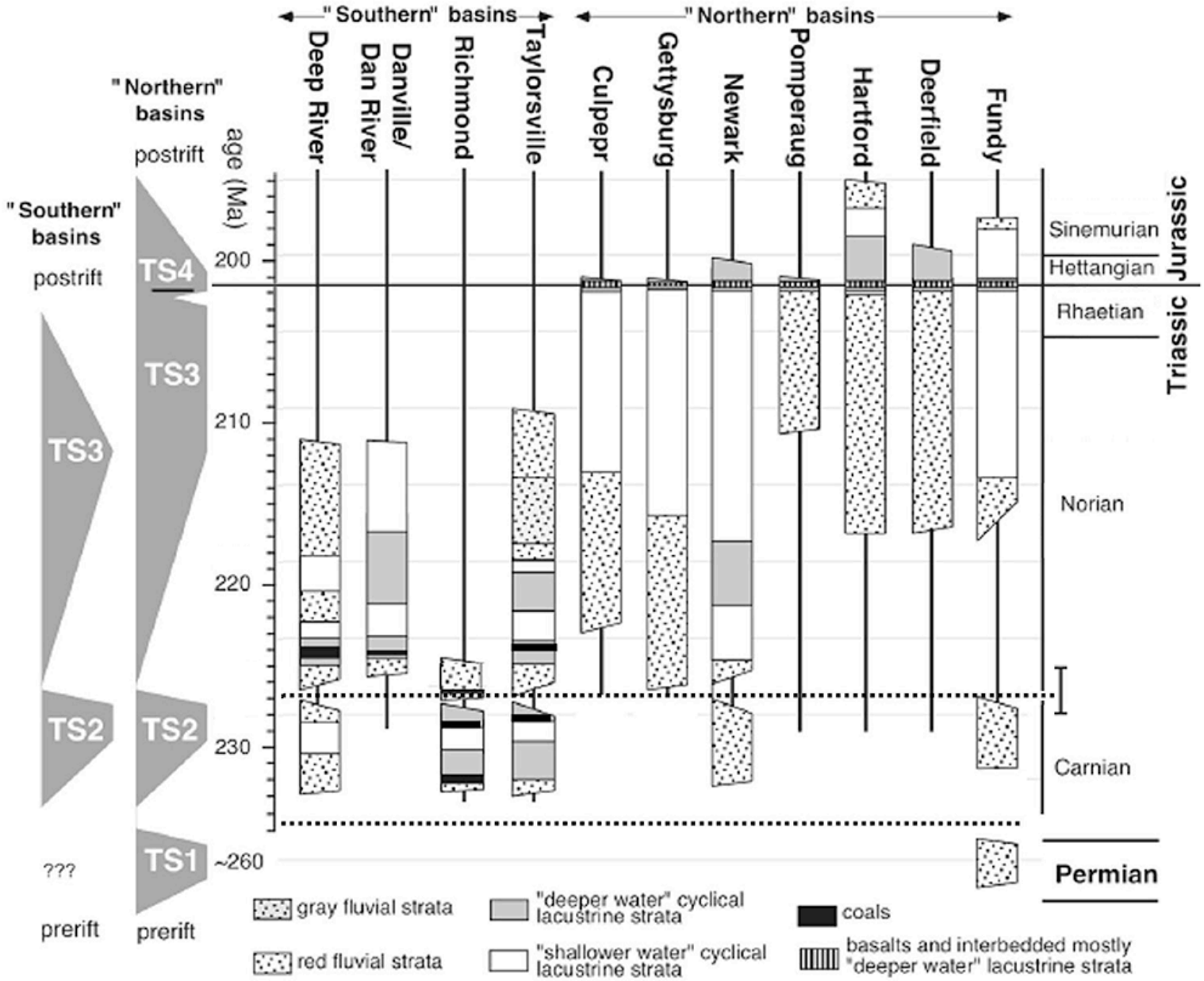
LETOURNEAU, Peter M., Dept. of Biology-Environmental Science, Iona College, New Rochelle, NY 10801

THE NEWARK SUPERGROUP AND RELATED SUBSURFACE BASINS

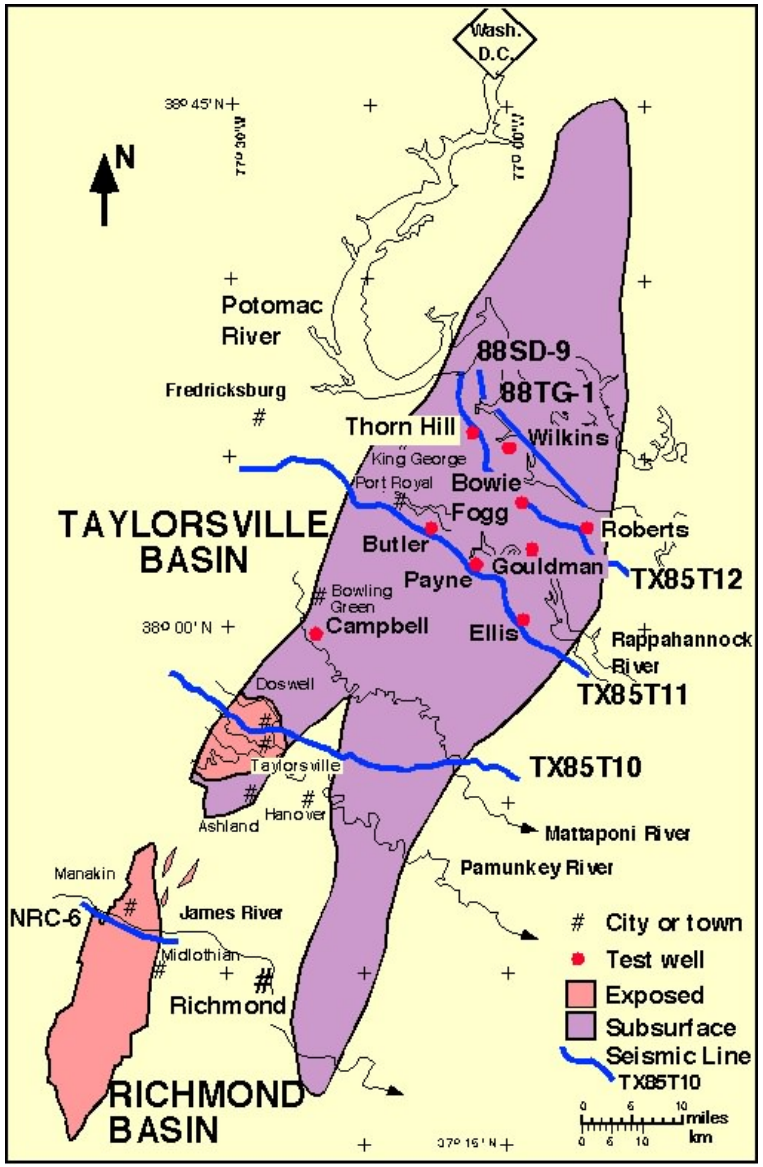


Withjack et al., 2013

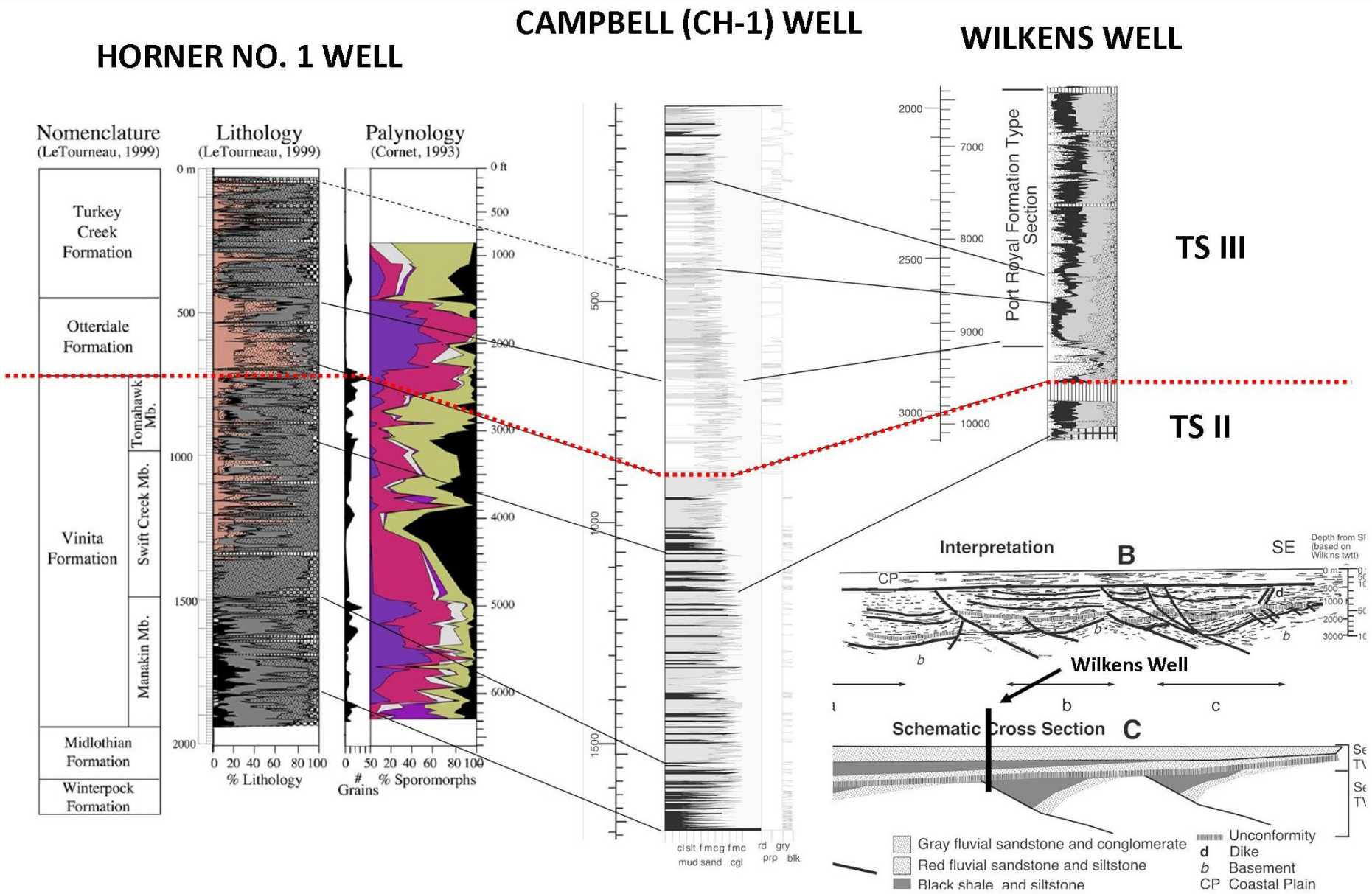
NEWARK SUPERGROUP TECTONOSTRATIGRAPHIC SEQUENCES



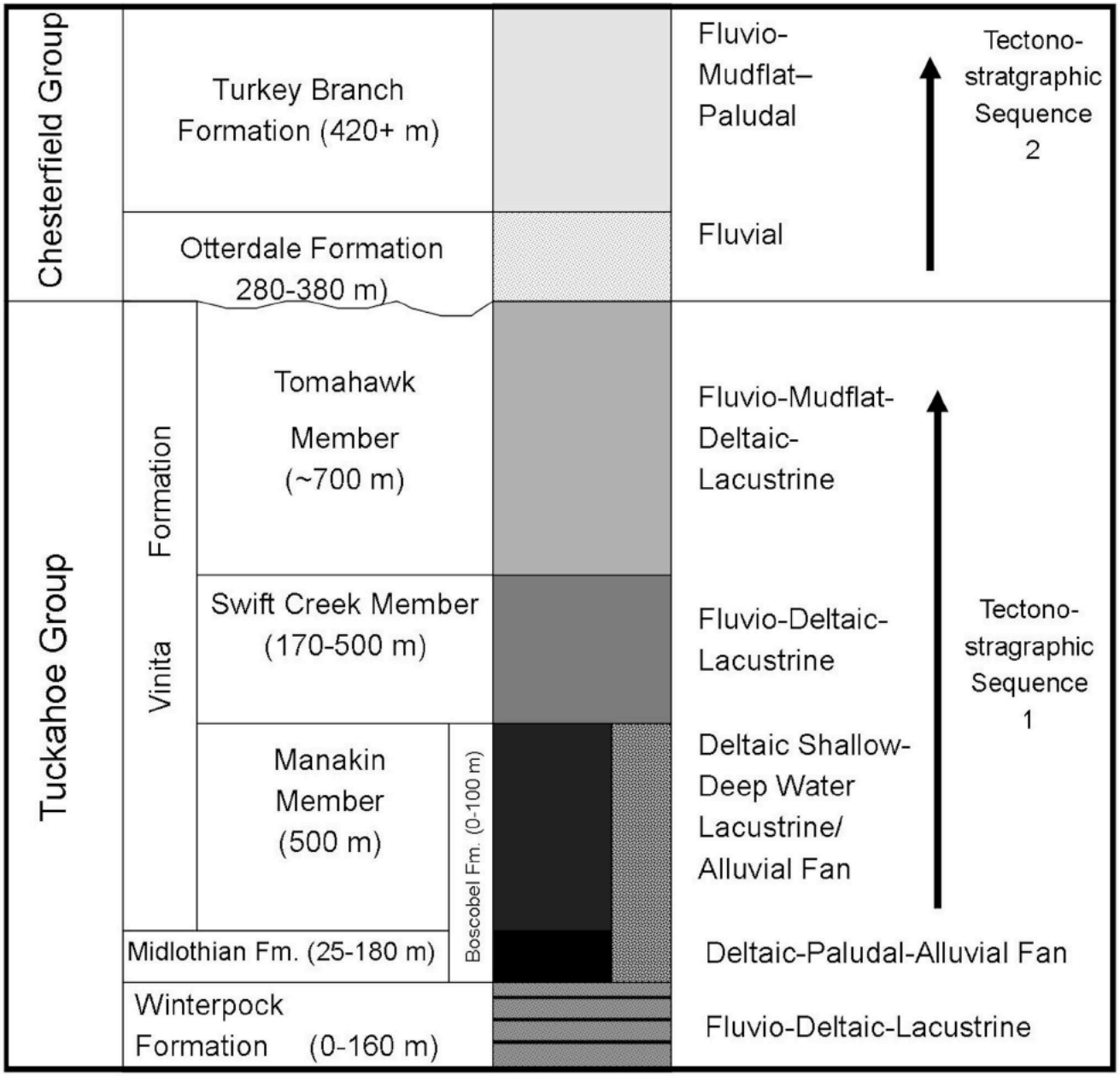
TS II CONTAINS THE ONLY KNOWN SUBSTANSTIAL RECORDS OF NONMARINE CARNIAN STRATA IN NORTH AMERICA, BEST ILLUSTRATED BY THE RICHMOND AND TAYLORSVILLE BASINS



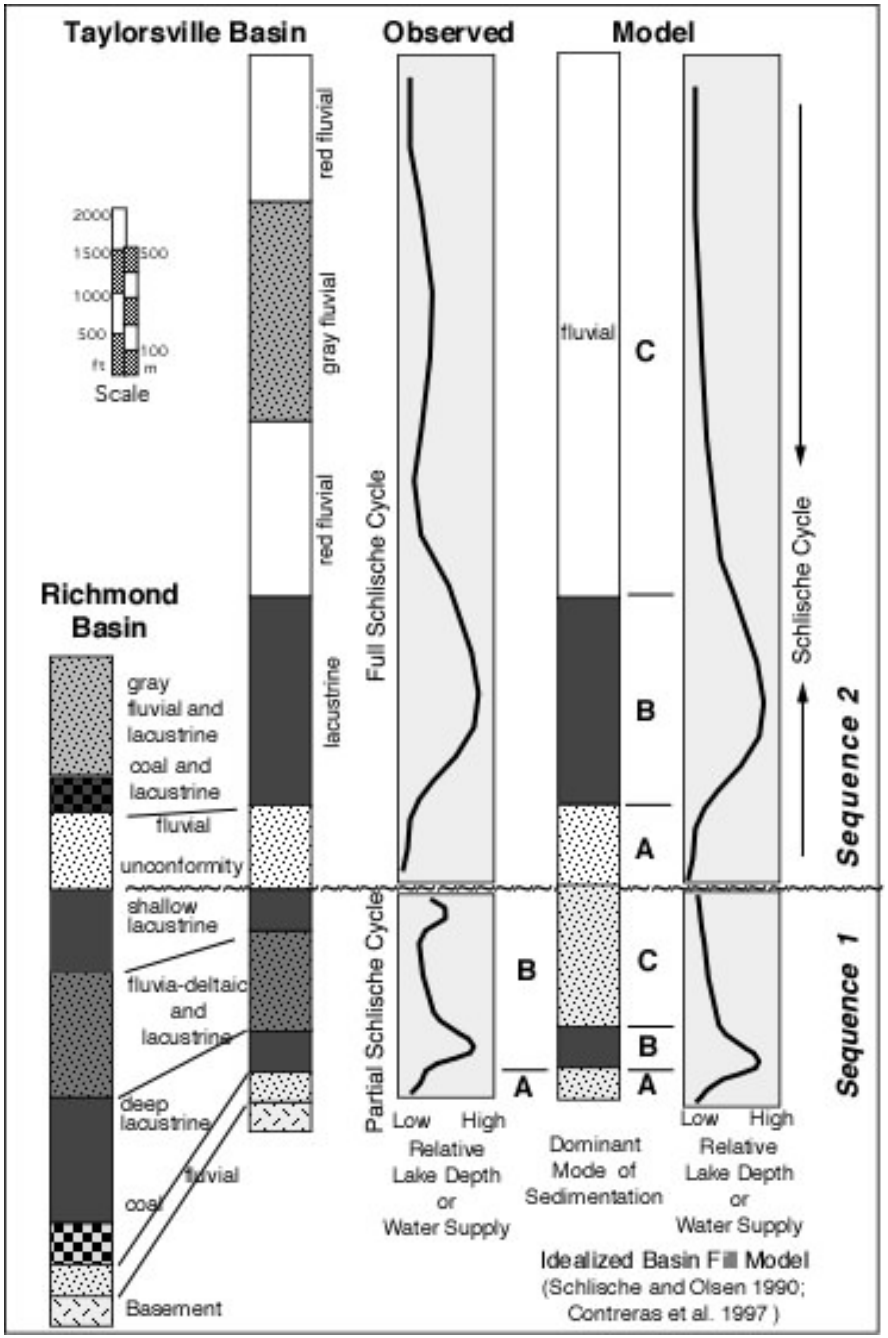
RICHMOND – TAYLORSVILLE BASIN LITHOSTRATIGRAPHY



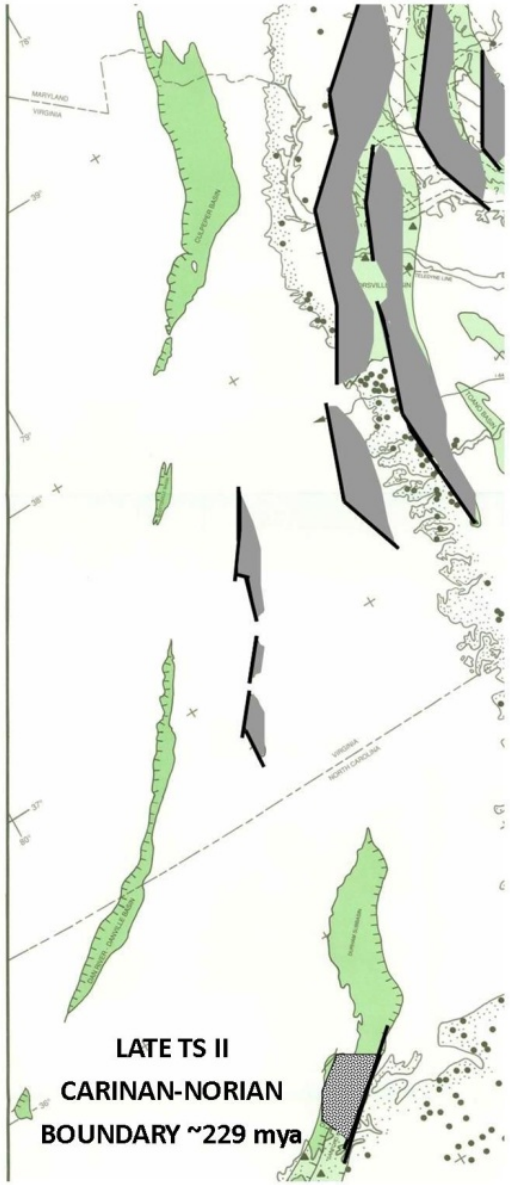
SUMMARY OF RICHMOND BASIN STRATIGRAPHY, MAJOR FACIES AND SEQUENCE BOUNDARY



BASIN-FILL MODEL



TIMING AND GROWTH OF SOUTHEASTERN NEWARK RIFTS



SOMETHING BIG HAPPENED APPROXIMATING THE CARNIAN-NORIAN BOUNDARY!

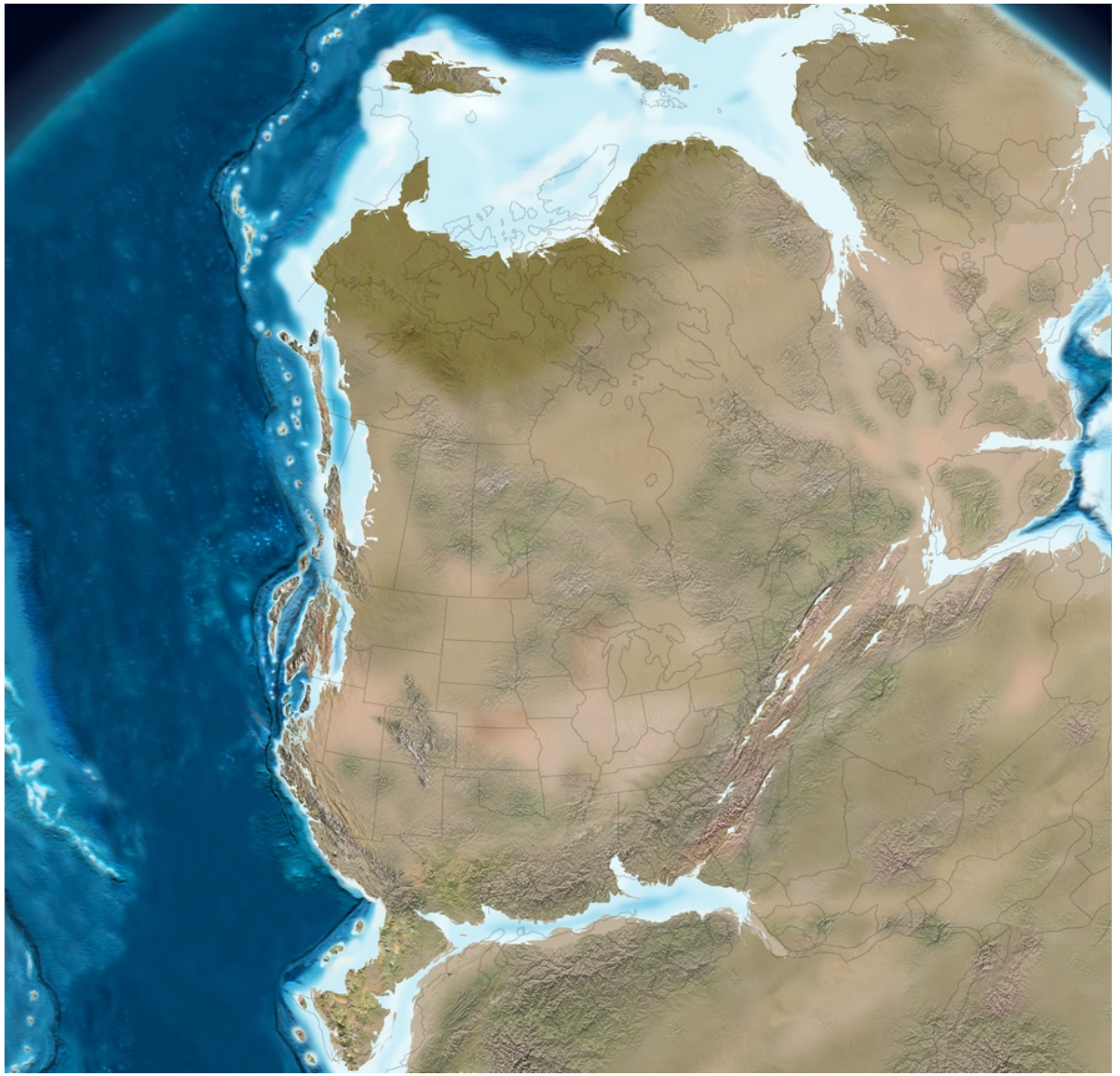
1. EXISTING NEWARK SUPERGROUP BASINS EXPERIENCED ACCELERATED GROWTH.

2. NEW RIFT BASINS DEVELOPED, INCLUDING EAGLE MILLS RIFTS PARALLEL TO THE PRESENT GULF COAST.

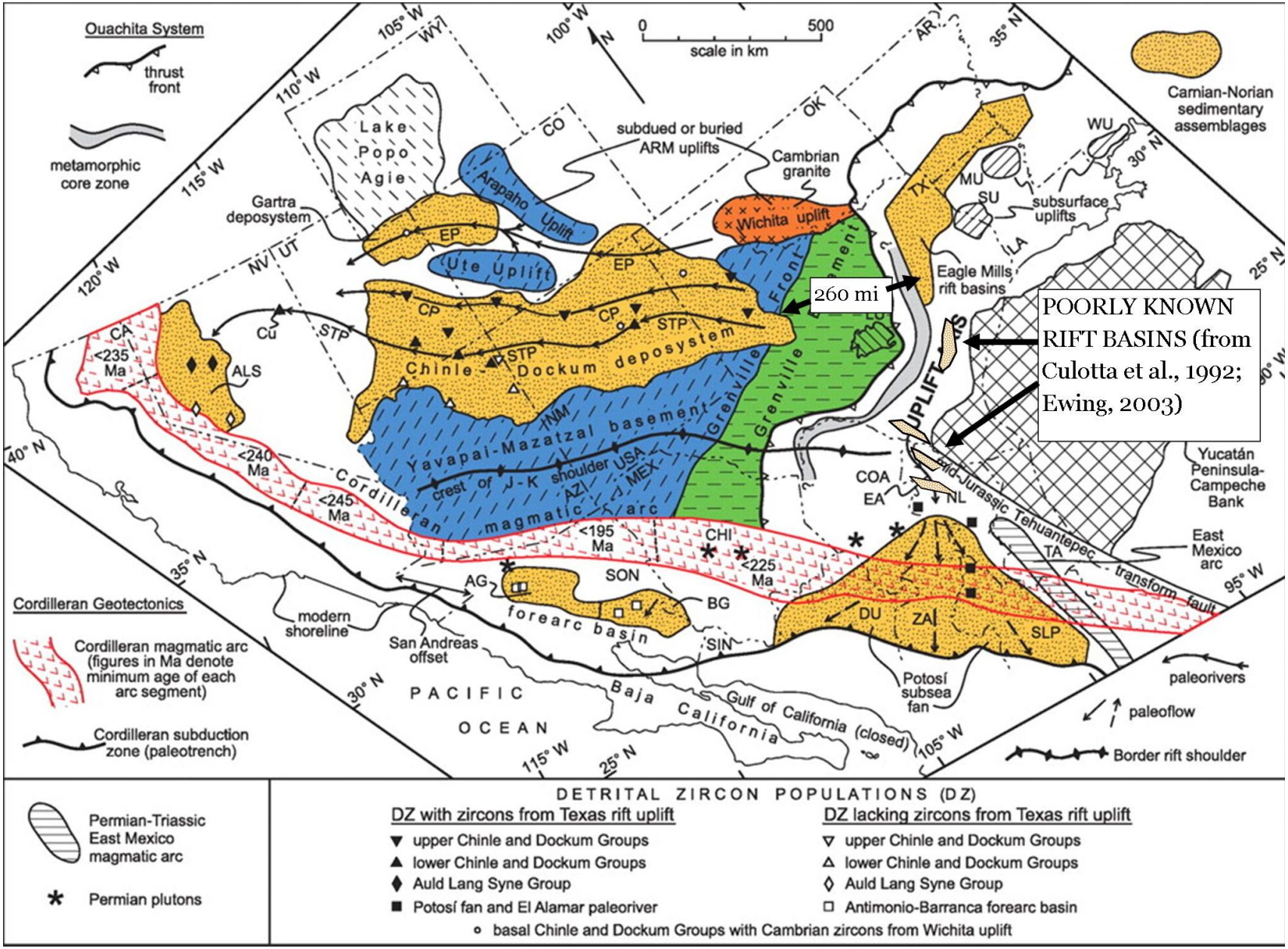
3. POSSIBLE CHANGE IN REGIONAL STRESS REGIME.

4. INITIAL SEDIMENTATION COMMENCED IN THE DOCKUM-CHINLE BASIN.

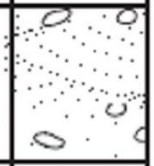
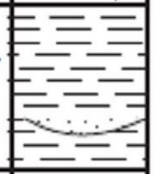
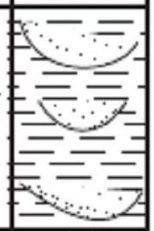
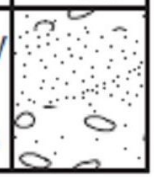
CONCURRENT WITH THE TS II – TS III BOUNDARY, THE DOCKUM-CHINLE BASIN BEGAN TO DEVELOP.



MAJOR TECTONIC FEATURES AND TRIASSIC BASINS, SOUTHWEST U. S. AND MEXICO (after Dickenson et al., 2010)

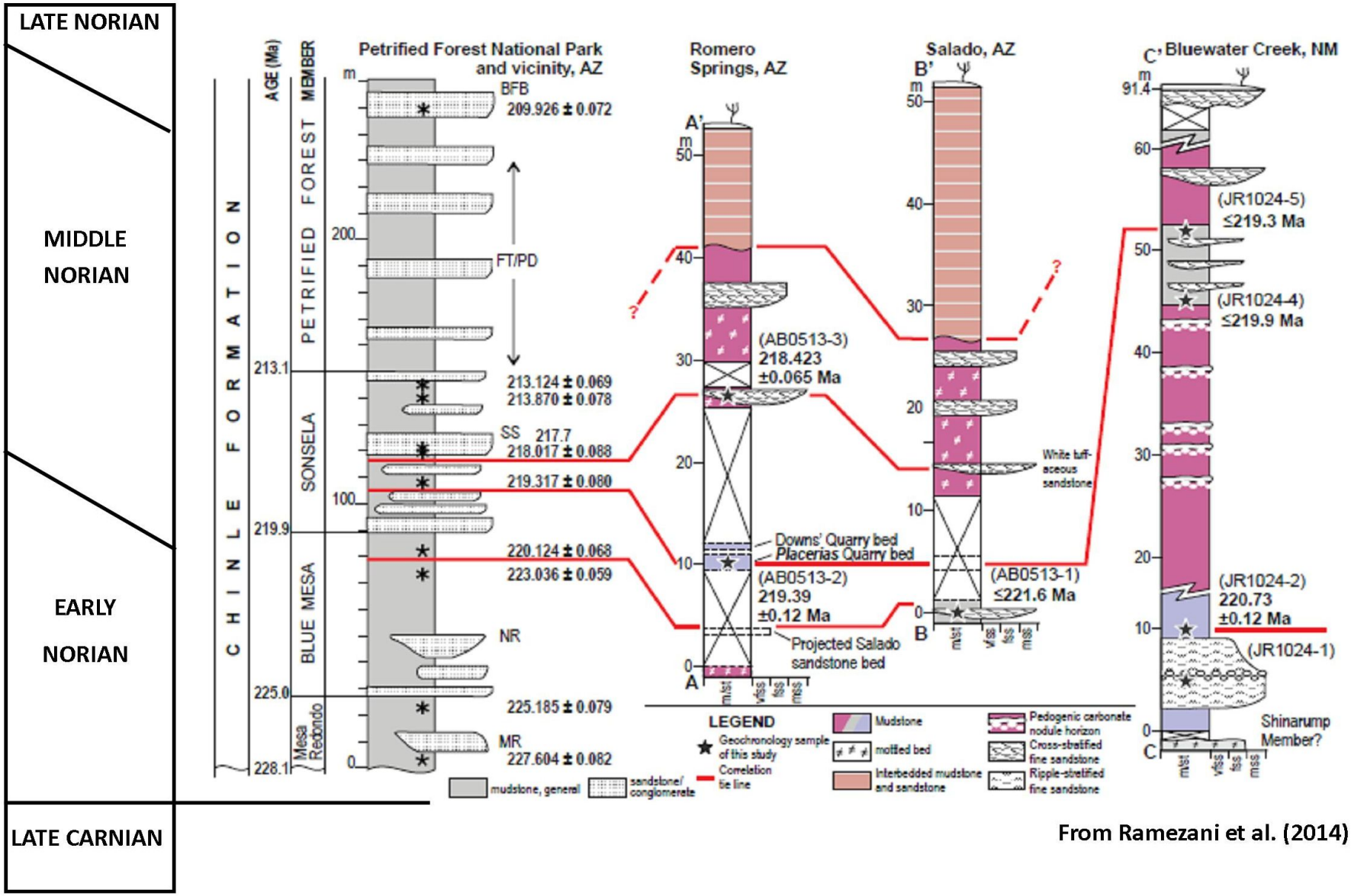


PREVIOUS REGIONAL LOWER CHINLE-DOCKUM CORRELATIONS ARE IN FLUX AND NOT RELIABLE

Chronology & Sequences				southern Colorado Plateau	Rio Grande Rift	New Mexican High Plains	Texas Panhandle	Southwest Texas	lith.
Late Triassic	Nor.	MB-OW Seq.	loc.	Sonsela Mbr (PF Fm)	Poleo Formation	Trujillo Formation	Trujillo Mbr Dockum Fm.	Trujillo Mbr Dockum Fm.	
	Carnian	Shinarump-Blue Mesa seq.	DG 3764	Blue Mesa Mbr (PF Fm)	Salitral Formation	Garita Creek Formation	Tecovas Mbr Dockum Fm	Tecovas Mbr Dockum Fm	
			354 1430 2739	Bluewater Creek Fm	Salitral Formation	Tres Lagunas & Los Esteros mbrs Santa Rosa Fm	Tecovas Mbr Dockum Fm	Tecovas Mbr Dockum Fm	
			1312 860	Shinarump Fm/ "mottled strata"	Agua Zarca Formation	Tecolotito Mbr Santa Rosa Fm	Camp Springs Mbr Dockum Fm	Colorado City & Camp Springs mbrs	

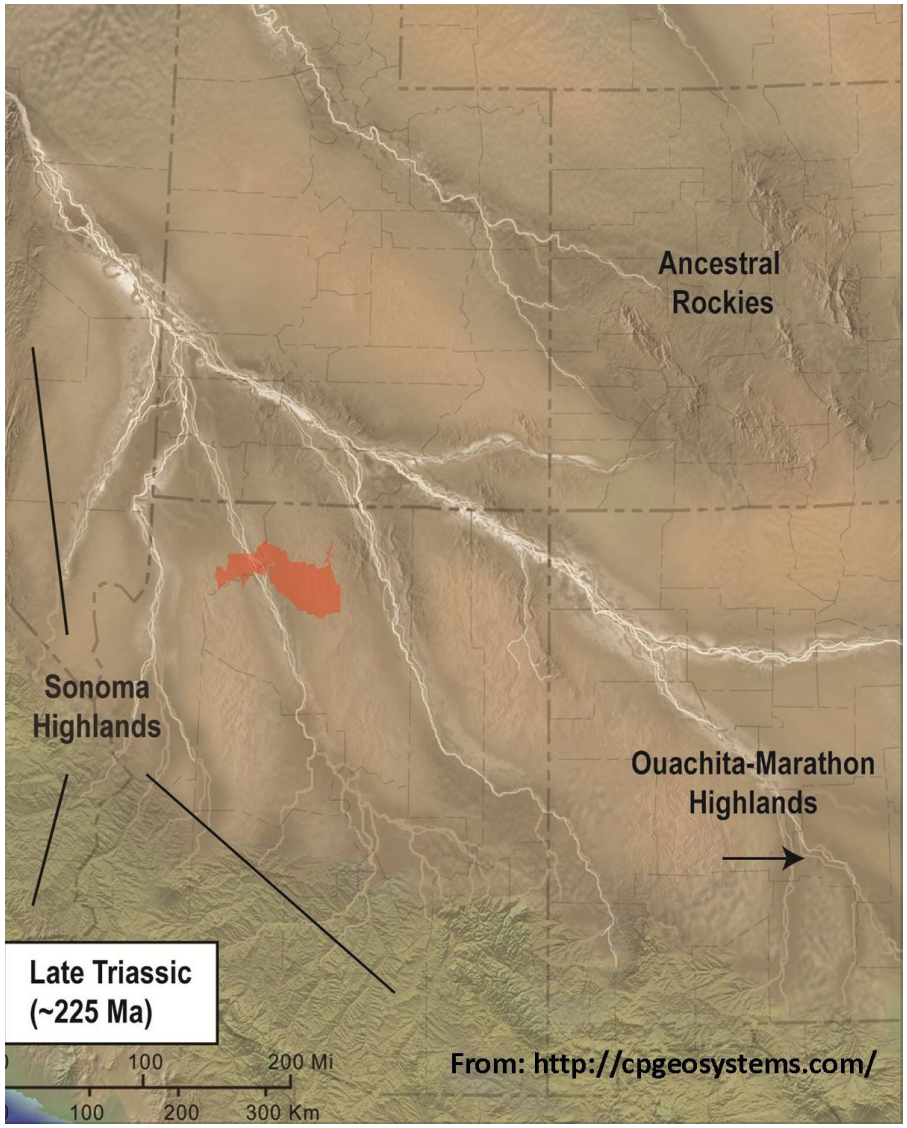
From Heckert, 2004.

RECENT U-PB ZIRCON DATING OF NUMEROUS CHINLE ASH BEDS TIED TO GLOBAL TRIASSIC TIMESCALES INDICATE STRATA OF CARNIAN AGE ARE ABSENT



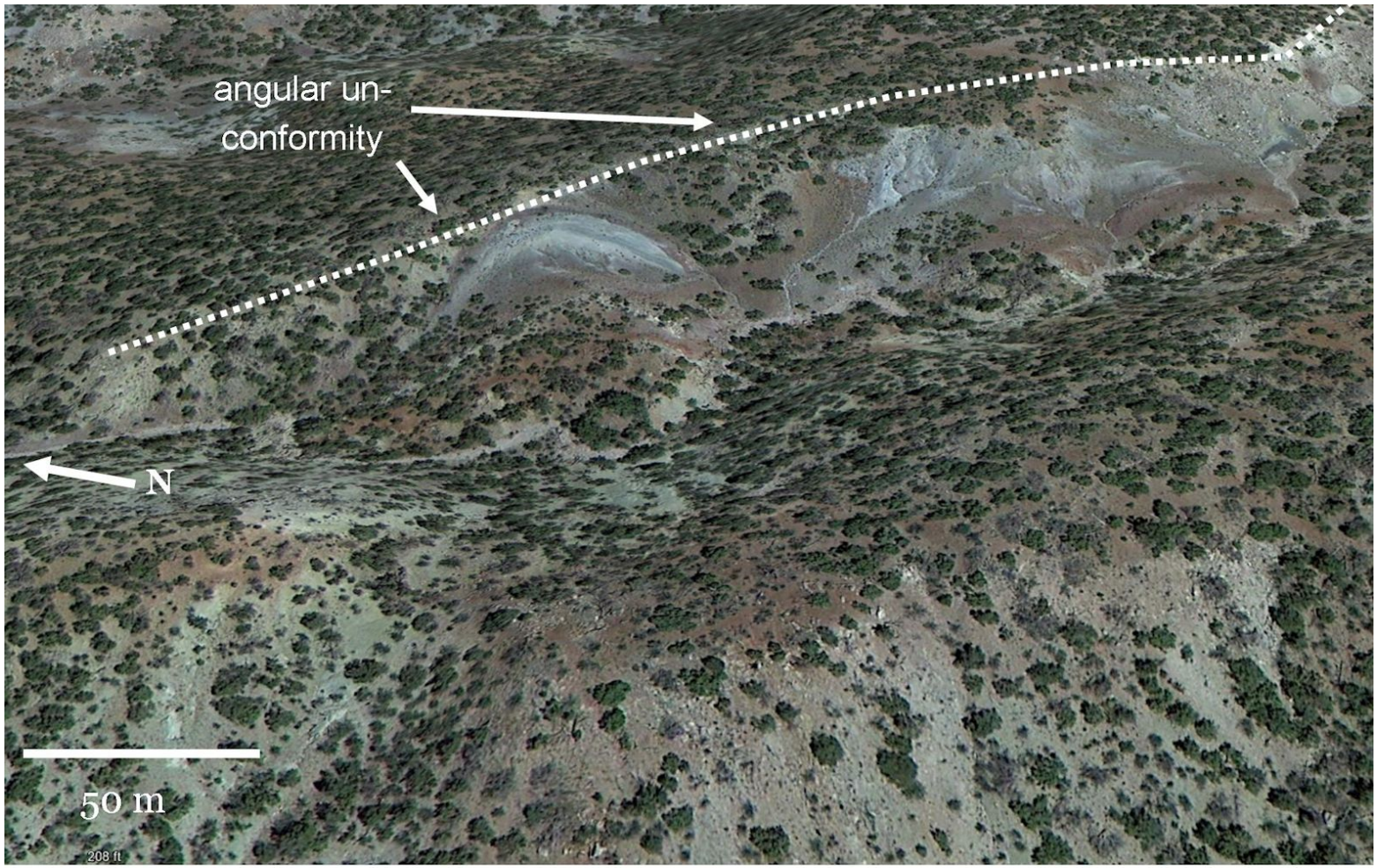
From Ramezani et al. (2014)

LOWER CHINLE – DOCKUM IS DESCRIBED AS CHARACTERIZED BY BROAD PALEOVALLEYS INCISED INTO UNDERLYING PERMIAN TO MIDDLE TRIASSIC STRATA



IN THIS THIS INTERPRETATION THESE BROAD VALLEYS CONTAIN THE CLASSIC LOWER CHINLE SEQUENCES SUCH AS THAT AT THE PETRIFIED FOREST NATIONAL PARK

SEDIMENTATION IN MANY AREAS WAS RESTRICTED TO THIN SEQUENCES WITH PALEOSOLS OR IN LOCAL BASINS FORMED BY SALT MOBILIZATION. ONE SUCH BASIN IS LOCATED AT FORT WINGATE, NM



HALOKENETIC BED DEFORMATION NEAR FORT WINGATE, NEW MEXICO, BASAL CHINLE FORMATION.

(Google Earth image)

TR-3 UNCONFORMITY- MOTTLED STRATA AND SHINARUMP CONGLOMERATE, FORT WINGATE, NM

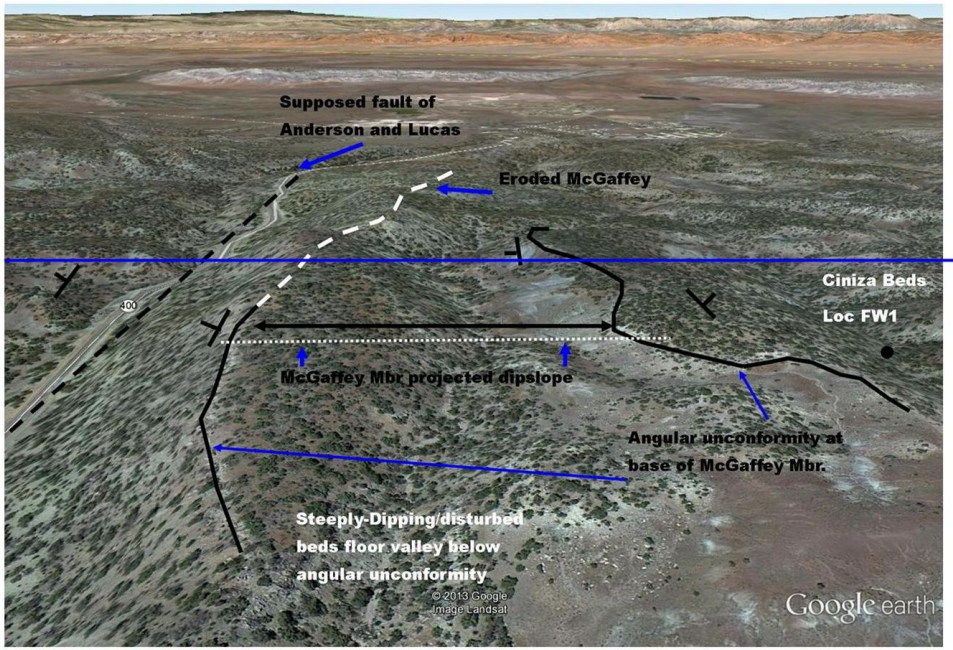
INTERSEQUENCE PALEOSOLS, FT. WINGATE, NM

RECUMBENT FOLD IN MONITOR BUTTE-LIKE FACIES, FORT WINGATE, NEW MEXICO

LACUSTRINE MONITOR BUTTE-LIKE FACIES, FORT WINGATE, NEW MEXICO

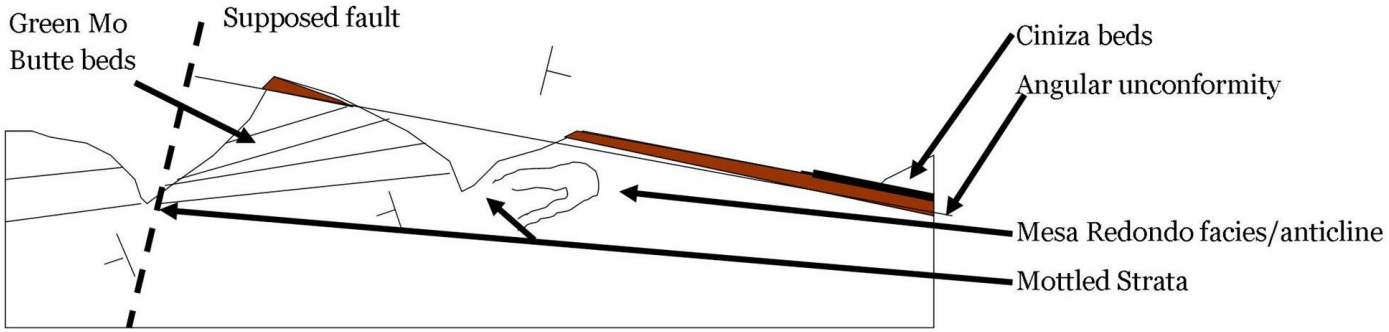
PROFOUND INTER-CHINLE ANGULAR UNCONFORMITY, FORT WINGATE, NM: PROBABALE SALT WITHDRAWL BASIN

INTERPRETATION OF HALOKINETIC DEFORMATION AT FORT WINGATE

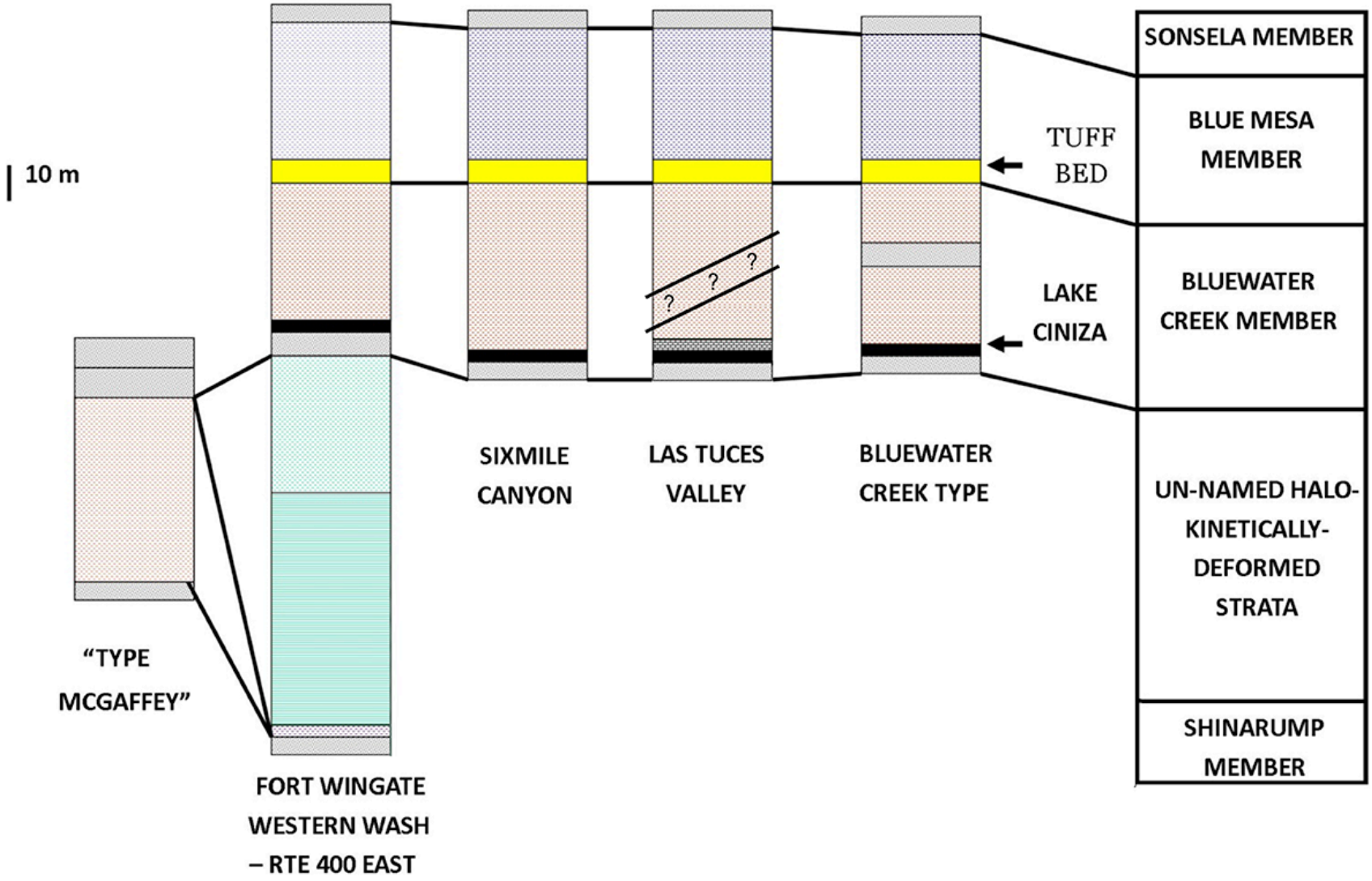


GENERALIZED INTERPRETATION AT FORT WINGATE, NEW MEXICO

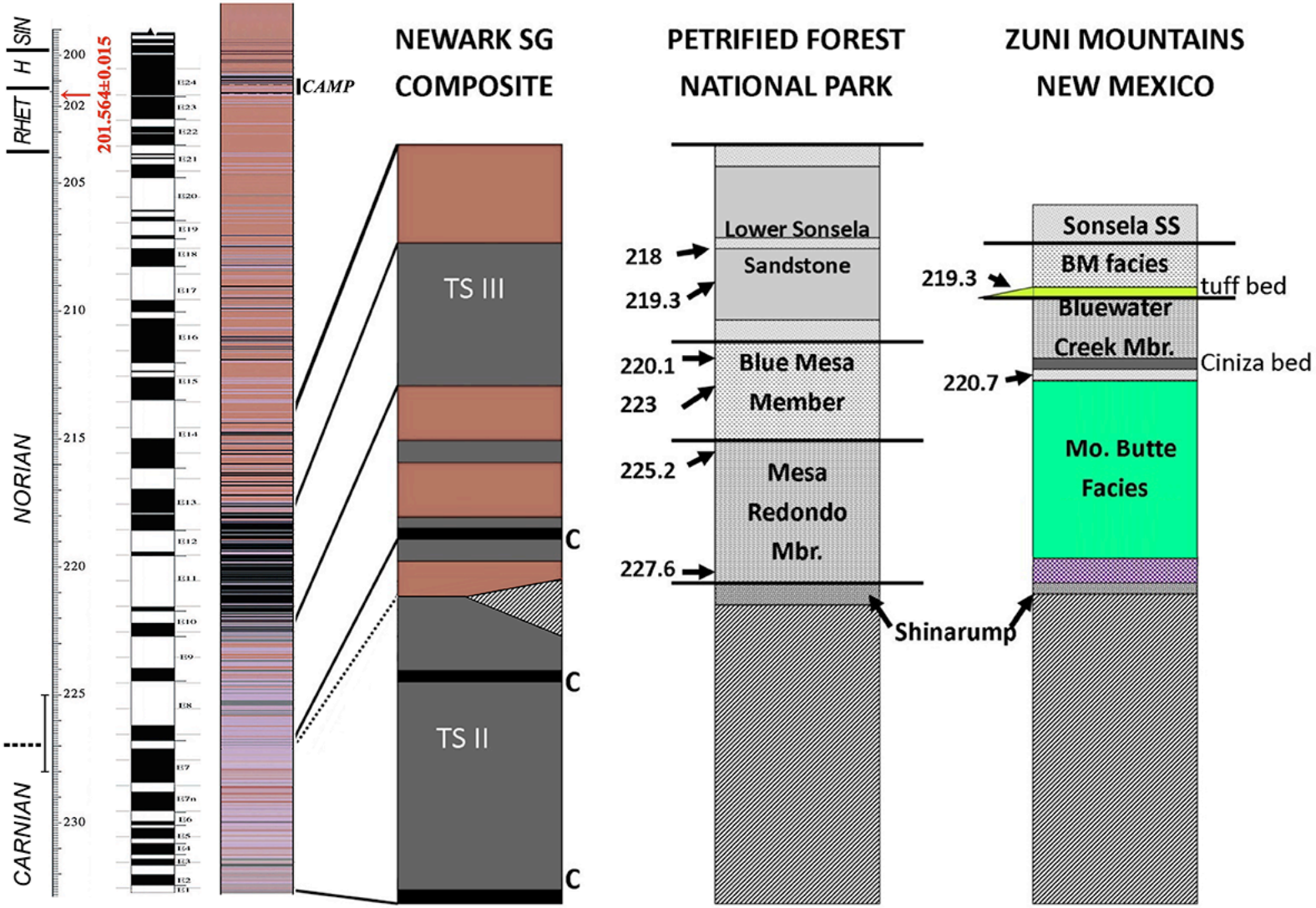
The fault mapped by Anderson and Lucas (1998) is probably the edge of a salt wall basin in which the Monitor Butte-like facies accumulated.



BY ~222 MYA, MOST OF THE BROAD VALLEY LOWLANDS WERE INFILLED WITH REGIONAL DEPOSITION MARKED BY LATERALLY-PERSISTENT LITHOSOME ASSOCIATIONS AND UNIFORM SUBSIDENCE



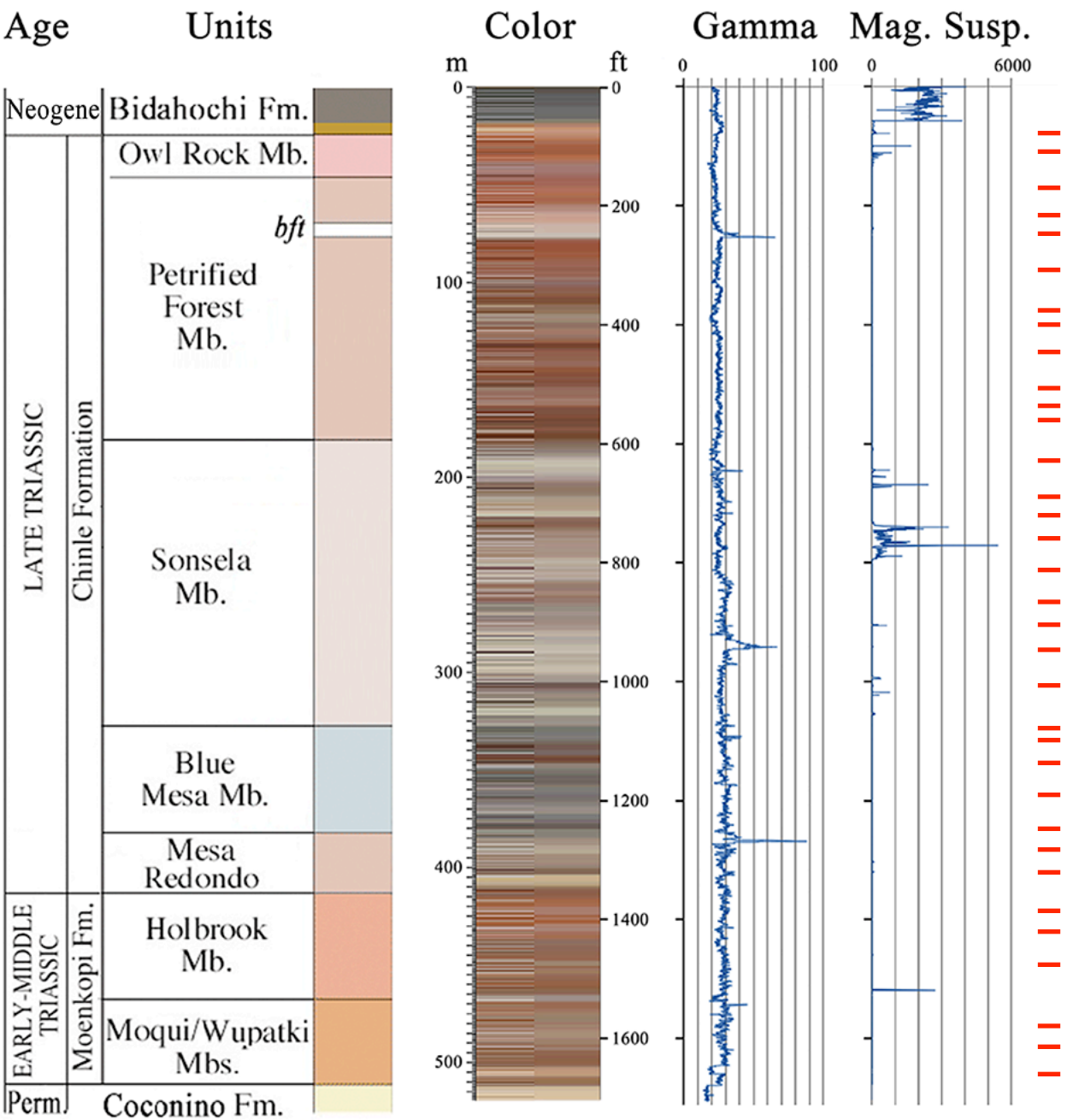
CORRELATION OF NEWARK SUPERGROUP TS III AND THE LOWER CHINLE FORMATION (U-Pb dates from Ramezani et al., 2011; 2014; Atchley et al., 2013)



CPCP : Phase I, Petrified Forest Core

November 2013

CPCP CORE 1A



Published U-PB CA-TIMS Outcrop Dates
(Ramezani et al., 2011; Atchely et al., 2013)

≤207.8

209.926 ± 0.072 Ma

213.124±0.069; 213.870±0/78

214.36±0.16 (CA-TIMS)

218.017±0.017

219.317±0.080

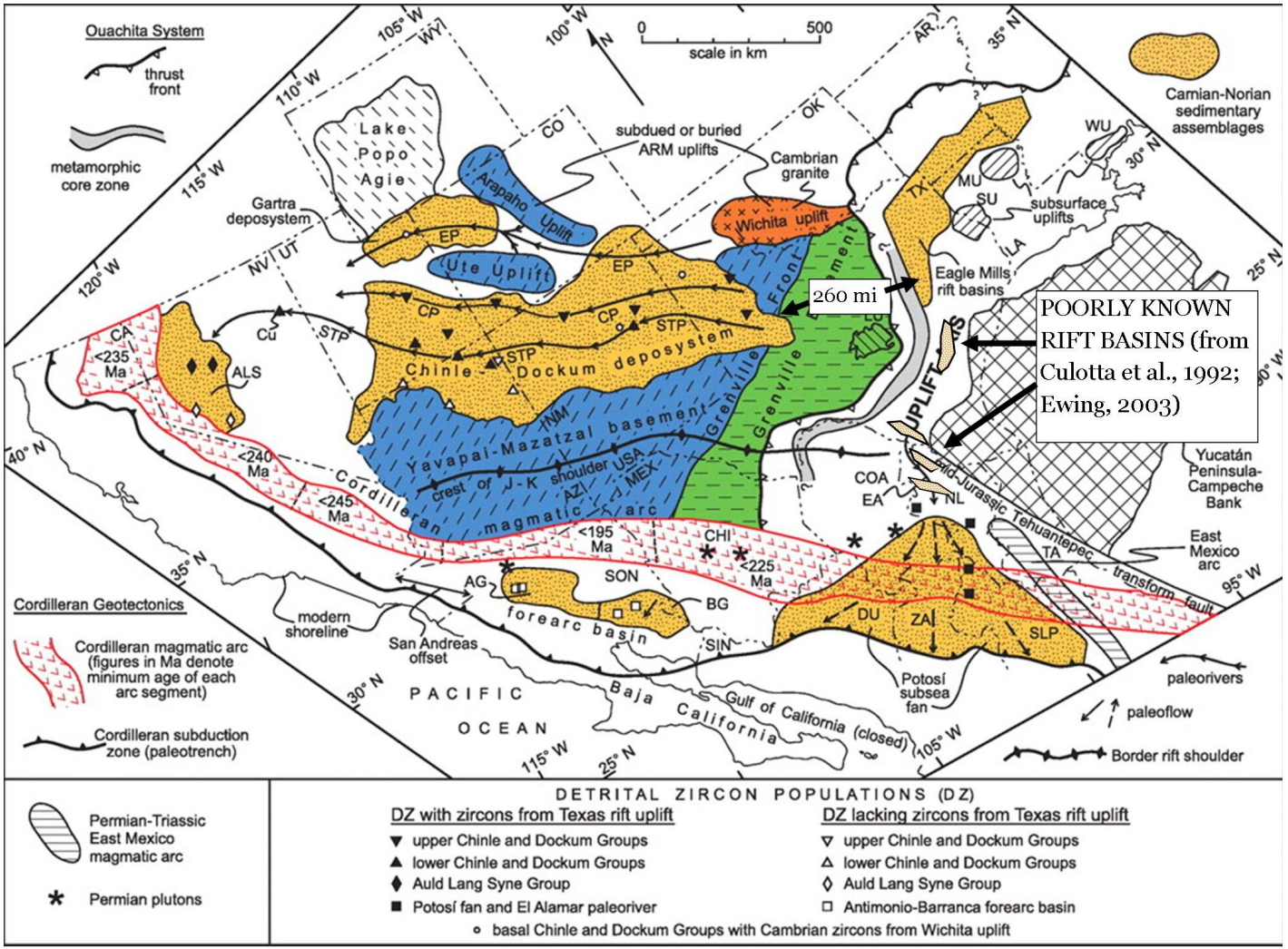
220.124±0.068

223.036±0.059

225.185±0.072

227.604±0.082

MAJOR TECTONIC FEATURES AND TRIASSIC BASINS, SOUTHWEST U. S. AND MEXICO (after Dickenson et al., 2010)



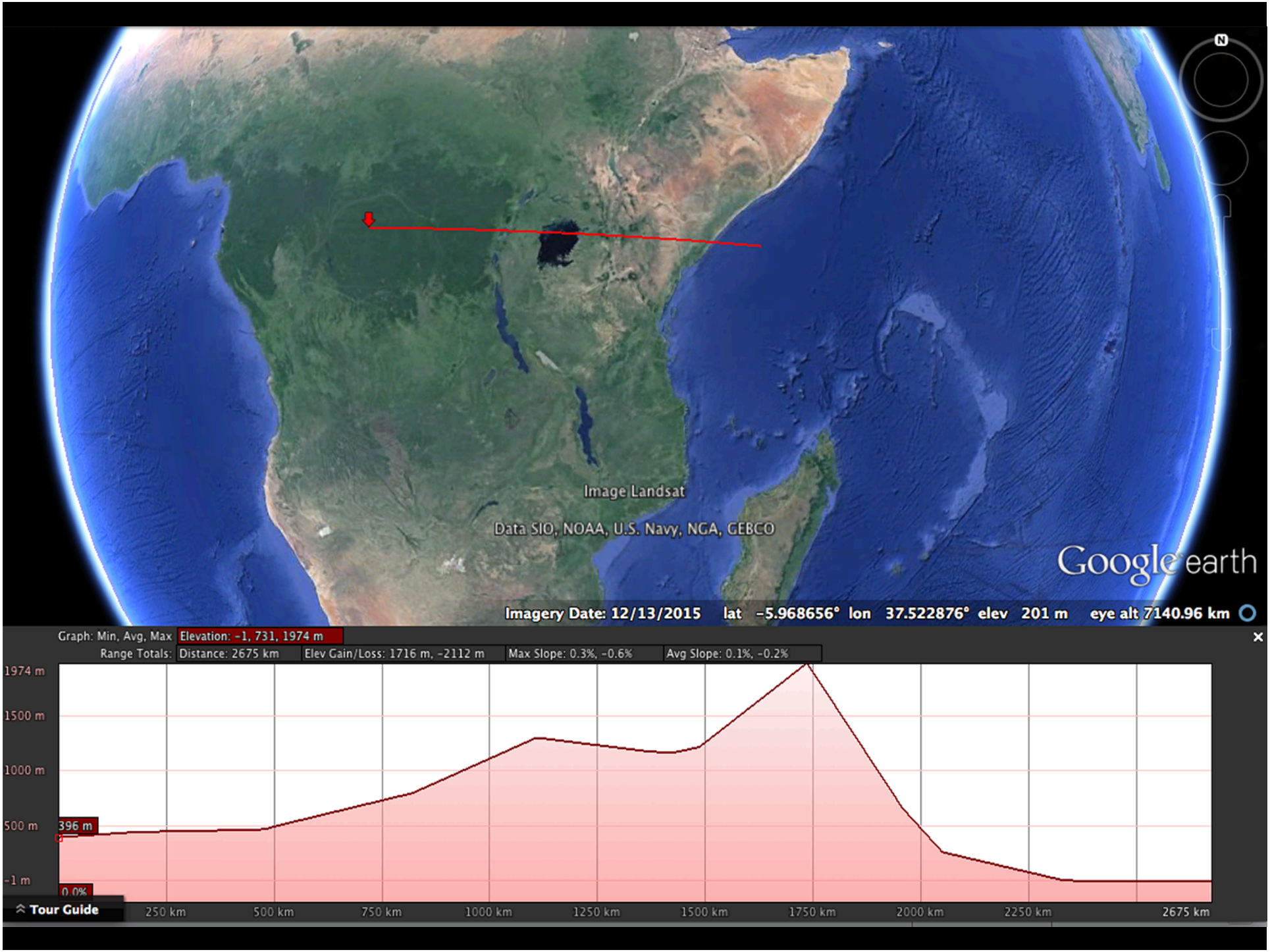
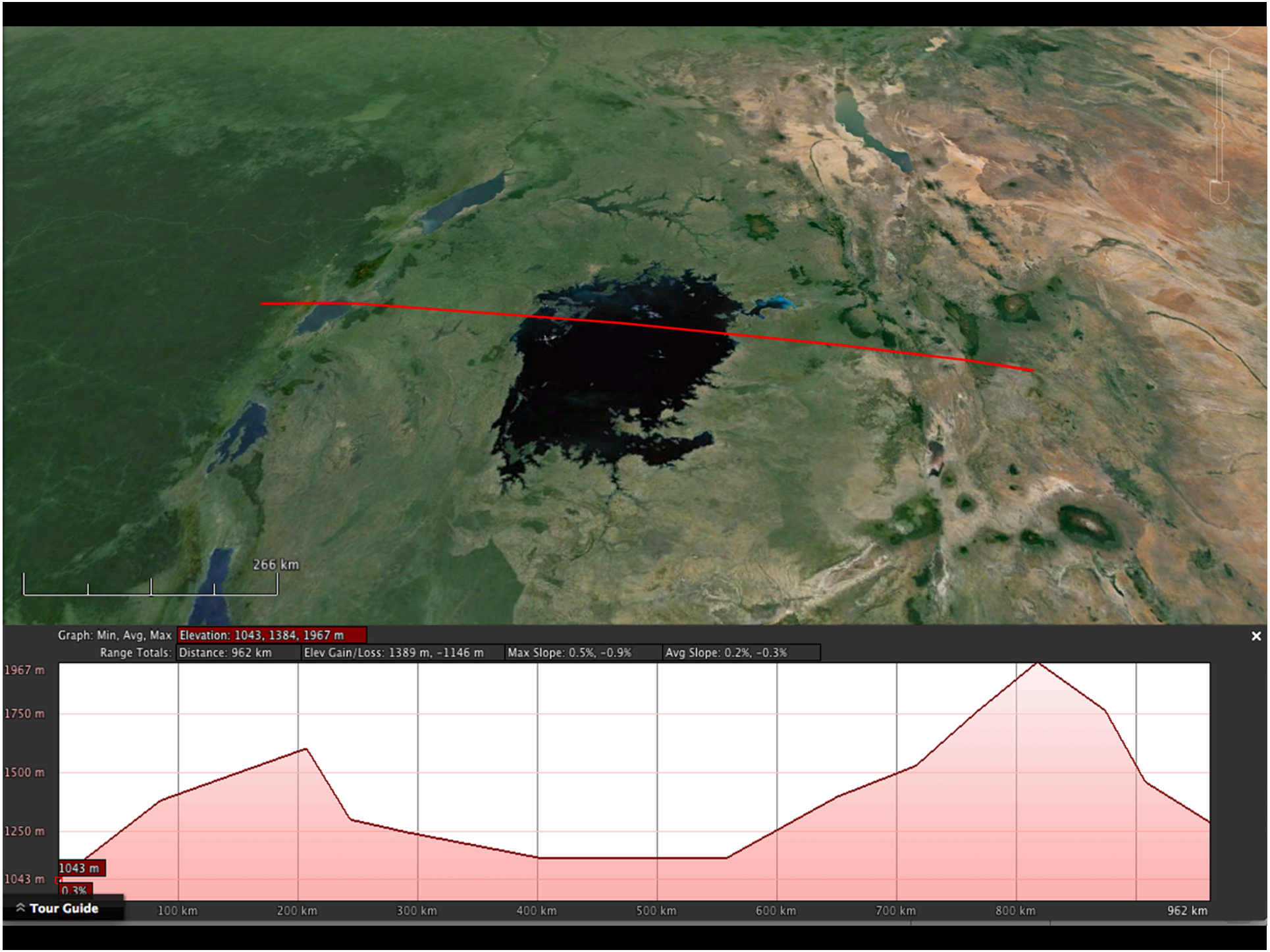


Image Landsat
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google earth
Imagery Date: 12/13/2015 lat -5.968656° lon 37.522876° elev 201 m eye alt 7140.96 km
Graph: Min, Avg, Max Elevation: -1, 731, 1974 m
Range Totals: Distance: 2675 km Elev Gain/Loss: 1716 m, -2112 m Max Slope: 0.3%, -0.6% Avg Slope: 0.1%, -0.2%
1974 m
1500 m
1000 m
500 m
-1 m
396 m
0.0%
Tour Guide
250 km
500 km
750 km
1000 km
1250 km
1500 km
1750 km
2000 km
2250 km
2675 km


266 km
Graph: Min, Avg, Max
Elevation: 1043, 1384, 1967 m
Range Totals:
Distance: 962 km
Elev Gain/Loss: 1389 m, -1146 m
Max Slope: 0.5%, -0.9%
Avg Slope: 0.2%, -0.3%
1967 m
1750 m
1500 m
1250 m
1043 m
1043 m
0.3%
Tour Guide
100 km
200 km
300 km
400 km
500 km
600 km
700 km
800 km
962 km

CONCLUSIONS

1. **Revised geochronologies, including U-Pb dating of zircons, lithostratigraphy, magnetostratigraphy, tectono-stratigraphy, cyclostratigraphy and biostratigraphy indicate Late Carnian strata are entirely restricted to Newark Supergroup TS II.**

2. **The Carnian-Norian boundary coincides with a major extensional pulse along the central and southern rifted margin of North America that generated opening of the Dan River, Culpeper, and possibly segments of the Deep River and Gettysburg basins. Existing basins experienced a dramatic shift in sedimentation and hydrologic regimes, and increased tilting and subsidence which generated the TS II- TS III unconformity across multiple synrift basins.**

CONCLUSIONS (CONTINUED)

3. **This extenstional pulse propogated the rifting margin along the southern flank of the Appalachian-Ouachita front, resulting in formation of numerous, poorly known rift basins that extend in the subsurface from Alabama into northern Mexico. The fill of these rifts are collectively called the "Eagles Mills Formation", and are paralleled seaward by other deeply buried rifts throughout the Gulf Coast region.**

4. **Synchronous uplift of the Ouachita-Marathon trend with this extension event generated initial sedimentation in the Chinle-Dockum basin. Note that "Eagle Mills" basins are only 260 miles distant from the preserved Dockum margin.**

CONCLUSIONS (CONTINUED)

5. **The Chinle-Dockum is underlain by large areas of evaporates and carbonates as shallow depths (10s-100s of m). While early sedimentation was largely confined to broad, Mississippi River scale (or larger) valleys, salt mobilization created numerous, localized depositional basins on broad interfluve uplands that are filled by lacustrine-paludal strata and paleosols. Past workers have concluded these strata were deformed by Laramide tectonics or syndepositional slumping. We suggest they are the product of halokenisis as illustrated by our example of the lower Chinle at Fort Wingate, New Mexico.**

CONCLUSIONS (FINALE!)

6. **Correlation of the lower Chinle-Dockum with the Newark Supergroup suggests that early sedimentation patterns in the later region were dictated by synrift, rather then by cordilleran arc tectonics.**

7. **The stratigraphic interval of halokentic basins in the lower Chinle-Dockum correlate with a ~1.2 my duration wet phase in the Newark, which produced coal bearing strata in the Deep River, Dan River, Richmond and Taylorsville basins.**