Illinois Geologic Quadrangle Map
IGQ Welge-BG

Bedrock Geology of Welge Quadrangle

Randolph and Jackson Counties, Illinois

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Introduction

This map depicts the bedrock formations of the Welge 7.5-minute Quadrangle. The map illustrates the bedrock surface as it would appear if all surficial deposits (including soil, loess, and glacial and alluvial sediments) were removed. In other words, it shows the first rock formation to be encountered in drilling. Formations are classified according to the type of rocks they contain (sandstone, shale, limestone, etc.) and are named for places at or near which they were first described. For example, the Kinkaid Formation was named for Kinkaid Creek, and the Degonia Formation for Degonia (or Degognia) Township, both located in Jackson County.

Several sources of information were used to compile this map:

1. Outcrop mapping conducted by the author during the winter of 2005–2006. Rock outcrops were examined along streams and bluffs and in artificial exposures, such as road cuts.

2. Field notes and maps made by previous ISGS geologists, dating back to the 1920s and archived in the Illinois State Geological Survey (ISGS) library.

3. Examination of available records of drilling. Bridge borings made by the Illinois Department of Transportation provide depth to bedrock and type of rock at the bedrock surface. ISGS files contain logs of water wells, coal exploration boreholes, and test holes for oil and gas. For most water wells, the only record is a driller's log. Such logs, although lacking detail, can be useful and accurate. Well locations reported by drillers frequently are incorrect, so well locations were field-verified. Coal-test boreholes have detailed driller's logs, often based on core samples. Some oil and gas test holes have electric logs and/or sample logs made by geologists. Sample sets from 7 wells were examined specifically for this study. The ISGS drilled a continuously cored test hole 215 feet deep on land owned by Vernon Sickmeyer in Sec. 11, T7S, R5W. A second continuously cored hole, 545 feet deep, was drilled on the Michael Vasquez property near the southwest corner of Sec. 24, T7S, R6W.

Before constructing the bedrock geologic map, a contour map showing the elevation of the bedrock surface was prepared. This task was necessary because some deep valleys in the bedrock are completely concealed by surficial deposits. For example, the pre-glacial valley of Cox Creek is in places more than a mile south of the present stream, and the buried bedrock valley of Mary's River deviates somewhat from the stream's present course. Thus, the contacts between bedrock units commonly cut across topography, even though the layers are nearly horizontal in most places.

Structural Geology

The Welge Quadrangle is situated along the border between the Ozark Uplift on the southwest and the Illinois Basin on the northeast. As a consequence, rock strata dip gently toward the northeast so that the youngest formation (Carbondale) is found at the northeast corner. Contours on the map show the structure of the top of the Menard Limestone, a unit that is entirely in the subsurface and mapped from well data. The degree and direction of dip are variable, averaging approximately 50 feet per mile.

Cottage Grove Fault System

The Cottage Grove Fault System is one of the larger fracture zones in southern Illinois. It extends more than 70 miles west-northwest from Gallatin County into Randolph County. The main or "master" fault of the system extends into the Precambrian basement and is thought to be a right-lateral strike-slip fault that was active during Late Pennsylvanian to Permian time (Nelson and Krausse 1981, Duchek et al. 2004).

The master fault is inferred to run east-west about 1 to 1½ miles south of the northern map border. Evidence is meager, as the trace is mantled in Quaternary glacial drift and alluvium. Well records suggest bedrock strata are displaced 50 to 90 feet downward on the north side of the fault. A dry oil-test hole, O.R. McHughes No. 1 Wilson in the SW¼ SW¼, Sec. 23, T6S, R6W, apparently penetrated the fault surface. A sample log made by the author indicates 50 to 90 feet of missing section in the Glen Dean and Golconda Formations. Also, cuttings of Palestine sandstone in this well are silicified and recrystallized.

Immediately west of the Welge Quadrangle in the SW ¼ of Sec. 22, T6S, R6W, Chester Quadrangle, outcrop data strongly suggest continuation of the Cottage Grove master fault. Evidence includes northward bedding dips of 10° to 15° (and possibly steeper), slickensided sandstone float, and apparent displacement of Caseyville through Degonia rocks on the north against Clore and Palestine on the south (Devera 2006). This feature corresponds with the northern flank of the Bremen Anticline, as mapped by Weller (1915) and Kay (1916). Data from wells drilled after 1916 cast doubt on the presence of an anticline and, together with outcrops, support a fault interpretation. These new findings extend the Cottage Grove master fault farther west than it was previously mapped.

Several smaller faults have been inferred in the Welge Quadrangle. One is shown striking northwest near Rockcastle Creek in the north-central part of the map area. Well records here indicate Chesterian rocks are displaced as much as 100 feet down to the northeast. This fault likely intersects the Cottage Grove master fault. A small fault formerly was exposed in a road cut near the center of the W½, Sec. 33, T6S,

R5W, as depicted by J. Huner, Jr. and Harold R. Wanless (1934, ISGS unpublished field notes, ISGS library). Field notes and a sketch portray a normal fault striking N 35°W and dipping 65° northeast, with throw probably less than 10 feet. This structure is probably part of the larger fault zone evident from well data. The road has been rerouted, and the place where the fault was observed is now covered by soil.

A pair of northwest-trending faults is mapped along Fricke's Branch in Sec. 1, T7S, R6W and Sec. 35, T6S, R6W. A block of Degonia Sandstone between the faults is dropped down relative to Clore Formation on either side. Displacement is roughly 50 feet. The faults are not exposed.

About one mile southeast of Bremen is a fault zone trending northeast. The Clore-Degonia contact seems to be displaced about 50 feet down to the southeast. Along the ravine in the SW¼ SW¼ of Sec. 35, T6S, R6W, brown-weathering sandstone and shale thought to be Palestine crop out with bedding that dips 10° to 40° northwest. This outcrop suggests a narrow, upthrown slice of rock between two faults, but again, the faults are not visible.

Weller and Weller (1939) mapped a fault 3 miles long trending west-northwest along Mill Creek in the southeastern part of the Welge Quadrangle. Their map shows the northeast side downthrown, juxtaposing Pennsylvanian rocks on the northeast with Kinkaid and Degonia Formations on the southwest. This fault does not exist. Large sandstone bluffs that cross the alleged fault show no fractures or evidence of offset. Several areas Weller and Weller mapped as Degonia actually are the Pennsylvanian Caseyville Formation, filling a channel cut deeply into the Degonia. The channel relationship explains some of the apparent offset that Weller and Weller interpreted as a fault.

Root (1928) mapped the Wine Hill Dome. His map shows a small dome centered in Sec. 5, T7S, R5W and faulted on the south flank. Root based the dome on structure contours on the "Ava shale," a unit not currently identified. Root mapped various shale units in the Tradewater and Caseyville Formation as the Ava shale. All such shales are lenticular, and none is mappable. The Caseyville-Tradewater contact around Wine Hill is nearly horizontal, whereas data from drilling indicate that Mississippian rocks form a syncline. Presence of a hill may have led Root to posit a structural high. The nearby Campbell Hill Anticline, site of the Ava-Campbell Hill oil and gas field, forms a prominent ridge in the Willisville quadrangle (Nelson 2005).

Economic Geology

Coal

The only coal mining of record in the Welge Quadrangle was at the Southwestern Illinois Coal Company's Streamline Mine. This surface mine extracted the Springfield and Herrin Coals between 1936 and 1950 at the extreme northeastern corner of the map area.

Coal-test drilling and water wells indicate that small areas of unmined Springfield and Herrin Coal occur at shallow depth near the old Streamline Mine. These remnants could be surface-mined, although doing so might not be economically feasible.

The Houchin Creek and Colchester Coals in the lower part of the Carbondale Formation are each 1 to 3 feet thick and laterally continuous. Several coal seams in the Tradewater Formation range from a few inches to at least 3 feet and possibly 5 feet in the case of the Murphysboro (?) Coal. Coal beds in the Tradewater are not laterally continuous. All of these coal seams are potential targets for surface mining in the northeastern part of the map area, but none is an attractive target for mining. Negative factors include (1) thick overburden of glacial and alluvial sediments in some areas, (2) the necessity of rerouting Cox Creek to mine beneath its valley, and (3) the likelihood of faults that interrupt and displace the coal beds. Records of these coal seams are limited to water wells, which lack detailed logs. Drilling for coal would be required to accurately assess thickness, depth, quality, and mineability of coal in the Welge Quadrangle.

Oil and Gas

Approximately 30 test holes for oil and gas have been drilled in the Welge Quadrangle. None achieved production, although some encountered shows of oil, natural gas, or both.

Root (1928) mapped a dome at Wine Hill (Sec. 5, T7S, R5W) and recommended the area for petroleum testing. Five holes have been drilled in Sec. 5. All were dry, and as already noted, the structure actually is a syncline in Mississippian rocks.

The Bremen Anticline in the northwestern part of this quadrangle and the adjacent Chester 7.5-minute quadrangle was mapped by Weller (1915) and Kay (1916) and recommended for drilling. More than a dozen holes have been drilled, covering the entire area of the anticline as shown in the early reports. Data from these wells indicate that there is no closure to the south, and therefore, that the structure is not an anticline. North-dipping beds in the Chester Quadrangle northwest of Bremen apparently represent drag along a fault having the north side downthrown (as discussed under Structural Geology). Several holes in the Bremen area encountered shows of natural gas in the Tar Springs and shows of oil in the Cypress, Paint Creek, and Yankeetown Formations. One test hole in the Chester Quadrangle was drilled into Devonian strata. No shows were reported.

Fault structures along the Cottage Grove Fault System produce traps for oil production elsewhere in Illinois. Failure of test drilling at Bremen may reflect a lack of suitable reser-

voir rocks as well as up-dip migration of hydrocarbons on the flank of the Ozark Dome.

The only deep test hole in the Welge Quadrangle is Chester Research No. 1 Charley Depew in Sec. 33, T6S, R5W. The Depew hole was drilled in 1951 to a total depth of 2,159 feet in Silurian(?) dolomite. No shows of oil or gas were reported. In 1966, Clarence and Juanita Gutermuth deepened the Depew hole to 2,168 feet, but no hydrocarbons were found, and the hole was abandoned.

The nearest petroleum production took place about 5 miles east of the map area in the Ava-Campbell Hill field, which was discovered in about 1918 and depleted by 1943. Gas was produced from the Tar Springs; oil was chiefly from the Cypress, with lesser output from Paint Creek, Yankeetown, and Aux Vases formations (all Chesterian). The trap is a large, faulted anticline, which is evident from surface outcrops. Scanty records indicate that the field was, at best, marginally productive. New drilling took place after World War II, including several tests to the Ordovician Kimmswick (Trenton) Limestone. All resulted in dry holes, except for one well completed in 2001 for the meager output of 2 barrels of oil per day (Nelson 2005).

Groundwater

The Caseyville Formation (Pennsylvanian) is an important aquifer in the northeastern part of the Welge Quadrangle. The Caseyville contains thick beds of sandstone that are typically coarse-grained and porous. Many domestic wells produce from the Caseyville, as do municipal wells at Steeleville just north of the map area. Because of structural dip, wells farther northeast must be drilled to greater depths to reach the Caseyville.

Beyond the Caseyville outcrop, drillers must seek water in Mississippian rocks. The Degonia Sandstone commonly contains sandstone that is a good aquifer; however, the Degonia is at the surface or eroded in many areas. Deeper targets are mostly limestone formations, principally the Menard and Glen Dean. Getting water from limestone depends on intersecting fractures or solution cavities, and such features are not predictable. A number of dry holes have been drilled in the southwestern part of the quadrangle, and homeowners are forced to rely on springs, cisterns, and hauled water. Several good springs from the Kinkaid Limestone have been tapped as water sources.

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