STRUCTURAL FEATURES IN ILLINOIS

W. John Nelson

Department of Natural Resources
ILLINOIS STATE GEOLOGICAL SURVEY

BULLETIN 100 1995

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Cover Photo Steeply tilted lower Pennsylvanian sandstone on the southeast side of the Lusk Creek Fault Zone near Manson Ford, about 5 miles northeast of Dixon Springs, Pope County. Photo by W. John Nelson.

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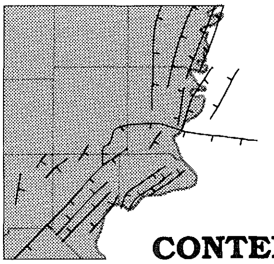

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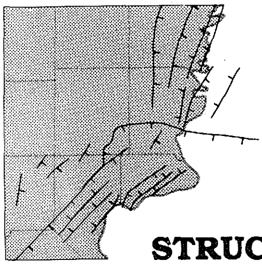


STRUCTURAL FEATURES IN ILLINOIS

ABSTRACT

Structural geologic features that lie wholly or partly within the state of Illinois have been compiled into a comprehensive catalog. The starting point for this work was *Structural Features in Illinois—A Compendium* by Janis D. Treworgy (1981). Treworgy's report consisted of a statewide map and bibliography of all previously named and many significant unnamed structural features. All references cited by Treworgy were reviewed, along with many more recently published and unpublished maps and reports on the structural geology of Illinois. The result is an alphabetical listing of 450 named structural features. All well documented significant structures are mapped on plate 1; 167 previously named structures no longer considered valid are listed in the catalog. In addition, 33 structural features have been renamed and 33 newly named structures introduced. This report also discusses the regional setting of major structures of Illinois and summarizes the structural history of the state.

INTRODUCTION

This comprehensive guide to the structural geology of Illinois gathers from hundreds of published and unpublished sources, information on every named fold and fault in the state, together with many significant, previously unnamed structures. Thus, this is a catalog of structural names, much as the Illinois State Geological Survey (ISGS) Bulletin 95, *Handbook of Illinois Stratigraphy* (Willman et al. 1975) is a catalog of stratigraphic names.

Structural Features in Illinois was written to serve a variety of users. Students and researchers will find capsule descriptions of all structures, along with references to the detailed original works. Petroleum geologists will find information on the geometry and origin of structures that provide traps in established fields and guide the search for new fields. Mining companies will acquire information on faults that affect minability of coal and on structures that control mineralization of fluorspar, lead, and zinc. Hydrologists will read for data on fault zones that can act as barriers or conduits for flow of groundwater. Environmental geologists and engineers can learn about faults that may affect the stability of abandoned mine workings or the integrity of underground storage chambers for tunneling projects. Many readers will be interested in the latest findings on the history of faulting in southern Illinois in relation to the New Madrid Seismic Zone.

This document expands upon *Structural Features in Illinois—A Compendium* by Treworgy (ISGS Circular 519, 1981). Based on an exhaustive literature search, the Treworgy report contained a list of references on every named structural feature in Illinois, and a map (scale approximately 1:700,000) showing them all. The task of preparing the present report would have been overwhelming without this groundwork.

There were several reasons for expanding the compendium, patterned after McCracken's (1971) *Structural Features of Missouri*, to include descriptive and interpretive text on every structure. First, there has been a surge of new structural mapping in Illinois since 1981, and many new seismic profiles have become available. Second, Treworgy's map and list did not assess the relative significance of named structures. Third, many of the most prominent and economically important structures in Illinois were never named and so did not appear in Treworgy's compendium. Fourth, new mapping has demonstrated that many structural features named in earlier publications either do not exist, or their existence is of doubtful validity. This document updates the previous compendium and presents a comprehensive study of the structural features of Illinois. Also included is a brief structural history featuring wells that reached Precambrian rocks (table 1).

Guidelines for Naming Structures

No formal code comparable to the North American Stratigraphic Code (1983) governs the naming of structural features. Structural names may be introduced by simple mention in a report or on a map. Vague definition, duplication of names, or multiple names for the same feature are thus common. The only rule that seems to be universally followed is that structures are named for geographic features. There is no agreement on whether all the words in the name of a structure should be capitalized. For example, the U.S. Geological Survey, Geological Society of America, and American Association of Petroleum Geologists capitalize only the geographic component of structural names (i.e. Cottage Grove fault system). The ISGS originally published structural names in that manner. Since 1959, all words in a name have been capitalized (i.e. Cottage Grove Fault System), a practice continued in this report bcause structural names are proper nouns.

Structural nomenclature was not "formalized," but consistency of names was striven for in this document. Duplication or close similarity of structural names within a basin or region was avoided. For example, the Cottage Grove Fault System of southern Illinois is not likely to be confused with the Cottage Grove Fault of Minnesota. But the Mt. Carmel–New Harmony Fault in southeastern Illinois has been confused with the Mt. Carmel Fault in south-central Indiana; therefore, the name of the Mt. Carmel–New Harmony Fault of Illinois has been changed to the New Harmony Fault Zone. Similarly, the Lincoln Dome (in Logan County) has been renamed the Logan Dome to avoid confusion with the Lincoln Anticline of Calhoun County and adjacent Missouri.

Geologists also are inconsistent in defining structures. Different authors have varying concepts of what constitutes a "dome" versus an "anticline," or a "fault zone" versus a "fault system."

Table 1 Wells that reach Precambrian rocks in Illinois. See figure 4.

	Well	County	Sec.-T-R	Elev (ft)	TD (ft)	Elevation (ft), datum msl Top of Knox	Top of Mt. Simon	Top of basement
1	Amboy Oil and Gas No. 1 McElroy	Lee	30-20N-10E	714	3,772	−151	−1,356	−3,046
2	Northern Ill. Oil and Gas No. 1 Taylor	Boone	28-43N-3E	815	2,998	absent	−510	−2,104
3	Schulte No. 1 Wyman	De Kalb	35-41N-5E	910	4,484	−105	−810	−2,953
4	Herndon No. 1 Campbell	Pike	15-4S-5W	716	3,207	−374	−2,044	−2,488
5	Panhandle Eastern No. 1-21 Mumford	Pike	21-5S-4W	812	2,226	−58	absent	−1,409
6	Carr No. 1 Vedovell	Lee	35-20N-10E	812	3,653	+288	−888	−2,653
7	Miss. River Fuel No. A-15 Theobold	Monroe	35-1S-10W	666	2,768	−293	absent	−2,093
8	Lawinger No. 1 Miller	La Salle	1-36N-4E	681	3,659	+435	−339	−2,788
9	Otto No. 1 Swenson	La Salle	1-36N-5E	659	3,725	+539	−473	−3,041
10	Vickery No. 1 Mathesius	La Salle	32-35N-1E	677	3,556	+607	−744	−2,838
11	H.L. Kelley No. 1 Fullerton	Mercer	19-13N-4W	584	3,716	−356	−1,916	−2,671
12	Miss. River Transmission No. S-5 Baer	Madison	27-3N-6W	516	4,868	−2,451	absent	−4,341
13	Humble Oil No. 1 Weaber-Horn	Fayette	28-8N-3E	538	8,616	−4,097	−6,352	−7,676
14	R.E. Davis No. 1 South	Henry	30-16N-1E	803	3,863	−500	−1,797	−3,052
15	I. Seele No. 1 Seele	Winnebago	24-44N-2E	870	3,385	+255	−381	−1,786
16	C. Reed No. 1 McCoy	Will	20-35N-9E	632	4,300	−385	−1,272	−3,593
17	Texaco No. 1 Cuppy	Hamilton	6-6S-7E	393	13,051	−7,365	absent	−12,574
18	Texaco No. 1 Johnson	Marion	6-1N-2E	541	9,210	4,835	−7,909	−8,629
19	Jones and Laughlin Steel Corp. No. 1 WD-1	Putnam	3-32N-2W	527	4,877	−1,063	−2,608	−4,315
20	American Potash and Chemical No. WD-1	Du Page	9-39N-9E	741	4,043	−309	−1,084	−3,279
21	Union Oil of California Cisne Comm. No. 1	Wayne	3-1S-7E	504	11,614	−7,072	−10,653	−11,010
22	Maryland Service No. S-1 Kircheis	Madison	27-3N-6W	504	5,018	−2,446	−4,462	−4,506
23	Miss. River Transmission Klein No. S-2	Madison	33-3N-6W	513	5,213	−2,655	−4,631	−4,688
24	North. Ill. Gas No. 1 Lillard	Henderson	14-9N-5W	627	3,180	−297	−1,793	−2,531
25	Harza Engineering UPH-1 Commonwealth Edison	Stephenson	18-29N-6E	905	2,096	+377	−260	−1,090
26	R.W. Beeson No. 1 Poiter Unit	Perry	28-5S-3W	486	7,043	−4,270	absent	−6,464
27	C.E. Brehm Drilling and Prod. No. 1 Hemminghaus	Clinton	33-3N-1W	486	7,040	−4,384	absent	−6,394
28	C.E. Brehm Drilling and Prod. No. 1 Bochantin Comm.	Washington	35-3S-2W	458	7,332	−4,588	absent	−6,838
29	Harza Engineering UPH-2 Commonwealth Edison	Stephenson	12-28N-5E	996	5,442	+527	−314	−1,182
30	Harza Engineering UPH-3 Commonwealth Edison	Stephenson	7-28N-6E	990	5,272	+515	−319	−1,187
31	Ross Production No. 1 Goodwin	La Salle	30-29N-2E	739	5,775	−1,148	−2,811	−4,881
32	U.S. Geological Survey No. 1 Ill. Beach State Park	Lake	14-46N-12E	585	3,500	absent	−1,055	−2,875
33	Thor Resources No. 1 Sleight	Pike	12-4S-3W	624	3,602	−682	−2,362	−2,946
34	Wood Energy No. 1 Borowiak	Washington	24-3S-1W	522	9,222	−5,469	−8,176	−8,186

Information compiled by M.L. Sargent, ISGS, 1992

The following definitions are used in this document.

Anticline An upward fold of strata that has a well defined axis and a length of at least twice its width. Example: Salem and Louden Anticlines. An anticline that lacks closure may be called a nose. Minor, irregular structural highs, especially those that lack closure, should not be named anticlines.

Anticlinorium An upward fold of regional extent, composed of or containing lesser anticlines; a group or zone of closely related anticlines. Individual folds in the belt may be subparallel or arranged en echelon. Example: La Salle Anticlinorium.

Arch An elongated structural rise of regional extent; a divide between regional basins. On most arches the width is many times greater than the vertical relief. Typically the sedimentary section is thinner on an arch than in adjacent basins. Example: Kankakee Arch.

Basin (1) An enclosed, roughly equidimensional structural depression of any size. (2) A regional depression of any shape. Because subsidence occurred during sedimentation, the sedimentary succession is thicker in the basin than on surrounding arches and domes. Example: Illinois Basin.

Disturbance A localized circular or polygonal area of intense structural deformation, commonly called "cryptoexplosive." In Illinois, the Des Plaines Disturbance and Glasford Structure have been described as probable impact structures. The term "disturbance" does not imply the nature of the deforming agent.

Dome (1) An upward fold without a well defined axis and with the length less than twice the width; closure must be demonstrated. (2) A roughly equidimensional area of regional extent that remained high while adjacent basins subsided. An area of thinned or absent sedimentary section. Example: Ozark Dome.

Fault A fracture in rock along which displacement has occurred parallel to the fracture surface.

Fault zone A set of closely spaced parallel or subparallel faults, generally all of the same type. Example: Sandwich Fault Zone.

Fault system A group of closely related or interconnected faults that may differ from one another in type and orientation. A fault system typically is wider and more complicated than a fault zone. Example: Cottage Grove Fault System.

Fault complex A group of two or more fault systems that have similar trend and character. The only example in Illinois is the Fluorspar Area Fault Complex.

Graben A block downdropped between two subparallel faults or fault zones. Generally the faults bordering a graben are normal faults that developed under extensional stress.

Horst A block upraised or left high between two subparallel faults or fault zones; the opposite of a graben.

Monocline A step-like fold having an inclined or vertical flank between more or less horizontal upper and lower limbs. A monocline commonly overlies a buried fault. Example: Du Quoin Monocline.

Shelf A raised region of nearly horizontal strata within or adjacent to a basin. A shelf typically subsided more slowly than the deep part of the basin and so has a thinner sedimentary section. Example: Sparta Shelf.

Syncline An elongated downward fold with a well defined axis and generally bordered by anticlines.

Uplift An arch or dome of regional extent that was raised relative to surrounding areas. The term uplift should be reserved for structures that definitely rose at one or more times in history.

The definitions have not been rigidly applied to cases in which the name of a structural feature is well established from long usage. For example, the Moorman Syncline might better be called a basin, and Hicks Dome could be called a disturbance. Names such as these have not been changed because such change would serve no useful purpose and might cause confusion.

Removal of Names

Structural features in Illinois were named between 1910 and 1945, when abundant subsurface data became available. Dozens of structural names were introduced in ISGS county reports that emphasized structural targets for oil and gas exploration. Many of these reports included structure maps contoured on shallow units (generally Pennsylvanian coals and limestones). Partly to aid reference from text to map and partly to emphasize exploration potential, authors of county reports commonly named all known or suspected areas of closure as anticlines or domes.

For example, Easton (1942) published a subsurface structure map of the Herrin Coal Member (Pennsylvanian) in Macoupin County, west-central Illinois. Easton named numerous anticlines and domes and discussed them in his text. The anticlines that Easton named are short, curving, or irregularly shaped upwarps, most of which lack closure and have relief of only a few tens of feet. These domes are small, irregular areas of enclosed contours, mapped on the basis of one or a few control points. The reader who has Easton's map at hand will not be misled about the significance of the features he named. When such minor or questionable structures are transferred to regional or statewide maps that lack contour lines and control points, however, a distorted picture develops. Treworgy's (1981) map shows all of the structures named by Easton (1942). The structures appear as a dense swarm of folds, arranged in a semicircular pattern. They present the impression that Macoupin County is a strongly deformed area. In reality, the folds mapped and named by Easton are gentle undulations, probably of nontectonic origin. Remapping of the Herrin Coal in Macoupin County (Nelson 1987b) was based on hundreds of control points unavailable to Easton and revealed a pattern of undulations substantially different from that mapped by Easton. Most of the anticlines and domes that Easton named do not appear on the map in Nelson (1987b).

The names of 167 structural features recommended for removal from stratigraphic records were assigned prior to 1945 and cited only once or twice in the literature (table 2). These structures are indicated in the catalog by the term "discarded," which appears in parentheses after the name. These structural features are not shown on plate 1. Catalog entries explain specific reasons for discontinuing the use of certain structural names. Decisions to discard a named structural feature were made according to the following criteria.

- Originally the feature was improperly defined (for example, a "dome" with no closure).

- Later studies have shown that the feature does not exist or that its existence is questionable.

- The name refers to a small portion of a larger structure, and no useful purpose is achieved by naming that part

Table 2 167 structures recommended for removal from stratigraphic records and shown in the catalog as follows: (discarded).

Abingdon Dome
America Graben
Anderson Anticline
Aviston Anticline

Babylon Anticline
Beckemeyer Dome
Bellair–Champaign Uplift
Bellair Dome
Belleville Anticline
Beltrees–Melville Anticline
Blackoak Dome
Bonpas Anticline
Bourbon Anticline
Burton Anticline
Butler Anticline

Canton Anticline
Carlinville Anticline
Carlinville North Dome
Carlinville-Centralia Anticlinal Belt
Carlyle Dome
Carrollton Anticlines
Cedar Creek Dome
Cedar Point Anticline
Chesterville Anticline
Clifford Anticline
Conant Dome
Court Creek Dome

Darmstadt Anticline
Dayton Syncline
Depue Anticline
Dimick Fault
Donnellson Anticline
Drake–White Hall Anticline
Dwight Anticline

Earlville Sag
East Louden Anticline
Extension Fault

Fancher–Mode Anticline
Fosterburg–Staunton Anticline

Garfield Dome
Glenridge Anticline
Gold Hill Fault
Good Hope Fault
Goreville Anticlinal Nose
Granville Basin
Greathouse Island Fault
Greenridge Syncline
Grimes Anticline

Harrisburg Fault
Hayes Dome
Hennepin Syncline
Hickory Grove Anticline
Highland Dome
Hill Fault
Hill Graben
Holland Anticline

Irishtown Anticline
Iuka Anticline

Jamestown Anticline
Junction Horst
Junction West Fault

Kane Anticline
Kempton Syncline
Kritesville Syncline

Last Chance Fault
Lenzburg Anticline
Levan Anticline
Longbranch Monocline
Louisville Anticline
Lowder Anticline

Macoupin Dome
Main structure
Makanda Anticline
Marseilles Anticline
Mason Anticline
McClure Anticlinal Nose
McWade Fault
Mendota Anticline
Metropolis Depression
Millstadt Anticline
Mink Island Fault
Modesto Anticline
Morris Syncline

New Douglas Dome
New Madrid Rift Complex
Noble Anticline
Nokomis Anticline

Oakdale Syncline
Oakland Anticlinal Belt
Oakland Dome
Odell Anticline
O'Fallon Dome
Oglesby Fault
Oglesby Syncline
Ohlman Anticline or Dome
Old Ripley Anticline
Omega Anticline
Oswego Syncline
Ottawa Anticline
Ottawa Horst

Paducah Graben
Paine Dome
Panama Anticline
Parker Dome
Parkersburg Dome
Payson Anticline
Peru Anticline
Petersburg Basin
Plainview Syncline
Pocahontas Anticline
Potato Hill Syncline

Ransom Syncline
Redhead Anticline
Reno Anticline
Ritchey–Herscher Arch
Rose Creek Fault

Sailor Springs Dome
St. Louis Arm
Saline River Fault
Samsville Anticline
Savanna–Sabula Anticline
Schuyler Arch
Seatonville Syncline
Shattuc Dome
Shaw Dome
Shawneetown Anticline
Shelby Fault
Shelbyville Anticline
Shipman Anticline
Shoal Creek Syncline
Sigel Anticline
Siggins Dome
Siloam Anticline
Sorento Dome
South Johnson Dome
South Litchfield Dome
Southern Indiana Arm or Rift
Spanish Needle Creek Dome
Sparta Syncline
Spring Valley Anticline
Star Union Syncline
Staunton Dome
Stavanger Syncline
Stone Church Fault
Stonefort Anticline
Stubblefield Anticline
Sugar Creek Syncline
Sugar Hill Dome
Swansea Anticline

Thayer Dome
Thebes Anticline
Trowbridge Anticline
Tuscola Fault

Vandalia Arch
Venedy Dome
Vevay Park Dome

Wabash River Anticline
Wamac Dome
Waverly Anticline
West Green Fault Zone
West Salem Dome
West Union Syncline
Weyen (or Wyen) Anticline
White Oak Anticline
Wittenburg Trough
Woodlawn–Drivers Anticline
Wyen (or Weyen) Anticline

York Dome

Zeigler Anticline

separately. In many cases, part of an anticline or fault system was named before continuity of the part with a larger whole was recognized.

Care was taken not to remove structures merely because they are small or obscure. For example, the named synclines in Jo Daviess County (A-3 on plate 1) are tiny compared with most named structures in Illinois, but they reflect regional stress patterns and control mineralization in the Upper Mississippi Valley Zinc–Lead District. Another example is a series of parallel anticlines and synclines called the Peoria Folds, mapped by Wanless (1957) in west-central Illinois (E-2 to D-4, plate 1). These folds were mapped from little evidence; many do not have closure. Yet a striking match between mapped folds and the regional drainage pattern exists, and the parallelism of the folds indicates an origin in a regional stress field. Structural names such as these should be preserved at least for the purpose of stimulating further research.

New Names

Many large and significant structural features in Illinois have never been named on published maps or in reports. Treworgy (1981) listed 19 "significant unnamed structures" in Illinois. Most of these, along with several features that were not mentioned previously, are named in this report (table 3). A search of the literature revealed additional unnamed structures not listed or shown by Treworgy; these newly named structural features are included in this catalog (table 4). Among the newly named structures are several of the largest domes and anticlines that support major oil fields in Illinois. For example, the Bridgeport Anticline in Lawrence County is 10 miles (16 km) long, 2 miles (3 km) wide, and has closure of more than 200 feet (60 m) on Mississippian strata. The Lawrenceville Dome, just south of the Bridgeport Anticline, is about 6 miles by 3 miles (10 km by 5 km) and has closure of more than 100 feet (30 m). These two structures provide traps for oil fields that account for most of the nearly 400 million barrels of oil that have been produced in Lawrence County. The Johnsonville Dome in Wayne County is about 3 miles (5 km) in diameter and has closure of more than 100 feet (30 m). It supports the Johnsonville Oil Field, which has yielded approximately 55 million barrels. Two large monoclines, previously unnamed,

Table 3 33 renamed structures shown as follows: (new name).

Old name	New name	Old name	New name
Albion–Ridgway Fault	Albion–Ridgway Fault Zone	La Salle Anticlinal Belt	La Salle Anticlinorium
Ancona Dome	Ancona Anticline	Lee Fault	Lee Fault Zone
Ashton Arch	Ashton Anticline	Lincoln Dome (in Logan County)	Logan Dome
Bodenschatz–Lick Fault	Bodenschatz–Lick Fault Zone	Martinsville Dome	Martinsville Anticline
Clay City Anticlinal Belt	Clay City Anticline	Maunie Fault	Maunie Fault Zone
Crescent City Dome	Crescent City Anticline	Mt. Carmel–New Harmony Fault	New Harmony Fault Zone
Herald–Phillipstown Fault	Herald–Phillipstown Fault Zone	Mud Creek Fault	Mud Creek Fault Zone
Herscher Dome	Herscher Anticline	Pecatonica Dome	Pecatonica Anticline
Hillsboro Dome	Hillsboro North and Hillsboro South Domes	Polo Basin	Polo Syncline
Hobbs Creek Fault System	Hobbs Creek Fault Zone	Raum Fault	Raum Fault Zone
Hoffman Anticline	Hoffman Dome	Rend Lake Fault System	Rend Lake Fault Zone
Hume Dome	Hume Anticline	St. James Anticline	St. James Dome
Interstate Fault	Interstate Fault Zone	Saratoga Anticlinal Nose	Saratoga Anticline
Iola Dome	Iola Anticline	Stewardson Anticline	Stewardson Dome
Kenner Dome	Kenner Anticline	Walpole Anticline	Walpole Dome
		Warsaw Anticline	Warsaw Dome
		Wolrab Mill Fault	Wolrab Mill Fault Zone

are major elements in the La Salle Anticlinorium. On the north, the Peru Monocline is 65 miles (105 km) long and shows relief of up to 1,600 feet (400 m). The Charleston Monocline on the south, is more than 100 miles (160 km) long and shows relief of up to 2,500 feet (750 m) on pre-Pennsylvanian horizons. Its relief makes it the largest fold in the Illinois Basin.

MAJOR STRUCTURAL FEATURES

Basins, Arches, and Domes

Illinois lies within the interior of the North American craton. The area of Illinois is a southern extension of the Canadian Shield; a thin northward-tapering wedge of Phanerozoic sedimentary rocks covers the Precambrian crystalline basement complex. Since Precambrian time, the cratonic interior has undergone relatively mild structural deformation, as compared with the severe folding and faulting produced along the continental margins during numerous mountain-building events. The largest structural features of the cratonic interior are broad gentle basins, arches, and domes that involve both basement and sedimentary cover (fig. 1).

The Illinois Basin (also called the Eastern Interior Basin) covers roughly three-quarters of Illinois along with much of southwestern Indiana, a large area in western Kentucky, and small parts of Iowa, Missouri, and Tennessee (fig. 1). The east-west-trending Rough Creek–Shawneetown Fault System divides the Illinois Basin into two unequal parts (fig. 2). The large northern part includes the Fairfield Basin and its bordering shelves. The Fairfield Basin, which is oval with the long axis oriented north–south, contains approximately 15,000 feet (4,600 m) of sedimentary rocks at its deepest point. The Moorman Syncline, south of the Rough Creek–Shawneetown Fault System, is smaller than the Fairfield Basin but considerably deeper. As much as 23,000 feet (7,000 m) of layered rocks have been identified seismically near the north edge of the Moorman Syncline in Kentucky (Bertagne and Leising 1991). The strongly asymmetrical Moorman Syncline has a steep north flank and a very gentle south flank.

The Ozark Dome in southeastern Missouri, northern Arkansas, and a small area of extreme southwestern Illinois lies west of the southern part of the Illinois Basin. In Illinois, the boundary between the Ozark Dome and Illinois Basin is along the Ste. Genevieve Fault Zone and an associated monocline (fig. 2). Northward, the Du Quoin Monocline separates the Fairfield Basin from the Sparta Shelf. The gently sloping Sparta Shelf grades without definite boundaries to the northern Ozark Dome on the west and the Western Shelf on the north. North of the Ozark Dome, the Mississippi River Arch divides the Illinois Basin on the east from the Forest City Basin on the west (fig. 1).

The Wisconsin Arch extends southeast from central Wisconsin into northern Illinois, and borders the Illinois Basin on the north (fig. 1). The Kankakee Arch, which extends southeastward from the Wisconsin Arch, separates the Illinois and Michigan Basins. Farther east and south, the Cincinnati Arch divides the Illinois Basin from the Appalachian Basin. The Nashville Dome flanks the Moorman Syncline on the south. All of these arches and domes lack definite boundaries and grade through broad shelves into the adjacent basins.

Table 4 33 newly named structural features shown as follows: (new).

Aden Anticline	Edgar Monocline	Miletus Dome
Akin Dome	Elkton Anticline	Oblong Anticline
Assumption Anticline	Goldengate Anticline	Peoria Folds
Battle Ford Syncline	Hardinville Anticline	Peru Monocline
Bay Creek Syncline	Herscher–Northwest Anticline	Raleigh Dome
Benton Anticline	Irvington Anticline	Russellville Dome
Boyd Anticline	Johnsonville Dome	Sesser Anticline
Bridgeport Anticline	Kincaid Anticline	Sicily Fault
Charleston Monocline	Lawrenceville Dome	Wartrace Fault Zone
Cook County Faults	Little Cache Fault Zone	Wobum Anticline
Cooksville Anticline		
Cordes Anticline		
Divide Anticline		

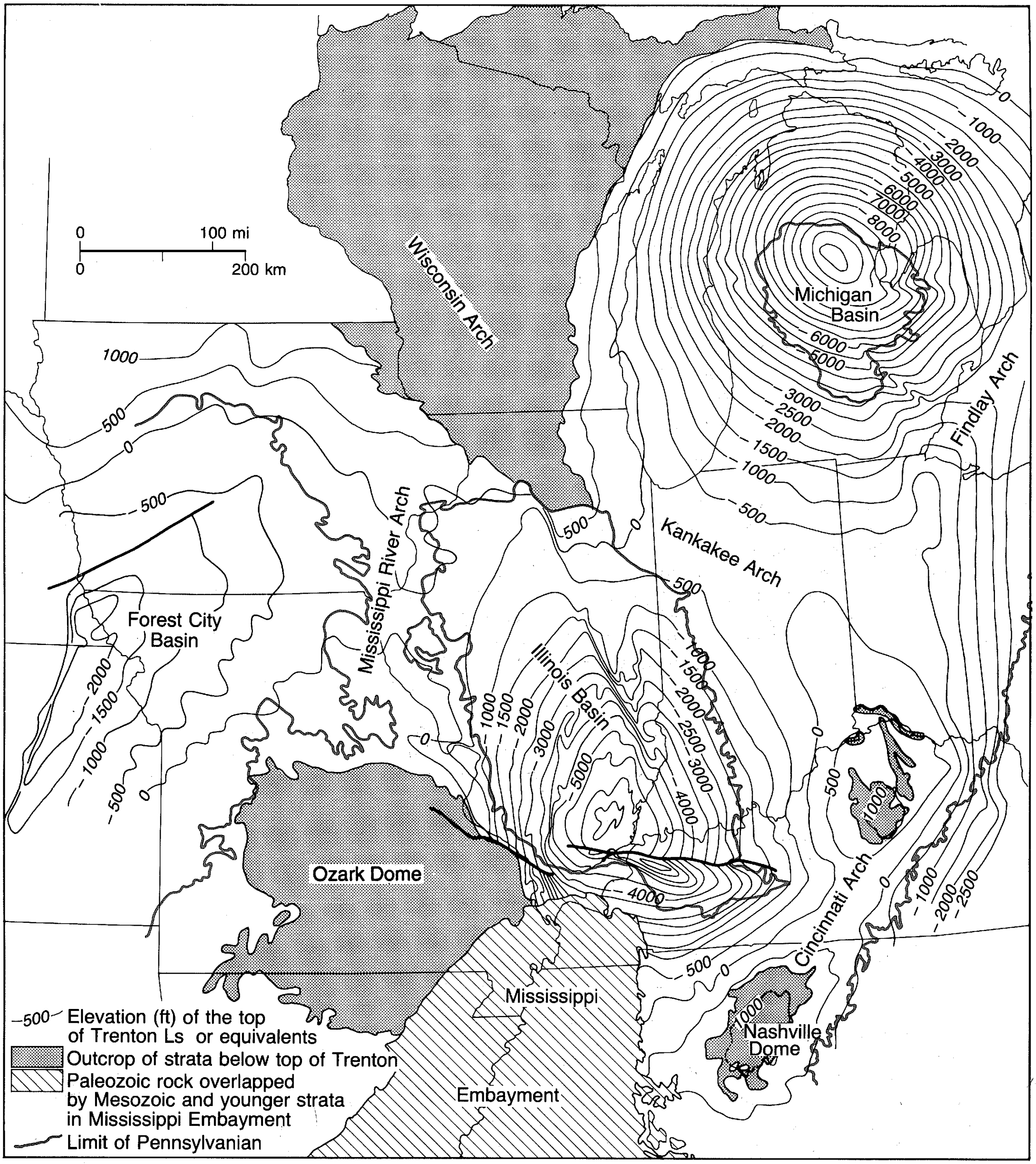


Figure 1 Regional structural setting of Illinois. From Collinson et al. 1988.

The Pascola Arch (fig. 2) closes off the southwestern margin of the Illinois Basin between the Nashville and Ozark Domes (fig. 1). The Pascola Arch was uplifted some time after the middle of the Pennsylvanian Period and eroded, truncated, and buried beneath Upper Cretaceous and younger rocks in the Mississippi Embayment. The Embayment, as defined by the extent of Cretaceous rocks, reaches into southernmost Illinois and is a northern extension of the Gulf Coastal Plain.

The origin of intracratonic basins, arches, and domes is an enigma of geology. The processes responsible are obviously deep seated, slow acting, and not readily accessible to examination and comparison with modern analogues. Recent researchers such as Heidlauf et al. (1986) and Quinlan and Beaumont (1984) have attacked the problem through theoretical modeling. Testing of these models will require synthesis of vast amounts of stratigraphic and regional geophysical data. Kolata and Nelson (1991b) presented a review of recent findings and ideas.

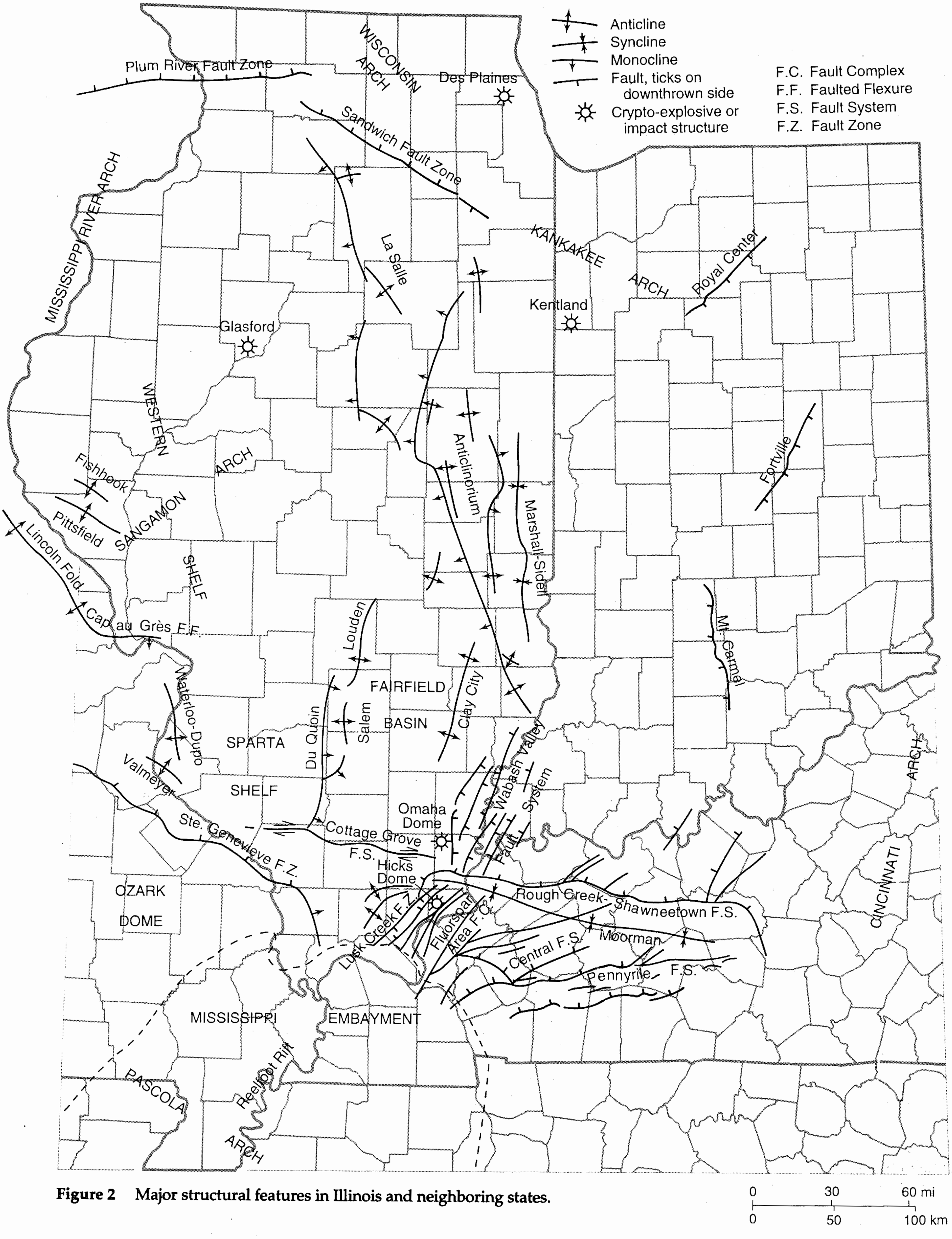


Figure 2 Major structural features in Illinois and neighboring states.

Folds and Faults

Numerous folds, which are smaller in scale than regional basins, arches, and domes, as well as many fault zones and systems, have been described in Illinois. The more prominent folds and faults are discussed here and shown on figure 2 and plate 1. These features illustrate a variety of structural styles, including basement-seated normal and strike-slip faulting, basement-seated reverse faulting with folding of sedimentary cover, and detached folding and thrust faulting. There are structures of igneous origin, structures of probable impact origin, and domes due to differential compaction. In a number of cases, the same structure has undergone deformation under more than one stress regime.

Northern Illinois As used here, northern Illinois is the area north of the limit of Pennsylvanian strata, which runs approximately from Rock Island to Joliet. Northern Illinois is underlain by Cambrian through Silurian bedrock on the crest and flanks of the Wisconsin Arch. Structures have been defined mostly on the basis of outcrop mapping (exposures are scarce because of glacial drift), water well records, and geophysical studies.

The largest structural features of northern Illinois are the Sandwich and Plum River Fault Zones (fig. 2). Both are zones of high-angle faults that have net downthrow to the north. On the Sandwich Fault Zone, maximum vertical displacement is about 800 feet (240 m). The crustal block between the Sandwich Fault Zone and the Peru Monocline (new) apparently was raised and tilted toward the southwest (Kolata et al. 1978). The timing of this movement is uncertain, but it was probably late in the Paleozoic Era. The west-trending Plum River Fault Zone has up to 400 feet of throw. It is flanked by gentle anticlines and domes on the south and synclines on the north (Kolata and Buschbach 1976). Research from Iowa indicates recurrent middle Paleozoic faulting; the principal movements occurred during the Devonian Period (Bunker et al. 1985). Kinematic analysis of stresses involved in the Plum River and Sandwich Fault Zones has been hindered by a lack of suitable exposures.

Several systems of high-angle normal and reverse faults, small folds, and joints have been described in the Upper Mississippi Valley Zinc–Lead District of northwesternmost Illinois, southwestern Wisconsin, and the adjacent part of Iowa (Heyl et al. 1959, Carlson 1961, Allingham 1963). Several episodes of extension, compression, and solution collapse may be involved. Geologists disagree on the interpretation of the origin of the various structures and any relationship to regional events.

The Des Plaines Disturbance northwest of Chicago is believed to be a post-Pennsylvanian astrobleme (Emrich and Bergstrom 1962, Buschbach and Heim 1972, McHone et al. 1986a, b). The Cook County Faults (new) have small displacements and uncertain affinities (Buschbach and Heim 1972).

Western Illinois Western Illinois includes the Western Shelf and small areas of the Ozark Dome and Mississippi River Arch. Ordovician through Pennsylvanian bedrock dips regionally eastward toward the Fairfield Basin. The area west of the Illinois River has not been studied extensively because outcrop and well data are scarce. The quality and density of data improve for the areas to the east and south. Detailed structure maps, based on thousands of coal and oil test borings, are available for most of the Western Shelf south of Springfield.

The most conspicuous structures are northwest-trending anticlines and monoclines, such as the Valmeyer, Waterloo–Dupo, Pittsfield, and Fishhook Anticlines and the Cap au Grès Faulted Flexure (fig. 2). Most of these structures are strongly asymmetrical; one limb dips a few degrees and the other dips 20° or steeper (locally overturned on the Cap au Grès). The steep limbs of the Cap au Grès, Waterloo–Dupo, and Media structures are faulted. All of these folds probably overlie faults in the Precambrian crystalline basement (Rubey 1952, Tikrity 1968, Gibbons 1972, Nelson and Lumm 1985).

Northwestern structural trends prevail not only in western Illinois, but through most of Missouri (McCracken 1971), eastern Kansas (Merriam 1963), and southeastern Iowa (Harris and Parker 1964). A strong northwestern grain, also apparent on gravity and magnetic maps of Missouri, indicates that surface faults and folds are rejuvenated Precambrian structures (Guinness et al. 1982, Braile et al. 1984, Kisvarsanyi 1984).

Small, nearly symmetrical, north-trending anticlines and numerous circular to irregularly shaped domes are present on the eastern Sparta Shelf from Bond and Madison Counties southward (fig. 3, plate 1). Not much is known about the anticlines. Many of the domes are products of draping and compaction over Silurian reefs. The St. Jacob Domes, and possibly other domes, overlie Precambrian hills.

Farther north on the Western Shelf are several scattered domes of seemingly random orientation and distribution. Among these are the Hillsboro North and South, Waverly, Logan, Haw Creek, and Toulon Domes. Their origins and ages are unknown. The Glasford Structure south of Peoria probably is a pre-Cincinnatian (Late Ordovician) meteorite impact site (Buschbach and Ryan 1963, McHone et al. 1986b).

The Peoria Folds (new) in Fulton, Peoria, and neighboring counties are east-plunging anticlines and synclines of low relief (Wanless 1957). Drainage in the area closely corresponds with the fold axes; yet the origin and existence of these subtle structures remain in doubt.

Structure maps of Pennsylvanian coal seams in west-central Illinois show numerous minor irregularities having no preferred trend. Most of these irregularities probably resulted from differential compaction or similar nontectonic causes (see Removal of Names).

Eastern Illinois The Fairfield Basin, La Salle Anticlinorium, Marshall–Sidell Syncline, and part of the northern flank of the Illinois Basin lie in eastern Illinois. The largest structures in this region are monoclines and asymmetrical anticlines that trend mostly north–south. The La Salle Anticlinorium is more than 200 miles (320 km) long and has as much as 2,500 feet (750 m) of vertical relief. The anticlinorium is a complex uplift that consists of branching, sinuous monoclines, most of which face west or southwest. Anticlines and domes are arranged like strings of beads along the upper limbs of the monoclines. Axial trends of individual folds commonly differ from the regional trend of the belt. The east-facing Du Quoin Monocline on the west side of the basin exhibits similar geometry on a smaller scale.

Other important north-trending folds are the Salem, Louden, Mattoon, and Clay City Anticlines. All of these structures experienced major uplift late in the Mississippian Period to early in the Pennsylvanian Period; also most of these continued to rise during and after the Pennsylvanian (Payne 1939, Du Bois 1951, Siever 1951, Clegg 1970). The folds

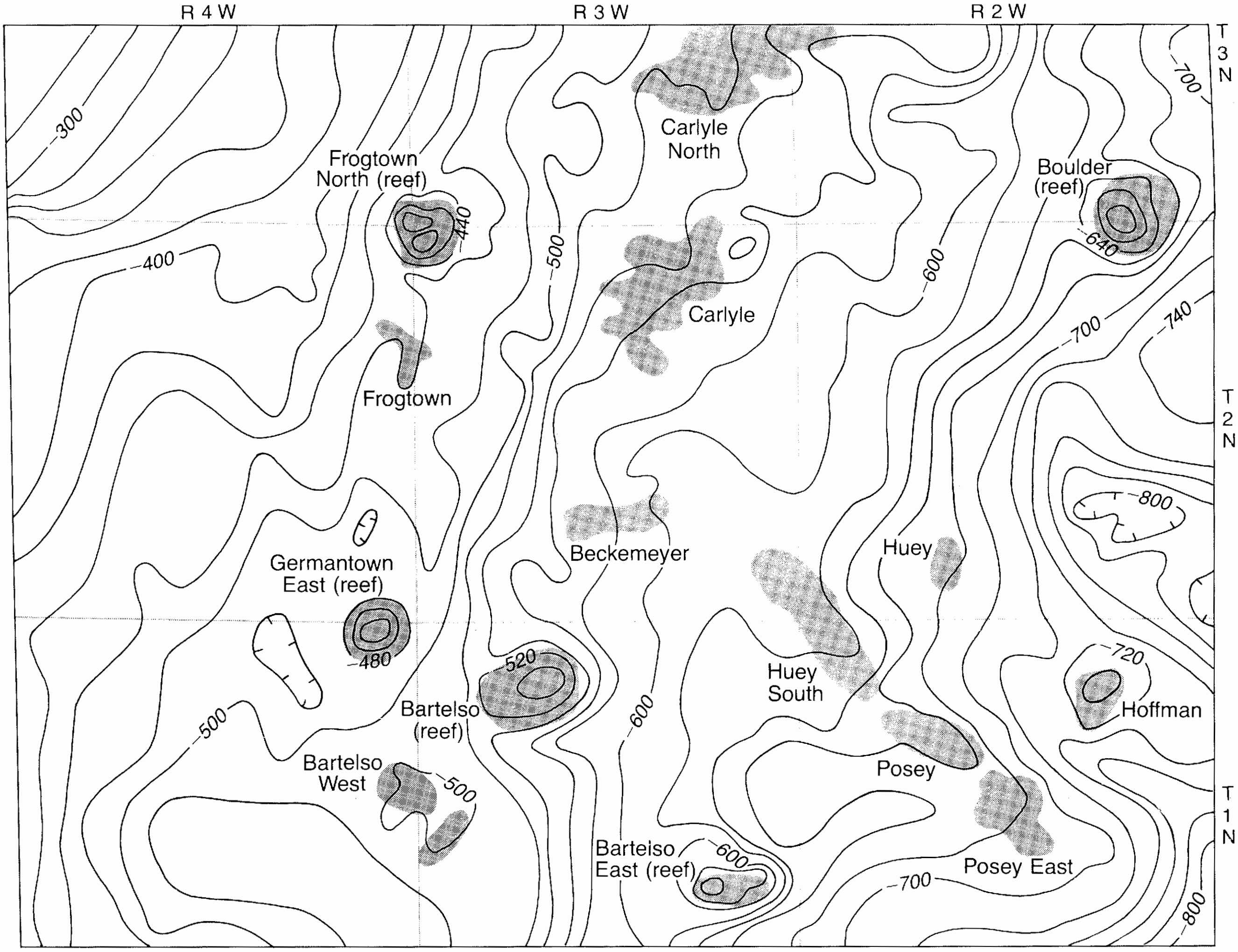


Figure 3 Oil fields and structure of the Beech Creek ("Barlow") Limestone in part of Clinton County. Contour interval is 20 feet. Structure in this area is typical of most of the eastern Sparta Shelf: a gentle eastward regional dip punctuated by small circular domes. Doming in the Bartelso, Bartelso East, Boulder, Frogtown North, and Germantown East Fields is due to draping over Silurian reefs. Production in the Beckemeyer, Carlyle, and Carlyle North Fields is from stratigraphic traps in lower Chesterian sandstones. Oil in the Huey South, Posey, and Posey East Fields comes from the Cypress Sandstone, Lower Devonian carbonate rock, and nonreef Silurian strata along a subtle anticlinal nose.

appear to affect all Paleozoic rocks and probably overlie faults in basement, although published evidence of faulting is insufficient. Several of the largest oil fields in the Illinois Basin are developed in structural traps on these anticlines.

Circular to irregularly shaped domes are common in the Fairfield Basin, particularly in Clay and Hamilton Counties (plate 1). They range from about 1 to 4 miles (1.6–6.4 km) across and have up to 100 feet (30 m) of closure. Their distribution seems to be random and unrelated to major anticlines and monoclines. Drilling on the Hoodville and Dale Domes indicates Precambrian hills. Several small domes in Marion County (plate 1, H-5, 6) overlie Silurian reefs. The origin of other domes is unknown.

Southern Illinois Southern Illinois is the most intensely deformed region of the state. Structural styles include basement-rooted reverse, normal, and strike-slip faulting, as well as detached thrust faults and folds, and doming caused by igneous intrusion. Some faults have undergone recurrent movement in response to different stress regimes.

The Ste. Genevieve Fault Zone in southwestern Illinois and the adjacent part of Missouri comprises high-angle normal and reverse faults that reflect at least two major episodes of deformation. The southwest side of the fault zone was downdropped during an episode of normal faulting in Middle Devonian time (S. Weller and St. Clair 1928, Nelson and Lumm 1985). Later, in latest Mississippian and early Pennsylvanian time, the southwest block was uplifted in an episode of reverse faulting (Desborough 1961b, Nelson and Lumm 1985). The later episode of faulting induced strong monoclinal folding of strata along the fault zone.

The Lusk Creek Fault Zone and Rough Creek–Shawneetown Fault System also underwent multiple episodes of displacement. These faults originated as normal faults outlining the northwest and north margins of a Precambrian to early Cambrian rift zone (Soderberg and Keller 1981, Nelson and Lumm 1987, Bertagne and Leising 1991). The fault zones were reactivated as high-angle reverse faults late in the Paleozoic Era.

This structural inversion probably accompanied the Alleghenian Orogeny. A second episode of normal faulting followed reverse faulting; the southeastern block collapsed, and slices of the hanging wall were sheared off and left high within the fault zone (Smith and Palmer 1974). The steep north limb of the Eagle Valley Syncline also developed during downward movement of the southeast block (Nelson and Lumm 1987).

The Fluorspar Area Fault Complex (plates 1 and 2), southeast of the structures described above, contains intricate zones of high-angle faults, most of which strike northeast. The displacements are predominantly normal, but some faults exhibit reverse and oblique slip. Mine exposures indicate multiple episodes of faulting and mineralization. These faults have undergone movement from Mississippian through Tertiary time, but the largest displacements are believed to be early Mesozoic (Kolata and Nelson 1991a).

The Wabash Valley Fault System north of the Rough Creek–Shawneetown is composed of high-angle normal faults having up to 480 feet (145 m) of throw (Bristol and Treworgy 1979, Ault et al. 1980). The relationship of the fault system to the Fluorspar Area Fault Complex is unclear. Braile et al. (1984) and Sexton et al. (1986) proposed that the Wabash Valley Fault System represents reactivated basement faults of a Precambrian rift system. Seismic data indicate no rift structure in the area, however, and they show that some of Wabash Valley faults die out at depth (Pratt et al. 1989, Nelson 1990).

The east-trending Cottage Grove Fault System is a right-lateral wrench fault that developed late in the Pennsylvanian to early in the Permian Period (Clark and Royds 1948, Nelson and Krausse 1981). Considered by some to be a westward continuation of the Rough Creek–Shawneetown Fault System, the Cottage Grove exhibits a different structural style and history; however, both fault systems may follow a Precambrian shear zone (Heyl 1972).

Hicks Dome is a large, nearly circular, fractured dome in the Fluorspar Area Fault Complex. It has been labeled cryptovolcanic and is thought to be the product of explosive igneous activity at depth (Brown et al. 1954, Bradbury and Baxter 1992). Numerous dikes, small stocks, and diatremes of ultramafic rocks and breccia occur near Hicks Dome. They appear to radiate from the dome and are concentrated along an axis that trends north-northwest. Similar dikes occur within the eastern part of the Cottage Grove Fault System and sills underlie Omaha Dome. Ultramafic rocks from the Cottage Grove and from near Hicks Dome have been radiometrically dated as Early Permian (Zartman et al. 1967).

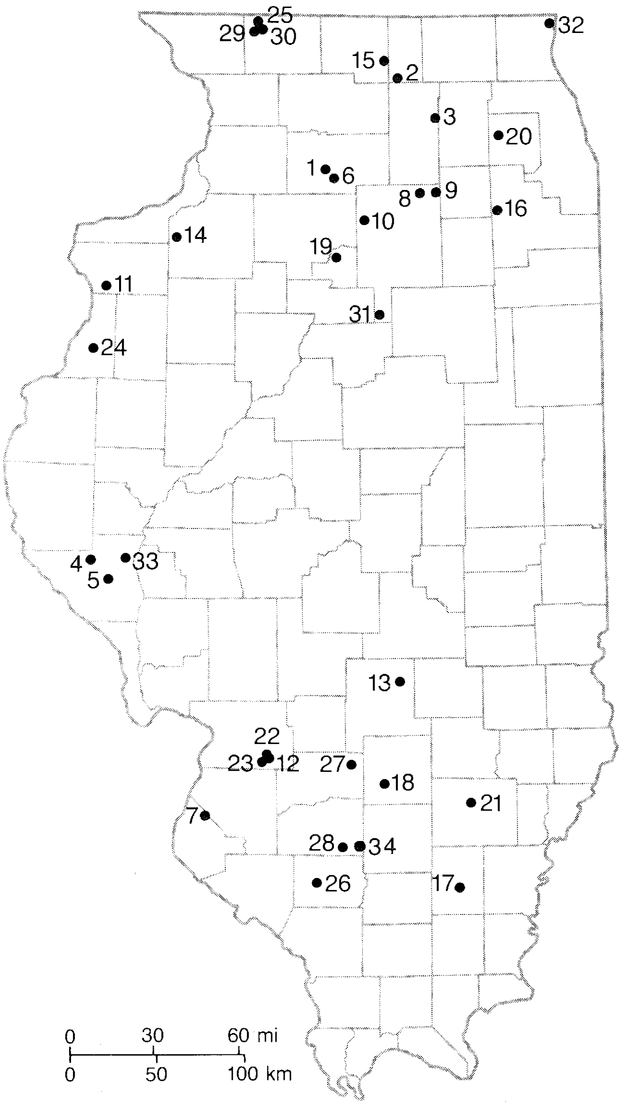


Figure 4 Wells that reach Precambrian rocks in Illinois. See table 1.

STRUCTURAL HISTORY

Precambrian

Little is known of the Precambrian geology of Illinois. Precambrian rocks do not crop out anywhere in the state and have been reached by only 34 drill holes to date (fig. 4). Of these holes, only ten include cores of Precambrian rocks, and only two cored holes have penetrated more than a few tens of feet into basement. The deep basement penetrations (holes 29 and 30, table 1) are both in Stephenson County near the Wisconsin border. These borings penetrated 3,264 feet (996 m) and 3,095 feet (944 m) of Precambrian rock, mainly biotite granite and granitic gneiss.

Granite and similar igneous rocks were found in 28 of the Precambrian borings that have been studied; rhyolite was encountered in four holes. Radiometric ages have been reported on samples of granite from four holes: two in Stephenson County, one in Henry County, and one in Madison County. All four dates range from 1,463 to 1,486 million years ago; similar Middle Proterozoic ages are reported on granites from nearby parts of Iowa, Wisconsin, and northern Indiana (Hoppe et al. 1983).

The oldest rock in the region is Archean migmatitic gneiss (3,000 to 3,600 million years old), which is exposed in southern Minnesota. Its southern extent is unknown. The gneiss is interpreted as a remnant of a sialic protocontinent (Sims et al. 1987). North of the gneiss is a greenstone-granite terrane, part of the Superior Province of the Canadian Shield (2,600 to 2,700 million years old). The greenstone/granite represents subaqueous volcanic and volcaniclastic rocks and associated granites. These were part of an island arc system sutured to the gneissic terrane during the Late Archean Era (Sims 1985, Sims et al. 1987).

Subsequent crustal extension produced a sedimentary basin in the Lake Superior region during the Early Proterozoic Era about 1,900 to 2,100 million years ago. Among the sediments deposited in this basin were the banded iron formations of the Mesabi, Cayuna, and Gunflint Ranges in Minnesota. An island arc system developed to the south in what is now Wisconsin. Approximately 1,850 million years ago, collision between the island arc and the northern craton resulted in the Penokean Orogeny (Ojakangas and Matsch 1982, Sims et al. 1987).

After a lapse of roughly 100 million years, crustal extension south of the Penokean collision zone in present Wisconsin led to intrusion of anorogenic granite and extrusion of rhyolite. Next, sedimentary rocks including the Sioux and Baraboo Quartzites were deposited. Sedimentary rocks about 1,600 to 1,700 million years old crop out in the Baraboo Range about 60 miles (100 km) north of the Illinois border. The rocks of the Baraboo Range have been metamorphosed to greenschist facies and deformed into east-trending folds (Sims et al. 1987).

Another major collisional event, the Central Plains Orogeny, took place about 1,630 to 1,800 million years ago (Bickford et al. 1986, Sims and Peterman 1986). Granitic and metamorphic rocks of the Central Plains Orogen underlie large areas of Nebraska, Kansas, and northern Missouri and may extend into Illinois just north of St. Louis (fig. 5). Widespread acidic igneous activity succeeded the Central Plains Orogeny. Anorogenic granite and rhyolite were emplaced in present northern Illinois and adjacent areas 1,450 to 1,500 million years ago (Hoppe et al. 1983). The name Transcontinental Anorogenic Province has been applied to these rocks (Sims et al. 1987). At nearly the same time (1,350 to 1,480 million years ago), the St. Francois granite-rhyolite terrane, part of the Eastern Granite-Rhyolite Province, developed in what became southern Illinois, southeastern Missouri, and adjacent areas.

Nearly all of the Precambrian rocks that have been encountered in Illinois wells can be ascribed to either the Transcontinental or St. Francois Terrane (fig. 5), although the boundary between these terranes is ill-defined. The St. Francois Terrane, which crops out and has been drilled extensively in southeastern Missouri, is much better known than the Transcontinental Terrane. Kisvarsanyi (1981) characterized the St. Francois Terrane as a series of granite ring complexes, similar to those of the African and Brazilian Shields. The St. Francois Terrane may have been a rift zone. Volcanic rocks seem to be confined between two major northwest-trending shear zones, the Grand River and Northeast Missouri Tectonic Zones (Kisvarsanyi 1984, Sims et al. 1987). The Ste. Genevieve Fault Zone (fig. 2) partly coincides with the Northeast Missouri Tectonic Zone. Other northwest-trending shear zones in Missouri, eastern Kansas, and southern Iowa are similarly defined by Proterozoic igneous intrusions, geophysical anomalies, cataclasis of basement rocks, and folding and faulting of the Paleozoic rocks (Guinness et al. 1982, Sims et al. 1987).

Middle Proterozoic granite and rhyolite in Illinois may be largely a veneer on top of older layered rocks. Both proprietary and published seismic reflection profiles (Braile et al. 1984, Pratt et al. 1989) reveal strong, moderately to highly continuous, subhorizontal reflectors at depths far below the top of granite-rhyolite. Xenoliths of schist and gneiss found in diatremes in southeastern Missouri (Tarr and Keller 1933) provide further evidence that the St. Francois Terrane rests on an older basement.

No record is known in Illinois of geologic events between about 600 and 1,350 million years ago. The Midcontinent Rift System, which curves from southern Michigan through Lake Superior and then southwestward to Kansas, formed approximately 1,000 to 1,200 million years ago. At roughly the same time, continental collision along the eastern and southern margin of North America resulted in the Grenville Orogeny (King 1977). After the Grenville Orogeny, what is now Illinois was situated in the interior of a Late Proterozoic supercontinent.

The Precambrian supercontinent broke apart near the end of the Precambrian Era about 600 million years ago. The North American craton, as part of a continent called Laurentia, separated from the southern landmass of Gondwanaland, and ocean basins developed between the two continents. The line of separation roughly coincided with the present trends of the Ouachita and Appalachian Mountains (fig. 5). Several aulacogens extended into Laurentia, roughly perpendicular to the coastline (Burke and Dewey 1973). Among these intracratonic aulacogens was the Reelfoot Rift and its eastward extension, the Rough Creek Graben. The Reelfoot Rift (Ervin and McGinnis 1975) underlies the present Mississippi Embayment from northeastern Arkansas and western Tennessee to southern Illinois. The Rough Creek Graben (Soderberg and Keller 1981, Schwalb 1982) trends eastward into Kentucky. The Reelfoot Rift and Rough Creek Graben are bounded by large listric normal faults that penetrate crystalline basement (fig. 6).

Cambrian Period

The Reelfoot Rift and Rough Creek Graben actively subsided during the Cambrian Period and received thick successions of sediments, while areas outside the grabens remained as eroding uplands (Houseknecht and Weaverling 1983, Howe and Thompson 1984, Nelson and Kolata 1988, Consortium for Continental Reflection Profiling [COCORP] Atlas 1988, Profiles AR-6 and TN-3, Bertagne and Leising 1991). Rapid sedimentation took place in these trenches concurrent with movement along their bounding faults. Faulting continued through the early St. Croixan Epoch when the Mt. Simon/Lamotte Sandstone was being deposited (Howe and Thompson 1984, Bertagne and Leising 1991).

A hilly topography with as much as 800 feet (240 m) of documented local relief was carved from Precambrian granite and rhyolite in the rest of Illinois. In the St. Croixan Epoch (Late Cambrian), the sea invaded the continental interior, depositing the Mt. Simon/Lamotte Sandstone (fig. 7). The lower part of the Mt. Simon/Lamotte, derived from weathered granite, is generally coarse and arkosic; upward it becomes finer grained and more quartzitic. Two basins of deposition developed (fig. 8). One was located over

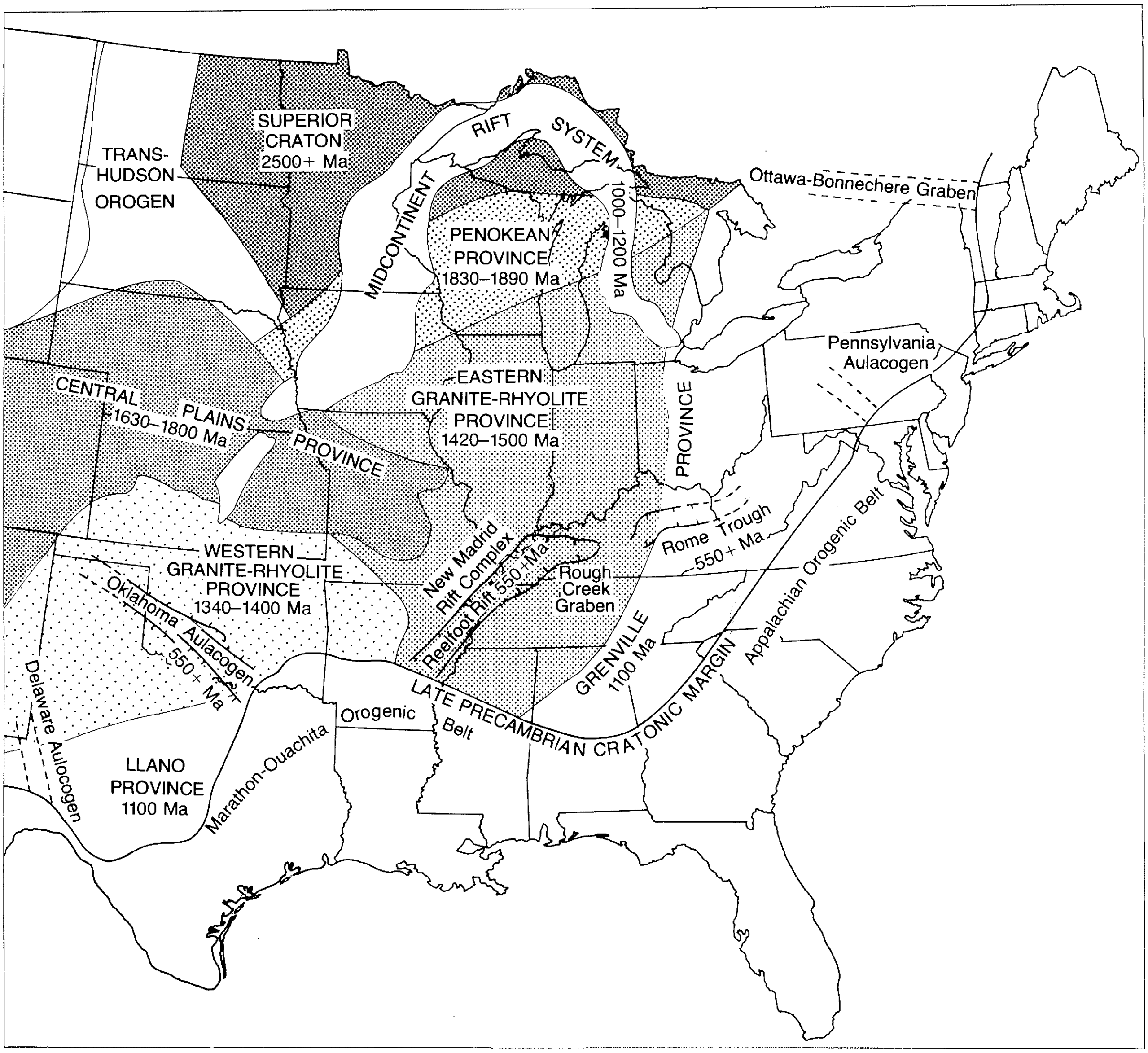


Figure 5 Generalized Precambrian geology of eastern and central United States. Ages of rocks given in millions of years.

the rapidly subsiding Reelfoot Rift and Rough Creek Graben in southernmost Illinois; the other was in northeastern Illinois and parts of adjacent states. This northern basin disappeared after Mt. Simon/Lamotte deposition. The Sparta Shelf was a positive area; the Mt. Simon/Lamotte is thin or absent in the area. An ancestral Du Quoin Monocline may have formed a structural hinge line on the east margin of the Sparta Shelf. The St. Francois Mountains and other large Precambrian hills remained above sea level, so the Mt. Simon/Lamotte does not overlap them.

By the end of Mt. Simon/Lamotte deposition, active movement ceased on the faults that bounded the Reelfoot Rift and Rough Creek Graben, but the rifted area continued to subside rapidly. The resulting structural depression, of which the deepest point lay south of Illinois, is called the Reelfoot Basin (Schwalb 1969). The configuration of the Reelfoot Basin is poorly known; it may have been a trough that connected with the open ocean south of Laurentia. The Reelfoot Basin was a Cambrian–Ordovician predecessor to the Illinois Basin.

After deposition of the Mt. Simon/Lamotte, a carbonate bank (Bonneterre Dolomite) developed on the Ozark Dome and extended into southwestern Illinois. The Bonneterre intertongues northeastward with siliciclastics of the Eau Claire Formation (Workman and Bell 1948, Howe et al. 1972, Schwalb 1982, Sargent 1991). Within the Reelfoot Basin, this interval becomes predominantly shale and more than doubles in thickness (Schwalb 1982). Only a few of the highest knobs in the St. Francois Mountains and on the Sparta Shelf remained above water during late St. Croixan time (Dake and Bridge 1932).

The patterns established during Eau Claire sedimentation continued for the rest of the Cambrian Period. Subsidence was most rapid in southern Illinois but the sea was shallow; carbonate sedimentation (Knox Group) was predominant. Tongues of supermature quartz sandstone, derived and extended from the north, interfingered with carbonates in northern Illinois (Buschbach 1975, Ostrom 1970, 1978).

Ordovician Period

Sedimentation continued with little or no break from the Cambrian into the

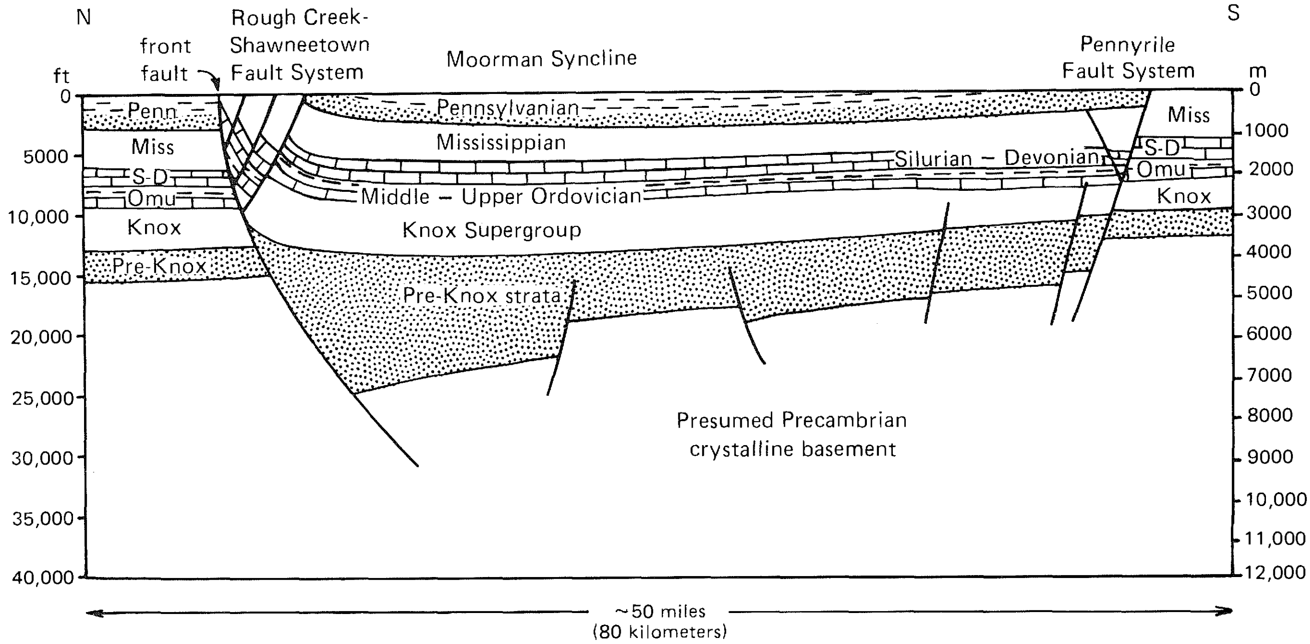


Figure 6 An interpretive cross section of Rough Creek Graben in western Kentucky.

Ordovician Period in Illinois. Rapid deposition of shallow water carbonate took place in southern Illinois during Canadian (Lower Ordovician) time. Knox strata may exceed 7,000 feet (2,100 m) in the Reelfoot Basin, and they thin rapidly northward (Schwalb 1982). Equivalent rocks of northern Illinois are less than 500 feet (150 m) thick and consist mainly of cherty dolomite and dolomitic sandstone.

The sea withdrew from most of the North American craton at the end of the Canadian Epoch, and the region was subjected to subaerial erosion. The resulting uncomformity separates the Sauk Sequence below from the Tippecanoe Sequence above (Sloss et al. 1949, Sloss 1963). The Kankakee Arch emerged, a karst topography developed in exposed Canadian carbonates, and channels were locally cut as deep as the Franconia Formation (Cambrian), (Buschbach 1964, 1975). Southward, this sub-Tippecanoe unconformity becomes less pronounced. Sedimentation possibly was uninterrupted in the deep part of the Reelfoot Basin. Sandstone and sandy dolomite of the Everton Formation overlie the sub-Tippecanoe unconformity in southern Illinois (Schwalb 1982). The St. Peter Sandstone unconformably overlies the Everton, and oversteps it northward. The almost pure, well rounded, frosted quartz sand that constitutes the St. Peter probably was recycled from older sandstones to the north of Illinois. The thickness of the St. Peter varies in irregular fashion, reflecting both its deposition upon an erosion surface and its intertonguing facies relationship with overlying carbonates (Templeton and Willman 1963).

After St. Peter sedimentation, carbonate deposition resumed early in the Champlainian Epoch. The Dutchtown and Joachim Formations and Platteville Group steadily increase in thickness from northwestern to southeastern Illinois toward the Reelfoot Basin (Willman and Buschbach 1975). The Decorah Subgroup, a wedge of fine grained, siliciclastic sediment derived from the Transcontinental Arch far to the northwest, was deposited above the Platteville in northwestern Illinois and around the east margin of the Ozark Dome. The succeeding upper Champlainian–Cincinnatian Galena (Trenton) Group, unlike most older units, is more than twice as thick in northwestern Illinois as it is in the south (Willman and Buschbach 1975). This trend suggests that by early in the Cincinnatian Epoch the Reelfoot Basin was no longer subsiding more rapidly than the rest of Illinois. Such interpretations must be made cautiously, however, because thickness trends of carbonate rocks are not necessarily reliable indicators of subsidence rates. In some instances, carbonates accumulate more rapidly on stable shelves than in basins.

The Taconian Orogeny took place east of Illinois late in the Champlainian and during the Cincinnatian (Late Ordovician) Epochs as a consequence of collision between North America and an eastern landmass. The chief effect in Illinois was the introduction of fine siliciclastic sediment that was eroded from distant highlands raised during the orogeny. These siliciclastics constitute the Cincinnatian Maquoketa Group, which is predominantly shale. The Maquoketa thickens eastward from about 300 feet (90 m) in eastern Illinois to more than 1,000 feet (300 m) in western Ohio (Kolata and Graese 1983, Whitaker 1988). This eastward thickening may reflect downwarping of the crust in a foreland basin adjacent to the orogenic belt, and it also reflects proximity to the source area. Local thickening of the Maquoketa in extreme western Kentucky indicates that part of the Reelfoot Basin continued to subside more rapidly than most of Illinois. Other local structural movements in and near Illinois, possibly triggered by the Taconian Orogeny, are indicated by Cincinnatian sedimentation patterns. The Thebes Sandstone of southwesternmost Illinois and adjacent Missouri may have been derived from uplift of part of the Ozark Dome. In northern Illinois, thickness and lithofacies distribution of Maquoketa rocks indicate slight concurrent uplift of the Wisconsin Arch, La Salle Anticlinorium, and related structures (Kolata and Graese 1983, Graese 1988).

Silurian Period

The Silurian Period was a quiet time tectonically in Illinois and surrounding areas. Marine sediments, now largely dolomite in the north and limestone, shale, and siltstone in the south, were laid down in Illinois during the Silurian Period.

Alexandrian (Lower Silurian) carbonates were deposited on the Maquoketa Group after a brief episode of erosion. The Alexandrian Series is less than 50 feet (15 m) thick in most of central Illinois. Its maximum thickness of 125 to 150 feet (38–46 m) is attained in a few areas of northeastern Illinois and Franklin County in southern Illinois (Willman and Atherton 1975). It is unknown to what degree, if any, the thickness trends reflect structural movement.

Pinnacle reefs first appeared early in the Niagaran (Silurian) Epoch and grew throughout the Niagaran and Cayugan (Late Silurian) Epochs. Known reefs in Illinois lie mainly in the Chicago area and along a broad zone that trends northeastward from St. Louis toward Terre Haute, Indiana. Reefs in Illinois appear to have grown preferentially along the margins between areas of shallow and deep water. Reefs in the Chicago area are part of an archipelago that surrounds the Michigan Basin. Reefs in southern Illinois flanked a depression known as the Vincennes Basin (Droste et al. 1975), which was similar in shape and size to the present Fairfield Basin; but the axis of the Vincennes Basin lay east of that of the Fairfield Basin. The Vincennes Basin extended south of the Rough Creek Fault System into Kentucky and thus was a proto-Illinois Basin, successor to the Reelfoot Basin of Cambrian and Ordovician time. The thickest Silurian strata are not found in the Vincennes Basin, but in the reef areas—a significant fact indicating that carbonate thickness is not a reliable guide to subsidence rates. Interpretation of Silurian paleogeography is based more on lithofacies than on isopach mapping (Droste and Shaver 1980, 1987, Whitaker 1988).

Devonian Period

Sedimentation apparently continued without a break from the Silurian into the Devonian Period in southern Illinois, where the Silurian–Devonian systemic boundary has not been accurately located. Because pre-Middle Devonian erosion moved Lower Devonian rocks elsewhere, they are extant only in southern Illinois and thicken southward. A basin probably existed with its trough or axis in southernmost Illinois and adjacent parts of Kentucky. Rogers (1972) called this feature the Metropolis De-

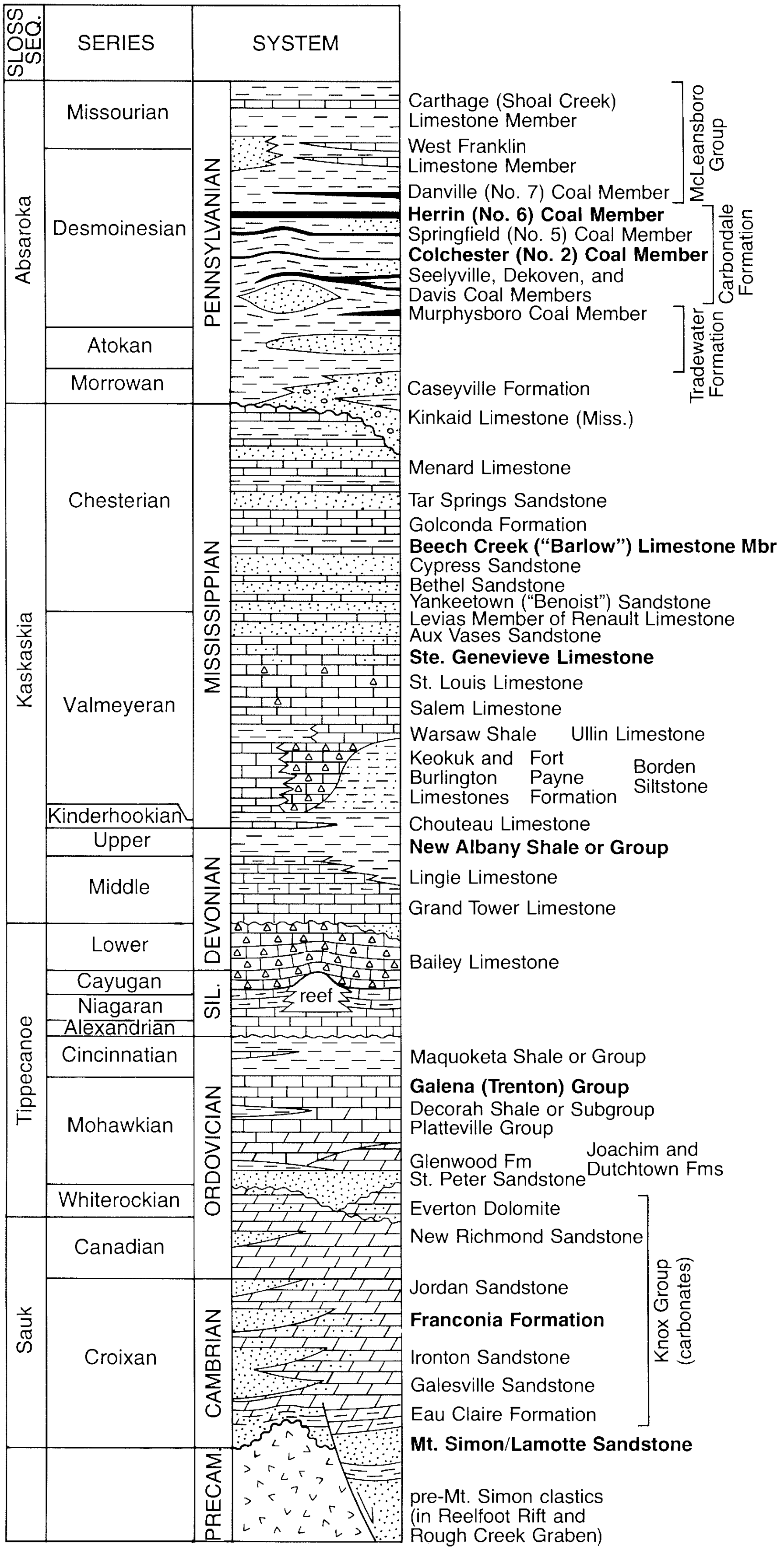


Figure 7 Stratigraphic column showing the units mentioned in the text. Units of greatest value in structural mapping appear in bold type. Not to scale.

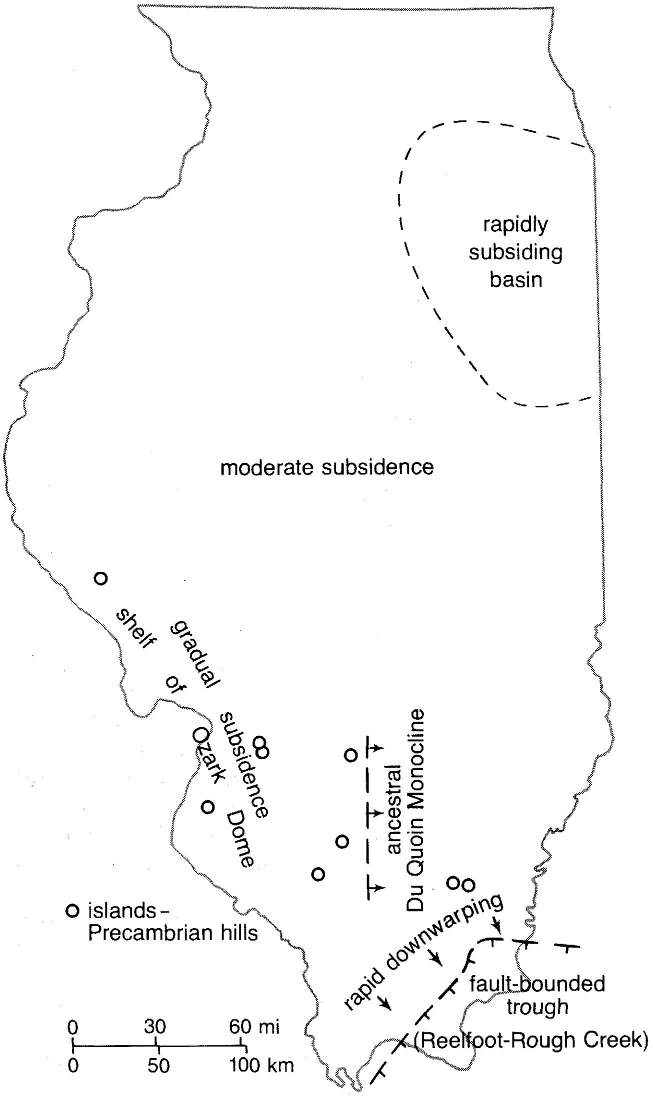


Figure 8 Paleogeography of Illinois during deposition of the Mt. Simon Sandstone (Upper Cambrian).

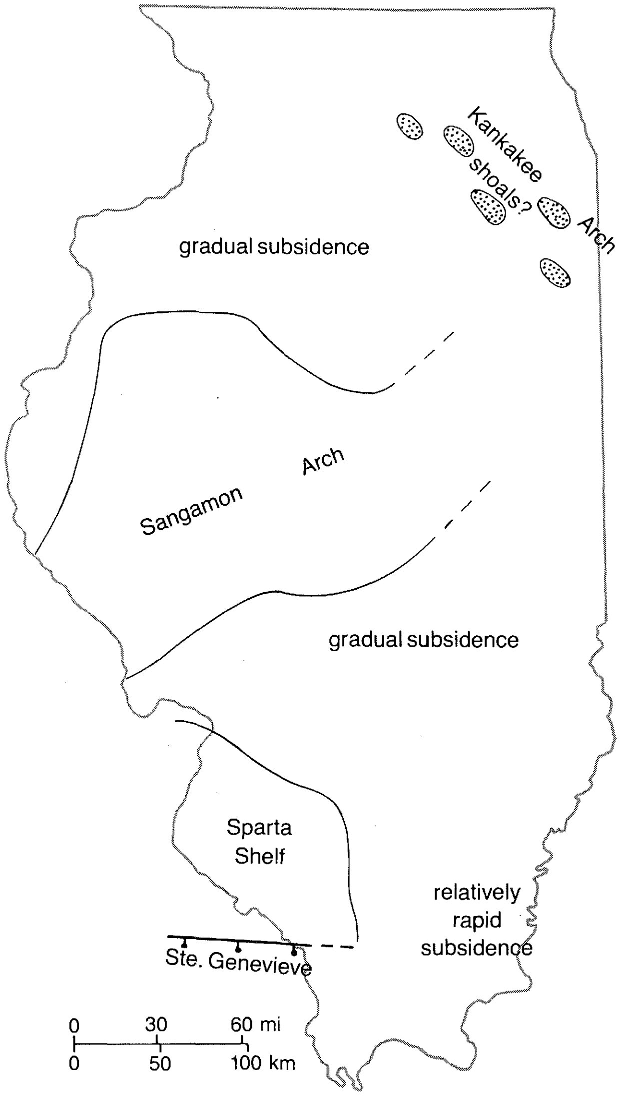


Figure 9 Paleogeography of Illinois during the Middle Devonian Epoch.

pression, but the term Vincennes Basin (Droste et al. 1975) is more widely used. Lower Devonian strata within this basin are dominantly fine grained, highly siliceous limestone and dolomite interbedded with chert. A coarse bioclastic limestone, the Backbone Limestone, represents basin-fringing shoals (Rogers 1972, Droste and Shaver 1987).

At the end of the Early Devonian Epoch, the sea withdrew from much of the North American craton, including all except southernmost Illinois. Subaerial erosion exposed strata as old as the Galena Group (Upper Ordovician) in western Illinois (Willman et al. 1967, Collinson and Atherton 1975). The resultant unconformity separates the Tippecanoe Sequence from the overlying Kaskaskia Sequence (Sloss et al. 1949, Sloss 1963).

As Middle Devonian sedimentation began, two areas in Illinois remained above sea level. One was the Sparta Shelf in the southwestern part of the state (fig. 9). The other was the Sangamon Arch, a broad northeast-trending arch that divided the Devonian seaway into two basins, one in southern Illinois and the other in northwestern Illinois and Iowa. Both basins primarily received carbonate sediments, but the detailed successions differ.

Another episode of continental collision along the eastern coast of North America brought on the Middle to Late Devonian Acadian Orogeny. Active faulting in and near Illinois may have been triggered by Acadian stresses. The buried Rough Creek Graben and Reelfoot Rift subsided, creating a Middle Devonian depocenter in southernmost Illinois and western Kentucky. The north side of the Rough Creek Fault System was raised in Kentucky (Freeman 1951). To the northwest, the Sparta Shelf was uplifted relative to the Ozark Dome along the Ste. Genevieve Fault Zone shortly after deposition of the Grand Tower Limestone (lower Middle Devonian). The fault zone, known mostly from subsurface data, trends eastward from Missouri into Jackson County, Illinois (fig. 10). Devonian, Silurian, and Ordovician strata were eroded from the northern block; clastic detritus was incorporated into upper Middle Devonian units south of the fault scarp (S. Weller and St. Clair 1928, Nelson and Lumm 1985). In Iowa and northern Illinois, the east-trending Plum River Fault Zone was also active during Middle Devonian sedimentation (Bunker et al. 1985).

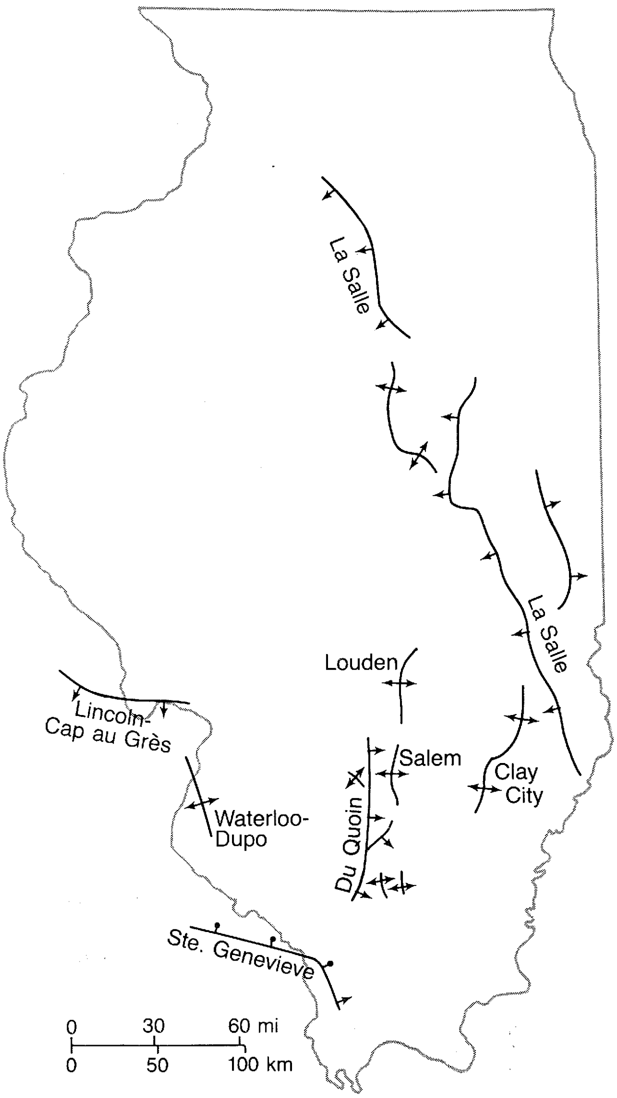


Figure 10 Structures active from late in the Mississippian Period through early in the Pennsylvanian Period.

Meanwhile in the eastern United States, the Catskill Delta Complex prograded westward from sources in new mountains uplifted during the Acadian Orogeny. Distal, dark organic clay and silt (New Albany Group) reached Illinois late in the Middle Devonian Epoch and continued to accumulate through the Late Devonian into the Kinderhookian (lower Mississippian) Epoch. By the Late Devonian, the Sangamon Arch and Sparta Shelf were again largely submerged and received marine sediment. Regionally the New Albany is thickest near the western end of the Rough Creek Graben. Isopach mapping (Schwalb and Potter 1978) revealed that both the northern and southern boundary faults of the graben were active during New Albany sedimentation. Also active was the Media Anticline in Henderson County, Illinois, and several northwest-trending anticlines nearby in Iowa. Folding evidently was caused by movement on basement faults reactivated under stresses associated with the Acadian Orogeny.

Mississippian Period

The basin or embayment that was established in southern Illinois during the Devonian Period continued into the Mississippian Period, while the basin that had existed northwest of the Sangamon Arch became a shelf. Nevertheless, Kinderhookian strata are considerably thicker in west-central than in southern Illinois. Lineback (1969) referred to the southern basin early in the Mississippian as a starved basin. Only a little mud and fine silt (Springville Shale) accumulated there. The shallow, well oxygenated water on the Western Shelf was conducive to carbonate formation. By early in the Valmeyeran (middle Mississippian) Epoch, a carbonate bank (Burlington and Keokuk Limestones) flourished on the Western Shelf.

An Acadian clastic wedge, the Borden Delta, prograded into Illinois from the east or northeast early in the Valmeyeran (Swann et al. 1965). The delta eventually reached southwestern Illinois and overlapped the Burlington–Keokuk carbonate bank. A relatively deep basin remained on the south, flanked by the Borden foreset beds. Siliceous lime mud (Fort Payne Formation) began to fill this basin and overlapped the flanks of the Borden Delta (Lineback 1966).

Tectonic stability prevailed in Illinois for the rest of Valmeyeran time. Carbonates gradually filled the southern basin and overlapped the Borden Delta and Western Shelf. The Ullin, Salem, St. Louis, and Ste. Genevieve Limestones record gradual shoaling and infilling of the basin. By the end of the Valmeyeran, the sea was very shallow across most of Illinois. The epicontinental shelf and adjacent coastal plain sloped very slightly southwest toward the rapidly deepening Ouachita geosyncline.

During the Chesterian Epoch (late Mississippian), terrigenous clastics once again were introduced into Illinois and neighboring areas. According to Swann (1963), a series of streams called the Michigan River System delivered clay, silt, and fine quartz sand from source areas far to the northeast. Deltas prograded into the epicontinental ocean; the shoreline periodically advanced and retreated, most likely because of eustatic changes in the sea level. As a consequence, the Chesterian Series consists of numerous alternating units of limestone and terrigenous clastics. Chesterian structural movements in Illinois were subtle. Lithofacies mapping suggests that the Du Quoin Monocline, La Salle Anticlinorium, and Rough Creek Graben were elevated slightly during deposition of the Golconda Group (middle Chesterian) (Treworgy 1988).

Widespread structural deformation took place in Illinois and through much of North America near the end of the Mississippian Period. Major episodes of mountain building took place both east and west of Illinois at this time. On the east, an early episode of the collisional Alleghenian Orogeny occurred in latest

Mississippian through the early Pennsylvanian time. Mountains rose from Alabama to Nova Scotia, while adjacent foreland basins such as the Black Warrior (Alabama) and Pocahontas (Virginia and West Virginia) sank. West of Illinois, many basement-cored fault blocks were uplifted, notably the Ancestral Rockies (Colorado and Wyoming), Wichita–Amarillo Mountains (Texas and Oklahoma), and the Nemaha Anticline and Central Kansas Uplift (Kansas). Uplifts in Illinois were similar in style, although smaller in scale, than the western examples. Most late Mississippian uplifts in Illinois involved movement on north- to northwest-striking, high-angle reverse faults in basement, and the movements forced folding of sedimentary cover. Active structures included the La Salle Anticlinorium; Clay City, Salem, Louden, and Waterloo–Dupo Anticlines; Du Quoin Monocline; Ste. Genevieve Fault Zone; and the Lincoln Anticline/Cap au Grès Faulted Flexure (fig. 10). Most of these structures continued to undergo movement both during and after Pennsylvanian sedimentation.

Late Mississippian deformation in Illinois was a compressional event analogous to the Laramide foreland deformation in the Wyoming Province (Stearns 1978). As a consequence of either the widespread tectonic activity or a eustatic drop in sea level, all of Illinois was exposed to subaerial erosion at the end of the Mississippian Period. The resultant unconformity separates the Kaskaskia and older sequences from the overlying Absaroka Sequence. Erosion was deepest on active uplifts; St. Peter Sandstone (Middle Ordovician) underlies the unconformity near the northern end of the La Salle Anticlinorium. Progressively younger rocks are preserved beneath the unconformity southward. A system of anastomosing rivers cut southwest-trending valleys into Mississippian strata of central and southern Illinois (Bristol and Howard 1974, Howard 1979).

Pennsylvanian Period

After erosion of the sub-Absaroka surface, sedimentation resumed in the Morrowan (early Pennsylvanian) Epoch. First the valleys aggraded, then the intervening divides were covered. Rivers flowing from the northeast were the primary source of clastic sediment, as in Chesterian time. Basal Pennsylvanian deposits (Caseyville Formation) of southern Illinois represent a variety of

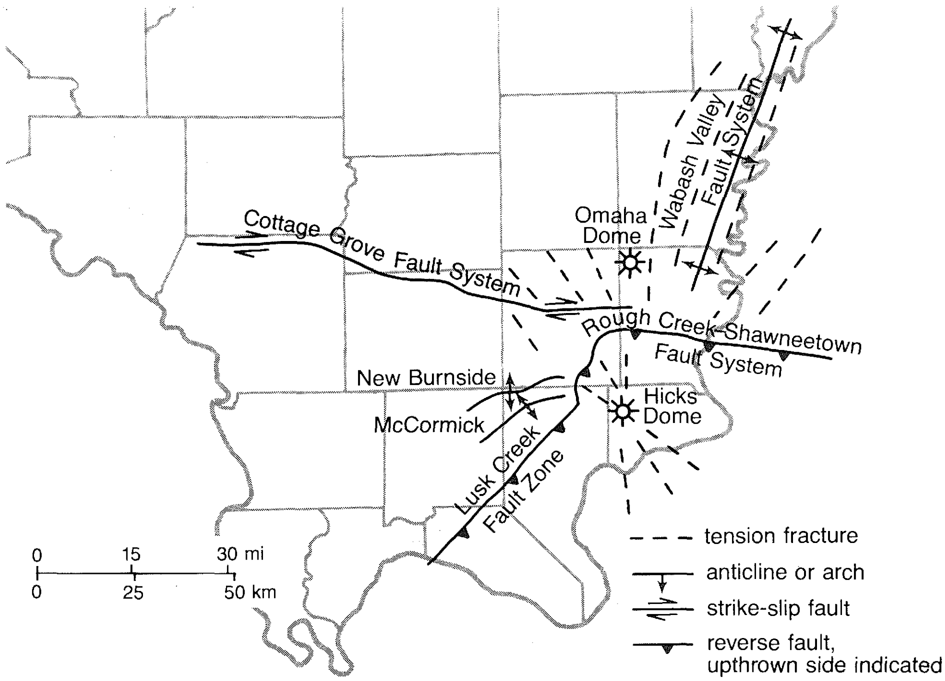


Figure 11 Structures active in southern Illinois from late in the Pennsylvanian Period through the Permian Period.

fluvial, deltaic, coastal swamp, and marginal marine environments. A small area of the Caseyville, probably from a northwestern source, also accumulated in Rock Island County and adjacent parts of Iowa. The rest of Illinois was still undergoing subaerial erosion, but the sea gradually encroached northeastward. Almost all of Illinois received sediments during Atokan time, although a few structural uplifts were not covered until early in the Desmoinesian Epoch. Uplift along the Du Quoin Monocline continued; the Fairfield Basin sank more rapidly than did the Sparta Shelf. The Fairfield Basin probably was connected to the Arkoma Basin, so that sediment was carried around the southeast side of the Ozark Dome (Houseknecht 1983). The La Salle Anticlinorium and other anticlines and monoclines in Illinois rose intermittently throughout the Pennsylvanian Period (fig. 11).

By middle Desmoinesian time, Illinois had become a level plain or shelf. Vast coal swamps flourished. Highly continuous but thin marine limestones were interlayered with fluvial and deltaic clastic units and coal. Local, minor movements on the Du Quoin Monocline, La Salle Anticlinorium, and other structures have left an imprint on Desmoinesian sedimentary patterns.

These conditions persisted, with minor and subtle variations, through the Missourian and Virgilian Epochs and probably into the Permian Period. Very early Permian rocks identified in a drill core in western Kentucky (Kehn et al. 1982) imply that marine strata of this age formerly covered at least the southern part of the Illinois Basin.

Late Paleozoic (?) Compressional Events

Reverse and strike-slip faulting and folding occurred in southern Illinois late in the Paleozoic Era. The resulting structural pattern indicates compression from the south or southeast. Associated with this deformation is alkalic ultrabasic igneous activity; these rocks have been dated as Early Permian (Zartman et al. 1967). The style and timing of deformation indicate a relation to the Alleghenian and Ouachita Orogenies, which were caused by continental collision. Many compressional faults in southern Illinois are reactivated faults that originated during Cambrian rifting. Major events of the late Paleozoic compressional phase were as follows (fig. 11):

• The south side of the Rough Creek–Shawneetown Fault System rose along a reverse fault that dips steeply to the south. Maximum uplift was at least 3,500 feet (1,050 m) at the "Horseshoe Upheaval" in eastern Saline County (Nelson and Lumm 1987, Bertagne and Leising 1991).

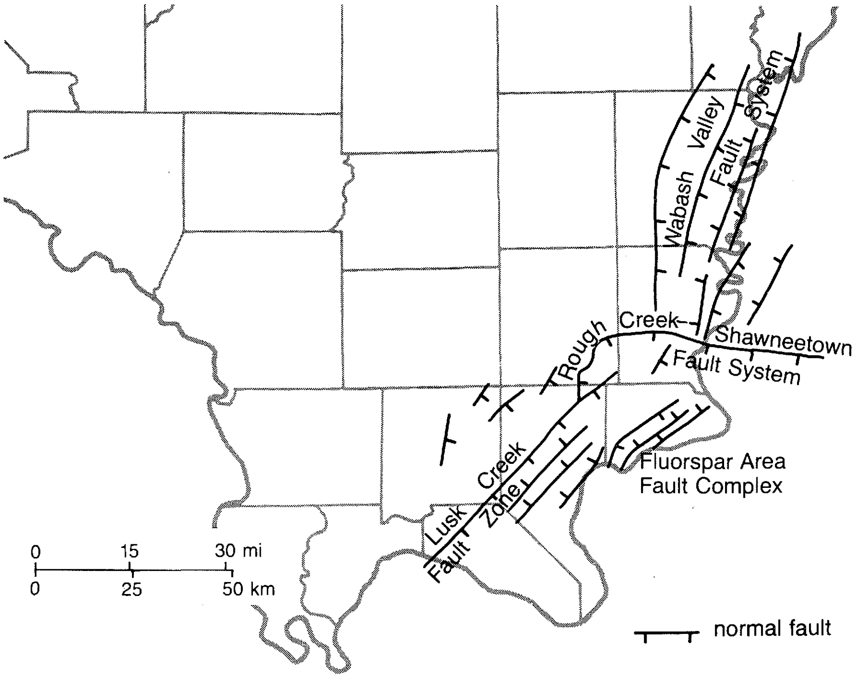


Figure 12 Structures active in southern Illinois during the Mesozoic Era.

• In similar fashion, the southeast side of the Lusk Creek Fault Zone was raised (Nelson 1986).

• Right-lateral movement and intrusion of ultramafic igneous rocks took place along the Cottage Grove Fault System and at the Omaha Dome.

• Hicks Dome and its radial and concentric faults were produced by cryptovolcanic explosions at depth. Diatremes and ultramafic dikes, dated as early Permian (Zartman et al. 1967), appeared in the vicinity. The Tolu Arch probably also formed at this time.

• The McCormick and New Burnside Anticlines developed, probably in response to horizontal thrusting along one or more décollements northwest of the Lusk Creek Fault Zone (Nelson 1987a).

In addition, post-Pennsylvanian uplift affected many structures in the Fairfield Basin, including the Du Quoin Monocline, the La Salle Anticlinorium, and the Salem, Louden, and Clay City Anticlines. Whether these movements were related to compressional deformation farther south is not known. The Pascola Arch is also a post-Pennsylvanian feature, but its structural style is not understood and timing of uplift is poorly constrained. The Pascola Arch was formed sometime between the Late Pennsylvanian and Late Cretaceous period.

Mesozoic (?) Extensional Events

Reversal of the stress field from the compressional phase described above resulted in a period of extensional stress typified by normal faulting. In many cases, reverse faults formed in the compressional phase were reactivated as normal faults. Major structural events include the following (fig. 12):

• Normal faulting occurred along the Rough Creek–Shawneetown Fault System. The southern block sank back to approximately its pre-Permian position; drag along the fault zone created the northern limb of the Eagle Valley–Moorman Syncline (Nelson and Lumm 1987).

• Similarly, the Lusk Creek Fault Zone underwent normal faulting. Normal faults along the McCormick and New Burnside Anticlines probably formed at the same time (Nelson 1986b, 1987).

• The northeast-trending normal faults of the Fluorspar Area Fault Complex developed; mineralization took place.

• The Wabash Valley Fault System developed.

The cause and timing of extensional faulting are poorly understood. Several observations suggest, however, that the most likely time of normal faulting was Triassic or Jurassic. Normal faults in the fluorspar district displace the Permian dikes and are therefore younger than the dikes. Drag and the position of fault slices in the Lusk Creek Fault Zone and Rough Creek–Shawneetown Fault System indicate that the last movements on these faults were normal and down to the south or southeast. Displacement of Cretaceous and Tertiary rocks of the Mississippi Embayment by faults of the Fluorspar Area Fault Complex is small compared with offsets of Paleozoic bedrock (Rhoades and Mistler 1941, Kolata et al. 1981). The stress regime implied by northeast-trending normal faults is inconsistent with inferred stresses that produced the Permian Alleghenian Orogeny; also, it does not match the modern, measured stress regime. The Triassic was a period of widespread graben formation in the eastern United States. Most of the Triassic grabens trend north–south to northeast–southwest. The Atlantic Ocean, with its north-south-trending central rift, opened during the Jurassic Period. These observations indicate that normal faulting in southern Illinois probably took place in Triassic or Jurassic time.

Cretaceous to Recent Events

Documenting post-Cretaceous structural movement in Illinois is difficult because Cretaceous and Tertiary strata are restricted to small areas and, where present, are poorly exposed. Cretaceous rocks occur only in the Mississippi Embayment of southernmost Illinois and in several small outliers in Adams, Brown, and Pike Counties in western Illinois. Clay, silt, and sand of Paleocene and Eocene age overlie Cretaceous strata in the Embayment. Scattered deposits of Pliocene or early Pleistocene gravel variously overlie Tertiary, Cretaceous, or Paleozoic bedrock in both southern and western Illinois, beyond the limits of glacial drift. Exposures of these materials are limited to occasional river bluffs, stream cuts, and small quarries for clay, sand, and gravel.

Faulting of Cretaceous and Tertiary sediments has been documented adjacent to Illinois in both Kentucky and Missouri. Rhoades and Mistler (1941) reported Cretaceous and possibly Tertiary deposits offset along northeast-trending faults of the Fluorspar Area Fault Complex near Paducah, Kentucky. Geologic maps of the same area show faults displacing the Cretaceous Tuscaloosa Gravel and McNairy Sand (Amos 1967, 1974, Amos and Wolfe 1966, Amos and Finch 1968). Offsets of Cretaceous units are small, 100 feet

(30 m) or less, in contrast to displacements as great as 2,000 feet (600 m) along the same faults in Paleozoic bedrock. In Missouri, Tertiary strata are folded and faulted along the southeast face of Crowleys Ridge, a linear northeast-trending scarp within the Mississippi Embayment. Mapping in this area demonstrates displacements of units as young as the Mounds Gravel (Pliocene to early Pleistocene?) and possible offsets of Quaternary loess and alluvium (Grohskopf 1955, McCraken 1971, W. Johnson 1985, Harrison and Schultz 1992, Nelson and Harrison 1993). In the Thebes Gap area of Scott County, Missouri, and Alexander County, Illinois, late Tertiary faults mostly strike northeast and exhibit right-lateral slip.

Post–Cretaceous tectonic faulting in southernmost Illinois was postulated by Ross (1963, 1964) and on the basis of field observations and subsurface data. Kolata et al. (1981) disputed Ross's findings and attributed all observed deformation to nontectonic processes such as landsliding and solution-collapse; however, new mapping has uncovered tectonic deformation of Cretaceous and Tertiary sediments in several areas in southernmost Illinois. The Mounds Gravel and older units are offset by northeast-trending faults in the Illinois portion of the Thebes Quadrangles (Harrison and Schultz 1992). A zone of post-Eocene faults trends slightly east of south through southern Union and northern Alexander counties (Devera et al. 1994, Nelson and Devera 1994). These faults dip steeply and exhibit probable strike-slip with a component of extension. The McNairy Formation and Mounds Gravel are deformed with probable right-lateral slip in the Dixon Springs Graben near the edge of the Mississippi Embayment (W.J. Nelson, unpublished mapping).

The contemporary tectonic stress field on the central United States, including Illinois, has been measured by a variety of methods (Sbar and Sykes 1973, Zoback and Zoback 1980, Nelson and Bauer 1987). The principal compressive stress axis is oriented from east to west to east-northeast to west-southwest in southern Illinois (fig. 13, table 5). Joint patterns in bedrock, directional ground failures in underground mines, and a small thrust fault in coal-bearing strata (fig. 14) apparently are products of present stress. Immediately south of Illinois, ancient faults of the Reelfoot Rift are being reactivated under contemporary stress, producing earthquakes in

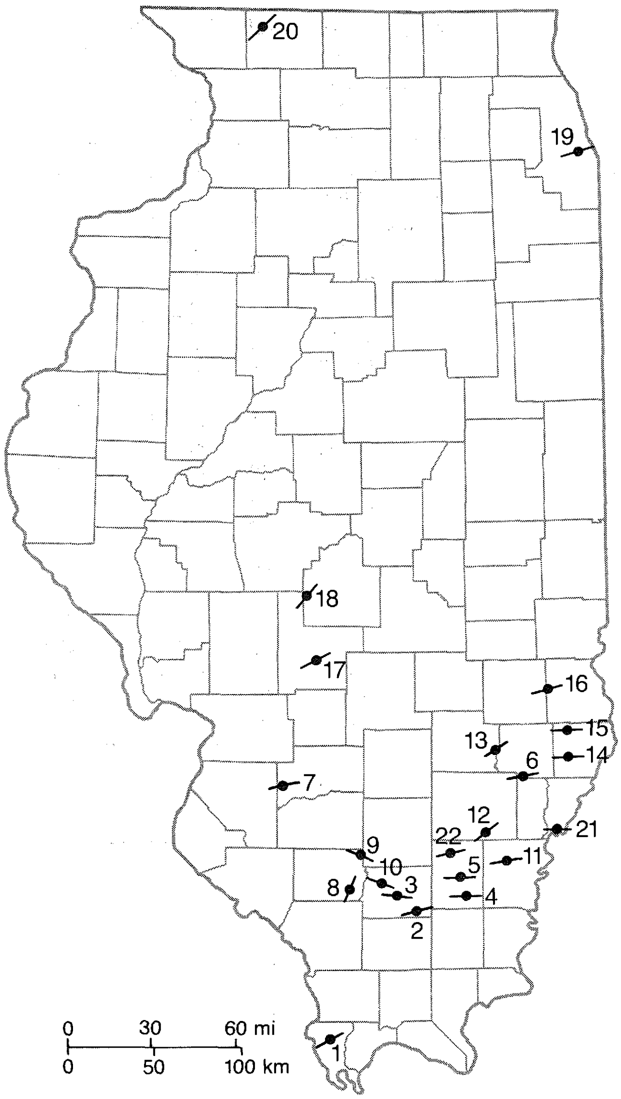


Figure 13 In situ stress measurements in Illinois. Line indicates orientation of stress. See table 5.

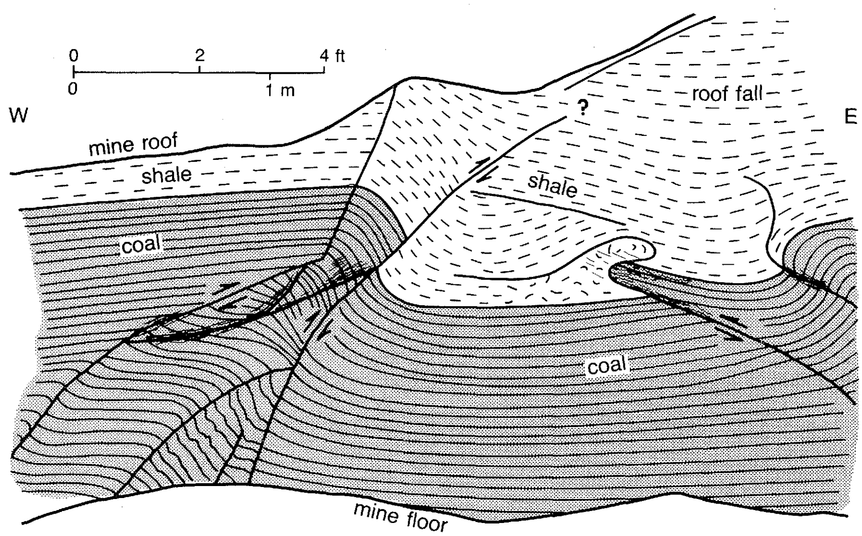


Figure 14 Zone of thrust faults exposed on the wall of an underground entry in the Sahara Coal Company's No. 21 Mine, Section 20, T9S, R5E, Saline County. The fault zone strikes due north and has been traced more than 1 mile (1.6 km) through the mine workings. Strata exposed are the Springfield Coal and Dykersburg Shale Members of the Carbondale Formation. From Nelson and Krausse 1981.

the New Madrid Seismic Zone (Braile et al. 1982, 1984, Hamilton and Zoback 1982, Russ 1982, Stearns et al. 1986). The most prominent faults in the New Madrid Seismic Zone (fig. 15) trend northeast and are undergoing right-lateral slip. Tertiary faults newly mapped in the Thebes area and Dixon Springs Graben have the same trend and sense of slip (Harrison and Schultz 1992, Nelson and Harrison 1993).

As this bulletin goes to press, research in southern Illinois continues in an attempt to determine whether any faults there are presently active.

Elsewhere in Illinois, Rubey (1952) reported that terrace deposits of the Grover Gravel were uplifted about 150 feet (45m) along the Cap au Grès Faulted Flexure. The Grover Gravel is considered equivalent to the Mounds and Pliocene to early Pleistocene in age (Willman et al. 1975). Quaternary structural movements in southern Illinois and southeastern Missouri were inferred on the basis of anomalous drainage patterns and tilted terraces and peneplains (Shaw 1915). No later geologist has addressed Shaw's ideas.

Table 5 In situ stress measurements in Illinois. See figure 13.

	Principal stress orientation	Method of measurement	Reference
1	N 59 E	Earthquake focal solution	Herrmann 1979
2	N 76 E	Strain gauge in coal mine	Y.P. Chugh 1984 (pers. comm.)
3	N 76 W	Strain gauge in coal mine	Y.P. Chugh 1984 (pers. comm.)
4	N 90 E	Earthquake focal solution	Stauder and Nuttli 1970
5	N 87 E	Strain gauge in coal mine	Blevins 1982
6	N 83 E	Earthquake focal solution	Stauder and Nuttli 1970
7	N 73 E	Borehole breakout measurement	Dart 1985
8	N 29 E	Borehole breakout measurement	Dart 1985
9	N 72 W	Borehole breakout measurement	Dart 1985
10	N 67 W	Borehole breakout measurement	Dart 1985
11	N 81 E	Borehole breakout measurement	Dart 1985
12	N 50 E	Borehole breakout measurement	Dart 1985
13	N 56 E	Borehole breakout measurement	Dart 1985
14	N 88 E	Borehole breakout measurement	Dart 1985
15	N 89 E	Borehole breakout measurement	Dart 1985
16	N 72 E	Borehole breakout measurement	Dart 1985
17	N 62 E	Hydrofracturing in boreholes	Haimson 1974 (exact location not specified)
18	N 41 E	Overcoring in coal mine	Hanna et al. 1985
19	N 72 E	Overcoring in tunnel	Shuri and Kelsey 1984
20	N 48 E	Hydrofracturing in boreholes	Haimson and Doe 1983
21	N 90 E	Overcoring in coal mine	Ingram and Molinda 1988
22	N 78 E	Overcoring in coal mine	Ingram and Molinda 1988

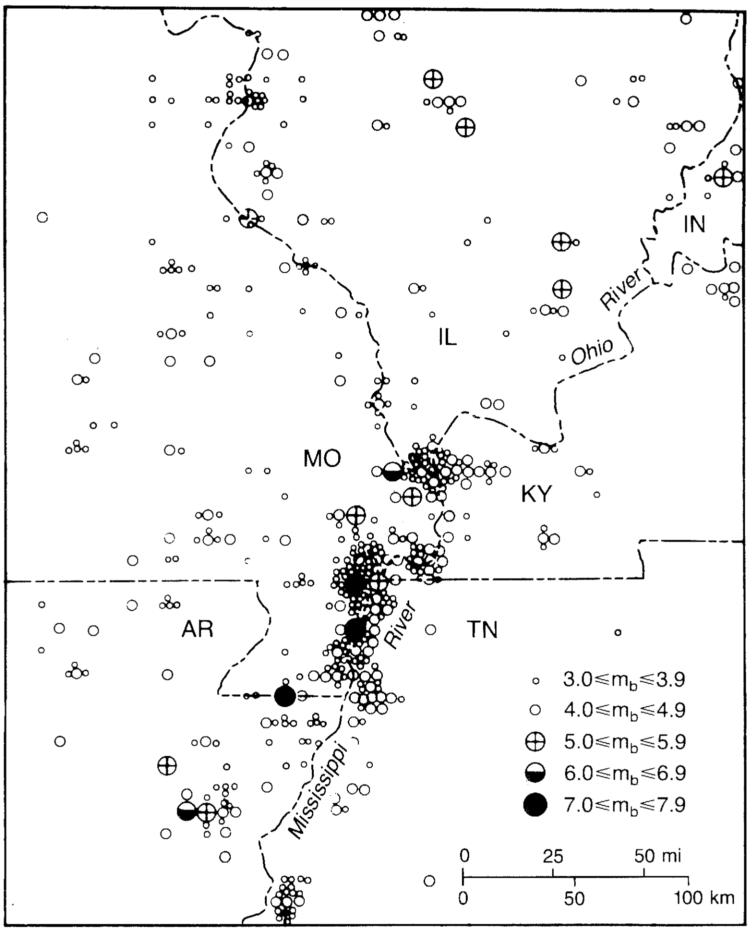
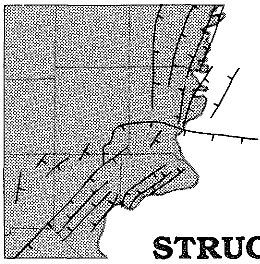


Figure 15 Epicenters of 488 earthquakes that occurred between 1811 and 1974 in the central Mississippi Valley, from Stauder 1982. The line of intense earthquake activity near the Mississippi River from northeastern Arkansas to the southern tip of Illinois is the New Madrid Seismic Zone. Earthquakes appear to be randomly distributed in the rest of the region.



STRUCTURAL FEATURES IN ILLINOIS — CATALOG

All 450 named structural geologic features in Illinois are listed alphabetically in this section. Information about the location, references, and a description are provided for each entry. Structural features that are recommended for removal from stratigraphic records are shown as follows: (discarded). These 167 names are also listed in table 2 and not shown on plate 1. The 33 structures that have been renamed (table 3) are shown as follows: (new name). The 33 newly named structural features are indicated by (new) in the catalog and listed in table 4. Map coordinates are also listed. Some structures are part of a larger system or group of structures that are described under separate headings. In such cases the name of the larger group is given below the name of the individual feature. Example: Ancona Anticline is part of the La Salle Anticlinorium.

A stratigraphic column showing units mentioned in this document is shown in figure 7. All oil production figures, except as noted, indicate cumulative production through the end of 1992, and were compiled by Bryan G. Huff (ISGS, personal communication 1992).

ABINGDON DOME (discarded)

Location T9N, R1E, Knox County

References Poor 1927

The Abingdon Dome was defined by subsurface mapping of the Colchester Coal Member. A single control point was used to infer roughly 20 feet (6 m) of closure in Sections 10 and 15, T9N, R1E. Remapping of the Colchester Coal showed no suggestion of a dome or anticline (Smith and Berggren 1963); therefore, use of the name Abingdon Dome should be discontinued.

ADEN ANTICLINE (new)

Location T2 and 3S, R7E, Hamilton and Wayne Counties (I-7)

References None

The Aden structure is a prominent anticline that was listed by Treworgy (1981) as a "significant unnamed structure." It is newly named for the small village of Aden and the Aden Consolidated Oil Field, which is developed within structural traps on the anticline.

The Aden Anticline lies almost in line with the Clay City Anticline to the north. The axis trends north-northeast and is about 8 miles (13 km) long. Three separate areas of closure are mapped on the Beech Creek ("Barlow") Limestone (ISGS open files). Maximum closure is about 30 feet (9 m); the axis plunges toward the south. Closure of more than 60 feet (18 m) is indicated in Section 16, T3S, R7E, on top of the Karnak Member of the Ste. Genevieve Limestone (R. Howard, ISGS, unpublished mapping).

AKIN DOME (new)

Location T6S, R4E, Franklin County (I, J-6)

References None

The Akin Dome is named for the structure that provides the trap in the Akin West Oil Field near the village of Akin. The Akin Dome is oval, about 2 miles (3 km) north to south, and 1.5 miles (2.4 km) east to west, as mapped on the Beech Creek ("Barlow") Limestone (ISGS open files). Closure on the Beech Creek is approximately 30 feet (9 m). Regional dip in the vicinity of the Akin Dome is eastward toward the center of the Fairfield Basin. Production in the Akin West Field is from Mississippian rocks; the deepest penetration to date is Devonian. The isolated occurrence of this dome suggests that it is a product of compaction or draping across a sub-Devonian feature.

ALBION–RIDGWAY FAULT ZONE (new name)
Wabash Valley Fault System

Location From T9S, R8E, Gallatin County, northward through White County to T2S, R14W, Edwards County (I-7, J-7)

References Cady et al. 1939, Harrison 1951, Pullen 1951, Smith and Cady 1951, Bristol 1975, Bristol and Treworgy 1979, Nelson and Lumm 1987

This fault zone has been known by several names, including the Albion Fault, Ridgway Fault, Ridgway–Omaha Monocline or Fault Zone, and Albion–Ridgway Fault. The name is revised to Albion–Ridgway Fault Zone to reflect the compound nature of faulting in the area. The fault zone consists of a series of high-angle, normal faults that mark the western edge of the Wabash Valley Fault System. The southern part of the zone strikes due north; northward, it curves to the north-northeast. Individual faults are straight to gently arcuate along the strike and overlap slightly end-to-end. Displacements are down to the east to as much as 430 feet (130 m).

AMERICA GRABEN (discarded)

Location Eastern Pulaski County

References Ross 1963, Heyl et al. 1965, Kolata et al. 1981

The America Graben was described as part of a complex zone of northeast-trending faults that displace Paleozoic rocks beneath Mississippi Embayment sediments in southernmost Illinois (Ross 1963). From the distribution of Cretaceous and Tertiary deposits, Ross inferred recurrent displacements through the Eocene Epoch and possibly later. Heyl et al. (1965) showed the America Graben on a map, but presented no new evidence for its existence. Kolata et al. (1981), using additional subsurface data, showed fewer faults cutting Paleozoic strata and found no compelling evidence for Cretaceous or younger

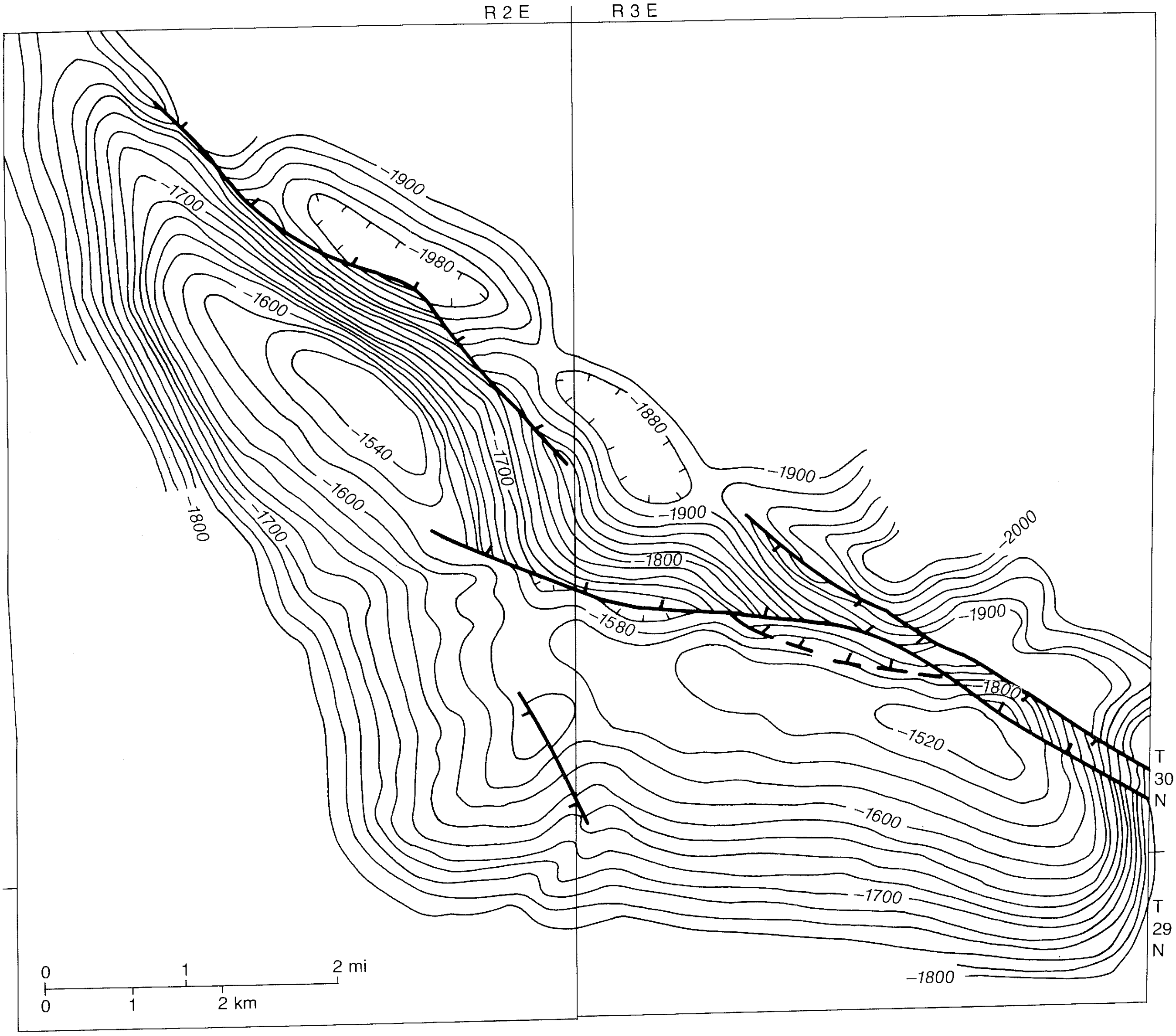


Figure 16 Structure of the top of the Mt. Simon Sandstone on the northwestern part of the Ancona Anticline. Map is based on both seismic and borehole data. Northwestern and southeastern areas of closure formerly were called the Garfield and Ancona Domes, respectively. Contour interval is 20 feet.

movement. Their map does not indicate a graben; therefore, the use of the name America Graben should be discontinued.

ANCONA ANTICLINE (new name)

La Salle Anticlinorium

Location Southernmost La Salle and western Livingston Counties (C-6)

References Buschbach and Bond 1967, 1974

Buschbach and Bond (1967) used the names Ancona Dome and Garfield Dome for enclosed structural highs where gas storage fields were developed near the towns of Ancona and Garfield. A structure map by Buschbach and Bond (1974) shows that these structures are not domes, but separate areas of closure on a large southeast-trending anticline. The name Ancona Anticline is applied to the larger structure, and use of the names Ancona Dome and Garfield Dome should be discontinued.

The Ancona Anticline is mapped on the basis of deep drilling for gas storage. More than 125 wells have reached the basal Cambrian Mt. Simon Sandstone, the unit that serves as the gas reservoir. A structure map contoured on the top of the Mt. Simon shows closure in an area 10 miles (16 km) long and 2 to 3 miles (3–5 km) wide, encompassing the previously named Ancona and Garfield Domes (fig. 16). Maximum closure on top of the Mt. Simon near Ancona is 290 feet (88 m). Anticlinal nosing continues for more than 15 miles (24 km) southeast of the enclosed area to Graymont, in the southern part of T28N, R4E, and the northeastern part of T27N, R4E, where several small areas of closure have been mapped on the top of the Mt. Simon. On Buschbach and Bond's (1974) structure map of the top of the Galena Group (Ordovician), nosing at the southeast end of the Ancona Anticline continues southeast of Graymont into northern McLean County.

The Ancona structure differs from most folds in the La Salle Anticlinorium in that the steep flank is on the northeast rather than the southwest flank. The southwest flank dips at 2° or less, but the northeast flank locally dips at 25° or more. Rocks on the steep northeast flank evidently are fractured, but no faults have been detected. Cambrian units in wells on the flank are thicker than normal because of steep dips, but do not exhibit repeated section. Borehole data and proprietary seismic profiles across the anticline rule out faults of greater than 100 feet (30 m) displacement in the Paleozoic succession (Merle Williams, independent petroleum geologist, personal communications 1991 and 1993).

Cross sections prepared from borehole data demonstrate both pre- and early-Pennsylvanian uplift of the Ancona Anticline. Basal Pennsylvanian strata truncate Ordovician units with angular unconformity. At the crest of the anticline, pre-Pennsylvanian erosion removed as much as 420 feet (125 m) of Ordovician strata (Maquoketa, Galena, and Platteville Groups) that are present off the structure. In comparison, maximum structural relief at the base of the Pennsylvanian System is about 150 feet (45 m), and the Colchester Coal (Desmoinesian) is nearly horizontal across the fold (M. Williams, personal communication 1991). The timing of uplift on the Ancona structure is similar to that of the other elements of the La Salle Anticlinorium.

ANDERSON ANTICLINE (discarded)

Location Northeastern Macoupin County

References Easton 1942, Ball 1952

A slight southeastward structural nosing of the Herrin Coal Member (Pennsylvanian) on the maps of Easton (1942) and Ball (1952) was designated as the Anderson Anticline. No closure was indicated. Nelson's (1987b) map, based on many more control points than were available to Easton or Ball, does not indicate closure or nosing. Use of the name Anderson Anticline should be discontinued.

ARGO FAULT

Fluorspar Area Fault Complex

Location Sections 29, and 32, T12S, R8E, Hardin County (pl. 2)

References Hubbert 1944, J. Weller et al. 1952, Baxter and Desborough 1965

The Argo Fault is part of a complex zone of faulting along the southeast margin of the Rock Creek Graben. Few details of the Argo Fault have been published. The fault carries the Argo fluorspar vein, which was mined just west of Rosiclare. It is about 2 miles (3 km) long and strikes N20°E; the northwest side is downthrown a maximum of about 75 feet (23 m). J. Weller et al. (1952) reported that the fault plane was "nearly vertical and locally overturned," suggesting that reverse or strike-slip faulting may be involved.

ASHMORE DOME

La Salle Anticlinorium

Location Southeastern Coles County (G-7,8)

References Clegg 1965b, Meents 1965, Buschbach and Bond 1974

The roughly oval Ashmore Dome provides structural traps for gas storage in basal Pennsylvanian sandstone and the Mississippian Salem Limestone. It trends north–south and is about 4 miles (6.5 km) long by 2 miles (3.2 km) wide. The Dome lacks a well defined axis. Dips on the west flank are about twice as steep as those on the east flank. Closure is 144 feet (44 m) on the Salem, 87 feet (26.5 m) on the Pennsylvanian gas sand, and only 25 feet (7.6 m) on the younger Seelyville (?) Coal Member (Meents 1965). The upward decrease in closure suggests that most uplift took place in late Mississippian and early Pennsylvanian time.

ASHTON ANTICLINE (new name)

Sandwich Fault Zone

Location Southeastern Ogle, northeastern Lee, and southern De Kalb Counties (B-5, 6)

References Willman and Templeton 1951, Templeton and Willman 1952, Green 1957, Kolata et al. 1978, Kolata et al. 1983

The term "arch" denotes a feature such as the Kankakee or Cincinnati Arch, which are regional in extent. Because this feature is a local and not a regional structure, its name is changed from Ashton Arch to Ashton Anticline. The axis of the Ashton Anticline is about 1 mile (1.6 km) southwest of and parallel to the Sandwich Fault Zone (fig. 17). The southwest flank of the anticline is broad and has an average dip of only 50 feet per mile (1/2°). The short northeast flank is relatively steep and truncated by the fault zone. Closure on the anticline has been mapped only in a small area that straddles the Lee–Ogle county line (Kolata et al. 1978).

The structure of the Ashton Anticline suggests that an underlying basement block was uplifted and tilted southwestward along the Sandwich Fault Zone. The steep northeast limb of the anticline may be the product of drag or forced folding along the fault zone.

ASSUMPTION ANTICLINE (new)

Location T13 and 14N, R1E, Christian County (F-5)

References Bell and Leighton 1949, Whiting 1956, Howard 1979, Nelson 1987b

Although this is one of the largest anticlines in central Illinois, it has not been named. Treworgy (1981) listed it as a "significant unnamed structure." The name Assumption Anticline is introduced for this structure, which provides the structural trap for the Assumption Consolidated Oil Field and lies about 3 miles (5 km) northwest of the town of Assumption.

Whiting (1956) stated that about 50 feet (15 m) of structural closure exists on the top of the productive Middle Devonian carbonates in the Assumption Consolidated Oil Field. The map of the base of the New Albany Group (Cluff et al. 1981) has a contour interval of 100 feet (30 m) and shows a northeast-trending anticline with one contour line of closure. The anticline is mapped as trending north-northeast on the Beech Creek ("Barlow") Limestone (ISGS open files) and is about 5 miles (8 km) long by 1.5 miles (2.5 km) wide. Two separate highs are mapped on the Beech Creek. The larger high has about 70 feet (21 m) of closure and is centered in Section 9, T13N, R1E. A smaller high is centered in Sections 20 and 29 of the same township and has only about 20 feet of closure. Howard (1979) mapped a basal Pennsylvanian paleovalley crossing the Assumption Anticline and inferred that the structure was extant or rising during earliest Pennsylvanian time. The Assumption Anticline has almost the same areal extent and vertical relief on the Herrin Coal Member (Middle Pennsylvanian) as on the Beech Creek Limestone (Nelson 1987b). In this respect, the Assumption Anticline differs from many

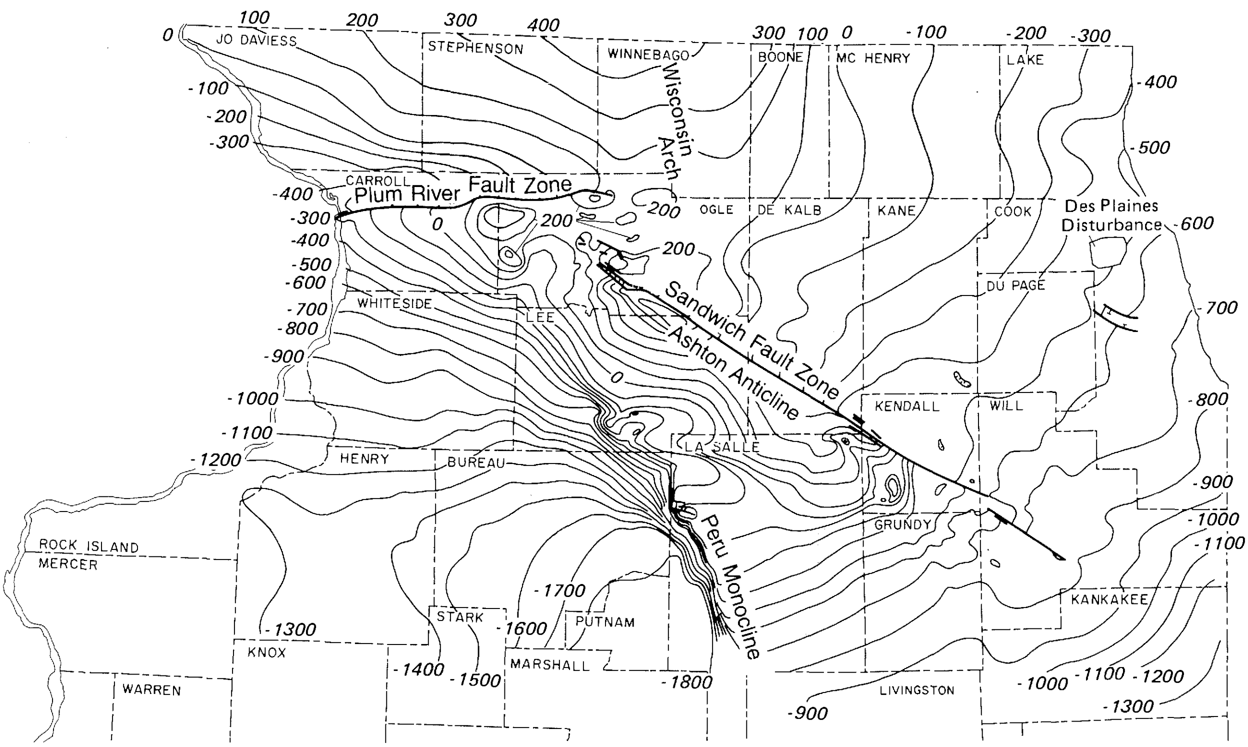


Figure 17 Structure map of the top of the Franconia Formation (Upper Cambrian) in northern Illinois. Contour interval is 100 feet. From Kolata et al. 1983.

of the large anticlines of central Illinois, which have considerably less relief on Pennsylvanian than on pre-Pennsylvanian horizons. Most of the uplift of the Assumption Anticline evidently took place after deposition of the Herrin Coal.

ASTORIA ANTICLINE

Peoria Folds

Location Southern Fulton County (E-3)

References Wanless 1957

Mapped from subsurface data on the Colchester Coal Member (Pennsylvanian), the Astoria Anticline trends slightly north of east and has about 40 feet (12 m) of relief. No closure was indicated on the Wanless map.

ATWOOD FAULT

Ste. Genevieve Fault Zone

Location Southwestern Union County (K–5)

References J. Weller and Ekblaw 1940, Heyl et al. 1965, Segar 1965, Nelson and Lumm 1985, Nelson and Devera 1994)

J. Weller and Ekblaw (1940) defined the Atwood Fault based on surface mapping. Recent remapping (Nelson and Devera 1994) confirms the Atwood Fault to be much as depicted by Weller and Ekblaw. The fault is about 3.5 miles (5.5 km) long and strikes north–south at its northern end, curving to N15°W at its southern end. The east side is downthrown throughout the length of the fault. Maximum displacement is 300 to 500 feet (90–150 m) in Section 33, T12S, R2W, where the Clear Creek Formation on the east is juxtaposed with Bailey Limestone on the west. The fault surface is not exposed, but evidently dips steeply. The lack of strong drag folding and the parallelism of minor faults and joints with the main fault imply that the Atwood Fault, like the nearby Delta Fault, is a high-angle normal fault.

Segar (1965) mapped large positive gravity anomalies on the west side of the Atwood Fault, conditions suggesting that basement rocks are upthrown west of the fault. The time of faulting and its relation to regional tectonics are unclear.

AURORA SYNCLINE

Location Southern Kane to northwestern Will County (B-7)

References Cady 1920, Willman and Payne 1942, McGinnis 1966, Graese 1988, Graese et al. 1988

Cady (1920) described the "Aurora–Pawpaw syncline" or "Pawpaw–Aurora syncline" as trending approximately east-west from Lee County across southern De Kalb and northern Kendall Counties. Definition of this feature is vague on Cady's structure map of the top of the St. Peter Sandstone (Ordovician). The map has a contour interval of 200 feet (61 m) and was based on five or fewer control points per county in the area of concern. As described, the syncline would obliquely cross the Sandwich Fault Zone, the existence of which was unknown to Cady.

Willman and Payne (1942) applied the name Aurora Syncline to a structure that trends northeast from T37N, R6E, Kendall County into Kane County. Their structure maps did not cover Kane County and show only slight downwarping in Kendall County. Treworgy (1981), who listed the Aurora Syncline but did not show it on her map, considered its existence dubious.

Graese (1988) and Graese et al. (1988) resurrected the name Aurora Syncline for a syncline revealed by contouring the elevation of the top of the Galena Group (Champlainian) and Ancell Group (St. Peter Sandstone and Glenwood Formation; Blackriveran). The syncline trends eastward across southern Kane County, then turns southeastward into northwestern Will County. It is 2 to 6 miles (3–10 km) wide and has maximum relief of a little more than 100 feet (30 m) on both contouring surfaces. According to Graese (1988), the Galena Group consists mainly of limestone within the Aurora Syncline and of dolomite elsewhere in northeastern Illinois. Graese deduced that the syncline was downwarped during Galena deposition, lowering the sea floor below the zone of freshwater and saltwater mixing where dolomitization takes place.

The Aurora Syncline is also indicated, but not named, on a map of the Precambrian basement surface by McGinnis (1966). The map, based on geophysical and borehole data, indicates a syncline extending slightly south of east from T40N, R2E, Ogle County to northwestern Will County. McGinnis mapped the syncline within a graben bordered by the Sandwich Fault Zone on the southwest and an unnamed fault zone on the northeast (see UNNAMED FAULT ZONE).

AVA–CAMPBELL HILL ANTICLINE see CAMPBELL HILL ANTICLINE

AVISTON ANTICLINE (discarded)

Location Northwestern Clinton County

References Bell 1941

Bell's (1941) structure map of the Herrin Coal Member (Pennsylvanian) showed an east-trending nose with a small area of closure in Sections 23 and 24, T2N, R5W. From the crest of the fold southward, the coal was mapped as dropping 100 feet (30 m) in less than 1 mile (1.6 km); relief is much gentler on the north limb. No more recent structure maps of the coal in this area are available, and the Aviston Anticline is not present on deeper horizons. The structure map of the Beech Creek ("Barlow") Limestone (ISGS open files) shows an east-southeast-dipping homocline with a dip of approximately 30 feet per mile in this area. A uniform east-southeast dip also is portrayed on a structure map of the Karnak Limestone Member (R. Howard, ISGS, unpublished mapping). The Aviston Anticline, if it exists, is confined to Pennsylvanian strata. The existence of this structure is insufficiently demonstrated to warrant retention of the name and it should be discarded.

AYERS ANTICLINE

Location T6N, R3, and 4W, Bond County (H-4, 5)

References Blatchley 1914, Kay 1915, Bell 1926c, 1928, 1941

As originally mapped by Blatchley (1914), the Ayers Anticline extended almost all the way across northern Bond County. The area was remapped by Bell (1941), who used considerably more control points and renamed part of the former western extent of the Ayers Anticline the Reno Anticline. The two are shown on Bell's map as small separate highs along a continuous anticlinal nose. Separate naming of two such closely related features does not appear warranted; therefore, the use of the name Reno Anticline is discontinued, and the older name of Ayers Anticline now includes both areas of closure.

The Ayers Anticline has at least 25 feet (7.5 m) of closure on the Herrin Coal Member and maximum structural relief of more than 100 feet (30 m). The outline is somewhat irregular and the axis trends east to west. A gas field producing from the Yankeetown ("Benoist") Sandstone was developed on the Ayers Anticline during the 1920s and abandoned in 1950. Total production from the field is listed as 298.7 million cubic feet from 21 wells.

The Ayers Anticline may reflect a larger deep structure. A structure map of the top of the Karnak Limestone Member (R. Howard, ISGS, unpublished mapping) shows sharp eastward nosing of contour lines in the Ayers Gas Field. Stevenson et al. (1981) also portrayed similar nosing on the base of the New Albany Group (Devonian–Mississippian). The Devonian high trends southeastward from western Macoupin County through Bond County.

BABYLON ANTICLINE (discarded)

Location T7N, R1E, Fulton County

References Moulton 1925

Moulton (1925) promoted this feature as a target for oil exploration. His map, which was based on coal outcrop data and limited drilling, indicated an east-trending nose with an area of possible closure in Sections 11 and 12. No geologist has confirmed the existence of such a structure. Wanless (1957) mapped the axis of the Bushnell Syncline a short distance south of Moulton's anticline. Use of the name Babylon Anticline should be discontinued because its existence is doubtful.

BARDOLPH ANTICLINE
Peoria Folds

Location T6N, R2W, McDonough County (D, E-2)

References Wanless 1957

The Bardolph Anticline was mapped on the basis of subsurface data on top of the Kinderhookian Series (basal Mississippian). The southeast limb is steep and has at least 228 feet (70 m) of relief. The northeast flank is less pronounced, and the western extent was not mapped. The Bardolph Anticline has the greatest amplitude of all the Peoria Folds, but little or no closure.

BATTLE FORD SYNCLINE (new)

Location Northeastern Johnson, northwestern Pope, and southernmost Saline County (J-6 and pl. 2)

References Nelson et al. 1991

The Battle Ford Syncline, named for Battle Ford Creek, lies between the McCormick and New Burnside Anticlines. It is an asymmetrical trough with a long gentle southeast limb (dip 2–3°) and a short, relatively steep northwest limb (dip 5–10°, locally steeper). The axis of the syncline is about 1 mile (1.6 km) southeast of the crest of the New Burnside Anticline. The eastern terminus of the syncline is abruptly closed off and crossed by the Winkleman Fault Zone, a northeast-trending fault zone. At its western end, the Battle Ford Syncline gradually loses expression, as the flanking anticlines die out.

BAY CREEK SYNCLINE (new)

Location Northwestern Pope County (J, K-6 and pl. 2)

References Nelson et al. 1991

The axis of the Bay Creek Syncline is approximately 2 miles (3.2 km) southeast of the McCormick Anticline and strikes northeast, parallel with it. The northwest limb of the syncline exhibits a variable dip of 5° to more than 10°. The southeast flank of the trough is gentle; essentially this flank represents regional dip of the strata slightly west of north at 3° or less. The Bay Creek Syncline dies out gradually at both ends.

BECKEMEYER DOME (discarded)

Location Southern T2N, R3W, Clinton County

References Bell 1941

Bell (1941) mapped the structure of the Herrin Coal Member (Pennsylvanian) in western Clinton County and provided two alternative structural interpretations of the Bartelso Oil Field. In one interpretation, a single dome was mapped. In the other, two separate domes, Bartelso on the south and Beckemeyer on the north, were indicated. Bell's control points were widely spaced and some may have been unreliable. The dome at Bartelso subsequently was found to be a Silurian reef and is discussed under that heading. The Beckemeyer Gas Field contains two wells that produced gas from Chesterian sandstones; tests of Silurian strata have not yielded hydrocarbons or encountered reef facies. The current Beech Creek ("Barlow") Limestone map (ISGS open files) indicates a terrace on a southeast-plunging anticlinal nose in the area of Bell's Beckemeyer Dome (fig. 4). No closure is shown on this map, which has abundant control points and a 20-foot (6.1 m) contour interval. The use of the name Beckemeyer Dome, therefore, should be discontinued.

BELLAIR–CHAMPAIGN UPLIFT (discarded)

Location Champaign, Douglas, Coles, and parts of adjacent counties

References Mylius 1923, 1927, Clegg 1959

Mylius applied the name Bellair–Champaign Uplift to a narrow, triangular uplift that he mapped in east-central Illinois. Subsequent geologists greatly refined the subsurface structural mapping that revealed a complex pattern of anticlines, domes, and synclines along the central part of the La Salle Anticlinorium. Thus, the name Bellair–Champaign Uplift has outlived its usefulness and should be discontinued.

BELLAIR DOME (discarded)
La Salle Anticlinorium

Location Northwestern corner of Crawford County

References Mylius 1927

Mylius (1927) gave the name Bellair Dome to an irregular uplifted area comprising several domes and intervening saddles that covered an area of 6 square miles (15 km^2). The Bellair Dome was part of the uplift interpreted by Mylius as the larger Bellair–Champaign Uplift. Mylius was severely handicapped in attempting to map subsurface structure in east-central Illinois. The only well records available were drilling logs of doubtful quality, and the sandstones indicated on those logs are lenticular. Newer structure maps, based on far more reliable data from the area, do not show a structural high where Mylius mapped the Bellair Dome. The name Bellair Dome should not be used.

BELLEVILLE ANTICLINE (discarded)

Location Central St. Clair County

References Bell 1941

The name was applied to a subtle anticlinal nose extending about 6 miles (9.6 km) east-southeast from Belleville, as mapped on the Herrin Coal Member (Pennsylvanian). Newer maps of deeper units, as interpreted from more control points, fail to reveal any structural high in this area. Use of the name Belleville Anticline should be discontinued.

BELTREES–MELVILLE ANTICLINE (discarded)

Location T6N, R11W, Jersey County

References Collingwood 1933

Collingwood's (1933) surface mapping indicated a broad and subtle anticlinal nose or terrace that has no closure and extends for several miles northeastward. Maps by Bristol and Buschbach (1973) and Cluff et al. (1981) indicate the east-plunging nose of the Lincoln Anticline in this area. The name Beltrees–Melville Anticline is redundant and should be discontinued.

BENTON ANTICLINE (new)

Location Eastern T5 and 6S, R2E, Franklin County (I, J-6)

References Howell 1948, Cameron 1951, Parkison 1957

This anticline is partly responsible for the trapping of hydrocarbons in the Benton Oil Field. Treworgy (1981) listed it as a "significant unnamed structure." The Benton Anticline is named after the city and oil field. Cameron (1951) and Parkison (1957) provided structure maps showing a north-trending anticline with about 70 feet (21 m) of closure in the productive Tar Springs Sandstone (Chesterian) in the Benton Oil Field. Some of the apparent closure is due to stratigraphic thickening of the Tar Springs. The Benton Anticline also exists, however, on the underlying Beech Creek ("Barlow") Limestone and continues beyond the limits of the Benton Oil Field. On the Beech Creek (ISGS open files), the anticline is about 7 miles (11 km) long and has two separate areas of closure. Anticlinal nosing continues another 6 miles (10 km) southward from the area of closure.

Maps by Keys and Nelson (1980) show that the Benton Anticline is well developed on the Walche Limestone Member of the Menard Formation (Chesterian), but has little or no relief on the Herrin Coal Member (Pennsylvanian). This evidence implies that major uplift of the Benton Anticline was post-Chesterian, pre-middle Pennsylvanian (fig. 18).

BIG CREEK FAULT
Fluorspar Area Fault Complex (pl. 2)

Location T12 and 13S, R8E, Hardin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Baxter and Desborough 1965

The Big Creek Fault is mapped as trending N25°E from the Ohio River just west of Rosiclare to Section 16, T12S, R8E, where it merges with other faults. The Big Creek Fault probably is not a single break, but a part of a complex zone of fractures forming the southeast side of the Rock Creek Graben. The net displacement is as much as 350 feet (105 m) down to the northwest.

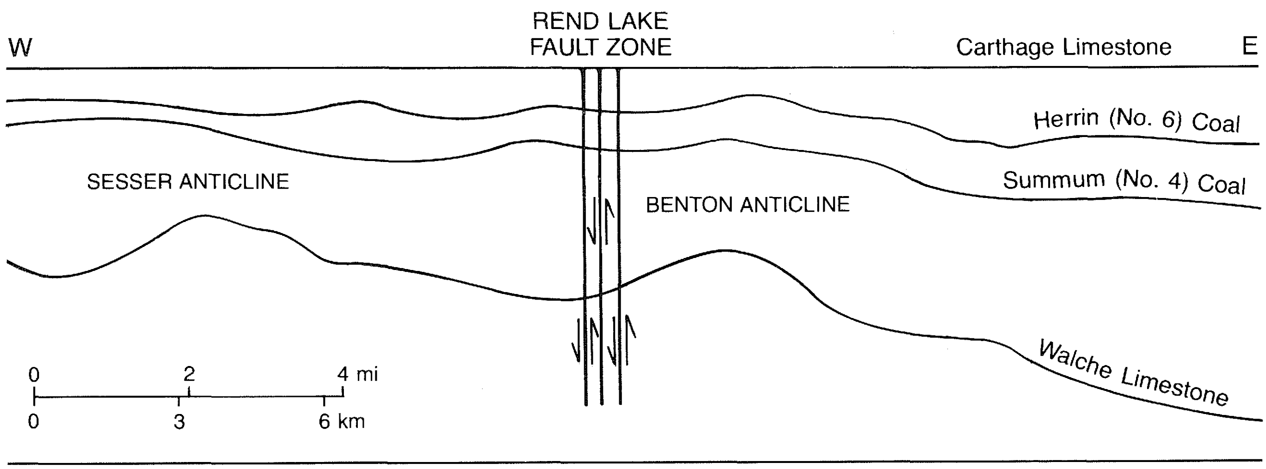


Figure 18 Profile across northern Franklin County, with the Carthage (Shoal Creek) Limestone as datum. The Benton and Sesser Anticlines are prominent on the Walche Limestone Member of the Formation (Chesterian), but have little effect on Pennsylvanian markers. Thus, major uplift of these anticlines evidently took place after limestone deposition and before Summum Coal Member deposition. After Keys and Nelson 1980. See figure 31 for location.

BIRKBECK SYNCLINE

Upper Mississippi Valley Zinc–Lead District

Location T29N, R1E, Jo Daviess County (A-3)

References Willman and Reynolds 1947, Bradbury et al. 1956

The Birkbeck is a gentle fold that was mapped from outcrops and prospect borings for lead and zinc. The axis strikes north-northwest and is slightly sinuous. Dips on both flanks are gentle from 1° to 4°; maximum structural relief is about 50 feet (15 m). Two zinc and lead mines formerly operated within the syncline.

BLACK JACK SYNCLINE

Upper Mississippi Valley Zinc–Lead District

Location T27N, R1E, Jo Daviess County (A-3)

References Willman and Reynolds 1947, Bradbury et al. 1956

The Black Jack Syncline was extensively mineralized with zinc and lead, and mapped from mine and borehole data. It is a sharp, narrow fold at least 2.7 miles (4.5 km) long and 200 to 500 feet (60–150 m) wide; it has maximum relief of about 30 feet (9 m). Like other synclines in the Galena district, it may be the product of solution collapse.

BLACKOAK DOME (discarded)

Location Southwestern T3N, R14W, Richland County

References Easton 1943

When Easton (1943) defined the Blackoak Dome, he was using subsurface mapping of two Mississippian units, the Beech Creek ("Barlow") Limestone and Levias Member of the Renault Limestone. The map shows a roughly oval dome that is about 3 miles (5 km) long from north to south, and has about 30 feet (9 m) of closure. The current Beech Creek structure map (ISGS open files), based on dozens of control points not available to Easton, shows no dome or anticline in the vicinity of Easton's Blackoak Dome. Instead, the area is depicted as an irregular terrace on the east flank of a syncline, east of the Clay City Anticline. The Parkersburg Dome, which Easton placed south of the Blackoak Dome, proves to be part of the same terrace. Because of the lack of demonstrated closure, the names Blackoak and Parkersburg Domes should be discontinued.

BLAIRSVILLE DOME

Location T4S, R7E, Hamilton County (I-7)

References Rolley 1951

Rolley's (1951) map of the Herrin Coal Member (Pennsylvanian) shows a roughly equidimensional enclosed area covering about 1 square mile (2.5 km^2). The current structure map of the Beech Creek ("Barlow") Limestone (ISGS open files) for the area indicates a dome having an area of closure somewhat larger than that mapped on the Herrin Coal. On the Beech Creek, the Blairsville Dome is nearly merged with the Bungay Dome. Oil fields have been developed on both structures.

BLUE DIGGINGS FAULT

Fluorspar Area Fault Complex

Location Sections 6 and 8, T13S, R8E, southwestern Hardin County (pl. 2)

References S. Weller et al. 1920, Hubbert 1944, J. Weller et al. 1952, Baxter and Desborough 1965

The Blue Diggings Fault was so named because it carries the Blue Diggings vein, one of the largest fluorspar veins in the Rosiclare district. The fault itself is part of a broad, complex fracture zone on the southeast side of the Rock Creek Graben. It is a north-trending normal fault, and the east side is downthrown less than 100 feet (30 m). The dip of the fault is locally as shallow as 45°, which is an unusually low dip for faults in the Fluorspar Area Fault Complex.

BODENSCHATZ–LICK FAULT ZONE (new name)

Location Jackson County, Illinois; Cape Girardeau and Perry Counties, Missouri (J-4, 5)

References Flint 1925, Bristol and Buschbach 1973, Nelson and Lumm 1985

The Bodenschatz–Lick Fault Zone in Perry County, Missouri, was named and defined on the basis of information from surface mapping (Flint 1925). Flint showed a single fault striking northeast and downthrown about 100 feet (30 m) to the southeast. Recent mapping in Missouri (Middendorf et al. 1988, Whitfield and Middendorf 1989) revealed a complex zone of faulting as much as 3.5 miles (5.5 km) wide. The zone is composed of individual faults having diverse trends, but the net displacement is down to the southeast. In Missouri, Ordovician through Lower Devonian rocks are offset by these faults. Missing section in well bores is evidence of normal faulting (Nelson and Lumm 1985).

Using borehole data, Nelson and Lumm (1985) demonstrated that the Bodenschatz–Lick Fault Zone extends northeastward into Illinois. Displacement on the Beech Creek Limestone (Mississippian) is as great as 600 feet (180 m) down to the southeast. Limited data suggest even larger displacements of older strata. Pennsylvanian rocks are not faulted but are folded into an east–facing monocline having maximum dips of 12° to 14°. These findings suggest progressive growth of the structure during the late Paleozoic.

A fault that corresponds with the northeastern portion of the Bodenschatz–Lick Fault Zone appears on a structure map of the top of the Galena (Trenton) Group (Ordovician, Bristol and Buschbach 1973).

The Bodenschatz–Lick Fault Zone crosses the more extensive Ste. Genevieve Fault Zone at roughly a right angle. The relative ages and structural relationships of the two fault zones are not understood.

BOGOTA–RINARD SYNCLINE

Location From northern Coles County (F–7) to Wayne County (I–7)

References Lowenstam 1951, Du Bois and Siever 1955, Williams and Rolley 1955

The Bogota–Rinard Syncline initially was recognized from subsurface mapping of the Pennsylvanian Herrin Coal Member in Jasper, Richland, and Wayne Counties. Subsequent mapping shows that the syncline is present in deeper strata, including the Mississippian Karnak Limestone Member (Bristol and Howard 1976), Devonian New Albany Shale (Stevenson et al. 1981), and Ordovician Galena Group (Bristol and Buschbach 1973). These authors' maps show the syncline following a sinuous course southward from northern Coles County to central or southern Wayne County. The syncline is bordered on the east by the Charleston Monocline (new) and Clay City Anticline (new name). The trough or axis of the Fairfield Basin partially coincides with the Bogota–Rinard Syncline.

BONPAS ANTICLINE (discarded)

Location Boundary of T2N and T3N, R14W, Richland County

References Easton 1943

Easton (1943) mapped a small, west-trending nose on the Levias Limestone Member and Beech Creek ("Barlow") Limestones mainly in Section 34, T2N, R14W. Control points were provided by four wells, of which two produced oil. The current Beech Creek map, based on dozens of wells not available to Easton, shows a terrace on the east flank of an unnamed syncline in this area (ISGS open files). No anticline exists; therefore, use of the name Bonpas Anticline should be discontinued.

BOURBON ANTICLINE (discarded)

Location T15N, R7E, Douglas County (F-7)

References Clegg 1959

Clegg (1959) used the name "Bourbon structure" for an anticlinal nose plunging south-southwest off the west flank of the La Salle Anticlinorium. It is prominent on Clegg's map of the Danville Coal Member (Pennsylvanian), but vague and ill-defined on his map of the older Colchester Coal Member. Clegg noted that the Bourbon structure coincides with part of a large Pennsylvanian paleochannel, now called the Walshville channel, where sandstone replaces the Herrin Coal Member. He suggested that the anticline may reflect differential compaction of the Danville Coal over this immediately subjacent sandstone.

Treworgy (1981) suggested, and I concur, that use of the name Bourbon Anticline should be discontinued because (as Clegg noted) the feature is not a true anticline and probably not of tectonic origin.

BOYD ANTICLINE (new)

Location T1S, R1 and 2E, Jefferson County (I-5)

References None

The Boyd structure was listed by Treworgy (1981) as a "significant unnamed structure." The Boyd Anticline is hereby named after the Boyd Oil Field, which is developed in a structural trap on the anticline. As mapped on the Beech Creek ("Barlow") Limestone (ISGS open files), the Boyd Anticline is about 4 miles (6.5 km) long by 2 miles (3 km) wide, and has 40 feet (12 m) of closure. The axis trends north-northwest. The Boyd Anticline lies west of the south end of the much larger Salem Anticline and is separated from the latter by a plunging syncline.

BREMEN ANTICLINE

Location T6S, R6W, Randolph County (J-4)

References S. Weller 1915, Kay 1916, S. Weller and J. Weller 1939, Nelson and Krausse 1981

This structure was defined from outcrop mapping of Chesterian strata (S. Weller 1915, Kay 1916). The axis trends N70°E and is less than 3 miles (5 km) long. The northwest limb is steeper and has dips as steep as 13°, as compared with only 2° on the southeast flank. Cady (ISGS unpublished field notes) reported a dip of 45° on one outcrop along the northwest flank of the fold. A steep dip suggests the possibility of faulting.

Nelson and Krausse (1981) observed that the Bremen Anticline, along with the Wine Hill Dome and Campbell Hill Anticline, is in line with and oriented en echelon to the Cottage Grove Fault System. These relationships suggest that all three folds are products of right-lateral wrenching along the Cottage Grove.

BRERETON ANTICLINE
Peoria Folds

Location Southern Peoria and eastern Fulton Counties (D-3, 4)

References Wanless 1957

The Brereton Anticline is a subtle fold mapped by Wanless (1957). It trends slightly north of east and is about 20 miles

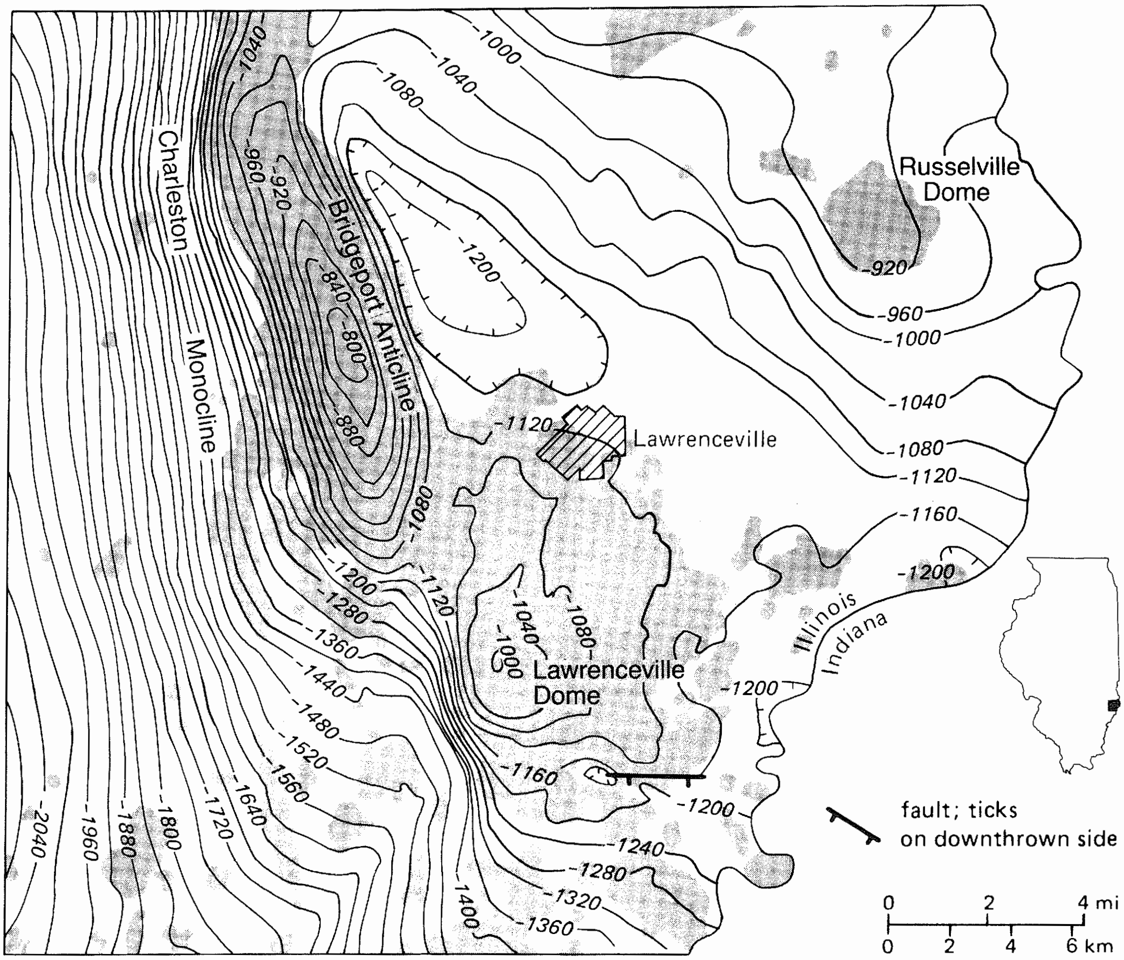


Figure 19 Structure map of the base of the Beech Creek ("Barlow") Limestone in Lawrence County, Illinois. Oil fields are shaded. Contour interval is 40 feet. After Bristol 1968.

(32 km) long. Structural relief on the Springfield Coal Member (Pennsylvanian) is about 50 feet (15 m), and the south limb is steeper than the north one.

BRIDGEPORT ANTICLINE (new)

La Salle Anticlinorium

Location Northwestern Lawrence County (H–8)

References Blatchley 1913, Cady 1920, Potter 1956

A large north-trending anticline in northwestern Lawrence County was documented by the authors cited above and noted as a "significant unnamed structure" by Treworgy (1981). The name Bridgeport Anticline is proposed here; the name is taken from the town of Bridgeport, which lies near the southern end of the structure.

The Bridgeport Anticline has been mapped at numerous structural levels, but it is portrayed in greatest detail on the Beech Creek ("Barlow") Limestone (fig. 19). At this level, the enclosed area is about 10 miles (16 km) long and 2 miles (3 km) wide. Closure on the Beech Creek is about 220 feet (67 m); the highest point is in the northeast quarter of Section 30, T4N, R12W. The Bridgeport Anticline lies along the crest of the newly named Charleston Monocline, near the southern end of the La Salle Anticlinorium. The monocline, which faces west-southwest, has more than 1,500 feet (450 m) of structural relief.

The Bridgeport Anticline is bordered on the east by an irregular, unnamed syncline. Northward, it is separated from the Hardinville Anticline by a saddle, the axes of the two anticlines being offset. On the south the Bridgeport Anticline plunges abruptly, and it is offset from the Lawrenceville Dome to the southeast.

Like other structures in the La Salle Anticlinorium, the Bridgeport Anticline bears evidence of both pre- and post-Pennsylvanian movement. The area of the anticline and the amount of closure (about 100 ft; 30 m) are considerably less on the Herrin Coal Member (Pennsylvanian) than on Mississippian strata (Potter 1956).

Although oil production data for the Bridgeport Anticline are not available, the so-called "Lawrence County Division," which includes pools on the Bridgeport Anticline, Lawrenceville Dome, and several smaller structures, had produced (as of December 1992) more than 413 million barrels of oil from 7,526 acres. Of the 24 pay zones, ranging from middle Pennsylvanian to the Ordovician Galena Group, the most important are the Chesterian Cypress and Yankeetown ("Benoist") Sandstones, the Ste. Genevieve Limestone, and lower Pennsylvanian sandstones.

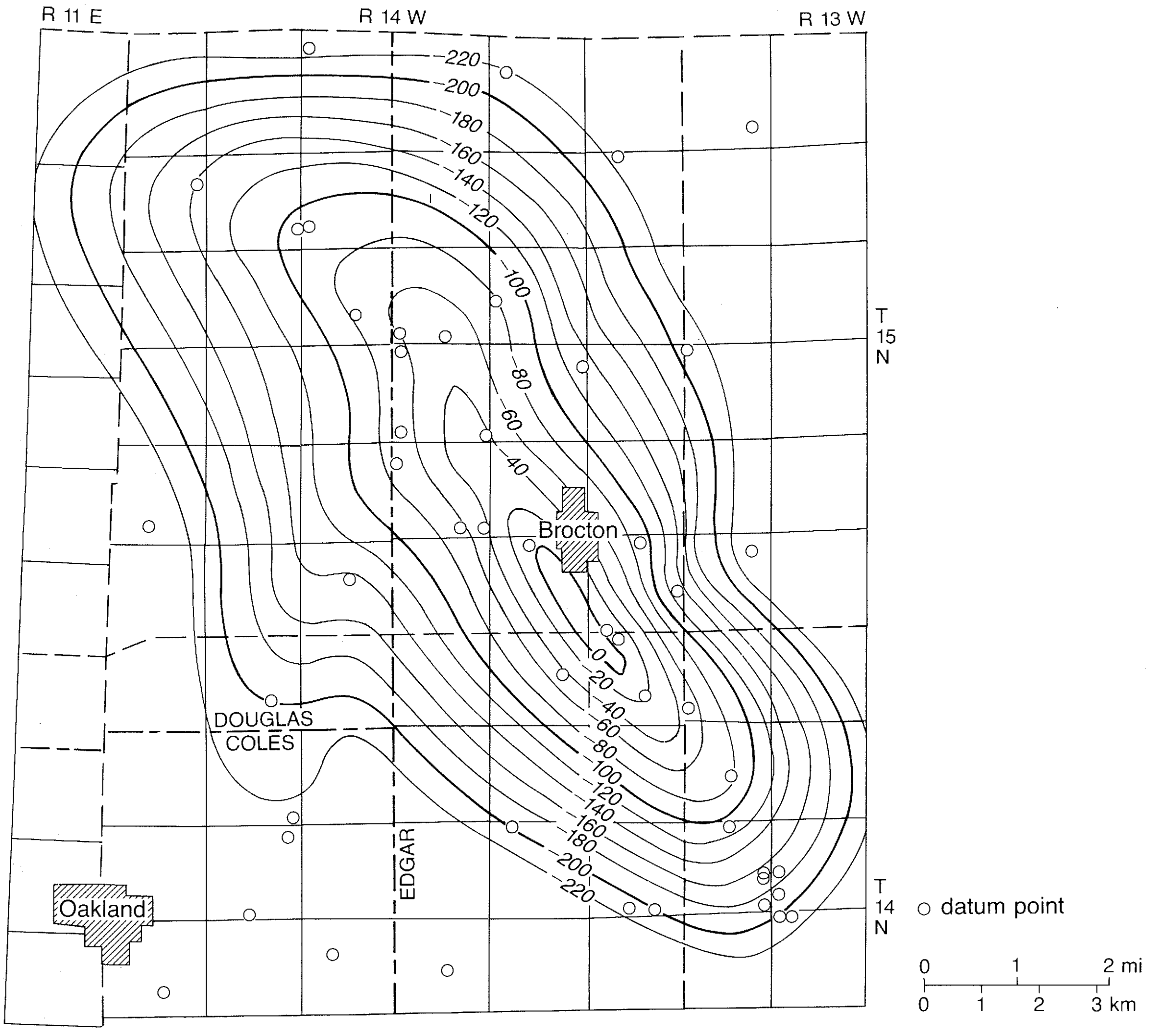


Figure 20 Brocton Dome, contoured on the base of the New Albany Shale (Devonian). From Buschbach and Bond 1974. Contour interval is 20 feet.

BROCTON DOME

La Salle Anticlinorium

Location Southeastern Douglas and west-central Edgar County (F-8)

References Mylius 1923, Clegg 1959, 1965b, Buschbach and Bond 1974

Mylius (1923) and Clegg (1959) referred to this structure as the Oakland Dome; Clegg (1965b) renamed it the Brocton Dome to distinguish it from the Oakland Anticlinal Belt, of which the Brocton Dome was considered a part.

Clegg's (1965b) structure map of the Colchester Coal Member (Pennsylvanian) shows the Brocton Dome. It is elongated along a northwest to southeast axis and is about 12 miles (19 km) long and 7 miles (11 km) wide. The east flank of the anticline merges with the steep limb of the Edgar Monocline. Westward, the coal gradually declines toward the Murdock Syncline. Closure of the Brocton Dome on the Colchester Coal is approximately 100 feet (30 m).

Drilling for a potential gas storage field provided data for the Buschbach and Bond (1974) structure map of Brocton Dome on the Middle Devonian Lingle Limestone (fig. 20). Shape and size of the dome at this horizon are similar to the Pennsylvanian configuration, but closure on the Lingle is 220 feet (67 m), roughly twice as great as the Pennsylvanian closure. Here, as elsewhere on the La Salle Anticlinorium, uplift probably was partly late Mississippian to early Pennsylvanian, and partly post-Pennsylvanian.

BROOKVILLE DOME

Location Southwestern Ogle County (A, B-4)

References Templeton and Willman 1952, Buschbach and Bond 1974, Kolata and Buschbach 1976, Kolata and Graese 1983

Templeton and Willman (1952) reported an anticlinal area, which they termed the Brookville Uplift, in western Ogle and eastern Carroll Counties. Subsequent drilling for a gas storage facility (abandoned) demonstrated the presence of two separate domes. Kolata and Buschbach (1976) named the north dome Forreston and the south one Brookville.

As contoured on the Glenwood Formation (Ordovician), the Brookville Dome is roughly circular, 3 to 4 miles (5–6.5 km) in diameter, and has 138 feet (42 m) of closure (Kolata and Buschbach 1976). Dips are steepest on the northeast side of the dome. The structure persists into the basal Cambrian Mt. Simon Sandstone, which was explored as a potential gas storage reservoir (Buschbach and Bond 1974). The project was abandoned because the caprock proved to be permeable.

BRUSHY ANTICLINE
Cottage Grove Fault System

Location T9N, R5E, Saline County (J-6)

References Cady et al. 1939, Nelson and Krausse 1981

Cady et al. (1939) originally defined the anticline on the basis of drill-hole data on the Herrin Coal Member (Pennsylvanian). Subsequent elevation surveys and geologic studies in underground coal mines now provide detailed information on the Brushy Anticline at the level of the Springfield Coal Member (fig. 21).

The Brushy Anticline lies between two westward-converging branches of the master fault of the Cottage Grove Fault System. The anticline has a broad, almost flat crest and steep limbs near the bordering faults (fig. 21). Maximum structural relief on the Springfield Coal is about 140 feet (43 m). Several northwest-trending, high-angle normal and oblique-slip faults have been encountered in coal mines in the central area of the anticline.

Located as it is, within an upthrust block between segments of a wrench fault system, the Brushy Anticline fits the definition of a positive flower structure (Harding 1985).

BRUSSELS SYNCLINE see TROY–BRUSSELS SYNCLINE

BRYANT SYNCLINE
Peoria Folds

Location Central Fulton County (E-3, 4)

References Wanless 1957

This shallow syncline, as mapped by Wanless (1957), trends slightly north of east and is about 19 miles (31 km) in length.

BUNGAY DOME

Location T4S, R7E, Hamilton County (I-7)

References Rolley 1951

Rolley's (1951) map of the Herrin Coal Member (Pennsylvanian) shows the Bungay Dome as an irregular, north-trending anticline with two small areas of closure. Structure on the Beech Creek ("Barlow") Limestone (ISGS open files) is similar. The Bungay and Blairsville Domes are virtually connected at the Beech Creek horizon. Together, the domes provide structural traps for the Bungay Consolidated Oil Field.

BURTON ANTICLINE (discarded)

Location T10N, R7W, Macoupin County

References Easton 1942, Ball 1952

The Burton Anticline, as mapped by Easton (1942), was a slight northeastward nosing of structural contours on the Herrin Coal Member. Remapping of the area (Nelson 1987b) confirms the general validity of Easton's contouring; however, the structure is not expressed on deeper units and is too insignificant to merit naming; therefore, its use should be discontinued.

BUSHNELL SYNCLINE
Peoria Folds

Location Northeastern McDonough and northwestern Fulton Counties (D-2, 3)

References Wanless 1957

The syncline, as mapped by Wanless (1957), trends slightly south of east and is about 18 miles (29 km) long. It was mapped from subsurface data on Kinderhookian strata.

BUTLER ANTICLINE (discarded)

Location Mostly in T9N, R4W, Montgomery County

References Lee 1915, 1926

Lee inferred the presence of an anticline from widely scattered outcrop and well data. His structure contour map on the Herrin Coal Member (Pennsylvanian) shows a northeast-trending high, having possible closure in Section 4, T9N, R4W. Many of Lee's elevations on the Herrin Coal were extrapolated downward from younger beds exposed at the surface or penetrated in shallow boreholes. This technique introduced uncertainty into his contouring.

Subsequent drilling in the area has revealed that the Herrin Coal is replaced by sandstone and shale of the Walshville channel under most of the Butler Anticline. It is possible that the relatively high elevations of younger strata, from which Lee projected his contour lines, are due to differential compaction of the sediments over the relatively incompactable fill of the channel. No indication of a genuine anticline is apparent (Nelson 1987b), and use of this name should be discontinued.

CAMPBELL HILL ANTICLINE
Cottage Grove Fault System

Location Northwestern Jackson County (J-4, 5)

References Shaw 1910, St. Clair 1917b, Root 1928, S. Weller and J. Weller 1939, Nelson and Krausse 1981

The most thorough description and best map of the Campbell Hill Anticline were done by Root (1928), who employed both surface and subsurface information. Little drilling has taken place in the area since 1928.

Root's map was contoured partly on the Herrin Coal Member and partly on the "Ava shale," a local marker bed in the lower part of the Pennsylvanian. The map (fig. 22) shows an elongate fold that is about 15 miles (24 km) long and has several separate areas of closure. The axis of the western part of the fold trends N55°E; eastward, it curves to the east. The northwest limb is steeper than the southeast and has greater structural relief, more than 300 feet (90 m). Several small faults, all trending northwestward, were mapped at the surface on the northwest flank of the anticline.

The master fault of the Cottage Grove Fault System follows the north flank of the Campbell Hill Anticline, and the western part of the anticline lies in en echelon relation to the fault. This implies that the anticline is a product of right-lateral wrenching along the fault zone (Nelson and Krausse 1981).

The Ava–Campbell Hill Oil and Gas Field was developed in structural traps on the Campbell Hill Anticline. Production, chiefly gas, was obtained from the Cypress Sandstone (Mississippian). The field was discovered in 1916, abandoned in 1943, and briefly revived in 1956–1957. Cumulative production is listed as 25,000 barrels of oil and an unknown quantity of gas.

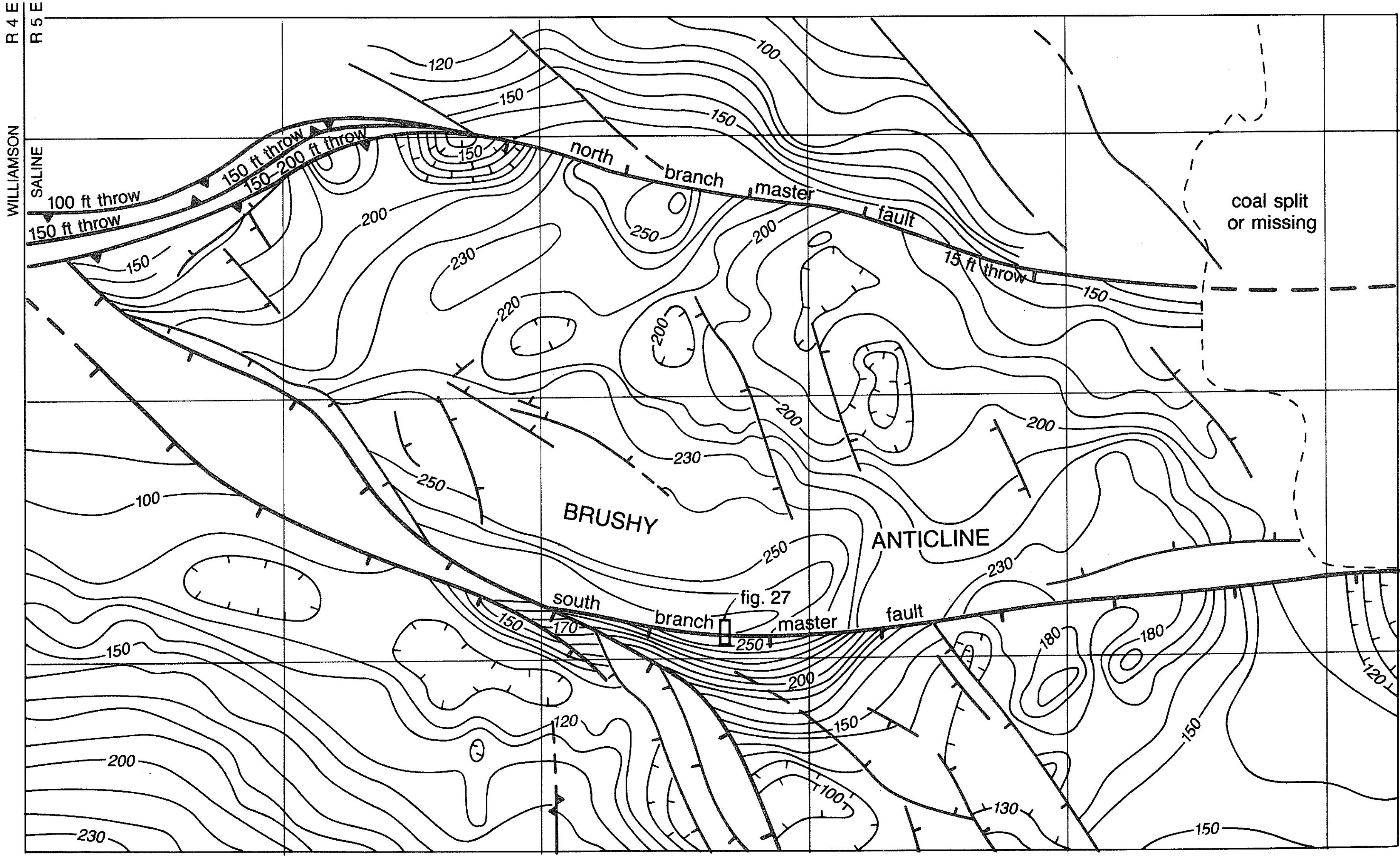
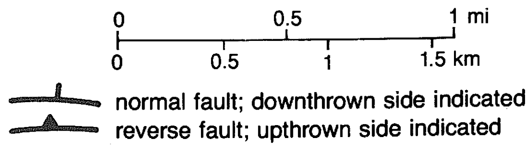


Figure 21 Structure (ft) of the base of the Springfield Coal Member in part of western Saline County is based on mine surveys and borehole data. The Brushy Anticline lies between two subparallel strands of the Cottage Grove Fault System. It might better be labeled a horst than an anticline. Note reversals in direction of throw on the north branch of the master fault: evidence of strike-slip movement. Contour interval is 10 feet.



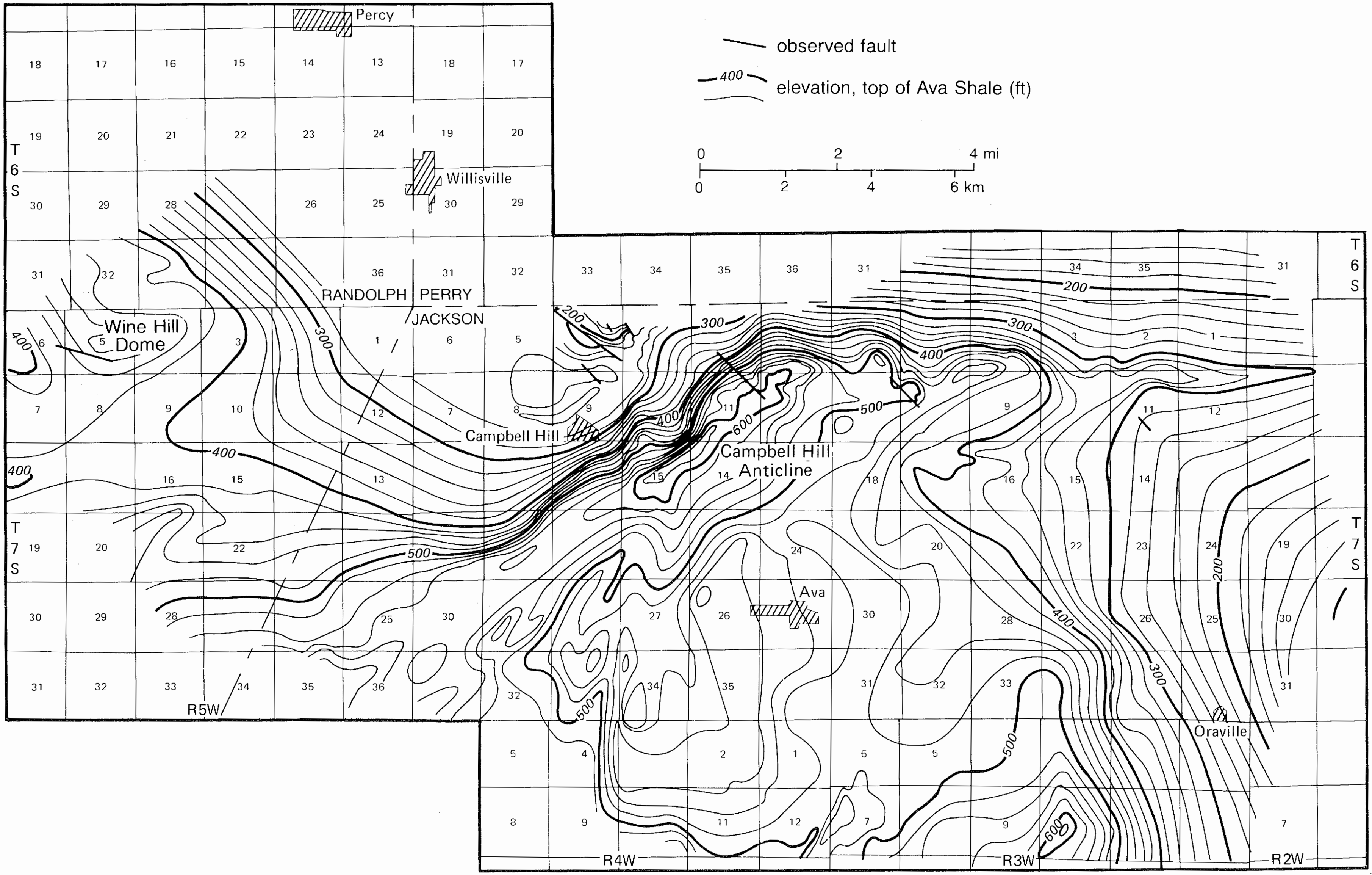


Figure 22 Campbell Hill Anticline and related structures (after Root 1928). Note northwest-trending faults along the steep north flank of the fold near the Campbell Hill Anticline. The west-northwest-trending fault near the Wine Hill Dome is inferred from drill hole data. Contours are on the "Ava Shale," a local marker bed about 100 feet (30 m) below the Colchester (No. 2) Coal Member. Contour interval is 20 feet.

CANTON ANTICLINE (discarded)

Location Northern part of T6N, R4E, Fulton County

References Moulton 1925

Moulton's (1925) structure map, based on outcrops and drilling records of the Springfield Coal Member (Pennsylvanian), showed the Canton Anticline as an east-trending nose with less than 20 feet (6 m) of relief. An area of possible closure was denoted as a target for oil exploration.

The coal structure was remapped by Wanless (1957), who used more control points than Moulton. On this map, the Canton Anticline (not mentioned by name) appears as a western extension of the larger St. David Anticline. The use of the name Canton Anticline should, therefore, be discontinued and the structure included as part of the St. David Anticline.

CANTON SYNCLINE
Peoria Folds

Location Southern Peoria and Fulton Counties (D-3, 4)

References Wanless 1957

The Canton Syncline was mapped from borehole data on the Colchester and Springfield Coal Members (Pennsylvanian). The fold axis trends slightly north of east and is about 23 miles (37 km) long. Structural relief is 50 to 75 feet (15–23 m).

CAP AU GRÈS FAULTED FLEXURE

Location Southern Jersey and Calhoun Counties, Illinois (H-2, 3), and Lincoln and Pike Counties, Missouri

References Worthen 1870, Keyes 1894, 1898, 1917, Krey 1924, Rubey 1952, Collinson et al. 1954, Mateker 1958, Douthit 1959, Cole 1961, Tikrity 1968, McCracken 1971, Treworgy 1979a, Nelson and Lumm 1985

The Cap au Grès structure has been called a fold, a fault, and a fault zone, but the term faulted flexure best describes it. Worthen (1870), during the first geological survey of Illinois, observed the deformed zone, but Keyes (1894) named it. The name Cap au Grès means sandstone point and was taken from a headland along the Mississippi River where St. Peter Sandstone is exposed on the high side of the structure.

In general, the name Cap au Grès has been applied only to the steeply dipping and faulted southwest limb of the Lincoln Anticline in Illinois and the adjacent part of Missouri. The name Cap au Grès is, therefore, redundant and a case could be made for eliminating Cap au Grès in favor of Lincoln Anticline. The name Cap au Grès, however, is so firmly established in the literature that any attempt to discontinue using this name would be futile.

The flexure is about 60 miles (100 km) long. It trends generally east-southeast in Missouri and runs east to west in Illinois. The north side has been raised as much as 1,200 feet (360 m) relative to the south side. Steepest dips range from about 65° south through vertical to 65° north (overturned). The zone of dips steeper than 5° is only 1,000 to 1,500 feet (300–450 m) wide.

Interpretation of the Cap au Grès structure is hampered by incomplete exposures. Most geologists originally believed folding to be the product of drag along a large fault. Rubey (1952) took a more cautious approach and mapped faults only where data required them. By means of careful calculations and geometric constructions, he demonstrated that no more than one-third of the structural relief need be attributed to faulting. Rubey mapped a series of high-angle, discontinuous faults parallel to and slightly north of the line of maximum flexure along the Cap au Grès. A few small faults transverse to the fold also were recognized. Rubey concluded that the drag hypothesis was not tenable. Instead, he favored an origin by horizontal compression that came from the north and produced a deep-seated reverse fault and a sharp, locally fractured fold near the surface. Rubey suggested an alternative—uplift of the northern basement block along a steep reverse fault with forced folding of sedimentary strata above.

Cole (1961) proposed alternatively that the Cap au Grès is a left-lateral strike-slip fault. He regarded the Waterloo–Dupo Anticline in Illinois as the offset continuation of the Lincoln Anticline in Missouri. If true, it would imply approximately 30 miles (48 km) of horizontal displacement. Cole's theory is untenable because there is no way to account for such a huge displacement at the two ends of the structure. Moreover, no indications, such as en echelon folds, have been reported along the Cap au Grès.

Mateker (1958) conducted a gravity survey and Douthit (1959) conducted a magnetic survey of the Cap au Grès Faulted Flexure. Both concluded that Precambrian basement is cut by a continuous fault along which the north side has been uplifted about 1,000 feet (300 m). Tikrity (1968) postulated uplift of the northern block of the Cap au Grès along a high-angle reverse fault in the Precambrian basement and forced folding of the Paleozoic sedimentary cover. Nelson and Lumm (1985) agreed with Tikrity and compared the Cap au Grès flexure with Laramide monoclines in the Rocky Mountains and Colorado Plateau, where folds in the sedimentary cover overlie faults in Precambrian crystalline basement.

The Cap au Grès structure has undergone recurrent movement. Initial uplift of the structure occurred in Devonian and early Mississippian time (Rubey 1952, Tikrity 1968). Major displacements took place in late Mississippian to early Pennsylvanian time, as shown by angular unconformity along the flexure (Rubey 1952). Later movements tilted and displaced Pennsylvanian rocks. Still more recent uplift is indicated by apparent displacement of the Grover Gravel (Pliocene to early Pleistocene) and its underlying peneplain. The gravel and erosional surface lie about 150 feet (45 m) lower, south of the flexure, as compared with the north (Treworgy 1979a). This is one of the few places where Tertiary tectonic activity has been documented in Illinois.

See also LINCOLN ANTICLINE.

CARLINVILLE ANTICLINE (discarded)

Location Central Macoupin County

References Kay 1915, Blatchley 1914, Lee 1926, Easton 1942, Ball 1952

The Carlinville Anticline or Dome, as shown on early maps, is a minor, irregular eastward nosing of contour lines on the Herrin Coal Member (Pennsylvanian). The term "dome" is inappropriate, for none of the maps indicate closure. New structural mapping (Nelson 1987b) that uses many additional well records indicates a series of small irregular rises and depressions on the Herrin Coal in the area of the Carlinville Anticline. No structure worthy of naming is present, and reference to the Carlinville Anticline should be discontinued.

CARLINVILLE NORTH DOME (discarded)

Location T10N, R7W, Macoupin County

References Easton 1942, Ball 1952

This dome was mapped on the basis of a single borehole. Newly available well records (Nelson 1987b) show that no closure exists; the name Carlinville North Dome is inappropriate and should be discontinued.

CARLINVILLE–CENTRALIA ANTICLINAL BELT (discarded)

Location Marion, Clinton, Bond, and Macoupin Counties

References Workman 1940, Folk and Swann 1946

Workman (1940) observed that several oil-producing domes and anticlines, extending from Macoupin County on the northwest to southern Marion County on the southeast, are arranged more or less in a line. This observation led him to postulate the existence in this area of a fold belt or anticlinorium comparable to the La Salle. Subsequent deep drilling and structural mapping (Bristol and Buschbach 1973, Bristol and Howard 1976, Stevenson et al. 1981) demonstrated that the structures noted by Workman are unrelated and do not constitute a fold belt. The term Carlinville–Centralia Anticlinal Belt has dropped out of usage.

CARLYLE DOME (discarded)

Location T2N, R3W, Clinton County

References Shaw 1915a, Kay 1915, Bell 1941

The Carlyle Dome, an irregular, enclosed area of several square miles, was shown on early structure maps of the Herrin Coal Member (Pennsylvanian). Newer mapping demonstrates that no closure exists on the Chesterian Beech Creek ("Barlow") Limestone (ISGS open files) or on deeper horizons in the Carlyle Oil Field. The coal high may be the product of differential compaction over lenticular lower Pennsylvanian sandstones. The name Carlyle Dome should, therefore, be discontinued.

CARROLLTON ANTICLINES (discarded)

Location South-central Greene County

References Collingwood 1933

Two minor anticlinal noses were mapped from scattered outcrop and borehole data near the town of Carrollton. Few new data have become available in Greene County since Collingwood's study. These structures, if they exist, are poorly defined, and use of the name should be discontinued.

CEDAR CREEK DOME (discarded)

Location T10S, R2W, Jackson County

References St. Clair 1917a, Desborough 1961a

The Cedar Creek Dome was one of several structures defined on the basis of reconnaissance geologic mapping by St. Clair and J. Weller. Maximum dips on its limbs were reported to be about 3°. Desborough's (1961a) map of the Pomona Quadrangle, however, shows no indication of a dome where St. Clair mapped it. Desborough's map shows the surface rocks of the lower Pennsylvanian Caseyville Formation dipping gently northward and being cut by several faults of small displacement in the area of St. Clair's Cedar Creek Dome. The use of the name Cedar Creek Dome should be discontinued.

CEDAR POINT ANTICLINE (discarded)

Location Putnam and southwestern La Salle Counties

References Willman and Payne 1942

Definition of this structure was based on subsurface contouring of several Cambrian and Ordovician units. As mapped by Willman and Payne (1942), the anticline strikes N65°E, perpendicular to the La Salle Anticlinorium, and terminates against the latter. No closure was mapped. Maximum structural relief was stated to be about 300 feet (90 m) and the steepest dip, about 200 feet per mile.

No indication of the Cedar Point Anticline appears on maps of the top of the Galena (Trenton) Group (Bristol and Buschbach 1973), the top of the Franconia Formation (Kolata et al. 1983), or the Colchester Coal (Pennsylvanian; Jacobson 1985). The well records used by the later mappers were more numerous and better in quality than those available to Willman and Payne. The use of the name Cedar Point Anticline should therefore be discontinued.

CENTRALIA ANTICLINE

Location Southeastern Clinton County (H, I-5)

References Bell 1926a, b, 1927, 1939, Koch and Farlee 1939, Brownfield 1954.

The Centralia Anticline, where the Centralia Oil Field is developed, lies on the upthrown west side of the Du Quoin Monocline. The anticlinal axis curves from a north–south to a northwest trend. As mapped by Brownfield (1954) on the Beech Creek ("Barlow") Limestone, the Centralia Anticline has more than 100 feet (30 m) of closure (fig. 31). It is about 8 miles (13 km) long and up to 3.5 miles (5.5 km) wide.

Using a series of isopach and structure maps, Brownfield showed that arching of the Centralia Anticline began during Silurian or Devonian time and continued through and after the Pennsylvanian Period. The largest movements apparently took place late in the Mississippian Period and early in the Pennsylvanian Period.

The Centralia Oil Field was discovered in 1937. By 1992, it had produced more than 58 million barrels of oil from pay zones in Pennsylvanian, Mississippian, Devonian, and Ordovician strata.

CENTRALIA FAULT ZONE

Location Along the west edge of Marion and Jefferson Counties (H, I-5)

References Bell 1927, Brownfield 1954, Bristol and Buschbach 1973, Keys and Nelson 1980, Nelson 1981

The Centralia Fault Zone is known from exposures in underground coal mines (now abandoned), well records, and seismic profiles. The zone consists of high-angle normal faults that strike north to south and follow the east-dipping flank of the Du Quoin Monocline. The largest fault was traced through mines for 10 miles (16 km) northward from the Marion–Jefferson county line. It is downthrown to the west and has a maximum displacement of 160 to 200 feet (51–61 m). Smaller faults strike parallel to the main one. They are downthrown to the east and west, and produce horsts and grabens. Maximum width of the fault zone, as indicated from mining records, is about 1,250 feet (380 m; Brownfield 1954).

Borehole data indicate that the Centralia Fault Zone continues southward along the west edge of Jefferson County. Keys and Nelson (1980) mapped a fault displacing the Shoal Creek Limestone (upper Pennsylvanian) as much as 200 feet (60 m) down to the west in T3S, R1E. Recent remapping, using additional well data, indicates that the displacement is only 50 to 100 feet (15–30 m) here. Several well logs show missing sections or strata, indicative of normal faulting.

The Centralia Fault Zone is directly in line with the Dowell Fault Zone of southeastern Perry County. These fault zones are alike in structural style and relation to the Du Quoin Monocline. In all probability, they are part of a continuous fracture zone along the limb of the monocline.

Two east–west, seismic reflection profiles that cross the Centralia Fault Zone in Jefferson County indicate a normal fault that has downthrow to the west. Dip of the fault plane was calculated to be 70° to 75° and displacement is 100 to 150 feet (30–45 m). The fault displaces all reflectors down to the St. Peter Sandstone (Ordovician), the deepest coherent reflector on these profiles.

The fact that the Centralia Fault Zone follows the Du Quoin Monocline, but has an opposite direction of throw, led Brownfield (1954) to propose two periods of deformation here. He theorized that the monocline developed during late Mississippian through Pennsylvanian time. Uplift on the west, succeeded by post-Pennsylvanian uplift on the east, produced the faulting.

Brownfield's hypothesis of two episodes of deformation is plausible. Folding of the Du Quoin Monocline was accomplished mainly during the late Mississippian to middle Pennsylvanian Periods, as shown by thinning of strata of these ages on the upthrown limb of the monocline. The Du Quoin, similar to monoclines in the Rocky Mountain region, probably was produced by compression and overlies a reverse fault in basement. The Centralia Fault Zone is younger than the main stage of folding (faults displace upper Pennsylvanian rocks). I infer that post-Pennsylvanian extension induced normal movement on the fault and propagated itself to the surface. Sedimentary rocks fracture readily under extension, whereas they tend to fold under compression.

CHARLESTON MONOCLINE (new)

La Salle Anticlinorium

Location From southern Lawrence County (H-8) to southwestern Champaign County (F–7)

References None

The name Charleston Monocline is introduced here for the great monocline that marks the west edge of the southern part of the La Salle Anticlinorium. It is named after the city of Charleston, county seat of Coles County, which lies along the flexure. The Charleston Monocline terminates at the north end of the Tuscola Anticline in T18N, R7E, Champaign County. A northward extension, offset several miles to the west at this point, is the Osman Monocline.

The Charleston Monocline is slightly sinuous; it strikes N20°W and faces to the west-southwest. Several named domes and anticlines are aligned along the upper limb of the flexure. From south to north, these include the Lawrenceville Dome; the Bridgeport and Hardinville Anticlines; the Oblong, Martinsville, and Westfield Domes; and the Tuscola Anticline. The Charleston Monocline is flanked on the west by the Bogota–Rinard Syncline and other unnamed, shallow, south-plunging troughs. Maximum relief, measured on top of the Galena Group from the crest of domes along the monocline to the troughs of adjacent synclines, is as great as 2,500 feet (750 m) in several places (Bristol and Buschbach 1973). This is the greatest structural relief on any fold in the Illinois Basin.

The Charleston Monocline probably overlies a fault in Precambrian crystalline basement. Available evidence does not, however, establish the presence of faulting at Galena or higher levels. Delineation of possible faults is difficult because little drilling has taken place along the steep flank of the flexure. A seismic reflection profile (fig. 23) shows no detectable offset of reflectors down to the base of the Knox Group (Upper Cambrian). The quality of reflection is poor below this level. Faulting rather than folding in basement is assumed because the lack of metamorphism of Paleozoic rocks indicates that temperatures and pressures were insufficient to produce ductile deformation of crystalline Precambrian rocks.

CHESTERVILLE ANTICLINE (discarded)

Location Southwest part of T15N, R8E, Douglas County

References Clegg 1959

The Chesterville Anticline is represented by a modest westward nosing of contour lines on the west flank of the Tuscola Anticline (La Salle Anticlinorium). It is fairly prominent on Clegg's (1959) map of the subsurface structure of the Danville Coal Member (Pennsylvanian), but barely discernible on his maps of older coals.

Like the Bourbon Anticline, the Chesterville may be chiefly a product of differential compaction. It does not meet the definition of an anticline and therefore, the use of the name Chesterville Anticline should be discontinued.

CLAY CITY ANTICLINE (new name)

Location From central Jasper County to southern Wayne County (H, I-7)

References Bell and Cohee 1938, Bell 1943, Lowenstam 1951, Siever and Cady 1951, Du Bois and Siever 1955

Bell and Cohee (1938) mapped an anticline in Richland County and informally called it the "Noble anticline." Bell (1943) and other geologists applied the name Clay City Anticlinal Belt to a larger structure that includes the Noble anticline. Although the name Noble has priority, it never achieved widespread usage and has been supplanted by Clay City. The Clay City structure is a long, sinuous, southward-plunging anticlinal nose with numerous small areas of closure. It is properly called an anticline; therefore, the name is changed here to Clay City Anticline. The term "anticlinal belt" implies a series of parallel or en echelon anticlines and is not appropriate in this case.

From the west flank of the La Salle Anticlinorium in Jasper County, the Clay City Anticline trends on a heading of S15°W through Richland and Wayne Counties. It is flanked on the west by the Bogota–Rinard Syncline and bordered on the east by an unnamed trough. Numerous stratigraphic and structural traps within the Clay City Anticline support prolific oil fields. Cumulative production from the Clay City Consolidated field is 361 million barrels.

The Clay City Anticline has been mapped at numerous levels, including the Ordovician Galena Group (Bristol and Buschbach 1973), Devonian–Mississippian New Albany Group (Bell 1943, Stevenson et al. 1981), Mississippian Karnak Limestone Member of the Ste. Genevieve Limestone (Bristol and Howard 1976), Beech Creek ("Barlow") Limestone (Bristol 1968), and Pennsylvanian Herrin Coal and West Franklin Limestone Members (Lowenstam 1951, Siever and Cady 1951, Du Bois and Siever 1955). The anticline is plotted on plate 1 as it appears at the base of the New Albany on the map of Stevenson et al. (1981).

A cross section made by Bell and Cohee (1938) demonstrates that principal deformation of the Clay City ("Noble") Anticline took place in early Pennsylvanian time, in common with most anticlinal structures in the region. A seismic reflection profile (fig. 24) shows that the anticline affects all strata down to the deepest identifiable Paleozoic reflector at the base of the Knox Group (Upper Cambrian). No faulting is detectable at the scale of the profile. The profile shows sets of strong reflectors below two-way travel times of 1.5 seconds within Precambrian basement. Such deep reflectors have appeared on many seismic lines in southern Illinois and are discussed by Pratt et al. (1989) and Heigold and Oltz (1991).

CLIFFORD ANTICLINE (discarded)

Location T8S, R1E, Williamson County (?)

References Cady 1916

Cady mentioned the feature once in his writings (1916, p. 83), but did not specify its location. No anticline is apparent near the village of Clifford on Cady's structure map of the Herrin Coal Member or on subsequent structure maps of the area. Use of the name Clifford Anticline should be discontinued.

CLINTON SYNCLINE

Location Western McLean and De Witt Counties (E-5, 6)

References Clegg 1972, Bristol and Buschbach 1973

The Clinton Syncline is a broad, shallow trough that plunges south and has a sinuous axis. Maps of the Danville Coal Member (Pennsylvanian; Clegg 1972) and the top of the Galena Group (Champlainian; Bristol and Buschbach 1973) show no internal closure. The west flank is gentle, and the east flank merges with the west flank of the Downs Anticline, which is part of the La Salle Anticlinorium.

COLFAX SYNCLINE
La Salle Anticlinorium

Location Eastern Livingston, McLean, and Piatt Counties (D, E-6)

References Clegg 1970, 1972

The Colfax Syncline plunges southward and separates the Downs Anticline on the west from the Tuscola Anticline and Osman Monocline on the east. The position of its sinuous axis varies, depending on which contouring horizon is selected. The Colfax Syncline, as depicted on plate 1, is based on Bristol and Buschbach's (1973) map of the top of the Galena Group.

COLMAR ANTICLINE

Location Southwestern McDonough and adjacent parts of Hancock and Schuyler Counties (E-2)

References Hinds 1914, 1919, Morse and Kay 1915, Howard 1961

Hinds (1914) mapped an anticline south of Colmar and recommended the area for oil prospecting. In the same year the Colmar–Plymouth Oil Field was discovered; the lenticular Hoing Sandstone (Middle Devonian) is the producing horizon. Morse and Kay (1915) mapped a dumbbell-shaped anticline that trends east to west and is contoured on the Hoing. Hinds (1919) was the first author to call this structure the Colmar Anticline.

A structure map contoured by Howard (1961) on top of the Galena Group (Champlainian) shows several irregular areas of closure in the Colmar–Plymouth field. The name Colmar Anticline is retained for the largest area of closure, which has a strongly curved axis (pl. 1). Howard shows about 60 feet (18 m) of maximum closure on the Galena and states that 80 to 100 feet (24–30 m) of closure exists at the base of the New Albany Group (Upper Devonian). A smaller area of closure, roughly oval in plan view, occurs north of the main Colmar Anticline. Oil accumulation in the Colmar–Plymouth field was controlled partially by structure and partially by stratigraphic factors.

COLUMBIA SYNCLINE

Location Monroe and St. Clair Counties H, I-3

References J. Weller 1939, S. Weller and J. Weller 1939, Bristol and Buschbach 1973

The Columbia Syncline separates the Waterloo–Dupo and Valmeyer Anticlines. The synclinal axis runs north-northwest, parallel with the Waterloo–Dupo. Structural relief on the top of the Galena Group (Champlainian) is more than 450 feet (135 m). The east limb dips steeper than 45° in places; the west limb is considerably broader and gentler.

CONANT DOME (discarded)

Location West-central Perry County

References Cady et al. 1940

The structure contour map on the Herrin Coal Member (Pennsylvanian) indicates a small elliptical closure along the border of T5N, R3 and 4W (Cady et al. 1940). The dome was mapped on the basis of a single control point. Existence of this structure is too poorly established to warrant continued use of the name Conant Dome.

COOK COUNTY FAULTS (new)

Location Cook County (greater Chicago area) and vicinity (A, B-8)

References Buschbach and Heim 1972, Graese et al. 1988, Harza with ISGS 1988

Faults mapped by Buschbach and Heim (1972) in the greater Chicago area were listed as "significant unnamed structures" by Treworgy (1981). Because these faults form no clearly defined zones or systems, the term "Cook County Faults" is applied as an informal name of convenience.

The faults were interpreted on the basis of detailed seismic reflection surveys made in connection with the rock-tunneling project of the Metropolitan Water Reclamation District of Greater Chicago. The faults were indicated by small offsets of the prominent reflection that marks the contact of the

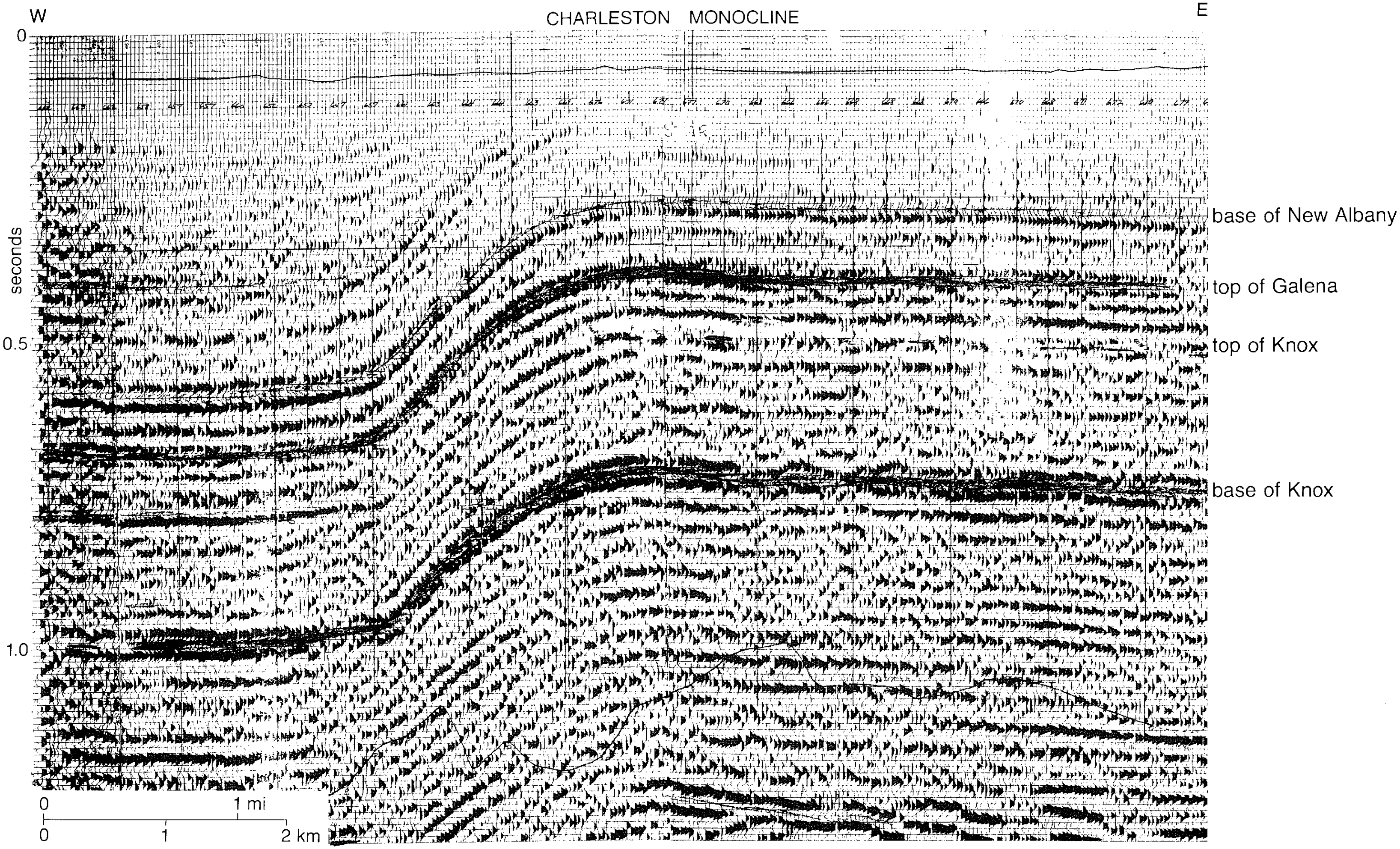


Figure 23 Seismic reflection profile across the Charleston Monocline, Coles County. From Heigold and Oltz 1991.

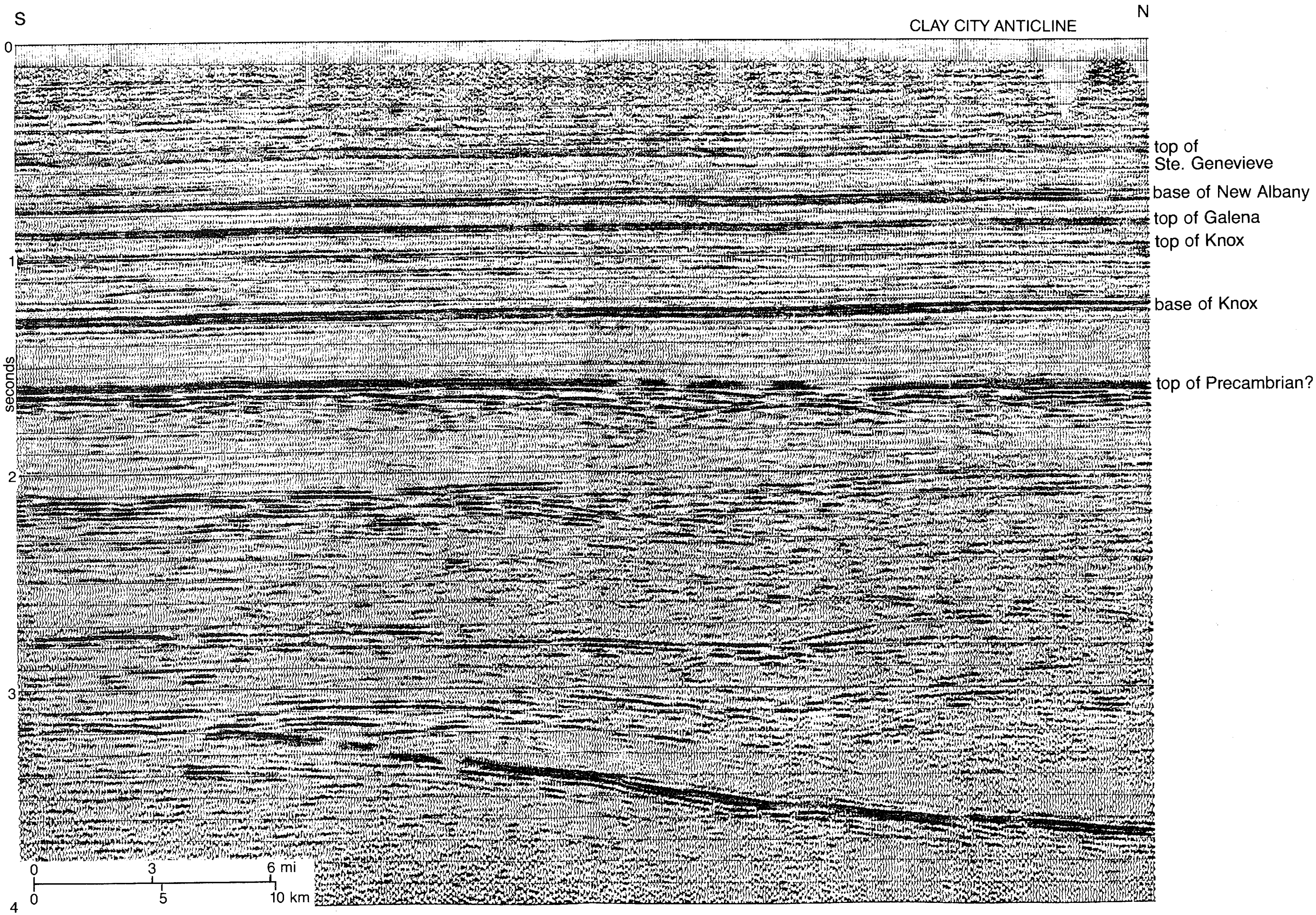


Figure 24 Seismic reflection profile across the Clay City Anticline. From Heigold and Oltz 1991.

Maquoketa Group (shale) above and Galena Group (carbonates) below. Inferred displacements of the faults range from 10 to 55 feet (3–17 m). Subsequent tunneling confirmed the existence of some faults, but showed that other predicted faults are folds. Observed faults have vertical offsets ranging from a few inches to 50 feet (15 m) and also bear evidence of strike-slip displacement (Graese et al. 1988, Harza with ISGS 1988).

Defining patterns of these faults is difficult because the seismic traverses covered a limited area (most of Cook County, except for the northwestern and southwestern corners, plus a very small part of Du Page County). Some of the faults mapped in northern Cook County may be related to the Des Plaines Disturbance. These faults are roughly tangential to the intensely disturbed area. Southward, the dominant trend of faults is northwest to west-northwest. The nearest major structure, the Sandwich Fault Zone, has a similar trend. Paul C. Heigold (ISGS, personal communication 1990) has examined some of the seismic profiles upon which fault interpretations were based, however, and considers interpretation of the faults to be questionable.

COOKS MILLS ANTICLINE

Location Northwestern Coles and southwestern Douglas Counties (F-7)

References Clegg 1959, 1965b

Clegg mapped this structure from subsurface data on the base of the Pennsylvanian System and on the Colchester, Herrin, and Danville Coal Members. It is also defined on structure maps of the Beech Creek ("Barlow") and Karnak Limestones (ISGS open files). Configuration is similar at all four levels: an elongate high, about 10 miles (16 km) long and 3 miles (4.8 km) wide, plunging about S35°W. A series of irregular domes, saddles, and depressions occurs on the broad crest of the anticline. Local closure is at least 60 feet (18 m). The Cooks Mills structure is separated from the much larger Tuscola Anticline on the east by a slight saddle, and lies offset to the Mattoon Anticline on the south. The Cooks Mills Consolidated Field, on the anticline, has produced 1.9 billion cubic feet of gas and 2.56 million barrels of oil from Chesterian, Valmeyeran, and Devonian pay zones. Natural gas is stored in the Chesterian Cypress Sandstone.

COOKSVILLE ANTICLINE (new)

Location T24 and 25N, R4E, McLean County (D-6)

References None

The name Cooksville Anticline is introduced to refer to an elongated structural high near the village of Cooksville in northeastern McLean County. As contoured on the Cambrian Mt. Simon Sandstone (fig. 25), the Cooksville Anticline is approximately 6 miles (10 km) long and up to 1.5 miles (2.5 km) wide; it has about 40 feet (12 m) of closure. The Cooksville Anticline adjoins the Lexington, Lake Bloomington, and Hudson Domes, but unlike the domes, Cooksville is not associated with a gravity high (fig. 25). The Cooksville Anticline was defined using drilling and seismic surveys made during exploration for underground gas storage reservoirs, but no gas is stored there now.

CORDES ANTICLINE (new)

Location Eastern T3S, R3W, Washington County (I-5)

References Treworgy 1981

The Cordes structure, listed as a "significant unnamed structure" by Treworgy (1981), is one of the most prominent anticlines on the eastern Sparta Shelf. It is named the Cordes Anticline after the Cordes Oil Field, which is developed in a structural trap on the anticline. It is defined best on structure maps of the Beech Creek ("Barlow") Limestone (ISGS open files). On this horizon, the fold trends almost north to south and is about 4 miles (6.5 km) long by 2 miles (3 km) wide. Closure on the Beech Creek is about 70 feet (21 m). The Cordes Anticline is nearly in line with the Pinckneyville Anticline to the south.

COTTAGE ANTICLINE

Cottage Grove Fault System

Location T9S, R7E, Saline County (J-7)

References Nelson and Krausse 1981

The Cottage Anticline was mapped from borehole data on the Herrin Coal Member. These data show a small area of closure in the northwest quarter of Section 15. The north limb dips about 100 feet per mile (1°), and the steeper south limb is truncated by the master fault of the Cottage Grove Fault System, which shows about 70 feet (21 m) of downthrow to the south.

COTTAGE GROVE FAULT SYSTEM

Location Western Gallatin, Saline, Williamson, southern Franklin and Perry, northern Jackson Counties; possibly westward into Randolph County (J-7 to J-4)

Selected references Butts 1925, Cady 1925, Fisher 1925, Cady et al. 1938, 1939, Clark and Royds 1948, Heyl and Brock 1961, Heyl et al. 1965, Heyl 1972, Wilcox et al. 1973, Nelson and Krausse 1981, Nelson and Lumm 1987

The Cottage Grove Fault System is a principal tectonic feature of southern Illinois. It is known in more detail than most fault systems of Illinois as a result of extensive exposures in underground coal mines. The structural pattern is further defined by hundreds of coal and oil test borings and by seismic profiles. Because of covering glacial drift, surface exposures are rare and the fault system has slight topographic expression. Thus, the faulting was unknown until widespread coal mining began in the early 20th century.

The Cottage Grove presents a classic pattern of right-lateral, strike-slip faulting. Clark and Royds (1948) were the first to postulate wrench faulting; other geologists since have refined this hypothesis. Horizontal displacement probably is on the order of several hundred to a few thousand feet (100–1,000 m). Mapping of two Pennsylvanian paleochannels that cross the fault zone limits maximum horizontal offset to less than 1 mile (1.6 km) (Nelson and Krausse 1981).

The fault system consists of (1) a master fault zone, (2) a series of en echelon or pinnate extensional faults flanking both sides of the master fault, and (3) a belt of anticlines along the master fault (fig. 26). The master fault zone trends slightly north of west and is approximately 70 miles (113 km) long. It is several hundred feet wide in most places and comprises high-angle faults outlining narrow horsts and grabens (fig. 27). Maximum dip-slip displacements are about 200 feet (60 m) in Pennsylvanian and Chesterian strata. In some

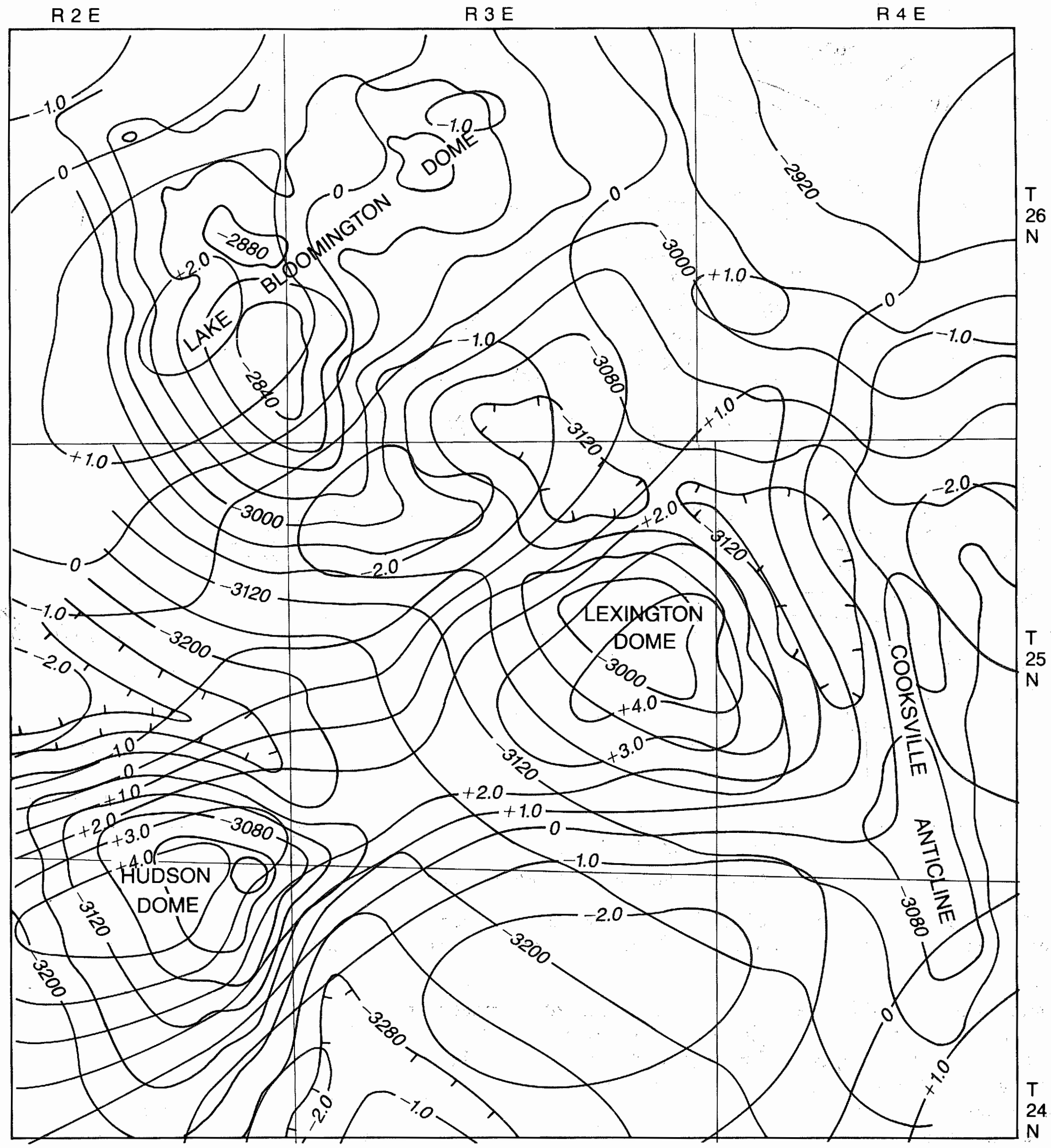


Figure 25 Cooksville Anticline and Hudson, Lake Bloomington, and Lexington Domes, McLean County. Black lines are structure contours (ft) on top of the Upper Cambrian Mt. Simon Sandstone. Red lines are residual gravity isogals. From Heigold et al. 1964.

places, the major displacements are down to the north; elsewhere, they are down to the south. Drag and slickensides indicate strike-slip motion, but no direct measurements of offset have yet been obtained. Proprietary seismic reflection profiles indicate that the master fault zone in Williamson and Jackson Counties is almost vertical and penetrates the entire sedimentary column. The seismic data show that several reverse faults diverging upward from the main vertical strand produce a "positive flower structure," which is an earmark of strike-slip faulting (Harding 1985).

Northwest-trending extensional faults occur en echelon both north and south of the master fault zone throughout its length. Some extensional faults are several miles long and reach at least 7 miles (11 km) away from the master fault. Most extensional faults are high-angle normal faults that have displacements ranging from less than 1 inch to about 50 feet (15 m). High-angle reverse, oblique-slip, and strike-slip faults also have been observed in mines. Some faults give evidence of two or more episodes of movement. Ultramafic dikes follow many of the faults in the eastern part of the fault system (fig. 28).

Named folds along the Cottage Grove Fault System include, from east to west, the Cottage, Brushy (fig. 21), Pittsburg (fig. 26), Vergennes, and Campbell Hill Anticlines (fig. 22). Additional, small, unnamed anticlines have also been mapped (fig. 26). Anticlinal axes either strike parallel with the

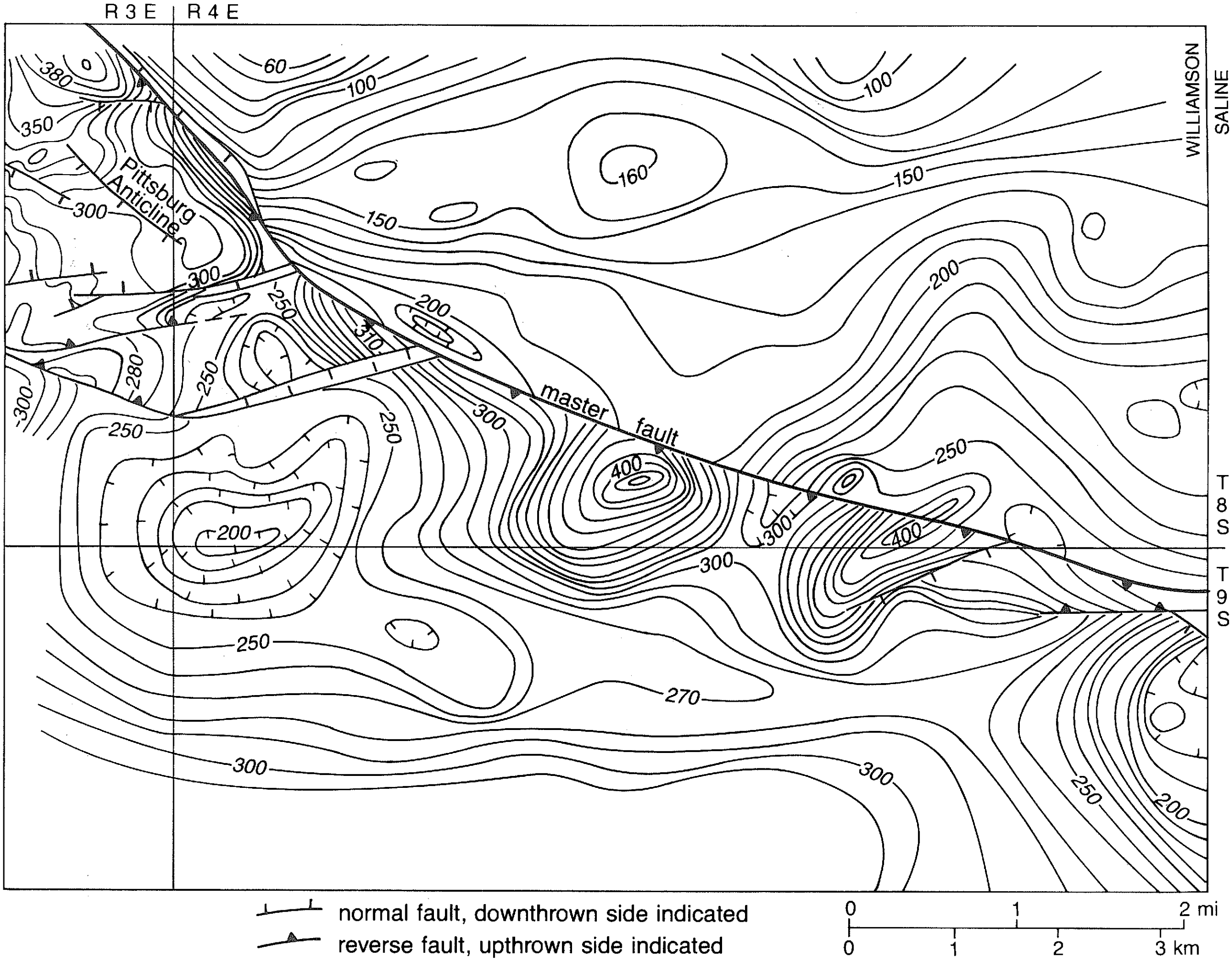


Figure 26 Structure (ft) of the base of the Herrin Coal Member in eastern Williamson County. Data are from mine surveys and closely spaced coal test boreholes. Note en echelon anticlines and synclines in central part of the area. Contour interval is 10 feet.

master fault or lie in right-handed en echelon arrangement. The limbs adjacent to the master fault are short, steep, and truncated by the fault; the opposite limbs are wide and the slopes are gentle. This style of folding is characteristic of strike-slip faults (Harding 1973).

The eastern terminus of the Cottage Grove master fault is accurately placed by using coal mine data from Section 17, T9S, R8E, Gallatin County. Here the fault lies about 2.5 miles (4 km) north of and strikes parallel to the Shawneetown Fault Zone. No connection between the Cottage Grove and Shawneetown is evident in near-surface strata (Nelson and Lumm 1987). The western terminus of the Cottage Grove is poorly defined because of the lack of suitable data. The westernmost mapped faults lie on the north flank of the Campbell Hill Anticline in northwestern Jackson County. The Wine Hill Dome and Bremen Anticline, in Randolph County, are in line with and en echelon to the master fault, and may express westward continuation of the fault system. Heyl (1972) suggested that the Cottage Grove continues into Missouri and links with the Ste. Genevieve Fault Zone, but no geologic evidence has been presented to support this idea.

The time of faulting is well indicated. The faults displace Missourian (late Pennsylvanian) and older strata. Peridotite intrusions along extensional faults in Saline County have been radiometrically dated as Early Permian (Nelson and Lumm 1987). Only a few of the intrusions that have been observed in mines are faulted (Clegg 1955). Therefore, most faulting probably was post-Missourian, pre-Early Permian, and only minor displacements occurred later.

Geologists have speculated about whether the Cottage Grove Fault System existed prior to the Pennsylvanian Period. Heyl (1972) included the Cottage Grove in his 38th Parallel Lineament, which also contains the Rough Creek–Shawneetown Fault System and Ste. Genevieve Fault Zone. Heyl proposed that the lineament represents a Precambrian suture or shear zone of continental proportions, and he suggested that it may have undergone several tens of miles of right-lateral displacement in Precambrian time. This hypothesis cannot be verified at present. Schwalb (1982) thought that the Cottage Grove was part of the northern boundary of the Rough Creek Graben. The strong magnetic gradient that roughly follows the Cottage Grove Fault System across southern Illinois suggests either a fault or contrasting basement lithologies. Proprietary seismic reflection profiles indicate no growth faulting at the Cambrian level across the Cottage Grove Fault System. The graben boundary instead appears to swing toward the southwest in Saline and Pope Counties and follows the Lusk Creek Fault Zone into the Mississippi Embayment.

Nelson and Lumm (1987) speculated that the Cottage Grove Fault System may have acted as a transform fault

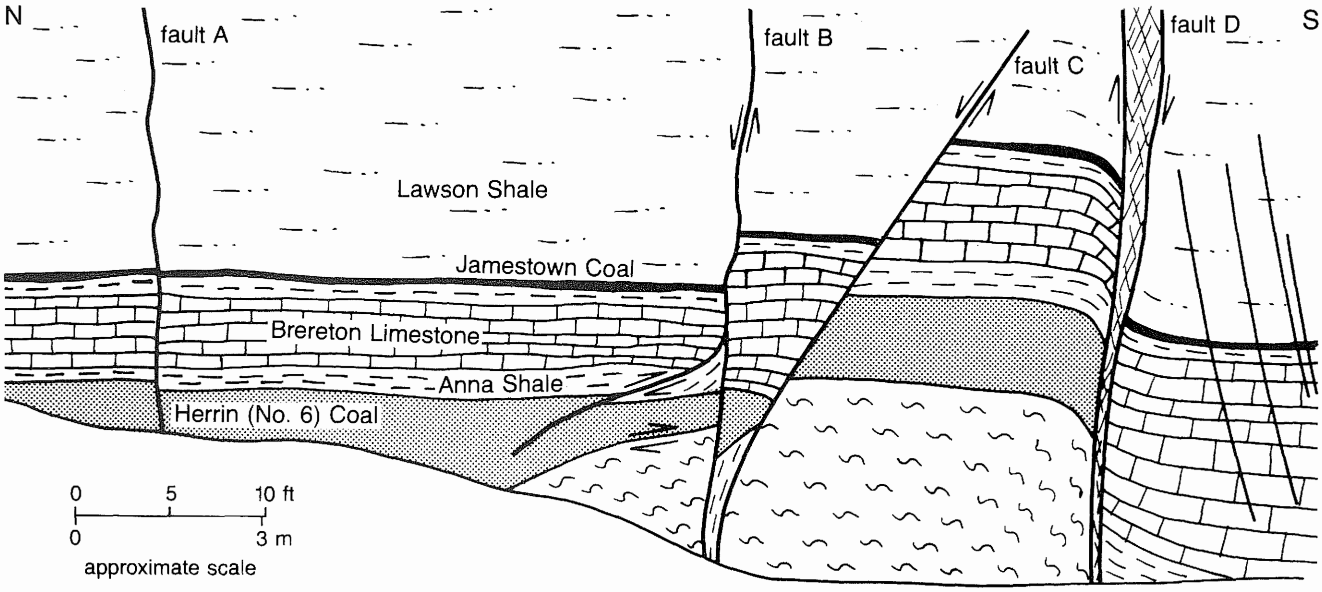


Figure 27 Exposure of the southern branch of the master fault of the Cottage Grove Fault System on the highwall of a strip mine in the SW, SE, Section 9, T9S, R5E, Saline County. This feature has been covered by mine reclamation. Four parallel east-striking faults are present. Faults A and B are nearly vertical but sinuous in the dip direction, and bear prominent horizontal slickensides and mullion. Further evidence that the major motion was strike-slip is shown by difference in thickness of the Anna Shale on opposite sides of fault A, and of the Brereton Limestone across fault B. Dip-slip movement is primarily indicated by orientation of drag and slickensides of faults C and D. For location see figure 21.

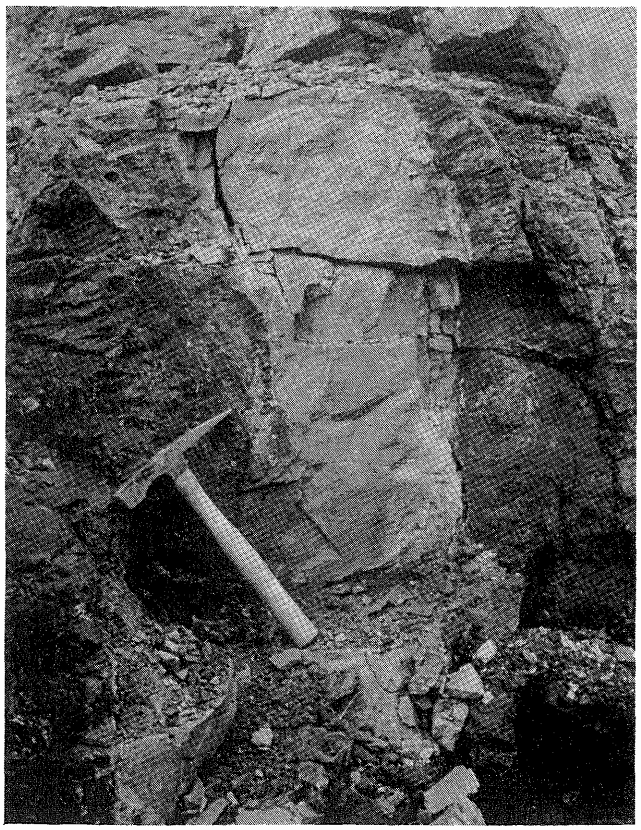


Figure 28 The Absher Dike, peridotite intrusion into the Springfield Coal Member in a now abandoned strip mine in southeastern Williamson County. This is one of many such dikes found along northwest-trending subsidiary faults in the Cottage Grove Fault System. Coal alongside the dike is coked (photo by K.E. Clegg 1955).

separating extensional faulting in the Fluorspar Area Fault Complex and Wabash Valley Fault System.

This scenario seems unlikely because the Early Permian was a time of compressional rather than extensional tectonics. Right-lateral movement on the Cottage Grove, and reverse faulting in the Rough Creek–Shawneetown Fault System and Lusk Creek Fault Zone, are all consistent with a compressive force from the southeast, associated with the Alleghenian Orogeny. A Precambrian zone of weakness, as proposed by Heyl (1972), might have guided the strike-slip faulting.

COTTONWOOD FAULT
Wabash Valley Fault System

Location T7S, R9E, Gallatin and White County (J-7)

References Bristol 1975, Bristol and Treworgy 1979

The Cottonwood Fault is about 3 miles (5 km) long and strikes north to south. It is a normal fault with the west side downthrown as much as 100 feet (30 m). The Cottonwood Fault lies just east of the larger Albion–Ridgway Fault Zone and may intersect the latter at depth.

COURT CREEK DOME (discarded)

Location T11N, R2E, Knox County

References Poor 1927

Poor (1927) named and defined the Court Creek Dome on the basis of elevation data on the Colchester Coal Member (Pennsylvanian). It was mapped as a small area of closure on a subtly defined anticlinal nose. Insufficient data exist for further definition of the structure at the same or deeper horizons in this area. The name Court Creek Dome should, therefore, be removed from stratigraphic records.

CRESCENT CITY ANTICLINE (new name)

Location Central Iroquois County (D-8)

References Bell 1961, Buschbach and Bond 1974

Bell (1961) named this structure a dome, but it is better called an anticline because its length is twice its width and it has a well defined axis. The Crescent City Anticline was delineated by drilling for gas storage. Buschbach and Bond's (1974) map shows at least 120 feet (36 m) of closure covering roughly 25 square miles (65 km^2) on the top of the Cambrian Mt. Simon Sandstone. The axis trends southeast, and the northeast limb is much steeper than the southwest limb.

Bristol and Buschbach's (1973) structure contour map of the top of the Galena Group (Ordovician) depicts anticlinal nosing that extends southward from the Crescent City Anticline into central Vermilion County. The name Crescent City Anticline is here restricted to the area of closure. At first glance the Crescent City Anticline appears to be an isolated structure; however, its trend and asymmetry are similar to those of the Ancona Anticline and the Sandwich Fault Zone.

CROWN FAULT

Location T12N, R5 and 6W, Macoupin and Montgomery Counties (G-4)

References Nelson and Nance 1980, Nelson 1981 (p. 28), Nelson 1987b, Ledvina 1988

Detailed geologic mapping in the Crown II underground mine of Freeman United Coal Mining Company disclosed a left-lateral fault in the Herrin Coal Member (Pennsylvanian) and adjacent strata. The fault trends east to west and to date has been traced 17,000 feet (5,200 m) without either end being found. Unpublished field notes (ISGS open files) suggest that the fault also was encountered in the northern workings of the abandoned Crown I Mine, east of Crown II. This would extend the length of the fault to at least 7 miles (11 km). The fault was named the Crown Fault by Ledvina (1988) for the Crown Mines.

Left-lateral displacement is demonstrated by offset of lenticular rock bodies in the mine roof. Measured horizontal offset varies from about 15 to 70 feet (4.5–21 m); observed vertical slip is up to 4 feet (1.2 m). The fault branches and splits in several places. Northeast-trending vertical open joints and fissures occur along the fault and reflect the tensional component of the shearing stress. The vertical extent of the fracture zone is unknown, but it is thought to be considerable because freshwater enters the mine along the fault from above and oil and gas enter from below. The Crown Fault offsets and therefore is younger than one of the Girard Faults, which are normal faults (fig. 29).

The Crown Fault occurs in a region of the Western Shelf noted for its lack of tectonic structure. Nevertheless, it is difficult to conceive of a nontectonic origin for this fault. Because the displacement is so small, a feature like the Crown Fault would be nearly impossible to detect by ordinary subsurface mapping techniques.

See also GIRARD and SICILY FAULTS.

DAHLGREN ANTICLINE

Location T3S, R5E, Hamilton County (I-6)

References Rolley 1951

The Dahlgren Anticline was named by Rolley (1951). Her structure map of the top of the Herrin Coal Member (Pennsylvanian) shows a northeast-trending anticline about 2 miles (3.2 km) long and 1 mile (1.6 km) wide; it has at least 25 feet (8 m) of closure. Rolley's coal structure map was based on information gathered from closely spaced drill holes. On the deeper Beech Creek ("Barlow") Limestone and Karnak Limestone Member (ISGS open files), the Dahlgren Anticline lacks mapped closure, but nosing of contour lines to the southeast is evident.

DAISY FAULT

Fluorspar Area Fault Complex

Location Sections 29 and 32, T12S, R8E, Hardin County (pl. 2)

References S. Weller et al. 1920, Bastin 1931, Hubbert 1944, J. Weller et al. 1952, Baxter and Desborough 1965

The Daisy Fault was named for the Daisy fluorspar vein, which in turn took its name from the abandoned Daisy Mine. The fault and vein are part of a complex system of fractures along the southeast margin of the Rock Creek Graben. The Daisy Fault strikes N20°E, dips 70° to 80°W, and has as much as 350 feet (106 m) of normal displacement. Bastin (1931) reported that slickensides on the fault plane varied in plunge from 10°S to 80°N, indicating a component of strike-slip. He also stated that the western or hanging wall of the vein is a postmineralization fault plane, whereas the ore is "frozen" to the east wall.

DALE DOME

Location Southeastern Hamilton County (I-7)

References Cady et al. 1939, Rolley 1951

Mapping of the Herrin Coal Member (Pennsylvanian) indicates a north-trending dome about 4 miles long by 2 miles wide (6.5 × 3 km); it has at least 50 feet (15 m) of closure (Cady et al. 1939). A structure map of the Beech Creek ("Barlow") Limestone (ISGS open files) shows a dome with about the same amount of closure but smaller areal extent. A test hole drilled on the dome in 1965 reached Precambrian granite at a depth of almost 13,000 feet (4,000 m). The Eau Claire Formation rested directly on granite in this well; the Mt. Simon Sandstone is absent. Such a relationship is common on the buried Precambrian hills that occur on the Ozark Dome and in the Illinois Basin, and it suggests that Dale Dome is the result of differential compaction around a granite knob.

See also PRECAMBRIAN HILLS.

DARMSTADT ANTICLINE (discarded)

Location T2 and 3S, R6W, St. Clair County

References Shaw 1915a and 1921, Moulton 1925, Bell 1929a, J. Weller and Bell 1937, Cady et al. 1940

Subsurface mapping of the Herrin Coal Member (Pennsylvanian) by Shaw and other researchers indicated an anticlinal nose, the Darmstadt Anticline. The structure is about 10 miles (16 km) long and plunges toward the north-northeast. The highest point on this nose and the only mapped area of closure is what Bell (1929a) called the Marissa Dome in Section 32, T3S, R6W. Bell recommended the Darmstadt Anticline for petroleum exploration and compared it with the Waterloo–

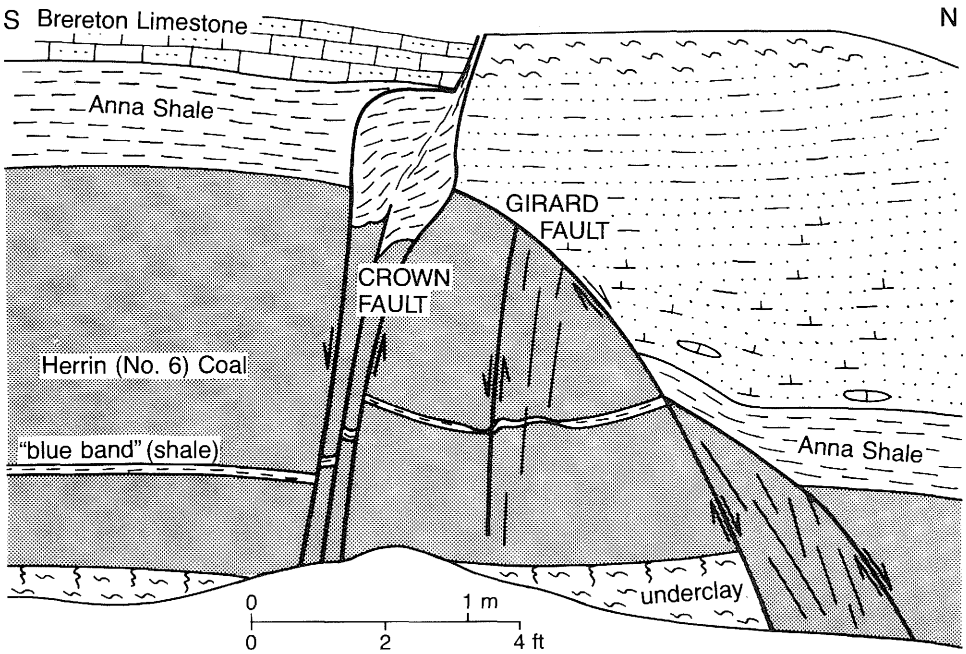


Figure 29 Intersection of the Girard and Crown Faults on the west wall of entry in the Crown II underground coal mine, Macoupin County. The Girard Fault is a normal fault that strikes southeast and dips northeast. It is displaced by the Crown Fault, a nearly vertical, east-trending left-lateral fault. Indicators of horizontal movement on Crown Fault include inconsistent displacement (top of the coal is downthrown to the north, but the "blue band" is downthrown to the south), and abrupt stratigraphic changes across the fault (Anna Shale is much thinner, and the Brereton Limestone is absent north of the fault in this view).

Dupo Anticline. Subsequent drilling has shown no anticline, and no oil has been discovered. The name Marissa Dome is retained because closure has been mapped, but use of the name Darmstadt Anticline should be discontinued.

See also MARISSA DOME.

DAVIS SYNCLINE
Fluorspar Area Fault Complex

Location Sections 34 and 35, T11S, R9E, Hardin County (pl. 2)

References Brecke 1962

This feature actually was named the W.L. Davis–A.L. Davis Syncline, after fluorspar mines that were developed there. Brecke provided a structure map, showing that the syncline is about 1/2 mile long and trends S60°E. Structural relief is about 55 feet (17 m), and slight closure is indicated. Brecke (1962) suggested that the syncline probably is the result of solution collapse along preexisting small faults or fractures. Structures of this type commonly are associated with bedded-replacement fluorspar deposits, but most have not been named.

DAYTON SYNCLINE (discarded)

Location Northern La Salle and southern De Kalb Counties

References Willman and Payne 1942

This minor structure was interpreted as having developed before deposition of the St. Peter Sandstone. It was shown on Willman and Payne's (1942) map of the New Richmond Sandstone (Canadian), but not expressed in the St. Peter or younger beds. As mapped on the New Richmond, the axis trends roughly north to south, and no closure is indicated. A structure map by Kolata et al. (1983) of the Cambrian Franconia Formation (below the New Richmond) does not indicate the Dayton Syncline. Because Kolata et al. had better data than Willman and Payne, the existence of Dayton Syncline is questionable and use of the name should be discontinued.

DEER LICK DOME
Cap au Grès Faulted Flexure

Location T6N, R13W, Jersey County (H-2)

References Rubey 1952, Collinson 1957, Treworgy 1979a

Deer Lick Dome, as defined by Rubey (1952), is a local area of closure along the Lincoln Anticline, immediately north of the Cap au Grès Faulted Flexure. As contoured on the top of the Chouteau Limestone (lower Mississippian), the dome is about 0.8 miles (1.3 km) long and 0.3 miles (0.5 miles) wide; it has at least 50 feet (15 m) of closure.

DE LAND DOME
La Salle Anticlinorium

Location T19N, R5E, Piatt County (E-6)

References Heigold et al. 1964, Howard 1964, Clegg 1972, Treworgy 1978

The De Land Dome is a small enclosed high, which some researchers have considered to be part of the Downs Anticline. The De Land and Parnell Domes, however, are distinctly offset to the east of the Downs Anticline. Clegg (1972) showed 30 to 40 feet (9–12 m) of closure on the Danville Coal Member on the De Land Dome, whereas Treworgy (1978) indicated about 60 feet (18 m) of closure on the top of Middle Devonian carbonates. The Deland Oil Field was discovered in Silurian strata in 1981.

DELTA FAULT

Ste. Genevieve Fault Zone

Location T14S, R2W, Alexander County (K-5)

References J. Weller 1940, J. Weller and Ekblaw 1940, Nelson and Lumm 1985

The Delta Fault was named by J. Weller (1940) for a now-abandoned village near the fault trace. Recent mapping (Devera et al.1994) confirms the Delta Fault to be essentially as shown by J. Weller. The fault trace is nearly linear and strikes N15°W for a distance of about 4 miles (6.4 km). It is a normal fault, dipping 60° to 80° east and having 100 to 200 feet (30–60 m) of throw down to the east. Slickensides and mullion on the fault surface indicate nearly pure dip-slip displacement. Zones of chert breccia, heavily cemented by silica and iron oxide, have been observed along the fault. In places the fault splits into several closely spaced parallel fractures, which displace strata in a stepwise fashion. Minor faults and joints adjacent to the Delta Fault strike parallel with the latter.

The youngest rocks offset by the Delta Fault are Middle Devonian, and were clearly well lithified when faulting took place. The time of faulting cannot be bracketed more closely than post-Devonian, pre-Quaternary. The Atwood Fault and several smaller, unnamed faults are similar in trend and style to the Delta Fault.

DEPUE ANTICLINE (discarded)

Location Southeastern Bureau County

References Willman and Payne 1942

Willman and Payne (1942) defined the Depue Anticline based on subsurface mapping of various Cambrian and Ordovician horizons, which indicated a southeast-trending anticlinal nose having maximum relief of roughly 150 feet (46 m). Willman and Payne's well control was extremely sparse, and the existence of an anticline in this location was not confirmed by subsequent studies (Kolata et al. 1983). The use of the name should be discontinued.

DES PLAINES DISTURBANCE

Location Centered in T41N, R12E, Cook County (A-8)

References Thwaites 1927, Longwell et al. 1944, Bays et al. 1945, Pemberton 1954, Emrich and Bergstrom 1962, Buschbach 1964, Beck 1965, Willman 1971, Buschbach and Heim 1972, Buschbach et al. 1982, McHone et al. 1986a, b

Anomalous geologic conditions in the northwest Chicago suburb of Des Plaines were noted by water well drillers as early as the 1890s. Thwaites (1927) first suggested faulting in the area. On their tectonic map of the United States, Longwell et al. (1944) identified the area of faulting as the "Des Plaines Disturbance," which has generally been used since. The disturbance was labeled a "cryptovolcanic structure" by Bays et al. (1945).

The Des Plaines Disturbance is roughly circular and about 5 miles (8 km) in diameter. It lies on the east flank of the Wisconsin Arch and is surrounded by Silurian bedrock that dips gently eastward. Within the disturbance, rocks ranging from Champlainian to Pennsylvanian subcrop beneath Pleistocene glacial deposits. The oldest rock at the bedrock surface, St. Peter Sandstone, is found at the center of the disturbance and is more than 800 feet (240 m) above its expected position. The sandstone is pervasively shattered and contains abundant silt-sized quartz shards. Sand-sized grains contain prominent strain lamellae and sets of crystallographically oriented planar fractures (McHone et al. 1986a, b). Outward from the center, younger rocks are downdropped within a mosaic of fault blocks (Emrich and Bergstrom 1962, Buschbach and Heim 1972). Ordovician rocks in cores south of the central uplift are steeply tilted, intensively brecciated, and cut by reverse faults (McHone et al. 1986a, b). Mississippian and Pennsylvanian rocks have been identified in wells north and east of the central uplift. These include bluish gray to black shale with beds of coal (Pennsylvanian), dolomite of the Keokuk–Burlington (Valmeyeran), and at least 500 feet (150 m) of shale and siltstone thought to be of Kinderhookian and early Valmeyeran age (Emrich and Bergstrom 1962). The next nearest outliers of Pennsylvanian and Mississippian strata are about 40 and 90 miles (65 and 145 km) south of the Des Plaines Disturbance.

McHone et al. (1986b) found shatter cones (fig. 30) in cores of dolomitic beds within the Maquoketa Group. The presence of shatter cones confirms the theory that the Des Plaines Disturbance was caused by impact of an extraterrestrial body (Dietz 1959).

The time of deformation cannot be more accurately determined than post-Pennsylvanian, pre-Pleistocene (Emrich and Bergstrom 1962, p. 962).

See also GLASFORD STRUCTURE, HICKS DOME, OMAHA DOME.

DIMICK FAULT (discarded)

Fluorspar Area Fault Complex

Location Sections 20 and 29, T12S, R8E, Hardin County

References J. Weller et al. 1952

J. Weller et al. (1952) did not clearly identify this fault, and it does not appear in subsequent publications. It apparently is part of the complicated fault zone that makes up the heavily exploited Rosiclare Mining District and may be part of what is now called the Argo Fault. The use of the name Dimick Fault should be discontinued.

DIVIDE ANTICLINE (new)

Location T1S, R3 and 4E, Jefferson County, and T1S, R5E, Wayne County (I-6)

References None

The Reservoir, Divide Consolidated, Coil West, Coil, Keenville, and Keenville East Oil Fields form a conspicuous east–west trend just east of the south end of the Salem Anticline. Associated with these oil fields is an east-plunging anticlinal nose, herein named the Divide Anticline after the Divide Consolidated field. The east–west trend of the Divide Anticline contrasts with the predominant north–south alignment of most structures in the Fairfield Basin.

The Divide Anticline is reflected on structure maps of the Beech Creek ("Barlow") Limestone (fig. 31), the Ste. Genevieve Limestone (Bristol and Howard 1976), and the base of the New Albany Group (Stevenson et al. 1981). The fold is broad and irregular on these horizons and shows less than 100

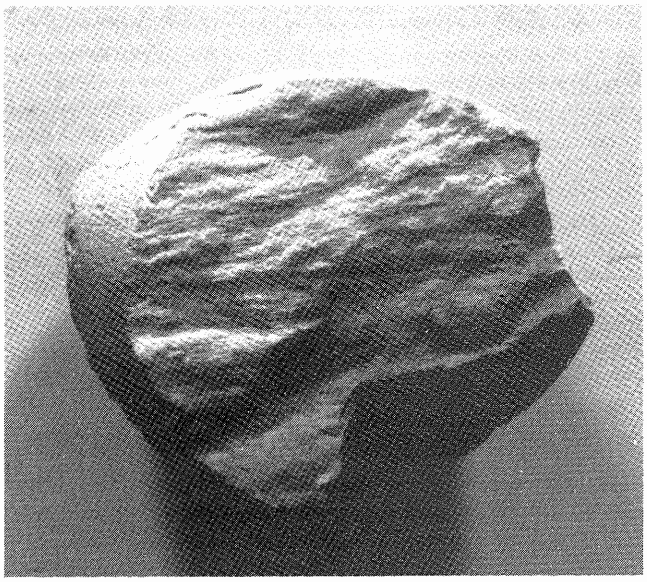


Figure 30 Shatter cone in drill core from the Des Plaines Disturbance indicates a probable impact origin of the structure. Diameter is about 2 inches (5 cm). Photo by J. McHone, Arizona State University.

feet (30 m) of relief. Small areas of closure are indicated on the Beech Creek and Ste. Genevieve structure maps (ISGS open files), which have a contour interval of 20 feet (6.1 m). Insufficient data are available to determine whether the structure affects strata below the New Albany.

The Divide Anticline illustrates the frequent association of oil production with subtle structural features in the Fairfield Basin. The main producing horizons in fields along the Divide trend are the Aux Vases Sandstone and Ste. Genevieve, St. Louis, and Salem Limestones (Mississippian). Structural closure alone does not account for these fields. Stevenson (1978) concluded that the primary trapping mechanism in the Keenville Field is stratigraphic, although structural influence is evident. It must be kept in mind, however, that many (perhaps most) stratigraphic traps are discovered during testing of structural prospects. Thus, the Divide trend of oil fields may reflect patterns of exploration more than it reflects the actual distribution of hydrocarbons.

DIXON SPRINGS GRABEN

Fluorspar Area Fault Complex

Location From northeastern Pope to Massac County (K-6, 7; pl. 2)

References S. Weller and Krey 1939, J. Weller et al. 1952, Ross 1963, Heyl et al. 1965, Baxter et al. 1967, Kolata et al. 1981, Bertagne and Leising 1991, Weibel et al. 1993

The Dixon Springs Graben is bounded by the Lusk Creek and Herod Fault Zones on the northwest and by the Hobbs Creek Fault Zone on the southeast. The southernmost Pennsylvanian rocks in Illinois are preserved within it. Drilling indicates that the graben extends beneath Cretaceous cover in the Mississippi Embayment and probably continues into Kentucky.

The Dixon Springs Graben apparently has undergone no fewer than five episodes of displacement. A seismic profile (Bertagne and Leising 1991) showing a thicker Cambrian section southeast of the Lusk Creek Fault Zone, implies normal faulting during Cambrian sedimentation. Additional normal displacements during the Morrowan and Atokan Epochs (Pennsylvanian) are indicated by thickness and facies relationships mapped in the Waltersburg Quadrangle (Weibel et al. 1993). Post-Pennsylvanian deformation first involved reverse faulting that raised the crustal block between the Lusk Creek and Raum Fault Zones, then normal faulting that lowered this block below its original position (Weibel et al. 1993). Finally, late Tertiary faulting in the southern part of the graben displaced units as young as the Mounds Gravel with apparent normal right–lateral slip (Nelson, unpublished mapping).

DONNELLSON ANTICLINE (discarded)

Location T7N, R3W, Montgomery and Bond Counties

References Bell 1941

Five test borings into the Herrin Coal Member (Pennsylvanian) suggested a broad east-trending anticlinal nose, which Bell (1941) called the Donnellson Anticline. Remapping of the coal structure using additional control points (Nelson 1987b) reveals a structural configuration totally different from that mapped by Bell, and no anticline is present; therefore, the use of the name Donnellson Anticline should be discontinued.

DOWELL FAULT ZONE

Location T7S, R1W, Jackson County, and T6S, R1W, Perry County (I,J-5)

References Nelson and Krausse 1981, Nelson 1981

The Dowell Fault Zone consists of a series of high-angle normal faults encountered in underground coal mines on the east-dipping limb of the Du Quoin Monocline. The faults strike parallel to the monocline, and most of them have the west side downthrown (fig. 31). Maximum displacement is about 40 feet (12 m). The Dowell Fault Zone may be a southward extension of the Centralia Fault Zone.

See also CENTRALIA FAULT ZONE and DU QUOIN MONOCLINE.

DOWNS ANTICLINE

La Salle Anticlinorium

Location McLean and eastern De Witt Counties (D, E-6)

References Heigold et al. 1964, Howard 1964, Clegg 1972

The Downs Anticline is a major element of the La Salle Anticlinorium and forms the west edge of the belt at this latitude. It is a strongly asymmetrical structure with a steep west flank and a gently sloped east one. A series of domes occurs along the crest of the Downs Anticline. Named domes include, from north to south, the Lake Bloomington, Hudson, and Wapella East. Clegg (1972) also included the Parnell and De Land Domes as part of the Downs Anticline, but those domes are offset southeast of the axis of the Downs Anticline. Structural relief is expressed at all mapped horizons and increases with depth. Maximum relief on the Danville Coal Member (Pennsylvanian) is about 325 feet (100 m) (Clegg 1972); Stevenson et al. (1981) showed relief of more than 700 feet (200 m) on the New Albany Group (Devonian–Mississippian) at the same point. Borehole and seismic data from gas storage projects (Buschbach and Bond 1974) show that the Hudson and Lake Bloomington Domes affect the basal Cambrian Mt. Simon

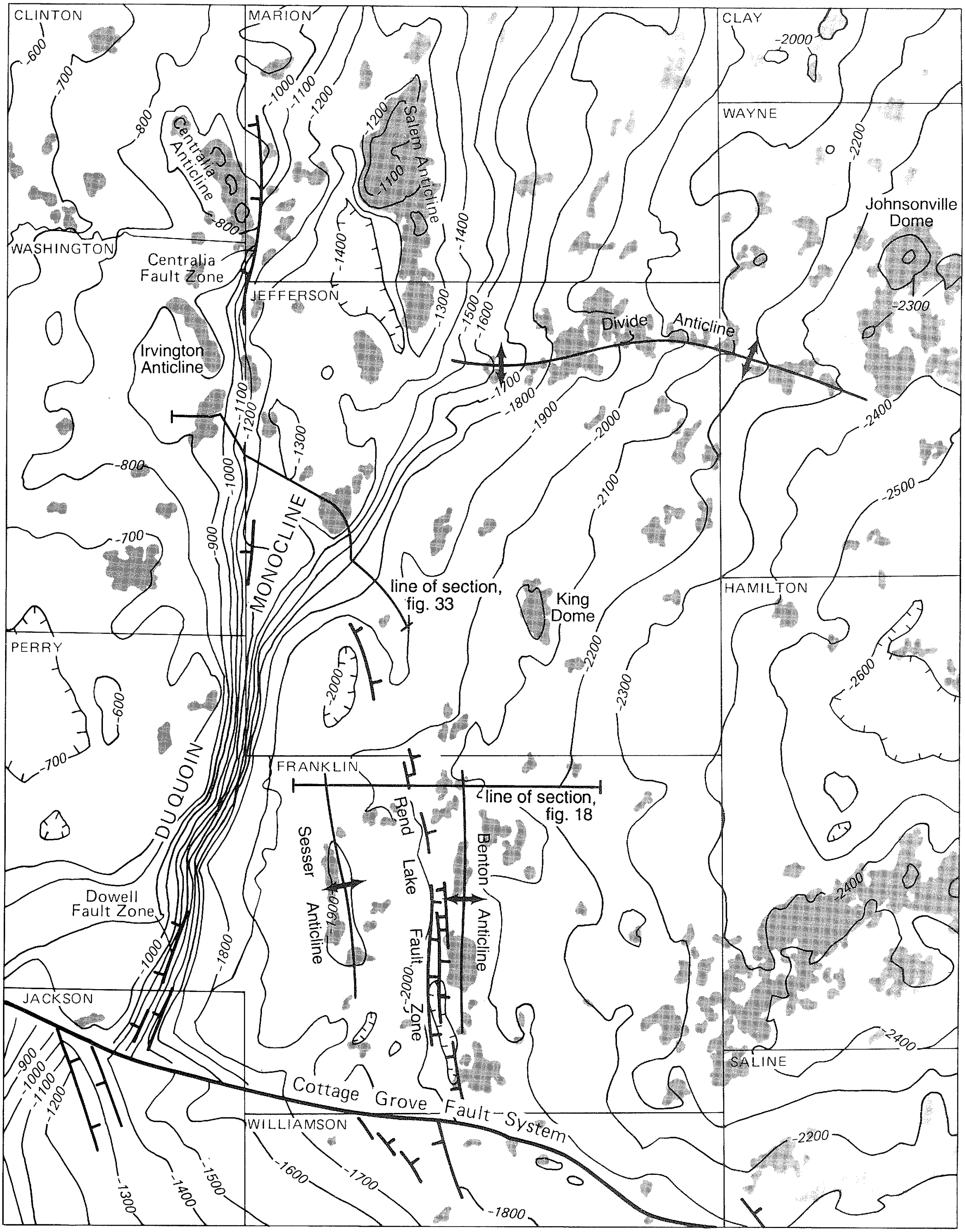


Figure 31 Du Quoin Monocline and neighboring area, contoured on base of the Beech Creek ("Barlow") Limestone. Contour interval is 100 feet (30 m). Oil fields are shaded. After Nelson 1991 as modified from Bristol 1968.

faults, ticks on downthrown side

0 5 10 mi
0 5 10 15 km

Sandstone. The Downs Anticline, in all probability, is a basement structure.

The Downs Anticline, which plunges abruptly southward, is separated from the Osman Monocline by the Colfax Syncline. Northward, the Downs flattens out, loses definition, and ends in offset relation to the Peru Monocline.

DRAKE–WHITE HALL ANTICLINE (discarded)

Location Northwestern Greene County

References Collingwood 1933

The name Drake–White Hall Anticline was given to a subtle anticlinal nose that plunges southeastward and was mapped from a handful of subsurface control points. No researcher since has confirmed the existence of such a structure. Even as originally defined, this feature did not merit naming and its use should be discontinued.

DUDLEY DOME
La Salle Anticlinorium

Location T13N, R13W, Edgar County (F-8)

References Clegg 1965b

The Dudley Dome is a minor high point on the upper limb of the Edgar Monocline (new) southeast of Brocton Dome. Closure of no more than 20 feet (6 m) is indicated on Clegg's structure contour maps of several Pennsylvanian coal seams.

DUPO ANTICLINE
see **WATERLOO–DUPO ANTICLINE**

DU QUOIN MONOCLINE

Location Closely follows Third Principal Meridian from northeastern Jackson to northwestern Marion County (H-5 to J-5)

References Kay 1915, Fisher 1925, Cady et al. 1938, Clark and Royds 1948, Siever 1951, Brownfield 1954, Bristol and Buschbach 1973, Keys and Nelson 1980, Nelson 1981, Stevenson et al. 1981, Treworgy 1988, Whitaker and Treworgy 1990

The Du Quoin Monocline separates the Sparta Shelf on the west from the Fairfield Basin on the east. Probably more than 100 published reports mention the Du Quoin Monocline in passing; only a few have devoted detailed attention to its nature, age, or origin.

Although called an anticline in many early reports, the Du Quoin is a monocline with the east side downwarped. From the north side of the Cottage Grove Fault System, it trends northeastward for several miles and gradually curves due northward (fig. 31). Near the northeast corner of Perry County, the flexure splits: the west branch continues northward and the east branch veers to the northeast. The west branch flattens out and loses its identity in northwestern Marion County, whereas the east branch curves toward and merges with the east flank of the Salem Anticline.

The Du Quoin Monocline has a long geologic history. It may have affected St. Croixan sedimentation; scattered boreholes indicate the Mt. Simon Sandstone to be thin or absent on the Sparta Shelf but well developed in the Fairfield Basin. A seismic profile (fig. 32) showing slight eastward thickening of the Knox Group across the monocline, suggests continued folding into the Canadian Epoch. Silurian and Devonian strata thin westward across the Sparta Shelf, but thickness patterns point to gentle tilting rather than development of a sharp flexure. Effects of the monocline on Mississippian sedimentation were, at most, modest. Treworgy (1988) attributed facies changes in the Golconda Group (Chesterian) to slight movement along the flexure. The monocline definitely was developing by the end of the Mississippian Period; the sub-Pennsylvanian erosional pattern suggests southward deflection of pre-Pennsylvanian streams that approached it (Bristol and Howard 1971). The greatest uplift took place, however, during the early part of the Pennsylvanian Period. Strata of this age abruptly thicken eastward by several hundred feet across the flexure (fig. 33). Intermittent movement continued during later Pennsylvanian time and is reflected by thickness and facies changes of individual beds or members. For example, the Springfield Coal Member is 4 to 5 feet (1.2–1.5 m) thick on the east side of the monocline, but it is thin or absent to the west. The younger Herrin Coal Member, in contrast, crosses the fold without change of thickness. Post-Pennsylvanian movement is documented by development of several hundred feet of structural relief on Desmoinesian and younger Pennsylvanian horizons.

Because of this progressive deformation, the structural relief of the monocline is greater on pre-Pennsylvanian than on Pennsylvanian horizons. Maximum elevation change of the Herrin Coal is about 550 feet (165 m) (Cady et al. 1938), but the Beech Creek ("Barlow") Limestone (Chesterian) rises more than 1,000 feet (300 m) in the same place (Bristol 1968). The New Albany Group (Stevenson et al. 1981) and Galena Group (Bristol and Buschbach 1973) also show approximately 1,000 feet (300 m) of maximum relief across the monocline. These maps are based on far fewer control points than the maps of the Beech Creek Limestone and Herrin Coal.

A proprietary seismic reflection profile across the Du Quoin Monocline in Perry County (fig. 32) shows the monocline affecting all Paleozoic reflectors. The deepest continuous reflector on this profile was believed to represent the base of the Knox Group above the Mt. Simon Sandstone. No faulting could be discerned on the seismic section. Yet the rather sharp hinge on the lower step of the fold suggests the possibility of a basement fault that does not offset the Knox. The Du Quoin Monocline shares many characteristics, including a branching pattern, with the classic Laramide monoclines of the Colorado Plateau and Rocky Mountains. Laramide monoclines overlie faults in Precambrian crystalline basement (Davis 1978, Lisenbee 1978, Reches 1978).

The Dowell and Centralia Fault Zones, zones of normal faulting, follow the dipping flank of the Du Quoin Monocline. These faults displace strata down to the west, whereas the monocline warps beds down to the east. The faults are known from coal mine exposures in Pennsylvanian rocks and from missing sections of Mississippian strata in well records. Seismic profiles indicate that the Centralia Fault Zone extends downward at least to Ordovician rocks with no loss of displacement. These faults, therefore, are not merely superficial features or adjustments to folding. Brownfield (1954) hypothesized that the Du Quoin Monocline was produced by compression and that the faults developed during a later (post–Pennsylvanian) episode of extension.

Brownfield's hypothesis seems to be the most likely explanation for the structure.

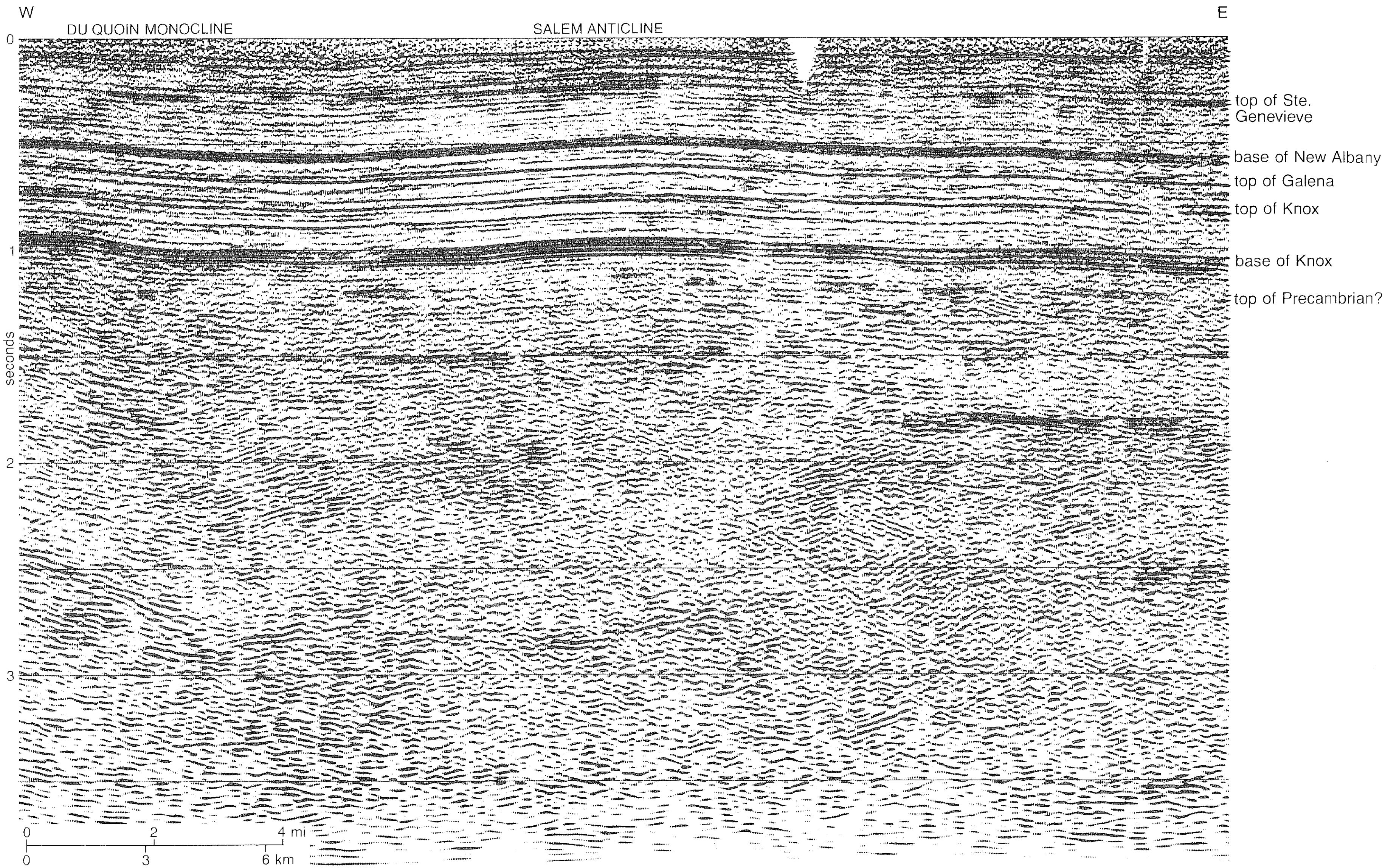


Figure 32 Seismic reflection profile across the Du Quoin Monocline and the Salem Anticline. From Heigold and Oltz 1991.

DWIGHT ANTICLINE (discarded)

Location From east-central La Salle County to southeastern Livingston County

References Willman and Payne 1942

The Dwight Anticline, a subtle feature, was mapped as lying 25 to 30 miles (40–48 km) east of and approximately parallel to the La Salle Anticlinorium. Mapping of various Cambrian and Ordovician horizons by Willman and Payne (1942) indicated the Dwight to be an anticlinal nose (no closure) with maximum relief of about 200 feet (60 m). Continuity of the structure is suspect because Willman and Payne had so few control points. The Dwight Anticline is not recognizable on Bristol and Buschbach's (1973) structure map on the Galena Group or on Jacobson's (1985) map of the Colchester Coal Member. Use of the name Dwight Anticline should be discontinued.

EAGLE VALLEY SYNCLINE
Rough Creek–Shawneetown Fault System

Location Southeastern Saline and southern Gallatin Counties (J-7)

References Butts 1917, 1925, S. Weller et al. 1920, Cady 1952, Smith 1957, Heyl et al. 1965, Baxter et al. 1967, Nelson and Lumm 1987, 1986a, b, c

The name Eagle Valley Syncline is applied to the narrow western extension of the Moorman Syncline in Illinois. The Eagle Valley Syncline lies immediately south of and trends approximately parallel with the east–west part of the Shawneetown Fault Zone. As defined, the Eagle Valley Syncline is about 15 miles (24 km) in length, and its width increases from about 6 miles (10 km) near the west end to about 9 miles (15 km) at the Ohio River. It is abruptly closed off at the west end, where the Shawneetown Fault Zone turns to the southwest. The flanks are marked by rugged hills of resistant lower Pennsylvanian sandstone, whereas the central area is a lowland underlain by easily eroded Desmoinesian and younger Pennsylvanian strata.

Detailed structural mapping by Nelson and Lumm (1987, 1986a, b, c), as measured on the Springfield Coal Member, reveals more than 2,000 feet (600 m) of relief in the syncline (fig. 34). The axis is sinuous and contains several enclosed depressions. The south limb dips rather uniformly at 5° to 10°; dips on the north limb are much more variable, from less than 10° to 60° (locally steeper).

The north limb of the Eagle Valley Syncline is a strong drag fold or fault propagation fold that was produced by displacement along the Rough Creek–Shawneetown Fault System. The south flank of the syncline merges with the north flank of Hicks Dome and the northeast flank of the Tolu Arch.

EARLVILLE SAG (discarded)

Location Northwestern La Salle County

References Willman and Payne 1942

The name Earlville Sag was applied to a barely discernible depression trending east-northeast from the crest of the Peru Monocline. Scanty subsurface data on Cambrian and Ordovician horizons were used to define the sag. The name is discarded because the feature was so poorly defined, and it is not shown on newer maps based on more data.

EAST LOUDEN ANTICLINE (discarded)

Location T8N, R3E, Fayette County

References Newton 1941

Newton (1941) mapped the structure of the "upper Bogota" limestone in Effingham, Fayette, and Shelby Counties, and he named several anticlines. The "upper Bogota," according to Newton, is a Pennsylvanian limestone located 40 to 150 feet (12–45 m) above the La Salle Limestone Member of the Bond Formation. Subsequent studies (Hopkins and Simon 1975, Weibel 1986) have considerably revised Missourian and Virgilian (upper Pennsylvanian) stratigraphy. Newton's "upper Bogota" almost certainly is not the Bogota Limestone Member of current usage; its identity is uncertain. Considering the poor quality of logs available to Newton and the doubtful correlations, Newton's structural interpretations are questionable.

The East Louden Anticline was mapped directly southeast of and trending parallel to the Louden Anticline, the existence of which is indisputable. Treworgy (personal communication 1981) stated that "recent unpublished structure maps on Beech

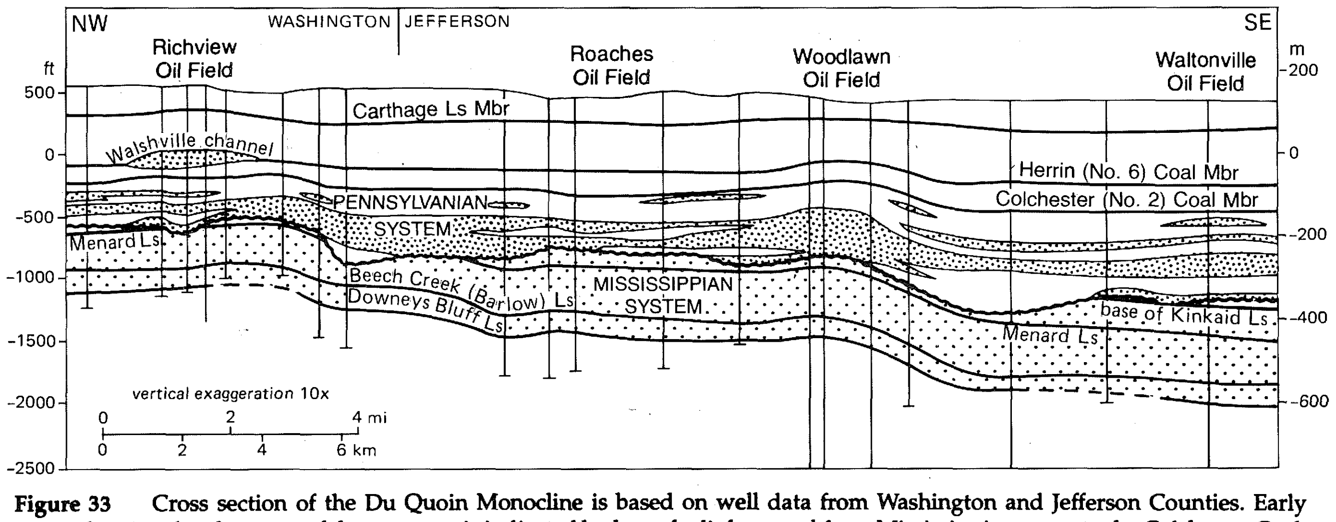


Figure 33 Cross section of the Du Quoin Monocline is based on well data from Washington and Jefferson Counties. Early Pennsylvanian development of the structure is indicated by loss of relief upward from Mississippian strata to the Colchester Coal. The monocline continued to rise slowly during and after the Pennsylvanian Period. Sandstones are shaded. See fig. 31 for location.

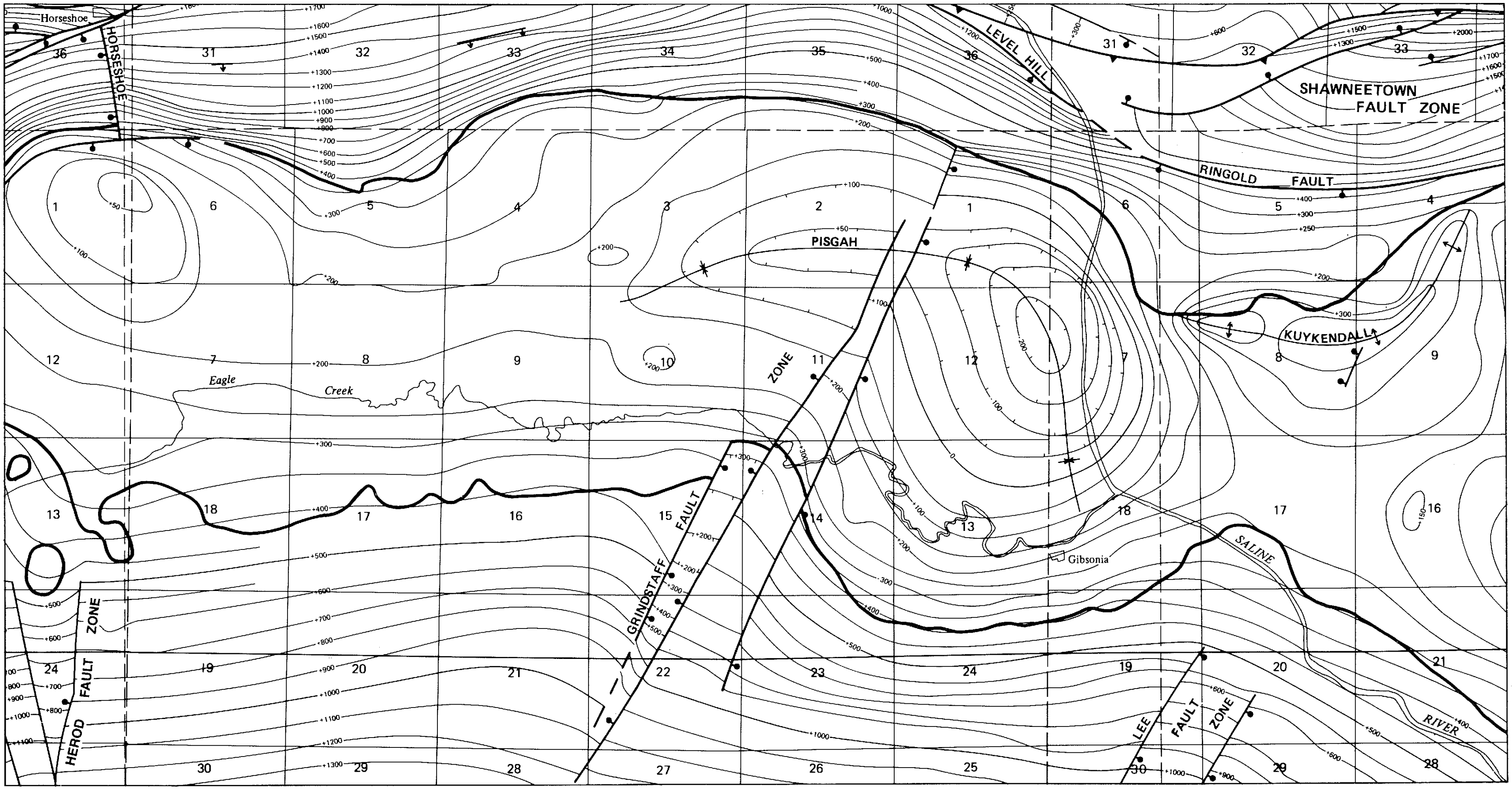


Figure 34 Structure of top of the Springfield Coal Member in the central part of Eagle Valley Syncline. Contour interval is 50 feet inside coal outcrop and 100 feet elsewhere (Nelson and Lumm 1987).

0 1 2 mi
0 1 2 3 km

+300 elevation, top of Springfield Coal (ft)
outcrop line of Springfield Coal
reverse fault, upthrown side indicated
normal fault, downthrown side indicated
anticline
syncline

Creek ("Barlow") Limestone and Ste. Genevieve Limestone indicate this feature (East Louden oil pool) to be stratigraphic, not structural." The name should therefore be discontinued.

EASTERN INTERIOR BASIN
see **ILLINOIS BASIN**

EDGAR MONOCLINE (new)
La Salle Anticlinorium

Location From southwestern Vermilion through western Edgar and Clark to northwestern Crawford County (E–8 to G–8)

References Clegg 1965b, Stevenson et al. 1981

A large monocline defines the east margin of the La Salle Anticlinorium in east-central Illinois and separates the anticlinorium from the Marshall–Sidell Syncline on the east. The monocline is about 60 miles (95 km) in length and has vertical relief ranging from about 200 to more than 800 feet (60–240 m). The name Edgar Monocline, taken from Edgar County, is introduced for this flexure.

Detailed structure contour maps of the Pennsylvanian Colchester, Herrin, and Danville Coal Members show the Edgar Monocline in Edgar and Clark Counties (Clegg 1965b). As mapped on the coals, the monocline trends due north and faces east. It is sinuous along strike, and has several salients and reentrants. A series of domes or short ovate anticlines occurs along the upper limb of the flexure. These include, from north to south, the Hume Anticline and Brocton, Dudley, and Grandview Domes. The axes of these features are aligned at various angles to the trend of the Edgar Monocline; they are neither parallel nor en echelon.

As mapped on the Pennsylvanian coals by Clegg, the dipping flank of the monocline is 1.5 to 4 miles (2.5–6.5 km) wide and relief ranges from 225 to 450 feet (69–137 m). The amount of relief increases downward by 15% to 25% from the Danville to the Colchester Coal. At the base of the New Albany Group (Upper Devonian), the structural relief of the Edgar Monocline is 700 to 800 feet (210–240 m), which is twice the relief mapped on the coals (Stevenson et al. 1981). This pattern of relief increasing with depth is typical of the entire La Salle Anticlinorium and reflects the progressive growth of the structure during the late Mississippian and Pennsylvanian Periods.

ELKTON ANTICLINE (new)

Location T2S, R4W, Washington County (I-4)

References None

The Elkton Anticline is a north-trending structural high containing two separate areas of closure, as mapped on the Beech Creek ("Barlow") Limestone (ISGS open files). It is named for the nearby village and the oil fields developed on the structure. The anticline plunges at both ends and is about 6.5 miles (10.5 km) long and 1.5 miles (2.5 km) wide. Maximum closure on the Beech Creek is about 65 feet (20 m) on the northern high, near the center of Section 17, and 55 feet (17 m) on the southern high in Section 32. Stevenson et al. (1981) showed closure on their map (contour interval 100 feet, 30.5 m) with a single contour line around both highs on the base of the New Albany Group (Devonian–Mississippian). The Elkton and Elkton North Oil Fields are producing from Devonian strata on the structure.

The Elkton Anticline is on the southern Sparta Shelf, where the regional dip is eastward at approximately 40 feet per mile (less than 1/2°). Many neighboring domes are products of draping and differential compaction across Silurian reefs, but no evidence of reef development has been found in Silurian rocks on the Elkton Anticline (S.T. Whitaker, ISGS, personal communication 1987).

ELMWOOD SYNCLINE
Peoria Folds

Location Southeastern Knox and western Peoria Counties (D-3, 4)

References Wanless 1957

The Elmwood Syncline, northernmost of the Peoria Folds, trends slightly north of east and is about 26 miles (42 km) long. Structural relief is 40 to 50 feet (12–15 m) and the fold is roughly symmetrical as mapped on the base of the Pennsylvanian. The fold becomes asymmetrical on deeper horizons and has a steeper north limb.

EMPIRE FAULT
Fluorspar Area Fault Complex

Location Section 27, T11S, R7E, Hardin County (pl. 2)

References J. Weller et al. 1952, Baxter et al. 1967

The Empire Fault is located about 3 miles (5 km) west of the apex of Hicks Dome and trends northeast. It is a high-angle normal fault that has only about 15 feet (4.6 m) of displacement down to the southeast.

EQUALITY FAULT
Wabash Valley Fault System

Location T8 and 9S, R9E, Gallatin County (J-7)

References Bristol 1975, Bristol and Treworgy 1979, Nelson and Lumm 1987

Bristol (1975) mapped the Equality Fault as branching northeastward off and forming a graben with the Albion–Ridgway Fault Zone. Bristol and Treworgy (1979) reinterpreted the structure as a flexure rather than a fault. Nelson and Lumm (1987) showed the Equality Fault, although they did not name it, on their structure map of the Springfield Coal Member (Pennsylvanian). Their subsurface data indicate about 80 feet (25 m) of throw, down to the west on this fault in Section 5, T9S, R9E, Gallatin County. The name Equality Fault is reinstated here.

EUREKA FAULT ZONE
Fluorspar Area Fault Complex

Location Sections 21, 22, and 29, T12S, R8E, Hardin County (pl. 2)

References J. Weller et al. 1952, Baxter and Desborough 1965

The Eureka Fault Zone branches from the north-trending Hillside Fault near Rosiclare and curves northeastward, becoming part of the complex fault zone on the southeast side of the Rock Creek Graben. Displacement is down toward the northwest and less than 100 feet (30 m). The fault zone is mineralized with fluorspar.

EXTENSION FAULT (discarded)
Fluorspar Area Fault Complex

Location Section 5, T13S, R8E, Hardin County

References J. Weller et al. 1952, Baxter and Desborough 1965

The authors cited above mentioned the Extension Fault briefly and stated that this name was sometimes given to the southern part of the Rosiclare Fault. The name was apparently derived from the abandoned Extension Mine, which was developed in fluorspar veins along the fault. Giving separate names to different parts of the same structure causes confusion, particularly in a region of complex structure. The name Extension Fault should therefore be suppressed in favor of Rosiclare Fault.

FAIRFIELD BASIN

Location Southeastern Illinois (fig. 2)

References Bell et al. 1964, Allgaier and Hopkins 1975

The name Fairfield Basin is frequently used to describe the central, deep part of the Illinois Basin within Illinois. The Du Quoin Monocline on the west, the La Salle Anticlinorium on the northeast, and the Rough Creek–Shawneetown and Cottage Grove Fault Systems on the south, respectively, are generally taken as boundaries of the Fairfield Basin. The north and northwest boundaries are indefinite.

The Fairfield Basin was not a sedimentary basin, and it did not exist during most of the Paleozoic Era. The structural movements responsible for the basin began late in the Chesterian Epoch (Mississippian) and culminated after Pennsylvanian sedimentation. The basin subsided more rapidly than surrounding shelves during Pennsylvanian time, but the region was open to the southwest and north of the Ozark Dome. Principal drainage passed through to the Arkoma Basin. Southern closure, caused by uplift of the Pascola Arch, did not commence until the Desmoinesian Epoch (Pennsylvanian) at the earliest (Houseknecht 1983).

The Fairfield Basin is roughly oval in outline and lacks a well defined axis. The lowest points structurally are irregular depressions in northeastern Hamilton and northwestern White Counties. Within the Fairfield Basin are numerous anticlines and synclines, most of which trend north to south, with many circular or irregular domes. The most prominent anticlines are the Salem, Louden, and Clay City structures. These anticlines probably all overlie faults in Precambrian crystalline basement. The origin of most domes is unknown; however, the Omaha Dome was formed by igneous intrusion. The Dale and Hoodville Domes probably overlie Precambrian hills, and several domes in Marion and Cumberland Counties overlie Silurian reefs. High-angle normal faulting is present in the Wabash Valley Fault System and Rend Lake Fault Zone.

Although the Fairfield Basin contains the geographic center of the Illinois Basin, it does not contain the structurally lowest point, the youngest rocks, or the thickest total sedimentary succession. All of these are found in western Kentucky, south of the Rough Creek–Shawneetown Fault System. In the deepest part of the Fairfield Basin, in northeastern Hamilton County, the Springfield Coal Member (Pennsylvanian) is 786 feet (240 m) below sea level (Hopkins 1968). The same coal is more than 1,050 feet (315 m) below sea level in southeastern Webster County, Kentucky (Tennessee Valley Authority 1969). The youngest Paleozoic bedrock in Illinois is of Virgilian (late Pennsylvanian) age in Cumberland County, approximately 75 miles (120 km) north of the structural low point of the Fairfield Basin (Weibel 1986). Permian strata were identified in a drill core from a graben in western Kentucky (Kehn et al. 1982). The maximum total thickness of Paleozoic strata in the Fairfield Basin is approximately 15,000 feet (4,600 m), as compared with 23,000 feet (7,000 m) or more in Kentucky south of the Rough Creek–Shawneetown Fault System (Bertagne and Leising 1991).

Most of the oil production in Illinois is from anticlinal, domal, and stratigraphical traps in the Fairfield Basin. The three largest oil fields in the Fairfield Basin are on the Salem, Louden, and Clay City Anticlines. Cumulative production from these three fields is more than a billion barrels of oil.

FAIRMAN ANTICLINE

Location Near common corner of Bond, Clinton, and Marion Counties (H-5)

References Smoot 1958, Bristol and Buschbach 1973

This anticline trends and plunges toward the northeast and is roughly parallel with the Patoka Anticline on the northwest. The Fairman is near the north end of the Du Quoin Monocline. The southeast flank of the Fairman Anticline merges with the east flank of the Du Quoin Monocline.

Structural and isopach mapping (Smoot 1958) based on abundant borehole data demonstrate that the Fairman Anticline is present at all levels from the Galena Group (Trentonian) through Pennsylvanian. Two Silurian reefs, Boulder and Patoka East, are located near the southwest and northeast ends of the Fairman Anticline. Most oil production in the Boulder and Patoka East fields is from Devonian and Mississippian rocks in structural traps overlying the reefs. Structural closure in these fields resulted from a combination of tectonic folding and drape or compaction over the reefs. Smoot surmised that the anticline is a pre-Silurian structure, where a high point on the sea floor was favorable for reef development.

See also PATOKA ANTICLINE.

FAIRVIEW SYNCLINE
Peoria Folds

Location Peoria and northeastern Fulton Counties (D-3, 4)

References Wanless 1957

The Fairview Syncline has 50 to 70 feet (15–20 m) of relief on Pennsylvanian rocks. It becomes asymmetrical and its north limb is steeper in pre-Pennsylvanian strata. The axis trends east-northeast and it is about 28 miles (45 m) long.

FAIRVIEW–ROSICLARE FAULT
see **ROSICLARE FAULT**

FANCHER–MODE ANTICLINE (discarded)

Location T10S, R4E, Shelby County

References Newton 1941

Newton (1941) defined the Fancher–Mode Anticline as a northeast-plunging anticline that is about 5 miles (8 km) long and has three areas of closure. He mapped it primarily on the basis of outcrop study and selected the "upper Bogota limestone" of the Virgilian Series (upper Pennsylvanian) as his contouring horizon. More recent studies have demonstrated that Newton and other early researchers miscorrelated upper Pennsylvanian strata (Weibel 1986). The contouring that Newton used to define the anticline is questionable.

Subsequent development of the Clarksburg (discovered 1946), Mode (1961), and Fancher (1962) Oil Fields has provided borehole data that demonstrate that structural highs exist in T10S, R4E, Shelby County. The structural pattern mapped on the Beech Creek ("Barlow") Limestone (ISGS open files) bears little resemblance, however, to the anticline mapped by Newton. Each of the three fields occupies a separate circular or ovoid dome having 10 to 15 feet (3–4.5 m) of closure on the Beech Creek. The Fancher Oil Field is located near the southwest end of Newton's Fancher–Mode Anticline, but the Mode and Clarksburg fields are considerably northwest of Newton's structure. Regional dip is east-southeast.

The name Fancher–Mode Anticline should be discontinued because no anticline is present. The three small domes are not worth naming.

FARMINGTON ANTICLINE

Peoria Folds

Location Peoria, Knox, and Fulton Counties (D-3, 4)

References Wanless 1957

The Farmington Anticline is about 30 miles (48 km) long and strikes slightly north of east. Like many of the Peoria Folds, the Farmington Anticline has greater relief and becomes more asymmetrical in deeper strata. Structural relief is about 70 feet (20 m) on the Springfield Coal Member, and both limbs have roughly equal dip. The north limb has relief of 50 feet (15 m) on pre-Pennsylvanian horizons; the south limb has 150 to 200 feet (45–60 m).

FISHHOOK ANTICLINE

Location Northern Pike and southeastern Adams Counties (F-2)

References Meents 1958, Howard 1961

Fishhook is a doubly plunging anticline approximately 30 miles (48 km) long and as much as 5 miles (8 km) wide. Closure of approximately 100 feet (30 m) has been mapped on top of the Silurian (Meents 1958) and on top of the middle Ordovician Galena Group (Howard 1961). Dips on both limbs are more or less equal. The anticline strikes northwest, parallel with the Pittsfield Anticline. A gas field was discovered in 1955 in vuggy dolomite of the Alexandrian Series (Silurian) at the crest of the Fishhook Anticline. Gas from this field went to local users until 1979, when a pipeline was completed, allowing commercial production. Cumulative production of 2 billion cubic feet has been reported.

FLORA DOME

Location T3N, R6–7E, Clay County (H-7)

References Lowenstam 1951

Lowenstam (1951) defined the Flora Dome on the basis of subsurface mapping of the Herrin Coal Member (Pennsylvanian). His map shows an irregular dome that is about 1 mile (1.6 km) in diameter and has about 25 feet (8 m) of closure. The current Beech Creek ("Barlow") Limestone map of the area (ISGS open files) shows a dome that is 1.5 to 2 miles (2.4–3.2 km) across and has closure of about 30 feet (10 m). The Flora Dome lies along a northeast-trending structural terrace in an area of southeastward regional dip. The Sailor Springs Consolidated Oil Field lies along the same terrace. The Flora Dome is near the southwestern end of this field, which has yielded more than 68 million barrels of oil from Chesterian, Valmeyeran, and Devonian pay zones in combination structural and stratigraphic traps.

FLUORSPAR AREA FAULT COMPLEX (pl. 2)

Location Hardin and Pope Counties, Illinois (J, K-6, 7); Crittenden and Livingston Counties, Kentucky and parts of adjacent counties

Selected references Bain 1905, S. Weller et al. 1920, Bastin 1931, Currier and Hubbert 1944, Clark and Royds 1948, J. Weller et al. 1952, Williams et al. 1954, Clegg and Bradbury 1956, Palmer 1956, Heyl and Brock 1961, Baxter et al. 1963, Brecke 1962, 1964, McGinnis and Bradbury 1964, Baxter and Desborough 1965, Heyl et al. 1965, Baxter et al. 1967, Grogan and Bradbury 1968, Hook 1974, Trace 1974, Pinckney 1976, Treworgy 1981, Trace and Amos 1984, Nelson and Lumm 1987, Bradbury and Baxter 1992, Sargent et al. 1992, Whitaker et al. 1992, Nelson and Harrison 1993

The term Fluorspar Area Fault Complex was first used by Treworgy (1981) for the complexly faulted area associated with the Illinois–Kentucky Fluorspar District. The complex contains a variety of structural elements, reflecting a long and complicated history of recurrent tectonic, igneous, and mineralizing activity.

The boundaries of the Fluorspar Area Fault Complex more or less coincide with the limits of commercial fluorspar deposits. These limits can be taken as the Lusk Creek Fault Zone on the west, the Rough Creek–Shawneetown Fault System on the north, and the Tabb and westernmost Pennyrile Fault Zones on the south in Kentucky (fig. 2). To the southwest, the Fluorspar Area Fault Complex continues beneath sediments filling the Mississippi Embayment. Eastward, the faults of the complex die out in Webster, Hopkins, and western Union Counties, Kentucky.

Structural elements of the Fluorspar Area Fault Complex include Tolu Arch, Hicks Dome and associated ultramafic intrusions and diatremes, faults radial and concentric to Hicks Dome, northeast-trending block faults, and northwest-trending strike-slip faults.

Tolu Arch is a southeast-trending anticlinal feature located mainly in Kentucky but extending into Hardin County, Illinois. It is in line with Hicks Dome and greatly broken by northeast-trending block faults.

Hicks Dome is a roughly circular uplift centered in western Hardin County. It is approximately 10 miles (16 km) in diameter and has structural relief of about 4,000 feet (1,200 m). Many diatremes or explosion breccias have been encountered near the dome at the surface and in a well drilled at the apex (Brown et al. 1954, Bradbury and Baxter 1992). Also, numerous dikes and small stocks and sills of lamprophyre and mica peridotite occur near Hicks Dome. The dikes radiate from the dome and are concentrated along a northwest-southeast axis that includes Tolu Arch on the southeast and the Cottage Grove Fault System on the northwest. Radiometric dating places the time of intrusion as Early Permian (Zartman et al. 1967). Diatremes contain fragments of sedimentary and

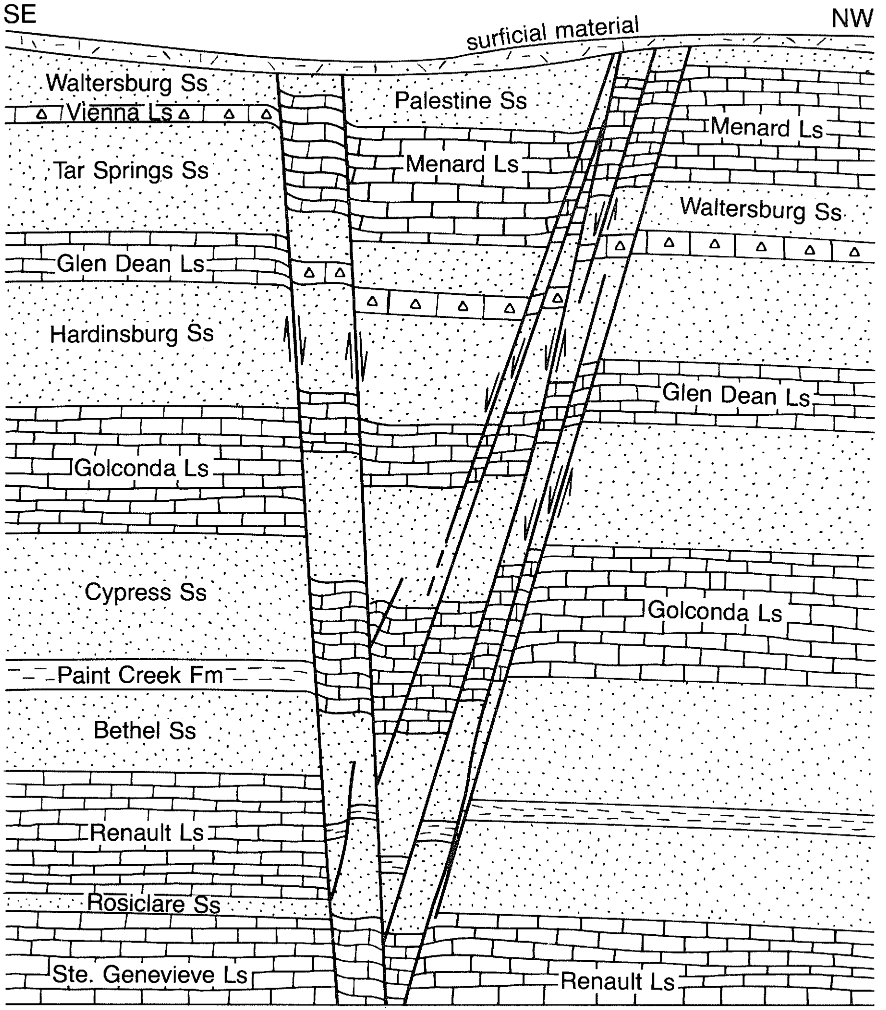


Figure 35 Typical graben in the Fluorspar Area Fault Complex. Nearly planar normal faults dip steeply and display little drag. Sketch is from boreholes and mine data, courtesy of Ozark–Mahoning Company. Stratigraphic names are those commonly used by miners.

igneous rocks in a fine grained calcareous matrix. Palmer (1956) reported fragments of "slate, quartzite, and granite" in two diatremes south of Hicks Dome in Section 31, T12S, R8E. The granite probably is Precambrian. The nature and origin of the slate and quartzite are unknown. Most geologists now attribute Hicks Dome to explosive igneous activity (Bradbury and Baxter 1992).

Faults radial and concentric to Hicks Dome were mapped by Baxter and Desborough (1965) and Baxter et al. (1967). They are concentrated in a belt 3 to 4 miles (5–6.5 km) out from the center of the dome. Most apparent are high-angle normal faults, having displacements of a few hundred feet at most. They evidently are products of the doming process.

Northeast-trending block faults dominate the Fluorspar Area Fault Complex and carry rich vein deposits of fluorite, galena, sphalerite, and barite. They are high-angle faults that outline complicated horsts and grabens (fig. 35). Most are normal faults but some are reverse, and many faults bear obliquely plunging striae and corrugations indicative of strike-slip movement (fig. 36). Maximum dip-slip displacement may reach 3,000 feet (900 m); strike-slip displacement generally is less than dip-slip. Many faults show evidence of multiple periods of movement before, during, and after mineralization.

Small northwest-trending strike-slip faults have been encountered in underground mines of the district. Some of these faults contain ultramafic dikes. Dikes and faults are offset by northeast-trending block faults.

The sequence and timing of structural events in the Fluorspar Area Fault Complex have not been worked out entirely. Most of the movements occurred after early Pennsylvanian and before Late Cretaceous time. No rocks from the intervening period exist to help date the movements. As noted above, the ultramafic dikes are Early Permian, as determined from radiometric dating. Hicks Dome, its radial and concentric faults, and the northwest-trending strike-slip faults probably also are Early Permian (Bradbury and Baxter 1992).

Regional relationships point to an early episode of compressional deformation and igneous activity followed by an episode of extension, normal faulting, and mineralization. The compressional episode probably took place during the Permian Period in conjunction with the Alleghenian Orogeny. In this event the principal stress axis was oriented northwest to southeast. High-angle basement faults, including the Rough Creek–Shawneetown Fault System and the Lusk Creek Fault Zone, were reactivated as reverse faults. Ultrabasic magma was injected upward along northwest-trending tension fractures, and Hicks Dome was formed. Following the compression came an episode of northwest-southeast extension, probably during early Mesozoic time. Earlier formed reverse faults underwent normal movement, and many new northeast-trending normal faults were created. These faults provided pathways for recurrent mineralization with fluorite and associated minerals.

The last movements on faults in the Fluorspar Area Fault Complex extended well into the Tertiary Period, and possibly into the Quaternary. Rhoades and Mistler (1941) documented displacements of Cretaceous strata along northeast-trending faults near the Tennessee and Cumberland Rivers in western Kentucky. Their findings were confirmed by geologic quadrangle mapping in the same area (Amos 1967, Amos and Finch 1968). In Illinois, Ross (1963, 1964) reported tectonic deformation of Cretaceous through Eocene strata of the Mississippi Embayment. Kolata et al. (1981) reexamined the evidence and reported that all known post-Cretaceous deformation in Illinois could be attributed to nontectonic causes such as landsliding or solution collapse. I have recently discovered, however, several examples of faults offsetting units as young as the Mounds Gravel in the Dixon Springs Graben near the edge of the Mississippi Embayment. The age of the Mounds is believed to be Pliocene to possibly early Pleistocene (Willman and Fry 1970). The Dixon Springs Graben is directly in line with the zone of most intense earthquake activity in the New Madrid Seismic Zone immediately south of Cairo, Illinois (Nelson and Harrison 1993).

In terms of cumulative production, the Illinois–Kentucky district is the largest fluorspar-producing region in the United States. Metallic sulfides provide lead, zinc, some copper, and silver (from argentiferous galena) as byproducts; barite is produced when markets permit. Deposits are classified as veins (found along faults) and bedded replacement (mainly in upper Valmeyeran and lower Chesterian limestones).

FORRESTON DOME
Plum River Fault Zone

Location West-central Ogle and east-central Carroll Counties (A-4)

References Kolata and Buschbach 1976, Kolata et al. 1983

The Forreston is an asymmetrical dome located on the south (upthrown) side of the Plum River Fault Zone (fig. 37). It is approximately 10 miles (16 km) long from east to west and 7 miles (11 km) wide. The dome has closure of about 175 feet (43 m) on the Ordovician Glenwood Formation and closure of more than 200 feet (61 m) on the Cambrian Franconia Formation (Kolata et al. 1983). The north flank, adjacent to the Plum River Fault Zone, is steep. Minor faulting has been mapped near the crest of the dome.

FOSTERBURG–STAUNTON ANTICLINE (discarded)

Location Northern edge of Madison County

References Bell 1941

Bell (1941) applied the name Fosterburg–Staunton Anticline to an east-trending anticlinal nose about 14 miles (22.5 km) long on his map of the Herrin Coal Member (Pennsylvanian). No closure was indicated on Bell's map. Neither an anticline nor an anticlinal nose is indicated on maps of deeper horizons (Bristol and Buschbach 1973, Stevenson et al. 1981). Use of the name Fosterburg–Staunton Anticline should be discontinued because the structure apparently does not exist.

GALENA SYNCLINE
Upper Mississippi Valley Zinc–Lead District

Location Northwestern Jo Daviess County (A-3)

References Shaw and Trowbridge 1916, Willman and Reynolds 1947, Bradbury et al. 1956

The Galena Syncline has been traced about 12 miles (19 km) in Illinois. It extends northeastward into Wisconsin and westward into Iowa. Its axis is sinuous; dips on both limbs are gentle and appear to be approximately equal. The maximum structural relief is about 50 feet (15 m). It is the largest named structure in the Illinois portion of the Upper Mississippi Valley Zinc–Lead District.

GALENA JUNCTION SYNCLINE
Upper Mississippi Valley Zinc–Lead District

Location Section 36, T28N, R1W, Jo Daviess County (A-3)

References Willman and Reynolds 1947

The Galena Junction Syncline, mapped from outcrop data, is a minor fold that strikes northeast, is about 1.5 miles (2.5 km) long, and has structural relief of less than 30 feet (10 m). It was mapped as a target for zinc and lead prospecting.

GARFIELD DOME (discarded)
see **ANCONA ANTICLINE**

Figure 36 Obliquely plunging slickensides on a fault surface in an underground fluorspar mine, eastern Pope County. Striations indicate a combination of normal and right-lateral movement.

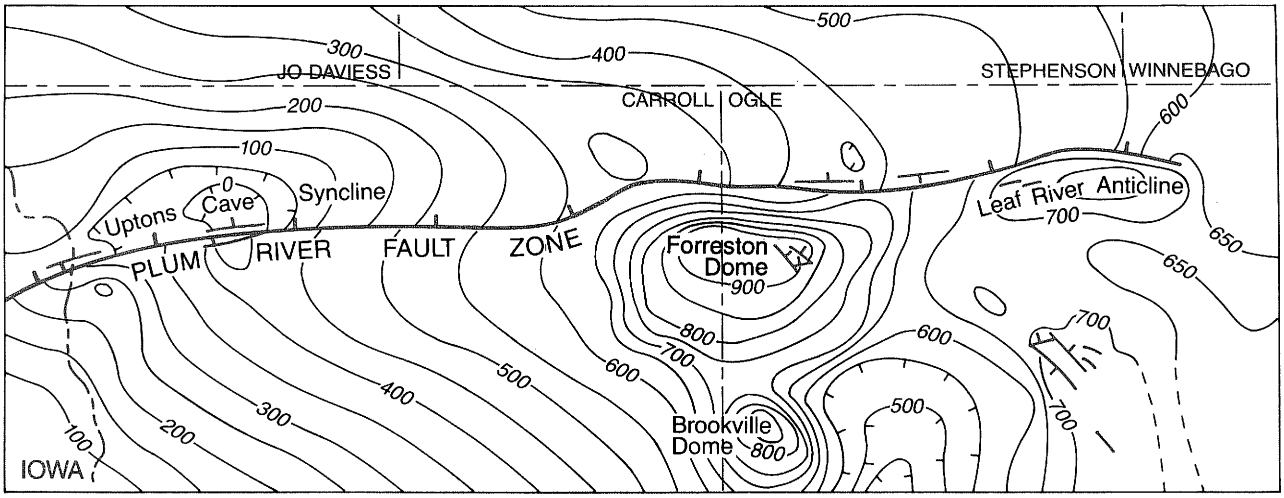


Figure 37 The Plum River Fault Zone and related structures, northwestern Illinois. Structure contours on top of the Glenwood Formation (Middle Ordovician). After Kolata and Buschbach 1976. Contour interval is 50 feet.

GIBSON CITY DOME

La Salle Anticlinorium

Location T23N, R7E, Ford County (E-7)

References Heigold et al. 1964, Howard 1964, Clegg 1970

The Gibson City Dome is a small area of apparent closure along the Osman Monocline, which is the east branch of the La Salle Anticlinorium in this area. The Gibson City Dome was mapped, using sparse well control, on the base of the Silurian System (Howard 1964). Howard showed an enclosed high covering approximately 15 square miles (38 km^2), but indicated only one control point within the area of closure. Closure also is depicted on Bristol and Buschbach's (1973) map of the Galena Group.

GILEAD ANTICLINE

Location T10 and 11S, R2W, Calhoun County (G-2)

References Rubey 1952

The Gilead anticline, mapped from scanty outcrop and well data, trends north-northwest and may have 50 to 100 feet (15–30 m) of closure. It may extend into Missouri beneath the Mississippi River floodplain.

GIRARD FAULTS

Location Christian, Sangamon, Macoupin, and Montgomery Counties (G-4)

References Krausse et al. 1979b, Nelson and Nance 1980, Nelson 1981, 1987b, Ledvina 1988

Ledvina (1988) gave the name Girard Faults to a group of northwest-trending faults encountered in underground coal mines in west-central Illinois. The Girard Faults do not fit the definition of a fault zone or system; but because of similar trend and geometry, they appear to be related (Nelson and Nance 1980, Nelson 1981, 1987b). The type example is located in the workings of the Crown II coal mine near Girard, Macoupin County (fig. 38, G-4 on pl. 1). The Sicily Fault in Christian County (F-5 on pl. 1) may also be considered one of the Girard Faults. Other Girard Faults are too small to show at the scale of plate 1.

These faults are linear in map view and strike northwest to north-northwest. They dip at moderate angles of 35° to 70° and exhibit little or no drag. The largest Girard Faults are several miles (km) long and have displacements up to 18 feet (5.5 m); most are much smaller. There is little or no gouge, breccia, or mineralization. Slickensides indicate dip-slip displacements. Units displaced include the Herrin Coal Member and adjacent roof and floor strata.

The Girard Faults differ from the "clay-dike faults" that are numerous in many coal mines (Krausse et al. 1979b). Clay-dike faults are strongly curved in strike and dip, exhibit "false drag" and clay fillings, and generally do not cut all the way through the coal. They are evidently nontectonic faults that formed before the sediments were lithified. The linearity and parallelism of Girard Faults implies origin in a tectonic stress field, but the low dip angle suggests that they developed early during lithification. They may have dipped steeply initially, but subsequently, compaction reduced the dip angle.

One of the Girard Faults intersects the left-lateral Crown Fault within the mine workings. The Crown Fault offsets and therefore is younger than the Girard fault (fig. 29). Furthermore, the faults must have formed in different stress fields. The principal stress responsible for the Crown Fault was oriented northeast to southwest, whereas the Girard fault developed under a principal stress directed northwest to southeast.

See also CROWN FAULT and SICILY FAULT.

GLASFORD STRUCTURE

Location Northeastern T7N, R6E, Peoria County (D-4)

References Wanless 1957, Buschbach and Ryan 1963, Buschbach and Bond 1974, McHone et al. 1986b

Various names have been applied to the unique structure northeast of Glasford. Wanless (1957) showed a dome on his map of the Colchester Coal Member (Pennsylvanian), but he did not name it. Buschbach and Ryan (1963) called the feature the Glasford explosion structure, whereas Buschbach and Bond (1974) referred simply to the Glasford Structure. Trew-

Figure 38 Exposure of the Girard Faults in the Crown II underground mine. Coal and overlying strata are downthrown approximately 4 feet (1.2 m) to the northeast (right in this view). A thin layer of light gray clay gouge is present along the fault surface.

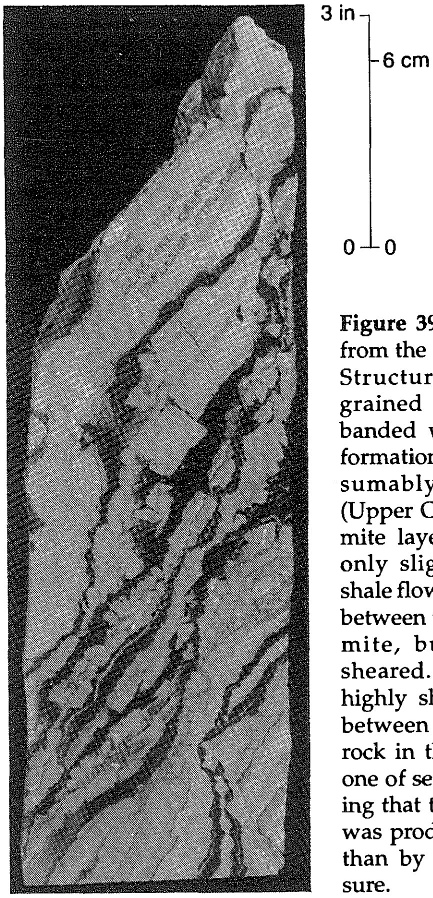


Figure 39 Slab of drill core from the center of the Glasford Structure. The rock is fine grained light gray dolomite banded with black shale; the formation is unknown but presumably is pre-Maquoketa (Upper Ordovician). The dolomite layers are shattered but only slightly displaced. The shale flowed into the interstices between the fragments of dolomite, but it has not been sheared. Ordinarily shale is highly sheared and squeezed between layers of competent rock in the fault zone. This is one of several features indicating that the Glasford Structure was produced by shock rather than by steady tectonic pressure.

orgy (1981) revised the name to Glasford Disturbance, probably for the sake of consistency with the Des Plaines Disturbance. McHone et al. (1986b) reverted to Glasford Structure, a name that is used here because it is simple, generic, and conforms to the most common usage for similar structures in other areas. The Glasford Structure is difficult to classify because it is partly a dome and partly a chaotic breccia. It is considered a probable meteorite impact feature (astrobleme).

Indications of a dome based on coal test drilling prompted Central Illinois Light Company to evaluate the Glasford Structure as a gas storage site. Between 1959 and 1961 they drilled a number of test holes, some of which were cored. They also conducted a gravity survey, which showed a very strong positive anomaly (Otto 1962). Drilling revealed a roughly circular dome, about 2.5 miles (4 km) in diameter, coinciding with a circular 0.7-milligal gravity high. All units and intervals from Pennsylvanian through Silurian are domed and thin somewhat across the structure. Closure increases downward from about 100 feet (30 m) on the Pennsylvanian Colchester Coal to 250 feet (75 m) on the Fort Atkinson Limestone (Cincinnatian). The Maquoketa Group (Cincinnatian) is 75 to 110 feet (23–34 m) thicker on the dome than it is elsewhere (Buschbach and Ryan 1963). An intensely shattered breccia of older rocks is beneath the Maquoketa. A well drilled near the apex of the dome cored 1,500 feet (450 m) of breccia without reaching undisturbed rock. The breccia consists of large and small blocks of dolomite, sandstone, and other materials in a matrix of finely broken to pulverized sand and rock fragments. The blocks themselves are greatly fractured or internally smashed and recemented (fig. 39). Buschbach and Ryan identified fragments of several Cambrian formations 800 to 1,000 feet (240–300 m) above their normal stratigraphic position. Ordovician rocks, normally distinctive, were not recognized within the breccia. Buschbach and Ryan also observed that the intensity of deformation seemed to be diminishing near the bottom of the cored hole.

Buschbach and Ryan concluded that the Glasford Structure was produced by impact of an extraterrestrial body as Maquoketa deposition began. The Glasford area was covered by a shallow sea at that time. The crater was filled with the anomalously thick lower Maquoketa and then covered by younger sediments. Continuous rebound of the brecciated core or effects of differential compaction resulted in thinning and doming of all strata overlying the impact breccia.

McHone et al. (1986b) identified shatter cones in cores from the Glasford Structure. These are the first identified features indicative of shock metamorphism, and they strengthen the case for impact origin of the deep-seated brecciation.

Central Illinois Light Company is storing natural gas in the vuggy Silurian dolomite arched across the Glasford Structure.

See also DES PLAINES DISTURBANCE, HICKS DOME, OMAHA DOME.

GLENRIDGE ANTICLINE (discarded)

Location Section 25, T2N, R1W, Clinton County

References Bell 1926a, b, 1927, Brownfield 1954

Bell mapped an anticlinal nose on the basis of borehole data and mine surveys in the Herrin Coal Member. He called the nose the Glenridge Anticline and recommended it for oil prospecting. Later studies, such as those of Brownfield (1954), show that the "anticline" is at most a minor irregularity on the east flank of the Centralia Anticline and use of the name should be discontinued.

GOLDENGATE ANTICLINE (new)

Location T2S, R9E, Wayne County (I-7)

References Meents and Swann 1965, Bristol and Howard 1976, Treworgy 1981

Treworgy (1981) listed Goldengate as a significant unnamed structure and cited the references given above. Meents and Swann (1965) discussed production from the Goldengate Consolidated Oil Field, but they did not mention its structure. Bristol and Howard (1976) neither mentioned Goldengate nor showed any notable structure at or near Goldengate on their map. Treworgy's map indicated an anticline with a curving, northeast-trending axis, but did not further document the Goldengate structure.

An unpublished structure map of the top of the Ste. Genevieve Limestone (R. Howard, ISGS, unpublished mapping) shows an anticline about 8 miles (13 km) long and 3 miles (5 km) wide in the Goldengate Consolidated field. The axis trends northeast to southwest and has maximum closure of at least 40 feet (12 m). There are two separate areas of closure. The Goldengate Anticline, as named in this report, includes both enclosed areas and the connecting axis. Cumulative production from the Goldengate Consolidated field is more than 21 million barrels of oil. Principal producing units are the Aux Vases Sandstone and the Ste. Genevieve Limestone.

GOLD HILL FAULT (discarded)

Brokaw (1917) used this name for the Shawneetown Fault Zone, but long priority of usage establishes Shawneetown Fault Zone as the name of choice.

GOOD HOPE FAULT (discarded)

Location Section 5, T13S, R8E, Hardin County

References J. Weller et al. 1952, Baxter and Desborough 1965

According to the authors cited above, the names Good Hope Fault and Extension Fault were formerly used interchangeably for the southern part of the Rosiclare Fault. Because the name Rosiclare Fault is better established by published usage, the names Good Hope and Extension should be suppressed.

GOOSE CREEK FAULT ZONE
Fluorspar Area Fault Complex

Location Northeastern Hardin County (pl. 2)

References Johnson 1957, Baxter et al. 1963, Baxter and Desborough 1965

This structure has been called the Goose Creek Fault and the Goose Creek Fault System. The name Goose Creek Fault Zone is used here because the structure consists of several closely spaced subparallel faults. The Goose Creek Fault Zone forms part of the northwest margin of the Rock Creek Graben. It extends from Section 3, T12S, R8E, northeastward to Section 1, T11S, R9E, where it disappears beneath Ohio River alluvium. Palmer (1976) mapped a possible continuation into Kentucky. The Goose Creek Fault Zone consists of a series of high-angle normal step-faults having a total displacement of as much as 700 feet (210 m) down to the southeast.

GOREVILLE ANTICLINAL NOSE (discarded)

Location T11S, R2E, Johnson County

References J. Weller 1940, Jacobson 1991, 1992, Weibel and Nelson 1993

J. Weller (1940) used outcrop data on lower Pennsylvanian sandstones to map a gentle, northeast-plunging anticlinal nose near Goreville. He stated that the feature may not be entirely structural, but based in part on "unequal original deposition." Current geologic mapping (Jacobson 1991, 1992, Weibel and Nelson 1993) indicates no anticline in the area denoted by J. Weller; therefore, use of the name should be discontinued.

GRAHAM–GINTE SYNCLINE
Upper Mississippi Valley Zinc–Lead District

Location T29N, R1E, Jo Daviess County (A-3)

References Willman and Reynolds 1947, Bradbury et al. 1956

Bradbury et al. (1956) mapped a syncline with a sinuous axis approximately 2.5 miles (4 km) long. It has less than 30 feet (9 m) of structural relief. Willman and Reynolds (1947) suggested that the syncline resulted from solution-collapse of carbonates along a major joint system.

GRANDVIEW DOME
La Salle Anticlinorium

Location T12 and 13N, R13W, Edgar County (F-8)

References Clegg 1965b

The Grandview Dome is a small area of closure on the upper limb of the east-facing Edgar Monocline. The dome is slightly elongated north to south and has closure of 25 to 50 feet (8–15 m) on the various Pennsylvanian coals, as contoured by Clegg.

GRANVILLE BASIN (discarded)

Location Putnam County and vicinity

References Willman and Payne 1942, Bristol and Bushbach 1973, Kolata et al. 1983

The name Granville Basin was applied to an irregularly lobed depression located just west of La Salle Anticlinorium. The basin was identified from subsurface mapping of various Cambrian and Ordovician horizons. It was mapped as having closure of about 50 feet (15 m). Several other structural ridges and troughs, named as anticlines and synclines, were shown as radiating from the Granville Basin.

No evidence for an enclosed depression in this area appears on the structure map of the Galena (Trenton) Group (Bristol and Bushbach 1973) or the map of the Franconia Formation (Cambrian; Kolata et al. 1983). The use of the name Granville Basin should be discontinued.

GRANITE KNOBS see **PRECAMBRIAN HILLS**

GRAYVILLE GRABEN
see **SOUTHERN INDIANA RIFT** (discarded)

GREATHOUSE ISLAND FAULT (discarded)
Wabash Valley Fault System

Location Gallatin and White Counties, Illinois, and Posey County, Indiana

References Bristol 1975, Bristol and Treworgy 1979

The Greathouse Island Fault was named by Bristol (1975), but Bristol and Treworgy (1979) redefined it as part of the Mt. Carmel–New Harmony Fault, a name that is herein changed to New Harmony Fault Zone.

GREENRIDGE SYNCLINE (discarded)

Location Northeastern Macoupin County

References Ball 1952

Ball's (1952) structure map on the Herrin Coal Member indicates a poorly defined southeast-plunging syncline with no closure. Nelson's map (1987b), based on many more control points than Ball's map, indicates a southeastward homoclinal dip in this area. Use of the name Greenridge Syncline should be discontinued.

GREENVILLE DOME

Location T5N, R3W, Bond County (H-5)

References Bell 1941

Bell (1941) mapped this irregular dome from subsurface data on the Herrin Coal Member. The area of closure shown on Bell's map is approximately 2 square miles (5 km^2), and maximum structural relief is about 50 feet (15 m). A similar configuration appears on the Beech Creek ("Barlow") Limestone and Karnak Limestone (ISGS open files). The Greenville Dome roughly corresponds with the eastern end of the Pocahontas Anticline of Kay (1915) and the Stubblefield Anticline of Blatchley (1914) and Moulton (1925).

GRIDLEY DOME
La Salle Anticlinorium

Location T26N, R3E, McLean County (D-6)

References Clegg 1972

Gridley Dome lies just to the northeast and can be regarded as an offshoot of the Lake Bloomington Dome, which in turn is part of the Downs Anticline. As mapped on the Danville Coal Member, Gridley Dome is circular and about 2 miles (3 km) across. It has closure of about 50 feet (15 m). No detailed map is available for a deeper horizon.

GRIMES ANTICLINE (discarded)

Location T8N, R7 and 8W, Macoupin County

References Easton 1942, Nelson, 1987b

An irregular eastward nosing of contour lines on Easton's map of the Herrin Coal Member was labeled the Grimes Anticline. Remapping with more control points shows no definable anticline (Nelson 1987b); therefore, use of the name should be discontinued.

GRINDSTAFF FAULT ZONE
Fluorspar Area Fault Complex

Location T10S, R8E, Gallatin County (pl. 2)

References Butts 1925, Smith 1957, Baxter and Desborough 1965, Nelson and Lumm 1986b, 1987

Butts (1925) named the Grindstaff Fault and depicted it as striking N25°E from the Gallatin–Hardin county line (the south edge of his map) to Section 2, T10S, R8E. He showed it as a single fault with the southeast side downthrown a maximum of about 200 feet (60 m). Smith (1957) mapped the Grindstaff Fault essentially as shown by Butts. Nelson and Lumm (1986b, 1987), using borehole data not available to Butts or Smith, found evidence for three faults and renamed the structure Grindstaff Fault Zone. The three faults are parallel and produce a horst and a graben (fig. 34). They are concealed by alluvium in Eagle Valley, but the linear trend of Grindstaff Hollow may be controlled by associated fractures. The northern extent is unknown; the zone may reach the Shawneetown Fault Zone. Nelson and Lumm (1986b, 1987) and Baxter and Desborough (1965) found no evidence to extend the fault zone south of Section 28, T10S, R8E, Gallatin County.

HAMP FAULT
Fluorspar Area Fault Complex

Location Mainly in T11S, R8E, Hardin County (pl. 2)

References J. Weller et al. 1952, Brown et al. 1954, Baxter and Desborough 1965, Baxter et al. 1967

The Hamp Fault is one of the arcuate faults concentric to Hicks Dome. It lies about 3 miles (5 km) north of the apex of the dome and has a length of about 4 miles (6.4 km). Its north side is downthrown through most of its length, but the direction of throw is reversed near the western end.

HARDIN SYNCLINE

Location Near the common corner of Calhoun, Greene, and Jersey Counties (G-2)

References Rubey 1952, Collinson et al. 1954, Collinson 1957, Treworgy 1979a

Rubey (1952) mapped the Hardin Syncline as a sharp depression, the axis of which trends southeast. Rubey measured dips of 5° to 12° on the flanks, and his contour map of the Chouteau Limestone (lower Mississippian) indicates several hundred feet of closure. The Hardin Syncline is about 10 miles (16 km) north of the Cap au Grès Faulted Flexure and is subparallel to the Gilead and Nutwood Anticlines.

Author's note: The Hardin Syncline is mislabeled the "Hardin Anticline" on plate 1.

HARDINVILLE ANTICLINE (new)
La Salle Anticlinorium

Location Southwestern Crawford County (H-8)

References Blatchley 1912, 1913, Cady 1920, Potter 1956, Bristol and Buschbach 1973, Bristol and Howard 1976, Stevenson et al. 1981, Treworgy 1981, Howard and Whitaker 1988

The Hardinville Anticline, named by Howard and Whitaker (1988), is part of the La Salle Anticlinorium. This anticline was mapped but not named by many previous geologists. Treworgy (1981) listed it as the Main structure under the heading "significant unnamed structures." It lies on the upper limb of the west-facing Charleston Monocline, which trends slightly west of north through Lawrence and Crawford Counties. The monocline has more than 1,600 feet (480 m) of relief on pre-Pennsylvanian strata in this area. The axis of the Hardinville Anticline strikes about N30°W and aligns with that of the Oblong Anticline to the northwest. The Hardinville Anticline is offset to the east of the Bridgeport Anticline.

The Hardinville Anticline has been mapped at numerous structural horizons. It has more than 200 feet (60 m) of closure on top of the Galena (Trenton) Group (Bristol and Buschbach 1973) and on the base of the New Albany Group (Stevenson et al. 1981). Closure apparently is less on the Ste. Genevieve Limestone (Bristol and Howard 1976) and on the Chesterian Downeys Bluff Limestone (Howard and Whitaker 1988). The anticline is not shown clearly on the Beech Creek ("Barlow") maps (ISGS open files) because the Beech Creek is missing below the sub-Pennsylvanian unconformity on the structure. The anticline has an irregular outline and less than 50 feet (15 m) of closure on the Herrin Coal Member (Pennsylvanian; Potter 1956) (fig. 40). Potter had many control points, so the loss of closure evidently is real and reflects pre-Pennsylvanian uplift of the anticline.

A significant portion of the 51 million barrels of production at the Main Consolidated Oil Field has come from lower Pennsylvanian, Chesterian, Valmeyeran, and Galena (Trenton) reservoirs in structural traps on the Hardinville Anticline.

HARRISBURG FAULT (discarded)
Cottage Grove Fault System

Location Central Saline County

References Cady 1919, Nelson and Krausse 1981

The fault that Cady (1919) named the Harrisburg Fault is now recognized as part of the master fault of the Cottage Grove Fault System (Nelson and Krausse 1981). Use of the name should therefore be discontinued.

HARRISON CREEK ANTICLINE
Ste. Genevieve Fault Zone

Location Union and northernmost Alexander Counties (J, K-5)

References Savage 1920, J. Weller 1940, J. Weller and Ekblaw 1940, Heyl et al. 1965, Nelson and Lumm 1985, Devera et al. 1994, Nelson and Devera 1994, Sargent et al. 1992

The Harrison Creek Anticline was first mapped by Savage (1920) and was remapped and named by J. Weller and Ekblaw (1940). New mapping (Devera et al. 1994, Nelson and Devera 1994) provides additional information on this structure. The fold axis is slightly sinuous and extends about 7 (11.3 km) miles north from its southern terminus near the Union–Alexander County line. The anticline is depicted on plate 1 as it was mapped by J. Weller and Ekblaw (1940), who showed the fold extending about 8 miles farther north and 3 miles farther south than its true extent. The nearly symmetrical Harrison Creek has maximum dips of about 20° on the west flank and 15° on the east flank. Total structural relief is at least 550 feet (170 m), and closure is several hundred feet. Strata of the upper part of the Maquoketa Group (Cincinnatian) are exposed at the core and flanked by outward dipping Silurian and Lower Devonian beds.

At its southern end, the Harrison Creek Anticline plunges gently and dies out. Near its northern end, the east flank of the fold is truncated by the Atwood Fault. The anticline and fault disappear northward beneath the alluvium of Dutch Creek and do not reemerge north of that stream.

A dry oil test hole, Humble No. 1 Pickel, was drilled near the apex of the Harrison Creek Anticline. The well bottomed in the Cambrian Mt. Simon Sandstone at a total depth of 8,492 feet (2,590 m).

A gravity survey by Coe (Nelson and Lumm 1985), indicates a large positive anomaly coincident with the anticline. This evidence suggests that the anticline is the product of uplift of a basement fault block.

HAW CREEK DOME

Location T10 and 11N, R1 and 2E, Knox County (D-3)

References Poor 1927

Outcrop and well data on the Colchester Coal Member were used to define the Haw Creek Dome (Poor 1927). The dome, as Poor mapped it, covers an area of roughly 5 square miles (13 km^2) and has closure of 30 to 40 feet (9–12 m). It lies along the crest of a southeast-plunging anticline that has a steep northeast limb. The anticlinal nose is shown, but no closure is indicated on Bristol and Buschbach's (1973) map of structure on top of the Galena Group.

HAYES DOME (discarded)
La Salle Anticlinorium

Location Northern Douglas and southern Champaign Counties

References Bristol and Prescott 1968, Bristol and Buschbach 1973

The name Hayes Dome, taken from the Hayes oil pool, was applied to the structurally highest part of the Tuscola Anticline. Continued recognition of the Hayes Dome, and of the smaller Shaw Dome to the south, does not appear to be justified because they are small areas of closure on the larger Tuscola Anticline; therefore, use of the name should be discontinued.

HENNEPIN SYNCLINE (discarded)

Location Southeastern Bureau County

References Willman and Payne 1942

This shallow trough was shown as an east-southeast-trending lobe of Willman and Payne's (1842) irregular Granville Basin. It was defined based on subsurface mapping of various Cambrian and Ordovician horizons. Neither the Hennepin Syncline nor the Granville Basin can be recognized on a more recent structure map of the area (Kolata and Graese 1983). The existence of the Hennepin Syncline is doubtful and use of the name should be discontinued.

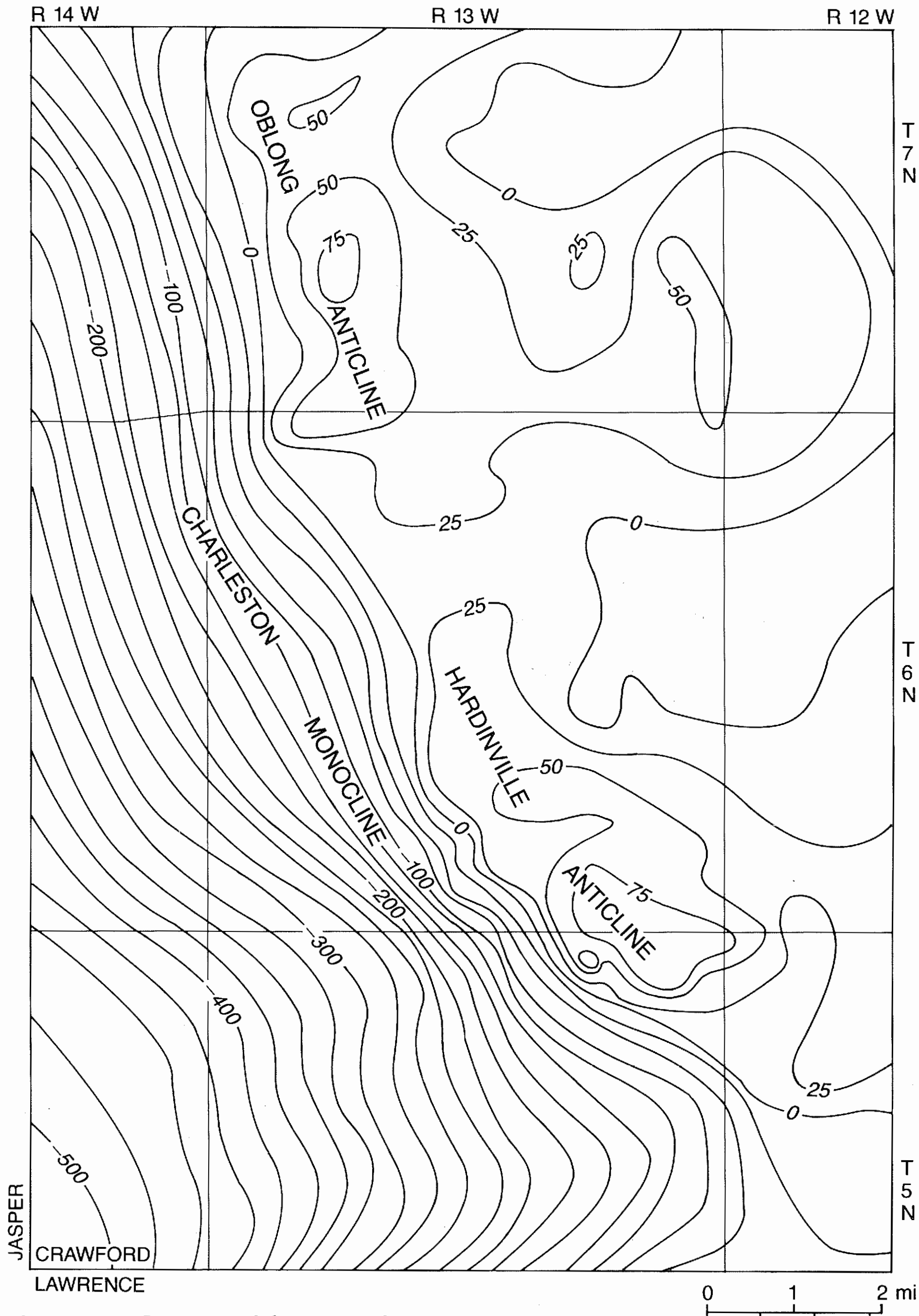


Figure 40 Structure of the Herrin Coal Member, southwestern Crawford County. Contour interval is 25 feet. After Potter 1956.

HERALD–PHILLIPSTOWN FAULT ZONE (new name)

Wabash Valley Fault System

Location Mainly in eastern White County (J-7 to I-8)

References Harrison 1951, Pullen 1951, Bristol 1975, Bristol and Treworgy 1979

The Herald–Phillipstown Fault Zone, previously called Herald–Phillipstown Fault, is composed of two subparallel, slightly arcuate faults or narrow fault zones, the ends of which overlap in map view. The faults strike slightly east of north and, like the other faults of the Wabash Valley Fault System, are high-angle normal. Maximum displacement is approximately 350 feet (105 m) down to the east. Between the two overlapping fault segments, the strata dip to the north.

HEROD FAULT ZONE

Fluorspar Area Fault Complex

Location From Section 25, T11S, R6E, Pope County, to Section 24,T10S, R7E, Saline County (pl. 2)

References Butts 1917, S. Weller et al. 1920, J. Weller et al. 1952, Baxter et al. 1967, Nelson and Lumm 1987

The Herod Fault Zone is a northeastern extension of the Lusk Creek Fault Zone. As mapped by Baxter et al. (1967), the Herod Fault Zone contains from one to as many as five subparallel, interconnected faults. Southwest of Herod the net displacement is down to the southeast, but northeast of Herod the direction of throw reverses. This zone is thought to be composed entirely of high-angle normal faults. Several normal faults are exposed on coal mine highwalls near the northeastern end of the zone (Nelson and Lumm 1987). A body of igneous breccia was mapped adjacent to the Herod Fault Zone in the NW SE, Section 19, T11S, R7E (Baxter et al. 1967).

HERSCHER ANTICLINE (new name)

La Salle Anticlinorium

Location T30N, R10E, Kankakee County (C-7)

References D.J. Fisher (unpublished) cited in Athy 1928, Willman and Templeton 1951, Bell 1961, Buschbach 1964, Bristol and Buschbach 1973, Buschbach and Bond 1967, 1974

Interpreting borehole data and outcrops of Silurian strata along the Kankakee River, Fisher (cited in Athy 1928) identified a north-trending anticline, which he called the Ritchey–Herscher arch, in the Herscher area. Subsequent researchers referred to this structure as the Herscher Anticline or Dome. The name Herscher Anticline is used in this report because the fold is elongated and has a well defined axis. The Herscher Anticline trends north to north-northwest. It was delineated by drilling for a gas storage field in the Cambrian Galesville and Mt. Simon Sandstones.

The Galena (Trenton) Group structure map of Bristol and Buschbach (1973) shows the Herscher Anticline is a southward-plunging, asymmetrical anticline that has a steeper west flank and is a part of the La Salle Anticlinorium. The long axis of the anticline can be traced for approximately 18 miles (29 km). The top of the Mt. Simon Sandstone has closure of approximately 90 feet (27 m); the area of closure has a width of slightly more than 2 miles (3.2 km) and a length, trending north-northwest, of slightly more than 6 miles (10 km). A saddle, perpendicular to the long axis and dropping to approximately 40 feet (12 m) above the closure elevation, divides the anticline into a northern dome covering about one-third of the total area of closure and a southern anticline covering about two-thirds. Three smaller areas of closure, the Herscher–Northwest Anticline and two unnamed domes, lie northwest of the Herscher Anticline (Bristol and Buschbach 1973). Gas is stored in the Elmhurst Sandstone Member of the Eau Claire Formation at Herscher and in the Mt. Simon Sandstone, as well as the substantially thinner Elmhurst Member at Herscher–Northwest.

The Herscher Anticline is rather unusual among anticlines along the La Salle Anticlinorium in that the amount of closure decreases with depth. Closure decreases from about 200 feet (60 m) on the Galena to 100 feet (30 m) on the Galesville and 80 feet (24 m) on the Mt. Simon. Downward loss of closure has been attributed to northward thinning of most beds (Buschbach and Bond 1967, 1974). No well on or near Herscher Dome has reached Precambrian rock, and no evidence of its basement configuration is available.

The Herscher Anticline may have developed concurrently with the La Salle Anticlinorium, but direct proof is unavailable because the La Salle structures are post-Mississippian, and no rock younger than Silurian is preserved on or near the Herscher Anticline.

HERSCHER–NORTHWEST ANTICLINE (new)

La Salle Anticlinorium

Location T30 and 31N, R9E, Kankakee County (C-7)

References Buschbach and Bond 1967, 1974, Bristol and Buschbach 1973

The name Herscher–Northwest Anticline is used for the structure at the Herscher–Northwest gas storage project (Buschbach and Bond 1974). The structure was not listed by Treworgy (1981). As mapped from subsurface data on top of the Cambrian Mt. Simon Sandstone, the area of closure on the doubly plunging anticline is slightly more than 3 miles (5 km) long and approximately 1.5 miles (2.4 km) wide. The anticline has a long axis that trends north-northwest and is more than 6 miles (9.5 km) long. It is asymmetrical and steeper on the west limb. Closure is 58 feet (17.7 m) on top of the Mt. Simon (Buschbach and Bond 1974). The Herscher and Herscher–Northwest Anticlines lie more or less en echelon with approximately 2 miles (3 km) of offset on their axes. The anticlines are separated by a syncline that plunges toward the south-southwest.

HICKORY GROVE ANTICLINE (discarded)

Location T9N, R6 and 7W, Macoupin County

References Easton 1942, Nelson 1987b

Easton's (1942) structure map of the Herrin Coal Member indicated a subtle eastward-nosing structural high, which he called the Hickory Grove Anticline. Remapping with more data indicates a very irregular structure with no definable closure or anticlinal nosing; therefore, use of the name should be discontinued (Nelson 1987b).

HICKS DOME

Fluorspar Area Fault Complex

Location Western Hardin County (J-7 and pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Brown et al. 1954, Clegg and Bradbury 1956, Heyl and Brock 1961, McGinnis and Bradbury 1964, Baxter and Desborough 1965, Baxter et al. 1967, Heyl et al. 1965, Zartman et al. 1967, Hook 1974, Trace 1974, Nelson and Lumm 1987, Bradbury and Baxter 1992

Hicks Dome, a cryptovolcanic feature in the northwestern part of the Fluorspar Area Fault Complex, played a key role in the structural evolution of the region.

The roughly circular dome has prominent topographic expression on aerial photos and satellite images. Middle Devonian chert and limestone form a hill at the center. Surrounding this is a circular valley underlain by shale of the New Albany Group. Farther outward, alternating resistant and weak Valmeyeran and Chesterian strata produce concentric cuestas and strike valleys. Hicks Dome is approximately 10 miles (16 km) in diameter and its total structural relief is approximately 4,000 feet (1,200 m). Flanking dips increase to a maximum of about 20° (as much as 45° locally) about 1 mile (1.6 km) out from the apex and gradually diminish farther outward.

Ultramafic dikes, small stocks, and diatremes radiate from the center of Hicks Dome along a northwest-trending axis coinciding with the broad Tolu Arch that crosses the Fluorspar District. The rocks are dated radiometrically as early Permian

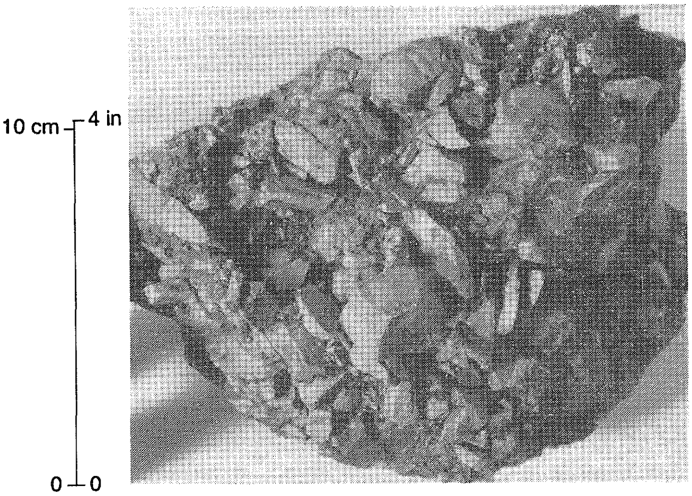


Figure 41 Breccia collected from an outcrop at the apex of Hicks Dome.

(Zartman et al. 1967). Highly brecciated rock crops out near and at the apex of Hicks Dome (fig. 41) and was also encountered in a test well drilled there. Rotary drill cuttings from this site were radioactive and contained unusual concentrations of fluorite, apatite, and metal sulfides (Brown et al. 1954). Bradbury et al. (1955) reported small quantities of uranium in outcrop samples from the dome.

The small radial and arcuate faults that surround Hicks Dome apparently developed during its formation. The northwest-trending mineralized block faults that cross Hicks Dome are younger than the dome and ultramafic intrusions.

The origin of Hicks Dome is clearly related to igneous activity, but no pluton or laccolith at depth is indicated, as in the case of Omaha Dome. The borehole at the apex encountered much breccia, but no conclusively igneous rock was identified (Brown et al. 1954). An aeromagnetic survey by McGinnis and Bradbury (1964) showed no magnetic high beneath the dome, as would be expected if a large mafic body were still in place; however, the survey did indicate a strong magnetic high, interpreted as a mafic pluton, about 6 miles (10 km) northeast of the apex.

Bradbury and Baxter (1992) described three types of breccias at Hicks Dome: shatter breccias, vent breccias, and carbonatitic breccias. Like most previous researchers, Bradbury and Baxter attributed Hicks Dome and its associated breccias to explosive, alkaline igneous activity at depth. The intense fracturing at the juncture of the Reelfoot Rift and Rough Creek Graben provided pathways for mantle-derived magmas to intrude into the sedimentary column.

Compare with the OMAHA DOME, DES PLAINES DISTURBANCE, and GLASFORD STRUCTURE.

HIGHLAND DOME (discarded)

Location Southeastern Madison County

References Shaw 1915a

The Highland Dome was defined on the basis of scanty subsurface data on the Herrin Coal Member and was not confirmed by later studies (such as Payne and Bell 1941), which employed many additional control points. The use of the name should be discontinued.

HILL FAULT (discarded) and HILL GRABEN (discarded)

Location Gallatin County

References Bristol 1975, Bristol and Treworgy 1979

These features were named in Bristol (1975), but they were renamed the Inman West Fault and Inman Graben in Bristol and Treworgy (1979). The Inman West Fault is a branch of the Inman Fault.

HILLSBORO NORTH and HILLSBORO SOUTH DOMES (new names)

Location Western T8–10N, R3W, Montgomery County (G-5)

References Buschbach and Bond 1974, Treworgy 1981

Buschbach and Bond (1974) mapped and described a dome near Hillsboro, within which a gas storage reservoir has been developed in the St. Peter Sandstone (Ordovician). As mapped on the top of the St. Peter, this dome is about 3 miles (5 km) north to south, 2 miles east to west, and fairly symmetrical. It has closure of about 100 feet (30 m) on the St. Peter and is centered near the northeast corner of Section 5, T9N, R3W (Buschbach and Bond 1974). Treworgy (1981) listed the structure as the Hillsboro Dome.

A second dome south of the first is indicated on maps of the top of the Karnak Limestone (Mississippian; Bristol and Howard 1976) and base of the New Albany Group (Upper Devonian; Stevenson et al. 1981, W.F. Meents, undated and unpublished). The map by Meents shows the greatest detail. It shows an elongated dome or anticline that is 5 miles (8 km) north to south, 2 miles (3 km) wide, and has closure of about 60 feet (18 m). The south dome is centered in Section 31, T9N, R3W. The two domes are situated along a terrace on an east-facing monocline. The names Hillsboro North and Hillsboro South are given to the two domes.

HILLSIDE FAULT
Fluorspar Area Fault Complex

Location Sections 29 and 32, T12S, R8E, and Section 5, T13S, R8E, Hardin County (pl. 2)

References Hubbert 1944, J. Weller et al. 1952, Baxter and Desborough 1965

This fault is part of the complicated, extensively mineralized system of fractures near Rosiclare on the southeast side of the Rock Creek Graben. The Hillside Fault strikes north and has the west side downthrown as much as 200 feet (60 m). The Hillside fluorspar vein reportedly reached a width of 34 feet (10.3 m), the greatest of any vein in the Illinois–Kentucky Fluorspar District.

HOBBS CREEK FAULT ZONE (new name)
Fluorspar Area Fault Complex

Location From west-central Hardin across Pope to Massac County (pl. 2)

References Baxter et al. 1967

The Hobbs Creek Fault Zone defines the southeast border of the Dixon Springs Graben. Originally called the Hobbs Creek Fault System by Baxter et al. (1967), the name is changed here to Hobbs Creek Fault Zone because this is a narrow belt of parallel faults. It extends from the Mississippi Embayment northeast across the apex of Hicks Dome and eventually merges with the Ridge Fault. The zone is as much as 0.5 mile (0.8 km) wide and the vertical offsets reach several hundred feet. It most likely consists entirely of high-angle normal faults.

HOFFMAN DOME (new name)

Location T1N, R2W, Clinton County (H-5)

References Shaw 1915a, Kay 1915, St. Clair 1917c, Bell 1926a, b

Previous researchers used the name Hoffman Anticline for a structural high, which they interpreted from well data on the Herrin Coal Member. The Hoffman Oil Field was discovered in 1939 and produces from lower Chesterian sandstones. Structure maps of the Beech Creek ("Barlow") Limestone (ISGS open files) for the area reveal a roughly circular, symmetrical dome. It is about 1.5 miles (2.5 km) in diameter and has about 25 feet (8 m) of closure. The name of the structure, therefore, should be changed from Hoffman Anticline to Hoffman Dome.

HOGTHIEF CREEK FAULT ZONE

Fluorspar Area Fault Complex

Location From Section 9, T12S, R8E, to Section 1, T11S, R9E, Hardin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Baxter et al. 1963, Baxter and Desborough 1965

The Hogthief Creek Fault Zone is part of complex system of faults along the northwest side of the Rock Creek Graben. The narrow zone has vertical displacements as great as 1,600 feet (480 m) in places. Some segments are downthrown to the northwest, others to the southeast. The authors cited above reported that the zone may include reverse faults, but they provide no details. The fault zone is hidden by Ohio River alluvium on the northeast, but it may extend into Kentucky. Southwestward, the Hogthief Creek merges into a highly fractured region. Previous researchers have referred to the Hogthief Creek Fault or Fault System, but it is properly defined as a fault zone.

HOLLAND ANTICLINE (discarded)

Location T9N, R4E, Effingham and Shelby Counties

References Newton 1941, Du Bois 1951

The Holland Anticline was mapped as being about 3 miles (5 km) long, trending east-northeast, and having a closure of 10 to 20 feet (3–6 m) on the "upper Bogota" limestone. The structure was defined by a single control point; moreover, Newton's (1941) correlations are questionable. Newer maps based on more and better data (Du Bois 1951) show that the area is situated on the northeastern nose of the Louden Anticline and is not a separate structure; therefore, use of the name should be discontinued.

See also EAST LOUDEN ANTICLINE.

HOODVILLE DOME

Location T5 and 6S, R6E, Hamilton County (I-6)

References Rolley 1951, Bristol and Howard 1976

The Hoodville Dome lies immediately west of the Dale Dome and, like the latter, exhibits closure on the Herrin Coal Member (Pennsylvanian), the Beech Creek ("Barlow") Limestone (ISGS open files), and the Karnak Limestone Member of the Ste. Genevieve Limestone (Bristol and Howard 1976). Adequate data are not available to demonstrate closure on deeper horizons. The enclosed area is roughly equidimensional but irregular in outline on all three horizons. The Dale Consolidated Oil Field covers the Dale and Hoodville Domes. It is likely that both domes are the product of differential compaction across Precambrian hills.

HOOKDALE DOME

Location T4N, R2W, Bond County (H-5)

References Buschbach and Bond 1974

The Hookdale Dome provides structural trapping for the Beaver Creek Northeast Gas Field, which was discovered in 1961 and converted to gas storage in 1963. The Yankeetown ("Benoist") Sandstone of the Chesterian Series serves as the reservoir. Stratigraphic factors play a role in entrapment, but an irregular dome covering roughly 1 square mile (2.6 km^2) and having closure of 28 feet (8.5 m) has been defined on top of the Yankeetown. A second unnamed dome, slightly smaller than Hookdale and lying just to the west, has closure of about 25 feet (7.6 m) on the Beech Creek ("Barlow") Limestone (ISGS open files). The western dome holds the Beaver Creek North Field, which produced oil and gas between 1949 and 1964. The domes are on the Western Shelf, where strata dip gently southeastward.

"HORSESHOE UPHEAVAL" see SHAWNEETOWN FAULT ZONE

HORTON HILL ANTICLINE

Fluorspar Area Fault Complex

Location From Section 8, T11S, R7E, Pope County to Section 28, T10S, R7E, Saline County (pl. 2)

References Butts 1917, 1925, S. Weller et al. 1920, Cady 1926, J. Weller 1940, Baxter et al. 1967

The most recent and detailed map of this structure is that of Baxter et al. (1967). According to this map, the anticline lies between and strikes parallel with the Shawneetown Fault Zone and the southwestern end of the Eagle Valley Syncline. The Horton Hill Anticline can best be described as a local reversal in the general southeastward dip of the strata between fault zone and syncline. Dips on the southeast limb reach 35°, whereas the northwest limb dips less than 10° in most places. Several faults complicate the structural picture.

HUDSON DOME

La Salle Anticlinorium

Location T24 and 25N, R2E, McLean County (D-5, 6)

References Clegg 1972, Buschbach and Bond 1974

Hudson Dome is a high point on the Downs Anticline, which marks the west edge of the La Salle Anticlinorium in this area. The dome is irregular in outline and 5 to 6 miles (8–10 km) in diameter. The east and north flanks are steeper than the south and west flanks. It apparently affects the entire stratigraphic column, and closure increases with depth. On the Danville

Coal Member, as mapped by Clegg (1972), closure is about 85 feet (26 m); Buschbach and Bond (1974) mapped 160 feet (50 m) of closure on the basal Cambrian Mt. Simon Sandstone. A gas storage reservoir has been developed in the Mt. Simon.

Residual gravity contours (Heigold et al. 1964) show a similar configuration to structure contours of the top of the Mt. Simon Sandstone (fig. 25). This map also shows pronounced gravity highs corresponding with the neighboring Lake Bloomington and Lexington Domes. Note that the gravity survey was conducted before the domes were discovered. The coinciding gravity highs, the irregular outlines of the domes, and the absence of faulting on proprietary seismic reflection surveys suggest that Hudson, Lake Bloomington, and Lexington Domes overlie Precambrian hills composed of relatively dense rock. This example illustrates the value of gravity surveys in prospecting for structural traps.

HUME ANTICLINE (new name)
La Salle Anticlinorium

Location	Northwest corner of Edgar County (F-8)
References	Buschbach and Bond 1974, Treworgy 1981

Treworgy (1981) listed this structure as Hume Dome, but it should be called an anticline because it is elongated and has a well defined axis. The Hume Anticline is located between the Murdock and Marshall–Sidell Synclines, and it was defined from drilling for a potential gas storage field in the Middle Devonian Grand Tower Limestone. Subsurface mapping at the top of Middle Devonian carbonates reveals a closed structure approximately 6 miles (10 km) long and 2 miles (3 km) wide. The axis trends about 30° west of north, and the gradient on the east limb is approximately three times that on the west limb. Maximum closure is approximately 120 feet (36 m) at the top of the Middle Devonian (Buschbach and Bond 1974).

ILLINOIS BASIN

Location	See text below
Selected references	J. Weller 1936, J. Weller and Bell 1937, Clark and Royds 1948, Swann and Bell 1958, Eardley 1962, Wanless 1962, Snyder 1968, Bond et al. 1971, Willman et al. 1975, King 1977, Palmer and Dutcher 1979, Treworgy and Whitaker 1990a, b, Whitaker and Treworgy 1990, Leighton et al. 1991, Whitaker et al. 1992, Treworgy et al. 1994

The Illinois Basin, also called the Eastern Interior Basin, is bordered on the southwest by the Ozark Dome. On the west, it is separated from the Forest City Basin by the Mississippi River Arch and the Missouri portion of the Lincoln Anticline. Northward it abuts the Wisconsin Arch. To the northeast, the Kankakee Arch separates it from the Michigan Basin; and to the east and southeast, the Cincinnati Arch divides it from the Appalachian Basin. Southern closure of the Illinois Basin was effected by uplift of the Pascola Arch that subsequently was beveled by pre-Late Cretaceous erosion and overlapped by rocks of the Mississippi Embayment fill.

The term Eastern Interior Basin has various connotations. For many geologists it is the same as the Illinois Basin. Wanless (1962) used Eastern Interior Basin for the larger feature and applied the name Illinois Basin to what is now called the Fairfield Basin. The term Eastern Interior also has been applied to both the Illinois and Michigan Basins (Snyder 1968).

The boundaries of the Illinois Basin are somewhat arbitrary. In most places, the basin grades almost imperceptibly into the adjacent domes and arches. The extent of the Pennsylvanian System commonly is taken as the limit by those interested in coal; but when the focus is on petroleum, the extent of the Chesterian Series or the Devonian New Albany Group frequently is used. Another boundary that has been used is the -500 foot (-150 m) elevation contour of the top of the Galena Group (Trenton). According to most of these definitions, the Illinois Basin covers three-quarters of Illinois, west-central and southwestern Indiana, and part of western Kentucky. Small adjacent areas of Iowa, Missouri, and Tennessee fall within some versions of the boundaries.

The definitive work on the Illinois Basin is Leighton et al. (1991), which contains more than 500 pages of text on geology and petroleum in this basin.

ILLINOIS FURNACE FAULT
Fluorspar Area Fault Complex

Location	From Section 17, T12S, R8E, to Section 26, T11S, R8E, Hardin County (pl. 2)
References	S. Weller et al. 1920, J. Weller et al. 1952, Baxter and Desborough 1965

This feature is part of an intensely fractured zone southeast of the apex of Hicks Dome. The Illinois Furnace Fault trends northeast and intersects other faults at both ends. Maximum displacement is more than 500 feet (150 m), with the southeast side downthrown. J. Weller et al. (1952) stated that "thrust faulting is probably locally important," but provided no details.

INA DOME

Location	T4S, R2 and 3E, Jefferson County (I-6)
References	Cady et al. 1938, Keys and Nelson 1980

As shown on the Herrin Coal Member structure map of Cady et al. (1938), the Ina Dome is a small dumbbell-shaped closure in Sections 23, 24, 25, and 26. Structural relief is indicated to be roughly 25 feet (8 m). Using many more control points, Keys and Nelson (1980) remapped the Herrin Coal in the same area and confirmed the presence of an enclosed high larger than the one shown by Cady et al. Maps of the Beech Creek ("Barlow") Limestone (ISGS open files) show a southeast-plunging nose with no closure. Valmeyeran Series clastic and carbonate units in the Ina Oil Field have produced 759,000 barrels of oil since 1938.

INMAN, INMAN EAST, and INMAN WEST FAULTS; INMAN GRABEN
Wabash Valley Fault System

Location	East-central Gallatin County, Illinois (J-7 and pl. 2) and Posey County, Indiana
References	Bristol 1975, Bristol and Treworgy 1979, Nelson and Lumm 1987

These structures were first mapped by Bristol (1975) and acquired their current names from Bristol and Treworgy (1979). They are typical elements of the Wabash Valley Fault System—high-angle normal faults striking slightly east of north. The Inman East Fault is the longest, about 20 miles

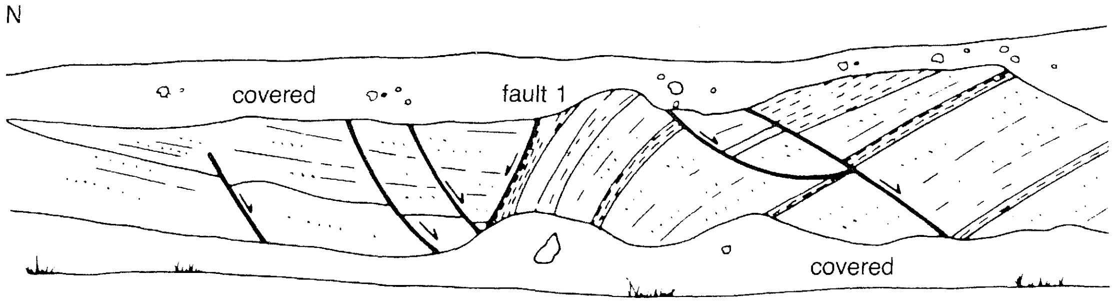


Figure 42 Jones Fault Zone in a roadcut, NE SE SE, Section 36, T9S,R7E, Saline County. Major faults (1, 2, and 3) are high-angle normal faults. The block between faults 1 and 2 is rotated counterclockwise so that antithetic normal faults within this block now dip at a low angle.

(32 km), and extends into Indiana. Its displacement, 480 feet (145 m), is the largest of any fault in the Wabash Valley Fault System. The eastern side is downthrown, and the fault bifurcates near its southern end. The Inman Fault is about 9 miles (15 km) long, and the west side is downthrown as much as 300 feet (90 m). The Inman West Fault splits off from the Inman Fault toward the south; the downthrown block between them is the Inman Graben. Nelson and Lumm (1987) determined that the Inman Graben terminates against the north edge of the Shawneetown Fault Zone. Data are inadequate to show whether the Inman East Fault does the same.

INTERSTATE FAULT ZONE (new name)
Fluorspar Area Fault Complex

Location West-central T12S, R8E, Hardin County (pl. 2)

References Baxter and Desborough 1965

The Interstate Fault Zone structure was initially named the Interstate Fault, but it is a fault zone composed of multiple, subparallel fractures along the northwest side of the Rock Creek Graben. The southeast side is downthrown more than 2,000 feet (610 m) in places, juxtaposing Pennsylvanian strata against St. Louis Limestone.

IOLA ANTICLINE (new name)

Location T8N, R5E, Effingham County to T3N, R6E, Clay County (G, H-6)

References J. Weller and Bell 1936

J. Weller and Bell (1936) mapped a structure they called the Iola Dome in the northeast part of T4N, R4E, Marion County, and the northwest part of T4N, R5E, Clay County. Their map was based on scattered outcrops of upper Pennsylvanian limestone, and the existence of a dome in this area has not been borne out by subsequent study. The name Iola Anticline refers to an elongated southward-plunging anticline that contains the Iola Consolidated Oil Field and lies east of the Iola Dome.

The Iola Anticline can be discerned on maps of the New Albany Group (Stevenson et al. 1981) and Galena Group (Bristol and Buschbach 1973), but it is shown in greatest detail on maps of the Beech Creek ("Barlow") Limestone and Karnak Limestone Member of the Ste. Genevieve Limestone (ISGS open files). The anticline is approximately 32 miles (51 km) long and has an average width of about 2 miles (3 km) on these units. Several irregular areas of closure are present along the crest. Although total relief is less than 50 feet (15 m) in most places, the Iola Anticline is prominently shown on structure maps as it interrupts the gentle regional southeast dip. The northern terminus is indefinite. On the south, the anticline dies out just north of the Kenner Anticline.

The Iola Consolidated, Iola South, and Oskaloosa Oil Fields have been developed along the Iola Anticline. Cumulative production of these fields is about 24 million barrels from Chesterian, Valmeyeran, and Devonian reservoirs.

IRISHTOWN ANTICLINE (discarded)

Location Northwestern Clinton and southern Bond Counties

References Shaw 1915a, Blatchley 1914, Kay 1915, Bell 1941

The above authors, using sparse subsurface data on the Herrin Coal Member, defined the Irishtown Anticline as a broad and subtle anticlinal nose that trends east-northeast. Structure maps on deeper horizons do not indicate an anticlinal structure in this area. The nose mapped on the coal, if it exists, does not merit naming; therefore, use of the name Irishtown Anticline should be discontinued.

IRVINGTON ANTICLINE (new)

Location T1S, R1W, Washington County (I-5)

References None

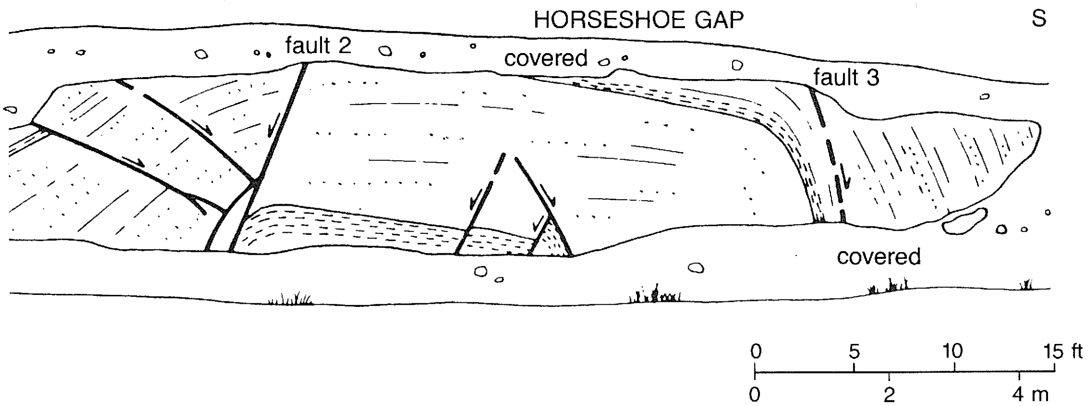
The name Irvington Anticline is proposed for an anticline near the village of Irvington in northeastern Washington County. The Irvington Anticline lies on the upper limb of the Du Quoin Monocline and south of the Centralia Anticline; it strikes northwest, en echelon with the Centralia Anticline (fig. 31). The enclosed area of the Irvington Anticline, as mapped on the Beech Creek ("Barlow") Limestone (ISGS open files), is about 3 miles (5 km) long and as much as 1 mile (1.6 km) wide. The fold plunges gently at both ends so that the total length is 5 to 6 miles (8–10 km). Closure on the Beech Creek is approximately 40 feet (12 m). The Irvington Oil Field, developed on the anticline, has yielded 10.7 million barrels of oil to date from the Mississippian Cypress and Yankeetown ("Benoist") Sandstones, Devonian Clear Creek Chert, and Ordovician Galena Group (Trenton).

IUKA ANTICLINE (discarded)

Location T2N, R4E, Marion County

References Easton 1944

Easton (1944), using scanty subsurface data on the Levias Limestone Member of the Renault Limestone (uppermost Valmeyeran), mapped a north-trending enclosed anticline



about 3 miles (5 km) long and 1 mile (1.6 km) wide. No such anticline appears on the current maps of the Beech Creek ("Barlow") Limestone (ISGS open files) or on Bristol and Howard's (1976) structure map of the Ste. Genevieve Limestone (upper Valmeyeran). The newer maps were made using many control points not available to Easton; therefore, the name Iuka Anticline should no longer be used.

JAMESTOWN ANTICLINE (discarded)

Location Southwestern Perry County

References Bell et al. 1931

A structural high with an irregular outline was mapped by Bell et al. (1931), who based their interpretations on surface and subsurface data on the Herrin Coal Member. A small area of closure was indicated in Section 34, T5S, R4W. The shape of the feature suggests that it is a product of differential compaction. It does not fit the definition of an anticline and is too insignificant to merit naming as a dome. Moreover, data on the Beech Creek ("Barlow") Limestone (ISGS open files) do not indicate a dome or anticline in this area. The name Jamestown Anticline should no longer be used.

JOHNSONVILLE DOME (new)

Location T1N, R6E, Wayne County (I-6)

References Cassin 1949, Du Bois and Siever 1955, Cluff et al. 1981, Treworgy 1981

Previously unnamed, this dome was listed as a "significant unnamed structure" by Treworgy (1981). It is now named Johnsonville Dome, for the nearby town and Johnsonville Consolidated Oil Field. As mapped on the top of the Ste. Genevieve Limestone and Beech Creek ("Barlow") Limestones, the Johnsonville Dome is roughly circular and is 2.5 to 3 miles (4–5 km) in diameter (Cassin 1949). Closure on the Ste. Genevieve and Beech Creek is about 120 feet (36 m). Closure decreases upward to less than 20 feet on the Herrin Coal and Carthage (Shoal Creek) Limestone of Pennsylvanian age (Cassin 1949, Du Bois and Siever 1955). Upward loss of structural relief is accompanied by thinning of Chesterian and Pennsylvanian strata across the crest of the dome.

The Johnsonville Dome is situated on a terrace northwest of the structurally lowest point of the Fairfield Basin. Several smaller domes are located on the same terrace. The east flank of the terrace is rather sharp and linear.

A deep well drilled near the apex of the Johnsonville Dome disclosed two unusual features. The Ullin Formation (lower Valmeyeran Series) is thicker than normal for the area and is composed of pure, white, crinoidal, bioclastic limestone, in contrast to the finer grained argillaceous or silty limestone of neighboring wells. Cassin (1949) hypothesized that this represents a reef. In the same well (Texas Co. No. 1 Greathouse in Section 27, T1N, R6E.), approximately 130 feet (40 m) of strata in the Devonian–Mississippian New Albany Group appears to be repeated by a reverse fault. Below the fault, regional mapping of the base of the New Albany Group indicates that no dome is present (Cluff et al. 1981).

A COCORP seismic profile that traversed the Johnsonville Dome indicates a probable fault east of the dome, along the east edge of the structural terrace. The fault is normal, dips steeply, and penetrates Precambrian basement (Whitaker and Treworgy 1990). Whitaker speculated that Johnsonville Dome is situated on a horst, which favored the local development of reefs in early Mississippian time. According to this interpretation, Johnsonville Dome is a reef-drape structure analogous to those associated with numerous Silurian pinnacle reefs in Illinois.

JONES FAULT ZONE

Rough Creek–Shawneetown Fault System

Location Section 11, T10S, R7E, Saline County to Section 6, T10S, R8E, Gallatin County (pl. 2)

References Nelson and Lumm 1987

The Jones Fault Zone lies 1 to 1.5 miles (1.6–2.4 km) southeast of the front fault of the Rough Creek–Shawneetown Fault System, and it strikes parallel with the fault system at the northwest end of the Eagle Valley Syncline. The Jones Fault Zone is a complex, narrow fault zone or faulted flexure that has net displacement down to the southeast. Coal test boreholes along its trend show both missing and repeated intervals of strata. A roadcut made in 1986 just east of Glen O. Jones Lake reveals complexly faulted Pennsylvanian sandstone and shale (fig. 42). Three large faults and many small ones are exposed in this cut. The large faults are high-angle normal, and they strike east-northeast to east. Slices of rock between the faults have been rotated and are displaced by small, low-angle normal faults.

JUNCTION CITY DOME

Location T1 and 2N, R1E, Marion County (H-5)

References St. Clair 1917c, Shaw 1923, Bell 1926b, Brownfield 1954

This feature, better described as a half-dome, is truncated on the west by the Centralia Fault Zone, which follows the dipping flank of the Du Quoin Monocline. As mapped by Brownfield on the upper Pennsylvanian "Shoal Creek" (now called Carthage) Limestone Member of the Bond Formation, the Junction City Dome is about 4.5 miles (7 km) from north to south and 2 miles (3 km) east to west. Closure at this horizon is 80 to 100 feet (24–30 m), and flanking dips are nearly symmetrical. On the Beech Creek ("Barlow") Limestone (ISGS open files), the enclosed area is smaller and centered farther south than on the Carthage. No doming is found west of the fault zone. These facts suggest the dome and fault zone developed at the same time in late or post-Pennsylvanian time.

JUNCTION FAULT
Wabash Valley Fault System

Location T9S, R9E, Gallatin County (J-7 and pl. 2)

References Bristol 1975, Bristol and Treworgy 1979, Nelson and Lumm 1987

The Junction Fault is about 3 miles (4.5 km) long and extends northeastward from the northeast corner of Section 20 to the northeast corner of Section 10. Closely spaced coal test borings show the southeast side to be downthrown as much as 90 feet (27 m). Underground workings of the Peabody Coal Company Eagle No. 2 Mine cross the fault near its northeastern end. A narrow zone of parallel, high-angle normal faults is exposed in the mine (fig. 43).

JUNCTION HORST (discarded)
see **JUNCTION WEST FAULT**

JUNCTION WEST FAULT (discarded)

Location T9S, R9E, Gallatin County

References Bristol 1975, Bristol and Treworgy 1979, Nelson and Lumm 1987

Bristol (1975) mapped the Junction West Fault as a northeast-trending branch of the Albion–Ridgway Fault Zone. The upthrown block between the Junction and Junction West Faults was named the Junction Horst. Bristol and Treworgy (1979) did not recognize the Junction West Fault or the Junction Horst. Nelson and Lumm (1987) mapped a fault that almost corresponds with Bristol's (1975) Junction West, but they indicated it to be part of the Albion–Ridgway Fault Zone. The use of the names Junction West Fault and Junction Horst are discontinued because the structures that these names refer to are minor elements of the Albion–Ridgway Fault Zone.

KANE ANTICLINE (discarded)

Location T9N, R12W, Greene County

References Collingwood 1933

This slight upwarp was mapped from outcrop data in Mississippian rocks and has no closure. The name, Kane Anticline, is discontinued because the feature, as designated by Collingwood, is not an anticline. Very little new information is available on any structure in Greene County.

KANKAKEE ARCH

Location Northeastern Illinois and north-central Indiana (fig. 1)

Selected references Pirtle 1932, Ekblaw 1938, Willman and Payne 1942, Workman and Bell 1948, Willman and Templeton 1951, Green 1957, Bell et al. 1964, Atherton 1971, Fisher and Barratt 1985, Treworgy and Whitaker 1990b

The Kankakee Arch separates the Illinois Basin from the Michigan Basin. It is a broad divide or saddle connecting the Wisconsin Arch on the northwest with the Cincinnati Arch on

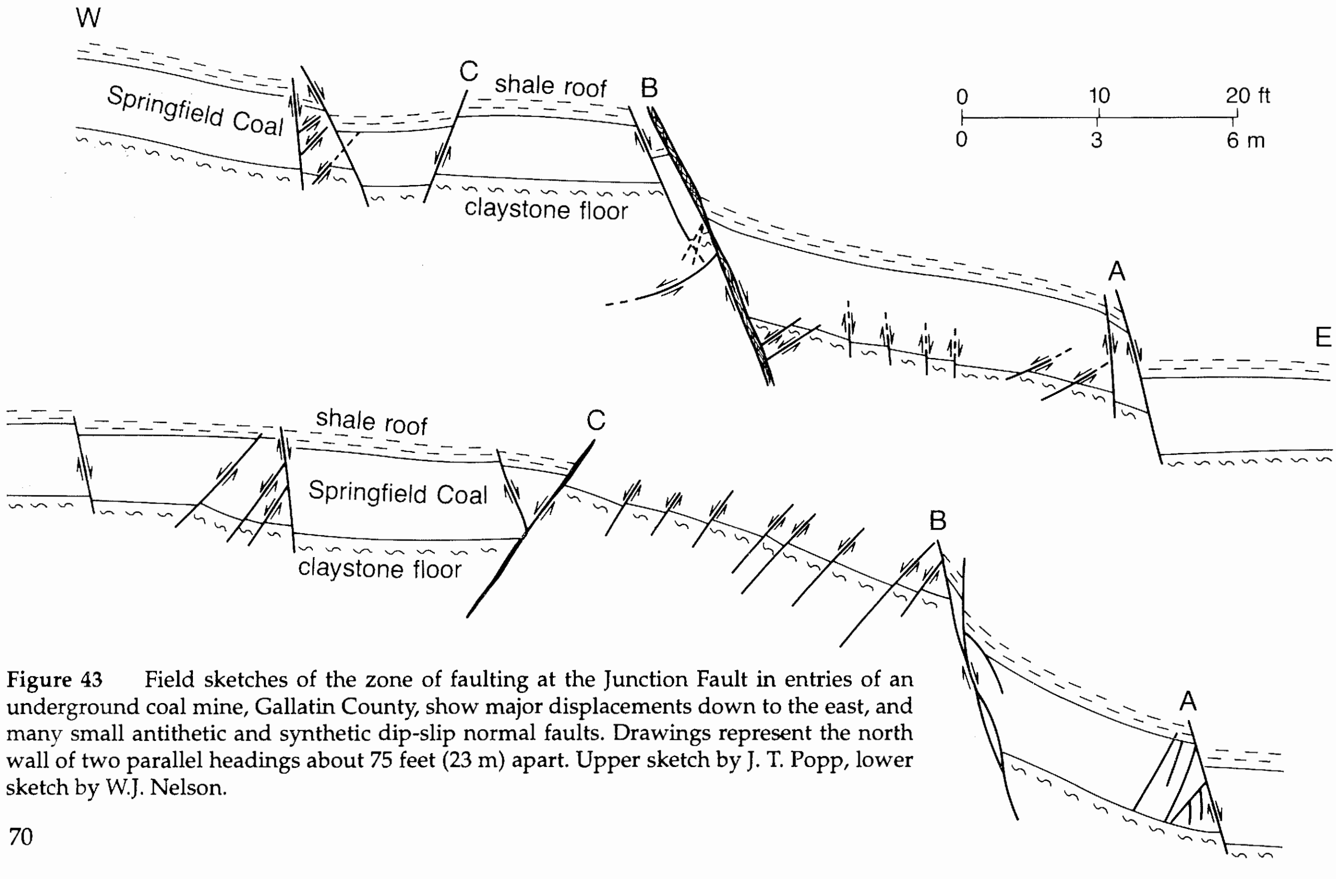


Figure 43 Field sketches of the zone of faulting at the Junction Fault in entries of an underground coal mine, Gallatin County, show major displacements down to the east, and many small antithetic and synthetic dip-slip normal faults. Drawings represent the north wall of two parallel headings about 75 feet (23 m) apart. Upper sketch by J. T. Popp, lower sketch by W.J. Nelson.

the southeast. The limits of the Kankakee Arch are not precisely defined because dips on its flanks are extremely gentle.

The Kankakee Arch first came into being late in the Canadian Epoch. Figure 44 shows that the Prairie du Chien Group is arched and truncated by erosion beneath the St. Peter Sandstone. The St. Peter thins across the arch and nearly pinches out. The overlying Platteville Group (Blackriveran) also thins. The Ordovician Kankakee Arch lay slightly northeast of the current arch (Atherton 1971). During the Silurian Period, the arch became the scene of reef development between the deeper seas to the north and south. By the Middle Devonian Epoch, the division became almost complete between the Illinois and Michigan Basins; evaporites were deposited in the latter. Not much is known about subsequent development because post-Devonian rocks have been eroded from the arch. Mississippian and Pennsylvanian sediments at least partially overlapped the Kankakee Arch, as shown by the presence of rocks of that age in the Des Plaines Disturbance, which lies on the north flank of the arch.

KEMPTON SYNCLINE (discarded)

Location Southwestern Kankakee and northernmost Ford Counties

References Willman and Payne 1942

The Kempton Syncline was mapped as trending slightly west of north and situated west of the Herscher Dome. Willman and Payne's (1942) structure maps of the St. Peter, Galena, and Maquoketa horizons show only part of the west limb of the Kempton Syncline. Bristol and Buschbach's (1973) structure map of the Galena Group shows a trough, more or less equivalent to Willman and Payne's Kempton Syncline, curving southwestward and connecting with the Colfax Syncline in McLean and Piatt Counties. The use of the name Kempton Syncline should be dropped because the feature is not distinct from the well defined Colfax Syncline.

KENNER ANTICLINE (new name)

Location Southwestern Clay and northwestern Wayne Counties (H-6)

References Easton 1944, Lowenstam 1951

Easton (1944) named the Kenner Dome and defined it based on subsurface mapping of the Herrin Coal (Pennsylvanian). Lowenstam (1951) mapped the Kenner Dome as a small oval high located mainly in the southwest corner of T3N, R5E, Clay County. Lowenstam's (1952) map shows closure of about 50 feet (15 m) on the Kenner Dome as contoured on the Herrin Coal Member.

Recent structure maps contoured on the Mississippian Beech Creek ("Barlow") Limestone and Karnak Limestone Member (ISGS open files) indicated the Kenner Dome, as defined above, to be part of a larger anticline having a sinuous northeast-trending axis. The name Kenner Anticline is introduced for the larger structure, and the name Kenner Dome discarded.

The anticline extends on the Beech Creek from Section 28, T2N, R5E, Wayne County, to Section 19, T3N, R6E, Clay County. Closure is 60 to 80 feet (18–24 m) at this horizon. The Kenner Oil Field was developed in structural traps produced by the anticline in multiple Mississippian and Devonian pay zones. A satellite dome, centered in Section 23, T3N, R5E,

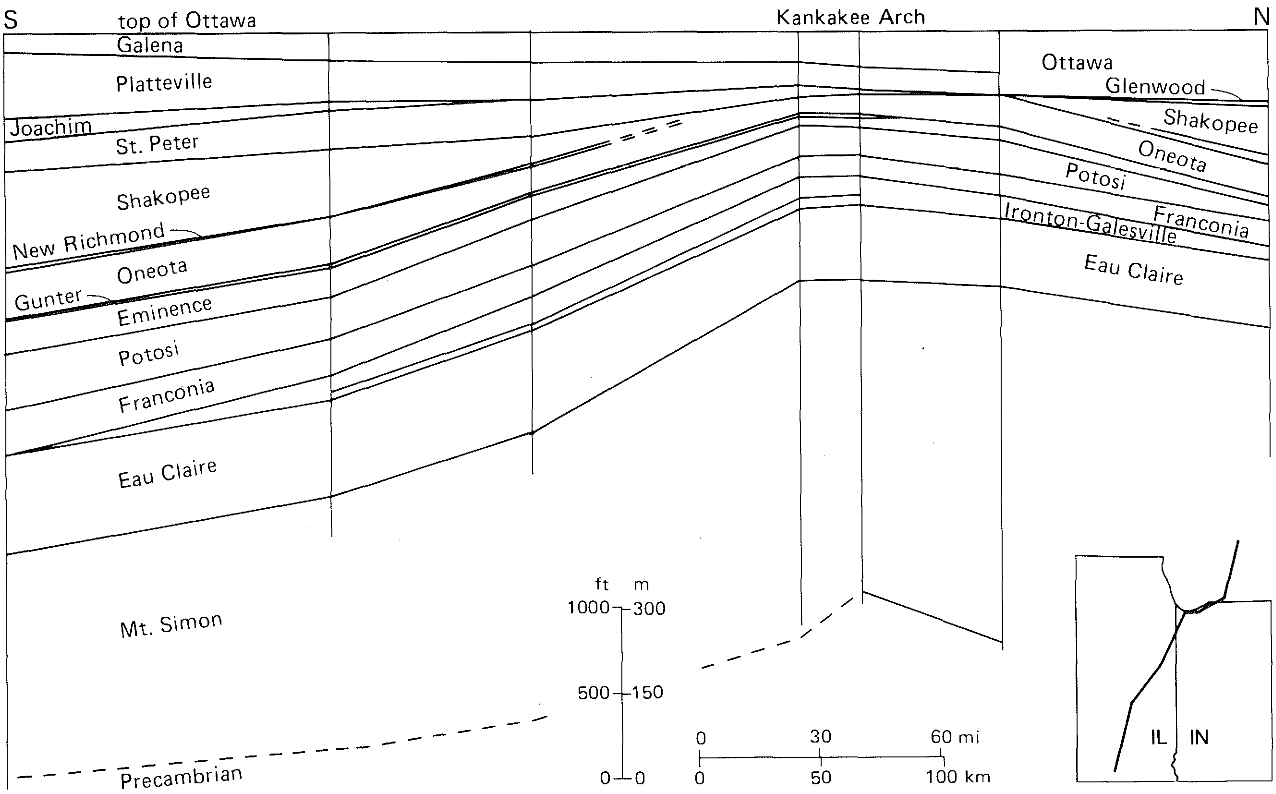


Figure 44 Stratigraphic cross section through the Kankakee Arch from east-central Illinois to southwestern Michigan, with the top of the Galena Group as datum. Rise of the arch in the Early and Middle Ordovician Epochs produced an angular unconformity beneath the St. Peter Sandstone, and thinning of the St. Peter, Joachim, and Platteville across the crest of the arch. After Atherton 1971.

contains the Kenner West Oil Field. Both structures lie along a terrace on a southeast-facing homocline.

KING ANTICLINE

Location T3S, R3E, Jefferson County (I-6)

References Folk and Swann 1946

King Oil Field was developed on this structure, which shows about 40 feet (12 m) of closure on the Aux Vases Sandstone (Mississippian). The anticline is irregular in outline and elongated northwest to southeast (fig. 31). Subsurface mapping of the Carthage Limestone Member of the Bond Formation (upper Pennsylvanian) reveals an anticline at that horizon also.

KINCAID ANTICLINE (new)

Location T13 and 14N, R3W, Christian and Sangamon Counties (F-5)

References None

The name Kincaid Anticline is proposed for an anticline that is prominent on a structure map of the top of the Mississippian Karnak Limestone Member (R. Howard, ISGS, unpublished mapping). The name is taken from the town of Kincaid, which is located on the southern end of the anticline. On Howard's map, the Kincaid Anticline is about 11 miles (18 km) long and plunges S15°E. Closure is mapped in the northern part of the fold; vertical relief is about 80 feet (24 m) on both flanks. The fold is relatively flat topped and has equal dips on both flanks.

The Kincaid Anticline also is shown on Nelson's (1987b) structure map of the Pennsylvanian Herrin Coal Member. The anticline is more irregular in outline and lower in relief on the coal than it is on the Karnak Limestone. A normal fault, the Sicily Fault, offsets the Herrin Coal along the west flank of the Kincaid Anticline. The fault is parallel to the fold axis and is downthrown toward the crest of the anticline.

The upward loss of structural relief suggests that the Kincaid Anticline, like many anticlines in central Illinois, may have developed during late Mississippian to early Pennsylvanian time. The Edinburg West and Kincaid Consolidated Oil Fields are situated on or close to the crest of the Kincaid Anticline.

KRITESVILLE SYNCLINE (discarded)

Location T11S, R2W, Calhoun County

References Rubey 1952

Rubey (1952), using scattered data from outcrops, described the Kritesville Syncline as a subtle southeast-plunging syncline beneath the Mississippi River. It appears on Rubey's plate 2 and is mentioned once in Rubey (1952, p. 139). Retaining the name does not appear justified because the structure is so poorly defined.

KUYKENDALL ANTICLINE

Location Northwestern T10S, R9E, Gallatin County (pl. 2)

References Nelson and Lumm 1987

Mapped from dozens of coal test drill holes, the Kuykendall Anticline lies between the Rough Creek–Shawneetown Fault System and the sinuous axis of the Eagle Valley Syncline (fig. 34). The axis of the Kuykendall Anticline curves from the east to the northeast and is a little more than 2 miles (3 km) long. Closure of more than 100 feet (30 m) is mapped on the Springfield Coal Member (Pennsylvanian).

LAKE BLOOMINGTON DOME
La Salle Anticlinorium

Location T26N, R2 and 3E, McLean County (D-6)

References Clegg 1972, Buschbach and Bond 1974

The Lake Bloomington Dome lies along the Downs Anticline, which marks the west edge of the La Salle Anticlinorium in this area. It is about 4.5 miles (7 km) long (north to south) and 3 miles (4.5 km) wide. The Gridley and Lexington Domes can be regarded as offshoots (fig. 25). The Lake Bloomington Dome proper has about 60 feet (18 m) of closure on the Pennsylvanian Danville Coal Member (Clegg 1972) and about 100 feet (30 m) on the Cambrian Mt. Simon Sandstone (Buschbach and Bond 1974). A gas storage field has been developed in the Mt. Simon.

See also HUDSON DOME.

LA SALLE ANTICLINORIUM (new name)

Location From Lee to Lawrence Counties, Illinois (fig. 1)

Selected references Freeman 1868, Blatchley 1910, 1912, 1913, Cady 1920, Payne 1939, Willman and Payne 1942, Clark and Royds 1948, Green 1957, Clegg 1959, 1965a, 1970, McGinnis and Heigold 1961, Atherton 1971, Buschbach and Bond 1974, McGinnis et al. 1976, Stearns 1978, Kolata and Graese 1983, Suppe and Medwedeff 1984, Jacobson 1985, Lowell 1985, Treworgy and Whitaker 1990a, b, Reed et al. 1991, Treworgy et al. 1994

The name La Salle Anticlinorium is introduced for the feature that has been called La Salle Anticlinal Belt in most recent reports. The La Salle structure neatly fits the definition of an anticlinorium, as given in the *Glossary of Geology* (Gary et al. 1972): "A composite anticlinal structure of regional extent, composed of lesser folds." The term "anticlinorium" is more widely used in the geologic literature than is the term "anticlinal belt." Changing the name from anticlinal belt to anticlinorium also avoids the possible implication that the La Salle is a fold-thrust belt comparable to the Ouachita or Allegheny fold-thrust belts.

The La Salle Anticlinorium first became known from outcrops along the Illinois River in La Salle County (fig. 45). Subsequent drilling for oil and gas extended knowledge of the structure southward through the subsurface. Tens of thousands of wells have been drilled and approximately 750 million barrels of oil produced from reservoirs along the La Salle Anticlinorium. In spite of considerable economic interest, the deeper structure remains unknown. Little has been published concerning structural style, geophysical character, origin, and tectonic evolution of the La Salle.

The anticlinorium has subparallel anticlines, domes, monoclines, and synclines, several dozen of which are individually named. The pattern frequently is described as en echelon, but this term is misleading. In a true en echelon fold belt, the individual structures are aligned at an angle to the overall trend of the system. Such a pattern commonly reflects strike-slip deformation, as is illustrated by the en echelon anticlines and subsidiary faults in the Cottage Grove Fault

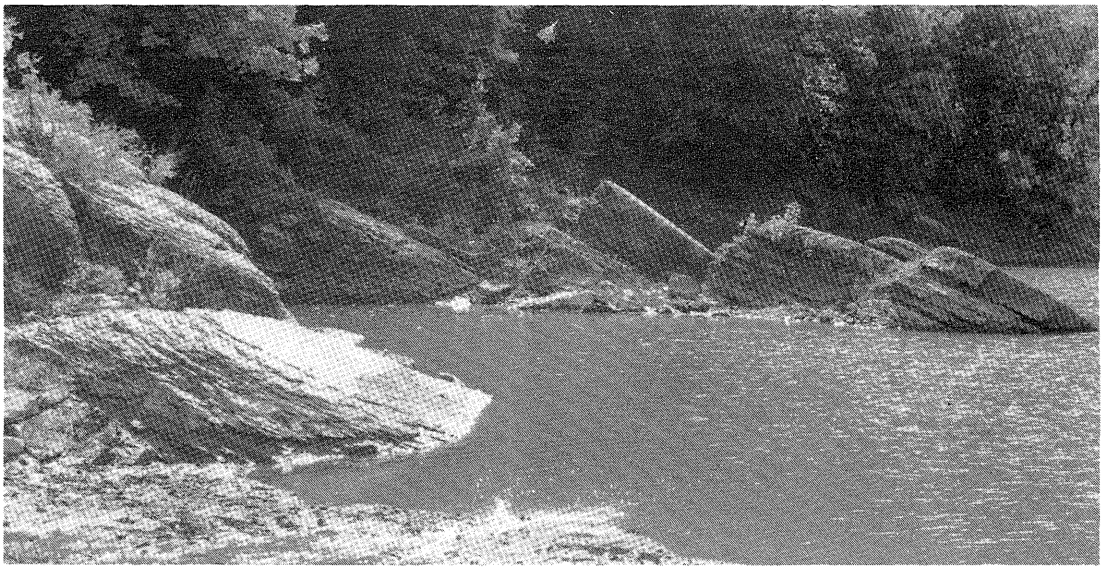


Figure 45 Dolomite beds of the Platteville Group tilted on the flank of the Peru Monocline along the Vermilion River at Oglesby in La Salle County. West is to the right.

System. The La Salle Anticlinorium, in contrast, consists of folds that are oriented mainly parallel to the north-northwest strike of the larger structure. Individual folds are offset from one another and partially overlap. Northward, the individual folds generally step off toward the west.

The anticlinorium also exhibits a branching pattern, which is better shown on a structure contour map such as the one on the Galena Group (Bristol and Buschbach 1973), than it is on plate 1. From southern Lawrence through Crawford and Clark Counties, a single slightly misaligned row of elongated domes and anticlines occurs on top of a west-dipping monocline, newly named the Charleston Monocline. The structure splits in northwestern Clark County. One arm continues northward as the Edgar Monocline, whereas the Charleston Monocline continues northwestward to the west side of the Tuscola Anticline. Another split takes place in eastern Piatt County, where the Osman Monocline trends northward and the Downs Anticline is offset toward the west (pl. 1). The Osman Monocline extends through Ford County and approximately lines up with unnamed anticlines farther north, which in turn line up with the Herscher Anticline in Kankakee County. The Downs Anticline terminates in northern McLean County. The Peru Monocline (new name) arises east of the Downs Anticline and extends northwestward to the northern terminus of the anticlinorium in Lee County.

Strong asymmetry marks the La Salle Anticlinorium. The major folds are monoclines topped by irregular domes and anticlines. Along most of the trend, the steeper dip and greater structural relief is toward the west into the Fairfield Basin. The folds in northern Edgar County have steep eastern limbs, but the relief is much less than on the western limb of the Tuscola Anticline to the west. Some smaller elements also deviate from the overall trend. For example, the Ancona Anticline (C, D-6) has a steep northeast flank, and some folds in Lawrence and Crawford Counties are steepest on the southwest limb.

The principal uplift of the La Salle Anticlinorium took place late in the Paleozoic Era. Clegg (1965a, 1970) documented that approximately half of the overall uplift occurred after Chesterian and before Pennsylvanian sedimentation. As a result, an angular unconformity is found beneath Pennsylvanian strata through the length of the structure. The time represented by missing strata increases northward to La Salle County, where Pennsylvanian strata overlie rocks as old as the St. Peter Sandstone (Ordovician) on the crest of the fold. Thinning of various beds and intervals in the middle Pennsylvanian demonstrates that uplifts continued gradually through this time (Jacobson 1985). Major folding resumed after the Pennsylvanian Period. Some authors have suggested pre-Mississippian activity in the La Salle Anticlinorium, but such effects are slight compared with Mississippian and later movements. For example, Kolata and Graese (1983) found moderate thinning of the Upper Ordovician Maquoketa Group across the Peru Monocline in La Salle County.

Drilling for gas storage fields at several places along the La Salle Anticlinorium produced data showing that folds on the basal Cambrian Mt. Simon Sandstone are similar in location, shape, and magnitude to folds on younger pre-Pennsylvanian horizons (Buschbach and Bond 1974). Seismic profiles confirm that the entire sedimentary column is folded and the amount of structural relief does not change appreciably with depth. Figure 23 is a seismic profile across the Charleston Monocline a few miles north of Charleston, Coles County. The fold axis is essentially vertical and the lower hinge is sharp, whereas the upper hinge is a smooth curve.

Faulting has been documented in several places along the La Salle Anticlinorium. Proprietary seismic reflection profiles (interpreted in 1992 by P.C. Heigold, ISGS) reveal faulting at depth along the southern part of the anticlinorium. Specifically, high-angle reverse faults are present on the west flank of the Lawrenceville Dome, the east flank of the Bridgeport Anticline, and the southwest flank of the Hardinville Anticline. These faults displace reflectors correlative with the top of Precambrian basement and Cambrian strata and die out at or below the base of the Knox Group. Displacement of the basement surface on the east flank of the Bridgeport Anticline is estimated to be about 500 feet (150 m); the largest fault on the Hardinville Anticline may have 300 to 400 feet of throw (90–120 m). These seismic profiles did not cross the Charleston Monocline, which has considerably greater relief than the structures that were profiled.

Elsewhere, several east-west faults mapped on the Troy Grove Dome in La Salle County were based on borehole data on the Mt. Simon Sandstone (Cambrian). These faults outline a graben perpendicular to the steep west flank of the dome (Buschbach and Bond 1974). In eastern Coles County, borehole records indicate faulting in Mississippian strata near the west flank of the Ashmore Dome. A missing section in one well indicated 250 feet (75 m) of displacement (Reed et al. 1991). The orientations of these faults are unknown.

The La Salle Anticlinorium evidently is the product of Late Paleozoic displacements on faults in crystalline basement. Most, if not all, of the basement faults die out upward through sedimentary cover. Thus, faults in the La Salle could be classified as drape folds (Stearns 1978) or fault-propagation folds (Suppe and Medwedeff 1984); and the La Salle is very similar in structural style to monoclines produced during the Laramide orogeny in the western United States (Lowell 1985, chapter 3). The complex arrangement of folds in the La Salle Anticlinorium suggests a mosaic of faults in the basement of eastern Illinois.

LAST CHANCE FAULT (discarded)

Location Section 32, T12S, R8E, Hardin County

References J. Weller et al. 1952

This fault was described as a minor branch of the Blue Diggings Fault; the southeast side was reported to be downthrown 5 to 20 feet (1.5–6 m). J. Weller et al. (1952) did not label the Last Chance Fault on any map, nor accurately describe its location. Pending a better definition and description, use of the name should be discarded.

LAWLER FAULT
Rough Creek–Shawneetown Fault System

Location Section 27, T9S, R8E, to Section 31, T9S, R9E, Gallatin County (pl. 2)

References Strunk 1984, Nelson and Lumm 1987

The name Lawler Fault is used here for the structure that was originally named the Negro Spring Fault (Strunk 1984). The small community of Lawler lies close to the fault trace.

The Lawler Fault was mapped by Nelson and Lumm (1987) on the basis of well data. It is north of the front fault of the Shawneetown Fault Zone and strikes N70°W. Maximum throw is 250 to 300 feet (75–90 m) down to the south. One well penetrated the fault; a missing section indicated two closely spaced normal faults. Strunk (1984) inferred, on the basis of a gravity survey, that the Lawler Fault may join the east end of the Cottage Grove Fault System

I recently remapped the Lawler area using records of wells drilled since 1987. The new data indicate that the Lawler Fault is approximately ½ mile north of where it was mapped by Nelson and Lumm (1987). Oil in the Lawler oil field is trapped in a tilted block that is bounded on the southwest by the Lawler Fault.

Saline springs along the foot of the Wildcat Hills, a short distance south of the Lawler Fault, formed the basis for an important pioneer industry. Before Illinois became a state, slaves were brought in to gather and boil brine from the springs to make salt. Saline County owes its name to the saline springs.

LAWRENCEVILLE DOME (new)
La Salle Anticlinorium

Location Central Lawrence County (H-8)

References None

The name Lawrenceville Dome is given to the large enclosed structural high located just south of the city of Lawrenceville, mostly in T3N, R12W, and the western part of T3N, R11W. This dome is evident on maps of several structural horizons, but it is portrayed best on maps of the Beech Creek ("Barlow") Limestone (fig. 19). On this horizon the dome is approximately 6 miles (10 km) north to south, and 3 to 4 miles (5–6.5 km) east to west. It shows closure of more than 100 feet (30 m). Closure is approximately 50 feet (15 m) on the Pennsylvanian Herrin Coal Member (Potter 1956). The Lawrenceville Dome is an asymmetrical structure, roughly rectangular in outline, and has steep west and south flanks and gently dipping, uneven north and east flanks. The south flank may be faulted. The highest point on the dome is near the southwest corner of Section 26, T3N, R12W. This is an important oil-producing structure, but production figures from the dome are not separately tabulated.

LEAF RIVER ANTICLINE
Plum River Fault Zone

Location North-central Ogle County (A-5)

References Buschbach and Bond 1974, Kolata and Buschbach 1976, Kolata et al. 1983

This anticline is located immediately south of the Plum River Fault Zone near the east end of the fault zone (fig. 37). It trends east to west and is about 6 miles (10 km) long and 2 miles (3 km) wide. Closure on the Ordovician Glenwood Formation is approximately 80 feet (25 m). The Leaf River Anticline was also mapped on the Cambrian Franconia Formation (fig. 17), and small faults have been observed in outcrops along the crest of the anticline (Kolata and Buschbach 1976). The close relationship of the anticline to the fault zone suggests that they formed under the same stress regime.

LEE FAULT ZONE (new name)
Fluorspar Area Fault Complex

Location From Section 15, T11S, R8E, Hardin County, to Section 20, T10S, R9E, Gallatin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Brown et al. 1954, Baxter and Desborough 1965, Heyl et al. 1965, Nelson and Lumm 1987

Published references call the structure "Lee Fault," but it is a fault zone consisting of several northeast-trending, closely spaced, parallel or branching fractures that are downthrown as much as 450 feet (140 m) on the southeast side. It dies out to the northeast on the south flank of the Eagle Valley Syncline and merges with other named faults to the southwest.

LENZBURG ANTICLINE (discarded)

Location T3S, R6 and 7W, St. Clair County

References Bell 1929a

Bell used the name Lenzburg Anticline for a nose that trended west-northwest and was mapped from borehole data on the Herrin Coal Member. The structural picture is incomplete because the feature lies at the cropline of the coal and in an area where drilling has been limited. This is, at most, a minor irregularity in contouring, lacking a well defined axis or structural closure. Usage of the name Lenzburg Anticline should be discontinued.

LEVAN ANTICLINE (discarded)

Location Northeastern T8S, R3W, Jackson County

References Root 1928

Root mapped the Levan Anticline from scanty outcrop and borehole data on the "Ava Shale," a local marker bed in lower Pennsylvanian strata approximately 100 feet (30 m) below the Colchester Coal Member. The anticline was shown as having a north-trending axis, a steep east flank, and a small area of closure. It was mapped as being about 8 miles (13 km) southeast of the Campbell Hill Anticline, which is within the Cottage Grove Fault System.

Nelson and Lumm (1985) traced the Bodenschatz–Lick Fault Zone from Missouri toward the area of the Levan Anticline. Pre-Pennsylvanian rocks apparently are faulted in this area, but Pennsylvanian rocks only display a monoclinal flexure, with the east or southeast side downwarped. Further definition of the Levan Anticline, if it exists, is not possible without new information; therefore, use of the name should be discontinued.

LEVEL HILL FAULT
Rough Creek–Shawneetown Fault System

Location Southern T9S, R8E, Gallatin County (pl. 2)

References Nelson and Lumm 1987

This fault, mapped from outcrops, is a few hundred yards south of and strikes parallel with the front fault of the Rough Creek–Shawneetown Fault System. It joins the front fault at its western end; it may connect with the Ringold Fault eastward. Numerous perpendicular and diagonal cross faults connect the Level Hill and front fault, and they outline tilted upthrown and downthrown slices.

LEXINGTON DOME

Location T25N, R3E, McLean County (D-6)

References Clegg 1972, Buschbach and Bond 1974

The Lexington Dome is a roughly circular, symmetrical upwarp. Clegg (1972) mapped about 20 feet (6 m) of closure on the Pennsylvanian Danville Coal Member, and Buschbach and Bond (1974) indicated about 100 feet (30 m) of closure on the Cambrian Mt. Simon Sandstone. The enclosed area is about 2 miles (3 km) in diameter on the coal and 3.5 miles (5.6 km) on the Mt. Simon (fig. 25). The Lexington Dome is separated from the Lake Bloomington Dome on the northwest by a saddle. A gas storage field has been developed in the Mt. Simon.

See also HUDSON DOME.

LINCOLN ANTICLINE or **FOLD**

Location Northeastern Missouri and southern Calhoun and Jersey Counties, Illinois (H-2,3)

Selected references Keyes 1896, Krey 1924, McQueen et al. 1941, Rubey 1952, Cole 1961, Koenig 1961, Searight and Searight 1961, Tikrity 1968, McCracken 1971, Treworgy 1979a, Nelson and Lumm 1985

This structure has been called the Lincoln Fold by most researchers, but the name Lincoln Anticline is more descriptive and thus seems preferable. The Lincoln Anticline is the most prominent structural feature in northeastern Missouri and follows the pronounced northwest to southeast structural grain of that region. It is at least 165 miles (265 km) long and as much as 15 miles (24 km) wide. It has structural relief of as much as 1,000 feet (300 m). The northeast limb is gentle, whereas the southwest limb is steep and faulted in places. The Cap au Grès Faulted Flexure arises on the southwest flank of the Lincoln Anticline in Lincoln County, Missouri. Both fold and flexure then swing eastward into Illinois and terminate in southernmost Jersey County. The south flank of the Lincoln Anticline in Illinois coincides with the Cap au Grès Faulted Flexure, where bedding dips steeply and is overturned locally. In contrast, the north limb dips so gently as to be barely noticeable. The relationship of the Lincoln Anticline to the Cap au Grès structure suggests that the anticline throughout its length is the surface expression of a fault in the Precambrian basement.

Most of the uplift of the Lincoln Anticline and Cap au Grès Faulted Flexure took place in late Mississippian to early Pennsylvanian time. Additional uplift occurred after Pennsylvanian sedimentation in the area. Stratigraphic relationships indicate earlier, less pronounced upwarping of the structure from Middle Devonian through Kinderhookian time (Rubey 1952, Tikrity 1968). A final episode of uplift along the eastern part of the fold may have occurred late in the Tertiary Period (Rubey 1952).

See also CAP AU GRÈS FAULTED FLEXURE.

LINCOLN DOME see **LOGAN DOME** (new name)

LITTLE CACHE FAULT ZONE (new)

Location T11, 12 and 13S, R3E, Johnson County (K-6)

References S. Weller and Krey 1939, J. Weller 1940, Dial 1963, Trask and Jacobson 1990, Jacobson 1991, Nelson et al. 1991, Nelson 1993

The name Little Cache Fault Zone was given by Nelson et al. (1991) to a zone of high-angle normal faults that follows the valley of Little Cache Creek in central Johnson County. This fault zone first appeared on the maps of S. Weller and Krey (1939) and J. Weller (1940). Recent mapping (Dial 1963, Trask and Jacobson 1990, Jacobson 1991, Nelson 1993) has modified details of the earlier mapping only slightly. The faults outline grabens that are 0.25 to 0.5 mile (0.4 to 0.8 km) wide and trend slightly east of north. A maximum displacement of 280 feet (85 m) was noted on a west-dipping fault in Section 15, T12S, R3E (Nelson 1993). Relatively little drag or brecciation is associated with this fault zone. Fault surfaces dip 70° to 80° and show vertical (dip-slip) striations.

The Little Cache Fault Zone lies a short distance west of the western termini of the McCormick and New Burnside Anticlines. Several normal faults are thought to be products of an extensional episode that postdate the compressional event responsible for the anticlines (Nelson 1987a, Nelson et al. 1991).

LITTLETON ANTICLINE
Peoria Folds

Location Northeastern Schuyler County (E-2)

References Wanless 1957, Howard 1961

The Littleton Anticline is a relatively short fold (6 mi, 10 km) that strikes northeast and shows relief of 50 to 100 feet (15–30 m). Mapping of the anticline on pre-Pennsylvanian horizons was based on outcrop and borehole information (Wanless 1957). An unpublished structure map of the base of the New Albany Group shows about 60 feet (18 m) of closure on this anticline (R. Howard, ISGS, unpublished mapping). A structure map contoured on the top of the Galena Group shows eastward nosing but no closure in T3N, R2W (Howard 1961).

LOGAN DOME (new name)

Location West-central Logan County (E-4, 5)

References Heigold et al. 1964, Howard 1964, Buschbach and Bond 1974

The structure previously called Lincoln Dome is renamed the Logan Dome to avoid confusion with the Lincoln Anticline. The new name is taken from Logan County. This dome lies near the center of a large region otherwise devoid of named structural features. It is approximately 30 miles (48 km) west of the La Salle Anticlinorium and does not appear to be part of the La Salle or any other group of structures.

Drilling for gas storage in Silurian dolomite defined the Logan Dome. It is a slightly asymmetrical dome about 3 miles (5 km) long and 2 miles (3 km) wide; the long axis trends north-northwest. Logan Dome has about 85 feet (26 m) of closure on top of the Silurian System (Buschbach and Bond 1974).

LONGBRANCH MONOCLINE (discarded)

Location Northern Saline County

References Cady et al. 1939

Cady et al. (1939) used subsurface mapping of the Herrin Coal Member (Pennsylvanian) to define the Longbranch Monocline. Their map shows that the coal dips northward at a maximum rate of about 100 feet per mile (about 1°) near the north edge of Saline County. A structure map by Hopkins (1968) on the slightly older Springfield Coal Member shows a similar pattern, but places it in better regional perspective. The Longbranch Monocline is seen here as merely an area in which the regional northward tilt of the coal, toward the center of the Fairfield Basin, is slightly steeper than the average. On maps of the Beech Creek ("Barlow") Limestone (ISGS open files), much more irregularity is apparent and neither a linear trend nor a steeper than normal dip is shown. The Longbranch Monocline does not appear to be a valid structural feature, and reference to it should be discontinued.

LOUDEN ANTICLINE

Location Northeastern Fayette County and vicinity (G-6)

References Cohee and Carter 1939, Newton 1941, Lyons 1948, Du Bois 1951, Bristol and Buschbach 1973, Buschbach and Bond 1974, Bristol and Howard 1976, Cluff and Lasemi 1980, Stevenson et al. 1981, Heigold and Oltz 1991

The Louden Anticline is one of the largest oil-producing structures of the Illinois Basin. Delineated by seismic means during the oil boom of the late 1930s, the Louden Oil Field has a cumulative production of 392 million barrels. Thus, it is a truly "giant" oil field and ranks just behind Salem, the leader for Illinois in production. The name Louden Anticline, as used here, refers to the area of structural closure in the Louden Oil Field. An anticlinal nose continues more than 15 miles (24 km) south of the enclosed area. The St. James, St. James East, Wilberton, St. Paul, and Kinmundy Oil Fields are located on small domes along this unnamed anticlinal nose. Their cumulative output is about 25 million barrels of oil.

The Louden Anticline lies north of and almost in line with the Salem Anticline, which in turn aligns with the east fork of the Du Quoin Monocline. At its northern end, the Louden Anticline terminates abruptly into an area of southeastward homoclinal dip. The Mattoon Anticline is offset about 15 miles (24 km) east of the Louden trend.

The axis of the Louden Anticline is slightly sinuous, curving eastward near its northern end. Maximum closures on the Beech Creek Limestone, New Albany Group, and Galena Group (Trenton) exceed 200 feet (60 m) in T8N, R3E, Fayette County. The west limb of the Louden Anticline is considerably steeper than the east limb. Dips on the east limb are parallel to and only slightly greater than regional dip. A seismic profile (fig. 46) reveals possible normal faults at depth on the west flank of the structure (Heigold and Oltz 1991).

Du Bois (1951) showed on a series of structure maps that relief on the Louden Anticline decreases markedly upward from Chesterian through upper Pennsylvanian strata. The loss of relief reflects thinning of Pennsylvanian intervals across the anticline. Du Bois also found that some, but not all, Pennsylvanian key beds (e.g. limestones) thin, pinch out, or change facies across the structure. He concluded that uplift took place during as well as after Pennsylvanian sedimentation. Cluff and Lasemi (1980) presented evidence for uplift during early Chesterian sedimentation. A tidal channel filled with fine grained, argillaceous limestone transects the Cypress Sandstone (the main producing horizon in the Louden Field) at a right angle to the anticline. Linear bodies of Cypress Sandstone, interpreted as offshore sandbars or barrier islands, parallel the anticline and pinch out updip along its east flank. Cluff and Lasemi (1980) also recognized thinning and facies changes in pre-Cypress Chesterian strata on the anticline.

Thus, the structural style and history of development of the Louden Anticline are similar to those of other major structures in the vicinity, including the Salem Anticline, Du Quoin Monocline, and La Salle Anticlinorium.

LOUISVILLE ANTICLINE (discarded)

Location Mostly in T4N, R5E, Clay County

References J. Weller and Bell 1936, Siever 1950

A large anticline with a curved axis was mapped by J. Weller and Bell (1936) on the basis of outcrops of upper Pennsylvanian rocks. No such anticline appears on maps of deeper horizons, including the Herrin Coal (Siever 1950), Beech Creek ("Barlow") Limestone, or Karnak Limestone Member (ISGS open files). Beech Creek and Karnak structure maps show slight southward nosing of contour lines in the area where Weller and Bell mapped the western part of the Louisville Anticline. This nosing is interpreted as representing the southward termination of the Iola Anticline; therefore, the name Louisville Anticline should be dropped.

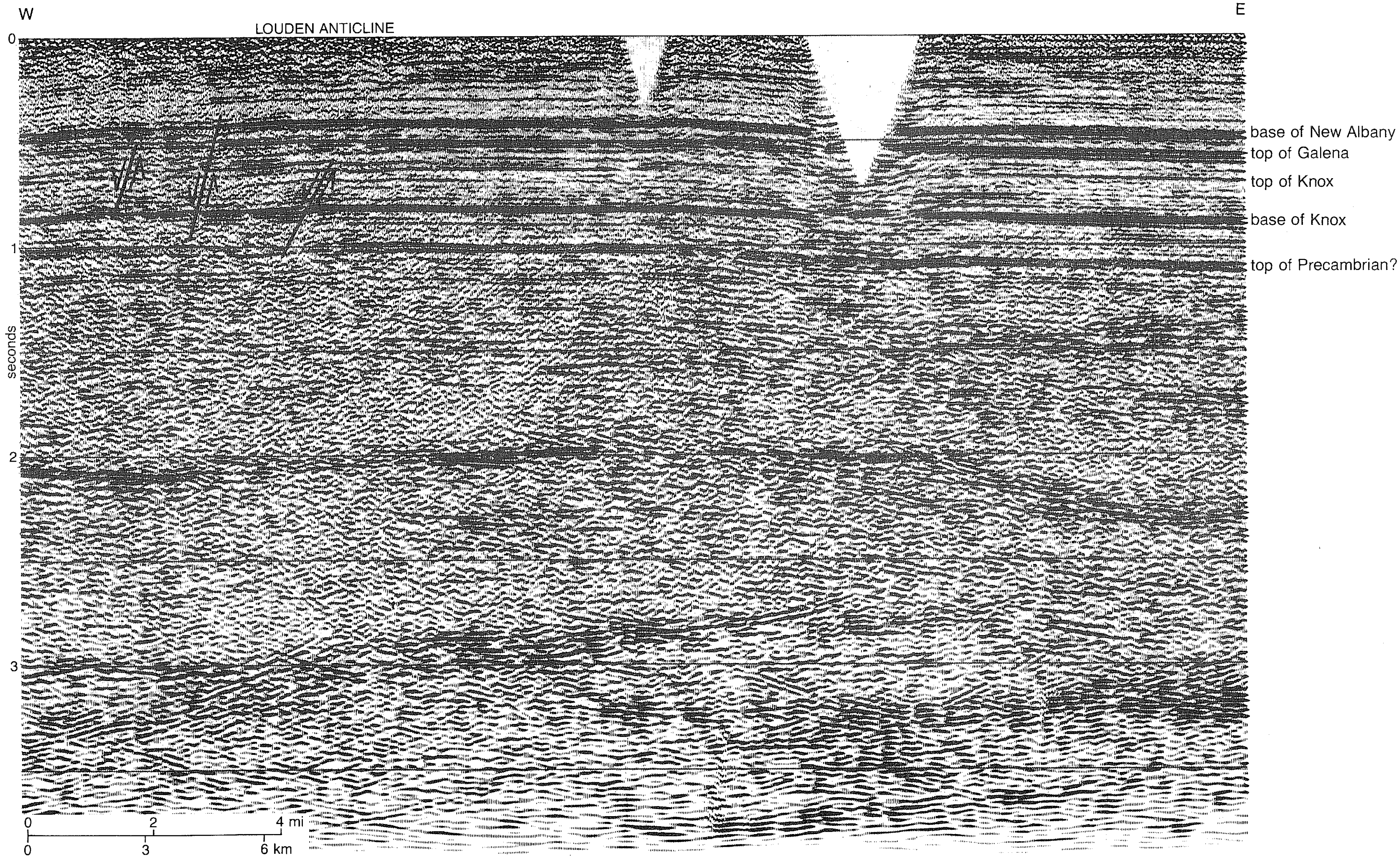


Figure 46 Seismic profile across the Louden Anticline. Faults are possibly present at depth on the west flank. Interpreted by Heigold and Oltz 1991. Note intra-basement reflectors (below 1.1 sec.).

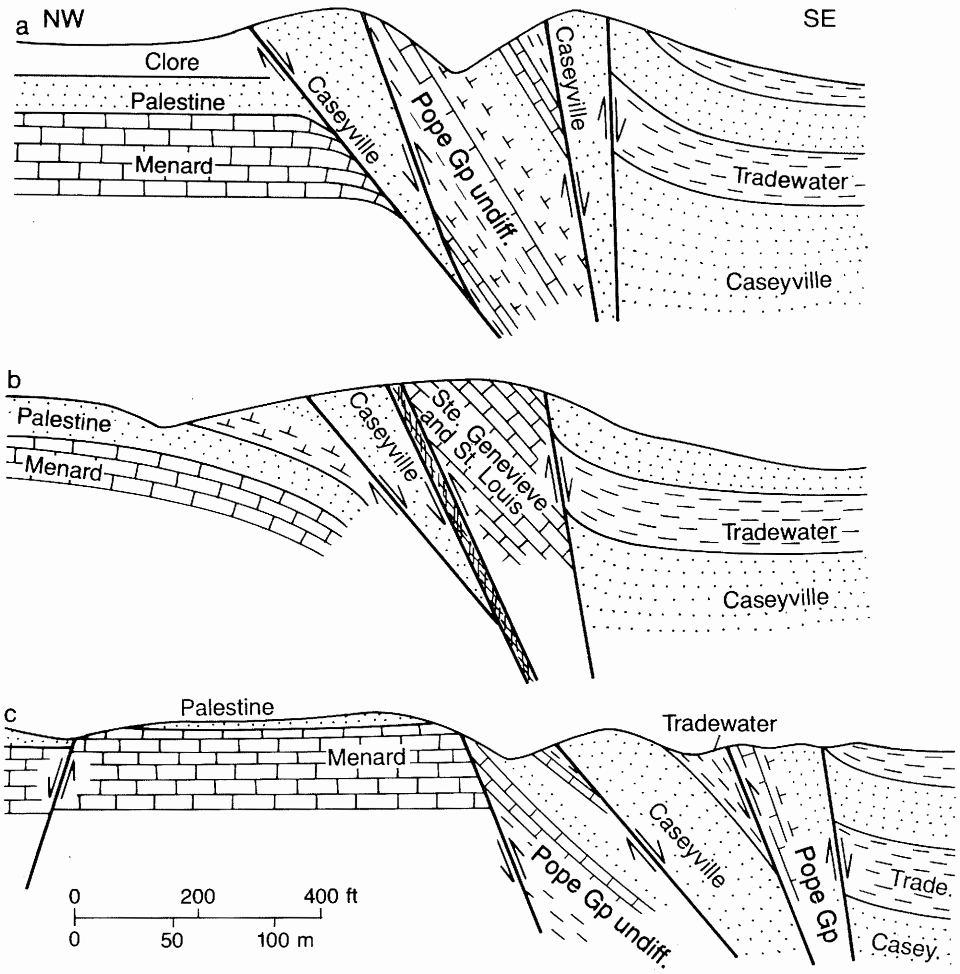


Figure 47 Cross sections of the Lusk Creek Fault Zone, northern Pope County. In all three sections the fault zone contains slices of Mississippian rocks, upthrown relative to rocks on both sides of the fault zone. Also, the fault zone contains downdropped slivers of Pennsylvanian strata. The fault zone is interpreted as having undergone two or more post-Mississippian episodes of dip-slip movement with opposite displacement. (a) Ora Scott Mine, S½ SE NW, Section 10, T12S, R6E. (b) Clay Diggings Mine, SW NE SE, Section 16, T12S, R6E. (c) SE NE, Section 20, T12S, R6E, and NW SW, Section 21, T12S, R6E. From Weibel et al. 1993.

LOWDER ANTICLINE (discarded)

Location Southwestern Sangamon County

References Easton 1942, Nelson 1987b

Easton's (1942) basis for defining this feature is unknown because he shows no control points near it on his contour map. The area has been remapped using several dozen borehole records that were not available to Easton (Nelson 1987b). These data indicate a structural depression where Easton showed an anticline; therefore, use of the name Lower Anticline should be discontinued.

LUSK CREEK FAULT ZONE

Fluorspar Area Fault Complex

Location From western Massac to northeastern Pope County (K-6, 7 and pl. 2)

References S. Weller and Krey 1939, J. Weller 1940, J. Weller et al. 1952, Heyl et al. 1965, Baxter et al. 1967, Kolata et al. 1981, Klasner 1982, Nelson 1986, Nelson and Lumm (1987), Nelson et al. 1991, Bertagne and Leising 1991, Weibel et al. 1993

The Lusk Creek Fault Zone marks the northwest boundary of the Fluorspar Area Fault Complex, and it is the northwesternmost structure along which fluorspar has been mined. The zone extends southwestward from the southern end of the Shawneetown Fault Zone in Section 25, T11S, R6E, Pope County, into western Massac County, where it disappears beneath the Quaternary alluvium. The northeastern continuation of the Lusk Creek Fault Zone is known as the Herod Fault Zone. The Lusk Creek Fault Zone forms the northwest margin of the Dixon Springs Graben.

The Lusk Creek Fault Zone is composed of subparallel, high-angle normal and reverse faults. Width of the fault zone varies from a few hundred feet to almost 1 mile (1.5 km). Cumulative displacement averages roughly 500 feet (150 m) down to the southeast, but local displacements on individual faults may be as great as 1,500 feet (450 m). The fault zone dips approximately 70° to the southeast near the surface.

The Lusk Creek Fault Zone appears to have undergone at least three major episodes of movement. The first was during

Early Cambrian time when the Reelfoot Rift developed. A seismic reflection profile (Bertagne and Leising 1991) indicates that this was an episode of normal faulting. The southeast side of the fault zone was downthrown, allowing thicker accumulation of sediment on the southeast. The second episode in late Pennsylvanian to Permian time was compressional and resulted in reverse faulting. The third episode (early Mesozoic?) was again normal faulting, which canceled the reverse movement. Slices of rock raised during reverse faulting have remained high within the fault zone at several places (fig. 47). The most striking example is at Clay Diggings (NE SE, Section 16, T12S, R6E) where a central slice of Ste. Genevieve Limestone is juxtaposed with upper Chesterian strata on the northwest and Pennsylvanian rocks on the southeast (Weibel et al. 1993). The final episode of normal faulting sharply dragged and tilted the layers down to the southeast all along the fault zone (fig. 48). The Dixon Springs Graben is a product of the last movement (Nelson 1986, Nelson et al. 1991, Weibel et al. 1993).

This inferred sequence of movement is the same as that proposed by Nelson and Lumm (1987) for the Shawneetown Fault Zone, which connects with the Lusk Creek Fault Zone.

Several small fluorspar mines operated within the Lusk Creek Fault Zone during the 1940s and earlier. Most of these worked at stratigraphic levels higher than those of the richest deposits farther southeast. Deeper exploration along the Lusk Creek Fault Zone might yield additional reserves.

See also DIXON SPRINGS GRABEN.

MACOUPIN DOME (discarded)

Location T9N, R8W, Macoupin County

References Lee 1915, Easton 1942

Lee (1915) defined the Macoupin Dome from subsurface mapping of the Herrin Coal Member (Pennsylvanian). Easton (1942) used more control points when he mapped the same horizon. Easton's contour map shows nosing, but no closure. Nelson's (1987b) map also indicates no dome in the area; therefore, use of the name should be discontinued.

MAIN STRUCTURE (discarded)

Location (H-8)

References Treworgy 1981

The anticline that Treworgy (1981) designated informally as the Main structure is renamed the Hardinville Anticline.

MAHOMET DOME
La Salle Anticlinorium

Location Northeastern Champaign County (E-7)

References Bell 1961, Heigold et al. 1964, Howard 1964, Buschbach and Bond 1974

This structure was delineated by test drilling and the Manlove gas storage field was established in the Cambrian Mt. Simon Sandstone. The Mahomet Dome is the largest area of closure along the Osman Monocline, which is an eastern branch of the La Salle Anticlinorium. Mapping of the top of the Mt. Simon (Buschbach and Bond 1974) indicates an irregular dome approximately 7 miles (11 km) from north to south and 6 miles (10 km) east to west. Maximum closure is more than 120 feet (37 m). The west flank is steep and the other limbs relatively gentle. A broad saddle separates the Mahomet Dome from the smaller Gibson City Dome to the north.

MAKANDA ANTICLINE (discarded)

Location Southeastern Jackson and southwestern Williamson Counties

References St. Clair 1917a, Lamar 1925

Using data from an outcrop study, St. Clair (1917a) mapped a fold near the village of Makanda and named it the Makanda Anticline. St. Clair indicated the anticlinal axis to be about 8 miles (13 km) long and trending slightly north of east. Remapping of the area by Lamar (1925) and Jacobson and Weibel (1993) showed that this structure does not exist. The Pennsylvanian sandstones that crop out near Makanda commonly exhibit irregular dips due to loading, differential compaction, and other nontectonic causes. Use of the name Makanda Anticline should be discarded.

MARISSA DOME

Location Southwestern, T3S, R6W, St. Clair County (I-4)

References Bell 1929a, Cady et al. 1940, Bristol 1974

The Marissa Dome was originally defined as a small area of closure mapped from subsurface data on the Herrin Coal Member. Mapping of the Beech Creek ("Barlow") Limestone (ISGS open files) indicates an irregular high that is elongated from north to south and has closure of about 40 feet (13 m).

MARSEILLES ANTICLINE (discarded)

Location La Salle and northwestern Grundy Counties

References Willman and Payne 1942

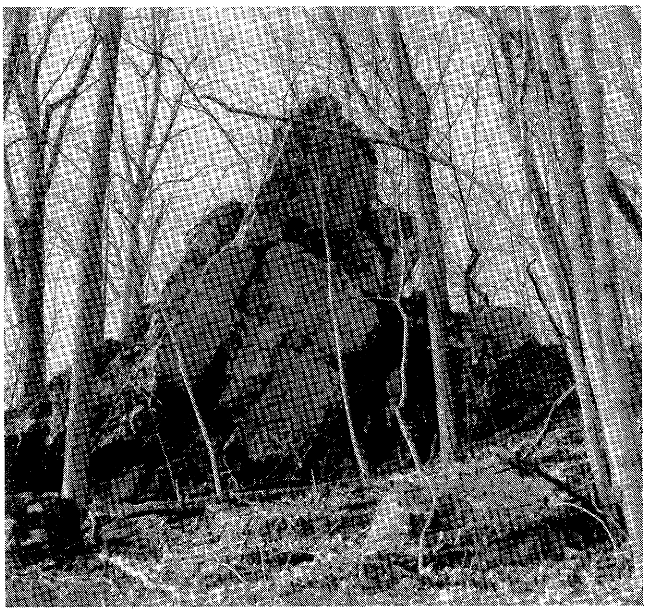


Figure 48 Steeply tilted lower Pennsylvanian sandstone on the southeast (downthrown) side of the Lusk Creek Fault Zone near Manson Ford, about 5 miles (8 km) northeast of Dixon Springs in Pope County. This tilting was a product of the last movement in the fault zone, an episode of normal faulting during which the southeast side was downthrown.

Willman and Payne (1942) used subsurface mapping of the Galesville Sandstone (Cambrian) to define the Marseilles Anticline. On their map the fold trends east-northeast and has maximum relief of about 100 feet (30 m). Finding no anticline on their map of the St. Peter Sandstone (Ordovician), Willman and Payne postulated that the Marseilles is a pre-St. Peter structure.

The subsurface structure map of the top of the Franconia Formation (Cambrian, slightly younger than the Galesville) (Kolata et al. 1983; fig. 17) shows a southeast homoclinal dip where Willman and Payne mapped the Marseilles Anticline. Considering that the data obtained by Kolata et al. were more numerous and better in quality than those available to Willman and Payne (1942), it is reasonable to assume that the Marseilles Anticline does not exist at any stratigraphic level and use of the name should be discontinued.

MARSHALL–SIDELL SYNCLINE

Location From central Crawford to northern Vermilion County (E, F, G-8)

References Mylius 1927, Moulton and Young 1928, Cady 1952, Potter 1956, Clegg 1965a, b, Stevenson and Whiting 1967

The Marshall–Sidell Syncline is an elongated, north-trending depression between the La Salle Anticlinorium and the east flank of the Illinois Basin. The syncline is marked by relatively steep but irregular dips on the west flank and gentle dips on the east flank. The syncline is closed off obliquely on the south and terminates against the Kankakee Arch on the north.

MARTINSVILLE ANTICLINE (new name)
La Salle Anticlinorium

Location Southwestern Clark County (G-8)

References Moulton 1926a, Mylius 1927, Moulton and Young 1928, Cohee 1941, Clegg 1965a, b, Bristol and Buschbach 1973, Stevenson et al. 1981

Although the structure is reflected on Bristol and Buschbach's (1973) map of the Galena Group and the Stevenson et al. (1981) map of the New Albany Group, the most detail of the Martinsville Anticline was presented by Clegg (1965b), who mapped three Pennsylvanian coals. Clegg's maps of the Colchester, Herrin, and Danville Coal Members all show similar configurations. The structure has been called a dome, but it is better described as an anticline with a slightly sinuous north-south axis. In cross sectional view, it is an asymmetrical box fold. The steep east limb, shared with the Marshall–Sidell Syncline, has 425 to 500 feet (130–150 m) of relief. The west limb is also steep and shows 200 to 300 feet (60–90 m) of relief. The crest or axial zone is 1.5 to 2.5 miles (0.8–4 km) wide and carries several small irregular domes and depressions. The Martinsville structure narrows and plunges to the south, whereas it merges with the larger Westfield Dome to the north. Significant reservoirs in Pennsylvanian, Valmeyeran, Devonian, and Galena (Trenton) strata have been exploited during its productive, 80-year history. The name should be changed from Martinsville Dome to Martinsville Anticline.

MASON ANTICLINE (discarded)

Location T6N, R5E, Effingham County

References Newton 1941

The structure, which was mapped as an east-trending nose with small closure, was defined by a single control point. Newer maps based on more and better data show that the Mason North Oil Field is located along the north-trending Iola Anticline. The use of the name Mason Anticline should be discontinued.

MATTOON ANTICLINE

Location Northwestern Cumberland and western Coles Counties (F, G-7)

References Clegg 1959, 1965b

Clegg (1959) used borehole data on the Herrin and Danville Coal Members (Pennsylvanian) to define the Mattoon Anticline. The structure extends to all deeper mapped horizons, including the Beech Creek ("Barlow") Limestone (ISGS open files), the Ste. Genevieve Limestone (Bristol and Howard 1976), the New Albany Group (Stevenson et al. 1981), and the Galena (Trenton) Group (Bristol and Buschbach 1973). Proprietary seismic-reflection data confirm that strata down to at least Upper Cambrian are folded. The Mattoon Anticline has a gently curved axis that trends slightly east of north. On the south, the fold plunges and dies out; northward, an offset saddle separates the Mattoon Anticline from the Cooks Mills Anticline. The Mattoon Anticline has closure of 60 to 70 feet (18–21 m) on the Pennsylvanian coals and similar relief (not precisely defined) at deeper horizons. The west limb is steeper than the east one.

The Mattoon Anticline is not generally considered to be part of the La Salle Anticlinorium, although its form and position suggest a genetic relationship.

The Mattoon Oil and Gas Field is developed along the anticline. The field has yielded nearly 22 million barrels of oil, principally from Cypress Sandstone and Ste. Genevieve Limestone reservoirs. Eleven billion cubic feet of gas from Devonian strata have also been produced. Mattoon field has been the largest commercial gas producer in Illinois.

MAUNIE FAULT ZONE (new name)
Wabash Valley Fault System

Location Northeasternmost Gallatin and eastern White Counties (I-7, 8; J-7)

References Harrison 1951, Pullen 1951, Bristol 1975, Bristol and Treworgy 1979

This structure has been labeled the "Maunie Fault," but was mapped as a narrow zone of subparallel, overlapping and bifurcating, high-angle normal faults. The fractures trend north-northeast, and the major displacements are down to the west as much as 175 feet (53 m). Near its southern end, the Maunie Fault Zone splinters upward through the Pennsylvanian strata. The Maunie Fault should be renamed the Maunie Fault Zone.

McCLURE ANTICLINAL NOSE (discarded)

Location Northwestern Alexander County

References J. Weller 1940

J. Weller (1940) reported a southeast-plunging anticlinal nose in the Mississippi River bluffs east of the village of McClure. His geologic map indicates that Silurian rocks come to the surface at the crest of the structure in Section 12, T14S, R3W, and that uppermost Silurian–Lower Devonian Bailey Lime-

Figure 49 Dip slope on the Pounds Sandstone Member, Caseyville Formation, dipping southeast on the flank of the McCormick Anticline, NE SE NW, Section 7, T11S, R6E, Pope County.

stone crops out on the flanks. Remapping of the McClure Quadrangle (Devera et al. 1994) confirms the presence of a structural high in the area indicated by J. Weller. This high brings the Sexton Creek Limestone, St. Clair Limestone, and Moccasin Springs Formation (all Silurian) into view along the Mississippi River bluffs for a lateral distance of about 1.5 miles (2 km). These formations are overlain by the Bailey Limestone (Silurian–Devonian) and dip beneath Quaternary alluvium to the north and south. The high point of the structure is north of the mouth of Dongola Hollow near the center of Section 12. The base of the Bailey here is about 100 feet (30 m) above the floodplain. A small northwest-trending fault has been mapped near the apex. Dips on the flanks are 1° to 3°. No fold axis is apparent.

The northwest part of the McClure structure is concealed by alluvium and no subsurface data are available. This could be either the nose or the flank of the anticline or dome. Pending better definition, the feature should be unnamed.

McCORMICK ANTICLINE

Location Eastern Johnson and northern Pope Counties (J, K-6 and pl. 2)

References Brokaw 1917, J. Weller 1940, Stonehouse and Wilson 1955, Potter 1957, Heyl et al. 1965, Jacobson and Trask 1983, Nelson et al. 1991, Nelson 1991

The structure was first identified as an anticline and later shown to be faulted. It is defined by surface mapping, and several oil tests (all dry) were drilled on it. Recent, detailed surface mapping and seismic data add many details and suggest new interpretations of its origin.

The McCormick Anticline strikes northeastward in Johnson County and gradually curves to an east-west trend in northern Pope County. It reaches maximum relief of more than 700 feet (229 m) in Section 11, T11S, R5E, where small exposures of Kinkaid Limestone (Mississippian) are found at the crest. The surface rocks along the anticline are of Pennsylvanian age elsewhere. The north or northwest limb is steep and commonly has dips in excess of 30°. Dips on the southeast limb typically are gentle (fig. 49), less than 10°, although steeper dips have been measured in the vicinity of faults. The anticline plunges irregularly eastward and appears to die out as it approaches the Shawneetown Fault Zone. Southwestward in Johnson County, the fold appears to gradually die out, but faulting continues for several miles beyond.

The discontinuous faults mapped at the surface do not run the length of the anticline. Toward the east end of the structure, most faults strike east-northeast, slightly oblique to the fold axis. Westward the faults gradually change to northeastward strike, then almost north to south in southern Johnson County. The southeast side is downthrown on most faults, and displacements range from a few feet to more than 100 feet (30 m). Most faults apparently are high-angle normal. Potter (1957) reported low-angle thrust faults and large-scale sedimentary breccia in lower Pennsylvanian strata exposed in railroad cuts through the anticline in Sections 19 and 31, T11S, R5E. He interpreted these as evidence of large-scale slumping off the flanks of a structure that was rising during early Pennsylvanian sedimentation. Jacobson and Trask (1983) reported northwest-trending strike-slip faults, apparently offsetting northeast-striking faults in Johnson County. Continued study confirms the presence of strike-slip faults, but displacements greater than a few feet cannot be verified (Nelson et al. 1991).

A proprietary seismic reflection profile indicates that the McCormick and New Burnside Anticlines are "thin skinned" folds that do not involve basement. Reflectors near the surface are folded, but no folding was detectable on reflectors from Ordovician and deeper levels. The seismic profile also indicated reverse faults that dip southward and flatten with depth on both anticlines. These features suggest that compression from the southeast was transmitted along one or more

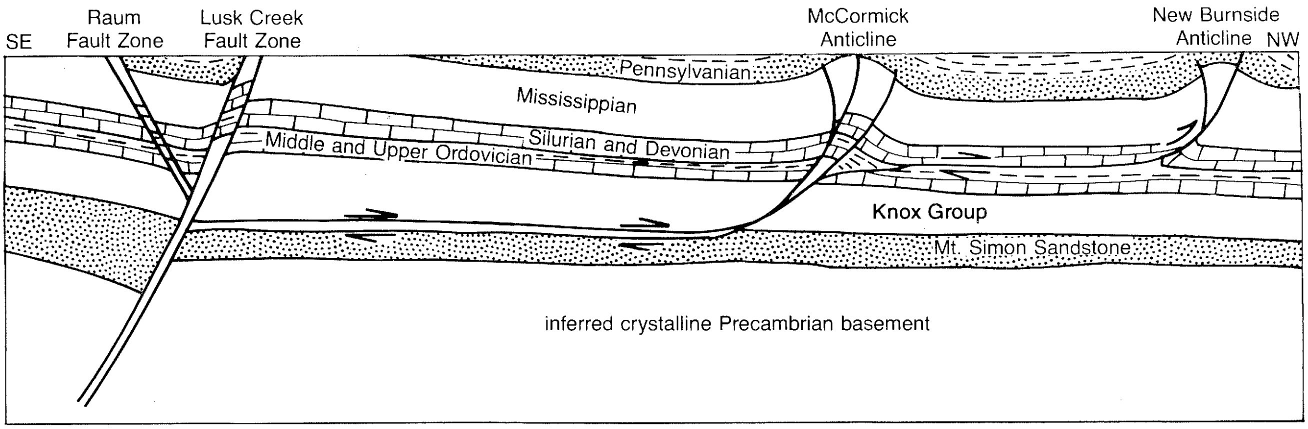


Figure 50 Interpreted relationships of the Lusk Creek and Raum Fault Zones to the McCormick and New Burnside Anticlines. This section is based on a seismic reflection profile. Not to scale.

décollements in the middle of the sedimentary succession and produced the anticlines (fig. 50).

It has been postulated (Nelson 1987a, 1991) that the anticline developed under northwestward-directed compression during the late Paleozoic, and that normal faults formed during early Mesozoic extension.

See also NEW BURNSIDE ANTICLINE.

McWADE FAULT (discarded)
Fluorspar Area Fault Complex

Location Hardin County

References Schwerin 1928, Currier and Hubbert 1944

Schwerin (1928) described the McWade Fault as branching eastward off the Peters Creek Fault Zone north of Cave in Rock, then turning northward and rejoining the Peters Creek. Currier and Hubbert (1944, p. 28) remapped the area and could not confirm the existence of the McWade Fault. Baxter et al. (1963) again mapped the area and did not mention or indicate the McWade Fault; therefore, the name McWade Fault should not be used.

MEDIA ANTICLINE

Location T9N, R4 and 5W, Henderson County (D-2)

References Bell and Workman 1928, Electric Power Research Institute (EPRI) 1982

Bell and Workman (1928) defined an anticline near the town of Media by mapping the base of the Burlington Limestone (Mississippian) from outcrop and well data. Their map shows the anticline trending west-northwest and having two areas of closure separated by a saddle. Maximum closure is about 60 feet (18 m), and total relief on the structure is 80 to 110 feet (24–34 m) on the base of the Burlington. Bell and Workman reported oil and gas in wells and natural seeps along the anticline; they recommended the area for further prospecting.

From 1973 to 1974, Northern Illinois Gas Company extensively drilled the Media Anticline and conducted seismic and gravity surveys to evaluate the structure as a gas storage reservoir. Their findings were summarized by EPRI (1982) and logs of their test holes are on file at the ISGS. These data permit interpretation of the time and manner of origin of the Media Anticline.

A structure map of the top of the Galena (Trenton) Group (fig. 51) reveals considerably greater relief on that horizon than at the base of the Burlington. The anticline has a steep north flank on the Galena; the Galena drops 300 feet (90 m) within a horizontal distance of about 3,000 feet (900 m). Closure is at least 90 feet (27 m). The highest point on the Galena is located about 1 mile (1.6 km) northwest of the highest point on the Burlington, as shown by Bell and Workman (1928). The reduction in relief is due to thinning of the New Albany Shale (Upper Devonian and Kinderhookian) across the crest of the fold (figs. 51, 52). The New Albany is reduced from about 250 feet (75 m) in thickness north of the anticline to less than 40 feet (12 m) on the crest. Other mappable intervals between top of Galena and base of Burlington do not change in thickness appreciably across the anticline. Thus, the major uplift of the Media Anticline can be dated to the Late Devonian Epoch and/or the Kinderhookian Epoch, with additional lesser movement after deposition of the Burlington.

Northern Illinois Gas Company drilled numerous test holes to the Cambrian Galesville Sandstone; several wells reached the Mt. Simon Sandstone. A structure map of the top of the Galesville (EPRI 1982) shows a configuration similar to that on the Galena, and its maximum relief is about 400 feet (120 m). Seismic and gravity surveys indicate a steeply dipping fault with the north side downthrown roughly 150 feet (45 m) just north of the steepest dips on the north limb of the anticline. The fault offsets Cambrian rocks but dies out upward into the Ordovician. The Media Anticline is thus one of the clearest examples in Illinois of a fold controlled by faulting at depth.

Regional mapping of structure on the Galena Group (Bristol and Buschbach 1973) shows that the Media Anticline lies along a structural ridge that extends southeastward into central McDonough County. Westward, the Media Anticline may line up with the Burlington Anticline in Iowa. The Burlington Anticline is one of several northwest-trending anticlines that have been mapped in southeastern Iowa. Harris and Parker (1964) showed that the lower Valmeyeran Series (Burlington, Keokuk, and Warsaw Formations) thins markedly across the crests of all of these anticlines, thickens into the intervening synclines, and thus provides additional evidence for structural movements during Mississippian sedimentation.

See also MISSISSIPPI RIVER ARCH.

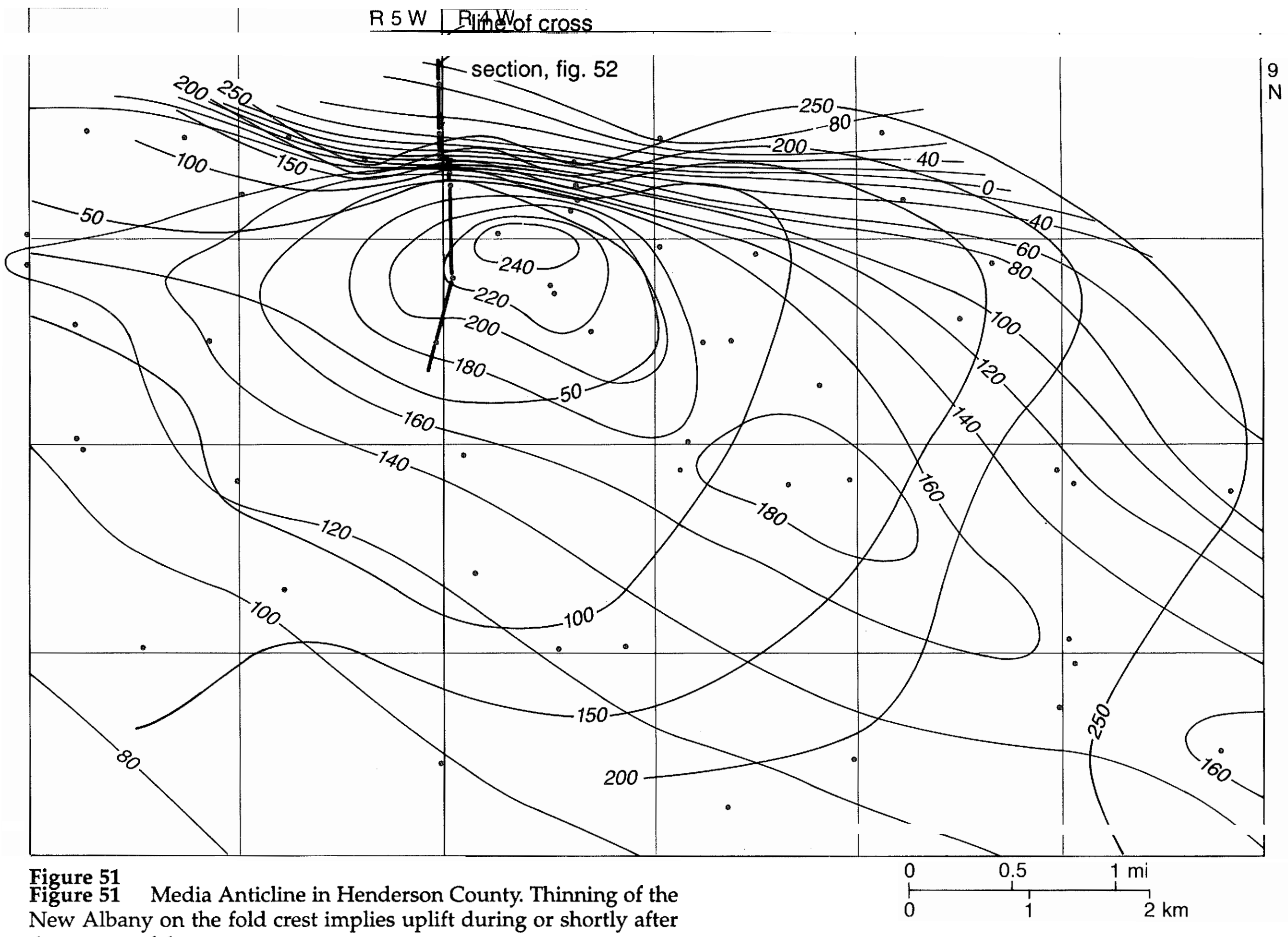


Figure 51
Figure 51 Media Anticline in Henderson County. Thinning of the New Albany on the fold crest implies uplift during or shortly after deposition of the unit.

structure (ft), top of Galena Group
thickness (ft) of New Albany Shale
control well

MENDOTA ANTICLINE (discarded)

Location Northwestern La Salle and southeastern De Kalb Counties

References Willman and Payne 1942

Using widely scattered borehole data, Willman and Payne (1942) mapped the Mendota Anticline trending east-northeast. They interpreted it as a pre-Middle Ordovician structure because Cambrian strata were folded but the St. Peter Sandstone was not. A structure map of the Franconia Formation (Cambrian) by Kolata et al. (1983; fig 17) shows only a subtle east-trending anticlinal nose in northern La Salle County. Kolata et al. (1983) had considerably better data than Willman and Payne. Hence, the Mendota Anticline is, at best, a minor inflection of contour lines and use of the name should be discontinued.

MEPPEN SYNCLINE

Cap au Grès Faulted Flexure

Location T11S, R2W, Calhoun County (G-2)

References Rubey 1952, Collinson et al. 1954, Collinson 1957, Treworgy 1979a

The Meppen Syncline is a shallow trough bordering a saddle along the Lincoln Anticline, a few miles north of the Cap au Grès Faulted Flexure. It is approximately 4 miles (6 km) long and 2 miles (3 km) wide, and its axis runs east to west.

METROPOLIS DEPRESSION (discarded)

Location Southern Illinois, westernmost Kentucky and vicinity

References Rogers 1972, Nelson and Lumm 1985

Rogers (1972) proposed the name Metropolis Depression for an inferred basin or depocenter that existed during the Silurian Period and Early Devonian Epoch. The Metropolis Depression is essentially the same as the Vincennes Basin of Droste et al. (1975) and later researchers. Although the name Metropolis Depression has priority, Vincennes Basin has been more widely accepted and published; therefore, use of the name Metropolis Depression should be discontinued.

MILETUS DOME (new)

Location T4N, R4E, Marion County (H-6)

References None

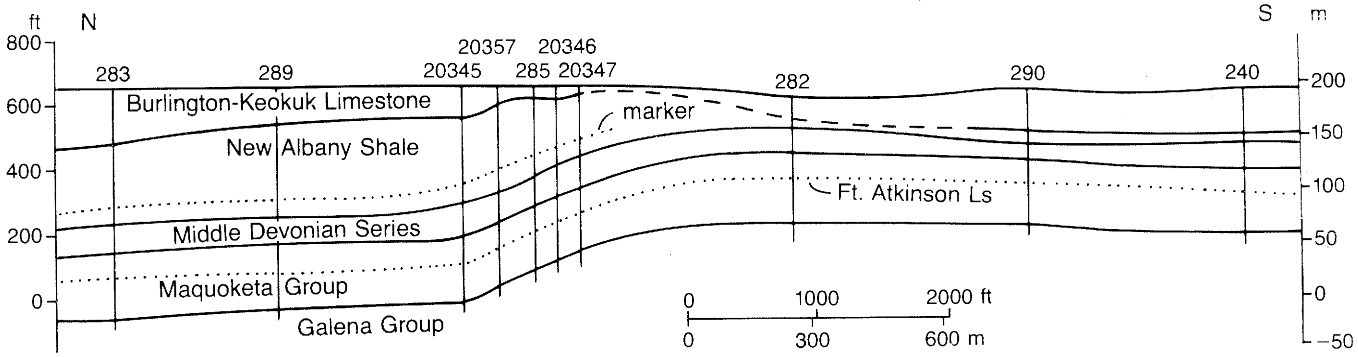


Figure 52 Cross section of the Media Anticline, Henderson County. Wells are designated by ISGS county number. See figure 51 for location.

The dome that provides the structural trap for the Miletus Oil Field, east of Kinmundy in northeastern Marion County, is named the Miletus Dome. As mapped on the Beech Creek ("Barlow") Limestone (ISGS open files), the Miletus Dome is pear-shaped in plan view, and the long axis runs north to south. The dimensions are 1.2 by 1.7 miles (2.0 × 2.8 km) and closure is approximately 40 feet (12 m). Doming also has been mapped on the Ste. Genevieve Limestone (Bristol and Howard 1976), on the base of the New Albany Group (Stevenson et al. 1981), and on top of the Galena Group (Bristol and Buschbach 1973). The dome lies on a south-plunging anticlinal nose in a region of east-southeast dip. The Miletus Oil Field has produced about 381,000 barrels from the Yankeetown ("Benoist") and Aux Vases Sandstones, and from a Ste. Genevieve ("McClosky") Limestone oolite bar (R. Howard, ISGS, personal communication 1989).

MILLBRIG SYNCLINE
Upper Mississippi Valley Zinc–Lead District

Location Section 28, T29N, R1E, and vicinity, Jo Daviess County (A-3)

References Shaw and Trowbridge 1916, Willman and Reynolds 1947

The Millbrig Syncline is a very minor and poorly delineated downwarp that trends northeast, in common with other synclines of the district. It would not be named, except it has been shown that synclines in this district have been important in localizing mineralization (fig. 53).

MILLSTADT ANTICLINE (discarded)

Location T1S, R9W, St. Clair County

References Bell 1941

The Millstadt Anticline was defined as a small structural high mapped on the Herrin Coal Member (Pennsylvanian). The feature is poorly shown on Bell's (1941) map and lies along the outcrop of the coal. No subsequent study confirms the presence of an anticline here; therefore, the name should be discarded.

MINICK ANTICLINE
La Salle Anticlinorium

Location Southeastern Lee County (B-5)

References Willman and Payne 1942, Kolata et al. 1983

The name Minick Anticline was applied to a sharp southwest-trending nose on the flank of the Peru Monocline (new). The structure was mapped by Willman and Payne (1942) in subsurface on various Cambrian and Ordovician horizons. A structure map of the Franconia Formation (Kolata et al. 1983) confirms the existence of this feature.

MINK ISLAND FAULT (discarded)
Wabash Valley Fault System

Location T4 and 5S, R14W, White County

References Harrison 1951

Harrison (1951) defined the Mink Island Fault on the basis of limited borehole data for White County. Using more control points, Bristol and Treworgy (1979) remapped the Wabash Valley Fault System. On their map the Mink Island Fault loses its identity as part of the New Harmony Fault Zone; thus, use of the name Mink Island should be discontinued.

MISSISSIPPI EMBAYMENT

Location Southernmost Illinois and southward along Mississippi Valley (fig. 1)

Selected references Pryor and Ross 1962, Ross 1963, 1964, Kolata et al. 1981

The Mississippi Embayment is a northward extension of the Gulf Coastal Plain. It is a broad synclinal trough filled with Mesozoic and Cenozoic sedimentary rocks. In southernmost Illinois the Embayment contains poorly lithified Upper Cretaceous, Paleocene, and Eocene strata that unconformably overlie Paleozoic sedimentary rocks and unconformably underlie the Pliocene–Pleistocene Mounds Gravel and Quaternary alluvium. The limit of the Embayment is generally drawn at the north edge of the Cretaceous rocks.

The Reelfoot Rift, a Cambrian fault-bounded trough, was ancestral to the Mississippi Embayment. Faults in the Reelfoot Rift have been reactivated periodically throughout Phanerozoic time. In late Paleozoic or early Mesozoic time uplift occurred along the axis of the rift, and a large domal uplift called the Pascola Arch developed. The Pascola Arch was beveled by erosion prior to Late Cretaceous time, when the northern Mississippi Embayment began to subside. The Cretaceous Tuscaloosa Gravel overlies beveled Paleozoic rocks with angular unconformity at the site of the Pascola Arch.

Tectonic activity took place throughout the Tertiary Period in the northern Mississippi Embayment and continues today. Post-Cretaceous faulting was documented in parts of western

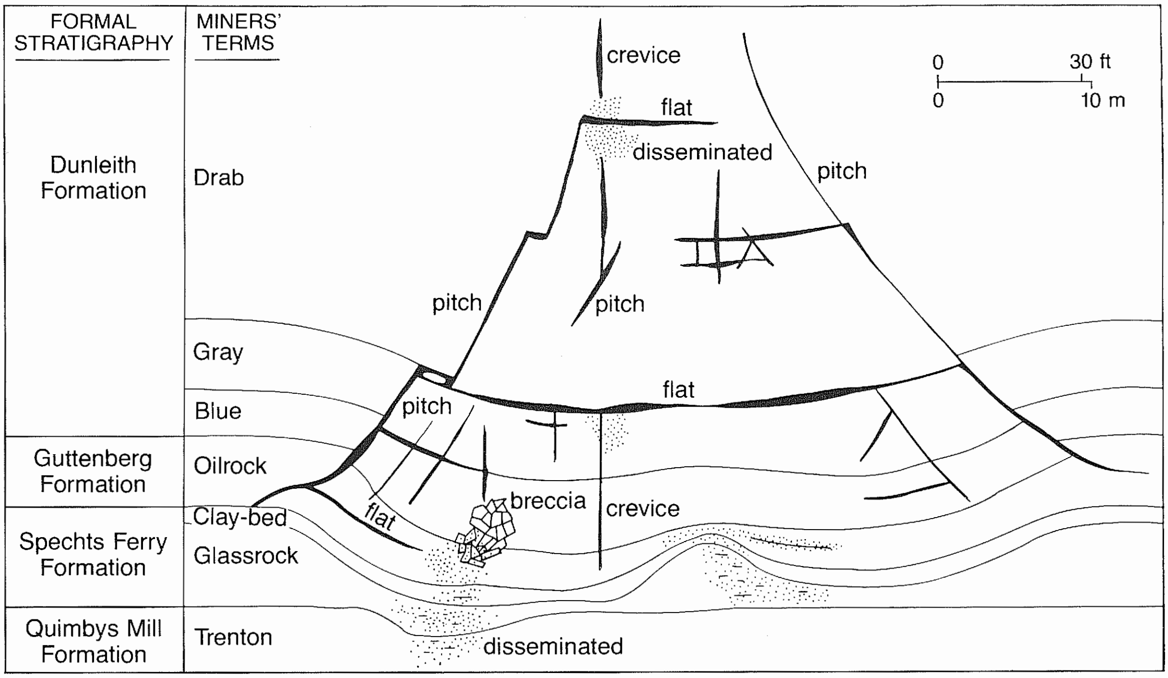


Figure 53 Typical ore deposits of the Upper Mississippi Valley Zinc–Lead District. Pitch-and-flat deposits occur at lower levels, whereas crevice (gash vein) ores occur mainly at higher levels. After Willman et al. 1946.

Kentucky (Rhoades and Mistler 1941, Amos 1967, Amos and Finch 1968) and southeastern Missouri (Grohskopf 1955, McCracken 1971, W. Johnson 1985) immediately adjacent to Illinois. Kolata et al. (1981) disputed Ross's (1963) claims of post-Cretaceous tectonism in southernmost Illinois; but recent mapping has vindicated Ross. Tectonic faults that displace units ranging from the Tuscaloosa Gravel to the Mounds Gravel occur in the Thebes area (Harrison and Schultz 1992, Nelson and Harrison 1993), the Jonesboro–Mill Creek area (Nelson and Devera 1994, Devera et al. 1994), and in the southern Dixon Springs Graben (W.J. Nelson, ISGS, unpublished mapping).

The New Madrid Seismic Zone, which begins near Cairo, Illinois, and extends southwest, is the most active earthquake region in the central United States. Faults inherited from the Reelfoot Rift are being reactivated under contemporary tectonic stress in the New Madrid Seismic Zone. The principal compressive stress in the New Madrid area is oriented from east–west to east-northeast to west-southwest, and the principal active faults strike northeast and are undergoing right-lateral slip. Some faults that were active during the Tertiary in southernmost Illinois exhibit the same trend and slip (Nelson and Harrison 1993). As of 1993, no Quaternary displacements have been demonstrated along faults in the Mississippi Embayment in Illinois.

MISSISSIPPI RIVER ARCH

Location Along the Mississippi River in southeastern Iowa, northwestern Illinois, and northeastern Missouri (fig. 1)

References Howell 1935, Wilson 1939, Lee 1943, Bell et al. 1964, Edmund and Anderson 1967, Atherton 1971, Bunker et al. 1985

The name Mississippi River Arch has been applied rather vaguely and loosely to the structural divide between the Illinois and Forest City Basins. Bunker et al. (1985) advocated that the term Mississippi River Arch be restricted to the present arch that developed after the Morrowan (early Pennsylvanian) Epoch. A basin existed astride the position of the arch in the Quad Cities area during the Morrowan Epoch, and sediments (Caseyville Formation) were deposited. An earlier arch existed in the same general area and was beveled by the sub-Kaskaskia (pre-middle Devonian) unconformity. Bunker (1981) proposed the name Northeast Missouri Arch for the pre-Kaskaskia structure, the axis of which lay somewhat west of the post-Morrowan Mississippi River Arch. The recommendations of Bunker are accepted here.

MODESTO ANTICLINE (discarded)

Location Northern Macoupin County

References Easton 1942, Ball 1952

A subtle east-trending anticlinal nose was mapped on the basis of sparse subsurface data from the Herrin Coal Member. Abundant, newly available well records indicate that an anticline is indeed present in the Herrin Coal in the northeast part of T12N, R7W (Nelson 1987b). The long axis of the fold trends northeastward and closure is about 30 feet (9 m). The anticline that I mapped differs substantially in trend and extent from the Modesto Anticline of Easton (1941) and Ball (1952). No anticline is evident on any mapped horizons below the Herrin Coal Member. The high on the coal, like most such features in west-central Illinois, is probably a product of differential compaction of the Pennsylvanian rocks that contain numerous sandstone lenses. I do not regard such minor nontectonic structures worthy of naming.

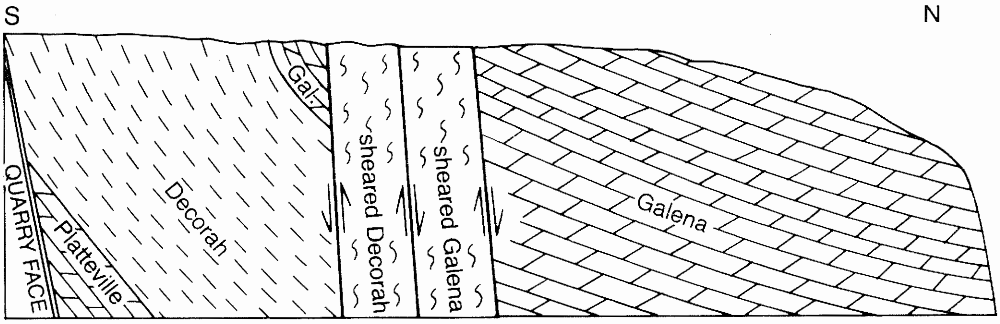


Figure 54 The Mud Creek Fault Zone exposed in a quarry wall, Section 30, T24N, R10E, Ogle County. The zone consists of parallel high-angle normal and reverse faults, with net displacement and last movement down to the north. The structure is similar to that of the Lusk Creek Fault Zone (fig. 47). Steepening of the dip of beds near the top of the quarry wall south of the fault zone is due to hillside creep. After Templeton and Willman 1952.

MONROE CITY SYNCLINE

Location Southern Monroe County (I-3)

References S. Weller and J. Weller 1939, Bristol and Buschbach 1973

The Monroe City Syncline flanks the Valmeyer Anticline on the southwest. As shown on Bristol and Buschbach's (1973) map of the Galena (Trenton) Group, the syncline is open to the southwest. Relief from the trough of the syncline to the crests of adjacent anticlines is more than 200 feet (60 m).

MOORMAN SYNCLINE

Location Southeastern Illinois and western Kentucky (fig. 1)

References Hager 1949, Swann and Bell 1958, Smith and Palmer 1974, Schwalb 1979, Nelson and Lumm 1987

The origin of the name Moorman Syncline is obscure. Swann and Bell (1958) probably were not the first to use the term, but they did not cite earlier usage. Hager (1949) referred to the feature as the Kentucky Basin. Considering the regional extent of the structure, Moorman Basin might be a more appropriate name than Moorman Syncline, but the latter name is solidly established by common usage.

The Moorman Syncline lies south of and trends almost parallel with the Rough Creek–Shawneetown Fault System. The north flank is defined by strata sharply upturned against the south side of the Rough Creek–Shawneetown Fault System. The south limb corresponds with the gentle north flank of the Nashville Dome. The syncline terminates eastward against the Cincinnati Arch, whereas it is pinched out on the west between Hicks Dome and the southwest-trending segment of the Shawneetown Fault Zone. The narrow western end of the trough in Illinois is commonly called the Eagle Valley Syncline.

The Moorman Syncline actually is a sub-basin within the Illinois Basin and comparable with the Fairfield Basin. Both structures are bounded partly by sedimentary shelves or arches and partly by post-Pennsylvanian fault zones or monoclines. No separation existed between the Fairfield Basin and Moorman Syncline prior to late Pennsylvanian–Permian uplift along the Rough Creek–Shawneetown Fault System. Development of the Moorman Syncline in its present form apparently resulted from subsidence and collapse of the block south of the fault system, probably in the Mesozoic Era (Nelson and Lumm 1987).

The Moorman Syncline overlies the Rough Creek Graben, a Cambrian fault-bounded trough. The syncline contains the thickest (as much as 25,000 feet of Paleozoic sediment, according to estimates from seismic data) and most complete sedimentary succession in the Illinois Basin. This succession includes the oldest rocks that are approximately 8,000 feet (2,400 m) of pre-Mt. Simon strata. It also includes the youngest Paleozoic rocks, Lower Permian, identified in a core in western Kentucky (Kehn et al. 1982).

MORRIS SYNCLINE (discarded)

Location Grundy County

References Willman and Payne 1942

Willman and Payne (1942) gave the name Morris Syncline to a structural depression that trends south-southeast and was mapped from sparse borehole data. About 50 feet (15 m) of structural relief was indicated. Willman and Payne interpreted the feature as having formed before deposition of St. Peter Sandstone (Ordovician) and not affecting younger strata. Mapping of the Cambrian Franconia Formation by Kolata et al. (1983) shows no syncline in this area, as indicated by Willman and Payne (1942). In fact, the northern end of this "syncline" corresponds with a dome on the map of Kolata et al. 1983; therefore, use of the name should be discontinued.

MT. CARMEL FAULT and MT. CARMEL–NEW HARMONY FAULT see NEW HARMONY FAULT ZONE (new name)

MUD CREEK FAULT ZONE (new name)
Sandwich Fault Zone

Location T24N, R9 and 10E, Ogle County (A-5)

References Templeton and Willman 1952, Kolata et al. 1978, Kolata et al. 1983

Templeton and Willman (1952) described and illustrated the Mud Creek Fault in a quarry in Section 30, T24N, R10E. Their illustrations of the structure indicated several faults, therefore, the feature should be called a fault zone. Kolata et al. (1978) mentioned the faults in the quarry and also mapped several more faults in T24N, R9 and 10E. These newly discovered faults were mapped on the basis of outcrop data.

Templeton and Willman (1952) illustrated a sharp flexure cut by steep faults and downthrown on the north side (fig. 54). Displacement observable within the quarry is 100 feet (30 m); overall displacement undoubtedly is greater, because rocks at both ends of the exposure dip steeply. Most of the faults are normal. Reverse movement is indicated on the south fault (fig. 54). Along this fault a narrow slice of sheared shale of the Decorah Subgroup is upthrown relative to dolomite of the Galena Group on either side. Templeton and Willman (1952) mentioned open horizontal tension cracks and evidence for bedding-plane slippage within the quarry.

The Mud Creek Fault Zone lies on the northeast flank of the Oregon Anticline near its northwestern end. The Oregon Anticline is immediately northeast of the Sandwich Fault Zone. If projected northwestward, the Mud Creek Fault Zone would intersect the Plum River Fault Zone. Structural relationships in this area are poorly known because of the scarcity of outcrops and well data.

MURDOCK SYNCLINE

La Salle Anticlinorium

Location Northeastern Douglas to eastern Coles County (F, G-7)

References Clegg 1959, 1965a, b, Bristol and Prescott 1968

The Murdock Syncline is within the La Salle Anticlinorium and separates the Tuscola Anticline on the west from the Brocton and Ashmore Domes on the east. The syncline trends north to south and is present at all mapped horizons. It is open on the south and plunges obliquely down the steep west flank of the La Salle Anticlinorium. Clegg mapped minor enclosed depressions on Pennsylvanian horizons near the north end of the syncline. Clegg's contour interval was 25 feet (7.6 m), but other maps that have larger contour intervals do not indicate closure. The limbs of the syncline dip gently at the north end and become steeper southward.

NEGRO SPRING FAULT see LAWLER FAULT

NEW BURNSIDE ANTICLINE

Location From T11S, R3E, Johnson County, to T10S, R6E, Saline County (J-6 and pl. 2)

References Brokaw 1917, J. Weller 1940, Stonehouse and Wilson 1955, Heyl et al. 1965, Jacobson and Trask 1983, Nelson 1987a, Nelson et al. 1991

The New Burnside Anticline, as originally defined by Brokaw (1917), lies in northeastern Johnson County. J. Weller (1940) defined the Stonefort Anticline in Pope County. Recent mapping (Nelson et al. 1991) demonstrates that the New Burnside Anticline connects eastward with the Stonefort Anticline. A single name, rather than two or more separate names, should be applied to this continuous structural feature. Because the name New Burnside has priority, the term New Burnside Anticline is applied to the entire feature, and the name Stonefort Anticline is discarded.

The New Burnside Anticline lies northwest of and trends parallel to the McCormick Anticline. The New Burnside and McCormick structures are similar in geometry, although the New Burnside has gentler dips and less relief. The New Burnside Anticline has as much as 200 feet (60 m) of structural relief in Saline County and possibly more than 300 feet (90 m) in northeastern Johnson County. The fold is asymmetrical; the northwest limb is steeper than the southeast flank and has greater relief. Strata on the northwest limb commonly dip 15° to 25°, but dips greater than 5° are unusual on the southeast flank except next to faults.

A broad saddle separates the previously named Stonefort and New Burnside Anticlines about 1 mile (1.6 km) east of the common corner of Johnson, Pope, Saline, and Williamson Counties. In the saddle a railroad cut along the Illinois Central Railroad shows the structure to be a monocline that has local flexures and small normal faults on the north-dipping flank.

Discontinuous faults occur along the anticline and extend beyond both ends. High-angle normal faults, striking to the northeast, predominate (fig. 55). In Saline County, they splay outward to the northeast and are en echelon to the fold axis. In central Johnson County where the anticline dies out, the faults curve southward, as do those of the McCormick Anticline.

A proprietary seismic reflection profile suggests that the New Burnside Anticline, like the McCormick Anticline, is a thin-skinned anticline detached from basement. Ordovician and younger reflectors are folded on the seismic profile and older ones are not. Thrust faults that flatten downward are also indicated on both anticlines. Compressional stress that

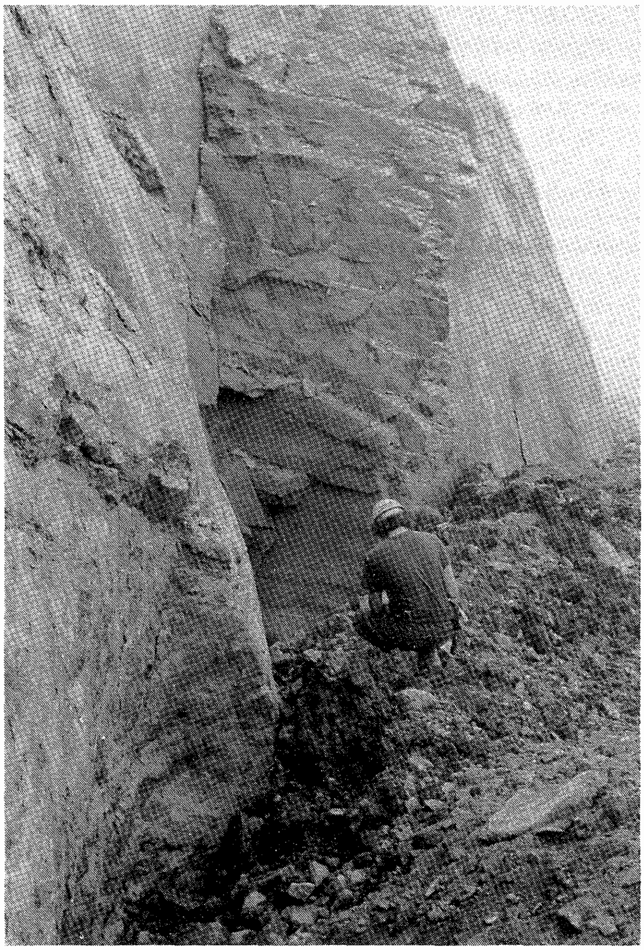


Figure 55 Fault surface in now-reclaimed Brown Bros. coal mine west of Mitchellsville, Saline County. This was one of a swarm of northeast-striking faults that branch off the north flank of the New Burnside Anticline. All of the faults exposed in the mine were high-angle normal faults exhibiting vertical slickensides and little or no drag.

caused folding may have been transmitted northwest from the Lusk Creek Fault Zone along one or more décollements (fig. 50).

The association of an anticlinal fold (compressional) and subparallel normal faulting (extensional) points to two different stress fields and periods of deformation. Comparison with the McCormick, Lusk Creek, and Shawneetown structures suggests that an early phase of compression was followed by later extension. The movements were largely, if not entirely, post-Pennsylvanian.

See also McCORMICK ANTICLINE.

NEW DOUGLAS DOME (discarded)

Location	Near the common corner of Bond, Madison, and Montgomery Counties
References	Bell 1926c, 1941, Allgaier and Hopkins 1975, Bristol and Howard 1976, Stevenson et al. 1981

The New Douglas Dome, as named by Bell (1926c), represented the western part of Blatchley's (1914) Sorento Dome. Bell's structural interpretation was based on borehole data on the Herrin Coal Member. His map depicted a roughly elliptical dome that was elongated from northeast to southwest and about 6 miles (10 km) long by 3 miles (5 km) wide. Indicated closure is about 50 feet (15 m); however, the mapping of closure depends on interpretation of one well where the Herrin Coal Member is missing as Bell had noted. Absence of coal here is due to erosion or nondeposition in what is now called the Walshville channel (Allgaier and Hopkins 1975). Bell estimated the position of the Herrin Coal in the key well by matching younger strata with nearby wells. The correlations employed by Bell appear less than convincing. Moreover, even if the higher strata are correctly correlated, their arching may be due to differential compaction across the Walshville channel fill and not to tectonic movements.

Bell's (1941) revised structure map of the Herrin Coal shows the channel cutting through the area where the anticline had been mapped. The elevation contours of the coal on either side of the channel do not support the existence of a dome or anticline, so Bell did not label the New Douglas Dome on his 1941 map.

The Beech Creek ("Barlow") Limestone (ISGS open files) is not present, and the Ste. Genevieve Limestone (Bristol and Howard 1976) is not mappable in the New Douglas area. The Stevenson et al. (1981) structure map of the New Albany Group indicates a small high near the common corner of Bond, Madison, and Montgomery Counties. Because the existence of the New Douglas Dome as originally defined on the Herrin Coal is questionable, this name should not be attached to the high on the New Albany.

See also PANAMA ANTICLINE (discarded) and SORENTO DOME (discarded).

NEW HARMONY FAULT ZONE (new name)
Wabash Valley Fault System

Location	Wabash and White Counties, Illinois, and Gibson and Posey Counties, Indiana (I-7, 8; J-7)
References	Pullen 1951, Cady et al. 1955, Bristol and Treworgy 1979, Ault et al. 1980, Tanner et al. 1980a–c, Tanner et al. 1981a–c, Braile et al. 1984, Ingram and Molinda 1988

The New Harmony Fault was originally identified in Indiana and in White County, Illinois. It was named after the town of New Harmony, Indiana. A fault in Wabash County, Illinois, was named the Mt. Carmel Fault after the county seat. Bristol and Treworgy (1979) established that the two faults connected and combined the names as Mt. Carmel–New Harmony Fault. The name Mt. Carmel, however, also is used for a large fault in south-central Indiana, east of the Wabash Valley Fault System. In an attempt to avoid confusion, the Mt. Carmel–New Harmony Fault is changed to the New Harmony Fault Zone; the word "zone" is being added to reflect the compound nature of the faulting.

The New Harmony Fault Zone is composed of parallel, overlapping, normal faults that strike N25°E and dip 65° or steeper to the west (figs. 56, 57). The zone is about 43 miles (69 km) long and as much as 0.5 mile (0.8 km) wide. In areas of close well control, as many as five separate faults have been mapped within the zone. Displacements are down to the west. The maximum throw is 450 feet (137 m), which was measured in a well that cuts a fault in Posey County, Indiana (Ault et al. 1980). A set of three east-trending cross faults, connecting overlapping ends of two major fault segments, was observed in an underground coal mine in Wabash County, Illinois (Bristol and Treworgy 1979). The New Harmony Fault Zone splits and becomes more complex upward through the sedimentary section. This is shown by both the borehole data (Bristol and Treworgy 1979) and the seismic profiles of Braile et al. (1984).

NEW MADRID RIFT COMPLEX (discarded)

Location	Underlies the Mississippi Valley from Arkansas and Tennessee northward to southeast Missouri, southern Illinois, and western Kentucky
Selected references	Ervin and McGinnis 1975, Soderberg and Keller 1981, Braile et al. 1982, 1984, Sexton et al. 1986, Pratt et al. 1989, Nelson 1990

A buried rift system underlies St. Croixan (Cambrian) strata in the central Mississippi Valley. Elements of the rift include the northeast-trending Reelfoot Rift (Ervin and McGinnis 1975) and the east-trending Rough Creek Graben (Soderberg and Keller 1981, see fig. 5). Two additional "arms" or branches of the rift were postulated by Braile et al. (1982). These were the northeast-trending Southern Indiana Arm and the northwest-trending St. Louis Arm. As envisioned by Braile et al. (1982, 1984) and Sexton et al. (1986), the Reelfoot, Rough Creek, Southern Indiana, and St. Louis branches formed a quadruple junction in southernmost Illinois. The name New Madrid Rift Complex was applied to the entire hypothetical four-armed rift system. It was named after New Madrid, Missouri, the scene of devastating earthquakes in 1811 and 1812.

Recent studies, including COCORP seismic profiling (Pratt et al. 1989), indicate that the southern Indiana and St. Louis Arms do not exist. The actual configuration is a dogleg comprising the Reelfoot and Rough Creek segments. In a comment to Pratt et al. (Nelson 1990), I recommended that usage of the term New Madrid Rift Complex be discontinued to avoid the implication that the dogleg rift and New Madrid Seismic Zone are coextensive.

See also REELFOOT RIFT, ROUGH CREEK GRABEN, ST. LOUIS ARM (discarded), and SOUTHERN INDIANA ARM (discarded).

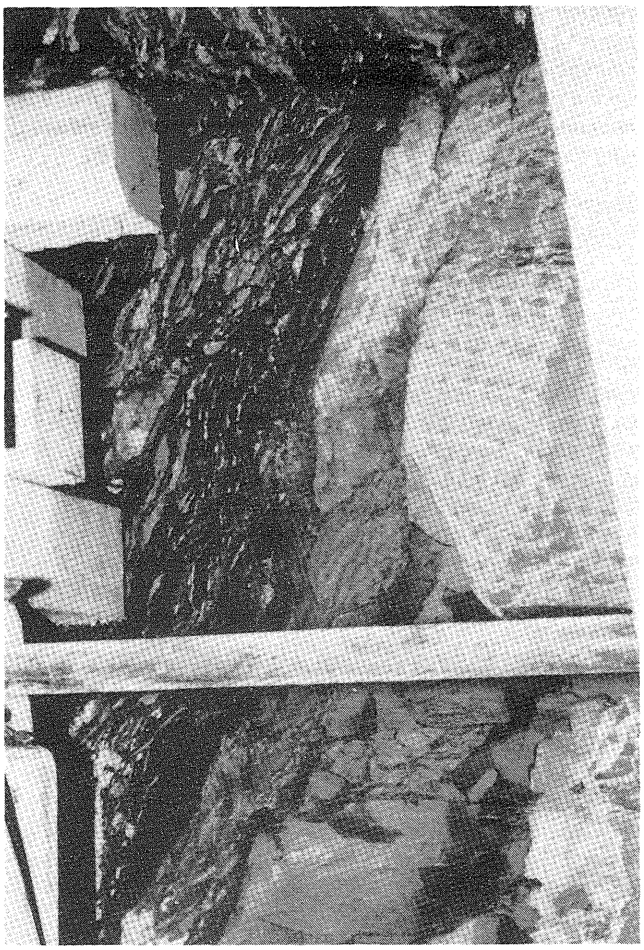


Figure 56 A segment of the New Harmony Fault Zone in an underground coal mine, Wabash County. Nearly horizontal mudstone on the footwall (right) is displaced against steeply dipping and sheared sandstone and dark shale on the hanging wall. Total throw on this fault is approximately 120 feet (37 m) down to the northwest (left).

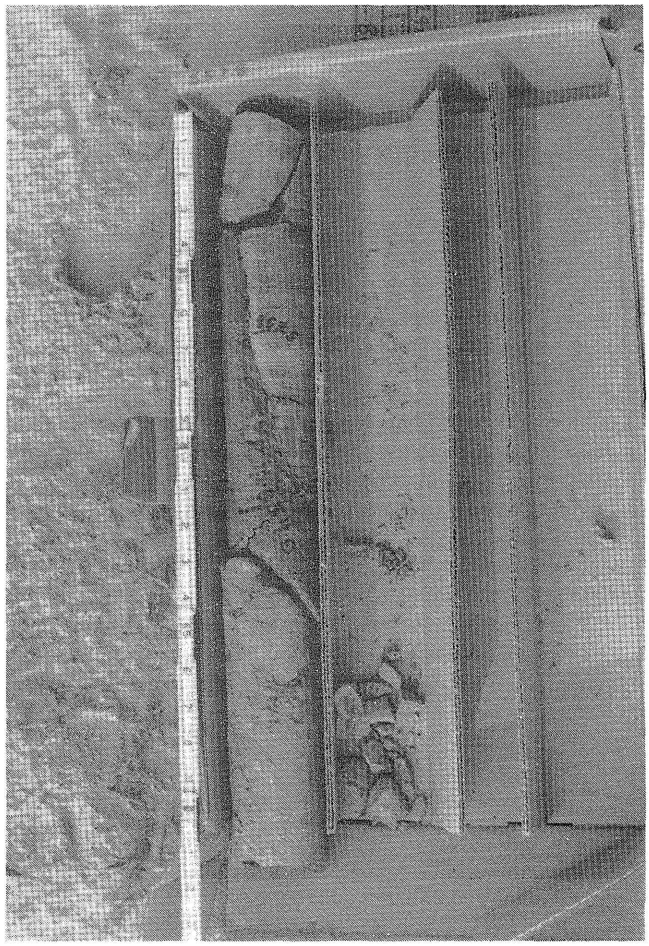


Figure 57 Drill core penetrating a segment of the New Harmony Fault Zone, Wabash County. Pennsylvanian siltstone at top of core is in the hanging wall and displays nearly horizontal laminations. Remainder of the core consists of gouge and breccia. Note steep angle of fault plane (compare with fig. 56). Scale is graduated in tenths of feet.

NEW MADRID SEISMIC ZONE

Location See text

Selected references Fuller 1912, Penick 1981, Stauder 1982, McKeown and Pakiser 1982, Gori and Hays 1984, Nuttli 1990, Stewart and Knox 1993

Although it is neither within Illinois nor a structural feature, the New Madrid Seismic Zone must be mentioned here as a subject of public interest and concern. The earthquakes that shook the central Mississippi Valley in 1811 and 1812 were probably the most powerful experienced in the conterminous United States since the start of European settlement. Nuttli (1990) estimated that five separate events had surface-wave magnitudes of 8.0 or greater. That compares with 7.1 for the 1989 San Francisco Bay area earthquake. The New Madrid Seismic Zone is continuously active and hundreds of tremors are recorded yearly by modern seismographs. Most of these are too small to be felt. Quakes large enough to cause damage occur at infrequent intervals.

When earthquake epicenters are plotted on a map, a narrow zone of intense activity is seen to trend from northeastern Arkansas to the northwest corner of Tennessee, where it jogs north-northwest to New Madrid, Missouri.

From New Madrid the zone turns again northeast and terminates near Cairo, Illinois. The complete zone of intense activity is the New Madrid Seismic Zone. Away from the New Madrid Zone epicenters are scattered in a seemingly random pattern across a large area, which includes approximately the southern one-third of Illinois. The scattered quakes are mostly too small to detect except by instruments, but an occasional event attains a magnitude of 5.0 to 6.0, which is large enough to cause localized damage.

The New Madrid Seismic Zone overlies the Reelfoot Rift, a great fault-bounded trough that formed during the Cambrian Period. Since Cambrian time faults in the rift have been reactivated repeatedly under various tectonic stress fields. Because of these repeated movements the earth's crust in the New Madrid area is greatly weakened. Today, plate-tectonic movements subject the central United States to compressive stress oriented from east–west to east-northeast to west-southwest (Sbar and Sykes 1973, Zoback and Zoback 1980, Nelson and Bauer 1987). Stress builds in the New Madrid area until it is suddenly released by slippage along faults, producing earthquakes. The greater the amount of energy stored before release, the larger the quake. Because the New Madrid Seismic Zone has been observed for less than 200 years, the recurrence interval for destructive quakes similar to those of 1811 and 1812 is a matter of speculation.

NILWOOD ANTICLINE

Location T10 and 11N, R6W, Macoupin County (G-4)

References Easton 1942, Ball 1952

Easton (1942) and Ball (1952) both mapped the Nilwood Anticline as a southeast-plunging nose that trends southeast at the northern end and nearly south at the southern end. The Herrin Coal Member (Pennsylvanian) was the contouring horizon. Remapping of the Herrin Coal structure using additional control points shows an anticline that trends south-southeast from Section 20, T11N, R6W, to Section 9, T10N, R6W, and has closure of about 20 feet (6 m) (Nelson 1987b). This feature corresponds closely with the southern part of the Nilwood Anticline as originally defined. Toward the northwest where Easton and Ball indicated slight nosing, Nelson's map shows a southeast-facing homocline.

NOBLE ANTICLINE (discarded)

Location T3N, R9E, Richland County

References Bell and Cohee 1938, Siever and Cady 1951

The feature that Bell and Cohee (1938) designated as the Noble Anticline, named for the Noble Oil Field, has become incorporated into the larger Clay City Anticline as further subsurface control data have become available. Use of the name should be discontinued.

NOKOMIS ANTICLINE (discarded)

Location Eastern Montgomery County

References Moulton 1925, Payne and Cady 1944

Using scanty data from mines and boreholes, Moulton (1925) inferred the presence of a structural high centered in Section 22, T10N, R2E. He called it the Nokomis Dome, although his map indicates no closure. Payne and Cady (1944) using a few more control points, likewise found no structural closure, but applied the name Nokomis Arch to an anticlinal nose trending slightly north of east in eastern Montgomery County.

Few new data have become available since Payne and Cady's report. A new map (Nelson 1987b) of Herrin Coal Member structure does not confirm a dome or anticline similar to those of the earlier reports. A structural high on my map near the center of T10N, R3E, is based on a single control point and provides insufficient evidence for naming a structure. Use of the name Nokomis Anticline should be discontinued.

NORTHEAST MISSOURI ARCH

Location Northeastern Missouri, southeastern Iowa, and west-central Illinois

References Bunker 1981, Bunker et al. 1985, Lee 1943, Howell 1935

Bunker (1981) introduced the name Northeast Missouri Arch for a pre-Middle Devonian paleotopographic high that apparently was a northward extension of the Ozark Dome. Strata ranging from the Middle Ordovician St. Peter Sandstone through Niagaran (Upper Silurian) are upturned, truncated, and overstepped by Middle Devonian rocks on this arch. Several geologists prior to Bunker, notably Collinson (1967), recognized the existence of this feature, but either did not name it or called it the Mississippi River Arch. The latter name was restricted by Bunker et al. (1985) to a feature that developed in post-Morrowan (early Pennsylvanian) time.

NORTH FORK FAULT
Wabash Valley Fault System

Location Sections 10 and 15, T8S, R9E, Gallatin County (J-7)

References Bristol 1975, Bristol and Treworgy 1979

The North Fork is a small fault that is nearly in line with the southern end of the Herald–Phillipstown Fault Zone. It is recognized only in Pennsylvanian rocks. The fault is about 1.5 miles (2.4 km) long and has a maximum throw of about 25 feet (8 m) down to the east.

NUTWOOD ANTICLINE

Location T8N, R13W, Jersey County (G-2)

References Rubey 1952, Collinson et al. 1954, Collinson 1957, Treworgy 1979a

Scattered surface and subsurface data points indicate a northwest-trending anticline that is about 4 miles (6.4 km) long and has closure of about 50 feet (15 m) on the Chouteau Limestone (lower Mississippian). The Nutwood Anticline is one of several northwest-trending folds located north of the Cap au Grès Faulted Flexure.

OAKDALE SYNCLINE (discarded)

Location From east-central La Salle to south-central Livingston Counties

References Willman and Payne 1942

A subtle trough between the Dwight and Odell Anticlines was named the Oakdale Syncline. It was mapped from scattered well data on Cambrian and Ordovician strata. Willman and Payne (1942) had so few control points that the existence of all of these structures is considered questionable. The Bristol and Buschbach (1973) structure map of the Galena Group and the Kolata et al. (1983) map of the Franconia Formation do not show the Dwight, Odell, and Oakdale structures. Use of the name Oakdale Syncline should be discontinued.

OAKLAND ANTICLINAL BELT (discarded)
La Salle Anticlinorium

Location Mainly in western Clark and Edgar Counties

References Mylius 1923, 1927, Clegg 1959, 1965b

The Oakland Anticlinal Belt was named by Mylius (1923) before drilling had revealed the full extent and nature of the La Salle Anticlinorium. Mylius recognized that the anticlines in Clark and Edgar Counties lie almost in line with major anticlines in La Salle County to the northwest and Lawrence County to the south. He also saw no continuous anticline, but rather a series of subparallel or branching folds in eastern Illinois. Mylius (1923) chose to distinguish the group of anticlines in Clark and Edgar Counties from those farther north and south, to which the relationships were yet unclear.

The character of the La Salle Anticlinorium was well established by the time Clegg reported on the subsurface geology of eastern Illinois. Clegg chose to retain the names Oakland Anticlinal Belt and the equally awkward Bellair–Champaign Uplift probably more for the sake of continuity than to serve any useful purpose. The group of structures at Oakland lacks natural boundaries and does not differ in form, size, or orientation from other elements of the La Salle Anticlinorium. The name Oakland Anticlinal Belt has outlived its original usefulness and should be discarded.

OAKLAND DOME (discarded)
see **BROCTON DOME**

OBLONG ANTICLINE (new)
La Salle Anticlinorium

Location T7N, R13W, Crawford County (G, H-8)

References Blatchley 1913, Cady 1920, Potter 1956, Bristol and Buschbach 1973, Bristol and Howard 1976, Stevenson et al. 1981

Treworgy (1981) listed the Oblong structure as a "significant unnamed structure." It is hereby named the Oblong Anticline for the nearby town of Oblong.

The Oblong Anticline is in line with the Hardinville Anticline, from which it is separated by a saddle. Both anticlines follow the upper limb of the Charleston Monocline in the La Salle Anticlinorium. The axis of the Oblong Anticline trends slightly west of north and plunges to the south.

Potter's (1956) map of the Herrin Coal Member (Pennsylvanian) is the most detailed structure map of the Oblong Anticline. This map (fig. 40) shows the anticline to be about 3 miles (5 km) long and 1 mile (1.6 km) wide, and to have about 50 feet (15 m) of closure. Bristol and Howard's (1976) map of the Ste. Genevieve Limestone indicated a small enclosed area on the Oblong Anticline. Their unpublished work map (ISGS, open files) indicates at least 60 feet (18 m) of closure on the anticline. No closure is shown on the New Albany Group (Stevenson et al. 1981) or Galena (Trenton) Group (Bristol and Buschbach 1973). These two maps show a south-trending nose separated from the Hardinville Anticline by a saddle. A shortage of control points on the deeper horizons and the use of a 100-foot contour interval may account for absence of mapped closure.

ODELL ANTICLINE (discarded)

Location La Salle, Grundy, and Livingston Counties

References Willman and Payne 1942

The Odell Anticline was one of a belt of anticlines and synclines that were mapped by Willman and Payne (1942) on the basis of Cambrian and Ordovician subsurface data. The folds could be considered part of the La Salle Anticlinorium, but their existence is questionable because Willman and Payne used so few control points. As they mapped it, the Odell Anticline is a vaguely defined anticlinal nose. It cannot be recognized on the structure map of the Galena Group (Bristol and Buschbach 1973) or on the structure map of the Franconia Formation (Kolata et al. 1983), both of which were mapped from additional data not available to Willman and Payne. The name should be dropped from usage.

O'FALLON DOME (discarded)

Location T2N, R7 and 8W, St. Clair County

References Kay 1915, Bell 1941

The name O'Fallon Dome was applied to a structural high on the Herrin Coal Member (Pennsylvanian). Only one well lies within the area mapped as having closure. Bell's (1941) map differs considerably from Kay's (1915). No new data have been published confirming the existence of a dome; therefore, use of the name should be discontinued.

OGLESBY FAULT (discarded)

Location North-central Illinois

References Green 1957

The Oglesby Fault appears in Green's paper that treated aspects of the structural geology of Ohio, Indiana, and Illinois. Green interpreted the western, steep limb of the La Salle Anticlinorium as being faulted along most of its length. The Oglesby Fault was shown as extending approximately from Lee County on the north to McLean County on the south. Green stated that the fault had a maximum displacement of about 1,200 feet (360 m) between closely spaced drill holes near La Salle. Green (1957) provided no details; his interpretations were not accepted by Bristol and Buschbach (1973) on their statewide structure map of the Galena Group (Trenton). Faulting at depth has been documented at several places along the La Salle Anticlinorium, and it is probable that faults occur along parts of Green's Oglesby Fault. Available data do not permit interpretation of a continuous fault in this area.

See also TUSCOLA FAULT (discarded).

OGLESBY SYNCLINE (discarded)

Location T33N, R1E, La Salle County

References Willman and Payne 1942

The Oglesby Syncline is a short, east-northeast-trending depression that could be considered a lobe of Willman and Payne's (1942) Granville Basin. It was mapped from borehole data on various Cambrian and Ordovician formations and shown as lying immediately west of what is now called the Peru Monocline. Newer maps, including those of Bristol and Buschbach (1973) and Kolata et al. (1983), do not indicate the Oglesby Syncline; accordingly, use of the name should be discontinued.

OHLMAN ANTICLINE or DOME (discarded)

Location T10N, R1W, Montgomery County to T11N, R2W, Christian County

References Blatchley 1914, Kay 1915, Moulton 1925, Payne and Cady 1944

The structure described as the Ohlman Anticline or Dome was mapped by these authors, who were using scanty subsurface data for the Herrin Coal Member, as an east-trending anticlinal nose. None of the references cited indicates any closure on the structure, thus it should not have been called a dome. Nelson's (1987b) structure map does not indicate any form of structural high in the vicinity of Ohlman; therefore, use of the name should be discontinued.

OLD RIPLEY ANTICLINE (discarded)

Location Mainly in T5N, R4W, Bond County

References Bell 1941

Bell (1941) mapped an anticlinal nose on the Herrin Coal Member (Pennsylvanian); the structure trends eastward from Section 24, T5N, R5W, to Section 24, T5N, R4W, then turns northeastward. The only indicated closure in Section 6, T5N, R3W was based on a single well.

The structure Bell named Old Ripley partly corresponds with the Pocahontas Anticline of Kay (1915) and the Stubblefield Anticline of Blatchley (1914) and Moulton (1925). Bell renamed the eastern end of the latter, the Greenville Dome. A fault shown on Moulton's (1925) map was not recognized by Bell. Use of the name Old Ripley Anticline should be discontinued because of the small extent, irregular outline, and scarcity of evidence for the existence of this structure.

OMAHA DOME

Location Northwestern Gallatin County (J-7)

References Cady et al. 1939, English and Grogan 1948, Pullen 1951, Swann 1951, Clegg and Bradbury 1956, Bradbury 1962, Bristol 1975

Omaha Dome is a nearly circular, symmetrical uplift that is 3 to 4 miles (4.8–6.4 km) in diameter and centered in Section 4, T8S, R8E, in Gallatin County. Bristol (1975) mapped structural closure of 160 feet (48 m) on the Brereton Limestone Member (just above the Herrin Coal Member), 200 feet (60 m) on the base of the Kinkaid Limestone, and at least 150 feet (45 m) on the base of the Beech Creek ("Barlow") Limestone. Current Beech Creek maps (ISGS open files) indicate about 200 feet (60 m) of closure. Drilling on the structure has shown doming to be caused by a series of igneous sills or laccoliths intruded into shales of the New Albany Group and younger strata. Units below the New Albany are not domed (Stevenson et al. 1981). The igneous rock is peridotite or lamprophyre and probably is related to the Early Permian ultramafic intrusions found around Hicks Dome and in the Cottage Grove Fault System. Nearly 7 million barrels of oil have been produced from Pennsylvanian, Chesterian, and Ste. Genevieve pay zones on the Omaha Dome.

See also DES PLAINES DISTURBANCE, GLASFORD STRUCTURE, and HICKS DOME.

OMAHA GRABEN

Location T7S, R8E, Gallatin and White Counties (J-7)

References Bristol 1975

The Omaha Graben is bounded by two parallel normal faults that strike northward from the north edge of Omaha Dome. The faults are at most 4 miles (6.4 km) long and less than 0.5 mile (0.8 km) apart. Maximum throw is about 60 feet (18 m) in Pennsylvanian rocks and it decreases downward. Bristol (1975) interpreted the faults as tension-release structures associated with igneous intrusion under the Omaha Dome. This explanation appears unlikely because the faults are far from the apex of the dome and no other faults radial to Omaha Dome have been detected in spite of dense drilling. An alternate interpretation is that the graben developed under regional east–west extensional stress that created the Wabash Valley Fault System.

OMEGA ANTICLINE (discarded)

Location T3N, R3-4E, Marion County

References J. Weller and Bell 1936

J. Weller and Bell (1936), working with outcrops of upper Pennsylvanian strata, mapped a large anticline near the village of Omega. Siever's (1950) structure map of the Herrin (No. 6) Coal Member and current maps of the Beech Creek ("Barlow") Limestone (ISGS open files) show no anticline, but only an irregular dip from the southeast. J. Weller and Bell may have miscorrelated their marker beds and misinterpreted the structure. Upper Pennsylvanian stratigraphy of Illinois has been revised several times since 1936 (Weibel 1986). Usage of the name Omega Anticline should be abandoned.

OREGON ANTICLINE

Sandwich Fault Zone

Location Southern Ogle County (A, B-5)

References Bevan 1935, 1939, Willman and Templeton 1951, Templeton and Willman 1952, Kolata et al. 1978, Kolata et al. 1983

The Oregon Anticline is a broad, low flexure located on the northeast downthrown side of the Sandwich Fault Zone, near the northwestern end of the fault zone. The anticline trends nearly parallel to the fault zone. Its maximum structural relief is 200 to 300 feet (60–90 m) on the Franconia Formation (Cambrian; Kolata et al. 1978, Kolata et al. 1983). The position of the fold relative to the fault zone suggests a genetic relationship.

OSMAN MONOCLINE

La Salle Anticlinorium, Piatt (D, E-6, 7)

Location Southwestern Champaign and Ford, and eastern Piatt and McLean Counties (D, E-7)

References Clegg 1972

The Osman Monocline is a west-facing monocline that has several domes along its upper limb. The southern end of the Osman Monocline is sharply offset about 6 miles (10 km) westward from the northern end of the Charleston Monocline in T18N, R7E, Champaign County. The relief is more than 1,000 feet (300 m) on pre-Pennsylvanian strata near the southern end of the flexure. It decreases northward toward Ford County, where the monocline gradually loses expression. Farther north a sinuous south-plunging anticline (unnamed), almost in line with the Osman Monocline, continues as far as southwestern Kankakee County. The Herscher Anticline is situated along this trend (pl. 1).

The Osman Monocline shows clearly on Bristol and Buschbach's (1973) map of the top of the Galena (Trenton) Group (Ordovician) and on the Stevenson et al. (1981) map of the base of the New Albany Group (Devonian–Mississippian). The monocline also affects Pennsylvanian strata (Clegg 1972). Total relief on Pennsylvanian beds is undetermined because these rocks are eroded from the crest of the monocline.

OSWEGO SYNCLINE (discarded)

Location Northern Kendall County

References Willman and Payne 1942

Willman and Payne's (1942) subsurface structure maps of the St. Peter Sandstone and Galena Group show a broad, very subtle eastward depression trending northeast from the Sandwich Fault Zone. Even as originally defined, this feature should not be called a syncline. Newer maps (Bristol and Buschbach 1973, Kolata et al. 1978, Kolata et al. 1983) do not indicate a syncline in this area; therefore, the name Oswego Syncline should not be used.

OTTAWA ANTICLINE (discarded)

Location Central La Salle County

References Willman and Payne 1942

An anticlinal nose with a curving southeastward trend was mapped from well data of the Galesville (Cambrian) and New Richmond (Ordovician) Sandstones. The structure is barely perceptible on the St. Peter Sandstone (Willman and Payne 1942). The Ottawa Anticline was interpreted as being largely of pre-St. Peter age. Using many additional control points, Kolata et al. (1983) mapped a homoclinal southerly dip on the top of the Cambrian Franconia Formation in this area. The anticline apparently does not exist and the name should not be used.

OTTAWA HORST (discarded)

Location North-central Illinois

References Green 1957

Green (1957) described the Ottawa Horst as an uplifted block between the Sandwich Fault Zone and the Oglesby Fault. The existence of the latter is doubtful; therefore, the term Ottawa Horst is inappropriate and should not be used.

OTTER CREEK SYNCLINE

Location Northern T7N, R13W, Jersey County (G-2, 3)

References Rubey 1952, Collinson et al. 1954, Collinson 1957, Treworgy 1979a

The Otter Creek Syncline is a subtle trough that plunges eastward and apparently has no closure. It is about 7 miles (11 km) north of and approximately parallel with the Cap au Grès Faulted Flexure.

OZARK DOME

Location See text below and figures 1, 2

References Swallow 1855, Keyes 1894, Koenig 1961, Stearns and Marcher 1962, McCracken 1971, Tikrity 1968, Atherton 1971, Kisvarsanyi 1981, Houseknecht 1983

The Ozark structural region has been called a dome, an uplift, and occasionally an arch. The term Ozark Dome is preferable to Ozark Uplift because the whole area has not been raised tectonically. Furthermore, during most of the Paleozoic Era the Ozark region was a shoal or low upland that remained stable while adjacent basins subsided. The region is nearly equidimensional and lacks a definite axis, so the term dome is more appropriate than arch.

The Ozark Dome covers southern Missouri, part of northern Arkansas, northeastern Oklahoma, and southwestern Illinois. Narrow strips of southwestern Illinois lie on the flanks of the structural dome and are included in the Ozark Plateaus physiographic province. The rugged terrain of north-dipping cuestas in southernmost Illinois sometimes is loosely called the "Illinois Ozarks," but that name is not correct from a geologic or physiographic standpoint.

Precambrian rocks of the Ozark Dome consist mainly of granite and rhyolite approximately 1.4 billion years old. By the Cambrian Period, a rugged topography of rounded hills had developed. The Late Cambrian sea lapped around these hills and deposited the Lamotte Sandstone (Mt. Simon equivalent). Later, the entire region was inundated except perhaps the highest peaks of what are now the St. Francois Mountains of southeastern Missouri. The Upper Cambrian through Ordovician succession of the Ozark Dome is similar to, although thinner than, that of the Illinois Basin. The Silurian and Devonian Systems are thin and the Mississippian rocks are largely stripped by erosion from the eastern Ozarks. From the Cambrian through Mississippian Period, the Ozark Dome was, at most, a minor source of clastic sediment for the Illinois Basin. The Thebes Sandstone (Maquoketa Group, Upper Ordovician) is present only on the east flank of the dome and presumably had a local provenance. Some of the sand in the Dutch Creek Sandstone Member (base of Middle Devonian) may also have come from the Ozark Dome (Smunt 1964, Summerson and Swann 1970).

The northeastern part of the Ozark Dome was uplifted along the Ste. Genevieve Fault Zone in latest Mississippian to early Pennsylvanian time (Nelson and Lumm 1985). A short-lived fault scarp apparently existed, as evidenced by Ozark-derived chert clasts in basal Pennsylvanian conglomerates (Poor 1925) and diversion of Pennsylvanian paleochannels (Desborough 1961b) along the fault zone in southwestern Illinois. Numerous Pennsylvanian outliers on the northwestern Ozark Dome indicate that the area was not greatly elevated. The dome probably was a low positive area during most of the Pennsylvanian Period (Houseknecht 1983) and since then has remained an upland.

PADUCAH GRABEN (discarded)

Location T16N, R6E, Massac County

References Ross 1963, 1964, Heyl et al. 1965, Kolata et al. 1981

The Paducah Graben, as defined by Ross (1963), displaces Mississippian bedrock beneath Cretaceous cover in the Mississippi Embayment. The graben was interpreted as a southwestward extension of faults that are part of the Fluorspar Area Fault Complex. Ross based his interpretation of the graben on scanty borehole information. Kolata et al. (1981) reexamined the data and stated that they were unable to substantiate the existence of the Paducah Graben; therefore, use of the name should be discontinued.

PAINE DOME (discarded) see XENIA DOME

PANAMA ANTICLINE (discarded)

Location Northwestern Bond County

References Bell 1926c, 1941, Lee 1926

Blatchley (1914) and Kay (1915) mapped a structure in southern Montgomery and northwestern Bond Counties and named it the Sorento Dome. Bell (1926c) divided the Sorento Dome into the New Douglas Dome on the west and the Panama Anticline on the east. On Bell's (1941) revised subsurface structure map of the Herrin Coal Member, the New

Douglas Dome was deleted but the Panama Anticline was retained.

Bell's (1941) structure map shows the Panama Anticline as an irregular east-trending anticlinal nose with possible small areas of closure. Well control in the area is sparse. The western end of the nose terminates against the Walshville channel where the Herrin Coal is absent.

Mapping at deeper horizons does not reveal a structure resembling that mapped by Bell on the coal. The structure in the coal is too ill-defined to name.

See also NEW DOUGLAS DOME (discarded) and SORENTO DOME (discarded).

PARKER DOME (discarded) see WESTFIELD DOME

PARKERSBURG DOME (discarded)

Location Western T2N, R14W, Richland County

References Easton 1943

The Parkersburg Dome was defined on the basis of subsurface contouring on the Beech Creek ("Barlow") Limestone and the Levias Limestone Member of the Renault Formation (Chesterian). Easton (1943) showed that the dome trends slightly east of north and is about 5 miles (8 km) long by 2 miles (3 km) wide. The current Beech Creek structure map (ISGS open files), based on numerous control points not available to Easton, indicates no closure in this area. Parkersburg Dome and the adjacent Blackoak Dome, as mapped by Easton, actually are parts of an irregular terrace that lies along the east flank of a broad syncline east of the Clay City Anticline. The Parkersburg Consolidated Oil Field has been developed along this terrace. Its cumulative production, mainly from stratigraphic traps in the Cypress and Bethel Sandstones and Ste. Genevieve and Salem Limestones, is more than 12.8 million barrels. Use of the name Parkersburg Dome should be discontinued.

PARNELL DOME
La Salle Anticlinorium

Location Eastern De Witt County (E-6)

References Heigold et al. 1964, Howard 1964, Clegg 1972, Treworgy 1978

The Parnell Dome structure is sometimes mapped as part of the Downs Anticline. The dome is roughly L-shaped with the legs extending west and south-southeast. Clegg (1972) showed about 40 feet (12 m) of closure on the Danville Coal Member (Pennsylvanian) and Treworgy (1978) mapped approximately 200 feet (60 m) of closure on the top of Middle Devonian carbonates. The Parnell Oil Field, developed on the structure, has produced more than 261,000 barrels of oil from the Valmeyeran Sonora Sandstone and Middle Devonian limestone.

PASCOLA ARCH

Location See text below and figure 2

References Freeman 1949, Grohskopf 1955, Stearns and Marcher 1962, Tikrity 1968, McCracken 1971, Schwalb 1971, 1982, Atherton 1971, Houseknecht 1983

Wilson (1939) suspected the existence of an eroded and buried structural high in the northern Mississippi Embayment, but borehole and geophysical data were not available then to prove it. Freeman (1949) confirmed the existence of the high, but considered it to be part of the Ozark Dome. Grohskopf (1955) showed the high to be separate from the Ozark Dome and named it the Pascola Arch.

Schwalb (1982) mapped the Pascola Arch as a roughly circular domal uplift, covering approximately 15,000 square miles (38,000 km^2) and centered in the "bootheel" of Missouri.

As interpreted by the authors cited above and by Stearns and Marcher (1962), the Pascola Arch is a pre-Cretaceous structure. Paleozoic strata were upwarped, eroded, and truncated with angular unconformity by the Tuscaloosa Gravel (Upper Cretaceous) in the Mississippi Embayment. Cambrian rocks are directly overlain by Tuscaloosa at the apex of the arch. The northeast dip of Paleozoic strata and southern closure of the Illinois Basin in southernmost Illinois are attributed to the Pascola Arch.

Recent geophysical data and subsurface mapping have revealed a sharply upwarped, northeast-trending linear anticline in the northern Mississippi Embayment. This structure, called the Blytheville Anticline or Charlie's Ridge, has been variously interpreted as a positive flower structure created by wrench faulting (Howe and Thompson 1984) or as a diapir that formed under tensional stress (McKeown et al. 1991). Some of the wells used by early researchers to interpret the Pascola Arch are located along the Blytheville Anticline. McKeown et al. (1991) questioned the existence of the Pascola Arch, interpreting the structural high in the bootheel as part of the Blytheville Anticline. Vincent T. Larson (personal communication 1991), who has extensively studied borehole and seismic data from the Mississippi Embayment, also believes that the Pascola Arch as originally conceived does not exist. Nevertheless, regional outcrop and subcrop patterns of Paleozoic rocks indicate a regional uplift larger than the Blytheville Anticline and centered in southeast Missouri. A recent map by Dennis R. Kolata (1993, unpublished data) depicts the Pascola Arch as a broad, southeast-trending nose off the Ozark Dome. The narrow Blytheville Anticline crosses this structure at right angles. Thus, presence of the Pascola Arch seems to be confirmed, although the nature and tectonic history of this feature requires further study.

See also REELFOOT RIFT.

PATOKA ANTICLINE

Location Near the common corner of Fayette, Clinton, and Marion Counties (H-5)

References Smoot 1958, Bristol and Buschbach 1973, Bristol 1974

The Patoka Anticline, like the flanking Fairman Anticline, strikes northeast and displays closure at all mapped horizons from Galena (Trenton) Group (Ordovician) through Pennsylvanian. A Silurian reef occurs at the northeastern end of the Patoka Anticline. Compactional draping over the reef accentuates the anticlinal structure in post-Silurian strata. Smoot (1958) thought that the Patoka Anticline was initially developed in pre-Silurian time and provided a high spot on the sea floor favorable for formation of the reef. Nearly 15 million barrels of oil have been produced from lower Chesterian and upper Valmeyeran sandstones. Devonian and Galena (Trenton) limestone reservoirs also have been produced in the Patoka Oil Field.

PAYSON ANTICLINE (discarded)

Location Southwestern Adams County

References Cox 1927

The Payson Anticline was mapped mainly on the basis of outcrops of the Keokuk Limestone. The structure was portrayed by Cox (1927) as a north-plunging anticlinal nose having slight closure near its northern end and a slightly sinuous axis. Maximum dip is about 50 feet per mile (less than 1°). Structural relief is difficult to define because no flanking synclines are indicated on Cox's map.

No subsequent studies have confirmed the existence of this subtle feature, but the region has seen no detailed mapping and little exploratory drilling since Cox's time; therefore, use of the name should be discontinued.

PECATONICA ANTICLINE (new name)

Location T26 and 27N, R10E, Winnebago County (A-5)

References Buschbach and Bond 1974

The Pecatonica Anticline is a northwest-trending structure at least 6 miles (10 km) long and as much as 2 miles (3 km) wide. The northeast flank is the steeper. The anticline has about 30 feet (9 m) of closure, covering 4 square miles (10 km^2). A gas storage field has been developed on it with the Proviso Siltstone Member of the Eau Claire Formation (Cambrian) serving as the reservoir. Treworgy (1981) labeled this structure a dome, but it should be called an anticline because its length is more than twice its width.

PELL FAULT

Fluorspar Area Fault Complex

Location Sections 24 and 25, T12S, R7E, Hardin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Palmer 1956, Baxter et al. 1967

The Pell Fault is a normal fault that strikes slightly east of north. The east side is downthrown 400 feet (120 m) at the south end, where it joins the Wallace Branch Fault Zone. Displacement dies out northward.

PEORIA FOLDS (new)

Location Peoria, Fulton, McDonough, Schuyler, and Brown Counties

References Wanless 1957

A series of subtle anticlines and synclines mapped by Wanless (1957) are designated the Peoria Folds. Although many of these folds do not meet the usual standards of named features, the close parallelism of the folds is intriguing and indicates an origin in a regional stress field.

Individual folds named by Wanless are the Astoria Anticline, Bardolph Anticline, Brereton Anticline, Bryant Syncline, Bushnell Syncline, Canton Syncline, Elmwood Syncline, Fairview Syncline, Farmington Anticline, Littleton Anticline, Ripley Syncline, St. David Anticline, Sciota Anticline, Seville Anticline, Table Grove Syncline, and Versailles Anticline. They were mapped from surface and subsurface data on various Pennsylvanian and Mississippian horizons. Nearly all strike slightly north of east. They are linear to slightly arcuate and the convex side is to the north. The folds plunge eastward with regional dip. Most have less than 100 feet (30 m) of structural relief; dips on the flanks are generally measured in a few tens of feet per mile (less than 1°). The southern limbs of anticlines are generally steeper than the northern limbs.

Not mentioned by Wanless is the correspondence these minor folds have with topography. The east-northeast alignment of small streams is apparent not only in the area mapped by Wanless, but also farther west in McDonough and Schuyler Counties (fig. 58). The pattern on high-altitude aerial photographs and satellite images is striking. This is remarkable, considering that the entire region has been glaciated. Nowhere else in Illinois is topography apparently so strongly influenced by bedrock structure through glacial drift.

Wanless did not speculate about the origin of the folds.

The presence of so many apparently parallel flexures of similar length and amplitude tempts one to theorize that horizontal compression was involved, but no likely source of compressive force can be named. Another tantalizing idea is of a possible structural link to the Upper Mississippi Valley Zinc–Lead District. Cobb (1981) reported abnormally high concentrations of sphalerite in Pennsylvanian coal seams of the Peoria district. The zinc sulfide occurs in joints, fractures, clastic dikes, and similar disturbed zones in coal. The sulfide is chemically very similar to sphalerite from the Upper Mississippi Valley District. Major folds of the latter, like the Peoria Folds, dominantly trend east to west. Southward on the Western Shelf, however, the principal trend of structures is northwest. The northwest-trending structures appear to be products of faulting in basement, possibly inherited Precambrian trends. The nature and origin of the Peoria Folds require further study.

PERU ANTICLINE (discarded)

Location T33N, R1E, La Salle County

References Willman and Payne 1942

Willman and Payne (1942) described the Peru Anticline as a narrow and strongly asymmetrical fold, possibly faulted on its southeast limb. Their structure maps do not seem to indicate such a structure, however, and their control points do not define an anticline. The area in question lies on the steep southwest flank of what is now called the Peru Monocline.

PERU MONOCLINE (new)

La Salle Anticlinorium

Location From western Livingston to Lee County (D-6 to B-5)

References None

The name Peru Monocline is proposed for the northernmost major segment of the La Salle Anticlinorium. It is named for Peru, the sister city of La Salle. This was the first part of the La Salle Anticlinorium to be recognized, based on exposures along the Illinois River (fig. 45). The structure originally was named the La Salle Anticline. The name was changed to the La Salle Anticlinal Belt when the compound nature of the zone was recognized and no individual name was assigned to its northernmost element.

The Peru Monocline, as mapped on top of the Galena (Trenton) Group by Bristol and Buschbach (1973), is about 65 miles (100 km) long. It arises in western Livingston County, north of the Downs Anticline, striking northwest and facing

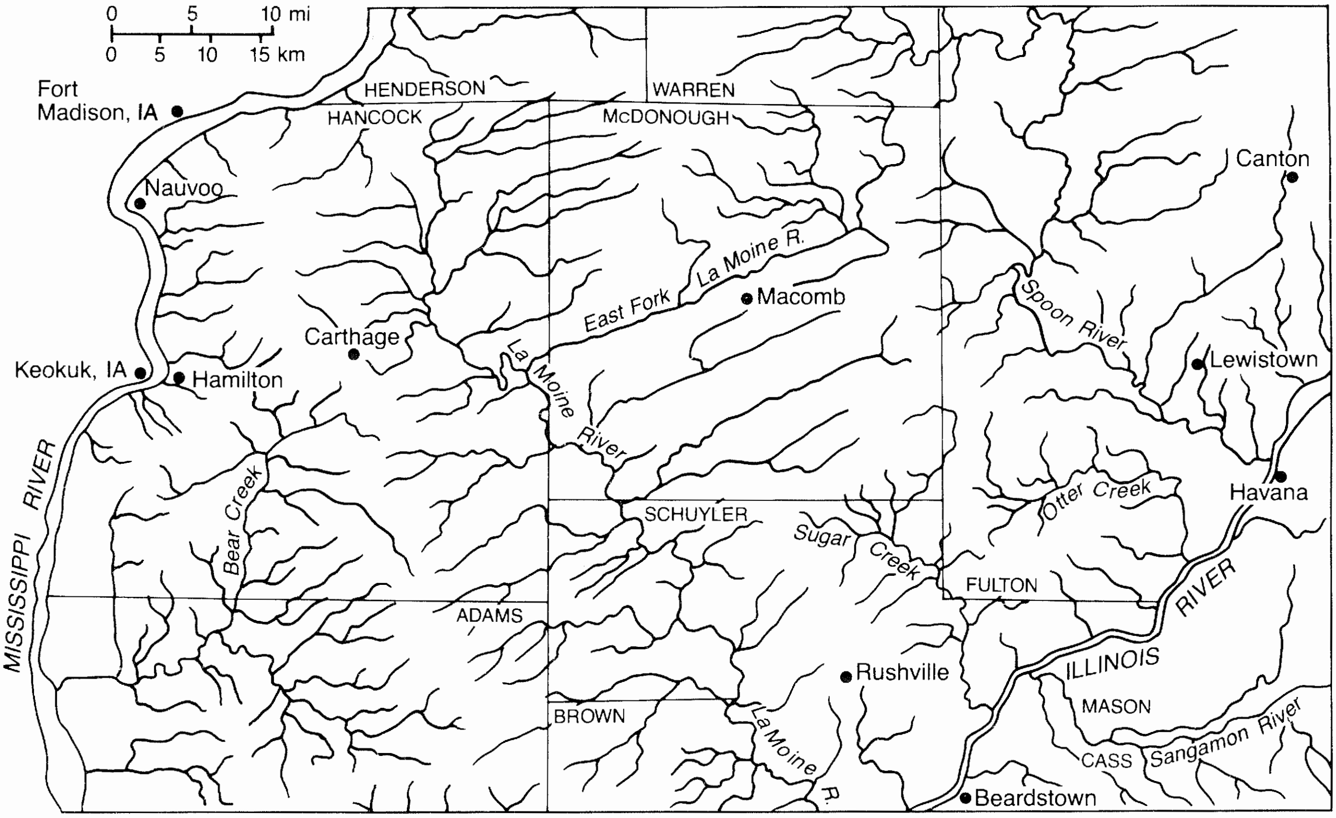


Figure 58 Drainage pattern in part of west-central Illinois. A well developed east-northeast-trending parallel drainage is apparent, particularly along tributaries of the La Moine River. Drainage in turn is parallel to anticlines and synclines (Peoria Folds) mapped by Wanless (1957) in the eastern half of the area shown. The western half of region has not been mapped in detail. The apparent parallelism of drainage and bedrock structure is surprising because the region is mantled by glacial deposits that commonly exceed 50 feet (15 m) and are locally more than 200 feet (61 m) thick.

southwest. The monocline is broad and gentle on the south, but the dips steepen sharply northward; relief exceeds 1,300 feet (390 m) near the west end of the Ancona Anticline in southern La Salle County. The trend of the monocline in this area changes to nearly north and then curves back toward the northwest as the flexure continues across western La Salle and eastern Bureau Counties into Lee County. The Galena Group is missing east of the monocline in La Salle and Lee Counties, where basal Pennsylvanian rocks lie unconformably on strata as old as St. Peter Sandstone (Middle Ordovician) and are considerably less deformed than pre-Pennsylvanian rocks. Structural relief on Pennsylvanian beds is less than half of that on pre-Pennsylvanian units.

The Kolata et al. (1983) structure map of the top of the Cambrian Franconia Formation (fig. 17) shows as much as 1,600 feet (480 m) of relief across the Peru Monocline in western La Salle County. Relief decreases farther north and the monocline gradually loses its identity. The northern part of the flexure is markedly sinuous.

Coal mining activities provided some details of structure on the flank of the Peru Monocline. In the Black Hollow mine near Oglesby, a set of headings was driven down the flank of the fold in the Colchester Coal Member, which is near the base of the Pennsylvanian System in this area. The dip of the coal increased steadily down the flank to a maximum of 45°. The coal was reported to be harder and more brittle than usual; both the coal and the overlying shale were severely fractured. Low-angle normal faults, having displacements of several feet, displaced the dipping coal. A low-angle thrust fault and bedding-plane faults within the coal (flexural slip?) were encountered in the Oglesby mine that operated on the lower limb of the monocline near the foot of the steep flank (Cady 1915, 1919). Younger Pennsylvanian strata that crop out on the flank of the monoclines dip less steeply than the coal and are not faulted (Cady 1919). The latter observation probably reflects the progressive growth of the fold during Pennsylvanian sedimentation.

PETERSBURG BASIN (discarded)

Location West-central Illinois

References Workman and Gillette 1956, Cluff et al. 1981

Workman and Gillette (1956) applied the name Petersburg Basin to a broad area where the "Kinderhookian Series" becomes relatively thick. An area of thin sediments to the southeast was termed the Vandalia Arch and another thin area to the west was named Schuyler Arch. (Workman and Gillette included the entire New Albany Group in the Kinderhookian Series. The New Albany is now recognized as largely of Late Devonian age.)

Cluff et al. (1981) in their study of the New Albany recognized the same general thickness pattern mapped by Workman and Gillette. Cluff et al. (1981) substituted western depocenter for Petersburg Basin and central thin for Vandalia Arch. They observed that naming arches and basins is inappropriate without evidence that actual tectonic or topographic features existed.

See also SCHUYLER ARCH (discarded) and VANDALIA ARCH (discarded).

PETERS CREEK FAULT ZONE

Fluorspar Area Fault Complex

Location Eastern Hardin County (pl. 2)

References S. Weller et al. 1920, Hubbert 1944, Grogan 1949, J. Weller et al. 1952, Brown et al. 1954, Heyl and Brock 1961, Baxter et al. 1963, Brecke 1964, Baxter and Desborough 1965, Heyl et al. 1965

The Peters Creek Fault is a northeast-trending fracture zone that forms part of the southeast side of the Rock Creek Graben in Illinois. It has been called a fault system but the correct term is a fault zone. To the northeast it apparently is a single fault; southwestward, it divides into numerous subparallel branches. The overall displacement is down to the northwest and approaches 1,000 feet (300 m) in places. Palmer (1976) mapped a possible northeastern extension of the Peters Creek Fault Zone into Kentucky.

PIERCE FAULT

Fluorspar Area Fault Complex

Location Sections 33 and 34, T11S, R7E, Hardin County (pl. 2)

References J. Weller et al. 1952, Baxter et al. 1967

The Pierce Fault is one of the radial faults that surround Hicks Dome. It lies west-southwest of the apex and has less than 100 feet (30 m) of displacement down to the north. At its western end the Pierce Fault joins the Raum Fault Zone.

PINCKNEYVILLE ANTICLINE

Location Central Perry County (I-5)

References Bell et al. 1931, Cady et al. 1938

Bell et al. (1931) defined the Pinckneyville Anticline largely on the basis of elevation surveys from underground mines in the Herrin Coal Member. The fold trends due north and has a relatively steep west flank and a gentle east limb. It plunges abruptly at the south end and gently at the north end. Closure is indicated to be about 60 feet (18 m). Bell et al. (1931) stated that a normal fault was encountered in mines about 0.75 mile (1.2 km) west of the anticlinal crest. The fault strikes due north and the east side is downthrown 28 feet (8.5 m) in a mine in the northeast quarter of Section 26, T5S, R3W. They noted that the fault is parallel to the Du Quoin Monocline and suggested that it developed under the same stresses.

Cady et al. (1938) mapped the anticline essentially the same as did Bell et al. (1931), but they did not show the fault. The Pinckneyville Anticline persists in Mississippian strata. A map of the top of the Karnak Limestone (R. Howard, unpublished mapping) shows an anticline with closure of 40 to 60 feet (12–18 m) essentially as mapped on the coal.

PISGAH SYNCLINE

Eagle Valley Syncline

Location From Section 10, T10S, R8E, to Section 18, T10S, R9E, Gallatin County (pl. 2)

References Nelson and Lumm 1987

The Pisgah Syncline is a deep enclosed depression within the Eagle Valley Syncline, which in this area consists of several irregular basins and synclines separated by saddles. The axis of the Pisgah Syncline curves sharply from east-northeast to south and is about 4 miles (6 km) long (fig. 34). More than 200 feet (60 m) of internal closure is mapped on the Springfield Coal Member (Pennsylvanian). The outline of the Pisgah Syncline, shown on plate 2, is the area of internal closure.

PITCHER LAKE FAULT

Wabash Valley Fault System

Location T7S, R14W, White County, Illinois, and Posey County, Indiana (J-7)

References Harrison 1951, Bristol 1975, Bristol and Treworgy 1979, Ault et al. 1980, Tanner et al. 1980a–c, Tanner et al. 1981a–c

The Pitcher Lake Fault is a small fault that lies between the overlapping ends of the Inman East Fault and New Harmony Fault Zone. It extends into Indiana and is approximately 2.5 miles (4 km) long. It strikes N30°E and dips 62° to 80°NW, as determined from the logs of wellbores that intersect the fault. The maximum downthrow is about 50 feet (15 m) to the northwest.

PITTSBURG ANTICLINE

Cottage Grove Fault System

Location T8S, R3E, Williamson County (J-6)

References Nelson and Krausse 1981

The Pittsburg Anticline was mapped from numerous coal test boreholes and from elevation surveys and geologic mapping in underground mines. It strikes west-northwest and is approximately 6 miles (10 km) long and 2 miles (3 km) wide (fig. 26). The fold is relatively flat-topped and has dips as steep as 15° to 20° on the northwest and southeast flanks. Many faults, most of which strike northwest, cross the fold axis.

Nelson and Krausse (1981) interpreted the Pittsburg Anticline as a subsidiary fold resulting from the compressional component of right-lateral wrenching in the Cottage Grove Fault System. An alternate explanation is that the Pittsburg Anticline is part of a positive flower structure (Harding 1985, Harding and Lowell 1983). This interpretation is supported by the presence of reverse faults dipping inward on the northeast and southwest flanks of the fold (fig. 59). The anticline thus occupies an up-faulted block, partially surrounded by branches of the Cottage Grove Fault System. The steeply dipping flanks of the anticline are adjacent to the bordering faults. The anticline may have developed as the central block was squeezed upward by oblique slippage along the bordering faults.

The Pittsburg North, Johnston City East, and Stiritz Oil Fields were developed in Mississippian pay zones on the Pittsburg Anticline. The three fields together have yielded approximately 1.5 million barrels of oil and more than 1 billion cubic feet of gas.

PITTSFIELD ANTICLINE

Location Central Pike County (F-1,2)

References Coryell 1919, Krey 1924, Bell 1926d, Collingwood 1933, J. Weller and Bell 1937, Workman and Bell 1948, Bristol and Buschbach 1973

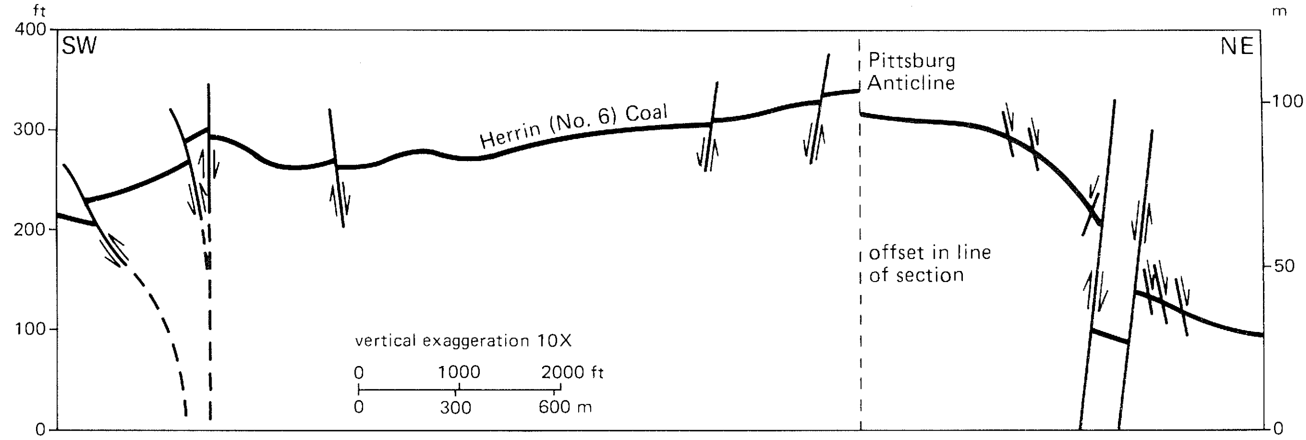


Figure 59 Pittsburg Anticline, according to mine survey data on the Herrin Coal Member. The anticline is flanked on both sides by faults that dip inward. Seismic data suggest that the faults join at depth and that the anticline lies at the crest of a flower structure in the Cottage Grove Fault System.

The Pittsfield Anticline, also called the Pittsfield–Hadley Anticline, is the largest anticline in western Illinois north of the Cap au Grès Faulted Flexure. It is a highly elongated anticline and has a northwest-trending axis. The highest point is located in the western part of T5S, R4W, where Krey (1924) reported 175 feet (53 m) of structural closure on the base of the Mississippian Burlington Limestone. Bristol and Buschbach (1973) showed more than 200 feet (60 m) of closure on top of the Galena Group (Ordovician). Nosing of contours extends well beyond the area of closure at both ends of the fold axis. Some authors have traced nosing as far southeast as Greene County, Illinois, and northwestward into Missouri.

One well near the crest of the Pittsfield Anticline was drilled to Precambrian granite. The top of Precambrian is about 800 feet (240 m) higher than in another well 8 miles (13 km) northwest and off the structure. The Mt. Simon Sandstone is absent in the well on the anticline; the Eau Claire Formation rests directly on the granite. Workman and Bell (1948) inferred that a Precambrian hill underlies the highest point of the Pittsfield Anticline. That inference appears well founded; however, the anticline is much too large to attribute solely to compaction over a buried hill. The parallelism of the Pittsfield to other large folds and fault zones in western Illinois and eastern Missouri suggests an origin by reactivation of faults in the crystalline basement.

In 1886, gas was discovered in Silurian dolomite on the Pittsfield Anticline at a depth of 265 feet (81 m). The Pittsfield Gas Field was subsequently developed, but was abandoned by 1930.

PLAINVIEW SYNCLINE (discarded)

Location Southern Macoupin County

References Easton 1942

Easton, who was interested in promoting oil exploration, named many domes and anticlines in Macoupin County and vicinity. The Plainview was his only syncline. Easton's (1942) map shows an extremely subtle nosing of the contour lines with only one small area of possible closure. Remapping of the Herrin (No. 6) Coal Member, by using many newly available control points, revealed no indication of the Plainview Syncline or its flanking "anticlines" (Nelson 1987b); therefore, use of the name should be discontinued.

PLUM RIVER FAULT ZONE

Location Northern Ogle and Carroll Counties, Illinois, westward to Linn County, Iowa (A-3,4)

References Kolata and Buschbach 1976, Ludvigson et al. 1978, Heyl and West 1982, Trapp and Fenster 1982, Heyl 1983, Kolata et al. 1983, Bunker et al. 1985, Ludvigson 1985

Structural disturbance was recognized early in this area, but it was interpreted to be an anticline rather than a fault zone (Cady 1920). The geologic map of Illinois (Willman et al. 1967) indicates a fault 4 miles long at Savanna, Illinois, on the Mississippi River. Kolata and Buschbach (1976) named the Plum River Fault Zone and traced it from T25N, R10E, Ogle County, Illinois, to the vicinity of Maquoketa, Iowa. Bunker et al. (1985) used geophysical surveys, core drillings, and detailed outcrop studies to extend the fault zone as far west as Cedar Rapids, Iowa.

As presently mapped, the Plum River Fault Zone is 112 miles (180 km) long and trends slightly north of east. Its width varies from a few hundred feet to about 3,900 feet (1,170 m). The zone is composed of high-angle faults that are subparallel or possibly braided in map view. The cumulative displacement is 100 to 400 feet (30–120 m) down to the north. At several places in Iowa, the fault zone contains a central graben in which downfaulted slices of Devonian rocks are preserved between Silurian and Upper Ordovician strata outside the fault zone. Vertical offsets of individual faults are as great as 500 feet (150 m) in near-surface rocks and may reach 1,100 feet (33 m) at the Precambrian basement surface (Bunker et al. 1985).

The fault zone is generally bordered by anticlines along the south side and synclines along the north (fig. 37). Prior to recognition of the fault zone, the southern anticlinal belt was called the Savanna–Sabula Anticline and it included the Leaf River Anticline and Forreston Dome in Illinois. The northern syncline in Illinois is called the Uptons Cave Syncline.

Sedimentary rocks along the Plum River Fault Zone generally dip gently, except in immediate proximity of faults, where dips reach or exceed 45°. Dolomite along faults has undergone severe cataclastic deformation. Mineralization with lead and zinc has been reported at several localities (Heyl and West 1982).

Bunker et al. (1985) inferred, on the basis of detailed stratigraphic studies, that the north side of the Plum River Fault Zone may have begun to subside near the middle of the Silurian Period. Movement early in the Middle Devonian Epoch is strongly indicated; formations of this age are present north of the fault zone but absent south of it in Iowa. The main movements evidently were post-Devonian, pre-Pennsylvanian. Small outliers of Pennsylvanian rocks are found at similar elevations on opposite sides of the fault zone. Structural relationships of these outliers could allow at most about 30 feet (9 m) of post-Pennsylvanian movement (Bunker et al. 1985, Ludvigson 1985).

The stress field responsible for the Plum River Fault Zone has not been defined. Several geologists (Ludvigson et al. 1978, Heyl and West 1982, Trapp and Fenster 1982, Heyl 1983) have suggested that right-lateral faulting has taken place. Following comprehensive study, Bunker et al. (1985, p. 65) concluded, "While the interpreted structural geometries described in this report are not incompatible with strike-slip faulting, this hypothesis is untestable with the current data set."

POCAHONTAS ANTICLINE (discarded) see GREENVILLE DOME and STUBBLEFIELD ANTICLINE (discarded)

POLO SYNCLINE (new name)

Location Southwestern Ogle County (B-4)

References Horberg 1946, Willman and Templeton 1951, Templeton and Willman 1952, Kolata and Buschbach 1976, Kolata et al. 1983

Willman and Templeton (1951) indicated a circular enclosed depression in west-central Ogle County on their structure-contour map of the top of the Galena Group. They named this depression the Polo Basin. Their structure map was modified from the Horberg (1946) map that shows a syncline open to the southwest in the same area. The state geologic map (Willman et al. 1967) and the Galena structure map of Bristol and Buschbach (1973) indicate the top of the Galena to be eroded in most of Ogle County. Small outliers of the Maquoketa Group in southern T24N, R8E, and northern T23N, R8E, indicate a structurally low area approximately coincident with Willman and Templeton's (1951) Polo Basin. Structure maps by Kolata and Buschbach (1976) of the top of the Glenwood Formation and by Kolata et al. (1983) of the top of the Franconia Formation show an open syncline much like the one originally mapped by Horberg (1946). The name Polo Basin is modified to Polo Syncline because the structure apparently lacks the internal closure needed to define a basin.

POMONA FAULT

Ste. Genevieve Fault Zone

Location Southwestern Jackson County (J-5)

References Desborough 1958, 1961a, b, Pickard 1963, Satterfield 1965, Johnson 1970, Nelson and Lumm 1985

The Pomona Fault was mapped from outcrops in bedrock uplands by Desborough (1958), Pickard (1963), and Satterfield (1965). The fault was traced farther west by means of subsurface data collected from beneath the Mississippi River floodplain (Nelson and Lumm 1985). The Pomona Fault strikes parallel with and lies 3 to 5 miles (5–8 km) northeast of the Ste. Genevieve Fault Zone. The Pomona Fault strikes about N60°W across the uplands and curves to due west across the floodplain.

Desborough (1958), Pickard (1963), and Satterfield (1965) all indicated that the Pomona Fault displaces the lower Pennsylvanian and upper Chesterian bedrock at the surface with the northeast side downthrown as much as 200 feet (60 m). Nelson and Lumm (1985) observed that Pennsylvanian rocks along the Pomona Fault are folded and heavily jointed but not displaced. Pennsylvanian rocks define a northeast-facing monocline with the flank dipping at 7° to 15°. Both outcrops and well data indicate, however, that underlying Mississippian rocks are faulted. Well records in T10S, R3W, suggest several hundred feet of displacement down to the north on Chesterian rocks. These findings also suggest that a major episode of faulting took place after Chesterian deposition and before the first Pennsylvanian rocks were deposited. Subsequent post-early Pennsylvanian movements along the Pomona Fault were sufficient to bend but not shear Pennsylvanian rocks.

PONTIAC DOME

Location T27 and 28N, R6E, Livingston County (D-6)

References Buschbach and Bond 1974, Jacobson 1985

Pontiac Dome is best described as two domes separated by a saddle. The southern dome is nearly circular and approximately 2 miles (3 km) in diameter. It has about 100 feet (30 m) of closure on the top of the basal Cambrian Mt. Simon Sandstone that was developed as a gas storage reservoir. The northern dome is smaller than the southern and more irregular in outline. Its closure is about 70 feet (21 m) on the Mt. Simon. Both domes lie along the axis of a broad, south-plunging anticline.

The configuration of Pontiac Dome, as contoured on the Pennsylvanian Colchester Coal Member (Jacobson 1985), is similar to that contoured on the Mt. Simon, but the amount of closure is less on the younger horizon. The Pontiac Dome lies within the broad confines of the La Salle Anticlinorium, but whether a genetic relationship exists is not known.

PORTAGE SYNCLINE

Upper Mississippi Valley Zinc–Lead District

Location Sections 35 and 36, T28N, R1W, Jo Daviess County (A-3)

References Willman and Reynolds 1947

Mapping of this subtle feature was based on scattered outcrop data. The axis strikes N60°E and the southeastern limb has greater relief. Willman and Reynolds (1947) stated that the Portage Syncline structure could be considered a monocline interrupting the regional southward dip.

POTATO HILL SYNCLINE (discarded)

Location Southern part of T10S, R7E, Saline County

References Butts 1917, 1925, S. Weller et al. 1920, Cady 1926

Early geologists mapped a syncline west of and roughly parallel with the Horton Hill Anticline in northeastern Pope and southeastern Saline Counties. Detailed mapping of the same area by Baxter et al. (1967) and Nelson and Lumm (1987) indicates that the structure is better characterized as a graben. Use of the name Potato Hill Syncline should be discontinued.

POTTSVILLE SYNCLINE

Location Western Union County (J, K-5)

References J. Weller 1940, J. Weller and Ekblaw 1940

The Pottsville Syncline was defined on the basis of surface mapping. It trends north to south and lies 2 to 3 miles (3–5 km) west of and parallel with the Harrison Creek Anticline. The syncline is poorly delineated because it is partly concealed by Mississippi River alluvium and occurs in a region for which the subsurface data are sparse.

PRECAMBRIAN HILLS

Location See Plate 1

References Thwaites 1931, Dake and Bridge 1932, Hayes 1961, Bradbury and Atherton 1965, Atherton 1971, Wharton et al. 1975

Buried Precambrian hills are not structural features, but because they are probably responsible for several named domes in Illinois, they merit discussion here.

On the Ozark Dome the Precambrian surface is rugged and has as much as 1,500 feet (450 m) of local relief (Dake and Bridge 1932). The highest knobs protrude through sedimentary cover in the St. Francois Mountains and in numerous isolated hills to the south and west. Many additional Precambrian buried hills and ridges in the Ozarks have been located by drilling and mining operations. Most of the largest hills are composed of rhyolite porphyry, an extremely resistant rock. Dake and Bridge (1932) showed that the Precambrian topography was the product of a dendritic drainage system established prior to deposition of the basal Cambrian Lamotte (Mt. Simon equivalent) Sandstone.

The Lamotte and younger Cambrian formations of the Ozarks thin and pinch out against the flanks of the Precambrian hills and display original dips as steep as 30°. Mapped structural relief on Cambrian horizons near buried hills locally exceeds 300 feet (90 m). The presence of residual chert of the Gasconade Formation (base of Ordovician) on the tops of some of the higher knobs suggests that the Precambrian surface was mantled in sediments early in the Ordovician Period, but it was subsequently exhumed by erosion (Dake and Bridge 1932).

Information on the Precambrian surface in Illinois is limited, because only 34 boreholes to date have reached Precambrian rocks (fig. 4). Some of these wells do, however, provide evidence for considerable relief on the Precambrian surface. Two wells drilled 8 miles (13 km) apart in Pike County indicated about 800 feet (240 m) of local relief on the Precambrian. In the higher well the Mt. Simon Sandstone was absent and the Eau Claire Formation was found resting directly on red granophyre. Three Precambrian tests were drilled within 1 mile (1.6 km) of one another on the southern St. Jacob Dome in southeastern Madison County. These revealed that local relief was at least 347 feet (107 m) and that the Mt. Simon was absent on top of one of the domes. This evidence strongly implies that the domes, which affect Ordovician strata, resulted from uneven deposition and compaction across Precambrian knobs. A similar origin of the Dale Dome in Hamilton County is suggested by the absence of the Mt. Simon in a Precambrian test drilled on top of the dome. Other Precambrian hills, indicated by wells that encountered Eau Claire or younger formations resting directly on basement, are shown on plate 1. These wells are isolated from other Precambrian tests and not associated with named domes.

Domes related to Precambrian hills would be expected to occur alone or in small groups. They should have irregular outline, random orientation, and abnormally thin or missing basal Cambrian formations. Structural relief should increase with depth.

Such domes obviously are targets for petroleum exploration and for gas storage reservoirs. Many zinc and lead deposits in the Ozarks occur on the flanks of buried hills. Paleotopography influenced facies distribution of the ore-bearing Bonneterre Formation (Eau Claire equivalent) and structural irregularities around buried hills probably controlled movement of the ore-forming fluids (Wharton et al. 1975).

RALEIGH DOME (new)

Location Section 2, T8S, R6E, and Section 35, T7S, R6E, Saline County (J-6)

References None

The name Raleigh Dome is introduced for the domal structure that holds part of the Raleigh Oil Field near the village of Raleigh in northern Saline County. As mapped on the Beech Creek ("Barlow") Limestone and Karnak Limestone Member (ISGS open files), the Raleigh Dome is about 2 miles (3 km) from north to south and 1.25 miles (2 km) east to west. Closure on both horizons is approximately 50 feet (15 m). The structure map of the Springfield Coal Member (Hopkins 1968) shows a nose but no closure at a contour interval of 50 feet. The Raleigh Oil Field was discovered in 1953 and contains 52 wells, most of which produce from the Cypress and Aux Vases Sandstones. Cumulative oil production is 2.17 million barrels.

RANSOM SYNCLINE (discarded)

Location From northern La Salle to southern Livingston County

References Willman and Payne 1942

This long and subtle depression was mapped from subsurface data on various Cambrian and Ordovician horizons. The position and trend of the axis, as indicated by Willman and Payne (1942), vary somewhat at different levels. On their structure map of the top of the Galena Group, Bristol and Buschbach (1973) showed a trough approximately in the position of Willman and Payne's (1942) Ransom Syncline between the Pontiac Dome and Ancona Anticline. Willman and Payne (1942) had no information on the Pontiac Dome, which has proved to be one of the largest structures in the area. Because of its ambiguous definition, use of the name Ransom Syncline should be discontinued.

RATTLESNAKE FERRY FAULT ZONE
see **STE. GENEVIEVE FAULT ZONE**

RAUM FAULT ZONE (new name)
Fluorspar Area Fault Complex

Location T11S, R7E, Pope County to T14S, R3E, Massac County (pl. 2)

References Baxter et al. 1967, Weibel et al. 1993

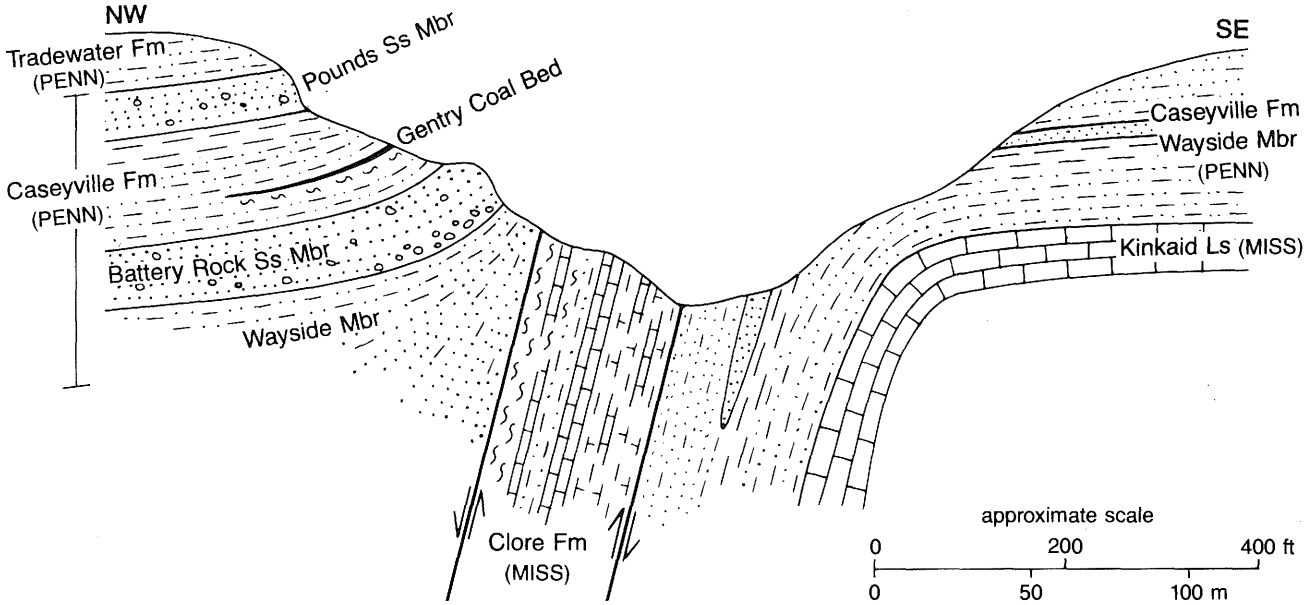


Figure 60 Cross section of the Raum Fault Zone, as interpreted from an outcrop study in SW NW, Section 13, T12S, R6E, Pope County. Test borings for fluorspar and a seismic reflection profile confirm the steep northwest dip of faults. Net displacement across the fault zone is slight, but the central slice of Mississippian rock is upthrown. Configuration of the fault zone indicates initial reverse movement followed by normal faulting, during which the northwest block dropped back to approximately its original position.

The Raum Fault was named by Baxter et al. (1967), but it is a zone of several parallel faults and is renamed Raum Fault Zone. It strikes northeast and is parallel to the Lusk Creek Fault Zone, about 3 miles (5 km) northwest, and the Hobbs Creek Fault Zone, 2 to 3 miles (3–5 km) southeast. The Raum Fault Zone merges at its northeast end with faults radial and concentric to Hicks Dome. Southwestward, it has been mapped to the edge of the Mississippi Embayment and it probably continues beneath the embayment sediments. Several faults obliquely interconnect the southwestern Raum and Lusk Creek Fault Zones.

In Sections 13 and 14, T12S, R6E, Pope County, the Raum Fault Zone consists of two parallel faults a few hundred feet (approximately 100 m) apart at the surface. Pennsylvanian rocks crop out on both sides of the fault zone and display little or no relative displacement. Between the two faults is a narrow slice of Chesterian rock that is upthrown several hundred feet relative to rocks outside the fault zone. These strata and Pennsylvanian rocks adjacent to the faults dip steeply northwest (fig. 60). Surface exposures and test drilling for fluorspar indicate that the faults themselves also dip steeply toward the northwest (Weibel et al. 1993).

The configuration of the Raum Fault Zone is best explained by two opposing episodes of dip-slip motion. The first involved reverse faulting with the northwest side upthrown. The second was normal and nearly canceled the earlier reverse movement, returning the fault blocks nearly to their original positions. Narrow slices of Mississippian rock were sheared off the hanging wall in the second episode and were left stranded high within the fault zone. Thus, the Raum Fault Zone is virtually a mirror image of the adjacent Lusk Creek Fault Zone. A proprietary seismic reflection profile indicates that the Raum Fault Zone intersects the Lusk Creek Fault Zone in Upper Cambrian or Lower Ordovician strata, whereas the Lusk Creek Fault Zone continues into Precambrian basement (fig. 50). The Raum Fault Zone thus is antithetic to the Lusk Creek Fault Zone and shared its post-Pennsylvanian history.

REDHEAD ANTICLINE (discarded)

Location T2N, R14W, Richland County

References Easton 1943

Easton (1943) gave the name Redhead Anticline to a west-trending nose that was mapped, on the basis of a few well records, on the Beech Creek ("Barlow") Limestone and the Levias Limestone Member of the Renault Limestone (Mississippian). Current structure maps of the area, contoured on the Mississippian Beech Creek ("Barlow") Limestone and Karnak Limestone Member (ISGS open files), show no indication of the anticline mapped by Easton. These newer maps were based on dozens of control points that were not available to Easton. Use of the name Redhead Anticline should be discontinued.

REELFOOT BASIN

Location See text below

References Schwalb 1969, 1971, 1982, Bond et al. 1971, Atherton 1971

Schwalb (1969) introduced the term Reelfoot Basin for a Cambrian–Ordovician center of deposition that existed in the area of the present northern Mississippi Embayment. At that time, Schwalb was unaware of the existence of the Reelfoot Rift, but he recognized that the Cambrian–Ordovician succession is substantially thicker in the northern embayment area than in the surrounding region. Schwalb (1969) further envisioned the Reelfoot Basin as ancestral to the Eastern Interior (Illinois) Basin.

The definition of the Reelfoot Basin becomes unclear in Schwalb (1982), which refers to Pennsylvanian deposition in the Reelfoot Basin. The 1982 paper also fails to distinguish clearly between the Reelfoot Basin and the Illinois Basin and it does not suggest geographic limits for either.

I recommend that the name Reelfoot Basin be restricted to the paleogeographic depression that developed above the

Reelfoot Rift and Rough Creek Graben after the cessation of active faulting in the rifts.

Faulting apparently ceased during or shortly after deposition of the Mt. Simon/Lamotte Sandstone in the St. Croixan (Late Cambrian) Epoch. The Reelfoot Basin subsided very rapidly in the St. Croixan and Canadian (Early Ordovician) Epochs, and it gradually lost expression during the Champlainian and Cincinnatian Epochs (Middle and Late Ordovician). The Reelfoot Basin covered part of western Kentucky, southern Illinois, southeastern Missouri, and northwestern Tennessee. It lay above the Reelfoot Rift and Rough Creek Graben, and it extended an indefinite distance onto flanking areas that had been subaerially exposed prior to Mt. Simon /Lamotte sedimentation. Although evidence is obscure, the Reelfoot Basin probably connected with the developing Ouachita geosyncline. No definite basin existed in the Reelfoot area after the Ordovician Period. The name Vincennes Basin has been applied to a trough that developed somewhat north of the older Reelfoot Basin during the Silurian Period.

Although names such as Reelfoot Basin may cause confusion, they are useful reminders that the Illinois Basin is largely a product of post-Pennsylvanian structural movement and that it did not exist as a depositional basin during most of the Paleozoic Era. Some researchers have chosen to use nongeographic terms such as proto-Illinois Basin to express the same idea.

REELFOOT RIFT

Location See text below and figures 1 and 6

Selected references Ervin and McGinnis 1975, McKeown and Pakiser 1982, Schwalb 1982, Houseknecht and Weaverling 1983, Gori and Hays 1984, Howe and Thompson 1984, Buschbach 1986, COCORP 1988, Heigold 1991, Kolata and Nelson 1991a

The existence of a buried rift zone in the northern Mississippi Embayment was postulated by Burke and Dewey (1973) and elaborated by Ervin and McGinnis (1975), who named the feature Reelfoot Rift. The name is taken from Reelfoot Lake that formed when an area in northwestern Tennessee near the Mississippi River sank during the New Madrid earthquakes of 1811 and 1812.

The rift is indicated by geophysical data including seismic reflection and refraction profiles as well as gravity and magnetic surveys. Several deep oil test holes have entered the rift-filling sedimentary rocks, but none has penetrated completely. These data indicate a northeast-trending graben about 40 miles (65 km) wide and more than 200 miles (320 km) long. It is bordered by normal faults that, in places, may have more than 10,000 feet (3,000 m) of displacement (Howe and Thompson 1984, COCORP 1988). The northwest border runs from northeastern Arkansas across the bootheel of Missouri into southernmost Illinois. The Lusk Creek Fault Zone appears to coincide with part of the northwest border fault. The southeast border of the Reelfoot Rift crosses westernmost Tennessee and Kentucky. At its northeastern end the Reelfoot Rift connects with the east-trending Rough Creek Graben, a fault-bounded trench of similar dimensions.

The Reelfoot Rift (and Rough Creek Graben) contains 10,000 feet (3,000 m) or more of layered rocks older than the Mt. Simon Sandstone (Upper Cambrian). Deep well penetrations indicate arkoses and basinal shales (Houseknecht and Weaverling 1983), but layered volcanic rocks, common in rift settings, may be present below. Upper Cambrian and Lower Ordovician rocks thicken markedly into the rift but do not appear to be displaced by the boundary faults (Howe and Thompson 1984). Thus, the graben is interpreted as having formed in Early Cambrian time, while the rest of Illinois and adjacent areas were stable uplands (Kolata and Nelson 1991a). Thickening of the Mt. Simon and younger strata signify continued subsidence of the rift after cessation of active faulting. A zone of deformation termed the axial fault zone is expressed seismically along the centerline of the Reelfoot Rift, and it is interpreted as a product of post-Pennsylvanian compressional and strike-slip faulting (Howe and Thompson 1984). The same compressional stresses may have been responsible for uplift of the Pascola Arch, which is centered within the rift. Post-Pennsylvanian reverse faulting and later normal faulting are documented along the Lusk Creek Fault Zone (Nelson 1986). Other northeast-trending faults in the Fluorspar Area Fault Complex are probably related to extensional reactivation of the northern part of the Reelfoot Rift. The junction of the Reelfoot Rift and Rough Creek Graben was the scene of intense post-Pennsylvanian faulting, igneous activity, and mineralization (see FLUORSPAR AREA FAULT COMPLEX). A series of large, approximately circular magnetic and gravity anomalies along both borders of the rift are interpreted to be igneous intrusions (McKeown and Pakiser 1982). One of these is situated in Alexander County, Illinois; it has not been confirmed by drilling.

The area of the Reelfoot Rift began to subside again in the Cretaceous Period and became the Mississippi Embayment. Subsidence continued through the Holocene Epoch. Earthquake activity is concentrated in a narrow northeast-trending zone along the axis of the rift, offset by a short northwest-trending segment near New Madrid, Missouri. Earthquakes in the New Madrid Seismic Zone are believed to be the result of slippage along faults reactivated in the present compressional stress field (McKeown and Pakiser 1982, Gori and Hayes 1984).

See also ROUGH CREEK GRABEN, ST. LOUIS ARM (discarded), and SOUTHERN INDIANA ARM (discarded).

REND LAKE FAULT ZONE (new name)

Location From T7S, R2E, Franklin County, to T3S, R1E, Jefferson County (I-5 to J-6)

References Keys and Nelson 1980, Nelson 1981

Keys and Nelson (1980) referred to this structure as the Rend Lake Fault System, but the name is changed to Rend Lake Fault Zone because the faults are parallel and all the same type. In addition, the faults are confined to a zone that is nearly 50 times as long as it is wide.

The Rend Lake Fault Zone is known in considerable detail from exposures in underground coal mines. Its mapped length is about 24 miles (39 km) and its width varies from about 30 feet (10 m) to more than 0.5 mile (0.8 km). The southern end of the Rend Lake Fault Zone is just north of the Cottage Grove Fault System (fig. 31). The fault zone strikes due north for about 15 miles (24 km) then curves to a heading of N15°W. It apparently terminates along the flank of the northeast branch of the Du Quoin Monocline.

The Rend Lake Fault Zone is composed mainly of high-angle normal faults that strike parallel to the overall trend of the zone. Individual faults overlap one another end-to-end. Displacements range from less than 1 inch to about 55 feet (17 m). Some faults are downthrown to the east, others to the

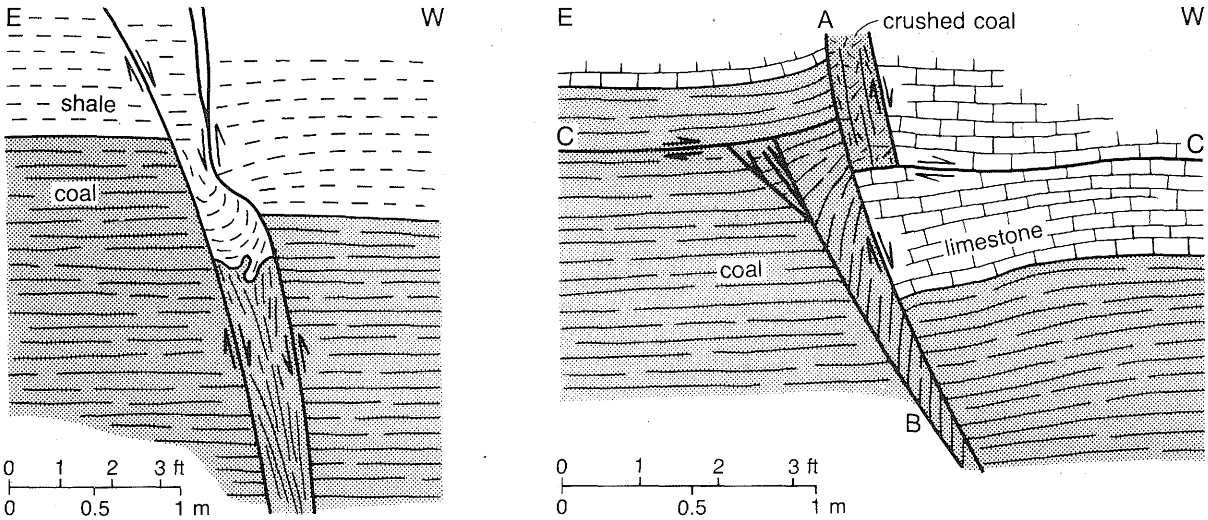


Figure 61 Field sketches showing small scale complexity of faults in the Rend Lake Fault Zone in an underground coal mine in Franklin County. Left sketch shows two parallel faults with a downdropped block between them. Striations on the surface of the east fault plunge 25° south, indicating a component of left-lateral movement. Right sketch demonstrates at least three periods of movement: (1) reverse movement on fault A with fracture B as a hinge, (2) horizontal movement on bedding plane fault C displacing fault A, and (3) normal movement down to the west on fault A, offsetting fault C.

west. The overall displacement is not consistent along the length of the fault zone. Horsts and grabens are common. Aside from minor drag, no folding or tilting of strata adjacent to faults is observed. Small reverse and oblique-slip faults occur in some areas in the Rend Lake Fault Zone (fig. 61). These may signify an episode of compression or they may simply reflect local wedging or rotation of fault slices during normal faulting.

The fault zone follows the west flank of a long narrow shallow syncline parallel to the Benton Anticline on the east. The syncline evidently began to form late in the Mississippian or early in the Pennsylvanian Period and it underwent further development after Pennsylvanian sedimentation. Faulting was interpreted as a product of late-stage differential uplift and subsidence along the syncline (Keys and Nelson 1980). The extent of the Rend Lake Fault Zone at depth is unknown.

RENO ANTICLINE (discarded)

Location Sections 21 and 22, T6N, R4W, Bond County

References Bell 1941

The Reno Anticline originally was mapped as part of the Ayers Anticline (Blatchley 1914). Bell (1941) remapped the area and separated the Reno Anticline from the Ayers. The Reno was depicted as a small high, having no closure at a contour interval of 25 feet (7.6 m). Bell restricted the name Ayers Anticline to an enclosed high east of the Reno Anticline. Both highs occur along a continuous nose. Separate naming of two small closely related features seems unwarranted. The name Reno Anticline is discarded and the Ayers Anticline is extended to include the Reno.

RIBEYRE ISLAND FAULT
Wabash Valley Fault System

Location White County, Illinois, and Posey County, Indiana (I-8)

References Bristol and Treworgy 1979, Ault et al. 1980, Tanner et al. 1980a–c, Tanner et al. 1981a–c

The extent of the Ribeyre Island Fault is poorly known because of a lack of well control along its inferred northern portion. It is about 2,000 to 6,000 feet (0.6–1.8 m) west of the New Harmony Fault Zone. The east side is downthrown. Along its southern portion where it is well defined, the Ribeyre Island Fault displaces the West Franklin Limestone Member of the Modesto Formation by 170 feet (52 m), but less than 50 feet (15 m) of offset is shown on the Beech Creek ("Barlow") Limestone (Bristol and Treworgy 1979). Bristol and Treworgy interpreted the Ribeyre Island Fault as dying out northward into a monocline.

RIDGE FAULT
Fluorspar Area Fault Complex

Location T10S, R8E, Gallatin County, and T11S, R8E, Hardin County (pl. 2)

References Baxter and Desborough 1965

The Ridge Fault is essentially a northeastern extension of the Hobbs Creek Fault Zone. The Ridge Fault runs northeast across the apex of Hicks Dome and merges with the Lee Fault Zone. Displacement is less than 50 feet (15 m) down to the northwest.

RIDGWAY FAULT and RIDGWAY–OMAHA MONOCLINE or FAULT ZONE
see ALBION–RIDGWAY FAULT ZONE

RIDGWAY GRABEN
Wabash Valley Fault System

Location T7S, R9E, Gallatin County (J-7)

References Bristol 1975, Bristol and Treworgy 1979

The downthrown block between the Albion–Ridgway Fault Zone and the Cottonwood Fault is known as the Ridgway Graben.

RINGOLD FAULT and **RINGOLD SOUTH FAULT**
Rough Creek–Shawneetown Fault System

Location Northern T10S, R9E, Gallatin County (pl. 2)

References Nelson and Lumm 1987

The Ringold Fault lies 1.5 to 1.25 mile (0.8–2 km) south of and strikes parallel with the front fault of the Rough Creek–Shawneetown Fault System. The Ringold South Fault is just south of and parallel to the Ringold Fault. As interpreted from borehole data, the displacement on both faults is several hundred feet down to the south.

RIPLEY SYNCLINE
Peoria Folds

Location Schuyler and southernmost Fulton Counties (E-2,3)

References Wanless 1957

The Ripley Syncline is a subtle syncline that was mapped on the basis of subsurface data on Mississippian strata. The axis strikes east-northeast and is about 25 miles (40 km) long.

RITCHEY–HERSCHER ARCH (discarded)
see **HERSCHER ANTICLINE** (new name)

ROCK CREEK GRABEN
Fluorspar Area Fault Complex

Location Hardin and Pope Counties, Illinois and Livingston County, Kentucky (J, K-7 and pl. 2)

References J. Weller et al. 1952, Baxter et al. 1963, Ross 1963, 1964, McGinnis and Bradbury 1964, Baxter and Desborough 1965, Heyl et al. 1965, Baxter et al. 1967, Kolata et al. 1981, Trace and Amos 1984

Like the Dixon Springs Graben, the Rock Creek Graben is a large and complicated zone of downfaulting. The Rock Creek Graben is as much as 2.5 miles (4 km) wide and strata have been displaced downward as much as 2,000 feet (600 m) within it. The trend is N55°E in eastern Hardin County. This trend changes to N20°E near Rosiclare where the graben crosses into Kentucky and then reenters Illinois in southern Pope County. Drilling in Massac County indicated that the graben continues beneath Cretaceous and Tertiary rocks in the Mississippi Embayment. The total length is more than 30 miles (50 km).

Most of the faults are high-angle normal, but high-angle reverse faults are reported to occur along the northwest side of the graben. The combination of reverse and normal faulting might indicate two or more periods of movement under different (compressional and tensional) stress regimes, as on the Lusk Creek and Shawneetown Fault Zones.

ROSE CREEK FAULT (discarded)
Fluorspar Area Fault Complex

Location Section 11, T11S, R7E, Hardin County

References J. Weller et al. 1952, Brown et al. 1954

Weller et al. (1952) described the Rose Creek Fault as a normal fault striking east-northeast and dipping south-southeast in Section 11, T11S, R7E. Baxter et al. (1967) remapped the area and did not label or discuss the Rose Creek Fault. Their geologic map shows a complex system of faults extending through Section 11. These faults lie north of the apex of Hicks Dome and are mostly tangential to the dome. The Rose Creek Fault is too poorly defined to warrant continued use of the name.

ROSICLARE FAULT
Fluorspar Area Fault Complex

Location Section 32, T12S, R8E, and Section 5, T13S, R8E, Hardin County (pl. 2)

References S. Weller et al. 1920, Hubbert 1944, J. Weller et al. 1952, Baxter and Desborough 1965

The Rosiclare Fault contained the richest fluorspar vein in the entire Illinois–Kentucky district. Its trend is arcuate, curving from slightly west of north to northeast. The plane is nearly vertical, with the west side downthrown 200 to 300 feet (60–90 m). Numerous other mineralized faults interconnect with the Rosiclare Fault, along the southeast side of the Rock Creek Graben.

ROUGH CREEK GRABEN

Location See text below and figure 6

Selected references Soderberg and Keller 1981, Schwalb 1982, Nelson and Lumm 1987, Bertagne and Leising 1991, Kolata and Nelson 1991a, Nelson 1991

The idea of a deep graben in western Kentucky was suggested by several researchers (Rudman et al. 1965, Avila 1971, Schwalb 1979) before Soderberg and Keller (1981) delineated and named the Rough Creek Graben. Unpublished seismic data constitute the main source of evidence for this buried structure, which is partially expressed by faulting at the surface.

The Rough Creek Graben is an eastward extension or branch of the Reelfoot Rift. Its north boundary is marked by the subsurface portion of the Rough Creek–Shawneetown Fault System, whereas the south border is along the parallel Pennyrile Fault System of southwestern Kentucky. The Reelfoot Rift and Rough Creek Graben intersect in southeastern Illinois. The junction of the northern borders probably underlies the sharp turn in the Shawneetown Fault Zone in southeastern Saline County.

Seismic reflection profiles from Bertagne and Leising (1991) and various unpublished sources indicate pre-Eau Claire Formation (Upper Cambrian) growth faulting along both the Rough Creek–Shawneetown and Pennyrile Fault Systems. Displacements reach 8,000 feet (2,500 m) on the former and are considerably smaller on the latter (Bertagne and Leising 1991). Thus, the graben is asymmetrical, with its floor tilted down to the north. Some seismic profiles show deep faulting within the graben as well. Downfaulted areas contain thick pre-Mt. Simon Sandstone layered rocks. As in the Reelfoot Rift, a few deep wells have penetrated dark shales and arkoses in the upper part of this sequence. The Exxon No. 1 Bell well in Webster County, Kentucky, encountered both felsic and basaltic igneous rock near total depth. As indicated by radiometric dating, the felsic rock is tentatively considered to be Permian and the basaltic rock to be early Cambrian (James A. Drahovzal, Kentucky Geological Survey, personal communication 1995).

The main period of graben faulting apparently ended by Late Cambrian, but the area continued to subside rapidly and contains overthickened Mt. Simon Sandstone through Knox

Group sections. The western part of the Rough Creek Graben probably contains the thickest and most complete Paleozoic succession in the Illinois Basin (see Structural History).

Post-Pennsylvanian stresses reactivated faults in the Rough Creek Graben and created the surficial Rough Creek–Shawneetown, Pennyrile, and related fault systems. It is uncertain when this faulting died out. The area is seismically quiet today and no indication of Quaternary deformation has been reported (Nelson and Lumm 1987).

ROUGH CREEK–SHAWNEETOWN FAULT SYSTEM

Location Northeastern Pope, southeastern Saline, and Gallatin Counties, Illinois (J-6, 7); eastward to Grayson County, Kentucky (fig. 1)

Selected references Owen 1856, Norwood 1876, Brokaw 1917, Butts 1925, J. Weller 1940, Clark and Royds 1948, Freeman 1951, Sutton 1953, 1971, Heyl and Brock 1961, Heyl et al. 1965, Heyl 1972, Davis et al. 1974, Schwalb 1979, 1982, Smith and Palmer 1974, Krausse et al. 1979, Soderberg and Keller 1981, Nelson and Lumm 1987, Bertagne and Leising 1991, Sargent et al. 1992

Confusing nomenclature has arisen because segments of this fault system were named before its full extent was known. The name Shawneetown Fault dates back to Owen (1856) and has been generally applied to that part of the fault system in Illinois. Although Gold Hill Fault appears in some old reports, that name has not been used for more than 70 years. The name Rough Creek originated with Norwood (1876) and has been used by most researchers in Kentucky. Because both names are established, the compound form Rough Creek–Shawneetown Fault System is chosen to refer to the entire system. It is designated a fault system rather than a fault zone because it contains a complex arrangement of normal, reverse, and strike-slip faults reflecting at least three separate episodes of movement.

The western end of the Rough Creek–Shawneetown Fault System is in northeastern Pope County, Illinois, where the fault system intersects the Lusk Creek Fault Zone. This part of the Rough Creek–Shawneetown Fault System trends north-northeast for about 12 miles (19 km) into southeastern Saline County, where it turns sharply to the east. It continues eastward with a slightly sinuous course as far as Grayson County, Kentucky, where it turns southeastward, branches, and dies out. The total length of the Rough Creek–Shawneetown Fault System is about 130 miles (210 km).

The fault system exhibits a complex braided pattern in map view. The system is widest, more than 5 miles (8 km) in places, in Union, Webster, and McLean Counties, Kentucky. It narrows to about 1 mile (1.6 km) at the Illinois–Kentucky border. Westward, only a single fault has been mapped in some places. East of McLean County, Kentucky, the Rough Creek–Shawneetown Fault System also becomes narrower and loses displacement.

In cross section view the Rough Creek–Shawneetown generally takes the form of a complex arched series of horsts or a faulted anticline in near-surface strata. Although blocks within the fault system are upthrown hundreds or thousands of feet, little relative vertical displacement takes place across the fault system in post-Cambrian strata. Rocks north of the Rough Creek–Shawneetown Fault System typically are horizontal or gently dipping and only slightly deformed. Strata south of the Rough Creek–Shawneetown Fault System dip at 10° to 25°, and locally much steeper, into the Eagle Valley–Moorman Syncline. Rocks within fault slices dip at various attitudes, but most are tilted southward, commonly at 45° or steeper. An anticlinal structure is more prevalent in the eastern half of the system. Grabens also are present; one graben in Kentucky contains the only known Permian strata in the Illinois Basin (Kehn et al. 1982).

Drilling, outcrop studies, and seismic reflection profiles indicate that the largest near-surface fault of the Rough Creek–Shawneetown Fault System is a reverse fault. It generally crops out at or near the north edge of the Rough Creek–Shawneetown Fault System and was designated the front fault by Nelson and Lumm (1987). The front fault dips southward 60° or steeper in most places, although near Morganfield, Kentucky, it dips as gently as 25° (Smith and Palmer 1974). Most of the other faults in the system are normal. Seismic profiles indicate that they intersect the front fault at or above the upper Cambrian Eau Claire Formation (Bertagne and Leising 1991).

Seismic data (Bertagne and Leising 1991 and proprietary seismic lines viewed by the author) demonstrate that near-surface faults of the Rough Creek–Shawneetown Fault System follow the north boundary of an Early Cambrian graben. The existence of this Rough Creek Graben previously was inferred from gravity and magnetic data, as well as scattered information from deep wells (Soderberg and Keller 1981, Schwalb 1982). The north boundary fault of the Rough Creek Graben is a listric normal fault that penetrates crystalline basement (fig. 62). Displacement along this fault is as great as 8,000 feet (2,400 m) and the south side is downthrown. The Rough Creek Graben was filled with a thick sequence of layered rocks prior to deposition of the Eau Claire Formation (Upper Cambrian).

The importance of the Rough Creek Graben in tectonic evolution of the Illinois Basin is discussed further in the section on Structural History. Some geologists, including Clark and Royds (1948), Heyl and Brock (1961), Heyl et al. (1965), and Heyl (1972), inferred wrench faulting along the Rough Creek–Shawneetown Fault System. The braided pattern of faults in map view and the narrow upthrust slices along the fault zone are typical features of strike-slip faults. Several lines of evidence, most notably the lack of offset of pre-Pennsylvanian paleochannels that cross the Rough Creek–Shawneetown Fault System in Kentucky (Davis et al. 1974), seem to rule out large post-Pennsylvanian horizontal displacements. Nelson and Lumm (1987) and Bertagne and Leising (1991) proposed that in the Permian or late in the Pennsylvanian Period, the northern boundary fault of the Rough Creek Graben was reactivated as a reverse fault under compressional stress (fig. 62). This event raised the southern block of the front fault. A later episode of extension allowed the southern block to drop back to its earlier position. As the southern block dropped, many slices of rock were sheared off the hanging wall and left high within the fault zone, while strong drag on the descending block produced the northern limb of the Eagle Valley–Moorman Syncline (fig. 62).

RURAL HILL DOME

Location T6S, R5E, Hamilton County (I, J-6)

References Rolley 1951

Rolley called this feature an anticlinal nose, but it does not differ significantly from other structures she called domes. An

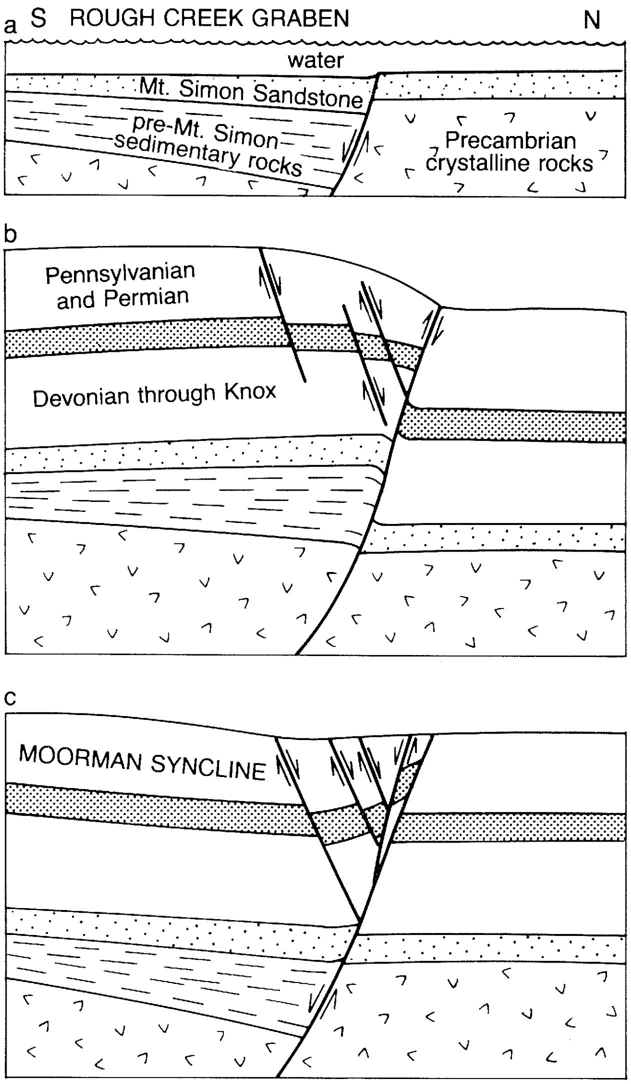


Figure 62 Development of the Rough Creek–Shawneetown Fault System. (a) During deposition of the Mt. Simon Sandstone (Late Cambriam) — normal faulting, down to the south; the Rough Creek Graben is south of the fault system. (b) Late Paleozoic — reverse faulting, down to north. (c) Early Mesozoic — normal faulting, down to the south. Slivers sheared off the hanging wall; the Moorman Syncline developed south of the fault system.

irregular, enclosed area of about 2 square miles (5 km^2) was mapped on the Herrin Coal Member (Pennsylvanian). Similar structure is shown on the Beech Creek ("Barlow") Limestone (Mississippian). Structural relief on both horizons is at least 25 feet (8 m). An oil field developed on the Rural Hill Dome is part of the Dale Consolidated Field, which has produced nearly 105 million barrels of oil since 1940.

See also DALE DOME.

RUSSELLVILLE DOME (new)

Location T4N, R10 and 11W, Lawrence County (H-8)

References Potter 1956, Bristol and Howard 1976

Treworgy (1981) listed the "Russellville structure" in her table of significant unnamed structures. It was named for the Russellville Gas Field and it appears variously as a dome, an anticline, and an anticlinal nose at different structural levels. The structure appears as an elongated dome or anticline and has an axis trending slightly west of north on the Springfield and Herrin Coal Members (Potter 1956). Potter indicated about 50 feet (15 m) of closure on the Herrin Coal. A south-plunging nose with no closure appears on maps of the Beech Creek ("Barlow") Limestone (fig. 19; ISGS open files). Structure maps of the Ste. Genevieve Limestone show a nearly circular dome (Bristol and Howard 1976, Howard, unpublished mapping). On the New Albany Group (Stevenson et al. 1981) and Galena Group (Bristol and Buschbach 1973) the Russellville structure is best described as a terrace. Control points are few, however, on these deeper units. Production in the Russellville Gas Field comes from Pennsylvanian sandstones. The structure is named Russellville Dome.

SAILOR SPRINGS DOME (discarded)

Location T3N, R7E, Clay County

References Lowenstam 1951

Lowenstam mapped the Sailor Springs Dome as an irregularly shaped area of closure on the Herrin Coal Member near the center of T3N, R7E. Current structure maps of the Mississippian Beech Creek ("Barlow") Limestone and Karnak Limestone Member (ISGS open files) show a terrace with several small areas of closure, none of which is worth naming. It is likely that the dome mapped by Lowenstam (1951) on the Herrin Coal is a product of differential compaction of Pennsylvanian strata.

The Sailor Springs Consolidated Oil Field is developed along an irregular sinuous terrace that trends northeast from southern Clay County to southeastern Effingham County. This field has yielded a total of 68.1 million barrels of oil from numerous separate reservoirs in multiple producing horizons. The Chesterian Cypress Sandstone is the most important oil-producing formation, followed by the Ste. Genevieve Limestone, Aux Vases Sandstone, Tar Springs, other Chesterian sandstones, St. Louis and Salem Limestones, and Devonian limestones. Stratigraphic trapping is important in this field, but structural factors undoubtedly played a role in localizing petroleum accumulation. The Sailor Springs terrace trends nearly parallel with adjacent structures that are better defined, including the Louden, Iola, and Clay City Anticlines. The terrace may therefore reflect a more subtle manifestation of the tectonic processes that created the anticlines. The name Sailor Springs Dome should not be used.

ST. DAVID ANTICLINE

Peoria Folds

Location Eastern Fulton County (D-4, E-3)

References Wanless 1957

The St. David Anticline was defined on the basis of several hundred subsurface control points on the Springfield Coal Member (Pennsylvanian). These data indicate an irregular anticline that has subordinate rises and depressions and trends east-northeast. The greater density of control points reveals more irregularities here than are apparent on most other Peoria Folds.

ST. JACOB DOMES

Location T3N, R6W, Madison County (H-4)

References Lowenstam 1948, Bell 1961, Bristol and Buschbach 1973, Buschbach and Bond 1974, Sargent 1991

The St. Jacob structure has two domes, one centered in Section 16 and the other centered in Section 27, T3N, R6W, about two miles south-southeast. The northern dome is nearly circular and approximately 1 mile (1.6 km) in diameter. Closure is about 100 feet (30 m) on top of the St. Peter Sandstone (Buschbach and Bond 1974), 75 feet (23 m) on top of the Galena Group (Bristol and Buschbach 1973), and less than 50 feet (15 m) on top of the Silurian System (Lowenstam 1948). The southern dome, elongated from north to south, is 2 miles (3 km) long and 1.25 miles (2 km) wide. It has closure of 75 to 100 feet (23–30 m) on the Galena and 50 to 75 feet (15–23 m) on the Silurian.

A test hole on the southern dome was drilled directly from the Cambrian Eau Claire Formation into Precambrian granite and encountered no Mt. Simon Sandstone. A second test hole penetrated an abbreviated section of Eau Claire and a thin section of Mt. Simon above the Precambrian. An off-structure test hole encountered a normal section of Eau Claire overlying thin Mt. Simon and granite. These findings suggest that the southern dome overlies a Precambrian paleotopographic high (Sargent 1991). Doming may be the result of differential compaction over the buried knob. A gas storage field has been developed in the St. Peter Sandstone on the northern dome.

ST. JAMES DOME (new name)

Location Mainly in T6N, R3E, Fayette County (H-6)

References Newton 1941, Stevenson 1964

This is the only structure that was named by Newton and confirmed by another geologist. Newton mapped a small north-trending closure on the "upper Bogota" limestone (see EAST LOUDEN ANTICLINE). Stevenson confirmed that a similar structure exists on the Carper sand, a lenticular oil-producing sandstone within the Borden Siltstone (Mississippian). The structure is a slightly elongated north–south dome on the Carper. It is about 3 miles (4.5 km) long and 2 miles (3 km) wide, and shows about 40 feet (12 m) of closure. The dome lies along the axis of the south-plunging anticline that extends south of the enclosed part of the Louden Anticline. About 22 million barrels of oil have been recovered from the Cypress Sandstone (Mississippian) and Carper sand in the St. James Oil Field. Newton's name for the structure, St. James Anticline, should be revised to St. James Dome.

ST. LOUIS ARM (discarded)

Location See text and figure 5

References Braile et al. 1982, 1984

Interpretation of geophysical data led Braile et al. (1982, 1984) to propose a northwest branch of the Reelfoot Rift extending into Missouri. They labeled this branch the St. Louis Arm and postulated that the St. Louis Arm is one branch of a four-armed late Precambrian to early Cambrian rift system in the Mississippi Valley. The entire system has been called the New Madrid Rift Complex.

Evidence for the St. Louis Arm consists of northwest–southeast alignment of regional gravity and magnetic anomalies, as well as apparent northwest-trending zones of earthquake epicenters. One belt of epicenters more or less follows the Ste. Genevieve Fault Zone, which approximately bisects the purported rift arm. As shown by Braile et al. (1984), the St. Louis Arm is approximately 175 miles (275 km) long and 95 miles (150 km) wide. It covers all of the Sparta Shelf, the northeast flank of the Ozark Dome, and part of the western Fairfield Basin.

Geologic evidence disproves the existence of the St. Louis Arm. No rift-related sedimentary rocks or structures analogous to those of the Reelfoot Rift and Rough Creek Graben occur within the St. Louis Arm. Outcrops in the St. Francois Mountains and deep wells on the Sparta Shelf (fig. 4) all show Mt. Simon/Lamotte Sandstone and younger Upper Cambrian rocks of shelf facies in direct contact with granitic and rhyolitic Precambrian rocks. In contrast, the Reelfoot Rift and Rough Creek Graben both contain thick successions of layered rocks older than the Mt. Simon. Precambrian igneous rocks of the Ozark region are radiometrically dated as 1.4 to 1.6 billion years old, far older than the Reelfoot Rift. These rocks have been interpreted as being formed in a series of calderas and underlying stocks not in a rift (Kisvarsanyi 1981, 1984). Although many faults in the area trend northwest, they do not outline a graben and no pre-Devonian movement has been documented. Most of these faults are interpreted as products of differential uplift of basement blocks (Tikrity 1968, Gibbons 1972, Nelson and Lumm 1985, Clendenin et al. 1989). A COCORP seismic profile that crossed the area of the St. Louis Arm showed no crustal layering or evidence for a rift in Precambrian rocks (Pratt et al. 1989).

Braile et al. (1982, 1984) suggested that absence of graben-fill sediment in the St. Louis Arm is a result of uplift in the region. This would require major uplift and erosion during Middle Cambrian time before deposition of the Mt. Simon/Lamotte Sandstone. Even if this had occurred, the graben-bounding faults would be preserved. Braile et al. (1982, 1984) alternatively proposed that rifting in the St. Louis Arm never attained the stage of graben formation, but dense rock was intruded into the lower crust, accounting for the geophysical anomalies. Another possibility is that geophysical trends reflect features of Precambrian rocks much older than the Reelfoot Rift. Geophysical and structural trends from the northwest are evident not only within the St. Louis Arm, but also in most of the rest of Missouri, western Illinois, and large areas of neighboring states. In conclusion, the St. Louis Arm does not exist and the name should not be used.

See also REELFOOT RIFT, ROUGH CREEK GRABEN, SOUTHERN INDIANA ARM (discarded).

STE. GENEVIEVE FAULT ZONE

Location Union and southwestern Jackson Counties, Illinois (J, K-4, 5), northwestward to Franklin County, Missouri

Selected references Flint 1926, S. Weller and St. Clair 1928, J. Weller and Ekblaw 1940, Desborough 1958, 1961a, b, Segar 1965, Heyl et al. 1965, Tikrity 1968, Olsson 1966, McCracken 1971, Heyl 1972, Gibbons 1972, Adair 1975, Nelson and Lumm 1985, Devera 1986, Clendenin et al. 1989, Nelson 1991, Kolata and Nelson 1991a

The Ste. Genevieve Fault Zone crosses the western Sparta Shelf and partly separates the Ozark Dome from the Illinois Basin (fig. 2). Various segments of the fault zone have been named individually. The largest fault of the Ste. Genevieve Fault Zone in Illinois has been called the Rattlesnake Ferry Fault or Fault Zone. The Pomona, Atwood, and Delta Faults,

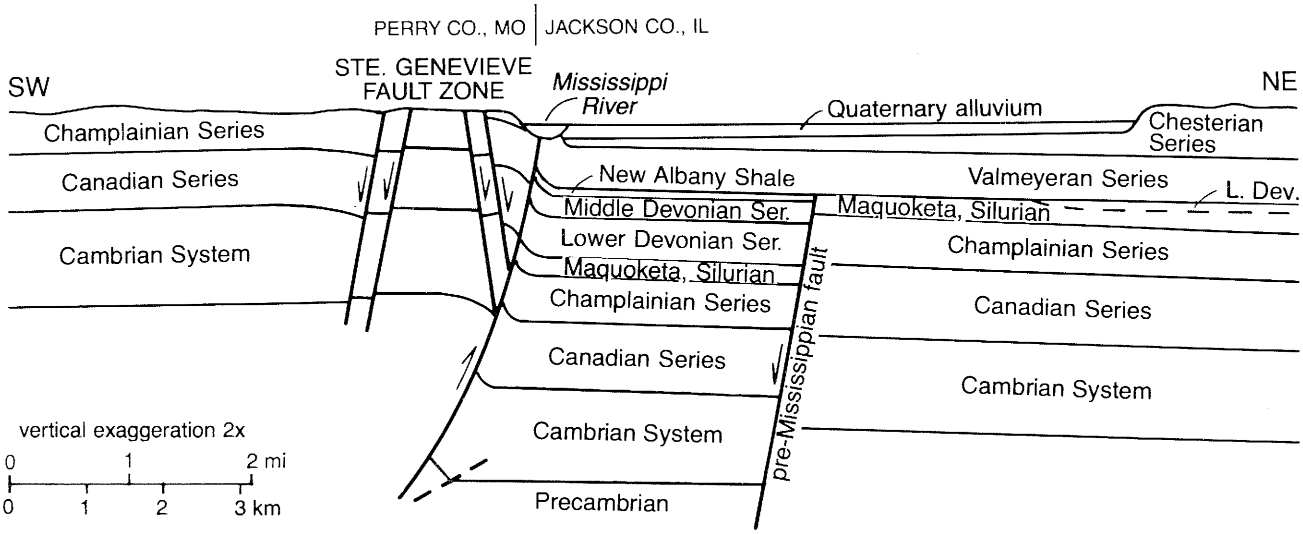
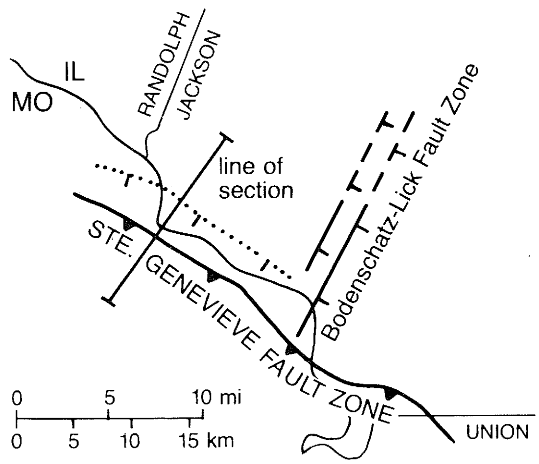


Figure 63 Cross section of the Ste. Genevieve Fault Zone illustrating two episodes of movement. The northern fault (now concealed by alluvium) moved down to the south in the Middle to Late Devonian Epochs. The southern fault, a high-angle reverse fault, moved down to the north late in the Mississippian and in the Pennsylvanian Periods. Note the preserved Devonian strata between faults (Wittenberg Trough).



and the Harrison Creek Anticline may be related to the Ste. Genevieve Fault Zone.

At least two periods of movement occurred along the fault zone, as documented by S. Weller and St. Clair (1928). The first documented movement took place in late Middle Devonian time and the second, late in the Mississippian to early in the Pennsylvanian Periods. Displacement was opposite for the two episodes. Post-Pennsylvanian displacement may have taken place but cannot be proven because no Pennsylvanian or younger rock is preserved on the southwest side of the fault zone.

Devonian faulting took place mainly in Missouri, but it may have extended eastward into Illinois (fig. 9). This movement raised the Sparta Shelf relative to the Ozark Dome. The uplift began during or immediately after deposition of the Grand Tower Limestone (early Middle Devonian) and ended during deposition of the New Albany Shale (fig. 63). The northern block eroded as it rose. Coarse detritus from the Sparta Shelf was deposited in the Beauvais Sandstone and St. Laurent Formation south of the fault in Missouri, whereas silt and clay-sized sediment was incorporated into the time-equivalent Alto and Lingle Formations in southwestern Illinois (Nelson and Lumm 1985, Devera 1986). Eroded strata as old as upper Ordovician were then overlain unconformably by thin New Albany and younger Mississippian strata on the Sparta Shelf, whereas a complete Silurian and Devonian section is preserved south of the fault zone. As much as 1,000 feet (300 m) of vertical offset is indicated.

The late Mississippian–Pennsylvanian deformation was more extensive than the Devonian movement. All faults exposed at the surface along the Ste. Genevieve Fault Zone in Illinois probably date from the second episode. The Carboniferous uplift reversed the Devonian so that the Ozark Dome rose relative to the Sparta Shelf and Illinois Basin (figs. 10, 63). The time of movement is demonstrated by angular unconformity between Chesterian and Pennsylvanian strata (Ekblaw 1925), eroded clasts of older rocks from the Ozark Dome incorporated into the lower Pennsylvanian Caseyville Formation (Poor 1925), and trends of Pennsylvanian paleochannels (Desborough 1961a, b). Unconformities within Caseyville strata near Pomona are attributed to contemporaneous deformation (Desborough 1961a, b).

The structure resulting from the Carboniferous uplift can be characterized as a steeply dipping reverse fault and an associated monocline. Structural relief exceeds 3,000 feet (900 m) in places. Toward the northwest end of the Ste. Genevieve Fault Zone in Missouri, the fault zone is narrow and nearly vertical, and end folding is minimal. Southeastward, as the sedimentary thickness above basement increases, folding becomes more prominent. Surface faulting dies out entirely in northern Union County, Illinois. Proprietary seismic reflection profiles indicate that faulting continues at depth beneath the surface monocline. The Ste. Genevieve Fault Zone may continue as a basement feature into the northern Mississippi Embayment.

Several authors including Heyl (1972), Viele (1983), Clendenin et al. (1989), and Schultz et al. (1992) have proposed that strike-slip displacement has occurred along the Ste. Genevieve. Among these, only Schultz et al. (1992) offered supporting field evidence. They reported that fold orientations, joint patterns, slickensides, and other kinematic indicators are consistent with left-lateral oblique slip.

Recent mapping by Nelson and Devera (1994) in northern Union County, Illinois, has disclosed offsets of Eocene sediments along faults near the southeast end of the Ste. Genevieve Fault Zone. Post-Eocene faults strike north-northwest, dip nearly vertical, and outline narrow pull-apart grabens. This new finding emphasizes the long, complex tectonic history of the Ste. Genevieve.

SALEM ANTICLINE

Location From T1S, R2E, Jefferson County, to T3N, R2E, Marion County (H-5, 6; I-6)

References Arnold 1939, Cohee and Carter 1939, Siever 1950, Brownfield 1954, Bristol and Buschbach 1973, Whitaker and Treworgy 1990

The Salem Anticline is most noteworthy for providing the structural trap for the Salem Oil Field. This giant field with multiple pay horizons has a cumulative production of about 389.5 million barrels and is the largest in the Illinois Basin.

The Salem Anticline lies east of the main branch of the Du Quoin Monocline and more or less in line with the northeast branch of the monocline (fig 31). Projected northward, the axis of the Salem Anticline aligns with that of the Louden Anticline, which holds the second largest oil field, in terms of cumulative production, in the Illinois Basin.

The area of closure on the Salem Anticline is approximately 7 miles (11 km) north to south and 3.5 miles (5.6 km) maximum east to west. Closure on the top of the lower Chesterian Yankeetown ("Benoist") Sandstone is more than 220 feet (67 m). The east limb has an average dip of 80 to 90 feet per mile (approximately 1°), whereas the west limb dips about 220 feet per mile (approximately 2°) (Arnold 1939). Gradual elongate nosing occurs at the north and south ends of the structure.

A series of isopach maps showed that the Salem Anticline began to develop in the Chesterian Epoch but the major folding took place early in the Pennsylvanian Period (Brownfield 1954). Additional deformation occurred during and after middle Pennsylvanian sedimentation. The history of the Salem Anticline is thus similar to that of the Du Quoin Monocline and other adjacent folds.

The steep west limb of the Salem Anticline suggests that the anticline was controlled by faulting in the basement (Arnold 1939). Although the seismic profile as illustrated (fig. 32) does not reveal faulting, other proprietary seismic lines reveal faulting on the west flank of the anticline at depth. Thus, the anticline probably overlies a basement fault block that was raised and tilted eastward.

SALINE RIVER FAULT (discarded)

Location T10S, R9E, Gallatin County

References Butts 1925, Cady et al. 1939, Smith 1957, Nelson and Lumm 1987

Butts (1925), Cady et al. (1939), and Smith (1957) mapped a fault that had a northwest trend and crossed the Eagle Valley Syncline in southeastern Gallatin County. Nelson and Lumm (1987), using dozens of coal test control points not available to earlier geologists, established that the structure is an unfaulted flexure; therefore, the name Saline River Fault should be not be used.

SAMSVILLE ANTICLINE (discarded)

Location T1N, R11E, Edwards County

References Easton 1943

Easton (1943) defined this anticline on the basis of a very slight westward nosing of structural contours on the Levias Limestone Member (Renault) and the Beech Creek ("Barlow") Limestone. He had only five control points. The current Beech Creek maps (ISGS open files), which are based on dozens of additional wells, show eastward nosing in the same area. Use of the name Samsville Anticline should be discontinued because the structure, both as originally mapped and as presently known, is too subtle to name as an anticline.

SANDWICH FAULT ZONE

Location Central Ogle to southern Will County (B-5 to C-7)

References Willman and Payne 1942, Willman and Templeton 1951, Green 1957, McGinnis and Heigold 1961, Beck 1965, McGinnis 1966, Heigold 1972, Kolata et al. 1978, Kolata et al. 1983

The largest fault zone in northern Illinois, the Sandwich Fault Zone, is approximately 85 miles (135 km) long and 0.5 to 2 miles (0.8–3 km) wide. It strikes overall about N60°W and the southwest side is upthrown along most of the zone. The Sandwich Fault Zone is known from surface exposures, primarily in quarries and other artificial cuts, and from water well records. The zone displaces rocks ranging from the Upper Cambrian to Silurian. The oldest surficially exposed rock in Illinois is dolomitic sandstone of the Cambrian Franconia Formation adjacent to the Sandwich Fault Zone in Lee and Ogle Counties.

A structure-contour map of the Franconia Formation (fig. 17) reveals a gentle regional east-southeast dip on the flank of the Wisconsin Arch northeast of the Sandwich Fault Zone. The Franconia is deformed into the highly asymmetrical Ashton Anticline southwest of the fault zone. The Franconia dips at approximately 100 feet per mile (approximately 1°) on the long southwest limb of the Ashton Anticline. The steeper northeast limb of the arch is truncated against the fault zone. Displacement of the fault zone increases from the ends toward the midpoint, where it reaches a maximum of about 800 feet (240 m).

All of the good exposures of the Sandwich Fault Zone are near the ends of the zone where the net displacements are down to the southwest, which is opposite to the major displacement in the poorly exposed central portion of the zone. Faults observed in quarries and other manmade cuts are dominantly vertical or steeply inclined dip-slip normal faults (fig. 64). Most faults display little or no drag; however, some small faulted monoclines suggest faulting increases with depth. Also observed were small thrust faults and reverse kink bands within shale in a horst between two large normal faults at Vicks Pit near Channahon, Will County. In spite of these local compressional faults, the fault pattern is indicative of northeast–southwest horizontal extension near the two ends of the Sandwich Fault Zone. The configuration of the central part of the zone suggests that the basement block southwest of the fault zone was raised and tilted back toward the southwest. Possibly, the Sandwich Fault Zone has been subjected to multiple episodes of deformation under different stress fields.

Regionally the Sandwich Fault Zone is approximately in line with the Kankakee Arch to the southeast and is southeast of the Plum River Fault Zone. The Sandwich and Plum River Fault Zones display similar structural styles but have different trends and apparently do not interconnect. The Sandwich Fault Zone is nearly parallel with, and has overall throw opposite to, the Peru Monocline at the northwest end of the

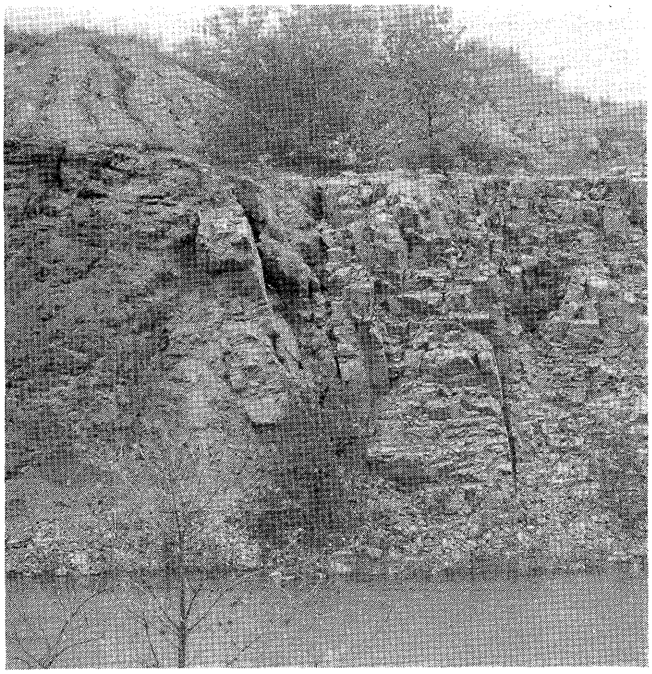


Figure 64 A high-angle normal fault in the Sandwich Fault Zone at Vicks Pit, Meyer Construction Company, Channahon, Will County. Dolomite of the middle Silurian Joliet Formation on the northeast (right) is downthrown against shale of the lower Silurian Wilhelmi Formation on the southwest. Drag and slickensides on this fault indicate nearly pure dip-slip movement.

La Salle Anticlinorium. Both structures may have formed simultaneously when the crustal block between them rose (Kolata et al. 1978). The fact that the Sandwich Fault Zone exhibits dominantly brittle failure (faulting), whereas the La Salle shows dominantly ductile failure (folding), is not explained. The degree of faulting along the Peru Monocline is not known because of outcrop scarcity and lack of good well control on the steep flank. The Sandwich Fault Zone is observed at mostly lower structural levels (closer to basement) than the La Salle; potentially, faults originating in basement would die out upward, particularly in Pennsylvanian shale. Another possibility is that the Peru Monocline is underlain by a reverse fault, which would have induced compression, favoring folding of overlying strata. Whether the Sandwich Fault Zone and the Peru Monocline developed at the same time or at different times is not clear.

The youngest rocks demonstrably displaced by the Sandwich Fault Zone are Upper Silurian. Mississippian (?) and lowermost Pennsylvanian sandstone, shale, and coal are preserved in sinkholes in faulted Silurian dolomite at Vicks Pit, Will County.

Neither Kolata et al. (1978) nor I, while examining these Pennsylvanian rocks, could determine whether they were deformed by faults. Pleistocene glacial sediments along the Sandwich Fault Zone are not deformed. The Sandwich Fault Zone may be the same age as the Peru Monocline. The major uplift was during late Mississippian to early Pennsylvanian time; the lesser uplift was during and after Pennsylvanian time.

SANGAMON ARCH

Location West-central Illinois (pl. 1 inset)

References Whiting and Stevenson 1965, Collinson 1967, Peppers and Damberger 1969, Atherton 1971, Calvert 1974, Stevenson and Calvert 1975, Collinson and Atherton 1975, Stevenson et al. 1981, Treworgy et al. 1994

As proposed by Whiting and Stevenson (1965) and accepted by most geologists, the Sangamon Arch was a broad subaerially exposed rise that existed during the Devonian Period. It extended southwestward from central Illinois toward Pike County and possibly beyond into Missouri (fig. 65).

The Sangamon Arch has no present structural expression. It was primarily a Middle Devonian feature. Its extent during the Early Devonian Epoch cannot be assessed because strata of that age are absent from the region. Silurian rocks have been partially eroded along the crest of the arch and are unconformably overlain by Middle Devonian beds (fig. 65). Vugs and fissures that extend 90 feet (27 m) or more below the top of the Silurian are filled with Devonian green clay, clean white sand, and limestone fragments (Whiting and Stevenson 1965). A basal Devonian lag gravel of chert clasts commonly overlies the corroded Silurian surface. The arch apparently formed a barrier between two separate basins of deposition where different facies accumulated. Southeast of the arch are open-marine limestone and dolomite of the Grand Tower and Lingle Formations (fig. 65). The Cedar Valley and Wapsipinicon Formations northwest of the arch contain evaporites, indicating restricted circulation, near the basin center in Iowa and shallow water oolitic limestone and sandstone on the flank of the Sangamon Arch. Coal containing fragments of land plants occurs on the north flank of the arch in De Witt and McLean Counties, Illinois (Peppers and Damberger 1969). Older Middle Devonian units pinch out on the flanks of the arch and are progressively overlapped by younger Middle Devonian units. The Upper Devonian New Albany Group was deposited entirely across the Sangamon Arch, although it is thinner there than elsewhere. The thinning axis ("central thin" between southern and western depocenters [Cluff et al. 1981]) of the New Albany is south of the crest of the Middle Devonian Sangamon Arch.

Most researchers have interpreted the relationships described above as evidence that the Sangamon Arch was a short-lived structural high that was subaerially exposed at the beginning of the Middle Devonian Epoch and gradually became submerged. Calvert (1974) doubted the existence of a structural arch and proposed instead that Silurian and Devonian rocks were eroded in a southwest-trending drainage basin. Calvert won no public supporters (see Stevenson and Calvert 1975 for argument and rebuttal).

SARATOGA ANTICLINE (new name)

Location Eastern T11S, R1W, Union County (K-5)

References J. Weller 1940

The Saratoga Anticlinal Nose was defined by J. Weller (1940) on the basis of scattered outcrop data. He described and mapped it as a broad and ill-defined northward-plunging anticline about 3 miles (5 km) long. New surface mapping in the area by Jacobson and Weibel (1993) confirms the existence of an anticline that has more than 100 feet of maximum relief. Dips on the west flank are gentle; on the east flank, dips as steep as 39° have been measured in Section 24, T11S, R1W (R. Jacobson, ISGS, personal communication 1989). Because

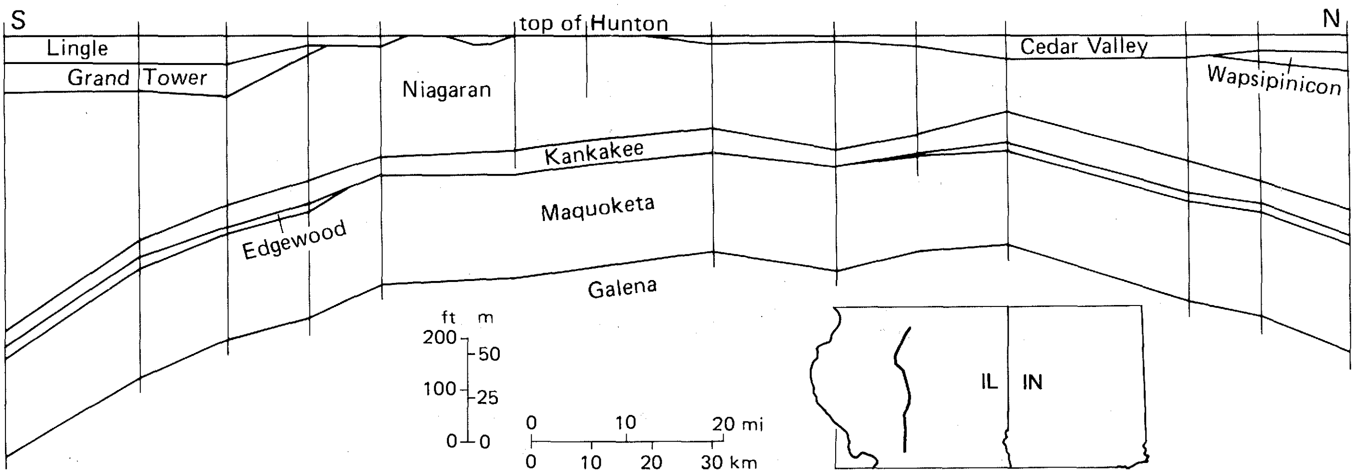
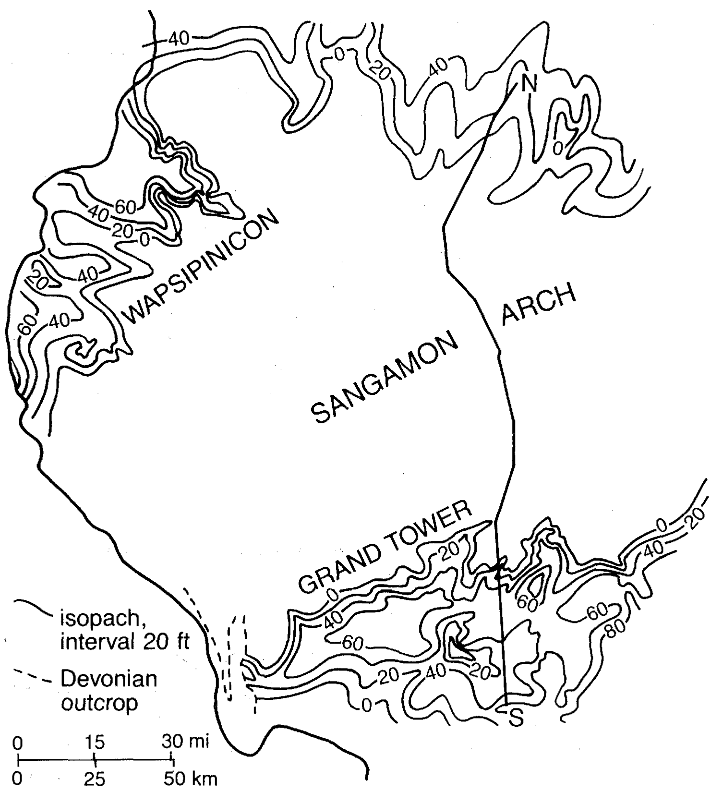


Figure 65 The Sangamon Arch in west-central Illinois. Map shows thickness of the Middle Devonian Grand Tower Limestone south of the arch and the age-equivalent Wapsipinicon Limestone north of the arch. The cross section illustrates the up-dip pinch-out of the Grand Tower and the Wapsipinicon and the unconformity between Devonian and Niagaran (Silurian) strata. Note also that the lower Silurian Edgewood Formation pinches out on the arch. After Whiting and Stevenson 1965.



the structure may have closure, the name is changed from Saratoga Anticlinal Nose to Saratoga Anticline.

SAVANNA-SABULA ANTICLINE (discarded)

Location Northern Ogle and Carroll Counties, Illinois; westward into Iowa

References McGee 1890, Savage 1906, Cady 1920, Templeton and Willman 1952, Kolata and Buschbach 1976, Bunker et al. 1985

Before the Plum River Fault Zone was recognized, several geologists interpreted the structure as an east-trending anticline with a steep north flank. This anticline was called by various names, but Savanna-Sabula was most widely used. Recent studies (Kolata and Buschbach 1976) have demonstrated that the feature is a fault zone flanked on the south by a series of asymmetrical domes and anticlines, of which the Forreston and Brookville Domes and Leaf River Anticline of Illinois are examples. Although Bunker et al. (1985) continued to apply the name Savanna-Sabula to the group of anticlines and domes south of the fault zone in Iowa, such usage is not necessary in Illinois because these appear to be isolated highs rather than a continuous anticline.

SCHUYLER ARCH (discarded)

Location Schuyler County and vicinity

References Workman and Gillette 1956, Cluff et al. 1981

The Schuyler Arch represents an area where the Devonian–Mississippian New Albany Group (called Kinderhookian Series by Workman and Gillette 1956) is relatively thin. The name should be discontinued because evidence is lacking for a structural upwarp in this area (Cluff et al. 1981).

See also PETERSBURG BASIN (discarded) and VANDALIA ARCH (discarded).

SCIOTA ANTICLINE

Location Northwestern McDonough County (D-2)

References Wanless 1957, Buschbach and Bond 1974

Wanless (1957) mapped this anticline from subsurface data on the Kinderhookian (New Albany Group) shale. According to his text (p. 157) the fold lies in McDonough County, but his map of named structures shows the anticline in Warren County. The map evidently is erroneous. Buschbach and Bond (1974) presented a map of the Sciota Anticline based on drilling for gas storage in the Mt. Simon Sandstone. This map shows an irregular anticline, the axis of which trends north-northwest, perpendicular to the Peoria Folds. The western limb is steeper than the eastern and at least 60 feet (18 m) of closure is shown on the Mt. Simon. The highest point on the fold in Section 31, T7N, R3W, corresponds with the crest as mentioned by Wanless (1957). The anticline, as drawn on plate 1, is taken from Buschbach and Bond (1974).

SEATONVILLE SYNCLINE (discarded)

Location Bureau and southernmost Lee Counties

References Willman and Payne 1942

A north-trending depression, which could be considered a lobe of the Granville Basin, was defined on the basis of very sparse well data on Ordovician horizons. The Seatonville feature has not been confirmed by newer structural mapping; therefore, using the name Seatonville Syncline should be discontinued.

SESSER ANTICLINE (new)

Location Eastern T5 and 6S, R1E, Franklin County (I,J-5)

References J. Treworgy 1981

The Sesser Anticline is named for the town of Sesser and the Sesser Oil Field. It was listed as a "significant unnamed structure" by Treworgy. As mapped on the Beech Creek ("Barlow") Limestone (ISGS open files), the Sesser Anticline is about 8 miles (13 km) long and has about 50 feet (15 m) of closure. The axis trends north to south and is slightly curved. The Sesser Anticline is not apparent on Keys and Nelson's (1980) structure map of the Herrin Coal Member. Like the Benton Anticline, the Sesser Anticline probably developed mostly in latest Mississippian to early Pennsylvanian time. The anticline supports a major part of Sesser Consolidated Oil Field, which has produced 4.6 million barrels of oil, mainly from the Aux Vases (Chesterian) Sandstone and Lower Devonian Clear Creek reservoirs.

SEVILLE ANTICLINE
Peoria Folds

Location Eastern McDonough and western Fulton Counties (E-2,3)

References Wanless 1957

This structure apparently was defined based largely on surface mapping, which shows a large inlier of the St. Louis and Salem Limestones and the Warsaw Shale beneath the pre-Pennsylvanian unconformity. Wanless suggested that the Seville Anticline feature may be, at least in part, an erosional remnant rather than a structural high.

SHANGHAI DOME

Location T12 and 13N, R1W, Warren and Mercer Counties (C-2,3)

References Buschbach and Bond 1974

As mapped on top of the Ironton–Galesville Sandstone (Cambrian), the Shanghai Dome is an oval structure about 2 miles (3 km) in diameter and has about 95 feet (28 m) of closure. On younger strata the closure decreases, suggesting that some structural movement took place before Champlainian (Middle Ordovician) time. A gas storage field has been developed on the dome in the Ironton–Galesville Sandstone.

SHATTUC DOME (discarded)

Location T2N, R1W, Clinton County

References St. Clair 1917c, Brownfield 1954, Bristol and Buschbach 1973

St. Clair (1917c) mentioned a Shattuc "terrace"; Brownfield (1954) mapped a dome that was defined by drilling in the Shattuc Oil Field and covers less than 1 square mile (2.6 km^2) and is centered in Section 28, T2N, R1W. Closure on the Beech Creek ("Barlow") Limestone is about 50 feet (15 m). The Shattuc Dome is a high point along the axis of the Centralia Anticline and should be regarded as part of that structure rather than as a separate structure.

SHAW DOME (discarded)

Location Southern T16N, R8E, Douglas County

References Bristol and Prescott 1968

The Shaw Dome is not a separate feature, but merely a minor area of closure on the crest of the Tuscola Anticline. As such, the Shaw Dome does not merit naming.

SHAWNEETOWN ANTICLINE (discarded)

Location T10S, R7E, Saline County

References Butts 1925, J. Weller 1940, Nelson and Lumm 1987

The structure that Butts (1925) and J. Weller (1940) interpreted as an anticline has been reinterpreted as part of the Shawneetown Fault Zone (Nelson and Lumm 1987). The name Shawneetown Anticline should not be used.

SHAWNEETOWN FAULT ZONE
Rough Creek–Shawneetown Fault System

Location Northeastern Pope, southeastern Saline and southern Gallatin Counties (J-7 and pl. 2)

References Owen 1856, Butts 1925, J. Weller 1940, Baxter et al. 1967, Nelson and Lumm 1986 a, b, c, 1987

The name Shawneetown Fault Zone is applied to the portion of the Rough Creek–Shawneetown Fault System that is in Illinois.

The Shawneetown Fault Zone enters Illinois just south of Old Shawneetown in Gallatin County and trends westward for about 15 miles (24 km). In southeastern Saline County the fault zone curves sharply to the south-southwest and continues about 12 miles (19 km) to Section 25, T11S, R6E, Pope County, where it intersects the Lusk Creek Fault Zone. Along most of its length the Shawneetown Fault Zone is well expressed topographically by a range of hills of resistant lower Pennsylvanian Caseyville Formation south and southeast of the fault zone. These include several of the highest points in southern Illinois: Williams Hill (elevation 1,064 feet, 324.3 m), Wamble Mountain, and Cave Hill. The fault zone itself tends to form a strike valley and is concealed by alluvium or glaciolacustrine deposits in many places.

The fault zone ranges in width from a few yards (meters) to as much as 8,000 feet (2,400 m). The largest fault in the zone is near the north edge of the east-west-trending part of the zone and it exhibits as much as 3,500 feet (1050 m) of vertical separation. Well penetrations show this to be a high-angle reverse fault dipping about 70°S. Nelson and Lumm (1986 a, b, c, 1987) have referred to this as the front fault. It apparently continues the full length of the Rough Creek–Shawneetown Fault System in Kentucky, as indicated by seismic reflection

Figure 66 An exposure of shale, New Albany Group, dipping nearly vertically in the "Horseshoe Upheaval," Shawneetown Fault Zone near Equality. This Upper Devonian shale is upthrown approximately 3,500 feet (1,070 m) relative to the Pennsylvanian rocks on either side of the fault zone.

data and repeated section in boreholes. The front fault probably continues to the western terminus of the Shawneetown Fault Zone, but definite proof of reverse faulting is not available along the south-southwest-trending portion of the zone.

Other faults in the Shawneetown Fault Zone strike subparallel to the front fault and have throws measured in hundreds of feet. Some of these join the front fault at one or both ends and probably connect with it at depth, but other faults appear to be isolated. In places the fault zone assumes a braided pattern with interconnected faults outlining a series of polygonal or lens-shaped slices. This is shown best in the area where the fault zone bends in Saline County (Nelson and Lumm 1986c) and in the Herod Quadrangle between Wamble Mountain and the intersection with the Lusk Creek Fault Zone (Baxter et al. 1967). Most of the smaller faults in the Shawneetown Fault Zone probably are normal faults.

Although displacements on individual faults are large, the net offset across the fault zone is small. Pennsylvanian coal beds in the Eagle Valley Syncline south of the fault zone lie at the same or slightly lower elevation as the same beds north of the fault zone. Southwest of the syncline a block composed mainly of Caseyville Formation and upper Chesterian strata is uplifted between the Shawneetown and Herod Fault Zones. Net uplift in this area is on the order of 300 to 500 feet (90–150 m). Large displacements in the Shawneetown Fault Zone are the result of sharp tilting and upthrow of slices adjacent to the front fault. The most extreme case is at a place called the "Horseshoe Upheaval" in Section 36, T9S, R7E, just west of the Saline–Gallatin county line (Nelson 1987c). At this point a slice of nearly vertical Mississippian Fort Payne Formation and Upper Devonian New Albany Group south of the front fault is juxtaposed with middle Pennsylvanian strata north of the fault (fig. 66). An oil test hole 0.75 mile (1.2 km) west of the Horseshoe Upheaval penetrated the front fault and passed from Lower Devonian chert above into Pennsylvanian strata below. The vertical separation at both places is approximately 3,500 feet (1,050 m), which is the largest known offset on any near-surface fault in Illinois. At numerous other places tilted blocks of Mississippian strata are upthrown between Pennsylvanian rocks along the fault zone.

Rocks north and northwest of the Shawneetown Fault Zone are mostly horizontal or gently dipping. In the fault slices and immediately south or southeast of the fault zone, the rocks generally dip steeply south or southeast and strike parallel with the faults. These dips rapidly diminish away from the fault zone.

The presence of the upthrown slices and the steep tilting of strata along the fault zone imply that two periods of movement took place after Pennsylvanian sedimentation. The first movement was reverse with the south or southeast side upthrown; the second movement involved normal faulting with the south or southeast side downdropped (Nelson and Lumm 1987).

No oil production has been achieved in or south of the Shawneetown Fault Zone, although numerous fields have been developed in and south of the Rough Creek–Shawneetown Fault System in adjacent parts of Kentucky. Small-scale mining and prospecting for fluorite and associated minerals have taken place along the southwest-trending portion of the Shawneetown Fault Zone.

SHELBY FAULT (discarded)

Location T12S, R7E, Pope County

References J. Weller et al. 1952, Brown et al. 1954, Baxter et al. 1967

The Shelby Fault, as defined by the researchers above, is a normal fault that strikes N55°E, dips 60° southeast, has about 200 feet (60 m) of throw, and is part of the Hobbs Creek Fault Zone. Although the existence of the Shelby Fault seems to be well established, there is no apparent reason for this fault to be individually named among many closely related, unnamed faults of similar magnitude in the Hobbs Creek Fault Zone. The name should no longer be used.

SHELBYVILLE ANTICLINE (discarded)

Location T11N, R3E, and vicinity, Shelby County

References Newton 1941

The Shelbyville Anticline was mapped as trending northwest for about 9 miles (14 km) and having two separate areas of closure on the "upper Bogota" limestone. Maps contoured on several Pennsylvanian units (DuBois 1951) indicate structural highs in the area, but the configuration varies markedly from one unit to another. The current Beech Creek ("Barlow") Limestone structure map (ISGS open files) indicates this to be an area that dips toward the east with subtle troughs and noses. Because no well defined anticline exists in this area, use of the name Shelbyville Anticline should be discontinued.

See also EAST LOUDEN ANTICLINE (discarded).

SHETLERVILLE FAULT

Fluorspar Area Fault Complex

Location Sections 23, 26 and 35, T12S, R7E, Hardin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Palmer 1956, Baxter et al. 1967

This fault strikes slightly west of north and has the west side downthrown less than 100 feet (30 m). The Shetlerville Fault lies about 5 miles (8 km) south-southwest of the apex of Hicks Dome and joins the Stewart Fault on the north and the Rock Creek Graben on the south.

SHIPMAN ANTICLINE (discarded)

Location Southern Macoupin County

References Easton 1942, Nelson 1987b

The name was applied to a minor eastward-trending nose defined by structural contours on the Herrin Coal Member (Pennsylvanian). Remapping (Nelson 1987b) partially confirms the existence of a nose, but it is too small and obscure to be named as an anticline.

SHOAL CREEK SYNCLINE (discarded)

Location T8N, R4W, Montgomery County

References Lee 1915

Lee (1915) mapped and named a northwest-trending syncline on the basis of borehole data on the Herrin Coal Member (Pennsylvanian). Using many more subsurface control points, Nelson (1987b) remapped the structure of coal in the area. The remapping revealed several irregular enclosed depressions in Lee's Shoal Creek Syncline area in southwestern Montgomery County. These depressions, which most likely are products of differential compaction, are not worthy of being named synclines.

SICILY FAULT (new)

Location Western Christian County (F-5)

References Nelson 1981 (p. 28), Nelson 1987b

The Sicily Fault, named for the nearby village of Sicily, is known from coal test drilling, exposures in underground coal mines, and high resolution seismic surveys (M. Hopkins, ISGS, personal communication 1981). The fault strikes N25°W and is at least 6 miles (9 km) long. It is a high-angle normal fault with the northeast side downthrown as much as 15 feet (6 m) in places.

Several other faults of similar trend and type (Girard Faults) have been encountered in coal mines of Christian, Macoupin, Montgomery, and Sangamon Counties. Their length, linearity, and parallelism suggest origin in a regional stress field.

See also GIRARD FAULTS.

SIGEL ANTICLINE (discarded)

Location T9N, R6E, Effingham County

References Newton 1941

Newton (1941) postulated the Sigel Anticline on the basis of a single control point in Section 26, T9N, R6E. Subsequent mapping based on dozens of test holes drilled since 1941 demonstrates that no dome or anticline exists at the point indicated by Newton. No structural highs are apparent on Du Bois' (1951) maps of four Pennsylvanian units in this area. The nearest areas of closure indicated on current Beech Creek ("Barlow") Limestone maps (ISGS open files) are small domes associated with the Teutopolis and Lillyville North Oil Fields, which are about 2 miles (3 km) south and 3 miles (5 km) east of Newton's Sigel Anticline. The dome at Lillyville North is due to draping of strata over a Silurian reef. The origin of the dome in the Teutopolis Field is uncertain; no wells there have reached Silurian rocks.

SIGGINS DOME (discarded)

Location T10N, R10 and 11E, Cumberland County

References Mylius 1927, Clegg 1959

Mylius (1927) mapped a dome on the producing Pennsylvanian sandstones in the Siggins Oil Field. Clegg (1959) recontoured the area on the Herrin and Danville Coal Members (Pennsylvanian), which are far more reliable mapping horizons than the discontinuous and questionably correlated sandstones. Clegg's (1959) maps indicate no closure. The Siggins Oil Field is located along the upper limb of the west-facing Charleston Monocline. It is likely that lenticular form of

Table 6 Silurian reefs in Illinois and cumulative oil production (thousand barrels).

Reef	Location	County	Oil production
Baldwin	T4S, R6W	Randolph	16.4
Bartelso	T1N, R3W	Clinton	4,426
Bartelso East	T1N, R3W	Clinton	1,026
Boulder	T2N, R2W	Clinton	8,299
Brubaker	T2N, R3E	Marion	637
Chicago Heights	T35N, R14E	Cook	0
Coulterville North	T3S, R5W	Washington	45.6
Darmstadt	T2S, R6W	St. Clair	0
Elbridge	T12N, R11W	Edgar	15,463
Frogtown North	T2N, R3W	Clinton	2,242
Germantown East	T1N, R4W	Clinton	2,174
Lillyville North	T9N, R7E	Cumberland	132
Lively Grove	T3S, R5W	Washington	0
Marine	T4N, R6W	Madison	12,637
McKinley	T3S, R4W	Washington	797
Nashville	T2S, R3W	Washington	2,315
Nevins	T12N, R11W	Edgar	0
New Baden East	T1N, R5W	Clinton	320
New Memphis	T1S, R5W	Clinton	3,522
New Memphis South	T1S, R5W	Washington	0.7
Okawville	T1S, R4W	Washington	64.7
Okawville North	T1S, R4W	Washington	216
Patoka	T4N, R1E	Marion	14,777
Patoka East	T4N, R1E	Marion	6,241
Raccoon Lake	T1N, R1E	Marion	4,316
St. Libory	T1S, R6W	St. Clair	0
Sandoval	T2N, R1E	Marion	6,480
*Springfield East	T15N, R4W	Sangamon	366
State Line	T12N, R10E	Clark	0
Stony Island	T37N, R14E	Cook	0
Thornton	T36N, R14E	Cook	0
Tilden	T4S, R5W	Randolph	4,921
Tilden North	T3S, R6W	St. Clair	1,085
Tonti	T3N, R2E	Marion	14,125
*Wapella East	T21N, R3E	De Witt	3,325
Weaver	T11N, R10W	Clark	2,574
Unnamed	T5N, R11W	Crawford	0
Unnamed	T17N, R2E	Macon	0
Unnamed	T19N, R11W	Vermilion	0
Unnamed	T20N, R11W	Vermilion	0
Unnamed	T2S, R5E	Wayne	0
Unnamed	T2S, R6E	Wayne	0

Information from Treworgy (1981) and *Whitaker (1988). Oil production figures from B.G. Huff, personal communication 1992. Cumulative production is given in thousands of barrels through January 1, 1993. Not all production is necessarily from reef rock or reef-related structure.

the producing sandstones accounts for the doming noted by Mylius (1927). The name Siggins Dome should not be used.

SILOAM ANTICLINE (discarded)

Location T3N, R4E, Marion County

References Easton 1944, Bristol and Howard 1976

Easton (1944) did not define the Siloam Anticline explicitly. The name Siloam Anticline apparently refers to a southeastward bulge in the contour lines on his structure map of the Levias Limestone Member of the Renault Limestone (Mississippian). Similar structural patterns can be seen on current maps of the Beech Creek ("Barlow") Limestone (ISGS open files) and on Bristol and Howard's (1976) structure map of the Ste. Genevieve Limestone. Such a modest nosing of contour lines, however, does not merit a name.

SILURIAN REEFS

Location Plate 1

References Bretz 1939, Lowenstam and DuBois 1946, Lowenstam 1948, 1950, 1952, 1957, Smoot 1958, Ingels 1963, Droste and Shaver 1980, 1987, Howard 1963a, b, 1964, Bristol 1974, Willman and Atherton 1975, Shaver et al. 1978, Whitaker 1988

Although they are not of tectonic origin, Silurian reefs are structural features and responsible for doming of overlying strata. A number of named anticlines and domes originally thought to be tectonic structures have been shown to be the result of differential compaction over reefs. For these reasons Treworgy (1981) listed reefs in her structural compendium, and in this document reefs are listed in table 6 and shown on plate 1.

Pinnacle reefs of Niagaran (middle Silurian) age are widespread in the northeastern United States and eastern Canada. They form a belt or archipelago around the Michigan Basin and around the north and west margins of the Illinois Basin. In Illinois, reefs crop out near Chicago and in the northwestern part of the state. They also are found in the subsurface along a broad zone trending northeastward from St. Clair to Clark and Edgar Counties. Individual reefs are generally less than 2 miles (3 km) in diameter and as much as 1,000 feet (300 m) thick. In map view they are roughly circular or oval. The Marine Reef (pl. 1, H-4), the first and largest reef discovered by drilling, is horseshoe-shaped and has been interpreted to be an atoll (Lowenstam 1957).

Reefs generally contain a core (fig. 67) of massive, often vuggy or fractured limestone or dolomite composed of the skeletons of corals, algae, stromatoporoids, and numerous other types of invertebrates. Surrounding the core and dipping away from it at angles of 20° to 45° are reef flank beds of detritus shed from the core. These interfinger outward with normal interreef facies of fine grained, often highly silty or argillaceous carbonates. Satellite reefs and huge slump blocks of reef core material may be found on the reef flanks (Ingels 1963).

The reef core rises from 20 feet to more than 150 feet (6–45 m) above the top of adjacent Silurian strata. Original relief probably was even greater, but the tops of many reefs were truncated by post-Silurian erosion. Overlying Devonian beds drape over the reef core and conform to its upper surface. Mississippian and Pennsylvanian strata likewise are arched above reefs; the structural relief gradually diminishes upward. For example, the Marine Reef has about 120 feet (36 m) of relief and produces 110 feet (34 m) of closure on the top of the Devonian. Closure is reduced to 70 feet (21 m) on a Mississippian marker 900 to 950 feet (270–290 m) above the reef, and to 60 feet (18 m) on Pennsylvanian markers 400 to 800 feet (120–240 m) higher (Lowenstam 1948). It is even possible that the present ground surface may be slightly domed above some reefs. Geologists have prospected for reefs by searching for radial drainage patterns of small creeks (Whitaker 1988); however, most buried reefs have been discovered by gravity and seismic methods or by contouring of shallow subsurface horizons.

Oil production in Illinois from fields containing Silurian reefs approached 100 million barrels as of 1992. The Marine Field has yielded more than 12 million barrels. Even greater production is reported from the Elbridge and Patoka Fields, but here structural factors not directly related to reefs play a role in trapping hydrocarbons (Smoot 1958). Oil is found in porous reef core and reef flank carbonates, Devonian sand-

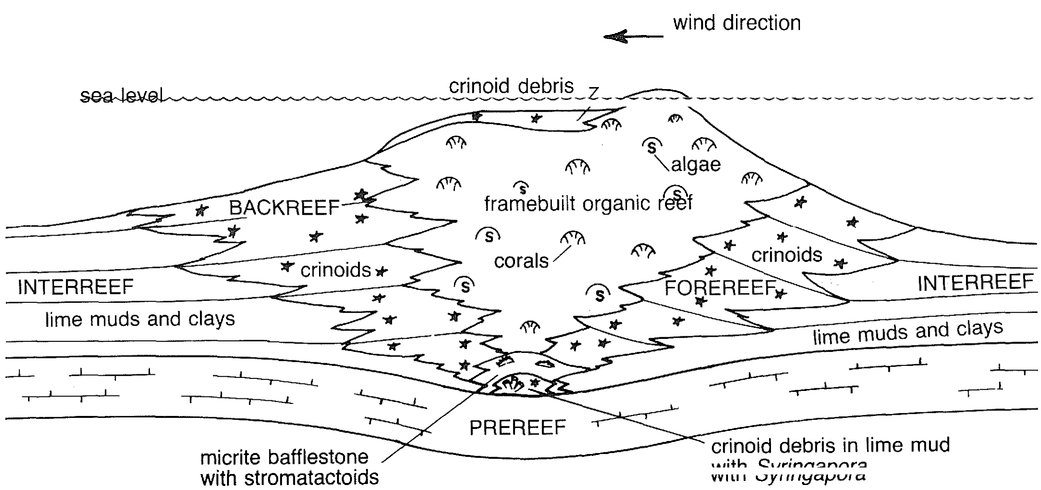


Figure 67 An idealized middle Silurian reef showing the typical geometry of various facies composing the buildup. Relief between the reef top and the interreef beds grew to as much as 250 feet (Wilson 1975) during deposition. Note the steeper forereef facies and the sag of prereef strata due to compaction under the reef (Whitaker 1988, after Lowenstam 1950).

stone and fractured carbonates, and various Mississippian and Pennsylvanian pay zones draped over the reefs.

SMALLPOX CREEK SYNCLINE
Upper Mississippi Valley Zinc–Lead District

Location Western Jo Daviess County (A-3)

References Trowbridge and Shaw 1916, Bradbury et al. 1956

Trowbridge and Shaw (1916) suggested that a northeast-trending syncline controlled the course of Smallpox Creek. Bradbury et al. (1956) named the Smallpox Creek Syncline and mapped its sinuous axis on the basis of outcrop study. Structural relief is a few tens of feet at the most. No significant mineralization has been discovered along the Smallpox Creek Syncline.

SORENTO DOME (discarded)

Location Near common corner of Bond, Madison, and Montgomery Counties

References Blatchley 1914, Kay 1915, Bell 1926c, 1941

Blatchley (1914) and Kay (1915) defined the Sorento Dome as an enclosed structural high mapped on the basis of scattered coal test drilling. Using additional control points, Bell (1926c) remapped the area and divided the Sorento Dome into the New Douglas Dome on the west and the Panama Dome on the east. In a further update, Bell (1941) discarded the New Douglas Dome and retained the Panama Dome. Maps of this area by Bristol and Howard (1976), Stevenson et al. (1981), and the current structure map of the Beech Creek ("Barlow") Limestone (ISGS open files) do not indicate any structural high worthy of naming. Accordingly, the name Sorento Dome is discarded.

SOUTH JOHNSON DOME (discarded)

Location T9S, R14W, Clark County

References Mylius 1927

Mylius (1927) gave a separate name to a small dome that geologists now consider to be the southern part of the Martinsville Anticline. The name South Johnson Dome should not be used.

SOUTH LITCHFIELD DOME (discarded)

Location Mainly in T8N, R5W, Montgomery County

References Lee 1915, Easton 1942

Lee (1915) mapped a structural high on the Herrin Coal Member (Pennsylvanian) centered in Section 20, T8N, R5W. Easton (1942) mentioned the dome, but his map did not confirm its presence. Remapping using additional borehole data (Nelson 1987b) indicated two or more irregular highs with slight closure in the southwestern part of T8N, R5W. This area is near the edge of the Walshville channel, a large paleochannel in which the Herrin Coal was eroded or not deposited. Coal near the channel margins may be deformed as a result of differential compaction or slumping. Naming these little upwarps as "domes" does not seem justified.

SOUTHERN INDIANA ARM or RIFT (discarded)

Location See text below and figure 5

References Braile et al. 1982, 1984, Sexton et al. 1986

The researchers above postulated the existence of a buried extension of the Reelfoot Rift northeastward into Indiana and possibly southeasternmost Illinois. They called this proposed extension the Southern Indiana Arm or Rift. As proposed, the Southern Indiana Arm would form a triple (or quadruple) junction with the well established Reelfoot Rift, Rough Creek Graben, and the hypothetical St. Louis Arm. Collectively, these structures are sometimes referred to as the New Madrid Rift Complex.

Braile et al. (1982) based their interpretation of the Southern Indiana Arm on patterns of gravity and magnetic anomalies and on an apparent slight concentration of earthquake epicenters along the Wabash River. Braile et al. (1984) and Sexton et al. (1986) published two seismic reflection profiles: one runs eastward across southern Hamilton and White Counties, Illinois; the other follows the north border of White County and continues into Gibson County, Indiana. These profiles were interpreted as showing layered rocks cut by large normal faults beneath the normal Paleozoic succession. The "Grayville Graben," a downfaulted block near Grayville, Illinois, was interpreted from the northern seismic profile. Several faults of the Wabash Valley Fault System offset Paleozoic reflectors on the seismic sections. Some of the Paleozoic faults appear to line up with inferred deeper faults, but no direct connection is seen.

A COCORP seismic profile (Pratt et al. 1989) does not substantiate the existence of a rift in the Wabash Valley region. Also, several sets of proprietary seismic reflection profiles that I have viewed fail to substantiate a northeastern extension of the Reelfoot Rift into Indiana. These seismic profiles display sets of prominent but discontinuous reflections below the normal Paleozoic succession, as seen on the profiles of Braile et al. (1984) and Sexton et al. (1986). These intrabasement reflectors extend as deep as 5 seconds two-way travel time, corresponding to a depth of approximately 35,000 feet (11 km) in parts of southeastern Illinois and southwestern Indiana. Intrabasement reflectors also appear on some profiles far west of the proposed Southern Indiana Arm. The deep reflectors, in places, appear to be slightly tilted, but no faults were interpreted by oil company geophysicists. Apparent angular discordance is shown between the intrabasement reflectors and the lowest Paleozoic reflectors on some sections.

The nature of the intrabasement reflectors is open to speculation. They may represent a Precambrian terrane older than and unrelated to the New Madrid Rift Complex (Pratt et al. 1989). More drilling and geophysical information are needed to define deep structural relations in this region. Use of the name Southern Indiana Arm, however, should be discontinued.

See also REELFOOT RIFT, ROUGH CREEK GRABEN, ST. LOUIS ARM (discarded).

SPANISH NEEDLE CREEK DOME (discarded)

Location T9N, R7W, Macoupin County

References Lee 1915, Easton 1942

Lee (1915) inferred a dome from scattered well data. Easton's (1942) map showed no closure and so the feature should not have been called a dome. Remapping with new control points shows no structural high in the area (Nelson 1987b). The name Spanish Needle Creek Dome should be discarded.

SPARTA SHELF

Location Southwestern Illinois, southeastern Missouri (fig. 2)

References Meents and Swann 1965, North 1969, Nelson and Lumm 1985

The name Sparta Shelf is applied to the southern part of the western shelf of the Illinois Basin. The Sparta Shelf lies west of the Fairfield Basin and northeast of the Ozark Dome. Its east margin is the Du Quoin Monocline. The southern border generally is described as following the Cottage Grove Fault System and Ste. Genevieve Fault Zone, whereas the western and northern limits are indefinite.

Little is known about the early Paleozoic history of the Sparta Shelf because of the lack of data. An ancestral Du Quoin Monocline may have existed during deposition of the Mt. Simon Sandstone (Upper Cambrian) and intermittently thereafter (Whitaker and Treworgy 1990). The shelf emerged during the Middle Devonian Epoch when faulting took place along its south margin. The sea reoccupied the area during the Late Devonian Epoch and the Mississippian Period; the Sparta Shelf then was not sharply differentiated from adjacent areas on the west flank of a broad embayment. Principal uplift on the Du Quoin Monocline began early in the Pennsylvanian Period and continued throughout the Pennsylvanian. Thus, the slowly subsiding Pennsylvanian Sparta Shelf was clearly separated from the more rapidly sinking Fairfield Basin to the east. Post-Pennsylvanian movement along the Du Quoin Monocline and Cottage Grove Fault System completed the evolution of the Sparta Shelf.

SPARTA SYNCLINE (discarded)

Location Randolph County

References Moulton 1926b

Moulton (1926b, p. 3) described the Sparta Syncline as a "pronounced syncline" that extends from the vicinity of Sparta northeastward at least as far as Coulterville. His structure contour map indicated a sinuous irregular trough in the area. The structure is so poorly defined that naming it is not justified. Newer mapping in the area does not indicate a syncline where Moulton showed the Sparta Syncline.

SPRING VALLEY ANTICLINE (discarded)

Location T33N, R1E, La Salle County

References Willman and Payne 1942

Willman and Payne (1942) described this structure as a southwest-plunging nose emerging from the steep southwest flank of the fold that is now named the Peru Monocline. Their structure contour maps do not, however, indicate any feature resembling the anticline mentioned in the text. Use of the name Spring Valley Anticline should be discontinued.

STAR UNION SYNCLINE (discarded)

Location T33N, R1E, La Salle County

References Willman and Payne 1942

The Star Union Syncline was named for a brewery in Peru, Illinois. The axis of the syncline was shown by Willman and Payne (1942) but none of their structure contour maps indicate a syncline corresponding to the Star Union Syncline as shown in their figure 102 and described in the text. The area in question is on the steep flank of the Peru Monocline (new); presence of a syncline here is dubious.

STAUNTON DOME (discarded)

Location T7N, R7W, Macoupin County

References Blatchley 1914, Kay 1915, Mylius 1919, Lee 1915, Bell 1941, Easton 1942, Nelson 1987b

Early researchers defined the Staunton Dome on the basis of limited well data on Pennsylvanian horizons. Bell (1941) used borehole data and surveys in underground mines to outline an enclosed high covering most of Section 14, T7N, R7W. To the north is a very irregular structural depression. Gas was produced from Pennsylvanian sandstone partially on the high; but little is known about the influence of structural versus stratigraphic factors for trapping gas because of the low-quality logs. The structure map of Nelson (1987b) shows that the Staunton Gas Field is situated on an irregular high having about 20 feet of closure on the Herrin Coal Member. The structure is too poorly defined and the high too subtle and irregular to merit naming.

STAVANGER SYNCLINE (discarded)

Location East-central La Salle and northwestern Grundy Counties

References Willman and Payne 1942, Jacobson 1985

Willman and Payne's (1942) structure map of the Colchester Coal Member (Pennsylvanian) showed a shallow depression with a curving southeast-trending axis. Closure of 20 to 30 feet (6–9 m) was indicated. Jacobson's (1985) structure map of the same horizon was based on many more control points indicating irregular depressions in the area, but nothing that can be properly called a syncline. Use of the name Stavanager Syncline should be discontinued.

STEELE FAULT
Fluorspar Area Fault Complex

Location Section 32, T12S, R8E, and Sections 6 and 7, T13S, R8E, Hardin County (pl. 2)

References J. Weller et al. 1952, Baxter and Desborough 1965

The Steele Fault, as indicated by core drilling, strikes north-northeast and has the west side downthrown 25 to 90 feet (8–27 m). It is part of the complex fault zone on the southeast side of the Rock Creek Graben near Rosiclare.

STEPHENSON–OGLE COUNTY LINE SYNCLINE see UPTONS CAVE SYNCLINE

STEWARDSON DOME (new name)

Location Sections 22 and 27, T10N, R5E, Shelby County (G-6)

References Newton 1941

Newton (1941) discussed a Stewardson Anticline but stated that he was not sure of its existence and did not indicate closure on his structure map. Only three subsurface control points were used by Newton. Subsequent development of the Stewardson Oil Field disclosed a roughly circular dome about 1 mile (1.6 km) in diameter and having about 20 feet (6 m) of closure on the Beech Creek ("Barlow") Limestone and Karnak Limestone Member of the Renault Limestone (ISGS open files). DuBois' (1951) maps on several Pennsylvanian units also indicate the dome. The name Stewardson Anticline should therefore be changed to Stewardson Dome.

The Stewardson Oil Field has produced more than 1.1 million barrels of oil from 28 wells completed in the Aux Vases and Spar Mountain Sandstones.

STEWART FAULT
Fluorspar Area Fault Complex

Location T12S, R7E, Hardin and Pope Counties (pl. 2)

References J. Weller et al. 1952, Palmer 1956, Bradbury 1959, Brecke 1964, Baxter et al. 1967

This high-angle normal fault or fault zone strikes N25°E and carries extensive mineralization. The Stewart Fault is more or less radial to Hicks Dome. The direction of throw changes along the length of the fault. Near the southern end, the southeast side is downthrown; northward, the northwest side is downthrown. Bradbury (1959) described deposits of barite found in veins along this fault.

STONE CHURCH FAULT (discarded)
Fluorspar Area Fault Complex

Location T12S, R8E, Hardin County

References J. Weller et al. 1952

The name Stone Church Fault apparently was used by miners; J. Weller et al. (1952) stated that the location of the fault was uncertain. The fault seems to lie within an intensely fractured area about 2 miles (3 km) north of Rosiclare. Because the Stone Church Fault was never clearly defined, the name should not be used.

STONEFORT ANTICLINE (discarded)
see **NEW BURNSIDE ANTICLINE**

STUBBLEFIELD ANTICLINE (discarded)

Location Central Bond County

References Blatchley 1914, Kay (1915), Moulton 1925, Bell 1941

Stubblefield Anticline is one of four names that have been applied to a subtle anticlinal nose in Bond County. Blatchley (1914) first described and named the Stubblefield Anticline. Kay (1915) reprinted Blatchley's description practically verbatim, but renamed the feature Pocahontas Anticline. Bell (1941) separated the Stubblefield Anticline into the Old Ripley Anticline on the west and Greenville Dome on the east. Of these names, only Greenville Dome is considered useful and valid, designating a fold with demonstrated closure. The name Stubblefield Anticline should not be used.

SUGAR CREEK SYNCLINE (discarded)

Location T10N, R6 and 7W, Macoupin County

References Ball 1952

Ball (1952) gave the name Sugar Creek Syncline to a shallow northeast-trending depression on a structure map of the Herrin Coal Member (Pennsylvanian). The syncline lay between two subtle anticlinal noses, which Ball called the Burton and Carlinville Anticlines. A new structure map of the Herrin Coal (Nelson 1987b) shows a structural pattern totally different from that mapped by Ball (1952). Although an irregular enclosed depression occurs in the general area on the new map, the Sugar Creek Syncline, as initially defined, does not exist and the name should not be used.

SUGAR HILL DOME (discarded)

Location T7S, R3W, Jackson County

References Shaw 1910, St. Clair 1917b, Root 1928

St. Clair (1917b) applied the name Sugar Hill Dome to a small structural high mapped by Shaw (1910) in Sections 4, 5, 8, and 9, T7S, R3W. Shaw's (1910) map was based on subsurface information on the Murphysboro Coal Member (Pennsylvanian), then called No. 2 Coal, in the Murphysboro Quadrangle. Root (1928) depicted the same dome on his structure map, but did not call it by name. From Root's (1928) map, it is evident that Sugar Hill Dome is a minor enclosed area along the eastern part of the greater Campbell Hill Anticline. As such, Sugar Hill Dome should not be retained as a separate named feature.

SWANSEA ANTICLINE (discarded)

Location T1N, R8W, St. Clair County

References Bell 1941

Bell's (1941) map of the Herrin Coal Member (Pennsylvanian) shows a northeast-trending anticline about 3 miles (5 km) long and having closure of about 50 feet (15 m). It was based on only two control points. No anticline has been recognized in this area on deeper horizons. The existence of the Swansea Anticline is thus questionable, and use of the name should be discontinued.

SYCAMORE FAULT
Fluorspar Area Fault Complex

Location T11S, R7E, Hardin County (pl. 2)

References J. Weller et al. 1952, Baxter et al. 1967

The Sycamore Fault trends northeast and lies west of the apex of Hicks Dome. Displacement is down to the northwest and is less than 100 feet (30 m).

TABLE GROVE SYNCLINE
Peoria Folds

Location Southeastern McDonough and western Fulton Counties (E-2,3)

References Wanless 1957

This subtle depression strikes east-northeast and is about 14 miles (23 km) long. The Table Grove Syncline was outlined chiefly on the basis of subsurface data on pre-Pennsylvanian horizons.

THAYER DOME (discarded)

Location T12N, R6W, Macoupin County

References Easton 1942

Easton (1942) used borehole data to map a small kidney-shaped area of closure on the Herrin Coal Member. Several of the key wells Easton used to define the Thayer Dome have questionable records. Remapping using additional control points fails to confirm the existence of a dome (Nelson 1987b).

THEBES ANTICLINE (discarded)

Location T15S, R3W, Alexander County

References J. Weller and Ekblaw 1940, Pryor and Ross 1962

The Thebes Anticline was defined on the basis of surface mapping of the bedrock uplands near Thebes. J. Weller and Ekblaw (1940) illustrated a structure section along the Mississippi River bluff and showed a series of anticlines and synclines cut by vertical faults. The largest upfold has Kimmswick Limestone (Upper Ordovician) exposed at the core and Silurian and Lower Devonian strata along the flanks. Pryor and Ross (1962) stated that the Thebes Anticline extends east-southeast several miles inland from the bluffs. The anticline is poorly delineated on their geologic map, which shows several faults striking north-northeast near Thebes.

The Commerce Anticlinorium (McCracken 1971) in Missouri is more or less in line with the Thebes Anticline; however, the axis of the Commerce structure strikes northwest.

New mapping in the Thebes Quadrangle (Harrison and Schultz 1992, and unpublished data) reveals a complex pattern of faulting at Thebes Gap. The most prominent faults strike northeast and exhibit right-lateral offsets, displacing units as young as the Mounds Gravel (Pliocene to early Pleistocene?). No structure resembling the Thebes Anticline is apparent on Harrison and Schultz's maps; therefore, the name Thebes Anticline should not be used.

Author's note: Because plate 1 was printed before final revisions to the text, the Thebes Anticline appears on plate 1 as it was described by J. Weller and Ekblaw (1940) and Pryor and Ross (1963).

THREEMILE CREEK FAULT
Fluorspar Area Fault Complex

Location T12S, R7 and 8E, Hardin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Baxter and Desborough 1965, Baxter et al. 1967

This fault has been called various names, Threemile Fault, Threemile Creek Fault, and Three Mile Creek Fault. S. Weller et al. (1920) called it the Threemile Creek Fault and described it as extending about 3.5 miles (5.5 km) east-northeast from the west half of Section 25, T12S, R7E, to the west half of Section 16, T12S, R8E. The Threemile Creek Fault connects with the Pell Fault on the west and the Big Creek Fault on the east. The throw is down to the north and decreases westward. Defining and naming of the Threemile Creek Fault was quite arbitrary among the many intersecting and branching, mostly unnamed faults in this area.

TOLU ARCH
Fluorspar Area Fault Complex

Location Hardin County, Illinois, Crittenden and Livingston Counties, Kentucky (pl. 1)

References Baxter et al. 1963, Trace and Amos 1984

The origin of this name is unknown; the feature has been labeled both as an arch and a dome. The term arch is preferable for such an elongated feature. The arch trends about N40°W, toward Hicks Dome, which can be regarded as its culmination. Tolu Arch is greatly broken by northeast-trending block faults. Ultramafic intrusions that radiate from Hicks Dome are numerous along the Tolu Arch. The origin of the arch is uncertain. It may be a partially collapsed magmatic or explosive volcanic uplift.

TOULON DOMES

Location T13 and 14N, R5E, Henry and Stark Counties (C-4)

References Treworgy 1979b, 1981

Data from drilling for a compressed-air storage field indicates three domes, the Toulon Domes, in a north–south line near Toulon. Treworgy's (1979b) map shows structure on top of the Tonti Member of the St. Peter Sandstone, but only two wells actually reached this horizon; remaining control was projected downward from the top of the Galena Group. On this basis, the northern dome has about 100 feet (30 m) of closure and covers approximately 5 square miles (13 km^2). The middle dome has 85 feet (26 m) of closure and covers 2.5 square miles (6.5 km^2); the southern dome has about 55 feet (17 m) of closure and covers more than 2 square miles (5 km^2). A pronounced anticlinal nose runs southeast from the middle dome. All three domes are roughly symmetrical, a fact that suggests they resulted from compaction over Precambrian hills rather than from horizontal compression or uplift of faults in the basement. The larger southern dome shown on plate 1 includes the middle and southern domes.

TOWER ROCK FAULT
Fluorspar Area Fault Complex

Location SE Section 17, T12S, R9E, Hardin County (pl. 2)

References Baxter et al. 1963

The Tower Rock is a little fault that strikes N20° to 30°E and has unspecified displacement. It was indicated by breccia, silicification, and mineralization observed in prospect pits. No other faults are known in the immediate vicinity.

TROWBRIDGE ANTICLINE (discarded)

Location T10N, R6E, Shelby County

References Newton 1941, DuBois 1951

A small anticline trending northeast and having about 20 feet (6 m) of closure was mapped on the "upper Bogota" limestone (Newton 1941). Correlation of this limestone is questionable and its value as a structural datum is dubious. DuBois' (1951) maps, contoured on several Pennsylvanian units, indicate only gentle structural irregularity in this area. The current Beech Creek ("Barlow") Limestone map of the area (ISGS open files) indicates that the Trowbridge Anticline lies near the low point of a saddle between two synclines. Use of the name should therefore be discontinued.

See also EAST LOUDEN ANTICLINE (discarded).

TROY-BRUSSELS SYNCLINE

Cap au Grès Faulted Flexure

Location Southern Jersey and Calhoun Counties, Illinois (H-2,3); then westward into Missouri

References Krey 1924, Rubey 1952, Collinson et al. 1954, Collinson 1957, McCracken 1971, Treworgy 1979a

In Illinois, the northern limb of this highly asymmetrical trough is the Cap au Grès Faulted Flexure, whereas the southern limb is produced by gentle regional northeastward dip of strata off the Ozark Dome. In Missouri, the Troy-Brussels Syncline runs northwest, parallel with the Lincoln Anticline.

TROY GROVE DOME

La Salle Anticlinorium

Location T34 and 35N, R1E, La Salle County (B,C-5)

References Bell 1961, Buschbach and Bond 1974, Kolata et al. 1983

Troy Grove Dome is an irregular faulted dome near the northern end of the La Salle Anticlinorium. The western limb of the dome coincides with the Peru Monocline (new), which has approximately 1,500 feet (450 m) of relief on the Franconia Formation (Kolata et al. 1983; fig. 17). The other limbs of the dome dip gently. As mapped on the basal Cambrian Mt. Simon Sandstone, Troy Grove Dome has about 100 feet (30 m) of closure and is about 5 miles (8 km) north to south by 3 miles (5 km) east to west (Buschbach and Bond 1974). Four faults trending east to west have been mapped across the central part of the dome. They form a series of grabens that have maximum vertical offset of about 180 feet (55 m). The dome has been developed as a gas storage field with the Mt. Simon as the principal reservoir and additional storage in sandstones in the lower part of the overlying Eau Claire Formation.

TUSCOLA ANTICLINE

La Salle Anticlinorium

Location Coles, Douglas, and southern Champaign Counties (E,F-7)

References Bell 1943, Clegg 1959, Bristol and Prescott 1968, Buschbach and Bond 1974

The Tuscola Anticline is the largest anticline in Illinois in terms of area and amount of closure. As contoured on top of the Galena Group (Bristol and Buschbach 1973), the Tuscola Anticline has closure of more than 700 feet (210 m). The enclosed area extends 25 miles (40 km) from southern Champaign County almost to the southern border of Douglas County and is 10 miles (16 km) wide in places. The southward-plunging nose extends well into Coles County. On the western limb, the top of the Galena (Trenton) Group drops 2,500 feet (760 m) in 3 to 4 miles (5–6.5 km). This is the greatest structural relief found along the La Salle Anticlinorium. In Illinois, only the Ste. Genevieve and Shawneetown Fault Zones produce greater vertical offsets.

The Tuscola Anticline lies along the eastern uplifted side of the Charleston Monocline that runs from southern Lawrence to southern Champaign County.

Like the rest of the La Salle Anticlinorium, the Tuscola Anticline underwent major uplift very late in the Mississippian Period and early in the Pennsylvanian Period. As a result, structural relief is considerably less on Pennsylvanian than on older horizons. Pennsylvanian rocks surround the anticline but have been eroded from its crest. Silurian rocks subcrop beneath glacial drift at the apex of the fold.

Hayes Oil Field was developed in the Galena (Trenton) on the Tuscola Anticline. About 147,000 barrels were produced between 1962 and 1971. In 1970 a gas storage field, developed on the anticline, used Mt. Simon Sandstone (Cambrian) as the reservoir.

TUSCOLA FAULT (discarded)

Location East-central Illinois

References Green 1957

The Tuscola Fault was mentioned in Green's (1957) paper on the structural geology of Ohio, Indiana, and Illinois. Green interpreted the steep western limb of the La Salle Anticlinorium as being faulted along most of its length. The Tuscola Fault was shown on Green's map as running approximately from Livingston County southward to Crawford County. Green (1957, p. 634) claimed that data from "carefully located core drill holes ranging in depth from 335 feet to 1,734 feet" (102–528 m) confirmed the presence of the fault, with displacement as great as 2,000 feet (600 m) near the town of Tuscola in Douglas County. This interpretation was not accepted by Clegg (1959), Bristol and Buschbach (1973), or Stevenson et al. (1981) in their maps of the area. Moreover, a proprietary seismic reflection profile that crossed the La Salle Anticlinorium in Coles County revealed no indication of faulting at Galena (Trenton) Group or higher levels. These data do not rule out the possibility of faulting at greater depth in crystalline basement along parts of the La Salle Anticlinorium. But until presence of a fault can be documented, it should not be named.

See also OGLESBY FAULT (discarded).

TWITCHELL FAULT

Fluorspar Area Fault Complex

Location Section 24, T12S, R7E, Hardin County (pl. 2)

References Palmer 1956, Baxter et al. 1967

The Twitchell Fault is part of an intricate zone of faulting along the northwest side of the Rock Creek Graben. It is a normal fault that strikes northeast and has the southeast side downthrown approximately 50 feet (15 m).

UNNAMED FAULT ZONE

Location From central Cook County to southeastern Winnebago County (B-8 to A-6)

References McGinnis 1966, Sargent and Buschbach 1985, Graese et al. 1988, Heigold 1991

McGinnis (1966) inferred, on the basis of geophysical and borehole data, that a basement fault zone extended west-northwest from Chicago to Rockford, Illinois. Graese et al. (1988) also discussed this fault zone, which was not named in either report. This fault zone will not be named herein because its existence is doubtful.

McGinnis stated that the Precambrian basement surface is displaced more than 1,000 feet down to the southwest along the unnamed fault zone. According to his interpretation, the unnamed fault zone and the Sandwich Fault Zone outline a graben. Little or no displacement of Paleozoic rocks has occurred along McGinnis's fault zone. Structure on the Ironton Sandstone (Upper Cambrian) sags to the south near the inferred fault zone, whereas the Glenwood Formation (Middle Ordovician) apparently is not deformed (McGinnis 1966). From these data McGinnis inferred that principal displacements along the fault zone occurred before deposition of the Ironton. Graese et al. (1988), using additional subsurface control not available to McGinnis, mapped minor folding of the Glenwood Formation and the younger Galena Group in the vicinity of McGinnis's fault zone. They suggested minor reactivation of the fault zone during the Ordovician Period.

Other newly available data appear, however, to disprove significant offsets of the Precambrian surface in the area indicated by McGinnis. New wells drilled to basement in northeastern Illinois indicate that the Precambrian surface is unfaulted and slopes gently southeastward in this area. One of the new wells is in northern Du Page County a few miles south of McGinnis's fault zone and along his seismic line. The actual elevation of the top of Precambrian in this well is 800 feet higher than the elevation contoured by McGinnis. Recontouring the area using the new well data eliminates the fault zone (Sargent and Buschbach 1985). Also, a high-resolution seismic reflection profile was acquired for Du Page County across the trend of the McGinnis fault zone. The new seismic profile, which has reflection quality much better than that of McGinnis's seismic profiles, indicates no offset of the Precambrian surface (Heigold 1991).

UPPER MISSISSIPPI VALLEY ZINC–LEAD DISTRICT

Location Southwestern Wisconsin, northeastern Iowa, and northern Jo Daviess County, Illinois (A-3)

Selected references Trowbridge and Shaw 1916, Willman et al. 1946, Willman and Reynolds 1947, Agnew 1955, Heyl et al. 1955, 1959, Bradbury et al. 1956, Reynolds 1958, Carlson 1961, Allingham 1963, Taylor 1964, Klemic and West 1964, Mullens 1964, Heyl and West 1982

Mineral deposits were noted by 16th-century French explorers and were mined long before Illinois, Wisconsin, and Iowa achieved statehood. The district became the largest lead producing region in the United States during the middle 1800s. Lead production declined after the Civil War, but zinc mining boomed as smelting techniques and markets for the metal were developed. Production peaked during World War I, fell abruptly afterward, then rose again during and after World War II. Although large reserves remain, poor market conditions, small ore bodies, and high mining costs have brought another decline; no mine is currently active in the district.

The ore, principally sphalerite and galena, occurs in Upper and Middle Ordovician limestone, dolomite, and shale (fig. 53). Although some early geologists believed the minerals were deposited by meteoric waters, a hydrothermal origin is now generally accepted. Structural factors play a major role in localizing ore deposits.

The regional dip in the zinc–lead district is 15 to 20 feet per mile (1:265 to 1:350, a small fraction of 1°) to the south or southwest. Superimposed on this are several sets of gentle open folds. The largest anticlines and synclines cross the entire district from east to west. Their axes are sinuous and structural relief ranges from about 100 to 260 feet (30–80 m). Northern limbs of anticlines generally are steeper than southern limbs and in places are cut by high-angle reverse or normal faults parallel to fold axes (Heyl et al. 1959, Carlson 1961, Allingham 1963). Smaller folds 1 to 12 miles (1.6–19 km) long and having less than 100 feet (30 m) of relief, lie between or on the backs of major folds. Small folds display three dominant trends: east to west, northeast to southwest, and north-northwest to south-southeast. Joints are prevalent and may have served as conduits for mineralizing fluids. In most parts of the district, the primary joints trend east to west and one or two sets of secondary joints strike north, northeast, or northwest.

Ore deposits are strongly concentrated along synclines. The highest ore is mainly galena and occurs in vertical crevices or gash veins that trend parallel to synclinal axes (fig. 53). At lower levels sphalerite and minor galena are found in "pitch-and-flat" deposits. The pitches are inclined fractures that dip away from a central, downdropped core ground (fig. 53). Geometrically, they are reverse faults that steepen and die out upward; below, most of them merge with bedding of the incompetent shale of the Spechts Ferry Formation (basal Galena Group). Flats parallel to bedding intersect and offset pitches.

In most pitch-and-flat deposits, the limestone of the Quimbys Mill (Platteville Group) and Guttenberg Formations (Galena Group), which respectively underlie and overlie the Spechts Ferry, have undergone much dissolution. These limestones commonly are greatly thinned, brecciated, deformed, and locally reduced to a shaley residuum. Adjacent dolomites have experienced little or no dissolution.

Geologists debate the relative importance of tectonic processes versus solution-collapse in producing pitch-and-flat ore bodies and associated structures. Heyl et al. (1959) proposed that horizontal compression produced not only all the folds in the region but also the pitches, which they viewed as tectonic reverse faults. They theorized that Paleozoic strata simultaneously were shoved northward out of the subsiding Illinois Basin and northwestward from the Forest City Basin against the buttressing Wisconsin Dome. Heyl et al. (1959) accepted that solution-collapse took place, but considered its effects minor and secondary to tectonic stresses. Most other geologists attribute pitch-and-flat structures to solution-collapse localized along preexisting vertical fractures. Some have likened pitch-and-flat structures to fractures that develop in a masonry wall when the foundation subsides (Trowbridge and Shaw 1916, Carlson 1961, Mullens 1964). Supporting this view is the observation that many ore-bearing synclines do not extend below the zone of dissolution. Also, many are better described as troughs than as folds; intervening anticlines are absent. Larger folds of the district are, however, considered to be tectonic structures. Reynolds (1958) and Klemic and West (1964) believed they originated through uplift and tilting of basement blocks; whereas Allingham (1963) suggested that sedimentary strata were crumpled as they slid off the rising Wisconsin Arch.

In Illinois, nine synclines within the zinc–lead district have been named in published reports. Three of these, the Galena, Smallpox Creek, and Vinegar Hill Synclines, are northeast-trending folds of moderate scale; the other six are small and trend northeast or northwest.

UPTONS CAVE SYNCLINE
Plum River Fault Zone

Location Northern Carroll and Ogle Counties (A-3, 4, 5)

References Cady 1920, Kolata and Buschbach 1976

Cady (1920) first recognized the presence of this structure, which he called the Stephenson–Ogle County Line Syncline. As mapped by Kolata and Buschbach (1976), the Uptons Cave Syncline lies immediately north of and trends parallel with the Plum River Fault Zone (fig. 37). It is indicated by outcrops and scanty well data.

VALMEYER ANTICLINE

Location Western Monroe County (I-3)

References J. Weller 1939, S. Weller and J. Weller 1939, Willman et al. 1949, Odom et al. 1961, Bristol and Buschbach 1973

The Valmeyer Anticline lies southwest of the Waterloo–Dupo Anticline, strikes northwest, and is strongly asymmetrical. The Kimmswick Limestone (Middle Ordovician) comes to the surface at the crest of the anticline and Mississippian rocks crop out on both flanks. The southwest limb dips 15° to 25° and the northeast flank dips gently. No oil production has been obtained as the Kimmswick (Trenton), which is the principal producing horizon in the Waterloo and Dupo Fields, is breached by erosion on the Valmeyer Anticline.

McCracken (1971) indicated a possible extension of the Valmeyer Anticline into Missouri. The dominant structural trend in that part of Missouri is northwest.

VANDALIA ARCH (discarded)

Location South-central Illinois

References Workman and Gillette 1956, North 1969, Cluff et al. 1981

The Vandalia Arch represents a northeast-trending saddle or divide between two depositional basins that existed in the Late Devonian and Kinderhookian Epochs. It separated a southern depocenter near Hardin County and a shallower broader western depocenter in west-central Illinois. Cluff et al. (1981) rejected the term Vandalia Arch and substituted the informal name "central thin" because of a lack of evidence that showed this was a real tectonic feature.

See also PETERSBURG BASIN (discarded) and SCHUYLER ARCH (discarded).

VENEDY DOME (discarded)

Location Sections 3 and 4, T2S, R5W, Washington County

References Shaw 1915a, Kay 1915

Shaw (1915a) proposed the Venedy Dome and Kay (1915) copied his discussion verbatim. The dome was suggested by scanty well records on the Herrin Coal Member (Pennsylvanian). The Cady et al. (1940) map of the Herrin Coal, which was based on additional control points, does not show such a structure; therefore, use of the name Venedy Dome should be discontinued.

VERGENNES ANTICLINE

Cottage Grove Fault System

Location T7S, R1 and 2W, Jackson County (J-5)

References Nelson and Krausse 1981

As contoured on the Herrin Coal Member (Pennsylvanian), the Vergennes Anticline is about 3 miles (5 km) long and 1 mile (1.6 km) wide. Its axis strikes west-northwest and is about 1.5 miles (0.8 km) south of and parallel with the master fault of the Cottage Grove Fault System. Maximum closure is about 100 feet (30 m). Oil is produced from Devonian limestone in the Vergennes field on this anticline.

VERSAILLES ANTICLINE

Peoria Folds

Location Brown and southern Schuyler Counties (E,F-2,3)

References Wanless 1957

The fold axis of the Versailles Anticline was mapped as trending northeastward and about 18 miles (29 km) long. The structure was mapped from subsurface data on "Kinderhookian" (New Albany Group) shale. No closure is indicated.

VEVAY PARK DOME (discarded)

Location Section 25, T10N, R10E, Cumberland County

References Mylius 1927

It is doubtful whether Mylius (1927) intended to name this structure. The indicated dome is an irregular area of closure less than 1 square mile mapped on the "Siggins" pay sand (Pennsylvanian) in the Vevay Park Oil Field. Clegg's (1959) maps of the same area indicate no closure on the Herrin or Danville Coal Members, which are much more reliable mapping horizons than the "Siggins" sand. The Vevay Park Oil Field is situated at the crest of the west-facing Charleston Monocline, which is part of the La Salle Anticlinorium.

VINCENNES BASIN

Location See text below

References Droste et al. 1975, Droste and Shaver 1980, 1987, Whitaker 1988

The name Vincennes Basin is applied to an inferred trough or embayment that existed during the Silurian and Devonian Periods. The authors listed above differ on details but agree that an area of deeper water lay in southeastern Illinois, southwestern Indiana, and western Kentucky from the Alexandrian Epoch (Early Silurian), at least through the Early Devonian Epoch. This trough was closed on the north, probably was open on the south, and had a north–south axis. The Vincennes Basin, like the older Reelfoot Basin, can be regarded as an ancestor of the present Illinois Basin. A nongeographic term such as proto-Illinois Basin can serve equally well for such features.

VINEGAR HILL SYNCLINE

Upper Mississippi Valley Zinc–Lead District

Location T29N, R1W and 1E, Jo Daviess County (A-3)

References Willman and Reynolds 1947, Bradbury et al. 1956

The Vinegar Hill Syncline is about 4 miles (6.5 km) long in Illinois and extends into Wisconsin. The irregular axis trends northeastward. Structural relief reaches about 40 feet (12 m) in places. Several deposits of zinc and lead have been mined along the syncline.

WABASH RIVER ANTICLINE (discarded)

Location Northeasternmost Gallatin to southern Wabash County

References Bell 1943, Siever 1951, Swann 1951

This feature lies within the Wabash Valley Fault System and was mapped and named before the extent of faulting was recognized. The anticline, as defined, lies between the Herald–Phillipstown Fault Zone on the west and the Maunie and New Harmony Fault Zones on the east. Structure contour maps by Bristol and Treworgy (1979) indicate that the feature formerly defined as an anticline is actually an arched graben. The axis of the arch is sinuous and little or no closure is present at mapped horizons. The name Wabash River Anticline or Anticlinal Belt is discontinued because it does not accurately represent the structure of the area.

WABASH VALLEY FAULT SYSTEM

Location Southeastern Illinois, southwestern Indiana, and adjacent part of Kentucky (I, J-7, 8)

Selected references Cady et al. 1939, Clark and Royds 1948, Pullen 1951, Heyl et al. 1965, Bristol 1975, Sullivan et al. 1979, Bristol and Treworgy 1979, Ault et al. 1980, Tanner et al. 1980a–c, Tanner et al. 1981a–c, Sexton et al. 1986, Nelson and Lumm 1987, Treworgy 1988b

The Wabash Valley Fault System is composed of high-angle normal faults, most of which trend north-northeast, in the lower Wabash River valley of southeastern Illinois, southwestern Indiana, and a small part of Kentucky. The system extends about 55 miles (88 km) northward from the Rough Creek–Shawneetown Fault System and is as wide as 30 miles (48 km). Structure of the Wabash Valley Fault System is known from records of thousands of oil test holes, including many that penetrate fault surfaces. Additional details are provided by exposures in underground coal mines and by seismic reflection profiles.

The Wabash Valley Fault System contains more than one dozen named faults and fault zones, many of which contain parallel faults that overlap one another end to end. Faults along the west edge of the Wabash Valley Fault System trend north to south, whereas those farther east strike more northeast. The faults outline elongated gently arched or tilted horsts and grabens. Overall, the axial portion of the Wabash Valley Fault System is downfaulted relative to the margins.

Most individual faults are simple normal shears dipping 60° or steeper (figs. 43, 56, 57). Fault surfaces are generally planar. Drag is minimal. Faults exposed in mines have fairly narrow zones of gouge and breccia and numerous antithetic fractures are present. Slickensides indicate dip-slip movement, except in a few cases where horizontal striations indicate a minor component of strike-slip movement on part of a fault zone. The greatest recorded vertical displacement on a single fault is 480 feet (145 m) on the Inman East Fault. A few cross faults, normal faults that strike east to west and connect the overlapping ends of northeast-trending faults, have been mapped.

Well data indicate that the faults of the Wabash Valley Fault System tend to splinter upward. Thus, more faults are mapped on Pennsylvanian than on Mississippian horizons (Bristol and Treworgy 1979, Tanner et al. 1980a–c, Tanner et al. 1981a–c). Upward splitting of faults is confirmed by seismic reflection profiles of Sexton et al. (1986) and also by proprietary seismic profiles. On these seismic profiles, faults also appear to lose displacement downward. Most of them appear to die out within the Knox Group; only a few visibly offset the prominent basal Knox (Cambrian) reflector.

The time of structural movement in the Wabash Valley Fault System cannot be defined more precisely than post-late Pennsylvanian, pre-Pleistocene. There is no evidence of faulting contemporaneous with Paleozoic sedimentation.

The Wabash Valley Fault System is clearly a product of horizontal extension, but its regional significance is obscure. Contrary to Heyl et al. (1965), the Wabash Valley Fault System is not simply a northeast extension of the Fluorspar Area Fault Complex. The Wabash Valley and Fluorspar Area faults are separated by the east-trending Rough Creek–Shawneetown Fault System (Nelson and Lumm 1987). Moreover, faults of the Wabash Valley Fault System trend more northward than faults of the Fluorspar Complex.

Bristol and Treworgy (1979) and Treworgy (1988b) suggested that the faults in the Wabash Valley Fault System extend down into basement and may be reactivated basement faults. Sexton et al. (1986) proposed that the Wabash Valley Fault System formed when faults of a Precambrian rift zone, the Southern Indiana Arm, were reactivated. They based their theory on interpretation of their own seismic reflection profiles. Some of the Wabash Valley faults do not line up with inferred deeper faults of the Precambrian rift on the seismic profiles. Also, most of the Wabash Valley faults seen on seismic lines, die out downward in Ordovician and Cambrian strata. If these faults were reactivated basement faults, their displacement should increase with depth. Moreover, reactivation of basement faults should have produced monoclinal folds in sedimentary cover (Stearns 1978). No such folds are present in the Wabash Valley Fault System.

An alternate explanation of the Wabash Valley Fault System is that the crust was arched gently along a north-northeast-trending axis, probably in late Paleozoic time. Arching stretched the sedimentary layers and created a series of axial tension fractures. The tension would have been greatest at the surface where the arc of folding was longest and would have diminished with depth. Thus, the tension fractures died out downward. This style of faulting was demonstrated by Sanford (1959) in laboratory experiments (fig. 68).

WALLACE BRANCH FAULT ZONE

Fluorspar Area Fault Complex

Location Sections 25 and 36, T12S, R7E, Hardin County (pl. 2)

References S. Weller et al. 1920, Currier and Hubbert 1944, J. Weller et al. 1952, Baxter and Desborough 1965, Baxter et al. 1967

This fault zone forms the west margin of the Rock Creek Graben where the graben changes trend from N55°E to N20°E northwest of Rosiclare. The Wallace Branch Fault Zone is reported to be a high-angle reverse fault with the southeast side downthrown as much as 1,000 feet (300 m) in places. The zone continues south of the Ohio River in Kentucky.

WALPOLE DOME (new name)

Location T6S, R6E, Hamilton County (J-6)

References Cady et al. 1939, Rolley 1951

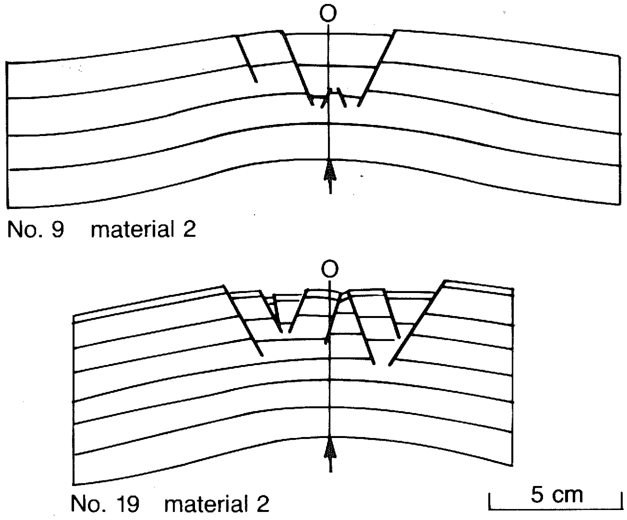


Figure 68 A fracture pattern resulting from arching in laboratory experiments by Sanford (1959, fig. 15). The pattern shown here is similar to that of the Wabash Valley Fault System.

Cady et al. (1939) and Rolley (1951) called this feature an anticline, but it is more accurately called a dome. Their mapping of the Herrin Coal Member (Pennsylvanian) and subsequent mapping of the Beech Creek ("Barlow") Limestone by Bristol (1968) and the Karnak Limestone Member of the Ste. Genevieve Limestone (Mississippian) by Bristol and Howard (1976) indicated a kidney-shaped structural high having irregular areas of closure. Walpole Oil Field, developed on the structure, has produced more than 10.6 million barrels from Chesterian, Valmeyeran, and Devonian reservoirs. The Walpole Dome is connected by saddles to the Hoodville and Dale Domes.

See also DALE DOME.

WAMAC DOME (discarded)

Location Near common corner of Clinton, Marion, and Washington Counties

References Bell 1926a, Brownfield 1954

The Wamac Dome was defined as a small area of closure mapped on Mississippian horizons at the southern end of the Centralia Anticline. Like the Shattac Dome, the Wamac Dome does not appear to merit separate recognition.

WAPELLA EAST DOME

La Salle Anticlinorium

Location T21N, R3E, De Witt County (E-6)

References Howard 1963a, b, 1964, Heigold et al. 1964, Clegg 1972, Treworgy 1978, Whitaker 1988

A structural high and a partially eroded Silurian reef combine in the Wapella East Oil Field. The dome lies along the axis of the Downs Anticline, westernmost fold in the La Salle Anticlinorium of this area. Clegg (1972) mapped closure of about 35 feet (11 m) on the Danville Coal Member (Pennsylvanian). Howard (1963a, b) indicated closure of 90 feet (27 m) on the Devonian Cedar Valley Limestone and 110 feet (33 m) on top of the Silurian. By comparing the relative thinning of various units across the dome, Howard (1964) attributed relief of 25 feet (8 m) to compactional thinning across the reef and the remaining 85 feet (26 m) to tectonic uplift.

Insufficient data are available to map the dome on pre-Silurian horizons. Thus, one can only speculate on whether Wapella East was a high place favoring reef development during the Silurian Period.

WARSAW DOME (new name)

Location T4N, R9W, Hancock County (E-1)

References Bell 1932

Bell (1932) mapped the structure of part of Hancock County. The contact of the Warsaw and Keokuk Formations (Mississippian) was contoured on the basis of outcrops and water well and oil test records. His map shows an irregular dome about 2 miles (3 km) in diameter and centered in Section 1, T4N, R9W. The indicated closure is at least 30 feet (9 m). Bell (1932) defined the feature as an anticline, but the name is changed to Warsaw Dome to reflect the nearly circular shape of the structure.

WARTRACE FAULT ZONE (new)

Location T13S, R4E, Johnson County (K-6)

References S. Weller and Krey 1939, J. Weller 1940, Knight 1968, Nelson 1993

This fault zone is named for the small village of Wartrace, which apparently refers to an Indian war trail (Nelson 1993). S. Weller and Krey (1939), J. Weller (1940), and Knight (1968), all mapped the fault zone but did not name it. On their maps, it appears as a single fault striking northwest and downthrown to the southwest. New mapping in the Bloomfield Quadrangle (Nelson 1993) indicates a pair of faults forming a graben. The central block is downthrown 100 to 150 feet (30–45 m) in the vicinity of Wartrace (Sections 8, 9, and 20, T13S, R4E). A seismic profile shows the faults to be nearly vertical and to penetrate the entire Paleozoic section.

The Wartrace Fault Zone lies between the McCormick Anticline and the Lusk Creek Fault Zone and is nearly perpendicular to both. The role of the Wartrace Fault Zone in regional tectonics is uncertain.

WATERLOO–DUPO ANTICLINE

Location Western Monroe and St. Clair Counties, Illinois (H,I-3); St. Louis County, Missouri

References S. Weller 1906, Fenneman 1911, Mylius 1921, Lamar 1922, Bell 1929b, S. Weller and J. Weller 1939, Cole 1961, Tikrity 1968, Buschbach and Bond 1974, Nelson and Lumm 1985

The Waterloo–Dupo Anticline is a sharply asymmetrical structure, the axis of which strikes slightly west of north. Some early reports refer to it as the Waterloo Anticline, and others, as the Dupo Anticline. The names were derived from two oil fields developed in separate areas of closure on the same structure. The compound form Waterloo–Dupo Anticline has become widely, but not universally accepted in later reports.

The east limb of the anticline dips at 2° to 4°, whereas the west limb dips steeper than 45° in places. Lamar (1922) and S. Weller and J. Weller (1939) both asserted that the western limb is faulted, although details are lacking. Bristol and Buschbach (1973) mapped more than 300 feet (90 m) of closure on the top of the Galena (Trenton) Group in the Waterloo Oil Field near the south end of the anticline. The Dupo Oil Field, farther north, is in a separate smaller area of closure.

The Waterloo–Dupo Anticline apparently underwent at least two separate periods of movement. Late Devonian uplift is indicated by subsurface thinning of Silurian and Devonian strata across the crest of the fold (Tikrity 1968). The main episode of folding took place near the end of the Mississippian or early in the Pennsylvanian Period. Nearly horizontal strata of the Carbondale Formation (middle Pennsylvanian) overlie Chesterian formations dipping 40° to 50° on the west limb of the fold (fig. 69, Nelson and Lumm 1985). Slight post-Pennsylvanian folding may have taken place, but is difficult to demonstrate because Pennsylvanian rocks are absent along the anticlinal crest.

The structural style and timing of deformation of the Waterloo–Dupo Anticline are similar to those of the La Salle Anticlinorium, Salem and Louden Anticlines, and most other major anticlines north of latitude 38°N in Illinois. Drape-folding of sedimentary layers across a basement fault is strongly suggested.

More than 405,000 barrels of oil have been produced from the Galena (Trenton) Group in the Waterloo Oil Field, which was discovered in 1920 and converted in part to gas storage in 1951. The Dupo Oil Field, discovered in 1928, has yielded more than 3 million barrels from the Galena.

WAVERLY ANTICLINE (discarded)

Location Southwestern Sangamon County

References Easton 1942, Nelson 1987b

A minor east-trending anticlinal nose was mapped from sparse data on the Herrin Coal Member (Pennsylvanian). No evidence of such a structure is shown on a new map (Nelson 1987b), which was based on many control points not available to Easton (1942). The southeast end of the Waverly Dome extends into the area where Easton designated the Waverly Anticline.

WAVERLY DOME

Location Southeastern Morgan County (F-4)

References Bell 1961, Buschbach and Bond 1974

The Waverly Dome is an irregular asymmetrical dome elongated northwest to southeast. Its length is about 7 miles (11 km) and its width 3 to 4 miles (5 to 6.5 km). Closure of more than 100 feet (30 m) has been mapped on the top of the Galena (Trenton) Group and 68 feet (20.7 m) on top of the Cambrian Ironton-Galesville Sandstone. The enclosed area is about 11 square miles (28 km^2). A gas storage field developed on the dome uses the St. Peter and Ironton–Galesville Sandstones as reservoirs.

The Waverly Dome is a prominent feature in an area of Illinois characterized by few large structures. Both the Cluff et al. (1981) map of the base of the New Albany Group and the Bristol and Buschbach (1973) map of the top of the Galena Group show the Waverly Dome as lying along a southeast-trending anticlinal nose that extends as far as Montgomery County. This trend is similar to that of many structures of western Illinois and adjacent parts of Missouri. Regional interpretation is rendered speculative, however, by a shortage of control points.

WEST GREEN FAULT ZONE (discarded)

Fluorspar Area Fault Complex

Location T12S, R9E, Hardin County

References Brecke 1962

Figure 69 The angular unconformity between steeply dipping lower Chesterian strata (in stream bed) and nearly flat-lying middle Pennsylvanian coal and claystone (in bank) on the west flank of the Waterloo–Dupo Anticline. This exposure demonstrates that the principal uplift of the anticline occurred late in the Mississippian Period and early in the Pennsylvanian Period.

The name West Green Fault Zone referred to a northwest-trending normal fault encountered in an underground fluorspar mine. Displacement of the fault is "very small" (probably a few feet), according to Brecke. Retaining a name for such an insignificant feature does not appear justified.

WEST SALEM DOME (discarded)

Location T1N, R11E, Richland County
References Easton 1943

The West Salem Dome was mapped on the basis of two control points, one of which Easton later found to be in error. (See Supplement to Illinois Petroleum 46, "Revised Structural Data Eliminating the West Salem Dome"). This is the only known example in Illinois of a structural feature expunged by its own author.

WEST UNION SYNCLINE (discarded)

Location Clark County
References Moulton and Young 1928

The feature that Moulton and Young (1928) called the West Union Syncline is now regarded as part of the larger Marshall–Sidell Syncline.

WESTERN SHELF

Location Western Illinois and adjacent parts of Missouri (fig. 2)
References Bell et al. 1964

The Western Shelf is the west flank of the Illinois Basin lying west of the Fairfield Basin and east of the Ozark Dome and the axis of the Mississippi River Arch. Its boundaries are quite indefinite in most places except along the Du Quoin Monocline, which forms part of the eastern border. The Western Shelf was a carbonate platform during much of the Paleozoic Era and it was characterized by slow rates of deposition, open marine circulation, and low clastic input. The shelf experienced only mild structural deformation, most of which apparently took place late in the Mississippian Period or early in the Pennsylvanian Period and produced northwest-trending anticlines and faulted monoclines. The southern part of the Western Shelf is commonly called the Sparta Shelf.

WESTFIELD DOME

La Salle Anticlinorium

Location Northwestern Clark and parts of Coles and Cumberland Counties (G-7,8)
References Mylius 1923, 1927, Moulton and Young 1928, Cohee 1941, Clegg 1959, 1965a, b, Bristol and Buschbach 1973, Stevenson et al. 1981

The Westfield Dome, formerly called the Parker Dome, is an asymmetrical box-fold with a long steep western limb (the Charleston Monocline), a gently dipping eastern limb, and a slightly domed crest. The dome underwent uplift before Pennsylvanian sedimentation, and additional uplift after Pennsylvanian time. Structural relief, therefore, is greater on pre-Pennsylvanian than on Pennsylvanian strata (see table).

Structural horizon	Relief of western limb	Relief of eastern limb
PENNSYLVANIAN		
Herrin (No. 6) Coal Mbr (Clegg 1965b)	1,060 ft (323 m)	600 ft (183 m)
Colchester (No. 2) Coal Mbr (Clegg 1965b)	1,170 ft (357 m)	680 ft (207 m)
DEVONIAN		
Base of New Albany Group (Stevenson et al. 1981)	2,700 ft (823 m)	1,200 ft (366 m)
ORDOVICIAN		
Top of Galena Group (Bristol and Buschbach 1973)	2,500 ft (762 m)	1,100 ft (336 m)

The Westfield Oil Field, developed on the dome, has been producing since 1904 from Pennsylvanian, Valmeyeran, and Galena reservoirs.

WEYEN ANTICLINE (discarded)

see **WYEN ANTICLINE** (discarded)

WHITE ASH FAULT ZONE

Location T8 and 9S, R2E, Williamson County (J-6)
References Nelson and Krausse 1981, Nelson 1981

The White Ash Fault Zone was mapped from borehole data and from exposures (none currently accessible) in coal mines. It consists of high-angle normal faults that strike about N15°E and have up to 58 feet (17.7 m) of offset. Some of the faults have the east side downthrown; others have the west side downthrown. The faults are known only to cut Pennsylvanian strata. The White Ash Fault Zone may be a southward continuation of the Rend Lake Fault Zone.

WHITE OAK ANTICLINE (discarded)

Location Through common corner of Randolph, St. Clair, and Washington Counties
References Shaw 1915a, Kay 1915, Cady et al. 1940

Shaw (1915a) defined this structure and Kay (1915) merely copied Shaw's discussion. The structure was described as a northeast-trending nose, but is difficult to locate on Shaw's structure map. Newer maps show no anticline in the area; for example, Cady et al. (1940) mapped a small basin in this area. The name White Oak Anticline should not be used.

WINE HILL DOME

Location Northern T7S, R5W, Randolph County (J-4)
References Root 1928, Nelson and Krausse 1981

Root (1928) mapped the Wine Hill Dome on the basis of scanty outcrop data. The dome was depicted as elongated slightly north of east, about 2 miles (3 km) long, and less than 1 mile (1.6 km) wide (fig. 22). Root (1928) inferred a fault south of the crest of the dome. The dome cannot be defined any better today than when Root's report was published, but Nelson and Krausse (1981) speculated that it may reflect a westward extension of the Cottage Grove Fault System.

WINKLEMAN FAULT

Location T10S, R6E, Saline County, and T11S, R6E, Pope County (J-6, and pl. 2)

References Cady 1926, Nelson et al. 1991

Cady (1926) mapped the Winkleman Fault on the basis of outcrops. He showed the fault as trending northeastward for about 3 miles (5 km) in Saline County and having the southeast side downthrown. New geologic mapping (Nelson et al. 1991) indicates that the Winkleman Fault is part of a complex zone of faulting associated with the McCormick and New Burnside Anticlines. The part recognized by Cady approximately follows the axis of the New Burnside Anticline and is a high-angle fault with the southeast side downthrown about 100 feet (30 m). The fault can be traced southwestward into Pope County, where it diagonally connects the New Burnside and McCormick Anticlines. The structure is complex in Section 5, T11S, R6E, where displacements may exceed 200 feet (60 m). The fault, which dies out about 1.5 miles (2.5 km) southwest of Section 5, has a total mapped length of about 7 miles (11 km).

WISCONSIN ARCH

Location Central Wisconsin, northern Illinois (fig. 1; pl. 1 inset)

References Pirtle 1932, Bieber 1949, Willman and Templeton 1951, Green 1957, Heyl et al. 1959, Doyle 1965, Paull and Paull 1977, Kolata et al. 1978, Kolata et al. 1983

The Wisconsin Arch is a broad, positive area that separates the Michigan Basin on the east from the Forest City Basin on the west. The northern end of the arch is termed the Wisconsin Dome and is a region of Precambrian outcrops in northern Wisconsin. The rest of the arch is overlapped by Cambrian, Ordovician, and Silurian sedimentary rocks. On the southeast the Wisconsin Arch connects with the Kankakee Arch, which runs between the Michigan and Illinois Basins.

The Wisconsin Arch apparently began to emerge late in the St. Croixan Epoch (Cambrian) and was well established by the middle of the Ordovician Period. It may have been covered by seas in late Ordovician through middle Silurian time, but rose again in late Silurian or Devonian time (Paull and Paull 1977).

WITTENBERG TROUGH (discarded)

Location From central Union County, Illinois, to Perry and Ste. Genevieve Counties, Missouri

References Meents and Swann 1965, North 1969, Nelson and Lumm 1985, Devera 1986, Tarr and Keller 1933

As defined by Meents and Swann (1965), the Wittenberg Trough was a narrow fault-bounded trench that contained outliers of Devonian rocks. As mapped, it was 70 miles (113 km) long, 1 to 10 miles (1.6–16 km) wide, and 100 to more than 1,000 feet (30–300 m) deep. Meents and Swann (1965) stated that the Wittenberg Trough developed before or during deposition of the Grand Tower Limestone (Middle Devonian) and persisted into the Mississippian Period.

More recent studies indicate that the Wittenberg Trough was not a depositional basin, but merely the product of structural movements along the Ste. Genevieve Fault Zone. The history of the fault zone was first worked out by S. Weller and St. Clair (1928) and refined by Nelson and Lumm (1985). Late in the Middle Devonian Epoch, just after deposition of the Grand Tower Limestone, the north side of the Ste. Genevieve Fault Zone was uplifted. Devonian strata then were eroded from the upthrown northern block; Mississippian rocks now unconformably overlie pre-Devonian strata north of the fault. Then late in the Mississippian to early in the Pennsylvanian Period, the southern (Ozark Dome) side of the fault zone was raised; Devonian rocks subsequently have been eroded from most of the area south of the Ste. Genevieve Fault Zone. Because the later movements took place on faults mostly located a few miles south of the faults that moved in Devonian time, a narrow strip of Devonian rocks has been preserved within the Ste. Genevieve Fault Zone. Devonian rocks originally may have covered a much larger area of the present Ozark Dome and Sparta Shelf. Partial onlap of Devonian rocks onto the Ozark Dome is indicated by the finding of residual chert containing fossils from the lower-Middle Devonian Series (Grand Tower) in a diatreme near Avon, Missouri, about 10 miles (16 km) outside the Wittenberg Trough (Tarr and Keller 1933).

Additional evidence against the existence of a trough during deposition of the Grand Tower is provided by the paleoecology and sedimentary features of the Grand Tower Limestone. A shallow, well-agitated marine environment ranging from shallow subtidal to above storm wave base is indicated (Devera 1986).

In summary, the term Wittenberg Trough is misleading and does not accurately represent the depositional and structural setting of Devonian rocks in the east flank of the Ozark Dome; therefore, use of the term should be discontinued.

WOBURN ANTICLINE (new)

Location Northeastern Bond County (G, H-5)

References Bristol and Buschbach 1973, Bristol and Howard 1976, Stevenson et al. 1981

The Woburn structure, formerly referred to as a "significant unnamed structure" (Treworgy 1981), is now named the Woburn Anticline. The name comes from a nearby town and the Woburn Consolidated Oil Field that is developed in a structural trap on the anticline. Structure maps of the Beech Creek ("Barlow") Limestone (ISGS open files) show a prominent linear anticline, plunging slightly west of south and having several areas of closure. The anticline is about 10 miles (16 km) long and 3 to 4 miles (5–6.5 km) wide. Maximum closure is only about 20 feet (6 m) on the Beech Creek, but total structural relief is greater than 150 feet (45 m). On the older Karnak Limestone Member, the Woburn Anticline is shown to have closure of more than 100 feet (30 m) (R. Howard, unpublished mapping). The west limb is nearly linear and dips more steeply than the east limb at this horizon. The form of the west limb suggests an underlying basement fault.

The Woburn Anticline also is mapped as having closure on the Ste. Genevieve Limestone (Bristol and Howard 1976), the base of the New Albany Group (Stevenson et al. 1981), and the Galena (Trenton) Group (Bristol and Buschbach 1973). Woburn is one of several small north-trending anticlines on the eastern Sparta Shelf.

WOLRAB MILL FAULT ZONE (new name)
Fluorspar Area Fault Complex

Location Section 14, T12S, R7E, to Section 28, T10S, R9E, Hardin County (pl. 2)

References S. Weller et al. 1920, J. Weller et al. 1952, Brown et al. 1954, Palmer 1956, Baxter et al. 1963, Baxter and Desborough 1965, Baxter et al. 1967

Although the structure is poorly defined, the name has recurred in the literature. Wolrab Mill Fault Zone is a more appropriate name than the Wolrab Mill Fault. This zone of northeast-trending faults lies in the upthrown block between the Dixon Springs and Rock Creek grabens and extends from the Stewart Fault near the Hardin–Pope county line northeast to the Ohio River bottomlands. Individual faults in the zone have throws ranging from about 30 feet (10 m) to several hundred feet down to either the northwest or the southeast. Although shown on some maps as extending southwest beyond Bay Creek in Pope County, no evidence of the Wolrab Mill Fault Zone was observed in extensive workings along the Stewart vein (S. Weller et al. 1920, J. Weller et al. 1952).

WOODLAWN–DRIVERS ANTICLINE (discarded)

Location T2S, R1 and 2E, Jefferson County

References Cady et al. 1938, Keys and Nelson 1980

A map of the structure of the Herrin Coal Member (Pennsylvanian) by Cady et al. (1938) shows an east-trending anticlinal nose running through the villages of Woodlawn and Drivers. Their interpretation apparently was based on a single control point. The structure map of the Herrin Coal by Keys and Nelson (1980) covers the same area, uses many more subsurface data points, and shows no anticline. The eastern branch of the Du Quoin Monocline runs through this area.

WYEN ANTICLINE (discarded)

Location T8N, R6W, Macoupin County

References Easton 1942, Nelson 1987b

The Wyen or Weyen Anticline (Easton used both spellings) was defined by a kink in a single contour line on a structure map of the Herrin Coal Member (Pennsylvanian). New data (Nelson 1987b) do not confirm the existence of this structure.

XENIA DOME

Location Northern part of T2N, R5E, Clay County (H-6)

References J. Weller and Bell 1936, Easton 1944, Lowenstam 1951

J. Weller and Bell (1936), who mapped a structure they called the Xenia Dome in the east-central part of T3N, R5E, based this mapping on outcrop studies of the Omega Limestone (upper Pennsylvanian) Member of the Mattoon Formation. Easton (1944) showed the Paine Dome in Sections 4, 5, 8, and 9, T2N, R5E, as mapped from well data on the Ste. Genevieve Limestone. Lowenstam (1951) substituted the name Xenia Dome for Paine Dome and further defined it on the basis of subsurface data on the Herrin Coal Member (Pennsylvanian). The current map of the Beech Creek ("Barlow") Limestone (ISGS open files) shows a small dome very similar to that mapped on the coal by Lowenstam. It is elongated east to west and has closure of less than 20 feet (6 m). The Xenia Oil Field, which produces from the Mississippian Aux Vases Sandstone, Carper sand (Borden), and Devonian limestone, is developed on this dome. No dome or anticline exists in the area where J. Weller and Bell (1936) originally defined the Xenia Dome.

YORK DOME (discarded)

Location T9N, R10 and 11E, Cumberland County

References Mylius 1927, Clegg 1959

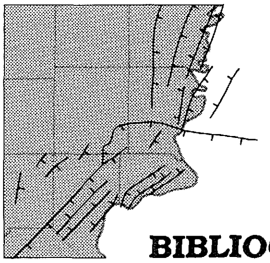
The name York Dome was given by Mylius (1927) to slight doming on the "Siggins sand" (Carbondale Formation, Pennsylvanian) in the York Oil Field. Clegg did not mention a York Dome; his structure maps of Pennsylvanian coals indicate no closure in the York Oil Field. The field lies on the upper limb of the west-facing Charleston Monocline, which is part of the La Salle Anticlinorium. Because no dome is evident, the name York Dome should not be used.

ZEIGLER ANTICLINE (discarded)

Location T7S, R1E, Franklin County (?)

References Cady 1916

Cady (1916) mentioned this feature once and did not specify its location. No anticline near the village of Zeigler appears on Cady's structure map of the Herrin Coal Member (Pennsylvanian). The name Zeigler Anticline should not be used.



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