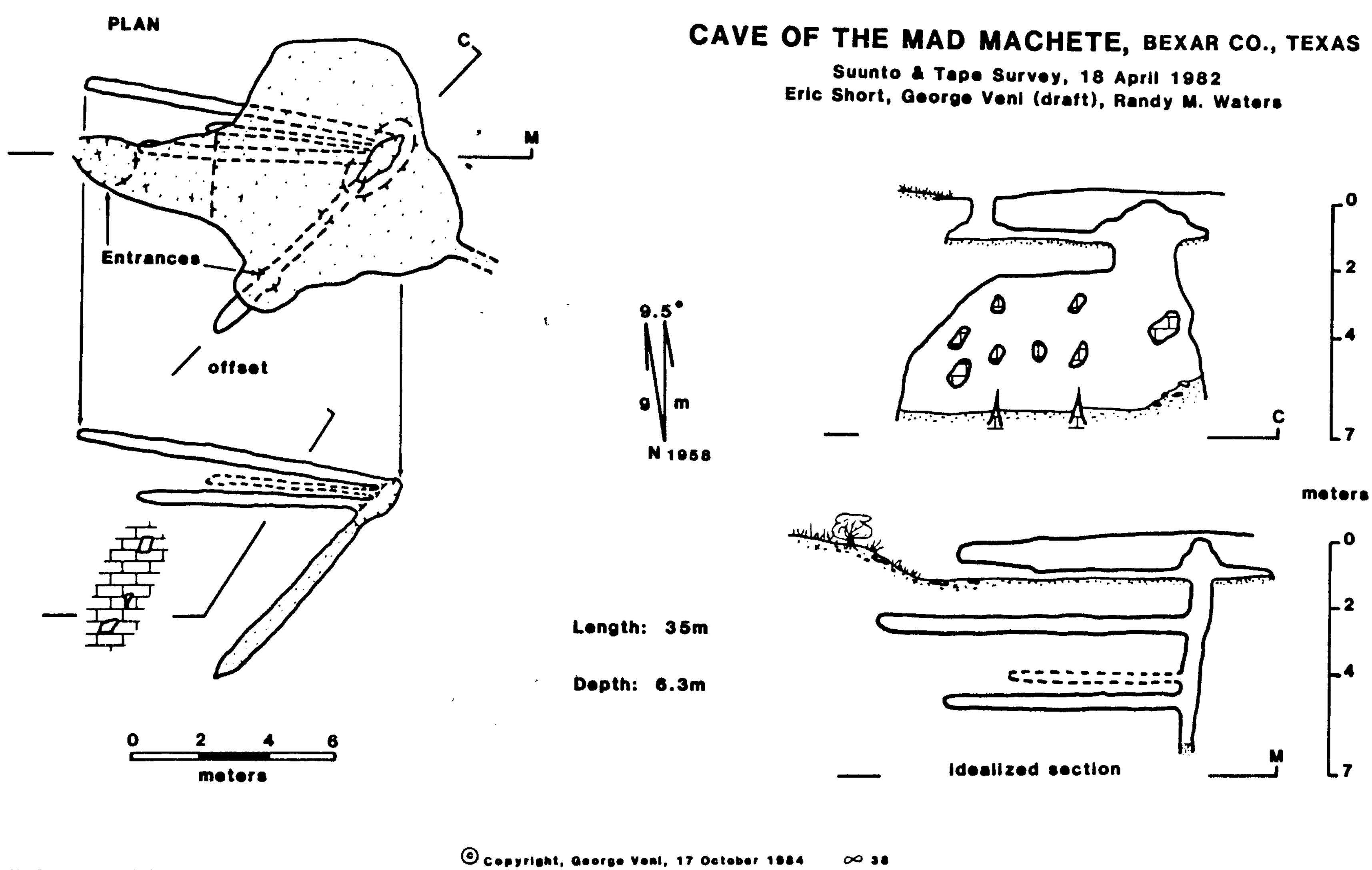
COMPASS & TAPE



Volume 2 Number 2 Fall 1984

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COMPASS & TAPE Volume 2 Number 2 Fall 1984

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SURVEY & CARTOGRAPHY SECTION (1984-1985)

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SUBMISSIONS , COMMUNICATIONS , DUES

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COVER: Cave of the Mad Machete, Bexar County, Texas by George Veni. George sent this and several other maps along, suggesting that I file them under "S" for "strange little caves." We'll be seeing more of them in succeeding issues. Incidentally, Bexar is pronounced "bear."

Contents

Editor and Publisher: John Ganter

How To Build An Ultrasonic Rangefinder

by Bill Mixon

Bill Torode's review of the Kwik Tape in the summer COMPASS & TAPE reminds me of a similar experiment by Frank Reid about 5 years ago. He had bought an experimenter's kit from the Polaroid people that included the circuits they use for the ultrasonic rangefinder in some of their cameras. I was with him in James Cave, Kentucky, when he tried to use it to measure ceiling heights. Besides the problems of ledges and irregular walls and ceilings that plagued Torode's experiment, we were amused to discover also that flying bats totally jammed the unit, causing it to read out apparently random numbers. Not surprising, when you think about it.

I would guess that the Kwik Tape in fact incorporates the Polaroid device. It certainly must have something like it. And the difficulty of using a device that depends on echoes in an irregular passage is obvious. Torode correctly observed that what one needs is a device with separate transmitter and reciever. I have had a mental design for such a thing since about 1970, and I have described it to a number of people who might be capable of building it. But so far nobody has. Perhaps this note will stir up some action.

The problem with echoes is that they come from everything within the beam, which can't be very narrow because sound waves are roughly an inch long and a transducer for use in a cave can't be very many inches wide. The Polaroid device detects the first echo, on the reasonable assumption that the user will want to focus on the closest object near the center of the picture. But the first echo is certainly not useful in cave surveying, since it will usually come from an irregularity on the walls, floor or ceiling that is closer to the instrument than the intended target. There may well, in fact, be no source at all of a prominent echo at an intended target, since the next station may be the tip of a tiny formation, or just an arbitary point on a slowly curving wall. The solution is to have the transmitter at the next station and to measure the time between the transmission of the sound and it's arrival at the instrument. In this case, the earliest detected sound IS what is wanted, since echoes from walls and other things will follow less direct paths and thus take longer to reach the reciever than the direct beam.

My idea is very simple. A device held at the target station would, when a button was pressed, simultaneously emit a flash of light and a burst of sound. The light might come from a cheap, low-power photographic strobe. The instrument at the previous station would measure the elapsed time between the arrival of the light, which we can assume travels infinitely fast, and the sound, which travels quite slowly.

Sound travels roughly 1100 feet per second, or about an inch in a tenth of a millisecond. In order to be able to time the arrival of the sound pulse within a tenth of a millisecond, we want the wavelength of the sound to be a fraction of that, or, equivalently, the frequency to be several times 10 kilohertz. Perhaps 40 kilohertz, which is ultrasonic, would do nicely. High-frequency sound is severely attenuated in air, especially moist air, so you don't want to use a higher frequency than necessary. (At room temperature, air with 100 percent humidity absorbs 40 kilohertz (kHz) at 27 decibels (db) per 100 feet, whereas the corresponding figure for 20 kHz sound is only about 7 db per 100 feet.)

It would be necessary to calibrate the ultrasonic tape for the particular cave conditions, since the speed of sound depends both on temperature (changing about 1 % per degree) and the elevation (about 1% per thousand feet). This could be done by taking one reading over a taped distance in the cave. But it sure would be nice not to have to use a tape on every shot.

Such a gadget should be able to substitute for the traditional tape. Since it requires a transmitter at the target, it is no good for measuring the height of inaccessible ceilings and such, of course, so it does not do all that the Kwik Tape sort of thing might have done, had it worked. And it is certainly not inherently immune to jamming by bats, though a clever engineer might be able to avoid the jamming without adding too much complexity. I'd be interested in hearing from anyone who builds such a thing.

No Ports, No Problem

by John Canter

Over the past year I've learned a few things about flush-porting Suunto instruments. While this is an easy operation for any machinist to perform, I've come to wonder if it is really necessary.

I have ports in my Suuntos (see the last issue of C&T), but havn't opened them since having the instruments rebuilt. The reason is simple; I seldom let them touch mud or water, except the little bit on my hands! This sounds hard to do, but it really isn't. It requires three things: 1) a rubber band made from a piece of inner tube on one's helmet 2) thin rubber gloves 3) a rag. With these three things, and some practice, you can keep your instruments reasonably clean and damp under really bad conditions.

Whenever you're not reading, the instruments stay on your hat; the last place they will get wet, unless you're in a cave with waterfalls. If they need additional protection, use a plastic bag or the "Skylon" cases that came with them. When these wear out, Preston Forsythe recommends small compression bandage packs, which can often be found as military surplus. They're just the right size. Get in the habit of always positioning the instruments with the viewing window DOWN, so that water will not collect there. Won't the instruments fall off your helmet? If you have a good rubber band, you'll have no problem.

If you're wearing thin rubber gloves, you can often do all the read ing with them on. This saves time spent in removing and replacing your gloves, but may lead to messy instrumnets if you're wallowing in mud. In this case, I like to wear my gloves between stations and take them off for each reading. I havn't had any problems with fogging due to the vapor coming off my hands, but my instruments are well-sealed.

The final item is very important; your rag. As soon as you get mud and/or water on your instruments, wipe it off! Of course, your rag will soon become a sodden mass, but it doesn't matter. Just wring it out in the nearest pool or puddle and you're ready to go. Terrycloth is particularly desirable, since it remains absorbent when damp.

In conclusion, I would try all of these things before going to flushporting. If you get ports installed, they will help you clean out the instruments after you trash them, but you're still going to have problems while in the cave. If you do a lot of low airspace work, and can't possibly keep your Suuntos from getting submerged, then consider installing ports.

Suunto instruments carried high and dry. Lanyards are run through holes cut in "Skylon" cases so that they can be slipped on and off quickly. (Tommy Shifflett at Perkins Spring Cave, Trigg Co.,KY)

The Dos and Don'ts of Cave Mapping

by Bill Douty

DO

Do get involved with several groups and study how they handle their data.

Do learn about different equipment and how to use it.

Do use short shots. Big passage= short shots. Crawlways= long shots.

Do write legibly and stagger the notes.

Do choose a passage survey philosophy, i.e. degree of detail.

Do a survey of the entrance area.

Do many cross sections.

Do note unique features.

Do reduce your data as soon as possible.

Do photocopy your notes and store separately.

Do use a computer or programmable calculator to reduce the data.

Do use heavy 3 mil mylar or polyester drafting film

Do position the cave with the North arrow up.

Do the plan view first and study it before drawing the profile.

Do as many cross sections as possible .

Do give the landowner several copies of the map and a copy to every person who helped on the survey.

DON'T

Don't get in abig hurry to start your own project.

Don't begin by surveying a big cave.

Don't use a tape longer than 50 feet or 15 meters. (except for drops)

Don't save paper.

Don't erase .

Don't stop sketching at any point along the traverse.

Don't have more than 4 on a crew.

Don't make a "base line survey."

Don't try to produce a working map.

Don't place cross sections on the draft.

Don't assume that loops are bad, study the data.

Don't start the final draft until the survey is complete.

Don't use worn or bad pens, or old ink.

Don't letter without planning layout carefully.

Don't sell the map.

(Reprinted from the Carabiner Wrapup, December 1980, Vol. 7 Number 2. Submitted to C&T by George Dasher.)

CAVING PAPERWORK

by Jim Borden

As of 31 December 1983, the Central Kentucky Karst Coalition has put 276 surveys into Toohey Ridge caves- 262 of them into Roppel Cave alone. You can not appreciate the difficulties involved in managing this amount of data of data until you have tried to keep over 250 surveys organized and correlated. CKKC's handling of the survey notes has evolved into a long and painstaking process which I will describe here only briefly. I don't claim that this is the best way; I am willing to consider recommended adjustments or additions to the scenario. However, these procedures work. I know of few large cave projects whose data processing people can make the same claim.

HANDLING NOTES

After each expedition (*ad hoc* or formal), all originals are turned over to the data archivist (myself). I cannot stress too strongly that one of the keys to long range success is in cave data management is to treat the origional survey notes as sacred- always get them and never let them go.

LOGGING

Each survey gets a number, always chronological by start of survey. The numbers are assigned sequentially, and a survey is defined as one party's survey on one trip. In the event of underground camping trips and the like, a survey is defined as a party's survey survey without significant break (e.g. sleeping in camp.)

The first thing done once all the surveys are in hand is logging. This is a two phase process which includes constructing and augmenting the connectivity sheets and adding to the sectional descriptions. Figure A shows a sample connectivity sheet. The sheet describes the surveys (strings) put in and their ties to other surveys. Building the connectivity network is the most difficult part of logging. I must know the area of the cave where the survey was put in, and be able to figure out how the survey ties to the Roppel survey network. Given some of the descriptions which come out of the cave, it is occasionally a wonder that I can figure out where the survey is in the cave. It is essential that the connectivity is done correctly, for any error will result in the cave not hanging together right. All connectivity sheets are cross-referenced with each other.

Once the connectivity sheets have been completed and double-checked for accuracy, the sectional diagrams are updated. These diagrams provide a schematic overview of the relationships between surveys, and they are especially helpful to the cartographers working on a particular area of the cave. A section diagram is shown in Figure B.

Once the survey's relationship with the rest of the cave has been established, there remains the painstaking process of calculating redundant survey. The redundant survey (that is, resurvey to tie into a previous survey, splay or perimeter shots in bug rooms, accidental resurvey of previously surveyed passage, etc.) cannot be included in the length of the cave. The redundant survey must be calculated and totaled for each survey, and this information must be recorded for later subtraction from the cave length as reported by the computer.

DATA PROCESSING

Once the logging has been completed, the data can be entered into the computer. By using the connectivity sheets, the data can be related properly to the database. Trial runs are used to reduce the data and to detect compass blunders, tie errors or general discrepancies in the survey. These errors can be corrected by experimental computer runs (essentially, trial and error), or noted for correction on future trips. Once all correctible errors have been eliminated, the data are deemed correct and added to the official Roppel database.

ARCHIVING

Once all the above procedures have been completed, copies of the survey notes are made and sent to depositories, and the originals are filed. The process is complete.

ROPPEL SECTIONS

Roppel Cave has been divided into more-or-less geographically distinct sections. Currently, there are 18 sections, which may be further subdivided if they grow to an unmanagable size (since a cave survey is dynamic, no such division can be considered permanent). These sections are chosen by applying the following criteria:

1) geographical distinctness- Is the section logical in concept, and reasonably distinct from other sections?

2) reasonable size- Is the section of sufficient size to merit separation from other sections?

3) defineability- Can the area be defined in logical terms that are understandable to CKKC's members?

The cave is divided into sections in order to be able to segregate surveys into areas and to determine more easily which surveys are associated with one another. The sections reduce the number of surveys someone must scan when searching for a particular tie during the logging process. The resultant section diagrams aid the user of the data in chaining through surveys in search of a certain feature in a survey, and in assembling surveys for cartography.

SURVEY TITLE SHEETS

Survey title sheets are important! Since the cave is so large and complex, we must have information on where the survey party went and and what survey(s) they tied to. It's also useful to know who was on the survey, in case we have questions. Good title sheets are vital to data processing, since they summarize the information used to establish the relationship of the new survey to the rest of the survey network.

CENTRAL KENTUCKY KARST COALITION

FIELD SURVEY LOG SHEET

DATE ________ FS# ____

OBJECTIVE ____________________

PARTY 1) ________ IN ____
2) ________ OUT ____
3) ________ HUG ____
4) ________ MHUG ____
5) ________
6) ________

| S U R V E Y   S U M M A R Y |

COMPASS # ________ STATIONS ____
INCLINOMETER # ________ DISTANCE ____
TAPE CALIBRATION FEET __ TENTHS __ INCHES __ NEW SURVEY ____
METS __

| S U R V E Y   S T R U C T U R E |

SURVEY DESIGNATION	TIE STATION	FROM		TO	TIE STATION
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____
____	____	____	====>	____	____

| S U R V E Y   C O N N E C T I V I T Y |

NEW STATION	TIE STATION	SURVEY NUMBER	NEW STATION	TIE STATION	SURVEY NUMBER
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
____	____	____	____	____	____
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____	____	____	____	____	____
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NOTES

FIGURE A

CONNECTIVITY SHEET

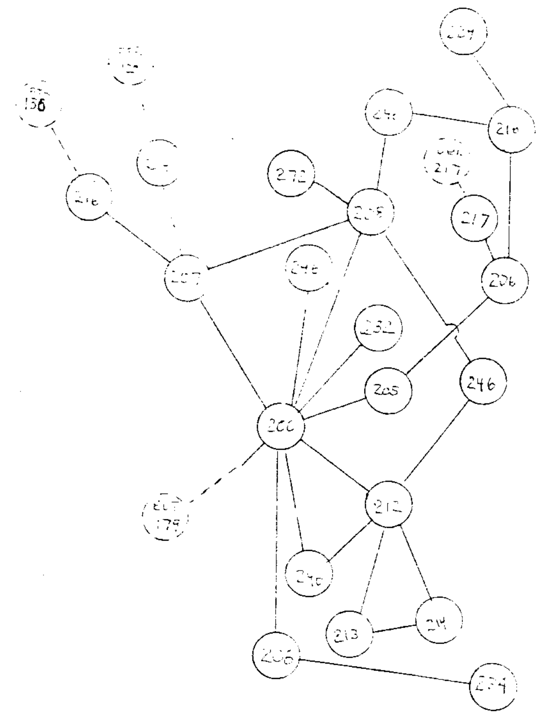


FIGURE B

SECTION DIAGRAM

Somtimes (and it seems to be happening more often lately), we have recieved surveys with no indication that they were even put into Roppel Cave. Please include the following information, at a minimum, on the title sheet of every survey:

1) Cave
2) Date
3) Personnel
4) Area

Area should describe a prominant nearby feature, the name of the passage a survey branches from, survey letter, or (if you are desperate) give a brief description of the route you took to get there. Any information that helps locate the survey in the cave will save us hours of headaches later. There are, for example, up to 20 surveys in Roppel using the same popular and easy-to-write designation. For this reason, location information is essential to establishing the survey connectivity and tieing the network together correctly.

(From CKKC Newsletter, Volume 5, Numbers 1&2, Winter/ Spring 1984)

Heavy Questions...

Dear Capt. Carbide,

Our cave surveying team has run into some troubles with calculations. The formulas for two crucial figures continue to elude us. How do we determine: a)the VOLUME of the cave? b)how much the cave WEIGHS?

Our grotto is ready to split into 16 factions over the squabbling on how best to calculate these figures. Your help would be appreciated. (signed) Perplexed, Calculus, Ark.

Dear Perplexed,

The answer is: insulation.

Think about it. You just simply contract with one of those home insulation guys and shoot the cave full of cellulose. They can tell you exactly how much volume that insulation will fill, and quickly adding up the bags used gives you the weight, too --just subtract the weight of the insulation from the total. Look in the Yellow Pages right now, before winter sets in and all the contractors are busy. No need to be Perplexed any longer! ---Captain Carbide.

(adapted from Warren Hoemann. DEVIL'S ADVOCATE,(Diablo Grotto), October, 1984.)

MAP REVIEWS

MAMMOTH CAVE

in "Mammoth Cave: Kentucky's Buried Treasure" by Laura White Alderson, photos by Chip Clark. National Geographic TRAVELER, Autumn 1984, Vol 1 Number 3. Available for $4.70 pp from National Geographic, P.O. Box 2174, Washington, DC 20013.

A friend who knows I like cave maps showed me this; upon opening it I was immediately confronted by section member Miles Drake grinning at me from a crawlway! What really caught my eye was the foldout color map, painted by Richard Schlect, with consultation by Art Palmer. The map is part geologic "fence diagram" and part 3-D cave map. It's very attractive and does an excellent job of conveying the form of this small part of the system.

The text of the article is the usual purple prose popular press article, in which the writer sounds like a combination Arne Saknusson/ pilgrim in Mecca having an orgasm. Catchy phrases such as "my imagination caught fire" abound. Whatever pays the rent. --- J. Ganter

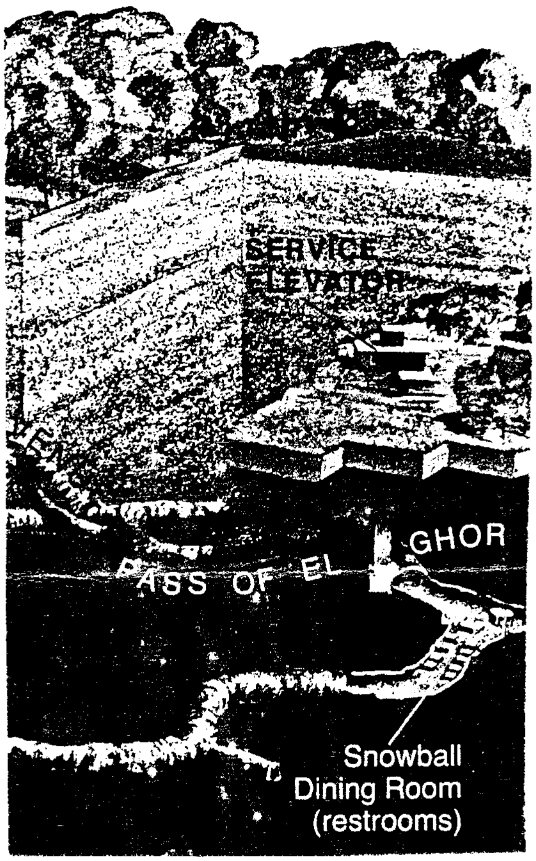
SELECTED KARST FEATURES OF THE NORTHERN VALLEY AND RIDGE PROVINCE, VIRGINIA

by David A. Hubbard, Jr. Cartography by L.E. Valente Published by the Division of Mineral Resources, Virginia Department of Conservation and Economic Development. Available for $4.71 pp from Division of Mineral Resources, Natural Resources Building, McCormick Road, Box 3667, Charlottesville, VA 22903.

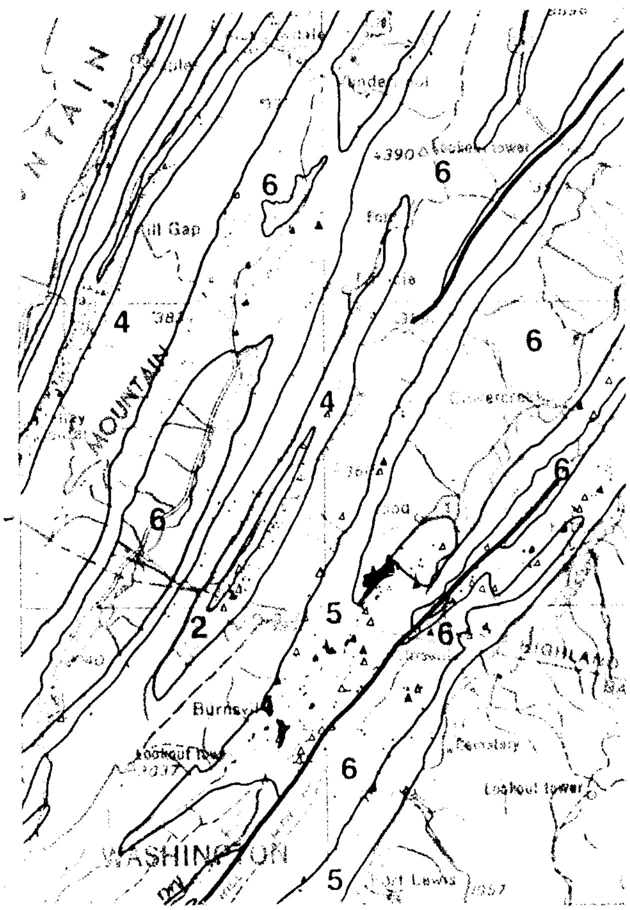
This is the first small scale (1:250,000), state-sponsored karst map that I've seen. Mr. Hubbard summarizes it's use nicely in the first sentence: "This publication is intended as a regional guide to the planner to minimize unnecessary development of potentially hazardous karst areas." The map is printed in three colors; non-carbonate areas have a grey shading, while carbonates are left white. Red dots represent sinkholes visible on aerial imagery, open red triangles denote cave entrances, and solid red triangles represent multiple cave entrances. Streams are shown in blue, while heavy black lines delineate faults. Numbers describe the geologic units; in the included example from the map (the Burnsville Cove area), 5 means the Helderburg Group. The number 6 represents non-carbonates; the shading does not show up in this reproduction.

An extensive explanatory text and bibliography is included on the map; the user is cautioned that the purpose of the map is to give a general idea of where hazards may lie, and that each potential building site needs to be individually evaluated.

The need for this map becomes readily apparent when studying it; a number of rapidly expanding towns and subdivisions, like Harrisonburg and Waynesboro, lie on or near karst areas. Dave Hubbard and the Virginia Division of Mineral Resources are to be commended for producing this valuable tool for responsible land use. --- J. Ganter



A piece of MAMMOTH CAVE from National Geographic TRAVELER. Original is a color lithograph.



A piece of SELECTED KARST FEATURES OF THE NORTHERN VALLEY AND RIDGE PROVINCE, VIRGINIA . Original is a 3 color offset print.

Area shown is the Burnsville Cove, home of 21 mile Butler Cave.

**** Readers are encouraged to submit map reviews of their own ****

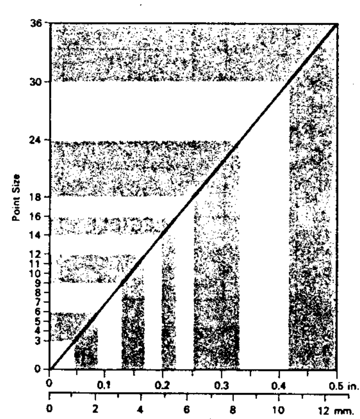
LETTERING

The reason we find maps so useful is that they take advantage of a uniquely human ability called "graphicy." This power allows one to instantly grasp ideas about how places relate to one another in space, without the need for slow, awkward, intermediate steps like language. However, there are some concepts, like people's names, that are awfully hard to show graphically. So we need to use some written language, and lettering (or if you want to be technical, "typography") enters the picture.

Lettering can make or break a map. Very few people have the talent to do hand lettering. If you doubt your ability, please do us a favor and use some sort of mechanical means. And there are a lot of those. The simplest is probably a typewriter. This method is quite satisfactory for small newsletter maps. Add a couple of pages of transfer letters to your kit, and you have the ability to do a lot of lettering with a minimal investment. I do NOT recommend the "lettering guide" templates available to help guide your pen; this usually looks almost as bad as straight hand lettering. Before I go on to talk more about devices, let's look at the letters themselves.

STYLES: One of the basic divisions of type styles is whether or not they have serifs. Serifs are the little curls on the letters, a holdover from the days when lettering was done with brushes. Serifs are not found on the more "modern" (Sans Serif) styles, but they are still present in most type which is meant for general reading, because they make the words and letters "flow" more easily. Serif styles also add an aura of respectability; you'll notice I use them extensively in this publication! Style is largely a matter of personal preference, but please avoid excessively ornate (e.g. Cloister) styles, at least on cave maps.

SIZE: Choosing the size of your lettering is probably more important than the style. It takes practice. Remember to take into consideration whether or not your map will be reduced after you draw it. The samples below show the effect on legibility of a 50% reduction. One measure of type size which may be confusing is "points." This is a printers term ; the chart below shows the relation of point size to height in inches.



(chart from Robinson, Arthur H. Elements of Cartography, Wiley & Sons, Inc. 1978.)

HELVETICA Regular 8PT

HELVETICA Regular 10PT

HELVETICA Regular 12PT

HELVETICA Regular 14PT

HELVETICA Regular 18PT

HELVETICA Regular 24PT

HELVETICA REGULAR 30PT

HELVETICA REGULAR 36PT

SOUVENIR Medium 8PT

SOUVENIR Medium 10PT

SOUVENIR Medium 12PT

SOUVENIR Medium 14PT

SOUVENIR Medium 18PT

SOUVENIR Medium 24PT

SOUVENIR MEDIUM 30PT

SOUVENIR MEDIUM 36PT

CENTURY Schoolbook 8PT

CENTURY Schoolbook 10PT

CENTURY Schoolbook 12PT

CENTURY Schoolbook 14PT

CENTURY Schoolbook 18PT

CENTURY Schoolbook 24PT

CENTURY SCHOOLBOOK 30PT

CENTURY SCHOOLBOOK 36PT

SAMPLES OF 3 STYLES AND SEVERAL FONTS OF KROY LETTERING

HELVETICA Regular 8PT
HELVETICA Regular 10PT
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HELVETICA Regular 18PT
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CENTURY Schoolbook 14PT
CENTURY Schoolbook 18PT
CENTURY Schoolbook 24PT
CENTURY SCHOOLBOOK 30PT
CENTURY SCHOOLBOOK 36PT

As above, but reduced to 50% of original size

(Courtesy of Deasy GeoGraphics Lab)

Cave survey with a Wild GLO laser eyepiece and T16 Theodolite. The thin band on the cave wall is produced by the laser beam. This is profile number 319; the surrounding area is being flashed to illuminate additional detail.

Cave Survey With Laser Profiles

by P. Waldhausl

Generally, the documentation available to speleologists for their scientific work is in the form of often primitive plans which are metrically and cartographically unsatisfactory. For their diploma thesis at the Technical University Vienna, F. Schlogelhofer and F. Wackenreuther have now used the light-section by K. Hubeny for surveying caves. They optimized this method by the use of laser, photogrammetry and modern computer techniques to such an extent tha it is now possible to construct a digital cave model (DCM) which can be evaluated for cartographic, geological or hydrological purposes.

1. SURVEY USING LASER PROFILE PHOTOGRAMMETRY (LAPROPHOT)

For surveying the passages and halls, a spatial traverse is first set out and measured. By fitting a Wild T16 Theodolite with a Wild GLO laser eyepiece, it is possible to make the legs of the traverse and any shots visible by means of a laser beam. Azimuth and zenith angles of the laser beams are recorded as usual. A control-point target is placed on a camera tripod in the profile to be photographed so that it intersects the laser beam in such a way that one surface of the pentaprism fitted at the center of the control-point target and set in rotation by a motor is perpendicular to the laser beam. This is easy to achieve by autocollimation, since in this case part of the laser beam striking the front surface of the prism is reflected back to the theodolite. For alignment, the control-point target is placed on a pivot head with a cross-slide. Only one or two minutes are needed for setting up and orientation.

As the prism rotates, the laser produces a thin band of light on the wall surface of the cave. This is photographed with a 35mm camera attached to the theodolite telescope and with it's film plane parallel to the profile. In order to allow the picture format to suit the profile of the cave, the camera can be rotated about the camera axis and fixed at any required angle of inclination. A special adapter was built for the camera, which fits into the standard Distomat adapter on the theodolite telescope. The time exposures are made on high-speed color diapositive film (Kodachrome 400 ASA/27 DIN), varying from 5 s to 60 s depending on distance, size of profile and reflectivity of the wall surface. It is possible to either to photograph the laser profile on its own or use a photoflash in addition to show the adjacent area of cave wall, for example to allow a geologist to make a more detailed study of the profile.

Depending on the specific purpose, the profiles are recorded at larger or smaller distances. The distance from theodolite to profile need be measured only if it is not to be computed indirectly via the image scale of the control-point target, but the latter will normally be adequate in this case. Where greater accuracy is required for the profiles, the Wild P32 Terrestrial Camera may be used instead. For most speleological work, however, a 35mm camera such as the Pentax ME will suffice, since the adapter is suitable for use with any good single-lens reflex camera.

2. EVALUATION

A digitizer is used, first to digitize the control-points of the target and then the profiles at an appropriate point density, and these data are then stored on magnetic tape. If a Wild A10 with EK22 or a Wild AC1/BC1 is available, digitizing can be carried out with any one of these. The sum of all the profile data forms the digital cave model, after they have been transformed into a uniform coordinate system by means of the known orientation parameters of the polar rays of the survey. With such a digital cave model, it is now possible to solve a wide variety of problems, such as: 1) plot plan and profile or any elevation of the profiles 2) produce a special regular DCM from selected profiles 3) compute the volume of caverns 4) show the contours in perspective, isometric or axonometric drawings and thus give the observer a three-dimensional impression of the caves.

In the Koppenbruller cave in the Dachstein region of Upper Austria, which was chosen for testing this new surveying method, the two surveyors measured over 500 profiles, thus recording those sections of the cave which are accessible to the public. The representation on plan has been supplemented by characteristic cross sections where a plan alone would provide too little information on the shape of the cave, thus providing a clearer appearence of the cave.

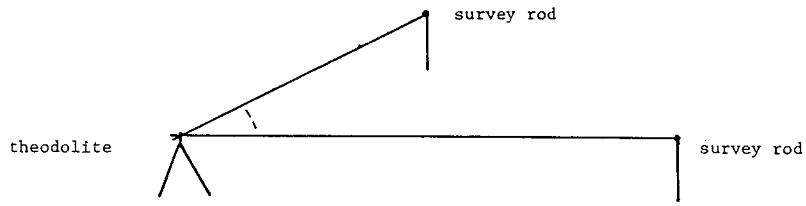
From WILD REPORTER #21 ,May 1983.
(Newsletter of Wild-Heerbrugg Ltd.)

Do you owe a caving friend a few beers? some gasoline? Why not give them a subscription to COMPASS & TAPE for Christmas. Just send $4.00 and their name and address to the editor; they'll get two issues right away and 2 more in the year to come.

SOME COMMENTS ON CAVE SURVEY WITH LASER PROFILES

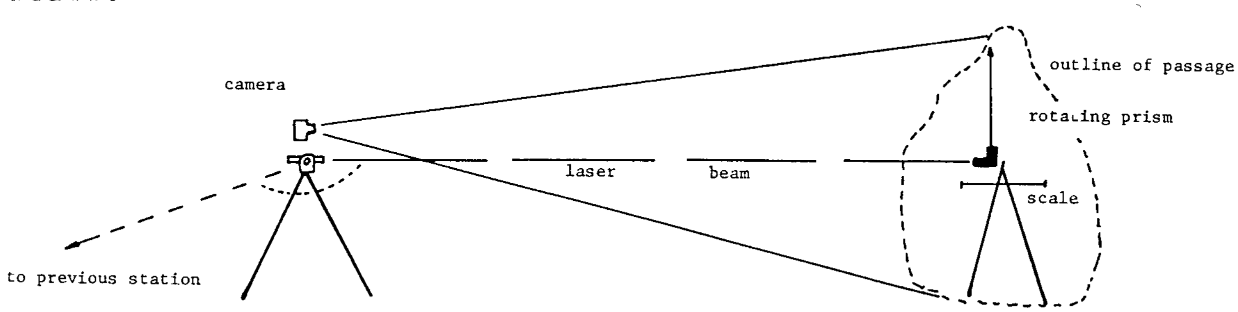
The preceding article, which was kindly submitted by Section member Rick Banning, was written for professional surveyors, so some of the things the author talks about may be a bit foreign to us cavers.

First of all, a theodlite is simply an extremely accurate protractor, with a telescope fitted so that one may sight along it. Unlike a transit or a hand compass, it has no provision for pointing to north. Instead, it is used to measure the relative angles between stations. Multiple loops are made as the theodolite operator and the "stickmen" who hold the target poles triangulate their way along the survey leg. In the sketch below, the theodolite is measuring the relative angle between the target poles. Next, it will switch to each of the pole positions and



repeat the process. This horizontal measurement is referred to (at least by some) as the "azimuth"; the theodolite also measures the vertical angle (or "zenith"), of course. As you might expect, the instruments are extremely precise; $10,000 will buy you state-of-the-art; 1 arc second or 1/3600 of one degree precision!

In this case, our surveyors are adding a few twists. They're making their lines of sight visible with a laser beam, as shown below.



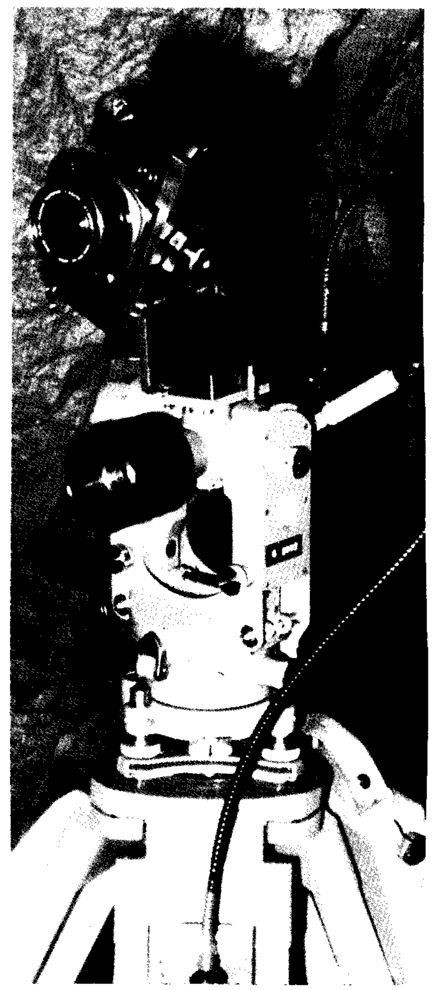
Then the beam is being "sprayed" around the cross section with a rotating prism. The "control-point target" the author refers to is simply a stick of known length, included in the picture, something like the scales paleontologists, et al, include in their photos so you know how big things are.

Once the traverse is plotted out, i.e. a "stick map", the photographs are converted into coordinates by a technique known as digitizing. Now both the trends of the cave and the relative positions of all these collections of points which are the sections are known and the whole mess can be manipulated and plotted at any scale, view and projection desired.

RIGHT: Close-up view of laser theodolite with attached 35mm camera.

BELOW: View towards profile, with control- point target visible.

(Photos from WILD REORTER; captions by J. Ganter)



DEPTH ..... Revisited

Way back in 1970, Fred Wefer published what I consider to be a classic article. Entitled simply "On the Measurement of Depth", this 24 page tome is, as then-editor Nevin W. Davis put it, "absolutely the last word on pit depth determination." Well, almost. Bob Thrun wrote a rather lengthy reply in the next issue. But Wefer's work is interesting. With enough calculus and physics to drown an engineer, he discusses various approaches to measuring depth: falling object, triangulation, comparison of telescope image and object distance, direct measurement, measuring pulley on rope, weight decrease as a rope is pulled from a pit, etc. Perhaps the most useful result was the formulation of two curves showing the time vs. depth relation for a falling object. These tables are reproduced below. Fred was thorough; his derivation has 24 variables. But don't worry; all you need are rocks about the size shown and the table. Note that the rocks can be thrown horizontally into the pit; just make sure you impart no vertical motion. Start timing when the rock leaves your hand, stop when you hear it hit. Reference: Nittany Grotto News, Vol.18, Number 4, MAR/APR 1970. --J. Ganter.

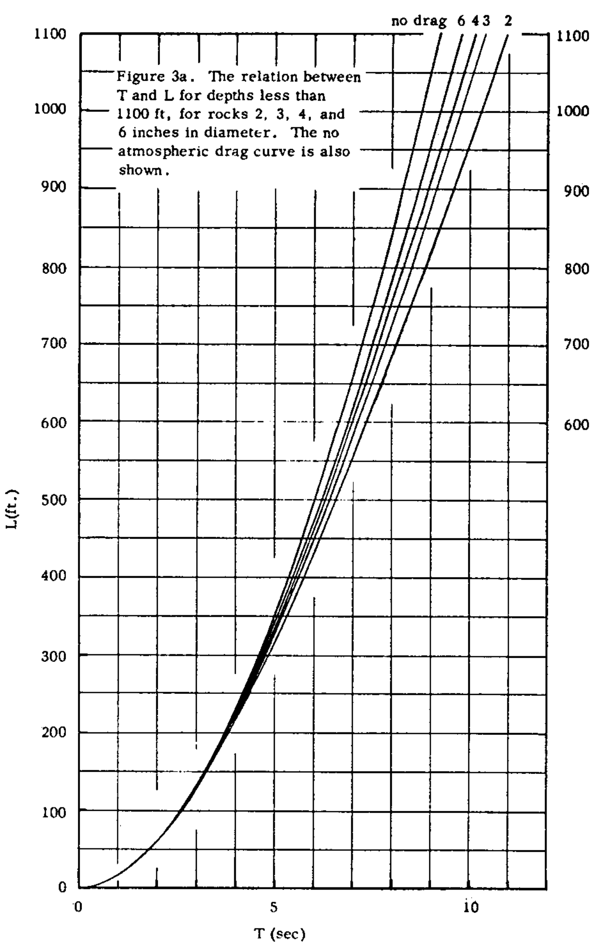


Figure 3a. The relation between T and L for depths less than 1100 ft, for rocks 2, 3, 4, and 6 inches in diameter. The no atmospheric drag curve is also shown.

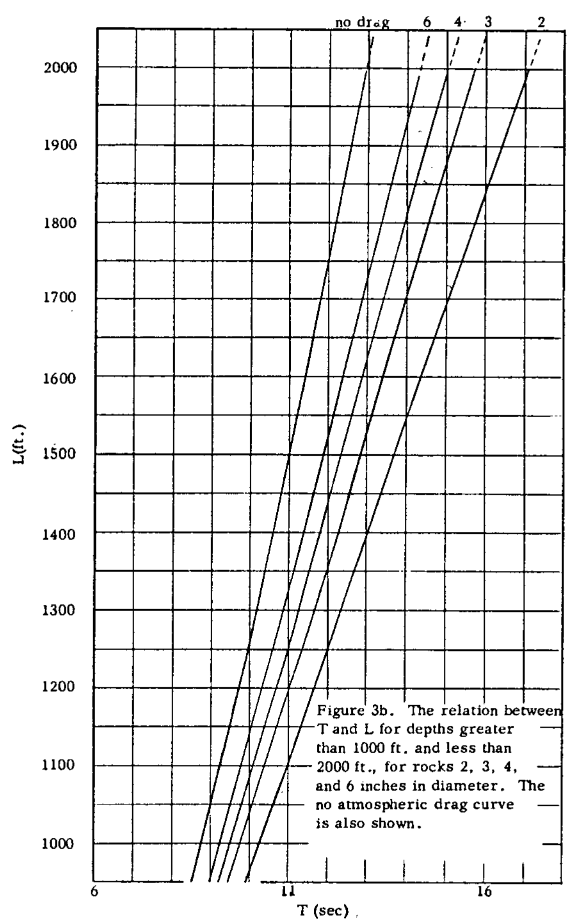


Figure 3b. The relation between T and L for depths greater than 1000 ft. and less than 2000 ft., for rocks 2, 3, 4, and 6 inches in diameter. The no atmospheric drag curve is also shown.

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1984 CART SALON

by Ernst Kastning

The 7th annual NSS Cartographic Salon was held at the NSS Convention in Sheridan, Wyoming, June 25 - 29, 1984. Thirty-three maps (four more than last year) were entered by seventeen cartographers (two more than last year), making this the most successful salon to date (other than that of the 1981 International Congress). Maps from nine states, Puerto Rico, Mexico, New Guinea, and Thailand were submitted. The judges of the Salon were Lang Brod, Doc Dougherty and Terry Raines.

Category	Award	Map	Cartographer
0 - 0.5 km	Merit	Sea Caves of Sunset Cliffs, CA	Carol Vesely
	HM	Meander Cave, CA	Peter Bosted
	HM	Lechuguilla Cave, NM	David Jagnow
0.5 - 1.0 km	Merit	Sistema Punta Bunda, Mexico	Bob Richards
	Merit	Crockett's Cave, NM	David Jagnow
	HM	Pickard's Synch Lava Tube, WA	Randy Boyd
	HM	Surprise River Cave, New Guinea	Carol Vesely
1.0 - 3.0 km	Merit	Mystery Cave, NY	Bruce Jelen
	Merit	Nambawan Ananda, New Guinea	Carol Vesely
Over 3.0 km	HM	Columbine Crawl, WY	Jean Benedict
	HM	Wind Cave, SD	John Scheltens
Best map showing cave and relation to its surroundings		Sistema de Cavernas del Rio Camuy	Thalia D. Veve
Overall Winner	Plaque	Nambawan Ananda, New Guinea	Carol Vesely

Ernst notes that this should have been printed in the NSS NEWS along with the other Awards announcements, but was lost by the editor. Copies of the judges' comments will be distributed to entrants, hopefully within the next couple months.