Illinois Preliminary Geologic Map
IPGM FIshhook-BG

Bedrock Geology of Fishhook Quadrangle

Adams, Brown, and Pike Counties, Illinois

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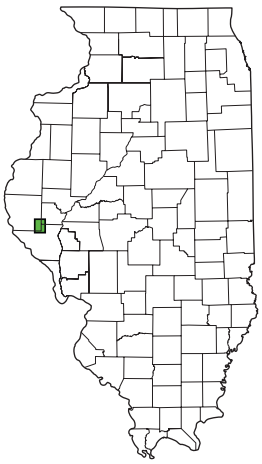

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Structural Geology

The Fishhook 7.5-minute Quadrangle is located in eastern Adams, southwestern Brown, and northwestern Pike Counties, Illinois, a few miles east of the crest of the north-south trending Mississippi River Arch. Regional dips average 8 feet per mile to the east (Howard 1961), but local flexures obscure this regional dip.

The most important structural feature in the quadrangle is the Fishhook Anticline (Meents 1958, Howard 1961). Howard's structure contour map, drawn on the top of the Ordovician Galena Group (1961, p. 9), shows that the axis of the anticline extends diagonally southeastward across the Fishhook Quadrangle from near the center of the north line of Sec. 5, T3S, R5W to approximately the center of the east edge of Sec. 32, T3S, R4W.

According to Howard's map, along the nine miles of the axis that lie within the quadrangle, the elevation of the top of the Galena rises from about 20 feet above the sea level datum at the west edge of the quadrangle to more than 120 feet near the southeast corner. Limited subsurface data indicate that the axis may extend as much as 5 miles beyond the west edge of the quadrangle to elevations as low as -40 feet. The crest of the anticlinal axis, with an elevation of slightly more than 140 feet, occurs about one mile to the southeast of the quadrangle, near the border between the Perry West and New Salem Quadrangles. The Fishhook Gas pool is associated with this anticlinal crest. On the basis of limited subsurface data, the anticlinal axis apparently plunges southeastward from the crest for another 11 miles to an elevation of 20 feet above sea level a few miles south-southeast of Griggsville (Howard 1961).

At most of the bedrock outcrops we examined on the Fishhook Quadrangle, the bedding appears to be essentially horizontal, suggesting that the anticline has little discernable surface expression. Dips of 3 and 5 degrees to the northeast were measured at two outcrops (south-center, Sec. 2, T3S, R5W, and in Sec. 3, T3S, R5W), but no other evidence of regional deformation was found during field work. Despite the general absence of measurable surface deformation associated with the anticlinal axis, the general trends of the bedrock units shown by the map suggest that they slope gently away from an ill-defined anticlinal axis that trends NW-SE across the quadrangle.

The weak surface expression of the anticline and its stronger subsurface expression in older Ordovician rocks suggest that most of the folding of the Fishhook Anticline occurred before deposition of the Pennsylvanian and younger rocks. The Pennsylvanian rocks appear to be only slightly folded and, instead, are essentially draped over the topographic and structural high formed by the more distinctly folded and eroded Mississippian rocks exposed at the Mississippian-Pennsylvanian unconformity. With no rocks of the late Mississippian Chesterian Series present here, the major folding event can only be dated as post middle-Mississippian and pre-Pennsylvanian. A little more of the folding may have occurred some time after the Pennsylvanian rocks were deposited. The Fishhook Anticline is apparently a broad upfold that includes several minor subfolds, or shelves, in the overall flexure, and possibly a pre-Pennsylvanian fault near the axis of the fold.

Economic Geology

Oil and Gas Resources

Gas has accumulated along the crest of the Fishhook Anticline in the quadrangle. Gas was discovered on the Fishhook Anticline (south of the village of Fishhook) in March of 1955 when a well was drilled on the Layne farm in the NE NE NE Sec. 30, T3S, R4W, Pike County. This well was completed in Silurian rocks at a depth of 460 feet, with an open-flow gauge of 1,140,000 cubic feet per day (Howard 1961). A total of 57 wells followed, with open-flow gauges averaging 624,000 cubic feet per day: all are now plugged due to depletion. The pay zone is 15 feet of sucrosic, vuggy dolomite in the Silurian Edgewood Formation (the same as in the abandoned Pittsfield gas pool). Meents (1958) tested nearly every well in this pool, and reported some gas analyses as well as descriptions of cores from some of the wells.

The Beverly gas pool, located 4 miles to the northwest of the Fishhook gas pool, also lies along the the axis of the Fishhook Anticline. The discovery well was drilled in February of 1957 by the G. and W. Oil Company, in the NW NW NW of Sec. 10, T3S, R5W, Adams County and had an open-flow gauge of 218,000 cubic feet per day from the top of the Silurian at a depth of 416 feet. The same company drilled the only other well in this pool a quarter mile southwest of the discovery well with an open-flow gauge of 565,000 cubic feet per day. Both wells are now shut in like those at the Fishhook pool.

Howard (1961) noted the presence of considerable quantities of salt water and sulfur water, with a few shows of oil in tests drilled into rocks of the Ordovician Galena Group. Howard (1961) argued that stratigraphic traps similar to those found in the Silurian may also be present in the Galena.

Limestone Resources

Middle Mississippian rocks in western Illinois that are commonly quarried for construction aggregate include the Burlington, Keokuk, Warsaw, Salem, and St. Louis Formations (Harvey 1964, Goodwin and Harvey 1980, Cloos and Baxter 1981).

The Burlington and Keokuk Limestones are major sources of construction aggregate and high-calcium limestone in western Illinois (Goodwin and Harvey 1980, Cloos and Baxter 1981). Several quarries and underground mines operate in the Burlington-Keokuk elsewhere in Adams County and in several neighboring counties.

The Burlington and Keokuk Limestones are light gray, cherty, crinoidal limestones with some high-calcium limestone intervals. In most areas in the quadrangle, the top of the Burlington-Keokuk occurs 75 to nearly 200 feet below the Quaternary sediments and the unit is buried too deeply to be accessible for surface mining at the present time. Only the upper 10 to 30 feet of the Burlington-Keokuk are exposed in the quadrangle. Outcrops are found along McKee Creek in the eastern part of Sec. 32, T2S, R4W, Brown County and the northeast corner of Sec. 5, T3S, R4W, Pike County and along an unnamed creek in the central and western part of Sec. 4, T4S, R5W, Adams County. In these and other areas where the overburden is thin, the combined thickness of the Burlington-Keokuk and the upper Warsaw-Salem could provide approximately 300 feet of limestone resource potential for a major quarrying operation.

The combined Warsaw and Salem Formations form a unit which is widely present in the quadrangle. The Warsaw-Salem is divisible into two informal "members" (Lasemi et al. 1999): a lower, shale-dominated "member" (the lower Warsaw) and an upper, carbonate-dominated "member" (the upper Warsaw-Salem).

Thick limestone beds in the upper "member" the Warsaw Formation crop out in the northern half of the quadrangle along McKee Creek, in the central part of the quadrangle along Fishhook Creek, and in the western and northwestern parts of the quadrangle along Lanes Branch and Grindstone Creeks. Along these streams, the upper "member" of the Warsaw contains 10 to 30 feet or more of dolomitic, slightly sandy, fossiliferous limestone. In some areas, such as along McKee Creek, this upper Warsaw carbonate forms large cliffs or bluffs over 30 feet high, consisting of one or two massive carbonate ledges interbedded with greenish gray shale. In other areas, these ledges grade into thinner, argillaceous, fossiliferous limestones (grainstones to packstones) similar to those seen in the lower "member" that makes up the lower two thirds of the formation. Locally, the upper Warsaw carbonate is eroded, and Pennsylvanian rocks rest unconformably on the shaley lower "member" of the Warsaw.

It should be noted that where these carbonates are found at or near the surface and not covered by the thicker Salem-St. Louis, they are weathered and relatively soft for most construction purposes. However, in areas of relatively thick Salem-St. Louis, the upper Warsaw carbonates are less weathered and the quality improves significantly. Thus in west-central and northwestern Illinois, the upper Warsaw and Salem, like their equivalents in southeastern Iowa, may contain dense bioclastic dolomite that is a source of good quality construction aggregate (Lasemi et al. 1999). However, because of their limited thickness and distribution in the Fishhook Quadrangle, these carbonates will likely be utilized only locally in small or moderate sized quarrying operations.

In the Fishhook Quadrangle, the St. Louis Limestone occurs only in scattered places due to Pre-Pennsylvanian erosion and, where present, the unit is much thinner (maximum of only 20 feet) than it is to the north in the Kellerville Quadrangle. Because of its thinness and very limited areal extent, the St. Louis probably is not a significant limestone resource in the Fishhook Quadrangle.

The Burlington-Keokuk and Warsaw Formations, where they can be mined together, can provide significant amounts of construction aggregates for maintaining local and state transportation infrastructure. The abundant aggregate resources in rapidly developing regions such as the St. Louis Metro East or Quincy areas are being lost to urbanization. Less heavily populated areas such as west-central Illinois (e.g., Fishhook Quadrangle) may be exploration targets for these valuable resources that are needed to maintain the infrastructure in the rapidly developing regions.

Clay Resources

Beds of gray, fine-grained, non-laminated claystone that range in thickness from a few feet to over 15 feet are found throughout much of the quadrangle directly beneath the Colchester Coal (in the top of the Tradewater Formation). To the west on the crest of the Mississippi River Arch, where the Tradewater is very thin because of long periods of erosion or non-deposition, the claystone below the Colchester Coal represents a stack of several paleosols. The characteristics of this claystone (named Cheltenham Clay by Willman et al. 1975) are of potential interest in the production of a number of ceramic products.

These clays were referred to as "stoneware clays" by White (1963). The clays and some associated shales are buff-burning. White (1963) noted that the clays in this interval have a set of consistent physical properties that enhances their utilization in ceramic work. He sampled this claystone interval just a mile to the west of the Kellerville Quadrangle (on the Liberty Quadrangle, NE SW NE Sec. 18, T2S, R5W, Adams County) and found them to be largely of this character. According to White, the clays are suitable for manufacturing drain tile, fillers, flower pots, flue liners, pottery, low-heat-duty refractories, sewer pipe, stoneware, structural clay products, and terra cotta. Mapping of the Tradewater interval below the Colchester Coal has revealed many occurrences of this claystone in the Fishhook Quadrangle that might have commercial potential.

White noted that shales and clays of the Carbondale Formation in western Illinois (the remainder of the Pennsylvanian above the Colchester Coal on the quadrangle) are all red-burning in character. These shales and clays could be used in the manufacture of a number of ceramic products, including drain tiles, flower pots, pottery, sewer pipes and structural clay products.

Coal Resources

The Colchester Coal Member of the Carbondale Formation is the most prominent coal bed mapped in the quadrangle, but it averages only about 18 inches in thickness. Although many small mines were operated for local consumption by farmers and landowners, there has been no large-scale coal mining anywhere in the quadrangle. The sulfur content of the Colchester Coal is high (> 3%), primarily due to sulfur contributed by the seawater that deposited the overlying marine rocks. Reinertsen (1964) reported a sulfur value of 3.9% for a Colchester Coal sample taken from a mine in Adams County. The coal also has a relatively low heating value (marginal subbituminous to bituminous). These unfavorable factors, together with its average thickness of 18 inches, make it unlikely that the Colchester Coal will have much economic potential in the near future.

In addition to the Colchester, in two small areas (north center of Sec. 34 and southwestern quarter of Sec. 26, T3S, R5W, Adams County), the Houchin Creek Coal Member is present. This coal is shaly, only about 1 foot thick, and underlies 3 feet of black fissile Excello Shale. As with the Colchester, a number of small pits were noted on the quadrangle where this poor-quality coal was mined for local consumption. Here, the Houchin Creek is so shaley that it blends in with the overlying black shale. Therefore with its high ash content and thinness, it is unlikely that it will ever be considered as a major resource.

References

Cloos, M. and J. Baxter, 1981, Subsurface variation in the high-calcium Dolbee Creek Limestone in western Illinois: Illinois State Geological Survey, Industrial Mineral Notes 78, 23p.

Frye, J.C., H.B. Willman, and H.D. Glass, 1964, Cretaceous deposits and the Illinoian glacial boundary in western Illinois: : Illinois State Geological Survey, Circular 364, 28 p., 7 figs., 5 tables.

Goodwin, J.H., and R.D. Harvey, 1980, Limestone resources of Adams and Brown Counties: Illinois State Geological Survey Circular 512, 20 p.

Harvey, R.D., 1964, Mississippian limestone resources in Fulton, McDonough, and Schuyler Counties, Illinois: Illinois State Geological Survey Circular 370, 27p.

Howard, R.H., 1961, Oil and gas in the Adams-Brown-Schuyler County area, Illinois: Illinois State Geological Survey, Circular 325, 23 p.

Huff, B.G, 1988, Oil and gas developments in Illinois, 1988: Illinois State Geological Survey Illinois Petroleum 154, 72 p.

Lasemi, Z., R.D. Norby, J.A. Devera, B.W. Fouke, H.E. Leetaru, and F.B. Denny, 1999, Middle Mississippian carbonates and siliciclastics in western Illinois: Illinois State Geological Survey Guidebook 31, 60 p.

Meents, W.F., 1958, Fishhook gas pool, Pike and Adams Counties, Illinois: Illinois State Geological Survey Circular 250.

Reinertsen, D.L., 1964, Strippable coal reserves of Illinois: Part 4-Adams, Brown, Calhoun, Hancock, McDonough, Pike, Schuyler, and the southern parts of Henderson and Warren Counties: Illinois State Geological Survey, Circular 374, 32 p.

White, W.A., 1963, Buff-burning clay resources of western Illinois: Illinois State Geological Survey, Circular 353, 23 p.

Willman, H.B., E. Atherton, T.C. Buschbach, C. Collinson, J.C. Frye, M.E. Hopkins, J.A. Lineback, and J.A. Simon, 1975, Handbook of Illinois stratigraphy: Illinois State Geological Survey Bulletin 95, 261 p.