U.S. DEPARTMENT OF THE INTERIOR

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Program Kolor-Map & Section

Amiga Version 2.0

By

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93-585 Manual and program listing (paper copy)
93-585 Disk with program, source code, and examples.

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SYSTEM REQUIREMENTS

Hardware and Operating System:

The minimum hardware requirement is an Amiga personal computer with at least 5 Mb of memory (4 Mb Fast RAM and 1 Mb Chip RAM) running under AmigaDOS 1.3 or higher. A math coprocessor is strongly recommended but not required. For multitasking purposes, 10 Mb of RAM are recommended.

The program was developed and tested on an Amiga 3000 running under AmigaDOS 2.04 with 10 Mb of RAM (8 Mb Fast RAM and 2 Mb of Chip RAM) and a math coprocessor. The program was also tested on an Amiga 2000 (running under AmigaDOS 1.3, the Motorola 68000 chip, and no math coprocessor), and on the Amiga 4000 (running under AmigaDOS 3.0 and the Motorola 68040 chip which has a builtin math coprocessor).

A Super-VGA (1024x768) monitor is strongly recommended but not required (for example the Sony Multiscan HG). Running under AmigaDOS 2.04 or 2.05 it is possible to display a *Hires-Interlaced screen mode with a visible size of 722 x 482 pixels.* AmigaDOS 1.3 and AmigaDOS 3.0 display a smaller visible area. In spite of that, all the necessary information in the program (menus, file requester, images, etc) will be completely visible.

Software:

For duplication and distribution purposes by the USGS, the program is provided on a 3.5 inch, DS/DD (double-sided double-density) disk which is formatted as an MS-DOS 720 Kb disk. In order to read or to copy the program from an MS-DOS disk into an Amiga computer, a utility program such as CrossDOS (Consultron, 1990) is needed. CrossDOS is included in AmigaDOS 2.1 and 3.0 and it is transparent to the user.

Users who do not have CrossDOS or an equivalent program may contact the author directly for a copy of the program on an Amiga formatted disk.

Important Note: The two files arp.lib and extend.lib, provided on the disk under a directory named LIBRARY, must be copied to the System's Libs directory, and renamed to arp.library and extend.library, respectively. Otherwise, the program will not run.

DISK CONTENTS

This open-file report is composed of two parts: (a) the manual you are reading now (including the program code, given in the appendix), and (b) a 3.5 inch DS/DD disk with the following files:

1) The executable-program named KolorMap (as an abbreviation for the name: Kolor-Map & Section program) *and the source-code file KolorMap.Asc.*

2) An executable-utility program named MakeVist (abbreviation for MakeVista) *and the source-code file MakeVist.asc.*

3) A file named header.dem (used with MakeVista).

4) A directory named LIBRARY containing two files: arp.lib and extend.lib (abbreviations for arp.library and extend.library). Two other files named arp.bmap and extend.bmap are required to *compile* the program, but since these two files are not required to *run* the program, they are not included on the disk.

5) A directory named EXAMPLES which contains examples of data files, image files of colored maps and cross sections, and an Anim File.

Note that all the file names are abbreviated to conform with MS-DOS requirements, since the distribution of the disk is made on an MS-DOS formatted disk.

The Kolor-Map & Section program is written in HiSoft BASIC Professional version 1.05 (HiSoft, 1989) which is a fast interactive BASIC compiler for the Amiga computer. Since the KolorMap program is an executable program, you do not need HiSoft BASIC Professional to run it. Commands to load and save IFF-ILBM (Interchange File Format-InterLeaved Bit Map), or for short IFF files, are implemented in the program using the Extend Library (Sunsmile Software, 1989; Hisoft, 1992).

The utility-program MakeVista converts calculated z-data files generated by the Kolor-Map & Section program into digital-elevation-model (DEM) files that can be loaded into VistaPro (Virtual Reality Laboratories Inc, 1992a). The MakeVista program was kindly provided in AmigaBASIC by Mr. Clint Woeltjen of Virtual Reality Laboratories Inc (VRLI). I modified the program and compiled it using HiSoft BASIC Professional because AmigaBASIC does not run on the Amiga 3000. The MakeVista program is included on the disk with Mr. Woeltjen's written permission. A utility program that performs the same function, is available from VRLI for a nominal fee. **Note: To run the MakeVista program, the**

"header.dem" file must be in the same directory as the MakeVista program.

A NOTE ABOUT COMMERCIAL SOFTWARE

In this manual, I will refer to the name of the publisher of a commercial software only when the product is mentioned for the first time. A complete list of the names of the publishers and the software products that can be used in conjunction with this program is given at the end of the manual in standard reference form. The mention of a particular commercial product is intended only as an example of the kind of product that I used and tested, other products may be available on the market that can perform the same functions. For brevity, no mention of the possibility of other products will be made when I refer to a particular product that I used.

GETTING STARTED

If you have obtained a copy of this program on an MS-DOS formatted disk (as opposed to an Amiga formatted disk) then please do the following (otherwise skip the next two paragraphs).

Using CrossDOS, click the mouse pointer on the MountMF icon to mount the floppy drive(s) as MS-DOS drive(s). To activate the drive type di0: (for drive 0) or di1: (for drive 1). Do this either in the Shell or CLI (command line interface) or in a utility program that may help you copy such files. Create a directory and name it KolorMap (this is optional). Now copy program KOLORMAP and the file KOLORMAP.INF (and all other programs and files, and the EXAMPLES directory, but not the LIBRARY directory), to the new directory on your Amiga's hard disk. Once the program is under AmigaDOS, it is a good idea to rename these two files to KolorMap and KolorMap.info for easier readability (note: you must change .inf to .info). The (.info) file contains the necessary information to generate the proper icon that can be double clicked to start the program.

On the MS-DOS formatted disk there are two files in the LIBRARY directory: arp.lib and extend.lib. These are MS-DOS style file names (limited to an extension of 3 characters). Copy these two files into the Amiga System's Libs directory and rename them to: arp.library and extend.library. **It is very important to copy these two files to the Libs directory and to rename them, otherwise the program will not run.**

If you acquired the program on an Amiga formatted disk, then please **copy the files arp.Library and Extend.Library from the LIBRARY directory on the program disk to your Amiga-System Libs directory. It is very important to do this, otherwise**

the program will not run.

The arp.library is a public domain library file and it is needed to generate the File Requester. The Extend.library was originally published by Sunsmile Software in the United States but later it was sold and became part of the HiSoft BASIC Professional package (version 1.05) developed and published by HiSoft in England. The inclusion of the Extend.library on the disk is made with permission from Sunsmile and from HiSoft.

To start the program, **double click** on the **KolorMap** icon.

INTRODUCTION

This is version 2.0 of the Kolor-Map & Section program. Several new features and improvements have been implemented in this version, and similar to version 1.0 (Zohdy, 1993), it is designed to be user-friendly, menu-driven, and multitasking. For example, you may use a word processor to write a memo or you may edit a map in Deluxe Paint (Electronic Arts, 1989) while the program computes or colors a map with several thousand randomly located stations.

The purpose of the Kolor-Map & Section program is to enter, save, and load map or cross-section data files; to calculate, display, and save computed images; and to load map or cross-section images for viewing. In addition, in this new version of the program, the user can easily generate either a single interpreted-resistivity map at a specified depth, or automatically generate a large sequence of interpreted-resistivity maps at a succession of closely spaced depths, that is: Animation Frames. Each frame is a map of the interpreted resistivity at a successive depth. The number of frames, the starting and ending depths, are specified by the user.

All computed images are saved in standard IFF format, and therefore can be loaded into Deluxe Paint to be edited, annotated, and printed. A sequence of depth slices showing **the variation of resistivity with depth** can be loaded in Deluxe Paint to be played, edited, annotated, and then saved as an Anim File.

In writing this program I attempted to satisfy two conditions: (1) the resulting map or cross section will honor, or at least display, the values of the original data; that is, the original data will not be "lost" as a result of the gridding routines; and (2) the resulting map or cross section will resemble what an experienced person might have produced contouring the data by hand. For example, **within the boundary of the data on the map**, no contour closures are generated where there are no stations, and no contour levels are generated with values that are higher or lower than the maximum or minimum values in the data, respectively. At large

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distances from the data points, however, the calculated values will decrease in amplitude and some closures may be formed away from the data boundary.

GENERAL FEATURES

Maps Based on x,y,z Data Files:

The Kolor-Map & Section program was primarily developed for generating interpreted-resistivity maps and cross sections but it can be used to generate other geophysical, topographic, isopach, isobath, or geochemical maps from any (x,y,z) ASCII file (text-only file) that is written in a free form (with blank spaces, or commas, to separate the values of x, y, and z and a carriage return to delimit the end of each line). The maximum number of randomly-located stations for a given (x,y,z) map is 10,000 stations. Maps in portrait form (height greater than width) can be optionally rotated 90 degrees and automatically scaled into landscape form in order to fill a larger portion of the screen. The station locations for maps may be plotted as squares, points, or may not be plotted at all (your choice).

Depth Slices and Animation Frames:

Interpreted-resistivity maps at one or several consecutive depths (depth slices) are easily generated using a "VES Number and (x,y)" file and the "Layering" files (depths and interpreted resistivity) resulting from the automatic interpretation method for direct-current resistivity soundings (Zohdy, 1989; Zohdy and Bisdorf, 1989). VES is an abbreviation for Vertical Electrical Sounding. The maximum number of randomly-located sounding stations is 500. The number of slices, and the starting and ending depths, are all specified by the user. For generating animation frames, the maximum number of frames (depth slices) is only limited by the available space on the hard disk and the maximum available memory on the computer to play back the animation from memory using Deluxe Paint. The generation of 200 frames is not unusual for most computer configurations that can run this program. Note that it is possible to use this feature to generate animation frames of any other property such as water quality or even lithology using data from drill holes, provided the file format conforms to the layering file format (Zohdy and Bisdorf, 1989) which is described more fully in the section on File Formats. Also note that numeric values must be used to describe the lithologic units in the layering file.

Output to VistaPro:

A map computed in the Kolor-Map & Section program can be automatically scaled, and the z-values saved, for input into VistaPro. The resulting z-values file must be converted into another file that can be read by VistaPro. This is done using

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the MakeVista program provided on the disk. Once this is done, then 3-D shaded relief renderings in 24-bit color, or in other Amiga graphic modes can be produced. Impressive renderings by VistaPro may be viewed in three to four million colors using DCTV (Digital Creations, 1990). Furthermore, using VistaPro, it is possible to drape geophysical maps on top of DEM (Digital Elevation Model) maps and it is also possible to generate several types of computer animations including "fly by" using the program MakePath (Virtual Reality Laboratories, 1992b).

Cross Sections:

The generation of cross sections is particularly suited for use with interpreted electrical-sounding data (Zohdy, 1989; Zohdy and Bisdorf, 1989) where the depths increase logarithmically and the last layer is theoretically infinitely thick. The program accepts a maximum of 50 sounding stations per cross section, with up to 50 layers beneath each sounding station.

Similar to the generation of a depth slice, a cross section is easily generated using a "VES Number, Distance, and Elevation" file and the "Layering" files generated by the resistivity automatic interpretation program (Zohdy and Bisdorf, 1989).

Cross sections may be drawn at various vertical exaggerations (from no vertical exaggeration up to 20 times vertical exaggeration). The program provides an option to generate either the top part of a vertically exaggerated section or to generate the whole cross section. The purpose of this option is to combine two displays of the cross section on a single page (using Deluxe Paint) with an upper figure showing the upper portion of the vertically exaggerated section and a lower figure showing the complete section with no vertical exaggeration.

Simplified topography (based on the elevation of each station) forms the top line of a cross section. The sounding stations are shown, as small solid triangles at the top of this simplified topographic line.

In the calculation of cross sections, I incorporated a stretch factor in the horizontal direction (Xstretch) to help generate images that look more like cross sections than images that look like maps. Thus, the program generates horizontally-extended features on cross sections as opposed to more rounded features on maps. **The Xstretch routine does this without altering the original data points, it only affects the interpolated values.**

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<u>Honoring Original Data Values</u>:

Maps or cross sections displayed on the screen may show not only the results based on data gridding but also the colors of the station values of the original data, thus honoring (see section on Grid Size) or at least showing all the values of the original data (optional). These features allow you to make decisions about: (i) the quality of the map or cross section as it is displayed on the screen before saving it and printing it; (ii) the necessity of recalculating the map or cross section (using different options); and (iii) the editing you may wish to do later in Deluxe Paint.

<u>Editing, Annotating, and Printing</u>:

The maps or cross sections may be edited, annotated, resaved, and printed using Deluxe Paint, or they may be only edited and resaved, then loaded into a structured-draw program for higher quality annotations. A draw program is based on calculating vectors whereas a paint program is based on calculating a bit map. The draw program **must be** capable of **loading** the bit map image for annotation with high-quality scalable fonts and must be capable of simultaneously **printing** the bit-map image and the vector annotations. Professional Draw (Gold Disk, 1992) provides this facility. Furthermore, with Professional Draw the final map can be saved as a color Encapsulated PostScript File for printing on high-end, color, Post Script printers or for transferring the file to other computer platforms.

USER-FRIENDLY FEATURES

A considerable amount of effort went into making this program "a user-friendly program". The program is menu driven, and most responses require a single key stroke such as pressing a number, pressing Y or the <ENTER> key for (Yes), or pressing N for (No), pressing-any-key to continue, and pressing the <Esc> key to return to Main Menu. Where an input is required, the word: "Type" is used (instead of Press) and <ENTER> is shown at the end of the prompt statement (to indicate that an input is required and that it must be followed by pressing the <ENTER> key after each entry).

In order to load or save files, an Amiga-style File Requester is used. The use of the File Requester and its properties are described in the next section.

You will notice that at any part of the program you can always go back to a previous menu or to the Main Menu.

During the calculation and simultaneous color display of a given map or a cross section, or a sequence of depth slices (animation frames); you may pause the calculation by pressing

P and resume it by pressing any key, or you may abort the calculation by pressing <Esc> and then either restart it using the same or different options in the program, or simply return to the Main Menu.

When saving a file that already exists you will be prompted with a message as to Replace it, Append it, or Cancel. This protects against accidentally writing a new file over an existing file with the same name. If you select "Replace it", the old file will be completely replaced by the new file and no backup file is generated. If you select "Append it", the new file will be appended to the old file. This means that when entering a large data set, you do not have to complete entering the whole data set in one session because you can always append one segment of the data set to a previously entered one. If you select "Cancel", you return to the File Requester to save the file under a different file name.

The following several sections (The File Requester, Multitasking, ..., etc) are presented here to help you understand their general features before describing the actual flow of the Kolor-Map & Section program which begins with the section on "Starting The Program".

THE FILE REQUESTER

I modified and implemented a File Requester routine which is included as a utility program on the HiSoft BASIC Professional disks. This File Requester is used to load and save: data-files and image-files, in a style familiar to Amiga users. The File Requester (Figure 1) is composed of: a header window at the top; a main window that displays names of drives, directories, and files; a vertical slider on the right with two arrows at the bottom for automatically sorting and for scrolling names in the main window; two horizontal windows near the bottom named: Drawer and File, respectively; and four buttons at the bottom named: OK, Drives, Parent, and Cancel, respectively.

When the File Requester is accessed for the first time, the names of files and directories that exist in the same directory as the Kolor-Map & Section program will be displayed in the main window.

To start, click on the **Drives** button to display the available drives. Drive and Directory names are highlighted in red. Click in the vertical slider to alphabetize the drive names shown in the main window of the requester. Use the bottom arrows on the vertical slider to scroll up and down the alphabetized list of drives. In the main window, click on the name of the drive you wish to access then click on the name of the directory of your choice to open it. Files that have the extension (.info) are files with information related to

icons of the actual files; ignore them.

The two-horizontal windows (near the bottom of the File Requestor) are labelled **Drawer** and **File**, respectively. A yellow cursor indicates which of these two windows is active. To activate one of these windows, click the mouse pointer in the required window. The **Drawer** window shows the names of selected drives, directories, and subdirectories whereas the **File** window shows the name of the selected file. You may **double click** on the name of a file (in the main window) to load it.

If you know the name of a directory or a file, you may click in the **Drawer** or **File** window and type the name of the directory or file *without waiting* for the program to load all the directories or files and press <ENTER> or click on the **OK** button.

As you gain expertise in using this File Requester you will find that a combination of mouse clicks and some typing or editing in the **Drawer** and **File** windows is the fastest way to load or save files.

I modified the original File Requester code so that it will remember and display the drive, directory, and file that were used last. The original code always displayed the default directory where the program resided, and the user had to start "from the top" every time.

Useful tips about the File Requester:

1) Note that each File Requester displays a heading to remind you of what you are supposed to be doing. Example: Load XYZ, or Load Contours, etc.

2) Remember that clicking in the vertical slider sorts the file or directory names in the main window of the File Requester.

3) Clicking the mouse in the **File** window, clearing it, and typing the first few characters of the file you need, will trigger the main window to scroll and display the file name at the top of the main window. Another shortcut is to do the following: if the last file name was named xyz.data and now you wish to load xyz.contours, then (instead of scrolling up and down) just click in the File window, delete the word "data", and type c (for contours). If the file name xyz.contours exists, it will be displayed near the top of the main window. **Double click** on xyz.contours in the main window to load it. Thus, by editing a few characters of a file name, you force the main window to quickly scroll and display the set of files that are closest to what is being edited in the File window. In this way, you avoid typing errors and see whether the file name was xyz.contour or xyz.contours.

4) To move up a directory, click on the **Parent** button near the bottom of the requester. **Click once** if the yellow cursor is in the **Drawer** window, and **click twice** if the yellow cursor is in the **File** window (the first click will put the yellow cursor in the Drawer window and the second click will move the "event" up to the parent directory).

5) If you click the **CANCEL** button when you were about to save an ASCII file of a data set that you just entered, you will get the message: "Do you wish to discard the data you just entered! (Y/N)". If you press Y, you lose all the data you entered and return to the previous data-entering menu. If you press N, then you get the File Requester back to save the data. If you click the **CANCEL** button when you were about to save a map or cross section as an image (IFF file), but then you change your mind, you will return to a menu to regenerate the map or cross section at a different scale without having to reload the original data.

6) Do not use "/" or ":" in a file name. If you do, the program may crash or may not save the file, respectively. The "/" and ":" are reserved delimiters in AmigaDOS.

7) Pressing the Shift and Left-Arrow keys, or the Shift and Right-Arrow keys, moves the yellow cursor (in the **Drawer** window or in the **File** window) to the beginning or to the end of the text, respectively.

MULTITASKING

The program allows easy multitasking, memory permitting. There are three methods to access the Workbench (the Amiga's visual operating system) and hence launch other programs while the Kolor-Map & Section program continues to run. These three methods are well known to most Amiga users. The first method is to hold down the Left-Amiga key and press the m key (this applies to AmigaDOS 2.04 and higher; some utility programs running under AmigaDOS 1.3 use the n key instead of the m key). By doing this repeatedly, you successively display the stack of open screens and finally you get back to the program screen. This is the fastest and most foolproof method. The second method is to pull down the program screen by placing the mouse pointer at the top-horizontal screen bar (not the window bar), hold down the left mouse and drag the screen down to expose the screen behind it. The third method is to click in the upper right-hand gadget of the screen to place the present screen behind the one immediately behind it. If you are not using a SVGA monitor and AmigaDOS 2.04 then this third method may not be available, because the required gadget will be off the screen to the right.

Note: If you use multitasking and you return to the program screen and window, you may have to click the left

mouse button anywhere in the window to activate it (unless you have selected AutoPoint from the Utilities Drawer in AmigaDOS 2.04). The program window is active when its border is a solid color (usually white).

FILE TYPES

Files Generated or Loaded Using This Program:

1) (x,y,z) files. These are standard x,y,z files giving the station coordinates and the z-values at each station. The x,y,z values may be entered using this program or other programs (see next section). The maximum number of stations is 10,000.

2) VES numbers, and (x,y) coordinates of sounding stations. This file is used in conjunction with Layering Files (see next section) generated by the Zohdy-Bisdorf programs (Zohdy and Bisdorf, 1989; Bisdorf and Zohdy, 1990) to generate depth slices and animation frames. The maximum number of sounding stations is 500.

3) (x,y) file and corresponding (z) file (two separate files). In version 1.0 of the program, these files were used to generate depth slices, but now this function is performed more efficiently using the files described in item 2 above. This type of file could still be useful in generating geochemical, ground radiometric, or other types of maps in which the (x,y) coordinates of the measured quantity are the same but the z-values of the mapped substances are different. The maximum number of stations is 10,000.

4) VES Numbers, Distances, and Elevation of soundings along a profile. This file is used in conjunction with Layering Files (Zohdy and Bisdorf, 1989; Bisdorf and Zohdy, 1990) to generate cross sections. The maximum number of sounding stations along a profile is 50, and the maximum number of layers beneath each sounding is also 50.

5) Contour-Levels file. This file is used for storing contour values that are used in contouring the maps and cross sections. Different sets of Contour-Levels files may be generated and saved as separate files. The maximum number of contour levels is 13. These 13 levels separate 14 contour intervals. The generated maps or cross sections are composed of 14 colors plus black and white for a total display of 16 colors. The black and white colors are reserved for background and foreground colors.

6) AnimCounter File. This is a file automatically generated by the program to save critical information during the making of animation frames. It allows the program to resume the creation of animation frames after an interruption (e.g. power failure).

7) Z-Calc File. This is an optional file of z-values for input in the MakeVista program to generate a DEM (digital elevation model) file in VistaPro format. Note, the program "header.dem" must be in the same directory as the MakeVista program.

8) All data files, entered via the Kolor-Map & Section program, are saved as ASCII files and may be edited using any word processor that is capable of reading **and saving** ASCII files. Similarly all image files generated by the program are saved as IFF files and may be edited using Amiga paint programs.

9) IFF files. These are standard Amiga Files for images. IFF is abbreviation for Interleaved File Format.

Files Generated Using Other Programs:

1) Although the Kolor-Map & Section program allows you to enter a variety of data sets, it has limited editing facilities. Therefore, you may enter large data sets of (x,y,z) values using a word processor or a spread-sheet program that allows you to save the data as an ASCII file. If you use an external program, then make sure that there are no page breaks or extra carriage returns in the file before saving it. Any of these will prevent the file from being loaded in the Kolor-Map & Section program. ProWrite version 3.1 or higher (New Horizons, 1990) is a word processor for the Amiga that can show invisible delimiters and help edit them out if necessary. Make sure to save the edited file as a text-only file (ASCII file) when using ProWrite or any other text editor.

2) X,y,z data generated using MS-DOS programs should be saved on an MS-DOS formatted DS/DD 720 Kb disk. Such data can be read into the Amiga using CrossDOS. High-density disks can be used with the Amiga 4000.

3) **Layering Files** are files generated by the Zohdy-Bisdorf automatic interpretation programs (Zohdy and Bisdorf, 1989; Bisdorf and Zohdy, 1990). These are used in conjunction with the creation of depth slices or cross sections of interpreted resistivity. *Note: Inasmuch as layering files would have been generated on an IBM or compatible computer, the files should be copied from the floppy disk to the Amiga hard disk (using CrossDOS) to increase access speed and to avoid possible problems of saving files with long names to an MS-DOS formatted disk.*

4) An **Anim File** is a file generated by Deluxe Paint that groups and compresses animation-frame files into a single file.

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FILE FORMATS

1) **x,y,z files** must be in free form with blank spaces (or commas) between each value of x, y, and z and a carriage return at the end of each line.

2) **VES Number and (x,y) File (for depth slices).** For each sounding in the file: the VES Number of the sounding station must be on one line, and the x and y coordinates of the station must be on the following line. The x and y values must be separated by blank spaces or a comma and followed by a carriage return at the end of each line. The reason for placing the VES Number on a separate line is that it is saved and read as a string.

3) **(x,y) file and corresponding (z) file (two separate files).** The two separate files are free-form format files (see x,y,z file format above).

4) **VES Number, Distance, and Elevation file (for cross sections).** For each sounding in the file the VES Number of the sounding station must be on one line, and the distance to the previous station and the station elevation must be on the following line. The distance and elevation values are separated by blank spaces (or commas) and followed by a carriage return at the end of each line. The reason for placing the VES Number on a separate line is that it is saved and read as a string. *Note: This file format is different from version 1.0 of the program. Old files should be edited so that a carriage return is added after each VES Number.*

5) **Contour-Levels file.** Each contour level must be entered on a separate line.

6) **Layering Files.** Layering files contain the sounding title on one line, the depth units (meters, feet, etc) on a second line, and the number of layers on a third line. These three lines must be followed by a list of depths and corresponding resistivities. Each depth and resistivity is separated by blank spaces or a comma, and a carriage return at the end of each line. This is the file format generated by the Zohdy-Bisdorf programs (Zohdy and Bisdorf, 1989; Bisdorf and Zohdy, 1990).

SAVING AND LOADING IFF IMAGES

The Kolor-Map & Section program saves the generated maps and cross sections as standard overscan (704x480) 4-bit plane (16 color) IFF images.

The program can load any standard IFF image for viewing. Images loaded for viewing are not limited to the 4-bit plane (16 color) format, you can load 32 color images, HAM (Hold and

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modify) images, and DCTV images provided you have the DCTV
hardware (Digital Creations, 1990) to display them. The DCTV
must be hooked up to an NTSC (National Television Standards
Committee) monitor or to a proper television set with a
connector **and** a switch for video displays (as in most Sony
television sets).

If you load a Superbit map (provided the *screen format*
does not exceed 704x480 pixels), only the upper left corner of
the image will be viewed. Screen scrolling is not offered in
this program. A superbit map can have a *page size* > 704x480.

Do Not attempt to load an image made on a screen format
larger than 704x480 pixels and **do not** attempt to load a 24-bit
IFF file. Either image will crash the program.

SCREEN MODE AND COLOR PALETTES

The color maps or cross sections are generated on a
screen of 704 x 480 pixels (standard high-resolution
overscan). In this resolution, up to 16 colors can be used on
an Amiga 3000 or earlier. The AGA (Advanced Graphic
Architecture) chips, in the Amiga 4000, which can display 256
colors at any screen resolution are not supported in this
version of the program. The contour-interval values: above,
between, and below the contour levels are colored using 14
colors. Color-registers 0 and 1 (which are usually black and
white), in the 16 color palette, are deliberately not used in
coloring the map or cross section; instead, they are uniquely
used as foreground and background colors (to show the station
locations, the map frame, and for later annotations using
Deluxe Paint).

For screen display, the background color is black and the
station locations are shown in white, which makes viewing the
map on the screen more pleasing and reduces eye-strain (as
compared to a white background). However, before saving a
completed map or cross section, the two colors (0 and 1) may
be switched (optional), to provide a white background and a
black foreground for station-location symbols. The reason for
the switch is that a white background is much more preferred
than a black background for printing purposes. This color
switch could have been done later in Deluxe Paint; however,
this option in the Kolor-Map & Section program, saves you a
step and you do not have to remember to make the switch in
Deluxe Paint.

The color palette is generated by the program and you can
not modify it (except later when you use Deluxe Paint). The
highest z values on a map or cross section are colored with
color number 3 (Dark Red) and the lowest are colored with
color number 15 (Dark Blue), with a rainbow-color spread for
intermediate color numbers. The association of **low** color
numbers with **high** z values is *numerically* not very logical but

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it is *visually* more logical when using the Deluxe Paint III
Palette display, where color 3 is third from the **top** (high z
values) and color 15 is at the **bottom** (low z values). The
colors can be changed to any other colors using Deluxe Paint.
In fact, for best printing results, it may be necessary to
adjust some color *values* (as in: hue, saturation, and value)
depending on the printer and the printer driver being used.

Although the display screen in the program is in overscan
mode (704 x 480 pixels), the map or cross section area is
limited to a size of 615 x 365 pixels, this leaves adequate
space around the map or cross section for annotation without
having to change the page size in Deluxe Paint. You do not
have to remember any of these numbers, the program will
automatically scale the map or cross section to fit it
appropriately within the display area.

STARTING THE PROGRAM

When you double click on the KolorMap icon, you will open
the first window which states the name of the program, the
version, the author, the date and a brief description of what
the program does. To continue, press any key (as indicated at
the bottom of the window).

The second window is the Main Menu which is comprised of
ten items. In this program there are no pull down menus,
selections are made from the Main Menu (or other menus) by
pressing appropriate numbers. However, as mentioned above, an
Amiga style File Requester is used to load and save data or
image files, where almost everything can be done with a click
of the left-mouse button.

In the following sections I will briefly describe the
items under the Main Menu, what each one does, and what
subsequent menus it leads to, even though all the menus and
submenus contain instructions that are very much self
explanatory.

There are several similarities in the menus, submenus,
and options presented after selecting a given item in the Main
Menu. Features that are similar will be described only once
to avoid redundancy.

It is important to remember, before you start using the
program, that if, after loading data files, you press the
<Esc> key to return to the Main Menu, the data in memory is
cleared and you must reload the required data files. The
Return-to-Main-Menu message, however, has a warning to that
effect.

MAIN MENU

The main menu is comprised of 10 items. These are grouped into 3 categories: Enter data, Load data, and Quit. The Main Menu looks like this:

ENTER DATA:
1) Enter Map (x,y,z) data.
2) Enter Map (VES Nmbrs and x,y) data.
3) Enter Map (x,y) data .
4) Enter Map (z) data corresponding to above (x,y) data.
5) Enter Contour levels.
6) Enter Cross-Section data (VES Nmbrs,Distances,Elevations)

LOAD DATA:
7) Load Map data.
8) Load Cross-Section data.
9) Load IFF image.
   ----

   0) Quit.

Please press appropriate number.

Pressing a number will take you into a subsequent menu (when entering data) or will usually display the File Requester (when loading data). **In the next section, I will describe several features that also apply to the next 4 sections. For brevity, I will not repeat the description of these features in the subsequent sections.**

(1) <u>Enter Map (x,y,z) data:</u>

If you press 1 on the Main Menu, you get a new window that shows a station entry number and three successive prompts to enter X-data, Y-data, and Z-data. Start entering your data by typing the values for x, y, and z. You may enter data for up to 10,000 stations. When done entering your data, type 00 (Zero Zero) at the next X-data prompt. You will get the File Requester; it will have the heading (Save X,Y,Z) to remind you of what you are about to do.

If you realize that you do not have a directory already created (to save your files under) and assuming you are using AmigaDOS 2.04 or higher, *do not* click on the CANCEL button, instead use multitasking as described earlier to access the Workbench screen, create a new drawer (directory) by using the Workbench "Icons" pull-down menu. When done, hold down the Left-Amiga key and press m to return to the Kolor-Map & Section program. Activate the File Requester window with a mouse click, click on **Drives** button, select the appropriate drive and see the name of your newly created directory

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displayed in the main window.

You need not enter all your data in one session. You can
type 00 (Zero Zero) at any time at the X-data prompt, save the
data, and later enter some more data and append it to the
previous data set. If you type 00 (Zero Zero) in the Y-data
or Z-data prompt, the values entered in the immediately
preceding X-data (or the preceding X-data and Y-data prompts)
will be ignored. When saving a subsequent portion of the same
data set, use the same file name in the File Requester you
used previously (click on the Ok button or press <Enter>) and
then select "Append it" from the next menu.

You may edit any entry before you press <ENTER>. If you
think you made a mistake after entering a number and pressing
<ENTER>, you may: (a) Continue entering the data and correct
the mistake later using a text editor. (b) Type 00 (Zero
Zero), save what you have entered, then without exiting the
program, use multitasking (as described earlier) to launch a
word processor, fix the mistake, save the results as an ASCII
file, exit the word processor, get back to the program and
continue from the Main Menu by pressing 1. Enter and save the
next part of the data under the same file name and use the
Append option as described above. (c) Type mm to return to
the Main Menu (lose the data you entered) and start over!.

(2) <u>Enter Map (VES Number and x,y) data</u>:

If you press 2 on the Main Menu, you get a new window
showing instructions and an entry number that will be updated
automatically (1, 2, 3, 4, etc) as you enter your data. This
entry number is followed by prompts to type: the VES Number,
the Xdata, and the Ydata (Xdata and Ydata are the x and y
coordinates of the sounding station). The coordinates are
expected to be in length units of meters, kilometers (using
the Universal Transverse Mercator grid), feet, miles, or even
pixels (using Deluxe Paint coordinates), but not in latitude
and longitude or in township and range, etc. The sounding
number may include descriptive suffixes like S for smoothed, X
for extended, C for corrected, or any other letters. The rest
of the data entry procedure is the same as described above.
You may enter data for up to 500 sounding stations. When
ready to save your data type 00 (zero zero) and note that the
heading window of the File Requester now shows "Save VES Nmbr
& xy". This file will be used in conjunction with the
Layering Files generated by the automatic interpretation
program (Zohdy and Bisdorf, 1989) to generate interpreted
resistivity maps at given depths including those required to
make an animation (see section on loading map data).

(3) Enter Map (x,y) data:

If you press 3 on the Main Menu, you get a new window
that shows an entry number and a prompt to enter X-data
followed by a prompt to enter Y-data. The rest of the data
entry procedure is the same as described in the above section
for entering (x,y,z) data. When ready to save your data type
00 (zero zero) and note that the heading window of the File-
Requestor now shows "Save XY-Data" .

(4) Enter Map (z) data:

If you press 4 on the Main Menu, you get a new window for
entering z data. The rest of the data entry procedure is the
same as described in the section on entering (x,y,z) data.
The File Requester will show the heading "Save Z-data".

(5) Enter Contour levels:

If you press 5 on the Main Menu, you get a new window for
entering contour levels. The contour levels can be entered in
any order you wish and their values can be anything you think
is appropriate to the map or cross section you wish to
generate later. The contour values will be displayed in the
order you enter them. If you wish to enter less than 13
contour values type 00 (Zero Zero) and press <ENTER> to exit.
If you enter all 13 values then you need not type 00 (Zero
Zero) as the program will automatically exit the Contour Menu,
sort these values from high to low, and redisplay them in a
new window for your inspection.

The sorted contour values will be followed by the prompt
"Contour values look OK? (Y/N)". If you press Y or <ENTER>
you will get the File Requester to save the contour values.
The File Requester will show the heading "Save Contour". If
you press N, you will go back to the Contour Menu to reenter
the contour levels from the start.

**(6) Enter Cross-Section data (VES-Numbers, Distances, and
Elevations):**

If you press 6 on the Main Menu, you get a new window in
which you select the units (meters, kilometers, feet, etc)
that you will use for entering the distances and elevations
between the sounding stations. Press the appropriate number to
select the units and proceed to the next window.

*The units for distance between sounding stations, the
elevations, and the layer depths should all be the same (for
example: meters). If the units are different, for example:
feet for distances and elevations and meters for layer depths,
then the vertical exaggeration (to be selected later on) and*

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the displayed cross section will be incorrect.

The instructions in the next window fully describe what is needed: enter the sounding numbers along the cross section **starting with the sounding on the left side of the cross section**, enter the distances between successive sounding stations, and enter the elevation of each sounding station. If you entered this menu by mistake and you wish to return to the Main Menu, type mm and press <ENTER>.

For the distance of the first sounding station enter 0 (Zero). When done entering the sounding numbers, the successive distances, and successive elevations, type 00 (Zero Zero) and press <ENTER>. You will get the File Requester to save your file as described earlier. The File Requester will show the heading "Save NmbrDistnElevation".

Suggestions:

Usually, I create a directory with the name of the survey area (e.g. Barstow) then I create a subdirectory called "Cross Section Data" and then for the file name I may use the prefix "X" followed by the numbers of the first and last sounding stations on the cross section (e.g. 22 - 44) followed by a designation like EW for east west. For an extension (or suffix), I use data. Thus, the file name may be written as "X-22-48-EW.data". Such a long file name is allowed under AmigaDOS. Make sure however (when you use such a long file name) that you are saving them to an Amiga disk and not to an MS-DOS formatted floppy disk, otherwise CrossDOS will chop the file name down to an 8 charcter long name plus an extension of only 3 characters to make it conform to MS-DOS format. As mentioned earlier do not use "/" in a file name. It is a good idea to use the word "data", in the subdirectory name and in the file name, in order to distinguish these data files from cross-section image files which should be kept in a different subdirectory called Cross-Section Images and the file names of these images should have the extension .iff.

To abort the File Requester and start over, click on the **CANCEL** button. If you do, you will get a message (see section on File Requester) as to whether you wish to discard the data you just entered or not.

If at any time you think you made a mistake in entering the data, save the data you entered, edit it in a word processor, and resume entering the data.

(7) <u>Load Map data</u>:

If you press 7 on the Main Menu, you get a new window with three options:

1) Load (x,y,z) file then load contour values.

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2) Load VES Nmbrs & (x,y) file, to generate one Depth Slice or several Animation Frames.

3) Load (x,y) file, then load (z) file, then load contour values.

Several features and menus are common to the above three options. These features and menus will be described only in the first section on loading (x,y,z) files and will not be repeated in the subsequent sections.

(1) <u>Load an xyz file and Generate a Map</u>:

To load an (x,y,z) file, press 1 to display the File Requester and double click on the required (x,y,z) file name.

The next window will show the number of stations in the file you loaded, the map width and height, the maximum and minimum values of z (Zmax and Zmin), and a suggested value for the contour interval based on the values of Zmax and Zmin.

Furthermore, as indicated on the window, if you have not already created a file for the contour levels, you may press C on the keyboard to open the menu for entering the 13-contour levels. You may use the suggested contour interval or you may use any other suitable interval. Otherwise, if you already have a file for the contour levels, press any key to continue; later a File Requester will be automatically displayed for you to load the contour-levels file .

<u>Map Orientation</u>:

The next window prompts you as to whether the y-axis of your map points upward or downward. For most data sets the y-axis is positive upward and the x axis is positive to the right. Press the appropriate number to continue on.

<u>Map Rotation</u>:

The next window may or may not be displayed depending on whether your map dimensions represent a portrait form or a landscape form. If the map height is larger than the map width (portrait form) then the next window will state that, and ask you if you wish to rotate the map in order to maximize its size on the window (because the painting-area width of 615 pixels is larger than the painting-area height of 365 pixels). The displayed-map height in this window is not the absolute map height displayed in the previous window, instead it is an adjusted map height that takes into account the screen aspect ratio (which makes the display and the printing of the map have the correct proportions). This is a result of the fact that the pixels in this screen resolution are not square. You

need not be concerned with the displayed numbers for width and height. All you need to do is to decide whether you wish to rotate the map or not, but before you decide in favor of a rotated map of larger size please read the next section first.

Helpful tips regarding map rotation:

1) Keep in mind that if you rotate the map, the map will be larger and therefore the computations will take longer.

2) Later on, when you edit the map in Deluxe Paint, you will have to rotate all the labels to conform to the rotated map orientation. Do **not** attempt to rotate the map in Deluxe Paint. If you do, the resulting image will not have the correct aspect ratio.

3) Consider the fact that you may wish to keep the map in the portrait display because perhaps you may compute another map and using Deluxe Paint you may be able to place the second map next to first map on the same screen.

4) Remember that if you rotate a map and later you change your mind, you will have to reload the (x,y,z) file. Having to reload the data does not apply to other scaling choices in the program which will be discussed below.

Load Contours:

The next step is to load the Contour values. The Requester File will be automatically displayed and it will show the heading "Load ... Contours" to remind you of what you are supposed to do next. Simply double click on the appropriate contour-file name. The contours will be loaded and displayed with the prompt "Contours look OK? (Y/N)" which gives you the opportunity to make sure you loaded the correct set of contour values.

Taking the Logarithm of Z-Values:

If the z-values are all positive, a prompt will be displayed querying you about taking the logarithm of the z values. This is an important option in generating resistivity maps and cross sections. If you select to take the logarithm, then the logarithm of the contours will also be taken (automatically) and you will generate maps in which high resistivity contours do not extend into areas between low resistivity data points. Taking the logarithm of z-values results into pleasing and balanced resistivity maps and cross sections. If the map or cross section does not represent resistivity data, or if you do not wish to take the logarithm of z values, or if the map has negative z-values, then (for maps) a prompt will query you about possibly converting z-

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values that may represent depths to z-values that represent elevations above a certain datum.

Depth slices, animation frames, and cross sections (but not xyz maps) can be recomputed using different options *including* the option to take the logarithm without reloading the original data. For xyz maps, however, if you change your mind about taking the logarithm (similar to rotating the map, see above) you must reload the xyz file. Reloading the xyz file is not necessary for other scaling options.

Note: In creating depth slices do not hesitate to take the logarithm of z-values even if the value of Zmin = 0. Here Zmin simply indicates that the depth of the slice is larger than the probing depth of one or more soundings on the map. These soundings will be ignored and will be shown on the map as solid squares rather than open squares (see section on depth slices).

Scale Menu:

The next window displays a Scale Menu with three options and it also shows the width and height of the map in the original units of x and y. The three options are:

1) Auto Scale.

2) Specify Scale Factor multiplier.

3) Generate a map and a Z-data file for VistaPro.

Note: if you are generating a cross section instead of a map then option 3 above will not be displayed, and the Scale Menu will show the length of the cross section and the selected vertical exaggeration.

Normally, you would select option 1 to automatically scale the map to fit within 615 x 365 pixels (or to fit in one fourth that size as explained in the next section).

If you select option 2, then you will be prompted to enter a number (the scale factor multiplier) that will be multiplied by the map width and height to generate a specific map size in pixels. If the resulting map dimensions (in pixels) are too small or too large to fit on the screen, the program will let you know with a message to that effect. If the resulting map dimensions are reasonable, you will get a window that displays the map dimensions in pixels and a prompt asking you if this size is acceptable.

The main purpose of option 2 is to generate a map or cross section in which the present data set represents a subset or segment of a larger map or cross section data set.

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Later, you may load *another subset* that compliments (or better yet, overlaps) the first subset and then combine the two maps in a superbit map using Deluxe Paint. If this is what you plan to do, then **the value of the scale-factor multiplier must be the same for both maps**, so that the two maps will have the **same scale**. *For extra long cross sections that may be split in two or more parts, it is important to use the last sounding on the first part of the cross section as the first sounding on the second part of the cross section.*

If you press 3, you will generate a map in which the largest side is scaled to 258 pixels and you will have the opportunity to save a file of z-values that can be entered into VistaPro after using the utility program: MakeVista. During the course of generating a file of z-values for VistaPro, you will encounter a window that states **the width and height of the map in pixels (as it is scaled for VistaPro), with a message to copy these numbers down for later use in the MakeVista program.** Do just that.

Regardless of which option you select from the **Scale Menu**, some or all of the following menus will be displayed. Furthermore, *some or all of the following menus will be used when you are making a cross section and (for brevity) their function will not be repeated in the section on loading and displaying cross-section data.*

Map or Cross Section Size:

If you select Auto-scale, then the next window will present a choice of making the map or cross section at:

1) Full size.
2) 1/4 size (... good for testing).
3) Return to previous menu.

The prompts on this window are self explanatory. If you select option 2 from the above menu, you can later generate the full-size map or cross section without reloading the data.

Radius of Influence:

The next window will display a recommended value for the Radius of Influence and a prompt asking whether you wish to use the recommended value or to enter another value. If you press <ENTER>, then this means you wish to use the recommended value. The Radius of Influence is here defined as the radius around a grid point that is not a data point and hence does not have a z-value assigned to it yet. Z-values of stations that fall within this radius are used to compute an interpolated z-value at that grid point.

To speed up computations, the distance from a given grid

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point to a station is based on a diamond-shaped figure (rather than a circle) where only the absolute value of the distances in the x and y directions are used (rather than the square root of the sum of the squares).

For maps, the recommended radius of influence is equal to the square root of the ratio of the scaled-map area (in pixels) to the total number of stations; the result (average number of pixels around each station) is multiplied by a factor of 3.3. The 3.3 factor was determined empirically by computing several maps of different types and different station distribution patterns.

For cross sections, the recommended radius of influence is equal to the ratio of the length of the cross section to the number of sounding stations, and the result is multiplied by a factor of 2.5. Here, again, the 2.5 factor was determined empirically.

The smaller the radius of influence the faster the computations, and conversely. The smaller the radius of influence, however, the greater the chance that an inadequate number of stations is used to calculate representative interpolated values at certain grid points. If the radius of influence is so small that no stations are used in the computations, a void with zero-color number (black) will be created at those grid points. If an inadequate number of stations is used then a wavy-diagonal pattern will be displayed in that area of the map or section. **This wavy-diagonal pattern may show in parts of the map or cross section even when the recommended value for the radius of influence is used.**

Do not be alarmed by the appearance of voids or wavy-diagonal patterns, because this simply indicates lack of data in that area of the map or cross section, and these voids and patterns should be deleted from the map or cross section using Deluxe Paint. It is better to have voids and wavy patterns using a reasonable radius of influence to generate a map quickly, than to use a large radius of influence, spend a long time in computation, generate smooth contours everywhere on the map, only to delete these areas later (using Deluxe Paint) because of a lack of nearby stations.

For greater speed, you may use a radius of influence that is as small as half the recommended one provided the station distribution is dense enough and provided the stations are nearly spatially distributed on a grid. Later, after calculating and displaying the color map or cross section on the screen, if you do not like the results you can always "Redo" the map using different options without reloading the original data.

Grid Size

The next window displays several choices for a grid size ranging from 11x11 pixels to a 1x1 pixel grid. The window will also display a recommended grid size. The grid size of 11x11 is the coarsest and fastest, whereas the 1x1 grid is the finest and slowest.

A grid size of 1x1 pixel honors each original data point that can be represented within the pixel resolution of the scaled map or cross section. This grid size may be used when the number of stations is not very large (about 50 stations) and the stations are randomly distributed on the map. Even then, it is recommended to use a grid size of 3x3 pixels so that the computation of the map (including regridding) will be completed in a shorter period of time. If the data is already in a tightly gridded form (with the scaled distance between data points being only a few pixels apart), a grid size 1x1 may not produce the best results. For this type of data it is recommended to use either a coarser grid interval than the scaled data grid (which will act as a spacial low-pass filter) or to divide the original data set into two or more data subsets, each of which will not crowd the screen as much as the entire data set, and then recombine them into a single superbit map in Deluxe Paint.

The recommended grid size is based on the station density on the map or cross section. Generally you should *use the recommended grid size or some smaller value (except for tightly gridded data as mentioned above)*. The recommended grid size for maps (as opposed to cross sections) is based on the square root of the ratio of the scaled-map area (in pixels) divided by the number of stations. For cross sections, the recommended grid size is based on the scaled length of the cross section (in pixels) divided by the number of soundings.

Calculation and Display of a Color Map or Cross Section:

A grid with square elements is calculated on the basis of the selected grid size in pixels. The calculation of z values at each grid point is based on the z-values of all stations that fall within the radius of influence; the z-value at each of these stations is divided by the distance (from the station to the given point) raised to the fourth power. The sum of all these weighted z-values determines the interpolated value at the grid point. If a grid point coincides with the location of a station, then the z-value of that station is used at that grid point.

I experimented with several inverse distance power values (see Ldvill.iff file in the EXAMPLES directory on the disk). I used the inverse of the distance, the inverse of the square of the distance, the inverse of the cube of the distance, the inverse of the distance raised to the fourth power, as well as

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other in between values. I found that using the inverse of the cube of the distance or the inverse of the distance raised to the fourth power gave the best results. Using the inverse distance and the inverse of the square of the distance generated separate and spatially small anomalies; but the inverse cube or inverse of the distance raised to the fourth power generated a single significant anomaly. For speed of computations, I use the distance raised to the fourth power. *Note: the use of the inverse of the distance raised to the fourth power tends to (but does not always) create steep gradients in the interpolated areas and thus may enhance the appearance (or imply the presence) of faults or sharp boundaries on maps and cross sections.*

Subsequent to the calculation of "coarsely" gridded data, I use a bilinear interpolator to compute a smoothed version of the gridded data. Thus, if you select a grid size other than 1x1, you will get a pixelized display of the gridded map. Next, you will be asked if you wish to Smooth it (i.e. regrid it)? (Y/N). If you press Y, you will see the pleasing results of using the bilinear interpolator on the gridded data. The smoothing will progress from the bottom to the top of the map or cross section.

When the display of a map or cross section is completed, you may superimpose the color-coded values of the original station z-values and see how well the gridding routine did in honoring the original z-values (optional). You may also add the station locations on the map (optional). For cross sections, the station locations and the topography are automatically displayed.

For maps, the station locations may be plotted as squares (default), points, or may not be plotted at all. It is recommended not to plot the stations, if you wish to use the map in VistaPro and convert the map colors into elevations, or if you wish to drape the map on top of the corresponding DEM model. If you plan to convert the map colors into elevations using VistaPro then you must first use Deluxe Paint to reverse the color registers (using the Fill function) because VistaPro associates *high elevations* with *high color numbers*.

For cross sections, the digitized points beneath each sounding will be shown as points and the sounding stations will be shown as small solid triangles at the top of the simplified topography.

All of the above options are presented as prompts on a separate small window which also serves to let you know what is going on during calculations. You may move this small window around even during calculations or during the coloring of the map or cross section in order to see what is behind it. In standard Amiga style, you may move the small window by placing the mouse pointer at the top-horizontal bar of the window, hold down the left mouse button, and drag the small

window to a different location, and then release the mouse button. While you drag this window, the calculation or coloring of the map will pause until you release the mouse button.

You may pause or abort the calculation and simultaneous coloring of the map or cross section by pressing P or <Esc>, respectively. To resume the calculation after a pause, press any key.

When the coloring of the map or cross section is completed and you have responded to the subsequent prompts, you will be asked if you wish to reverse the black and white colors before saving, and finally you will be prompted to save the image.

If you press Y to save the image, you will get a message instructing you to exit all other programs that you may be running in a multitasking environment and to close their windows before saving the image. The reason for this message is that if you do not close the windows of the other applications, the Kolor-Map & Section program might save the contents of a window of another program instead of saving the map or cross section you just generated (even though the map or cross section is in the front screen!). This minor short coming will hopefully be eliminated in a future version of the program. When ready to save, press any key to continue. Next, a window will appear with information regarding the width of the map or cross section in the original units you used **and the horizontal scale in pixels.** *For cross sections, the vertical exaggeration also will be stated in the same window*. Copy this information down or use it in the file name, as it will be needed in Deluxe Paint to construct a scale. Press any key to continue, and you get the File Requester to save your map or cross section. You may use the extension (.iff) in the file name to indicate that this an image file.

If you press N to "save the image" prompt, or if you click on the **CANCEL** button on the File Requester, you will be asked if you wish to "Redo" the map or cross section using different options. If you press Y to "Redo" the map or cross section, you return to the Scale Menu when making a map, or you return to the Vertical Exaggeration Menu (described in a subsequent section) when making a cross section. If you press N to the "Redo" prompt you return to the Main Menu.

2) Load VES Numbers and (x,y) File:

To load a VES Numbers and (x,y) file, press 2 on the Load Map Data menu, to display the File Requester, and then double click on the required (VES-Nmbrs & xy) file name. The next window will show the number of stations that were loaded. Press any key to continue. A new window will display three

options:

> 1) Generate a single depth slice.
> 2) Generate a sequence of depth slices (for animation).
> 3) Return to Main Menu and discard loaded data.

Here is what the first-two options do:

> 1) <u>Generate a Single Depth Slice</u>:

If you press 1 you get a new window with a prompt to type the slice depth. Next, you will see the File Requester with the message in the heading window "Load Layering Files." Now, all you have to do is to click on the appropriate subdirectory that contains all the layering files which have the format of the resistivity automatic interpretation program (described earlier) then **double click on ANY file name that starts with the first four characters which describe the name of the survey area**. For example, if the survey area was called BARSTOW then all the layering files would start with the letters "BARS" followed by the sounding number (which is up to four more characters including any descriptive suffixes) and followed by the extension ".LYR" meaning layering. By clicking on the name of the subdirectory where the layering files are kept, opening it, and then double clicking on the name of any file that starts with the first 4 characters of the survey area, you have shown the program the **path** to these layering files. The program then will use the VES Numbers, from the already loaded "VES Nmbr & (x,y) file", to successively load the layering files and successively calculate the resistivities at the required depth.

After selecting all the options that lead to the generation of the map (see section on loading x,y,z data), you will have the choice either to "Redo" the map or to return to the Main Menu. If you select "Redo" then you get back to the Slice Depth menu and you may enter the same or a different depth value and go through the various options that lead to the generation of another map.

If you select a slice depth that is deeper than the probing depth of some of the soundings, then the stations of these soundings will be shown on the map as **solid** squares whereas the stations of soundings that do probe to that depth, will be shown as **open** squares. The maximum probing depth is here defined as approximately 50 percent greater than the depth to the **top** of the bottom "infinitely thick" layer. If the slice depth you selected is deeper than the probing depth of *all* the soundings, you will generate a black map showing only the station locations as solid-white squares.

> 2) <u>Generate a Sequence of Depth Slices (for Animation)</u>:

If you press 2 to generate a sequence of depth slices

(that is: animation frames), you will be asked if this is a continuation of a partially generated sequence of frames.

If you press Y, you will get the File Requester with a message on the screen prompting you to load a file named "AnimCounter" from the subdirectory where you have saved the previously generated animation frames.

The AnimCounter file is generated automatically by the program and it has all the necessary information regarding your previous selections of various menu options for the maps you were generating. Needless to say this file is a great time saver in case you had to terminate the automatic generation of the animation frames or the computer was turned off because of power failure or other reasons.

If you press N, then the next window will show the following three prompts:

       Shallowest depth (must be > 0) ..... =
       Deepest depth (must be > 0) .... =
       Number of Slices (must be >= 2) .... =

The number of slices includes: the shallowest-depth slice, the in-between slices, and the deepest-depth slice.

The next window will display the File Requester with a prompt in the heading window to "Load Layering Files." Follow the same instructions used to show the **path** to the layering files for a single slice (see above section) and then double click on ANY file name that starts with the first 4 characters of the name of the survey area.

When generating a sequence of slices, the program defaults to Auto Scale (see Scale Menu) and the Scale Menu is not displayed. Similarly, the possibility to rotate the map is ignored and the Map Rotation option is not displayed. All other menus mentioned under the (x,y,z) file will be displayed.

After you generate the first depth-slice map (the first animation frame) you will be asked if you wish to save it. Using the File Requester, click on the directory name where you wish to save these animation frames (it is a good idea to create a special subdirectory for this purpose). In the File Requester, type the name for the first frame using the first 4 characters in the name of the survey area followed by 0001.iff. For example, if the survey area is named "Barstow", then type Bars0001.iff. Upon saving the first frame, the program will take over (as it now knows the **path** to where you wish to save all the animation frames, and it also knows the options you have selected for generating the first frame) and successively generate and save the required number of frames, unattended. The depth of each slice will be displayed in the lower-right corner of each map (animation frame).

Similar to the generation of a single depth slice, soundings that do not probe to a given depth are shown as solid squares whereas those that do probe to the given depth are shown as open squares. If the maximum depth you selected is deeper than the probing depth of all the soundings, then at the depths where this condition occurs, the program will generate black maps showing only the station locations as solid squares.

Note: If you wish to do multitasking during the automatic generation and saving of animation frames, then remember to close the windows of other programs before the automatic saving of each animation frame. Or, you may either pause or abort the generation of the animation frames while you do multitasking by pressing P or <Esc>, respectively.

The saved animation frames may be edited, played, or saved as a single Anim File, using the powerful features of Deluxe Paint.

3) Load an xy-file and corresponding z-file:

This option was used in version 1.0 of the Kolor Map and Section program (Zohdy, 1993) for making interpreted-resistivity maps at selected depths while using the same (x,y) coordinates; but now this function is replaced by using the more elegant depth slice and animation frames options described above. This option, however, may still be useful in generating geochemical or ground-gamma-ray spectrometry maps. The "concentration" of a variety of elements, element ratios, or compounds may be displayed on different maps using the same (x,y) coordinates file.

There is only one prompt that is different from loading an xyz file. The program will query you as to whether you should adjust the aspect ratio in the y-direction. The instructions on the window state that you should press N only if you read the x and y coordinates in pixels using Deluxe Paint.

The Completed Map:

When an (x,y,z) map, a single depth- slice map, a sequence of animation frames, or an (x,y) and associated z-values map, is generated and saved as an IFF file(s), the single IFF file or a whole sequence of IFF animation frames may be loaded and edited in Deluxe Paint (Figure 2) where:

1) A map scale is added as follows: in Deluxe Paint, click the right mouse button on the straight-line icon, click the "Every Nth Dot" button, type the value of the map scale in pixels in the little window and press <ENTER>, then click on

the OK button. Now press the left mouse and drag it to
generate a few dots. The distance between any two dots
represents the correct scale for the map or cross section.
Click the right mouse button on the straight-line icon, click
on the Continuous button and then click on OK. Connect any
pair of dots by a straight line and annotate the scale.

    2) A resistivity (or z value) scale is added.

    3) Areas where there are no nearby stations are deleted.

    4) A title or figure caption is added.

It is beyond the scope of this manual to describe all the
editing and animation-display possibilities that can be done
with Deluxe Paint.

8) Load Cross-Section data:

If you press 8 on the Main Menu, you will get the File
Requester to load the data file for VES Numbers, Distances,
and Elevations. The File Requester will show the heading
"Load VesNmbr, Dist, Elevtn" to remind you of what is needed.
Load the required file by double clicking on its name. The
next window will display a table of the data you loaded.

Next, the File Requester will be displayed so that you
may load the layering files of the successive sounding
stations on the cross section. The heading of the File
Requester will prompt you with the message "Load Layering
Files". Double click on the name of ANY file (in the layering
subdirectory) that starts with the first 4 characters in the
name of the survey area, and the program will automatically
load all the required layering files for this cross section.
This procedure is similar to automatically loading the
layering files for generating depth slices (described
earlier).

*NOTE: This procedure is different but much easier than
the procedure for loading layering files in version 1.0 of the
program. Old "VES Nmbrs,Distances & Elevation" files, that
were generated using version 1.0 of the program, must be
edited so that for each sounding along the cross section, the
VES Number must be on one line, and the Distance and Elevation
values must be on the following line.*

When the layering files are loaded, the next window will
display the largest and smallest z-values in the cross
section, and a prompt will ask you about the existance of a
file with appropriate contour levels. If you already have
such a file, press Y, otherwise press N and the program will
take you to the Contour Entry menu.

<u>Vertical Exaggeration:</u>

The next window displays the Vertical Exaggeration Menu. The available options are as follows: None (No vertical exaggeration), times 2, times 3, times 4, times 5, times 10, and times 20. Select the vertical exaggeration you wish.

The next window will have a menu prompting you to select 1) Full Cross-Section, or 2) Upper-Part of Cross- Section. If you press 1, then this means you wish to calculate and display the entire cross section. If you press 2, then this means you wish to calculate and display only the upper part of a vertically exaggerated cross section which fills the *upper half* of the display window. For either selection, the cross section will be scaled so that its length will fill the allocated width (615 pixels) of the display window. Thus all cross sections (vertically exaggerated or not) will have the same horizontal scale.

For some cross sections (with large depths and relatively short lengths), even the selection of "no vertical exaggeration" may result in the display of a message stating that the entire depth of the cross section cannot be displayed if its length is to fill the width of the window. You may direct the program (by selecting amongst the displayed options) to rescale the cross section so that its length does not fill the entire width of the window and thus enable the entire depth of the cross section to be displayed.

Note that when displaying only the upper part of a cross section, you will get a message indicating the percentage of the cross section that will be displayed in the vertical direction.

The purpose of calculating and displaying only the upper portion of a vertically-exaggerated section is that it is often desirable to calculate two cross sections: one in which only the upper portion of the cross section is vertically exaggerated and at the same time leave enough space below it to place the non-vertically exaggerated version of the complete cross section (using Deluxe Paint).

If you select a large vertical exaggeration and you select the Upper-Part representation of the cross section, and if the topography along the cross section is pronounced; then the bottom line of the cross section (which by definition coincides with the horizontal line that bisects the window) may intersect the topography line. If this happens, you will get a warning message stating that: the cross section will be truncated, and that the soundings that lie at elevations below the bottom line (maximum calculated depth) will not be shown on the cross section, and that you should either select a smaller vertical exaggeration or you may proceed to see how the truncated cross section looks.

<u>Xstretch</u>:

Xstretch is a parameter that attempts to stretch the subsurface anomalies in a horizontal direction so that cross sections will look like cross sections rather than look like maps. The manipulation of the shape of the subsurface anomalies only affects the interpolated values between the actual layering data. <u>It does not change the original data points</u>. I have implemented two Xstretch values: XstretchBtm and XstretchTop to define Xstretch at the bottom and at the top of the cross section, respectively. I use a linear interpolator between the bottom and top values of Xstretch to generate a spread of Xstretch values which are then applied from the bottom to the top of the cross section. The larger the value of Xstretch the greater the stretch in the horizontal direction.

The next window will display two recommended values for the Spread of Xstretch and a message that if you wish to change them then you should use values between Xstretch > 0 and Xstretch <= 20. Usually you should use smaller values for the bottom of the section and larger values of Xstretch for the top of the section. You may experiment with different Xstretch values to see the effect of this function. Generally the given default values of Xstretch are a good choice but depending on the cross section a better or more pleasing representation may be generated by selecting different Xstretch values.

The Xstretch.iff image in the EXAMPLES directory shows a top figure using a uniform Xstretch Spread with XstretchTop = XstretchBtm = 1 (thus forming rounded anomalies, which look odd on a cross section), whereas the bottom figure shows a uniform Xstretch Spread with XstretchTop = XstretchBtm = 5 (thus forming horizontally elongated anomalies which look like what one would expect to see on a cross section). This IFF image, in the EXAMPLES directory, displays two "equivalent" cross sections, both cross sections honor the original data but one is more geologically reasonable than the other.

The next sequence of windows and options (Scale Menu, etc) have already been discussed earlier and will not be repeated here.

<u>The Completed Cross Section</u>:

When a cross section is completed (Figure 3), it will have a top line of variable height representing the topography and the location of the sounding stations will be shown as triangles located above of the topographic line. Furthermore, beneath each sounding, there will be points which represent the sampling points from the layering file. The bottom point beneath each sounding station shows the maximum probing depth

for that sounding. These bottom points can be used as a guide in Deluxe Paint to erase (whiten out) those parts of the cross section at depths that are deeper than the maximum probing depth. You may also place question marks (?) at appropriate parts of the cross section. Using Deluxe Paint you add horizontal and vertical scales and a scale for the interpreted resistivity (see previous section on "The Completed Map").

9) Load IFF Image:

    If you press 9 on the Main Menu, you will get a window with a message on how to exit the image display **after** viewing it. The message will state that to exit the image display: first press any key to exit and if nothing happens, then click the mouse in the upper left corner. The mouse click is required to exit images that were edited and resaved in Deluxe Paint. The File Requester will be displayed to load the IFF image. This option is used to view examples of maps and cross sections that were generated using this program (see EXAMPLES section below for further details). When done viewing the images you wish to display, click on the Cancel button to return to the Main Menu. As mentioned earlier, several types of images can be loaded for viewing, including those that were not generated using the Kolor-Map & Section program (see section on SAVING AND LOADING IFF IMAGES).

0) Quit:

    If you press 0 on the Main Menu, you will get a window with the message "Are you sure you want to Quit? (Y/N)". If you press Y, you exit the program, and if you press N you return to the Main Menu.

EXAMPLES

    On the program disk, there is a drawer (directory) called EXAMPLES. This drawer contains small data files that you may load to practice generating maps and cross sections; there are also examples of IFF images and an animation file, all of which were generated using the Kolor-Map & Section program. Some of the IFF images were edited and annotated in Deluxe Paint. One of the IFF files shows depth to basement in 3-D shaded relief using VistaPro. The complete annotated version of this example is in Zohdy and Bisdorf (1991) where VistaPro was used to generate the 3-D shaded relief and ProDraw was used to annotate the figure with high quality scalable fonts. You may view these IFF images using option 9 on the Main Menu, and you may view the animation file using Deluxe Paint or any other animation player.

PROGRAM MAKEVISTA

As mentioned earlier, MakeVista is a separate utility program that converts z-values generated by the Kolor-Map & Section program into a file that is readable by VistaPro. Before you run the MakeVista program, make sure that the file called "header.dem" is in the same directory as MakeVista. Also make sure that you have the map width and map height in pixels available for input into MakeVista. These values were specifically displayed in the Kolor-Map & Section program with instructions to copy them for this purpose.

To run MakeVista, double-click on its icon. This will open a window in which you are prompted for the path to the input file of z-values generated by the Kolor-Map & Section program, and a second prompt for the path and name of the output file. It is recommended that the output-file name have an extension of ".DEM". Also you will be prompted to input the map height and map width in pixels (one or both of these numbers will be equal to 258). Once you successfully generate the DEM (Digital Elevation Model) file, you may load that file into VistaPro, but before rendering in VistaPro, you must load a color map. A color map in VistaPro terminology is equivalent to a color Palette. One of VistaPro features is the ability to load, modify, and save color maps. You may have to use the vertical exaggeration function in VistaPro to generate reasonable "topography" on the loaded z-values surface. Now you can render 3-D shaded reliefs. When satisfied with the results, resave the DEM file (i.e. use the same name) using VistaPro. In this way, you generate a smaller file size and that file will also have the color-map information stored in it. Once this is done, you may delete the z-value file generated earlier.

ACKNOWLEDGEMENTS

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Appendix

Kolor-Map & Section Program Listing

```
' Program Kolor-Map & Section version 2.0
' By
' Adel A.R. Zohdy, USGS
' Last compiled on November 8, 1993

OPTION BASE 1
REM $OPTION k3100

DEFINT i-n

DIM Xd (10000), Yd(10000), Zd(10000), ContourLvl(13),ContourLvlTemp(13)
DIM VESNmbr$(500), VESNmbrTemp$(500), Xdist(50), Elevation(50), ElevationTemp (50),DN(13)
DIM XdTemp (10000), YdTemp(10000), ZdTemp(10000), YdTemp2(50), ZdTemp2(50)
DIM XdTemp3(500), YdTemp3 (500), Zcalc(630,380), HZcalc(630,380)
DIM ZcalcY(630,380)

ON ERROR GOTO ChkError

LIBRARY "extend.library"

' When compiling, several warning messages will be displayed because of
' arp.library duplicate commands with the extend.library,
' ignoring the warnings and pressing Yes to continue .. works!
' Note: To Compile this program: the arp.library, arp.bmap, extend.library,
'       and extend.bmap must be placed in the System Libs directory.
' Note: Window Size is made smaller than could be to make it look OK on
'       Amiga 4000 and Amiga 2000!  Screen Size is bigger than what
'       Amiga 4000 under AmigaDOS 3.0 can show under HiResInterlaced!.

        SCREEN 1,704,480,4,4
        WINDOW 1,"",(15,15)-(640,400),16,1
        GOSUB Palet1
        COLOR 1,2
Title:
        CLS
        a$ = "P r o g r a m   K o l o r - M a p   &   S e c t i o n "
                Center 4, a$
        a$ = " By "
                Center 8, a$
        a$ = " Adel A.R. Zohdy "
                Center 10, a$
        a$ = " U.S. Geological Survey, Denver, Colorado. "
                Center 12, a$
        a$ = " Amiga Version 2.0 "
                Center 16, a$
        a$ = " Compiled November 8, 1993. "
                Center 18, a$
        a$ = " Program for Entering, Loading, Computing, Displaying and "
                Center 22, a$
        a$ = " and Saving: Map and Cross-Section data and images."
                Center 24, a$
        a$ = " Color images are saved as standard IFF files. "
                Center 26, a$
        PRINT
```

```
                PRINT
                GOSUB PrsAnyKey
                GOTO StartHere


MainMenu:
                GOSUB Initlz
StartHere:
                CLS
                PRINT
                a$ = " Main Menu "
                        Center 2, a$
                LOCATE 6,10
                        PRINT " ENTER DATA: "
                LOCATE 8,10
                        PRINT "    (1) Enter Map (x,y,z) data."
                LOCATE 10,10
                        PRINT "    (2) Enter Map (VesNmbrs and x,y). "
                LOCATE 12,10
                        PRINT "    (3) Enter Map (x,y) data. "
                LOCATE 14,10
                        PRINT "    (4) Enter Map (z) data corresponding to above (x,y)."
                LOCATE 16,10
                        PRINT "    (5) Enter Contour levels. "
                LOCATE 18,10
                        PRINT "    (6) Enter Cross-Section data (VesNmbrs,Distances,and Elevtns)."
                LOCATE 19,10
                        PRINT " ----------------------------------------------------------"
                LOCATE 22,10
                        PRINT " LOAD DATA:"
                LOCATE 24,10
                        PRINT "    (7) Load Map data."
                LOCATE 26,10
                        PRINT "    (8) Load Cross-Section data."
                LOCATE 28,10
                        PRINT "    (9) Load IFF image. "
                LOCATE 29,10
                        PRINT " ----------------------------------------------------------"

                LOCATE 32, 10
                        PRINT "    (0) Quit. "
                LOCATE 34,10
                        PRINT " Please press appropriate Number."

                PrsNmbr 9, a$
                IF a$ = CHR$(27) THEN Title
                Nmbr = VAL(a$)
                IF Nmbr = 0 THEN Kwit

ON Nmbr GOTO
EnterXYZ,EnterVESNmbrNxy,EnterXY,EnterZ,EnterContour,EnterXnID,MakeMap,MakeSection,IFFLo
ad
```

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```
EnterXYZ:

        CLS
        i = 1
        a$ = " Enter XYZ-data "
        Center 6,a$

        LOCATE 10,5
                PRINT " Type X-data <ENTER>,  Y-data <ENTER>, and Z-data <ENTER> "
        LOCATE 12,5
                PRINT " * When done, type 00 (ZeroZero) for X-data  "
        LOCATE 14, 5
                PRINT " * To Return to MainMenu and Discard Data ... type MM <ENTER> "
        XdRow = 20 : XdColumn = 20
        YdRow = 20 : YdColumn = 38
        ZdRow = 20 : ZdColumn = 56


EnterXdXYZ:
        LOCATE 20,2
                PRINT "Entry Number =";i
        LOCATE XdRow, Xdcolumn + 9
                PRINT STRING$(7, " ")
        LOCATE XdRow, YdColumn
                PRINT " Xdata = "
        LOCATE YdRow , YdColumn
                PRINT " Ydata = "
        LOCATE ZdRow, ZdColumn
                PRINT " Zdata = "
        LOCATE XdRow, XdColumn
                LINE INPUT " Xdata = ", Xd$
        IF Xd$ = "MM" OR Xd$ = "mm" THEN MainMenu
        IF Xd$ = "" THEN BEEP: GOTO EnterXdXYZ
        IF Xd$ = "00" THEN ExitXYZ
        IF Xd$ = "0" THEN GOTO EnterYdXYZ
        IF VAL(Xd$) = 0 THEN BEEP: GOTO EnterXdXYZ


EnterYdXYZ:
        LOCATE YdRow, YdColumn + 9
                PRINT STRING$(7," ")
        LOCATE YdRow , YdColumn
                LINE INPUT " Ydata = ", Yd$
        IF Yd$ = "MM" OR Yd$ = "mm" THEN MainMenu
        IF Yd$ = "" THEN BEEP : GOTO EnterYdXYZ
        IF Yd$ = "00" THEN ExitXYZ
        IF Yd$ = "0" THEN GOTO EnterZdXYZ
        IF VAL(Yd$) = 0 THEN BEEP: GOTO EnterYdXYZ


EnterZdXYZ:
        LOCATE ZdRow, ZdColumn + 9
                PRINT STRING$(7," ")
        LOCATE ZdRow , ZdColumn
```

```
                LINE INPUT " Zdata = ", Zd$
      IF Zd$ = "MM" OR Zd$ = "mm" THEN MainMenu
      IF Zd$ = "" THEN BEEP : GOTO EnterZdXYZ
      IF Zd$ = "00" THEN ExitXYZ
      IF Zd$ = "0" THEN GOTO Evaluate
      IF VAL (Zd$) = 0 THEN BEEP: GOTO EnterZdXYZ


Evaluate:
      Xd(i) = VAL (Xd$)
      Yd(i) = VAL (Yd$)
      Zd(i) = VAL (Zd$)


ExitXYZ:
      IF Xd$ = "00" OR Yd$ = "00" OR Zd$ = "00" THEN
              i = i-1


SaveXYZ:
                Work$ = "SaveXYZ"
                CLS
                ReqMsg$ = "Save XYZ-data"
                GOSUB GetReq
                IF Worked% = 0 THEN     ' Worked% = 0 means Cancel button was clicked
                        CLS
                        LOCATE 10,10
                                PRINT " Do you wish to discard the data you entered! (Y/N)"
                        YsNo a$
                        IF a$ = "Y" THEN
                                GOTO EnterXYZ
                        ELSE
                                GOTO SaveXYZ
                        END IF
                END IF
                CLS
                FileExists% = -1
                OPEN File$ FOR INPUT AS #1
                CLOSE #1


WriteXYZ:
                IF FileExists% = -1 THEN
                        LOCATE 10,10
                                PRINT File$
                        LOCATE 14,10
                                PRINT " Above File Exists."
                        LOCATE 18,10
                                PRINT " Append it (A),  Replace it (R), or Cancel (C) ?"
                        GOSUB wayt
                        a$ = UCASE$(a$)
                        IF a$ = "R"  THEN OPEN File$ FOR OUTPUT AS #1
                        IF a$ = "A" THEN OPEN File$ FOR APPEND AS #1
                        IF a$ = "C" THEN GOTO SaveXYZ
```

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```
                    IF a$ <> "R" AND a$ <> "A" AND a$ <> "C" THEN BEEP : GOTO
WriteXYZ
            END IF

            IF FileExists% = 0 THEN
                    OPEN File$ FOR OUTPUT AS #1
            END IF


            FOR j = 1 TO i
                            PRINT #1, Xd(j), Yd(j), Zd(j)
            NEXT j
            CLOSE #1
            CLS
            LOCATE 20,20
                    PRINT "(x,y,z) File saved!"
            GOSUB PrsAnyKey
            GOTO MainMenu
        END IF
        i = i + 1
        GOTO EnterXdXYZ


'_____

EnterXY:
        CLS
        i = 1
        a$ = " Enter XY-data"
        Center 6,a$
        LOCATE 10,5
                PRINT " Type X-data <ENTER> and Y-data  <ENTER> "
        LOCATE 12,5
                PRINT " * When done, type 00 (ZeroZero) for X-data and Y-data <ENTER> "
        LOCATE 14, 5
                PRINT " * To Return to MainMenu and Discard Data ... type MM <ENTER> "
        XdRow = 20 : XdColumn = 30
        YdRow = 20 : YdColumn = 50


EnterXd:
        LOCATE 20,5 : PRINT "Entry Number = "; i
        LOCATE XdRow, Xdcolumn + 9 : PRINT STRING$(5, " ")
        LOCATE XdRow, YdColumn
        PRINT " Xdata = "
        LOCATE YdRow , YdColumn
        PRINT " Ydata = "
        LOCATE XdRow, XdColumn
        LINE INPUT " Xdata = ", Xd$
        IF Xd$ = "MM" OR Xd$ = "mm" THEN MainMenu
        IF Xd$ = "" THEN BEEP: GOTO EnterXd
        IF Xd$ = "00" THEN ExitXd


EnterYd:
        LOCATE YdRow, YdColumn + 9 : PRINT STRING$(5," ")
```

```
          LOCATE YdRow , YdColumn
          LINE INPUT " Ydata = ", Yd$
          IF Yd$ = "MM" OR Yd$ = "mm" THEN MainMenu
          IF Yd$ = "" THEN BEEP : GOTO EnterYd
          Xd(i) = VAL (Xd$)
          Yd(i) = VAL (Yd$)


ExitXd:
          IF Xd$ = "00" OR Yd$ = "00" THEN
                    i = i-1

SaveXY:
                    Work$ = "SaveXY"
                    CLS
                    ReqMsg$ = "Save XY-data"
                    GOSUB GetReq

                    IF Worked% = 0 THEN       ' Worked% = 0 means Cancel button was clicked
                            CLS
                            LOCATE 10,10
                                    PRINT " Do you wish to discard the data you entered! (Y/N)"
                            YsNo a$
                            IF a$ = "Y" THEN
                                    GOTO EnterXY
                            ELSE
                                    GOTO SaveXY
                            END IF
                    END IF
                    CLS
                    FileExists% = -1
                    OPEN File$ FOR INPUT AS #1
                    CLOSE #1


WriteXY:
                    IF FileExists% = -1 THEN
                            LOCATE 10,10
                                    PRINT File$
                            LOCATE 14,10
                                    PRINT " Above File Exists."
                            LOCATE 18,10
                                    PRINT " Append it (A),  Replace it (R), or Cancel (C) ?"
                            GOSUB wayt
                            a$ = UCASE$(a$)
                            IF a$ = "R"  THEN OPEN File$ FOR OUTPUT AS #1
                            IF a$ = "A" THEN OPEN File$ FOR APPEND AS #1
                            IF a$ = "C" THEN GOTO SaveXY
                            IF a$ <> "R" AND a$ <> "A" AND a$ <> "C" THEN BEEP : GOTO WriteXY
                    END IF

                    IF FileExists% = 0 THEN
                            OPEN File$ FOR OUTPUT AS #1
                    END IF
```

```
                    FOR j = 1 TO i
                                PRINT #1, Xd(j), Yd(j)
                    NEXT j
                    CLOSE #1
                    CLS
                    LOCATE 20,20
                            PRINT "(x,y) File saved!"
                    GOSUB PrsAnyKey
                    GOTO MainMenu
            END IF
            i = i + 1
            GOTO EnterXd




EnterVESNmbrNxy:

            CLS
            i = 1
            a$ = " Enter VesNmbrs and x,y -data "
            Center 6,a$

            LOCATE 10,5
                    PRINT " Type VES Nmbr <ENTER>,  x-data <ENTER>, and y-data <ENTER> "
            LOCATE 12,5
                    PRINT " * When done, type 00 (ZeroZero) for VES Nmbr "
            LOCATE 14, 5
                    PRINT " * To Return to MainMenu and Discard Data ... type MM <ENTER> "
            VESRow = 20 : VESColumn = 20
            XdRow = 20 : XdColumn = 38
            YdRow = 20 : YdColumn = 56

EnterVESNmbr:
            LOCATE 20,2
                    PRINT "Entry Number =";i
            LOCATE VESRow, VEScolumn + 9
                    PRINT STRING$(7, " ")
            LOCATE VESRow, VESColumn
                    PRINT " VES Nmbr = "
            LOCATE XdRow , XdColumn
                    PRINT " Xdata = "
            LOCATE YdRow, YdColumn
                    PRINT " Ydata = "
            LOCATE VESRow, VESColumn
                    LINE INPUT " VES Nmbr = ", VESNmbr$
            IF VESNmbr$ = "MM" OR VESNmbr$ = "mm" THEN MainMenu
            IF VESNmbr$ = "" THEN BEEP: GOTO EnterVESNmbr
            IF VESNmbr$ = "00" THEN ExitVESNmbrNxy
            IF VESNmbr$ = "0" THEN GOTO EnterXdVES


EnterXdVES:
```

```
        LOCATE XdRow, XdColumn + 9
                PRINT STRING$(7," ")
        LOCATE XdRow , XdColumn
                LINE INPUT " Xdata = ", Xd$
        IF Xd$ = "MM" OR Xd$ = "mm" THEN MainMenu
        IF Xd$ = "" THEN BEEP : GOTO EnterXdVES
        IF Xd$ = "00" THEN ExitVESNmbrNxy
        IF Xd$ = "0" THEN GOTO EnterYdVES
        IF VAL(Xd$) = 0 THEN BEEP: GOTO EnterXdVES

EnterYdVES:
        LOCATE YdRow, YdColumn + 9
                PRINT STRING$(7," ")
        LOCATE YdRow , YdColumn
                LINE INPUT " Ydata = ", Yd$
        IF Yd$ = "MM" OR Yd$ = "mm" THEN MainMenu
        IF Yd$ = "" THEN BEEP : GOTO EnterYdVES
        IF Yd$ = "00" THEN ExitVESNmbrNxy
        IF Yd$ = "0" THEN GOTO Evaluate
        IF VAL(Yd$) = 0 THEN BEEP: GOTO EnterYdVES

EvaluateVESNmbrNxy:
        Xd(i) = VAL (Xd$)
        Yd(i) = VAL (Yd$)
        VESNmbr$(i) = UCASE$(VESNmbr$)


ExitVESNmbrNxy:
        IF VESNmbr$ = "00" OR Xd$ = "00" OR Yd$ = "00" THEN
                i = i-1


SaveVESNmbrNxy:
                Work$ = "SaveVESNmbrNxy"
                CLS
                ReqMsg$ = "Save VES Nmbr & xy"
                GOSUB GetReq
                IF Worked% = 0 THEN     ' Worked% = 0 means Cancel button was clicked
                        CLS
                        LOCATE 10,10
                                PRINT " Do you wish to discard the data you entered! (Y/N)"
                        YsNo a$
                        IF a$ = "Y" THEN
                                GOTO EnterVESNmbrNxy
                        ELSE
                                GOTO SaveVESNmbrNxy
                        END IF
                END IF
                CLS
                FileExists% = -1
                OPEN File$ FOR INPUT AS #1
                CLOSE #1

WriteVESNmbrNxy:
                IF FileExists% = -1 THEN
```

```
                    LOCATE 10,10
                            PRINT File$
                    LOCATE 14,10
                            PRINT " Above File Exists."
                    LOCATE 18,10
                            PRINT " Append it (A),  Replace it (R), or Cancel (C) ?"
                    GOSUB wayt
                    a$ = UCASE$(a$)
                    IF a$ = "R"  THEN OPEN File$ FOR OUTPUT AS #1
                    IF a$ = "A" THEN OPEN File$ FOR APPEND AS #1
                    IF a$ = "C" THEN GOTO SaveVESNmbrNxy
                    IF a$ <> "R" AND a$ <> "A" AND a$ <> "C" THEN BEEP : GOTO
WriteVESNmbrNxy
              END IF

              IF FileExists% = 0 THEN
                            OPEN File$ FOR OUTPUT AS #1
              END IF


              FOR j = 1 TO i
                            PRINT #1, VESNmbr$(j)
                            PRINT #1, Xd(j), Yd(j)
              NEXT j
              CLOSE #1
              CLS
              LOCATE 20,20
                            PRINT "(VES Nmbr & x,y) File saved!"
              GOSUB PrsAnyKey
              GOTO MainMenu
          END IF
          i = i + 1
          GOTO EnterVESNmbr


EnterZ:
        i = 1
        CLS
        LOCATE 10,10
                PRINT " Please type values of Z-data."
        LOCATE 12,10
                PRINT " When done ..... Type 00 (ZeroZero)"
        LOCATE 13,10
                PRINT " * To Return to Main Menu and Discard Data ... type MM <ENTER>. "

Wait4Z:
        LOCATE 16,27
        PRINT STRING$(10," ")
        LOCATE 16,10
                PRINT " Station Number =  ";i
        LOCATE 16,49
        PRINT STRING$(10," ")
        LOCATE 16,40
                LINE INPUT "Z-data =  "; Zd$
```

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```
        IF Zd$ = "" THEN BEEP : GOTO Wait4Z
        IF Zd$ = "MM" OR Zd$ = "mm" THEN MainMenu
        IF Zd$ = "00"     THEN
                i = i-1


SaveZ:
                Work$ = "SaveZ"
                CLS
                ReqMsg$ = "Save Z-data"
                GOSUB GetReq
                IF Worked% = 0 THEN      ' Worked% = 0 means Cancel button was clicked
                        CLS
                        LOCATE 10,10
                                PRINT " Do you wish to discard the data you entered! (Y/N)"
                        YsNo a$
                        IF a$ = "Y" THEN
                                GOTO EnterZ
                        ELSE
                                GOTO SaveZ
                        END IF
                END IF
                CLS
                FileExists% = -1
                OPEN File$ FOR INPUT AS #1
                CLOSE #1


WriteZ:
                IF FileExists% = -1 THEN
                        LOCATE 10,10
                                PRINT File$
                        LOCATE 14,10
                                PRINT " Above File Exists."
                        LOCATE 18,10
                                PRINT " Append it (A), Replace it (R), or Cancel (C) ?"
                        GOSUB wayt
                        a$ = UCASE$(a$)
                        IF a$ = "R"  THEN OPEN File$ FOR OUTPUT AS #1
                        IF a$ = "A" THEN OPEN File$ FOR APPEND AS #1
                        IF a$ = "C" THEN GOTO SaveZ
                        IF a$ <> "R" AND a$ <> "A" AND a$ <> "C" THEN BEEP : GOTO WriteZ
                END IF
                IF FileExists% = 0 THEN
                        OPEN File$ FOR OUTPUT AS #1
                END IF
                CLS
                FOR j = 1 TO i
                        PRINT #1, Zd(j)
                NEXT j
                CLOSE #1
                LOCATE 20,20
                        PRINT "(z) File Saved!"
                GOSUB PrsAnyKey
                GOTO MainMenu
```

```
        END IF

        Zd(i) = VAL (Zd$)
        IF Zd(i) = 0 THEN BEEP : GOTO Wait4Z
        i = i + 1
        GOTO Wait4Z


EnterContour:
        CLS
        a$ = " Enter Contour Values "
        Center 4,a$
        IF b$ = "C" THEN
                LOCATE 6,10
                PRINT " Reminder ... Zmax = "; Zdmax, "Zmin = "; Zdmin

        END IF
        i = 1
        LOCATE 10,10
                PRINT " Please type up to 13 Contour Values. "
        LOCATE 12,10
                PRINT " * ANY ORDER IS OK! I will sort them out later .. Hi2Lo."
        LOCATE 14,10
                PRINT " * If done at less than 13 values ... type 00 to exit."
        LOCATE 16,10
                PRINT " * To Return to Main Menu and Discard Data ... type MM. "


Wait4Contour:
        LOCATE 18,27
        PRINT STRING$(10," ")
        LOCATE 20,10
                PRINT " Contour Number =  ";i
        LOCATE 20,49
                PRINT STRING$(20," ")
        LOCATE 20,40
                LINE INPUT "Contour Level =  "; ContourLvl$
        LOCATE 22+i,40
                PRINT ContourLvl$

        IF ContourLvl$ = "" THEN BEEP : GOTO Wait4Contour
        IF ContourLvl$ = "MM" OR ContourLvl$ = "mm" THEN MainMenu
        DN(i) = VAL (ContourLvl$)        ' DN(i) = ContourLvls before sorting
        IF ContourLvl$ = "00" THEN i= i-1
        IF i = 0 THEN GOTO MainMenu
        IF ContourLvl$ = "00" OR i = 13 THEN
                CALL QwickSort (i, DN())
'               Now sort them from high to low
                FOR j  = 1 TO i
                        ContourLvl(j) = (DN(i-j+1))
                NEXT j
                CLS
                FOR j = 1 TO i
                        PRINT j, ContourLvl(j)
```

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```
NEXT j
PRINT
PRINT " Contour values Look Ok ? (Y/N) "
YsNo a$
IF a$ = "N" THEN GOTO EnterContour


SaveContour:
                Work$ = "SaveContour"
                CLS
                ReqMsg$ = "Save Contour"
                GOSUB GetReq
                IF Worked% = 0 THEN        ' Worked% = 0 means Cancel button was clicked
                        CLS
                        LOCATE 10,10
                                PRINT " Do you wish to discard the data you entered! (Y/N)"
                        YsNo a$
                        IF a$ = "Y" THEN
                                GOTO EnterContour
                        ELSE
                                GOTO SaveContour
                        END IF
                END IF
                CLS
                FileExists% = -1
                OPEN File$ FOR INPUT AS #1
                CLOSE #1


WriteContour:
                IF FileExists% = -1 THEN
                        LOCATE 10,10
                                PRINT File$
                        LOCATE 14,10
                                PRINT " Above File Exists."
                        LOCATE 18,10
                                PRINT " Replace it (R), Append it (A), or Cancel (C) ?"
                        GOSUB wayt
                        a$ = UCASE$(a$)
                        IF a$ = "R" THEN OPEN File$ FOR OUTPUT AS #1
                        IF a$ = "A" THEN OPEN File$ FOR APPEND AS #1
                        IF a$ = "C" THEN GOTO SaveContour
                        IF a$ <> "R" AND a$ <> "A" AND a$ <> "C" THEN BEEP : GOTO
WriteContour
                END IF
                IF FileExists% = 0 THEN
                        OPEN File$ FOR OUTPUT AS #1
                END IF

                FOR j = 1 TO i
                        PRINT #1, ContourLvl(j)
                NEXT j
                CLOSE #1
                NmbrOfContours = i
```

```
                    LOCATE 20,20
                    PRINT "Contours Saved!"
                    GOSUB PrsAnyKey
                    IF nd <> 0 AND MakeSectn = 0 THEN
                            GOTO LetsGo
                    ELSEIF MakeSectn = 1 THEN
                            GOTO VrtExg
                    ELSE
                            GOTO MainMenu
                    END IF
            END IF
            i = i + 1
            GOTO Wait4Contour


EnterXnID:
        CLS
        LOCATE 8,10
                PRINT " What units will you use for DISTANCES, between sounding stations:"
        LOCATE 12,20
                PRINT " (1) Meters."
        LOCATE 14,20
                PRINT " (2) Kilometers."
        LOCATE 16, 20
                PRINT " (3) Feet. "
        LOCATE 18, 20
                PRINT " (4) Miles."
        LOCATE 20,10
                PRINT " Please press appropriate Number. "
        LOCATE 24, 10
                PRINT " Note: You may enter the distances in any of the above units  "

        LOCATE 26,10
                PRINT "     and 1 will convert them to meters later, if you wish. "

        GOSUB MainMenuEsc

        PrsNmbr 4, a$
        IF a$ = "1" THEN XUnit$ = "Meters"
        IF a$ = "2" THEN XUnit$ = "Kilometers"
        IF a$ = "3" THEN Xunit$ = "Feet"
        IF a$ = "4" THEN XUnit$ = "Miles"
        IF a$ = CHR$(27) THEN GOTO MainMenu

        CLS
        LOCATE 8,10
                PRINT " What units will you use for ELEVATIONS of sounding stations:"
        LOCATE 12,20
                PRINT " (1) Meters."
        LOCATE 16, 20
                PRINT " (2) Feet. "
        LOCATE 20,10
                PRINT " Please press appropriate Number. "
        LOCATE 24, 10
```

```
                PRINT " Note: you may enter Elevations in Feet "
        LOCATE 26, 10
                PRINT " and I will convert them to Meters later, if you wish. "


        GOSUB MainMenuEsc

        PrsNmbr 2, a$
        IF a$ = "1" THEN EUnit$ = "Meters"
        IF a$ = "2" THEN EUnit$ = "Feet"
        IF a$ = CHR$(27) THEN GOTO MainMenu

VesNmbrDistElev:
        CLS
        i = 1
        LOCATE 8,10
                PRINT " Type Sounding Numbers along Xsection from Left to Right"
        LOCATE 10,10
                PRINT " Type Distances between successive Sounding Stations. "
        LOCATE 12, 10
                PRINT " Type Elevations of successive soundings <ENTER> "
        LOCATE 27,10
                PRINT " * When done, type 00 (ZeroZero) for Sounding Number <ENTER> "
        LOCATE 28, 10
                PRINT " * To Return to Main Menu and Discard Data ... type MM <ENTER> "


EnterVesNmbrDistElevn:
        LOCATE 14, 10
                PRINT " Entry Number ........................ = ";i
        LOCATE 16, 60
                PRINT STRING$(10," ")
        LOCATE 16, 10
                PRINT " Sounding Number <ENTER> ............... = "
        LOCATE 18, 60
                PRINT STRING$(10, " ")
        LOCATE 18, 10
                PRINT " Distance from Previous Sounding <ENTER>   = "
        LOCATE 20, 60
                PRINT STRING$(10, " ")
        LOCATE 20, 10
                PRINT " Station Elevation <ENTER> ............... = "
        LOCATE 22,10
                PRINT " * Enter 0 for First distance. "
        LOCATE 24, 10
                PRINT " * Enter Distances in " + XUnit$ + "."
        LOCATE 25, 10
                PRINT " * Enter Elevations in " + EUnit$ + "."
        LOCATE 16,60
                LINE INPUT a$
        IF a$ = "" THEN BEEP: GOTO EnterVesNmbrDistElevn
        IF a$ = "00" THEN GOTO ExitNmbrnDist
        IF a$ = "MM" OR a$ = "mm" THEN MainMenu
```

```
                VesNmbr$(i) = a$

EnterXDist:
        LOCATE 18, 60
        LINE INPUT a$
        IF a$ = "00" THEN GOTO ExitNmbrnDist
        IF a$ = "MM" OR a$ = "mm" THEN MainMenu
        IF a$ = "" THEN BEEP : GOTO EnterXDist
        Xdist(i) = VAL (a$)
        IF VAL (a$) = 0 AND a$ <> "0" THEN
                BEEP
                GOTO EnterXDist
        END IF


EnterElevation:
        LOCATE 20, 60
        LINE INPUT a$
        IF a$ = "00" THEN GOTO ExitNmbrnDist
        IF a$ = "MM" OR a$ = "mm" THEN MainMenu
        IF a$ = "" THEN BEEP : GOTO EnterElevation
        Elevation(i) = VAL (a$)
        IF VAL (a$) = 0 AND a$ <> "0" THEN
                BEEP
                GOTO EnterElevation
        END IF
        i = i + 1
        GOTO EnterVesNmbrDistElevn


ExitNmbrnDist:
        i = i-1
ConvertDistElev:
        CLS
        IF XUnit$ <> "Meters" THEN
                LOCATE 10,10
                PRINT" Convert Distnances from " Xunit$ " to Meters before saving? (Y/N)"
                YsNo a$
                IF a$ = "Y" THEN

                        IF XUnit$ = "Kilometers" THEN
                                FOR iii = 1 TO i
                                        XDist(iii) = XDist(iii) * 1000
                                NEXT iii
                        END IF

                        IF XUnit$ = "Feet" THEN
                                FOR iii = 1 TO i
                                        XDist(iii) = XDist(iii) * 0.3048
                                NEXT iii
                        END IF

                        IF Xunit$ = "Miles"
                                FOR iii = 1 TO i
```

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```
                              XDist(iii) = XDist(iii) * 5280 * 0.3048
                    NEXT iii
          END IF

     END IF

END IF

IF Eunit$ <> "Meters" THEN
          LOCATE 12,10
                    PRINT " Convert Elevations from " Eunit$ " to Meters before saving? (Y/N)"
          YsNo a$
          IF a$ = "Y" THEN
                    FOR iii = 1 TO i
                              Elevation(iii) = Elevation(iii) * 0.3048
                    NEXT iii
          END IF

     END IF

SaveNmbrnDist:
     Work$ = "SaveNmbrnDist"
     CLS
     ReqMsg$ = "Save NmbrnDistnElvtn"
     GOSUB GetReq
     IF Worked% = 0 THEN        ' Worked% = 0 means Cancel button was clicked
               CLS
               LOCATE 10,10
                         PRINT " Do you wish to discard the data you entered! (Y/N)"
               YsNo a$
               IF a$ = "Y" THEN
                         GOTO VesNmbrDistElev
               ELSE
                         GOTO SaveNmbrnDist
               END IF

     END IF
     CLS
     FileExists% = -1
     OPEN File$ FOR INPUT AS #1
     CLOSE #1


WriteNmbrnDist:
     IF FileExists% = -1 THEN
               LOCATE 10,10
                         PRINT File$
               LOCATE 14,10
                         PRINT " Above File Exists."
               LOCATE 18,10
                         PRINT " Append it (A),  Replace it (R), or Cancel (C) ?"
               GOSUB wayt
               a$ = UCASE$(a$)
               IF a$ = "R"  THEN OPEN File$ FOR OUTPUT AS #1
```

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```
                    IF a$ = "A" THEN OPEN File$ FOR APPEND AS #1
                    IF a$ = "C" THEN GOTO SaveNmbrnDist
                    IF a$ <> "R" AND a$ <> "A" AND a$ <> "C" THEN BEEP : GOTO WritenmbrnDist
          END IF
          IF FileExists% = 0 THEN
                    OPEN File$ FOR OUTPUT AS #1
          END IF

          FOR j = 1 TO i
                    PRINT #1, VesNmbr$(j)
                    PRINT #1, Xdist(j), Elevation(j)
          NEXT j
          CLOSE #1
          CLS
          LOCATE 20,20
                    PRINT "Sounding Numbers, Distances and Elevations saved!"
          GOSUB PrsAnyKey
          GOTO MainMenu


MakeSection:
          MakeSectn = 1


LoadNmbrnX:
          Work$ = "LoadNmbrnX"
          CLS
          ReqMsg$ = " Load VesNmbr,Xdist,Elevtn"
          GOSUB GetReq
          IF Worked% = 0  THEN  MainMenu          ' Worked% = 0 means Cancel

          i = 1
          VesSection$ = File$
          OPEN File$ FOR INPUT AS #1


ReadNmbrnX:
          INPUT #1, VesNmbr$(i)
          GOSUB TrimIt
          INPUT #1, Xdist(i), Elevation (i)
          PRINT i,VesNmbr$(i), XDist(i), Elevation (i)

          IF EOF (1) THEN
                    CLOSE #1
                    GOTO DoneNmbrnX
          END IF
          i = i+1
          GOTO ReadNmbrnX


DoneNmbrnX:
          NmbrofVES = i          'NmbrofVES = Nmbr of VES soundings
          PRINT
          PRINT "Done Loading VES Nmbrs, Distances, and Elevations!"
```

```
        GOSUB PrsAnyKey


LoadLayering:
        CLS
        k = 1
        NmbrofPts = 0
        Counter = 1
        SumXdist = XDist (1)


        FOR j = 1 TO NmbrofVES


                Work$ = "LoadLayering"
'               CLS
                ReqMsg$ = "Load Layering Files"

                IF J = 1 THEN
                        GOSUB Warning
                        GOSUB GetReq
                        IF Worked% = 0  THEN  MainMenu
                        FOR ii = 0 TO LEN(File$)
                                File2$ = LEFT$(File$,LEN(File$)-ii)
                                File3$ = RIGHT$(File2$,1)
                                IF File3$ = "/"  OR File3$ = ":" THEN

                                        File4$ = LEFT$(File$,LEN(File2$)+4)  '4=LEN(root file
name)
                                        CLS
                                        EXIT FOR
                                END IF
                        NEXT ii
                END IF

                File$ = File4$ + VesNmbr$(J) + ".LYR"

OpenFile2:

                OPEN File$ FOR INPUT AS #1


ReadLayering:

                LOCATE 15,20
                PRINT "Loading Layering ... "
                INPUT #1, VesName$
                INPUT #1,  Units$
                INPUT #1, NmbrofLayers

                FOR i = 1 TO NmbrofLayers
                        INPUT #1, YdTemp(i), ZdTemp(i)
                NEXT i
```

```
                GOSUB Step2Cont

                FOR i = 1 TO M-1
                            Xd (Counter) = SumXdist
                            Yd (Counter) = YdTemp2 (i)

                            Zd (Counter) = ZdTemp2 (i)
                            Counter = Counter + 1
                NEXT i

                CLOSE #1
                k = k + 1
                SumXdist = SumXdist + Xdist(k)


        NEXT j


DoneLayering:
        nd = Counter - 1
        GOSUB MaxMin
        SectionLength = Xdmax-XdMin
        GOSUB Origin
        GOSUB FixAspect
        CLS
        LOCATE 10, 10
        PRINT "Done Loading Layering              "
        LOCATE 14, 10
                PRINT " Zmax = " ZdMax, "Zmin = " ZdMin
        LOCATE 18,10
                PRINT " Do you have a File of Contour Values "
        LOCATE 20, 10
                PRINT " ready to be used in making the "
        LOCATE 22, 10
                PRINT " Cross Section?  (Y/N)"
        YsNo a$
                IF a$ = "N" THEN
                        MakeSectn = 1
                        b$ = "C"
                        GOTO EnterContour
                END IF


VrtExg:
        GOSUB Palet1
        GOSUB RestoreAll
        CLS
        LOCATE 10,10
        PRINT " Which Vertical Exaggeration do you want: "
        LOCATE 12,10
                PRINT " (1) None."
        LOCATE 14, 10
                PRINT " (2) Two    times. "
        LOCATE 16,10
                PRINT " (3) Three  times. "
```

```
LOCATE 18, 10
        PRINT " (4) Four   times. "
LOCATE 20, 10
        PRINT " (5) Five   times. "
LOCATE 22, 10
        PRINT " (6) Ten    times. "
LOCATE 24, 10
        PRINT " (7) Twenty times. "
LOCATE 26, 10
        PRINT "    Please press appropriate number. "
GOSUB MainMenuEsc
PrsNmbr 7, a$
IF a$ = CHR$(27) OR a$ ="" THEN GOTO MainMenu
VertExg = VAL(a$)
IF VertExg = 6 THEN VertExg = 10
IF VertExg = 7 THEN VertExg = 20


MaximumDepth:
        CLS
        LOCATE 10,10
        PRINT " Vertical Exaggeration =  " + STR$(VertExg) + " times"

        LOCATE 12,10
        PRINT " Do You Wish to see:  "
        LOCATE 14,10
        PRINT "  (1) Full Cross-Section Display."
        LOCATE 16, 10
        PRINT "  (2) Upper-Part of Cross-Section Display."
        LOCATE 18,10
        PRINT "  (3) Previous Menu."
        LOCATE 20, 10
        PRINT " Please press appropriate Number"
        LOCATE 22, 10
        PRINT " * If you select either 1 or 2, cross section will be "
        LOCATE 23, 10
        PRINT "   scaled to fill WIDTH of the screen, unless"
        LOCATE 24, 10
        PRINT "   cross section depth is greater than its length."
        LOCATE 26,10
        PRINT " * Upper-Part of Cross Section fills Upper-Half of screen."
        GOSUB MainMenuEsc
        PrsNmbr 3, c$
        IF c$ = CHR$(27) THEN MainMenu
        IF c$ = "3" THEN GOTO VrtExg


Exaggerate:

        IF VertExg < 3 THEN
                XstretchTop = 10
        END IF
        IF 3 <= VertExg AND VertExg <=10 THEN
                XstretchTop = 5
```

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```
                                END IF
                                IF VertExg = 20 THEN
                                        XstretchTop = 2
                                END IF


XstretchOpt:
                                CLS
                                XstretchBtm = 2
                                LOCATE 10,10
                                PRINT " Recommended Xstretch-Spread  = ";XstretchBtm; "(bottom) to";XstretchTop;"
(top)"
                                LOCATE 12,10
                                PRINT " Do you wish to use it? (Y/N)"
                                LOCATE 16,10
                                PRINT " * The larger the value of Xstretch the greater the stretch of the "
                                LOCATE 18, 10
                                PRINT "   contours in the horizontal direction."
                                LOCATE 20,10
                                PRINT " * Xstretch values must be >0 and <=20."
                                YsNo a$
                                IF a$ ="N" THEN
                                        LOCATE 25,10
                                        LINE INPUT " Please type value of Xstretch at Bottom of section: ", a$
                                        IF VAL (a$) <= 0 OR VAL(a$) > 20 THEN BEEP: GOTO XstretchOpt
                                        XstretchBtm = VAL(a$)
                                        LOCATE 27, 10
                                        LINE INPUT " Please type value of Xstretch at   Top  of section: ", a$
                                        IF VAL (a$) <= 0 OR VAL(a$) > 20 THEN BEEP: GOTO XstretchOpt
                                        XstretchTop = VAL(a$)
                                END IF

                                FOR i = 1 TO nd
                                        Yd(i) = Yd(i) * VertExg
                                NEXT i

                                FOR j = 1 TO NmbrOfVES
                                        Elevation (j) = Elevation (j) * VertExg
                                NEXT j
                                GOSUB MaxMin
                                DepthMax = YdMax/VertExg
                                GOSUB AdjstElevn
                                GOSUB MaxMin
                                IF c$ = "1" THEN ShowScreen = 1
                                IF c$ = "2" THEN ShowScreen = .5
                                GOTO LogZee


MakeMap:
                        Xstretch = 1
                        MakeMp = 1
                        CLS
                        LOCATE 10,10
                                PRINT " Do you wish to: "
```

```
        LOCATE 12,10
                PRINT " 1) Load XYZ file."
        LOCATE 14, 10
                PRINT " 2) Load VES Nmbrs & (x,y) file, to generate"
        LOCATE 15,10
                PRINT "    one Depth Slice or several Animation Frames."
        LOCATE 17, 10
                PRINT " 3) Load XY file, then load corresponding Z file."
        LOCATE 20,10
                PRINT " Please Press Appropriate Number."
        GOSUB MainMenuEsc
        PrsNmbr 3, a$
        IF a$ = "1" THEN LoadXYZ
        IF a$ = "2" THEN LoadVESNmbrNxy
        IF a$ = "3" THEN LoadXY
        IF a$ = CHR$(27) THEN MainMenu
        BEEP
        GOTO MakeMap


LoadXY:
        Work$ = "LoadXY"
        CLS
        ReqMsg$ = "Load XY-data"
        GOSUB GetReq
        IF Worked% = 0  THEN  MakeMap
        i = 1
        OPEN File$ FOR INPUT AS #1


LoadXnY:
        INPUT #1, Xd(i), Yd(i)
        IF EOF (1) THEN
                CLOSE #1
                GOTO DoneLoading
        END IF
        i = i+1
        GOTO LoadXnY


DoneLoading:
        CLS
        FOR j = 1 TO i
                LOCATE 10,10
                        PRINT "StnNmbr = ", j
                LOCATE 12,10

                        PRINT "X-data  = ", Xd(j)
                LOCATE 14,10
                        PRINT "Y-data  = " , Yd(j)
        NEXT
        LOCATE 20,10
        PRINT " Done Loading X- & Y-data."
        nd = i   'nd = Nmbr of stations
```

```
            GOSUB MaxMin
            XMapWidth = Xdmax - Xdmin
            XMapHight = YdMax - YdMin
            GOSUB PrsAnyKey
            GOSUB Origin
            GOSUB FixAspect


LoadZ:
            Work$ = "LoadZ"
            CLS
            ReqMsg$ = "Load Z-data"
            GOSUB GetReq
            IF Worked% = 0 THEN MakeMap
            i = 1
            OPEN File$ FOR INPUT AS #1


LoadZee:
        INPUT #1, Zd(i)
        IF EOF (1) THEN
                CLOSE #1
                CLS
                FOR j = 1 TO i
                        LOCATE 10,10
                        PRINT j, Zd(j)
                NEXT
                LOCATE 15,10
                PRINT " Done Loading Z-values."
                GOSUB PrsAnyKey
                ndz = i          ' ndz = NmbrofzDatapoints
                IF nd <> 0 AND ndz <> nd THEN
                        BEEP
                        PRINT " Number of Z data points is not equal to Number of XY data points!!!"
                        GOSUB PrsAnyKey
                        GOTO LoadZ
                END IF

                GOTO LogZee
        END IF
        i = i+1
        GOTO LoadZee


LogZee:
            LogZ$ = "N"
            CLS
            IF ZdMin < 0 THEN GOTO SkipLog

'   If ZdMin = 0 then its log will not be taken. This is a special
'   feature to deel with shallow soundings whose probing depth
'   at the required depth slice is 0.
```

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```
        LOCATE 10,10
                PRINT " Do you wish to take LOG of the Z Values ? (Y/N)"
        YsNo a$
        IF a$ = "Y" THEN
                FOR i = 1 TO nd
                        IF Zd(i) > 0 THEN
                                Zd(i) = LOG10 (Zd(i))
                        END IF
                NEXT
                LogZ$ = "Y"
                LOCATE 20,20
                        PRINT " Done, Log Z values taken!"
                GOSUB PrsAnyKey
        END IF
SkipLog:
        IF nd <> 0 THEN GOTO LoadContour
        GOTO MakeMap


LoadXYZ:
        Work$ = "LoadXYZ"
        CLS
        ReqMsg$ = "Load XYZ-data"
        GOSUB GetReq
        IF Worked% = 0  THEN  MakeMap
        CLS
        LOCATE 20,20
        PRINT " Loading XYZ ..."
        i = 1
        OPEN File$ FOR INPUT AS #1


LoadXYnZ:
        INPUT #1, Xd(i), Yd(i), Zd(i)
        IF EOF (1) THEN
                CLOSE #1
                GOTO DoneLoadXYZ
        END IF
        i = i+1
        GOTO LoadXYnZ


DoneLoadXYZ:
        CLS
        LOCATE 8,10
        PRINT " Done Loading XYZ"
        nd = i   'nd = Nmbr of stations
        GOSUB ContourInfo

        a$ = UCASE$ (a$)
        IF a$ = "C" THEN
                b$ = a$
                GOTO EnterContour
        END IF
```

```
        GOSUB Origin
        GOTO LogZee


LoadVESNmbrNxy:
        Work$ = "LoadVESNmbrNxy"
        Slice = 1
        CLS
        ReqMsg$ = "Load VES Nmbrs & x,y"
        GOSUB GetReq
        IF Worked% = 0  THEN  MakeMap
        CLS
        LOCATE 20,20
        PRINT " Loading VES Nmbrs & x,y ..."
        i = 1
        OPEN File$ FOR INPUT AS #1


LoadVESnXY:
        INPUT #1, VESNmbr$(i)
        GOSUB TrimIt
        INPUT #1, Xd(i), Yd(i)
        IF EOF (1) THEN
                CLOSE #1
                GOTO DoneLoadVESNmbrNxy
        END IF
        i = i+1
        GOTO LoadVESnXY


DoneLoadVESNmbrNxy:

        CLS
        LOCATE 8,10
        PRINT " Done Loading VES Nmbrs and x,y"
        nd = i   'nd = Nmbr of stations
        LOCATE 12, 10
                PRINT " Total Number of stations = ";nd

        LOCATE 14,10
        PRINT " Press Any Key to continue."
        GOSUB Wayt

SelectSlicing:
        CLS
        LOCATE 10,10
        PRINT " Do you wish to: "
        LOCATE 12,10
        PRINT " 1. Generate a single depth slice."
        LOCATE 14,10
        PRINT " 2. Generate a sequence of depth slices (for Animation)."
        LOCATE 16,10
        PRINT " 3. Return to Main Menu and discard loaded data."
        LOCATE 18,10
```

```
PRINT " Please press appropriate number."
PrsNmbr 3, a$
IF a$ = "1" THEN DepthofSlice
IF a$ = "3" THEN MainMenu
IF a$ = "2" THEN
CLS
LOCATE 10,5
        PRINT "Is this a Continuation of a Partially Generated sequence? (Y/N)"
YsNo a$
IF a$ = "Y" THEN
        CLS
        LOCATE 15,10
                PRINT " Please Load appropriate AnimCounter File. "
        LOCATE 17, 10
                PRINT " You will find it in the same directory where"
        LOCATE 18,10
                PRINT " the previous IFF-animation frames were saved."

        Work$ = "LoadAnimCounter"
        ReqMsg$ = "Load .. AnimCounter"
        GOSUB GetReq
        IF Worked% = 0 THEN SelectSlicing
        OPEN File$ FOR INPUT AS #1
        INPUT #1, File4$
        INPUT #1, File7$
        INPUT #1, XLogInterval, SliceDepth, AnimCounter, NmbrOfSlices,Radius
        INPUT #1, AnimShrink, AnimFlip, AnimSmooth,stp,pix, NmbrOfContours
        INPUT #1, LogZ$
        FOR kk = 1 TO NmbrOfContours
                INPUT #1, ContourLvl(kk)
        NEXT kk
        AnimCounter = AnimCounter + 1
        CLOSE #1
        GOTO DepthofSlice
END IF

PickSlices:
        AnimCounter = 1
        CLS
        LOCATE 10,10
        PRINT " Shallowest slice depth (must be > 0) ..... = "
        LOCATE 12,10
        PRINT " Deepest slice depth (must be > 0)......... = "
        LOCATE 14,10
        PRINT " Number of slices (must be >= 2) ........... = "
        LOCATE 17,10
        PRINT " * To Return to Previous menu type P <ENTER>."
        LOCATE 18,10
        PRINT " * To Return to Main Menu and discard data type mm <Enter>."
        LOCATE 19,10
        PRINT " * To Clear entries press ... <ENTER>."

        LOCATE 10,56
        LINE INPUT " ", SliceMin$
```

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```
IF UCASE$(SliceMin$) = "P" THEN
        AnimCounter = 0
        GOTO SelectSlicing
END IF
IF UCASE$(SliceMin$) = "MM" THEN GOTO MainMenu
SliceMin = VAL (SliceMin$)
IF SliceMin <= 0 THEN BEEP: GOTO PickSlices
LOCATE 12,56
LINE INPUT " ", SliceMax$
IF UCASE$(SliceMax$) = "P" THEN
        AnimCounter = 0
        GOTO SelectSlicing
END IF
IF UCASE$(SliceMax$) = "MM" THEN GOTO MainMenu
SliceMax = VAL(SliceMax$)
IF SliceMax <= 0 OR SliceMax <= SliceMin THEN BEEP: GOTO PickSlices
LOCATE 14, 56
LINE INPUT " ", Nmbrofslices$
IF UCASE$(NmbrOfSlices$) = "P" THEN
        AnimCounter = 0
        GOTO SelectSlicing
END IF
IF UCASE$(NmbrOfSlices$) = "MM" THEN GOTO MainMenu
NmbrofSlices = VAL(Nmbrofslices$)
IF NmbrofSlices < 2 THEN BEEP : GOTO PickSlices

XLogInterval = LOG10(SliceMax)-LOG10(SliceMin)
XLogInterval = XLogInterval/(NmbrOfSlices - 1)
XLogInterval = 10^XLogInterval
END IF


DepthOfSlice:
        GOSUB Palet1
        COLOR 1,2
        CLS
        GOSUB RestoreSlice
        IF AnimCounter > NmbrOfSlices AND NmbrOfSlices <> 0 THEN
                CLS
                LOCATE 10,10
                PRINT " All Animation Frames Completed."
                GOSUB PrsAnyKey
                GOTO MainMenu
        END IF
        IF AnimCounter = 1 THEN
                SliceDepth = SliceMin
                GOTO LoadLyr4Slice
        END IF

        IF AnimCounter > 1 THEN
                SliceDepth = SliceDepth * XLogInterval
                GOTO LoadLyr4Slice
        END IF
```

```
        LOCATE 10,10
        PRINT " Last Depth of Slice = ";SliceDepth$

        LOCATE 17, 10
                PRINT " * Depth of Slice = depth at which resistivity is sampled."
        LOCATE 18, 10
                PRINT " * To Return to Main Menu and discard loaded data, type MM."
        LOCATE 19, 10
                PRINT " * To Return to previous Menu type P <ENTER>"

        LOCATE 14,10
                LINE INPUT " Type Depth of Slice = ", SliceDepth$
        IF UCASE$(SliceDepth$) = "MM" THEN MainMenu
        IF UCASE$(SliceDepth$) = "P"THEN SelectSlicing

        IF SliceDepth$ = "" THEN BEEP : GOTO DepthOfSlice
        SliceDepth = VAL(SliceDepth$)
        IF SliceDepth <=0 THEN BEEP : GOTO DepthOfSlice


LoadLyr4slice:

        CLS

        FOR J = 1 TO nd

ResumeLyr4Slice:

                Work$ = "LoadLyr4Slice"
'               CLS

                ReqMsg$ =  "Load Layering Files."

                IF J = 1 THEN

                        IF AnimCounter > 1 THEN GOTO PassRequestor
                        GOSUB Warning
                        GOSUB GetReq
                        IF Worked% = 0  THEN  MainMenu

                        FOR ii = 0 TO LEN(File$)
                                File2$ = LEFT$(File$,LEN(File$)-ii)
                                File3$ = RIGHT$(File2$,1)
                                IF File3$ = "/"  OR File3$ = ":" THEN

                                        File4$ = LEFT$(File$,LEN(File2$)+4)  '4=LEN(root file
name)
                                        CLS
                                        EXIT FOR
                                END IF
                        NEXT ii
                END IF


PassRequestor:
```

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```
                File$ = File4$ + VesNmbr$(J) + ".LYR"


OpenFile:

                OPEN File$ FOR INPUT AS #1


ReadLyr4slice:
'               CLS
                LOCATE 15,20
                        PRINT "Loading Layering ... "
                LINE INPUT #1, VesName$
                LINE INPUT #1,  Units$
                INPUT #1, NmbrofLayers
                FOR i = 1 TO NmbrofLayers
                        INPUT #1, YdTemp(i), ZdTemp(i)
                NEXT i

                GOSUB Step2Cont

                IF SliceDepth <= YdTemp2 (1) THEN
                                Zd(J) = ZdTemp2(1)
                                GOTO NextJ
                END IF

                IF SliceDepth >= YdTemp2 (M-1) THEN
'                               Zd(J) = ZdTemp(M-1)
                                Zd(j) = 0
                                GOTO NextJ
                END IF

                FOR i = 1 TO M-2

                        IF SliceDepth > YdTemp2 (i) AND SliceDepth < YdTemp2(i+1) THEN
                                Slope4Slice = (ZdTemp2(i+1) - ZdTemp2(i))/(YdTemp2(i+1)-
YdTemp2(i))
                                Intercept4Slice= ZdTemp2(i) - (Slope4Slice * Ydtemp2(i))
                                Zd(J) = (Slope4Slice * SliceDepth) + Intercept4Slice
                                GOTO NextJ

                        END IF

                NEXT i


                CLOSE #1
NextJ:
        NEXT J


DoneLyr4slice:
```

```
IF AnimCounter > 1 THEN
        IF LogZ$ = "Y" THEN
                FOR qq = 1 TO nd
                        IF Zd(qq) > 0 THEN

                                Zd(qq) = LOG10(Zd(qq))

                        END IF
                NEXT qq
        END IF
        GOTO LetsGo
END IF

CLS
LOCATE 10, 10
PRINT " Done Loading Layering data              "
LOCATE 12, 10
        PRINT " Total Number of stations = ";nd

GOSUB ContourInfo
a$ = UCASE$(a$)
IF a$ = "C" THEN
        MakeMp = 1
        b$ = "C"
        GOTO EnterContour
END IF
GOSUB Origin
GOTO LogZee

LetsGo:

GOSUB Origin

IF AnimCounter > 1 THEN GOTO Specs

IF AnimCounter = 1 THEN GOTO LoadContour

IF XMapWidth < XMapHight*.86 THEN
        CLS
        LOCATE 10,10
                PRINT " Map Width (";XMapwidth;")"; " is less than adjusted Map Height (";
XMapHight*.86;") "
        LOCATE 12,10
                PRINT " * Adjusted Map Height = Map Height x Screen Aspect Ratio."
        LOCATE 14,10
                PRINT " Do you wish to ROTATE the map side ways"
        LOCATE 16,10
                PRINT " to maximize its size on the screen? (Y/N)"
        YsNo a$
        IF a$ = "Y" THEN
                GOSUB Rotate
                GOSUB Origin
        END IF
```

```
        END IF

        GOSUB FixAspect


LoadContour:

        IF AnimCounter > 1 THEN GOTO Specs

        IF NmbrOfContours <> 0 THEN GOTO LogCntrLvls
        CLS
        Work$ = "LoadContour"
        ReqMsg$ = "Load .. Contours"
        GOSUB GetReq
        IF Worked% = 0 THEN
                CLS
                LOCATE 10,10
                        PRINT " Discard Loaded data and return to Main Menu? (Y/N)"
                YsNo a$
                IF a$ = "Y" THEN MainMenu
                IF a$ = "N" THEN LoadContour
        END IF
        i = 1
        OPEN File$ FOR INPUT AS #1


LoadCL:
        INPUT #1, ContourLvl(i)
        IF EOF (1) THEN
                CLOSE #1
                NmbrOfContours = i
                CLS
                FOR j = 1 TO NmbrOfContours
                        PRINT j, ContourLvl(j)
                NEXT j

                LOCATE 22,10
                PRINT " Contour values look OK? (Y/N)"
                YsNo d$
                IF d$ = "N" THEN
                        CLS
                        LOCATE 10,10
                                PRINT " Do you wish to:"
                        LOCATE 12,10
                                PRINT " 1) Load a different set of contours"
                        LOCATE 14,10
                                PRINT " 2) Enter a new set of contours."
                        PrsNmbr 2, a$
                        IF a$ = "1" THEN
                                NmbrOfContours = 0
                                GOTO LoadContour
                        END IF
                        IF a$ = "2" THEN
                                GOTO EnterContour
```

```
                                END IF
                        END IF
                        IF d$ = "Y" THEN
                                FOR j = 1 TO NmbrOfContours
                                        ContourLvlTemp (j) = ContourLvl (j)
                                NEXT j
                                GOTO LogCntrLvls
                        END IF
                        GOTO LoadContour
                END IF
                i = i+1
                GOTO LoadCL


LogCntrLvls:

        IF LogZ$ = "Y" THEN
                IF ContoursLogged = 1 THEN GOTO Specs

                FOR i = 1 TO NmbrOfContours
                        IF ContourLvl(i) <= 0 THEN
                                i = NmbrOfContours
                                CLS
                                BEEP
                                LOCATE 10,10
                                        PRINT " Contours have zero or negative values."
                                LOCATE 12,10
                                        PRINT " Cannot take LOG of <= 0 contour values"
                                LOCATE 14,10
                                        PRINT " Please load a proper set of contour levels."
                                NmbrOfContours = 0

                                GOSUB PrsAnyKey
                                GOTO LoadContour
                        END IF
                NEXT i

                FOR i=1 TO NmbrOfContours
                        ContourLvl(i) = LOG10(ContourLvl(i))
                NEXT
                ContoursLogged = 1
        END IF

ChkLogCont:
'       Restore Contours
        IF LogZ$ = "N" AND ContoursLogged = 1 THEN
                FOR i = 1 TO NmbrOfContours
                        ContourLvl (i) = ContourLvlTemp (i)
                NEXT i
                ContoursLogged = 0
        END IF

Specs:
        CLS
```

```
        GOSUB MaxMin


ScaleXY:
        Scalem$ = ""
        Size = 0
        IF MakeMp = 1 AND Slice = 0 THEN GOSUB RestoreAll
        GOSUB Palet1
        COLOR 1,2


ScaleMenu:

        IF AnimCounter >= 1 THEN
                a$ = "1"
                GOTO AutoScale
        END IF
        CLS
                COLOR 2,1
                a$ = " SCALE MENU "
                Center 2, a$
                COLOR 1,2
        LOCATE 5,20
                IF MakeMp = 1 THEN
                        PRINT " Length Units in X-direction =   ", XMapWidth
                ELSE
                        PRINT " Length of Cross Section     = ", SectionLength, Unit$
                END IF
        LOCATE 6,20
                IF MakeMp = 1 THEN
                        PRINT " Length Units in Y-direction =   ", XMapHight

                ELSE
                        PRINT "  Vertical Exaggeration     = ", VertExg
                END IF
        LOCATE 10, 10
                PRINT " Do you wish to: "
        LOCATE 12,10
                PRINT " 1) ";
                COLOR 2,1
                PRINT " Auto-Scale ";
                COLOR 1,2
                PRINT " map/section to fit nicely within a 640x400 window. "
        LOCATE 15,10
                PRINT " 2) ";
                COLOR 2,1
                PRINT " Specify Scale Factor multiplier. ";
                COLOR 1,2
                PRINT " Good for merging two maps/sections and making them the same scale."
        LOCATE 17,10
                PRINT "   Use above Length Units as a guide to decide on a Scale Factor."

        IF MakeMp = 1 THEN
                LOCATE 20, 10
```

```
                    PRINT " 3) Make map for ";
                    COLOR 2,1
                    PRINT " VistaPro ";
                    COLOR 1,2
                    PRINT " with largest side = 258 pixels"
END IF
LOCATE 25,10
            PRINT " Please press appropriate number. "
GOSUB MainMenuEsc
IF MakeMp = 1 THEN
            PrsNmbr 3, a$
ELSE
            PrsNmbr 2, a$
END IF
IF a$ = CHR$(27) THEN GOTO MainMenu


AutoScale:

    IF a$ = "1" THEN
            CLS
            PixMaxX% = 615
            PixMaxY% = 365



ChngPixMax:
            ScaleFactorX = PixMaxX% / (Xdmax - XdMin)
            ScaleFactorY = PixMaxY% / (YdMax - YdMin)
            IF MakeSectn = 1 THEN
                    IF ScaleFactorX * (YdMax-YdMin) > 365 AND VertExg = 1 AND
ShowScreen = 1 THEN
                                CLS
                                LOCATE 8,10
                                PRINT " With No Vertical Exaggeration and a full Screen Display,"
                                LOCATE 10, 10
                                PRINT " the bottom part of this cross section can not be displayed"
                                LOCATE 12,10
                                PRINT " unless you select option 1 below ."
                                LOCATE 16,10
                                PRINT " Do you wish to:"
                                LOCATE 18,10
                                PRINT " 1) Display the FULL section (at less than full screen width)."
                                LOCATE 20, 10
                                PRINT " 2) Display only UPPER part of section (at full screen width)."
                                LOCATE 22, 10
                                PRINT "    Upper part = ";INT(365/((YdMax-
YdMin)*ScaleFactorX)*100);"%";
                                PRINT " of section."
                                LOCATE 24, 10
                                PRINT " Please press the appropriate Number."

                                PrsNmbr 2, a$
                                IF a$ = "1" THEN
                                        ScaleFactor = ScaleFactorY
                                        AdjustWidth = 1
```

```
                    END IF
                    IF a$ = "2" THEN
                            ScaleFactor = ScaleFactorX
                            AdjustWidth = 0
                    END IF

            ELSE
                    ScaleFactor = ScaleFactorX
                    AdjustWidth = 0
            END IF

            FOR i = 1 TO nd
                    Xd(i) = INT ((Xd(i) - XdMin) * ScaleFactor)
                    Yd(i) = INT ((Yd(i) - YdMin) * ScaleFactor)
            NEXT i
            GOSUB MaxMin

            IF ShowScreen = 1 THEN DepthMax = 365
            IF ShowScreen = 0.5 THEN DepthMax = 180

            IF YdMax > DepthMax AND VertExg <> 1 THEN
                    CLS
                    LOCATE 12,10
                    PRINT " For your information:"
                    LOCATE 14,10
                    PRINT " At a Vertical Exaggeration of ";VertExg
                    LOCATE 16,10
                    PRINT " and a vertical-screen display of ";
INT(ShowScreen*100);"%."
                    LOCATE 18,10
                    COLOR 2,1
                    PRINT " [Only] the upper "; INT(DepthMax/YdMax*100) ;"% of the
section will be displayed "
                    COLOR 1,2
                    LOCATE 20 ,10
                    PRINT " Is this OK? (Y/N) [if not, use smaller vertical exaggeration]."
                    YsNo a$

                    IF a$ = "N" THEN GOTO VrtExg

            END IF
            GOSUB ChopDpth
            GOSUB MaxMin

            IF XdMax - XdMin < 615 AND AdjustWidth = 0 THEN
                    CLS
                    LOCATE 10,10
                    PRINT " WARNING! With Vertical Exaggeration = "; VertExg
                    LOCATE 12, 10
                    PRINT "         and a vertical-screen display of ";
INT(ShowScreen*100);"%"
                    LOCATE 14,10
                    PRINT "         the maximum-depth surface will intersect the "
                    LOCATE 16, 10
```

```
                              PRINT "        topographic surface.  The width of the cross section "
                              LOCATE 18,10
                              PRINT "        will be incomplete and some soundings will be
missing!!"
                              LOCATE 20, 10
                              PRINT " Do you wish to: "
                              LOCATE 22, 10
                              PRINT " (1) Return to Vertical Exaggeration Menu."
                              LOCATE 24, 10
                              PRINT " (2) Go on, let's see how it looks. "
                              PrsNmbr 2, a$
                              IF a$ = "1" THEN GOTO VrtExg
                              IF a$ = "2" THEN GOTO ScaleZ
                      END IF

                      GOTO ScaleZ

              END IF


'    The following is used with MakeMap = 1 since MakeSectn <> 1
              IF ScaleFactorX * (YdMax - YdMin) <= 365 THEN
                      ScaleFactor = ScaleFactorX
                      FOR i = 1 TO nd
                              Xd(i) = INT ((Xd(i) - XdMin) * ScaleFactor)
                              Yd(i) = INT ((Yd(i) - YdMin) * ScaleFactor)

                      NEXT i
                      GOSUB MaxMin
                      GOTO ScaleZ
              END IF

              IF ScaleFactorY * (XdMax -XdMin) <=615 THEN
                      ScaleFactor = ScaleFactorY
                      FOR i = 1 TO nd
                              Xd(i) = INT ((Xd(i) - XdMin) * ScaleFactor)
                              Yd(i) = INT ((Yd(i) - YdMin) * ScaleFactor)

                      NEXT i
                      GOSUB MaxMin
                      GOTO ScaleZ
              END IF

              PixMaxX% = PixMaxX% - XdMax
              PixMaxY% = PixMaxY% - YdMax
              IF PixMaxX% < 10 OR PixMaxY% < 10 THEN
                      PRINT " We Have trouble scaling!! bug in program!"
                      GOSUB PrsAnyKey
              END IF
              GOTO ChngPixMax
      END IF


      IF a$ = "2" THEN
              LOCATE 27,10
```

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```
                COLOR 2,1
                PRINT " Scale Factor (multiplier for above Length Units) = ";
                COLOR 1,2
                LINE INPUT " ", a$
IF a$ = "" OR VAL(a$) <= 0 THEN
                BEEP
                GOTO ScaleMenu
END IF
ScaleFactor = VAL(a$)

ScaledX = ScaleFactor * (XdMax - XdMin)
ScaledY = ScaleFactor * (YdMax - YdMin)

IF INT(ScaledY) <= 365 AND INT(ScaledX) <= 615 THEN
                CLS
                LOCATE 10,10
                        PRINT " Using a Scale Factor of  " + a$
                LOCATE 12,10
                        PRINT " will result in a map/section of: ";

                        PRINT INT(ScaledX) "x" INT(ScaledY) " pixels."
                LOCATE 14, 10
                        PRINT " Is this size OK? (Y/N)"
                LOCATE 16, 10
                        PRINT " Note: maximum map/section size = 615 x 365 pixels "

        YsNo a$

        IF a$ = "Y" AND MakeSectn = 1 THEN
                FOR i = 1 TO nd
                        Xd(i) = INT ((Xd(i) - XdMin) * ScaleFactor)
                        Yd(i) = INT ((Yd(i) - YdMin) * ScaleFactor)

                NEXT i
                GOSUB MaxMin
        END IF

        IF a$ = "N" AND MakeSectn = 1 THEN
                GOTO ScaleXY
        END IF

        IF a$ = "N" AND MakeMp = 1 THEN GOTO ScaleXY

        GOSUB MaxMin

        IF MakeSectn = 1 THEN

                IF ShowScreen = 1 THEN DepthMax = 365
                IF ShowScreen = 0.5 THEN DepthMax = 180

                IF YdMax > DepthMax THEN
                        CLS
                        LOCATE 12,10
                        PRINT " For your information:"
```

```
                              LOCATE 14,10
                              PRINT " At a Vertical Exaggeration of ";VertExg
                              LOCATE 16,10
                              PRINT " and a vertical-screen display of ";
INT(ShowScreen*100);"%."

                              LOCATE 18,10
                              COLOR 2,1
                              PRINT " [Only] the upper "; INT(DepthMax/YdMax*100)
;"% of the section will be displayed "

                              COLOR 1,2
                              LOCATE 20 ,10
                              PRINT " Is This OK? (Y/N)"
                              YsNo a$
                              IF a$ = "N" THEN GOTO VrtExg
                    END IF
                    GOSUB ChopDpth
                    GOSUB MaxMin
                    Scalem$ = "ScaleFactor"

                    GOTO ScaleZ


              END IF
        ELSE

              CLS
              LOCATE 10,10
                    PRINT " Scale Factor of " ScaleFactor  " is too big ... "

              LOCATE 12, 10
                    PRINT " Map/Section is too big to fit in window with a size of:"

              LOCATE 14, 10
                    PRINT "             ";
                    PRINT INT(ScaledX);
                    PRINT "x";
                    PRINT INT(ScaledY) "pixels"
              LOCATE 16, 10
                    PRINT " Maximum size = 615 x 365 pixels"

              LOCATE 18,10
                    PRINT " Please choose a smaller Scale Factor!"
              GOSUB PrsAnyKey
              GOTO ScaleXY
        END IF
END IF

IF a$ = "3" THEN
        PixMax% = 258

        GOSUB AspectOut
        GOSUB MaxMin

        ScaleFactorX = (PixMax% - 1)/(XdMax-XdMin)
        ScaleFactorY = (PixMax% - 1)/(YdMax-YdMin)
```

```
IF ScaleFactorX >= ScaleFactorY THEN
        ScaleFactor = ScaleFactorY
ELSE
        ScaleFactor = ScaleFactorX
END IF


FOR i = 1 TO nd
        Xd(i) = ((Xd(i) - XdMin) * ScaleFactor)
        Yd(i) = ((Yd(i) - YdMin) * ScaleFactor)

NEXT i

Scalem$ = "VistaPro"
GOSUB MaxMin


CLS
LOCATE 8,10
        PRINT " Done!... Map scaled for VistaPro."

LOCATE 12,10
        PRINT " Please write down these two numbers:"
LOCATE 14,10
        PRINT " Map Width  = "; INT((XdMax - XdMin) + 1)
LOCATE 16,10
        PRINT " Map Height = "; INT((YdMax - YdMin) + 1)
LOCATE 19,10
        PRINT " You will need the values of Map Width and Map Height in the"
LOCATE 20,10
        PRINT " MakeVista program to convert z-values file into VistaPro format."
LOCATE 22,10
        PRINT " Note: Screen aspect ratio is not adjusted when you select"
LOCATE 23,10
        PRINT "      map for VistaPro. This is better scaling for VistaPro."


LOCATE 28,10
        PRINT " To return to Previous Menu press P, otherwise ..."

GOSUB PrsAnyKey
a$ = UCASE$ (a$)
IF a$ = "P" THEN ScaleXY
END IF


ScaleZ:
IF LogZ$ = "Y" AND Scalem$ = "VistaPro" THEN
        IF ZdMin < 0 THEN
                CLS
                LOCATE 5,10
                        PRINT " Smallest (Z) Value = "; 10^ZdMin
                LOCATE 7, 10
                        PRINT " Do you wish to scale Z values "
```

```
                    LOCATE 8, 10
                              PRINT " so that smallest value is greater than 1 (for VistaPro) (Y/N) "

               YsNo a$
               IF a$ = "Y" THEN
                              LOCATE 12,10
                                    LINE INPUT " Please type factor to multiply by (10, 100,
etc.) "; Zfactor$

                              Zfactor = VAL(Zfactor$)
                              FOR i = 1 TO nd
                                    Zd(i) = 10 ^ Zd(i)
                                    Zd(i) = Zd(i) * Zfactor
                                    Zd(i) = LOG10 (Zd(i))
                                    LOCATE 14, 10
                                           PRINT Zd(i)
                              NEXT i
                              FOR i = 1 TO NmbrOFContours
                                    ContourLvl(i) = 10^ContourLvl(i)
                                    ContourLvl(i) = INT(ContourLvl(i) * Zfactor)
                                    LOCATE 16,10
                                           PRINT ContourLvl(i)
                                           ContourLvl(i) = LOG10 (ContourLvl(i))

                              NEXT i
                              LOCATE 18, 10
                                    PRINT "Done! Contours also scaled."
                              GOSUB PrsAnyKey
                    END IF
            END IF
       END IF

       IF AnimCounter >=1 THEN GOTO MapSize

       IF MakeMp = 1 AND LogZ$ = "N" AND Scalem$ = "VistaPro" THEN
               CLS
               LOCATE 8,10
               PRINT " If Z values represent depths, do you wish to"
               LOCATE 10,10
               PRINT " change them to elevations above a certain datum? (Y/N)"
               YsNo a$
               IF a$ = "Y" THEN
                              LOCATE 12, 10
                                    PRINT " Greatest depth (ZMax) = " , ZdMax
                              LOCATE 14,10
                                    LINE INPUT " Type value for datum (must be equal to or below
ZdMax)", Datum$
                              Datum = VAL(Datum$)
                              FOR i = 1 TO nd
                                    Zd(i) = Datum - Zd(i)
                              NEXT i
                              LOCATE 16,10
                              PRINT "Done! Depths converted to elevations above datum."
                              GOSUB PrsAnyKey
               END IF
```

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```
'            IF Scalem$ = "VistaPro" THEN
                 CLS
                 LOCATE 5, 10
                      PRINT "XdMax - XdMin  = ", (XdMax - XdMin)/ScaleFactor
                 LOCATE 6, 10
                      PRINT "Ydmax - YdMin  = ", (YdMax - YdMin)/ScaleFactor
                 LOCATE 7, 10
                      PRINT "ZdMax - ZdMin  = ", (ZdMax - ZdMin)


                 LOCATE 14,10
                      PRINT "For VistaPro type 10."
                 LOCATE 12, 10
                      LINE INPUT "Please type Vertical Exaggeration (for VistaPro)? ", a$

                 VertExg = VAL(a$)
                 IF VertExg = 0 THEN VertExg = 1

                 ' For VistaPro we must multiply by 10 !!!
                 FOR i = 1 TO nd
                      Zd(i) = Zd(i) * ScaleFactor * VertExg
                 NEXT i
                 FOR i = 1 TO NmbrOFContours
                      ContourLvl(i) = ContourLvl(i) * ScaleFactor * VertExg
                 NEXT i
                 GOSUB MaxMin
                 PRINT ZdMax, ZdMin
                 GOSUB PrsAnyKey

'            END IF
        END IF




MapSize:
        IF AnimCounter > 1 THEN
                 IF AnimShrink = 1 THEN
                      a$ = "2"
                      GOTO ShrinkIt
                 END IF
                 IF AnimShrink = 0 THEN GOTO ShiftXnY
        END IF

        IF Scalem$ = "VistaPro" OR Scalem$ = "ScaleFactor" THEN GOTO ShiftXnY
        CLS
        LOCATE 10,10
                 PRINT " Do you wish the Map/Section to be: "
        LOCATE 12, 10
                 PRINT "   (1) Full Size. "
        LOCATE 14, 10
                 PRINT "   (2) 1/4  Size (... good for testing). "
        LOCATE 16, 10
                 PRINT "   (3) Return to Previous Menu."
```

```
        GOSUB MainMenuEsc
        PrsNmbr 3, a$
        IF a$ = CHR$(27) THEN GOTO MainMenu


ShrinkIt:
        IF a$ = "2" THEN
                size = .5
                GOSUB Shrink
                IF AnimCounter >= 1 THEN AnimShrink = 1
        END IF
        IF a$ = "3" AND MakeSectn = 1 THEN GOTO VrtExg
        IF a$ = "3" THEN GOTO ScaleXY



ShiftXnY:
'   purpose of shift is to avoid painting at Xd or Yd = 0 and
'   overshooting top of page when paining coarse grids.
        FOR i = 1 TO nd
                Xd(i) = Xd(i) + 5
                Yd(i) = Yd(i) + 15
        NEXT i



RadiusOfInfluence:
        GOSUB MaxMin
        IF AnimCounter > 1 THEN GOTO CoarseFine
        CLS
        IF MakeMp = 1 THEN
                AreaofMap = (XdMax-XdMin)*(YdMax-YdMin)
                PixelsPerStn = INT(SQR(AreaofMap/nd))
                Radius = INT (3.3 * (PixelsPerStn))
        ELSE
                PixelsBtwnVES = INT((XdMax-XdMin)/NmbrofVES)
                Radius = INT (2.5 * (PixelsBtwnVES))
        END IF
        IF Radius = 0 THEN Radius = 1
        LOCATE 10,10
                PRINT " Recommended Radius of influence = ";Radius
        LOCATE 14,10
                PRINT " Use above Recommended Radius? (Y/N)"
        LOCATE 16,10
                PRINT " To return to Previous Menu press P "
        GOSUB Wayt
        a$ = UCASE$(a$)
        IF a$ = "P" THEN GOTO ScaleXY
        IF a$ = "Y" OR a$ = CHR$(13) THEN GOTO CoarseFine
        IF a$ = "N" THEN
                LOCATE 14, 10
                PRINT " To return to Previous Menu type P <ENTER>          "
                LOCATE 16,10
                LINE INPUT " Please type new value for Radius          ", a$
                IF a$ = "" THEN GOTO Radiusofinfluence
                a$ = UCASE$(a$)
                IF a$ = "P" THEN GOTO ScaleXY
```

```
                    NewRadius = VAL (a$)
                    Radius = NewRadius
                    GOTO CoarseFine
          END IF
          GOTO RadiusOfInfluence


CoarseFine:
          IF AnimCounter > 1 THEN GOTO DoIt
          CLS
          LOCATE 10,1
          PRINT " Do you wish the map/section to be gridded:"
          PRINT
          PRINT " Extra Coarse (11x11 pixels) ......... 11 ?"
          PRINT " Coarse        ( 9x9  pixels) ......... 9 ?"
          PRINT " MediumCoarse ( 7x7  pixels) ......... 7 ?"
          PRINT " Medium        ( 5x5  pixels) ......... 5 ?"
          PRINT " Fine          ( 3x3  pixels) ......... 3 ?"
          PRINT " Extra Fine    ( 1x1  pixels) ......... 1 ?"
          PRINT
          PRINT
          IF PixelsperStn <= 1 THEN PixelsperStn = 1
          IF PixelsBtwnVES <= 1 THEN PixelsBtwnVES = 1
          IF PixelsperStn >= 11 THEN PixelsperStn = 11
          IF PixelsperStn = 11 AND size = 0.5 THEN PixelsperStn = 5
          IF PixelsBtwnVES >=11 THEN PixelsBtwnVES = 11
          IF PixelsBtwnVES = 11 AND size = 0.5 THEN PixelsBtwnVES = 5
          IF Scalem$ = "VistaPro" THEN PixelsperStn = 3
          IF MakeMp = 1 THEN
                    PRINT " Note: Recommended grid size for this map should be <= "; PixelsperStn

          ELSE
                    PRINT " Note: Recommended grid size for this section should be <= "; PixelsBtwnVES
          END IF
          PRINT
          PRINT
          PRINT "     To use recommended grid size press <ENTER>. "
          PRINT
          PRINT "     To Return to Previous Menu type P <ENTER>. "
          PRINT
          PRINT
          PRINT "     Please press <ENTER>, type P, or type a grid size <ENTER> "
          LOCATE 28,65
          LINE INPUT " ", a$
          a$ = UCASE$(a$)
          IF a$ = "P" THEN GOTO RadiusofInfluence
          IF a$ = "" AND MakeMp = 1 THEN a = PixelsperStn
          IF a$ = "" AND MakeSectn = 1 THEN a = PixelsBtwnVES
          IF a$ <> ""       THEN a = VAL(a$)
          IF a = 11 OR a = 10 THEN stp = 11: pix = 5 : GOTO DoIt
          IF a = 9 OR a = 8 THEN stp = 9 : pix = 4 : GOTO DoIt
          IF a = 7 OR a = 6 THEN stp = 7 : pix = 3 : GOTO DoIt
          IF a = 5 OR a = 4 THEN stp = 5 : pix = 2 : GOTO DoIt
          IF a = 3 OR a = 2 THEN stp = 3 : pix = 1 : GOTO DoIt
```

```
        IF a = 1 THEN stp = 1 : pix = 0 : GOTO DoIt
        BEEP
        GOTO CoarseFine


DoIt:
        IF AnimCounter = 1 THEN
                GOSUB Palet1
                CLS
                GOSUB CloseWindows
        END IF
        GOSUB Palet2
        COLOR 1,0
        CLS
        Xmax = Xdmax + stp
        YMin = YdMin - stp
        Xmin = XdMin
        Ymax = Ydmax

        IF MakeSectn = 1 THEN
                DeltaXstretch = (XstretchTop - XstretchBtm) / (Ymax - Ymin)
        END IF

        FOR iy = Ymax TO Ymin  STEP -stp
                IF MakeSectn = 1 THEN
                        Xs = 1 / XstretchBtm
                END IF
                FOR ix = XMin TO  XMax  STEP stp
                        Zsum = 0 : Zwts = 0: Zvalu = 0
                        FOR i = 1 TO nd

                                IF Zd(i) = 0 THEN
                                        GOTO Nxti
                                END IF


                                IF ABS(ix - Xd(i))+ ABS(iy - Yd(i)) < Radius THEN
                                        IF (ix - Xd(i))= 0 AND (iy- Yd(i))= 0 THEN
                                                Zvalu = Zd(i)

                                                i = nd
                                                GOTO PlotIt
                                        END IF
                                        IF MakeSectn = 1 THEN
                                                Zdst = 1/(((ix-Xd(i))*Xs)^2 + ((iy-Yd(i)))^2)^2

                                        ELSE
                                                Zdst = 1/((ix-Xd(i))^2 + (iy-Yd(i))^2)^2
                                        END IF
                                        Zsum = Zsum + Zdst * Zd(i)
                                        Zwts = Zwts + Zdst
                                        Zvalu = Zsum/Zwts
                                END IF
Nxti:
```

```
                    NEXT i

PlotIt:

                Zcalc(ix,iy) = Zvalu

                WINDOW OUTPUT 1
                Kolor = NmbrOfContours + 2
                FOR j = 1 TO NmbrOfContours

                        IF Zvalu >= ContourLvl(j) THEN
                                Kolor = j + 1
                                j = NmbrOfContours
                        END IF
                NEXT j
                IF Zcalc(ix,iy) = 0 THEN Kolor = 0
                IF pix = 0 THEN
                        PSET (ix,iy),Kolor
                        GOTO nxt

                END IF

                LINE (ix-pix,iy-pix)-(ix+pix,iy+pix),Kolor,bf
nxt:

        a$ = INKEY$
        IF a$ = CHR$(27) AND AnimCounter >= 1 THEN GOTO MainMenu
        IF a$ = CHR$(27) THEN GOTO Redo
        IF a$ = "P" OR a$ = "p" THEN
                LOCATE 1,1
                PRINT " Program Haulted ... Press Any Key to Resume."
                GOSUB Wayt
                LOCATE 1,1
                PRINT "                               "
        END IF

        WINDOW OUTPUT 1
        NEXT ix
        IF MakeSectn = 1 THEN
                XstretchBtm = XstretchBtm + (DeltaXstretch * stp)
        END IF
NEXT iy


SmoothIt:
        IF stp = 1 THEN GOTO SaveZcalc

'       GOSUB ColorStns
'       GOSUB CleanUp

        IF AnimCounter >= 1 THEN GOSUB PrintDepth

        IF AnimCounter > 1 THEN
                IF AnimSmooth = 1 THEN GOTO SmoothX
```

```
                IF AnimSmooth = 0 THEN GOTO PlotStation
        END IF
        WINDOW 2,"",(200,200)-(600,250),2,1
        LOCATE 2,2
                PRINT " Smooth It (i.e. regrid it)? (Y/N)"
        YsNo a$
        IF a$ = "Y" THEN
                IF AnimCounter = 1 THEN AnimSmooth = 1
                GOTO SmoothX
        END IF

        IF a$ = "N" AND Scalem$ = "VistaPro" THEN
                        CLS
                        WINDOW 2,"",(200,200)-(600,250),2,1
                        LOCATE 2,7
                                PRINT "For VistaPro you must Smooth image to get"
                        LOCATE 3,7
                                PRINT "correct Zcalc values.  Smooth It? (Y/N)"
                        YsNo a$
                        IF a$ = "Y" THEN GOTO SmoothX
                        IF a$ = "N" THEN GOTO Redo
        END IF
        IF a$ = "N" THEN
                IF AnimCounter = 1 THEN AnimSmooth = 0
                GOTO PlotStation
        END IF

SmoothX:
        GOSUB CleanUp
        Smoothing = 1
        WINDOW OUTPUT 2
        CLS
        LOCATE 2,2
        PRINT " Computing ... Coarse Horizontal      "


HrzntlSweep:
        FOR iy = Ymax TO Ymin STEP -stp
                FOR ix = Xmin TO Xmax-stp STEP stp
                        Slope = (Zcalc(ix+stp,iy) - Zcalc(ix,iy))/stp
                        XIntercept = Zcalc(ix,iy) - (Slope*ix)
                        FOR X = ix TO ix+stp
                                HZcalc(X,iy) = (X * Slope) + XIntercept
                        NEXT X
                NEXT ix
        NEXT iy


DetailY:
        LOCATE 2,2
                PRINT " Computing ... Fine Vertical        "
        FOR ix = Xmin TO Xmax-stp
                FOR iy = Ymax TO Ymin+stp STEP -stp
                        Slope = (HZcalc(ix,iy) - HZcalc(ix,iy-stp))/stp
```

```
                    YIntercept = HZcalc(ix,iy) - (Slope*iy)
                    FOR Y = iy TO iy-stp STEP -1
                              ZcalcY(ix,Y) = (Y * Slope) + YIntercept


                    NEXT Y
            NEXT iy
      NEXT ix



PaintIt:


      WINDOW 2,"",(100,200)-(630,300),2,1
      LOCATE 2,1
              PRINT " Smoothing Btm to Top .., To Pause: Press P, To Abort: Press <Esc>."

      IF AnimCounter >= 1 THEN
              LOCATE 4,1
              PRINT " AnimCounter = " AnimCounter; ", ";"SliceDepth = ";SliceDepth;",
      ";NmbrOfSlices-AnimCounter;"slices to go"
              LOCATE 5,1
              PRINT " CAUTION: If multitasking, close windows of other programs"
              LOCATE 6,1
              PRINT "         before automatic saving of an animation frame."
      END IF


      FOR iy = Ymax TO Ymin+stp STEP -1
              FOR ix = Xmin TO Xmax-stp


                    WINDOW OUTPUT 2
                    a$ = INKEY$
                    IF a$ = CHR$ (27) THEN GOTO Redo
                    IF a$ = "P" OR a$ = "p" THEN
                              LOCATE 7,1
                              COLOR 2,1
                              PRINT " Program Haulted ... press any key to Resume."
                              GOSUB Wayt
                              COLOR 1,0
                              LOCATE 7,1
                              PRINT "                              "

                    END IF

                    WINDOW OUTPUT 1
                    Zcalc (ix,iy) = ZcalcY(ix,iy)
                    Zvalu = Zcalc(ix,iy)
                              Kolor = NmbrOfContours + 2
                              FOR j = 1 TO NmbrOfContours


                              IF Zvalu >= ContourLvl(j) THEN
                              Kolor = j + 1
                                      j = NmbrOfContours
                                      PSET (ix,iy),Kolor
                              END IF
```

```
                    NEXT j
            NEXT ix
      NEXT iy


SaveZcalc:
      IF MakeSectn = 1 THEN GOTO PlotStation
      IF Scalem$ <> "VistaPro" THEN GOTO PlotStation
      IF Smoothing = 0 AND stp <> 1 AND Scalem$ = "VistaPro" THEN GOTO PlotStation
      Work$ = "SaveZcalc"
      WINDOW 2,"",(200,200)-(500,240),2,1
      LOCATE 2,7
            PRINT "Save Zcalc? (Y/N)"
      YsNo a$
      IF a$ = "N" THEN GOTO PlotStation
      IF a$ = "Y" THEN
            IF LogZ$ = "Y" THEN
                  FOR iy = YdMax TO YdMin STEP -1
                        FOR ix = XdMin TO XdMax
                              Zcalc(ix,iy) = 100 * Zcalc(ix,iy)
                        NEXT ix
                  NEXT iy
            END IF
            WINDOW CLOSE 2
            GOSUB Palet1
            ReqMsg$ = "Save .. Zcalc"
            GOSUB GetReq
            IF Worked% = 0 THEN
                  GOSUB Palet2
                  GOTO SaveZcalc
            END IF
            GOSUB Palet2
            WINDOW 2, "", (200,200)-(500,240),2,1
            LOCATE 2,7
                  PRINT " Saving Zcalc ..."
            OPEN File$ FOR OUTPUT AS #1
            FOR iy = YdMax TO YdMin STEP -1
                  FOR ix = XdMin TO XdMax
                        PRINT #1,Zcalc(ix,iy);
                  NEXT ix
                  PRINT #1,
            NEXT iy
            CLOSE #1
            WINDOW CLOSE 2
      END IF


PlotStation:



      IF AnimCounter >= 1 THEN
            a$ = "S"
```

```basic
                GOSUB PrintDepth
                GOTO DrawBoxNStns
        END IF


        WINDOW 2,"",(100,200)-(600,240),2,1
        IF stp <> 1 THEN
                LOCATE 2,7
                        PRINT " Color the Stations with their original values? (Y/N)"
                YsNo a$
                IF a$ = "Y" THEN GOSUB ColorStns
        END IF


        IF MakeSectn = 1 THEN
                WINDOW OUTPUT 1
                FOR i = 1 TO nd
                        PSET (Xd(i),Yd(i)), 1
                NEXT i
                GOSUB DrawTopo
                GOTO SaveImage
        END IF


        WINDOW 2,"",(100,200)-(600,240),2,1
                LOCATE 2,7
                        PRINT " PLOT stations as: Squares, Points, or None? (S/P/N)      "


        GOSUB Wayt
        a$ = UCASE$ (a$)
        IF a$ = "N" THEN
                WINDOW CLOSE 2
                GOTO SaveImage
        END IF
        WINDOW CLOSE 2

DrawBoxNStns:
        IF MakeMp = 1 THEN
                WINDOW OUTPUT 1
                LINE (Xdmin-1,Ydmin-1)-(Xdmax+1,YdMax+1),1,b
        END IF


        IF a$ = "S" OR a$ = "Y" OR a$ = CHR$(13) THEN
                FOR i = 1 TO nd
                        WINDOW OUTPUT 1
                        IF Zd(i) = 0 AND ZdMin >= 0 THEN
                                LINE (Xd(i)-1,Yd(i)-1)-(Xd(i)+1,Yd(i)+1),1,bf
                        ELSE
                                LINE (Xd(i)-2,Yd(i)-2)-(Xd(i)+2,Yd(i)+2),1,b
                        END IF
                NEXT i
                GOTO SaveImage
        END IF


        IF a$ = "P" THEN
                FOR i = 1 TO nd
                        IF Zd(i) = 0 AND ZdMin >= 0 THEN GOTO NoPoint
```

```
                        PSET (Xd(i),Yd(i)), 1
NoPoint:
                NEXT i
                GOTO SaveImage
        END IF
        BEEP
        GOTO PlotStation


SaveImage:

        IF AnimCounter >= 1 THEN
                a$ = "Y"
                WINDOW CLOSE 2
                GOTO IffSave
        END IF

        WINDOW 2,"",(200,200)-(500,240),2,1
        LOCATE 2,7
                PRINT" Save Image? (Y/N)"                -
        YsNo a$
        WINDOW CLOSE 2


IffSave:
        IF a$ = "Y" THEN
                IF AnimCounter >=1 THEN
                        AnimNmbr = 10000 + AnimCounter
                        AnimNmbr$ = STR$(AnimNmbr)
                        AnimNmbr$ = RIGHT$(AnimNmbr$,4)
                        GOTO AnimPath
                END IF
                GOSUB CloseWindows
                WINDOW 2,"",(150,200)-(600,240),2,1
                LOCATE 2,2
                PRINT" Switch Black and White colors before saving? (Y/N)"
                YsNo a$

                IF a$ = "Y" THEN
                        WINDOW OUTPUT 1
                        GOSUB Palet3
                        Switch = 1
                END IF

                WINDOW 2,"",(100,100)-(600,350),2,1
                CLS
                IF MakeSectn = 1 THEN
                        LOCATE 4,2
                                PRINT " The Cross Section you wish to save is from File:"
                        LOCATE 6,2
                                PRINT " ";VesSection$
                        LOCATE 8,2
                                PRINT " Section Length        = " SectionLength; Units$
                        LOCATE 9,2
```

```
                        XSScale = ((XdMax - XdMin) + 1)/SectionLength
                        IF XSScale < 1 THEN
                                PRINT " Scale: 1000 Length Units = "; INT(XSScale * 1000) ;"
pixels"
                        ELSE
                                PRINT " Scale: 1 Length Unit     = ";XSScale;"pixels"

                        END IF

                        LOCATE 10,2
                                PRINT " Vertical Exaggeration    = " VertExg
                        LOCATE 11,2
                                PRINT " Copy above information to make Cross-Section Scale when "

                        LOCATE 12,2
                                PRINT " you later edit and annotate the section in Deluxe Paint."

                ELSE
                        LOCATE 4,2
                                PRINT " Map Width             = " XMapWidth  " Length Units."
                        LOCATE 6,2
                        XMScale = ((XdMax - XdMin) + 1)/XmapWidth
                        IF XMScale < 1 THEN
                                PRINT " Scale: 1000 Length Units = "; INT(XMScale * 1000) ; "
pixels"
                        ELSE
                                PRINT " Scale: 1 Length Unit     = "; XMScale ; " pixels"

                        END IF
                        LOCATE 8,2
                                PRINT " Copy above information to make Map Scale when "

                        LOCATE 9,2
                                PRINT " you later edit and annotate the map in Deluxe Paint."

                        IF Slice = 1 THEN
                                LOCATE 5,2
                                PRINT " Depth of Slice          = " ;SliceDepth$; " Depth Units"
                        END IF
                END IF
                LOCATE 16,2
                        PRINT " Press Any Key When Ready. "
                GOSUB Wayt
                WINDOW CLOSE 2

AnimPath:

                GOSUB Palet1
                work$ = "SaveIFF"
                ReqMsg$ = "Save .. IFF image"

                IF AnimCounter > 1 THEN
                        File$ = File7$ + AnimNmbr$ + ".iff"
                        GOTO WriteIff
                END IF
```

```
IF AnimCounter = 1 THEN
        WINDOW 2,"",(45,200)-(630,350),2,1
        CLS
        LOCATE 2,2
        PRINT " To save the first Anim Frame, in the directory of your"
        LOCATE 4,2
        PRINT " choice, please type the first 4 characters of the"
        LOCATE 6,2
        PRINT " survey-area name followed by 0001.iff.  Example: ABCD0001.iff."
END IF

GOSUB GetReq

IF worked% = 0 THEN
        IF AnimCounter = 1 THEN
                WINDOW OUTPUT 2
                CLS
                BEEP
                LOCATE 2,2
                        PRINT " Do You wish to cancel the Animation? (Y/N)"
                YsNo a$
                IF a$ = "Y" THEN
                                WINDOW OUTPUT 1
                                WINDOW CLOSE 2
                                GOTO MainMenu
                ELSE
                        GOTO AnimPath
                END IF
        END IF

        WINDOW CLOSE 2
        GOTO Redo
END IF
WINDOW CLOSE 2
IF AnimCounter = 1 THEN
        FOR ii = 0 TO LEN(File$)
                File5$ = LEFT$(File$,LEN(File$)-ii)
                File6$ = RIGHT$(File5$,1)
                IF File6$ = "/"  OR File6$ = ":" THEN

                        File7$ = LEFT$(File$,LEN(File5$)+4)  '4=LEN(root file
```
name)
```
                        EXIT FOR
                END IF
        NEXT ii

        File$ = File7$ + AnimNmbr$ + ".iff"
END IF

FileExists% = -1
OPEN File$ FOR INPUT AS #1
CLOSE #1
IF FileExists% = -1 THEN
```

```
                    WINDOW 2,"File Exists",(30,150)-(630,240),2,1
                    LOCATE 2,2
                    PRINT File$ "-File exists, Replace it? (Y/N)"
                    YsNo a$
                    IF a$ = "Y" THEN
                            WINDOW CLOSE 2
                            GOSUB Palet2
                            IF switch = 1 THEN
                                    switch = 0
                                    GOSUB Palet3
                            END IF
                            WINDOW OUTPUT 1
                            SetWindow WINDOW(7)
                            SaveIFF SADD(File$+CHR$(0))
                            GOTO Redo
                    END IF
                    IF a$ = "N" THEN GOTO SaveImage
            END IF


WriteIFF:

            GOSUB Palet2
            IF switch = 1 THEN
                    switch = 0
                    GOSUB Palet3
            END IF
            WINDOW OUTPUT 1
            SetWindow WINDOW(7)
            SaveIFF SADD(File$+CHR$(0))

            IF AnimCounter >= 1 THEN

                    OPEN File7$+ "AnimCounter" FOR OUTPUT AS #1
                    PRINT #1, File4$
                    PRINT #1, File7$
                    PRINT #1, XLogInterval, SliceDepth, AnimCounter, NmbrOfSlices,Radius
                    PRINT #1, AnimShrink, AnimFlip, AnimSmooth,Stp,Pix,NmbrOfContours
                    PRINT #1, LogZ$
                    FOR i = 1 TO NmbrofContours
                            PRINT #1, ContourLvl(i)
                    NEXT i


                    File$ = File4$ + VesNmbr$(J) + ".LYR"      'this restores original path



                    CLOSE #1
            END IF

        END IF


Redo:
            GOSUB Palet2
```

```
IF AnimCounter >= 1 THEN
        IF a$ = CHR$(27) AND AnimCounter >= 1 THEN
                WINDOW CLOSE 2
                GOSUB Palet1
                GOTO MainMenu
        END IF
        AnimCounter = AnimCounter + 1
        GOTO DepthOfSlice
END IF

WINDOW 2,"",(100,200)-(630,240),2,1
LOCATE 2,3
PRINT "Redo the Map/Section using different options? (Y/N)"
YsNo a$
WINDOW CLOSE 2
GOSUB Palet1

IF a$ = "Y" AND SliceDepth$ <> "" OR a$ = "Y" AND AnimCounter>=1 THEN
        Slice = 1
        CLS
        GOTO DepthOfSlice
END IF
IF a$ = "Y" AND MakeMp = 1 THEN GOTO ScaleXY
IF a$ = "Y" AND MakeSectn = 1 THEN
        AdjustWidth = 0
        GOTO VrtExg
END IF
GOTO MainMenu
```

' ************** Subroutines and SubPrograms follow *************

```
Palet1:
'        This Palet is for colors in the windows, reqesters, etc
'  ForeGround and BackGround colors are determined by COLOR command.
        PALETTE 0, 0.1, 0.1,.6   ' Outside boundary and requestor typein bars
        PALETTE 1, 1, .95, .95   ' Foreground Color (off white)
        PALETTE 2, 0, 0, .8                ' BackGround Color (dark blue)
        PALETTE 3, 1, 0, 0
        PALETTE 4, 1, .4, 0
        PALETTE 5, 1, .6, 0
        PALETTE 6, 1, 0.8, 0
        PALETTE 7, 1, 0.9, 0
        PALETTE 8, 0, .9, 0
        PALETTE 9, 0, .7, 0
        PALETTE 10, 0,.5, 0
        PALETTE 11, 0, 1, 1
        PALETTE 12, 0,.7, 1
        PALETTE 13, 1, 1, 1   ' color of "vertical bar" cursor (White)
        PALETTE 14, 0, 0, 0
        PALETTE 15, 1, 1, 0   ' color of cursor in file-requester (Yellow)
RETURN
```

```
' This palette is for painting the Image
Palet2:
          PALETTE 0, 0, 0, 0
          PALETTE 1, 1, 1, 1
          PALETTE 2,.8, 0, 0
          PALETTE 3, 1, 0, 0
          PALETTE 4, 1, .4, 0
          PALETTE 5, 1, .6, 0
          PALETTE 6, 1, .8, 0
          PALETTE 7, 1, .9, 0
          PALETTE 8, 0, .9, 0
          PALETTE 9, 0, .7, 0
          PALETTE 10, 0,.5, 0
          PALETTE 11, 0, 1, 1
          PALETTE 12, 0,.7, 1
          PALETTE 13, 0,.5, 1
          PALETTE 14, 0, 0, 1
          PALETTE 15, 0, 0, .75
RETURN


Palet3:
              PALETTE 0,1,1,1
              PALETTE 1,0,0,0
RETURN



Wayt:
          a$ = INKEY$
          IF a$ = "" THEN Wayt
RETURN


PrsAnyKey:
          a$ = " Press Any Key to continue ... "
          Center 30, a$
          a$ = INKEY$
          IF a$ = "" THEN PrsAnyKey
RETURN



MainMenuEsc:
          a$ = " To Return to Main Menu and Discard Data press <Esc> "
          Center 30, a$
RETURN


RestoreSlice:
          IF RestoreIt = 0 THEN
                  FOR i = 1 TO nd
                          VESNmbrTemp$(i) = VESNmbr$(i)
                          XdTemp3(i) = Xd(i)
                          YdTemp3(i) = Yd(i)
                  NEXT i
                  RestoreIt = 1
                  GOSUB MaxMin
```

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```
                    RETURN
            END IF
            IF RestoreIt = 1 THEN
                    FOR i = 1 TO nd
                            Xd(i) = XdTemp3(i)
                            Yd(i) = YdTemp3(i)
                            VESNmbr$(i) = VESNmbrTemp$(i)
                    NEXT i
                    GOSUB MaxMin
                    RETURN
            END IF
RETURN


RestoreAll:

            IF Restorem = 0 THEN
                    FOR i = 1 TO nd
                            XdTemp(i) = Xd(i)
                            YdTemp(i) = Yd(i)
                            ZdTemp(i) = Zd(i)
                    NEXT i

                    FOR j = 1 TO NmbrOfVES
                            ElevationTemp(j) = Elevation (j)
                    NEXT j
                    ndTemp = nd
                    Restorem = 1
                    RETURN
            END IF

            IF Restorem = 1 THEN
                    nd = ndTemp
                    FOR i = 1 TO nd
                            Xd(i) = XdTemp(i)
                            Yd(i) = YdTemp(i)
                            Zd(i) = ZdTemp(i)
                    NEXT i

                    FOR j = 1 TO NmbrOfVES
                            Elevation (j) = ElevationTemp (j)
                    NEXT j
                    GOSUB MaxMin
            END IF
RETURN


ColorStns:
            WINDOW 2,"",(100,200)-(500,240),2,1
            CLS
            LOCATE 2,7
            PRINT " Superimposing station colors"
            WINDOW OUTPUT 1

            FOR i = 1 TO nd
```

```
                    Zvalu = Zd(i)
                    Kolor = NmbrOfContours + 2
                    FOR j = 1 TO NmbrOfContours

                            IF Zvalu >= ContourLvl(j) THEN
                                    Kolor = j + 1
                                    j = NmbrOfContours
                            END IF
                            IF size = .5 THEN
                                    PSET (Xd(i),Yd(i)),Kolor
                            ELSE
                                    LINE (Xd(i)-1,Yd(i)) - (Xd(i)+1,Yd(i)), Kolor
                                    LINE (Xd(i),Yd(i)-1) - (Xd(i),Yd(i)+1), Kolor
                            END IF
                    NEXT j
            NEXT i
            WINDOW OUTPUT 2
RETURN


CleanUp:
        WINDOW 2,"",(200,200)-(500,240),2,1
        CLS
        LOCATE 2,2
        PRINT " Trimming and Cleaning up .... "
        WINDOW OUTPUT 1
        LINE (Xdmin-1,Ydmin-1)-(Xdmax+1,YdMax+1),1,b
        PAINT (Xdmax+3,Ydmax+3),0,1
        LINE (Xdmin-1,Ydmin-1)-(Xdmax+1,YdMax+1),0,b
RETURN


Rotate:
        FOR i = 1 TO nd
                XdRotate = Xd(i)
                Xd(i) = Yd(i)
                Yd(i) = XdRotate
        NEXT i
RETURN


Origin:
        IF MakeSectn = 1 THEN RETURN

        IF AnimCounter > 1 AND AnimFlip = 1 THEN
                a$ = "1"
                GOTO FlipY
        END IF

        IF AnimCounter > 1 AND AnimFlip = 0 THEN RETURN

        IF XdRotate <> 0 THEN
                a$ = "1"
                GOTO FlipY
```

```
        END IF
        GOSUB Palet1
        COLOR 1,2
        CLS
        LOCATE 8,10
        PRINT " Is the Y-axis on your map:"
        LOCATE 12, 10
        PRINT " (1) Pointing upward."
        LOCATE 14, 10
        PRINT " (2) Pointing downward."
        LOCATE 16,10
        PRINT " (3) Return to Main Menu and discard data. "
        LOCATE 24,10
        PRINT "    Please Press Appropriate Number. "
        PrsNmbr 3, a$

FlipY:
        IF a$ = "1" THEN
                GOSUB MaxMin
                FOR i = 1 TO nd
                            Yd(i) = YdMax - Yd(i)

                NEXT i
                IF AnimCounter >= 1 THEN AnimFlip = 1
        END IF
        IF a$ = "3" THEN GOTO MainMENU
RETURN


FixAspect:
        IF MakeMp = 1 AND Work$ = "LoadXY" THEN
                CLS
                LOCATE 10,10
                PRINT " Adjust Screen-Aspect Ratio in Y direction ? (Y/N)"
                LOCATE 14,10
                PRINT " In general Press  Y"
                LOCATE 16,10
                PRINT " Press  N  only if (X,Y) data were entered in pixels using"
                LOCATE 18,10
                PRINT "                a digitizing tablet and Deluxe Paint."
                YsNo a$
                IF a$ = "Y" THEN
                        FOR i = 1 TO nd
                                Yd(i) = Yd(i) * 0.855
                        NEXT i
                END IF
        ELSE
                FOR i = 1 TO nd
                        Yd(i) = Yd(i) * 0.855
                NEXT i
        END IF
'   I use an aspect ratio correction of 0.855 instead of 0.9.
'   I am using a Sony Monitor with 0.25 pitch. Using 0.855 gives a more
'   correct ratio of width to Height on both HP-Laser and Xerox 4020 printers.
```

' Graphics printer options in Amiga DOS set at Absolute to maximize print size.
RETURN

AspectOut:
```
        FOR i = 1 TO nd
                Yd(i) = Yd(i)/0.855
        NEXT i
RETURN
```

ChopTop:
```
                Counter = 1

                TopChop = DepthMax/50
                FOR i = 2 TO nd
                        IF Yd(i) >= TopChop THEN
                                Counter = Counter + 1
                                Xd(Counter) = Xd(i)
                                Yd(Counter) = Yd(i)
                                Zd(Counter) = Zd(i)
                        END IF
                NEXT i
                nd = Counter
RETURN
```

AdjstElevn:
```
        j = 1
        FOR i = 1 TO nd
                IF Xd (i) = Xd (i+1) THEN Yd(i) = Yd(i) - Elevation (j)
                IF Xd(i) <> Xd (i + 1) THEN
                        Yd(i) = Yd(i) - Elevation (j)
                        j = j + 1
                END IF
        NEXT i
RETURN
```

DrawTopo:
```
        WINDOW 2,"",(100,200)-(600,240),2,1
        CLS
        LOCATE 2,2
        PRINT " One moment .. adding topography, soundings, and cleaning up. "

        WINDOW OUTPUT 1
        J = 1
        K = 1
        GOSUB Triangle
        FOR i = 1 TO nd-1
                IF Xd(i) = Xd(i+1) THEN K = K + 1
                IF Xd(i) <> Xd(i+1) THEN
                        GOSUB Triangle
                        LINE (Xd(J), Yd(J)) - (Xd(K+1), Yd(K+1))
```

```
                        K = K + 1
                        J = K
                END IF
            NEXT i
            GOSUB Triangle
            LINE (XdMax+1,Yd(J)) - (XdMax+1, YdMax+1)
            LINE (XdMax+1, YdMax+1) - (XdMin-1, YdMax+1)
            LINE (XdMin-1, YdMax+1) - (XdMin-1,Yd(1))
            PAINT (Xdmax+3,Ydmax+3),0,1
            WINDOW CLOSE 2
RETURN


Triangle:
            PSET (Xd(J), Yd(J)-2)
            PSET (Xd(J), Yd(J)-3)
            LINE (Xd(J)-1, Yd(J)-4) - (Xd(J)+1, Yd(J)-4)
            LINE (Xd(J)-1, Yd(J)-5) - (Xd(J)+1, Yd(J)-5)
            LINE (Xd(J)-1, Yd(J)-6) - (Xd(J)+1, Yd(J)-6)
            LINE (Xd(J)-2, Yd(J)-7) - (Xd(J)+2, Yd(J)-7)
            LINE (Xd(J)-2, Yd(J)-8) - (Xd(J)+2, Yd(J)-8)
            LINE (Xd(J)-2, Yd(J)-9) - (Xd(J)+2, Yd(J)-9)
            LINE (Xd(J)-2, Yd(J)-10) - (Xd(J)+2, Yd(J)-10)
RETURN



ChopDpth:
                    YdCounter = 0
                    FOR i = 1 TO nd
                            IF Yd(i) <= DepthMax THEN
                                    YdCounter = YdCounter + 1
                                    Xd(YdCounter) = Xd(i)
                                    Yd(YdCounter) = Yd(i)
                                    Zd(YdCounter) = Zd(i)
                            END IF
                    NEXT i
                    nd = YdCounter
RETURN



Shrink:
            FOR i = 1 TO nd
                    Xd(i) = INT(Xd(i)/2)
                    Yd(i) = INT(Yd(i)/2)
            NEXT i
            XdMin = INT(XdMin/2)
            XdMax = INT(XdMax/2)
            YdMin = INT(YdMin/2)
            YdMax = INT(YdMax/2)
RETURN



MaxMin:
            XdMax = Xd(1)
```

```
                XdMin = Xd(1)
                YdMin = Yd(1)
                YdMax = Yd(1)
                ZdMax = Zd (1)
                ZdMin = Zd(1)
                FOR i = 2 TO nd
                        IF XdMin > Xd(i) THEN XdMin = Xd(i)
                        IF XdMax < Xd(i) THEN XdMax = Xd(i)
                        IF YdMin > Yd(i) THEN YdMin = Yd(i)
                        IF YdMax < Yd(i) THEN YdMax = Yd(i)
                        IF ZdMin > Zd(i) THEN ZdMin = Zd(i)
                        IF ZdMax < Zd(i) THEN ZdMax = Zd(i)
                NEXT i
RETURN


ContourInfo:
        LOCATE 12, 10
                PRINT " Total Number of stations = ";nd
        GOSUB MaxMin
        XMapWidth = Xdmax - Xdmin
        XMapHight = YdMax - YdMin
        LOCATE 14,10
                PRINT " Map Width = " XMapWidth " (m, km, etc). "
        LOCATE 16, 10
                PRINT " Map Height = " XMapHight " (m, km, etc). "

        LOCATE 19,10
                PRINT " Zmax = "Zdmax, " Zmin = "Zdmin
        SugstContrIntrvl = (Zdmax - Zdmin)/13
        LOCATE 21,10
                IF SugstContrIntrvl >= 1 THEN
                        PRINT " FYI: Contour interval should be about  " INT(SugstContrIntrvl)
                ELSE
                        PRINT " FYI: Contour interval should be about  " SugstContrIntrvl
                END IF
        LOCATE 23, 10
                PRINT " If you wish to enter contour levels now, Press C, otherwise .."
        GOSUB PrsAnyKey
RETURN


Warning:
        GOSUB Palet1
        COLOR 1,2
        CLS
        LOCATE 17,10
        PRINT "CAUTION: When Loading a layering file, the File Name MUST start "
        LOCATE 19,10
        PRINT "        with the first 4 characters of the survey-area name."
        LOCATE 23, 10
        PRINT " HINT: After you click on the layering directory, you may "
        LOCATE 24, 10
        PRINT "        double click on ANY file name with the appropriate "
```

```
                    LOCATE 25, 10
                    PRINT "      first 4 characters and the program will load"
                    LOCATE 26, 10
                    PRINT "      the correct sequence of layering files!!."
                    COLOR 1,2
RETURN


PrintDepth:

                    WINDOW OUTPUT 1
                    LOCATE 34,66
                    SliceChop = VAL(LEFT$(STR$(SliceDepth),5))
                    PRINT " Depth =";SliceChop
                    WINDOW OUTPUT 2
RETURN


TrimIt:
         FOR kk = 1 TO LEN(VESNmbr$(i))
                    IF LEFT$(VESNmbr$(i),1) = " " THEN VESNmbr$(i) = RIGHT$(VESNmbr$(i),
LEN(VESNmbr$(i))-1)
                    IF RIGHT$(VesNmbr$(i),1) = " " THEN VESNmbr$(i) = LEFT$(VESNmbr$(i),
LEN(VESNmbr$(i))-1)
         NEXT kk
RETURN


CloseWindows:
                    WINDOW 2,"",(100,100)-(600,300),2,1
                    COLOR 1,3
                    CLS
                    LOCATE 4,2
                              PRINT " Close Windows and exit ALL other programs including"

                    LOCATE 6,2
                              PRINT " Screen Savers or Blankers. Workbench Windows are OK."
                    IF AnimCounter = 1 THEN
                              LOCATE 10,2
                              PRINT " * Above instructions MUST be observed during automatic"
                              LOCATE 11,2
                              PRINT "   saving of ANIMATION-FRAMES."
                              LOCATE 13,2
                              PRINT " * During the generation of Animation Frames you may:"
                              LOCATE 14,2
                              PRINT"    Press P to Pause (& multitask) or Press <Esc> to Abort."
                    END IF
                    LOCATE 16,2
                              PRINT " Press Any Key When Ready."
                    GOSUB Wayt
                    COLOR 1,2
                    WINDOW CLOSE 2
RETURN


Step2Cont:


' M = Counter for sampled layer depths and resistivities.
' i = Counter for number of layers
```

' YdTemp = depths of layers, ZdTemp = resistivity of layers

'Sampling of the top layer

```
M = 1
Ydtemp2(M) = YdTemp (1) / 1.2
ZdTemp2(M) = ZdTemp (1)
```

'Sampling of middle layers

```
FOR i = 1 TO NmbrofLayers - 1

    M = M + 1
    YdTemp2 (M) = YdTemp (i)
    ZdTemp2 (M) = SQR(ZdTemp (i) * ZdTemp (i+1))

    IF i = NmberOfLayers - 1 THEN EXIT FOR 'to avoid averaging
99999

    M = M + 1
    YdTemp2 (M) = SQR(YdTemp (i) * YdTemp (i+1))
    ZdTemp2 (M) = ZdTemp (i+1)

NEXT i
```

' Sampling last layer

```
YdTemp2 (M) = YdTemp (NmbrofLayers - 1) * 1.1
ZdTemp2 (M) = ZdTemp (NmbrofLayers)

M = M + 1
YdTemp2 (M) = YdTemp2 (M - 1) * 1.1
ZdTemp2 (M) = ZdTemp2 (M - 1)

M = M + 1
YdTemp2 (M) = YdTemp2 (M - 1) * 1.1
ZdTemp2 (M) = ZdTemp2 (M - 1)

M = M + 1
YdTemp2 (M) = YdTemp2 (M - 1) * 1.1
ZdTemp2 (M) = ZdTemp2 (M - 1)
```

RETURN

Initlz:
```
        CLS
        LOCATE 14,20
        PRINT " One Moment .... Clearing Memory."
'       CLEAR command is flaky, it can corrupt memory and I will not use it anymore.
```

```
        FOR i = 1 TO 50
                XDist (i) = 0
                YdTemp2(i) = 0
                ZdTemp2(i) = 0
        NEXT i

        FOR i = 1 TO 10000
                YdTemp (i) = 0
                XdTemp (i) = 0
                ZdTemp(i) = 0
        NEXT i

        FOR i = 1 TO 500
                YdTemp3(i) = 0
                XdTemp3(i) = 0
        NEXT i

        Scalem$ = ""
        LogZ$ = ""
        a$ = ""
        b$ = ""
        c$ = ""
        d$ = ""
        SliceDepth$ = ""
        Slice = 0
        nd = 0
        ndz = 0
        AdjustWidth = 0
        Restorem = 0
        RestoreIt = 0
        Size = 0
        Smoothing = 0
        XdRotate = 0
        MakeSectn = 0
        MakeMp = 0
        NmbrOfContours = 0
        ContoursLogged = 0
        AnimCounter = 0
        AnimShrink = 0
        AnimFlip = 0
        AnimSmooth = 0

        GOSUB Palet1
        COLOR 1,2
RETURN


SUB QwickSort (md,DN()) STATIC

        SA=1
        U(1)=1
        R(1)=md         ' md = number of elements to be sorted
10 UA=U(SA)
        RA=R(SA)
```

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```
            SA=SA-1
20 UZ=UA
        RZ=RA
        RR=(UA+RA)/2
        X=DN(RR)
30 C=C+1
        IF DN(UZ)>=X THEN 40
         UZ=UZ+1
        GOTO 30
40 C=CA
        IF X>=DN(RZ) THEN 50
        RZ=RZ-1
        GOTO 40
50 IF UZ>RZ THEN 60
        S=S+1
        TZ=DN(UZ)
        DN(UZ)=DN(RZ)
        DN(RZ)=TZ
        UZ=UZ+1
        RZ=RZ-1
60 IF UZ<=RZ THEN 30
        IF UZ>=RA THEN 70
        SA=SA+1
        U(SA)=UZ
        R(SA)=RA
70 RA=RZ
        IF UA<RA THEN 20
        IF SA>0 THEN 10


END SUB



SUB Center (y, a$) STATIC
        X = (80 - LEN(a$))/2
        LOCATE y,x
                PRINT a$
END SUB



SUB PrsNmbr (Nmbr, a$) STATIC
Wait4Nmbr:
                a$ = INKEY$
                IF a$ = "" THEN Wait4Nmbr
                IF a$ = CHR$(27) THEN EXIT SUB
                IF Nmbr = 9 AND a$ = "0" THEN EXIT SUB

                b = VAL (a$)
                IF  b < 1   OR b > Nmbr THEN BEEP : GOTO Wait4Nmbr
END SUB



SUB YsNo (a$) STATIC
Wait4YsNo:
        a$ = INKEY$
```

```
        IF a$ = "" THEN Wait4YsNo
        a$ = UCASE$(a$)
        IF a$ = CHR$(13) THEN a$ = "Y"
        IF a$ = "Y" OR a$ ="N" THEN EXIT SUB
        BEEP
        GOTO Wait4YsNo
END SUB


Kwit:
        CLS
        LOCATE 10,10
        PRINT " Are you sure you want to Quit?  (Y/N)"
        YsNo a$
        IF a$ = "Y" THEN LIBRARY CLOSE : SYSTEM
        IF a$ = "N" THEN GOTO StartHere


ChkError:
        ON ERROR GOTO ChkError   'This is needed to keep on error active after resume!

'  ERR code 53 is for file not found
        IF ERR = 53 AND Work$ = "SaveXYZ" THEN FileExists% = 0 : RESUME WriteXYZ
        IF ERR = 53 AND Work$ = "SaveXY" THEN FileExists% = 0 : RESUME WriteXY
        IF ERR = 53 AND Work$ = "SaveVESNmbrNxy" THEN FileExists%=0 : RESUME
WriteVESNmbrNxy
        IF ERR = 53 AND Work$ = "SaveZ"  THEN FileExists% = 0 : RESUME WriteZ
        IF ERR = 53 AND Work$ = "SaveContour" THEN FileExists% = 0 : RESUME WriteContour
        IF ERR = 53 AND Work$ = "SaveNmbrnDist" THEN FileExists% = 0 : RESUME
WriteNmbrnDist
        IF ERR = 53 AND Work$ = "SaveIFF" THEN FileExists% = 0 : RESUME WriteIFF

        BEEP
        WINDOW 2,"",(50,150)-(600,300),16,1
        CLS
        PRINT
        PRINT " Error Number ", ERR
        PRINT
        IF ERR = 49 THEN PRINT " Error - Volume not found. Check drive name."
        IF ERR = 53 THEN PRINT " Error - Path not found. Check Drive, Directory, and File Names!"
        IF ERR = 64 THEN PRINT " Error - Directory not found "
        PRINT " ";Work$
        IF ERR = 23 OR ERR = 62 THEN
                PRINT
                PRINT "    Are you Loading the right file?"
                PRINT "    Are there extra carriage returns in the file you are loading?"
        END IF
        IF ERR = 11 THEN
                PRINT
                PRINT "    Can't Read this File, may be some non-ASCII stuff in it?"
        END IF
        PRINT
        PRINT " Press Any Key to Continue ..."
        GOSUB Wayt
```

```
WINDOW CLOSE 2
GOSUB Palet1
IF Work$ = "LoadXYZ" THEN RESUME LoadXYZ
IF Work$ = "LoadXY" THEN RESUME LoadXY
IF Work$ = "LoadZ" THEN RESUME LoadZ
IF Work$ = "LoadContour" THEN RESUME LoadContour
IF Work$ = "LoadNmbrnX" THEN RESUME LoadNmbrnX
IF Work$ = "LoadLayering" THEN RESUME MainMenu
IF Work$ = "LoadLyr4Slice" THEN
        CLS
        LOCATE 10,10
        PRINT " Check VES Nmbrs in VESNmbr and (x,y) file."
        LOCATE 12,10
        PRINT " Press Any Key to go back to Main Menu"
'       RESUME ResumeLyr4Slice
        GOSUB Wayt
        RESUME MainMenu
END IF
IF Work$ = "SaveZ" THEN RESUME SaveZ
IF Work$ = "SaveContour" THEN RESUME SaveContour
IF Work$ = "SaveXYZ" THEN  RESUME SaveXYZ
IF Work$ = "SaveXY" THEN  RESUME SaveXY
IF Work$ = "SaveNmbrnDist" THEN RESUME SaveNmbrnDist
IF Work$ = "SaveZcalc" THEN RESUME SaveZcalc

RESUME MainMenu


GetReq:
        OPTION BASE 0
        DEFINT a-z
        LIBRARY "arp.library"
        DECLARE FUNCTION FileRequest&(buffer&) LIBRARY
        DECLARE FUNCTION BaseName&(pathptr&) LIBRARY
        DECLARE SUB TackOn(path&,file&) LIBRARY
        FUNCTION GetFile%(fname$,message$,VAL scrnum%)
        LOCAL path$,file$,buffer&(11),result&,term%,scr&,buf&
'       split up the pathname as required
        path$=SPACE$(80)
        LSET path$=fname$+CHR$(0)
        file$=SPACE$(40)
        result&=BaseName(SADD(path$))
        POKEB result&,0                          'into path$
        term%=result&-SADD(path$)
        LSET file$=RIGHT$(fname$,LEN(fname$)-term%)+CHR$(0)
'       get the fr_buffer nset up and call ARP
        buf&=VARPTR(buffer&(0))
        POKEL buf&,SADD(message$+CHR$(0))
        POKEL buf&+4,SADD(file$)
        POKEL buf&+8,SADD(path$)
        POKEL buf&+12,0
        POKEW buf&+16,0                    'flag
        POKEL buf&+18,0                    'function
        POKEL buf&+22,0                    'reserved
```

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```
'       handle custom screens (this is a bit messy, but it works...)
        IF scrnum% THEN
                scr&=PEEKL(SYSTAB+8+4*scrnum%)
                IF (scr&=0) OR (scrnum%<1) OR (scrnum%>4) THEN PRINT "Error":STOP
                POKEW buf&+26,&h217C
                POKEL buf&+28,scr&
                POKEL buf&+32,&h001E317C
                POKEL buf&+36,&h000F002E
                POKEW buf&+40,&h4E75
                POKEL buf&+18,buf&+26
                POKEB buf&+16,8
        END IF
        result&=FileRequest(buf&)
        IF result&=0 THEN
                GetFile%=0
        ELSE
                TackOn SADD(path$),SADD(file$)
                fname$=LEFT$(path$,INSTR(path$,CHR$(0))-1)
                GetFile%=-1
        END IF
        END FUNCTION


'       file$=""
'  By Commenting above line the file requestor stays at the last place it was.

        DO
                worked = GetFile(file$,ReqMsg$,1)        '0=on Workbench screen
        LOOP UNTIL worked <=  0                 'until selected or  cancelled
RETURN


IFFLoad:


' Note: Label changed from LoadIFF to IFFLoad to avoid conflict with LOADIFF command
        SetWindow WINDOW(7)
        CLS
        LOCATE 16,5
        PRINT "   AFTER viewing the IFF image: "
        LOCATE 18, 5
        PRINT "  Press Any Key. If nothing happens, Click Mouse in UpperLeft Corner. "
        LOCATE 19, 5
        PRINT " -------------------------------------------------------------"
        LOCATE 22, 5
        PRINT "  Note: Images saved under AmigaDOS (<2.04) may be unstable."
        LOCATE 23, 5
        PRINT "        DO NOT Load images on screens larger than 704x480, and "
        LOCATE 24,5
        PRINT "        DO NOT Load 24-bit images, you may lock up the computer!."
        LOCATE 26,5
        PRINT "  Note: If you load a non-image file, nothing will be displayed!"
        LOCATE 28,5
        PRINT "  Note: To Return to Main Menu click CANCEL button on file requester."

        Work$ = "IFFLoad"
```

```
ReqMsg$ = "Load .. IFF image"
GOSUB GetReq
IF Worked% = 0 THEN StartHere
LOADIFF SADD(File$+CHR$(0))
GOSUB wayt
GOSUB Palet1
COLOR 1,2
GOTO IFFLoad
```
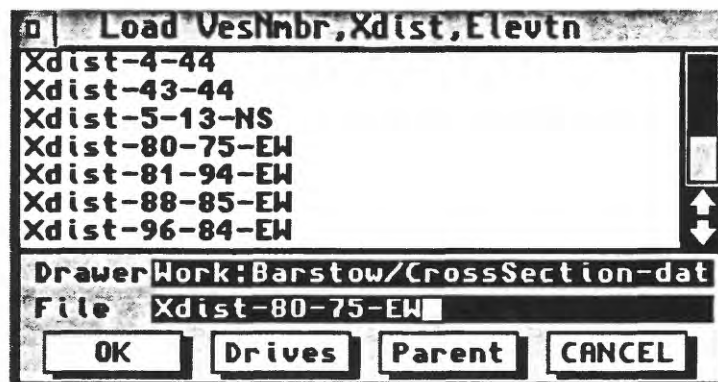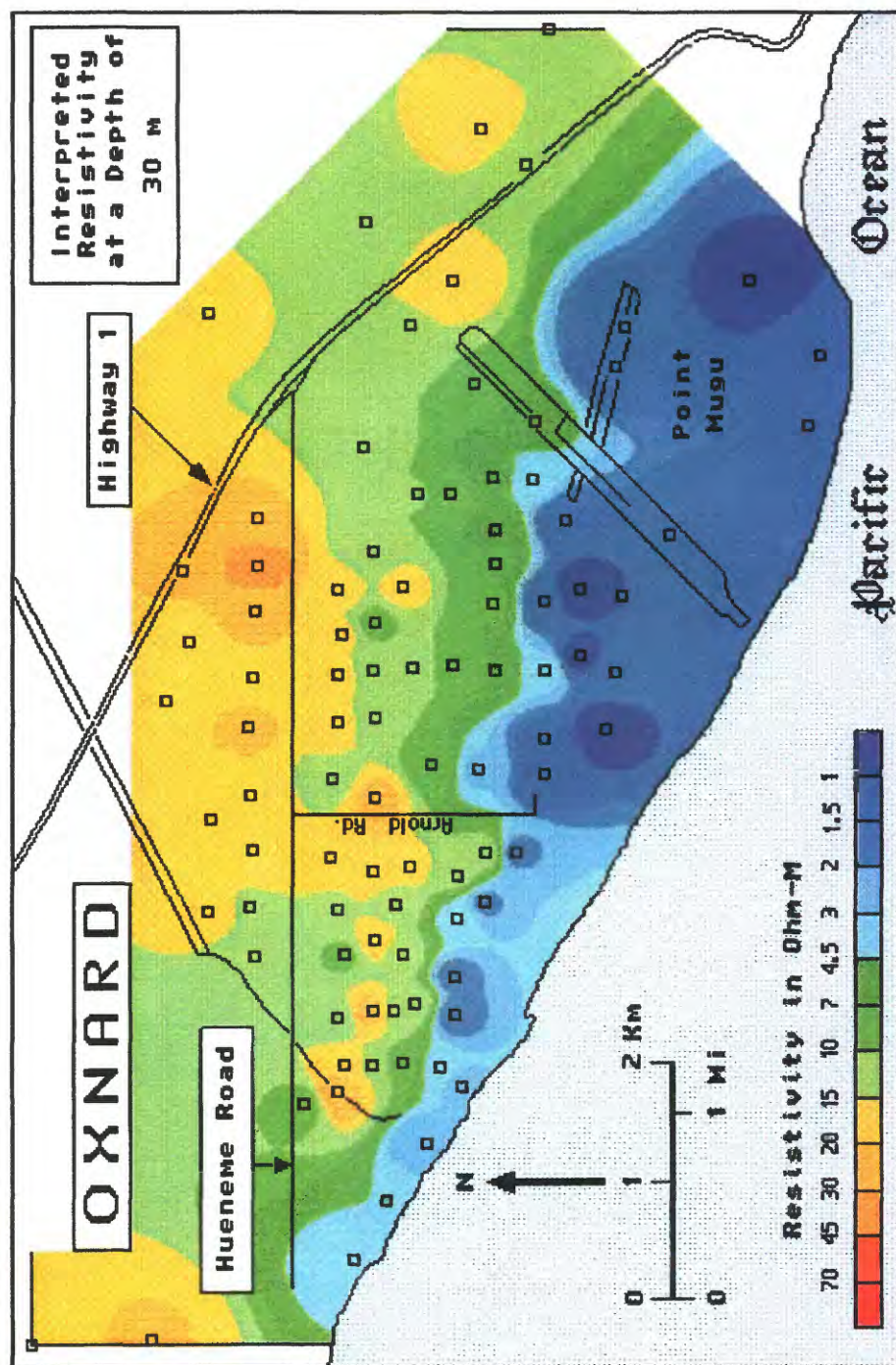
Figure 1. File Requester

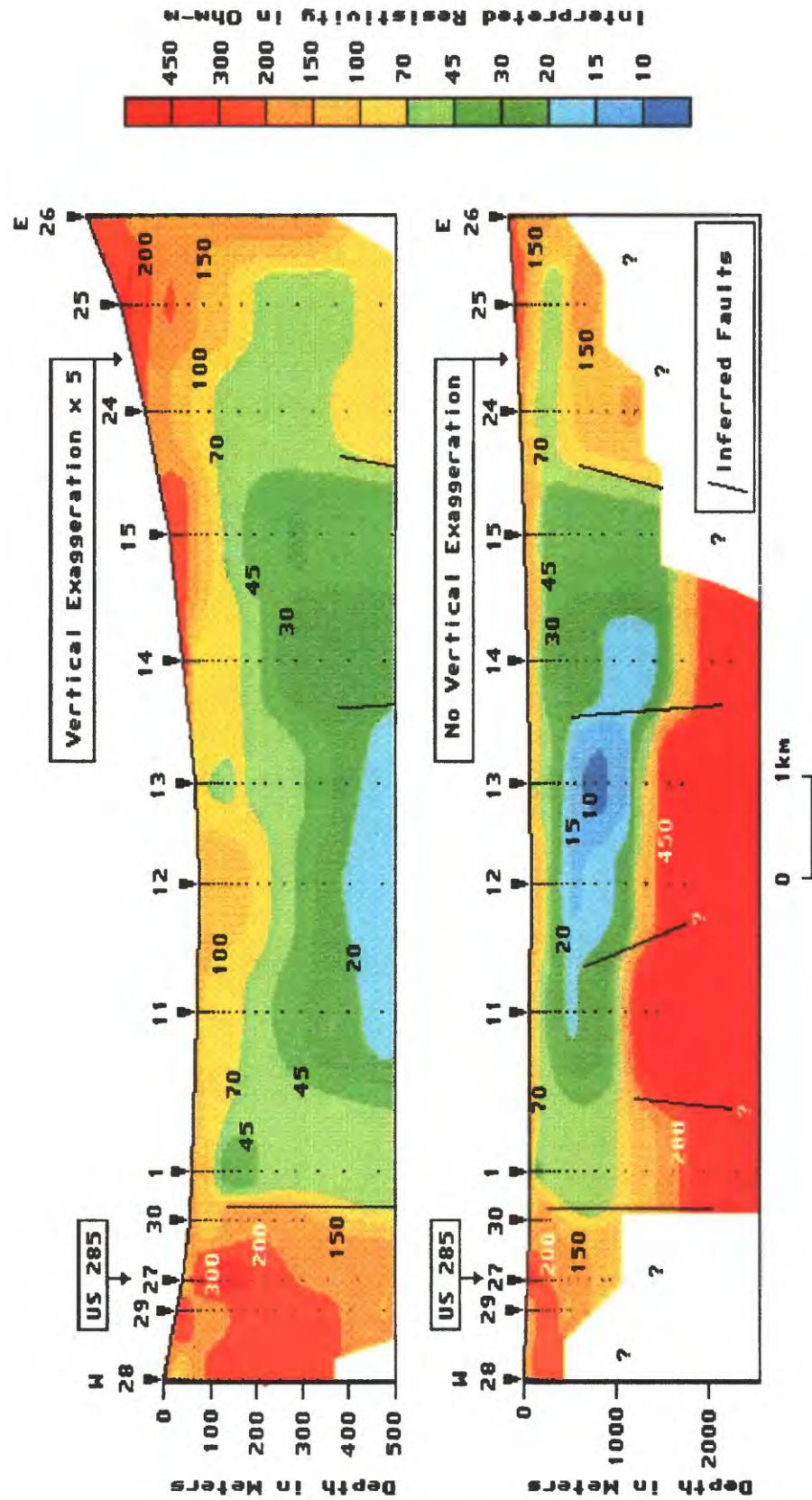Figure 2. Example of a completed map after annotation in Deluxe Paint (from Zohdy and others, 1993).

Figure 3. Example of a completed (interpreted resistivity) cross section, after editing and annotating in Deluxe Paint (from Zohdy and Bisdorf, 1993).