

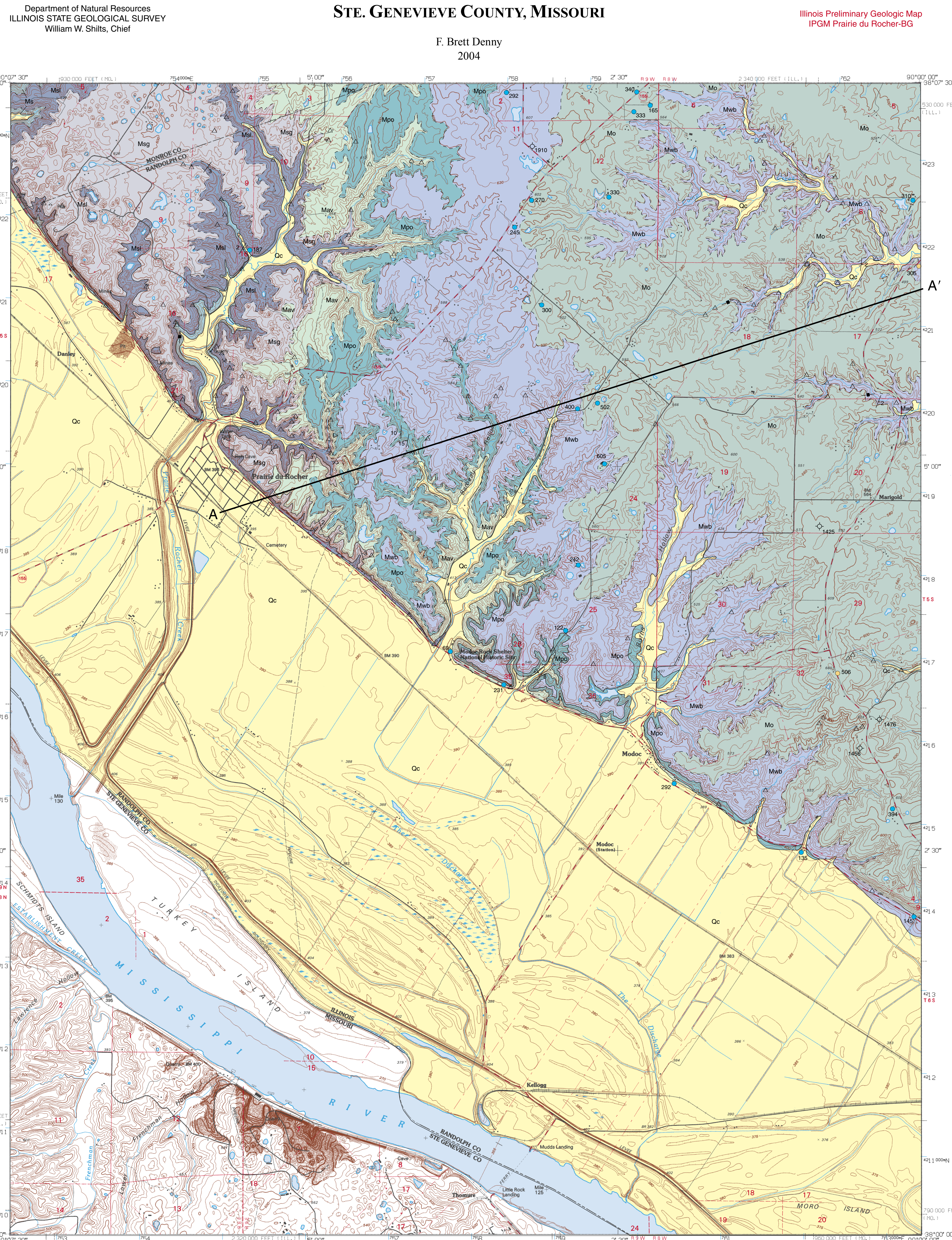
BEDROCK GEOLOGY OF PRAIRIE DU ROCHER QUADRANGLE

RANDOLPH AND MONROE COUNTIES, ILLINOIS

STE. GENEVIEVE COUNTY, MISSOURI

F. Brett Denny
2004

Illinois Preliminary Geologic Map
IPGM Prairie du Rocher-BG



SYSTEM	SERIES	FORMATION	MEMBER	GRAPHIC COLUMN	THICKNESS FEET	DESCRIPTION UNIT		
QUATERNARY	HOLOCENE	Cahokia			0-100	A		
MISSISSIPPIAN	CHESTERIAN	Okaw	Glen Dean Limestone		4-5	B		
			Hardinsburg		10	C		
		Hanev Limestone	Hanev Limestone		40-45	D		
			Frailies Shale		20-25	E		
			Beech Creek Ls.		15	F		
		Cypress	Cypress		25-30	G		
			West Baden	Ridenhower		60-70	H	
		VALMIEREAN	VALMIEREAN	St. Louis	Bethel Ss.		35-40	I
					Downey's Bluff Ls.		10	J
				Salem	Yankeetown		15-20	K
Renault					10	L		

- Symbols**
- 40 Strike and dip of bedding; number indicates degree of dip
 - Active quarry
 - Abandoned quarry
 - Vertical joints
 - Outcrop from field notes
- Drill Holes**
- 1234 From which subsurface data was obtained
 - 156 Stratigraphic boring
 - 210 Water well
- Note:** Numbers indicate total depth of boring in feet.
- Line Symbols**
- dashed where inferred, dotted where concealed
 - Contact
 - Line of cross section

Stratigraphy

The bedrock exposed in the quadrangle is dominated by limestones and dolomites of the Valmeyerian Series in the northwest, and Chesterian limestones and shales to the southeast. The Valmeyerian carbonates represent a prolonged marine transgression which covered the region for millions of years. The oldest Valmeyerian unit exposed in the quadrangle is the Salem Limestone. This unit is approximately 200 feet thick in the region and is dominantly an open marine system. This formation has been studied in detail by Cluff (1984) and Baxter (1960). Cluff suggested that the Salem was composed of up to 4 cycles consisting of a marine shal overlain by a thin bedded, fine grained, tidal flat unit. The cycles can be observed on electric logs (Figure 1). This example is from an oil test 32-55-W and the thin bedded limestone and shales show as anomalously high porosity on neutron logs. Northwest of Prairie du Rocher, the upper 100 feet of the Salem can be observed along Bluff Road. At this location the shales and thin bedded tidal flat limestone, dolomite, and shales can be observed. The contact with the overlying St. Louis can be observed along a remnant of the bluff.

The St. Louis Limestone may be divided into upper and lower unit. Laemi and Norby (1999) described the lower St. Louis as a non-shore restricted marine facies consisting of pelleted and fenestral limestone, algal limestone, collapsed brachiopods, and microcrystalline dolomite. The upper St. Louis is characterized by bioclastic limestone to packstone, lime mudstone, and peloidal grainstones which are interpreted as a return to normal open marine conditions. There is an acme zone of the colonial coral *Aerocyathus floriformis* (*Libosirostrata*) about 20 feet up from the base of the St. Louis Formation. This colonial coral is an excellent stratigraphic marker. Higher in the unit there is a significant break in the conodont fauna which occurs just above a bryozoan-rich cherty limestone bed named the Lost River Chert zone (Laemi and Norby, 1999). The contact with the overlying Ste. Genevieve Formation is placed just above this chert zone.

The Ste. Genevieve Limestone consists of oolitic, crinoidal, cross bedded limestones and dolomites. Thin beds of sandy limestone are present and in part the unit is very similar to the underlying St. Louis Limestone. Oolitic shales are well developed and extensively cross bedded, and a few sandy lenses occur within the unit indicating this is shallow marine limestone. The upper portion of the Ste. Genevieve is unconformable with the overlying Aux Vases Sandstone, which in places has down cut several feet into the Ste. Genevieve or the St. Louis Limestone.

Above this thick sequence of limestone lies a complex sequence of siltstones, claystones, limestones, and sandstones. The Aux Vases Sandstone is well developed in this region and is exposed in the hills along Bluff Road south of Prairie du Rocher to Modoc. This unit is dominantly a fluvial unit and contains root zones, clay rip up clasts, and is bioturbated near the base. It is locally present in incised valleys of the older marine limestone units. The sedimentation appears to back fill these paleo-valleys in the lower portions which are shaly and contains desiccation cracks and limestone conglomeration. The upper most portion is cross bedded fine-grained sandstone. Most portions of the unit are cemented with calcite and the lower portion is bioturbated, but no marine fauna were observed. Because this is a fluvial-dominated unit, it is highly variable and sections may vary considerably over short distances. The Aux Vases has been studied by Swann (1963), Cole (1990), and Lettau (2000). The Aux Vases produces petroleum at several fields in the southeastern portion of the Illinois Basin.

The Renault is generally a thin limestone and shale unit in this area that is highly variable in composition. Previous workers have put the shales above and below the limestone into either the Aux Vases or the overlying Yankeetown. Swann (1963) observed a red bed at the top of the Renault in this region. This red bed was not observed during field work for the project and therefore it includes only the main limestone that is 10 feet thick into the Renault. We observed a red bed about 5 feet below the Renault which we included in the Aux Vases Sandstone. The Aux Vases grades upward into the overlying Yankeetown.

As originally defined, the "Yankeetown Chert" (Weller, 1913) is composed of sandstone and limestone that has been altered to chert by long continued weathering. The Yankeetown is described by Weller (1939) as being rarely over 20 feet thick, and this unit contained beds that were undoubtedly equivalent in age to the Bethel Sandstone with the lower portion equivalent to the Renault Formation in southern Illinois. Swann (1963) stated that the sandstone in the Yankeetown, informally called "Benesit", was not equivalent to the Bethel. The Paint Creek was defined by Weller to include all the strata above the Yankeetown to the base of the Ruma ("Cypress" Formation). Swann (1963) utilized the term Yankeetown to include all of the section between the Renault and the Downey's Bluff Formation, and raised the Paint Creek from Formation to Group status (Table 1). The Downey's Bluff is a well bedded limestone with large petalotenuid fragments. It represents a major marine transgression across the region. This limestone package from the base of the Renault upward to the Downey's Bluff is called the Paoli Limestone Group. This unit was lowered in rank to formation by Nelson (1966). The Paoli Formation makes a good mappable unit for this portion of the section from the Renault to Downey's Bluff.

The Cypress, Bethel, and Hardinsburg Sandstones normally present in the Chesterian of southern Illinois are poorly developed in this area. The absence of sandstone in the region makes stratigraphic correlation extremely difficult. There are several paleosols in western Illinois that correlate with the well-developed sandstones southern and southeastern Illinois. These paleosols and claystones probably represent a topographic high during the time of sedimentation. This regional topographic high has previously been referred to as the extension of the Ozarks (Workman, 1944) and the Sparta Shelf (Meents and Swann, 1965). The Bethel, Ridenhower, and Cypress have been grouped into a mappable unit that correlates with the West Baden Group in this report. The West Baden Group, which was originally designated to be used in areas where the limestone portions of the Ridenhower were so thin that differentiation of the units is impractical (Swann, 1963), Cole (1990) adopted the term West Baden Sandstone for this interval and reduced the unit from a Group to Formation status.

Swann corrected the thick red claystone of the Paint Creek with the Bethel. This unit represents a thick paleosol at the base of the West Baden. Above the Bethel is a variable series of siltstone, sandstone, shale, and limestone of the Ridenhower. The Ridenhower is a calcareous siltstone at the base that grades into a siltstone with plant debris and upward into a marine limestone. There are thin to laminated red and green siltstones that are tidal to supertidal that grade upward into a 15 to 20 feet thick limestone at the top of the unit.

The Cypress is composed of red claystone and fine grained sandstone at the base and grades upward into a calcareous shale with carbonaceous plant debris. The sandstone typical of the Cypress Formation are not well developed in this area. The term West Baden Formation is utilized for the section from the base of the Bethel to the top of the Cypress. The sandstones are not well developed in this area and the dominantly composed of siltstone and shales, with limestones of the Ridenhower in the middle of the unit. Therefore the unit is termed the West Baden Formation.

The Waterloo is a package of limestones named Okaw that was first described by Weller (1913). These limestones correlate with the Beech Creek through Glen Dean of the standard southern Illinois section. The Okaw is 150 to 200 feet thick and is composed of a variety of limestones and shales, with several red beds. The unit represents a marine incursion across the region with little silicification into this immediate area. The Hardinsburg Sandstone is not well developed in this region, but may be correlated with a siltstone and red claystone, just below the base of the Glen Dean. The Okaw represents a major sea level rise over the region.

Structural Geology

The Prairie du Rocher Quadrangle is located in Randolph County, southwestern Illinois. This quadrangle is in line with the Waterloo-Dupo Anticline, Columbia Syncline, Monroe City Syncline, and the Valmeyer Anticline. The Waterloo Anticline is an asymmetrical structure that trends approximately N20°W to N25°W and the Chesterian and older units have dips over 40° on the southwest side and gentle 2° to 4° of degrees on the northeast side. The structure is called the Waterloo Anticline near Waterloo, Illinois and the Dupo Anticline in the vicinity of Dupo, Illinois. In the Waterloo Quadrangle, the structure appears to dip to the south and the features can be traced through much of the Waterloo Syncline in the south and the features can be traced through much of the Waterloo Syncline in the south and the features can be traced through much of the Waterloo Syncline in the south and the features can be traced through much of the Waterloo Syncline in the south.

In the Prairie du Rocher Quadrangle, two outcrops were observed striking nearly north-south with beds dipping 10 to 15 degrees to the west. These outcrops were observed at slightly more than 1 mile east of Prairie du Rocher and may be the southern extension of the Waterloo-Dupo Anticline. A large Aux Vases Sandstone channel is present along this trend which complicates the mapping in this area. The Aux Vases thins from a feather edge at this point to over 100 feet in less than 1 mile eastward and the Chesterian units also thicken along this hinge-line. We can not positively draw a fault in this area, but one is strongly suggested. If present this fault would trend parallel to the strike of the dipping beds in this area, which is N10-15 degrees west. Several large blocks of basal Okaw were observed in section 8 T55 R180 W1, 2500 S1 striking N45°W to N50°W and dipping about 45° NE. This may either be a tectonic feature or the result of slumping on the underlying shales of the upper West Baden. The conclusion at present is the blocks are a result of slumping but detailed mapping should clarify the nature of this structure.

Economic Geology

Sand and gravel
Sand and gravel are located in the Mississippi River Valley. No significant quantities of these deposits is currently in operation.

Limestone
Limestone is being mined underground northwest of Prairie du Rocher. This operation mines the upper portion of the Salem Limestone. There are several small abandoned open pit quarries that have mined the St. Louis and Ste. Genevieve Limestones in the northern portion of the quadrangle. The Okaw Limestone, which consists of the Glen Dean and Hanev Limestones,

offers a potential source of limestone for construction purposes. In this area, the Hardinsburg Sandstone, which typically separates the Glen Dean and Hanev Limestone, is not well developed. In the southeastern portion of the quadrangle and to the east this unit is a potential source of aggregate.

Oil and Gas
Three oil wells have been drilled in the Prairie du Rocher Quadrangle. All of these wells were drilled to the Kimmswick and were dry and abandoned. A water well (32-T55-R5W) was reported to produce oil. The land owner of the well reported to the Illinois State Geological Survey (ISGS) in 1966 that his water well was producing oil. Wayne Meents, an ISGS geologist, was dispatched to investigate. The water well was completed in the Ste. Genevieve Limestone. A synopsis of the report indicates the water well was drilled to a depth of 378 feet and produced a show of oil, which the driller ceased off. In September of 1966, the pump lowered the water level and a slug of petroleum was pumped through the washing machine and facets of the well. Mr. Meents directed the well to be pumped 15 minutes which produced 75 gallons of water and many small globules of oil.

Oil was discovered while drilling a water well in the 1920s, about 10 miles to the north of the Prairie du Rocher Quadrangle, in the Waterloo Quadrangle. The field was abandoned in 1920, revised in 1939 and converted to gas storage in 1951 (Schwab, 1968). Initial production of the wells was 75 to 125 barrels per day quickly decreasing to 25 to 50 barrels per day. Structure contours on the top of the Kimmswick in the Waterloo area reveals at least 300 feet of closure (Bristol and Bushback, 1973). Over 400,000 barrels of oil have been produced from this structure, all from the Ordovician Kimmswick Limestone (Nelson, 1965). This structure strikes N20° to N25° degrees west and the projection of this structure to the southeast would intersect the Prairie du Rocher Quadrangle just east of the community of Prairie du Rocher. The depth to the Kimmswick "Trenton" in the Prairie du Rocher area is less than 1500 feet, making this a very interesting petroleum prospect. Two outcrops were observed striking nearly north-south with beds dipping 10 to 15 degrees to the west, similar to the trend of the Waterloo Syncline. These outcrops were observed at slightly more than 1 mile east of Prairie du Rocher and may be the southern extension of the Waterloo-Dupo Anticline. The nearest oil test to this feature is over 2 miles to the northeast. Structure contours on the top of both the Aux Vases Sandstone and Ste. Genevieve Limestone show regional dips to the east and no closure. More data is necessary to determine the petroleum potential of this quadrangle.

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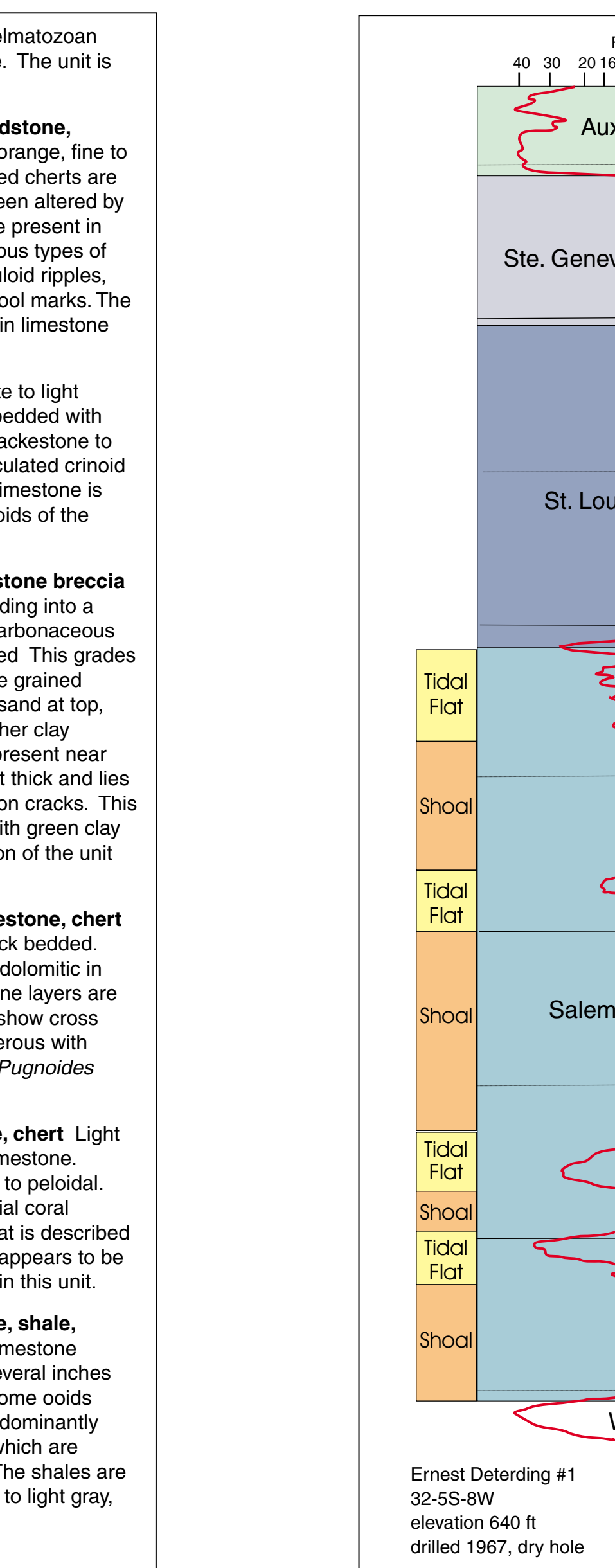
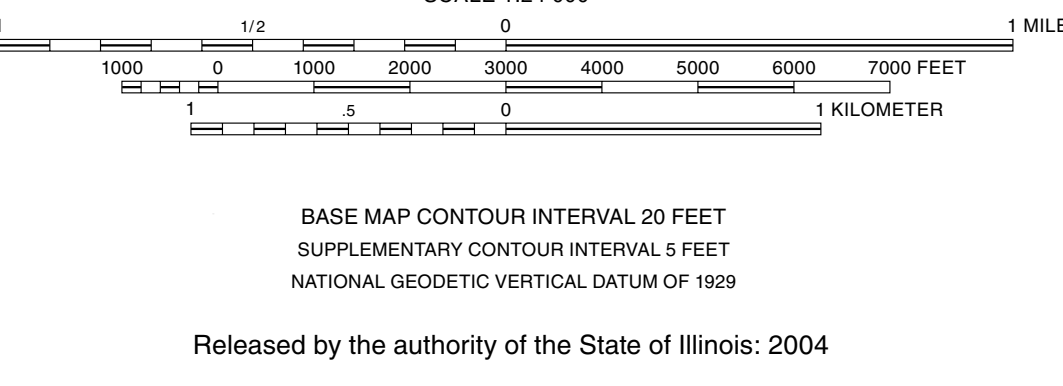


Figure 1 Neutron log of Earnest Deterring #1.

Base map compiled by Illinois State Geological Survey from digital data provided by the United States Geological Survey. Compiled from imagery dated 1986. Revised from map originally dated 1963. Map edited 1996.

North American Datum of 1983 (NAD 83)
Projection: Transverse Mercator
10,000-foot (3,048-meter) grid zone and Missouri (east zone) State Plane Coordinate system (Transverse Mercator)
1,000-meter (3,281-foot) grid system, zone 15

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Geology based on fieldwork by F. B. Denny, 2003-2004.

Digital cartography by L. Verheist and J. Dornier, Illinois State Geological Survey.

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ADJOINING QUADRANGLES
1. Bureau
2. Anna
3. Red Bud
4. Exponent
5. Exponent
6. Exponent
7. Ste. Genevieve
8. Kaskaskia

ROAD CLASSIFICATION	Symbol
Primary highway, hard surface	—
Secondary highway, hard surface	—
Light-duty road, hard or improved surface	—
Unimproved road	—
Interstate Route	—
U.S. Route	—
State Route	—