KAEMPER'S DISCOVERIES IN THE MAMMOTH CAVE.

BY DR. HORACE C. HOVEY.

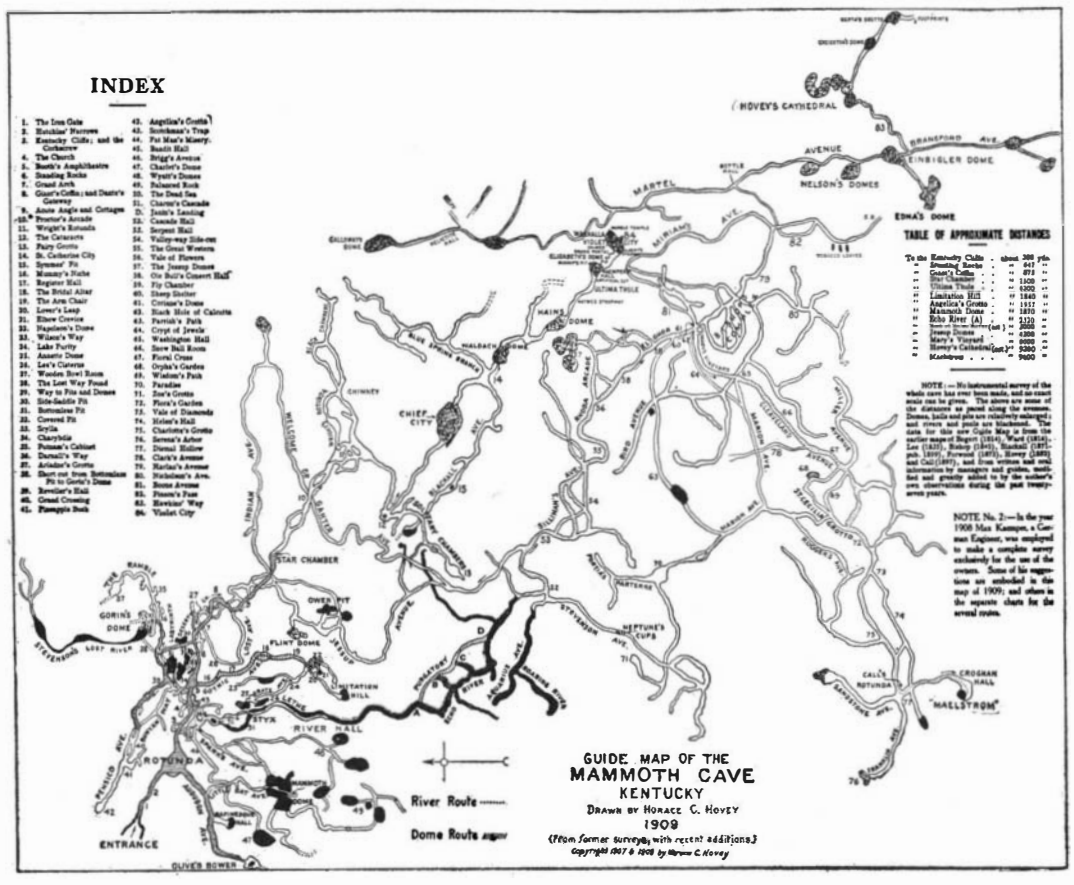
Clippings have been received from many newspapers to the effect that, because of the drought last summer, the Echo River, the Styx, and other waters in Mammoth Cave had dried up, thus making possible, as never before, great discoveries in regions before unknown. This false report is all the more exasperating for the reason that really the underground waters have been higher than formerly on account of the setting back of Green River, in consequence of a series of dams and locks built by the government in the interest of navigation. All underground voyages are more difficult than they used to be; and certain locations once accessible are now closed by permanent inundation. An example of this is Stevenson's Lost River, now occluded, on which Mr. F. J. Stevenson, of London, once sailed for seven hours in a boat that is still visible stranded on the floor of Gorin's Dome.

In my frequent trips through Mammoth Cave last November, when the long drought was at its height, I found no indications that the cave waters had fallen more than is usual in summer, and I had an especially delightful sail on the deep, limpid waters of Echo River, whose marvelous arches rewarded shout and song by as wonderful reverberations as ever.

But it is perfectly true that remarkable explorations have been recently made, not because of the drought, but by reason of the systematic, skillful work done by Max E. Kaemper and Edward Bishop. To appreciate their work it must be understood that all published maps of the cave, including my own, were made under difficulties, without any general instrumental survey, which was allowed only in certain portions.

Max Kaemper, whose name must be henceforth identified with Kentucky's greatest cavern, came from Germany to America to acquaint himself with American manufactures and mining methods, and also to learn the English language. After six months in the city of New York he took a trip, early in 1908, through the South and West, in the course of which he visited Mammoth Cave, with no thought of staying in its vicinity more than a week. But his week grew into a month, and then into a period of eight months, during which his thoughts by day and night were on the mazes of the cavern.

In his first subterranean visits he was guided by my map of 1907, following whose courses he made his way to Hovey's Cathedral (described in SCIENTIFIC AMERICAN SUPPLEMENT, August 27th, 1907). He discovered that there were at least three different ways to this locality, besides the one taken by Mr. Einbigler's party, and later by myself. Then he pressed beyond the Cathedral to other domes, pits and grottoes. More than once he came across the name of Creighton carved on the limestone rocks—a man unknown to the cave owners. In honor of this early and unknown explorer he named a large room "Creighton's Dome." To another still farther beyond he gave his sister's name, calling it Gerta's Grotto. These localities and some other discoveries are indicated on my new guide map for 1909.



Copyright 1907 and 1909 by H. C. Hovey.

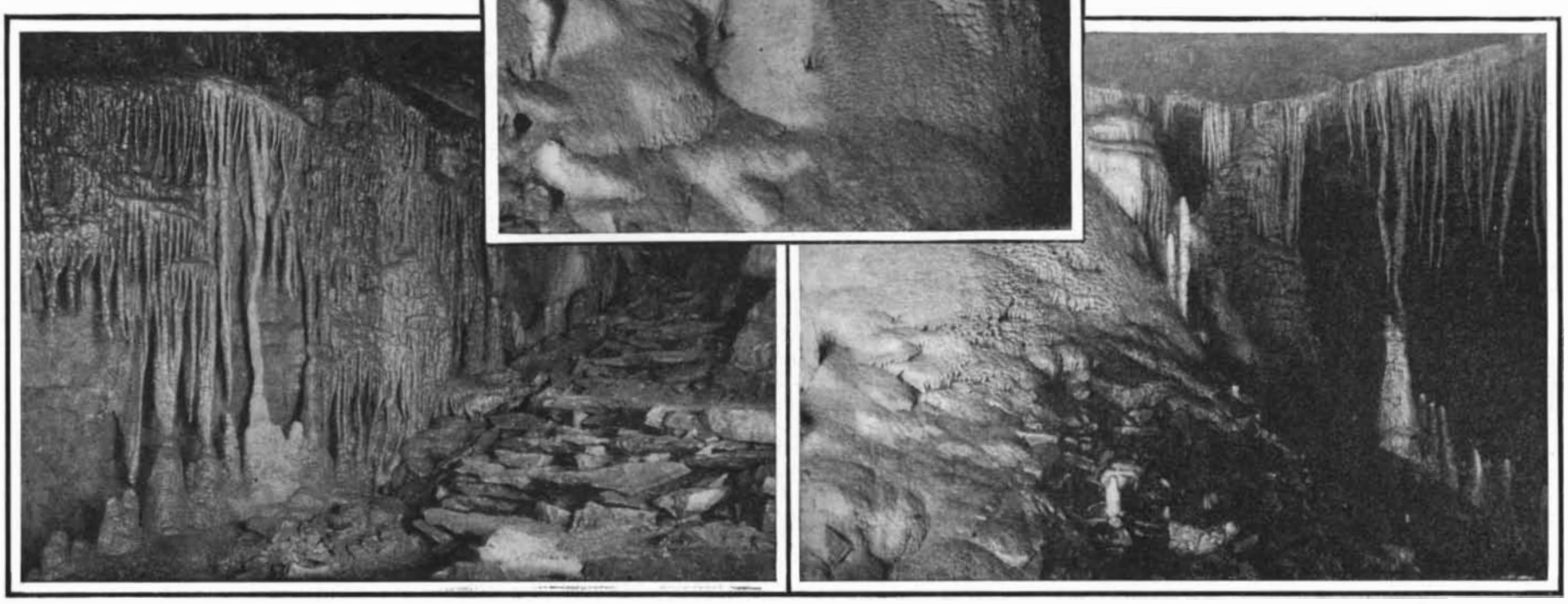
Dr. Hovey's guide map of Mammoth Cave.

Those in local authority at Mammoth Cave began to feel that this young man was possibly learning too much about the cave, and they threw discouragements in his way. But at the suggestion of Mr. H. C. Ganter (who formerly had been for many years local manager), the controlling trustee, Judge Albert Covington Janin, of Washington, D. C., gave permission for Mr. Kaemper, not only to explore to his heart's content, but to go ahead and do what many have long felt should be done, namely, make a complete survey of the entire cavern. Accordingly it was done.

When the time arrived to terminate this great undertaking, Judge Janin did me the honor to invite me, as a veteran cave man, to visit Mammoth Cave, and see what had been accomplished.

I did so last November. I found an honest young German, about twenty-three years of age, an admirable draftsman, a fearless and capable explorer, and one ready to answer any questions put to him. He told me frankly that the dimensions of the cavern were too great to warrant any general method of measurement other than pacing, to which he had been trained in military service. He also said that he had taken no barometric observations. He used a good surveyor's compass for taking bearings in the main cave and principal branches, but relied on a pocket compass for the narrower passages and crawlways. Though taking Edward Bishop along as his constant guide, he relied altogether on his own bearings and distances for direction and never once lost his reckoning. His plan was to take the Main Cave and the Long Route as a kind of base line, from which to branch out in every direction. In every instance he followed any given passage to its remotest end, completing his sketch as he went along. Incidentally, his guide, Edward Bishop, the grandnephew of the famous Stephen Bishop, served as his daily teacher in conversational English, with a result highly to the credit of both instructor and scholar. It was my earnest wish that the entire map thus patiently made by Mr. Kaemper might be given to the world. But the management, for prudential reasons, courteously decline to do this at present. The most that they have consented to do is to let me publish special sketches of the routes ordinarily taken by visitors, and to allow me to consult with Mr. Kaemper in the revision of my own guide map for 1909, with a few corrections and additions. Thus it still remains true that the latter is the best guide map extant or that will probably appear for some time.

(*Concluded on page 390.*)



"The Chimes" in Mammoth Cave. **The Marble Temple.** **In "Violet City."**

Photographs copyright 1908 by H. C. Ganter.

NEW DISCOVERIES IN THE MAMMOTH CAVE.

XIV, each in their time patrons of the arts. On the front of the weight tower are paintings of Urania, the Muse of Astronomy; Nicholas Copernicus, the famous astronomer; J. B. Schnilgue, the maker of the reconstructed Strasburg clock; three fates spinning, measuring and cutting the thread of life. A spiral staircase in the original leads to the mechanism in the central tower and to the church tower. In 1890, at the instigation of the Hon. Bruce Smith and Sir William McMillan, the New South Wales government decided to purchase Mr. Smith's model and appointed the Hon Bruce Smith, Q. C., minister for public works, and the Hon. J. H. Carruthers, minister for education, to make the purchase for the Sydney Technological Museum.

KAEMPER'S DISCOVERIES IN THE MAMMOTH CAVE.

(*Concluded from page 388.*)

Should the occasion arise for selling the Mammoth Cave estate, it would be to the advantage of the owners to possess this complete and exclusive survey made by Mr. Kaemper at their own expense. The fact that such a survey has been made is of interest to men of science. But by far the larger part of it will never be seen by any except "cave cranks"; and even now the average visitor sees only about the tenth part of what is found on the guide map.

Yet it ought to interest the general public that the new survey covers about fifty miles more than the hundred previously mapped; and that, not counting mere enlargements, there are now known and located 69 pits and 39 domes, or in all 120 vertical shafts, 35 of which are newly discovered. As yet few of them have been named. Mammoth Cave is really a congeries of hundreds of caves joined into one vast cavern by the breaking down of walls and floors through at least five distinct levels or tiers. This fact is only partly indicated on the standard guide map; but in the new survey the levels are shown by proper shading or colors. As an example, the combination known as Ganter Avenue, and which was accurately surveyed by myself some years ago, includes Black Snake Avenue, Indian Avenue, Welcome Avenue, etc., making a total of 8,500 feet of passageway from the Wooden Bowl Room to Serpent Hall. But to show all this on a portable map would make it unwieldy. Instead of attempting bulky details, let us limit ourselves to the description of the lately found "Violet City."

When Dr. R. E. Call and myself were preparing our manual in 1897, we were anxious to work a passage through a certain "tumbledown" in the Main Cave; but failing to do so, we named the spot "Ultima Thule." A massive wall of limestone blocks closed the avenue entirely, with the exception of an extremely narrow "crawlway," which we had found impracticable. Kaemper and Bishop attacked this crevice again, and at the risk of their lives. A broad slab pinned down Kaemper's neck to the floor, and another his back. With difficulty he extricated himself. But while there he heard the sound of falling water, which proved to him that the Main Cave continued beyond.

Nearly a month later, on the singular theory that there must be a connection between Ultima Thule and Sandstone Avenue at the end of the Long Route, where there is also a waterfall and a tumbledown, the explorers tried to force their way through from the latter, but in vain. Then they renewed their attack on Ultima Thule. By patiently removing many fragments of rock, they finally succeeded in worming their way through—not as was expected into Sandstone Avenue, but into a great oval hall 160 feet long, 120 wide, and 60 high, which now bears the appropriate name of "Kaemper's Hall." On the left they found a pit 90 feet deep, to which the name of "Bishop's Pit" has been given, in honor of the guide. Down into this profound abyss dashes the waterfall the music of which had led them on. Fifty steps to the right brought them to a short passage opening into a second hall, 75 feet in diameter and of about equal height, vaulted by symmetrical arches closing in a beautiful circle above. This they named "Elizabeth's Dome," for Mr. Kaemper's sister. On the left are several pits, making with others eleven pits in this general locality. One of them is named the Parrish Pit, for the cave explorer, Mr. Norman A. Parrish, of Buffalo, N. Y.; and the rest are as yet unnamed. It is supposed that they all open into an unexplored hall below. In the short avenue leading into Elizabeth's Dome, an iron gate is now fixed as a protection against spoliation of the brilliant formations beyond. The exit from the dome is by the Grand Portal, an arch 60 feet high by 50 wide, commanding one of the most impressive views in the underground world.

A steep hill of loose rocks forms the natural dividing line between two immense chambers. When I was there, last November, my companions, Kaemper and Bishop, requested me to seat myself at the top of a flight of steps, while they went forward, Bishop carrying an automobile searchlight brought in for the purpose, thus giving me my first view of the wonderful and fascinating region to which has been given the name of "Violet City," in honor of Mrs. Violet Blair Janin, the fair owner of two-thirds of the Mammoth Cave estate, whereof her husband, Judge Janin, is the principal trustee. The central portion of the so-called "city" is a massive formation named "Blair Castle," from its striking resemblance to a castle on the crest of a hill. The environs are styled "Walhalla," for the fabled realm above the clouds where dwell the heroes and gods of old German mythology.

Picking up our torches again, and carrying my bicycle acetylene lamp (to which a convenient handle had been affixed), we followed a natural pathway near the wall on the left that led us from place to place in Violet City. We found it an immense expanse, measuring by the tape line 250 feet in length and 125 feet in width, with an estimated height of about 100 feet—dimensions rivaled only by Wright's Rotunda and the Chief City. A great cave-in of sandstone rocks closes the end of the chamber, which seems to indicate the proximity to the Sandstone Avenue, or a similar locality. These rocks are cemented together by a wonderful profusion of onyx.

Stalactites and stalagmites abound throughout the Violet City, varying in color from the purest white alabaster through every imaginable shade. The upper central part of the hill is crowned by three masses of fluted white onyx, glistening with exquisite crystals, while from the roof hang in fine array stalactites eight or ten feet long. The right wall is decorated with pure white formations, and the left wall is coated with brown onyx. A row of beautiful stalactites of varying length emit musical notes when struck by the staff or the knuckles, and by skillful percussion simple airs can be played. Other attractions excite surprise. "The Beer Mug," a small stalagmite resembling a mug of foaming ale; the "Ripe Tomato," a rare bit of red onyx, and other odd specimens of natural mimicry are among these. One familiar with the brilliant formations found in the wonderful caverns of Luray might easily imagine himself in that Virginian fairyland, instead of in the Mammoth Cave of Kentucky. Thus far these marvelous treasures have been untouched by vandal fingers, such as have robbed or destroyed elsewhere what should have been most jealously guarded in the greatest cavern in the world.

In his zeal to open a passage from Violet City to the Sandstone Avenue, Mr. Kaemper obtained permission to use explosives, by means of which he made considerable progress. But indications appeared that he was likely to burst through to the surface, instead of into the Sandstone Avenue, and accordingly he desisted. In either event the result might have been of advantage. An opening into Sandstone Avenue would enable visitors to make the circuit through the Main Cave to the Maelstrom, and return by the Long Route without having to retrace their steps. And an opening to the surface would enable them to return by coach to the cave hotel, thus saving a tiresome tramp underground. To prove the proximity of the places mentioned, Kaemper and Bishop repaired, the one to Violet City and the other to Sandstone Avenue, agreeing on a fixed moment by the watch when they would fire revolvers, and likewise hammer on the rocks. The pistol shots were not audible; but the blows on the walls were faintly heard. By similar sound-tests it was determined that Wright's Rotunda is directly over the Serpent Hall, so that it would be possible to connect them by a stairway through a shaft. Incidentally, I may say that while we stood in the Chief City, we plainly heard the steam cars running overhead along the Mammoth Cave railroad.

It will be good news to all persons who have ever visited the Chief City and region beyond it, that a comfortable path has lately been cleared by removing the myriads of teetering slabs, over which so many have hitherto toiled slowly and in peril of sprained ankles or broken bones. It will also interest the public to know that, instead of the two long-established exhibition routes, four are now marked out for showing the most accessible and attractive features of the cavern. Three routes are shown in the accompanying sketches; while the fourth and longest one, to the Maelstrom and Hovey's Cathedral, follows lines indicated on the general guide map.

The facts now offered indicate that substantial progress has been made toward the solution of some of the mysteries of the greatest of all known caverns. Although the long-delayed instrumental survey is at present only in the hands of the trustees, it is sure to be an important factor when the cave is offered for sale; as it shortly must be, according to the terms of the will of the late Dr. John Croghan.

A happy suggestion has been made that, whenever the proper time arrives, this noble estate, and a number of adjacent caverns, along with the primeval forest by which they are yet environed, and including some of the mighty cliffs that flank Green River, should be reserved, either by the State of Kentucky or by the United States, and be known as the Mammoth Cave Park.

The SCIENTIFIC AMERICAN Fourth Dimension Contest, which closed April 1st, will be decided in June or July.

FEEDING THE AMERICAN ARMY.

BY B. R. WINSLOW.

Every great general who has maneuvered a large fighting force has discovered the truth of Napoleon's declaration that "an army travels on its stomach"; and to more than one has come the bitter realization that the best army is the army that has the best stomach. There is nothing which so completely withers patriotism and smothers courage as the gnawing pain of indigestion; therefore, the feeding of an army has been given as much study as its equipment as a destroying force.

In the superiority of food, based on the cost of the ration, the American army stands far ahead of the other armies of the world; in fact, there is no comparison whatever between the American ration and that of any other country on the globe. The cost of the American army ration is nearly one hundred per cent greater than the British army ration, and none of the other countries with big military establishments feeds its soldiers anywhere nearly as expensively as the English government does.

The American army ration is divided into three kinds: Garrison ration, field ration, and emergency ration. The garrison ration is that given soldiers at regularly established military posts; field ration, that issued to troops in the field in active campaign. The emergency ration is a condensed ration, in which the best and most valuable nutritive elements are combined in the smallest bulk. In composition the garrison and field ration are almost identical. Each ration, which is supposed to keep the soldier one day, furnishing breakfast, dinner, and supper, consists of 20 ounces of fresh beef or mutton, 12 ounces of bacon, 16 ounces of canned meat or canned fish, 14 ounces of dried fish or 18 ounces of pickled fish, 18 ounces of flour or 20 ounces of cornmeal, either 2 2/5 ounces of beans or peas or 1 3/5 ounces of rice or hominy, and either 16 ounces of potatoes or 12 4/5 ounces of potatoes together with 1 3/5 ounces of either onions or tomatoes, 1 3/5 ounces of dried fruit, 1 3/5 ounces of coffee, and 3 1/5 ounces of sugar. The ration also includes very small quantities of vinegar, salt, pepper, soap, and candles.

Nowhere except in the army can the food supply of 30,000 men be managed by 120 men. This can be done with the army on the march, changing station every day. The unit of administration is the corps, supposed to consist of 30,000 men. The unit of actual accountability, however, is the brigade. Ordinarily, an army corps will consist of three divisions, and each division will have three brigades. The chief commissary of the division issues his stores to each brigade in bulk. The brigade commissary in turn issues to each regimental commissary, also in bulk, and the regimental commissary issues to the companies. The rations are usually computed by the hundred, and are issued for ten days. A company of one hundred men would, therefore, be issued one thousand rations. In the field each soldier is supposed to carry one regular ration and one emergency ration all the time. The emergency ration is never eaten except in case of emergency, and the regular ration is issued every day.

The army ration, it will be seen, contains none of those things which are ordinarily considered luxuries. For instance, there is no milk included in the ration, and the soldier must take his coffee black unless he is able to purchase a can of condensed milk from the "sales store" with his "savings." Congress has authorized the commissary department to keep on hand other articles of food that are not included in the regular ration. These are kept in the "sales stores," and are issued to the mess steward in return for "savings" from the regular rations. Out of a company of a hundred men, there are a number who do not eat all of the articles in the ration. These would be wasted if drawn by the mess steward; therefore, when the thousand rations are issued to him, he returns to the commissary that part of the various components that he thinks will not be used. This, in the language of the army, is making a "saving" on the rations.

The value of the articles returned to the commissary is computed, and the mess steward is allowed to draw from the "sales stores" a sufficient quantity of luxuries that are not in the regular issue, equal to the value of his "saving." The government, however, will not allow a "saving" to be made on certain articles in the ration. Fresh meat, dried or preserved fish, potatoes, onions, tomatoes, prunes, apples, and peaches must be used; a "saving" cannot be made on these articles. They contain just the proper nutritive elements, and the quantities given are what the normal soldier should eat.

The company fund is another way in which the ration may be improved, especially at regular army posts. There are many sources of revenue for the company where there is plenty of ground at the post. Many of the companies have vegetable gardens, and keep pigs and cows. The pigs are fattened on the leavings from the kitchen, making their feed cost nothing. They are fattened and sold, the money go-