

I have thus in the broadest lines indicated what seemed to me some of the evident duties of the Academy to the State, and what seemed to be opportunities for increasing its value to the State. All are dependent upon the combined work of many individuals. Few, if any, can be accomplished save through an organization such as this.

I look over the secondary schools of the State and find that the teachers of science, with few exceptions, are poorly paid; that science courses are, almost without exception, arranged with reference to recitation schedules rather than to logical sequence of subjects or intellectual capacity of pupils. That science is assigned a value in the curriculum far less than language, or number, or form. I find in our colleges, again, with few exceptions, that while it is not expected that one man can teach both Latin and Greek, it is expected often that one man can teach Botany, and Zoölogy, and Physiology, and Chemistry, and Physics, with other incidental subjects to fill his schedule. I find a prevailing belief that the scientific specialist is a narrow man, when, by the very nature of things, he must be, if a true specialist, one of the broadest of men; a belief, in general, that science is impractical, theoretical, visionary. All this in spite of the fact that far more than any other force has science directed—yes, dominated—the progress of the past decades. I believe the cause of all this to be that science has not been fairly dealt with by her devotees. That the scientist, absorbed in the work of the laboratory, has too often forgotten his citizenship and neglected to transfer to the State the truth which science had placed in his hands. Primarily the objects of the Academy are inspirational, but secondarily, at least, and certainly in its relations to the State, its objects should be eminently practical.

If we fully grasp the idea of this relationship, which I have but imperfectly outlined, the possibilities of science in Indiana are almost limitless. Its influence will be increased, its constituency broadened, its achievements more splendid, and the prophecy of a high place in science, born in the New Harmony days, will have its realization in the effective and beneficent work of this Academy.

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THE EVOLUTION OF THE MAP OF MAMMOTH CAVE, KENTUCKY. BY R. ELLSWORTH CALL.

There probably does not exist elsewhere on earth so famous a natural feature concerning which so little is definitely known as the Mammoth Cave of Kentucky. Its scientific exploration has been so hampered and guarded by a jealous fear of rival interests that no one has been permitted to survey the great cavern and to

project it on the surface in order to determine its relations to the topography of the region in which it is located. There have been but few attempts to so delineate its hundreds of ramifications that the visitor may know his whereabouts by reference to surface features. These are commonly conjectural; the guides profess to have, and for the most part are honest, but little knowledge of the relations of the outdoor topography to that of the avenues and chambers of the cave. The liberal management of the present Superintendent, Mr. Henry C. Ganter, extended to the writer in a hundred different ways the most complete opportunities to examine and study the cave in the usually inaccessible localities as well as those commonly visited. Measurements and compass work was permitted within the cave but the line was drawn when surface work was planned or attempted. Courtesy freely extended must be regarded, and while the results attained are not of the most exact kind, nearly four years of exploration have given a better idea of its surface relations and internal ramifications than could otherwise have been possible.

The interests of the present owners are as jealously guarded as ever, and in this communication, therefore, I shall not violate any confidence which has been vouched to me. Nevertheless, I can not refrain from placing on record, in this manner, my firm belief that a survey which has been made ought to be projected in map form and given to the world of science. Only good could result to all the interests involved should an accurate knowledge of the cavern's relations to the surface be made public. Such information would be invaluable to one who wishes to know the great cavern as a geological entity. Perhaps, as the years roll by, wiser counsels will prevail and the world will eventually know Mammoth Cave in all its ramifications and will see them represented on a map which will also show their relations to the surface. For the present it is my purpose to give a history of the several published maps, and the manner in which they have been prepared, to show how difficult has been the process of evolving the map and to emphasize the present need of a cartograph which shall exhibit the cave as it is.

Mammoth Cave was discovered through an accident of the chase in the year 1809 by one Hutchins, a hunter who, tradition says, traced a wounded bear to the entrance, then quite hidden in a dense growth of underbrush and fallen trees. It would be difficult to imagine a more rough and wild region than is the country in which this greatest of caverns is situated. Facing north, on the side of the Green River Canyon, far away from the traveled routes of the olden time, accident only could have brought it to view. If Hutchins ever really lived there now remains no trace of him beyond the tradition of discovery; none of his kith or kin have been discovered in the region. Perhaps with this single act to make him forever

known he was content to pass from human view. In those good old Kentucky days, when firearms were as much in vogue as they are in these later days, and with worthier ends be it remarked in passing, gunpowder was a scarce article and was husbanded beyond comparison. A roving Philadelphia chemist, Dr. Samuel Brown by name, first taught the earlier settlers the methods of manufacture of gunpowder, with probably as great acceptability as Latinus first taught the Latins agriculture. But the nitre-bearing sheltered cliffs and caves of the Blue Grass region could not alone furnish all the needed nitrate, originally obtained in the form of calcium nitrate, from which the needed saltpetre, or potassium nitrate, was procured through the medium of wood ashes in the clumsy chemistry of nearly a century ago. Recourse was therefore had to other caverns, which were assiduously sought after and many found. From these the needed nitrate was obtained in abundance and a great industry was built up in Kentucky. Rumors of the great cave in Warren County, for we may be sure that coupled with the growth and size of that famous bear each time the story was recounted, Hutchins did not fail to tell of the cave he had found, reached the ears of the middle Kentucky folk and business enterprise soon made Mammoth Cave a fact of history.

Mammoth Cave appears to have attracted great attention from the very first, though its chief value seems to have been connected with the manufacture of saltpetre. When the war of 1812 came and the resources of the United States were taxed to the utmost in securing materials for the making of powder because the foreign supply was rendered uncertain through the exigencies of war, the caverns of Kentucky furnished nearly all the saltpetre used in that memorable conflict. With central Kentucky, and notably with Lexington, the great eastern city of Philadelphia had intimate commercial relations. It resulted that the caverns of this portion of the State soon were exhausted of their precious nitrate and the new, stupendous Green River cave came prominently into view. A Philadelphian of Hebrew descent, and a patriot, by name Hyman Gratz, associated with one Charles Wilkins, of Lexington, leased Mammoth Cave from its earliest owner and carried on in extensive scale the manufacture of saltpetre. Many tons of "petre-dirt," as the miners called it, were brought from far within the cave, the places where they last dug and the vats in which they leached the earth still attesting the magnitude of their operations. With the development of this industry came visitors, and with the visitors went wonderful stories of the great cave. It thus happened that in August of 1814 a gentleman unknown to later days wrote an extended account to "a respectable gentleman of New York," which was published in the *Medical Repository*, then under the editorial control of the eminent Dr. Samuel Latham Mitchill, accompanied by a map. The account

and map appeared in the seventeenth volume of that journal. It is presented herewith, not because it has value as being an accurate map of the cave, but because it possesses a certain archaic value as being the first map to have appeared in print. A previous map, essentially the same, is known to have been made, but there is no record of its having found a way into literature. The author of our map is unknown, so far as any fact connected with its publication goes, but in a later number of the same journal another map is mentioned as accompanying a description of a mummy from a cave near by and on deposit for exhibition purposes in the Mammoth Cave, and is said to be the same, substantially, "as that which we had received before from Mr. Bogert:" from which fact it appears that such was the name of the man who presented the original map. But nothing more is known of him. This map is not drawn to scale, nor was the compass employed in determining the relations and directions of the several halls. With the exception of a very few localities near the entrance, which are fairly correctly located, it is impossible to identify any of these avenues with those now known. But the map is important as being the beginning of the published cartography of the cave.

The second map of Mammoth Cave was the one prepared by Dr. Nahum Ward, a photographic copy of which is presented herewith, its original, the only copy now known to be extant, being in my own library. This map first appeared in the Worcester *Spy*, a newspaper of Massachusetts, in June or July, 1816. My copy is a *facsimile*, printed on one-half of a newspaper sheet, with blank reverse. As presented herewith it is reduced one-half.

As in the case of Bogert's map, so in this one, it is impossible to identify very many of the localities mentioned. The descriptions of Doctor Ward are quite full but are by no means exact. He appears to have been thoroughly impressed by the great magnitude of the cavern, and the terms selected to convey his ideas of the cave comport well with its greatness. But the map is drawn to no scale and, as may be noted from the map itself, its horizontal distances are grossly inaccurate. In addition this writer makes the cavern to pass under the Green River in three separate places. As a matter of fact it is impossible for such an extension to happen; the area of the cave is limited by the configuration of the country around it; while its depth is determined by the level of Green River, into which, by several separate channels, breaking out as large or small springs, the waters of the cavern eventually find their way. The drainage levels of the subterranean streams are all determined by that of the Green. While Ward employed the compass at places and determined thus the directions of the longest diameters of the great halls, he did not employ it constantly or systematically and nowhere did

he run long lines or have points for "tying" those he did run. His published account is the first extensive one in literature, though it, like all the earlier ones, abounds in exaggerations.\*

The next map, in order of publication, bears the date of 1835, the year of its copyright, and was prepared by Edmund F. Lee, a civil engineer of Cincinnati, Ohio. It is based upon the first instrumental survey ever made of the cave, and is both complete and accurate for that portion which may be called the cisrriparian cave. The rivers and all that vast area of the cavern which lies beyond, were then unknown and undreamed of.

The rivers were discovered by Stephen Bishop, the guide, in the year 1840, for the way to them, over what is now the Bottomless Pit, had not been known; the Pit itself was not crossed until 1840, the crossing being almost immediately followed by the discovery of River Hall and all its wonders. Consequently none of this portion of the cavern appears in Lee's map, a copy of which is herewith given, from a faded copy in my library, which, like the others mentioned, is the only copy now known to be in existence. Lee's map is further characterized by sections of the several known avenues and chambers, and is the result of many month's of underground work. As laid down in his map the relations of the avenues and chambers are absolutely accurate; the nomenclature has since very greatly changed, as the fancy of visitors or the caprice of the several managers have dictated. It will be at once recognized that this map has extraordinary value when it is stated that it forms the basis of several other maps which have appeared from time to time; further, it is the first map to have been professionally made. Complete surveys of most of the newer or transrriparian avenues have never been made. Some of these avenues and passages, like that which leads to Mystic River, leaving El Ghor just below Martha's Vineyard, have been entirely closed up by the management and never will be surveyed. A complete map of the cave will, therefore, always be impossible, and some avenues will only

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\*Since this article was completed, chance has thrown in my way an old volume published by Lee & Shepard, Boston, in 1873, "The Wonders of the World," which reproduces Ward's account of Mammoth Cave, together with his original map; the map appears as page 327 and has a cut of the "mummy, now in the American Museum, New York." It is interesting to note that this old map is useless in such a book. It is further interesting to note that the mummy was not then in the American Museum, nor ever had been, beyond a few days for exhibition purposes, but was deposited in the museum of the American Antiquarian Society, at Worcester, Massachusetts. A short time since, following the World's Fair, where it was on exhibition, it was removed to the National Museum, at Washington, where it may now be seen. A most excellent photograph of this famous mummy was recently made for me and forwarded by the courtesy of the late Dr. G. Brown Goode. The account of the cave, which this volume gives, in 1873, is a verbatim reproduction of Nahum Ward's original description, made in 1816. In this way do great publishing houses give us new and fresh knowledge of the world's wonders.



have historic names. They will never be visited by future explorers. But Lee alone has surveyed the intricate and devious windings which make up the Labyrinth, together with its associated chambers. Use was made of his work by the maps which followed.

The parts of the cavern which are beyond the pass known as El Ghor, including a considerable portion of explored but unmapped cave, have had several names bestowed on them by the earlier visitors. Of the parts which it will now be impossible to visit, owing to the artificial occlusion of the small passage under Martha's Vineyard, are the following: Byrd's Avenue, Miriam's Avenue, Harlan's Avenue and Hebe's Spring. The Mystic River itself rivals the famous Echo River, but is less in size. It has probably some connection with Roaring River, a great stream at times, reached from Stephenson's Avenue at the Cascades, but as yet unexplored fully. Several attempts made by the writer to reach its end were defeated by lack of boats, the only means by which the deeper and unfamiliar places can be passed.

Lee's map was followed by one prepared from accounts and free-hand sketches of Stephen Bishop, in 1845, and is found in a little volume called "Mammoth Cave, by a Visitor," and published by Morton & Griswold, of Louisville, Kentucky. This map appears to have Lee's map as its basis for the older portion of the cave; the newer portion, which had not then been surveyed, is laid down by Bishop and from his notes. In common with all the published maps of later date than Lee's, the distances are grossly exaggerated, and the relations of some of the avenues are certainly hypothetical. But this map stands to-day as the best that has been published, and while inaccurate for any scientific purpose is certainly exact enough for the visitor. It names and shows the points of departure of the side avenues from the larger and better known or more traveled portions and gives a sketch of their turnings and ramifications. It is to be constantly remembered that none of the maps, except Lee's, have been based upon compass-bearings, even, to say nothing of determining their relations by exact methods.

No other map appeared until 1875, when Forwood's "The Mammoth Cave of Kentucky," Fourth Edition, appeared from the Lippincott press, of Philadelphia. His map gives only the two traveled routes, called the "long" and the "short" routes, and is grossly inaccurate even for these. No dependence can be placed upon any of the details of this map. It is noticed here simply because it is one of the few which have ever been published.

Hovey's map, which appeared in his "Celebrated American Caverns," in 1882, is the next in order of time. It is probably the best known map of the cave having been reproduced in a number of other publications and been sent abroad.

in numerous copies of his guide book, itself a separately bound excerpt from the larger volume, with slight changes in the later editions. This map is chiefly that of Bishop; all the main features of Bishop's map appear and few additional facts. For the older portion of the cave, like Bishop's map, this one follows very closely the original work of Lee. No mention is made of these sources, and Doctor Hovey did not himself map any part of this great cave except Ganter's Avenue. Some measurements of separate localities were made by him, but beyond this his map has very little original matter or matter not already known. It is, however, a useful one, for more names to localities appear on this map than on any other, many of which have been happily bestowed by Hovey who, in these matters, has appreciated the "eternal fitness of things." In his names record is often made of the pioneers of discovery in the cave; in other cases he has happily made allusions to mythologic characters to which is added the uncanny suggestiveness of the gloom of the underground world.

The latest map of the cave is still unpublished, but will appear within a few months. In it the attempt will be made to correct the errors of the older maps and to add to them as wholes the newly discovered portions or those portions of which little has hitherto been known. But when this map shall have appeared it will demonstrate the need of accurate surveys, which are never likely to be made, rather than add very greatly to our knowledge of the cave. Still, errors of others being corrected, the golden goal of exact knowledge will be brought a very little nearer.

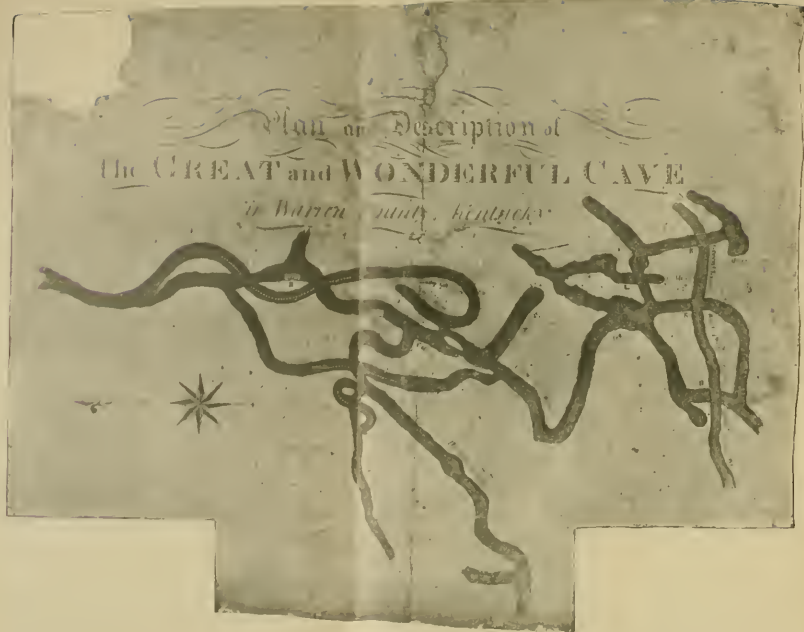
It is well known that the main avenues of the cave have been "run" by competent engineers, and they have been platted on the surface, in part at least. This was done in the attempt to learn whether any of the more valuable parts of the cave extended beyond the limits of the present "cave estate." No one has been allowed to see these plats except those who are directly interested. The closeness with which this information is kept argues for the fact that without doubt the cavern extends beyond the estate. Numerous attempts have been made to find other entrances than the one on the estate; that they exist is proven by the free circulation of the air and the presence, in places miles from the well-known mouth, of seeds and leaves, sticks and bark, from the surface, and oftentimes in a fairly fresh condition. But these entrances are small and not likely to ever prove valuable to others if found. It is this fear of attempts to enter the property of the present estate that operates to make impossible, at present, a cartograph which exhibits Mammoth Cave in its true relations to the region in which it is situated.



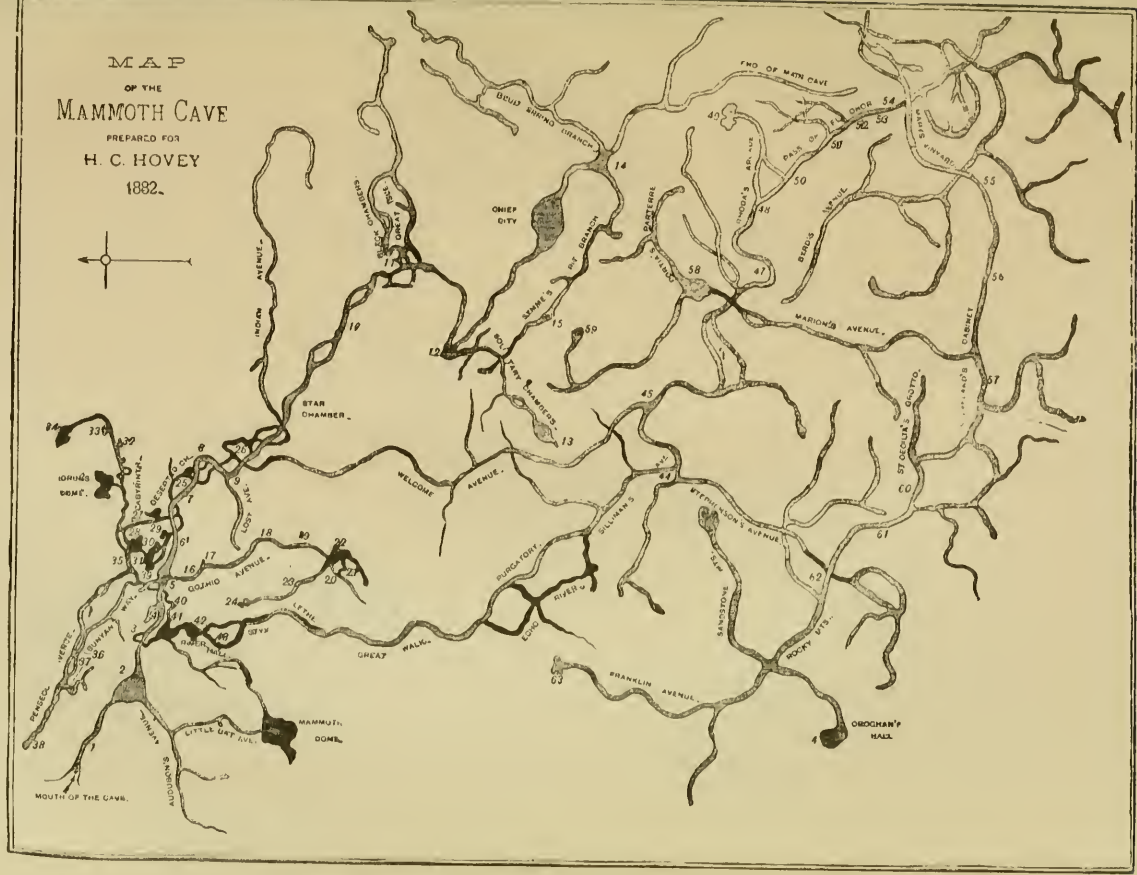
Fig 1  
Boeger's Map.  
1814.



Plan and Description of  
The GREAT and WONDERFUL CAVE  
in Warren county, Kentucky



MAP  
OF THE  
MAMMOTH CAVE  
PREPARED FOR  
H. C. HOVEY  
1882.



# MAMMOTH CAVE OF KENTUCKY.



Forwood's Map, 1875.

