

JOHN
PICKLE

CAVES OF CEDAR SINK

Mammoth Cave National Park

Kentucky

MAMMOTH CAVE NATIONAL PARK

DEC 13 1967

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PROGRESS REPORT

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ABSTRACT

The principal objective is a study of the hydrology and geomorphic history of Cedar Sink, Mammoth Cave National Park. The first phase of this study includes a cartographic survey of existing cave passages extending from the sink. Three such cave systems exist, and have been described to the extent that present exploration permits. Surveying has been started or is well along on all of the caves. Preliminary observations on hydrology have been made, but major studies in this area will be delayed until the exploration and cartographic survey has progressed to a point that will make such studies more meaningful. Stratigraphic delineation has not been attempted at this time but will be included in our future efforts. Preliminary attempts to locate inaccessible, upper-level, truncated cave passages through surface resistivity measurements have been made, but the equipment will require some modification before adequate studies can be conducted. A description of the survey methods employed is given as is also a description of the preliminary cartography. Maps, appropriate to the area of interest, are presented in a preliminary form with uncorrected line weight. These will be refined as the surveying of the sections is completed.

Project Objectives

The principal objective is a study of the hydrology and geomorphic history of Cedar Sink, Mammoth Cave National Park. The study includes a cartographic survey of existing cave passages extending from Cedar Sink and, where such passages are truncated, surface resistivity measurements will be made to determine their course. Stream tracing techniques will be employed if needed. Data accumulated will be analyzed in an attempt to reconstruct the geomorphic history of the sink, especially as it relates to current and paleo-hydrology.

Personnel

The following individuals have participated in this project:

Mr. and Mrs. Kenneth M. Burdsall

Michael A. Cox

Robert J. Hosley

Tim Moran

David W. Morthland

Mr. and Mrs. Lawrence Mullins

John A. Ratz

James A. Richards

Gregg S. Rodgers

Work Accomplished to Date

Cedar Sink is an unusually large collapse sink located in the southeast $2\frac{1}{2}$ minute section of the Rhoda, Kentucky quadrangle, within the borders of Mammoth Cave National Park. Its approximate location is $37^{\circ} 09'$ latitude and $86^{\circ} 09'$ longitude. In the north-south direction, the sink is slightly over 1,000 feet in length, and in the east-west direction, approximately 700 feet in width. It reaches a depth of 120 feet.

Although the stratigraphy of Cedar Sink has not yet been defined by us in the course of this study, at least three distinct levels of cave development are present and accessible in deposits of the Gerkin formation. A fourth level, currently active and not accessible, is developed in the upper Ste. Genevieve strata and represents a major drainage route from the sinkhole plain south of the park boundaries to its outlet in Sand Hole Cave at Turnhole Bend on the Green River. Upper level passages appear to be truncated at the north end of the sink, and heavily alluviated at the south end. There are four principal cave openings in the sink, one at the southwest corner, one at the northwest corner, (both of these representing upper level openings), and two in the northeast corner. The latter two represent a single cave passage which has been intersected by the collapse of the sink. Hydrology studies have not begun as yet, and probably will await further progress in the cartographic survey in order that the hydrological observations may be more meaningful. Surface resistivity measurements have been started to trace the course of the truncated passage leading from the northwest corner of the sink. However, we believe at present that modifications of electronic circuit design may be desirable in order to increase the sensitivity of the instrument before additional measurements are made. Such modifications are now in progress.

Surveying is in progress in all of the cave passages. This work has been somewhat hampered, especially in lower level passages, by periodic flooding of the caves commensurate with a rise in the level of the Green River. Evidence (e.g. mud deposits on vegetation in the sink) suggests that water may reach a level some 20 feet above the lowest accessible cave openings.

A brief description of the caves is given below along with a summary of survey statistics to date. For convenience, names have been assigned to the caves after an inquiry among park rangers and people from the nearby community did not reveal that these cave openings were known by familiar or local names. South Cave was so named because of its location in the sink, Smith Valley Cave because of its general trend into the valley, and Cedar Sink Cave because

it represents the largest, in passage size though not in length, of the known cave openings. Notes on the survey method and preliminary cartography follow the cave descriptions.

Cedar Sink Cave

The entrance to this cave is located in the nearly vertical wall at the northwest corner of the sink. The opening is 44 feet below the ground surface, is 4 feet high and 70½ feet wide. Entering the cave, one descends a steep talus slope over a horizontal distance of 88 feet to where the slope becomes nearly vertical and drops 44 feet below to a pool of water. The cave passage has narrowed to 36 feet at this point, and continues at this width until the passage terminates in breakdown at 233 feet from the entrance. Total drop from the entrance to the pool level is about 85 feet. The pool extends the full width of the passage and is about 35 feet long. This varies, of course, with the level of the pool which, in turn, reflects the level of the Green River. At low water level (2 to 6 feet deep) a fair current can be observed in the water. Ceiling height increases directly above the pool, and is estimated to be about 110 feet. An accurate measurement of ceiling height will be made at a later date. Across the pool, a talus slope rises steeply over a horizontal distance of 42 feet, and terminates in a flowstone-cemented wall of breakdown. It is possible to ascend this wall with appropriate rope techniques, and there is an upper ledge near the ceiling which surrounds the pool below in a semi-circular manner. At the distal end of the cave, this ledge is about 20 feet deep and leads back to an ancient cave passage which is now completely occluded with flowstone. The passage rather clearly had formed at a bedding plane anastomosis. Further, the abrupt rise in ceiling height over the pool probably reflects this upper-level cave passage prior to the collapse of the floor at what is now the level of the ledge. There are no open passages leading from the main cave at any location. Formations, mainly stalactites, are found in abundance in the recesses of the wide ledge near the ceiling.

Smith Valley Cave

This cave is located in the northeast corner of the sink very near or in the Ste. Genevieve exposure. There are two openings, the left opening being known as the water passage. This passage may well turn out to hold important clues to the hydrology of the area although the passage is often inaccessible. At times when the water gauge at the Houchins Ferry landing reads 5.0 feet or less, it is possible to penetrate beyond a sump at 186 feet from the entrance to

where the passage intersects a major stream at 236 feet which trends in a northwest direction. There is a good water volume and current although these have not been precisely measured as yet. The stream disappears in a sump at this point, but the joint-controlled passage makes a nearly right-angle bend and continues south for an additional 93 feet where the stream appears from under a ledge, still inaccessible at a gauge reading as low as 1.9 feet. To the right, as one follows the stream, is a large room with a substantial alluvial fill which is gradually being eroded. The room is 150 feet long, 106 feet wide, and 30 feet high. At one end there is a large pool of water. There are no openings from the room.

Water flows from the right-hand opening of Smith Valley Cave and disappears immediately under rocks surrounding a small pool in front of the cave opening. This water joins that in the left-hand passage, connecting to the main underground stream. The cave curves southward for approximately 182 feet to a passage bifurcation. To the left is a small waterfall coming through a crevice from an upper-level passage. To the right at this point is a low stoop-way which carries off the main volume of water for about 100 feet where the water sinks through a crevice in the floor. This water subsequently emerges from under rocks and flows into the small pool directly in front of the cave opening. The remainder of this passage circles around and, after a total distance of 274 feet, opens again at the waterfall. There are also side passages leading off this circle route. The upper level passage at the waterfall is readily accessible when the volume of water is low. Rather large passage is encountered in this upper level, about 45 feet wide by 20 feet high. This continues for a total distance of 705 feet to what we have termed the Junction Room. However, at about 150 feet from the waterfall entrance to this passage, a side passage trending north is encountered. This passage contains a stream which flows under breakdown to join the stream in the main passage. This side passage has not been surveyed as yet. The Junction Room is so named because there are four passages, besides the main passage, which lead from this room. Two of these, trending in the direction of Smith Valley, later reconnect. The other passages lead to a stream route, with a good volume of water, which has not been surveyed as yet. The character of the cave passage changes at this point, with many potholes and solution sculpturing in the "maze" which leads toward Smith Valley. There are many interconnecting passages here, and we believe that this is the principal drainage route for surface water from Smith Valley. Only 362 feet of the maze route, which is difficult and tortuous, have been surveyed to date.

South Cave

Located in the southwest corner of the sink, the cave opening is about 35 feet above the floor of the sink. There is an inaccessible, water-filled opening at the floor level and evidence that a water-level gauge had been anchored to the rock at one time. The cave opening is small, and is little more than a wide, low crawl for 104 feet to where it opens to a heavily alluviated, dry chamber. The walls of this passage (strata unidentified as yet) contain exceptionally fine examples of coral. This upper level is blocked by silt fill at 265 feet. It is entirely developed along a bedding plane anastomosis, and exhibits joint control. A narrow solution crevice enables one to enter a lower and much more extensive level of the cave although this passage is also heavily alluviated. As yet, no opening has been found which leads to a level known to exist below this second-level cave. At least a portion of the water supplied to this inaccessible lower level is believed to come from a sinking stream which has cut a deep channel in the valley surface south of Cedar Sink, a relatively short distance inside the park boundary.

Summary of Survey Work

<u>Cedar Sink Cave:</u>	233 feet surveyed, completed except for determination of ceiling height.
✓ <u>Smith Valley Cave:</u>	2270 feet surveyed to date, 329 feet of this in the water passage.
<u>South Cave:</u>	295 feet surveyed to date, representing upper level passage only.

Survey Methods

Methods currently in use for the surveying of cave passages can, at best, be regarded as relatively crude. Low crawlways, mud or water-filled passages, or large accumulations of breakdown place limitations on equipment which can be used in addition to difficulties occasioned by light sources. In the present survey, azimuths were determined with a Keuffel and Esser surveying compass mounted on a tripod made of non-magnetic material. Measurements were estimated to the nearest 5th of a degree (12 minutes), and the surveyor was careful to have his carbide lamp reflector and other magnetic materials beyond the range of influence on the instrument. The compass had been corrected for magnetic declination (1967) in accordance with data provided in U.S. 3077 Isogonic Chart of the United States, 1965.0. While certain magnetic anomalies had been reported near our area of interest, these were not checked further with the U.S. Coast and Geodetic Survey since the relative accuracy of the surveying method did not permit adequate utilization of more precise information. Horizontal distances were measured with a fifty-foot length of 300 ohm twin-line television antenna wire. The latter is made of a durable plastic with encased supporting wires which minimize dimensional changes, and it holds up well in mud and water. The "tape" was calibrated with a steel surveyor's tape and marked at one-foot intervals. Surveying stations were chosen at a convenient marking on the tape.

With few exceptions, the caves involved in this study were developed along bedding planes, often at the anastomoses of such planes, which made vertical control unnecessary. Where large breakdown slopes, silt fill, or crevice connections to lower or higher levels were encountered, vertical measurements were made with a plumb bob, line, and line level. Survey data were plotted by rectangular coordinates.

Preliminary Cartography

The precedent of relating surface topography to subsurface features and the use of quadrangles representing 30 seconds of longitude and latitude was established by Cave Research Foundation in their outstanding presentation of surveying work conducted in the Flint Ridge Cave System, Mammoth Cave National Park. It appeared desirable to follow this precedent so that, ultimately, our efforts in the area of Cedar Sink would complement their work. For the present we have chosen a scale which differs from that used by CRF, namely 1:3600 or 300 feet to the inch. Preliminary "working" 30-second quadrangles were prepared in the following manner. A dimensionally stable acetate copy of the hypsography master for the Rhoda, Kentucky quadrangle was obtained from the U.S.G.S. in Arlington, Va. While this hypsography master represents the 1967 edition of the Rhoda topographic

map, it should be noted that the basic hypsography is from the photogrammetric survey of 1953. Some areas of the master were rescribed by the U.S.G.S. to reflect changes in the culture plate which was totally revised. A laterally reversed negative was prepared on Kodalith contact film, Estar base, which is also dimensionally stable. Using a light table, a rigid graver with optic, an .008" carborundum scribing point, and a K & E machine-ruled 1/100 inch ruler, the southeast 2½ minute section of the quadrangle was subdivided into 30-second graticules according to book values for the 2½ minute grid ticks provided by the U.S.G.S. A laterally reversed positive was then made from the gridded negative, again on dimensionally stable Kodalith contact film. Precisely controlled 6 2/3 X photographic enlargements of the individual 30-second quadrangles were then made on Estar base film. The resulting negatives, emulsion side down, were placed directly on presensitized aluminum offset masters for transfer and subsequent printing. It should be noted that the contour line weight (width) is grossly exaggerated in the preliminary maps. When final maps are prepared, these will be rescribed on K & E Stabilene rust scribe coat using contact positives of the preliminary maps as templates. These maps will then have the appropriate line weight.

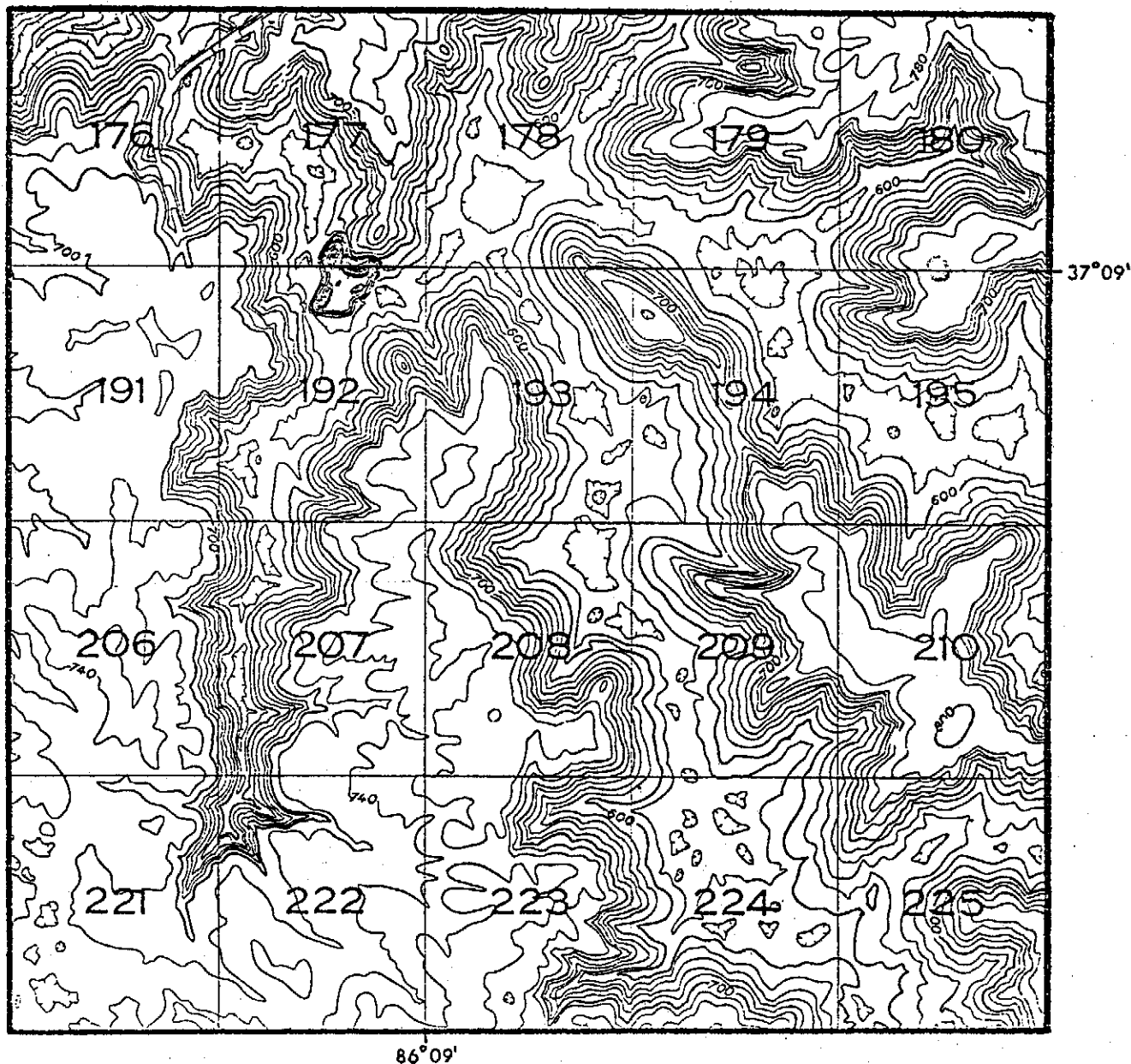
Preliminary Maps

Attached is a locator for numbered 30-second quadrangles of interest in the section of Joppa Ridge which lies on the Rhoda, Kentucky 7½ minute quadrangle. Accompanying this is a survey station plot representing the work accomplished to date. Three 30-second quadrangles showing the topography in the area of the caves we are surveying and a fourth map with Cedar Sink approximately centered are included. While it was impractical to trace the survey station plot on topographic maps with uncorrected line weight, these may be superimposed according to grid markings to indicate the trend of the caves since both the plot and the maps are at a scale of 1:3600.

JOPPA RIDGE CAVE SYSTEM

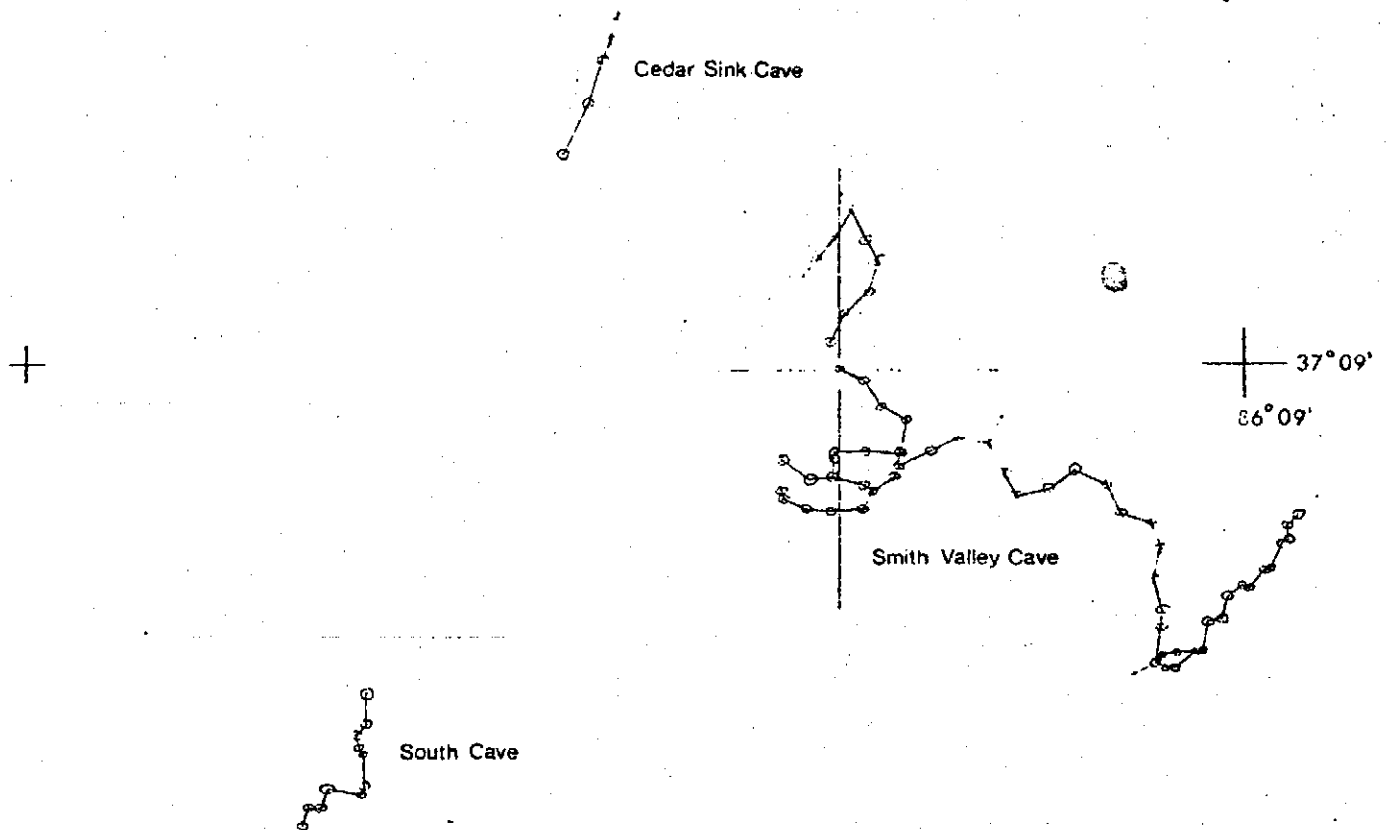
MAMMOTH CAVE NATIONAL PARK, KENTUCKY

LOCATION OF 30 SECOND QUADRANGLES ON RHODA, KY. TOPOGRAPHIC MAP



JOPPA RIDGE CAVE SYSTEM

MAMMOTH CAVE NATIONAL PARK, KENTUCKY



SURVEY STATION PLOT AT SCALE OF 1:3600

