

The Geology and Geomorphology of Wyandotte Cave Crawford County, Indiana

RICHARD L. POWELL, Indiana Geological Survey¹

Abstract

Wyandotte Cave, western Crawford County, Indiana, consists of about 5.5 miles of known passages at two major levels entirely within strata of the upper part of the Blue River Group. The Old Cave (upper level) lies above a prominent shale about 50 feet above the New Cave (lower level) which lies below the Lost River Chert Bed entirely within the Ste. Genevieve Limestone. Large rooms extend upward into the base of the Paoli Limestone where the passages collapsed, apparently into a lower level, now filled, in the upper part of the St. Louis Limestone. The floors of the passages are nearly everywhere covered with thick sediments consisting predominantly of clay. Bedrock floor is seen in a few hanging passages.

Disconnected remnants of the upper level passages were fed by vertical tributaries that headed on adjacent hillsides. This passage drained southward at about the level of the Blue River Strath during late Tertiary time. The lower level lies slightly above Blue River at grade with a minor strath level of early Pleistocene age. There are indications that a large filled passage of early to middle Pleistocene age lies at grade with the deep channel of Blue River.

Wyandotte Cave was apparently first explored in about the year 1800 with the discovery of the upper level and westernmost passage. The cave was known as Epsom Salts Cave in 1820 following mining of that mineral from the passage, and was also known as Indiana Saltpeter Cave, perhaps mistakenly. Additional discoveries were made in about 1850 that opened into lower levels and were named the "New Cave." The upper level then became known as the "Old Cave." Subsequent exploration led to the naming of the "South Branch" and the "Northern Arm" in 1851. Another major discovery in 1858 opened the northernmost upper levels, subsequently named the "Unexplored Regions" and here renamed the "Langsdale Passage" because they were first mapped by George I. Langsdale (5). Numerous minor discoveries have increased the length of the cave, particularly the "Discovery of 1941" (3). The most recent survey by the Indiana Geological Survey, assisted by the Bloomington Indiana Grotto of the National Speleological Society, and explorations by the present management and guides have discovered several new passages in excess of the more than five miles that have been mapped. The place names used, however, are those used by earlier surveys and reports (1).

The ridge that contains Wyandotte Cave is located in the eastern part of the Crawford Upland, just north of Blue River (Figure 1). The upper part of the ridge is capped with about 200 feet of alternating units of sandstone, shale and limestone of the West Baden Group (Figure 2A). The base of this group is at an altitude of 620 feet near

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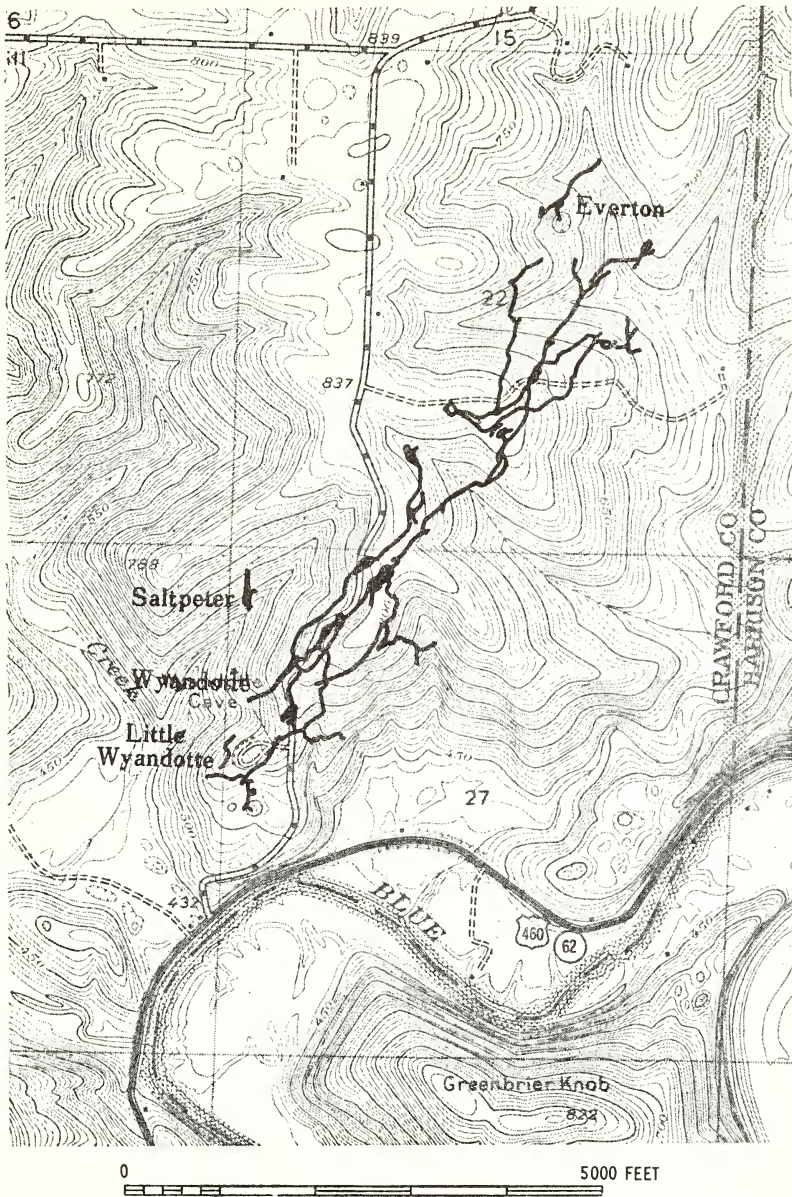


Figure 1. Topographic map of Wyandotte Cave and vicinity showing the extent of mapped cave passages. Base from the Leavenworth Quadrangle, U.S.G.S., 1947.

the entrance to Wyandotte Cave. The lower part of the ridge and adjacent valleys are underlain by carbonate strata of the Blue River Group. These strata contain the cave passages, which range in altitude from about 450 feet to 600 feet. Nearby, Blue River flows at about 390 feet above sea level. The entrance to the cave is 575 feet in altitude and is stratigraphically in the lower part of the Paoli Limestone, as may be the unexamined ceiling portions of Odd Fellows Hall and Rothrock Cathedral, the two largest rooms in the cave (Figure 2B). The remainder of the passages are entirely within the Ste. Genevieve Limestone, but the lowest levels, which are filled with alluvial materials, may extend as deep as the St. Louis Limestone.

Five major factors have controlled orientation and the evolution of the passage levels of Wyandotte Cave: joint pattern, structure, piezometric slope, lithology and geomorphic history of the area. The cave consists of a series of subparallel passages that trend from the northeast to the southwest, generally following the local dip of the bedrock. The passages that exhibit solution features follow the joint pattern of the particular beds within which the passages have been dissolved (Figure 3A), but the same joint patterns usually are not found in the immediately overlying beds seen in the ceilings of the cave passage. Traversable passages lie at numerous levels and are developed on particular stratigraphic horizons, each with particular hydrologic gradient and each have distinct cave sediment surfaces. These different levels are here grouped into three major levels: the upper level, the lower level, and an unexplorable, completely sediment filled lowest level.

Four distinct erosion surfaces are recognizable in the Wyandotte Cave area (2). The highest surface, that represented by accordant summits on the ridges of the Crawford Upland, has been called the Lexington (Highland Rim) Peneplain and is of Tertiary age. The present topography postdates this erosion surface. The valley of Blue River, which is deeply entrenched below the Lexington Peneplain, contains two bedrock terrace levels above the deeply filled bedrock valley bottom. The Blue River Strath, the uppermost of these terraces, lies at an altitude of about 525 feet in the vicinity of Wyandotte Cave, but may be traced upstream to lie at grade with the Mitchell Plain (6). This erosion surface is of late Tertiary or Pleistocene age. A lower bedrock terrace is preserved at an altitude of about 420 feet just southwest of the cave in an abandoned meander loop of Blue River. Other remnants along Blue River upstream from Wyandotte Cave lie at grade slightly above the present stream level. Collectively, they represent an unnamed strath or stage of valley deepening of early or middle Pleistocene age, possibly of Kansan age. The bedrock floor of the Blue River valley was established by the maximum erosion during middle Pleistocene time, and is probably of Illinoian age. The downstream part of the valley of Blue River was the site of a Wisconsin age lake (8). The present stream is incised into the lacustrine sediments.

The upper level of Wyandotte Cave, including the Old Cave and the Langsdale Passage, lies at grade with the Blue River Strath and is therefore of similar age (Figure 2A). The Old Cave formed in the upper

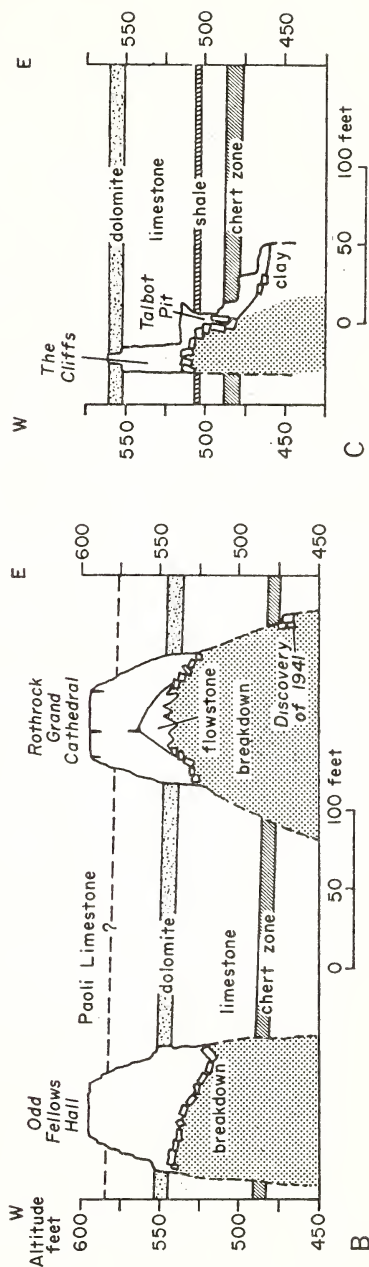
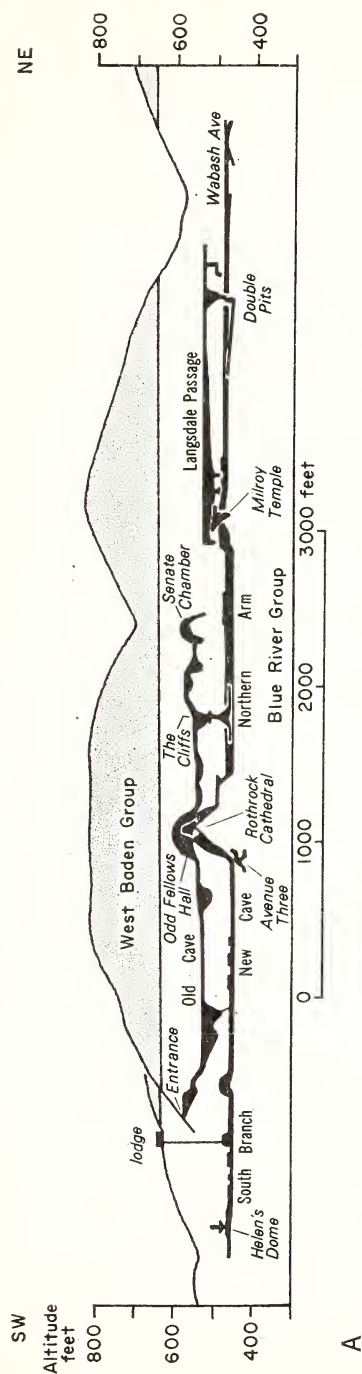


Figure 2A. Generalized projected profile of Wyandotte Cave.

Figure 2B. Geologic cross section through Odd Fellows Hall and Rothrock Cathedral.

Figure 2C. Geologic cross section at the Cliffs.

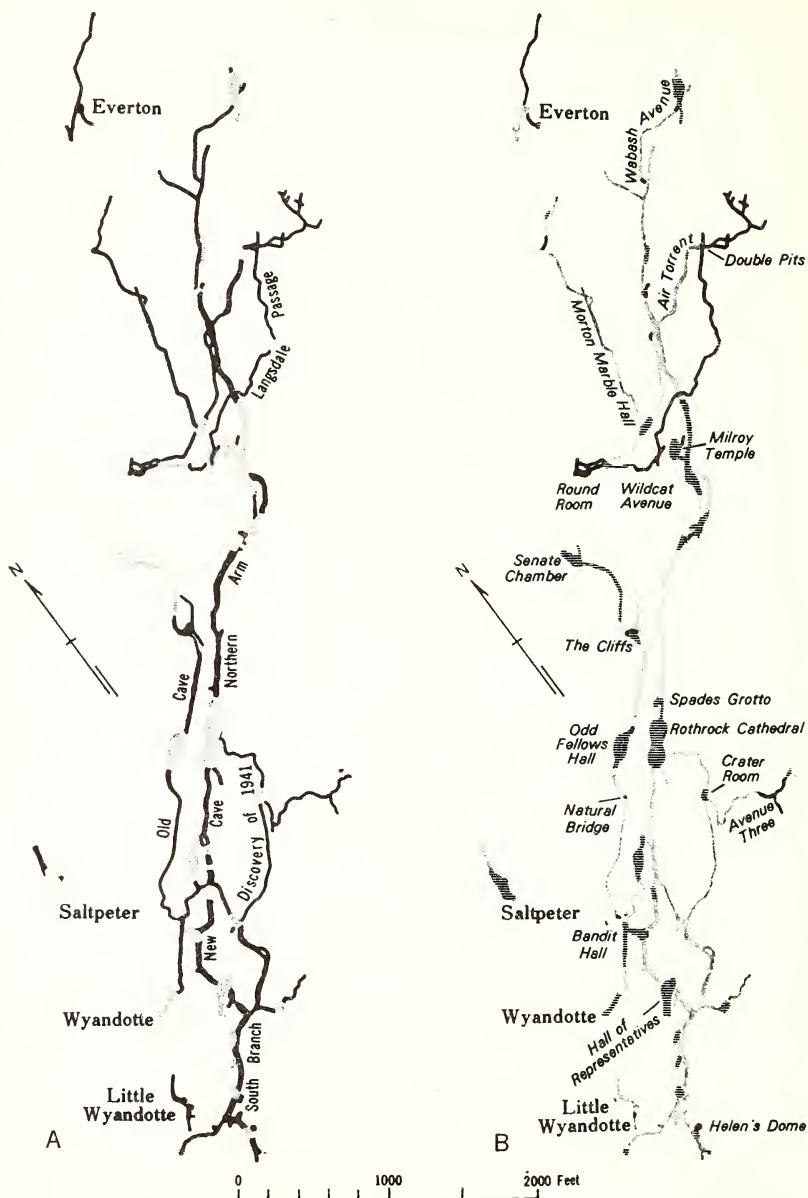


Figure 3A. Map of Wyandotte Cave showing passages formed by solution (black) and those modified by collapse (gray).

Figure 3B. Map of Wyandotte Cave showing floor areas of bedrock (black), breakdown (lines) and alluvium (gray).

part of the Ste. Genevieve Limestone below a prominent bed of thick dolomite that resembles a siltstone. The dolomite bed formed the ceiling of the original solution passage from Bandit Hall to the Cliffs. North of the Cliffs the limestone units above the dolomite have collapsed into the passage. Bedrock floor of the Old Cave is on limestone above a prominent shale bed that is exposed in the Old Cave only at the Cliffs (Figure 2C). Elsewhere the floor of the passage is buried by as much as 20 feet of sediments or breakdown (Figure 3B).

All of the key marker beds useful in establishing continuity in Wyandotte Cave are exposed in the section at the Cliffs (Figure 2C). The section measured there exposes most of the strata that can be seen in the cave. Units higher than the dolomite bed are well exposed at the entrance. Lower units are well exposed at the end of Avenue Three.

The Langsdale Passage, a new name here used for the passage that for more than 100 years has been called the "Unexplored Regions," is an upstream segment of the upper level below the dolomite bed and above the shale. The connection between the two segments of the upper level is not traversable because of collapse of the passage. The passage generally is high and narrow whereas the Old Cave is wider and has therefore been more susceptible to collapse. The floor of the passage is bedrock in many places, and thick sediments are generally lacking. The dolomite bed is not seen in the Langsdale Passage because the ceiling of the passage has not collapsed and exposed that stratigraphic horizon. The dip of the bedrock is slightly greater than the original stream gradient of the upper level.

The upper level of the cave originally developed at the top of a fluctuating water table just above the level of the shale bed (7). The passage was formed by precipitation diverted underground vertically from the local hillsides to the water table. The water then followed the piezometric slope down dip along joints to Blue River where it discharged at the level of the Blue River Strath. The Old Cave sediments were probably deposited as a result of aggraded conditions at the level of the Blue River Strath.

The lower levels of Wyandotte Cave generally have formed within the lower part of the Ste. Genevieve Limestone, below the Lost River Chert Bed, and include nearly all of the passages of the New Cave, excluding the Langsdale Passage. A bed of dolomite that averages about 2 feet thick was traced along the ceiling of the Northern Arm from Rothrock Cathedral northward to Wabash Avenue, where it is near the passage floor. The gradient of the original ceiling of the lower level prior to any ceiling collapse was slightly less than the local dip of the strata. The New Cave passages predominantly have an alluvial clay floor, although collapsed portions are covered with breakdown (Figure 3B). Bedrock floor is seen within a few passages, such as Wabash Avenue and Avenue Three, and a few remnants of bedrock floor that lie above the level of the clay fill are scattered along the routes of the New Cave. These bedrock areas are within a few feet of the ceiling of the lower level and thus they indicate a primary stage in its

development that would correlate with the minor strait on Blue River discussed earlier that lies slightly above present stream level.

The alluvial floor of the New Cave passages slopes from the northeast end of the cave at Wabash Avenue and Morton Marble Hall southwestward to the Hall of Representatives. South of there the floor slopes northward to the Hall of Representatives, except for smaller, more recent, channels eroded into the fill material. The depth to which the passage is filled is estimated to range from 20 to 50 feet, assuming that the bedrock floor lies at grade with or is slightly above the bedrock valley of Blue River. This lowest level of the cave was formed as a tributary to Blue River during the period of maximum Pleistocene downcutting which is probably of Illinoian age. Most of the alluvial fill material is of Illinoian and Sangamon age, but the upper fill materials in the south end of the cave are Wisconsin age backwater deposits.

The lowest observable level of Wyandotte Cave is that floored by the alluvial deposits, but the lowest level is obviously that of the bedrock floor. Several collapsed areas of more than normal cave passage width suggest that this lowest level is large and deep. The inferred size of this passage is such that it may have been formed by a much larger stream than that which dissolved the higher passages in the cave. Such a stream may have been fed by water diverted from Blue River to the northeast as suggested by Malott (4), in addition to water from the local hillsides above the cave and that water diverted from the upper level.

The shale horizon in the upper level is breached by erosion and collapse in several places, particularly in the Langsdale Passage. The diversion of the stream from the upper level into the lower level was apparently progressive in an upstream direction, first through several pits in the Round Room area, then in a series of six pits northeast of Wildcat Avenue, and finally in a half dozen pits in the northeast end of the Langsdale Passage near the Double Pits and the present sources of the water.

Wyandotte Cave lacks any significant stream at the present time, although water is encountered in several places in the cave in small amounts depending upon the weather. Drainage off the hillside brings water into the main passage at the south end of Wabash Avenue at Crawfish Spring (not shown on map), in the northern end of the Langsdale Passage, and in the South Branch, particularly at Helen's Dome. A small waterfall is usually flowing in Milroy Temple in a passage near the ceiling above the shale unit. Small seeps of water occur at scattered locations in the cave. The water does not form a stream because it percolates into the fill materials in the floor of the lower level within a short distance of where it enters the cave. The water probably passes through the fill and enters the valley of Blue River at one or more springs south of the cave.

The major collapse features of Wyandotte Cave are nearly all associated with the lowest levels. Two different types of collapse were recognized. The large rooms, such as Odd Fellows Hall, Rothrock Cathedral, the Hall of Representatives and Milroy Temple, appear to

have collapsed into a large lower level. The amount of collapse exceeds 30 feet in the Hall of Representatives, is about 50 feet in Odd Fellows Hall and Milroy Temple, and is 100 feet in Rothrock Cathedral.

Several small rooms south of Rothrock Cathedral in the New Cave and north of the Hall of Representatives are of another type of collapse. Six rooms in this area have formed by collapse of the Lost River Chert Bed at places where two passages intersect, producing a room higher than the intersecting passages by the thickness of the chert bed which ranges from about 4 to 5 feet thick. The Lost River Chert Bed is well exposed in the collapsed areas where it consists of numerous thin irregular lenses and nodules of chert.

In most of the cave the Lost River Chert Bed consists of scattered chert nodules in a few bands within a thick limestone unit. The sedimentation of the shale bed, which lies 10 to 20 feet above the chert, was apparently related to the conditions that caused deposition of the chert bed, for where the chert is well developed, as in the area south of Rothrock Cathedral, the shale unit is absent. The shale is about 5 feet thick in Spades Grotto and northward, but thins southward and is absent at the south end of Rothrock Cathedral. It is also absent in Bandit Hall and the Hall of Representatives, but is 3 feet thick in Helen's Dome. The shale unit has served as the base of a perched water table because flowstone has been deposited on it in places and water still flows off it in other places.

Wyandotte Cave is unique among caverns in the Crawford Upland mainly because of the clarity with which its stratigraphic position and geomorphic history may be interpreted. Wyandotte Cave has developed along joints in the bedrock, more or less along the dip of the strata, as a subterranean tributary to Blue River. The three major cavern levels lie at grade with three erosion levels along Blue River, indicating that the different levels range in age from tertiary to middle Pleistocene age. Each level, however, has its peculiarities, depending upon differences in lithology which markedly control the shape of the original solution passages and the mechanics of cavern collapse.

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