

GUIDEBOOK

TO THE GEOLOGY OF THE DEVILS ICEBOX KARST, BOONE COUNTY, MISSOURI

By Jerry D. Vineyard

Karst: A type of topography that is formed over limestone, dolomite, or gypsum by dissolving or solution, and that is characterized by closed depressions or sinkholes, caves, and underground drainage. Etymol: German, from the Slavic kras, "a bleak, waterless place". Type locality: Karst, a limestone plateau in the Dinaric Alps of Yugoslavia and the Free Territory of Trieste.

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INTRODUCTION

Geologic features produced by solution of the Burlington Limestone (Mississippian) are prominent in Rock Bridge Memorial State Park and adjacent lands south of Columbia. These landforms are collectively called the Devils Icebox karst. Primary features include 1) the Rock Bridge, a natural rock span remaining after the collapse of cave roofs; 2) the Devils Icebox, a six-mile long cave system that drains 3) the Sinkhole Plain; and 4) incised valleys (Unklesbay; 1952, p. 15) of Gans Creek and Little Bonne Femme Creek, which receive drainage from the Sinkhole Plain through the Devils Icebox cave system.

The Burlington Limestone is a massively-bedded, coarsely crystalline, crinoidal, cherty biosparite that is overlain by glacial drift and loess upon which modern soils have developed. The results of weathering by corrosion and corrasion have produced a scenic topography attractive to residential housing development because of its proximity to Columbia.

When Rock Bridge Memorial State Park was dedicated by Governor Bond in 1974, the State owned the Devils Icebox and the Rock Bridge, but only a small part of the Sinkhole Plain. As residential housing development accelerated on the adjacent surface karst, geologists (Williams and Vineyard; 1966, and Vineyard and Williams; 1971) became concerned about the effects of pollution from septic tanks entering the cave system through sinkholes, then flowing out through the Park where visitors would be exposed to contaminated waters.

The geology--and to some extent the social implications--of this interesting situation will be the topics of this field trip.

ROAD LOG

| Mileage | |
|---------|-------|
| Cum. | Diff. |

| | |
|-----|---|
| 0.0 | Leave parking lot of Columbia Inn Downtown. Proceed west on Broadway. Stay in left lane. |
|-----|---|

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- .4
- .4 Cross Fifth Street. Prepare to turn left on Providence Road.
- .1
- .5 Turn left on Providence Road (Hwy. 163 South)
- .8
- 1.3 University dormitories along street on left. In this street, circa 1956, a large sinkhole collapse occurred that threatened to swallow one of the dormitories (then under construction). The local press corps immediately dubbed it the "Mystery Hole," and for several days the hole, which was filled with muddy water so the bottom could not be seen, swallowed whatever was dumped into it and seemed to pose considerable hazard to the nearby dorm. Finally, city street crews got the upper hand and enough truckloads of fill material were dumped into the hole to fill it. When the fill stabilized, the street was paved and there has been no recurrence of collapse activity.
- .2
- 1.5 Jct. Hwy. 740 (Stadium Blvd.). Continue straight ahead on 163. Mizzou Stadium on left.
- .3
- 1.8 Burlington Limestone in cut on right.
- .2
- 2.0 University nuclear reactor building (with deep blue vertical panels) on right.
- .2
- 2.2 Crossing Hinkson Creek. Old quarried area in Burlington Limestone on right. Burlington in cuts on both sides of road to top of hill.
- .9
- 3.1 STOPLIGHT. Green Meadows Road. Continue straight ahead on 163.
- 1.7

- 4.8 Turn left (Hwy. K goes straight ahead).
Rock Bridge Elem. School on right after turn.
.8
- 5.6 Headquarters area, Rock Bridge Memorial State
Park on right.
.5
- 6.1 Crossing Little Bonne Femme Creek.
.2
- 6.3 Crossing Gans Creek. Prepare to turn right.
.1
- 6.4 Turn right and proceed into parking lot for
Rock Bridge and Devils Icebox.
.2
- 6.6 STOP 1. Park and prepare for walking tour of
Rock Bridge and entrance to Devils Icebox.

Most of the land now known as Rock Bridge Memorial State Park was presented to the State as a memorial to the daughter of a professor at the University of Missouri-Columbia who died in a traffic accident. A community fund-raising effort culminated in dedication of the park by then-Governor Christopher "Kit" Bond in April, 1974. As mentioned earlier, the initial land acquisition did not include the Sinkhole Plain, and subsequent purchases by the Missouri Division of Parks and Recreation have been made to reduce environmental pressures caused by unsewered residential housing on the Sinkhole Plain.

The stream flowing from Devils Icebox, under the Rock Bridge, and through the Park drains a surface karst of at least 3 square miles. Normally, it is a tiny stream (.05 cfs in August 1964; Vineyard and Feder, 1974), but it responds almost immediately to heavy rains because of the funneling effect of sinkholes in the surface karst just south of the entrance. Strong flood flows boil from the cave entrance, and because the conduit is constricted in some places, floodwaters have temporarily ponded to depths of more than 25 feet in the Big Room of Devils Icebox. Cave explorers have been trapped by floodwaters on occasion, and at least two have drowned in the cave (though not because of flooding; Weaver, 1974).

The entrance to Devils Icebox, reached by a short trail from the parking lot, is a double karst window exposing the stream that flows from the nearby flooded entrance (called Connor's Cave), and beneath Rock Bridge. No tour of the cave

will be attempted on this field trip, because a ¼-mile boat trip with several portages is required to reach the large main passages of the cave. The name Devils Icebox comes from the cool air currents that continually blow through the entrance. In winter, the cave stream freezes solid enough to walk on for several hundred feet upstream (inside the cave).

The Icebox is typical of caves that develop in the Burlington Limestone. It has characteristic effluent stream drainage, extensive silty fill derived from the drift and loessial deposits at the surface, and many vertical shafts or domes. Secondary calcite/aragonite mineral deposits (speleothems) are relatively rare compared to caves in the Gasconade and Eminence Dolomites of the Ozarks, but there are some impressive examples in the Icebox. Large trunk passages that may have evolved in the phreatic zone (Bretz, 1956, p. 286) have been extensively modified by free-surface streams in the current erosion cycle. Speleogens (host-rock modifications by solution) are also well developed, the most interesting being chert roof pendants and ceiling channels (Deike and Deike, 1959).

The Icebox stream rises about 38 feet from the entrance to the terminal siphon, a distance of about 5 miles. The stream has several tributaries entering from side passages to the main trunk channel, and much recharge enters the cave vertically through domes (vertical shafts) that penetrate the Burlington at numerous places along the cave passages. Vertical extent of the domes is limited by a chert zone in the Burlington (Hargrove, 1968). Effluent from septic tanks has also been documented entering the cave through the vertical shafts (Middaugh, 1971).

Exploration and mapping of the Devils Icebox was begun in the mid-1950's by Paul A. Johnson and others, peaked with the work of UMC graduate student George H. Deike III in 1959 and 60, and continues intermittently today. Many others, including the writer, participated in the difficult underground surveying work with Brunton and tape. Elevations were determined in an altimeter survey by Deike. To tie the cave survey to surface points, a cave radio location device developed and operated by Paul Wightman was used to tie in points established by Stanley Elmore and Assoc., a local engineering firm.

During the late 60's and early 70's considerable attention was given to the potential water pollution problems in the Devils Icebox, by the State Clean Water Commission, the Boone County Planning and Zoning Commission, and the County Court. In addition, considerable public pressure was exerted through several local interest groups, the media, and nationally-based conservation organizations. Efforts of the private groups were summarized in a "Report of the Devils Icebox - Rockbridge Park Conservation Task Force", brought together by the National Speleological Society (Hargrove, et al., 1973).

Mileage
 Cum. Diff.

- .1 Return to Hwy. 163.
- 6.7 Turn right (uphill) on 163. Gans Creek Wild Area on left. The Missouri Division of Parks and Recreation has designated some areas of existing state parks as Wild Areas if they are in an essentially undisturbed state.
- .3
- 7.0 Polly's Pot (cave with pit-type entrance) in woods on right.
- .2
- 7.2 Sinkhole on left. Entering Sinkhole Plain.
- .1
- 7.3 Subdivision among sinkholes on left. From here on the field trip route passes many sinkholes and many homes. Some sinks have trash in them, others are plugged as sinkhole ponds, and some have been landscaped and mowed. It is not uncommon to see a sinkhole pond beside a deep open sinkhole.
- .5
- 7.8 Intersection of Hwys. N and 163. Village of Pierpont. Go straight ahead on paved but unmarked road. Devils Icebox passes about 1/8th mile west of this intersection, at a depth of about 130 feet.
- .1
- 7.9 "Wet" sink on right, "dry" sink on left. Note numerous well-kept homes on both sides of road; broad, sometimes steep-sided sinks, some with obvious central drains. All of these homes have individual sewage disposal systems, usually septic tanks. The area is served, however, by Boone County Public Water Supply District No. 1.
- .2
- 8.1 Sharp left; stay on blacktop.
- .1

- 8.2 Blacktop ends; continue straight ahead on gravel road.
- .5
- 8.7 T-junction. Turn left on Fox Lane. Sinkhole pond on right. For next 0.7 mile, road passes through a wooded, exclusive residential area in intense surface karst. Large homes can be glimpsed through the trees on the right; undeveloped land on the left.
- .7
- 9.4 Junction Hwy. 163. Turn right and proceed east on 163.
- .3
- 9.7 Large sinkhole pond on left.
- .3
- 10.0 STOP 2. Park on shoulder and assemble on north right-of-way.

The field trip route from Stop 1 to Stop 2 led through the intense surface karst known as the Devils Icebox Sinkhole Plain. The suburbanization now underway has not yet progressed to a serious problem because of the dilution factor. However, it seems obvious that if the number of unsewered residences continues to grow in an area that has been classified as unsuitable for septic tanks, the levels of contaminants associated with septic effluent are likely to increase beyond acceptable levels (Middaugh, 1971; Dreiss, 1973).

In order to reduce the potential number of homes in the Sinkhole Plain and increase the dilution factor, the Missouri Division of Parks has purchased several tracts in the Plain, and the State now owns the land over about a third of the cave. The remainder of the cave lies beneath a patchwork of land ownership.

Fear of collapse is a first reaction to thoughts of building in an intense karst setting, but this seems not to be a critical problem on the Sinkhole Plain. It is obvious that houses are being built immediately adjacent to fairly deep sinkholes, yet there seem to be few problems. The Missouri Survey has documented no serious collapse events anywhere on the Sinkhole Plain, though minor soil subsidence is fairly common (but see p. 2, collapse in Columbia off the Sinkhole Plain). The key seems to be to build on the intersink areas and try to maintain the natural drainage relationships in the open sinkholes.

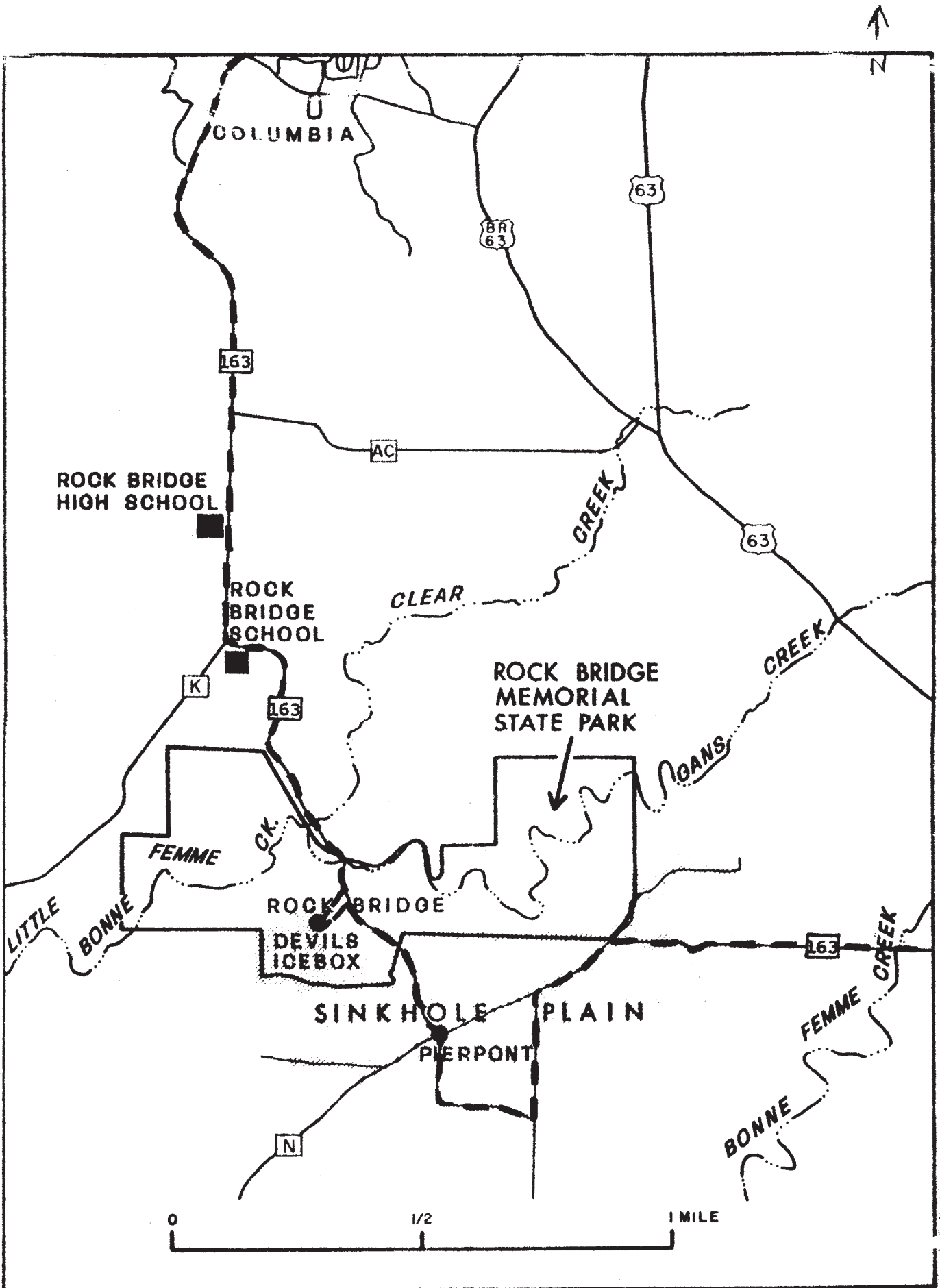
Sinkhole ponds come and go. A free-draining sinkhole may become clogged with debris and a temporary pond will form, only to disappear at some unpredictable future time when the plug fails. One such event occurred several years ago in a large sinkhole pond just off the Sinkhole Plain to the southwest. The owner had stocked the pond with catfish, and when the plug failed, the pond water and catfish were flushed through a cave with an entrance in a nearby valley.

Sinkholes have traditionally been used for out-of-sight out-of-mind trash and garbage disposal. One example, called Hog Graveyard Cave, is tributary to the Devils Icebox and was used for many years to dispose of trash and dead animals from a large hog farm. The State eventually purchased the farm and eliminated that source of pollution. As might be expected, shallow wells that bottom in the Burlington, or deeper wells improperly cased, are highly susceptible to pollution.

| Mileage | |
|---------|--|
| Cum. | Diff. |
| | .2 |
| 10.2 | Large twin sinkhole ponds on left. |
| | .7 |
| 10.9 | Leaving Sinkhole Plain. |
| | 1.3 |
| 12.2 | Junction Hwy. 63. End of field trip. Return to headquarters motel. |

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FIELD TRIP ROUTE - - - - -