Report Title

"Resource Assessment of the In-Place and Potentially Recoverable Deep Natural Gas Resource of the Onshore Interior Salt Basins, North Central and Northeastern Gulf of Mexico"

Type of Report

Semiannual Progress Report for Year 1

Reporting Period Start Date

October 1, 2003

Reporting Period End Date

March 31, 2004

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Date Report was Issued

April 16, 2004

DOE Award Number

DE-FC26-03NT41875

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Disclaimer

Abstract

The principal research effort for Year 1 of the project is data compilation and petroleum system identification. The research focus for the first nine (9) months of Year 1 is on data compilation and for the remainder of the year the emphasis is on petroleum system identification.

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Semiannual Report for Year 1
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Introduction

The University of Alabama and Louisiana State University have undertaken a cooperative 3-year, advanced subsurface methodology resource assessment project, involving petroleum system identification, characterization and modeling, to facilitate exploration for a potential major source of natural gas that is deeply buried (below 15,000 feet) in the onshore interior salt basins of the North Central and Northeastern Gulf of Mexico areas. The project is designed to assist in the formulation of advanced exploration strategies for funding and maximizing the recovery from deep natural gas domestic resources at reduced costs and risks and with minimum impact.

The results of the project should serve to enhance exploration efforts by domestic companies in their search for new petroleum resources, especially those deeply buried (below 15,000 feet) natural gas resources, and should support the domestic industry's endeavor to provide an increase in reliable and affordable supplies of fossil fuels.

Executive Summary

The principal research effort for Year 1 of the project is data compilation and petroleum system identification. The research focus for the first nine (9) months of Year 1 is on data compilation and for the remainder of the year the emphasis is on petroleum system identification.

Project Objectives

The objectives of the study are: to perform resource assessment of the in-place deep (>15,000 ft) natural gas resource of the onshore interior salt basins of the North Central and Northeastern Gulf of Mexico areas through petroleum system identification, characterization and modeling and to use the petroleum system based resource assessment to estimate the volume of the in-place deep gas resource that is potentially recoverable and to identify those areas in the interior salt basins with high potential to recover commercial quantities of the deep gas resource.

The project objectives will be achieved through a 3-year effort. First, emphasis is on petroleum system identification and characterization in the North Louisiana Salt Basin, the Mississippi Interior Salt Basin, the Manila Sub-basin and the Conecuh Sub-basin of Louisiana, Mississippi, Alabama and Florida panhandle. This task includes identification of the petroleum systems in these basins and the characterization of the overburden, source, reservoir and seal rocks of the petroleum systems and of the associated petroleum traps. Second, emphasis is on petroleum system modeling. This task includes the assessment of the timing of deep (>15,000 ft) gas generation, expulsion, migration, entrapment and alteration (thermal cracking of oil to gas). Third,

emphasis is on resource assessment. This task includes the volumetric calculation of the total in-place hydrocarbon resource generated, the determination of the volume of the generated hydrocarbon resource that is classified as deep (>15,000 ft) gas, the estimation of the volume of deep gas that was expelled, migrated and entrapped, and the calculation of the potential volume of gas in deeply buried (>15,000 ft) reservoirs resulting from the process of thermal cracking of liquid hydrocarbons and their transformation to gas in the reservoir. Fourth, emphasis is on identifying those areas in the onshore interior salt basins with high potential to recover commercial quantities of the deep gas resource.

Experimental

Work Accomplished

Data Compilation—The existing information on the North Louisiana Salt Basin, Mississippi Interior Salt Basin, Manila Sub-basin and Conecuh Sub-basin (Figure 1) have been evaluated and an electronic database of these data for each basin is being compiled (Table 1). Ten (10) cross sections (Figure 2) consisting of 141 wells for the North Louisiana Salt Basin have been selected and constructed (Figure 3). The log curves for the wells used in the cross sections have been digitized. Five (5) cross sections consisting of 48 wells (Figure 4) for the Mississippi Interior Salt Basin have been prepared (Figure 5). The log curves for the wells used in the cross sections have been digitized. Five (5) cross sections (Figure 6) consisting of 26 wells for the Manila and Conecuh Sub-basins are being prepared (Figure 7). These log curves are being digitized.

Source rock geochemical data for the Mississippi Interior Salt Basin and Manila and Conecuh Sub-basins have been reviewed and compiled (Tables 2 and 3). Source rock geochemical data for the North Louisiana Salt Basin have been reviewed, and additional Smackover samples have been sent to GeoChem Laboratories for source rock characterization and analysis (Table 4).

The research team met in Tuscaloosa on the University of Alabama campus to discuss the project plan for Year 1.

Work Planned

Data Compilation—Digitization of the well logs for the Manila and Conecuh Sub-basins will be completed and cross section construction for these sub-basins will continue. The results from the characterization and analysis of potential source rocks in the North Louisiana Salt Basin will continue.

Petroleum System Identification—The source rock information compiled, in conjunction with the cross sections constructed, will be analyzed to determine if any additional petroleum source rocks other than the Upper Jurassic (Oxfordian), such as the Upper Jurassic (Kimmeridgian, Tithonian), Lower Cretaceous (Aptian, Albian), Upper Cretaceous (Cenomanian, Turonian) and Paleocene, were active source rocks in the North Louisiana Salt Basin, Mississippi Interior Salt Basin, Manila Sub-basin, and Conecuh Sub-basin.

Results and Discussion

No problems have been encountered at this point.

Conclusions

The project work is on schedule.

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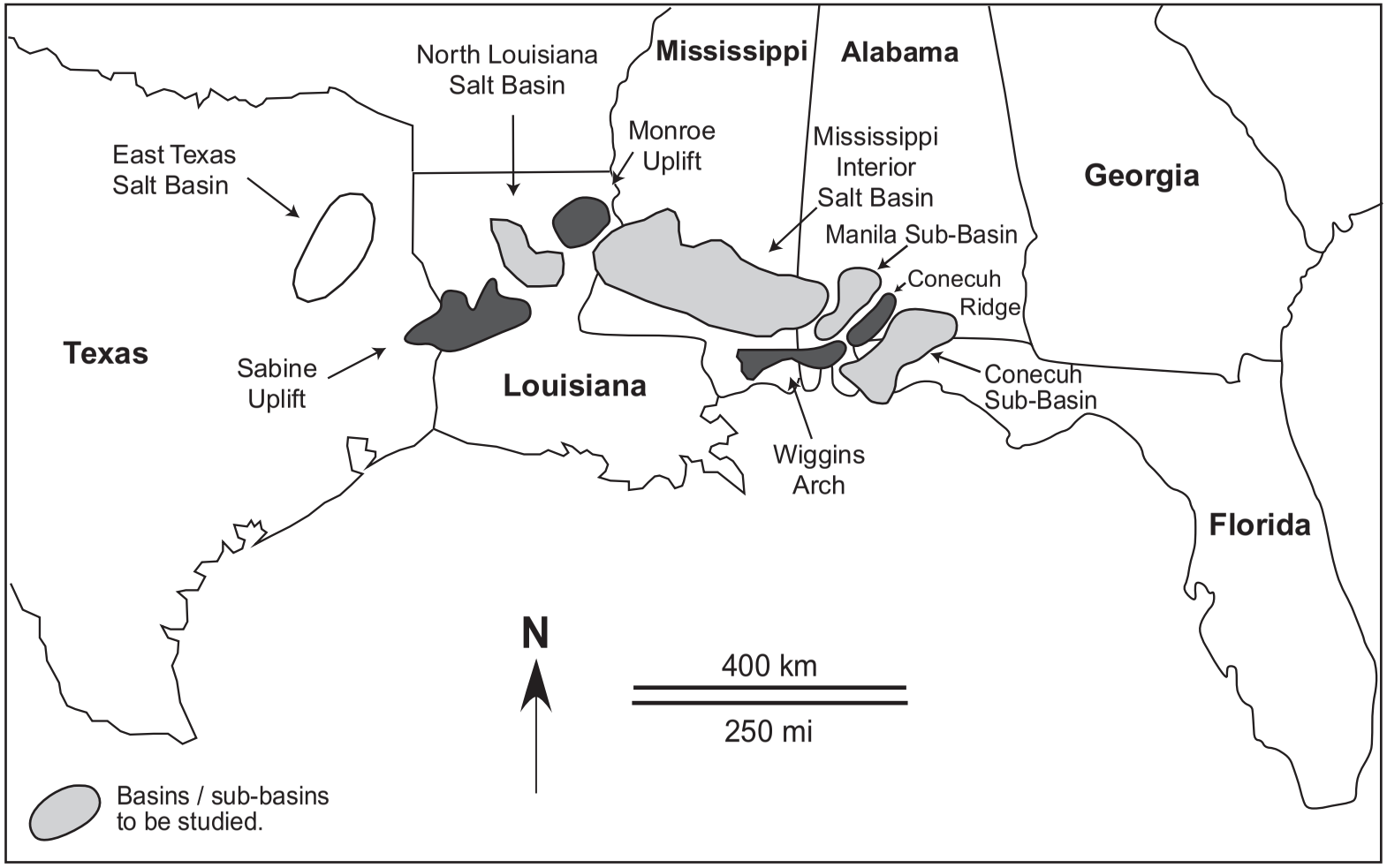

Figure 1. Map illustrating location of basins and sub-basins to be studied.

Table 1

Milestone Chart—Year 1

	O	N	D	J	F	M	A	M	J	J	A	S
Data Compilation	xxxxxxxxxxxxxxxxxxxxx											
Petroleum System Identification												

Work Planned
Work Accomplished xx

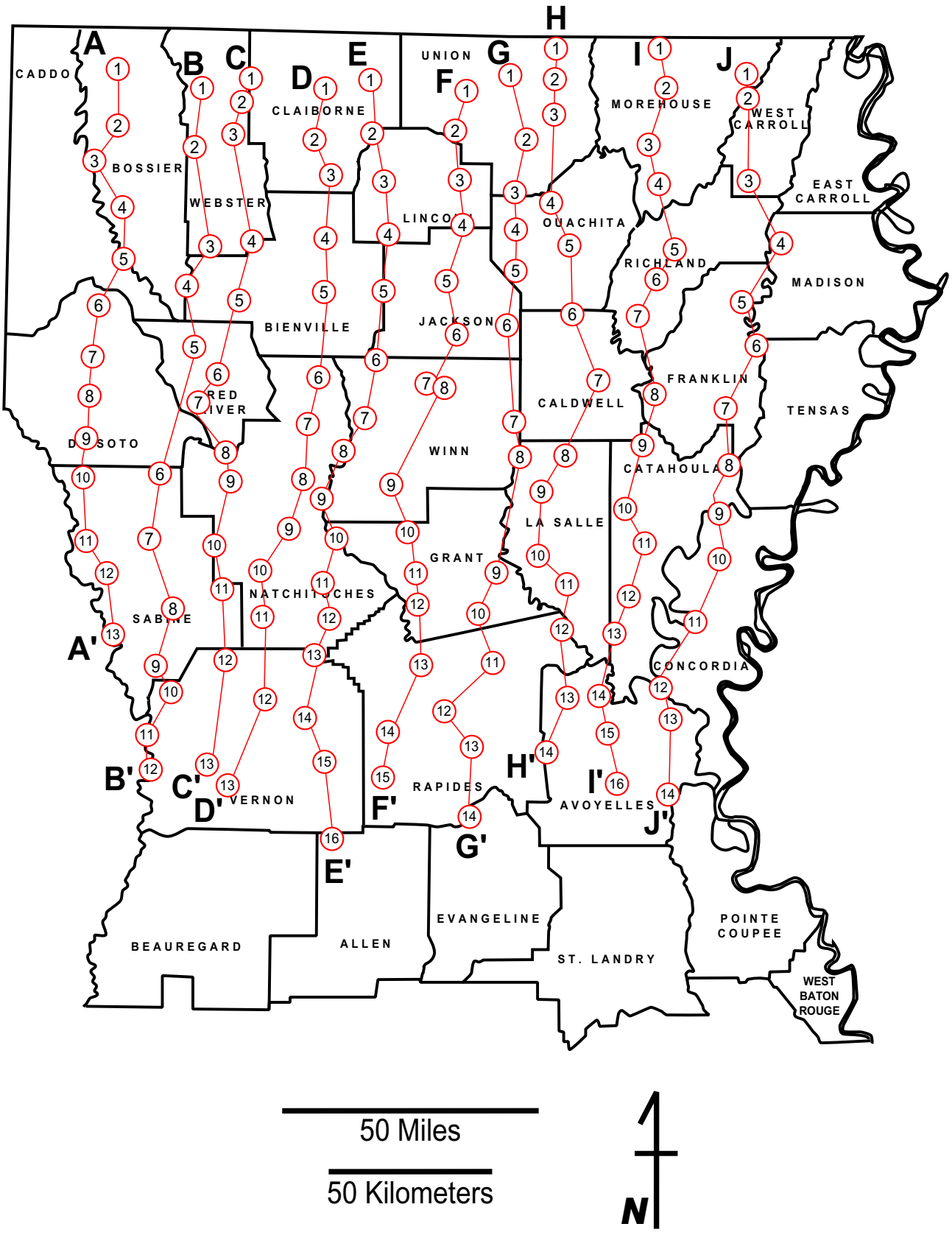

Figure 2. Map illustrating locations of cross sections and wells selected for study in the North Louisian Salt Basin area.

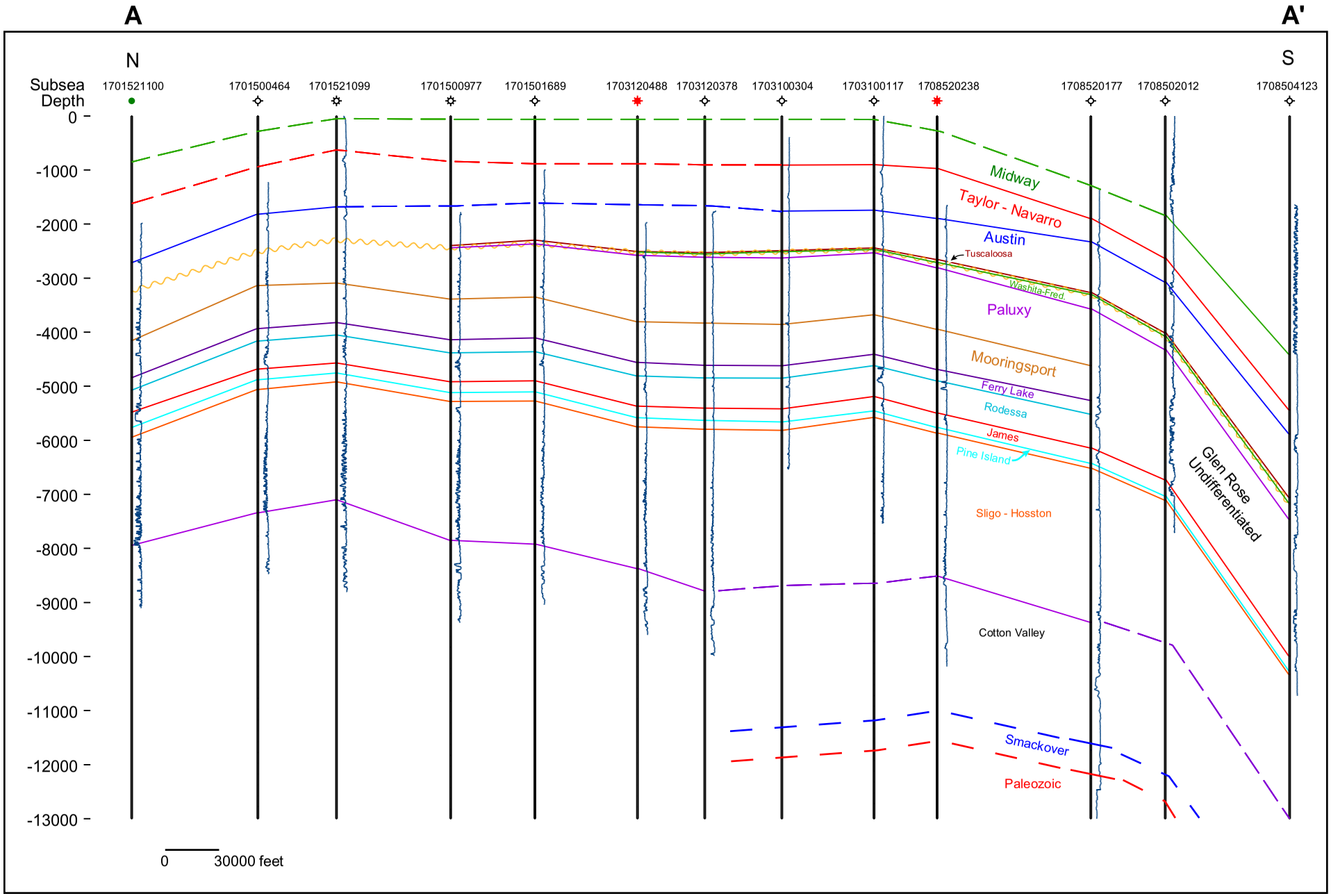

Figure 3. Cross section illustrating stratal changes in the North Louisiana Salt Basin area.

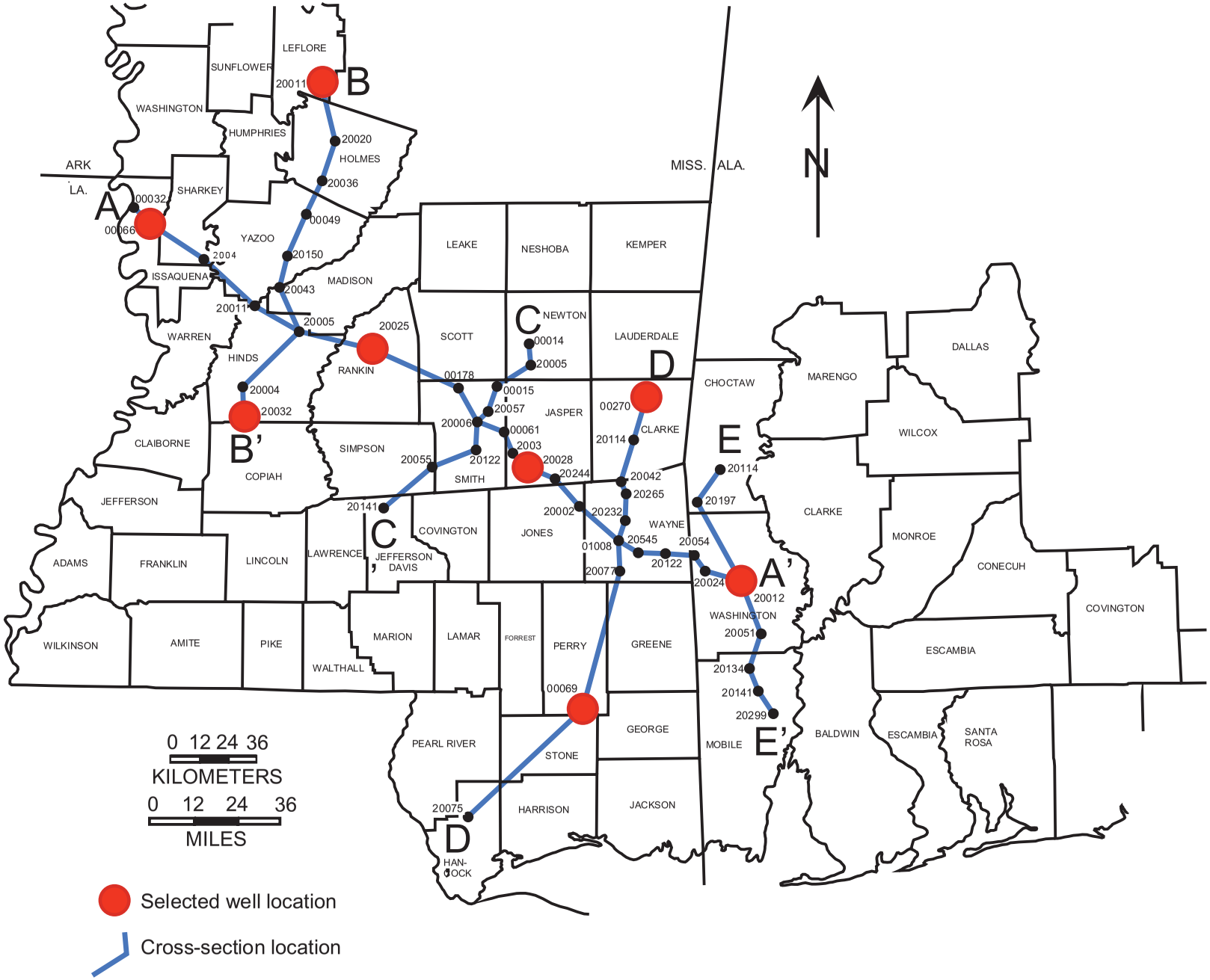

Figure 4. Map illustrating locations of cross sections and wells selected for study in the Mississippi Interior Salt Basin area.

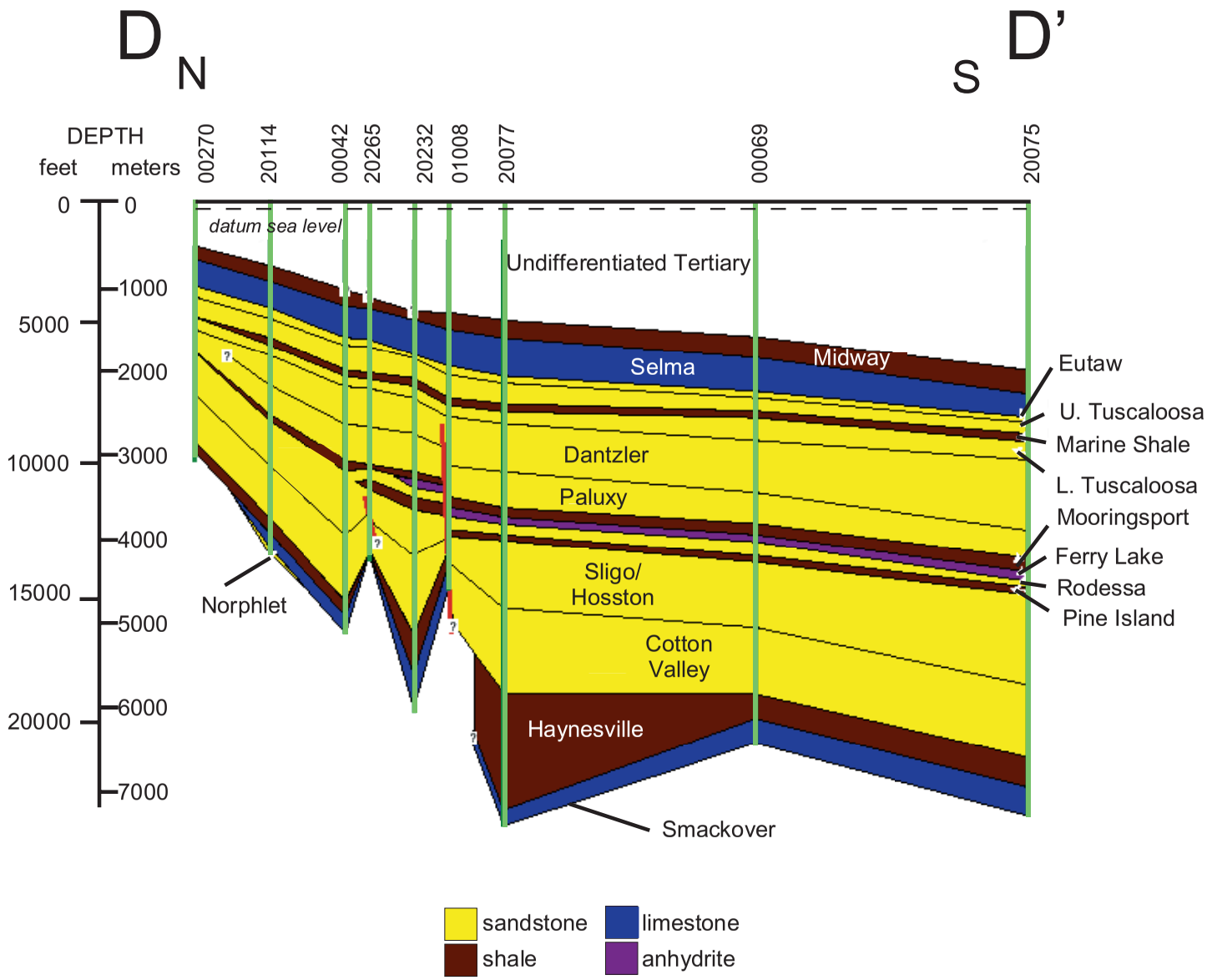

Figure 5. Cross section illustrating stratal changes in the Mississippi Interior Salt Basin area.

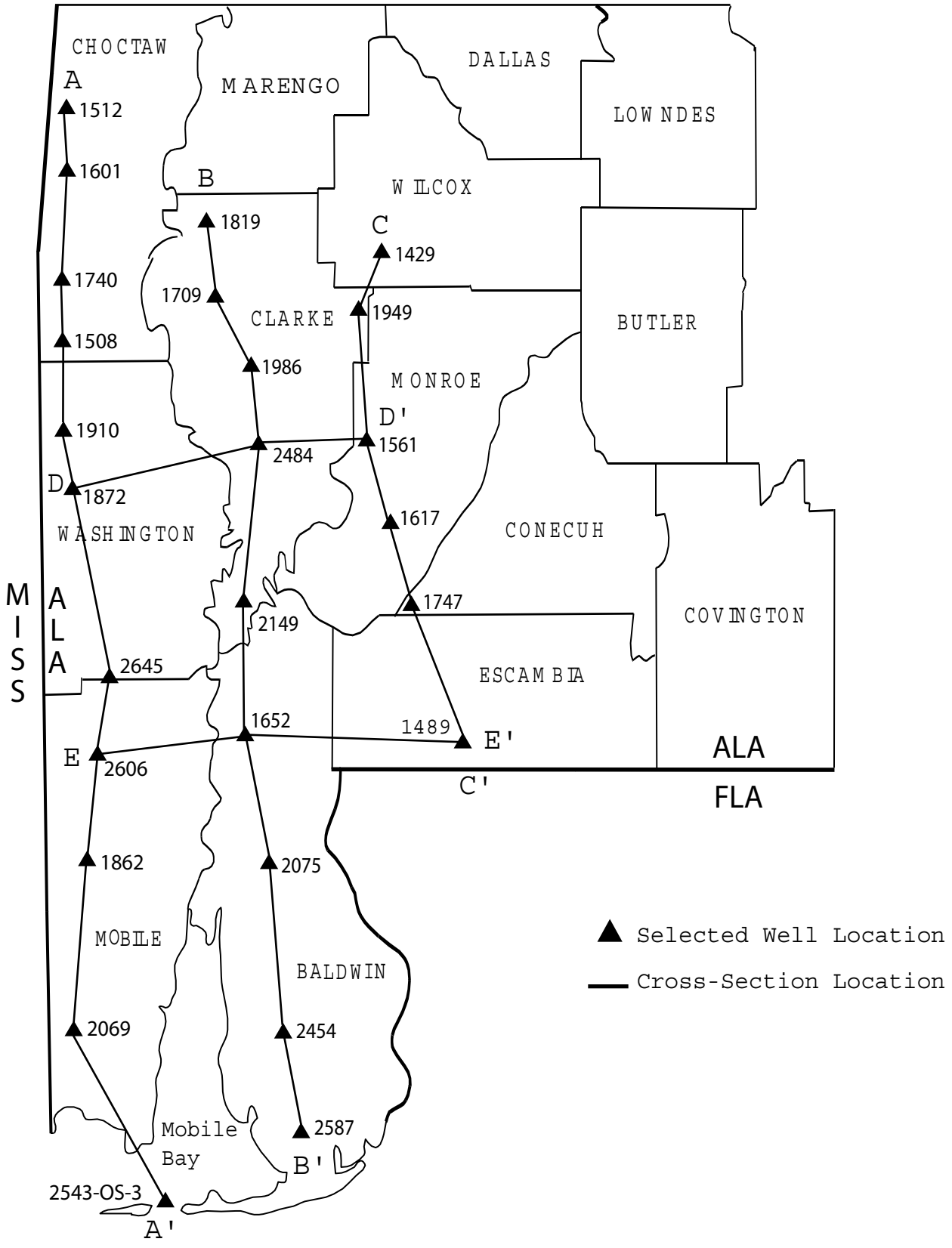

Figure 6. Map illustrating locations of cross sections and wells selected for study in the Manila and Conecuh Sub-basins area.

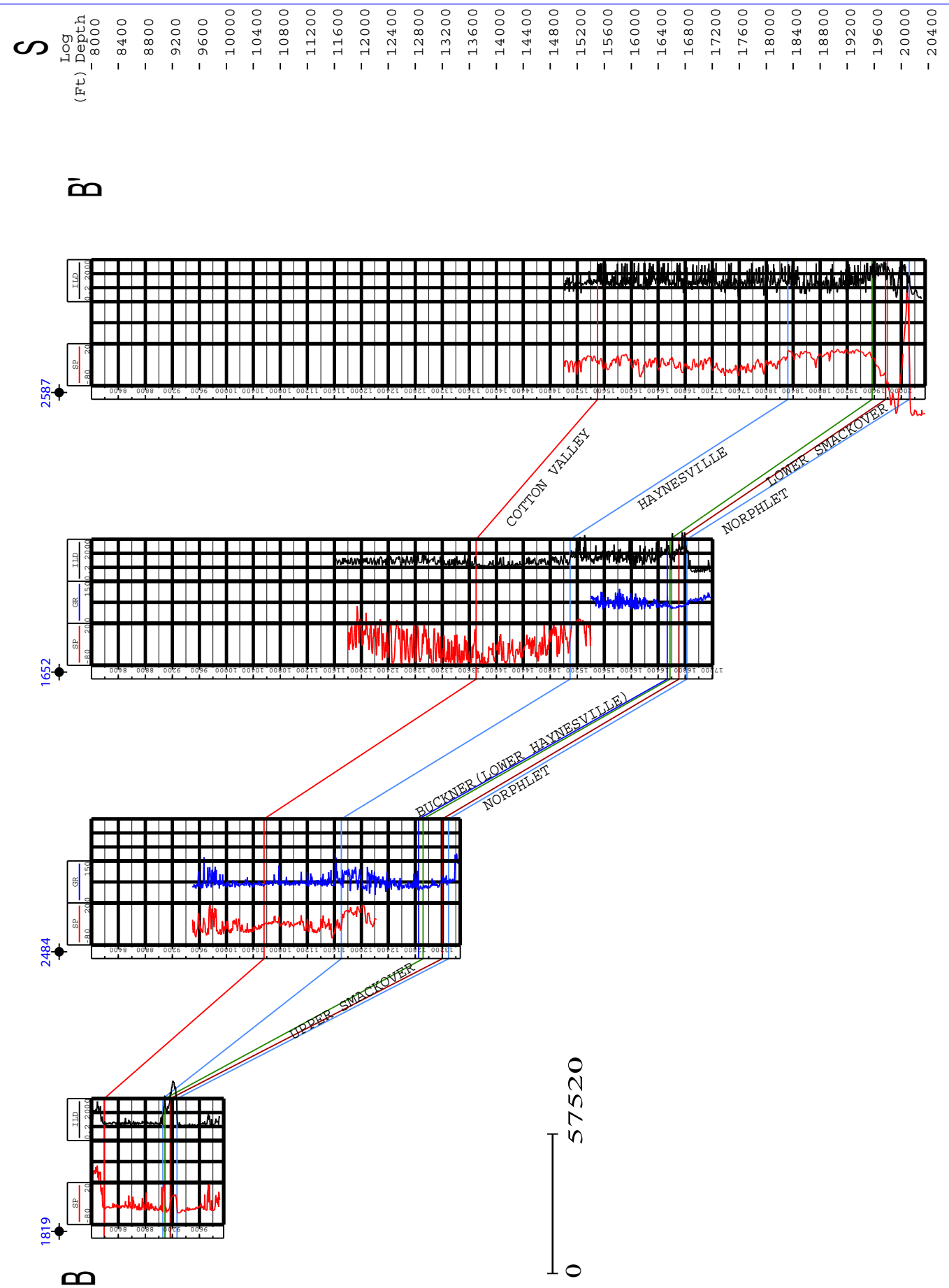

Figure 7. Cross section illustrating stratal changes in the Jurassic section in the Manila and Conecuh Sub-basins area.

Table 2

Analyses of potential Smackover source rocks, Mississippi Interior Salt Basin

Well name	Number on Figure 15D	County	Depth (ft)	TOC (wt %)	Organic type	$\%R_o$*	Tmax (°C)	HI
Weissinger Lumber #1	1	Issaquena[+]	8,451	0.36	Am/Al	2.00	430	66
Flora Johnson #1	2	Newton[+]	11,775	0.26	Am/Al	0.55	431	134
Masonite 25-14	3	Clarke [+]	14,586	0.24	Am/Al	0.90	429	91
USA Rubie Bell #1	4	Scott[+]	14,902	0.48	Am/Al	0.90	431	137
Bishop-Cooley #1	5	Wayne[+]	15,541	1.35	Am/Al	1.50	427	27
R. M. Thomas #1	6	Smith[+]	16,554	0.27	Am/Al	1.50	432	62
Grief Bros. #1	7	Jasper[+]	17,015	0.44	Am/Al	0.55	433	54
McFarland #1	8	Jones[+]	19,865	0.28	Am/Al	1.50	410	25
Crain et al. 1-4	9	Rankin[+]	20,179	0.24	Am/Al	2.00	420	50
Crown Zellerbach #1	10	Simpson[+]	23,981	4.55	Am/Al	2.00	367	23
Jackson #1	11	Choctaw[++]	10,532	0.30	Am/Al	0.45	--	--
Bolinger 3-4	12	Choctaw[++]	10,610	0.07	Am/Al	0.45	--	42
Stewart 6-5	13	Choctaw[++]	12,245	0.24	Am/Al	0.45	--	22
Britton #1	14	Washington[++]	16,101	0.08	Am/Al	1.50	--	12
Chatom 2-01	15	Washington[++]	16,167	0.19	Am/Al	1.50	--	10
Foster 10-6	16	Washington[++]	19,359	0.25	Am/Al	1.50	--	4

*Vitrinite reflectance ($\%R_o$) was determined by converting TAI values to R_o values using the conversion chart of Geochem Laboratories, Am = Amorphous, Al = Algal (microbial), [+]Mississippi, [++]Alabama.

Table 3

Organic geochemical analyses of core samples, Manila and Conecuh Sub-basins

Well permit no.	County/area[1]	Rock unit[2]	Depth (ft)	Carbonate (%)	Organic carbon (%)	S1+S2 yield (MG/G)	Transfor-mation ratio	Temp max yield (C)	H index	Kerogen type[3]	TAI 1-5 scale	Bitumen (ppm)	Hydro-carbons (ppm)	HC/org C[4]	Saturate/ aromatic ratio	Pristane/ phytane	CPI	$\delta^{13}C$ saturate (‰)	$\delta^{13}C$ aromatic (‰)
355	Esc	Tus	5,814	2.3	1.18	1.11	0.05	416	89	Am (Al)	2-	634	338	2.9	3.5	>1	>1	-26.4	-24.5
427	Esc	Tus	6,080	51.0	2.63	7.38	0.02	431	273	Am (Al)	2-	1,440	630	2.1	1.9	>1	>1	-26.3	-25.3
2182	Cla	Tus	5,271	15.6	2.75	7.75	0.01	415	277	Am (Al)	2-	1,050	540	2.0	2.3	<1	>1	-26.2	-24.6
3299	Bal	Hay	15,002	--	0.05	--	--	--	--	--	--	--	--	--	--	--	--	--	--
735	Cla	Smk	11,155	85.1	0.29	0.28	0.46	425	51	Am (Al)	2-	395	164	5.6	3.6	>1	1	-27.4	-24.3
1438	Cla	Smk	10,980	99.0	0.11	0.08	0.12	426	63	Am (Al)	2-	48	28	2.5	2.8	1	>1	-27.5	-26.8
3648	Cla	Smk	13,488	59.2	0.28	0.27	0.19	433	78	Am (Al)	2-	235	164	5.9	3.3	>1	>1	-26.5	-24.6
1352	Mon	Smk	9,221	--	0.04	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1592	Mon	Smk	14,245	75.0	0.54	0.47	0.17	433	72	Am	2+	449	266	4.9	2.1	<1	>1	-24.0	24.9
4673	Mon	Smk	14,596	94.2	0.05	0.03	0.50	--	40	--	--	--	--	--	--	--	--	--	--
1584	Bal	Smk	16,225	--	0.42	--	--	--	--	Am	2-	--	--	--	--	--	--	--	--
2075	Bal	Smk	18,335	89.2	0.49	0.30	0.43	--	34	Am	3-	327	322	6.6	16.1	1	1	-26.4	-25.9
2587	Bal	Smk	19,860	95.8	0.20	0.04	0.25	--	15	Am (Al)	3+	37	27	1.4	5.2	<1	1	-27.8	-25.5
2621	Bal	Smk	18,470	78.6	1.17	0.10	0.20	506	6	Am	3	97	52	0.4	3.0	1	1	26.9	-25.9
2915	Bal	Smk	19,409	95.2	0.88	0.03	0.00	--	3	Am	3+	--	--	--	--	--	--	--	--
1460	Esc	Smk	15,304	87.9	0.33	0.27	0.58	455	36	--	--	382	215	6.5	4.4	<1	1	-25.8	-24.5
1674	Esc	Smk	16,003	84.5	0.32	0.08	0.37	424	15	Am	2+	127	81	2.5	3.3	1	1	-25.9	-25.5
1766	Esc	Smk	15,326	98.3	0.26	0.19	0.44	--	42	Am (Al)	2+	119	118	4.6	5.3	>1	1	-26.7	-24.8
1770	Esc	Smk	15,637	90.7	0.99	0.95	0.44	444	54	Am	2+	823	617	6.2	7.1	<1	1	-24.6	-22.1
1837	Esc	Smk	15,619	97.9	0.17	0.04	0.50	411	11	--	--	--	--	--	--	--	--	--	--
1895	Esc	Smk	15,611	87.1	0.91	0.64	0.34	448	46	Am (Al)	2+	428	323	3.5	7.3	>1	1	-24.3	-22.4
2041	Esc	Smk	14,742	76.7	1.35	1.61	0.38	431	74	Am	2	1,410	1,110	8.2	6.2	<1	<1	-23.6	-22.8
2991	Esc	Nor	15,496	18.4	0.17	0.03	0.50	--	11	--	--	24	6	0.4	34.0	1	1	--	--
3402	Esc	Smk	15,514	77.7	1.05	0.52	0.42	440	28	--	--	581	411	3.9	6.5	>1	1	-25.1	-24.2
3900	Esc	Smk	15,301	90.7	0.91	0.63	0.47	446	37	Am	2+	489	365	4.0	11.2	>1	<1	-22.9	-21.4
4395	Esc	Nor	14,914	1.0	0.07	0.11	0.30	--	114	--	--	69	49	7.0	4.7	>1	<1	-29.0	-25.1

[1]Baldwin (Bal), Clarke (Cla), Escambia (Esc), Monroe (Mon).
[2]Tuscaloosa (Tus), Haynesville (Hay), Smackover (Smk), Norphlet (Nor).
[3]Amorphous (Am), Algal (Al).
[4]Hydrocarbon/organic carbon (HC/org C).

Table 4

Smackover samples UA-1 through UA-9 for analyses, North Louisiana Salt Basin

	Well	Company	Parish	Location	Depth (ft)
1.	George Franklin #1	Houston Explo.	Richland	S24 18N 8E	11690.5
2.	George Franklin #1	Houston Explo.	Richland	S24 18N 8E	11770
3.	Colvin #2	Bass Enterprise	Lincoln	S16 20N 3W	10856
4.	McGehee #1	IMC Explor.	Lincoln	S34 19N 4W	13439
5.	McGehee #1	IMC Explor.	Lincoln	S34 19N 4W	13602
6.	Bearden #1	Woods & Deas	Union	S28 21N 1W	10170
7.	B-1 Hamiter	Woods & Deas	Bossier	S11 23N 13W	10568
8.	Waller #1	Marathon	Claiborne	S2 23N 8W	10390
9.	Sherman #1	Cheyenne	Claiborne	S4 23N 5W	10216