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STRUCTURAL TRENDS IN THE ILLINOIS BASIN

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STRUCTURAL TRENDS IN THE ILLINOIS BASIN

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The Illinois basin is here defined as that area between the Ozark uplift to the south and southwest, the Mississippi arch to the west, the Wisconsin uplift to the north, and the LaSalle anticline to the east. The basin, which has been notably an area of depression and sedimentation since pre-Cambrian time, has experienced repeated uplifts and downwarpings with associated folding. Many structural features have resulted from these diastrophic movements. Of these the LaSalle anticline is the most pronounced.

Information regarding some of these structures has been made available from studies of outcrops, well borings, and coal tests in the shallow parts of the basin. Until the recent oil development, which began in 1937, very few data were available for the central part of the Illinois basin which lies in the southern half of the State between the DuQuoin anticline on the west, the LaSalle anticline on the east, and the Ozark uplift in the extreme south. Geologic information from the many wildcat wells and wells drilled in the new oil fields has contributed much to knowledge of the details of structure in the deep part of the basin. These recent data show that this part of the basin is by no means a simple downwarped area, but is crossed by numerous folds with various trends. There are now several oil fields located on the structures within the central basin area.

The largest fields developed so far in this area are Clay City and Noble. Both fields are located on separate closed structures on a regional "high". There is a closure of 100 feet on the Ste. Genevieve limestone in both fields. Each structure is an elongated anticline with a northeast-southwest trend and at the southwestern end of each there is a nose extending to the southeast. This southeastern nose in both fields extends toward a small producing area which is apparently a small dome with little closure. The Olney field, which was discovered more recently than the Clay City and Noble fields, is of the same regional "high". The McClosky "sand" of the Ste. Genevieve limestone is the principal producing formation in the central basin fields. The Cypress sandstone is also productive in the north Noble field.

The Salem (Lake Centralia) field in Marion County and the Louden (Beecher City) field in Fayette County are the major fields on the west edge of the deep part of the Illinois basin. Both fields are elongated anticlines with more than 200 feet of closure on the producing formations.

The Salem (Lake Centralia) structure is elongated northeast-southwest and at the southwestern end there is an anticlinal nose extending southeastward toward the Dix field in central north Jefferson County. From the axis of the anticline the formations dip steeply westward and northwestward as much as 200 feet per mile into the syncline between the field and the DuQuoin monocline. The formations dip more gradually toward the east. The Bethel and Aux Vases sandstones and the McClosky "sand" are productive in the field.

The Louden (Beecher City) field is likewise on a northeast-southwest trending anticline. The formations dip steeply to the west and northwest at a rate of approximately 200 feet per mile and more gradually to the east into the deep part of the basin. Unlike the other fields in the deep part of the basin there is a north-south extension of the structure instead of the common southeastward extension. The Cypress and Bethel sandstones are the principal producing formations in the field. Production has also been obtained in the sandstone of the Paint Creek formation.

Mylius[1] in his detailed study of structural conditions in the north part of the southeastern fields found that the structural irregularities along the LaSalle anticline suggest that closed structures on the uplift are related to a series of cross-

[1] Mylius, L. A. Oil and Gas Development and Possibilities in East-Central Illinois. Ill. Geol. Survey Bull. 54 (1927), pp. 167-168.

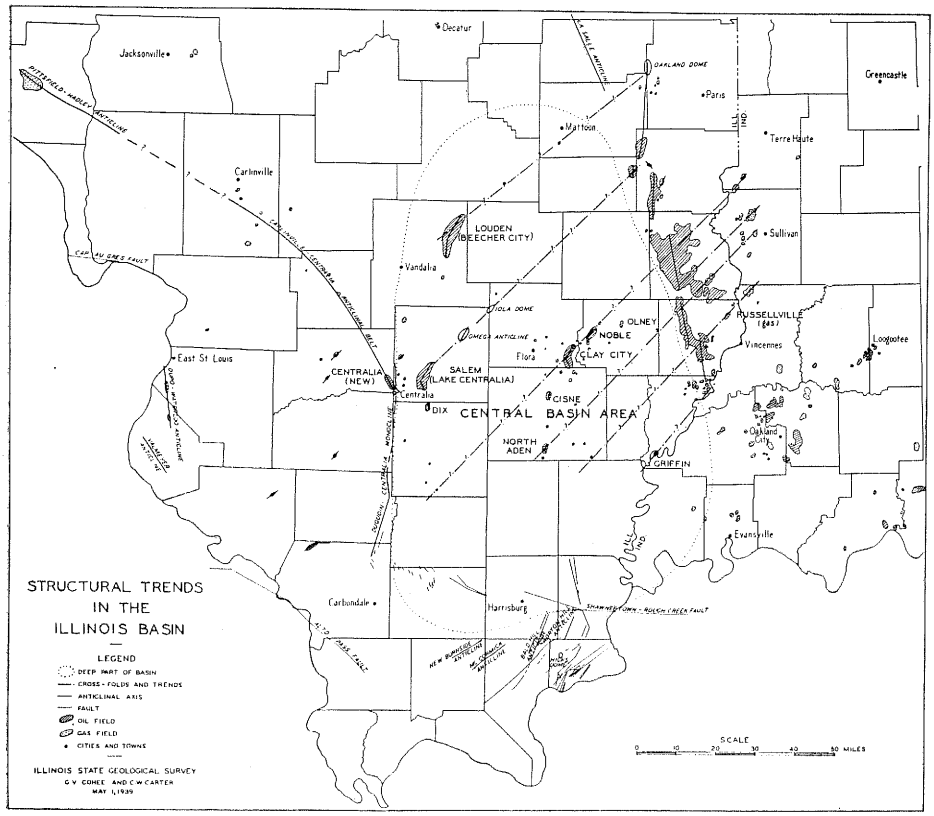

Fig. 1

folds which trend east of north and west of south. He stated that "If such a system of cross-folds of definite trend exists, as suggested, the knowledge would be of vital importance to future prospecting in the way of guidance of the search for new closed structures." Weller and Bell[2] showed cross-folds extending northeastward from the producing area on the LaSalle anticline in Crawford County to anticlinal structures in Indiana which are productive.

Cross-folds are also present in Lawrence and Wabash counties. The Russellville gas field in northeastern Lawrence County, discovered in 1937, is located on a northeast-southwest dome on the cross-fold that extends northeast from the producing area southwest of Lawrenceville, Illinois, to the Oaktown gas field in northwestern Knox County, Indiana. Contours on the Biehl sand[3] in Wabash County show a southwest trend from the Allendale field toward the Griffin pool which was recently discovered near the Wabash River in Gibson County, Indiana.

The influence of the cross-folds is shown by the structural irregularities of the LaSalle anticline and there is a corresponding irregularity of the producing areas. The cross-fold in northern Crawford County along which there is a considerable eastward extension of the producing area is in a northeast-southwest line with the Clay City and Noble fields in the central basin area and there is a suggestion that the influence of the cross-fold was extended into this area. A

[2] Weller, J. Marvin and Bell, Alfred H. Illinois Basin. Ill. Geol. Survey Illinois Petroleum 30 (1937), fig 4.

[3] Moulton, G. F. Further Contributions to the Geology of the Allendale Oil Field, with a revised structure map. Ill. Geol. Survey Report of Investigations 7 (1925), Plate I.

similar condition is suggested for the Salem and Louden fields. The north part of the Salem field is in a northeast-southwest line with the Omega anticline, Iola dome, the recent Iola field in northwestern Clay County, and the Siggins pool in the southeastern fields. The latter is located on a cross-fold described by Mylius and indicates a definite break in the LaSalle anticline. The north part of the Louden field is in line with similar trend extending through the new Stewardson field in Shelby County, the recent Mattoon field in Coles County, and the Oakland dome in Edgar County.

The principal axes of folds upon which the new fields in the basin are located are more north-south than the trends, suggesting an *en echelon* arrangement of the structures along the trends.

The southeast extensions of these new fields may reflect northwest-southeast trends which parallel the axis of the LaSalle anticline. These trends are suggested by the Centralia field in which the axis is northwest-southeast and by the southeast extension of the Salem field toward the Dix field.

Important folding occurred at the close of the Mississippian period when all of the borders of the Illinois basin were raised. The LaSalle anticline was the most important structure formed at this time,[4] and preexisting structures such as the Valmeyer and Waterloo anticlines were accentuated. It is also possible that the Pittsfield-Hadley anticline was formed then. Studies of the thickness of the Chester series and the Lower Mississippian by L. E. Workman and J. N. Payne show a region of thinning from Carlinville to Centralia which they designated the Carlinville-Centralia anticlinal belt. This region was likewise accentuated at the end of Mississippian time. It is suggested that the Pittsfield-Hadley anticline may connect with this structural axis. Faulting in Union County occurred at this time; also renewed movement along the Alto Pass fault which is thought to have existed previously.[5] Studies of well data in the deep basin area show upper Chester beds eroded from the tops of the structures,[6] which suggests that there was considerable folding of these structures then. Folding occurred during Pennsylvanian time in the Illinois basin and approximately 2,500 feet of Pennsylvanian sediments were deposited. The last important folding took place at the end of Pennsylvanian time. Preexisting structures in the Illinois basin were accentuated. The extreme southern part of the State was folded into a complexly faulted northeastward dipping monocline which cut off the Illinois basin from its southward extension. The Shawneetown-Rough Creek fault area, which is apparently a thrust fault with the upthrow side to the south, was formed at the same time. It has been suggested by various authors[7] that this fault may connect with faults and folds farther east in Kentucky and West Virginia. Small anticlines in the southern part of the State having northeast-southwest axes were formed at this time.

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[4] Cady, G. H. Structure of the LaSalle Anticline. Ill. Geol. Survey Bull. 36 (1920).
[5] Weller, J. Marvin. Personal communication.
[6] Workman, L. E. Unpublished manuscript on the Subsurface Stratigraphy of the Chester Series.
[7] Weller, J. Marvin and Bell, Alfred H. op. cit.
Russell, W. L. Relation of Rough Creek Fault of Kentucky to Ouachita Deformation. Bull. Am. Assoc. Petr. Geol., vol. 22 (1938), pp. 1682-1686.