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The End is Our Beginning

1st Edition
March-May 2002

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The Carroll Cave Digs by Rick Hines

Introduction

Carroll Cave, located in Camdenton County, in south-central Missouri, is one of the most significant caves in Missouri with over 12 miles of mapped passages and over 100 known, but unmapped, side passages.

Most of the mapped passage of Carroll Cave consists of two major river passages, the Carroll River passage and the Thunder River passage. The DL7 passage is an exception that enters on the left side of the lower Thunder River passage. The Carroll River is a small, slow flowing stream that flows out of the natural entrance. The Thunder River carries a much larger flow of about 1,000,000 gallons a day and feeds Toronto Spring that is located about 3.5 miles northwest of the natural entrance. Much of the current volume that moves through the Thunder River passage, in an earlier geological time, flowed out the natural entrance, before finding its way to the lower elevations of the Thunder River. The junction of the two river passages is known as the T-Junction.

The current owner of the natural entrance (and only known entrance) will not grant permission for anyone to enter the cave. The Carroll Cave Conservancy has leased land over the cave from a cooperative landowner and is working to dig a new entrance.

Where Should I Start?

Where should I start on this project that has been a passion of mine for most of my life:

> My first trip into the cave in 1970,
>
> The early 1990's breakdown of the originally excellent landowner/caver relations as the entrance ownership moved to a new generation and grottos squabbled for control,
>
> My search for a new entrance or a point to dig a new entrance that started in earnest in October 1994 with a fact-finding trip to the area to try to meet with all the owners of land over the known cave,
>
> The sinkhole dig that started November 18, 1995 and was reluctantly abandoned after five years and over 1000 man-days of digging, due to safety concerns,
>
> The formation of the Carroll Cave Conservancy in January 1998 "to manage Carroll Cave in a manner that minimizes damage to the cave and its fauna while providing access for scientific study and exploration by responsible cavers,"
>
> The T-Junction dig that started with the drilling of a nine-inch pilot hole into the cave 118.5 feet below on November 10, 2000,
>
> The first explosive blast at the T-Junction dig on October 14, 2001 that started the relatively efficient process that has moved us to within in 52 feet of our goal?

Well, this is a publication for diggers so I will assume I have already said enough about ancient history, landowner relations and cave politics.

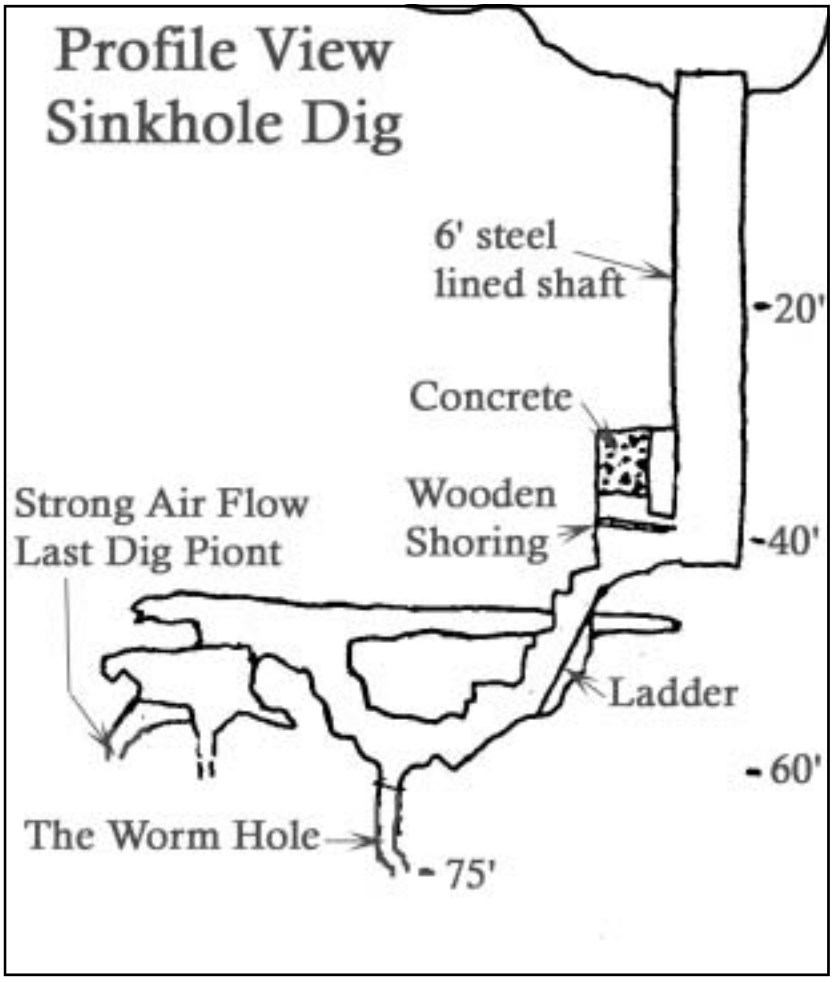
I will briefly summarize the sinkhole dig and then describe in a little more detail the T-Junction dig that is much more promising.

The sinkhole dig is located over a breakdown choke that was once thought to be the end of the Upper Thunder river passage. It is located approximately 2.5 miles west of the natural entrance. I found the sink as a result of my October 1994 visit when I met a 93-year-old gentleman, Mr. Chris Danuser, who pointed me to the sink. Plotting the GPS coordinates of the sink on my Carroll map confirmed my suspicion that the sink was directly over the upper end of the Thunder River Passage. The point is over a large breakdown pile known incorrectly as the Collapsed End. (Hard core cavers have pushed through the breakdown and traveled over 1500' beyond the collapsed end before turning around in a large bore hole passage!)

The original name for the sinkhole dig was the Trash Dig. Enthusiasm was high on the first dig. We hoped to remove a few loads of trash, discover a deep pit and drop into Carroll. After a dozen truck loads of trash and at least that many refrigerators were hauled to a more ecologically-stable resting place a couple miles away, it became clear that our goal would not be reached with a one day effort.

Three trucks rotated between the sink and the more ecologically-stable resting place. Greg Fry, Chris Danuser's grandson (one of two grandson's who own most of the land over the cave) worked with us all day. His four-wheel drive truck was the only one of the three with enough traction to drag the refrigerators from the pit. A human chain ferried five gallon buckets of glass, cans and plastic to the waiting trucks. We entertained ourselves by dating the artifacts uncovered. We estimated the age of everything from pop cans to bed pans. I was amazed at how well some of the plastic items had survived. A nicely preserved plastic water gun, plastic Santa and a bright yellow ball bat were found. As the yellow ball bat was thrown to the surface, Greg was heard to say, "you must be getting close, I just saw **a bat fly out!"** Well, Greg's humor continues to this day but it got harder to find anything humorous about the sinkhole dig as we continued digging nearly every month for five years.

The dig soon became too deep for the bucket brigades to effectively move material to the surface. Two runs of a 1" polypropylene rope were strung horizontally between two trees on opposite sides of the dig. A 4-to-1 block and tackle system was rigged from the poly rope and dropped directly into the dig. A board, approximately 2 feet by 3 feet with a chain in each corner was hung from the block and tackle system. Five-gallon plastic buckets would be filled with mud and rock and placed on the board. The board and buckets would be raised to the surface and the buckets carried to the sides and dumped far enough a way so that the material would not wash into the dig.



As we moved deeper it became necessary to line the hole to prevent material from washing in as fast as we could remove it. As we searched for a steel tank to shore up the dig we were fortunate to meet Danny Schupbach at a local construction company. Danny had access to some salvaged 6' diameter pipe that he donated to the cause. Danny has remained a strong supporter of the CCC, providing much needed material and equipment.

The first shoring to go in to the dig was an 11-foot long section of the 6-foot diameter 5/16-inch wall pipe. This section weighed about 2700 lb.

We moved straight down 42 feet through loose breakdown and mud. We cut up pieces of the 6-foot steel pipe and lowered them down the hole and welded them in place as needed to shore up the lose sidewalls. Progress was not easy. Often we would arrive for a dig and find that a heavy rain during the prior month had washed in more mud and rock than we had removed in the prior six months. I have a feeling that we dug some of the same mud and rock four or five times.

However, there were some very encouraging signs associated with the dig. In December 1997 we reached 32 feet and felt a good airflow between the rocks. Soon a bat crawled out and flew away. An hour later a second bat emerged. Yes real bats, not plastic.

As we continued down we had strong airflow. Velocities up to 800 feet per minute(10 mph) were measured. We followed the air straight down to 42 feet with our 6-foot shaft and then horizontally for 10 feet. The floor of the 10-foot long alcove trended down and under a bedrock wall.

On Sinkhole Dig 34 on July 17, 1999, we opened a small hole at the end of the horizontal shaft. As we dug the gravel and mud started falling into a cave below. A strong breeze was flowing into the cave. Our spirits were high as we slid through the small opening, down a steep gravel bank, to the cave below. We found ourselves in a room, 15 by 25 feet, with a ceiling height of about 5 feet in the center. Following the air we picked our way into an even larger cave room about 50 feet long. A small corkscrew passage dropped down about 12 feet below the floor of the second room to a total distance of about 75' below the top of the steel pipe and only 45 or 50 feet above the estimated depth to the Thunder river.

For several months we continued to dig at the far end of the second room. We tried to follow a bedrock wall down. We had very strong airflow and a clean fist size opening between the rocks.

We also had a very unstable cave. Most of the walls consisted of a loose stack of crumbling bolder. Large slabs of rock hung precariously from the ceiling. At the back wall where we were digging, we placed screw jacks to prevent a large rock from sliding in.

After Dig 39 in December 1999, we decided that additional work in the sinkhole dig could only be continued safely if a great deal of additional shoring were put into place in the small cave. The shoring would be difficult and time consuming. We decided it was time to put the sinkhole dig on hold and look at other options.

Drill a 36" Shaft

We contacted several companies to determine the cost of drilling a 36" diameter hole in to Carroll. Estimates ranged from $20,000 to $100,000. The only catch with the $20,000 bid was that the driller's equipment could drill through no more than 80 feet. We spent several months surveying on the surface to locate a point over the cave with less than 80 feet between the cave ceiling and the surface. Most of the surveyed Carroll passage lays about 120 to 140 feet below the surface. We found one spot that might have worked. The landowner would allow us to drill and would give us access but he did not want to do it formally with a long-term lease. In order for the CCC to maintain our 501 (c) (3) status, however, we needed a lease on any property in which we invested tax-free dollars.

Steel Going In

The Board

Harley in Water

Looking Down

From Dig to Small Cave

Drill a Pilot Hole and Jackhammer

The next approach considered was to drill a 9-inch diameter pilot hole into the cave and then open the hole to 30” using a jackhammer. We could have a 9-inch hold drilled for less than $1000 and we recently had an industrial strength air compressor and jackhammer donated.

With depth not as critical a factor, we then focused on finding the best spot for a new entrance with out worrying about the depth. This brought us to the T-Junction. The T-Junction is where the Carroll River Passage Ts into the Thunder river passage. Ceiling heights are as much as 40-feet and the room volume can easily accept the volume of material in the planned entrance shaft. The obvious advantage of the T-Junction entrance is three directions to explore from a central point. Other advantages include a large room to target for drilling, a good area for an in-cave base camp, a surface point with access to AC power, avoiding traffic through areas with high bat populations, and avoiding much of the nasty mud and water that Carroll is infamous for.


Drilling 9” Pilot

The T-Junction Dig

We carefully surveyed to locate the drill point. We hired a local well driller to drill a 9-inch hole. We estimated the depth to the ceiling to be 120 feet. On the first try we broke into the cave at 118.5 feet. The T-Junction dig had started!

After Drilling the 9-inch pilot hole we hired a backhoe to dig down to bedrock. We hit bedrock at 9 feet.

We were eager to try jackhammering. But the donated air compressor would not run and the repair work was going slowly. We rented a compressor and jackhammer to test the process. The first 4 inches of rock was difficult to get through even though the layer below was soft and crumbly. When we got into the crumbly material we forced it into the 9-inch pilot hole too fast and plugged the hole. We eventually got the hole unplugged by probing with a ½-inch steel pipe.

Before trying additional jackhammering we needed to stabilize the 9 feet of overburden, which was tending to wash in with every rain. We obtained an 8-foot diameter by 16-foot tall steel tank. We cut a 4-foot diameter hole in the bottom of the tank at the perimeter of the tank (not centered). With the help of a backhoe we lowered the tank into place. The tank extends 9 feet below the surface. The top of the tank was cut off leaving about 3 feet above ground for a safety rail.

A 20’ tall tripod was centered over the 9” hole and welded to the steel tank. Doors were cut and hung to provide access. A 4 to 1 block and tackle system with 600 feet of 7/16 nylon climbing rope is attached between the tripod and the “elevator.” The elevator moves the digger in and out of the 30-inch shaft. The elevator consists of two 16-inch diameter boards separated by 3 lengths of 7-foot chain. One stands on the lower board and the top board provides some protection from anything that might fall from above.

Let's Blast

Our first jackhammer experience led us to consult with others and consider additional options. One option to speed up the process was to drill, set explosives and blast. Others around the country had had success with several variations on the blasting approach. The 9-inch pilot hole and large cave room below provided an opportunity to safely remove the blast debris without hauling it out overhead. Two things were needed before we could test blasting. We needed access to explosives and we needed expert help. As I searched the internet for information on explosives I stumbled on to The University of Missouri Explosives Lab at Rolla (http://www.umr.edu/~explosiv). The web page mentioned the director of the lab, Dr Paul Worsey. I emailed Dr. Worsey and asked his advice. He promptly got back with me and to my surprise I found that he was already familiar with the dig. One of Dr. Worsey's students is a caver and had been following our progress. Paul is also a caver with most of his experience in his native England.

8' Steel Tank to Bedrock

Paul has turned out to be a very valuable resource. Paul has trained CCC people on site. Additionally the CCC sponsored one of our members at a blasting seminar taught by Paul. Paul has obtained donations of blasting caps and the main charge explosive, and he has provided several students to help the dig by transporting explosives from and to Rolla.

One of Paul's students, Ryan Freeman, is doing a project on our dig and is conducting experiments to develop an optimum drilling and blasting process. Seismographs are being used to measure shockwave velocities so that explosives charges can be reduced to the appropriate levels to minimize damage to the cave as we get closer to the ceiling.

With Dr. Paul Worsey's help we set of the first blast on October 14, 2001. As of December 23, 2001, we had completed 33 blast cycles and had moved the bottom of our 30-inch diameter shaft to within 52 feet of the ceiling of Carroll Cave.

A blasting cycle consists of the following:

1) drilling 1.5-inch diameter holes,
2) placing non-electric caps in the main charge explosive,
3) loading the explosive into the drilled holes (typically eight),
4) taping the "non-el" shock tubes to an electric cap,
5) moving to a safe distance,
6) detonating the blast,
7) starting exhaust air to clear the shaft,
8) working the debris down the pilot hole,
9) scaling the walls of loose rock and squaring up the bottom of the hole with a pneumatic chipping hammer,
10) setting a drill template,
11) measuring the distance to the template and to the debris cone in the cave,
12) Start all over!

We have experimented with a number of variables in the blast cycle and have learned a lot but may never have the optimum recipe.

We have learned that for the 1.5-inch holes we are drilling, the 7/8 inch drill stem gets stuck in the hole less often than with the 1-inch drill. We have drilled holes from 2 feet deep to over 4 feet deep. The deeper holes take longer to drill but the depth gained per day is larger. Well I guess the list of things we know with a high degree of confidence is fairly short.

The list of things we think we know, debate, and test is longer. We have experimented with the amount of explosive loaded in each hole. Our friends at Rolla are interested in finding the minimum amount necessary to do the job. My feeling is the more the better. We use a metal template with 6 equally-spaced holes on a 28-inch circle to locate the start of the drilled holes. We drill away from the center with about a 6-degree angle from vertical so that the shaft ends up at about 30 to 34 inches in diameter. We are currently

using an 8-hole pattern that adds 2 holes nearer to the 9-inch pilot hole. The 8-hole pattern is the currently preferred pattern. When the 8-hole pattern is used the 2 holes near the pilot hole are loaded with zero delay detonators. Two of the neighboring outer holes have an intermediate delay and the remaining four charges go off last. The first explosion opens a hole for the next blast that in turn opens a hole for the material from the final blast.

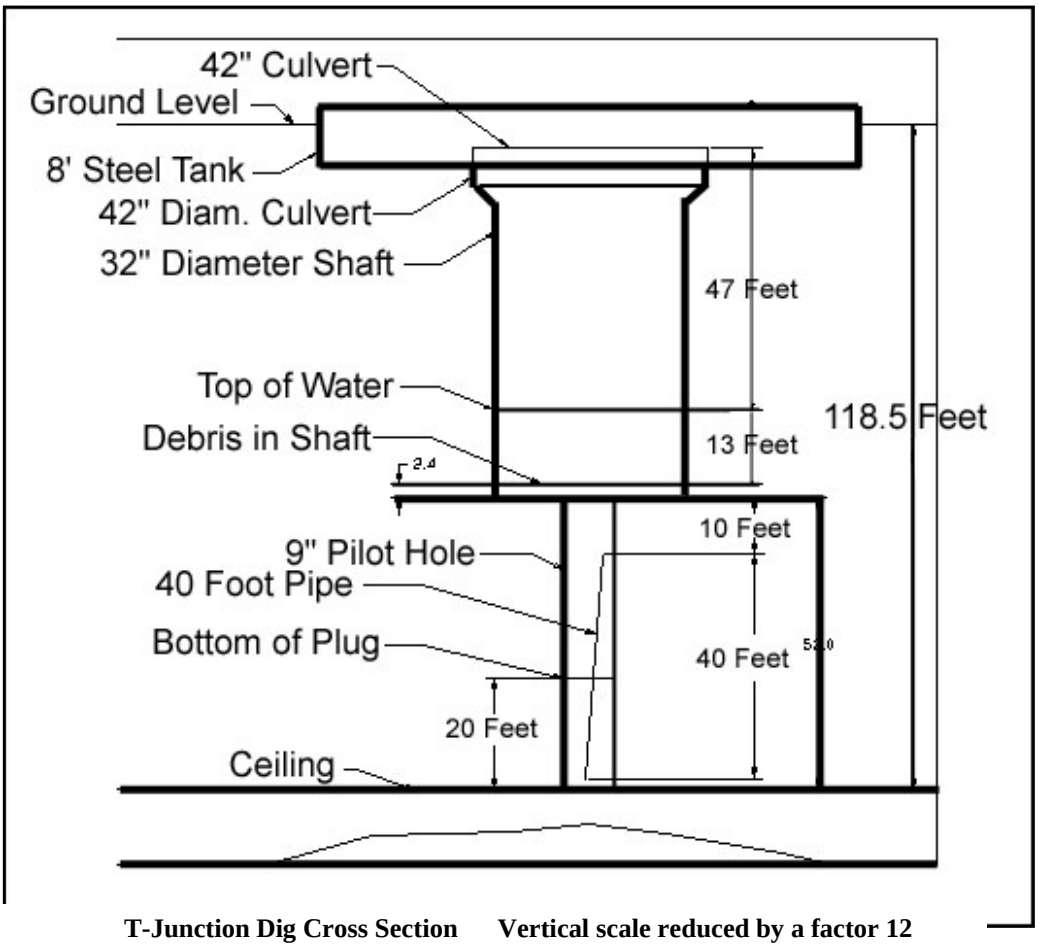
We have had problems clearing to the bottom of our drilled holes. We sometimes leave a step at the bottom that requires jack hammering or a second round of explosives to square up. Variations in the rock are a factor. We hit one layer where quartz grains had replaced all or nearly all of the limestone. It took three blasts to clear the foot thick layer.

By far the biggest problem we have encountered is plugging the pilot hole. A plug tends to occur when too much material flows down the 9-inch hole too fast. We have tried to control the rate by hanging a 4-inch pipe or an I-beam in the pilot hole and we have never had a plug occur with this system. The pipe or I-beam is about 8 feet long and is suspended in the 9-inch hole so that the bottom of the steel is near the bottom of the drilled holes. The steel prevents the debris from the blast from falling down the pilot hole until the steel is wiggled. With this method the debris can be slowly worked down the 9-inch hole at a rate that prevents plugging. Although this process works, it is not without problems. It is difficult to thread the steel down the hole with 8 non-el tubes crossing over the hole. Each blast severely deforms the steel limiting its life and making it more difficult to thread it into the hole.

Because of the problems associated with hanging a pipe or I-beam in the hole, we have tried other systems as well. We thought with the 8-hole system with delayed blasts, the material would flow down the hole in an orderly manner. That seemed to work for a while but then we plugged the hole. We tried several lengths of a heavy chain and that seemed to work for a while but again we plugged the hole. The chain may still work if it is hung deeper into the hole to prevent it from being lifted out with the upward moving debris from the zero delay dets.

As of February 2002, the pilot hole is plugged with 13 feet of water over the plug. We have constructed a 63-foot long drill stem by welding ¾-inch pipe together. With air, rotation and hammering provided by our pneumatic drill we hope to break through the plug. If we can get it started moving the water pressure should flush it into the cave below. When the weather improves we will try again. You can follow our progress at

www.carrollcave.org



T-Junction Dig Cross Section Vertical scale reduced by a factor 12

Thanks

I would like to thank all the people who have made this project possible.

Greg Fry: Owner of much of the land over the cave and manager of the cattle ranch where the dig is located. Greg tolerates us, encourages us, and even helps pull rope.

Chris Danuser: Owner of the land the dig is on. Chris has given the CCC a lease on the property at the dig site.

Bill Hays: Our pro bono attorney

Danny Schupbach: Has provided steel for both digs and loaned us a compressor and pneumatic drills.

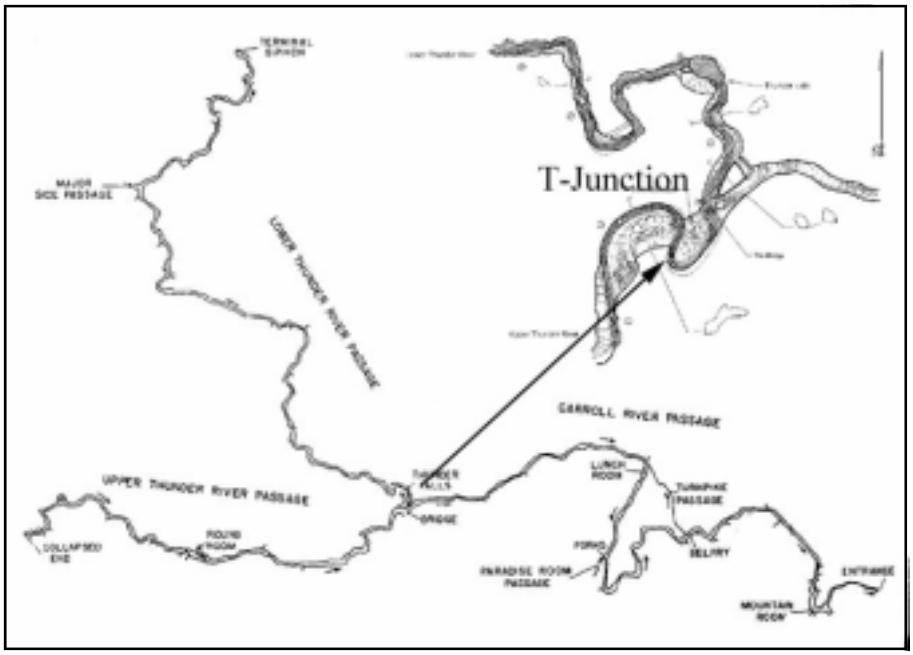
Paul Worsey: Explosive expert, that has arranged the donation of explosive for us.

Ron Jaeger: Has made substantial cash donations.

Jason Percival: Backhoe operator who has donated his services.

Jim Stamper: Well driller who drilled the 9-inch hole at a reduced cost.

Kay Hines: My wife who has put up with me being at the dig for a "few" weekends.



More photos, articles and maps available online at:
www.carrollcave.org

WinKarst was born sometime in 1987, with the early exploration of Lechuguilla Cave. With as much as five miles of passages discovered a week, cavers needed an efficient method to determine where the cave was going. In the early days WinKarst was simply called Karst and was DOS based. Plotting the first 50 miles of cave presented a significant challenge for a portable DOS machine used in the field at the time.

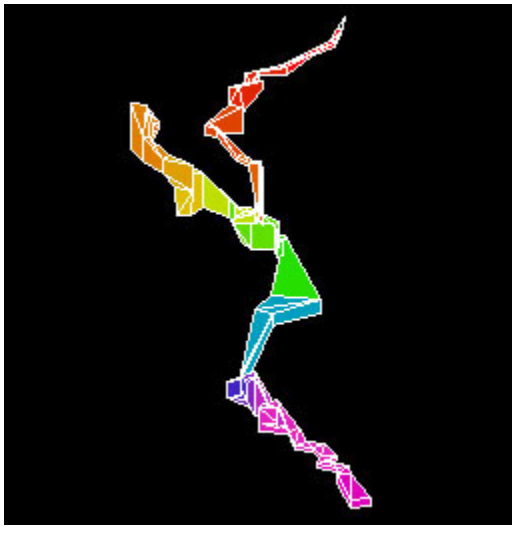
The evolution of WinKarst mirrored that of the personal computer. Sometime around 1995, with the introrduction of Windows ’95 and 32-bit processing, Karst became WinKarst. The change was more than the cosmetic user interface, as Karst was written in Pascal and WinKarst in C++. The year 1995 was also the first year WinKarst was distributed over the World Wide Web.

Over the years, new versions of Windows were introduced and WinKarst evolved with the addition of important functions. WinKarst is the first and only cave surveying program to incorporate automatic calculation of magnetic declination. Key to determining magnetic declination is geographic position. Rather than relying on difficult surface surveys or unreferenced coordinate systems, cave entrances in WinKarst can be specified by latitude and longitude. Users can record cave locations with GPS and plot them on master system maps. WinKarst is the only program to import waypoints and tracks downloaded from a GPS unit.

Geographic locations give users more than one way to show the relationship between entrances, as well as access to a wealth of data available from the USGS. Around 1997 the USGS began providing digital elevation models (DEM) to the public. Later the USGS modified the file format to include map features such as road, waterways, and political boundaries. WinKarst can read elevation data provided in original DEM or the newer SDTS file formats. Once the data is loaded, inferior elevation data provided by a GPS is subsisted and accurate 3-D maps are created. WinKarst is also the only program to generated elevation contours and surface mesh models in three-dimensional views.

WinKarst enables the user to accomplish more with their data than other programs. An indexed text file exported from WinKarst is suitable for import into database software such as Microsoft Access. The export includes all of the raw survey data and the reduced coordinates of stations and entrances. WinKarst has a WYSIWYG DXF export routine. If you are viewing a two-dimensional drawing you get a 2D DXF file, and likewise for a three dimensional drawing. The program can also export bitmaps and waypoints suitable for uploading into a GPS unit.

With the advent of Windows XP, all applications must use 32-bit processing. WinKarst runs with Windows XP. WinKarst has an integrated editor, which means the user can edit data and see the results without saving the data to the hard disk. This makes it more difficult to corrupt data saved on the disk. WinKarst can also open surveys directly from the file manager, web browser or email application through file associations.



Version 9 of WinKarst for 2002 will include two major enhancements. In the next update, the program will process SDTS files to incorporate roads, waterways, and political boundaries into maps. The new version will also register bitmaps of sketches with survey stations and display a composite view of the sketches and line plot. With two registered stations, WinKarst will scale and rotate each sketch to match the view of the line plot. Watch for the update during the spring of 2002.

http://www.resurgentsoftware.com/WinKarst.html

Canyon Widening

By Mark Minton (reprint from Digger's Gazette)

We have all encountered places where chemical persuasion was necessary to demolish a boulder, knock off a corner, reduce a bulge, or remove some other obstruction in a small passage. Such occasional enlargements are relatively easily accomplished by various techniques. But what about when the passage itself is too tight?

In most cases that is the end of exploration, since mining out a passage large enough to get through would not be practical for any distance. Or so I had thought before confronting such a situation in a cave with tremendous potential and super airflow. In our case the passage was a tall, narrow canyon ten or more feet high but only a few inches wide for as far as our lights could shine. There was actually probably enough volume to be passable if it could just be rearranged to more human-sized dimensions. This lead sat idle for several years while we contemplated strategy.

After discussions with several cavers adept at digging, we learned of and refined a technique whereby one drills small-diameter holes and inserts detonation cord (primer cord) as the charge, rather than placing a larger charge on the surface of the rock. Anyone who has seen the difference between charges on the surface of a rock and embedded in it will appreciate the tremendous difference in efficiency the latter provides.

This seemed promising, but there were still some big unknowns. Could we really remove enough rock to enlarge such a narrow canyon to passability over a relatively long distance? And how would we be able to drill enough holes to accomplish this task? Hand drilling was out of the question, and battery drills just wouldn't be practical either. At this point a little reckoning of the survey notes provided a solution.

Although it seemed like we were a good ways underground due to the presence of several short drops and some very tight passage, the actual traverse distance was less than 500 feet. We could run wire and use a generator! With a 110-volt drill we could drill holes all day if we needed to. Another feature of the cave to our advantage was the tremendous airflow, which was always going into the cave. That meant that smoke and vapors from the blasts would not be a hazard. (Had we been much farther into the cave where 110-volt power wouldn't have been practical, we could still have used a gasoline-powered hammer drill, since the airflow would have carried its exhaust away as well.)

After a six-year hiatus we returned to the lead. Our primary equipment consisted of a heavy duty industrial Black and Decker 110-volt rotary hammer with two carbide-tipped SDS-Plus bits a half inch in diameter and one foot long, 500 feet of ordinary household 12/2 Romex electrical cable, a portable generator, a spool of quarter-inch-diameter det cord, and a couple of boxes of electric blasting caps. It took a couple of trips to rig the wire in the cave and get it stowed up out of the way of traffic. One person stayed topside to look after the generator while two or three headed in to try the system. At the appointed hour the generator was fired up and almost exactly on schedule we tried the drill at the lead. It worked great! We could drill a hole in only a few minutes' time, although sometimes finding enough room to position the drill with its long bit was a problem. (We realized later that in extremely tight quarters one could use a shorter bit to drill a shallower pilot hole, then insert the longer bit into that hole and attach it to the drill in place.) We even put an electric light bulb in the circuit so that we had ample light to work by.

The strategy was to start drilling where the passage was still passably wide, and drill holes parallel to the canyon walls six to eight inches back from the edge and eight to twelve inches apart vertically, like giant perforations. The drill bit had to be pulled out of the hole periodically to clear the accumulating rock dust, especially if any moisture was present, which turned it into mud and caused binding. The reverse setting on the drill was handy for this, as well as for getting it unstuck if it bound in the hole. When a hole was complete we would blow the final dust out with a blow tube from a bolt kit (two-feet-long, quarter-inch-diameter rubber

tubing). Holes were drilled on both sides of the canyon whenever possible for maximum widening, typically four to a side. As it happened, in our case the easiest place to work was not at the floor of the canyon, but rather near the middle. This turned out to be especially fortunate later on.

When a set of holes was complete, the drill and wire were pulled back to a safe distance and loading of the holes began. (Note on handling det cord: it should always be cut with a knife, folded over the blade that is pulled through the cord and into the air. Never cut against a hard surface or use diagonal cutters or scissors, which could trap and compress some of the powder and detonate it!) An advantage to using smaller diameter det cord is that you can choose how many strands to put into each hole. It turned out that every hole did not even need to be loaded, as some empty ones still served to direct the blast along the desired direction. Anywhere from one to three strands of cord were used in the loaded holes, depending on the situation. The strands were bound together with electrical tape to insure intimate contact for good propagation. One of the strands ran from one hole to the next, so that the entire set was connected into a single charge, requiring only one cap to set it off. Electrical tape was also used to secure the cap near the end of one of the strands, which was cut long enough to stick out of its hole and wrap over the end of the cap, where the majority of its power is directed. No mud packing is required, which makes for a nice, clean operation. With so much det cord exposed outside the holes, however, the blast is pretty loud!

When everything was ready we backed off to a safe haven to set off the charge. Even though we had the electric wire from the generator, for safety we chose to run a smaller separate wire for the cap and use our electric lamp batteries to set it off. The effects of the blasts were impressive.

The sides of the canyon would be sheared off generally along the line of holes with little damage further back into the wall. Along the length of the canyon the blast often sheared off rock two or three times the depth of the holes, especially where there was a natural seam or crack in the rock. The spoil came off in impressively large chunks, sometimes so large we had to break them up in order to dispose of them. The fact that we were not working at floor level turned out to be a tremendous advantage, since we could drop most of the spoil down the crevice of the canyon below our level.

In many cases we were able to transform impassably tight canyon into essentially walking passage in one operation, complete with a solid 'floor' made up of spoil. A small sledgehammer and chisel are useful for this mucking out stage. In almost no case did we ever encounter any smoke, as the airflow carried it all further into the cave.

The process would then be repeated through drilling, loading, blasting, and mucking. We never really found the limit to how far back from the existing canyon wall we could drill and still succeed in shearing off the walls, but we never took more than about an eight- to ten-inch bite. Our reward for this labor was encountered thirty-five feet from the start of work: a three-hundred-foot free fall pit, with more drops and going passage below! The wire was left rigged in the cave for several years, during which time it was tapped into at various points to improve especially nasty squeezes. The drill was always brought out after every trip, however, to avoid corrosion. In all of our countless holes, we never broke or dulled a bit - the spare never came into play. Although we used it for a canyon, this technique should work for any passage that has an already exposed face to work back from. I would recommend it to anyone who needs to widen a tight passage, as long as you have sufficient air flow (and if you don't, it probably isn't worth pursuing anyway).

The name and location of the cave as well as the names of the other participants in this project have been intentionally omitted due to the controversial nature of blasting. Get proper training before attempting any use of explosives.

Cracking An Old Cave

By Yvonne Droms

This cave has been known for a long time, as any cave with an accessible, large entrance usually is. The cave was surveyed quite a few years ago, but it was not fully explored though, and leads remained. Just recently, a group of local cavers took on the task to resurvey its known passages and to continue its exploration.

Thanks to their work, the re-mapping of the cave had been accomplished a few weeks prior, and so today our little group was looking forward to continue in virgin territory. There were three of us today. We parked in front of the majestic entrance at the foot of a little crag, and were soon ready to go in.

This one is not an easy cave, and I can see why it got abandoned by the initial explorers for bigger and better caves... Progressing along its main passage is done mainly on hands and knees or by belly crawling, sometimes for hundreds of feet in water. It's really rough on your knees because the passage is often covered with big cobble stones, and pebbles can easily get under your kneepads and into your boots. At times the ceiling would dip inconveniently, forcing us to crawl through water and to get our chests wet.

Eventually though, we were able to leave the water when the stream sank into a lower passage to our left. We continued crawling straight ahead, staying in a wide but low passage. Unfortunately the ceiling slowly kept lowering until there was no recourse but for us to flatten ourselves and continue on our bellies. Picking the deepest channel in the virgin passage ahead, we elbowed our way onward. Even though it was at least 20 feet wide, the passage was only about 18 inches high at best by then.

It did not look very promising. Sure enough, after a bit more belly-crawling we came upon an old rimstone dam that barred the passage ahead. We scanned the wall carefully from left to right, hoping to find a spot where the ceiling was possibly a bit higher, which would allow us to squeeze through. But the ceiling was flat as a pancake and the rimstone dam reached to within about four inches of it quite uniformly.

Memories of various occasions when formations or flowstone obstructed the way on flashed through my mind. I am not one to break anything willingly, and it is never an easy decision to use brute force to continue onward. Often, when there is no air, or when the passage does not obviously look passable beyond, the decision to turn around is easily made. But sometimes the temptation to break something in order to continue is too strong to resist, especially if there is good reason to believe that much more cave lies beyond.

This time, the very strong wind that blew by us made it obvious we should continue onward. We peered into the unknown, faces pressed flush against the ceiling in order to see over the edge of the obstacle. We could see for quite a distance, and by passing an arm over the rim, we could feel that the floor dropped off right on the other side of the wall, allowing for hands-and-knees crawling. With such promising passage ahead, the decision to break through this obstacle came easy.

We had not brought our hammer with us, and really regretted that decision. We looked around for a rock suitable for our purpose, but there was none. We had to belly-crawl back quite a long way until we found a couple of rocks big enough to use as rams. While my two buddies finished some surveying in order to connect to an existing station, I rolled and dragged the two rocks the few hundred feet to the barrier. I checked along the entire edge of the dam to see where it would be the least difficult to break through. I finally picked one obvious spot where the ceiling was a tiny bit higher and started hitting the rim of the wall with one of the rocks. It was not easy to do, since I was lying on my side in a passage barely 14 inches tall, and therefore the blows were quite ineffective. I continued for as long as I could, but I had only bashed out a couple inches of the upper, thinner part of the wall by the time my friends came back.

Acknowledging the superior upper-body strength of my male companions, I graciously allowed my two

buddies to continue my work. In other words, I knew they would be much more efficient at it than me... So I squeezed myself into a 9-inch-tall nook of the passage, in order to let one of them pass by to have a turn. Not much room to work in those tight quarters! I watched the action, trying to make myself as small as possible in order to ward off the cold. We were quite wet from all the stream passages we had crawled through to get here, and the wind was pretty strong. Every now and then I took a turn at the ramming, in order to warm up. The wall resisted for a long, long time. Amazing how strong a rimstone dam is! But it was no match for our resolve.

Eventually, after what seemed like ages, we had created a 10-inch-tall by 20-inch-wide slot through which we managed to slither, while scraping our bodies against the jagged edges of the rock. Each one in turn, we landed in a pile at the bottom of the dry pool, all elated to have crossed that obstacle. Onward with the exploration! Peering ahead, we crawled on to explore this exciting new territory. Soon, however, our lights hit upon a similar obstacle. Another rimstone dam ahead! Disappointed, we searched in all directions to find a way to squeeze through. Far to the right, there seemed to be a place that was choked with what looked like only mud, but when I backed into it, trying to use my feet to kick through, it turned out to be rimstone or rock instead. When we aimed our strongest lights through the gap, we again found going passage, as far as we could see. So we gathered for a pow-wow in the deepest part of the dry pool, where it was possible to sit up.

Should we "break and enter" again? "The wind is howling through here... This has to go somewhere! There must be big passage ahead! We will find that elusive mother of all drainage basins yet! Today's the day, if only we can get through this obstacle!" ... Contradictory thoughts battled in my mind once again—but my reluctance to break any part of a cave was in the end easily overcome by my intense desire to continue the exploration. “Let's find out where that wind is going,” we all agreed. We set off to carefully check the rim of the dam, which wove a drunken line across the entire width of the passage, like a wave lapping a beach. I found a place where the wall was quite thin, and pointed it out to the guys.

We retrieved the rock we had used before, and started working at poking a hole into the thinnest part of the wall about six inches below the top edge of the dam. Lifting the heavy rock and bashing it against the wall was very difficult this time, because the passage was a bit taller here, and there was no leverage and nothing to push against. So my buddy asked me to support the back of his helmet, so he would not have to hold his head up at the same time as he hit the rock. I settled into position with my elbows braced on the floor and acted as a head support while he swung the rock as hard as he could. It really helped, and slowly a small hole was opening in the dam.

Taking turns as much to keep warm as to take a much needed break, we enlarged the hole for what seemed like a very long time until, after one final big bash, the upper edge gave way and we had ourselves a way onward. I got the honor to go off and explore and so I slipped through the narrow gap, landing on the other side into very sticky mud lining the bottom of the empty but wet pool. While the guys were busy enlarging the hole some more, I crawled ahead, using my strong light beam to check for a way on. It started to look mighty familiar when my light hit yet another obstacle. Oh no, not another one, I grumbled to myself, not wanting to disappoint my buddies quite yet. I carefully followed the edges of my basin, hoping for a way through, please, please, anywhere, but I had to finally announce that indeed, we had a third rimstone dam ahead. I knew we should not have joked earlier about "three being the charm" and about the French saying "jamais deux sans trois" which means that always, inevitably, there will be a third one... And this third time, the obstacle seemed impossible to breach. The rim was much closer to the ceiling, allowing only two or three inches of space, and when I squeezed my arm through trying to check out the other side, I could feel a shelf almost two feet wide. There was no way of telling how thick the wall actually was, or if there was any space at all to crawl beyond, if we did break through.

By then my friends had caught up with me, and we commiserated over our bad luck. The wind was just as

strong here, and we stared into the unknown virgin passage, unable to tell what lay ahead, and feeling very frustrated. There was no way of attacking this obstacle with a rock the way we had done it with the previous two dams. This called for at least a hammer or a sledge, if not some even more convincing method such as Micro-blasting. We therefore resolved on the spot to come back with adequate equipment in order to find our way onward in this very promising, windy lead.

We turned around, scraping our way painfully through the two mail-slots then belly-crawling on until we rejoined the stream. Continuing towards the entrance, we eventually came upon a side lead that was not on the map and so we decided to tackle that. I was setting point, so I started into the passage, following the infeeder upstream. It became miserable almost immediately, twisting and turning and constricting and forcing us to belly-crawl through cold puddles. But continued it did, without reprieve. We almost wished the passage would tighten enough so we could stop. We were not wearing wetsuits, but even though we were by now almost completely wet, we did not feel cold because of all our exertions.

We were causing so much fog that it was hard for me to see ahead and plan my next station because the wind only slowly cleared the fog away. Going forward to check out the passage then coming back to set the station was out of the question! It was way too tight, gnarly and miserable, especially with having to drag our packs along, and there was no way to turn around. The sketcher in our group was not very happy about the cramped quarters or having to sit in puddles waiting for us to survey, and the other, who was on instruments, was having a lousy time reading them, especially in the positions I was forcing him with my choice of stations. The passage was zigzagging madly with successive 90-degree turns, was partially filled with water, and there were no convenient projections on the wall, therefore there was not much of a choice for good survey stations.

We surveyed on, stoically, for 33 stations, then called it quits. We had been in cave for 10.5 hours by then, and ahead, there was no end in sight: it looked no better, no worse. Packing up our equipment, we backed up until we found a place to turn around, then meandered our way back to the main passage. All we had left to do then was the tedious crawling through the deep water and the cobble crawls. We got out after a 12-hour trip, tired and bashed up and sore, with only 577 feet of surveying to show for all that misery. But somehow, we were still happy and excited about the possibilities left in that cave. We will be back to find out where that strong wind is going to.

Crush Syndrome

By Rachel Bosch, WEMT, NREMT-P

The information presented here will hopefully be a reminder of how dangerous digging can be, and also help you plan in case the dig goes bad. As in all cave-related activities, digging presents a set of hazards, such as entrapment, that may be life threatening, even long after the entrapment has occurred.

Let's say you and your friend are working on a dig in your favorite big-air blowhole. The passage is slightly unstable, but you can "smell" cave ahead, so you keep going without shoring up. Then a loose rock falls on your friend's leg, trapping her so she can't move. If you can safely remove the rock soon after it has fallen, then do so. If you can't get the rock off her leg, what do you do? In this situation, if there are three or more people in the area, one person should stay with the injured digger, while the others go for help. You will need to have trained rescue and emergency personnel on the scene as soon possible in order to get your friend out. However, if you are alone, first make sure your friend's airway is clear, she is breathing, and she has a pulse. Next take action to make the area safer by stabilizing loose rock or using padding to keep your friend out of water or mud. Now go for help and get that help back to your friend as quickly as possible.

To aid in your decisions in getting your friend extricated from beneath the rock as well as providing appropriate information to rescuers, it is important to understand what happens to a body that is crushed by a heavy object. Crush Syndrome, is the body's reaction to the removal of the heavy object. Sudden death, or death later can result from the removal of the heavy object, thus your recognition of this potentially fatal outcome could save your friend's life.

When a person is being crushed, the tissues at the crush site are being damaged, and toxins are building up at the site. Generally, damaged tissue releases potassium, while damaged skeletal muscle releases myoglobin. When the heavy object is lifted from the injured site, these substances are released to the rest of the body. The large amounts of potassium can cause heart problems including the possibility of sudden death from cardiac arrest. Myoglobin is toxic to the kidneys and therefore can cause renal failure, resulting in death a few days later. In addition to toxins being released, fluid flows into the damaged site from the rest of the body. This sudden flow of fluid into the damaged area can affect the fluid balance in the rest of the body and lead to shock.

While your friend is trapped, avoid giving her anything to drink or eat since she may not be able to swallow, and because there is a risk she may vomit, which could cause her to choke. Medical professionals will administer fluids when they arrive.

Now that you have the information to understand what may be happening to your friend's trapped leg, alert medical personnel when they arrive about the possibility of Crush Syndrome. You will also want to tell them (1) the sequence of events that lead to your friend becoming entrapped, (2) how long your friend was trapped, and (3) anything your friend might have told you about how she was feeling. Ideally, medical personnel will arrive who are knowledgeable about Crush Syndrome, and about how to prevent it from occurring. Usually they will treat it with administration of intravenous or oral fluids with potential addition of certain medications to diminish the effect of the toxins and/or shock.

Given this information on Crush Syndrome and the dangers of removing a rock from a digger who has been trapped for a long time, are there circumstances when removing the rock is the best course of action? The answer is yes. When the rock is prohibiting your friend from breathing, then the rock must be moved immediately.

Finally, the best way to help your friend is to take precautions before the rock falls. Shore up the dig. Work from above. Be vocal about your concerns. If you don't like the way it looks, call the dig off until a safer route can be found. For more information on cave safety and rescue techniques, see
On Call, A Complete Reference for Cave Rescue, 2001 Edition.

Aaron Bird: "How long have you been caving?"

Bob Handley: "Oh, I started out in earnest with VPI in I guess it was January or February of 1948. So that's makes it going on 54 years now I guess. Before that I had been in some caves with my older brother. He was studying mamalogy in college and so he was looking for study specimens of bats and we went in several of the caves around Blacksburg. Much earlier than that I had gone in several caves back in 1937, when I was about 9 years old there at Frankford. So I have been caving in caves for quite a while, I think its 8 different decades."

Aaron: "Where were you living when you first caved in the Frankford area? Did you grow up in West Virginia?"

Bob: "My dad was born and raised in Lewisburg, and his home place is there just west of Lewisburg. We would come from … I guess at that point I was in Blacksburg… we'd come over to visit to my grandparents and I had a bunch of uncles and cousins and so forth in the area and so that's the reason I was here… in Frankford."

Aaron: "Bob, I've been curious about how digging came to be so important. I think… probably up through the 1970's at least, weren't there a lot of open caves that people didn't have to dig?"

Bob: "Well… that's true, but in order to explore a known cave, we did dig on occasion when we had a good blast of air blowing through a very small passage that required digging to get through… and that was the case in Organ Cave. We dug … in fact the Charleston Grotto I think it was back in '46, '47 something like that, had opened what we called the 'Old Saltpeter Route' by digging. They moved some rocks… and if you're familiar with that passage at all then you know there's one place about where the connection back to the Main Room … the Entrance Room there in Organ…. what Jane Morgan calls the Chapel Room… where that connection is, is about where the breakdown was. I imagine really the saltpeter workings there in the 'Old Saltpeter Route' were "worked" through that connection to the Chapel Room. I was seriously doubt if they went down to the Organ Stream and down the 13' waterfall and down that way. Probably came directly in from the Chapel Room down into the saltpeter workings… but that would have been back in the latter 1700's, early 1800's.

One of the early, very notable digs that Bob Flack and I did was to get into Cyclops Hall. There was one passage –just a short section of it— that was too tight, but there was a good blast of air coming out of it, and we dug the floor down, which was just old mud and gravel and we got through… and on the Life Magazine trip in 1959, we made sort of a game out of seeing who could go through that particular little section of cave the
fastest, and that's the way it got it's the name, 'The Drag Strip'… and we got drug pretty severely going through it [chuckles].

And there are a number of other digs around over the cave that… one notable one was when we opened up the Breezeway out of the Left Hand Passage that was full of breakdown… and we had to clear that out… and probably the most notable dig of all and the one I remember… I consider the most important one I've ever done was to remove breakdown in the passage that lead us on over into Lipps and connected Organ to Lipps… one big cave!" [chuckles]

Aaron: "When did that happen?"

Bob: "That was in the Fall of 1958, actually… and Hugh Jones and I -- and Jones was the one Jones Canyon was named for—were the ones that made the connection. Connie Revak –who the first big room there on the upper stream passage was changed to, to be called the Revak Room— so anyway, the three of us were on the trip, but Jones and I were actually the ones that opened the passage and found that we were in Lipps then, and Connie came on along and then we exited Lipps."

Aaron: "I bet that was exciting!"

Bob: [chuckles] "Well that was sort of a high point really, and I don't think I've ever been quite so excited in a cave before."

Aaron: [laughing] "It's a good feeling."

Bob: "Oh yea… and then as time went on… of course in those early days we didn't haul anymore than we had to unless there was a real good reason to, and blowing air was good a reason. There were a lot of places left that weren't that enticing when we had walking passage to explore… so you're very correct in saying there were a lot of open entrances… and there were.

Another notable dig was when we actually figured a sinkhole to get into Ludington's Cave… and that was the Bell Entrance to Ludington."

Aaron: [surprised] "I didn't know that entrance was dug open."

Bob: [chuckling] "Well… we didn't move dirt, but did we move one heck of a pile of trash!"

Aaron: [laughing] "Yep, that's digging too!"

Bob: "Then Kay Robins, a Girl Scout, and I were the ones who found that from the inside. We were working up in that area we called the 'Belfry' and saw daylight, and went out there and of course we were looking up through a pile of trash, and didn't make it out at that point. We went on back and came out the Ludington entrance. Then… I think Rutherford [Bud Rutherford] was the one who pinpointed that particular sinkhole, and it turned out he was correct. We dug it out the next day."

Aaron: "It didn't take long to dig it out?"

Bob: "It took… oh I don't know, probably 3 or 4 hours to dig out because there was quite a bit of trash there of all sorts and descriptions."

Aaron: "Did you find anything interesting?"

Bob: "Well… there didn't seem to be a whole lot [of trash] at that point, but there was another time that it was blocked again… it had flooded… and when we went to go back in, there must have been 30 old wine bottles [chuckling] that were flushed out of the trash pile and they had all sorts of fancy designs on them and so forth. That entrance has collapsed or partially collapsed on several occasions and its been worked on –dug open—a number of times, and I don't know what the state of it is at this point since it is closed by an unfriendly landowner."

Aaron: "Bob, if its O.K., I would like to ask about Organ again? Specifically… about the Red Wagon Dig? What can you tell us about the Red Wagon Dig?"

Bob: [laughing] "Actually… it's the second Red Wagon Dig. The first Red Wagon Dig…was… let's see, Dave West and some of the D.C. people were trying to dig around the siphon there at the end of the big canyon, and it was actually their Red Wagon that we moved up there next to the Revak Room. Cliff Lindsay and Ed Swepston were the ones who started that dig… the second Red Wagon Dig. We've added wagons to it…I think West's dig at the end of the of big canyon had only one wagon… but we have either three or four wagons operating, when we do dig, trying to get into Foxhole."

Aaron: "Do you think someone will eventually break through?"

Bob: "I think so. We're under Foxhole now according to the map and just how far under, we don't know, because we're not at all confident of the survey data… the elevation. The map itself seems to be fairly accurate, but the elevations haven't matched up in all cases. Supposedly there's around 40 or 50 feet between where we're at now and Foxhole, but I don't think that's right, because of the map."

Aaron: "What technique is used in the Red Wagon Dig? Can you describe how the dig proceeds?"

Bob: "Well its proceeded in several different ways [chuckling]. We've used the regular entrenching shovel that folds up and we can screw a collar up over the handle to secure the blade either as a hoe or a shovel. Its used pretty much as a hoe to dig with, and a shovel to load the wagon. One interesting part of it… well the lower part of it was pretty much clay and almost pure sand for quite a ways. One part of it was vertical; we went up 8 or 10 feet and that was all sand, very clean sand actually. I don't know whether you've ever tried digging sand when its over your head, but [chuckling] it comes down all over you. So one way that I got around that was to take a section of galvanized stove pipe in, and dug with the stove pipe and most of the sand fell down through the inside of the stove pipe."

Aaron: "Wow! That's a good idea!"

Bob: "… just dabbed it up into the sand from below and you could almost stay out of the fall of sand that way. On up… when we got to the other level, it turned out there was real gooey clay on top of the sand, and as it worked out, the best way to dig that out was to undermine it… to dig the sand out first and then the clay would just collapse in chunks down so you could handle and that worked very well. The clay was very difficult to dig because you would stick your shovel into it and get a shovel full and you couldn't get it off your shovel… it was tacky. By digging to undermine it, and taking it out in chunks, it really wasn't a whole lot of problem with handling it.

But it's been an interesting dig, and it's gone back into the hill so far now… the last survey that I know was 80 feet from where it started there in the edge of the room. I think that room is now called the Red Wagon Room. It got to the point that we pretty quickly used up all of our oxygen at the face where we were digging. We started out running a piece of garden hose in from a bellows out in the room... just a little bellows that you blow to help start a charcoal fire or whatever… I think it was a foot-operated bellows and that worked for a while but we got so far back there was too much friction loss in the garden hose that it didn't work anymore. The latest was … we ran a piece of 4-inch diameter corrugated plastic pipe, with a hand-cranked blower – a squirrel-cage blower—back into the face and that provided plenty of air to keep things moving… and that could be extended without whole lot of trouble as the dig progressed. The problems with access to the cave has slowed that dig up considerably. Too many people have been locked in [chuckling] who weren't supposed to be…so the only … if you don't know how to get around the gate, there is a bypass… of course only the 13' waterfall and out through the end of the Chapel Room, but then you get out and then your car is locked in because there's a pole across the road up next to the highway [chuckling]

and Janie Morgan lives five miles away, so it's not a good situation. The alternative is to go out Lipps."

Aaron: "So, some careful preplanning is necessary?"

Bob: "Well, yea… we're gonna have to work out a way to get a key, if the gate is locked and then we'll have a way to open it."

Aaron: "You used some pretty unique tools in the Red Wagon Dig, such as the wagons and the bellows to provide air into the face. What other unique tools have you used in your digging career?"

Bob: "Well… there've been all manner of crowbars and wrecking bars and pry bars, and all that sort of thing… various different tools. I've even used a mattock and a regular, long-handled shovel in some of the digs. One of the… I guess the second most notable that I've accomplished was getting into that cave there at Gene Turner's. When we got in, we named that for Gene's mother… called it Nellie B. Cave. One method that I've used in finding a cave like that… that was a collapsed entrance, I've gone on up next to the remaining cliff, and dug a narrow trench down the hill, just digging it down to bedrock as I went, and that would be just about a shovel width. And follow the bedrock down and when it drops, you're there at the entrance of the cave. I think in Nellie B.'s we dug done maybe a couple of feet after the bedrock turned vertical and we had a crack and had air, and of course there was a lot more involved then in getting the entrance open. When we did get that opening big enough, wide enough, so a person that could get in, there was so much silt in the cave that it was… I think we got Sonja Ostrander to go in first because she was smallest… course she said it went, so it wasn't too long before we had it opened up enough so the rest of us could follow. That was mostly pick and shovel. Now a pick, a pointed pick, works real well on gravel and rock… it's much, much better than a blade like you have on a mattock. Bars work very well to punch down through or into gravel, but a pick with a handle on it is a whole lot easier to break up gravel. Sometimes gravel has the consistency of concrete almost and it's been there and it's really sat in place.

But then probably one of the most difficult digs and one that involved the most effort was a dig down at Davis Spring, and trying to get into the cave there. We started out there digging ditch down across the hillside until the bedrock dropped vertically and at that point there was about… and how we managed it, I'm not sure… about a 14 inch Maple Tree right in our way. We tried to pull the thing over with a big come-along, but that didn't work, then we went around and tried to dig under the thing, and that just didn't work out either… it was all broken rock… we just weren't accomplishing anything. So the dig sat for a number of years, and finally I got a bug that I wanted to get going on it again. I went in and dug a ditch around the Maple Tree about 4 feet away from the trunk, and cut all the roots. So that was in November, probably of 1988 or 1989, and then we snow and freezing weather and so forth. I went back in February or March of the next year to cut a ditch around the other side of the tree, so I could maybe get it out of there. When I got onsite the tree had fallen down on its own [chuckles]. There was quite a root ball. Cutting the roots on that one side was enough to do it. So we worked on that dig all that next summer… a pretty concentrated effort. We had set up a 3" x 3" x 3/8" steel channel, angle, that we used as a boom. We supported that from a tree on up above the dig, and that gave us a high anchor to place a come-along to, and we moved some pretty big rocks up out of the hole with that system, and we finally got into cave. But as has happened, the hole we opened up was not big enough for me to get through, but it was big enough for the some of the smaller cavers. That was because we had gone down through breakdown and had moved all of the rocks we figured we could move without collapsing the pile. The hole that was left, was not really big enough for me. We did get down into a small cave there, and found that air was blowing up through the breakdown in the floor, which would have just been an impossible job to try to dig in breakdown, twenty feet below the surface. So I've made it a practice not to abandon a dig unless it is dangerous or absolutely fruitless. You get into something that shows signs of imminent collapse is just not a good place to be. In this case, we figured the main cave was about a 100 feet further on to the west in amongst really big breakdown, and the spot that we had dug was the highest exit for water during floods. We thought we would get a channel back into the hillside, but apparently what was happening was the water

was following right along the face of the cliff, underground… that's sort of a horseshoe-shaped cliff, so it was working its way through breakdown, and exiting where we had dug into. That would have meant that had we continued that dig, we would had to have dug hundred feet through breakdown, and that just didn't work, and we gave that one up."

Aaron: "Well, that would have been a very exciting find, had you guys gotten into cave at Davis Spring."

Bob: "But… we haven't given up on that area yet. I do intend to go back and work on that some more. Hopefully, we can get permission from the landowner to use explosives on that one now. That's another technique that is available to us at this point… but another big dig that a lot of people worked on is what we called the Tripod Dig at Cliff Lindsay's. We had good air blowing out of a pile of breakdown. We had gotten down about twenty feet there… there were several pretty close calls where we had rock falls. Nobody got hurt, but it appeared that if we continued to move rocks, that somebody was going to get hurt or killed… it isn't worth that."

Aaron: "No. Its not. Digging can be dangerous…"

Bob: "Oh yea... so that's another one we've backed off from."

Aaron: "Now you've dug with Cliff quite a bit… is that true?"

Bob: "Well… Cliff is a great supervisor [Aaron and Bob chuckling]. But… Cliff did quite a bit there, and I think we also had Tim Brown and Dave Cowen, Mike Phelps, Bassett… Carroll Bassett got in on that, Liz McGowan, and her daughter worked on it for a while. It was very enticing because we kept getting blackness. We would move a rock and see black void ahead of us, but it didn't develop into anything of any size. So that one is awaiting a time when its dry when we can get a tracked excavator down in there, and we'll dig back into bedrock where we'll have solid rock over our heads."

Aaron: "Now, excavators have been used a number of times in digs. I believe Cliff hired an excavator to dig open Charlie's Slot."

Bob: "We dug at Charlie' Slot… it didn't get open. We never did find an opening there. It went down twenty feet or so… as far as the excavator could reach and moved a considerable bit of dirt and boulders the size of small compact cars even. I mean its fantastic the size and amount of material one of those excavators can move… and they're pretty fast. One of them can dig in 15 minutes what it would take us a month to dig by hand. So it can be worthwhile.

Dave Scott also used an excavator over on his property across from the airport, trying to dig out a sinkhole. He dug the sinkhole out, and there was some air blowing through cracks in the some of the rocks, but we never did open a void, so Dave had 'em close it up… he thought it would be a hazard if somebody would wander in and fall in the thing… it's pretty well all closed up now, but there again, that area hasn't been given up on either."

Aaron: "I believe Jeff Bray just finished some micro-gravity work where they might have identified a place where there's a void below the surface, so perhaps that will be a dig site in the future."

Bob: "Well, there's a hole up on top of the hill that we dug out of a very shallow sinkhole. The sinkhole wasn't much over a foot deep, and that hole is now over 40 feet deep, and takes water during wet weather, and we know the water goes into the Maxwelton Sink Cave, and I haven't been down to the bottom of that dig at all, but it's supposed to have a mud floor… but they've used micro-shaving to open up the crevice going down."

Aaron: "Maxwelton would be an exciting cave to get back into wouldn't it?"

Bob: "Definitely!"

Aaron: "Now that one was originally opened by digging."

Bob: "Yah. The dig was in the streambed, and a bunch of people had been working on that dig for years, and Chuck Hempel and Ray Pollick and some of the Pittsburgh Grotto were some of the ones who actually achieved an opening. But then, I don't know whether it was Hurricane Camile or whatever, but there was one hurricane that closed it again, and they dug it open, and then Camile really closed it, and so I'm against trying to open the stream channel. If we do get hold of that cliff face somehow in the future… if we can buy a few acres there, then the way to get into is to dig out a hillside. There were two big passages that intersected the hillside and were full of breakdown, and that would be a great place for a tracked excavator to dig in, and then that would never flood and wouldn't silt closed like the stream entrance did."

Aaron: "At last count, before the cave was closed by the hurricane, I believe the mileage was about 10 miles?"

Bob: "There was somewhere around 13, I think. The feeling is that the survey wasn't finished at all, and so there's possibly quite a bit more cave there. From the sinkholes that are across Vago Road from the cliff face, there's definitely something else going on… whether the passages are collapsed… you just don't know. There's all sorts of indication of cave between Maxwelton Sink and McClungs, so they very well could be connected to McClungs at some point."

Aaron: "Contact caves have mostly been dug open?"

Bob: "No, not really… of course McClungs and the Lightner Entrance to McClungs… Lightner's is not a contact entrance, but McClungs is. Ludington's is open, and then I guess is the next one down the line, and it doesn't have a very big entrance, but it wasn't dug open. [One of the entrances to McClungs] did involve a little bit of digging to get into it. I'm not sure they dug any to get into Wade's or not."

Aaron: "What about the Monroe County Caves? Do you consider some of those contact caves as well?"

Bob: "Some of them are."

Aaron: "Like Hurricane Ridge, for example?"

Bob: "I'm not that familiar with Hurricane Ridge or the area around Union Cave. I've been down through there many times, but Monroe County wasn't of that much interest to me."

Aaron: "Well those were two good digs to get into those caves… and Scott Hollow as well."

Bob: "Scott Hollow was dug with backhoe. But before we get over into that [area], I want to point out too that Organ Cave is a contact cave. An interesting contact cave in that its located in a syncline, and you have contact entrances… or waters… and yes entrances from both sides of the syncline, so you access the cave from the east and the west. I think probably Union Cave is going to be the same way. Scott Hollow, course has just one entrance, and they desperately need more entrances, and they haven't been able to find any at this point… so far as I understand. Windy Mouth is the same, but Windy Mouth has the one entrance on the river, and it was a natural, open entrance. I can't say about… of course Bone Cave… it has two entrances, Bone and Norman… well the Bone entrance was opened by a massive dig…"

Aaron: "Oh yes… the quarry operation."

Bob: "And Norman's was opened, so far as I know… at least it was when I first went in. I think a good many of the Friar's Hole entrances were open. Some of them had… they had to move trash to get in, but Snedegar's and Crookshanks and all those were big, open entrances, and that is not a contact cave… its on over in the limestone… course now, Cowen dug into what's called the Borehole, and then when Bassett bought the property, then he and Bassett dug into the other side of the hill with a much better entrance than the original Borehole entrance. Bassett has dug into another cave on his place, I think he calls it Carroll's Cave, and he's Micro-shaving to open parts of it up to get through. I think Becky Jones was leading quite a bit of that effort, back last year. … Bill Southington, from down in Greensboro, and I dug into what we've called Wake Robin Cave, there on my place. We dug down 12 feet, dug a 4 x 4 square hole down 12 feet, and the bottom-center of our hole fell out… that was the cave, and that's the way I like to dig… I like to have space to work. I do not like to be really cramped so that you can't swing a pick or a mattock or whatever, when you're trying to dig. But then another cave that quite a few of the WVACS people had a hand in digging, was what we called Our Cave, which was over part of Buckeye Creek, and that was just a little wet place in the snow when we went over there looking, and the more leaves we pulled away, the more air blew out of it, and that was quite an exciting dig for a while. We used a small come-along to move a pretty big boulder, and actually demolished the come-along but it did move the boulder, and turned out to be a thirty foot deep pit with a little crevice running off one side that dropped down into another crevice and was blocked. So we shot off a stick of Tovex and shattered the rock that was blocking us, and moved that out of the way, and got into a little bit of an enlargement, and the cave continued on as a little meandering crevice about 6 inches wide and 14 inches high, but there were quantities of air blowing out of it. Nearby, there was another hole that's blowing air, and just this last winter, we discovered a spring down at the bottom of the hole, in the bed of Spring Creek, below that one. I'm beginning to think maybe that some of the water in Buckeye Creek, that we think went into Buckeye Creek [cave], is not really going to Buckeye Creek, and may be going to this new spring… and its not a new spring, its just new to us. The way you find that sort of thing is to wait until the creeks freeze over solid and where there's a melted area, you've got cave water coming out… so we look for warm air coming out of the top of the hill, and warm water coming out of the bottom of the hill [chuckling]."

Aaron: "Bob, if you could pick three spots in Greenbrier and Monroe Counties, to concentrate on digging, what would those spots be?"

Bob: "Well, Greenbrier and Monroe… the Union Cave is an ideal site in Monroe… the folks who dug at Dixon Spring trying to following the cliff down there, that seemed to be a hopeless job… I don't know… I would say somewhere over top of Scott Hollow Cave would be a very pertinent place to dig… a very important achievement of another entrance to Scott Hollow, but I'm sure Mike Dore's working on that. It seems very strange to me that a cave with 27 miles of passage doesn't have another entrance."

Aaron: [laughing] "It's a big cave, for one entrance."

Bob: "Right."

Aaron: "I think they're working on it…"

Bob: "Yah, think so. Of course you all have gotten into your Deel's Hole, and wasn't Zigafoose Blowing Cave dug into?"

Aaron: "Yes. Mark Passerby, Mike Dore, Jim Thompkins, Pat Dolin, and a bunch of other people… dug to get into Zigafoose."

Bob: "Well, we've worked on Davis Spring off and on for twenty years, and that is still a prime area. If you project a line along Mystic River in Scott Hollow, then follow that line on the North, it intersects Davis Spring."

Aaron: "I have observed that as well. That's a really interesting thing to see on the topo map for the first time. When I saw it, I was pretty excited about it."

Bob: "So probably you have a syncline there and the cave never did run clear across the river, I don't imagine. You have a cave on one side and the biggest spring in the state on the other, you're bound to have a big cave."

Aaron: "That's part of the reason why we're working so hard in Rader's Valley."

Bob: "It would be very, very interesting to find out where your water in Deel's Hole is going… whether its going down into Mill Creek, or does it go into the mountain and come out at Davis Spring?"

Aaron: [chuckling] "I think there's a lot of people who would like to know the answer to that question."

Bob: "Personally, I think one of the most fertile areas is up between Frankford and Maxwelton. Or between Spring Creek and Maxwelton, because I believe there's potential there for a 100 mile cave."

Aaron: "What makes you feel that way?"

Bob: "Well, we've got the Hole, with a 23 or 24 mile start, with blowing air on the south end of it, and a little hole up on a solid rock wall that blows air. Then on the North end of Ludington's, there's breakdown with air blowing out of it."

Aaron: "If Ludington and the Hole were to contact, wouldn't there have to be a drainage divide?"

Bob: "Possibly, and that drainage divide would be the cave that runs under Rt. 219 Ridge. If we would get into that, that's another maybe 20, 30 miles of cave."

Aaron: "Are there any good dig sites down in that area?"

Bob: "We're working on it. We think Ludington's and McClungs have already been connected… hasn't been surveyed, but we'll have to await that survey to find out. But if that's the case, then it bumps McClungs-Ludingtons up into the 25-30 mile class. With Lightner's open, we may very well be working in the lower end of McClungs some more, which can possibly produce some more cave. Like I say, that area from Maxwelton to Spring Creek is very, very interesting."

Aaron: "So the future of caving in West Virginia is still pretty exciting then?"

Bob: "Absolutely. I think we've found maybe 30% of our cave."

Aaron: "Do you think digging will be required to find a lot of the rest of it?"

Bob: "I think so. I think digging very definitely has its place in caving. Once you've dug into a cave and have a better chance of preserving what's there than we certainly did walking into an open entrance that people had been into frequently in the past. We can either just not say anything about it and hope its protected, or if it's a dug entrance, then we can certainly put a gate on a lot of them, if that's what it takes. Of course there are going passages in known caves that are too small to follow as is the case in the back end of Rapp's Cave. It's a small passage that is solid rock that has a good blast of air coming out of it, and one of these days we'll

work on that with micro-shaving. I'm still working on a hillside on my place here, that's a little seepy blowhole that has been too small for anyone to get in, but it blows air out in the summertime, and sucks it in in the winter, and when there's a flood, water comes out of it, and it very likely leads into the Wake Robin Cave, so I'm going to exhaust all possibilities of that sort before I get divers to go in and dive the pool in Wake Robin. I want to see what's there first. There's a considerable area to the North of Buckeye Creek that I know there's caves in. There's water running into, and at this point, we don't know where the water that comes out Wake Robin comes from… its sort of a mystery stream. "

Aaron: "Well its always good to have a couple of those left to work on… isn't it?"

Bob: "Right… [chuckling] Other … you've spoken of Jeff Bray's micro-gravity, I've also used dousing to locate caves and site cave digs. That was the way I… one of the tools I used to located the Wake Robin dig. If we had dug three feet in any direction, we would have missed the entrance."

Aaron: "Wow! You know, I've heard that Mike Dore used dousing to choose the location where to dig open Scott Hollow."

Bob: "Right… yah."

Aaron: "Sounds like its been successful in some circumstances."

Bob: "Well… I've used it over at Nellie B. Cave too, but I didn't understand what I was finding. I thought at that time I was dousing for water, and the rods were affected over an area that was about twenty feet wide. It turned out that was the width of the cave, not the width of the stream. I've learned considerably more about dousing since that time. We used it when we were working on Callison's Pond Cave. There were so many levels of cave and broken rock and so forth that I didn't understand what results I was getting there either. Now I know more about dousing and how to sort things out a little better… there are ways."

Aaron: "Maybe we can get you down to Rader's Valley sometime, and do some dousing for us down there."

Bob: "Well, I want to go over Jeff Bray's courses with my rods, but I don't want an audience. The influence… I guess that sounds silly…"

Aaron: "No, it has to be done the right way… just like all things."

Bob: "So anyway one of these days… if I hadn't been in New York this last weekend, it would have been a great time to go down and work on that while it was warm."

Aaron: "We have had some nice weather, haven't we?"

Bob: "Hmm, hmm… but we'll have more. I've talked to Jeff, and he's set to let me work over the courses and that will happen this spring, and if he's worked in Rader's Valley, then that will be one place where I'll work."

[discussion changes to blasting]

Bob: "I think its best that when we get into actually using explosives and blasting, that we do go to the trouble of obtaining a license, which in West Virginia doesn't seem very hard to get. You have to apply for it through the State Fire Marshall's office, and I got one for agricultural use only license for 10 dollars a year. So most of the blasting we're doing is on farms, so if that's agricultural use… there were a number of choices and all were more expensive per year than the agricultural license was."

Aaron: "I agree with you completely that laws should be followed. People using explosive devices should definitely have a license approved by the State."

Bob: "…and we need to be trained because we can really cause personal damage and that goes for micro-blasting if its not done properly… so we're learning and as time goes on, we'll perfect the techniques and so forth, and hopefully we'll survive long enough to use them."

Aaron: "I hope so… so far we've had a pretty good track record."

Bob: "We've been damn lucky so far. [chuckling]"

Aaron: [laughing] "I'm going to quote you on that one!"

Bob: "Well, I think I've had a very active angel."

Aaron: "Yep… I think you have… and I think you've been an angel over a lot of other people too. I think a lot of people have learned good techniques from you and have been able to learn how to cave and dig and just be good people in general."

Bob: "I would like that if they can benefit from my experiences, and if my time has been worthwhile. As I've said many times, I'm not done yet."

Aaron: "No sir, I'll be seeing you down at WVACS real soon."

Bob: "O.K."

Aaron: "Well, thank you for very much for answering my questions and sharing such great information with us."

Bob: "You're very welcome, and I'll catch you later then. Bye."

Klein Bull Pins

Bull Pin Ordering Info: http://www.mytoolstore.com/klein/3255.html or call: 1-847-677-0816

In light of the recent accident with micro-shaving and the likelihood that micro-shaving is illegal, consider Bull Pins as an alternative.

Bull Pins are hardened-metal wedges that look somewhat like chisels. They come in lengths of 10", 13", or 15" and are about 1/4" in diameter at their narrow end but taper up to about 1-1/4" at their thick end, and they are capped with a striking head.

The technique for using Bull Pins is quite simple. A row or rows of 4, 6, or 8 3/8" or 1/2" holes (depends on how big the rock is and how many Bull Pins you have) are drilled in the rock you wish to split with a spacing of 2-3". Depth does have an impact on the amount of rock that comes off, so the deeper the better,

Continued on Page 34

Compressed Air Chiselling

By Bill Chadwick

Cave Digging With Man Portable Compressed Air Equipment

The Tackle Master of our UK Club, Biff Frith, has recently perfected a man portable set up for compressed air rock chiselling. The system comprises a small petrol engine (about 80 cc) driving a small compressor (about 5 cubic feet per minute). Following this is an air reservoir of about 30 litres with a pressure gauge. Finally a CP9 (Chicago Pneumatics) type air chisel is used.

The engine and compressor are sited on the surface with the reservoir near the work face. We have used two 60’ hoses between the compressor and reservoir, more would probably be OK. A shorter hose of about 20’ is used between the reservoir and chisel. The chisel is designed to operate from 90-100 PSI. The system cannot be used continually. The fully charged reservoir gives 10-15 seconds of drilling, to 50 PSI, which must be followed by a 75 second recharge period. In operation, a mate is required to shout out when full pressure is available.

The system has been most effective in use. With two and a half digging sessions, a tiny drafting hole has been enlarged to a 6’ long man sized tube. Obviously calcite is quicker and easier to remove than Limestone bedrock, which requires some patience and operator skill.

For the future we are looking to a slightly bigger engine and higher capacity compressor. The use of a Propane powered engine should allow operation in large, underground air spaces.

February 2002.

Bill Chadwick, Secretary to Bracknell District Caving Club and member of Mendip Caving Group. (wackychad@lineone.net).

Figure 1
The Engine and Compressor

Figure 2
The Air Reservoir and Guage

Figure 3
The Chisel in Operation

Figure 4
From Tiny Hole to This!

Digging History

By Shelly Wolf

NOTE: Photographs not reprinted due to some State Laws governing this.

In the summer of ‘97 four people decided to do a 110-foot pit about 13 miles from the great Mammoth Cave National Park. As we geared up and rigged the rope we all anticipated the trip we were about to do. We had heard we could possibly find things in the pit that most people had only seen in National Geographic. We were more than anxious to drop and check out this precious long forgotten place of the past.

I was first on rope. As I started down towards the open 70-foot pit below, my adrenalin ran with excitement. I knew while standing there, I was standing on a pile of breakdown that became the head stones to an unknown amount of people that were close to 2,600 years old. It seemed like a long time before I heard the 2nd caver yell, “on rope”. My mind was running: why were these people placed here? How were they put in here? Were they already dead when they were placed in the cave, or were they all here for another reason unknown to men of this time?
Leaving the fall zone I started looking around the breakdown pile that took me to the lower part of this cave. As I looked up one, formation about 70 feet in length started as a stalactite turned into draperies then turned into the most beautiful flowstone I had ever seen hung from the ceiling on the left hand side. Looking around on the floor many animals had come to join the people that were here from long ago. An opening on the bottom of the left hand wall had many human remains that had caught on rocks as the water flowed over them to a lower level. The human remains seemed mostly to be on the left hand side of the wall all the way down this 60-foot pile of breakdown.

As the others made it down one by one we started looking the cave over trying not to disturb how nature had put things in place, including the peoples remains laying all over the place. The left wall that seemed to hold so many pieces is what kept my attention. I saw what appeared to be a very smooth white rock and decided to check it out a little closer. The water that ran down the left hand wall had washed the mud off the top off of an intact skull. This was the first time I had ever seen anything like this in my life and I am not afraid to admit goose bumps covered me from head to toe as I carefully and slowly rinsed and removed the mud to take a better look at the skull. I uncovered it and lifted it up and as I held it I wondered what this person had done in the life they had lived, I sat for a long time holding it and wondering. I could see marks near one of the eye sockets were it had been chewed on by pack rats or some other rodent in the cave that had its own way of coming and going. So with much respect the skull was placed on a protruding rock on the flat wall so nothing else could get to it. We found so many human remains and so many parts of other skulls it was almost creepy. The lower we went in the cave the more remains we found uncovered by the water than ran like a waterfall from the entrance above. With the 60 feet of breakdown at the bottom of the drop one can only imagine the people that are buried underneath it. The breakdown was never bothered as we carefully went back to where our rope was waiting.

To this day the skull that sits high on its shelf still watches over its people. Since that trip it didn't take me long to get this cave gated to protect it from people who might not have felt the life we felt that day in that cave. This cave is still untouched and its entire people are still there where they have been since their time. We were told right, there is something very special about this cave and the people in it. And yes I guess you can say it’s something most people will only see on National Geographic. The topic around the campfire that night at camp never left the Pit we had done that afternoon. The feeling we all felt that day I believe we all still carry with us. With due respect to the land owner the name of this cave or it's location cannot be given. I do go back a couple of times a year to pay respect and make sure the gate is ok and no one had altered it. And I drop it from time to time to check on the skull on the shelf. It still sits there watching and protecting the people that remain there in this now protected cave.

Shelly Wolf, Aka cavewolf

Stuck!

By Shelly Wolf

We started Saturday morning off with a good warm breakfast we knew working on the dig down in the cave would wear us down fast and a good meal helps a lot. After the three of us ate, Barry, Joey and myself headed out to Mammoth Cave Park to visit Floyd Collins grave site. He was trapped in a cave in 1927 and lost his life due to a rock that had fallen on his leg.

We drove around the park for a bit and headed back to start working the dig. We started into the cave about 3:00pm. after Barry and I put on our wet suits. I sat up the pulley system and got Joe into a seat harness to work the pulley to pull buckets of mud and rock from the hole 13 feet below. Barry and I climed down the old wooden stairs and down into the hole. At the bottom of the hole there is a seven foot hands and knees crawl about two feet wide and two feet high, at the end of the crawl there is enough room for a small person to stand up straight. Off to the right there is a 90 degree turn to the left and up into a small room 5 foot by 4 foot. I would start moving the mud and rock from the small room above and Barry would fill buckets of mud and rock from the fractured wall and floor. We had been working about three hours when Barry called for a break. I hated to stop I had found a ledge on the left hand wall that seemed to go under the wall. Its so hard to stop when you start! But I knew I was getting tired and I knew Barry was tiring too, and he was right we had worked hard. Its not easy filling buckets in that small crawl and getting them out to pull up the rope. After a couple of minutes giving Barry time to clear the passage under me I started to back down from the little room. As I slid down and looked up I seen a rock about three feet above me that looked like it was ready to fall. I didn't want it to fall on me while I passed under it. I went to pull out the rock that looked like it was sitting on a shelf and it fell! The rock MUCH bigger than it looked from below fell on top of my legs about a 50 pound rock. I yelled for Barry as the fallen rock was pinching my left leg against the wall. Barry came back in and tried to move it but it was above him and in the small passage and couldn't be moved. He yelled for Joey to go back to the office of the Show Cave and get a jack so we could try and get it up off of my leg. The rock was laying on my leg and on top of Barry's head. It wasn't but a few seconds later and more of the wall fell on top of me. I yelled to Barry to go get help, he was holding the rock from below trying to keep it from putting so much weight on me. But he had to go get more help. The wall had fallen and I had to much rock and mud on me all I could move was my arms. Barry didn't want to go, he didn't want to leave me in the hole alone. I could hear it in his voice he was as scared as I was. There was no choice he had to go get more help by now just a jack was useless. I needed a rescue. It was now an entrapment. I could hear Barry running up the wooden stairs and then lost all sound there was nothing. I could feel the rock on my left leg pushing on the wall, my right leg was buried under the rock and had twisted under me when everything fell. It was killing me. But I couldn't move it at all, at least the one pinned to the wall I could move my foot and toes. I have been on rescues before "not mine" and I knew how long it takes to get help together. It takes a long time. I knew Tracers would be called and some of them are close friends of mine, even though I didn't want them to be called I knew deep down that would be the best thing to do. I could hear someone coming down the stairs from above. It was Barry, I was so happy to see him back. It seemed like I was there for a long time by myself. He came back down into the hole and we talked. I'm not sure what we said though. I remember getting a cramp in my leg and I let out a scream I couldn't move it my God I was starting to hurt all over. From Barry's side of the passage all you could see was my left knee down, if you looked up through some of the rocks on the right hand side of the wall you could see my face. Barry stayed down there and Karen came down to see if there was anything she could do or help me with. I guess Ed came down in the hole too but I don't remember him being there. I'm not sure what happened from time to time, seems my memory slipped a bit down in that cold dark hole. Or maybe the pain was just getting so bad from having all the weight of the rock on me and my leg being pinned on the wall I blocked some things out. I guess I will never know. I know my right leg had gone to sleep and I didn't feel it anymore at the time that was fine, I needed some kind of a release. I kept asking when someone was coming I was hurting all I wanted was out from under the rock. I couldn't help but wonder if on the other side of this breakdown mess if anyone heard me cry. Barry told me that Chris and Jason my friends from Tracers had arrived. I heard Chris's voice and seen his light through the hole. He looked things over and ask how I was doing. He said more people would be there shortly and together they would assess the situation

and see what would be the best way to remove the rock. He tried to take my pulse but I was covered with too much mud and he didn't have very good access to me. I remember him trying to dig out some mud so the rock would move off my leg a bit, but it shifted and put more pressure on me. He tried to keep me calm by singing to me and talking, I guess it worked. I was getting tired my body had stopped shaking and it would have been so easy to go to sleep I remember that. But I didn't go to sleep and waited what seemed like forever for everyone to get there.

At some point they did. With me passing mud and small rock through the hole on the left, and Tracers and the Fire Dept. moving rock from below after about 4 or 5 hours Chris climbed over me and held back a rock that was leaning on my shoulders so they could pull me out from below. After that point I know I walked out of the cave with someone holding me on each side and they took me to the showers to get my core temp back up. The showers was the first time I seen my son and Barry again after what seemd like forever. It was a long night, one I am glad is over and I am glad I had good friends beside me through out it all.

Micro-Shavers Beware by David Berman

Ok, we all know that micro blasting is dangerous. More than likely any one of us that has participated in shaving off sections of rock have thought about what could happen.

Unfortunately the weekend of 12/9/01 brought many of these fears to a reality for our party and I'd like to share this experience with everyone, before a fatality and/or greater accident takes place. In sharing this information I'm hoping that we (all of us involved with micro shaving) will implement more precautions or even better develop a better technique that does not require standing anywhere near the charge. What follows is a quick synopsis of the what and where's of our accident, then a section on what we think took place to cause the accident and finally some thoughts on possible design changes to help prevent a similar accident from taking place with your shaving activities.

We were shaving limestone rocks outside in a wooded area as part of an ongoing process of refining techniques and simultaneously helping the owner "clean" a desired four wheeler path. On previous weekends we had used blank 22's ("yellows"), as well as some 223's. This particular weekend we were devoting ourselves to 223's as there were a number of large boulders in the way. Based on conversations and reading our techniques used on that weekend were considered rather normal for micro-shavers (which is why we are frightened that similar events could easily take place to others). In brief for the 223's a 3/8"hole is drilled to a depth of six to eight inches long. A small piece of electrical tape is wrapped around the end of the round, and it is then tamped into place. A ¼"steel plate is then placed over the hole and it covers the immediate blast area. A 3/8"hole is in the center of the plate, and a 3/8"rod which has a small centered "tit" on it is then inserted into the hole. Over everything a piece of carpet is put down which helps control the smaller fragments etc. And finally a pair of vise grips are attached to the rod to holding on, and to aid one in getting further away from the rod. And of course earplugs & safety glasses.. Using this configuration we (and others) have been able to stand well off to the side of the rod (goes without saying to not be behind the rod) reach over with a large hammer and tap the round off. This particular day was going very smoothly. All of the shots went off well, there was minimal movement of the firing rod (though periodic "straightening" was required) and considerable progress was made in moving the boulders out of the way.. At least until our last shot.

We did not intend to stop with this last shot, but our situation became very serious due to the nature of the accident that took place with it. As we all know the firing rod can "shoot" from the hole, and that is exactly what happened. While kneeling beside (not in front) the firing rod came out of the hole and went

through the "shooter". It went through two layers of clothing, penetrated his body directly below the collar bone and exited through his back under the arm pit- after being diverted by the scapula which was shattered from the impact of the rod. There is not space to write about the events that followed, let alone the thoughts of what could have happened (a half inch in any other direction would have been immediately fatal..) The shooter is alive and will be recovering for some time which is a blessing for all involved. Had our accident taken place in a cave where immediate access to transportation and a hospital were not available the situation probably would have turned out different. well as I said there is not space to write about what could have happened. Two questions we have considered for the sake of all those currently participating in and for the future participators is "how did it happen" and "what can be done to prevent similar situations from taking place."

Our theory to how the shooter was hit even though standing to the side, is that when the rod became a projectile it glanced off the hammer and then traveled in a completely unplanned pattern. Mind you this took place in the same blink of an eye that the blast takes place. Conscience effort has and was taking place to use a directed blow to "help keep the blast in place"; based on this experience we think that this technique is possible folly. Yes one can feel a difference and knows to hold down, but can your extended hand really be expected to hold the load down into place.

With this in mind our thoughts have come to rest on the necessity of designing rods which can not blow back past and/or out of the retaining plate, or even better would be the use of some type of remote detonation device. It is not thought that the accident took place from being negligent beyond the current accepted practices- maybe the odds are one in a thousand, but based on the number of people starting to utilize the techniques those odds will prove very dangerous. Consider the confines of a cave, even if the projectile missed the hammer it could easily ricochet off of a wall.

David Berman contact at: davekrista@eurekanet.com

Continued from Page 28 ————BULLPINS

but if you have to conserve battery power, then use the 3/8" bit rather than a 1/2" so you can get more holes. Typically a hole 6" deep should give good results.
After the holes are drilled, simply tap Bull Pins into each of the holes until they are tight. Then tap each of the Bull Pin heads a couple of times to begin splitting the rock. Continue tapping the heads in turn for a few more cycles and the rock will split. Very easy, very elegant, very effective, and much safer than

Some rules of thumb:
(1) keep the holes 3" apart (or less)
(2) attach lanyards to the Bull Pins, by drilling small holes in the tops of them and thread a cord through so you don't loose them down a crack
(3) try to find existing zones of weakness and take advantage of them
(4) this technique works well only on exposed rocks where microshaving
is effective, i.e. it will not work for mining out walls or floors
where micro-shaving is NOT EFFECTIVE.

(Ed. Note: Micro-shaving is what it says it is: shaving. It is not blasting and should not be used as such. Numerous close calls and one accident have proven that micro-shaving must be conducted where the rock has somewhere to go. If the rock does not have somewhere to go, the firing rod will blast out of the hole because the energy must go somewhere. Bull Pins work the same way: the rock must have somewhere to go, otherwise you will just lose your pins.)

Klein Model #3252 Standard Bull Pin

Klein Model #3255 Broad Head Bull Pin

Raders Valley History of Exploration by Mark Passerby

Raders Valley to anyone who has driven West on I-64 out of Lewisburg WV is a familiar scene. A massive karst valley with little or no surface flow surrounded by steep side ridges on both side. Formerly this valley carried the drainage of Culverson Creek, however as time past and Culverson Creek downcut it was eventually pirated over to a now known cave system called Culverson Creek which re-routed the stream to resurgences far from its original route. This left the lower portions of Raders Valley without a major stream or surface flow, however carved into the ridges as can be evidenced by massive air flow in openings in the valley is most likely a large cave system. This was my thoughts when I first visited a cave in the upper portions of Raders Valley with Dave Goldman in the mid 80's. Dave went on to introduce me to various landowners and field walked with me to many of the prominent sinkholes, drains, and impressive air holes in the valley.

Looking down main valley toward

It was these early trips that peaked my interest, but perhaps most mystical was the absolute lack of any relative cave entrances into what most certainly was a major system. As I studied and learned more of the geology of the area it became evident that while the system may be there finding a way down to its key passages would not be easy. The limestone dips steep back into the mountain and a majority of the potential entrances are far above any level that could perch the stream flow thus resulting in small and sinuous passages that downcut very quickly and become quite difficult to follow. This is the nature of Raders Valley.

Two Cave Systems--One Valley

To further complicate the mystery is the presence of two large springs in the lower end of Raders Valley. The first is on the left(East) looking down the valley and the second is on the right(West) and perhaps another 1/2 mile down valley from the first. My general feeling is that the first spring is the outlet for the system we are most actively seeking, however I feel that there are a few high saddles up the valley that could very well have dry connecting" passages that will link the two drainages to form an even much larger system than we currently envision. The importance of dye tracing is crucial to really grabbing an understanding of what is going on, which is planned to begin in late March 2002. What I do know is a few scant things shared with me by Dave Goldman of a huge amount of dye being dumped into a very prominent stream sink that should have turned the spring and creek green just a mile away but never showed up in either the traps or visibly.

Large Spring…..likely resurgence of valleys main drainage

The occurrence of a rare salamander in the lower portions of Deels Hole also shares a commonality with another cave area directly in line with the structure but a few miles away and under the mountain near the Greenbrier River. Needless to say dye tracing will answer a lot of questions concerning the speculation on the various insurgences in the valley and their eventual resurgences.

Digging Begins:

Burnt Toilet Paper Pit--This cave was the first dig that I began. It was located in a small valley just east of the main Raders Valley and quite far up in the system. I now am not sure if it even drains into the main system but at the time and early on it would provide the necessary catalysts to keep me looking for more. The cave extended perhaps 1000' through some nasty tight water and gravel filled passages. The end was never reached but trips by Herman Hertz(Britain) and Miles Drake pushed it quite far considering the conditions. The cave was never mapped and as far as I know no one has ever been back to it.

After this I began massive walking trips covering everything on the ridges and in the valley trying to understand more of what was going on and mentally scoping out the best possibility for a dig project. At some point in the process I visited Zigafoose Blowhole. I was told by everyone that the air was massive, the entrance tight, and the possibility for a dig horrible. My first visit was with Herman Hertz who being a bit smaller than me decided to try to sqeeze in. It was not to be and he got very stuck in an entrance that was blowing air at probably 25 mph. I literally could not pull him out and being stuck at a 30 degree angle in the cold air he quickly became concerned as did I. We contemplated going to get help but opted to pull his boots off and I got in a position braced against the headwall and pulled as hard as possible. He began to break free but with considerable scraping. About 10 min. past and after some very tense moments finished backing out. It was very evident that the entrance would need to be comfortable before I could bring a digging crew in to start a project.
A few weeks later I was back with a stick of Tovex to do a little comfort fix on the entrance. As my feet were held I found a perfect ledge to pack the charge and after setting everything in place blasted the constriction to a large opening. Everyone could now get in, however I still didn't know if there would be anything worth digging inside the cave. I crawled in and was met with a nice little room with a large mess of breakdown just to the right. The area that I felt represented the best place to dig was largely under the breakdown pile so digging would be somewhat riskier than normal.

Zigafoose Blowhole--Digging Begins

Now that the entrance was enlarged and the spot to dig evident it was time to find people who would be interested in working in there. By luck I managed to convince 8 to 10 WVACS members on a project weekend to come start the dig. It was impressive crew and a huge amount of dirt got moved rather quickly with no need to blast. Pete Waller and I continued to dig from that point for a bit to a point where a major rock slid into the hole and a major piece of breakdown above us resettled a bit. It was somewhat ominous and made us reconsider getting under the pile. Some time later Pat Dolin got involved digging on it with me and we continued to work down. Mike Dore and Jim Tompkins were invited on a trip and provided the necessary bravery for making the final hit on a few key rocks that would end up dropping the bottom out. It was late one evening and a few rocks had been removed when all of the sudden and unexpectedly we were looking down into cave! Mike, Jim, Pat, and I were there that night and slipped down through the new hole. Immediately we were in solid passage and took off down it. The end was not far however but in the floor was a tight pit that dropped a considerable distance. This would need to be enlarged and getting down it and through it not a straightforward situation. As in all of the Raders Valley holes this would prove in character by being tight, windy and difficult. The cave was continued on by Mike and Jim mainly down a few more very tight drops to a lower level at -200' and perhaps over a mile of cave seen. The way on to a main stream or main trunk, however would prove elusive although one lower stream lead that was not followed to a bitter end could be the way on. Getting wet and muddy at the bottom of Zigafoose however and having to navigate all the tight windy squeezes out is not for everyone to do. We have plans to revisit the cave and do a finished map.

Taking a break from digging...

DryStream Cave

Cave is located just Southeast of Zigafoose Blowhole about a 1/5 of the way up Deels Valley. This small cave I learned of from Dave Goldman takes alot of water during large rains from what is normally a dry streambed. The entrance is impressive and air flow in the back even more so. We dug on this for many many days and I personally gave up on it, however Dave and Danny Gillespie continued and eventually found a small crack that dropped down a series of small pits to a bitter end. Because of the gradient and the massive amount of silt and debris stuffed in this cave and its inherit ability to quickly bury your work I think this site is better left buried.

Freelanders Well--Good Potential

This cave was a rare find just by the shear nature of how high it was on the ridge and how much briars it was buried in to get to it. Pat Dolin and I had decided one cold day to get on our Carharts and do a trek through the snaggy brush infested higher parts of Raders Valley. It was not fun walking but it needed to be done and we chose to walk up near the upper contact of the limestone hoping to find a pit. About 1/2 way down from the Interstate and Zigafoose Blowhole we came across a ground hog size hole howling air. Quickly we found a rock and dropped it in and to our surprise it dropped a considerable distance before crashing to a halt. This dig however was quite inaccesible and would require alot of blasting to open it up big enough for us.
We did however manage to get a key for a crucial gate that did allow us to drive into the valley bottom which would leave us only the walk up the hill through the briars and brush left. The Gillespies, Pat Dolin and I did a large part of the blasting and enlarging. Once inside the cave dropped about 40' to a small natural bridge that had a pit(60') below it. The bottom of the 60' pit still is a relevant lead and was only dropped by Dave Gillespie. Around the corner in the main passage though the cave opened up into a fairly large passage that would prove difficult to drop into. Eventually Mike Dore and Jim Tompkins were able to get a rope rigged along the left wall and over the edge of about a 20' drop into the passage below but the lip is very deep mud and the rope quickly disappears if not directed over some type of mat at the lip. The bottom went for some 400-600 feet before ending in breakdown filled passage. I feel there may be a way on in this cave either by beginning a small dig at the bottom of the 60' pit or by poking in the breakdown in the main passage. The 60' pit though would drop below the main passage and could and quite likely does bypass whatever is being blocked by the breakdown in the main passage. If this cave were connected to either Deels or Zigafoose the overall depth could be over 650'!

Deels Hole--Seeing the Valley's Water Underground

There were other small caves that were worked on but none provided human sized openings for us to breakthrough. It was slowly becoming obvious that the Secrets of Raders Valley would not easily be unveiled. At this point I decided to go back to Deels Hole. Deels Hole is an impressive and massive sink in the middle of the woods far up the Deels Valley that cuts into Muddy Ck. mountain. The gradient of the stream that flows into it during the rainy season is impressively steep and agressive and the air flow from cracks equally so. Finding a viable dig site and choosing the best route was not easy but we opted to begin in a small shelter just behind where the stream sinks. The stream at this time of the year was pouring in water so the stream sink just wasn't a viable alternative at that time. Bob Kirk and I worked hard on this dig even camping in the sink and working way into the night on occasion. We blasted some large rocks and worked our way down some 12-15 feet but digging was difficult and the breakdown large. Still the air beckoned us on. I ended up moving and the digging stopped until 2001. Late in 2001' digging re-began and we opted to dig in the stream sink because no water was flowing in. This looked like it may take a while but to our surprise lasted only 6 hours at which point Aaron Bird was able to squeeze through. I could hear him moving rocks as he squeezed through a few tight spots and then I heard it....the yelp of excitement when you crawl out of horrific breakdown into solid passage!! He was at the top of a 20' drop looking into solid cave. It was a big surprise to us all and we

quickly saw 600-700' of passage albeit very unstable with an almost constant lack of certainty of the ceilings integrity. The cave was dropping fast with each new breakthrough happening by digging and micro-blasting we continued to work down and down. At minus 175' we were at a place where the leads were quickly disappearing but decided to break up with one crew mapping and the other going to the bottom and seeing if the lower small stream drain could be followed by moving rocks etc. It didn't look good but I could see an open area above through a small triangle opening in the rocks. It would be impossible because of the instability to dig or blast to that point so we backtracked a bit and found a small climb up that eventually weaved its way around to that point. Here was a very tight spot that appeared to open up and continue over top of what would be the stream drain below. Bob Kirk, Mike Corbett and I began to micro-shave this area to enlarge so we could proceed, however after quite a few hits we ran out of battery power and stopped. Meeting up with Aaron later we told him of the lead and vowed to come back later and in fact Aaron and Rachel Bosch did return and managed to squeeze through! After weaving though a bit of passage they emerged into a very large room with a very large stream flowing in it. Considering the drought, the stream was impressive and definitely represented a major portion of the Raders Valley drainage. Being now at -200' and almost at the level of the spring it is now time to follow the stream upstream through a couple of leads both with air and with the promise of miles of new cave beckoning us on.

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This magazine is published quarterly beginning in late February 2002. Articles should be submitted one month prior to publishing. Subscriptions are $15 per year. Mail check to: Mark Passerby, P.O. Box 80693, Lansing, MI 48908 Make check payable to: Mark Passerby