COMPASS & TAPE

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Quarterly Newsletter Of The N.S.S. Survey & Cartography Section

COMPASS & TAPE

Vol. 1 No. 1 SUMMER 1983

Compass & Tape is the quarterly newsletter of the Survey and Cartography Section of the National Speleological Society. Dues are $4.00/year and include four issues. When paying dues, please give your NSS number and make checks payable to the NSS Survey & Cartography Section. Subscriptions for non-NSS members, Grottos, etc., are also $4.00 per year. The dues year begins at the annual NSS Convention. Those joining the section or subscribing after convention will receive all back issues for the year.

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Credits: The cover this quarter, Surveying in Roppel, is by Ray Keeler.

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FROM THE EDITORS:

As the summer of '83 drew to a close, it appeared that there would be no Compass & Tape published. No contributions of material had been received, my borrowed Selectric was misbehaving, and there were caves to survey and maps to draw.

Then the Dynamic Duo, Cady Soukup and Roberta Swicegood, approached me with an offer of assistance. Most of the credit for Compass & Tape #1 goes to these two highly-motivated cavers. We're off to a good start—please contribute!! If there is something you want to say about surveying caves and/or drawing maps--this is the place to say it . . . we hope to hear from you.

John

Those of you who receive both Compass & Tape and the CKKC Newsletter will notice certain close family relationships between the two publications--no surprise, since their layouts were designed by the same person and are generated on the same word processor. Therein lies the secret of why we were willing to do it: the availability of labor-saving devices and "pre-established" procedures and formats. Nevertheless, we appreciate John's kind words.

We would like to say something now about contributions. A newsletter such as Compass & Tape cannot exist without contributions from you. As seasoned newsletter editors, we have heard all the reasons given for not contributing: I don't write well, no one is interested in what I am doing, I don't know enough to write for a specialized publication, people will disagree and I'll be involved in a multi-issue controversy, I don't have time, etc., etc., etc. We don't believe any of them!!!

Newsletter editors exist for the express purpose of smoothing over roughly written materials, so that shouldn't be a worry. What people are doing in the field is always of interest—"standard survey procedures" vary surprisingly widely among caving areas, and avid surveyors want to know how other people are working. Short paragraphs discussing surveying practices are welcome—we have heard impassioned discussions of keeping books clean and dry, managing tapes by dragging along or by reeling in, the joys of licking Suuntos clean, tape-joined vs. separate Suuntos, the desirability of (or the loathesomeness of) backsights, and more, a list that could fill pages. It would be useful to document some of the information that fills the air whenever surveyors get together. As for controversy, so long as it is technical in nature it is healthy. Compass & Tape will not become involved in personality conflicts; they waste space and are not productive.

The editors of publications receiving few contributions burn out very quickly, since it is difficult to write, edit, type, reproduce, and distribute multi-page publications with no support. If you enjoy Compass & Tape, please do your part in keeping it going.

Cady & Roberta

HOT AIR BALLOONING IN CAVES . . . .

According to the Time-Life Book Underground Worlds, the famous French speleologist E.A. Martel (1860-1938) used to measure ceiling heights by pulling a light string aloft by means of an alcohol-heated paper balloon. One wonders how this idea would work with one of the new mylar-foil balloons popular today.

Has anyone tried it? --John Ganter

BALLOONS AND CAVE SURVEYS . . . .

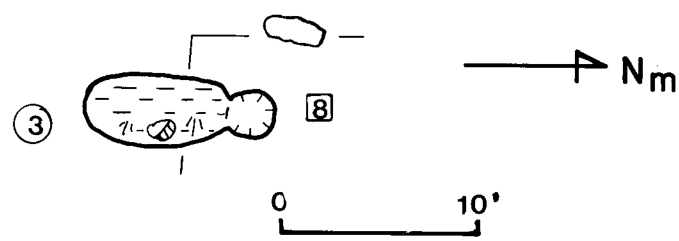
At this year's NSS convention (1983), there was a presentation on the California Sea Caves by Dave Bunnell, Ernie Garza, and Carol Veseley which included the use of (no less than) a Snoopy mylar-foil balloon on a string to measure ceiling heights of the sea caves from the relative comfort of a rubber raft. They did mention some problems with measurement when the wind buffeted Snoopy around, resulting in a less than vertical angle in the string. Perhaps the angle could be measured, and the appropriate trig. equation applied for accurate measurement in a case where the wind is a constant feature of the room? --Cady Soukup

FERROUS TRIPODS . . . .

In The Texas Caver (April 1982) "Survey Issue," editor James Jasek mentions modifying a small Vivitar camera tripod for use with a Brunton. It looks like a good idea, but James mentions nothing about testing for ferrous (magnetic) components in the tripod.

I checked my "Slik" brand tripod and found some steel. Brunton does sell non-magnetic tripods for about $80. If someone knows about a cheaper camera tripod which is definitely non-ferrous, let's hear about it. --John Ganter

MANHOLE Bedford Co. PA.



Sketch Map from memory
J. Ganter, D. Carns December 25, 1982.

TAKING THE "SURVEY WHAT YOU FIND" ETHIC A LITTLE FAR ??

HOW TO USE THE SUUNTO

. . . . GEORGE VENI

(Reprinted from The Texas Caver, April 1982)

The complete Suunto survey instrument is actually two separate units, the compass and the clinometer. The method of reading them is similar. In the case of the compass, the instrument is held level in one hand and the small window is placed up to the eye. If the right eye is used, then hold it with the right hand or vice versa. The reason is that the other eye, unoccupied by the Suunto, must be open and have a clear, unobstructed field of view. Let us assume the instrument is to the right eye. Through the window, this eye sees a rotating pin wheel, slowing to a stop, and a vertical hairline in front of it. The wheel is divided into 360 degrees. While this is going on, the left eye is looking at the survey station. Now the following takes a bit of getting used to. You must mentally merge the two different images, so you see the hairline on the station and read the large number degree increment on the wheel that lines up with the hairline and station. This is your compass bearing or azimuth. The smaller number (sometimes in red) is the 180 degree reverse or backsight. The clinometer is similar except that it is held perpendicular to the ground and instead of moving your head (and instrument) left and right to locate the station, you tilt it up and down. The clinometer also has two scales on it. You want the one on the left which is degrees. The scale on the right is percentage.

In a cave, the Suunto needs illumination. Some are made containing a glowing radioactive element to light it. These, however, are not sold in the U.S.[1] What is generally done is to use the unoccupied hand to hold a light that shines on the Suunto's face. This face has a large window, over the pin wheel, which lets light in. Remember that a compass works on magnetism and your electric light or 4 inch steel carbide lamp reflector will affect your reading. If you use a Premier carbide lamp, dig out the small aluminum reflector that was originally on it and you are safe. If you must use an electric or steel reflector, hold these lights away as far as possible to avoid deflection.[2] This does not apply to the clinometer.

One more thing on magnetism and deflection. Wire-framed, rimmed, or reinforced glasses are a no-no.[3] I have found that the safest and easiest way to light up your Suunto is with a Cyalume. This is a plastic tube with two chemicals in it. Bending the tube will allow the chemicals to mix, which produces a bright green glow for about an hour, then a progressively dimmer glow for up to another five hours or so. The Cyalume is packaged in an aluminum foil wrapper. Do not discard the wrapper! Make a 3 inch longitudinal slit in it, fold it back and it serves as a reflector. The same procedure can get up to an hour or two more use out of the dying Cyalume. Finally, strap it to your Suunto with a big, heavy-duty rubber band (keep a couple extra in your pack just in case) and you are ready to survey.

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1 Speleoshoppe and Caves Unlimited carry illuminated Suunto compasses. Cost is about $20 more. --John Ganter (The availability of these illuminated Suuntos is dependent on the current U.S. government position on radioactive materials, since their light source contains tritium.--Roberta Swicegood)

2 Also watch out for flint strikers on carbide lamps.--John Ganter

3 Some metal-framed glasses are non-ferrous. However, they still may have ferrous screws which may or may not cause significant errors.--John Ganter

The true beauty of the Suunto is its ease of use. You just stand there, look through it, and voila! Some people argue that because of this method, the Suunto is not accurate. This is true to a point. Like any instrument, the Suunto is as accurate as the person using it. Care must be taken to ensure exact position over the station. A Suunto can be tripod-mounted, but it defeats the purpose of using it, which is ease. Some cavers carry plumb bobs to maintain exact instrument position over the station. It has been my experience that with careful eye-balling, dropping a rock from the instrument when in doubt, and using a plumb bob for long drops, my survey accuracy has only had about 0.5% error. A good way to maintain station accuracy is to pick station the Suunto can be easily placed on, under, or next to. Examples are tops of boulders, tips of stalactites, knobs on the wall, and manufactured markers of wood, plastic, mud, or rock.

Suunto extras! If you expect to use your Suunto in a wet cave, I strongly recommend you cover all seals with contact cement or epoxy. It is really worth doing because fogging Suuntos can be very frustrating, especially if you have traveled far and caved hard for many hours to get to your survey area. [4] Another problem with Suuntos is in reading a very large vertical angle where the station is far above or below the sight line. The merging views from each eye will result with the station far above or below the hairline. The compass cannot be tilted up or down to merge the station onto the hairline because the directional pin wheel, trying to stay level, will jam against the Suunto body and not rotate freely to north. This problem can be remedied by taking a small, clear plastic, inch-long tube, cutting it in half (lengthwise), and mounting one half on top and the other half on the bottom of the Suunto's front end, perpendicular to the line of sight. Incoming light from the station will now be refracted to allow accurate readings.[5]

Suunto use is increasing. Their already mentioned ease and speed are wonderful assets, especially in places where a tripod-mounted Brunton compass would be difficult, if not impossible, to use (certain crawlways and treading water in Honey Creek cave come to mind). With a little caution and care, the Suunto can be very accurate. It's true that the Brunton on tripod is more exact, but it is much slower and cumbersome for the little extra accuracy it gives. A hand-held Brunton is even slower to use and its accuracy, by today's standards, is often unacceptable. The Suunto instruments are also more compact, and much more rugged than the Brunton, and a little cheaper too! This is not an effort to downgrade the Brunton, which is a very fine, accurate, and durable instrument. Yet the caving challenge is seeking the larger, more difficult cave systems, where speed and technical versatility are essential. The Suunto is the instrument that accepts and overcomes the challenge.

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4 Ian Ellis of Speleoshoppe has a new Suunto that has a small screw on the side that enables the caver to flush water through it for cleaning and fog removal.—Editor, The Texas Caver

5 I assume the author means a solid plastic rod, as the air in a tube does not refract much.—John Ganter

THE WET SUUNTO: A TREATISE ON THE CARE AND FEEDING OF ABUSED CAVE SURVEY INSTRUMENTS .... ROBERTA SWICEGOOD

Suunto compasses and clinometers are extraordinarily frustrating instruments in one respect: as Bill Storage once said, as the two of us lay side by side in a mud puddle directing twin carbide lamp flames at a foggy compass, "How can anything that looks so waterproof be so leaky?"

Dealing with the wet Suunto takes three forms: prevention (good luck!), in-cave therapy, and post-cave resuscitation. The techniques you use depend on both your temperament and the types of caves you inhabit.

A Suunto leaks in two places: the gasketed window, and the eyepiece. Unfortunately, the window, relatively easy to waterproof, is a minor source of leaks, while the eyepiece, almost impossible to seal, is a flood path.[1] Preventive maintenance will make these leaky areas more water-resistant.

The immediately obvious waterproofing technique is sealing. Many cavers use epoxy, but this makes the instruments extremely difficult to repair (Mike MacHost of Forestry Supply complains bitterly about all waterproofing materials, and dislikes epoxy particularly). The epoxy also fails in time. A second waterproofing material, aquarium silicone sealer, works quite well at stopping water but does not entirely bar water vapor transmission. Its advantage is that it remains flexible and thus can be peeled away during repairs. Both sealers help keep out silt, the primary destroyer of Suuntos used in wet caves.

To waterproof Suuntos, spread the epoxy or silicone onto the sides of the gasketed window, working it in well with your fingers. That was the easy part. Now, load up the broad end of a toothpick with silicone or epoxy. Carefully spread is around the edges of the eyepiece, avoiding the center. Clean up with a piece of rag wrapped around a small rigid object (jeweler's screwdriver, e.g.). Let the material cure for at least 48 hours before use, and remember that you have made your Suuntos water resistant, not waterproof—don't expect to dunk them and avoid the consequences.

The most innovative Suunto waterproofing technique I have seen was developed by Lee Noon. He enclosed the instruments in Suunto-sized cases of epoxy-joined Lexan sheets. This worked for a while, but eventually the epoxied joints failed, and the instrument reader had to bust apart the leaking cases and rescue the waterlogged instruments. It's basically a good idea—if the joints can be made stronger, the Suuntos within the case will in fact be waterproofed.

Transporting Suuntos to the survey site dry is a necessity. Rigid waterproof cases work best (wide-mouthed bottles or even Sushi boxes). I have never had much luck with plastic bags, even with double and triple bagging. It depends on the travel route—bagging will get the Suuntos through damp passages, but won't work for truly wet passages (i.e., your pack gets soaking wet). Some cavers carry Suuntos in their helmets, which keeps them out of the water but allows water vapor transmission in the form of sweat. Bagged instruments in a helmet will survive everything but very low air space.

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[1] The eyepiece has no gasket; it is pushed into the Suunto housing and positioned to magnify the card and allow optimum reading.

In-cave therapy involves proper instrument handling and dealing with emergencies. The instruments must be carried between survey stations in some way that keeps them out of water. Many cavers use a band of inner tube rubber around the helmet, behind which the Suuntos are slipped between stations—a far superior technique to the in-mouth carry, the hand-in-the-air carry (hard on the elbows), and the tacky dragged-through-the-water-and-mud carry (a good way to end surveys early).[2] Stuffing Suuntos into a wetsuit, while it keeps the instruments out of the water, warms them up and is a sure-fire fog generator.

There is some disagreement about the best way to clean mud off Suuntos. I advocate licking them—saliva is a good anti-fog treatment, and the sound of spitting warns the notetaker that a reading is on the way. Others recommend cleaning them off with a rag, which is fine (and certainly more refined) if you have a relatively clean rag handy--a handkerchief around the neck works admirably. The brave, the heretical, and the foolish wash them off in mud puddles.

If, despite all precautions, your Suuntos fog up or (desperation!) actually have a water film inside the eyepiece, all is not quite lost. Mildly fogged Suuntos can be cleared by holding them under an armpit; however, if the instruments are fairly damp, this will increase rather than decrease the fog. To clear severe fog, lick the eyepiece, heat it with a carbide lamp flame held at a distance of about three inches, and read quickly. This technique will keep the instruments going for quite a while, though it may need to be repeated at every station if the instruments have gotten a good dose of water vapor.

Severe fogging--you can see a water film through the eyepiece—necessitates another step. Take the instrument, hold it with the eyepiece away from your body, and slap it against your palm until the interior water film consolidates into droplets and runs to the side of the eyepiece. Then lick, heat, and read as fast as you can.[3] Instruments in this state are almost dead, but if only a few more shots will finish the survey they can be kept going.

After a wet trip, Suuntos should be washed thoroughly. If you have flush ports, open then and wash the guts. If not, look through the eyepieces and swear at the silt that has accumulated inside the instruments. Check for algae (it has happened to those who do not dry instruments thoroughly between trips and who leave them out in the light!). Air dry the Suuntos; heat sources will cause the plastic of the windows to expand and bubble up, ruining the instruments. Store them away from ferrous metals. Repeat procedure next week (and the week after, and the week after . . .).

Next quarter: Suuntos with flush ports, purchased and home-grown.

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2 The inner tube rubber helmet band may also be used to secure a carbide lamp in place, preventing both loss and bracket stress after knocking the reflector against an unyielding object.

3 The heat from your face and/or your hand will re-fog a Suunto in this condition, hence the need for fast reading.

THOUGHTS ON SURVEYING PITS .... BILL STEELE

(Reprinted from The Texas Caver, April 1982)

If you have never surveyed a pit, you may think it is harder than it is. Oft times it's little different than horizontal caves. Most cave surveyors these days use thirty meter tapes. Some fifty. So if the shaft is less than that deep, then it is possible to do it in one shot and be done with it. If it does not allow a line of sight, then put a station half way down and take the instrument readings from the top first, then backsight from the bottom back up to the mid-point.

Long freefall shafts are usually measured by measuring the rope. Knots are put on the bottom, and a piece of tape, a knot, the end of the survey tape, or something at the top. Then as it is derigged, a tape is passed alongside it. I bought a 400 yard length of thin copper wire at a craft store in Austin for less than $4 (1977$). We used in the survey of Hoya de Guaguas. It was about the size of a fist on the spool. To measure the wire back in Austin, we pounded two nails into asphalt exactly 300 meters apart (Kirkwood Road). We tied the wire off and wrapped it around the nails more than six times for the high side depth. Then we taped the overage.[1]

Long drops against the wall are usually surveyed by climbers in tandem as a two person survey team. When two on a rope is not possible, often a person finds a place to hold onto or clip into the wall, maintaining a safety on the rope. The other climbs up and they take turns while surveying. You have got to figure every pit out individually. There is always some way to do it.

A trick used in free falls is dropping a pebble to find the -90 degree vertical spot. I would not recommend this above 25 meters. There is no azimuth, obviously. In multi-drop caves there are a lot of steep compass shots. Reading a Suunto (and heaven forbid a Brunton) is tricky as veterans will testify. Unless a split plastic tube is secured onto the compass both top and bottom, which almost none have, then the compass reader needs to look up and down many times to get an acceptable reading. In Huautla, we wondered how accurate our survey really was since most all of our shots were done this way. We held our breath when we made a connection and closed a large loop. We had the data to know the truth. We reckoned the reason the error was so miniscule was that we had dependable compass readers who take almost as much time as the book person.

To relate some ramblings. While surveying in Sumidero Yochib in Chiapas, Mexico, a river cave with some loud sections, I was keeping book in a two person survey team. I had to have the smart end of the tape because I could not hear the reading. For the same reason, I had to have the instruments. That was less like a two person and more like a one and three-fifths, two-fifths person survey team.

A good general procedure is to have the tape person, and the instrument person, and the note person repeat all the readings. Then say a loud "Correct" everytime! It is surprising how many times they heard it wrong. There have been many times in Huautla when I remember using a broken tape, say two meters short. We would read the tape, and a middleman would do the subtraction. The note person would only

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[1] Since copper wire is ductile, care must be taken not to stretch it when doing the measurements.--John Ganter

take the readings from the middleman and not the other. Though I remember an agonizing twelve hour survey once when we religiously did that and got by with it, we switched to noting it boldly in the book and always reading the tape as seen.

Map Symbols

Reprinted from The Texas Caver, April 1982.

These official AMCS survey symbols were submitted by Peter Sprouse.

CEILING SYMBOLS

- Sharp drop in ceiling, hatchures point toward low ceiling
- Dome
- Ceiling height

FLOOR SYMBOLS

- Bedrock floor
- Mud or clay
- Sand or silt
- Gravel
- Rounded stream cobbles
- Talus
- Breakdown
- Large breakdown, drawn to shape and scale
- Guano
- Pottery or other archeological material
- Slope: down in splayed direction
- Organic debris
- Trail
- Survey station, survey point datum

GEOLOGIC SYMBOLS

- 25 Strike and dip of strata with dip in degrees
- Vertical joint
- Dipping joint
- U/D Fault: D side moved down relative to U side

- Passage walls
- Lower level passage
- Upper level passage
- Unsurveyed passage
- Breakdown walls
- Sharp drop in floor: down in hatchured direction
- Pit or entrance drop
- Cross section of passage viewed in direction of half barbed arrow and rotated to horizontal
- 321 Depth below entrance (or datum)
- 62 Height above entrance (or datum)

WATER SYMBOLS

- Direction and course of flowing stream
- Direction and course of intermittent stream
- Standing water, lake or pool
- Intermittent or relict pool
- Sump (cross hatched)
- Large stream or rapids

FORMATION SYMBOLS

- Flowstone on floor: may indicate slope contours with bulged side downslope
- Rimstone dams, drawn to scale and shape when possible
- Flowstone on walls
- Stalactite
- Stalagmite
- Soda-straws
- Column

SAY, HOW HIGH IS THAT DOME ? ...... JOHN GANTER

Upon encountering a dome or high ceilinged room, considerable debate will often erupt in a survey party.

"Sixty feet," confidently asserts the sketcher.

"No way—it's not over forty-five," replies the instrument reader, who happens to be a 5.12 scaling-pole climber.

"Wow!" says the rank novice, revolving in wonderment and tangling the tape, "That's at least one-hundred-fifty feet high!"

So who's right? If the party is equipped with carbide lamps, any one of them probably could be. Most will agree that reasonable estimates require a powerful electric lamp. A Wheat Lamp with a 4 amp "Coon Shiner" bulb works great. But estimates are still difficult, especially since many surveyors have not had experience with pits or domes of known height.

If the dome (or room) is not much over 100 feet high and has a drip or small waterfall, a fairly accurate estimate can be made by using the water as a "plumb line." The equipment needed is a powerful electric lamp, a clinometer, and a survey tape. Also, a calculator with trig. functions will be handy, but it can be left outside the cave.

The procedure is as follows:

1.) Use the lamp to find the source of the water. If the source is a slow drip, there will often be a highly reflective drop hanging there.

2.) Find where the water falls. This will often be a small hole if the floor is of clay, or may be a spatter area, or fluting on rock.

3.) Measure the distance (d) from this spot to where you will take the clinometer reading. (See illustration)

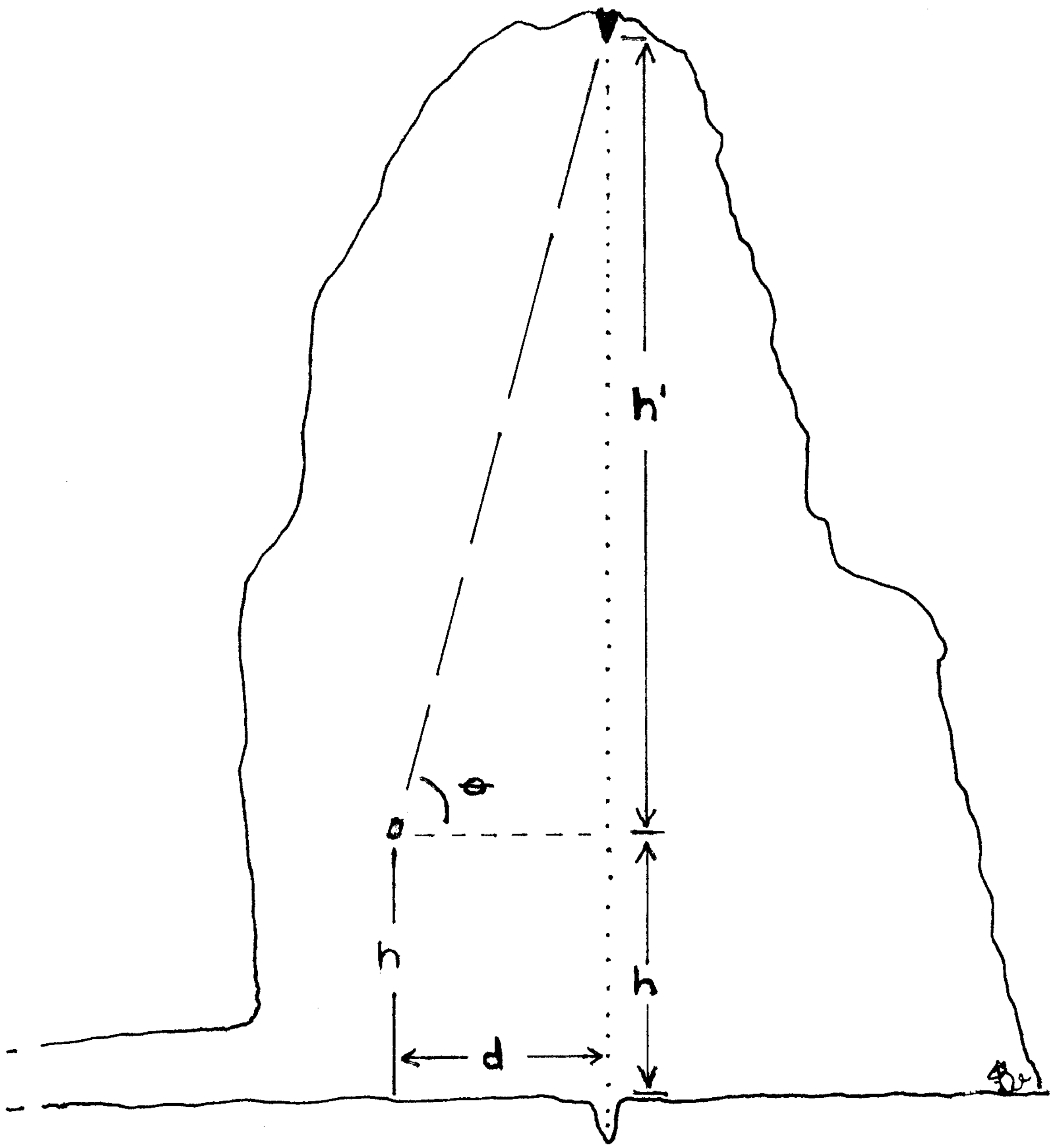
4.) Have someone help you hold the instrument directly above the end of your (d) line.

5.) Measure the height (h) from the end of (d) to the clinometer.

6.) Read the angle to the source of the water. By using the proper equation, the height of the dome can be calculated with some accuracy.

It may be educational to make estimates of the height before you work the equation, so that one can improve his or her estimating ability.

A Suunto, Abney Level, etc. type of clinometer works best for this measurement procedure. I haven't tried it with a Brunton. This procedure won't work when the ceiling gets really high, or the dome is very narrow, or if there is a lot of mist. For some situations it is an interesting and useful method of accurately estimating heights.



H = DOME HEIGHT

h' = ELEVATION

h = INSTRUMENT HEIGHT

d = DISTANCE FROM INSTRUMENT TO DRIP

θ = INCLINATION

$$h' = (d)\ (\text{cosine } \theta)$$

$$H = (d)\ (\text{cosine } \theta) + h$$

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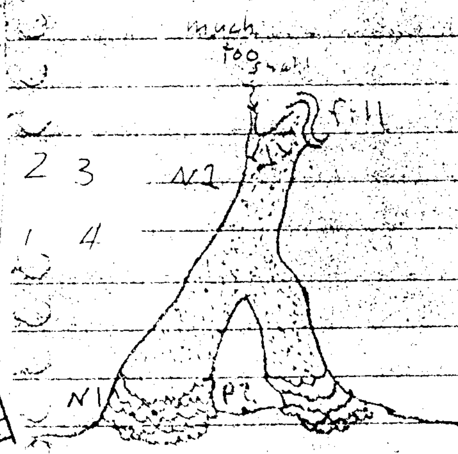
(GREAT!?) MOMENTS IN SURVEYING... *

(3)

1st std is not numbered
it is between the two
leads on right wall
just beyond the Turtle
Hurdles

D 2 1
35.7 BAD 071.0 12.5 GOOD 204.0 0 5 2 3
1 4

Northtown Cave sure as hell isn't this way!!!!!!!!



All dist good

(1) ☆ SUBTRACT 1 (ONE) FOOT (1) FROM ALL DISTANCES + TAPE IN FEET + INCHES

(2) Inst: owned by D. BLACK
Tape is off by -1.0', must subtract
Tape reading to get corr Dist.
Comp Suunto, degree, 139505, Outhouse 112°
Inc Suunto, degree, 13643

(3) All INSTRUMENTS Owned by D. Black
Tape in Feet & TENTHS of Feet AND
was 1.0 FT Short, must subtract
1.0 FT from Tape Readings

(4!) All INST. owned by D. BLACK
TAPE in FT & TENTHS (Tape is not off)
Comp: Suunto
INC: Suunto

* courtesy of the Reppel notebooks

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COMPASS & TAPE

c/o JOHN GANTER
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FIRST CLASS

V1#1 14