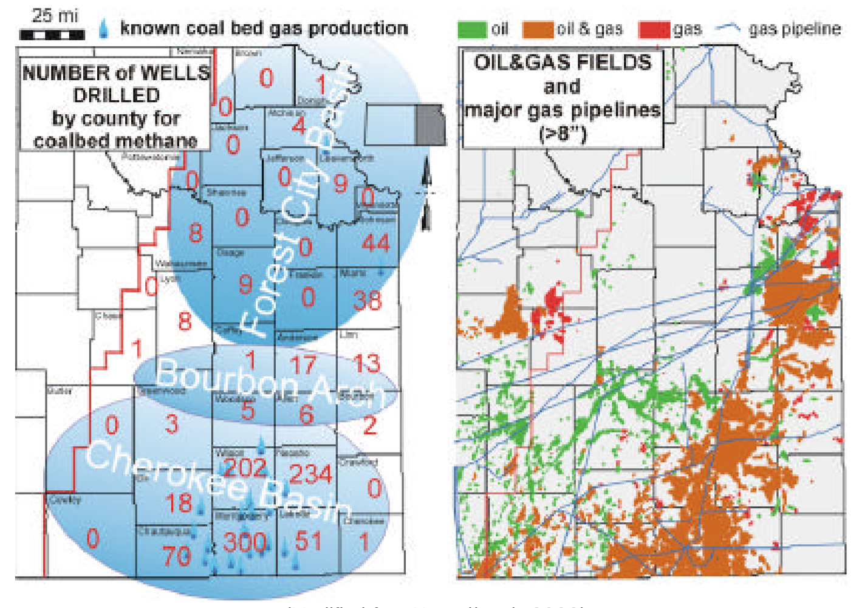
ABSTRACT

The Middle Pennsylvanian Series in eastern Kansas includes thin coal beds (typically less than 0.7m) within siliciclastic and carbonate successions. Across the study area, coal rank ranges from high-volatile A to B bituminous. Coalbed methane has become an active play due to contributing factors such as sufficient overburden, overlying seals of thick shale, the probability of encountering multiple coal beds in a single well, and excellent pipeline infrastructure. A better understanding of coalbed methane potential requires identification of thick (>0.5 m), gas-rich coals in proximity to existing pipelines.

Coal-forming depositional environments were interpreted by integrating core descriptions with well logs to construct cross sections and structure/isopach maps. Coal samples from cores and cuttings were analyzed for methane content and desorption rates, ash and sulfur contents, and other coal properties. Preliminary analysis of numerous coals shows gas contents ranging from 20 to 200 scf/ton between coals and across the Bourbon Arch region. Coal qualities also vary, on a moisture-free basis, from 6% to 50% ash and 1% to 10% sulfur. Coal-bearing successions were interpreted within a sequence stratigraphic framework to develop a better understanding of the lateral variability of coal thickness, quality, and gas content. Possible modern analogues of peat-forming settings for Pennsylvanian coals in eastern Kansas include fluvial or estuarine floodplains, deltaic interdistributaries, coastal strandplains, marshes, and back-barrier marine raised platforms and lowlands. The improved geologic understanding of Pennsylvanian coals should aid in coalbed methane exploration and development in eastern Kansas.

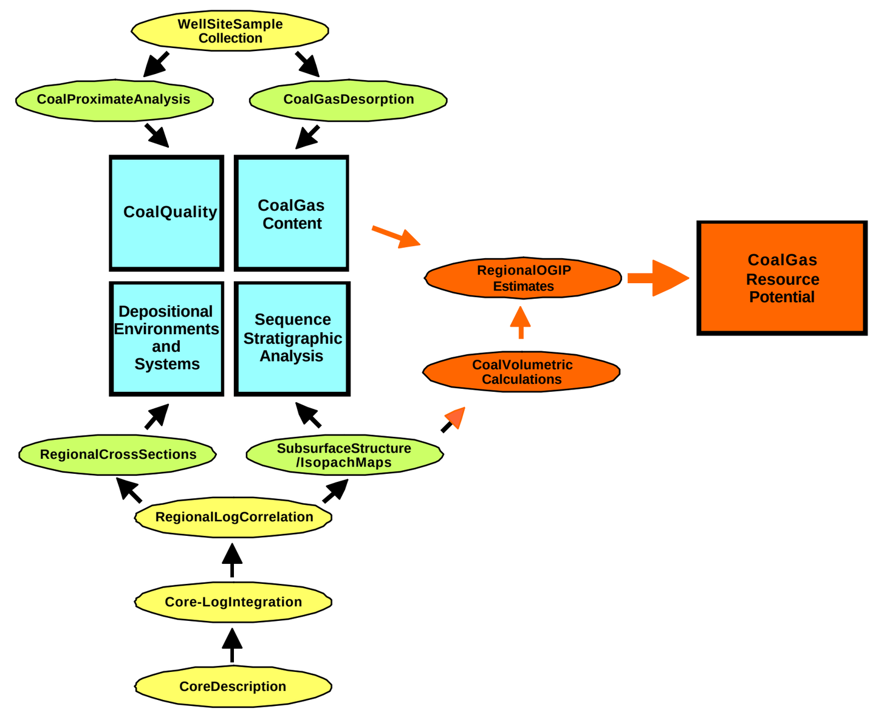
PETROLEUM SIGNIFICANCE

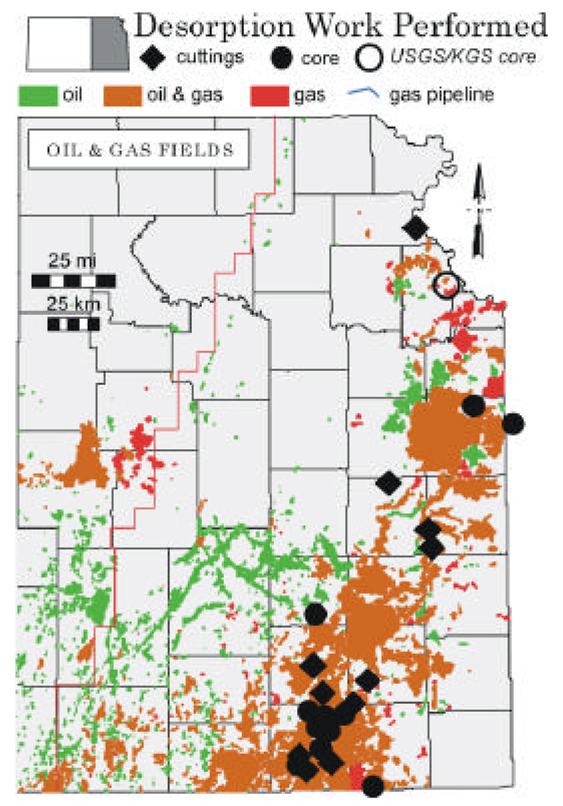


(Modified fromNewelletal.,2002)

Eastern Kansas is the setting of a growing coalbed gas play in recent years. Although most activity is concentrated in the more gas-rich Cherokee Basin in the southeastern part of the state, northward expansion into the Bourbon Arch and Forest City Basin is gaining momentum. Early expansion is partly controlled by a pre-existing pipeline infrastructure (Newell et al., 2002). Coalbed gas resource assessment may further aid companies and local operators in play development around and beyond this pipeline infrastructure.

METHODS

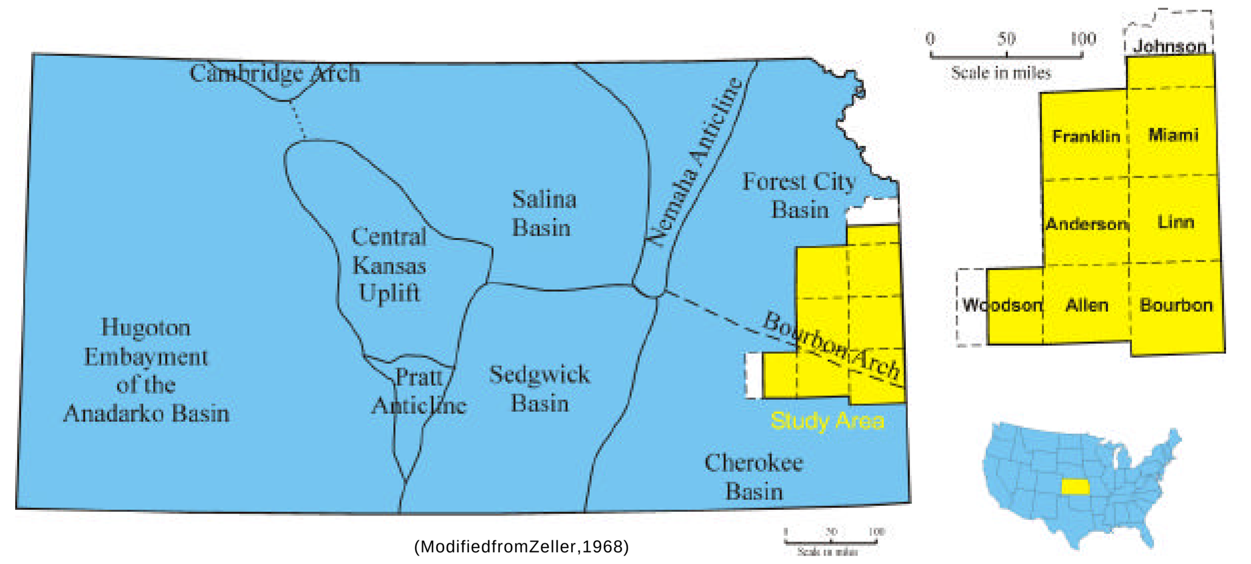





KGS coring operation in Woodson County, Kansas.

This study focuses on geologically significant coals with possibly large resource potential in eastern Kansas. Lithologic descriptions and interpretations of several continuous core and accompanying compensated density logs (CDL) serve as the basis for regional correlation of more than 800 other CDL and gamma ray-neutron logs over the area. Subsurface log cross sections, and coal and non-coal isopach maps, permit strata to be depositionally interpreted and placed into a sequence stratigraphic framework. Coal quality and gas desorption data are related to peat-forming environment and sequence stratigraphic position to discern the controls on coalbed gas productivity. Through the use of coal-gas content and quality data, this study assesses potential coalbed gas resources for the Bourbon Arch region of eastern Kansas.

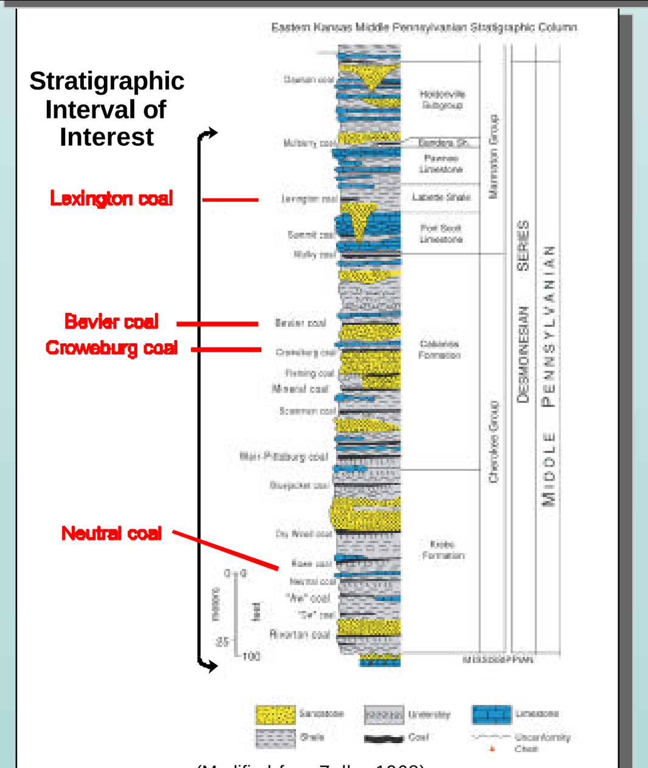
GEOLOGIC BACKGROUND



(ModifiedfromZeller,1968)

The study area encompasses eight counties of east-central Kansas overlying and flanking the Bourbon Arch -- a low, WNW-ESE-trending structural feature dividing the Forest City Basin from the Cherokee and Arkoma basins (Jewett, 1951). The Bourbon Arch and adjacent basins are bound by early Middle Pennsylvanian (Atokan) orogenic features -- the Nemaha Uplift to the west and the Ouachita foldbelt to the south -- and by the pre-Pennsylvanian Ozark Dome to the east. All three tectonic features may have acted as the source of Desmoinesian sediments in the region (Rascoe and Adler, 1983). According to Golonka et al. (1994), the study area was considered to be near-equatorial and humid, with seasonal variations in rainfall as evident by the semi-vertic pedogenic nature of the paleosols underlying coals.

STRATIGRAPHY



(Modified fromZeller,1968)

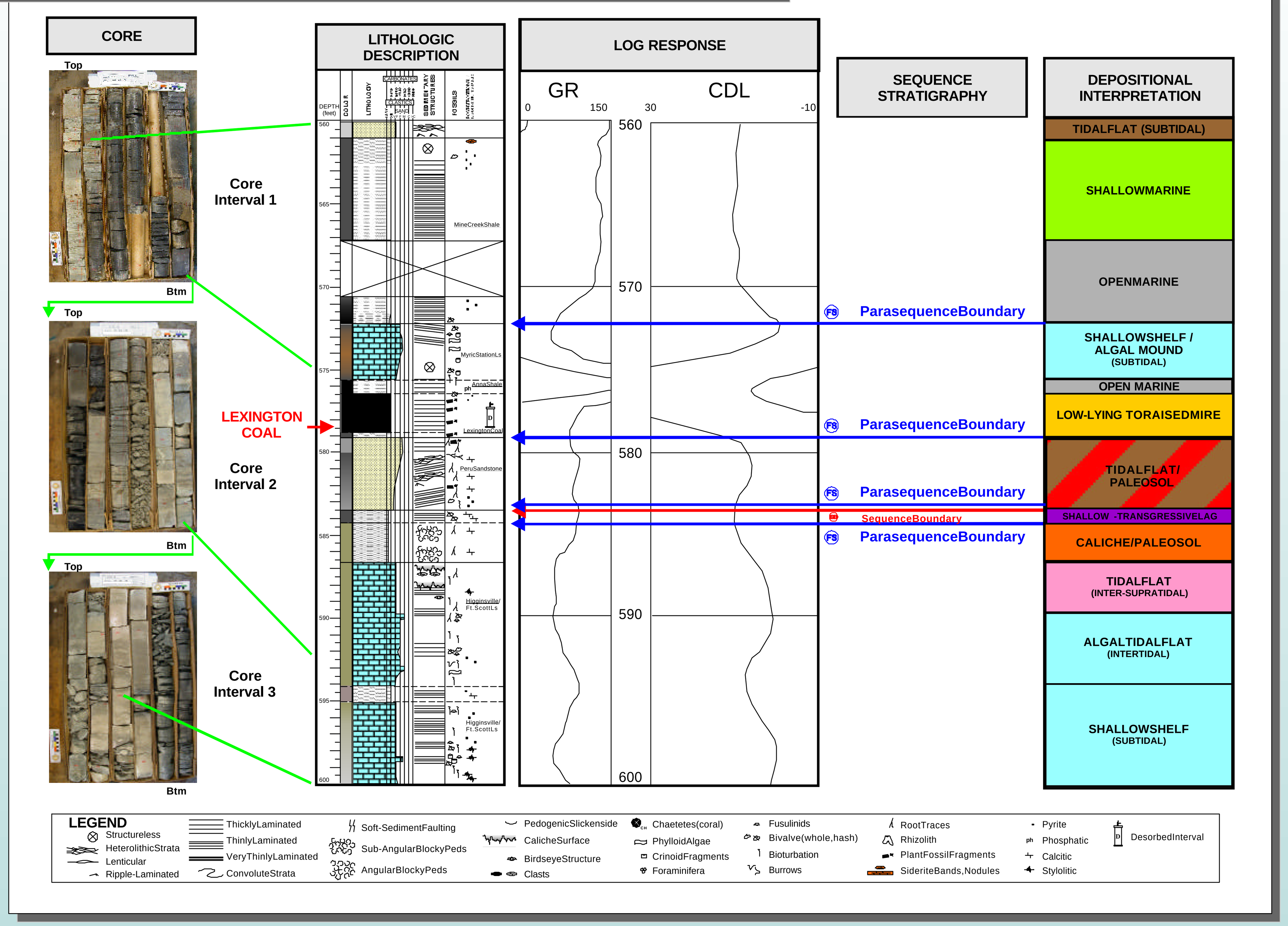
The Middle Pennsylvanian Series (Desmoinesian Stage) of eastern Kansas includes numerous thin (<28 inches or 0.71m) coal seams within both siliciclastic and mixed siliciclastic-carbonate "Kansas-type" cyclothems. Coals range in maturity from high-volatile A to B bituminous within the study area (Jewett et al., 1968; Brady, 1997). Atokan and younger sediments found in the Forest City Basin onlap the northern part of the Bourbon Arch. Desmoinesian sediments become thinner over the arch, but are continuous into the Cherokee Basin where they thicken with paleodepth. Mid-Pennsylvanian sediments rest unconformably on a karsted Mississippian carbonate surface.

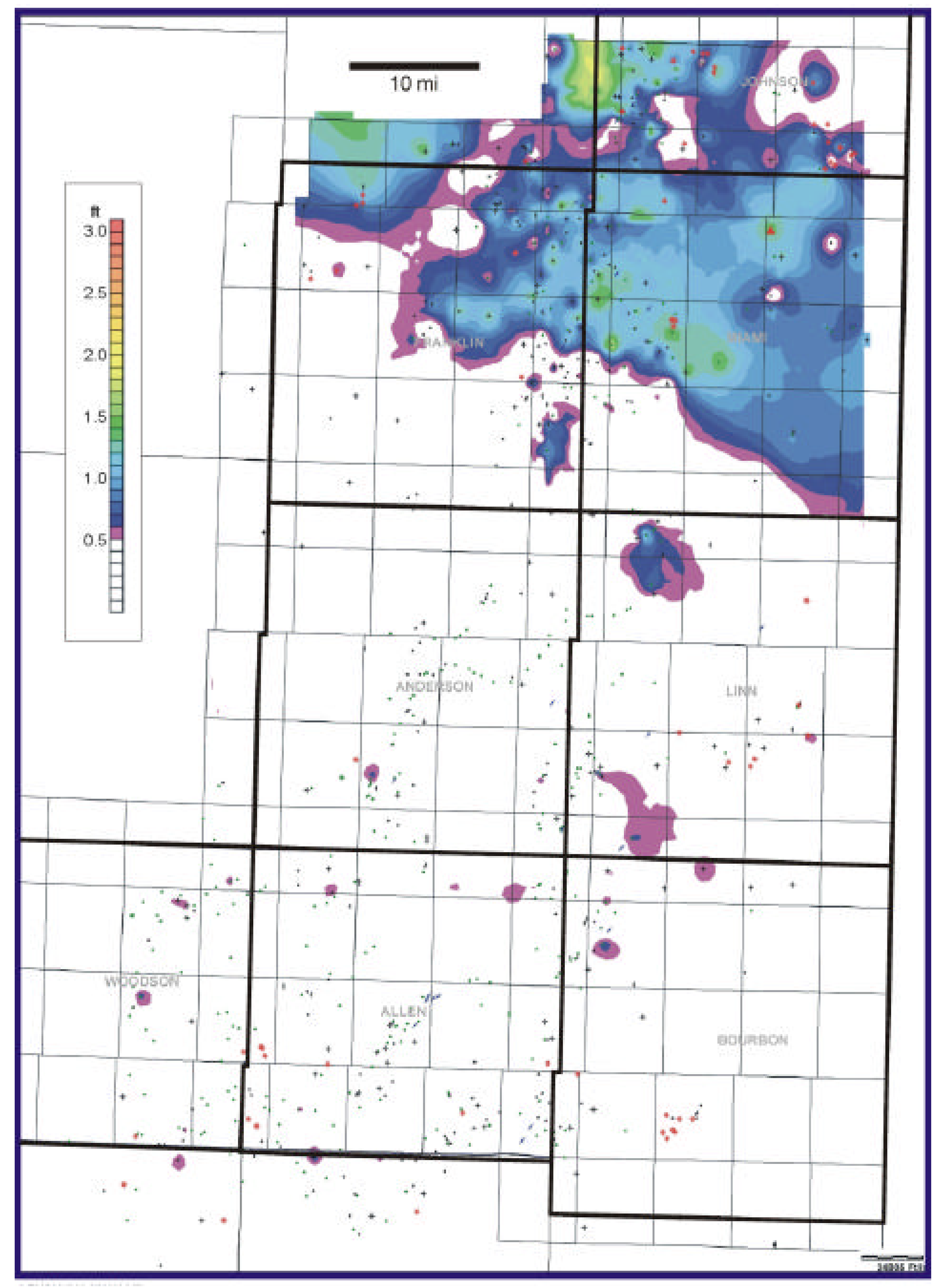
Four coals are discussed in this poster: Lexington, Bevier, Croweburg, and Neutral.

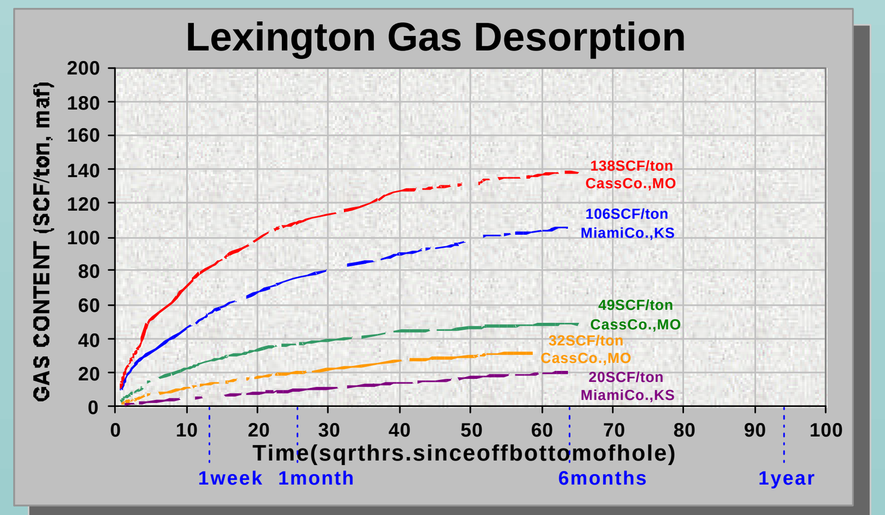
DEPOSITIONAL ENVIRONMENTS: LEXINGTON COAL

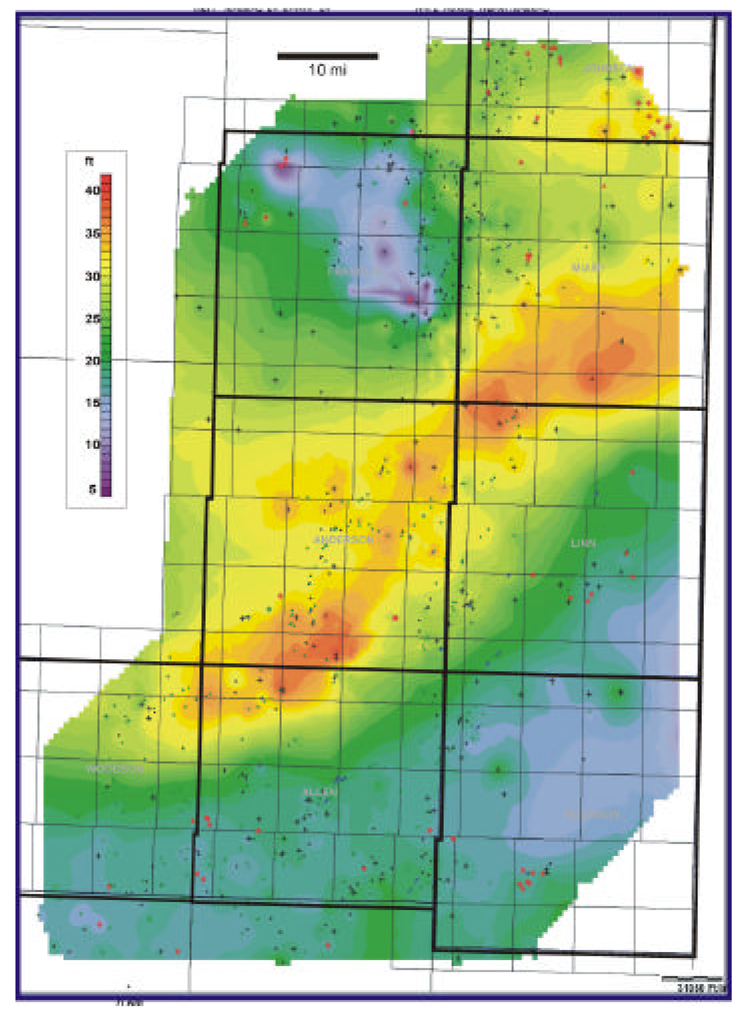
Due to depositional hiatus, peat-forming environments and their overlying and underlying sediments are not necessarily related (McCabe, 1984). However, depositional environments can influence coal-seam geometry, thickness, lateral extent, and ash and sulfur contents (McCabe, 1991). These characteristics, along with the type of peat-forming environment, may affect coal-gas productivity. Additionally, depositional interpretation allows for the placement of coals and adjacent strata into a sequence stratigraphic framework resulting in a better understanding of the variability of coal characteristics and gas potential.

The information (lithologic descriptions and interpretations, log curves, and coal-quality and gas-content data) presented for the four selected coals of this poster are based from a core location in Miami County, Kansas.




Lexington Coal Isopach Map (C.I. = 0.1 ft.)




HigginsvilleIsopach (C.I. = 1 ft.)

The Lexington coal is only present in the northeastern portion of the study area where it appears to form in the isopach lows of the underlying Higginsville Limestone Member. Isopach highs and flanks in the Higginsville Limestone Member are interpreted as carbonate mounds. In core, the Lexington lies directly above a heterolithic, tide-influenced sand that infills eroded valleys in the Higginsville. Ash and sulfur contents indicate that the peat may have formed in a low to slightly raised mire with some marine influence and protection from detrital influx. The Lexington at relatively shallow depth has high gas contents (>100 scf/ton)--higher than deeper coals within the same well.

Coal	Depth (below surface)	Orientation	Geometry	Extent	Thickness	Ash	S	Btu(k)/lb	Depositional Environment	Gas Content scf/ton
Lexington (Regional)	320-790ft; 502ftavg	Dip	Elongate, circularpods	Several townships	<3.0ft	10-66%; 39%avg	1.1-3.4%; 2.6%avg	14.5-14.7; 14.6avg	Estuarinetidal flats-lows of karsted carbonate	20-138; 80avg
Lexington (MiamiCo.)	576feet				2.4ft	10-17%; 14%avg	3.4%;	14.5		20-106; 77avg