Hudelson Cavern, A Stormwater Route of Underground Lost River, Orange County, Indiana

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Drainage Characteristics of Indiana Caverns

The limestone caverns of Indiana are features of subterranean drainage, though many of them are now above drainage level and are dry. The relationship of many of the dry caverns to their former sources of water supply is relatively obscure, chiefly because only remnants of their courses are available for study and too little is known about their actual linear ramifications. Numerous caverns in the limestone region of southwestern Indiana, however, are still the routes of subsurface drainage, though only a few of them may be explored through much of their courses. Many of the stream-coursed caverns have definite relations to their sources of water supply, while some have rather obscure relations. Most of the stream-coursed caverns get some of their waters from seepage through the general overlying and contiguous bedrock which slowly feeds clear waters into them, mainly through joint controlled routes. Such a supply of waters to the cavern streams is relatively continuous and uniform. These caverns are usually developed close to drainage level and their courses, except in a few cases, may not be followed far. But many of the stream-coursed caverns of the limestone belt receive surface waters from definite places of intake, and their stream volumes are subject to rainfall and drainage variations. These caverns in addition to their flows of clear groundwater, are subject to the excess waters of rainy periods, and the stormwaters fed into them from the surface may be charged with muds, silts, sands and gravels. Such caverns may be entered only during dry periods when their water flow is relatively small. Some of the stream-coursed caverns carry only stormwaters and have intermittent flows of water. Such caverns occasionally have higher levels which are subject only to the influx of storm-born waters which over-tax the lower routes, and occasionally they may have dry sections completely above the inflooding storm-born waters.

Nearly all of the better known caverns of southern Indiana are stream-coursed with the exception of Marengo and Wyandotte caverns, and most of them carry storm-born waters entering at definite places of intake. As such they are the routes of underground drainage. Many caverns are completely sealed and carry both ground and storm waters. Their terminal ends are the sites of large springs which are at or slightly below drainage level and cannot be entered. Many caverns, however, terminate above drainage level and open widely at their lower ends. Porter's, Boone's, Ray's, May's, Donnehue's, Hamer's, Donaldson's, and the Clifty caverns are examples which discharge their waters through relatively large openings that in large part are above drainage

level. Only a few caverns in southern Indiana may be entered at their upper ends where they receive their surface waters. The American Bottoms caverns of eastern Greene County and Eller's and Saltpetre caverns of western Monroe County are examples. In many cases entrances to caverns are through sinkholes which may open directly or indirectly into the cavernous routes. Entrances to the underground Lost River at Wesley Chapel gulf, the Tolliver gulf, and Hudelson cavern are examples. Trinkle cavern, near Hardinsburg, Washington County, is a collapse sinkhole entrance to Sinking Creek, Marengo cavern was originally entered through a sinkhole. The Donaldson cavern system of the Spring Mill State Park may also be entered at two different places where sinkhole breakdowns have occurred.

Stream-coursed caverns, especially those which carry gathered stormwaters from the surface, offer little attraction as scenic features and are seldom visited by the public. Only a few of them have been described in detail, and still scantier attention has been given to them as subterranean drainage routes. It is the purpose of this paper to present some of the details of a stormwater course of underground Lost River, locally known as the Hudelson cavern. This cavern was entered and mapped by the writer and Robert Shrock in August, 1929, during a study of the Lost River region of Orange County. Few people know about the presence of the cavern and only a small number have been in it. It is an unattractive, muddy cavern, and in addition may be considered dangerous.

Lost River Drainage

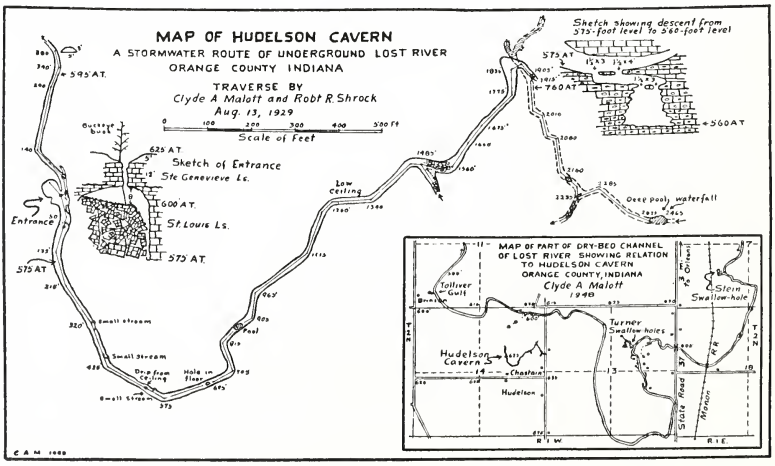
Lost River, carrying waters from 53 square miles of drainage, sinks in various small and several large swallow-holes along its middle course. Its first sink is a small one in the SW ¼ of sec. 4, T. 2 N., R. 1 E., about two miles southeast of Orleans. This sink carries all of the water fed into it during rather dry periods and marks the very beginning of the dry-bed channel. During much of the year, however, Lost River sinks in several rather well defined but shallow swallow-holes west of the center of sec. 8, about one mile farther down stream. If rains overtax the capacity of these swallow-holes, the excess waters enter various swallow-holes farther down stream. The Stein swallow-hole in the SW¼ of sec. 7 has a large capacity, but heavy rains send stormwaters beneath the bridge on State Road 37, about three and one-half miles south of Orleans, and on to the Turner swallowholes in the NE¼ of sec. 13, T. 2 N., R. 1 W. Still heavier or continued rains send the waters throughout the winding course of the dry-bed channel which is more than 20 miles in length. The rise of the underground stream is on the Allen farm, near the center of sec. 7, T. 2 N., R. 1 W., about three-fourths of a mile south of the village of Orangeville. The direct distance between the first swallow-hole and the rise is about 8 miles, but the underground course is undoubtedly much longer.

Very little is known about the underground course of Lost River. It is probably not a simple underground course, but is characterized by many channels developed along routes hewed out from the joint system in

the upper part of the St. Louis limestone in which it is developed. This complex system is well illustrated in the explored routes of the underground system at Wesley Chapel gulf where it has been partially mapped and described by the writer in a special paper written in 1931. The underground routes in the region of the first sinks are but little below the surface channel, but descend to as much as 30 feet below the dry-bed at the Turner swallow-holes. They are as much as 40 feet below the dry-bed at the Hudelson cavern and at Tolliver swallow-hole to the west. In approaching the rise of the underground stream, the dry-bed is cut deeply below the general sinkhole plain and the underground channel or channels are only slightly below the dry-bed. During flood periods, however, the system occupies levels much above the low water routes, coursing through levels as high as the dry-bed itself. The underground system has both low and high water levels. At the Hudelson cavern and the Wesley Chapel gulf these have a vertical range of 40 feet or more.

Name and Location of Hudelson Cavern

The Hudelson cavern takes its name from a former owner of the farm on which the sinkhole entrance is located. The land is now owned by Austin Chastain. The entrance is in the east part of the SW of the NE¼ of sec. 14, T. 2 N., R. 1 W., about midway between Orleans and Paoli and about one and one-half miles west of the bridge across the dry-bed channel on State Road 37. It is 360 yards north of the Chastain residence and 550 yards south of the dry-bed channel of Lost River. See inset map of figure 1. The Hudelson cavern is in the midst of the sinkhole plain through which the dry-bed channel of Lost River passes. Entrance to the cavern is attained through a small sinkhole at an altitude of about 625 feet, some 25 feet above the level of the dry-bed of Lost River. The relief of the sinkhole plain is relatively small



though in about one mile to the south the edge of the rugged Chester escarpment rises as much as 200 feet above the sinkhole plain, exceeding 800 feet in altitude. The cavern itself is developed at three levels beneath the sinkhole plain. The cavern floor immediately beneath the entrance is about 25 feet down. A small high-level channel extends northward at an altitude of about 595 feet. The middle floor is at an altitude of 575 feet. The lowest floor, at or near the permanent watertable, is at 560 feet in altitude and lies 60 to 100 feet beneath the undulating sinkhole plain. All the floors of the cavern are developed in the St. Louis limestone, though the uppermost floor is near the contact with the Ste. Genevieve limestone which composes the surface lands of this part of the sinkhole plain.

Description of Hudelson Cavern

The sinkhole entrance to the Hudelson cavern is a small one. It is about 15 feet across and depressed only about 5 feet below its rim. It is marked by a buckeye bush which grows at the edge of the open hole in the bottom of the sinkhole. The opening in the sinkhole is about 2½ feet across. It extends vertically downward through 12 feet of rock to the ceiling of an expansive room 8 feet above a rather flat floor. The room is approximately 40 feet across in an east-west direction. It extends northwest 45 feet where the ceiling descends to the floor. The land floor of the room is composed of blocks of mud-covered rock, indicating that the muddy stormwaters of underground Lost River cover the floor. They do not reach to all parts of the ceiling of the room. Southward the floor descends slightly and in about 75 feet descends abruptly into muddy pits into which stormwaters from the south disappear during high-water periods. This east wall of the room is composed of thick bedded layers of rock, and the floor, composed of mud-covered fallen blocks of rock, abuts closely. The wall, however, descends about 25 feet to the 575-foot level of the cavern. Northward, a rather small passage was followed for about 400 feet at an altitude of 595 feet. It is a high-level escape route of stormwaters at or near the level of the dry-bed channel of Lost River. It's floor and ceiling are rather irregular and in places the passage itself is rather constricted. Everywhere the route indicates the northward passage of muddy stormwaters. At 380 feet from the entrance the passage was only 3 feet high and 5 feet wide and was not followed farther.

Southward 75 to 100 feet from the entrance the 575 foot level of the cavern is reached. A stream channel with a mud wall on one side and the massive rock of the cavern on the other side terminates in muddy pits and against the blocks of rock composing the platform of the entrance room. This channel is continuous with the 575-foot level throughout with few interruptions. The stormwaters when present apparently enter the pits and in part go around the east wall of the entrance room and thence northward down the high-level passage. The 575-foot level extends south-southeast for a distance of 575 feet, where it turns northeastward. See traverse map, figure 1. A little water trickles along

on the narrow floor of the mud channel. This channel is 5 to 10 feet in depth and the cavern ceiling is 5 to 15 feet above its floor. The cavern itself is 12 to 25 feet in width. A small trickle of water enters from the east (left side) at 320 feet from the entrance, and another at about 400 feet, and still another at about 540 feet. Water drips noisily from a hole in the roof at 525 feet and a shallow plunge pool is present in the mud floor here.

After turning northeastward the narrow bottom of the mud channel is directed into a small hole in the floor at a distance of 675 feet from the cavern entrance. The northeastward stretch of the mud-floored channel shows little change. It turns slightly here and there and the mud wall is first on one side of the cavern and then on the other. The cavern ceiling is slightly uneven in an undulating manner, but is not rough. It is usually 6 to 9 feet above the mud floor of the channel The cavern sides are 12 to 20 feet apart, averging about 15 feet. The rock everywhere is covered with mud. The mud surface is minutely uneven, and locally resembles berries. An occasional stalactite is present here and there, also well covered with mud. Nowhere does rock show on the floor of the cavern.

At 1,270 feet from the entrance the cavern is so filled with mud that it is necessary to crawl for a distance of about 120 feet. Here the roof is 2 to 3 feet above the shallow mud channel of the floor. At 1,485 feet from the entrance the mud channel becomes double, one channel coming from the left (nearly due east) and the other coming from the right (southeast). The cavern widens into a room about 60 feet across. The channel on the right comes out of broken-down rock next to the right wall of the cavern. It did not appear big enough to enter, and no attempt was made to follow it. The channel on the left comes through broken-down rock, and a ridge of mud rises sharply between the two channels. The left channel was followed by going over mud-coated rock slabs adjacent to its right wall, and in about 75 feet the mud channel was again entered.

The mud channel continues northeasterly to a large room 1,835 feet from the entrance to the cavern. The ceiling of the room is 15 to 20 feet above the floor, and on the northwest the mud floor rises to the ceiling in a distance of about 40 feet. It seems probable that the main cavern once extended in that direction, but has been completely sealed off by accumulated muddy silts. A hole above allows water to fall into the room, and a ditch-like channel leads from the plunge basin southeasterly under the rock ceiling to a lower level. Apparently surface waters enter here during rains. At the southeast end of the big room, close under the ceiling, ragged holes in the rock floor lead to the low-level route of the cavern developed at an altitude of about 560 feet. These holes are 1,905 feet from the entrance of the cavern. It is quite apparent that stormwaters fill the lower route to its full capacity and then rise through the holes and flood the next level above.

The 560-foot level is at or near the permanent watertable of the region. It extends in a northwest-southeast direction. It is developed

in a very cherty phase of the St. Louis limestone and presents a rough and ragged appearance as a cavern channel. Rough cherty masses extend from the walls and ceilings, and the floor is partly covered with loose chert masses. Excavated holes in the floor add to the unevenness. The storm waters appear to pass through the cavern with great force in a northwest direction. The rugged route is 6 to 10 feet in height and 10 to 15 feet in width, with occasional wider places. A mud coating is present on the walls and ceiling, but the floor is relatively free from mud.

After descending through the ragged holes to the lower level, the passage was mapped northwest in a downstream direction. At a distance of 70 feet, a pool of clear water was encountered measuring 5 feet or more in depth with a ceiling only 2½ to 3 feet above the water. The passage turns slightly to the right and could be observed for only 30-40 feet beyond the end of the traverse. Upstream from the entrance holes the low-level cavern route was mapped for a distance of 550 feet from the entrance holes and 2,425 feet from the entrance to the cavern, where the traverse was stopped by a pool of water occupying a plunge basin beneath a waterfall ledge 3 feet above water level. A blind fish fully 5 inches in length was observed in the clear water of the pool. At 320 feet from the entrance holes, a lead goes off to the right (south-southwest). It is smaller than the main channel and is nearly filled with loose rock. Apparently stormwaters from the main channel feed into it. Ripple marks and etched rock clearly indicate water passage into it. It's floor 75 feet back from the main channel is considerably higher than that of the main channel. It is possible that the waters which follow this lead are fed into the 575-foot level in the room 1,485 feet from the sinkhole entrance to the cavern system.

Stormwater Drainage in Hudelson Cavern

The Hudelson cavern was entered and explored in the hope that it would lead to the low-water route of the main channel of underground Lost River. It seems quite probable that the explored part of the cavern is south of the main route. The 560-foot level, however, very probably leads directly into it. Swallow-holes in the dry-bed just to the north of the cavern are directed southward from the dry-bed, evidently leading into the underground route of Lost River somewhere between the mapped part of the cavern and the dry-bed channel. The cavern was again entered during a dry period in June, 1931, and a further attempt was made to trace the low-level route to the main course of underground Lost River. The route was extended for 100 feet or more by wading through water varying from knee to waist deep, avoiding the deeper places. Numerous white blind crawfish were noted and two blind fish up to four inches in length were observed in the clear water. The walls of the cavern are very rugged with chert masses, and the ceiling is irregular in height, varying from a few inches up to 10 feet above the water. At the end of the traverse the ceiling came down to within a few inches of the water, but beyond it could

be seen to rise again over rather deep water. The total traverse of the cavern system aggregated 3,200 feet.

The stormwaters which course through the triple-floored Hudleson cavern rise as high as 605 feet in altitude, as much as 45 feet above the low-water route at or near the watertable of the region. There are two possible sources of these stormwaters. It is possible for them to come from the surface streams which descend from the Chester escarpment south and southeast of the cavern, where several ravines send their rain-born waters into individual swallow-holes on reaching the sinkhole plain. These waters undoubtedly reach into the underground system of Lost River, though their actual routes are unknown. The second possible source of the muddy stormwaters is from the dry-bed channel of Lost River entering through the numerous Turner swallow-holes near the center of the NE¼ of sec. 13, about one mile east of the cavern entrance. See in-set map, figure 1. It appears quite probable that this is their source. The traverse of the cavern system ended at the up-stream end 1,400 feet nearly due east of the cavern entrance and directly toward the area of the dry-bed swallow-holes. It is regrettable that the traverse was not continued in this direction in spite of the deep pool of water which discouraged further exploration. This source is highly adequate, and the behavior of the waters flowing through the cavern system seems to indicate such a source.

It is apparent that the stormwaters course through the cavern with considerable velocity during an early period of flow, but later the waters become stagnated or flow very slowly. The high velocity period is associated with a filling period when large quantities of water enter the Turner swallow-holes from the dry-bed. Later, the underground routes become filled with stormwaters and the velocity of flow is checked, chiefly because of the stormwaters entering the lower part of the system down-stream. These waters in their use of the down-stream part of the underground system partially block the waters in the up-stream part. Decreased volumes then enter through the swallow-holes in the upper part of the system, and the excess stormwaters descend down the dry-bed channel. The stagnated muddy waters deposit muds in the underground routes of the system, especially in the higher levels, such as the 575-foot level of the Hudelson cavern. The walls and ceilings become heavily coated with mud and dead-end channels become filled. These waters stand as high in the system as the flood waters in the dry-bed channel and they cannot be evacuated until the dry-bed is lowered or emptied. Following the cessation of flow in the dry-bed, the stormwaters in the subterranean system subside and eventually cease to flow. Only clear waters seeping into the system from groundwater sources then flow through the lowest routes, except for the constant passage of waters from the upper part of the system which is spring-fed.

Conclusion

It appears quite likely that the compound vertical components of a system like that of Hudelson cavern are a result of the development of

successive levels as the watertable is lowered, and that the older and higher levels are maintained and further developed by the inflooding waters from the surface. The upper levels are maintained as long as the underground tubes are not too much clogged by breakdowns in them, or as long as they are occupied by stormwaters passing through them. Later stages in their history are associated with incoming flood waters which do not flow freely because of occasional breakdowns in the passages which clog them. These stages are associated with accumulations of clays and silts brought in by the muddy waters which may fill the dead-end passages and largely eliminate them. Such clays are highly characteristic of dry caverns now above the reach of inflooding stormwaters and high above the watertable. New levels are initiated at or near the watertable by the normal phreatic waters along the permissive bedding planes and the joint system of the limestone. As such the initiated water passages are small and of little significance. When taken over by the high-pressure flood waters from the surface, they become enlarged and the selected routes of subterranean drainage are established from those more favorably located or which have more quickly become etched out and become subject to the inflooding of stormwaters gathered from surface areas. The caverns into which they develop are the result of subterranean drainage, not so much by the phreatic waters, but by the stormwaters directed into and through them.