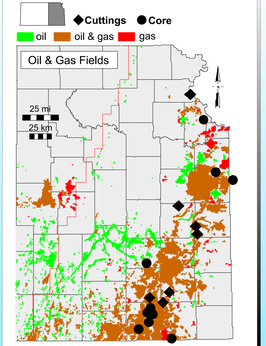
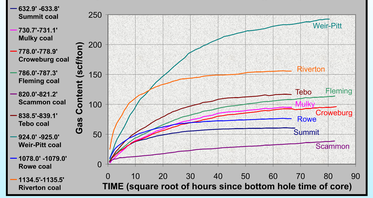
Desorption Work Performed

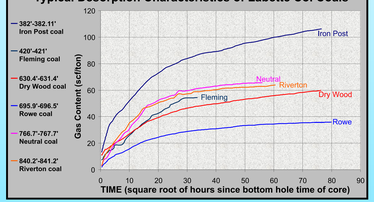


Locations of core and cuttings samples desorbed for gas content from eastern Kansas.

Typical Desorption Characteristics of Montgomery Co. Coals

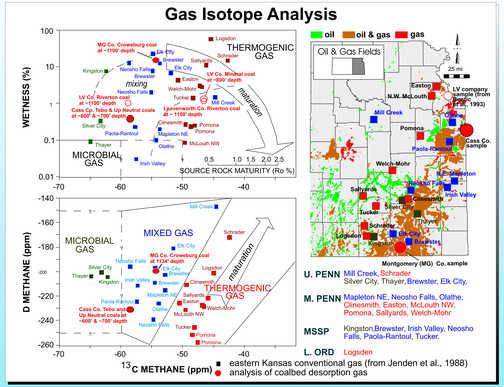


Typical Desorption Characteristics of Labette Co. Coals



Typical desorption characteristics for coal from Montgomery and Labette counties. In general, coals have higher gas contents in Montgomery County as opposed to Labette County. This may be due to the up-dip nature of coal deposits in Labette County or the fact sampling has been more limited within the county.

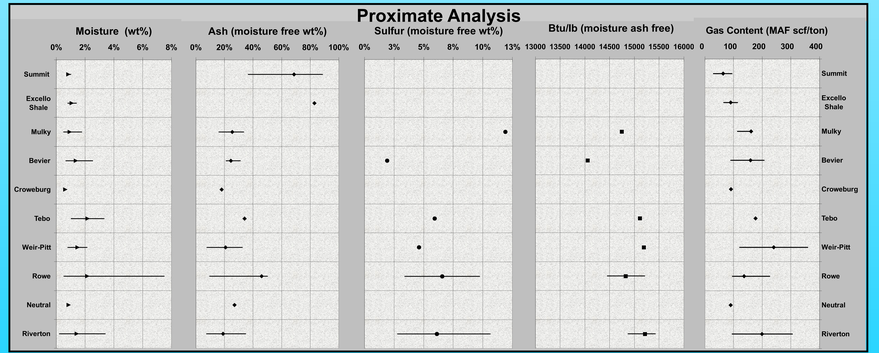
Gas Isotope Analysis



Lower plot of methane D vs. methane ^{13}C, suggests that natural gases in eastern Kansas are derived from three different origins (thermogenic, microbial carbon dioxide reduction and microbial). Of the conventional gases sampled in the Cherokee basin most have intermediate compositions that suggest a mixed thermogenic and microbial origin. Coal gases sampled in Montgomery County and Cass County also have intermediate compositions.

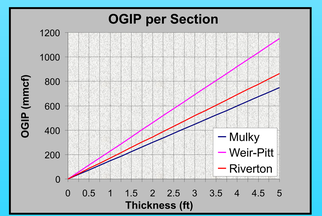
Upper plot of wetness vs. methane ^{13}C supports a mixing of microbial and thermogenic gases. Most Cherokee basin samples plot below the thermogenic gas arrow and in the mixed gas field suggesting a microbial and thermogenic origin. Coal gases sampled in Montgomery County, Leavenworth County and Cass County also have mixed origins.

Proximate Analysis



The ASTM Book of Standards (2002) describes the process of proximal analysis on coals. To report analytical results on a dry (moisture free) basis, moisture content needs to be determined first. Testing for moisture entails calculating the weight loss of a sample when heated. Determining ash content involves burning the sample and weighing the residue. Ash is an important indicator of clastic input, likely derived from marine invasion during peat development. Calculation of sulfur entails mixing part of the sample with Eschka mixture, the sulfur dissolves in hot water and precipitates as barium sulfate. The barium sulfate is filtered, ashed, and weighed. Sulfur content is an indicator of coal quality. The graphs above show a relationship between ash and sulfur, where ash content increases with sulfur content. Like ash, coals with higher sulfur contents reflect a marine influence. Once calculations for moisture and ash content are obtained the calorific value (Btu/lb) can be determined on a moisture ash free basis. Calculating the calorific value involves burning a sample in an adiabatic oxygen bomb calorimeter. Observation of temperature before and after combustion represents the calorific value. The calorific value provides a basis to determine rank of coals. For example, coals such as the ones above have calorific values greater or equal to 14,000 Btu/lb and are classified as high-volatile A bituminous.

OGIP per Section

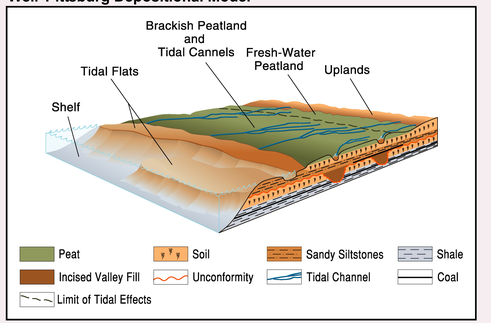


Gas in place per section (one square mile) assuming a constant thickness in coal and given an average gas content of 130 scf/ton for the Mulky, 200 scf/ton for the Weir-Pittsburg and 150 scf/ton for the Riverton.

Poster available online at:
http://www.kgs.ku.edu/PRS/Publication/2003/ofr2003-28/index.html

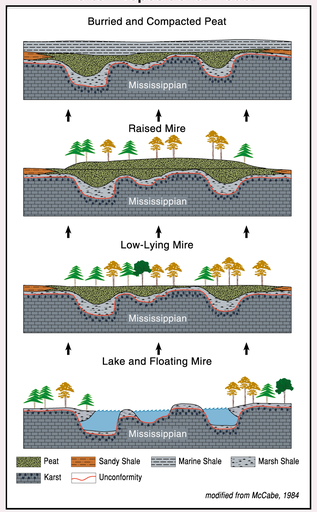
Depositional Models

Weir-Pittsburg Depositional Model



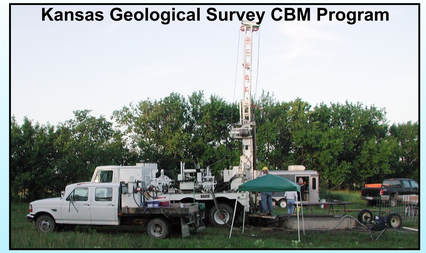
Peatlands in coastal plains develop above and behind open and back barrier shorelines, on estuaries, above infilled lagoons, and atop interfluves (Flores, 1993). Sustained growth and preservation of peat requires protection from marine influence. A gradual increase of base level will raise the water table aiding in the growth of mires. Continued transgression will eventually bury the peatland, protecting it from marine processes. Low-lying peatlands are prone to tidal effects and form brackish mires, while fresh water peatlands form in elevated areas and migrate across the low-lying mires to form protected raised mires (Flores, 1993).

Riverton Depositional Model



The karst topography on top of the Mississippian limestones provided many low-lying areas where lakes and marshes developed. Low-lying mires formed across lows as the water table rose during a gradual transgression. Raised mires developed above the low-lying mires and sustained their own water table while building upward (McCabe, 1991). Margins of raised mires are typically steep and pinch out into marginal marine sediments. Continued transgression eventually buried and compacted the peat formed in the mires. As a result, Riverton coals will tend to thicken into Mississippian lows where peat developed from both raised and low-lying mires.

Kansas Geological Survey CBM Program



The Kansas Geological Survey plans on continuing the research of Middle Pennsylvanian coalbed methane resources throughout eastern Kansas. Masters thesis work for the Bourbon arch is in progress, while thesis work for the Forest City basin and along the Nemaha ridge will start in the near future.

Conclusions

Thicker and laterally extensive coals develop toward the end of the transgressive systems tract and beginning of the highstand systems tract.

The Mulky coal is associated with marine carbonate sediments, which explain its tendency to be a carbonaceous shale or high-ash coal.

The geometry, orientation and associated depositional environments of the Weir-Pittsburg coal is interpreted as a mire on a coastal plain environment.

The Riverton coal is interpreted to have accumulated in raised and low-lying mires above marsh and lake environments associated with the karstic Mississippian limestone lows. The Riverton coal thickens into Mississippian lows and thins on highs.

Based on preliminary gas isotopic analysis, Cherokee basin coal gas samples represent a mixed thermogenic and microbial origin.

Preliminary desorption data indicates that coals of the central part of the Cherokee basin have higher methane contents than coals at the margins of the basin.

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