STATEMAP
Wabash Island-BG

Bedrock Geology of Wabash Island Quadrangle

Gallatin County, Illinois and Posey County, Indiana and

Union County, Kentucky

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Introduction

This is a bedrock geologic map of the Wabash Island 7.5-minute quadrangle. It depicts the fully lithified rocks, which are entirely of Pennsylvanian age and underlie unlithified sediments of Quaternary age at depths ranging from zero to more than 150 feet. Although outcrops of bedrock are present in bluffs near the southwestern and southeastern corners of the map area, this map is based almost entirely on data from test drilling for coal and petroleum.

Sources of Data and Methods of Interpretation

The map area has been drilled extensively for oil and gas. Several oil fields have been developed; many wells are still producing. Records of these wells are on file at the Illinois, Indiana, and Kentucky Geological Surveys and can be accessed online via the websites of the respective surveys. The large majority of these records include electric logs; some contain supplemental gamma-ray, density, neutron, and sonic logs and a few include sample studies and core descriptions that provide direct information on rock types. Also, several companies have carried out exploration for coal, the Springfield Coal Member of the Carbondale Formation being the primary objective. Records of these holes include drillers' logs that vary in detail but are generally accurate, and in some cases electric, gamma-ray, and neutron logs were run. A number of coal-test holes were cored continuously, and detailed core descriptions made by geologists are on file. These provide highly detailed information on the upper part of the Pennsylvanian succession.

Faced with constraints on time, travel budget, and the principle of diminishing returns, I did not personally examine every available borehole record in the Wabash Island Quadrangle. Such an effort would have been superfluous and redundant, considering that portions of the map area contain more than 50 petroleum test holes per square mile, and that detailed published maps already exist for the Indiana and Kentucky portions of the quadrangle. In Illinois, where borehole data are directly at hand, I used all of the coal-test records and generally included 4 to 6 oil-test records per section (square mile), except in proximity to faults, where I used every available record.

In Indiana, Tanner et al. (1981) mapped faults and provided information on elevation of my chosen mapping datum, top of the Springfield Coal, using every available petroleum test hole. Tanner et al. did not publish structure contours, so I contoured their map by hand, using their posted well locations and coal elevations. I supplemented their data with my own interpretations of many well logs accessed via the Indiana Geological Survey's online Petroleum Database Management System. I looked at every available log close to the Inman East Fault Zone and produced my own interpretation of the faults in this area.

In Kentucky, Johnson and Norris (1976) published a geologic quadrangle map at 1:24,000 scale and it includes structure contours on the top of the Springfield Coal. Regarding their work as reliable and accurate, I simply transferred their faults and structure contours to my map, making adjustments to conform with data in Indiana and Kentucky. My formation boundaries do not match those used by Johnson and Norris, but fortuitously the Carthage Limestone, which defines the contact between my Bond and Patoka Formations, crops out along the base of the bluff in the southeast corner of the quadrangle, enabling accurate interpolation of the contact.

Surficial Geology

Bryk et al. (2012) published a surficial geologic map of the Wabash Island Quadrangle at 1:24,000 scale. Summarizing briefly, more than 95% of the map area is covered by Holocene alluvial sediments of the Wabash and Ohio rivers. The Shawneetown Hills at the southwest corner and the union Hills at the southeast corner (in Kentucky) are bedrock uplands mantled by Pleistocene wind-blown silt (loess) as thick as 50 feet. A small deposit of Wisconsinan (late Pleistocene) dune sand is mapped at the mouth of the ravine in the NE¼ NE¼ of Sec. 8, T9S, R10E. A larger area, roughly 200 acres, on the west side of Hulda Lake in Secs. 28 and 33, T8S, R10E, is mapped as the Wisconsinan Equality Formation. Bryk et al. describe these sediments as gray to brown silty clay loam and clay and interpret them as lake deposits. Heinrich (1982) mapped, described, and interpreted Pleistocene lake sediments in a larger area of Saline and Gallatin counties.

Holocene alluvium ranges from about 70 to 130 feet thick in most of the map area and is composed predominantly of sand. These deposits become finer grained upward overall, grading from coarse, gravelly sand at the base through progressively finer grained sand upward. Surface morphology clearly depicts a series of scroll bars formed by the meandering rivers and separated by sloughs where overbank and lake sediments accumulated. Sandy sediments are at the surface among the scroll bars, whereas sloughs contain darker and finer grained silty clay loam and silty clay (Bryk et al., 2012).

Structure and Igneous Rocks

Regional Setting

The map area is situated near the southern edge of the Fairfield Basin, which is the deeper part of the Illinois Basin north of the Rough Creek Fault System (Fig. 1). However, structure within the New Haven Southwest Quadrangle is dominated by the Wabash Valley Fault System, an array of high-angle normal faults trending overall north-northeast. The influence of these faults overwhelms the gentle, regional northward dip of rocks surrounding the southern edge of the Fairfield Basin.

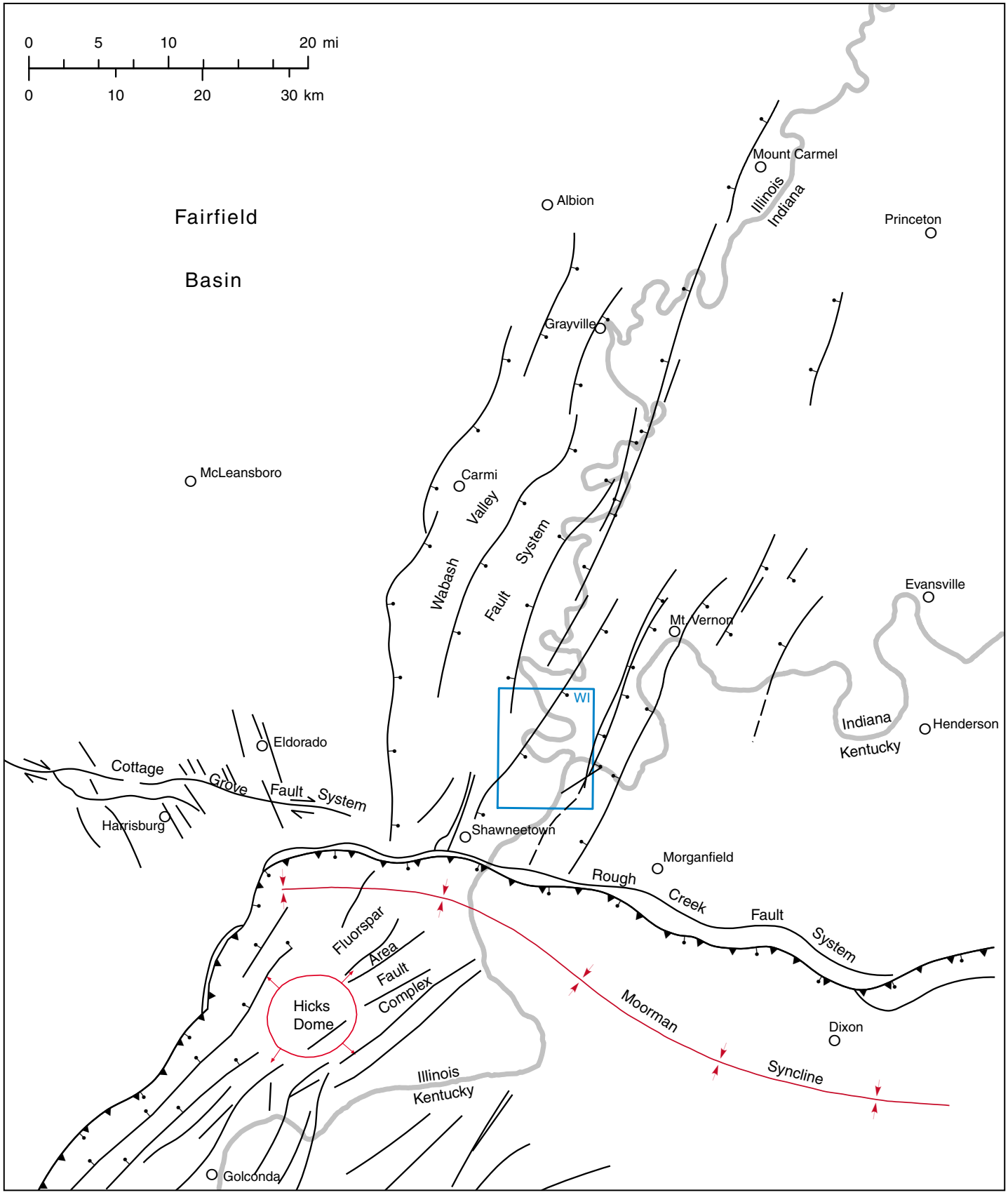

Figure 1 Map showing relation of Wabash Island (WI) Quadrangle to Wabash Valley Fault System and other structural features. After Gray et al. (1987), Noger (1988), and Kolata (2005).

Wabash Valley Fault System

As shown on Fig. 1, the Wabash Valley Fault System extends northward from the Rough Creek Fault System as far north as Mount Carmel, Illinois, a distance of about 60 miles (100 km). Maximum width of the zone is 28 miles (945 km). Faults dip steeply both east and west, outlining subparallel horsts and grabens. Maximum throw reaches 500 feet along the Inman East Fault in the Wabash Island Quadrangle.

The Inman East Fault attains maximum throw in or near Sec. 28, T8S, R10E. Toward the northeast the fault splits into two diverging branches that gradually lose displacement. As shown by structure contours on the geologic map, strata in the hanging wall (southeast) dip toward the fault, whereas rocks on the footwall (northwest) generally dip away from the fault. This configuration is common among normal faults formed by crustal extension and has been labeled "reverse drag" (Hamblin, 1965). Missing section in numerous wells that penetrate the Inman East Fault demonstrate normal faulting.

The Wabash Island Fault in the southeastern part of the map area comprises two normal faults that unite toward the northeast and continue into Indiana beyond the mapped area. Maximum throw exceeds 250 feet near the eastern end of Wabash Island. The southern end of the Maunie Fault enters the northwestern part of the Wabash Island Quadrangle.

Small dikes and sills of ultramafic igneous rock occur along some of the faults in the southern part of the Wabash Valley Fault System. An aeromagnetic survey by Hildenbrand and Ravat (1997) shows an aligned series of narrow, linear, strong magnetic highs along or closely adjacent to the Inman East Fault in the northern half of the Wabash Island Quadrangle. An oil-test hole, the Eastern Petroleum #B-1 Johnson in Sec. 22, T8S, R10E (county number 1694) penetrated at least three closely-spaced faults that comprise the Inman East Fault Zone. Strong high-resistivity "kicks" on the electric log at depths 1680-1696 and 1715-1730 feet, within the Kinkaid Limestone, probably represent igneous intrusive rocks.

Economic Geology

Coal

No coal mining is on record in the Wabash Island Quadrangle, but coal companies have carried out exploratory drilling and the ISGS has evaluated underground-mineable coal resources (Treworgy and Bargh, 1982). The most attractive target for mining is the Springfield Coal, which is present throughout the map area and maintains a consistent thickness of 4 to 5 feet in most areas. The black, hard Turner Mine Shale generally forms a competent roof and unlike many gray shales, is not overly sensitive to moisture. Aside from faults, no geologic interruptions of the Springfield Coal are known to occur in the quadrangle. Elevation of the top of the Springfield is depicted by structure contours on the geologic map. The younger (and shallower) Herrin Coal is more variable in thickness than the Springfield and averages 3 to 4 feet thick, which is marginal for underground operations. The Dekoven and Davis Coals, which lie roughly 250 to 300 feet deeper than the Springfield, both attain thicknesses of 3 to 6 feet thick in large areas of the quadrangle (Jacobson, 1993).

Oil and Gas

Extensive oil production has taken place in the New Haven SW Quadrangle. Following initial discoveries in 1939, oil fields were rapidly developed throughout the quadrangle and the larger Wabash Valley. Most were fully developed by the 1960s, but scattered infill drilling continues to the present day. Oil fields in the New Haven Southwest Quadrangle are assigned for permitting and statistical purposes to several named oil fields, but each of these comprises multiple pools that bear little relation to one another aside for geographic proximity. The Inman East Consolidated field covers a large area in the central and northern parts of the quadrangle. Portions of the Inman West Consolidated, Ab Lake South, and Ab Lake West fields also lie within the Wabash Island Quadrangle (Fig. 2). Each of these fields has multiple producing formations, including Lower Pennsylvanian sandstone and Chesterian and upper Valmeyeran (Mississippian) sandstone and limestone. Inman West Consolidated field includes reservoirs (in descending order) in Pennsylvanian, Palestine, Waltersburg, Tar Springs, Hardinsburg, Cypress, Sample, "Renault", Aux Vases, Ste. Genevieve, and St. Louis Formations (Huff, 1998). A combination of structural and stratigraphic trapping mechanisms are involved, but tilted fault blocks associated with the Wabash Valley fault system play the dominant role in localizing production. Fields lie mostly on the upthrown sides of faults, the faults themselves serving as seals that prevent escape of hydrocarbons (Bristol, 1975; Bristol and Treworgy, 1979).

Several horizontal wells have been completed in the quadrangle. For example, Pioneer #13-2 Lawler in SE¼, Sec. 13, T9S, R8E drilled more than 500 feet horizontally in sandstone of the Tar Springs Formation and yielded initial production of 60 BOPD. The LLA Exploration #2 McGuire in SW ¼, Sec. 19, T8S, R10E was finished for 160 BOPD in sandstone of the Waltersburg Formation, slightly shallower than the Tar Springs. Other horizontal wells have between completed in the older Cypress Formation. To date, only isolated experiments such as these have been carried out.

The ISGS formerly published annual, detailed statistical reports on oil and gas fields in Illinois. These reports were discontinued after 1988, and data on oil fields are no longer readily available.

Acknowlegements

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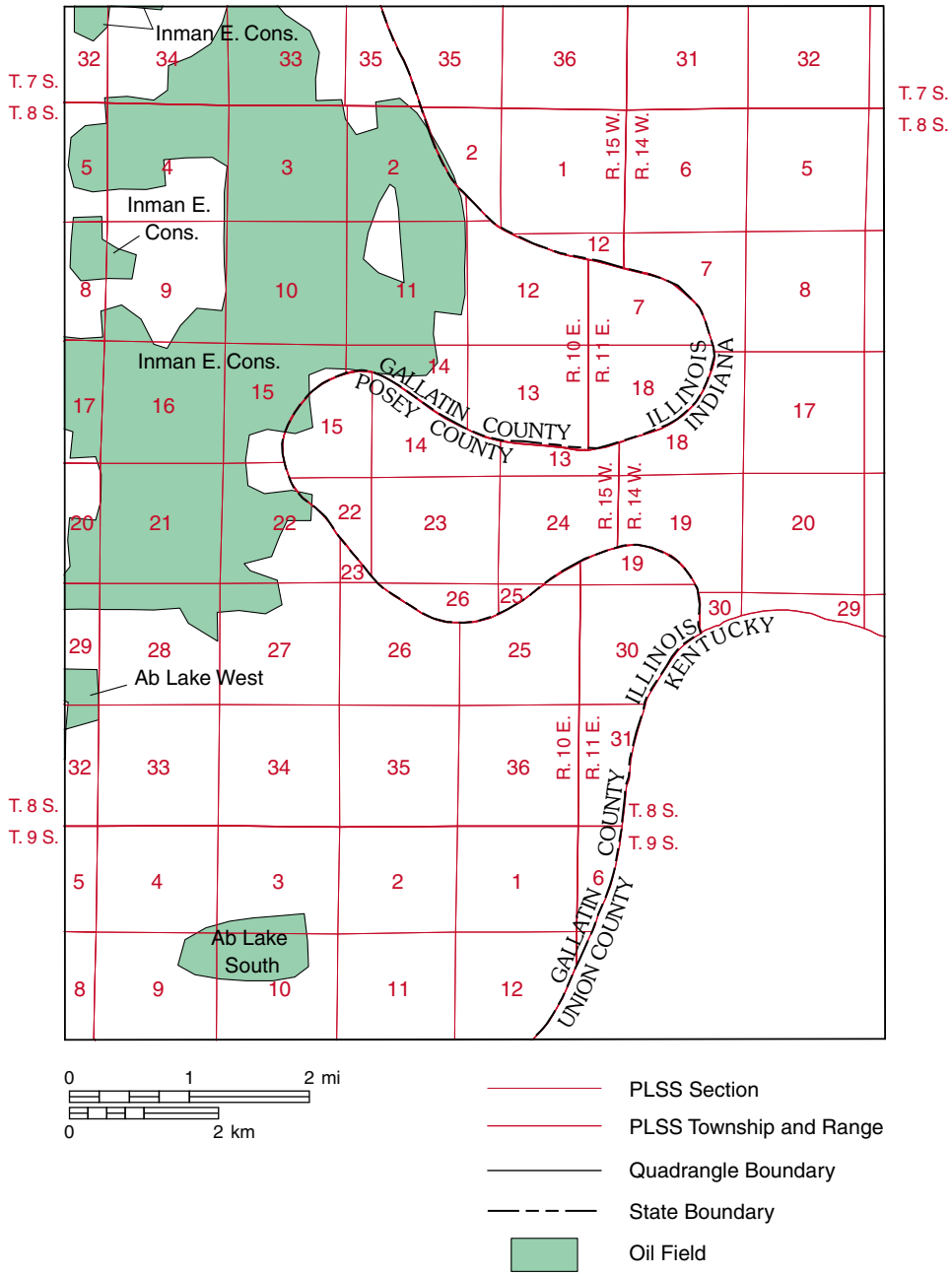
Figure 2 Oil fields in the Illinois portion of the Wabash Island Quadrangle.



G18AC00290. The views and conclusions contained in this document are those of the author and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

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