Shallow Coal Exploration Drill-Hole Data, South and East-Central Texas

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Chapter K of

Shallow Coal Exploration Drill-Hole Data—Alabama, Georgia, Kentucky, Louisiana, Mississippi, Missouri, North Carolina, South Carolina, Tennessee, and Texas

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Contents

Figures

Tables

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Introduction

Coal exploration drill-hole data from 3,825 wells in southern to east-central Texas drilled between 1975 and 1984 by Phillips Coal Company, a division of Phillips Petroleum Company (Phillips), are discussed in this chapter, and the data are provided in an accompanying spreadsheet. The data are part of a larger dataset donated to the U.S. Geological Survey (USGS) by the North American Coal Corporation, which purchased Phillips assets in 2001 (see chapter A, this volume). The data in 10 State reports have been digitized from field maps to create unified and spatially consistent coal exploration drill-hole datasets for each of the States included in the donation (chapters B–K, this volume). The drill-hole data for Texas have been divided into three coal exploration drill-hole datasets: northeast Texas, south Texas, and east-central Texas. Included in this report chapter are maps of major coal-bearing formations in south Texas and east-central Texas overlaid with drill-hole locations (figs. K1, K2), a list of data attributes and explanations of the data format (table K1), a list of comments found in the data and their descriptions (table K2), a list of counties and the number of drill holes for each county (tables K3, K4), and two electronic files in spreadsheet format with tabulated data for south Texas and east-central Texas (see appendixes K1 and K2). Information for northeast Texas can be found in chapter J of this open-file report.

Methods

Hardcopy Phillips exploration maps, in Texas central, south-central, and south 1927 State coordinate plane projection, were scanned and georeferenced into a geographic information system (GIS) using ArcMap™ software from the Environmental Systems Research Institute, Inc. (ESRI). Drill-hole locations were then digitized in the GIS, and coal data were recorded in an attribute table (table K1) for each drill-hole point. Each data point is uniquely labeled, first identifying the county with one or two letters followed by a numeral. The drill-hole name listed is the same name presented on the original maps. Alterations to the name occurred only when text was illegible on the original maps, or in the case of a duplicate drill-hole name the letter "b" was added after the number in the name. The attribute table for each point contains basic site information and location references along with information on the coal beds found during exploration (tables K1, K2). For example, drill-hole points where coal was found will have the beds numbered sequentially (for example: 1,2,3…16), followed by thickness of coal (1_C), thickness of coal and partings (1_CP), depth to the top of the bed (1_DEPTH), a bed regional name (1_BED), and any comments about quality or information in regard to the coal bed (1_COMMENTS). All of the depth and thickness measurements are measured in decimal feet. Comments have been added by USGS staff if there were problems or uncertainties during compiling or if any additional information on the maps needed to be described. Once the digitizing of the maps was complete, the spatial data were then reprojected into a North American Datum of 1983 geographic coordinate system in order to standardize all of the Phillips datasets into a common projection.

Generalized Coal Geology of South and East-Central Texas

South Texas Coal Deposits

The major coal-bearing formations in south Texas are found in sediments deposited during the Upper Cretaceous and the Tertiary (fig. K3). Upper Cretaceous coal-bearing strata of the Olmos Formation (Navarro Group) extend north out of the Sabinas Basin in Mexico and cross the Rio Grande at Eagle Pass, Texas, where the Olmos Formation's extent diminishes in the northeastern corner of Maverick County (fig. K1). The Olmos was deposited in a deltaic (fluvial dominated) depositional system (SanFilipo, 1999).

Coal-bearing formations of the Tertiary age in south Texas are found in the lower Wilcox, Claiborne, and Jackson Groups (fig. K3). Unlike the Olmos Formation, these Paleogene-aged formations can be found throughout the Gulf of Mexico Coastal Plain. While the majority of the coal resources in the Gulf of Mexico Coastal Plain are lignitic,

coals of the Claiborne Group in south Texas are bituminous, blocky, and non-banded, resembling cannel and boghead coals of the bituminous coalfields of the Appalachian basin and Great Britain (Warwick and Hook, 1995). These coals formed in a transitional system between a marine-influenced, sandstone dominated, lower delta plain depositional environment and a more inland, mudstone, predominately freshwater deltaic environment (Warwick and Hook, 1995). Lignite deposits of the lower Wilcox Group and Jackson Group primarily formed in a barrier bar-strandplain depositional system, where clastic sediments were trapped as lagoonal muds up-dip of barrier bars (Kaiser, 1974).

East-Central Texas Coal Deposits

East-central Texas (fig. K2) is dominated with outcrops of Upper Cretaceous- and Tertiary-aged rocks with younger Quaternary sediments distributed along drainage systems of the Colorado, Brazos, and Trinity Rivers. The major coal-bearing formations within the region are found in the Wilcox, Claiborne, and Jackson Groups (see fig. K3). The Wilcox Group is divided into the Hooper, Simsboro, and Calvert Bluff Formations, which dip to the southeast increasing from 0.5° to 2°, from northeast to southwest (Tewalt and others, 1983; Tewalt and Jackson, 1991). Coal-bearing strata of the Wilcox Group formed during progradation of a delta in the region during the late Paleocene and early Eocene. The Hooper Formation of the lower Wilcox is characterized by multi-stacked, upward coarsening sedimentary layers including discontinuous lignites that were deposited as interdistributary peats (Kaiser, 1974). Discontinuously overlying the Hooper Formation is the Simsboro Formation, a massive, cross-bedded, quartz and kaolinitic sand that displays typical fluvial sedimentary structures (Bammel, 1979). Deposition slowed in the lower Eocene, allowing an extensive accumulation of thick blanket peats, mainly of marsh (non-woody) origin, to form at the contact between the Simsboro and the Calvert Bluffs Formations (fig. K3), with some coals containing woody material suggesting formation higher in the deltaic plain (Atlee and others, 1968; Kaiser, 1974). Most of the lignite of the Calvert Bluff Formation can be found at the contact with the Simsboro sands and within 200 feet of the overlying Carrizo Formation (middle Eocene Claiborne Group), but secondary occurrences are scattered irregularly throughout (Johnston and Jobling, 1979; Ayers and Kaiser, 1987).

The late Eocene-aged lignite-bearing intervals of the Yegua Formation (Claiborne Group) and the Manning Formation (Jackson Group) formed during transgressive–regressive cycles of deposition, with each cycle containing sediments from multiple environments (Yancey, 1997). Yancey (1997) characterized the Yegua-Jackson lignites to be part of a strand plain system, where peat was deposited near the marine shoreline, and was preserved as the shoreline migrated over the accumulated organic material.

Data

South Texas Coal Exploration Drill-Hole Dataset

The south Texas drill-hole dataset contains coal exploration information for 980 drill-hole locations within eight counties in the Gulf Coast region (fig. K1, table K3). Geophysical instruments were used on 939 drill holes and had an average depth of 254 feet, with a maximum depth of 367 feet. The 41 drill holes that did not have any probe depth information were assigned a depth of 0 within the attribute table. The area that has the densest coverage with 694 drill holes is along the margin of Upper Cretaceous- and Paleocene-aged sediments, extending from Eagle Pass to Bexar County, Texas (fig. K1). The remainder of the data (286 drill holes), explores Oligocene- to Eocene-aged sediments located along the Rio Grande from Webb County to Starr County, Texas. Due to the generalized nature of the original highway maps that contained the drill-hole information and the process of georeferencing these maps to a new base layer, we expect the location error to be ±0.25 mile.

East-Central Texas Coal Exploration Drill-Hole Dataset

The east-central Texas drill-hole dataset contains coal exploration information for 2,845 drill-hole locations within 17 counties in the Gulf Coast region (fig. K2, table K4). Geophysical instruments were used on 2,273 drill holes and had an average probe depth of 228 feet, with a maximum depth of 944 feet. The 572 drill-hole points that did not have a recorded probe depth were given a value of 0 within the attribute table. The drill-hole locations are concentrated in areas along the Wilcox and lower Claiborne Formation boundaries shown in figure K2, between Bastrop to Henderson Counties, and along the Upper Claiborne and Jackson Formation boundaries shown in figure K2, between Fayette and Trinity Counties. Due to the generalized nature of the original highway maps that contained the drill-hole information and the process of georeferencing these maps to a new base layer, we expect the location error to be ±0.25 mile.

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Appendix K1

The south Texas coal exploration drill-hole dataset in spreadsheet format is available at *pubs.usgs.gov/of/2011/1261/Appendices/K1-STX.xls.*

Appendix K2

The east-central coal exploration drill-hole dataset in spreadsheet format is available at *pubs.usgs.gov/of/2011/1261/Appendices/K2-ECTX.xls.*

Table K1. Attribute titles and data descriptions and formats for the south and east-central Texas drill-hole datasets.

Attribute title	Data description and format
DRILL-HOLE NAME	County code followed by drill-hole number. In some cases a county may have both a one-letter and two-letter code for drill-hole names.
COUNTY	County where the drill hole is located.
ELEVATION	Elevation above sea level in feet.
DEPTH_TOTAL	Depth of drill hole in feet.
DEPTH_PROBED	Depth of geophysical probe measurement in feet.
LATITUDE	Decimal degree location values given to 4 decimal places.
LONGITUDE	Decimal degree location values given to 4 decimal places.
COMMENT	Additional information regarding the entire drill hole.
X_C	Thickness of coal for bed number X in decimal feet.
X_CP	Thickness of coal and partings combined for bed number X in decimal feet.
X_DEPTH	Top depth of bed number X in feet.
X_BED	Coal bed regional name for coal bed X.
X_COMMENT	Additional information regarding coal bed X.

Table K2. Explanation of comments used to describe the south and east-central Texas drill-hole datasets (modified from J.A. Luppens, U.S. Geological Survey, written commun., 2009).—Continued

Symbol/Comment	Description
-	Notation is on the original coal exploration maps and is listed under the drill-hole name and elevation, with no coal data recorded. No information about the definition of this notation is listed on any of the Phillips coal exploration maps or drilling logs. The meaning of the notation is unknown.
“A”?	The letter “A” was written next to the surface elevation on the original maps. May be related to the occurrence of a geologic formation or a specific coal bed.
“B”?	The letter “B” was written next to the surface elevation on the original maps. May be related to the occurrence of a geologic formation or a specific coal bed.
?	Questionable data/information.
+	More coal than the amount that was recorded could be expected.
>	Greater than.
b	Found at the end of a drill-hole name if the name had already been used for another location in the dataset. This symbol was added after digitizing in order to give each drill hole a unique drill-hole name.
BED DEPTHS NOT RECORDED	No coal bed depth information was recorded on the original maps for this drill hole.
BH	Abbreviation for “bore hole.”
BLANK COAL	No data were recorded on the original maps for this location.
C (After the drill-hole name)	Found at the end of the drill-hole name representing that the drill hole was cored.
CARB ZONE	Describing that the coal bed is “carbonaceous” and that it contains a high ash content.
CARBY	Describing that the coal bed is “carbonaceous” and that it contains a high ash content.
CM	Abbreviation for “carbonaceous material.” The coal was described to contain a high ash content.
CORED	Indicating that the drill hole was cored.
DH	Abbreviation for “drill hole.”
DUPLICATE DH NAME	The drill-hole name was used for two different locations on the original coal exploration maps.
GAS LEAK	Observed natural gas seeping from the drill hole during exploration.

Table K2. Explanation of comments used to describe the south and east-central Texas drill-hole datasets (modified from J.A. Luppens, U.S. Geological Survey, written commun., 2009).—Continued

Symbol/Comment	Description
GRAVEL?	A gravel layer may have been found during exploration.
HB	This comment was written on the original coal exploration maps and the meaning is unknown. Could possibly be the abbreviation for "hole bridged," meaning that the drill-hole walls collapsed during exploration.
HOLE BRIDGED	The drill-hole walls collapsed during exploration.
I	Abbreviation for "inferior." Subjective term used to describe poor coal quality.
ILLEGIBLE	Original information on maps was not legible for this drill hole and may not be correct as transcribed.
ILLEGIBLE DEPTH	The coal depth was not legible on the original coal exploration maps and may not be accurate as transcribed.
ILLEGIBLE PROBE DEPTH	The probe depth was not legible on the original coal exploration maps and may not be accurate as transcribed.
INACCURATE LOCATION	Original coal exploration maps could not be accurately georeferenced due to insufficient reference points. Drill-hole location accuracy maybe greater than 0.25 miles.
INF	Abbreviation for "inferior." Subjective term used to describe low quality coal.
NC	Abbreviation for "no coal." No coal was found during exploration for this drill hole.
NDE	Abbreviation for "not deep enough." This comment was used on the original coal exploration maps for a drill hole when a particular coal bed was not found due to insufficient depth of exploration.
NO COAL	No coal was found during exploration for this drill hole.
NO DATA RECORDED	No data were recorded on original coal exploration maps for this drill hole.
NO ELEVATION RECORDED	No ground elevation information was recorded on the original coal exploration maps for this drill hole.
NO LOG	No geophysical logging was completed for this drill hole.
NO PROBE DEPTH RECORDED	No probe depth information was recorded on original coal exploration maps for this drill hole.
NP	Abbreviation for "not probed." Geophysical logging never occurred at this location.
NSL	Abbreviation for "no significant lignite." Coal may have been found during exploration but because the coal beds were thin (usually less than 2 feet thick) no coal data were recorded.
ODOR	Comment was written on the original coal exploration maps above the drill-hole name and the meaning is unknown.
OK	Comment was written at the end of coal-bed data on the original coal exploration maps and the meaning is unknown. Typically information written after coal-bed data subjectively describes the coal quality of the bed.
P	Abbreviation for "poor." A subjective term used to describe a low quality coal.
P BOTTOM	The coal quality of the bottom of the coal bed was found to be poor. Coal quality in the bed decreased with depth.
P.B.	Abbreviation for "poor bottom." The coal quality of the bottom of the coal bed was found to be poor. Coal quality in the coal bed decreased with depth.
P.T.	Abbreviation for "poor top." Poor coal quality on the top section of the coal bed. Quality improved with depth in the coal bed.
PI	Abbreviation for "partially inferior." Used to describe that a portion of the coal bed is of a low quality.
POOR	A subjective term used to describe coal of poor quality. In some cases only a portion of the entire coal bed was listed as "POOR" (example: POOR (1.5')).
RD (after the drill-hole name)	Abbreviation for "re-drill." Was used when a location had to be re-explored either due to problems with the first drill hole at the location or in some cases the location was re-drilled to explore deeper strata.
SCZ	Notation is listed with a depth range (example: 15-25' SCZ) on the original coal exploration maps with no coal data listed at the drill-hole location. No information about the definition of this notation is listed on any of the Phillips coal exploration maps or drilling logs. The meaning of the notation is unknown.

Table K2. Explanation of comments used to describe the south and east-central Texas drill-hole datasets (modified from J.A. Luppens, U.S. Geological Survey, written commun., 2009).—Continued

Symbol/Comment	Description
SL	Abbreviation for "silt." A layer of silt was encountered during exploration.
TD IN COAL	Terminated drilling in a coal bed. Coal extends deeper than the depth explored.
TRI	Abbreviation for "triangle." Signifies that the drill-hole/coal bed was cored during exploration.
TRIANGLES	Signifies that multiple coal beds were cored during exploration.
V. INF	Abbreviation for "very inferior." Subjective term used to describe coal of a very low quality.
VP	Abbreviation for "very poor." Subjective term used to describe coal of a very low quality.
WASHOUT	Occurs when a loose layer of material is eroded in the bore hole and the well diameter is enlarged.
WEATHERED	Used to describe coal that has been altered by chemical or physical means.
WSOUT	Abbreviation for "washout." Occurs when a loose layer of material is eroded in the bore hole and the well diameter is enlarged.

Table K3. South Texas counties and the number of drill holes by county.

County	Number of drill holes
Atascosa	32
Bexar	39
Maverick	208
Medina	374
Starr	35
Uvalde	41
Webb	167
Zapata	84
Total	980

Table K4. East-central Texas counties and the number of drill holes by county.

County	Number of drill holes
Anderson	4
Bastrop	160
Brazos	2
Burleson	334
Falls	7
Fayette	258
Freestone	591
Henderson	38
Houston	65
Lee	305
Leon	4
Limestone	629
Milam	175
Polk	4
Trinity	88
Walker	48
Washington	133
Total	2,845

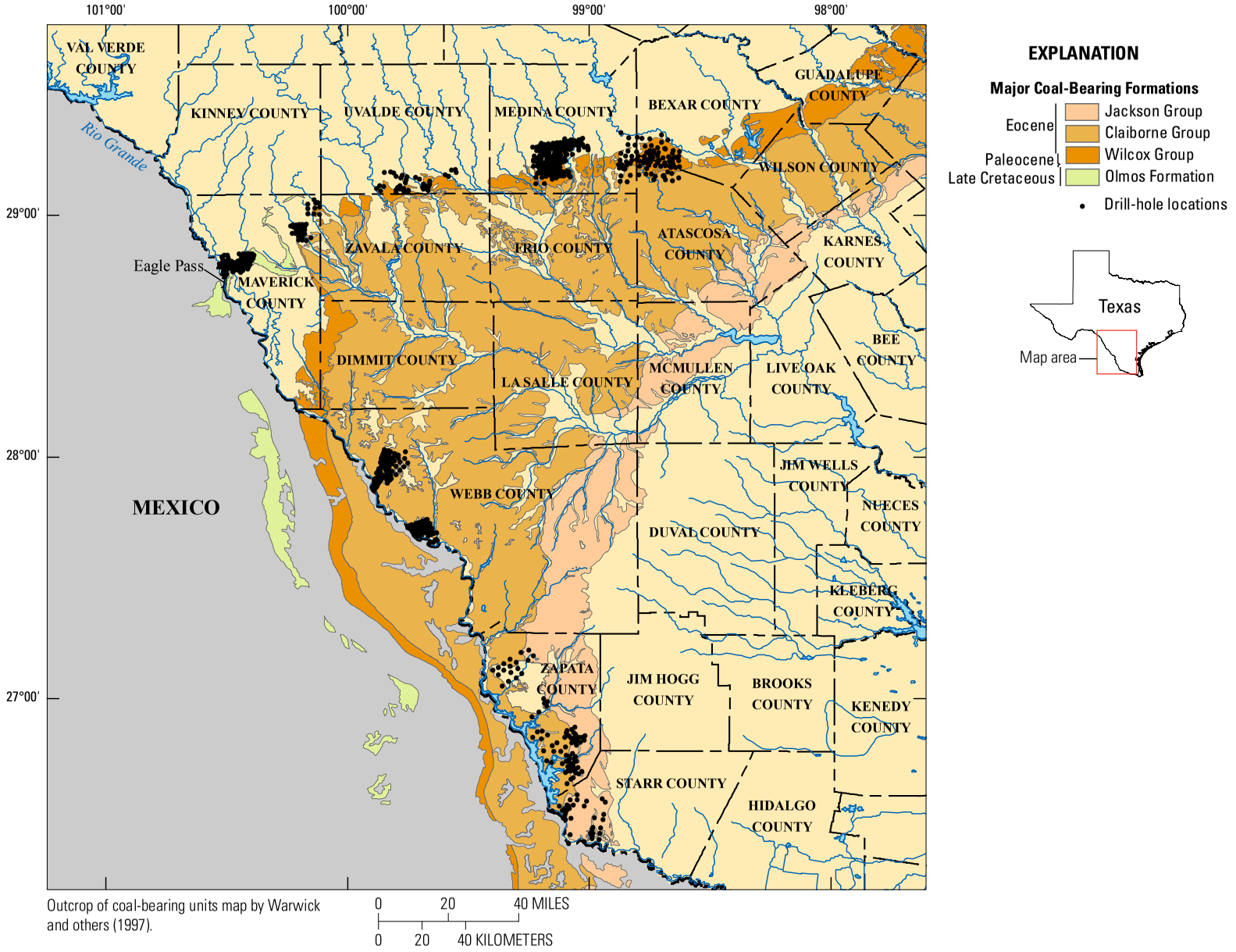
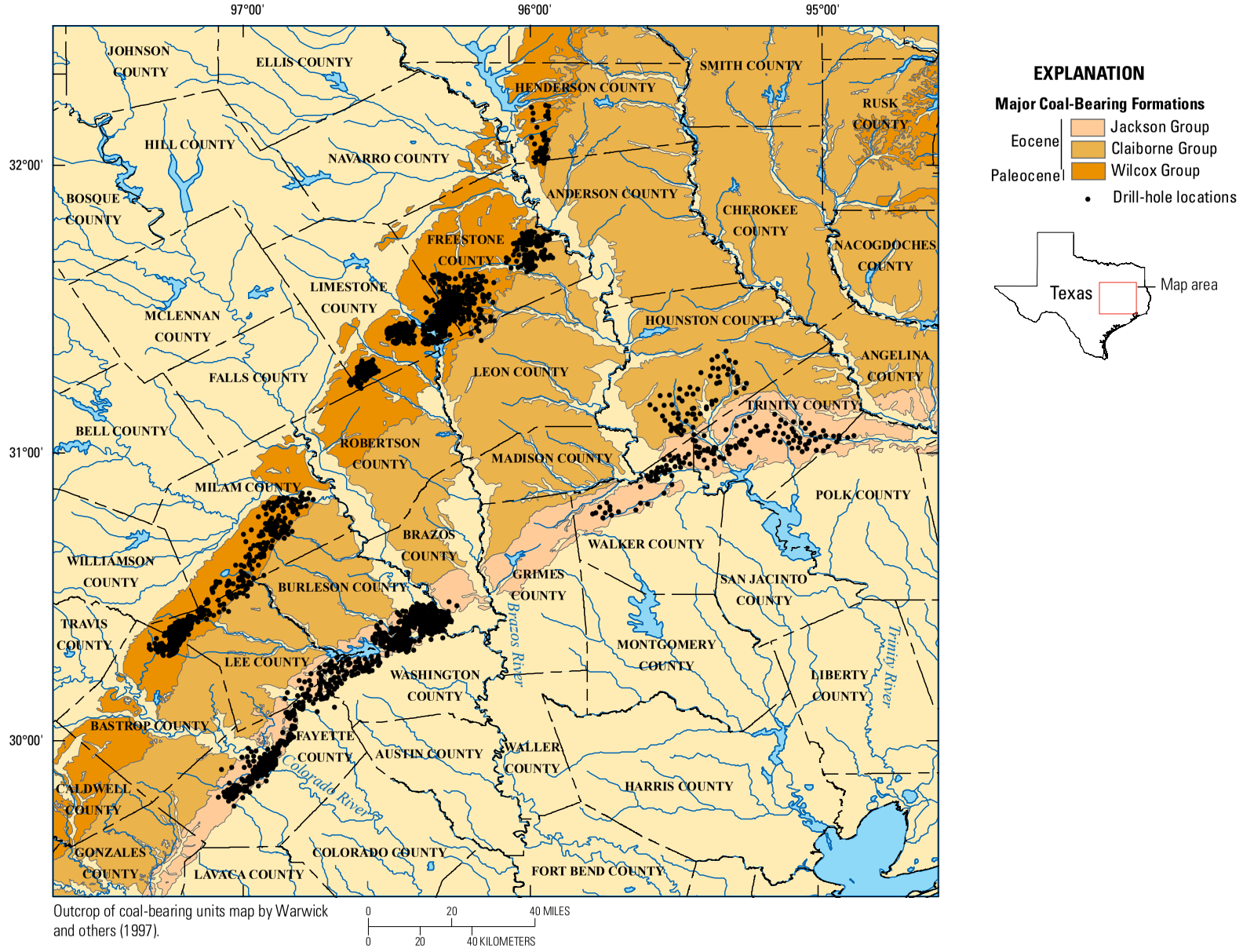


Figure K1. Regional map of south Texas with county boundaries overlaid with drill-hole locations and major coal-bearing formations of the Gulf Coast Region (Warwick and others, 1997).



Outcrop of coal-bearing units map by Warwick and others (1997).

Figure K2. Regional map of east-central Texas with county boundaries overlaid with drill-hole locations and major coal-bearing formations of the Gulf Coast Region (Warwick and others, 1997).

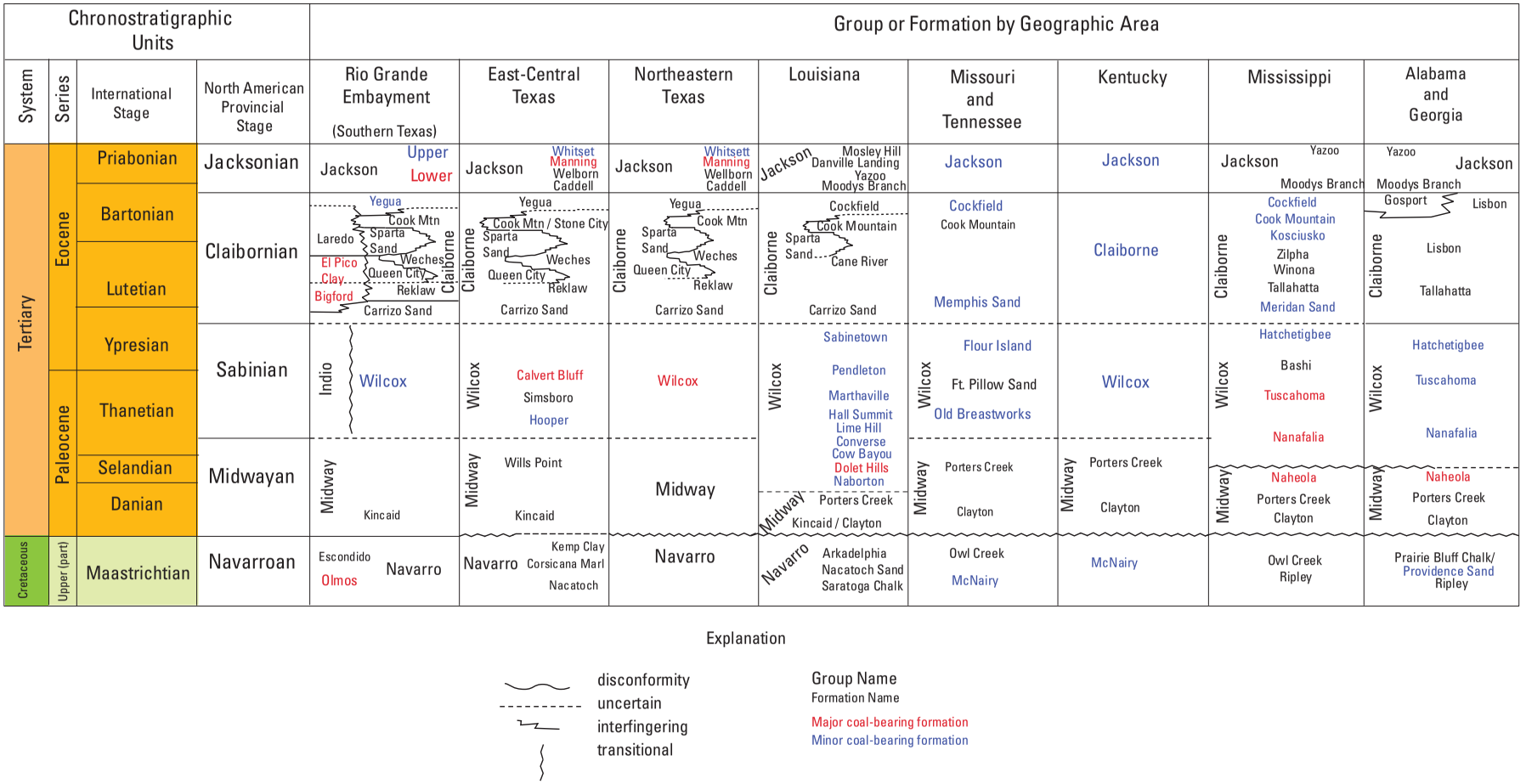


Figure K3. Generalized stratigraphic chart showing major and minor coal-bearing formations in the Mississippi Embayment and Gulf Coastal Plain (modified from Warwick and others, 1997; Ogg and others, 2008).