

A Karst Valley in Western Monroe County, Indiana

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The name karst has been applied to regions which are underlain by limestone, and which possess a topography due to underground solution by meteoric waters and diversion of surface drainage through these underground channels. The term is taken from a plateau in Jugoslavia bordering the Adriatic Sea, upon which a vast number of solution features have been studied. This area is underlain principally by limestone beds of Mesozoic and Cenozoic age. The entire plateau possesses rather high relief, and has undergone considerable folding and faulting, which in itself can cause a region to have unique topography. Solutional activity in such an area can cause landforms to occur which may not necessarily be characteristic of karst in other regions possessing lower relief and structure.

The physiographic forms discussed in this presentation are typical of relatively flat limestone regions such as those found in the Mississippi valley.

A karst plain or sinkhole plain is a region underlain by limestone in which all the drainage is underground, and sinkholes form the principal relief, taking up much of the upland area. Seldom do any but large streams succeed in crossing karst plains without sinking underground.

A karst valley is a valley in which karst features have developed in a valley floor to such an extent that the stream no longer carries surface drainage except in periods of excessive rainfall. Only the valley floor exhibits karst features however; the slopes and uplands are usually capped by clastic sediments in which solution is of little importance.

As a stream erodes through clastics and uncovers a limestone bed, some of the water is diverted downward through the joint system of the limestone, and solution of the calcium carbonate starts. As the openings along the joints and bedding planes increase in size, they are capable of diverting more and more of the surface drainage into underground channels. When swallow-holes along the course of a stream are able to take the entire volume of runoff, the stream channel becomes a dry-bed, carrying only stormwaters. This condition is a common occurrence at the top of the upper Mississippian limestones, along the western edge of the outcrop of upper Mississippian rocks in Indiana and Kentucky. (Malott, 3).

It is the purpose of this paper to describe a karst valley located in western Monroe County, Indiana, about 7 miles southwest of Bloomington, Indiana (Fig. 1). This particular region has been referred to by Beede (1), who noted the case of subterranean piracy of the headwaters of Indian Creek by Richland and Clear Creeks.

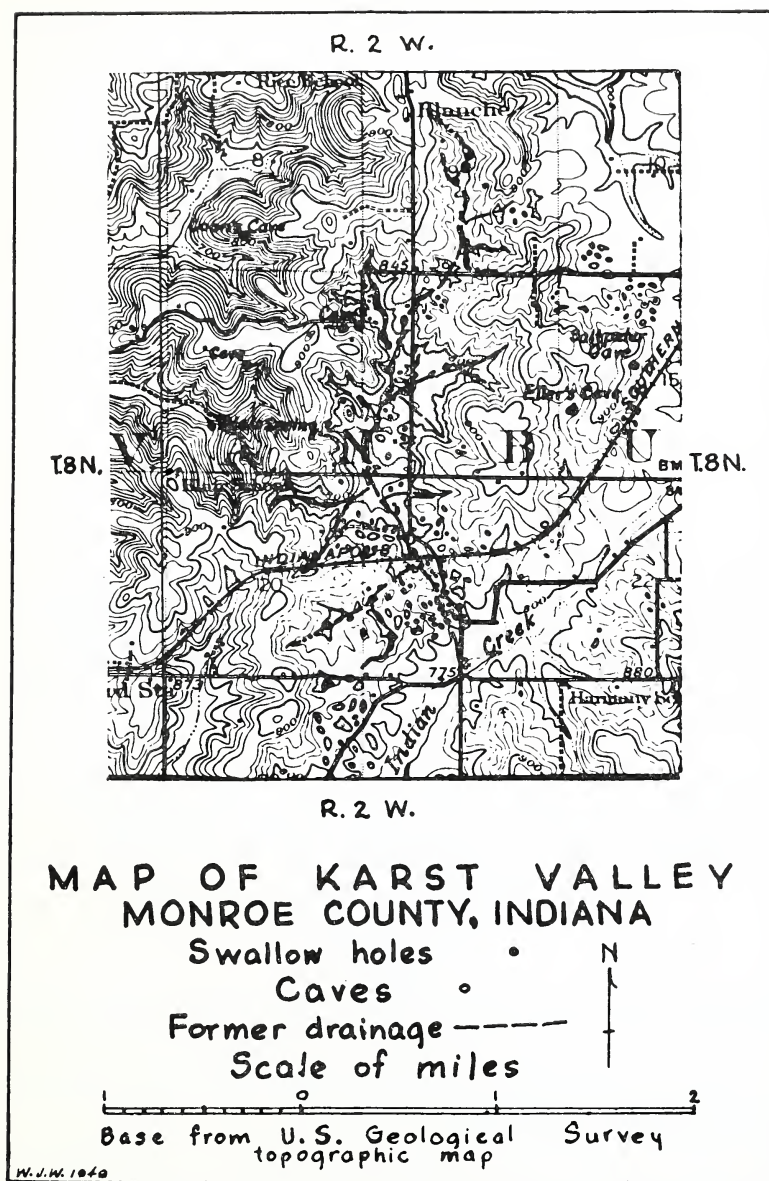


Fig. 1. Map of the karst valley south of Blanche, showing the probable restored drainage and with the major dry-beds and swallow-holes indicated. (Base from the U. S. Geological Survey topographic map of the Bloomington, Indiana quadrangle.)

In the stratigraphic setting of the area under discussion, the Ste. Genevieve formation, a dense, jointed limestone of middle Mississippian

age immediately underlies the mantle rock in the western part of the Mitchell Plain. The majority of the sinkholes in the bottom of the valley are found in this formation. Overlying it are the members of the lower part of the Chester series. The lowest of these is the Aux Vases sandstone, a bed about one foot thick here, which is seldom exposed. Above it is the Paoli limestone, a somewhat oolitic limestone about 15 to 20 feet thick. Karst features show extensive development in this limestone, and continue downward into the thicker Ste. Genevieve formation. The first of the Chester clastics of any thickness is the Mooretown sandstone and shale, which caps many of the lower hills. It is about 20 feet in thickness. Overlying the Mooretown sandstone and shale is a thin limestone generally about 15 feet in thickness called the Beaver Bend limestone. Occasionally a few sinkholes are found on its outcrop, but it is not sufficiently thick for extensive underground drainage to

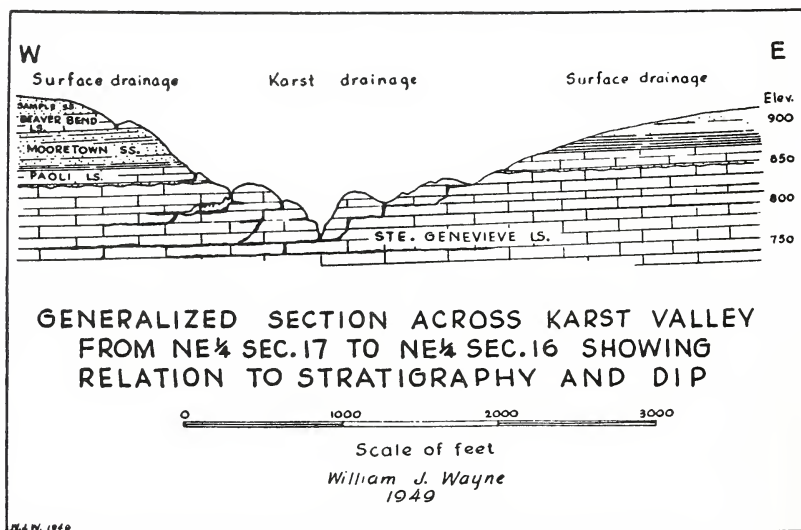


Figure 2. Generalized east-west section across the karst valley at a place about 1 mile south of Blanche, showing relationships of the karsted area to the underlying rock and the regional dip.

develop. The Sample shale and sandstone, overlain by the Elwren sandstone caps the higher hills of the region. In only a few places can the Reelsville limestone be found between the two, since in many places it has been removed completely by solution. Figure 2 shows the relationships of the karst valley to its stratigraphic setting.

Much of the former headwater region of Indian Creek, in T. 8 N., R. 2 W. is now drained by subterranean streams rather than by surface runoff. The Mitchell Plain west of Bloomington is pock-marked by numerous sinkholes. Some of the water entering the ground in this area emerges in springs west of the Chester escarpment. One of the largest of these is Blair Spring, northeast of Blair School, in the S. W. quarter of sec. 17, T. 8 N., R. 2 W. When the streams flowing across the clastic rocks of the upland encounter the jointed dense limestone beds that characterize the karst plain they become pirated by subterranean drainage. As more and more of the drainage goes underground, the stream ceases to carry any water over its course except during storms. Such is the case of the small southward tributary of Indian Creek heading at Blanche.

The valley south of Blanche was developed along the strike of the westward dipping rocks of the Crawford Upland, probably sometime previous to the late Tertiary peneplanation of the region, and was eroded downward until it reached the limestones of the lower Chester and upper Meremec series. The downcutting may have reached the soluble limestone prior to peneplanation or afterward, but shortly after the region was rejuvenated, the runoff waters from the surrounding hillsides began to disappear into swallow-holes along the stream channel until the entire normal volume of the stream had been pirated by subterranean channels. As the disruption of the normal surface drainage began near where the valley enters that of Indian Creek, the solution action has had more time to operate there than further upstream, and the former stream channel has been entirely obliterated. By careful examination of topographic maps, the former surface drainage system of the area can be approximated (Malott, 2, pp. 199-200).

The lower part of the karst valley in the vicinity of the Illinois Central Railroad is about one-half mile wide, and the floor of the valley appears nearly level. It is pock-marked with sinkholes, many of them compound. Sinkholes of both simple solution and collapse types are present, although the latter are few in number. Frequently sinkhole outlets are so tightly silted shut that the depressions hold water.

Upstream a ridge crosses the valley transversely in the S. half of N. W. quarter of sec 16, T. 8 N., R. 2 W. This ridge appears to have been a portion of the valley floor at the time of sinking, but undoubtedly has been lowered somewhat by solution. On the north side of this ridge there are several large swallow-holes, two of which have visible openings in the bottom. One of these is a deep conical depression with a hole in the bottom into which stormwaters pour. A raft of tree limbs usually fills the bottom of the pit. The opening apparently takes a great volume of water quite rapidly, as no flooding of the pit has been observed due to choking of the subterranean channels.

In the blind valley which ends at this point, the flood waters course over a dry bed incised 10 to 15 feet below the surrounding valley. There are several small swallow-holes present along the dry bed, each of which takes up some of the stormwaters. During a heavy rain, muddy water as much as three feet deep rushes along the stream. Each opening takes some of the water, but most of it pours into the large terminal swallow-hole. A few hours following a rain, the dry bed is completely drained.

The portion of the valley in sec. 9, T. 8 N., R. 2 W. is completely dismembered, but it has been so recently karsted that the former channel can be followed along a series of sinkholes. There is little surface drainage, and no dry bed is present, but a long shallow depression with a swampy area in the middle takes the water coming off the gullies on the sides of the valley. A large swallow-hole a short distance north of a gravel road along the south edge of sec. 9 intercepts the drainage down two westward flowing ravines before it reaches the center of the valley. A similar sinkhole, although frequently much smaller, is found at the end of every gully running down the side of the valley.

The area in the center of the section one-half mile southeast of Blanche shows the last stages of recognizable surface drainage before complete disappearance of the former channel. The valley is a chain of funnel-shaped sinkholes strung together by a shallow dry bed that is completely overgrown with vegetation. A small dry bed coming from the west at this place loses itself completely into a shallow swallow-hole just before reaching the center of the karsted valley.

A small gully heading at Blanche tumbles as an intermittent stream over sandstone and shale until entering the limestone outcrop. About 500 yards below its head the creek enters a large flat-bottomed sinkhole into which it disappears. Over the alluviated floor of the sink at least five deep conical holes swallow stormwaters. The floor of the sink is littered with rafted debris and a mat of tree branches covers each of the holes.

Surface drainage on the sides of the karsted valley is quite evident in many places, as gullying has occurred since the land was cleared. Badland topography has not formed to the extent found farther westward, but at several places gullies 3 to 4 feet deep expose weathered shale.

It would be interesting to explore the subterranean route followed by the waters diverted downward into enlarged passages along the joints and bedding planes of the limestone. Several openings are present in the valley large enough to admit a man, but only one of these has been entered and explored by the writer. This one is a small cavern in the N. E. quarter of sec. 17, T. 8 N., R. 2 W. Other holes that appear to be possible entrances to a portion of the hidden cavern system are one in the bottom of the main swallow-hole in the N. W. quarter of sec. 16, and a nearly vertical tubular channel about two feet in diameter in a small sinkhole southwest of Blanche, in the N. W. of the S. E. quarter of sec. 9.

The entrance of the cave which was in part explored is in an insignificant looking sinkhole perched on the side of the valley. A vertical hole in the ground about 10 feet deep enters on a narrow leaf-strewn platform. This platform is about 10 feet above the floor of a cavernous room. The size of this chamber, as well as the opening to the surface appear to be due in great part to collapse and stoping. The floor of the room is partially alluviated, and during a storm carries the water from the surrounding sinkholes.

Two openings, both about 2 feet high and 6 to 8 feet wide lead out from the first room. One of these, toward the southeast, appeared to get smaller and was not followed. The other has a dry silt floor, and after about 50 feet opens into a cavern through which one can easily walk erect. Dripstone features in this portion of the cavern are quite abundant, and collapse is taking place along the cavern roof. Pebbles in several pools into which water drips are coated with calcium carbonate. A hole is present in the cave floor in which one can obtain a glimpse of a more active section of the cave.

The caverns which carry the underground streams at the present time are undoubtedly quite youthful. Only a few opportunities have presented themselves to view much of this cavern system. Those portions no longer used by the phreatic waters have begun to collapse, but beneath them are many tubes through which the unseen subterranean streams course.

This valley shows the first stages in the encroachment of a karst terrane upon a non-soluble upland. Above the limestone floor of the karsted valley, gullies tributary to the former drainage end in sinkholes. Many of the forms typical of a karst region are already well under way in their development. Erosion will eventually lower the divide on the eastern side of the valley, and the escarpment separating the two physiographic areas will be farther west.

Literature Cited

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