Internet Map Services Building on Oil and Gas Payzone Dataset

Sources of Data - Related Projects

The large panel examples to the right and below show recent project work in Illinois involving oil & gas and coal-related datasets, respectively, *Examples of Custom Maps Created With New Payzone Database* and *Coalbed Methane Potential in Illinois – Regional Mapping Data*. Datasets from these projects are also of interest to MIDCARB and other geologic carbon sequestration studies in that the injection of CO2 into these geologic reservoirs can enhance the production of oil and coalbed methane. Viable products are recovered, and the environmental benefit of CO2 capture underground, in depleted oil reservoirs and unminable coal seams, is realized. These map examples show a sampling of the variety, level of detail, and complexity inherent in certain geologic datasets that may contain too much information for multi-state IMS projects having a larger scope or focus.

Use of Oracle Database and ArcSDE

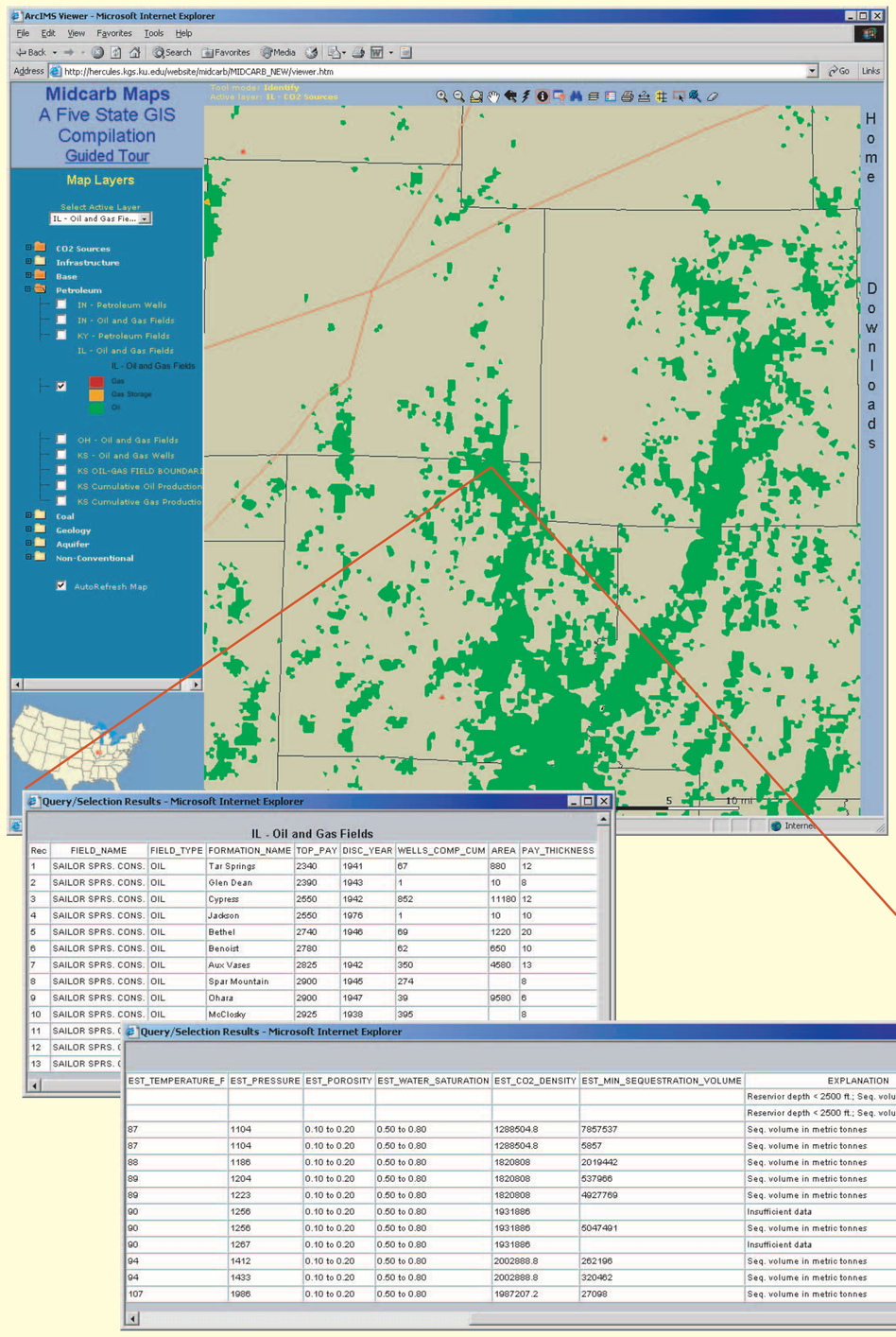
Mapping or database projects such as these have generated important data that are related to, and shared within the MIDCARB project website. Some data tables are a foundation for derivative or custom mapping and database work, and serve well the purpose of regional studies like MIDCARB when they are summarized and joined to regional spatial data layers using Oracle and ArcSDE. The joining of database tables via common data fields allows for flexibility, and the scaling of data to match the needs of different users and audiences.

One of the challenges faced by a multi-state, group IMS project such as MIDCARB is to serve and share as much data as possible, while limiting the detail to that which is not overwhelming to the users of the website, or the website itself.

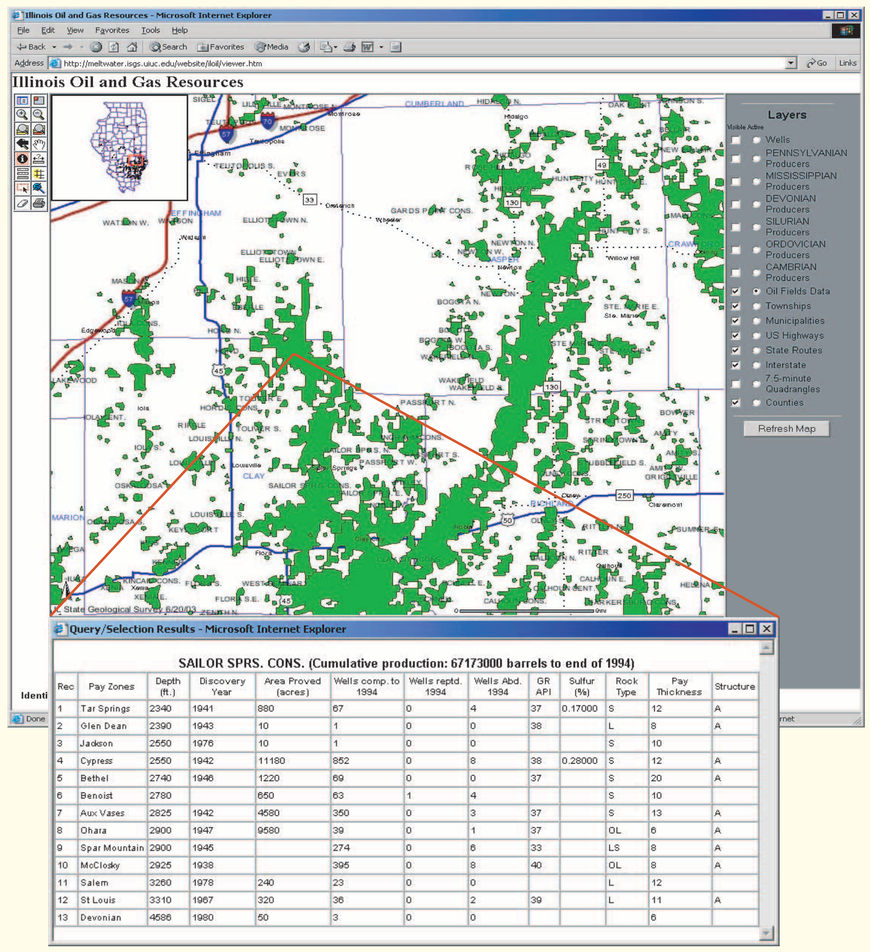
IMS Applications

The screen-capture images show examples of two different internet mapping projects (MIDCARB and ILOIL) built on the same oil and gas payzone dataset. These projects focus on presenting different components of the data for analysis, such as reservoir characteristics for potential CO2 storage, or production summary and well information for oil and gas development.

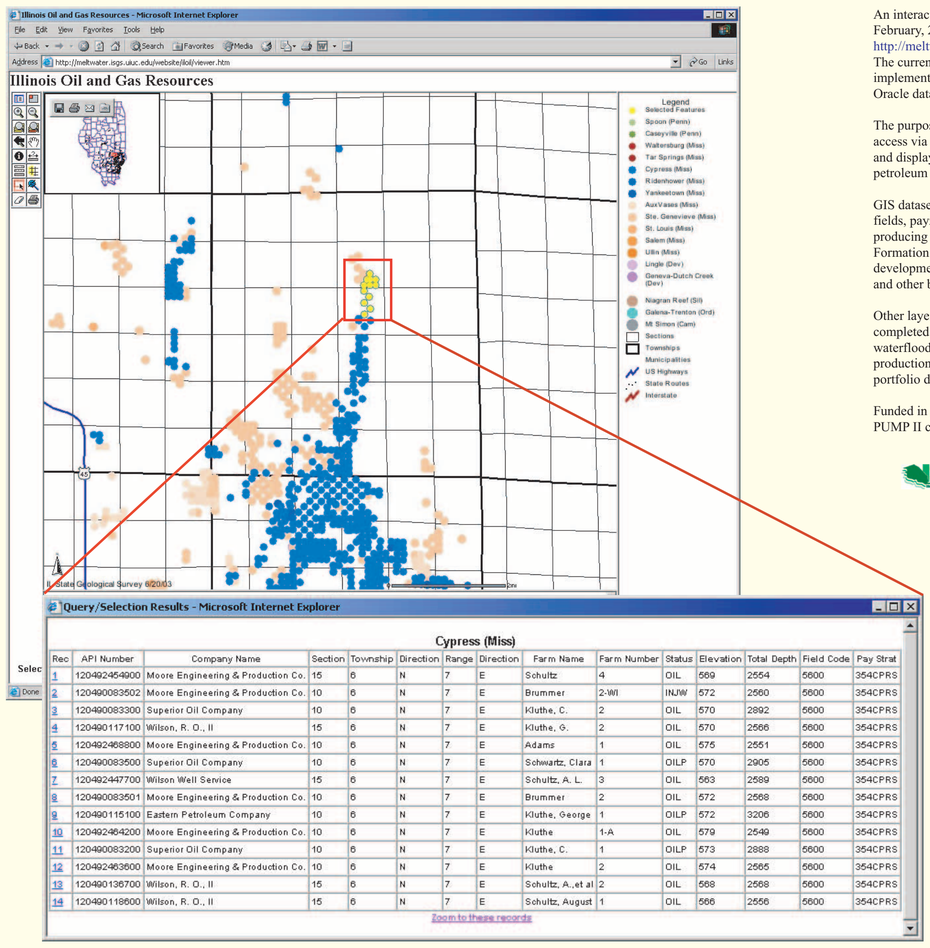
Future directions include using ArcMap Server for IMS (ILOIL), and building on the coalbed methane project results to incorporate volumetric data and estimations of CO2 sequestration potential along with similar reservoir calculations for saline aquifers and unconventional reservoirs (MIDCARB).



Use of payzone dataset in MIDCARB IMS application: Payzone data are summarized per oilfield. New datafields for oil and gas reservior characteristics (Temperature, Pressure, Porosity, Water Saturation) were added to basic payzone data (Formation Name, Top of Pay, Thickness, etc.) for this project. These values were used to calculate estimations of potential CO2 storage volumes in the reservoirs. Detailed study of reservior geology and volumetrics along with CO2/oil interactions is needed to further characterize individual reservoirs for sequestration potential.



Use of payzone dataset in ILOIL IMS application, Example 1: As with MIDCARB example, payzone data are summarized per oilfield. Additional production and well count information included here is useful to oil and gas operators and developers.



Use of payzone dataset in ILOIL IMS application, Example 2: As the user zooms in, payzone and well data are combined and listed per oil well. At this zoom level, location information as well as payzone information per well are important to users. Shown selected (in yellow) is a small area of oil wells containing payzone information for the Cypress Formation in southeastern Illinois.

An interactive map website was activated in February, 2003 and can be accessed at http://meltwater.isgs.uiuc.edu/website/iloil . The current ILOIL IMS application was implemented with ESRI ArcIMS4.0, ArcSDE, and Oracle database applications.

The purpose of the ILOIL IMS is to enable public access via their Web browser to interactively search and display various GIS datasets pertinent to petroleum exploration and development in Illinois.

GIS datasets used in the IMS include oil and gas fields, payzone summary data tables, oil wells, producing wells classified by Series and/or Formation payzone strata, and oil and gas development map overlays as well as infrastructure and other basemap layers.

Other layers to be added as contract subtasks are completed include contoured structure maps, waterflood unit coverages, waterflood injection and production data tables, core analysis data, and play portfolio data.

Funded in part by U.S. Department of Energy PUMP II contract.

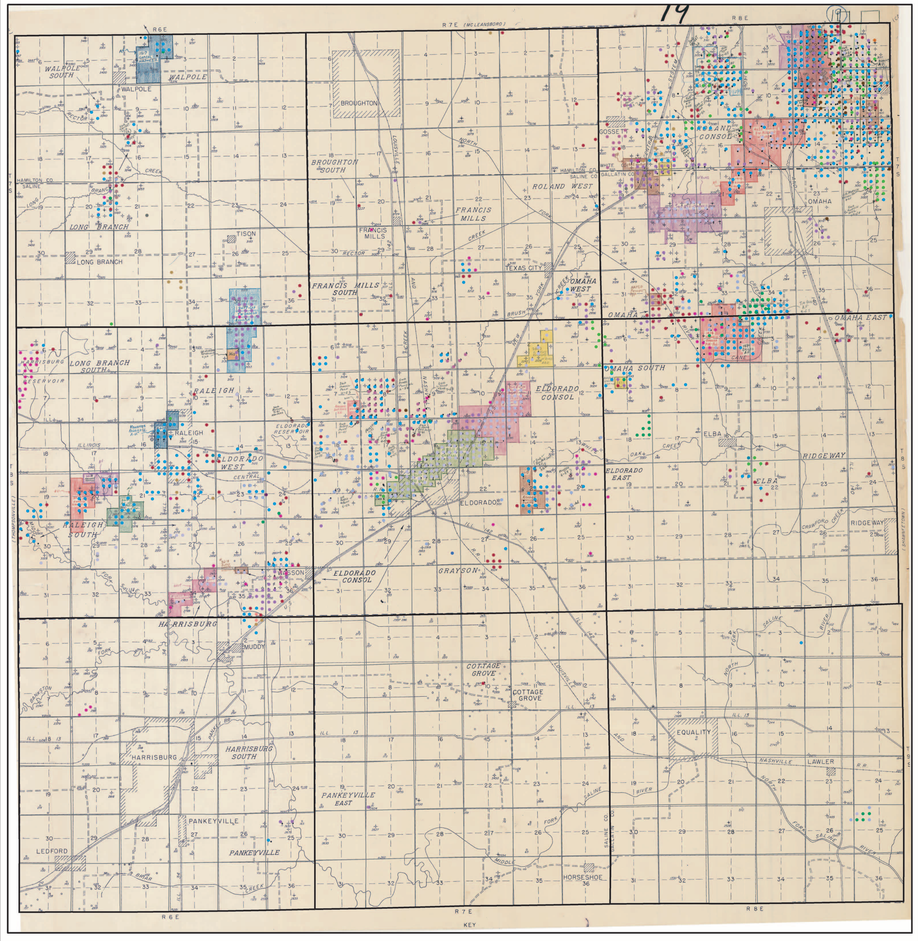
MIDCARB is:

Funding by:

-cpk 7/1/03

Examples of Custom Maps Created With New Payzone Database

Producing Wells from Eldorado Development Map with Scanned Image of Eldorado Waterflood Map



ILLINOIS STATE GEOLOGICAL SURVEY

Producing Wells from Eldorado Development Map with Scanned Image of Eldorado Waterflood Map

LEGEND

PAYZONE

353WRSW	354CLOR	354HRBG	354TSPG	404HRBGC		
353TGV	354AVIS	354CPRS	354MNRD	354WLBG	404NOG_C	
353TSTG	354BNST	354DGON	354PLSN	403BIHL	409PSLV	
353STLS	354BTHL	354GLCD	354RNLT	404CBDL	Townships	
					Sections	

0 3,500 7,000 14,000 21,000 28,000 Feet

1 inch equals 2.288510 miles

1:145,000

N

ISGS Illinois State Geological Survey

PHILIP JOHANEK, STEVE GUSTISON and JOAN CROCKETT
Illinois Geological Survey, Champaign, IL

ILLINOIS DEPARTMENT OF NATURAL RESOURCES

The combined use of a digital database along with other background information to create custom maps is only limited by one's imagination. The Illinois State Geological Survey (ISGS) offers custom mapping to service the petroleum industry. These three examples represent the wide range of possibilities. The left panel combines the spatial information from a geo-tiff showing waterflood unit outlines that have been overlain by a color plot of current payzone information. These type maps are excellent ways to align historical observations with current data. The middle panel shows current payzone data plotted over a Digital Ortho-quarterquad (DOQQ) comprising the Stephen A. Forbes State Park area. State regulations prohibited any drilling inside the park boundaries so horizontal drilling technology was used successfully to position this important discovery well. These type maps support operations around environmentally sensitive areas. Industry also uses this type of map to assist project designs for flow lines and injection systems. The third panel shows a previously published contoured map that was scanned and geo-referenced and then overlain with wells producing from the Silurian/Devonian and Trenton formations. These regional type maps allow for easier recognition of producing trends and their associated structure to show prospective areas not yet explored.

The Miletus Oil Field and the Stephen A. Forbes State Park

Legend

- Dry Holes
- Bethel
- Aux Vases
- McClosky
- Carper
- Geneva
- Horizontal/Directional
- Stephen A. Forbes State Park
- Townships

0 2,300 4,600 6,900 Feet

1 inch equals 0.631313 miles

1:40,000

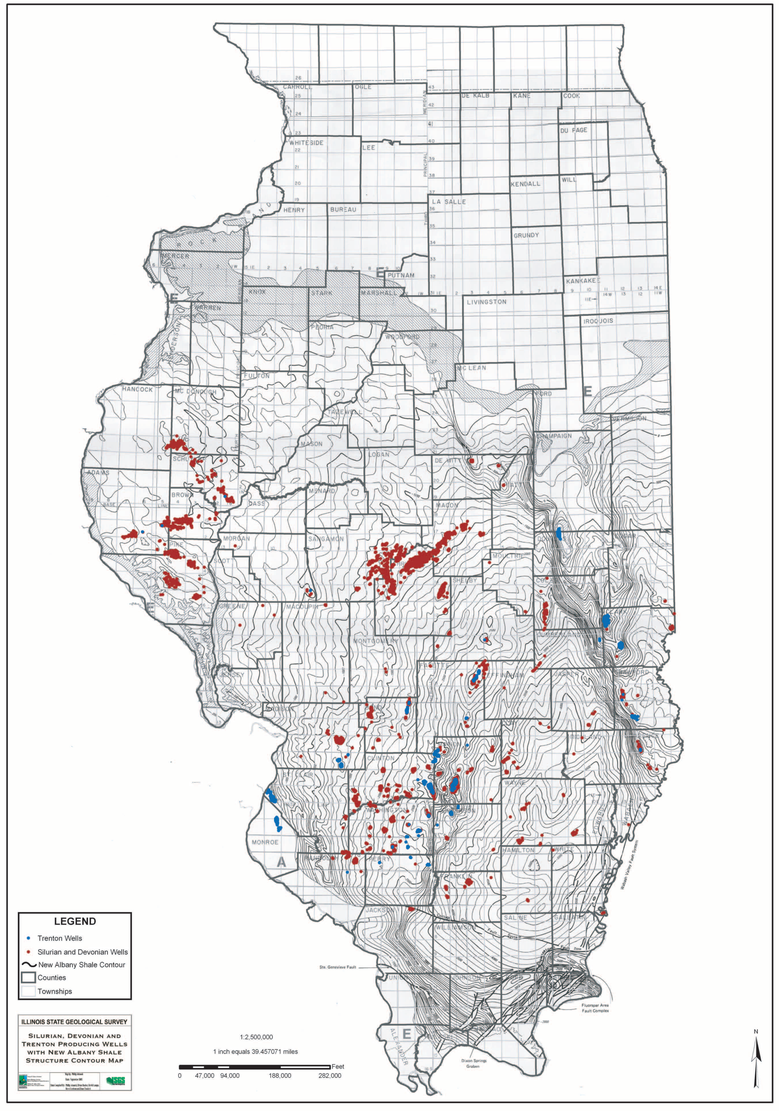
Dashed white lines terminate at approximate bottom hole location for horizontal and directional wells.

ISGS Illinois State Geological Survey

This map represents the Miletus oil field and the neighboring area, including the Stephen A. Forbes State Park.

This map created on 29 March 2002 by Philip Johanek at the Illinois State Geological Survey.

Silurian, Devonian and Trenton Producing Wells with New Albany Shale Stucture Contour Map



LEGEND

- Trenton Wells
- Silurian and Devonian Wells
- New Albany Shale Contour
- Counties
- Townships

ILLINOIS STATE GEOLOGICAL SURVEY

Silurian, Devonian and Trenton Producing Wells with New Albany Shale Structure Contour Map

1:2,500,000

1 inch equals 39.457071 miles

0 47,000 94,000 188,000 282,000 Feet

N

COALBED METHANE POTENTIAL IN ILLINOIS - REGIONAL MAPPING DATA

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Introduction

Renewed interest in coalbed methane (CBM) in the U.S. is likely to be sustained over the next decade as natural gas demand is expected to exceed 33 trillion cubic feet (Tcf) per year by 2020 from about 23 Tcf currently (EIA, 2002), mostly due to the increasing share of natural gas for generating electricity from newly built power plants. Proven CBM reserves of the U. S. have steadily increased from less than 4 Tcf in 1989 to almost 16 Tcf in 2000, and provided 1.25 Tcf gas production in 2000 (EIA, 2002). As a result, CBM accounted for 9% of proved reserves and 7% of production of dry natural gas in the U.S. for the year 2000.

In spite of large coal resources, commercial coal gas production in Illinois Basin has been restricted to relatively small amounts of production of abandoned mine gas. Other than such mine gas production, Illinois does not have any commercial CBM production directly from virgin coal seams. Part of the reason is that there has not been much effort to determine well completion and treatment techniques that are suitable for local conditions because of the uncertainty of recoverable reserves and lack of local infrastructure to deliver the gas to major distribution lines. Therefore, the Illinois State Geological Survey (ISGS) initiated a new project, supported by IL Department of Commerce and Community Affairs (DCCA) and several industrial partners, to produce new data relevant to CBM development in Illinois.

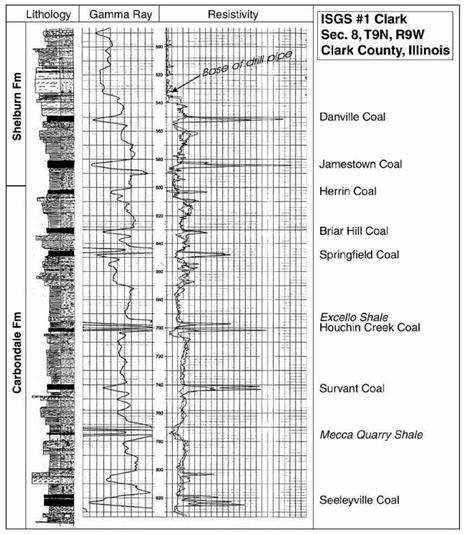
As part of the new ISGS CBM project, coal parameters relevant to CBM potential (cumulative thickness, depth, structure, tectonic features, rank etc.) have been mapped. Such maps, as presented in this poster and subject to further revision, can be useful tools for industry to locate areas for drilling commercial CBM production wells. Additionally, five wells were drilled in the Illinois coal field in order to measure the gas content of coals and shales (see histograms for results and cumulative thickness map for locations).

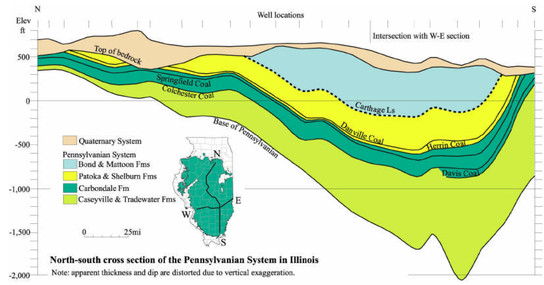
Stratigraphy and General Cross Section

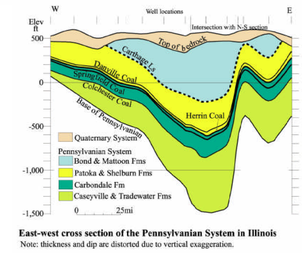
- Right - Generalized stratigraphic column showing approximate vetical relationships between coals in Illinois

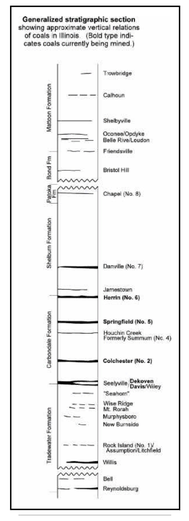
- Middle - Generalized cross section of the Pennsylvanian system in Illinois

- Left - Example of well log from ISGS CBM study (Clark County)



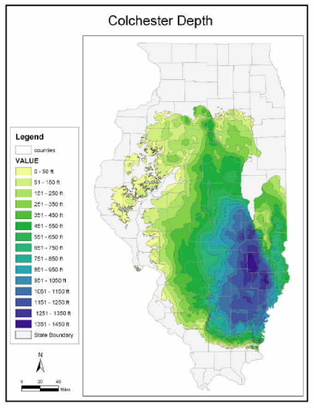


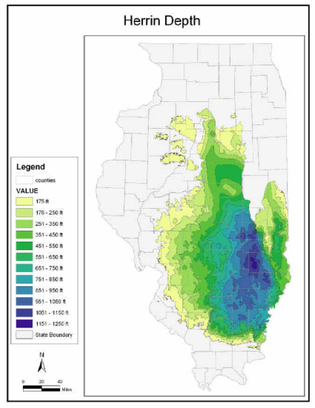


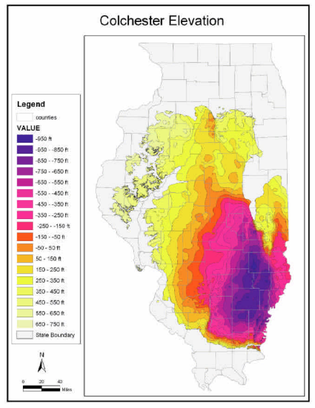


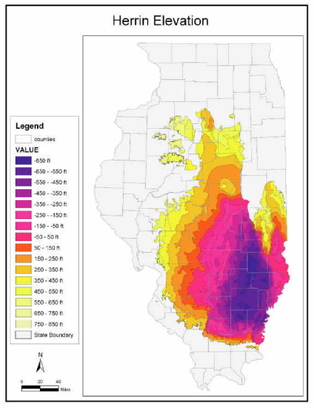
Coal Elevation and Depth

The CBM content of coal tends to increase with depth, due primarily to increasing hydrostatic pressure which increases the amount of gas adsorbed to coal. The simultaneous increase in temperatures with depth somewhat lessens this trend. Because regional dips of coal beds in Illinois Basin are commonly only around 10 ft per mile, large portions of the major coal seams lie at shallow depths (about half at depths <525 ft), and even in the deepest part of the basin only small portions of the major coals occur at depths in excess of 1300 ft.



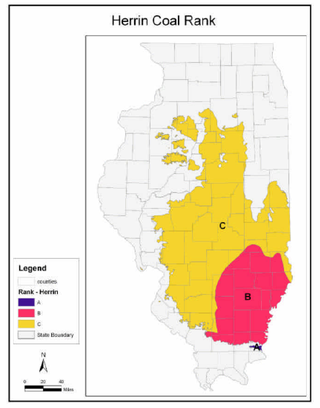


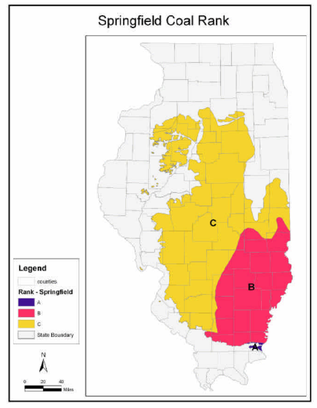




Coal Rank

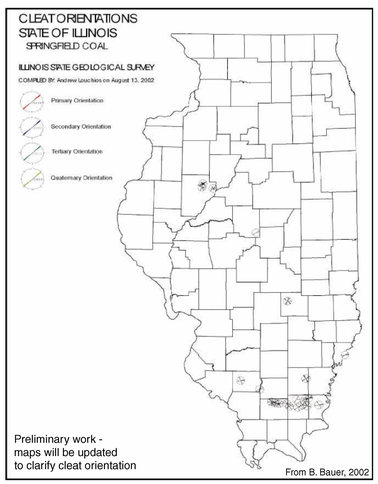
Coal rank increases systematically from lowest rank high volatile C bituminous (<1300 Btu/lb moist-mmf calorific value) in the northwest and west central parts of the coal field to highest rank high volatile A bituminous (>1400 Btu/lb moist-mmf calorific value) in the southeast. Everything else being equal, coalbed methane contents in lower rank coals are smaller than in higher rank ones.

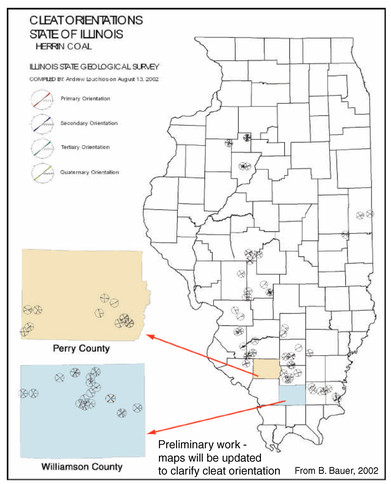


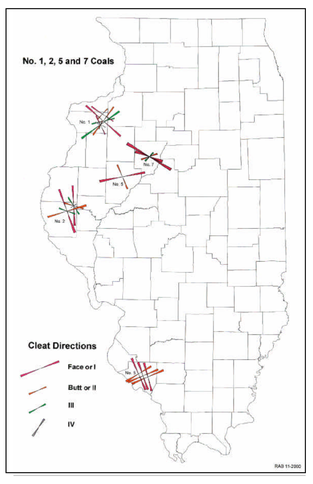


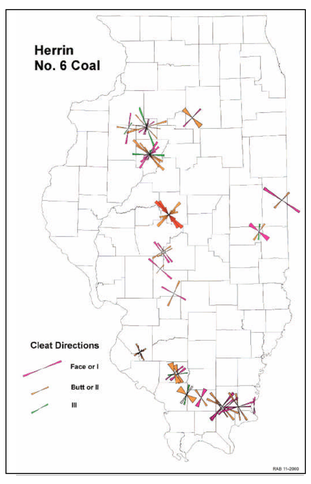
Cleats, Joints and Tectonic Features

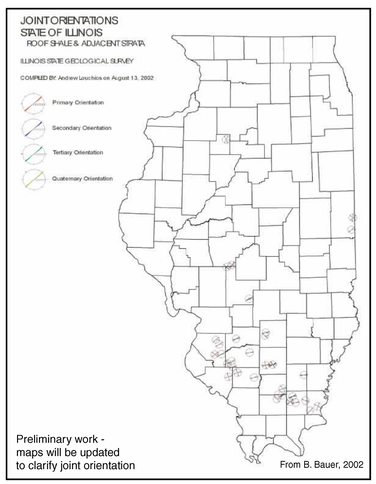
Tectonic deformation of coal seams can significantly affect their CBM potential. Cleats and other micro fractures introduced into the coal by tectonic stress can increase permeability by serving as conduits to gas and water movement during CBM production if they are not filled with secondary minerals. At the same time tectonic faults may disturb local hydrogelogic systems in some places, resulting in the removal of gas from coal by circulating groundwater moving through the faults. Cleat development and the effect of tectonic structures on CBM potential of Illinois coals have not been sufficiently studied.

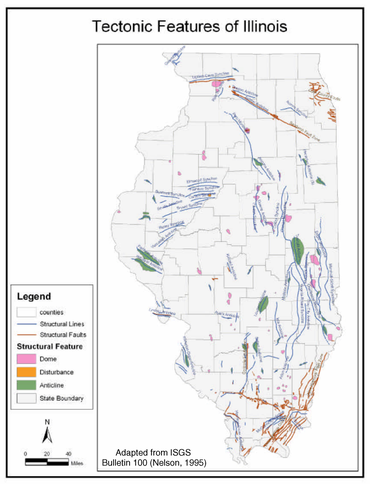












COALBED METHANE POTENTIAL IN ILLINOIS - REGIONAL MAPPING DATA

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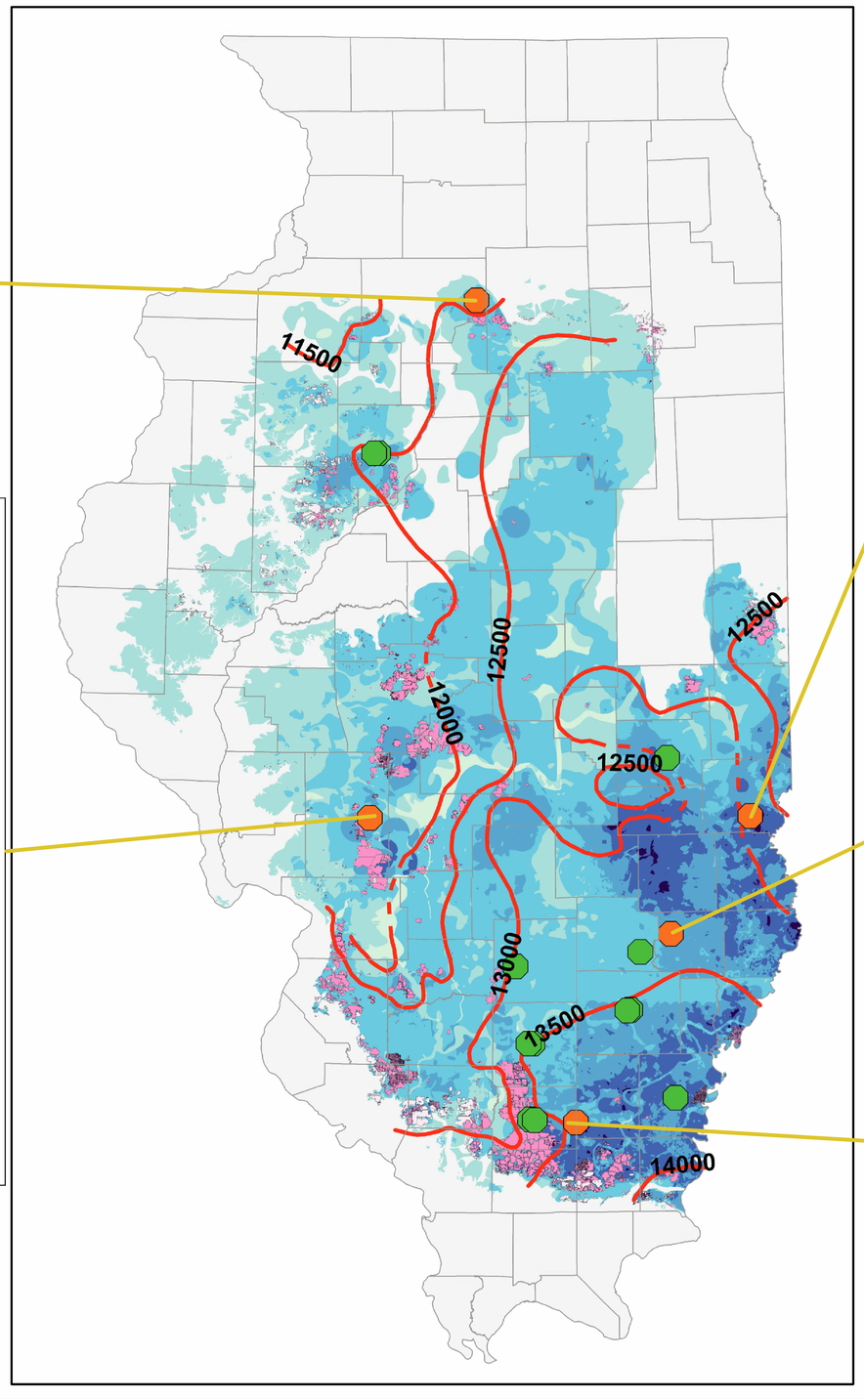
Cumulative Remaining Coal Thickness, Rank of Coals and Location of CBM Drill Holes



Legend

- counties

CBM Test Wells

- Current Study
- Earlier Studies
- Rank Line (BTU)
- Inferred
- Underground mines
- Surface mines

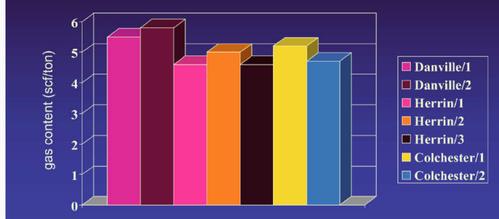
THICKALL

- < 5 feet
- 5 - 10 feet
- 10 - 15 feet
- 15 - 20 feet
- 20 - 25 feet
- > 25 feet
- State Boundary

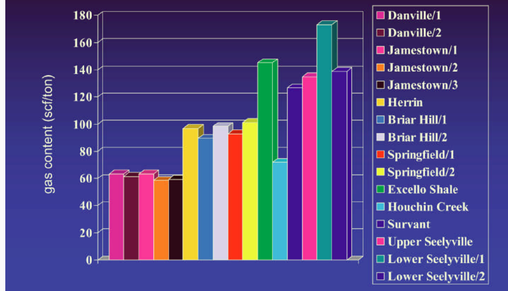
N

0 20 40 Miles

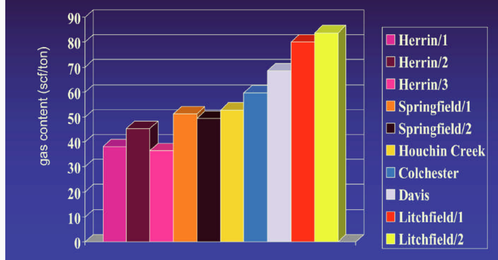
Bureau County Gas Contents
(dry, mineral matter free basis)



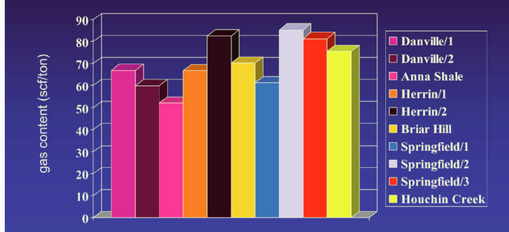
Clark County Gas Contents
(dry, mineral matter free basis)



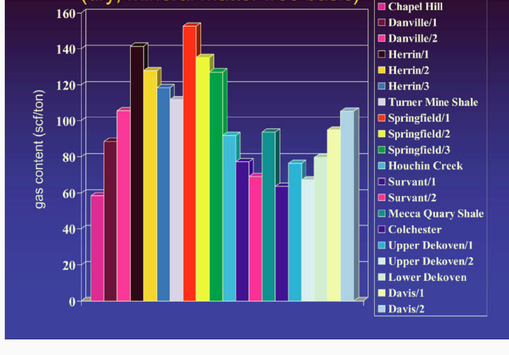
Macoupin County Gas Contents
(dry, mineral matter free basis)



Richland County Gas Contents
(dry, mineral matter free basis)



Franklin County Gas Contents
(dry, mineral matter free basis)



Acknowledgements

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ISGS geologists
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-Curt Blakley
DeMier Oil Company
CNX Coal Company
American Coal Company
Monterey Coal Company
Elysium Oil Company
Raimonde Drilling Co.