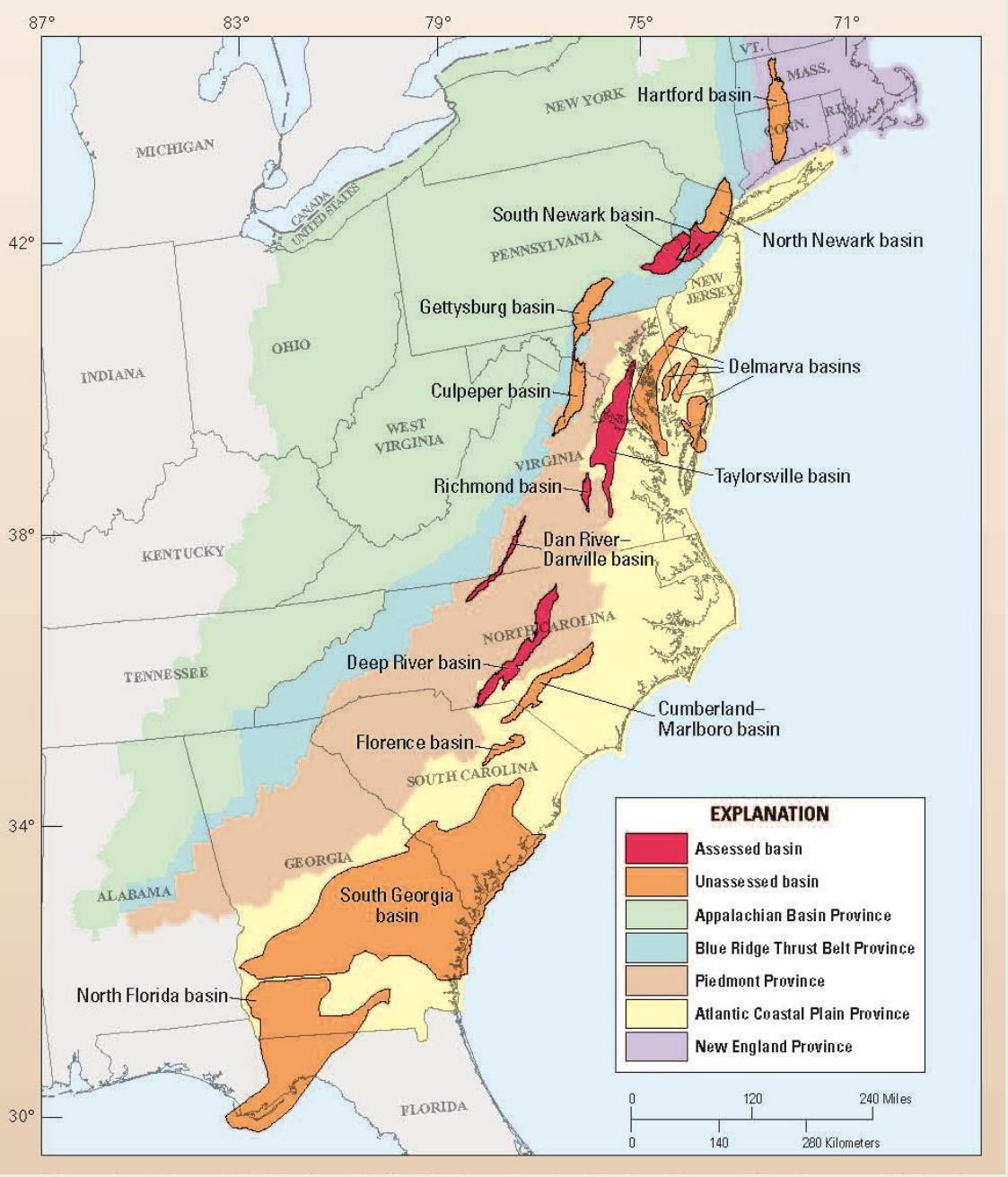
Outline

1. Where we are today – resource assessment results.
2. Legislative charge.
3. Geological glimpses – Total Petroleum System (TPS) and continuous Assessment Unit (AU).
   - Sanford sub-basin, Deep River Basin, and the
   - Dan River-Danville Basin.
4. Public participation, new legislation, and process toward permitting.

North Carolina (USA) Mesozoic rift basin shale gas: A fifth year perspective

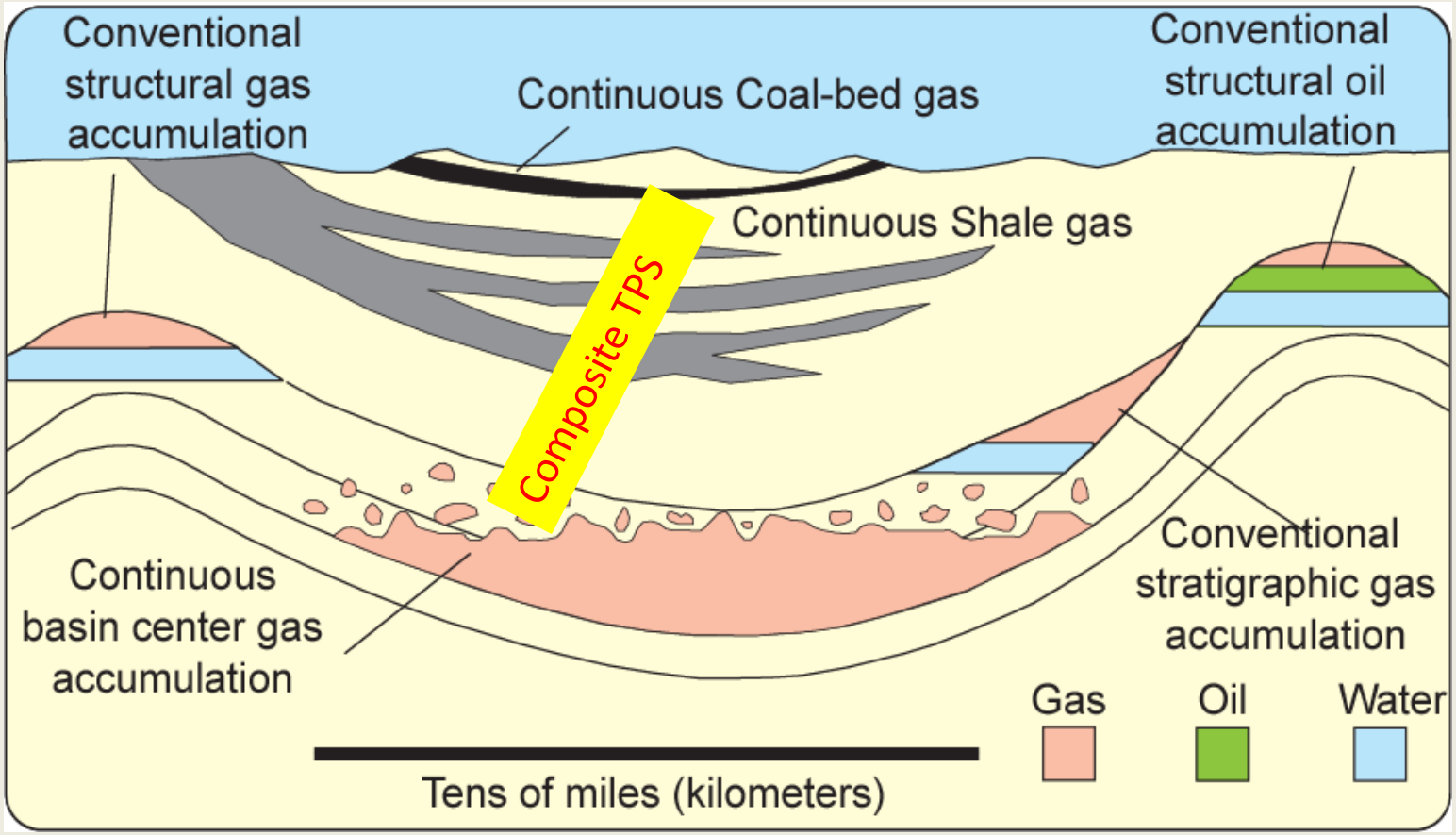
- Two continuous composite total petroleum systems (TPS) in N.C.
- USGS assessed 5 of 14 basins (Fact Sheet 2012-3075)
- North Carolina results:
  - Deep River Basin: 1.66 TCF + 83 MMBNGL; and
  - Dan River-Danville Basin: 49 BCF and NGL?
- New N.C. law legalizes horizontal drilling and hydraulic fracturing (SB 820).
- New N.C. process leading to permitting in 2014.
- Geometry: thick shale sequences, with long strike extent => large volume of source rock / reservoir.



East Coast Mesozoic basins: Common characteristics

- Formed: along the continental margin from regional uplift, extension (rifting), and crustal thinning from the early Atlantic opening.
- Rifting: started about 227 mya – Middle Triassic – Carnian time.
- Basin fill (fluvial to lacustrine environments): boulder beds, coarse-grained fluvial to deltaic sandstones, red siltstone, mudstones, gray and black shales.
- Rifting ended: in Jurassic accompanied by regional volcanism and intrusion of diabase dikes and sills (CAMP).
- Source rocks: gray and black shales and coal beds.
- Kerogen: derived from vascular plants and algae => gas and oil.
- Thermal maturation: Wide range from immature to dry gas.
- Potential reservoirs: Continuous accumulations in wide range of lithologies (boulder conglomerates, very coarse sandstones to mudstone, shale and coal).
- Seals (potentially): shale beds interbedded with coarser strata.

Categories of hydrocarbon occurrence
(Schmoker, 1995)



From Milici, Coleman and Reid - 2012

USGS Assessment Methodology

For Continuous-Type Accumulations

1. Based on Geology and Geological Models
2. Identify and Outline Total Petroleum System(s)
3. Total Area and 'Cell' Area
   - Drainage Area (Cells)
   - Numbers of Potential Cells of Undrilled Area
4. Historical Exploration and Production Analyses
   - Well-Performance Based – Time and Technology
   - EUR (Estimated Ultimate Recovery)
   - Success/Failure (Historical and Future Success Ratio)
5. Undiscovered, Technically Recoverable Resource
   - Not Economically Recoverable Resource Estimates
   - Not In-Place Resource Estimates
6. http://energy.cr.usgs.gov/oilgas/noga/methodology.html

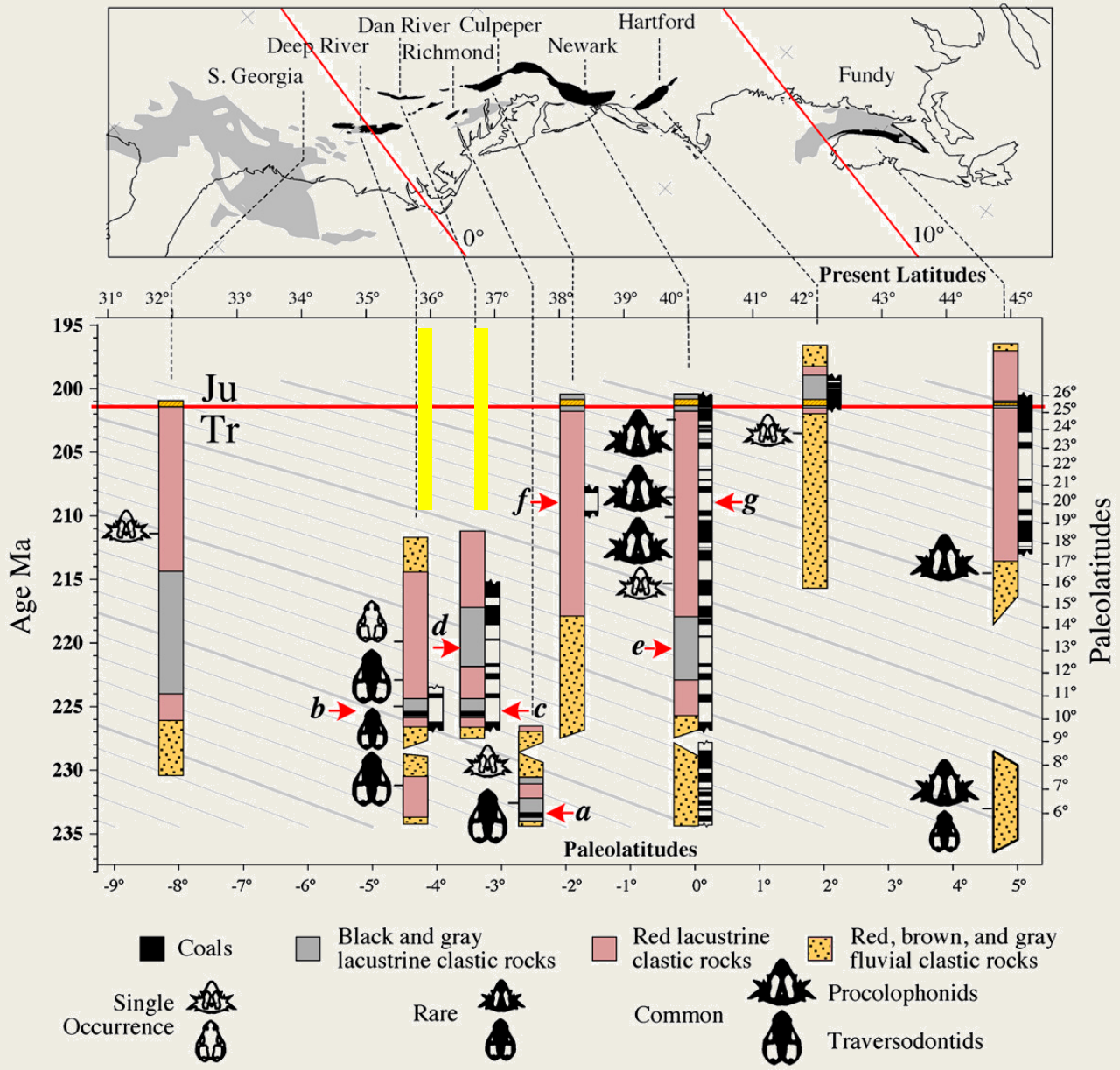
USGS

USGS East Coast Mesozoic Basin assessment results: Fact Sheet 2012-3075

Total Petroleum System (TPS) and Assessment Unit (AU)	Field type	Total undiscovered resources											
		Oil (MMBO)				Gas (BCFG)				NGL (MMBNGL)			
		F95	F50	F5	Mean	F95	F50	F5	Mean	F95	F50	F5	Mean
Taylorsville Basin Composite TPS													
Taylorsville Basin Continuous Gas AU	Gas					516	985	1,880	1,064	16	34	71	37
Richmond Basin Composite TPS													
Richmond Basin Continuous Gas AU	Gas					99	194	382	211	4	10	20	11
Newark Basin Composite TPS													
South Newark Basin Continuous Gas AU	Gas					363	785	1,698	876	1	4	10	4
Deep River Basin Composite TPS													
Deep River Basin Continuous Gas AU	Gas					779	1,527	2,990	1,660	35	75	158	83
Dan River-Danville Basin Composite TPS													
Dan River-Danville Basin Continuous Gas AU	Gas					17	42	106	49	0	0	1	0
Total continuous resources						**1,774**	**3,533**	**7,056**	**3,860**	**56**	**123**	**260**	**135**

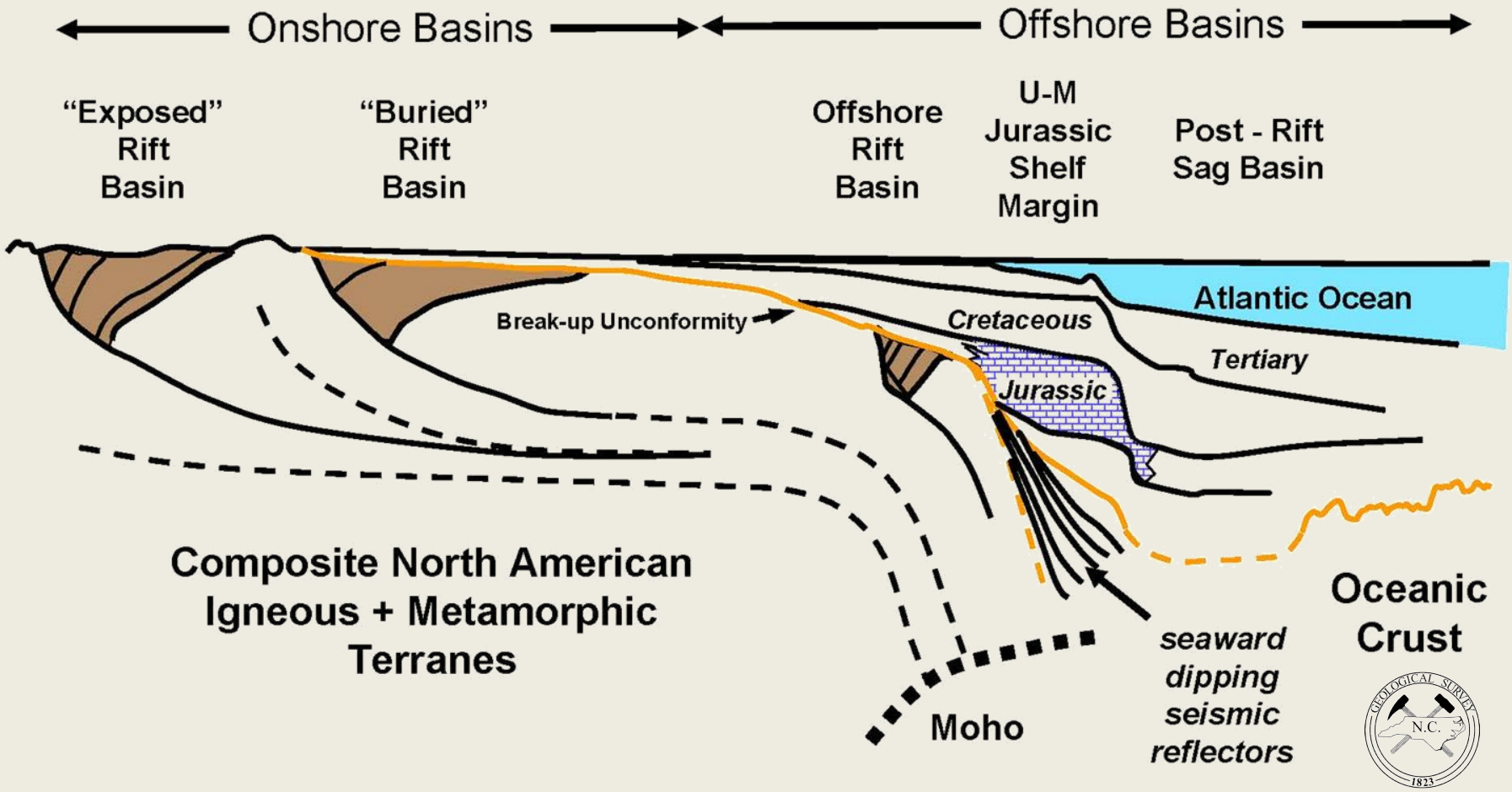
Triassic paleogeography ~210mya, from Ron Blakey, NAU Geology.

Triassic paleogeography



From Whitehead and others, May 2011.

U. S. Atlantic Mesozoic Basin Types



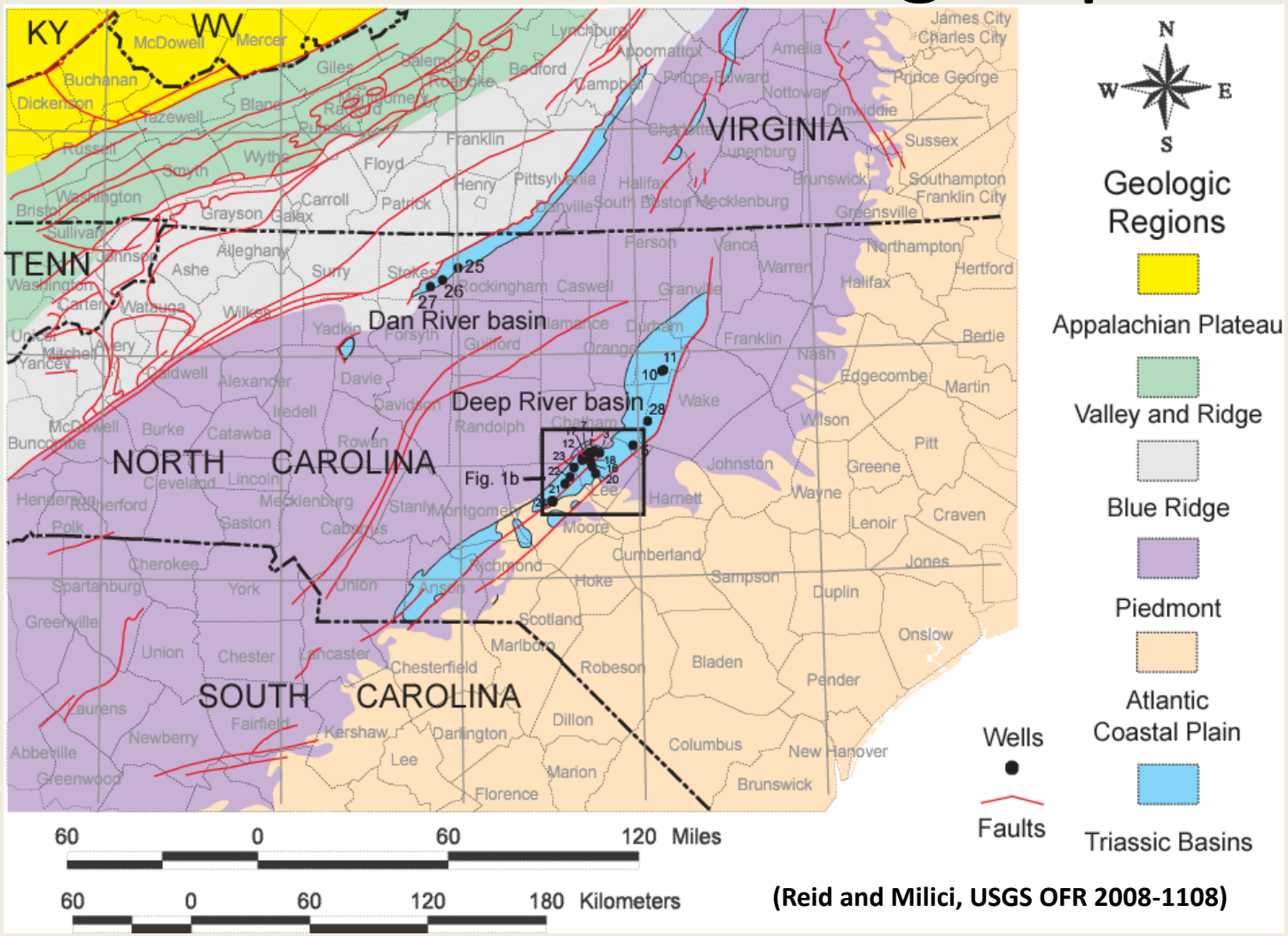
Coleman, 2009, *in* Lassetter, Jr., Proceedings of the 2009 Southeastern U.S. Mesozoic Basins Energy Resources Potential Workshop.

USGS

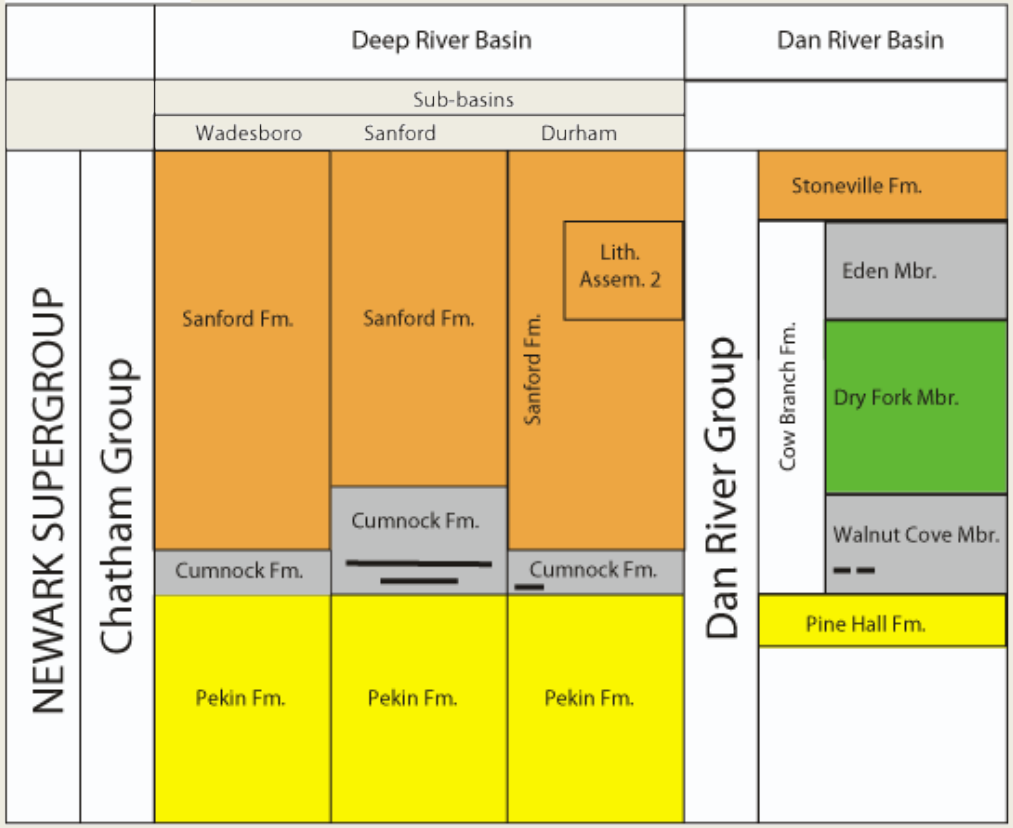
Legislative charge

- 2011- Session Law-276 (H.B. 242) – required our department to prepare a draft report on shale gas drilling.
- Session Law 2011-276 (H.B. 242) "**§ 113-424. Applicability; effect, SECTION 4.** Directs, in part, "…DENR…shall report their (study) findings…(on) the following: (1) Oil and gas resources present in the Triassic Basins and in any other areas of the State…." and report to the N.C. General Assembly by 1 May 2012.
- Law required public hearings – heavily attended by citizens both pro and con.

Sanford sub-basin glimpse

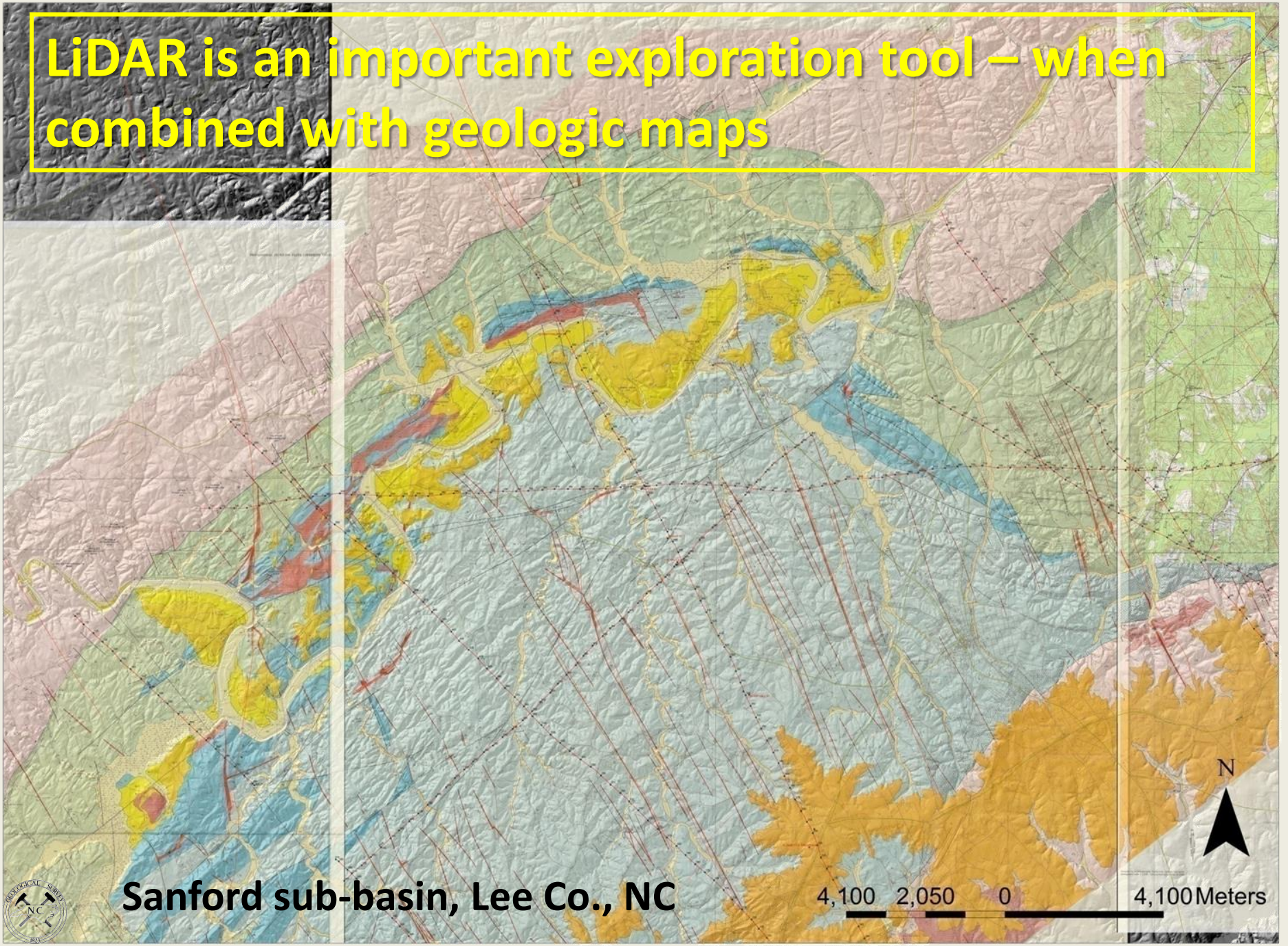


Stratigraphy – Proposed revision



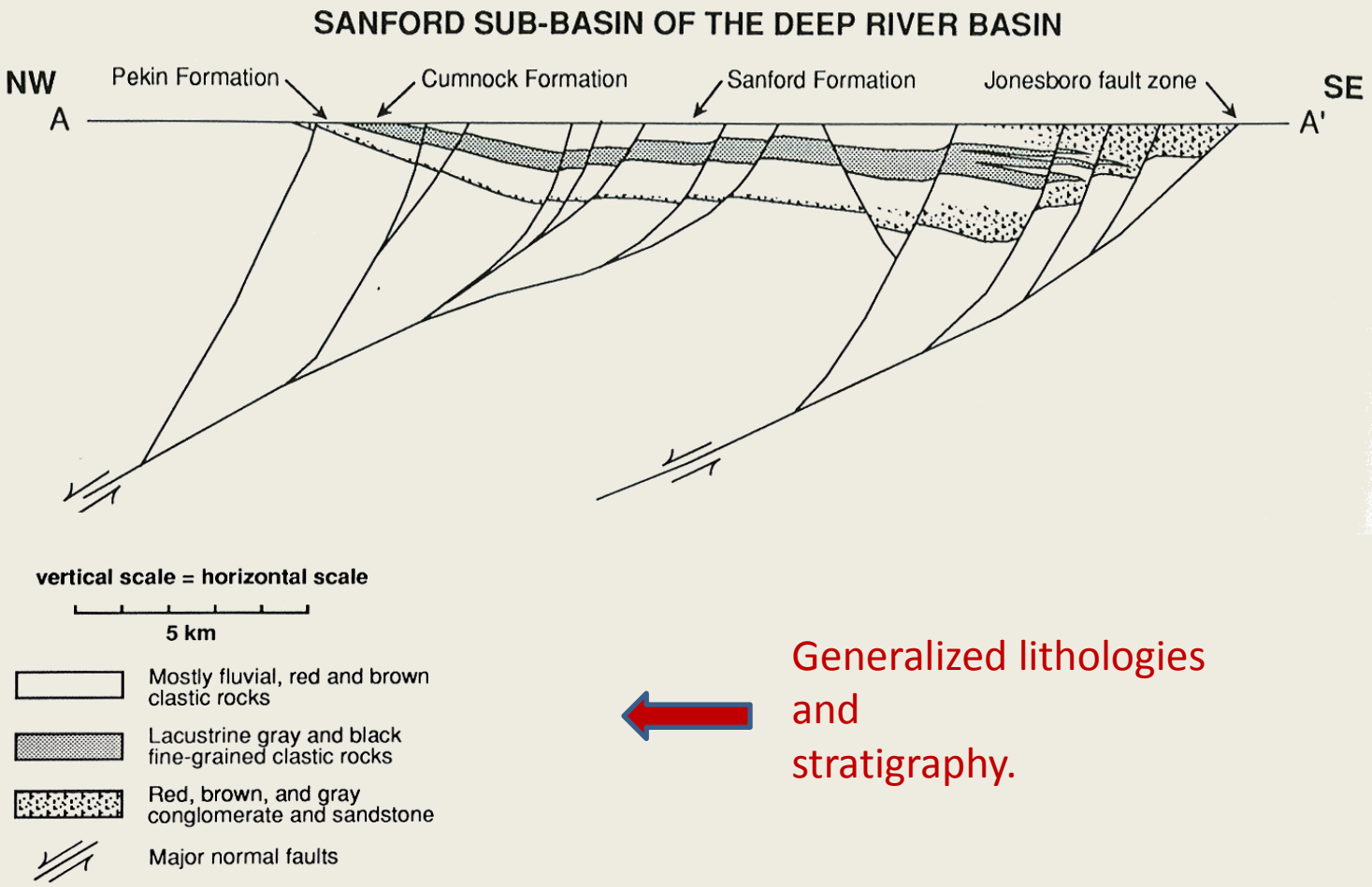
From Olsen, Reid, Kent and Whiteside, 2012 manuscript in preparation

LiDAR is an important exploration tool – when combined with geologic maps



Sanford sub-basin, Lee Co., NC

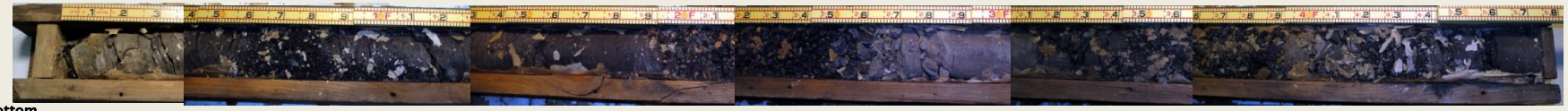
Sanford sub-basin - Structure



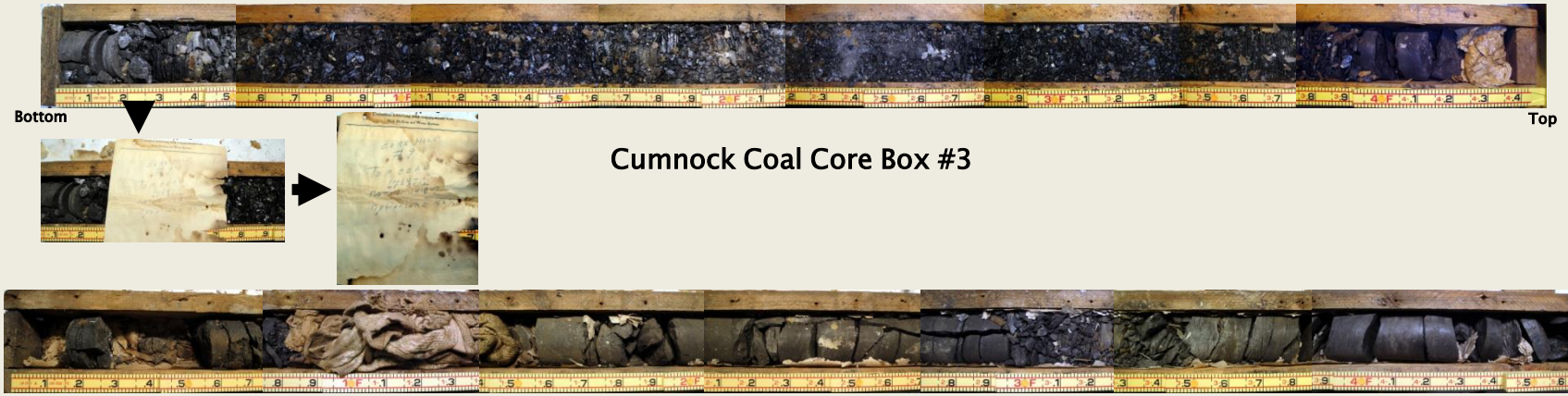
Generalized lithologies and stratigraphy.

Potential source / reservoir rock - coal

Cumnock Coal Core Box #1
Note: Top of core cannot be determined.



Cumnock Coal Core Box #2



Cumnock Coal Core Box #3

Cumnock Coal Core Box #4
Note: Top of Core cannot be determined.

Coal Cores from the Cumnock Mine (previously known as Egypt Mine), donated by Mr. J. Daniel Butler – February 12, 2010

Potential source/reservoir rock

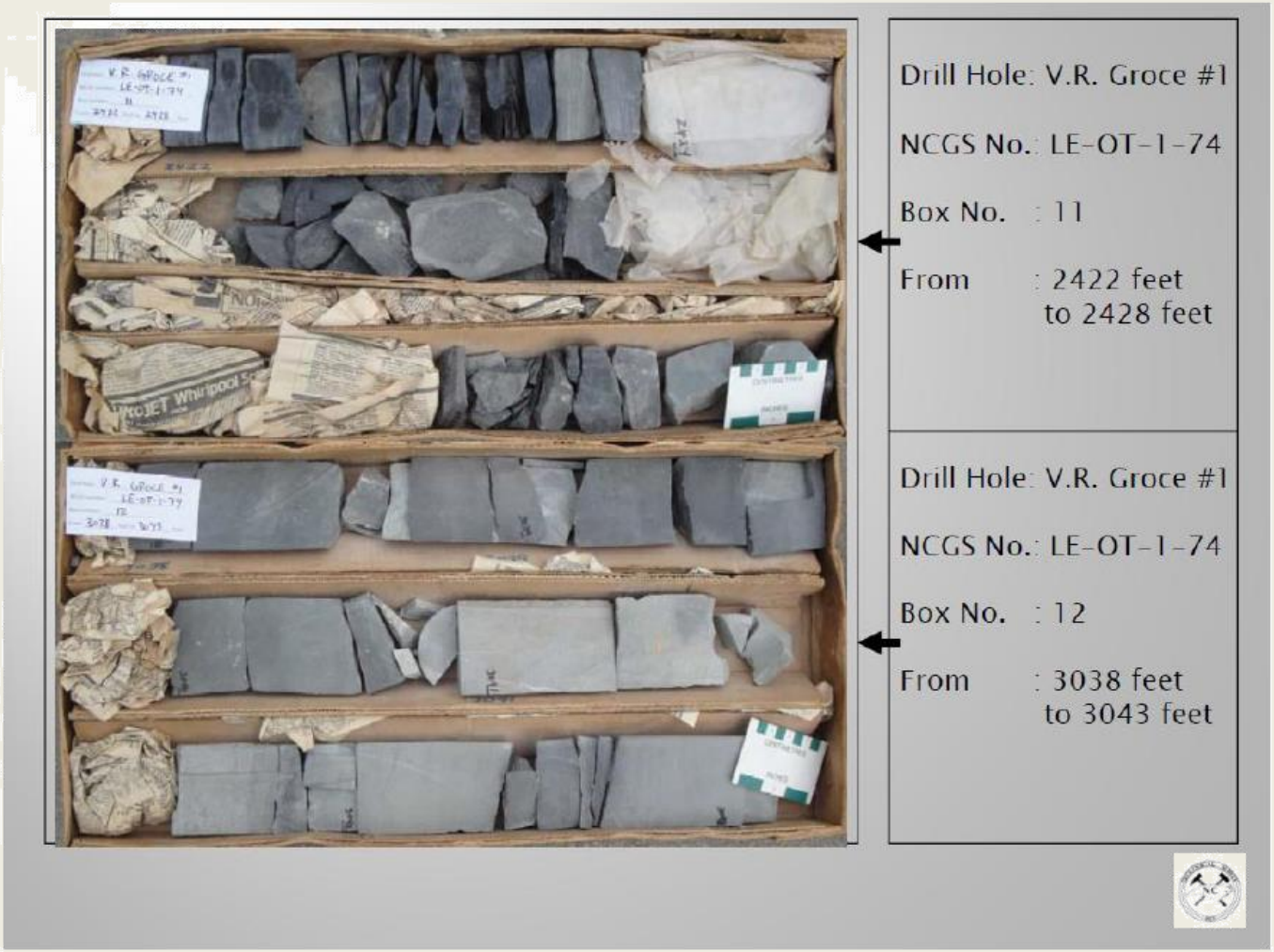


Figure 30. V.R. Groce #1 well – Selected core from the interval 2422 – 2428 feet and the interval 3038 – 3043 feet depth. This well is located near the center of the Sanford sub-basin. The presence of gray to black shale confirms basinward extent of the lacustrine facies. The well had a number of good petroleum shows.

Potential reservoir rocks

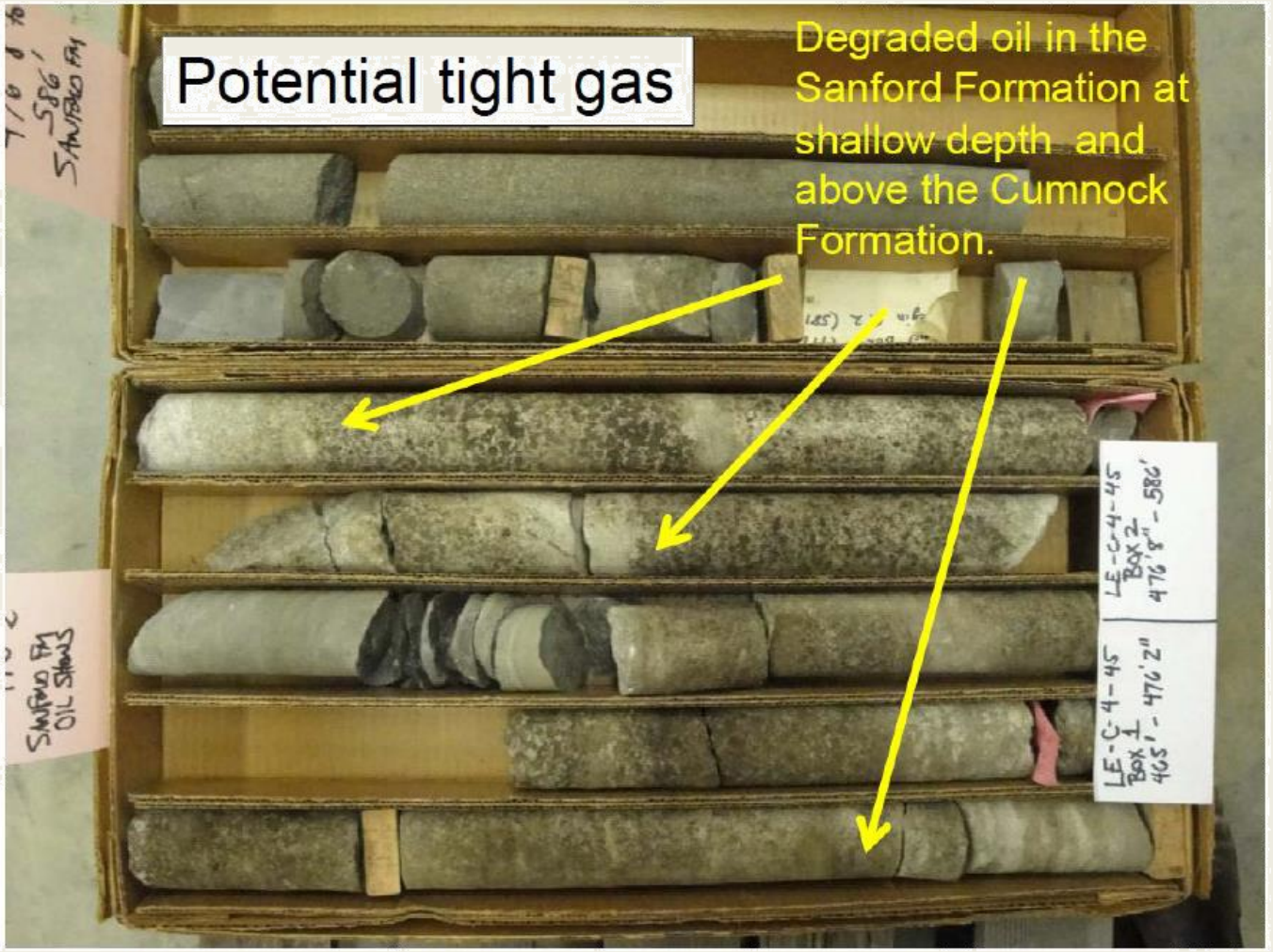
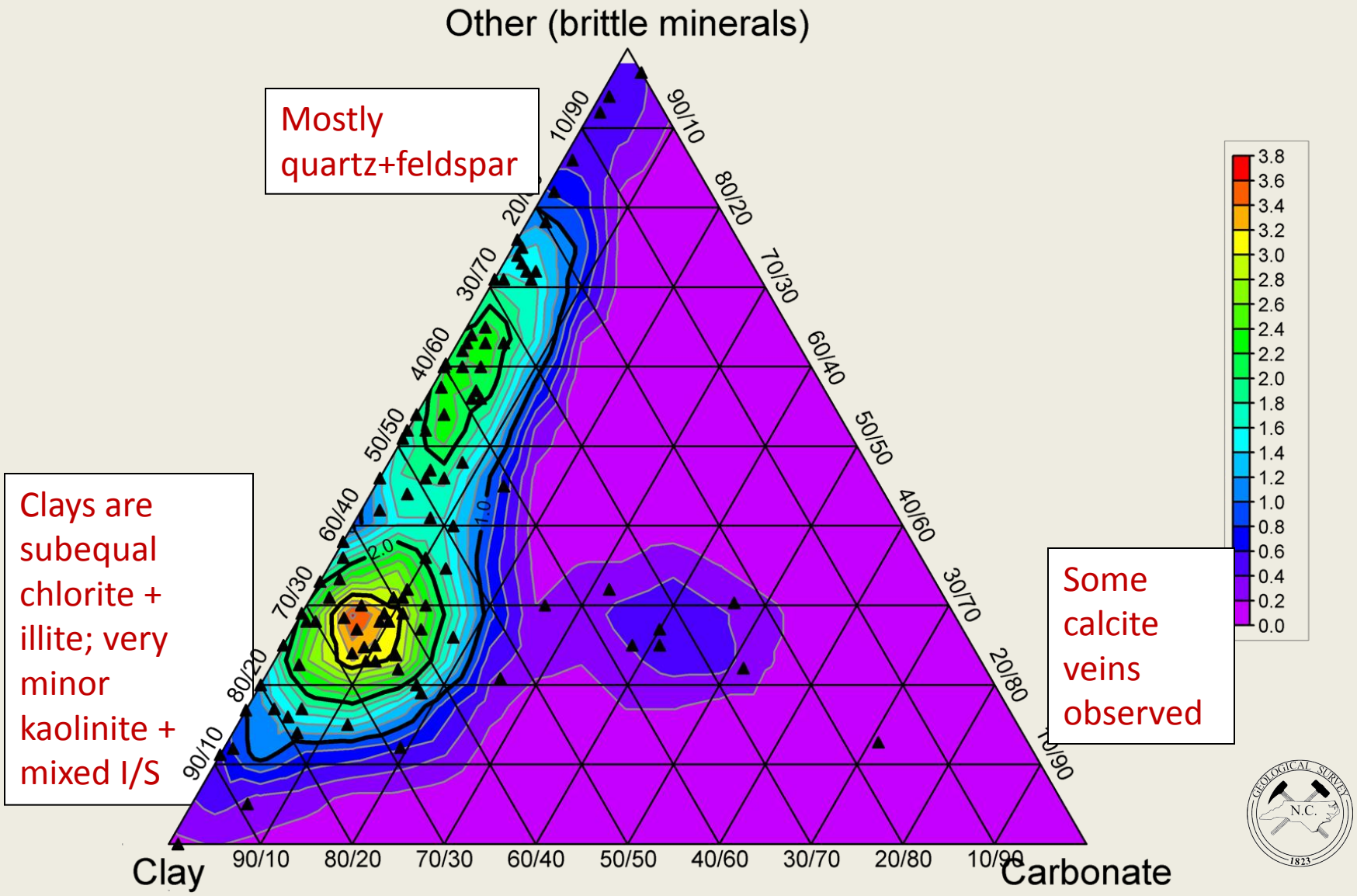
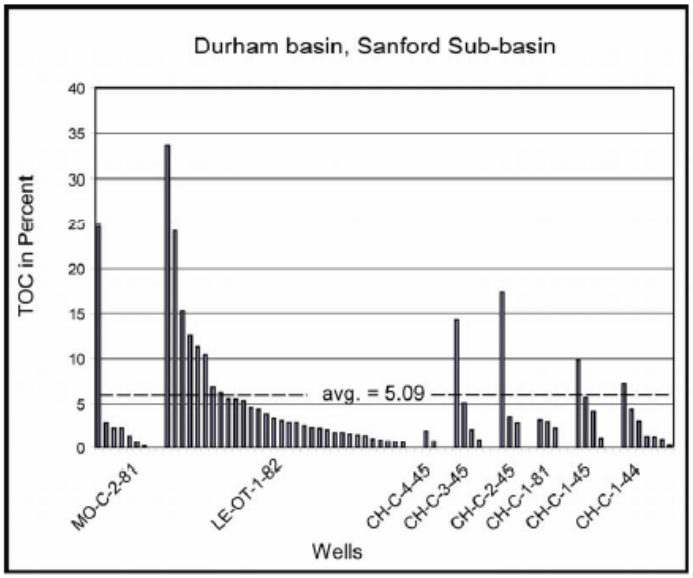


Figure 28. Degraded oil in the Sanford Formation about 300 feet stratigraphically above the Cumnock Formation. The total depth of this hole (BDH-9) is 1425 feet. Cumnock was logged from 723 feet to TD – this also shows the Cumnock to be at least 700-feet thick here. These oil shows plus gas kicks in the well logs suggest the possibility of tight gas. There is a fair amount of porosity in these sands to hold the oil. gas is not included in the geologic units (GU's).

Sanford sub-basin, Deep River Basin
Other (brittle minerals) - clays - carbonate (N=101)



TOC data distribution



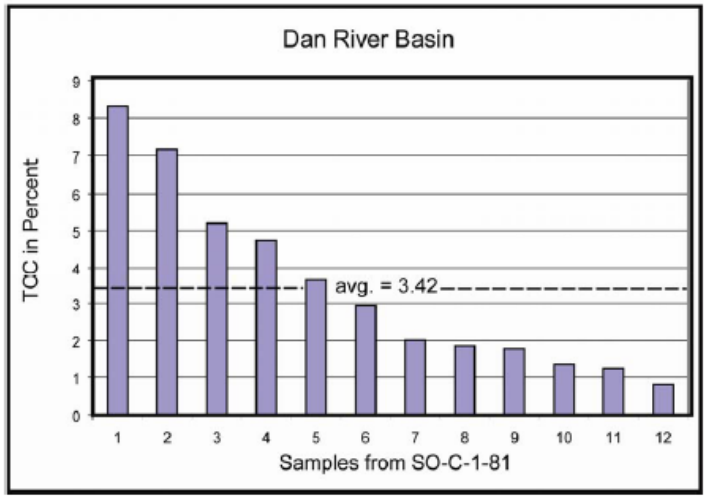


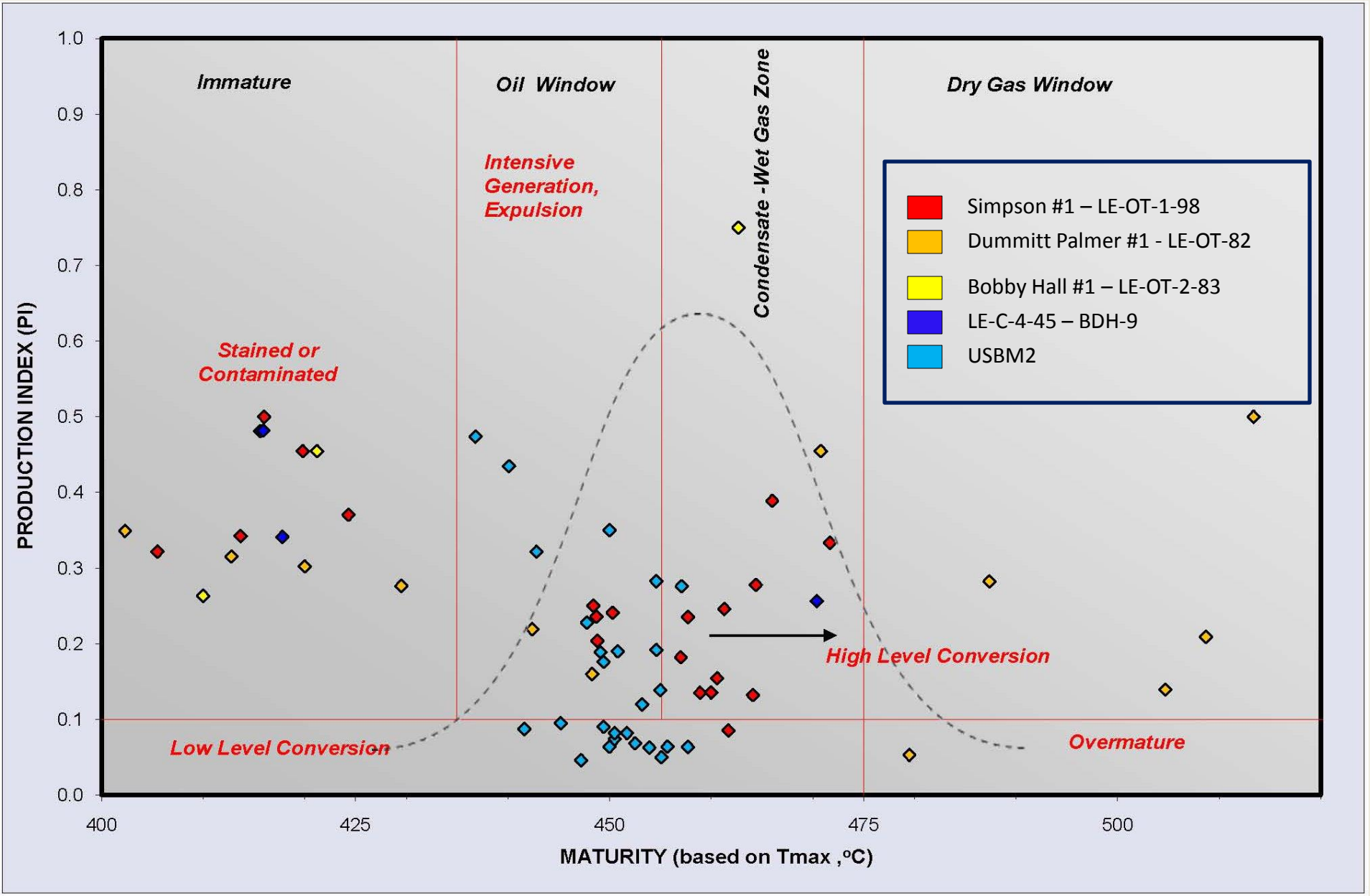
Figure 4. Distribution of TOC data from wells in the Dan River and Durham basins.

Distribution of TOC data, Sanford sub-basin, Deep River Basin
(Reid and Milici, USGS OFR 2008-1108)

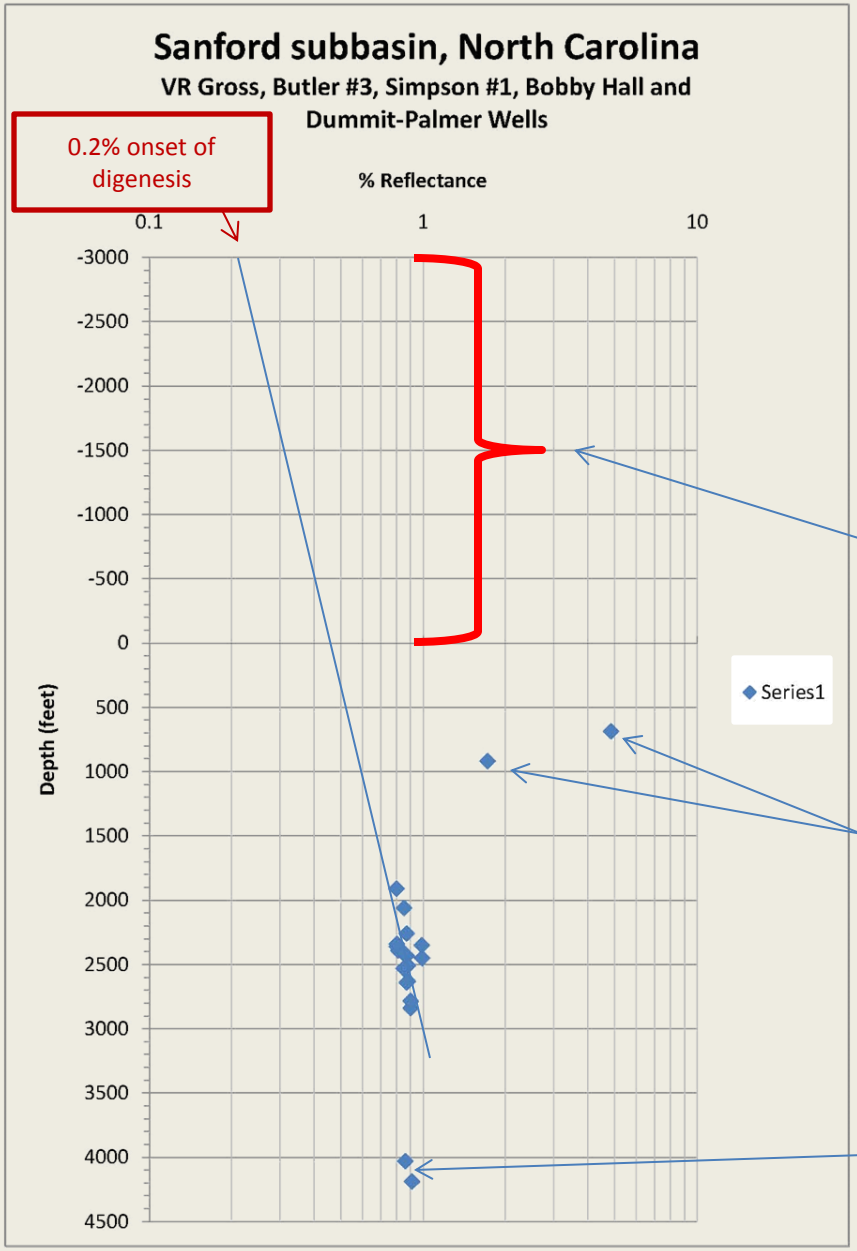
** TOC Sanford sub-basin = 1.96; N = 353 as of August 2012

Distribution of TOC data, Dan River-Danville Basin
(Reid and Milici, USGS OFR 2008-1108)

Kerogen type and maturity (Tmax) – multiple wells: Sanford sub-basin



**%Ro = 1.25%, N = 42 as of August 2012



%Ro – All data, Sanford sub-basin

Estimated maximum erosion is ~3,000 ft

Observed variations are:

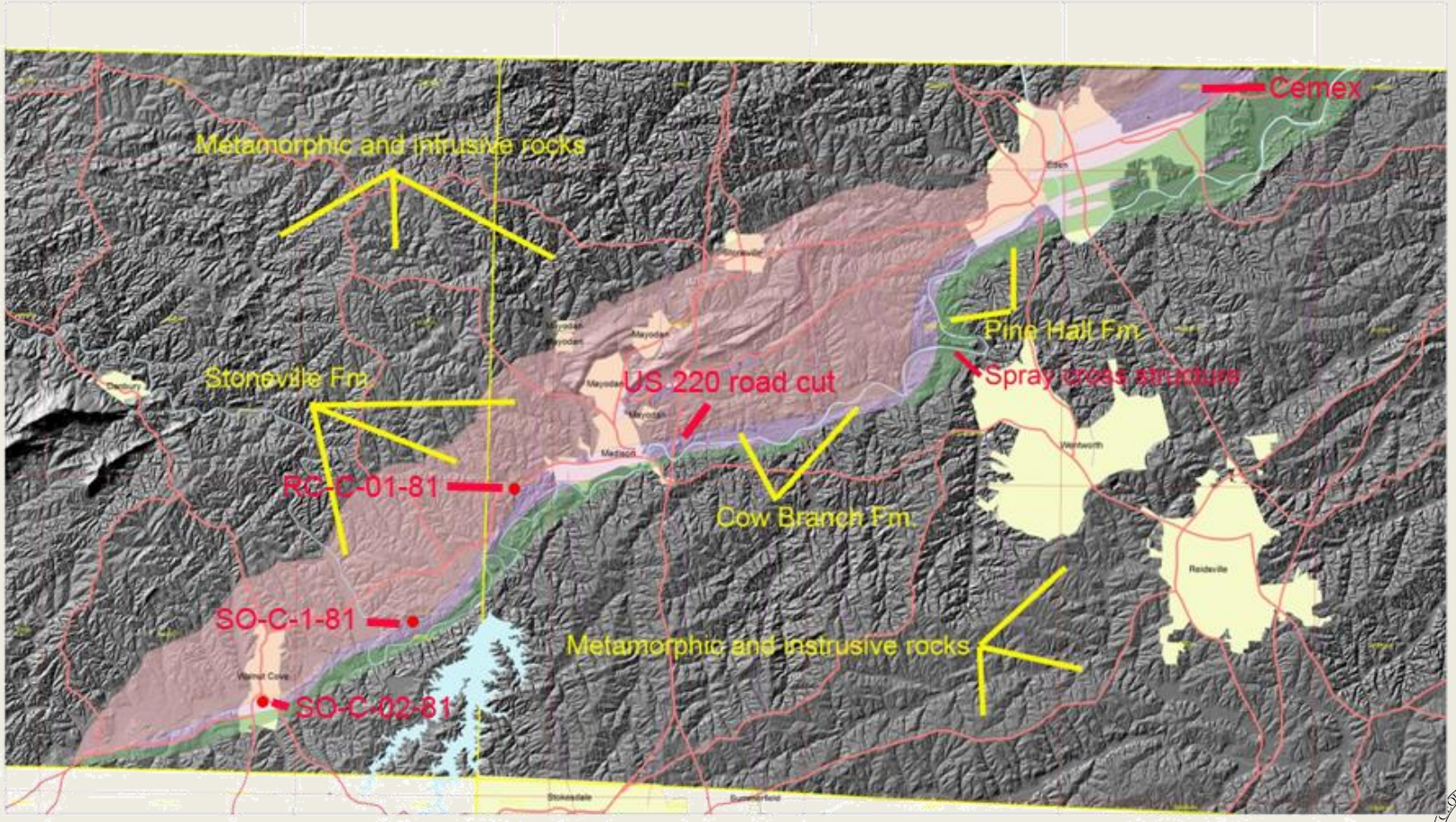
- V.R. Groce #1: -1,800 ft
- Butler #3: -1,000 ft
- Simpson #1: -3,000 ft (maximum observed)

Dummitt-Palmer #1 (CBM) – "near dikes" and "overcooked" (updip, basin edge)

Bobby Hall #1

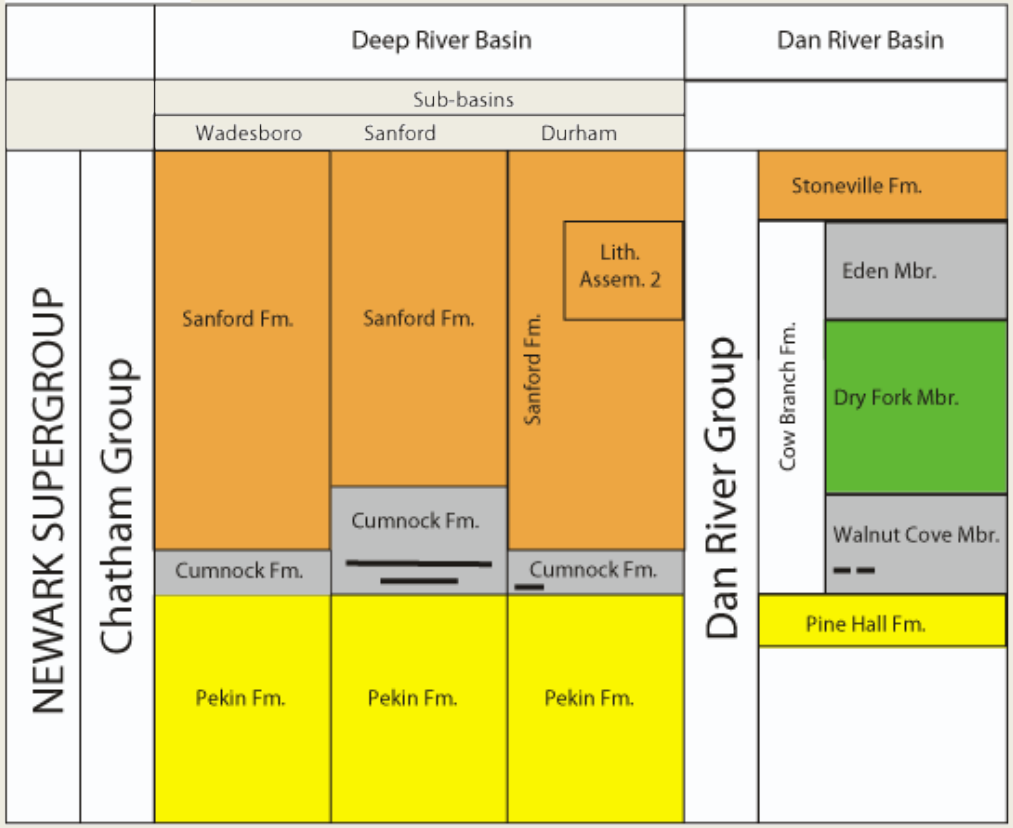
After Dow, 1977 (method)

Dan River-Danville Basin – Glimpse



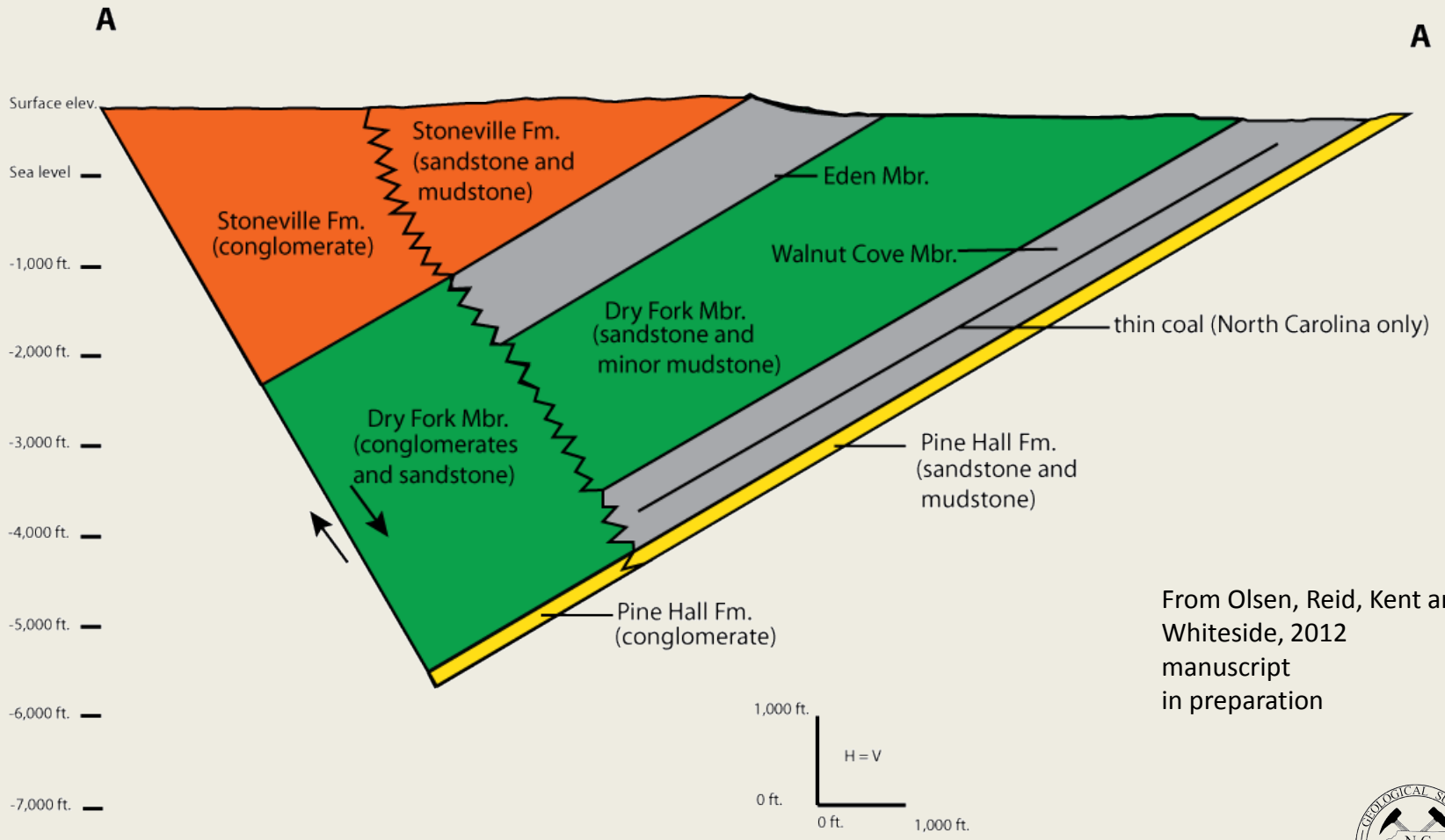
From Reid, Taylor and Simons, 2011

Stratigraphy – Proposed revision



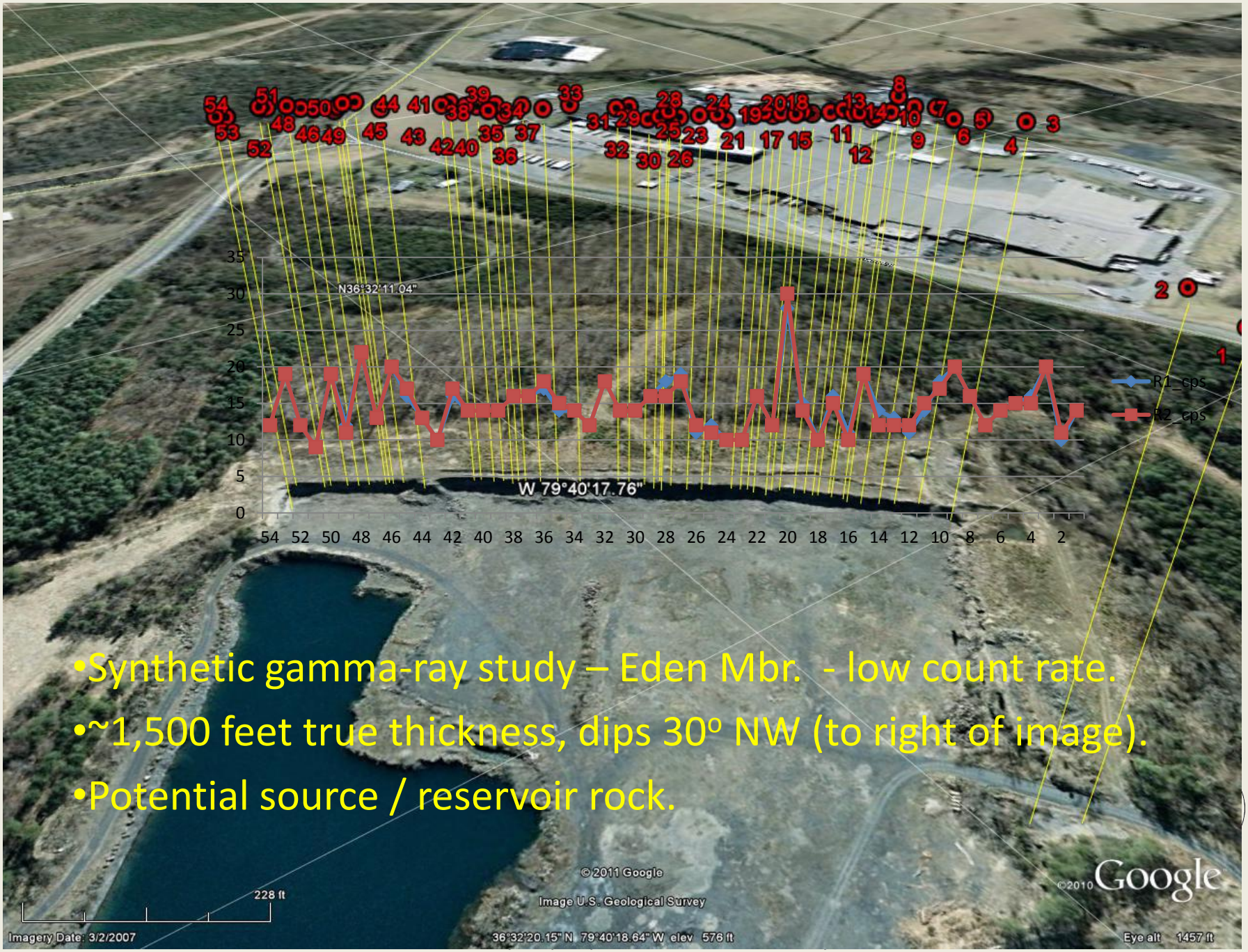
From Olsen, Reid, Kent and Whiteside, 2012 manuscript in preparation

Dan River-Danville Basin – Structure



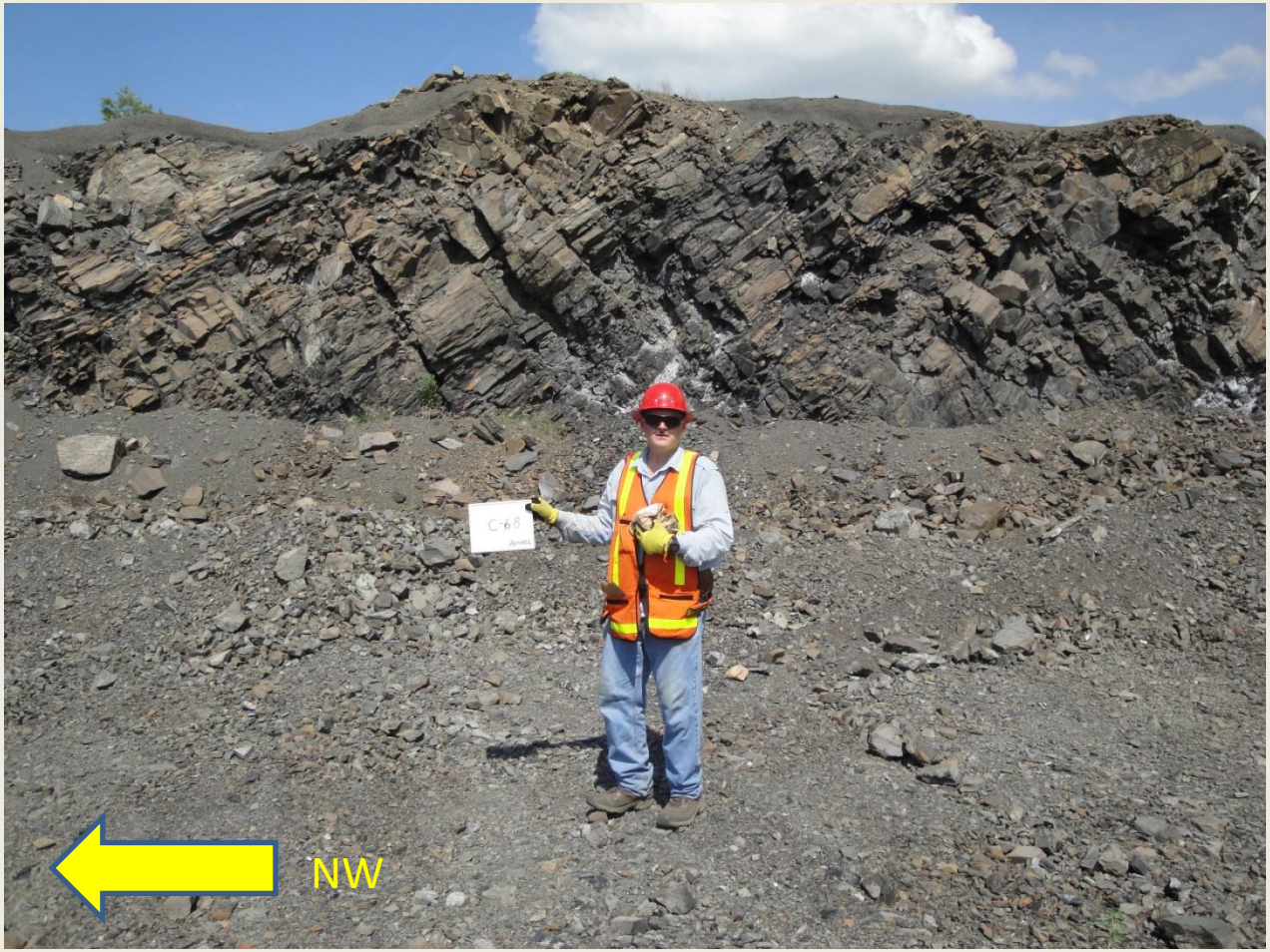
From Olsen, Reid, Kent and Whiteside, 2012 manuscript in preparation

View to northeast



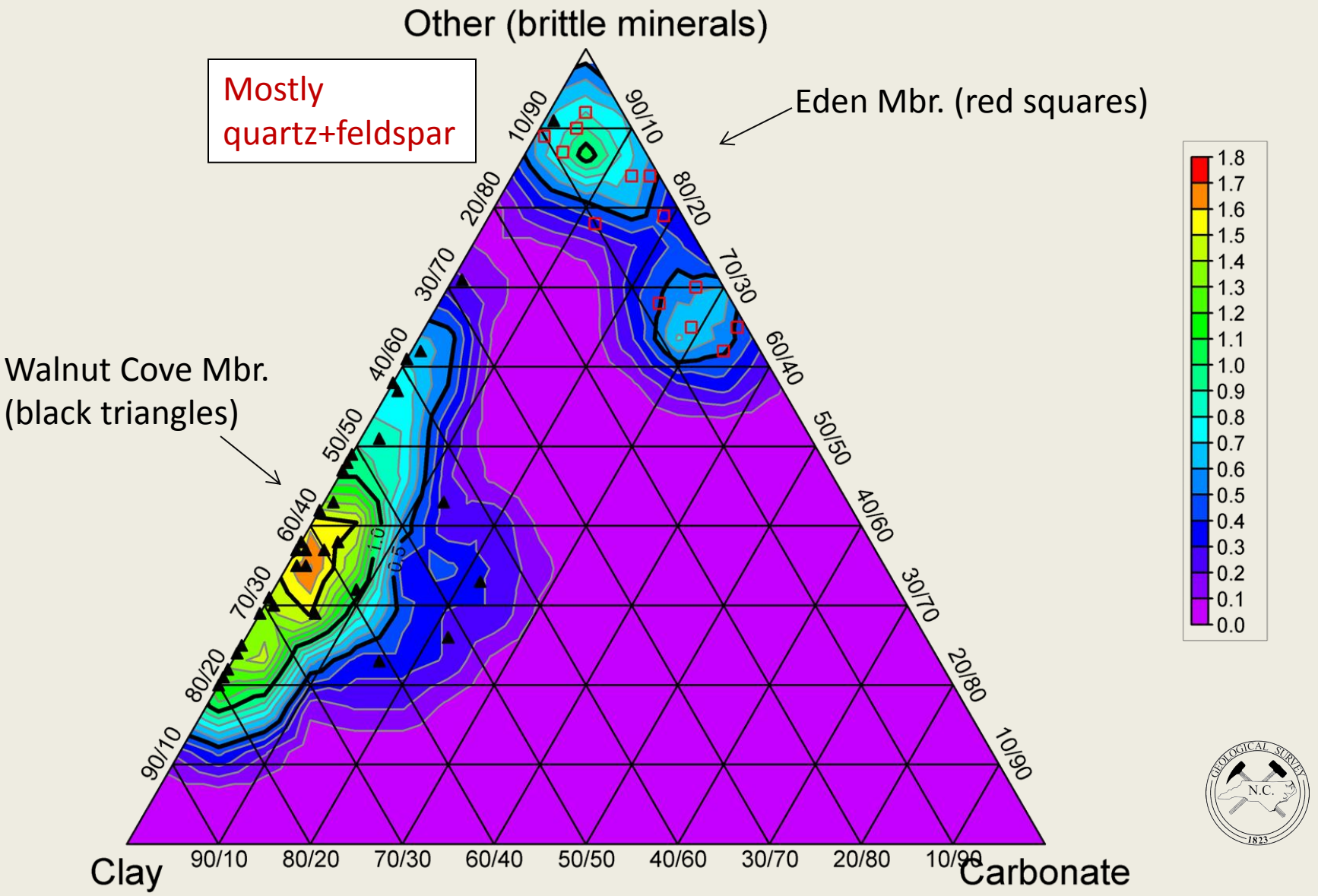
- Synthetic gamma-ray study – Eden Mbr. - low count rate.
- ~1,500 feet true thickness, dips 30° NW (to right of image).
- Potential source / reservoir rock.

Eden Mbr. – potential source rock/reservoir



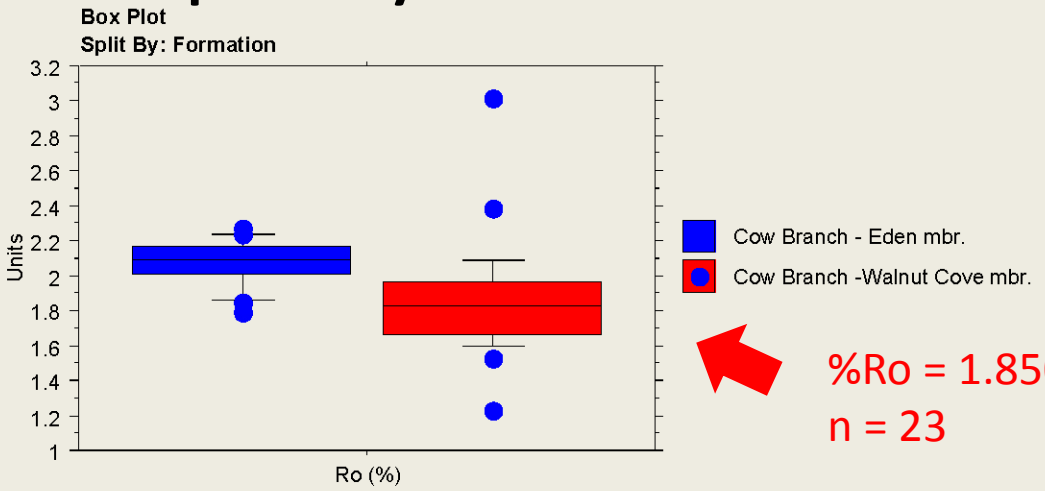
Dan River-Danville Basin

Other (brittle minerals) - clays - carbonate (N=49)

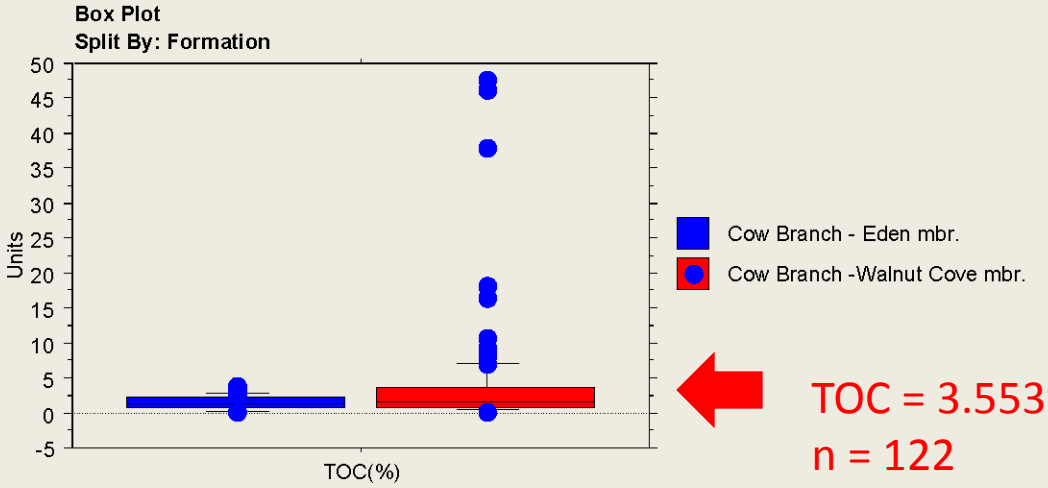


Dan River-Danville Basin: 2012 %Ro and TOC results – split by Cow Branch member

Ro% = 2.077,
n = 25



%Ro = 1.850,
n = 23



TOC = 1.384%,
n= 42

TOC = 3.553%,
n = 122

U, Th content of the shales

Basin	Geologic unit	U ppm (mean, ICP-MS)	U ppm (mean, INAA)	Th ppm (mean by ICP-MS)	Th ppm (mean by INAA)
Sanford sub-basin	Cumnock Fm.	3.176 N = 76	3.365 N = 20	8.72 N = 76	9.427 N = 22
Dan River – Danville Basin	Cow Branch - Eden Mbr.	16.279 N = 56		12.736 N = 56	
	Cow Branch - Walnut Cove Mbr.	3.369 N = 78		11.597 N = 78	
Detection limit		0.1 ppm	0.5 ppm	0.1 ppm	0.2 ppm

Black shale average from AGI Data Sheets, 1982: U = 3.7 ppm; Th = 12 ppm

Public participation

- Oct. 10, 2011 – Public meeting in Sanford sub-basin
  - Draft plan of study was presented; the STRONGER process was discussed.
  - Public comment was received as to how the study should be conducted.
  - Comment was received and written comment on the draft outline of the study were accepted through Oct. 18, 2011.
- March 20 and 27, 2012 – Additional public meetings in Sanford sub-basin,
  - Draft findings and recommendations were presented in a public meetings.
  - Meetings were streamed live online, the same information was presented, and public comments were accepted at both meetings, *via* mail and email.
- April 2, 2012 - Last day to agency received written comments on the draft report.
- April 3, 2012 - Chatham Co. hosted a third meeting; public comments were received.
- STRONGER (State Review of Oil & Natural Gas Environmental Regulations)
  - Reviewed N. C.'s oil & gas regulatory programs in October 2011 at the agency's request.
  - STRONGER report issued in February 2012.
- DENR study released: URL http://portal.ncdenr.org/web/guest/denr-study
- Extensive legislative debate – spring and summer 2012.

S820 Highlights

- Begins process to create regulations & standards *via* a 'Mining and Energy Commission'.
- Three study reports due October 1, 2013
  - Impact on local government and infrastructure (includes fee structure),
  - Local government authority in regulation, and
  - Forced pooling.
- State legislature will vote 2 years hence to approve final rules to allow permit applications.
- Rule-making deadline is October 2014.
- Any contamination is assumed to be from drilling unless proven otherwise. Provides for groundwater supply remedy.
- Mineral rights owner:
  - to be paid 12.5% minimum royalties;
  - deduction of operating expenses not allowed; and
  - 7 day period to back out of lease.

Conclusions

- North Carolina Mesozoic basins contain continuous gas deposits (Deep River Basin, Dan River-Danville Basin).
- With new completion technology, these deposits may become economically recoverable.
- Horizontal drilling and hydraulic fracturing are now legal in North Carolina.
- A process is in place to establish rules and regulation could allow permits as early as 2014 following final legislative approval.

Dr. Jeffrey C. Reid, PG, CPG, Senior Geologist
North Carolina Geological Survey, Telephone 919.707.9205 email: jeff.reid@ncdenr.gov

East Coast Mesozoic Basins – not numerically assessed

Table 2. East Coast Mesozoic basins with probable total petroleum systems that were not quantitatively assessed, showing type of total petroleum system and assessment unit.

Basin	Type of total petroleum system	Type of assessment unit
Hartford	Composite	Continuous gas
North Newark (northern half of Newark basin)	Composite	Continuous gas
Gettysburg	Composite	Continuous gas
Culpeper	Composite	Continuous gas
Delmarva (basins)	Composite	Continuous gas
Cumberland-Marlboro	Composite	Continuous gas
Florence	Composite	Continuous gas
South Georgia	Composite	Continuous gas
North Florida	Composite	Continuous gas

Source: USGS Fact Sheet 2012-3075

Examples of input EUR data for shale gas and tight gas assessment units (USGS OFR 2012-118)

Table 1. Input data for estimated ultimate recovery distributions for United States shale-gas assessment units, values in billions of cubic feet of natural gas. [AU, assessment unit; and EUR, estimated ultimate recovery]

AU number	AU name	Province	Year assessed	Minimum EUR	Median EUR	Maximum EUR	Mean EUR
50490161	Haynesville Sabine Platform Shale Gas	Gulf Coast Mesozoic	2010	0.02	2	20	2.617
50490163	Mid-Bossier Sabine Platform Shale Gas	Gulf Coast Mesozoic	2010	0.02	1	10	1.308
50580161	Woodford Shale Gas	Anadarko Basin	2010	0.02	0.8	15	1.233
50670468	Interior Marcellus	Appalachian Basin	2011	0.02	0.8	12	1.158
50490167	Eagle Ford Shale Gas	Gulf Coast Mesozoic	2010	0.02	0.8	10	1.104

Table 3. Input data for estimated ultimate recovery distributions for United States tight-gas assessment units, values in billions of cubic feet of natural gas. [AU, assessment unit; and EUR, estimated ultimate recovery]

AU number	AU name	Province	Year assessed	Minimum EUR	Median EUR	Maximum EUR	Mean EUR
50370661	Mesaverde-Lance-Fort Union Continuous Gas	Southwestern Wyoming	2002	0.02	1.2	15	1.657
50370561	Almond Continuous Gas	Southwestern Wyoming	2002	0.02	0.9	20	1.460
50200261	Uinta Basin Continuous Gas	Uinta-Piceance	2000	0.02	0.5	40	1.293
50030161	Tuxedni-Naknek Continuous Gas	Southern Alaska	2011	0.02	0.6	30	1.286
50620161	Arkoma-Ouachita Foredeep Continuous	Arkoma Basin	2010	0.02	0.6	30	1.286
50350261	Frontier-Muddy Continuous Gas	Wind River Basin	2005	0.02	0.7	15	1.123
50370261	Mowry Continuous Gas	Southwestern Wyoming	2002	0.02	0.7	15	1.123
50350265	Lance-Fort Union Sandstone Gas	Wind River Basin	2005	0.02	0.6	20	1.110
50370861	Lance-Fort Union Continuous Gas	Southwestern Wyoming	2002	0.02	0.8	10	1.104
50370761	Lewis Continuous Gas	Southwestern Wyoming	2002	0.02	0.6	15	1.009

USGS Open-File Report 2012–1118

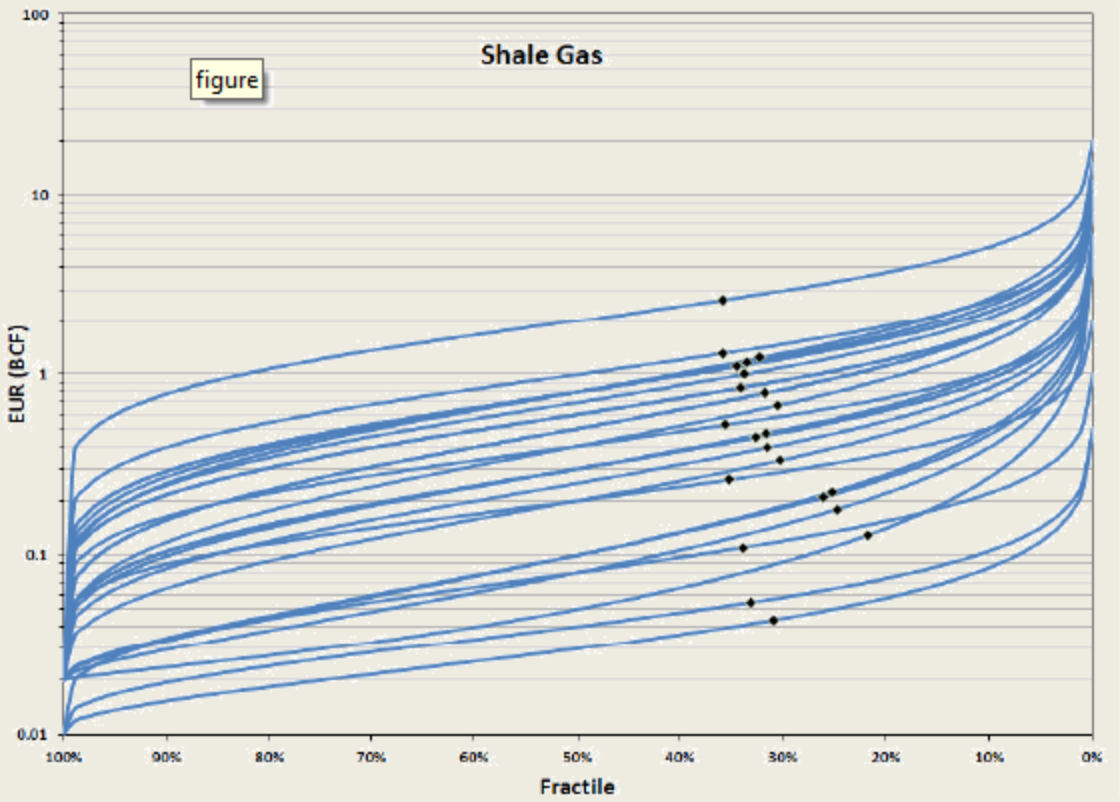


Figure 1. Cloud plot for United States shale-gas assessment units. Each curve represents one assessment unit and is based on the input data in table 1. Black diamonds indicate the mean value for each curve. [AU, assessment unit; EUR, estimated ultimate recovery; and BCF, billions of cubic feet]

USGS Open-File Report 2012–1118

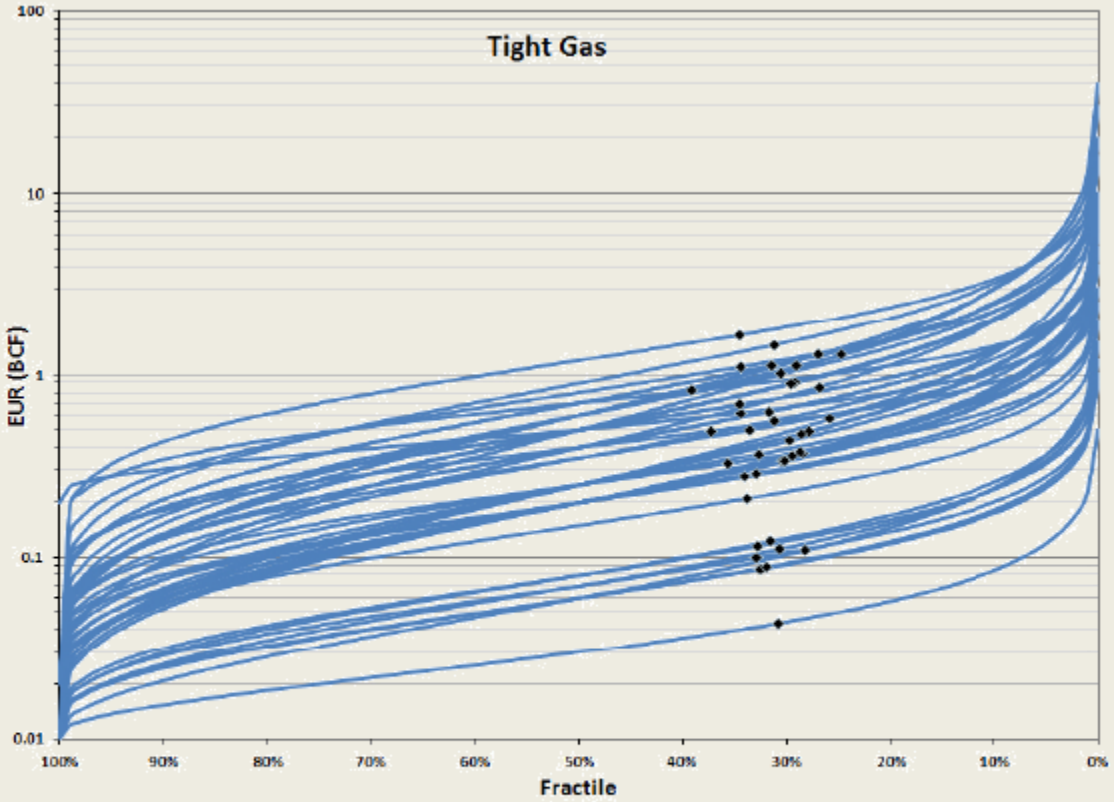
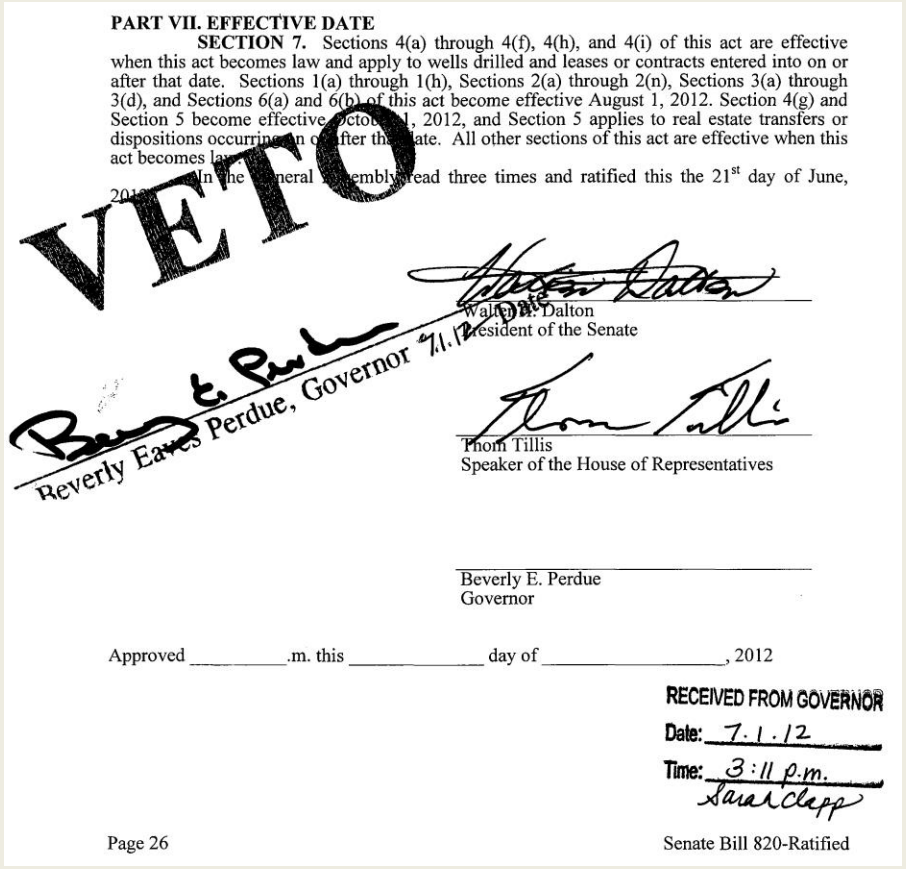


Figure 3. Cloud plot for United States tight-gas assessment units. Each curve represents one assessment unit and is based on the input data in table 3. Black diamonds show the mean value for each curve. [AU, assessment unit; EUR, estimated ultimate recovery; and BCF, billions of cubic feet]

Exploration overview - North Carolina on-shore Triassic lacustrine rift basins
As of August 15, 2012 - J.C. Reid

Basin name =>	Deep River			Dan River - Danville	Davie	Ellerbe	Bertie County	Cumberland-Marlboro
sub-basin name =>	Sanford sub-basin	Durham sub-basin	Wadesboro sub-basin	(N.C. portion only)	Once part of Dan River-Danville Basin	Once part of Wadesboro sub-basin	buried basin under CP, no outcrop	buried basin under CP, no outcrop
Size (surface acres)	146,530 (~59,000 best known)	~405,236	~205,809+	~64,817	~3,932	6,283	Very small from USGS basement magnetics	Moderate size; inferred from USGS basement "quiet" magnetics
Coal present ?	Yes	No data	No data	Yes (thin)	No	No	Unknown	
TOC (core and /or cuttings)	1.96; N = 353	No data	No data	3.08 (avg.); N = 159	n/a	n/a	Unknown	
%Ro (core and / or cuttings)	1.28; N = 42	No data	No data	1.97 (avg.); N = 48	n/a	n/a	No data	
Source rock / reservoir thickness (feet)	up to 800 (Cumnock Fm.)	Likely similar to Sanford sub-basin	Unknown but Cumnock-like rocks present	~425 (Walnut Cove mbr.), ~1,500 (Eden mbr.)	0	0	No organic facies in the single drill hole	
Strike length and width (miles)	~24 x ~11	~58 x ~16	~45 x ~10	~17? X 5 (Eden mbr.); ~22 x ~5 (Walnut Cove mbr.)	n/a	n/a	Minute based on USGS magnetic data	
Targets	Shale, CBM, tight gas	Shale, CBM, tight gas	Shale, CBM, tight gas	Shale, tight gas ?	None	None	None at present	
USGS assessment type	Continuous	Continuous	Continuous	Continuous				Not assessed
Shut-in wells	2	0	0	0				
Well pressures (psi)	900, 250							
Geophysical logs available	Yes	Yes	No	Yes	No	No	Yes	
Depth to basement (feet) - from surface	~7,100 (from seismic and drill holes)	~5,500-6,200 (from seismic)	Probaly similar to Sanford and Durham sub basins	About 4,700 feet inferred by stepped drilling; prossibly deeper	Probably very shallow	200 feet maximun	Unknown	
Shows (gas, oil, asphalt, pyrobitumen)	Many (gas, oil, bitumen, pyrobitumen); wells flared; oil blebs in abandoned coal mines	None reported	None reported	None reported	No organic facies	No organic facies	No organic facies in single drill hole	
Erosion estimates (feet)	~3,000	Probably similar to Sanford sub-basin	Probably similar to Sanford sub-basin	Probably similar to Sanford sub-basin	Unknown	Unknown	Basin buried; past thermal history unknown	
Tight gas	Maybe	Possibly	Maybe	Maybe	n/a	n/a	n/a	
Leasing (acres)	8,765							
Previous drilling (gas & oil)	Yes	None; 1 shallow well	No	Yes	No	No	No	
Previous drilling (coal)	Yes	No	No	Yes (historical)	No	No	No	
Seismic available	Yes - dynamite source	Yes - vibroseis source	No	No	No	No	No	
Core available?	Yes	No	No	Yes	n/a	No	Yes	
Cuttings available?	Yes	Yes	No	No	n/a	n/a	No	
Paleo lake water depth	Shallow - subject to currents action	Probably shallow - subject to current action, one shallow water well	Likely shallow - subject to current action	Shallow - subject to current action, and deep - below current action	No lake facies present	No lake facies present	No identified organic facies. One shallow water well.	
Counties	Lee, Chatham, Moore	Durham, Chatham, Orange, Wake, Granville	Union, Anson, Richmond, Montgomery	Stokes, Rockingham (continues into Pittsylvania Co., VA)	Davie, Yadkin	Richmond	Bertie, and perhaps others ?	
Key citations	Reid and others, 2011; Reid and Milici, 2008; Reid and Taylor, 2008-2010 -- multiple reports			Thayer and Robbins, 1992; Whiteside, 2006; Stone, 1910; Kirstein *in* Thayer and others, 1970; Robbins, 1982; Reid and others, 2011; Olsen, Reid, Kent, Whiteside 2012 in preparation	Thayer, 1970	Dineen, 1982	Weems and others, 2007	

SB 820 - What hath the legislature wrought?



PART VII. EFFECTIVE DATE

SECTION 7. Sections 4(a) through 4(f), 4(h), and 4(i) of this act are effective when this act becomes law and apply to wells drilled and leases or contracts entered into on or after that date. Sections 1(a) through 1(h), Sections 2(a) through 2(n), Sections 3(a) through 3(d), and Sections 6(a) and 6(b) of this act become effective August 1, 2012. Section 4(g) and Section 5 become effective October 1, 2012, and Section 5 applies to real estate transfers or dispositions occurring on or after that date. All other sections of this act are effective when this act becomes law.

In the General Assembly read three times and ratified this the 21st day of June, 2012.

VETO

Beverly Eaves Perdue, Governor 7.1.12

Walter H. Dalton
President of the Senate

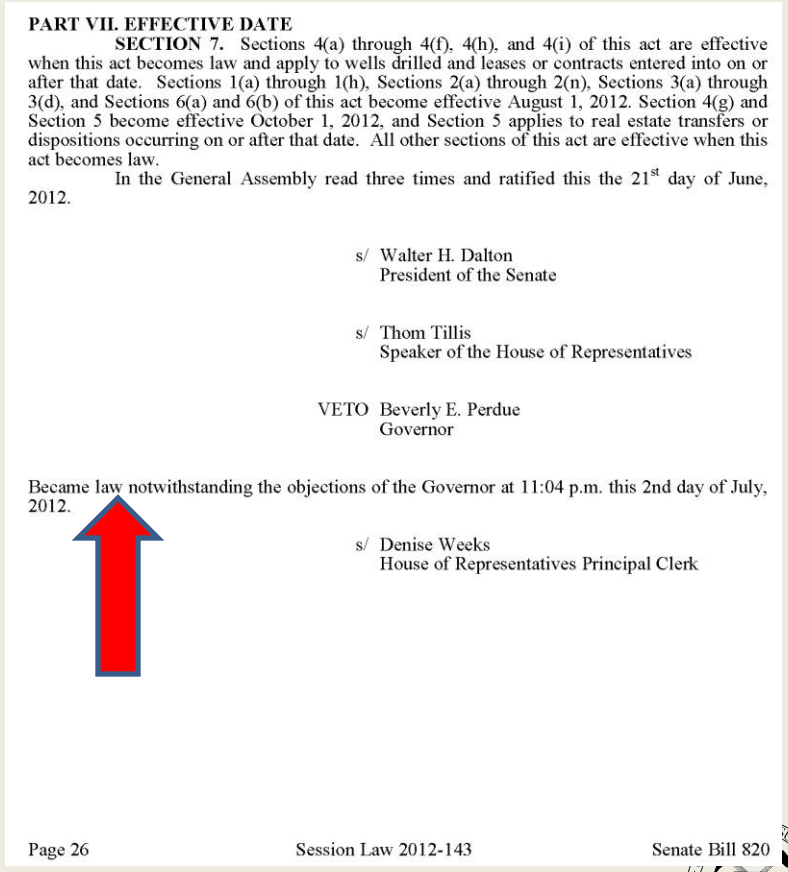
Thom Tillis
Speaker of the House of Representatives

Beverly E. Perdue
Governor

Approved _____.m. this _____ day of _____, 2012

RECEIVED FROM GOVERNOR
Date: 7.1.12
Time: 3:11 p.m.
Sarah Clapp

Page 26 Senate Bill 820-Ratified



PART VII. EFFECTIVE DATE

SECTION 7. Sections 4(a) through 4(f), 4(h), and 4(i) of this act are effective when this act becomes law and apply to wells drilled and leases or contracts entered into on or after that date. Sections 1(a) through 1(h), Sections 2(a) through 2(n), Sections 3(a) through 3(d), and Sections 6(a) and 6(b) of this act become effective August 1, 2012. Section 4(g) and Section 5 become effective October 1, 2012, and Section 5 applies to real estate transfers or dispositions occurring on or after that date. All other sections of this act are effective when this act becomes law.

In the General Assembly read three times and ratified this the 21st day of June, 2012.

s/ Walter H. Dalton
President of the Senate

s/ Thom Tillis
Speaker of the House of Representatives

VETO Beverly E. Perdue
Governor

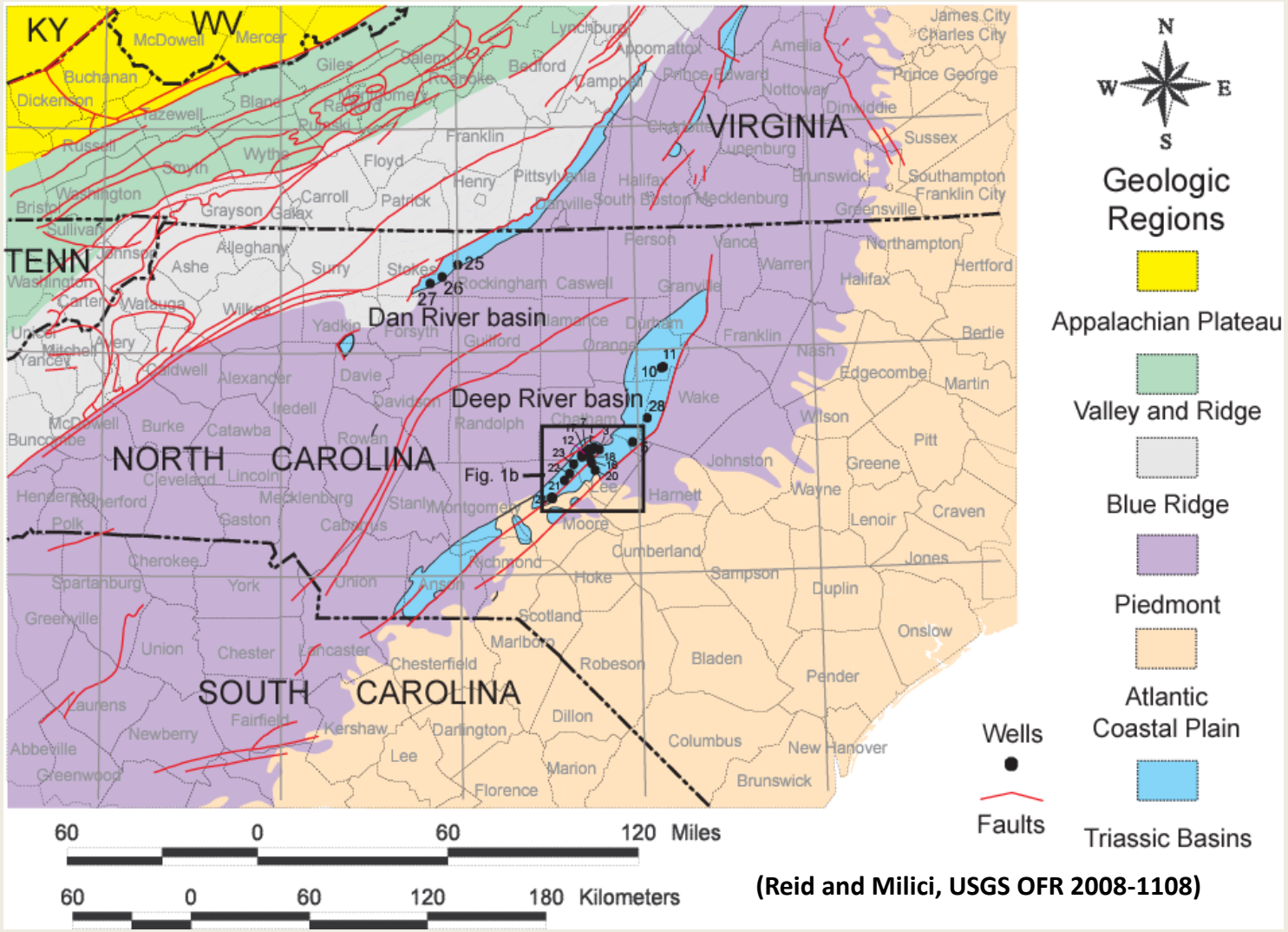
Became law notwithstanding the objections of the Governor at 11:04 p.m. this 2nd day of July, 2012.

s/ Denise Weeks
House of Representatives Principal Clerk

Page 26 Session Law 2012-143 Senate Bill 820

Controversial bill; passed by one vote overriding the Governor's veto.

Dan River-Danville Basin glimpse



Drill Hole : USBM DH-2

NCGS No.: CH-C-1-45

Box No. : 118

From : 1423 feet
to 1440 feet

Drill Hole :USBM DH-2

NCGS No.: CH-C-1-45

Box No. : 119

From : 1440 feet
to 1449 feet

Our 25-year journey

- Jan. 1987 – organic data collection started (Reid).
- Dec. 1987 – manuscript completed; on hold – other work assignments (Reid).
- 1998 – Simpson #1 and Butler #3 wells drilled.
- Jun. 2008 – USGG OFR 2008-1108 (Reid and Milici) released.
- Aug. 2009 – DENR issues 2009-2013 Strategic Plan tasked the N.C. Geological Survey to continue evaluation and exploration of natural gas in the State.
- Spring 2010 – leasing starts; ~10,000 acres in the Sanford sub-basin and flurry of inquiries.
- 2010-2012 - Many(65) presentations to state, local and professional meetings; legislation mulled to update the out-dated 1945 Oil and Gas Act.
- 2011 - NC General Assembly "study bill" Session Law 2011-276 (H.B. 242) to "determine the oil and gas resources present in the Triassic basins and in any other areas of the State…."
- July 2011 - USGS geologic assessment meeting – Denver (Reid and Simons).
- 2011 - DENR study and public comment.
- 2012 – STRONGER review of state regulations.
- 2012 - USGS Assessment released, Fact Sheet 2012-3075.
- 2012 - General Assembly enacts 'energy bill' (S820);
  - Overrides Governor's veto; legalizes hydraulic fracturing and horizontal drilling
  - Mining Commission expanded to Mining and Energy Commission,
  - Members appointed.

Exploration overview - North Carolina on-shore Triassic lacustrine rift basins
As of August 15, 2012 - J.C. Reid

Basin name =>	Deep River			Dan River - Danville	Davie	Ellerbe	Bertie County	Cumberland-Marlboro
sub-basin name =>	Sanford sub-basin	Durham sub-basin	Wadesboro sub-basin	(N.C. portion only)	Once part of Dan River-Danville Basin	Once part of Wadesboro sub-basin	buried basin under CP, no outcrop	buried basin under CP, no outcrop
Size (surface acres)	146,530 (~59,000 best known)	~405,236	~205,809+	~64,817	~3,932	6,283	Very small from USGS basement magnetics	Moderate size; inferred from USGS basement "quiet" magnetics
Coal present ?	Yes	No data	No data	Yes (thin)	No	No	Unknown	
TOC (core and /or cuttings)	1.96; N = 353	No data	No data	3.08 (avg.); N = 159	n/a	n/a	Unknown	
%Ro (core and / or cuttings)	1.28; N = 42	No data	No data	1.97 (avg.); N = 48	n/a	n/a	No data	
Source rock / reservoir thickness (feet)	up to 800 (Cumnock Fm.)	Likely similar to Sanford sub-basin	Unknown but Cumnock-like rocks present	~425 (Walnut Cove mbr.), ~1,500 (Eden mbr.)	0	0	No organic facies in the single drill hole	
Strike length and width (miles)	~24 x ~11	~58 x ~16	~45 x ~10	~17? X 5 (Eden mbr.); ~22 x ~5 (Walnut Cove mbr.)	n/a	n/a	Minute based on USGS magnetic data	
Targets	Shale, CBM, tight gas	Shale, CBM, tight gas	Shale, CBM, tight gas	Shale, tight gas ?	None	None	None at present	
USGS assessment type	Continuous	Continuous	Continuous	Continuous				Not assessed
Shut-in wells	2	0	0	0				
Well pressures (psi)	900, 250							
Depth to basement (feet) - from surface	~7,100 (from seismic and drill holes)	~5,500-6,200 (from seismic)	Probaly similar to Sanford and Durham sub-basins	About 4,700 feet inferred by stepped drilling; prossibly deeper	Probably very shallow	200 feet maximun	Unknown	
Shows (gas, oil, asphalt, pyrobitumen)	Many (gas, oil, bitumen, pyrobitumen); wells flared; oil blebs in abandoned coal mines	None reported	None reported	None reported	No organic facies	No organic facies	No organic facies in single drill hole	
Erosion estimates (feet)	~3,000	Probably similar to Sanford sub-basin	Probably similar to Sanford sub-basin	Probably similar to Sanford sub-basin	Unknown	Unknown	Basin buried; past thermal history unknown	
Leasing (acres)	8,765							

Public participation

- Three public hearings were held in the Triassic Basin. The first was on Oct. 10, 2011, and the draft plan of study was presented; the STRONGER process was discussed; and public comment was received as to how the study should be conducted. Comment was received and written comment on the draft outline of the study were accepted through Oct. 18, 2011.
- Two additional public meetings occurred in March 2012 to discuss the draft report.
- Draft findings and recommendations were presented in a public meetings on March 20, 2012 and on March 27, 2012. Both meetings were streamed live online, the same information was presented, and public comments were accepted at both meetings, *via* mail and email.
- Chatham County hosted a third meeting on April 2 where public comments were received.
- Written comments on the draft report were accepted through April 2, plus feedback received at the two public meetings.
- DENR requested a nonprofit organization called State Review of Oil & Natural Gas Environmental Regulations (STRONGER) to review of North Carolina's oil and gas regulatory programs. The STRONGER review process brought together representatives from the state, the oil and gas industry, and public interest stakeholders to evaluate the state's regulatory programs against STRONGER's set of national guidelines. STRONGER's review panel met in late October to gather information about the state's processes, and issued a report in late February 2012. DENR study located at URL http://portal.ncdenr.org/web/guest/denr-study

STRONGER Review - 2012

- DENR requested a nonprofit organization called State Review of Oil & Natural Gas Environmental Regulations (STRONGER) to review of North Carolina's oil and gas regulatory programs.
- The STRONGER review process brought together representatives from the state, the oil and gas industry, and public interest stakeholders to evaluate the state's regulatory programs against STRONGER's set of national guidelines.
- STRONGER's review panel met in October 2011 to gather information about the state's processes, and issued a report in February 2012.

Potential reservoir rocks

Drill Hole : NCST–2

NCGS No.: SO–C–2–81

Box No. : 19

From : 220 feet
to 230 feet

Drill Hole : NCST–2

NCGS No.: SO–C–2–81

Box No. : 20

From : 230 feet
to 240 feet

Lower member of the Cow Branch Fm.

S820 Highlights – cont'd

- **Boldface disclosure** that property owners leasing land secure written approval from their mortgage lenders.
- Groundwater testing:
  - Energy companies required to test groundwater in a 5,000-feet radius of a drill site before and after drilling.
  - Any contamination is assumed to be from drilling unless proven otherwise. Provides for groundwater supply remedy.