

## KARST WINDOWS

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WM. VON OSINSKI, Indiana University

Southern Indiana is indeed rich in the features of karst. The limestone belt of the St. Louis-St. Genevieve formations, extending in a general north-south direction in the middle southern part of the state, contains splendid examples of subsurface drainage in all stages of development. In the past few years there have appeared several articles on karst in the Proceedings of this Academy. The bulk of this work has been contributed by Dr. C. A. Malott of Indiana University or by students of his. It was at the suggestion of Dr. Malott that this author began his study of the problem herein presented. The writer here wishes to acknowledge his indebtedness to Dr. Malott for his kindly help and suggestions.

The writer believes that the feature to be described in this paper is more unusual in occurrence and more special in its development than the general run of karst features.

The most common of all surface features of the karst plain is the sinkhole depression. Sinkhole depressions mark the surface by the thousands. As depressions, they are all much alike but differ in size, in depth, and in certain other characteristics. It appears that the greater number by far are of solutional origin.

It is a well-known fact that water passes down through the soluble limestone into the underground conduits which have been dissolved out by the slightly acid ground waters percolating along joints and bedding planes. The water seeps downward and removes part of the country rock, and funnel-shaped basins are produced on the surface. The small ones are only a few feet or yards across and relatively deep, but once formed they are subjected to continued surface solution and become opened up to wide, saucer-like depressions.

Holes in the bottoms of the broad, saucer-shaped sink-holes are often so small or so masked by washed-in soil and debris that they are not noticeable to the observer at the surface. This type of sinkhole depression rarely or never reveals caverns or openings sufficiently large to permit entrance below.

Entrance to caverns is often gained through sinkholes which bear evidence of having been formed wholly or in part by collapse. Such sinkhole depressions occasionally open directly into a cavern, but as a rule they are either closed or have incidental openings among the collapse debris, through which the underlying cavern may be reached. Frequently such openings incline into the cavern at a fairly steep angle.

It might be well to bear in mind that only a small percentage of sinkhole depressions are in a position where they could have been formed by collapse. Most sinkholes are not in close proximity to underground

routes of consequence, and their drainage enters the major systems through tubes developed along joints and bedding planes. Thus the majority of sinkhole depressions do not have the opportunity to develop their drainage routes to proportions that permit collapse.

Sinkholes which happen to be developed above major underground routes or above caverns vacated by former underground streams are the most subject to collapse. Here surface solution is augmented by the falling-in of the weakened rock from below (see A, Fig. 1).

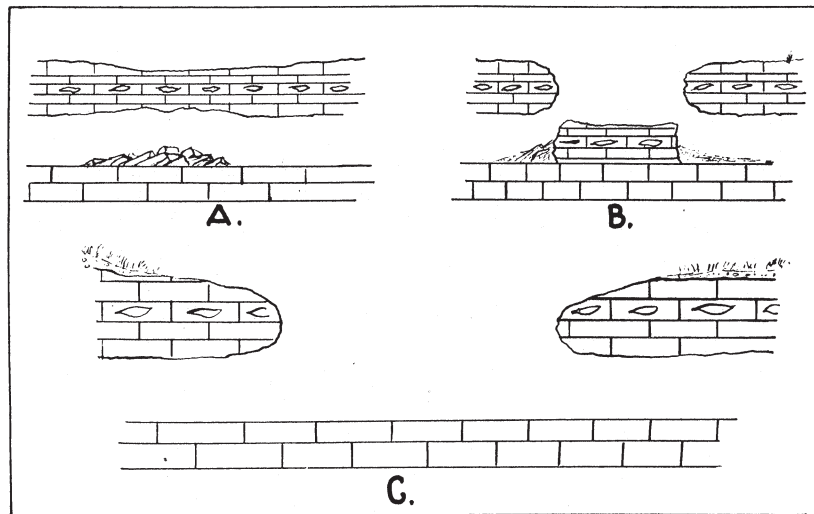


Fig. 1.

- A. Initial stage. Cross section parallel to flow of water.  
 B. Intermediate stage. Cross section showing collapse of roof rock.  
 C. Karst window. Feature with debris removed and opening widened by weathering and erosion.

Under certain conditions, a sinkhole depression formed largely by collapse may be greatly enlarged by the forces of weathering and erosion, until in time it may reach such proportions and such characteristics that the term *gulf* is used to designate the feature. Since karst gulfs are closely related to the type of feature described in this paper, it is necessary to call attention to their characteristics.

The rather large depressions known as gulfs in the Lost River region of southern Indiana appear to have had their beginnings in collapse depressions located over underground streams, and in their earlier stages were but little more than collapse sinkhole depressions. Through continued enlargement or growth, they developed such characteristics that the common term of sinkhole does not seem applicable to them. The term has been used for many years by the local residents of the Lost River region to designate a steep-walled depression possessing an appreciable alluviated floor in which the waters of a subterranean stream rise, and again enter the subsurface system. Malott used the term in

this technical sense in his recent paper on the Lost River region<sup>1</sup>, thus placing it in the karst nomenclature.

In speaking of gulfs in this same paper, Dr. Malott brings in another feature. The following quotation is taken from this work.

"The term [gulf] does not appear to have been applied to the unroofed section of an underground stream which flows out of an open cavern and across an open space and thence into an open cavern on the other side. No name appears to have been given to this latter feature, though it is a relatively common karst feature. I would suggest *karst fenster*, or *karst window*."

There seems to have been no one who has made use of this term since it was suggested, nor does there seem to be any other term in the literature for this feature. For this reason, the present writer desires to enlarge somewhat upon the brief definition given in the Lost River paper, in the hope that it may find its way into general usage.

A karst window, in the sense that it was originally proposed and in the sense that the present writer intends, applies to the surface depression made where a brief section of a cavern, preferably with a stream, has been unroofed.

The original definition stated that the waters of the underground stream leave an open cavern, flow at the surface, and again enter the subterranean passages through an open cavern. However, Dr. Malott and the writer, through personal communication have agreed that the definition should be altered so as not to restrict the term to only those features possessing open caverns. There seems to be no valid reason for making a distinction simply because in one case the stream emerges into the open and then disappears through open caverns, while on the other hand the openings are blocked or partly blocked by rubble. This very minor change in nowise detracts from the fact that this feature is a distinct physiographic form and as such is worthy of a name.

It does not appear necessary to give definite descriptive limits to the karst window form. It is rather a type of karst feature. It is a short exposure of an underground stream or stream-way in a more or less steep-sided depression. It is usually a little longer than wide. If such a depression has abrupt sides and a flat alluvial floor, it may be called a gulf. A gulf is then a karst window in an advanced stage of development, and thus falls in with this type of karst feature. The gulf itself may be included as one of the varieties of karst windows.

But, while the gulf may be a late stage of karst window, it does not necessarily hold that every karst window will become a gulf. Extensive unroofing along the route of an underground stream will destroy the karst window (and the gulf as well) as a distinct physiographic form and initiate the valley form in its stead.

Intermittent collapse along a shallow cavern route may result in tunnel-sections which occasionally produce the topographic form known as the natural bridge. This is beautifully illustrated by the Lytton's Natural Bridges near McCormick's Creek State Park, where two closely-

<sup>1</sup> Malott, C. A. Lost River at Wesley Chapel Gulf, Orange County, Indiana. Proc. Ind. Acad. Sci. 41:285-316. 1931.

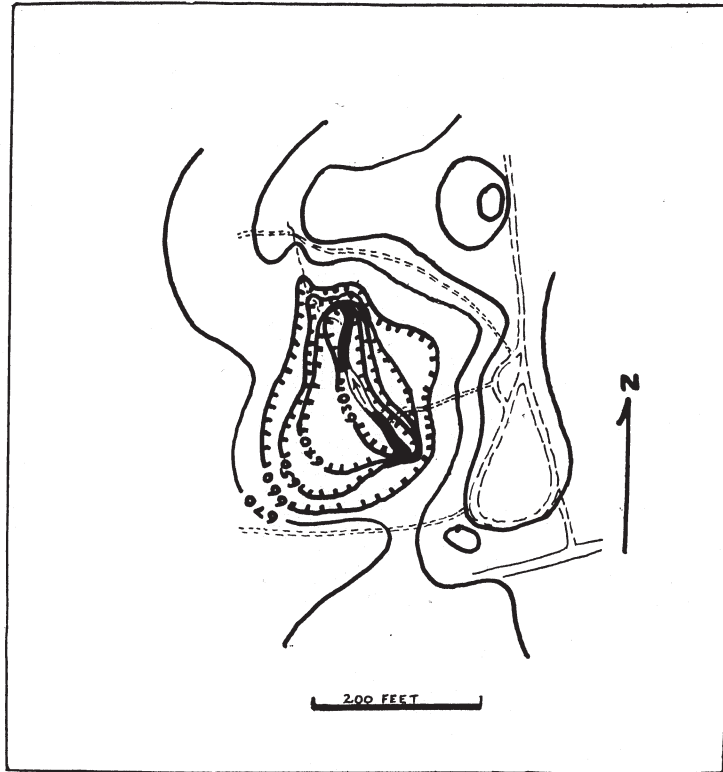


Fig. 2. Topographic map of Twin Caves at Spring Mill State Park, Mitchell, Indiana. This is the type karst window.

spaced karst windows are responsible for the intervening bridges. In the final stage, the bridge and tunnel form give way to the valley form.<sup>2</sup>

From the above data the present writer derives the following definition: A *karst window* is a negative feature, typically a steep-walled, V-shaped depression, with the waters of an underground stream emerging at one end, flowing over the floor, and disappearing into the interrupted cavern system at the other end. It does not seem appropriate to call a depression with such characteristics by the general name of sinkhole. To strengthen the statement that the karst window is a distinct form, a partial list of such features to be found in the cavern districts of Indiana is here set forth:

The two karst windows at Lytton's Natural Bridges; Patten Spring and Harden Spring in Sinking Creek karst valley, north of Hardinsburg, Washington County<sup>3</sup>; at least four karst windows in the region of the headwaters of Stamper's Creek, east of Millersburg in Orange County; and Blue Spring, Owen County, sec. 14, T. 9 N., R. 3 W. (about five miles west of Ellettsville).

<sup>3</sup> Bates, Robt. E. Underground Features of Sinking Creek, Washington County, Indiana. Proc. Ind. Acad. Sci. 41:263-268. 1932.

<sup>2</sup> Addington, Arch. Lytton's Natural Bridges and Closely Associated Phenomena, Eastern Owen County, Indiana. Proc. Ind. Acad. Sci. 37:143-151. 1927.

Twin caves at Spring Mill State Park is the classic example of the karst window. Bronson Cave, which is about 300 yards from Twin Caves, is another excellent example of a karst window. Twin Caves was formed by the collapse of the roof rock of the underground stream now exposed. The stream is exposed for about 225 feet and flows in a northerly direction. The depression is about 50 feet deep. In places the sides slope back rather gently into the upland. The walls about the cavern openings, particularly the northern one, are perpendicular. In all likelihood, all of the collapsed roof rock has been removed. Such unconsumed rock as may be at the bottom of the depression has fallen from the walls more recently. There is no well-developed alluvial floor (see Fig. 2).

Peacher's Cave, three and one-half miles southwest of Orleans, Orange County, is typical of the intermediate stage (see B, Fig. 1).

In conclusion, the author wishes to point out the inadequacy of the term *sinkhole* in form depiction. It may be a mere karst hole or variety of depression, leaving little idea of size, shape, or method of development. It is hoped that the term *karst window*, as described in this paper, will serve to give a more definite conception of the form, the characteristics and development of a karst feature which is too special to be included under the term *sinkhole*.