COMPASS & TAPE

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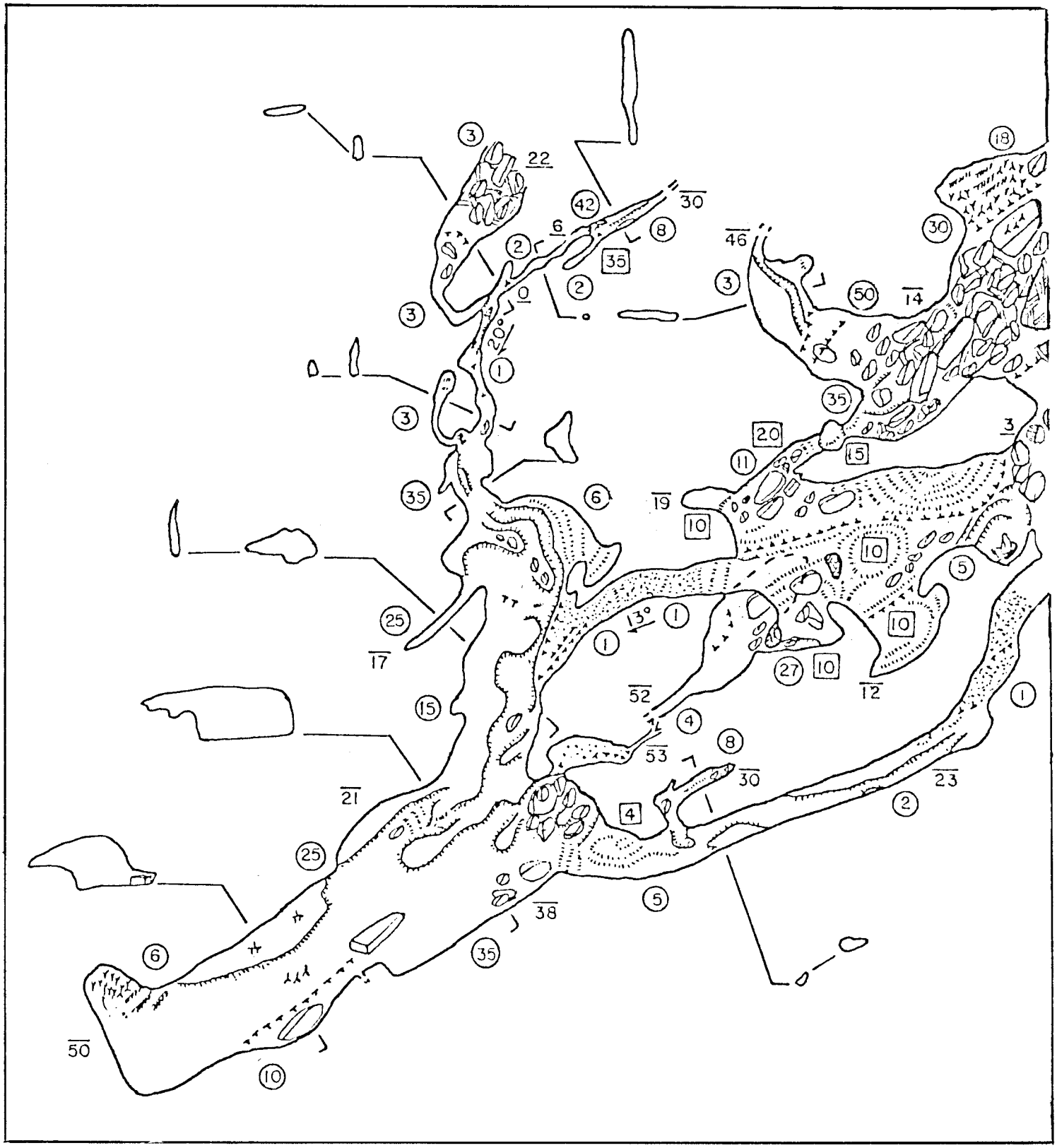

COMPASS & TAPE

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Cover: Part of a map of Patton cave, West Virginia by George Dasher

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THE COMPUTERIZATION OF THE CAVE MAP

by

Fred L. Wefer

1. BACKGROUND

At the 1983 NSS Convention in Elkins, West Virginia, Wefer et al (1983) presented a paper called "An Application of Interactive Computer Graphics to the Study of Caves". Paul Hill presented a similar paper [see Hoke (1983a)] on work he had done independently on the same topic, viz the application of "state of the art" computer graphics hardware and software to the problem of viewing and studying cave survey data. We both also showed video tapes.

The papers and video tapes received mixed reviews, partly because what was "state of the art" to us was a bit futuristic to everyone else. Both Paul and I had ready access to high performance graphics display devices because we worked for companies which manufactured them (Paul for Evans & Sutherland in Salt Lake City, UT, myself for Megatek Corporation in San Diego, CA). The hardware (CPU, disk drives, graphics display device, etc.) and software (OS, FORTRAN compiler, graphics package, etc.) used by Wefer et al (1983) cost in excess of $250,000.00 back in 1983.

Considerable time has now passed. Personal Computers (PCs), which were not in such widespread use in 1983, have now begun to approach in graphics capabilities the equipment which Paul and I had available to us back then.

Graphics workstations, which can easily provide the required capabilities, have experienced a dramatic reduction in cost. One can now purchase a system which is nearly functionally equivalent to our 1983 systems for about $25,000.00. While that is still a great deal of money, it is more than a factor of ten reduction in price in only six years!

A price reduction by an additional factor of three to five is probably achievable, so that by about 1993 the hardware available to, and affordable by cave surveyors ought to be comparable to what was available to us in 1983. It is time, therefore, to begin to discuss some of the things learned over the last seven years so that they may be applied to systems being designed today and in the near future. This is the first in a series of papers presenting such information.

2. STAGES OF DEVELOPMENT

The use of computers in the creation of cave maps is hardly a new subject. In the "good old days", computers were large, expensive, complicated pieces of equipment operated and maintained almost

exclusively by universities and/or large commercial businesses. After normal working hours, time on these computers was, shall we say, "borrowed", for cave survey purposes.

As PCs have become more powerful, both the amount and type of computing done on a "borrowed" time basis has changed. Borrowed time was originally used for even the most basic mathematical computations. It is now most often used for more sophisticated operations still beyond the capabilities of PCs.

Many "activities" have been affected by the development of the computer, e.g., checking out at the supermarket and even writing papers for Compass & Tape. The computerization of activities tends to occur in identifiable and somewhat predictable stages. These stages can be described in terms which are nearly independent of the application, something like the following.

2.1 STAGE-1 -- SIMPLE

During development Stage-1, portions of the activity which were previously performed without computers are simply computerized. Some portions are still done "the old way".

In the case of cave mapping, this corresponds to computing the horizontal and vertical components of each shot and also computing the Cartesian coordinates of the survey stations [see e.g.: Lawrence (1969), Bassham (1969), Wefer (1971), Rea (1973), Rutherford and Amundson (1974), O'Holleran and Dayton (1979), Heaton (1985), and Nieuwenhuis (1985)]. Plotting is usually done by hand on graph paper. When computer graphics are used, it is in an attempt to mimic the non-computer version of traverse line plots with existing hardware, e.g., line printers [see e.g., Frater (1969), Rutherford and Amundson (1974), and Hoke (1980)].

2.2 STAGE-2 -- ENHANCED

During development Stage-2, the computerized version of the activity is enhanced to provide additional functionality. Additional capabilities are provided which were seldom done before because they were time consuming or difficult.

In the case of cave mapping, this corresponds to several things. First, to closing simple and multiple loops [see e.g.: Plantz and Schmidt (1970), Schmidt and Schelleng (1970), Wefer (1971), Thrun (1976 & 1980), O'Holleran and Dayton (1980 & 1981), Dotson (1983), Conover (1983), and Hoke (1983b)]. Second, to the plotting of traverse lines of the survey in plan and profile on paper using specialized hardware, e.g., pen plotters [see in addition to the above: Wilcock (1970), Coward (1972), McKenzie (1980), Hoke (1981), Wefer (1982), Peerman (1982 & 1986), and Crowl (1988)]. Third, to plotting specialized maps, e.g., stereoscopic or hidden line views [see e.g., Goodchild (1969), Ulfeldt (1975), and Halleck (1983a & 1983b)].

2.3 STAGE-3 -- COMPLETE

During development Stage-3, the computerized version is further enhanced by the use of more sophisticated algorithms and added functionality, to the point where all or nearly all operations are performed on the computer. The computerized process completely replaces the previous manual process.

In the case of cave mapping, more sophisticated algorithms include loop closure and placement of the cave on the maps [see e.g., Hill (1982), Smith (1982), and McKenzie (1987)]. Cave maps are produced digitally and rendered on paper only as the final step [see e.g., Glover (1986), Nepstad (1987 & 1988), and Ganter (1989a & 1989b)]. While the cave map may be viewed on a computer graphics screen, this is done mainly as an interim step in generating the final rendition on paper. The cave maps produced by the computerized process are on nearly the same medium as the ones produced the traditional way and are of similar "quality".

2.4 STAGE-4 -- REDEFINITION

During development Stage-4, the functionality of the computerized version greatly exceeds that of the traditional activity. Aspects of the computerized version are recognized as new manifestations of existing ideas, processes, and/or products. This recognition results in a reconsideration of definitions of the fundamental terms previously used to describe the activity. The activity itself undergoes a redefinition.

In the case of cave mapping, operations which could not be performed before are now feasible. Map content can be changed at will, virtually instantaneously [see e.g., Wefer (1985)]. Maps can be viewed in any direction in 3 Dimensions (3D) and rotated in real time [see e.g., Wefer et al (1983), Wefer (1985), Jelen (1985), and Schaecher (1986)]. Sequences of changes in content and view can be defined interactively and played back in a movie-like fashion [see e.g., Wefer (1986)]. New definitions of terms like "cave map" are required. New ways of thinking about cave maps affect other aspects of speleology.

2.5 TIME FRAME OF THE STAGES

The time frame of these stages of development is diagrammed in Figure 1 below. Note that the beginning and ending points of the development stages as well as the boundaries between stages are not all that well defined. The time scale in Figure 1 should be viewed accordingly.

Once development is complete, the systems are used on a continuing basis to generate cave maps. It is normal for the development of the stages to overlap somewhat. Stage-3 and Stage-4 development will, I believe, continue well into the next decade.

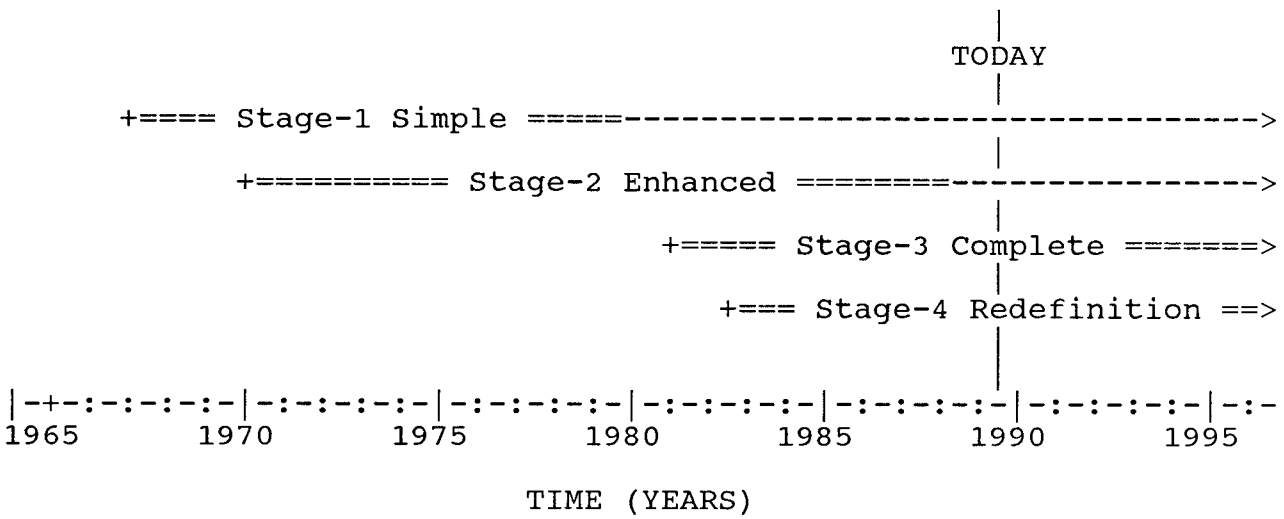

Figure 1. The stages of computerization are schematically illustrated for the example of cave mapping. The development of a stage is indicated by "====". The continuing use of techniques of the stage is indicated by "----".

3. THE REDEFINITION

To those not directly involved in the redefinition, the distinctions between Stage-3 and Stage-4 may still not be fully appreciated. Even Ganter (1989b) in a thorough and perhaps exhaustive discussion of the application of digital techniques and computer graphics to cave mapping does not draw the distinction. Because I think understanding the distinction is important, in this section I will try to make the differences clear.

3.1 WHAT IS A CAVE MAP?

The most important distinction between Stage-3 and Stage-4 relates to the question, "What is a cave map?" It is self-evident that a "cave map" is a "map" of a "cave". The related question, "What is a cave?" is an interesting one, but it is not the subject of this paper. Webster's Ninth New Collegiate Dictionary contains two relevant definitions of the noun "map", viz:

- A representation usually on a flat surface of the whole or part of an area
- Something that represents with a clarity suggestive of a map

Perhaps the easiest way to clearly show the differences between Stage-3 and Stage-4 is to review the aspects of a cave map, first listing each aspect generically, then listing the same aspect specifically for Stage-3 and then for Stage-4.

3.2 SURFACE

The cave map is presented on some surface, usually flat. This distinguishes maps from other representations such as dioramas and sculptures [see Ganter (1989b)].

Stage-3 - The surface is mylar, vellum, paper, or some similar material.

Stage-4 - The surface is the screen of a computer graphics terminal. The cave map is designed to be viewed on the screen of a graphics display device. A hard copy of the screen may be made; however, the hard copy is actually a Stage-3 or even a Stage-2 cave map.

3.3 MARKING

The information content of the map is presented using some form of marking, including whatever auxiliary mechanisms are required for the marking to exist on the surface.

Stage-3 - The marking is ink and/or pencil. The auxiliary mechanisms include the chemical and physical processes which bind the ink or pencil marking to the surface. These processes are an integral part of the cave map, i.e., without them the map could not fulfill its function of conveying information to the viewer.

Stage-4 - The marking is pixels on the screen. The auxiliary mechanisms include both the hardware and the software required to make the pixels visible on the surface. The hardware and software are an integral part of the cave map, i.e., without them the map could not fulfill its function of conveying information to the viewer.

3.4 ELEMENTS AND ATTRIBUTES

The information on a map is conveyed via marking elements placed on the surface. Marking elements have attributes such as width, size, font, etc.

Stage-3 - The elements used are lines, symbols, and text. Their attributes are: line width, line style (solid, dashed, etc.), symbol size, text size, text font, etc. Once placed on the surface the elements and attributes are not easily changed. It is possible, however, to generate a new map with different elements and attributes.

Color has seen limited use, generally in portraying secondary information, such as passages in different layers of limestone or contour map overlays. The number of colors used for these purposes is rather limited.

Stage-4 - The elements used are lines, symbols, text, and polygons. Their attributes are: line width, line style, symbol size, text size, text font, polygon fill, polygon hatch, fill color, hatch color, hatch density, hatch angle, hatch line style, etc.

A major difference from Stage-3 is that after placement on the surface, at least some of the Stage-4 elements can be changed at will, e.g., one symbol can easily be replaced by another. Some attributes can also be changed, e.g., colors can be changed, literally in the blink of an eye. The user interface (hardware and software) which makes element and attribute changes available to the viewer is an integral part of the cave map.

Color is used to portray primary information, such as floor detail, formations, etc. Because hundreds of colors are available, subtle variations in information can be portrayed.

3.5 CONTENT

The information actually conveyed by the marking elements of lines, symbols, etc. is the content of the map.

Stage-3 - Lines are used to portray such things as: passage outlines, cross sections, traverse lines, profiles, etc. Symbols are used to portray: survey stations, floor details, formations, streams, pools of water, etc. Text is used to portray: ceiling heights, lengths of pitches and drops, depths of water, elevations of stations, etc. Once placed on the surface the content is not easily changed. It is possible, however, to generate a new map with different information content.

Stage-4 - Lines, symbols and text are used as in Stage-3, but some information may be portrayed in a different fashion. For example, a pit may be shown as a 3D depression in the passage, instead of as a circle with tic marks on the inside plus the depth in a nearby square box. Polygons are used when one surface needs to hide another in a 3D representation. Again one of the major differences is that after placement on the surface the content can changed, i.e., elements can be made to disappear and then reappear nearly instantaneously. The user interface (hardware and software) which makes these content changes available to the viewer is an integral part of the cave map.

3.6 VIEWING

The position and orientation of the cave on the map in relation to the viewer defines the viewing. Possible changes in viewing include changes in the scale, translation, and rotation of the cave on the map.

Stage-3 - The views are fixed by the content of the map. Plan and profile views may be contained on the surface, but they are fixed and cannot be changed.

Stretching the point a little (or perhaps a lot), changes in scale can actually be achieved by using a magnifying glass. Translation can also be achieved by the viewer moving in relation to the surface. Rotation is possible in 2D, again by the viewer moving in relation to the surface. Limited dynamics in 3D can be achieved, but the results are not what one wants, since the information presented on the surface does not change, it merely becomes foreshortened. In any case, these gyrations are not changing the position and orientation of the cave on the map. They are changing the viewer.

Stage-4 - The views are not constrained by the content of the map. Changes in scale, rotation, and translation of the cave on the map are achieved in 3D virtually instantaneously and under viewer control. This allows the viewer to select a portion of the cave and zoom in (or zoom out) on it. It also allows the viewer to switch from plan view to profile view and to view the cave in any 3D direction. The user interface (hardware and software) which makes these viewing options available is an integral part of the cave map.

Sequences of changes in both content and viewing can be defined interactively by the viewer and played back in a movie-like fashion. The user interface (hardware and software) which makes these content and viewing sequences available is also an integral part of the cave map.

4. SUMMARY AND DISCUSSION

The distinctions between Stage-3 and Stage-4 cave maps are summarized in Table I below. Note that Stage-1 and Stage-2 cave maps are identical to Stage-3 cave maps. What is different among them is how the maps are generated, but the resulting maps look identical and no new ways of thinking about maps are needed.

A Stage-4 cave map is a map of a cave designed to be viewed on the screen of a computer graphics terminal. The information content of the map is conveyed via lines, symbols, text, and polygons comprised of pixels on the screen. Extensive use is made of color. The content of the cave map can be changed at the option of the viewer. Any portion of the cave may be viewed in any 3D direction at any reasonable scale, all at the option of the viewer. Sequences of changes in both content and viewing can be defined interactively by the viewer and played back in a movie-like fashion. The hardware and software which makes all this possible are an integral part of the map.

Considerable space has been devoted in the past few issues of this journal to the subject of judging cave maps at the annual NSS Convention Cartographic Salon. At a convention in the not too dis-

TABLE I. The distinctions between Stage-3 and Stage-4 cave maps are summarized. Note that Stage-1 and Stage-2 cave maps have almost the same aspects as Stage-3.

MAP ASPECT	STAGE-3	STAGE-4
surface	mylar, vellum, paper	computer graphics screen
marking	ink and/or pencil plus chemical and/or physical bonding to the surface	pixels plus the hardware and software required to make them visible
elements	lines, symbols, text	lines, symbols, text, and polygons
attributes	line width, line style, symbol size, text size, text font color used sparingly	same plus: fill, hatch, fill color, hatch color, hatch density, hatch angle, hatch line style, etc color used extensively
content	passage outlines, cross sections, profiles, traverse lines, survey stations, floor detail, formations, streams, pools of water, ceiling heights, lengths of pitches, elevations of stations, surface contours, scale, depth of water, north direction, etc content is fixed	possibly only a subset content can change, disappear, and reappear, at the option of the viewer
viewing	fixed views consisting of plan and profile plus cross sections	map can be viewed at any scale and can be viewed in any 3D direction, the view can be continuously changing in movie-like fashion, all at the option of the viewer

tant future the judges will be faced with evaluating a Stage-4 cave map. It may not be too early to begin to think about the related judging criteria.

As a judge, you might ask the question, "Is there a north arrow on the map?" With a Stage-4 cave map the answer is likely to be, "Yes, if you like; no if you would rather not have one; several if you would prefer."

A more controversial question might be, "Is the entrance location shown on the map?" The answer can be, "Yes or no, depending on who is looking over your shoulder."

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THE 1989 NSS CARTOGRAPHIC SALON

by George Veni

The cart salon this year had some rough spots, twists and resulting changes which are hoped to make things better in future years. The rough spots developed when salon chairman Bill Nelson didn't show up at the NSS Convention and hadn't delegated responsibility to anyone else. (Anyone who had sent a map to Bill for entry into this year's salon may want to contact him about its status. They did not arrive at convention. These maps will be accepted at next year's salon and no entry fee will be charged.) Its now 3 days after convention and I don't know the reason for Bill's absence, so I will not start casting stones. Fortunately though, other people stepped in to take over for him. As maps and entry fees began rolling in, Karen Kastning began collecting them and put the maps on the walls. Soon afterwards, George Dasher noticed something was amiss and began to search for evidence of Nelson. When Nelson could not be found, George went searching for judges. If not for the efforts of Karen and George, this year's map salon would not have taken place.

George tried to find judges representing a cross section of the country. He got Bob Gulden (Maryland), Ward Foeller (Virginia, although George thought Ward was from California since he saw him associating with California cavers), and me (Texas) to coordinate the ensemble. Voluntarily thrust into the leadership position, I began to think of all the gripes I've had and read about the salon since it began in 1978, and I'd hoped I could conduct the salon in a manner equitable to all.

Probably the biggest complaints I've had and heard about the cartographic salon was the preponderance of subjectivity, the lack of uniform standards year-to-year, the lack of objective accountability of the judges, and the lack of feedback from the judges. Some of these things have seen improvement over the years and some have not.

To address these concerns I considered the intent of the salon itself. In my mind it is a forum for the exchange of ideas and techniques in cave cartography. Although the maps are judged in a competitive fashion, I've always entered maps to get feedback and to learn from others. Winning ribbons is secondary. I've also learned a lot by examining other cavers' maps and seeing their strengths and weaknesses. The salon should encourage this forum for learning, yet provide a fair standard for competition.

Figure 1 was my hasty solution to my concerns. I made 160 copies so each judge could fill one in for each map. The top line of the form is, of course, the cave name. The second line groups the maps according to their lengths. After quickly scanning the maps it seemed the 0-500m, 500-1600m and >1600m breakdown would work out best -- and it did, with almost one-third the total number of maps fitting into each category.

The tough part was the point system. I'd seen too many judges say "I like this" or "I don't like that," without quantifying their reasoning. True, some decisions are purely subjective but most subjective responses are due to some underlying objective experience or reasoning -- you just have to dig deep to uncover it. The point system I prepared was an attempt to uncover those reasons.

A maximum of 10 points was possible in each of 6 categories. The judges looked for:

-- Completeness: Did the map have a north arrow, border, title, legend; was the entrance marked?
-- Balance/harmony: Were the line widths proportional to best bring out the features of the cave; were the lines too narrow so that the cave did not stand out on the map; was the layout easy to follow; were there any excessively crowded or empty areas on the map?
-- Visual impact: How did it strike you subjectively; did you "like it"; what was the quality of the draftsmanship and lettering?
-- Vertical control/profile: Was the vertical nature of the cave adequately displayed by either symbols or profile? (A cave does not have to be "deep" to have a vertical component.)
-- Details/thoroughness: How complete were the details of the cave; were there areas with no indication of the floor material?
-- Cross sections: Did the map have cross sections; were they drawn to scale; did they -match the details in the plan view; was the direction of view indicated?

These compulsory points provided a total maximum of 60. The judges assumed each map was "perfect" and deducted points as they saw fit. When points were deducted the reason for the deduction was usually stated in the "Comments" column. One problem we noted with this method of commentary was that it lent itself to discussion of what was done wrong and did not give equal emphasis to what was done right.

Because some maps require, and some cartographers give a little more than normal, a category was set aside for "Perks." A maximum of 2 points would be given for anything considered "extra" on the map. The extras had to be drawn well to qualify for any such points. The perks were:

-- Site details: any additional information to that particular site, such as geologic and archaeologic information, the surface area near the cave, and insets showing the local topography.
-- Complex representations: taking a complex cave and displaying its character in an easy to understand form.
-- Innovations: anything new that was done to overcome a problem or to better illustrate the cave.

After tallying the points, we found the totals were generally very similar among the judges, and this occurred in spite of the subjectivity allowed for in both the visual impact category and in the assignment of point values (we did not agree to any type of standard point deductions). The point system also restricted interaction of the judges as each judge filled in his forms whenever he had the time or inclination, thus precluding the judges from influencing each others' opinions. But after this first round of judging it was time for the judges to interact.

We combined our point totals (maximum of 180 compulsory points) and saw a clear division in map quality at about 170 points. After assessing the maps from as low as 164.5 points, we saw that those having less than 171 points did not compare favorably with those having 171 points or more. It was then decided that

every map having more than 171 points would get at least a green honorable mention ribbon. Of the 46 maps entered, 15 maps qualified -- and this says a lot for cave cartographers when one-third of the maps make at least 171 of 180 points (perk points were closely rationed).

Coincidentally, of the 15 maps, 5 maps ended up in each length category. The point slate was then wiped clean for each of these maps and we nit-picked to select the blue ribbon winner for each length category. From the three blue ribbon winners, one was selected as the overall medal winner. Again, the point system held up because after our final evaluation (not based on points) the point winners for each category won the blue ribbons and the top point scorer (177 points) won the medal. Figure 2 lists the winning maps and cartographers. We are glad to have had so many fine entries and we encourage continued participation by all cartographers in future salons.

A map salon workshop was held on the last day of convention. The purpose of the workshop was to be educational and to make the judges accountable to the cartographers. During that workshop I gave a briefing of how we judged the maps, the forms we used, the problems we ran into, the questions we had and how we worked out any such conflicts. A lively discussion followed and we passed out the critique forms to the cartographers present. Those cartographers not present were mailed their critiques.

Most of the people seemed to enjoy the workshop and learned a thing or two. I know I did. Afterwards, the judges discussed their specific critiques of the maps with the cartographers. There were no acts of violence that I am aware of and we received several compliments on how the salon was conducted. We are very appreciative on both counts.

I've always felt I should try to leave the world in a better state than I found it, so simply having a good cart salon wasn't good enough for me. What about the years to come? Well, a couple of changes came about during the Survey and Cartography Section meeting. First, since Bill Nelson has had trouble running the salon for the past two years SACS nominated George Dasher to replace him should the NSS BOG decide a replacement was needed. (The job of salon chairman is a BOG appointment, and the BOG decided to be as fair as possible and wait until contacting Bill, before considering his replacement.)

The second change was the formation of a committee to set definitive standards for the running and judging of the map salon. George Dasher, Tom Kaye, Bob Gulden, Doug Robertson, Carol Vesley, and I comprised that committee. The form I'd used for this year's salon served as a guide which we liberally modified. George Dasher will be submitting these new guidelines to Compass and Tape, and we hope they will be published far enough in advance to be useful to next year's entrants to the map salon. The new guidelines are not perfect, but George, Bob, Tom, Doug, Carol and I feel they provide a good balance of objectivity with subjectivity and regional biases. After a trial run for a couple of-salons they may need to be modified, but they will nonetheless provide a standard upon which everyone can depend.

Figure 1

Cave Name:			
Length:	0-500m 0-1600ft ☐	500m - 1.6km 1600ft - 1 mile ☐	>1.6km >1mile ☐
Qualities	Points (1-10)	Comments	
General:			
Completeness (North arrow, scale, border entrance, legend, title)			
Balance / Harmony (Line widths, spacing)			
Visual impact			
Specifics:			
Vertical control / profile			
Detail / thoroughness			
Cross sections			
Perks:			
Site details (Surface, Geology, etc.)			
Complex representations			
Innovations			
Total points =			
Other Comments:			

Figure 2

RESULTS OF THE 1989 NSS MAP SALON

Caves	Location	Cartographer
Medal Winner:		
Cave Spring Cave	Virginia	Tom Spina
0-500 m Category		
Blue Ribbon:		
Cueva Tres Pisos	Mexico	Bob Richards
Honorable Mention:		
Bull Thistle Cave	Virginia	George Dasher
Cano Seco and Cueva Escondida	Costa Rica	Hope Uhl
Cueva de California	Mexico	Peter Sprouse
Ireland's Cave	Texas	William Russell & Dale Pate
500-1600 m Category		
Blue Ribbon:		
Carma Cave	Costa Rica	Hope Uhl
Honorable Mention:		
Bailey's Cave	Virginia	Bill Balfour
Bearwallow Cave	Virginia	Tom Spina
Hanging Rock Drop	Indiana	Dave Black
Kahf Khashayl (Funnel Cave)	Oman	John Ganter
>1600 m Category		
Blue Ribbon:		
Cave Spring Cave	Virginia	Tom Spina
Honorable Mention:		
Bayn Halayn (Arch Cave)	Oman	John Ganter
Caverna Corredores	Costa Rica	Hope Uhl
Kahf Aqabat Khusil (Seventh Hole)	Oman	John Ganter
No Sweat Cave	Indiana	Dave Black

Judges: Ward Foeller, Bob Gulden, George Veni

CAVE MAPPING AND SENSITIVE INFORMATION

by John Ganter

Since information about caves is valuable to the caving community, it follows logically that in the wrong hands the same information may be dangerous. Those in possession of this information, but not training or the sense to behave properly, may damage themselves, the caves or our carefully nurtured relations with cave owners and stewards. The cave mapper is thus in a dilemma. On one hand they need to distribute their reports (maps and descriptions) widely, since it is difficult to predict which interested and responsible cavers or scientists will wish to know about a cave. On the other hand, publication is synonymous with "out of control." When a publication is sold or mailed, it is gone and thus difficult or impossible to track. Fortunately literature about caves is obscure. Subscribers to caving periodicals or buyers of cave books must become part of the caving community, which means that they should be well aware of responsible caving practices. Nonetheless, there is always the chance that a report will fall into the wrong hands. This has been a particularly serious problem with reports sold the public (e.g. by state geological surveys). Here a brief conservation message can be easily ignored. Reports of this type are generally discouraged today because of their virtually unlimited availability.

The most restrictive solution, which may be appropriate for very sensitive caves, is to not publish. Still the information must be carefully produced and stored in such a way that it will be available to those who need it and will use it responsibly. For example, copies of the report may be retained by the cave owner, controlling organization or local caving group. This tends to assure that the information will remain with those who have a genuine long-term responsibility for the cave. Another solution which is becoming increasingly popular is the state or county Cave Survey. This is typically a central information repository run by a small group of very responsible and trusted cavers. Usually there will be very clear policies on information dissemination. The contributing caver may be sure that their materials will be handled as they have requested, and they will have the satisfaction of knowing that their work is much safer from accidental loss. The relationship is similar to that between a bank and its customers. Some information is available with few restrictions and there is the expectation that somewhat more will be returned (e.g. reporting on new caves discovered or leads pushed). Other information remains in the equivalent of safety deposit boxes, its location known to owners and the keepers, but the details secure for the future.

Publication, whether in a periodical (e.g. a newsletter) or book (e.g. a county report published by a state Cave Survey), provides information to a wide audience. The majority of readers will do nothing with the information; others may decide to visit the cave or even make a project out of it. Depending on the situation, the author may try to limit visitation by various devices. First, the report might be on important and newsworthy explorations, discoveries, etc. in a cave where the access situation is very sensitive. Here the author may state that the cave is closed and/or that access arrangements should be made through them or in some other specified way. It is the responsibility of readers to respect these instructions, since they are made on trust. Failing to do so may cause the loss of a major project and/or irreparable damage to the reputation of the caving community.

Second, the author may be vague about the cave location. This practice takes several forms. Many caves have been lost because a reliable location was never determined, but a map or description survived the authors interest and/or memory. If the location of a cave cannot be recovered, then from a speleological perspective it may as well never have been explored. Another popular method is encoding of entrance locations. The reader must be knowledgeable of coordinate systems and take the trouble to plot locations. This approach has been fairly successful in discouraging the young and naive who may end up with a published report, and is generally a discouragement to running around and visiting a great many caves.

One issue here is the location of the entrance coordinates (e.g. on the map, in the description or elsewhere). Some argue that the coordinates should go on the map so that they cannot be lost; others argue that the map can too easily fall into the wrong hands. In most situations it seems that anyone who has access to the map will usually have access to the accompanying description; a map is seldom published or otherwise made available in isolation. Nonetheless, placing the coordinates with the text can add an extra measure of security by requiring that the user have more access to, and command of, the speleological literature. Unorganized cave visitors tend to have unorganized information. A loose map which is handed down will be less useful to the new holder if they must rely on folklore to locate the cave.

Another solution is, again, the central Cave Survey or database. If a cave report is published, but the author feels that visitation should still be restricted, then the survey is a secure place for the location. The report (and probably the map) should contain some sort of "pointer" to this organization. Typically this is done through a serial number which is the reference into the survey's database. Thus the process of locating a cave becomes two-part; the prospective caver must not only hold the map, but be known to and verified by the cave survey. This is a daunting problem to the unorganized caver, and will most likely result in their exposure to the caving community and its ethics. On the other hand the established and responsible caver can simply request a listing of locations for a county or region of interest.

Wind Cave Map in 3D

by Rich Breisch

The August, 1989 issue of Computer, published by IEEE, is devoted to scientific visualization of data. What makes this issue interesting to cave cartographers is that it contains, what I believe is, the first publication of a cave map in a professional computer journal. A perspective projection map of Wind Cave in South Dakota is shown in a color photograph on page 55. The data was supplied by Jim Nepstad of the U.S. National Park Service. The cave map is just one example in:

Hubbard, William & David Santek (1989)
"Visualizing Large Data Sets in the Earth Sciences",
Computer, Vol. 22, No. 8, pp 53-57.

Of the 12 color photographs in this article, 10 deal with meteorology. The Wind Cave map is the least informative, since it is a line map shown in 3D, but in a solid color. A color coding by elevation would have significantly enhanced its value.

Letter to the Editor

by George Dasher

One more time: Even at the risk of picking up heat on the Cartographic Salon, I would prefer that my feelings as a Cartographic Salon judge be known. That way, the Salon may hopefully be better.

To answer Becky Jagnow's questions: "Why did we not give more awards?" Two reasons: We either thought of it too late or one of the judges (me) is living in a dreamworld. The three of us may have decided to give only that amount. I personally wish we had given at least a couple of more ribbons. I see no reason why future judges do not give more ribbons.

My list of judging criteria may have been astounding. The only thing my criteria had in common was that I liked them. I do not want to steal George Veni's thunder, but we had a meeting concerning the Salon at this year's convention. Six items were considered very important: Cave Name, an obvious entrance or connection with the remainder of the cave, North Arrow, Barscale, vertical control, date, and the cartographer or survey group's name. Hopefully, this set of "standardized criteria" will give us less to argue about in the future and will provide both judge and entrants a common ground for agreement. This criteria should be published in an upcoming C&T. Hopefully, future judges will use it.

I wish that both Sue Bozeman and Carol Vesley had been aware that we would be judging by this set of criteria. Had their two maps had some kind of vertical control, it is my opinion that the 1988 Salon would have been a whole new contest. I can sympathize with Becky's feelings that Sue's map was damn good and deserved a ribbon. I too have entered some damn good maps which have gotten nothing. Losing with a good map in the Salon can be frustrating and tearful beyond words.

I think Becky's five suggestions are very relevant. I believe that the people involved in the Salon are trying very hard to implement the first four. The last can be achieved only by the editor of the C&T; however, Tom Kaye is a very affable person, and I am sure he will reproduce some of the winning maps just as soon as he can figure out how to reduce them onto paper-sized format.

As for my comments on "toilet paper for the future". These statements were meant to be colorful, not to offend. I apologize if they did offend. I feel very strongly that precise cave locations should be put on 99% of our maps, but this is my opinion as a cave mapper, not as a Salon judge or as an officer of SACS.

Now let me hop up on my soapbox again--I think it is a good thing that Sue Bozeman was able to completely map her cave before drawing the map. So far--with

one exception--I too have been able to completely map my caves before drawing the maps. However, I realize that there are many cavers (particularly in the Greenbrier County area of West Virginia) who are not going to finish 'their' caves. We are not talking the Salon now, but I think that it is very important that these people publish their results, no matter how incomplete the map. With a published, incomplete map, at least someone else can take up the work; an unpublished, waiting-to-survey-that-last-lead map, can be too easily lost for all time.

One again, I am sorry if I hurt anyone feelings. I thought it important.for people to know how and why the 1988 Salon Judges judged. Judging is long and hard work and it is very easy to make mistakes--for that reason I have had many second thoughts. (But then--right or wrong--I am a person who always has second thoughts.) I hope that everyone will continue to enter the Salon, that way we can compare and improve our efforts; and I hope that we can reach some sort of standard so that people with a "damn good map" don't get caught by a technicality.

That's it. My white horse has died. Let me trudge off into the sunset.

THE MINUTES OF THE 1989 SURVEYING AND CARTOGRAPHY SECTION MEETING

by George Dasher

The 1989 meeting of the Surveying and Cartography Section of the National Speleological Society was held on Wednesday, 2 August 1989, in the dining hall of the University of the South, located near Sewanee, Tennessee. Attending the meeting were twenty-six of the Section's members and friends.

These persons were: Bill Balfour, Rick Banning, Barry Chute, Martha Clark, Don Conover, Hubert Crowell, George Dasher, Doug Dotson, Ward Fuller, John Ganter, Beth Gervase, Bob Gulden, Bob Hoke, Frank Hutchison, Tom Kaye, Jack Lake, Robert Lenz, Kirk MacGregor, Ed Ricketts, Doug Robertson, Hope Uhl, Jeff Uhl, James Vaughn, George Veni, Carol Vesely, Jim Washington, and Dave West.

Chairman John Ganter called the meeting to order at 12:07 pm.

The minutes from the 1988 meeting had been printed in the Summer 1988 issue of The Compass and Tape (Vol. 6, No. 1, Pg. 17). No one had complained; thus no changes were suggested to the minutes.

John Ganter gave his Chairman's report. He stated that he had answered five or six letters and had still had plenty of back issues of most of the C&Ts. He complimented Tom Kaye on the job he had been doing as editor and he thanked D.C. Grotto for their help with the collating and mailing.

Tom Kaye gave his Editor's report. He thanked Bob Hoke, his printer, and all the people who had helped with the collating. He stated that no one--except Bill Mixon--had complained about any of the C&T issues. Bill had complained because Tom had left something Bill had written out of one of the C&Ts.

There was no old business.

New Business: John Ganter suggested that SACS change their name from the Surveying and Cartography Section to the Mapping Section. He felt that everyone used the second name more, so the Section might as well make it official.

There was some disseussion, then a vote was taken. 5 favored the change, 8 were opposed, and no one abstained. The motion failed.

The suggestion was made to recess the meeting to the front lawn of the dining hall. This was done.

Andy Frankland stopped by to say that he was teaching a surveying class the next day at 10 am in front of Walsh Hall. He would like any assistance the Section could provide.

The Cartographic Salon was disscussed next. There were three problems.

First, Bill Nelson, the Salon Chairman, was absent from Convention for the second year in a row. Once again he had the awards and all the entries that had been sent to him before the Convention.

Second, it was generally felt that the Awards Committee was providing very little recognition for the Cartographic Salon. It is only recently that the Awards Committee has allowed the Salon winners on stage during the Thursday night ceremonies and now it seems that the committee is not going to even allow the Medal Winner on stage, much less the ribbon winners.

Third, none of the maps donated to the NSS in past Salons have ever been delivered to Bill Torode, the NSS' librarian.

There was a great deal of discussion. Many people were very upset that Bill Nelson had missed two Conventions in a row, especially considering that he had made no arrangments either year for someone to replace him. George Dasher stated that he had appointed himself God and had been managing the Cartographic Salon this year.

George Veni said that he had spoken to Paul Stevens, Chairman of the Awards Committee. Paul had stated that he intended to allow the Medal Winner on stagel however, he did not have enough time to allow all the winners onto the stage. Everyone thought this was better, but it was a general feeling that, considering the time devoted to the Slide Salon, all the winners of the Cartography Salon could be brought onto the stage.

George Veni made a motion that SACS recommend to the BOG that George Dasher be made the Chairman of the Cartographic Salon. George Dasher would then attempt to resolve the three problems. George Dasher would also write Bill Nelson and Ernst Kastning, the past chairmen of the Salon, encouraging them to send Bill Torode all the NSS maps in their possession. Tom Kaye seconded the motion; it passed by acclamation.

Secretarial Note: On Firday morning of Convention, I spoke to Kathy Hornaday, the person on the BOG in charge of the Salons. She informed me that the BOG would like to hear Bill Nelson's side of the story before they replace him. At this time, Bill is still chairman of the Cartographic Salon. I have also written letters to Bill Nelson and Ernst Kastning, asking them to send their maps to Bill Torode, and to Paul Stevens, asking him for more time at the 1990 Awards Ceremony.

Tom Kaye made the announcement that since Rich Rice, SACS' Treasurer, was not present, Bob Hoke was collecting the money for dues. Most everyone responded by throwing their money at Bob. Bob responded by throwing it back.

George Dasher announced that he would be hosting a meeting on the NSS Cave Surveying Book at 9 am the next morning in Walsh Hall.

Tom Kaye stated that he would like to publish the Cartographic Salon judging criteria in the next issue of the C&T. George Dasher said that George Veni, one of this year's Judges, had come up with an excellent point system. George Dasher thought that Tom could publish George Veni's form, however, since the Cartographic Salon was so subjective; George Dasher did not feel that any solid criteria could be instigated.

Many people disagreed. After several minutes of discussion, it was agreed to have a meeting concerning Cartographic Salon Judging Criteria at 1 PM in the same room that the Surveying Book people were using.

John Ganter had a point of information. He was selling back issues of the C&T for $4.00.

Someone brought up map symbols. Tom Kaye said it was a dead issue. There was no further discussion.

Elections followed. George Dasher nominated John Ganter for Chairman. Barry Chute seconded the nomination. John was elected Chairman by acclamation.

John Ganter nominated Carol Vesley for Vice-Chairman. Jim Washington seconded the nomination. Carol was elected Vice-Chairman by acclamation.

John Ganter nominated Rich Rice for Treasurer. George Veni seconded the nomination. Rich was elected Treasurer by aclamation.

John Ganter nominated George Dasher for Secretary. George said that he would do it.

John adjorned the meeting at 12:54.

Survey and Cartography Section
NATIONAL SPELEOLOGICAL SOCIETY

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