STATEMAP
New Haven SW-BG

Bedrock Geology of New Haven SW Quadrangle

Gallatin County, Illinois

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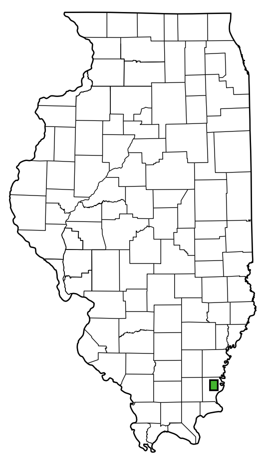

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Introduction

This is a bedrock geologic map of the New Haven Southwest 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. Small bedrock outcrops may exist in the Shawneetown Hills near the southeastern corner of the map area, but none were found during this investigation and none are mentioned in field notes of previous geologists on file at the ISGS. Thus, the present map is based entirely on subsurface 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 State Geological Survey and can be accessed online via the ISGS website. 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, 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. I used all 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.

Surficial Geology

Heinrich (1982) mapped and described Quaternary sediments in an area of four 7.5-minute quadrangles, including all of the New Haven SW Quadrangle. His geomorphic map depicts surficial features and relates them to Quaternary sedimentary processes. The Shawneetown Hills are bedrock hills thickly mantled in Pleistocene wind-blown silt or loess. The low-lying area along the eastern edge of the quadrangle, including a series of arcuate sloughs, represents part of the Holocene flood plain of the Wabash River. Sloughs in this area are abandoned meanders or oxbow lakes. Extending from the southwestern corner of the quadrangle toward the northeast is a scarp or terrace that faces southeast. This feature marks the northwest bank of the former channel of the Ohio River. The remainder of the map area is a very gently rolling plain underlain by fine-grained sediments (Equality Formation) deposited in slack-water lakes that occupied this area during Wisconsinan time.

Stratigraphy

The interval in the upper Shelburn Formation between the Danville Coal and the Chapel Coal is too complex to portray properly on the stratigraphic column. An illustration (Fig. 1) is added here to portray the relationships. The Farmington Shale Member, overlying the Danville Coal, thickens markedly northward across the quadrangle. Overlying the Farmington in the southern part of the quadrangle are three thin limestone units separated by mudstone and shale. The three limestone units are the Piasa (oldest), Lonsdale, and Exline Limestone Members. As these three members are traced northward, they thicken and apparently merge into a single unit, the West Franklin Limestone Member. Thus, the West Franklin comprises marine limestone that developed during three distinct depositional episodes.

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. 2). 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.

Wabash Valley Fault System

As shown on Fig. 2, 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, just east of the present map area.

Where it crosses the southeast corner of the New Haven SW Quadrangle, the Inman East Fault comprises two parallel faults that appear to merge southward. Total displacement increases from about 200 feet (60 m) at the southern edge of the map to about 350 feet (107 m) where the faults cross the eastern edge of the quadrangle. Next to the west is the feature that Bristol (1975) called the Hill Graben and Bristol and Treworgy (1979) renamed the Inman Graben. A pair of

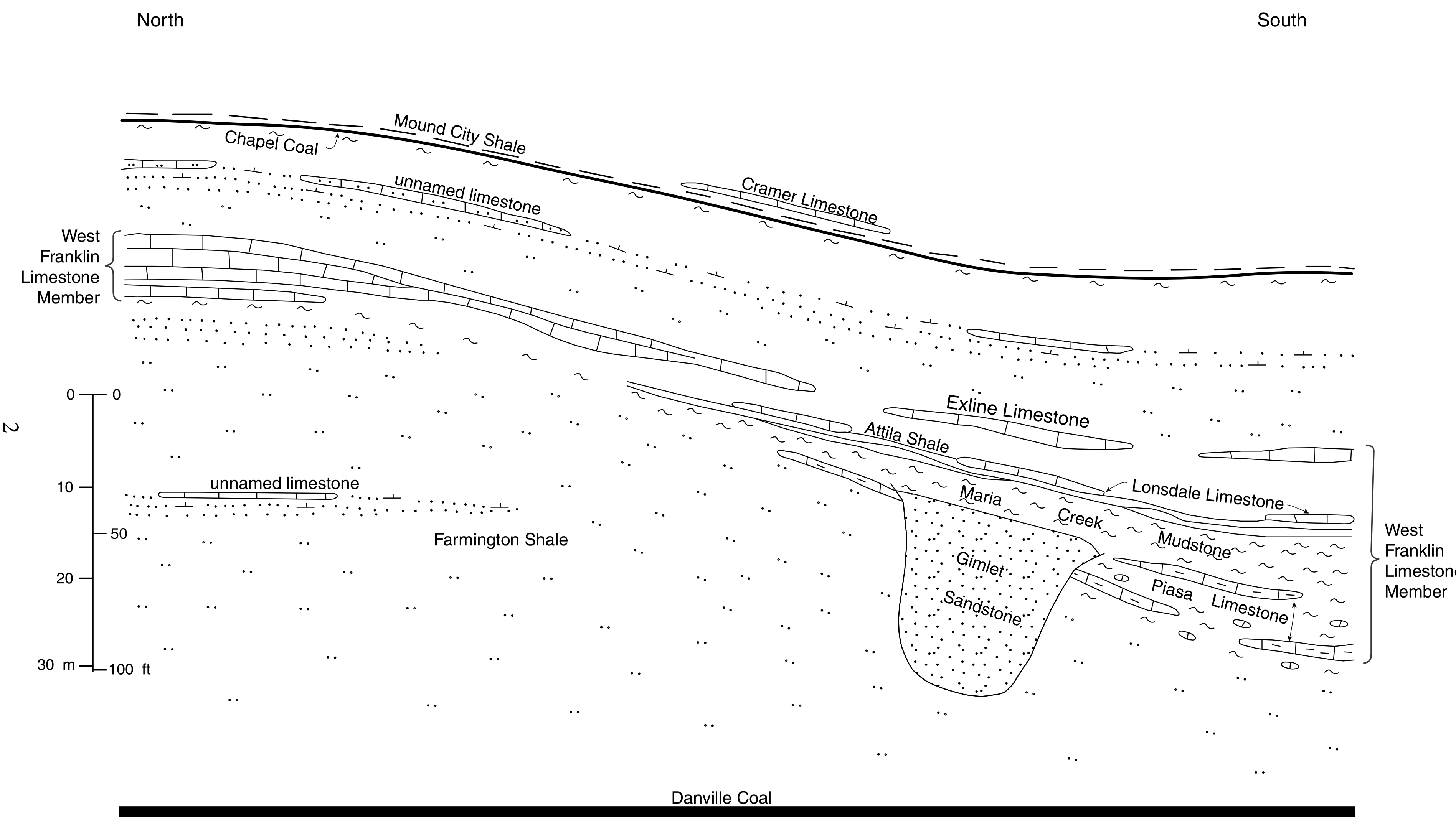

Figure 1 Diagram showing relationship of strata in the interval between the Mound City Shale and the Danville Coal.

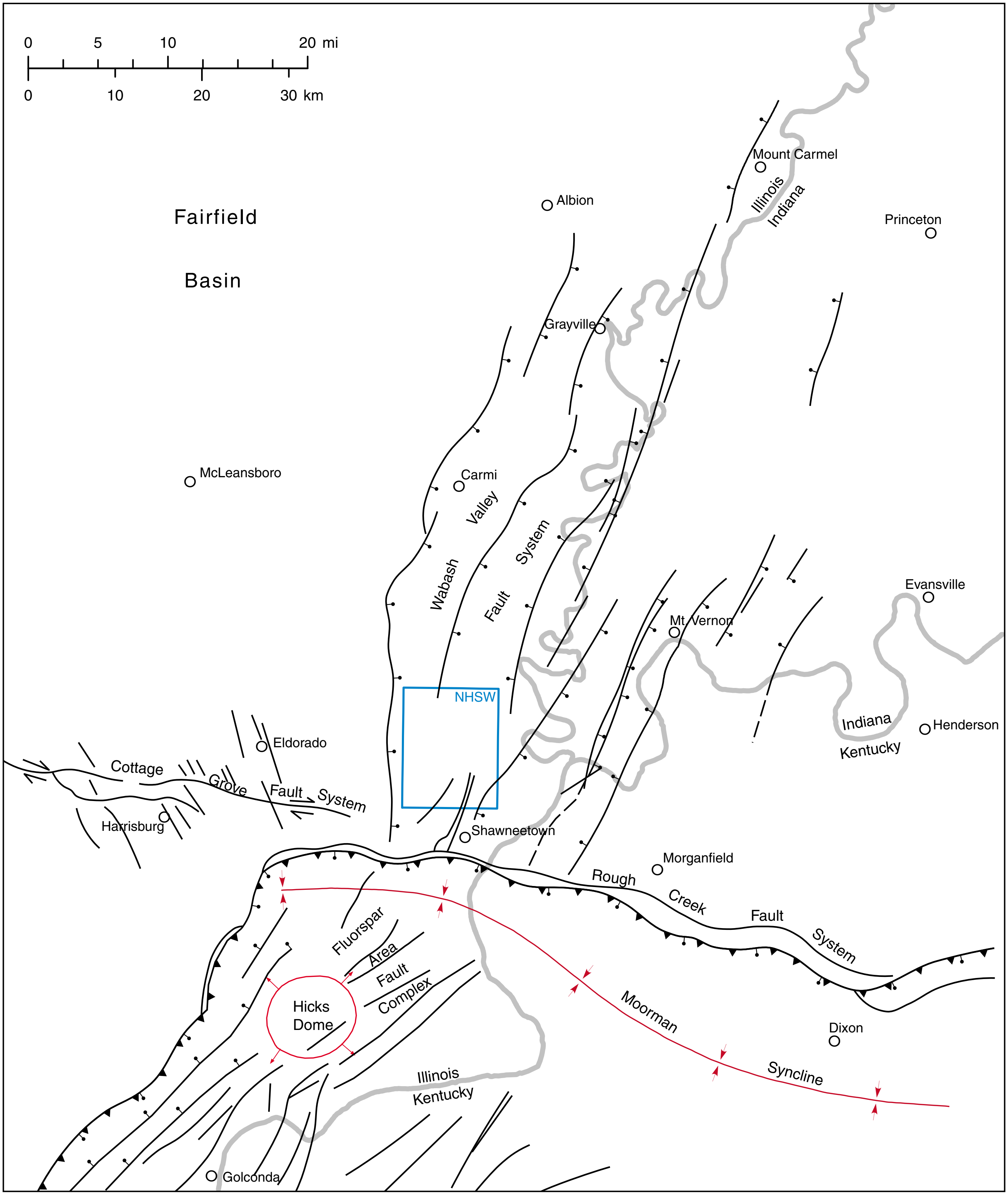

Figure 2 Map showing relation of New Haven SW (NHSW) Quadrangle to Wabash Valley Fault System and other structural features. After Gray et al. (1987), Noger (1988), and Kolata (2005).

faults outline a down-dropped block that varies from 600 to 2,000 feet (180 to 610 m) wide. Throw along the two faults diminishes from 250 feet (76 m) at the southern border of the map to undetectable within 3 miles (5 km) north. Two additional faults having modest throws down to the southwest carry the trend northward.

The Junction Fault extends a distance of approximately 3 miles (5 km) through the northwestern part of the Shawneetown Quadrangle (Nelson and Lumm, 1986) and southwestern part of the New Haven SW Quadrangle. It is a normal fault with the southeast side downthrown a maximum of about 80 feet (27 m) at the level of the Springfield Coal. Along the middle section where throw is greatest, the fault strikes N20°E, bending to more easterly trends near its northeastern and southwestern ends. A set of entries was driven across the fault near its northeastern end in the Eagle No. 2 underground coal mine, where I and other ISGS geologists made detailed notes and sketches. In this area, the fault zone takes the form of a monocline offset by a series of southeast-and northwest-dipping normal faults (Fig. 3). Most of the faults are essentially clean breaks; the larger ones bear gouge and breccia zones a few inches wide. Seeps of petroleum and gas occurred along one of the faults. Survey geologists sampled and analyzed the gas, which had the composition of oilfield rather than coal gas. These observations suggest that the Junction Fault communicates with oil and gas reservoirs in Mississippian rocks and that throw on the fault likely increases with depth. The monocline along the fault is probably a fault-propagation fold that developed as the Junction Fault extended itself upward from depth.

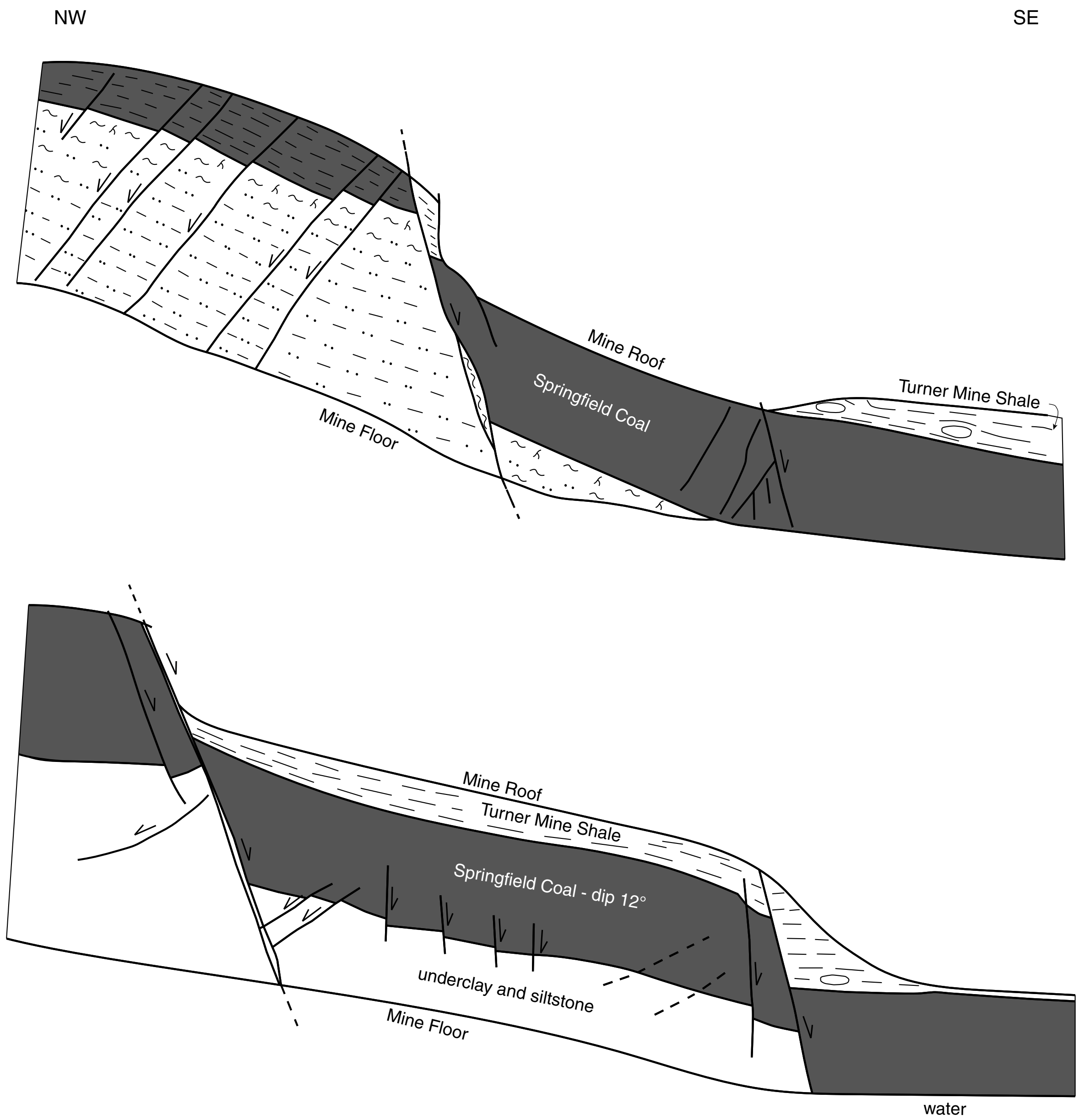

Figure 3 Sketches of Junction Fault Zone exposed in underground workings of Peabody Coal's Eagle No. 2 Mine. The two sketches were made on adjacent, parallel entries by John Nelson (top) and John T. Popp (bottom) in 1997. The coal is approximately 5 feet thick.

Two other faults are mapped along the western edge of the quadrangle. The Albion-Ridgway Fault, a major structure, crosses the extreme northwest corner or the New Haven SW quadrangle. In the Ridgway Quadrangle (Nelson et al., 2017) the Albion-Ridgeway Fault strikes nearly due north and its east side is downthrown as much as 400 feet (120 m). A small fault having west side downthrown extends into the New Haven SW Quadrangle largely in Sec. 31, T8S, R9E. This fault, which is poorly constrained by drilling records, intersects the main Albion-Ridgway Fault in the Ridgway Quadrangle.

Six drill holes are known to have encountered igneous intrusive rock along the Inman (Hill) Graben within the map area. Two of these were coal-test borings for which the ISGS examined and retained core samples of ultramafic igneous rock and contact-metamorphosed wall rock (Table 1). The other four holes are oil-test holes from which resistivity logs indicate zones of highly resistive rock, believed to represent intrusions within the sedimentary succession.

Joints and stress

During several tours of the Eagle No. 2 underground coal mine, other ISGS geologists and I observed well developed vertical joints in the black, fissile Turner Mine Shale overlying the Springfield Coal. The prevalent strike trend of joints varied from N85°E to N80°W, which is similar to joint trends observed in other mines of southeastern Illinois. In some areas of the Eagle No. 2 Mine, joints striking approximately north-south also were noted. There was a marked tendency for roof falls to develop in north-south headings at this mine. Survey geologists and company engineers eventually attributed roof failures to *in situ* horizontal stress with the principal compressive stress axis oriented approximately east-west. Such a stress orientation fits the regional picture (Nelson and Bauer, 1991). The orientation of joints parallel with the principal stress axis suggests that joints developed under the same stress regime.

Economic Geology

Coal

The only coal mine known to have operated within the New Haven SW Quadrangle is the Eagle No. 2 Underground Mine of Peabody Coal Company, which was active from 1967 to 1993. The Eagle No. 2 Mine removed coal beneath 5,658 acres and produced nearly 28 million tons over its life span. Workings underlay roughly 7 square miles in the southwestern part of the New Haven SW Quadrangle and extended southward into the Shawneetown Quadrangle. The Springfield Coal was extracted, ranging in thickness from 3.5 to 5.6 feet and lying 180 to 400 feet below the surface (Myers, 2005).

Geologists from the ISGS made detailed observations underground in the Eagle No. 2 Mine on numerous occasions; I personally made four visits. A set of entries driven across the Junction Fault provided excellent exposures, discussed above under “Structure and Igneous Rocks”. Survey geologists and mine personnel noted a strong tendency for roof failures to concentrate in headings that trended north to north-northeast. Initially, the problem was attributed to mining parallel to the fault zone. Later observations included development of compressive “kink zones” shortly after mining, leading to occurrence of major falls. These observations pointed to

Table 1 Drill holes that encountered igneous rock in New Haven SW Quadrangle.

County #	Operator and Lease	Location	Depth (feet) and Unit	Source of Information
1803	Carter Oil #2 Dolan	330' NL, 330' WL, 30-8S-10E	335-375, Shelburn Fm.	Electric log
			1650-1670, Kinkaid	Electric log
			1685-1740, Degonia-Clore	Electric log
			1860-1910, Palestine	Electric log
1144	Union Colliery hole 44	2850' SL, 1500' EL, 1-9S-9E	382-391 Shelburn Fm.	Core retained by ISGS
2017	Sun Production #1-B Miller	330' SL, 1650' EL, 1-9S-9E	1588-1632, Tradewater	Electric log
2047	Sun Production #1 Logsdon	990' SL, 990' EL, 1-9S-9E	2450-2485, Golconda	Electric log
2367	Absher #2 Morris-McBride	990' NL, 990' EL, 1-9S-9E	265-278, Shelburn Fm.	Electric log
1140	Union Colliery hole 40	1320' NL, 2640' EL, 12-9S-9E	435-438, Shelburn Fm.	Core retained by ISGS

in situ compressive stress oriented approximately east-west as the cause of roof failure, as outlined by Nelson and Bauer (1991). When the company realigned the Main North entries from N15°E to N50°E, a significant improvement in roof stability was observed.

Petroleum

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 from geographic proximity. The northern two-thirds of the map area largely lies in the Inman West Consolidated field. The Ab Lake West field is largely in the southeastern part of the quadrangle, whereas the small Junction, Junction North, and Junction East fields are in the south-central and southwestern part of the area. 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).

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.

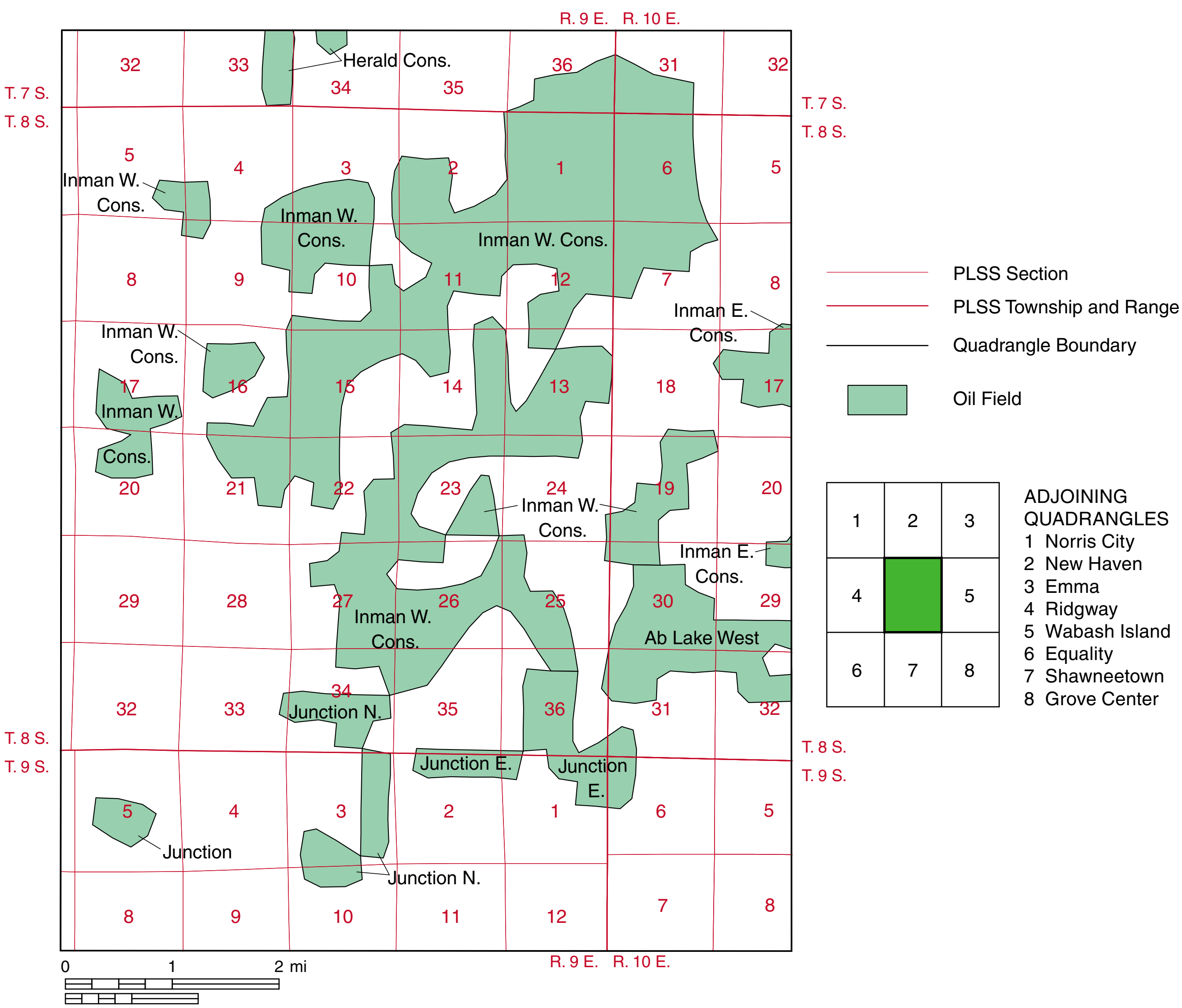

Figure 4 Oil fields in the New Haven SW Quadrangle.

Acknowlegements

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