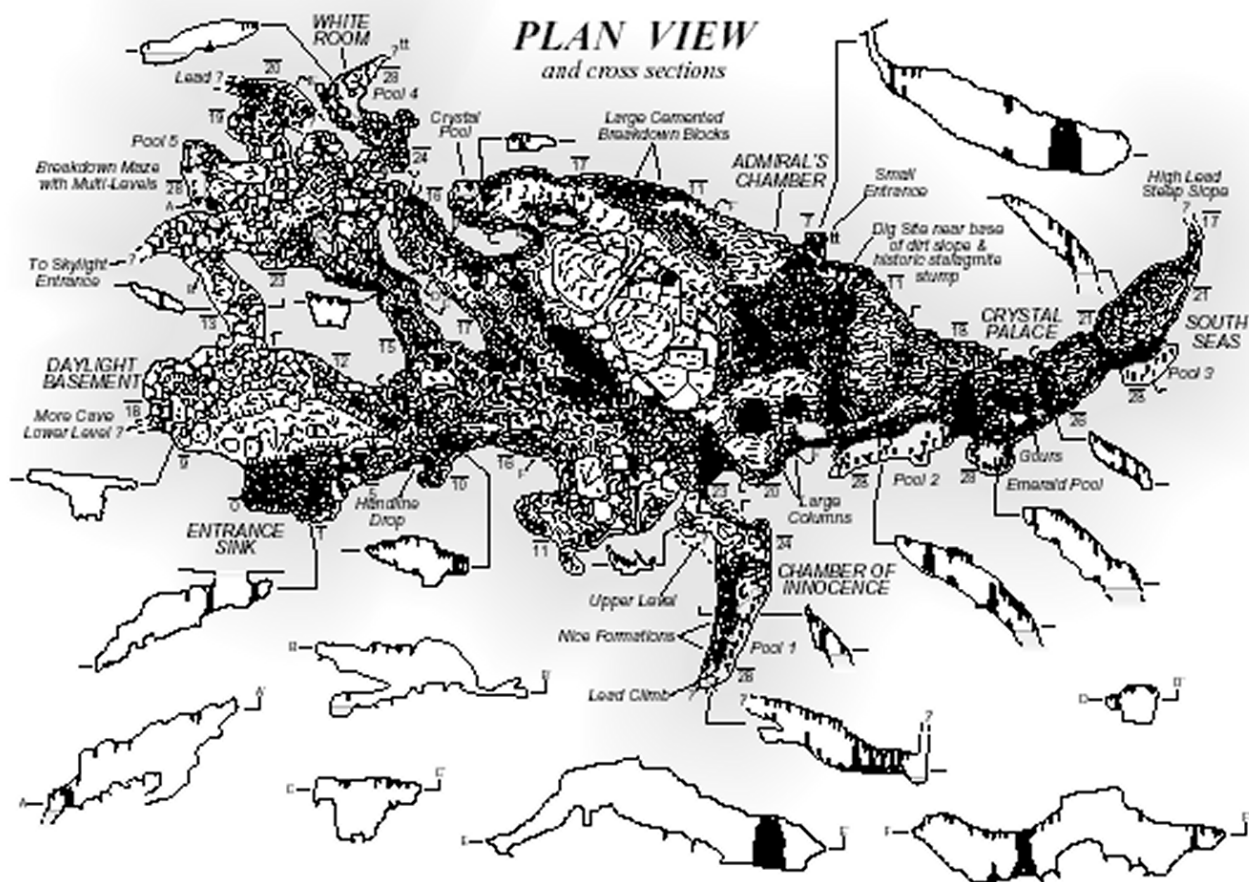




ADMIRAL'S CAVE

Hamilton Parish, Bermuda



LEGEND

- | | |
|--------------------|--------------------------------|
| Entrance dripline | Passage walls |
| Breakdown blocks | Underlying passage walls |
| Flintstone | Slope (slopes downward) |
| Wall of Flintstone | Trail or pathway |
| Columns | Drop or ledge (lower on right) |
| Stalagmites | Ceiling drop (higher on right) |
| Stalactites | Passage too tight for entry |
| Dirt, Silt or Soil | Depth below entrance |
| Water | Lead |

← NORTH →

SCALE



COMPASS and TAPE SURVEY BY:

Robin Barber, Rebecca Belcher, Darcy Gibbons,
Tom Wille, Bob Richards, Sandy Stephens and
Bernie Szukalski.

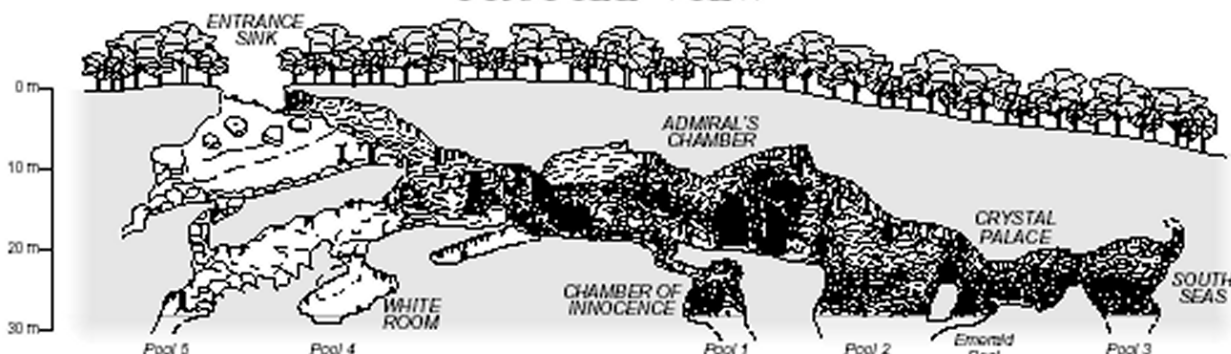
SURVEYED DATES: January 7-8, 2002

CARTOGRAPHY BY: Bob Richards

TOTAL SURVEYED TRAVERSE: 745 meters

TOTAL VERTICAL EXTENT: 28 meters

PROFILE VIEW



©2003, BaCKIS Proj

Survey and Cartography Section



The Survey and Cartography Section (SACS) is an internal organization of the NSS that is devoted to improving the state of cave documentation and survey, cave data archiving and management, and of all forms of cave cartography.

Membership: Membership in the Section is open to anyone who is interested in surveying and documenting caves, management and archiving of cave data and in all forms of cave cartography. Membership in the National Speleological Society is not required.

Dues: Dues are \$4.00 per year and includes four issue of *Compass & Tape*. Four issues of the section publication are scheduled to be published annually. However, if there are fewer, then all memberships will be extended to ensure that four issues are received. Dues can be paid in advance for up to 3 years (\$12.00). Checks should be made payable to "SACS" and sent to the Treasurer.

Compass & Tape: This is the Section's quarterly publication and is mailed to all members. It is scheduled to be published on a quarterly basis, but if insufficient material is available for an issue, the quarterly schedule may not be met. *Compass & Tape* includes articles covering a wide range of topics, including equipment reviews, techniques, computer processing, mapping standards, artistic techniques, all forms of cave cartography and publications of interest and appropriate material reprinted from national and international publications. It is the primary medium for conveying information and ideas within the U.S. cave mapping community. All members are strongly encouraged to contribute material and to comment on published material.. Items for publication should be submitted to the Editor.

NSS Convention Session: SACS sponsors a Survey and Cartography session at each NSS Convention. Papers are presented on a variety of topics of interest to the cave mapper and cartographer. Everyone is welcome and encouraged to present a paper at the convention. Contact the Vice Chair for additional information about presenting a paper.

Annual Section Meeting: The Section holds its only formal meeting each year at the NSS Convention. Section business, including election of officers, is done at the meeting.

Back Issues: SACS started in 1983 and copies of back issues of *Compass & Tape* are available. The cost is \$1.00 each for 1-2 back issues, \$0.75 each for 3-6 back issues and \$.50 each for more than six back issues at a time. Back issues can be ordered from the Treasurer.

Overseas Members: SACS welcomes members from foreign countries. The rate for all foreign members is US\$4.00 per year and SACS pays the cost of surface mailing of *Compass & Tape*. If you need air mail delivery, please inquire about rates. All checks MUST be payable in US\$ and drawn on a U.S. bank.

Chair: Carol Vesely
817 Wildrose Avenue
Monrovia, CA 91016-3022
(818) 357-6927

Secretary: Robin Barber
4312 Winding Way
Fort Worth, TX 76126
cavewoman@ev1.net

Vice Chair: VACANT

Treasurer: Bob Hoke
6304 Kaybro Street
Laurel, MD 20707
(301) 725-5877
bobhoke@smart.net

Editor: Patricia Kambesis
Hoffman Environmental Research Institute
Western Kentucky University
Bowling Green, KY 42721
ph: 270-745-5201
pnkambesis@juno.com

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Front Cover: Admiral's Cave, Bermuda, by Bob Richards. Blue Ribbon - Masters Cartegory, NSS 2003 Cartographic Salon

Back Cover: Moonstone Cave, Baxter County, Arkansas, by Tom Lounsbury using Xara X software.

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SUBMISSIONS

All types of materials related to cave survey and survey data, cartography, and cave documentation in general, are welcome for publication in *Compass & Tape*. Manuscripts are accepted in ANY form but are most welcome on 3.5 inch diskettes, CD's either IBM compatible or Mac format or via email. Typed material is next best although we will accept handwritten material as long as it is legible. Artwork is any form. shape or size is also welcome. Send all submission for *Compass & Tape* to:

Patricia Kambesis
Hoffman Environmental Research Institute
Dept. of Geography/Geology -
Western Kentucky University
Bowling Green, KY 42121
270-745-5201
Email: pnkambesis@juno.com



2004 NSS Convention, Marquette, Michigan Survey and Cartography Section

CALL FOR PAPERS

This is a call for papers for the Survey and Cartography session at the 2004 NSS Convention. The session is informal and provides a good way to tell other cave mappers what you are doing, and to discuss problems related to cave surveying, data management and manipulation, and cartography. Most cave surveyors have either developed useful techniques that may benefit others or are encountering problems that someone else may have solved. In either case, an informal session presentation would be appropriate.

The session is informal and the audience is friendly. There are no requirements to provide fancy visual aids or to provide a written paper (other than an abstract to be included in the Convention Program.) Of course, the *Compass & Tape* editor would be glad to receive any written papers for publication.

Presentations can be on any topic related to any aspect of cave mapping, and the material presented can be for any level of mapping/cartographic experience. A partial list of potential presentation topics include:

- Cave mapping applications of high-accuracy GPS and digital mapping technology
- How to keep cave mud off your survey instruments
- How to minimize instrument fogging
- How to resolve blunders without another trip to the cave
- How to set and maintain mapping standards in a project
- Keeping track of survey data in a large project
- Mapping standards (accuracy, symbols, etc)
- New and improved computer programs for mapping (compare, describe, critique)
- New tools and toys to aid in mapping or cartography
- Representing complex vertical caves on a 2-dimensional map
- Use of computers to draw cave maps (techniques, pros, cons)
- Use of computers to interactively view cave maps (views, colors, rotation, perspective)

The above list is obviously incomplete. If you are doing something that you think would be of interest to other cave surveyors, please consider doing a presentation on it. When you submit your abstract, please let the session coordinator, Bob Hoke, know what equipment you will need for your presentation. You can assume that the usual 35mm slide projector or computer projector will be available, but don't make any other assumptions.

Abstract deadline is May 20, 2004. Please send your abstracts either by email or snailmail to:

Bob Hoke
6304 Kaybro Street
Laurel, MD 20707
(301) 725-5877
bob@hoke.net

2004 NSS Convention, Marquette, Michigan Survey and Cartography Section

CARTOGRAPHIC SALON

Exhibition of cave and karst-related maps

The 2004 Cartographic Salon will be held during the NSS Convention in Marquette, Michigan July 12-16, 2004. **All entries can either be mailed to George Dasher (63 Valley Drive, Elkview, West Virginia 25071), postmarked no later than June 20th, 2004, or delivered to George in the Cartographic Salon exhibition area at the NSS Convention by noon Monday, July 12th, 2004.**

There is no entry fee. Entries will be considered to have been donated to the NSS unless picked up by the cartographer on the afternoon of Friday, July 16th, 2004, or otherwise specified when submitted. If you wish your entry returned by mail, please provide \$5 postage cost. If you want someone else to pick up your entry, please specify this in writing when the entry is submitted. Entries must be representations of caves or karst-related features. Enter copies of maps rather than originals.

There is no restriction on method of presentation and innovative techniques are encouraged. Entries will be divided into three categories (Apprentice, Experienced, and Master-Professional) at convention. Judging will occur at convention. Include a self-portrait preferably as a digital image [a slide is acceptable] if you wish it shown at the awards ceremony. Maps may be displayed in the salon, but not judged at the entrant's option. No cave map will be reproduced by the NSS without the owner's explicit permission, except for display during the convention.

More information about the Cartographic Salon (including judging criteria) can be found on the Surveying and Cartography Section's website at <http://caves.org/section/sacs/salons>. If you have any questions, please contact George at 304-965-1361 (home) or wvcaver@juno.com.

Cave Maps by Xara X

Tom Lounsbury NSS 38646



Introduction

Digital cave maps are now easier to draw than ever before. It appears almost everyone has a computer these days and there are a myriad of graphic programs available everywhere. I feel that Xara X is the cave cartographers dream come true. Xara X must be the most powerful, lowest costing, most intuitive, graphics drawing program out there with results far easier to obtain than with the other big programs. It brings the reluctant pen and ink cartographer into the digital age for a mere \$150.00 and a copy of this free tutorial. That is chicken feed pricing for a graphics program this powerful, capable of doing anything a cave cartographer can imagine. Lets compare Freehand, Canvas, Illustrator and Corel Draw at \$400 to \$500 and never mind the CAD programs at thousands of dollars and a mind-boggling learning curve. Xara X will always win hands down. I have literally seen beginners drawing great maps in less than an hour of hands on training.

Xara X is quite simply the best value vector graphics drawing package you can use at this time. I will attempt to provide yet another option for digital cave cartography through my own personal experience and methods using Xara X. Even though there are several methods that can be used to achieve the same result I will make all attempts to keep it as basic as I can. Xara X has an incredible help file. Xara X's help contains hundreds of pages of information. If you need a hand using the program or want to know how to do something, try searching the help. Not only are there pages describing what all the parts of the program do, there are overviews, pages explaining terms, step-by-step procedures to help you get your work done and many examples. You will also find that many pages have buttons you can click to run movies. To open the help, just press F1 on your keyboard.

XARA X has many enhancements and improvements over its predecessor, CorelXARA. The pioneers of real-time on screen anti-aliasing and transpar-

ency now bring you a whole collection of new features to make Xara X an irresistible choice for the creation of vector graphics of any sort.

<http://www.xara.com/products/xarax/>

You can find lots more information on Xara X, including tutorials, examples, discussions, hints, tips and featured artists at the XaraXone website.

<http://www.xaraxone.com/>

Getting started

I must only assume you are operating Microsoft Windows 98 or better and have Xara X installed. A free 30 day trial version is available at <http://www.xara.com/products/xarax/>. You also must have the ability to export the line plot out of your favorite data reduction program as a common graphic form such as a bitmap, metafile, jpeg, tiff etc. I have recently changed from Compass to Winkarst because I like its ability to morph the sketches to the line plot. This now alleviates the need to actually draw the working map. The working map is created for you as you add your scanned sketches. When I am satisfied with all the sketches and the surveying is done I export the map (bitmap) into a folder on my desktop being sure the scale bar is also exported with it being line plot or morphed map. Don't worry Xara X handles gigantic bitmaps with ease and redraw (when the bitmap is rescaled, skewed, or moved) is almost instantaneous. Xara X tools used to create cave maps. .

Layers

Xara X does permit multi-layer drawing so it is easy to produce highly variable maps just by turning on and off corresponding layers of your drawing to achieve the desired result. I use to import my scanned sketches into Xara then manipulate the sketch to fit my accurate line plot that I generated and exported from Compass. I now use Winkarst because of the saved step in creating a working map. Winkarst uses your scanned sketches to build a working map of the cave as you go. Morphing

Export formats:		EPS Export Formats:	
.BMP	Windows Bitmap	.AI	Illustrator EPS
.DCX	DCX	.EPS	Illustrator EPS
.PCX	PCX	.EPS	ArtWorks EPS
.GIF	CompuServe GIF	.EPS	Xara X EPS
.GIF	Animated GIF files		
.JPG	JPEG	Other Export Formats:	
.PCT	PICT	.XAR	CorelXARA
.PNG	PNG	.WEB	Xara Webster files
.RAS	Sun Raster	.WMF	Windows Metafile
.TGA	TrueVision TARGA	.EMF	Enhanced Windows Metafile
.TIF	TIFF (RGB)	.CMX	Corel CMX 5 & 6
.WPG	Word Perfect Group (256 color)	.HTM	Image map
		.SWF	Macromedia Flash
Import formats:		.XBM	X Windows (2 color)
.301	Brook Trout	.XPM	X Windows (256 color)
.BMP	Windows Bitmap	EPS Import Formats	
.CAL	CALS (2 color)	.AI	Illustrator EPS
.CUT	Halo CUT (256 color)	.EPS	Illustrator EPS
.DCX	DCX	.EPS	CorelDRAW 3 & 4 EPS
.GIF	CompuServe Graphics Interchange Format (see Importing transparent bitmap files)	.EPS	FreeHand 3.0 EPS
.GX2	Storyboard	.EPS	ArtWorks EPS
.ICA	IOCA (2 color)	Xara X cannot import Photoshop EPS files; use PSD files instead.	
.ICO	Microsoft Windows Icon (16 color)	Other Import Formats	
.IFF	Amiga IFF	.XAR	CorelXARA (1.1 and 1.5)
.IMG	IMG (16 color)	.ART	Xara Studio
.JPG	JPEG	.WEB	Xara Webster files
.KFX	KOFAX	.AFF	Acorn Draw
.LV	LaserView (2 color)	.CDR	CorelDRAW (3,4 & 5) (see Importing CDR files)
.MAC	MacPaint (2 color)	.CDT	CorelDRAW Template
.MSP	Microsoft Paint (2 color)	.CMX	Corel CMX 5 & 6 (see Importing CMX files)
.PCD	PhotoCD	.DRW	Acorn Draw
.PCT	PICT	.HTM	Graphics on HTML pages
.PCX	PCX Paintbrush	.WMF	Windows Metafile
.PBM	UNIX monochrome	.WIX	For internal use by Xara
.PGM	UNIX grayscale	Palette Import Formats	
.PNG	PNG (see Importing transparent bitmap files)	.CPL	CorelDRAW Palette
.PPM	UNIX color (up to 24 bit)	.PAL	CorelDRAW Palette
.PSD	Photoshop	.PAL	Microsoft Palette
.RAS	Sun Raster	.PAL	PaintShop Pro Palette
.TGA	TrueVision TARGA	.ACT	Adobe Color Table
.TIF	TIFF (RGB, RGBA with alpha-channel transparency & CMYK)	.ACO	Adobe Color Swatch
.WPG	Word Perfect Group (256 color)		
Bitmap Export Formats		.EPS	ArtWorks EPS
.BMP	Windows Bitmap (see Creating BMP files)	.EPS	Xara X EPS (see Xara X EPS Overview)
.DCX	DCX (see Creating DCX files)	Other Export Formats	
.PCX	PCX (see Creating PCX files)	.XAR	CorelXARA
.GIF	CompuServe GIF (see Creating GIF files)	.WEB	Xara Webster files (see Creating Xara WEB files)
.GIF	Animated GIF files (see Creating animated GIF files)	.WMF	Windows Metafile (see Exporting Windows Metafiles)
.JPG	JPEG (see Creating JPEG files)	.EMF	Enhanced Windows Metafile (see Exporting Windows Metafiles)
.PCT	PICT (see Creating PICT files)	.CMX	Corel CMX 5 & 6 (see Exporting CMX files)
.PNG	PNG (see Creating PNG files)	.HTM	Image map
.RAS	Sun Raster (see Creating RAS files)	.SWF	Macromedia Flash (see Exporting Macromedia Flash files)
.TGA	TrueVision TARGA (see Creating TARGA files)	.WIX	For internal use by Xara
.TIF	TIFF (RGB) (see Creating TIFF files)		
.WPG	Word Perfect Group (256 color) (see Creating WPG files)		
EPS Export Formats			
.AI	Illustrator EPS		
.EPS	Illustrator EPS		

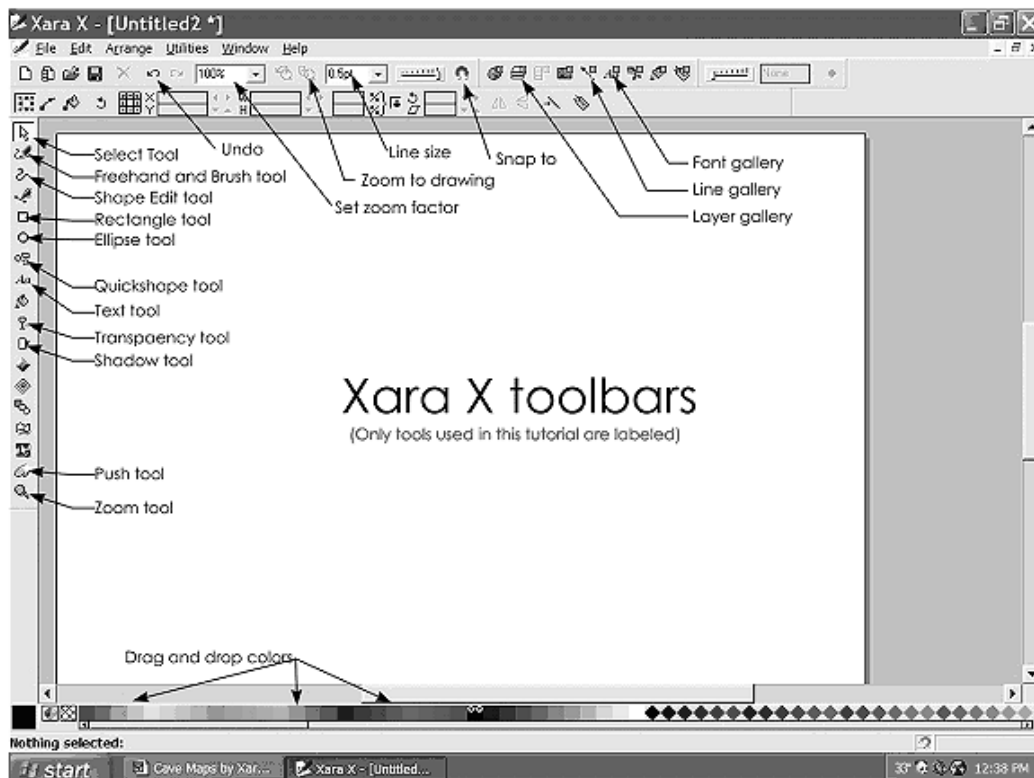


Figure 1: Xara tools to create cave maps

the sketch around the line plot so you don't have to move and rotate each separate sketch by hand. However you import your drawings, Xara X provides several ways to manipulate the drawings to achieve the last step in drawing your final map.

Tools

Each tool in Xara X has many attributes that can be manipulated in several ways (Figure 1). I will attempt to describe the actions and steps needed to gain the necessary results rather than fill this tutorial with many unnecessary screenshots or impertinent information. There are always several different methods that can be used to achieve the same results your looking for. I am attempting to keep it simple so the most basic methods will be described.

Lets Begin

Open Xara X. You will see the default page is 800 x 600 pixels. This is where you will need to set the page parameters you will want to use for your new drawing. Go to **Utilities/Options** and choose the **units** tab. Change the units from Pixels to Inches **hit apply**. Then choose the **Page** tab. Here you can specify any page size you need to get the map on one page at the desired scale. Hit **apply** then **OK**. These settings can

be changed later if you discover you need a larger page to accommodate your drawing.

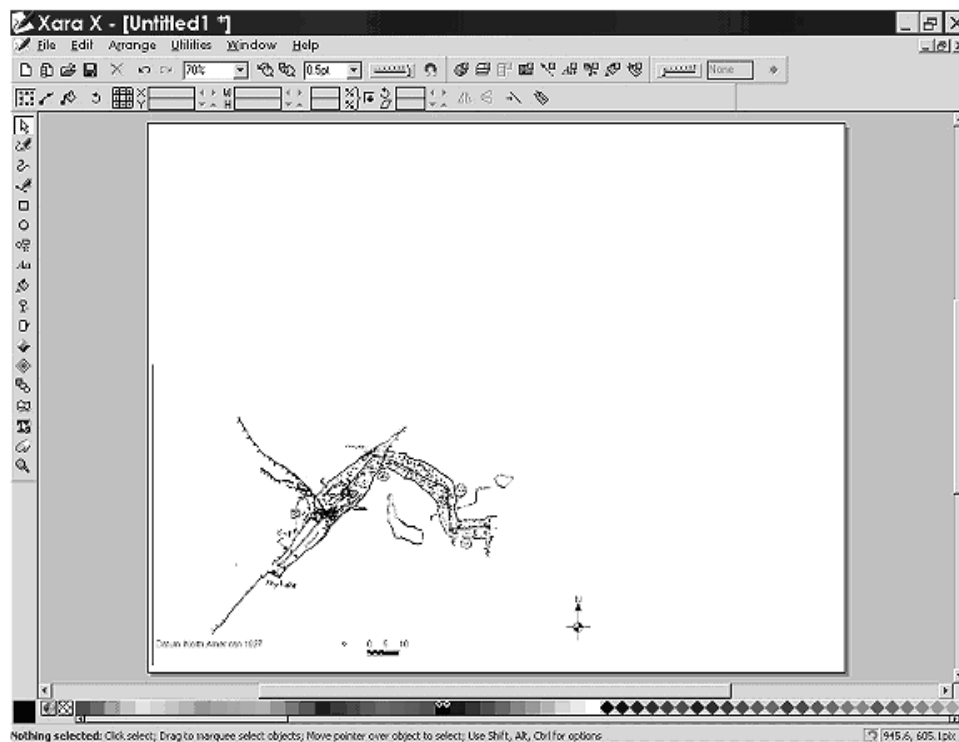
Winkarst method:

Next you will need to Import your saved bitmap of the line plot and/or the finished working map into this drawing. Go to **File/Import** locate your file and double click to finish the import process. Your file should be visible now as in the following screenshot. If you are not using Winkarst and only have the ability to export the line plot then you can assemble and align each individual sketch as well. This is much more time consuming and can be prone to error if your not very careful. This is called the Compass Method that is detailed below.

If you can't see the imported bitmap you are to close on the magnification scale. To change to full page view simply set your **Zoom factor** to **Page** or **Drawing** whichever display you prefer.

Compass method:

Begin by scanning all of your sketches as bitmaps and storing them in a separate folder labeled Sketches. Create the line plot in Compass being sure to adjust your scale and export it into a folder as well.



If you can't see the imported bitmap you are too close on the magnification scale.

Next import the line plot. Next open the **Layer gallery** (Figure 2). You will see that there is only one layer called Layer one. Go to the **Properties tab** and rename this layer **Line plot**. Next create a **New** layer called **sketches** it will default to the layer just above the Line Plot layer. you should see two layers in the layer gallery (Figure 3). The two check boxes next to each layer indicates whether the layer is visible or editable. The following screenshot shows the line plot layer visible but not editable and the sketch layer both visible and editable with this being the active layer. This is needed to easily edit the different aspects of your map without affecting other features. Complex cave maps can appear quit busy when all layers are visible so turning off separate layers is vital in sorting out all the different features of a cave map.

Now import the first sketch being sure that the sketch layer is highlighted. Your sketch should now be visible (Figure 3). The line plot should not be visible where it is covered by your first sketch. To make the line plot visible use the **Select tool** and select the sketch you just imported. Now select the **Transparency Tool**. Adjust the transparency of the sketch until your satisfied with the transparency level you can affectively see the line plot under your sketch as in the following screen shot by moving the transparency scale bar (visible when

the transparency tool is selected) to around 50%. You will do this to each sketch as you need them. (Figure 4).

Next you will need to turn off editable on the line plot layer so you can move the sketch over the line plot without moving the line plot. This is done by unchecking the edit box on the line plot layer in the layer gallery. Start with the first sketch and place it where it belongs in accordance with the line plot by putting the cursor on the first station hold down on the left button



Figure 2 Layer gallery

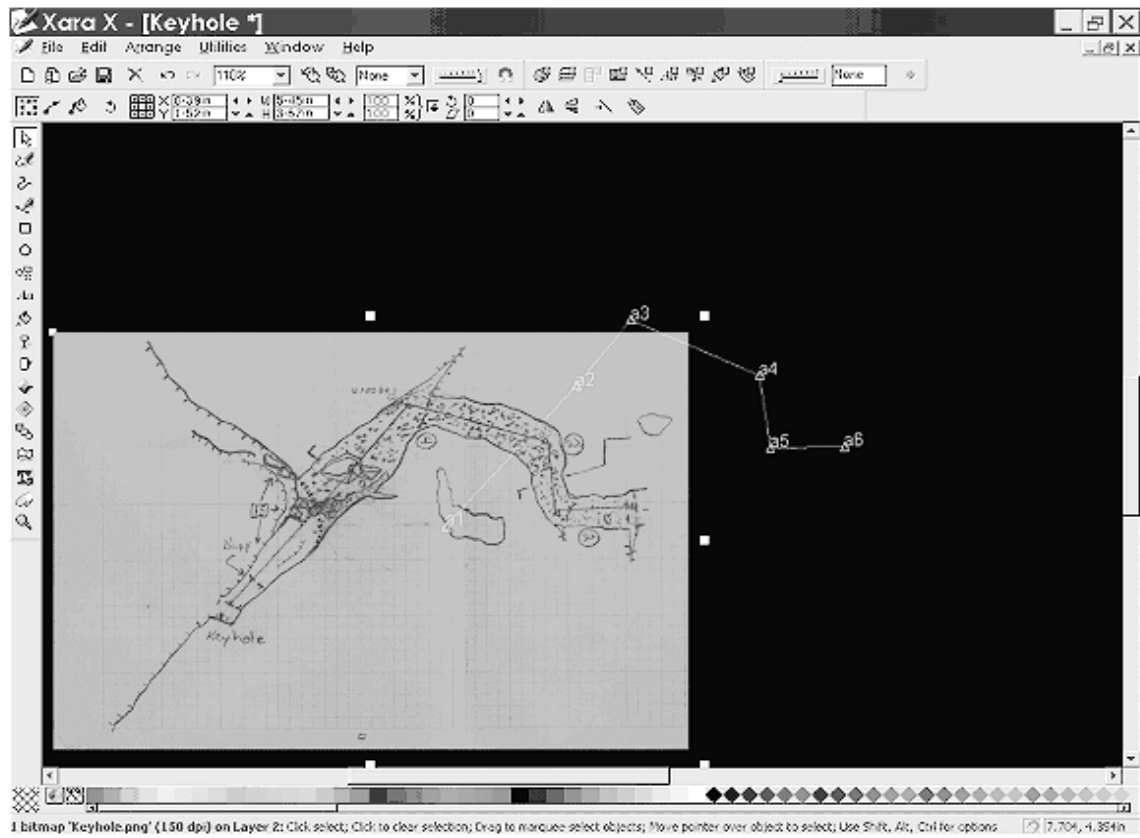


Figure 3 - Your sketch should now be visible

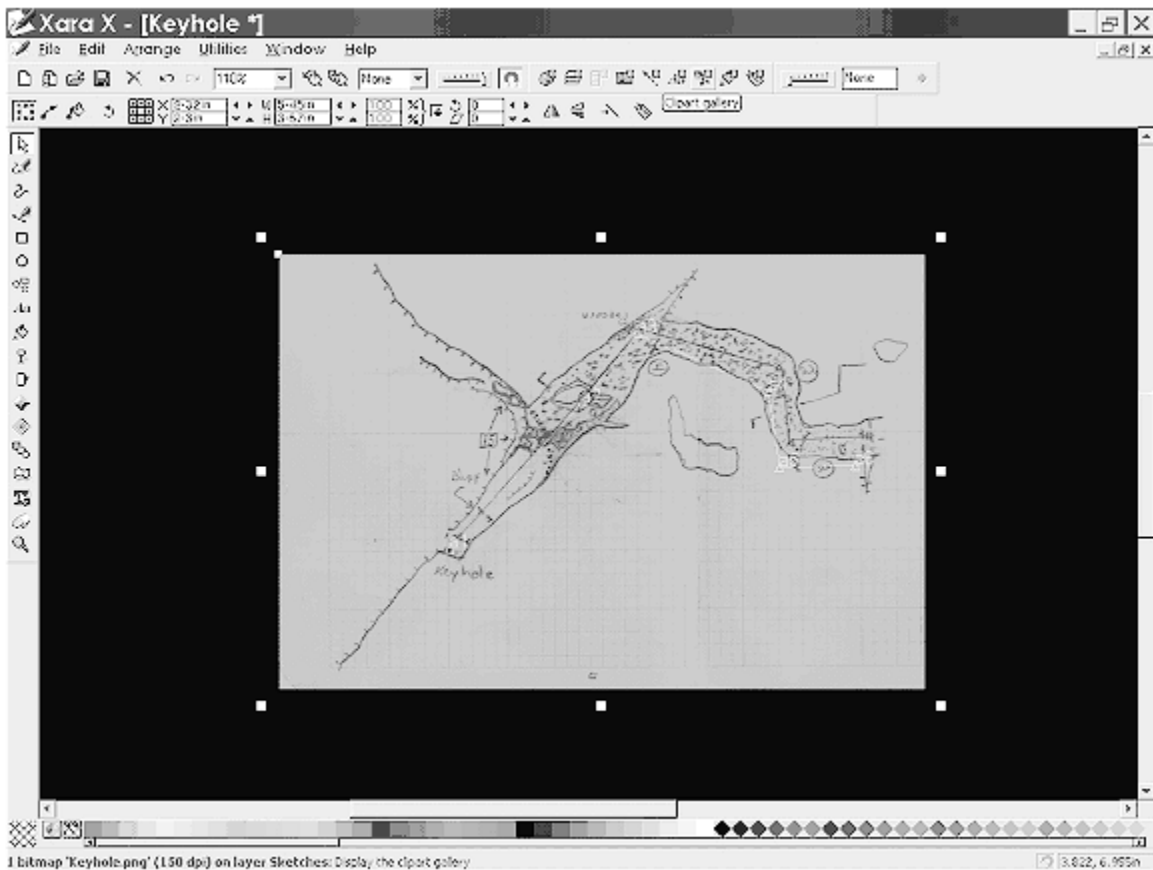


Figure 4 You may notice some discrepancies in the sketch as you align the sketch over the line plot. This is normal because it isn't a perfect world and no sketch is as perfect as a reduced line plot.

of your mouse and drag it to align the first station on the sketch with the first station of the line plot release the mouse button and repeat where necessary.

You may notice some discrepancies in the sketch as you align the sketch over the line plot. This is normal because it isn't a perfect world and no sketch is as perfect as a reduced line plot. (Figure 4)

Drawing walls:

Begin your drawing by adding a new layer to the **Layer gallery** called **Walls**. Turn off the other layers but leave them visible. Highlight the walls layer and make sure both boxes are checked and the Sketch layer and the line plot layer have only the visible box checked and the editable box un-checked. Close the layer gallery. Next choose the **Zoom tool** and select an area of the drawing by holding down the left mouse button and drag it down to create a rectangle of the area you will need to zoom in on. Release the left mouse button and you should be much closer now and ready to trace the walls for the first few stations. Start by selecting the **Freehand and Brush tool**. Set the **Freehand smoothing bar** down to almost 10%. The smoothing bar is directly above the select toolbox and becomes visible when you select the freehand and brush tool. Xara X has the ability to smooth out your lines to alleviate the harsh jagged line you would draw using a mouse. I like my walls rough because cave walls are rarely perfectly smooth. Now trace the wall for the first 2 stations. If the line thickness needs changed simply change it by selecting it, then change it using the **Line width bar** or changing its properties in the line gallery. I use 2.0 for walls.(Figure 5)

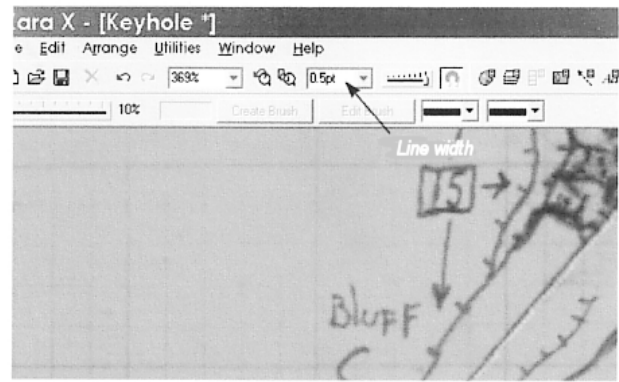
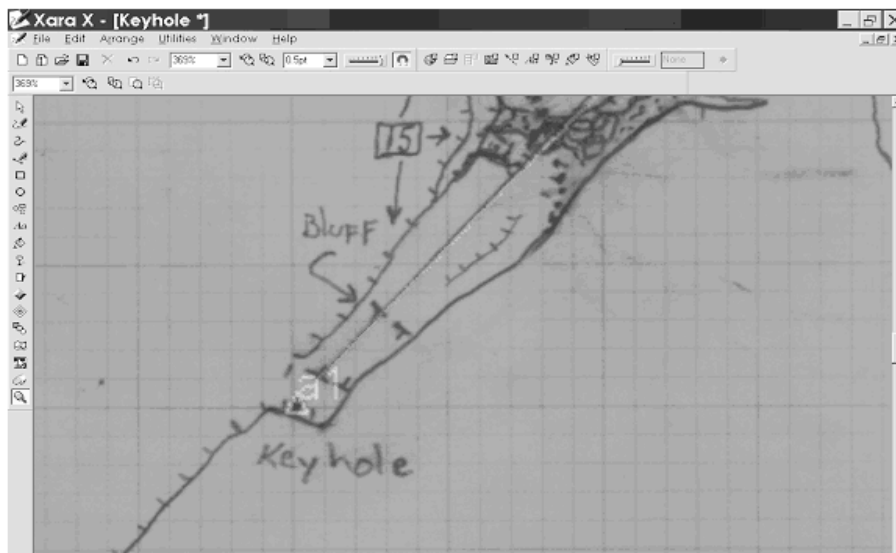


Figure 5 - line width

Do not draw all the walls yet. (Figure 6). You will need to move the sketch around to align the corresponding stations that were not perfectly aligned to begin with. To rotate a sketch just click on the sketch twice to bring up the rotation handles. You may also move the pivot point so you can rotate the sketch around any point that you choose by holding down the left mouse button while you drag the rotation point. I normally rotate my sketch around a survey station, draw some wall, then repeat as necessary until I am satisfied the sketch walls have been adequately traced.

Creating the interior.

As you begin the next step in filling in your map I would like to stress here how critical it is to keep the details of the cave separated using the **Layer gallery**. Normally I begin by adding the floor detail to the map by creating a new layer called **Floor**. I found out through a few trial an error maps that its better to put this layer beneath the walls layer. Just drag it down in the layer gallery. This layer sits just below your walls layer. This is so any feature on the floor will not sit atop the walls lines. Sometimes using a brush stroke can cause certain features like cobbles to spill a little onto the wrong line. This is a good time to make sure the visibility is on and the editable is off for you walls layer.

Figure 6 Do not draw all the walls yet.

Sand:

Sand floors are a monotonous part of cave floors and there can at times be a great deal of it in our Ozark caves. To create sand use the same procedure you did for Cobbles only reduce the size of your cobbles to look like sand grains. Or do what I do. I select the **Text tool** and create three or four periods from the default font which is of course is new times roman. I then place them in a random appearance and group them with the **selector tool** selection rectangle. Again choose the **Freehand and Brush tool**. Select the **Create brush stroke** button. Name this new brush stroke **Sand**. To paint your floors takes a little practice so it does not give the appearance of uniformity. Again overlapping and random patterns give the best results for this and do not let your imagination hold you back. It is easy to get your map to look its best when the sand is not exactly evenly distributed with even blank places to represent almost featureless floors, not in my maps.

Clay and silt:

This was a daunting task to do in the old days of pen and ink. To get the pattern just right is as easy as drawing a line.

Using the **Freehand and Brush tool** select a dashed line pattern out of the line gallery and its size to .25 with a round cap. Next hold down the Alt key while dragging out horizontal line that is the proper length to cover the width of your area. Next using the **Selector tool** select the line and duplicate it by holding down the Ctrl key and D. Notice that Xara has duplicated your line and it now sits just below and to the right of your first line. If this space (duplication distance) is to large you can change it by going to **Utilities/Options** and on the **General tab** at the bottom is the duplication distance. It can be set to any desirable distance to fit your individual needs. Try subtracting half of the value to start until you have achieved the results you want. Next you will need to trim them so each line fits into its designated position. Using the **Selector tool** select a line and grab one of the middle resize handles on either end of the line. Resize the line by dragging the handle to lengthen or shorten the length of the line to fit your needs.

Cobbles:

Again cobbled floors can be tedious work if done by hand. Xara allows this feature to be drawn as a brush stroke. Start by selecting the **Freehand and Brush tool** and set a line width of .25 and a pure white fill. The fill color bar is

located across the bottom of your Xara screen. Left click it, the “+” means it is now going to fill anything drawn by this line that closes will be a filled shape. Next draw three different cobble shapes close together. When you see the + sign when your close to completing the circle it means when you release the left mouse button Xara closes the circle for you. Now we group these three cobbles together by selecting our selector tool and dragging a selection rectangle around the three of them. When done correctly all three shapes will show a handle, letting you know that it has been selected. Next go to **Arrange/Group**. Now select the **Freehand and Brush tool**. Choose **Create Brush button**. Name this brush stroke Cobbles. Now each time you want to add an area of cobbles or small breakdown piles you can select this brush and literally watch Xara paint the cobbles for you. I normally use a small tight figure 8 pattern to get it just right. This brush doesn’t take a lot of imagination to realize the possibilities of brush strokes are limitless. We use brush strokes for a great deal of drawing in Xara X. All brush strokes are fully editable and various attributes can be added or subtracted through the use of the **Edit brush** button. Play with it when you want to experiment a little for various attributes can be spectacular and beyond your expectations. Xara X is made for cavers.

**Breakdown:**

Drawing breakdown using Xara X is a breeze. Any shape you can dream up is a great piece of breakdown. Look at a rock, notice its shades and shadow lines.

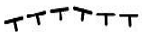
Make all attempts to stray away from standardizing your breakdown. Its random variations are what gives depth to your map. Start by drawing a closed shape. Choose your **Freehand and Brush tool**. Next choose line size of .50 and fill color of 20% black. Next hold down the Ctrl key and D to make an instant duplicate. Using your selector tool grab a corner resize handle and shrink the second shape just a little. Now drag a 10% black fill box up to this shape. It’s now filled with a slightly lighter shade of gray. Next move it so it sits on top of your first shape. It should look like a slab of breakdown. Now we group these two shapes together by dragging a selection rectangle with the **Selector tool** around them both and then going to **Arrange/Group** now resize, skew, or rotate as needed. Next we will apply shadows to just the biggest blocks and the shadow parameters. This can quickly get out of hand if you’re a new Xara user. Its just to easy. Xara will apply a shadow to any shape you select. First we will select a block of breakdown. Next choose the **Shadow tool**. When selected a new

attribute bar becomes visible. Just above the Selector tool is 4 choices of shadows. Choose **Wall Shadow**. Next you will see a shadow has been applied to your breakdown block. Now you can use the **shadow blur bar** to sharpen the shadows edge if you like. Also by clicking on the shadow you can drag adjust the shadow to any angle of observation. Shadows should not necessarily be applied to small breakdown. It can greatly affect your printers ability to print at a reduced scale and besides it just makes little sense. Big breakdown benefits from shadows, small breakdown does not.



Floor ledges:

Ledges on floors look there very best when it looks uniform and almost machine made. Xara gives the cartographer an easy means of drawing floor ledges with again the use of a brush stroke. Begin by selecting your **Freehand and Brush tool**. Select a line size of .50 and in the line gallery choose Round Cap. Hold down the Alt key on your keyboard and draw a short horizontal line. Repeat the process only this time drawing a short vertical line. By holding down the Alt key Xara draws a perfectly straight line instead of a freehand line. Now select the **selector tool** and select the short vertical line. Move this line so it intersects the horizontal line in the middle with one end of the vertical line forming a **T**. Next go to **Arrange/Group**. Selecting the Freehand and Brush tool click on the create Brush button and name this brush stroke **Hatch**. Next, draw the floor ledge where you need it on your map. It may not look correct at first so using the Edit brush button it is easy to rotate the hatches so they all line up perfectly. You may also need to adjust the spacing so each hatch just touches its neighbor hatch forming a great looking floor ledge. Hit save when your satisfied and from now on all of your floor ledges will be perfect with little to no editing needed.



Ceiling ledges:

Ceiling ledges are as easy to create as floor ledges and in fact the **Hatch** brush you created earlier for floor ledges is a simple means of creating ceiling ledges as well. Start by selecting the **Freehand and Brush tool**. Next locate the hatch brush in the drop down box located next to the edit brush button. Draw a length of floor ledge then select the **Edit Brush button**. On the spacing tab you can simply move the slider bar and Xara will separate each hatch for you. When you obtain the desired look click on **save as new**. Name this brush Ceiling. Keep in mind everything associated with a ceiling fea-

ture should be separated to its own layer. Open the layer gallery to add and rearrange layers as needed.



H₂O:

Color is a wonderful thing if it is not too distracting. I now use a transparent blue along with a flat transparent line fill to create nice water features.

I have seen several different methods on Xara for creating pools and streams and I will describe a few ways to create the three samples here. The nice thing also is once you have a design you like just save it as a Xara template. It becomes available for all your future drawings and can be manipulated with ease to accommodate any desired affect your looking for in later drawings.

Pools:



I Igenerally start by selecting the **Freehand and Brush tool**. I apply a blue fill color and a line size of .25. I draw the shape of the pool in accordance with the sketch I am tracing. Next I duplicate it (Ctrl, D) and apply a no color fill that I drag up onto the duplicated shape. It will now be colorless. Using the **Freehand and Brush tool** draw a .25 horizontal line just above the pool shape and then duplicate it with the Ctrl +D keys on your keyboard. If the lines are not close enough to achieve the desired result you can change the duplication distance with **Utilities/Options**. On the general tab at the bottom is the duplication distance parameter settings. These two numbers can be changed to increase or decrease the amount of distance between duplicated objects. I normally use a 5pix separation for the desired affect.

Streams:



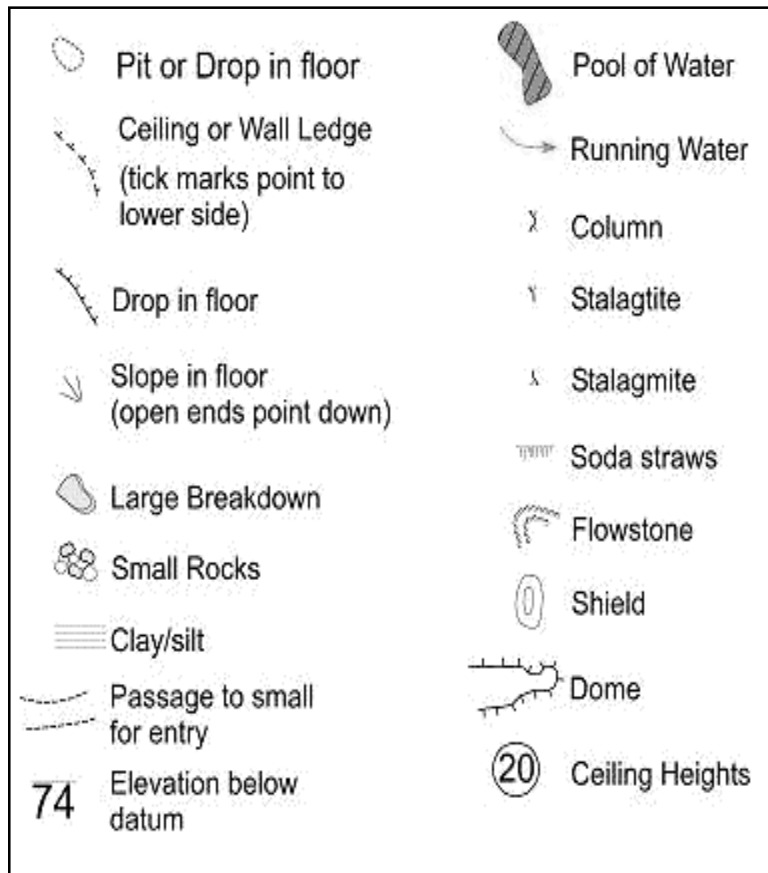
Streams are quit common features that in some cases will be the focal point of the map because of its distinct look or size. It can be easy to draw the stream if you want to use the standard symbols for water. I however like to see the stream looking as if flow was occurring. To do this is as easy as it comes. I start by selecting the **Freehand and brush tool**. I next choose the VanGogh brush and make it blue by selecting this color on the color bar at the bottom of the screen. I begin to paint the stream changing the line thickness to best suit the need of the drawing. Small streams can be a line size of 4 or 5 while

large rivers could get as big as 10 or 12. It is your scale of the drawing plus the size of the stream that will best dictate the line size for your needs. Next select the **Transparency tool** and adjust the shade so the rocks can be seen beneath your water if you so desire.

Flowstone:

Nothing more than a letter C, Flowstone that often coats the walls or floors is drawn by using the **Text tool** to create the letter C using a font that has a wide opening and is symmetrically shaped. I use Century Gothic. Next create a brush called Flowstone and drag out a length of C's so you can begin to edit the brush so it is configured to your own personal taste. Next you will want to activate the brush edit button by selecting the **Freehand and Brush tool** and here is where the final shape of your new brush is acquired. By first selecting the Rotation tab you can drag the rotation bar until all the letter C's are lined up side by side. Then on the Spacing tab again slide the spacing bar over to get the letters to just touch. When your satisfied click save and close the edit box and begin to draw your flowstone.

Some Xara Examples:



Exterior:

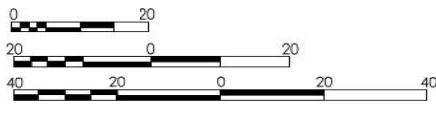
The exterior parts of a cave map normally include the cross-sections, profiles, offsets, and any pertinent technical information about the cave including the scale and north arrow. Cross sections are as simple as tracing the sketch cross-section

then re-size it for the correct scale. To add the cross-section locator lines is a matter of holding down the Alt key while drawing a straight line using the **Freehand and Brush tool**. Drawing this line directly across the section of cave you wish to portray you can easily add another directional leg by holding the tip of the pen on a handle when you see the + its ready to resume drawing and will attach another leg directly onto your existing line. When you have the length you need just release the left mouse button. Now you will need to remove the section of line that intersects the cave passage and remove all of it contained between the cave walls. This requires you to actually make two cuts in your line. The process is this simple. With your **Selector tool** select the line and then select the **Shape editor tool**. Use this tool to cut your line by moving the cursor over the line and when it changes into the arrowhead click on the line. You will notice a small red box attached to the line where you placed the cursor. Now

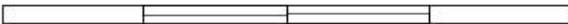
move the cursor up to the Break at Points button. Click it to make the cut. Now repeat this process for the other wall. Once you have completed that cut now using the **Selector tool** select the line between your two cuts. Now delete it using the delete button in Xara or the delete key on your keyboard. You can add arrowheads to the end of your lines if you like by selecting one of many in the **Line Gallery**. Just open it up and open the folder labeled Arrowheads. If it points the wrong direction just flip it using the flip buttons located directly above your drawing on the first bar.

Scale:

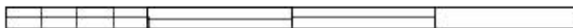
Lets see how easy it is to create a very nice scale that will need to be saved as a template so you never need to recreate it. Just import it and rescale it according to the scale imported on your line plot. To begin this project you will select the **Rectangle tool** and drag out a long thin rectangle. To make it easy just copy it length to the scale length on your line plot. Next make



a duplication by using Ctrl + D on the keyboard. Now at the top of the drawing along the first bar you should see a closed padlock button that is depressed. Click on this button to open the padlock. This unlocks the drawing aspect ratio setting so we can physically enter the ratio of reduction you desire. Its simple mathematics. To divide the length of the original rectangle so we have 4 equal parts we need to reduce the duplicate by 50% in length and 25% in width on the first set. Use Ctrl + D to create 3 more duplicates. Now making sure the **Snap to Objects** button (the red magnet) is active and using the **Selector tool** drag one smaller rectangle and align it on top of the first. When you see the mini-magnet show up for your cursor it means they are aligned and snapped to the next object. Your drawing should look like this.



Next we need to duplicate the smaller boxes and again reduce there size to 25% in length and 50% in height this will again give us a total of 4 equal size 1/4 scale of the parent box. Again we are ready to select one of the 4 smaller boxes and align them with the box directly below. Now your scale should look like this.



Next the black squares. Using the selector tool select on of the squares you want to color black. Once selected left click on the solid black fill color at the bottom of the Xara screen. It is now filled with black. Repeat the process for each additional box you want filled. It should now look something like this.



Next we add the numbers by selecting the Text tool and then choosing the font and the font size. Anywhere drag your mouse to the right to create the text line. Type your numbers you need for the scale. (0, 10, 20, 40, etc.) now using the selector tool drag each number where you need it in relation to the scale. Its fin-

ished. This can be used over and over just by saving it as a template. And importing it when you need it for future maps.



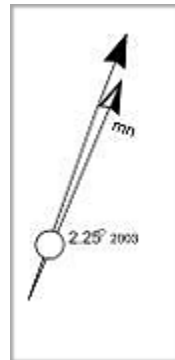
Conclusion:

I believe that this tutorial, as simple as I could make it, is a complete testament to the ease and simplicity Xara X has become. I also believe that all of the real basics are covered well enough that you can use Xara to advance your own talents quickly and without a 50 hour learning curve. Try to understand the basic philosophy of the program. Its simple point and click drawing make it one of the easiest programs to master

even for the most inept computer user.

I am no graphic artist by anyone standards and it would not be difficult for a real pro to work some real map magic using Xara X. Your only limit seems to be your own imagination. Xara makes you a better cartographer while still allowing your own personal styles to come out in your maps. Xara files are tiny and easily attach to most emails and will print at any size with clear crisp lines. Exporting to other formats is also a joy. I have never

seen Xara lock up or tell me I am out of memory. Like I said before, Xara X is the cave mapper dream program come true.



Tom Lounsbury NSS 38646, is a native of Arkansas now living in Kansas. He started caving in 1974 with the Boy Scouts then went on to join N.A.D.U. in 1990, and the M.O.L.E.S. in 1992. He started surveying in 1993 and began cartography in 1994. Tom has caved in 14 states and Mexico but his heart is always in the Ozark Plateau of northwestern Arkansas. Currently a member of the Middle Ozarks Lower Earth Society, The cartography Section of the NSS, Association for Arkansas Cave Studies, Missouri Speleological Survey and the National Speleological Society.

Digital Airbrushing of Cave Maps

by Bob Richards

One of my favorite effects to do on cartographic salon maps is the airbrush look. This effect allows for cave passages and floor detail to stand out. The proper use of color can add visual impact and a finishing touch to the map. It is quite easy to achieve with the current graphics software programs.

The Past

When I entered my hand-drafted Olaa Cave map in the salon several years ago, I wanted to show off the passage detail more and give it some visual impact. So I airbrushed that salon map by hand. To do this, I had to mask out all of the cave floor detail and cross sections. This is done by cutting and pasting a spare copy of the map as the mask template on those areas. Once the airbrush painting is done, the mask is peeled off. It is very time consuming but the results are beautiful. You could make two or three copies before the mask was unusable. It was my only airbrushed cave map until computers made it possible again.

The Present

Computer generated maps have the advantage of easily adding color and the airbrush look. The four major drawing software are: *Adobe Illustrator*, *CorelDraw*, *Deneba Canvas* and *Macromedia FreeHand*. All are cross-platform (Mac or PC) and are vector based programs which allow the files to remain quite small. I use *FreeHand* so I'll discuss how that is done, but feel free to use the software of your choice as they can all blend colors. The process and steps are similar.

Using the blending tool, you can transfer one color shade into another over a series of interpolated steps. This allows you to have an airbrushed look for outlining your cave passages. This can be done quickly by cloning the outer passage cave wall line, copying that line again and dragging the line outward a couple inches (+/- depending on the physical size of the map). I assign the lines two different colors, with the outer line being white (or whatever the background color of the map will be). Using the Xtras menu (along the top of the program menu bar) click on Create and Blend.

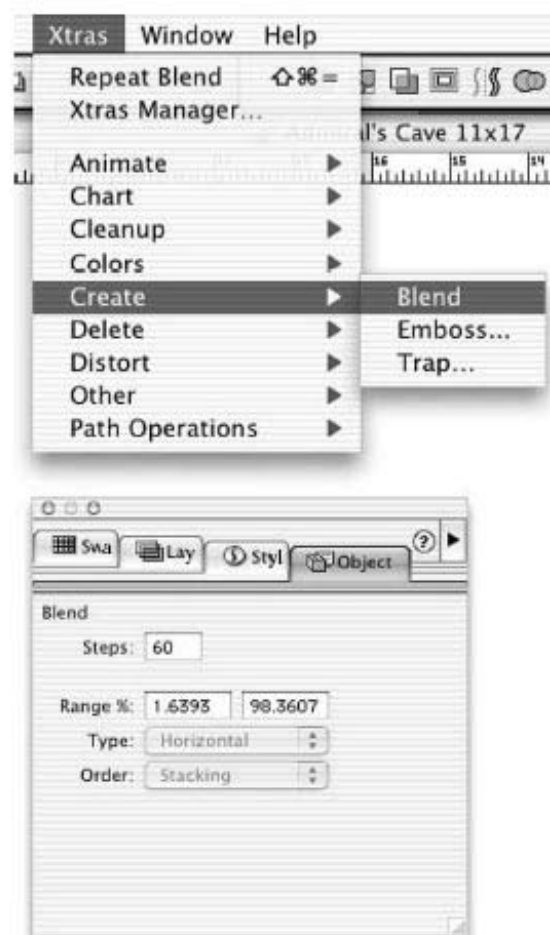


Figure 1 The Blending Tools for creating the airbrush look

Figure 1 shows what this pull down menu and object tab box looks like. The object pallet box will appear and by assigning it with at least 60 blend steps, it duplicates a series of lines blending the two colors. This will give a smooth gradient color effect on the outer edges of your cave passage. I put this color on a separate layer. The cross sections on my map are given a white fill which sits on a higher layer so it can float above the color airbrush layer.

Figure 2 shows a portion of my Admiral's map in "Keyline" mode. Keyline is another pull down menu found on the bottom of the program window. It shows the illustration as a basic black and white line drawing. Figure 3 shows the same illustration area in "Preview" mode, which is also found in the same pull down menu.

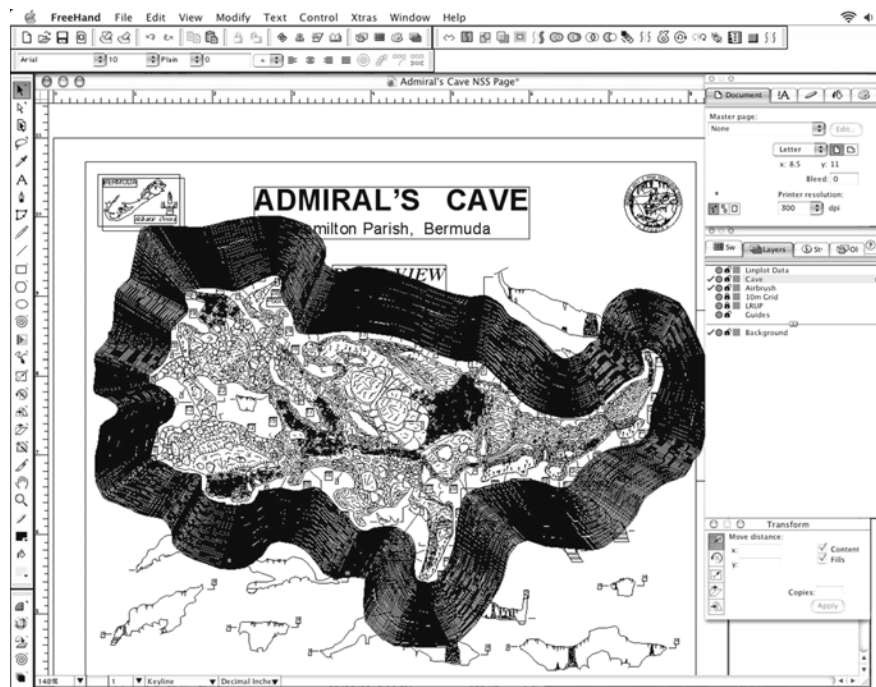


Figure 2. Screen capture showing the cave map in “Keyline” mode and the 60 blended lines around the outer passage walls.

Setting up your drawing is important. I have a couple of palette boxes floating around my cave map. This gives me easy access to the number of tools used for completing the map. The upper right box shown in Figures 2 & 3 is the Inspector pallet. It has a number of functions organized on tabs. It currently shows the Document tab open, which allows you to select the page size and printer resolution. Other tabs on this pallet allow for Font styles or sizes and Pen weight options. The pallet box below the Inspector box is the Swatches, Layers and Object tabs. The tab currently shown open in figures 2 & 3 is my Layers tab. Layers are very important for how you arrange your drawing. Please note that the Airbrush layer is below the Cave layer. This will allow all the cave detail and cross section information to float above the airbrush color. I also have layers called Lineplot (survey data) and LRUD (Left,Right,Up,Down). These two layers are checked off and not shown. However, I could easily turn these layers on for viewing or printing. They are useful for drafting the finished map because they show the general outline plot of the cave walls and survey points. The survey points were generated by the cave survey program *CavePlot*. Other cave programs like *Compass* and *Walls* can also generate this data information.

Another program that I have found very useful is *Adobe Acrobat*. This program can save any docu-

ment no matter what program it was created in as a PDF (Portable Document Format). The PDF's make any graphics, maps and text readable by most computers. *FreeHand* can export directly to PDF as can most other graphics programs. You will find many PDF's on the web because they include vectors which you can zoom in to at microscopic levels without the map becoming “pixelated”. This makes *Acrobat* ideal for tasks like publishing, emailing or viewing cave maps. The *Acrobat* PDF viewer is preloaded on most computers. If not, it's a free software and is downloadable from the *Adobe* website. The files are very compact and will print to whatever printer the user has available. Most printshops are now using PDF for output of maps and brochures.

With a computer generated map you have many options and tools to use. As evident in the 2003 NSS Cartographic Salon, 95% of all entered maps were computer generated. A couple years ago it was just the opposite. Graphic drawing programs are changing the way we draft cave maps. They give us color choices and multiple copies at various scales which you could not achieve with the old hand airbrushed method. However, for an aesthetically pleasing map, the use of color, lineweights and the cave layout have to be balanced.

I hope that I have given you some insight into this technique, along with some understanding of how

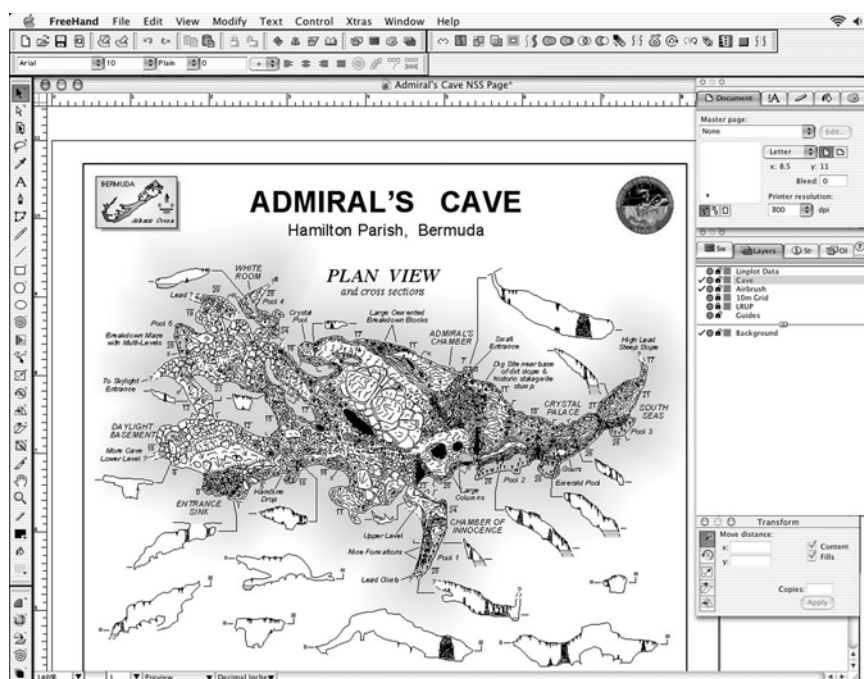


Figure 3. Screen capture in “Preview” mode showing the airbrushed transition of the lines around the outer passage walls.

to set up and execute it. I encourage you to open your graphics program, grab your mouse and have fun creating the airbrush look on your cave maps.

Catastrophic Compass Failure

by Wookey

Reprinted from "Compass Points", Issue 32, November 2003 "Compass Points" is the Journal of the British Cave Research Association's Surveying Group

During the 2003 Mulu Caves Expedition the team suffered a very unusual mechanical failure in a Suunto compass which was both unobvious and seriously compromised data collected with it. This article describes the incident, the reason for it, its effect on the expedition and what can be learned from it.

Poring over the new "grumble2" survey data at base camp we were perplexed as to why we were having trouble getting a new loop off the Snail Chamber survey to fit properly. The passage looked right, but connecting both ends produced a massive error and connecting one end meant the other end was hanging in space some 104m from where it should be. This was a huge error for a 193m survey. It was late - we gave up and went to bed, leaving more rigorous analysis for the morning.

Next day I was doing some surface surveying, connecting various refindable points and other surveys to our mainline surface survey. On the second leg I noticed that the compass reading was very suspicious. The path was more or less north-south so a reading along it saying east had to be wrong. Fortunately I had my watch compass and trusty MCI hand-bearing mirror compass along too and those agreed that the Suunto compass was just plain wrong! Fortunately we were able to get our tasks for the day done using the MC 1.

Back at camp, comparing the suspicious compass with other instruments showed that it was indicating 84° east of "correct"! Applying this correction to the "grumble2" data made those surveys look a lot more sensible. However it rotated the new loop section too far. Rotating it 55° gave the best fit (and now the loop error was within expected limits). This was bizarre.

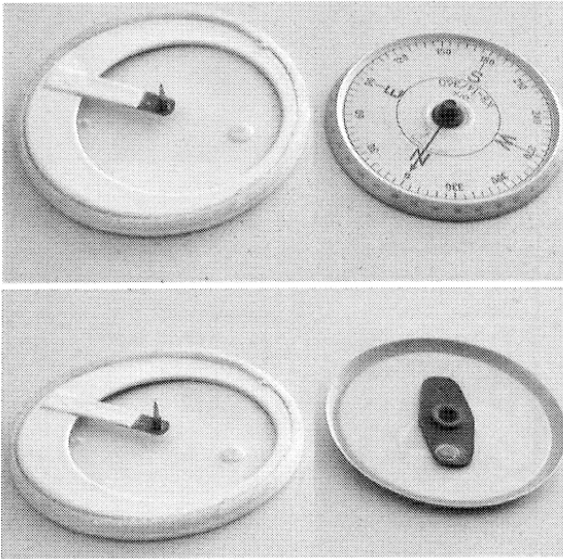


Figure 1: *Insides of the broken compass. The capsule base is on the left, showing the pin on which the compass bezel rotates. The top figure shows the upper surface of the aluminium disc on which the numbers are inscribed. The lower picture shows the underside and the magnet which should be firmly attached but which is now free to rotate independently of the disc.*

Clearly things weren't quite as simple as this instrument having acquired a huge offset. There were three separate sections of survey done on that trip - the Snail Chamber loop, a connection down a pitch and a lot of new stuff in "mustn't grumble". The pitch section seemed to need a 30° offset adding to align it properly, whilst the Snail Chamber loop needed 55°. For the rest it was hard to tell exactly but something around 60° was about right. The legs within each section seemed to have consistent direction with respect to each other and the pictures.

This suggested that the compass offset had changed at least once during the course of the 8 hour trip, but only when it wasn't being used for surveying. Now it seemed resolutely stuck at 84° east. No amount of belting it made it change.

So how had it suddenly started reading with a massive, but apparently mostly-consistent offset, and when did it first go wrong?

The instrument was a Suunto KB360/PC, owned by Cambridge UCC and loaned to the Mulu trip. It was approximately 10 years old. Disassembling it on return to the UK and cutting open the capsule with a hacksaw showed that the cause of failure was detachment of the magnet from the aluminium disc bearing the num-

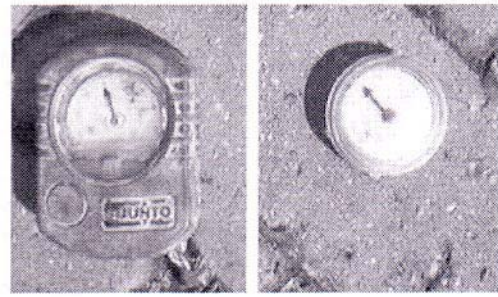


Figure 2 : *Comparison of the broken compass (left) with a working compass. Note the North arrows differing by about 20°. (N.B. The compasses were placed far enough apart such that they don't affect each other).*

bered degree markings (see Figure 1). The two are normally glued together and I have never heard of another case where they have separated in this way.

At the time of disassembly the offset was about 20° east (see Figure 2). Clearly the two parts tended to move together most of the time, but every so often would rotate relative to each other to give a different offset.

This form of failure is much more problematic than the more usual forms of compass failure (lens fogged, numbers illegible, dirt behind lens, card sticking, capsule cracked, card jammed) as the compass appears to be still working - and because it isn't obvious it could continue to be used for some time, collecting junk data.

The one advantage of this incident is that it illustrates the need for writing down which instruments were used on which survey trip. I pointed this out in the "how to survey properly" pep talk at the start of the expedition, and it was often ignored along with much of the other advice and strictures I gave. This event brought home to the expedition members that there are actually good reasons for recommendations like this and that when this sort of thing happens it is really useful to know which surveys are, or could be, affected. Some sceptics were definitely converted from thinking that this info. was pointless to realising it could be very valuable.

By working backwards and eliminating options we worked out the previous trip the instrument was used on and it seemed to be about right, but the data remains suspect. No other surveys are obviously squiff so it looks like only that trip (and its 3 surveys), and the following trip the next day, were affected. As is often the case on expeditions, there was no chance to resurvey these bits of cave-- things just have to be positioned as best they can.

