Illinois Preliminary Geologic Map
IPGM Vienna-BG

Bedrock Geology of Vienna Quadrangle

Johnson County, Illinois

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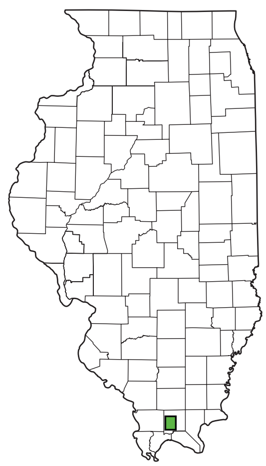
2004



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Introduction

This map is based primarily on outcrop study in the field. Most of the quadrangle was mapped by Hintz in 1997 and 1998. Nelson mapped small areas in 1987 and 1988, then mapped the Pennsylvanian and Kinkaid outcrop belts in the northern part of the quadrangle in 2004. Devera mapped several small areas and carried out most of the fossil identifications.

Well records in ISGS files were consulted for information on subsurface geology. In 2004 a continuous cored test hole 591 feet deep was drilled by the ISGS on the Jones property in Sec. 17, T12S, R3E. This core provides a complete record of the lower Caseyville Formation, all of the Kinkaid, Degonia, and Clore Formations, and the upper part of the Palestine Formation. Field notes made by previous ISGS geologists and filed in the ISGS Library were another valuable source of data.

This map principally depicts the bedrock geology. Thin surficial deposits of upland areas, including loess, colluvium, and residual soils, are not shown. Thicker alluvial deposits in bottom lands are mapped as the Cahokia and Equality Formations. Formations of alluvium and bedrock are classified according to the type(s) of materials they contain, such as clay, sandstone, and limestone. Each formation is detailed on the stratigraphic column and accompanying unit descriptions.

Previous Mapping

Two previous geologic maps of the Vienna Quadrangle are available. Weller and Krey (1939) mapped a large rectangle in the southern Shawnee Hills including the present map area. Their map was published on a planimetric base (no topography) at 1:63,360 scale. Accompanying text (by J.M. Weller) includes brief descriptions of structure and stratigraphy. The map of Dial (1963) is based on an enlarged version of the old 15-minute Vienna topographic map (scale 1:63,360), which corresponds to the present Vienna 7.5-minute quadrangle. Dial's thesis contains detailed descriptions of all the rock units except those above the Battery Rock Sandstone, which curiously were omitted. His discussion of faults is brief.

Stratigraphy employed by Weller and Krey (1939) and Dial (1963) is the same as ours except in a couple of areas. Weller and Krey did not subdivide the Pennsylvanian. Dial divided the Pennsylvanian into two units: (1) the Lusk Member of the Caseyville Formation, which is the same as our Wayside Member, and (2) the Battery Rock Sandstone Member of the Caseyville, which includes strata we mapped as younger members of the Caseyville and lower part of the Tradewater Formation. Also, portrayal of the Degonia and Clore Formations on the two older maps differs from our usage. On the older maps, the Degonia includes the Ford Station and Tygett Sandstone Members of the Clore (as we mapped them), with the Clore including only the Cora Member.

Structural Geology

The Vienna Quadrangle is situated along the southern margin of the Illinois Basin. Carboniferous bedrock in the quadrangle dips regionally north-northeast at ½ ° to 5°. Fractures in bedrock trend dominantly north-south and northeast-southwest; a northwest-southeast fracture set is locally developed.

Little Cache Fault Zone

The Little Cache Fault Zone runs north-south along the eastern edge of the quadrangle. Portions of this structure previously were mapped by Weller and Krey (1939) and Dial (1963). The zone is 2,000 to 5,000 feet wide and is composed of steeply dipping faults that outline grabens and horsts. Faults are accompanied by narrow zones of breccia and parallel, steeply dipping to vertical fractures. Drag is absent or confined to a narrow zone along the fault. Slickensides on fault surfaces plunge vertically. No mineralization was observed.

Missing stratigraphic section in a well, the C.L. Owens # 1 McCall oil test in Sec. 4, T13S, R3E, signifies normal faulting. Fault surfaces in the adjacent Creal Springs (Nelson et al., 1991) and Bloomfield (Nelson, 1993) quadrangles dip 75° to 85° and bear near-vertical slickensides, indicative of dip-slip normal faulting.

In the northeast part of the map area the faults outline a graben in which Pennsylvanian rocks are downdropped at least 200 feet (Cross Section A-A', fig. 1). Segments of the western fault split and re-join, outlining smaller grabens. All the faults in this area appear to be simple high-angle normal faults.

Structure in the southeastern part of the map area is more complicated. The western fault south of McCorkle Creek (Secs. 4 and 9, T13S, R3E) has the western side downthrown. However, strata along both sides of this fault dip east or southeast at 10° to 40°, suggesting that the last movement was down to the east. Southward along this fault the offset decreases to zero, then changes to east side downthrown near the southern edge of the quadrangle. A similar relationship appears on the middle of three faults exposed in the bed of Dutchman Creek near the center of the NW 1/4 of Sec. 16, T13S, R3E. Upper Cypress sandstone and lower Golconda shale and limestone dip steeply east-southeast in the stream bed, marking the edge of the fault zone. West of this fault the Hardinsburg Formation is found. The west side therefore is downthrown, but the drag indicates last motion was down to the east.

Notice that the ball-and-bar symbols on the geologic map signify stratigraphic offset (younger rocks on downthrown side), whereas arrows on the cross sections indicate the direction of last movement, as indicated by drag. We interpret the geometry shown on Cross Section B-B' to reflect early movement with the west side downthrown and later movement with the east side downthrown. Many other faults in southern Illinois have undergone two or more episodes of movement, with reversal of the direction of throw. Generally, an early episode of reverse faulting was followed by normal faulting (Nelson, 1995).

The Little Cache is one of several north- trending, normal fault zones in southern Illinois. Others include the Rend Lake Fault Zone (Keys and Nelson, 1980), the Atwood and Delta Faults (Nelson et al., 1995), and the Shiloh Church and Bradshaw Creek Faults (Jacobson and Weibel, 1993). The time of faulting is not accurately known, but most of the above-named

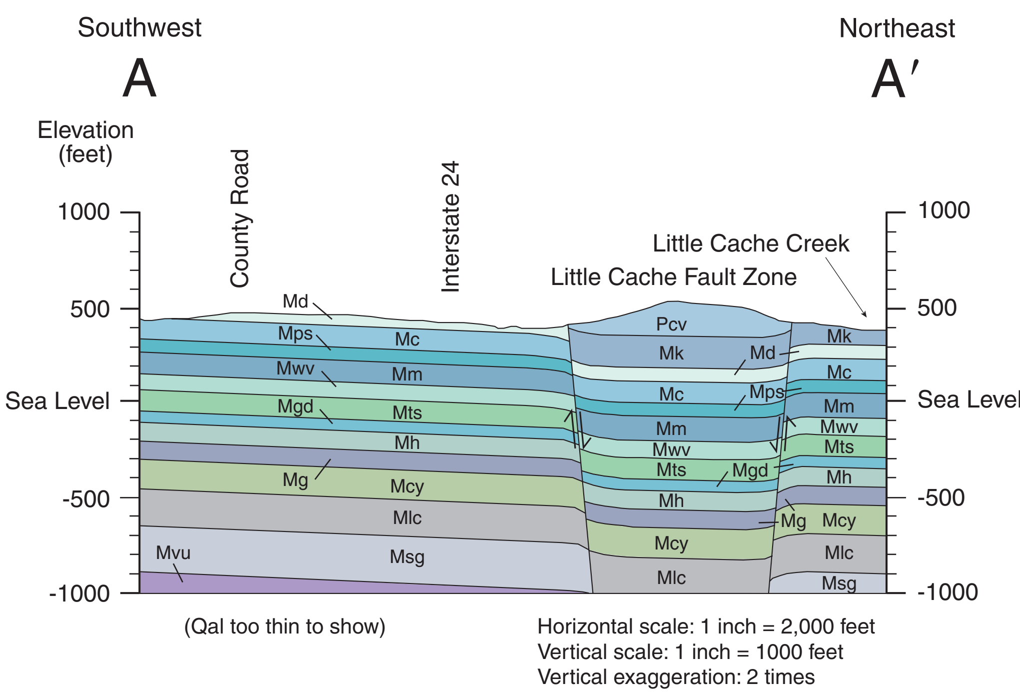

Figure 1 Cross section a A-A′.

structures, like the Little Cache, displace Middle Pennsylvanian rocks.

Fault near Buncombe

A northeast-striking fault is mapped southwest of Buncombe in Sec. 21, T12S, R2E. The northwest side is downthrown about 20 feet; the fault surface is not exposed. This fault is in line with one in the adjoining Mt. Pleasant Quadrangle to the southwest (Nelson and Devera, in press). The fault southwest of Buncombe also aligns with the steep scarp capped by Caseyville Formation northeast of Buncombe. Moreover, this fault is in line with the highly linear Harco paleovalley at the base of the Caseyville. As mapped by Bristol and Howard (1971), the Harco paleovalley extends about 35 miles through Johnson, Williamson, and Saline counties. All of these features coincide with the Commerce geophysical lineament, traced from northeast Arkansas to southwestern Indiana. Faults along the Commerce lineament in Missouri have undergone Holocene movement (Langenheim and Hildenbrand, 1997; Harrison et al., 1999; Stephenson et al., 1999).

Economic Geology

Limestone

Limestone is the only mineral resource currently being extracted in the Vienna Quadrangle. The New Buncombe Quarry is operated by Southern Illinois Stone Co. mainly in Sec. 11, T12S, R2E, northeast of Buncombe. The entire thickness of the Kinkaid Limestone, including the Negli Creek, Cave Hill, and Goreville Members, is being quarried for use as aggregate, road surfacing material, agricultural lime, and rip-rap.

Four abandoned quarries in the northwest part of the quadrangle formerly operated in the Kinkaid Limestone. Another small abandoned quarry is on the west side of U.S. Rt. 45 about 1 ½ miles south of Vienna (NE NE NE, Sec. 17, T13S, R3E). Lamar (1959) reported that a 25-foot interval of limestone in the upper Glen Dean was mined here. The Vienna Limestone formerly was quarried in the NE SW NW of Sec. 5, T13S, R3E (Swann, 1963). This quarry was backfilled during construction of Ill. Rt. 146 in the 1970s.

The Kinkaid Limestone clearly is the most favorable target for quarrying in the Vienna Quadrangle. The Kinkaid offers as much as 150 feet of limestone that is suitable for a variety of industrial purposes. The only significant shale intervals in the Kinkaid are at the top and base of the Cave Hill Member; these can be removed by quarrying in benches. Other formations that have lesser potential for limestone operations include the Menard Limestone, the Glen Dean Limestone, and the Haney Member of the Golconda Formation. These units contain lesser thicknesses of limestone than the Kinkaid and more numerous shale interbeds. Further information on limestone resources of Johnson County is available in Lamar (1959 and 1967).

Sandstone

A small abandoned sandstone quarry is east of the railroad in the NE NE SE of Sec. 16, T12S, R3E. A 30-foot interval of sandstone in the Caseyville Formation was taken. Operator and date of quarrying are unknown. Considering location, this pit may have been a source of fill for the railroad grade.

Dial (1963) reported the “Ramona Quarry” worked the Wayside Member of the Caseyville Formation in the NE 1/4 of Sec. 11, T12S, R2E. We did not find this quarry during mapping and no other information is on record.

There is little market today for the type of sandstone available in southern Illinois. Small amounts of flagstone have been quarried from the Caseyville Formation near Eddyville in Pope County and from the Cypress Formation near Golconda in Pope County. The Caseyville and several Chesterian formations in the Vienna Quadrangle contain thin-bedded sandstone that might be suitable for flagstone.

Coal

Coal resources of the Vienna Quadrangle are negligible and no mining is on record. The

Reynoldsburg Coal Bed, near the base of the Tradewater Formation, is exposed along Interstate 24 near the northern edge of the map area. The seam ranges up to 2.3 feet thick and its lateral extent is unknown. Coal beds in the Caseyville Formation are less than one foot thick, lenticular, and shaly.

Oil and Gas

Only two test holes for oil and gas in the Vienna Quadrangle are on record. The Zeppa & Coates #1 Albright was drilled in Sec. 22, T12S, R2E to a total depth of 1,748 feet in the St. Louis Limestone (Middle Mississippian). The C.L. Owen #1 McCall was drilled in Sec. 4, T13S, R3E to a depth of 335 feet in the Cypress (?) Formation. Both holes were dry and abandoned; no shows of hydrocarbons were reported.

The Pratt, Porter et al. #1 Smith in SE NE SW of Sec. 35, T12S, R2E, was drilled in 1918 to a total depth of about 2,000 feet. The purpose of drilling is unknown, but considering the depth, oil was probably the objective. The only log is a driller's log, which is of little value in interpreting the geology. It reports the top of "big lime" (Ste. Genevieve?) at 870 feet and the hole was still in limestone at total depth. Sulphur water and gas were encountered at 1,240 feet; the water was highly corrosive and turned the drilling tools black.

The nearest producing oil wells are in Williamson County about 15 miles north of the map area.

Ground Water

The Vienna area is not an easy place to obtain water from drilled wells. Many dry holes have been drilled; one landowner reported four on his property. Most completed wells produce between 1 and 10 gallons per minute, which is marginal for residential use and inadequate for commercial or municipal water supplies. Some wells yield adequate volume, but the water is rusty or otherwise unfit to use. Given the sketchy nature of most drillers' logs, little information on water-bearing units can be gleaned. Most wells are finished in Chesterian sandstone or limestone, the latter likely producing via fractures or solution channels.

Two wells (not plotted on the geologic map) near the center of Sec. 32, T12S, R3E (less than 1 mile north of Vienna) achieved production of 50 gallons per minute. One well was completed at a depth of 60 to 65 feet in "gravel", which appears unlikely. The other was finished in crevices in the Menard Limestone at a depth of 40 to 50 feet. Solution channels in the limestone are the likely feeder for both wells.

Acknowledgments

This project would have been impossible without the cooperation of numerous landowners, who allowed us onto their land for outcrop study. Special thanks are in order for the Southern Illinois Stone Company, who gave us access to their active and abandoned quarries; and James and Bonnie Jones, who let us drill a cored test hole on their land. Mike Puchalski, Julie Brown, Christine Wiscombe, and Brett Denny mapped small areas of the Vienna Quadrangle and accompanied the authors in the field on various occasions.

References

Bristol, H.M. and R.H. Howard, 1971, Paleogeologic map of the sub-Pennsylvanian Chesterian (Upper Mississippian) surface in the Illinois Basin: Illinois State Geological Survey, Circular 458, 14 p. and 2 plates.

Dial, D.C., 1963, The geology of the northwest quarter of the Vienna Quadrangle: M.S. thesis, Southern Illinois University, Carbondale, 66 p. and 1 plate.

Devera, J.A., 1991, Geologic map of the Glendale Quadrangle Johnson and Pope Counties: Illinois State Geological Survey, Geologic Quadrangle Map IGQ-9, 1 sheet, scale 1:24,000.

Gutschick, R.C., 1965, *Pterotocrinus* from the Kinkaid Limestone (Chester, Mississippian) of

Illinois and Kentucky: Journal of Paleontology, v. 39, no. 4, p. 636-646.

Gutschick, R.C., 1968, Late Mississippian (Chester) *Allagecrinus* (Crinoidea) from Illinois and Kentucky: Journal of Paleontology, v. 42, no. 4, p. 987-999.

Harrison, R.W. and 9 others, 1999, An example of neotectonism in a continental interior - Thebes Gap, Midcontinent, United States: Tectonophysics, v. 305, p. 399-417.

Jacobson, R.J., 1993, Geology of the Goreville Quadrangle, Johnson and Williamson Counties, Illinois: Illinois State Geological Survey, Bulletin 97, 32 p.

Jacobson, R.J. and C.P. Weibel, 1993, Geologic map of the Makanda Quadrangle, Jackson, Union, and Williamson Counties, Illinois: Illinois State geological Survey, IGQ-11, 1 sheet, scale 1:24,000.

Keys, J.N. and W.J. Nelson, 1980, The Rend Lake Fault System in southern Illinois: Illinois State Geological Survey, Circular 513, 22 p. and 1 plate.

Lamar, J.E., 1959, Limestone resources of extreme southern Illinois: Illinois State Geological Survey, Report of Investigations 211, 81 p.

Lamar, J.E., 1967, Handbook on limestone and dolomite for Illinois quarry operators: Illinois State Geological Survey, Bulletin 91, 119 p.

Langenheim, V.E. and T.G. Hildenbrand, 1997, Commerce geophysical lineament - its source, geometry, and relation to the Reelfoot Rift and New Madrid seismic zone: Geological Society of America Bulletin, v. 109, no. 5, p. 580-595.

Nelson, W.J., 1993, Geology of the Bloomfield Quadrangle, Johnson County, Illinois: Illinois State Geological Survey, Bulletin 99, 30 p.

Nelson, W.J., in press, Geologic map of the Mt. Pleasant Quadrangle, Johnson and Union Counties, Illinois: Illinois State Geological Survey, IGQ Series, 1 sheet, scale 1:24,000.

Nelson, W.J., J.A. Devera, and J.M. Masters, 1995, Geology of the Jonesboro 15-minute quadrangle, southwestern Illinois: Illinois State Geological Survey, Bulletin 101, 57 p.

Nelson, W.J. and C.P. Weibel, 1996, Geology of the Lick Creek Quadrangle, Johnson, Union, and Williamson Counties, Illinois: Illinois State Geological Survey, Bulletin 103, 39 p.

Nelson, W.J., and 11 others, Geology of the Eddyville, Stonefort, and Creal Springs Quadrangles, southern Illinois: Illinois State Geological Survey, Bulletin 96, 85 p. and 1 plate.

Stephenson, W.J., J.K. Odum, R.A. Williams, T.L. Pratt, R.W. Harrison, and D. Hoffman, 1999, Deformation and Quaternary faulting in southeast Missouri across the Commerce geophysical lineament: Bulletin of the Seismological Society of America, v. 89, no. 1, p. 140-155.

Swann, D.H., 1963, Classification of Genevievian and Chesterian (Late Mississippian) rocks of Illinois: Illinois State Geological Survey, Report of Investigations 216, 91 p.

Trace, R.D. and P. McGrain, 1985, The *Chaetetella* zone in the Kinkaid Limestone (Mississippian); a useful stratigraphic marker along the southern rim of the Eastern Interior (Illinois) Basin: Kentucky Geological Survey, Series11, Information Circular 14, 9 p.

Weller, Stuart and F.F. Krey, 1939, Preliminary geologic map of the Mississippian formations in the Dongola, Vienna, and Brownfield Quadrangles: Illinois State Geological Survey, Report of Investigations 60, 11 p. and 1 plate, scale 1:62,500.