

Potential Ordovician Hydrocarbon Plays in the Cumberland Plateau of Tennessee and Southern Kentucky: Finding a Needle in a Haystack?

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Acknowledgments
Pasminco
Fred Smith

Introduction

- Ordovician plays within the Cumberland Plateau has been explored for over a century with only moderate success
- Most developed fields are in Mississippian limestones
- Knox, Stones River, and Nashville Groups have only been cursorily explored in the region
- Hydrocarbon discoveries in the Rose Hill (SW VA) and Swan Creek fields (NE TN) indicate Ordovician rocks should be further explored
- Source of the these hydrocarbons is the Ordovician rocks (gas chromatography by R. Burruss, USGS)

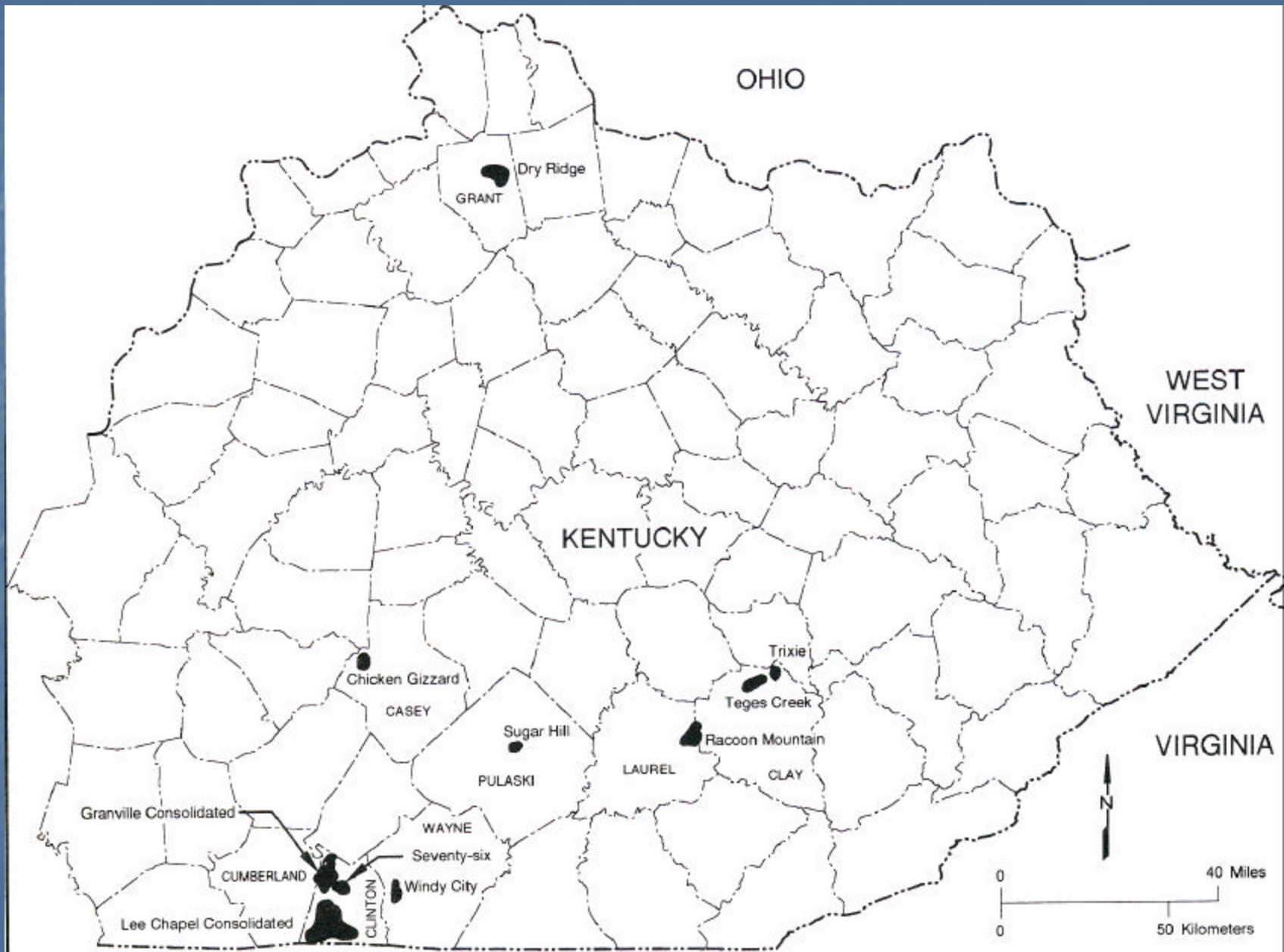
Middle Ordovician Stratigraphy

	Tennessee	Kentucky Western Basin	Ohio	West Virginia / Pennsylvania Central Basin	Pennsylvania / New York Eastern Basin
UPPER ORDOVICIAN	Sequatchie Formation	Drakes Formation	Queenston Shale	Juniata Formation	Queenston Shale
	Leipers Formation	Kope Formation	Cincinnati group	Martinsburg Formation	Reedsville Shale
MIDDLE ORDOVICIAN	Inman Formation	Clays Ferry Formation			Lorraine Group
	Nashville Group	Lexington Limestone	Pt. Pleasant Formation	Utica Shale	Trenton Group
			Lexington Limestone	"Trenton" Limestone	
			Trenton Limestone		
LOWER ORDOVICIAN	Stones River Group	High Bridge Group	Black River Limestone	Black River Limestone	Black River Group
	Carters Limestone	Tyrone Limestone			
	Lebanon Limestone	Oregon Formation			
	Ridley Limestone	Camp Nelson Limestone	"Gull River" Limestone	Loysburg Formation	
UPPER CAMBRIAN	Pierce Limestone	Wells Creek Formation	Wells Creek Formation	Shadow Lake Formation	
	Murfreesboro Limestone	Beekmantown Dolomite	"Beekmantown" Dolomite	Mines Member	
	Wells Creek Formation	Rose Run Sandstone	Rose Run Sandstone	Upper Sandy Member	
		Copper Ridge Dolomite	"Copper Ridge" Dolomite	Ore Hill Member	
				Gatesburg Formation	? Theresa Formation

From Wickstrom, 1996

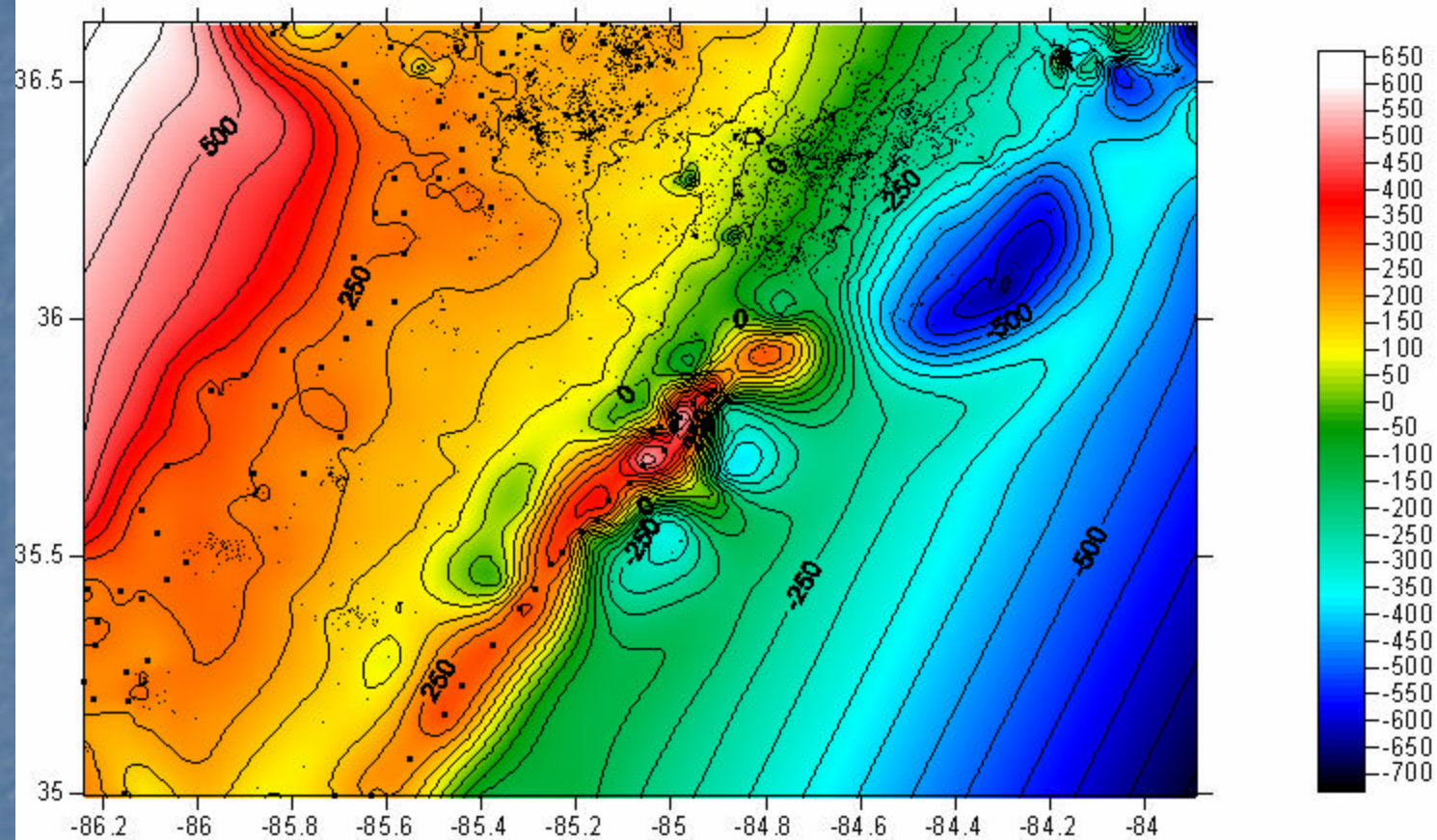
**So where are the known plays
and future targets?**

Nashville Plays

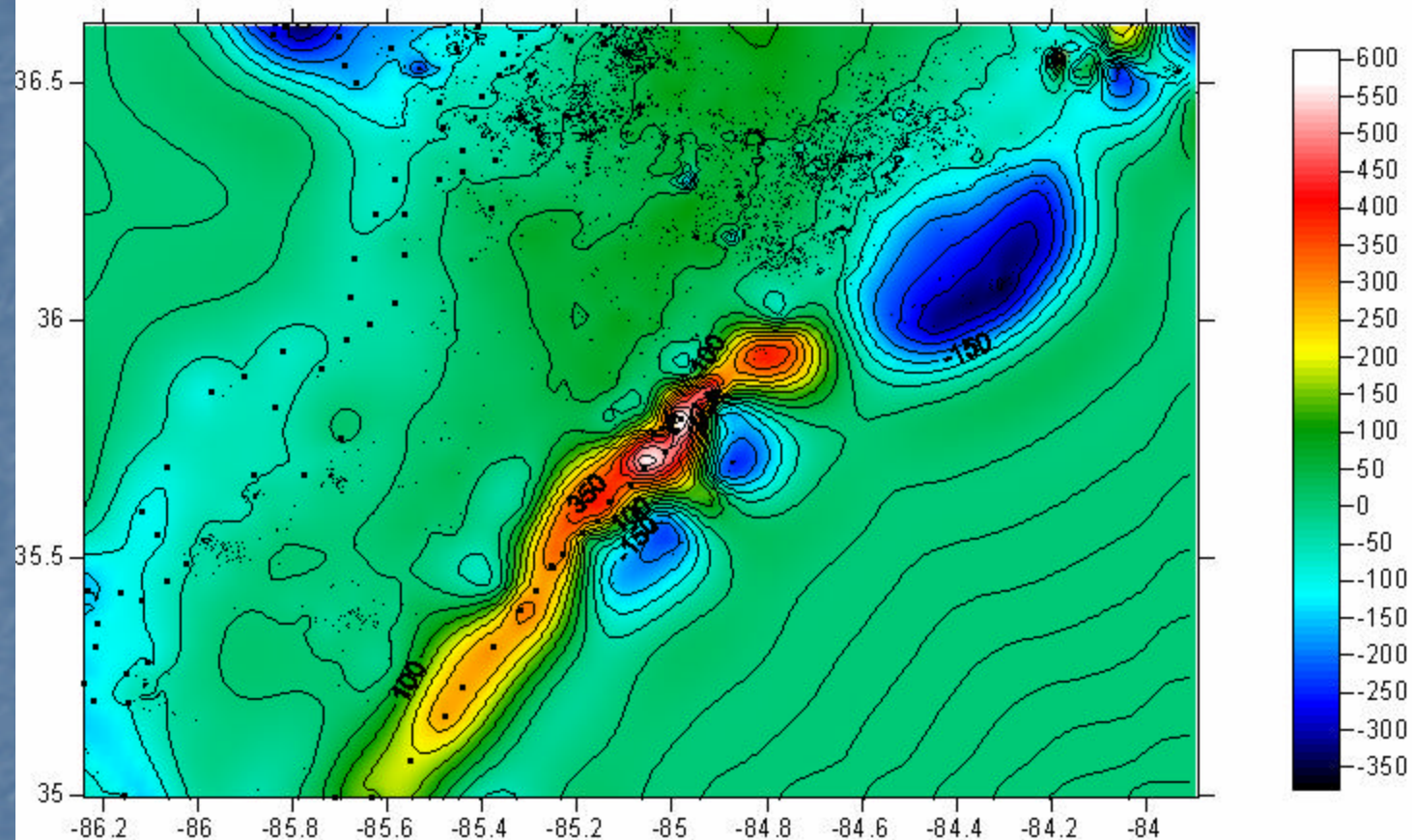


From Nuttall, 1996

Chattanooga Structure Contour Map



Chattanooga Residual Anomaly Map

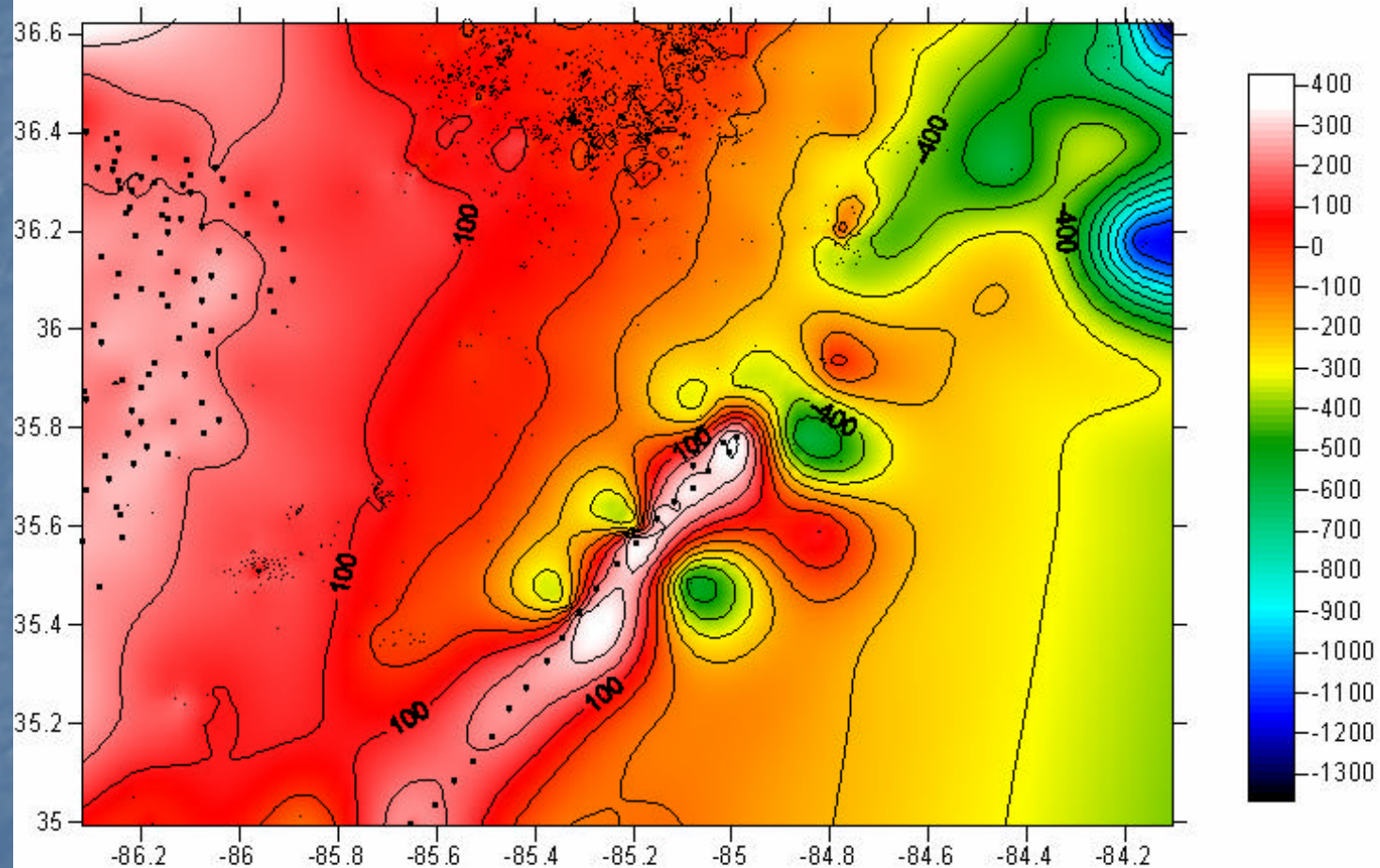


Stones River Plays

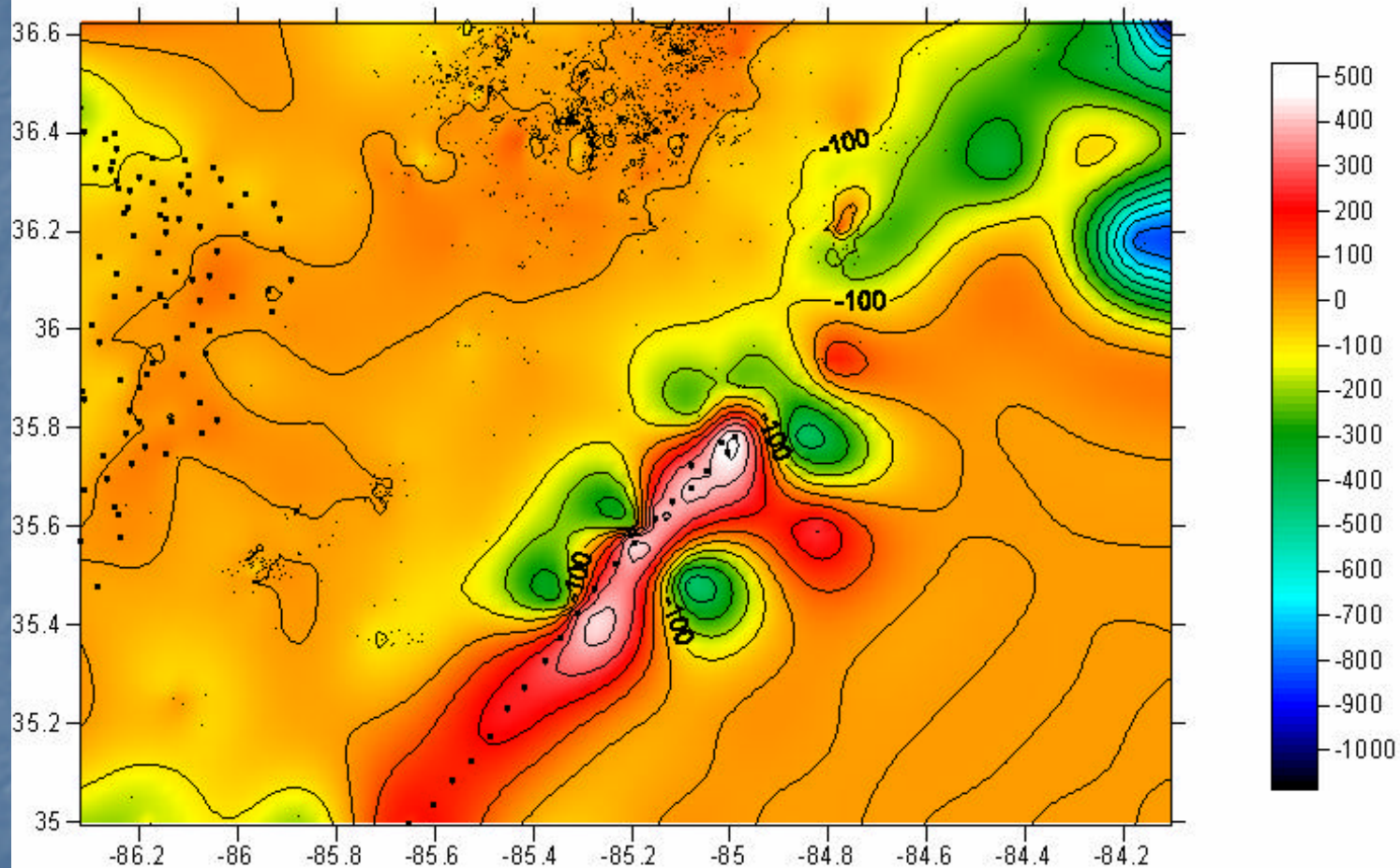


From Wickstrom, 1996

Stones River Structure Contour Map



Stones River Residual Anomaly Map

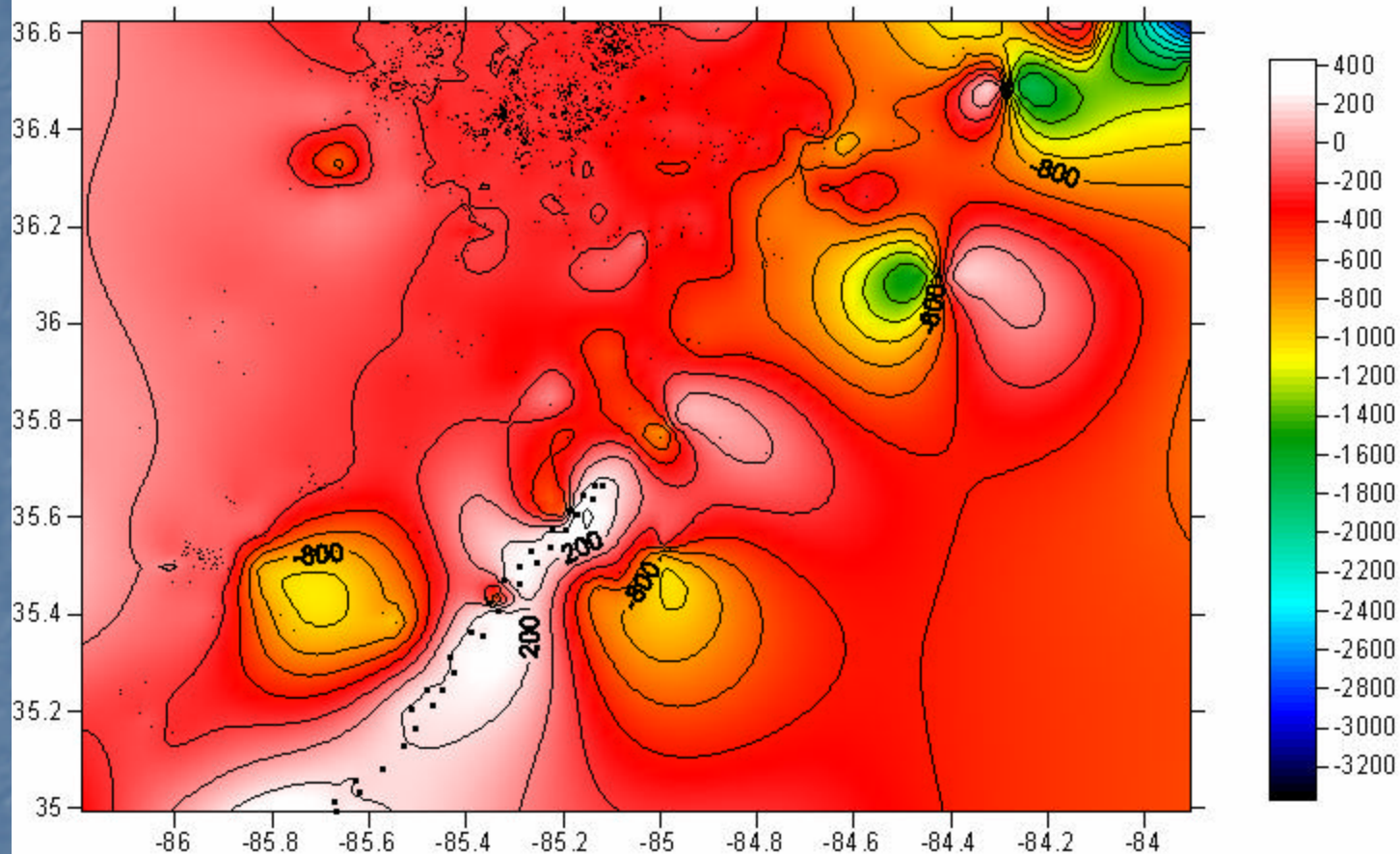


Knox Plays

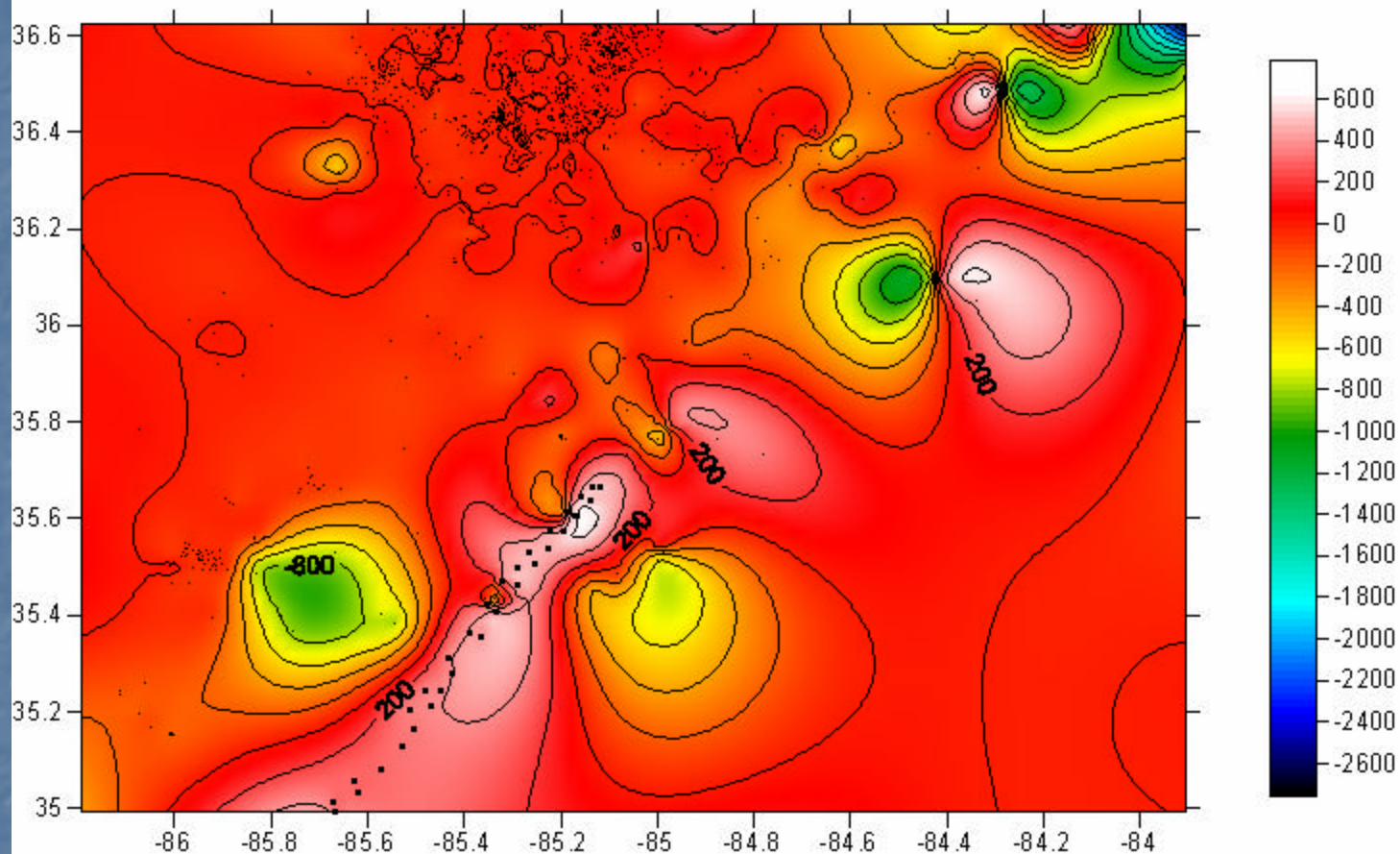


From Baranoski et al., 1996

Knox Structure Contour Map

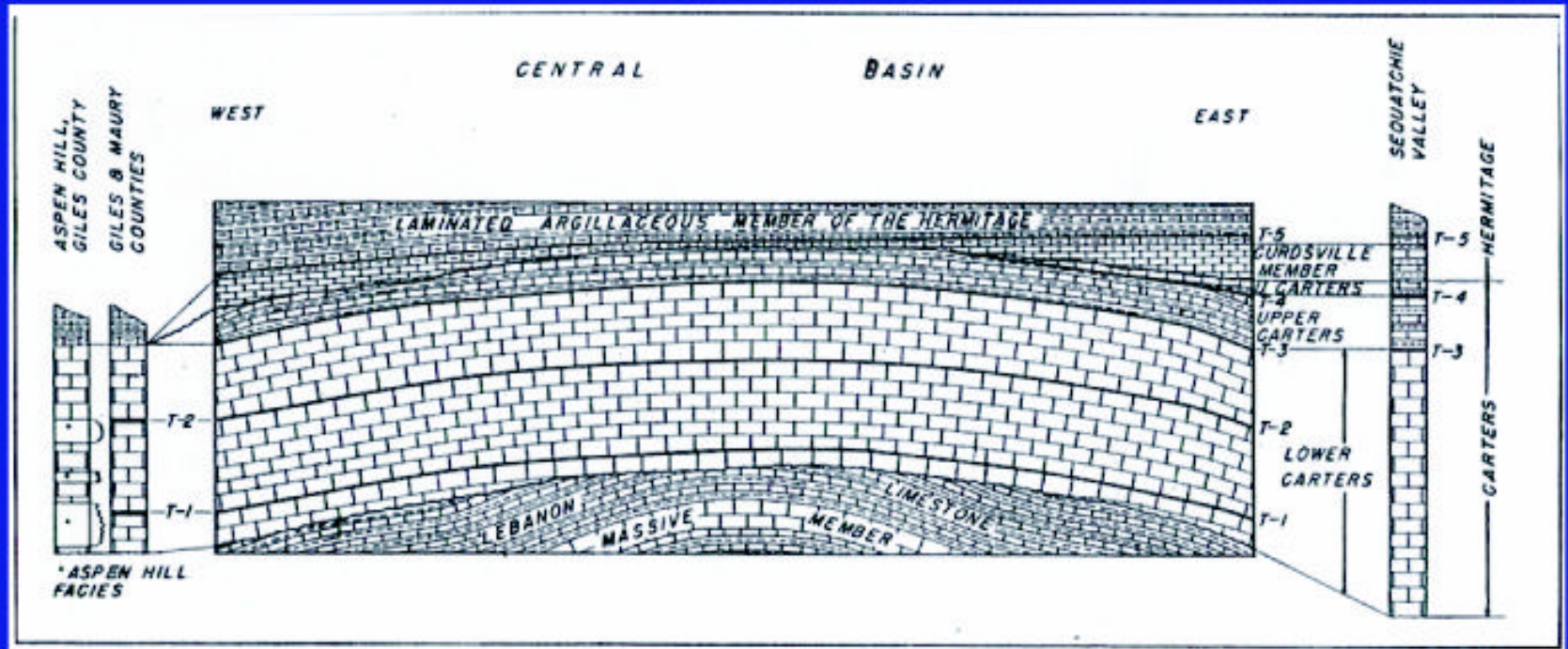


Knox Residual Anomaly Map

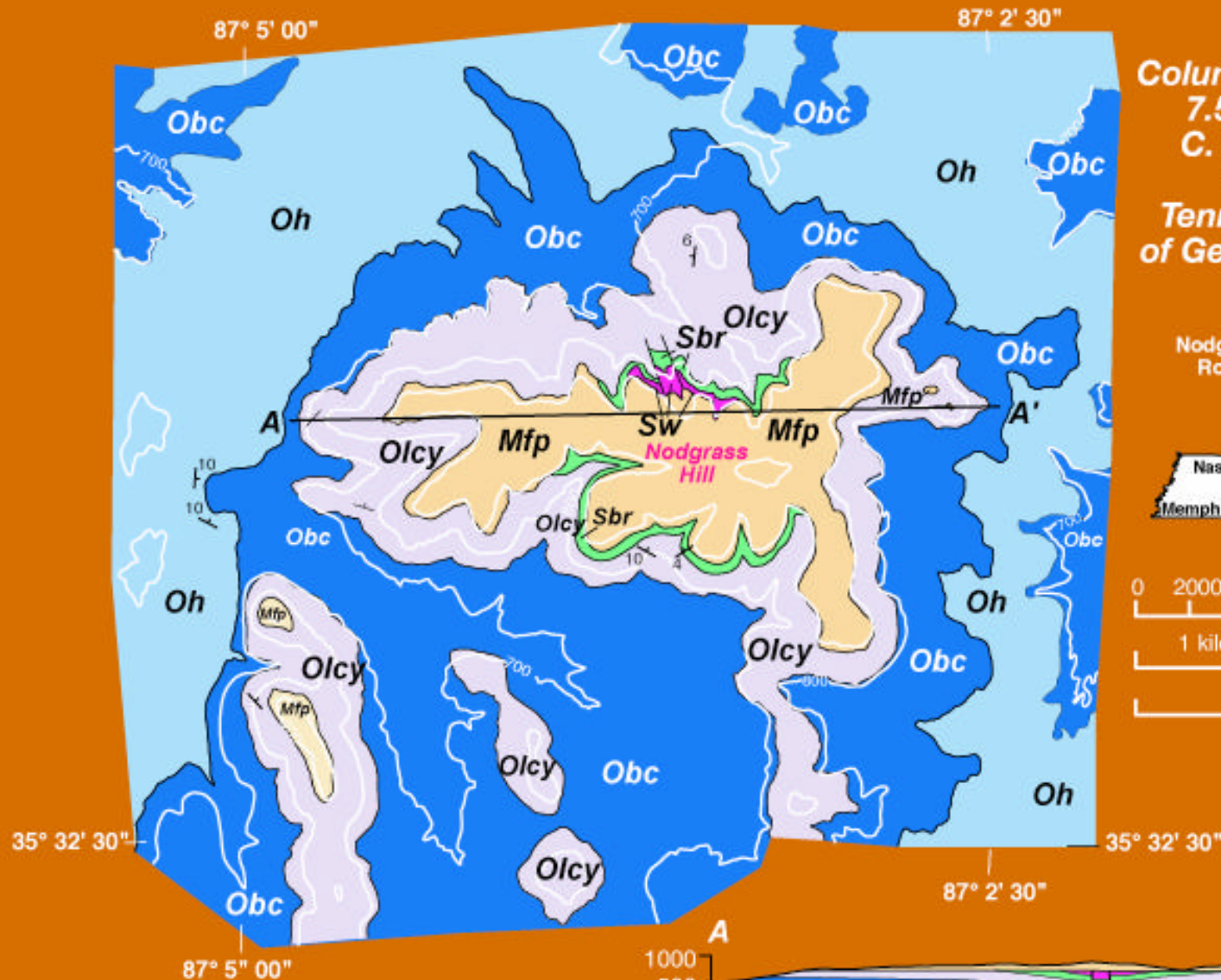


**So why do we need to subdivide
the Nashville and Stones River
groups?**

Lebanon-Carters-Hermitage Facies, Central Tennessee



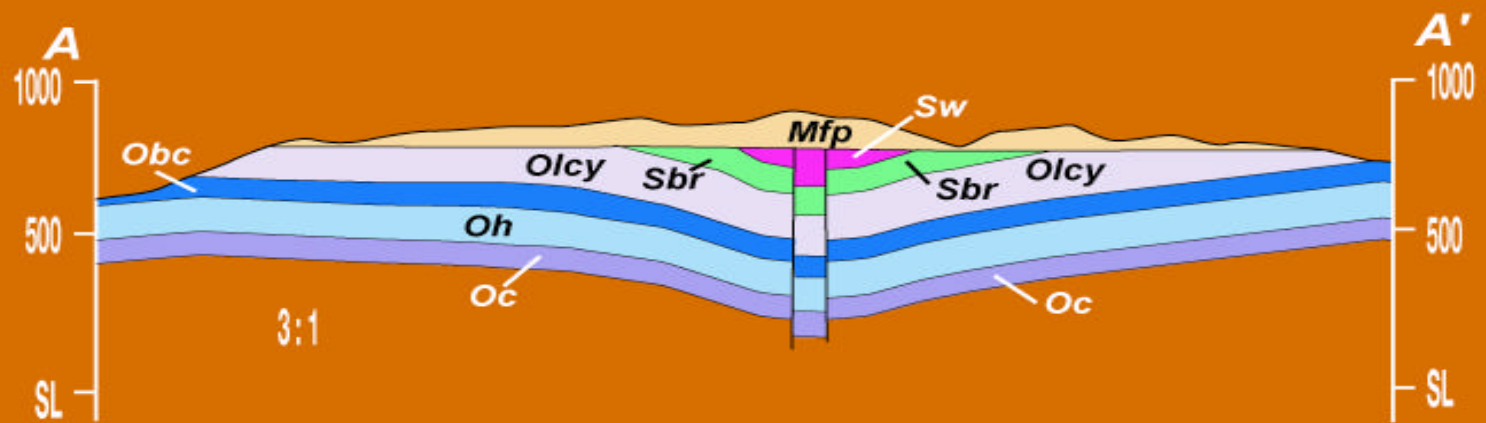
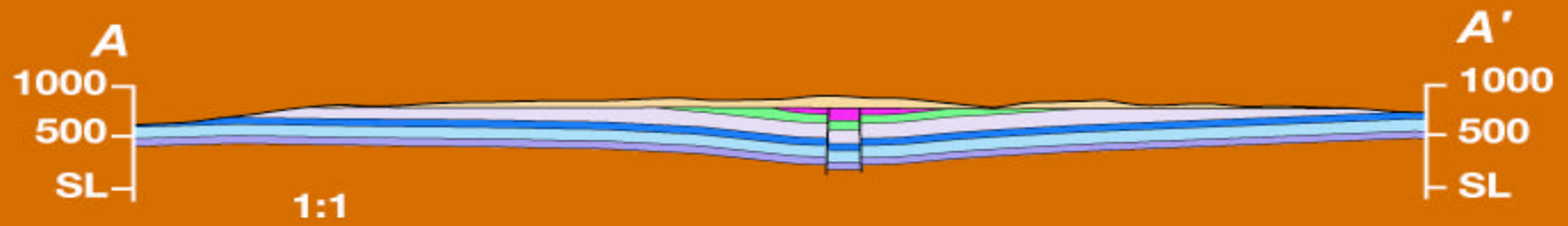
from C. W. Wilson, Jr., 1949, TDG Bulletin 56

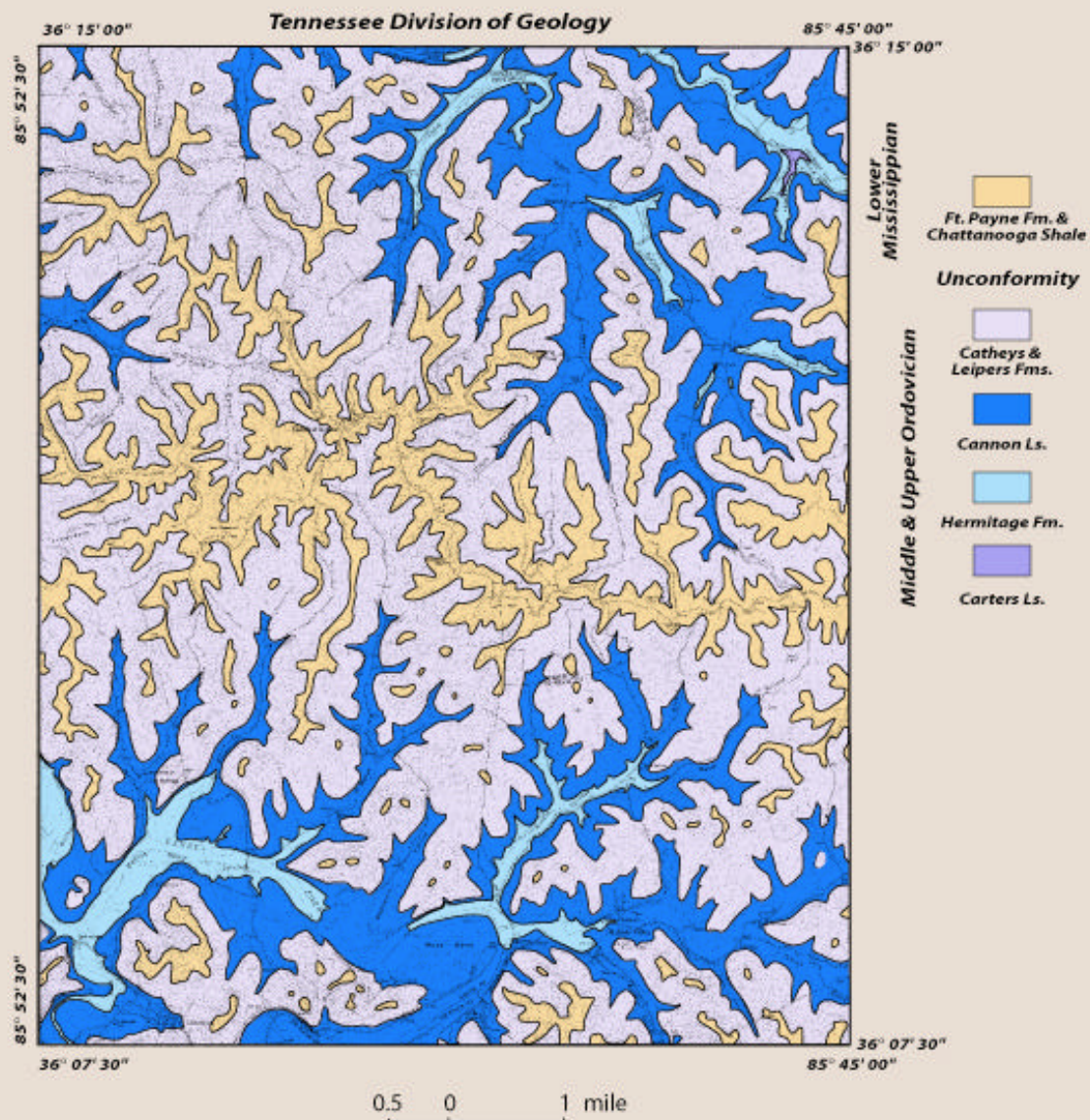


*Part of
Columbia, Tennessee,
7.5-minute quad
C. W. Wilson, Jr.,
et al., 1964,
Tennessee Division
of Geology GM-57 SE
1964*

Nodgrass Hill geology by
Robert D. Hatcher, Jr.
1962





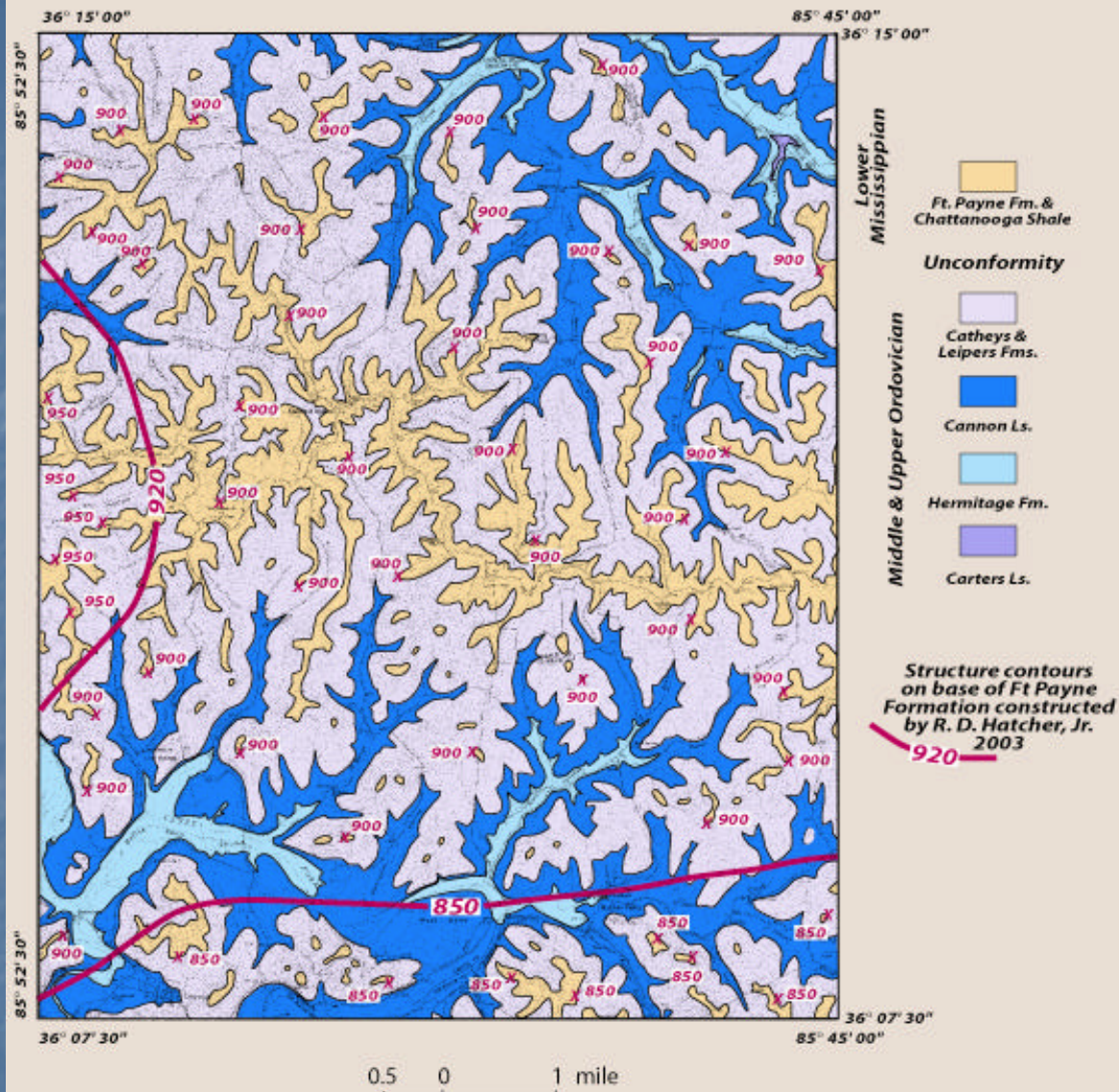


Geologic Map of the Buffalo Valley Quadrangle, Tennessee

Charles W. Wilson, Jr.

GM 322-NE

1971

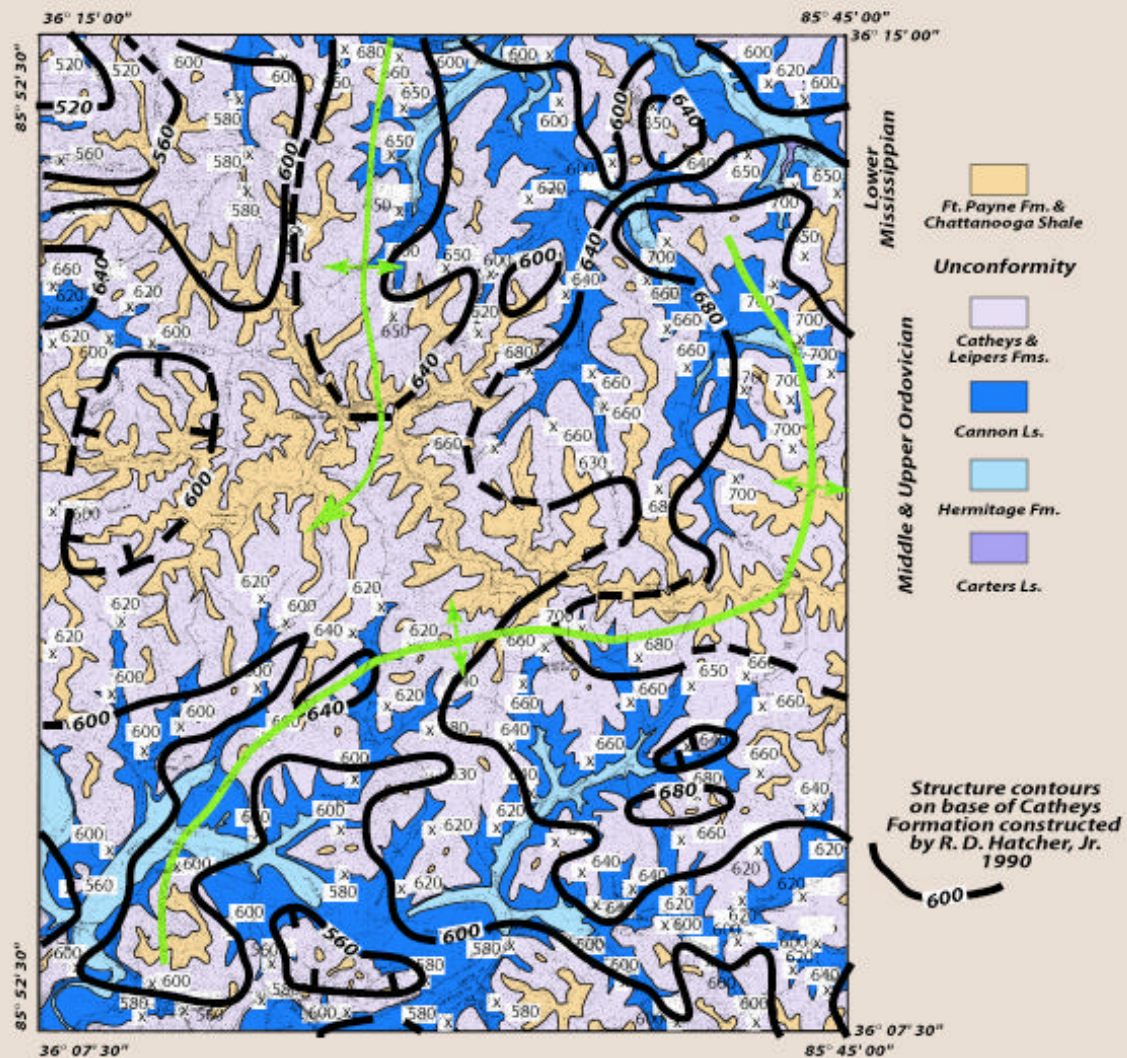


**Structure contour map based on the
Geologic Map of the Buffalo Valley Quadrangle, Tennessee**

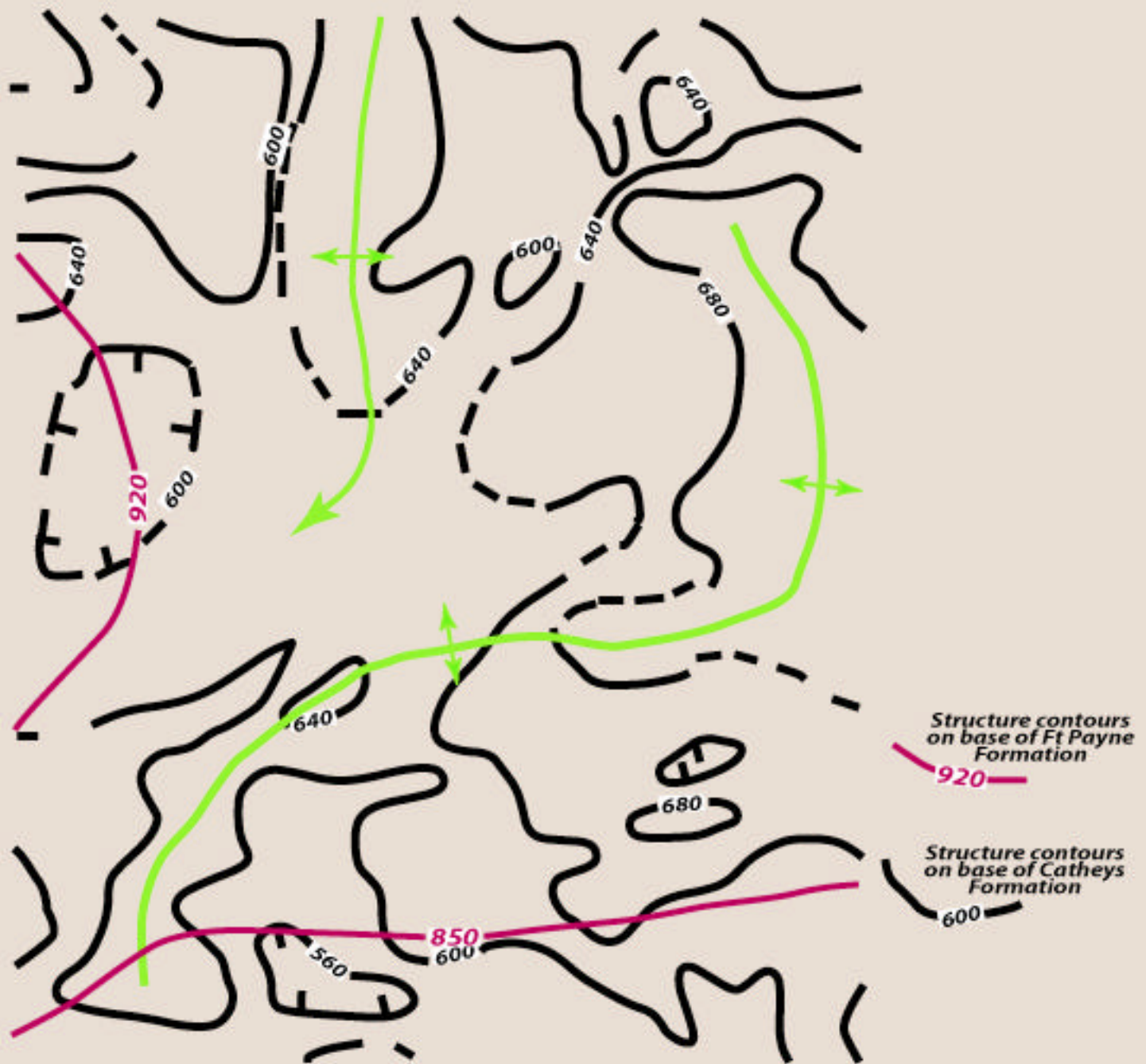
**Charles W. Wilson, Jr.
GM 322-NE**

Tennessee Division of Geology

1971



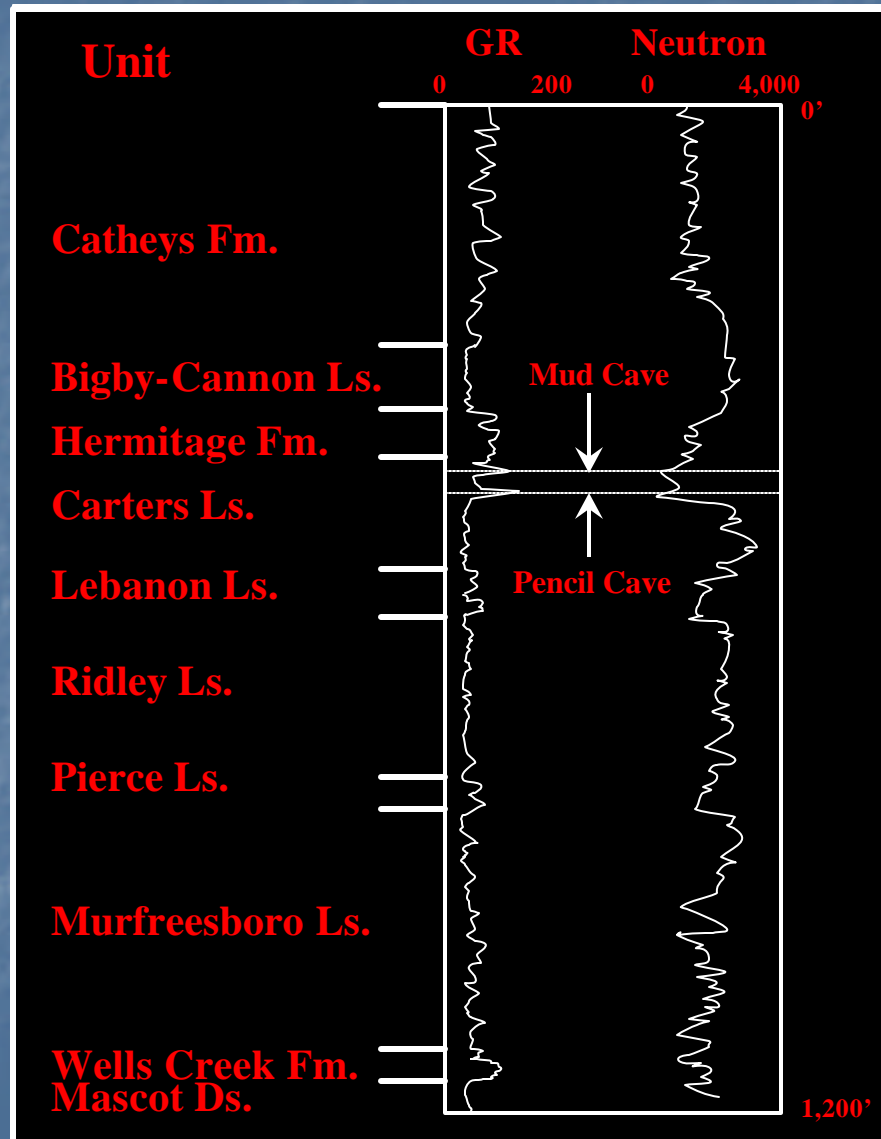
**Structure Contours based on the
Geologic Map of the Buffalo Valley Quadrangle, Tennessee**
Charles W. Wilson, Jr.
GM 322-NE
Tennessee Division of Geology
1971



**This is all well and good...
but is it possible to subdivide
the groups?**

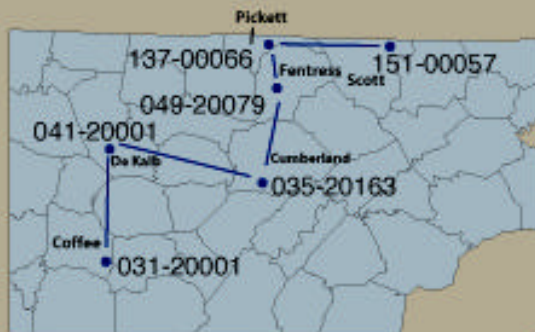
YES, but it takes time.

Composite Type Section

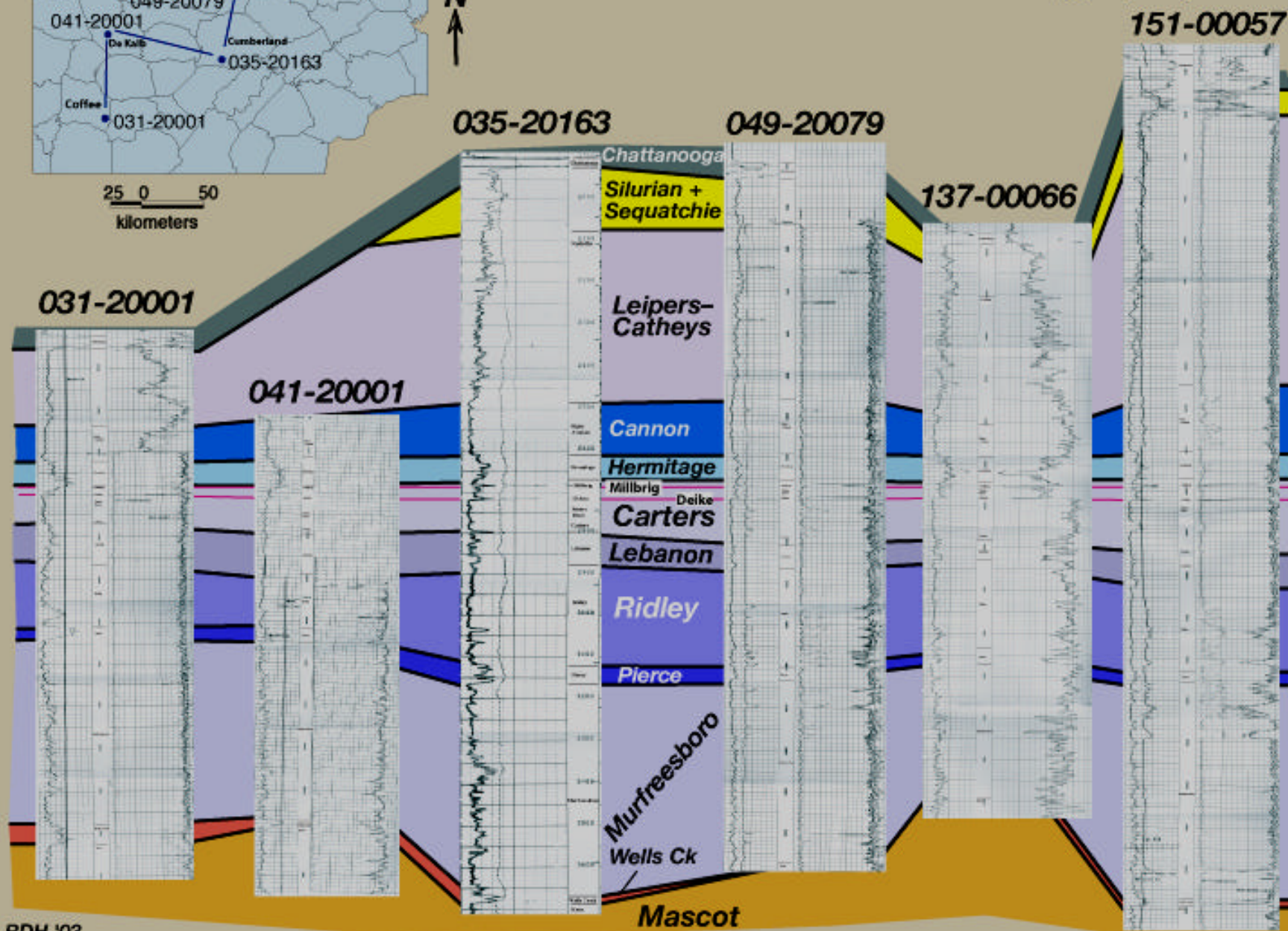


Middle Ordovician Stratigraphy

Age	Group	Unit	Thickness	Drillers Terms
Middle Ordovician	Nashville	Catheys Formation	40m - 120m	
		Bigby-Cannon Limestone	25m - 40m	Upper Sunnybrook
		Hermitage Formation	20m - 25m	Lower Sunnybrook
	Stones River	Carters Limestone	25m - 50m	Mud cave, Pencil Cave
		Lebanon Limestone	30m	
		Ridley Limestone	40m - 75m	
		Pierce Limestone	9m - 12m	
		Murfreesboro Limestone	100m - 160m	
		Wells Creek Formation	0m - 20m	
Lower Ordovician	Knox	Mascot Dolomite	100m - 240m	

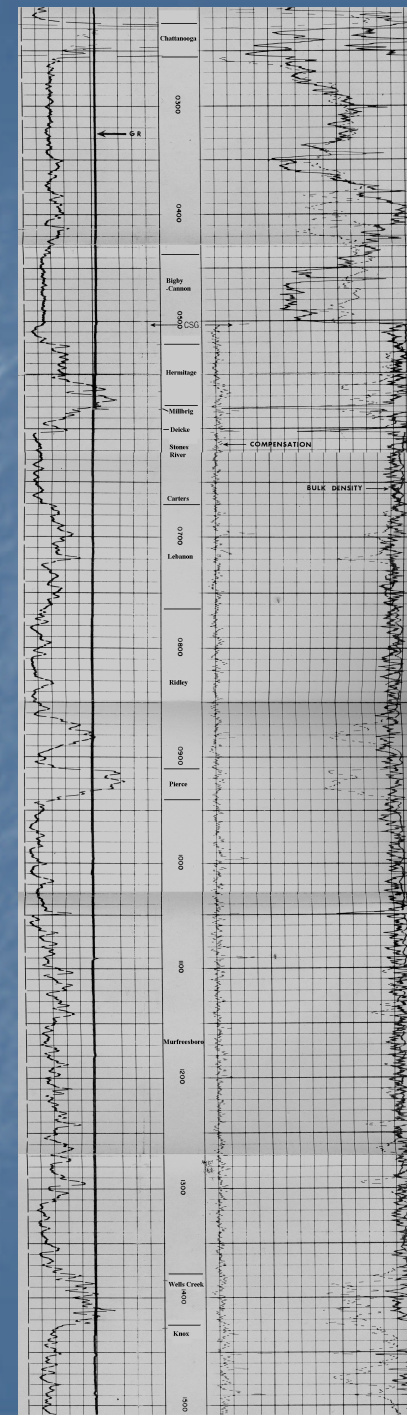


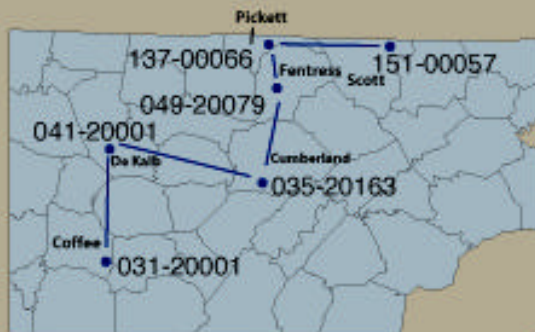
Possible Subsurface Stratigraphy



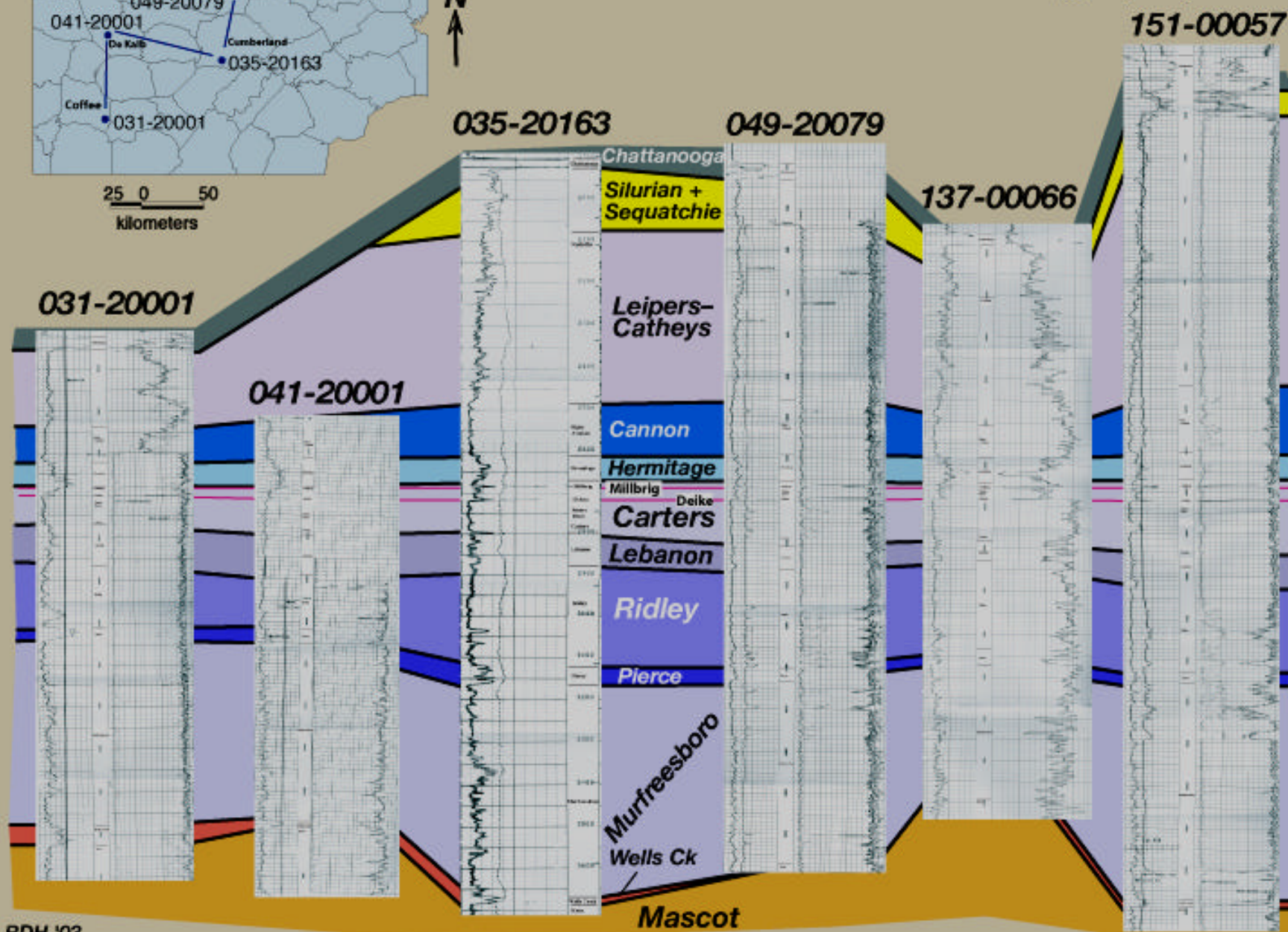
J. J. Brothers #1

41-031-20001



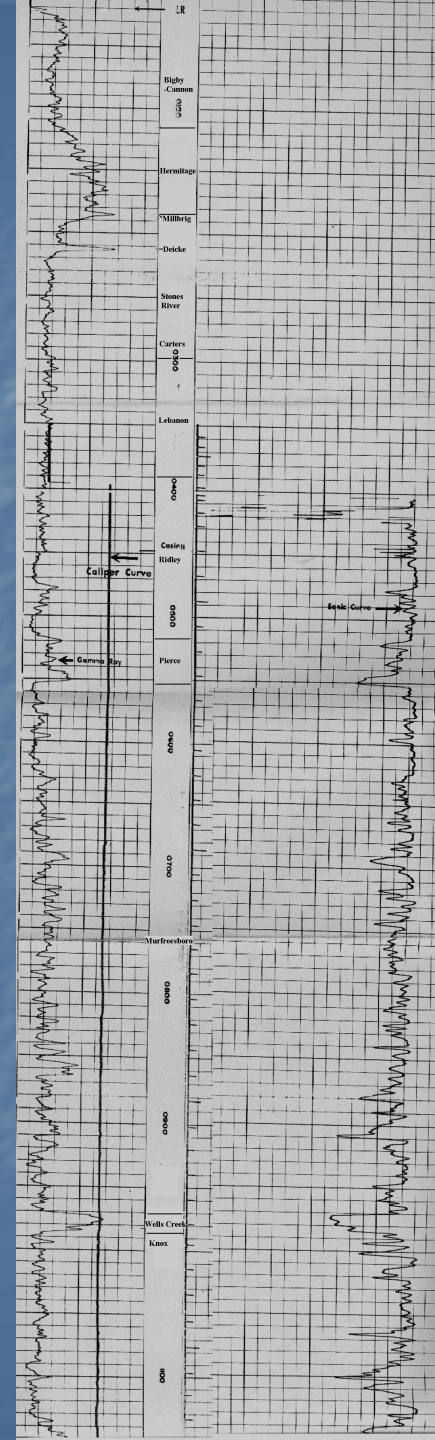


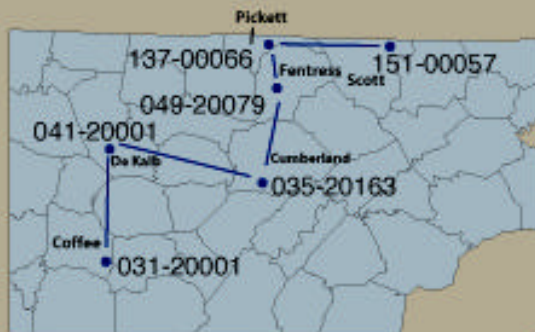
Possible Subsurface Stratigraphy



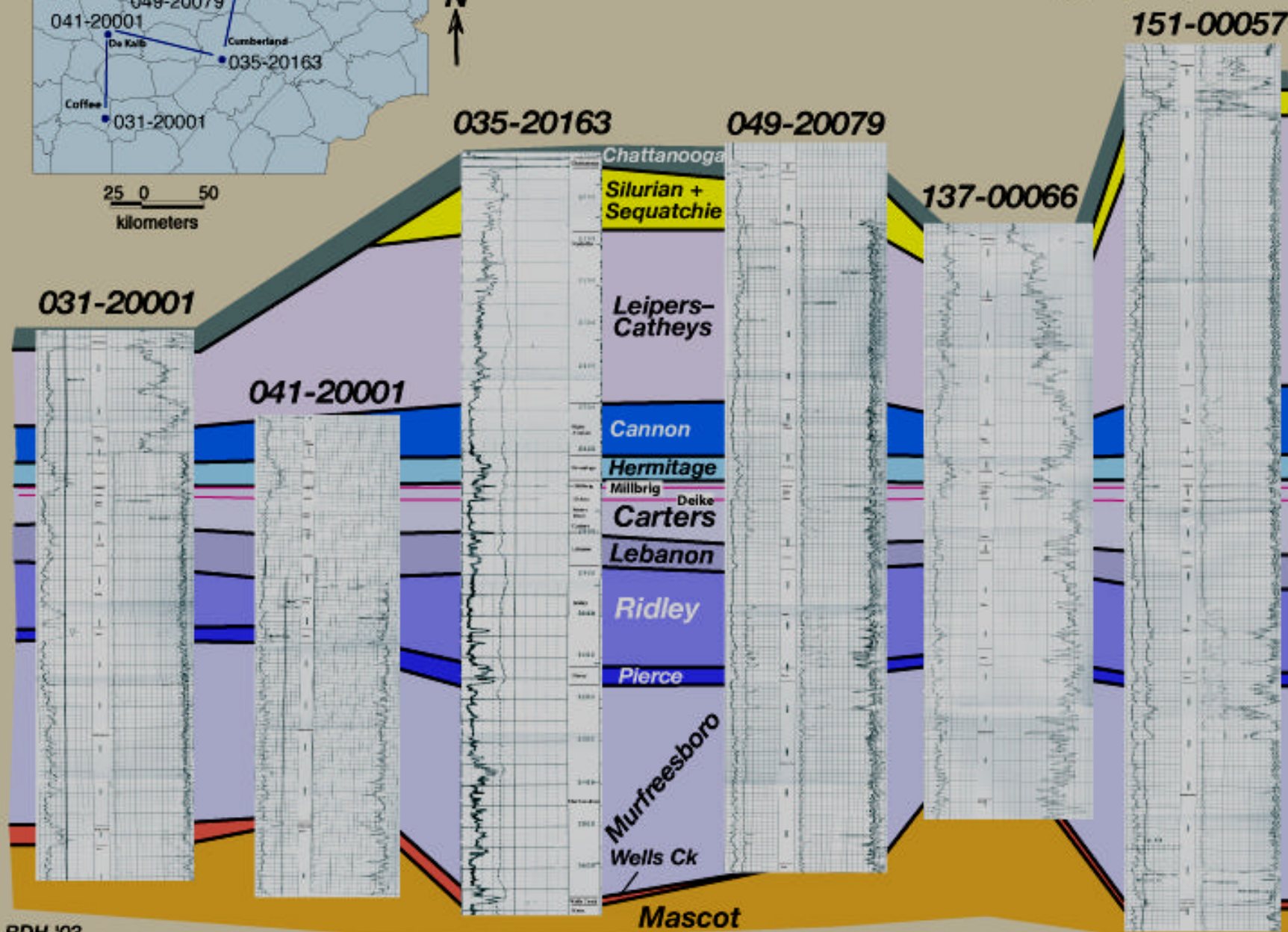
R. S. Driver #1

41-041-20001



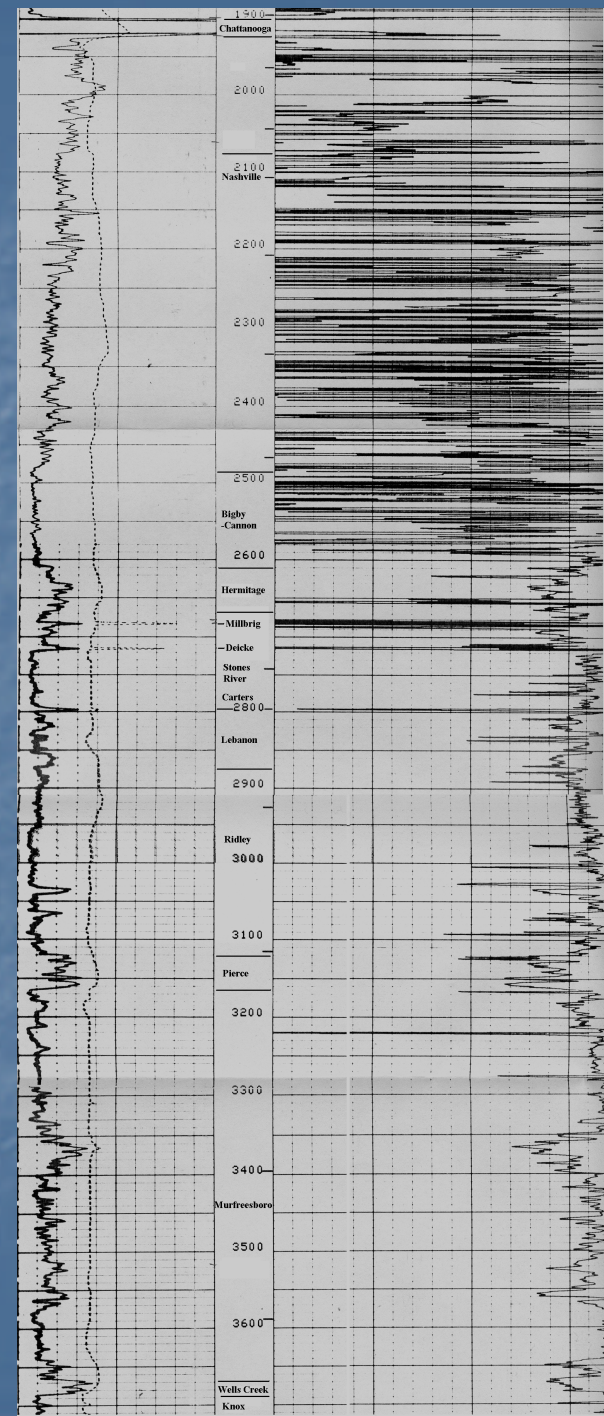


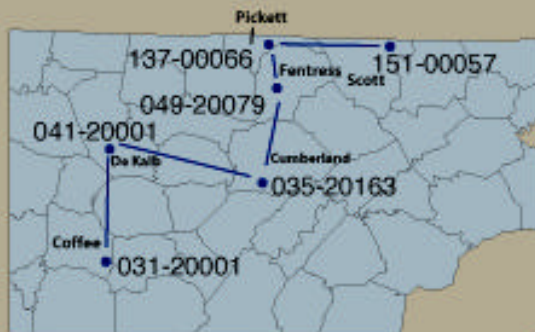
Possible Subsurface Stratigraphy



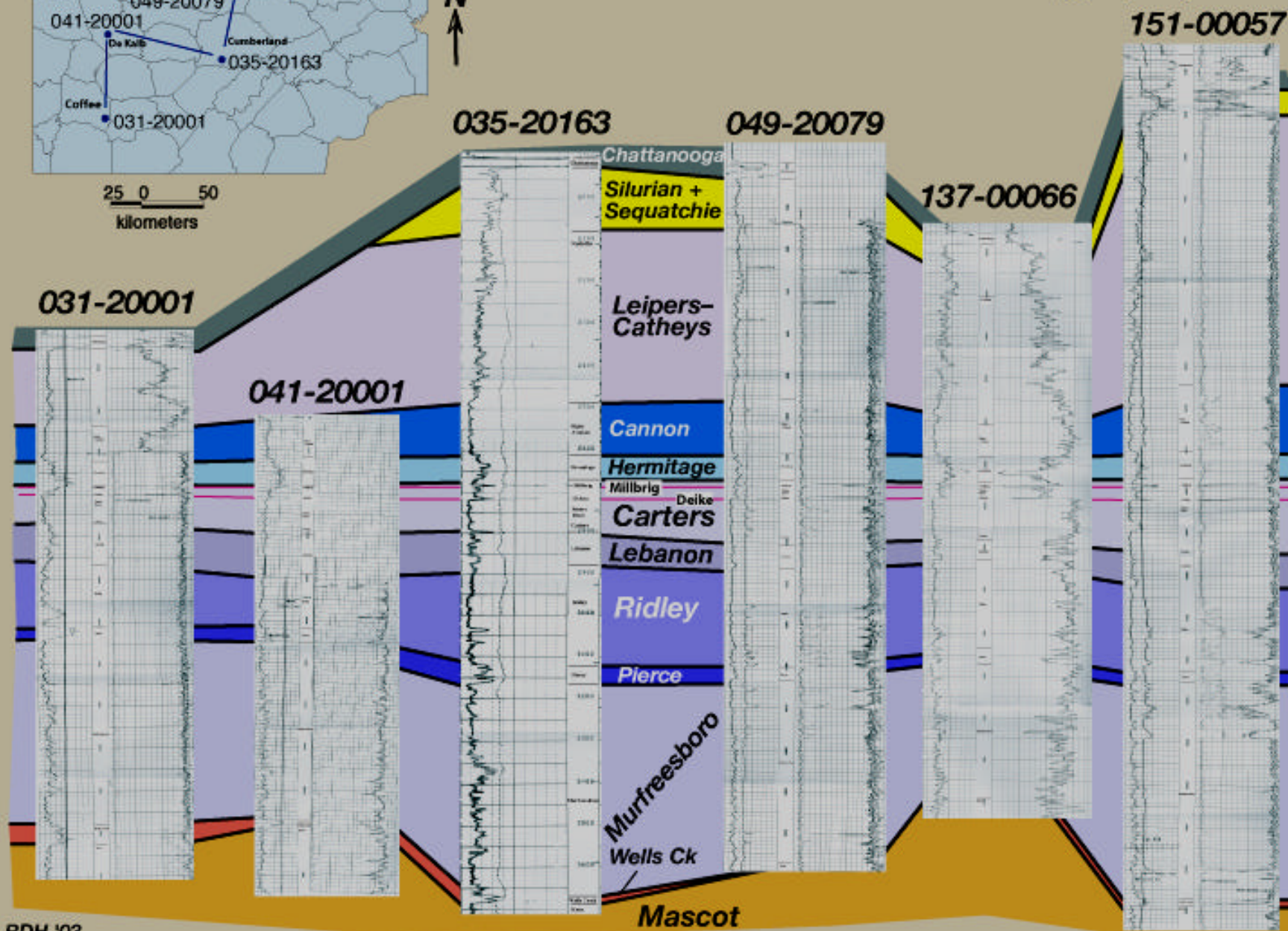
C. C. Simonton #1

41-035-20163



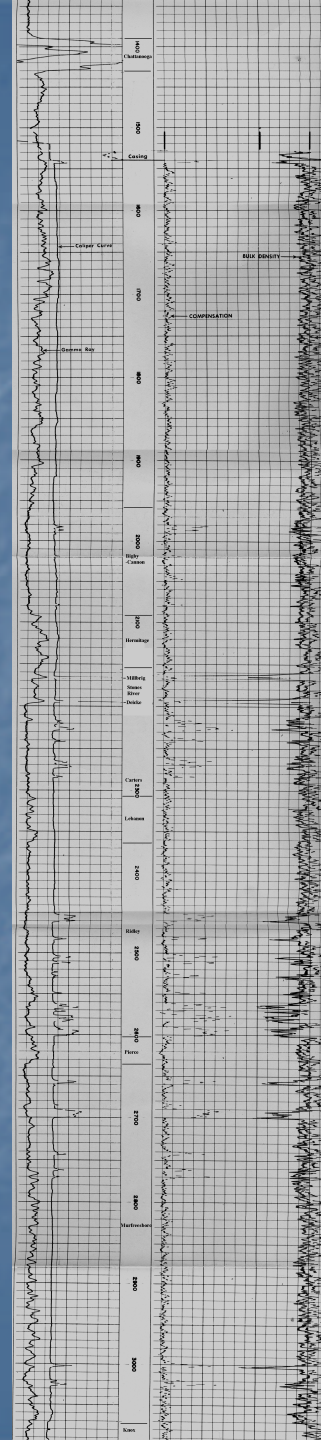


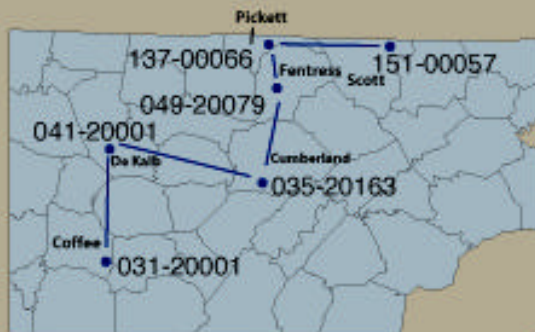
Possible Subsurface Stratigraphy



Gernt Estate #8

41-049-20079





Possible Subsurface Stratigraphy

035-20163

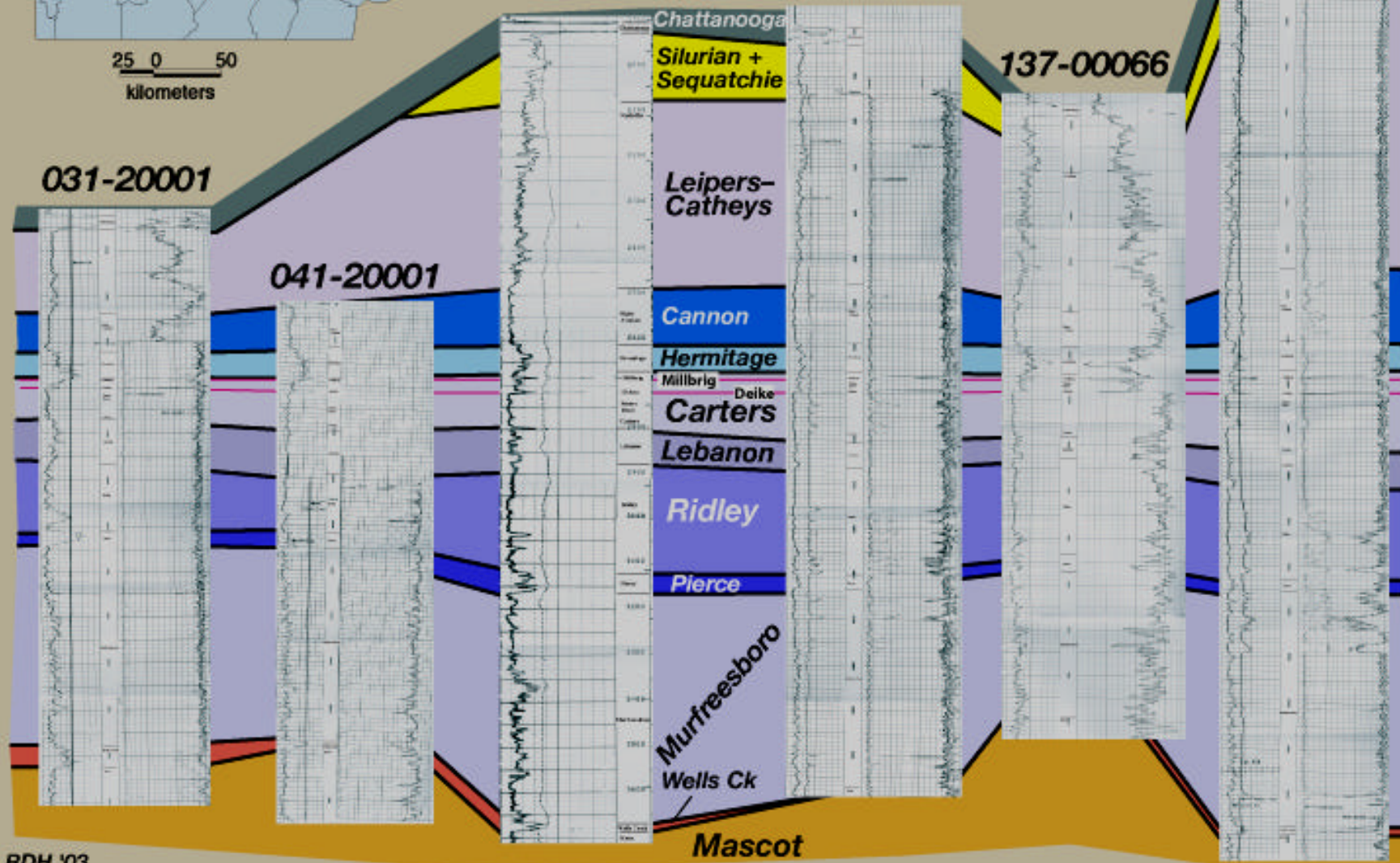
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151-00057

031-20001

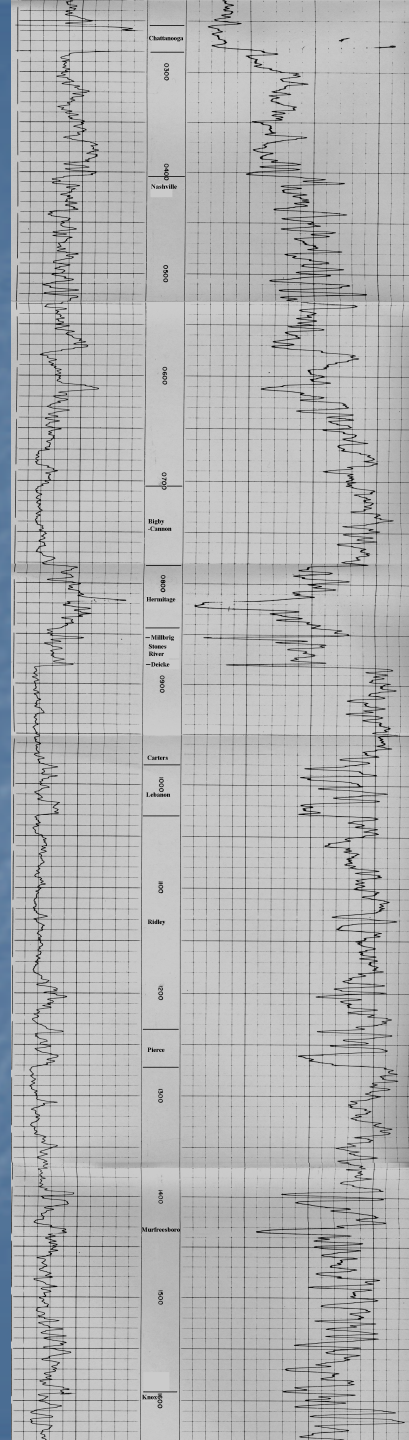
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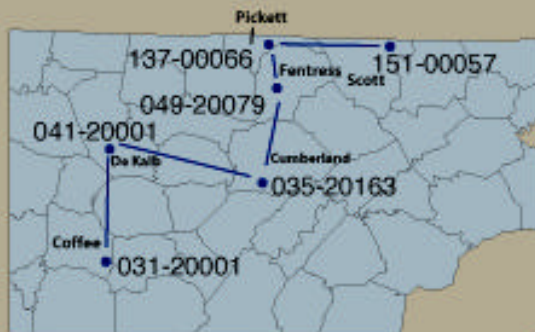
137-00066



F. & A. Sells #1

41-137-00166





Possible Subsurface Stratigraphy

035-20163

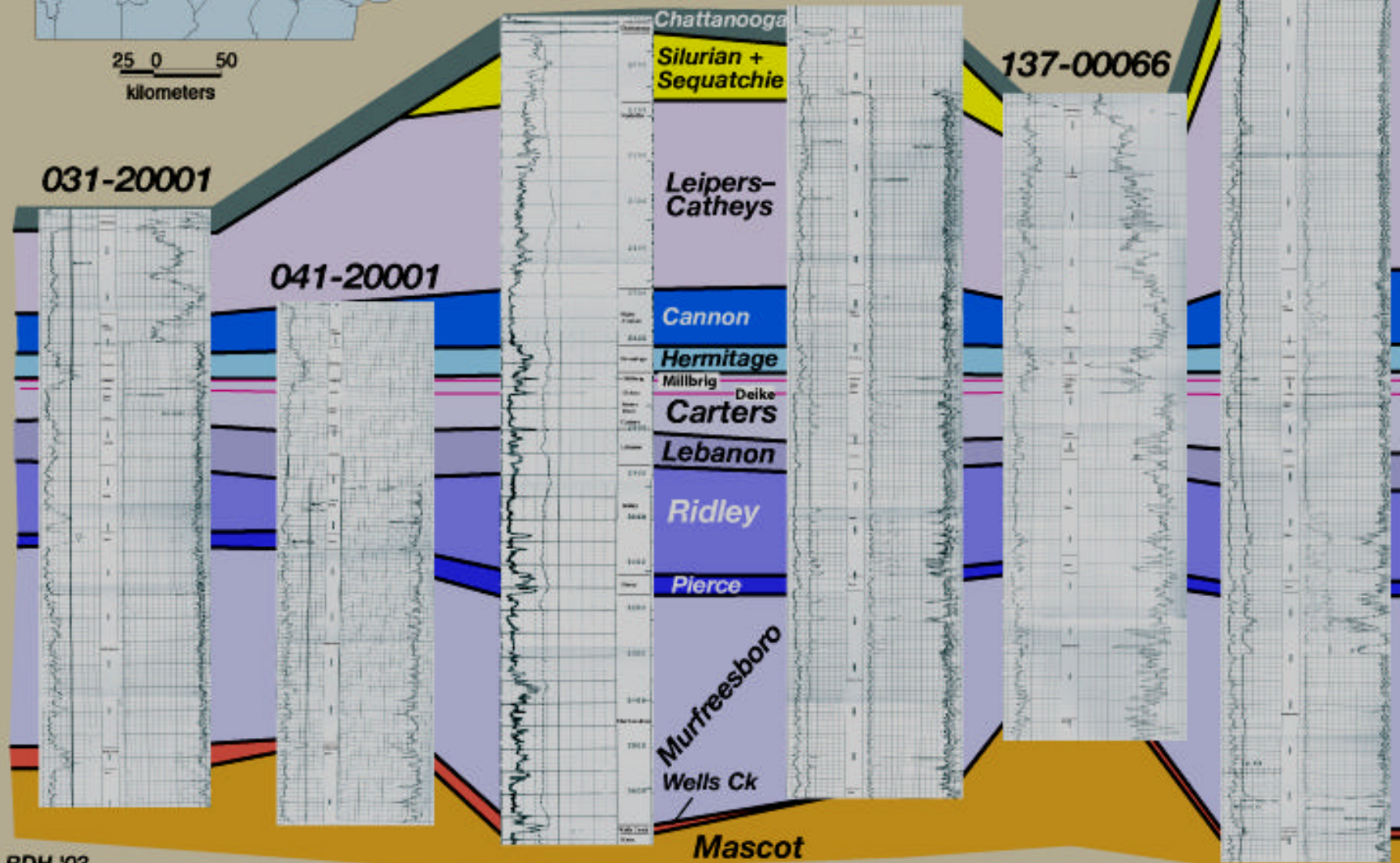
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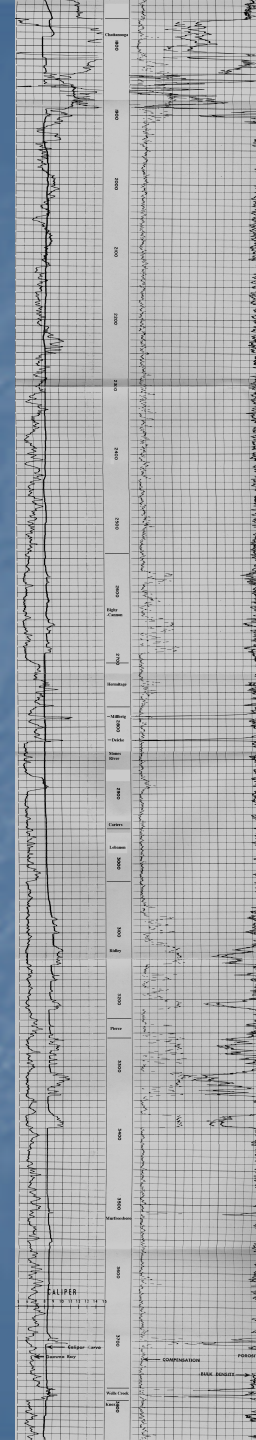
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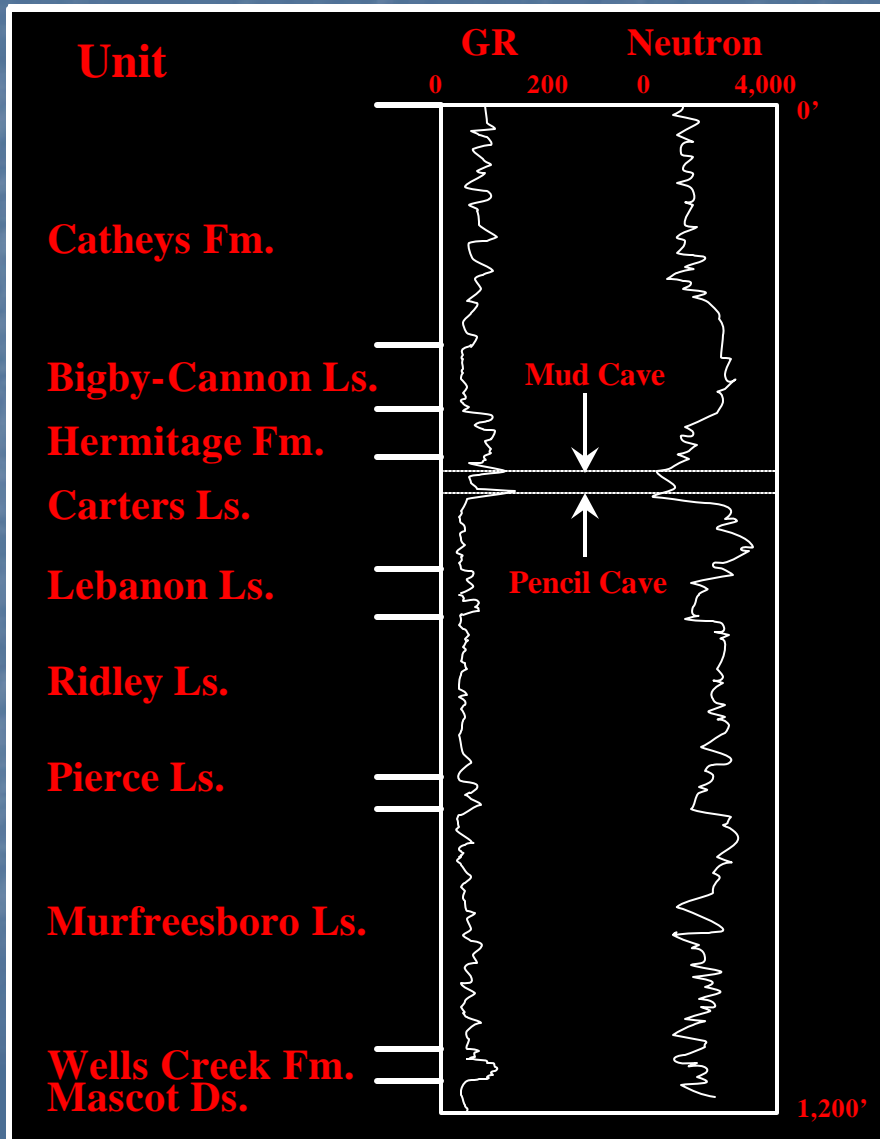


Ketchen Coal Co. #1

41-151-00057



Problems and Solutions



1) The Pencil Cave is not the top of the Carters Limestone

Use the 1st limestone above the Mud Cave or the mud cave if no limestone is present

2) A shale near the base of the Ridley Limestone is similar to the top of the Pierce Limestone

The Pierce Limestone has rather constant thickness 9-12 m and typically a limestone in the middle

3) A major shale bed within the Carters Limestone appears toward SW VA

Remember where the well is located and check to see if the Lebanon Ls. is too thick (should be around 30 m)

It is easiest to work from the bentonites up and down section rather than working down from the Chattanooga Shale

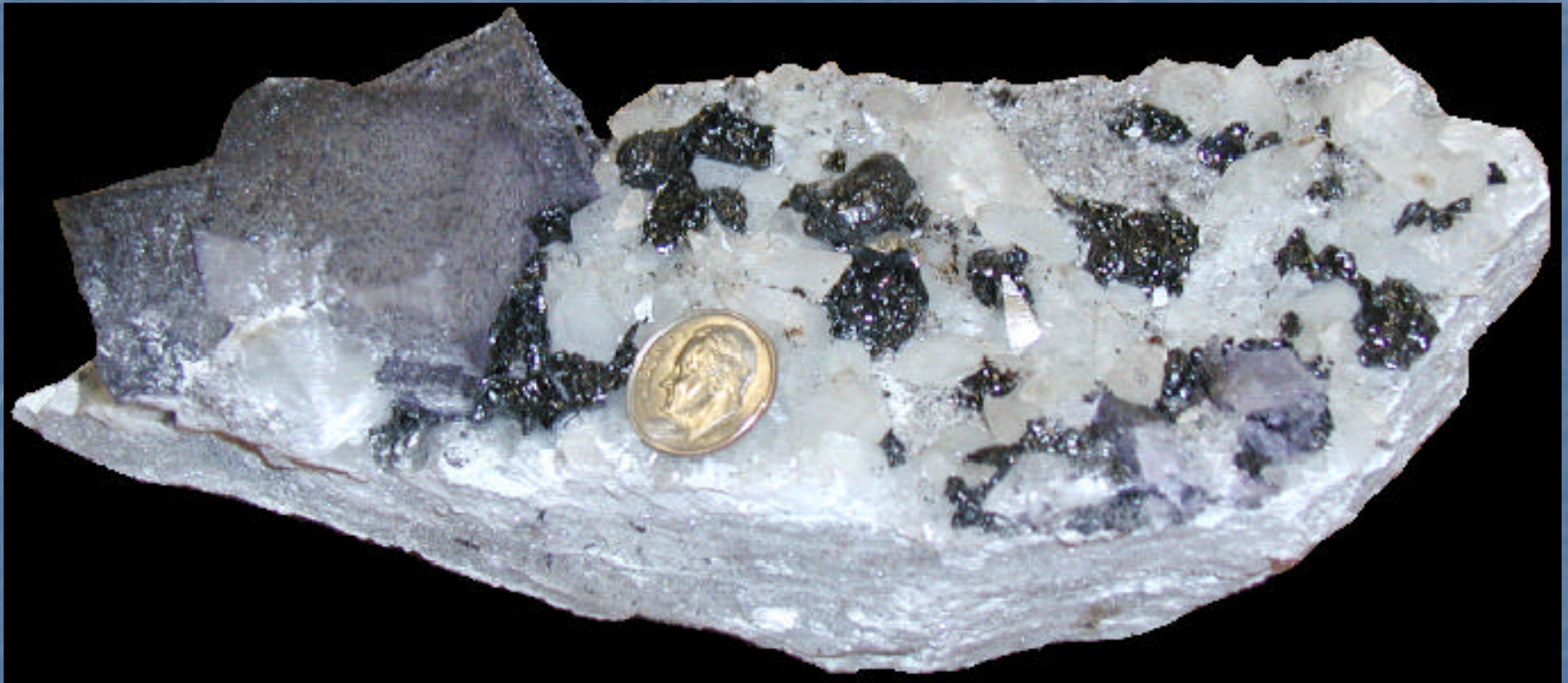


TN 109 (Gallatin) Exit off I-40 E



Upper Knox breccia, Gordonsville, TN

Oil Residues in Upper Knox Dolomite



Specimen donated to UT by Fred Smith (Pasminco)

Conclusions

- There are large Ordovician potential plays in the southern Appalachian basin
- The Stones River and Nashville Groups can be geophysically subdivided and such detail is needed to adequately analyze potential plays
- Using known geological information and more detailed Ordovician subsurface maps based on current well data will prove that finding petroleum is not finding a needle in a haystack