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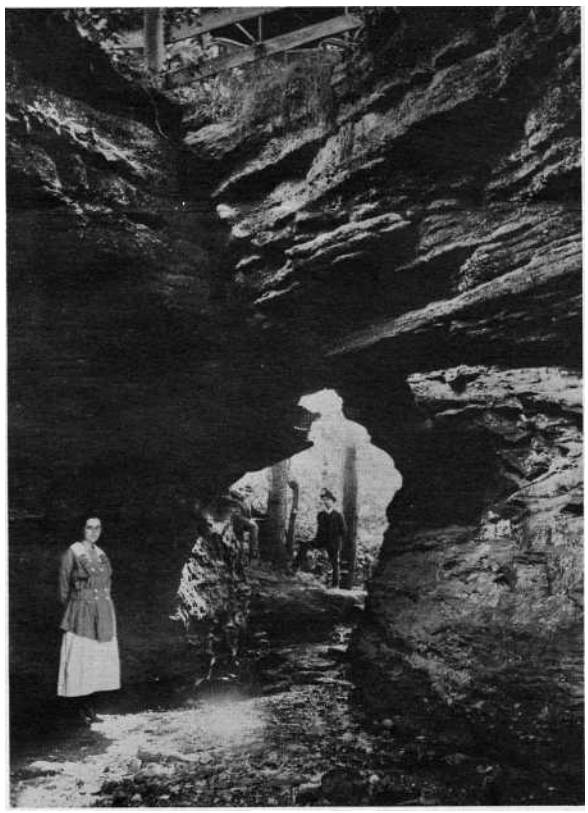
Ohio Geology Newsletter

Division of Geological Survey

NATURAL BRIDGES IN OHIO

by Michael C. Hansen

Although in a practical sense they are commonly pathways to nowhere, natural rock bridges and arches are among the most fascinating geological features to the public and stir no small interest among geologists as well. Ohio can't brag of natural bridges that rival in size the famous one in Virginia or those in Utah and Kentucky, but there are more than three dozen in the state that meet the criteria for a natural bridge — a narrow, continuous archway of rock commonly spanning a ravine or valley. Some of the Ohio bridges were popular in the last century as picnic sites and several were touted as a local "claim to fame." In the last few decades, however, most natural bridges in the state have fallen into relative obscurity, and there appears to be a general unawareness, even locally, among most people about the existence of these features. Several bridges have been "rediscovered" recently through perusal of old geologic reports and "photo books" from early in the century, and a few others have been discovered that apparently were never recorded in a formal way. Thus the Ohio total, which was thought to be about a dozen a decade ago, is now more than three times that number.



Natural bridge in the Sharon sandstone, of Pennsylvanian age, beneath Cat's Den Road near South Russell, Geauga County. Photo courtesy of the Ohio Historical Society.

Small natural bridge in sandstone at Raven Rock, Scioto County. From C. S. Van Tassel, 1900, The book of Ohio. Photo courtesy of the Ohio Historical Society.

FORMATION OF NATURAL BRIDGES

Natural bridges form in a variety of ways. Some are of complex and sometimes debatable origin, but all are the product of erosion and weathering of resistant rocks, such as sandstone or limestone, that possess layers exhibiting differential resistance to these degratory processes. Commonly, differential cementation of the rock grains causes some layers to be hard and resistant to chemical and mechanical weathering, whereas other, poorly cemented layers are easily weathered and eroded. If the resistant layer is above a softer layer of rock it tends to form a cap that protects the underlying softer layer. However, concentration of moisture at a particular area of softer rock, generally where a vertical joint penetrates, accelerates weathering and erosion in that specific area, thus allowing the softer rock to be eroded and to undercut the resistant capping layer.

Moisture may be in the form of a flowing stream,

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in which case the term "bridge" may be most appropriate, or may be in the form of percolation of surface waters. The term "arch" has been used to refer to a span that has no natural stream flowing beneath it.

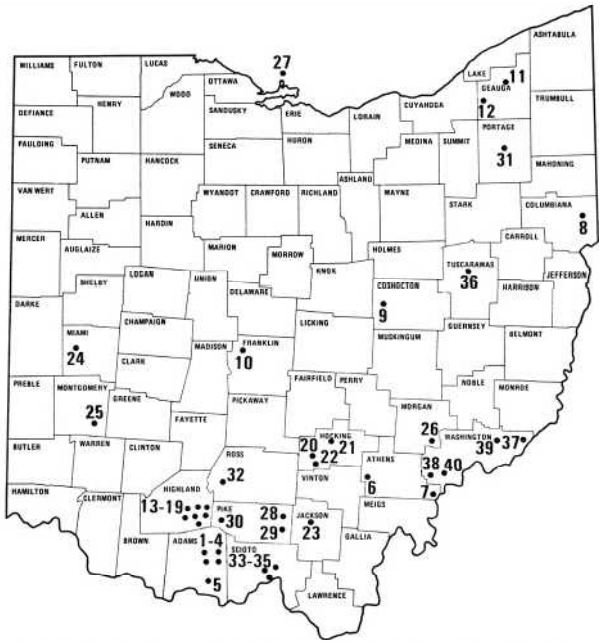
Many natural bridges formed in sandstone represent rock-shelter caves in which part of the roof has collapsed, either through breaking away of large blocks of rock or through the slower but just as effective process of grain-by-grain spalling; only a narrow portion of the roof is left intact and forms a bridge. The roof collapse generally takes place in a section that is bounded by joints. It is also probable that water from a surface stream that cascades over the lip of a sandstone cliff is captured upstream in joints and that much flow is within the rock rather than over its surface. Eventually these joints are widened by the flowing water to such a degree that they cut below the uppermost layer of rock and form a natural bridge.

Natural bridges formed in carbonate rocks, such as limestone and dolomite, are also a result of the chemical and mechanical weathering of an underlying, less resistant layer of rock. Commonly, the opening beneath the bridge has been widened by solution weathering from water percolating from the surface along a vertical joint. Many such bridges formed in limestone or dolomite are on narrow ridges. The passage beneath the bridge span is, in effect, a segment of a limestone cavern, formed by solution along a joint, that has been exposed at either end as the ridge of carbonate rock has been narrowed by erosion. Other small bridges or arches are associated with sinkholes. Sea arches, such as Needle's Eye on Gibraltar Island in western Lake Erie, have been created by wave action on limestone cliffs with zones of differential hardness.

Another type of natural bridge is formed when a large, detached block of rock falls or tilts so that it bridges the gap between two other blocks of rock. Although features formed in this way are indeed natural bridges, they are somewhat on the periphery of most strict concepts of natural bridges because they are the result of movement of rocks.

The processes of erosion and weathering are ongoing and continual; natural bridges thus are ephemeral features that represent only one phase in the geomorphic process of landscape development. Eventually, perhaps after only a few hundreds or thousands of years, a span will collapse and leave only a narrow chasm or gap.

Although some reports mention wind as a contributing agent of erosion in the formation of natural bridges in Ohio, it is highly unlikely that wind has played a significant, or even any, role in most natural bridge development. Most bridges in Ohio are in protected valleys where high or continous winds are rare. Thus, running water, mechanical weathering, chemical solution, and the force of gravity are the primary factors involved in the formation of most natural bridges and many other scenic features in the state.



Approximate locations of natural bridges in Ohio. Numbers correspond to those in the accompanying list.

OHIO NATURAL BRIDGES

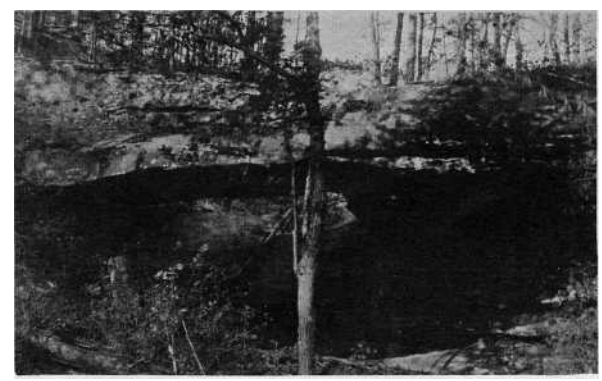
	County	Name	Size'
1	Adams	River Bend Bridge	small
2	Adams	Roadside Arch	small
3	Adams	Scioto Brush Creek Bridge	small
4	Adams	Tiffin Bridge	small
5	Adams	LuPaul Bridge	small
6	Athens	Mineral Rock Bridge	medium
7	Athens	Mustapha Island Bridge	medium
8	Columbiana	Beaver Creek Bridge	small
9	Coshocton	Woodbury Wildlife Area Bridge	small
10	Franklin	Columbus Bridge	small
11	Geauga	Bass Lake Road Bridge	small
12	Geauga	Cat's Den Bridge	medium
13	Highland	Keyhole Bridge (Fort Hill State Memorial)	medium
14	Highland	Baker Fork Bridge (Fort Hill State Memorial)	medium
15	Highland	unnamed (Fort Hill State Memorial)	small
16	Highland	unnamed (Fort Hill State Memorial)	small
17	Highland	unnamed (Fort Hill State Memorial)	small
18	Highland	Miller Nature Sanctuary Bridge	medium
19	Highland	Miller Nature Sanctuary Arch	small
20	Hocking	Conkles Hollow Arch	small
21	Hocking	Rock Bridge	large
22	Hocking	Chapel Ridge Bridge	small
23	Jackson	Lake Katherine Bridge	small
24	Miami	Greenville Falls Bridge	medium
25	Montgomery	David Church Bridge	small
26	Morgan	Lucas Run Bridge	small
27	Ottawa	Needle's Eye Arch	small
28	Pike	Jackson Bridge	medium
29	Pike	Chimney Rocks Arch	small
30	Pike	Lion's Den Bridge	small
31	Portage	Camp Christopher Bridge	small
32	Ross	Trimmer's Bridge	medium
33	Scioto	Raven Rock Bridge	small
34	Scioto	Raven Rock Arch No. 1	small
35	Scioto	Raven Rock Arch No. 2	small
36	Tuscarawas	Devil's Den Bridge	small
37	Washington	Independence (Irish Run) Bridge	large
38	Washington	Ladd Bridge	large
39	Washington	Liberty Bridge	small
40	Washington	Little Bridge	medium

'Size: small, <25 ft; medium, 25-50 ft; large, > 50 ft .

DISTRIBUTION OF NATURAL BRIDGES IN OHIO

At least 40 natural bridges have been reported in Ohio from various sources, although some may no longer exist and a few reports are unchecked and perhaps dubious. There are undoubtedly other unreported bridges, especially small ones. Most of the bridges in the state are located in southeastern Ohio in sandstone of Mississippian, Pennsylvanian, and Permian ages. Those bridges reported from northeastern Ohio are in rocks of Pennsylvanian age. Thirteen bridges in southwestern Ohio are in carbonate rocks of Silurian age; one bridge in central Ohio is in Devonian limestone; and one bridge in western Ohio (thought to now be destroyed) was in firmly cemented glacial sand and gravel. A small bridge in Spring Grove Cemetery in Cincinnati, pictured as a natural bridge in C. S. Van Tassel's *Book of Ohio, is* not of natural origin according to Survey geologist Scott Brockman, who recently examined the structure. The apparent absence or scarcity of natural bridges in western and northwestern Ohio (except for the Erie islands) is probably due to the lack of relief of the landscape and a consequent paucity of bedrock exposures.

It is probable that all of the large and spectacular natural bridges in the state have been noted on inventories of such features. Small bridges, however, seem to have "fallen through the cracks" simply because most people are unaware that these structures are of any particular interest to anyone. The thrill of discovery can be exciting and leave one with a satisfied feeling of having contributed to the knowledge of the state's geological features. I recall the experience a decade ago of walking up a small valley in Geauga County in order to map outcrops of Sharon sandstone and encountering a delightful little natural bridge, developed in the Sharon,



Lucas Run bridge formed in sandstone, of Pennsylvanian age, in Morgan County. Photo courtesy of the Ohio Historical Society.

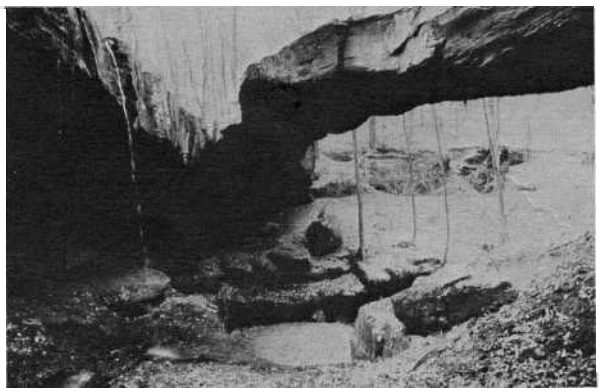
that spanned a valley only a few feet in width. Much to my surprise at the time, this bridge (Bass Lake Road Bridge) had not been previously recorded in the literature. The bridge was known to local residents, but its size was such that it had never been a tourist attraction or even gained any local fame.

A similar "discovery" occurred in 1985 when a color slide was submitted by Sally J. Lewis for the Ohio Geology Slide Contest. The slide did not win an award but it did depict a small, unrecorded natural bridge (LuPaul Bridge) developed in carbonate rocks of Silurian age near Blue Creek in Adams County. Although this is not a spectacular span in terms of size, the record of its existence is important in terms of the inventory of natural features of the state. Those individuals who regularly walk the hills and valleys of the state should keep in mind that many geologic features that they note may not be well known to the scientific community. Such reports are always welcomed by the Survey.

SELECTED OHIO NATURAL BRIDGES

Rock Bridge

The largest and perhaps best known natural bridge in the state is Rock Bridge, near the town of Rockbridge, in Hocking



View of Rock Bridge, in Hocking County, from below and within the rock-shelter cave. The space between the ceiling of the rock-shelter cave, to the left, and the bridge, to the right, is an area where ceiling blocks have collapsed along joint planes. The ceiling and bridge represent a well-cemented, resistant zone in the Black Hand Sandstone, of Mississippian age. Photo by Preston Fettrow.

County. The bridge is developed in the thick Mississippian-age Black Hand Sandstone, which is a resistant, cliff-forming unit in the region. Numerous rock-shelter caves are developed in the area and Rock Bridge was once an undistinguished member of this group. The well-cemented, resistant upper zone of the Black Hand Sandstone forms the roof of these shallow caves, whereas the poorly cemented middle layer of this unit tends to weather much faster, forming a shallow recess.

The distinguishing aspect of the rock-shelter cave at Rock Bridge is the partial collapse of a portion of the roof, which left a narrow section of the roof spanning the valley as a natural bridge. The roof collapse took place along two converging joints which formed the boundaries of the fallen roof block.

The gently arched span is about 100 feet long and stands about 40 feet above the valley floor. The bridge is 20 feet wide at its widest point and narrows to 4½ feet. The thickness of the bridge is about 5 feet.

Rock Bridge has long been known and was a favorite spot for picnicking, especially during the last century, when canal boats plied the nearby Hocking Valley Canal, and later when the Columbus, Hocking Valley, and Toledo Railroad was an active line in the valley. Apparently, the bridge was never a commercial venture and in recent years it has become relatively obscure. Indeed, some residents of the town of Rockbridge, a nearby community that derives its name from the natural feature, have never visited the bridge and are not sure of its precise location. In 1978 the Division of Natural Areas and Preserves of the Ohio Department of Natural Resources acquired the natural bridge and surrounding property as a state nature preserve. The preserve is open year-round from dawn to dusk and is located on the east side of U.S. Route 33 on Good Hope Township Road 503 (Dalton Road).

Ladd Bridge

Another impressive natural bridge, known as Ladd Bridge, is located in Washington County near Frost. The size of this massive bridge rivals Rock Bridge in Hocking County and it appears to have developed in similar fashion, either by partial collapse of the roof of a rock-shelter cave or by slow widening of the cross joint behind the span. The massive sandstone that forms the bridge is of Pennsylvanian age. The bridge has been poorly known in recent years, but a few decades ago it was a minor tourist attraction, as is attested by a weathered barnside sign along U.S. Route 33 south of Guysville in Athens County inviting travellers to see the natural bridge. Although the bridge is under the private ownership of the Ladd family, it was dedicated in 1984 as the Ladd Bridge Nature Preserve, and can be visited by permit obtained from the Division of Natural Areas and Preserves.

David Church Bridge

Perhaps one of the most unusual bridges in Ohio was located along a small unnamed stream south of Kettering, near Dayton in Montgomery County, and mile south of David Church. This bridge was illustrated by August F. Foerste, Dayton high school teacher and renowned Ohio

Natural bridge developed in glacial sand and gravel near David Church, south of Kettering, Montgomery County. This bridge, illustrated by A. F. Foerste in 1915 in his book Geology of the vicinity of Dayton, is now buried beneath fill.

geologist and paleontologist, in his 1915 book, Geology *of* the vicinity *of* Dayton. Foerste gave only a brief description and explanation of the origin of the bridge, but his photograph shows a small bridge with an estimated span of 10 feet and a height of 6 feet. What is particularly unusual about this small bridge is that it is constructed of coarse glacial sand and gravel that has been secondarily cemented in layers that are resistant to erosion. Recently, Timothy A. Snyder of the Division of Natural Areas and Preserves visited the site of David Church Bridge and found that the small valley in which it was located had been filled in during development of the area. It is unknown if this bridge still survives buried beneath fill, but certainly such weakly cemented glacial materials would not resist the forces of weathering and gravity for an extended period of time.

Fort Hill bridges

Fort Hill State Memorial, an area encompassing an Indian earthwork in Highland County and administered by the Ohio Historical Society, has five natural bridges or arches developed in carbonate rock of Silurian age. One of these, known as Keyhole Bridge, consists of a narrow, slit-like opening beneath the span. This enlargement is along a readily visible vertical joint. Baker Fork Bridge is the largest of the five in the area and has a relatively symmetrical, arch-shaped passage beneath it. The three additional bridges are small and comparatively unspectacular.

The Fort Hill bridges have not been studied in detail and

Natural bridge, known as Baker Fork Bridge, formed in carbonate rocks of Silurian age at Fort Hill State Memorial, Highland County. This bridge is the largest of five bridges at Fort Hill.

their precise origins are somewhat speculative until such studies are undertaken. However, it is probable that joint-controlled solution weathering of a less resistant lower layer of carbonate rock created the passageway for the bridge. It is possible that the passageways beneath the bridges represent former solution caves that have been exposed at either end by erosion. Fort Hill is open to the public and several of the bridges are readily visible on the hiking trails that traverse the area.

SUMMARY

Of the 40 natural bridges currently identified in the state, 14 are on state-owned or state-administered land. Five of these bridges are at Fort Hill State Memorial. Rock Bridge (Hocking County), Miller Nature Sanctuary Bridge and Arch (Highland County), Lake Katherine Bridge (Jackson County), and Ladd Bridge (Washington County) are state nature preserves. Woodbury Wildlife Area Bridge (Coshocton County), Needles Eye Arch (Lake Erie), and Conkle's Hollow Arch (Hocking County) are on state property. Independence (Irish Run) Natural Bridge (Washington County) is on Wayne National Forest property. The remainder of the bridges are on private property; although many landowners will grant permission to visit the feature, the precise locations are not generally published in order to avoid continual irritation to the landowner. Mustapha Island Bridge, although apparently on private property, is located only a few yards off the pavement on Ohio Route 124 in Athens County just south of the Athens-Washington County line.

Mustapha Island Bridge, along Ohio Route 124, in Athens County. This span is formed in sandstone of Permian age.

The Division of Natural Areas and Preserves of the Ohio Department of Natural Resources maintains a formal list of natural rock bridges (as well as other natural features in the state) and the Division of Geological Survey maintains an informal record of these features. Information on additional natural bridges in the state would be welcomed by either agency.

ACKNOWLEDGMENTS

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FURTHER READING

Goodwin, 5. W., and Williams, Jan, eds., 1987, *Ohio's natural areas and preserves—a directory*: Ohio Department of Natural Resources, Division of Natural Areas and Preserves, 182 p.

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