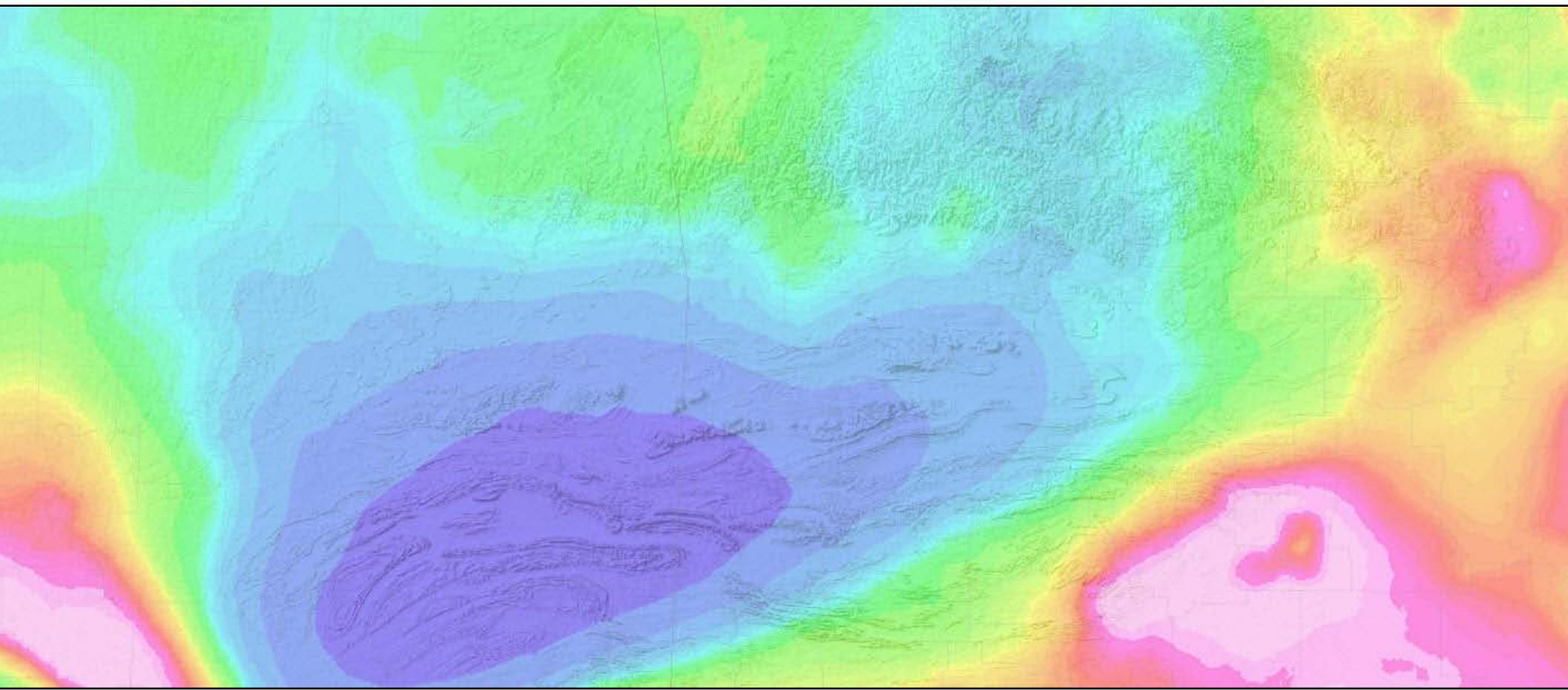


Natural Gas Assessment of the Arkoma Basin, Ouachita Thrust Belt, and Reelfoot Rift *Regional Geologic Framework*

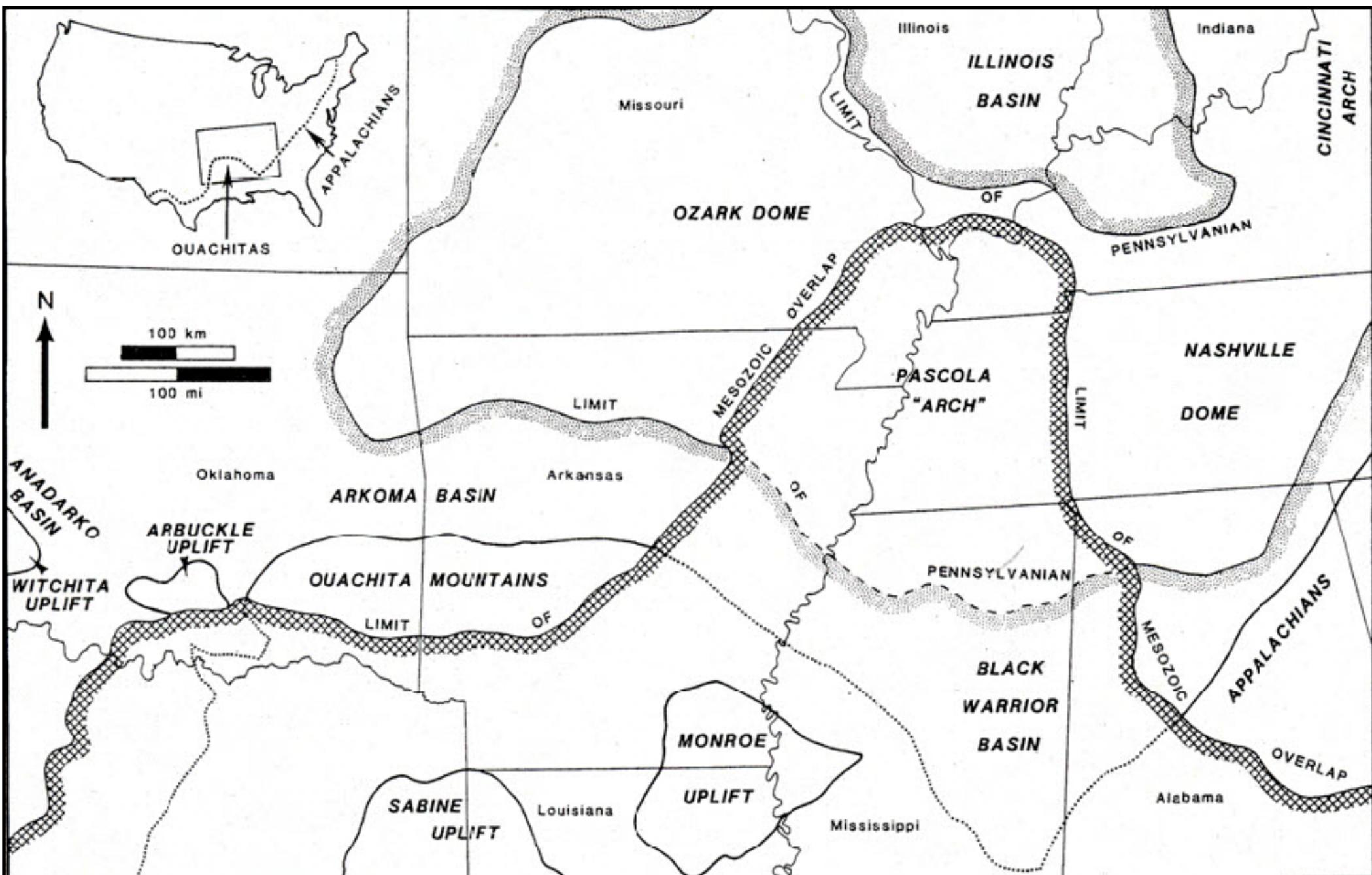


Dave Houseknecht

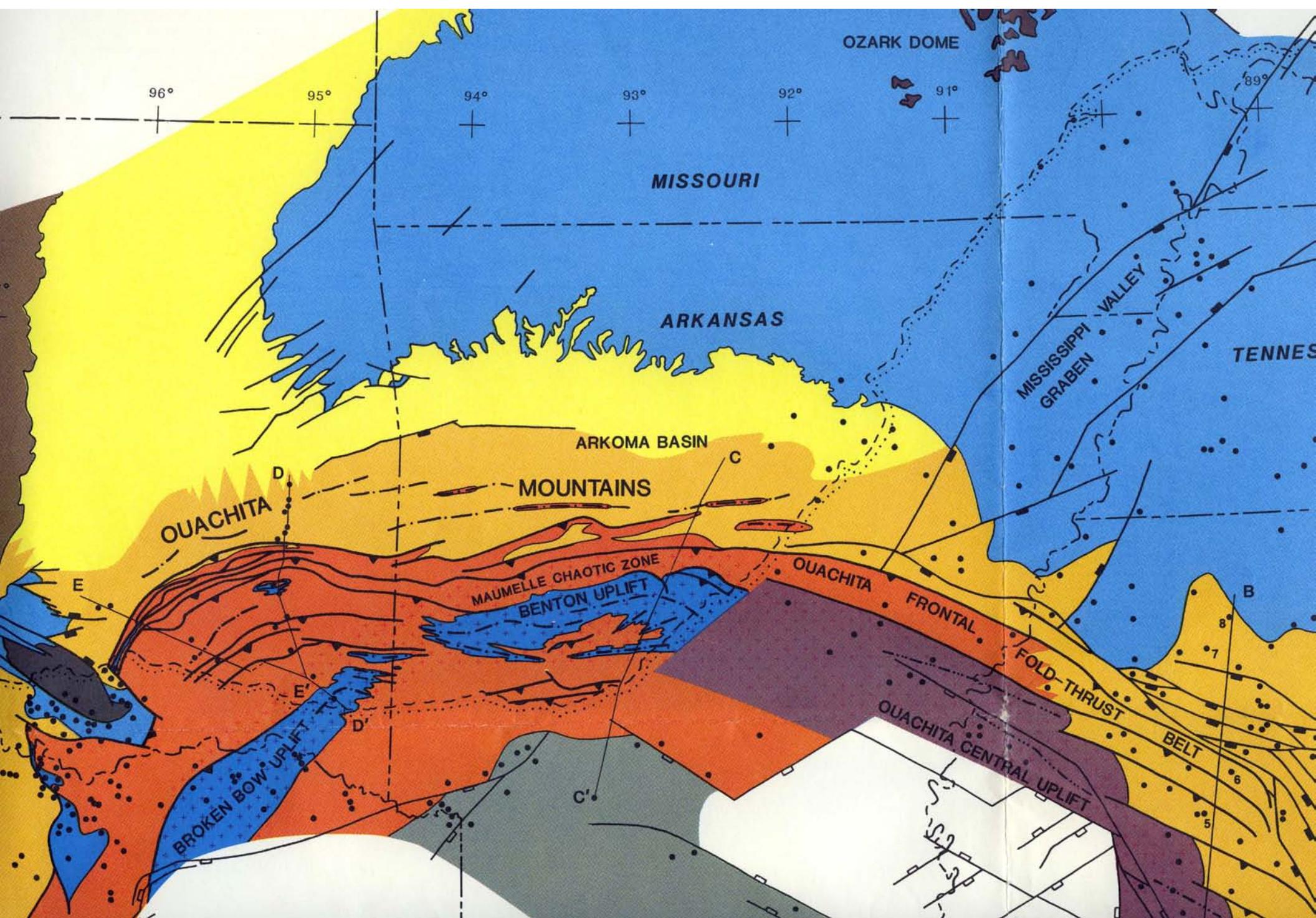
U.S. Department of the Interior
U.S. Geological Survey

*Complete Bouguer Anomaly Map Centered on Arkoma Basin
(Hildenbrand et al., 2002; Keller et al., 2002; Saltus, 2009)*

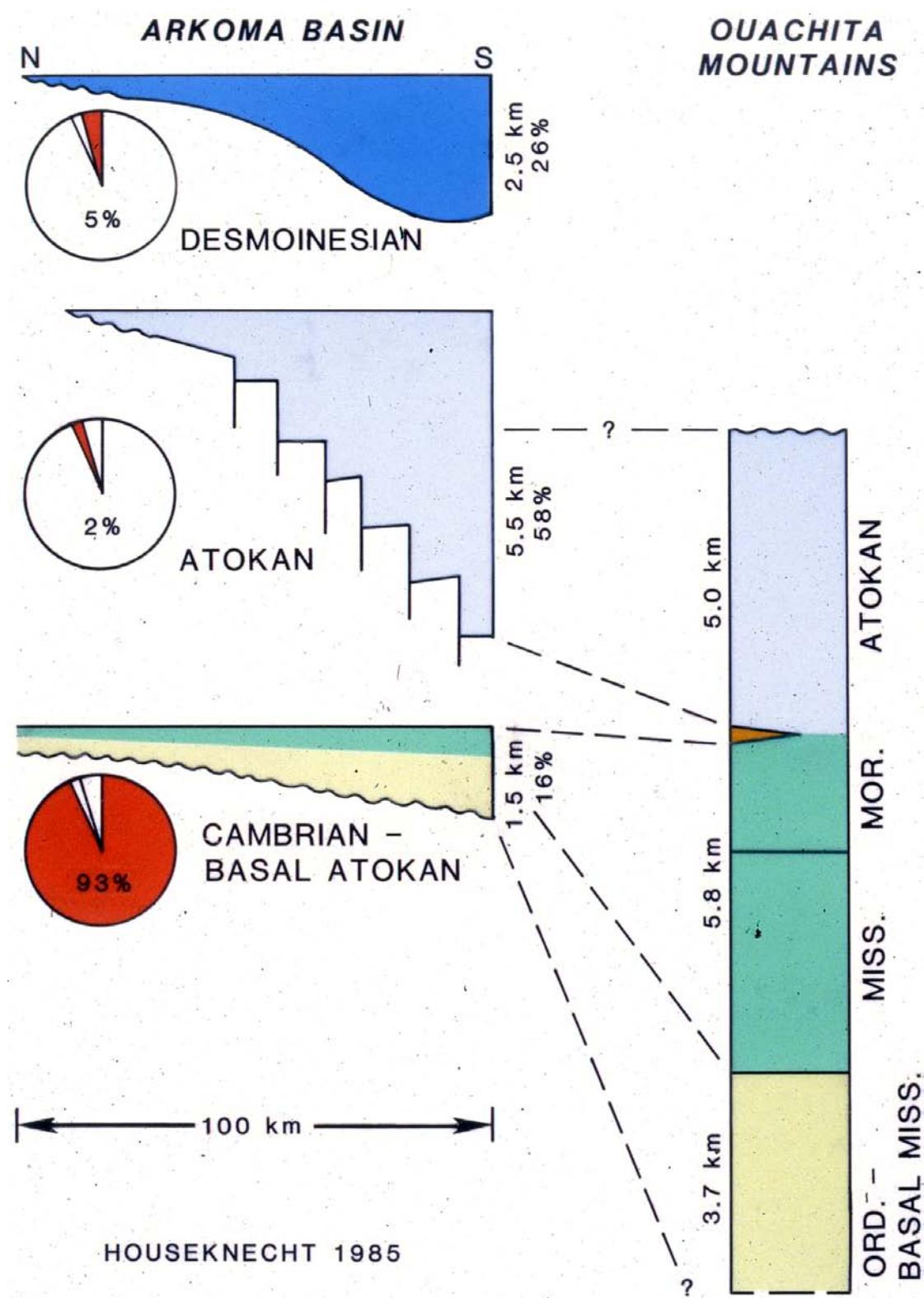
Regional Setting



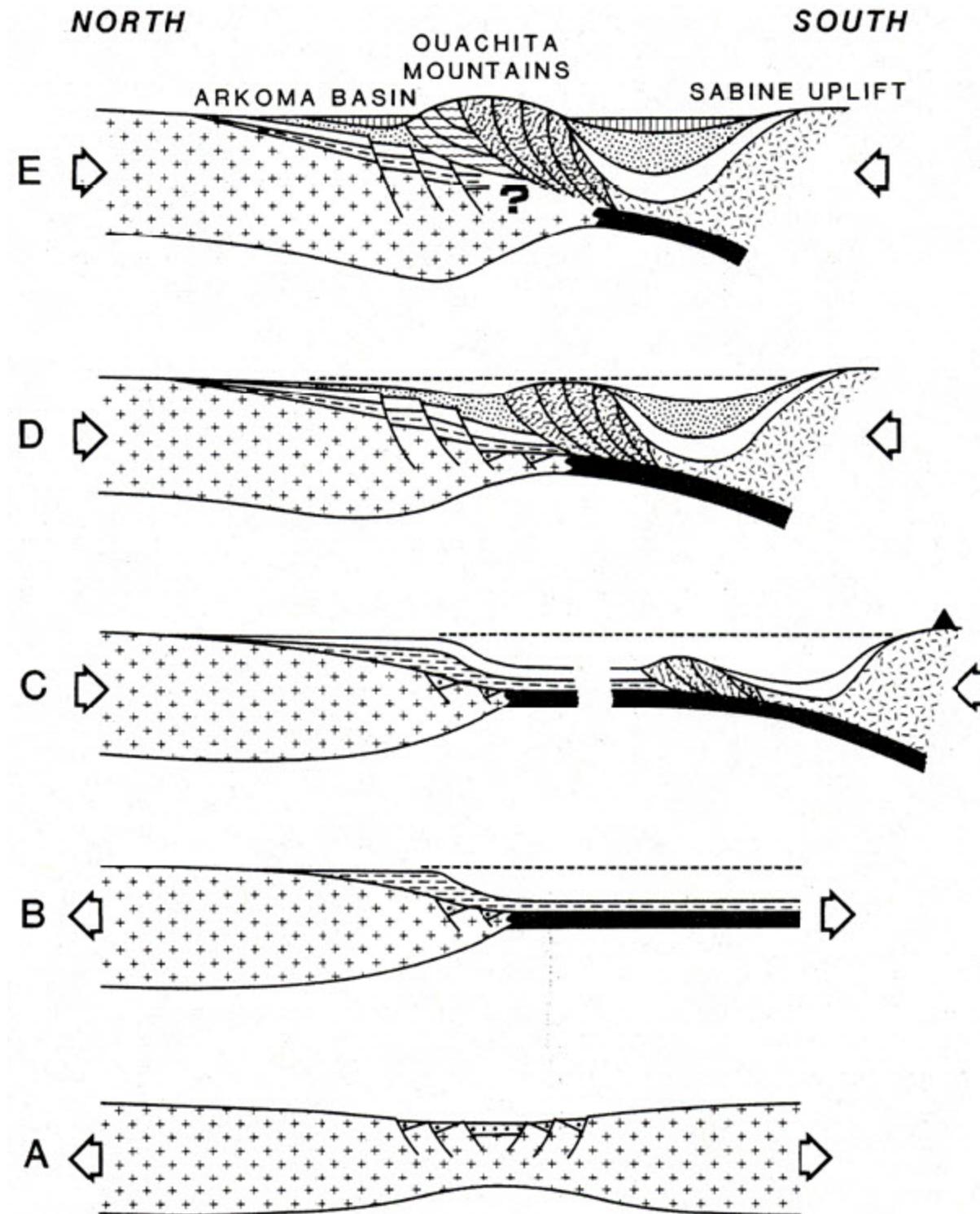
DNAG Tectonic Map



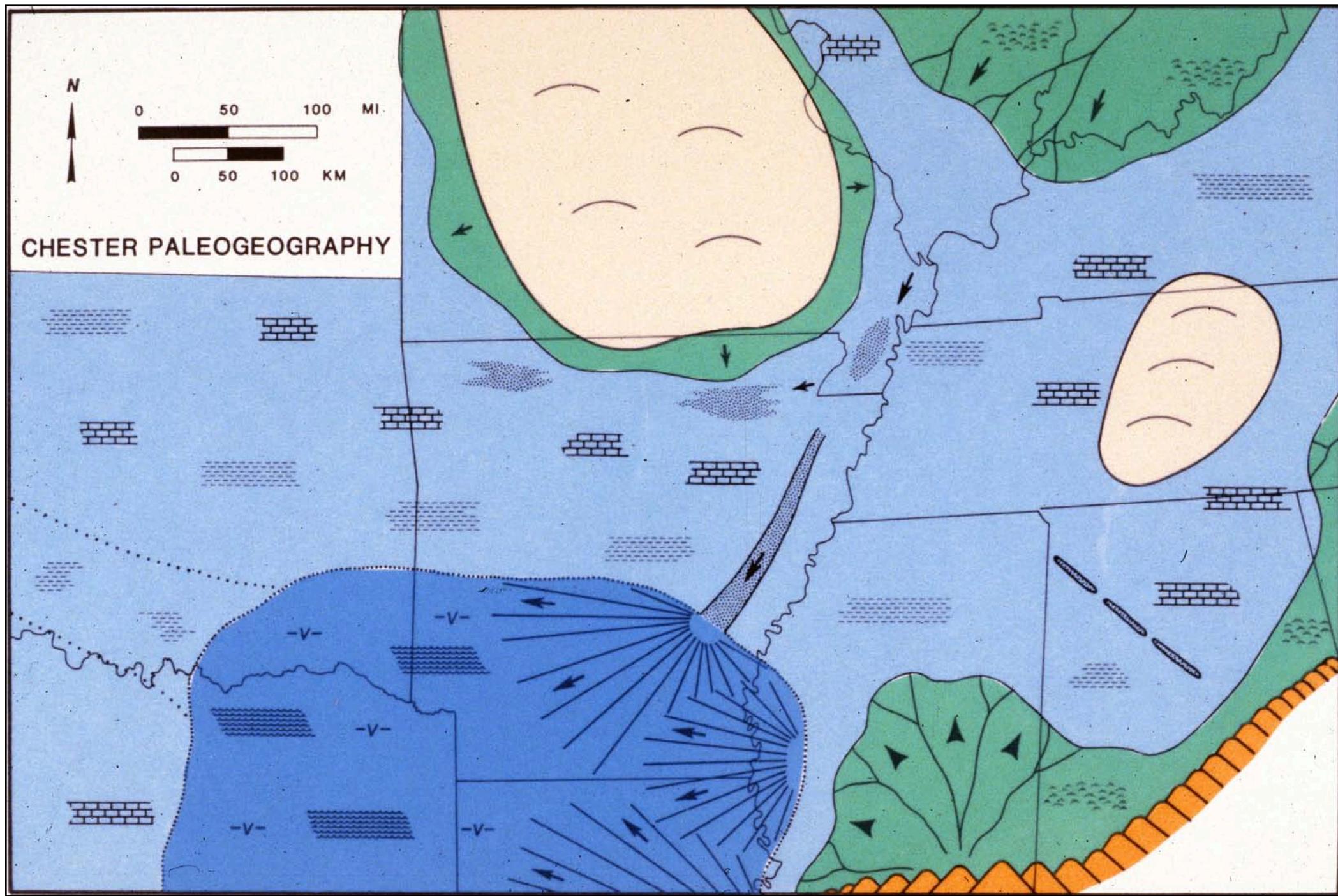
Tectono-Stratigraphy



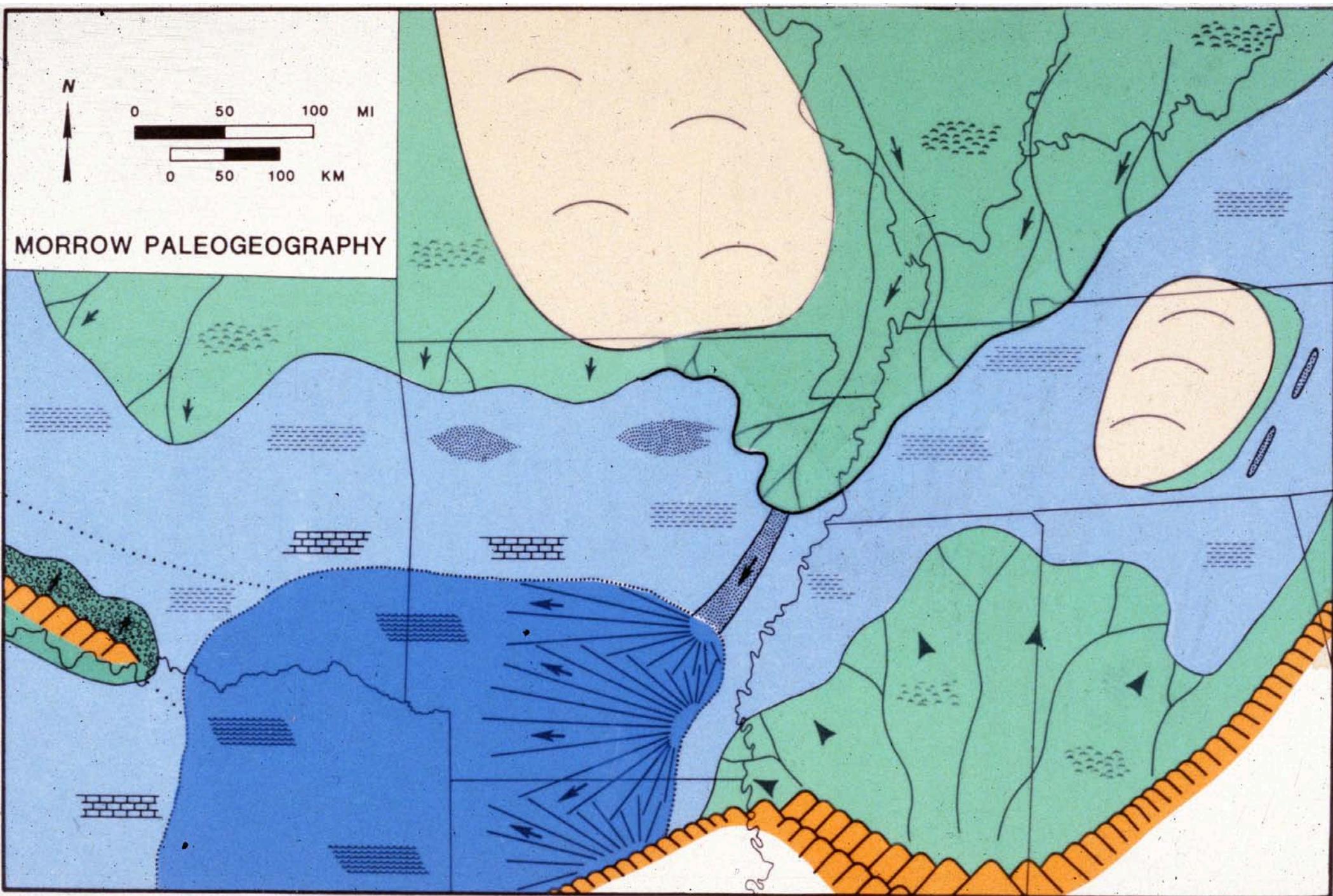
Inferred Tectonic Evolution



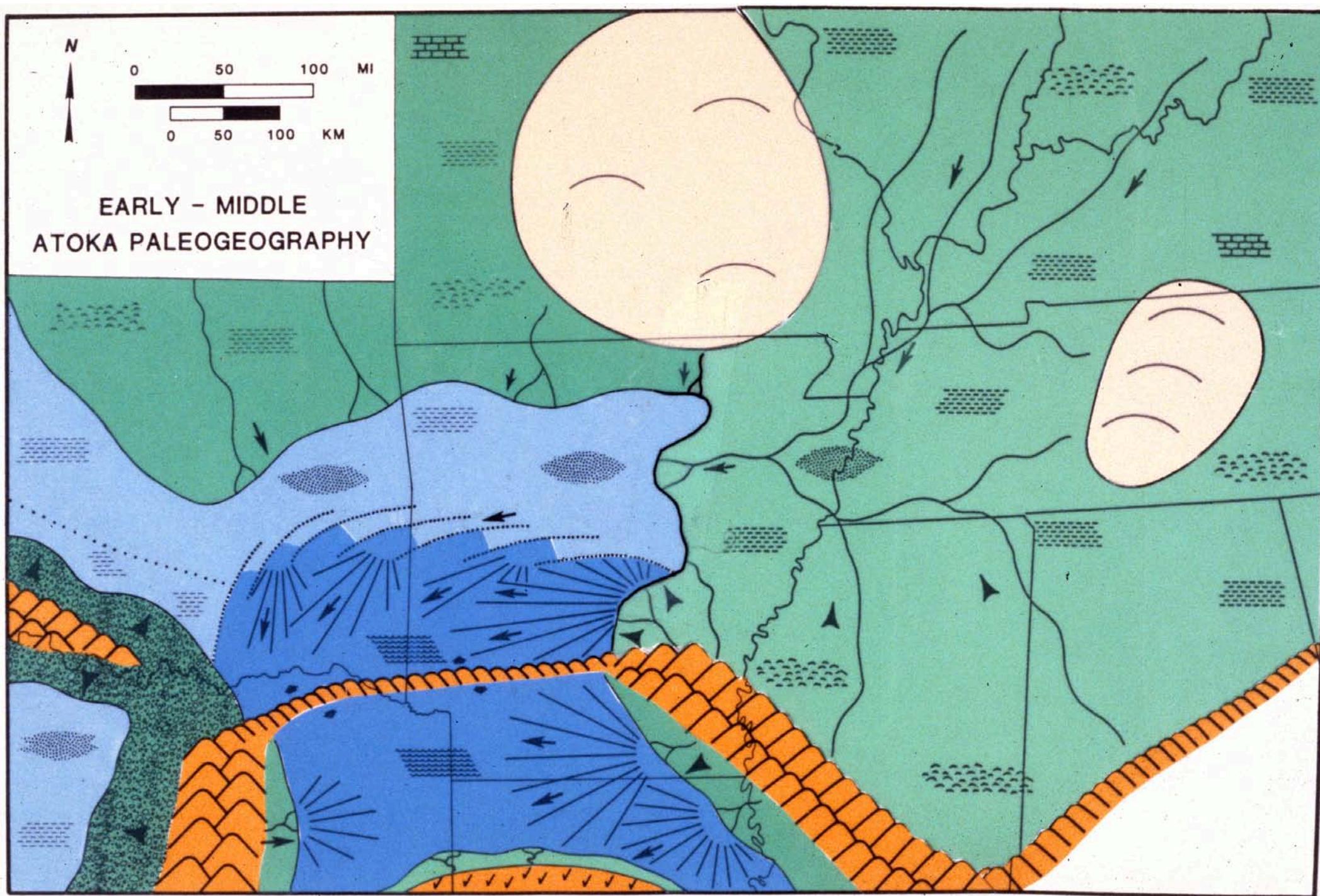
Chesterian Paleogeography



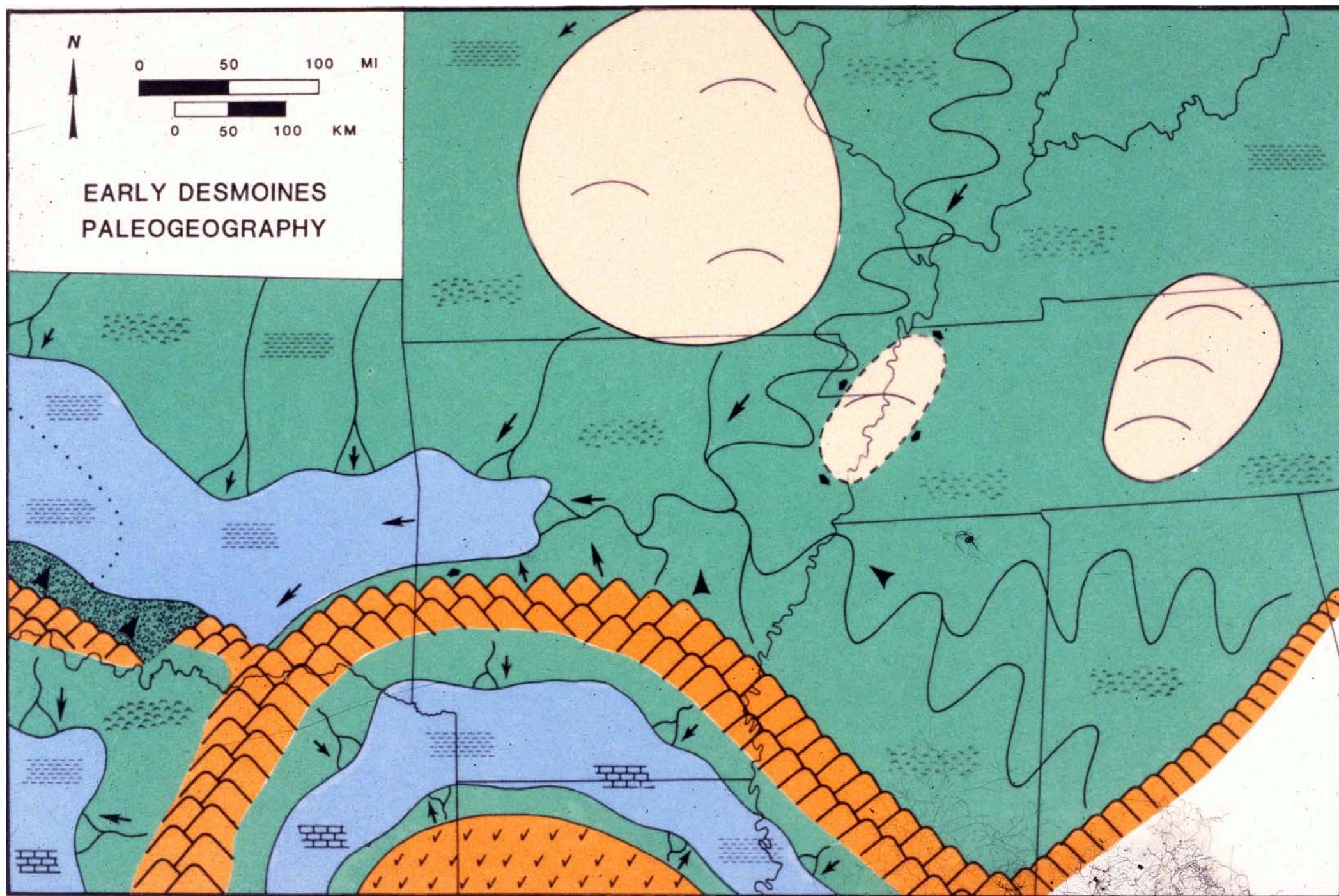
Morrowan Paleogeography



Atokan Paleogeography



Early Desmoinesian Paleogeography



Chronostratigraphy

Oklahoma Nomenclature

		North American Continental Platform Section			Ouachita Deep-Water Facies Ouachita Basin Section		Pennsylvanian		Mississippian		Devonian		Ordovician		Cambrian		Precambrian	
		Arbuckle Facies Arkoma Basin Section		Deep-Water Facies Foredeep Section														
		Tertiary–Quaternary	Sedimentary formations (undivided)	TQ														
Cretaceous		Sedimentary formations (undivided); intrusives	K	Ki														Tertiary–Quaternary
Pennsylvanian	Desmoinesian	Senora Formation	IPs															Cretaceous
		Stuart Formation	IPst															Desmoinesian
		Thurman Formation	IPt															Pennsylvanian
		Boggy Formation	IPbg															
		Bluejacket Sandstone Member	IPbj															
		Savanna Formation	IPsv															
		McAlester Formation	IPma															
		Hartshorne Formation	IPh															
		Atoka Formation	IPa	Atoka Formation (IPa)			Upper	IPau										
Mississippian	Morrowan	Wapanucka Formation	IPw	Wapanucka Formation			Middle	IPam										
		Springer Group and Union Valley Formation (undivided)	IPm	Morrowan and Caney Shale (undivided)			Lower	IPal										
		Caney Shale	Mc	Atoka Formation														
		Woodford Shale	Dw	Johns Valley Shale														
		Hunton Group	OSDh	Jackfork Group														
		Sylvan Shale	Osy	Stanley Group														
		Viola Group	Ov	Arkansas Novaculite														
		Simpson Group	Os	Missouri Mountain Shale														
		Arbuckle and Timbered Hills Groups (undivided)	EOa	Blaylock Sandstone														
Ordovician	Silurian	Continental Basement (granite, rhyolite)	P-E	Polk Creek Shale														
				Bigfork Chert														
Cambrian	Upper			Womble Shale														
				Blakely Sandstone														
Precambrian				Mazarn Shale														
				Crystal Mountain Sandstone														
				Collier Shale														

Geologic Map – Southern Arkoma Basin & Ouachita Mountains

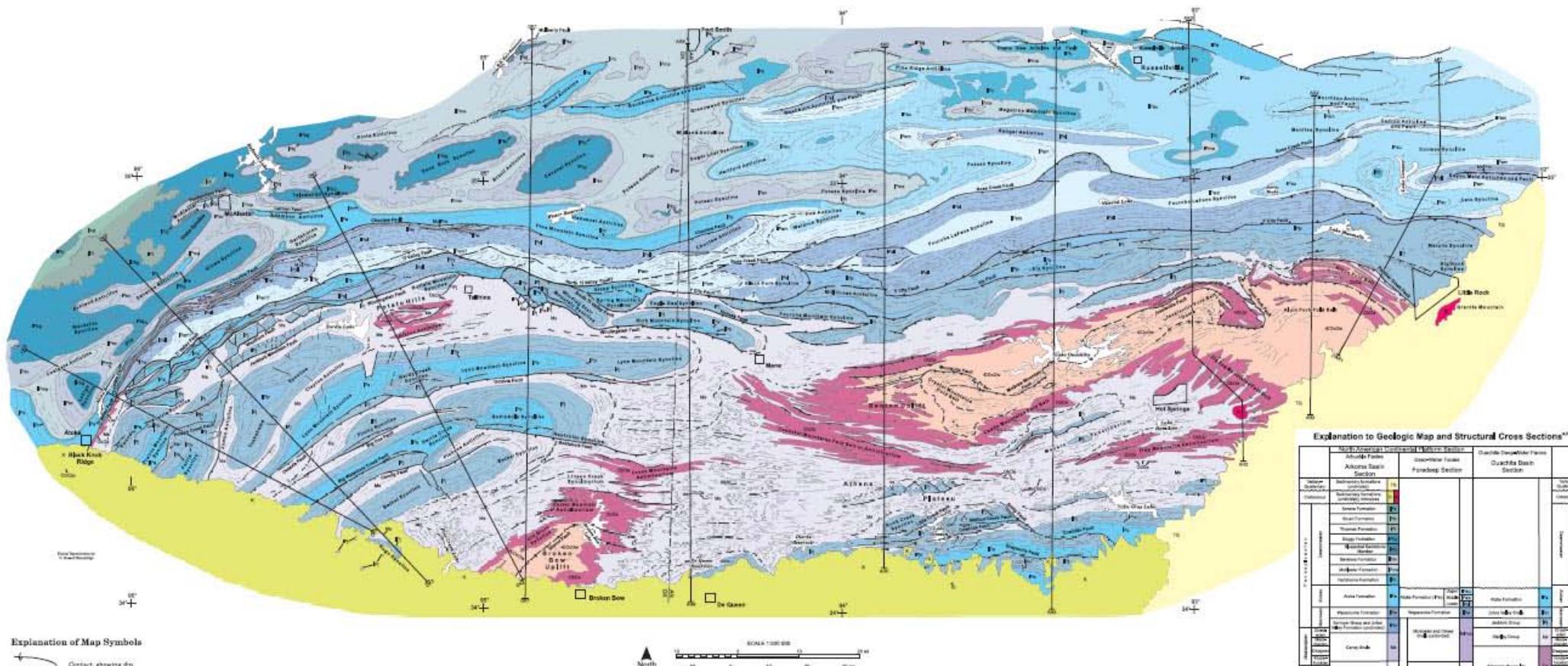
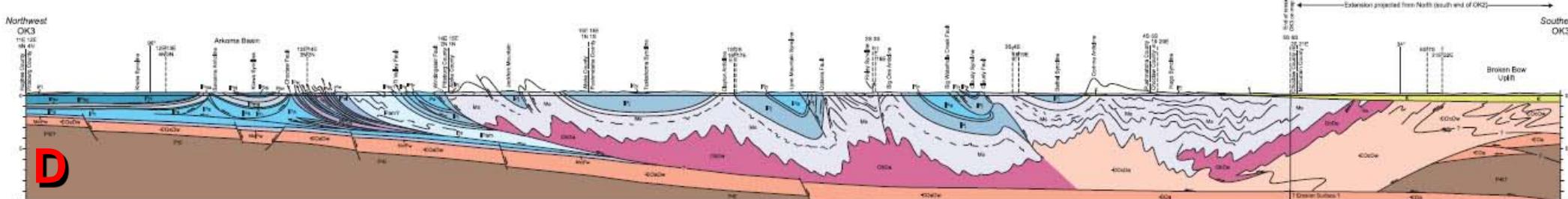
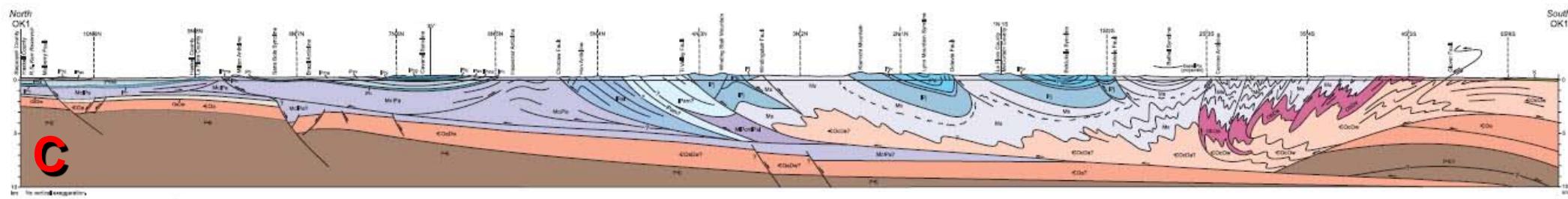
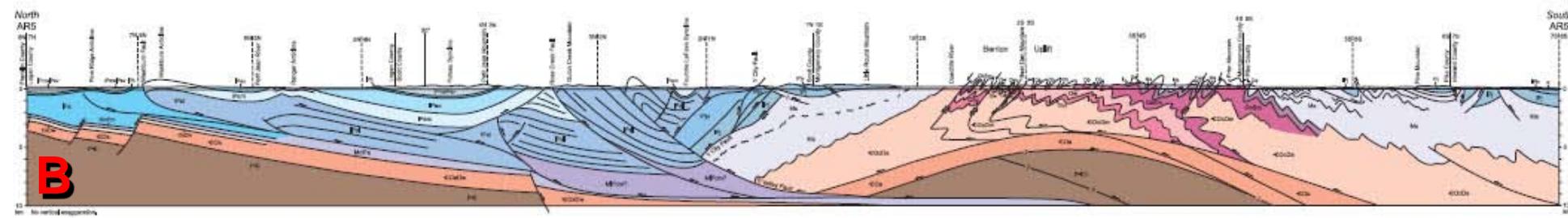
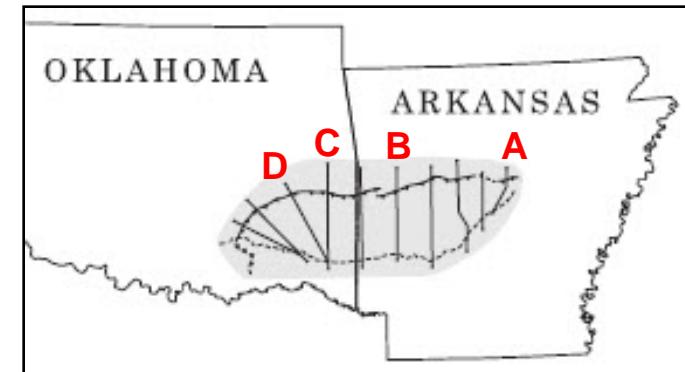
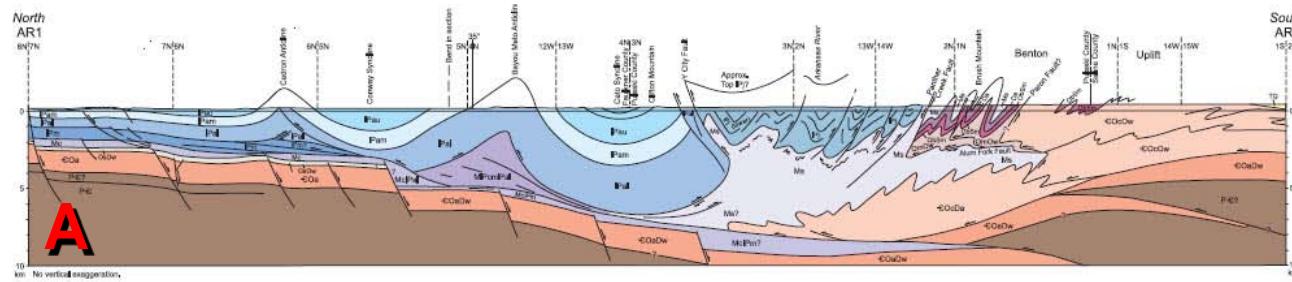


PLATE 2
GEOMORPHIC-STRUCTURAL MAP OF THE OUACHITA MOUNTAINS

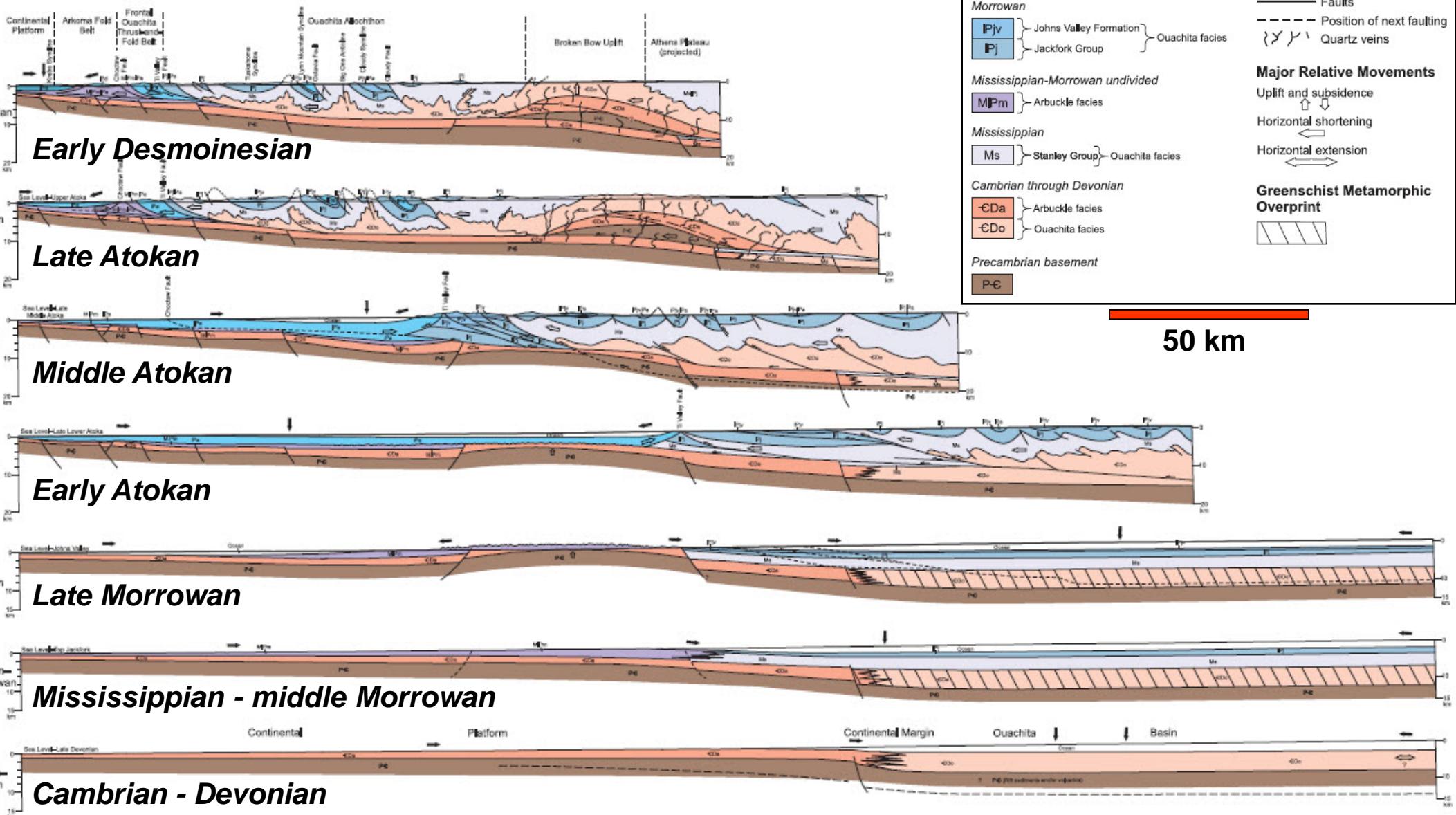
By
J. Kaspar Arbenz
2008



Structural Cross Sections – Southern Arkoma Basin & Ouachitas



Inferred Structural Evolution – Southern Arkoma Basin & Ouachitas



EXPLANATION

Sediment Transport
→ In direction of arrow
↓ Toward viewer

Structure
— Formation contacts
— Faults
- - - Position of next faulting
YY Quartz veins

Major Relative Movements
Uplift and subsidence
Horizontal shortening
Horizontal extension

Greenschist Metamorphic Overprint

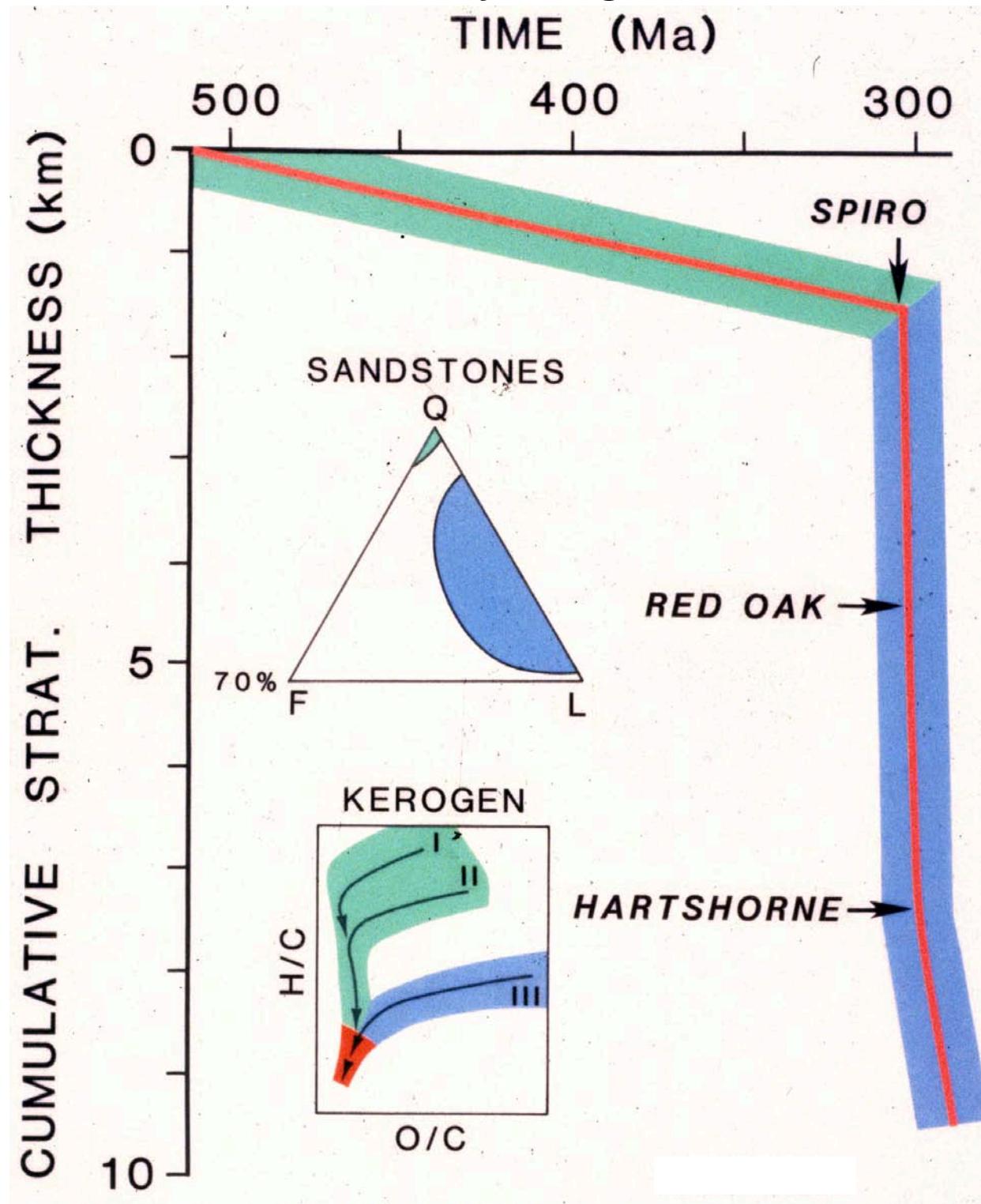
No Vertical Exaggeration

Arbenz, 2008

Regional Petroleum Systems



Arkoma Basin Accommodation History – *Organic & Petrofacies*

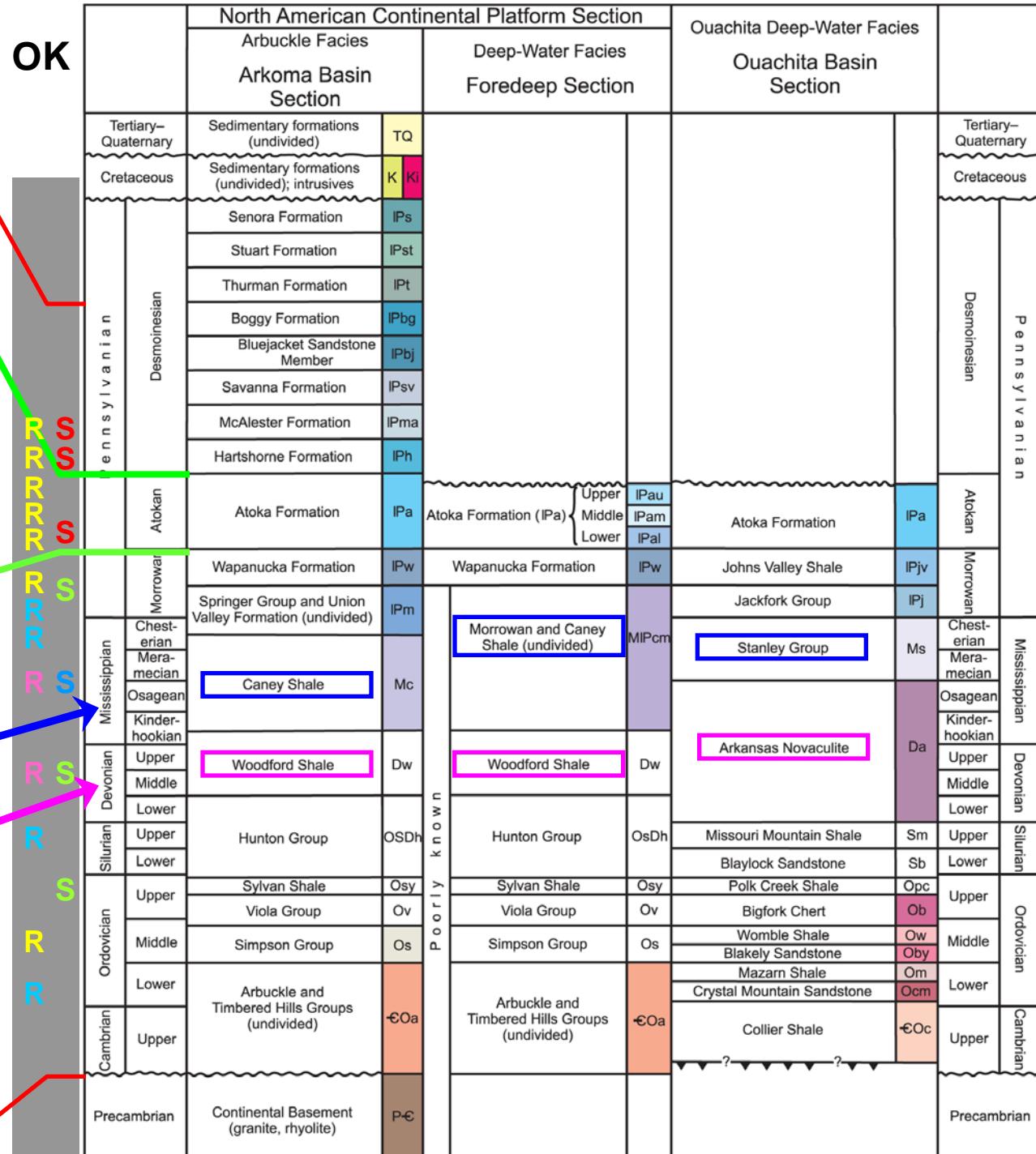
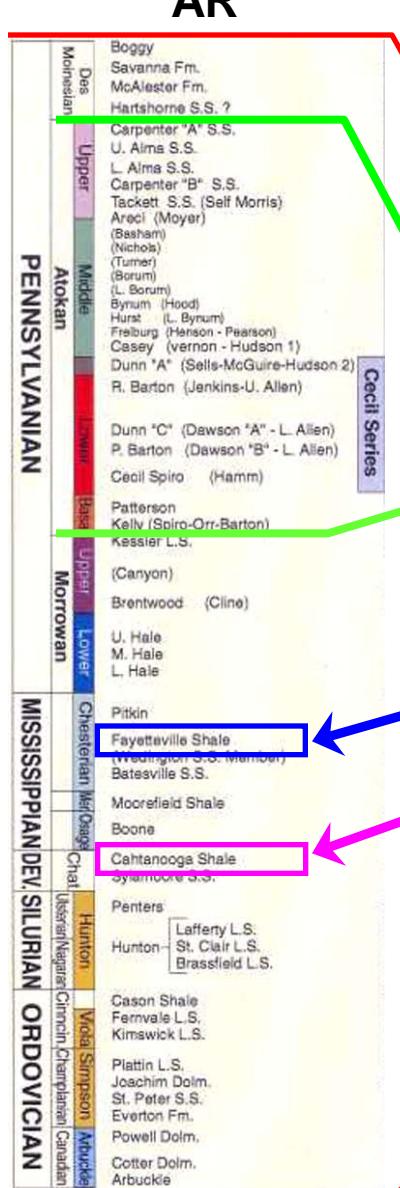


Stratigraphy – *Main Source and Reservoir Rocks*

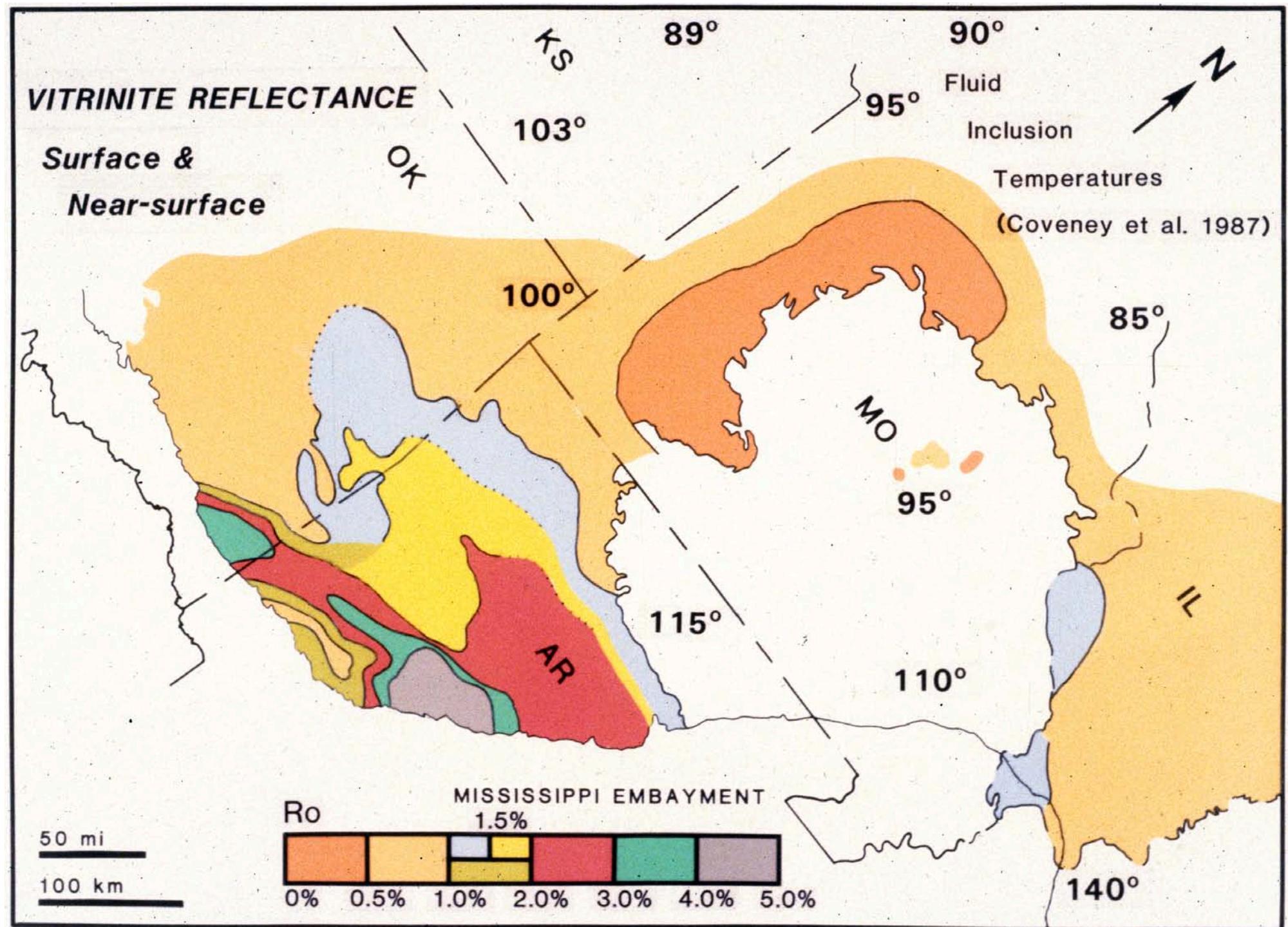
Source Rocks
Oil Prone
Gas Prone
Mixed

Reservoir Rocks

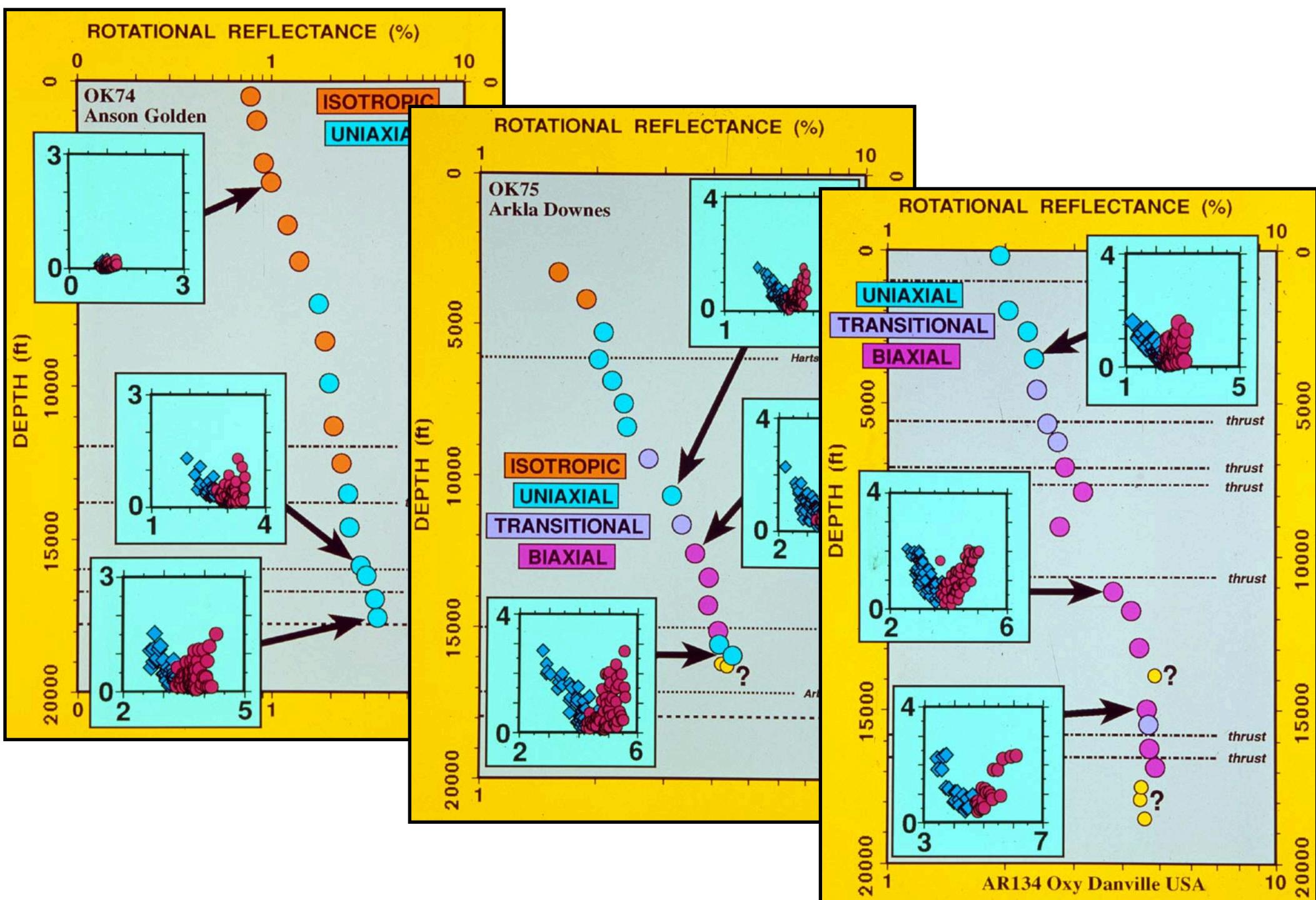
Sandstone Carbonate Shale



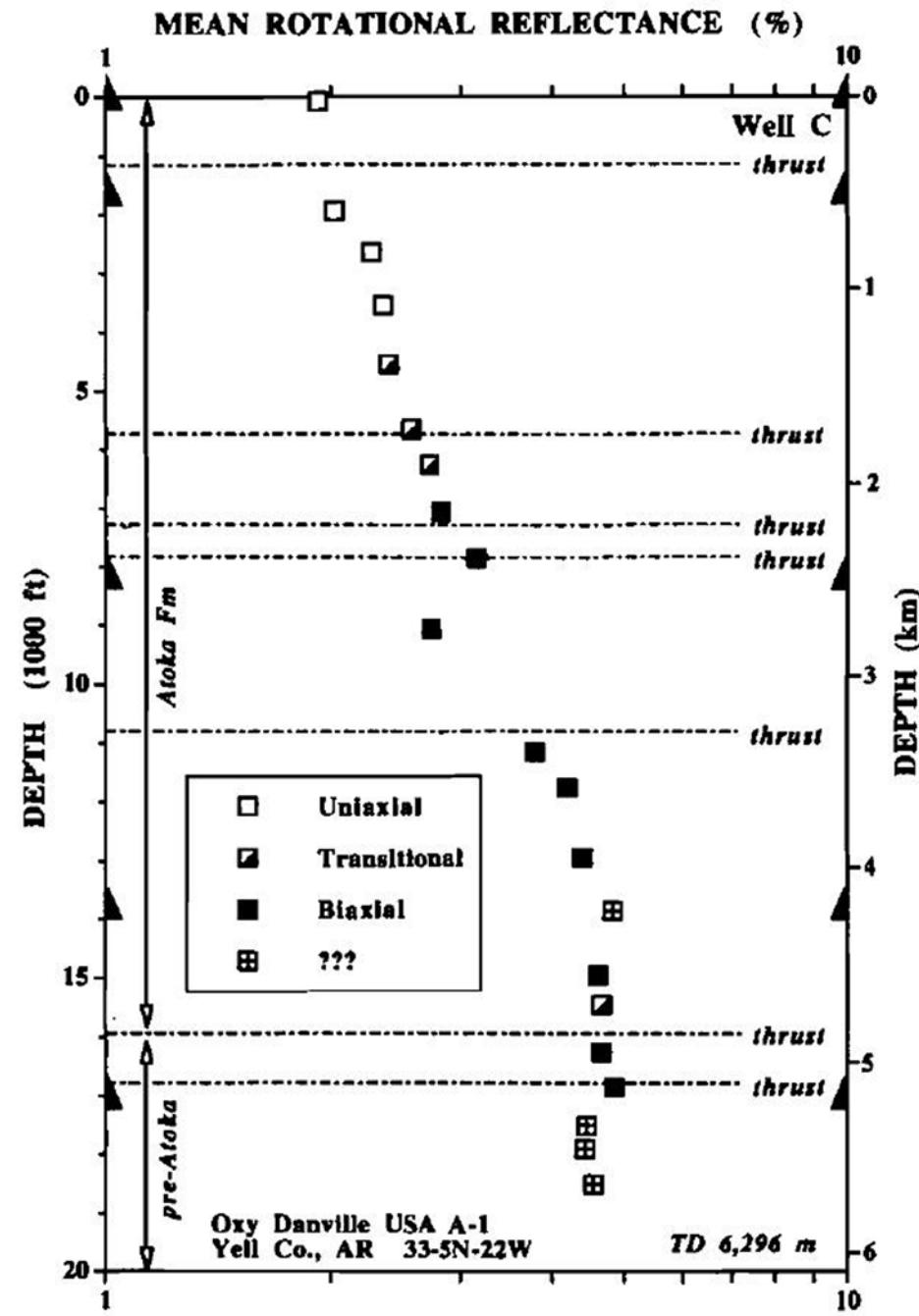
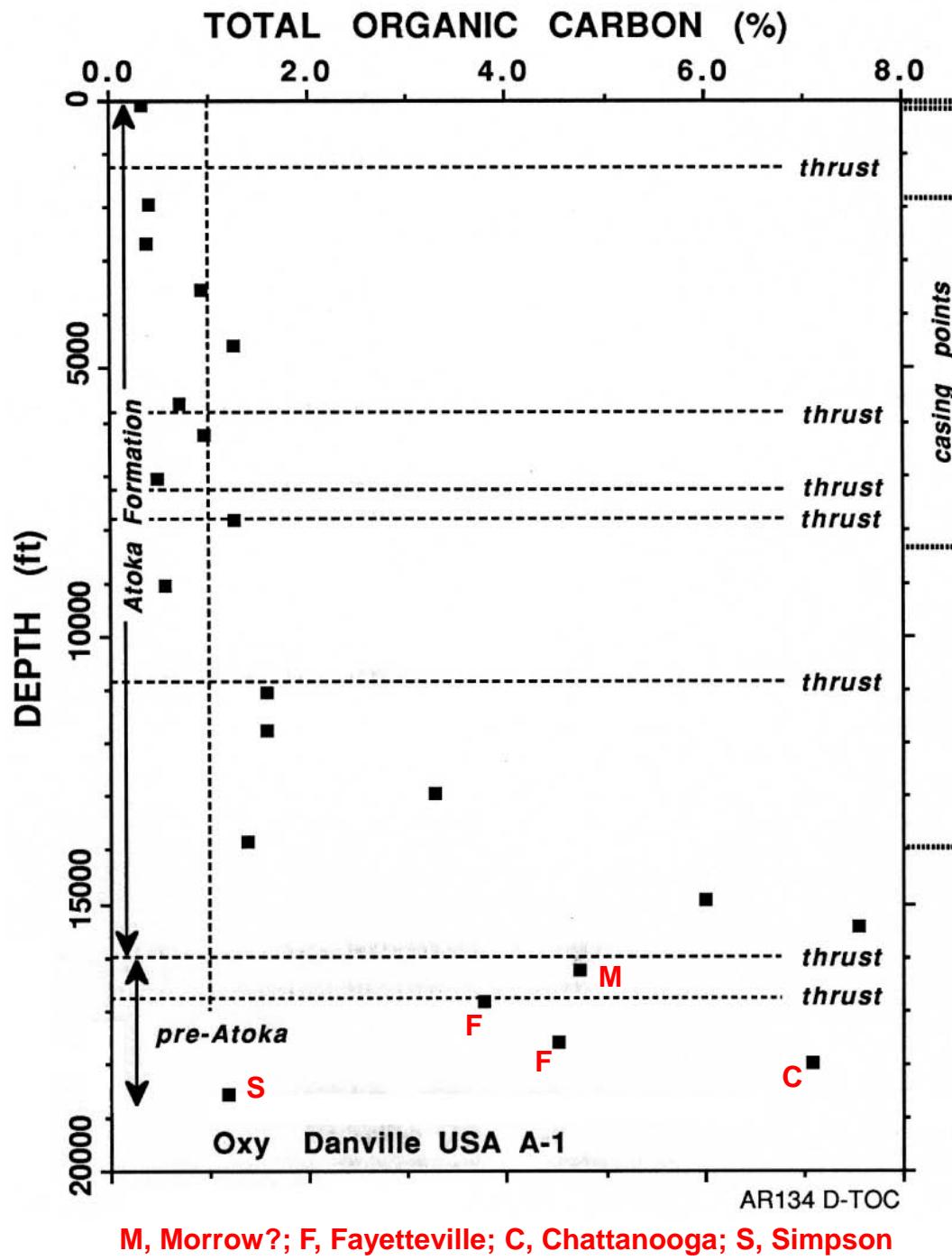
Regional Thermal Maturity – Surface & Shallow Subsurface



Regional Thermal Maturity – Subsurface Profiles, West to East



Oxy Danville – Depth vs. TOC & Vitrinite Reflectance



Houseknecht, 1992; Houseknecht & Weesner, 1997

Summary of Isotope Geochemistry Analysis of Produced Gas

Based on recent USGS work plus results presented publicly by the petroleum industry and universities:

- Strong indication of multiple gas sources with variable thermal histories
- Ethane & propane C-isotopic composition is typical of thermogenic gas
- Methane C-isotopic values are too heavy to be consistent with the ethane and propane values
- A later, higher maturity source (oil or heavy gas cracking?) is the most likely cause for the observed methane carbon isotopic signature
- A more comprehensive interpretation of the geochemistry of gases from the Arkoma Basin could be achieved with the addition of more geologic data and additional gas data

Conclusion: Composite Petroleum System