

Everything is Somewhere



By Angus W. Stocking, LS

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Caving's Holy Grail



Photo: Pete Lindale

A combined compass/inclinometer and a tape are the standard survey equipment in the tight quarters of most cave systems.

Cave exploration is not for everyone, in fact it is for very few. Just *reading* about it can make a claustrophobe cringe. But for those few – those strong, fit, physically narrow and psychologically hardy few – an entrance to an immense world, almost a different planet, is available in Central Kentucky. The massive limestone stratum that underlies that region has been carved by the waters of the Green River Basin, and the mapped stretches of labyrinth in what is now known officially as the Mammoth Cave System total more than 360 miles, making it the world's longest by a factor of three. It is a wonder of the world as

impressive as any mountain, glacier, or ocean, but photographs can only capture slices of it and few humans will ever grasp it as anything like a whole.

Accurate surveying of the cave system began in 1908, when a young German mining engineer named Max Kaemper came to the area, intending to visit for two weeks. He ended up staying several months and produced an accurate map of many miles of cave passage, including several new discoveries. He set a precedent that has endured; exploration, discovery, and surveying are nearly synonymous in this sector of the planet, more closely entwined than in any other human endeavor. Disorientation underground is the default state; it has

even been said that a sense of direction underground is something of a handicap, because the circuitous passages so often double back on themselves. When exploring new passages, cavers will sometimes stumble into a known section and reel with vertigo as they reorient. Explorers can push on a bit from known regions, looking backwards often, and find their way back. But only careful surveying and mapping make it possible to have a sense of the cave as a system, locate new passages, explore them, and return safely. Without maps, far fewer miles of cave passage would now be known.

Beginning about the 1950s, it became apparent that careful surveying

and mapping were also the keys to connecting cave systems, a goal of exploration that is unique to caving and which attained its fullest expression on September 9th, 1972. That's when a party of six cavers, led by John Wilcox, then Chief Cartographer of the Cave Research Foundation (the body that has organized Flint Ridge exploration for several decades), entered the Austin Entrance of the Flint Ridge Cave System and left through the Elevator Exit of the Mammoth Cave System, thus connecting the two and conquering what had become known as the "Everest of Speleology". One team member, a small, tough woman named Pat Crowther, compared the experience to giving birth.

At the time, the Flint Ridge System was already the world's longest known cave system, with 86.5 miles of mapped cave passage. The Mammoth Cave System was not too far behind at 57.9 miles of mapped cave. Between them was a deep valley that seemed to sever the most promising passages. Connecting the two was an awesome event in speleology, much like finding a way to stack Mt. Everest on top of K2 to create the new world's tallest mountain – some even called it the 'Holy Grail'.

The actual moment of connection could hardly have been more definite, or more dramatic. A series of remote Flint Ridge 'leads' – promising new passages 10 hours or more from cave entrances - had been systematically explored for several months. One expedition had even found scratched initials of early Mammoth Cave explorers, suggesting strongly that a connection was at hand. But the actual route remained frustratingly elusive, and optimistic parties would often return the way they came, crawling and wriggling for hours at a time rather than walking out the easy way. Wilcox's party faced a particularly heart-sinking moment; after nearly a day of work, they knew from survey data that they were within *a few hundred feet* of the Mammoth Cave System, but they appeared to be blocked by a 'siphon' – a section of river with no airspace. Wilcox decided to take a closer look and discovered that he could duck carefully through the worst section. Pushing on he saw up ahead... a straight line?... could it be... a railing?! It *was*, and Wilcox turned back to shout to his companions, "*I see a tourist trail!*" – the



Photo: Pete Lindale

Sometimes the most difficult part of surveying in caves is keeping the field book clean and dry.

words became immortal among cavers. Wilcox later wrote, "*My memory of the next few moments is indistinct. Victory is a feeling of vastness inside the skull. In this case, it is doubly sweet because it seemed so far away only moments before.*"

This awesome moment would not have happened without the careful, cumulative work of hundreds of cavers over several decades. In particular, meticulous surveys were essential. Intuitively, it would seem that surveying would come *after* the pathfinders pushed new routes and came back to tell the tales. Alternately, it seems that cave exploration might follow the 'base camp' model of mountain expeditions,

with a few individuals pushing deep into a cave for days at a time, supported by 'porters' schlepping in food and other supplies. But neither approach held up to the realities of Flint Ridge caving. Without surveys, pathfinders had no way of knowing where they were in the vastness of the cave system, and no way of telling others how to follow and build on their lead. Of course, some cavers *like* that aspect of caving – the thrill of having miles of cave forever to oneself – but under the aegis of the Cave Research Foundation, Flint Ridge exploration was remarkably cooperative, with most of the teams contributing to the gradually accreting knowledge of



Plane table survey used for precision sketch in the historic section, Mammoth Cave. L-R Pat Crowther, Carol Hill, unknown caver, Greer Price.

the system. Conversely, the base camp system didn't work, at least in Flint Ridge, because it was terribly inefficient. Resupplying and sleeping underground took enormous amounts of energy. 'Blitzkriegs' with occasional catnaps turned out to be the right formula.

The system eventually settled on worked for team players *and* individuals, and is probably the single factor most responsible for the great successes of Central Kentucky caving. Caving parties of (typically) four would strike out on long expeditions, sometimes lasting 24 hours or more. Support crews on the surface stood ready to assist. The underground teams would go to the furthest limits of an explored cave and begin surveying, so that surveying and exploration happened more or less simultaneously. There were variations. On occasion, a party would explore several hundred feet (a very long distance in the twisty, narrow passages) and then survey *back* to known areas. But this method was frowned on; too often the surveys were left 'hanging' – not connected – and were useless. A better system was when two parties surveyed together, leapfrogging each other and moving relatively quickly.

The resulting maps were maintained obsessively; reading histories of Flint Ridge caving suggests that donating rooms – or whole houses – to the maps was a good way to become president of the Cave Research Foundation, and perusing 'map walls' was an occupation nearly as absorbing to veteran explorers as actual caving. The maps definitely took on a life of their own, and even have an application outside the Mammoth Cave System. Portions of the maps were used as a template for the early (and groundbreaking) computer game "Adventure", and aficionados have been known to recognize rooms and passages solely from game descriptions.

Equipment used was (and is) sparse compared to modern surveying; it resembled colonial surveying. The use of tripods, total stations and prisms was literally impossible in some passages, due to bulk, and merely impractical in most of the cave. Survey equipment had to be small and light. Flint Ridge cavers relied on tapes and compasses with built-in inclinometers for their surveys, a minimalist set of equipment that has been in use for hundreds of years. In 'stand up' passages, the procedure is straightforward: the compass is used

to determine direction, inclinometers measure vertical angle, and the tape is used to measure distance. A good survey will also include sketches of the passage cross section, to give a sense of volume. Simple. But doing the same thing in tight tubes or watery channels is difficult and tedious; in some constricted areas, cavers have to back out of a passage after taking a reading so they can move their hands enough to take notes. Keeping the field book dry is a constant consideration. And sometimes progress is painfully slow – in difficult areas sight lines of just a few feet are common, meaning that it takes dozens of readings to get through short passages. To do this kind of work many hours from a cave entrance, with the prospect of a difficult return journey, seems superhuman... and perhaps it is. Certainly there are very few who attempt it. But the work has been done, and done well; the overall mapping error is believed to be within about 0.3 percent.

The connection of the Flint Ridge and Mammoth Cave Systems was as momentous as any achievement in the history of exploration. It built on several decades of difficult work by hundreds of individuals. It's curious that cave exploration isn't as closely followed as, say, mountaineering – perhaps it's because one can't see a cave, not in the way a mountain or ocean can be seen. But the physical work involved, and the privation, loneliness and danger, make cave exploration one of the most difficult of sports. The achievements in Central Kentucky, though underground, are one summit of human endeavor. *A*

Author note: This information was drawn largely from *The Longest Cave* by Roger W. Brucker and Richard A. Watson. It is a splendid book, one of the great classics of adventure writing. If the above has piqued your interest even slightly, you will thoroughly enjoy reading this superb tale, told by two veteran cavers. Additional information, and a much appreciated review, was provided by Bill and Sarah Bishop who were elite members of the Cave Research Foundation during the connection era – Sarah is a past president of the Foundation. This essay is an excerpt from the forthcoming *Lasting Impressions: A Glimpse Into the Legacy of Surveying*, a book about surveying and survey monuments produced by Rhonda Rushing, President of Berntsen International, Inc.